



# Power and sensing

Selection guide 2023-2024

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## Dear customer,



Adam White,  
Division President of  
Power and Sensor Systems  
电源与传感系统事业部总裁

Semiconductors are essential building blocks for a climate-neutral and digitalized world. Both are global challenges. Both are strong motivators for us to contribute to a better future. Never before have our technological possibilities been as great as they are today: Using technology as an enabler for decarbonization; leveraging the great potential of digitalization; innovations enabling growth and prosperity for billions of people in harmony with nature and our planet.

The great importance of semiconductors as a basic technology for entire economic sectors is now recognized everywhere. The attention paid to our industry has grown significantly. This is another strong motivation for us to continue our leadership in power and sensor systems and an offering for our customers of leading products with the highest quality and delivery reliability.

Our “Product to System”-approach is a differentiator. It goes beyond thinking in terms of technologies and products. Derived from our system knowledge, we holistically understand our customers’ problems: their applications, future roadmaps and use cases, supply chain demands, and the resulting challenges and opportunities. This way, we can offer the right solutions – from stand-alone products to system solutions or supply-security and other services.

Infineon has the broadest portfolio of ambient sensors for consumer, smart homes, IoT, and automotive. Sensors are essential for digitalization and decarbonization, for example, through reducing device and building energy consumption with the help of our radar solutions. Following the “Product to System”-approach Infineon offers optimized solutions comprising hardware, software, and algorithms.

To further expand our leadership in power systems, we are accelerating our wide bandgap offering and therefore strengthening our market position by adding significant manufacturing capacities for SiC and GaN in Kulim, Malaysia. Such innovative technologies will further lead to solutions addressing decarbonization and digitalization. These semiconductors offer added value to our customers because of better system performance in terms of efficiency, size and cost compared to silicon-based solutions. In 2024, the first wafer for our customers will leave this fab.

In order to answer the structurally growing demand for semiconductors, we are expanding our manufacturing capacities. In May 2023, we have broken ground for a new plant in Dresden, Germany, to strengthen our manufacturing basis for the semiconductors that drive decarbonization and digitalization from 2026 onwards. These analog/mixed-signal components are used in power supply systems, for example, in energy-efficient charging systems, in data centers or in applications for the Internet of Things (IoT). The interaction of power semiconductors and analog/mixed-signal components makes it possible to create particularly energy-efficient and intelligent system solutions.

This Power and Sensing Selection Guide 2023-2024 catalog is the most comprehensive consolidated overview of our products and the latest advancements in power and sensing technology designed to cater to your unique needs. I strongly believe that this digital catalog can support you to stay ahead of the competition and make your projects more successful. Please feel free to contact our talented teams to provide personal support on any product-related questions.

Let’s drive decarbonization and digitalization. Together.

## 尊敬的客户，

低碳化和数字化是我们共同面临的全球性挑战，这些促使我们为更美好的未来做出更大贡献，而半导体则是其中重要组成部分。我们可以实现的技术潜能从未像今天这样强大，技术进步能够实现更大程度的低碳化，可充分利用数字化带来的巨大潜力，并通过创新使数十亿人与自然和地球和谐相处，实现可持续的增长和繁荣。

半导体作为一项基础技术，对整个经济的重要性已经在世界各地得到充分认可，社会对我们这个行业的关注度也在显著增加，这些不仅不断促使我们继续在电源与传感器领域保持领先地位，还是我们为客户提供具有更高质量和更高可靠性的领先产品的又一强大动力。

我们的“从产品到系统”策略在业内具有与众不同的领先优势，它不再局限于技术和产品的范畴。基于我们深厚的系统知识，我们能够对客户遇到的问题有更全面的了解，包括他们的应用、未来发展路线图和用例、供应链需求以及由此带来的挑战和机遇。通过这种方式，我们能够为客户提供更加正确的解决方案，不论是提供从独立产品到系统解决方案，还是提供安全保障和其他服务。

英飞凌能够为消费电子、智能家居、物联网和汽车等行业提供更广泛的环境传感器产品组合。传感器技术对低碳化和数字化至关重要，例如通过我们的雷达解决方案，能够进一步降低设备和建筑物能耗。通过实施“从产品到系统”策略，英飞凌可提供包括硬件、软件和算法在内的整体优化解决方案。

为了进一步扩大我们在电源系统方面的领先优势，我们正在加快向市场提供宽禁带产品，通过在马来西亚库林 (Kulim, Malaysia) 大幅增加SiC和GaN的产能，我们的市场领先地位将会得到进一步加强。与硅基解决方案相比，这些创新半导体技术在效率、尺寸和成本方面具有更好的系统性能，能够为我们的客户提供更多附加价值，将会成为有效应对低碳化和数字化挑战的解决方案。2024年，我们客户的第一块晶圆将会从这家晶圆厂成功出货。

为了从布局上满足不断增长的半导体需求，我们正在扩大各地产能。2023年5月，我们位于德国德累斯顿 (Dresden, Germany) 的一家新工厂破土动工，目标是在2026年后加强我们的半导体制造能力，推动全球的低碳化和数字化进程，这些模拟/混合信号组件可用于高能效的充电系统、数据中心或物联网 (IoT) 等应用的电源系统。功率半导体和模拟/混合信号组件的优化组合将极大地促进构建更高能效和更加智能的系统解决方案。

这份《2023-2024电源与传感选型手册》是我们最全面的产品综合概述，同时也体现了电源与传感技术的最新进步，能够满足您具体应用的独特需求。我坚信，该手册可以帮助您在激烈的市场竞争中保持领先地位，并使您的项目更加成功。如果您有任何与产品相关的问题，请随时联系我们优秀的团队，您将会得到满意的支持和服务。

让我们一起推动低碳化和数字化进程。

Adam White,  
Division President of Power and Sensor Systems  
电源与传感系统事业部总裁

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# Solutions

## SMPS, battery management systems, motor control, UPS, contactless power and sensing

- SMPS - server power supply
- SMPS - telecom power supply
- SMPS - industrial SMPS
- SMPS - PC power supply
- SMPS - TV power supply
- Power over Ethernet (PoE)
- Fast/wireless EV-charging
- Wireless charging for consumer/industrial
- USB-C chargers and adapters
- Condition monitoring and predictive maintenance
- Battery chargers for mobile appliances
- Battery protection
- Battery monitoring & control
- Relay replacement
- Low-voltage low-power motor drive and control
- HP LV motor drive and control
- UPS
- Contactless power and sensing



Server

# Server SMPS

## Highly efficient server power supply

The trend in the field of data center and enterprise servers is to deliver more power per rack. Meanwhile, the rising cost of energy and environmental concerns make SMPS efficiency optimization a key requirement across the entire load range for server and data center designs. This challenging task is combined with the requirement for higher power, higher power density, and cost effectiveness.

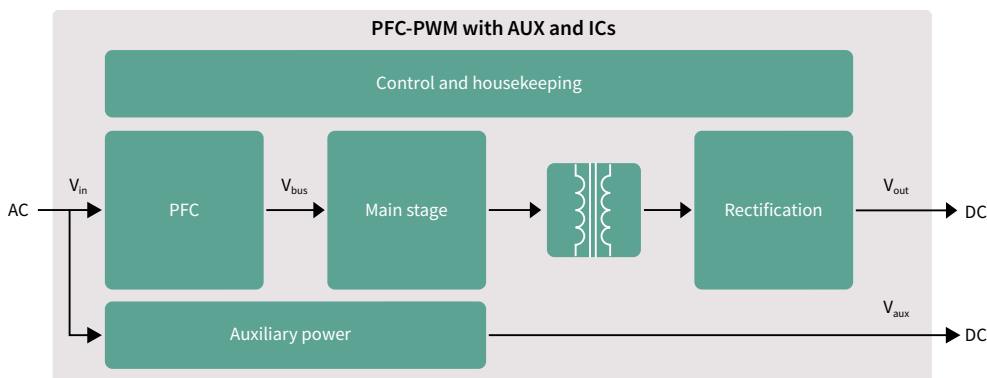
In the PFC stage and generally in hard-switching topologies used in server applications, Infineon recommends its 600 V **CoolMOS™ C7** and G7 families offering the lowest FOM  $R_{DS(on)} * Q_G$  and  $R_{DS(on)} * E_{oss}$ . These MOSFET series provide the lowest switching losses, which is necessary in fast-switching-frequency operations in high-end server SMPS. With Infineon's C7 and G7 series, the efficiency is optimized already from a very light-load operation. Available in compact SMD packages such as ThinPAK, DPAK, and TOLL, these SJ MOSFETs offer benefits in space usage and power density. The 600 V **CoolMOS™ C7** and G7 products are best used with Infineon's industry benchmark, the non-isolated **EiceDRIVER™ 2EDN752x** and the isolated **EiceDRIVER™ Compact 1ED AF** gate driver families.

Complementary to the 600 V **CoolMOS™ C7** in high efficiency PFC are the **CoolSiC™** Schottky diodes. The 600 V **CoolMOS™ P7** family offers a good compromise between price and performance. This is valuable in both PFC and HV DC-DC stages where low  $Q_g$  and turn-off losses are important benefits, especially in case of high-switching-frequency operations and high light-load efficiency requirements.

As high power (2-6 kW and above) requires ultrahigh efficiency (96-98 percent peak) and high power density, Infineon's **CoolGaN™** GIT HEMT 600 V family with totem-pole PFC controls deliver the highest efficiency and power density in the world. Using the **600 V CoolMOS™ S7** devices with active bridge circuit fulfills the Titanium® requirement at the lowest cost. Operating expenses (OPEX) and capital expenditures (CAPEX) are both reduced through simplified topologies and the power density in the server PSU is doubled.

In applications with low output voltage and high output current, further efficiency improvements are enabled by the continuous reduction of on-resistance. This can be achieved by using Infineon's low-voltage **OptiMOS™** MOSFET series in the synchronous rectification stage. Infineon's low-voltage products are complemented by **StrongIRFET™** devices that are optimized for lower switching frequencies and highest system robustness. Infineon's **EiceDRIVER™** gate-driver IC family perfectly matches the **CoolGaN™** and **CoolSiC™** wide-bandgap products, and **CoolMOS™** and **OptiMOS™** MOSFET products.

In addition, **ISOFACE™** digital isolators, based on the Infineon's coreless transformer (CT) technology, provide robust galvanic isolation for safety requirements.



[www.infineon.com/smps](http://www.infineon.com/smps)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



Recommended products

| Functional block  | Product category           | Topology  | Product family   | Benefits  |
|---|----------------------------|---|--|---|
| PFC   | High-voltage MOSFETs       | CCM/interleaved PFC; TTF  | 600 V/650 V CoolMOS™ C7<br>650 V CoolMOS™ G7<br>600 V CoolMOS™ S7  | Best FOM $R_{DS(on)} \cdot Q_g$ and $R_{DS(on)} \cdot E_{oss}$<br>Lowest $R_{DS(on)}$ per package<br>Low dependency of switching losses from $R_{g,ext}$  |
|   | High-voltage GaN           | Totem-pole PFC  | CoolGaN™ GIT HEMT 600 V  | Enable the highest efficiency and highest power density   |
|   | High-voltage SiC MOSFET    | Totem-pole PFC  | CoolSiC™ 650 V   | Highest power handling capability<br>Highest temperature handling   |
|   | SiC diodes                 | CCM/interleaved PFC   | CoolSiC™ Schottky diode 650 V G5   | Low FOM $V_f \cdot Q_g$   |
|   | Control ICs                | CCM PFC ICs   | ICE3PCS0xG   | Ease of use   |
|   | GaN gate driver ICs        | Totem-pole PFC  | EiceDRIVER™ 1EDF5673F<br>and 1EDF5673K   | Negative $V_{gs}$ voltage to avoid false triggering<br>Differential output for GIT technology based GaN driving   |
|   | SiC MOSFET gate driver ICs | Totem-pole PFC  | EiceDRIVER™ 2EDF9275F/1EDB9275F*   | 37 ns/45 ns typical propagation delay time<br>Functional isolation 1.5 kV   |
|   | Gate driver ICs            | Interleaved PFC   | EiceDRIVER™ 2EDN852x/1EDN8511B<br>EiceDRIVER™ 1EDN8550B for Kelvin-source<br>CoolMOS™  | Source and sink driver capability:<br>- 5 A for 2EDN<br>- 4 A/8 A for 1EDN<br>17 ns (45 ns for 1EDN8550B) propagation delay precision for fast MOSFET and GaN switching<br>(-10 V input robustness (1EDN8550B has true differential inputs for ground-shift robustness CMR up to ±150 V))           |
|   |                            |   | EiceDRIVER™ low side: 2ED24427N01F   | Dual-channel, 10 A low-side driver in DSO-8 with power-pad<br>Integrated UVLO protection and enable (EN) function<br>High frequency, high power operation with BOM savings  |
|   |                            | Totem-pole PFC  | EiceDRIVER™ level-shift:<br>2ED2181S06F, 2ED21814S06J  | 650 V half-bridge SOI driver with integrated bootstrap diode<br>Superior -VS transient voltage immunity<br>High frequency switching (500 kHz)   |
| EiceDRIVER™ level-shift: IRS2186S, IRS21864S<br>EiceDRIVER™ Compact: 1EDI60N12AF,<br>1ED3124MU12F |                            |   | 4 A/4 A high- and low-side gate driver<br>Isolated gate driver, up to 14 A, 100 ns propagation delay   |   |
| Boost PFC   |                            | EiceDRIVER™ low side: 1ED44173N01B  | Single-channel with fast, accurate (± 5%), integrated overcurrent protection (OCP)   |   |
| Main stage  | High-voltage MOSFETs       | ITTF  | 600 V CoolMOS™ C7/P6   | Fast switching speed for improved efficiency and thermals<br>Low gate charge for enhanced light-load efficiency and low power consumption at no-load condition<br>Optimized $V_{gs}$ threshold for lower turn-off losses<br>Rugged body diode which prevents device failure during hard commutation |
|   |                            | LLC, half-bridge below 1 kW   | 600 V CoolMOS™ P7, CFD7  | Low turn-off losses<br>Low $Q_{oss}$<br>Low $Q_g$   |
|   |                            | LLC, phase-shift full-bridge below 1 kW   | 600 V CoolMOS™ CFD7,<br>650 V CoolMOS™ CFD2  | Fast and rugged body diode<br>Optimized low $Q_g$ and soft commutation behavior to reach highest efficiency<br>Highest reliability for 650 V <sub>DS</sub>  |
|   |                            | ZVS PS FB, LLC, TTF   | 650 V TRENCHSTOP™ IGBT F5  | Improved ruggedness and high efficiency in low inductance designs   |
|   | Control ICs                | HB LLC ICs  | ICE1HS01G-1<br>ICE2HS01G   | High efficiency and low EMI   |
|   | Gate driver ICs            | LLC, ZVS phase-shift full-bridge, TTF   | EiceDRIVER™<br>2EDS8165H, 2EDS8265H  | 37 ns typical propagation delay time<br>Reinforced (safe) isolation 6 kV, CMTI > 150 V/ns   |
|   |                            |   | EiceDRIVER™ Compact:<br>1EDI60N12AF, 1ED3124MU12F  | Isolated gate driver, up to 14 A, 100 ns propagation delay  |
|   |                            |   | EiceDRIVER™ 2EDN8524F<br>with pulse transformer  | 5 A source and sink driver capability<br>17 ns propagation delay precision for fast MOSFET and GaN switching  |
|   |                            |   | EiceDRIVER™ low side: 2ED24427N01F<br>with pulse transformer   | Dual-channel, 10 A low-side driver in DSO-8 with power-pad<br>Integrated UVLO protection and enable (EN) function<br>High frequency, high power operation with BOM savings  |
|   |                            |   | EiceDRIVER™ level-shift: 2ED2181S06F,<br>2ED21814S06J  | 650 V half-bridge SOI driver with integrated bootstrap diode<br>Superior -VS transient voltage immunity<br>High frequency switching (500 kHz)   |
| EiceDRIVER™ level-shift: IRS2186S, IRS21864S  |                            |   | 4 A/4 A high- and low-side gate driver   |   |
| Synchronous rectification   | Low-voltage MOSFETs        | HB LLC and center tap   | OptiMOS™ 40 V  | High efficiency over whole load range, layout tolerance   |
|   |                            | ITTF  | OptiMOS™ 60 V  | High efficiency, low thermals, low $V_{ds}$ overshoot   |
|   | ZVS PS FB and center tap   | OptiMOS™ 80 V   | High efficiency over whole load range, low $V_{ds}$ overshoot and oscillations   |   |
| Gate driver ICs   | Synchronous rectification  | EiceDRIVER™<br>2EDF7275K/2EDF7235K<br>2EDL811x/2EDL801x<br>for bridge rectifier | EiceDRIVER™ 2EDF72x5K<br>Functional isolation up to 650 V <sub>DC</sub> channel-to-channel isolation<br>Compact solution available in LGA-13 5x5 mm package<br>EiceDRIVER™ 2EDL8x1x<br>Level-shift half-bridge gate driver up to 120 V isolation |   |
|   |                            | Low side: EiceDRIVER™<br>2EDN75xx/2EDN85xx,<br>1EDN751x/1EDN8511B               | 5 A source and sink driver capability for 2EDN (4A/8A for 1EDN)<br>17/19 ns propagation delay precision for fast MOSFET and GaN switching<br>(-10 V input robustness)  |   |
|   |                            | EiceDRIVER™ low side: 2ED24427N01F  | Dual-channel, 10 A low-side driver in DSO-8 with power-pad<br>Integrated UVLO protection and enable (EN) function<br>High frequency, high power operation with BOM savings   |   |
|   |                            | EiceDRIVER™ level-shift:<br>2ED2181S06F, 2ED21814S06J                           | 650 V half-bridge SOI driver with integrated bootstrap diode<br>Superior -VS transient voltage immunity<br>high frequency switching (500 kHz)  |   |
|   |                            | EiceDRIVER™ level-shift: IRS2186S, IRS21864S<br>EiceDRIVER™ 1EDNx550B           | 4 A/4 A high- and low-side gate driver<br>True differential inputs for ground shift robustness CMR up to ±150 V  |   |
|   |                            |   |  |   |
| Auxiliary power supply  | Control ICs                | QR/FF flyback CoolSET™  | 700 V - ICE5xR0070xx<br>800 V - ICE5xR0080AG<br>800 V - ICE5QRxx80BG   | Low standby power, high efficiency and robustness<br>An integrated 700 V/800 V superjunction power MOSFET with avalanche capability<br>Burst mode entry/exit to optimize standby power at different low load conditions   |
| Isolation   | Digital isolator           | -   | ISOFACE 2DIB0400F;<br>ISOFACE 2DIB0410F  | 2+0 digital isolator with TTL input threshold and fail-safe default low output state<br>3 kV <sub>RMS</sub> isolation voltage (UL 1577) in DSO-8 package<br>High common mode transient immunity > 100 kV/us   |
| Housekeeping  | Microcontrollers           | -   | XMC1xxx  | Flexibility, HR PWM, digital communication<br>Arm®-based standard MCU family and wide family  |
| Conversion  | Microcontrollers           | -   | XMC4xxx  | Flexibility, HR PWM and digital communication   |

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\* Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





Telecom

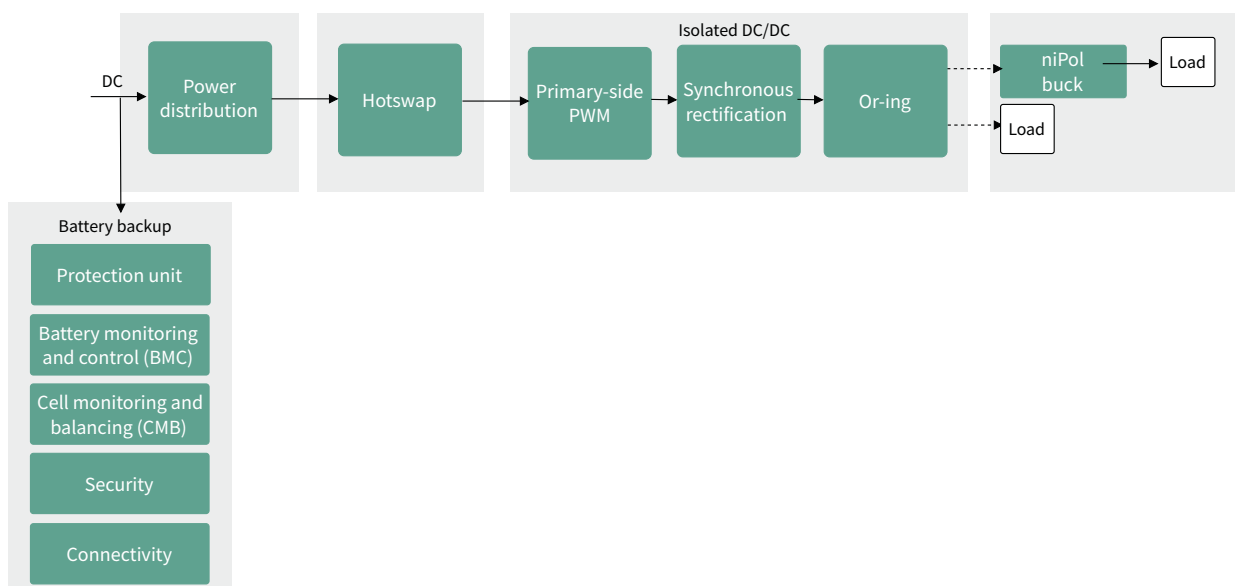
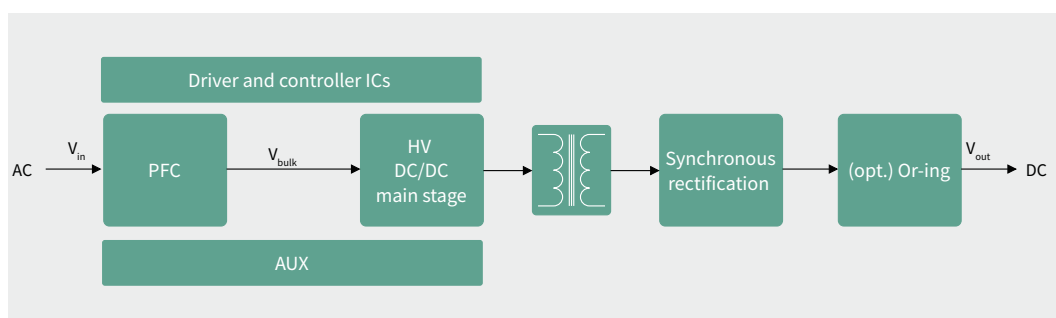
# SMPS

## Full system solution for telecom power supply

The ever-increasing data consumption, coupled with new levels of virtualization and complexity of the 5G telecom infrastructure, is bringing its demanding requirements into the telecom power sector. Semiconductor technologies are key for enabling telecom SMPS performance.

The remarkable improvements in telecom SMPS performance in the past resulted from the dramatic reduction of the on-resistance achieved in high-voltage MOSFETs, thanks to the revolutionary superjunction principle introduced by Infineon at the end of the nineties with its **CoolMOS™** series. To achieve today's demanding energy efficiency targets, synchronous rectification has become popular to take advantage of the unique properties of medium-voltage power MOSFETs. Infineon's low- and medium-voltage **OptiMOS™** MOSFET product family – which has gained terrific popularity in DC-DC brick solutions – coupled with gate-driver ICs and microcontrollers efficiently powers the BBUs, RRUs and AAUs of macro and small cells.

Infineon's wide bandgap technologies, such as the **CoolGaN™** GIT HEMT 600 V (gallium-nitride-based) and the **CoolSiC™** 650 V (silicon-carbide-based) for the primary side and the upcoming **CoolGaN™** SG HEMT 100 V/200 V\* complement the wide portfolio of silicon-based switches, enabling higher system and electrical conversion efficiency at an attractive system costs. Infineon's **EiceDRIVER™** gate driver IC family perfectly matches the **CoolGaN™** and **CoolSiC™** wide bandgap products, as well as **CoolMOS™** and **OptiMOS™** MOSFETs.



[www.infineon.com/smps](http://www.infineon.com/smps)

\* in development

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Recommended products

| Functional block                                 | Product category            | Topology  | Product family   | Benefits  |   |
|--|-----------------------------|---|--|---|---|
| PFC  | High-voltage MOSFETs        | Classic CCM/interleaved PFC/Dual-boost PFC                    | 600 V/650 V CoolMOS™ C7  | <ul style="list-style-type: none"> <li>Best FOM <math>R_{DS(on)} \cdot Q_c</math> and <math>R_{DS(on)} \cdot Q_{oss}</math></li> <li>Lowest <math>R_{DS(on)}</math> per package</li> <li>Low dependency of switching losses from <math>R_{g,ext}</math></li> </ul>  |   |
|  |                             |   | 600 V CoolMOS™ P7  | <ul style="list-style-type: none"> <li>Low turn-off losses</li> <li>Low <math>Q_{oss}</math></li> <li>Low <math>Q_g</math></li> </ul>   |   |
|  |                             |   | 600 V CoolMOS™ S7  | <ul style="list-style-type: none"> <li>The lowest <math>R_{DS(on)}</math> MOSFET for line frequency rectification</li> </ul>  |   |
|  | High-voltage GaN            | CCM totem-pole PFC  | CoolGaN™ 600 V   | <ul style="list-style-type: none"> <li>Switching at high frequencies (&gt; Si)</li> <li>Enables high power density</li> <li>Enable very high efficiency with ease of use</li> </ul>   |   |
|  | High-voltage SiC MOSFET     | CCM totem-pole PFC  | CoolSiC™ 650 V   | <ul style="list-style-type: none"> <li>Low FOM <math>V_F \cdot Q_c</math></li> </ul>  |   |
|  | SiC diodes                  | Classic CCM/interleaved PFC/Dual-boost PFC                    | CoolSiC™ Schottky diode 650 V G6                               | <ul style="list-style-type: none"> <li>Low FOM <math>V_F \cdot Q_c</math></li> </ul>  |   |
|  | Control ICs                 | CCM PFC ICs   | ICE3PCS0xG   | <ul style="list-style-type: none"> <li>High PFC and low THD</li> </ul>  |   |
|  | GaN gate-driver ICs         | Totem-pole PFC  | EiceDRIVER™ 2EDF9275F/1EDB9275F                                | <ul style="list-style-type: none"> <li>Negative <math>V_{GS}</math> voltage to avoid false triggering GaN driving</li> <li>Differential output for GIT technology based</li> <li>CMTI &gt; 200 V/ns</li> <li>37 ns/45 ns typical propagation delay time</li> <li>Functional isolation 1.5 kV</li> <li>CMTI &gt; 150 V/ns</li> </ul>   |   |
|  | SiC MOSFET gate-driver ICs  | Totem-pole PFC  | EiceDRIVER™ 2EDF9275F/1EDB9275F                                | <ul style="list-style-type: none"> <li>37 ns/45 ns typical propagation delay time</li> <li>Functional isolation 1.5 kV</li> <li>CMTI &gt; 150 V/ns</li> <li>Isolated gate driver, up to 14 A, 100 ns propagation delay</li> </ul>   |   |
|  | Gate-driver ICs             | Totem-pole PFC  | Interleaved dual-boost PFC                                     | EiceDRIVER™ Compact: 1ED160N12AF, 1ED3124MU12F  | <ul style="list-style-type: none"> <li>Integrated bootstrap diode using Infineon SOI technology, low level-shift loss</li> <li>Excellent ruggedness against negative transient voltages on VS pin</li> <li>5 A source and sink driver capability for 2EDN</li> <li>8 A sink and 4 A source driver capability for 1EDN</li> <li>17 ns propagation delay precision for fast MOSFET and GaN switching</li> <li>8 A sink and 4 A source driver capability</li> <li>45 ns for propagation delay precision for fast MOSFET and GaN switching</li> <li>True differential inputs for ground shift robustness (CMR up to ±150 V)</li> <li>Dual-channel, 10 A low-side gate driver in PG-DSO-8 package with power-pad</li> <li>UVLO and enable (EN), high frequency, high power operation with BOM savings</li> <li>Fast-switching speed for improved efficiency and thermal</li> <li>Low gate charge for enhanced light load efficiency</li> <li>Optimized <math>V_{GS}</math> threshold for lower turn-off losses</li> <li>Rugged body diode which prevents device failure during hard commutation</li> <li>Low turn-off losses</li> <li>Low <math>Q_{oss}</math></li> <li>Low <math>Q_g</math></li> <li>Best-in-class <math>Q_{tr}</math> and <math>t_{rr}</math> level</li> <li>Significantly reduced <math>Q_{tr}</math> previous CoolMOS™ fast-body-diode series improved efficiency over</li> <li>37 ns typical propagation delay time</li> <li>Reinforced isolation 8 kVpk</li> <li>CMTI &gt; 150 V/ns</li> <li>5 A source and sink driver capability</li> <li>17 ns propagation delay precision for fast MOSFET and GaN switching</li> <li>(-)10 V input robustness</li> <li>Isolated gate driver, up to 14 A, 100 ns propagation delay</li> </ul> |
|  |                             |   |  | EiceDRIVER™ level-shift: 2ED2304S06F, 2EDL23N06PJ, 2ED2182S06F  |   |
|  |                             |   |  | EiceDRIVER™ 2EDN852x/1EDN851x   |   |
| EiceDRIVER™ 1EDN8550B for Kelvin-source CoolMOS™ |                             |   |  |   |   |
| EiceDRIVER™ low side: 2ED24427N01F               |                             |   |  |   |   |
| HV DC-DC main stage                              | High-voltage MOSFETs        | TTF, ITTF   | 600 V CoolMOS™ C7/P7   | <ul style="list-style-type: none"> <li>Low turn-off losses</li> <li>Low <math>Q_{oss}</math></li> <li>Low <math>Q_g</math></li> <li>Best-in-class <math>Q_{tr}</math> and <math>t_{rr}</math> level</li> <li>Significantly reduced <math>Q_{tr}</math> previous CoolMOS™ fast-body-diode series improved efficiency over</li> <li>37 ns typical propagation delay time</li> <li>Reinforced isolation 8 kVpk</li> <li>CMTI &gt; 150 V/ns</li> <li>5 A source and sink driver capability</li> <li>17 ns propagation delay precision for fast MOSFET and GaN switching</li> <li>(-)10 V input robustness</li> <li>Isolated gate driver, up to 14 A, 100 ns propagation delay</li> </ul>  |   |
|  |                             |   | HB/FB LLC  |   | 600 V CoolMOS™ P7   |
|  |                             |   | HB/FB LLC, ZVS PSFB  |   | 600 V, 650 V CoolMOS™ CFD7  |
|  | Gate-driver ICs             | HB LLC, ZVS phase-shift full-bridge                           | EiceDRIVER™ 2EDS8x65H  | <ul style="list-style-type: none"> <li>Integrated bootstrap diode using Infineon SOI technology, low level-shift loss</li> <li>Excellent ruggedness against negative transient voltages on VS pin</li> <li>High efficiency and low EMI</li> </ul>   |   |
|  |                             |   | EiceDRIVER™ 2EDN8524F with pulse transformer                   |   |   |
|  |                             |   | EiceDRIVER™ Compact: 1ED160N12AF, 1ED3124MU12F                 |   |   |
|  |                             |   | EiceDRIVER™ level-shift: 2ED2304S06F, 2EDL23N06PJ, 2ED2182S06F |   |   |
|  | Control ICs                 | HB LLC  | ICE1HS01G-1, ICE2HS01G   | <ul style="list-style-type: none"> <li>Negative <math>V_{GS}</math> voltage to avoid false triggering GaN driving</li> <li>Differential output for GIT technology based</li> <li>CMTI &gt; 200 V/ns</li> <li>Enables the highest efficiency and highest power density</li> </ul>  |   |
|  | GaN gate-driver ICs         | LLC, ZVS phase-shift full-bridge                              | EiceDRIVER™ 1EDS5663H  | <ul style="list-style-type: none"> <li>Negative <math>V_{GS}</math> voltage to avoid false triggering GaN driving</li> <li>Differential output for GIT technology based</li> <li>CMTI &gt; 200 V/ns</li> <li>Enables the highest efficiency and highest power density</li> </ul>  |   |
|  | High-voltage GaN            | LLC, ZVS phase-shift full-bridge                              | CoolGaN™ GIT HEMT 600 V  | <ul style="list-style-type: none"> <li>Negative <math>V_{GS}</math> voltage to avoid false triggering GaN driving</li> <li>Differential output for GIT technology based</li> <li>CMTI &gt; 200 V/ns</li> <li>Enables the highest efficiency and highest power density</li> </ul>  |   |
|  | Synchronous rectification   | Low-voltage MOSFETs   | Synchronous rectification MOSFET                               | OptiMOS™ 80-200 V   | <ul style="list-style-type: none"> <li>Industry's lowest FOM (<math>R_{DS(on)} \cdot Q_c</math>) leading to high efficiency at good price/performance</li> <li>Low voltage overshoots enabling easy design-in</li> <li>Industry's lowest <math>R_{DS(on)}</math></li> <li>Highest system efficiency and power density</li> <li>Outstanding quality and reliability</li> <li>Reduces the need for a snubber circuit</li> <li>Functional isolation up to 650 VDC channel-to-channel isolation</li> <li>Compact solution available in LGA-13 5x5 mm package</li> <li>Level-shift half-bridge gate driver up to 120 V isolation</li> </ul>  |
| Gate-driver ICs                                  |                             |   |  | Synchronous rectification   |   |
| Gate-driver ICs                                  |                             | Synchronous rectification                                     | EiceDRIVER™ 2EDL811x/2EDL801x                                  | <ul style="list-style-type: none"> <li>5 A source and sink driver capability for 2EDN</li> <li>8 A sink and 4 A source driver capability for 1EDN</li> <li>17/19 ns propagation delay precision for fast MOSFET and GaN switching</li> <li>(-)10 V input robustness</li> <li>4 A/4 A high- and low-side gate driver</li> </ul>  |   |
|  |                             |   | Low side: EiceDRIVER™ 2EDN75xx/2EDN85xx, 1EDN751x/1EDN851x     |   |   |
|  |                             |   | EiceDRIVER™ level-shift: IRS2186S, IRS21864S                   |   |   |
| EiceDRIVER™ low side: 2ED24427N01F               |                             |   |  |   |   |
| Auxiliary power supply                           | Control ICs                 | 5th generation QR/FF flyback CoolSET™                         | QR 800 V - ICE5QRxx80BG FF 800 V - ICE5XRxx80AG                | <ul style="list-style-type: none"> <li>Robust protection with adjustable line input overvoltage protection, <math>V_{GS}</math> and CS pin short-to-ground protection</li> <li>Optimized light-load efficiency with selectable burst mode entry/exit profile</li> <li>Frequency reduction for mid- and light-load condition to reduce switching losses and increase efficiency</li> <li>Direct feedback and regulation with integrated error amplifier for non-isolated output</li> <li>High power delivery of up to 42 W with 800 V CoolSET™ in heatsink-free SMD package</li> <li>SOIC-16 WB package</li> <li>Data rates up to 40 Mbps</li> <li>Operating supply voltage: 2.7 V – 6.5 V (abs. max 7.5 V)</li> <li>VISO of 5700 V<sub>RMS</sub> (UL1577, VDE 0884-17)</li> <li>CMTI: 100 kV/μs (min)</li> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Optimized for 48 V telecom isolated conversion</li> <li>Highly flexible digital core</li> <li>State-of-the-art dedicated AFE</li> <li>State-machine based fast loop control</li> <li>Pre-programmed peripherals in ROM</li> <li>Negligible internal power consumption</li> <li>Industry smallest digital power controller</li> </ul> |   |
| Communication                                    | 4-channels digital isolator | Data transmission between the primary side and secondary side | ISOFACE™ 4DIR1400H   | <ul style="list-style-type: none"> <li>SOIC-16 WB package</li> <li>Data rates up to 40 Mbps</li> <li>Operating supply voltage: 2.7 V – 6.5 V (abs. max 7.5 V)</li> <li>VISO of 5700 V<sub>RMS</sub> (UL1577, VDE 0884-17)</li> <li>CMTI: 100 kV/μs (min)</li> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Optimized for 48 V telecom isolated conversion</li> <li>Highly flexible digital core</li> <li>State-of-the-art dedicated AFE</li> <li>State-machine based fast loop control</li> <li>Pre-programmed peripherals in ROM</li> <li>Negligible internal power consumption</li> <li>Industry smallest digital power controller</li> </ul>  |   |
| Housekeeping                                     | Microcontrollers            | -   | XMC1xxx  | <ul style="list-style-type: none"> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Optimized for 48 V telecom isolated conversion</li> <li>Highly flexible digital core</li> <li>State-of-the-art dedicated AFE</li> <li>State-machine based fast loop control</li> <li>Pre-programmed peripherals in ROM</li> <li>Negligible internal power consumption</li> <li>Industry smallest digital power controller</li> </ul>   |   |
| Power conversion                                 | Microcontrollers            | -   | XMC1xxx, XMC4xxx   | <ul style="list-style-type: none"> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Optimized for 48 V telecom isolated conversion</li> <li>Highly flexible digital core</li> <li>State-of-the-art dedicated AFE</li> <li>State-machine based fast loop control</li> <li>Pre-programmed peripherals in ROM</li> <li>Negligible internal power consumption</li> <li>Industry smallest digital power controller</li> </ul>   |   |
| Isolated DC-DC                                   | Microcontrollers            | -   | XDPP1100   | <ul style="list-style-type: none"> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Flexibility, HR PWM, digital communication</li> <li>Arm®-based standard MCU family and wide family</li> <li>Optimized for 48 V telecom isolated conversion</li> <li>Highly flexible digital core</li> <li>State-of-the-art dedicated AFE</li> <li>State-machine based fast loop control</li> <li>Pre-programmed peripherals in ROM</li> <li>Negligible internal power consumption</li> <li>Industry smallest digital power controller</li> </ul>   |   |





## Recommended products

| Functional block                             | Product category   | Topology                           | Product family   | Benefits   |
|--|--|------------------------------------|--|--|
| Or-ing                                       | Low-voltage MOSFETs  | Or-ing MOSFET                      | OptiMOS™ 60-200 V  | <ul style="list-style-type: none"> <li>Industry's lowest FOM (<math>R_{DS(on)} \cdot Q_g</math>) leading to high efficiency at good price/performance</li> <li>Low-voltage overshoots enabling easy design-in</li> </ul>   |
| Battery management and protection            | Low- and medium-voltage MOSFETs  | Back-to-back disconnect            | OptiMOS™ 60-200 V<br>OptiMOS™ 80-200 V<br>StrongIRFET™ 80-200 V                          | <ul style="list-style-type: none"> <li>Industry's lowest Low <math>R_{DS(on)}</math></li> <li>Wide SOA</li> <li>Perfect match of robust and excellent price/performance</li> </ul>   |
|  | Gate-driver ICs  | protection switch drivers          | EiceDRIVER™  | <ul style="list-style-type: none"> <li>Faster reaction time (~ 10 µs)</li> <li>Integrated bidirectional high or low-side current sense amplifiers</li> <li>High current source or sink support (1 A pull down, 0.3 A pull up)</li> <li>Robust against under/overvoltage in the board-net</li> <li>Flexible configuration of protection features plus accessibility of diagnosis information via SPI</li> </ul> |
|  | Microcontroller  | Battery Monitoring and controlling | PSoc™ 4  | <ul style="list-style-type: none"> <li>32-bit MCU Subsystem CPU</li> <li>48-MHz Arm® Cortex®-M0+</li> <li>Flash: Up to 256 kB flash</li> <li>RAM: 32 kB SRAM</li> <li>Up to 2 CAN serial channels</li> <li>USB/Up to 4</li> </ul>  |
|  | Memory   | Datalogging                        | SEMPER™<br>EXCELON™  | <ul style="list-style-type: none"> <li>Energy efficient</li> <li>High density</li> <li>Reliable data logging memories</li> </ul>   |
|  | Current sensing  | Current measurement                | XENSIV™ TLI4971  | <ul style="list-style-type: none"> <li>Ultralow-power loss due to minimal resistance of the current rail</li> <li>Reliable current measurement over the lifetime (no re-calibration)</li> <li>Functional isolation for high-voltage application design</li> <li>Easy and compact package allows high power density</li> </ul>  |
|  | Battery management IC  | Cell monitoring and Balancing      | TLE9012  | <ul style="list-style-type: none"> <li>Robust communication without the need for transformers or common-mode chokes</li> <li>Best-in-class voltage measurement accuracy even after soldering thanks to stress sensor technology</li> <li>Integrated diagnosis easing functional safety design Integrated UART communication for systems with a microcontroller on local ground</li> </ul>                      |
|  | Small signal N/P channel MOSFET  | Cell balancing                     | OptiMOS™ 20-30 V<br>StrongIRFET™ 20-30 V   | <ul style="list-style-type: none"> <li>Wide range of packages</li> <li>Suitable for space constraints between 0.5 A to 2.5 A</li> <li>Suitable equalizing current PCB footprint</li> <li>Compact solution with smalle</li> </ul>   |
|  | Communication  | Wired and wireless interface       | Lin CAN  | <ul style="list-style-type: none"> <li>Low quiescent current</li> <li>ISO11898 compliant</li> <li>Excellent EMI performance</li> <li>Standby/sleep mode</li> <li>Wake and failure detection</li> <li>High ESD robustness</li> </ul>  |
|  |  |                                    |  | AIROC™   |
|  | Security   | -                                  | -  | OPTIGA™ Authenticate S   |
| Digital Isolator                             | Isolators  | Isolators                          | ISOFACE™ Digital Isolators   | <ul style="list-style-type: none"> <li>2/4-channel digital isolators</li> <li>Max. supply voltage: 6.5 V</li> <li>Benchmark highest CMTI: 100 kV/us min.</li> <li>CMOS and TTL input thresholds</li> <li>Wide operating temperature range</li> <li>Low power consumption</li> <li>Accurate timing performance</li> </ul>   |
| Isolated DC-DC                               | Microcontrollers   |                                    | XDP™   | <ul style="list-style-type: none"> <li>Optimized for 48 V telecom isolated conversion</li> <li>Highly flexible digital core AFE</li> <li>State-of-the-art dedicated control</li> <li>State-machine-based fast loop ROM</li> <li>Pre-programmed peripherals in</li> <li>Negligible internal power consumption</li> <li>Industry smallest digital power controller</li> </ul>                                    |
|  | Medium and Low-voltage MOSFETs   | Primary-side PWM MOSFETs           | OptiMOS™ 80-200 V<br>StrongIRFET™ 80-200 V<br>Small-signal MOSFETs 60-200 V              | <ul style="list-style-type: none"> <li>Industry's lowest <math>R_{DS(on)}</math> and power density</li> <li>Highest system efficiency reliability</li> <li>Outstanding quality and circuit</li> <li>Reduces the need for a snubber</li> </ul>  |
|  |  | Synchronous-rectification MOSFET   | OptiMOS™ 40-100 V<br>StrongIRFET™ 40-100 V   |  |
|  |  | Or-ing MOSFET                      | OptiMOS™ 25-30 V<br>StrongIRFET™ 25-30 V   |  |
|  |  | Active snubber                     | OptiMOS™ power MOSFET 60 V/100 V/150 V   |  |
|  | Gate-driver ICs  | Primary side                       | EiceDRIVER™ 2EDF7275K  | <ul style="list-style-type: none"> <li>Functional isolation up to 650 V<sub>DC</sub> channel-to-channel isolation</li> <li>Compact solution available in LGA-13 5x5 mm package</li> </ul>  |
|  |  |                                    | EiceDRIVER™ 2EDL811x/2EDL801x  | <ul style="list-style-type: none"> <li>Functional isolation up to 650 V<sub>DC</sub> channel-to-channel isolation</li> <li>Compact solution available in LGA-13 5x5 mm package</li> </ul>  |
|  |  | Synchronous rectification          | EiceDRIVER™ 2EDF7275K  | <ul style="list-style-type: none"> <li>Functional isolation up to 650 V<sub>DC</sub> channel-to-channel isolation</li> <li>Compact solution available in LGA-13 5x5 mm package</li> </ul>  |
|  |  |                                    | EiceDRIVER™ 2EDL811x/2EDL801x  | <ul style="list-style-type: none"> <li>Level-shift half-bridge gate driver up to 120 V isolation</li> </ul>  |
|  |  |                                    | Low side: EiceDRIVER™ 2EDN75xx/2EDN85xx, 1EDN751x/1EDN851x                               | <ul style="list-style-type: none"> <li>5 A Source and Sink driver capability for 2EDN</li> <li>8 A sink and 4 A source driver capability for 1EDN and GaN switching</li> <li>17/19 ns propagation delay precision for fast MOSFET (-)10 V input robustness</li> </ul>  |
| EiceDRIVER™ level-shift: IRS2186S, IRS21864S |  |                                    | <ul style="list-style-type: none"> <li>4 A/4 A high- and low-side gate driver</li> </ul> |  |
| EiceDRIVER™ low side: 2ED24427N01F           | <ul style="list-style-type: none"> <li>Dual-channel, 10 A low-side gate driver in PG-DSO-8 package with power-pad UVLO and Enable (EN), high frequency, high power operation with BOM savings</li> </ul> |                                    |  |  |
| Digital Isolator                             | Isolators  | Isolators                          | ISOFACE™ Digital Isolators   | <ul style="list-style-type: none"> <li>2/4-channel digital isolators</li> <li>Max. supply voltage: 6.5 V</li> <li>Benchmark highest CMTI: 100 kV/us min.</li> <li>CMOS and TTL input thresholds Wide operating temperature range</li> <li>Low power consumption</li> <li>Accurate timing performance</li> </ul>  |

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Industrial  
SMPS

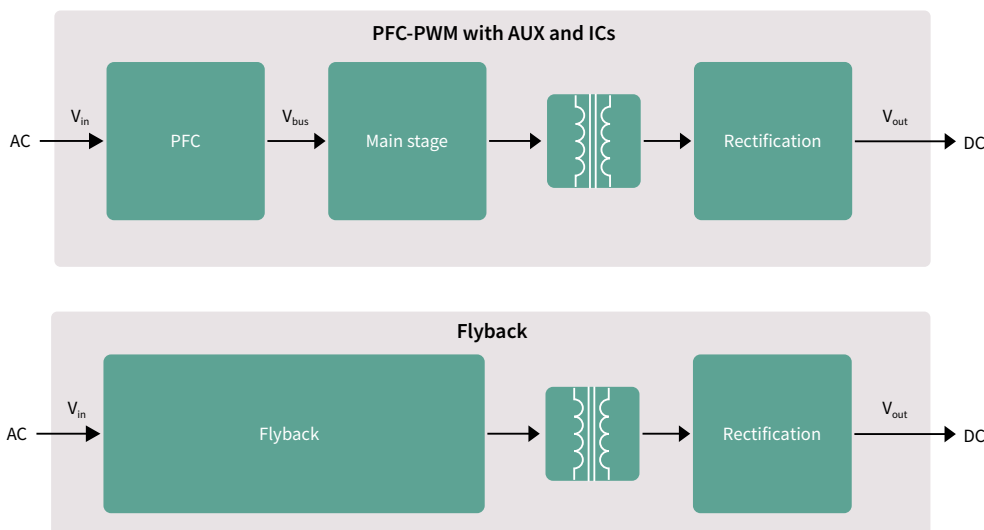
# Industrial SMPS

## Reliable and robust

Industrial SMPS powers a wide range of devices from industrial automation robots to medical equipment and vending machines. With the expansion of the Internet of Things (IoT) and the adoption of Industry 4.0, the demand for industrial SMPS is on the rise. Industrial switch-mode power supplies (SMPS) are mostly operated in outdoor environments without air conditioning or systems without fans. Such operating conditions make reliability and robustness the key requirements for the industrial SMPS, especially when it comes to high-temperature operations, outdoor use, line surges, load jumps, short circuit, and so on. In addition to quality, reliable supply and long-term product availability are also some of the key customer concerns. Industrial SMPS life cycle goes beyond 10 years and it takes 3 to 5 years to ramp. Hence, not only do customers need high-quality products, but also stable and reliable supply over the industrial SMPS life cycle (10 to 20 years).

Infineon meets all of these requirements with its **CoolMOS™**, **OptiMOS™**, **StrongIRFET™** and **EiceDRIVER™** gate-driver product families. Infineon's products offer the best price/performance ratio along with the highest efficiency and reliability. For new designs, we recommend our **CoolMOS™ P7** 600 V/800 V/950 V parts, as well as the latest generation of **OptiMOS™ 30 V/40 V/60 V/80 V/100 V/150 V** and 250 V products. For high-power designs with convection cooling and high power supplies, our **CoolMOS™ S7** in active bridge configuration will reduce the power losses to enable fanless operation. In addition, the **ISOFACE™** digital isolators, based on the Infineon's coreless transformer (CT) technology, provide robust galvanic isolation for safety requirements.

### Application diagrams



Product portfolio

| Functional block                             | Product category        | Topology                   | Technology  | Benefits  |
|--|-------------------------|----------------------------|---|---|
| PFC/Main stage                               | High-voltage MOSFETs    | CrCM/DCM PFC               | 600 V/800 V/950 V CoolMOS™ P7                         | Best thermal performance<br>Rugged body diode<br>ESD enhancement for production line<br>Wide R <sub>DS(on)</sub> portfolio including both THD and SMD packages  |
|  |                         |                            | 600 V CoolMOS™ P6                                     | Fast-switching speed for improved efficiency and thermals<br>Low gate charge for enhanced light-load efficiency and low power consumption at no load condition<br>Optimized V <sub>GS</sub> threshold for low turn-off losses |
|  |                         |                            | 600 V CoolMOS™ S7                                     | PFC efficiency boost ~1%<br>Lowest R <sub>DS(on)</sub> in SMD packages  |
|  | High-voltage SiC MOSFET | Totem-pole PFC             | CoolSiC™ 650 V  | Highest power handling<br>Best thermal capability   |
|  | Boost diodes            | DCM PFC                    | 650 V EC7   | Improved diode softness and humidity rugged. Allows a more reliable design with lower failure rates   |
|  |                         | CCM PFC                    | 650 V EC7   |   |
|  | Control ICs             | CCM PFC ICs                | ICE3PCS0xG  | High PFC and low THD  |
| Main stage                                   | Control ICs             | HB LLC ICs                 | 650 V – ICE1HS01G-1/ICE2HS01G                         | High efficiency and low EMI   |
| Synchronous rectification                    | Medium-voltage diodes   | HB LLC + center-tap        | OptiMOS™ 30 V/40 V/60 V/80 V/150 V/250 V              | Optimized cost/performance and low thermals   |
| PFC/Main stage/<br>Synchronous rectification | Gate driver ICs         | Boost PFC                  | EiceDRIVER™ low side:<br>1ED44173N01B                 | Single-channel with fast, accurate (± 5%), integrated over-current protection (OCP)   |
|  |                         | Totem-pole PFC/<br>HB LLC  | EiceDRIVER™ Compact:<br>1EDI60N12AF, 1ED3124MU12F     | Isolated gate driver, up to 14 A, 100 ns propagation delay  |
|  |                         |                            | EiceDRIVER™ level-shift:<br>2ED2181S06F, 2ED21814S06J | 650 V half-bridge SOI driver with integrated bootstrap diode<br>Superior -VS transient voltage immunity<br>High-frequency switching (500 kHz)   |
|  |                         |                            | EiceDRIVER™ level-shift:<br>IRS2186S, IRS21864S       | 4 A/4 A high- and low-side gate driver  |
|  |                         | Interleaved PFC/<br>HB LLC | EiceDRIVER™ low side:<br>2ED24427N01F                 | Dual-channel, 10 A low-side driver in DSO-8 with power-pad<br>Integrated UVLO protection and enable (EN) function<br>High frequency, high power operation with BOM savings  |
| Flyback                                      | Control ICs             | QR flyback                 | ICE5QSBG  | High efficiency and low standby power   |
|  | High-voltage MOSFET     | Flyback                    | 700 V/800 V CoolMOS™ P7                               | Best price-competitive CoolMOS™ family<br>Lower switching losses versus standard MOSFET<br>Controlled dV/dt and di/dt for better EMI  |
| Auxiliary power supply                       | Control ICs             | QR/FF flyback<br>CoolSET™  | 700 V/800 V<br>ICE5QRxx70/80A(Z)(G)                   | Low standby power, high efficiency and robustness   |
| Isolation                                    | Digital isolator        |                            | 2DIB0410F   | 2+0 digital isolator with TTL input threshold and fail-safe default low output state<br>3 kV <sub>RMS</sub> isolation voltage (UL 1577) in DSO-8 package<br>High common mode transient immunity > 100 kV/μs                   |





PC power

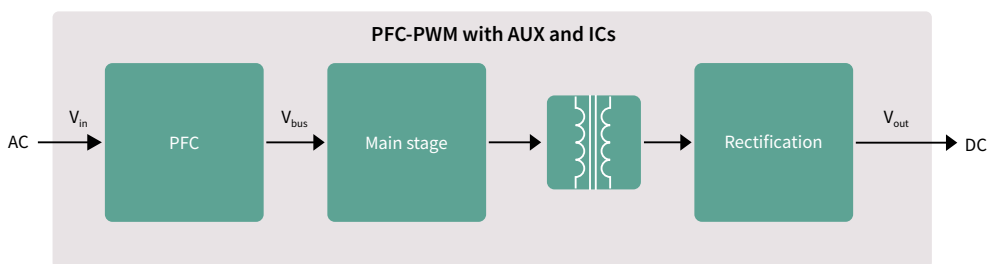
# SMPS

## More efficient PC power supply

The PC power market is divided into high-end gaming PC and better cost-performance sectors to achieve a better price/performance for desktop SMPS. The PC OEMs are implementing the desktop SMPS by removing the AUX power block to save the cost of having a flyback circuit.

Due to the new structure of the CPU and GPU, higher and higher peak power is needed (1.5 to 2 times higher than normal power). In addition to the needed CCM PFC, Infineon 600 V CoolMOS™ P7 and OptiMOS™ 40 V/60 V offer the best price/performance and reliability to meet the design requirements, as well as to achieve the highest efficiency enabled by semiconductors available in the market.

For CPU and GPU power-hungry gaming PCs, the ICE3PCS0xG CCM PFC IC provides high efficiency over the whole load range and low count of external components, besides that, the ICE3PCS0xG CCM PFC IC offers fast output dynamic response during load jump. In addition to PGFC IC, Infineon's LLC IC ICE2HS01G support customers to minimize the external component count.



### Recommended products

| Functional block          | Product category      | Topology            | Technology                    | Benefits  |
|---------------------------|-----------------------|---------------------|-------------------------------|---|
| PFC/main stage            | High voltage MOSFETs  | CrCM/DCM PFC        | 600 V CoolMOS™ P7             | Best thermal performance<br>Rugged body diode<br>ESD enhancement for production line<br>Wide R <sub>DS(on)</sub> portfolio including both THD and SMD packages  |
|                           |                       |                     | 600 V CoolMOS™ P6             | Fast switching speed for improved efficiency and thermals<br>Low gate charge for enhanced light-load efficiency and low power consumption at no load condition<br>Optimized V <sub>GS</sub> threshold for low turn-off losses |
|                           |                       |                     | 500 V CoolMOS™ CE             | Optimized cost/performance<br>Lower transition losses versus standard MOSFET  |
|                           | Boost diodes          | DCM PFC             | 650 V EC7                     | Improved diode softness and humidity rugged. Allows a more reliable design with lower failure rates   |
|                           |                       |                     | CCM/interleaved PFC           | CoolSiC™ Schottky diode<br>650 V G6   |
| Control ICs               | CCM PFC ICs           | ICE3PCS0xG          | High PFC and low THD          |   |
| Main stage                | Control ICs           | HB LLC ICs          | 650 V – ICE1HS01G-1/ICE2HS01G | High efficiency and low EMI   |
| Synchronous rectification | Medium voltage diodes | HB LLC + center-tap | OptiMOS™ 40 V                 | Optimized cost/performance and low thermals   |
|                           |                       |                     | OptiMOS™ 60 V                 | Layout tolerance and low thermals   |





# SMPS

## Diversify TV power supply with cost, performance, and ease of use

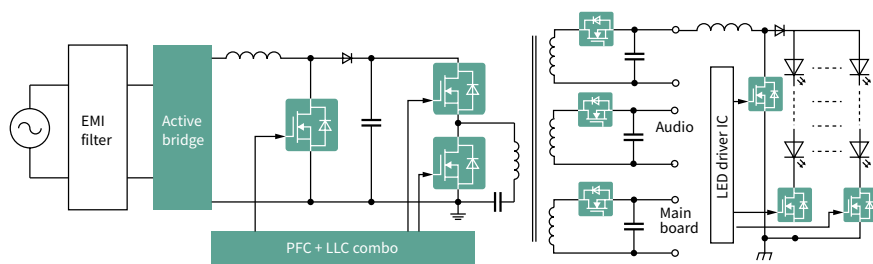
In addition to their outstanding image quality, new generation TVs gain attention for their user interface, low power consumption and slim design. This requires the power supply unit (PSU) either to keep a low profile to maintain the slim appearance of a TV and a low thermal dissipation image or to have an external adapter. In addition, a growing number of TV manufacturers use external adapters to deliver DC power to the TV. Infineon products based on digital power technology have been designed to meet the challenges of efficiency and standby power requirements for the IoT-enabled TVs (both embedded PSU and adapter).

Thanks to digital power, our customers can reduce the number of TV power supplies by easily and flexibly adapting the digital IC parameters to different TV and screen models. Infineon's digital-based flyback controllers are ideal for low-power adapters for TVs and monitors. With digital soft switching, the adapter power density can significantly be improved.

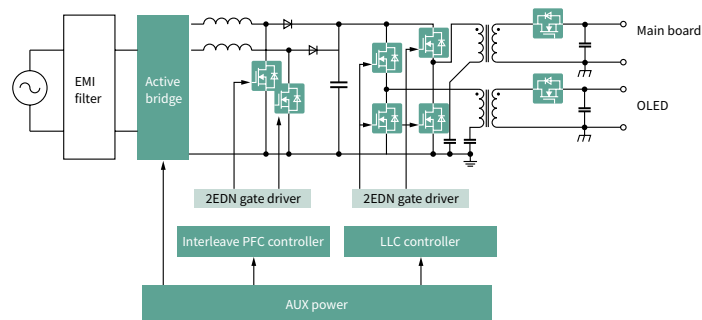
The 600 V CoolMOS™ P7 power MOSFET series has been developed to cover a broad spectrum of different applications where excellent performance and perfect ease of use are required. The rugged body diode enables the use of hard-switching topologies, such as power factor correction (PFC), boost, and two-transistor forward (TTF) and resonant topologies such as LLC, where the technologies lead to high efficiency in both hard-switching and resonant circuits.

For higher on-state resistance ( $R_{DS(on)}$ ) classes, a new feature of an integrated ESD diode helps to improve the quality in manufacturing. At the same time, the low  $R_{DS(on)}$  and gate charge ( $Q_G$ ) enable high efficiency in the various topologies. The 600 V CoolMOS™ P7 with a wide variety of  $R_{DS(on)}$  and packages on consumer-grade for TV power. Infineon developed a family of packages specifically for TV power supplies, characterized by short lead, SOT-223 mold stopper, and wide creepage distance, which enable low-cost and reliable manufacturing for our customers.

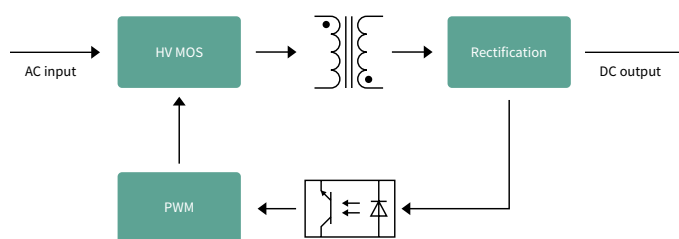
### Non-AUX digital solution for large screen size



### High-power solution for larger screen size



### Flyback solution for small screen size

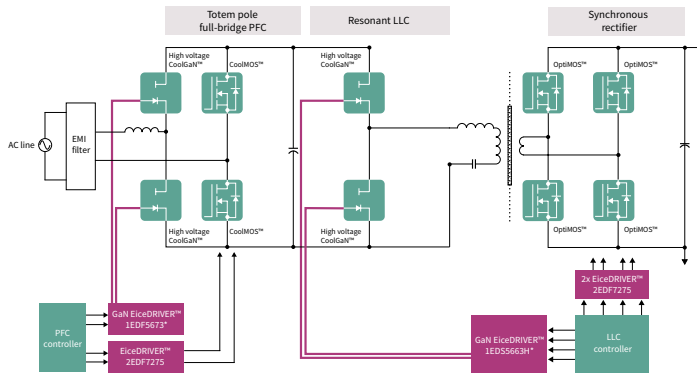


[www.infineon.com/smps](http://www.infineon.com/smps)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



### High-power solution for larger screen size



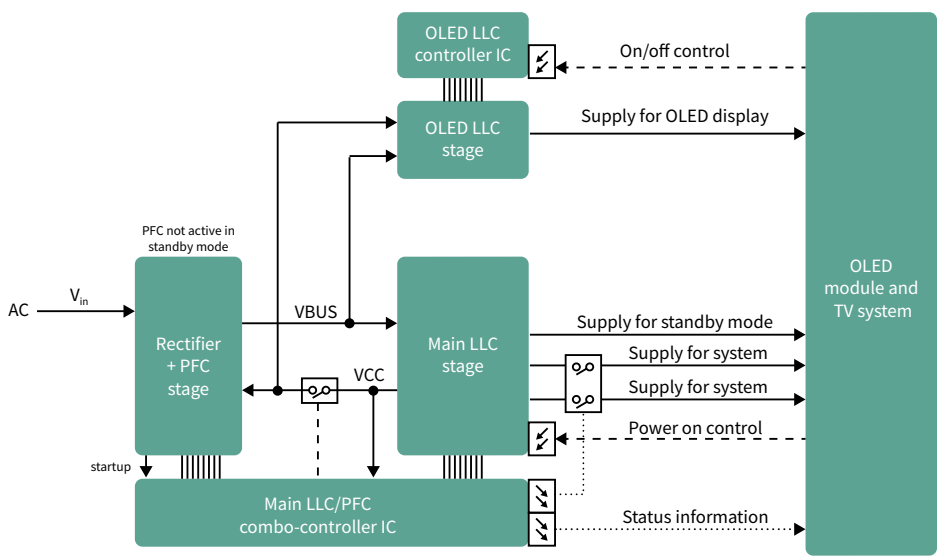
### Recommended products

| Functional block             | Product category             | Topology                     | Product family  | Benefits   |
|------------------------------|------------------------------|------------------------------|---|--|
| Main stage/PFC combo non-AUX | High-voltage MOSFETs         | Active bridge                | 600 V CoolMOS™ S7                                     | <ul style="list-style-type: none"> <li>Body diode robustness at AC line commutation</li> <li>Improved thermal resistance</li> <li>Absolute lowest <math>R_{DS(on)}</math> in the market</li> <li>Enables top-side cooling with DDPAK and QPAK</li> <li>Ideal fit for solid-state and hybrid relays and circuit breakers</li> </ul>     |
|                              |                              | Active bridge DCM PFC HB LLC | 600 V CoolMOS™ P7                                     | <ul style="list-style-type: none"> <li>Fast-switching speed for improved efficiency</li> <li>Low gate charge for enhanced light-load efficiency and low power consumption at no-load condition</li> <li>Optimized <math>V_{GS}</math> threshold for lower turn-off losses</li> <li>Rugged body diode for HB LLC application</li> </ul> |
|                              |                              | DCM PFC, HB LLC              | 600 V CoolMOS™ PFD7                                   | <ul style="list-style-type: none"> <li>Robustness and reliability with integrated robust, fast body diode and up to 2 kV ESD protection in gate</li> <li>Reduced gate charge for enhanced light-load efficiency, and lower hysteresis loss</li> </ul>  |
|                              | Gate-driver IC               | HB LLC                       | EiceDRIVER™ level-shift: 2ED2181S06F, 2ED21814S06J    | <ul style="list-style-type: none"> <li>650 V half-bridge SOI driver with integrated bootstrap diode</li> <li>High-frequency switching (500 kHz)</li> </ul>   |
|                              | Control ICs                  | IDP2308                      | PFC-LLC non-AUX digital IC for TV embedded PSU        | <ul style="list-style-type: none"> <li>Low BOM count/system cost due to high integration</li> <li>Low standby power</li> <li>High system reliability</li> <li>Shorter development cycles and higher design and production flexibility</li> </ul>   |
|                              |                              | IDP2303A                     | PFC-LLC non-AUX digital IC for TV adapter             | <ul style="list-style-type: none"> <li>Low BOM count/system cost due to high integration</li> <li>Low standby power</li> <li>Small form factor designs</li> <li>High system reliability</li> </ul>   |
| Synchronous rectification    | Low-voltage MOSFETs          | Synchronous rectification    | OptiMOS™ 5 100-150 V StrongIRFET™ 2 100 V             | <ul style="list-style-type: none"> <li>Low conduction losses, reduced overshoot</li> <li>FullPAK package available</li> </ul>  |
| PFC                          | Boost diodes                 | DCM PFC                      | 650 V Rapid diode                                     | <ul style="list-style-type: none"> <li>Low conduction losses</li> </ul>  |
|                              | Control ICs                  | CCM PFC ICs                  | ICE3PCS0xG  | <ul style="list-style-type: none"> <li>High PFC and low THD</li> </ul>   |
|                              | WBG                          | PFC                          | CoolGaN™ 600 V e-mode HEMTs                           | <ul style="list-style-type: none"> <li>Highest efficiency contribution via less parasitic parameter</li> <li>Space saving with SMD smaller package</li> </ul>  |
|                              | Gate-driver IC               | PFC                          | 1ED44173N01B  | <ul style="list-style-type: none"> <li>Single-channel with fast, accurate (<math>\pm 5\%</math>), integrated over-current protection (OCP)</li> </ul>  |
| High voltage MOSFETs         | Active bridge DCM PFC HB LLC |                              | 600 V CoolMOS™  | <ul style="list-style-type: none"> <li>Fast switching speed for improved efficiency</li> <li>Low gate charge for enhanced light load efficiency and low power consumption at no-load condition</li> <li>Optimized <math>V_{GS}</math> threshold for lower turn-off losses</li> <li>Rugged body diode for HB LLC application</li> </ul> |
| Main stage                   | Control ICs                  | HB LLC ICs                   | ICE1HS01G-1/ICE2HS01G                                 | <ul style="list-style-type: none"> <li>High efficiency and low EMI</li> </ul>  |
|                              | WBG                          | HB LLC                       | CoolGaN™ 600 V Integrated Power Stage                 | <ul style="list-style-type: none"> <li>Highest efficiency, highest power density</li> <li>High reliability</li> <li>Isolated gate driver integrated</li> </ul>   |
|                              | High-voltage MOSFETs         | HB LLC                       | 600 V CoolMOS™ P7                                     | <ul style="list-style-type: none"> <li>Fast-switching speed for improved efficiency</li> <li>Low gate charge for enhanced light-load efficiency and low power consumption at no-load condition</li> <li>Optimized <math>V_{GS}</math> threshold for lower turn-off losses</li> <li>Rugged body diode for HB LLC application</li> </ul> |
| Auxiliary power supply       | Control ICs                  | QR/FF flyback CoolSET™       | QR CoolSET™ - ICE5QRxx80BG FF CoolSET™ - ICE5xRxxxxXX | <ul style="list-style-type: none"> <li>Low standby power, high efficiency and robustness</li> </ul>  |
| Flyback                      | Control ICs                  | QR flyback                   | ICE2QS03G   | <ul style="list-style-type: none"> <li>Forced resonant ZVS control reduces the switching loss</li> <li>Multilevel protection enables the robust design</li> <li>Flexible firmware provides more differentiation for OEMs</li> </ul>  |
|                              | High-voltage MOSFETs         | Flyback                      | 700 V CoolMOS™ P7                                     | <ul style="list-style-type: none"> <li>Optimized for flyback topologies</li> <li>Best price competitive CoolMOS™ SJ MOSFET family</li> <li>Lower switching losses versus standard MOSFET</li> <li>Controlled <math>dV/dt</math> and <math>dI/dt</math> for better EMI</li> </ul>   |





### OLED TV power block diagram



OLED TVs improve user experience as they can be thinner, lighter, more flexible and consume less power than LCD/LED TVs.





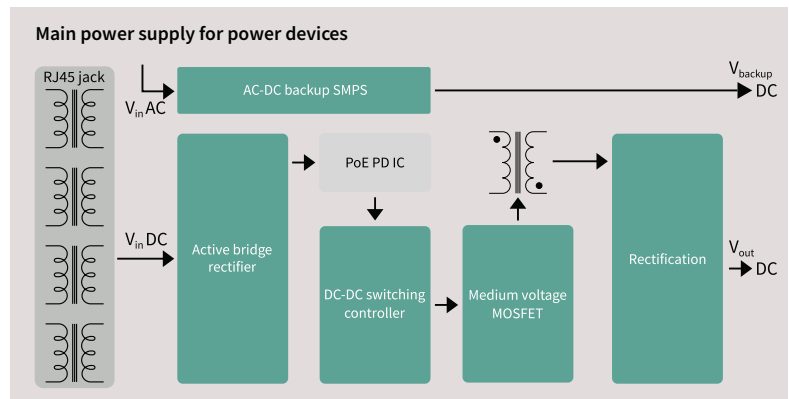
# Power over Ethernet (PoE)

## Designing reliable and power-efficient PoE power supplies

The latest IEEE 802.3bt standard for Power over Ethernet (PoE) not only increased the available power via PoE but also changed requirements for its power supply. Power sourcing equipment (PSE) now provides up to 100 W per port via a twisted pair of Ethernet cabling, whereas powered devices (PD) have up to 71 W available. Adopting this new PoE standard also largely depends on the capability to increase the power density on the PSE side while maintaining the same form factor as wide load conditions and higher power budgets change requirements. Infineon has long-standing expertise in switched-mode power supply (SMPS) designs and offers a highly reliable, rugged and efficient high-quality MOSFET portfolio for your PoE PSE and PD designs.

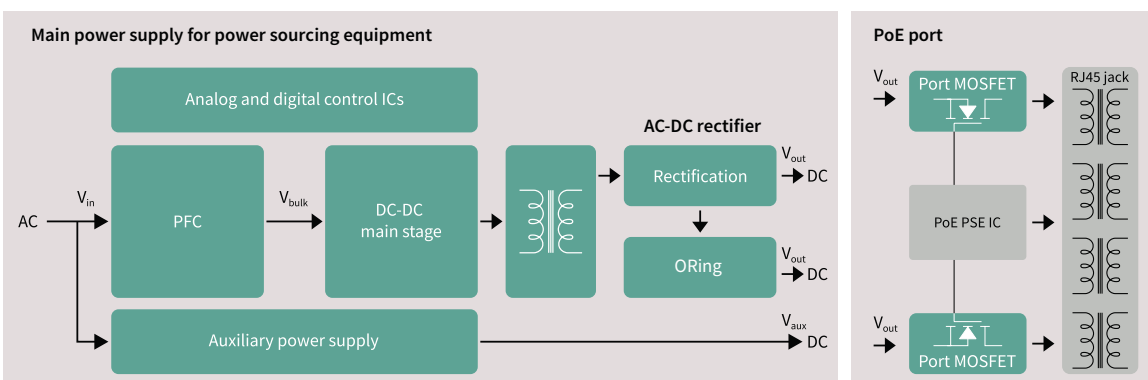
### Powered devices

Powered devices (PD) include devices powered by PoE such as wireless access points, 5G small-cell radio units, IP cameras, conference systems, thin clients or public address systems. DC-DC SMPS designs need to be power efficient to maximize the available power for the PD itself with the simultaneous increase of power density. Moreover, PDs need to function reliably in the field, even under potentially rough conditions for a long time.



### Power sourcing equipment

Power sourcing equipment (PSE) is any equipment that is able to provide and source power on the twisted pair Ethernet cable, such as PoE switches, PoE extenders and PoE injectors. PSE needs to be highly reliable to prevent device failure and ensure uninterrupted operations of connected power devices. With IEEE 802.3bt PoE, the power demand for PoE switches significantly increases with highest efficiency over wide load conditions. For example, to fully enable a switch with twenty-four 802.3bt compliant PoE ports, up to 2.4 kW of available PoE power budget is required. Fulfilling these requirements makes modifications in AC-DC SMPS designs necessary.





### Recommended product portfolio for power sourcing equipment

| Functional block              | Product category   | Topology                                    | Product family  | Benefits  |
|-------------------------------|--|---|---|---|
| PFC                           | High-voltage MOSFETs   | DCM, CrCM, CCM,                             | 600 V/650 V CoolMOS™ C7<br>600 V CoolMOS™ P7                                      | <ul style="list-style-type: none"> <li>Best FOM <math>R_{DS(on)} \times Q_G</math> and <math>R_{DS(on)} \times E_{oss}</math></li> <li>Lowest <math>R_{DS(on)}</math> per package</li> <li>Lowest dependency of switching losses from <math>R_{g,ext}</math></li> <li>Low turn-off losses, low <math>Q_{oss}</math> and low <math>Q_G</math></li> </ul> |
|                               | Control ICs  | DCM, CrCM, CCM                              | ICE3PCS0xG  | <ul style="list-style-type: none"> <li>Simple external circuitry</li> <li>High PFC and low THD</li> </ul>   |
|                               | High-voltage GaN   | CCM totem-pole                              | CoolGaN™ GIT HEMT 600 V   | <ul style="list-style-type: none"> <li>Highest efficiency and highest power density</li> </ul>  |
|                               | GaN driver ICs   | CCM totem-pole                              | EiceDRIVER™ 1EDF5673Fx/1EDS5663H  | <ul style="list-style-type: none"> <li>Low driving impedance (on-resistance 0.85 Ω source, 0.35 Ω sink)</li> <li>Input-output propagation delay accuracy: ± 5 ns</li> <li>Functional and reinforced isolation available</li> </ul>  |
|                               | SiC Schottky diode   | DCM, CrCM, CCM                              | CoolSiC™ Schottky diode 650 V G5/G6   | <ul style="list-style-type: none"> <li>Low FOM <math>V_F \times Q_C</math></li> </ul>   |
|                               | Silicon power diode  | DCM, CrCM, CCM                              | 650 V EC7   | <ul style="list-style-type: none"> <li>Improved diode softness and humidity rugged. Allows a more reliable design with lower failure rates</li> </ul>   |
| DC-DC main stage              | High-voltage MOSFETs   | Flyback (ACF), HB LLC, FB LLC, ITTF, ZVS    | 600 V CoolMOS™ P7/C7/CFD7<br>650 V TRENCHSTOP™ F5                                 | <ul style="list-style-type: none"> <li>Best FOM <math>R_{DS(on)} \times Q_G</math> and <math>R_{DS(on)} \times E_{oss}</math></li> <li>Lowest <math>R_{DS(on)}</math> per package</li> <li>Lowest dependency of switching losses from <math>R_{g,ext}</math></li> <li>Low turn-off losses, low <math>Q_{oss}</math> and low <math>Q_G</math></li> </ul> |
|                               | Low- and medium-voltage MOSFETs                                | Isolated DC-DC primary-side PWM             | OptiMOS™ 60 V-200 V<br>StrongIRFET™ 60 V-200 V<br>Small-signal MOSFETs 60 V-200 V | <ul style="list-style-type: none"> <li>Industry's lowest <math>R_{DS(on)}</math> and power density</li> <li>Highest system efficiency</li> <li>Outstanding quality and reliability</li> <li>Reduces the need for a snubber circuit</li> </ul>   |
|                               | Gate-driver ICs  | -   | EiceDRIVER™ 1EDNx/1EDI/2EDN7x/2EDLx/2EDFx/2EDSx                                   | <ul style="list-style-type: none"> <li>Broadest portfolio in terms of isolation, channels, and protection</li> </ul>  |
|                               | Control ICs  | HB LLC PWM-QF<br>PWM-FF                     | ICE2HS01G ICE2QS03G/ICE5QSBG<br>ICE5ASAG/ICE5GSAG                                 | <ul style="list-style-type: none"> <li>High efficiency and low EMI</li> </ul>   |
|                               | High-voltage GaN   | Flyback (ACF), HB LLC, FB LLC, ZVS          | CoolGaN™ GIT HEMT 600 V   | <ul style="list-style-type: none"> <li>Highest efficiency and highest power density</li> </ul>  |
|                               | GaN driver ICs   | -   | EiceDRIVER™ 1EDF5673Fx/1EDS5663H  | <ul style="list-style-type: none"> <li>Low driving impedance (on-resistance 0.85 Ω source, 0.35 Ω sink)</li> <li>Input-output propagation delay accuracy: ± 5 ns</li> <li>Functional and reinforced isolation available</li> </ul>  |
| PFC-main stage combo          | High-voltage MOSFETs   | HB LLC                                      | 600 V CoolMOS™ P7   | <ul style="list-style-type: none"> <li>Low turn-off losses, low <math>Q_{oss}</math> and low <math>Q_G</math> and thermals</li> <li>Fast-switching speed for improved efficiency</li> </ul>   |
| Synchronous rectification     | Low- and medium-voltage MOSFETs                                | Synchronous rectification                   | OptiMOS™ 100 V-150 V<br>OptiMOS™ 40 V-120 V<br>StrongIRFET™ 40 V-100 V            | <ul style="list-style-type: none"> <li>Industry's lowest <math>R_{DS(on)}</math> and power density</li> <li>Highest system efficiency</li> <li>Outstanding quality and reliability</li> <li>Reduces the need for a snubber circuit</li> </ul>   |
|                               | Gate-driver ICs  | -   | EiceDRIVER™ 1EDNx/1EDI/2EDN7x/2EDLx/2EDFx/2EDSx                                   | <ul style="list-style-type: none"> <li>Broadest portfolio in terms of isolation, channels, and protection</li> </ul>  |
| Oring                         | Low- and medium-voltage MOSFETs                                | ORing MOSFETs                               | OptiMOS™ 25 V-200 V   | <ul style="list-style-type: none"> <li>Industry's lowest FOM (<math>R_{DS(on)} \times Q_G</math>)</li> <li>Highest system efficiency and power density</li> </ul>   |
| Auxiliary power supply        | AC-DC integrated power stage                                   | Fixed-frequency (FF)<br>Quasi-resonant (QR) | CoolSET™ ICE5Rxx80AG CoolSET™ ICE5QRxx80BG  | <ul style="list-style-type: none"> <li>Quasi-resonant switching operation for high efficiency and low EMI signature</li> <li>Fixed-frequency switching operation for ease of design</li> </ul>  |
| Analog and digital control IC | 32-bit XMC™ industrial microcontroller based on Arm® Cortex®-M | -   | 32-bit XMC1000 32-bit XMC4000   | <ul style="list-style-type: none"> <li>Flexibility, HR PWM, digital communication</li> <li>Arm® based standard MCU family and wide family</li> </ul>  |
| Port MOSFET                   | Medium-voltage MOSFETs   | -   | OptiMOS™ 100 V<br>OptiMOS™ Linear FET<br>StrongIRFET™ 100 V                       | <ul style="list-style-type: none"> <li>Wide SOA and outstanding reliability for PoE ports</li> <li>Low <math>R_{DS(on)}</math></li> <li>Space-saving 3.3 x 3.3 S308/PQFN package</li> </ul>   |

### Recommended product portfolio for powered devices

| Functional block          | Product category                | Topology  | Product family   | Benefits  |
|---------------------------|---------------------------------|---|--|---|
| Active bridge rectifier   | Medium-voltage MOSFETs          | Active bridge rectifier                         | OptiMOS™ 100 V-150 V<br>StrongIRFET™ 100 V   | <ul style="list-style-type: none"> <li>Industry's lowest <math>R_{DS(on)}</math></li> <li>Highest system efficiency and power density</li> </ul>  |
| Synchronous rectification | Low- and medium-voltage MOSFETs | Synchronous rectification                       | OptiMOS™ 25 V-100 V<br>OptiMOS™ 40 V<br>IR MOSFET™ 20 V-100 V  | <ul style="list-style-type: none"> <li>Industry's lowest <math>R_{DS(on)}</math> and power density</li> <li>Highest system efficiency</li> <li>Outstanding quality and reliability</li> </ul>   |
| DC-DC switching stage     | Medium-voltage MOSFETs          | Flyback (ACF)                                   | OptiMOS™ 100 V-150 V   | <ul style="list-style-type: none"> <li>Low conduction losses, reduced overshoot</li> <li>Logic level switching</li> </ul>   |
| AC-DC backup SMPS         | High-voltage MOSFETs            | Flyback (ACF)                                   | 600 V to 950 V CoolMOS™ P7   | <ul style="list-style-type: none"> <li>Fast-switching speed for improved efficiency and thermals</li> <li>Reduced gate charge for enhanced light load efficiency</li> <li>Optimized gate-to-source voltage (<math>V_{GS}</math>) threshold for lower turn-off losses</li> </ul> |
|                           | AC-DC integrated power stage    | Fixed-frequency (FF)<br><br>Quasi-resonant (QR) | CoolSET™ 800 V ICE5GRxx80AG,<br>800 V ICE5ARxx80BZS,<br>700 V ICE5ARxx70AG,<br>700 V ICE5ARxx70BZS<br>CoolSET™ 700 V ICE5QRxx70A(Z) (G),<br>800 V ICE5QRxx80A(Z)(G),<br>800 V ICE5QRxx80BG | <ul style="list-style-type: none"> <li>Quasi-resonant switching operation for high efficiency and low EMI signature operation for ease of design</li> <li>Fixed-frequency switching</li> </ul>  |





EV charger

# Fast/wireless EV-charging

## Advanced solutions for DC EV-charging

As e-mobility increasingly becomes part of daily life, there is a growing need for more efficient charging solutions. Fast electric vehicle (EV) charging stations equipped with powerful DC chargers are the answer. DC EV-chargers are an attractive choice because they allow much faster charging than the standard AC EV ones that many EV owners have at home. Today, a DC charger with 150 kW can put a 200 km charge on an EV in around 15 minutes. As fast charging and battery technologies continue to evolve and improve in the near future, experts anticipate the charging time to drop even further.

As a market leader and the global front-runner in power electronics, Infineon enables you to bring energy-efficient DC EV-charger designs to life, with our highly efficient components and in-depth technical support. We cover power ranges from kilowatts to megawatts in our broad portfolio of high-quality power semiconductors, microcontrollers, gate drivers, security, safety, and authentication solutions. Our CoolMOST™ and CoolSiC™ MOSFETs, together with EiceDRIVER™ gate drivers, for example, are ideal in a wide range of DC EV-charging designs. Their matchless advantages include high-frequency operation, high power density and reduced switching losses, allowing you to reach high efficiency levels in any battery charging system.

### Infineon offering and customer benefits

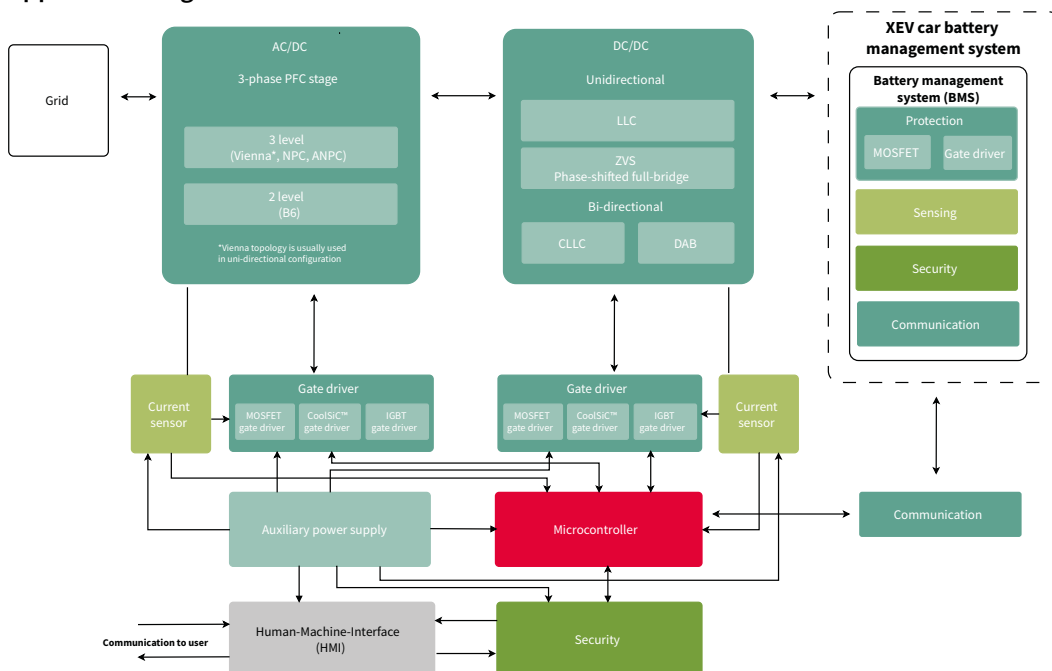
#### Infineon offering

- CoolMOST™ and CoolSiC™ discrete and power module semiconductor solutions
- EiceDRIVER™ gate driver and XMC™ microcontroller
- XENSIV™ magnetic current sensor
- OPTIGA™
- Power supply ICs (LDO, DC-DC)
- Communication (CAN transceiver)

#### Customer benefits

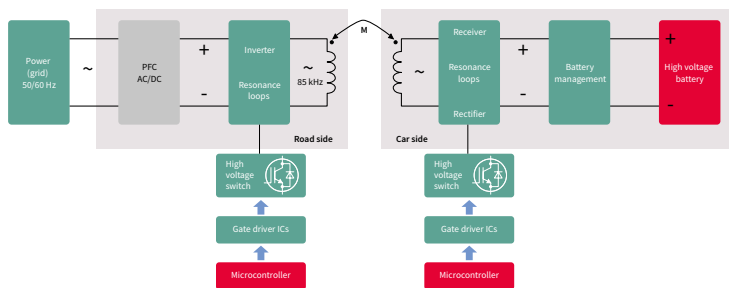
- Highly efficient power conversion for reducing system size by up to 50 percent and reduced cooling efforts
- Scalability across various platforms for upgrading system power charger levels on demand
- Safe drive, advanced protection and ease of control
- Bidirectional high precision current sensing
- Identity protection against fake devices and protection against the manipulation of the data
- Robust quality and easy to use implementation shorten time to market and guarantee long operation

### Application diagram



## Wireless EV-charging

Wireless methods for power transfer to charge the batteries of electric vehicles are gaining attention. Several concepts for wireless power transfer systems have been proposed, which in general seek to compensate the significant stray inductances on primary and secondary sides of the magnetic couplers by adaptive resonant methods. At the end of 2013, SAE announced a new standard for inductive charging which defined three power levels at 85 kHz. Infineon's CoolMOS™ CFD7, C7, and P7 series along with TRENCHSTOP™ 5 IGBTs, CoolSiC™ diodes, and EiceDRIVER™ gate-driver ICs are perfectly suited for driving inductive power transfer systems on the road side which operate inside the 80 to 90 kHz band.



### Infineon's solution recommendation for DC EV-charging system blocks

Our solutions have been designed for harsh environmental conditions and long lifetime thanks to Infineon's deep understanding of quality requirements. Take the next step by exploring our product portfolio for DC EV-charging systems.

#### PFC stage (3-phase input)

| Product category                        | Product family  | Product                             | Additional information             |
|---|---|-------------------------------------|------------------------------------|
| High-voltage MOSFET/<br>SiC MOSFET/IGBT | 650 V CoolMOS™ C7   | IPW65R019C7                         | 650 V, 19 mΩ, TO-247               |
|   | 600 V CoolMOS™ C7   | IPW60R017C7                         | 600 V, 17 mΩ, TO-247               |
|   | 600 V CoolMOS™ P7   | IPW60R024P7                         | 600 V, 24 mΩ, TO-247               |
|   |   | IPW60R037P7                         | 600 V, 37 mΩ, TO-247               |
|   | CoolSiC™ MOSFET 650 V   | IMW65R027M1H                        | 650 V, 27 mΩ, TO-247-3             |
|   |   | IMZ65R027M1H                        | 650 V, 27 mΩ, TO-247-4             |
|   |   | IMWA65R027M1H                       | 650 V, 48 mΩ, TO-247-3             |
|   |   | IMZA65R027M1H                       | 650 V, 48 mΩ, TO-247-4             |
|   | 650V TRENCHSTOP™ 7 H7   | IKZA50N65EH7                        | 650 V, 50 A, TO-247-3/4            |
|   |   | IKZA75N65EH7                        | 650 V, 75 A, TO-247-3/4            |
|   | EasyPACK™ hybrid module 650 V HighSpeed IGBT H3                                 | FS3L50R07W2H3F_B11                  | 650 V, 50 A, Easy 2B, three-level  |
|   | EasyPACK™ hybrid module with 650 V TRENCHSTOP™ 5 H5                             | FS3L40R07W2H5F_B11                  | 650 V, 40 A, Easy 2B, three-level  |
|   |   | FS3L40R07W2H5F_B67                  | 650 V, 40 A, Easy 2B, three-level  |
|   |   | F3L200R07W2S5FP_B55                 | 650 V, 200 A, Easy 2B, three-level |
|   | EasyPACK™ hybrid module with 650 V TRENCHSTOP™ 5 H5 and CoolSiC™ Schottky diode | F3L200R07W2S5FP_B56                 | 650 V, 200 A, Easy 2B, three-level |
|   |   | F3L200R07W2S5F_B11                  | 650 V, 200 A, Easy 2B, three-level |
|   | EasyPACK™ module with 650 V TRENCHSTOP™ 5 S5                                    | F3L200R07W2S5_B11                   | 650 V, 200 A, Easy 2B, three-level |
|   | CoolSiC™ MOSFET 1200 V  | IMW120R045M1/IMZ120R045M1           | 1200 V, 45 mΩ, TO-247-3/4          |
|   |   | MW120R030M1H/IMZ120R030M1H          | 1200 V, 30 mΩ, TO-247-3/4          |
| EasyPACK™ modules with CoolSiC™ 1200 V  | F3L11MR12W2M1_B74   | 1200 V, 11 mΩ, Easy 2B, ANPC        |                                    |
|   | FF6MR12W2M1(P)_B11*   | 1200 V, 6 mΩ, Easy 2B, half-bridge  |                                    |
|   | FF8MR12W2M1(P)_B11*   | 1200 V, 8 mΩ, Easy 2B, half-bridge  |                                    |
|   | FF11MR12W1M1(P)_B11*  | 1200 V, 11 mΩ, Easy 1B, half-bridge |                                    |
|   | FF23MR12W1M1(P)_B11*  | 1200 V, 23 mΩ, Easy 1B, half-bridge |                                    |
|   | IDW15G120C5B/IDWD15G120C5   | 1200 V, 15 A, TO-247-3/2            |                                    |
|   | IDW20G120C5B/IDWD20G120C5   | 1200 V, 20 A, TO-247-3/2            |                                    |
| SiC diodes                              | CoolSiC™ Schottky diodes 1200 V G5  | IDW30G120C5B/IDWD30G120C5           | 1200 V, 30 A, TO-247-3/2           |



## HV DC-DC main stage

| Product category                          | Product family  | Product                           | Additional information                  |                          |
|---|---|-----------------------------------|---|--------------------------|
| High-voltage MOSFET/<br>SiC MOSFET        | 600 V CoolMOS™ CFD7/CSFD                                  | IPW60R018CFD7                     | 600 V, 18 mΩ, TO-247                    |                          |
|   |   | IPW60R024CFD7                     | 600 V, 24 mΩ, TO-247                    |                          |
|   |   | IPW60R037CSFD                     | 600 V, 37 mΩ, TO-247                    |                          |
|   |   | IPW60R040CFD7                     | 600 V, 40 mΩ, TO-247                    |                          |
|   | 600 V CoolMOS™ C7   | IPW60R040C7                       | 600 V, 40 mΩ, TO-247                    |                          |
|   | 650 V CoolMOS™ CFD7                                       | IPW65R018CFD7/IPZA65R018CFD7      | 650 V, 29 mΩ, TO-247-3/4                |                          |
|   |   | IPW65R029CFD7/IPZA65R029CFD7      | 650 V, 29 mΩ, TO-247-3/4                |                          |
|   |   | IPW65R041CFD7                     | 650 V, 41 mΩ, TO-247                    |                          |
|   | CoolSiC™ MOSFET 650 V                                     | IMW65R027M1H/IMZA65R027M1H        | 650 V, 27 mΩ, TO-247-3/4                |                          |
|   |   | IMW65R048M1H/IMZA65R048M1H        | 650 V, 48 mΩ, TO-247-3/4                |                          |
|   | CoolSiC™ MOSFET 1200 V                                    | IMW120R040M1H/IMZA120R040M1H      | 1200 V, 40 mΩ, TO-247-3/4               |                          |
|   |   | IMW120R030M1H/IMZ120R030M1H       | 1200 V, 30 mΩ, TO-247-3/4               |                          |
|   | EasyPACK™ module with CoolSiC™ 1200 V                     | FF6MR12W2M1(P)_B11*               | 1200 V, 6 mΩ, Easy 2B, half-bridge      |                          |
|   |   | FF8MR12W2M1(P)_B11*               | 1200 V, 8 mΩ, Easy 2B, half-bridge      |                          |
|   |   | FF11MR12W1M1(P)_B11*              | 1200 V, 11 mΩ, Easy 1B, half-bridge     |                          |
|   |   | FF23MR12W1M1(P)_B11*              | 1200 V, 23 mΩ, Easy 1B, half-bridge     |                          |
|   |   | FF45MR12W1M1(P)_B11*              | 1200 V, 45 mΩ, Easy 1B, half-bridge     |                          |
|   |   | F4-45MR12W1M1(P)_B76*             | 1200 V, 45 mΩ, Easy 1B, four-pack       |                          |
|   |   | F4-23MR12W1M1(P)_B76*             | 1200 V, 23 mΩ, Easy 1B, four-pack       |                          |
|   |   | F4-15MR12W2M1(P)_B76*             | 1200 V, 15 mΩ, Easy 2B, four-pack       |                          |
| F4-11MR12W2M1(P)_B76*                     |   | 1200 V, 11 mΩ, Easy 2B, four-pack |   |                          |
| FS45MR12W1M1_B11                          |   | 1200 V, 45 mΩ, Easy 1B, sixpack   |   |                          |
| SiC diodes output<br>rectification diodes |   | CoolSiC™ Schottky diode 1200 V G5 | IDW15G120C5B/IDWD15G120C5               | 1200 V, 15 A, TO-247-3/2 |
|   |   |                                   | IDW20G120C5B/IDWD20G120C5               | 1200 V, 20 A, TO-247-3/2 |
|   | IDW30G120C5B/IDWD30G120C5                                 |                                   | 1200 V, 30 A, TO-247-3/2                |                          |
|   | IDWD40G120C5  |                                   | 1200 V, 40 A in TO-247-2                |                          |
|   | IDW40G120C5B  |                                   | 1200 V, 40 A in TO-247-3                |                          |
|   | EasyBRIDGE™ module with CoolSiC™ Schottky diode 1200 V G5 | DDB2U20N12W1RF(P)_B11*            | 1200 V, 20 A, Easy 1B, rectifier bridge |                          |
|   |   | DDB2U40N12W1RF(P)_B11*            | 1200 V, 40 A, Easy 1B, rectifier bridge |                          |
|   |   | DDB2U60N12W1RF(P)_B11*            | 1200 V, 60 A, Easy 1B, rectifier bridge |                          |
|   | CoolSiC™ Schottky diode 650 V G5                          | IDW10G65C5                        | 650 V, 10 A, TO-247-3                   |                          |
|   |   | IDW12G65C5                        | 650 V, 12 A, TO-247                     |                          |
|   |   | IDW16G65C5                        | 650 V, 16 A, TO-247                     |                          |
|   |   | IDW20G65C5                        | 650 V, 20 A, TO-247                     |                          |
|   |   | IDW20G65C5B                       | 650 V, 10 A, TO-247                     |                          |
|   |   | IDW30G65C5                        | 650 V, 30 A, TO-247                     |                          |
| IDW32G65C5B                               |   | 650 V, 32 A, TO-247               |   |                          |
| IDW40G65C5                                |   | 650 V, 40 A, TO-247               |   |                          |
| CoolSiC™ Schottky diode 650 V G6          | IDH20G65C6  | 650 V, 20 A, TO-220               |   |                          |
|   | IDH16G65C6  | 650 V, 16 A, TO-220 real 2-pin    |   |                          |
|   | IDH12G65C6  | 650 V, 12 A, TO-220 real 2-pin    |   |                          |
|   | IDH10G65C6  | 650 V, 10 A, TO-220 real 2-pin    |   |                          |
|   | IDH08G65C6  | 650 V, 8 A, TO-220 real 2-pin     |   |                          |
|   | IDH06G65C6  | 650 V, 6 A, TO-220 real 2-pin     |   |                          |
|   | IDH04G65C6  | 650 V, 4 A, TO-220 real 2-pin     |   |                          |
|   | IDD16G65C6  | 650 V, 16 A, DDPK                 |   |                          |
|   | IDD12G65C6  | 650 V, 12 A, DDPK                 |   |                          |
| IDD08G65C6                                | 650 V, 8 A, DDPK  |                                   |   |                          |



## Gate driver and galvanic isolation

| Product category                          | Product family                           | Product   | Additional information   |  |
|---|--|---|--|--|
| Gate-driver ICs                           | EiceDRIVER™ (non-isolated)               | 1EDN family, 2EDN family                              | - Single-channel/dual-channel, non-isolated low-side gate driver ICs   |  |
|   |  | 1ED4417xN01B  | - Single-channel with fast, accurate ( $\pm 5\%$ ), integrated overcurrent protection (OCP)  |  |
|   |  | 2ED24427N01F  | - Dual-channel, 10 A low-side gate driver in DSO-8 package with power-pad<br>- Integrated UVLO and enable (EN) function<br>- Suitable for high frequency, high power operation w/BOM savings |  |
|   | EiceDRIVER™ level-shift gate driver      | 2ED2184S06F<br>2ED2110S06M                            |  | - 650 V half-bridge gate driver for IGBTs and MOSFETs with SOI technology<br>- Integrated bootstrap diode<br>- High-frequency switching (500 kHz) and superior - VS transient voltage immunity |
|   |  |   | IRS2186S, IRS21864S  | - 600 V, 4 A high- and low-side gate driver  |
|   |  | IR2214SS, IR2214SS                                    | - 600 V/1200 V half-bridge gate driver with DESAT, 2L SRC, soft-SD   |  |
|   |  | IR2213S   | - 1200 V high- and low-side gate driver  |  |
|   | EiceDRIVER™ 2EDi/S isolated gate driver  | 2EDF7175F, 2EDF7275F                                  | - Dual-channel functional isolated (1,5 kV)  |  |
|   | EiceDRIVER™ compact isolated gate driver | 1EDI20I12MF, 1EDI20N12AF,<br>1EDI60N12AF, 1EDI60I12AF |  | - 1200 V single-channel, cost-effective functional isolated driver with Miller clamp/separate output   |
|   |  |   | 1ED3122MU12H, 1ED-3124MU12H,<br>1ED3125MU12F, 1ED3124MU12F   | - 5.7 kV/3 kV single-channel isolated driver with Miller clamp or separate output, UL 1577 certification   |
| EiceDRIVER™ enhanced isolated gate driver | 1ED3491MU12M,<br>1ED3890MU12M            |   | - 5.7 kV single-channel isolated driver with analog/digital configurability, DESAT, Miller clamp, and Soft-off, UL 1577 certification  |  |
|   |  | 1ED3321MC12N  | - 1200 V, single-/dual-channel, functional isolated driver with DESAT and Miller clamp   |  |

## Current sensor

| Product category        | Product family | Product                | Additional information |
|-------------------------|----------------|------------------------|------------------------|
| Magnetic current sensor | XENSIV™        | TLI4971-A120T5-E0001   | -                      |
|                         |                | TLI4971-A120T5-U-E0001 | UL certified           |

## Microcontroller

| Product category | Product family | Product                              | Additional information   |
|------------------|----------------|--------------------------------------|--|
| Microcontroller  | XMC™           | XMC1400 family (PFC stage)           | Arm® Cortex® M0 based microcontroller  |
|                  |                | XMC4500/XMC4700 (HV DC-DC/PWM stage) | Arm® Cortex® M4F based microcontroller   |
|                  | AURIX™         | TC26X/TC27X<br>TC36X/TC37X           | TriCore™ AURIX™ 32-bit microcontroller<br>HSM (hardware secure module) full EVITA compliance |

## Internal power supply

| Product category       | Product family                          | Product                  | Additional information  |
|------------------------|---|--------------------------|---|
| AC/DC power conversion | Fixed-frequency/quasi-resonant CoolSET™ | ICESQR0680BG             | 800 V, 42 W, 710 mΩ, PG-DSO-12  |
|                        |   | ICESAR0680AG             | 800 V, 42 W, 710 mΩ, PG-DSO-12  |
|                        | Quasi-resonant CoolSET™ PWM controller  | ICESQSBG and IPP80R360P7 | 800 V, 360 mΩ, TO-220   |
|                        |   | ICESQSBG and IPA95R450P7 | 950 V, 450 mΩ, TO-220 FP  |
|                        | CoolMOS™ SJ MOSFETs                     | IPN95R1K2P7              | 950 V, 450 mΩ, SOT-223  |
|                        | IPN80R1K4P7                             | 800 V, 1.4 Ω, SOT-223    |   |
| DC-DC power conversion | Low power LDOs                          | TLS805/TLS810/TLS820     | 50 mA/100 mA/200 mA ultralow quiescent current linear voltage regulator with a wide input voltage range |
|                        |   | TLS202                   | 150 mA LDO in a small-footprint package   |
|                        |   | TLS203/TLS205            | 300/500 mA low noise LDO  |
|                        |   | TLS850                   | 500 mA wide input voltage LDO   |
|                        | Buck converter                          | TLE8366E                 | 1.9 A DC-DC buck converter  |
|                        | Safety PMIC for AURIX™ MCU              | TLF35584/TLF35585        | Multichannel power supply IC, optimized for AURIX™ MCU, up to ASIL-D rated                              |





## Authentication and encryption

As embedded systems are increasingly becoming targets of attackers, Infineon offers OPTIGA™ - a turnkey security solution.

| Product category | Product family    | Product                          | Additional information  |
|------------------|-------------------|----------------------------------|---|
| Security         | OPTIGA™ Trust B   | SLE952500000XTSA1                | Asymmetric ECC authentication with individual certificate key pair and an extended temperature range of -40 to 110°C  |
|                  | OPTIGA™ Trust TPM | SLB9670XQ2.0                     | Fully TCG TPM 2.0 standard compliant module with the SPI interface  |
|                  | SLC37             | SLC37ESA2M0,<br>SLI97CSIFX1M00PE | New class of performance and security cryptocontroller adhering to CC EAL6+ high targeted and EMVCo targeted certifications for payment and eSIM applications |

## Communication

| Product category | Product family             | Product                   | Additional information                            |
|------------------|----------------------------|---------------------------|---|
| CAN transceiver  | Automotive CAN transceiver | TLE9350, TLE9351, TLE9252 | High-speed automotive CAN transceiver with 5 Mbps |





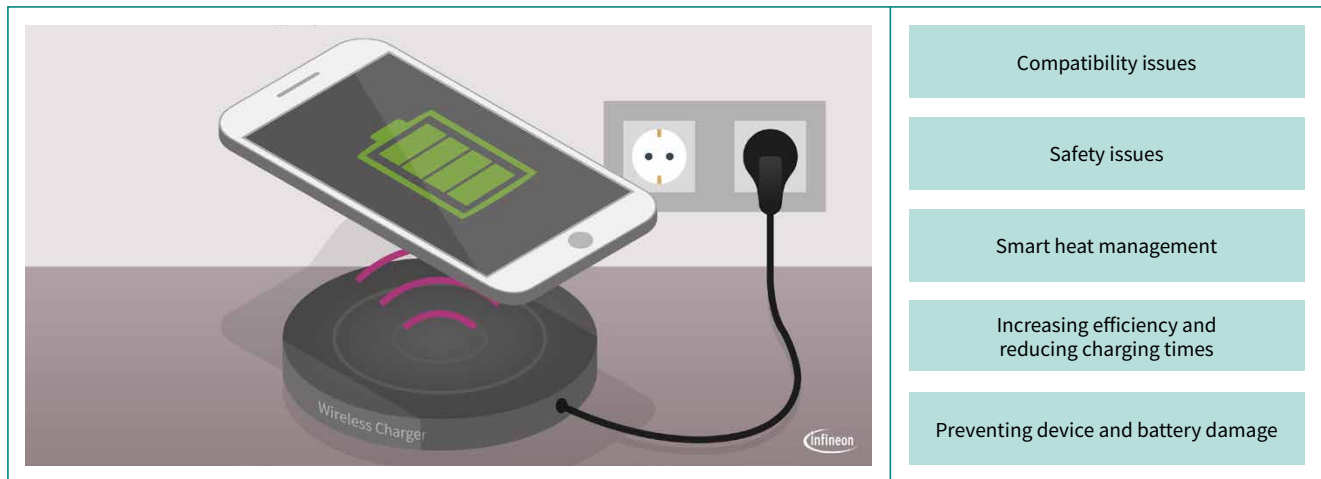
Wireless charging

# Wireless charging

## Cost-effective and secure system solutions for consumer, industrial and automotive applications

Infiniteon offers a broad portfolio of efficient, high-quality products and solutions to serve the key requirements of the dominant market standards: inductive (Qi (WLC)) and resonant (AirFuel) in consumer, industrial and automotive.

### Overcome common design challenges with Infineon



### Applications that benefit from wireless charging



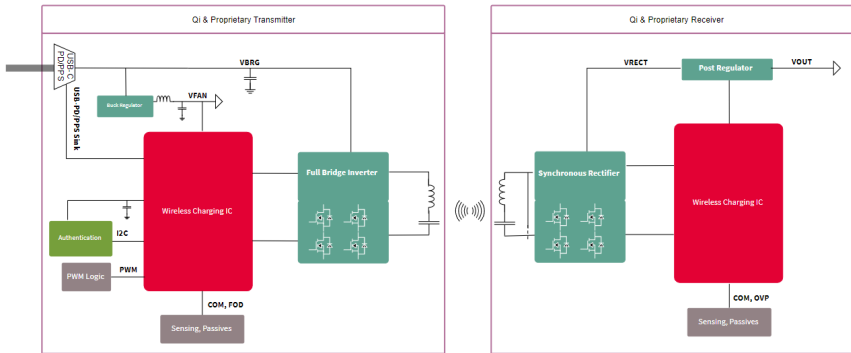
### Infineon's key enabling products for wireless charging

- Wireless charging ICs (WLC)
- Power MOSFETs – OptiMOS™, StrongIRFET™ and CoolMOS™
- P-channel and N-channel small signal power MOSFETs
- Gate-driver ICs – EiceDRIVER™: MOTIX™ 3-phase gate-driver IC
- Authentication - OPTIGA™ Trust Automotive, OPTIGA™ trust auto
- XMC™, XMC™-SC (including software IP), TRAVEO™ MCU Automotive, AURIX™, PSoC™
- USB-C and power delivery (PD): EZ-PD™ CCG3PA and EZ-PD™ PAG1
- PWM/flyback controllers and integrated power stage ICs – CoolSET™
- GaN GIT HEMT - CoolGaN™
- Voltage and buck regulators for component and bridge supply
- Reverse Conducting IGBTs R5/R6 - 650 V

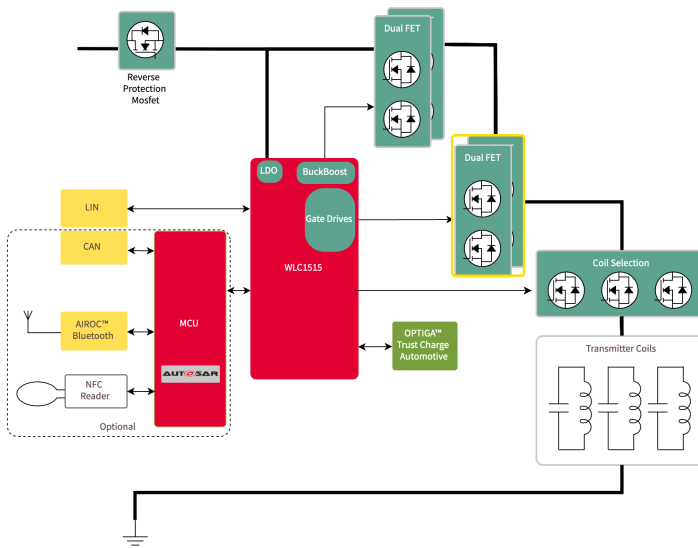


# Inductive wireless charging for consumer and industrial

## Example: 50 W inductive system solution



# Inductive wireless charging for automotive



# Key components for inductive designs for consumer, industrial and automotive

## Wireless charging product portfolio for inductive

| Sub-application                        | Products   |
|--|--|
| Wireless charging IC                   | WLC1115-68LQXQ transmitter IC<br>WLC1150-68LQXQ transmitter IC<br>WLC1250 receiver IC**<br>WLC1515-68LQXQ transmitter IC for automotive  |
| MOSFETs*                               | 30 V BSC0996NS, BSC0993ND, BSZ0909NS, BSZ0909ND, BSZ0910ND, IRL8342<br>40 V BSZ097N04LS, BSZ063N4LS6, BSC035N04LSG, BSC072N04LD<br>60 V BSZ099N06LS5, BSZ065N06LS5, BSZ040N06LS5<br>80 V IRL80HS120<br>100 V IRL100HS121, BSZ146N10LS5, BSZ096N10LS5 |
| Driver IC                              | WCDSC006, PX3519, IRS2301S, 1EDN7512B, 1ED44173N01B, 1EDI60N12AF, 2EDN7524G, IRS2007M, 2ED2182S06F, 6EDL7141   |
| Microcontroller                        | XMC™, AURIX™ XMC™-SC (including software IP), PSoC™ family 4, TRAVEO™ (automotive)   |
| Voltage regulators                     | TLE4296G V33, TLF50211EL, TLE8366EV  |
| MCU + BLE controller                   | PSoC™ 4 Bluetooth® Low Energy (Bluetooth® Smart): CY8C4248LQI-BL573 (QFN)  |
| AIROC™ Bluetooth® LE and Bluetooth®    | CYW20719B2 / CYW20721B2  |
| USB-C and power delivery (PD)          | EZ-PD™ PAG1, EZ-PD™ CCG3PA, EZ-PD™ CCG3, EZ-PD™ PMG1, EZ-PD™ barrel connector replacement (BCR)  |
| Small-signal MOSFETs                   | See the portfolio on our webpage small-signal MOSFETs  |
| Authentication                         | SLS32AIA020Ux – OPTIGA™ Trust Charge (USON10 3x3 package)<br>OPTIGA™ Trust Charge automotive   |
| Reverse conducting IGBTs R5/R6 - 650 V | Package TO-247 IHW30N65RS (30 A), IHW40N65R5 (40 A), IHW50N65R5 (50 A)   |
| Reference designs and kits             | REF_WLC_TX15W_C1 – 15 W Qi power transmitter solution<br>REF_WLC_TX50W_N1 – 50 W transmitter solution<br>REF_WLCAUTO_TX15W_C1  |

[www.infineon.com/wirelesscharging](http://www.infineon.com/wirelesscharging)

\* Explore more MOSFET offerings at our webpage

\*\* Coming soon

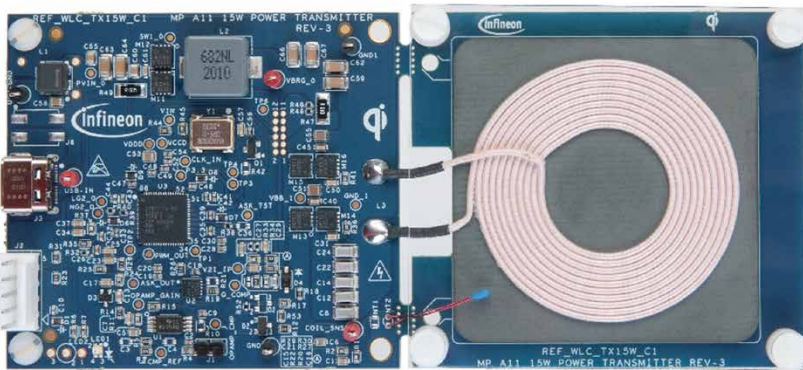
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





## 15 W Qi transmitter solution with Infineon's wireless charging IC WLC1115

The REF\_WLC\_TX15W\_C1 MP A11 power transmitter solution board, is an highly integrated, Qi v1.3 compliant extended power profile (EPP) transmitter design. This reference board is powered using a USB PD 3.0-compliant USB-C power adapter and can support DC connector input of 9 V - 20 V through firmware option. Combined with the OptiMOS™ power MOSFETs and OPTIGA™ Trust Charge, this solution offers a highly efficient and secure wireless charging platform. The solution board supports firmware upgrades using USB-C or I<sup>2</sup>C interface along with the included dongle and the wireless charging configuration graphical user interface (GUI). There are additional options provided for firmware updates using serial wire debug (SWD) while using the ModusToolBox™ and programmer.



### Key components

- Wireless charging IC – [WLC1115-68LQXQ](#)
- OptiMOS™ power MOSFETs – [BSZ0910LS](#)
- OPTIGA™ Trust Charge – [SLS32AIA020Ux](#)
- Small Signal MOSFETs



### Features and benefits

#### Key features

- Qi v1.3 compliant transmitter
- UDB-PD/legacy protocol input >9 V<sub>DC</sub>
- Peak system efficiency >83%
- Typical active charging area ±10 mm
- Serial communication ports: I<sup>2</sup>C, UART
- Programming, EXT clock option
- Foreign object detection with LEDs
- Configurable using wireless charging GUI

#### Key benefits

- Compliant Qi stack with library support
- Programmable solution for evolving Qi standard
- Zero voltage switching for high efficiency
- Configurable gate drivers for EMC
- Configurable thresholds for FOD, protection

### Explore more details:

[www.infineon.com/REF\\_WLC\\_TX15W\\_C1](http://www.infineon.com/REF_WLC_TX15W_C1)

A new reference design supporting Qi2 MPP protocol is coming soon:

learn more [here!](#)

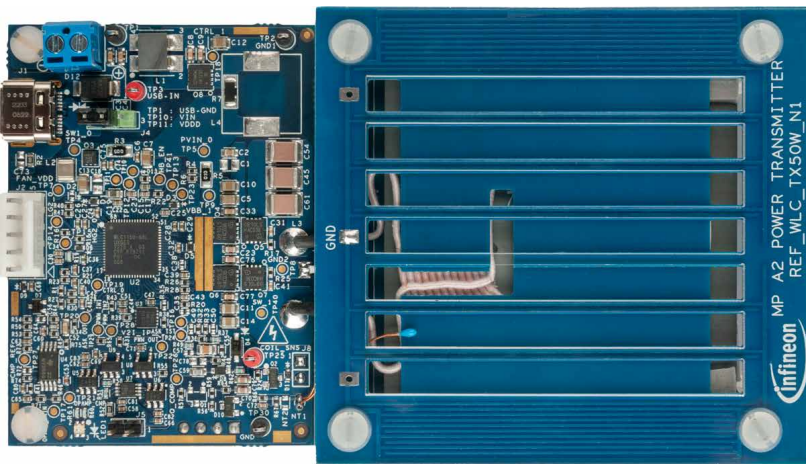
[www.infineon.com/wirelesscharging](http://www.infineon.com/wirelesscharging)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## 50 W transmitter solution with Infineon's wireless charging IC WLC1150

The REF\_WLC\_TX\_50W\_N1 transmitter solution board using WLC1150 enables high performance and low-cost wireless charging solutions for various applications up to 50 W output power. The configurable WLC1150 solution, with Infineon's OptiMOS™ power devices, offers highly efficient charging with flexible thermal management options. Combined with Infineon's USB-C charger solutions, it offers a complete product package that can help meet stringent regulatory and compliance requirements. The WLC1150 uses Infineon high power proprietary protocol to deliver 50 W power and is also compatible to Qi 1.3.x specification with extended power profile (EPP), basic power profile (BPP) and proprietary power delivery extension (PPDE). The controller is offered with both configuration utility and ModusToolbox™ software options to develop your wireless charging solutions for proprietary charging protocols as well as Qi latest specification.



### Key components

- Wireless charging IC – [WLC1150-68LQXQ](#)
- OptiMOS™ power MOSFETs – [BSZ0910LS](#)
- OPTIGA™ Trust Charge – [SLS32AIA020Ux](#) (optional)
- Small signal MOSFETs



### Features and benefits

#### Key features

- High power proprietary charging up to 50 W
- Qi v1.3.x compliant transmitter (MP-A2 and similar)
- Integrated USB-PD/PPS sink functionality
- Integrated DC/DC controller for fan that enables thermal management
- Integrated gate drivers for buck-boost, inverter
- Input voltage range: 4.5 V - 24 V
- Communication ports: I<sup>2</sup>C, UART
- Temperature range: -40°C - 105°C
- Packing type: tray

#### Key benefits

- 50 W transmitter with software included
- Adaptive foreign object detection (FOD)
- Adjustable protection – OVP, OCP, OTP
- Graphical utility tool for ease of configuration, debug without code
- ModusToolbox™ Software Library for Infineon Proprietary, Qi Stack

### Explore more details:

[www.infineon.com/ref\\_wlc\\_tx50w\\_n1](http://www.infineon.com/ref_wlc_tx50w_n1)

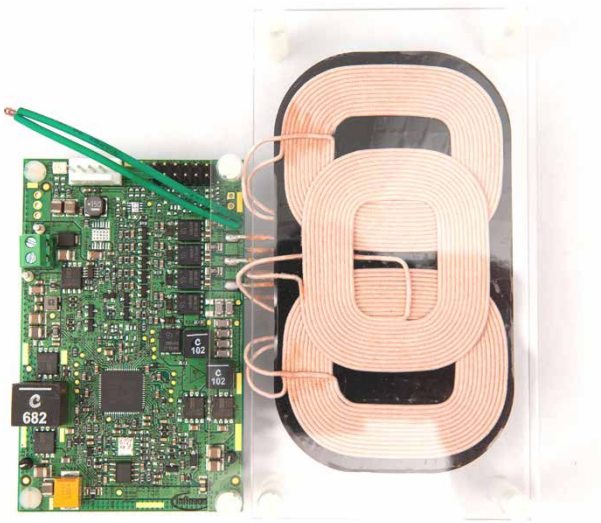
[www.infineon.com/wirelesscharging](http://www.infineon.com/wirelesscharging)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## 15 W automotive transmitter solution with Infineon's wireless charging IC WLC1515

The REF\_WLCAUTO\_TX15W\_C1 MP A13 power transmitter solution board using WLC1515 is a highly integrated, Qi v1.3 compliant Extended Power Profile (EPP) transmitter design ideal as a scalable platform for automotive in-cabin charger. It can also support basic power profile (BPP), Proprietary power delivery Extensions (PPDE) and custom protocols. This reference board operates with variable automotive battery input voltage of 9 V-18 V, supporting reverse polarity protection and auto transients. Its integrated buck-boost controller enables low EMI fixed frequency mode of operation. On chip LIN or serial communication are used to interface with the Host system for additional functionality. With an optional external automotive MCU such as Traveo™ II, it is possible to add AUTOSAR, CAN and NFC interface functionality. The solution board supports firmware updates using Serial Wire Debug (SWD) while using the ModusToolbox™ and programmer.



### Key components

- Wireless charging IC - WLC1515-68LDXS
- OptiMOS™ automotive MOSFETs
- OPTIGA™ Trust Charge auto

### Features and benefits

#### Key features

- Integrated Qi controller
- Input voltage range: 4.5 V – 24 V (40 V tolerant)
- Output power: 15 W Qi EPP free position
- Programmable high-side current sense amplifier
- Gate drivers for full-bridge inverter
- Coil selection control
- Integrated buck-boost controller
- 150 kHz – 600 kHz switching frequency for synchronous buck-boost
- Integrated gate drivers with slew rate and dithering controls
- Comprehensive protection: UVLO, OVP, OCP and OTP
- LIN and Host Interface
- In-built LIN interface to LIN transceiver
- Interface for external MCU over I2C
- Configurable firmware registers

#### Key benefits

- Qi stack with library support
- Fixed frequency operation for low EMI
- Configurable gate drivers for EMC
- Configurable thresholds for FOD, protections
- ModusToolbox™ code examples

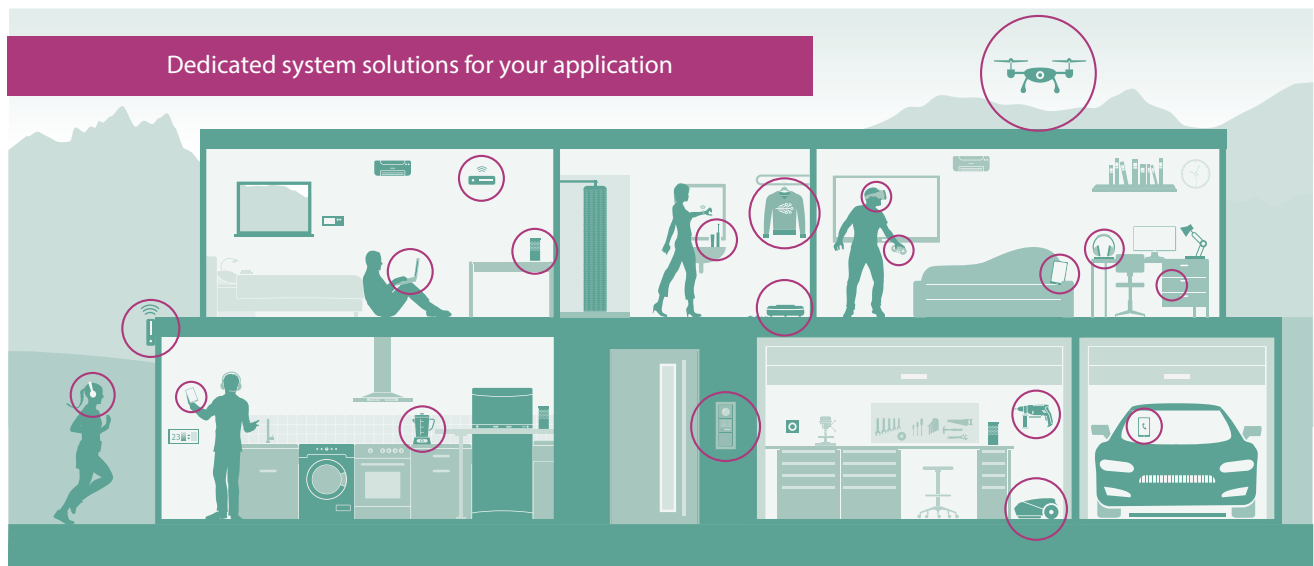


## Key components for resonant designs for consumer and industrial

### Wireless charging product portfolio for resonant

| Sub-application                   | Products  |  |
|-----------------------------------|---|--|
| MOSFETs**                         | 30 V  | IRLHS6376PBF, B SZ0909ND, B SZ0910ND, IRLML0030PBF |
|                                   | 40 V  | IRLML0040  |
|                                   | 60 V  | IRLML0060  |
|                                   | 80 V  | IRL80HS120   |
|                                   | 100 V   | IRL100HS121  |
|                                   | 150 V   | BSZ900N15NS3, BSZ520N15NS3                         |
|                                   | 200 V   | BSZ900N20NS3, BSZ22DN20NS3, BSZ12DN20NS3           |
| Driver ICs                        | EiceDRIVER™ 2EDL71*, 1EDN7512, 2EDN7524, 2ED2182S06F, 2ED24427N01F, 1EDI60N12AF, 1ED44173N01B               |  |
|                                   | EiceDRIVER™ for CoolGaN™ GIT HEMTs 1EDS5663H, 1EDF5673F, 1EDF5673K  |  |
| GaN e-mode HEMTs                  | CoolGaN™ GIT HEMT 600 V IGT60R190D1 (HDSOF-8-3)   |  |
| Microcontroller                   | XMC™, AURIX™ MCU and wireless power controller XMC™-SC (including software IP), PSoC™ family 4              |  |
| MCU + BLE Controller              | PSoC™ 4 Bluetooth® Low Energy (Bluetooth® Smart): CY8C4248LQI-BL573 (QFN)                                   |  |
| AIROC™ Bluetooth® LE & Bluetooth® | CYW20719B2 / CYW20721B2   |  |
| USB-C and power delivery (PD)     | EZ-PD™ PAG1, EZ-PD™ CCG3PA, EZ-PD™ CCG3, EZ-PD™ PMG1, EZ-PD™ barrel connector replacement (BCR)             |  |
| Voltage regulators                | TLE4296G V33, TLE4296G V50, TLE4296-2G V33, TLE4296-2G V50, TLF50211EL, TLE8366EV, TLE8366EV33, TLE8366EV50 |  |
| Small signal MOSFETs              | See the portfolio on our webpage small-signal MOSFETs   |  |

## Are you searching for a turnkey solution for your application?



Wireless power becomes an important part of our connected lifestyles. Infineon puts an emphasis on the development of the next-generation technologies and standards that allow easy charging without the limitation of wires. What started out with phones will quickly evolve - applications such as tablets, laptops, robots, drones, power tools, handheld gaming devices, medical devices, infrastructure, and applications around Industry 4.0 will have wireless charging included. For more information, please get in contact with us via [www.infineon.com/support](http://www.infineon.com/support) to get your customized system solution.

[www.infineon.com/wirelesscharging](http://www.infineon.com/wirelesscharging)

\*coming soon

\*\* Explore more MOSFET offerings at our webpage.

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





USB PD charger

# USB-C chargers and adapters

## Outstanding solution offering for mobile chargers and laptop adapters

USB-C power delivery (USB-PD) has become the standardized solution for unified. Furthermore, from smartphones to laptops, smart speakers to TVs - USB-PD is now the go-to power supply and the enabler of fast charging. USB-C power delivery (USB-PD) has revolutionized the way we charge our mobile devices, providing a unified and speedy charging experience. The implementation of USB-C technology has significantly enhanced the convenience for end-users. In addition, with the incorporation of GaN HEMTs and higher switching frequencies, it is now possible to produce chargers and adapters that are both compact and lightweight.

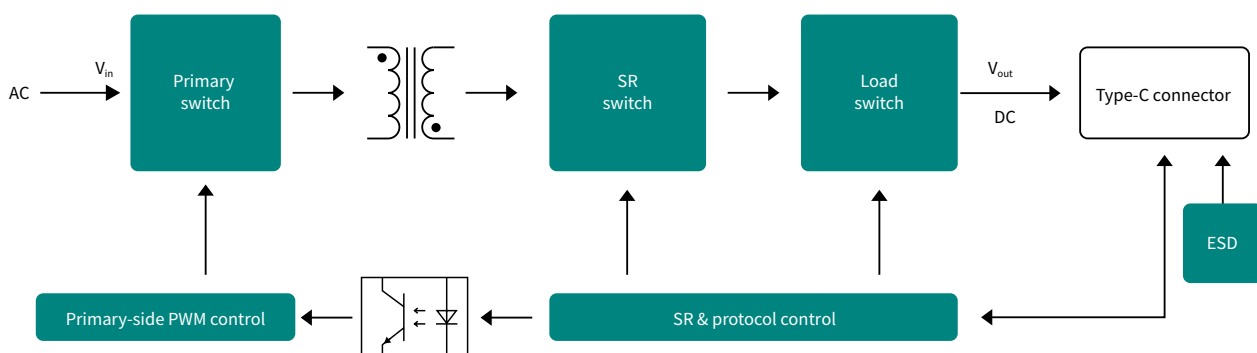
Infinion offers a leading portfolio of power controllers, flexible and programmable USB Type-C controllers, high-voltage CoolMOS™ superjunction MOSFETs, medium- and low-voltage OptiMOS™ MOSFETs as well as CoolGaN™ discretes and integrated power stages.

Our USB-C reference and demo designs are based on quasi-resonant (QR), zero-voltage switching (ZVS) and hybrid flyback (HFB) operation for different power levels and power density requirements and for single- and dual-output chargers.

### Features and benefits

| Key features   | Key benefits  |
|--|---|
| <ul style="list-style-type: none"> <li>– Ready-to-use reference designs</li> <li>– Comprehensive offering of power and protocol controllers, high- and low-voltage switches and TVS diodes allow customers to source all components from a single supplier</li> <li>– Highly integrated solutions</li> <li>– Smallest form factor, low <math>R_{DS(on)}</math> and low parasitic capacitances, Kelvin-source engaged ThinPAK and PQFN packages</li> <li>– Digital controllers enabling high-efficiency designs</li> <li>– Fully programmable USB-C PD port controllers</li> <li>– Configurability and upgradability</li> </ul> | <ul style="list-style-type: none"> <li>– Ease-of-use and reduced complexity</li> </ul>  |
| <ul style="list-style-type: none"> <li>– Infineon has the largest installed in-house power semiconductor capacity with 12" wafer production for discretes for maximum supply security</li> <li>– Dedicated supply chain programs to secure capacity and enable flexibility to demand fluctuations</li> </ul>   | <ul style="list-style-type: none"> <li>– High-efficiency designs</li> <li>– Differentiation and short time to market</li> <li>– Secured supply chain</li> </ul> |

### Application diagram



## Recommended products

| Functional block      | Product category                                      | Topology  | Product family  | Benefits   |
|-----------------------|---|---|---|--|
| Flyback converter     | High-voltage power devices (Si MOSFETs and GaN HEMTs) | Quasi-resonant flyback (QR)                     | 600 V/700 V/800 V CoolMOS™ P7   | <ul style="list-style-type: none"> <li>Fast switching speed for improved efficiency and thermals</li> <li>Reduced gate charge for enhanced light-load efficiency</li> <li>Optimized gate-to-source voltage (VGS) threshold for lower turn-off losses</li> </ul>  |
|                       |   |   | 600 V/650 V CoolMOS™ C7   | <ul style="list-style-type: none"> <li>High switching performance enabling highest efficiency</li> <li>Ease of use level high</li> <li>Optimized devices for highest efficiency switched-mode power supplies</li> </ul>  |
|                       |   | Active-clamp flyback (ACF) Hybrid flyback (HFB) | 600 V CoolMOS™ PFD7   | <ul style="list-style-type: none"> <li>Robustness and reliability with integrated robust fast body diode and up to 2 kV ESD protection</li> <li>Reduced gate charge for enhanced light-load efficiency</li> <li>Lower hysteresis loss</li> </ul>   |
|                       | Controller  | Hybrid flyback controller                       | CoolGaN™ GIT HEMTs 600 V  | <ul style="list-style-type: none"> <li>Highest efficiency</li> <li>Highest power density</li> </ul>  |
|                       |   |   | XDPS2201  | <ul style="list-style-type: none"> <li>Asymmetrical half-bridge ZVS control to maximize efficiency</li> <li>Supports a wide range of configurable parameters</li> <li>Supports ultra-high power density (20 W/in<sup>3</sup>) design</li> </ul>  |
|                       | Gate-driver IC  | Active-clamp flyback (ACF)                      | EZ-PD™ PAG1P/S  | <ul style="list-style-type: none"> <li>Secondary-side-controlled flyback solution</li> <li>Dual-chip flyback solution with integrated SR+PD controller</li> </ul>  |
| IRS25752L             |   |   | <ul style="list-style-type: none"> <li>High-side gate driver enables active clamp mode of operation</li> <li>Cost-effective, 600 V, single-channel driver in SOT23 package</li> </ul> |  |
| PFC DC-DC             | High-voltage power devices (Si MOSFETs and GaN HEMTs) | DCM PFC   | IRS21271S   | <ul style="list-style-type: none"> <li>High-side gate driver enables active clamp mode of operation</li> <li>600 V, single-channel driver with over-current protection (OCP)</li> </ul>  |
|                       |   |   | 600 V CoolMOS™ P7   | <ul style="list-style-type: none"> <li>Fast switching speed for improved efficiency</li> <li>Reduced gate charge for enhanced light load efficiency</li> <li>Optimized gate-to-source voltage (VGS) threshold for lower turn-off losses</li> </ul>   |
|                       | Boost diode   | DCM/CCM PFC                                     | CoolGaN™ GIT HEMTs 600 V  | <ul style="list-style-type: none"> <li>Highest efficiency contribution via less parasitic parameter</li> <li>Space saving with SMD smaller package</li> </ul>  |
|                       |   |   | 650 V Rapid 1 diodes  | <ul style="list-style-type: none"> <li>Low conduction losses</li> </ul>  |
|                       | Controller  | PFC/LLC combo                                   | IDP2308   | <ul style="list-style-type: none"> <li>Digital multimode PFC and LLC combined controller with a floating high-side driver and a startup cell</li> <li>Comprehensive and configurable protection features</li> <li>Wide set of configurable parameters</li> </ul>   |
|                       | Controller  | PFC/HFB combo                                   | XDPS2221  | <ul style="list-style-type: none"> <li>Digital multimode PFC and HFB combined controller</li> <li>High-side driver and a 600 V startup cell</li> <li>Integrated gate drivers supporting GaN switches</li> <li>Configurability for protections and system performance</li> </ul>  |
|                       | High-voltage power devices (Si MOSFETs and GaN HEMTs) | HB LLC  | 600 V CoolMOS™ P7   | <ul style="list-style-type: none"> <li>Fast switching speed for improved efficiency and thermals</li> <li>Reduced gate charge for enhanced light load efficiency</li> <li>Optimized gate-to-source voltage (VGS) threshold for lower turn-off losses</li> </ul>  |
| CoolGaN™ IPS 600 V    |   |   | <ul style="list-style-type: none"> <li>Highest efficiency and highest power density</li> <li>Isolated gate driver integrated</li> </ul>   |  |
| Gate-driver IC        | HB LLC  | EiceDRIVER™ Compact: 1ED160N12AF, 1ED3124MU12F  | <ul style="list-style-type: none"> <li>Isolated gate driver, up to 14 A, 100 ns propagation delay</li> </ul>  |  |
| Synchronous rectifier | Low-voltage MOSFETs                                   | Synchronous rectification                       | OptiMOS™ PD 60-150 V  | <ul style="list-style-type: none"> <li>Low conduction losses, reduced overshoot</li> <li>Adapter-oriented synchronous rectification MOSFETs</li> </ul>   |
|                       | Control ICs   | Synchronous rectification                       | EZ-PD™ PAG1S  | <ul style="list-style-type: none"> <li>Integration of synchronous rectification and PD controller</li> <li>Configurable protection, like OTP, OCP, OVP, UVP, short circuit, etc.</li> </ul>  |
| Protocol controller   | USB-C ICs   | Protocol controller                             | EZ-PD™ PAG1S  | <ul style="list-style-type: none"> <li>Supports USB PD 2.0, PD 3.0 with PPS, QC4+, QC 4.0, QC 3.0, QC 2.0, Samsung AFC, Apple charging, and BC v1.2 charging protocols</li> </ul>  |
|                       |   |   | EZ-PD™ CCG3PA-NFET  | <ul style="list-style-type: none"> <li>Supports USB PD 3.0 with Programmable Power Supply (PPS) modes</li> <li>Independent constant current (CC) and constant voltage (CV) modes</li> <li>Configurable OVP, OCP, and OTP</li> <li>Integrates NFET gate driver to drive the load switch 64 kB flash memory</li> </ul>   |
|                       |   |   | EZ-PD™ CCG3PA   | <ul style="list-style-type: none"> <li>Supports USB PD 3.0 with PPS, QC4, Apple 2.4 A charging, AFC, BC1.2 etc.</li> <li>Supports 1C and 1A port</li> <li>64 kB flash memory</li> </ul>  |
|                       |   | Multi-port controller                           | EZ-PD™ CCG7DC multi-port controller   | <ul style="list-style-type: none"> <li>Integrates 2 USB-C PD controllers + 2 DC-DC controllers in one single chip</li> <li>Supports latest USB-C PD v3.0 with PPS, QC4+, QC4.0, Samsung AFC, Apple 2.4A, Cv1.2</li> <li>Configurable switching frequency of 150 kHz - 600 kHz</li> <li>Arm® Cortex®-M0 with flash allows users to implement custom features</li> </ul> |
| Connector             | ESD   | ESD protection                                  | Multi-purpose diodes for ESD protection   | <ul style="list-style-type: none"> <li>Small packaging to support minimum board space consumption</li> <li>High linearity - reducing harmonic generation/enabling suppression EMC problems</li> <li>Exceptional quality and reliability</li> </ul>   |

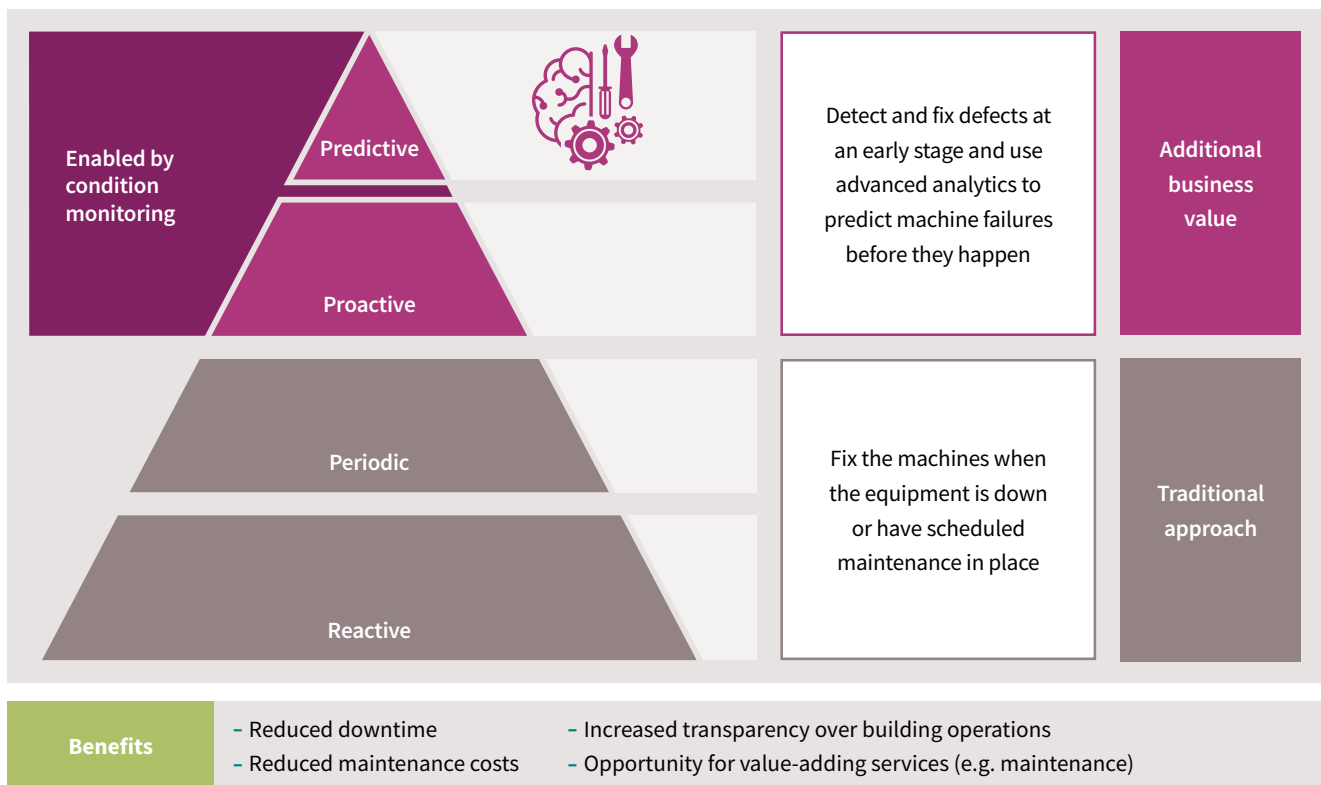




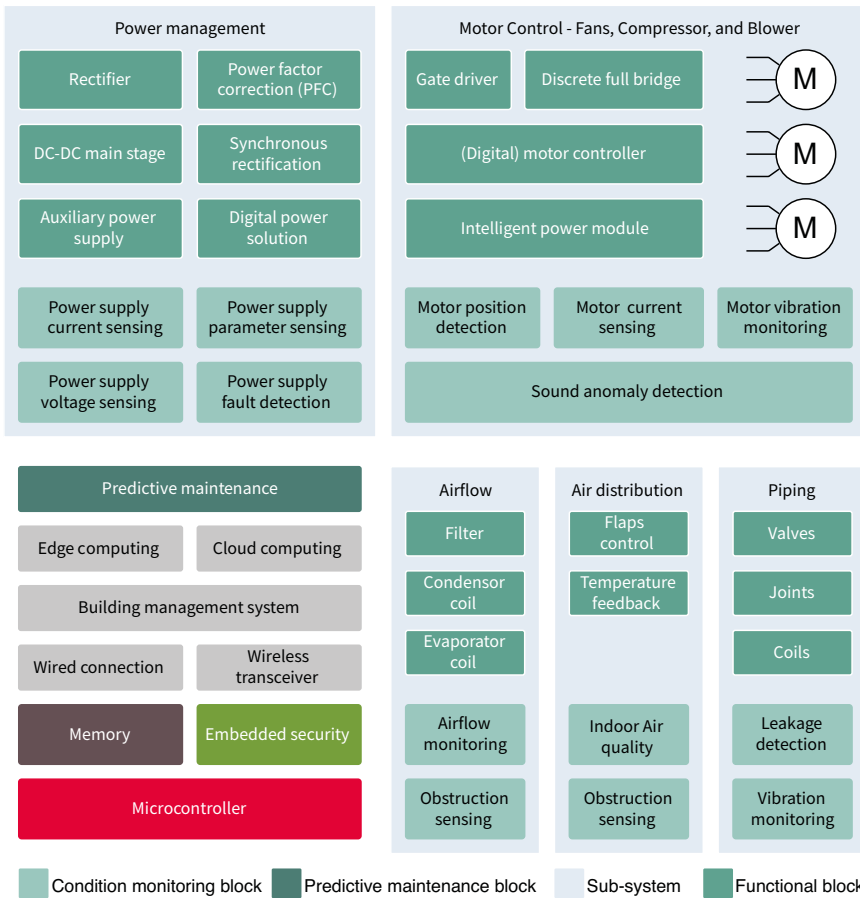
# Condition monitoring and predictive maintenance

## Accurate and reliable data collection and processing for condition monitoring and predictive maintenance

Smart Building and Industry 4.0 must answer the needs of our connected business and optimize its operations to anticipate maintenance before it becomes urgent and critical. This enables an innovative maintenance strategy that predicts system failures and aims to prevent them. Various parameters are constantly monitored, and the collected data is analyzed to make the new scheme possible. As soon as function anomalies become apparent, maintenance or repairs can be planned around the regular operation of intelligent buildings, infrastructure, or industry-critical equipment, reducing downtime and costs. Infineon’s sensors, microcontrollers, connectivity, security and memory solutions offer all you need to leverage predictive maintenance’s full potential. Thanks to our partner network, you can use advanced analytics and artificial intelligence to predict machine failures before they happen or to anticipate maintenance needs before they become urgent – on the Edge or in the Cloud.



## Application diagram



## XENSIV™ Predictive Maintenance Evaluation Kit

Our latest XENSIV™ Predictive Maintenance Evaluation Kit\* lets you quickly and efficiently evaluate various condition monitoring and predictive maintenance use cases. This kit utilizes Infineon's broad XENSIV™ sensor portfolio along with the FreeRTOS XMC4700 Arm® Cortex®-M4F XMC™ qualified device to monitor the condition of most crucial elements such as filters, compressors, motors, or fans, for example, in HVAC. Based on the collected sensor data, e.g., of current consumption, airflow, and many other upcoming systems combined with the power of algorithms and deep learning techniques, failures can be detected.

### Features and benefits

| Key features   | Key benefits   |
|--|--|
| <ul style="list-style-type: none"> <li>– Extension for the XMC4700 XMC™ Relax Kit</li> <li>– Full software support of the FreeRTOS kernel</li> <li>– AWS Cloud integration</li> <li>– Full AWS CloudFormation template and software application stack</li> <li>– On-board Wi-Fi and ethernet connectivity</li> <li>– mikroBUS™ ClickBoard interface for extending connectivity</li> <li>– XENSIV™ sensor satellite boards with a broad range of sensors for data collection and condition monitoring</li> <li>– Multi-account registration support with OPTIGA™ Trust M</li> </ul> | <ul style="list-style-type: none"> <li>– Current monitoring (up to 120 A), e.g. for overall current anomaly detection</li> <li>– Vibration and position sensing, e.g., for drives and compressor</li> <li>– Airflow and pressure measurement, e.g., for filters</li> <li>– Open/closed lid detection, e.g., for detecting status of service lids</li> <li>– Hall speed sensors, e.g., for blocked fan and fan speed monitoring</li> <li>– Sound anomaly detection, e.g., for gears and joints</li> </ul> |



## Recommended products portfolio

| Functional block | Product category       | Product family                                 | Benefits  |
|------------------|------------------------|--|---|
| Sensing          | XENSIV™ sensors        | XENSIV™ DPS368 pressure sensor                 | Ultra-small waterproof pressure sensor, environmentally protected against water (IPx8), dust and humidity, ideal for harsh environments   |
|                  |                        | XENSIV™ TLI4971 magnetic current sensor        | Magnetic current sensor for AC and DC measurements in industrial applications with an analog interface and dual fast over-current detection outputs   |
|                  |                        | XENSIV™ TLI493D-W2BW 3D magnetic sensor        | Small WLB-5 package with low current consumption of 7 nA in a power-down mode for compact system designs  |
|                  |                        | XENSIV™ IM69D128S MEMS microphone              | Ultra-low power digital XENSIV™ MEMS microphone for building automation and IoT devices with high sensitivity   |
|                  |                        | XENSIV™ TLE4997E Hall sensor                   | Hall sensor for highly accurate rotation and position detection, ideally suited to analog-to-digital (A/D) conversion with the supply voltage as a reference                                |
|                  |                        | XENSIV™ TLE4964-3M Hall effect magnetic switch | Hall effect switch dedicated for position detection applications highly accurate applications with superior supply voltage capability   |
|                  |                        | XENSIV™ TLI4966G double Hall switch            | Double Hall switch with two output pins for industrial applications with a rotating pole wheel  |
| Security         | OPTIGA™                | OPTIGA™ Trust M                                | A high-end security solution that provides an anchor of trust for connecting IoT devices to the cloud   |
|                  |                        | OPTIGA™ Trust M Express                        | Offered with CIRRENT™ Cloud ID – Infineon's cloud service automates IoT device certificate registration and device provisioning in the product cloud at scale with zero manual intervention |
| Control          | XMC™ microcontrollers  | XMC4800 microcontroller                        | 32-bit first-ever EtherCAT® node on an ARM® Cortex®-M microcontroller with on-chip flash and analog/mixed-signal capabilities   |
|                  |                        | XMC4700 microcontroller                        | 32-bit optimized solution to meet the performance challenges of today's embedded control applications, ideal for motor control and SMPS   |
|                  | PSoC™ microcontrollers | PSoC™ 6 series                                 | Dual-core Arm® Cortex®-M4 and Cortex-M0+ architecture with ultra-low power consumption purpose-built for IoT applications   |
|                  |                        | PSoC™ 4 series                                 | 32-bit microcontroller tackling some of the complex portions of embedded system design, making it easier and more flexible  |
| Connectivity     | Wireless connectivity  | AIROC™ Wi-Fi + Bluetooth® Combos               | IEEE 802.11a/b/g/n/ac/ax Wi-Fi and Bluetooth® 5.2 in a single-chip for small-factor IoT designs   |





# SMPS

## Battery chargers for mobile appliances

Infiniteon's solutions for battery chargers are designed to fit the large variety of topologies and power ratings for applications like e-bike or cordless power tools. Whether the design requires ultra-high efficiency or a cost-performance oriented implementation, we help you simplify the design process and accelerate time-to-market.

[REF\\_ICC80QSG\\_84W1\\_BPA](#) proposes flyback topology for chargers that require an output power level between 65 and 130 W with minimized bill of material. By taking advantage of the [ICC80QSG](#) controller, this design achieves a high efficiency of 90.8 % at full load and supports a wide output voltage of 9 – 21 V. The controller IC and the 700 V [CoolMOS™ P7](#) MOSFET ([IPN70R450P7S](#)) are offered in compact wave-solderable SMD packages. With a small heat sink and no fan being required, the design offers additional flexibility.

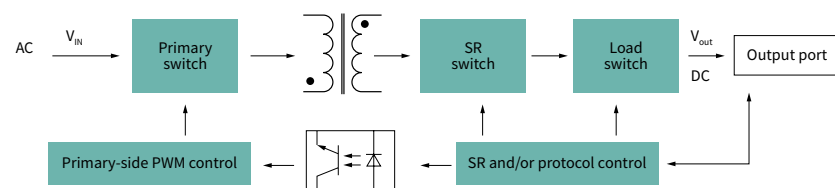
[REF\\_XDPS2201\\_170W\\_BPA](#) combines the [XDPS2201](#) digital controller and two 600 V [CoolMOS™ P7](#) MOSFETs ([IPA60R280P7S](#)) in a half-bridge configuration. [XDPS2201](#) is based on an asymmetrical half-bridge control and operates directly from rectified mains with no PFC input stage. The solution demonstrates a wide output voltage range of 18 V to 42 V at 95 % peak efficiency.

For output power of up to 240 W, Infineon offers a variety of USB-C PD solutions that feature a comprehensive portfolio of [USB-PD power and protocol controllers](#).

### Features and benefits

| Key features  | Key benefits   |
|---|--|
| – Wide output voltage range                                     | – Scalable design to support different battery cell configurations |
| – High efficiency (>90 % for flyback, >94 % for hybrid flyback) | – Fewer heatsinks and fanless operation for outdoor use            |
| – High level of integration                                     | – Ease of design and BOM cost reduction                            |
| – Externally configurable parameters                            | – Flexible system parameterization                                 |
| – Inrush current, reverse polarity protection                   | – Robust operation   |
| – No auxiliary voltage supply, no PFC stage                     | – Suitable for cost-conscious designs                              |

### Application diagram



### Product portfolio

| Application                               | Topology                       | Product type                  | Product/product family                                      | Package                  |
|---|--------------------------------|-------------------------------|---|--------------------------|
| Chargers for battery-powered applications | QR flyback                     | QR flyback controller         | <a href="#">ICC80QSG</a>                                    | DSO-8                    |
|   |                                | High-voltage MOSFETs          | 700 V <a href="#">CoolMOS™ P7</a>                           | SOT-223                  |
|   | Hybrid flyback                 | Standalone digital controller | <a href="#">XDP™</a> digital power <a href="#">XDPS2201</a> | DSO-14                   |
|   |                                | Combo digital controller      | <a href="#">XDP™</a> digital power <a href="#">XDPS2221</a> | DSO-14                   |
|   |                                | High-voltage MOSFETs          | 600 V <a href="#">CoolMOS™ P7</a>                           | TO-220-FP                |
|   |                                | Medium-voltage MOSFETs        | OptiMOS™ 5 60 V/80 V/100 V                                  | Multiple                 |
|   |                                | Medium-voltage MOSFETs        | <a href="#">OptiMOS™ 5 150 V</a>                            | <a href="#">SuperSO8</a> |
| AC/DC integrated power stage              | <a href="#">CoolSET™</a> Gen 5 | DIP-7                         |   |                          |



[www.infineon.com/charging](http://www.infineon.com/charging)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





Battery protection

# Battery protection

## Solutions that allow easy design-in ensuring safe charging/discharging

The high-power density of lithium-ion batteries has made them very popular. However, the unstable behavior of lithium-ion cells under critical conditions requires them to be handled with care. That means a battery management system (BMS) is needed to monitor the battery state and ensure safe operation. BMS is typically equipped with an electronic switch that disconnects the battery from the charge or load under critical conditions that can lead to dangerous reactions. A battery protection unit (BPU) prevents possible damage to the battery cells and the failure of the battery.

Such critical conditions include:

- Over-charge that occurs when the battery is charged over the allowed maximum capacity
- High and low temperature when the internal temperature of the battery cells exceeds their safe operational temperature range
- Over-discharge when the battery is discharged under the allowed minimum capacity
- Overcurrent when the battery is exposed to a short circuit condition or a high inrush turn-on current
- Reverse polarity when the battery terminals are wrongly plugged into the device

Failing to disconnect the battery during such conditions can lead to the following problems:

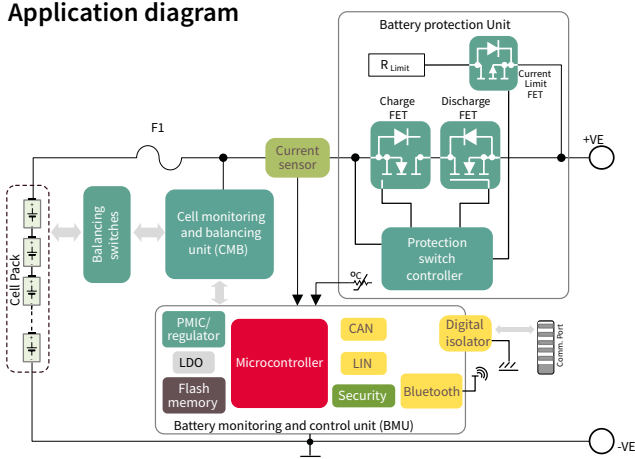
- Thermal runaway often due to over-charging or overheating of the battery. The overheating event can be due to a rise in the ambient temperature or due to charging/discharging the batteries with high current rates. Thermal runaway damages the battery cells and can lead to fires
- Death of the cell often due to the discharge of batteries below its specified thresholds
- Damage of load device often due to either improper inrush current management or reverse polarity

In order to prevent these failures, Infineon offers a wide range of battery protection solutions that increase the lifetime and efficiency of lithium-ion batteries under stressful conditions.

### Features and benefits

| Key features                                 | Key benefits  |
|--|---|
| - $R_{DS(on)}$ and safe operating area (SOA) | - Higher performance with lower $R_{DS(on)}$ and wider safe operating area (SOA)                      |
| - Compact bill of material (BOM)             | - Cheaper solutions with a more compact bill of material and more effective parallelization solutions |
| - Short circuit protection                   | - Short circuit protection with higher peak current rates to withstand higher current values          |
| - Turn-on and turn-off capabilities          | - Turn-on and turn-off solutions tailored to applications needs                                       |
| - All voltage class solutions                | - Up to 600 V MOSFET protection solutions (including single- and multi-module)                        |

### Application diagram



[www.infineon.com/battery-protection](http://www.infineon.com/battery-protection)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

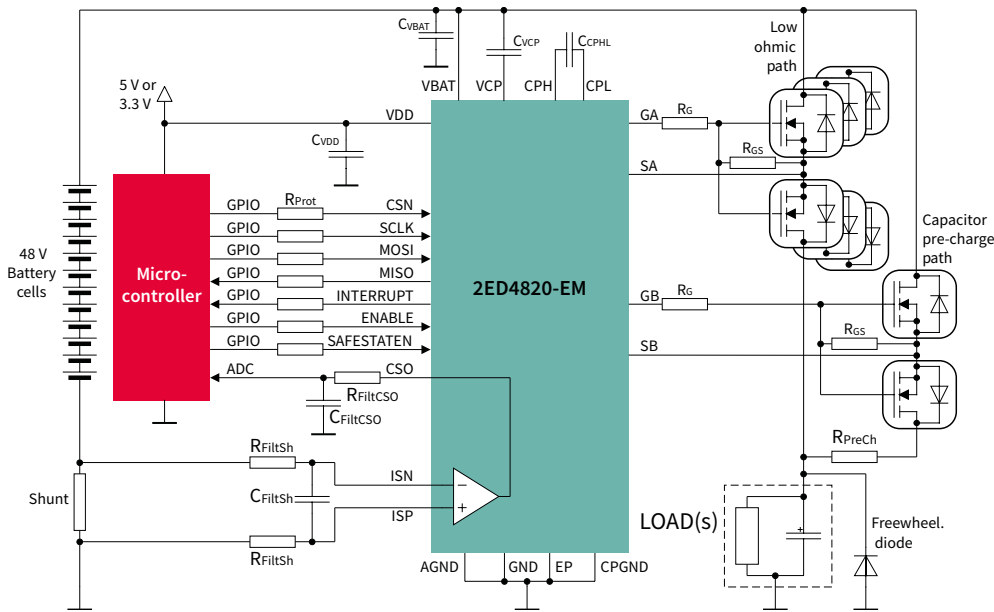


Product portfolio

| Battery voltage | Application                 | Recommended power MOSFETs                    |  |  |  |  |
|-----------------|-----------------------------|--|--|--|--|--|
| 18 V            | Charge and discharge MOSFET | IST007N04NM6<br>40 V, 0.7 mΩ,<br>sTOLL       | IRPB011N04NF2S<br>40 V, 1.15 mΩ,<br>D <sup>2</sup> PAK   | BSC005N03LS5I<br>30 V, 0.55 mΩ,<br>SuperSO8                | IQE008N03LM5CG<br>30 V, 0.85 mΩ,<br>PQFN 3.3x3.3 Source-<br>Down Center-Gate | BSZ0500NSIATMA1<br>30 V, 1.5 mΩ,<br>PQFN 3.3x3.3       |
|                 | Balancing MOSFET            | ISK024NE2LM5<br>25 V, 2.4 mΩ,<br>PQFN 2x2    | IRLML6244<br>20 V, 21 mΩ,<br>SOT-23                      | IRLHS6376<br>30 V, 63 mΩ,<br>PQFN 2x2-Dual                 | IRLML2244<br>-20 V, 54 mΩ,<br>SOT-23   | IRFHS9301<br>-30 V, 37 mΩ,<br>PQFN 2x2                 |
|                 | Pre-charge MOSFET           | BSC084P03NS3 G<br>-30 V, 8.4 mΩ,<br>SuperSO8 | IRFH9310<br>-30 V, 4.6 mΩ,<br>SuperSO8                   | SPD50P03L G<br>-30 V, 7.0 mΩ,<br>DPAK                      | BSZ180P03NS3 E<br>-30 V, 18 mΩ,<br>PQFN 3.3x3.3                              | BSZ120P03NS3 G<br>-30 V, 12 mΩ,<br>PQFN 3.3x3.3        |
| 24 V            | Charge and discharge MOSFET | IST007N04NM6<br>40 V, 0.7 mΩ,<br>sTOLL       | IRPB011N04NF2S<br>40 V, 1.15 mΩ,<br>D <sup>2</sup> PAK   | ISC007N04NM6<br>40 V, 0.7 mΩ,<br>SuperSO8                  | IQE013N04LM6CG<br>40 V, 1.35 mΩ,<br>PQFN 3.3x3.3 Source-<br>Down Center-Gate | BSZ018N04LS6<br>40 V, 1.8 mΩ,<br>PQFN 3.3x3.3          |
|                 | Balancing MOSFET            | ISK024NE2LM5<br>25 V, 2.4 mΩ,<br>PQFN 2x2    | IRLML6244<br>20 V, 21 mΩ,<br>SOT-23                      | IRLHS6376<br>30 V, 63 mΩ,<br>PQFN 2x2-Dual                 | IRLML2244<br>-30 V, 54 mΩ,<br>SOT-23   | IRFHS9301<br>-30 V, 37 mΩ,<br>PQFN 2x2                 |
|                 | Pre-charge MOSFET           | ISC240P06LM<br>-60 V, 24 mΩ,<br>SuperSO8     | ISC800P06LM<br>-60 V, 80 mΩ,<br>SuperSO8                 | IPD900P06NM<br>-60 V, 90 mΩ,<br>DPAK                       | ISZ810P07LM<br>-60 V, 81 mΩ,<br>PQFN 3.3x3.3                                 | ISP25DP06LM<br>-60 V, 125 mΩ,<br>SOT-223               |
| 36 V            | Charge and discharge MOSFET | IPT007N06N<br>60 V, 0.75 mΩ,<br>TOLL         | IPTG007N06N<br>60 V, 0.75 mΩ,<br>TOLG                    | IPF010N06NF2S<br>60 V, 1.05 mΩ,<br>D <sup>2</sup> PAK 7pin | IPB013N06NF2S<br>60 V, 1.3 mΩ,<br>D <sup>2</sup> PAK                         | IST011N06NM5<br>60 V, 1.1 mΩ,<br>sTOLL                 |
|                 | Balancing MOSFET            | ISK024NE2LM5<br>25 V, 2.4 mΩ,<br>PQFN 2x2    | IRLML6244<br>20 V, 21 mΩ,<br>SOT-23                      | IRLHS6376<br>30 V, 63 mΩ,<br>PQFN 2x2-Dual                 | IRLML2244<br>-20 V, 54 mΩ,<br>SOT-23   | IRFHS9301<br>-30 V, 37 mΩ,<br>PQFN 2x2                 |
|                 | Pre-charge MOSFET           | ISC240P06LM<br>-60 V, 24 mΩ,<br>SuperSO8     | ISC800P06LM<br>-60 V, 80 mΩ,<br>SuperSO8                 | IPD900P06NM<br>-60 V, 90 mΩ,<br>DPAK                       | ISZ810P07LM<br>-60 V, 81 mΩ,<br>PQFN 3.3x3.3                                 | ISP25DP06LM<br>-60 V, 125 mΩ,<br>SOT-223               |
| 48 V            | Charge and discharge MOSFET | IPT012N08N5<br>80 V, 1.2 mΩ,<br>TOLL         | IPTG011N08NM5<br>80 V, 1.1 mΩ,<br>TOLG                   | IPT010N08NM5<br>80 V, 1.0 mΩ,<br>TOLT                      | IPB016N08NF2S<br>80 V, 1.65 mΩ,<br>D <sup>2</sup> PAK                        | IST019N08NM5<br>80 V, 1.9 mΩ,<br>sTOLL                 |
|                 | Balancing MOSFET            | ISK024NE2LM5<br>25 V, 2.4 mΩ,<br>PQFN 2x2    | IRLML6244<br>20 V, 21 mΩ,<br>SOT-23                      | IRLHS6376<br>30 V, 63 mΩ,<br>PQFN 2x2-Dual                 | IRLML2244<br>-20 V, 54 mΩ,<br>SOT-23   | IRFHS9301<br>-30 V, 37 mΩ,<br>PQFN 2x2                 |
|                 | Pre-charge MOSFET           | ISC750P10LM*<br>-100 V, 75 mΩ,<br>SuperSO8   | IPD19DP10NM<br>-100 V, 186 mΩ,<br>DPAK                   | ISZ24DP10LM*<br>-100 V, 245 mΩ,<br>PQFN 3.3x3.3            | ISP16DP10LM<br>-100 V, 250 mΩ,<br>SOT-223                                    | BSP322P<br>-100 V, 800 mΩ,<br>SOT-223                  |
| 72 V            | Charge and discharge MOSFET | IPT030N12N3 G<br>120 V, 3.0 mΩ,<br>TOLL      | IPT039N15N5<br>150 V, 3.9 mΩ,<br>TOLL                    | IPB044N15N5<br>150 V, 4.4 mΩ,<br>D <sup>2</sup> PAK 7pin   | IPB048N15N5<br>150 V, 4.8 mΩ,<br>D <sup>2</sup> PAK                          | IPT111N20NFD<br>200 V, 11.1 mΩ,<br>TOLL                |
|                 | Balancing MOSFET            | ISK024NE2LM5<br>25 V, 2.4 mΩ,<br>PQFN 2x2    | IRLML6244<br>20 V, 21 mΩ,<br>SOT-23                      | IRLHS6376<br>30 V, 63 mΩ,<br>PQFN 2x2-Dual                 | IRLML2244<br>-20 V, 54 mΩ,<br>SOT-23   | IRFHS9301<br>-30 V, 37 mΩ,<br>PQFN 2x2                 |
|                 | Pre-charge MOSFET           | ISC16DP15LM<br>-150 V, 160 mΩ,<br>SuperSO8   | ISZ56DP15LM<br>-150 V, 560 mΩ,<br>PQFN 3.3x3.3           | ISZ75DP15LM<br>-150 V, 750 mΩ,<br>PQFN 3.3x3.3             | IPD42DP15LM<br>-150 V, 420 mΩ,<br>DPAK                                       | ISP14EP15LM<br>-150 V, 1380 mΩ,<br>SOT-223             |
| 96 V            | Charge and discharge MOSFET | IPT039N15N5<br>150 V, 3.9 mΩ,<br>TOLL        | IPB044N15N5<br>150 V, 4.4 mΩ,<br>D <sup>2</sup> PAK 7pin | IPB048N15N5<br>150 V, 4.8 mΩ,<br>D <sup>2</sup> PAK        | IRF135SA204<br>135 V, 5.9 mΩ,<br>D <sup>2</sup> PAK 7pin                     | IPT111N20NFD<br>200 V, 11.1 mΩ,<br>TOLL                |
|                 | Balancing MOSFET            | ISK024NE2LM5<br>25 V, 2.4 mΩ,<br>PQFN 2x2    | IRLML6244<br>20 V, 21 mΩ,<br>SOT-23                      | IRLHS6376<br>30 V, 63 mΩ,<br>PQFN 2x2-Dual                 | IRLML2244<br>-20 V, 54 mΩ,<br>SOT-23   | IRFHS9301<br>-30 V, 37 mΩ,<br>PQFN 2x2                 |
|                 | Pre-charge MOSFET           | ISC16DP15LM<br>-150 V, 160 mΩ,<br>SuperSO8   | ISZ56DP15LM<br>-150 V, 560 mΩ,<br>PQFN 3.3x3.3           | ISZ75DP15LM<br>-150 V, 750 mΩ,<br>PQFN 3.3x3.3             | IPD42DP15LM<br>-150 V, 420 mΩ,<br>DPAK                                       | ISP14EP15LM<br>-150 V, 1380 mΩ,<br>SOT-223             |
| 144 V           | Charge and discharge MOSFET | IPT111N20NFD<br>200 V, 11.1 mΩ,<br>TOLL      | IPTG111N20NM3FD<br>200 V, 11.1 mΩ,<br>TOLG               | IPT210N25NFD<br>250 V, 21.0 mΩ,<br>TOLL                    | IPTG210N25NM3FD<br>250 V, 11.1 mΩ,<br>TOLG                                   | IPB107N20N3 G<br>200 V, 10.7 mΩ,<br>D <sup>2</sup> PAK |
|                 | Balancing MOSFET            | ISK024NE2LM5<br>25 V, 2.4 mΩ,<br>PQFN 2x2    | IRLML6244<br>20 V, 21 mΩ,<br>SOT-23                      | IRLHS6376<br>30 V, 63 mΩ,<br>PQFN 2x2-Dual                 | IRLML2244<br>-20 V, 54 mΩ,<br>SOT-23   | IRFHS9301<br>-30 V, 37 mΩ,<br>PQFN 2x2                 |
|                 | Pre-charge MOSFET           | BSP317P<br>-250 V, 4000 mΩ,<br>SOT-223       | BSP92P<br>-250 V, 12000 mΩ,<br>SOT-223                   | BSR92P<br>-250 V, 12000 mΩ,<br>SC59                        | BSS192P<br>-250 V, 12000 mΩ,<br>SOT-89                                       |  |



## Gate drivers



## Main reasons to use 2ED4820-EM in dependable 48 V power supplies

- Faster reaction time ( $\sim 10 \mu\text{s}$ )
- Integrated bidirectional high or low side current sense amplifier
- High current source or sink support
- Robust against under-/overvoltage in the board-net
- Flexible configuration of protection features plus the accessibility of diagnosis information via SPI



Battery  
monitoring

# Battery monitoring and control

## Optimize system performance by cell balancing and monitoring key battery parameters

Dedicated cell monitoring controllers are being used to keep lithium-ion cells within their allowed operational ranges regarding voltages, currents, and temperatures. They monitor the state of each cell according to pre-adjusted voltages and temperatures using high-precision ADCs. Synchronizing the distributed measurements across all cells inside a battery is key to achieving the best possible insights into the battery's dis-/charging state (SOD/SOC) and overall battery health (SOH). The critical battery state assessment becomes less precise if these measurements are spread across wider time windows and if the measurement accuracy for each parameter is not high enough. A robust high-speed communication link across multiple daisy-chained monitoring devices supports complex cell topologies for a battery. For additional robustness, the daisy-chaining realizes a redundant ring, which keeps communication up between all connected ICs in case of a broken link. CRC-protected data frames complement communication robustness. To achieve extremely low-power dedicated housekeeping functions such as periodically scheduled cell measurements and state analysis required for functional safety, the cell controller can perform independently from the master controller of the BMS. Safety features for signaling over-/undervoltage, thermal stress, etc., including emergency alarms, are triggered autonomously. When the number of cells increases, a reliable transfer of information from the cell balancing IC to the BMS controller becomes very important. Digital isolators can be used to ensure that the right data is transferred reliably by isolating the low-voltage side (BMS controller) from the high-voltage battery side.

### TLE9012DQU – Li-ion battery monitoring and balancing IC

#### Features

- Voltage monitoring of up to 12 battery cells connected in series
- Hot plugging support
- Dedicated 16-bit delta-sigma ADC for each cell with selectable measurement mode
- High accuracy measurement for SOC and SOH calculation
- Integrated stress sensor with digital compensation algorithm and temperature-compensated measurements
- Secondary ADC with the same averaging filter characteristics as an advanced end-to-end safety mechanism
- Five temperature measurement channels for external NTCs
- Internal temperature sensors
- Integrated balancing switch allows up to 200 mA balancing current
- Differential robust serial 2 Mbit/s communication interface
- Additional four GPIO pins to e.g., connect an external EEPROM
- Internal round-robin cycle routine triggers the majority of diagnostics mechanisms
  - Automatic balancing over- and undercurrent detection scheme
  - Automatic open load and open wire detection scheme
  - Automatic NTC measurement unit monitoring scheme
- End to end CRC secured iso UART/UART communication
- Emergency mode for communication
- ISO 26262 safety element out of context for safety requirements up to
- Automotive safety integrity level D
- Green product (RoHS compliant)


  
 ISO 26262  
 compliant


  
 RoHS


  
 AEC  
 Qualified


[www.infineon.com/battery-monitoring](http://www.infineon.com/battery-monitoring)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



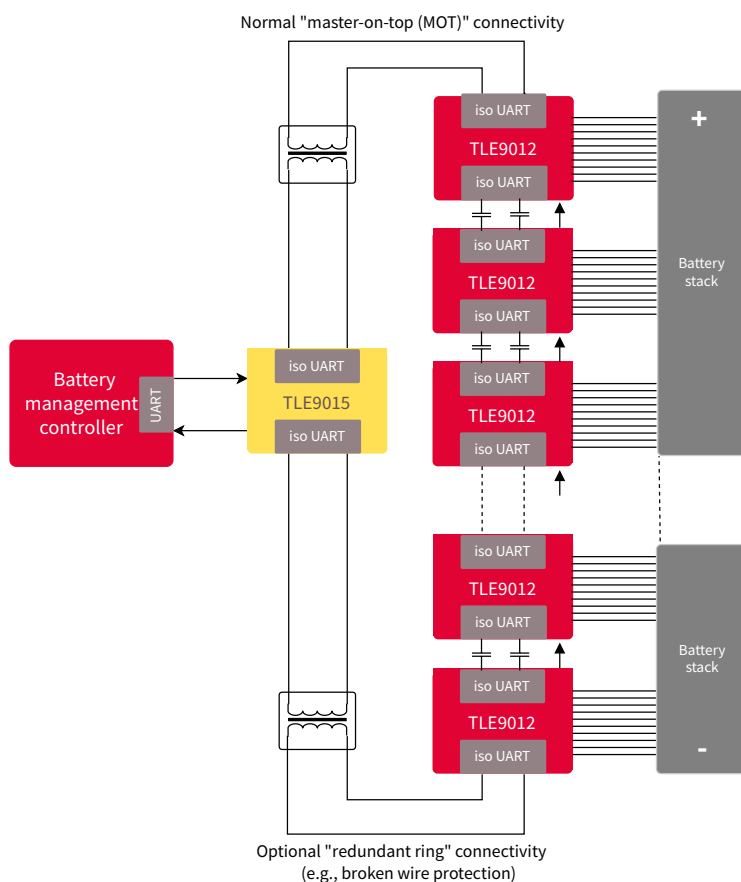
# TLE9015QU – BMS transceiver IC - UART to iso UART



## Features

- General
  - Two UART ports for serial communication to host microcontroller
  - Two iso UART interfaces for communication to other BMS ICs
  - 2 Mbit/s data rate for fast communication
  - Fully transparent communication scheme from UART to iso UART
  - Ring mode topology compatible
- Communication ports
  - Integrated internal logic to minimize pin count on the UART side
  - Differential current edge triggered iso UART communication interface
  - High robustness against external noise
- General purpose error pin
  - Two external fault inputs (EMM and ERRQ\_ext)
  - Latching error output pin to trigger external microcontroller
- Supporting diagnosis features
  - Internal supply monitoring
  - Green product (RoHS compliant)

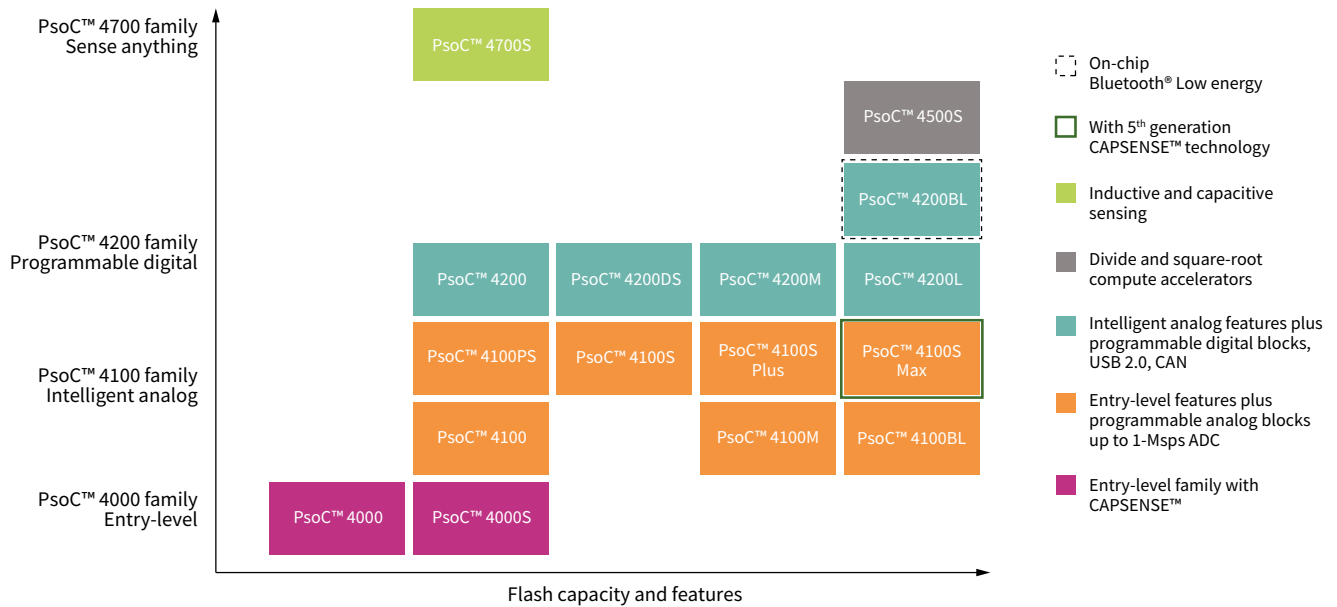
## Application diagram



### Digital isolators for battery monitoring

| Part number | Isolation ring  | Safety certifications                                 | Channel configuration <sup>1)</sup> | Input thresholds   | Default output state | Package              |
|-------------|---|---|-------------------------------------|--------------------|----------------------|----------------------|
| 2DIB0400F   | V <sub>ISO</sub> =3000 V <sub>RMS</sub><br>(UL1577 Ed. 5) | UL1577 (Ed. 5)  | 2 forward<br>0 reverse<br>(2+0)     | Variable<br>(CMOS) | Low                  | PG-DSO-8<br>5 x 4 mm |
| 2DIB0401F   |   | VDE 0884-11<br>VDE 0844-17                            |                                     |                    | High                 |                      |
| 2DIB1400F   |   |   | 1 forward<br>1 reverse<br>(1+1)     |                    | Low                  |                      |
| 2DIB1401F   |   | IEC 62368-1<br>IEC 60601-1<br>IEC 61010-1<br>GB4943.1 |                                     |                    | High                 |                      |
| 2DIB0410F   |   |   | 2 forward<br>0 reverse<br>(2+0)     | Fixed<br>(TTL)     | Low                  |                      |
| 2DIB0411F   |   |   |                                     |                    | High                 |                      |
| 2DIB1410F   |   |   | 1 forward<br>1 reverse<br>(1+1)     |                    | Low                  |                      |
| 2DIB1411F   |   |   |                                     |                    | High                 |                      |

### Microcontrollers for BMS



### Battery security and authentication

OPTIGA™ Authenticate S provides enhanced device authentication to protect against counterfeits

| Rich set of customization options  | Effortless implementation  | Security to rely on  |
|--|--|--|
| <ul style="list-style-type: none"> <li>– 4 authentication modes</li> <li>– 4 separate life cycle counters to prevent manipulation</li> <li>– 3 temperature ranges</li> <li>– 2 communication profiles</li> <li>– 3 sets of memory</li> </ul> | <ul style="list-style-type: none"> <li>– Full turnkey solution – no security know-how required</li> <li>– Full system integration support including embedded software, host software and advanced ecosystem support tools</li> </ul> | <ul style="list-style-type: none"> <li>– Enhanced HW security with an extended key length</li> <li>– Asymmetric cryptography</li> <li>– Protection against reverse engineering</li> <li>– Provisioning in a common criteria certified environment</li> </ul> |



1)Certifications planned







Super solid state solutions

# FET-based high-voltage solid-state relays

Best-in-class  $R_{DS(on)} \times A$  enables unprecedented low losses in combination with advanced control and protection features

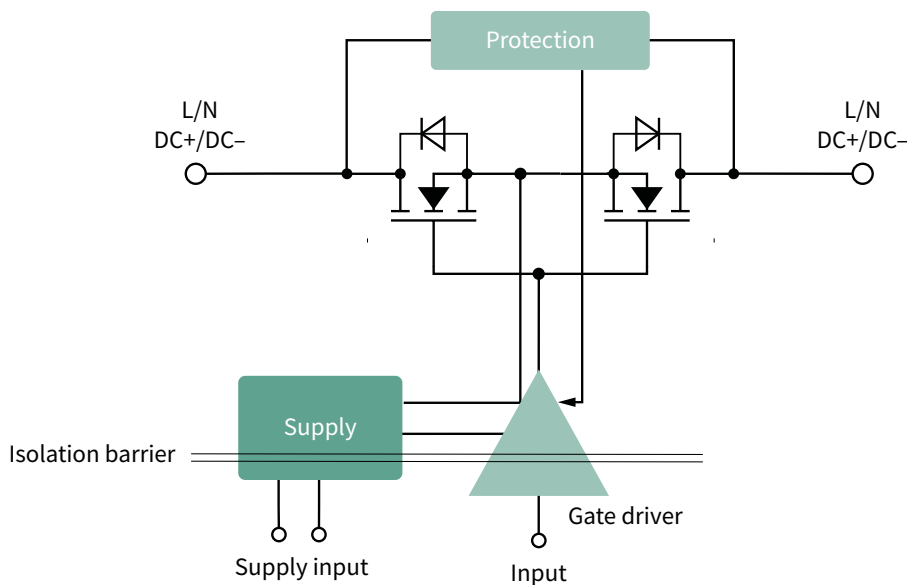
Electromechanical relays are a mature and well-established technology. However, they suffer from some inherent weaknesses. The mechanical movement of metal contacts causes noise. The high voltages can arc before the contacts are completely opened or closed, which leads to contact degradation. An increase in contact resistance over the lifetime causes the behavior to become less predictable. Triacs (or silicon-controlled rectifiers, SCRs) are widely used as solid-state relays in AC applications. However, their controllability is limited and they suffer from high power dissipation in the range of 1 W/A.

FET-based solid-state solutions offer many benefits in relay applications. This includes significantly faster switching while eliminating arcing and the noise associated with electromechanical devices. Inherently, this results in higher reliability and more stable performance. When considering the maintenance, repair and operations (MRO) cost, a strong argument can be made for using solid-state relays. Compared to triacs, a FET-based solution offers advanced control and protection methods. The significantly lower power dissipation minimizes the cooling effort in the application. The latest CoolMOS™ S7(A) technology is a perfect match for solid-state relay applications. It offers an unprecedentedly low  $R_{DS(on)} \times A$  figure of merit that will meet the needs of customers and their end markets.

## Features and benefits

| Key features   | Key benefits   |
|--|--|
| - Operational lifetime: tens of millions of operations | - Maintenance-free (no degradation of contacts), MRO cost savings                  |
| - No mechanical parts                                  | - Arcing-free operation, no contact bounce, clicking noise is eliminated           |
| - Significantly faster switching                       | - Advanced control and protection methods  |
| - No increasing resistance vs. lifetime                | - Stable performance, predictable behavior   |
| - Lowest $R_{DS(on)} \times A$ in class                | - Highest power density, minimized cooling effort, parallelization and scalability |

## Application diagram



[www.infineon.com/ssr](http://www.infineon.com/ssr)  
[www.infineon.com/S7](http://www.infineon.com/S7)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Product portfolio

| Product | Product family          | Voltage class [V <sub>DS_max</sub> ] | R <sub>DS(on)</sub> | Package                  | Part number  |
|---------|-------------------------|--------------------------------------|---------------------|--------------------------|--|
| MOSFETs | CoolMOS™ S7 industrial  | 600 V                                | 22 mΩ to 65 mΩ      | TO-220                   | IPP60R022S7, IPP60R040S7, IPP60R065S7                      |
|         |                         |                                      |                     | TOLL                     | IPT60R022S7, IPT60R040S7, IPT60R065S7                      |
|         |                         |                                      | 10 mΩ to 65 mΩ      | QDPAK top-side cooled    | IPDQ60R010S7, IPDQ60R022S7, IPDQ60R040S7, IPDQ60R065S7     |
|         |                         |                                      | 10 mΩ to 65 mΩ      | QDPAK bottom-side cooled | IPQC60R010S7, IPQC60R040S7, IPDQ60R017S7                   |
|         | CoolMOS™ S7A automotive |                                      | 10 mΩ to 40 mΩ      | QDPAK top-side cooled    | IPDQ60R010S7A, IPDQ60R017S7A, IPDQ60R022S7A, IPDQ60R040S7A |
|         |                         |                                      | 10 mΩ to 40 mΩ      | QDPAK bottom-side cooled | IPQC60R010S7A, IPQC60R017S7A, IPQC60R040S7A, IPQC60R017S7  |

| Product      | Product family | Output voltage | Output current [typ.] | Isolation type             | Part number                                |
|--------------|----------------|----------------|-----------------------|----------------------------|--|
| Gate drivers | EiceDRIVER™    | 20 V           | 5 A/9 A               | functional/basic isolation | 1EDB6275F, 1EDB8275F, 1EDB9275F            |
|              |                |                | 5 A/9 A               | non-isolated               | 1EDN6550B, 1EDN8550B, 1EDN9550B, 1EDN8511B |
|              |                |                | ±2 A to ±6 A          | functional isolation       | 1EDI10112MF, 1EDI20112MF, 1EDI30112MF      |
|              |                | 25 V           | ±2.6 A                | non-isolated               | 1ED44173N01B                               |
|              |                | 40 V           | ±3 A to ±6 A          | functional isolation       | 1ED3431MU12M, 1ED3461MU12M                 |
|              |                |                | ±3 A to ±6 A          | reinforced isolation       | 1ED3431MC12M, 1ED3461MC12M                 |

| Product                       | Product family               | Load voltage | Output/load current | Isolation voltage | Part number |
|-------------------------------|------------------------------|--------------|---------------------|-------------------|-------------|
| Integrated solid-state relays | Photovoltaic isolators (PVI) | -            | 2 x 5 μA            | 3.75 kV           | PVI5033R    |
|                               |                              |              |                     | 2.5 kV            | PVI1050N    |
|                               | Photovoltaic relays (PVR)    | 60 V         | 2 A                 | 4 kV              | PVG612A     |
|                               |                              | 400 V        | 1 A                 | 3.75 kV           | PVX6012     |

[www.infineon.com/ssr](http://www.infineon.com/ssr)  
[www.infineon.com/S7](http://www.infineon.com/S7)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





Motor control

# Low-voltage motor drive and control

## Low-power battery applications

When it comes to increased efficiency and durability, brushless DC (BLDC) motors offer the ideal solution for power electric motor applications. Compared to traditional brushed motors, brushless DC motors are quieter, lighter, and offer an overall smaller design footprint while providing increased reliability. These improvements, however, come with an increased need for monitoring and control, requiring significantly more complex electronics and supporting algorithms. This move toward BLDC motors occurs in concert with a continuous push towards higher energy efficiency, resulting in trade-offs between power delivery and battery lifetime. This, in turn, puts a significant burden on semiconductor technologies to deliver high performance in motor control applications. In parallel, shortening life cycles and increased product diversity put an additional burden on suppliers to provide that same high performance, cost-efficient solutions across an increasing variety of use cases.

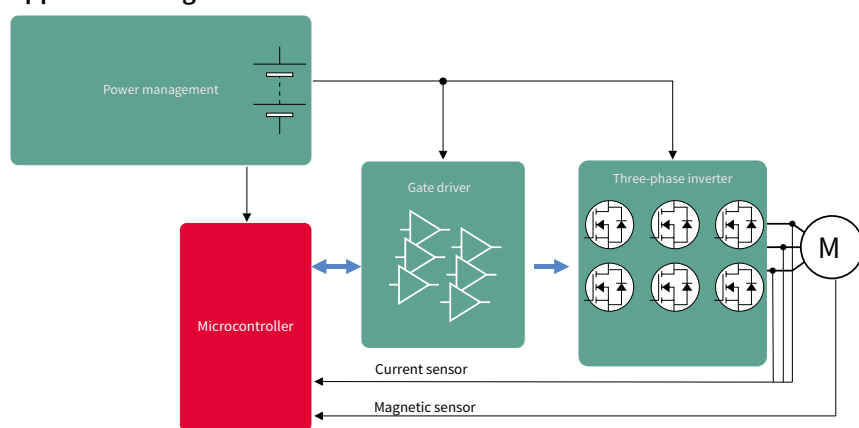
With industry-leading technology and reliability, Infineon's extensive portfolio of discrete and integrated circuits offers the breadth and depth of solutions necessary to meet the demands across a wide spectrum of motor control needs.

### Features and benefits

| Key features   |
|--|
| - A complete eco-system of simulations, documentation and demonstration boards   |
| - Comprehensive portfolio of products and solutions  |
| - Best in class MOTIX™ gate drivers for OptiMOS™ and StrongIRFET™ MOSFETs offering high efficiency and protection                        |
| - World-class broad and deep portfolio of LV FETs with SMD packaging improves capability and reliability while reducing assembly cost    |
| - Components featuring small form factor and compact design offering highest power density and BOM savings thanks to lowest $R_{DS(on)}$ |
| - High reliability of Infineon components results in prolonged product life spans  |

| Key benefits   |
|--|
| - Fast time-to-market  |
| - Broad portfolio allows for right product fit to meet application needs |
| - Extended battery life and product life span                            |
| - Reduction overall system size and cost                                 |

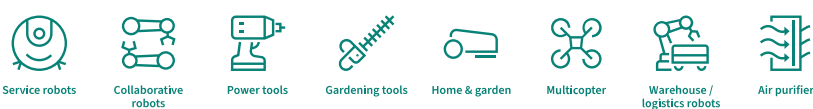
### Application diagram



### Key enabling products

- Power MOSFETs – OptiMOS™, StrongIRFET™
- MOTIX™ low-voltage motor control solutions
- XMC1000 microcontrollers
- XMC4000 microcontrollers
- PSoC™ 4100 microcontrollers
- PSoC™ 62 microcontrollers
- XENSIV™ angle sensor
- XENSIV™ magnetic sensor
- XENSIV™ current sensor
- XENSIV™ Hall switch

### Target end applications



[www.infineon.com/bldc](http://www.infineon.com/bldc)  
[www.infineon.com/bdc](http://www.infineon.com/bdc)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



Product portfolio

| Product category | Product family           | Package options   | Battery voltage support [V] | Voltage class [V <sub>DS</sub> max.] | Representative part numbers  |
|------------------|--------------------------|---|-----------------------------|--------------------------------------|--|
| Inverter/MOSFETs | StrongIRFET™<br>OptiMOS™ | SuperSO8<br>SuperSO8 SC<br>PQFN 3x3<br>DirectFET™ S/M/L-Can<br>PQFN 5x6 Source Down<br>TOLL<br>TOLG<br>TOLT<br>TO-220<br>TO-247<br>DPAK<br>D <sup>2</sup> PAK<br>D <sup>2</sup> PAK 7-pin | 12-16                       | 25-30                                | BSC005N03LS5, IQE006NE2LM5, IPT004N03L, IQE006NE2LM5CGSC, ISZ019N03LS5, IQE008N03LM5,  |
|                  |                          |   | 18                          | 40                                   | IRL40DM247, BSC010N04LS, IST011N06NM5, IRF40SC240, IPB011N04NF2S, IPB023N04NF2S, IPF013N04NF2S, ISC012N04NM6   |
|                  |                          |   | 36-48                       | 60                                   | IST011N06NM5, BSC012N06NS, BSZ100N06NS, IPT007N06N, IRFS7534, BSC014N06NS, IPTC007N06NM5, IPB013N06NF2S, IPB015N06NF2S, IRF60DM206, IQE030N06NM5SC                             |
|                  |                          |   | 48-60                       | 75-80                                | BSC021N08NS5, BSC030N08NS5, IPT010N08NM5, IPTG011N08NM5, IPP040N08NF2S, IPB049N08NS5, IPB016N08NF2S, IPB040N08NF2S, IPB024N08NF2S, IPF017N08NF2S, IQE050N08NM5, BSC023N08NS5SC |
|                  |                          |   | 60-72                       | 100-120                              | BSC035N10NS5, ISZ080N10NM6, IPT015N10NF2S, IPTC015N10NM5, IPP050N10NF2S, IPB018N10NS5, ISC030N12NM6, IPP018N10NS5, IPT014N10NS5, IPTC017N12NM6                                 |
|                  |                          |   | 72-96                       | 150                                  | BSC074N15NS5, BSC110N15NS5, BSC110N15NS5SC, BSC093N15NS5SC, IPTG039N15NM5, IPTG044N15NM5, IPTC054N15NM5, IPTC039N15NM5,  |
|                  |                          |   | 96-144                      | 200                                  | BSC220N20NSFD, IPTG111N20NM3FD, IPT111N20NFD, IRFP4127, IRF200P222, IRF6785, IRFP4668, IRFH5020  |

| Product category | Voltage class [V] | Configuration      | Part number     | Current source/sink | Comment  |
|------------------|-------------------|--------------------|-----------------|---------------------|--|
| Gate drivers     | 25                | Low-side           | 1ED44173        | 2.6 A/2.6 A         | Integrated fast over-current protection, fault re- porting and enable functionality, SOT-23 package  |
|                  | 60                | Three-phase        | 6EDL7141        | 1.5 A/1.5 A         | Fully configurable gate driver for battery operated motor control applications, integrated power management and current sense amplifiers, VQFN-48 package. >50 SPI programmable parameters. Highly integrated with MOSFET slew rate control, 3 OpAmps, Buck+LDO, dual charge pump      |
|                  | 70                | Three-phase        | 6EDL7151*       | 1.5 A/1.5 A         | High performance, highly integrated, programmable, PSU integrated, space saving, slew rate control, MOSFET optimizations, >50 SPI programmable parameters, slew rate control, 3 OpAmps, Buck+LDO, dual charge pump, and VDS sensing for hardware system protection                     |
|                  | 135               | High-Side          | 1EDL8011*       | 1 A sink            | 1EDL8011 high-side gate driver provides a simple and highly robust solution to drive a high side disconnect switch to protect battery operated systems, OCP protection, adjustable current setting threshold, time delay, safe start, UVLO.  |
|                  | 160               | Three-phase        | 6ED2742S01Q NEW | 1 A/2 A             | 160 V SOI process product for superior NPSOA with Bootstrap diodes. Support multi protection features. Pre-regulated three phase SOI gate driver with integrated charge pump, current sense amplifier, over-current protection& Fault out report in 5x5 VQFN-32 package. 2K HBM ESD.   |
|                  | 160               | High- and low-side | 2ED2732S01G NEW | 1 A/2 A             | 160 V SOI process product for superior NPSOA with Bootstrap diodes. Separate VSS/COM, thermal pad, DFN10 package, high side/ low side's own dead-time, 2 kV HBM ESD, smaller footprint, cost effective, simple, easy to use  |
|                  | 160               | Half-bridge        | 2ED2742S01G NEW | 1 A/2 A             | 160 V SOI process product for superior NPSOA with Bootstrap diodes. Separate VSS/COM, thermal pad, DFN10 package, integrated shoot-through protection logic, 2 kV HBM ESD, smaller footprint, cost effective, simple, easy to use  |
|                  | 160               | Half-bridge        | 2ED2748S01G NEW | 4 A/8 A             | 160 V SOI process product for superior NPSOA with Bootstrap diodes. High current drive for parallel MOSFET applications. Separate VSS/COM, thermal pad, DFN10 package, integrated shoot-through protection logic, 2 kV HBM ESD, smaller footprint, cost effective, simple, easy to use |
|                  | 160               | High- and low-side | 2ED2738S01G NEW | 4 A/8 A             | 160 V SOI process product for superior NPSOA with Bootstrap diodes. High current drive for parallel MOSFET applications. Separate VSS/COM, thermal pad, DFN10 package, high side/ low side's own dead-time, 2 kV HBM ESD, smaller footprint, cost effective, simple, easy to use       |
|                  | 200               | Three-phase        | 6EDL04N02       | 0.165 A/0.375 A     | SOI, integrated BSD, OCP, enable, fault reporting, TSSOP-28 package  |
|                  | 200               | High- and low-side | IRS2005S        | 0.29 A/0.6 A        | V <sub>CC</sub> and V <sub>BS</sub> UVLO, matched propagation delay, DSO-8 package   |
|                  | 200               | Half-bridge        | IRS2007S        | 0.29 A/0.6 A        | V <sub>CC</sub> and V <sub>BS</sub> UVLO, matched propagation delay, DSO-8 package   |
|                  | 200               | Low- or high-side  | 1EDN7550        | 4 A/8 A             | Low propagation delay, differential input, high common-mode input, UVLO, SOT23-6 and TSNP-6 package options  |
|                  | 600               | Half-bridge        | IRS21867S       | 4 A/4 A             | High current level-shift gate driver with low V <sub>CC</sub> operation, DSO-8 package   |
|                  | 600               | Three-phase        | 6EDL04N06PT     | 0.165 A/0.375 A     | SOI, integrated BSD, tolerant to -VS up to 100 V, OCP, enable, fault reporting, DSO-28W package  |
|                  | 650               | Half-bridge        | 2ED2304S06F     | 0.36 A/0.7 A        | SOI, integrated BSD, tolerant to -Vs up to 100 V, DSO-8 package  |

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[www.infineon.com/bdc](http://www.infineon.com/bdc)

\* Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



| Category           | Product name                     |                    | Description   |
|--------------------|----------------------------------|--------------------|---|
| Integrated devices | MOTIX™                           | IFX9201SG          | Integrated brushed DC motor driver  |
|                    |                                  | TLE9140EQW NEW     | 3-Phase BLDC motor gate driver IC, voltage to 110 V, 24 V/48 V systems, gate driving capability: ~230 nC/MOSFET up to 20 kHz, gate-shaping, diagnostics and protections, developed acc. to ISO26262 achieving ASIL-B  |
|                    |                                  | IMD701A            | Fully programmable motor controller integrating XMC1404 microcontroller with MOTIX™ 6EDL7141 3-phase gate driver IC in one package. Include hardware MATH Co-Processor (96 MHz) for FOC algorithms, includes PWM timers, position interface (POSIF) or serial communication modules including CAN |
| Microcontrollers   | XMC™                             | XMC1300<br>XMC1400 | ARM™ Cortex® -M0 core. 32/48 MHz core, math coprocessor, peripherals up to 96 MHz peripherals, CCU4/CCU8 PWM timers, 2x serial channels, hall and encoder interface, analog comparators, 12-bit ADC, up to 200 kB flash/16 kB RAM 16-64 pins  |
|                    |                                  | XMC4400            | ARM™ Cortex® -M4F core, up to 144 MHz, up to 512 kB flash/80 kB RAM, 4xCCU4/2xCCU8/2xPOSIF timers, serial channels, up to 4x 12-bit ADC/2x DAC, 4xΔΣ demodulator, 64-100 pins   |
|                    | PSoC™                            | PSoC™ 4100         | ARM™ Cortex® -M0/M0+ CPU with DMA controller, up to 384 kB flash/32 kB SRAM, cryptographic coprocessor, 12-bit ADC/13-bit DAC, configurable amplifiers, 16-bit PWM timers, configurable serial communication blocks, up to 84 GPIO, 28-100 pin packages   |
|                    |                                  | PSoC™ 62           | Dual-core 150 MHz ARM™ Cortex® -M4 and 100 MHz M0/M0+, ultra-low power and low-power operation modes, up to 2 MB flash, 1 MB SRAM with DMA, 24x16-bit and 8x32-bit timer blocks, USB 2.0, up to 104 GPIOs   |
| Sensors            | Hall switches                    | XENSIV™ TLI4963    | 3-5.5 V operation, active error compensation, high stability magnetic thresholds, low jitter  |
|                    | Angle sensor                     | XENSIV™ TLI5012    | Integrated angle calculation, incremental interface, SPI with 8 Mbit/s, ≤ 1.9o angle error over-t emperature/life, integrated giant magnetoresistance-based angle sensor, 15-bit representation of angle value with 0.01o resolution, bi-directional SSC interface                                |
|                    | 3D magnetic sensor               | XENSIV™ TLI493D    | ± 50 mT to ± 160 mT ranges, up to 30.8 LSB12/MT sensitivity, low-power mode, low offset and match drift, wake up function   |
|                    | Magnetic coreless current sensor | XENSIV™ TLI4971    | 25 A to 120 A measurement range, 240 kHz bandwidth, low sensitivity error over temperature, galvanic functional isolation up to 1150 V, differential sensing, two independent over current detection outputs  |

### Evaluation platforms

| Category    | Product name  | Description   |
|-------------|---|---|
| Application | DEMO-PTOOL-300W-M                                     | This design kit for cordless power tools uses the DirectFET™ ME/MF and firmware developed using the XMC1300 family  |
|             | KIT_MOTOR_DC_250W_24V                                 | Three-phase DC motor control power card (V <sub>DC</sub> 24 V, 250 W motor drive power card for XMC1000 and XMC4000)  |
|             | Stepper motor control shield with IFX9201 and XMC1300 | The stepper motor control shield based on Infineon's H-bridge IFX9201 and XMC1300 microcontroller can drive the two coils in a stepper motor featuring a dual-H-bridge configuration. This current stepper motor control board is compatible with Arduino microcontroller boards and Infineon's XMC™ microcontroller kits using the Arduino form factor   |
|             | KIT_XMC1X_AK_MOTOR_001                                | XMC1000 motor control application kit   |
| Product     | CY8CKIT-037   | The CY8CKIT-037 is used for PSoC™ 4 solution evaluation for motor control application. The kit supports BLDC motors, PMSM (permanent magnetic synchronous motors), and stepper motors. We provide example projects including single-shunt and sensorless FOC (field-oriented control), sensored BLDC control, sensorless BLDC control, and stepper motor control example projects   |
|             | EVAL_6EDL7141_TRAP_1SH                                | The EVAL_6EDL7141_TRAP_1SH features fully configurable operating parameters with an on-board debugger ready for direct USB connection to PC. The BLDC motor drive board uses trapezoidal commutation based on the MOTIX™ 6EDL7141 smart three-phase driver and XMC1400 series micro-controller  |
|             | EVAL_6EDL7141_FOC_3SH                                 | The EVAL_6EDL7141_FOC_3SH features fully configurable operating parameters with an on-board debugger ready for direct USB connection to PC. The BLDC motor drive board uses sensor-less FOC based on the MOTIX™ 6EDL7141 smart three-phase driver and XMC1400 series micro-controller   |
|             | EVAL_IMD700A_FOC_3SH                                  | The EVAL_IMD700A_FOC_3SH features fully configurable operating parameters with an on-board debugger ready for direct USB connection to PC. The BLDC motor drive board uses sensor-less FOC based on the MOTIX™ IMD700/1A integrated XMC1400 series microcontroller with 6EDL7141 smart three-phase driver in a single package   |
|             | EVAL_TOLT_DC48V_3KW                                   | The evaluation board features a motor drive inverter power stage using high efficiency, OptiMOS™ 5 100 V power MOSFETs in top-side cooling TOLT package. The top-side cooled MOSFET solution for 3-phase BLDC motor drive leads to increase power handling capability. The power board operates with Infineon's XMC1300 Drive Card (KIT_XMC1300_DC_V1). Firmware is provided with trapezoidal control for 48 V BLDC motor with hall sensors |
|             | S2GO_CUR-SENSE_TLI4971                                | For evaluation purposes of the latest XENSIV™ current sensor TLI4971, we rely on our proven evaluation concept of Shield2Go and 2GO Kits – therefore the TLI4971 evaluation environment is also offered in those two configurations:<br>– TLI4971 MS2GO: 2GO Kit version<br>– TLI4971 S2GO: Shield2Go version   |

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[www.infineon.com/bdc](http://www.infineon.com/bdc)

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Drives

# HP LV motor drive and control

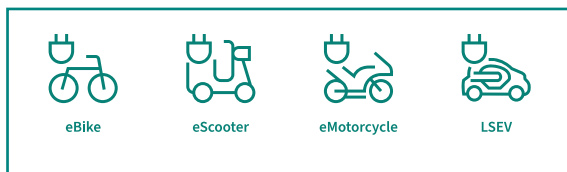
## Powering light e-mobility and material handling

High-power low-voltage motor drives power both personal light e-mobility vehicles such as e-bikes, e-scooters, e-motorcycles, micro EVs, as well as material handlers such as e-forklifts, delivery vehicles (xDVs), autonomous mobile robots (AMR), automated guided vehicles (AGV), and commercial, construction and agricultural vehicles (CAV). These applications can be collectively referred to as light electric vehicles (LEVs). LEVs have an ever-growing need for highly efficient, intelligent, and powerful motor-drive systems to address requirements such as high speed, high peak and continuous torque, safety, reliability, and most of all, long battery lifetime. Infineon offers a comprehensive, end-to-end solution for every segment and variation of this diverse market with power levels ranging from 200 W to even greater than 50 kW. The OptiMOS™ and StrongIRFET2™ MOSFET families form a powerful yet efficient muscle of the system, while the EiceDRIVER™ and MOTIX™ gate driver families offer a broad range of both isolated and non-isolated gate drivers. An array of motor control MCUs such as iMOTION™, XMC™, PSoC™, TRAVEO™ T2G and AURIX™ along with their software/tools ecosystem, enable quick, easy, and tailor-made implementations of advanced motor control algorithms while meeting increasing safety requirements. The XENSIV™ current and angle/position sensors enable accurate closed-loop control. Along with an extensive product portfolio, Infineon simplifies and accelerates the design process by offering demonstration, evaluation, and reference boards, simulation models, application notes, comprehensive technical support, and a vibrant developer community.

### Features and benefits

| Key features   | Key benefits   |
|--|--|
| <ul style="list-style-type: none"> <li>MOSFETs with best FOMs for drives with low <math>R_{DS(on)}</math>, low <math>Q_{rr}</math>, low <math>\Delta V_{GS(th)}</math></li> <li>Broad and deep microcontroller portfolio enabling varied design approaches (plug n-play, optimized custom design), S/W tool libraries, hall and encoder I/F MATH Co-processor, <math>\Delta\Sigma</math> de-modulator, functional safety</li> <li>Gate drivers with robust isolation, TDI, high/programmable output current, active miller clamp</li> <li>Current sensors having high current range, coreless sensing, high resolution, noise immunity and programmability</li> <li>Hall switches, angle/position sensors and 3D angle sensors with high accuracy, low jitter and low power consumption</li> </ul> | <ul style="list-style-type: none"> <li>Extended range/increase in battery life</li> <li>Precise motor control</li> <li>Enable compact motor drive design</li> <li>Quick and easy system design enabling fast time-to-market</li> <li>Rugged, reliable and safe motor drives</li> </ul> |

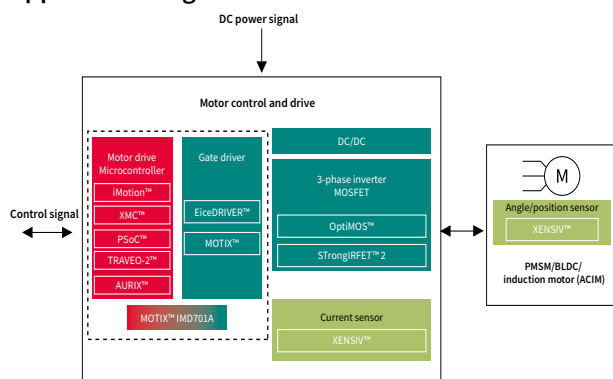
### Personal e-mobility



### Material handling



### Application diagram



| Product                        | Product family  |
|--------------------------------|---|
| 3-phase inverter (MOSFETs)     | OptiMOS™, StrongIRFET™  |
| Microcontroller                | iMOTION™ IMC 300, XMC™, PSoC™, TRAVEO™ T2G, AURIX™            |
| Gate driver                    | EiceDRIVER™, MOTIX™   |
| Position/speed sensor          | XENSIV™ angle sensors and Hall switches                       |
| Current sensor                 | XENSIV™ current sensor  |
| Software and Design Enablement | IPOSIM, ModusToolbox™, AURIX™ Development Studio, DAVE™ Drive |

[www.infineon.com/high-power-drive-up-to-200v](http://www.infineon.com/high-power-drive-up-to-200v)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



Typical power level of the inverter system: 200 W-4 kW

| Component | Product family          | Battery voltage (V) | Voltage class (V <sub>DS</sub> max) | Package options  | Battery voltage support (V) | Voltage class (V <sub>DS</sub> max) | Representative part numbers  | Features  |
|-----------|-------------------------|---------------------|-------------------------------------|--|-----------------------------|-------------------------------------|--|---|
| MOSFETs   | StrongIRFET™ 2 OptiMOS™ | 24-36               | 60                                  | TOLL<br>TOLG<br>TOLT<br>D <sup>2</sup> PAK 7-pin<br>D <sup>2</sup> PAK<br>TO-220<br>TO-247<br>SuperS08 | 24-36                       | 60                                  | IPTC007N06NM5*, IPTC012N06NM5*, ISC015N06NM5LF*, IPF010N06NF2S, IPF012N06NF2S, IPF016N06NF2S, IPB029N06NF2S, IPB018N06NF2S, IPB015N06NF2S, IPB013N06NF2S, IPP040N06NF2S, IPTG007N06NM5, IPT008N06NM5LF, BSC014N06NSSC, IPP030N06NF2S, IPP019N06NF2S, IPP016N06NF2S, IPP014N06NF2S, IQD009N06NM5CG, IQDH88N06LM5CG  | Low R <sub>DS(on)</sub> and low conduction losses, tight V <sub>GS(th)</sub> spread for efficient paralleling, low Q <sub>rr</sub> , soft body diode, innovative packages<br><br>Catering to diverse application mission profile requirements with OptiMOS™ (industrial grade) and StrongIRFET™ 2 (standard grade and grade with broad availability from distribution partners) |
|           |                         | 36-48               | 80                                  |  | 36-48                       | 80                                  | IPTG011N08NM5, IPTC012N08NM5, IPT012N08NM5, IPT010N08NM5, IPB015N08N5, IPB017N08N5, BSC019N08NS5, IPP024N08NF2S, IPB024N08NF2S, IPP016N08NF2S, IPP040N08NF2S, BSC037N08NS5, IPB049N08N5, IPTC011N08NM5*, IPTC014N08NM5*, ISC025N08NM5LF*, IPT009N08NM6*, IPF011N08NM6*, ISC015N08NM6*, IQD016N08NM5CG*, IPF023N08NF2S, IPF039N08NF2S, IPT012N08NF2S, IPF017N08NF2S, IPF014N08NF2S, IPB055N08NF2S, IPB040N08NF2S, IPB024N08NF2S, IPB019N08NF2S, IPB016N08NF2S |   |

| Component    | Voltage class (V) | Configuration      | Part number   | Source/sink     | Package  | Features   |
|--------------|-------------------|--------------------|---------------|-----------------|----------|--|
| Gate drivers | 60                | Three-phase        | 6EDL7141      | 1.5 A/1.5 A     | VQFN48   | Configurable smart gate driver, integrated power management, 3 x current sense amplifiers (CSA)  |
|              | 70                | Three-phase        | 6EDL7151*     | 1.5 A/1.5 A     |          | Configurable smart gate driver, integrated power management, 3 x current sense amplifiers (CSA) and VDS sensing for hardware system protection |
|              | 90                | Three-phase        | TLE9140EQW    | 0.48 A          | DSO32    | Active LS freewheeling during overvoltage, ASIL-B functional safety, automotive grade 0 qualified  |
|              | 90                | Three-phase        | TLE9180D-32QK | 2 A/2 A         | LQFP64   | 3 x current sense amplifiers (CSA), ASIL-C Functional safety, automotive grade 1 qualified   |
|              | 160               | Three-phase        | 6ED2742S01Q   | 1 A/2 A         | QFN32    | SOI, integrated BSD, trickle charge pumps, power management and current sense amplifiers, RFE  |
|              | 160               | Half-bridge        | 2ED2742*      | 1 A/2 A         | DFN10    | SOI, integrated BSD, integrated shoot-through protection logic, 2 kV HBM ESD   |
|              | 160               | High- and low-side | 2ED2732*      | 1 A/2 A         | DFN10    | SOI, integrated BSD, integrated shoot-through protection logic, 2 kV HBM ESD   |
|              | 200               | Three-phase        | 6EDL04N02PR   | 0.165 A/0.375 A | TSSOP-28 | SOI, integrated BSD, OCP, enable, fault reporting, UVLO enable   |
|              | 200               | High- and low-side | IRS2005S      | 0.29 A/0.6 A    | DSO-8    | V <sub>CC</sub> and V <sub>BS</sub> UVLO, matched propagation delay  |
|              | 200               | High- and low-side | IRS2011S      | 1/1 A           | DSO-8    | UVLO, MTON/OFF, max=20 ns, 3.3 - 5 V input   |
|              | 600               | High- and low-side | 2EDL05N06PF   | 0.36/0.7 A      | DSO-8    | SOI, UVLO, MTON/OFF, max=60 ns, 3.3 - 15 V input, BSD  |
|              | 600               | Single high-side   | IRS21271S     | 0.2/0.42 A      | DSO-8    | UVLO, OCP, 3 - 15 V input, fault reporting   |
|              | 600               | Three-phase        | 6EDL04N06PT   | 0.165 A/0.375 A | DSO-28   | SOI, integrated BSD, OCP, enable, fault reporting, UVLO enable   |



Typical power level of the inverter system: 4 kW-11 kW

| Component | Product family             | Package options  | Battery voltage support (V) | Voltage class (V <sub>DS max</sub> ) | Representative part numbers   | Features  |
|-----------|----------------------------|--|-----------------------------|--------------------------------------|---|---|
| MOSFETs   | StrongIRFET™ 2<br>OptiMOS™ | TOLL, TOLG<br>TOLT D <sup>2</sup> PAK<br>7-pin D <sup>2</sup> PAK<br>TO-220 TO-247<br>SuperSO8<br>SuperSO8<br>SourceDown | 48-72                       | 100-120                              | IPTG014N10NM5, IPTC014N10NM5, IPT015N10N5, IPT015N10NF2S*, IPB020N10N5, ISC022N10NM6, IPB017N10N5, IPT030N12N3-G, IPB036N12N3 G, IPP039N10N5, IPP050N10NF2S, IPT017N12NM6, IPTC017N12NM6, IPF019N12NM6, IPT030N12N3-G, IPTC030N12NM3, IPB055N08NF2S, IPF016N10NF2S, IPF050N10NF2S, IPF042N10NF2S, IPF024N10NF2S, IPP082N10NF2S, IPP026N10NF2S, IPP050N10NF2S, IPT022N10NF2S, IPT017N10NF2S, IPT015N10NF2S, IQD020N10NM5CG | Low R <sub>DS(on)</sub> and low conduction losses, tight V <sub>Gsth</sub> spread for efficient paralleling, low Q <sub>rr</sub> , soft body diode, innovative packages<br><br>Catering to diverse application mission profile requirements with OptiMOS™ (industrial grade) and StrongIRFET™ 2 (standard grade and with broad availability from distribution partners) |
|           |                            |  | 72-96                       | 135-150                              | IRF150P220, IPT039N15N5, IPTG039N15NM5, IPTC039N15NM5, IPB044N15N5, IPT044N15N5, IPB048N15N5, IPT054N15N5, IQD063N15NM5CG, BSC093N15NS5, IRFP4568, IPT063N15N5, IPB073N15N5, IRF7779L2, IPP076N15N5, IRFS4115   |   |

| Component    | Voltage class (V) | Configuration      | Part number    | Source/sink | Package                 | Features  |
|--------------|-------------------|--------------------|----------------|-------------|-------------------------|---|
| Gate drivers | 160               | High- and low-side | 2ED2738S01G*   | 4/8 A       | DFN10                   | SOI, integrated BSD, integrated dead time, integrated shoot-through protection logic, 2 kV HBM ESD                              |
|              | 160               | Half-bridge        | 2ED2748*       | 4/8 A       | DFN10                   | Truly differential input, high-side and low-side driver, high common mode rejection capability (TDI), 8 V UVLO                  |
|              | 200               | 1-ch non-isolated  | 1EDN8550B      | 4/8 A       | SOT23-6                 | Truly differential input, high-side and low-side driver, high common mode rejection capability (TDI), 8 V UVLO                  |
|              | 200               | 1-ch non-isolated  | 1EDN7550U      | 4/8 A       | TSNP                    | Compact package, truly differential input, high-side and low-side driver, high common mode rejection capability (TDI), 4 V UVLO |
|              | 250               | Half-bridge        | 2EDF5215F      | 5/9 A       | DSO-8                   | Dual channel, 7 V UVLO, functional isolation gate driver, in compact package  |
|              | 500               | High- and low-side | IRS2110S       | 2/2 A       | DSO-16W                 | MTON/OFF, max=10 ns, separate power and logic ground, SD pin, 3 - 20 V input  |
|              | 600               | High- and low-side | 2EDL23N06PJ    | 2.3/2.8 A   | DSO-14                  | 3.3 V - 15 V input, -100 V transient, PGND, SOI, integrated BSD, OCP, UVLO, enable, fault reporting                             |
|              | 600               | High- and low-side | IRS21867S      | 4/4 A       | DSO-8                   | High current level shift gate driver with low V <sub>CC</sub> operation   |
|              | 600               | 1-ch isolated      | IR2127         | 0.25/0.5 A  | DIP8                    | Over current protection and fault reporting   |
|              | 650               | High- and low-side | 2ED2181S06 F/J | 2.5/2.5 A   | DSO-8 (F)<br>DSO-14 (J) | SOI, integrated BSD, 3.3 - 15 V input, MTON/OFF, max=35 ns, -100 V transient, separate logic and power ground (only J version)  |

Note: The MOSFET parts listed under various power-levels in the above tables is only for guidance purposes; higher power levels can be achieved even with lower voltage class MOSFETs through paralleling.

Typical power level of the inverter system: >11 kW

| Component | Product family             | Package options   | Battery voltage support (V) | Voltage class [V <sub>DS max</sub> ] | Representative part numbers  | Features  |
|-----------|----------------------------|---|-----------------------------|--------------------------------------|--|---|
| MOSFETs   | StrongIRFET™ 2<br>OptiMOS™ | TOLL<br>TOLG<br>TOLT<br>D <sup>2</sup> PAK<br>7-pin<br>D <sup>2</sup> PAK<br>SuperSO8<br>TO-220<br>TO-247 | 96-144                      | 200                                  | IRF200P222, IPB107N20N3G, IPTG111N20NM3FD, IRFP4668, IRFS4127, IPT067N20NM6*, ISC119N20NM6*, IPT129N20NM6*, IPP319N20NM6*, IPP069N20NM6*, IPF067N20NM6*, IPB068N20NM6* | Low R <sub>DS(on)</sub> and low conduction losses, tight V <sub>Gsth</sub> spread for efficient paralleling, low Q <sub>rr</sub> , soft body diode, innovative packages<br><br>Catering to diverse application mission profile requirements with OptiMOS™ (industrial grade) and StrongIRFET™ 2 (standard grade and with broad availability from distribution partners) |
|           |                            |   | 144-200                     | 250-300                              | IRF250P224, IRF300P226, IPT210N25NFD, IPTG210N25NM3FD, IPB407N30N, IPB600N25N3 G, IRFP4868, IRFB4229, IRFS4229   |   |

| Component    | Voltage class (V) | Configuration                  | Part number             | Source/sink | Package         | Features  |
|--------------|-------------------|--------------------------------|-------------------------|-------------|-----------------|---|
| Gate drivers | 650               | 1-ch isolated                  | 1EDB8275F               | 5/9 A       | DSO-8           | 3 kV basic isolation with CT technology, (UL1577), separate SRC/SNK output, UVLO (4 types), CMTI > 300 V/ns |
|              | 1200              |                                | 1EDI60N12AF             | 10/9 A      |                 | Short circuit clamping, active shut-down, UVLO, separate SRC/SNK output, 3.3 - 15 V input                   |
|              | 1200              | 2-ch isolated                  | 2EDB8259F/<br>2EDB8259Y | 5/9 A       | DSO16/<br>DSO14 | 3 kV basic isolation w. CT technology, (UL1577), 8 V UVLO (4 types), DIS, STP/DTC, CMTI > 300 V/ns          |
|              | 1200              | 2-ch with reinforced isolation | 2EDR8259X               | 5/9 A       | DSO-14          | Dual-channel, 8 V UVLO, gate driver with increased ch to ch creepage  |
|              | 1200              | 2-ch with reinforced isolation | 2EDR7259X               | 5/9 A       | DSO-14          | Dual-channel, 4 V UVLO, gate driver with increased ch to ch creepage  |

\* Coming soon





Microcontrollers and sensors for precision control and accurate sensing (power-level agnostic)

| Component        | Product family | Core/MaxClock speed  | Representative parts       | Package                      | Features   |
|------------------|----------------|--|----------------------------|------------------------------|--|
| Microcontroller  | iMOTION™       | Arm® Cortex® M0, 48 MHz  | IMC301A-F048, IMC301A-F064 | LQFP-48, LQFP-64             | UART, SPI, I <sup>2</sup> C, LIN, MATH, 2x ACMP, CCU4  |
|                  | XMC™           | Arm® Cortex® M0, 32 MHz  | XMC13xx                    | TSSOP-16/28/38, VQFN-24/40,  | UART, SPI, I <sup>2</sup> C, I <sup>2</sup> S, POSIF, MATH, 3x ACMP, CCU8  |
|                  |                | Arm® Cortex® M0, 48 MHz  | XMC14xx                    | TSSOP-38, VQFN-0/48, LQFP-64 | UART, SPI, I <sup>2</sup> C, I <sup>2</sup> S, CAN, POSIF, MATH, 4x ACMP, 2x CCU8  |
|                  |                | Arm® Cortex® M4F, up to 144 MHz                                  | XMC4xxx                    | VQFN-48, TQFP-64             | UART, SPI, I <sup>2</sup> C, I <sup>2</sup> S, CAN, POSIF, HRPWM, CCU8, Ethernet, EtherCAT   |
|                  |                | Single and dual core Arm® Cortex®-M7 and Cortex®-M0+             | XMC7100, XMC7200           | TQFP-100/176, LFBGA-272      | TCPWM timers of 102 ch 16 bit and 16 ch 32-bit, cryptography engine support, CAN-FD  |
|                  | TRAVEO™ T2G    | Single and Dual Arm® Cortex® M7 and M0+ Arm® Cortex® M4F and M0+ | TRAVEO™ T2G                | LQFP-64/100/176              | ASIL-B functional safety, 16-bit dedicated motor TCPWM and 32-bit TCPWM, clock extension peripheral, CAN-FD, cryptography engine support, SOTA support |
|                  | AURIX™         | up to 6x TriCore™ at 300 MHz +                                   | AURIX™ TC3xx               | LQFP-144/176, LFBGA-292/516  | ASIL-D functional safety with up to 4-lockstep cores, CAN-FD, cryptography engine support, support high PWM (5 ns @ 200 MHz), SOTA support             |
| Motor Control IC | MOTIX™         | Arm® Cortex® M0, 48 MHz  | IMD701A                    | VQFN-64                      | XMC1404 microcontroller integrated with 6EDL7141 3-ph smart gate driver in a single package  |

| Component  | Product family                                    | Representative parts  | Features   |
|--|---|---|--|
| Angle/position sensors                                 | XENSIV™ Hall switches (end of shaft/out of shaft) | XENSIV™ TLx4961/68  | 3 - 32 V operation, active error compensation, high stability magnetic thresholds, low jitter  |
|  | XENSIV™ angle sensor (end of shaft)               | XENSIV™ TLI5012   | Integrated angle calculation, incremental interface, SPI with 8 Mbit/s, ≤ 1.9° angle error over temperature/life, integrated giant magneto resistance-based angle sensor, 15-bit representation of angle value with 0.01° resolution, bi-directional SSC interface |
|  |   | XENSIV™ TLE5501   | Sin/cos output via analog interface, precise rotation sensing (typ. angle error of 1 deg), very-low current consumption (~2 mA), extended magnetic field range up to 100 mT, ISO-26262 (functional safety) compliant option  |
| XENSIV™ 3D magnetic sensor (end of shaft/out of shaft) | XENSIV™ TLI493D                                   | Enables out-of-shaft angular sensing, ±50 mT to ±160 mT ranges, up to 30.8 LSB12/MT sensitivity, low power mode, low offset and match drift, wake up function; recommended for motors with max-speed up to 3000 rpm |  |
| Current sensor   | XENSIV™ magnetic coreless current sensor          | XENSIV™ TLI4971   | ±25 A, ±50 A, ±75 A and ±120 A measurement range, 240 kHz bandwidth, low sensitivity error over temperature, galvanic functional isolation up to 1150 V, differential sensing, two independent over current detection outputs, user programmable parameters        |
|  |   | XENSIV™ TLE4972   | Analog output, up to ±2000 A measurement range, 210 kHz bandwidth, fast overcurrent detection output with programmable threshold, differential sensing, galvanic isolation between current rail and sensor, user programmable parameters                           |

Design resources

Low-voltage drives scalable power demoboard platform

XMC™ demonstration and eval boards

ModusToolbox™

TRAVEO™ T2G Motor Control

[www.infineon.com/high-power-drive-up-to-200v](http://www.infineon.com/high-power-drive-up-to-200v)

\* Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





eBike



Warehouse /  
logistics robots

### System specification example

$V_{bat} = 36\text{ V}$ , 250 W (continuous power) PMSM motor with configurable controller and smart gate driver

#### BoM Exemplar

| Component             | Part Numbers           | Description   |
|-----------------------|------------------------|---|
| MOSFETs               | BSC012N06NS            | Small form-factor in a SuperSO8 package, low $R_{DS(on)}$ , low $Q_{rr}$ , soft body diode  |
| Microcontroller       | IMC301A-F048           | Configurable (No-Code) motor control IC; communication: UART, SPI, I <sup>2</sup> C, LIN<br>Motor control peripherals: MATH, 2x ACMP, CCU4  |
| Gate driver           | 6EDL7141               | 3-phase configurable gate driver with >50 configurable parameters (slew rate, output voltage etc.); fully integrated programmable buck (7,9,10,15 V) + LDO (3.3,5 V) power supply; 3* integrated current sense amplifiers (CSA) |
| Position/speed sensor | TLI49611MXTMA1         | Bipolar Hall latch with 3.0 V to 32 V operating supply voltage, active error compensation, low jitter (typ. 0.35 $\mu$ s), high ESD performance   |
| Current sensor        | TLI4971-A120T5-U-E0001 | 120 A measurement range with integrated current rail, high bandwidth of 240 KHz, high robustness to voltage slew rates up to 10 V/ns, two independent fast over-current detection (OCD) pins with configurable thresholds       |



eBike



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logistics robots

### System specification example

$V_{bat} = 48\text{ V}$ , 250 W (continuous power) PMSM motor with dedicated motor control MCU

#### BoM Exemplar

| Component             | Part Numbers           | Description   |
|-----------------------|------------------------|---|
| MOSFETs               | BSC019N08NS5           | Small form-factor in a SuperSO8 package, low $R_{DS(on)}$ , low $Q_{rr}$ , soft body diode  |
| Microcontroller       | XMC1302-T038X-0032     | Core: 32 MHz Arm <sup>®</sup> Cortex <sup>®</sup> M0, peripherals clock: 64 MHz; communication: UART, SPI, I <sup>2</sup> C, motor control peripherals: POSIF, MATH, 1x CCU8  |
| Gate driver           | 6ED2742S01Q            | 3-phase gate driver built on silicon on insulator (SOI) technology with integrated BSD, trickle charge pumps, power management and current sense amplifiers   |
| Position/speed sensor | TLI49611MXTMA1         | Bipolar Hall latch with 3.0 V to 32 V operating supply voltage, active error compensation, low jitter (typ. 0.35 $\mu$ s), high ESD performance   |
| Current sensor        | TLI4971-A120T5-U-E0001 | 120 A measurement range with integrated current rail, high bandwidth of 240 KHz, high robustness to voltage slew rates up to 10 V/ns, two independent fast over-current detection (OCD) pins with configurable thresholds |



eBike



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### System specification example

$V_{bat} = 36\text{ V}$ , 250 W (continuous power) PMSM motor with functional safety requirement

#### BoM Exemplar

| Component             | Part Numbers           | Description   |
|-----------------------|------------------------|---|
| MOSFETs               | BSC016N06NS            | Small form-factor in a SuperSO8 package, low $R_{DS(on)}$ , Low $Q_{rr}$ , soft body diode  |
| Microcontroller       | CYT4BB5CEBQ0AESGS      | Core: One/two Arm <sup>®</sup> Cortex <sup>®</sup> M7 at 250MHz + Arm <sup>®</sup> Cortex <sup>®</sup> M0+ at 100 MHz, 4 MB flash, Up to 12 16-bit counters for motor control, Up to 220 programmable I/Os                |
| Gate driver           | TLE9180D-32QK          | 3-phase gate driver with 3 x current sense amplifiers (CSA), ASIL-C functional safety; automotive grade 1 qualified   |
| Position/speed sensor | TLI49611MXTMA1         | Bipolar Hall latch with 3.0 V to 32 V operating supply voltage, active error compensation, low jitter (typ. 0.35 $\mu$ s), high ESD performance   |
| Current sensor        | TLI4971-A120T5-U-E0001 | 120 A measurement range with integrated current rail, high bandwidth of 240 KHz, high robustness to voltage slew rates up to 10 V/ns, two independent fast over-current detection (OCD) pins with configurable thresholds |





**System specification exemplar**

$V_{bat} = 48\text{ V}$ , 3 kW PMSM motor

| Component             | Part Numbers           | Description   |
|-----------------------|------------------------|---|
| MOSFETs               | IPTC012N08NM5          | OptiMOS™ 5 80 V power MOSFET in TOLT package enabling top-side cooling, high current rating >300 A, low $Q_g$ of 175 nC   |
| Microcontroller       | XMC1403-Q048X0200 AA   | Core: 48 MHz arm cortex M0, peripherals clock: 96 MHz; communication: UART, SPI, I <sup>2</sup> C, 2*MultiCAN; motor control peripherals: POSIF, MATH, 4x ACMP, 2x CCU88  |
| Gate driver           | 2ED2738S01G            | 2-channel (half-bridge) gate driver with SOI isolation, integrated BSD, UVLO, separate $V_{ss}/COM$ , thermal pad   |
| Position/speed sensor | TLE5012B E1000         | Giant magneto resistive (GMR) based analog sensor with a high magnetic field range of 20 mT to 100 mT; Max. 1.0° angle error over lifetime, discrete bridge with differential sine and cosine output                      |
| Current sensor        | TLI4971-A120T5-U-E0001 | 120 A measurement range with Integrated current rail, high bandwidth of 240 KHz, high robustness to voltage slew rates up to 10 V/ns, two independent fast over-current detection (OCD) pins with configurable thresholds |



**System specification exemplar**

$V_{bat} = 48\text{ V}$ , 20 kW PMSM motor

| Component             | Part Numbers           | Description   |
|-----------------------|------------------------|---|
| MOSFETs               | IPTG014N10NM5          | OptiMOS™ 5 100 V power MOSFET in TOLG (TO-Leaded with gullwing) package, high current rating >300 A, low $Q_g$ of 169 nC  |
| Microcontroller       | SAK-TC377TX-96F300S AB | AURIX™ TC377TX 3 * Tricore @ 300 MHz; functional safety ASIL - D; HSM (hardware security module); communication: 12-ch CAN-FD, 128-ch DMA   |
| Gate driver           | 2EDB8259F              | Half-bridge gate driver with 3 kV basic isolation based on coreless transformer (CT) technology, (UL1577), UVLO (4 types), DIS, STP/DTC, CMTI > 300 V/ns                                      |
| Position/speed sensor | TLE5014(D)             | Giant magneto resistive (GMR) angle sensors with a wide range of selectable interfaces (SPC, SENT, PWM, SPI), low error rate < 1.0°, easy-to-use pre-configured sensors with high flexibility |
| Current sensor        | TLE4972-AE35S5         | High-precision coreless current sensor with full-scale up to 31 mT for high current applications; two independent fast over-current detection (OCD) pins with configurable thresholds         |



**System specification exemplar**

$V_{bat} = 48\text{ V}$ , 3 kW PMSM motor

| Component             | Part Numbers         | Description   |
|-----------------------|----------------------|---|
| MOSFETs               | IPT039N15N5          | OptiMOS™ 5 150 V power MOSFET in TOLL package, high current rating >190 A, low $Q_g$ of 78 nC   |
| Microcontroller       | XMC4700-F100K1536 AA | Core: ARM® Cortex®-M4 @ 144 MHz<br>Communication: channel USIC (configurable to SPI, UART, IIC, IIS)<br>Motor Control Peripherals: 2 x POSIF, 4-channel $\Delta\Sigma$ Demodulator, 4 x 12-bit ADC, 18 input channels, 4 x parallel sampling and conversion |
| Gate driver           | 2EDB8259F            | Half-bridge gate driver with 3 kV basic isolation based on coreless transformer (CT) technology, (UL1577), UVLO (4 types), DIS, STP/DTC, CMTI > 300 V/ns  |
| Position/speed sensor | TLE5501              | Tunnel magneto resistive (TMR) based pre-calibrated sensor with 360° angle measurement; Max. 1.0° (1.9°) angle error over lifetime, 16-bit representation of sine/cosine values   |
| Current sensor        | TLE4972-AE35S5       | High-precision coreless current sensor with full-scale up to 31 mT for high current applications; two independent fast over-current detection (OCD) pins with configurable thresholds   |





# UPS

## Attractive solutions for highest efficiency and power density

Today's uninterruptible power supply systems introduce a wide range of challenges. Overcoming them requires an increase in output power, energy efficiency and power density. We offer complete system-level solutions and high-quality products for diverse uninterruptible power supply applications. Equipped with our semiconductors, UPS applications can achieve the best-possible power-conversion efficiency and cutting-edge power density. The benefits are cost reduction and fewer passive components – regardless of the topology used.

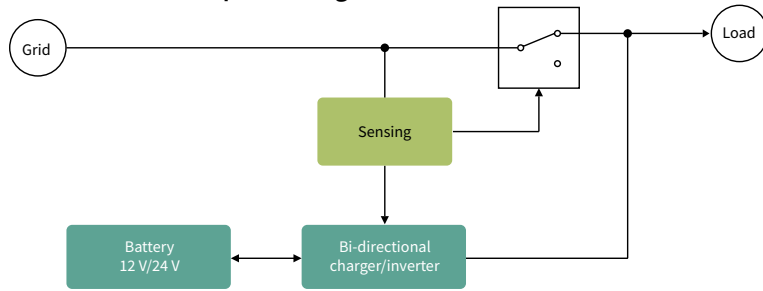
Our solutions and products for UPS applications fulfill the latest market requirements. This includes the trend of modularization of UPS brick units due to scalable power demand from data centers, as well as the topology shift from two-level to three-level to achieve higher efficiency. Our products are suitable for any kind of uninterruptible power supplies in telecom, data center, server or industrial automation environments. Our microcontroller solutions fulfill the control and power conversion requirements to enable UPS market needs. Finally, Infineon's portfolio of Wi-Fi / Bluetooth combos enables UPS proper connectivity for monitoring.

|                        | Offline UPS   | Online UPS   |
|------------------------|---|--|
| MOSFETs                | OptiMOS™ and StrongIRFET™<br>20-300 V<br><br>CoolMOS™ SJ MOSFETs<br>500-950 V | CoolSiC™ MOSFETs   |
| SiC diodes             |   | CoolSiC™<br>Schottky diode                               |
| IGBTs                  |   | TRENCHSTOP™ IGBT7<br>TRENCHSTOP™ 5<br><br>HighSpeed 3 H3 |
| Power module and stack |   | EasyPACK™  |
| Driver ICs             | EiceDRIVER™ 1EDi<br>EiceDRIVER™ 2EDi  | EiceDRIVER™ X3 Compact                                   |
| Auxiliary power supply |   | CoolSET™<br>650-800 V                                    |
| Microcontrollers       | XMC1300 series / PSoC™ 4 series   | XMC1000 and XMX4000 series<br>PSoC™ 4 series             |
| Connectivity           | AIROC™ Wi-Fi/Bluetooth® combos  |  |

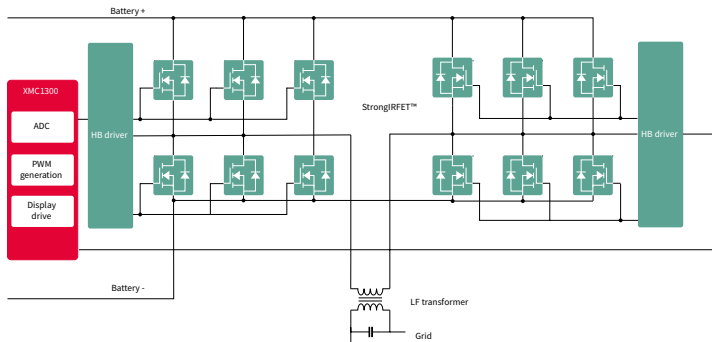


# Offline UPS

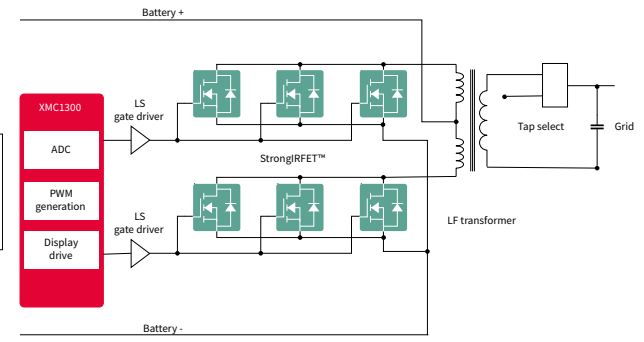
## Bi-directional UPS power stage



## Full-bridge bi-directional power stage



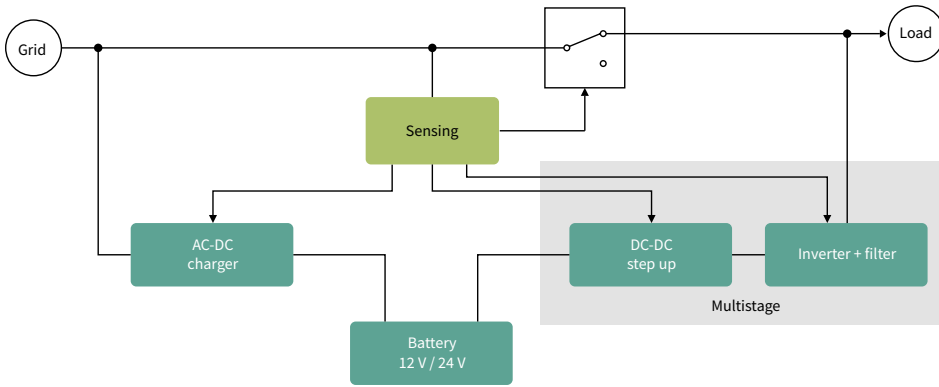
## Push-pull bi-directional power stage



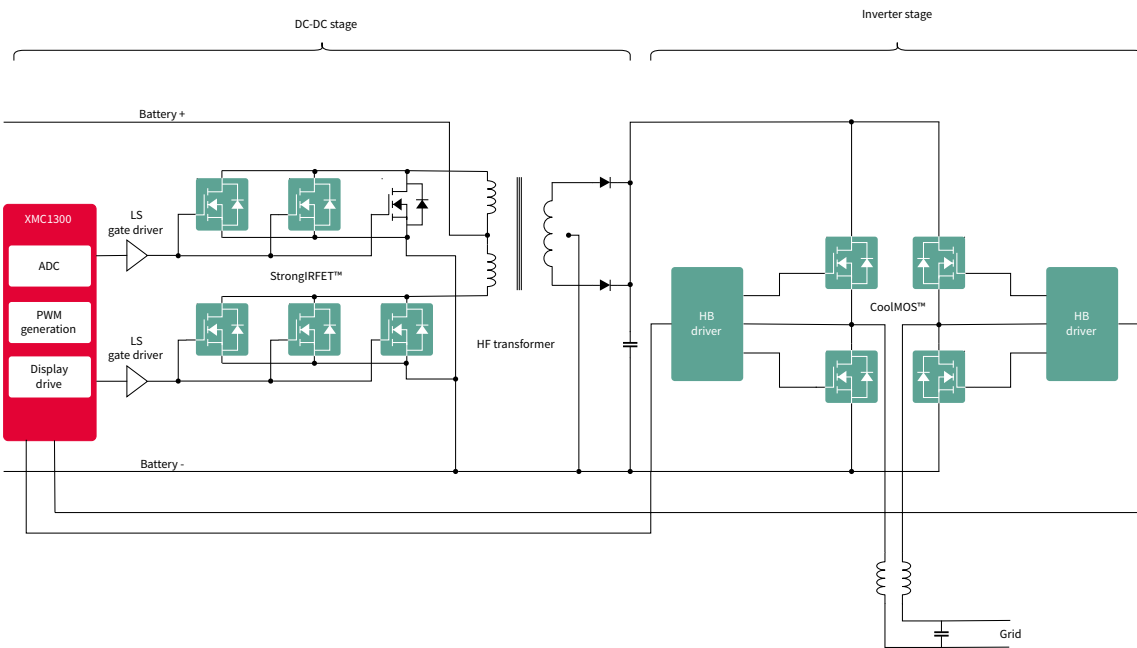
| Functional block         | Battery voltage | Topo-logy                     | MOSFET voltage class | Through hole devices TO-220 and TO-247   | Standard SMDs D <sup>2</sup> PAK and D <sup>2</sup> PAK-7 | Advanced SMDs TOLL, TOLG, TOLT, sTOLL  | Gate drivers   |
|--------------------------|-----------------|-------------------------------|----------------------|--|---|--|--|
| Inverter/charger MOSFETs | 12 V            | Push-pull                     | 60 V                 | IRFB7530/IRFB7534/IRFB7540/IRFB7537<br>IRFP3006/IRFP7530/IRFP7537  | IPB011N04NF2S<br>IRFS7530                                 | IPT012N06N<br>IPTG007N06NM5<br>IPTC012N06NM5   | IRS44273/IRS4427<br>1EDN7512B/2ED2181S06J<br>2ED2184S06J           |
|                          |                 | Full-bridge                   | 30 V<br>40 V         | IRLB3813/IRLB8314/IRLB8743<br>IRFB7430/IRFP7430/IRLB4132   | IPF010N04NF2S<br>IRFS7430                                 | IPT004N03L<br>ISTO06N04NM6   | IRS2110/IRS2186<br>2EDL8114G/1EDN7550B<br>1EDN8550B                |
|                          | 24 V            | Push-pull                     | 80 V<br>100 V        | IPP023N08N5/IPA083N10N5<br><br>IRFB3077/IRFB3207/<br>IRFB7730/IRFB7734<br><br>IRFP4468/IRF100B201/<br>IRF100B202 | IPB017N10N5/IPB017N08N5<br>IRFS7430/IRFS7734/IRF3610S     | IPT014N08NM5/IPT015N10N5<br>IPTG011N08NM5/<br>IPTG014N10NM5<br>IPTC011N08NM5/<br>IPTC014N10NM5 | IRS44273/IRS4427<br>1EDN8511B/2EDN852X<br>2ED2181S06J/2ED2184S06J  |
|                          |                 | Full-bridge                   | 40 V<br>60 V         | IRFB7430/IRFB7434/IRFB7545<br>IRF60B217/IRFP7530/<br>IRFP3006<br>IRFP7537  | IPB011N04NF2S<br>IRFS7430/IRFS7530                        | IPT012N06N<br>IPTG007N06NM5<br>IPTC012N06NM5   | 1EDN7550B/2EDL811X<br>2ED2181S06J/2ED2184S06J<br>IRS2186/1EDN8550B |
|                          | 48 V            | Push-pull                     | 150 V                | IPP046N15N5/IRFB4321<br>IRFB4228/IRFB4019/IRFB4115<br>IRFP4568/IRFP4321/<br>IRF150P220                           | IPB048N15N5/IPB044N15N5<br>IRFS4321/IRFS4115/IRFS4615     | IPT039N15N5<br>IPTG039N15NM5<br>IPTC039N15NM5  | 1EDN851X/2EDN852X<br>IRS44273/IRS4427                              |
|                          |                 | Full-bridge                   | 100 V                | IPP030N10N5/IPP039N10N5<br>IPP030N10N/IRFB4110/<br>IPP086N10N3G<br>IRFB4510/IRF100P218/<br>IRF100P219            | IPB020N10N5/IPB017N10N5<br>IRF3710S/IRF8010S/IRFS4510     | IPT015N10N5<br>IPTG014N10NM5<br>IPTC014N10NM5  | 1EDN8550B<br>IRS2186<br>2EDL811X                                   |
|                          | 72 V            | Push-pull                     | 200 V                | IPP110N20N3/IRFB4127<br>IRFB4227/IRF200P223  | IPB110N20N3LF<br>IRFS4127                                 | -  | 1EDN851X/2EDN853X<br>IRS44273/IRS4427                              |
|                          |                 | Full-bridge                   | 150 V                | IPP046N15N5/IRFB4321<br>IRFP4568/IRF150P220  | IPB048N15N5/IPB044N15N5<br>IRFS4321                       | IPT039N15N5<br>IPTG039N15NM5<br>IPTC039N15NM5  | 2EDL811X<br>IRS2186  |
|                          |                 | Full-bridge                   | 200 V                | IPP110N20N3<br>IRFB4227<br>IRF200P222<br>IRFP4668  | IPB110N20N3LF<br>IRFS4127                                 | -  | 2EDL811X<br>IRS2186  |
| Microcontrollers         | 12-72 V         | XMC1300 series/PSoc™ 4 series |                      |  |   |  |  |



Unidirectional



Unidirectional power stage (output stage)



Unidirectional DC-DC stage

| Battery voltage  | Topology  | MOSFET breakdown voltage      | TO-220  | TO-247   | D <sup>2</sup> PAK and D <sup>2</sup> PAK-7    | Gate drivers   |
|------------------|-----------|-------------------------------|---|--|--|--|
| 12 V             | Push-pull | 40 V                          | IRFB7430/IRFB7434<br>IRLB4132/IRFP7718                  | IRFS7430/IRFS7430                                  | IPT004N03L<br>IST006N04NM6                     | IRS44273/IRS4427<br>1EDN851X/2EDN853X                                |
|                  |           | 60 V                          | IRFB7540<br>IRFB7545<br>IRF60B217                       | IPB011N04NF2S<br>IRFS7530                          | IPT012N06N<br>IPTG007N06NM5<br>IPTC012N06NM5   | 2ED2181S06J<br>2ED2184S06J<br>2EDF5215<br>2EDL23N06PJ<br>2ED2182S06F |
|                  |           | 80 V                          | IRFP7718<br>IRFP7718                                    | IPB017N08N5<br>IPB016N08NF2S<br>IPF014N08NF2S      | IPT014N08NM5<br>IPTG011N08NM5<br>IPTC011N08NM5 | 2EDF5215<br>2EDL23N06PJ<br>2ED2182S06F                               |
| 24 V             | Push-pull | 80 V                          | IPP023N08N5<br>IRFB3077/IRFB3207<br>IRFB7730/IRFB7734   | IPB017N08N5<br>IRFS7730<br>IRFS7734                | IPT014N08NM5<br>IPTG011N08NM5<br>IPTC011N08NM5 | 2ED2181S06J<br>2ED2184S06J   |
|                  |           | 100 V                         | IPP030N10N5/<br>IPP039N10N5<br>IRF100P218/IRFP4468      | IPB020N10N5<br>IPB017N10N5<br>IRFS4010<br>IRF3610S | IPT015N10N5<br>IPTG014N10NM5<br>IPTC014N10NM5  | 2ED2181S06J<br>2ED2184S06J<br>2EDF5215<br>2EDL23N06PJ<br>2ED2182S06F |
|                  |           | 150 V                         | IPP046N15N5<br>IRFB4115/IRFB4321<br>IRFB4019/IRF150P220 | IPB044N15N5<br>IRFS4321/IRFS4115<br>IRFS4615       | IPT039N15N5<br>IPTG039N15NM5<br>IPTC039N15NM5  | IRS2186<br>2EDL811X  |
| Microcontrollers |           | XMC1300 series/PSoC™ 4 series |   |  |  |  |





### Unidirectional inverter stage

| Battery voltage  | Topology                                    | MOSFET voltage class            | Through hole devices TO-220 and TO-247                 | Standard SMDs D <sup>2</sup> PAK and D <sup>2</sup> PAK-7 | Gate drivers                    |
|------------------|---|---------------------------------|--|---|---------------------------------|
| 200 V            | Full-bridge inverter<br>120 V <sub>AC</sub> | 300 V                           | IPP410N30N / IRFB4137<br>IRF300P226 / IRF300P227       | -<br>IPB60R180P7 / IPB60R080P7                            | 1EDB8275F / 2EDB825x<br>IRS2186 |
| 400 V            | Full-bridge inverter<br>220 V <sub>AC</sub> | 500 V<br>600 V                  | IPP50R190CE / IPW50R190CE<br>IPP60R180P7 / IPW60R099P7 | -<br>IPB60R180P7 / IPB60R080P7                            | 2EDN7524F<br>2EDR825x           |
| Microcontrollers |   | XMC1300 series / PSoC™ 4 series |  |   |                                 |

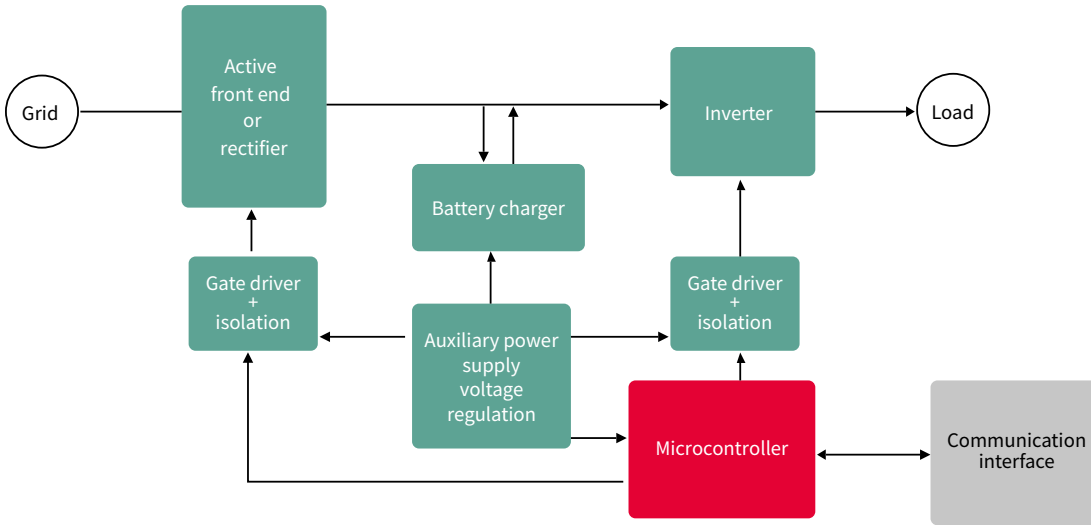
### Unidirectional charger

| Battery voltage | Topology | MOSFET Voltage class               | Through hole devices TO-220 and TO-220 FP | Standard SMDs D <sup>2</sup> PAK and DPAK |
|-----------------|----------|------------------------------------|---|---|
| 12-72 V         | Flyback  | 600 V                              | IPP60R180P7 / IPA60R180P7                 | IPB60R280P7 / IPD60R600P7                 |
|                 |          | 800 V                              | IPP80R280P7 / IPA80R280P7                 | IPD80R360P7                               |
|                 |          | 950 V                              | IPA95R450P7                               | IPD95R450P7                               |
| Control ICs     |          | ICE3AS03LJG, ICE3BS03LJG, XDPS2201 |   |   |



# Online UPS

## Online UPS power stage



| Stage            | Topology                      | Voltage class    | Technology                              | Power transistor part number                                  | Gate driver                  |
|------------------|-------------------------------|------------------|---|---|------------------------------|
| Rectifier        | Three-phase                   | 800 V/1600 V     | EasyBRIDGE, EconoBRIDGE™                | DDB6U144N16R/DDB6U104N16RRP_B3                                | 1ED3122MC12H<br>1ED3124MC12H |
| PFC              | Boost PFC/<br>Vienna "T-type" | 1200 V           | TRENCHSTOP™ H7                          | IKW40N120CH7/IKW40N120CH7                                     | 1ED020I12-F2                 |
|                  |                               | 1200 V           | CoolSiC™ MOSFET                         | F3L15MR12W2M1_B69   | 1ED020I12-F2                 |
|                  |                               | 650 V            | TRENCHSTOP™ H7                          | IKWH50N65EH7/IKWH75N65EH7                                     | 1EDI60I12AH                  |
|                  |                               | 650 V            | TRENCHSTOP™ 5 WR5                       | IKW40N65WR5   | -                            |
|                  | Boost PFC                     | 650 V<br>1200 V  | CoolSiC™ Schottky diode                 | IDH10G65C6/IDK10G65C5<br>IDWD40G120C5/IDH20G120C5/IDK10G120C5 | -                            |
|                  |                               | 600 V<br>600 V   | CoolMOS™ P7<br>CoolMOS™ C7              | IPP60R060P7/IPB60R060P7<br>IPW65R019C7/IPB65R045C7            | 1EDB7275F<br>1EDB7275F       |
| Inverter         | NPC 1                         | 650 V            | TRENCHSTOP™ H7                          | IKWH50N65EH7, IKWH75N65EH7/IKZA50N65EH7, IKZA75N65EH7         | 2EDF7275F                    |
|                  |                               | 650 V            | TRENCHSTOP™ HighSpeed3 IGBT Rapid diode | FS3L50R07W2H3F_B11  | 2EDF7275F                    |
|                  | NPC 2                         | 1200 V           | TRENCHSTOP™ H7                          | IKW40N120CH7/IKQ75N120CH7                                     | 2ED020I12-F2                 |
|                  |                               | 1200 V           | TRENCHSTOP™ HighSpeed3 IGBT Rapid diode | FS3L25R12W2H3_B11/F3L200R12W2H3_B11                           | -                            |
|                  |                               | 650 V            | TRENCHSTOP™ H7                          | IKWH50N65EH7, IKWH75N65EH7                                    | 2EDF7275F                    |
|                  | Two-level                     | 1200 V<br>1200 V | EconoPACK™, EasyPACK™<br>EconoDUAL™     | FS75R12W2T4_B11/FS200R12KT4R_B11<br>FF600R12ME4_B11           | 2ED020I12-F2<br>2ED020I12-F2 |
|                  |                               | Three-level NPC1 | 600 V/1200 V                            | EconoPACK™  | F3L300R07PE4                 |
| Battery charger  | Half-bridge                   | 1200 V           | TRENCHSTOP™ H7                          | IKW40N120CH7/IKQ75N120CH7                                     | 2ED020I12-F2                 |
|                  |                               | 1200 V           | CoolSiC™ MOSFET                         | FF6MR12W2M1_B11   | 2ED020I12-F2                 |
|                  |                               | 650 V            | TRENCHSTOP™ H7                          | IKWH50N65EH7/IKWH75N65EH7                                     | 2EDF7275F                    |
| Aux. supply      |                               | 650-800 V        | CoolSET™                                | ICE5AR4770BZS   |                              |
| Digital isolator |                               |                  | ISOFACE™                                | 1ED3122MC12H/1ED3124MC12H                                     |                              |
| Microcontroller  |                               |                  | XMCTM PSoC™                             | XMC1000 ARM® Cortex® M0/XMC4000 ARM® Cortex® M4 PSoC™ 4       |                              |
| Connectivity     |                               |                  | AIROC™                                  | Wi-Fi 4/Wi-Fi 5/Wi-Fi 6                                       |                              |





# NFC<sup>®</sup> Smart devices with NFC interface

## NFC-based configuration, actuation and sensing applications

Near-field communication (NFC) is a mature technology for contactless exchange of data over short distances. Besides the data exchange, NFC technology itself can also transfer power from the polling device to the receiver devices. Due to the working principle of resonant coupling, power transmission via NFC is efficient and user-friendly because it is less sensitive to antenna/coil alignment. The combination of data exchange and energy transfer in one interface and the availability in billions of smartphones make NFC an exciting enabler for the following novel use cases:

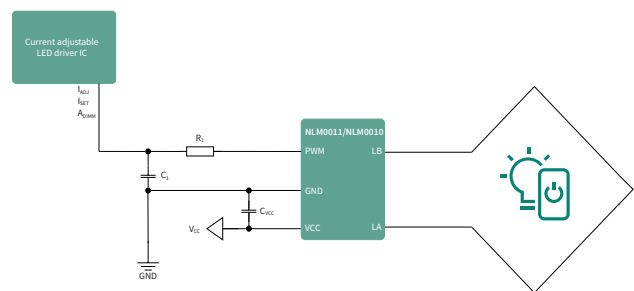
**Passive device parameter configuration:** Programming or configuring product operation parameters is sometimes complicated because of access problems or equipment requirements. Using an NFC interface, contactless or even passive operation can be performed anywhere. Modern LED power supplies are already equipped with the NFC interface to enable output current configuration in production, sales channel, and the field. Infineon's **NLM product series** supports customers to enable NFC configuration functions effectively.

**Smart actuator and sensing devices:** In the IoT age, smart devices help people make their life easier and more sustainable. NFC technology provides an option to develop battery-less smart devices that operate when the NFC reader device, like a mobile phone, is present. As a complement to mainstream active IoT technology, passive NFC technology is suitable for use cases like a passive smart lock, passive sensor inlay, medical care patch, etc.

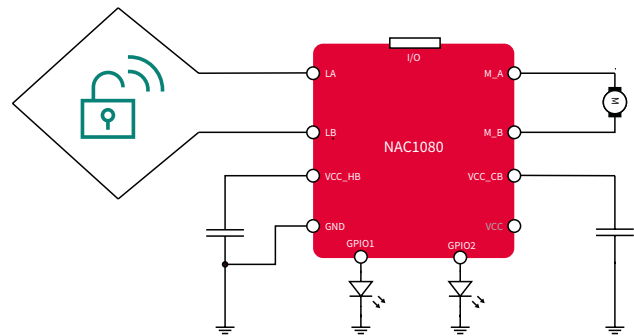
With Infineon's new **NFC tag-side controller** family a single-chip solution is available to develop cost-effective, miniaturized, actuation or sensing applications operating in either passive or active mode. The **NAC1080**, with integrated H-bridge and energy harvesting modules, enables cost-effective development of passive smart actuators like passive locks. AC1081 is a package variant in VQFN32 package.

The **NGC1081** is a low-power controller with ADC/DAC unit, integrated temperature sensor, and sophisticated analog and digital I/Os. It is the ideal solution for contactless sensing applications like temperature logger, gas detector, sensor inlay, medical patch, etc. Furthermore, both sensing and actuation control capability make the **NGC1081** a unique product in the market, ideally suited for applications that require these functions – for example, radiator thermostats.

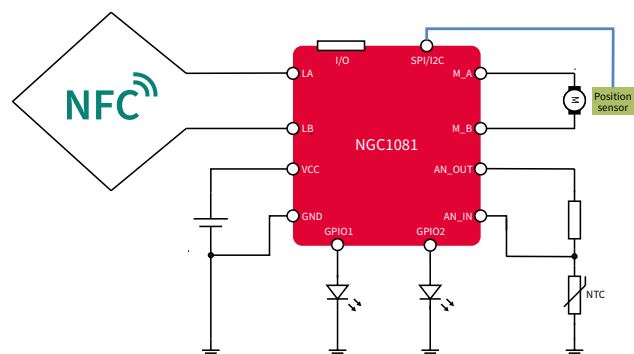
### Example: NFC LED power supply



### Example: NFC passive lock



### Example: Smart radiator thermostat





## NFC configuration – NLM series

| Type    | Description  | Package | Ordering code |
|---------|--|---------|---------------|
| NLM0011 | Dual-mode NFC configuration IC with PWM output and CLO function      | SOT23-5 | NLM0011XTSA1  |
| NLM0010 | Dual-mode NFC configuration IC with PWM output, without CLO function | SOT23-5 | NLM0010XTSA1  |

See [LED lighting](#) chapter for more information.

## NFC actuation and sensing – NAC1080 and NGC1081

### Highly integrated single-chip solution

The low-power Arm® Cortex®-M0 based microcontroller with integrated NFC frontend, sensing unit, motor driver, and energy harvesting function enables customers to develop smart actuation and sensing devices with minimum system BOM requirement.

### Full flexible software-defined functions

The flexible IC architecture and the smart partitioning between hardware and software enable customers to maximize the utilization of software-defined functions.

### Build-in security functions to meet the application requirements

These ICs include hardware security functions such as secure area in flash, 128 bit AES accelerator and true random generator. A separate secure element can be connected via the digital interface on demand.

| Type    | NFC       | Processor              | RAM   | NVM   | ADC    | DAC    | I2V | H-Bridge | I <sup>2</sup> C | SPI | UART | GPIO | Analog-in | Package    |
|---------|-----------|------------------------|-------|-------|--------|--------|-----|----------|------------------|-----|------|------|-----------|------------|
| NAC1080 | ISO14443A | 32-bit Arm® Cortex®-M0 | 16 kB | 60 kB | no     | no     | no  | yes      | no               | yes | yes  | 7x   | no        | PG-DSO-16  |
| NAC1081 | ISO14443A | 32-bit Arm® Cortex®-M0 | 16 kB | 60 kB | no     | no     | no  | yes      | no               | yes | yes  | 7x   | no        | PG-VQFN-32 |
| NGC1081 | ISO14443A | 32-bit Arm® Cortex®-M0 | 16 kB | 60 kB | 12 bit | 10 bit | yes | yes      | yes              | yes | yes  | 16x  | X4        | PG-VQFN-32 |





# Applications

## Appliances and consumer electronics, ITC infrastructure, renewables, robotics, e-mobility

- Major home appliances
- Small home appliances
- Cordless Power Tools, Cordless Gardening Tools and OPE
- Wrist-worn devices
- Class D audio
- Smart speaker
- Security camera and video doorbell
- LED lighting
- Plug & LEDs play solutions
- Smart lighting solutions
- Smart conference solutions
- ICT solutions
- DC-DC power solutions für data center, edge, enterprise, telecom and datacom
- DC-DC enterprise power solutions for data processing applications
- Solar
- Energy storage systems
- Robotics
- Onboard chargers for xEV appliactions
- Light electric vehicles and electric forklift

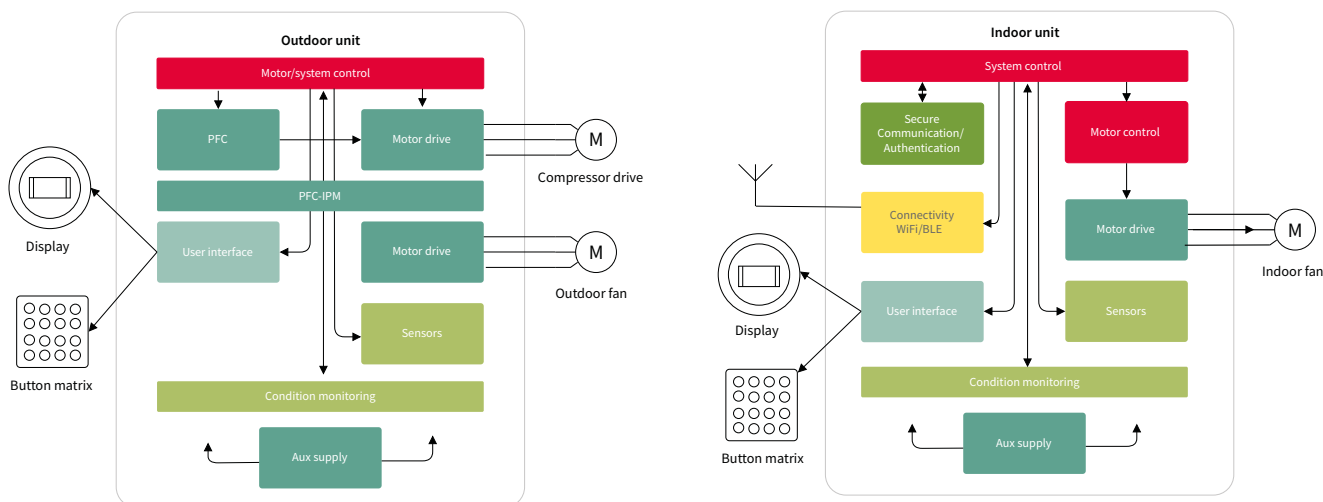


Aircon

# Major home appliances

## Innovative approach for air conditioning systems

Product designers are facing the daunting challenge of developing smaller, smarter, more powerful, and more energy-efficient appliances. Based on industry-leading technology and manufacturing expertise, Infineon’s line of innovative components for household appliances meets and exceeds even the most rigorous requirements for reliability and quality. The block diagram of an air conditioning system shown below, together with the product selection table, provides an effective recommendation for engineers to select the right component for each power management stage inside major home appliances.



In addition to efficiency gain through power solutions, Infineon’s XENSIV™ sensor portfolio also enhances major home appliances’ operation through advanced sensor-enabled use cases such as condition monitoring and predictive maintenance to detect potential device failures before they occur. Furthermore, integration of voice control or presence detection in those appliances increases user convenience and results in even more efficient devices.

| Product category                    | Product family  | Benefits   |
|-------------------------------------|---|--|
| Sensors                             | Pressure sensor   | Airflow and water pressure monitoring  |
|                                     | MEMS microphone   | Noise monitoring and voice control   |
|                                     | Radar sensor  | Motion sensing and people tracking   |
|                                     | Magnetic current sensor                                   | Current sensing  |
|                                     | 3D magnetic sensor  | Vibration and position monitoring  |
|                                     | Linear Hall sensor  | Vibration monitoring in predictive maintenance   |
|                                     | Hall sensors and switches                                 | Opened and closed lid detection  |
|                                     | Double Hall sensor  | Speed and direction measurement  |
|                                     | 32-bit XMC4000 industrial microcontroller Arm® Cortex®-M4 | Data processing, sensor system management, cloud connection management and ethernet connectivity |
| OPTIGA™ embedded security solutions | Data and cloud security                                   |  |



## Recommended products

| Functional block                                | Product family                        | Voltage class | Technology/product family   | Selection/benefit                                       |
|---|---------------------------------------|---------------|---|---|
| Outdoor unit (ODU) PFC                          | iMOTION™ controller                   | -             | IMC302A-F064  | Motor/PFC controller incl. software                     |
|   | Non-isolated EiceDRIVER™              | 25 V          | 1ED44175N01B  | Integrated over-current protection                      |
|   | Non-isolated EiceDRIVER™              | 25 V          | 1ED44171N01B  | Cost/performance  |
|   | Level-shift EiceDRIVER™               | 600 V         | 6EDL04I06PT   | Infineon SOI with integrated bootstrap diode            |
|   | TRENCHSTOP™ 5 IGBT WR5/WR6            | 650 V         | IKW30N65WR5, IKWH30N65WR6   | Recommended   |
|   | TRENCHSTOP™ 5 IGBT advanced isolation | 650 V         | IKFW40N65DH5  | Easy to use   |
|   | TRENCHSTOP™ IGBT7                     | 650 V         | IKW30N65ET7   | Recommended   |
|   | EC7                                   | 650 V         | IDWD60E65E7   | Recommended   |
|   | CIPOS™ Mini                           | 600 V         | CIPOS™ Mini PFC interleaved IPM series IFCM20T60GD/IFCM20U60GD/IFCM30T60GD/IFCM30U60GD<br>CIPOS™ Mini PFC integrated IPM series IFCM10P60GD/IFCM10S60GD/IFCM15P60GD/IFCM15S60GD IM564-X6D | Easy to use/system size saving                          |
| CoolMOS™ SJ MOSFETs                             | 600 V                                 | IPP60R120P7   | Recommended   |   |
| ODU motor drive (compressor)                    | iMOTION™ controller                   | -             | IMC302T-F064  | Motor/PFC controller incl. software                     |
|   | CIPOS™ IPM                            | -             | CIPOS™ Mini   | Easy to use/system size saving                          |
|   | Level-shift EiceDRIVER™               | 600 V         | 6EDL04I06PT   | Infineon SOI with integrated bootstrap diode            |
|   | RC-D2 IGBT                            | 600 V         | IKD15N60RC2   | Recommended   |
| ODU motor drive (outdoor fan)                   | iMOTION™ controller                   | -             | IMC101T-T038  | Motor controller incl. software                         |
|   | CIPOS™ IPM                            | 600 V         | CIPOS™ Micro IM241 series   | Easy to use/system size saving                          |
|   | Level-shift EiceDRIVER™               | 600V          | 6EDL04I06PT   | Infineon SOI with integrated bootstrap diode            |
|   | RC-D2 IGBT                            | 600 V         | IKD06N60RC2   | Recommended   |
|   | CoolMOS™ SJ MOSFETs                   | 600 V         | IPD60R1K0PFD7S  | Recommended   |
| Condition monitoring and predictive maintenance | XENSIV™ Hall switches                 | -             | TLI4963-2M  | Recommended   |
|   | XENSIV™ pressure sensor               | -             | DPS368  | Recommended   |
|   | XENSIV™ MEMS microphone               | -             | IM69D130  | Recommended   |
|   | XENSIV™ Hall sensors                  | -             | TLE4961, TLE4964, TLE4913, TLI4966G   | Recommended   |
|   | XENSIV™ 3D magnetic sensor            | -             | TLI493D-W2BW  | Vibration and position monitoring                       |
|   | XMC4000 microcontroller               | -             | XMC4700   | Recommended   |
| Indoor unit (IDU)                               | XMC™ microcontroller                  | -             | XMC1400, XMC4100  | Recommended   |
|   | iMOTION™ controller                   | -             | IMC302A-F064  | Motor/PFC controller incl. software                     |
|   | PSoC™ 6                               | -             | CY8C62x4/5  | Recommended   |
| IDU motor control                               | XMC™ microcontroller                  | -             | XMC1300, XMC1400  | Recommended   |
|   | iMOTION™ controller                   | -             | IMC101T-T038  | Motor controller incl. software                         |
|   | CIPOS™ IPM                            | 600 V         | CIPOS™ Nano   | Easy to use/system size saving                          |
| IDU motor drive                                 | iMOTION™ IPM                          | -             | IMI111T-026H, IMI111T-046H  | Motor controller incl. software, driver and power stage |
|   | Level-shift EiceDRIVER™               | -             | 6EDL04I06PT   | Infineon SOI with integrated bootstrap diode            |
|   | RC-D2 IGBT                            | 600 V         | IKN03N60RC2, IKD04N60RC2  | Recommended   |
|   | CoolMOS™ SJ MOSFETs                   | 600 V         | IPN60R1K5PFD7S  | Recommended   |
| Security  | OPTIGA™ Trust family                  | -             | OPTIGA TRUST M SLS32AIA   | Recommended   |
| Connectivity Wi-Fi/BLE                          | AIROC™                                | -             | CYW43439  | Recommended   |
| User interface                                  | PSoC™ 6                               | -             | CY8C62x4/5  | Recommended   |
| Sensors   | XENSIV™ radar                         | -             | BGT60LTR11AIP   | Recommended   |
|   | XENSIV™ PAS CO <sub>2</sub>           | -             | PASCO2V01   | Recommended   |
|   | XENSIV™ MEMS microphone               | -             | IM69D130  | Recommended   |
|   | XENSIV™ Hall switches                 | -             | TLI4963-2M  | Recommended   |
| Auxiliary supply                                | CoolMOS™ SJ MOSFETs                   | 800 V         | IPN80R4K5P7   | Recommended   |
|   | CoolSET™                              | 700 V         | ICE5AR4770BZS   | Flyback with error amplifier                            |
| UV-C LED for health                             | LED driver ICs                        | 42 V          | BCR43x  | Recommended   |



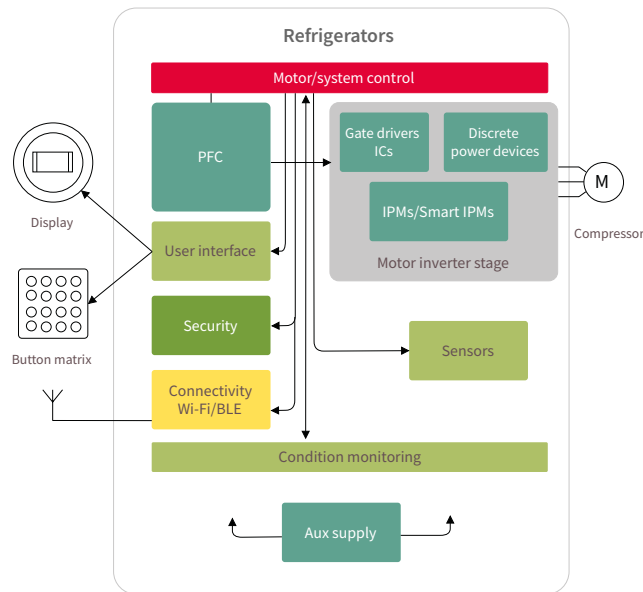


Fridge

# Refrigerators

## Higher efficiency at lower cost

Today, consumers are not only looking at energy consumption and noise levels. Compact design coupled with maximum storage space is also playing an increasingly important role. In addition, there is a desire for intelligent appliances that can be easily integrated into the home network. From the manufacturer's point of view, the challenge is to meet the stricter regulations on energy efficiency while at the same time ensuring the form factor and a reduction in costs. Thus, intelligent, compact, energy- and cost-efficient drive solutions for refrigerators and freezers meet the high customer requirements.



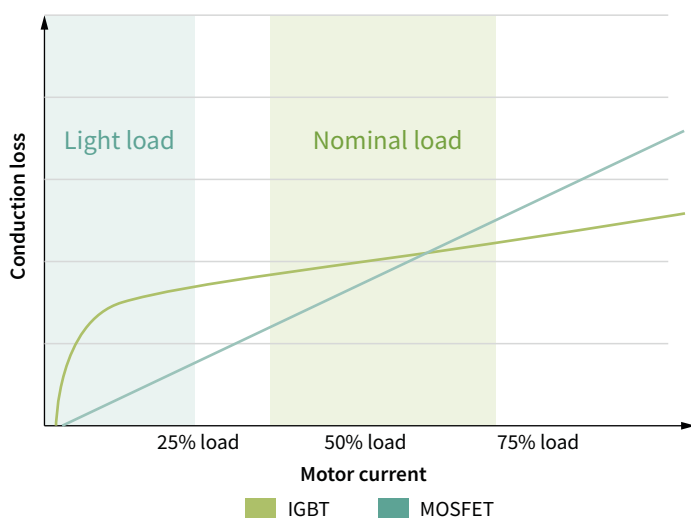
Infineon offers a comprehensive portfolio for refrigerator compressors. Whether you choose the highest level of integration with our intelligent power modules (IPM) or aim for the best price/performance ratio with discrete components, our IGBTs, MOSFETs, gate drivers, and microcontrollers are designed to work together seamlessly. CIPOS™ family of IPMs is the optimal solution for highly integrated compressor drives whilst discrete solutions like the 600 V RC-D2 IGBT or the CoolMOS™ PFD7 SJ MOSFET along with EiceDRIVER™ 600 V are the best choice whenever layout flexibility and thermal performance optimization are the key design targets. If full-load operation and EMI performance are key for the design, the 600 V RC-D2 is the best choice. The diode is monolithically integrated and its current rating has been optimized for price and performance. The RC-D2 is the first IGBT family to introduce the SOT-223 package to further improve the price with a smaller package that is pin-to-pin compatible and substitutable with the DPAK package. They can all be combined with iMOTION™ products for dedicated motor control. For the auxiliary power supply, the CoolSET™ family rounds up our power portfolio by offering increased robustness and performance. Our PSoC™ microcontroller family, AIROC™ Wi-Fi + Bluetooth® Combos connectivity products and XENSIV™ sensors complete the portfolio needed for a truly smart refrigerator. The energy-efficient CIPOS™ modules integrate various power and control components to increase reliability, optimize board size and reduce system costs. This simplifies power supply design and shortens time-to-market. Infineon offers the OPTIGA™ Trust hardware security solution and enables secure access to all major cloud providers.



### CoolMOS™ PFD7 for next-level energy saving

Although both MOSFETs and IGBTs can be used in refrigerator compressor drives, as most of the time, the refrigerator operates under light load, the MOSFET is highly recommended due to its lower conduction loss, thus reducing overall power loss at this condition.

The 600 V CoolMOS™ PFD7 high-voltage MOSFET series, shaped by Infineon's experience of more than twenty years in pioneering in superjunction SJ technology innovation, sets a new benchmark in 600 V SJ technologies. This product family combines best-in-class performance with state-of-the-art ease of use, features an integrated fast body diode ensuring a robust device and allowing for reduced BOM for the customer.



### Smart, connected and secured – system solutions for the new home appliance era

Modern refrigerators can sense their environment by being smart and connected. They provide data to their users as well as to the manufacturer (who can remotely analyze the performance data and suggest preventive maintenance). In this data exchange, secure communication systems play a crucial role.

Components and system solutions from Infineon enable you to build smart home appliances while providing secure data acquisition, control, and device connectivity. Furthermore, they enable the highest device efficiency, smallest form factors, and improved carbon footprint with smart power supply designs. Benefit from one of the most comprehensive, out-of-the-box product and design portfolios on the market to best meet your unique application needs.



## Recommended products

| Functional block       | Product family                     | Voltage class                 | Technology/product family                          | Selection/benefit   |
|------------------------|------------------------------------|-------------------------------|--|---|
| PFC                    | iMOTION™ driver                    | -                             | IMD112T-6F040                                      | Motor/PFC controller incl. software and integrated driver   |
|                        | Non-isolated EiceDRIVER™           | 25 V                          | 1ED44171N01B                                       | Integrated over-current protection                          |
|                        | CoolMOS™ SJ MOSFETs                | 25 V                          | 1ED44175N01B                                       | Cost/performance  |
|                        | CoolSiC™ Diodes                    | 600 V                         | IPP60R120P7  | Recommended   |
| Inverter               | CoolSiC™ Diodes                    | 650 V                         | IDW30G65C5   | Recommended   |
|                        | Level-shift EiceDRIVER™            | 600 V<br>650 V                | 6EDL04N06PT<br>2ED2304S06F                         | Infineon SOI with integrated boot strap diode               |
|                        | XMC™ microcontroller               | -                             | XMC1400; XMC1300                                   | Recommended   |
|                        | iMOTION™ controller                | -                             | IMC102T-F048                                       | Motor/PFC controller incl. software                         |
|                        | iMOTION™ driver                    | -                             | IMD111T-6F040                                      | Motor controller incl. software and integrated driver       |
|                        | iMOTION™ IPM                       | -                             | IMM101T-046M                                       | Motor/PFC controller incl. software, driver and power stage |
|                        | CIPOS™ IPM                         | -                             | CIPOS™ Mini IM523-S6A<br>CIPOS™ Micro IM241 series | Easy to use/system size saving                              |
| RC-D2 IGBT             | 600 V                              | IKN04N60RC2 IKD06N60RC2       | Recommended  |   |
|                        | 600 V                              | IPN60R1K5PFD7S IPN60R600PFD7S | Recommended  |   |
| CoolMOS™ SJ MOSFETs    | 600 V                              |                               | Recommended  |   |
| User interface         | PSoc™ 6                            | -                             | CY8C62x4/5   | Recommended   |
| Connectivity Wi-Fi/BLE | AIROC™                             | -                             | CYW43439   | Recommended   |
| Auxiliary supply       | CoolMOS™ SJ MOSFETs                | 800 V                         | IPN80R4K5P7  | Recommended   |
|                        | CoolSET™                           | 700 V                         | ICE5AR4770BZS                                      | Flyback with error amplifier                                |
| Security               | OPTIGA™ Trust family               | -                             | OPTIGA TRUST M SLS32AIA                            | Recommended   |
| Sensors                | XENSIV™ radar sensor               | -                             | BGT60LTR11AIP                                      | Recommended   |
|                        | XENSIV™ pressure sensor            | -                             | DPS368   | Recommended   |
|                        | XENSIV™ MEMS microphones           | -                             | IM69D130   | Recommended   |
|                        | XENSIV™ PAS CO <sub>2</sub> sensor | -                             | PAS CO <sub>2</sub>                                | Recommended   |
|                        | XENSIV™ magnetic position sensors  | -                             | TLV493D-A1B6                                       | Recommended   |

## XENSIV™ sensor solutions for smart refrigerators

| Product category | Product family                                     | Benefits   |
|------------------|--|--|
| Sensors          | XENSIV™ MEMS microphones IM69D130                  | High-performance microphone with low self-noise (high SNR) and low distortions enables noise monitoring for advanced predictive maintenance analytics  |
|                  | XENSIV™ digital barometric pressure sensors DPSxxx | Advanced predictive maintenance analytics are enabled based on highest precision and relative accuracy over a wide temperature range to detect anomalies in airflow                              |
|                  | XENSIV™ TLV493D-A1B6 3D magnetic sensor            | Accurate three-dimensional sensing with extremely low power consumption in a small 6-pin package to enable vibration and position monitoring of the compressor                                   |
|                  | XENSIV™ TLI4970 current sensor                     | Fully digital solution featuring high precision and ease of use, significantly reduces overall implementation efforts as well as PCB space to enable cost fan and compressor current measurement |
|                  | XENSIV™ 60 GHz radar sensor                        | Accurate presence detection and vibration detection based on ability to track sub-millimeter motion at high speed and accuracy, in both stand-alone chip as well as system solution available    |







Ceiling Fan

# Ceiling fan

## Energy-efficient and cost-effective with high integration for system size reduction

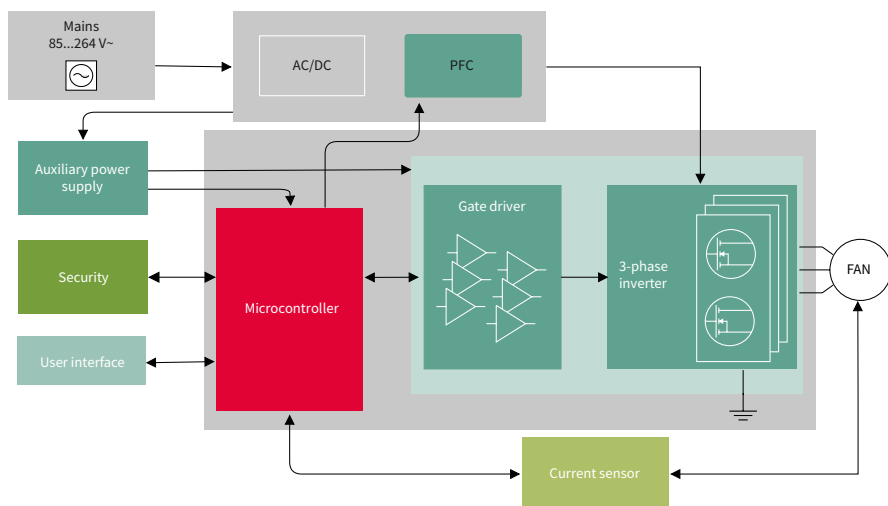
Ceiling fan manufacturers currently face more stringent regulations of the appliance’s form factor and are under constant pressure to reduce costs. Infineon is here to provide compact, energy-efficient, cost-effective motor drive solutions. We propose a competitive solution with an extensive portfolio, high integration for system size reduction, and low cost.

Infineon is your ideal partner for all ceiling fan designs. In our portfolio, you’ll find a wide range of solutions for inverterized fan motor control – whether your priority is achieving the highest level of integration using our IPMs or showcasing ultimate flexibility with the right price-performance ratio using our discrete IGBTs or MOSFETs. No matter your target, our power semiconductors, drivers, IPMs, and iMOTION™ motor controllers are designed to work together seamlessly. This means you can effortlessly realize smoother-running, quieter systems with low energy consumption and a smaller form factor.

### Features and benefits

| Key features   | Key benefits  |
|--|---|
| – Reference design for ready-to-copy PCB                               | – Compact and cost-effective system solution                |
| – Turnkey PFC and motor control with MCE                               | – Eliminate the need for motor control software development |
| – Integrated infrared remote control                                   | – Easy evaluation and system verification                   |
| – Suitable for single-sided PCB assembly process                       | – Reduce design-in effort and speed up time to market       |
| – Compatible with low- and high-voltage motors                         | – Achieve maximum system cost-performance                   |
| – MCU design option for higher flexibility                             | – Higher system reliability                                 |
| – IEC61000-4-5 4 kVs surge compliant and EN55032 class B EMI compliant | – One-stop-shop   |

### Application diagram



By selecting components from Infineon, you get parts engineered for best-in-class performance that upholds the highest quality standards for long-term reliability. Moreover, our excellent supply chain allows you to both build the most cost-effective, energy-efficient inverterized ceiling fan and meet the changing supply demands of the fluctuating consumer market. Explore our selection of semiconductor solutions now to find the best-fit components for your designs.

[www.infineon.com/ceiling-fan](http://www.infineon.com/ceiling-fan)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





Induction

# Induction cooking

## Enabled by Infineon's high-efficiency power switches, secured connectivity, and touch sensor technology for the best cooking experience

The huge global market for induction cooking appliances, such as induction ranges, microwave ovens, and rice cookers, is characterized by great competition and price pressure. Along with this, manufacturers must meet rising consumer expectations and produce more reliable, energy-efficient appliances that offer more and more functions. Benefits such as faster cooking, advanced functionalities, easy cleaning, and safety features play a crucial role. At Infineon, we are well equipped to help you overcome all the challenges common to induction cooking appliances. Our solutions target the increased consumer expectations regarding modern home appliances: appliances must be energy-efficient and fully integrable, ensuring a high levels of safety and reliability. An intelligent, user-friendly, and secure user interface is essential. We support you in creating intuitive devices with an intelligent touch interface.

### Features and benefits

#### Key features

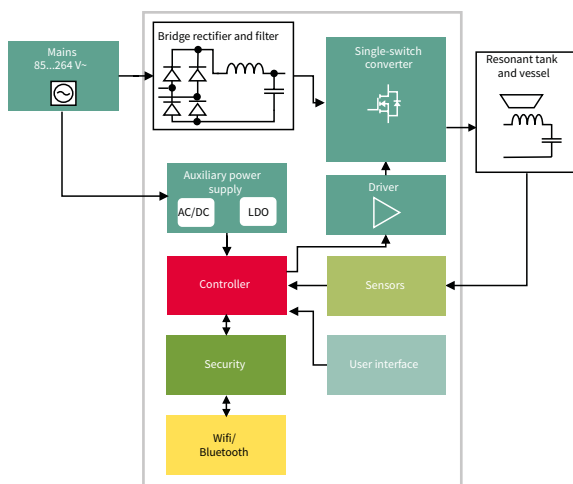
- Complete system solution offerings for inverter, system control, auxiliary power, HMI, connectivity, sensor, security blocks
- Highly reliable and market-proven Infineon products
- Evaluation and reference boards
- Innovative reverse conducting IGBT technology
- Cutting-edge touch-sensing technologies

#### Key benefits

- Faster time-to-market and saving system design efforts
- One-stop-shop
- Extend system lifetime and product life spans
- Fast prototyping and system verification
- Higher efficiency and better reliability
- "Just work" and deliver robustness and intelligence

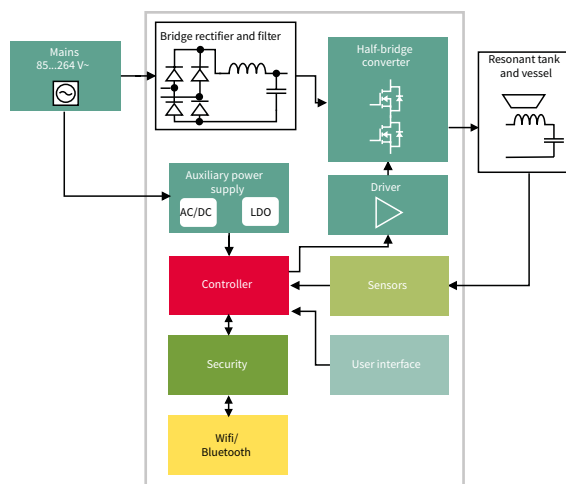
### Induction heating inverter (voltage resonance)

#### Single-switch



### Induction heating inverter (current resonance)

#### Half-bridge



## Product portfolio

| Functional block                      | Product               | Product family   | Specification  | Benefits   |
|---------------------------------------|-----------------------|--|--|--|
| Inverter (half-bridge/quasi-resonant) | IGBT discretes        | Reverse conducting R6  | 650 V up to 75 kHz   | – High performance and low losses  |
|                                       |                       | Reverse conducting R5  | 650 V/1100 V/1200 V/1350 V/1600 V up to 60 kHz                     | – High performance and low losses  |
|                                       |                       | Reverse conducting R5L   | 1400 V up to 60 kHz  | – High performance and lower losses  |
|                                       | Gate driver           | EiceDRIVER™ 1ED44173N01B, 1ED44175N01B, EiceDRIVER™ 1ED44171N01B | Low-side gate driver/25 V  | – 1ED integrated with overcurrent-protection fault and enable functions<br>– Cost-effective                                    |
|                                       |                       | EiceDRIVER™ 2ED2304S06F, 2ED2182S06F, 2EDL23I06PJ                | Half-bridge gate driver/650 V/600 V                                | – SOI with integrated bootstrap diode  |
| System control                        | Microcontroller       | XMC™ 1000 series   | 32-bit Arm® Cortex®-M0   | – #1 choice to bring traditional 8-bit designs to the next level   |
|                                       |                       | XMC™ 4000 series   | 32-bit Arm® Cortex®-M4   | – Successor to traditional DSP/DSC and 32-bit MCU solutions.   |
|                                       |                       | PSoC™ 4 series   | 32-bit Arm® Cortex®-M0   | – Tackled some of the complex portions of embedded system design making it easier  |
|                                       |                       | PSoC™ 6 series   | 32-bit Arm® Cortex®-M4   | – Dual-core Arm® Cortex®-M4 and Cortex-M0+ architecture  |
| Connectivity                          | Wireless connectivity | AIROC™ Wi-Fi + Bluetooth® combo                                  | IEEE 802.11a/b/g/n/ac/ax Wi-Fi and Bluetooth® 5.2 in a single-chip | – Technical support through our global network of IoT partners   |
| Aux power                             | CoolSET™              | ICE5AR4770BZS  | Up to 15 W flyback controller with integrated 700 V MOSFET         | – Higher switching frequency to take advantage of smaller magnetics  |
| HMI (Human-machine interface)         | Microcontroller       | PSoC™ 4 series   | CAPSENSE™ technology   | – Most flexible and scalable low-power mixed-signal architecture   |
| Security                              | OPTIGA™ Trust         | OPTIGA™ Trust M SLS32AIA   | High-end security solution for connected consumer devices          | – The OPTIGA™ Trust M is a high-end security solution that provides an anchor of trust for connecting IoT devices to the cloud |





# Cordless power tools, cordless gardening tools and OPE

## Battery-powered devices for home and professional applications

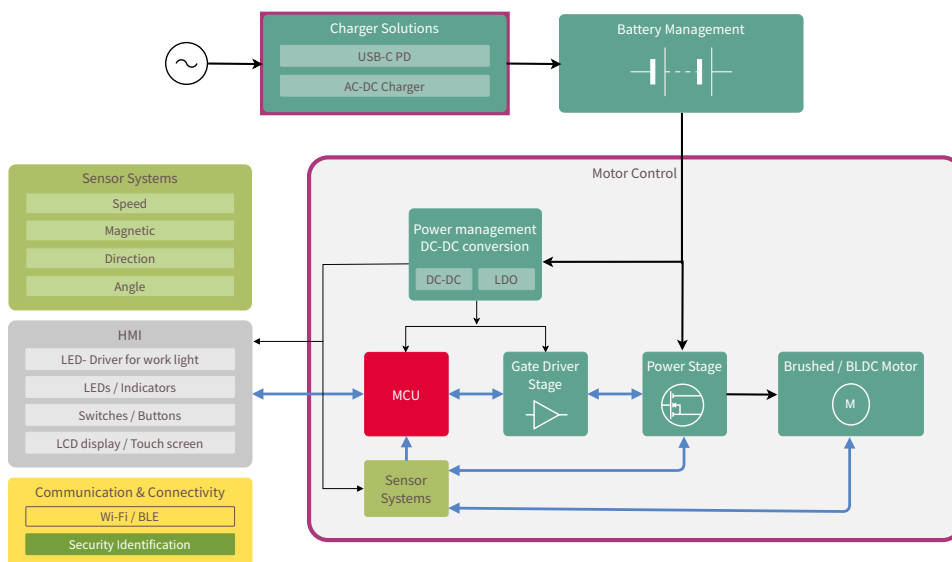
Millions of households worldwide rely on power tools to complete daily tasks or creative projects around the home. Consumers want robust, reliable, and easy-to-use portable power tools with low prices and long battery life as key selection criteria. High quality standards to earn the trust of the consumer also require diagnostic and safety features. Infineon's product portfolio is made to bring performance, safety and reliability to consumer projects. We help our customers meet all consumer needs at a reduce total costs. In addition to the extensive product portfolio, we offer wireless-charging reference designs. They deliver high performance and are easily optimized in our DAVE™ development platform. Configure your BOM and exceed expectations with Infineon components in your cordless power tool designs.

### Features and benefits

| Key features   |
|--|
| - Comprehensive product and solution portfolio, easy to tailor to any design specification   |
| - Infineon offers complete solutions for power supplies, chargers and motor drives   |
| - Best-in-class EiceDRIVER™ level-shift driver for OptiMOS™ and StrongIRFET™, offering high efficiency and protection                              |
| - High reliability of Infineon components  |
| - Offering LV FETs with SMD packaging improves the productive capability by automatic production, improves reliability and reduces assembly cost   |
| - Components featuring small form factor and compact design offering highest power density and BOM savings thanks to lowest $R_{DS(on)}$           |
| - Trustworthy hardware-based security  |
| - Highest quality standards and a safety-certified development process   |
| - Proven track record and outstanding partner network for embedded security  |
| - OPTIGA™ Trust enables authentication of components connected to the system (e.g., battery pack recognition to avoid second-party batteries etc.) |
| - Evaluation and demonstration boards for fast prototyping   |
| - Available simulations, documentation, and system support to reduce development time and cost   |

| Key benefits   |
|--|
| - Convenient selection of the right fit products thanks to broad portfolio and |
| - Complete solutions   |
| - Extended battery lifetime and product life span                              |
| - Increased production capability  |
| - Overall system size and cost reduction                                       |
| - Security, quality, and safety  |
| - Authentication   |
| - Short time to market   |

### Application block diagram example: cordless power tools



[www.infineon.com/powertools](http://www.infineon.com/powertools)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



Product portfolio

| Functional block          | Topology               | Product category   | Product family   | Part number  |   |
|---------------------------|------------------------|--|--|--|---|
| Motor control             | 12 V, 15 V, 18 V, 22 V | MOSFET   | OptiMOS™ 5<br>OptiMOS™ 6<br>StrongIRFET™                 | BSC005N03, IQE006NE2, IPT004N, IPP055N<br>IRL40DM2, BSC010N04, IST011N06, BSZ097N04, IRF40SC, IPB011N04, IRL40B215 |   |
|                           |                        | Gate drivers   | MOTIX™   | 6EDL6171, IDM700A, 2ED2742S01G, ED2744S01G, ED2748S01G, ED2732S01G, ED2734S01G, ED2738S01G                         |   |
|                           |                        |  | EiceDRIVER™  | 1ED44173N01B   |   |
|                           |                        | Microcontroller  | XMC™ series  | XMC1400, XMC1400, XMC4400  |   |
|                           |                        |  | PSoC™  | PSoC™ 4100, PSoC™ 62   |   |
|                           |                        | Sensor systems   | Hall switches  | TLV4963  |   |
|                           |                        |  | Angle  | TLI5012  |   |
|                           |                        |  | 3D magnetic  | TLV493D  |   |
|                           |                        |  | Magnetic coreless current                                | TLI4971  |   |
|                           |                        | 36 V   | MOSFET   | OptiMOS™ 5<br>OptiMOS™ 6<br>StrongIRFET™   | IRL40DM2, BSC010N04, IST011N06, BSZ097N04, IRF40SC, IPB011N04, IRL40B215, IPT009N08NM6, IPB016N08NF2S   |
|                           |                        |  | Gate drivers   | MOTIX™   | 6EDL7141, IDM 700A, 6ED2742 NEW, 2ED2742 NEW, 2ED2732 NEW   |
|                           |                        |  |  | EiceDRIVER™  | 1ED44173N01B  |
|                           | Microcontroller        |  | XMC™ series  | XMC1400, XMC1400, XMC4400  |   |
|                           |                        |  | PSoC™  | PSoC™ 4500S<br>PSoC™ 6   |   |
|                           | Sensor systems         |  | Hall switches  | TLV4963  |   |
|                           |                        |  | Angle  | TLI5012  |   |
|                           |                        |  | 3D magnetic  | TLV493D  |   |
|                           |                        |  | Magnetic coreless current                                | TLI4971  |   |
|                           | 48 V, 56 V, 72 V       |  | MOSFET   | OptiMOS™ 3<br>OptiMOS™ 5<br>OptiMOS™ 6<br>StrongIRFET™   | BSC021N08N, BSC030N08N, IPT010N08N, IPTG011N08N, IPP040N08N, IPB049N08N, IPT009N08NM6, IPB016N08NF2S<br>BSC035N10N, ISZ080N10N, IPT015N10N, IPTC030N12N, IPB036N12N, IPP050N10N |
|                           |                        |  | Gate drivers   | MOTIX™   | TLE9140EQW, 1EDN755X, 6ED2742, 2ED2732, 2ED2734, 2ED2748  |
|                           |                        |  | Microcontroller  | XMC™ series  | XMC1400, XMC1400, XMC4400   |
|                           |                        | PSoC™  |  | PSoC™ 4500S<br>PSoC™ 6   |   |
|                           |                        | Sensor systems   | Hall switches  | TLV4963  |   |
|                           |                        |  | Angle  | TLI5012  |   |
| 3D magnetic               |                        |  | TLV493D  |  |   |
| Magnetic coreless current |                        |  | TLI4971  |  |   |
| Charging                  |                        | MOSFET   | CoolMOS™ P7  | IPA60R280P7S, IPD60R080P7, IPD60R280P7S, IPD60R360PFD7S, IPN70R450P7S  |   |
|                           |                        | Controller IC  | -  | ICC80QSG, XDPS2201, XDPS2221, ICE3PCS01G   |   |
|                           |                        | HEMTs  | CoolGaN™   | IGI60F1414A1L IGI60F200A1L, IGLD60R190D1   |   |
|                           |                        | Gate drivers   | EiceDRIVER™  | 1EDB9275F, 2EDB7259Y, 2EDF9275F, 2EDL05N06PF, 2EDR8259X, 2EDS9265H   |   |
|                           | Schottky diodes        | CoolSiC™ G5 CoolSiC™ G6  | IMZA65R027M1H, IMZA65R048M1H, IMW65R027M1H, IMW65R048M1H |  |   |
|                           | SR switch              | OptiMOS™ 5   | BSC040N10NS5, BSC160N15NS5, IPP200N15N3                  |  |   |
|                           | Load switch            | OptiMOS™ 5   | BSC040N10NS5, BSC0902NSI, IPP034N08N5                    |  |   |
|                           | USB-PD                 | EZ-PD™ PMG1-B1   | CYPM1115-48LQXI, CYPM1116-48LQXI                         |  |   |
|                           |                        | EZ-PD™ PAG1  | PAG1P, PAG1S   |  |   |
|                           |                        | EZ-PD™ BCR   | CYPD3177-24LQXQ, CYPD3177-24LQXQT                        |  |   |
|                           | Microcontroller        | XMC™   | XMC1400  |  |   |
|                           | BMS                    | 12 V   | Protection MOSFET  | OptiMOS™<br>StrongIRFET™   | BSC004NE2LS5, IQE006NE2LM5, BSB008NE2LX, BSZ009NE2LS5, IRFH6200, IRF6200, IRF1324   |
| 18 V                      |                        | IPT004N03L, BSC005N03LS5, BSZ0500NSI, IRF6726M, IRLS3813, IRLB3813, BSC079N03LSCG  |  |  |   |
| 24 V                      |                        | IRL7472L1, IRL40SC228, BSC007N04LS6, IRL40T209, IRFS7430, IRL40B209, BSZ018N04LS6  |  |  |   |
| 36 V                      |                        | IPT007N06N, IRF60SC241, BSC014N06NS, IRF7749L1, IRL60B216, IRL60S216               |  |  |   |
| 48 V                      |                        | IPT012N08N5, IPP020N08N5, BSC025N08LS5, BSB044N08NN3G, BSZ070N08LS5, BSZ096N10LS5, |  |  |   |
| 72 V                      |                        | IPP041N12N3G, BSC077N12NS3G, BSZ240N12NS3G, IRF135SA204, IRF135S203, IRF135B203    |  |  |   |
|                           |                        | Monitoring balancing IC  | -  | TLE9012  |   |
|                           |                        | Cell balancing MOSFETs   | StrongIRFET™   | IRLML9303, IRFTS9342, IRLML9301  |   |
|                           |                        | Microcontrollers   | XMC™, PSoC™  | XMC1100, XMC1200, XMC1400, XMC1400, XMC4100, CY8C41x4/5/65, CY8C41x6/75, CY8C4147-S5                               |   |
| Communication and HMI     |                        | Authentication/security  | OPTIGA™ Trust  | SLE 95250, SLS 32AIA010MH  |   |
|                           | Bluetooth®             | AIROC™   | CYBT-213043-02, CYW20736, CYW20706, CYW20704             |  |   |
|                           | Wi-Fi                  | AIROC™   | CYW43907, CYW43439, CYW954907                            |  |   |
|                           | Pressure sensor        | XENSIV™  | DPS368   |  |   |





Smartwatch

# Smartwatches, sports watches, fitness bands and medical wrist-worn devices

All in one marketplace for wrist-worn devices with Infineon's excellent RF, sensing, connectivity, power, memory and security solutions

With its broad product portfolio, Infineon helps manufacturers of wearables to overcome the following design challenges across all device categories:

- the need for reliable device and data security to protect personal and sensitive information,
- accurate sensor readings for precise location tracking and recognition between everyday movements and a fall event,
- longer battery lifetimes and small form factors for elegant, unobtrusive designs.

Infineon's widely-deployed **AIROC™** Wi-Fi and Bluetooth® Combo ICs portfolio offers the industry's best interoperability and RF performance. Infineon also helps customers to differentiate their offerings with highly efficient, secured and innovative solutions supporting the integration of additional use cases such as smart payment and ticketing, notifications and voice calls, Bluetooth® audio streaming, smart access or different ways of charging (wireless, NFC, USB).



Smartwatch

A smartwatch provides a two-way connection via Bluetooth®, cellular baseband or Wi-Fi to a smartphone. It receives electronic communications like texts or voice calls, must display the time and have a glance-able display. These lifestyle devices monitor health and make communication (text, calls) more convenient.



Sports watch

A sports watch is a highly functional, robust and usually water-resistant device. Leisure or professional athletes mainly monitor their health conditions, fitness and sleep activities. Sports watches have fewer features compared to smartwatches as their main focus is on sports tracking.



Wristbands

A wristband or fitness band offers limited functionalities. Compared to a smartwatch, it just covers a selected amount of use cases (e.g. step counting, sleep monitoring, location tracking, access control, etc.).



Sports watch

A medical wrist-worn device measures and analyzes the physical activity and body functions of the wearer. These wristbands are used for elderly care, safety, connected health and much more.

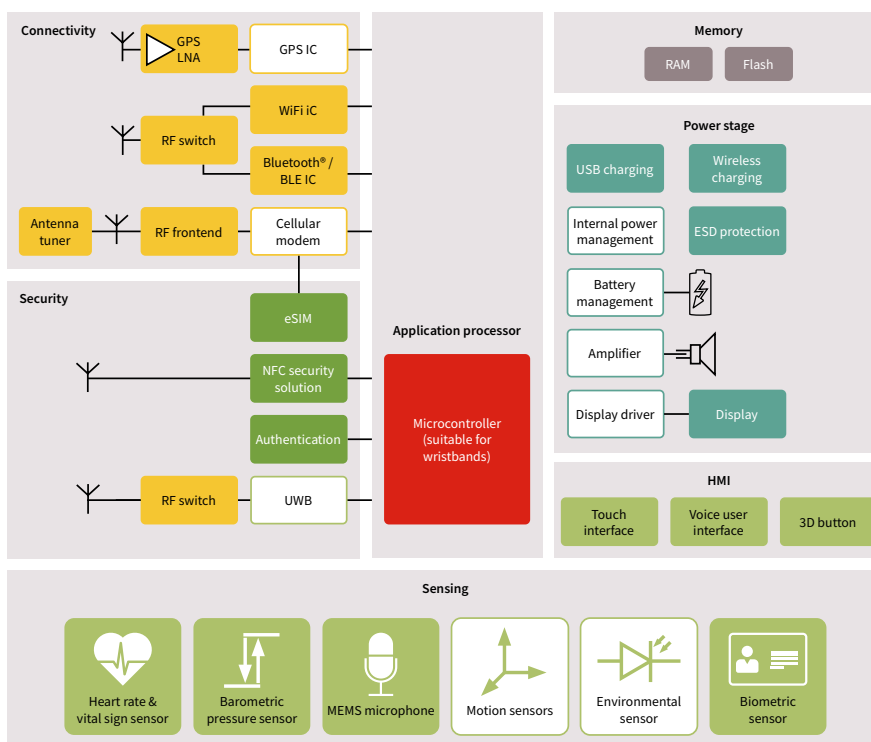
## Key enabling products

- › XENSIV™ 3D magnetic sensor
- › XENSIV™ 60 GHz radar sensor
- › XENSIV™ pressure sensor
- › XENSIV™ MEMS microphones
- › XENSIV™ Multigas sensor
- › [Wireless charging](#)
- › **AIROC™** Wi-Fi and Combos
- › **AIROC™** Wi-Fi
- › **AIROC™** Bluetooth® LE and Bluetooth®
- › **AIROC™** Bluetooth® 5.0 SOC for Audio
- › Wi-Fi MCUs
- › SECORATM Connect
- › PSoC™ 6 Microcontrollers
- › PSoC™ 4 Microcontrollers
- › PSoC™ 4 Bluetooth® Low Energy (Bluetooth® Smart)
- › PSoC™ including **CAPSENSE™** technology
- › RF switches
- › OPTIGATM Connect Consumer eSIM solution
- › OPTIGATM Authenticate S
- › NOR flash/F-RAM
- › GPS LNA
- › ESD protection
- › Antenna tuners
- › 4G/5G LTE LNAs





## Block diagram for smartwatch, sports watch and wristband






















| Functional block        | Product family   | Functional block | Recommended products and solutions  |
|-------------------------|--|------------------|---|
| Security                | <ul style="list-style-type: none"> <li>OPTIGA™ Authenticate S (e.g., SLE95401)</li> <li>OPTIGA™ Connect Consumer eSIM solution (OC1120)</li> <li>SECORA™ Connect (boosted SiP or MCP, passive NFC)</li> <li>RF switch (e.g., BGS12WN6, BGS14WMA9)</li> </ul> | Power stage      | <ul style="list-style-type: none"> <li>USB type-C controller (e.g., EZ-PD™ CCG2)</li> <li>ESD protection (e.g., ESD119-B1, ESD131-B1, ESD307-U1)</li> <li>Wireless charging</li> </ul>  |
| Human-machine interface | <ul style="list-style-type: none"> <li>XENSIV™ 3D magnetic sensor (e.g., TLI493-W2BWA0)</li> <li>XENSIV™ MEMS microphones (e.g., IM69D120/D130/D130)</li> <li>PSoC™ 6 MCU + BLE (e.g., CY8C68237FM-BLE)</li> </ul>   | Memory           | <ul style="list-style-type: none"> <li>SEMPER™ Nano NOR flash / F-RAM</li> </ul>  |
| Sensing                 | <ul style="list-style-type: none"> <li>XENSIV™ pressure sensor (e.g., DPS368/DPS310)</li> <li>XENSIV™ MEMS microphones (e.g., IM69D120/D130/D128S)</li> <li>XENSIV™ MEMS packaging partners</li> </ul>   | Connectivity     | <ul style="list-style-type: none"> <li>4G / 5G LTE LNAs (e.g., BGA5x1BN6 family)</li> <li>GPS LNA (e.g., BGA123L4, BGA524N6)</li> <li>AIROC™ Wi-Fi (e.g., CYW43362, CYW43364)</li> <li>AIROC™ Wi-Fi and combos (e.g., CYW43439, CYW43012)</li> <li>AIROC™ Bluetooth® 5.0 SoC for audio (e.g., CYW20719/21)</li> <li>Antenna tuners (e.g., BGS12UGL8, BGS14GN10)</li> <li>RF switches (e.g., BGS12WN6, BGS14WMA9)</li> </ul> |















## Main use cases for wrist-worn devices

Main use cases for smartwatches, sports watches and wristbands

|   |  |   |  |   |
|---|--|---|--|---|
|  |  Notifications                        |  Bluetooth® audio streaming                        |  Voice recording and assistant                                |  Gesture control   |
|  |  Location tracking                    |  Contactless payment, access control and ticketing |  Information visualization (maps, news, videos, etc.)         |  Physical condition monitoring (cardiac condition, blood pressure, blood glucose monitoring) |
|  |  Health monitoring (heart rate, etc.) |  Sleep monitoring                                  |  Body temperature monitoring                                  |  Smartphone autonomy & broader mobile network accessibility                                  |
|   |  Fitness monitoring                   |  Speed monitoring                                  |  Cloud authentication for safe data transfer and data privacy |  Car access control  |

● Use cases today ● Future use cases

## Infinion the right partner to solve your design challenges

|   |   |   |   |   |   |
|---|---|---|---|---|---|
|       |   |   |   |   |   |
| Highest accuracy and fast signal pick-up for location tracking and altitude measurement | Secure cellular network connection  | Products with smallest form factors enable high functional integration              | Integrated lowest power compute, BLE connectivity and most robust capacitive touch  | Bluetooth® audio streaming with BT/BLE Combo SoC                                      | Precise detection of single steps, body motions or fall events                        |
|      |  |  |  |  |  |
| Best performance for voice call and voice assistant with MEMS microphones               | Reliable and low-power code and data storage in a tiny footprint                    | Easy, convenient and secure data transmission by NFC                                | Device protection to enable high user experience                                    | High reliability and data throughput with Wi-Fi/BT connectivity                       | Low power consumption to increase battery lifetime                                    |





Audio amplifier

# Class D audio

## No compromise on quality – products for exceptional audio performance

At Infineon, we manufacture power-efficient class D audio amplifier solutions that maintain best-in-class audio quality, without heating up the surroundings. We believe smaller and lighter is better as well as that the amplifier embedded in your product should be heard but not seen. Our amplifier solutions help you design robust, flexible products that meet the needs of your customers and the market. Choose from our high-performance class D audio amplifier solutions for all power ranges and application requirements, from the smallest fully integrated single-chip solutions to the highly scalable driver and power MOSFET combinations (for a full portfolio, see [Audio amplifier ICs](#)).

Design with Infineon's solutions to benefit from:



Exceptional audio performance



Maximized power efficiency



Maximized output power



Design freedom



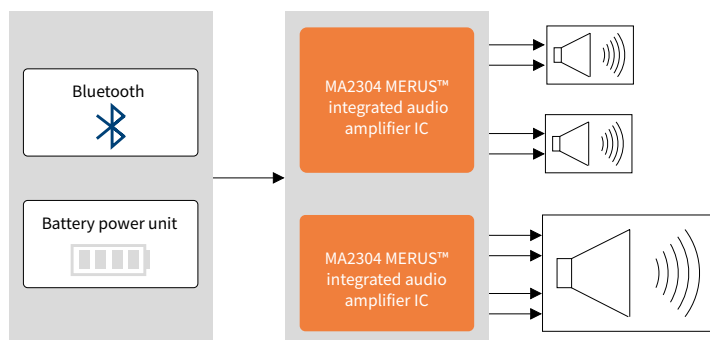
Fast time to market

| Portable/battery powered audio applications   | Home audio applications   | Professional audio applications  | Car & marine audio applications  |
|---|---|--|--|
| <ul style="list-style-type: none"> <li>Battery powered speakers:               <ul style="list-style-type: none"> <li>– On-the-go Bluetooth® speakers</li> <li>– Docking speakers</li> <li>– Boom boxes</li> <li>– Wearable speakers</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>– Multiroom systems</li> <li>– Audio hub</li> <li>– TVs</li> <li>– Sound bars</li> <li>– Home theater systems</li> <li>– Smart speakers</li> </ul> | <ul style="list-style-type: none"> <li>– Power-over-ethernet (PoE)</li> <li>– Audio systems</li> <li>– Touring amplifiers</li> <li>– Active speakers</li> <li>– Public announcement 70-100 V systems</li> <li>– Music instrument amplifiers</li> </ul> | <ul style="list-style-type: none"> <li>– After-market car audio</li> <li>– Marine audio</li> <li>– Motorcycle audio</li> </ul> |

### Home audio

Modern home audio products vary in shape, size and configuration, but a common requirement is a great sound in combination with outstanding industrial and acoustic design. In addition to producing exceptional sound quality, MERUS™ amplifiers from Infineon can completely eliminate the need for bulky and expensive LC output filters and heatsinks. This allows the design of new innovative and great-sounding home audio products in form factors and shapes that were previously unthinkable.

### Solution example: 2.1 configuration (2xBTL + 1xPBTL)



### Solution specification

**Number of audio channels:** 2 bridge-tied load (BTL) and 1 parallel BTL channel

**Peak power output:** 2x37 W @ 4 Ω, 10% THD and 74 W @ 2 Ω, 10% THD

**Featured audio ICs:** MA2304DNS or MA2304PNS

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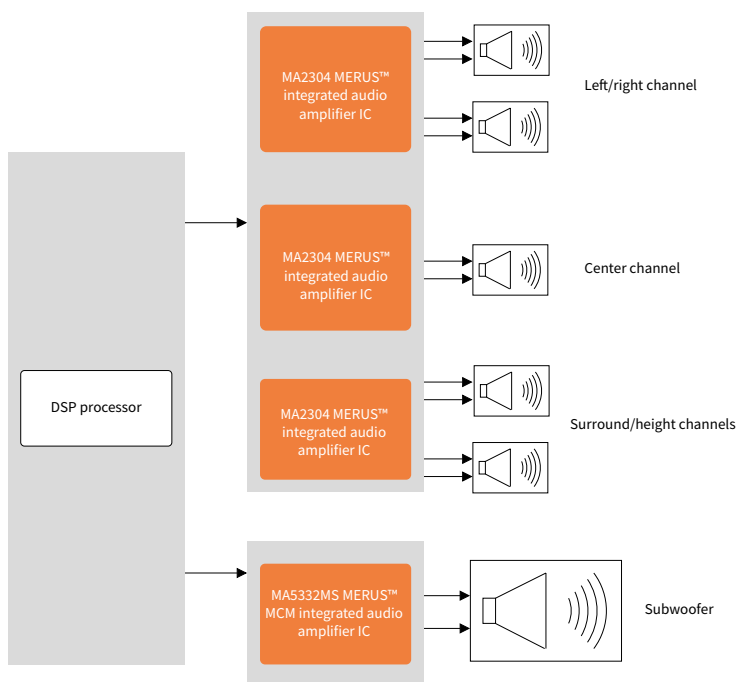
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For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



### 5.1/3.1.2 configuration soundbar example



#### Solution specification

**Number of audio channels:** 5 bridge-tied load (BTL) + 1 BTL Subwoofer

**Peak power output:**

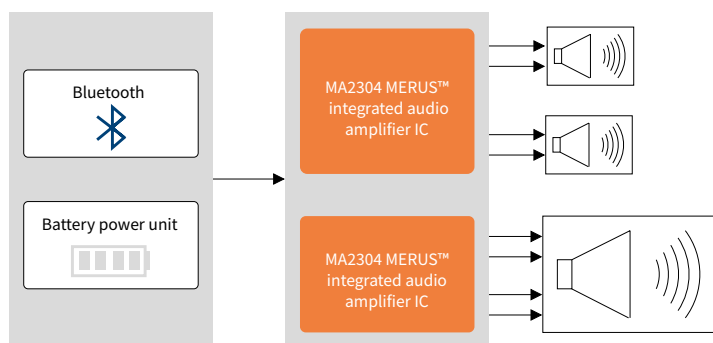
5x37 W @ 4 Ω, 10% THD; 400 W @ 8 Ω, 10% THD

**Featured audio ICs:** MA2304DNS, MA2304PNS, MA5332MS, MA5342MS \*

### Portable audio

When designing portable/battery-powered audio devices, it is essential to maximize battery playback time, and at the same time, maintain excellent audio performance. Infineon’s MERUS™ amplifiers provide up to twice as long battery playback time in combination with the best-in-class audio performance and unsurpassed sound quality.

### Solution example: 2.1 configuration (2xBTL + 1xBTL)



#### Solution specification

**Number of audio channels:** 2 bridge-tied load (BTL) and 1 parallel BTL channels

**Peak power output:** 2x37 W @ 4 Ω, 10% THD and 74 W @ 2 Ω, 10% THD

**Featured audio ICs:** MA2304DNS or MA2304PNS

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\*Coming soon

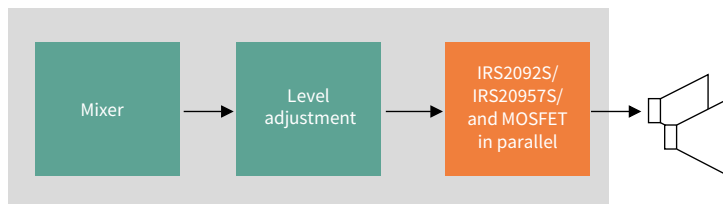
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Professional audio

Professional audio equipment is all about maximizing output power and power density. With the conception of Infineon's MERUS™ multilevel class D technology and GaN-based CoolGaN™ GIT HEMTs, it is now possible to conceive both amplifiers and power supply units with great audio performance and high efficiency in a very compact design. For engineers developing amplifiers, Infineon offers varied chip-set solutions with versatile MOSFET combinations for the scaling of output power.

### Solution example: active speakers



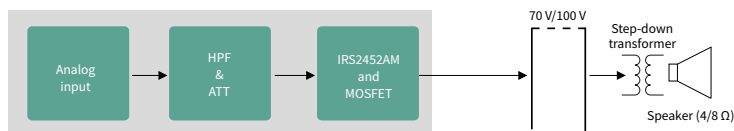
#### Solution specification

**Number of audio channels:** 2 half-bridge channels

**Peak power output:** >500 W @ 4 Ω, 1% THD

**Featured audio ICs:** IRS2092S, IRS20957S, IRS2461S, IRS2452AM

### Solution example: public announcement 70-100 V system



#### Solution specification

**Number of channels:** 2 half-bridge channels

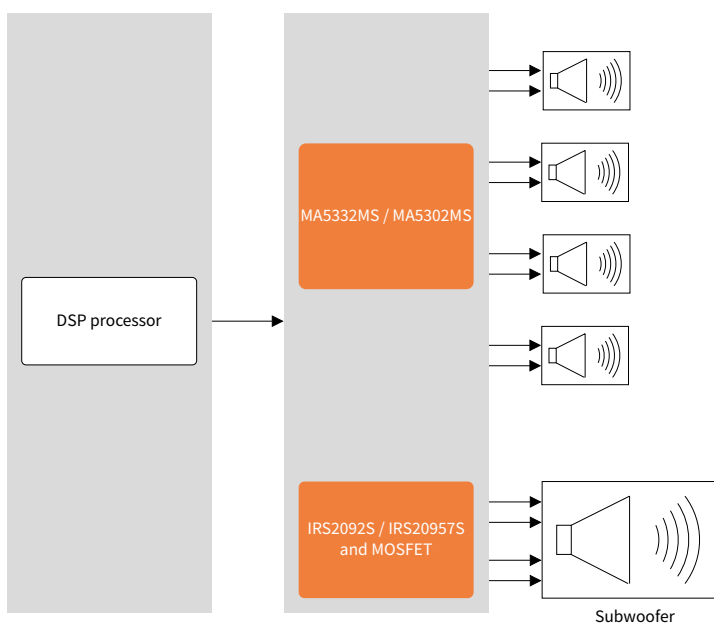
**Peak power output:** 500 W, 70 V<sub>RMS</sub>/100 V<sub>RMS</sub>, 1% THD

– **Featured audio IC:** IRS2452AM

## Car and marine audio

Car and marine audio systems need to generate powerful and great sound while limiting the system size and heat generation to a minimum level. Infineon's MERUS™ multi-chip module integrated class D amplifiers and class D controller + MOSFETs combinations enable high-level power density and design flexibility to deliver the best music listening experience regardless of where you are, whether it's in your car, on your motorcycle, or on the water.

### Solution example: 5 channel car audio amplifier



#### Solution specification

**Number of audio channels:** 5 half-bridge channels

**Peak power output:** 150 W @ 4/2 Ω, 1% THD;  
500 W @ 4 Ω, 1% THD

**Featured audio ICs:** MA5332MS, MA5302MS\*, IRS2092S, IRS20957S

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\*Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





Smart speaker

# Smart speaker

## Speakers for an intuitive and outstanding user experience

Once a novelty in households, smart speakers are more and more becoming increasingly commonplace. Rising user expectations accompany this rapid adoption. However, frustration with devices that do not understand or hear commands leads to lower user adoption. Consequently, growth rates for smart speakers are failing to reach their full potential. Components such as MEMS microphones, touch controllers, and new technologies such as radar are vital in improving the user experience in the smart speaker segment.

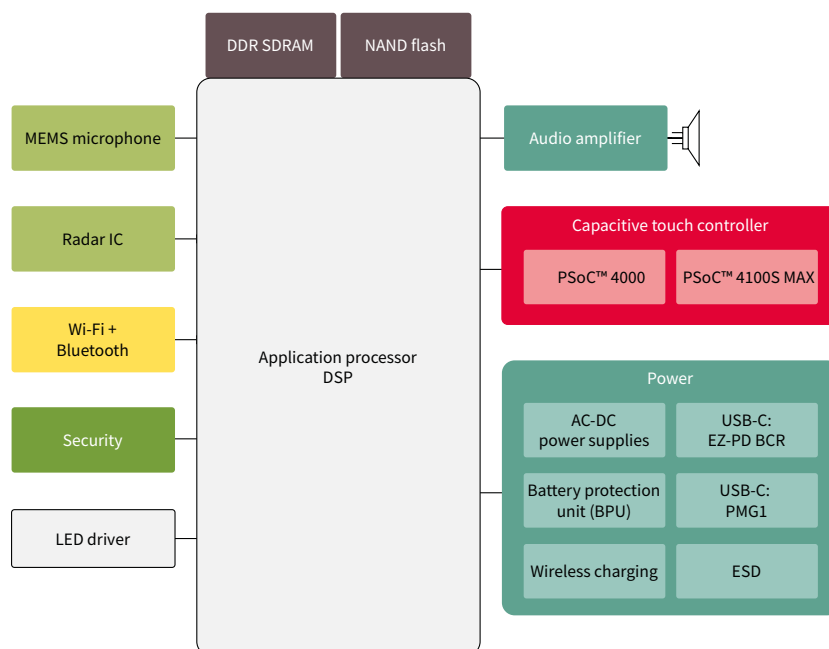
Infineon has long-standing expertise in sensors, connectivity and power solutions that fulfill the consumer market requirements in terms of outstanding performance, reliability and energy efficiency.

### Features and benefits

| Key features   |
|--|
| – High sensitivity, low self-noise (high SNR) and distortion, wide dynamic range, and high acoustic overload point with XENSIV™ MEMS microphones |
| – Multilevel switching technology at fully rated power in a wide range of MERUS™ class D amplifiers  |
| – Ultralow-power AIROC™ Wi-Fi and Bluetooth® combo in a single-chip solution enables small-form-factor IoT designs                               |
| – Reliable, elegant and durable CAPSENSE™ touch controller with advanced capacitive touch sensors  |
| – XENSIV™ 60 GHz radar sensor brings innovative, intuitive sensing capabilities  |
| – Highly efficient and power-dense SMPS solutions  |
| – Highly integrated EZ-PD™ USB-C controller supports all USB-PD profiles   |
| – IoT security controller OPTIGA™ Trust M maintains the unique identity and integrity of the speaker   |

| Key benefits   |
|--|
| – Improved audio input and thus voice command recognition, especially in extended use cases such as whispering or longer distances to the speaker for a better user experience   |
| – Best-in-class audio quality and lowest power consumption enable the class D audio amplifier to be used in filterless configurations  |
| – Connectivity for high interoperability and performance without dropouts anywhere in the home, extended battery playback time, or the reduction of battery size without compromising on battery playback time to save cost                |
| – Noise immunity, water resistance, and sleek, futuristic user interfaces and gesture recognition  |
| – Precise presence detection for more contextual awareness to ease interaction, sub-millimeter motion tracking to capture movement at high speed accurately, vital sensing for monitoring health status such as respiratory and heart rate |
| – Highly efficient charger in a small form factor  |
| – USB-IF certified with market-proven USB-PD stack, ensuring specification compliance and interoperability, requiring no firmware development  |
| – Easy and secure cloud provisioning services  |

### Application diagram





## Recommended products

| Functional block               | Product family                      |                | Product   | Benefits   |
|--------------------------------|-------------------------------------|----------------|---|--|
| Audio input                    | Microphones                         |                | XENSIV™ MEMS microphones  | <ul style="list-style-type: none"> <li>High-performance microphone with low self-noise (high SNR) and low distortions, setting a the new performance benchmark for a superior user experience</li> </ul>   |
| Audio output                   | Class D amplifier                   |                | MERUS™ class D audio amplifiers<br>MA2304DNS  | <ul style="list-style-type: none"> <li>Cooler, smaller and lighter amplifiers designed to maximize power efficiency and dynamic range while providing best-in-class audio performance in the product form factors for great-sounding audio products</li> <li>Extended battery playback time or the reduction of battery size without compromising on battery playback time to save cost</li> </ul> |
| Connectivity                   | Wi-Fi + Bluetooth® combos           |                | AIROC® Wi-Fi + Bluetooth combos   | <ul style="list-style-type: none"> <li>Best-in-class interoperability to the widest deployed wireless IP</li> <li>Whole Home Range with high throughput for multi-channel audio and RSDB (Real Simultaneous Dual Band) for speaker sub-networks</li> <li>Ultralow-power technology designed with battery operation in mind</li> </ul>  |
| Sensing                        | Capacitive sensing touch controller |                | CAPSENSE™ capacitive touch sensing controller   | <ul style="list-style-type: none"> <li>State-of-the-art noise immunity (SNR &gt; 100:1) &amp; water rejection have made CAPSENSE™ the industry leader</li> <li>Advanced inductive touch sensors make possible sleek, futuristic user interfaces with metallic overlay</li> </ul>   |
|                                | Radar sensor                        |                | XENSIV™ 60 GHz radar sensor   | <ul style="list-style-type: none"> <li>Accurate presence detection and vibration detection based on ability to track sub-millimeter motion at high speed and accuracy,</li> <li>Both stand-alone chip as well as system solution available</li> </ul>  |
|                                | CO <sub>2</sub> sensor              |                | XENSIV™ PAS CO <sub>2</sub> sensor  | <ul style="list-style-type: none"> <li>Superior accuracy, providing a direct readout of the real CO<sub>2</sub> level, not simply a correlation</li> <li>Size and cost advantages</li> </ul>   |
| Security                       | IoT security controller             |                | OPTIGA™ Trust M   | <ul style="list-style-type: none"> <li>Easy &amp; secure provisioning services with OPTIGA™ Trust M for maintaining speaker's unique identity &amp; integrity</li> <li>Unify different products under unified PKI architecture</li> </ul>  |
| Power                          | USB-C PD controller                 |                | EZ-PD™ USB-C controller   | <ul style="list-style-type: none"> <li>USB-IF certified with market-proven USB-PD stack, ensuring spec compliance and interoperability</li> <li>Supports all USB-PD profiles commonly used in USB-C power adapters and requires no firmware development</li> <li>A highly-integrated solution that minimizes incremental BOM costs</li> </ul>  |
|                                | ESD protection                      |                | ESD111, ESD245  | <ul style="list-style-type: none"> <li>Outstanding low capacitance devices for best signal integrity</li> <li>High protection performance by ultralow clamping voltage</li> </ul>  |
|                                | Wireless charging                   |                | 15 W inductive wireless power transmitter   | <ul style="list-style-type: none"> <li>Powerful and cost-effective wireless charging solutions for high performance, smart and secure charging solutions supported by Infineon's unique wireless power controllers</li> </ul>  |
|                                | High-voltage MOSFETs                | Flyback        | 700 V CoolMOS™ P7 (standard grade)  | <ul style="list-style-type: none"> <li>Best price-competitive CoolMOS™ SJ MOSFET family</li> <li>Lower switching losses than a standard MOSFET</li> </ul>  |
|                                |                                     | ACF, FMCI      | 600 V CoolMOS™ PFD7   | <ul style="list-style-type: none"> <li>Lower Q<sub>rr</sub>, lower hysteresis loss, low R<sub>DS(on)</sub></li> </ul>  |
|                                | SMPS Flyback converter Control ICs  | QR flyback ICs | ICE5QSAG  | <ul style="list-style-type: none"> <li>High efficiency and low standby power</li> </ul>  |
|                                |                                     | FFR flyback IC | XDPS21071   | <ul style="list-style-type: none"> <li>High power density and ideal for USB-PD</li> </ul>  |
| SMPS synchronous rectification | Low-voltage MOSFETs                 | OptiMOS™ PD    | <ul style="list-style-type: none"> <li>Low conduction losses and reduced overshoot</li> <li>Logic level switching / S308 / PQFN 3.3x3.3 packages available</li> </ul> |  |
|                                | Control ICs                         | IR1161LTRPBF   | <ul style="list-style-type: none"> <li>High efficiency</li> <li>Simple external circuitry</li> </ul>  |  |
| SMPS load switch               | Low voltage MOSFETs                 | OptiMOS™ 30 V  | <ul style="list-style-type: none"> <li>Low conduction losses</li> <li>S308 / PQFN 3.3x3.3 packages available</li> </ul>   |  |





# Security camera and video doorbell

## Make your wire-free camera smarter

Advancements in video surveillance technology take indoor and outdoor security solutions to the next level. Smart cameras that are connected to management systems and cloud platforms detect intruders more easily and alarm you in case of danger. By equipping cameras and doorbells with reliable connectivity and accurate sensor solutions, safety-enhancing IoT features can be implemented, significantly improving intrusion detection, and other unusual behavior. Camera hardware improvement enables differentiated features to move from the cloud to the edge. Cameras become an active component in smart homes, not just passive observers. Wire-free cameras and doorbells often demand low power with high integration features.

Infineon offers a broad range of products to make security cameras and video doorbells smart and connected. The **AIROC™** wireless connectivity solution portfolio for Wi-Fi, Bluetooth® and Matter offers stable connections to cloud and management systems, making cameras and doorbells linked with the whole smart home. Sensors such as Infineon's **XENSIV™** radar sensors can help overcome bandwidth limitations, for example, by the waking-up function and reducing false positives when motion near the camera is detected. And **XENSIV™** MEMS Microphone enables sound/voice-triggered recording and notification. At the same time, Infineon's embedded security solutions make connected cameras more robust against cyberattacks. Infineon's best-in-class low-power MCU and wireless support wire-free cameras and doorbells which are usually battery-operated.

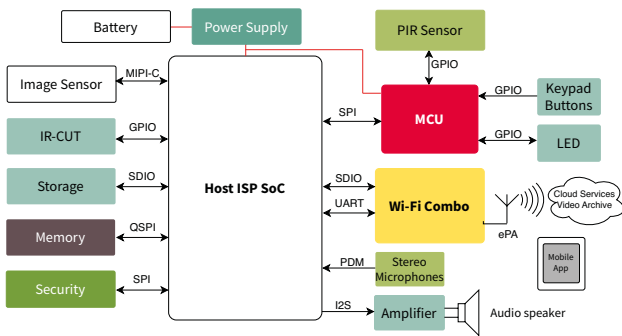
### Features and benefits

| Key features  | Key benefits   |
|---|--|
| – Reliable and robust connectivity with Wi-Fi6/E            | – Improvement in coverage, deploy density, latency, throughput, etc.                   |
| – Low power Wi-Fi and MCU                                   | – Longer battery life  |
| – Connectivity processor in wireless solution               | – Offloading host burden for power saving; BOM reduction                               |
| – Infineon leading solution of Matter                       | – Interoperability between devices in smart home                                       |
| – Highly accurate set of sensors with low power consumption | – Accurate data collection for new use cases, e.g. wake-up functions with radar sensor |
| – Turnkey embedded security solutions                       | – Ensuring device integrity and robust design against cyber attacks                    |

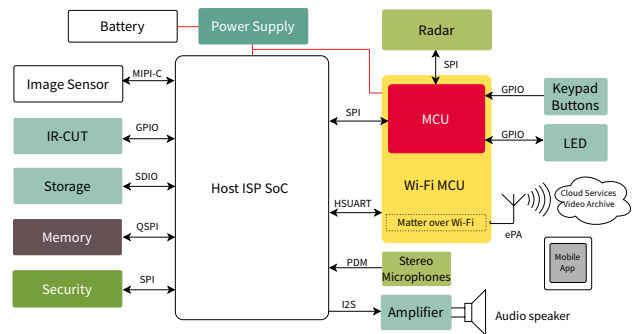




### Current generation block diagram – battery powered



### Next generation block diagram – battery powered



|                        | Sensing  | Security   | MCU   | Memory                                  | Software service  |
|------------------------|--|--|---|---|---|
| <b>MEMS Microphone</b> | <b>Radar IC</b><br>– BGT60LTR11AIP (60 GHz)<br>– BGT60UTR11AIP (60 GHz)<br>– BGT60TR13C (60 GHz)<br>– BGT60UTR13D (60 GHz)<br>– BGT24LTR11 (24 GHz)<br>– BGT24MTR11 (24 GHz) | <b>OPTIGA™ Trust M</b><br>– M5271SLS32AIA010MS / MH<br>– M5271SLS32AIA010MK / ML<br><b>OPTIGA™ TPM</b><br>– SLB 9670 TPM 2.0 | – PSoC™ 4 M0/M0+ processor<br>– PSoC™ 6 M4-M0+ processor<br>– Next-gen edge compute processor | – SEMPER™ Nano flash<br>– ULTREON™ RRAM | – IoT Network Intelligence (INI)<br>– Mobile App Intelligence (MAI) |

| Wi-Fi  |  |   |   |
|--|--|---|---|
| Good   | Better   | Best  | Wi-Fi 6/6E  |
| <b>CYW43439</b><br>– Single band, 1x1 11 n, iPA, SDIO<br>– Low power<br>– BT/BLE 5.0 UART<br>– TCP/IP keep alive<br>– WPA3<br>– Antenna diversity<br>– Cost-effective connectivity | <b>CYW4373</b><br>– 1x1 11 ac dual-band, USB and SDIO<br>– TCP/IP keep alive<br>– WPA3<br>– Antenna diversity<br>– External PA for long range<br><br><b>CYW43012 for low power</b><br>– Ultra-low-power, 28 nm<br>– 802.11a/b/g/n-compliant, dual-band<br>– TCP/IP keep a live<br>– High volume production, field-proven in battery cameras<br>– No capacity constraints | <b>CYW5459x for high performance</b><br>– RSDB, MU-MIMO, 2x2 11 ac<br>– 80 MHz channel, up to 867Mbps<br>– PCIe3.0 and SDIO 2.0 Wi-Fi<br>– BT/BLE 5.1<br>– 2- and 3-antenna configurations<br><br><b>CYW43022 for ultra-low power</b><br>– 43012 pin-compatible “drop-in” replacement with no RBOM change<br>– New Deep Sleep mode enabling improved DTIM power states<br>– ROM update frees up run-time RAM space for features & patches | <b>CYW557x for High performance</b><br>– 2x2 11 ax, tri-band capable<br>– Integrated high-power front end<br>– Highest throughput -1.2 Gbps max.<br>– Advanced Coexistence<br>– Novel long-range extension modes for devices<br><br><b>CYW55x13 for ULP and offloading</b><br>– 1x1 11 ax, Tri-band, 20 MHz for IoT<br>– Ultra low power, extended battery life<br>– Wi-Fi MCU with connectivity processor for system-level power saving and BOM reduction<br>– Software compatible with 5572 |





# LED lighting

## Solutions for cost-sensitive applications as well as for smart lighting

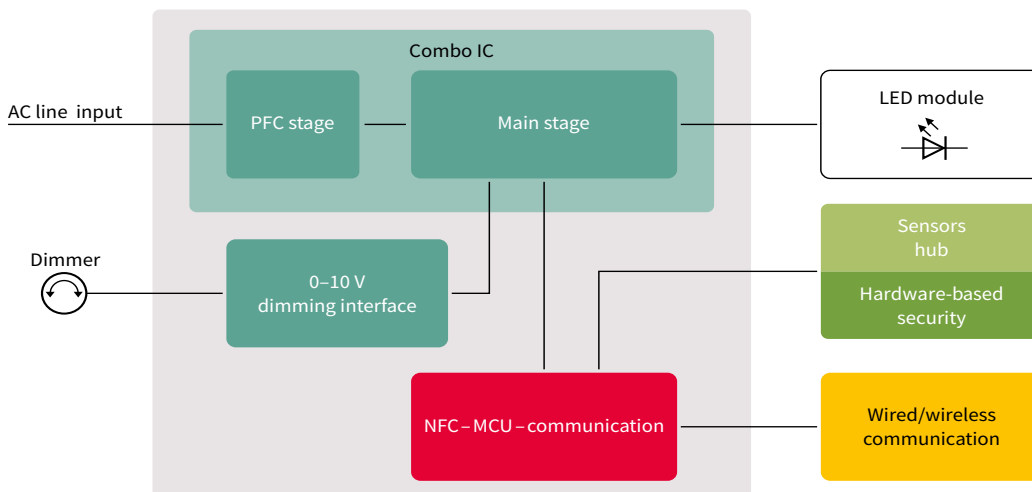
Infinion supplies tailored products for LED drivers, LED strips, horticultural, and smart lighting. Our broad portfolio of LED lighting comprises LED driver ICs, MOSFETs, and microcontrollers suited for LED drivers as well as sensors and dedicated ICs for secure communication. In addition to offering products of proven quality, a competent global lighting team supports our lighting customers in designing LED lighting products and systems in collaboration with our channel partners.

### Key trends and challenges in LED lighting and our offering:

- Human-centric lighting (HCL)
  - The lowest cost implementation of tunable white with single-stage flyback constant voltage and smart linear regulators with advanced headroom control ensuring high efficiency – [BCR601](#)
- Configuration of output current and some further parameters
  - Our NFC controller allows the configuration of the output current without the need for an additional microcontroller
  - Our XDPL lighting IC family allows, besides output current, also adjustment of other features like protection, dimming curves, etc.
- Cost reduction combined with efficiency increase
  - Integration of resonance inductor for PFC + resonant topology enables highest efficiency at low cost
  - Integration is enabled by the coreless transformer technology that enables high switching frequencies



### LED drivers

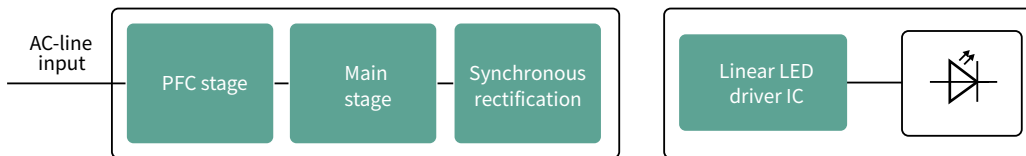




## Recommended LED driver products

| Functional block                     | Product type  | Product family                  | MOSFET technology          | Voltage class                         |
|--------------------------------------|---|---------------------------------|----------------------------|---------------------------------------|
| PFC stage                            | PFC   | IRS2505                         | CoolMOS™ P7                | 600 V/700 V/800 V/950 V <sup>1)</sup> |
| Main stage                           | PFC + LCC (constant current) PFC + LLC (constant current) | ICL5102 <sup>2)</sup>           | CoolMOS™ P7 (up to 600 mΩ) | 600 V/600V                            |
|                                      |   |                                 | CoolMOS™ PFD7              | 600 V                                 |
|                                      |   | ICL5102HV <sup>3)</sup>         | CoolMOS™ CE (above 600 mΩ) | 950 V                                 |
|                                      | PFC + flyback (dual-stage)                                | XDPL8221 <sup>2)</sup>          | CoolMOS™ P7                | 800 V/950 V                           |
|                                      | PFC/flyback (single-stage constant current)               | XDPL8105                        | CoolMOS™ P7                | 800 V/950 V                           |
|                                      | PFC/flyback (single-stage constant voltage)               | XDPL8219                        | CoolMOS™ P7                | 800 V/950 V                           |
|                                      | PFC/flyback (single-stage constant voltage)               | ICL8800/ICL8810/ICL8820         | CoolMOS™ P7                | 800 V/950 V                           |
|                                      | PFC, flyback low-side gate driver                         | 1EDN7550B                       | any CoolMOS™ SJ MOSFETs    | -                                     |
|                                      |   |                                 | any CoolMOS™ SJ MOSFETs    | -                                     |
|                                      |   | Half-bridge LLC gate driver     | 2ED2101S06F                | any CoolMOS™ SJ MOSFETs               |
| 1EDI20N12AF                          |   |                                 | any CoolMOS™ SJ MOSFETs    | 1200 V (coreless transformer/CT)      |
| 2EDF7275F                            | any CoolMOS™ SJ MOSFETs                                   | 650 V (coreless transformer/CT) |                            |                                       |
| Buck/linear solutions                | Secondary buck (single-channel)                           | ILD8150                         | integrated                 | 80 V                                  |
|                                      | Secondary buck (multichannel)                             |                                 |                            |                                       |
|                                      | High-side buck gate driver                                | 1EDB8275F                       | any CoolMOS™ SJ MOSFETs    | 650 V                                 |
|                                      | Low-side buck gate driver                                 | 1EDN8511B                       | any CoolMOS™ SJ MOSFETs    | -                                     |
|                                      | Secondary linear controller with feedback                 | BCR601                          | small-signal MOSFETs       | 75 V/100 V                            |
| Tunable white with linear LED driver | BCR601, BCR602  | small-signal MOSFETs            | 75 V/100 V                 |                                       |
| Dimming                              | 0-10 V dimming interface IC                               | CDM10V                          | -                          | -                                     |
|                                      |   | CDM10VD                         | -                          | -                                     |
|                                      |   | -                               | -                          | -                                     |
| NFC                                  | NFC configuration IC                                      | NLM0010/NLM0011 <sup>4)</sup>   | -                          | -                                     |
| Microcontroller                      | XMC™ microcontroller                                      | XMC1100                         | -                          | -                                     |

## LED driver with constant voltage output and linear/switch mode LED driver ICs



## Linear LED driver IC product portfolio

| Functional block               | Topology | IC product family | MOSFET technology |
|--------------------------------|----------|-------------------|-------------------|
| Lowest cost LED driver IC      | Linear   | BCR400W series    | Integrated        |
| Low voltage drop LED driver IC |          | BCR430U/BCR431U   |                   |
| Robust LED driver IC           |          | BCR40xU/BCR42xU   |                   |

For additional portfolio, take a look at [Lighting ICs](#).

[www.infineon.com/lighting](http://www.infineon.com/lighting)

1) 700 V, 800 V and 950 V CoolMOS™ P7 are optimized for PFC and flyback topologies. 600 V CoolMOS™ P7 is suitable for hard as well as soft switching topologies (flyback, PFC and LLC)

2) PFC and resonant combo controllers

3) Higher input voltage

4) In addition to current configuration also constant lumen output (CLO) feature is included.

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

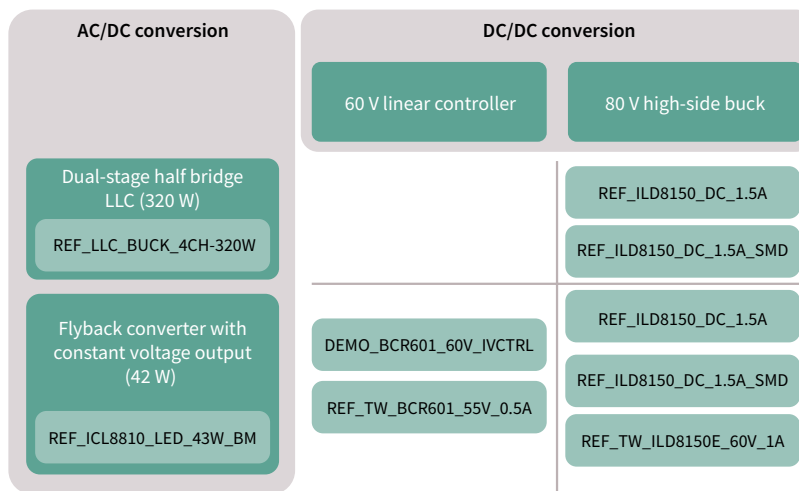




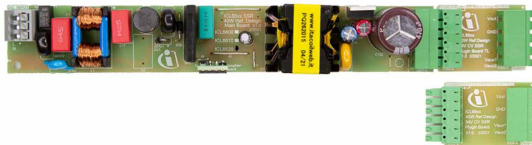
# Plug & LEDs play solutions

## Modular LED lighting reference designs for LLC, buck and PFC flyback topologies

LED lighting has become a mature technology with stringent requirements on light quality. In order to achieve high light quality, there is a strong trend towards two-stage topologies. These two-stage topologies ensure that the light flicker or, also called light ripple, remains at low levels according to the IEEE 1789 standard and other new upcoming regulations. Primary constant voltage output, followed by a DC-DC buck, enables dimming, efficiency, cost, and scalability benefits. Infineon has solutions for both the primary AC-DC stage as well as for the secondary DC-DC buck stage. These solutions can be combined in a plug & play concept. In other words, depending on the requirements, the suitable AC-DC stage and the best fitting DC-DC stage can be selected and tested.



Our solutions include but are not limited to:  
**Low to medium power platform promising tunable white at low cost**



REF\_ICL8810\_LED\_43W\_BM



REF\_TW\_BCR601\_55V\_0.5A

**320 W DCM PFC cost-effective and scalable platform design with up to 4 DC-DC channels**



REF\_LLC\_BUCK\_4CH\_320W



REF\_ILD8150\_DC\_1.5A

Discover more solutions on  
[www.infineon.com/leddriver-reference-solutions](http://www.infineon.com/leddriver-reference-solutions)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

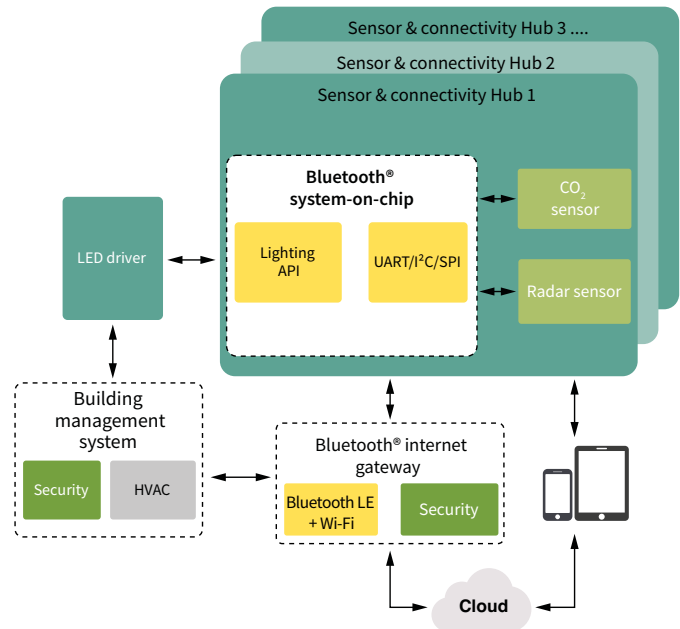




# Smart lighting solutions

## Connectivity and sensor solutions for connected and smart lighting to facilitate everyday life

In the last few years, connected and smart lighting has gained high momentum in the lighting industry. In this application field, sensing and connectivity play an essential role. Besides helping realize energy savings, they also enable new use cases beyond lighting controls.



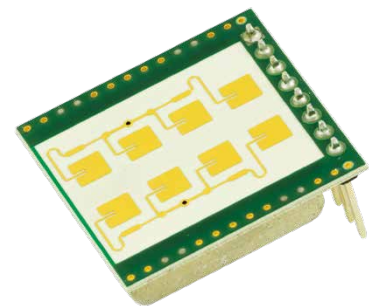
## Radar sensor solutions

For energy saving, passive infrared (PIR) sensors are used. Novel sensors like radar can overcome weaknesses of PIR sensors like poor design, limited detection of micro-movements, and limited area coverage, to name a few. Radar sensors can be seamlessly integrated into the luminaires enabling nice design as well as platform design of luminaires since there is no need for drilling holes as in the case of PIR sensors. Advanced use cases like people counting and people tracking can also be ensured with radar technology. In order to add more intelligence to the entire system, connectivity is a key element.

### Our partners:

Our system design house partners deliver both standard products and customized solutions to fit specific lighting applications from movement detection through automatic light activation to person counting. In addition, they offer all levels of support to get your intelligent lighting system up and running as quickly and efficiently as possible. See below a list of some of our partner solutions and check our [Lighting brochure](#) for more.

| Functional block | Topology         | IC product family                                      |
|------------------|------------------|--|
| RF Beam          | K-LD2            | Presence detection including slight movements          |
|                  | K-LD7            |  |
| InnoSent         | INS-313x         | Motion detection range up to 5 m                       |
|                  | INS-333x         | Motion detection range up to 10 m                      |
| Novelic          | RIOT100 – NRM302 | Turnkey motion and presence sensor solution up to 15 m |



Additionally, Infineon provides numerous radar solutions. Please find out more about them in [Radar sensor for IoT](#) chapter.

[www.infineon.com/smart-lighting](http://www.infineon.com/smart-lighting)  
[www.infineon.com/makeradar](http://www.infineon.com/makeradar)



### Bluetooth® Mesh devices and modules for connected and smart lighting applications

Embedding Bluetooth® Mesh networking in lighting systems, including luminaires, fixtures, and wall switches, opens a range of system applications to manage lighting brightness or color, efficiency based on occupancy movements, and correlation of lighting ecosystem components. The range and coverage of Bluetooth® Mesh devices allow for low latency, whole building coverage of automation and occupancy interaction via smartphone and tablet applications, as well as cloud applications for building management. Infineon provides a range of Bluetooth® Mesh MCUs and certified modules that enable lighting control functionality, safety and occupancy sensor management and robust, secure, reliable networked managed solutions.

### Bluetooth® Mesh SoCs and certified modules: solutions and benefits

Bluetooth® Mesh system-on-a-chip (SoCs) and certified modules offer a range of efficient and future-proof upgradeable solutions:

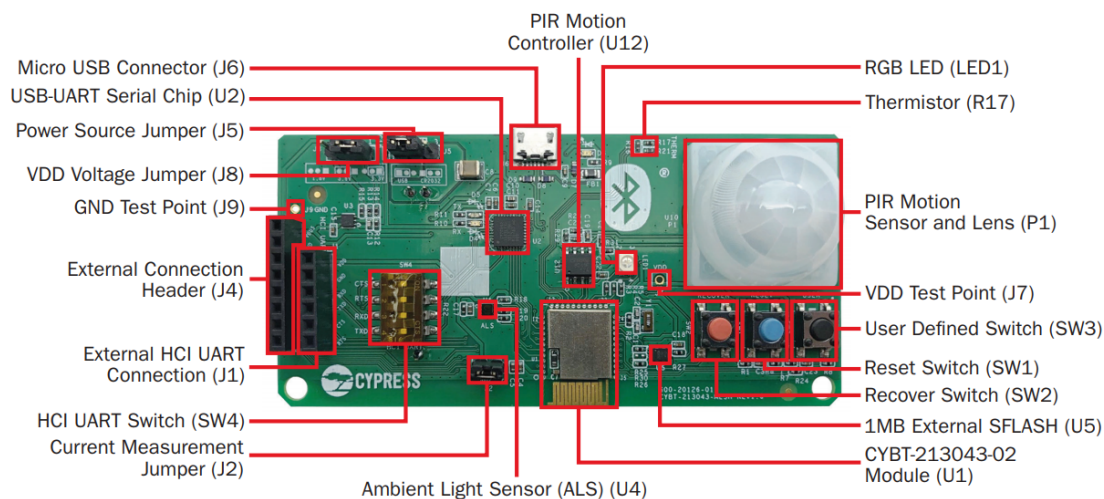
| Solutions  | Benefits   |
|--|--|
| <ul style="list-style-type: none"> <li>- Module diversity with integrated components ranging from the basic battery-powered sensor to the most sophisticated detection and safety devices</li> <li>- Fully-integrated modules</li> </ul> | <ul style="list-style-type: none"> <li>- Accommodating different needs now and in future</li> <li>- Accelerate time-to-market</li> <li>- Reducing development and manufacturing costs</li> </ul> |
| <ul style="list-style-type: none"> <li>- Ultra-high-transmit power designs with integrated antennas</li> <li>- Integrated CPU, memory (flash and RAM) and I/O</li> </ul>   | <ul style="list-style-type: none"> <li>- Enabling long range and unfailing node-node connections</li> <li>- Suiting all foreseeable applications hosting</li> </ul>                              |

### Bluetooth® Mesh evaluation kit **CYBT-213043-MESH**

The Bluetooth® Mesh evaluation kit (**CYBT-213043-MESH**) enables you to evaluate SIG Mesh functionality and features using the **CYBT-213043-02** module. The **CYBT-213043-02** module is an integrated, fully certified, 12.0 mm x 16.61 mm x 1.70 mm, programmable Bluetooth® Smart Ready module designed to reduce your time-to-market.

### Utilized device: **CYW20819**

- Kit contents:
- 4x mesh evaluation boards
  - 4x USB A to micro-B cables
  - 1x quick-start guide



Bluetooth® Mesh Networking - An Introduction for Developers  
 Bluetooth®-Mesh-Paving-the-Way-for-Smart-Lighting  
 Bluetooth®-Mesh specifications:  
[www.bluetooth.com/specifications/mesh-specifications](http://www.bluetooth.com/specifications/mesh-specifications)








Getting Started with Bluetooth® Mesh  
 (AppNote AN227069)

[www.infineon.com/smart-lighting](http://www.infineon.com/smart-lighting)  
[www.infineon.com/makeradar](http://www.infineon.com/makeradar)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).






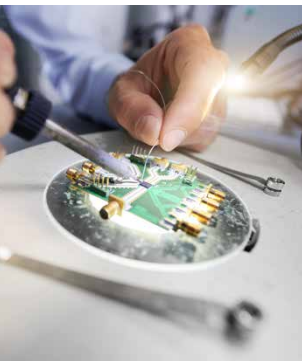




Mesh-enabled, silicon, dual-mode Bluetooth® 5.0 AIROC™ MCUs

|                       | CYW20706  | CYW20735  | CYW20819  | CYW20820  | CYW20719  |
|-----------------------|---|---|---|---|---|
| Product features      |  |  |  |  |  |
| TBA Processor         | CM3   | CM4 w/FPU   | CM4   | CM4   | CM4 w/FPU   |
| TBA Radio             | -   | ULP RF  | ULP RF  | ULP RF  | ULP RF  |
| Operating temperature | 105 C   | 85 C  | 125 C planned   | 125 C planned   | 85 C  |
| Transmit power        | 10 dBm Tx   | 10 dBm Tx   | 4 dBm Tx  | 10 dBm Tx   | 4 dBm Tx  |
| Memory                | -   | -   | 256 kB flash  | 256 kB flash  | 1 MB flash  |



Interested in more? We offer a broad silicon portfolio to support your Bluetooth® Mesh design.

Fully-certified Bluetooth® modules (FCC, ISED, MIC, CE)

|   |   |   |   |
|---|---|---|---|
|  | <p><b>Load range</b><br/>Up to 20 dBm transmit power</p>  <p>CYBT-483056-02</p>                    | <p><b>Size and simplicity</b><br/>EZ-Serial support enables fast time to market and 9x9 size for small form factor application</p>  <p>CYBT-353027-02</p> |  |
|  | <p><b>Value</b><br/>Balance of features for cost sensitive applications</p>  <p>CYBT-343052-02</p> | <p><b>Integration</b><br/>Fully integrated SoC with lowest power and extended range</p>  <p>CYBT-273063-02</p>  |  |

[www.infineon.com/smart-lighting](http://www.infineon.com/smart-lighting)  
[www.infineon.com/makeradar](http://www.infineon.com/makeradar)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



**Wi-Fi enterprise networking and internet connectivity**

Wi-Fi networking is the backbone of enterprise, retail, and home internet connectivity. Wi-Fi is the bridging medium for Bluetooth® Mesh networks to enterprise networks and cloud applications capturing messaging from across the lighting installation for secure enterprise building management applications. Wi-Fi can also connect sensors and fixtures directly to enterprise or home access points for long-range solutions or integrated solutions including security lighting and cameras. Infineon offers a range of secure, high-performance enterprise-ready Wi-Fi solutions that can be added to switches, panels, and lighting bays. These solutions can be stand-alone network nodes or offer Bluetooth® Mesh Gateway services bridging Mesh-networked devices to cloud applications.

**IoT Wi-Fi portfolio**

| Technology         | Wi-Fi                         | Wi-Fi + MCU                         | Wi-Fi + Bluetooth® Combos                                  |
|--------------------|-------------------------------|-------------------------------------|--|
| Wi-Fi 4 (802.11n)  | CYW43364<br>SB 1x1 11n   SDIO |                                     | CYW43439<br>SB 1x1 11n + BT5.2<br>SDIO/SPI                 |
|                    |                               | CYW43903<br>SB 1x1 11n + 160-MHz R4 | CYW43012<br>ULP DB 1x1 11n + BT5.1<br>SDIO/SPI WLBGA/WLCSP |
|                    |                               | 1x1 DB 11n + 320-MHz R4             |  |
| Wi-Fi 5 (802.11ac) |                               | 1x1ac DB + 320-MHz R4               | CYW54590**<br>DB 2x2 11ac + BT 5.1<br>PCIe/SDIO            |
|                    |                               |                                     | CYW4373/89373<br>DB 1x1 11ac + BT5.0<br>USB/SDIO/PCIe      |
|                    |                               |                                     | CYW54591<br>DB 2x2 11ac, RSDB, BT5.1<br>PCIe/SDIO          |

**Infineon’s Wi-Fi portfolio provides high-performance, flexible connectivity for Linux, Android, and RTOS.** Many of the Wi-Fi + Bluetooth® combos are supported on Infineon’s WICED Wi-Fi and ModusToolbox™ Software Development Kits (SDK) which provide code examples, tools and development support.

Infineon’s Wi-Fi and Bluetooth® combos use production-ready, fully-certified Wi-Fi + Bluetooth® combo modules based on both Linux and RTOS based platforms. Many of the Wi-Fi + Bluetooth® combos are supported on Infineon’s WICED Wi-Fi and ModusToolbox™ Software Development Kits (SDK) which provide code examples, tools and development support for **easier and faster development.**

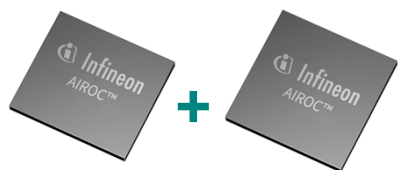
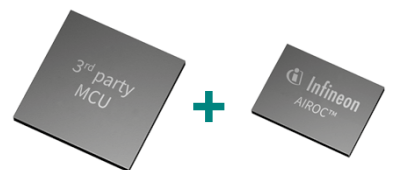
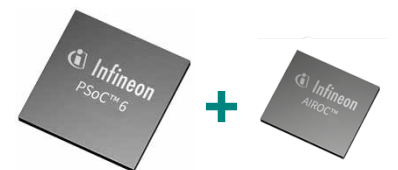
[www.infineon.com/smart-lighting](http://www.infineon.com/smart-lighting)  
[www.infineon.com/makeradar](http://www.infineon.com/makeradar)

\*Coming soon  
 \*\*For more information on this product, contact our product support.

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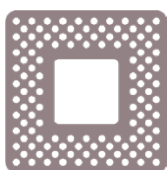
### Wi-Fi enterprise networking and internet connectivity

|   |   |   |
|---|---|---|
|  |  |  |
| CYW43907:<br>MCU + Wi-Fi  | PSoC™:<br>PSoC™ running RTOS<br>3 <sup>rd</sup> -party SoC running Linux OS       | P/N: CY8CKIT-06S2-43012<br>PSoC™ 6: Ultralow-power dual-core MCU                    |
| CYW20719:<br>Dedicated Bluetooth® 5.1 MCU   | CYW43439*:<br>1x1n Wi-Fi + Bluetooth® combo SoC                                   | CYW43012 (Murata Type 1LV): Dedicated low-power Wi-Fi + Bluetooth® 5 combo SoC      |

We offer a broad platform portfolio to support your Bluetooth® Mesh gateway.

### IoT Wi-Fi portfolio

A global Wi-Fi module partner ecosystem enables support and development for your IoT application.



Design, build and sell RF Modules with limited software and hardware certification support

#### Module makers



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[www.infineon.com/makeradar](http://www.infineon.com/makeradar)

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# Smart conferencing systems

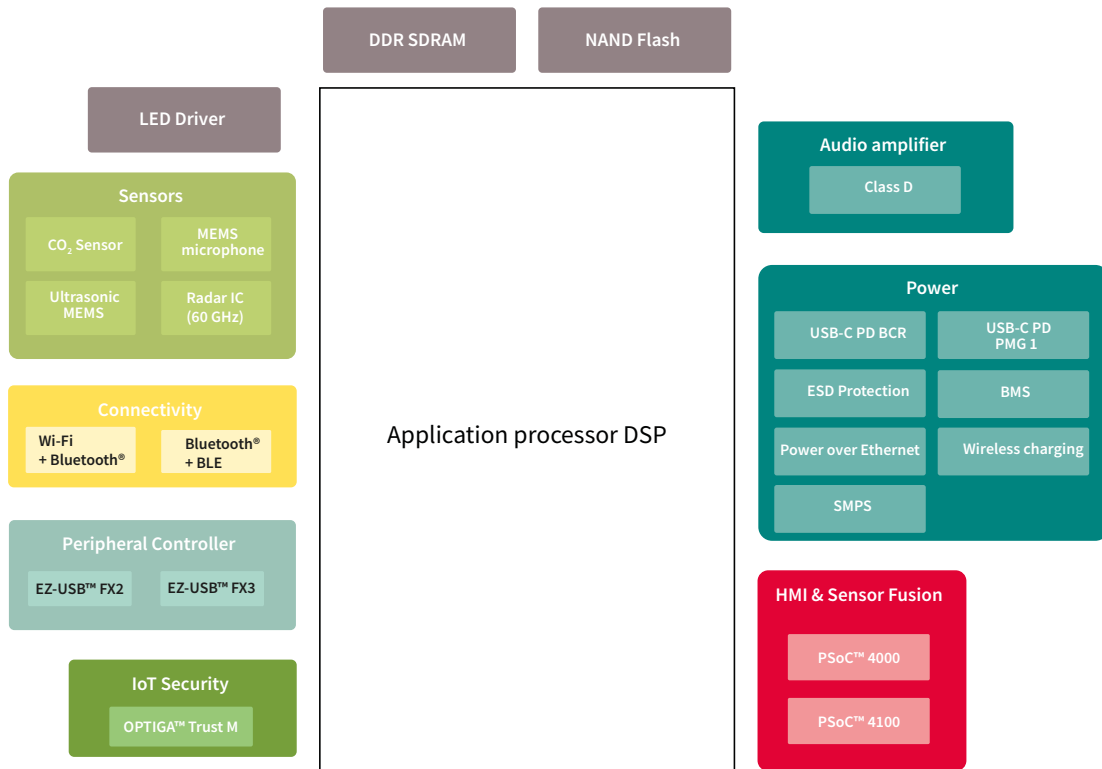
## Design conference phones and video conferencing systems for exceptional performance and user experience

The last few years have changed how we interact with our colleagues in the workspace. With the rise of remote work and flexible office spaces new challenges arise – new soft skills, but more importantly, new technology is needed to meet the hybrid way of working. In this changing environment, conferencing systems and speakerphones are essential to enhance the productivity of remote teams and serve customers effectively. The user experience and functionality are further enhanced by smart features, including voice assistants for businesses, user tracking, and new connectivity technologies. Infineon’s portfolio provides exceptional performance, user experience, and energy efficiency for the next generation of conferencing systems and speakerphones.

### Features and benefits

| Key features  | Key benefits   |
|---|--|
| – Best-in-class figures of merit                            | – Lower system power consumption and energy savings and enablement of deep sleep modes                                 |
| – Reliable connectivity and power solutions                 | – Less failure and increased up-time with stable connectivity of surveillance camera to cloud and management platforms |
| – Co-processor in connectivity solutions                    | – Keep-alive feature in connectivity solutions   |
| – Small footprints of components                            | – Sleeker designs and space savings  |
| – Turnkey embedded security solutions                       | – More robust designs against cyberattacks in connected eco-systems  |
| – Highly accurate set of sensors with low power consumption | – Accurate data collection for IoT use cases, e.g. wake-up functions with radar sensors                                |

### Application diagram





## Product portfolio

| Functional block   | Product family                                   | Product   | Benefits   |   |
|--------------------|--|---|--|---|
| Audio input        | Microphones                                      | XENSIV™ MEMS microphones                                | <ul style="list-style-type: none"> <li>High-performance microphone with low self-noise (high SNR) and low distortions, setting a new performance benchmark for a superior user experience</li> </ul>   |   |
| Audio output       | Class D amplifier                                | MERUS™ class D audio amplifiers                         | <ul style="list-style-type: none"> <li>Cooler, smaller and lighter amplifiers designed to maximize power efficiency and dynamic range while providing best-in-class audio performance in product form factors for great-sounding audio products</li> <li>Extended battery playback time or the reduction of battery size</li> </ul>    |   |
| Connectivity       | Bluetooth® modules and Wi-Fi + Bluetooth® Combos | AIROC™ Wi-Fi + Bluetooth® combos and Bluetooth® modules | <ul style="list-style-type: none"> <li>Best-in-class interoperability to the widest deployed wireless IP</li> <li>Whole Home Range with high throughput for multi-channel audio and RSDB (Real Simultaneous Dual Band) for speaker sub-networks</li> <li>Ultra-low-power technology designed with battery operation in mind</li> </ul> |   |
| Sensing            | Capacitive sensing touch controller              | CAPSENSE™ capacitive touch sensing controller           | <ul style="list-style-type: none"> <li>State-of-the-art noise immunity (SNR &gt; 100:1) and water rejection have made CAPSENSE™ the industry leader</li> <li>Advanced inductive touch sensors make possible sleek, futuristic user interfaces with metallic overlay</li> </ul>   |   |
|                    | Radar sensor                                     | XENSIV™ 60 GHz radar sensor                             | <ul style="list-style-type: none"> <li>Accurate presence detection and vibration detection based on the ability to track sub-millimeter motion at high speed and accuracy, both stand-alone chip as well as system solution available</li> </ul>   |   |
|                    | CO <sub>2</sub> sensor                           | XENSIV™ PAS CO <sub>2</sub> sensor                      | <ul style="list-style-type: none"> <li>Along with size and cost advantages, the sensor delivers superior accuracy, providing a direct readout of the real CO<sub>2</sub> level</li> </ul>  |   |
| Security           | IoT security controller                          | OPTIGA™ Trust M   | <ul style="list-style-type: none"> <li>Easy and secure provisioning services with OPTIGA™ Trust M for maintaining the speaker's unique identity and integrity</li> <li>Unify different products under unified PKI architecture</li> </ul>  |   |
| Data communication | USB peripheral controllers                       | EZ-USB™ FX SuperSpeed controllers                       | <ul style="list-style-type: none"> <li>Most versatile USB peripheral controller which can add a USB 5 Gbps connectivity to any system</li> </ul>   |   |
| Power              | USB-C PD controller                              | EZ-PD™ USB-C controller                                 | <ul style="list-style-type: none"> <li>USB-IF certified with market-proven USB PD stack, ensuring spec compliance and interoperability</li> <li>Supports all USB PD profiles commonly used in USB-C power adapters</li> <li>A highly-integrated solution that minimizes incremental BOM costs</li> </ul>                               |   |
|                    | ESD protection                                   | ESD111, ESD245  | <ul style="list-style-type: none"> <li>Outstanding low capacitance devices for best signal integrity</li> <li>High protection performance by ultra low clamping voltage</li> </ul>   |   |
|                    | Wireless charging                                | 15 W inductive wireless power transmitter               | <ul style="list-style-type: none"> <li>Powerful and cost-effective wireless charging solutions for high performance, smart and secure charging solutions supported by Infineon's unique wireless power controllers</li> </ul>  |   |
|                    | High-voltage MOSFETs                             | Flyback   | 700 V CoolMOS™ P7 (standard grade)   | <ul style="list-style-type: none"> <li>Best price-competitive CoolMOS™ SJ MOSFET family</li> <li>Lower switching losses than a standard MOSFET</li> </ul>           |
|                    |  | ACF, FMCI   | 600 V CoolMOS™ PFD7  | <ul style="list-style-type: none"> <li>Lower Q<sub>rr</sub>, lower hysteresis loss, low R<sub>DS(on)</sub></li> </ul>   |
|                    | SMPS flyback converter control ICs               | QR flyback ICs  | ICE5QSAG   | <ul style="list-style-type: none"> <li>High efficiency and low standby power</li> </ul>   |
|                    |  | FFR flyback IC  | XDPS21071  | <ul style="list-style-type: none"> <li>High power density and ideal for USB-PD</li> </ul>   |
|                    | SMPS synchronous rectification                   | Low-voltage MOSFETs                                     | OptiMOS™ PD  | <ul style="list-style-type: none"> <li>Low conduction losses and reduced overshoot</li> <li>Logic-level switching/S308/PQFN 3.3 x 3.3 packages available</li> </ul> |
| Control ICs        |  | IR1161LTRPBF  | <ul style="list-style-type: none"> <li>High efficiency/simple external circuitry</li> </ul>  |   |
| SMPS load switch   | Low-voltage MOSFETs                              | OptiMOS™ 30 V   | <ul style="list-style-type: none"> <li>Low conduction losses</li> <li>S308/PQFN 3.3 x 3.3 packages available</li> </ul>  |   |





DC-DC

# DC-DC power solution for data center, edge, enterprise, telecom and datacom

## Digital multiphase and point-of-load DC-DC solution

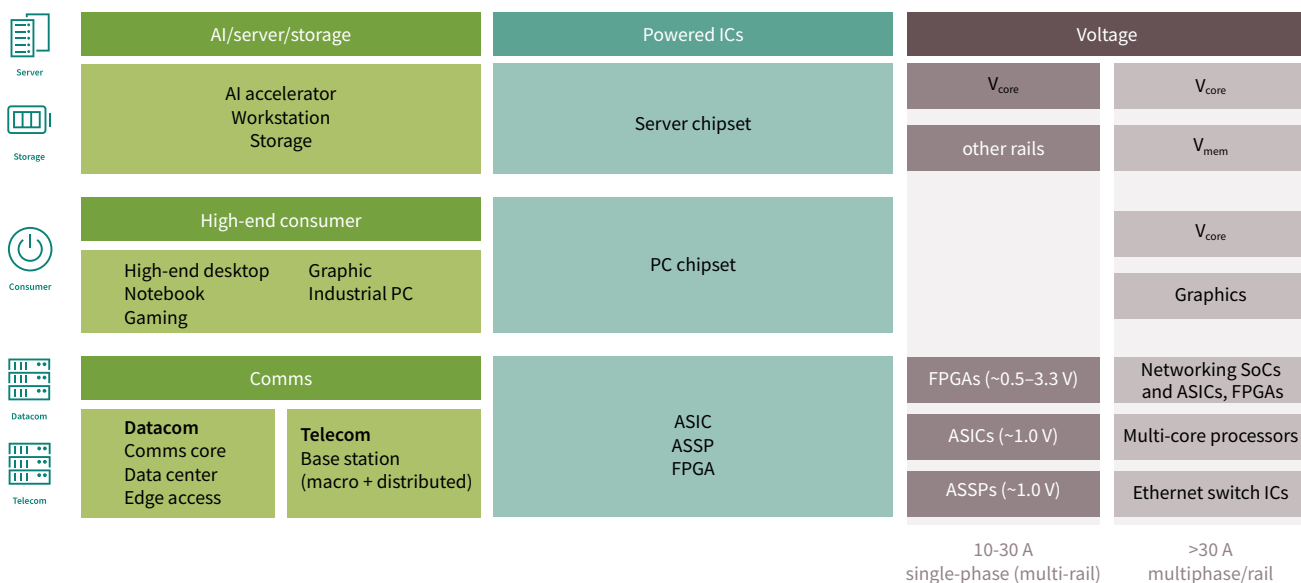
As an industry leader in digital power management, Infineon delivers solutions for the next-generation data center, edge, enterprise, server and telecom applications, storage and client computing applications. Infineon offers a complete portfolio including digital multiphase controllers, integrated power stages, integrated point-of-load (POL) voltage regulators and discrete MOSFETs. These proven technologies offer full flexibility to our customers to optimize a complete system solution for space, performance, ease-of-design and cost to meet critical design goals. In addition, our latest software tools help simplify design, shorten design cycles, and improve time-to-market.

### Features and benefits

| Key features                     |
|----------------------------------|
| - Best-in-class efficiency       |
| - Multi-protocol support         |
| - Complete system solution       |
| - Digital controller flexibility |
| - Ease-of-design                 |
| - Smallest solution size         |

| Key benefits   |
|--|
| - Digital multiphase controller and power stage provide industry's highest efficiency of more than 95 percent  |
| - Intel SVID, AMD SVI2/3, NVIDIA PWM VID, parallel VID (up to 8 bits) , PMBus Rev1.3, AVS Bus (PMBus Rev1.3)   |
| - A broad portfolio of fully integrated point-of-load, integrated power stage and digital controller solutions in addition to discrete drivers and MOSFETs offers full flexibility to optimize complete system solutions ranging from 1 A to 1000+ A |
| - Industry's benchmark for feature richness and low-quiescent power  |
| - Intuitive GUI enables faster optimization, thereby reduces design cycle time   |
| - Best-in-class OptiMOS™ MOSFETs combined with advanced packaging technologies enable high power density at high efficiency, and superior control engine with digital multiphase controllers help minimize output capacitance significantly          |

### Multiphase DC-DC system solution



Click here for more information on [server SMPS](#) and [telecom SMPS](#) solutions.

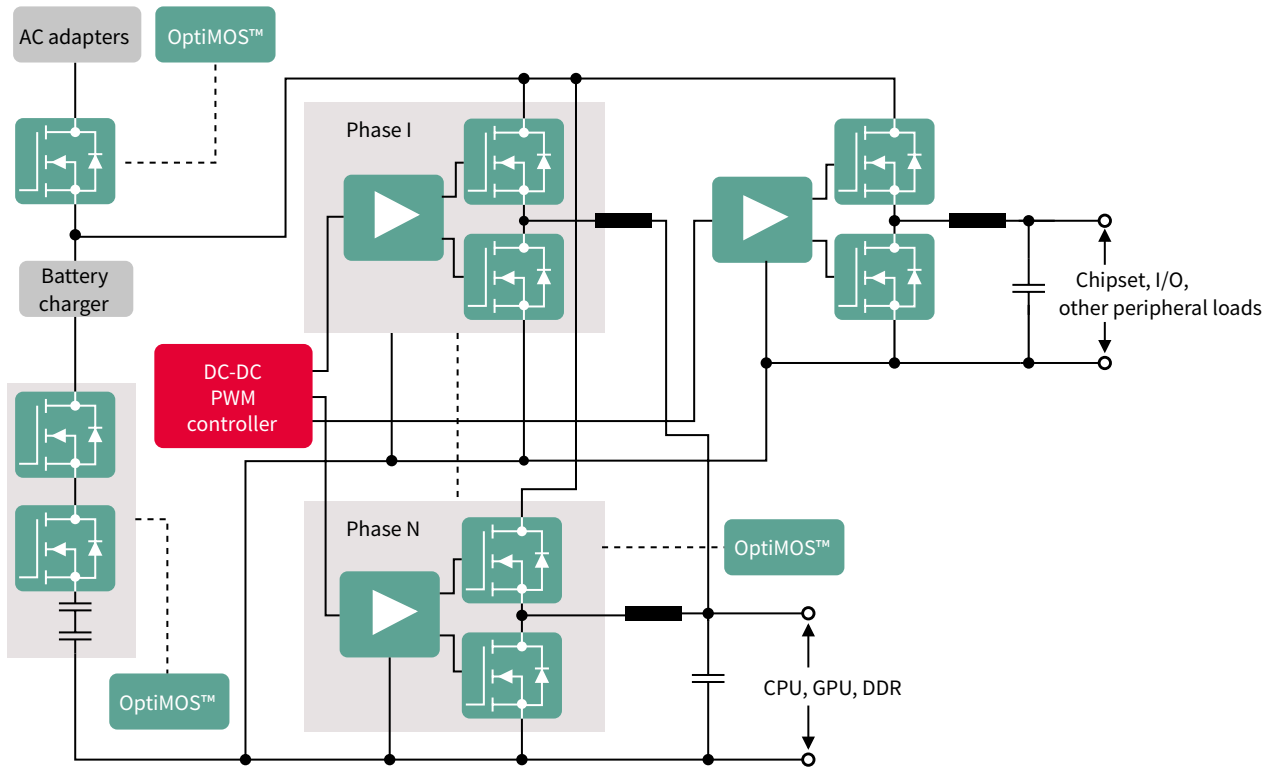
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### Multiphase DC-DC system solution





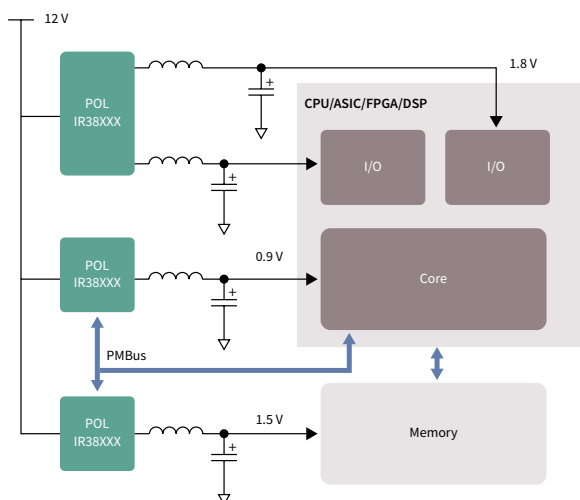
DC-DC

# DC-DC enterprise power solution for data processing applications

## Integrated point-of-load (IPOL) converters

Infinion's IPOL converters integrate a PWM controller, a driver, and MOSFETs into a small PQFN package for ease of use. The patented PWM modulation scheme allows greater than 1 MHz switching frequencies to deliver ultracompact layouts and the smallest bill of materials (BOM). A PMBus interface is available for monitoring and control in systems that use advanced CPUs, ASICs and FPGAs.

### Block diagram



### Key features

- › Input voltage range 4.5-21 V
- › Output current 1-40 A
- › Operating temperature range of -40 to 125°C

### Key benefits

- › Integrated controller, driver, MOSFETs for small footprint
- › High-efficiency MOSFETs and thermally enhanced packages for operation without heat sinks



## DC-DC IPOL portfolio

### Digital interface IPOL

| I <sup>2</sup> C PMBus, telemetry, margin, faults, SVID PVID<br>Digital control/configuration, telemetry and diagnostic |                  |                   |                      |                      |   |
|---|------------------|-------------------|----------------------|----------------------|---|
| Part number   | Max. current [A] | Package size [mm] | Max. V <sub>in</sub> | Max. f <sub>sw</sub> | Distinctive features                    |
| IR38064MTRPBF   | 35               | 5 x 7             | 21 V                 | 1500 KHz             | PMBus                                   |
| IR38063M  | 25               | 5 x 7             | 21 V                 | 1500 KHz             |   |
| IR38062M  | 15               | 5 x 7             | 21 V                 | 1500 KHz             |   |
| IR38060M  | 6                | 5x6               | 16 V                 | 1500 KHz             |   |
| IR38163M  | 30               | 5 x 7             | 16 V                 | 1500 KHz             | OptiMOS™ 5, SVID + PMBus                |
| IR38165M  | 30               | 5 x 7             | 16 V                 | 1500 KHz             | OptiMOS™ 5, SVID                        |
| IR38363M  | 15               | 5 x 7             | 16 V                 | 1500 KHz             | OptiMOS™ 5, SVID + PMBus                |
| IR38365M  | 15               | 5 x 7             | 16 V                 | 1500 KHz             | OptiMOS™ 5, SVID                        |
| IR38263M  | 30               | 5 x 7             | 16 V                 | 1500 KHz             | OptiMOS™ 5, PVID + PMBus                |
| IR38265M  | 30               | 5 x 7             | 16 V                 | 1500 KHz             | OptiMOS™ 5, PVID                        |
| IR38164M  | 30               | 5 x 7             | 16 V                 | 1500 KHz             | OptiMOS™ 5, SVID + PMBus, enhanced Imon |
| IRPS5401M   | 4+4+2<br>+2+0.5  | 7 x 7             | 14 V                 | 1500 KHz             | 5 output PMIC, PMBus                    |

### Analog IPOL

| „Performance“ voltage-mode PWM<br>Ultralow jitter and noise, high accuracy and low ripple |                  |                   |                      |                      |                        |
|---|------------------|-------------------|----------------------|----------------------|------------------------|
| Part number   | Max. current [A] | Package size [mm] | Max. V <sub>in</sub> | Max. f <sub>sw</sub> | Distinctive features   |
| IR3823AMTRPBF   | 3                | 3.5 x 3.5         | 17 V                 | 2000 KHz             | Constant-on-time (COT) |
| IR3899AMTRPBF   | 9                | 4 x 5             | 17 V                 | 2000 KHz             |                        |
| TDA38820  | 20               | 4 x 5             | 17 V                 | 2000 KHz             |                        |
| IR3888MTRPBF  | 25               | 5x6               | 17 V                 | 2000 KHz             |                        |
| IR3447AMTRPBF   | 25               | 5x6               | 17 V                 | 600 KHz              |                        |
| IR3887MTRPBF  | 30               | 4 x 5             | 17 V                 | 2000 KHz             |                        |
| IR3889MTRPBF  | 30               | 5x6               | 17 V                 | 2000 KHz             |                        |
| TDA38840  | 40               | 5x6               | 17 V                 | 2000 KHz             |                        |
| IR3846AMTRPBF   | 40               | 5 x 7             | 17 V                 | 600 KHz              |                        |

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# Solar

## High efficient solutions for photovoltaic energy systems

Infineon provides a comprehensive portfolio to deliver the best efficiency and reliability for solar applications. Cutting-edge technologies such as **CoolMOS™** SJ MOSFETs, **CoolSiC™** Schottky diodes, **CoolSiC™** MOSFETs, **CoolGaN™** HEMT and **TRENCHSTOP™** IGBTs. All these power transistors can be safely operated by **EiceDRIVER™** coreless transformer gate drivers. Beyond power stage with the rich experience and highest quality ensure Infineon's unique supplier position, which enables one-stop-shop for solar applications. **ARM® Cortex®-M4** and **Arm® Cortex®-M0** MCU families enable easy and high-efficiency design for power conversion blocks. Additionally, our **Arm® Cortex-M0-PSoC™** 4 entry-level family can also be used for PLC (Power Line Communication). Wi-Fi connectivity can be provided by our **AIROC™** family of devices.

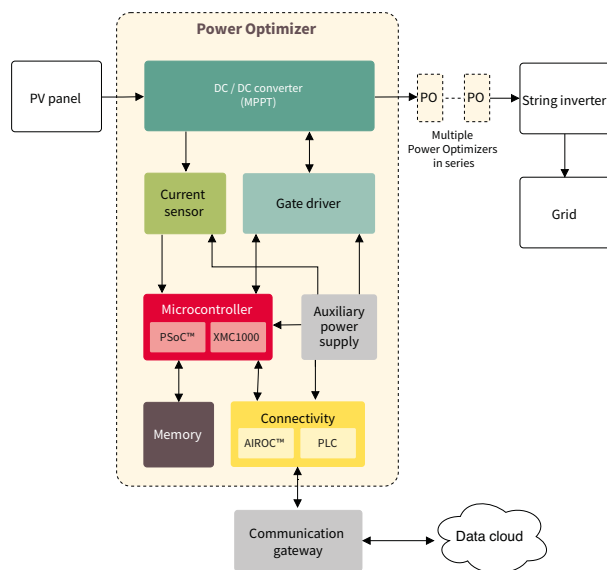
|                                    | Power optimizer<br>250 W - 1300 W                  | Micro inverter<br>250 W - 1500 W  | String inverter<br>1 kW - 200 kW   | Central inverter<br>500 kW - 5000 kW  |
|------------------------------------|--|---|--|---|
| <b>Si MOSFETs</b>                  | OptiMOS™<br>SuperSO8/TOLL/TOLT<br>60 V - 200 V     | OptiMOS™<br>SuperSO8/TOLL<br>60 V - 150 V                               | OptiMOS™<br>150 V - 300 V  | -   |
|                                    | -  | CoolMOS™<br>TOLL/D²PAK<br>600 V - 950 V                                 | CoolMOS™<br>TO-247-3/TO-247-4/D²PAK/TOLL/QDPAK<br>600 - 950 V                                      | -   |
| <b>SiC MOSFETs - discrete</b>      | -  | CoolSiC™ MOSFET discrete D²PAK-7/TOLL<br>650 V/1200 V                   | CoolSiC™ MOSFET discrete<br>TO-247-3/TO-247-4/D²PAK-7<br>650 V/1200 V/1700 V/2000 V                | CoolSiC™ MOSFET discrete<br>TO-247-3/TO-247-4/D²PAK-7<br>1200 V/1700 V/2000 V                       |
| <b>SiC MOSFETs - power modules</b> | -  | -   | CoolSiC™ hybrid modules<br>650 V to 1200 V   | Silicon Carbide CoolSiC™ MOSFET Modules<br>1200 V   |
| <b>GaN HEMT</b>                    | -  | CoolGaN™<br>DSO-20/TOLL<br>600 V  | CoolGaN™<br>DSO-20/TOLL<br>600 V   |   |
| <b>IGBTs - discrete</b>            | -  | -   | 650 V/1200 V TRENCHSTOP™ 7 H7<br>TO-247-3/TO-247-4/TO-247PLUS<br>600 V/650 V/1200 V                | CoolSiC™ hybrid modules<br>650 V to 1200 V  |
| <b>IGBTs - power modules</b>       | -  | -   | Easy 1B/2B   | PrimePACK™ EconoDUAL™ 3/62 mm   |
| <b>Gate driver ICs</b>             | EiceDRIVER™<br>2EDi/1ED Compact/2EDL/1EDN          | EiceDRIVER™<br>2EDi/1EDB/2EDL/<br>1ED Compact(1ED-AF)<br>650 V SOI/1EDB | EiceDRIVER™<br>2EDi/650 V SOI/<br>X3 Compact(1ED31xx)<br>X3 Analog(1ED34xx)<br>1ED-F3/1EDB/IRS2011 | EiceDRIVER™<br>X3 Compact(1ED31xx)/<br>X3 Analog(1ED34xx)/<br>1ED-F3/1EDB<br>2ED24427N01F/650 V SOI |
| <b>SiC diodes</b>                  | -  | CoolSiC™ Schottky diodes<br>DPAK/D²PAK<br>650 V/1200 V                  | CoolSiC™ Schottky diodes<br>TO-220/TO-247/D²PAK<br>650 V/1200 V                                    | -   |
| <b>Si diodes</b>                   | -  | -   | BAT165 Schottky diode<br>650 V EC7 diode   |   |
| <b>Connectivity</b>                | AIROC™ Wi-Fi + Bluetooth® Combos/PLC               | AIROC™ Wi-Fi + Bluetooth® Combos/PLC                                    | AIROC™ Wi-Fi + Bluetooth® Combos   | AIROC™ Wi-Fi + Bluetooth® Combos  |
| <b>Auxiliary power supply</b>      | -  | CoolSET™ 800 V  | CoolSET™ 800 V   | CoolSET™ 800 V  |
| <b>Memory</b>                      | F-RAM  | F-RAM   | F-RAM/Asynchronous SRAM  | F-RAM/Asynchronous SRAM   |
| <b>Current sensing</b>             | XENSIV™  | XENSIV™   | XENSIV™  | XENSIV™   |
| <b>Microcontrollers</b>            | XMC1000 Arm® Cortex®-M0<br>XMC4000 Arm® Cortex®-M4 | XMC1000 Arm® Cortex®-M0<br>XMC4000 Arm® Cortex®-M4                      | XMC1000 Arm® Cortex®-M0<br>XMC4000 Arm® Cortex®-M4   | XMC1000 Arm® Cortex®-M0<br>XMC4000 Arm® Cortex®-M4  |



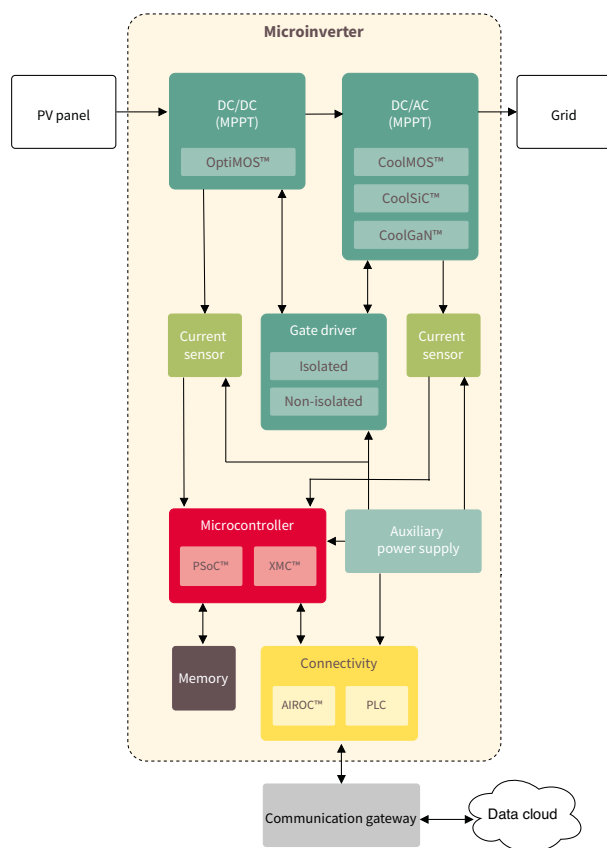
Infineon's product portfolio supports full solar ecosystem including energy storage and EV-charging. Solar power optimizers and micro inverter find their place on the roof right under PV panels. They are exposed to very high ambient temperatures, high thermal cycling and have to meet 25 years life-time, which is equivalent to PV panels. With Infineon's stringent quality measures and production screening processes all these can be met.

We see on the picture string inverter installed on the wall. Its product offering is shown below for single-phase and three-phase configurations. Energy Storage Solutions (ESS) and EV-charging solutions are placed in respective application chapters in this selection guide.

## Power optimizer



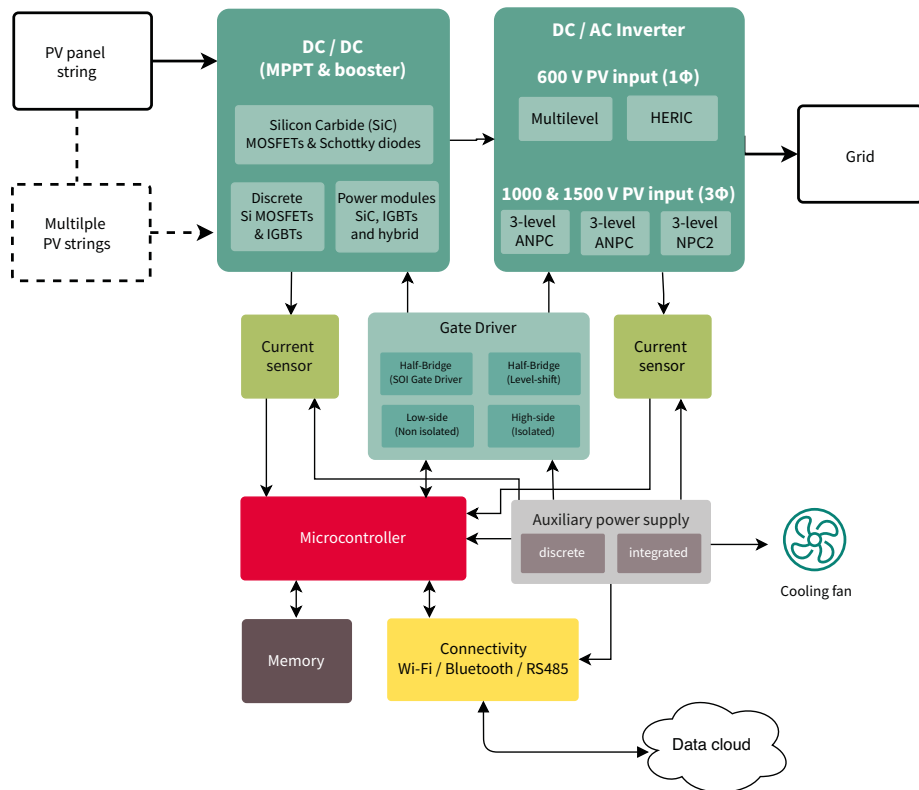
## Microinverter



| Functional block       | Product family | Voltage class [V <sub>DS max</sub> ]                     | Package*    | Part number*   | R <sub>DS(on)</sub> |
|------------------------|----------------|--|-------------|----------------|---------------------|
| DC-DC converter        | OptiMOS™       | 60 V   | SuperSO8    | ISC058N04NM5   | 5.8 mΩ              |
|                        |                |  | SuperSO8 SC | ISC060N06NM6*  | 6.0 mΩ              |
|                        |                | 80 V   | SuperSO8    | BSC028N06NSSC  | 2.8 mΩ              |
|                        |                |  | SuperSO8    | BSC021N08NS5   | 2.1 mΩ              |
|                        |                | 100 V  | SuperSO8    | ISC031N08NM6*  | 3.1 mΩ              |
|                        |                |  | SuperSO8    | ISC060N10NM6   | 6.0 mΩ              |
|                        |                | 120 V  | SuperSO8 SC | BSC040N10NS5SC | 4.0 mΩ              |
|                        |                |  | SuperSO8    | ISC030N12NM6   | 3.0 mΩ              |
|                        |                | 150 V  | SuperSO8    | BSC093N15NS5   | 9.3 mΩ              |
|                        |                |  | TOLT        | IPTC044N15NM5  | 4.4 mΩ              |
| 200 V                  | SuperSO8       | ISC119N20NM6*  | 11.9 mΩ     |                |                     |
|                        | TOLL           | IPT067N20NM6*  | 6.7 mΩ      |                |                     |
|                        | DSO            | IRS2011  |             |                |                     |
| Gate driver            | EiceDRIVER™    | Single channel   | PG-SOT23-6  | 1EDN8550       |                     |
|                        |                |  | SON-10      | 1EDN7116G      |                     |
|                        |                | Dual channel   | SON-8       | 2EDL8024G      |                     |
|                        |                |  | DSO         | IRS2011        |                     |
| Microcontroller        | XMC™ / PSoc™   | XMC1000 for control loop / PSoc™ 4 for PLC communication |             |                |                     |
| Memory                 | EXCELON™       | CY15B102QN-50SXE (F-RAM)                                 |             |                |                     |
| Auxiliary power supply | -              | TLE8366EV (PWM step-down DC/DC converter)                |             |                |                     |
| Connectivity           | AIROC™         | CYW43439 (Wi-Fi 4) / CYW4373 (Wi-Fi 5)                   |             |                |                     |
|                        | PLC            | CY8CPLC20-48LTXIT  |             |                |                     |
| Current sensor         | XENSIV™        | TLI4971-A025T5   |             |                |                     |

| Functional block         | Product family  | Voltage class [V <sub>DS max</sub> ]                     | Package*                | Part number*                           | R <sub>DS(on)</sub> |             |     |
|--------------------------|-----------------|--|-------------------------|--|---------------------|-------------|-----|
| MPPT – Boost stage       | OptiMOS™        | 60 V   | SuperSO8                | BSC066N06NS                            | 6.6 mΩ              |             |     |
|                          |                 |  | SuperSO8 SC             | ISC060N06NM6*                          | 6.0 mΩ              |             |     |
|                          |                 | 80 V   | SuperSO8                | BSC028N06NSSC                          | 2.8 mΩ              |             |     |
|                          |                 |  | SuperSO8                | BSC026N08NS5                           | 2.6 mΩ              |             |     |
|                          |                 | 100 V  | SuperSO8                | ISC031N08NM6*                          | 3.1 mΩ              |             |     |
|                          |                 |  | SuperSO8                | ISC060N10NM6                           | 6.0 mΩ              |             |     |
|                          |                 | 120 V  | SuperSO8                | BSC040N10NS5SC                         | 4.0 mΩ              |             |     |
|                          |                 |  | SuperSO8                | ISC030N12NM6                           | 3.0 mΩ              |             |     |
|                          |                 | 150 V  | SuperSO8                | BSC093N15NS5                           | 9.3 mΩ              |             |     |
|                          |                 |  | TOLT                    | IPTC044N15NM5                          | 4.4 mΩ              |             |     |
|                          |                 | 200 V  | SuperSO8                | ISC119N20NM6*                          | 11.9 mΩ             |             |     |
|                          |                 |  | TOLL                    | IPT067N20NM6*                          | 6.7 mΩ              |             |     |
|                          |                 |  | DSO                     | IRS2011S, IRS2005S, IRS2007S, IRS2008S |                     |             |     |
|                          |                 | CoolSiC™ Schottky diode                                  | CoolSiC™ Schottky diode | 1200 V                                 | DPAK                | IDM02G120C5 | 2 A |
|                          |                 |  |                         |  | DPAK                | IDM05G120C5 | 5 A |
| Gate driver: EiceDRIVER™ | EiceDRIVER™     |  | VDSO-8                  | 2EDL81xx                               |                     |             |     |
|                          |                 |  | DSO                     | 2EDN7524F                              |                     |             |     |
|                          |                 |  | DSO                     | 2ED24427N01F                           |                     |             |     |
|                          |                 |  | DSO                     | 2EDL8034F5B*                           |                     |             |     |
| Inverter stage           | CoolMOS™        | 600 V  | TO-Leadless             | IPT60R102G7                            | 102 mΩ              |             |     |
|                          |                 |  | D <sup>2</sup> PAK      | IPB60R145CDF7                          | 145 mΩ              |             |     |
|                          |                 |  | DDPAK                   | IPDD60R105CFD7                         | 105 mΩ              |             |     |
|                          |                 | 650 V  | D <sup>2</sup> PAK      | IPB65R125CFD7                          | 125 mΩ              |             |     |
|                          |                 |  | D <sup>2</sup> PAK      | IPB65R041CFD7                          | 41 mΩ               |             |     |
|                          |                 |  | DSO-20-87               | IGOT60R070D1                           | 70 mΩ               |             |     |
|                          | CoolGaN™        | CoolGaN™   | 600 V                   | TO-Leadless                            | IGT60R070D1         | 70 mΩ       |     |
|                          |                 |  |                         | TO-Leadless                            | IMT65R163M1H*       | 163 mΩ      |     |
|                          |                 |  |                         | D <sup>2</sup> PAK-7                   | IMBG65R163M1H       | 163 mΩ      |     |
|                          | CoolSiC™ MOSFET | CoolSiC™ MOSFET  | 650 V                   | TO-Leadless                            | IMT65R163M1H*       | 163 mΩ      |     |
|                          |                 |  |                         | D <sup>2</sup> PAK-7                   | IMBG120R140M1H      | 140 mΩ      |     |
|                          |                 |  |                         | DSO                                    | 2EDS8165H           |             |     |
| Gate driver: EiceDRIVER™ | EiceDRIVER™     | 650 V  | DSO                     | 2EDR258X                               |                     |             |     |
|                          |                 |  | DSO                     | 2EDS9265H                              |                     |             |     |
|                          |                 |  | DSO                     | 1EDI60I12AF, 1EDI30I12MF               |                     |             |     |
| Microcontroller          | XMC™ / PSoc™    | XMC1000 for control loop / PSoc™ 4 for PLC communication |                         |  |                     |             |     |
| Memory                   | EXCELON™ F-RAM  | CY15B102QN-50SXE   |                         |  |                     |             |     |
| Auxiliary power supply   | CoolSET™        | ICE5QR4780BG (800 V, 15 W, Quasi-Resonant)               |                         |  |                     |             |     |
|                          |                 | ICE5GR4780AG (800 V, 15 W, Fixed-Frequency)              |                         |  |                     |             |     |
| Connectivity             | AIROC™          | CYW43439 (Wi-Fi 4) / CYW4373 (Wi-Fi 5)                   |                         |  |                     |             |     |
|                          | PLC             | CY8CPLC20-48LTXIT  |                         |  |                     |             |     |
| Current sensor           | XENSIV™         | TLI4971-A025T5   |                         |  |                     |             |     |

## Single- and three-phase string inverter



| Inverter type                | Functional block   | Product category  | Product technology   | Voltage                    | Package                      | Part number                  | $R_{DS(on)}$ | [A]   |
|------------------------------|--------------------|---|----------------------|----------------------------|------------------------------|------------------------------|--------------|-------|
| Single-phase                 | MPPT – Boost stage | Si MOSFET   | CoolMOS™ C7          | 650 V                      | TO-247-3                     | IPW65R019C7                  | 19 mΩ        | -     |
|                              |                    | Si MOSFET   | CoolSiC™ MOSFET      | 650 V                      | TO-247-4                     | IPZ65R019C7                  | 19 mΩ        | -     |
|                              |                    | Si MOSFET   | CoolSiC™ MOSFET      | 650 V                      | TO-247-4                     | IMZA65R027M1H                | 27 mΩ        | -     |
|                              |                    | Si MOSFET   | CoolSiC™ MOSFET      | 650 V                      | TO-263-7                     | IMBG65R022M1H                | 22 mΩ        | -     |
|                              |                    | Si MOSFET   | CoolSiC™ MOSFET      | 650 V                      | TO-Leadless                  | IMT65R022M1H*                | 22 mΩ        | -     |
|                              |                    | Si MOSFET   | CoolSiC™ MOSFET      | 650 V                      | TO-Leadless                  | IMT65R022M1H*                | 22 mΩ        | -     |
|                              | IGBT               | TRENCHSTOP™ 7 H7  | 650 V                | TO-247-3                   | IKWH50N65EH7                 | -                            | 50 A         |       |
|                              |                    | TRENCHSTOP™ 7 H7  | 650 V                | TO-247-4                   | IKZA50N65EH7                 | -                            | 50 A         |       |
|                              |                    | Diode   | CoolSiC™ diode       | 650 V                      | TO-247                       | IDW20G65C5                   | -            | 20 A  |
|                              |                    | Diode   | CoolSiC™ diode       | 650 V                      | TO-247                       | IDW32G65C5B                  | -            | 32 A  |
|                              |                    | Diode   | CoolSiC™ diode       | 650 V                      | TO-247                       | IDW32G65C5B                  | -            | 32 A  |
|                              |                    | Diode   | CoolSiC™ diode       | 650 V                      | TO-247                       | IDW32G65C5B                  | -            | 32 A  |
| Inverter 5-level             | Si MOSFET          | OptiMOS™ 5  | 150 V                | SuperSO8                   | BSC093N15NS5                 | 9.3 mΩ                       | -            |       |
| Inverter 2-level, e.g. Heric | Si MOSFET          | CoolMOS™ CFD7   | 650 V                | TO-247-3                   | IPW65R018CFD7                | 18 mΩ                        | -            |       |
|                              |                    | CoolMOS™ CFD7   | 650 V                | TO-247-4                   | IPZA65R018CFD7               | 18 mΩ                        | -            |       |
|                              |                    | CoolMOS™ CFD7   | 650 V                | TO-247-4                   | IPZA65R029CFD7               | 29 mΩ                        | -            |       |
|                              |                    | CoolMOS™ CFD7   | 650 V                | QDPAK                      | IPDQ65R017CFD7               | 17 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 650 V                | TO-247-4                   | IMZA65R027M1H                | 27 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 650 V                | TO-247-3                   | IMW65R048M1H                 | 48 mΩ                        | -            |       |
|                              | SiC MOSFET         | CoolSiC™ MOSFET   | 650 V                | TO-263-7                   | IMBG65R022M1H                | 22 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 650 V                | TO-Leadless                | IMT65R022M1H*                | 22 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 650 V                | TO-247-4                   | IMZA65R027M1H                | 27 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 650 V                | TO-247-3                   | IMW65R048M1H                 | 48 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 650 V                | TO-263-7                   | IMBG65R022M1H                | 22 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 650 V                | TO-Leadless                | IMT65R022M1H*                | 22 mΩ                        | -            |       |
| Three-phase                  | MPPT – Boost stage | IGBT  | TRENCHSTOP™ 7 H7     | 1200 V                     | TO-247-4                     | IKZA50N65EH7                 | -            | 50 A  |
|                              |                    |   | TRENCHSTOP™ 7 H7     | 1200 V                     | TO-247-3                     | IKWH50N65EH7                 | -            | 50 A  |
|                              |                    |   | TRENCHSTOP™ 7 H7     | 1200 V                     | TO-247-3                     | IKW40N120CH7                 | -            | 40 A  |
|                              |                    | SiC MOSFET  | CoolSiC™ MOSFET      | 1200 V                     | TO-247PLUS-3                 | IKQ75N120CH7                 | -            | 75 A  |
|                              |                    |   | CoolSiC™ MOSFET      | 1200 V                     | TO-247PLUS-3                 | IKQ100N120CH7                | -            | 100 A |
|                              |                    |   | CoolSiC™ MOSFET      | 1200 V                     | TO-247-3/-4                  | IMW120R030M1H, IMZ120R030M1H | 30 mΩ        | -     |
|                              | SiC MOSFET         | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R040M1H, MZA120R040M1H | 40 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R060M1H, IMZ120R060M1H | 60 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R060M1H, IMZ120R060M1H | 60 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R060M1H, IMZ120R060M1H | 60 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R060M1H, IMZ120R060M1H | 60 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R060M1H, IMZ120R060M1H | 60 mΩ                        | -            |       |
| Inverter                     | IGBT               | TRENCHSTOP™ 7 H7  | 1200 V               | TO-247-3                   | IKW40N120CH7                 | -                            | 40 A         |       |
|                              |                    | TRENCHSTOP™ 7 H7  | 1200 V               | TO-247PLUS-3               | IKQ75N120CH7                 | -                            | 75 A         |       |
|                              |                    | TRENCHSTOP™ 7 H7  | 1200 V               | TO-247PLUS-3               | IKQ140N120CH7                | -                            | 140 A        |       |
|                              | SiC MOSFET         | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R030M1H, IMZ120R030M1H | 30 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R040M1H, MZA120R040M1H | 40 mΩ                        | -            |       |
|                              |                    | CoolSiC™ MOSFET   | 1200 V               | TO-247-3/-4                | IMW120R060M1H, IMZ120R060M1H | 60 mΩ                        | -            |       |
| SiC MOSFET                   | CoolSiC™ MOSFET    | 1700 V  | D <sup>2</sup> PAK-7 | IMBF170R650M1              | 650 mΩ                       | -                            |              |       |
|                              | CoolSiC™ MOSFET    | 2000 V  | TO-247-4-PLUS        | IMYH200R012M1H             | 12 mΩ                        | -                            |              |       |
|                              | CoolSiC™ MOSFET    | 1200 V  | Easy 2B              | IF3L8MR12W2M1HP_B11        | 8.1 mΩ                       | -                            |              |       |
| Gate-driver ICs              | EiceDRIVER™        | 25 V  | SOT23-6              | 1ED44175/3N01B             |                              |                              |              |       |
|                              |                    | 650 V   | DSO-16               | 2EDS7165H                  |                              |                              |              |       |
|                              |                    | 650 V   | DSO-16               | 2ED2181S06F                |                              |                              |              |       |
|                              |                    | 1200 V  | DSO-16               | IR2214SS, IR2213S          |                              |                              |              |       |
|                              |                    | 1200 V  | DSO-16               | 1EDI60I12AF, 1EDI30I12MF   |                              |                              |              |       |
|                              |                    | 2300 V  | DSO-16               | 1ED3124MU12H, 1ED3122MU12H |                              |                              |              |       |
|                              |                    | 2300 V  | DSO-16               | 1ED3322MC12N, 2ED020I12-F2 |                              |                              |              |       |
|                              |                    | 2300 V  | DSO-16               | 1ED3491MU12M, 1ED3890MU12M |                              |                              |              |       |
|                              |                    | EiceDRIVER™ 2EDN family, EiceDRIVER™ 1EDB   |                      |                            |                              |                              |              |       |
|                              |                    | Microcontroller   |                      | XMC4000 and PSoC™ 6        |                              |                              |              |       |
| Memory                       |                    | F-RAM / Asynchronous SRAM   |                      |                            |                              |                              |              |       |
| Auxiliary power supply       |                    | Integrated: CoolSET™ Quasiresonant (QR) / CoolSET™ with Fixed Frequency (FF)<br>Discrete: CoolSET™ (QR or FF) + CoolMOS™ P7 |                      |                            |                              |                              |              |       |
| Connectivity                 |                    | AIROC™ CYW43439 (Wi-Fi 4) / CYW4373 (Wi-Fi 5)<br>ISOFACE™ digital isolators for RS485                                       |                      |                            |                              |                              |              |       |
| Sensing                      |                    | XENSIV™ TLI4971   |                      |                            |                              |                              |              |       |



Battery

# Energy storage systems

## Make energy storage systems the backbone of the new energy era with our semiconductor system solutions

Facing diminishing fossil reserves, the world nonetheless needs to manage the rising demand for electrical energy while meeting the growing call for urgent climate action. The transition to renewable energies has become inevitable.

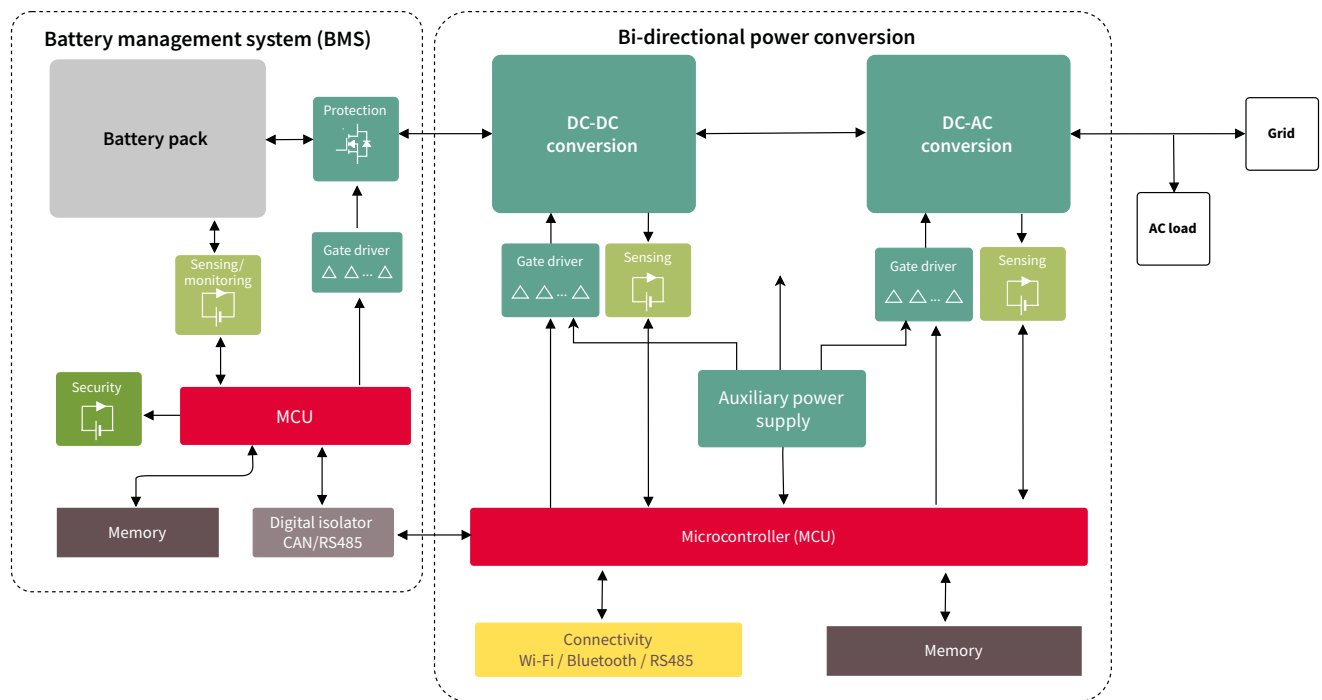
Energy storage systems play a vital role in managing this transition successfully. Our system solutions help to make energy storage the backbone of the new energy era. Our unique application expertise and comprehensive offering make us the natural choice to advance energy storage solutions in efficiency, performance, optimal cost, and innovation.

### Features and benefits

| Key features  |
|---|
| - Efficient power conversion in DC-DC and AC-DC stage |
| - Power-dense design                                  |
| - Bi-directional power flow                           |
| - Safe operation of Li-ion battery                    |
| - Long battery lifetime                               |
| - Wide range of Micro Controller Solutions            |
| - Safe data transfer is essential                     |

| Key benefits  |
|---|
| - Improvement of system performance with industry-leading semiconductor offering such as OptiMOS™, CoolMOS™, CoolSiC™ MOSFETs, CoolGaN™ HEMT but also best-in-class modules and matching EiceDRIVER™ gate drivers                 |
| - Reduction of design efforts and faster time to market   |
| - Trust in a true partnership during the whole system's lifetime  |
| - Full system provider from power conversion stage (PCS) to the battery management system (BMS), monitoring of battery's SOC, SOH and cell capacity through constant logging of critical parameters to measure the battery health |
| - OPTIGA™ Trust family protects BMS against cyber attacks   |
| - Ultra-low-energy data-logging of key battery health parameters in F-RAM   |
| - XMC7000, XMC4000 and XMC1000 ARM® Cortex®-M7, ARM® Cortex®-M4 and Cortex®-M0 MCU families enable easy-to-design and stable control over the system  |
| - ISOFACE™ digital isolators, AIROC™ Wi-Fi + Bluetooth® Combos  |

### Application diagram





Highlight/recommended product portfolio

| Functional block               | Power/battery voltage        | Voltage class [V <sub>DS</sub> max] | Product family                                       | Package   | Benefits  |  |
|--------------------------------|------------------------------|-------------------------------------|--|---|---|--|
| Power conversion systems (PCS) | < 10 kW                      | 40 V to 300 V                       | OptiMOS™ and StrongIRFET™                            | SuperSO8, TOLL, TOLT, TO-220, D <sup>2</sup> PAK              | – High power density and system cost reduction  |  |
|                                |                              | 600 V/650 V                         | CoolMOS™ CFD7  | TO-220/247, TOLL, QDPAK                                       | – Highest efficiency, enabling increased power density/more compact and easier design   |  |
|                                |                              | 650 V                               | CoolSiC™ Schottky diode                              | TO-220, D <sup>2</sup> PAK, DDPAK                             | – Improved system efficiency and extremely fast switching   |  |
|                                |                              | 650 V                               | CoolSiC™ MOSFET                                      | TO-247, D <sup>2</sup> PAK, TOLL*                             | – Combination of high performance, high reliability and ease of use   |  |
|                                |                              | 600 V                               | CoolGa™ HEMT   | DSO-20/TOLL   | – Ultra high-power density and efficiency   |  |
|                                | 10-100 kW                    | 650 V                               | TRENCHSTOP™ 5 H5/<br>CoolSiC™ hybrid devices         | TO-247  | – Conventional designs, high current operations   |  |
|                                |                              | 40 V to 300 V                       | OptiMOS™ and StrongIRFET™                            | TOLL, TOLT, TO-220, D <sup>2</sup> PAK                        | – High power density and system cost reduction  |  |
|                                |                              | 600 - 950 V                         | CoolMOS™ C7/P7                                       | TO-247, QDPAK, TOLL   | – Ease of use and fast design-in  |  |
|                                |                              | 650 V                               | CoolSiC™ MOSFET                                      | TO-247, D <sup>2</sup> PAK, TOLL*                             | – Combination of high performance, high reliability and ease of use   |  |
|                                |                              | 650 V                               | TRENCHSTOP™ 7 H7                                     | TO-247, TO-247PLUS, TO-247-HCC, TO-247-asymmetric (3 & 4 pin) | – Best-in-class performance and controllability   |  |
|                                |                              | 650 V                               | CoolSiC™ Schottky diode C6                           | TO-220, D <sup>2</sup> PAK, DDPAK                             | – Higher frequency and increased power density  |  |
|                                |                              | 1200 V - 2000 V                     | CoolSiC™ MOSFET                                      | TO-247, TO-247-HCC  | – Highest efficiency and increased power density  |  |
|                                |                              | 1200 V                              | TRENCHSTOP™ 7 H7                                     | TO-247, TO-247PLUS, TO-247-HCC, TO-247-asymmetric (3 & 4 pin) | – Best-in-class performance and controllability   |  |
|                                |                              | 101-250 kW                          | 40 V to 300 V  | OptiMOS™ and StrongIRFET™                                     | TOLL, TOLT, TO-220, D <sup>2</sup> PAK  | – Enables and simplifies the setup of 2nd life batteries<br>– Lower switching voltage enables higher inverter efficiency   |
|                                |                              |                                     | 1200 V - 2000 V                                      | CoolSiC™ MOSFET   | D <sup>2</sup> PAK-7, TO-247-HCC  | – Enables efficient auxiliary supply   |
|                                | 1200 V                       |                                     | EasyPACK™ 2B   | Modules   | – Highest efficiency for reduced cooling effort   |  |
|                                | > 0.25 MW                    | 1700 V                              | PrimePACK™ / EconoDUAL™                              | Modules   | – High power density  |  |
|                                |                              | 1200 V                              | PrimePACK™/EconoDUAL™                                | Modules   | – Easy and most reliable assembly   |  |
|                                |                              | 1700 V                              | PrimePACK™/EconoDUAL™                                | Modules   |   |  |
|                                |                              | 200 V                               | EiceDRIVER™ 1EDN gate driver                         | PG-SOT23-6/<br>PG-SOT23-5<br>WSON-6 / TSNP-6                  | – Single-channel non-isolated   |  |
| 650 V                          |                              | EiceDRIVER™ 2EDR gate driver        | PG-DSO-14-WB   | – Dual-channel reinforced (safe) isolated                     |   |  |
| BMS – battery protection       | 40 - 100 V                   | 60 V to 200 V                       | OptiMOS™ Linear FET                                  | TOLL, D <sup>2</sup> PAK                                      | – Minimize parallelization of MOSFETs<br>– Market-leading MOSFETs with lowest R <sub>DS(on)</sub> enabling low conduction losses<br>– Widest SOA area with LinearFET™       |  |
|                                |                              | 150 - 400 V                         | 600 V  | CoolMOS™ S7   | TOLL, QDPAK   | – Lowest R <sub>DS(on)</sub> MOSFET  |
|                                | BMS Monitoring and balancing | -                                   | -  | Battery management IC (TLE9012DQU)                            | PG-TQFP-48  | – ASIL-D compliant<br>– Cell balancing with integrated switches with up to 150 mA using external resistors to reduce chip power consumption<br>– 12x delta-sigma ADCs ensure that the voltage of all cells is measured synchronously<br>– ISO UART includes an 8-bit CRC to ensure data integrity until microcontroller register |
|                                |                              | BMS transceiver                     | -  | -   | Battery management IC (TLE9015QU)   | PG-TQFP-48   |
| Digital isolators              | -                            | -                                   | ISOFACE™ digital isolators 2DIB/4DIR                 | PG-DSO-8-8<br>PG-DSO-8-16                                     | – Isolated CAN/UART communication<br>– Support diagnosis feature, general purpose error pin   |  |
| Current sensors                | -                            | -                                   | XENSIV™ - high-precision coreless current sensors    | PG-TISON-8  | – High accuracy of current sensing<br>– Noise robustness  |  |
| Auxiliary power supply         | -                            | 650 V to 950 V                      | CoolSET™   | DSO-12  | – Compact, robust and easy to use solution  |  |
| Microcontroller                | -                            | -                                   | XMC™ families XMC1000/<br>XMC4000/XMC7000<br>PSoC™ 4 | PG-VQFN-40<br>PG-VQFN-56<br>PG-TSSOP-16<br>PG-TSSOP-38        | – 32-bit MCU subsystem<br>– 48/144/350MHz Arm® Cortex®-M0+ CPU<br>– Up to up to 8 MB flash<br>– 32 kB SRAM<br>– Up to 2 CAN<br>– USB/up to 4 serial channels                |  |
| Memory                         | -                            | -                                   | Serial SPI F-RAM<br>EXCELON™ F-RAM                   | PG-DSO-8  | – Zero-delay writes<br>– 1014 read/write cycles<br>– 10-year data retention at +85°C temperature<br>– 200x lower energy than EEPROM<br>– No complex wear-leveling overheads |  |
| Security                       | -                            | -                                   | OPTIGA™ Trust family                                 | PG-USON-10-2  | – The OPTIGA™ Trust family includes turnkey products for smaller platforms as well as programmable solutions  |  |
| Connectivity                   | -                            | -                                   | AIROC™ Wi-Fi + Bluetooth®<br>Combos                  | WLBGA   | – High integration, quick implementation<br>– It supports Wi-Fi 4, Wi-Fi 5  |  |

[www.infineon.com/energy-storage-systems](http://www.infineon.com/energy-storage-systems)

\*Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





Service robots



Collaborative robots

# Robotics

## Superior solutions for smart and safe robots

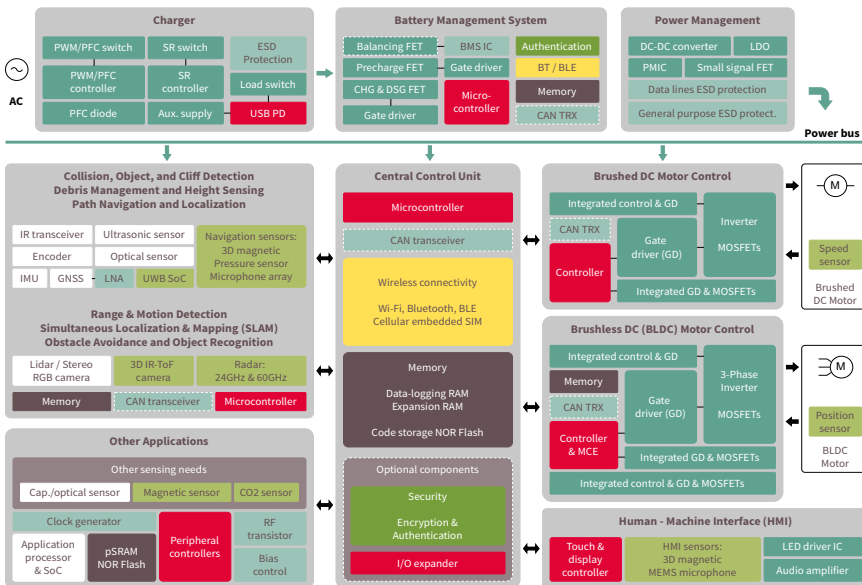
Disruptive technologies have significantly changed our lifestyle in the past few decades. Now a new era is on the horizon – the age of robots. Today’s robots can identify and navigate through surroundings, work alongside and even interact with humans. All this would not be possible without the recent advancements in semiconductor solutions. Drawing on Infineon’s insights into all facets of the robotics field and with a comprehensive portfolio of power products and sensors on offer, Infineon provides reliable system solutions that address the latest trends in robotics, whether it is Artificial Intelligence, Internet of Things, smart home, cloud-based services, human-machine interface, or any robotics-related field.

### Features and benefits

| Key features   | Key benefits   |
|--|--|
| <ul style="list-style-type: none"> <li>– Fast time to market</li> <li>– Complete solutions – broad portfolio from power to connectivity (Wi-Fi and Bluetooth®) and sensors</li> <li>– Extended battery lifetime and product life spans</li> <li>– Overall system size and cost reduction</li> <li>– Security, quality, and safety</li> <li>– Authentication</li> </ul> | <ul style="list-style-type: none"> <li>– A complete ecosystem of simulations, documentation, and demonstration boards enable faster time to market</li> <li>– Whatever design specification, Infineon has the answer thanks to its comprehensive portfolio of products and solutions which you can easily tailor to your needs</li> <li>– High reliability of Infineon components results in prolonged product life spans</li> <li>– Reduction of overall system size and cost thanks to small form factor and compact design of components, both of which are required for highest power density</li> <li>– BOM savings thanks to the lowest <math>R_{DS(on)}</math></li> <li>– Trustworthy hardware-based security</li> <li>– As a security market leader with a proven track record and outstanding partner network for embedded security, Infineon provides the highest quality standards and a safety-certified development process</li> <li>– OPTIGA™ Trust enables authentication of components connected to the system (e.g., battery pack recognition to avoid second-party batteries)</li> </ul> |

### Domestic robots - simplifying everyday life and work

#### Structural system overview: domestic robots

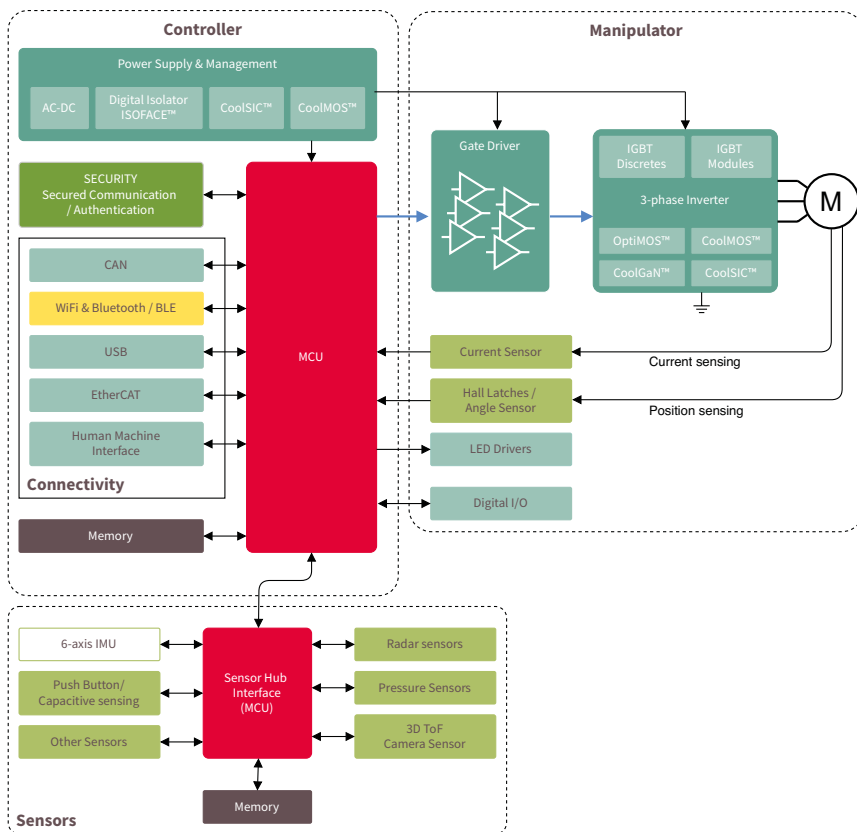


The latest generation of domestic robots, e.g. vacuum, lawn or pool robots, provide a new level of assistance and simplicity in homes and professional environments. They directly interact with humans, which imposes unique design challenges, especially in domestic environments. Energy efficiency, long battery life, security, sensing capabilities, and intelligent mind are key to user-friendly and safe designs. By choosing Infineon, you get a one-stop semiconductor shop for all your robot design needs.



## Industrial robots and cobots – advance through collaboration

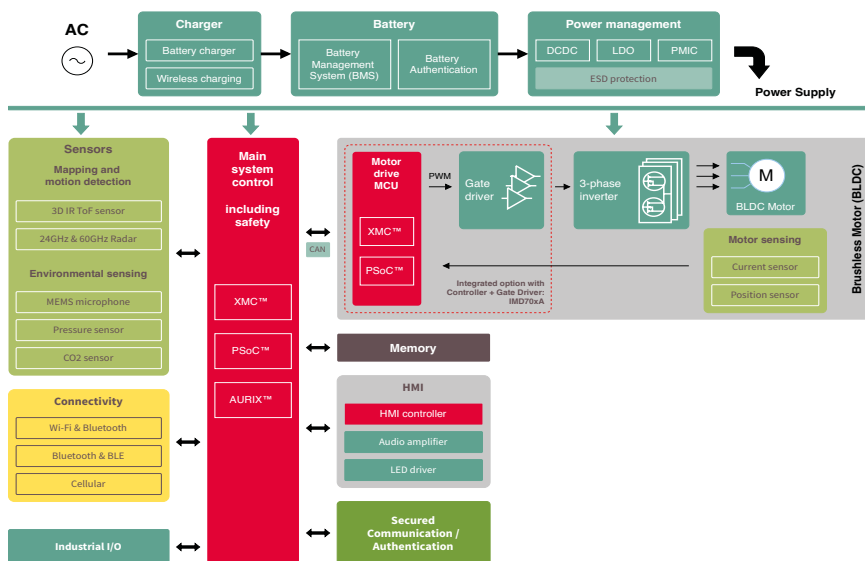
Structural system overview: industrial robots and cobots



With the experience we gained by serving industrial robot manufacturers with the best system solutions for years, Infineon is well set to provide the right fit products for the next generations of collaborative robots. Cobots, as they are shortly called, work outside the limitation of a safety cell, directly interacting with humans. This setup requires a precise set of design features, especially for the sake of workplace safety. With Infineon’s semiconductors for cobot systems, you benefit from the expertise of an experienced and reliable partner.

## Mobile robots – driving production and automation forward

Structural system overview: Mobile robots (AGV, AMR)



Autonomous mobile robots (AMRs) are a self-driving force behind automated processes and offer the highest degree of flexibility within working environments due to battery-powered systems. With its complete product portfolio for robotics applications- from the power supply to motor drives and sensors for navigation and environment scanning -Infineon makes it possible for mobile robots to find their way through nearly all environments.



Recommended products

|   |   | Industrial robots   |  | Cobots   | Mobile robots (AMR, AGV)  | Domestic robots   |  |
|---|---|---|--|--|---|---|--|
| Common system power   |   | > 5 KW  | < 5 KW   | 100 – 1000 W   | 200- 500 W  | 10 – 100 W  |  |
| Common operating/battery voltage                                    |   | 3 V ~ 400V <sub>AC</sub>  | 1 V~ 110 V-220 V <sub>AC</sub>   | 1 V~ 110 V-220 V <sub>AC</sub> /48 V <sub>DC</sub> Bus   | 24 V – 48 V <sub>DC</sub>   | 12 V – 36 V <sub>DC</sub>   |  |
| Power supply and charger  | Power switch  | 650 V and 1200 V CoolSiC™ MOSFET<br>600 V/650 V IGBT HighSpeed 5<br>650 V IGBT TRENCHSTOP™ 7 IGBT7 T7 and H7<br>650 V and 1200 V EasyPACK™ Module   |  | 600 V/650 V CoolMOS™<br>650 V CoolSiC™<br>20 V - 200 V OptiMOS™ and StrongIRFET™   | 600 V/650 V CoolMOS™<br>650 V CoolSiC™<br>20 V - 200 V OptiMOS™ and StrongIRFET™  | 600 V/650 V CoolMOS™<br>650 V CoolSiC™<br>20 V - 200 V OptiMOS™ and StrongIRFET™  |  |
|   | PFC power diodes  | 650 V CoolSiC™ Schottky diode   |  |  |   |   |  |
|   | Gate driver<br>EiceDRIVER™ family   | low-side single-channel: 1EDN7550B, 1EDN8550B, 1ED44175N01B, 1ED44173N01B<br>low-side dual-channel: 2ED24427N01F, 2EDN7523G<br><br>1200 V single-channel isolated:<br>1ED3124MU12F, 1EDI60N12AF         |  | 650 V half-bridge:<br>2EDF9275F, 2EDF7175F,<br>2ED2304S06F, 2ED2182S06F,<br>2ED2110S06M<br>650 V high-side:<br>1EDB9275F, 1EDB6275F, 1EDB8275F   |   |   |  |
|   | ISOFACE Digital Isolators<br>ISOFACE Isolated Industrial Interface<br>Microcontroller (MCU) | ISO1I813T, ISO1H816G<br>2DIB0410F<br><br>Arm® Cortex®-M0: XMC1100 or XMC1300<br>Arm® Cortex®-M4: XMC4200  |  |  |   |   |  |
| Motor control and drive   | Power switch  | 1200 V IGBT 7 S7 1200 V CoolSiC™ MOSFET 1200 V CoolSiC™ Easy1B Module   | 600V/650V CoolMOS™<br>650 V and 1200 V CoolSiC™ CoolGaN™ GIT HEMT 600 V<br>600 V/650 V/1200 V TRENCHSTOP™<br>600 V EasyPIM™ and EasyPACK™<br>600 V CIPOS™ (full integration) | 60 – 100 V OptiMOS™ and StrongIRFET™<br>Recommended packages:<br>PQFN 3 x 3 (space savings)<br>Super SO8 (price/performance)<br>TOLL (high current)  | 60 – 150 V OptiMOS™ and StrongIRFET™<br>Recommended packages:<br>PQFN 3 x 3 (space savings)<br>Super SO8 (price/performance)<br>TOLL (high current) | 25 – 60 V OptiMOS™ and StrongIRFET™ single- and dual-channel MOSFETs<br>Recommended packages:<br>PQFN 3 x 3 (space savings)<br>Super SO8 (price/performance)<br>TOLL (high current) |  |
|   | Gate driver<br>EiceDRIVER™ family   | 1200V single-channel isolated Compact: 1ED31xx and 1ED-MF<br><br>1200 V single-channel isolated Enhanced: 1ED34xx and 1ED-F2<br><br>1200 V half-bridge IR2214SS 1200 V three-phase: 6ED2230S12T         | 650 V half-bridge: 2EDF9275F, 2EDF7275F, 2EDF7175F, 2ED2304S06F, 2ED2182S06F,<br><br>650 V high-side: 1EDB8275F, 1EDB9275F, 1EDB6275F<br><br>650 V three-phase: 6EDL04N06PT  | 600 V half-bridge: IRS21867S, IRS2186S<br>200 V half-bridge: IRS2005S, IRS2007S, IRS2008S, 2EDF7275K<br>200 V three-phase: 6EDL04N02<br>160 V three-phase: 6ED2742S01<br>200 V high-side: 1EDN7550B & 1EDB8550B<br>160 V half-bridge: 2ED2748S01G, 2ED2738S01G<br>120 V half- bridge: 2EDL8124G<br>60 V three-phase programmable: 6EDL7141<br>25 V low-side: 1ED44173N01B, IRS44273L |   |   |  |
|   | Microcontroller (MCU)   | PSoC™: Arm® Cortex® M4F+M0 → CY8C61x8<br>XMC™: Arm® Cortex® M4F → XMC4800, Arm® Cortex® M0 → XMC1000<br>TRAVEO II™: Arm® Cortex® M7 Dual Core + Arm® Cortex® M0+ → CYT4BF8CD<br>AURIX™: TriCore → TC337 |  |  |   |   |  |
|   | ISOFACE Digital Isolators<br>ISOFACE Isolated Industrial Interface                          | 2DIB0410F<br>ISO1I813T, ISO1H816G   |  |  |   |   |  |
|   | Hall switch   | XENSIV™ TLx496x   |  |  |   |   |  |
|   | Current sensor  | XENSIV™ TLI4971   |  |  |   |   |  |
|   | Angle sensor  | XENSIV™ TLE/TLI5012B, TLE5014SP   |  |  |   |   |  |
|   | Battery management system (BMS)   | Microcontroller (MCU)   |  |  | XMC™: XMC4x00 (Arm® Cortex® - M4F)<br>PSoC™: PSoC™ 4 (Arm® Cortex®M4F+M0)   |   |  |
|   |   | Protection switches   |  |  | 100 V – 150 V OptiMOS™ or StrongIRFET™ IPT015N10N5, IRFS4115  | 30 V – 80 V LinearFET™ Gen.2 OptiMOS™, StrongIRFET™ BSC007N04LS6, IRL40T209, IRFS7430   |  |
| Balancing switches (small signal)                                   |   |   |  | 20 V or 30 V N/P MOSFETS in SOT23, TSOP6 or SOT363 dual-channel  |   |   |  |
| Monitoring and balancing IC   |   |   |  | TLE9012AQU (sensing IC), TLE9015QU (transceiver IC)  |   |   |  |
| Battery authentication  |   |   |  | OPTIGA™ Authenticate S   |   |   |  |
| Sensing (e.g., room mapping, HMI, collision avoidance, air quality) | Radar   | XENSIV™ 60 GHz: BGT60LTR11AIP<br>XENSIV™ 24 GHz: BGT24LTR11 or BGT24MTR11   |  |  |   |   |  |
|   | ToF (Time-of-Flight) 3D image sensors   | XENSIV™ REAL3™ 3D image sensor: IRS1125A, IRS2877AS (functional safety ISO26262)<br>XENSIV™ VCSEL Driver: IRS9100C, IRS9102C  |  |  |   | XENSIV™ REAL3™ 3D image sensor: IRS2381C, IRS2875C, IRS2877C<br>XENSIV™ VCSEL Driver: IRS9100C, IRS9102C  |  |
|   | MEMS microphones  | XENSIV™ MEMS microphones: IM72D128 (digital interface), IM68A130 (analog interface)   |  |  |   |   |  |
|   | Other sensors   | Pressure sensor: XENSIV™ DPS368 (e.g., airflow control)<br>CO <sub>2</sub> Sensor: XENSIV™ PAS CO <sub>2</sub>  |  |  |   |   |  |
|   | Connectivity and human-machine interface (HMI)  | Wi-Fi<br>CW43439 (1x1 2.4GHz Wi-Fi 4)<br>CW4373 (1x1 dual-band Wi-Fi 5)<br>CW55571 (1x1 Tri-band Wi-Fi 6)   |  |  |   |   |  |
| Security  | HMI   | PSoC™ 4000 - entry-level<br>PSoC™ 4100 - more touch buttons<br>PSoC™ 4700 - inductive sensing   |  |  |   |   |  |
|   | Main control MCU  | Single or dual core Arm® Cortex®-M7 and Cortex®-M0+   |  |  |   |   |  |
|   | Authentication and protection   | OPTIGA™ Trust M, OPTIGA™ TPM  |  |  |   |   |  |
| Memory  | NOR flash   | S25FL-L serial NOR flash memories Densities 64 MB to 256 MB   |  |  |   |   |  |
| Others  | Voltage regulator   | DC-DC voltage regulator 12 V/5 V or 3.3 V, watchdog, error monitoring, safe state control, BIST, etc.   |  |  |   |   |  |
|   | LED Driver  | Driving currents from 10 mA to 250 mA – linear driver ICs: BCR3xx, BCR4xx<br>Support currents from 150 mA to 3 A – DC-DC switch-mode: ILD4xxx, ILD6xxx  |  |  |   |   |  |





# On-board charger for xEV applications

## Best solutions for electrified powertrain in xEV applications: on-board chargers and HV/LV DC-DC converter

The electrification of the powertrain enables local emission-free mobility and driving pleasure. The needed energy is stored and delivered from a battery. Infineon's semiconductor solutions do not only enable core functionalities in the electrification but also extend the driving range, reduce charging times and energy transfer between the high voltage systems with the traditional 12 V domain.

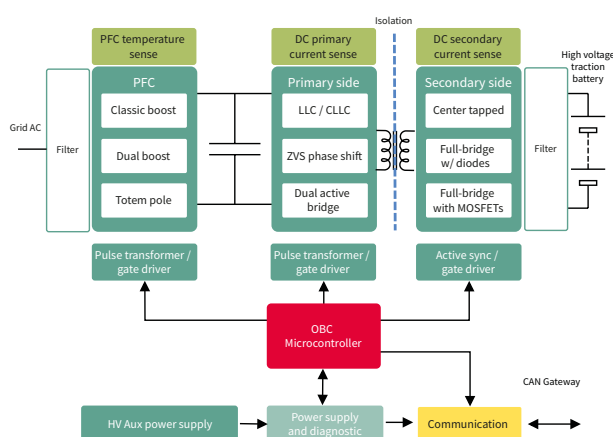
### On-board chargers

All plug-in hybrid electric vehicles (PHEV) and pure electric cars are equipped with at least one on-board charger, allowing battery recharge from any standard AC power outlet. Available power depends on regional regulations and installation base, typically providing up to 7.4 kW for PHEVs and up to 22 kW maximum power. System designers face the challenge of supporting the varied voltage and current levels while increasing the power density. When it comes to on-board charging, the key success factors involve efficiency and a high power density for a small form factor. The long-term trend is moving towards bidirectional charging, where the charger also feeds power from the car to the smart grid.

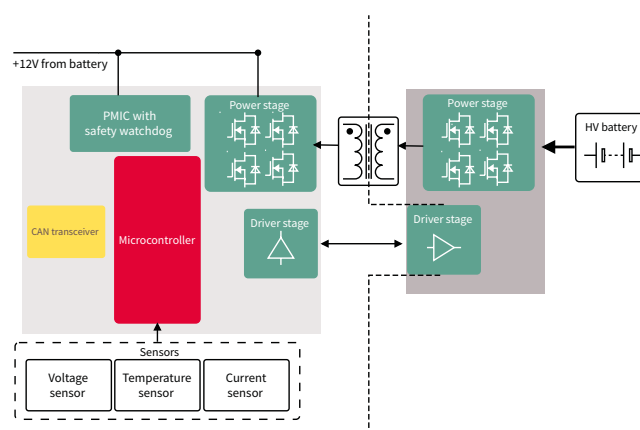
### High-voltage DC-DC converter

The architecture of electric vehicles comprises at least one low-voltage sub-network with low-voltage energy storage and multiple electrical loads and one high-voltage sub-network with high-voltage energy storage. The auxiliary HV/LV DC-DC converter's function is to enable the bidirectional energy flow between these two electrical subnets. Typical design challenges are achieving the greatest possible efficiency and keeping the overall system costs under control. The space required for the DC-DC converter should also be kept to an absolute minimum. Infineon's portfolio is specially designed to help overcome these barriers easily.

On-board chargers: functional blocks



HV/LV DC-DC converter: functional blocks



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[www.infineon.com/obc](http://www.infineon.com/obc)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Product portfolio for on-board charger and HV/LV DC-DC applications

Infineon's comprehensive portfolio of semiconductors (sensors, microcontrollers, power semiconductors, etc.) lends itself perfectly to designing compact units for on-board, off-board, and wireless EV-charging. Infineon products in this sector support high-switching frequencies at lowest possible on-state resistance ( $R_{DS(on)}$ ) to enable compact and efficient designs. The power offering includes MOSFETs such as **CoolMOS™**, IGBTs such as **TRENCHSTOP™ 5**, SiC Schottky diodes such as the **CoolSiC™** Schottky diode 650 V, the **CoolSiC™** Hybrid discrete (integrated IGBT and SiC diode), and easy module solutions. In addition, integrated MOSFET and IGBT drivers, controller ICs for active CCM PFC high-performance microcontroller solutions, and highly accurate current sensors complete the product portfolio. For more information about off-board chargers, refer to the [Fast/wireless EV-charging](#) chapter.

### Automotive products for on-board charger units

| Product family          | Part number                    | Description   |
|-------------------------|--------------------------------|---|
| CoolMOS™ 650 V          | IPx65RxxxCFD7A                 | 650 V MOSFETs with integrated fast body diode                         |
| TRENCHSTOP™ 5 AUTO IGBT | AIKW50N, AIKW40N, AIGW40       | IGBT discrete dedicated to automotive applications                    |
| CoolSiC™ 1200 V         | AIMW120Rx                      | Automotive 1200 V discrete SiC MOSFET                                 |
| Level shifter           | AUIRS2191S, AUIRS2113S         | Automotive high and low side driver                                   |
| EiceDRIVER™ Automotive  | 2ED020112FA                    | Dual-channel isolated driver for 650 V/1200 V IGBTs and MOSFETs       |
| AURIX™ microcontroller  | TC23xL, TC26xD, TX36x*, TC37X* | 32-bit lockstep microcontroller                                       |
| OPTIREG™ PMIC           | TLF35584, TLF35585             | ISO 26262 – system-supply optimized for AURIX™                        |
| CAN FD transceiver      | TLE9350, TLE9351, TLE9252      | High-speed automotive CAN transceiver with 5 Mbps                     |
| OPTIREG™ SBC            | TLE9461, TLE9471               | High integrated solution for microcontroller supply and communication |
| OPTIREG™ linear         | TLS810, TLS850, TLS105, TLS820 | Automotive linear voltage regulators                                  |
| XENSIV™ current sensor  | TLI4971                        | Coreless magnetic current sensors                                     |

### Modules for on-board charger units

| Product family              | Part number            | Description  |
|-----------------------------|------------------------|--|
| CoolMOS™ Easy module 650 V  | F4-35MR07W1D7S8_B11/A* | 650 V MOSFET in H-bridge configuration with integrated capacitor in Easy 1B package                        |
| CoolMOS™ Easy module 650 V  | F4-35MR07W2D7S8_B13/A* | 650 V MOSFET in H-bridge configuration with IGBT H5, rapid diode & integrated capacitor in Easy 2B package |
| CoolMOS™ Easy module 650 V  | F4-xxMR07WxD7_Bxx/A    | 650 V MOSFET in H-bridge configuration in Easy package   |
| CoolMOS™ Easy module 650 V  | FSxxMR07WxD7_Bxx/A     | 650 V MOSFET in SixPACK configuration in Easy package  |
| CoolMOS™ Easy module 650 V  | FFxxMR07WxD7_Bxx/A     | 650 V MOSFET in half-bridge configuration in Easy package  |
| CoolSiC™ Easy module 1200 V | F4-xxMR12WxM1H_Bxx/A   | 1200 V SiC MOSFET in H-bridge configuration in Easy package  |
| CoolSiC™ Easy module 1200 V | FSxxMR12WxM1H_Bxx/A    | 1200 V SiC MOSFET in SixPACK configuration in Easy package   |
| CoolSiC™ Easy module 1200 V | FFxxMR12WxM1H_Bxx/A    | 1200 V SiC MOSFET in half-bridge configuration in Easy package   |

For more information about off-board chargers, refer to the [Fast/wireless EV-charging](#) chapter.

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\* Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Automotive products for the car side\*\*

| Product family         | Part number                    | Description   |
|------------------------|--------------------------------|---|
| EiceDRIVER™ Automotive | 1ED02012FA2                    | Single-channel isolated driver for 650 V/1200 V IGBTs and MOSFETs         |
| EiceDRIVER™ Automotive | 1ED02012FTA                    | Single-channel isolated driver, two-level turn-off for 650 V/1200 V IGBTs |
| EiceDRIVER™ Automotive | 2ED02012FA                     | Dual-channel isolated driver for 650 V/1200 V IGBTs and MOSFETs           |
| CoolMOS™               | IPx65RxxxCFD7A                 | 650 V MOSFET with integrated fast body diode                              |
| AURIX™                 | TC23xL, TC26xD, TX36x*, TC37X* | 32-bit lockstep microcontroller   |
| OPTIREG™ PMIC          | TLF35584, TLF35585             | ISO 26262 – system-supply optimized for AURIX™                            |
| CAN FD transceiver     | TLE9350, TLE9351, TLE9252      | High-speed automotive CAN transceiver with 5 Mbps                         |
| OPTIREG™ SBC           | TLE9461, TLE9471               | High integrated solution for microcontroller supply and communication     |
| OPTIREG™ linear        | TLS810, TLS850, TLS105, TLS820 | Automotive linear voltage regulators                                      |

## Industrial products for the road side\*\*

| Product family                         | Part number                 | Description   |
|--|-----------------------------|---|
| CoolMOS™ CF7 SJ MOSFET                 | IPW60R031CFD7               | 600 V MOSFET, 31 mΩ, TO-247   |
| CoolMOS™ C7 SJ MOSFET                  | IPW60R040C7                 | 600 V MOSFET, 40 mΩ, TO-247   |
| CoolMOS™ P7 SJ MOSFET                  | IPW60R037P7                 | 600 V MOSFET, 37 mΩ, TO-247   |
| TRENCHSTOP™ 5 IGBTs                    | IKW40N65F5                  | Fast IGBT with Rapid 1 diode, 40 A, TO-247  |
| TRENCHSTOP™ 5 IGBTs                    | IGW40N65F5                  | Fast IGBT, single, 40 A, TO-247   |
| CoolSiC™ Schottky diode                | IDW40G65C5                  | 650 V SiC Schottky diode generation 5, 40 A, TO-247                                     |
| XMC™ microcontroller                   | XMC4000                     | 32-bit Arm® Cortex® -M4F microcontrollers, up to 125 °C ambient temperature             |
| Linear voltage regulators              | TLS805, TLS820, TLS850      | Scalable Linear regulator family from 50mA to 500mA with robust design and feature sets |
| Current sensor                         | TLI4970                     | 600 V functional isolation, ± 50 A  |
| EiceDRIVER™ SOI gate driver            | 2ED21xxS06F                 | 650 V half-bridge gate driver for IGBTs and MOSFETs                                     |
| EiceDRIVER™ 1ED Compact gate-driver IC | 1EDxxx12AF/MF, 1ED31xxMU12H | 1200 V, single-channel, isolated driver with Miller clamp or separate output            |

## Industrial products for the road side

| Part number                              | Product family        | Description   |
|--|-----------------------|---|
| EasyPACK™ module with CoolSiC™ 1200 V    | F3L11MR12W2M1_B74     | 1200 V SiC MOSFET in three-level configuration in Easy 2B package     |
| EasyDUAL™ 1B module CoolSiC™ 1200 V      | FF45MR12W1M1(P)_B11*  | 1200 V SiC MOSFET in half-bridge configuration in Easy 1B package     |
| EasyDUAL™ 1B module with CoolSiC™ 1200 V | FF23MR12W1M1(P)_B11   | 1200 V SiC MOSFET in half-bridge configuration in Easy 1B package     |
| EasyPACK™ 1B module with CoolSiC™ 1200 V | F4-45MR12W1M1(P)_B76* | 1200 V SiC MOSFET in H-bridge configuration in Easy 1B package        |
| EasyPACK™ 1B module with 1200 V CoolSiC™ | F4-23MR12W1M1(P)_B76* | 1200 V SiC MOSFET in H-bridge configuration in Easy 1B package        |
| EasyBRIDGE™ module with 1200 V CoolSiC™  | DDB2U20N12W1RF(P)_B11 | 1200 V SiC diode in rectifier bridge configuration in Easy 1B package |
| EasyBRIDGE™ module with 1200 V CoolSiC™  | DDB2U40N12W1RF(P)_B11 | 1200 V SiC diode in rectifier bridge configuration in Easy 1B package |
| EasyBRIDGE™ module with 1200 V CoolSiC™  | DDB2U60N12W1RF(P)_B11 | 1200 V SiC diode in rectifier bridge configuration in Easy 1B package |

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[www.infineon.com/obc](http://www.infineon.com/obc)

\* For more information on the product, contact our product support

\*\* Available in different current ratings

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





LEV

# Light electric vehicles and electric forklift

## eBike, eScooter, eMotorcycle, eRickshaw, eMicroCar, eForklift

As a leader in power semiconductors, Infineon strives to enable the most efficient, reliable, and smart solutions for the e-mobility, Minimobility, and Micromobility markets. Keeping up with the latest market trends worldwide, Infineon prepares for the ramp-up of all forms of light electric vehicles (LEVs).

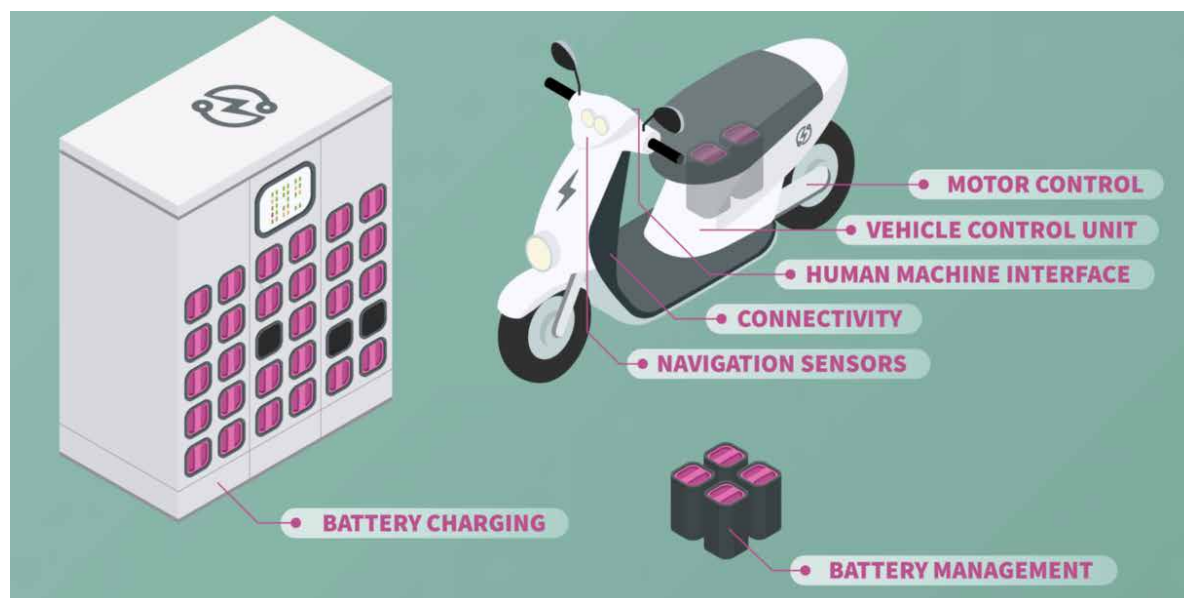
- Micromobility - electric bicycle (e-bike), electric kick-scooter
- Electric powered 2/3 wheelers (ePTW) - e-moped, e-scooter, e-rickshaw, e-motorcycle
- MicroEV – electric microcars, low-speed electric vehicles (LSEV), neighborhood EV (NEV), electric quadricycle
- Other electric transporters (e.g. e-forklift, e-golf cart, e-ATV) with less than 200 V batteries

Contrasting to automotive (passenger car) requirements, L-category (light) vehicles (though often also on-road) require different sets of safety and qualification standards. As an example, the newest motorcycle standards place more responsibility on the operator rather than the vehicle itself to mitigate risks. Infineon considers mission profiles of different end applications and offers suitable non-automotive and automotive components for this wide range of use cases. Different from the traditional vehicles with internal combustion engines, these types of vehicles are powered by battery technology with bus voltage ranging from 28 V to 168 V. The commonalities among these different types of LEVs are motor inverters/drives, battery management systems, battery chargers/battery charging stations/battery swapping stations. Additionally, LEVs house increasingly popular smart features and electronics made possible due to their larger battery sizes.

### Features and benefits

| Key features   | Key benefits   |
|--|--|
| - Leading power MOSFET technology  | - Highest power density and increased battery operating time |
| - Track record of reliability and quality  | - Prolonged lifetime and low failure rate                    |
| - Complete portfolio for driver, microcontroller, and sensors  | - One-stop shop for designers                                |
| - Broad connectivity products compliant with various standards   | - Enabling smart features                                    |
| - Complete design support with simulations, documentation, and demonstration boards for high-end solutions | - Shortened development cycle                                |

### Application diagram



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For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





### 6 kW motor drive with 96 V bus voltage

| Functional block | Topology                 | Product category                               | Product family | Part number                               |
|------------------|--------------------------|--|----------------|---|
| Motor drive      | 3-phase half-bridge (B6) | LV MOSFETs                                     | OptiMOS™ 5     | IPT039N15N5                               |
|                  |                          | Microcontrollers <sup>MSIL-relevant</sup>      | AURIX™         | SAK-TC334LP-32F200F <sup>MSIL-ready</sup> |
|                  |                          | Gate driver <sup>MSIL-relevant</sup>           | EiceDRIVER™    | 2EDB8259F, 2ED2738S01G                    |
|                  |                          | Position/speed sensor <sup>MSIL-relevant</sup> | XENSIV™        | TLE5501 E0002                             |
|                  |                          | Current sensor <sup>MSIL-relevant</sup>        | XENSIV™        | TLE4972-AE35S5 <sup>MSIL-ready</sup>      |

For additional configurations, please refer to [High power low voltage drives](#).

### Swappable 48 V 1.2 kWh battery

| Functional block | Topology                     | Product category                           | Product family         | Part number                   |
|------------------|------------------------------|--|------------------------|-------------------------------|
| BMS              | Back-to-back with pre-charge | LV MOSFETs (charge)                        | OptiMOS™ TOLT          | IPTC015N10NM5                 |
|                  |                              | LV MOSFETs (discharge)                     | OptiMOS™ TOLT          | IPTC015N10NM5                 |
|                  |                              | LV MOSFETs (pre-charge)                    | OptiMOS™               | BSC070N10NS5                  |
|                  |                              | Microcontrollers <sup>MSIL-relevant</sup>  | PSoC™                  | CY8C4146/7AZI-S463            |
|                  |                              | Gate driver <sup>MSIL-relevant</sup>       | EiceDRIVER™            | 2ED4820 <sup>MSIL-ready</sup> |
|                  |                              | Current sensor <sup>MSIL-relevant</sup>    | XENSIV™                | TLE4972 <sup>MSIL-ready</sup> |
|                  |                              | Cell balancing IC <sup>MSIL-relevant</sup> | TLE                    | TLE9012 <sup>MSIL-ready</sup> |
|                  |                              | Memory (RAM)                               | NOR flash              | S25FL256LAGMFB001             |
|                  |                              | Bluetooth®                                 | AIROC™                 | CW20719B1KUMLG                |
|                  |                              | Security                                   | OPTIGA™ Authenticate S | SLE95401TSP6XTSA1             |

For additional configurations, please refer to [Battery management systems](#).

### 3 kW AC-DC rectifiers in swapping battery stations

| Functional block | Topology        | Product category          | Product family                                    | Part number       |
|------------------|-----------------|---------------------------|---|-------------------|
| Battery charging | CCM PFC         | PFC switch                | CoolMOS™ P7                                       | IPW60R037P7       |
|                  |                 | Gate driver               | EiceDRIVER™                                       | 1EDN8511B         |
|                  |                 | PFC controller            | ICE3x family                                      | ICE3PCS01G        |
|                  | Resonant HB LLC | LLC switch (primary side) | CoolMOS™ CFD7                                     | IPW60R031CFD7     |
|                  |                 | Gate driver               | EiceDRIVER™ 2-ch functional-isolated gate drivers | 2EDS8265H         |
|                  |                 | FBSR switch               | OptiMOS™ 5  | BSC040N10NS5      |
|                  |                 | FBSR gate driver          | EiceDRIVER™ non-isolated driver IC                | 2EDF7275F         |
|                  |                 | MCU                       | XMC™ industrial microcontroller family            | XMC4200-F64k256BA |
|                  | QR flyback      | Aux power controller      | CoolSET™  | ICE5QR2280AZ      |

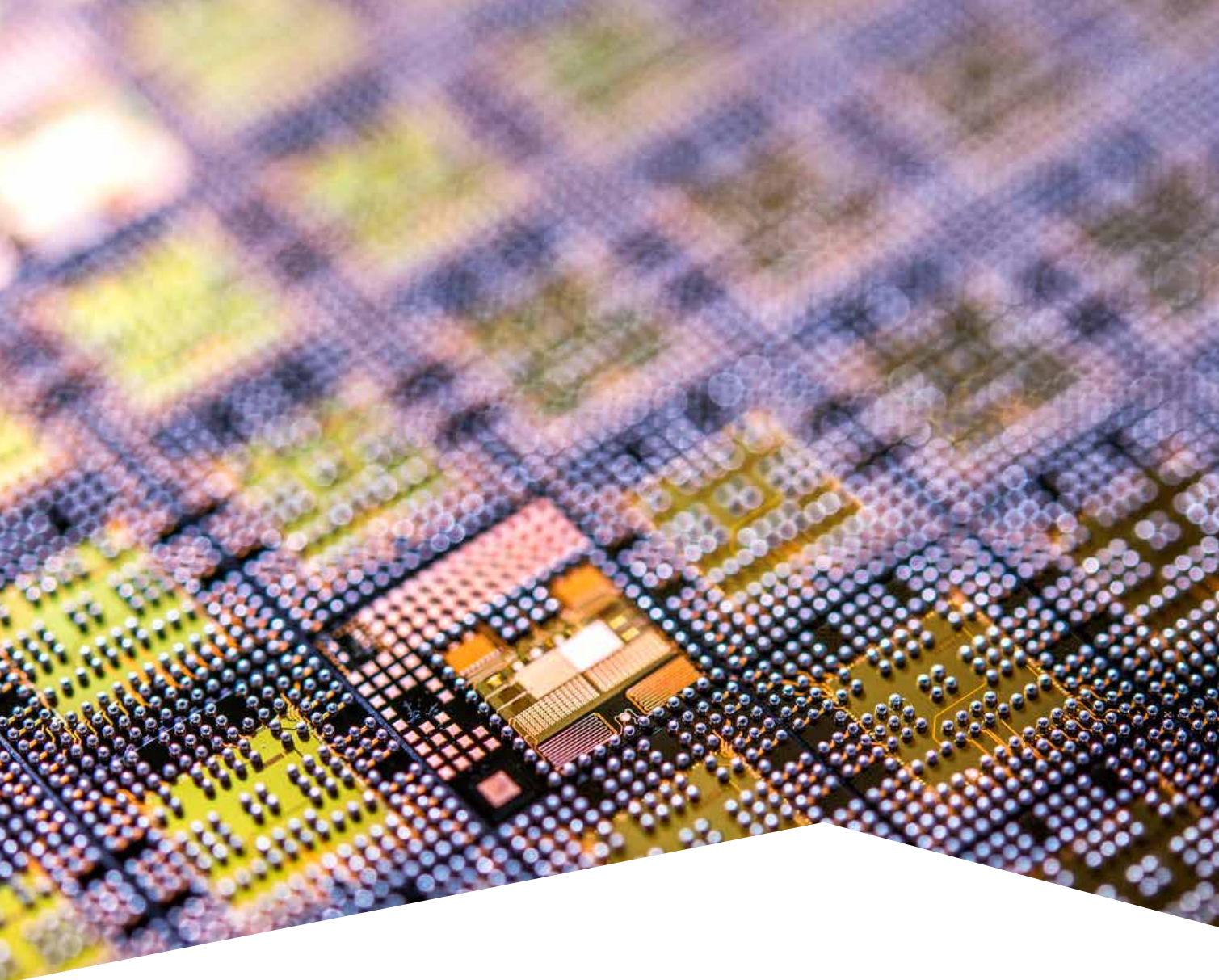
For additional configurations, please refer to [Battery chargers](#).

### 250 W AC-DC offline charger

| Functional block | Topology              | Product category | Product family | Part number  |
|------------------|-----------------------|------------------|----------------|--------------|
| Battery charging | PFC                   | Controller       | XDP™           | XDPS2222     |
|                  |                       | PFC switch       | CoolMOS™ P7    | IPA60R099P7  |
|                  | LLC HV DC-DC          | HB switch        | CoolMOS™ P7    | IPA60R280P7  |
|                  |                       | SR switch        | OptiMOS™       | BSC074N15NS5 |
|                  | QR flyback controller | Aux power IC     | CoolSET™       | ICE5AR4770AG |

For additional configurations, please refer to [Battery chargers](#).





## Products

- 15-300 V MOSFETs
- 500-950 V MOSFETs
- Gate-driver ICs
- Digital Isolators
- Discrete IGBTs and silicon power diodes
- Intelligent power switches and modules
- Microcontrollers
- USB-C controllers and peripherals
- Power management ICs
- Wide bandgap semiconductors
- XENSIV™ sensor technologies for automotive, industrial and consumer applications
- Packages

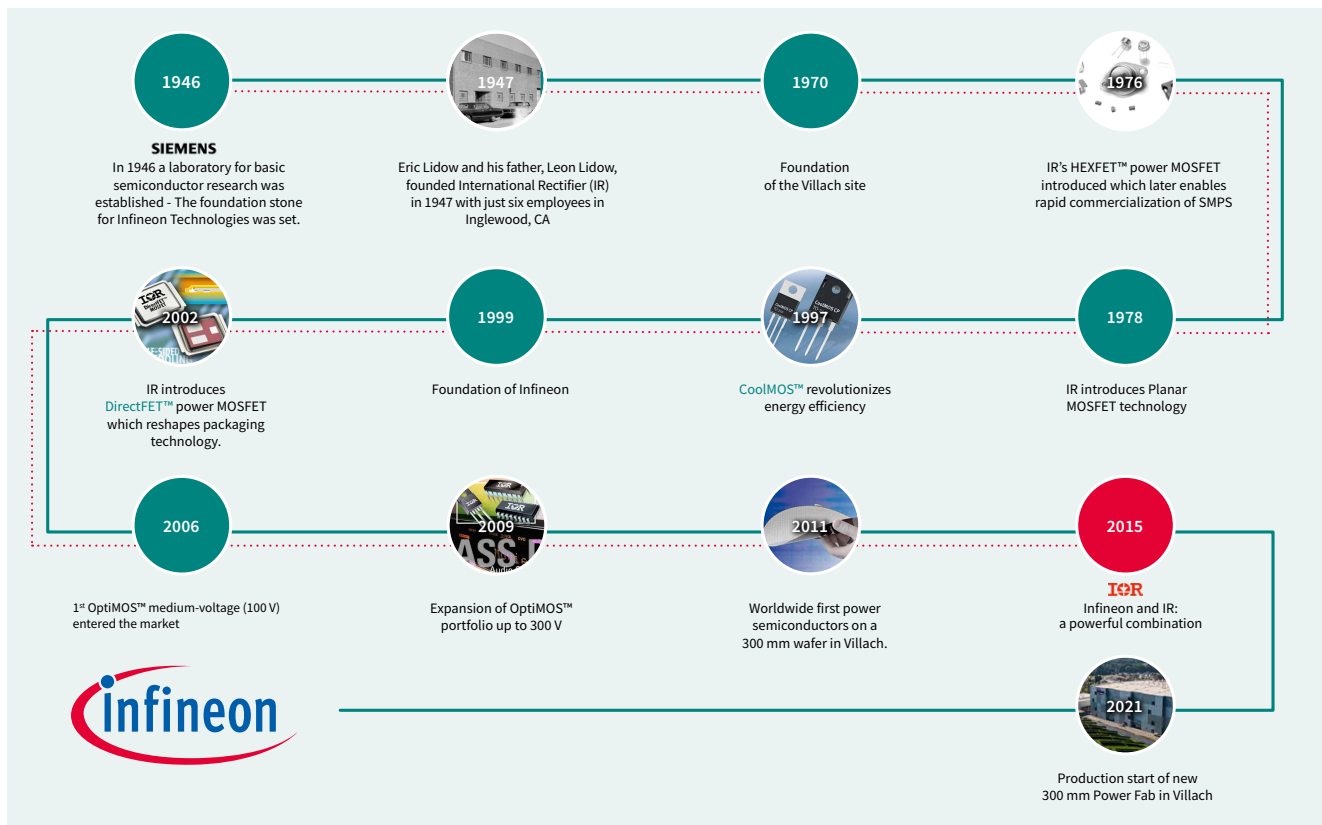


## 15-300 V MOSFETs

- 15-300 V MOSFETs N-channel power MOSFETs
  - Technology development and product family positioning
  - Guidance for applications and voltage classes
  - Space-saving and high-performance packages
  - Discrete packages
  - OptiMOS™ 40 V and 60 V in PQFN 8x6
  - Small-signal/small power MOSFETs -250 to 600 V
- OptiMOS™ power MOSFETs 15-150 V Source-Down
  - OptiMOS™ 6 power MOSFETs 100 V
  - OptiMOS™ PD
  - StrongIRFET™ 2 MOSFETs 40 V/60 V/80 V/100 V
  - TOLx family
  - Product portfolio
  - Nomenclature

# Infineon shapes power for growth through MOSFET innovation

With more than 40 years of experience in power MOSFET innovation, Infineon has led the way in solving the challenges design engineers face on a daily basis while enabling them achieve their targets. Although these targets may have changed over the years, the innovative spirit behind Infineon's product offering has persisted – from device design, technology, package and product development through manufacturing. Looking at the evolution of MOSFETs in the industry, numerous advancements in MOSFET technology have enabled the applications and trends that have become an indispensable part of our lives. Infineon power MOSFET innovation has proven that optimization at the component level brings significant system-level performance advantages and contributes to an easier, safer and greener future.



# OptiMOS™ and StrongIRFET™

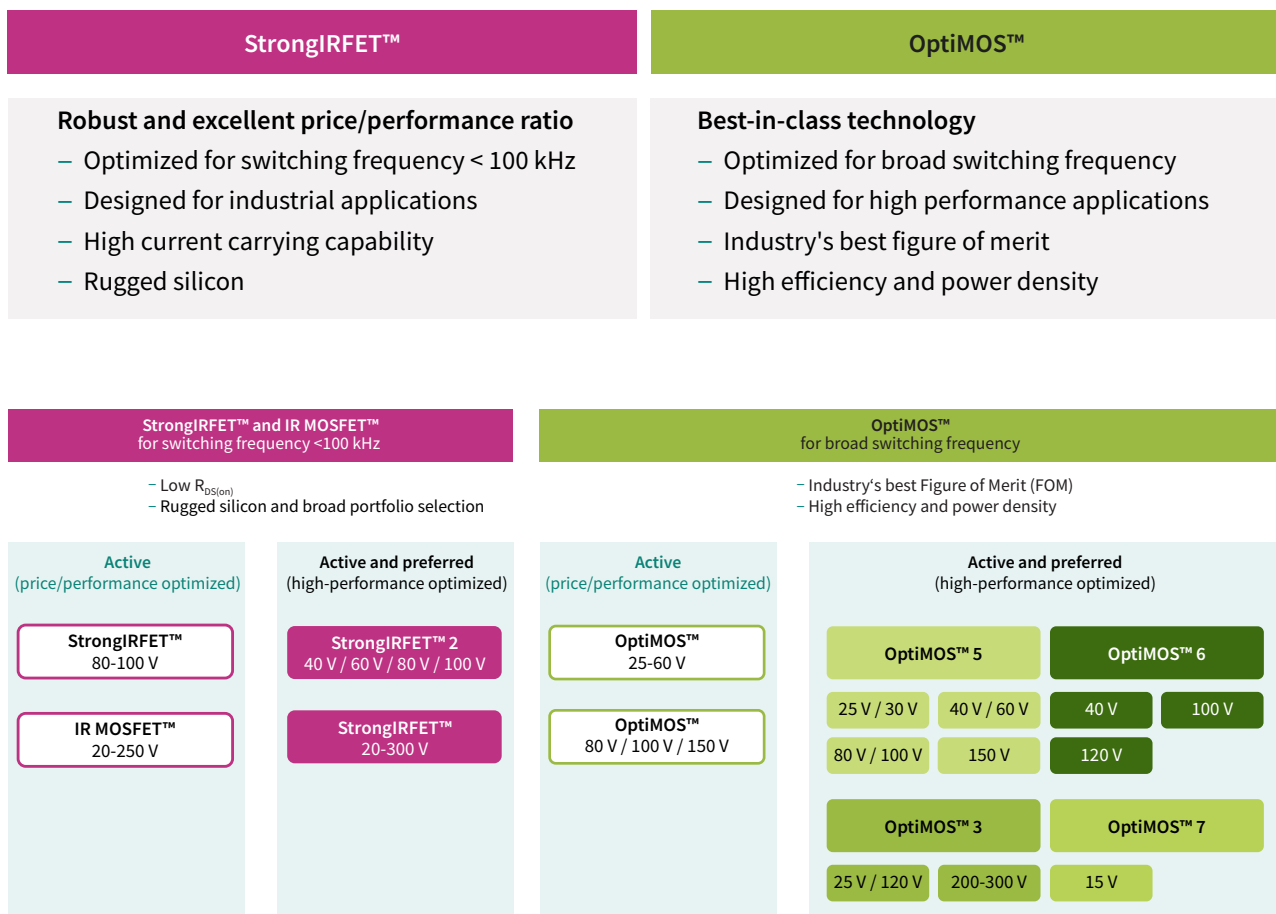
## 15-300 V N-channel power MOSFETs

Infiniteon's semiconductors are designed to bring greater efficiency, power density and cost-effectiveness. The full range of OptiMOS™ and StrongIRFET™ power MOSFETs enables innovation and performance in applications such as switch mode power supplies (SMPS), battery powered applications, motor control, drives, inverters, and computing.

Infiniteon's highly innovative OptiMOS™ and StrongIRFET™ families consistently meet the highest quality and performance demands in key specifications for power system designs such as on-state resistance ( $R_{DS(on)}$ ) and figure of merit (FOM).

OptiMOS™ power MOSFETs provide best-in-class performance. Features include ultra low  $R_{DS(on)}$ , as well as low charge for high switching frequency applications. StrongIRFET™ power MOSFETs are designed for drives applications and are ideal for designs with a low switching frequency, as well as those that require a high current carrying capability.

## Technology development and product family positioning





With more than 40 years of experience in power MOSFET innovation, Infineon offers a broad portfolio of products. The product portfolio is divided into “active and preferred”, referring to the latest technology available offering best-in-class performance, and “active”, consisting of well-established technologies which complete this broad portfolio.

**StrongIRFET™ 2** power MOSFETs are the latest generation to be added to the family. Available in 40 V, 60 V, 80 V and 100 V, this family offers broad availability and excellent price/performance ratio and are suitable for a broad range of applications.

Building on its legacy of innovation, Infineon now unveils the industry’s premier 15 V trench power MOSFETs, using the brand-new OptiMOS™ 7 technology. **The OptiMOS 7 15 V** series primarily targets optimized DC-DC conversion for servers, computing, datacenter, and artificial intelligence applications.

**OptiMOS™ 6** power MOSFETs 40 V, 80 V, 100 V and 120 V are the newest addition to the OptiMOS™ product family. They are the perfect solution when best-in-class (BiC) products and high efficiency over a wide range of output power are required. For other voltage classes, from 15 V up to 150 V, OptiMOS™ 5 represents the latest generation in the market, offering low conduction losses and high switching performance.

For high and low frequency applications OptiMOS™ 3 power MOSFETs is our largest OptiMOS™ family and complements our existing product portfolio as well as providing additional options when best-in-class is not required. **StrongIRFET™** is recommended for 20-300 V applications when the high performance is not essential and the cost is a more significant consideration.

[www.infineon.com/powermosfet-12V-300V](http://www.infineon.com/powermosfet-12V-300V)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).







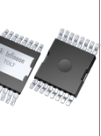











## Guidance for applications and voltage classes

OptiMOS™ and StrongIRFET™ portfolio, covering from 15 up to 300 V MOSFETs, can address a broad range of needs from low to high switching frequencies. The tables below provide a guidance on the recommended OptiMOS™ or StrongIRFET™ products for each major sub-application and voltage class.

| Recommended voltage |   | 15 V to 30 V   | 40 V | 60 V | 75 V to 80 V | 100 V | 120 V to 150 V | 200 V | 250 V | 300 V |   |
|---------------------|---|----------------|------|------|--------------|-------|----------------|-------|-------|-------|---|
| Battery powered     | Low power<br>Power tools, multicopter, battery, industrial drives | OptiMOS™       | ✓    | ✓    | ✓            | ✓     |                |       |       |       |   |
|                     |   | StrongIRFET™   | ✓    | ✓    | ✓            | ✓     |                |       |       |       |   |
|                     | High power<br>(LEV, LSEV)   | OptiMOS™       |      |      | ✓            | ✓     | ✓              | ✓     | ✓     |       |   |
|                     |   | StrongIRFET™   |      |      | ✓            | ✓     | ✓              | ✓     | ✓     |       |   |
| Inverters           | Solar   | OptiMOS™       |      |      | ✓            | ✓     | ✓              | ✓     |       |       |   |
|                     |   | StrongIRFET™   |      |      | ✓            | ✓     | ✓              |       |       |       |   |
|                     | Online UPS  | slow switching |      |      |              |       |                |       |       |       |   |
|                     |   | OptiMOS™       | ✓    | ✓    | ✓            | ✓     | ✓              | ✓     | ✓     | ✓     | ✓ |
|                     |   | StrongIRFET™   | ✓    | ✓    | ✓            | ✓     | ✓              | ✓     | ✓     | ✓     | ✓ |
|                     |   | fast switching |      |      |              |       |                |       |       |       |   |
|                     |   | OptiMOS™       | ✓    | ✓    | ✓            | ✓     | ✓              | ✓     | ✓     | ✓     | ✓ |
|                     |   | StrongIRFET™   | ✓    | ✓    | ✓            | ✓     | ✓              | ✓     | ✓     | ✓     | ✓ |
|                     | Offline UPS   | OptiMOS™       |      | ✓    | ✓            |       |                |       |       |       |   |
|                     |   | StrongIRFET™   |      | ✓    | ✓            |       |                |       |       |       |   |
| SMPS                | Adapter / Charger   | OptiMOS™       |      | ✓    | ✓            | ✓     | ✓              |       |       |       |   |
|                     |   | StrongIRFET™   |      | ✓    | ✓            | ✓     | ✓              |       |       |       |   |
|                     | PC Power  | OptiMOS™       |      | ✓    | ✓            |       |                |       |       |       |   |
|                     |   | StrongIRFET™   |      | ✓    | ✓            |       |                |       |       |       |   |
|                     | LCD TV  | OptiMOS™       |      |      | ✓            | ✓     | ✓              |       |       |       |   |
|                     |   | StrongIRFET™   |      |      | ✓            | ✓     | ✓              |       |       |       |   |
|                     | Server  | OptiMOS™       |      | ✓    | ✓            | ✓     |                |       |       |       |   |
|                     |   | StrongIRFET™   | ✓    | ✓    | ✓            | ✓     |                |       |       |       |   |
|                     | AC-DC   | OptiMOS™       |      |      |              | ✓     | ✓              | ✓     | ✓     |       |   |
|                     |   | StrongIRFET™   |      |      |              | ✓     | ✓              |       |       |       |   |
|                     | Telecom   | OptiMOS™       | ✓    | ✓    | ✓            | ✓     | ✓              | ✓     |       |       |   |
|                     |   | StrongIRFET™   | ✓    | ✓    | ✓            | ✓     | ✓              |       |       |       |   |

## Space-saving and high-performance packages

|  | TO-247  | TO-220  | TO-220 FullPAK  | D <sup>2</sup> PAK  | D <sup>2</sup> PAK 7-pin   | TO-Leadless   | TOLT (Top-side cooling)   | TOLG (Gullwing leads)   |
|--|---|---|---|---|--|---|---|---|
|  |  |  |  |  |  |  |  |  |
|  | Optimized for high power applications and high current capability                 |   |   |   |  |   |   |   |
| Special features                           |   |   |   |   |  |   | Optimized for top-side cooling  | Optimized for TCoB <sup>1)</sup> robustness   |
| Height [mm]                                | 5.0   | 4.4   | 4.5   | 4.4   | 4.4  | 2.3   | 2.3   | 2.3   |
| Outline [mm]                               | 40.15 x 15.9  | 29.5 x 10.0   | 29.5 x 10.0   | 15.0 x 10.0   | 15.0 x 10.0  | 11.7 x 9.9  | 15.0 x 9.9  | 11.7 x 9.9  |
| Thermal resistance R <sub>thJC</sub> [K/W] | 2.0   | 0.5   | 2.5   | 0.5   | 0.5  | 0.4   | 0.4   | 0.4   |

|  | sTOLL  | SuperSO8   | SuperSO8 dual-side cooling (DSC)   | Power Block  | PQFN 3.3x3.3 Source-Down  | PQFN 3.3x3.3   | PQFN 2x2   | DirectFET™   |
|--|--|--|--|--|---|--|--|--|
|  |  |  |  |  |  |  |  |  |
|  | Optimized for high power in small form factor                                      | For highest efficiency and power management  | Optimized for dual-side cooling  | Significant design shrink  | Highest power density per area  | High efficiency in small form factor   | Enables significant space saving   | Optimized for dual side cooling  |
| Height [mm]                                | 2.3  | 1.0  | 0.75   | 5.0 x 6.0: 1.0<br>6.3 x 6.0: 0.9<br>6.3 x 6.0 DSC: 0.7                             | 1.0   | 1.0  | 0.9  | Small: 0.65<br>Medium: 0.65<br>Large: 0.71   |
| Outline [mm]                               | 8.0 x 7.0  | 5.15x6.15  | 5.0 x 6.0  | 5.0 x 6.0<br>6.3 x 6.0   | 3.3 x 3.3   | 3.3 x 3.3  | 2.0 x 2.0  | Small: 4.8 x 3.8<br>Medium: 6.3 x 4.9<br>Large: 9.1 x 6.98                           |
| Thermal resistance R <sub>thJC</sub> [K/W] | 0.6  | 0.8  | 0.5  | 1.5  | 1.4   | 3.2  | 11.1   | 0.5  |

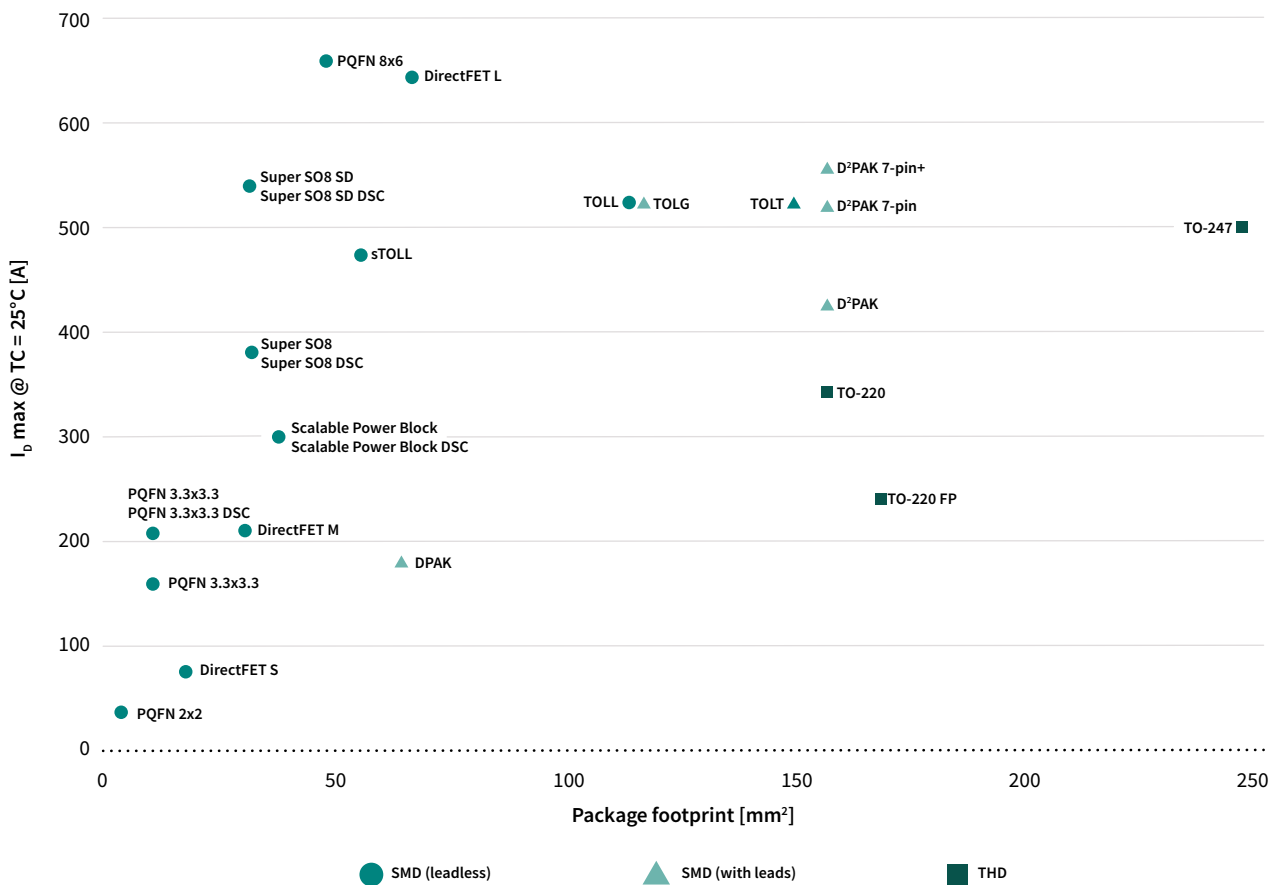


## Discrete packages

Infiniteon has been making an impact in the MOSFET industry with innovation in MOSFET manufacturing techniques and processes as well as pioneering new packages to meet the changing demands of cutting-edge designs in various applications. OptiMOS™ and StrongIRFET™ technologies are available in different packages to address demands for high current carrying capability and significant space saving. The broad portfolio enables footprint reduction, boosted current rating and optimized thermal performance. While the surface mount leadless devices are enabled for footprint reduction, through-hole packages are characterized by a high-power rating.

Infiniteon offers innovative packages such as DirectFET™ and TO-Leadless (TOLL). DirectFET™ is designed for high frequency applications by offering the lowest parasitic resistance. This package is available in three different can sizes: small, medium and large. TO-Leadless is optimized to dissipate power up to 375 W, increasing power density with a substantial reduction in footprint.

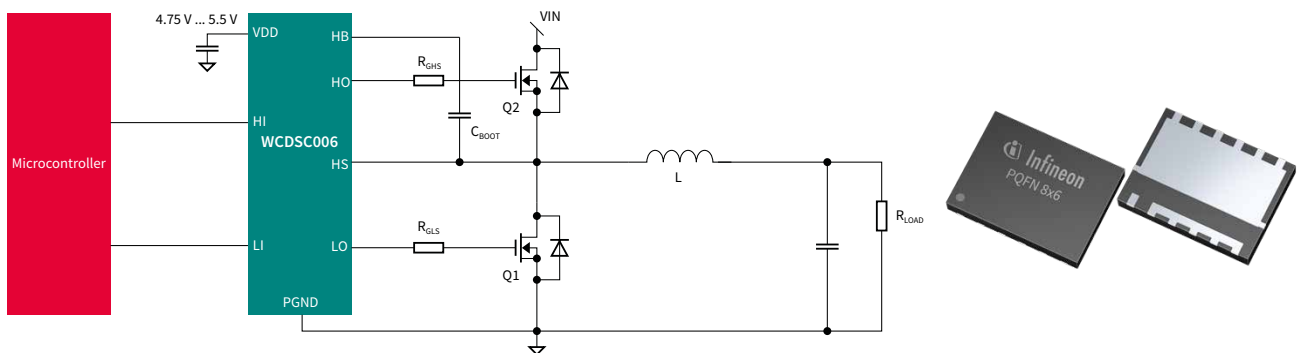
New package innovations include the SuperSO8 Source-Down package offering high power density and performance; the TOLG (Gullwing leads) optimized for TCoB (Thermal cycling on board) robustness; TOLT (top-side cooling) optimized for superior thermal performance; sTOLL optimized for high power in small form factor; and the SuperSO8 dual-side cooling (DSC) optimized for dual-side cooling in a standard 5x6 mm<sup>2</sup> footprint.



# OptiMOS™ 40 V and 60 V in PQFN 8x6

## A high-power density package family

Infiniteon's family of OptiMOS™ N-channel power MOSFETs in PQFN 8 x 6 packages are benchmark products optimized for very low  $R_{DS(on)}$  and high-current capability, alongside Infineon's renowned quality standard for robust industry designs. This makes the PQFN 8 x 6 MOSFET package the ideal solution for various battery powered, battery protection, and battery formation applications requiring low package resistance and high-current handling MOSFETs. The PQFN 8 x 6 family of MOSFETs is available in a small 8x6 mm leadless package to reduce the physical footprint and overall BOM of end products. The improved  $R_{DS(on)}$  and  $I_D$  ratings, continuous and pulsed, enable increased battery run time and higher power density.



## Features and benefits

### Key features

- >50% reduction in footprint compared to TOLL
- Best-in-class continuous current rating and competitive avalanche energy rating
- Excellent package area utilization
- Ultra low package parasitics
- Footprint compatability with SuperSO8 5x6

### Key benefits

- Power density increase enabling higher power designs while maintaining the space constraints
- Good design margin in worst case conditionals (e.g. in-rush motor stall/short)
- Ultra low  $R_{DS(on)}$  with good thermal resistance  $R_{th(jc)}$
- EMI improvement due to lower device parasitics
- Simple PCB design change based on SuperSO8 provides scalability across varying power requirements



# Small-signal/small-power MOSFETs -250 to 600 V

## Combining latest high-performance silicon technology with small and innovative packaging

Small-signal/small power products are ideally suited for space-constrained automotive and non-automotive applications. With an optimal price/performance ratio and small footprint packages, Infineon's small-signal and small-power MOSFETs are the best fit for a wide range of applications and circuits. These include **low-voltage drives**, **linear battery charger**, **battery protection**, load switches, DC-DC converters, reverse polarity protection and many more.

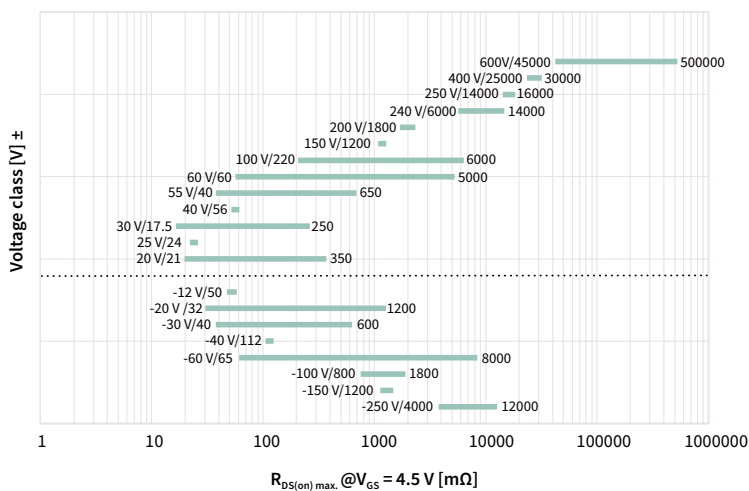
### The entire family includes different packages:

SOT-223, SOT-23, SOT-323, SOT-363, SOT-89, TSOP-6 and SC59

The product portfolio covers N-channel and P-channel enhancement mode MOSFETs as well as N-channel depletion mode products:

- 250 V to -12 V P-channel enhancement mode (available in single and dual configurations)
- 20 V to 600 V N-channel enhancement mode (available in single and dual configurations)
- 20/+20 V and -30/+30 V complementary (P + N channel) enhancement mode
- 60 V to 600 V N-channel depletion mode

| Key features  | Key benefits  |
|---|---|
| - Products available in Automotive, Industrial and Standard qualification levels    | - Suitable for automotive and high quality demanding applications |
| - Four $V_{GS(th)}$ classes available for 1.8 V, 2.5 V, 4.5 V, and 10 V gate drives | - Easy interface to MCU   |
| - ESD protected P-channel parts   | - Reduction of design complexity                                  |
| - $V_{DS}$ range from -250 V to 600 V   | - Wide selection of products available                            |
| - RoHS compliant and halogen free   | - Environmentally friendly  |



Small-signal/small-power MOSFETs are available in seven industry-standard package types ranging from the largest SOT-223 to the smallest SOT-323.

Products are offered in single, dual and complementary configurations and are suitable for a wide range of applications, including **battery protection**, **LED lighting**, **low-voltage drives** and DC-DC converters.






[www.infineon.com/smallsignal](http://www.infineon.com/smallsignal)  
[www.infineon.com/smallpower](http://www.infineon.com/smallpower)

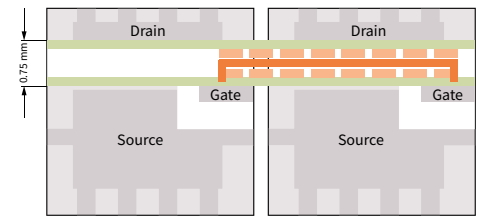
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

# OptiMOS™ power MOSFETs 15 -150 V Source-Down

## An innovative PQFN 3.3 mm x 3.3 mm product family

Once again, Infineon is setting a new standard in MOSFET performance with the new **Source-Down** package to support the requirement for high power density and optimized system-level efficiency. In comparison with a normal Drain-Down device, in the **Source-Down** technology, the source potential is connected to the thermal pad. The OptiMOS™ power MOSFET 3.3x3.3 mm<sup>2</sup> **Source-Down** packages are now available in 15 V-150 V in BSC (bottom-side cooling) and in DSC (dual-side cooling). The latest addition to the family is the OptiMOS™ power MOSFET 5x6 mm<sup>2</sup> **Source-Down**, available in BSC. Optional Center-Gate footprint is also available for both families. Here the gate pin is moved to the center supporting easy parallel configuration of multiple MOSFETs. With the larger drain-to-source creepage distance, it is possible to connect the gates of multiple devices on a single PCB layer.

|                  | Standard Drain-Down   | New Source-Down Bottom-Side Cooling  | New Source-Down dual-side cooling  |
|------------------|---|--|--|
|                  |  |     |     |
|                  | PQFN 3.3 x 3.3 mm standard Drain-Down footprint                                   | PQFN 3.3 x 3.3 mm Available in Standard and Center-Gate <b>Source-Down</b> footprint | PQFN 3.3 x 3.3 mm Available in Standard and Center-Gate <b>Source-Down</b> footprint |
| $R_{thJC}$ [C/W] | 1.8°C/W   | 1.4°C/W  | 1.4°C/W  |



## Features and benefits

### Key features

- Major reduction in  $R_{DS(on)}$ , up to 30% due to larger silicon die in same package outline
- Improved  $R_{thJC}$  overcurrent PQFN package technology
- High power density
- Standard-Gate and Center-Gate footprint options
- Available in standard and logic level options

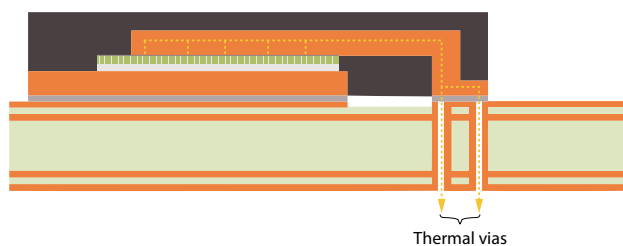
### Key benefits

- Enabling highest power density and performance
- Superior thermal performance
- Form factor reduction
- Optimized layout possibilities
- Simplifying parallel configuration of multiple MOSFETs with Center-Gate footprints
- Simplified gate drive

## Optimized thermal management

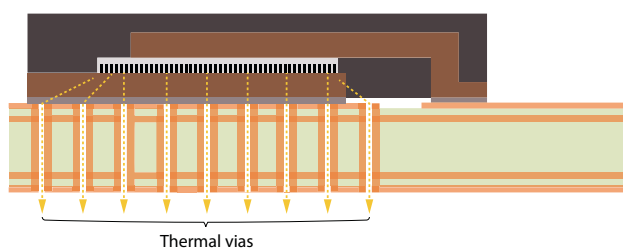
### Drain-Down

#### PQFN 3.3x3.3



### Source-Down

#### PQFN 3.3x3.3



In the **Source-Down** package technology, the heat is dissipated directly into the PCB through a thermal pad instead of over the bond wire or the copper clip. The package significantly improves the thermal resistance ( $R_{thJC}$ ) of this product family. In most cases, thermal vias cannot be used on the thermal pad if it is connected to the noisy switch node potential. With **Source-Down**, the thermal pad of the low-side MOSFET is now on the ground potential enabling the use of thermal vias right underneath the device. This considerably improves the thermal performance and the power density in the end application.

[www.infineon.com/PQFN-3-source-down](http://www.infineon.com/PQFN-3-source-down)



Drives



Server



Telecom



SMPS



BMS

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# OptiMOS™ 6 power MOSFETs 100 V

## Next generation of cutting-edge MOSFETs

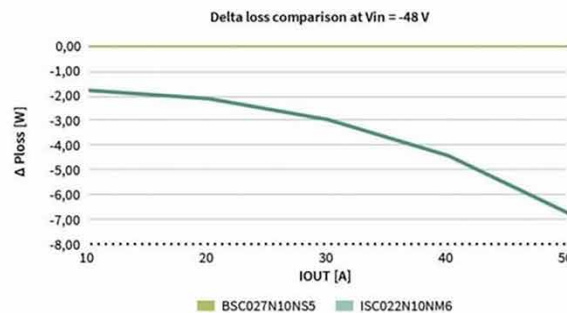
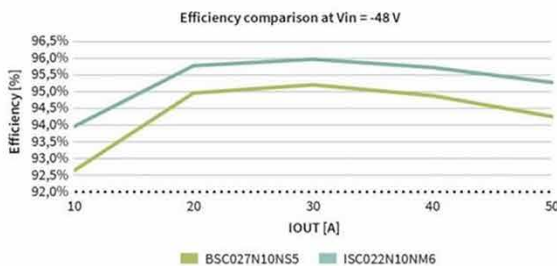
OptiMOS™ 6 100 V devices are setting a new technology standard in the field of discrete MOSFET devices. Compared to alternative products, Infineon's leading thin wafer technology enables significant performance benefits compared to OptiMOS™ 5:

- $R_{DS(on)}$  reduced by 22%
- Improved FOM  $Q_G \times R_{DS(on)}$  by 37%
- Improved FOM  $Q_{Gd} \times R_{DS(on)}$  by 38%

Infineon's OptiMOS™ 6 power MOSFET 100 V family offers an optimized solution for synchronous rectification in switched mode power supplies (SMPS) in servers, desktop PCs, wireless and quick chargers. The improved performance in on-state resistance ( $R_{DS(on)}$ ) and figure of merits (FOM -  $R_{DS(on)} \times Q_G$  and  $Q_{Gd} \times R_{DS(on)}$ ) yields an efficiency improvement, allowing easier thermal design and less paralleling, leading to system cost reduction. In addition, the best-in-class  $R_{DS(on)}$  and high switching performance makes these devices suitable for telecom applications.

Infineon's market-leading OptiMOS™ 6 power MOSFETs 100 V are available in two different packages:

- SuperSO8 – 5x6 mm<sup>2</sup> with  $R_{DS(on)}$  ranging from 23 mΩ down to 2.2 mΩ
- PQFN 3x3 – 3.3 x 3.3 mm<sup>2</sup> with  $R_{DS(on)}$  ranging from 23 mΩ down to 8 mΩ



Target applications include a ZVS inverting buck-boost (-36...60) V to 12 V DC-DC converter. In this topology, an active clamp circuit recovers, in a lossless way,  $Q_{rr}$  from the SR switch towards the output, while achieving zero-voltage switching for the control switch.

Best-in-class products in the newly released OptiMOS™ 6 technology (ISC022N10NM6) are compared to OptiMOS™ 5 (BSC027N10NS5) in SuperSO8 (PQFN 5x6) package in this application. The result is stunning: OptiMOS™ 6 in 2.2 mΩ achieves roughly 1% better efficiency across all the line and load conditions, compared to the 2.7 mΩ product in OptiMOS™ 5.

The improvement in efficiency is explainable as the joint contribution of the lower driving losses (thanks to approximately 20% lower (typ)  $Q_G$ ) lower turn-off losses (due the lower  $Q_{Gd}$  – an improvement just shy of 40%) and lower conduction losses with a 18% lower  $R_{DS(on)}$ . The improvement in efficiency lowers the total losses by 7 W, a remarkable improvement allowing easier thermal management and increased power density. ISC022N10NM6 represents the lowest  $R_{DS(on)}$  available in the market for SuperSO8 (PQFN 5x6) package in 100 V.

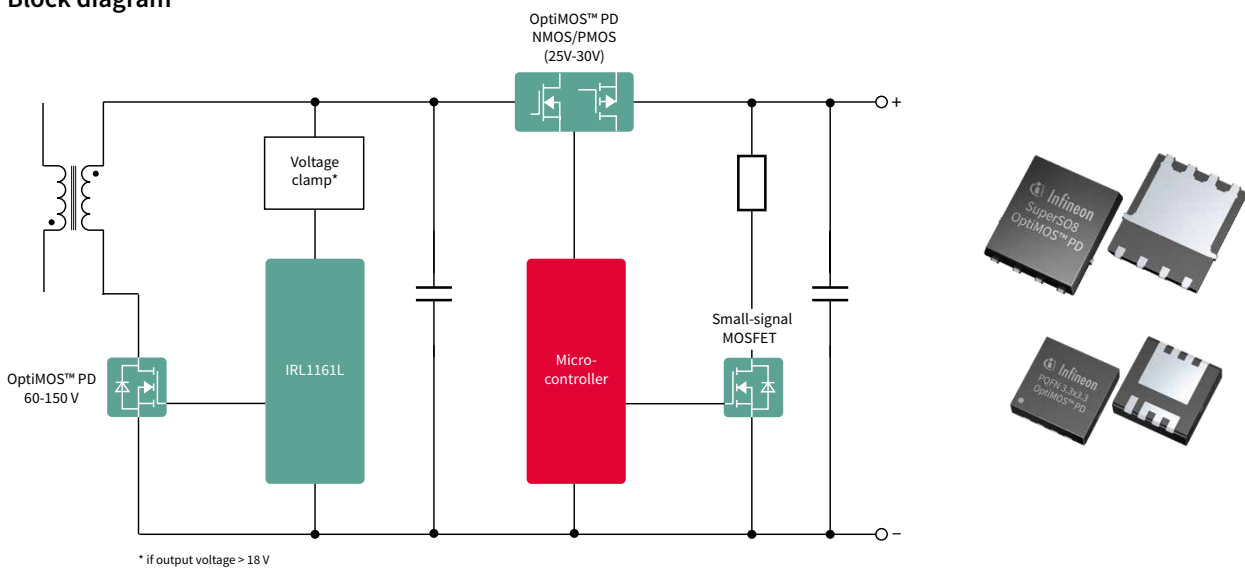


# OptiMOS™ PD

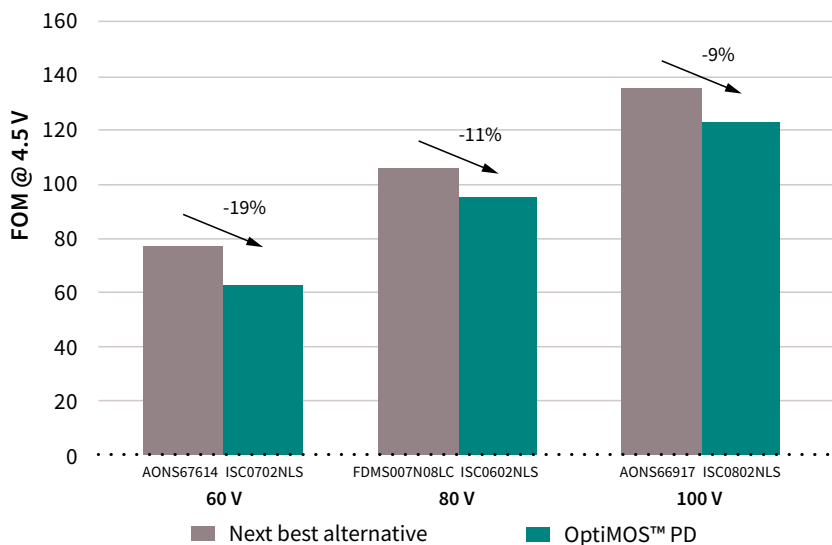
## The best fit for USB-PD and fast charger designs

OptiMOS™ PD is Infineon's new MOSFET portfolio representing the best fit for USB-PD and fast charger designs and is available in 2 small standard packages: PQFN 3.3x3.3 and SuperSO8. Logic level availability enables parts to be fully driven from 4.5 V or directly from microcontrollers resulting in a lower part count in the application. The portfolio ranges from 25 V up to 150 V MOSFETs where 25 V and 30 V products represent the fit as load switch and 60-150 V parts are the optimal choice to function as synchronous rectification FETs in charger and adapter designs.

### Block diagram



### OptiMOS™ PD comparison of $R_{DS(on)}$ in 60 V, 80 V and 100 V



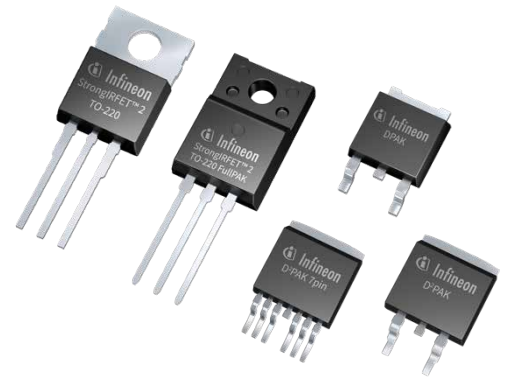
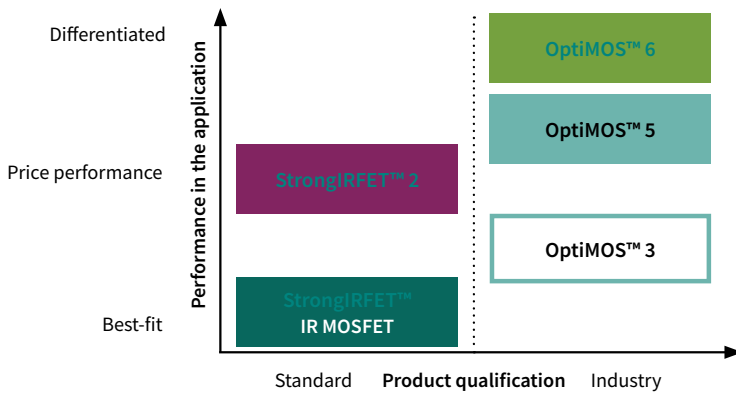
The OptiMOS™ PD family features MOSFETs offering a low on-state resistance ( $R_{DS(on)}$ ), less switching losses as well as low gate-, output- and reverse-recovery charges. The reduction in overall losses results in an excellent price/performance ratio leading to a decrease in total system BOM cost.



# StrongIRFET™ 2 MOSFETs – 40 V/60 V/80 V/100 V

## Right-fit products for a broad range of applications

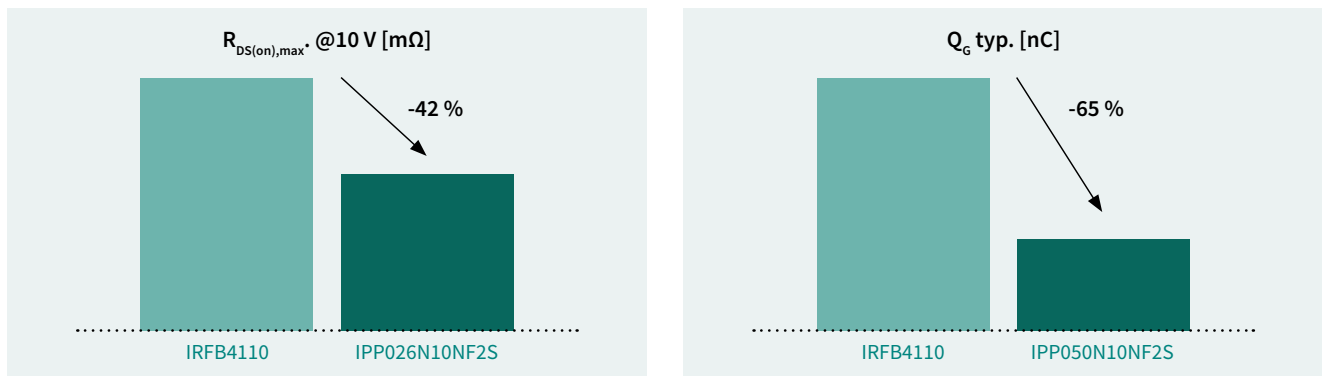
The new StrongIRFET™ 2 power MOSFETs are the latest generation of MOSFET technology addressing a wide range of applications such as adapters, motor drives, e-scooters, battery management systems, light electric vehicles, robotics, power and gardening tools. Featuring broad availability and excellent price/performance ratio, this new technology offers right-fit products with an easy choice for designers interested in convenient selection and purchasing. Optimized for both low- and high-switching frequencies, the family supports a broad range of applications enabling flexibility in design.



### Features and benefits

| Key features                                    | Key benefits                                      |
|---|---|
| – Broad availability from distribution partners | – Increased security of supply                    |
| – Excellent price/performance ratio             | – Right-fit products                              |
| – Ideal for high and low switching frequency    | – Supports wide variety of applications           |
| – Industry standard footprint                   | – Standard pin out allows for drop-in replacement |
| – High current rating                           | – Increased product ruggedness                    |

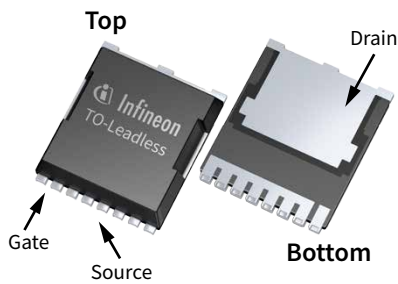
### StrongIRFET™ 2 vs. previous generation 100 V performance comparison



Compared to the previous StrongIRFET™ generation in 100 V TO-220 package, StrongIRFET™ 2 shows significant improvements such as ~40% lower  $R_{DS(on)}$  and ~65% reduced  $Q_g$ . This results in better efficiency and longer life time.



# TOLx family



## TO-Leadless (TOLL)

### Optimized for high power applications

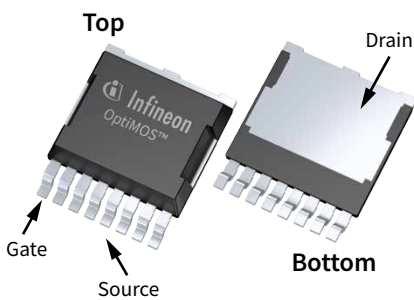
TO-Leadless is optimized to handle currents up to 500 A, increasing power density with a substantial reduction in footprint. A footprint reduction of 30% compared to D<sup>2</sup>PAK, together with a height reduction of 50%, results in an overall space saving of 60% enabling much more compact designs.

#### Key features

- Best-in-class technology
- High current rating > 500 A
- 60% space reduction compared to D<sup>2</sup>PAK 7-pin

#### Key benefits

- High performance capability
- High system reliability
- Optimized board utilization



## TOLG (Gullwing leads)

### Optimized for better TCoB robustness

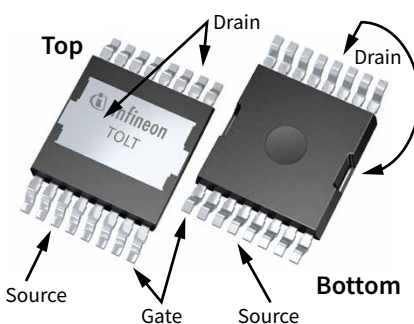
TOLG package offers a compatible footprint to the TO-Leadless with the additional feature of Gullwing leads resulting in two times higher TCoB performances compared to TO-Leadless. This package is excellent on aluminum insulated metal substrate boards (Al-IMS).

#### Key features

- Best-in-class technology
- High current rating > 450 A
- Low ringing and voltage overshoot
- 60% space reduction compared to D<sup>2</sup>PAK 7-pin
- Gullwing leads

#### Key benefits

- High performance capability
- High system reliability
- High efficiency and lower EMI
- Optimized board utilization
- High thermal cycling on board performance



## TOLT (Top-side cooling)

### Optimized for superior thermal performance

TOLT is the new top-side cooling package within the TOLx family. With top-side cooling, the drain is exposed at the surface of the package allowing for 95 percent of the heat to be dissipated directly to the heatsink, achieving 20 percent better  $R_{thJA}$  and 50 percent improved  $R_{thJC}$  compared to the TOLL package. With bottom-side cooling packages, like the TOLL or the D<sup>2</sup>PAK, the heat is dissipated via the PCB to the heatsink resulting in high power losses.

#### Key features

- Low  $R_{DS(on)}$
- High current rating
- Top-side cooling
- Negative standoff

#### Key benefits

- Reduction in conduction losses
- Increased product ruggedness
- Superior thermal performance
- Minimize thermal resistance to heatsink

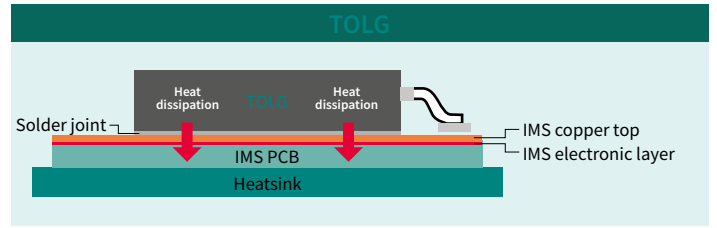
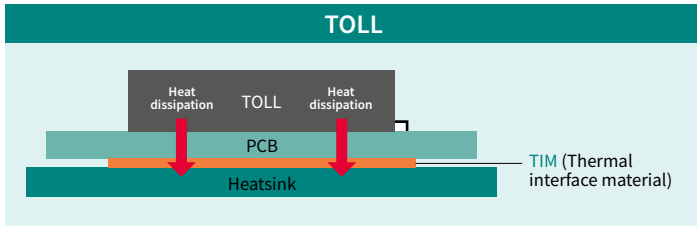
[www.infineon.com/toll](http://www.infineon.com/toll)  
[www.infineon.com/tolg](http://www.infineon.com/tolg)  
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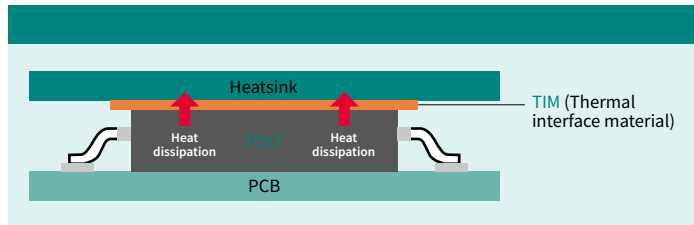




## TOLx family – Cooling concept



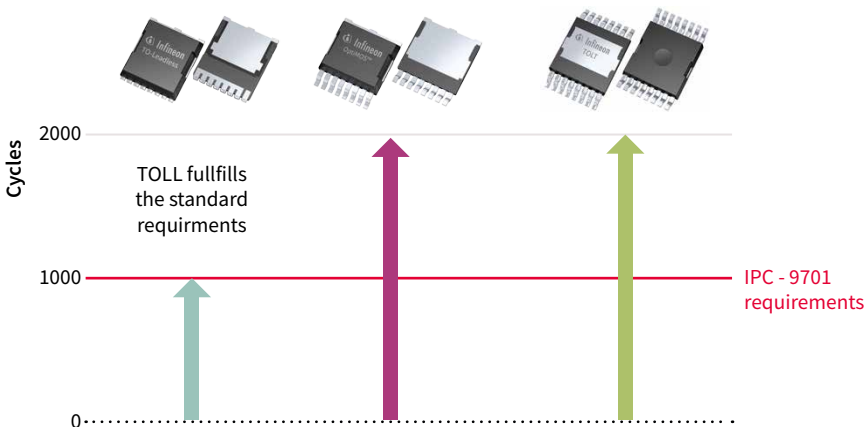
With TOLL/TOLG, board mounting, the heat is dissipated through the PCB to the heatsink. Due to the PCB thermal resistance, power losses occur.



With top-side cooling setup, the drain pad is exposed on the top of the package allowing the majority of the heat to be dissipated into the top-mounted heatsink. This pulls heat away from the PCB resulting in at least 20 percent better  $R_{thJA}$  compared to standard over-molded TOLL.



### Thermal cycling on IMS board (TCoB) performance



[www.infineon.com/optimos-tolg](http://www.infineon.com/optimos-tolg)  
[www.infineon.com/optimos-tolt](http://www.infineon.com/optimos-tolt)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## OptiMOS™ 7 15 V logic level



| $R_{DS(on),max}$<br>@ $V_{GS}=4.5\text{ V}$<br>[mΩ] | Source-Down<br>PQFN 3.3x3.3  | Source-Down<br>PQFN 3.3x3.3 dual-side  | PQFN 2x2   |
|---|--|--|--|
| < 1   | IQE004NE1LM7<br>$R_{DS(on)}=0.57\text{ m}\Omega$<br>IQE004NE1LM7CG<br>$R_{DS(on)}=0.57\text{ m}\Omega$ | IQE004NE1LM7SC<br>$R_{DS(on)}=0.57\text{ m}\Omega$<br>IQE004NE1LM7CGSC<br>$R_{DS(on)}=0.57\text{ m}\Omega$ |  |
| 2-4   |  |  | ISK018NE1LM7<br>$R_{DS(on)}=2.15\text{ m}\Omega$ |

## OptiMOS™ and StrongIRFET™ 20 V (super) logic level



| $R_{DS(on),max}$<br>@ $V_{GS}=4.5\text{ V}$<br>[mΩ] | PQFN 2x2   | PQFN 3.3x3.3  | SuperSO8  |
|---|--|---|---|
| < 1   |  |   | IRFH6200TRPBF <sup>1)</sup><br>$R_{DS(on)}=0.99\text{ m}\Omega$ |
| 2-4   |  | IRLHM620TRPBF <sup>** 1)</sup><br>$R_{DS(on)}=2.5\text{ m}\Omega$ |   |
| > 10  | IRLHS6242TRPBF<br>$R_{DS(on)}=11.7\text{ m}\Omega$<br>IRLHS6276TRPBF<br>$R_{DS(on)}=45\text{ m}\Omega$ |   |   |

## OptiMOS™ and StrongIRFET™ 25 V logic level



| $R_{DS(on),max}$<br>@ $V_{GS}=10\text{ V}$<br>[mΩ] | DirectFET™  | PQFN 2x2  | PQFN 3.3x3.3   | SuperSO8  | Source-Down<br>PQFN 3.3x3.3                        | Source-Down PQFN<br>3.3x3.3 dual-side<br>cooling (DSC) | Source-Down<br>PQFN 5x6                            |
|--|---|---|--|---|--|--|--|
| < 1  |   |   |  | BSC004NE2LS5<br>$R_{DS(on)}=0.45\text{ m}\Omega$              | IQE006NE2LM5<br>$R_{DS(on)}=0.65\text{ m}\Omega$   | IQE006NE2LM5CGSC<br>$R_{DS(on)}=0.58\text{ m}\Omega$   | IQDH29NE2LM5CG<br>$R_{DS(on)}=0.29\text{ m}\Omega$ |
|  | IRF6717MTRPBF<br>$R_{DS(on)}=0.95\text{ m}\Omega$ |   |  | BSC009NE2LS5<br>$R_{DS(on)}=0.9\text{ m}\Omega$               | IQE006NE2LM5CG<br>$R_{DS(on)}=0.65\text{ m}\Omega$ | IQE006NE2LM5SC<br>$R_{DS(on)}=0.58\text{ m}\Omega$     |  |
|  |   |   | BSZ009NE2LS5<br>$R_{DS(on)}=0.9\text{ m}\Omega$                  | BSC009NE2LS5 <sup>*</sup><br>$R_{DS(on)}=0.95\text{ m}\Omega$ |  |  |  |
|  |   |   | BSZ010NE2LS5<br>$R_{DS(on)}=1.0\text{ m}\Omega$                  | BSC010NE2LS<br>$R_{DS(on)}=1.0\text{ m}\Omega$                |  |  |  |
|  |   |   | BSZ011NE2LS5I<br>$R_{DS(on)}=1.1\text{ m}\Omega$                 | BSC010NE2LSI <sup>*</sup><br>$R_{DS(on)}=1.05\text{ m}\Omega$ |  |  |  |
|  |   |   |  | BSC014NE2LSI <sup>*</sup><br>$R_{DS(on)}=1.4\text{ m}\Omega$  |  |  |  |
|  |   |   | BSZ013NE2LS5I <sup>*</sup><br>$R_{DS(on)}=1.3\text{ m}\Omega$    |   |  |  |  |
|  |   |   | BSZ014NE2LS5IF <sup>**</sup><br>$R_{DS(on)}=1.45\text{ m}\Omega$ | BSC015NE2LS5I <sup>*</sup><br>$R_{DS(on)}=1.5\text{ m}\Omega$ |  |  |  |
|  |   |   | BSZ017NE2LS5I <sup>*</sup><br>$R_{DS(on)}=1.7\text{ m}\Omega$    | BSC018NE2LS<br>$R_{DS(on)}=1.8\text{ m}\Omega$                |  |  |  |
|  |   |   | BSZ018NE2LS<br>$R_{DS(on)}=1.8\text{ m}\Omega$                   |   |  |  |  |
| 2-4  |   | ISK024NE2LM5<br>$R_{DS(on)}=2.4\text{ m}\Omega$ | BSZ031NE2LS5<br>$R_{DS(on)}=3.1\text{ m}\Omega$                  | BSC024NE2LS<br>$R_{DS(on)}=2.4\text{ m}\Omega$                |  |  |  |
|  |   |   | BSZ033NE2LS5<br>$R_{DS(on)}=3.3\text{ m}\Omega$                  | BSC026NE2LS5<br>$R_{DS(on)}=2.6\text{ m}\Omega$               |  |  |  |
|  |   |   | BSZ036NE2LS<br>$R_{DS(on)}=3.6\text{ m}\Omega$                   | BSC032NE2LS<br>$R_{DS(on)}=3.2\text{ m}\Omega$                |  |  |  |
| 4-10   |   |   | BSZ060NE2LS<br>$R_{DS(on)}=6.0\text{ m}\Omega$                   | BSC050NE2LS<br>$R_{DS(on)}=5.0\text{ m}\Omega$                |  |  |  |
| > 10   |   |   |  |   |  |  |  |

[www.infineon.com/powermosfet-12V-300V](http://www.infineon.com/powermosfet-12V-300V)

<sup>\*</sup> Optimized for resonant applications (e.g. LLC converter)

<sup>\*\*</sup> Monolithically-integrated Schottky-like diode

<sup>\*\*\*</sup>  $R_{DS(on),max}$  @  $V_{GS}=4.5\text{ V}$

1) 2.5  $V_{GS}$  capable

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## OptiMOS™ 25 V in Power Block 5x6



| Part number | Package  | Monolithically-integrated Schottky-like diode | BV <sub>DSS</sub> [V] | R <sub>DS(on),max.</sub> [mΩ] @ V <sub>GS</sub> =4.5 V max. |          | Q <sub>G</sub> [nC] @ V <sub>GS</sub> =4.5 V typ. |          |
|-------------|----------|---|-----------------------|---|----------|---|----------|
|             |          |   |                       | High-side   | Low-side | High-side   | Low-side |
| BSG0810NDI  | SuperSO8 | ✓   | 25                    | 4.0   | 1.2      | 5.6   | 16.0     |
| BSG0811ND   | SuperSO8 | –   | 25                    | 4.0   | 1.1      | 5.6   | 20.0     |
| BSG0813NDI  | SuperSO8 | ✓   | 25                    | 4.0   | 1.7      | 5.6   | 12.0     |

## OptiMOS™ 25/30 V symmetrical and asymmetrical dual N-channel MOSFETs in 5x6 and 3x3 PQFN

Integrates the low-side and high-side MOSFET of a synchronous DC-DC converter into a single package. The small outline and the interconnection of the two MOSFETs within the package minimize the loop inductance which boosts efficiency.

| Part number | Package               | Monolithically-integrated Schottky-like diode | BV <sub>DSS</sub> [V] | R <sub>DS(on),max.</sub> [mΩ] @ V <sub>GS</sub> =4.5 V max. |          | Q <sub>G</sub> [nC] @ V <sub>GS</sub> =4.5 V typ. |          |
|-------------|-----------------------|---|-----------------------|---|----------|---|----------|
|             |                       |   |                       | High-side   | Low-side | High-side   | Low-side |
| BSC0911ND*  | asymmetrical dual 5x6 | –   | 25                    | 4.8   | 1.7      | 7.7   | 25       |
| BSC0921NDI* | asymmetrical dual 5x6 | ✓   | 30                    | 7   | 2.1      | 5.8   | 21       |
| BSC0923NDI* | asymmetrical dual 5x6 | ✓   | 30                    | 7   | 3.7      | 5.2   | 12.2     |
| BSC0924NDI* | asymmetrical dual 5x6 | ✓   | 30                    | 7   | 5.2      | 5.2   | 8.6      |

## OptiMOS™ 40 V, 60 V and 100 V in Symmetrical Power Block 6.3x6.3

| Part number                    | Package             | Dual-side cooling | BV <sub>DSS</sub> [V] | R <sub>DS(on)</sub> [mΩ] @ V <sub>GS</sub> = 10 V max | Q <sub>G</sub> [nC] @ V <sub>GS</sub> = 10 V typ. |
|--------------------------------|---------------------|-------------------|-----------------------|---|---|
| ISG0613N04NM6H <sup>1)</sup>   | Power Block 6.3x6.0 | –                 | 40V                   | 0,88  | 69  |
| ISG0613N04NM6HSC <sup>1)</sup> | Power Block 6.3x6.0 | ✓                 | 40V                   | 0,88  | 69  |
| ISG0614N06NM5H <sup>1)</sup>   | Power Block 6.3x6.0 | –                 | 60V                   | 1,61  | 68  |
| ISG0614N06NM5HSC <sup>1)</sup> | Power Block 6.3x6.0 | ✓                 | 60V                   | 1,61  | 68  |
| ISG0616N10NM5HSC <sup>1)</sup> | Power Block 6.3x6.0 | ✓                 | 100V                  | 3,4   | 52  |

## OptiMOS™/StrongIRFET™ 30 V - 100 V dual N-channel MOSFETs

Integrates two independent N-channel MOSFETs into a single package for high power density and compact design. Ideal for DC motors with power rating < 200 W

| Part number  | Package                   | Monolithically integrated Schottky like diode | BV <sub>DSS</sub> [V] | R <sub>DS(on),max.</sub> [mΩ] @ V <sub>GS</sub> =10 V max. |          | Q <sub>G</sub> [nC] @ V <sub>GS</sub> =10 V typ. |          |
|--------------|---------------------------|---|-----------------------|--|----------|--|----------|
|              |                           |   |                       | High-side  | Low-side | High-side  | Low-side |
| IRLHS6276*   | symmetrical dual PQFN 2x2 | –   | 20                    | 45**   | 45**     | 3.1**  | 3.1**    |
| IRF7907*     | asymmetrical dual SO8     | –   | 30                    | 16.4   | 11.8     | 6.7**  | 14**     |
| IRLHS6376*   | symmetrical dual PQFN 2x2 | –   | 30                    | 63**   | 63**     | 2.8**  | 2.8**    |
| BSC072N04LD* | symmetrical dual 5x6      | –   | 40                    | 7.2  | 7.2      | 39   | 39       |
| BSC076N04ND  | symmetrical dual 5x6      | –   | 40                    | 7.6  | 7.6      | 28   | 28       |
| BSC112N06LD* | symmetrical dual 5x6      | –   | 60                    | 11.2   | 11.2     | 41   | 41       |
| BSC155N06ND  | symmetrical dual 5x6      | –   | 60                    | 15.5   | 15.5     | 21   | 21       |
| IRF7351      | symmetrical dual SO8      | –   | 60                    | 17.8   | 17.8     | 24   | 24       |

## Dual N-channel audio MOSFETs

Digital audio MOSFET half-bridges are specifically designed for class D audio amplifier applications. They consist of two power MOSFET switches connected in half-bridge configuration.

| Part number    | Package                | Monolithically-integrated Schottky like diode | BV <sub>DSS</sub> [V] | R <sub>DS(on),max.</sub> [mΩ] @ V <sub>GS</sub> =4.5 V max. |          | Q <sub>G</sub> [nC] @ V <sub>GS</sub> =4.5 V typ. |          |
|----------------|------------------------|---|-----------------------|---|----------|---|----------|
|                |                        |   |                       | High-side   | Low-side | High-side   | Low-side |
| IRFI4212H-117P | half-bridge in TO220FP | –   | 100                   | 72.5  | 72.5     | 12  | 12       |
| IRFI4019H-117P | half-bridge in TO220FP | –   | 150                   | 95  | 95       | 13  | 13       |
| IRFI4020H-117P | half-bridge in TO220FP | –   | 200                   | 100   | 100      | 19  | 19       |

[www.infineon.com/powermosfet-12V-300V](http://www.infineon.com/powermosfet-12V-300V)

\* Logic level (capable of 4.5 V gate drive)

\*\* R<sub>DS(on)</sub> at V<sub>GS</sub>=4.5V

1) Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our product support.



## OptiMOS™ and StrongIRFET™ 30 V logic level



| $R_{DS(on), max.}$<br>@ $V_{GS}=10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK)                                 | TO-220  |
|--|--|---|
| 1-2  |  | IRLB3813PBF<br>$R_{DS(on)}=1.95\text{ m}\Omega$ |
|  | IRLR8743TRPBF<br>$R_{DS(on)}=3.1\text{ m}\Omega$ | IRLB8743PBF<br>$R_{DS(on)}=3.2\text{ m}\Omega$  |
| 4-10   |  | IRLB8748PBF<br>$R_{DS(on)}=4.8\text{ m}\Omega$  |
|  |  | IRLB8721PBF<br>$R_{DS(on)}=8.7\text{ m}\Omega$  |

## OptiMOS™ and StrongIRFET™ 30 V logic level



| $R_{DS(on), max.}$<br>@ $V_{GS}=10\text{ V}$<br>[mΩ] | DirectFET™ | PQFN 3.3 x 3.3<br>Source-Down                      | PQFN 3.3 x 3.3<br>Source-Down<br>Dual-side cooling (DSC) | PQFN 5x6<br>Source-Down                            | PQFN 3.3 x 3.3                                  | SuperSO8  |
|--|------------|--|--|--|---|---|
| < 1  |            | IQE008N03LM5<br>$R_{DS(on)}=0.85\text{ m}\Omega$   | IQE008N03LM5CGSC<br>$R_{DS(on)}=0.85\text{ m}\Omega$     | IQDH35N03LM5CG<br>$R_{DS(on)}=0.35\text{ m}\Omega$ |   | BSC005N03L55<br>$R_{DS(on)}=0.55\text{ m}\Omega$  |
|  |            | IQE008N03LM5CG<br>$R_{DS(on)}=0.85\text{ m}\Omega$ | IQE008N03LM5SC<br>$R_{DS(on)}=0.85\text{ m}\Omega$       |  |   | BSC005N03L55I*<br>$R_{DS(on)}=0.5\text{ m}\Omega$ |
| 1-2  |            |  |  |  |   | ISC011N03L55<br>$R_{DS(on)}=1.1\text{ m}\Omega$   |
|  |            |  |  |  |   | IRFH8303TRPBF<br>$R_{DS(on)}=1.1\text{ m}\Omega$  |
|  |            |  |  |  |   | BSC011N03L5<br>$R_{DS(on)}=1.1\text{ m}\Omega$    |
|  |            |  |  |  |   | BSC011N03L5I*<br>$R_{DS(on)}=1.1\text{ m}\Omega$  |
|  |            |  |  |  | BSZ0500NSI*<br>$R_{DS(on)}=1.5\text{ m}\Omega$  |   |
|  |            | IRF6727MTRPBF<br>$R_{DS(on)}=1.7\text{ m}\Omega$   |  |  | BSZ019N03L5<br>$R_{DS(on)}=1.9\text{ m}\Omega$  |   |
|  |            |  |  |  | ISZ019N03L55<br>$R_{DS(on)}=1.9\text{ m}\Omega$ |   |
|  |            |  |  |  |   | ISC019N03L55<br>$R_{DS(on)}=1.9\text{ m}\Omega$   |
|  |            |  |  | BSZ0501NSI*<br>$R_{DS(on)}=2.0\text{ m}\Omega$     |   | BSC0901NS<br>$R_{DS(on)}=1.9\text{ m}\Omega$      |
|  |            |  |  |  |   | BSC0501NSI**<br>$R_{DS(on)}=1.9\text{ m}\Omega$   |

[www.infineon.com/powermosfet-12V-300V](http://www.infineon.com/powermosfet-12V-300V)

\*Monolithically-integrated Schottky-like diode  
\*\*For more information on the product, contact our product support

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# OptiMOS™ and StrongIRFET™ 30 V logic level



| $R_{DS(on), max.}$<br>@ $V_{GS} = 10 V$<br>[mΩ] | PQFN 3.3x3.3                                  | SuperSO8                                    | SO8   | PQFN 2x2                                   |
|---|---|---|---|--|
| 2-4   | BSZ0901NSI**<br>$R_{DS(on)} = 2.1 m\Omega$    | IRFH8311TRPBF<br>$R_{DS(on)} = 2.1 m\Omega$ |   | ISK036N03LM5<br>$R_{DS(on)} = 3.6 m\Omega$ |
|   |   | IRFH5302TRPBF<br>$R_{DS(on)} = 2.1 m\Omega$ |   |  |
|   |   | BSC0502NSI*<br>$R_{DS(on)} = 2.3 m\Omega$   |   |  |
|   | BSZ0902NS<br>$R_{DS(on)} = 2.6 m\Omega$       | ISC026N03L5S<br>$R_{DS(on)} = 2.6 m\Omega$  |   |  |
|   | BSZ0902NSI*<br>$R_{DS(on)} = 2.8 m\Omega$     | BSC0902NS<br>$R_{DS(on)} = 2.6 m\Omega$     |   |  |
|   | BSZ0502NSI*<br>$R_{DS(on)} = 2.8 m\Omega$     | BSC0902NSI*<br>$R_{DS(on)} = 2.8 m\Omega$   | IRF8788TRPBF<br>$R_{DS(on)} = 2.8 m\Omega$  |  |
|   | BSZ0503NSI*<br>$R_{DS(on)} = 3.4 m\Omega$     | IRFH8318TRPBF<br>$R_{DS(on)} = 3.1 m\Omega$ |   |  |
|   | IRLHM630TRPBF**<br>$R_{DS(on)} = 3.2 m\Omega$ | BSC0503NSI*<br>$R_{DS(on)} = 3.0 m\Omega$   |   |  |
|   | IRFHM830<br>$R_{DS(on)} = 3.8 m\Omega$        | BSC0504NSI*<br>$R_{DS(on)} = 3.7 m\Omega$   | IRF7862TRPBF<br>$R_{DS(on)} = 3.3 m\Omega$  |  |
|   | BSZ0904NSI**<br>$R_{DS(on)} = 4.0 m\Omega$    |   |   |  |
|   | ISZ040N03L5IS<br>$R_{DS(on)} = 4.0 m\Omega$   | ISC037N03L5IS<br>$R_{DS(on)} = 3.7 m\Omega$ |   |  |
|   | 4-10  |   | IRFH8324TRPBF<br>$R_{DS(on)} = 4.1 m\Omega$ |  |
| BSZ0506NS<br>$R_{DS(on)} = 4.4 m\Omega$         |   | ISC045N03L5S<br>$R_{DS(on)} = 4.5 m\Omega$  |   |  |
| BSZ0589NS<br>$R_{DS(on)} = 4.4 m\Omega$         |   | BSC0906NS<br>$R_{DS(on)} = 4.5 m\Omega$     |   |  |
| ISZ065N03L5S<br>$R_{DS(on)} = 6.5 m\Omega$      |   | BSC052N03LS<br>$R_{DS(on)} = 5.2 m\Omega$   |   |  |
| BSZ065N03LS<br>$R_{DS(on)} = 6.5 m\Omega$       |   |   |   |  |
|   |   | IRFH8334TRPBF<br>$R_{DS(on)} = 9.0 m\Omega$ |   |  |

[www.infineon.com/powermosfet-12V-300V](http://www.infineon.com/powermosfet-12V-300V)

\*\* Monolithically-integrated Schottky-like diode  
 \*\*\*  $R_{DS(on)}$  max. @  $V_{GS} = 4.5 V$   
 \*\*\*\* For more information on the product, contact our product support

1) 2.5  $V_{GS}$  capable

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





## OptiMOS™ and StrongIRFET™ 40 V normal level

| $R_{DS(on), max.}$<br>@ $V_{GS} = 10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK)                                   | TO-263<br>(D <sup>2</sup> PAK)                      | TO-263<br>(D <sup>2</sup> PAK 7-pin)                 | TO-220  | PQFN 5.x6<br>Source-Down                            | TO-247   | DirectFET™  | sTOLL  | SuperSO8   | TO-220 FullPAK                                     |
|--|--|---|--|---|---|--|---|--|--|--|
| <1   |  |   | IRF40SC240<br>$R_{DS(on)} = 0.65\text{ m}\Omega$     |   | IQD005N04NM6CG<br>$R_{DS(on)} = 0.5\text{ m}\Omega$ |  |   | IST006N04NM6<br>$R_{DS(on)} = 0.6\text{ m}\Omega$  | ISC007N04NM6<br>$R_{DS(on)} = 0.7\text{ m}\Omega$  |  |
|  |  |   | IPF009N04NF2S<br>$R_{DS(on)} = 0.9\text{ m}\Omega$   |   | IQD005N04NM6<br>$R_{DS(on)} = 0.5\text{ m}\Omega$   |  |   | IST007N04NM6<br>$R_{DS(on)} = 0.7\text{ m}\Omega$<br>IST010N04NM5<br>$R_{DS(on)} = 1.0\text{ m}\Omega$ | ISC010N04NM6<br>$R_{DS(on)} = 1.0\text{ m}\Omega$  |  |
| 1-2  |  | IPB011N04NF2S<br>$R_{DS(on)} = 1.15\text{ m}\Omega$ |  |   |   | IRFP7430PBF<br>$R_{DS(on)} = 1.3\text{ m}\Omega$ |   |  | ISC012N04NM6<br>$R_{DS(on)} = 1.2\text{ m}\Omega$  |  |
|  |  | IPB012N04NF2S<br>$R_{DS(on)} = 1.25\text{ m}\Omega$ | IPF010N04NF2S<br>$R_{DS(on)} = 1\text{ m}\Omega$     | IPP011N04NF2S<br>$R_{DS(on)} = 1.15\text{ m}\Omega$ |   |  | IRF7739L1TRPBF<br>$R_{DS(on)} = 1.0\text{ m}\Omega$ |  | IRFH7084TRPBF<br>$R_{DS(on)} = 1.25\text{ m}\Omega$  |  |
|  |  |   | IRFS3004TRL7PP<br>$R_{DS(on)} = 1.25\text{ m}\Omega$ | IPP013N04NF2S<br>$R_{DS(on)} = 1.3\text{ m}\Omega$  |   |  | IRF7480MTRPBF<br>$R_{DS(on)} = 1.2\text{ m}\Omega$  |  | IRFH7004TRPBF<br>$R_{DS(on)} = 1.4\text{ m}\Omega$   |  |
|  |  | IPB014N04NF2S<br>$R_{DS(on)} = 1.45\text{ m}\Omega$ | IPF013N04NF2S<br>$R_{DS(on)} = 1.35\text{ m}\Omega$  | IPP015N04NF2S<br>$R_{DS(on)} = 1.5\text{ m}\Omega$  |   |  | IRF7946TRPBF<br>$R_{DS(on)} = 1.4\text{ m}\Omega$   |  | ISC015N04NM5<br>$R_{DS(on)} = 1.5\text{ m}\Omega$  |  |
|  |  | IRFS3004<br>$R_{DS(on)} = 1.75\text{ m}\Omega$      |  | IRFB3004PBF<br>$R_{DS(on)} = 1.75\text{ m}\Omega$   |   |  |   |  | ISC017N04NM5<br>$R_{DS(on)} = 1.7\text{ m}\Omega$<br>ISC019N04NM5<br>$R_{DS(on)} = 1.9\text{ m}\Omega$   |  |
| 2-4  | IPD023N04NF2S<br>$R_{DS(on)} = 2.3\text{ m}\Omega$ | IPB023N04NF2S<br>$R_{DS(on)} = 2.35\text{ m}\Omega$ |  |   |   |  |   |  | IRFH7440TRPBF<br>$R_{DS(on)} = 2.4\text{ m}\Omega$   | IPA028N04NM3S<br>$R_{DS(on)} = 2.8\text{ m}\Omega$ |
|  | IPD029N04NF2S<br>$R_{DS(on)} = 2.9\text{ m}\Omega$ |   |  | IPP026N04NF2S<br>$R_{DS(on)} = 2.6\text{ m}\Omega$  |   |  |   |  | ISC028N04NM5<br>$R_{DS(on)} = 2.8\text{ m}\Omega$  |  |
|  |  |   |  | IPP033N04NF2S<br>$R_{DS(on)} = 3.3\text{ m}\Omega$  |   |  |   |  | IRFH7446TRPBF<br>$R_{DS(on)} = 3.3\text{ m}\Omega$<br>ISC036N04NM5<br>$R_{DS(on)} = 3.6\text{ m}\Omega$<br>ISC046N04NM5<br>$R_{DS(on)} = 4.6\text{ m}\Omega$ |  |
| 4-10   |  |   |  |   |   |  |   |  | ISC058N04NM5<br>$R_{DS(on)} = 5.8\text{ m}\Omega$  |  |
|  | IRF40R207<br>$R_{DS(on)} = 5.1\text{ m}\Omega$     |   |  | IRF40B207<br>$R_{DS(on)} = 4.5\text{ m}\Omega$      |   |  |   |  |  |  |



## OptiMOS™ and StrongIRFET™ 40 V logic level



| $R_{DS(on), max.}$<br>@ $V_{GS} = 10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK) | TO-263<br>(D2PAK)                                   | TO-263<br>(D2PAK 7-pin)                             | PQFN 5x6 Sour-<br>ce-Down                            | PQFN 2x2 | PQFN 3.3x3.3<br>Source-Down | PQFN 3.3x3.3<br>Source-Down<br>dual-side<br>cooling (DSC) | TO-220 | TO-247 | DirectFET™   | PQFN 3.3x3.3 | SuperSO8  | SuperSO8<br>dual-side<br>cooling (DSC)   |
|--|------------------|---|---|--|----------|-----------------------------|---|--------|--------|--|--------------|---|--|
| <1   |                  |   |   | IQDH45N04LM6CG<br>$R_{DS(on)} = 0.45\text{ m}\Omega$ |          |                             |   |        |        | IRL7472L1TRPBF<br>$R_{DS(on)} = 0.45\text{ m}\Omega$ |              | BSC007N04LS6<br>$R_{DS(on)} = 0.7\text{ m}\Omega$ | BSC007N04LS6SC<br>$R_{DS(on)} = 0.7\text{ m}\Omega$<br>BSC009N04LSSC<br>$R_{DS(on)} = 0.94\text{ m}\Omega$ |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
| 1-2  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  | IRLS3034TRLPBF<br>$R_{DS(on)} = 1.7\text{ m}\Omega$ | IRLS3034TRL7PP<br>$R_{DS(on)} = 1.4\text{ m}\Omega$ |  |          |                             |   |        |        |  |              |   |  |
|  |                  | IRL40S212<br>$R_{DS(on)} = 1.9\text{ m}\Omega$      |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
| 2-4  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
| 4-10   |                  |   |   |  |          |                             |   |        |        |  |              |   |  |
|  |                  |   |   |  |          |                             |   |        |        |  |              |   |  |



## OptiMOS™ and StrongIRFET™ 60 V normal level

| $R_{DS(on),max}$<br>@ $V_{GS}=10V$<br>[mΩ] | TO-252<br>(DPAK)   | TO-263<br>(D <sup>2</sup> PAK)                                | TO-263<br>(D <sup>2</sup> PAK 7-pin)                          | TO-262<br>(I <sup>2</sup> PAK)                                | PQFN 5x6<br>Source-Down                             | TO-220  | TO-220<br>FullPAK   | TO-247   | SuperSO8<br>DSC (dual side<br>cooling)             |
|--|--|---|---|---|---|---|---|--|--|
| >1   |  |   |   |   | IQD009N06NM5CG<br>$R_{DS(on)} = 0.9\text{ m}\Omega$ |   |   |  |  |
| 1-2  |  |   | IPB010N06N <sup>2)</sup><br>$R_{DS(on)} = 1.0\text{ m}\Omega$ |   |   |   |   |  |  |
|  |  |   | IPF010N06NF2S<br>$R_{DS(on)} = 1.05\text{ m}\Omega$           |   |   |   |   |  |  |
|  |  |   | IPF012N06NF2S<br>$R_{DS(on)} = 1.2\text{ m}\Omega$            |   |   |   |   |  |  |
|  |  | IPB013N06NF2S<br>$R_{DS(on)} = 1.3\text{ m}\Omega$            |   |   |   |   |   |  |  |
|  |  |   |   |   |   | IPP014N06NF2S<br>$R_{DS(on)} = 1.4\text{ m}\Omega$            |   |  | BSC014N06NSSC<br>$R_{DS(on)} = 1.4\text{ m}\Omega$ |
|  |  |   |   |   |   | IPP016N06NF2S<br>$R_{DS(on)} = 1.6\text{ m}\Omega$            |   |  | BSC016N06NSSC<br>$R_{DS(on)} = 1.6\text{ m}\Omega$ |
|  |  |   |   |   |   | IPP019N06NF2S<br>$R_{DS(on)} = 1.9\text{ m}\Omega$            |   |  |  |
|  |  | IPB015N06NF2S<br>$R_{DS(on)} = 1.5\text{ m}\Omega$            |   |   |   |   |   |  |  |
|  |  |   | IPF016N06NF2S<br>$R_{DS(on)} = 1.7\text{ m}\Omega$            |   |   |   |   |  |  |
|  |  | IPB018N06NF2S<br>$R_{DS(on)} = 1.8\text{ m}\Omega$            |   |   |   |   |   |  |  |
|  |  |   |   |   |   | IPP020N06N <sup>2)</sup><br>$R_{DS(on)} = 2.0\text{ m}\Omega$ |   | IRFP7530PBF<br>$R_{DS(on)} = 2.0\text{ m}\Omega$ |  |
| 2-4  | IPD025N06N <sup>2)</sup><br>$R_{DS(on)} = 2.5\text{ m}\Omega$  |   |   |   |   |   |   |  | BSC028N06NSSC<br>$R_{DS(on)} = 2.8\text{ m}\Omega$ |
|  | IPD028N06NF2S<br>$R_{DS(on)} = 2.85\text{ m}\Omega$  |   |   | IPI029N06N <sup>2)</sup><br>$R_{DS(on)} = 2.9\text{ m}\Omega$ |   |   |   |  |  |
|  |  | IPB026N06N <sup>2)</sup><br>$R_{DS(on)} = 2.6\text{ m}\Omega$ |   |   |   | IPP029N06N <sup>2)</sup><br>$R_{DS(on)} = 2.9\text{ m}\Omega$ |   |  |  |
|  |  | IPB029N06NF2S<br>$R_{DS(on)} = 2.9\text{ m}\Omega$            |   |   |   |   | IPA029N06N <sup>2)</sup><br>$R_{DS(on)} = 2.9\text{ m}\Omega$ |  |  |
|  | IPD033N06N <sup>2)</sup><br>$R_{DS(on)} = 3.3\text{ m}\Omega$  |   |   |   |   | IPP030N06NF2S<br>$R_{DS(on)} = 3.05\text{ m}\Omega$           |   |  |  |
|  | IPD038N06NF2S<br>$R_{DS(on)} = 3.85\text{ m}\Omega$  | IRFS7537TRL PBF<br>$R_{DS(on)} = 3.3\text{ m}\Omega$          |   |   |   | IPP040N06NF2S<br>$R_{DS(on)} = 4.00\text{ m}\Omega$           |   | IRFP7537PBF<br>$R_{DS(on)} = 3.3\text{ m}\Omega$ |  |
|  |  |   |   |   |   | IPA040N06N <sup>2)</sup><br>$R_{DS(on)} = 4.0\text{ m}\Omega$ |   |  |  |
| 4-10                                       |  |   |   |   |   | IPP040N06N <sup>2)</sup><br>$R_{DS(on)} = 4.0\text{ m}\Omega$ |   |  |  |
|  |  | IRFS7540TRL PBF<br>$R_{DS(on)} = 5.1\text{ m}\Omega$          |   |   |   |   |   |  |  |
|  | IPD053N06N <sup>2)</sup><br>$R_{DS(on)} = 5.3\text{ m}\Omega$  |   |   |   |   |   |   |  |  |
|  |  | IPB057N06N <sup>2)</sup><br>$R_{DS(on)} = 5.7\text{ m}\Omega$ |   |   |   | IRFB7545PBF<br>$R_{DS(on)} = 5.9\text{ m}\Omega$              |   |  |  |
|  | IRFR7546TRPBF<br>$R_{DS(on)} = 7.9\text{ m}\Omega$<br>IRF60R217<br>$R_{DS(on)} = 9.9\text{ m}\Omega$ |   |   |   |   |   | IPA060N06N <sup>2)</sup><br>$R_{DS(on)} = 6.0\text{ m}\Omega$ |  |  |

1) Coming soon  
2) 6 V rated ( $R_{DS(on)}$  also specified @  $V_{GS} = 6\text{ V}$ )







## OptiMOS™ and StrongIRFET™ 60 V normal level

| $R_{DS(on), max.}$<br>@ $V_{GS} = 10\text{ V}$<br>[mΩ]          | PQFN 3.3x3.3   | PQFN 3.3x3.3 Source-Down                          | SO8   | SuperSO8   | TOLT   | TO-Leadless   | sTOLL   |
|---|--|---|---|--|--|---|---|
| <1  |  |   |   |  | IPTC007N06NM5<br>$R_{DS(on)} = 0.7\text{ m}\Omega$ | IPT007N06N <sup>1)</sup><br>$R_{DS(on)} = 0.7\text{ m}\Omega$ | IST011N06NM5<br>$R_{DS(on)} = 1.1\text{ m}\Omega$ |
|   |  |   |   |  |  | IPT009N06NM5<br>$R_{DS(on)} = 0.9\text{ m}\Omega$             |   |
| 1-2   |  |   |   | ISC010N06NM5<br>$R_{DS(on)} = 1.05\text{ m}\Omega$               | IPTC012N06NM5<br>$R_{DS(on)} = 1.2\text{ m}\Omega$ |   | IST015N06NM5<br>$R_{DS(on)} = 1.5\text{ m}\Omega$ |
|   |  |   |   | BSC012N06NS<br>$R_{DS(on)} = 1.2\text{ m}\Omega$                 |  | IPT012N06N <sup>1)</sup><br>$R_{DS(on)} = 1.2\text{ m}\Omega$ |   |
|   |  |   |   | BSC014N06NST <sup>1)</sup><br>$R_{DS(on)} = 1.45\text{ m}\Omega$ |  | IPT008N06NM5LF<br>$R_{DS(on)} = 0.8\text{ m}\Omega$           |   |
|   |  |   |   | ISC015N06NM5LF<br>$R_{DS(on)} = 1.55\text{ m}\Omega$             |  |   |   |
|   |  |   |   | BSC016N06NST <sup>1)</sup><br>$R_{DS(on)} = 1.6\text{ m}\Omega$  |  |   |   |
|   |  |   |   | BSC019N06NS <sup>1)</sup><br>$R_{DS(on)} = 1.9\text{ m}\Omega$   |  |   |   |
| 2-4   |  | IQE030N06NM5CG<br>$R_{DS(on)} = 3\text{ m}\Omega$ |   | BSC028N06NS <sup>1)</sup><br>$R_{DS(on)} = 2.8\text{ m}\Omega$   |  |   |   |
|   | BSZ039N06NS<br>$R_{DS(on)} = 3.9\text{ m}\Omega$               | IQE030N06NM5<br>$R_{DS(on)} = 3\text{ m}\Omega$   |   |  |  |   |   |
|   |  |   |   | BSC034N06NS <sup>1)</sup><br>$R_{DS(on)} = 3.4\text{ m}\Omega$   |  |   |   |
|   |  |   |   | BSC039N06NS <sup>1)</sup><br>$R_{DS(on)} = 3.9\text{ m}\Omega$   |  |   |   |
|   | BSZ042N06NS <sup>1)</sup><br>$R_{DS(on)} = 4.2\text{ m}\Omega$ |   | IRF7855TRPBF<br>$R_{DS(on)} = 9.4\text{ m}\Omega$ | IRFH7545TRPBF<br>$R_{DS(on)} = 5.2\text{ m}\Omega$               |  |   |   |
|   |  |   |   | BSC066N06NS <sup>1)</sup><br>$R_{DS(on)} = 6.6\text{ m}\Omega$   |  |   |   |
|   | BSZ068N06NS <sup>1)</sup><br>$R_{DS(on)} = 6.8\text{ m}\Omega$ |   |   | BSC097N06NS <sup>1)</sup><br>$R_{DS(on)} = 9.7\text{ m}\Omega$   |  |   |   |
| BSZ100N06NS <sup>1)</sup><br>$R_{DS(on)} = 10.0\text{ m}\Omega$ |  |   |   |  |  |   |   |





## OptiMOS™ and StrongIRFET™ 60 V logic level

| $R_{DS(on), max.}$<br>@ $V_{GS} = 10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK)                                   | PQFN 5x6<br>Source-Down                              | PQFN 3.3x3.3<br>Source-Down                           | TO-263<br>(D <sup>2</sup> PAK 7-pin)                | TO-220   | PQFN 2x2   | PQFN 3.3x3.3                                      | SuperSO8   |
|--|--|--|---|---|--|--|---|--|
| < 1  |  | IQDH88N06LM5CG<br>$R_{DS(on)} = 0.88\text{ m}\Omega$ |   |   |  |  |   | ISC009N06LM5<br>$R_{DS(on)} = 0.9\text{ m}\Omega$    |
| 1-2  |  |  |   |   |  |  |   | ISC011N06LM5<br>$R_{DS(on)} = 1.1\text{ m}\Omega$    |
|  |  |  |   | IRLS3036TRL7PP<br>$R_{DS(on)} = 1.9\text{ m}\Omega$ |  |  | ISZ034N06LM5<br>$R_{DS(on)} = 3.4\text{ m}\Omega$ | ISC015N06NM5LF*<br>$R_{DS(on)} = 1.5\text{ m}\Omega$ |
| 2-4  |  |  | IQE022N06LM5<br>$R_{DS(on)} = 2.2\text{ m}\Omega$     |   | IRLB3036PBF<br>$R_{DS(on)} = 2.4\text{ m}\Omega$ |  |   | BSC027N06LS5<br>$R_{DS(on)} = 2.7\text{ m}\Omega$    |
|  |  |  | IQE022N06LM5CG<br>$R_{DS(on)} = 2.2\text{ m}\Omega$   |   |  |  |   |  |
|  |  |  | IQE022N06LM5SC<br>$R_{DS(on)} = 2.2\text{ m}\Omega$   |   |  |  |   |  |
|  |  |  | IQE022N06LM5CGSC<br>$R_{DS(on)} = 2.2\text{ m}\Omega$ |   |  |  |   |  |
| 4-10   | IPD048N06L3 G<br>$R_{DS(on)} = 4.8\text{ m}\Omega$ |  |   |   |  |  | BSZ040N06LS5<br>$R_{DS(on)} = 4.0\text{ m}\Omega$ | BSC065N06LS5<br>$R_{DS(on)} = 6.5\text{ m}\Omega$    |
|  | IRLR3636TRPBF<br>$R_{DS(on)} = 6.8\text{ m}\Omega$ |  |   |   |  |  | BSZ065N06LS5<br>$R_{DS(on)} = 6.5\text{ m}\Omega$ | BSC094N06LS5<br>$R_{DS(on)} = 9.4\text{ m}\Omega$    |
|  | IPD079N06L3 G<br>$R_{DS(on)} = 7.9\text{ m}\Omega$ |  |   |   |  |  | BSZ099N06LS5<br>$R_{DS(on)} = 9.9\text{ m}\Omega$ |  |
| >10  | IPD220N06L3 G<br>$R_{DS(on)} = 22\text{ m}\Omega$  |  |   |   |  | IRL60HS118<br>$R_{DS(on)} = 17.0\text{ m}\Omega$ |   |  |





### OptiMOS™ and StrongIRFET™ 75 V normal level

| $R_{DS(on), max.}$<br>@ $V_{GS}=10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK)                                 | TO-263<br>(D <sup>2</sup> PAK)  | TO-263<br>(D <sup>2</sup> PAK 7-pin)                | TO-220  | TO-247  |
|--|--|---|---|---|---|
| 1-2  |  |   | IRFS7730TRL7PP<br>$R_{DS(on)} = 2.0\text{ m}\Omega$ |   |   |
| 2-4  |  | IRFS7730TRLPBF<br>$R_{DS(on)} = 2.6\text{ m}\Omega$   |   |   | IRFP4368PBF<br>$R_{DS(on)} = 1.85\text{ m}\Omega$<br>IRFP3077PBF<br>$R_{DS(on)} = 3.3\text{ m}\Omega$ |
|  |  | IRFS7734TRLPBF<br>$R_{DS(on)} = 3.5\text{ m}\Omega$   |   | IRFB7730PBF<br>$R_{DS(on)} = 2.6\text{ m}\Omega$  |   |
|  |  |   |   | IRFB7734PBF<br>$R_{DS(on)} = 3.5\text{ m}\Omega$<br>IRFB3307ZPBF<br>$R_{DS(on)} = 5.8\text{ m}\Omega$ |   |
|  | IRFR3607PBF<br>$R_{DS(on)} = 9.0\text{ m}\Omega$ | IRFS3307ZTRLPBF<br>$R_{DS(on)} = 5.8\text{ m}\Omega$<br>IRFS3607TRLPBF<br>$R_{DS(on)} = 9.0\text{ m}\Omega$ |   |   |   |



### OptiMOS™ and StrongIRFET™ 80 V normal level/logic level

| $R_{DS(on), max.}$<br>@ $V_{GS}=10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK)   | TO-263<br>(D <sup>2</sup> PAK)   | TO-263<br>(D <sup>2</sup> PAK 7-pin)  | TO-220   | TO-220<br>FullPAK                                | SuperSO8 DSC<br>(dual-side cooling)  | PQFN 5x6<br>Source-Down | PQFN 3.3x3.3<br>Source-Down  | PQFN 2x2   | PQFN 3.3x3.3                                       | SuperSO8   | TO-Leadless   |   |
|--|--|--|---|--|--|--|-------------------------|--|--|--|--|---|---|
| 1-2  |  |  |   |  |  |  |                         | IQD016N08NM5CG<br>$R_{DS(on)} = 1.6\text{ m}\Omega$  |  |  |  |   |   |
|  |  | IPB016N08NF2S<br>$R_{DS(on)} = 1.65\text{ m}\Omega$  | IPB015N08N5<br>$R_{DS(on)} = 1.5\text{ m}\Omega$<br>IPF014N08NF2S<br>$R_{DS(on)} = 1.4\text{ m}\Omega$  | IPPO16N08NF2S<br>$R_{DS(on)} = 1.6\text{ m}\Omega$<br>IPPO19N08NF2S<br>$R_{DS(on)} = 1.9\text{ m}\Omega$   |  |  |                         |  |  |  |  |   | IPT010N08NM5<br>$R_{DS(on)} = 1.0\text{ m}\Omega$   |
|  |  | IPB019N08NF2S<br>$R_{DS(on)} = 1.95\text{ m}\Omega$  | IPF017N08NF2S<br>$R_{DS(on)} = 1.7\text{ m}\Omega$  |  |  |  |                         |  |  |  |  |   | IPT012N08N5<br>$R_{DS(on)} = 1.2\text{ m}\Omega$<br>IPT012N08NF2S<br>$R_{DS(on)} = 1.23\text{ m}\Omega$   |
| 2-4  |  | IPB020N08N5<br>$R_{DS(on)} = 2.0\text{ m}\Omega$   | IPB019N08N5<br>$R_{DS(on)} = 1.95\text{ m}\Omega$<br>IPF023N08NF2S<br>$R_{DS(on)} = 2.3\text{ m}\Omega$ | IPPO24N08NF2S<br>$R_{DS(on)} = 2.4\text{ m}\Omega$<br>IPPO23N08N5<br>$R_{DS(on)} = 2.3\text{ m}\Omega$   |  | BSC023N08NS5SC<br>$R_{DS(on)} = 2.3\text{ m}\Omega$<br>BSC033N08NS5SC<br>$R_{DS(on)} = 3.3\text{ m}\Omega$ |                         |  |  |  |  | IPT013N08NM5LF<br>$R_{DS(on)} = 1.3\text{ m}\Omega$   |   |
|  |  | IPB024N08NF2S<br>$R_{DS(on)} = 2.4\text{ m}\Omega$   | IPF039N08NF2S<br>$R_{DS(on)} = 3.9\text{ m}\Omega$  |  | IPA030N10NF2S<br>$R_{DS(on)} = 3\text{ m}\Omega$ |  |                         |  |  |  | BSC025N08LS5<br>$R_{DS(on)} = 2.5\text{ m}\Omega$<br>ISC025N08NM5LF*<br>$R_{DS(on)} = 2.55\text{ m}\Omega$<br>BSC026N08NS5<br>$R_{DS(on)} = 2.6\text{ m}\Omega$<br>BSC030N08NS5<br>$R_{DS(on)} = 3.0\text{ m}\Omega$ | IPT014N08NM5<br>$R_{DS(on)} = 1.4\text{ m}\Omega$<br>IPT019N08N5<br>$R_{DS(on)} = 1.9\text{ m}\Omega$ |   |
|  |  | IPB031N08N5<br>$R_{DS(on)} = 3.1\text{ m}\Omega$   |   | IPPO34N08N5<br>$R_{DS(on)} = 3.4\text{ m}\Omega$   |  |  |                         |  |  |  |  |   |   |
|  |  | IPB040N08NF2S<br>$R_{DS(on)} = 4\text{ m}\Omega$   |   | IPPO40N08NF2S<br>$R_{DS(on)} = 4.0\text{ m}\Omega$   |  |  |                         |  |  |  |  |   |   |
| 4-10   | IPD046N08N5<br>$R_{DS(on)} = 4.6\text{ m}\Omega$<br>IPD040N08NF2S<br>$R_{DS(on)} = 4\text{ m}\Omega$<br>IPD055N08NF2S<br>$R_{DS(on)} = 5.5\text{ m}\Omega$ | IPB049N08N5<br>$R_{DS(on)} = 4.9\text{ m}\Omega$<br>IPB055N08NF2S<br>$R_{DS(on)} = 5.5\text{ m}\Omega$ |   | IPA040N08NM5S<br>$R_{DS(on)} = 4.0\text{ m}\Omega$<br>IPA052N08NM5S<br>$R_{DS(on)} = 5.2\text{ m}\Omega$<br>IPPO55N08NF2S<br>$R_{DS(on)} = 5.5\text{ m}\Omega$<br>IPA082N10NF2S<br>$R_{DS(on)} = 8.2\text{ m}\Omega$ |  |  |                         | IQE046N08LM5<br>$R_{DS(on)} = 4.6\text{ m}\Omega$<br>IQE046N08LM5CG<br>$R_{DS(on)} = 4.6\text{ m}\Omega$<br>IQE046N08LM5SC<br>$R_{DS(on)} = 4.6\text{ m}\Omega$<br>IQE046N08LM5CGSC<br>$R_{DS(on)} = 4.6\text{ m}\Omega$ |  |  |  |   | BSC037N08NS5<br>$R_{DS(on)} = 3.7\text{ m}\Omega$<br>BSC040N08NS5<br>$R_{DS(on)} = 4.0\text{ m}\Omega$<br>BSC052N08NS5<br>$R_{DS(on)} = 5.2\text{ m}\Omega$ |
|  |  |  |   |  |  |  |                         |  |  |  |  |   | BSZ070N08LS5<br>$R_{DS(on)} = 7.0\text{ m}\Omega$<br>BSZ075N08NS5<br>$R_{DS(on)} = 7.5\text{ m}\Omega$  |
|  |  |  |   |  |  |  |                         |  |  |  |  |   | BSC061N08NS5<br>$R_{DS(on)} = 6.1\text{ m}\Omega$<br>BSC072N08NS5<br>$R_{DS(on)} = 7.2\text{ m}\Omega$  |
|  |  |  |   |  |  |  |                         |  |  |  |  |   | BSZ084N08NS5<br>$R_{DS(on)} = 8.4\text{ m}\Omega$   |
| >10  |  |  |   |  |  |  |                         |  | IRL80HS120<br>$R_{DS(on)} = 32.0\text{ m}\Omega$ | BSZ110N08NS5<br>$R_{DS(on)} = 11.0\text{ m}\Omega$ |  | BSC117N08NS5<br>$R_{DS(on)} = 11.7\text{ m}\Omega$  |   |

## OptiMOS™ and StrongIRFET™ 80 V normal level/logic level



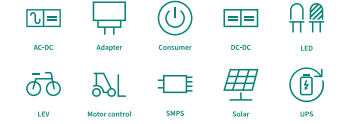
| $R_{DS(on), max.}$<br>@ $V_{GS}=10\text{ V}$<br>[mΩ] | TOLT<br>(TO-Leaded top-side cooling)               | sTOLL   | PQFN 3.3x3.3<br>Source-Down                       | PQFN 3.3x3.3<br>Source-Down DSC<br>(dual-side cooling) |
|--|--|---|---|--|
| 1-2  | IPTC011N08NM5<br>$R_{DS(on)} = 1.2\text{ m}\Omega$ | IST019N08NM5<br>$R_{DS(on)} = 1.9\text{ m}\Omega$ |   |  |
|  | IPTC014N08NM5<br>$R_{DS(on)} = 1.4\text{ m}\Omega$ |   |   |  |
| 5  |  |   | IQE050N08NM5<br>$R_{DS(on)} = 5\text{ m}\Omega$   | IQE050N08NM5SC<br>$R_{DS(on)} = 5\text{ m}\Omega$      |
|  |  |   | IQE050N08NM5CG<br>$R_{DS(on)} = 5\text{ m}\Omega$ | IQE050N08NM5CGSC<br>$R_{DS(on)} = 5\text{ m}\Omega$    |

## OptiMOS™ and StrongIRFET™ 100 V normal level



| $R_{DS(on), max.}$<br>@ $V_{GS}=10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK)                                    | TO-263<br>(D <sup>2</sup> PAK)                       | TO-263<br>(D <sup>2</sup> PAK 7-pin)                | TO-220  | TO-220<br>FullIPAK                                  | TO-247  |
|--|---|--|---|---|---|---|
| 1-2  |   |  | IPF015N10N5<br>$R_{DS(on)} = 1.53\text{ m}\Omega$   | IPP018N10N5<br>$R_{DS(on)} = 1.8\text{ m}\Omega$    |   | IRF100P218<br>$R_{DS(on)} = 1.1\text{ m}\Omega$   |
|  |   |  | IPF016N10NF2S<br>$R_{DS(on)} = 1.6\text{ m}\Omega$  |   |   | IRF100P219<br>$R_{DS(on)} = 2.1\text{ m}\Omega$   |
|  |   |  | IPB017N10N5<br>$R_{DS(on)} = 1.7\text{ m}\Omega$    |   |   |   |
|  |   |  | IPB017N10N5LF<br>$R_{DS(on)} = 1.7\text{ m}\Omega$  |   |   |   |
| 2-4  |   | IPB018N10N5<br>$R_{DS(on)} = 1.8\text{ m}\Omega$     |   |   |   |   |
|  |   | IPB020N10N5<br>$R_{DS(on)} = 2.0\text{ m}\Omega$     |   | IPP023N10N5<br>$R_{DS(on)} = 2.3\text{ m}\Omega$    | IPA030N10NF2S<br>$R_{DS(on)} = 3.0\text{ m}\Omega$  | IRFP4468PBF<br>$R_{DS(on)} = 2.6\text{ m}\Omega$  |
|  |   | IPB020N10N5LF<br>$R_{DS(on)} = 2.0\text{ m}\Omega$   | IPB024N10N5<br>$R_{DS(on)} = 2.4\text{ m}\Omega$    | IPP026N10NF2S<br>$R_{DS(on)} = 2.6\text{ m}\Omega$  |   |   |
|  |   | IPB026N10NF2S<br>$R_{DS(on)} = 2.65\text{ m}\Omega$  | IPB032N10N5<br>$R_{DS(on)} = 3.2\text{ m}\Omega$    | IPP030N10N5<br>$R_{DS(on)} = 3.0\text{ m}\Omega$    |   |   |
|  |   | IPB027N10N5<br>$R_{DS(on)} = 2.7\text{ m}\Omega$     | IRFS4010TRL7PP<br>$R_{DS(on)} = 4.0\text{ m}\Omega$ | IPP039N10N5<br>$R_{DS(on)} = 3.9\text{ m}\Omega$    |   |   |
| 4-10   | IPD050N10N5<br>$R_{DS(on)} = 5.0\text{ m}\Omega$    | IPB033N10N5LF<br>$R_{DS(on)} = 3.3\text{ m}\Omega$   | IPF042N10NF2S<br>$R_{DS(on)} = 4.25\text{ m}\Omega$ | IRF100B201<br>$R_{DS(on)} = 4.2\text{ m}\Omega$     |   | IRFP4110PBF<br>$R_{DS(on)} = 4.5\text{ m}\Omega$  |
|  | IPD052N10NF2S<br>$R_{DS(on)} = 5.2\text{ m}\Omega$  | IPB043N10NF2S<br>$R_{DS(on)} = 4.35\text{ m}\Omega$  | IPF050N10NF2S<br>$R_{DS(on)} = 5.05\text{ m}\Omega$ | IRFB4110PBF<br>$R_{DS(on)} = 4.5\text{ m}\Omega$    | IPA050N10NM5S<br>$R_{DS(on)} = 5.0\text{ m}\Omega$  | IRFP4310ZPBF<br>$R_{DS(on)} = 6.0\text{ m}\Omega$ |
|  |   | IRFS4010TRLPBF<br>$R_{DS(on)} = 4.7\text{ m}\Omega$  |   | IPP050N10NF2S<br>$R_{DS(on)} = 5.0\text{ m}\Omega$  |   |   |
|  |   | IPB050N10NF2S<br>$R_{DS(on)} = 5.05\text{ m}\Omega$  |   | IRFB4310ZPBF<br>$R_{DS(on)} = 6.0\text{ m}\Omega$   | IPA082N10NF2S<br>$R_{DS(on)} = 8.2\text{ m}\Omega$  |   |
|  |   | IRFS4310ZTRLPBF<br>$R_{DS(on)} = 7.0\text{ m}\Omega$ |   | IPP082N10NF2S<br>$R_{DS(on)} = 8.2\text{ m}\Omega$  | IPA083N10N5<br>$R_{DS(on)} = 8.3\text{ m}\Omega$    |   |
|  |   |  |   | IPP083N10N5<br>$R_{DS(on)} = 8.3\text{ m}\Omega$    | IPA083N10NM5S<br>$R_{DS(on)} = 8.3\text{ m}\Omega$  |   |
|  |   |  |   | IRF100B202<br>$R_{DS(on)} = 8.6\text{ m}\Omega$     |   |   |
|  |   | IRFS4410ZTRLPBF<br>$R_{DS(on)} = 9.0\text{ m}\Omega$ |   | IRFB4410ZPBF<br>$R_{DS(on)} = 9.0\text{ m}\Omega$   |   |   |
| 10-25  | IPD130N10NF2S<br>$R_{DS(on)} = 13\text{ m}\Omega$   |  |   | IPP129N10NF2S<br>$R_{DS(on)} = 12.9\text{ m}\Omega$ |   |   |
|  | IRFR4510TRPBF<br>$R_{DS(on)} = 13.9\text{ m}\Omega$ | IRFS4510TRLPBF<br>$R_{DS(on)} = 13.9\text{ m}\Omega$ |   | IRFB4510PBF<br>$R_{DS(on)} = 13.5\text{ m}\Omega$   | IPA126N10NM3S<br>$R_{DS(on)} = 12.6\text{ m}\Omega$ |   |
| >25  | IPD78CN10N G<br>$R_{DS(on)} = 78.0\text{ m}\Omega$  |  |   |   |   |   |





### OptiMOS™ and StrongIRFET™ 100 V normal level

| $R_{DS(on), max.} @ V_{GS}=10V [m\Omega]$ | DirectFET™                                   | PQFN 3.3x3.3                               | PQFN 3.3x3.3 Source-Down | PQFN 3.3x3.3 Source-Down DSC (dual-side cooling) | PQFN 5x6 Source-Down                         | SuperSO8  | SuperSO8 DSC (dual-side cooling)             | SO8   | TO-Leadless                                  | TOLT (TO-Leaded top-side cooling)           | sTOLL                                      |
|---|--|--|--------------------------|--|--|---|--|---|--|---|--|
| 1-2                                       |  | ISZ080N10NM6<br>$R_{DS(on)} = 8.0 m\Omega$ |                          |  |  |   |  |   | IPT014N10N5<br>$R_{DS(on)} = 1.4 m\Omega$    | IPTC015N10NM5<br>$R_{DS(on)} = 1.5 m\Omega$ |  |
|   |  |  |                          |  |  | ISC022N10NM6<br>$R_{DS(on)} = 2.2 m\Omega$                  |  |   | IPT015N10N5<br>$R_{DS(on)} = 1.5 m\Omega$    |   |  |
|   |  |  |                          |  |  | ISC027N10NM6<br>$R_{DS(on)} = 2.7 m\Omega$                  |  |   | IPT015N10NF2S<br>$R_{DS(on)} = 1.5 m\Omega$  |   |  |
|   |  |  |                          |  |  | ISC030N10NM6<br>$R_{DS(on)} = 3.0 m\Omega$                  |  |   | IPT017N10NF2S<br>$R_{DS(on)} = 1.75 m\Omega$ | IPTC019N10NM5<br>$R_{DS(on)} = 1.9 m\Omega$ |  |
| 2-4                                       |  |  |                          |  | IQD020N10NM5CGSC<br>$R_{DS(on)} = 2 m\Omega$ | BSC027N10NS5<br>$R_{DS(on)} = 2.7 m\Omega$                  | BSC030N10NS5SC<br>$R_{DS(on)} = 3 m\Omega$   |   | IPT020N10N5<br>$R_{DS(on)} = 2.0 m\Omega$    |   |  |
|   |  |  |                          |  |  | ISC035N10NM5LF <sup>1)</sup><br>$R_{DS(on)} = 3.55 m\Omega$ |  |   | IPT022N10NF2S<br>$R_{DS(on)} = 2.25 m\Omega$ |   |  |
|   | IRF7769L1TRPBF<br>$R_{DS(on)} = 3.5 m\Omega$ |  |                          |  |  | BSC035N10NS5<br>$R_{DS(on)} = 3.5 m\Omega$                  | BSC040N10NS5SC<br>$R_{DS(on)} = 4.0 m\Omega$ |   | IPT026N10N5<br>$R_{DS(on)} = 2.6 m\Omega$    |   | IST026N10NM5<br>$R_{DS(on)} = 2.6 m\Omega$ |
|   |  |  |                          |  |  | ISC035N10NM5LF<br>$R_{DS(on)} = 3.55 m\Omega$               |  |   |  |   |  |
| 4-10                                      |  |  |                          |  |  | BSC040N10NS5<br>$R_{DS(on)} = 4.0 m\Omega$                  |  |   |  |   |  |
|   |  |  |                          |  |  | BSC050N10N5<br>$R_{DS(on)} = 5.0 m\Omega$                   |  |   |  |   |  |
|   |  |  |                          |  |  | ISC060N10NM6<br>$R_{DS(on)} = 6.0 m\Omega$                  |  |   |  |   |  |
|   |  |  |                          |  |  | BSC070N10NS5<br>$R_{DS(on)} = 7.0 m\Omega$                  | BSC070N10NS5SC<br>$R_{DS(on)} = 7.0 m\Omega$ |   |  |   |  |
| 10-25                                     |  |  |                          |  |  | ISC080N10NM6<br>$R_{DS(on)} = 8.0 m\Omega$                  |  |   |  |   |  |
|   |  |  |                          |  |  | BSC098N10NS5<br>$R_{DS(on)} = 9.8 m\Omega$                  |  |   |  |   |  |
|   | IRF6644TRPBF<br>$R_{DS(on)} = 13.0 m\Omega$  | ISZ230N10NM6<br>$R_{DS(on)} = 23 m\Omega$  |                          |  |  |   |  |   |  |   |  |
|   |  |  |                          |  |  | IRFH5210TRPBF<br>$R_{DS(on)} = 14.9 m\Omega$                |  |   |  |   |  |
| >25                                       | IRF6645TRPBF<br>$R_{DS(on)} = 35.0 m\Omega$  |  |                          |  | ISC230N10NM6<br>$R_{DS(on)} = 23 m\Omega$    |   |  | IRF7853TRPBF<br>$R_{DS(on)} = 18.0 m\Omega$ |  |   |  |

### OptiMOS™ and StrongIRFET™ 100 V logic level



| $R_{DS(on), max.} @ V_{GS}=10V [m\Omega]$ | TO-252 (DPAK)                                 | TO-263 (D <sup>2</sup> PAK)                  | TO-220                                    | PQFN 2x2                                   | PQFN 3.3x3.3                                | SuperSO8                                    |
|---|---|--|---|--|---|---|
| 2-4                                       |   |  |   |  |   | BSC034N10LS5<br>$R_{DS(on)} = 3.4 m\Omega$  |
| 4-10                                      |   | IRLS4030TRLPBF<br>$R_{DS(on)} = 4.3 m\Omega$ | IRLB4030PBF<br>$R_{DS(on)} = 4.3 m\Omega$ |  | BSZ096N10LS5<br>$R_{DS(on)} = 9.6 m\Omega$  | BSC070N10LS5<br>$R_{DS(on)} = 7.0 m\Omega$  |
|   |   |  |   |  |   | IRLH5030TRPBF<br>$R_{DS(on)} = 9.0 m\Omega$ |
| 10-25                                     |   |  |   |  | BSZ146N10LS5<br>$R_{DS(on)} = 14.6 m\Omega$ | BSC096N10LS5<br>$R_{DS(on)} = 9.6 m\Omega$  |
|   | IRLR3110ZTRPBF<br>$R_{DS(on)} = 14.0 m\Omega$ |  |   |  |   | BSC146N10LS5<br>$R_{DS(on)} = 14.6 m\Omega$ |
| >25                                       |   |  |   | IRL100HS121<br>$R_{DS(on)} = 42.0 m\Omega$ |   |   |



## OptiMOS™ and StrongIRFET™ 120 V normal level/logic level

| $R_{DS(on), max.}$<br>@ $V_{GS} = 10 V$<br>[mΩ] | TO-263<br>(D <sup>2</sup> PAK 7-pin)       | PQFN 3.3x3.3                                | SuperSO8   | TO-220   | TO-263<br>(D <sup>2</sup> PAK)                            | TOLG<br>(TO-Leaded<br>Gullwing)                           | TO-Leadless<br>(TOLL)                       | TO-Leaded<br>Top-side Cooling<br>(TOLT)                   |
|---|--|---|--|--|---|---|---|---|
| 1-2   | IPF019N12NM6<br>$R_{DS(on)} = 1.9 m\Omega$ |   |  |  |   | IPTG017N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 1.7 m\Omega$ |   | IPTC017N12NM6<br>$R_{DS(on)} = 1.7 m\Omega$               |
| 2-4   |  |   | ISC030N12LM6<br>$R_{DS(on)} = 3.04 m\Omega$              | IPP022N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 2.2 m\Omega$ | IPB022N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 2.2 m\Omega$  |   | IPT017N12NM6<br>$R_{DS(on)} = 1.7 m\Omega$  | IPTC028N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 2.8 m\Omega$ |
|   |  |   | ISC032N12LM6 <sup>1)</sup><br>$R_{DS(on)} = 3.2 m\Omega$ |  | IPB035N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 3.5 m\Omega$  |   |   |   |
|   |  |   | ISC037N12NM6<br>$R_{DS(on)} = 3.7 m\Omega$               |  |   |   | IPT030N12N3 G<br>$R_{DS(on)} = 3.0 m\Omega$ |   |
| 4-10  |  |   | ISC037N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 3.7 m\Omega$ |  |   |   |   |   |
|   |  |   | ISC073N12LM6<br>$R_{DS(on)} = 7.3 m\Omega$               |  |   |   |   |   |
|   |  |   | ISC078N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 7.8 m\Omega$ |  |   |   |   |   |
|   |  |   | BSC080N12LS<br>$R_{DS(on)} = 8 m\Omega$                  |  |   |   |   |   |
| 10-25   |  | ISZ106N12LM6<br>$R_{DS(on)} = 10.6 m\Omega$ | ISC104N12LM6<br>$R_{DS(on)} = 10.4 m\Omega$              |  | IPB133N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 13.3 m\Omega$ |   |   |   |
|   |  | ISZ330N12LM6<br>$R_{DS(on)} = 33 m\Omega$   | ISC110N12NM6 <sup>1)</sup><br>$R_{DS(on)} = 11 m\Omega$  |  |   |   |   |   |
|   |  |   | BSC120N12LS<br>$R_{DS(on)} = 12 m\Omega$                 |  |   |   |   |   |
|   |  |   | ISC320N12LM6 <sup>1)</sup><br>$R_{DS(on)} = 32 m\Omega$  |  |   |   |   |   |

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\* logic level devices  
1) Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





## OptiMOS™ and StrongIRFET™ 135-150 V normal level

| $R_{DS(on), max.}$<br>@ $V_{GS} = 10\text{ V}$<br>[mΩ] | DirectFET™  | PQFN 3.3x3.3   | PQFN 5x6<br>Source-Down                               | SuperSO8 dual-side<br>cooling (DSC)   | SuperSO8   | TO-Leadless   |
|--|---|--|---|---|--|---|
| 4-10   |   |  | IQD063N15NM5CGSC<br>$R_{DS(on)} = 6.3\text{ m}\Omega$ | BSC093N15NS5SC<br>$R_{DS(on)} = 9.3\text{ m}\Omega$   | ISC037N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 3.7\text{ m}\Omega$  | IPT020N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 2.0\text{ m}\Omega$ |
|  |   |  |   |   | ISC046N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 4.6\text{ m}\Omega$  | IPT039N15N5<br>$R_{DS(on)} = 3.9\text{ m}\Omega$                |
|  |   |  |   |   | BSC074N15NS5 <sup>2)</sup><br>$R_{DS(on)} = 7.4\text{ m}\Omega$  | IPT044N15N5<br>$R_{DS(on)} = 4.4\text{ m}\Omega$                |
|  |   |  |   |   | BSC093N15NS5<br>$R_{DS(on)} = 9.3\text{ m}\Omega$  | IPT054N15N5<br>$R_{DS(on)} = 5.4\text{ m}\Omega$                |
|  |   |  |   |   |  | IPT063N15N5<br>$R_{DS(on)} = 6.3\text{ m}\Omega$                |
| 10-25  | IRF7779L2TRPBF <sup>2)</sup><br>$R_{DS(on)} = 11.0\text{ m}\Omega$  | ISZ143N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 14.3\text{ m}\Omega$ |   | BSC110N15NS5SC<br>$R_{DS(on)} = 11.0$<br>BSC160N15NS5SC<br>$R_{DS(on)} = 16.0\text{ m}\Omega$ | BSC110N15NS5<br>$R_{DS(on)} = 11.0\text{ m}\Omega$<br>BSC160N15NS5<br>$R_{DS(on)} = 16.0\text{ m}\Omega$ |   |
| >25  |   | BSZ300N15NS5<br>$R_{DS(on)} = 30.0\text{ m}\Omega$               |   |   | IRFH5015TRPBF<br>$R_{DS(on)} = 31.0\text{ m}\Omega$  |   |
|  | IRF6643TRPBF<br>$R_{DS(on)} = 34.5\text{ m}\Omega$<br>IRF6775MTRPBF<br>$R_{DS(on)} = 56.0\text{ m}\Omega$ |  |   |   |  |   |

## OptiMOS™ and StrongIRFET™ 135-150 V normal level



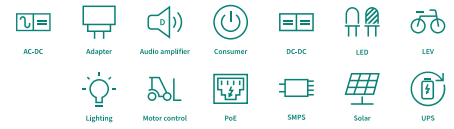
| $R_{DS(on), max.}$<br>@ $V_{GS} = 10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK)                               | TO-263<br>(D <sup>2</sup> PAK)   | TO-263<br>(D <sup>2</sup> PAK 7-pin)                            | TO-262<br>(I <sup>2</sup> PAK)                   | TO-Leaded<br>top-side cooling<br>(TOLT)                          | TO-Leaded<br>Gullwing (TOLG)                                     | TO-220  | TO-247  |
|--|--|--|---|--|--|--|---|---|
| 4-10   |  | IPB048N15N5<br>$R_{DS(on)} = 4.8\text{ m}\Omega$   | IPF021N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 2.1\text{ m}\Omega$ | IPI051N15N5<br>$R_{DS(on)} = 5.1\text{ m}\Omega$ | IPTC020N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 2.0\text{ m}\Omega$ | IPTG020N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 2\text{ m}\Omega$   | IPP051N15N5 <sup>2)</sup><br>$R_{DS(on)} = 5.1\text{ m}\Omega$  | IRF150P220<br>$R_{DS(on)} = 2.5\text{ m}\Omega$   |
|  |  | IPB048N15N5LF<br>$R_{DS(on)} = 4.8\text{ m}\Omega$   | IPF031N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 3.1\text{ m}\Omega$ |  | IPTC039N15NM5<br>$R_{DS(on)} = 3.9\text{ m}\Omega$               | IPTG029N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 2.9\text{ m}\Omega$ | IPP073N13NM6 <sup>1)</sup><br>$R_{DS(on)} = 7.3\text{ m}\Omega$   | IRF150P221<br>$R_{DS(on)} = 4.8\text{ m}\Omega$   |
|  |  |  | IPB044N15N5<br>$R_{DS(on)} = 4.4\text{ m}\Omega$                |  | IPTC044N15NM5<br>$R_{DS(on)} = 4.4\text{ m}\Omega$               | IPTG039N15NM5<br>$R_{DS(on)} = 3.9\text{ m}\Omega$               |   | IRFP4568PBF<br>$R_{DS(on)} = 5.9\text{ m}\Omega$  |
|  |  | IPB073N15N5<br>$R_{DS(on)} = 7.3\text{ m}\Omega$   | IPB060N15N5<br>$R_{DS(on)} = 6.0\text{ m}\Omega$                | IPI076N15N5<br>$R_{DS(on)} = 7.6\text{ m}\Omega$ | IPTC054N15NM5<br>$R_{DS(on)} = 5.4\text{ m}\Omega$               | IPTG044N15NM5<br>$R_{DS(on)} = 4.4\text{ m}\Omega$               | IPP076N15N5<br>$R_{DS(on)} = 7.6\text{ m}\Omega$  |   |
|  |  | IPB083N15N5LF<br>$R_{DS(on)} = 8.3\text{ m}\Omega$   |   |  | IPTC063N15NM5<br>$R_{DS(on)} = 6.3\text{ m}\Omega$               | IPTG054N15NM5<br>$R_{DS(on)} = 5.4\text{ m}\Omega$               |   |   |
|  |  |  |   |  |  | IPTG063N15NM5<br>$R_{DS(on)} = 6.3\text{ m}\Omega$               | IRF135B203 <sup>2)</sup><br>$R_{DS(on)} = 8.4\text{ m}\Omega$   |   |
| 10-25  |  | IRFS4321<br>$R_{DS(on)} = 15.0\text{ m}\Omega$<br>IRFS4115TRLPBF<br>$R_{DS(on)} = 12.1\text{ m}\Omega$ |   |  |  |  | IRFB4115PBF<br>$R_{DS(on)} = 11.0\text{ m}\Omega$<br>IRFB4321PBF<br>$R_{DS(on)} = 15.0\text{ m}\Omega$<br>IRFB4228PBF<br>$R_{DS(on)} = 15.0\text{ m}\Omega$ | IRFP4321PBF<br>$R_{DS(on)} = 15.5\text{ m}\Omega$ |
| >25  |  | IRFS4615PBF<br>$R_{DS(on)} = 42.0\text{ m}\Omega$  |   |  |  |  |   |   |
|  | IRFR4615<br>$R_{DS(on)} = 42.0\text{ m}\Omega$ |  |   |  |  |  | IRFB5615PBF<br>$R_{DS(on)} = 39.0\text{ m}\Omega$<br>IRFB4019PBF<br>$R_{DS(on)} = 95.0\text{ m}\Omega$  |   |

[www.infineon.com/powermosfet-12V-300V](http://www.infineon.com/powermosfet-12V-300V)

1) Coming soon  
2) 135 V

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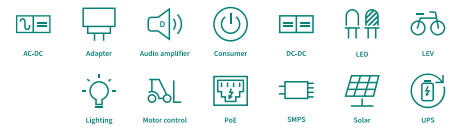




## OptiMOS™ and StrongIRFET™ 200 V normal level

| $R_{DS(on), max.}$<br>@ $V_{GS} = 10\text{ V}$<br>[mΩ] | TO-252<br>(DPAK)                                | TO-263<br>(D <sup>2</sup> PAK)                             | TO-263<br>(D <sup>2</sup> PAK 7-pin)                       | TO-220  | TO-220<br>FullPAK                              | TO-247                                       |
|--|---|--|--|---|--|--|
| 4-10   |   | IPB068N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 6.8\text{ mΩ}$ | IPF067N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 6.7\text{ mΩ}$ | IPP069N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 6.9\text{ mΩ}$  |  | IRF200P222<br>$R_{DS(on)} = 6.6\text{ mΩ}$   |
|  |   |  |  |   |  | IRFP4668PBF<br>$R_{DS(on)} = 9.7\text{ mΩ}$  |
| 10-25  |   | IPB107N20N3 G<br>$R_{DS(on)} = 10.7\text{ mΩ}$             |  | IPP110N20N3 G<br>$R_{DS(on)} = 11.0\text{ mΩ}$              |  | IRF200P223<br>$R_{DS(on)} = 11.5\text{ mΩ}$  |
|  |   | IPB110N20N3LF<br>$R_{DS(on)} = 11.0\text{ mΩ}$             |  |   |  |  |
|  |   | IPB117N20NFD<br>$R_{DS(on)} = 11.7\text{ mΩ}$              |  | IPP120N20NFD<br>$R_{DS(on)} = 12.0\text{ mΩ}$               |  | IRFP4127PBF<br>$R_{DS(on)} = 21.0\text{ mΩ}$ |
|  |   |  |  | IRFB4127PBF<br>$R_{DS(on)} = 20.0\text{ mΩ}$                |  | IRFP4227PBF<br>$R_{DS(on)} = 25.0\text{ mΩ}$ |
| >25  |   | IRFS4127TRLPBF<br>$R_{DS(on)} = 22.0\text{ mΩ}$            |  |   |  |  |
|  |   | IRFS4227TRLPBF<br>$R_{DS(on)} = 26.0\text{ mΩ}$            |  | IRFB4227PBF<br>$R_{DS(on)} = 26.0\text{ mΩ}$                | IPA320N20NM3S<br>$R_{DS(on)} = 32.0\text{ mΩ}$ |  |
|  | IPD320N20N3 G<br>$R_{DS(on)} = 32.0\text{ mΩ}$  | IPB320N20N3 G<br>$R_{DS(on)} = 32.0\text{ mΩ}$             |  | IPP319N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 31.9\text{ mΩ}$ |  |  |
|  |   |  |  | IPP320N20N3 G<br>$R_{DS(on)} = 32.0\text{ mΩ}$              |  |  |
|  | IRFR4620TRLPBF<br>$R_{DS(on)} = 78.0\text{ mΩ}$ | IRFS4620TRLPBF<br>$R_{DS(on)} = 78.0\text{ mΩ}$            |  | IRFB5620PBF<br>$R_{DS(on)} = 72.5\text{ mΩ}$                |  |  |
|  |   |  |  | IRFB4020PBF<br>$R_{DS(on)} = 100.0\text{ mΩ}$               |  |  |

## OptiMOS™ and StrongIRFET™ 200 V normal level



| $R_{DS(on), max.}$<br>@ $V_{GS} = 10\text{ V}$<br>[mΩ] | DirectFET™                                     | PQFN 3.3x3.3  | SuperSO8  | SO8   | TO-Leadless   | TOLG<br>(TO-Leaded Gullwing)                     |
|--|--|---|---|---|---|--|
| 10-25  |  |   | ISC119N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 11.9\text{ mΩ}$ |   | IPT067N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 6.7\text{ mΩ}$  |  |
|  |  |   | ISC151N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 15.1\text{ mΩ}$ |   | IPT111N20NFD<br>$R_{DS(on)} = 11.1\text{ mΩ}$               | IPTG111N20NM3FD<br>$R_{DS(on)} = 11.1\text{ mΩ}$ |
|  |  |   | BSC220N20NSFD<br>$R_{DS(on)} = 22.0\text{ mΩ}$              |   | IPT129N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 12.9\text{ mΩ}$ |  |
| >25  |  |   | BSC320N20NS3 G<br>$R_{DS(on)} = 32.0\text{ mΩ}$             |   |   |  |
|  |  |   | BSC350N20NSFD<br>$R_{DS(on)} = 35.0\text{ mΩ}$              |   |   |  |
|  |  |   | BSC500N20NS3G<br>$R_{DS(on)} = 50.0\text{ mΩ}$              |   |   |  |
|  |  | ISZ520N20NM6 <sup>1)</sup><br>$R_{DS(on)} = 52\text{ mΩ}$ | IRFH5020<br>$R_{DS(on)} = 55.0\text{ mΩ}$                   |   |   |  |
|  |  | BSZ900N20NS3 G<br>$R_{DS(on)} = 90.0\text{ mΩ}$           | BSC900N20NS3 G<br>$R_{DS(on)} = 90.0\text{ mΩ}$             | IRF7820TRPBF<br>$R_{DS(on)} = 78.0\text{ mΩ}$ |   |  |
|  | IRF6785TRPBF<br>$R_{DS(on)} = 100.0\text{ mΩ}$ |   | BSC12DN20NS3 G<br>$R_{DS(on)} = 125.0\text{ mΩ}$            |   |   |  |
|  |  | BSZ22DN20NS3 G<br>$R_{DS(on)} = 225.0\text{ mΩ}$          | BSC22DN20NS3 G<br>$R_{DS(on)} = 225.0\text{ mΩ}$            |   |   |  |







## OptiMOS™ and StrongIRFET™ 250 V normal level

| $R_{DS(on), max.}$<br>@ $V_{GS} = 10 V$<br>[mΩ] | TO-252<br>(DPAK)                             | TO-263<br>(D <sup>2</sup> PAK)                | TOLG<br>(TO-Leaded<br>Gullwing)              | TO-220                                       | TO-220<br>FullPAK                            | TO-247  | PQFN 3.3x3.3   | SuperSO8                                       | TO-Leadless                                 |
|---|--|---|--|--|--|---|--|--|---|
| 10-25   |  | IPB200N25N3 G<br>$R_{DS(on)} = 20.0 m\Omega$  | IPTG210N25NM3FD<br>$R_{DS(on)} = 21 m\Omega$ |  |  | IRF250P224<br>$R_{DS(on)} = 12.0 m\Omega$   |  |  |   |
|   |  |   |  | IPP220N25NFD<br>$R_{DS(on)} = 22.0 m\Omega$  |  | IRFP4768PBF<br>$R_{DS(on)} = 17.5 m\Omega$<br>IRF250P225<br>$R_{DS(on)} = 22.0 m\Omega$ |  |  | IPT210N25NFD<br>$R_{DS(on)} = 21.0 m\Omega$ |
| >25   |  |   |  |  |  |   |  | BSC430N25NSFD<br>$R_{DS(on)} = 43.0 m\Omega$   |   |
|   |  | IRFS4229TRLPBF<br>$R_{DS(on)} = 48.0 m\Omega$ |  | IRFB4332PBF<br>$R_{DS(on)} = 33.0 m\Omega$   |  | IRFP4332PBF<br>$R_{DS(on)} = 33.0 m\Omega$  |  | BSC600N25NS3 G<br>$R_{DS(on)} = 60.0 m\Omega$  |   |
|   | IPD600N25N3 G<br>$R_{DS(on)} = 60.0 m\Omega$ | IPB600N25N3 G<br>$R_{DS(on)} = 60.0 m\Omega$  |  | IRFB4229PBF<br>$R_{DS(on)} = 46.0 m\Omega$   |  |   |  | BSC670N25NSFD<br>$R_{DS(on)} = 67.0 m\Omega$   |   |
|   |  |   |  | IPP600N25N3 G<br>$R_{DS(on)} = 60.0 m\Omega$ | IPA600N25NM3S<br>$R_{DS(on)} = 60.0 m\Omega$ | IRFP4229PBF<br>$R_{DS(on)} = 46.0 m\Omega$  | BSZ16DN25NS3 G<br>$R_{DS(on)} = 165.0 m\Omega$<br>BSZ42DN25NS3 G<br>$R_{DS(on)} = 425.0 m\Omega$ | BSC16DN25NS3 G<br>$R_{DS(on)} = 165.0 m\Omega$ |   |

## OptiMOS™ and StrongIRFET™ 300 V normal level



| $R_{DS(on), max.}$<br>@ $V_{GS} = 10 V$<br>[mΩ] | TO-263<br>(D <sup>2</sup> PAK)            | TO-220                                    | TO-247                                    | SuperSO8                                      |
|---|---|---|---|---|
| 0-25  |   |   | IRF300P226<br>$R_{DS(on)} = 19.0 m\Omega$ |   |
| >25   | IPB407N30N<br>$R_{DS(on)} = 40.7 m\Omega$ | IPP410N30N<br>$R_{DS(on)} = 41.0 m\Omega$ |   |   |
|   |   |   | IRF300P227<br>$R_{DS(on)} = 40 m\Omega$   | BSC13DN30NSFD<br>$R_{DS(on)} = 130.0 m\Omega$ |

## Power MOSFETs complementary



| Voltage [V]   |        | PQFN 3.3x3.3   | SO8  |
|---------------|--------|--|--|
| Complementary | -20/20 | BSZ15DC02KD H*/**<br>N: 55 mΩ, 5.1 A<br>P: 150 mΩ, -3.2 A<br>BSZ215C H*/**<br>N: 55 mΩ, 5.1 A<br>P: 150 mΩ, -3.2 A |  |
|               | -30/30 |  | IRF9389<br>N: 27 mΩ, 6.8 A<br>P: 64 mΩ, -4.6 A |

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\*Products are qualified to Automotive AEC Q101

\*\* $R_{DS(on)}$  specified at 4.5 V

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# Power P-channel MOSFETs



| Voltage [V]                                     | TO-252 (DPAK)  | TO-263 (D <sup>2</sup> PAK)                   | TO-220  | PQFN 3.3x3.3                                    | SuperSO8   | SO8   | PQFN 2x2  |
|---|--|---|---|---|--|---|---|
| -20   |  |   |   |   |  | BSO201SP H<br>R <sub>DS(on)</sub> = 7.0 mΩ    |   |
|   |  |   |   |   |  |   | IRLHS2242TRPBF**<br>R <sub>DS(on)</sub> = 31.0 mΩ |
|   | IPD042P03L3 G<br>R <sub>DS(on)</sub> = 4.2 mΩ              |   |   |   | BSC030P03NS3 G<br>R <sub>DS(on)</sub> = 3.0 mΩ       | IRF9310<br>R <sub>DS(on)</sub> = 4.6 mΩ       |   |
|   |  |   |   |   | BSC060P03NS3E G<br>R <sub>DS(on)</sub> = 6.0 mΩ; ESD | IRF9317<br>R <sub>DS(on)</sub> = 6.6 mΩ       |   |
|   | SPD50P03L G <sup>1)*</sup><br>R <sub>DS(on)</sub> = 7.0 mΩ |   |   | BSZ086P03NS3 G<br>R <sub>DS(on)</sub> = 8.6 mΩ  | IRFH9310<br>R <sub>DS(on)</sub> = 4.6 mΩ             | IRF9321<br>R <sub>DS(on)</sub> = 7.2 mΩ       |   |
|   |  |   |   |   |  |   |   |
|   |  |   |   |   | BSC084P03NS3 G<br>R <sub>DS(on)</sub> = 8.4 mΩ       |   |   |
|   |  |   |   | BSZ120P03NS3 G<br>R <sub>DS(on)</sub> = 12.0 mΩ |  | BSO301SP H<br>R <sub>DS(on)</sub> = 8.0 mΩ    |   |
|   |  |   |   |   |  | IRF9388TRPBF<br>R <sub>DS(on)</sub> = 11.9 mΩ |   |
|   |  |   |   |   |  | IRF9358<br>R <sub>DS(on)</sub> = 16 mΩ; dual  |   |
|   |  |   | BSZ180P03NS3 G<br>R <sub>DS(on)</sub> = 18.0 mΩ       |   |  |   |   |
|   |  |   | BSZ180P03NS3E G<br>R <sub>DS(on)</sub> = 18.0 mΩ; ESD |   |  |   |   |
|   |  |   |   |   |  |   | IRFHS9301TRPBF<br>R <sub>DS(on)</sub> = 37.0 mΩ   |
|   |  |   |   |   |  | IRF9362<br>R <sub>DS(on)</sub> = 21 mΩ; dual  |   |
|   |  |   |   |   |  | IRF9335<br>R <sub>DS(on)</sub> = 59 mΩ        |   |
| -30   | IPD380P06NM<br>R <sub>DS(on)</sub> = 38 mΩ                 | IPB110P06LM<br>R <sub>DS(on)</sub> = 11 mΩ    | SPP80P06P H*<br>R <sub>DS(on)</sub> = 23.0 mΩ         | ISZ810P06LM<br>R <sub>DS(on)</sub> = 81 mΩ      | ISC240P06LM<br>R <sub>DS(on)</sub> = 24 mΩ           |   |   |
|   | IPD650P06NM<br>R <sub>DS(on)</sub> = 65 mΩ                 | SPB80P06P G*<br>R <sub>DS(on)</sub> = 23.0 mΩ |   |   | ISC800P06LM<br>R <sub>DS(on)</sub> = 80 mΩ           |   |   |
|   | SPD30P06P G*<br>R <sub>DS(on)</sub> = 75.0 mΩ              |   |   |   |  |   |   |
|   | IPD900P06NM<br>R <sub>DS(on)</sub> = 90 mΩ                 |   |   |   |  |   |   |
|   | SPD18P06P G*<br>R <sub>DS(on)</sub> = 130.0 mΩ             |   |   |   |  |   |   |
|   | SPD09P06PL G*<br>R <sub>DS(on)</sub> = 250.0 mΩ            |   |   |   |  |   |   |
|   | IPD25DP06NM<br>R <sub>DS(on)</sub> = 250 mΩ                |   |   |   |  |   |   |
|   | SPD08P06P G*<br>R <sub>DS(on)</sub> = 300.0 mΩ             |   |   |   |  |   |   |
|   | IPD40DP06NM<br>R <sub>DS(on)</sub> = 400 mΩ                |   |   |   |  |   |   |
|   | SPD15P10PL G*<br>R <sub>DS(on)</sub> = 200.0 mΩ            | IPB320P10LM<br>R <sub>DS(on)</sub> = 32 mΩ    |   | ISZ24DP10LM<br>R <sub>DS(on)</sub> = 245 mΩ     | ISC750P10LM<br>R <sub>DS(on)</sub> = 75 mΩ           |   |   |
| SPD15P10P G*<br>R <sub>DS(on)</sub> = 240.0 mΩ  | IPB330P10NM<br>R <sub>DS(on)</sub> = 33 mΩ                 | IPP330P10NM<br>R <sub>DS(on)</sub> = 33 mΩ    |   |   |  |   |   |
| SPD04P10PL G*<br>R <sub>DS(on)</sub> = 850.0 mΩ | IPB19DP10NM<br>R <sub>DS(on)</sub> = 185 mΩ                |   |   |   |  |   |   |
| IPD11DP10NM<br>R <sub>DS(on)</sub> = 111 mΩ     |  |   |   |   |  |   |   |
| IPD18DP10LM<br>R <sub>DS(on)</sub> = 178 mΩ     |  |   |   |   |  |   |   |
| IPD19DP10NM<br>R <sub>DS(on)</sub> = 186 mΩ     |  |   |   |   |  |   |   |
| -100  | IPD42DP15LM<br>R <sub>DS(on)</sub> = 420 mΩ                | IPB720P15LM<br>R <sub>DS(on)</sub> = 72 mΩ    |   | ISZ56DP15LM<br>R <sub>DS(on)</sub> = 560 mΩ     | ISC16DP15LM<br>R <sub>DS(on)</sub> = 160 mΩ          |   |   |
|   |  |   |   | ISZ75DP15LM<br>R <sub>DS(on)</sub> = 750 mΩ     |  |   |   |
|   |  |   |   | ISZ15EP15LM<br>R <sub>DS(on)</sub> = 1500 mΩ    |  |   |   |
|   |  |   |   |   |  |   |   |

P-channel MOSFETs

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\* Products are qualified to Automotive AEC Q101  
 \*\* R<sub>DS(on)</sub> specified at 4.5 V  
 1) 5-leg

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## Small-signal/small-power N-channel



| Voltage [V] | SOT-223   | TSOP-6   | SOT-89                                    | SC59                                       | SOT-23  | SOT-323                                      | SOT-363  |
|-------------|---|--|---|--|---|--|--|
| 20 V        |   | BSL202SN <sup>4)</sup><br>36 mΩ, 7.5 A, SLL      |   | BSR802N <sup>5)</sup><br>32 mΩ, 3.7 A, ULL |   | BSS816NW <sup>5)</sup><br>240 mΩ, 1.4 A, ULL | BSD214SN <sup>4)</sup><br>250 mΩ, 1.5 A, SLL       |
|             |   | IRLMS2002 <sup>1) 4)</sup><br>45 mΩ, 6.5 A, SLL  |   | BSR202N <sup>4)</sup><br>33 mΩ, 3.8 A, SLL | IRLML6244 <sup>1) 4)</sup><br>27 mΩ, 6.3 A, SLL           | BSS214NW <sup>4)</sup><br>250 mΩ, 1.5 A, SLL | BSD840N <sup>5)</sup><br>560 mΩ, 0.88 A, ULL, dual |
|             |   | BSL806N <sup>5)</sup><br>82 mΩ, 2.3 A, ULL, dual |   |  | IRLML6246 <sup>1) 4)</sup><br>66 mΩ, 4.1 A, SLL           |  | BSD235N <sup>4)</sup><br>600 mΩ, 0.95 A, SLL, dual |
|             |   |  |   |  | IRLML2502 <sup>1) 4)</sup><br>80 mΩ, 4.2 A, SLL           |  |  |
|             |   |  |   |  | BSS806N <sup>5)</sup><br>82 mΩ, 2.3 A, ULL                |  |  |
|             |   |  |   |  | BSS806NE <sup>5)</sup><br>82 mΩ, 2.3 A, ULL, ESD          |  |  |
|             |   |  |   |  | BSS205N <sup>4)</sup><br>85 mΩ, 2.5 A, SLL                |  |  |
| 25 V        |   |  |   |  | BSS214N <sup>4)</sup><br>250 mΩ, 1.5 A, SLL               |  |  |
|             |   |  |   |  | IRFML8244 <sup>1) 3)</sup><br>41 mΩ, 5.8 A, LL            |  |  |
| 30 V        |   | IRLTS6342 <sup>1) 4)</sup><br>22 mΩ, 8.3 A, SLL  |   |  | IRLML6344 <sup>1) 4)</sup><br>37 mΩ, 5.0 A, SLL           |  | BSD316SN <sup>3)</sup><br>280 mΩ, 1.4 A, LL        |
|             |   | IRFTS8342 <sup>1) 3)</sup><br>29 mΩ, 8.2 A, LL   |   |  | IRLML0030 <sup>1) 3)</sup><br>40 mΩ, 5.3 A, LL            |  |  |
|             |   | IRLMS1503 <sup>1) 3)</sup><br>200 mΩ, 3.2 A, LL  |   |  | IRLML6346 <sup>1) 4)</sup><br>80 mΩ, 3.4 A, SLL           |  |  |
|             |   |  |   |  | BSS306N <sup>3)</sup><br>93 mΩ, 2.3 A, LL                 |  |  |
| 40 V        |   |  |   |  | IRLML2030 <sup>1) 3)</sup><br>154 mΩ, 2.7 A, LL           |  |  |
|             |   |  |   |  | BSS316N <sup>3)</sup><br>280 mΩ, 1.4 A, LL                |  |  |
|             |   |  |   |  | IRLML2803 <sup>3)</sup><br>400 mΩ, 1.2 A, LL              |  |  |
|             |   |  |   |  | IRLML0040 <sup>1) 3)</sup><br>78 mΩ, 3.6 A, LL            |  |  |
| 55 V        | IRFL024Z <sup>1) 2)</sup><br>57.5 mΩ, 5.1 A, NL         |  |   |  | BSS670S2L <sup>3)</sup><br>825 mΩ, 0.54 A, LL             |  |  |
|             | IRLL2705 <sup>1) 3)</sup><br>65 mΩ, 3.8 A, LL           |  |   |  |   |  |  |
|             | IRFL4105 <sup>1) 2)</sup><br>45 mΩ, 3.7 A, NL           |  |   |  |   |  |  |
|             | IRLL024N <sup>1) 3)</sup><br>100 mΩ, 3.5 A, LL          |  |   |  |   |  |  |
|             | IRLL014N <sup>1) 3)</sup><br>280 mΩ, 2.0 A, LL          |  |   |  |   |  |  |
| 60 V        | IRFL014N <sup>1) 2)</sup><br>160 mΩ, 1.9 A, NL          |  |   |  |   |  |  |
|             | BSP295 <sup>3)</sup><br>500 mΩ, 1.8 A, LL               | BSL606SN <sup>3)</sup><br>95 mΩ, 4.5 A, LL       | BSS606N <sup>3)</sup><br>90 mΩ, 3.2 A, LL |  | IRLML0060 <sup>1) 3)</sup><br>116 mΩ, 2.7 A, LL           | BSS138W <sup>3)</sup><br>4 Ω, 0.28 A, LL     | 2N7002DW <sup>3)</sup><br>4 Ω, 0.3 A, LL, dual     |
|             |   |  |   |  | IRLML2060 <sup>1) 3)</sup><br>640 mΩ, 1.2 A, LL           | SN7002W <sup>3)</sup><br>7.5 Ω, 0.23 A, LL   |  |
|             |   |  |   |  | 2N7002 <sup>1) 3)</sup><br>4 Ω, 0.3 A, LL                 |  |  |
|             |   |  |   |  | BSS138I <sup>1) 3)</sup><br>4 Ω, 0.23 A, LL               |  |  |
|             |   |  |   |  | BSS138N <sup>3)</sup><br>4 Ω, 0.23 A, LL                  |  |  |
|             |   |  |   |  | SN7002I <sup>1) 3)</sup><br>7.5 Ω, 0.2 A, LL              |  |  |
| 100 V       | BSP373N <sup>2)</sup><br>240 mΩ, 1.8 A, NL              |  |   |  | SN7002N <sup>3)</sup><br>7.5 Ω, 0.2 A, LL                 |  |  |
|             | BSP372N <sup>3)</sup><br>270 mΩ, 1.8 A, LL              |  |   |  | BSS159N <sup>6)</sup><br>8 Ω, 0.13 A, depletion           |  |  |
|             | BSP296N <sup>3)</sup><br>800 mΩ, 1.2 A, LL              |  |   |  | IRLML0100<br>235 mΩ, 1.6 A, LL                            |  |  |
|             |   |  |   |  | BSS119N <sup>3)</sup><br>10 Ω, 0.19 A, LL                 |  |  |
| 150 V       | IRFL4315 <sup>1) 2)</sup><br>185 mΩ, 2.6 A, NL          | IRF5802 <sup>1) 2)</sup><br>1.2 Ω, 0.9 A, NL     |   |  | BSS123I <sup>1) 3)</sup><br>10 Ω, 0.19 A, LL              |  |  |
|             | BSP297 <sup>3)</sup><br>3 Ω, 0.66 A, LL                 | IRF5801 <sup>1) 2)</sup><br>2.2 Ω, 0.6 A, NL     |   |  | BSS123N <sup>3)</sup><br>10 Ω, 0.19 A, LL                 |  |  |
| 200 V       | BSP149 <sup>6)</sup><br>3.5 Ω, 0.14 A, LL, depletion    |  |   |  | BSS169I <sup>1) 6)</sup><br>12 Ω, 0.09 A, depletion       |  |  |
|             |   |  |   |  | BSS169 <sup>6)</sup><br>12 Ω, 0.09 A, depletion           |  |  |
|             |   |  |   |  |   |  |  |
| 240 V       | BSP88 <sup>3)</sup><br>7.5 Ω, 0.35 A, LL                |  | BSS87 <sup>3)</sup><br>7.5 Ω, 0.26 A, LL  |  | BSS131 <sup>3)</sup><br>20 Ω, 0.11 A, LL                  |  |  |
|             | BSP89 <sup>3)</sup><br>7.5 Ω, 0.35 A, LL                |  |   |  |   |  |  |
|             | BSP129 <sup>6)</sup><br>20 Ω, 0.05 A, LL, depletion     |  |   |  |   |  |  |
| 250 V       |   |  |   |  | BSS139I <sup>1) 6)</sup><br>30 Ω, 0.10 A, LL, depletion   |  |  |
|             |   |  |   |  | BSS139 <sup>6)</sup><br>30 Ω, 0.10 A, LL, depletion       |  |  |
| 400 V       | BSP324 <sup>3)</sup><br>22 Ω, 0.17 A, LL                |  |   |  |   |  |  |
|             | BSP125 <sup>3)</sup><br>60 Ω, 0.12 A, LL                |  | BSS225 <sup>3)</sup><br>45 Ω, 0.09 A, LL  |  | BSS127I <sup>1) 3)</sup><br>600 Ω, 0.021 A, LL            |  |  |
| 600 V       | BSP135I <sup>1) 6)</sup><br>60 Ω, 0.02 A, LL, depletion |  |   |  | BSS127 <sup>3)</sup><br>600 Ω, 0.021 A, LL                |  |  |
|             | BSP135 <sup>6)</sup><br>60 Ω, 0.02 A, LL, depletion     |  |   |  | BSS126I <sup>1) 6)</sup><br>700 Ω, 0.021 A, LL, depletion |  |  |
|             |   |  |   |  | BSS126 <sup>6)</sup><br>700 Ω, 0.021 A, LL, depletion     |  |  |

Solutions  
Applications  
15-300 V MOSFETs  
500-950 V MOSFETs  
Gate-driver ICs  
Digital isolators  
IGBT discretes and silicon power diodes  
Intelligent power switches and modules  
Microcontrollers  
USB-C controllers and peripherals  
Power management ICs  
WBG semiconductors  
Sensors  
Packages

1) not qualified to Automotive AEC-Q101  
2) R<sub>DS(on)</sub> specified at 10 V  
3) R<sub>DS(on)</sub> specified at 4.5 V

4) R<sub>DS(on)</sub> specified at 2.5 V  
5) R<sub>DS(on)</sub> specified at 1.8 V  
6) R<sub>DS(on)</sub> specified at 0 V



### Small-signal/small-power P-channel



| Voltage [V] | SOT-223  | TSOP-6  | SOT-89                                     | SC59  | SOT-23  | SOT-323  | SOT-363  |
|-------------|--|---|--|---|---|--|--|
| -250 V      | BSP317P <sup>3)</sup><br>5 Ω, -0.43 A, LL          |   | BSS192P <sup>3)</sup><br>15 Ω, -0.19 A, LL | BSR92P <sup>3)</sup><br>13 Ω, -0.14 A, LL   |   |  |  |
|             | BSP92P <sup>3)</sup><br>15 Ω, -0.26 A, LL          |   |  |   |   |  |  |
| -150 V      | ISP14EP15LM <sup>1)3)</sup><br>1.4 Ω, -1.29 A, LL  |   |  | BSR316P <sup>3)</sup><br>2.2 Ω, -0.36 A, LL |   |  |  |
| -100 V      | BSP322P <sup>3)</sup><br>1 Ω, -1.0 A, LL           |   |  |   |   |  |  |
|             | BSP316P <sup>3)</sup><br>2.3 Ω, -0.68 A, LL        |   |  |   |   |  |  |
|             | ISP16DP10LM <sup>1)3)</sup><br>190 mΩ, -3.9 A, LL  |   |  |   |   |  |  |
|             | ISP98DP10LM <sup>1)3)</sup><br>1.05 Ω, -1.55 A, LL |   |  |   |   |  |  |
|             | ISP20EP10LM <sup>1)3)</sup><br>2.2 Ω, -0.99 A, LL  |   |  |   |   |  |  |
| -60 V       | ISP650P06NM <sup>1)2)</sup><br>65 mΩ, -3.7 A, NL   |   |  | BSR315P <sup>3)</sup><br>1.3 Ω, -0.62 A, LL | ISS17EP06LM <sup>1)3)</sup><br>2.2 Ω, -0.3 A, LL  | BSS84PW <sup>3)</sup><br>12 Ω, -0.15 A, LL     |  |
|             | ISP12DP06NM <sup>1)2)</sup><br>125 mΩ, -2.8 A, NL  |   |  |   |   |  |  |
|             | ISP13DP06NMS <sup>1)2)</sup><br>125 mΩ, -2.8 A, NL |   |  |   | BSS83P <sup>3)</sup><br>3 Ω, -0.33 A, LL          |  |  |
|             | BSP613P <sup>2)</sup><br>130 mΩ, -2.9 A, NL        |   |  |   | ISS55EP06LM <sup>1)3)</sup><br>7 Ω, -0.18 A, LL   |  |  |
|             | ISP25DP06NM <sup>1)2)</sup><br>250 mΩ, -1.9 A, NL  |   |  |   | BSS84P <sup>3)</sup><br>12 Ω, -0.17 A, LL         |  |  |
|             | ISP26DP06NMS <sup>1)2)</sup><br>260 mΩ, -1.9 A, NL |   |  |   |   |  |  |
|             | BSP170P <sup>2)</sup><br>300 mΩ, -1.9 A, NL        |   |  |   |   |  |  |
|             | ISP25DP06LM <sup>1)3)</sup><br>310 mΩ, -1.9 A, LL  |   |  |   |   |  |  |
|             | ISP25DP06LMS <sup>1)3)</sup><br>310 mΩ, -1.9 A, LL |   |  |   |   |  |  |
|             | BSP171P <sup>3)</sup><br>450 mΩ, -1.9 A, LL        |   |  |   |   |  |  |
|             | ISP75DP06LM <sup>1)3)</sup><br>1 Ω, -1.1 A, LL     |   |  |   |   |  |  |
|             | BSP315P <sup>3)</sup><br>1.4 Ω, -1.17 A, LL        |   |  |   |   |  |  |
| -40 V       |  | IRF5803 <sup>1)2)</sup><br>112 mΩ, -3.4 A, NL           |  |   |   |  |  |
| -30 V       |  | IRFTS9342 <sup>1)2)</sup><br>40 mΩ, -5.8 A, NL          |  |   | IRLML9301 <sup>1)3)</sup><br>103 mΩ, -1.3 A, LL   |  |  |
|             |  | BSL307SP <sup>3)</sup><br>74 mΩ, -5.5 A, LL             |  |   | BSS308PE <sup>3)</sup><br>130 mΩ, -2.1 A, LL, ESD |  |  |
|             |  | BSL308PE <sup>3)</sup><br>130 mΩ, -2.1 A, LL, dual, ESD |  |   | IRLML5203 <sup>1)3)</sup><br>165 mΩ, -3.0 A, LL   |  |  |
|             |  |   |  |   | BSS314PE <sup>3)</sup><br>230 mΩ, -1.5 A, LL, ESD |  |  |
| -20 V       |  |   |  |   | BSS315P <sup>3)</sup><br>270 mΩ, -1.5 A, LL       |  |  |
|             |  | BSL207SP <sup>4)</sup><br>41 mΩ, -6.0 A, SLL            |  |   | IRLML9303 <sup>1)4)</sup><br>270 mΩ, -2.3 A, LL   |  |  |
|             |  | IRLTS2242 <sup>1)4)</sup><br>55 mΩ, -6.9 A, SLL         |  |   | IRLML5103 <sup>1)3)</sup><br>1000 mΩ, -0.76 A, LL |  |  |
|             |  | IRLMS6802 <sup>1)4)</sup><br>100 mΩ, -5.6 A, SLL        |  |   | IRLML2244 <sup>1)4)</sup><br>95 mΩ, -4.3 A, SLL   | BSS209PW <sup>4)</sup><br>900 mΩ, -0.58 A, SLL | BSV236SP <sup>4)</sup><br>285 mΩ, -1.5 A, SLL      |
| -12 V       |  | BSL211SP <sup>4)</sup><br>110 mΩ, -4.7 A, SLL           |  |   | IRLML6402 <sup>1)4)</sup><br>135 mΩ, -3.7 A, SLL  | BSS223PW <sup>4)</sup><br>2.1 Ω, -0.39 A, SLL  | BSD223P <sup>4)</sup><br>2.1 Ω, -0.39 A, SLL, dual |
|             |  |   |  |   | IRLML2246 <sup>1)4)</sup><br>236 mΩ, -2.6 A, SLL  |  |  |
|             |  |   |  |   | BSS215P <sup>4)</sup><br>280 mΩ, -1.5 A, SLL      |  |  |
|             |  |   |  |   | IRLML6401 <sup>4)</sup><br>125 mΩ, -4.3 A, ULL    |  |  |

### Small-signal/small-power complementary



| Voltage [V]   | TSOP-6   | SOT-363   |
|---------------|--|---|
| Complementary | -20/20   | BSD235C <sup>4)</sup><br>N: 600 mΩ, 0.95 A, SLL<br>P: 280 mΩ, -1.5 A, SLL |
|               | -30/30   |   |
|               | BSL308C <sup>3)</sup><br>N: 93 mΩ, 2.3 A, LL<br>P: 130 mΩ, -2.0 A, LL  |   |
|               | BSL316C <sup>3)</sup><br>N: 280 mΩ, 1.4 A, LL<br>P: 270 mΩ, -1.5 A, LL |   |

[www.infineon.com/smallsignal](http://www.infineon.com/smallsignal)

[www.infineon.com/small power](http://www.infineon.com/small power)

1) not qualified to Automotive AEC-Q101  
2) R<sub>DS(on)</sub> specified at 10 V  
3) R<sub>DS(on)</sub> specified at 4.5 V

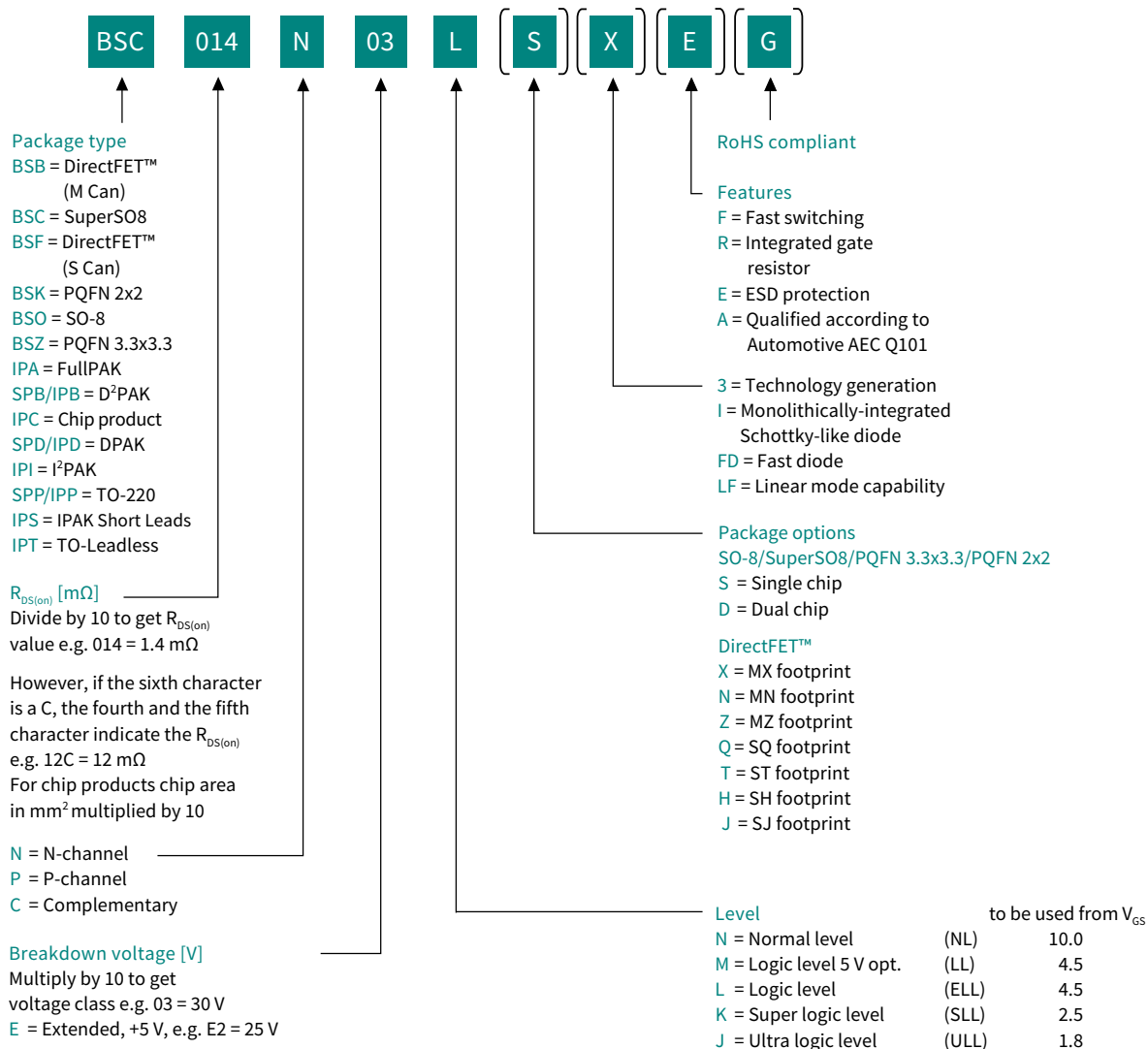
4) R<sub>DS(on)</sub> specified at 2.5 V  
5) R<sub>DS(on)</sub> specified at 1.8 V  
6) R<sub>DS(on)</sub> specified at 0 V

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our product support.

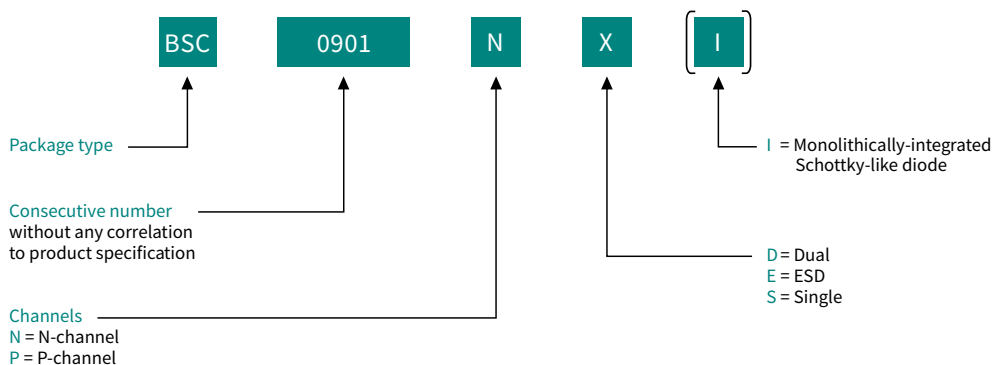


# Nomenclature

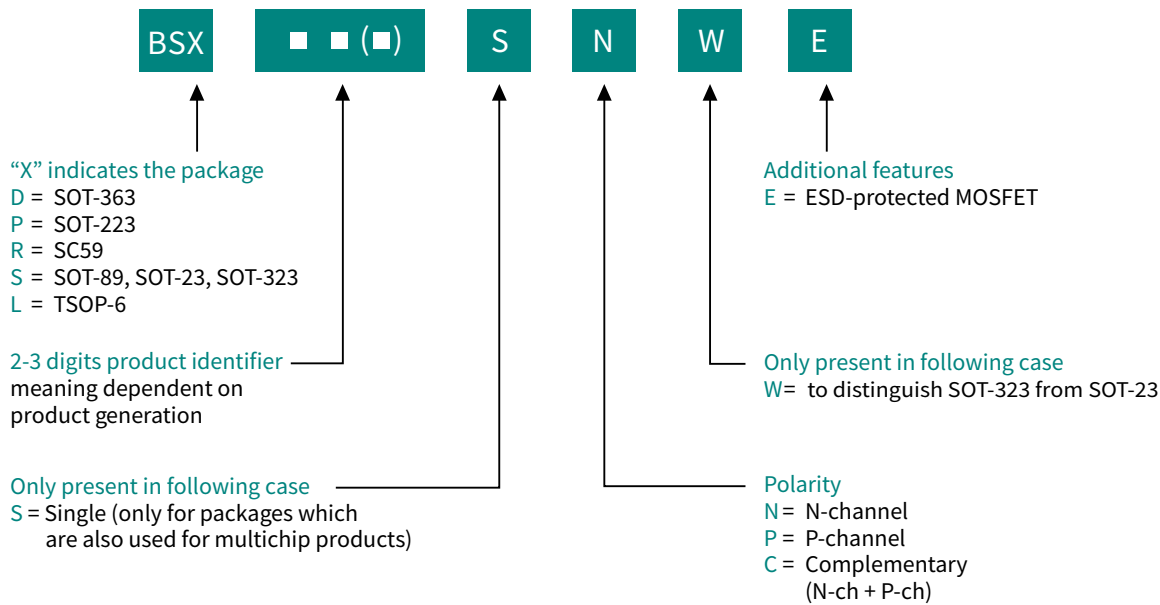
## OptiMOS™



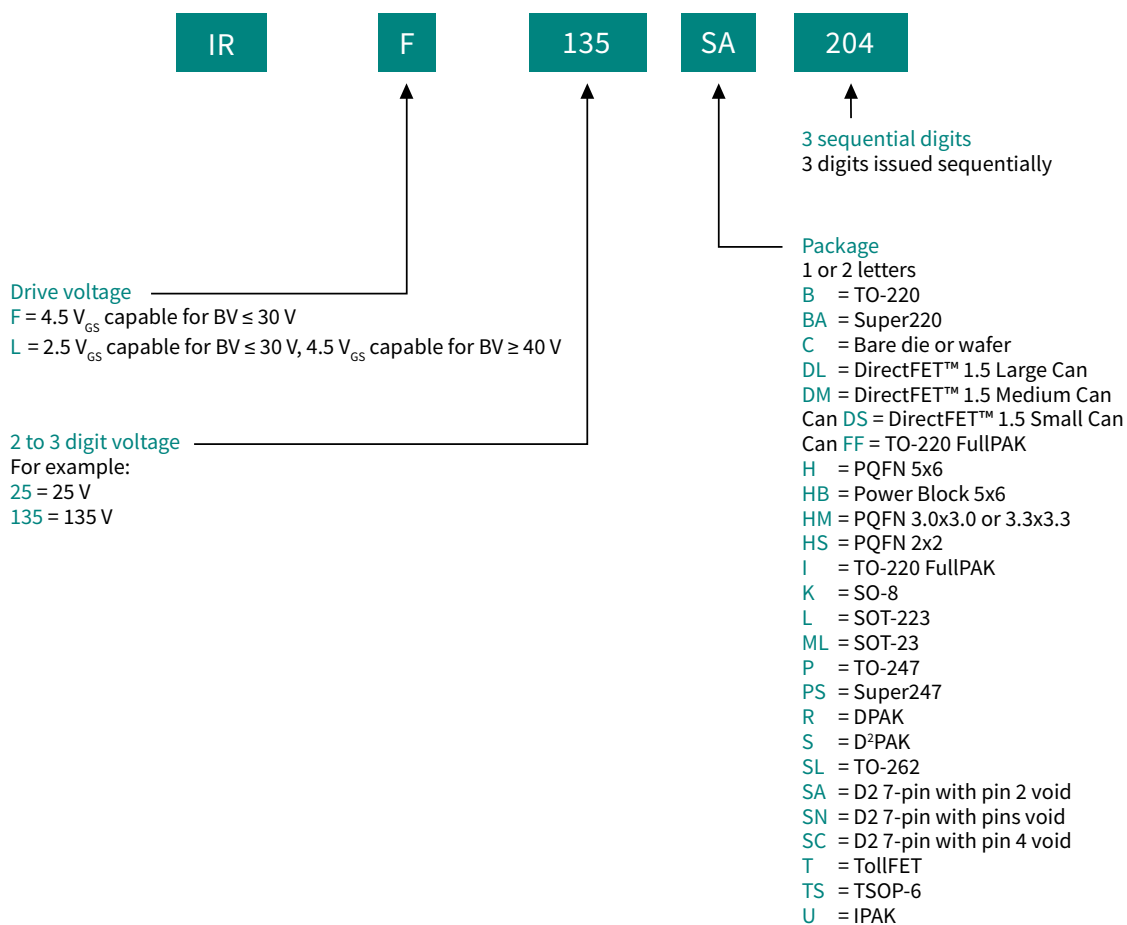
## OptiMOS™ 30 V



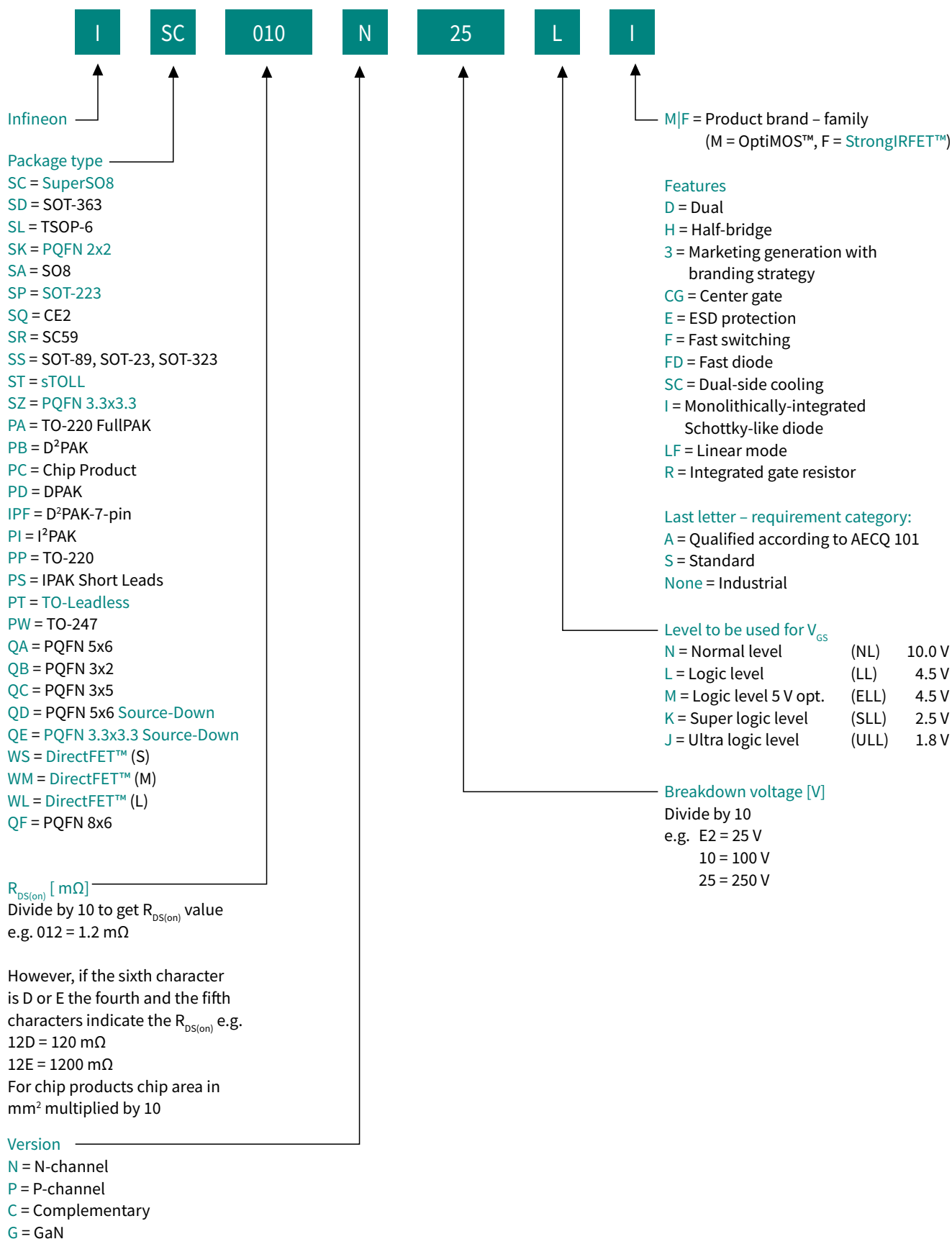
## Small signal



## StrongIRFET™ (from May 2015 to 2019)



## New nomenclature for OptiMOS™ and StrongIRFET™ MOSFETs (2019 onward)





# Infineon support for low voltage MOSFETs

## Useful links and helpful information

### Further information, data sheets and documents

[www.infineon.com/powermosfet-12V-300V](http://www.infineon.com/powermosfet-12V-300V)

[www.infineon.com/smallsignal](http://www.infineon.com/smallsignal)

[www.infineon.com/pchannel](http://www.infineon.com/pchannel)

[www.infineon.com/depletion](http://www.infineon.com/depletion)

[www.infineon.com/complementary](http://www.infineon.com/complementary)

### MOSFET Cross Reference

[www.infineon.com/cms/en/product/search/cross-reference](http://www.infineon.com/cms/en/product/search/cross-reference)

### Evaluation boards and simulation models

[www.infineon.com/powermosfet-simulationmodels](http://www.infineon.com/powermosfet-simulationmodels)

### Die support

[www.infineon.com/baredie](http://www.infineon.com/baredie)

### MOSFET Community

[community.infineon.com/t5/Power-MOSFET/bd-p/MOSFET](http://community.infineon.com/t5/Power-MOSFET/bd-p/MOSFET)

For more information regarding **StrongIRFET™** and **OptiMOS™** power MOSFET bare die products, please contact the Infineon Service Center or your local sales counterpart.



Support



Evaluation board



Tools



Simulation





## 500-950 V MOSFETs

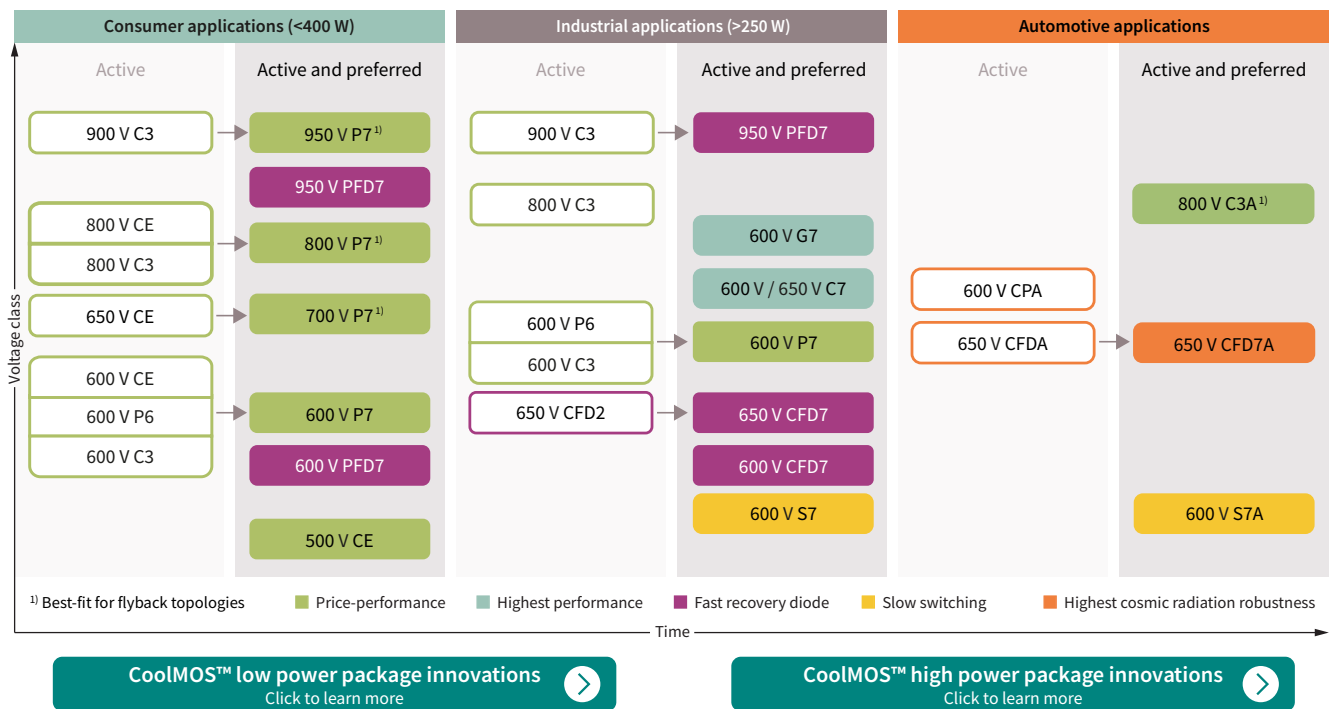
- CoolMOS™ SJ MOSFETs
- 950 V CoolMOS™ P7 SJ MOSFETs
- 950 V CoolMOS™ PFD7 SJ MOSFETs
- 800 V CoolMOS™ P7 SJ MOSFETs
- 700 V CoolMOS™ P7 SJ MOSFETs
- 600 V CoolMOS™ P7 SJ MOSFETs
- 600 V CoolMOS™ PFD7 SJ MOSFETs
- 600 V and 650 V CoolMOS™ C7 and 600 V C7 Gold (G7) SJ MOSFETs
- 600 V CoolMOS™ S7 SJ MOSFETs
- 600 V CoolMOS™ CFD7 SJ MOSFETs
- 650 V CoolMOS™ CFD7 SJ MOSFETs
- CoolMOS™ CE SJ MOSFETs
- CoolMOS™ SJ MOSFETs for automotive
- CoolMOS™ SJ MOSFET package innovations
- 500-950 V MOSFETs product portfolio
- 500-950 V MOSFETs nomenclature

# CoolMOS™ SJ MOSFETs

## Trusted leader in high-voltage MOSFETs

Infineon's CoolMOS™ products offer a significant reduction of conduction, switching and driving losses, and enable high power density as well as efficiency for superior power conversion systems.

### CoolMOS™ SJ MOSFETs overview\*



High-voltage superjunction MOSFETs address consumer applications, such as home appliance drives, smartphone/tablet chargers, notebook adapters, LED lighting, PC power, as well as audio and TV power supplies. Customers are increasingly replacing standard MOSFETs with superjunction MOSFETs to benefit from higher efficiency and lower power consumption for end users. CoolMOS™ P7 sets a benchmark by offering high performance and competitive price all at once. The CoolMOS™ PFD7 series is a state-of-the-art solution for high density chargers/adapters, lighting applications as well as home appliance drives (e.g., refrigerator compressors).

Also for industrial applications such as server, telecom, PC power, solar, ESS, UPS, EV-charging and others, Infineon's CoolMOS™ 7 superjunction MOSFETs with the C7, G7, CFD7, P7 and S7 product families offer what you need - from highest efficiency to best price performance. The S7 product family specifically addresses slow switching applications such as solid state relay and solid state circuit breaker offering the best-in-class  $R_{DS(on)}$  within the industry. Complementary to the silicon CoolMOS™ portfolio, Infineon offers a broad wide bandgap (WBG) portfolio of CoolGa™ GIT HEMTs, CoolGa™ IPS and CoolSiC™ MOSFETs to further optimize efficiency and system cost (see Wide bandgap semiconductors).

Infineon's industrial- and consumer-qualified CoolMOS™ superjunction MOSFET offering is complemented by the automotive-qualified series 600 V CPA, 650 V CFDA, 800 V C3A and the latest 650 V CFD7A as well as 600 V S7A. Infineon's excellent-performing automotive series address on-board chargers, DC-DC converters, active pre-charge and discharge function, insulation monitor, HV eFuse, and HV eDisconnect with proven outstanding quality standards going well beyond the AEC-Q101, supporting customers to gain momentum in the rapidly growing xEV market.

[www.infineon.com/coolmos](http://www.infineon.com/coolmos)

\* Subject to change and exceptions possible.  
For more details on product status check out the individual product pages online.

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# 950 V CoolMOS™ PFD7 SJ MOSFETs

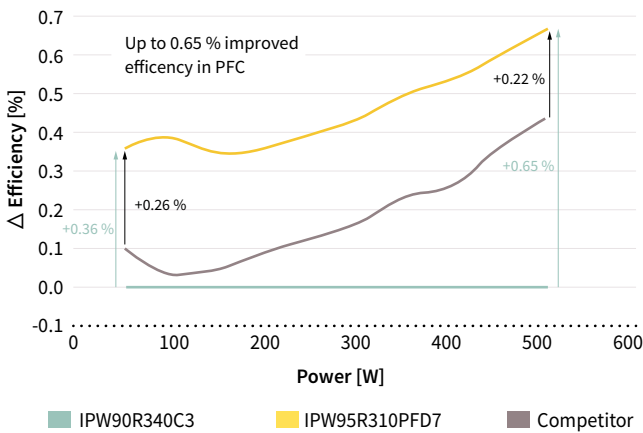
## Perfect fit for soft- and hard-switching topologies

The 950 V CoolMOS™ PFD7 is a revolutionary superjunction technology for high-voltage power MOSFETs, with an integrated fast body diode to address lighting and industrial SMPS applications. The new series is tailor-made for usage across several topologies, such as PFC, LLC, and flyback.

### Features and benefits

| Key features   | Key benefits   |
|--|--|
| <ul style="list-style-type: none"> <li>– Integrated ultra-fast body diode with BiC Q<sub>tr</sub></li> <li>– Best-in-class FOM <math>R_{DS(on)} \times E_{oss}</math>; reduced <math>Q_{G^?}</math>, <math>C_{iss}</math> and <math>C_{oss}</math></li> <li>– BiC <math>R_{DS(on)}</math> in various packages like 450 mΩ in DPAK and 60 mΩ in TO-247</li> <li>– <math>V_{(GS)th}</math> of 3 V and smallest <math>V_{(GS)th}</math> variation of ±0.5 V</li> <li>– ESD protection up to class 2 (HBM)</li> <li>– Offering the highest quality and reliability</li> <li>– Price competitiveness over previous CoolMOS™ families</li> </ul> | <ul style="list-style-type: none"> <li>– Hard commutation ruggedness that enables the usage of PFD7 in different circuit topologies</li> <li>– Improved efficiency and thermal behavior over internal and external comparable products</li> <li>– Enabling higher power density designs and BOM savings</li> <li>– Easy to drive and design-in</li> <li>– Improved production yield by reducing ESD-related failures and reduced field returns</li> <li>– Cost-competitive designs with superjunction</li> </ul> |

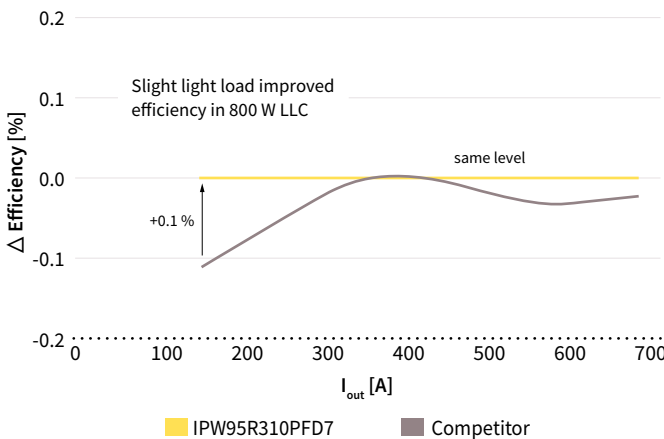
Efficiency measurements for 310 mΩ devices at 90 V<sub>AC</sub> ( $R_{g,ext} = 10 \Omega$ )



950 V CoolMOS™ PFD7 outperforms previous CoolMOS™ families as well as the main competition concerning PFC efficiency:

- Improvement of 0.26 percent in light-load and 0.22 percent in full-load efficiency compared to the main competition
- Improvement of 0.36 percent in light-load and 0.65 percent in full-load efficiency compared to 900 V CoolMOS™ C3

Efficiency measurements for 310 mΩ in 880 W ZVS FB set up



950 V CoolMOS™ PFD7 closes the gap and matches the performance of the main competition regarding LLC efficiency:

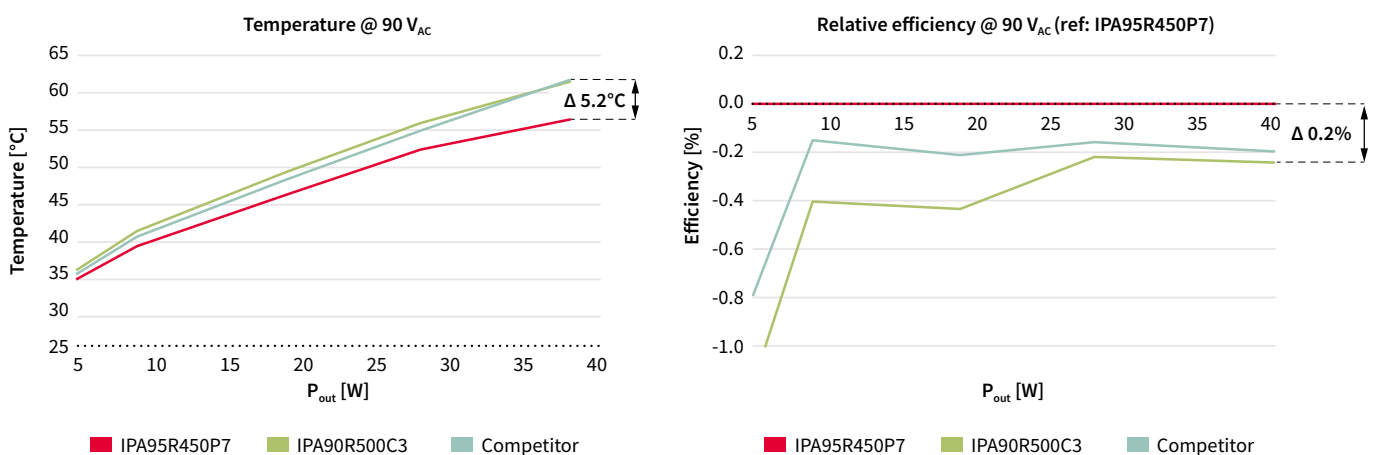
- Improvement of 0.1 percent in light-load efficiency compared to the main competition



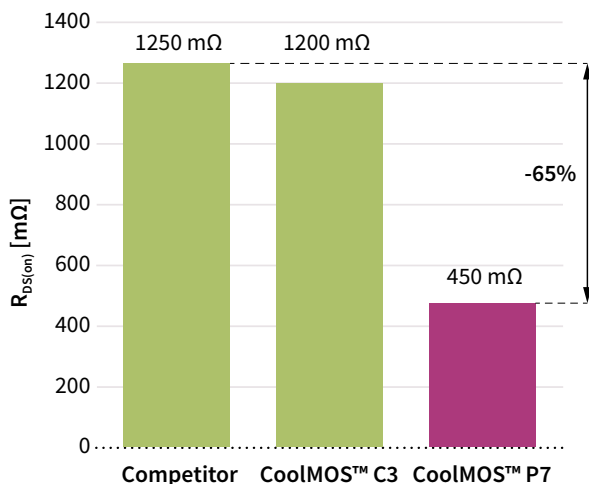
# 950 V CoolMOS™ P7 SJ MOSFETs

## Perfect fit for PFC and flyback topologies

Designed to meet the growing consumer needs in the high-voltage MOSFETs arena, the 950 V CoolMOS™ P7 technology focuses on the low-power SMPS market. The P7 family addresses applications ranging from lighting, smart meter, mobile phone charger, notebook adapter, to AUX power supply and industrial SMPS. Offering 50 V more blocking voltage than its predecessor 900 V CoolMOS™ C3, the 950 V CoolMOS™ P7 series delivers outstanding performance in terms of efficiency, thermal behavior, and ease of use. As all other P7 family members, the 950 V CoolMOS™ P7 series comes with an integrated Zener diode ESD protection. The integrated diode considerably improves ESD robustness, thus reducing ESD-related yield loss and reaching exceptional ease-of-use levels. CoolMOS™ P7 is developed with a best-in-class threshold voltage ( $V_{GS(th)}$ ) of 3 V and a narrow tolerance of only  $\pm 0.5$  V, which makes it easy to drive and design-in.



Compared to competition, the 950 V CoolMOS™ P7 delivers best-in-class efficiency and thermal performance. Plug-and-play at 90 V<sub>AC</sub> in a 40 W adapter reference design, featuring the snubberless concept, demonstrates excellent efficiency gains of up to 0.2 percent and lower MOSFET temperature of up to 5.2°C compared to similar competitor technology. With over 20 years of experience in superjunction technology, Infineon introduces 950 V CoolMOS™ P7 with best-in-class DPAK on-resistance ( $R_{DS(on)}$ ). This SMD device comes with the  $R_{DS(on)}$  of 450 mΩ - more than 60 percent lower  $R_{DS(on)}$  compared to the nearest competitor. Such low  $R_{DS(on)}$  value enables higher density designs while decreasing BOM and assembly cost.



### Best-in-class DPAK $R_{DS(on)}$

Customer benefits:

- Possible change from leaded to SMD packages
- High power density
- Lower BOM cost
- Lower production cost

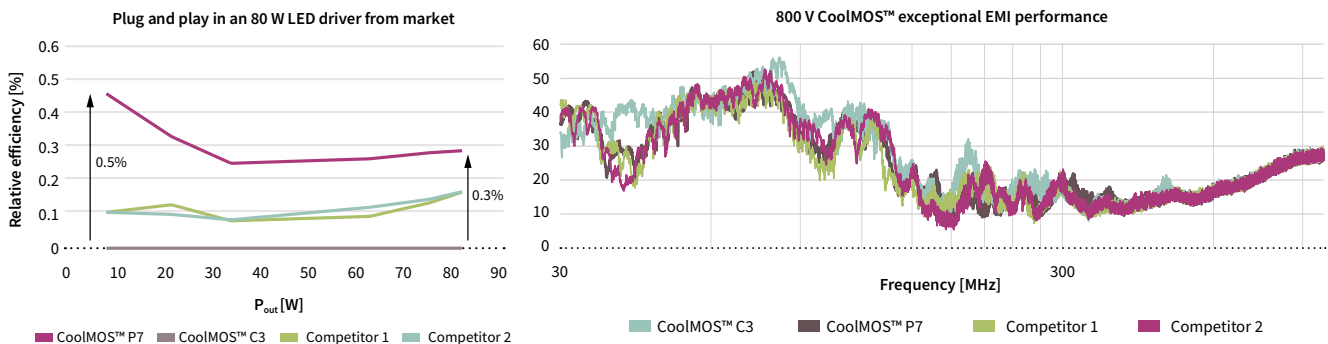


# 800 V CoolMOS™ P7 SJ MOSFETs

## A benchmark in efficiency and thermal performance

With the 800 V CoolMOS™ P7 series, Infineon sets a benchmark in 800 V superjunction technologies and combines best-in-class performance with the remarkable ease of use. This product family is a perfect fit for flyback-based consumer and industrial SMPS applications. In addition, it is also suitable for PFC stages within consumer, as well as solar applications, fully covering the market needs in terms of its price/performance ratio.

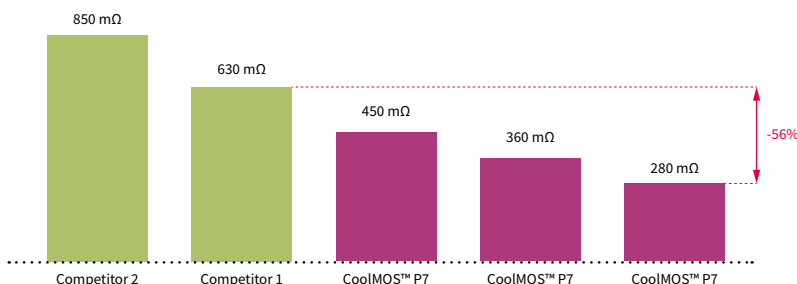
The technology offers fully optimized key parameters to deliver best-in-class efficiency as well as thermal performance. As demonstrated on an 80 W LED driver, bought on the market, the >45 percent reduction in switching losses ( $E_{oss}$ ) and output capacitance ( $C_{oss}$ ) as well as the significant improvement in input capacitance ( $C_{iss}$ ) and gate charge ( $Q_G$ ), compared to competitor technologies, lead to 0.5 percent higher efficiency at light load which helps to reduce standby power in the end application. At full load, the observed improvement is up to 0.3 percent higher efficiency and 6°C lower device temperature.



EMI is a system level topic, and the optimization needs to be done on the system level only. Nevertheless, a pure plug-and-play measurement on Infineon's 45 W adapter reveals that 800 V CoolMOS™ P7 shows similar EMI performance to Infineon's previous technologies as well as to competitors' technologies.

Compared to competition, the 800 V CoolMOS™ P7 technology allows to integrate much lower  $R_{DS(on)}$  values into small packages, such as a DPAK. This finally enables high power density designs at highly competitive price levels.

### Overview of lowest DPAK $R_{DS(on)}$ for 800 V superjunction MOSFET



### CoolMOS™ P7 sets a new benchmark in best-in-class DPAK $R_{DS(on)}$

Customer benefits:

- High power density
- Lower BOM cost
- Lower production cost

The complete P7 platform has been developed with an integrated Zener diode that is used as an electrostatic discharge (ESD) protection mechanism, which increases the overall device ruggedness up to human body model (HBM) class 2 level.

[www.infineon.com/800V-p7](http://www.infineon.com/800V-p7)



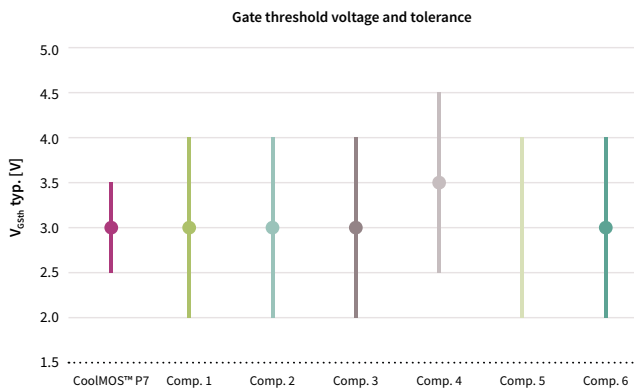
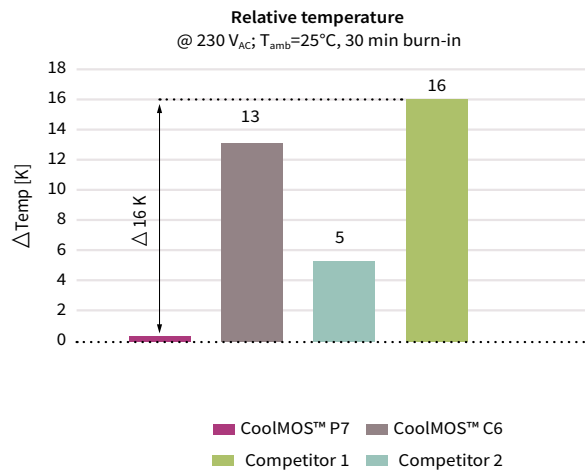
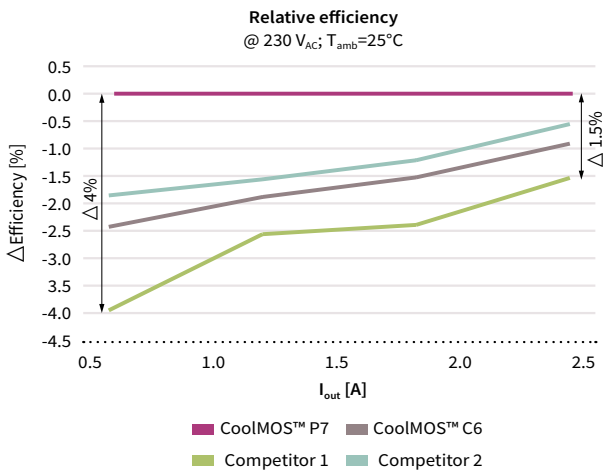
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# 700 V CoolMOS™ P7 SJ MOSFETs

## Infineon's solution for flyback topologies

The 700 V CoolMOS™ P7 family has been developed to serve today's and, especially, tomorrow's trends in flyback topologies. The products address the low-power SMPS market, mainly focusing on mobile phone chargers and notebook adapters, but are also suitable for power supplies, used within lighting applications, home entertainment (TV, game consoles or audio), and auxiliary power supplies. 700 V CoolMOS™ P7 achieves outstanding efficiency gains of up to 4 percent and a decrease in device temperature of up to 16 K compared to the competition. In contrast with the previous 650 V CoolMOS™ C6 technology, 700 V CoolMOS™ P7 offers 2.4 percent gain in efficiency and 12 K lower device temperature, measured at a flyback-based charger application, operated at 140 kHz switching speed.



Keeping the ease of use in mind, Infineon has developed the technology with a low threshold voltage ( $V_{GS(th)}$ ) of 3 V and a very narrow tolerance of  $\pm 0.5$  V. This makes the CoolMOS™ P7 easy to design-in and enables the usage of lower gate source voltage, which facilitates its driving and leads to lower idle losses. To increase the ESD ruggedness up to HBM class 2 level, 700 V CoolMOS™ P7 has an integrated Zener diode. This helps to support increased assembly yield, leads to reduction of production related failures and, finally, manufacturing cost savings on customer side.

## Features and benefits

### Key features

- Highly performant technology
  - Low switching losses ( $E_{oss}$ )
  - Highly efficient
  - Excellent thermal behavior
- Allowing high-speed switching
- Integrated protection Zener diode
- Optimized  $V_{GS(th)}$  of 3 V with very narrow tolerance of  $\pm 0.5$  V
- Finely graduated portfolio

### Key benefits

- Cost-competitive technology
- Further efficiency gain at higher switching speed
- Supporting less magnetic size with lower BOM costs
- High ESD ruggedness up to HBM class 2 level
- Easy to drive and design-in
- Enabler for smaller form factors and high power density designs
- Excellent choice in selecting the best-fitting product

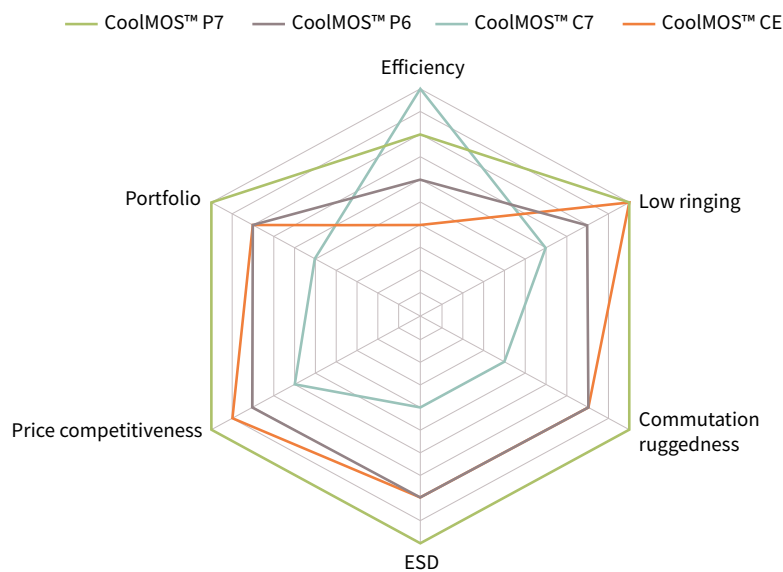


# 600 V CoolMOS™ P7 SJ MOSFETs

## Perfect combination of high efficiency and ease of use

The 600 V CoolMOS™ P7 is a general purpose series, targeting a broad variety of applications, ranging from low-power SMPS up to the highest power levels. In the low-power arena, it is the successor of the 600 V CoolMOS™ CE, and for high-power SPMS applications, it is the replacement for the 600 V CoolMOS™ P6, which makes it the perfect choice for applications such as chargers, adapters, lighting, TV and PC power supplies, solar, small light electric vehicles, server and telecom power supplies, and electric vehicle (EV) charging.

The 600 V CoolMOS™ P7 is Infineon's most well-balanced CoolMOS™ technology in terms of combining ease of use and excellent efficiency performance. Compared to its predecessors, it offers higher efficiency and improved power density due to the significantly reduced gate charge ( $Q_g$ ) and switching losses ( $E_{oss}$ ) levels, as well as optimized on-state resistance ( $R_{DS(on)}$ ). The carefully selected integrated gate resistors enable very low ringing tendency and, thanks to its outstanding robustness of body diode against hard commutation, it is suitable for hard as well as soft-switching topologies, such as LLC. In addition, an excellent ESD capability helps to improve the quality in manufacturing. The 600 V CoolMOS™ P7 family offers a wide range of on-resistance ( $R_{DS(on)}$ )/package combinations, including THD, as well as SMD devices, at an  $R_{DS(on)}$  granularity from 24 to 600 mΩ and comes along with the most competitive price/performance ratio of all 600 V CoolMOS™ offerings.



## Features and benefits

### Key features

- Suitable for hard and soft switching (PFC and LLC) due to an outstanding commutation ruggedness
- Optimized balance between efficiency and ease of use
- Significant reduction of switching and conduction losses leading to low MOSFET temperature
- Excellent ESD robustness >2 kV (HBM) for all products
- Better  $R_{DS(on)}$ /package products compared to competition
- Large portfolio with granular  $R_{DS(on)}$  selection qualified for a variety of industrial and consumer applications

### Key benefits

- Ease of use and fast design-in through low ringing tendency and usage across PFC and PWM stages
- Improved efficiency and simplified thermal management due to low switching and conduction losses
- Higher manufacturing quality due to >2 kV ESD protection
- Increased power density solutions enabled by using products with smaller footprint
- Suitable for a wide variety of applications and power ranges

[www.infineon.com/600V-p7](http://www.infineon.com/600V-p7)



Charger



Adapter



Lighting



TV



PC power



Solar



LSEV



Server



Telecom



EV charger

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



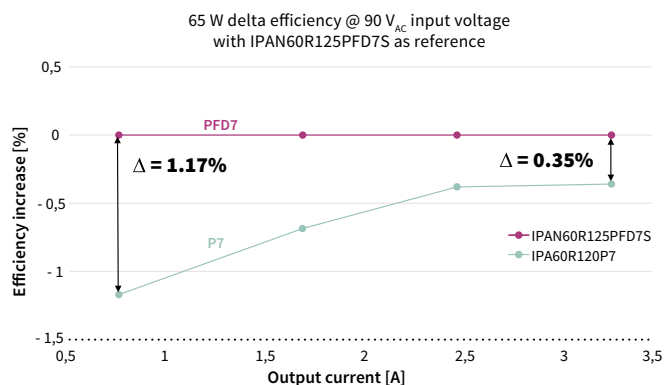
# 600 V CoolMOS™ PFD7 SJ MOSFETs

## The next level for ultrahigh power density designs and energy-efficient home appliance drives

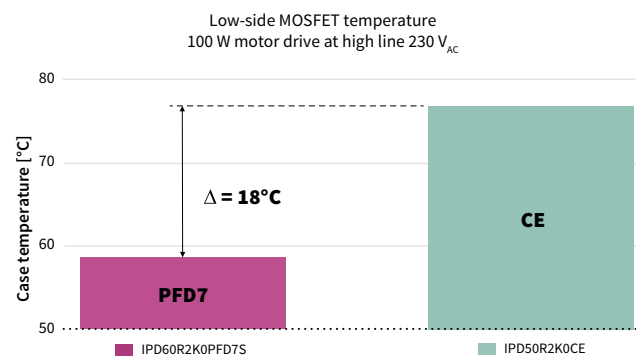
The 600 V CoolMOS™ PFD7 MOSFET series sets a new benchmark in 600 V superjunction (SJ) technologies, shaped by Infineon's experience of more than 20 years in pioneering in superjunction technology innovation. The series combines best-in-class performance with state-of-the-art ease of use and features an integrated fast body diode ensuring a robust device and in turn reduced BOM for the customer. This product family offers up to 1.17 percent efficiency increase compared to the CoolMOS™ P7 technologies, which leads to a power density increase of 1.8 W/in<sup>3</sup>.

CoolMOS™ PFD7 pushes the SJ MOSFET technology to new limits leading to outstanding improvement of lower conduction and charge/discharge losses as well as a reduced turn-off and gate-driving losses.

A broad range of  $R_{DS(on)}$  values in combination with a variety of packages helps in selecting the right part to optimize designs. Furthermore, an integrated ESD protection of up to 2 kV eliminates ESD-related yield loss. Infineon's industry-leading SMD package offering contributes to bill-of-material and PCB space savings and simplifies manufacturing. This unique set of product features and their resulting benefits, position the CoolMOS™ PFD7 superjunction MOSFET family exceptionally well for ultrahigh density applications like chargers and adapters, USB power delivery but also for home appliance drives (e.g. refrigerator compressors) and specific lighting SMPS applications.



600 V CoolMOS™ PFD7 increases efficiency in light- and full-load conditions. This results in a power density increase of 1.8 W/in<sup>3</sup> for ultrahigh power chargers and adapters.



600 V CoolMOS™ PFD7 provides up to 2 percent higher efficiency at 100 W, which results in an 18°C thermal improvement. Its excellent commutation ruggedness makes it the perfect fit for low-power drives.

### Features and benefits

#### Key features

- Very low FOM  $R_{DS(on)} \times E_{oss}$
- Integrated robust fast body diode
- Ultra-low  $Q_{rr}$  and industry's fastest recovery time ( $T_{rr}$ )
- Up to 2 kV ESD protection (HBM class 2)
- Wide range of  $R_{DS(on)}$  values and broad package portfolio
- Excellent commutation ruggedness

#### Key benefits

- Minimized switching losses
- Power density improvement compared to latest CoolMOS™ charger technology
- Increased efficiency (especially at light-load operation) and improved thermal behavior compared to CoolMOS™ CE technology for home appliance motor drives
- BOM cost reduction and easy manufacturing
- Robustness and reliability
- Easy to select right parts for design fine-tuning



# 600 V and 650 V CoolMOS™ C7 and 600 V C7 Gold (G7) SJ MOSFETs

## Infiniteon's superjunction MOSFET series for highest efficiency

The 600 V and 650 V CoolMOS™ C7 and 600 V C7 Gold (G7) superjunction MOSFET series are designed to achieve record level efficiency performance – they offer substantial efficiency benefits over the whole load range in hard-switching applications compared to previous series and competition. This is achieved by minimizing switching losses via ultralow levels of switching losses ( $E_{oss}$ ) (approximately 50 percent reduction compared to the CoolMOS™ CP), reduced gate charge ( $Q_g$ ) and a careful balance of other relevant product key parameters. The low  $E_{oss}$  and  $Q_g$  also enable operation at higher switching frequency and related size reduction of the circuit magnetics.

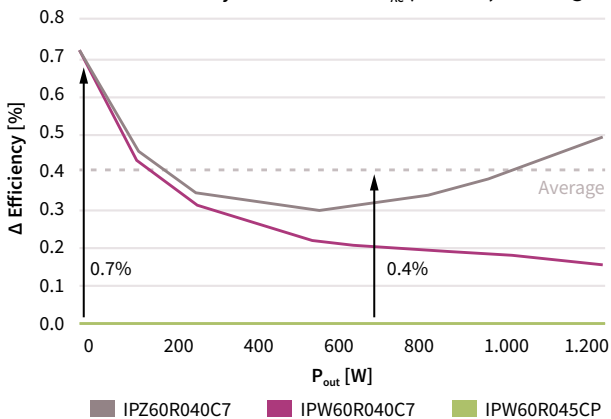
The outstanding figures of merit (FOM) and the best-in-class on-state resistance ( $R_{DS(on)}$ ) offerings make the CoolMOS™ C7 and C7 Gold series key enablers for highest efficiency and power density. While the 650 V CoolMOS™ C7 and 600 V C7 Gold (G7) superjunction MOSFETs are solely designed for hard-switching applications such as PFC, the 600 V version is also well suited for high-end LLC stages due to its rugged body diode that withstands slew rates up to 20 V/ns. The product portfolio contains TO-247 4-pin, ThinPAK 8x8, TO-Leadless and top-side cooled Double DPAK (DDPAK) packages which come with additional Kelvin source contacts enabling further efficiency advantages over the classical 3-pin approach.

### Features and benefits

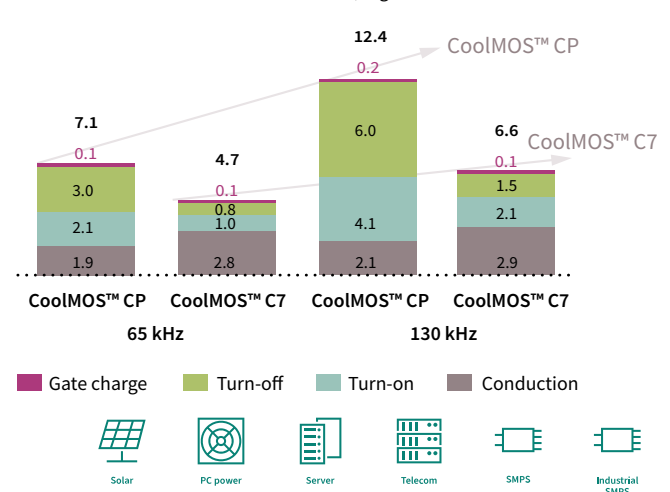
| Key features  |
|---|
| – Reduced switching loss parameters such as $Q_g$ and $C_{oss}$ , enabling higher switching frequency |
| – 50 percent $E_{oss}$ reduction compared to older CoolMOS™ CP  |
| – Suitable for hard-switching topologies (650 V and 600 V)  |
| – Suitable for high-end resonant (600 V only) topologies  |

| Key benefits   |
|--|
| – Increased efficiency in hard-switching topologies such as PFC and TTF                            |
| – Reduced size and cost of magnetic components by increased switching frequency (e.g. 65 -130 kHz) |
| – Increased power density by smaller packages for the same $R_{DS(on)}$                            |

PFC CCM 1200 W efficiency difference for 90 V<sub>AC</sub> (PFC CCM, 1.150 W @ 65 kHz)



MOSFET losses [W]  
IPW60R045CP vs. IPZ60R060C7, highline 2.5 kW



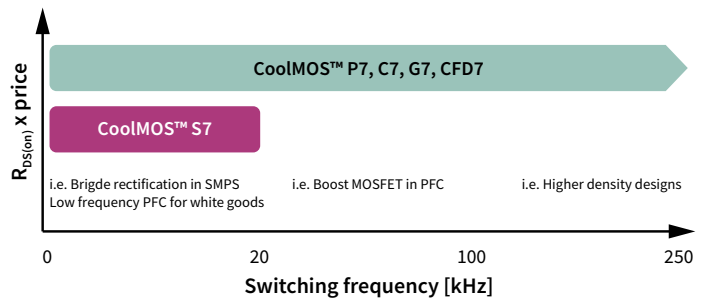
[www.infineon.com/c7](http://www.infineon.com/c7)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

# 600 V CoolMOS™ S7 SJ MOSFETs

## The best price/performance SJ MOSFET for low frequency switching applications

The 600 V CoolMOS™ S7 superjunction MOSFET is the perfect fit for applications where MOSFETs are switched at low frequency, such as active bridge rectification, inverter stages, in-rush relays, PLCs, power solid state relays and solid state circuit breakers. The new MOSFET design with the best conduction performance allows the CoolMOS™ S7 to offer cost-optimized distinctively low on-resistance ( $R_{DS(on)}$ ) values, ideally suited for applications looking to minimize conduction losses at the best price.



The CoolMOS™ S7 leads the way for power density, uniquely fitting a 22 mΩ  $R_{DS(on)}$  chip into an innovative small TO-Leadless (TOLL) SMD package.

### Use cases

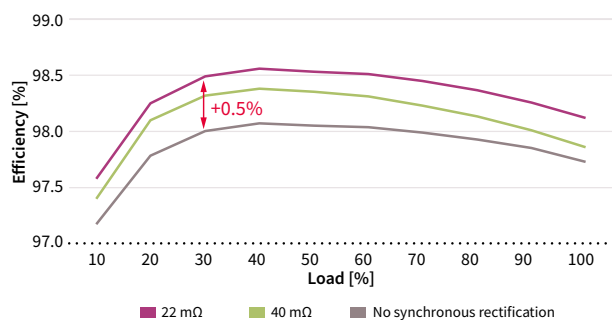
Typically, CoolMOS™ S7 is used in active rectification bridges, where diodes are replaced or paralleled with MOSFETs, obtaining an increase in efficiency without the need for extensive system redesign. In this application, the TO-leadless (TOLL) package in low  $R_{DS(on)}$  allows the most efficient and compact modular design based on daughter cards. The CoolMOS™ S7 delivers also tremendous value to solid state relay (SSR) and solid state circuit breaker (SSCB) designs, by bringing the superjunction MOSFET advantages to a system level cost comparable to other silicon alternatives. In addition, any socket or topology switching at low frequency can greatly benefit from the leading low  $R_{DS(on)}$  x price.

### Features and benefits

| Key features  |
|---|
| - Best-in-class $R_{DS(on)}$ in SMD packages                                    |
| - Optimized for conduction performance, reaching the lowest $R_{DS(on)}$ values |
| - High pulse current capability   |
| - Improved thermal resistance   |

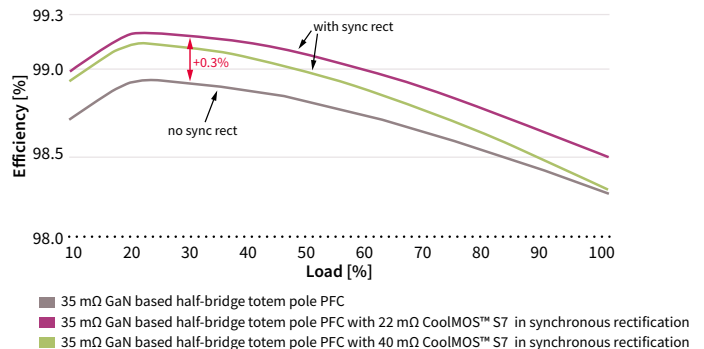
| Key benefits   |
|--|
| - Minimizes conduction losses  |
| - An easy step into Titanium level SMPS                                      |
| - Modular, more compact and easier designs                                   |
| - Eliminates or reduces heat sink in solid state relays and circuit breakers |
| - Lower TCO cost or BOM cost   |

### Efficiency in 2400 W PFC at $V_{in} = 230 V_{AC}$ Difference between using or not using the active-bridge rectification



### 3 kW GaN-based totem pole PFC efficiency calculation with and without synchronous rectification when

$V_{in} = 230 V_{AC}$ ,  $V_{out} = 400 V$ ,  $f_{sw} = 65 kHz$



CoolMOS™ S7 brings more efficiency to power supplies when used in an active rectification bridge.

CoolMOS™ S7 is the perfect complement for CoolSiC™ MOSFETs and CoolGaN™ GIT HEMTs in totem pole PFC topologies.

[www.infineon.com/s7](http://www.infineon.com/s7)



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



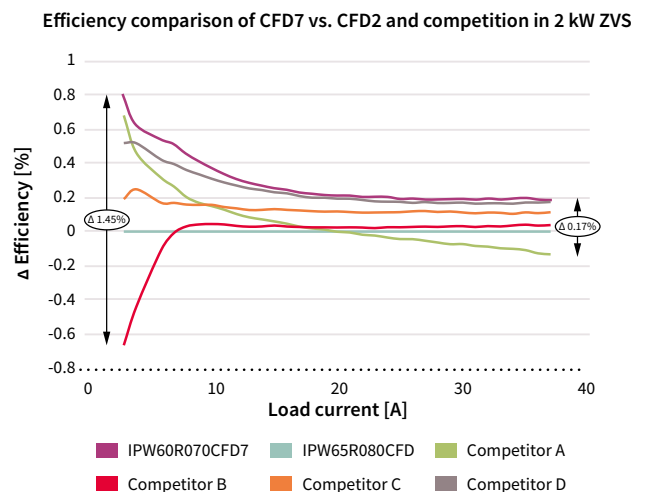
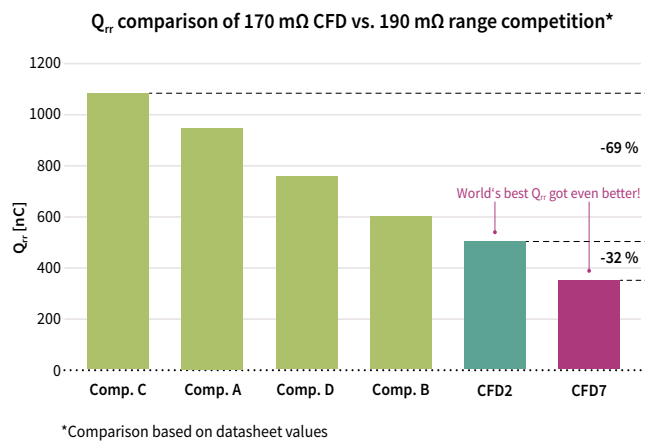
# 600 V CoolMOS™ CFD7 SJ MOSFETs

## Infiniteon's solution for resonant switching high-power applications

The 600 V CoolMOS™ CFD7 is one of Infineon's high-voltage superjunction MOSFET series with an integrated fast body diode. It is the ideal choice for resonant topologies, such as LLC and ZVS PSFB, and targets the high SMPS market.

As a result of significantly reduced gate charge ( $Q_g$ ), improved turn-off behavior, a reverse recovery charge ( $Q_{rr}$ ) of up to 69 percent lower compared to the competition, as well as the lowest reverse recovery time ( $t_{rr}$ ) in the market, it combines the highest efficiency and best-in-class reliability in soft-switching applications, without sacrificing the easy implementation in the design-in process.

In addition, the 600 V CoolMOS™ CFD7 enables higher power density solutions by offering the best-in-class on-state resistance ( $R_{DS(on)}$ ) package combinations in through-hole devices, as well as in surface mount devices. In ThinPAK 8x8 and TO-220 with CoolMOS™ CFD7, a  $R_{DS(on)}$  of around 30 percent below the next best competitor offering can be achieved. All this together makes CoolMOS™ CFD7 the perfect fit for server and telecom applications, and it is also suitable for EV-charging stations.



## Features and benefits

### Key features

- Ultrafast body diode
- Best-in-class reverse recovery charge ( $Q_{rr}$ )
- Improved reverse diode  $dv/dt$  and  $dif/dt$  ruggedness
- Lowest figure of merit ( $R_{DS(on)} \times Q_g \times E_{oss}$ )
- Best-in-class  $R_{DS(on)}$ /package combinations

### Key benefits

- Best-in-class hard commutation ruggedness
- Highest reliability for resonant topologies
- Highest efficiency with outstanding ease of use/performance trade-off
- Enabling increased power density solutions

[www.infineon.com/cfd7](http://www.infineon.com/cfd7)



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



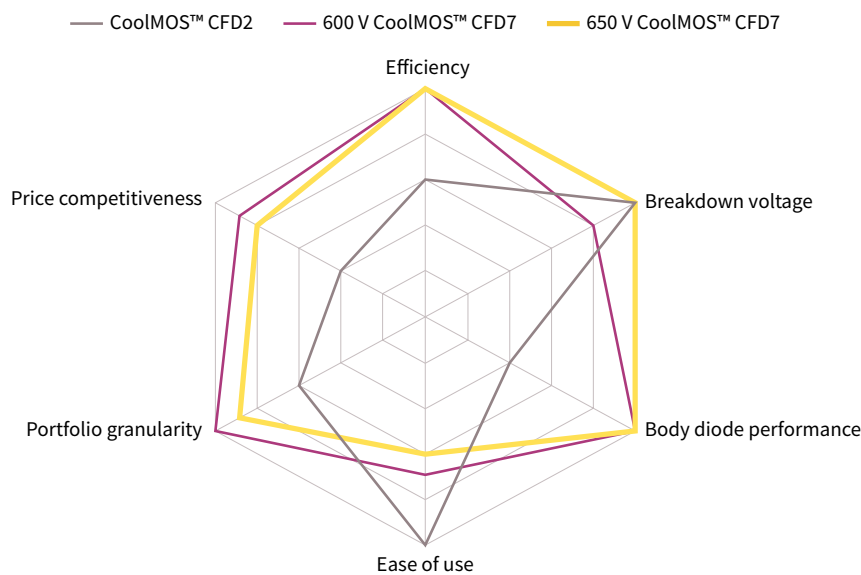
# 650 V CoolMOS™ CFD7 SJ MOSFETs

## Tailored to win in resonant topologies

The need for improved efficiency and higher power density in industrial SMPS applications is driven by the megatrends of the 21<sup>st</sup> century such as big data, digitalization and e-mobility. Furthermore, over the last few years, due to the higher nominal input voltages in the US, a trend towards 450 V bus voltage, and the need for worldwide applicable designs, the demand for 650 V breakdown voltage has increased significantly - also for resonant topologies.

The 650 V device family is the voltage-range extension of Infineon's renowned CoolMOS™ CFD7 family, the successor to the well-established CoolMOS™ CFD2. It comes along with an additional 50 V breakdown voltage, integrated fast body diode, improved switching performance (compared to previous generations), and excellent thermal behavior. Thanks to these features, the 650 V CoolMOS™ CFD7 allows for the highest efficiency and power density levels in soft-switching applications such as LLC and ZVS phase-shift-full-bridge.

The best-in-class  $R_{DS(on)}$  in TO-247, TO-220, and D<sup>2</sup>PAK enables customers to increase the power density level of their designs primarily addressing telecom, server, solar, and (off-board) EV-charging applications.



## Features and benefits

### Key features

- 650 V blocking voltage
- Ultrafast body diode
- Reduced switching losses
- Low  $R_{DS(on)}$  dependency over temperature

### Key benefits

- 50 V extra margin for increased bus voltage
- Excellent hard commutation ruggedness
- Outstanding light load efficiency
- High full load efficiency

[www.infineon.com/650v-cfd7](http://www.infineon.com/650v-cfd7)



Telecom



Server



EV charger



Solar

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

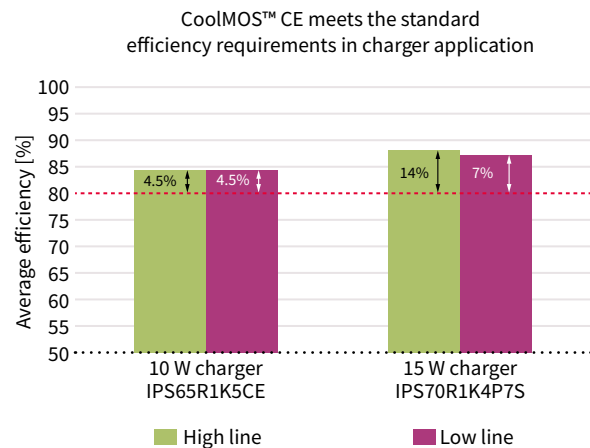
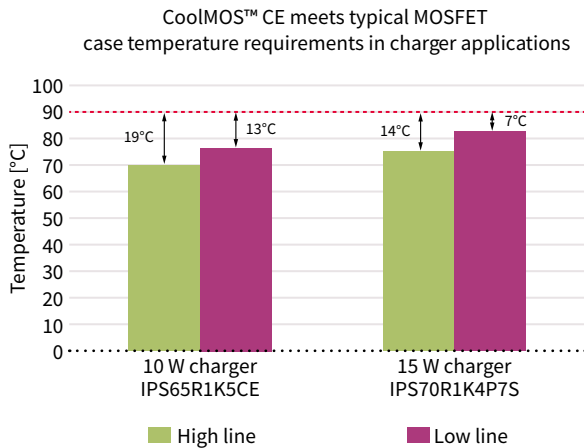


# CoolMOS™ CE SJ MOSFETs

## High-voltage superjunction MOSFETs for consumer applications

Infiniteon's CoolMOS™ CE is a product family that addresses consumer and lighting applications. It offers benefits in efficiency and thermal behavior versus standard MOSFETs and is optimized for ease of use and cost-competitiveness, while delivering the right-fit performance and excellent Infineon quality.

### Application example: 10 W and 15 W smartphone charger

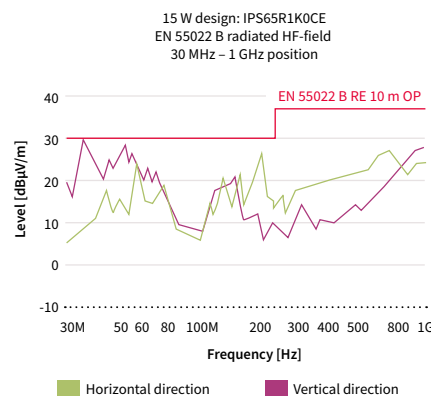
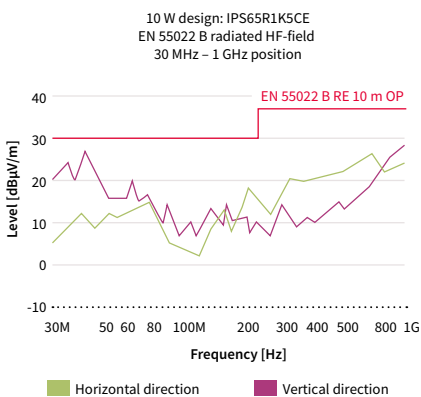


#### CoolMOS™ CE case temperature:

The maximum MOSFET case temperature is required to be below 90°C. CoolMOS™ CE meets this requirement and offers enough margin required for design-in flexibility.

#### CoolMOS™ CE efficiency performance:

CoolMOS™ CE meets the 80 percent standard efficiency requirement and offers enough margin required for design-in flexibility.



The performance of CoolMOS™ CE in the 10 W and 15 W design demonstrates that the series meets common EMI requirements for charger applications and thus, is also offering design-in flexibility.

#### CoolMOS™ CE customer benefits

|                          |   |
|--------------------------|---|
| <b>Product portfolio</b> | Broad portfolio covering five voltage classes in both through-hole and SMD packages                   |
| <b>Quality</b>           | Field failure rates are as low as 0.1 DPM   |
| <b>Design-in support</b> | Large field application engineering team to provide professional and flexible support for your design |



# CoolMOS™ SJ MOSFETs for automotive

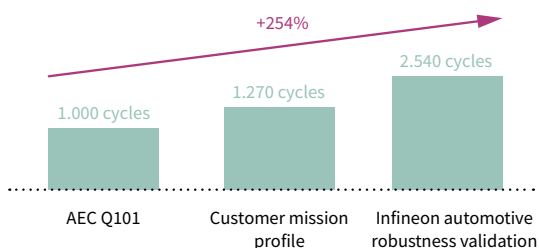
600 V CoolMOS™ CPA, 650 V CoolMOS™ CFDA, 800 V CoolMOS™ C3A, 650 V CoolMOS™ CFD7A – on the fast lane in automotive applications

The highest system performance in a size and weight constrained environment, outstanding and proven product quality and reliability, as well as 100 percent reliable delivery, are key requirements for manufacturers in the automotive market. With the high-voltage automotive MOSFET series 600 V CoolMOS™ CPA and 650 V CoolMOS™ CFDA, 800 V CoolMOS™ C3A and 650 V CoolMOS™ CFD7A, Infineon is perfectly prepared to take the challenges in the strongly growing automotive market.

| Product series       | Key features  | Applications  | Quality  |
|----------------------|---|---|--|
| 600 V CoolMOS™ CPA   | <b>Best choice for demanding hard-switching applications</b> <ul style="list-style-type: none"> <li>Lowest <math>R_{DS(on)}</math> per package</li> <li>Lowest gate charge value <math>Q_g</math></li> </ul>  | <ul style="list-style-type: none"> <li>Hard-switching topologies (with SiC diode)</li> <li>PFC boost stages in on-board charger</li> </ul>  | <b>Quality level well beyond the formal requirements of the AEC Q101 standard through</b><br>Special screening measures in front end, back end<br>Mission-profile based qualification procedures |
| 650 V CoolMOS™ CFDA  | <b>Easy implementation of layout and design</b> <ul style="list-style-type: none"> <li>Integrated fast body diode</li> <li>Limited voltage overshoot during hard commutation – self-limiting <math>dI/dt</math> and <math>dV/dt</math></li> <li>Low <math>Q_{rr}</math> at repetitive commutation on body diode and low <math>Q_{oss}</math></li> </ul> | <ul style="list-style-type: none"> <li>Resonant-switching topologies</li> <li>DC-DC stage of OBC</li> <li>LLC or full-bridge phase shift (ZVS) in DC-DC converter</li> <li>HID lamp</li> <li>Active DC link discharge</li> <li>Pre-charge</li> </ul>  |  |
| 800 V CoolMOS™ C3A   | <ul style="list-style-type: none"> <li>Outstanding performance in terms of efficiency, thermal behavior and ease-of-use</li> <li>High blocking voltage</li> </ul>   | <ul style="list-style-type: none"> <li>Flyback low-power auxiliaries</li> <li>On-board charger</li> <li>HV-LV DC-DC converter</li> <li>Battery disconnect unit</li> <li>Traction inverter auxiliaries</li> <li>DC-link pre-charge</li> <li>DC-link active discharge</li> <li>Isolation monitoring</li> </ul>  |  |
| 650 V CoolMOS™ CFD7A | <ul style="list-style-type: none"> <li>Improved 650 V CoolMOS™ CFDA</li> <li>Higher application voltage possible (at the same proven reliability level)</li> <li>D<sup>2</sup>PAK 7-pin with increased creepage distance and Kelvin source</li> <li>Considerable improvement in key parameters (higher efficiency)</li> </ul>                           | <ul style="list-style-type: none"> <li>On-board charger               <ul style="list-style-type: none"> <li>Hard-switching topologies (with SiC diode)</li> <li>PFC boost stages</li> <li>DC-DC stage of OBC</li> </ul> </li> <li>HV-LV DC-DC converter               <ul style="list-style-type: none"> <li>LLC or full-bridge phase shift (ZVS)</li> </ul> </li> <li>Auxiliary power supplies</li> </ul> |  |

## CoolMOS™ SJ MOSFET automotive – benchmark in quality and reliability

Robustness validation – example for thermal cycling test



Focus on top-notch quality and reliability without any compromise – that is the principle Infineon applies during development and qualification of all CoolMOS™ superjunction technologies. For our automotive grade derivatives, the great quality levels of the industrial-based technologies are further boosted by special screening measures in front- and back-end, as well as by extended qualification procedures. The Infineon robustness validation approach with extended stress-test procedures, doubling the real

application requirements, is one of our key measures to ensure a quality level well beyond the formal requirements of the AEC Q101 standard. Aside from extended stress times on standard qualification tests, it comprises test procedures, specially developed by Infineon to ensure highest quality of e.g., the power metallization of our devices. Usage of robust package technologies, 100 percent gate oxide screening, and top-notch production monitoring, including yield screening measures, part average testing (PAT), statistical bin alarm (SBA), and pattern recognition procedures, complete our package to guarantee highest automotive quality. This holistic approach results in an unrivalled quality position of Infineon's CoolMOS™ SJ MOSFETs for automotive..

[www.infineon.com/cfd7a](http://www.infineon.com/cfd7a)

[www.infineon.com/coolmos-automotive](http://www.infineon.com/coolmos-automotive)



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

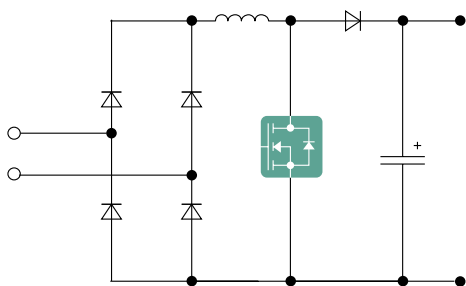




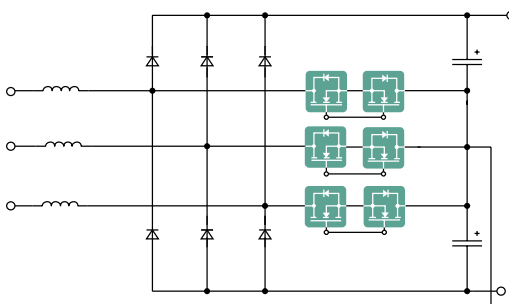
## CoolMOS™ SJ MOSFET automotive – ready to support future application trends

Driven by the carbon dioxide (CO<sub>2</sub>) reduction initiatives, the market of plug-in hybrid PHEV and pure EV is strongly growing. Higher ranges of the electric vehicles are realized by increasing the battery capacity and the energy efficiency of the used electric components. The used battery voltage classes tend to become standardized at approximately 450 V with a trend towards the higher voltages, as this supports faster charging times and enables lighter cabling within the vehicle. Discrete high-voltage components are widely used for on-board charger (OBC) and DC-DC converter (LDC) applications, as price pressure increasingly displaces module-based solutions. The trend towards fast charging impacts on the power range demanded from OBC topologies. Presently, as well as in the past, a vast majority of OBC topologies have been found in the range up to 7.2 kW, whereas the future tends to stir the trend towards 11 kW or even up to 22 kW. This development, paired with a demand for high efficiency and power density at low system cost, is a strong driver for the usage of three-phase solutions.

Classic PFC stage for OBC



OBC Vienna rectifier for three-phase PFC in OBC



While for the lower power OBC solutions classic PFC approaches are the well-established approaches in the market, the Vienna rectifier is the optimal solution for the higher power levels. As a true three-phase topology, it delivers full power if attached to a three-phase input but is flexible enough to run on a single-phase if required. The three-level topology minimizes the filter effort compared to other solutions. By using the doubled frequency on the magnetic components, it also helps to significantly reduce the size of the passives. As a three-level topology, the Vienna rectifier, followed by two paralleled DC-DC stages, furthermore leads to a relaxed voltage stress level on the power MOSFETs. This way, it enables to handle upcoming higher battery voltage levels. The  $R_{DS(on)}$ , required to yield a desired efficiency level in a Vienna Rectifier, is a function of applied switching frequency and demanded power level. With our 600 V CoolMOS™ CPA and 650 V CoolMOS™ CFDA portfolio, covering an  $R_{DS(on)}$  range from 45 to 660 mΩ, we are well-prepared to support your next-generation three-phase Vienna rectifier design. With CoolMOS™ you are ready to seize your share in the emerging high-power on-board charger markets.

[www.infineon.com/coolmos-automotive](http://www.infineon.com/coolmos-automotive)

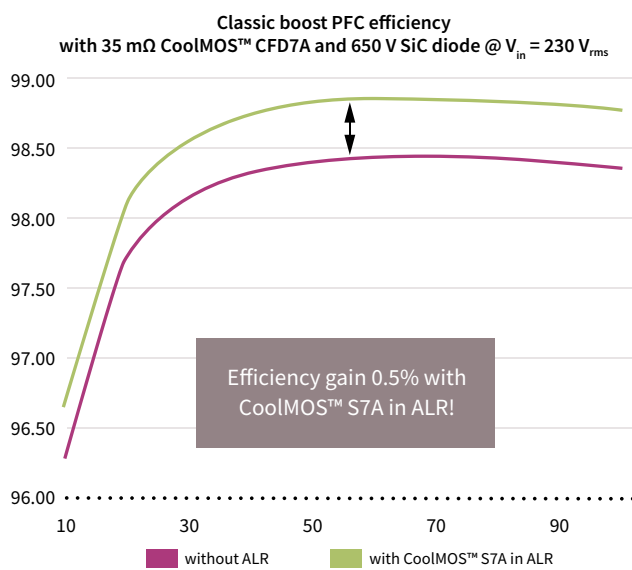
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# 600 V CoolMOS™ S7A

## Best-in-class $R_{DS(on)}$ x A SJ MOSFET for slow-switching automotive applications

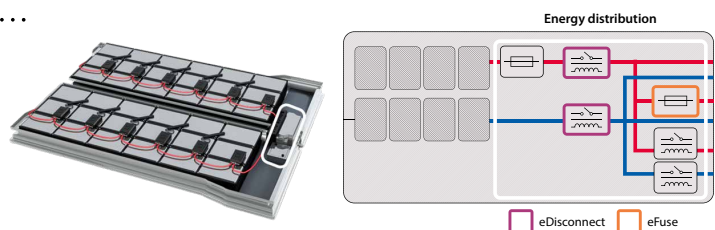
The automotive-grade 600 V CoolMOS™ S7A superjunction MOSFET addresses xEV applications where MOSFETs are switched at low frequency, such as HV eFuse, HV eDisconnect, and on-board charger in the slow-switching leg of the PFC stage. The more stringent requirements for increased power density, safety, and reliability in these applications are met by combining the superior robustness and performance of the S7A MOSFET with the innovative package concept offered by the QDPAK TSC. The new MOSFET design offers a cost-optimized, distinctively low on-resistance  $R_{DS(on)}$  of 10 m $\Omega$ , enabling increased power density and minimized conduction losses. The top-side cooled QDPAK package offers increased efficiency and controllability thanks to its intrinsic Kelvin source, high power dissipation capability, and innovative cooling concept.



CoolMOS™ S7A is the ideal device for the ALR active line rectification in a classic boost PFC topology, which offers a power loss reduction up to 30 percent and an overall PLC efficiency improvement of 0.5 percent.

CoolMOS™ S7A is the semiconductor solution for HV eDisconnect and HV eFuse. It answers e-mobility needs with respect to reliability (maintenance-free), flexible and cost-optimized system integration, scalability, and minimized failure propagation.

### HV power distribution unit



## Features and benefits

### Key features

- Best-in-class  $R_{DS(on)}$ : 10 m $\Omega$
- Smallest  $R_{DS(on)}$  in SMD packages
- Optimized for conduction performance
- Industry's leading heat-sinking capability
- High pulse current capability
- Body diode robustness at AC line commutation
- Kelvin-source concept

### Key benefits

- Minimized conduction losses
- Increased energy efficiency
- More compact and easier designs
- Increased power density
- Lower TCO cost or BOM cost
- Flexible system integration
- Variable cooling strategy



# CoolMOS™ SJ MOSFET high-power package innovations

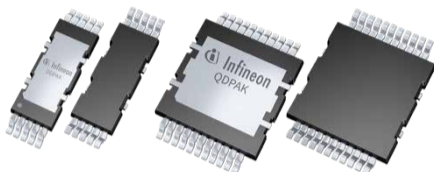
## Space-saving and high performance packages



An SMD package for high efficiency and controllability in automotive applications

### TO-263-7 (D<sup>2</sup>PAK-7-pin)

The TO-263-7-pin package is a SMD package addressing automotive-specific requirements including high efficiency and controllability. The Kelvin source pin leads to reduced switching losses. Furthermore, the 7-pin design increases the creepage distance at the PCB and therefore helps to improve the manufacturability.



Innovative top-side cooled SMD solution for high-power applications

### Top-side cooled Double & Quadruple DPAK (DDPAK + QDPAK)

These top-side cooled surface mount device (SMD) packages address high-power SMPS applications such as PC power, solar, server and telecom as well as automotive applications like HV eDisconnect, HV eFuse and on-board charger. SMD-based SMPS designs support fast switching and help to reduce the parasitic inductance associated with long leaded packages such as the common TO-220 and TO-247 package. In today's SMD-based designs, the output power is restricted by the thermal limit of the PCB material because the heat must be dissipated through the board. Thanks to the top-side cooling concept of DDPAK and QDPAK, the thermal decoupling of board and semiconductor is possible, enabling higher power density or improved system lifetime.



Innovative bottom-side cooled SMD solution for high-power applications

### Bottom-side cooled QDPAK

The bottom-side cooled surface mount device (SMD) packages address high-power SMPS applications such as solar, server, telecom as well as automotive applications. SMD-based SMPS designs support fast switching and help to reduce the parasitic inductance associated with long leaded package. Furthermore, SMD packages simplify assembly and reduce cost, while minimizing space requirements for the overall packages. The bottom-side cooled variant of QDPAK allow designers to benefit from these advantages, while implementing a more traditional cooling scheme for high power switches compared to the novel top-side cooled variants. Tried and tested PCB materials and assembly can be used, while improving the power path routing thanks to multiple source pins, as well as benefiting from advanced features such as multiple gate pins for safety applications.



For highest efficiency and controllability in high-power SMPS markets

### TO-247 4-pin with asymmetric leads

The TO-247 4-pin package with asymmetric leads is an optimized version of the standard TO-247 4-pin and enables highest efficiency and controllability in the high-power SMPS market. The fourth pin acts as a Kelvin source. The main current of the switch is placed outside of the gate loop and the feedback is eliminated. This leads to less switching losses, especially at high currents. Secondly, the EMI will be reduced due to cleaner waveforms. In addition, the asymmetric leads further improve the ease of use in the design-in process. Compared to the standard TO-247 4-pin the distance between the critical pins has been increased to enable simplified wave soldering and reduced board yield loss.



Enabling significant space savings

### ThinPAK 8x8

With a very small footprint of only 64 mm<sup>2</sup> (vs. 150 mm<sup>2</sup> for the D<sup>2</sup>PAK) and a very low profile with only 1 mm height (vs. 4.4 mm for the D<sup>2</sup>PAK) the **ThinPAK 8x8** leadless SMD package for high-voltage MOSFETs is a first choice to decrease system size in power-density driven designs. Low parasitic inductance and a separate 4-pin Kelvin source connection offer best efficiency and ease of use. The package is RoHS compliant with halogen-free mold compound.



Optimized for high-power applications

### TO-Leadless

Combined with the CoolMOS™ C7 Gold (G7) technology, the **TO-Leadless** (TOLL) package is Infineon's flagship SMD package for high power/high current SMD solutions. Compared to D<sup>2</sup>PAK 7-pin, **TO-Leadless** shows a 30 percent reduction in footprint, yet offers improved thermal performance. This, and the 50 percent height reduction result in a significant advantage whenever highest power density is demanded. Equipped with 4-pin Kelvin source connection and low parasitic inductances the package offers best efficiency and ease of use. The package is MSL1 compliant and reflow solderable.



# CoolMOS™ SJ MOSFET low-power package innovations

## Addressing today's consumer needs



Cost-effective drop-in replacement for DPAK

### SOT-223

The **SOT-223** package without middle pin is a cost-effective alternative to DPAK, addressing the need for cost reductions in price-sensitive applications. It offers a smaller footprint, while still being pin-to-pin compatible with DPAK, thus, allowing a drop-in replacement for DPAK and second sourcing. Moreover, **SOT-223** achieves comparable thermal performance to DPAK and enables customers to achieve improved form factors or space savings in designs with low power dissipation.



Solution for slim and small adapters and chargers

### ThinPAK 5x6

**ThinPAK 5x6** reduces the PCB area by 52 percent and height by 54 percent when compared to the DPAK package which is widely used in chargers and adapters. **ThinPAK 5x6** is the right device to replace DPAK and meet the market demands of slimmer and smaller designs. Also, **ThinPAK 5x6** enables a reduced charger and adapter case hot spot temperature by increasing the space between the MOSFET and the charger and adapter case.



Solution for height reduction in adapters and chargers

### TO-220 FullPAK Narrow Lead

Infineon's **TO-220 FullPAK Narrow Lead** addresses customer needs with regards to height reduction requirements in adapter and charger applications. By offering an optimized standoff width and height and improved creepage distance, the package can be fully inserted into the PCB without any production concerns and, therefore, is especially suitable for slim and semi-slim adapter solutions.



Improved creepage distance for open frame power supplies

### TO-220 FullPAK Wide Creepage

This package solution has an increased creepage distance between the pins to 4.25 mm compared to 2.54 mm of a TO-220 FullPAK package. It targets open frame power supplies such as TV sets and PC power, where dust can enter the case through air vents. Dust particles can reduce the effective creepage between pins over time, which may lead to high voltage arcing. The package meets the requirements of open frame power supplies without any additional measures. Thus, it reduces system cost by offering an alternative to frequently used approaches to increase creepage distance.



## 950 V CoolMOS™ PFD7



| $R_{DS(on)}$<br>[mΩ] | TO-220<br>FullPAK | TO247         | TO252<br>(DPAK) | TO263<br>(D <sup>2</sup> PAK) |
|----------------------|-------------------|---------------|-----------------|-------------------------------|
| 60                   |                   | IPW95R60PFD7  |                 |                               |
| 130                  | IPA95R130PFD7     | IPW95R130PFD7 |                 | IPB95R130PFD7                 |
| 310                  | IPA95R310PFD7     | IPW95R310PFD7 |                 | IPB95R310PFD7                 |
| 450                  | IPA95R450PFD7     |               | IPD95R450PFD7   | IPB95R450PFD7                 |

## 950 V CoolMOS™ P7



| $R_{DS(on)}$<br>[mΩ] | TO-220 | TO-220<br>FullPAK | SOT-223     | TO-251<br>Long lead | TO-252<br>(DPAK) |
|----------------------|--------|-------------------|-------------|---------------------|------------------|
| 450                  |        | IPA95R450P7       |             |                     | IPD95R450P7      |
| 750                  |        | IPA95R750P7       |             | IPU95R750P7         | IPD95R750P7      |
| 1200                 |        | IPA95R1K2P7       | IPN95R1K2P7 |                     | IPD95R1K2P7      |
| 2000                 |        |                   |             |                     | IPD95R2K0P7      |
| 3700                 |        |                   | IPN95R3K7P7 | IPU95R3K7P7         |                  |

## 900 V CoolMOS™ C3



| $R_{DS(on)}$<br>[mΩ] | TO-220      | TO-262<br>(I <sup>2</sup> PAK) | TO-263<br>(D <sup>2</sup> PAK) | TO-220<br>FullPAK | TO-247      | TO-252<br>(DPAK) |
|----------------------|-------------|--------------------------------|--------------------------------|-------------------|-------------|------------------|
| 120                  |             |                                |                                |                   | IPW90R120C3 |                  |
| 340                  | IPP90R340C3 | IPJ90R340C3                    | IPB90R340C3                    | IPA90R340C3       | IPW90R340C3 |                  |
| 500                  |             | IPJ90R500C3                    |                                | IPA90R500C3       | IPW90R500C3 |                  |
| 800                  | IPP90R800C3 |                                |                                | IPA90R800C3       |             |                  |
| 1200                 |             |                                |                                |                   |             | IPD90R1K2C3      |

## 800 V CoolMOS™ P7



| $R_{DS(on)}$<br>[mΩ] | TO-220      | TO-220<br>FullPAK | TO-247      | TO-252<br>(DPAK) | TO-251<br>(IPAK) | SOT-223     | TO-220<br>FullPAK<br>narrow lead | ThinPAK 5x6  |
|----------------------|-------------|-------------------|-------------|------------------|------------------|-------------|----------------------------------|--------------|
| 280                  | IPP80R280P7 | IPA80R280P7       | IPW80R280P7 | IPD80R280P7      |                  |             |                                  |              |
| 360                  |             | IPA80R360P7       | IPW80R360P7 | IPD80R360P7      |                  |             |                                  |              |
| 450                  | IPP80R450P7 | IPA80R450P7       |             | IPD80R450P7      |                  |             |                                  |              |
| 600                  |             | IPA80R600P7       |             | IPD80R600P7      | IPU80R600P7      | IPN80R600P7 |                                  | IPLK80R600P7 |
| 750                  |             | IPA80R750P7       |             | IPD80R750P7      |                  |             |                                  | IPLK80R750P7 |
| 900                  | IPP80R900P7 | IPA80R900P7       |             | IPD80R900P7      | IPU80R900P7      | IPN80R900P7 |                                  | IPLK80R900P7 |
| 1200                 |             |                   |             | IPD80R1K2P7      |                  |             |                                  | IPLK80R1K2P7 |
| 1400                 | IPP80R1K4P7 | IPA80R1K4P7       |             | IPD80R1K4P7      | IPU80R1K4P7      | IPN80R1K4P7 |                                  | IPLK80R1K4P7 |
| 2000                 |             |                   |             | IPD80R2K0P7      | IPU80R2K0P7      | IPN80R2K0P7 |                                  | IPLK80R2K0P7 |
| 2400                 |             |                   |             | IPD80R2K4P7      |                  | IPN80R2K4P7 |                                  |              |
| 3300                 |             |                   |             | IPD80R3K3P7      |                  | IPN80R3K3P7 |                                  |              |
| 4500                 |             |                   |             | IPD80R4K5P7      | IPU80R4K5P7      | IPN80R4K5P7 |                                  |              |

[www.infineon.com/coolmos](http://www.infineon.com/coolmos)  
[www.infineon.com/c3](http://www.infineon.com/c3)

[www.infineon.com/800v-p7](http://www.infineon.com/800v-p7)  
[www.infineon.com/950v-p7](http://www.infineon.com/950v-p7)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our product support.



## 800 V CoolMOS™ CE



| $R_{DS(on)}$<br>[mΩ] | TO-220<br>FullPAK | TO-252<br>(DPAK) |
|----------------------|-------------------|------------------|
| 310                  | IPA80R310CE       |                  |
| 460                  | IPA80R460CE       |                  |
| 650                  | IPA80R650CE       |                  |
| 1000                 | IPA80R1K0CE       | IPD80R1K0CE      |
| 1400                 | IPA80R1K4CE       | IPD80R1K4CE      |
| 2800                 |                   | IPD80R2K8CE      |

## 800 V CoolMOS™ C3



| $R_{DS(on)}$<br>[mΩ] | TO-220     | TO-263<br>(D <sup>2</sup> PAK) | TO-220<br>FullPAK | TO-247     | TO-252<br>(DPAK) |
|----------------------|------------|--------------------------------|-------------------|------------|------------------|
| 85                   |            |                                |                   | SPW55N80C3 |                  |
| 290                  | SPP17N80C3 | SPB17N80C3                     | SPA17N80C3        | SPW17N80C3 |                  |
| 450                  | SPP11N80C3 |                                |                   |            |                  |
| 650                  | SPP08N80C3 |                                | SPA08N80C3        |            |                  |
| 900                  | SPP06N80C3 |                                | SPA06N80C3        |            | SPD06N80C3       |
| 1300                 | SPP04N80C3 |                                |                   |            | SPD04N80C3       |
| 2700                 |            |                                |                   |            | SPD02N80C3       |

## 700 V CoolMOS™ P7



| $R_{DS(on)}$<br>[mΩ] | TO-251<br>(IPAK Short Lead) | TO-220<br>FullPAK | TO-252<br>(DPAK) | TO-220<br>FullPAK<br>narrow lead | SOT-223      | ThinPAK 5x6  |
|----------------------|-----------------------------|-------------------|------------------|----------------------------------|--------------|--------------|
| 360                  |                             | IPA70R360P7S      | IPD70R360P7S     |                                  | IPN70R360P7S |              |
| 450                  |                             |                   |                  |                                  | IPN70R450P7S |              |
| 600                  | IPS70R600P7S                | IPA70R600P7S      | IPD70R600P7S     | IPAN70R600P7S                    | IPN70R600P7S | IPLK70R600P7 |
| 750                  |                             |                   |                  | IPAN70R750P7S                    |              | IPLK70R750P7 |
| 900                  |                             |                   | IPD70R900P7S     |                                  | IPN70R900P7S | IPLK70R900P7 |
| 1200                 |                             |                   |                  |                                  |              | IPLK70R1K2P7 |
| 1400                 | IPS70R1K4P7S                |                   | IPD70R1K4P7S     |                                  | IPN70R1K4P7S | IPLK70R1K4P7 |
| 2000                 |                             |                   |                  |                                  | IPN70R2K0P7S | IPLK70R2K0P7 |



## 650 V CoolMOS™ C7



| $R_{DS(on)}$<br>[mΩ] | TO-220      | TO-263<br>(D <sup>2</sup> PAK) | TO-220<br>FullPAK | TO-247      | TO-247 4-pin | TO-252<br>(DPAK) | ThinPAK 8x8 |
|----------------------|-------------|--------------------------------|-------------------|-------------|--------------|------------------|-------------|
| 19                   |             |                                |                   | IPW65R019C7 | IPZ65R019C7  |                  |             |
| 45                   | IPP65R045C7 | IPB65R045C7                    | IPA65R045C7       | IPW65R045C7 | IPZ65R045C7  |                  |             |
| 65                   | IPP65R065C7 | IPB65R065C7                    | IPA65R065C7       | IPW65R065C7 | IPZ65R065C7  |                  |             |
| 70                   |             |                                |                   |             |              |                  | IPL65R070C7 |
| 95                   | IPP65R095C7 | IPB65R095C7                    | IPA65R095C7       | IPW65R095C7 | IPZ65R095C7  |                  |             |
| 99                   |             |                                |                   |             |              |                  | IPL65R099C7 |
| 125                  | IPP65R125C7 | IPB65R125C7                    | IPA65R125C7       | IPW65R125C7 |              |                  |             |
| 130                  |             |                                |                   |             |              |                  | IPL65R130C7 |
| 190                  | IPP65R190C7 | IPB65R190C7                    | IPA65R190C7       | IPW65R190C7 |              | IPD65R190C7      |             |
| 195                  |             |                                |                   |             |              |                  | IPL65R195C7 |
| 225                  | IPP65R225C7 | IPB65R225C7                    | IPA65R225C7       |             |              | IPD65R225C7      |             |
| 230                  |             |                                |                   |             |              |                  | IPL65R230C7 |

## 650 V CoolMOS™ CE



| $R_{DS(on)}$<br>[mΩ] | TO-220<br>FullPAK | TO-252<br>(DPAK) | TO-220 FullPAK<br>Narrow Lead |
|----------------------|-------------------|------------------|-------------------------------|
| 400                  | IPA65R400CE       | IPD65R400CE      |                               |
| 650                  | IPA65R650CE       | IPD65R650CE      | IPAN65R650CE                  |
| 1000                 | IPA65R1K0CE       |                  |                               |

## 650 V CoolMOS™ CFD2



| $R_{DS(on)}$<br>[mΩ] | TO-220       | TO-262<br>(I <sup>2</sup> PAK) | TO-263<br>(D <sup>2</sup> PAK) | TO-220<br>FullPAK | TO-247       | TO-252<br>(DPAK) | ThinPAK 8x8  |
|----------------------|--------------|--------------------------------|--------------------------------|-------------------|--------------|------------------|--------------|
| 41                   |              |                                |                                |                   | IPW65R041CFD |                  |              |
| 80                   |              |                                |                                |                   | IPW65R080CFD |                  |              |
| 110                  | IPP65R110CFD |                                | IPB65R110CFD                   | IPA65R110CFD      | IPW65R110CFD |                  |              |
| 150                  | IPP65R150CFD |                                | IPB65R150CFD                   | IPA65R150CFD      | IPW65R150CFD |                  |              |
| 165                  |              |                                |                                |                   |              |                  | IPL65R165CFD |
| 190                  | IPP65R190CFD | IPB65R190CFD                   | IPB65R190CFD                   | IPA65R190CFD      | IPW65R190CFD |                  |              |
| 210                  |              |                                |                                |                   |              |                  |              |
| 310                  | IPP65R310CFD |                                | IPB65R310CFD                   | IPA65R310CFD      |              |                  |              |
| 420                  | IPP65R420CFD |                                |                                |                   |              | IPD65R420CFD     |              |
| 660                  |              |                                |                                |                   |              | IPD65R660CFD     |              |
| 950                  |              |                                |                                |                   |              | IPD65R950CFD     |              |

## 650 V CoolMOS™ CFD7



| $R_{DS(on)}$<br>[mΩ] | TO-220        | TO-263<br>(D <sup>2</sup> PAK) | TO-247        | TO-247 4-pin   | TO-Leadless<br>(TOLL) | ThinPAK 8x8   | QPAK BSC        | QPAK TSC        |
|----------------------|---------------|--------------------------------|---------------|----------------|-----------------------|---------------|-----------------|-----------------|
| 17                   |               |                                |               |                |                       |               | IPQC65R017CFD7* | IPDQ65R017CFD7  |
| 18                   |               |                                | IPW65R018CFD7 | IPZA65R018CFD7 |                       |               |                 |                 |
| 29                   |               |                                | IPW65R029CFD7 | IPZA65R029CFD7 |                       |               |                 |                 |
| 40                   |               |                                |               |                | IPT65R040CFD7         |               | IPQC65R040CFD7* | IPDQ65R040CFD7  |
| 41                   | IPP65R041CFD7 | IPB65R041CFD7                  | IPW65R041CFD7 |                |                       |               |                 |                 |
| 60                   | IPP65R060CFD7 |                                | IPW65R060CFD7 |                | IPT65R060CFD7         |               |                 | IPDQ65R060CFD7  |
| 65                   |               |                                |               |                |                       | IPL65R065CFD7 |                 |                 |
| 80                   |               |                                |               |                | IPT65R080CFD7         |               |                 | IPDQ65R080CFD7* |
| 90                   | IPP65R090CFD7 | IPB65R090CFD7                  | IPW65R090CFD7 |                |                       |               |                 |                 |
| 95                   |               |                                |               |                |                       | IPL65R095CFD7 |                 |                 |
| 99                   |               |                                |               |                | IPT65R099CFD7         |               |                 | IPDQ65R099CFD7  |
| 110                  | IPP65R110CFD7 | IPB65R110CFD7                  | IPW65R110CFD7 |                |                       |               |                 |                 |
| 115                  |               |                                |               |                |                       | IPL65R115CFD7 |                 |                 |
| 125                  |               | IPB65R125CFD7                  | IPW65R125CFD7 |                | IPT65R125CFD7         |               |                 | IPDQ65R125CFD7  |
| 130                  |               |                                |               |                |                       | IPL65R130CFD7 |                 |                 |
| 155                  | IPP65R155CFD7 | IPB65R155CFD7                  | IPW65R155CFD7 |                | IPT65R155CFD7         |               |                 |                 |
| 160                  |               |                                |               |                |                       | IPL65R160CFD7 |                 |                 |
| 190                  | IPP65R190CFD7 |                                |               |                | IPT65R190CFD7         |               |                 |                 |
| 200                  |               |                                |               |                |                       | IPL65R200CFD7 |                 |                 |

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### 600 V CoolMOS™ PFD7



| R <sub>DS(on)</sub> [mΩ] | TO-220 FullPAK Narrow Leads | TO-252 (DPAK)  | SOT-223        | ThinPAK 5x6    |
|--------------------------|-----------------------------|----------------|----------------|----------------|
| 125                      | IPAN60R125PFD7S             |                |                |                |
| 210                      | IPAN60R210PFD7S             | IPD60R210PFD7S |                |                |
| 280                      | IPAN60R280PFD7S             | IPD60R280PFD7S |                |                |
| 360                      | IPAN60R360PFD7S             | IPD60R360PFD7S | IPN60R360PFD7S | IPLK60R360PFD7 |
| 600                      |                             | IPD60R600PFD7S | IPN60R600PFD7S | IPLK60R600PFD7 |
| 1000                     |                             | IPD60R1K0PFD7S | IPN60R1K0PFD7S | IPLK60R1K0PFD7 |
| 1500                     |                             | IPD60R1K5PFD7S | IPN60R1K5PFD7S | IPLK60R1K5PFD7 |
| 2000                     |                             | IPD60R2K0PFD7S | IPN60R2K0PFD7S |                |



### 600 V CoolMOS™ P7 industrial grade

| R <sub>DS(on)</sub> [mΩ] | TO-220      | TO-220 FullPAK | TO-247      | TO-252 (DPAK) | ThinPAK 8x8 | TO-263 (D <sup>2</sup> PAK) |
|--------------------------|-------------|----------------|-------------|---------------|-------------|-----------------------------|
| 24                       |             |                | IPW60R024P7 |               |             |                             |
| 37                       |             |                | IPW60R037P7 |               |             |                             |
| 45                       |             |                | IPW60R045P7 |               |             | IPB60R045P7                 |
| 60                       | IPP60R060P7 | IPA60R060P7    | IPW60R060P7 |               |             | IPB60R060P7                 |
| 65                       |             |                |             |               | IPL60R065P7 |                             |
| 80                       | IPP60R080P7 | IPA60R080P7    | IPW60R080P7 |               | IPL60R085P7 | IPB60R080P7                 |
| 99                       | IPP60R099P7 | IPA60R099P7    | IPW60R099P7 |               |             | IPB60R099P7                 |
| 105                      |             |                |             |               | IPL60R105P7 |                             |
| 120                      | IPP60R120P7 | IPA60R120P7    | IPW60R120P7 |               |             | IPB60R120P7                 |
| 125                      |             |                |             |               | IPL60R125P7 |                             |
| 160                      | IPP60R160P7 | IPA60R160P7    |             |               |             |                             |
| 180                      | IPP60R180P7 | IPA60R180P7    | IPW60R180P7 | IPD60R180P7   |             | IPB60R180P7                 |
| 185                      |             |                |             |               | IPL60R185P7 |                             |
| 280                      | IPP60R280P7 | IPA60R280P7    |             | IPD60R280P7   |             | IPB60R280P7                 |
| 285                      |             |                |             |               | IPL60R285P7 |                             |
| 360                      | IPP60R360P7 |                |             | IPD60R360P7   |             | IPB60R360P7                 |
| 365                      |             |                |             |               |             |                             |
| 600                      | IPP60R600P7 | IPA60R600P7    |             | IPD60R600P7   |             |                             |



### 600 V CoolMOS™ P7 standard grade

| R <sub>DS(on)</sub> [mΩ] | TO-220 FullPAK | TO-220 FullPAK Narrow lead | TO-252 (DPAK) | SOT-223      |
|--------------------------|----------------|----------------------------|---------------|--------------|
| 180                      | IPA60R180P7S   | IPAN60R180P7S              | IPD60R180P7S  |              |
| 280                      | IPA60R280P7S   |                            | IPD60R280P7S  |              |
| 360                      | IPA60R360P7S   |                            | IPD60R360P7S  | IPN60R360P7S |
| 600                      | IPA60R600P7S   |                            | IPD60R600P7S  | IPN60R600P7S |



### 600 V CoolMOS™ CFD7

| R <sub>DS(on)</sub> [mΩ] | TO-220        | TO-263 (D <sup>2</sup> PAK) | TO-220 FullPAK | TO-247        | TO-252 (DPAK) | ThinPAK 8x8   | DDPAK          | TO-Leadless (TOLL) | QDPAK           |
|--------------------------|---------------|-----------------------------|----------------|---------------|---------------|---------------|----------------|--------------------|-----------------|
| 15                       |               |                             |                |               |               |               |                |                    | IPDQ60R015CFD7* |
| 18                       |               |                             |                | IPW60R018CFD7 |               |               |                |                    |                 |
| 20                       |               |                             |                |               |               |               |                |                    | IPDQ60R020CFD7* |
| 24                       |               |                             |                | IPW60R024CFD7 |               |               |                |                    |                 |
| 25                       |               |                             |                |               |               |               |                |                    | IPDQ60R025CFD7* |
| 31/35                    |               |                             |                | IPW60R031CFD7 |               |               |                | IPT60R035CFD7      | IPDQ60R035CFD7* |
| 40/45                    |               | IPB60R040CFD7               |                | IPW60R040CFD7 |               |               | IPDD60R045CFD7 | IPT60R045CFD7      | IPDQ60R045CFD7* |
| 55                       |               | IPB60R055CFD7               |                | IPW60R055CFD7 |               |               | IPDD60R055CFD7 | IPT60R055CFD7      | IPDQ60R055CFD7  |
| 60                       |               |                             |                |               |               | IPL60R060CFD7 |                |                    |                 |
| 70                       | IPP60R070CFD7 | IPB60R070CFD7               |                | IPW60R070CFD7 |               |               |                |                    |                 |
| 75                       |               |                             |                |               |               | IPL60R075CFD7 | IPDD60R075CFD7 | IPT60R075CFD7      | IPDQ60R075CFD7* |
| 90/95                    | IPP60R090CFD7 | IPB60R090CFD7               |                | IPW60R090CFD7 |               | IPL60R095CFD7 | IPDD60R090CFD7 | IPT60R090CFD7      |                 |
| 105/115                  | IPP60R105CFD7 | IPB60R105CFD7               |                | IPW60R105CFD7 |               | IPL60R115CFD7 | IPDD60R105CFD7 | IPT60R105CFD7      |                 |
| 125/140                  | IPP60R125CFD7 |                             | IPA60R125CFD7  | IPW60R125CFD7 |               |               | IPDD60R125CFD7 | IPT60R125CFD7      |                 |
| 145/160                  | IPP60R145CFD7 |                             |                |               | IPD60R145CFD7 | IPL60R160CFD7 | IPDD60R145CFD7 |                    |                 |
| 170                      | IPP60R170CFD7 |                             | IPA60R170CFD7  |               | IPD60R170CFD7 |               | IPDD60R170CFD7 |                    |                 |
| 185                      |               |                             |                |               |               | IPL60R185CFD7 |                |                    |                 |
| 210/225                  | IPP60R210CFD7 |                             |                |               |               |               |                |                    |                 |
| 280                      | IPP60R280CFD7 |                             | IPA60R280CFD7  |               |               |               |                |                    |                 |
| 360                      |               |                             |                |               |               |               |                |                    |                 |

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## 600 V CoolMOS™ S7



| $R_{DS(on)}$<br>[mΩ] | TO -220     | TO-Leadless<br>(TOLL) | TO-Leadless (TOLL)<br>incl. temperature<br>sensor | QPAK BSC<br>incl. temperature<br>sensor | QPAK TSC<br>incl. temperature<br>sensor | QPAK TSC     | QPAK BSC     |
|----------------------|-------------|-----------------------|---|---|---|--------------|--------------|
| 10                   |             |                       |   | IPQC60T010S7*                           | IPDQ60T010S7*                           | IPDQ60R010S7 | IPQC60R010S7 |
| 17                   |             |                       |   | IPQC60T017S7*                           | IPDQ60T017S7*                           | IPDQ60R017S7 | IPQC60R017S7 |
| 22                   | IPP60R022S7 | IPT60R022S7           | IPT60T022S7*                                      | IPQC60T022S7*                           | IPDQ60T022S7*                           | IPDQ60R022S7 |              |
| 40                   | IPP60R040S7 | IPT60R040S7           | IPT60T040S7*                                      |   |   | IPDQ60R040S7 | IPQC60R040S7 |
| 65                   | IPP60R065S7 | IPT60R065S7           | IPT60T065S7*                                      |   |   | IPDQ60R065S7 |              |

## 600 V CoolMOS™ C7 Gold (G-series)



| $R_{DS(on)}$<br>[mΩ] | TO-Leadless<br>(TOLL) | TO-252<br>(Double DPAK) |
|----------------------|-----------------------|-------------------------|
| 28                   | IPT60R028G7           |                         |
| 50                   | IPT60R050G7           | IPDD60R050G7            |
| 80                   | IPT60R080G7           | IPDD60R080G7            |
| 102                  | IPT60R102G7           | IPDD60R102G7            |
| 125                  | IPT60R125G7           | IPDD60R125G7            |
| 150                  | IPT60R150G7           | IPDD60R150G7            |
| 190                  |                       | IPDD60R190G7            |

## 600 V CoolMOS™ C7



| $R_{DS(on)}$<br>[mΩ] | TO-220      | TO-263<br>(D <sup>2</sup> PAK) | TO-220<br>FullPAK | TO-247      | TO-247 4-pin | TO-252<br>(DPAK) | ThinPAK 8x8 |
|----------------------|-------------|--------------------------------|-------------------|-------------|--------------|------------------|-------------|
| 17                   |             |                                |                   | IPW60R017C7 | IPZ60R017C7  |                  |             |
| 40                   | IPP60R040C7 | IPB60R040C7                    |                   | IPW60R040C7 | IPZ60R040C7  |                  |             |
| 60                   | IPP60R060C7 | IPB60R060C7                    | IPA60R060C7       | IPW60R060C7 | IPZ60R060C7  |                  |             |
| 65                   |             |                                |                   |             |              |                  | IPL60R065C7 |
| 99                   | IPP60R099C7 | IPB60R099C7                    | IPA60R099C7       | IPW60R099C7 | IPZ60R099C7  |                  |             |
| 104                  |             |                                |                   |             |              |                  | IPL60R104C7 |
| 120                  | IPP60R120C7 |                                | IPA60R120C7       | IPW60R120C7 |              |                  |             |
| 125                  |             |                                |                   |             |              |                  | IPL60R125C7 |
| 180                  | IPP60R180C7 | IPB60R180C7                    | IPA60R180C7       | IPW60R180C7 |              | IPD60R180C7      |             |
| 185                  |             |                                |                   |             |              |                  | IPL60R185C7 |

## 600 V CoolMOS™ P6



| $R_{DS(on)}$<br>[mΩ] | TO-220      | TO-220<br>FullPAK | TO-263<br>(D <sup>2</sup> PAK) | TO-247      | TO-247 4-pin | TO-252<br>(DPAK) | ThinPAK 5x6  | ThinPAK 8x8 |
|----------------------|-------------|-------------------|--------------------------------|-------------|--------------|------------------|--------------|-------------|
| 41                   |             |                   |                                | IPW60R041P6 |              |                  |              |             |
| 70                   |             |                   |                                | IPW60R070P6 |              |                  |              |             |
| 99                   | IPP60R099P6 | IPA60R099P6       |                                | IPW60R099P6 | IPZ60R099P6  |                  |              |             |
| 125                  | IPP60R125P6 | IPA60R125P6       |                                | IPW60R125P6 |              |                  |              |             |
| 160                  | IPP60R160P6 | IPA60R160P6       | IPB60R160P6                    | IPW60R160P6 |              |                  |              |             |
| 180                  |             |                   |                                |             |              |                  |              |             |
| 190                  | IPP60R190P6 | IPA60R190P6       |                                | IPW60R190P6 |              |                  |              |             |
| 210                  |             |                   |                                |             |              |                  |              | IPL60R210P6 |
| 230                  |             | IPA60R230P6       |                                |             |              |                  |              |             |
| 255                  |             |                   |                                |             |              |                  |              |             |
| 280                  |             | IPA60R280P6       | IPB60R280P6                    |             |              |                  |              |             |
| 330/360              |             |                   |                                |             |              |                  | IPL60R360P6S |             |
| 380                  |             | IPA60R380P6       |                                |             |              | IPD60R380P6      |              |             |
| 600                  |             | IPA60R600P6       |                                |             |              | IPD60R600P6      |              |             |
| 650                  |             |                   |                                |             |              |                  | IPL60R650P6S |             |

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## 600 V CoolMOS™ CE



| $R_{DS(on)}$<br>[mΩ] | TO-220<br>FullPAK | TO-252<br>(DPAK) | TO-251<br>(IPAK) | SOT-223     | TO-220<br>FullPAK<br>Narrow Lead |
|----------------------|-------------------|------------------|------------------|-------------|----------------------------------|
| 190                  |                   |                  |                  |             |                                  |
| 280                  |                   |                  |                  |             |                                  |
| 380                  |                   |                  |                  |             |                                  |
| 400                  | IPA60R400CE       | IPD60R400CE      |                  |             |                                  |
| 460                  |                   |                  |                  |             |                                  |
| 600                  |                   |                  |                  |             |                                  |
| 650                  | IPA60R650CE       | IPD60R650CE      |                  |             |                                  |
| 800                  |                   | IPD60R800CE      |                  |             |                                  |
| 1000                 | IPA60R1K0CE       | IPD60R1K0CE      |                  | IPN60R1K0CE |                                  |
| 1500                 |                   | IPD60R1K5CE      | IPU60R1K5CE      | IPN60R1K5CE |                                  |
| 2100                 |                   | IPD60R2K1CE      | IPU60R2K1CE      | IPN60R2K1CE |                                  |
| 3400                 |                   | IPD60R3K4CE      |                  | IPN60R3K4CE |                                  |

## 500 V CoolMOS™ CE



| $R_{DS(on)}$<br>[mΩ] | TO-220      | TO-220<br>FullPAK | TO-252<br>(DPAK) | SOT-223     |
|----------------------|-------------|-------------------|------------------|-------------|
| 190                  | IPP50R190CE | IPA50R190CE       |                  |             |
| 280                  | IPP50R280CE | IPA50R280CE       | IPD50R280CE      |             |
| 380                  | IPP50R380CE | IPA50R380CE       | IPD50R380CE      |             |
| 500                  |             | IPA50R500CE       | IPD50R500CE      |             |
| 650                  |             |                   |                  |             |
| 800                  |             | IPA50R800CE       |                  |             |
| 950                  |             | IPA50R950CE       | IPD50R950CE      |             |
| 1400                 |             |                   |                  | IPN50R1K4CE |
| 2000                 |             |                   | IPD50R2K0CE      | IPN50R2K0CE |
| 3000                 |             |                   | IPD50R3K0CE      |             |

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# CoolMOS™ SJ MOSFET automotive

## 800 V CoolMOS™ C3A



| $R_{DS(on)}$ @ $T_J = 25^\circ\text{C}$<br>$V_{GS} = 10\text{ V}$<br>[ mΩ ] | TO-247       | TO-252<br>(DPAK) | TO-263<br>(D <sup>2</sup> PAK) |
|---|--------------|------------------|--------------------------------|
| 290   | IPW80R290C3A |                  | IPB80R290C3A                   |
| 2700  |              | IPD80R2K7C3A     |                                |

## 650 V CoolMOS™ CFDA



| $R_{DS(on)}$ @ $T_J = 25^\circ\text{C}$<br>$V_{GS} = 10\text{ V}$<br>[ mΩ ] | TO-220        | TO-247        | TO-252<br>(DPAK) | TO-263<br>(D <sup>2</sup> PAK) |
|---|---------------|---------------|------------------|--------------------------------|
| 48  |               | IPW65R048CFDA |                  |                                |
| 80  |               | IPW65R080CFDA |                  |                                |
| 110   | IPP65R110CFDA | IPW65R110CFDA |                  | IPB65R110CFDA                  |
| 150   | IPP65R150CFDA | IPW65R150CFDA |                  | IPB65R150CFDA                  |
| 190   |               |               |                  | IPB65R190CFDA                  |
| 310   |               |               |                  | IPB65R310CFDA                  |
| 420   |               |               | IPD65R420CFDA    |                                |
| 660   |               |               | IPD65R660CFDA    | IPB65R660CFDA                  |

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## 650 V CoolMOS™ CFD7A



| $R_{DS(on)}$ @ $T_J = 25^\circ\text{C}$<br>$V_{GS} = 10\text{ V}$<br>[mΩ] | TO-220         | TO-247         | TO-247<br>Short leads | TO-263-3<br>(D <sup>2</sup> PAK 3-pin) | TO-263-7<br>(D <sup>2</sup> PAK 7-pin) | QDPAK BSC       | QDPAK TSC       |
|---|----------------|----------------|-----------------------|--|--|-----------------|-----------------|
| 17  |                |                |                       |  |  | IPQC65R017CFD7A | IPDQ65R017CFD7A |
| 22  |                | IPW65R022CFD7A | IPWS65R022CFD7A       |  |  |                 |                 |
| 29  |                |                |                       |  |  |                 |                 |
| 35  |                | IPW65R035CFD7A | IPWS65R035CFD7A       |  |  |                 |                 |
| 40  |                |                |                       |  |  | IPQC65R040CFD7A | IPDQ65R040CFD7A |
| 50  | IPP65R050CFD7A | IPW65R050CFD7A | IPWS65R050CFD7A       | IPB65R050CFD7A                         | IPBE65R050CFD7A                        |                 |                 |
| 60  |                |                |                       |  |  |                 |                 |
| 75  | IPP65R075CFD7A | IPW65R075CFD7A | IPWS65R075CFD7A       | IPB65R075CFD7A                         | IPBE65R075CFD7A                        |                 |                 |
| 80  |                |                |                       |  |  |                 |                 |
| 99  | IPP65R099CFD7A | IPW65R099CFD7A |                       | IPB65R099CFD7A                         | IPBE65R099CFD7A                        |                 |                 |
| 115   | IPP65R115CFD7A | IPW65R115CFD7A |                       | IPB65R115CFD7A                         | IPBE65R115CFD7A                        |                 |                 |
| 125   |                |                |                       |  |  | IPQC65R125CFD7A | IPDQ65R125CFD7A |
| 145   | IPP65R145CFD7A | IPW65R145CFD7A |                       | IPB65R145CFD7A                         | IPBE65R145CFD7A                        |                 |                 |
| 190   | IPP65R190CFD7A | IPW65R190CFD7A |                       | IPB65R190CFD7A                         | IPBE65R190CFD7A                        |                 |                 |
| 230   |                |                |                       | IPB65R230CFD7A                         | IPBE65R230CFD7A                        |                 |                 |

## 600 V CoolMOS™ CPA



| $R_{DS(on)}$ @ $T_J = 25^\circ\text{C}$<br>$V_{GS} = 10\text{ V}$<br>[mΩ] | TO-247       | TO-263<br>(D <sup>2</sup> PAK) |
|---|--------------|--------------------------------|
| 45  | IPW60R045CPA |                                |
| 75  | IPW60R075CPA |                                |
| 99  | IPW60R099CPA | IPB60R099CPA                   |

## 600 V CoolMOS™ S7A



| $R_{DS(on)}$ @ $T_J = 25^\circ\text{C}$<br>$V_{GS} = 10\text{ V}$<br>[mΩ] | QDPAK TSC     | QDPAK BSC     |
|---|---------------|---------------|
| 40  | IPDQ60R040S7A | IPQC60R040S7A |
| 22  | IPDQ60R022S7A |               |
| 17  | IPDQ60R017S7A | IPQC60R017S7A |
| 10  | IPDQ60R010S7A | IPQC60R010S7A |

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[www.infineon.com/cfd7a](http://www.infineon.com/cfd7a)

[www.infineon.com/s7a](http://www.infineon.com/s7a)

\* Coming soon

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## CoolMOS™ SJ MOSFETs – packages



## SOT-223

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |               |                     |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|---------------|---------------------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500         |                     |
| 500         | CE     |                   |       |        |         |         |         |         |         |          |               |                     |
| 600         | P7     |                   |       |        |         |         | 360     | 600     |         | 650/800  | 950/1400      | 2000/3000           |
|             | CE     |                   |       |        |         |         |         |         |         |          | 1000/1500     | 2100/3400           |
| 700         | PFD7   |                   |       |        |         |         | 360     | 600     |         |          | 1000/1500     | 2000                |
|             | P7     |                   |       |        |         |         | 360     | 450/600 | 750     |          | 900/1200/1400 | 2000                |
|             | CE     |                   |       |        |         |         |         |         |         |          | 1500          |                     |
| 800         | P7     |                   |       |        |         |         |         |         |         | 600/750  | 900/1200/1400 | 2000/2400/3300/4500 |
| 950         | P7     |                   |       |        |         |         |         |         |         |          | 1200          | 2000/3700           |



## TO-247

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |                |         |         |         |         |         |          |       |  |
|-------------|--------|-------------------|-------|----------------|---------|---------|---------|---------|---------|----------|-------|--|
|             |        | 0-59              | 60-89 | 90-149         | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |  |
| 600         | P7     | 24/37/45          | 60/80 | 99/120         | 180     |         |         |         |         |          |       |  |
|             | C7     | 17/40             | 60    | 99/120         | 180     |         |         |         |         |          |       |  |
|             | P6     | 41                | 70    | 99/125         | 160/190 | 280     |         |         |         |          |       |  |
|             | CFD7   | 18/24/31/37/40/55 | 70    | 90/105/125/145 | 170     |         |         |         |         |          |       |  |
|             | CPA    | 45                | 75    | 99             |         |         |         |         |         |          |       |  |
| 650         | C3     |                   | 70    | 100            | 160/190 |         |         |         |         |          |       |  |
|             | CFD7   | 18/29/37/41       | 60    | 90/110/125     | 155     |         |         |         |         |          |       |  |
|             | C7     | 19/45             | 65    | 95/125         | 190     |         |         |         |         |          |       |  |
|             | CFD2   | 41                | 80    | 110            | 150/190 |         |         | 420     |         |          |       |  |
|             | CFDA   | 48                | 80    | 110            | 150/190 |         |         |         |         |          |       |  |
| 800         | CFD7A  | 22/35/50          | 75    | 99/115/145     | 190     | 230     |         |         |         |          |       |  |
|             | P7     |                   |       |                |         | 280     | 360     |         |         |          |       |  |
| 900         | C3     |                   | 85    |                |         | 290     |         |         |         |          |       |  |
| 950         | PFD7   |                   | 60    | 130*           |         |         | 340     | 500     |         |          |       |  |



## TO-247 short leads

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |  |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|--|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |  |
| 650         | CFD7A  | 22/35/50          | 75    |        |         |         |         |         |         |          |       |  |



## TO-247 4-pin

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |  |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|--|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |  |
| 600         | C7     | 17/40             | 60    | 99     |         |         |         |         |         |          |       |  |
|             | P6     |                   |       | 99     |         |         |         |         |         |          |       |  |
| 650         | C7     | 19/45             | 65    | 95     |         |         |         |         |         |          |       |  |



## TO-247 4-pin asymmetric leads

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |  |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|--|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |  |
| 600         | P7     | 24/37/45          | 60/80 | 99/120 | 180     |         |         |         |         |          |       |  |
| 650         | CFD7   | 18/29             |       |        |         |         |         |         |         |          |       |  |

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## IPAK

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |               |                        |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|---------------|------------------------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500      | >1500                  |
| 600         | CE     |                   |       |        |         |         |         |         |         | 1500          | 2100                   |
| 800         | P7     |                   |       |        |         |         |         | 600     | 750     | 900/1200/1400 | 2000/2400<br>3300/4500 |
| 950         | P7     |                   |       |        |         |         |         | 450     | 750     | 1200          | 2000/3700              |



## IPAK Short Lead

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 700         | P7     |                   |       |        |         |         | 360/600 |         |         | 900/1400 |       |



## I²PAK

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | CPA    |                   |       | 99/125 | 165/199 |         |         |         |         |          |       |
|             | C6     |                   |       |        | 190     |         |         |         |         |          |       |
| 650         | CFD2   |                   |       |        | 190     |         |         |         |         |          |       |
|             | C6     |                   |       |        | 190     |         | 380     |         |         |          |       |
| 900         | C3     |                   |       |        |         |         | 340     | 500     |         |          |       |



## DPAK

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |               |                        |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|---------------|------------------------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500      | >1500                  |
| 500         | CE     |                   |       |        |         | 280     | 380     | 500     | 650/800 | 950           | 3000                   |
| 600         | P7     |                   |       |        | 180     | 280     | 360     | 600     |         |               |                        |
|             | C7     |                   |       |        | 180     |         |         |         |         |               |                        |
|             | CE     |                   |       |        |         |         | 400     |         | 650/800 | 1000/1500     | 2100/3400              |
| 600         | P6     |                   |       |        |         |         | 380     | 600     |         |               |                        |
|             | CFD7   |                   |       | 145    | 170     | 210/280 | 360     |         |         |               |                        |
|             | PFD7   |                   |       |        |         | 210/280 | 360     | 600     |         | 1000/1500     | 2000                   |
| 650         | C7     |                   |       |        | 190     | 225     |         |         |         |               |                        |
|             | CE     |                   |       |        |         |         | 400     |         | 650     |               |                        |
|             | CFD2   |                   |       |        |         |         |         | 420     | 660     | 950           |                        |
| 650         | CFDA   |                   |       |        |         |         |         | 420     | 660     |               |                        |
|             | P7     |                   |       |        |         |         | 360     | 600     |         | 900/1400      |                        |
| 800         | P7     |                   |       |        |         | 280     | 360     | 450/600 | 750     | 900/1200/1400 | 2000/2400<br>3300/4500 |
|             | C3     |                   |       |        |         |         |         |         |         | 900/1300      | 2700                   |
|             | C3A    |                   |       |        |         |         |         |         |         |               | 2700                   |
| 800         | CE     |                   |       |        |         |         |         |         |         | 1000/1400     | 2800                   |
|             | C3     |                   |       |        |         |         |         |         |         | 1200          |                        |
| 900         | P7     |                   |       |        |         |         |         | 450     | 750     | 1200          | 2000                   |
|             | PFD7   |                   |       |        |         |         |         | 450     |         |               |                        |





## D²PAK

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |                   |         |            |         |         |         |          |       |
|-------------|--------|-------------------|-------|-------------------|---------|------------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149            | 150-199 | 200-299    | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | C7     | 40                | 60    | 99/120            | 180     |            |         |         |         |          |       |
|             | P7     | 45                | 60/80 | 99/120            | 180     | 280        | 360     |         |         |          |       |
|             | CPA    |                   |       | 99                |         |            |         |         |         |          |       |
|             | CFD7   | 40<br>55          | 70    | 90/105<br>125/145 | 170     | 210<br>280 | 360     |         |         |          |       |
| 650         | CFD7   | 41                |       | 90/110/125        | 155     |            |         |         |         |          |       |
|             | C7     | 45                | 65    | 95/125            | 190     | 225        |         |         |         |          |       |
|             | CFD2   |                   |       | 110               | 150/190 |            | 310     |         |         |          |       |
|             | CFDA   |                   |       | 110               | 150/190 |            | 310     |         | 660     |          |       |
| 800         | C3A    |                   |       |                   |         | 290        |         |         |         |          |       |
| 900         | C3     |                   |       |                   |         |            | 340     |         |         |          |       |



## D²PAK 7-pin

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 650         | CFD7A  | 50                | 75    | 99/115 | 145/190 | 230     |         |         |         |          |       |



## Double DPAK (DDPAK)

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |                    |         |         |         |         |         |          |       |
|-------------|--------|-------------------|-------|--------------------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149             | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | CFD7   | 45/55             | 75    | 90/105/<br>125/145 | 170     |         |         |         |         |          |       |
|             | G7     | 50                | 80    | 102/125            | 150/190 |         |         |         |         |          |       |



## QDPAK TSC

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |         |          |         |         |         |         |         |          |       |
|-------------|--------|-------------------|---------|----------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89   | 90-149   | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | S7     | 10/17/22/40       | 65      |          |         |         |         |         |         |          |       |
|             | S7A    | 10/17/22/40       |         |          |         |         |         |         |         |          |       |
| 650         | CFD7   | 17*/29*/40*       | 60*/80* | 99*/125* |         |         |         |         |         |          |       |
|             | CFD7A  | 17*/29*/40*       | 60*/80* | 99*/125* |         |         |         |         |         |          |       |



## QDPAK BSC

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | S7     | 10/17*/22*/40*    |       |        |         |         |         |         |         |          |       |
|             | S7A    | 10/17*/22*/40*    |       |        |         |         |         |         |         |          |       |
| 650         | CFD7   | 17*/29*/40*       | 60*   |        |         |         |         |         |         |          |       |
|             | CFD7A  | 17*/40*           |       | 125*   |         |         |         |         |         |          |       |





## TO-220 FullPAK

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |           |       |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|-----------|-------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500  | >1500 |
| 500         | CE     |                   |       |        | 190     | 280     | 380     | 500     | 800     | 950       |       |
| 600         | P7     |                   | 60/80 | 99/120 | 160/180 | 280     |         | 600     |         |           |       |
|             | C7     |                   | 60    | 99/120 | 180     |         |         |         |         |           |       |
|             | CE     |                   |       |        |         |         | 400     |         | 650     | 1000      |       |
|             | CFD7   |                   |       | 125    | 170     | 280     | 360     |         |         |           |       |
|             | P6     |                   |       | 99/125 | 160/190 | 230/280 | 380     | 600     |         |           |       |
|             | C3     |                   |       |        | 190     | 280     | 380     | 600     |         |           |       |
| 650         | C7     | 45                | 65    | 95/125 | 190     | 225     |         |         |         |           |       |
|             | CE     |                   |       |        |         |         | 400     |         | 650     | 1000      |       |
|             | CFD2   |                   |       | 110    | 150/190 |         | 310     | 420     | 660     |           |       |
| 700         | P7     |                   |       |        |         |         | 360     | 600     |         | 900       |       |
| 800         | P7     |                   |       |        |         | 280     | 360     | 450/600 | 750     | 900/1400  |       |
|             | C3     |                   |       |        |         | 290     |         |         | 650     | 900       |       |
|             | CE     |                   |       |        |         |         | 310     | 460     | 650     | 1000/1400 |       |
| 900         | C3     |                   |       |        |         |         | 340     | 500     | 800     | 1000/1200 |       |
| 950         | P7     |                   |       |        |         |         |         | 450     | 750     | 1200      |       |
|             | PFD7   |                   |       | 130*   |         |         | 310     | 450     |         |           |       |

## TO-220 FullPAK Narrow Lead

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | CE     |                   |       |        |         |         |         |         | 650     |          |       |
|             | P7     |                   |       |        | 180     |         |         |         |         |          |       |
|             | PFD7   |                   |       | 125    |         | 210/280 | 360     |         |         |          |       |
| 650         | CE     |                   |       |        |         |         |         |         | 650     |          |       |
| 700         | P7     |                   |       |        |         |         | 360     | 600     | 750     |          |       |
| 800         | P7     |                   |       |        |         | 280     | 360     | 450     |         |          |       |

## TO-Leadless

| Voltage [V] | Series | $R_{DS(on)}$ group [mΩ] |         |                |           |         |         |         |         |          |       |
|-------------|--------|-------------------------|---------|----------------|-----------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59                    | 60-89   | 90-149         | 150-199   | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | CFD7   | 35/45/55                | 75      | 90/105/125/145 |           |         |         |         |         |          |       |
|             | G7     | 28/50                   | 80      | 102/125        | 150       |         |         |         |         |          |       |
|             | S7     | 22/40                   | 65      |                |           |         |         |         |         |          |       |
| 650         | CFD7   | 40*                     | 60*/80* | 99*/125*       | 155*/190* |         |         |         |         |          |       |





## TO-220

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |                    |         |         |         |         |         |               |       |
|-------------|--------|-------------------|-------|--------------------|---------|---------|---------|---------|---------|---------------|-------|
|             |        | 0-59              | 60-89 | 90-149             | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500      | >1500 |
| 500         | CE     |                   |       |                    | 190     | 280     | 380     |         |         |               |       |
|             | P7     |                   | 60/80 | 99/120             | 160/180 | 280     | 360     | 600     |         |               |       |
| 600         | C7     | 40                | 60    | 99/120             | 180     |         |         |         |         |               |       |
|             | P6     |                   |       | 99/125             | 160/190 |         |         |         |         |               |       |
|             | CFD7   |                   | 70    | 90/105/<br>125/145 | 170     | 280     | 360     |         |         |               |       |
|             | S7     | 22                |       |                    |         |         |         |         |         |               |       |
|             | C3     |                   |       | 160                | 190     | 280     | 380     | 600     |         |               |       |
| 650         | CFD7   | 41                | 60    | 90/110             | 155     | 190     |         |         |         |               |       |
|             | C7     | 45                | 65    | 95/125             | 190     | 225     |         |         |         |               |       |
|             | CFD2   |                   |       | 110                | 150/190 |         | 310     | 420     |         |               |       |
|             | CFDA   |                   |       | 110                | 150     |         |         |         |         |               |       |
|             | CFD7A  | 50/75*            |       | 99/115/145*        | 190     |         |         |         |         |               |       |
| 800         | P7     |                   |       |                    |         | 280     | 360     | 450/600 | 750     | 900/1200/1400 |       |
|             | C3     |                   |       |                    |         | 290     |         | 450     | 650     | 900/1300      |       |



## TO-220 FullPAK Wide Creepage

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |          |       |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | P7     |                   |       |        |         | 280     | 360     | 600     |         |          |       |
|             | CE     |                   |       |        | 190     | 280     | 380     | 600     |         |          |       |
| 700         | CE     |                   |       |        |         |         |         | 600     |         | 950      |       |



## ThinPAK 5x6

| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |        |         |         |         |         |         |               |       |
|-------------|--------|-------------------|-------|--------|---------|---------|---------|---------|---------|---------------|-------|
|             |        | 0-59              | 60-89 | 90-149 | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500      | >1500 |
| 600         | PFD7   |                   |       |        |         |         | 360     | 600     |         | 1000/1500     |       |
| 700         | P7     |                   |       |        |         |         |         | 600     | 750     | 900/1200/1400 | 2000  |
| 800         |        |                   |       |        |         |         |         | 600     | 750     | 900/1200/1400 | 2000  |

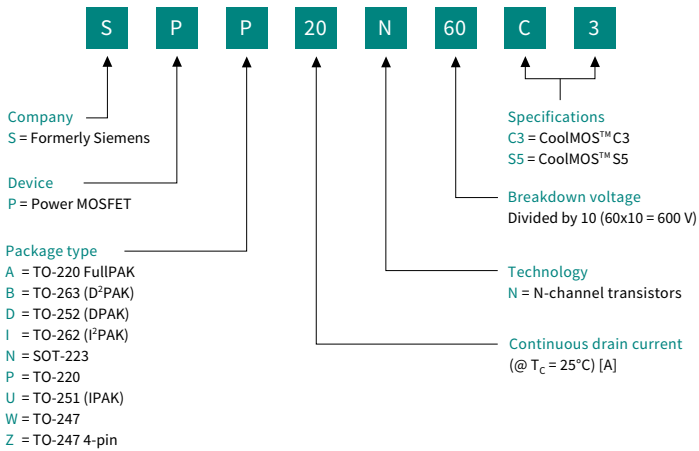


## ThinPAK 8x8

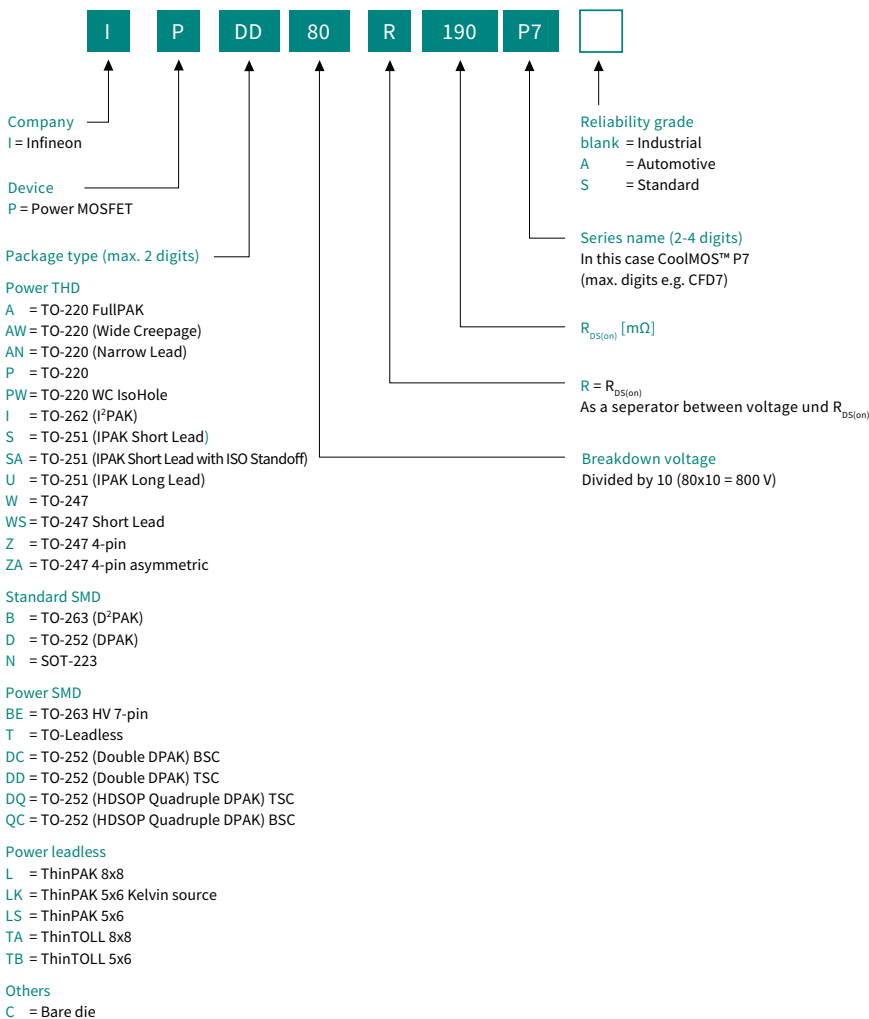
| Voltage [V] | Series | $R_{DS(on)}$ [mΩ] |       |            |         |         |         |         |         |          |       |
|-------------|--------|-------------------|-------|------------|---------|---------|---------|---------|---------|----------|-------|
|             |        | 0-59              | 60-89 | 90-149     | 150-199 | 200-299 | 300-400 | 401-600 | 601-899 | 900-1500 | >1500 |
| 600         | P7     |                   | 65/85 | 105/125    | 185     | 285     |         |         |         |          |       |
|             | C7     |                   | 65    | 104/125    | 185     |         |         |         |         |          |       |
|             | CFD7   |                   | 60/75 | 95/115/140 | 160/185 | 225     |         |         |         |          |       |
|             | P6     |                   |       |            | 180     | 210     |         |         |         |          |       |
| 650         | CFD7   |                   | 65    | 95/115/130 | 160     | 200     |         |         |         |          |       |
|             | C7     |                   | 70    | 99/130     | 195     | 230     |         |         |         |          |       |
|             | CFD2   |                   |       |            | 165     |         | 340     |         |         |          |       |

# Nomenclature

## Power MOSFETs (until 2005)

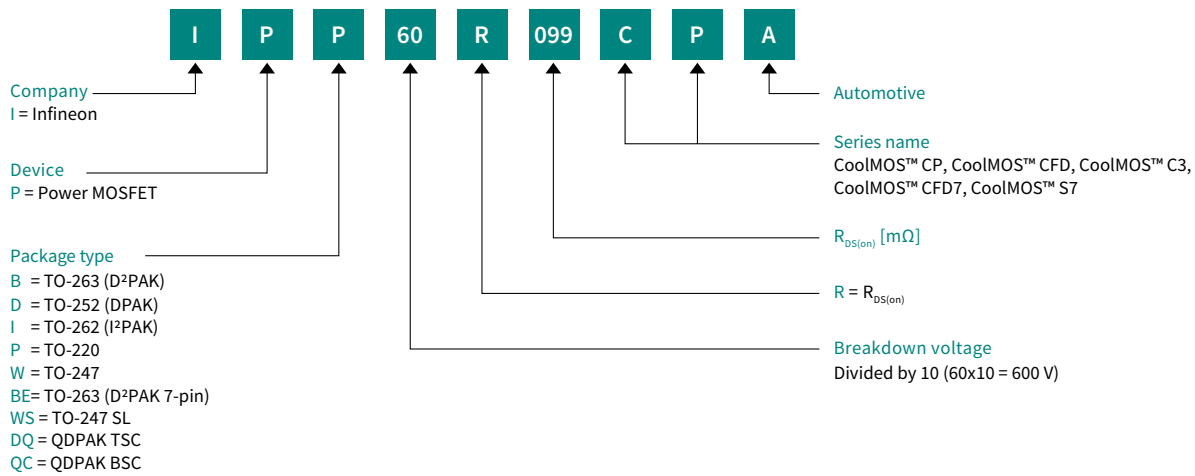


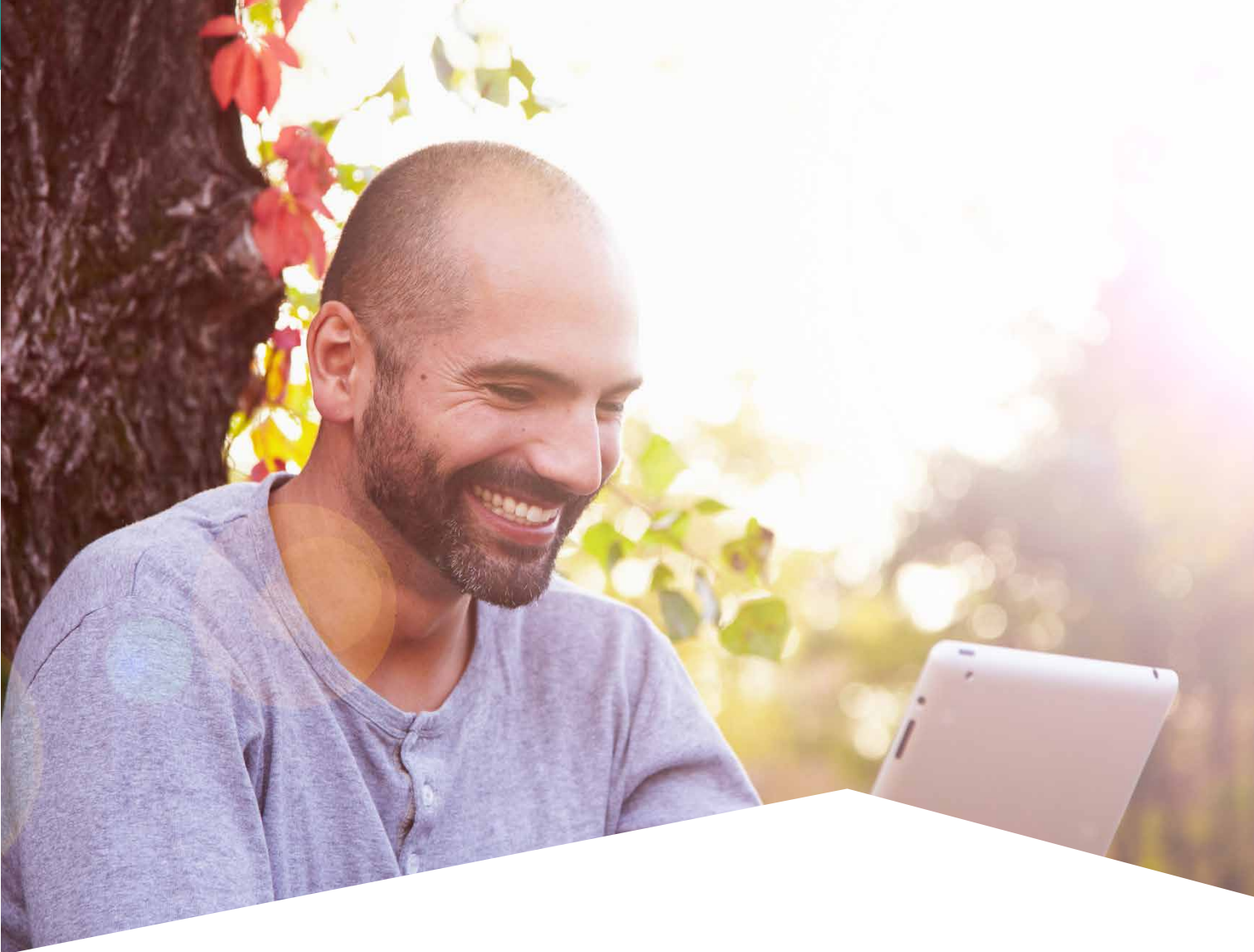
## Power MOSFETs (from October 2015 onwards)





## Automotive MOSFETs





# Infineon support for high-voltage MOSFETs

## Useful links and helpful information

### Further information, datasheets and documents

[www.infineon.com/coolmos](http://www.infineon.com/coolmos)

[www.infineon.com/coolmos-latest-packages](http://www.infineon.com/coolmos-latest-packages)

[www.infineon.com/coolmos-automotive](http://www.infineon.com/coolmos-automotive)

[www.infineon.com/gan](http://www.infineon.com/gan)

### Evaluationboards and simulation models

[www.infineon.com/coolmos-boards](http://www.infineon.com/coolmos-boards)

[www.infineon.com/powermosfet-simulationmodels](http://www.infineon.com/powermosfet-simulationmodels)



Support



Evaluation board



Tools



Simulation

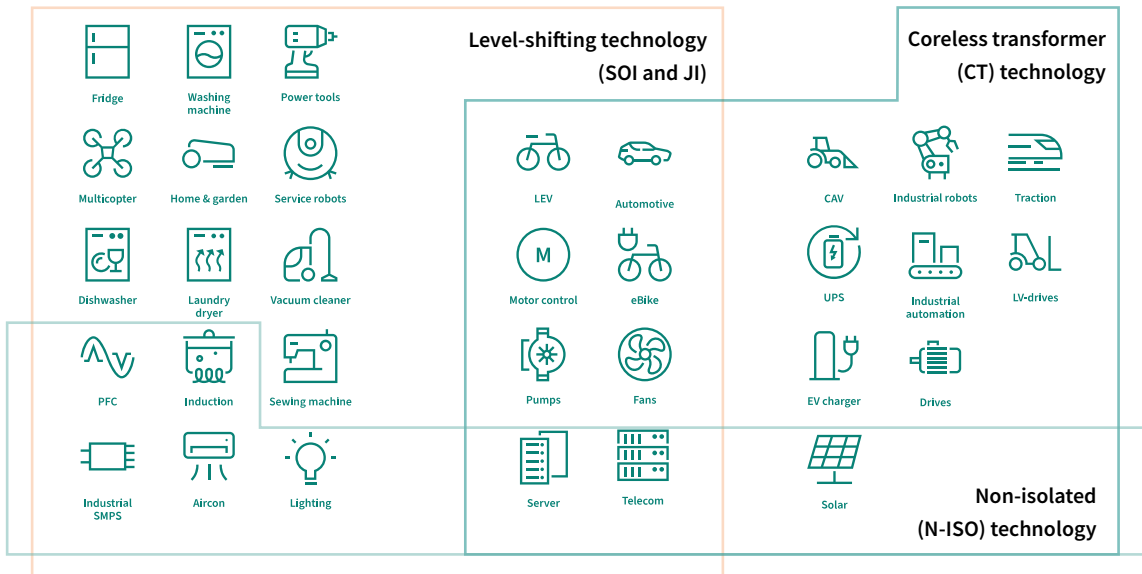
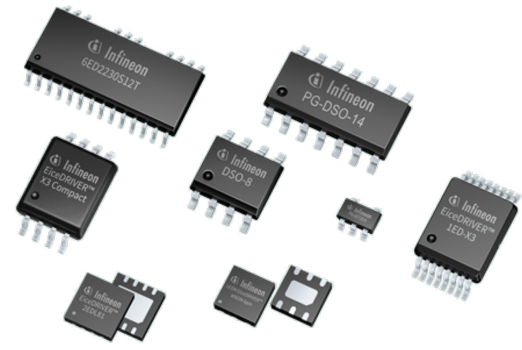


## Gate-driver ICs

- Infineon gate-driver IC applications
- Driver configuration overview
- Infineon gate-driver IC technologies
- How to choose a gate driver
- Infineon gate driver IC package options
- Gate-driver ICs for GaN HEMTs
- Gate-driver ICs portfolio
- Infineon solid-state relay package options
- Gate-driver ICs for SiC MOSFETs
- EiceDRIVER™ non-isolated low-side gate drivers
- 2EDN EiceDRIVER™ family
- EiceDRIVER™ 1EDN71x6G/U family
- EiceDRIVER™ 1EDL8011, 135 V high-side driver
- EiceDRIVER™ 2EDL8x2x family
- MOTIX™ 6EDL7141 high performance motor control
- MOTIX™ 3-phase smart gate drive controller IC
- MOTIX™ 160 V SOI gate-driver family
- EiceDRIVER™ 650 V level-shift SOI gate driver family
- EiceDRIVER™ 1200 V level-shift SOI gate driver family
- 2EDi EiceDRIVER™ family
- EiceDRIVER™ X3 Compact and 2L-SRC Compact
- EiceDRIVER™ Enhanced 1ED-F3 and X3 Analog
- EiceDRIVER™ Enhanced X3 Digital
- EiceDRIVER™ APD 2ED4820-EM
- EiceDRIVER™ 1EDI302xAS/1EDI303xAS
- Infineon solid-state relays (SSR) technologies
- Gate driver nomenclature

# Infinion gate-driver IC applications

Leveraging the application expertise and advanced technologies of Infineon and International Rectifier, EiceDRIVER™ gate-driver ICs are well-suited for many applications such as industrial motor drives, home appliances, solar inverters, automotive applications, EV-charging, UPS, switch-mode power supplies (SMPS), high-voltage lighting, battery-powered applications, and so on.



## Infinion gate-driver IC technologies

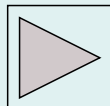
| Non-isolated GD  | Level-shift GD   |  | Isolated GD   |
|--|--|--|---|
| ● Non-isolated (N-ISO)   | ● Junction isolation (JI)  | ● Silicon on insulator (SOI)   | ● Coreless transformer (CT)   |
| <p>Monolithic construction of ground-reference gate drivers for 20 V to 35 V supply voltage applications</p> <p>Comprehensive families of single- and dual-low-side drivers with flexible options for output current, logic configurations and UVLOs (plus non-isolated TDI)</p> <p>Uses rugged and high-performance technologies of HVIC process or state-of-the-art 130 nm process</p> | <p>Monolithic construction of one to six gate drive channels up to 1200 V rating</p> <p>Industrial pioneering high-voltage IC (HVIC) technology used in all high-voltage gate drive applications</p> <p>Gen 2 technology (IR prefix): Industrial pioneering HVIC process</p> <p>Gen 5 technology (IRS prefix): Cost-effective pin-to-pin versions of Gen 2</p> | <p>Monolithic construction of 2 to 6 gate drive channels up to 1200 V rating</p> <p>Built-in PN-based bootstrap diode (36 Ω typ.) for simplified bootstrap operation &amp; reduced PCB area</p> <p>Negative transient immunity to prevent latch-up: -100 V for 300 ns</p> <p>&gt;50 percent lower level-shift losses for higher efficiency, higher frequency operation, smaller heat sinks, and higher reliability</p> | <p>Two separate chips solution with magnetic coupling providing galvanically isolated single- and dual channel gate drivers</p> <p>VDE 0884-11 isolation technology providing isolation up to 8 kVpk V<sub>IOTM</sub> and up to ±2300 V functional isolation</p> <p>CMTI of more than 300 V/ns</p> <p>Strongest gate-drive output currents (up to ±18 A) reducing need for external booster</p> |



# Driver configuration overview

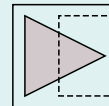
## 1-channel low-side driver

Allows low offset of the voltage between input and output



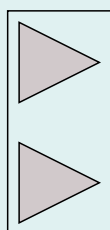
## 1-channel high-side driver

Allows high voltage offset between input and output



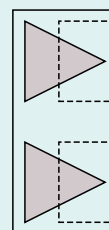
## 2-channel low-side driver

Both channels allow individual low voltage offsets, no interlock



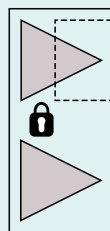
## 2-channel high-side driver

Both channels allow individual high voltage offsets, no interlock



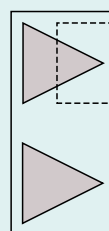
## Half-bridge driver

Two interlocked channels for shoot through protection where one of the channels allows a high voltage offset.



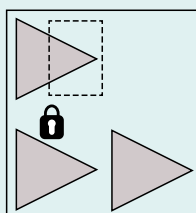
## High- and low-side driver

Two non-interlocked channels, one for high voltage, one for low voltage offsets. The industry may also refer this as half-bridge.



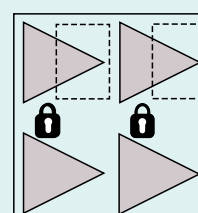
## Half-bridge plus single low-side driver

Half-bridge with one additional low-side driver.



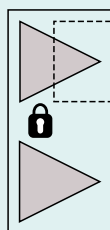
## Full-bridge driver

Four channels in a package with two independent half bridges.



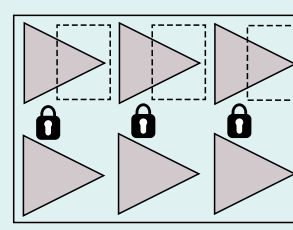
## Synchronous-buck drivers

High speed drivers for dual high side and low side MOSFETs in synchronous rectified buck converters.



## Three-phase bridge

Six channels in a package with three independent half bridges

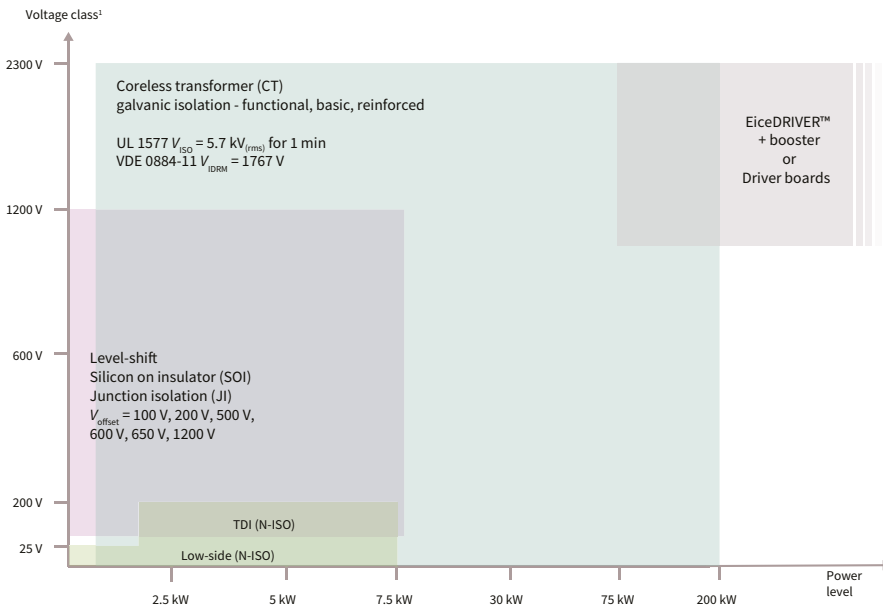


# EiceDRIVER™ and MOTIX™ gate-driver IC

Gate-driver ICs serve as the interface between control signals (digital or analog controllers) and power switches (IGBTs, MOSFETs, SiC MOSFETs, and GaN HEMTs). Integrated gate driver solutions reduce design complexity, development time, bill of materials (BOM), and board space while improving reliability over discretely-implemented gate-drive solutions.

Every switch needs a driver, the right driver makes a difference. Infineon offers a comprehensive portfolio of EiceDRIVER™ gate-driver ICs with a variety of configurations, voltage classes, isolation levels, protection features, and package options. EiceDRIVER™ gate-driver ICs are complementary to Infineon IGBT discretely and modules, silicon (CoolMOS™, OptiMOS™ and StrongIRFET™) and silicon carbide MOSFETs (CoolSiC™), gallium nitride HEMTs (CoolGaN™), or as part of integrated power modules (CIPOST™ IPM and iMOTION™ IPM).

In addition, MOTIX™ gate driver is part of the MOTIX™ scalable product portfolio for low-voltage motor control solutions including MOTIX™ Driver, MOTIX™ Bridge, MOTIX™ SBC, and MOTIX™ MCU.

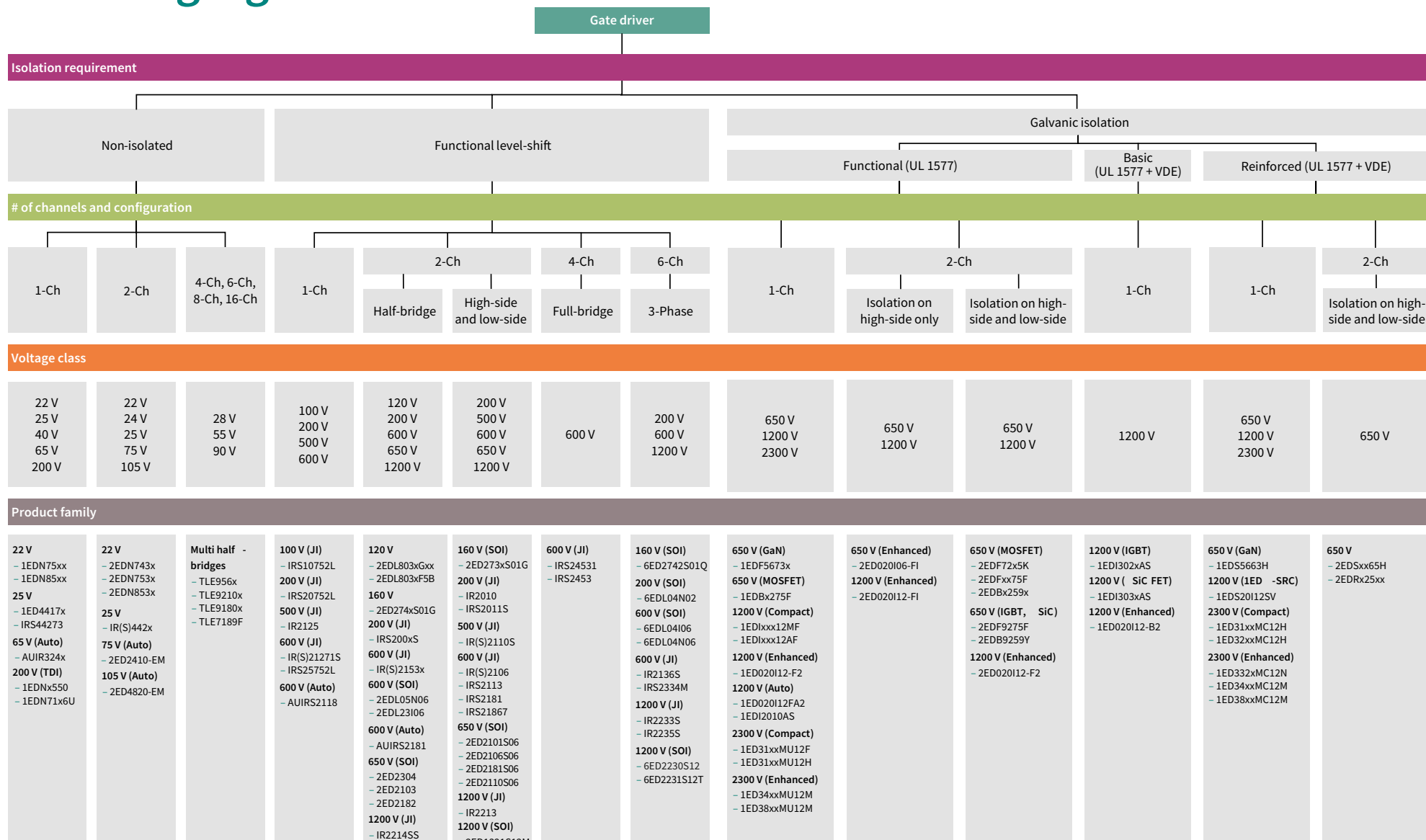


| Gate driver configuration |           |                      | 25 V | 25 - 105 V | 200 V | 500 V | 600 V | 650 V | 1200 V | 2300 V |
|---------------------------|-----------|----------------------|------|------------|-------|-------|-------|-------|--------|--------|
| Gate drivers              | 1-Channel | Isolated             |      |            |       |       |       | ●     | ●      | ●      |
|                           |           | High-side            |      | ● ●        | ● ●   | ●     | ●     |       |        |        |
|                           |           | Low-side             | ●    |            |       |       |       |       |        |        |
|                           | 2-Channel | Isolated             |      |            | ●     |       |       | ●     | ●      |        |
|                           |           | High-side            |      | ●          |       |       |       |       |        |        |
|                           |           | Low-side             | ●    |            |       |       |       |       |        |        |
|                           |           | High-side + Low-side |      |            | ● ●   | ●     | ● ●   | ●     | ●      |        |
|                           | 4-Channel | Half-bridge          |      | ●          | ● ●   |       | ● ●   | ●     | ●      |        |
|                           | 6-Channel | Three-phase          |      |            | ●     |       | ● ●   |       | ● ●    |        |

● Non-isolated (N-ISO) ● Junction isolation (JI) ● Silicon on insulator (SOI) ● Coreless transformer (CT)

Note 1 Voltage class on the top row is defined base on different driver configurations for the maximum Voltage class.  
 1. For single high-side, high-side and low-side, half bridge and three phase gate drivers, voltage class is defined as switch break down voltage in applications.  
 2. For low side drivers (N-ISO), voltage class is defined as maximum operating range supply voltage.  
 3. For special cases as LEDNx550 (LEDN-TDI, N-ISO), voltage class is defined as maximum bus voltage (highest floating voltage it can manage).

# Choosing a gate-driver IC



# Infineon gate-driver IC package options

|                               |  |                                      |  |                           |  |
|-------------------------------|--|--------------------------------------|--|---------------------------|--|
| DSO-8<br>(SOIC-8N)            |  | DSO-24<br>(DSO-28<br>without 4 pins) |  | TSSOP-8                   |  |
| DSO-8 with<br>power pad       |  | DSO-28<br>(SOIC-28WB)                |  | TSSOP-28                  |  |
| DSO-8 300-mil<br>(SOIC-8WB)   |  | DSO-36                               |  | VDSON-8                   |  |
| DSO-14<br>(SOIC-14N)          |  | LCC-32<br>(PLCC-44)                  |  | VQFN-14<br>(MLPQ 4x4 14L) |  |
| DSO-14<br>150mil              |  | LQFP-64                              |  | VQFN-28<br>(MLPQ 5x5 28L) |  |
| DSO-14<br>300mil              |  | MQFP-64                              |  | VQFN-32<br>5x5 mm         |  |
| DSO-16                        |  | SOT23-5                              |  | VQFN-34<br>(MLPQ 7x7 48L) |  |
| DSO-16 300-mil<br>(SOIC-16WB) |  | SOT23-6                              |  | VQFN-48                   |  |
| DSO-16<br>(fine pitch)        |  | SSOP-24                              |  | VSON-10<br>3x3 mm         |  |
| DSO-18                        |  | TFLGA-13                             |  | WSON-6                    |  |
| DSO-19                        |  | TQFN-48                              |  | WSON-8                    |  |
| DSO-20<br>(SOIC-20WB)         |  | TSDSO-24                             |  | CHIP                      |  |
| DSO-20<br>(fine pitch)        |  | TSNP-6                               |  |                           |  |
| DSO-20 WB                     |  | TSNP-7                               |  |                           |  |



# Gate-driver ICs for GaN HEMTs

GaN HEMTs represent a key technology for modern power electronics systems, providing high efficiency and power density. Infineon's **CoolGaN™** HEMT families and **EiceDRIVER™** gate-driver ICs are designed to provide the best possible performance in GaN-based systems, minimizing R&D effort and cost. Infineon offers a broad range of **EiceDRIVER™** gate-driver ICs optimized for driving GaN GIT (gate injection transistor) and SG (Schottky gate) HEMTs.

## Recommended drivers for GaN GIT HEMTs and 650 V GaN HEMTs

Infineon's **CoolGaN™** GIT technology is based on a hybrid-drain HEMT with p-GaN gate resulting in a robust normally-off power switch. To deal with the particularities of this concept, an innovative differential gate-drive concept has been implemented in tailor-made gate driver ICs of the **EiceDRIVER™** 1EDx56x3 product family optimized for **CoolGaN™** GIT HEMTs. These drivers ensure robust and highly efficient operation of the high-voltage GaN switch, and at the same time concurrently minimizing R&D efforts and shortening time-to-market. Infineon's **EiceDRIVER™** 1EDx56x3 provide negative  $V_{GS}$  voltage, which leads to safe off-states during switching transients. Additionally, it protects the GaN switch against spurious turn-on, even for the first pulse or after a burst mode operation. Thanks to the integrated galvanic isolation, Infineon's **EiceDRIVER™** GaN gate-driver ICs are best suited to drive high-voltage GaN HEMTs in hard-switching half-bridge applications, such as the totem-pole PFC topology. If the PWM signals have to cross the safe isolation barrier, such as in the resonant LLC with secondary-side control, the **1EDS5663H** with reinforced isolation is the right choice. Nevertheless, in many applications, standard gate-driver ICs with right fit UVLO protection can also be employed when coupled to an RC circuit to generate both the required small steady-state current and the turn-on/turn-off peak currents. Dual-channel drivers of the **EiceDRIVER™** 2EDxx259 product family feature dead-time control (DTC) and shoot-through protection (STP) to ensure safe operation in half-bridge topologies using a single IC. A hybrid gate driving configuration for half-bridge topologies, composed of two single-channel gate driver ICs of the **EiceDRIVER™** 1EDBx275F and 1EDNx550B, allows optimizing the driver IC placement on the PCB in order to minimize the gate loop parasitic inductances. This results in a PCB area saving (compared with a dual-channel gate-driver IC) and it comes with a highly competitive bill-of-material (BOM).

To summarize, the 1-channel and 2-channel gate-driver ICs of the **EiceDRIVER™** family are the best choices to match with Infineon's **CoolGaN™** GIT HEMTs and other 650 GaN HEMTs technologies (e.g., Schottky gate, Cascode) to achieve an optimum combination of efficiency, power density, and robustness in high-performance power conversion applications.

| Product family | Part number               | Current peak sink/source | VCC2 (-Vee2) | UVLO* | Prop delay | CMTI     | Other features  | Package        |
|----------------|---------------------------|--------------------------|--------------|-------|------------|----------|---|----------------|
| 1EDi-G1        | <a href="#">1EDF5673K</a> | 4 A / -8 A               | 20 V         | 5 V   | 37 ns      | 200 V/ns | Gate driver ICs for high-voltage GaN power switches ( <b>CoolGaN™</b> , GIT technology based products), functional isolation          | LGA-13 5x5mm   |
|                | <a href="#">1EDF5673F</a> |                          |              |       |            |          | Gate driver ICs for high-voltage GaN power switches ( <b>CoolGaN™</b> , GIT technology based products), reinforced isolation, UL 1577 | DSO-16 150 mil |
|                | <a href="#">1EDS5663H</a> |                          |              |       |            |          |   | DSO-16 300 mil |
| 1EDB           | <a href="#">1EDB7275F</a> | 5 A / -9 A               | 20 V         | 4 V   | 45 ns      | 300 V/ns | Separate source/sink outputs, fast start-up times and fast recovery, basic isolation, UL 1577   | DSO-8 150 mil  |
|                | <a href="#">1EDB8275F</a> |                          |              | 8 V   |            |          |   |                |
| 1EDN-TDI       | <a href="#">1EDN7550B</a> | 5 A / -9 A               | 20 V         | 4 V   | 45 ns      | n. a.    | Truly differential inputs to provide high common-mode robustness  | SOT23 6-pin    |
|                | <a href="#">1EDN8550B</a> | 5 A / -9 A               |              | 8 V   |            |          |   |                |
| 2EDB           | <a href="#">2EDB7259Y</a> | 5 A / -9 A               | 20 V         | 4 V   | 38 ns      | 150 V/ns | fast start-up times and fast output clamping, basic isolation, UL 1577  | DSO-14 150 mil |
|                | <a href="#">2EDB8259Y</a> |                          |              | 8 V   |            |          |   |                |
| 2EDR           | <a href="#">2EDR7259X</a> | 5 A / -9 A               | 20 V         | 4 V   | 38 ns      | 150 V/ns | fast start-up times and fast output clamping, reinforced isolation, UL 1577, VDE 0884-17, IEC 60747-17                                | DSO-14 300 mil |
|                | <a href="#">2EDR8259X</a> |                          |              | 8 V   |            |          |   |                |

[www.infineon.com/driver-gan](http://www.infineon.com/driver-gan)

[www.infineon.com/driver-gan-sg](http://www.infineon.com/driver-gan-sg)

[www.infineon.com/driver-gan-git](http://www.infineon.com/driver-gan-git)




\* 8 V UVLO parts recommended for bipolar driving or for unipolar driving with  $V_{DD} \geq 10V$

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Evaluation boards with gate-driver ICs for GaN GIT HEMTs and 650 V GaN HEMTs

Our evaluation board helps you to set up and test GaN driving solutions quickly and easily.

| EVAL_1EDF_G1B_HB_GAN   | EVAL_2EDB_HB_GAN   | KIT_1EDB_AUX_GAN  |
|--|--|---|
|   |   |    |
| High-frequency half-bridge evaluation board featuring EiceDRIVER™ 1EDi-G1.   | CoolGaN™ GIT HEMT half-bridge evaluation board with EiceDRIVER™ 2EDB.  | Complete driving solution for GaN HEMTs including an isolated gate driver IC with a configurable floating auxiliary supply supporting unipolar and bipolar driving. |
| <a href="http://www.infineon.com/cms/en/product/evaluation-boards/eval_1edf_g1b_hb_gan/">www.infineon.com/cms/en/product/evaluation-boards/eval_1edf_g1b_hb_gan/</a> | <a href="http://www.infineon.com/cms/en/product/evaluation-boards/eval_2edb_hb_gan/">www.infineon.com/cms/en/product/evaluation-boards/eval_2edb_hb_gan/</a> | <a href="http://www.infineon.com/cms/en/product/evaluation-boards/kit_1edb_aux_gan/">www.infineon.com/cms/en/product/evaluation-boards/kit_1edb_aux_gan/</a>        |

## Recommended drivers for GaN SG HEMTs

The 1EDN71x6Gx is a single-channel gate-driver IC product family optimized for driving Infineon CoolGaN™ SG HEMTs, as well as other GaN SG HEMTs and Si MOSFETs. This gate driver includes several key features that enable a high-performance system design with fast-switching transistors, including truly differential input (TDI), four driving strength options, active Miller clamp, bootstrap voltage clamp, and with or without adjustable charge pump in PG-SON-10 and PG-TSNP-7 package respectively.

| Product family | PN        | Current peak sink/source | CMR <sub>static</sub> / CMR <sub>dynamic</sub> | UVLO | Prop delay | CMTI      | Other features                     | Package    |          |
|----------------|-----------|--------------------------|--|------|------------|-----------|------------------------------------|------------|----------|
| 1EDN71x6x      | 1EDN7116G | 2.0A/2.0                 | 150 V/200 V                                    | 4 V  | 55 ns      | 100 V/ ns | Negative charge pump, miller clamp | PG-VSON-10 |          |
|                | 1EDN7126G | 1.5A/1.5A                |  |      | 75 ns      |           |                                    |            |          |
|                | 1EDN7136G | 1.0A/1.0A                |  |      | 105 ns     |           |                                    |            |          |
|                | 1EDN7146G | 0.5A/0.5A                |  |      | 125 ns     |           |                                    |            |          |
| 1EDN71x6x      | 1EDN7116U | 2.0A/2.0                 | 150 V/200 V                                    | 4 V  | 55 ns      | 100 V/ns  | Miller clamp                       | PG-TSNP-7  |          |
|                | 1EDN7126U | 1.5A/1.5A                |  |      | 75 ns      |           |                                    |            | 100 V/ns |
|                | 1EDN7136U | 1.0A/1.0A                |  |      | 105 ns     |           |                                    |            | 100 V/ns |
|                | 1EDN7146U | 0.5A/0.5A                |  |      | 125 ns     |           |                                    |            | 100 V/ns |

[www.infineon.com/driver-gan](http://www.infineon.com/driver-gan)

[www.infineon.com/driver-gan-sg](http://www.infineon.com/driver-gan-sg)

[www.infineon.com/driver-gan-git](http://www.infineon.com/driver-gan-git)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

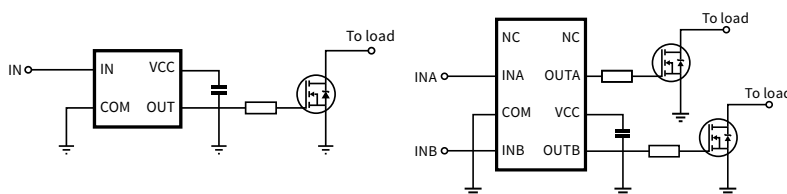


# Product overview

Infiniteon's gate-driver IC solutions are the expert's choice. With more than 400 reliable and efficient gate driver solutions, we provide a comprehensive portfolio for virtually any application. To ease the selection process, this overview is structured along the configurations of the gate-driver ICs, as opposed to application topology.

## Non-isolated low-side gate-driver IC

Typical connection



| Configuration | Voltage class [V] | I <sub>o</sub> /I <sub>o</sub> typ. [A] | UVLO on/off typ. [V] | Prop delay off/on typ. [ns] | Base PN      | Technology | Features |                 |                         |                               |                              |       |                        |       |         |         |        |
|---------------|-------------------|---|----------------------|-----------------------------|--------------|------------|----------|-----------------|-------------------------|-------------------------------|------------------------------|-------|------------------------|-------|---------|---------|--------|
|               |                   |   |                      |                             |              |            | Enable   | Fault reporting | Over-current protection | Programmable fault clear time | Separate sink/source outputs | DSO-8 | DSO-8 (with power-pad) | DIP-8 | SOT23-5 | SOT23-6 | WSON-6 |
| 1-channel     | 25                | 2.6/2.6                                 | 8.0/7.3              | 34/34                       | 1ED44173N01B | NEW        | N-ISO    | ✓               | ✓                       | ✓                             |                              |       |                        |       |         |         | ✓      |
|               |                   | 2.6/2.6                                 | 11.9/11.0            | 50/50                       | 1ED44175N01B | NEW        | N-ISO    | ✓               | ✓                       | ✓                             |                              |       |                        |       |         |         | ✓      |
|               |                   | 0.8/1.75                                | 11.9/11.4            | 50/50                       | 1ED44176N01F | NEW        | N-ISO    | ✓               | ✓                       | ✓                             | ✓                            |       |                        |       |         |         |        |
|               |                   | 2.6/2.6                                 | 11.9/11.0            | 50/50                       | 1ED44171N01B | NEW        | N-ISO    | ✓               | ✓                       |                               |                              |       |                        |       |         |         |        |
|               |                   | 1.5/1.5                                 | 10.2/9.2             | 50/50                       | IRS44273L    |            | N-ISO    |                 |                         |                               |                              |       |                        |       | ✓       |         |        |
|               | 22                | 4/8                                     | 4.2/3.9              | 19/19                       | 1EDN7511B    |            | N-ISO    |                 |                         |                               | ✓                            |       |                        |       |         |         | ✓      |
|               |                   | 4/8                                     | 4.2/3.9              | 19/19                       | 1EDN7512B    |            | N-ISO    |                 |                         |                               |                              |       |                        | ✓     |         |         |        |
|               |                   | 4/8                                     | 4.2/3.9              | 19/19                       | 1EDN7512G    |            | N-ISO    |                 |                         |                               |                              |       |                        |       |         | ✓       |        |
|               |                   | 4/8                                     | 8.0/7.0              | 19/19                       | 1EDN8511B    |            | N-ISO    |                 |                         |                               | ✓                            |       |                        |       | ✓       |         |        |
|               |                   | 5                                       | 1.6/3.3              | 8.9/8                       | 200/150      | IR2121     |          | N-ISO           |                         | ✓                             | ✓                            |       |                        |       |         | ✓       |        |
| 2-channel     | 25                | 2.3/3.3                                 | 10.2/9.2             | 50/50                       | IRS44262S    |            | N-ISO    |                 |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 2.3/3.3                                 | N.A.                 | 50/50                       | IRS4426S     |            | N-ISO    |                 |                         |                               |                              |       |                        | ✓     |         |         |        |
|               |                   | 2.3/3.3                                 | N.A.                 | 50/50                       | IRS4427S     |            | N-ISO    |                 |                         |                               |                              |       |                        | ✓     |         |         |        |
|               |                   | 2.3/3.3                                 | N.A.                 | 65/85                       | IR4426S      |            | N-ISO    |                 |                         |                               |                              |       |                        | ✓     |         |         |        |
|               |                   | 2.3/3.3                                 | N.A.                 | 65/85                       | IR4427S      |            | N-ISO    |                 |                         |                               |                              |       |                        | ✓     |         |         |        |
|               | 22                | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7523F    |            | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7523G    |            | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7523R    |            | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7524F    |            | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7524G    |            | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         | ✓       |        |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7524R    |            | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         | ✓       |        |
|               |                   | 5/5                                     | 8.0/7.0              | 19/19                       | 2EDN8523F    |            | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 5/5                                     | 8.0/7.0              | 19/19                       | 2EDN8523R    |            | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 5/5                                     | 8.0/7.0              | 19/19                       | 2EDN8524F    |            | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 5/5                                     | 8.0/7.0              | 19/19                       | 2EDN8524R    |            | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 4/4                                     | 4.2/3.9              | 19/19                       | 2EDN7424F    |            | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 4/4                                     | 4.2/3.9              | 19/19                       | 2EDN7424R    |            | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 4/4                                     | 4.2/3.9              | 19/19                       | 2EDN7434F    | NEW        | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 4/4                                     | 4.2/3.9              | 19/19                       | 2EDN7434R    | NEW        | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7533B    | NEW        | N-ISO    |                 |                         |                               |                              |       |                        |       | ✓       |         |        |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7533F    | NEW        | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7533R    | NEW        | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7534U    | NEW        | N-ISO    |                 |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7534B    | NEW        | N-ISO    |                 |                         |                               |                              |       |                        |       | ✓       |         |        |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7534F    | NEW        | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7534R    | NEW        | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         |         | ✓      |
|               |                   | 5/5                                     | 4.2/3.9              | 19/19                       | 2EDN7534G    | NEW        | N-ISO    | ✓               |                         |                               |                              |       |                        |       |         | ✓       |        |
|               |                   | 5/5                                     | 8.0/7.0              | 19/19                       | 2EDN8533F    | NEW        | N-ISO    | ✓               |                         |                               |                              |       | ✓                      |       |         |         |        |
| 5/5           | 8.0/7.0           | 19/19                                   | 2EDN8533R            | NEW                         | N-ISO        | ✓          |          |                 |                         |                               |                              |       |                        |       | ✓       |         |        |
| 5/5           | 8.0/7.0           | 19/19                                   | 2EDN8534F            | NEW                         | N-ISO        | ✓          |          |                 |                         |                               | ✓                            |       |                        |       |         |         |        |
| 5/5           | 8.0/7.0           | 19/19                                   | 2EDN8534R            | NEW                         | N-ISO        | ✓          |          |                 |                         |                               |                              |       |                        |       | ✓       |         |        |

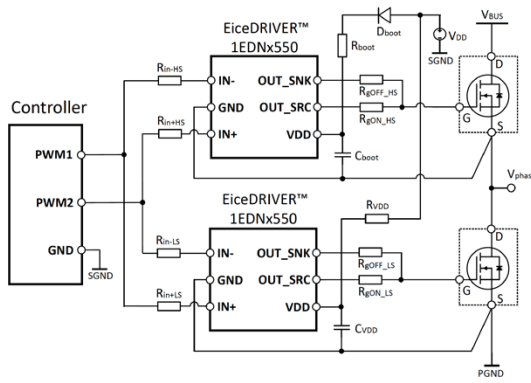
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# Non-isolated TDI gate-driver IC

Typical connection



|                                 |
|---------------------------------|
| Adjustable Negative charge pump |
| Active Miller clamp             |
| Separate sink/source outputs    |
| Truly differential inputs       |
| SOT23-6                         |
| TSNP-6                          |
| TSNP-7                          |
| VSON-10                         |

| Configura-tion | Voltage class [V] | $I_{on}/I_{off}$ typ. [A] | UVLO on/off typ. [V] | Prop delay off/on typ. [ns] | Base PN     | Technology | Features | Package |
|----------------|-------------------|---------------------------|----------------------|-----------------------------|-------------|------------|----------|---------|
| 1-channel      | 200               | 4/8                       | 4.2/3.9              | 45/45                       | 1EDN7550U   | N-ISO      | ✓        | ✓       |
|                |                   | 4/8                       | 4.2/3.9              | 45/45                       | 1EDN7550B   | N-ISO      | ✓        | ✓       |
|                |                   | 4/8                       | 8.0/7.0              | 45/45                       | 1EDN8550B   | N-ISO      | ✓        | ✓       |
|                |                   | 4/8                       | 12.2/11.5            | 45/45                       | 1EDN6550B   | NEW N-ISO  | ✓        | ✓       |
|                |                   | 4/8                       | 14.9/14.4            | 45/45                       | 1EDN9550B   | NEW N-ISO  | ✓        | ✓       |
|                |                   | 2/2                       | 3.85/3.75            | 55/55                       | 1EDN7116G   | NEW N-ISO  | ✓        | ✓       |
|                |                   | 2/2                       | 3.85/3.75            | 55/55                       | 1EDN7116U * | N-ISO      | ✓        | ✓       |
|                |                   | 1.5/1.5                   | 3.85/3.75            | 75/75                       | 1EDN7126G   | NEW N-ISO  | ✓        | ✓       |
|                |                   | 1.5/1.5                   | 3.85/3.75            | 75/75                       | 1EDN7126U * | N-ISO      | ✓        | ✓       |
|                |                   | 1/1                       | 3.85/3.75            | 105/105                     | 1EDN7136G   | NEW N-ISO  | ✓        | ✓       |
|                |                   | 1/1                       | 3.85/3.75            | 105/105                     | 1EDN7136U * | N-ISO      | ✓        | ✓       |
|                |                   | 0.5/0.5                   | 3.85/3.75            | 125/125                     | 1EDN7146G   | NEW N-ISO  | ✓        | ✓       |
| 0.5/0.5        | 3.85/3.75         | 125/125                   | 1EDN7146U *          | N-ISO                       | ✓           | ✓          |          |         |

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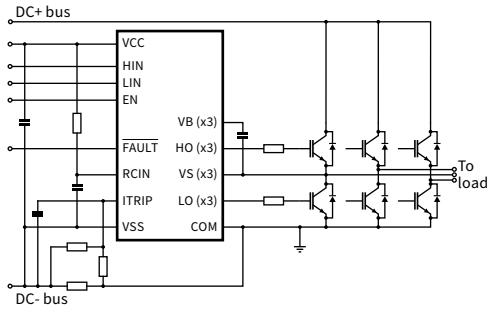
\* Coming soon

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# Three-phase gate-driver ICs

Typical connection



| Brake chopper | Desaturation protection Enable | Fault reporting | Integrated bootstrap diode | Operational amplifier | Over-current protection | Power Management Unit | Programmable dead time | Programmable Fault Clear/Reset | Programmable OCP Reference Threshold | Programmable Op-amp Voltage Gain | Trickle Charge Pumps (100% duty cycle) | Separate pin for logic ground | Shoot-through protection | Shutdown | Two stage turn on | Package |           |        |         |          |         |         |         |         |      |
|---------------|--------------------------------|-----------------|----------------------------|-----------------------|-------------------------|-----------------------|------------------------|--------------------------------|--------------------------------------|----------------------------------|--|-------------------------------|--------------------------|----------|-------------------|---------|-----------|--------|---------|----------|---------|---------|---------|---------|------|
|               |                                |                 |                            |                       |                         |                       |                        |                                |                                      |                                  |  |                               |                          |          | DSO-20 WB         | DSO-24  | DSO-28 WB | LCC-32 | MQFP-64 | TSSOP-28 | VQFN-28 | VQFN-32 | VQFN-34 | VQFN-48 | CHIP |

| Voltage class [V] | $I_{o1}/I_{o2}$ typ. [A] | UVLO on/off typ. [V] | Prop delay off/on typ. [ns] | Base PN         | Tech-no-logy | Features |   |   |   |   |   |   |   |   |   |   |   |   |   |   | Package |   |   |   |   |   |  |
|-------------------|--------------------------|----------------------|-----------------------------|-----------------|--------------|----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---------|---|---|---|---|---|--|
| 1200              | 0.35/0.65                | 12.2 / 11.3          | 600/600                     | 6ED2231S12T     | SOI          |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ | ✓ |   |   | ✓ |   |   |         |   |   |   | ✓ |   |  |
|                   | 0.35/0.65                | 11.4/10.4            | 600/600                     | 6ED2230S12T     | SOI          |          | ✓ | ✓ | ✓ |   |   |   |   | ✓ | ✓ |   |   | ✓ |   |   |         |   |   |   | ✓ |   |  |
|                   | 0.25/0.5                 | 8.6/8.2              | 700/750                     | IR2233S         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ | ✓ | ✓ |   |   | ✓ |   |         |   |   |   |   |   |  |
|                   | 0.25/0.5                 | 8.6/8.2              | 700/750                     | IR2233J         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ | ✓ | ✓ |   |   |   | ✓ |         |   |   |   |   |   |  |
|                   | 0.25/0.5                 | 10.4/9.4             | 700/750                     | IR2235S         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ | ✓ | ✓ |   |   |   | ✓ |         |   |   |   |   |   |  |
|                   | 0.25/0.5                 | 10.4/9.4             | 700/750                     | IR2235J         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ | ✓ | ✓ |   |   |   |   |         |   |   |   |   |   |  |
|                   | 0.35/0.54                | 11.2/10.2            | 550/550                     | IR2238Q         | J1           | ✓        | ✓ |   | ✓ |   | ✓ |   |   | ✓ |   | ✓ | ✓ |   |   | ✓ |         |   |   |   |   |   |  |
| 160               | 0.165/0.375              | 11.7/9.8             | 490/530                     | 6EDL04I06NT     | SOI          |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |   |         |   |   |   | ✓ |   |  |
|                   | 0.165/0.375              | 11.7/9.8             | 490/530                     | 6EDL04I06PT     | SOI          |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |   |         |   |   |   | ✓ |   |  |
|                   | 0.165/0.375              | 9/8.1                | 530/530                     | 6EDL04N06PT     | SOI          |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |   |         |   |   |   | ✓ |   |  |
|                   | 0.2/0.35                 | 8.9/8.2              | 400/425                     | IR2136S         | J1           |          | ✓ | ✓ |   | ✓ |   |   |   | ✓ |   |   |   |   | ✓ | ✓ |         |   |   |   | ✓ |   |  |
|                   | 0.2/0.35                 | 11.1/10.9            | 400/425                     | IR21363S        | J1           |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |   |         |   |   |   | ✓ |   |  |
|                   | 0.2/0.35                 | 10.4/9.4             | 530/500                     | IR21364S        | J1           |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |   |         |   |   |   | ✓ |   |  |
|                   | 0.2/0.35                 | 11.1/10.9            | 530/530                     | IRS2334M        | J1           |          |   |   |   |   |   |   |   |   |   |   |   |   |   |   | ✓       |   |   |   |   |   |  |
|                   | 0.2/0.35                 | 11.1/10.9            | 530/530                     | IRS2334S        | J1           |          |   |   |   |   |   |   |   |   |   |   | ✓ |   |   |   |         |   |   |   |   |   |  |
|                   | 0.2/0.35                 | 8.9/8.2              | 530/530                     | IRS2336DJ       | J1           |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   |   | ✓ |         |   |   |   | ✓ |   |  |
|                   | 0.2/0.35                 | 8.9/8.2              | 530/530                     | IRS2336DM       | J1           |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   |   |   |         |   | ✓ |   | ✓ |   |  |
|                   | 0.2/0.35                 | 8.9/8.2              | 530/530                     | IRS2336DS       | J1           |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   |   | ✓ |         |   |   |   | ✓ |   |  |
|                   | 0.2/0.35                 | 8.9/8.2              | 530/530                     | IRS23364DS      | J1           |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   |   | ✓ |         |   |   |   | ✓ |   |  |
|                   | 0.2/0.35                 | 8.9/8.2              | 530/530                     | IRS23365DM      | J1           |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   |   |   |         |   | ✓ |   | ✓ |   |  |
|                   | 200                      | 0.25/0.5             | 9/8.7                       | 425/675         | IR2130S      | J1       |   |   | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |         |   |   |   |   | ✓ |  |
| 0.25/0.5          |                          | 9/8.7                | 425/675                     | IR2130J         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |   |         |   |   |   | ✓ |   |  |
| 0.25/0.5          |                          | 9/8.7                | 425/675                     | IR2132S         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |   |         |   |   |   | ✓ |   |  |
| 0.25/0.5          |                          | 9/8.7                | 425/675                     | IR2132J         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ |   |   |   |   | ✓ |   |         |   |   |   | ✓ |   |  |
| 0.25/0.5          |                          | 8.6/8.2              | 700/750                     | IR2133S         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ |   | ✓ |   |   |   | ✓ |         |   |   |   |   |   |  |
| 0.25/0.5          |                          | 8.6/8.2              | 700/750                     | IR2133J         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ |   | ✓ |   |   |   | ✓ |         |   |   |   |   |   |  |
| 0.25/0.5          |                          | 10.4/9.4             | 700/750                     | IR2135J         | J1           |          |   | ✓ | ✓ | ✓ |   |   |   | ✓ |   | ✓ |   |   |   | ✓ |         |   |   |   | ✓ |   |  |
| 0.165/0.375       |                          | 11.7/9.8             | 490/530                     | 6ED003L02-F2    | SOI          |          | ✓ | ✓ |   | ✓ |   |   |   | ✓ |   |   |   |   |   |   |         | ✓ |   |   |   |   |  |
| 0.165/0.375       |                          | 9/8.1                | 530/530                     | 6EDL04N02PR     | SOI          |          | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓ | ✓ |   |   |   |   |   |         | ✓ |   |   |   |   |  |
| 160               | 1/2                      | 7.5/6.8              | 100/100                     | 6ED2742S01Q NEW | SOI          |          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |   |         | ✓ |   |   |   |   |  |
| 60                | 1.5/1.5                  | 5.8/4.5              | 140/140                     | 6EDL7141        | SOI          |          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |   |   |         |   |   | ✓ |   |   |  |

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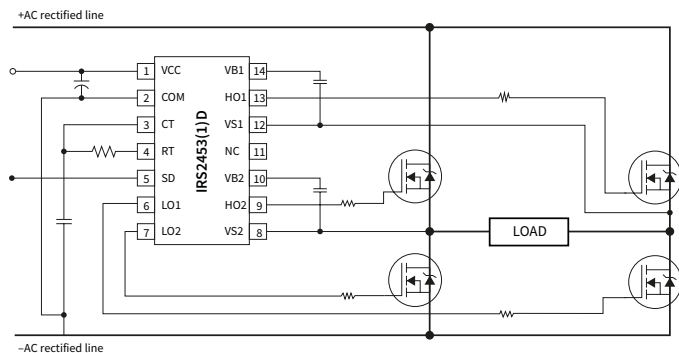
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## Full-bridge gate-driver ICs

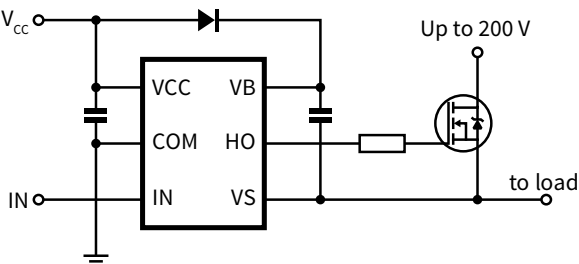
Typical connection



| Voltage class [V] | $I_{o1}/I_{o2}$ typ. [A] | UVLO on/off typ. [V] | Base PN   | Technology | Features   | Package |
|-------------------|--------------------------|----------------------|-----------|------------|--|---------|
| 600               | 0.18/0.26                | 11/9                 | IRS2453DS | J1         | Integrated bootstrap diode<br>Shoot-through protection<br>Shutdown | DSO-14  |

## Single high-side gate-driver ICs

Typical connection



| Voltage class [V] | $I_{o1}/I_{o2}$ typ. [A] | UVLO on/off typ. [V] | Prop delay off/on typ. [ns] | Base PN   | Technology | Features | Package |
|-------------------|--------------------------|----------------------|-----------------------------|-----------|------------|----------|---------|
| 600               | 0.16/0.24                | 9/8                  | 215/140                     | IRS25752L | J1         |          | ✓       |
|                   | 0.25/0.5                 | 8.6/8.2              | 105/125                     | IR2117S   | J1         |          | ✓       |
|                   | 0.25/0.5                 | 8.6/8.2              | 105/125                     | IR2118S   | J1         |          | ✓       |
|                   | 0.25/0.5                 | 10.3/9               | 150/200                     | IR2127S   | J1         | ✓        | ✓       |
|                   | 0.25/0.5                 | 10.3/9               | 150/200                     | IR2128S   | J1         | ✓        | ✓       |
|                   | 0.25/0.5                 | 7.2/6.8              | 150/200                     | IR21271S  | J1         | ✓        | ✓       |
|                   | 0.29/0.6                 | 8.6/8.2              | 105/125                     | IRS2117S  | J1         |          | ✓       |
|                   | 0.29/0.6                 | 8.6/8.2              | 105/125                     | IRS2118S  | J1         |          | ✓       |
|                   | 0.29/0.6                 | 10.3/9               | 150/150                     | IRS2127S  | J1         | ✓        | ✓       |
| 500               | 0.29/0.6                 | 7.2/6.8              | 150/150                     | IRS21271S | J1         | ✓        | ✓       |
|                   | 1.6/3.3                  | 9.2/8.3              | 200/170                     | IR2125S   | J1         | ✓        | ✓       |
| 200               | 0.16/0.24                | 9/8                  | 215/140                     | IRS20752L | J1         |          | ✓       |
|                   | 4/8                      | 4.2/3.9              | 5/45                        | 1EDN7550B | TDI        |          | ✓       |
|                   | 4/8                      | 8/7                  | 45/45                       | 1EDN8550B | TDI        |          | ✓       |
|                   | 4/8                      | 12.2/11.5            | 45/45                       | 1EDN6550B | TDI        |          | ✓       |
|                   | 4/8                      | 14.9/14.4            | 45/45                       | 1EDN9550B | TDI        |          | ✓       |
|                   | 4/8                      | 4.2/3.9              | 45/45                       | 1EDN7550U | TDI        |          | ✓       |
| 100               | 0.16/0.24                | 9/8                  | 215/140                     | IRS10752L | J1         |          | ✓       |

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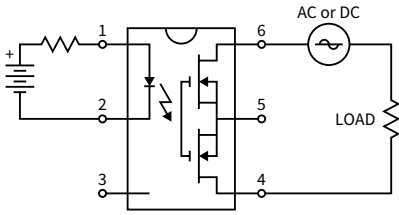


# Automotive gate-driver ICs

| Configuration          | Voltage class [V] | I <sub>o</sub> /I <sub>o</sub> typ. [A] | UVLO on/off typ. [V] | Prop delay off/on typ. [ns] | Base PN      | Technology | Features |                         |        |                 |                       |                         |                        |                        |                               |                               |                          |          |               |                           |                    | Package |             |                 |                     |       |        |           |           |                     |        |        |          |   |   |   |   |
|------------------------|-------------------|---|----------------------|-----------------------------|--------------|------------|----------|-------------------------|--------|-----------------|-----------------------|-------------------------|------------------------|------------------------|-------------------------------|-------------------------------|--------------------------|----------|---------------|---------------------------|--------------------|---------|-------------|-----------------|---------------------|-------|--------|-----------|-----------|---------------------|--------|--------|----------|---|---|---|---|
|                        |                   |   |                      |                             |              |            | Buffer   | Desaturation protection | Enable | Fault reporting | Operational amplifier | Over-current protection | Programmable frequency | Programmable dead time | Self-oscillating (Oscillator) | Separate pin for logic ground | Shoot-through protection | Shutdown | SPI interface | Synchronous rectification | Two-level turn-off | UL 1577 | VDE 0884-11 | ISO 26262 ready | ISO 26262 compliant | DSO-8 | DSO-14 | DSO-16 NB | DSO-16 WB | DSO-20 (sine pitch) | DSO-28 | DSO-36 | TSDSO-24 |   |   |   |   |
| 1-channel isolated     | 1200              | 12/12                                   | 12.6/11.8            | 60/60                       | 1EDI3020AS   | CT         | ✓        | ✓                       | ✓      | ✓               | ✓                     |                         |                        |                        |                               | ✓                             |                          |          |               | ✓                         | ✓                  | ✓       | ✓           |                 |                     |       |        |           |           |                     | ✓      |        |          |   |   |   |   |
|                        |                   | 12/12                                   | 12.6/11.8            | 60/60                       | 1EDI3021AS   | CT         | ✓        | ✓                       | ✓      | ✓               | ✓                     |                         |                        |                        |                               | ✓                             |                          |          |               | ✓                         | ✓                  | ✓       | ✓           |                 |                     |       |        |           |           |                     |        |        | ✓        |   |   |   |   |
|                        |                   | 12/12                                   | 12.6/11.8            | 60/60                       | 1EDI3023AS   | CT         | ✓        | ✓                       | ✓      | ✓               | ✓                     |                         |                        |                        |                               | ✓                             |                          |          |               | ✓                         | ✓                  | ✓       | ✓           |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
|                        |                   | 12/12                                   | 12.6/11.8            | 60/60                       | 1EDI3030AS   | CT         | ✓        | ✓                       | ✓      | ✓               | ✓                     |                         |                        |                        |                               | ✓                             |                          |          |               | ✓                         | ✓                  | ✓       | ✓           |                 |                     |       |        |           |           |                     |        |        |          |   |   | ✓ |   |
|                        |                   | 12/12                                   | 12.6/11.8            | 60/60                       | 1EDI3031AS   | CT         | ✓        | ✓                       | ✓      | ✓               | ✓                     |                         |                        |                        |                               | ✓                             |                          |          |               | ✓                         | ✓                  | ✓       | ✓           |                 |                     |       |        |           |           |                     |        |        |          |   |   | ✓ |   |
|                        |                   | 12/12                                   | 12.6/11.8            | 60/60                       | 1EDI3033AS   | CT         | ✓        | ✓                       | ✓      | ✓               | ✓                     |                         |                        |                        |                               | ✓                             |                          |          |               | ✓                         | ✓                  | ✓       | ✓           |                 |                     |       |        |           |           |                     |        |        |          |   |   | ✓ |   |
|                        |                   | 2.1/2.1                                 | 12/11                | 165/170                     | 1ED020112FA2 | CT         |          | ✓                       |        | ✓               |                       |                         |                        |                        |                               |                               |                          |          |               | ✓                         | ✓                  | ✓       |             |                 |                     |       |        |           |           |                     |        |        | ✓        |   |   |   |   |
|                        |                   | 2/2                                     | 12/11                | 1900/1750                   | 1ED020112FTA | CT         |          | ✓                       |        | ✓               |                       |                         |                        |                        |                               |                               |                          |          |               | ✓                         | ✓                  | ✓       |             |                 |                     |       |        |           |           |                     |        |        | ✓        |   |   |   |   |
|                        |                   | 2/2                                     | 12.5/11.7            | 215/215                     | 1EDI2004AS   | CT         |          | ✓                       | ✓      | ✓               | ✓                     | ✓                       |                        |                        |                               |                               | ✓                        |          |               |                           | ✓                  | ✓       | ✓           | ✓               |                     |       |        |           |           |                     |        |        |          |   |   |   | ✓ |
|                        |                   | 2/2                                     | 12.5/11.7            | 215/215                     | 1EDI2002AS   | CT         |          | ✓                       | ✓      | ✓               | ✓                     | ✓                       |                        |                        |                               |                               | ✓                        |          |               |                           | ✓                  | ✓       | ✓           | ✓               |                     |       |        |           |           |                     |        |        |          |   |   |   | ✓ |
| 2/2                    | 12.5/11.7         | 215/215                                 | 1EDI2010AS           | CT                          |              | ✓          | ✓        | ✓                       | ✓      | ✓               |                       |                         |                        |                        | ✓                             |                               |                          |          | ✓             | ✓                         | ✓                  |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
| 2-channel isolated     | 1200              | 2/2                                     | 12/11                | 165/170                     | 2ED020112FA  | CT         | ✓        | ✓                       | ✓      |                 |                       |                         |                        |                        | ✓                             |                               |                          |          | ✓             | ✓                         |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   |   | ✓ |   |
| Half-bridge            | 100               | 1/1                                     | 7.3/6.8              | N.A.                        | AUIR2085S    | Jl         |          |                         |        | ✓               |                       |                         |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
| High-side and low-side | 600               | 1.9/2.3                                 | 8.9/8.2              | 135/135                     | AUIRS21811S  | Jl         |          |                         |        |                 |                       |                         |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
|                        |                   | 1.9/2.3                                 | 8.9/8.2              | 200/160                     | AUIRS21814S  | Jl         |          |                         |        |                 |                       |                         |                        |                        |                               |                               | ✓                        |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          | ✓ |   |   |   |
|                        |                   | 1.9/2.3                                 | 8.9/8.2              | 200/160                     | AUIRS2181S   | Jl         |          |                         |        |                 |                       |                         |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
|                        |                   | 3.5/3.5                                 | 8.9/8.2              | 90/90                       | AUIRS2191S   | Jl         |          |                         |        |                 |                       |                         |                        |                        |                               |                               | ✓                        |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
|                        |                   | 0.2/0.35                                | 4.1/3.8              | 200/220                     | AUIRS2301S   | Jl         |          |                         |        |                 |                       |                         |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
| Single high-side       | 65                | 0.3/0.3                                 | 10/6.5               | 2500/2500                   | AUIR3241STR  | N-ISO      |          |                         |        | ✓               | ✓                     |                         |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
|                        | 65                | 0.3/0.3                                 | 10/6.5               | 2500/2500                   | AUIR3242STR  | N-ISO      |          |                         |        | ✓               | ✓                     |                         |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
| Dual high-side         | 75                | 0.3/1.4                                 | 12.5/10.0            | 4000/7000                   | 2ED2410-EM   | NEW N-ISO  |          |                         |        | ✓               | ✓                     | ✓                       |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
|                        | 105               | 0.3/1.0                                 | 7.0/6.6              | 3000/3000                   | 2ED4820-EM   | NEW N-ISO  |          |                         |        | ✓               | ✓                     | ✓                       |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     |       |        |           |           |                     |        |        |          |   | ✓ |   |   |
| Single low-side        | 200               | 3/6                                     | 10.2/9.3             | 60/90                       | AUIRS1170S   | N-ISO      |          |                         |        |                 |                       |                         |                        |                        |                               |                               |                          |          |               |                           |                    |         |             |                 |                     | ✓     |        |           |           |                     |        |        |          |   | ✓ |   |   |

## Complementary: Opto-isolated solid state relays

Typical connection



Microelectronic relays (MER) are power MOSFET or IGBT output photovoltaic relays where the output switch is controlled by radiation from a Ga-Al-As light emitting diode (LED) optically isolated from the output. MERs are a good choice to replace mechanical relays.

| Load voltage [V] | Load current [mA] | $R_{DS(on)}$ [ $\Omega$ ] | Isolation voltage [ $V_{RMS}$ ] | Base PN  |       |       |       |       |       |                     |
|------------------|-------------------|---------------------------|---------------------------------|----------|-------|-------|-------|-------|-------|---------------------|
|                  |                   |                           |                                 |          | DIP-6 | SMT-6 | DIP-8 | SMT-8 | DIP-4 | SMT-8 (with 4 pins) |
|                  | 140 AC-DC         | 27/7                      | 4000                            | PVU414   |       | ✓     |       |       |       |                     |
|                  | 120 AC-DC         | 35/9                      | 4000                            | PVT412L  | ✓     |       |       | ✓     |       |                     |
|                  | 240 AC-DC         | 6/2                       | 4000                            | PVT412A  | ✓     | ✓     |       |       |       |                     |
|                  | 140 AC-DC         | 27/7                      | 4000                            | PVT412   | ✓     | ✓     |       |       |       |                     |
|                  | 120 AC-DC         | 35                        | 4000                            | PVT422   |       |       | ✓     | ✓     |       |                     |
| 300              | 150 AC-DC         | 24                        | 4000                            | PVA3354N |       |       |       |       | ✓     | ✓                   |
|                  |                   |                           |                                 | PVA3324N |       |       |       |       | ✓     |                     |
|                  | 50 AC-DC          | 160                       | 4000                            | PVA3055N |       |       |       |       | ✓     | ✓                   |
|                  |                   |                           |                                 | PVA3054N |       |       |       |       | ✓     | ✓                   |
| 250              | 170 AC-DC         | 15/4.25                   | 4000                            | PVT312L  | ✓     | ✓     |       |       |       |                     |
|                  | 190 AC-DC         | 10/3                      | 4000                            | PVT312   | ✓     | ✓     |       |       |       |                     |
|                  | 170 AC-DC         | 8                         | 4000                            | PVT322A  |       |       |       | ✓     |       |                     |
|                  | 170 AC-DC         | 10                        | 4000                            | PVT322   |       |       | ✓     | ✓     |       |                     |
| 200              | 150 AC-DC         | 24                        | 4000                            | PVA2352N |       |       |       |       | ✓     |                     |
| 150              | 550 AC-DC         | 0.7/0.25                  | 4000                            | PVT212   |       | ✓     |       |       |       |                     |
| 100              | 550 DC            | 1.5                       | 4000                            | PVD1354N |       |       |       |       | ✓     | ✓                   |
|                  |                   |                           |                                 | PVD1352N |       |       |       |       | ✓     | ✓                   |
|                  | 375 AC-DC         | 5                         | 4000                            | PVA1354N |       |       |       |       | ✓     | ✓                   |
|                  |                   |                           |                                 | PVA1352N |       |       |       |       | ✓     | ✓                   |
| 60               | 1500 DC           | 0.25                      | 4000                            | PVDZ172N |       |       |       |       | ✓     | ✓                   |
|                  | 1000 AC           | 0.5                       | 4000                            | PVAZ172N |       |       |       |       | ✓     | ✓                   |
|                  | 2000 AC/4000 DC   | 0.1/0.035                 | 4000                            | PVG612A  | ✓     | ✓     |       |       |       |                     |
|                  | 1000 AC/2000 DC   | 0.5/0.15                  | 4000                            | PVG612   | ✓     | ✓     |       |       |       |                     |
| 20               | 2500 AC/4500 DC   | 0.1/0.04                  | 4000                            | PVN012   |       | ✓     |       |       |       |                     |

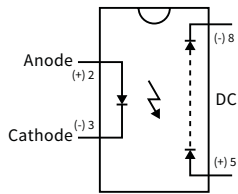


# Infineon solid-state relay package options



## Complementary: Opto-isolated solid state relays

Typical connection



Photovoltaic isolators generate an electrically isolated DC voltage upon receipt of a DC input signal and are capable of directly driving MOSFET or IGBT gates. The output is controlled by radiation from a GaAlAs light emitting diode (LED) optically isolated from the output

|                                       | DIP-8 | SMT-8 | DIP-8 (with 4 pins) | SMT-8 (with 4 pins) |
|---------------------------------------|-------|-------|---------------------|---------------------|
| Output voltage DC [V]                 | ✓     | ✓     |                     |                     |
| Short current [μA]                    | ✓     | ✓     |                     |                     |
| Nominal control current (DC) [mA]     |       |       | ✓                   | ✓                   |
| Isolation voltage [V <sub>RMS</sub> ] |       |       |                     | ✓                   |

| Output voltage DC [V] | Short current [μA] | Nominal control current (DC) [mA] | Isolation voltage [V <sub>RMS</sub> ] | Base PN  | Package |       |                     |                     |
|-----------------------|--------------------|-----------------------------------|---------------------------------------|----------|---------|-------|---------------------|---------------------|
|                       |                    |                                   |                                       |          | DIP-8   | SMT-8 | DIP-8 (with 4 pins) | SMT-8 (with 4 pins) |
| 5/10                  | 10/5               | 5                                 | 3570                                  | PVI5033R | ✓       | ✓     |                     |                     |
| 5/10                  | 10/5               | 10                                | 2500                                  | PVI1050N | ✓       | ✓     |                     |                     |
| 5                     | 8                  | 10                                | 4000                                  | PVI5080N |         |       | ✓                   | ✓                   |
| 5                     | 5                  | 10                                | 4000                                  | PVI5050N |         |       |                     | ✓                   |



# Features

Addressing various application requirements, Infineon delivers solutions with an assortment of features intended to optimize performance, minimize size and reduce cost. Below is a table of additional gate-driver IC features available in the current portfolio.

| Features                        | Abbreviation | Benefits  |
|---------------------------------|--------------|---|
| Active Miller clamp             | M-CLAMP      | Protection against inadvertent dynamic turn-on because of parasitic Miller effects  |
| Active shutdown                 | SD-ACT       | Ensures a safe IGBT off-state in case the output chip is not connected to the power supply or an undervoltage lockout is in effect  |
| Brake chopper                   | BRAKE        | Integrated brake IGBT driver with protection  |
| Comparator                      | CMP          | General purpose comparator included   |
| Desaturation protection         | DESAT        | Protects the IGBT at short circuit  |
| Enable                          | EN           | Dedicated pin terminates all outputs  |
| Fault reporting                 | FAULT-RPT    | Indicates an overcurrent or under-voltage shutdown has occurred   |
| Fault reset                     | FAULT-RST    | Dedicated pin resets the DESAT-FAULT-state of the chip  |
| High-voltage start-up           | HVSTART      | Provides easy and fast circuit start-up while enabling low circuit standby losses   |
| Integrated bootstrap diode      | BSD          | Integrated bootstrap reduces BOM  |
| Operational amplifier           | OPAMP        | An independent op-amp for current measurement or overcurrent detection  |
| Oscillator                      | OSC          | Integrated front end oscillator   |
| Over-current protection (ITRIP) | OCP          | Ensures safe application operation in case of overcurrent   |
| Programmable dead time          | DT-PROG      | Dead time is programmable with external resistor for flexible design  |
| Programmable fault clear time   | FLTC         | The length of the fault clear time period ( $t_{FLTC}$ ) is programmed by external capacitor which connected between FLTC and $V_{SS}$ ( $C_{FLTC}$ ).  |
| Programmable shutdown           | SD-PROG      | A shutdown feature has been designed into a pin   |
| Separate pin for logic ground   | SEP-GND      | Dedicated pin or logic ground for improved noise immunity   |
| Separate sink/source outputs    | SEP-OUT      | Simplifies gate resistor selection, reduces BOM, and improves dV/dt control   |
| Shoot-through protection        | STP          | Additional shoot-through protection logic such as interlock   |
| Short-circuit clamping          | SC-CLAMP     | During short circuit the IGBT's gate voltage tends to rise because of the feedback via the Miller capacitance. An additional protection circuit connected to OUT+ limits this voltage to a value slightly higher than the supply voltage. |
| Shutdown                        | SD           | Dedicated pin disables the IC outputs   |
| Soft overcurrent shutdown       | SD-SOFT      | Dedicated pin turns off the desaturated transistor, preventing overvoltages   |
| Truly Differential Inputs       | TDI          | Control inputs independent from gate driver GND, robust against ground shifts from power MOSFET switching   |
| Two-level turn-off              | TLTO         | Lowers VCE overshoots at turn-off during short circuits or overcurrent events   |
| UL 1577                         | UL           | Double galvanic isolation certification   |
| Undervoltage lockout            | UVLO         | Ensures safe application operation by avoiding unexpected driver behavior at low voltages   |
| VDE 0884-10 or VDE 0884-11      | VDE          | Reinforced galvanic isolation certifications for non-optical couplers   |

# Gate-driver ICs for SiC MOSFETs

Ultra-fast switching 650 V to 2000 V power transistors such as CoolSiC™ SiC MOSFETs can be more easily handled by isolated gate driver solutions.

The following EiceDRIVER™ gate driver ICs incorporate the most important key features for driving SiC MOSFET such as tight propagation delay matching, precise input filters, wide output supply voltage range, negative gate voltage capability, extended CMTI capability, Miller clamp, and DESAT protection.

| Product family  | Part number                         | Typ. current | $V_{CC2}$<br>$-V_{EE2}$ | UVLO                                      | Prop. delay<br>(accuracy) | CMTI     | Isolated | Other key features   | Package                          |
|---|-------------------------------------|--------------|-------------------------|---|---------------------------|----------|----------|--|----------------------------------|
| <b>Achieve high efficiency and power density: take advantage of low propagation delay and high CMTI</b> |                                     |              |                         |   |                           |          |          |  |                                  |
| EiceDRIVER™ 1EDB<br>1-channel family  | 1EDB9275F<br>1EDB6275F              | 5/9 A        | 20 V                    | 14.9/14.4 V<br>12.2/11.5 V                | 45 ns (+6/-4 ns)          | 300 V/ns | ✓        | Separate source/sink outputs, fast start-up times and fast recovery, basic isolation, UL 1577  | DSO-8, 150 mil                   |
| EiceDRIVER™ 2EDi<br>2-channel family  | 2EDR9259X<br>2EDR9258X<br>2EDR6258X | 5/9 A        | 20 V                    | 14.9/15.4 V<br>14.9/15.4 V<br>12.5/11.5 V | 38 ns (+9/-5 ns)          | 150 V/ns | ✓        | 2EDi Gen 2, dead-time control, disable/enable, reinforced isolation, UL 1577, VDE-11, IEC 62368-1, GB4943.1  | DSO-14, 300mil                   |
|   | 2EDB9259Y                           |              |                         | 14.9/15.4 V                               |                           |          | ✓        | 2EDi Gen 2, dead-time control, basic isolation, UL 1577, GB4943.1  | DSO-14, 150 mil                  |
| EiceDRIVER™ 1EDN-TDI<br>1-channel family  | 1EDN6550B<br>1EDN9550B              | 4/8 A        | 20 V                    | 12.2/11.5 V<br>14.9/14.4 V                | 45 ns (+10/-7 ns)         | N/A      | -        | Separate source/sink outputs   | SOT23-6                          |
| <b>Avoid parasitic turn-on: take advantage of Miller clamp options</b>                                  |                                     |              |                         |   |                           |          |          |  |                                  |
| EiceDRIVER™ 1ED Compact<br>1-channel family   | 1EDI20I12MF                         | 4 A          | 20 V                    | 12.7/10.5 V                               | 300 ns                    | 100 V/ns | ✓        | Miller clamp, functional isolation   | DSO-8, 150 mil                   |
|   | 1EDI60N12AF                         | 10 A         | 35 V                    | 10/8 V                                    | 125 ns                    | 100 V/ns | ✓        | Separate source/sink outputs, functional isolation   |                                  |
| EiceDRIVER™ X3 Compact<br>1-channel family  | 1ED3124MC12H<br>1ED31xxMU12F        | 5.5/10/14 A  | 35 V                    | 12.5/10.5 V<br>14.2/12 V                  | 90 ns (+/- 7 ns)          | 200 V/ns | ✓        | Miller clamp, reinforced isolation, UL 1577 and VDE-11   | DSO-8, 300 mil<br>DSO-8, 150 mil |
| EiceDRIVER™ 2L-SRC Compact<br>1-channel family  | 1ED32xxMC12H                        | 10/18 A      | 35 V                    | 12.5/10.4 V                               | 110 ns (+/- 15 ns)        | 200 V/ns | ✓        | Two-level slew-rate control, Miller clamp, reinforced isolation, UL 1577 and VDE-11  | DSO-8, 300 mil                   |
| <b>Short-circuit protect your CoolSiC™: take advantage of the fast and accurate DESAT protection</b>    |                                     |              |                         |   |                           |          |          |  |                                  |
| EiceDRIVER™ 1ED-F3<br>1-channel family  | 1ED332xMC12N                        | 3/6 A        | 35 V                    | 12.6/10.4 V<br>13.6/12.6 V                | 85 ns                     | 300 V/ns | ✓        | Miller clamp, short circuit protection, soft-off, reinforced isolation, UL 1577 and VDE-11   | DSO-16, 300 mil                  |
| EiceDRIVER™ X3 Analog<br>1-channel family   | 1ED34x1MC12M                        | 3/6/9 A      | 35 V                    | 12.6/10.4 V                               | 244 ns (+/- 30 ns)        | 200 V/ns | ✓        | Analog configurable, fast and accurate short circuit protection and soft turn-off Miller clamp, reinforced isolation, UL 1577 and VDE-11   | DSO-16, 300 mil                  |
| EiceDRIVER™ X3 Digital<br>1-channel family  | 1ED38x0MC12M                        | 3/6/9 A      | 35 V                    | 12.6/10.4 V<br>default, but adjustable    | 244 ns (+/- 30 ns)        | 200 V/ns | ✓        | Digital configurable (I <sup>2</sup> C), fast and accurate short circuit protection, rich monitoring functionality (predictive maintenance) Miller clamp, reinforced isolation, UL 1577 and VDE-11 | DSO-16, 300 mil                  |
| EiceDRIVER™ 2ED-F2<br>2-channel family  | 2ED020I12-F2                        | 2 A          | 28 V                    | 12.6/10.4 V                               | 170 ns                    | 50 V/ns  | ✓        | Miller clamp, short circuit protection   | DSO-36, 300mil                   |



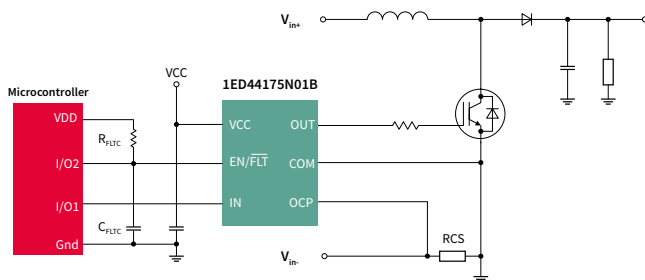
# EiceDRIVER™ non-isolated low-side gate drivers

## 1ED4417x, 1-ch, low-side drivers with integrated protection features

EiceDRIVER™ 1ED4417x family are 25 V, 1-channel low-voltage, non-inverting, low-side gate drivers designed for ground-referenced applications such as power-factor correction (PFC) circuits. Typically, over-current protection (OCP) is implemented by a current measurement with a comparator and multiple resistors and capacitors. The 1ED44176N01F, 1ED44175N01B, and 1ED44173N01B provides up to 20 percent cost and 50 percent space savings by integrating a fast and accurate over-current protection feature (OCP). The new family of low-side gate drivers utilize Infineon's proprietary latch immune CMOS technologies to enable a rugged monolithic construction while realizing best-in-class fault reporting accuracy with OCP threshold tolerance of +/-5 percent. In addition, Infineon's IC technology enables a tiny PG-SOT23 package (or DSO-8 for 1ED44176N01) by combining the fault output and enable functions into a single pin.

The family also includes 1ED44171N01B, a cost-effective, simple driver with enable and fault reporting functions. With a single PCB layout, 1ED44171N01B can be used as a second source option to the popular" IRS44273L. Enabling a single-supplier, dual sourcing strategy for fast-reacting supply flexibility.

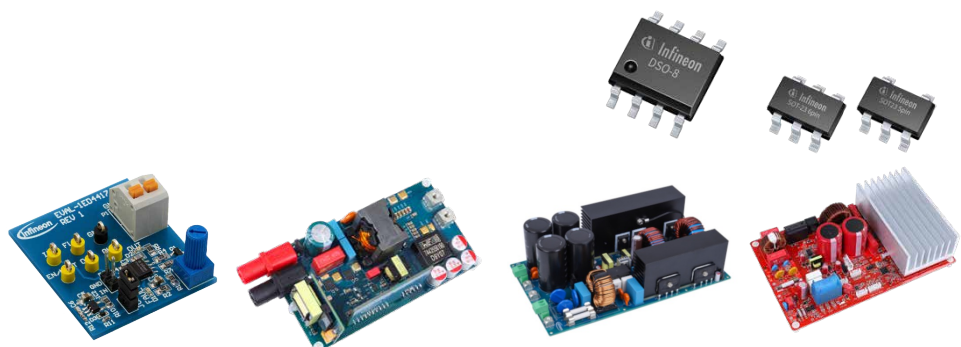
### Simplified application diagram



| Part Number  | Package | $I_{Oe}$ [A] | UVLO [V]    | $V_{OCTH}$ [mV] | $T_{on/off}$ [ns] | Ground pins  | Feature  |
|--------------|---------|--------------|-------------|-----------------|-------------------|--------------|--|
| 1ED44171N01B | SOT23-5 | 2.6/2.6 A    | 11.9/11.4 V | N/A             | 50/50 ns          | COM          | Enable, Fault, cost-effective  |
| 1ED44173N01B | SOT23-6 | 2.6/2.6 A    | 8/7 V       | -250 mV         | 34/34 ns          | COM          | OCP (negative current sensing), Enable, Fault                                |
| 1ED44175N01B | SOT23-6 | 2.6/2.6 A    | 11.9/11.4 V | -250 mV         | 50/50 ns          | COM          | OCP (positive current sensing), Enable, Fault, Programmable fault clear time |
| 1ED44176N01F | DSO-8   | 0.8/1.75 A   | 11.9/11.4 V | 500 mV          | 50/50 ns          | $V_{SS}/COM$ |  |

### Evaluation and reference board

- > EVAL-1ED44176N01F
- > EVAL-1ED44175N01B
- > EVAL-1ED44173N01B
- > EVAL-PFC5KIKWWR5SYS
- > REF-SHA35WRC2SYS
- > REF-AIRCON-C302A-IM564



Aircon



PFC



Induction



Server



Telecom



Solar



Drives



EV charging



Industrial SMPS



DC-DC

[www.infineon.com/1ED4417x](http://www.infineon.com/1ED4417x)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# 2EDN EiceDRIVER™ family

## Rugged, fast, dual-channel low-side 4 A/5 A gate-driver ICs

### EiceDRIVER™ 2EDN family overview

Dual-channel driver ICs are the crucial link between control ICs and powerful MOSFET, wide band gap (WBG) switching devices. Driver ICs enable high system level efficiencies, excellent power density and consistent system robustness.

### EiceDRIVER™ 2EDN family: Fast, precise and compatible

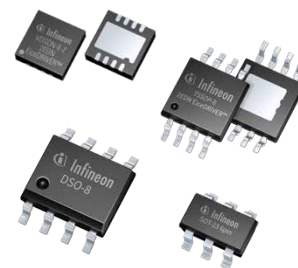
- Highly efficient SMPS enabled by 19 ns propagation delay and 2 ns channel-to-channel mismatch precision for fast MOSFET and WBG switches
- Diversified applications driven by strong output current 4 A/5 A per channel
- Unique designs are supported by the availability of numerous packages

### EiceDRIVER™ 2EDN family: The new reference in ruggedness and low power dissipation

- 4 V and 8 V UVLO (undervoltage lock out) options for instant FETs protection under abnormal conditions, further improved with active output voltage clamping
- -10 V robustness of control and enable inputs provides crucial safety margin when driving pulse transformers or driving FETs in various packages
- 5 A reverse output current robustness eliminates the need for Schottky switching diodes and reduces bill-of-material
- Cool driver ICs from true rail-to-rail low impedance output stages

### Applications

- Server
- Telecom
- DC-DC Converters
- Power tools
- Industrial SMPS
- Low speed electrical vehicles
- Solar power inverter
- LED lighting



| Key features   | Product benefits   | System benefits   |
|--|--|---|
| <ul style="list-style-type: none"> <li>– 5 A source/sink current</li> <li>– 2 ns channel-to-channel mismatch</li> <li>– 10 ns minimum input pulse width</li> </ul>               | <ul style="list-style-type: none"> <li>– Fast Miller plateau transition</li> <li>– Precise timing</li> </ul>                     | <ul style="list-style-type: none"> <li>– High power efficiency               <ul style="list-style-type: none"> <li>– in hard switching PFC with SiC diode</li> <li>– in half-bridges and synchronous rectifications</li> </ul> </li> </ul> |
| <ul style="list-style-type: none"> <li>– True rail-to-rail low impedance output stages</li> </ul>  | <ul style="list-style-type: none"> <li>– Low power dissipation in driver IC</li> </ul>   | <ul style="list-style-type: none"> <li>– Cooler driver IC operation</li> <li>– Higher FETs drive capability</li> </ul>  |
| <ul style="list-style-type: none"> <li>– 4 V and 8 V UVLO options, with active output voltage clamping</li> <li>– 19 ns propagation delay for both control and enable</li> </ul> | <ul style="list-style-type: none"> <li>– Fast and reliable FETs turn-off, independent of control IC</li> </ul>                   | <ul style="list-style-type: none"> <li>– Instant FETs protection under abnormal operation</li> </ul>  |
| <ul style="list-style-type: none"> <li>– -10 V robustness of control and enable inputs</li> <li>– 5 A reverse output current robustness</li> </ul>                               | <ul style="list-style-type: none"> <li>– Increased GND-bounce robustness</li> <li>– Saves switching diodes</li> </ul>            | <ul style="list-style-type: none"> <li>– Crucial safety margin to drive pulse transformer</li> </ul>  |
| <ul style="list-style-type: none"> <li>– 2 independent channels</li> </ul>   | <ul style="list-style-type: none"> <li>– Option to increase drive current by truly concurrent switching of 2 channels</li> </ul> | <ul style="list-style-type: none"> <li>– Increases power density</li> <li>– BOM savings</li> </ul>  |
| <ul style="list-style-type: none"> <li>– Industry standard pinout and packages</li> </ul>  | <ul style="list-style-type: none"> <li>– Straight forward design upgrades</li> </ul>   | <ul style="list-style-type: none"> <li>– One IC covering many applications</li> <li>– Short time to market</li> </ul>   |

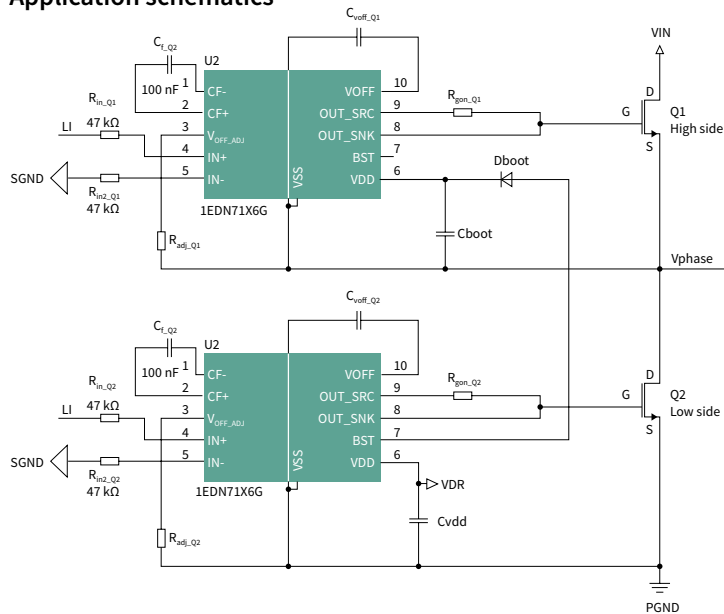


# EiceDRIVER™ 1EDN71x6G/U family

## 200 V 1-ch gate drivers with truly differential input (TDI)

The 1EDN71x6G/U is a 1-channel gate driver family optimized for Infineon CoolGaN™ Schottky-gate (SG) HEMTs, and also compatible with other GaN SG HEMTs and silicon MOSFETs. The TDI feature eliminates the risk of false triggering due to ground bounce in low-side applications and enable 1EDN71x6G/U to address even high-side applications. The TDI feature works by controlling the gate driver output state exclusively by the voltage difference between the two inputs, completely independent of the driver's reference (ground) potential as long as the common-mode voltage is below 150 V (static) and 200 V (dynamic).

### Application schematics



### Features and benefits

#### Product features

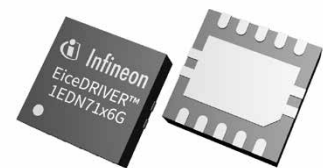
- Truly differential logic input (TDI)
- Four driving strengths
- Active Miller clamp
- Optional negative charge pump
- Active bootstrap capacitor

#### Product benefits

- High-side driving and low-side ground bounce immunity
- Optimize switching speed without external gate resistors
- Prevent induced turn-on
- Additional induced turn-on immunity
- No overcharging the bootstrap capacitor during deadtime

### Product family

| Product    | Output current | Source/sink resistance | Input pulse blanking time | Package |
|------------|----------------|------------------------|---------------------------|---------|
| 1EDN7116G  | 2 A            | 0.8 Ω                  | 20 ns                     | VSON-10 |
| 1EDN7126G  | 1.5 A          | 1.0 Ω                  | 40 ns                     | VSON-10 |
| 1EDN7136G  | 1 A            | 1.5 Ω                  | 60 ns                     | VSON-10 |
| 1EDN7146G  | 0.5 A          | 3.0 Ω                  | 80 ns                     | VSON-10 |
| 1EDN7116U* | 2 A            | 0.8 Ω                  | 20 ns                     | TSNP-7  |
| 1EDN7126U* | 1.5 A          | 1.0 Ω                  | 40 ns                     | TSNP-7  |
| 1EDN7136U* | 1 A            | 1.5 Ω                  | 60 ns                     | TSNP-7  |
| 1EDN7146U* | 0.5 A          | 3.0 Ω                  | 80 ns                     | TSNP-7  |



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\* Coming soon



DC-DC



Server



Telecom



Artificial intelligence



Collaborative robots



Multicopter



Audio

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





# EiceDRIVER™ 1EDL8011, 135 V high-side driver

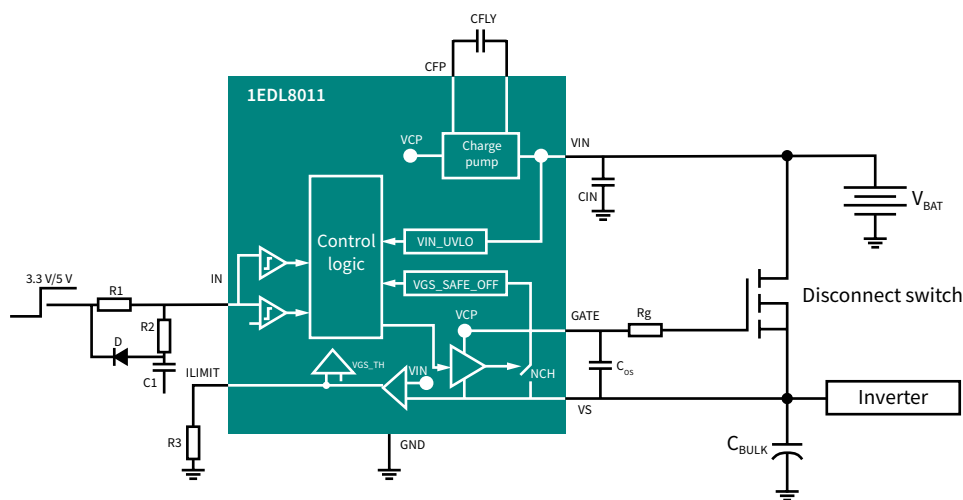
## Integrated high-side driver with strong gate drive and integrated charge pump

Infineon's upcoming EiceDRIVER™ 1EDL8011 high-side gate driver provides a simple and highly robust solution to drive a disconnect switch to protect battery operated systems during potential short conditions. 1EDL8011 enables fast turn on/off control of high side N-channel MOSFETs due to the powerful internal gate sourcing and sinking current capabilities. It consists of an integrated charge pump with an external capacitor to provide support for strong start-up and turn-off and scalable FETs in parallel application scenarios. The internal charge pump provides proper MOSFET gate voltage during low operating input voltage conditions. High-side protection avoids faulty shorting conditions in the load and the dangerous presence of in-rush currents for battery-powered applications.

1EDL8011 features include OCP protection, the adjustable current setting threshold, time delay as well as a safe start-up mechanism with flexible blanking during MOSFET turn-on transition. Input voltage under-voltage lockout (UVLO) avoids operation under hazardous conditions and ensures the right level of gate voltage to fully enhance the MOSFET.

The 1EDL8011 gate driver addresses two main use cases in battery operated systems:

- In-rush current control: allows controlled turn-on of the disconnect switch by using an external  $R_g$  combined with a safe start-up and blanking mechanism.
- Short circuit protection: whenever a short occurs at the load side, it allows disconnecting the load from the source by quickly turning off the disconnect switch. This is made possible by the strong pull-down inside the 1EDL8011, therefore protecting the whole system.



### Features and benefits

#### Product features

- Operating voltage: 7V – 135V
- Powerful gate sinking current up to 1A
- Off-mode quiescent current 1 $\mu$ A

#### Product benefits

- Wide voltage operating range
- Fast turn off for proper protection
- Efficiency and long battery life

### Product family

| Product   | Package | Voltage [A] |
|-----------|---------|-------------|
| 1EDL8011* | DSO-8   | 7 – 135 V   |

[www.infineon.com/1edl](http://www.infineon.com/1edl)

\* Coming soon



Power tools



Gardening tools



Multicopter



Service robots



eBike



Vacuum cleaner

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

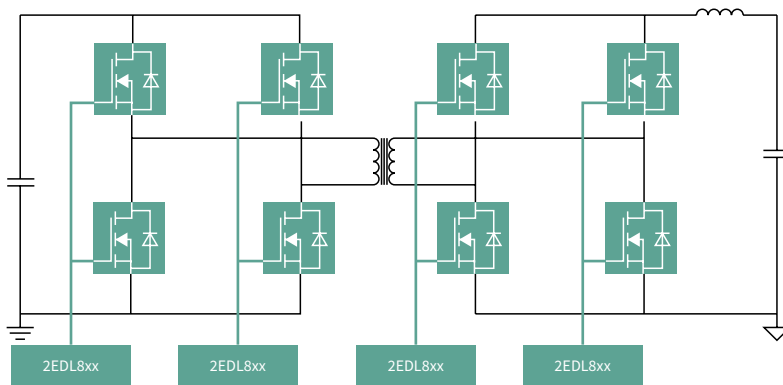


# EiceDRIVER™ 2EDL8x2x family

## 120 V, 3/4 A, junction-isolated high- and low-side gate drivers

The 2EDL8x2x is a family of high- and low-side gate driver designed for advanced switching DC-DC converters. The 2EDL802x takes in independent inputs while 2EDL812x takes in differential inputs with both having built-in hysteresis for enhanced noise immunity. The gate-driver family comes in two packages: VDSON-8 4x4 mm and VSON-10 3x3 mm.

### Application schematics



### Features and benefits

#### Product features

- 120 V integrated boot-strap diode with 10 ns reverse recovery time
- 2 A to 4 A output source currents
- 6 A output sink currents
- -8 V/+ 15 V differential input robustness
- 5 A reverse current output robustness
- ±1 ns (typ.) channel-to-channel delay matching

#### Product benefits

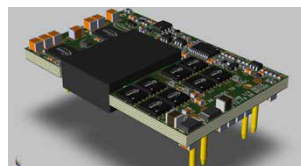
- Drive strength for fast Miller plateau transition
- Fast and robust
- Immunity against false triggering from ground bounce
- No need for Schottky clamping diodes

### Product family

| Part nu      | Input        | Source current | Sink current | Min. input pulse width | Propagation delay (typ.) | Matching delay (typ) | ESD  | Package           |
|--------------|--------------|----------------|--------------|------------------------|--------------------------|----------------------|------|-------------------|
| 2EDL8123G    | Differential | 3 A            | 6 A          | 40 ns                  | 45 ns                    | 2 ns                 | 2 kV | VDSON-8<br>4x4 mm |
| 2EDL8124G    |              | 4 A            |              |                        |                          |                      |      |                   |
| 2EDL8023G    | Independent  | 3 A            |              |                        |                          |                      |      |                   |
| 2EDL8024G    |              | 4 A            |              |                        |                          |                      |      |                   |
| 2EDL8123G3C* | Differential | 3 A            |              |                        |                          |                      |      | VSON-10 3x3 mm    |
| 2EDL8124G3C* |              | 4 A            |              |                        |                          |                      |      |                   |
| 2EDL8023G3C* | Independent  | 3 A            |              |                        |                          |                      |      |                   |
| 2EDL8024G3C* |              | 4 A            |              |                        |                          |                      |      |                   |

#### Evaluation board:

EVAL\_HB\_2EDL8x2xG\*  
REF\_600W\_FFB\_QB\*



[www.infineon.com/2edl8](http://www.infineon.com/2edl8)

\* Coming soon



DC-DC



Battery formation



Server



Solar



Telecom

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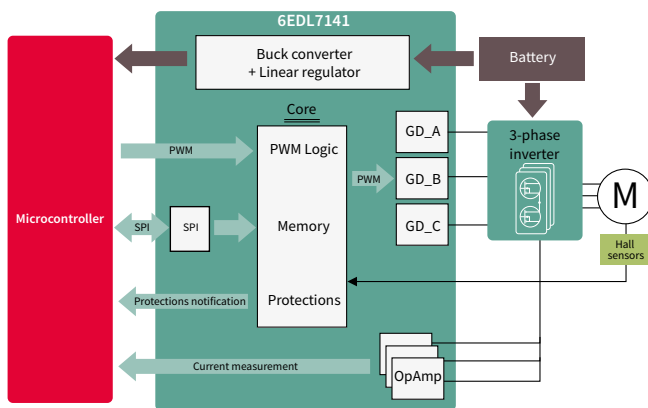
# MOTIX™ 6EDL7141 high performance motor control

## Next-generation fully programmable three-phase gate driver

6EDL7141, Infineon's latest three-phase motor control gate-driver IC allows our customers to develop their next generation of high performance battery operated products using BLDC or PMSM motors. Ideal applications include cordless power tools, gardening products, and automated guided vehicles. With over 50 fully programmable parameters using built-in digital SPI interface, 6EDL7141 is fully configurable to drive a wide range of MOSFET's to yield the best possible system efficiency. The integrated buck regulator provides the power for both the microcontroller and the Hall sensors in the motor, further reducing peripheral components and required PCB area. In addition, with a full suite of system protection features such as OCP, UVLO, over-temperature, and locked rotor detection, this dedicated motor controller will increase reliability and robustness in severe operating fault conditions.

### Block diagram

Three-phase BLDC battery-powered motor control



### Features and benefits

| Key features  |
|---|
| – Integrated power supply                           |
| – Programmable slew rate                            |
| – Programmable gate drive supply                    |
| – 3x current shunt amplifier                        |
| – ADC ref. of 5 V                                   |
| – Complete dedicated motor control protection suite |

| Key benefits   |
|--|
| – Reduced external components and PCB area                       |
| – Optimized efficiency and EMI                                   |
| – Maximum flexibility to use different inverter FETs             |
| – Highly accurate current sense while saving external components |
| – Higher dynamic range to increase signal resolution             |
| – Improve reliability and fault detection                        |



### EVAL\_6EDL7141\_TRAP\_1SH

**BC 1 shunt evaluation board**  
 Parallel 40 V OptiMOS™5 PQFN  
 XMC1404 MCU  
 On-board programming dongle  
 Featured module IC: 6EDL7141

[www.infineon.com/6edl7141](http://www.infineon.com/6edl7141)

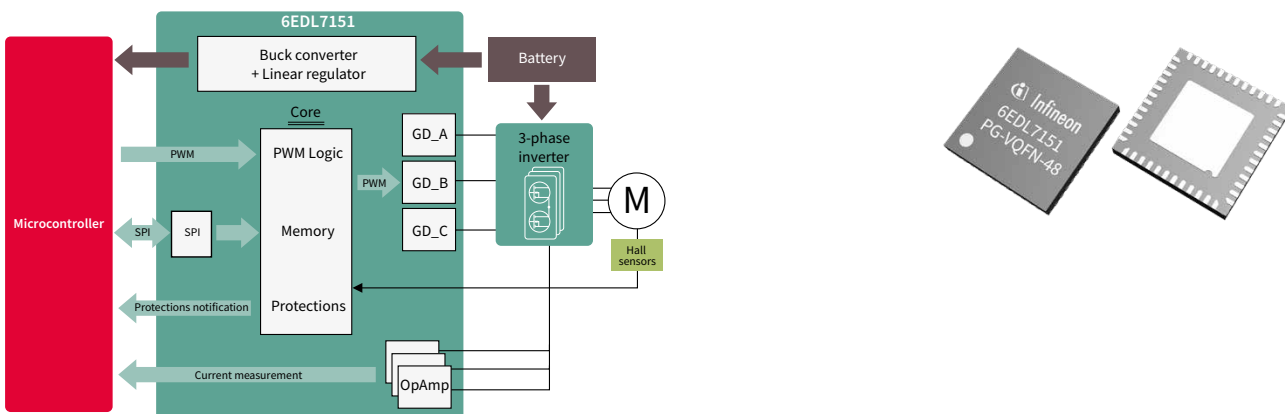
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# MOTIX™ 6EDL7151 3-phase smart gate drive controller IC

## Three-phase motor control gate-driver IC for battery supplied BLDC motor control

The 6EDL7151 is Infineon's latest 3-phase gate driver which includes added  $V_{ds}$  sensor to allow additional hardware system protection for battery supplied motor control products. Ideal applications include cordless power tools, gardening products, and automated guided vehicles. With over 50 programmable parameters using built-in digital SPI interface, 6EDL7151 is fully configurable to drive a wide range of MOSFET's to yield the best possible system efficiency. 6EDL7151 is also designed for maximum performance. Features include programmable dead time delays for preventing current shoot through between HS and LS switches in normal operation and separate charge pumps for low and high side gate drivers support 100 percent duty cycle and low voltage supply operation. Supplies for the gate drivers are programmable to one of the following levels: 7 V, 10 V, 12 V or 15 V. Additionally, the slew rate of the driving signal can be programmed with fine granularity to reduce EMI emissions. An integrated synchronous buck converter provides an efficient supply of current to the rest of the system. The 6EDL7151 also integrates a linear voltage regulator (up to 300 mA), powered by the buck converter to supply the MCU and other sensitive components in the system. 6EDL7151 includes three current sense amplifiers for accurate current measurements that support bi directional low side current sensing with programmable gain.  $R_{DS(on)}$  sensing is supported through internal connection of the phase nodes to the current sense amplifiers inputs. Temperature compensation if needed shall be provided by the user application. 6EDL7151 also includes highly programmable  $V_{ds}$  sensors for inverter MOSFET protection. In addition, 6EDL7151 provides numerous protections features for improving application robustness during adverse conditions like monitoring of power supply voltages as well as system parameters. The failure behavior, threshold voltages and filter times of the supervisions of the device are adjustable via SPI. Monitored aspects include inverter currents, gate drive voltages and currents, device temperature, and rotor locked.



## Features and benefits

### Product features

- Integrated power supplies
- Adjustable slew rate
- 3x current shunt amplifier
- Complete dedicated motor control protection suite
- $V_{ds}$  sensing

### Product benefits

- Reduced external component count and PCB area
- Lower voltage overshoots and EMI reduction
- Maximum flexibility to use different inverter MOSFET's
- Highly accurate integrated current sense saves external components
- Improved reliability and fault detection

## Product family

| Product   | Package           | Voltage [V] | DVDD regulator output [V] |
|-----------|-------------------|-------------|---------------------------|
| 6EDL7151* | VQFN 48 7mm x 7mm | 5.5 – 70 V  | 5.0 V                     |



Power tools



Gardening tools



Multicopter



Service robots



eBike



Vacuum cleaner

[www.infineon.com/6edl7151](http://www.infineon.com/6edl7151)

\* Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# MOTIX™ 160 V SOI gate-driver family

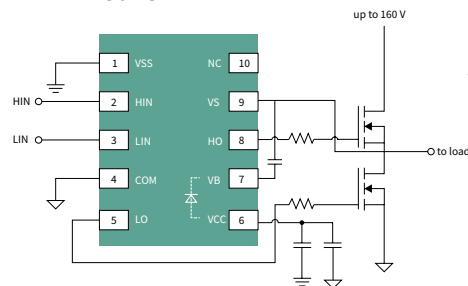
2ED27xxS01G half-bridge and high- and low-side gate-driver family with integrated bootstrap diode

6ED2742S01Q three-phase driver with charge pump, current sense amplifier, OCP and bootstrap diode

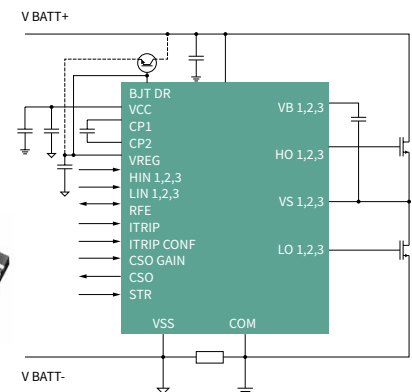
MOTIX™ 160 V SOI gate-driver family is designed for the BLDC motor drive applications. The SOI technology enables integrated bootstrap diodes, which can be used to supply the external high-side bootstrap capacitor. The output drivers feature a high-pulse current buffer stage designed for minimum driver cross-conduction. MOTIX™ 2ED27xxS01G family consists of three half-bridge and three high- and low-side 160 V SOI gate drivers. The UVLO protection is on both  $V_{CC}$  and  $V_B$  pins. Fast propagation delays (50 ns) are suitable for motor drive and power conversion applications in VSON-10 (3x3 mm) package with exposed ground pad. MOTIX™ 6ED2742S01Q is a 160 V three-phase SOI gate driver, which supports 100% duty cycle operation by a trickle charge pump. Protection features include UVLO, OCP with configurable threshold, fault and automatic fault clear. A current sense operational amplifier (CSA) with selectable gain is integrated between the  $V_{SS}$  and COM.

## Simplified application diagram

### 2ED27xxS01G



### 6ED2742S01Q



| Product                | Package        | Output current | Configuration              | Deadtime | Propagation delay |        |
|------------------------|----------------|----------------|----------------------------|----------|-------------------|--------|
| 2ED2732S01G*           | VSON-10 3x3 mm | 1/2 A          | High- and low-side (HS+LS) | None     | 50 ns             |        |
| 2ED2734S01G*           |                | 2/4 A          |                            |          | 65 ns             |        |
| 2ED2738S01G <b>NEW</b> |                | 4/8 A          |                            |          | 65 ns             |        |
| 2ED2742S01G*           |                | 1/2 A          | Half-bridge                |          | 50 ns             | 50 ns  |
| 2ED2744S01G*           |                | 2/4 A          |                            |          |                   | 65 ns  |
| 2ED2748S01G <b>NEW</b> |                | 4/8 A          |                            |          |                   | 65 ns  |
| 6ED2742S01Q            | VQFN-32 5x5 mm | 1/2 A          | Three-phase                | 100 ns   |                   | 100 ns |

## Applications for MOTIX™ 160 V SOI gate driver family

- Servo/stepper drives in robotics and factory automation
- General purpose low-voltage drives
- Battery-operated small home appliances (SHA)
- Professional and consumer service robotics
- Logistics vehicles (e-forklifts, autonomous warehouse robotics)
- Commercial and agricultural drones
- Hand-held battery-operated power tools
- Garden or outdoor power equipment (OPE) tools
- e-scooters, e-bikes, and other e-vehicles that do not require automotive qualification (LSEV)

[www.infineon.com/SOI](http://www.infineon.com/SOI)

\* Coming soon

## 6ED2742S01Q key features

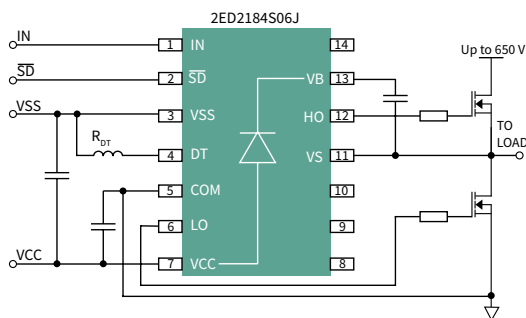
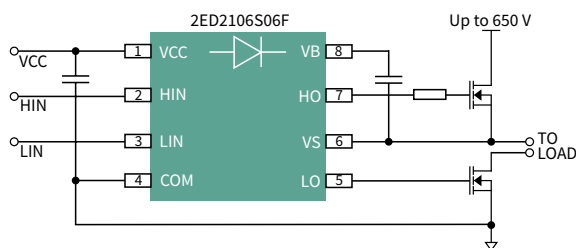
- Integrated power management with charge pump and pre-regulator supports wide input voltage range of 6 V to 140 V
- Integrated over-current protection comparator for single-shunt low side operation with programmable +/-5% reference threshold
- Integrated current sense amplifier with programmable voltage gain and ability to read output voltage offset during zero phase current
- Always positive output voltage offset to reduce need for +/-  $V_{REF}$  for downstream ADC in microcontroller.
- Integrated, per phase, high-side trickle charge pumps to enable 100% duty cycle operation
- Integrated, multi-function RFE pin combines FAULT, FAULT Clear, and Enable functionality

# EiceDRIVER™ 650 V level-shift SOI gate driver family

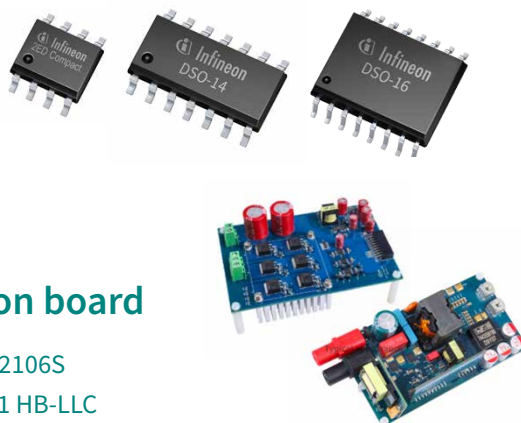
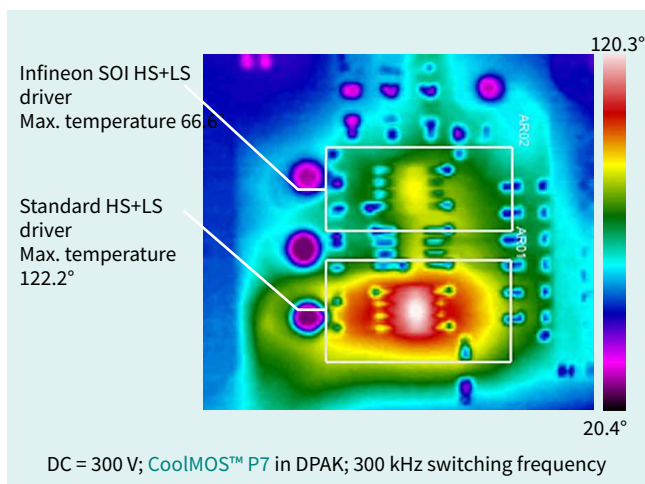
2ED2101/3/4 and 2ED2110: EiceDRIVER™ fast level-shift SOI family with 90 ns prop delay  
 2ED2106/8/9 and 2ED2181/2/3/4: EiceDRIVER™ general purpose SOI family

EiceDRIVER™ 650 V SOI is a family of high-voltage, high-speed MOSFET and IGBT gate drivers. Based on Infineon's SOI technology, this family features an integrated, ultra-fast, low  $R_{DS(on)}$  bootstrap diode and offers excellent ruggedness and noise immunity with tolerance to negative transient voltages of up to -100 V. The absence of parasitic thyristor structures ensures superior latch up immunity. The level-shift loss is significantly reduced on the EiceDRIVER™ SOI gate drivers compared to other technologies.

## Simplified application diagrams



## Power dissipation of Infineon SOI



## Evaluation board

EVAL-M1-2ED2106S  
 EVAL-2ED2101 HB-LLC

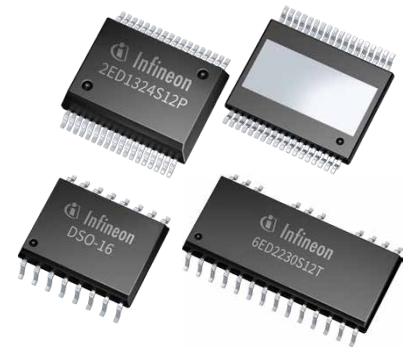
| Product family                   | Part number  | Output current | Prop. delay | Input logic        | Configuration      | Package   |
|----------------------------------|--------------|----------------|-------------|--------------------|--------------------|-----------|
| EiceDRIVER™ fast level-shift SOI | 2ED2101S06F  | 0.29/0.7 A     | 90 ns       | HIN, LIN           | High- and low-side | DSO-8     |
|                                  | 2ED2103S06F  |                |             | HIN, LIN           | Half-bridge        |           |
|                                  | 2ED2104S06F  |                |             | IN, SD             | Half-bridge        |           |
| EiceDRIVER™ general purpose SOI  | 2ED2110S06M  | 2.5/2.5 A      | 200/200 ns  | HIN, LIN           | High- and low-side | DSO-16 WB |
|                                  | 2ED2106S06F  | 0.29/0.7 A     |             | HIN, LIN           | Half-bridge        | DSO-8     |
|                                  | 2ED21064S06J |                |             | HIN, LIN           |                    | DSO-14    |
|                                  | 2ED2108S06F  |                | HIN, LIN    | DSO-8              |                    |           |
|                                  | 2ED21084S06J | 740/200 ns     | HIN, LIN    | Half-bridge        | DSO-14             |           |
|                                  | 2ED2109S06F  |                | IN, SD      |                    | DSO-8              |           |
|                                  | 2ED21094S06J |                | IN, SD      |                    | DSO-14             |           |
|                                  | 2ED21091S06F | 2.5/2.5 A      | IN, DT/SD   | High- and low-side | DSO-8              |           |
|                                  | 2ED2181S06F  |                | HIN, LIN    |                    | DSO-8              |           |
|                                  | 2ED21814S06J |                | HIN, LIN    |                    | DSO-14             |           |
|                                  | 2ED2182S06F  | 200/200 ns     | 2.5/2.5 A   | HIN, LIN           | Half-bridge        | DSO-8     |
|                                  | 2ED21824S06J |                |             | HIN, LIN           |                    | DSO-14    |
|                                  | 2ED2183S06F  |                |             | HIN, LIN           |                    | DSO-8     |
| 2ED21834S06J                     | 600/200 ns   | HIN, LIN       | Half-bridge | DSO-14             |                    |           |
| 2ED2184S06F                      |              | IN, SD         |             | DSO-8              |                    |           |
| 2ED21844S06J                     |              | IN, SD         |             | DSO-14             |                    |           |



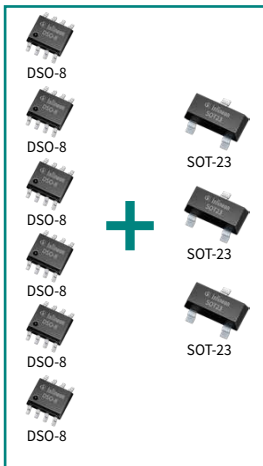
# EiceDRIVER™ 1200 V level-shift SOI gate driver family

**6ED223x: 1200 V three-phase SOI driver with OCP, bootstrap diode**  
**2ED132x: 1200 V half-bridge and high- and low-side SOI driver with OCP, Miller clamp and bootstrap diode**

The **6ED2231S12T** is a 1200-V three-phase SOI gate driver, with 0.35 A/0.65 A current in DSO-24 package (DSO-28 with 4 pins removed). The 2ED132x family consists of four 1200 V SOI gate drivers, in half-bridge or high- and low-side configurations. 2ED132x family offers 2.3 A output current in high creepage (8 mm)/clearance DSO-20 wide body package or higher sink option (4.6 A) in DSO-16 wide body package. Both **6ED2231S12T** and the 2ED132x family integrates ultra-fast over-current protection (OCP) with ± 5% accuracy, and bootstrap diode. In addition, the 2ED132x family also integrates active Miller clamp.



**Current solutions**  
 6 x opto-isolated drivers +  
 3 x 1200 V bootstrap diodes



— Space savings  
 — Cost savings  
 — Easy to design  
 — Higher reliability  
 — Faster time to market

**New 6ED2231S12T**  
 Integrates 6x gate-driver functionality and  
 3x bootstrap diodes  
 Over-current protection  
 IGBT/SiC MOSFET UVLOs



**6ED2231S12T easily fits within EasyPIM™ 1B module footprint**



**EVAl-M1-6ED2231-B1**

## Features and benefits

| Key features |  |
|--------------|--|
| –            | Leading negative VS immunity             |
| –            | > 50% lower level-shift switching losses |
| –            | Integrated bootstrap diode               |
| –            | 1200 V breakdown voltage                 |
| –            | Integrated input filters                 |

| Key benefits |  |
|--------------|--|
| –            | Increased robustness and reliability resulting in reduced manufacturing and field failures |
| –            | Reduced power dissipation, lower temperature   |
| –            | Faster frequency switching   |
| –            | Smaller PCB footprints   |
| –            | Reduced BOM costs  |
| –            | Improved noise sensitivity   |
| –            | Latch-up immunity  |

| Customer value |  |
|----------------|--|
| –              | Increased profitability from lower lifecycle costs |
| –              | Faster time to market for higher share capture     |
| –              | Enables new applications                           |
| –              | Increased flexibility                              |
| –              | Increased reliability                              |

| Product Name | Configuration   | Package                             | Output current | Key features        | Deadtime | T <sub>ON</sub> /T <sub>OFF</sub> |
|--------------|-----------------|-------------------------------------|----------------|---------------------|----------|-----------------------------------|
| 6ED2231S12T  | NEW Three-phase | DSO-24 (DSO-28 with 4 pins removed) | 0.35/0.65 A    | OCP, RFE            | 460 ns   | 700/650 ns                        |
| 2ED1324S12P  | NEW Half-bridge | DSO-20WB (20 fine pitch leads)      | 2.3/2.3 A      | OCP, SOFF, AMC, RFE | 380 ns   | 500 ns                            |
| 2ED1323S12P  | NEW HS+LS       | DSO-20WB (20 fine pitch leads)      | 2.3/2.3 A      | OCP, SOFF, AMC, RFE | None     | 350 ns                            |
| 2ED1322S12M  | NEW Half-bridge | DSO-16WB (300mil)                   | 2.3/4.6 A      | OCP, SOFF, RFE      | 400 ns   | 500 ns                            |
| 2ED1321S12M  | NEW HS+LS       | DSO-16WB (300mil)                   | 2.3/4.6 A      | OCP, SOFF, RFE      | None     | 350 ns                            |

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[www.infineon.com/1200VHVIC](http://www.infineon.com/1200VHVIC)  
[www.infineon.com/6ED2230](http://www.infineon.com/6ED2230)

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# 2EDi EiceDRIVER™ family

## Fast, robust, dual-channel galvanic isolated gate-driver ICs

### Galvanic isolated EiceDRIVER™ family overview

The 2EDi is a family of dual-channel isolated gate driver ICs designed to drive Si MOSFETs, SiC MOSFETs and GaN power switches. Isolation is achieved by means of Infineon's coreless transformer (CT) technology which guarantees robust operation and industry benchmark common-mode rejection (CMTI). The high propagation delay accuracy and low channel-to-channel mismatch makes the product ideal for use in fast-switching power system. In addition, high CMTI, high reverse current capability and fast clamping of the output below UVLO guarantees reliable operation in the application.

### 2EDi Gen 2: What is new?

- DSO-14 packages with increased channel-to-channel creepage to easier the layout or enable the use with higher working voltages or worst pollution layout
- New LGA 4 mm x 4 mm package enabling 70 percent space saving
- Fulfills the latest component standard for magnetic couplers (IEC 60747-17)
- Programmable dead-time and shoot-through functionality

### Applications

- Server
- Telecom
- DC-DC converters
- Power tools
- Industrial SMPS
- Low speed electrical vehicles
- Solar power inverter
- LED lighting



## Features and benefits

| Key features   | Key benefits   | Customer value   |
|--|--|--|
| <ul style="list-style-type: none"> <li>– Fast power switching with accurate timing</li> <li>– 5 A/9 A source/sink currents</li> <li>– Propagation delay typ. 38 ns with 6 ns channel-to-channel precision</li> </ul> | <ul style="list-style-type: none"> <li>– Efficiency gain and lower losses</li> <li>– Strong driving enables reduced switching losses</li> <li>– Accurate timing enables deadtime optimization or synchronized driving in case of parallel MOSFETs</li> </ul>                               | <ul style="list-style-type: none"> <li>– Enabling higher system efficiency and higher power density designs</li> </ul>   |
| <ul style="list-style-type: none"> <li>– Optimized for area and system BOM</li> <li>– &lt; 1 Ω source and sink output resistance</li> <li>– Output stages with 5 A reverse current capability</li> </ul>             | <ul style="list-style-type: none"> <li>– Improved thermal behavior at smaller form factor</li> <li>– Most of the driving power is dissipated externally with reduced thermal stress on the driver</li> <li>– Eliminates two costly protection diodes on the gate driver outputs</li> </ul> | <ul style="list-style-type: none"> <li>– Improving long term competitive cost position, integration and mass manufacturability</li> </ul>  |
| <ul style="list-style-type: none"> <li>– Robust</li> <li>– CMTI &gt;150 V/ns</li> <li>– Under voltage lockout function for switch protection</li> <li>– Deadtime control and shoot through protection</li> </ul>     | <ul style="list-style-type: none"> <li>– Protection and safe operation</li> <li>– Reliable driver operation against fast switching transients</li> <li>– MOSFET is protected from thermal stress in abnormal conditions</li> <li>– Protection against noise and spurious pulses</li> </ul> | <ul style="list-style-type: none"> <li>– Extending end-product lifetime</li> <li>– by improving safe operation of power switches in normal and abnormal field (grid) conditions</li> </ul> |
| <ul style="list-style-type: none"> <li>– Output-to-output channel isolation</li> <li>– Functional level galvanic isolation</li> </ul>  | <ul style="list-style-type: none"> <li>– Flexible configurations</li> <li>– High-side + low-side, high-side + high-side, low-side + low-side</li> </ul>  | <ul style="list-style-type: none"> <li>– Lower EMI by ground isolation</li> </ul>  |
| <ul style="list-style-type: none"> <li>– Input-to-output channel isolation</li> <li>– Functional, basic and reinforced galvanic isolation</li> </ul>   | <ul style="list-style-type: none"> <li>– Regulatory safety</li> <li>– Functional for level-shifting and ground bounce immunity</li> <li>– Reinforced for control of primary-side MOSFETs from secondary-side controller</li> </ul>   | <ul style="list-style-type: none"> <li>– Simplified safety approval</li> <li>– through component standards (UL1577, IEC60747-17) and system standards (IEC62368) certificates</li> </ul>   |





# EiceDRIVER™ X3 Compact and 2L-SRC Compact

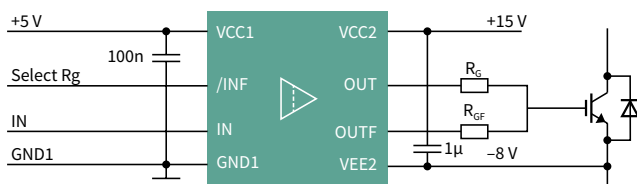
## 5.7 kV, 18 A, 1-ch, isolated drivers with Miller clamp and two-level slew rate control

The EiceDRIVER™ X3 Compact family (1ED31xx) provides Miller clamp or separate output options with up to 14 A current, in DSO-8 150 mil and 300 mil package. The EiceDRIVER™ 2L-SRC Compact family (1ED32xx) provides Miller clamp or 2-level slew rate control options with up to 18 A current, in DSO-8 300 mil package. The Miller clamp function is highly recommended for SiC MOSFET 0 V turn off and TRENCHSTOP™ IGBT7 against parasitic turn on. The two-level slew rate control function allows customers to change the output current on the fly. It is highly recommend for industrial drives application, where customer suffer from the EMI and switching loss optimization. Both EiceDRIVER™ X3 Compact and 2L-SRC Compact families are rated up to 2300 V functional isolation and 200 kV/μs CMTI. They are ideal for IGBTs, Si MOSFETs, and SiC MOSFETs in applications like solar inverter, EV-charging, industrial drives, CAC, industrial induction cooking, CAV, UPS, server and telecom SMPS, etc.

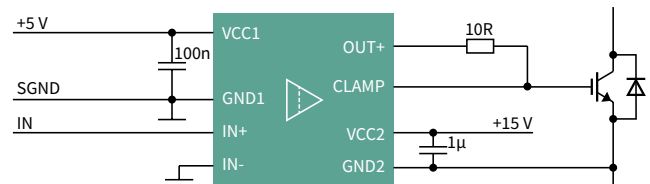


### Simplified application diagram

Two-level slew rate control (1ED3241MC12H)



Active Miller clamp (1ED3122MC12H)



### Evaluation board

- EVAL-1ED3121MX12H
- EVAL-1ED3241MC12H
- EVAL-1ED3122MX12H
- EVAL-1ED3251MC12H
- EVAL-1ED3124MX12H
- REF-22K-GPD-INV-EASY3B



| Family                     | Part number  | Typ. output current | Feature                                    | Prop. delay | Input filter | UVLO   | Prop. delay matching | Package      | Isolation rating  |       |        |
|----------------------------|--------------|---------------------|--|-------------|--------------|--------|----------------------|--------------|---|-------|--------|
| EiceDRIVER™ X3 Compact     | 1ED3127MU12F | 10 A                | Miller clamp                               | 90 ns       | 30 ns        | 12 V   | 7 ns                 | DSO-8 150mil | UL 1577:<br>V <sub>ISO</sub> = 3 kV <sub>RMS</sub>  |       |        |
|                            | 1ED3125MU12F | 10 A                | Separate output                            |             |              | 45 ns  |                      |              |   | 15 ns | 10.5 V |
|                            | 1ED3140MU12F | 6.5 A               |  |             |              |        |                      |              |   |       | 8.5 V  |
|                            | 1ED3141MU12F | 6.5 A               |  | 11 V        |              |        |                      |              |   |       |        |
|                            | 1ED3142MU12F | 6.5 A               |  | 12.5 V      |              |        |                      |              |   |       |        |
|                            | 1ED3124MU12F | 14 A                |  | 10.5 V      |              |        |                      |              |   |       |        |
|                            | 1ED3131MC12H | 5.5 A               | Miller clamp                               | 270 ns      | 180 ns       | 10.5 V |                      | DSO-8 300mil | UL 1577:<br>V <sub>ISO</sub> = 5.7 kV <sub>RMS</sub><br><br>VDE 0884-11:<br>V <sub>IORM</sub> = 1767 V (reinforced) |       |        |
|                            | 1ED3120MC12H | 5.5 A               |  |             |              | 8 V    |                      |              |   |       |        |
|                            | 1ED3121MC12H | 5.5 A               |  |             |              | 10.5 V |                      |              |   |       |        |
|                            | 1ED3122MC12H | 10 A                |  |             |              | 8 V    |                      |              |   |       |        |
|                            | 1ED3123MC12H | 14 A                |  |             |              | 8 V    |                      |              |   |       |        |
|                            | 1ED3124MC12H | 14 A                |  |             |              | 10.5 V |                      |              |   |       |        |
| EiceDRIVER™ 2L-SRC Compact | 1ED3240MC12H | 10 A                | Turn-on and turn-off slew rate control     | 110 ns      | 30 ns        | 10.5 V | 15 ns                |              |   |       |        |
|                            | 1ED3241MC12H | 18 A                |  |             |              | 10.5 V |                      |              |   |       |        |
|                            | 1ED3250MC12H | 10 A                | Turn-on slew rate control and Miller clamp | 90 ns       | 30 ns        | 10.5 V |                      |              |   |       |        |
|                            | 1ED3251MC12H | 18 A                |  |             |              | 10.5 V |                      |              |   |       |        |

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[www.infineon.com/src](http://www.infineon.com/src)



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# EiceDRIVER™ Enhanced 1ED-F3 and X3 Analog

## 5.7 kV, 9 A, 1-ch, isolated drivers with DESAT, Miller clamp and soft-off

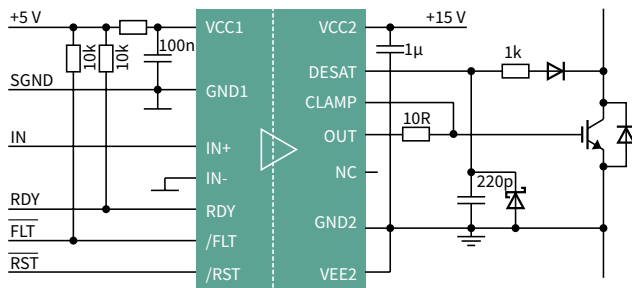
The EiceDRIVER™ Enhanced 1ED-F3 family (1ED332x) provides DESAT, Miller clamp and soft-off features with up to 6 A current, in DSO-16 300 mil package. The EiceDRIVER™ Enhanced X3 Analog family (1ED34xx) provides Miller clamp, resistor configurable DESAT and soft-off function with up to 9 A current, in DSO-16 300 mil fine pitch package.

The 1ED-F3 family (1ED332x) is pin-to-pin with our previous generation 1ED020I12-F2 (1ED-F2), with higher current, shorter propagation delay, higher isolation ratings and additional soft-off function. The X3 Analog family (1ED34xx) offers best-in-class DESAT protection accuracy with the resistor configurability on DESAT filter and leading edge blanking time and soft-off current.

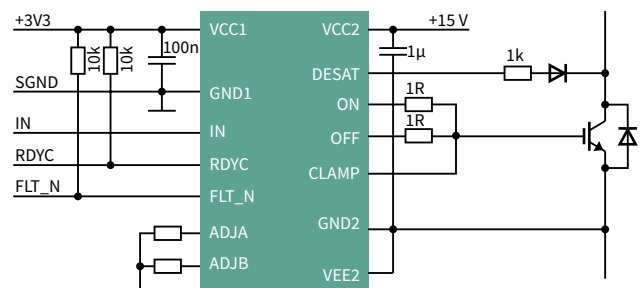
Both EiceDRIVER™ Enhanced 1ED-F3 and X3 Analog families are rated up to 2300 V functional isolation and 200 kV/μs CMTI. They are ideal for IGBTs, Si MOSFETs, and SiC in applications like solar inverter, EV-charging, industrial drives, CAC, industrial induction cooking, CAV, UPS, server and telecom SMPS, etc.

### Simplified application diagram

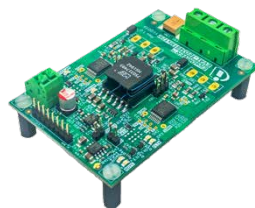
1ED-F3 (1ED332x)



X3 Analog (1ED34xx)



### Evaluation board



EVAl-1ED3321MC12N

EVAl-1ED3491MX12M

| Family                         | Part number  | Typ. output current | Feature  | Prop. delay | Input filter | UVLO   | Prop. delay matching | Package                  | Isolation rating  |
|--------------------------------|--------------|---------------------|--|-------------|--------------|--------|----------------------|--------------------------|---|
| EiceDRIVER™ Enhanced 1ED-F3    | 1ED3320MC12N | 3/6 A               | Miller clamp, DESAT, soft-off                        | 80 ns       | 35 ns        | 10.5 V | 15 ns                | DSO-16 300mil            | UL 1577:<br>$V_{ISO} = 5.7 \text{ kV}_{RMS}$<br><br>VDE 0884-11:<br>$V_{IORM} = 1767 \text{ V}$<br>(reinforced) |
|                                | 1ED3321MC12N | 6/8.5 A             |  |             |              | 10.5 V |                      |                          |   |
|                                | 1ED3322MC12N | 6/8.5 A             | Miller clamp, DESAT                                  |             |              | 12 V   |                      |                          |   |
|                                | 1ED3323MC12N | 6/8.5 A             | 10.5 V   |             |              |        |                      |                          |   |
| EiceDRIVER™ Enhanced X3 Analog | 1ED3431MC12M | 3 A                 | Miller clamp, resistor adjustable DESAT and soft-off | 236 ns      | 100 ns       | 10.5 V | 30 ns                | DSO-16 300mil fine pitch |   |
|                                | 1ED3461MC12M | 6 A                 | Clamp driver, resistor adjustable DESAT and soft-off |             |              | 10.5 V |                      |                          |   |
|                                | 1ED3491MC12M | 9 A                 |  |             |              | 10.5 V |                      |                          |   |

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For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

# EiceDRIVER™ Enhanced X3 Digital

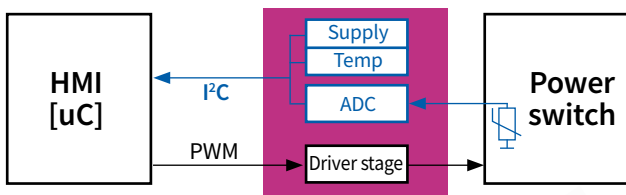
5.7 kV, 9 A, 1-ch, isolated drivers with I<sup>2</sup>C configurability for DESAT, Miller clamp, soft-off and many more

The EiceDRIVER™ Enhanced X3 Digital family (1ED38xx) provides I<sup>2</sup>C configurability for DESAT, soft-off, UVLO, Miller clamp, two-level turn off (TLTO), and fault function to simplify the design of highly reliable systems. All adjustments are done from the input side via the I<sup>2</sup>C interface (pin SDA and SCL). The 1ED38xx offers up to 9 A current, in DSO-16 300 mil fine-pitch package.

The EiceDRIVER™ Enhanced X3 Digital family is rated up to 2300 V functional isolation and 200 kV/μs CMTI. They are ideal for IGBTs, Si MOSFETs, and SiC MOSFETs especially due to the configurability of DESAT and UVLO. This family is recommended in applications like solar inverter, EV-charging, industrial drives, CAC, industrial induction cooking, CAV, UPS, server and telecom SMPS, etc. Two noticeable advantages of the digitally configurable approach for customers are predictive maintenance in sophisticated industrial systems and rapid prototyping for fast solution development.

### Predictive maintenance

Using the I<sup>2</sup>C interface, the 1ED38xx is able to register the counts of UVLO spikes, monitor the supply voltage and temperature increase. With the long-term analysis of the collected data, customers are able to decide when is the best time to schedule a maintenance cycle before the system fails.



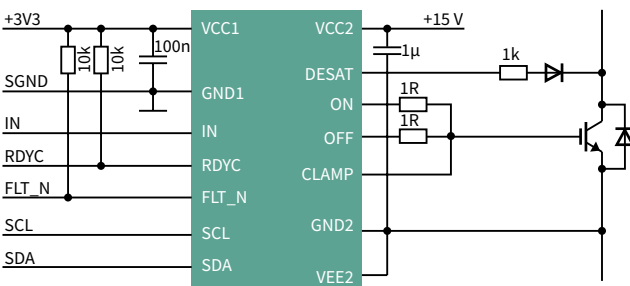
### Evaluation board

EVAL-1ED3890Mx12M  
EVAL-1ED38x0DCT



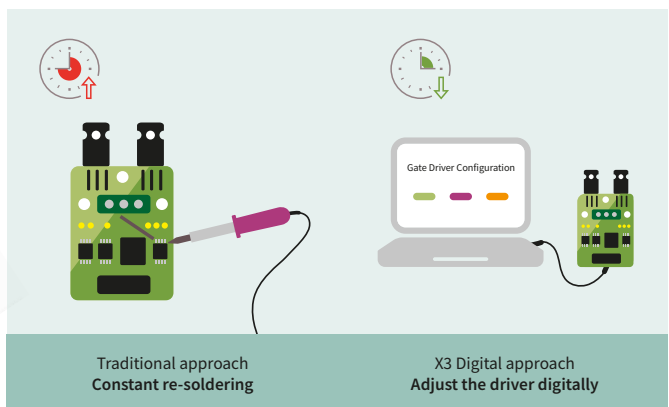
### Simplified application diagram

X3 Digital (1ED38xx)



### Rapid prototyping

The I<sup>2</sup>C interface enables rapid prototyping without hardware changes. Using a traditional gate driver, customers have to first design an initial PCB board, and then adjust and replace the components on the board during evaluation. However, with the 1ED38xx I<sup>2</sup>C interface, customers can configure up to 27 parameters to optimize the board without replacing the components. This feature extremely shortens the development flow.



| Family                          | Part Number  | Typ. output current | Feature   | Isolation rating  |
|---------------------------------|--------------|---------------------|---|---|
| EiceDRIVER™ Enhanced X3 Digital | 1ED3830MC12M | 3 A                 | I <sup>2</sup> C configurability, Miller clamp, DESAT, soft-off, two-level turn-off, integrated ADC | UL 1577: VISO = 5.7 kV <sub>RMS</sub><br><br>VDE 0884-11: VIORM = 1767 V (reinforced) |
|                                 | 1ED3860MC12M | 6 A                 |   |   |
|                                 | 1ED3890MC12M | 9 A                 |   |   |

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+SiC



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# EiceDRIVER™ APD 2ED4820-EM

## 48 V smart high-side MOSFET gate driver with SPI for automotive applications

The EiceDRIVER™ 2ED4820-EM is a smart high side N-channel MOSFET gate driver with two outputs controlled via SPI. The integrated powerful charge pump allows external MOSFETs to stay continuously on. Thanks to the enhanced turn-on and turn-off ability of the driver, the number of MOSFETs could be easily scaled up to manage large currents in the order of several hundred amps, while ensuring fast switch on and off. The MOSFETs could be controlled in a back to back configuration either common mode or common source. The integrated current sense amplifier supports high-side and even load-side current measurement with a dedicated monitoring output. The 2ED4820-EM comes along with several latching failure detections, to implement protections for the external MOSFETs, the load and the power source. Parameters can be adjusted by SPI; monitoring data, configuration, warning and failure detection registers can be read.

### Summary of features

- Extended supply voltage range: 20 - 70 V
- Two independent high-side gate driver outputs with 1 A pull down, 0.3 A pull up for fast switch off/on
- Low supply current in sleep mode  $IBAT\_Q < 5 \mu A$
- Device control, configuration and diagnostic via SPI
- Configurable overcurrent/short circuit protection
- Configurable Drain-Source overvoltage protection
- Gate undervoltage lockout ( $V_{GS}$ )
- Ground loss detection
- AEC-Q100 qualification

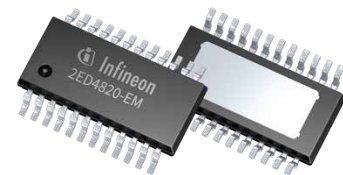
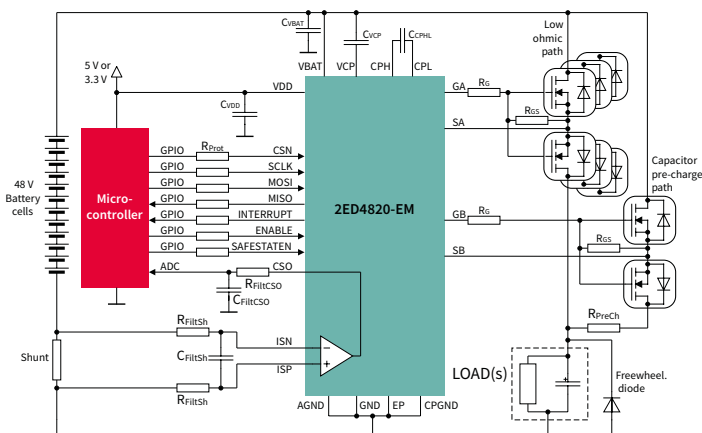


### Benefits

- Supports back-to-back MOSFET topologies (common drain or common source)
- SAFESTATEN input to trigger safe state mode in case of  $\mu C$  failure
- One bidirectional high or low side analog current sense interface with configurable gain to optimize power losses
- Robust against  $V_{bat}$  voltages up to 105 V and  $V_{source}$  voltages versus  $V_{bat}$  of -90 V

### Potential applications

- Battery protection switch
- Input protection switch
- Static load and supply switch for high currents



### Products and evaluation boards

| Product             | Description   | Ordering code | Package     |
|---------------------|---|---------------|-------------|
| 2ED4820-EM          | 48 V smart high-side MOSFET gate driver with SPI      | SP005629911   | PG-TSDSO-24 |
| 2ED4820 EB2 2HSV48  | 2ED4820 dual high-side switch - 48 V evaluation board | SP005353778   | BOARD       |
| R 48V BATT Switch10 | 48 V battery disconnect switch - reference design     | SP005595834   | BOARD       |



# EiceDRIVER™ 1EDI302xAS/1EDI303xAS

## 1200 V galvanically isolated automotive gate-driver IC family

The EiceDRIVER™ 1EDI302xAS/1EDI303xAS is a family of automotive qualified single-channel high-voltage gate drivers optimized for IGBT and SiC technologies. The robust Infineon coreless transformer (CT) technology is used to provide bi-directional signal transfer across the galvanic isolation barrier. Comprehensive safety features and ISO26262 compliance enable ASIL D classification on the system level. Accompanying safety documents ease and speed-up FMEDA analysis in the application. The compact package design and the high level of feature integration save valuable PCB space and system cost, while the pre-configured settings reduce design efforts. Pin-compatible product variants make it easy to switch between variants and swiftly adjust ECUs to different application needs (i.e., SiC MOSFET vs. IGBT).

### Product features

- › Single-channel isolated IGBT driver
- › For IGBTs up to 1200 V
- › High CMTI up to 150 V/ns
- › 8 kV basic insulation according to DIN VDE V 0884-11:2017-01
- › Basic insulation according to UL 1577
- › Min. 12 A peak current rail-to-rail output
- › Propagation delay 60 ns typical
- › Typ. 10 A integrated active Miller clamp supports unipolar switching
- › Integrated, accurate 12 bit ADC for temperature measurements
- › Integrated safety features to support ASIL B(D):
  - DESAT and differential OCP protection
  - Gate and output stage monitoring
  - Shoot-through protection
  - Primary/secondary supply monitoring
  - Internal supervision
- › Advanced driver diagnosis with duty cycle coded DATA pin
- › AEC-Q100 qualified
- › Compact DSO-20 fine pitch package



### Potential applications

- › Traction inverters for HEV and EV
- › Auxiliary inverters for HEV and EV
- › High-power DC-DC converters

### Evaluation board

1EDI30XXAS EVALBOARD

1EDI303XAS EVALBOARD

1EDI302XAS EVALBOARD



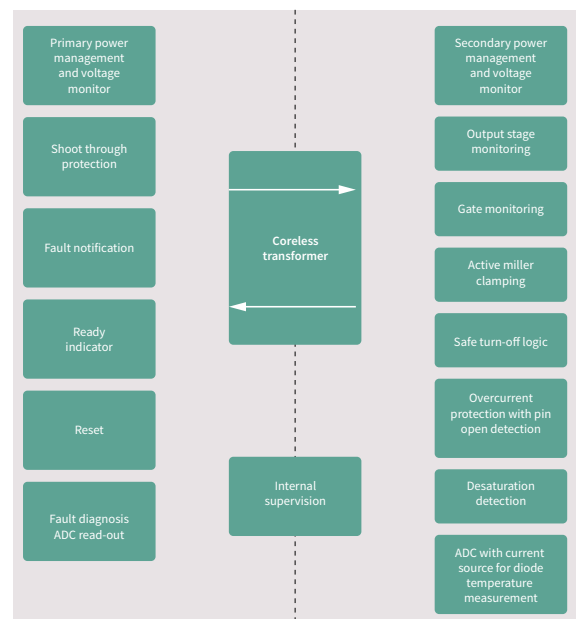
### Product family overview

| Product variant | Driver support | Additional functionality  |
|-----------------|----------------|---------------------------|
| 1EDI3020AS      | IGBT           | ADC for temperature Diode |
| 1EDI3021AS      | IGBT           | Active short circuit      |
| 1EDI3023AS      | IGBT           | ADC for NTC and DC-link   |
| 1EDI3030AS      | SiC            | ADC for temperature diode |
| 1EDI3031AS      | SiC            | Active short circuit      |
| 1EDI3033AS      | SiC            | ADC for NTC and DC-link   |

[www.infineon.com/eicedriver](http://www.infineon.com/eicedriver)



### Simplified block diagram



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# Infineon solid-state relays (SSR) technologies

Using Infineon power-switch technologies, Infineon solid-state relays (SSRs) are remotely controlled switches (on/off) with complete galvanic isolation from input to output. No power supply is needed on the output.

## Two main sub-groups:

- Photovoltaic isolators (PVI)
  - Isolated, low-power DC voltage sources capable of driving MOSFET or IGBT gates directly
- Photovoltaic relays (PVR)
  - PVI plus internal power MOSFET

## Main benefits of Infineon SSR technology:

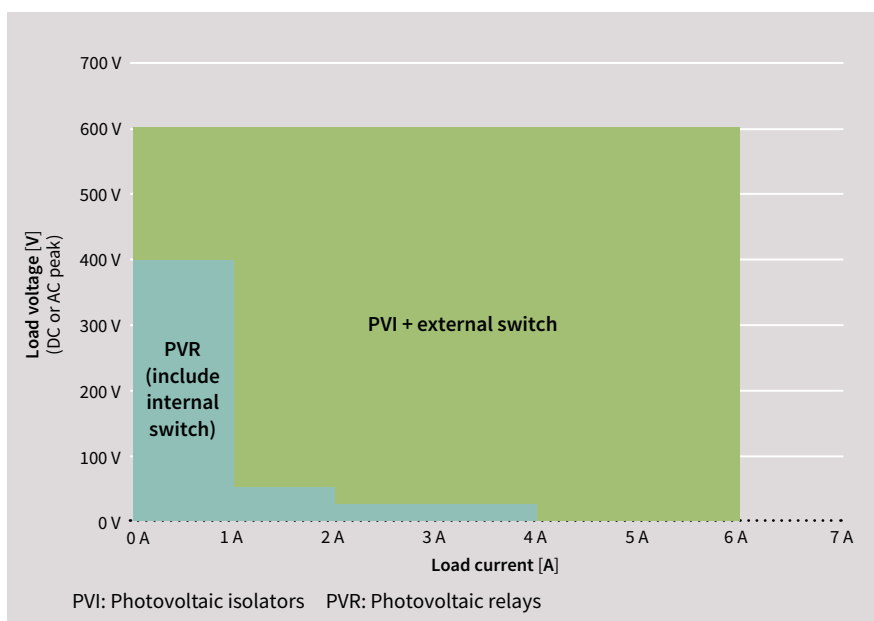
- Optically isolated technology provides galvanic isolation for safety applications
- Wide range of applications from industrial automation to test equipment
- Established and reliable products with over 20 years of history

## Key advantages over electromechanical relays:

- Silent operation
- No contact bounce
- Compact solution
- Fast response time
- High input sensitivity
- High reliability with long operational life
- Insensitivity to stray EMF, shock and vibration
- Stable contact resistance over life

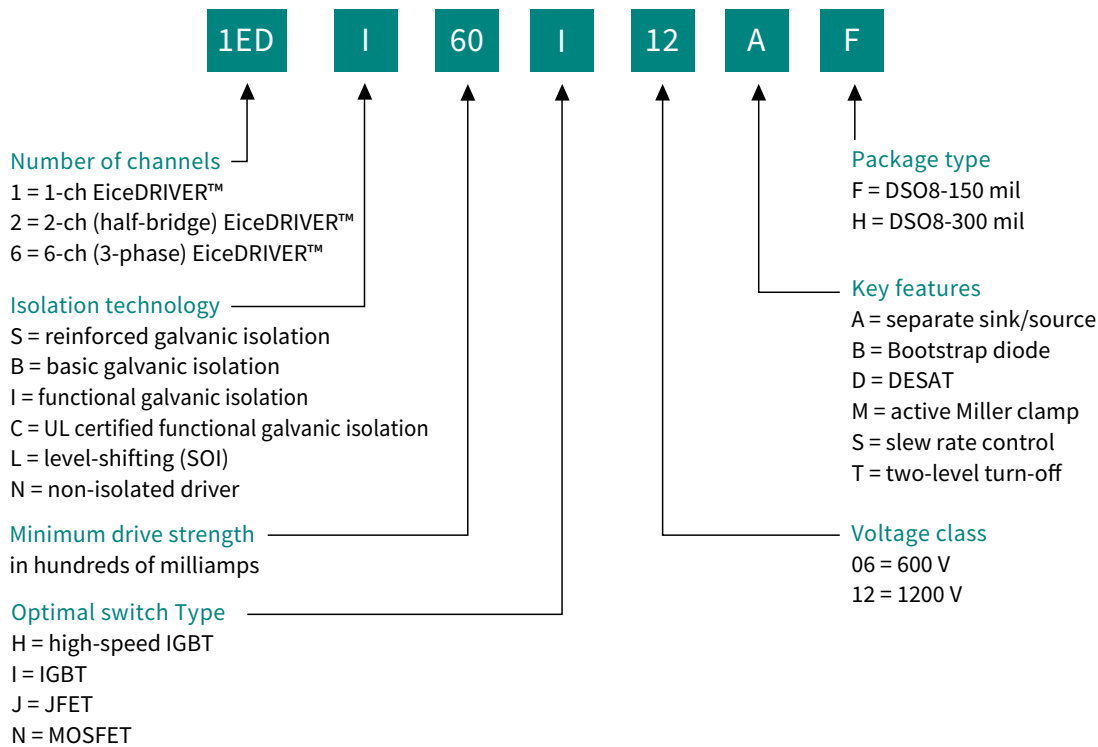
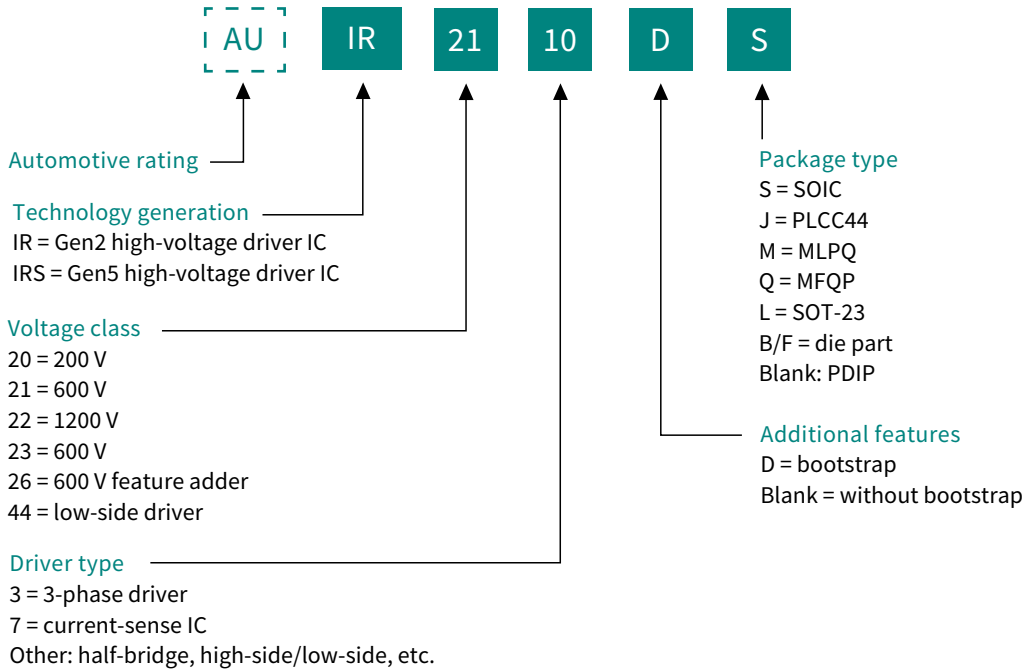
## Infineon SSRs can be used in a wide range of applications:

- Electro-mechanical relay (EMR) replacement
- Battery management systems
- UPS
- Automatic test equipment
- Instrumentation systems
- Industrial automation
- Thermostats
- Programmable logic controllers

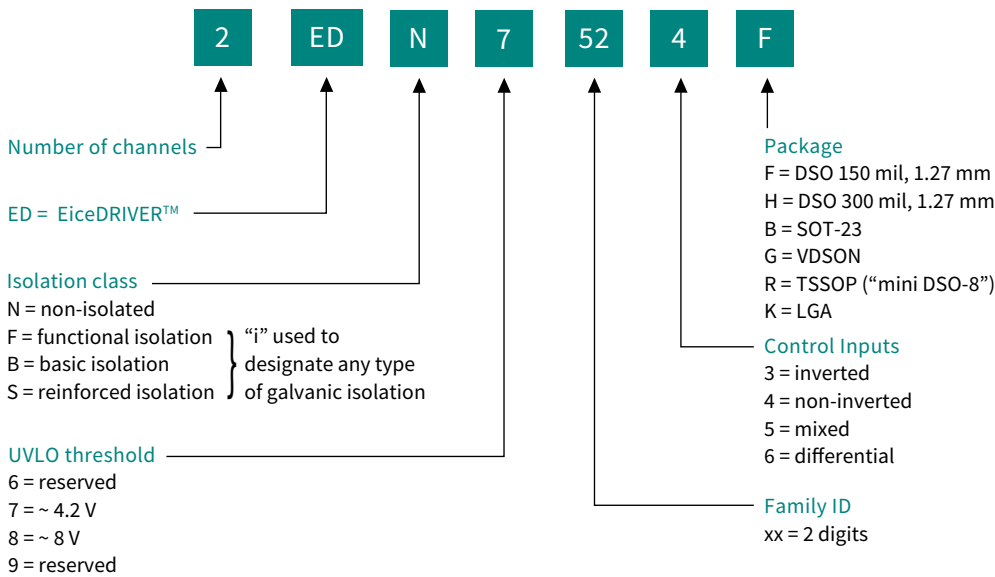
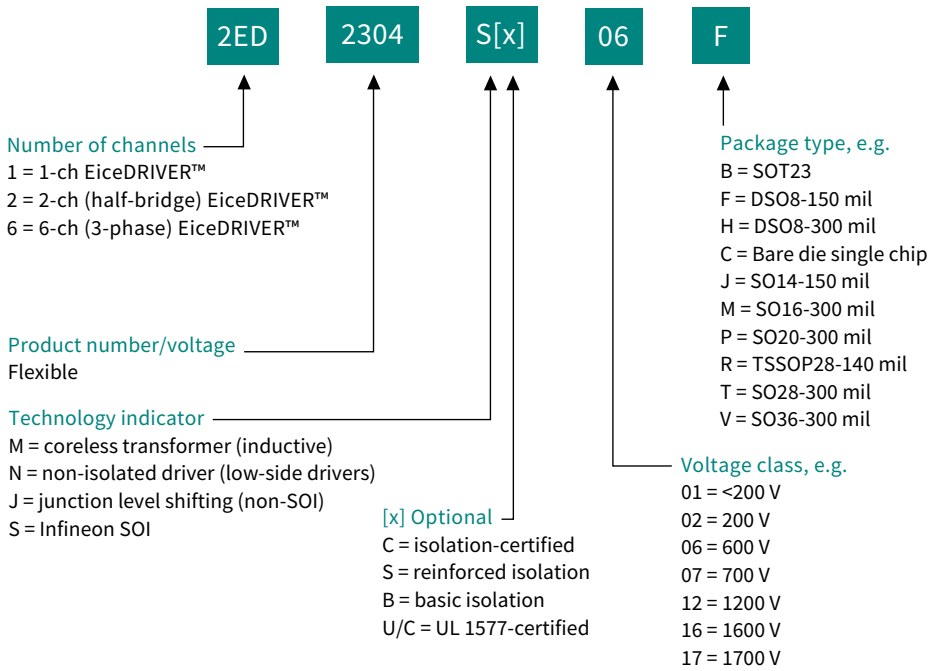


# Nomenclature

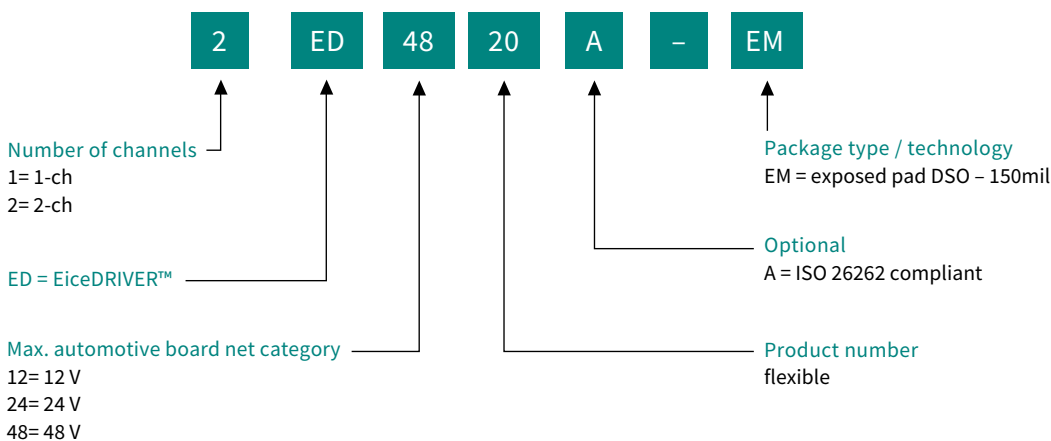
## Naming convention for existing families of gate-driver ICs



## Naming convention for existing and upcoming families of gate-driver ICs



## Naming convention for existing and upcoming families of gate-driver ICs







# Infineon support for gate-driver ICs

## Useful links and helpful information

### Further information, datasheets and documents

[www.infineon.com/200vhvic](http://www.infineon.com/200vhvic)

[www.infineon.com/700vhvic](http://www.infineon.com/700vhvic)

[www.infineon.com/1200vhvic](http://www.infineon.com/1200vhvic)

[www.infineon.com/gdsic](http://www.infineon.com/gdsic)

[www.infineon.com/gdsic-cn \(CN\)](http://www.infineon.com/gdsic-cn)

[www.infineon.com/gdcompact](http://www.infineon.com/gdcompact)

[www.infineon.com/gdlowside](http://www.infineon.com/gdlowside)

[www.infineon.com/gdenhanced](http://www.infineon.com/gdenhanced)

[www.infineon.com/src](http://www.infineon.com/src)

[www.infineon.com/src-cn \(CN\)](http://www.infineon.com/src-cn)

[www.infineon.com/1ED4417x](http://www.infineon.com/1ED4417x)

[www.infineon.com/1EDN](http://www.infineon.com/1EDN)

[www.infineon.com/2EDN](http://www.infineon.com/2EDN)

[www.infineon.com/TDI](http://www.infineon.com/TDI)

[www.infineon.com/2EDL8](http://www.infineon.com/2EDL8)

[www.infineon.com/gatedriver](http://www.infineon.com/gatedriver)

[www.infineon.com/gatedriver-cn \(CN\)](http://www.infineon.com/gatedriver-cn)

[www.infineon.com/ifxdesigner](http://www.infineon.com/ifxdesigner)

[www.infineon.com/gdevalboards](http://www.infineon.com/gdevalboards)

[www.infineon.com/gdlowside](http://www.infineon.com/gdlowside)

### Gate driver IC community FAQs

[www.infineon.com/gdforum](http://www.infineon.com/gdforum)

### Gate driver selection tools

[www.infineon.com/gdfinder](http://www.infineon.com/gdfinder)

### Gate driver simulation (SPICE) models

[www.infineon.com/gdmodel](http://www.infineon.com/gdmodel)

### Cross reference tool

[www.infineon.com/crs](http://www.infineon.com/crs)



Support



Evaluation board



Tools

# Digital isolators

- ISOFACE™ dual-channel digital isolators
- ISOFACE™ quad-channel digital isolators



# ISOFACE™ dual-channel digital isolators

## Robust digital isolators with precise timing and low power consumption

ISOFACE™ digital isolators are based on Infineon's coreless transformer (CT) technology and provide robust isolation for high voltage applications. They are the preferred choice for isolated gate signal transfer in high-density power designs and isolated communication such as UART or CAN.

### The 2DIBx4xxF family features

- Dual-channel digital isolators with eight variants and data rates up to 40 Mbits/s
- 3 kV<sub>RMS</sub> isolation voltage
- CMOS/TTL input thresholds
- High common-mode transient immunity (CMTI)
- Accurate timing performance
- Wide operating supply voltage from 2.7 V to 6.5 V



### Product variants

| Part number | Isolation rating   | Channel configuration           | Input thresholds   | Default output state | Package              |
|-------------|--|---------------------------------|--------------------|----------------------|----------------------|
| 2DIB0400F   | V <sub>ISO</sub> = 3000 V <sub>RMS</sub><br>(UL1577 Ed. 5) | 2 forward<br>0 reverse<br>(2+0) | Variable<br>(CMOS) | Low                  | PG-DSO-8<br>5 x 4 mm |
| 2DIB0401F   |  |                                 |                    | High                 |                      |
| 2DIB1400F   |  | 1 forward<br>1 reverse<br>(1+1) |                    | Low                  |                      |
| 2DIB1401F   |  |                                 |                    | High                 |                      |
| 2DIB0410F   |  | 2 forward<br>0 reverse<br>(2+0) | Fixed<br>(TTL)     | Low                  |                      |
| 2DIB0411F   |  |                                 |                    | High                 |                      |
| 2DIB1410F   |  | 1 forward<br>1 reverse<br>(1+1) |                    | Low                  |                      |
| 2DIB1411F   |  |                                 |                    | High                 |                      |

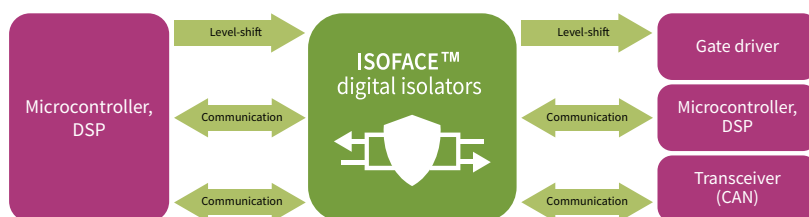
### Features and benefits

#### Key features

- High CMTI > 100 V/ns
- Wide supply voltage range 2.7 V ~ 6.5 V (abs. max. 7.5 V)
- TTL or CMOS input threshold
- Typical propagation delay 26 ns with -4/+6 ns spread
- Both high and low fail-safe default output state
- Both component and system level certification
- Pin-to-pin compatibility

#### Key benefits

- High immunity against system noise or high dv/dt
- Reliable performance in SMPS with switching noise on IC power supply
- Optimized noise margin for different applications
- For high system power efficiency
- Reliable high or low default output state in case of failures
- Simplified system certification process
- For easy device replacement and alternative sourcing

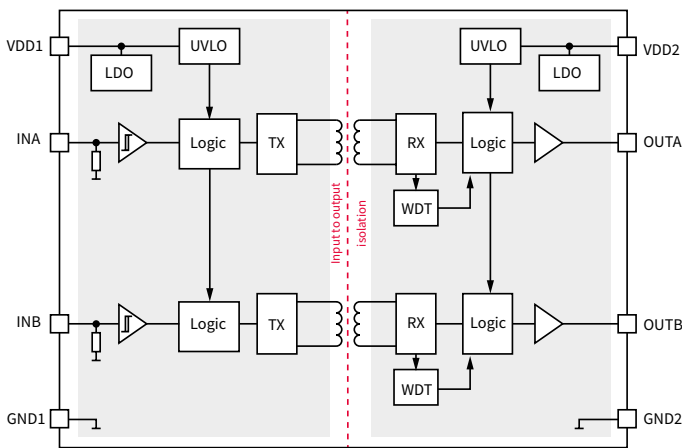


Infineon ISOFACE™ dual-channel digital isolators are used to transfer gate driving and communication signals like CAN and UART over the isolation barrier. With high robustness and accurate switching characteristics, they are suitable for high power density designs and isolated communication systems.

## Dual-channel digital isolator 2DIB0410F in SOIC-8 narrow body package

Infineon ISOFACE™ dual-channel digital isolator 2DIB0410F (with 2 forward channels) provides robust isolation for high voltage applications. With a wide supply voltage range, TTL input thresholds and default output state low, it is the perfect fit for high-power density DC-DC brick applications.

Block diagram of 2DIB041xF with two forward data channels

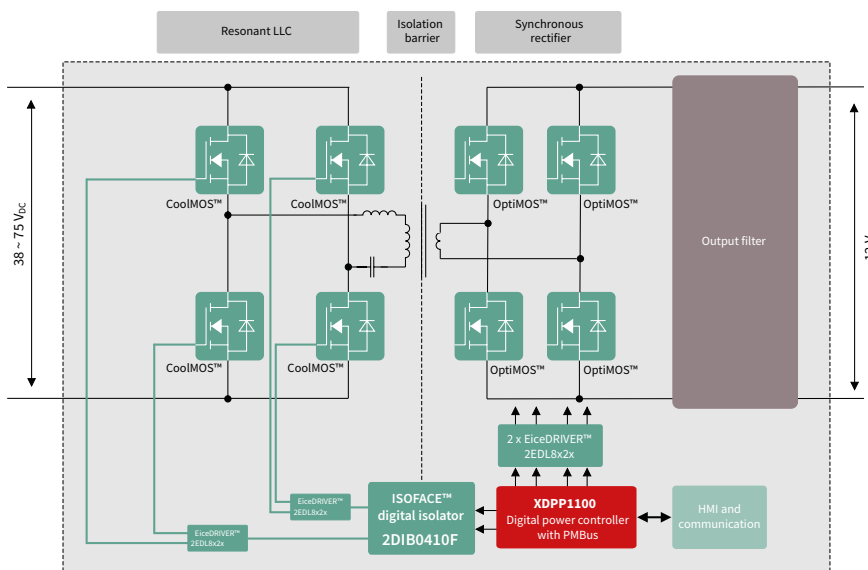


### Features and benefits

| Key features  |
|---|
| - High CMTI > 100 V/ns  |
| - Wide operating supply voltage range 2.7 V ~ 6.5 V (abs. max. 7.5 V) |
| - TTL input threshold   |
| - Integrated glitch filter  |
| - Default low fail-safe output state                                  |
| - Both component and system-level certification                       |

| Key benefits   |
|--|
| - High immunity against system noise                                   |
| - Reliable performance in SMPS with switching noise on IC power supply |
| - Optimized noise margin for SMPS applications                         |
| - Effective noise suppression in SMPS applications                     |
| - Reliable low output state in case of failures                        |
| - Simplified system certification process                              |

### 2DIB0410F used in isolated DC-DC brick application

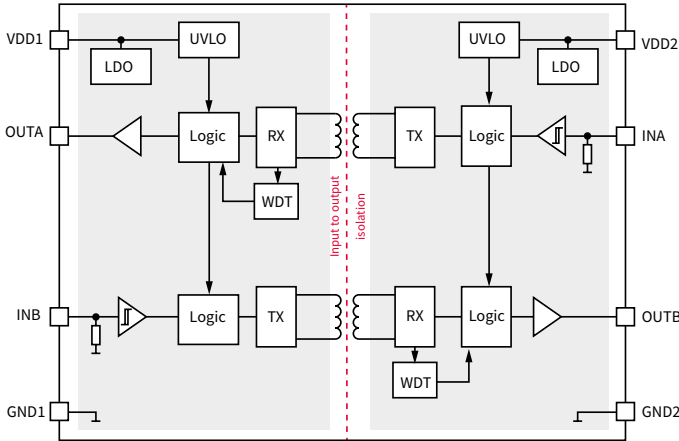


Infineon ISOFACE™ dual-channel digital isolator 2DIB0410F is a perfect fit for isolated DC-DC brick applications to transfer half- or full-bridge gate driving signals. The two-channel configuration allows transfer of low- and high-side gate-signals over the isolation barrier.

## Dual-channel digital isolator 2DIB1410F in SOIC-8 narrow body package

Infineon ISOFACE™ dual-channel digital isolator 2DIB1410F (with one forward and one reverse channel) provides robust isolation for high voltage applications. With high common-mode transient immunity (>100 V/ns), TTL input threshold, and default low output state, it is the perfect match for GaN-IPS with high dv/dt in high-density power designs (GaN with integrated non-isolated gate driver).

Block diagram of 2DIB14xxF with one forward and one reverse data channel

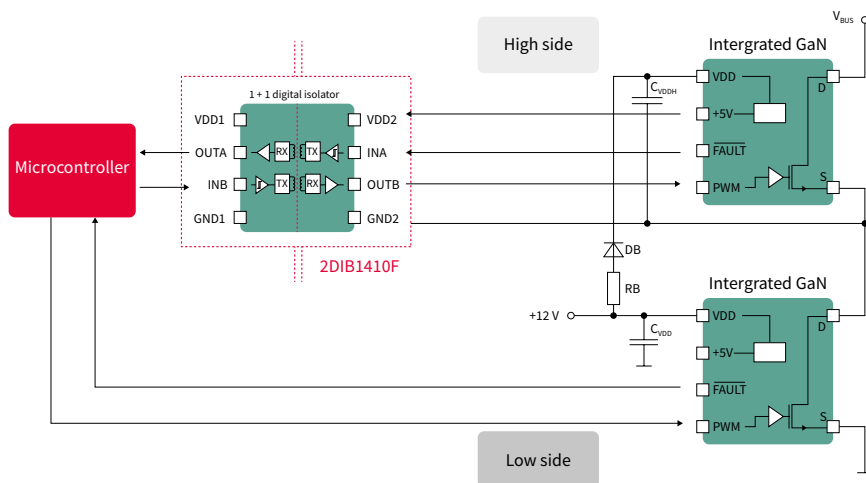


### Features and benefits

| Key features  |
|---|
| - High CMTI > 100 V/ns                                    |
| - Wide supply voltage range 2.7 ~ 6.5 V (abs. max. 7.5 V) |
| - TTL input threshold                                     |
| - Integrated glitch filter                                |
| - Default low fail-safe output state                      |
| - Both component and system-level certification           |

| Key benefits  |
|---|
| - For GaN with integrated non-isolated gate driver with high dv/dt      |
| - Reliable performance in SMPS with switching noises on IC power supply |
| - Optimized noise margin for SMPS applications                          |
| - Effective noise suppression in SMPS applications                      |
| - Reliable low output state in case of failures                         |
| - Simplified system certification process                               |

### 2DIB1410F used in totem-pole PFC with GaN IPS



Infineon ISOFACE™ dual-channel digital isolator 2DIB1410F can be used together with GaN IPS for high-side floating drive. One forward channel is used to transfer the gate signal. The reverse channel can be used for protection signal.

# ISOFACE™ quad-channel digital isolators

## Robust digital isolators with precise timing and low power consumption

ISOFACE™ digital isolators are based on Infineon's coreless transformer (CT) technology and provide reinforced isolation for high-voltage applications. They are the preferred choice for isolated gate signal transfer in high-density power designs and isolated communication such as UART/CAN and SPI. The quad-channel digital isolators also offer AEC-Q variants to meet even stringent customer application requirements.

### The 4DIRx4xxH family features

- Quad-channel digital isolators with eight variants and data rates up to 40 Mbits/s
- 5.7 kV<sub>RMS</sub> isolation voltage
- Active high or low enable logic level for the output on Side 1
- High common-mode transient immunity (CMTI)
- Accurate timing performance
- Wide operating supply voltage from 2.7 V to 6.5 V



### Product variants

| Part number                | Channel configuration        | Output enable | Default output state | Package           |
|----------------------------|------------------------------|---------------|----------------------|-------------------|
| 4DIR0400H                  | 4 forward<br>0 reverse (4+0) | Active-high   | Low                  | PG-DSO-16 300 mil |
| 4DIR0401H(A) <sup>1)</sup> |                              |               | High                 |                   |
| 4DIR1400H(A) <sup>1)</sup> | 3 forward<br>1 reverse (3+1) |               | Low                  |                   |
| 4DIR1401H(A) <sup>1)</sup> |                              |               | High                 |                   |
| 4DIR2400H(A) <sup>1)</sup> | 2 forward<br>2 reverse (2+2) |               | Low                  |                   |
| 4DIR2401H(A) <sup>1)</sup> |                              |               | High                 |                   |
| 4DIR1420H(A) <sup>1)</sup> | 3 forward<br>1 reverse (3+1) | Active-low    | Low                  |                   |
| 4DIR1421H(A) <sup>1)</sup> |                              |               | High                 |                   |

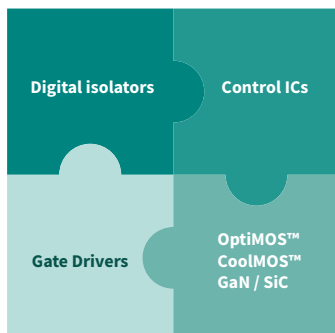
## Features and benefits

### Key features

- High CMTI > 100 V/μs
- Wide supply voltage range 2.7 V ~ 6.5 V (abs. max. 7.5 V)
- Active high or low enable logic level for the output on Side 1
- Typical propagation delay 26 ns with -4/+6 ns spread
- Both high and low fail-safe default output state
- Both component- and system-level certification
- Pin-to-pin compatibility

### Key benefits

- High immunity against system noise and high dv/dt
- Reliable performance in UART/CAN and SPI communication
- Compatible with chip select function in SPI communication
- For high system power efficiency
- Reliable high or low default output state in case of failures
- Simplified system certification process
- For easy device replacement and alternative sourcing



Infineon ISOFACE™ quad-channel digital isolators transfer gate driving and communication signals like CAN/UART and SPI over the isolation barrier.

[www.infineon.com/digitalisolators](http://www.infineon.com/digitalisolators)

1) (A)\* = AEC-Q100 qualified



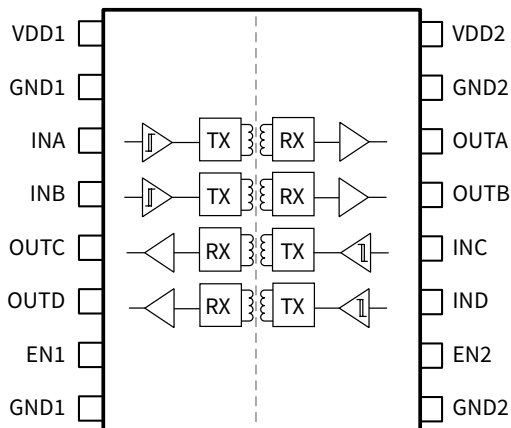
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Quad-channel digital isolator 4DIR2401H in SOIC-16 wide body package

Infineon ISOFACE™ quad-channel digital isolator 4DIR2401H (with 2 forward and 2 reverse channels) provides robust isolation for high-voltage applications. With a wide supply voltage range, CMOS input threshold, and default output state high, it is the perfect fit for a wide range of SMPS applications and isolated communication like UART/CAN.

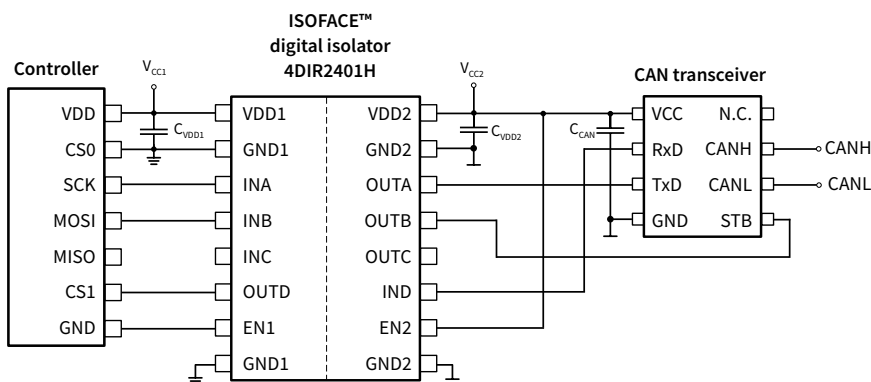
### 4DIR240xH with 2 forward and 2 reverse data channels



### Features and benefits

| Key features  |
|---|
| - High CMTI > 100 V/μs                                      |
| - Wide supply voltage range 2.7 V ~ 6.5 V (abs. max. 7.5 V) |
| - Active high enable logic level for the output on Side 1   |
| - Typical propagation delay 26 ns with -4/+6 ns spread      |
| - Low fail-safe default output state                        |
| - Both component- and system-level certification            |
| - Pin-to-pin compatibility                                  |

| Key benefits   |
|--|
| - High immunity against system noise                     |
| - Reliable performance in UART/CAN and SPI communication |
| - Output enable function for system-level protection     |
| - For high system power efficiency                       |
| - Reliable low default output state in case of failures  |
| - Simplified system certification process                |
| - For easy device replacement and alternative sourcing   |



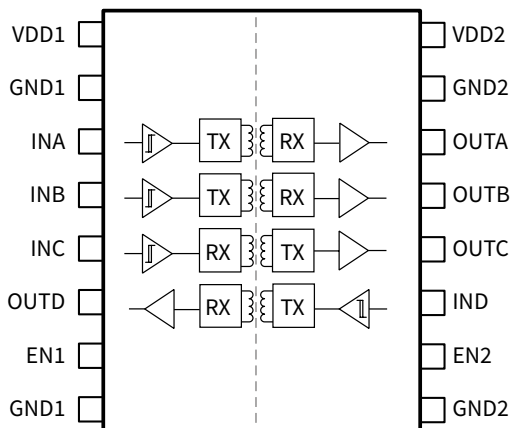
Infineon ISOFACE™ quad-channel digital isolators 4DIR2401H can be used in SMPS applications for inter-board communication and other isolated communication like UART/CAN.



## Quad-channel digital isolator 4DIR1421H in SOIC-16 wide body package

Infineon ISOFACE™ quad-channel digital isolator 4DIR1421H (with 3 forward and 1 reverse channels) provides robust isolation for high-voltage applications. With a wide supply voltage range, active-low enable logic level for the output on side 1 and default output state low; it is the perfect fit for isolated SPI communication.

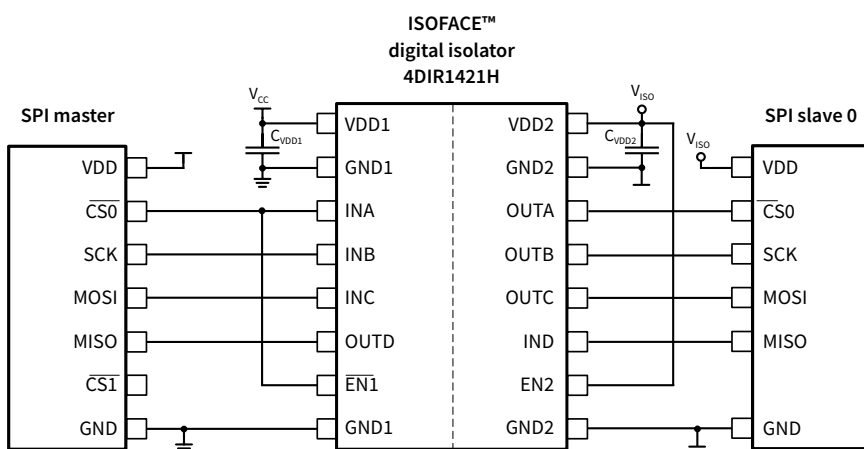
### 4DIR142xH with 3 forward and 1 reverse data channels



### Features and benefits

| Key features  |
|---|
| - High CMTI > 100 V/μs                                      |
| - Wide supply voltage range 2.7 V ~ 6.5 V (abs. max. 7.5 V) |
| - Active low enable logic level for the output on Side 1    |
| - Typical propagation delay 26 ns with -4/+6 ns spread      |
| - High fail-safe default output state                       |
| - Both component- and system-level certification            |
| - Pin-to-pin compatibility                                  |

| Key benefits  |
|---|
| - High immunity against system noise                        |
| - Reliable performance in SPI communication                 |
| - Compatible with chip select function in SPI communication |
| - For high system power efficiency                          |
| - Reliable high output state in case of failures            |
| - Simplified system certification process                   |
| - For easy device replacement and alternative sourcing      |



Infineon ISOFACE™ quad-channel digital isolator 4DIR1420H is designed for isolated SPI communication. The negative enable logic level for output on side 1 is compatible with the chip select function of SPI communication controllers. The default high output state is designed not to block the SPI communication bus in case of failure on the input side.

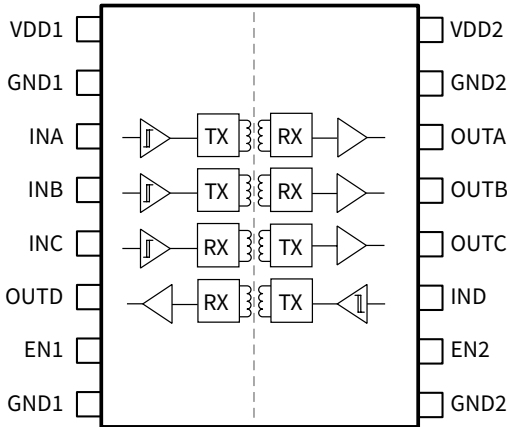




## Quad-channel digital isolator 4DIR1400H in SOIC-16 wide body package

Infineon ISOFACE™ quad-channel digital isolator 4DIR1400H (with 3 forward and 1 reverse channels) provides robust isolation for high-voltage applications. With a wide supply voltage range, active-high enable logic level for the output on side 1 and default output state low. It is the perfect fit for a wide range of applications, including [telecom/server PSU](#), [industrial SMPS](#), [EV-charging](#), and [industrial drives](#).

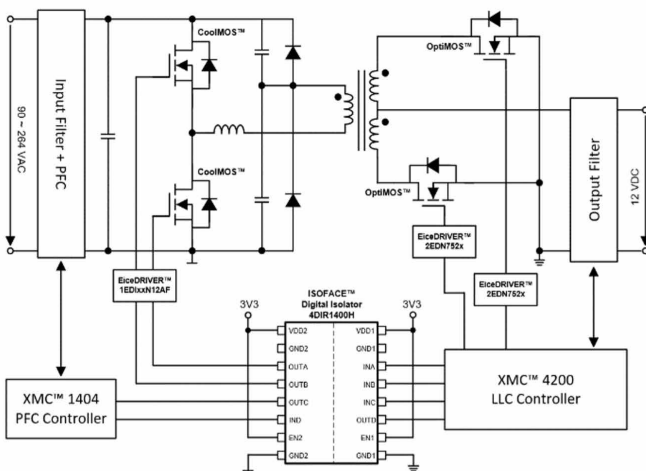
### 4DIR140xH with 3 forward and 1 reverse data channels



## Features and benefits

| Key features  |
|---|
| - High CMTI > 100 V/μs                                      |
| - Wide supply voltage range 2.7 V ~ 6.5 V (abs. max. 7.5 V) |
| - Active high enable logic level for the output on Side 1   |
| - Typical propagation delay 26 ns with -4/+6 ns spread      |
| - Low fail-safe default output state                        |
| - Both component and system-level certification             |
| - Pin-to-pin compatibility                                  |

| Key benefits   |
|--|
| - High immunity against system noise                     |
| - Reliable performance in UART/CAN and SPI communication |
| - Output enable function for system level protection     |
| - For high system power efficiency                       |
| - Reliable low default output state in case of failures  |
| - Simplified system certification process                |
| - For easy device replacement and alternative sourcing   |



Infineon ISOFACE™ quad-channel digital isolators 4DIR1400H can be used for HV DC-DC Converter in PSU for telecom and server. The quad-channel digital isolator controls the primary LLC converter indirectly and communicates with the PFC controller through the reinforced isolation barrier. Two data channels are used to transfer the half-bridge PWM control signals (HS and LS). The remaining two data channels are used for UART communication between the primary-side PFC controller and the secondary-side LLC controller. The default low output state ensures the safe turn-off of the half-bridge MOSFETs in any fault condition.





# Infineon support for digital isolators

## Useful links and helpful information

Further information, datasheets and documents

[www.infineon.com/digitalisolators](http://www.infineon.com/digitalisolators)



Support



Evaluation board



Tools



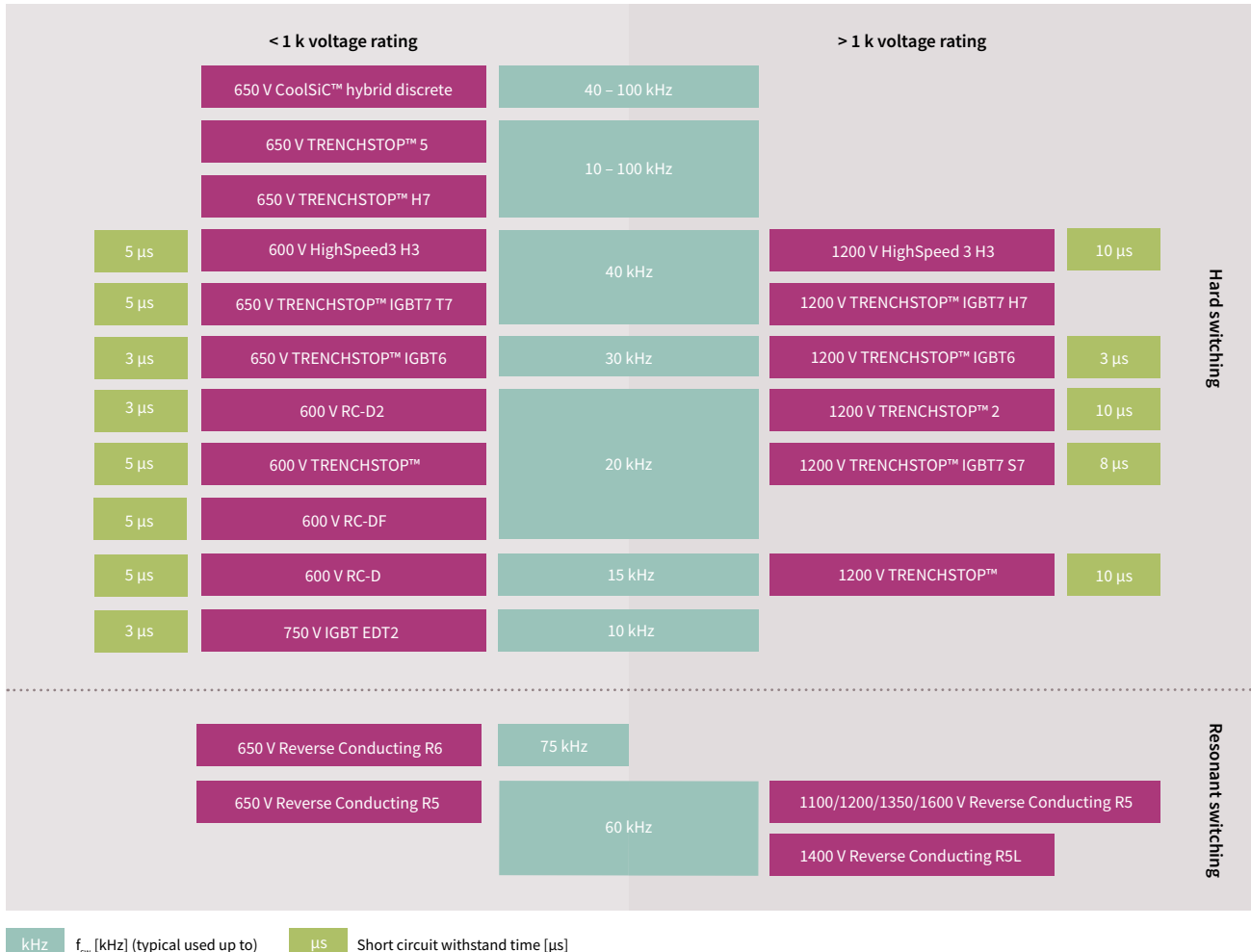
## Discrete IGBTs and silicon power diodes

- Discrete IGBTs
- 650 V - 1200 V TRENCHSTOP™ IGBT7 T7, H7 and S7
- 1200 V and above IGBT families
- 650 V TRENCHSTOP™ IGBTs
- Lower power drive IGBT portfolio
- 650 V Reverse Conducting R6 IGBT
- TRENCHSTOP™ 5 advanced isolation
- TRENCHSTOP™ 5 selection tree
- IGBT selection tree
- Discrete IGBTs product portfolio
- Silicon power diodes
- CoolSiC™ hybrid devices portfolio
- Discrete IGBT nomenclature
- Silicon power diodes nomenclature

# Discrete IGBTs

## Market leadership through groundbreaking innovation and application focus

Resolute to achieve the highest standards in performance and quality, Infineon offers a comprehensive portfolio of application-specific discrete IGBTs. From 600 V up to 1600 V, we offer a wide range of IGBT voltage classes to meet different voltage requirements in each application.



[www.infineon.com/igbt discret es](http://www.infineon.com/igbt discret es)  
[www.infineon.com/gatedriver](http://www.infineon.com/gatedriver)

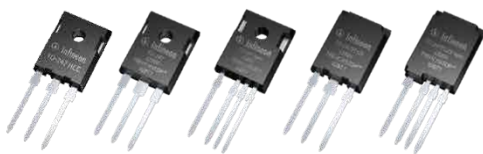
# It's time to SWITCH!

Infiniteon has revolutionized the world of IGBTs with the 7<sup>th</sup> generation of TRENCHSTOP™ IGBTs, designed with the latest micro-pattern trench technology. This advanced technology offers unparalleled control and performance, resulting in significant loss reduction, improved efficiency, and increased power density in your applications.

## 650 V - 1200 V TRENCHSTOP™ IGBT7 T7, H7 and S7

The 7<sup>th</sup> generation of TRENCHSTOP™ IGBTs sets a new benchmark in the world of discrete IGBT and diode technology. With its outstanding performance, it is the fastest IGBT on the market and boasts the highest power density with current rating devices up to 150 A. For the first time ever, this technology is now available in the 650 and 1200 V discrete IGBT market.

### Fulfilling the needs of decarbonization and industry 4.0



## IGBT7

2 voltage classes 650 V and 1200 V  
3 flavours T7, H7 and S7  
5 Packages



Produced in 300 mm fab  
Enabling future growth

The extensive portfolio of 650 V/1200 V TRENCHSTOP™ IGBT7 T7, H7 and S7 is specifically designed to meet the demands of various applications, including solar photovoltaic, uninterruptible power supplies, battery chargers, and industrial drives. This unique discrete offering provides a high current rating portfolio up to 150 A in four different package types, with conduction parameter  $V_{(CE)sat}$  50% lower compared to previous generations and switching losses up to 84% lower.

### Dynamic requirements

## IGBT7



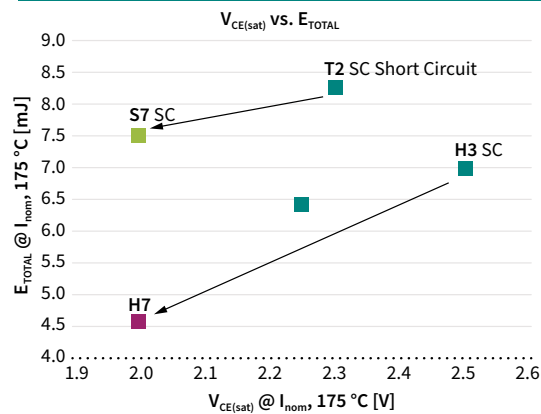
Harsh environments

Critical operation profiles

Long operation hours

Higher power density

### 1200 V IGBTs key parameters



## Make the switch today and revolutionize your applications!

Don't miss out on this opportunity to upgrade your applications with the latest and greatest in IGBT technology. The 7<sup>th</sup> generation of TRENCHSTOP™ IGBTs offers unparalleled performance and efficiency, making it the perfect choice for any application looking to take their power and performance to the next level. Make the switch today!

[www.infineon.com/discreteIGBT7](http://www.infineon.com/discreteIGBT7)

[www.infineon.com/igbtDiscretes](http://www.infineon.com/igbtDiscretes)

[www.infineon.com/gatedriver](http://www.infineon.com/gatedriver)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

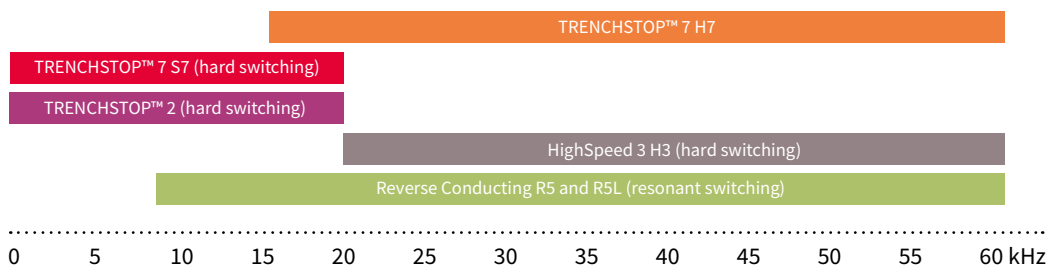


# 1200 V and above IGBT families

The 7<sup>th</sup> generation of TRENCHSTOP™ IGBTs, known as 650 V IGBT T7 and H7 and 1200 V IGBT7 H7 and S7, are setting new standards in the market. With its unparalleled speed, it is the fastest IGBT currently available. Furthermore, the IGBT7 boasts a remarkable power density, making it a top performer in terms of efficiency and performance. As a direct replacement for all previous industrial IGBT generations, including the high-voltage TRENCHSTOP™ T2 and HighSpeed 3 H3 series, these devices are an excellent choice for those looking to upgrade their technology and improve their system's overall performance.

The Reverse Conducting R5 and R5L are the latest generations in the RC-H series of reverse conducting IGBT. With a monolithically integrated diode, they offer optimized performance for resonant switching applications such as induction cooking. R5 devices are available in 1100 V, 1200 V, 1350 V and 1600 V blocking voltage while R5L devices are available in 1400 V blocking voltage.

EiceDRIVER™ isolated gate driver like X3 Compact family and EiceDRIVER™ 1200 V level shift gate driver family are perfect match for the 1200 V IGBT in motor control, general purpose inverter, solar, and UPS applications. EiceDRIVER™ low-side gate driver with over current protection is widely used in induction cooking application.



|                                      |  |   |
|--------------------------------------|--|---|
| <b>Reverse Conducting R5 and R5L</b> | <b>World-class Reverse Conducting RC-H products</b> <ul style="list-style-type: none"> <li>– High performance and low losses</li> </ul>  | <b>Induction cooking Resonant switching</b> <ul style="list-style-type: none"> <li>– Medium to high frequency converters</li> </ul> |
| <b>TRENCHSTOP™ 7 H7</b>              | <ul style="list-style-type: none"> <li>– High speed/high power IGBT</li> <li>– First tailless/low-loss IGBT on market</li> <li>– Market proven and recognized quality leader</li> </ul>                                      | <b>Solar, ESS, UPS, welding</b> <ul style="list-style-type: none"> <li>– Medium frequency converters</li> </ul>                     |
| <b>TRENCHSTOP™ IGBT7 S7</b>          | <ul style="list-style-type: none"> <li>– New low switching losses and high power IGBTs</li> <li>– Optimized for operation up to 20 kHz</li> <li>– Best-in-class <math>V_{CE(sat)}</math> and low switching losses</li> </ul> | <ul style="list-style-type: none"> <li>– Industrial drives, solar, HVAC</li> <li>– Low/medium frequency converters</li> </ul>       |

[www.infineon.com/rch5](http://www.infineon.com/rch5)

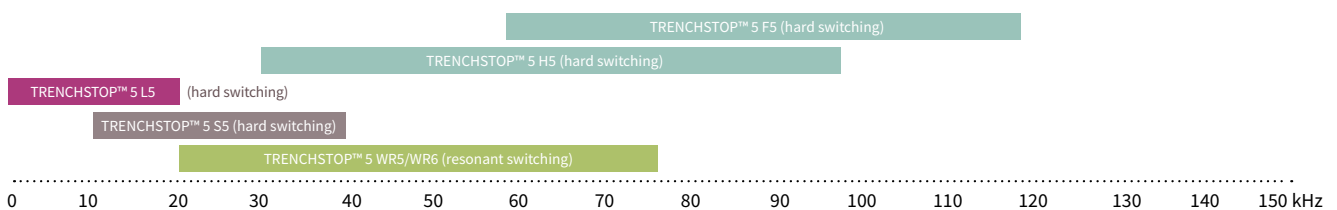
[www.infineon.com/discreteigt7](http://www.infineon.com/discreteigt7)

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# 650 V TRENCHSTOP™ 5 IGBT

Ideally suited for customers who are looking for outstanding efficiency and power density, the **TRENCHSTOP™ 5** is optimized to comprehend various switching frequencies. Wafer thickness has been reduced by more than 25 percent, which enables a dramatic improvement in both switching and conduction losses while providing an increased breakthrough voltage of 650 V. Based on the **TRENCHSTOP™ 5** IGBT technology, Infineon has developed six different product families targeting specific applications, allowing designers to optimize for high efficiency, system cost or reliability demands of the market. The quantum leap of efficiency improvement provided by the **TRENCHSTOP™ 5** IGBT families opens up new opportunities for designers to explore. **EiceDRIVER™** isolated gate driver such as the X3 Compact family which is perfect for 650 V IGBTs in solar and UPS applications. **EiceDRIVER™** low side gate driver with overcurrent protection is widely used in induction cooking application and PFC stage.



|                            |  |  |
|----------------------------|--|--|
| <b>TRENCHSTOP™ 5 L5</b>    | <b>Best-in-class IGBT</b><br><b>low <math>V_{CE(sat)}</math> IGBT</b><br>– $V_{CE(sat)}$ IGBT – 1.05 V<br>– Best trade-off $V_{CE(sat)}$ $V_{SS}$ $E_{ts}$ for frequencies below 20 kHz  | <b>Solar, UPS, welding</b><br>– Ultra-low frequency converters<br>– Three-level inverter type I NPC 1 and NPC 2<br>– Modified HERIC inverter<br>– AC output (aluminum/magnesium welding) |
| <b>TRENCHSTOP™ 5 S5</b>    | <b>Best-in-class ease-of-use IGBT</b><br>Elimination of:<br>– Collector-emitter snubber capacitor and gate capacitor in low inductance designs (<100 nH)<br>– Softer switching than <b>TRENCHSTOP™ 5 H5</b>  | <b>UPS, battery charger, solar, welding</b><br>– Medium frequency converters<br>– Multilevel inverter stages<br>– Output stages<br>– PFC   |
| <b>TRENCHSTOP™ 5 H5/F5</b> | <b>Best-in-class high frequency IGBT</b><br>– Bridge to SJ MOSFET performance<br>– Highest efficiency, especially under light load conditions  | <b>UPS, solar, welding</b><br>– High frequency converters<br>– Multilevel inverter stages<br>– Output stages<br>– PFC  |
| <b>TRENCHSTOP™ 5 WR5</b>   | <b>Price optimized reverse conducting <b>TRENCHSTOP™ 5</b> with an optimized monolithically integrated diode tailored for specific hard switching applications</b><br>– Monolithic diode optimized for PFC and welding applications<br>– Excellent $R_c$ controllability<br>– Perfect fit to mainstream design for 20 kHz < fsw < 60 kHz | <b>Air conditioning, welding</b><br>– RAC/CAC PFC outdoor compressor<br>– Compact/portable welding<br>– Light-medium industrial welding  |
| <b>TRENCHSTOP™ 5 WR6</b>   | <b>Outstanding price/performance ratio with the latest 650 V reverse-conducting IGBT in the new high creepage TO-247-3 package</b><br>– Very low $V_{CE(sat)}$ of 1.45 V @25°C<br>– High creepage and clearance TO-247 package<br>– Optimized for full-rated hard switching turn-off   | <b>Air conditioning, welding</b><br>– RAC/CAC PFC outdoor compressor<br>– Compact/portable welding<br>– Light-medium industrial welding  |

[www.infineon.com/trenchstop5](http://www.infineon.com/trenchstop5)  
[www.infineon.com/gatedriver](http://www.infineon.com/gatedriver)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



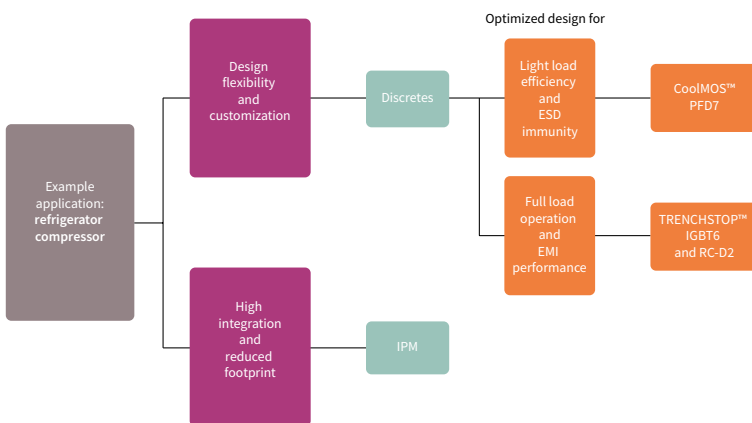
# Lower power drive IGBT portfolio

## 650 V TRENCHSTOP™ IGBT6 and 600 V RC-D2

Motor drives up to 1 kW are used in a wide variety of applications, from home appliance fans and compressors to pumps. The market for these products demands design flexibility, EMI performance, and easy controllability. Therefore, these compact motors require power electronics with the lowest losses and best thermal performance. The TRENCHSTOP™ IGBT6 family of discrete devices has been designed for the lowest switching losses, which is particularly important in systems with higher switching frequencies (up to 30 kHz). Additionally, the IGBTs are co-packed with the soft, fast-recovery Rapid 1 anti-parallel diodes for the lowest total losses. With a higher blocking voltage at 650 V, and short-circuit rating, TRENCHSTOP™ IGBT6 is a key contributor to robust motor designs.

The new RC-D2 family of discrete devices has been cost-optimized in surface-mounted packages. The device contains a monolithically integrated diode and has HV-H3TRB ruggedness capability. With a blocking voltage at 600 V, and 3 μs short-circuit rating, the RC-D2 is a key contributor to cost-effective motor designs.

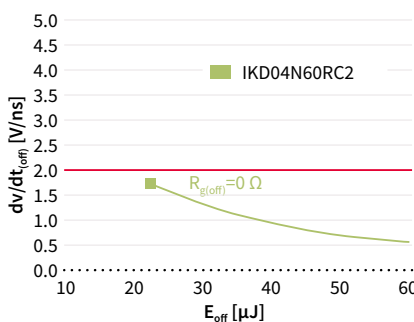
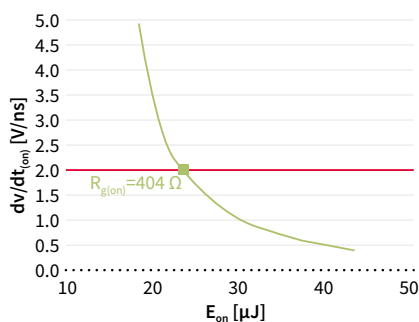
### Switch selection for low power drives < 300 W



### Features and benefits

| Key features   | Key benefits                               |
|--|--|
| - Available in surface-mounted packages                    | - Enable space limited application         |
| - IGBT6 co-packed with and without diodes (DPAK, TO-220FP) | - Performance improvement                  |
| - RC-D2 monolithically integrated diode (DPAK, SOT-223)    | - Cost-optimized solution                  |
| - SC rating up to 3 μs                                     | - SC protection                            |
| - Low EMI due to easy controllability                      | - No need for additional components on PCB |

### EMI performance



- $R_{g(on)}$  and  $R_{g(off)}$  are selected to meet  $dv/dt$  of 2 V/ns at 500 mA and  $T_j$  of 100°C
- IGBTs (IKD04N60RC2) are easily controllable by optimizing  $R_g$  values
- EMI performance can be enhanced with additional passive components

[www.infineon.com/IGBT6](http://www.infineon.com/IGBT6)  
[www.infineon.com/rcd2](http://www.infineon.com/rcd2)  
[www.infineon.com/gatedriver](http://www.infineon.com/gatedriver)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





# Reverse Conducting for soft-switching applications

## 650 V Reverse Conducting R6 IGBT in TO-247 package

The 650 V R6 IGBT offers the lowest  $V_{CE(sat)}$  and optimized  $E_{off}$  for best efficiency, minimized power losses and cooling effort. The good EMI behavior simplifies filtering design, reduces system costs and effort for the designers. Thanks to the best system performances and high compatibility with the existing gate driver solution, 650 V R6 IGBT represents the optimal choice for soft switching topologies.

### Features and benefits

| Key features   | Key benefits  |
|--|---|
| <ul style="list-style-type: none"> <li>– Very low <math>V_{CE(sat)}</math> and low <math>E_{off}</math></li> </ul> | <ul style="list-style-type: none"> <li>– Lowest losses on IGBT, high system efficiency for higher power output</li> </ul> |
| <ul style="list-style-type: none"> <li>– High ruggedness and stable temperature behavior</li> </ul>                | <ul style="list-style-type: none"> <li>– Fast and easy replacement of predecessor R5 portfolio</li> </ul>                 |
| <ul style="list-style-type: none"> <li>– Maximum operating <math>T_j</math> of 175 °C</li> </ul>                   | <ul style="list-style-type: none"> <li>– High device reliability</li> <li>– Good EMI behavior</li> </ul>                  |

## Package innovations

### Discrete IGBT package overview

Infineon discrete IGBT package portfolio contains SMD (surface mount device) packages, for example, D2PAK, DPAK, SOT-223, and through-hole packages, for example, TO-220, TO-220 FP, TO-247, TO-247-3-HCC, TO-247-4, TO-247-4 asymmetric (650V, 1200V; 76-136 A), TO-247PLUS, TO-247PLUS-4, and TO-247 advanced isolation packages. It provides discrete IGBTs solutions with and without anti-parallel diode, which is an excellent fit to use in industrial, home appliance, and automotive applications.

|  | SOT-223 SMD                                  | TO-252 (DPAK) | TO-263 (D2PAK) | TO-220 | TO-220 FullPAK | TO-247 | TO-247 4-pin | TO-247PLUS | TO-247PLUS 4-pin | TRENCHSTOP™ advanced isolation TO-247      | TO-247-3-HCC |
|--|--|---------------|----------------|--------|----------------|--------|--------------|------------|------------------|--|--------------|
| Package options  |  |               |                |        |                |        |              |            |                  |  |              |
| Voltage class  | 600 V, 650 V, 1100 V, 1200 V, 1350 V, 1600 V |               |                |        |                |        |              |            |                  | 600 V, 650 V                               | 650 V        |
| Configuration  | DuoPack (with diode), single IGBTs           |               |                |        |                |        |              |            |                  | DuoPack IGBTs with diode and single diodes |              |
| Continuous collector current $T_c = 100^\circ\text{C}$ | 3-120 A                                      |               |                |        |                |        |              |            |                  | 40-90 A                                    | 20 -70 A     |

[www.infineon.com/rch6](http://www.infineon.com/rch6)  
[www.infineon.com/latest-discrete-packages](http://www.infineon.com/latest-discrete-packages)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# TRENCHSTOP™ advanced isolation

## Fully isolated TO-247 package with industry leading IGBTs

TRENCHSTOP™ advanced isolation solution breaks the limits reached by traditional packaging and isolation techniques. This new isolated package enables the highest power density, the best performance and the lowest cooling effort thanks to an effective and reliable thermal path from the IGBT die to the heatsink.

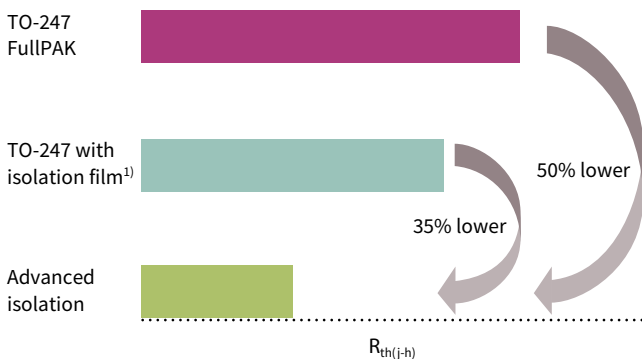
In addition to providing 100 percent electrical isolation, TRENCHSTOP™ advanced isolation also eliminates the need for thermal grease or thermal interface sheets. The new package delivers at least 35 percent lower thermal resistivity, helping designers to increase power density, as well as lower system complexity and assembling costs.

This new package solution allows industrial and home appliance designs to fully utilize the high performance of TRENCHSTOP™ IGBTs without compromises for isolation and cooling.

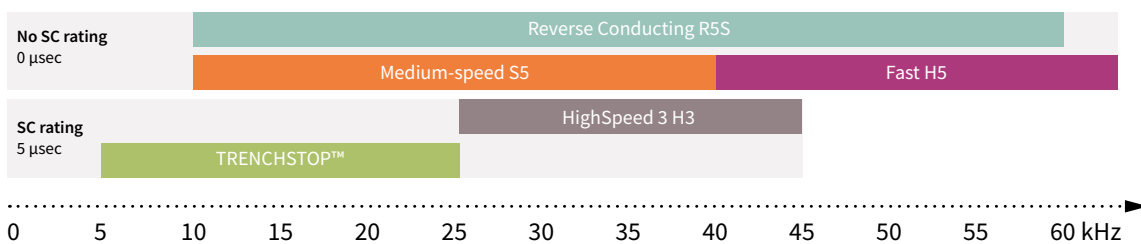
### Features and benefits

| Key features  | Key benefits  |
|---|---|
| - 2500 V <sub>RMS</sub> electrical isolation, 50/60 Hz, t = 1 min | - Up to 35 percent reduction in assembly time reduces manufacturing cost    |
| - 100 percent tested isolated mounting surface                    | - Increased power density   |
| - Lowest R <sub>th(j-h)</sub>                                     | - Improved reliability from higher yield and no isolation film misalignment |
| - Low coupling capacitance, 38 pF                                 | - Less EMI filter design effort   |
| - No need for isolation film or thermal interface material        | - Decreased heatsink size   |

### Thermal resistivity of package and isolation types

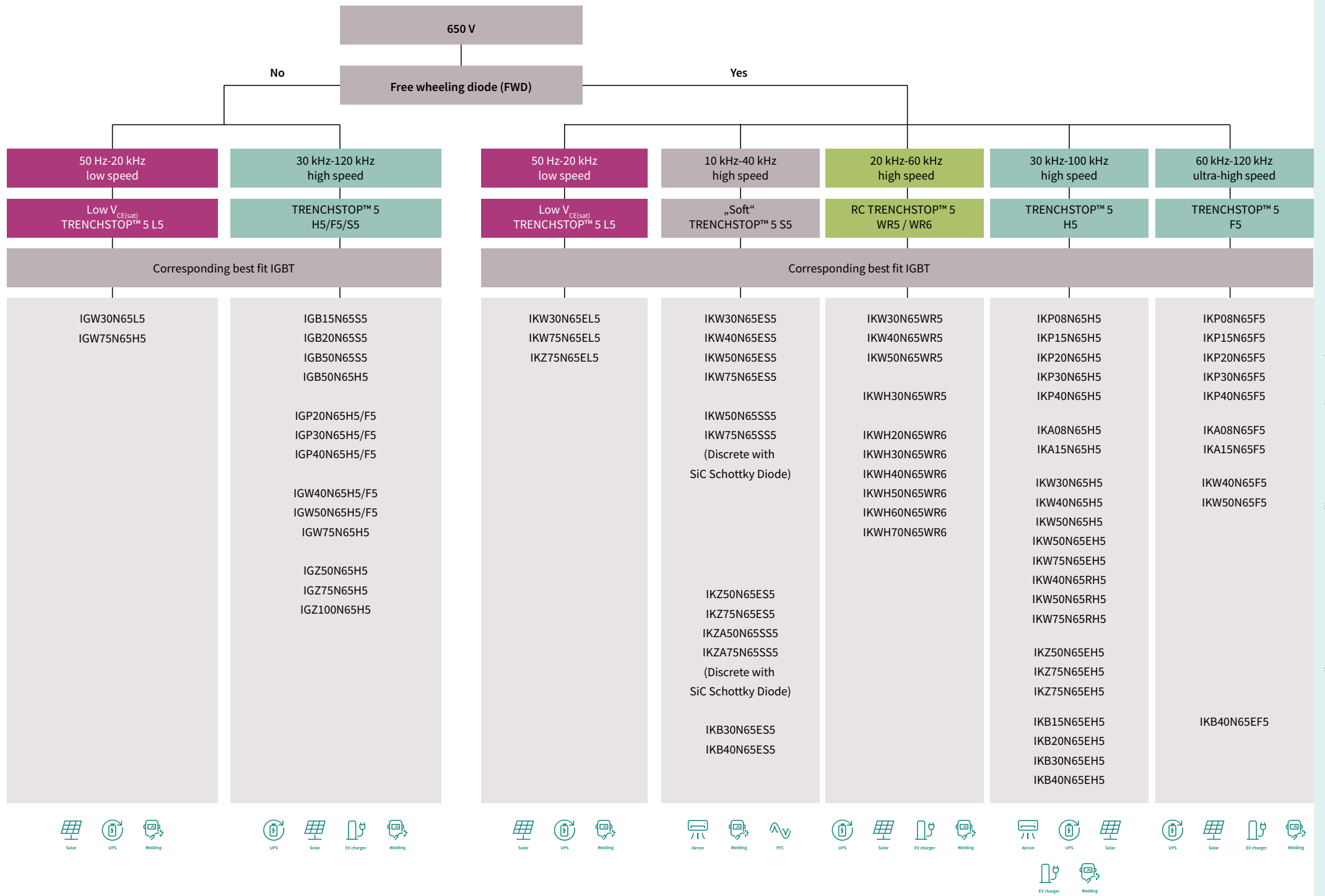


1) Isolation material: standard polyimide based reinforced carrier insulator film with 152 µm thickness, 1.3 W/mK thermal conductivity

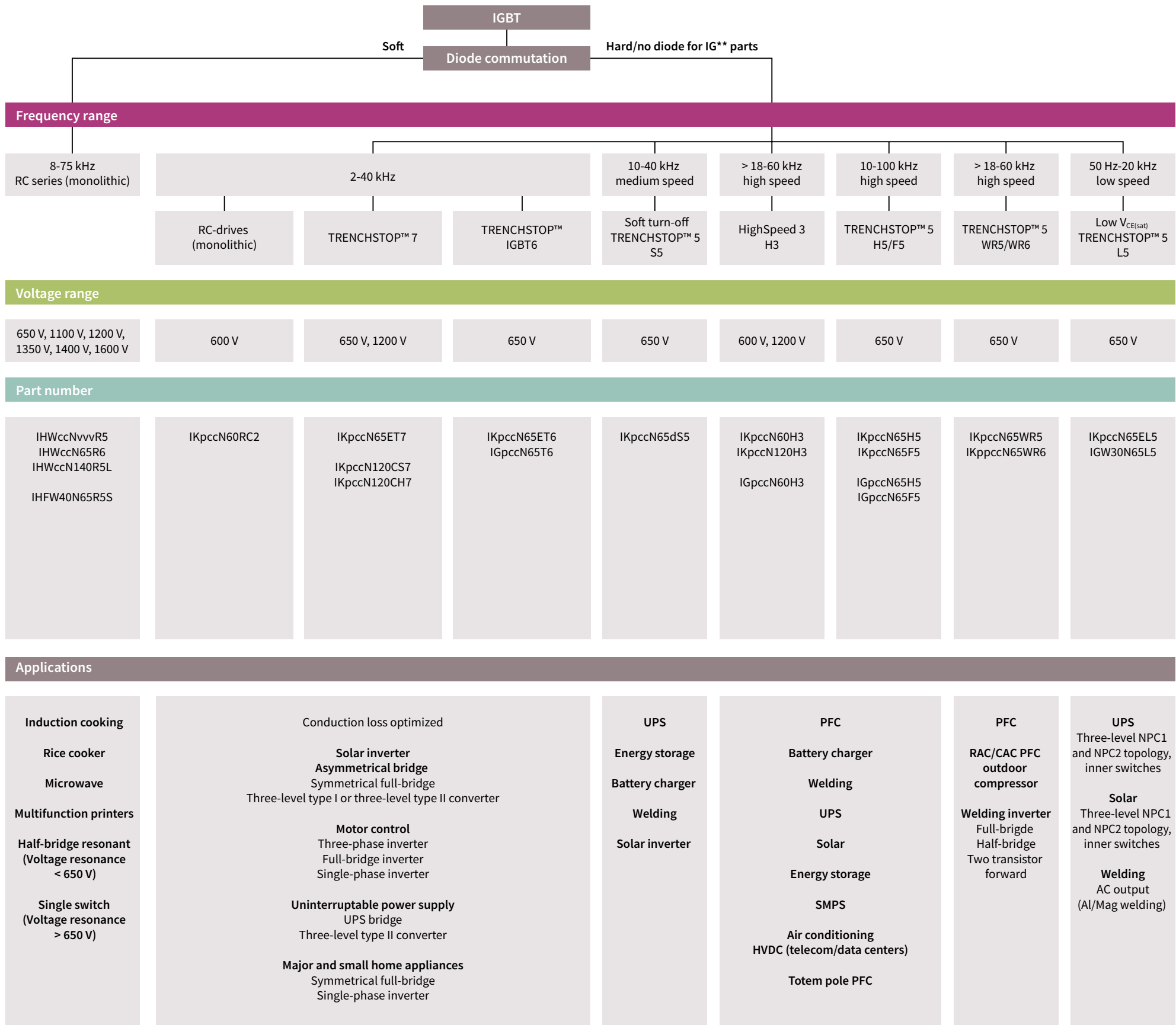


[www.infineon.com/advanced-isolation](http://www.infineon.com/advanced-isolation)  
[www.infineon.com/gatedriver](http://www.infineon.com/gatedriver)

# TRENCHSTOP™ 5 selection tree



# IGBT selection tree



## TRENCHSTOP™ and RC-D2 drives

600 V/650 V product family together with 650 V SOI gate driver family



|                | Continuous collector current @ T <sub>c</sub> =100°C [A] | TO-251 (IPAK) | TO-252 (DPAK)              | TO-263 (D <sup>2</sup> PAK) | TO-220    | TO-247 advanced isolation | TO-220 FullPAK | TO-247    | TO-247PLUS/ Super 247 (TO-247AA) | SOT-223     |
|----------------|--|---------------|----------------------------|-----------------------------|-----------|---------------------------|----------------|-----------|----------------------------------|-------------|
| Single IGBT    | 4  | IGU04N60T     |                            |                             |           |                           |                |           |                                  |             |
|                | 6  |               | IGD06N60T<br>IGD06N65T6    |                             | IGP06N60T |                           |                |           |                                  |             |
|                | 10   |               | IGD10N65T6                 | IGB10N60T                   | IGP10N60T |                           |                |           |                                  |             |
|                | 15   |               | IGD15N65T6                 | IGB15N60T                   | IGP15N60T |                           |                |           |                                  |             |
|                | 30   |               |                            | IGB30N60T                   |           |                           |                | IGW30N60T |                                  |             |
|                | 40   |               |                            |                             |           |                           |                |           |                                  |             |
|                | 50   |               |                            | IGB50N60T                   | IGP50N60T |                           |                | IGW50N60T |                                  |             |
|                | 75   |               |                            |                             |           |                           |                | IGW75N60T |                                  |             |
| IGBT and diode | 1  |               |                            |                             |           |                           |                |           |                                  | IKN01N60RC2 |
|                | 3  |               |                            |                             |           |                           |                |           |                                  | IKN03N60RC2 |
|                | 4  |               | IKD04N60RC2                |                             | IKP04N60T |                           |                |           |                                  | IKN04N60RC2 |
|                | 6  |               | IKD06N60RC2<br>IKD06N65ET6 | IKB06N60T                   | IKP06N60T |                           | IKA06N60T      |           |                                  | IKN06N60RC2 |
|                | 8  |               | IKD08N65ET6                |                             |           |                           |                |           |                                  |             |
|                | 10   |               | IKD10N60RC2                | IKB10N60T                   | IKP10N60T |                           | IKA10N60T      |           |                                  |             |
|                | 15   |               | IKD15N60RC2                | IKB15N60T                   | IKP15N60T |                           | IKA15N60T      |           |                                  |             |
|                | 20   |               |                            | IKB20N60T                   | IKP20N60T |                           |                |           | IKW20N60T                        |             |
|                | 30   |               |                            |                             |           |                           |                |           | IKW30N60T                        |             |
|                | 40   |               |                            |                             |           |                           |                |           |                                  |             |
|                | 50   |               |                            |                             |           |                           | IKFW50N60ET    |           | IKW50N60T                        |             |
|                | 75   |               |                            |                             |           |                           | IKFW75N60ET    |           | IKW75N60T                        |             |
|                | 100  |               |                            |                             |           |                           |                |           | IKQ100N60T                       |             |
|                | 120  |               |                            |                             |           |                           |                |           | IKQ120N60T                       |             |



## TRENCHSTOP™ IGBT6

650 V product family together with 650 V SOI gate driver family



| Continuous collector current @ T <sub>c</sub> =100°C [A] | TO-252 (DPAK)             | TO-220 FullPAK |
|--|---------------------------|----------------|
| 6  | IKD06N65ET6<br>IGD06N65T6 |                |
| 8  | IKD08N65ET6               | IKA08N65ET6    |
| 10   | IGD10N65T6                | IKA10N65ET6    |
| 15   | IGD15N65T6                | IKA15N65ET6    |

## TRENCHSTOP™ IGBT7 S7

1200 V product family together with isolated driver and 1200 V level-shift driver family



| Continuous collector current @ T <sub>c</sub> =100°C [A] | TO-247 | TO-247PLUS 3-pin | TO-247 4-pin  |
|--|--------|------------------|---------------|
| Single IGBT  | 40     |                  | IKZA40N120CS7 |
|  | 75     |                  | IQ75N120S7    |
|  | 100    |                  | IQ100N120S7   |
|  | 120    |                  | IQ120N120S7   |
| DuoPack  | 8      | IKW08N120CS7     |               |
|  | 15     | IKW15N120CS7     |               |
|  | 25     | IKW25N120CS7     |               |
|  | 40     | IKW40N120CS7     |               |
|  | 50     | IKW50N120CS7     |               |
|  | 75     |                  | IQ75N120CS7   |
|  | 100    |                  | IQ100N120CS7  |
|  | 120    |                  | IQ120N120CS7  |

## TRENCHSTOP IGBT7 T7

Together with isolated driver, 650 V SOI driver, and low-side driver family



| Continuous collector current @ T <sub>c</sub> =100°C [A] | TO-247-3 |             |
|--|----------|-------------|
| DuoPack  | 20       | IKW20N65ET7 |
|  | 30       | IKW30N65ET7 |
|  | 40       | IKW40N65ET7 |
|  | 50       | IKW50N65ET7 |
|  | 75       | IKW75N65ET7 |

## TRENCHSTOP™ IGBT7 H7

1200 V product family together with isolated driver and 1200 V level-shift driver family



| Continuous collector current @ T <sub>c</sub> =100°C [A] | TO247-3      | TO-247 4-pin assymetric | TO-247PLUS 3-pin | TO-247PLUS 4-pin |
|--|--------------|-------------------------|------------------|------------------|
| 40   | IKW40N120CH7 | IKZA40N120CH7           |                  |                  |
| 50   | IKW50N120CH7 | IKZA50N120CH7           | IKQ50N120CH7     | IKY50N120CH7     |
| 75   | IKW75N120CH7 | IKZA75N120CH7           | IKQ75N120CH7     | IKY75N120CH7     |
| 100  |              |                         | IKQ100N120CH7    | IKY100N120CH7    |
| 120  |              |                         | IKQ120N120CH7    | IKY120N120CH7    |
| 140  |              |                         | IKQ140N120CH7    | IKY140N120CH7    |

[www.infineon.com/igbt6](http://www.infineon.com/igbt6)

[www.infineon.com/discreteigbt7](http://www.infineon.com/discreteigbt7)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our product support.



## Reverse Conducting IGBTs



| Continuous collector current @ T <sub>c</sub> =100°C [A] | TO-247 advanced isolation (Hal) | TO-247 (Hal)             |             |             |             |              |             |
|--|---------------------------------|--------------------------|-------------|-------------|-------------|--------------|-------------|
|  |                                 | 650 V                    | 1100 V      | 1200 V      | 1350 V      | 1400 V       | 1600 V      |
| 20   |                                 | IHW20N65R5*              |             | IHW20N120R5 | IHW20N135R5 | IHW20N140R5L |             |
| 25   |                                 |                          |             |             |             | IHW25N140R5L |             |
| 30   |                                 | IHW30N65R6<br>IHW30N65R5 | IHW30N110R5 | IHW30N120R5 | IHW30N135R5 | IHW30N140R5L | IHW30N160R5 |
| 40   | IHFV40N65R5S                    | IHW40N65R6<br>IHW40N65R5 |             | IHW40N120R5 | IHW40N135R5 | IHW40N140R5L |             |
| 50   |                                 | IHW50N65R6<br>IHW50N65R5 |             |             |             |              |             |

## 600 V HighSpeed 3 H3

Together with isolated driver, 650 V SOI driver, and low-side driver family



| Continuous collector current @ T <sub>c</sub> =100°C [A] | TO-263 (D <sup>2</sup> PAK) (Hal) | TO-220 (Hal) | TO-247 advanced isolation (Hal) | TO-247 (Hal) |
|--|-----------------------------------|--------------|---------------------------------|--------------|
|  |                                   |              |                                 |              |
| 20   | IGB20N60H3                        | IGP20N60H3   |                                 | IGW20N60H3   |
| 30   | IGB30N60H3                        | IGP30N60H3   |                                 | IGW30N60H3   |
| 40   |                                   |              |                                 | IGW40N60H3   |
| 50   |                                   |              |                                 | IGW50N60H3   |
| 60   |                                   |              |                                 | IGW60N60H3   |
| 75   |                                   |              |                                 | IGW75N60H3   |
| 100  |                                   |              |                                 | IGW100N60H3  |
| <b>Duo-Pack</b>  |                                   |              |                                 |              |
| 20   | IKB20N60H3                        | IKP20N60H3   |                                 | IKW20N60H3   |
| 30   |                                   |              |                                 | IKW30N60H3   |
| 40   |                                   |              | IKFW40N60DH3E                   | IKW40N60H3   |
| 50   |                                   |              | IKFW50N60DH3E<br>IKFW50N60DH3   | IKW50N60H3   |
| 60   |                                   |              | IKFW60N60DH3E<br>IKFW60N60EH3   | IKW60N60H3   |
| 75   |                                   |              |                                 | IKW75N60H3   |
| 90   |                                   |              | IKFW90N60EH3                    |              |

## CoolSiC™ hybrid discrete

| Continuous collector current @ T <sub>c</sub> =100°C [A] |                                       | TO-247 3-pin |             | TO-247 4-pin |  |
|--|---------------------------------------|--------------|-------------|--------------|--|
| DuoPack  | TRENCHSTOP™ 5 H5 + „half“ rated diode | 40           | IKW40N65RH5 | IKZA40N65RH5 |  |
|  |                                       | 50           | IKW50N65RH5 | IKZA50N65RH5 |  |
|  |                                       | 75           | IKW75N65RH5 | IKZA75N65RH5 |  |
|  | TRENCHSTOP™ 5 S5 + „full“ rated diode | 50           | IKW50N65SS5 | IKZA50N65SS5 |  |
|  |                                       | 75           | IKW75N65SS5 | IKZA75N65SS5 |  |

For the CoolSiC™ MOSFET portfolio and our broad WBG offering, please check the [Wide bandgap semiconductors](#) chapter.

- [www.infineon.com/rch5](http://www.infineon.com/rch5)
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- [www.infineon.com/advanced-isolation](http://www.infineon.com/advanced-isolation)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## TRENCHSTOP™ 5 F5, H5 and S5

Together with isolated driver, 650 V SOI driver, and low-side driver family



| Continuous collector current @ T <sub>c</sub> =100°C [A] |    | TO-263 (D <sup>2</sup> PAK) | TO-220                | TO-247 advanced isolation | TO-220 FullPAK        | TO-247                | TO-247 4-pin          |             |
|--|----|-----------------------------|-----------------------|---------------------------|-----------------------|-----------------------|-----------------------|-------------|
| IGBT   | 15 | IGB15N65S5                  |                       |                           |                       |                       |                       |             |
|  | 20 | IGB20N65S5                  | IGP20N65F5/IGP20N65H5 |                           |                       |                       |                       |             |
|  | 30 |                             | IGP30N65F5/IGP30N65H5 |                           |                       |                       |                       |             |
|  | 40 |                             | IGP40N65F5/IGP40N65H5 |                           |                       | IGW40N65F5/IGW40N65H5 |                       |             |
|  | 50 | IGB50N60H5                  |                       |                           |                       |                       | IGW50N65F5/IGW50N65H5 | IGZ50N65H5  |
|  |    | IGB50N60S5                  |                       |                           |                       |                       |                       |             |
|  | 75 |                             |                       |                           |                       | IGW75N65H5            | IGZ75N65H5            |             |
| 100  |    |                             |                       |                           |                       | IGZ100N65H5           |                       |             |
| DuoPack  | 8  |                             | IKP08N65F5/IKP08N65H5 |                           | IKA08N65F5/IKA08N65H5 |                       |                       |             |
|  | 15 | IKB15N65EH5                 | IKP15N65F5/IKP15N65H5 |                           | IKA15N65F5/IKA15N65H5 |                       |                       |             |
|  | 20 | IKB20N65EH5                 | IKP20N65H5/IKP20N65F5 |                           |                       |                       |                       |             |
|  | 28 |                             | IKP28N65ES5           |                           |                       |                       |                       |             |
|  | 30 | IKB30N65EH5                 | IKP30N65H5/IKP30N65F5 |                           |                       |                       | IKW30N65H5            |             |
|  |    | IKB30N65ES5                 |                       |                           |                       |                       | IKW30N65ES5           |             |
|  | 39 |                             | IKP39N65ES5           |                           |                       |                       |                       |             |
|  | 40 | IKB40N65ES5                 | IKP40N65F5/IKP40N65H5 | IKFW40N65DH5              |                       |                       | IKW40N65F5/IKW40N65H5 |             |
|  |    | IKB40N65EH5                 |                       |                           |                       |                       | IKW40N65ES5           |             |
|  |    | IKB40N65EF5                 |                       |                           |                       |                       |                       |             |
|  | 50 |                             |                       | IKFW50N65ES5              |                       |                       | IKW50N65F5/IKW50N65H5 | IKZ50N65EH5 |
|  |    |                             |                       | IKFW50N65DH5              |                       |                       | IKW50N65EH5           | IKZ50N65ES5 |
|  |    |                             | IKFW50N65EH5          |                           |                       | IKW50N65ES5           |                       |             |
| 60   |    |                             | IKFW60N65ES5          |                           |                       |                       |                       |             |
| 75   |    |                             | IKFW75N65ES5          |                           |                       | IKW75N65EH5           | IKZ75N65EH5           |             |
|  |    |                             | IKFW75N65EH5          |                           |                       | IKW75N65ES5           |                       |             |
| 90   |    |                             | IKFW90N65ES5          |                           |                       |                       |                       |             |

## TRENCHSTOP™ 5 L5 low V<sub>CE(sat)</sub>

650 V product family together with low-side driver family



| Continuous collector current @ T <sub>c</sub> =100°C [A] |    | TO-251 (IPAK) | TO-252 (DPAK) | TO-263 (D <sup>2</sup> PAK) | TO-220 | TO-262 (I <sup>2</sup> PAK) | TO-220 FullPAK | TO-247      | TO-247 4-pin |
|--|----|---------------|---------------|-----------------------------|--------|-----------------------------|----------------|-------------|--------------|
| IGBT   | 30 |               |               |                             |        |                             |                | IGW30N65L5  |              |
| Duo-Pack   | 30 |               |               |                             |        |                             |                | IKW30N65EL5 |              |
|  | 75 |               |               |                             |        |                             |                | IKW75N65EL5 | IKZ75N75EL5  |

## TRENCHSTOP™ 5 WR5/WR6

650 V product family together with low-side driver family



| Continuous collector current @ T <sub>c</sub> =100°C [A] |    | TO-247      | TO-247 HCC                |
|--|----|-------------|---------------------------|
| DuoPack  | 20 |             | IKWH20N65WR6              |
|  | 30 | IKW30N65WR5 | IKWH30N65WR5/IKWH30N65WR6 |
|  | 40 | IKW40N65WR5 | IKWH40N65WR6              |
|  | 50 | IKW50N65WR5 | IKWH50N65WR6              |
|  | 60 |             | IKWH60N65WR6              |
|  | 70 |             | IKWH70N65WR6              |

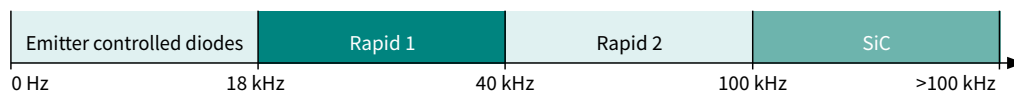




# Silicon power diodes

## Filling the gap between SiC diodes and emitter controlled diodes

The Rapid diode family complements Infineon's existing high-power 600 V/650 V diode portfolio by filling the gap between SiC diodes and previously released emitter controlled diodes. They offer a perfect cost/performance balance and target high-efficiency applications switching between 18 and 100 kHz. Rapid 1 and Rapid 2 diodes are optimized to have excellent compatibility with CoolMOS™ and high speed IGBTs (insulated gate bipolar transistor) such as the TRENCHSTOP™ IGBT7 and TRENCHSTOP™ 5.



### The Rapid 1 diode family

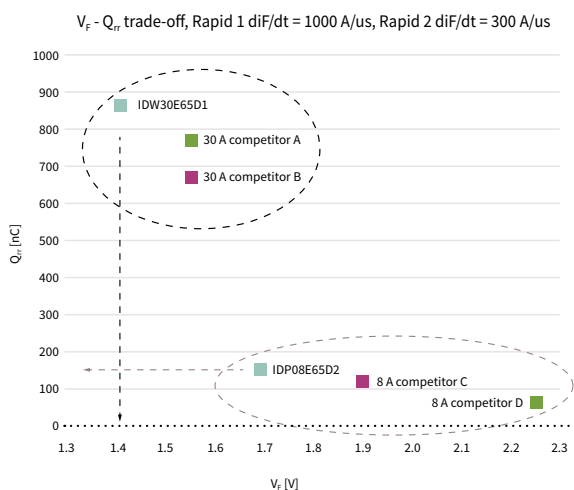
Rapid 1 is forward voltage drop ( $V_F$ ) optimized to address low switching frequency applications between 18 kHz and 40 kHz, for example, air conditioner and welder PFC stages.

- › 1.35 V temperature-stable forward voltage ( $V_F$ )
- › Lowest peak reverse recovery current ( $I_{rrm}$ )
- › Reverse recovery time ( $t_{rr}$ ) < 100 ns
- › High softness factor

### The Rapid 2 diode family

Rapid 2 is  $Q_{rr}/t_{rr}$  optimized hyperfast diode to address high-speed switching applications between 40 kHz and 100 kHz, typically found in PFCs in high efficiency switch mode power supplies (SMPS) and welding machines.

- › Lowest reverse recovery charge ( $Q_{rr}$ ):  $V_F$  ratio for best-in-class performance
- › Lowest peak reverse recovery current ( $I_{rrm}$ )
- › Reverse recovery  $t_{rr}$  < 50 ns
- › High softness factor



[www.infineon.com/rapiddiodes](http://www.infineon.com/rapiddiodes)  
[www.infineon.com/ultrasoftdiodes](http://www.infineon.com/ultrasoftdiodes)



## Rapid 1 diodes

650 V product family



| Continuous current $I_F$<br>@ $T_c=100^\circ\text{C}$<br>[A] | TO-220<br> | TO-220<br>FullPAK<br> | TO-247<br> | TO-247<br>common cathode<br> | TO-247<br>advanced isolation<br> |
|--|------------|-----------------------|------------|------------------------------|----------------------------------|
| 8  | IDP08E65D1 |                       |            |                              |                                  |
| 15   | IDP15E65D1 |                       |            |                              |                                  |
| 20   |            | IDV20E65D1            |            |                              |                                  |
| 30   | IDP30E65D1 |                       | IDW30E65D1 | IDW30C65D1                   |                                  |
| 40   |            |                       | IDW40E65D1 |                              | IDFW40E65D1E                     |
| 60   |            |                       |            | IDW60C65D1                   | IDFW60C65D1                      |
| 75   |            |                       |            | IDW75D65D1                   |                                  |
| 80   |            |                       |            | IDW80C65D1                   | IDFW80C65D1                      |

## Rapid 2 diodes

650 V product family



| Continuous current $I_F$<br>@ $T_c=100^\circ\text{C}$<br>[A] | TO-220<br> | TO-220<br>FullPAK<br> | TO-220<br>common cathode<br> | TO-247<br> | TO-247<br>common cathode<br> |
|--|------------|-----------------------|------------------------------|------------|------------------------------|
| 8  | IDP08E65D2 | IDV08E65D2            |                              |            |                              |
| 15   | IDP15E65D2 | IDV15E65D2            |                              | IDW15E65D2 |                              |
| 20   | IDP20E65D2 |                       | IDP20C65D2                   |            | IDW20C65D2                   |
| 30   | IDP30E65D2 | IDV30E65D2            | IDP30C65D2                   |            | IDW30C65D2                   |
| 40   | IDP40E65D2 |                       |                              | IDW40E65D2 |                              |
| 80   |            |                       |                              |            | IDW80C65D2                   |

## Emitter controlled diodes

600 V and 1200 V product families



| Continuous current $I_F$<br>@ $T_c=100^\circ\text{C}$<br>[A] | TO-263<br>(D <sup>2</sup> PAK)<br> | TO-220<br>Real 2-pin<br> | TO-247<br> |
|--|------------------------------------|--------------------------|------------|
| 600 V  | 30                                 |                          | IDW30E60   |
|  | 50                                 |                          | IDW50E60   |
|  | 75                                 |                          | IDW75E60   |
|  | 100                                |                          | IDW100E60  |
| 1200 V   | 12                                 | IDP12E120                |            |
|  | 18                                 | IDP18E120                |            |
|  | 30                                 | IDB30E120                | IDP30E120  |

[www.infineon.com/rapiddiodes](http://www.infineon.com/rapiddiodes)

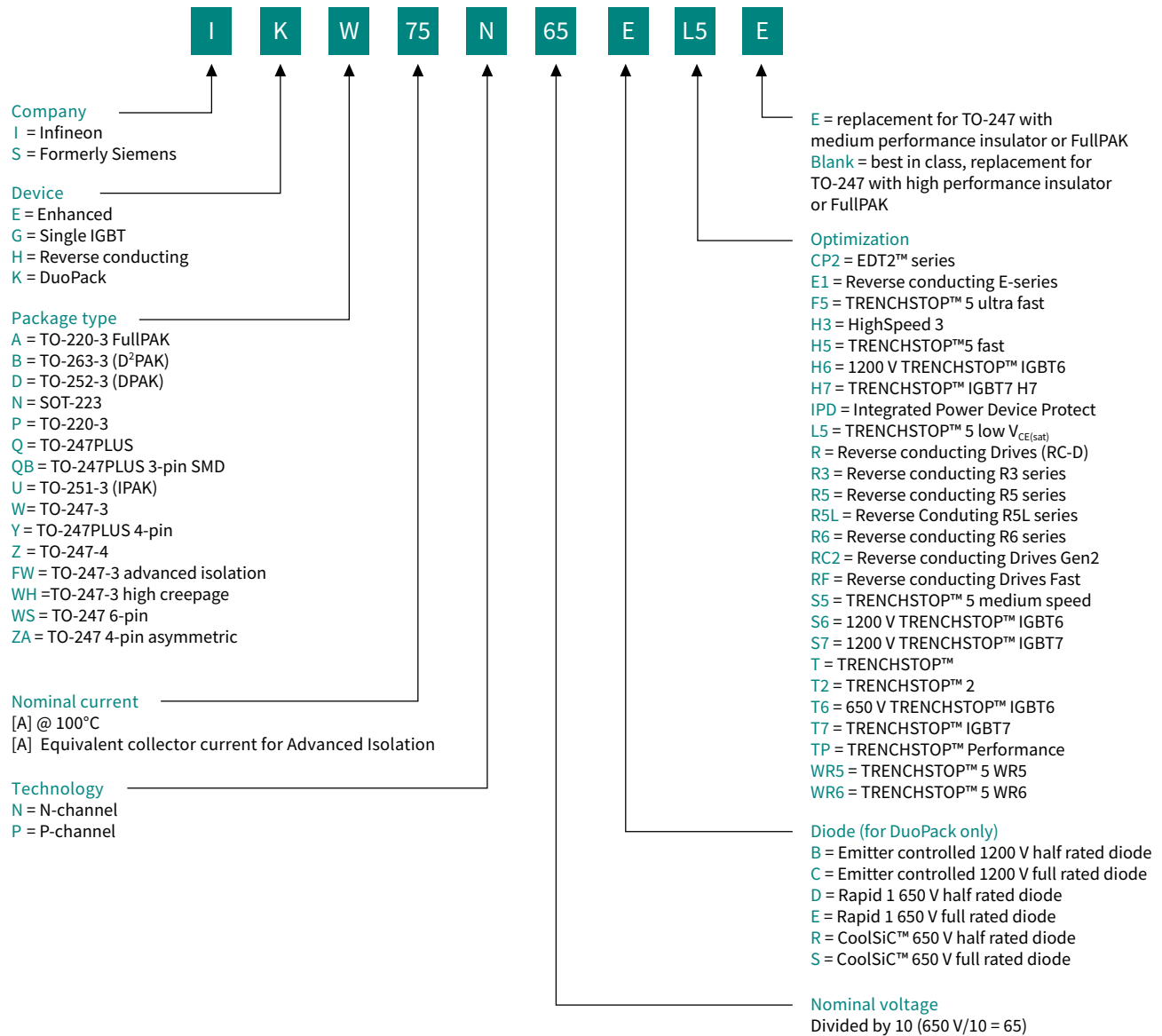
[www.infineon.com/ultrasoftdiodes](http://www.infineon.com/ultrasoftdiodes)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our product support.

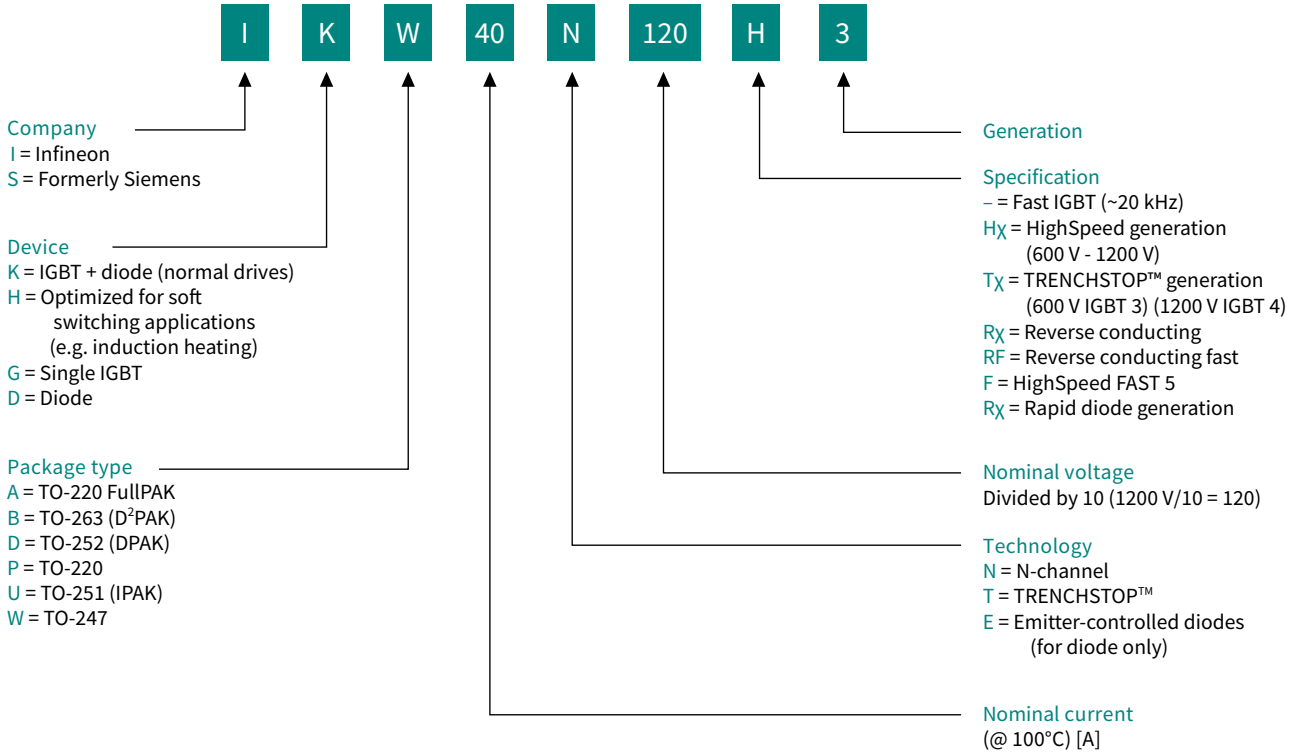


# Nomenclature

## IGBT (after 03/2013)

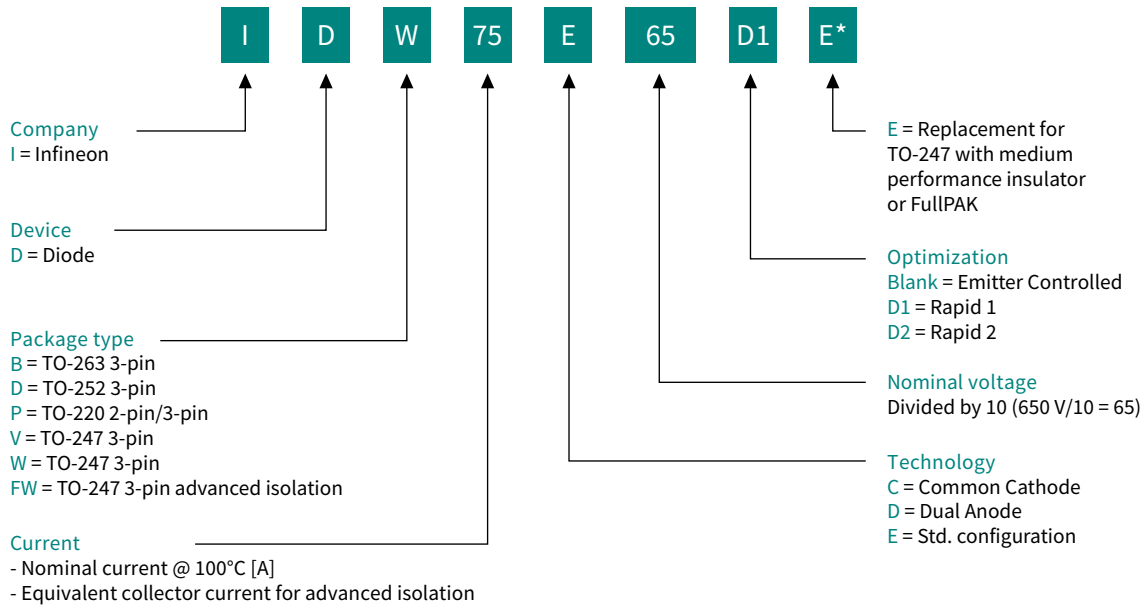


## IGBT (before 03/2013)



# Nomenclature

## Silicon power diodes





# Infineon support for discrete IGBTs and silicon power diodes

## Useful links and helpful information

### Further information, datasheets and documents

[www.infineon.com/igbt](http://www.infineon.com/igbt)

[www.infineon.com/igbt discret es](http://www.infineon.com/igbt discret es)

[www.infineon.com/rapid diodes](http://www.infineon.com/rapid diodes)

[www.infineon.com/discrete IGBT7](http://www.infineon.com/discrete IGBT7)

[www.infineon.com/ultrasoft diodes](http://www.infineon.com/ultrasoft diodes)

[www.infineon.com/discrete-automotive-igbt](http://www.infineon.com/discrete-automotive-igbt)

[www.infineon.com/latest-discrete-packages](http://www.infineon.com/latest-discrete-packages)

### Evaluation boards and simulation models

[www.infineon.com/eval-TO-247-4pin](http://www.infineon.com/eval-TO-247-4pin)

[www.infineon.com/igbt discrete-simulation models](http://www.infineon.com/igbt discrete-simulation models)



Support



Evaluation board



Tools



Simulation



## Intelligent power switches and modules

- CIPOST™ IPM family
- iMOTION™ IPM
- ISOFACE™ isolated industrial interface
- ISOFACE™ galvanic-isolated digital input ICs
- Industrial PROFET™
- HITFET™
- CIPOST™, iMOTION™, ISOFACE™, industrial PROFET™ and HITFET™ product portfolio

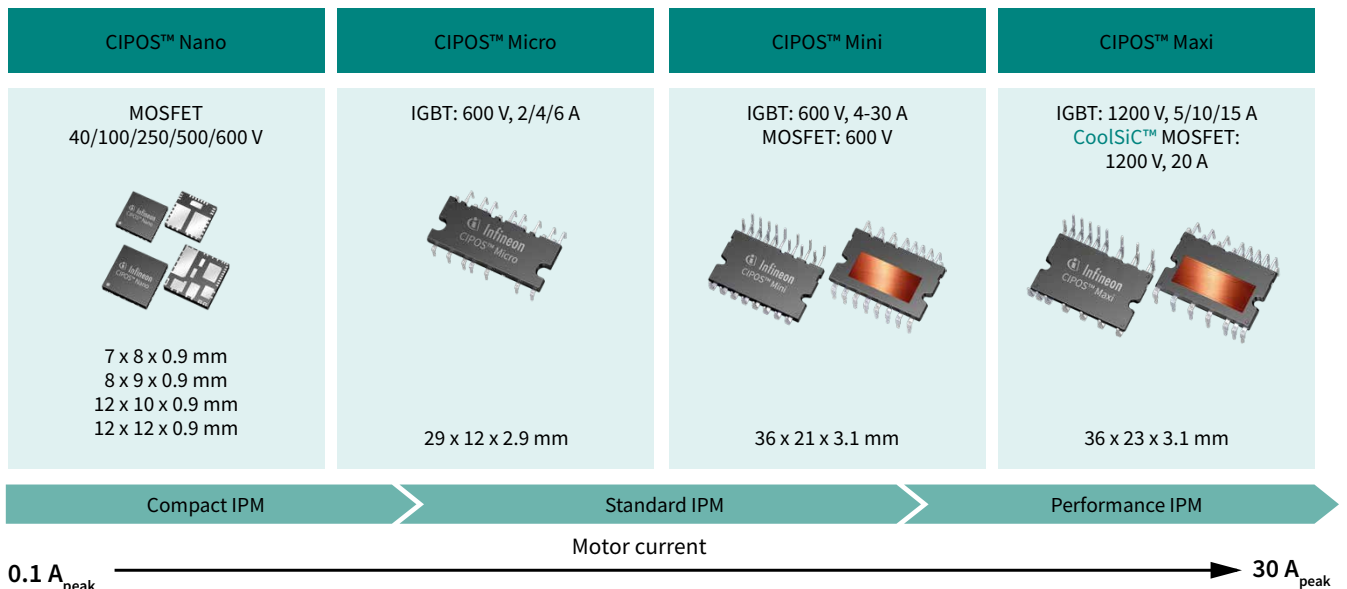
# CIPOS™ IPM family

## CIPOS™ intelligent power modules in different packages, voltage and current classes

Infiniteon has a broad portfolio of intelligent power modules (IPMs) with different semiconductors combined in various packages in varying voltage and current classes. These IPMs are separated into Compact, Standard and Performance families.

Part of the IPMs is divided into CIPOS™ Nano, CIPOS™ Micro, CIPOS™ Mini and CIPOS™ Maxi families. CIPOS™ IPMs are families of highly integrated, compact power modules designed to drive motors in applications ranging from home appliances, fans, pumps, HVAC to industrial drives. These energy-efficient intelligent power modules integrate the latest power semiconductor and ICs technologies from Infineon.

### CIPOS™ product overview



### Key benefits

- Fast time-to-market
- Increased reliability
- Reduced system design complexity
- Improved manufacturability

[www.infineon.com/ipm](http://www.infineon.com/ipm)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





# CIPOS™ Nano

## Smallest IPM in the world with various topology, voltage options

The ultra-compact CIPOS™ Nano is a family of highly integrated power modules for high-efficiency consumer and light industrial applications. CIPOS™ Nano is designed for the rectifier, converter, and inverter stage in power management circuits and motor drives for applications like fans, hair dryers, air purifiers, and circulation pumps. By implementing an innovative Power QFN package, which utilizes PCB copper traces to dissipate heat from the module, CIPOST™ Nano family delivers a new benchmark in device size, offering up to a 60 percent smaller footprint than existing three-phase motor control power IPMs.

The family is comprised of a series of fully integrated three-phase, half-bridge and H-bridge surface-mount motor control circuit solutions. The new alternative approach utilizes PCB copper traces to dissipate heat from the module, providing cost savings through a smaller package design and even eliminating the need for an external heat sink.





### Features and benefits

| Key benefits  | Key advantages   |
|---|--|
| <ul style="list-style-type: none"> <li>– Various switch technologies such as HEXFETs, Trench FREDFETs, Trench MOSFETs, CoolMOS™ and OptiMOS™ apply to motor drivers</li> <li>– Multiple package platforms with various topologies to suitable for a variety of application scenarios</li> <li>– Integrated bootstrap functionality and gate drivers</li> <li>– Realize a variety of protection (overcurrent protection, under-voltage lockout, over-temperature protection, fault reporting and etc.)</li> <li>– Accessible for heat sink-less operation</li> </ul> | <ul style="list-style-type: none"> <li>– Smallest modules in the market</li> <li>– Cost savings from smaller footprint and reduced PCB space</li> <li>– Easy implementation of 2 or 3-phase motor drives</li> <li>– Half bridge configuration enables more flexible board design w/better thermal performance</li> <li>– Same PCB footprint to address multiple application markets (100 VAC – 230 VAC)</li> </ul> |

### Key applications

- Hair dryer
- Fan motor
- Pump
- Air conditioner Indoor Unit
- Air purifiers
- Small kitchen appliances
- CPAP machine

### Package overview

| QFN 7x8<br>7 x 8 x 0.9 mm   | QFN 8x9<br>8 x 9 x 0.9 mm   | QFN 12x10<br>12 x 10 x 0.9 mm  | QFN 12x12<br>12 x 12 x 0.9 mm   |
|---|---|--|---|
|  |  |  |  |



# CIPOS™ Micro

## Solution for low power motor drive applications

CIPOS™ Micro is a family of compact, three-phase IPMs (intelligent power modules) for low-power (i.e., up to 500 W with heatsink) motor drive applications, including ventilation fans, circulation pumps, air purifiers, dish washer and refrigerator compressor drives. CIPOS™ Micro has several protection features, including precise overcurrent protection and a UL-certified temperature sensor. Available in both surface mount and through-hole configurations, the family features rugged and efficient high voltage IGBTs specially optimized for variable frequency drives with a 600 V rating. Also, these IPMs utilize high-voltage gate drivers tuned to achieve an optimal balance between EMI and switching losses.

### Features and benefits

#### Key features

- Wide range of product coverage
- Optimized dv/dt for loss and EMI trade offs
- HV H3TRB qualified
- Compatible with mass-market TO-2xx heat sinks and clips
- Power capability up to 500 W at isolation 2000 V<sub>RMS</sub>, 1 min

#### Key benefits

- Save system space and cost through the enhanced power capability
- Offer application-optimized solution for both fast switching and low EMI version
- Improve system ruggedness thru enhanced protection features and isolation voltage

### Key applications

- RAC outdoor fan
- Dish washer
- Fan motor and pump
- Washing machine
- Refrigerator
- General purpose drive

### Package overview



# CIPOS™ Mini

## Broad range of configurations from PFC to inverter

CIPOS™ Mini is a family of highly efficient intelligent power modules that has the highest power density with 4 A to 30 A rated products built into a single package platform. It integrates various power and control components to increase reliability, and optimize PCB size and system costs. Utilizing multiple configurations, CIPOS™ Mini IPMs apply to a wide range of applications to control variable speed drives, such as air conditioners, washing machines, refrigerators, vacuum cleaners, compressors, and industrial drives up to 3 kW.

The configurations offered within the CIPOS™ Mini family are IGBT 3-phase inverter, integrated PFC, and 2-phase and 3-phase interleaved PFC. All options include an integrated gate driver and a built-in temperature sensor. CIPOS™ Mini provides optimized performance for power applications, which need good thermal conduction and electrical isolation, but also EMI-safe control, innovative FAULT indication, and overload protection.

Infineon's TRENCHSTOP™ IGBTs and reverse-conducting IGBTs are combined with newly optimized Infineon SOI gate driver IC for excellent electrical performance. Also, CIPOS™ Mini family offers IPMs with DCB substrates, improving heat dissipation to provide higher power capability.

### Features and benefits

#### Key features

- Wide range of current rating: 4 A to 30 A
- High integration (bootstrap circuit, thermistor, single boost PFC)
- Optimized for target application requirements (separate version for washing machine and air conditioner)

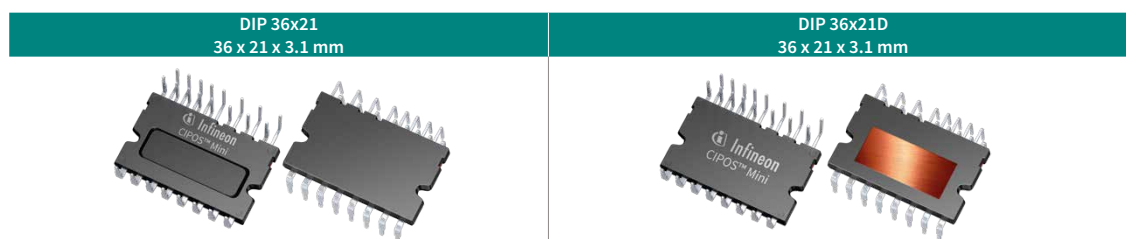
#### Key benefits

- Lower PCB size and system cost
- Easy power extension from 300 W to 3 kW
- Optimized performance for each application
- UL certified package and temp sensor

### Key applications

- Refrigerator
- Washing machine
- Room air conditioning
- Fans and pumps
- HVAC outdoor fan
- General purpose drives

### Package overview



# CIPOS™ Maxi

## Smallest package in 1200 V IPM class while still offering high power density and best performance

The high-performance CIPOS™ Maxi intelligent power modules (IPMs) integrate various switching devices and control components to increase reliability, optimize PCB size and system costs. CIPOS™ Maxi IPMs are designed to control three-phase AC motors and permanent magnet motors in variable speed drive applications such as low-power industrial motor drives, pumps, fan drives, and active filters for HVAC (heating, ventilation, and air conditioning). The product concept is specially adapted to power applications, which need excellent thermal performance and electrical isolation as well as meeting EMI requirements and overload protection.

The existing IGBT-based portfolio IM818 series offers 5 A and 15 A in 1200 V class up to 3.0 kW power rating, while the newly released IM828 series offers superior efficiency up to 99% and optimal reliability up to 4.8 kW power rating through the 6 revolutionary CoolSiC™ MOSFETs with an optimized 1200 V 6-channel SOI gate driver. IM828 series provides the exceptional power density with a wide switching speed range up to 80 kHz to adapt to fast-switching applications with superior lower power losses.

### Features and benefits

#### Key benefits

- Fully isolated dual in-line molded module with DCB
- 1200 V TRENCHSTOP™ IGBT 4
- 1200 V CoolSiC™ MOSFET
- Rugged 1200 V SOI gate driver technology
- Integrated bootstrap functionality
- Overcurrent shutdown
- Under-voltage lockout at all channels
- All of six switches turn-off during protection
- Cross-conduction prevention
- Independent NTC for temperature monitoring
- Allowable negative VS potential up to -11 V for signal transmission at  $V_{BS}$  of 15 V
- Low side emitter pins accessible for all phase current monitoring (open emitter)
- Programmable fault clear timing
- Enable input

#### Key advantages

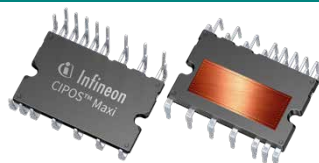
- The smallest package size in 1200 V IPM class with high power density and best performance
- Enhanced robustness of gate driver technology for excellent protection
- High efficiency
- Adapted to high switching application with lower power loss
- Simplified design and manufacturing
- Time-to-market

### Key applications

- Fan and pump
- HVAC outdoor fan
- Low-power general purpose drives (GPI, servo drive)
- Active filter (active power factor correction) for HVAC

### Package overview

DIP36x23D  
36 x 22.7 x 3.1 mm



[www.infineon.com/ipm](http://www.infineon.com/ipm)

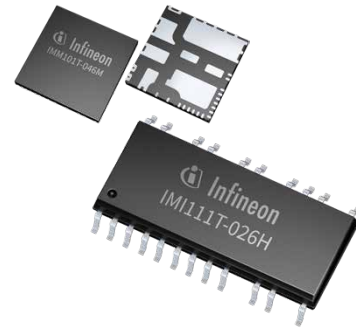
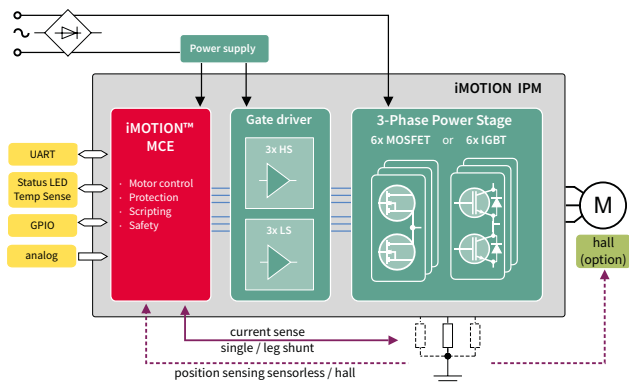
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# iMOTION™ IPM

## Fully integrated iMOTION™ IPM for BLDC motor control

iMOTION™ IPM is a family of fully integrated modules for the control of three-phase motors, optimized for low-power devices. Within the iMOTION™ IPM family, there are two different series: The IMM100 and IMI110, which combine the motor controller IC and a three-phase inverter stage in a single package, minimizing external components count and PCB area. The three-phase inverter stage is based either on six MOSFETs or six IGBTs. These iMOTION™ IPMs offer the highest integration level by making use of the field-proven iMOTION™ Motion Control Engine (MCE) in combination with providing all required hardware functions: From single shunt current sensing to bootstrap capability, signal filtering and several hardware protections like dead-time insertion and shoot through prevention. An iMOTION™ IPM does not require a heatsink and addresses motor drives with a rated output power between 30 W and 80W with 600 V maximum DC blocking voltage, depending on the chosen product variant. All IMM100 and IMI110 devices support the functional safety requirements according to the IEC/UL 60730-1 ("class B").



### Features and benefits

#### Key benefits

- Completely self-sustaining Motion Control Engine with identical feature set as the IMC100 series
- Up to 80 W without heatsink
- Support for IEC 60335-1 ('Class B')
- Controller, gate driver and power stage in one package
- IMI in DSO-22 package with single layer layout option

#### Key advantages

- Fastest time-to-market with easy parametrization and tuning of motor and PFC control
- Applicable for fans and small pumps
- Support for functional safety integrated
- Minimizing BOM count and PCB area
- Reducing PCB and production costs



EVAL-IMM101T-046 is a Starter Kit for iMOTION™ IMM101T-046M IPMs. Together with the iMOTION™ Solution Designer the board can be used for an easy system configuration, controlling, tuning and monitoring. EVAL-IMM101T-046 enables rapid prototyping of various inverterized motor control systems, for example fans, pumps and compressors.

### Product portfolio

| Product      | Function                     | Integration  | Description   | Package      |
|--------------|------------------------------|--|---|--------------|
| IMI111T-026H | Motor inverter               | MCE incl Scripting, gate driver, IGBT based inverter   | Output rating: 600V/2 A, single shunt sensorless operation                          | PG-DSO-22-1  |
| IMI111T-046H | Motor inverter               | MCE incl Scripting, gate driver, IGBT based inverter   | Output rating: 600V/4 A, single shunt sensorless operation                          | PG-DSO-22-1  |
| IMM101T-046M | Motor inverter               | MCE incl Scripting, gate driver, MOSFET based inverter | Output rating: 600 V/1.4 Ω R <sub>DS(on)</sub> , single/leg shunt, sensorless/hall  | PG-IQFN-38-1 |
| IMM101T-056M | Motor inverter               | MCE incl Scripting, gate driver, MOSFET based inverter | Output rating: 600 V/0.95 Ω R <sub>DS(on)</sub> , single/leg shunt, sensorless/hall | PG-IQFN-38-2 |
| IMM102T-056M | Motor inverter + PFC control | MCE incl Scripting, gate driver, MOSFET based inverter | Output rating: 500 V/6 Ω R <sub>DS(on)</sub> , single/leg shunt, sensorless/hall    | PG-IQFN-38-3 |
| IMM102T-046M | Motor inverter + PFC control | MCE incl Scripting, gate driver, MOSFET based inverter | Output rating: 600 V/1.4 Ω R <sub>DS(on)</sub> , single/leg shunt, sensorless/hall  | PG-IQFN-38-4 |
| IMM102T-056M | Motor inverter + PFC control | MCE incl Scripting, gate driver, MOSFET based inverter | Output rating: 600 V/0.95 Ω R <sub>DS(on)</sub> , single/leg shunt, sensorless/hall | PG-IQFN-38-5 |

[www.infineon.com/IMM100](http://www.infineon.com/IMM100)

[www.infineon.com/IMI110](http://www.infineon.com/IMI110)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# ISOFACE™ isolated industrial interface

Galvanic-isolated output switch and digital input ICs offers unmatched system uptime, high reliability and up to 50% shortened product launch time

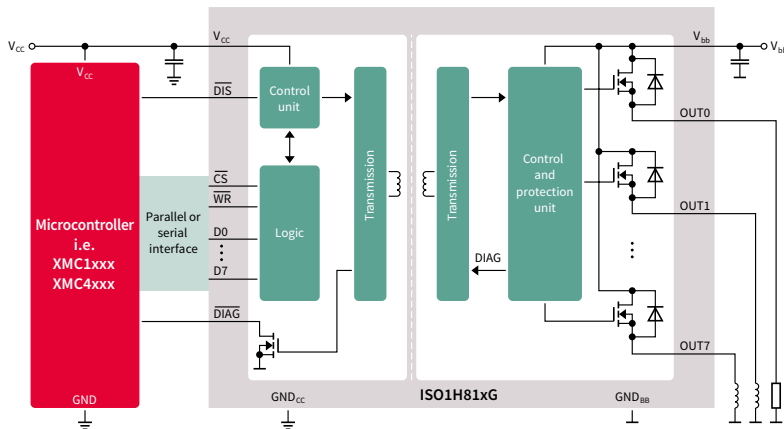
The ISOFACE™ product family provides robust and intelligent galvanic-isolation for various industrial control application such as programmable logic controllers, sensor input modules, distributed control systems, control panels and general control equipment. The output switches are compact in design, enabling robust and reliable operation at low system cost. The input ICs are equally robust, offers reliable operation in a compact form factor and offers industry leading superior EMI robustness setting a new standard in diagnostics.

## ISOFACE™ galvanic-isolated 8-channel output switches

The ISO1H81xG(A)<sup>1</sup> product family integrates:

- Robust galvanic isolation (UL508 and C22.2 NO14 certified) to protect the 3.3 V/5 V control domain of an industrial control system from the harsh 24 V process side
- 8-channel high-side power-switching capabilities of up to 1.2 A per channel
- Active current limitation and overtemperature protection
- Common diagnostic feedback for overtemperature and for  $V_{bb}$  undervoltage

### Isolated output switch block diagram



### Isolated output switches



## Features and benefits

### Key features

- Integrated galvanic isolation (500  $V_{AC}$ )
- Eight channels (0.6 or 1.2 A, each)
- Inductive load switching
- Diagnostic feedback (overtemperature, overload)
- Serial and parallel MCU interface

### Key benefits

- Robust and reliable
- Compact system solution
- Lower system cost
- System status feedback
- Directly interfacing with all MPUs and MCUs

[www.infineon.com/isoface](http://www.infineon.com/isoface)

1) (A)\* = AEC-Q100 qualified



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## ISOFACE™ galvanic-isolated 8-channel high-side switch with 10-fold diagnostics

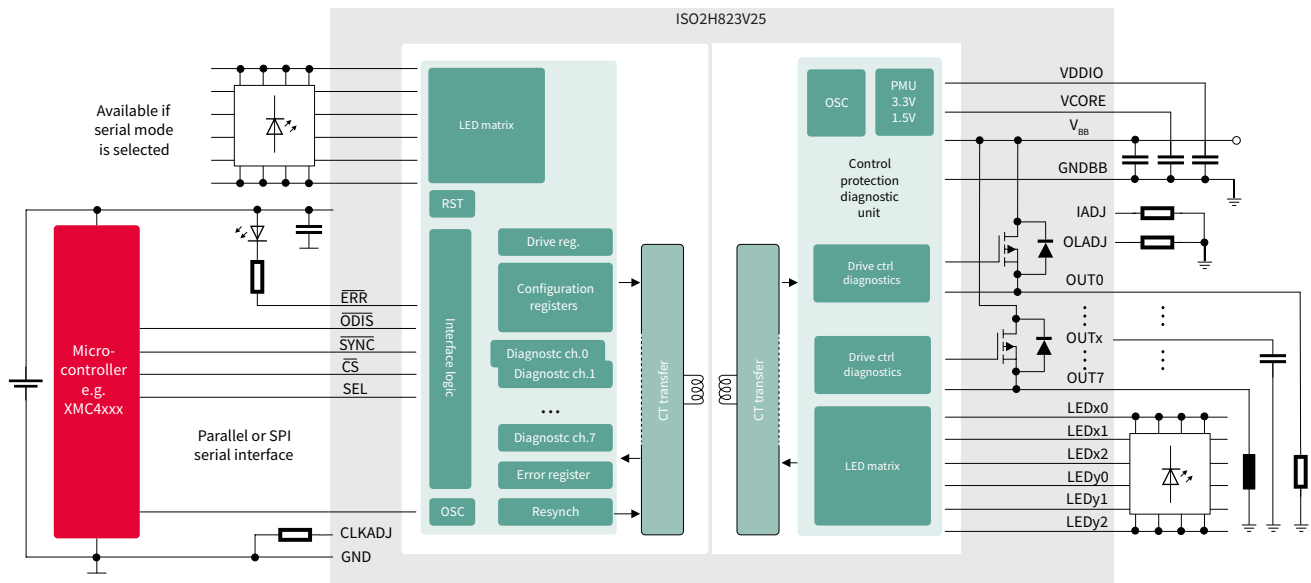
The ISO2H823V establishes a new standard in diagnostics for industrial control applications. For example, in industrial plants with capital-intensive single-tool equipment at work or with time-critical chemical processes running, obtaining in real-time differentiated feedback from the factory floor enables both, preventive maintenance and drastic reduction of the time to fix a problem. This is why the ISO2H823V is a highly desirable system solution. System designers benefit from the ISO2H823V through short time to market, reduced PCB area and uncompromised product reliability.

### The ISO2H823V integrates:

- Robust 2.5 kV AC galvanic isolation:
  - UL508 and CSA C22.2 No.14 certified
  - Protecting the 3.3 V control domain of an industrial control system from the harsh 24 V process side
  - Exceeding the IEC 61131-2 requirements for reinforced isolation
- 8-channel high-side power-switching capabilities of up to 0.6 A per channel with active current limitation and overtemperature protection
- 10-fold diagnostic feedback
  - 5 types of feedback which are available individually for each of the eight outputs
  - 5 types of IC-level feedback
- Common diagnostic feedback for overtemperature and for  $V_{bb}$  undervoltage



### Typical application



### Features and benefits

#### Key features

- Robust 2.5 kV AC galvanic isolation
- Eight channels (up to 0.6 A per channel)
- 10-fold diagnostic feedback (over-temperature, overload)

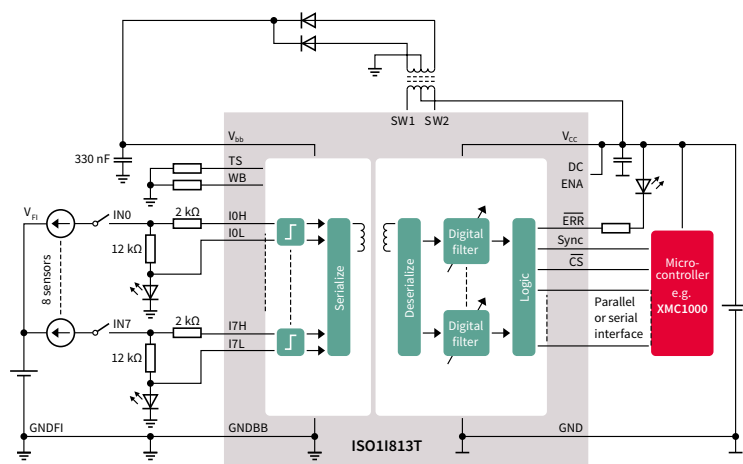
#### Key benefits

- Reliable and UL certified
- Small form factor solution
- Preventive maintenance and short down-times

## ISOFACE™ galvanic-isolated digital input ICs

The UL1577 certified ISO1181xT digital input IC family is an intelligent system solution offering robust galvanic isolation between the microcontroller on the “control side” and the 24 V factory floor environment, frequently referred to as the “process side”.

### Digital input switch block diagram



### Galvanic-isolated digital input ICs



### Features and benefits

#### Key features

- Integrated galvanic isolation (500 VAC)
- Eight channels (IEC type 1/2/3)
- Up to 500 kHz sampling speed
- Programmable input filters
- Channel-specific diagnostics (wire-break, undervoltage)

#### Key benefits

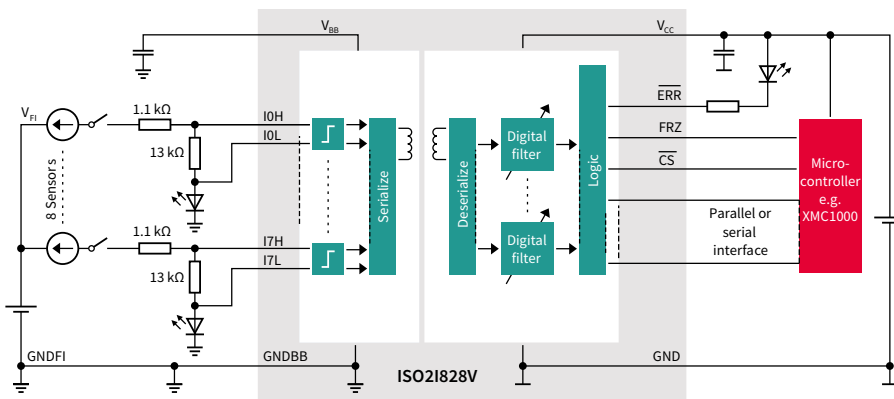
- Robust and reliable
- Compact system solution
- High-speed applications
- Superior EMI robustness
- System status feedback
- Valuable maintenance support



# ISOFACE™ galvanic-isolated digital input ICs

## Galvanic-isolated sink input ICs

The ISOFACE™ ISO21828V digital input IC family complements Infineon's portfolio of well-established digital input ICs. The latest generation offers enhanced performance with state-of-art low power consumption and a wide range of diagnostic capabilities. The input ICs are UL1577 certified and offer de facto industry standard isolation. The user can benefit from a smaller package size leading to PCB area saving and a compact design.



## Features and benefits

### Key features

- Integrated industry-standard galvanic isolation (2500 V<sub>rms</sub>)
- IEC type 1, 3: 8 x 24 V and 4 x 48 V
- Glitch filter per channel
- Interrupt on change
- Overtemperature and overvoltage alarm
- Robust SPI serial communication
- Low power consumption

### Key benefits

- Improved reliability and robustness
- Improved sensor compatibility
- Superior EMI robustness
- Reduces communication traffic
- System status feedback
- Full register access in daisy chain
- Excellent performance with lower power dissipation

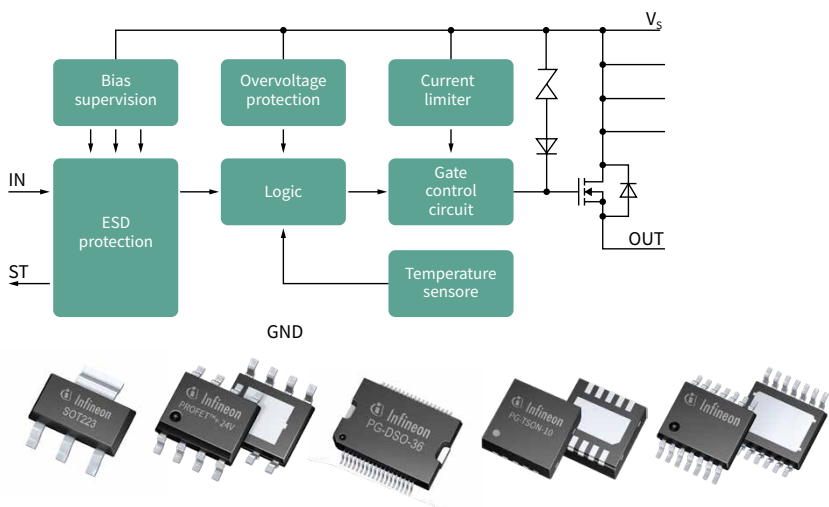


# Industrial PROFET™

## Protected high-side switches

Infiniteon's market-proven high-side switch Industrial PROFET™ products have been designed to target various industrial applications that drive all types of resistive, inductive and capacitive loads. Due to their outstanding energy robustness, they are perfectly suitable for switching challenging inductive loads and driving relays. Their main application areas include high-voltage and ( $V_{supply}$  up to 60 V) and PWM applications up to 1 kHz. Industrial PROFET™ can be applied to drive any kind of sensor units, indicators, displays, LEDs, relays, valves and magnetic actuators or replace electromechanical relays, fuses and discrete circuitry. Industrial PROFET™ products are also perfect for applications with long wiring or any other kind of inductive loads or applications with space constraints. Failsafe systems do make use of them as well.

### PROFET™ typical block diagram



### Key applications

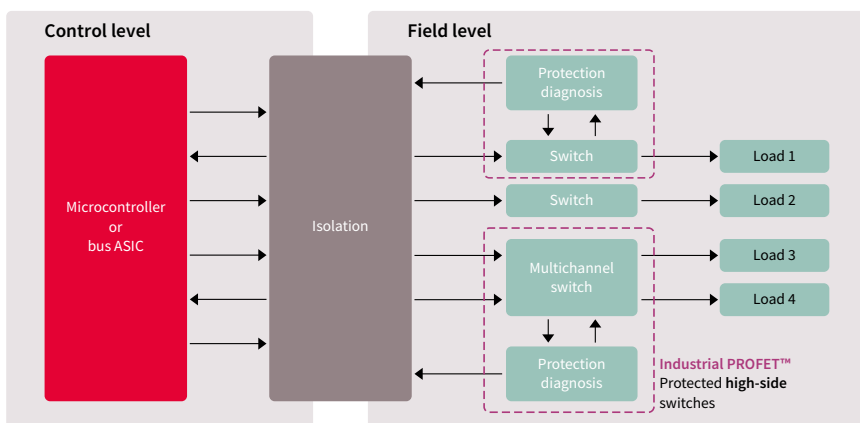
- Industrial automation
- Programmable logic controller (PLC)
- Digital DCS and PC I/O modules
- Robotics
- Building and home automation
- Solar applications
- Wind energy systems
- Failsafe systems
- Smart grid
- Motor control and drives
- Power supplies

### Features and benefits

- Key features**
- Right fit for digital output modules, motor or robot control, protected switching of decentralized loads like sensors or auxiliary supply
  - Outstanding robustness and reliability as required by industrial mission profiles
  - Thermally optimized products with low  $R_{DS(on)}$  to deal with the high ambient temperatures in applications with limited or even no cooling
  - Diagnosis and protection for safe system operation
  - Small and compact design for higher integration and applications with space constraints

- Key benefits**
- Small system form factor
  - No/little downtime of system in operation
  - Low heating up of a system
  - System cost saving by built-in protection and tailored featureset
  - Reduced system maintenance efforts by providing optimized diagnostics

### PLC – programmable logic controller digital output modules



PROFET™ as actuators typically address I/O modules supplying nominal currents of 2 A or 0.5 A. However, PROFET™ portfolio also provides devices for lower and higher currents. PROFET™ parts are suitable for switching resistive, capacitive and, by featuring high EAS, inductive loads.

**Corresponding PROFET™ evaluation boards are available on request.**

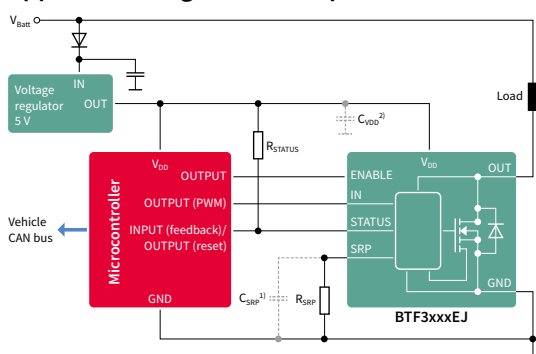
[www.infineon.com/industrial-profet](http://www.infineon.com/industrial-profet)

# HITFET™

## Low-side smart protected switches

HITFET™ stands for highly-integrated temperature-protected MOSFET. These well-established low-side switches offer a compelling feature set with protection against overtemperature, short circuit and overload conditions as well as ESD robustness. The HITFET™ + family is the new generation based on new technology, enabling a significant shrink compared to the existing Classic HITFET™ portfolio (up to 50 percent shrink). This novel generation consists of standard and fully-featured protected low-side switches (11 to 125 mΩ) in the TO-252-3 DPAK/TO-252-5 DPAK and TDSO-8 packages. Classic HITFET™ and HITFET™ + devices address a wide range of applications, including resistive, inductive and capacitive loads.

### Application diagram example for HITFET™ +



1)  $C_{SRP-GND} < 100 \text{ pF}$  – maximum permitted parasitic capacitance at the SRP-pin  
 2) Filter capacitor on supply, recommended 100 nF

### Key applications

- Industrial automation\*
- Programmable logic controller (PLC)\*\*
- Digital I/O modules
- Building and home management
- All kind of solenoid or valve driving
- Power modules
- Solar power inverters

## Features and benefits

### Key features

- Low-side switches with integrated protection features
- Scalable in  $R_{DS(on)}$  ranges from 800 mΩ down to 11 mΩ
- Adjustable slew rate control (BTFxxx and BTT30xxEJ)
- Thermal shutdown with auto restart or latch behavior
- Status feedback via
- Increased input current (HITFET™ +12 V/24 V)
- Digital readout via SRP (BTF3050TE)
- Via status pin (BTF3xxxEJ)

### Key benefits

- High design flexibility with scalable  $R_{DS(on)}$  and package
- Driving applications with high switching speed requirements up to 25 kHz (e.g. valve, solenoid)
- Easy to design-in
- Choice of packages to match individual application needs

## Low-side switch shield with BTF3050TE for Arduino



**Featured products:** Three BTF3050TE low-side switches of the HITFET™ +12 V family  
**Compatible with:** Microcontroller boards using the Arduino form factor and the corresponding Infineon's kits with Arm® powered XMC™ microcontroller  
**Orderable part number:** SHIELDBTF3050TETOBO1

## Evaluation board based on BTT3050EJ



**Featured products:** One single-channel low-side switch of BTT3050EJ a device of the HITFET™ +24 family  
**Compatible with:** Can be used as single stand and is also pin-compatible with microcontroller boards using the Arduino form factor (e.g. XMC1100 Boot Kit, Arduino Uno)  
**Orderable part number:** BTT3050EJDEMOBOARDTOBO1

[www.infineon.com/hitfet](http://www.infineon.com/hitfet)

[www.infineon.com/shields-for-arduino](http://www.infineon.com/shields-for-arduino)

\*See block diagram on page 278  
 \*\* See block diagram on page 279

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# ISOFACE™ product portfolio

## ISOFACE™ output switches

| Product overview          |   | ISO1H801G      | ISO1H811G      | ISO1H812G      | ISO1H815G      | ISO1H816G      | ISO2H823V        |
|---------------------------|---|----------------|----------------|----------------|----------------|----------------|------------------|
| Switch                    | V <sub>bb</sub> operational range: 11 V to 35 V                                 | ✓              | ✓              | ✓              | ✓              | ✓              | ✓                |
|                           | Max. continuous load current per channel  | 0.6 A          | 0.6 A          | 0.6 A          | 1.2 A          | 1.2 A          | 0.6 A            |
|                           | Load current increase by using outputs in parallel                              | ✓              | ✓              | ✓              | ✓              | ✓              | ✓                |
|                           | Inductive clamping energy per channel: 1 Joule                                  | ✓              | ✓              | ✓              | ✓              | ✓              | 150 mJ           |
| Microcontroller interface | Type  | Parallel       | Parallel       | Serial         | Parallel       | Serial         | Serial/Parallel  |
|                           | Nominal voltages  | 5 V            | 3.3 V/5 V      | 3.3 V/5 V      | 3.3 V/5 V      | 3.3 V/5 V      | 3.3 V            |
| Safety features           | Isolation voltage: V <sub>iso</sub> = 500 VAC<br>UL508 and EN 61131-2 certified | ✓              | ✓              | ✓              | ✓              | ✓              | 2.5 kV AC        |
|                           | Active current limitation   | ✓              | ✓              | ✓              | ✓              | ✓              | ✓                |
|                           | Thermal shutdown  | ✓              | ✓              | ✓              | ✓              | ✓              | ✓                |
|                           | Common output disable pin   | ✓              | ✓              | ✓              | ✓              | ✓              | ✓                |
| Diagnostics feedback      | Overtemperature   |                | ✓              | ✓              | ✓              | ✓              | ✓                |
|                           | V <sub>bb</sub> undervoltage  |                | ✓              | ✓              | ✓              | ✓              | ✓                |
| Package DSO-36 (16x14 mm) |   | ✓              | ✓              | ✓              | ✓              | ✓              | VQFN-70          |
| Ordering code             |   | ISO1H801GAUMA1 | ISO1H811GAUMA1 | ISO1H812GAUMA1 | ISO1H815GAUMA1 | ISO1H816GAUMA1 | ISO2H823V25XUMA1 |

## ISOFACE™ digital input IC

| Product overview                            |                              | ISO1I811T      | ISO1I813T                        |
|---|------------------------------|----------------|----------------------------------|
| Input characteristics                       | IEC type: I, II, III         | ✓              | ✓                                |
|   | Input status LED             | ✓              | ✓                                |
|   | Max. sampling frequency      | 125 kHz        | 500 kHz                          |
|   | Deglitching filter setting   | Hard wired     | Software, individual per channel |
|   | Synchronous data acquisition | -              | ✓                                |
| µC interface                                | 3.3 V/5 V                    | ✓              | ✓                                |
|   | Serial and parallel          | ✓              | ✓                                |
| Safety features                             | 500 VAC isolation voltage    | ✓              | ✓                                |
| Diagnostic feedback                         | Wire break, channel-specific | -              | ✓                                |
|   | V <sub>bb</sub> undervoltage | ✓              | ✓                                |
| Support for external V <sub>bb</sub> supply |                              | -              | ✓                                |
| Package TSSOP-48 (8x12.5 mm)                |                              | ✓              | ✓                                |
| Ordering code                               |                              | ISO1I811TXUMA1 | ISO1I813TXUMA1                   |



# Industrial PROFET™ product portfolio

| Load current<br>Typical, per channel | 1-channel   | 2-channel                                | 4-channel                                  | 8-channel  |
|--------------------------------------|---|--|--|--|
| 7 A                                  | ITS428L2 ●<br>7 A, 60 mΩ, TO-252-5                |  |  |  |
| 3 A                                  | ITS4060S-SJ-N, ISP772T<br>3.1 A, 60 mΩ<br>DSO-8   |  |  |  |
| 2 A ... 3 A                          | ITS4100S-SJ-N, ISP762T<br>2.4 A, 100 mΩ, DSO-8    |  |  |  |
| 1 A ... 2 A                          | ITS4200S-ME-P, ITS4142N<br>1.4 A, 200 mΩ, SOT223  | ITS4040D-EP-D ●<br>2.6 A, 40 mΩ, TSDSO14 | ITS4075Q-EP-D ●<br>2.6 A, 75 mΩ, TSDSO14   |  |
|                                      | ISP752T<br>1.3 A, 200 mΩ, DSO-8                   | ITS5215L ●<br>2 A, 90 mΩ, DSO-12         | ITS724G ●<br>2 A, 90 mΩ, DSO-20            |  |
|                                      | ITS4200S-SJ-D, ISP752R ●<br>1.2 A, 200 mΩ, DSO-8  |  | ITS716G ●<br>1 A, 140 mΩ, DSO-20           |  |
| 0.5 A ... 1 A                        | ITS6035S-EP-K**<br>2A, 27 mΩ, TSDSO14             |  | ITS711L1 ●<br>1 A, 200 mΩ, DSO-20          |  |
|                                      | ITS4200S-ME-N, ISP452<br>0.7 A, 200 mΩ, SOT223    |  | ITS4090Q-EP-D ●<br>0.7 A, 90 mΩ, TSDSO14   | ITS42008-SB-D, ITS4880R ●<br>0.6 A, 200 mΩ, DSO-36 |
| <0.5 A                               | ITS4200S-ME-O, ITS4141N<br>0.7 A, 200 mΩ, SOT223  |  | ITS4130Q-EP-D ●<br>0.65 A, 130 mΩ, TSDSO14 |  |
|                                      | ITS4300S-SJ-D, ISP742RI ●<br>0.4 A, 300 mΩ, DSO-8 | ITS42K5D-LD-F ●<br>0.25 A, 2.5Ω, TSON-10 |  |  |
|                                      | ITS41K0S-ME-N, ITS4140N<br>0.2 A, 1Ω, SOT223      |  |  |  |

● = With diagnosis

| Product         | Number of channels | R <sub>DS(on)</sub> (typ) [mΩ] | Nominal load current [A] | E <sub>AS</sub> [mJ] | Recommended operating voltage range [V] | I <sub>L(SC)</sub> (typ) [A] | Diagnosis          | Package   |
|-----------------|--------------------|--------------------------------|--------------------------|----------------------|---|------------------------------|--------------------|-----------|
| ITS6035S-EP-K** | 1                  | 27                             | 1.38 ... 5               | 350 @ 2.0 A          | 8.0 ... 36.0                            | 3.02 ... 13.2                | Digital and analog | TSDSO-14  |
| ITS4060S-SJ-N   | 1                  | 50                             | 3.10                     | 900 @ 1.50 A         | 5.00 ... 34.00                          | 17.0                         | n/a                | DSO-8     |
| ISP772T         | 1                  | 50                             | 2.60                     | 900 @ 1.50 A         | 5.00 ... 34.00                          | 17.0                         | n/a                | DSO-8     |
| ITS428L2        | 1                  | 60                             | 7.00                     | 190 @ 7.00 A         | 4.75 ... 41.00                          | 22.0                         | Digital            | TO252-5   |
| ITS4100S-SJ-N   | 1                  | 70                             | 2.40                     | 870 @ 1.00 A         | 5.00 ... 34.00                          | 10.0                         | n/a                | PG-DSO-8  |
| ISP762T         | 1                  | 70                             | 2.00                     | 870 @ 1.00 A         | 5.00 ... 34.00                          | 10.0                         | n/a                | DSO-8     |
| ITS4200S-ME-O   | 1                  | 150                            | 1.10                     | 700 @ 0.50 A         | 11.00 ... 45.00                         | 1.4                          | n/a                | SOT-223-4 |
| ITS4141N        | 1                  | 150                            | 1.10                     | 700 @ 0.50 A         | 12.00 ... 45.00                         | 1.4                          | n/a                | SOT-223-4 |
| ITS4200S-ME-P   | 1                  | 150                            | 2.20                     | 160 @ 1.00 A         | 11.00 ... 45.00                         | 3.0                          | n/a                | SOT-223-4 |
| ITS4142N        | 1                  | 150                            | 2.20                     | 160 @ 1.00 A         | 12.00 ... 45.00                         | 3.0                          | n/a                | SOT-223-4 |
| ITS4200S-ME-N   | 1                  | 160                            | 1.20                     | 500 @ 0.50 A         | 5.00 ... 34.00                          | 1.5                          | n/a                | DSO-8     |
| ISP452          | 1                  | 160                            | 1.20                     | 500 @ 0.50 A         | 5.00 ... 34.00                          | 1.5                          | n/a                | SOT-223-4 |
| ITS4200S-SJ-D   | 1                  | 150                            | 1.70                     | 125 @ 1.00 A         | 6.00 ... 52.00                          | 6.5                          | Digital            | DSO-8     |
| ISP752R         | 1                  | 200                            | 1.70                     | 125 @ 1.00 A         | 6.00 ... 52.00                          | 6.5                          | Digital            | DSO-8     |
| ISP752T         | 1                  | 200                            | 1.70                     | 125 @ 1.00 A         | 6.00 ... 52.00                          | 6.5                          | n/a                | DSO-8     |
| ITS4300S-SJ-D   | 1                  | 250                            | 0.80                     | 800 @ 0.30 A         | 5.00 ... 34.00                          | 1.2                          | Digital            | DSO-8     |
| ISP742RI        | 1                  | 350                            | 0.80                     | 800 @ 0.30 A         | 5.00 ... 34.00                          | 1.2                          | Digital, inverted  | DSO-8     |
| ITS41K0S-ME-N   | 1                  | 1000                           | 0.55                     | 1000 @ 0.15 A        | 4.90 ... 60.00                          | 0.9                          | n/a                | SOT-223-4 |
| ITS4140N        | 1                  | 1000                           | 0.55                     | 1000 @ 0.15 A        | 4.90 ... 60.00                          | 0.9                          | n/a                | SOT-223-4 |
| ITS4040D-EP-D   | 2                  | 40                             | 2 x 2.00                 | 185 @ 2 A            | 5.00 ... 45.00                          | 4.1                          | Digital            | TSDSO-14  |
| ITS5215L        | 2                  | 90                             | 2 x 2.00                 | 178 @ 3.50 A         | 5.50 ... 40.00                          | 15.0                         | Digital            | DSO-12    |
| ITS4075Q-EP-D   | 4                  | 75                             | 4 x 2.00                 | 60 @ 2 A             | 5.00 ... 45.00                          | 4.1                          | Digital            | TSDSO-14  |
| ITS4090Q-EP-D   | 4                  | 90                             | 4 x 0.50                 | 410 @ 0.5 A          | 5.00 ... 45.00                          | 1.5                          | Digital            | TSDSO-14  |
| ITS724G         | 4                  | 90                             | 4 x 2.00                 | 120 @ 3.30 A         | 5.50 ... 40.00                          | 15.0                         | Digital            | DSO-20    |
| ITS4130Q-EP-D   | 4                  | 130                            | 4 x 0.50                 | 380 @ 0.5 A          | 5.00 ... 45.00                          | 1.25                         | Digital            | TSDSO-14  |
| ITS716G         | 4                  | 140                            | 4 x 1.00                 | 76 @ 2.30 A          | 5.50 ... 40.00                          | 9.0                          | Digital            | DSO-20    |
| ITS711L1        | 4                  | 200                            | 4 x 1.00                 | 150 @ 1.90 A         | 5.00 ... 35.00                          | 7.5                          | Digital            | DSO-20    |
| ITS42008-SB-D   | 8                  | 200                            | 8 x 0.60                 | 10,000 @ 625 mA      | 11.00 ... 45.00                         | 3.0                          | Digital            | DSO-36    |
| ITS4880R        | 8                  | 200                            | 8 x 0.60                 | 10,000 @ 625 mA      | 11.00 ... 45.00                         | 3.0                          | Digital            | DSO-36    |



## Evaluation board

- ITS4040D-EP-D
- ITS4075Q-EP-D
- ITS4090Q-EP-D
- ITS4130Q-EP-D

[www.infineon.com/industrial-profet](http://www.infineon.com/industrial-profet)

\* Per one channel  
\*\* Coming soon

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## HITFET™ product portfolio

| Product type | Product family  | Channels | $R_{DS(on)}$<br>@ 25°C<br>[mW] | Nominal<br>load<br>current<br>[A] | EAS<br>[mJ] | Operating<br>voltage<br>range<br>[V] | $I_{L(lim)}$<br>(typ)<br>[A] | $I_{L(lim), TRIGGER}$<br>(typ)<br>[A] | Diagnosis         | Package                     |
|--------------|-----------------|----------|--------------------------------|-----------------------------------|-------------|--------------------------------------|------------------------------|---------------------------------------|-------------------|-----------------------------|
| BTS3011TE    | HITFET™ +       | 1        | 10.7                           | 10                                | 300 @ 5 A   | up to 28                             | 35                           | 70                                    | Status pin        | TO-252-5 (DPAK 5-leg)       |
| BTT3018EJ    | HITFET™ +       | 1        | 16                             | 7.0                               | 150         | up to 36                             | 45                           | –                                     | Status pin        | TDSO-8                      |
| BTS3035EJ    | HITFET™ +       | 1        | 28                             | 5.00                              | 105 @ 5 A   | up to 31                             | 20.00                        | –                                     | Status pin        | TDSO-8                      |
| BTS3035TF    | HITFET™ +       | 1        | 30                             | 5.00                              | 106 @ 5 A   | up to 31                             | 20.00                        | –                                     | –                 | TO-252-3 (DPAK 3-leg)       |
| BTF3035EJ    | HITFET™ +       | 1        | 28                             | 5.00                              | 95 @ 5 A    | up to 32                             | 14.00                        | 41.00                                 | Status pin        | TDSO-8                      |
| BTF3050TE    | HITFET™ +       | 1        | 40                             | 3.00                              | 120 @ 3 A   | up to 28                             | 8.00                         | 30.00                                 | Through SRP pin   | TO-252-5 (DPAK 5-leg)       |
| BTS3050EJ    | HITFET™ +       | 1        | 40                             | 4.00                              | 62 @ 3 A    | up to 31                             | 15.00                        | –                                     | Status pin        | TDSO-8                      |
| BTS3050TF    | HITFET™ +       | 1        | 44                             | 4.00                              | 64 @ 4 A    | up to 31                             | 15.00                        | –                                     | –                 | TO-252-3 (DPAK 3-leg)       |
| BTF3050EJ    | HITFET™ +       | 1        | 40                             | 4.00                              | 62 @ 4 A    | up to 32                             | 10.00                        | 29.00                                 | Status pin        | TDSO-8                      |
| BTS3060TF    | HITFET™ +       | 1        | 50                             | 3.00                              | 55 @ 3 A    | up to 35                             | 10.50                        | –                                     | –                 | TO-252-3 (DPAK 3-leg)       |
| BTS3080EJ    | HITFET™ +       | 1        | 64                             | 3.00                              | 35 @ 3 A    | up to 31                             | 10.00                        | –                                     | Status pin        | TDSO-8                      |
| BTS3080TF    | HITFET™ +       | 1        | 69                             | 3.00                              | 38 @ 3 A    | up to 31                             | 10.00                        | –                                     | –                 | TO-252-3 (DPAK 3-leg)       |
| BTF3080EJ    | HITFET™ +       | 1        | 64                             | 3.00                              | 33 @ 3 A    | up to 32                             | 7.00                         | 18.00                                 | Status pin        | TDSO-8                      |
| BTS3125EJ    | HITFET™ +       | 1        | 100                            | 2.00                              | 30 @ 2 A    | up to 31                             | 7.00                         | –                                     | Status pin        | TDSO-8                      |
| BTS3125TF    | HITFET™ +       | 1        | 108                            | 2.00                              | 24 @ 2 A    | up to 31                             | 7.00                         | –                                     | –                 | TO-252-3 (DPAK 3-leg)       |
| BTF3125EJ    | HITFET™ +       | 1        | 100                            | 2.00                              | 23 @ 2 A    | up to 32                             | 5.00                         | 12.00                                 | Status pin        | TDSO-8                      |
| BTS3018TC    | Classic HITFET™ | 1        | 14                             | 6.00                              | 1900        | up to 36                             | 30.00                        | –                                     | Through input pin | TO-263-3-2 (TO-220-3 (SMD)) |
| BTS141TC     | Classic HITFET™ | 1        | 25                             | 5.10                              | 4000        | up to 36                             | 25.00                        | –                                     | Through input pin | TO-263-3-2 (TO-220-3 (SMD)) |
| BTS3028SDL   | Classic HITFET™ | 1        | 28                             | 5.00                              | 350         | up to 36                             | 18.00                        | –                                     | Through input pin | TO-252-3 (DPAK 3-leg)       |
| BTS3028SDR   | Classic HITFET™ | 1        | 28                             | 5.00                              | 350         | up to 36                             | 18.00                        | –                                     | Through input pin | TO-252-3 (DPAK 3-leg)       |
| BTS133TC     | Classic HITFET™ | 1        | 40                             | 3.80                              | 2000        | up to 36                             | 21.00                        | –                                     | Through input pin | TO-263-3-2 (TO-220-3 (SMD)) |
| BTS3046SDL   | Classic HITFET™ | 1        | 46                             | 3.60                              | 140         | up to 36                             | 10.00                        | –                                     | Through input pin | TO-252-3 (DPAK 3-leg)       |
| BTS3046SDR   | Classic HITFET™ | 1        | 46                             | 3.60                              | 140         | up to 36                             | 10.00                        | –                                     | Through input pin | TO-252-3 (DPAK 3-leg)       |
| BTS117TC     | Classic HITFET™ | 1        | 80                             | 3.50                              | 1000        | up to 36                             | 7.00                         | –                                     | Through input pin | TO-263-3-2 (TO-220-3 (SMD)) |
| BTS3104SDL   | Classic HITFET™ | 1        | 104                            | 2.00                              | 50          | up to 36                             | 6.00                         | –                                     | Through input pin | TO-252-3 (DPAK 3-leg)       |
| BTS3104SDR   | Classic HITFET™ | 1        | 104                            | 2.00                              | 50          | up to 36                             | 6.00                         | –                                     | Through input pin | TO-252-3 (DPAK 3-leg)       |
| BTS3408G     | Classic HITFET™ | 2        | 480                            | 0.55                              | 800         | up to 36                             | 1.00                         | –                                     | Through input pin | DSO-8                       |
| BSP75N       | Classic HITFET™ | 1        | 490                            | 0.70                              | 550         | up to 36                             | 1.00                         | –                                     | Through input pin | SOT-223                     |



# CIPOS™ IPM product portfolio

| MOSFET based CIPOS™ IPMs |             |                  |                                 |             |  |
|--------------------------|-------------|------------------|---------------------------------|-------------|--|
| Product family           | Voltage [V] | Configuration    | $R_{DS(on),max}^*$ [ $\Omega$ ] | Package     | Product name   |
| CIPOS™ Nano              | 40          | Half-bridge      | 0.005                           | QFN 7x8     | IRSM005-800MH  |
|                          | 100         | Half-bridge      | 0.021                           | QFN 7x8     | IRSM005-301MH  |
|                          | 250         | H-bridge         | 0.063                           | QFN 12x10   | IM111-X3Q1B  |
|                          |             | Half-bridge      | 0.15                            | QFN 8x9     | IRSM808-204MH  |
|                          |             | 3-phase inverter | 0.45 ~ 2.40                     | QFN 12x12   | IRSM836-024MA/IRSM836-044MA<br>IRSM836-084MA               |
|                          | 500         | Half-bridge      | 0.80/1.70                       | QFN 8x9     | IRSM808-105MH/IRSM807-045MH                                |
|                          |             | 3-phase inverter | 1.70 ~ 6.00                     | QFN 12x12   | IRSM836-015MA/IRSM836-025MA/IRSM836-035MA<br>IRSM836-045MA |
| 600                      | H-bridge    | 0.28             | QFN 12X10                       | IM111-X6Q1B |  |
| CIPOS™ Maxi              | 1200        | 3-phase inverter | 0.055                           | DIP 36x23D  | IM828-XCC  |

| IGBT based CIPOS™ IPMs  |             |                         |                   |                         |  |             |  |
|-------------------------|-------------|-------------------------|-------------------|-------------------------|--|-------------|--|
| Product family          | Voltage [V] | Configuration           | Rated current [A] | Package                 | Product name   |             |  |
| CIPOS™ Micro            | 600         | 3-phase inverter        | 2.0/4.0/6.0       | DIP 29x12               | IM241-S6T2B/IM241-M6T2B/IM241-L6T2B<br>IM241-S6T2J/IM241-M6T2J   |             |  |
|                         |             |                         | 2.0/4.0/6.0       | SOP 29x12               | IM241-S6S1B/IM241-M6S1B/IM241-L6S1B<br>IM241-S6S1J/IM241-M6S1J   |             |  |
| CIPOS™ Mini             | 600         | PFC integrated          | 10.0 ~ 20.0       | DIP 36x21D              | IFCM10S60GD/IFCM10P60GD<br>IFCM15S60GD/IFCM15P60GD<br>IM564-X6D  |             |  |
|                         |             | 3-phase inverter        | 4.0 ~ 30.0        | DIP 36x21               | IGCM04F60GA/IGCM04G60GA/IGCM06F60GA/IGCM06G60GA<br>IGCM10F60GA/IKCM10H60GA/IKCM10L60GA<br>IGCM15F60GA/IKCM15L60GA/IKCM15F60GA/IKCM15H60GA<br>IGCM20F60GA/IKCM20L60GA<br>IKCM30F60GA<br>IM523-S6A/IM523-M6A/IM523-L6A/IM523-X6A |             |  |
|                         |             |                         |                   |                         | 15.0 ~ 30.0  | DIP 36x21D  | IKCM15L60GD/IKCM20L60GD/IKCM30F60GD<br>IM535-U6D |
|                         |             |                         |                   |                         | Single boost PFC + inverter  | 10.0 ~ 20.0 | DIP 36x21D                                       |
|                         | 650         | 3-phase interleaved PFC | 20.0/30.0         | DIP 36x21D              | IFCM20T65GD/IFCM30T65GD  |             |  |
| 2-phase interleaved PFC |             | 30.0                    | DIP 36x21D        | IFCM30T65GD/IFCM30U65GD |  |             |  |
| CIPOS™ Maxi             | 1200        | 3-phase inverter        | 5.0 ~ 15.0        | DIP 36x23D              | IM818-SCC/IM818-MCC/IM818-LCC  |             |  |





# Infineon support for intelligent switches and modules

Useful links and helpful information

Further information, datasheets and documents

[www.infineon.com/isoface](http://www.infineon.com/isoface)

[www.infineon.com/hitfet](http://www.infineon.com/hitfet)

[www.infineon.com/industrial-profet](http://www.infineon.com/industrial-profet)

[www.infineon.com/shields-for-arduino](http://www.infineon.com/shields-for-arduino)



Support



Evaluation board



Tools





## Microcontrollers

- XMC™ microcontrollers
- XMC™ ecosystem, enablement and partners
- XMC™ digital power explorer kit
- XMC™ starter kits
- XMC™ peripherals
- AURIX™ - 32-bit microcontrollers
- AURIX™ TC2xx family system architecture
- AURIX™ TC3xx family system architecture
- AURIX™ starter and application kits
- Application example: Industrial robotics
- Microcontroller PDH partner
- TRAVEO™ II portfolio
- MOTIX™ Embedded Power ICs
- BLDC Motor Control Shield for Arduino
- CAN-FD transceivers

# XMC™

## One microcontroller platform – countless solutions

Infiniteon's XMC™ 32-bit industrial microcontroller portfolio is designed for efficiency and demanding industrial applications.

### XMC™ MCU portfolio

- RAM: 8 kB up to 1 MB
- Flash: 16 kB up to 8 MB
- Accurate analog mixed-signal peripherals
- Fast timer/PWM peripherals
- Rich communication interfaces
- 16-pin to 272-pin count packages

### XMC1000 family

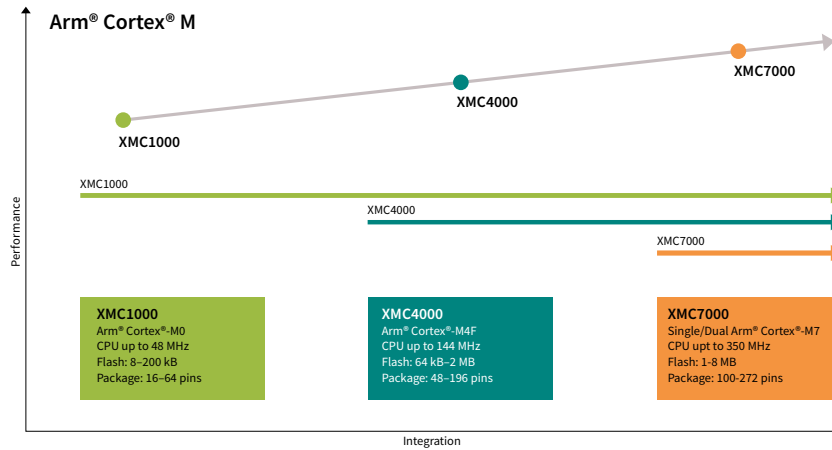
- Arm® Cortex®-M0 up to 48 MHz
- Peripherals up to 96 MHz
- One-time event request unit (ERU)
- $V_{DD}$ : 1.8 to 5.5 V
- $T_{Ambient}$ : -40°C to 105°C

### XMC4000 family

- Arm® Cortex®-M4 up to 144 MHz
- Built-in DSP, SFPW
- EtherCAT
- Event request unit (ERU)
- $T_{Ambient}$ : -40°C to 125°C

### XMC7000 family

- Single or dual core Arm® Cortex®-M7 and Cortex®-M0+
- Up to 8 MB flash
- Up to 10x CAN FD and 2x Ethernet
- $T_{Ambient}$ : -40°C to 125°C

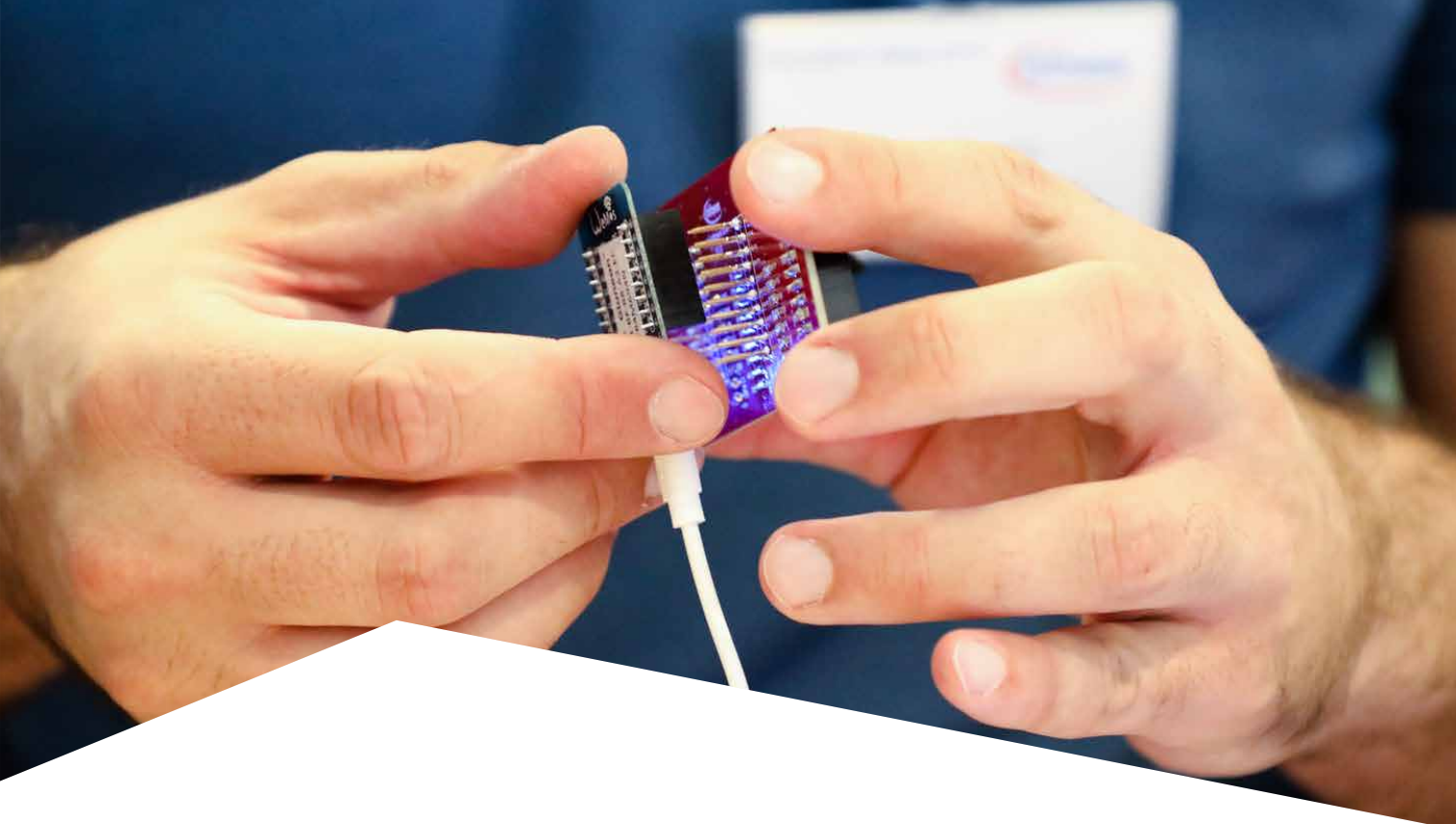


|   |  |   |  |  |
|---|--|---|--|--|
| <b>XMC7000</b><br>Dual ARM® Cortex®-M7 up to 350MHz core, 1MB - 8MB flash, up to 125°C Tamb, 2,7V-5,5V      | <b>XMC7100</b><br>Basic control & Connectivity single core @ 250MHz TQFP-100/144 | <b>XMC7100/7200</b><br>EV-Charging, TCPWM, CAN-FD TQFP-144/176, LFBGA-272                         | <b>XMC7100/7200</b><br>Industrial Drives, TCPWM, CAN-FD, up to 125°C Tamb TQFP-176, LFBGA-272          | <b>XMC7200</b><br>GB Ethernet, ADCs with 1MSPs, TCPWM, CAN-FD TQFP-176, LFBGA-272      |
| <b>XMC4000</b><br>Arm® Cortex®-M4F up to 144 MHz core 64 kB-2 MB flash up to 125°C                          | <b>XMC4100</b><br>Basic control and connectivity VQFN-48 LQFP-64                 | <b>XMC4200</b><br>Server power 150 ps HRPWM LQFP-64/100   | <b>XMC4700/4800</b><br>Industrial drives, Hall and encoder I/F, ΔΣ demodulator, LQFP-100/144 LFBGA-196 | <b>XMC4800, XMC4300</b><br>EtherCAT, +drives MultiCAN - 6 nodes LQFP-100/144 LFBGA-196 |
| <b>XMC1000</b><br>Arm® Cortex®-M0 up to 48 MHz core/ 96 MHz peripheral 8-200 KB flash up to 105°C 1,8-5,5 V | <b>XMC1100</b><br>Basic control and connectivity TSSOP-16/38 VQFN-24/40          | <b>XMC1400</b><br>Flicker-free, 4-Ch LED, SMPS, connectivity VQFN-40/64 LQFP-64                   | <b>XMC1400</b><br>SMPS control, connectivity VQFN-40/64 LQFP-64  | <b>XMC1400</b><br>Hall and encoder I/F, MATH co-processor, CAN VQFN-40/64 LQFP-64      |
|   |  | <b>XMC1200, XMC1300</b><br>Flicker-free, 4-Ch LED, SMPS, connectivity TSSOP-16/28/38 VQFN-24, -40 | <b>XMC1300</b><br>SMPS control, connectivity, TSSOP-16/38 VQFN-24/40                                   | <b>XMC1300</b><br>Hall and encoder I/F, MATH co-processor, TSSOP-16/38 VQFN-24/40      |
|   | XMC™ entry   | LED lighting  | Digital power  | Motor control  |
|   |  |   |  | Industrial I/O   |

[www.infineon.com/xmc](http://www.infineon.com/xmc)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





## XMC™ ecosystem, enablement and partners

A comprehensive set of tools, products, components, and services are available for fast and efficient design with XMC™ microcontrollers.

### Infinion enablement for XMC™ MCUs

**ModusToolbox™ Software** – [www.infineon.com/mtb](http://www.infineon.com/mtb)

Modern and extensible development environment supporting a wide range of Infineon microcontroller devices

**DAVE™** – [www.infineon.com/dave](http://www.infineon.com/dave)

Professional and free-of-charge development platform

**XMC™ library for Embedded Coder®** – [www.infineon.com/matlab](http://www.infineon.com/matlab)

Model-based design from MATLAB® and Simulink® environment, download free of charge

**IEC60730 class B library for XMC™** – [www.infineon.com/iec60730](http://www.infineon.com/iec60730)

Available for XMC™ industrial microcontrollers free of charge

**Microcontroller/Probe™ XMC™** – [www.infineon.com/ucprobexmc](http://www.infineon.com/ucprobexmc)

Free-of-charge version of microcontroller/Probe™ for XMC™ MCUs to build user interfaces for visualizing, observing, and control of the internals of XMC™ MCUs

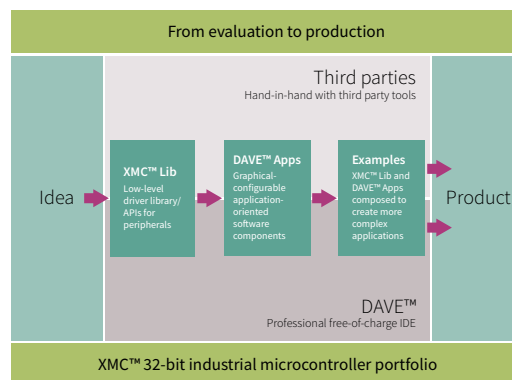
**XMC™ link** – [www.infineon.com/xmmlink](http://www.infineon.com/xmmlink)

Functional isolated debug probe, based on SEGGER J-Link technology

In addition to a rich third party ecosystem and enablement landscape, which support the entire development cycle from evaluation to production.

For more click [here](#).

[www.infineon.com/xmc](http://www.infineon.com/xmc)



Infineon's XMC™ 32-bit industrial microcontroller portfolio is designed for system cost and efficiency for demanding industrial applications. It comes with the most advanced peripheral set in the industry. Fast and largely autonomous peripherals can be configured to support individual needs.

Highlights include analog mixed-signal, timer/PWM and communication peripherals powered by either an Arm® Cortex®-M0 core (XMC1000 family) or an Arm® Cortex®-M4 core with a floating point unit (XMC4000 family).

| Arm® Cortex®-M0 | Co-processor | Clocks    |             | Memory |           | Analog         |                    |                    | Timer/PWM   |             |       |      | Connectivity |          | Package                      |
|-----------------|--------------|-----------|-------------|--------|-----------|----------------|--------------------|--------------------|-------------|-------------|-------|------|--------------|----------|------------------------------|
|                 |              | Frequency | Peripherals |        |           | ADC1 2-bit/S&H | Number of channels | Analog comparators | CCU4 (4 ch) | CCU8 (4 ch) | POSIF | BCCU | US IC        | CAN 2.0B |                              |
| XMC11x          | -            | 32        | 64          | Flash  | 8-64 kB   | 1/1            | Up to 12           | -                  | 1x          | -           | -     | -    | 2x           | -        | VQFN 24/40<br>TSSOP 16/38    |
|                 |              |           |             | RAM    | 16 kB     |                |                    |                    |             |             |       |      |              |          |                              |
| XMC12x          | -            | 32        | 64          | Flash  | 16-200 kB | 1/2            | Up to 12           | Up to 3            | 1x          | -           | -     | ✓    | 2x           | -        | VQFN 24/40<br>TSSOP 16/28/38 |
|                 |              |           |             | RAM    | 16 kB     |                |                    |                    |             |             |       |      |              |          |                              |
| XMC13x          | ✓            | 32        | 64          | Flash  | 8-200 kB  | 1/2            | Up to 12           | Up to 3            | 1x          | 1x          | ✓     | ✓    | 2x           | -        | VQFN 24/40<br>TSSOP 16/38    |
|                 |              |           |             | RAM    | 16 kB     |                |                    |                    |             |             |       |      |              |          |                              |
| XMC14x          | ✓            | 48        | 96          | Flash  | 32-200 kB | 1/2            | Up to 12           | Up to 4            | 2x          | 2x          | ✓     | ✓    | 4x           | ✓        | VQFN 40/48/64<br>LQFP 64     |
|                 |              |           |             | RAM    | 16 kB     |                |                    |                    |             |             |       |      |              |          |                              |

Supply voltage range 1.8-5.5 V

Temperature range -40°C ... 85°C/105°C

| Arm® Cortex®-M0 | Frequency [MHz] | Memory |             | Analog         |                    |            | Timer/PWM   |             |                |       |               | Connectivity |          |     |          |           | SDIO/SD/MMC External BUS Unit (EBU) | Package |                           |
|-----------------|-----------------|--------|-------------|----------------|--------------------|------------|-------------|-------------|----------------|-------|---------------|--------------|----------|-----|----------|-----------|-------------------------------------|---------|---------------------------|
|                 |                 |        |             | ADC1 2-bit/S&H | Number of channels | DAC1 2-bit | CCU4 (4 ch) | CCU8 (4 ch) | HRPWM (150 ps) | POSIF | Σ Demodulator | US IC        | CAN 2.0B | USB | Ethernet | EtherCAT® |                                     |         |                           |
| XMC41x          | 80              | Flash  | 64-128 kB   | 2/2            | Up to 9            | 2 ch       | 2x          | 1x          | ✓              | ✓     | -             | 4x           | Up to 2  | ✓   | -        | -         | -                                   | -       | VQFN 48<br>TQFP 64        |
|                 |                 | RAM    | 20 kB       |                |                    |            |             |             |                |       |               |              |          |     |          |           |                                     |         |                           |
| XMC42x          | 80              | Flash  | 256 kB      | 2/2            | Up to 9            | 2 ch       | 2x          | 1x          | ✓              | ✓     | -             | 4x           | 2x       | ✓   | -        | -         | -                                   | -       | VQFN 48<br>TQFP 64        |
|                 |                 | RAM    | 40 kB       |                |                    |            |             |             |                |       |               |              |          |     |          |           |                                     |         |                           |
| XMC43x          | 144             | Flash  | 256 kB      | 2/2            | 14                 | 2 ch       | 2x          | 1x          | -              | -     | -             | 4x           | 2x       | ✓   | ✓        | ✓         | ✓                                   | -       | LQFP 100                  |
|                 |                 | RAM    | 128 kB      |                |                    |            |             |             |                |       |               |              |          |     |          |           |                                     |         |                           |
| XMC44x          | 120             | Flash  | 256-512 kB  | 4/4            | Up to 18           | 2 ch       | 4x          | 2x          | ✓              | 2x    | 4 ch          | 4x           | 2x       | ✓   | ✓        | -         | -                                   | -       | TQFP 64<br>LQFP 100       |
|                 |                 | RAM    | 80 kB       |                |                    |            |             |             |                |       |               |              |          |     |          |           |                                     |         |                           |
| XMC45x          | 120             | Flash  | 512 kB-1 MB | 4/4            | Up to 26           | 2 ch       | 4x          | 2x          | -              | 2x    | 4 ch          | 4x           | Up to 3  | ✓   | ✓        | -         | ✓                                   | ✓       | LQFP 100/144<br>LFBGA 144 |
|                 |                 | RAM    | 128-160 kB  |                |                    |            |             |             |                |       |               |              |          |     |          |           |                                     |         |                           |
| XMC47x          | 144             | Flash  | 1.5-2 MB    | 4/4            | Up to 26           | 2 ch       | 4x          | 2x          | -              | 2x    | 4 ch          | 6x           | 6x       | ✓   | ✓        | -         | ✓                                   | ✓       | LQFP 100/144<br>LFBGA 196 |
|                 |                 | RAM    | 276-352 kB  |                |                    |            |             |             |                |       |               |              |          |     |          |           |                                     |         |                           |
| XMC48x          | 144             | Flash  | 1-2 MB      | 4/4            | Up to 26           | 2 ch       | 4x          | 2x          | -              | 2x    | 4 ch          | 6x           | 6x       | ✓   | ✓        | ✓         | ✓                                   | ✓       | LQFP 100/144<br>LFBGA 196 |
|                 |                 | RAM    | 276-352 kB  |                |                    |            |             |             |                |       |               |              |          |     |          |           |                                     |         |                           |

Supply voltage range 3.1-3.6 V

Temperature range -40°C ... 85°C/125°C

| Arm® Cortex®-M7 | Frequency [MHz] | Memory |        | Analog    |                    | Timer/TCPWM          |                        |                        | Connectivity |          |          |             |                       | Package                               |
|-----------------|-----------------|--------|--------|-----------|--------------------|----------------------|------------------------|------------------------|--------------|----------|----------|-------------|-----------------------|---------------------------------------|
|                 |                 |        |        | ADC 12bit | Number of Channels | 16 bit motor-control | 16 bit general-purpose | 32 bit general-purpose | SCB          | CAN-FD   | Ethernet | Gb Ethernet | SDHC (eMMC, SD, SDIO) |                                       |
| XMC71xx         | 250             | Flash  | 4 MB   | 3         | 18 ch              | 12 ch                | 63 ch                  | 8 ch                   | up to 11 ch  | up to 8  | ✓        | -           | ✓                     | QFP-100, QFP-144,<br>QFP-176, BGA-272 |
|                 |                 | RAM    | 768 kB |           |                    |                      |                        |                        |              |          |          |             |                       |                                       |
| XMC72xx         | 350             | Flash  | 8 MB   | 3         | 18 ch              | 15 ch                | 87 ch                  | 16 ch                  | up to 11 ch  | up to 10 | ✓        | ✓           | ✓                     | QFP-176, BGA-272                      |
|                 |                 | RAM    | 1 MB   |           |                    |                      |                        |                        |              |          |          |             |                       |                                       |

Supply voltage range 2.7-5.5V

Temperature range -40 ... 125°C

[www.infineon.com/xmc](http://www.infineon.com/xmc)  
[www.infineon.com/mtb](http://www.infineon.com/mtb)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# XMC™ 7000 microcontrollers

## High-quality grade MCU platform for industrial applications

The XMC7000 is the latest entry in Infineon's industrial microcontroller portfolio, equipped with peripherals such as CAN-FD, TCPWM and Gb Ethernet, which increase flexibility and offer added value. The XMC7000 architecture is built on a low-power 40-nm process technology and the MCUs offer best-in-class compute performance addressing high-end industrial applications.

The XMC7000 offers both single and dual-core Arm® Cortex®-M7 options, supported by an Arm® Cortex®-M0+ enabling designers to optimize their end products to meet the dynamic and demanding business conditions of industrial applications. The advanced peripheral set and robust security features make it attractive to customers, who need a high-quality MCU platform. The MCU can operate in harsh environments with a temperature range of -40°C to 125°C, and it is ideal for power-critical applications based on its low-power modes, which go down to 8 µA. The flexible XMC7000 comes in four package/pin types with 17-part number variants to meet many design requirements.

### XMC7100/7200

4 MB flash / 768 kB RAM,  
250 MHz single/dual core  
100 – 272 pin (QFP/BGA)

### XMC7200

8 MB flash / 1 MB RAM,  
350 MHz single/dual core  
176 – 272 pin (QFP/BGA)

- Single or dual core Arm® Cortex®-M7 and Cortex®-M0+
- M7 CPU core Frequency up to 350 MHz
- Temperature range: Ta = -40 to 125°C
- Memory Up to 8 MB flash, 1 MB RAM
- TCPWM timers of 102Ch 16 bit and 16Ch 32 bit
- Cryptography Engine support
- Interfaces such as CAN-FD, Gb Ethernet
- SMIF and SDHC interface supported
- Extended voltage operating range: 2.7 to 5.5V
- low power modes( LP/deep sleep, hibernate)
- Add. timer, ADC and Serial COM. Chs
- Read While Write (RWW) flash capability



BGA-272



QFP-176

## Features and benefits

### Key benefits

- Best-in-class computing performance
- Low power to support electrification and digitization
- Optimal solution for motor control & power conversion applications
- Advanced security options
- Ability to operate in high ambient environments
- XMC7000 is easy to adapt to existing PCB
- Different core/memory/package combinations

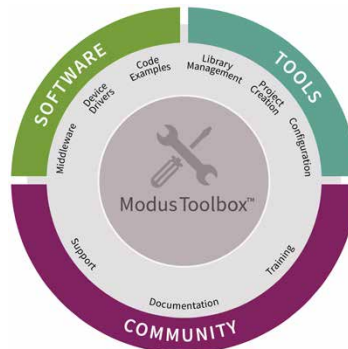


## XMC™ 7000 part numbers

| Type                 | Description   |
|----------------------|---|
| XMC7100-F100K1088AA  | Single Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 100 pins, 1 MB flash  |
| XMC7100-F100K2112AA  | Single Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 100 pins, 2 MB flash  |
| XMC7100-F100K4160AA  | Single Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 100 pins, 4 MB flash  |
| XMC7100D-F100K2112AA | Dual Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 100 pins, 2 MB flash    |
| XMC7100D-F100K4160AA | Dual Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 100 pins, 4 MB flash    |
| XMC7100-F144K2112AA  | Single Core Arm® Cortex® M7(+ Arm® Cortex®-M0+), TQFP 144 pins, 2 MB flash  |
| XMC7100-F144K4160AA  | Single Core Arm® Cortex® M7(+ Arm® Cortex®-M0+), TQFP 144 pins, 4 MB flash  |
| XMC7100D-F144K2112AA | Dual Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 144 pins, 2 MB flash    |
| XMC7100D-F144K4160AA | Dual Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 144 pins, 4 MB flash    |
| XMC7100-F176K4160AA  | Single Core Arm® Cortex® M7(+ Arm® Cortex®-M0+), TQFP 176 pins, 4 MB flash  |
| XMC7100D-F176K4160AA | Dual Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 176 pins, 4 MB flash    |
| XMC7100-E272K4160AA  | Single Core Arm® Cortex® M7(+ Arm® Cortex®-M0+), LFBGA 272 pins, 4 MB flash |
| XMC7100D-E272K4160AA | Dual Core Arm® Cortex® M7(+ Arm® Cortex®-M0+), LFBGA 272 pins, 4 MB flash   |
| XMC7200-F176K8384AA  | Single Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 176 pins, 8 MB flash  |
| XMC7200D-F176K8384AA | Dual Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), TQFP 176 pins, 8 MB flash    |
| XMC7200-E272K8384AA  | Single Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), LFBGA 272 pins, 8 MB flash |
| XMC7200D-E272K8384AA | Dual Core Arm® Cortex® M7 (+Arm® Cortex®-M0+), LFBGA 272 pins, 8 MB flash   |

## Software

### ModusToolbox™ Software Environment



ModusToolbox™ software supports application development using the XMC7200 evaluation kit by providing board support package (BSP) and validated code examples to help you get started. To download the latest version of the software, please visit the ModusToolbox™ webpage.





## XMC™ digital power explorer kit

The new digital power explorer kit is designed with the particular goal of making it easy for engineers to take the first steps into digital power control with XMC™ microcontrollers. It showcases both XMC™ families Arm® Cortex-M microcontrollers: XMC4000 and XMC1000, 30 V dual n-channel OptiMOS™ MOSFETs and IRS2011S gate drivers. The kit includes two different control card options, XMC1300 control card (Arm® Cortex®-M0) and XMC4200 control card (Arm® Cortex®-M4F), which allow designers to evaluate both XMC™ microcontroller families and make the right price/performance choice for their application.

### Features and benefits

#### Key features

- Synchronous buck converter evaluation kit controlled with XMC4200 or XMC1300 Arm® Cortex®-M MCUs
- Onboard resistive load banks
- Featuring BSC0924NDI dual n-channel OptiMOS™ MOSFET and IRS2011S high- and low-side gate driver
- Different control schemes possible
- Voltage mode control
- Peak current mode control (with slope compensation)

#### Key benefits

- Easy entry in digital power control applications
- Understand the details of voltage/peak current control and how to extract the maximum of XMC™ devices
- DAVE™ v4 APPs for buck converter and many more example




## High power density 800 W 130 kHz platinum server design with XMC1300

The 800 W PFC CCM evaluation board demonstrates design and practical results of an 800 W 130 kHz platinum server PFC evaluation board based on Infineon devices, in terms of power semiconductors, non-isolated gate drivers, analog and digital controllers for the PFC converter, as well as flyback controller for the auxiliary supply. This evaluation board verifies the performance of the latest 600 V CoolMOS™ C7 superjunction MOSFET technology working at 130 kHz in a PFC CCM boost converter along with EiceDRIVER™ ICs and CoolSiC™ Schottky diode 650 V G5 using digital control.

### Features and benefits

| Key features   | Customer benefits  |
|--|--|
| <ul style="list-style-type: none"> <li>– Classic PFC boost stage digitally controlled with XMC1302 including voltage and current loops</li> <li>– Protections, including cycle-by-cycle current protection</li> <li>– Run time debug with isolated UART to PC interface and PC software</li> </ul> | <ul style="list-style-type: none"> <li>– High efficient PFC stage with a complete system solution from Infineon</li> <li>– HW and SW available</li> <li>– Higher switching frequency permits higher power density</li> </ul> |

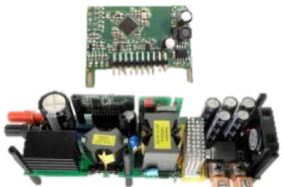
| 800 W PFC CCM with XMC1300   | Specification  | Infineon components    |               |                                    |
|--|----------------|------------------------|---------------|------------------------------------|
|  | $V_{in}$       | 90-265 V <sub>AC</sub> | MCU           | XMC1302 (TSSOP38)                  |
|  | $V_{out\_nom}$ | 380 V <sub>DC</sub>    | MOSFET        | 600 V CoolMOS™ C7                  |
|  | $I_{out}$      | 2 A                    | MOSFET driver | EiceDRIVER™ 2EDN7524F non-isolated |
|  | PWM frequency  | 130 kHz                | Diode         | CoolSiC™ Schottky diode 650 V G5   |
|  | THD            | <10%                   | Auxiliary PSU | ICE2QR4780Z                        |
|  | Power factor   | >0.9 from 20% load     |               |                                    |
|  | Efficiency     | 97% (peak)             |               |                                    |

## 600 W half-bridge LLC evaluation board with 600 V CoolMOS™ C7 SJ MOSFET with digital control

The 600 W LLC digital control evaluation board shows how to design the half-bridge LLC stage of a server SMPS with the target to meet 80+ Titanium standard efficiency requirements. For this purpose, the latest CoolMOS™ technologies, 600 V CoolMOS™ C7 or P6 superjunction MOSFETs have been used on the primary side, and OptiMOS™ low-voltage power MOSFET in SuperSO8, BSC010N04LS, in the synchronous rectification secondary stage in combination with QR CoolSET™ ICE2QR2280Z, high- and low-side driver 2EDL05N06PF, low-side gate driver 2EDN7524F and a XMC4200 microcontroller.

### Features and benefits

| Key features   | Customer benefits  |
|--|--|
| <ul style="list-style-type: none"> <li>– 600 W LLC half-bridge stage with synchronous rectification (SR)</li> </ul>  | <ul style="list-style-type: none"> <li>– Learn LLC topology with a complete system solution from Infineon</li> <li>– HW and- SW available</li> </ul>       |
| All controlled with XMC4200 including: <ul style="list-style-type: none"> <li>– Start up (PWM to PFM) and burst-mode algorithms</li> <li>– Adaptive dead time and capacitive-mode detection</li> <li>– No hard commutation at any condition</li> </ul> | <ul style="list-style-type: none"> <li>– Close to customer solution</li> <li>– High efficiency → 97.8%</li> <li>– Reliability and power density</li> </ul> |

| 600 W LLC digital control   | Specification  | Infineon components     |               |                      |
|---|----------------|-------------------------|---------------|----------------------|
|  | $V_{in}$       | 350-410 V <sub>DC</sub> | MCU           | XMC4200 (VQFN48)     |
|   | $V_{out\_nom}$ | 12 V <sub>DC</sub>      | MOSFET SR     | BSC010N04LS          |
|   | $I_{out}$      | 50 A                    | HB driver     | 2EDL05N06PF          |
|   | $P_{out}$      | 600 W                   | LLC HB MOSFET | CoolMOS™ IPP60R190P6 |
|   | $f_{res}$      | 157 kHz                 | Auxiliary PSU | ICE2QR2280Z          |



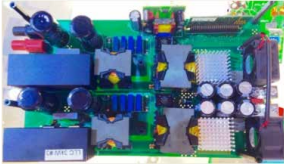


### 3 kW dual-phase LLC converter using XMC4400

The 3 kW dual-phase LLC demonstration board is an example of a high efficiency isolated DC-DC converter using the state-of-the-art Infineon components, both power devices and controller/driver ICs. The use of an advanced digital control using the XMC4400 microcontroller, together with the latest generation of CoolMOS™ and OptiMOS™ devices, allows achieving a very flat efficiency curve in the entire load range. The demonstration board is targets the high voltage DC-DC stage of high-end telecom rectifiers.

#### Features and benefits

| Key features  | Customer benefits  |
|---|--|
| – Full digital control by XMC4400 on the secondary side   | – Full digital control by XMC4400 on the secondary side              |
| – Digital current sharing with phase shedding   | – Efficiency peak 98.5% and more than 97.2% in the entire load range |
| – Accurate algorithm able to prevent hard commutation and capacitive load mode in LLC operation | – Easy monitoring and parameter setting via a graphic user interface |

| 3 kW dual-phase LLC converter using XMC4400  | Specification        | Infineon components     |                           |                            |
|--|----------------------|-------------------------|---------------------------|----------------------------|
|  | V <sub>in</sub>      | 350-410 V <sub>DC</sub> | MCU                       | XMC4400 (LQFP64)           |
|  | V <sub>out,nom</sub> | 54.3 V <sub>DC</sub>    | SR MOSFET                 | OptiMOS™<br>BSC093N15NS5   |
|  | I <sub>out,max</sub> | 55 A                    | Drivers                   | 1EDI60N12AF<br>2EDN7524R   |
|  | P <sub>out</sub>     | 3000 W                  | LLC<br>Half-bridge MOSFET | CoolMOS™ P6<br>IPW60R041P6 |
|  | f <sub>range</sub>   | 90-200 kHz              | Auxiliary PSU             | ICE2QR2280Z                |
|  | Peak efficiency      | >98.4%                  |                           |                            |

### RGB LED lighting shield with XMC1202 for Arduino

The RGB LED lighting shield with XMC1202 for Arduino uses a DC-DC buck topology and is able to drive up to three LED channels with constant current. The shield itself is powered by a programmable XMC™ 32-bit Arm® MCU with embedded brightness color control unit (BCCU, XMC1200 MCU series), for flicker-free LED dimming and color control.

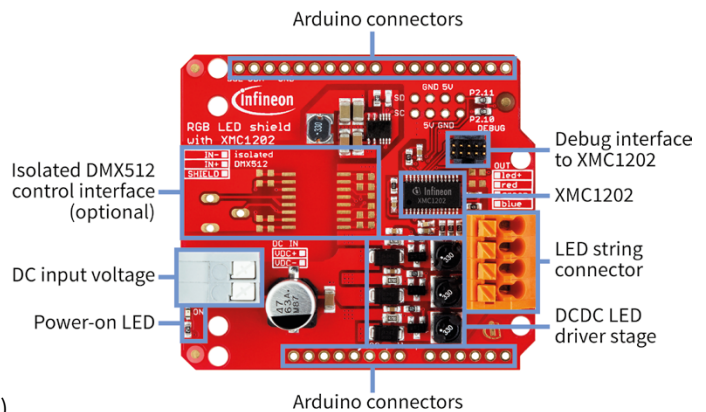
#### Features

- › Compatible with Arduino Uno R3 and XMC1100 boot kit from Infineon
- › Easily configurable for various light engines and any input voltage (within operating conditions)
- › Wide DC input voltage range
- › Simple I<sup>2</sup>C interface

#### Operating conditions

- › Nominal: 12-48 V input voltage (max. 6-60 V)
- › Average LED current up to 700 mA (max. peak current 1 A)

The Infineon shields mentioned above are hardware compatible with Arduino and Infineon's XMC™ boot and relax kits.



# 3 kW dual-phase LLC converter

## XMC4800 automation board V2 – explore XMC4800 microcontroller based on Arm® Cortex®-M4

The XMC4800 automation board V2 uses Infineon's industry leading XMC™ Arm® Cortex®-M4 microcontroller in combination with Infineon's supply, interface, communication and safety products. The XMC4800 automation board V2 is designed to evaluate the capabilities of the XMC4800 microcontroller especially in EtherCAT® slave applications and can be used with a wide range of development tools including Infineon's free-of-charge Eclipse based IDE, DAVE™.

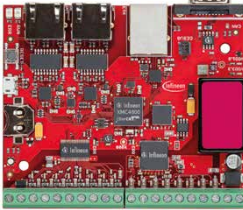
### Features and benefits

#### Key features

- XMC4800-E196 MCU based on Arm® Cortex®-M4 at 144 MHz
- EtherCAT® slave controller, 2 MB flash and 352 kB RAM
- OPTIGA™ Trust E embedded security solution (CC EAL6+)
- Real time clock crystal
- SPI FRAM (64 kB non-volatile memory)
- EtherCAT® slave node (2 EtherCAT® PHY and RJ45 Jacks)
- 24 V ISOFACE™ 8-channel inputs and 8-channel outputs CAN transceiver
- CAN transceiver

#### Customer benefits

- Complete automation kit gateway
- Combined MCU with EtherCAT slave application
- Isolated interfaces with diagnose
- Ethernet connectivity with software examples available
- 24 V supply
- CAN connectivity
- Full software DAVE™ examples

| XMC4800 automation board V2   | Type                  | Description  | OPN                      |
|---|-----------------------|--|--------------------------|
|  | KIT_XMC48_AUT_BASE_V2 | The XMC4800 automation board V2 utilizes Infineon's industry leading XMC™ Arm® Cortex®-M4 microcontroller in combination with Infineon's supply, interface/communication and safety products | KITXMC48AUTBASEV2TOBO1   |
|   | XMC4800-E196K2048     | Arm® Cortex®-M4 microcontroller  | XMC4800E196K2048AAXQMA1  |
|   | ISO2H823V2.5          | 24 V 8-channel isolated output   | ISO2H823V25XUMA1         |
|   | ISO1I813T             | 24 V 8-channel isolated input  | ISO1I813TXUMA1           |
|   | SLS 32AIA020A4 USON10 | OPTIGA™ Trust E – embedded security solution   | SLS32AIA020A4USON10XTMA2 |
|   | TLE6250GV33           | Infineon CAN transceiver   | TLE6250GV33XUMA1         |
|   | IFX54441LDV           | Infineon voltage regulator   | IFX54441LDVXUMA1         |



## XMC™ wireless power controller – enabling wireless charging transmitter applications

Infineon's XMC™ wireless power controller, based on the Arm® Cortex®-M0 core, provides a powerful and cost-effective platform for high performance, smart and safe wireless charging applications. The XMC™ wireless power controller helps the next-generation wireless charging systems to meet strict safety, environmental and regulatory requirements, while still enabling industry-leading charging performance and efficiency. This controller works seamlessly with Infineon's power devices in a scalable architecture to provide a complete charging solution for everything from a fast-charge smartphone, to a 20 W robot, or a 60 W drone and beyond.

### Features and benefits

| Key features   | Customer benefits  |
|--|--|
| – Supports inductive and resonant charging methods   | – Supports 15 W charging and existing standards, including fast charging of smartphones              |
| – Power levels up to 60 W  | – Full power 15 W without exotic thermal management  |
| – Multiple industry standard and custom charging profiles using the same hardware architecture | – Achieves charging rates equivalent to wired charging   |
| – Single- and multi-coil transmitters  | – Supports custom-charging profiles and industry standards on the same hardware                      |
| – Half- and full-bridge support  | – Foreign object detection (FOD) with improved accuracy quality-factor monitoring                    |
| – Variable and fixed-frequency transmitter types   | – Foreign object detection capability can be extended beyond existing standards to improve detection |
| – Buck and boost topologies  | – Supports custom coils, and greater than three coils  |
| – Integrated flash for parameter storage   |  |
| – Voltage supply 1.8-5.5 V   |  |
| – Space saving VQFN-40 package   |  |

For a detailed overview of Infineon's wireless charging solutions, check the Wireless charging chapter.

# XMC™ starter kits

## Kits and evaluation boards

### Xtreme2Go

Order number: [KIT\\_XMC\\_2GO\\_XTR\\_XMC1400](#)

- › [XMC1400](#) family kit with ADAFRUIT, MikroE and Shields2Go connectivity. Extension for IoT and other cloud applications.
- › The [XMC1400](#) series devices are optimized for motor control, power conversion and LED Lighting applications and Human-Machine Interface (HMI)

For more information on this product, please contact our product support.

### Platform2Go XMC4400

Order number: [KIT\\_XMC\\_PLT\\_2GO\\_XMC4400](#)

- › Equipped with an Arm® Cortex®-M4 based [XMC™](#) microcontroller, the [XMC4400](#) Platform2Go is designed to evaluate the capabilities of Infineon's [XMC4400](#) microcontroller. It can be used with a wide range of development tools including Infineon's free of charge Eclipse based IDE DAVE™
- › This kit has the [XMC4400](#) device with debugger plus Ethernet, CAN, Arduino, MikroBUS and Shields2Go form factor.

Click on the following to find/purchase the kit:

[www.infineon.com/XMC4400platform2go](http://www.infineon.com/XMC4400platform2go)



### XMC1400 Arduino

Order number: [KIT\\_XMC1400\\_ARDUINO](#)

- › This kit utilizes Infineon's industry leading Arm® Cortex® M0 microcontroller in combination with Arduino form factor.
- › It can be used with a wide range of development tools including Infineon's free of charge Eclipse based IDE, DAVE™ and much more.

Click on the following to find/purchase the kit:

[www.infineon.com/xmc1400\\_ARDUINO](http://www.infineon.com/xmc1400_ARDUINO)



## Platform2Go XMC4200

Order number: KIT\_XMC\_PLT 2GO\_XMC 4200

- › Equipped with an Arm® Cortex®-M4 based XMC™ microcontroller from Infineon Technologies AG, the XMC4200 Platform2Go is designed to evaluate the capabilities of Infineon's XMC4200 microcontroller.
- › It can be used with a wide range of development tools including Infineon's free of charge Eclipse based IDE DAVE™
- › This kit has the XMC4200 device with debugger plus CAN, Arduino, MikroBUS and Shields2Go form factor.

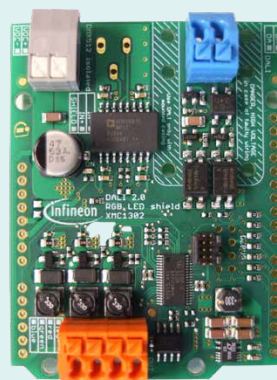
Click on the following to find/purchase the kit:  
[www.infineon.com/XMC4200platform2go](http://www.infineon.com/XMC4200platform2go)



## RGB LED Lighting Shield

Order number: KIT\_XMC\_LED\_DALI\_20\_RGB

- › One of the first intelligent evaluation boards compatible with Arduino as well as Infineon's XMC1100 BOOT KIT.
- › Designed to be easily configurable and combinable for different LED light engines and lamps, for fast prototyping and in-expensive evaluation of LED lighting applications.
- › The RGB LED lighting shield with XMC1302 uses a DC-DC buck topology.



Click on the following to find/purchase the kit:

[www.infineon.com/cms/en/product/evaluation-boards/kit\\_xmc\\_led\\_dali\\_20\\_rgb/](http://www.infineon.com/cms/en/product/evaluation-boards/kit_xmc_led_dali_20_rgb/)




# XMC™ peripherals

## IEC60730 class B library for XMC™

### Supporting the XMC1xxx and XMC4xxx families

In collaboration with the consultancy Hitex, Infineon developed the IEC60730 – class B software library for XMC™ industrial microcontrollers for household electrical appliances. This is a dedicated software library for XMC™ MCUs with routines for internal supervisory functions and for self-diagnostics.

Extended documentation and pre-certified software libraries to XMC™ Cortex® Arm® based controllers are free of charge. For more information, please check: [www.hitex.com/classb](http://www.hitex.com/classb)

| Documentation   | Consultancy   |
|---|---|
| Safety application note<br>Failure mode report<br>FMEA tool<br>by Infineon, revised in workshops by TÜV Süd | <br>EMBEDDED TOOLS & SOLUTIONS<br><br>Implementation support by Hitex |

## Embedded security for XMC™ MCUs

Infineon and its partners provide solutions which support with data protection, allowing authentication and encryption and securing firmware file updates to prevent cloning and downtimes.

| Security solutions                                       |  |  |
|--|--|--|
| Software   | Hardware   |  |
| <b>Secure bootloader</b><br>by Infineon, XMC1000         | <b>OPTIGA™ family by Infineon</b><br>Hardware-based security solutions   |  |
| <b>CodeMeter μEmbedded</b><br>by WIBU, XMC4000 exclusive |  |  |
| <b>KMS/CycurKEYS</b><br>by ESCRYPT, XMC4000              | <b>OPTIGA™ Trust family</b>  |  |
| <b>emSecure</b><br>by SEGGER                             | <b>OPTIGA™ TPM family</b>  |  |
|  | <br>Turnkey and programmable security solutions | <br>Standardized certified turnkey solution |

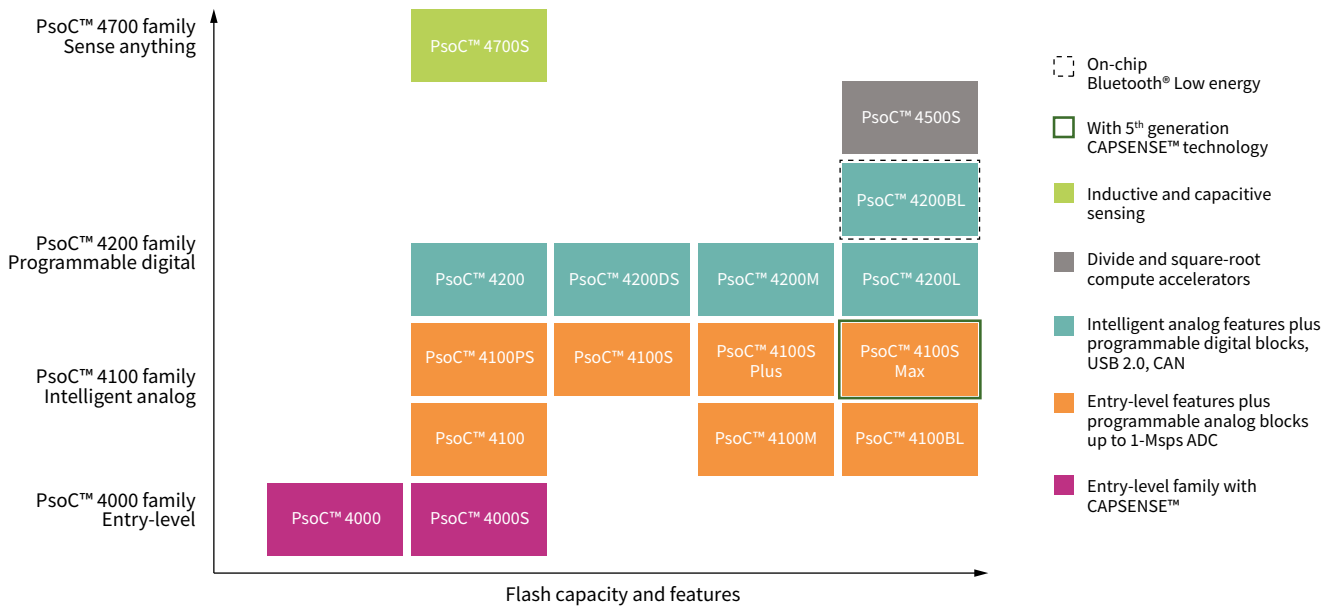


# PSoC™ 4 microcontrollers

## Your problem solver on chip

PSoC™ 4 has tackled some of the complex portions of embedded system design making it easier for you to get your product to market. Functions such as analog sensor integration, capacitive touch, and wireless connectivity have been integrated and optimized in PSoC™ 4 to just work.

The PSoC™ 4 portfolio consists of several families of Arm® Cortex®-M0 and Cortex-M0+ microcontrollers. Most devices in the portfolio include Infineon’s CAPSENSE™ technology for capacitive-sensing applications. Other key features in the PSoC™ 4 portfolio include a customizable analog front end through programmable analog blocks as well as wired and wireless connectivity options such as USB, CAN, and Bluetooth® Low Energy. These unique features make PSoC 4 the industry’s most flexible and scalable low-power mixed-signal architecture.



## Features and benefits

### Sense anything

Programmable analog and digital blocks in PSoC 4 enable you to customize your analog-front-end, apply simple glue logic and easily integrate intelligent analog sensors into an application

#### Intelligent sensor integration

### Easy-to-use HMI

PSoC 4 simplifies complex HMI interfaces such as capacitive and inductive sensing enabling sleek, robust, and easy-to-use interfaces

#### Capacitive and inductive sensing

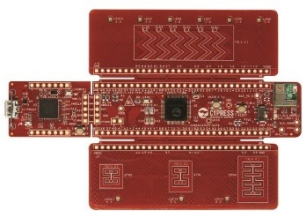

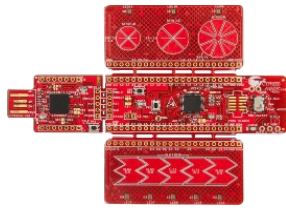





### Connected

Bluetooth® Low Energy (BLE) integrated into some PSoC 4 devices simplifies RF design. Additional wired interfaces such as USB and CAN are also available

#### Wired and wireless connectivity



## Evaluation kits

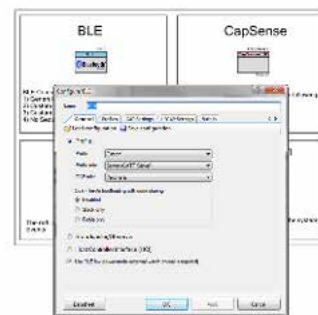
| Make it smarter  | Make it connected   | Make it easy to use  |
|--|---|--|
|  <p>PSoC™ 4100S Plus prototyping kit (CY8CKIT-149)</p>  | <p>Bluetooth® Low Energy kits</p>  <p>CY8CKIT-143-A      CY8CKIT-141</p>   | <p>HMI kits for capacitive/inductive sensing</p>  <p>PSoC™ 4000S prototyping kit (CY8CKIT-145-40xx)</p> |
|  <p>PSoC™ 4100PS prototyping kit (CY8CKIT-147)</p>      | <p>PSoC™ 4 Bluetooth® LE modules* with PCB or external antenna</p>  <p>PSoC™ 4 Bluetooth® LE Pioneer kit (CY8CKIT-042-BLE-A)</p> |  <p>PSoC™ 4700S Inductive Sensing Evaluation kit (CY8CKIT-148)</p>                                      |
|  <p>PSoC™ 4100S Max pioneer kit (CY8CKIT-041S-MAX)</p> |  <p>CySmart BLE USB Dongle (CY5677)</p>  |  |

## Software

ModusToolbox™ Software Environment



PSoC™ Creator IDE with graphical front ends

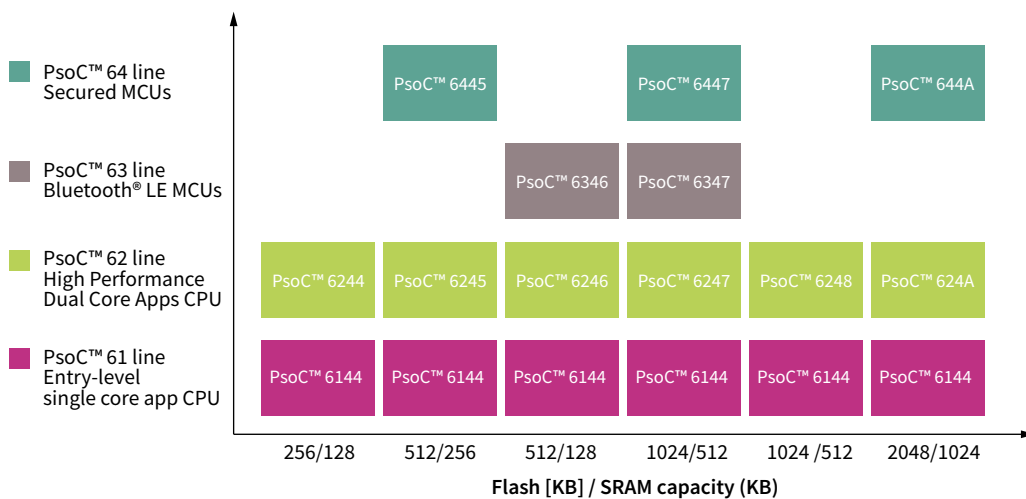




# PSoC™ 6 microcontrollers

## Purpose-Built for IoT

The PSoC™ 6 family is built on an ultra-low-power architecture, and the MCUs feature low-power design techniques that are ideal for battery-powered applications. The dual-core Arm® Cortex®-M4 and Cortex-M0+ architecture let designers optimize for power and performance simultaneously. Using its dual cores combined with configurable memory and peripheral protection units, the PSoC™ 6 MCU delivers the highest level of protection defined by the Platform Security Architecture (PSA) from Arm. Designers can use the MCU's rich analog and digital peripherals to create custom analog front ends (AFEs) or digital interfaces for innovative system components such as MEMS sensors, and electronic ink displays. The PSoC™ 6 MCU features the latest generation of industry-leading CAPSENSE™ capacitive-sensing technology, enabling modern touch and gesture-based interfaces that are robust and reliable. PSoC™ 6 MCU, paired with Infineon's AIROC™ Wi-Fi, AIROC™ Bluetooth®, or AIROC™ combos radio modules, is the perfect solution for secure, low-power, feature-rich IoT products.



## Features and benefits

### Lowest power

IoT devices are often portable, making battery life a critical factor. The PSoC™ 6 MCU architecture is built on a cutting-edge, ultra-low-power, 40-nm process technology with a dual Arm® Cortex®-M core architecture. Active power consumption is as low as 22- $\mu$ A/MHz for the M4 core, and 15- $\mu$ A/MHz for the M0+ core. PSoC™ 6 delivers extended battery life without sacrificing performance.

### Most flexibility

The PSoC™ 6 MCU architecture's best-in-class flexibility enables the addition of new features and addresses the need for unique IoT products with multiple connectivity options, such as USB and BLE. PSoC™ 6 also offers software-defined peripherals to create custom analog and digital circuits, and the industry's best capacitive-sensing solution, CAPSENSE®. In addition, a flexible dual-core architecture is used to optimize for system power consumption and performance. The possibilities are endless.

### Built-in security

The PSoC™ 6 MCU architecture supports multiple, simultaneous secure environments without the need for external memories or secure elements, and offers scalable secure memory for multiple, independent user-defined security policies, preventing your IoT device from becoming a security liability. PSoC™ 6 provides you with a new standard for IoT security.

[www.infineon.com/psoc6](http://www.infineon.com/psoc6)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## PSoC™ 6 Kits

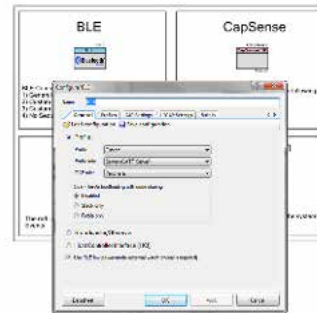
| Product family                           | Kit type    | Kit MPN               | Selection factors  |
|--|-------------|-----------------------|--|
| <b>PSoC™ 61, PSoC™ 62 product family</b> |             |                       |  |
| PSoC™ 62xA, 62x8, 61xA, 61x8             | Prototyping | CY8CPROTO-062-4343W   | Highest-end MCU, single-band Wi-Fi   |
|  | Pioneer     | CY8CKIT-062S2-43012   | Highest-end MCU, machine learning, graphics, dual-band/low power Wi-Fi, Arduino shield capability  |
|  | Evaluation  | CY8CEVAL-062S2        | Highest-end MCU, machine learning, graphics, flexible M.2 card-based Wi-Fi module evaluation (single-band, dual-band), Arduino shield capability, mikroBUS interface |
| PSoC™ 62x7, 62x6, 61x7, 61x6             | Pioneer     | CY8CKIT-062-WIFI-BT   | Standalone MCU, graphics, single-band Wi-Fi, analog rich, Arduino shield capability  |
| PSoC™ 62x5, 61x5                         | Prototyping | CY8CPROTO-062S3-4343W | Standalone MCU, single-band Wi-Fi connectivity processor, industrial (CAN-FD)  |
| PSoC™ 62x4, 61x4                         | Pioneer     | CY8CKIT-062S4         | Standalone MCU, low power analog, sensor coprocessor, Arduino shield capability  |
| <b>PSoC™ 64 Product Family</b>           |             |                       |  |
| PSoC™ 64xA                               | Pioneer     | CY8CKIT-064B0S2-4343W | Standalone secured MCU, trusted firmware-M, single-band Wi-Fi, Arduino shield capability   |
| PSoC™ 64x7                               | Prototyping | CY8CPROTO-064S1-SB    | Standalone secured MCU   |
| PSoC™ 64x5                               | Prototyping | CY8CPROTO-064B0S3     | Standalone secured MCU, industrial (CAN-FD)  |

## Software

### ModusToolbox™ Software Environment



### PSoC™ Creator IDE with graphical front ends





# AURIX™ – 32-bit microcontrollers

## 32-bit multicore TriCore™ – safety joins performance

AURIX™ is Infineon's family of microcontrollers serving the needs of industrial applications in terms of performance and safety. Its innovative multicore architecture, based on up to six independent 32-bit TriCore™ CPUs at 300 MHz, has been designed to meet the highest safety standards while increasing the performance at the same time. Using the AURIX™ scalable platform, developers will be able to implement applications such as motor control and drives, PLC or any other automation application. Developments using AURIX™ require less effort to achieve the SIL/IEC61508 standard based on its innovative safety concept and multiple HW safety features. Furthermore, AURIX™ has enhanced communication capabilities to support communication between CAN, LIN, FlexRay and Ethernet buses.

### Features and benefits

| Key features  |
|---|
| – TriCore™ with DSP functionality   |
| – Best-in-class real-time performance: up to six TriCore™ with up to 300 MHz per core |
| – Supporting floating point and fix point with all cores                              |
| – Up to 6.9 MB of internal RAM, up to 16 MB of flash                                  |
| – Innovative single supply 5 V or 3.3 V   |
| – IEC61508 conformance to support safety requirements up to SIL 3                     |
| – Embedded EEPROM   |
| – Advanced communication peripherals: CAN FD, LIN, SPI, FlexRay, Ethernet             |

| Customer benefits  |
|--|
| – High scalability gives the best cost-performance fit               |
| – High integration leads to significant cost savings                 |
| – High integration leads to reduced complexity                       |
| – Innovative supply concept leads to best-in-class power consumption |



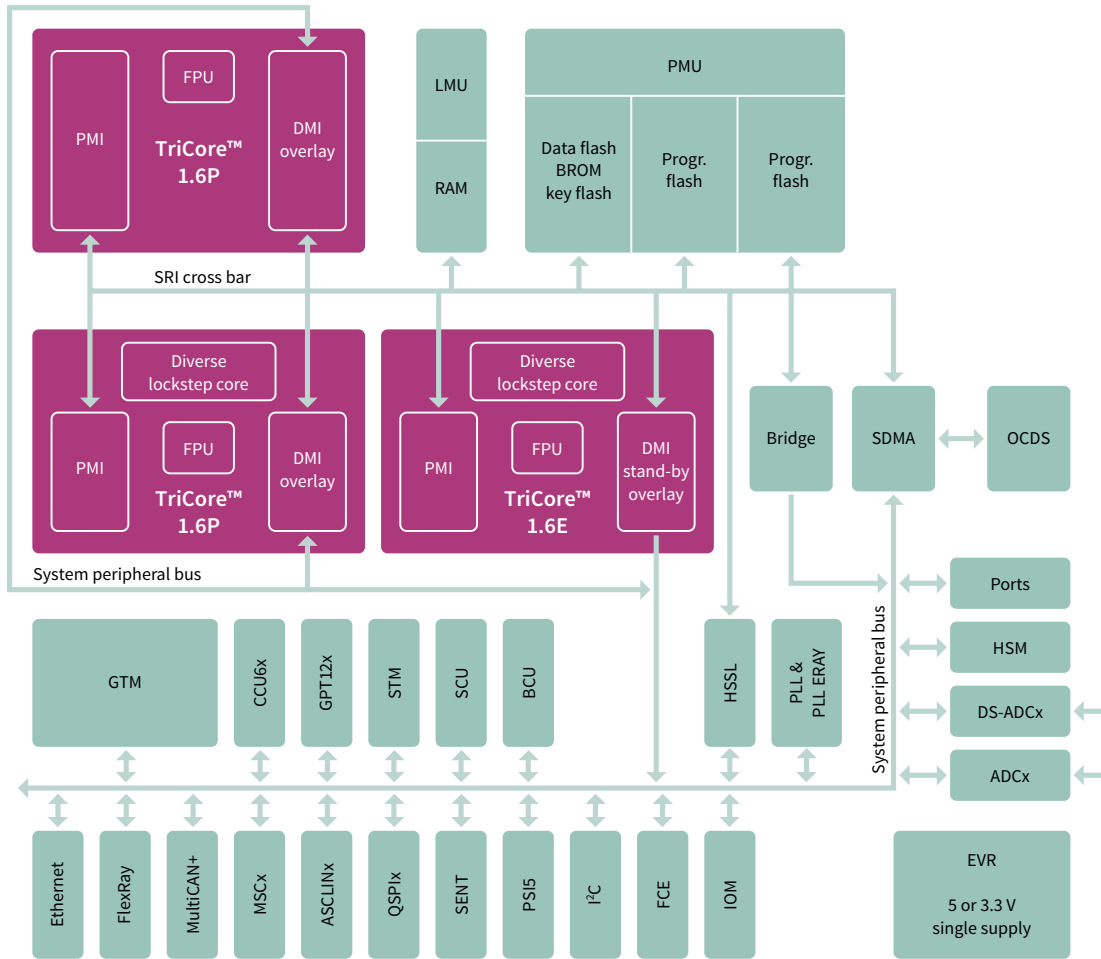
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For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# AURIX™ TC2xx family system architecture

## Powerful 1<sup>st</sup> generation AURIX™ TC2xx system architecture



## AURIX™ TC2xx family package scalability

|                           |                  |                  |                      |                  |                  |                  |                  |
|---------------------------|------------------|------------------|----------------------|------------------|------------------|------------------|------------------|
| 9x series<br>up to 8 MB   |                  |                  |                      |                  | TC297<br>300 MHz | TC298<br>300 MHz | TC299<br>300 MHz |
| 7x series<br>up to 4 MB   |                  |                  |                      | TC275<br>200 MHz | TC277<br>200 MHz |                  |                  |
| 6x series<br>up to 2.5 MB |                  |                  | TC264<br>200 MHz     | TC265<br>200 MHz | TC267<br>200 MHz |                  |                  |
| 3x series<br>up to 2 MB   |                  | TC233<br>200 MHz | TC234<br>200 MHz     |                  | TC237<br>200 MHz |                  |                  |
| 2x series<br>up to 1 MB   | TC222<br>133 MHz | TC223<br>133 MHz | TC224<br>133 MHz     |                  |                  |                  |                  |
| 1x series<br>up to 512 KB | TC212<br>133 MHz | TC213<br>133 MHz | TC214<br>133 MHz     |                  |                  |                  |                  |
| Flash<br>Package          | TQFP-80          | TQFP-100         | LQFP-144<br>TQFP-144 | LQFP-176         | LFBGA-292        | BGA-416          | LFBGA-516        |

↑ Upgrade/downgrade with pin-compatible packages

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## AURIX™ TC2xx portfolio

| Product type | Max. clock frequency [MHz] | Program memory [kB] | SRAM (incl. cache) [kB] | Co-processor <sup>1)</sup> | Cores/lockstep | Timed I/O | Number of ADC channels | External bus interface | CAN nodes | Communication interfaces <sup>2)</sup>  | Temperature ranges <sup>3)</sup> | Packages  | Additional features/remarks <sup>4)</sup> |
|--------------|----------------------------|---------------------|-------------------------|----------------------------|----------------|-----------|------------------------|------------------------|-----------|---|----------------------------------|-----------|---|
| TC299TX      | 300                        | 8000                | 2728                    | FPU                        | 3/1            | 263       | 84/10 DS               | yes                    | 6         | 4xASCLIN, 6xQSPI, 3xMSC, 2xI <sup>2</sup> C, 15xSENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet, CAN FD | K                                | LFBGA-516 | EVR, STBU, HSM                            |
| TC299TP      | 300                        | 8000                | 728                     | FPU                        | 3/1            | 263       | 84/10 DS               | yes                    | 6         | 4xASCLIN, 6xQSPI, 3xMSC, 2xI <sup>2</sup> C, 15xSENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet, CAN FD | K                                | LFBGA-516 | EVR, STBU, HSM                            |
| TC298TP      | 300                        | 8000                | 728                     | FPU                        | 3/1            | 232       | 60/10 DS               | yes                    | 6         | 4xASCLIN, 6xQSPI, 3xMSC, 2xI <sup>2</sup> C, 15xSENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet, CAN FD | K                                | LBGA-416  | EVR, STBU, HSM                            |
| TC297TA      | 300                        | 8000                | 2728                    | FPU, FFT, CIF              | 3/1            | 169       | 60/10 DS               | no                     | 6         | 4xASCLIN, 4xQSPI, 3xMSC, 2xI <sup>2</sup> C, 15xSENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet, CAN FD | K                                | LFBGA-292 | EVR, STBU, HSM                            |
| TC297TX      | 300                        | 8000                | 2728                    | FPU                        | 3/1            | 263       | 60/10 DS               | no                     | 6         | 4xASCLIN, 4xQSPI, 3xMSC, 2xI <sup>2</sup> C, 15xSENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet, CAN FD | K                                | LFBGA-292 | EVR, STBU, HSM                            |
| TC297TP      | 300                        | 8000                | 728                     | FPU                        | 3/1            | 169       | 60/10 DS               | no                     | 6         | 4xASCLIN, 4xQSPI, 3xMSC, 2xI <sup>2</sup> C, 15xSENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet, CAN FD | K                                | LFBGA-292 | EVR, STBU, HSM                            |
| TC277TP      | 200                        | 4000                | 472                     | FPU                        | 3/2            | 169       | 60/6 DS                | no                     | 4         | 4xASCLIN, 4xQSPI, 2xMSC, HSSL, 2xI <sup>2</sup> C, 10xSENT, 3xPSI5, FlexRay, Ethernet, CAN FD   | K                                | LFBGA-292 | EVR, WUT, HSM                             |
| TC275TP      | 200                        | 4000                | 472                     | FPU                        | 3/2            | 112       | 60/6 DS                | no                     | 4         | 4xASCLIN, 4xQSPI, 2xMSC, HSSL, 2xI <sup>2</sup> C, 10xSENT, 3xPSI5, FlexRay, Ethernet, CAN FD   | K                                | LQFP-176  | EVR, WUT, HSM                             |
| TC267D       | 200                        | 2500                | 240                     | FPU                        | 2/1            | 169       | 50/3 DS                | no                     | 5         | 4xASCLIN, 4xQSPI, 2xMSC, 2xI <sup>2</sup> C, 10xSENT, 3xPSI5, HSSL, FlexRay, Ethernet, CAN FD   | K                                | LFBGA-292 | EVR, STBU                                 |
| TC265D       | 200                        | 2500                | 240                     | FPU                        | 2/1            | 112       | 50/3 DS                | no                     | 5         | 4xASCLIN, 4xQSPI, 2xMSC, 2xI <sup>2</sup> C, 10xSENT, HSSL, 3xPSI5, FlexRay, Ethernet, CAN FD   | K                                | LQFP-176  | EVR, STBU                                 |
| TC264DA      | 200                        | 2500                | 752                     | FPU, FFT, CIF              | 2/1            | 88        | 40/3 DS                | no                     | 5         | 4xASCLIN, 4xQSPI, 2xMSC, 2xI <sup>2</sup> C, 10xSENT, HSSL, 3xPSI5, FlexRay, Ethernet, CAN FD   | K                                | LQFP-144  | EVR, STBU                                 |
| TC264D       | 200                        | 2500                | 240                     | FPU                        | 2/1            | 88        | 40/3 DS                | no                     | 5         | 4xASCLIN, 4xQSPI, 2xMSC, 2xI <sup>2</sup> C, 10xSENT, HSSL, 3xPSI5, FlexRay, Ethernet, CAN FD   | K                                | LQFP-144  | EVR, STBU                                 |
| TC237LP      | 200                        | 2000                | 192                     | FPU                        | 1/1            | 120       | 24                     | no                     | 6         | 2xASCLIN, 4xQSPI, 4xSENT, FlexRay, CAN FD   | K                                | LFBGA-292 | EVR, WUT, HSM                             |
| TC234LA      | 200                        | 2000                | 704                     | FPU, FFT                   | 1/1            | 120       | 24                     | no                     | 6         | 2xASCLIN, 4xQSPI, 4xSENT, FlexRay, Ethernet   | K                                | TQFP-144  | EVR, WUT, HSM                             |
| TC234LX      | 200                        | 2000                | 704                     | FPU                        | 1/1            | 120       | 24                     | no                     | 6         | 2xASCLIN, 4xQSPI, 4xSENT, FlexRay, Ethernet   | K                                | TQFP-144  | EVR, WUT, HSM                             |
| TC234LP      | 200                        | 2000                | 192                     | FPU                        | 1/1            | 120       | 24                     | no                     | 6         | 2xASCLIN, 4xQSPI, 4xSENT, FlexRay, CAN FD   | K                                | TQFP-144  | EVR, WUT, HSM                             |
| TC233LP      | 200                        | 2000                | 192                     | FPU                        | 1/1            | 78        | 24                     | no                     | 6         | 2xASCLIN, 4xQSPI, 4xSENT, FlexRay, CAN FD   | K                                | TQFP-100  | EVR, WUT, HSM                             |
| TC224L       | 133                        | 1000                | 96                      | FPU                        | 1/1            | 120       | 24                     | no                     | 3         | 2xASCLIN, 4xQSPI, 4xSENT, CAN FD  | K                                | TQFP-144  | EVR, WUT                                  |
| TC223L       | 133                        | 1000                | 96                      | FPU                        | 1/1            | 78        | 24                     | no                     | 3         | 2xASCLIN, 4xQSPI, 4xSENT, CAN FD  | K                                | TQFP-100  | EVR, WUT                                  |
| TC222L       | 133                        | 1000                | 96                      | FPU                        | 1/1            | 59        | 24                     | no                     | 3         | 2xASCLIN, 4xQSPI, 4xSENT, CAN FD  | K                                | TQFP-80   | EVR, WUT                                  |
| TC214L       | 133                        | 500                 | 96                      | FPU                        | 1/1            | 120       | 14                     | no                     | 3         | 2xASCLIN, 4xQSPI, 4xSENT, CAN FD  | K                                | TQFP-144  | EVR, WUT                                  |
| TC213L       | 133                        | 500                 | 96                      | FPU                        | 1/1            | 78        | 24                     | no                     | 3         | 2xASCLIN, 4xQSPI, 4xSENT, CAN FD  | K                                | TQFP-100  | EVR, WUT                                  |
| TC212L       | 133                        | 500                 | 96                      | FPU                        | 1/1            | 59        | 24                     | no                     | 3         | 2xASCLIN, 4xQSPI, 4xSENT, CAN FD  | K                                | TQFP-80   | EVR, WUT                                  |

<sup>1)</sup> CIF = camera and external ADC Interface, FFT = fast fourier transform accelerator, FPU = floating point unit, PCP = peripheral control processor

<sup>2)</sup> ASC = asynchronous serial channel, ASCLIN = asyn/synchronous local interconnect network, HSSL = high-speed serial link, I<sup>2</sup>C = inter-integrated circuit, LIN = local interconnect network, MLI = micro link interface, MSC = micro second channel, PSI5 = peripheral sensor interface 5, QSPI = queued serial peripheral interface, SENT = single edge nibble transmission, SSC = synchronous serial channel, CAN FD ISO11898-1:2015

<sup>3)</sup> Ambient temperature range: A = -40°C ... 140°C, B = 0°C ... 70°C, F = -40°C ... 85°C, H = -40°C ... 110°C, K = -40°C ... 125°C, L = -40°C ... 150°C, X = -40°C ... 105°C

<sup>4)</sup> EVR = embedded voltage regulator, HSM = hardware security module, STBU = stand-by control unit, WUT = wake-up timer

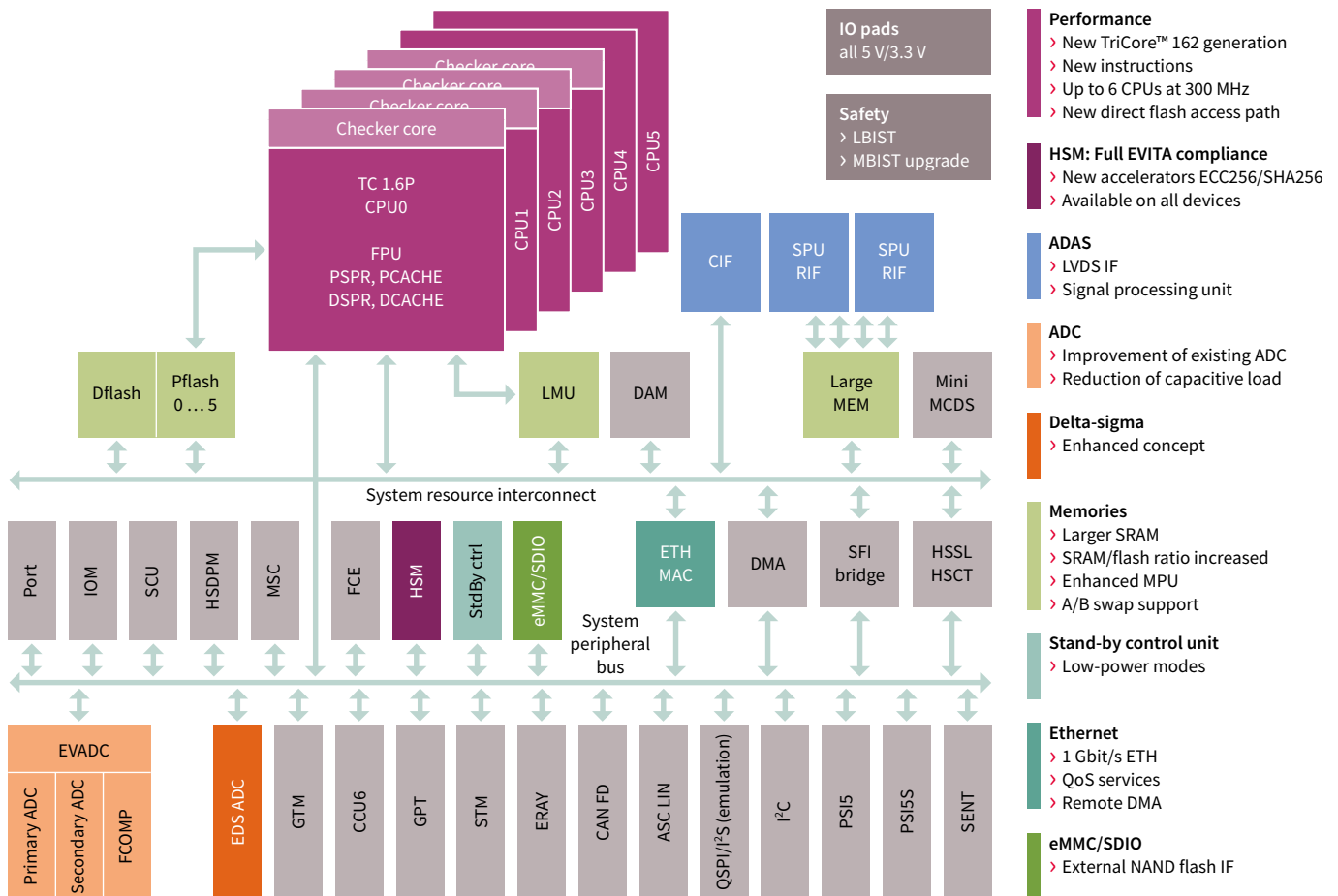
## Evolution from TC2xx to TC3xx - Easy migration with focus on reuse

- Fast conversion of existing AURIX™ TC2xx designs
  - Backwards compatibility
  - High AURIX™ TC3xx compatibility to pinout of existing QFP100/144/176 and BGA packages
- Flexibility - scalability within the AURIX™ TC3xx family
  - Up-/Downgrade paths for devices in identical packages
  - Compatible pin-out of QFP/BGA package options enabling combination designs
- Pin-to-pin compatibility between the devices of AURIX™ TC2xx/TC3xx and from generation to generation
- A high scalability with a very large portfolio for both AURIX™ TC2xx and TC3xx



# AURIX™ TC3xx family system architecture

AURIX™ TC3xx – scalable family - from low-cost to high-performance applications



## AURIX™ TC3xx provides an upgrade on key parameters with focus on SW and HW reuse

|  |  |   |
|--|--|---|
|  | Performance increase and reduction of power  | Increased from 3 to 6 cores<br>Developed in 40 nm for power consumption reduction |
|  | Scalable and backwards compatible with TC2xx | Fully compatible devices with focus on HW & SW reuse                              |
|  | Functional safety                            | IEC61508 compliant enabling SiL-3 level   |
|  | Enhanced security                            | Upgraded to Full EVITA support  |
|  | Improved networking                          | Richer peripheral set   |
|  | SOTA   | Full support of SOTA A/B swap   |

## AURIX™ TC3xx package scalability

|            |                      |                                 |                                 |                                 |                                  |                   |                   |                   |                                  |                   |
|------------|----------------------|---------------------------------|---------------------------------|---------------------------------|----------------------------------|-------------------|-------------------|-------------------|----------------------------------|-------------------|
| 6x 300 MHz | 9x A series<br>16 MB |                                 |                                 |                                 |                                  |                   |                   |                   | TC397XA<br>300 MHz               |                   |
| 6x 300 MHz | 9x series<br>16 MB   |                                 |                                 |                                 |                                  |                   |                   |                   | TC397x<br>300 MHz                | TC399x<br>300 MHz |
| 4x 300 MHz | Ex series<br>12 MB   |                                 |                                 |                                 |                                  |                   |                   |                   | TC387Qx<br>300 MHz               |                   |
| 4x 300 MHz | 8x series<br>10 MB   |                                 |                                 |                                 |                                  |                   |                   |                   | TC387Q<br>300 MHz                | TC389Q<br>300 MHz |
| 3x 300 MHz | 7x X series<br>6 MB  |                                 |                                 |                                 |                                  |                   |                   |                   | TC377TX<br>300 MHz               |                   |
| 3x 300 MHz | 7x series<br>6 MB    |                                 |                                 |                                 |                                  |                   | TC375T<br>300 MHz |                   | TC377T<br>300 MHz                |                   |
| 2x 300 MHz | 6x series<br>4 MB    |                                 |                                 | TC364D<br>300 MHz               | TC366D<br>300 MHz                | TC365D<br>300 MHz |                   |                   | TC367D<br>300 MHz                |                   |
| 4x 300 MHz | Ax series<br>4 MB    |                                 |                                 |                                 |                                  |                   |                   | TC3A8Q<br>300 MHz | TC3A7Q<br>300 MHz                |                   |
| 3x 300 MHz | 5x A series<br>4 MB  |                                 |                                 |                                 | TC356TA<br>300 MHz               |                   |                   |                   | TC357TA<br>300 MHz               |                   |
| 2x 300 MHz | 3x A series<br>2 MB  |                                 |                                 |                                 | TC336DA <sup>1)</sup><br>200 MHz |                   |                   |                   | TC337DA <sup>1)</sup><br>200 MHz |                   |
| 1x 300 MHz | 3x series<br>2 MB    | TC332L <sup>1)</sup><br>200 MHz | TC333L <sup>1)</sup><br>200 MHz | TC334L <sup>1)</sup><br>200 MHz | TC336L <sup>1)</sup><br>200 MHz  |                   |                   |                   | TC337L <sup>1)</sup><br>200 MHz  |                   |
| 1x 300 MHz | 2x series<br>1 MB    | TC322L<br>160 MHz               | TC323L<br>160 MHz               | TC324L<br>160 MHz               |                                  |                   |                   |                   | TC327L<br>160 MHz                |                   |
| Flash      | Package              | TQFP-80                         | TQFP-100                        | T/LQFP-144                      | BGA-180                          | LQFP-176          | BGA-233           | LFBGA-292         | LFBGA-516                        |                   |

L – Single lockstep core    D – Dual core    T – Triple core    Q – Quadruple core    X – Sextuple core  
 1) An option of 300 MHz is also available

Control and actuate    Sense and compute


- Advanced package technologies deliver the best price/performance ratio
- Customers can choose between different devices in the same pin-compatible package

**MCU scalability**

- > Performance and flash
- > Pin compatibility
- > Binary-compatible cores

**Safety/security concept**

- > ISO 26262 compliance
- > IEC61508 compliant



AURIX™ TC3xx

**Power consumption**

- > On-chip SC DC-DC high-efficiency power supply
- > Integrated standby controller

**Connectivity**

- > Ethernet: up to 2x1 GB
- > CAN FD: up to 12 channels
- > eMMC IF



## AURIX™ TC3xx portfolio

| Product type               | Cores/lockstep | Max clock frequency [MHz] | Program memory [kB] | SRAM (incl. cache) [kB] | Radar accelerator/ radar interface <sup>1)</sup> | CAN/CAN FD nodes | Ethernet 100/1000 Mbit | External bus interface <sup>2)</sup> | Communication interfaces  | HSM        | Temperature ranges | Packages  | Additional features/ remarks <sup>3)</sup> |
|----------------------------|----------------|---------------------------|---------------------|-------------------------|--|------------------|------------------------|--------------------------------------|---|------------|--------------------|-----------|--|
| <b>AURIX™ TC3xx family</b> |                |                           |                     |                         |  |                  |                        |                                      |   |            |                    |           |  |
| TC399XX                    | 6/4            | 300                       | 16000               | 6912                    | no   | 12               | 1                      | EBU, eMMC, 2x HSSL                   | 6x SPI, 2x FlexRay, 12x LIN, 25x SENT, 4x PSi5, 2x I <sup>2</sup> C, 4x MSC | EVITA full | K, L               | LFBGA-516 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC399XP                    | 6/4            | 300                       | 16000               | 2816                    | no   | 12               | 1                      | EBU, eMMC, 2x HSSL                   | 6x SPI, 2x FlexRay, 12x LIN, 25x SENT, 4x PSi5, 2x I <sup>2</sup> C, 4x MSC | EVITA full | K, L               | LFBGA-516 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC397XX                    | 6/4            | 300                       | 16000               | 6912                    | no   | 12               | 1                      | eMMC, 2x HSSL                        | 6x SPI, 2x FlexRay, 12x LIN, 25x SENT, 4x PSi5, 2x I <sup>2</sup> C, 4x MSC | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC397XP                    | 6/4            | 300                       | 16000               | 2816                    | no   | 12               | 1                      | eMMC, 2x HSSL                        | 6x SPI, 2x FlexRay, 12x LIN, 25x SENT, 4x PSi5, 2x I <sup>2</sup> C, 4x MSC | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC397XA                    | 6/4            | 300                       | 16000               | 6912                    | 2x SPU/<br>8x 400 Mbit/s LVDS                    | 12               | 1                      | 2x HSSL                              | 6x SPI, 2x FlexRay, 12x LIN, 25x SENT, 4x PSi5, 2x I <sup>2</sup> C, 4x MSC | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC389QP                    | 4/2            | 300                       | 10000               | 1568                    | no   | 12               | 1                      | HSSL                                 | 5x SPI, 2x FlexRay, 24x LIN, 25x SENT, 4x PSi5, 2x I <sup>2</sup> C, 3x MSC | EVITA full | K, L               | LFBGA-516 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC387QP                    | 4/2            | 300                       | 10000               | 1568                    | no   | 12               | 1                      | HSSL                                 | 5x SPI, 2x FlexRay, 24x LIN, 25x SENT, 4x PSi5, 2x I <sup>2</sup> C, 3x MSC | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC377TX                    | 3/3            | 300                       | 6000                | 4208                    | no   | 12               | 2                      | eMMC, HSSL                           | 5x SPI, 1x FlexRay, 12x LIN, 15x SENT, 2x PSi5, 1x I <sup>2</sup> C, 2x MSC | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC377TP                    | 3/2            | 300                       | 6000                | 1136                    | no   | 8                | 1                      | HSSL                                 | 5x SPI, 2x FlexRay, 12x LIN, 15x SENT, 2x PSi5, 1x I <sup>2</sup> C, 2x MSC | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC375TP                    | 3/2            | 300                       | 6000                | 1136                    | no   | 8                | 1                      | HSSL                                 | 5x SPI, 1x FlexRay, 12x LIN, 15x SENT, 2x PSi5, 1x I <sup>2</sup> C, 2x MSC | EVITA full | K, L               | LQFP-176  | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC367DP                    | 2/2            | 300                       | 4000                | 672                     | no   | 8                | 1                      | HSSL                                 | 4x SPI, 1x FlexRay, 12x LIN, 10x SENT, 2x PSi5, 1x I <sup>2</sup> C, 1x MSC | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC366DP                    | 2/2            | 300                       | 4000                | 672                     | no   | 8                | 1                      | HSSL                                 | 4x SPI, 1x FlexRay, 12x LIN, 10x SENT, 2x PSi5, 1x I <sup>2</sup> C, 1x MSC | EVITA full | K, L               | LFBGA-196 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC365DP                    | 2/2            | 300                       | 4000                | 672                     | no   | 8                | 1                      | HSSL                                 | 4x SPI, 1x FlexRay, 12x LIN, 10x SENT, 2x PSi5, 1x I <sup>2</sup> C, 1x MSC | EVITA full | K, L               | LQFP-176  | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC364DP                    | 2/2            | 300                       | 4000                | 672                     | no   | 8                | 1                      | HSSL                                 | 4x SPI, 1x FlexRay, 12x LIN, 10x SENT, 2x PSi5, 1x I <sup>2</sup> C, 1x MSC | EVITA full | K, L               | TQFP-144  | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC364DP                    | 2/2            | 300                       | 4000                | 672                     | no   | 8                | 1                      | HSSL                                 | 4x SPI, 1x FlexRay, 12x LIN, 10x SENT, 2x PSi5, 1x I <sup>2</sup> C, 1x MSC | EVITA full | K, L               | LQFP-144  | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC357TA                    | 3/2            | 300                       | 4000                | 3664                    | 2x SPU/<br>8x 400 Mbit/s LVDS                    | 8                | 1                      | no                                   | 4x SPI, 1x FlexRay, 4x LIN  | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC356TA                    | 3/2            | 300                       | 4000                | 3664                    | 2x SPU/<br>8x 400 Mbit/s LVDS                    | 8                | 1                      | no                                   | 4x SPI, 1x FlexRay, 4x LIN  | EVITA full | K, L               | LFBGA-196 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC337DA                    | 2/1            | 200                       | 2000                | 1568                    | 1x SPU/<br>4x 400 Mbit/s LVDS                    | 8                | 1                      | eMMC                                 | 4x SPI, 1x FlexRay, 12x LIN, 6x SENT  | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC336DA                    | 2/1            | 200                       | 2000                | 1568                    | 1x SPU/<br>4x 400 Mbit/s LVDS                    | 8                | 1                      | eMMC                                 | 4x SPI, 1x FlexRay, 12x LIN, 6x SENT  | EVITA full | K, L               | LFBGA-196 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC337LP                    | 1/1            | 200                       | 2000                | 248                     | no   | 8                | no                     | no                                   | 4x SPI, 1x FlexRay, 12x LIN, 6x SENT  | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC336LP                    | 1/1            | 200                       | 2000                | 248                     | no   | 8                | no                     | no                                   | 4x SPI, 1x FlexRay, 12x LIN, 6x SENT  | EVITA full | K, L               | LFBGA-196 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC334LP                    | 1/1            | 200                       | 2000                | 248                     | no   | 8                | no                     | no                                   | 4x SPI, 1x FlexRay, 12x LIN, 6x SENT  | EVITA full | K, L               | TQFP-144  | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC333LP                    | 1/1            | 200                       | 2000                | 248                     | no   | 8                | no                     | no                                   | 4x SPI, 1x FlexRay, 12x LIN, 6x SENT  | EVITA full | K, L               | TQFP-100  | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC332LP                    | 1/1            | 200                       | 2000                | 248                     | no   | 8                | no                     | no                                   | 4x SPI, 1x FlexRay, 12x LIN, 6x SENT  | EVITA full | K, L               | TQFP-80   | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC327LP                    | 1/1            | 160                       | 1000                | 96                      | no   | 8                | no                     | no                                   | 4x SPI, 6x SENT, 6x LIN   | EVITA full | K, L               | LFBGA-292 | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC324LP                    | 1/1            | 160                       | 1000                | 96                      | no   | 8                | no                     | no                                   | 4x SPI, 6x SENT, 6x LIN   | EVITA full | K, L               | TQFP-144  | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC323LP                    | 1/1            | 160                       | 1000                | 96                      | no   | 8                | no                     | no                                   | 4x SPI, 6x SENT, 6x LIN   | EVITA full | K, L               | TQFP-100  | 5 V/3.3 V EVR, 8-bit SCR                   |
| TC322LP                    | 1/1            | 160                       | 1000                | 96                      | no   | 8                | no                     | no                                   | 4x SPI, 6x SENT, 6x LIN   | EVITA full | K, L               | TQFP-80   | 5 V/3.3 V EVR, 8-bit SCR                   |

1) SPU – Signal processing unit  
 2) HSSL – High-speed serial link  
 3) 8-bit SCR – Standby controller for low power modes  
 4) EVR – Embedded voltage regulator





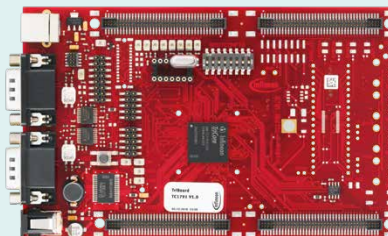
# AURIX™ starter and application kits

## Infineon starter kits – 32-bit microcontrollers

### AURIX™ Triboards Kits

- Full evaluation board for development to write and debug your 1<sup>st</sup> programs
- Includes getting started advice, free TriCore™ entry tool chain, technical documentation, compiler and debugger
- TriBoard available for all productive silicon

[www.infineon.com/aurix-kits](http://www.infineon.com/aurix-kits)



### AURIX™ TFT Kits

- Low cost board for early evaluation with limited access to signals
- Additional touchscreen display for convenient handling
- TFT board available for every silicon

Click on the following to find/purchase the kit:

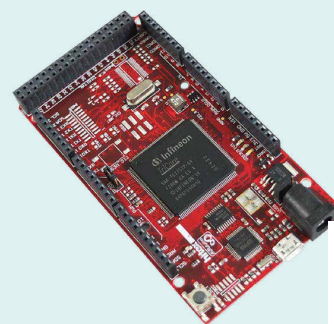
[www.infineon.com/aurix-kits](http://www.infineon.com/aurix-kits)



### Arduino AURIX™ TC275 ShieldBuddy Kit

- The Hitex TC275/TC375 ShieldBuddy follows the Arduino standard
- Compatible with hundreds of Arduino application shields
- Evaluation licenses available
- Ideal for getting started on a high-end real time embedded industrial or automotive application as well as students and hobbyists

[www.infineon.com/aurixlowcostarduinokits](http://www.infineon.com/aurixlowcostarduinokits)



### Arduino AURIX™ TC375 ShieldBuddy Kit

Order number: **KIT\_A2G\_TC375\_ARD\_SB**

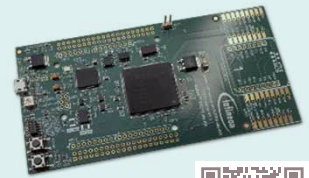
- Compatible with hundreds of Arduino application shields
- Evaluation licenses available
- Ethernet
- Ideal for getting started on a high-end real time embedded industrial or automotive application as well as students and hobbyists

[www.infineon.com/aurixlowcostarduinokits](http://www.infineon.com/aurixlowcostarduinokits)



## AURIX™ TC275 Lite kit

- AURIX™ TC275 device in LQFP-176 package
  - FTDI based debugger with micro USB
  - Use of Arduino Uno/compatible platform
- [www.infineon.com/aurixlowcostarduinokits](http://www.infineon.com/aurixlowcostarduinokits)



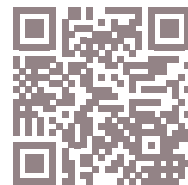
## AURIX™ TC375 Lite kit

- AURIX™ TC375 device in LQFP-176 package
  - Ethernet PHY
  - FTDI based debugger with micro USB
  - Use of Arduino Uno/compatible platform
- [www.infineon.com/aurixlowcostarduinokits](http://www.infineon.com/aurixlowcostarduinokits)



# Discover our AURIX™ kits platform for more starter and application kits

[www.infineon.com/aurixkits](http://www.infineon.com/aurixkits)



## Infineon application kits – 32-bit microcontrollers

### 24 GHZ Radar

Based on the Infineon AURIX™ and MMIC BGT24A families

- BGT24A transceiver MMIC family, e.g. BGTA24ATR12,
- 2-bit radar microcontroller family, e.g. SAK-TC264DA-40F200
- FFT acceleration engine and extended memory for radar image storage
- Ethernet as measurement interface

[www.infineon.com/aurixapplicationkits](http://www.infineon.com/aurixapplicationkits)



### 60 GHZ Radar

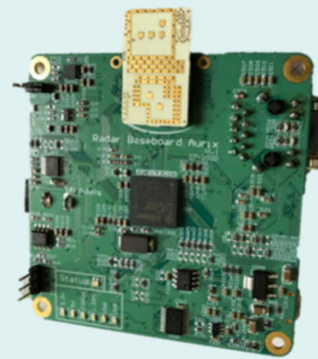
XENSIV™ BGT60ATR24C

+ AURIX™ TC356TA

+ OPTIREG™ TLS4120D0EPV33/TLS715B0EJV50

- Modular architecture
- Automotive qualified components
- Virtual array processing (TDM MIMO)
- Ultra-wideband operation of 4 GHz
- Optimized performance versus power with SPU

[www.infineon.com/aurixapplicationkits](http://www.infineon.com/aurixapplicationkits)



### Motor control

Order number: **KIT\_AURIX\_TC234\_MOTORCTR**

- TC234 application kit with TFT display incl. safety supply TLF35584
- Driving of a 3-phase PMSM/BLCD (12 V/max. 50 W)
- BLDC motor from Nanotec integrated
- Software available with flexible configuration

[www.infineon.com/aurixapplicationkits](http://www.infineon.com/aurixapplicationkits)

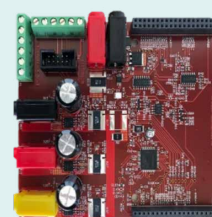


### Motor control board AURIX™ TC387

Order number: **KIT\_AURIX\_TC234\_MOTORCTR**

- TC387 Application Kit with TFT Display incl. safety supply TLF35584
- eMotor Power board: 3-phase motor control power board with TLE9180D-31QK 3-phase gate driver IC, MOSFET power stage, and auxiliary components
- Commands and monitoring via TFT touch screen
- Field oriented control (FOC) algorithm using 3-phase current sensing (EVADC) encoder as position sensor (GPT12) and AURIX™ GTM as PWM generator

[www.infineon.com/aurixapplicationkits](http://www.infineon.com/aurixapplicationkits)

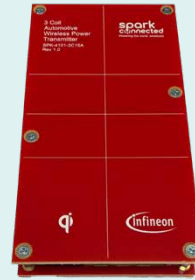


## Infineon application kits – 32-bit microcontrollers

### Wireless charging: the beast 1.0

- WPC Qi v1.2.4 certified
- Support fast charging enabled devices (7.5W and 9W)
- AUTOSAR support
- Improved accuracy Foreign Object Detection (FOD)

[www.infineon.com/aurixapplicationkits](http://www.infineon.com/aurixapplicationkits)



### Wireless charging: the beast 2.0

- Beast 2.0 is powered by the high-performance Infineon AURIX™ or Traveo™ II
- Latest WPC Qi functionality
- Supports 15W charging for Qi-certified devices
- Improved accuracy Foreign Object Detection (FOD)
- Supports future products and standards with field-upgradeable Pantheon™ software

[www.infineon.com/aurixapplicationkits](http://www.infineon.com/aurixapplicationkits)



# Industrial robotics

## Application example

### Application features

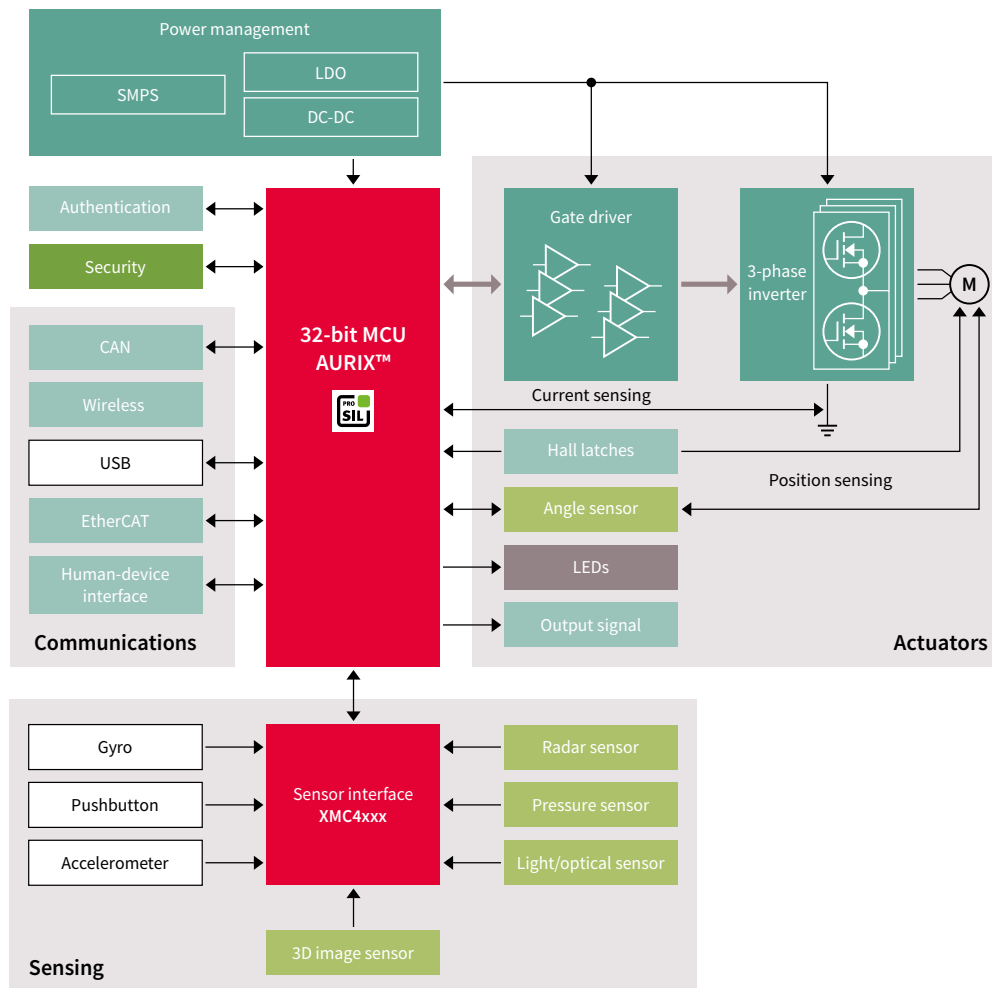
- High computing performance
- High level of accuracy, integration and efficiency
- Safety management in line with current norms
- Various topologies for axis, joints and motors
- Security features that protect intellectual property from counterfeiting

### Suggested products

- TC23x
- TC33x
- TC36x
- TC37x
- TC38x
- TC39x
- XMC4xxx

### System benefits

- High computing performance: up to 6x 300 MHz
- High flexibility thanks to tailored peripherals
- Integrated safety support (EN ISO 10218 and ISO/TS15066)
- Integrated security with hardware security module
- Robust 3 V-, 5 V-, LVDS – PortPins
- Large portfolio with long-term availability



# Microcontroller PDH partner

Preferred Design Houses (PDH) and software resellers –  
AURIX™ Traveo and PSoC™, AURIX™ tools and software

## AURIX™ Tools and Software

To enable customers to achieve optimal performance when using the powerful AURIX™ architecture, Infineon has built a network of strong partnerships with companies highly specialized in multicore software development. Infineon's multicore partners can offer the best multicore expertise and tools on the market for each stage of the software design process, covering everything from the initial multicore knowledge acquisition phase right up to final optimization of the multicore software.

### AURIX™ Embedded Software



- AURIX™ Applications software
- Autosar
- Non-Autosar OS/RTOS
- Middleware
- Communication and connectivity
- Bootloader/OTA
- Safety

### AURIX™ Tools



- AURIX™ Free Tools
- Calibration/Measurement/Prototyping
- Compilers
- Debugger, Test Tools
- Flash Tools
- **Simulation/Modelling**
- SW Automation/Autocoding






Discover our new AURIX™ Tools and Software ecosystems where you can find everything you need within easy reach  
[www.infineon.com/aurixtools](http://www.infineon.com/aurixtools) and [www.infineon.com/aurixsoftware](http://www.infineon.com/aurixsoftware)



|  |  |   |
|--|--|---|
| <p style="text-align: center;"><b>Classic</b><br/>(Free of charge)</p>   | <ul style="list-style-type: none"> <li>- 1<sup>st</sup> level customer support covering Infineon products/solutions</li> <li>- Technical interface and support to the customer</li> </ul>  | <ul style="list-style-type: none"> <li>- Driving design at customer</li> <li>- Basic training for design teams at customer</li> <li>- 24 h response time to the customer</li> </ul>   |
| <p style="text-align: center;"><b>Premium</b><br/>(Consultancy mode)</p> <p>To be agreed between customers and PDH</p> | <ul style="list-style-type: none"> <li>- Project management and project-specific application support</li> <li>- Specification of general software architecture, defining required layers, control and data flow structure etc.</li> <li>- Specification and implementation of custom device drivers</li> <li>- Optimization of software components with regard to speed/code size</li> </ul> | <ul style="list-style-type: none"> <li>- Software testing</li> <li>- Support for project-specific functional safety engineering</li> <li>- Project-specific support for security solution</li> <li>- Safety support</li> <li>- Security support</li> <li>- Multicore support</li> </ul> |

### Preferred Design Houses (PDH)

The preferred design house extends the support force by specifying and customizing the know-how. Furthermore, it brings an additional value for customer service. The preferred design house supports the set up for systems using AURIX™ and XMC™, including software and other Infineon products. Our partners are trained to use AURIX™ and XMC™.

| Infinion Preferred Partner       | GLOBAL  | EMEA   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | AMERICAS |   |   |   | CHINA | KOREA |   |   |   |   |
|----------------------------------|---|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|---|---|---|-------|-------|---|---|---|---|
|                                  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |          |   |   |   |       |       |   |   |   |   |
| Autosar                          | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + |   |
| Motor Control                    | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| MOTIX™ MCU general support HW&SW | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Lighting                         | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| PFC Power conversion             | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| AURIX™ general support HW        | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| AURIX™ general support SW        | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Safety Support IEC61508          | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Safety Support ISO26262          | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Security support /SHE+           | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| XMC™ general support HW          | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| XMC™ general support SW          | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Class B classification           | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Capacitive sensing with XMC      | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Secure boot for XMC™             | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| 24 GHz radar                     | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| 77 GHz radar                     | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Brochure                         | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Email                            | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |
| Phone                            | +   | +  | +   | +   | +   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | +        | + | + | + | +     | +     | + | + | + | + |

**Basic** ● Essential principles and elementary know-how to support a customer; provision of basic training for design teams

**Advanced** ● High-level project-specific application support/consulting

**Expert** ● Extensive knowledge and ability to fully support development

# TRAVEO™ II portfolio

Thanks to its special features the Traveo™ II family is the perfect match for industrial applications. With processing power and network connectivity built into a single Arm® Cortex®- M4F and dual Cortex®- M7F, the Traveo™ II family comes up with an enhanced performance up to 1500 DMIPS and a high-performance CPU operating up to 350 MHz.



| Product type              | Supply Voltage [V] | Main Core frequency [MHz] | Flash (Code + Work) [kB] | SRAM [kB] | GPIO | ADC Channels | CAN/CAN FD Channels | Ethernet 100/1000 Mbit | SCB Channel | CXPI Channel | SMIF (SPI/HyperBus) | LIN Channel | I <sup>2</sup> S Channel     | eMMC Channels | HSM | Temperature ranges | Packages  | SIL Level |
|---------------------------|--------------------|---------------------------|--------------------------|-----------|------|--------------|---------------------|------------------------|-------------|--------------|---------------------|-------------|------------------------------|---------------|-----|--------------------|-----------|-----------|
| TRAVEO™ T2G CYT2B7 series |                    |                           |                          |           |      |              |                     |                        |             |              |                     |             |                              |               |     |                    |           |           |
| CYT2B75CADQ0AZEGS         | 2,7 to 5,5         | 160                       | 1088 + 96                | 128       | 78   | 39           | 6                   | no                     | 8           | 0            | -                   | 7           | -                            | 0             | Yes | E                  | 100-LQFP  | ASIL-B    |
| CYT2B78CADQ0AZEGS         | 2,7 to 5,5         | 160                       | 1088 + 96                | 128       | 152  | 64           | 6                   | no                     | 8           | 0            | -                   | 8           | -                            | 0             | Yes | E                  | 176-LQFP  | ASIL-B    |
| TRAVEO™ T2G CYT2B9 series |                    |                           |                          |           |      |              |                     |                        |             |              |                     |             |                              |               |     |                    |           |           |
| CYT2B95CACQ0AZEGS         | 2,7 to 5,5         | 160                       | 2112 + 128               | 256       | 78   | 39           | 8                   | no                     | 8           | 4            | -                   | 9           | -                            | 0             | Yes | E                  | 100-LQFP  | ASIL-B    |
| CYT2B98CACQ0AZEGS         | 2,7 to 5,5         | 160                       | 2112 + 128               | 256       | 152  | 64           | 8                   | no                     | 8           | 4            | -                   | 12          | -                            | 0             | Yes | E                  | 176-LQFP  | ASIL-B    |
| TRAVEO™ T2G CYT4BF series |                    |                           |                          |           |      |              |                     |                        |             |              |                     |             |                              |               |     |                    |           |           |
| CYT3BB8CEBQ0AESGS         | 2,7 to 5,5         | 250                       | 4160 + 256               | 768       | 148  | 64           | 8                   | 1                      | 10          | 0            | 1                   | 16          | TX 3ch, RX 3ch (3 instances) | 1             | Yes | S                  | 176-TEQFP | ASIL-B    |
| CYT3BBBCEB-Q0BZEGS        | 2,7 to 5,5         | 250                       | 4160 + 256               | 768       | 220  | 72           | 8                   | 1                      | 11          | 0            | 1                   | 16          | TX 3ch, RX 3ch (3 instances) | 1             | Yes | E                  | 272-BGA   | ASIL-B    |
| TRAVEO™ T2G CYT4BF series |                    |                           |                          |           |      |              |                     |                        |             |              |                     |             |                              |               |     |                    |           |           |
| CYT4BF8CEDQ0AEEGS         | 2,7 to 5,5         | 350                       | 8384 + 256               | 1024      | 148  | 81           | 10                  | 1                      | 10          | 0            | 1                   | 17          | TX 3ch, RX 2ch (3 instances) | 1             | Yes | E                  | 176-TEQFP | ASIL-B    |
| CYT4BFCJJDQ0BZEGS         | 2,7 to 5,5         | 350                       | 8384 + 256               | 1024      | 240  | 86           | 10                  | 2                      | 11          | 0            | 1                   | 20          | TX 3ch, RX 2ch (3 instances) | 1             | Yes | E                  | 320-BGA   | ASIL-B    |





## TRAVEO™ II kits

### CYTVII-B-E-BB

- The **CYTVII-B-E-BB** is a generic base board that can be connected to compatible Traveo™ II entry or high-end evaluation boards so as to extend its functionality
- Connects to most CYTVII-B-E-xxx and CYTVII-B-H-xxx evaluation boards  
[www.infineon.com/cms/en/product/evaluation-boards/cytvii-b-e-bb](http://www.infineon.com/cms/en/product/evaluation-boards/cytvii-b-e-bb)



### CYTVII-B-E-176-SO

- The **CYTVII-B-E-176-SO** evaluation board is based on the Traveo™ II entry family of devices.
- Traveo™ II is CYT2B78CADES  
[www.infineon.com/cms/en/product/evaluation-boards/cytvii-b-e-176-so](http://www.infineon.com/cms/en/product/evaluation-boards/cytvii-b-e-176-so)



### CYTVII-B-E-1M-SK

- The **CYTVII-B-E-1M-SK** is a low-cost easy to use evaluation board based on the Traveo™ II entry family of devices.
- Traveo™ II CYT2B75CADES MCU
- Designed in an Arduino form factor so that users can connect many off-the-shelf Arduino shields to it, to expand its functionality  
[www.infineon.com/cms/en/product/evaluation-boards/cytvii-b-e-1m-sk](http://www.infineon.com/cms/en/product/evaluation-boards/cytvii-b-e-1m-sk)



### CYTVII-B-H-8M-320-CPU

- The **CYTVII-B-H-8M-320-CPU** evaluation board is based on the Traveo™ II high-end family of devices.
- Traveo™ II CYT4BFCCHCES MCU
- Audio, Ethernet, SD Card, SMIF  
[www.infineon.com/cms/en/product/evaluation-boards/cytvii-b-h-8m-320-cpu](http://www.infineon.com/cms/en/product/evaluation-boards/cytvii-b-h-8m-320-cpu)



# MOTIX™ MCU – Embedded Power ICs

## System-on-chip solution for motor control applications

Infiniteon's MOTIX™ Embedded Power ICs include a 32-bit Arm® Cortex®-M microcontroller, a voltage regulator, the communication interfaces, along with the driving stages for motor control applications. These system-on-chip solutions offer an unmatched level of integration of all functions required to sense, control and actuate a motor. They save space and energy, improve the overall system reliability through advanced diagnosis features and reduce the overall cost due to a minimum number of external components. They perfectly fit with a range of motor control applications where a small package form factor and a minimum number of external components are essential.

| Criteria                    | TLE984x         | TLE9845            | TLE9850/1                | TLE985x                  | TLE986x                                 | TLE987x         |
|-----------------------------|-----------------|--------------------|--------------------------|--------------------------|---|-----------------|
| Controller                  | Arm® Cortex®-M0 |                    |                          | Arm® Cortex®-M3          |   |                 |
| Core frequency              | 25-40 MHz       | 40 MHz             |                          |                          | 24-40 MHz                               |                 |
| Flash size                  | 36 KB – 64 KB   | 48 KB              | 48/64 KB                 | 48 KB – 96 KB            | 36 KB – 256 KB                          |                 |
| Driver stage                | Relay           | Half-bridge        |                          | H-bridge                 |   | B6-bridge       |
|                             | Relay           | PN FET half-bridge | NN FET half-bridge       | N FET H-bridge           |   | N FET B6-bridge |
| HV monitor inputs           | 4-5             | 5                  | 4                        |                          | 0-1                                     |                 |
| Junction temperature levels | 150°C           | 150°C              | 150°C and 175°C          | 150°C and 175°C          | 150°C and 175°C                         |                 |
| Packages                    | VQFN-48-31      |                    | VQFN-48-31<br>VQFN-48-29 | VQFN-48-31<br>VQFN-48-29 | VQFN-48-29 and VQFN-48-31<br>TQFP-48-10 |                 |

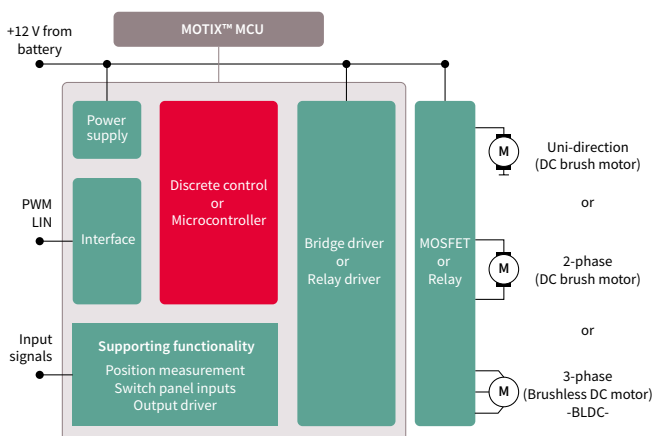
## Features and benefits

### Key features

- Extensive diagnostics and protections embedded within the system-on-chip
- Minimum number of external components needed
- Platform based approach with compatible software between the product families
- Data processing, actuation and sensing integrated into the product with 32-bit Arm® Cortex®-M
- Compact package with 7x7 mm footprint (VQFN-48/TQFP-48)
- Intelligent power saving modes including stop and sleep mode and energy management for external sensors (on demand)

### Customer benefits

- High levels of system reliability
- Reduced cost
- Support multiple and flexible designs with minimal effort
- Space saving
- Energy saving



- › MOTIX™ Embedded Power ICs enable mechatronic motor control solutions for either relay, half-bridge or full-bridge DC and BLDC motor applications
- › They are supported by a complete development tool chain provided by Infineon and third party vendors. The tool chain includes compilers, debuggers, evaluation boards, LIN low level drivers and configuration tools as well as variety of example software code.



# BLDC Motor Control Shield for Arduino

## 3-phase motor control shield with MOTIX™ TLE9879QXA40

The BLDC Shield for Arduino uses TLE9879QXA40, which is a part of the MOTIX™ TLE987x family of the Infineon MOTIX™ MCU portfolio. It enables the shield to drive 3-phase BLDC motors with a variety of different features. One Arduino base board can control up to four BLDC shields via SPI. The BLDC Shield firmware provides an auto-addressing functionality. Every shield in the stack can be controlled independently and run completely different motor control algorithms if desired.

The shield implements three different advanced motor control algorithms:

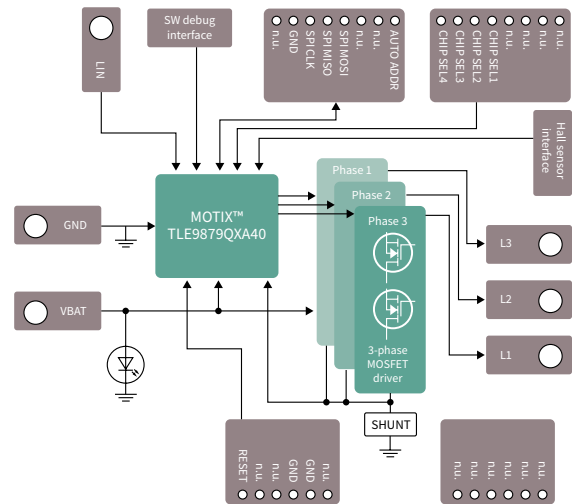
- › Sensorless field-oriented control (FOC),
- › Block commutation with back EMF (BEMF)
- › Hall based block commutation (HALL)

The firmware can be changed using the SWD Interface. Additional connectors for voltage supply, motor-phases and hall sensors speed up the evaluation.

### Features and benefits

| Key features   |
|--|
| – Implemented motor control algorithms (FOC, BEMF, Hall)         |
| – Controlled over Arduino via SPI                                |
| – Compatible with the Arduino Uno or the Infineon XMC™ baseboard |
| – Up to four shields can be used simultaneously                  |
| – Each shield can be controlled independently                    |
| – Motor parameters can be set for each shield individually       |

| Customer benefits  |
|--|
| – Easy to use API, allowing the user to quickly setup an application |
| – High performance BLDC motor control in form of the TLE987x chip    |



Our BLDC Shield for Arduino comes with a library which includes a collection of code that makes it easy for you to run your project. The Arduino library offers an intuitive API to quickly setup and configure an application.

[www.infineon.com/bldcmotorshield](http://www.infineon.com/bldcmotorshield)  
[www.infineon.com/shields-for-arduino](http://www.infineon.com/shields-for-arduino)



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

# CAN-FD transceivers

## High- and low-speed CAN-FD Transceivers for automotive and many other applications

Recently the automotive industry newly established the CAN-FD (Flexible Data-rate) protocol for faster CAN communication up to 5Mbit/s and CAN PN (Partial Networking) for improved energy efficiency.

Dependent on the respective network architecture and the related ECU supply path, different transceiver types are used. Infineon transceivers ensure reliable communication and help minimizing the current consumption. The products provide the best value by its high performance, ruggedness and reliability.

### Features and benefits

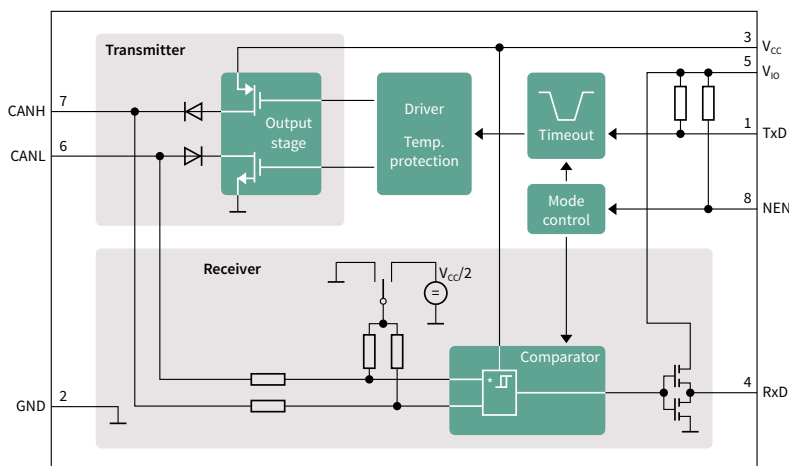
#### Key features

- Transmission rates up to 5 Mbit/s ISO11898 compliant
- Low-power modes
- Receive-only mode
- Standby/sleep mode
- Bus wake up
- Thermal protection
- CAN FD compliance

#### Key benefits

- Low current consumption
- Excellent EMI performance & robustness
- Pin-to-pin replacements for industry-standard parts

### Block diagram TLE9250V



| PG-DSO-8-65    | PG-TSON-8-1    |
|----------------|----------------|
| TLE9250SJ_GRN  | TLE9250LE_GRN  |
| TLE9250VSJ_GRN | TLE9250VLE_GRN |
| TLE9250XSJ_GRN | TLE9250XLE_GRN |
| TLE9251SJ_GRN  | TLE9251LE_GRN  |
| TLE9251VSJ_GRN | TLE9251VLE_GRN |
|                | TLE9251VLE     |





# Infineon support for industrial microcontrollers

## One platform, countless solutions

Further information, datasheets and documents

- [www.infineon.com/xmc](http://www.infineon.com/xmc)
- [www.infineon.com/xmc1000](http://www.infineon.com/xmc1000)
- [www.infineon.com/xmc4000](http://www.infineon.com/xmc4000)
- [www.infineon.com/aurix](http://www.infineon.com/aurix)
- [www.infineon.com/makers](http://www.infineon.com/makers)

XMC SC Wireless power controller:

[www.infineon.com/xmcs wireless power controllers](http://www.infineon.com/xmcs wireless power controllers)



XMC™ MCUs ecosystem and enablement – kits, board, tools and software

Boards and kits:

- [www.infineon.com/xmc-dev](http://www.infineon.com/xmc-dev)
- [www.infineon.com/connectivitykit](http://www.infineon.com/connectivitykit)
- [www.infineon.com/ethercat](http://www.infineon.com/ethercat)

Ecosystem and tools:

[www.infineon.com/xmc-ecosystem](http://www.infineon.com/xmc-ecosystem)

DAVE™ IDE:

[www.infineon.com/dave](http://www.infineon.com/dave)



## USB-C controllers and peripherals

- Moving to USB-C with EZ-PD™ family
  - USB-C charging port controllers
  - USB-C high voltage microcontrollers
- USB-C power delivery controllers
  - EZ-PD™ CCG8 – USB-C PD controller
  - EZ-PD™ CMG2 – USB-C EMCA controller
- USB-C AC-DC and DC-DC charging solutions
  - EZ-PD™ CCG7DC – USB-C PD and DC-DC controller
  - EZ-PD™ PAG1 – USB-C PD and DC-DC controller
- Peripheral controllers for USB 5Gbps
  - EZ-USB™ CX3 - MIPI CSI-2 to USB 5Gbps camera controllers
  - EZ-USB™ FX3 - USB 5Gbps peripheral controllers
  - EZ-USB™ SX3 - FIFO to USB 5Gbps controllers
- USB 2.0 peripheral controllers
  - EZ-USB™ serial bridge controller
- USB hub and USB Type-C port controllers
  - EZ-USB™ HX3
  - EZ-USB™ HX2LP and HX2VL
  - EZ-USB™ HX3PD

# Moving to USB-C with EZ-PD™ family

## A wide portfolio for your easy transition to the new universal connector

More and more products in consumer, industrial, and communications segments are adopting USB-C ports to source power. Infineon offers dedicated solutions to integrate USB-C ports into customers' embedded applications. Typical use cases include smart speakers, cameras, headphones, game consoles, **power tools**, VR headsets, and other portable electronics and home appliances. As the leader in USB-C end-to-end solutions, Infineon also provides a comprehensive portfolio of solutions for **USB-C chargers and power adapters**.

### System approach:

- Market-proven USB-C power delivery stack (USB-C PD)
- Complete and easy-to-use design portfolio to build robust, efficient and cost-effective system solutions
- Robust evaluation kits for quick prototyping

The EZ-PD™ portfolio includes two different families of solutions to help you easily integrate USB-C into your embedded application: EZ-PD™ PMG1 (Power Delivery Microcontroller Gen 1) and EZ-PD™ BCR (Barrel Connector Replacement).

Are you looking for a plug-and-play solution to replace an old barrel connector or legacy USB connector with USB-C?



Or do you need additional control and want to add some extra functions to your device with a USB-C port controller + MCU in a single-chip solution?



[www.infineon.com/ez-pd-pmg1](http://www.infineon.com/ez-pd-pmg1)  
[www.infineon.com/ez-pd-bcr](http://www.infineon.com/ez-pd-bcr)



Smart speaker



Smartwatch



Power tools



Body care

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# USB-C charging port controllers

## EZ-PD™ BCR: the easiest solution for moving to USB-C

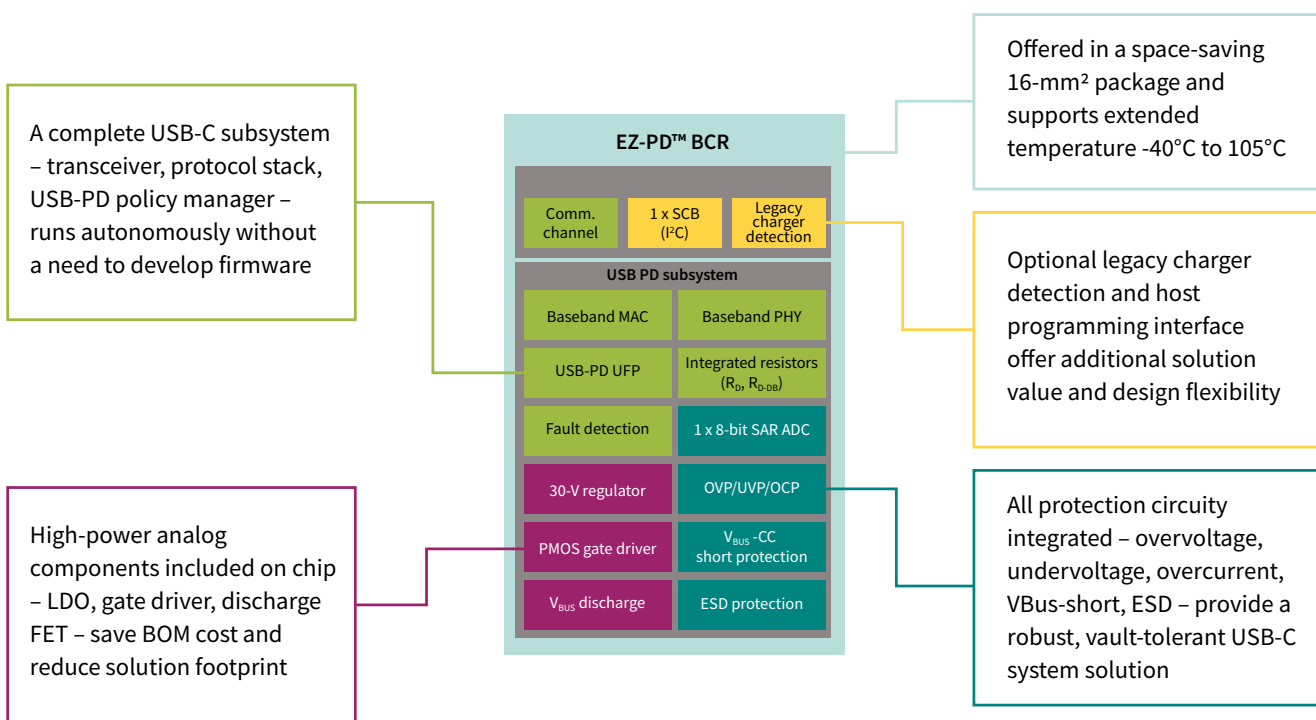
EZ-PD™ BCR is a highly-integrated pre-programmed USB Type-C charging port controller targeting all electronic devices with legacy barrel connectors up to 100 W or USB micro-B connectors. It easily adds USB-C power consumer capability to a device, allowing it to be powered by any USB-C power source including USB-C chargers, power adapters, power banks, and in-wall or in-car charging ports.

EZ-PD™ BCR is compliant with the latest USB Type-C and USB power delivery standards, it allows designers to quickly convert their devices' power input from a barrel connector to a USB-C connector without invasive changes to their existing designs. It contains a market-proven, fully-automated USB power delivery policy manager that interoperates with virtually any USB-C power source. To safeguard against system-level fault conditions, EZ-PD BCR™ controllers integrate various protection circuitries including VBus-to-CC short, overvoltage, overcurrent and ESD.

No expert knowledge of the USB-C and power delivery standards or firmware development is required to develop a robust USB-C powered system with EZ-PD™ BCR.

### Features and benefits

| Key features                                      | Key benefits  |
|---|---|
| - Highly integrated one-chip solutions            | - Area and BOM saving   |
| - No firmware programming required                | - Shorter development cycle, faster time to market                |
| - Market-proven solution with mature design tools | - No implementation risk  |
| - Availability of software utilities              | - Configurability, product differentiation                        |
| - USB-IF compliant and certified                  | - Pre-certified silicon to support USB logo certification         |
| - No expert knowledge of USB-C or USB-PD required | - No steep learning curve   |
| - Extended industrial temperature -40°C to 105°C  | - Suitable for virtually any commercial or industrial application |



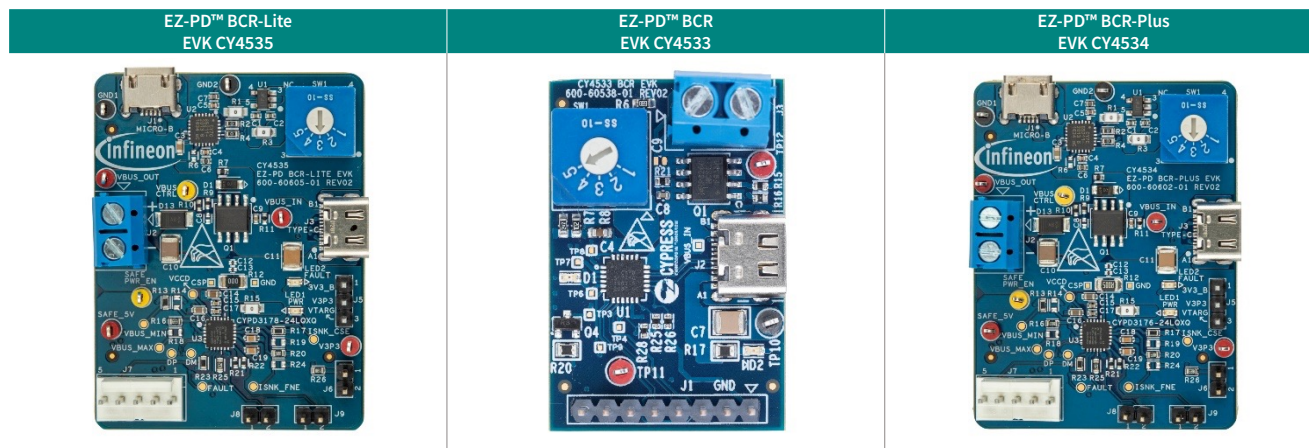


The wide portfolio offers different combinations of flash/RAMs sizes and features to address all possible needs:

| Features   | EZ-PD™ BCR family                   |                                     |                                     |
|--|-------------------------------------|-------------------------------------|-------------------------------------|
| Product name   | EZ-PD™ BCR-Plus                     | EZ-PD™ BCR                          | EZ-PD™ BCR-Lite                     |
| Part number  | CYPD3176-24LQXQ<br>CYPD3176-24LQXQT | CYPD3177-24LQXQ<br>CYPD3177-24LQXQT | CYPD3178-24LQXQ<br>CYPD3178-24LQXQT |
| USB PD role  | UFP (power sink)                    | UFP (power sink)                    | -                                   |
| Programmable power supply (PPS)                            | ✓                                   | -                                   | -                                   |
| USB Type-C charging (5V @ 0.5 A, 0.9 A, 1.5 A, 3 A)        | ✓                                   | ✓                                   | ✓                                   |
| Legacy charging support (BC 1.2 and others)                | ✓                                   | -                                   | ✓                                   |
| USB data compatible  | ✓                                   | ✓                                   | ✓                                   |
| VBUS gate driver   | PFET                                | PFET                                | PFET                                |
| Supply voltage   | 3.0 V – 24.5 V                      | 3.0 V – 24.5 V                      | 3.0 V – 24.5 V                      |
| VBUS to CC short protection (20 V)                         | ✓                                   | ✓                                   | ✓                                   |
| OVP/UVP  | ✓                                   | ✓                                   | ✓                                   |
| OCF  | ✓                                   | -                                   | -                                   |
| ESD protection on CC, D+/D-, ±8 kV (contact), ±15 kV (air) | ✓                                   | ✓                                   | ✓                                   |
| I <sup>2</sup> C Interface                                 | 1                                   | 1                                   | 1                                   |
| EZ-PD BCR HPI utility                                      | ✓                                   | ✓                                   | ✓                                   |
| EZ-PD configuration utility                                | ✓                                   | -                                   | -                                   |

## Boards

Once the preferred characteristics are identified, it is possible to get started with the product of choice by utilizing the available evaluation kits: they provide a USB Type-C receptacle to consume power from a charger and then supply it over a terminal block. A barrel connector can be attached to this block using wires to convert a barrel input to USB-C. In addition, selective GPIOs and I<sup>2</sup>C interface are available on headers to easily control or monitor the BCR chip from an external microcontroller.



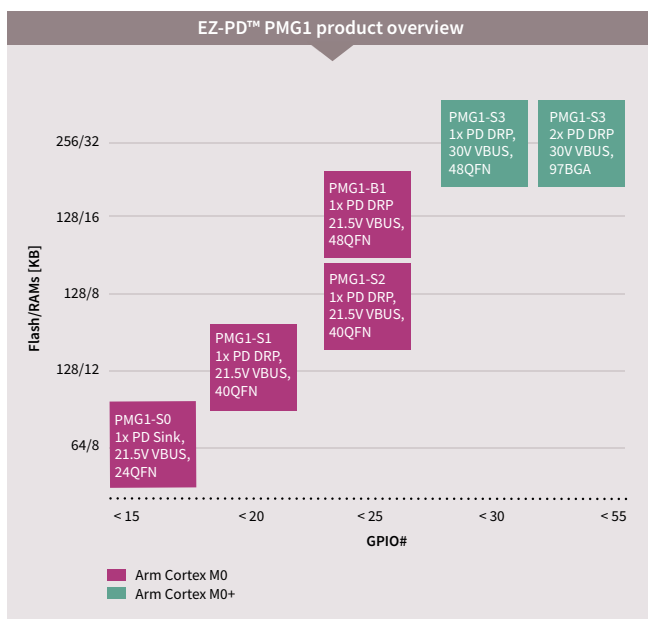
# USB-C high voltage microcontrollers

## EZ-PD™ PMG1: the single-chip solution for moving to USB-C

Power Delivery Microcontroller Gen 1 (EZ-PD™ PMG1) is a high-voltage USB-C power delivery microcontroller (PD MCU) targeted to any embedded system that provides/consumes power to/from a high-voltage USB-C PD port and leverages the microcontroller to provide additional control capability.

The EZ-PD™ PMG1 family of devices has a market-proven USB power delivery stack, ensuring spec compliance and interoperability. It's the only high-voltage, programmable USB power delivery solution on the market today, and comes with an integrated ARM® Cortex®-M0/M0+, up to 256 kB flash and 32 kB RAM, a USB full-speed device, and analog and digital peripherals. With an SDK supported in ModusToolbox™, EZ-PD™ PMG1 family provides customers with a unified firmware view, facilitating seamless migration between all EZ-PD™ PMG1 devices.

The wide portfolio offers different combinations of flash/RAMs sizes and features to address all possible needs:



### Features

- > USB, Crypto, LDO  
NFET Gate Drivers,  
CAPSENSE™, 12-bit ADC,  
SCB, TCPWM
- > Buck Boost, LDO,  
NFET Gate Drivers,  
12-bit ADC, SCB, TCPWM
- > USB, Crypto, LDO  
NFET Gate Drivers, 8-bit  
ADC, SCB, TCPWM
- > LDO,  
PFET Gate Drivers,  
8-bit ADC, SCB, TCPWM
- > LDO,  
PFET Gate Drivers, 8-bit  
ADC, SCB1, TCPWM<sup>2</sup>

<sup>1</sup> SCB stands for Serial Communication Block

<sup>2</sup> TCPWM stands for Timer Counter Pulse Width Modulator



## Features and benefits

### Key features

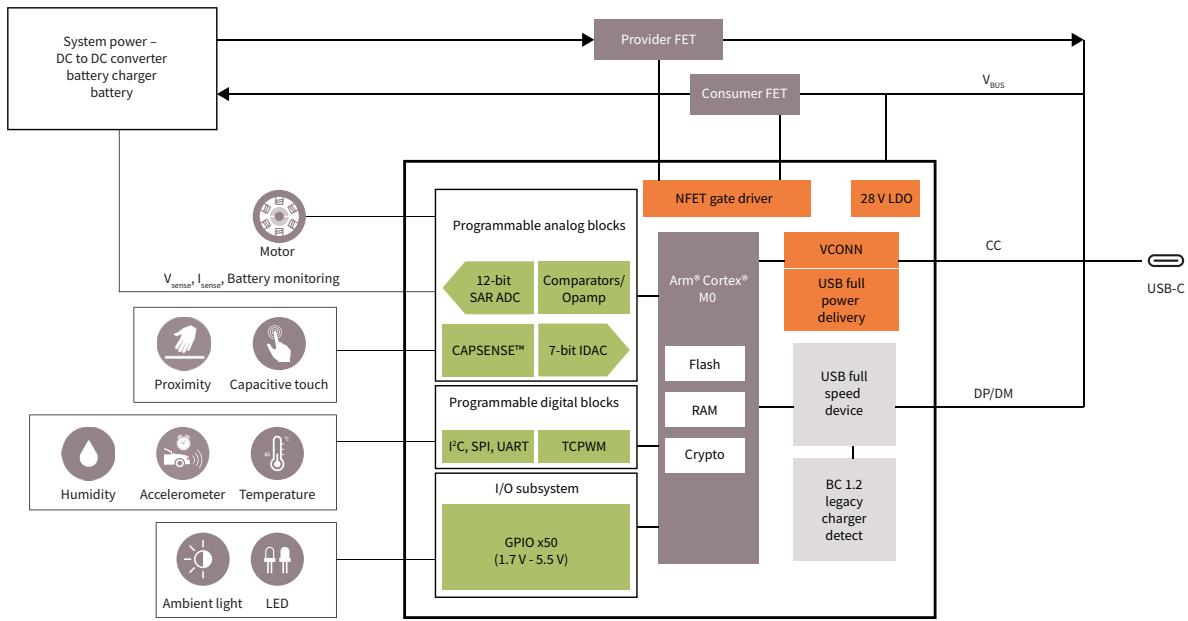
- Highly-integrated single-chip solution, included high-voltage protection
- Configuration utility and wide support material available
- Market-proven solution with mature design tools
- Integrated flash/MCU
- USB-IF compliant and certified
- Extended industrial temperature -40°C to 105°C

### Key benefits

- Area and BOM saving
- Faster time to market
- No implementation risk
- Programmability, product differentiation
- Interoperability
- Suitable for virtually any commercial or industrial application



### Block diagram



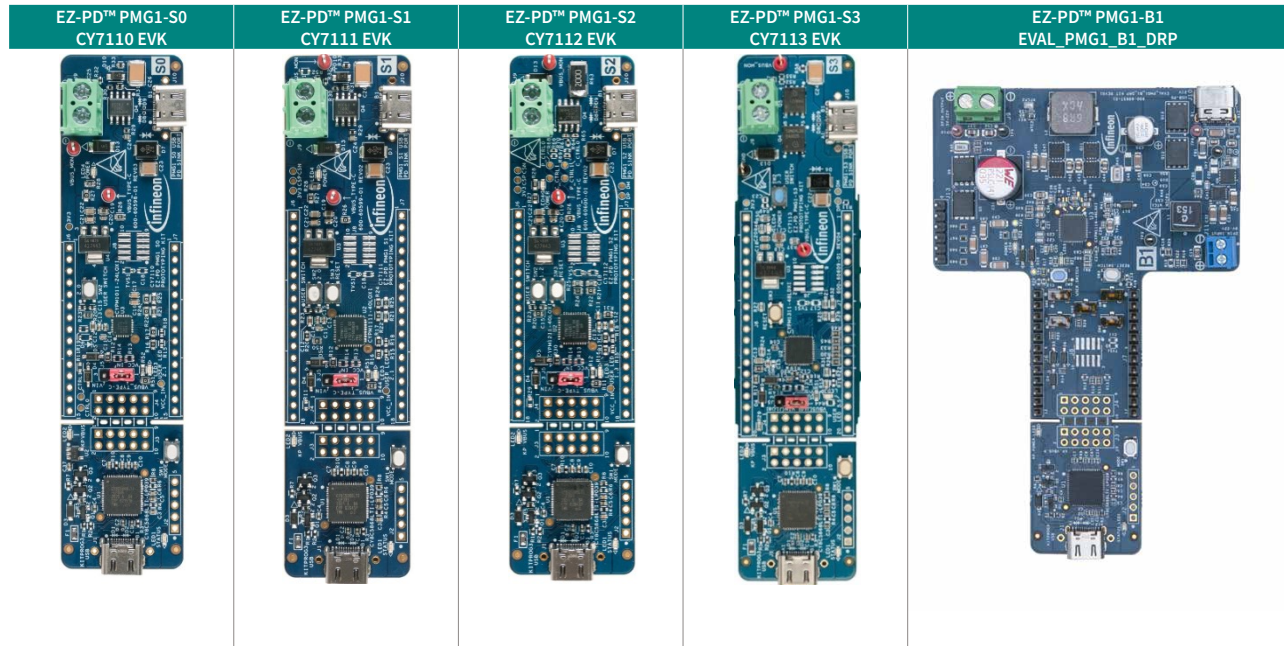
### Product portfolio

| Part number      | Product name | CPU              | Flash [kB] | GPI-Os | I/O Pins | Operating temperature range [°C] | Operating voltage min [V] | Operating voltage max [V] | Serial communication blocks | Termination resistor | Type-C ports |
|------------------|--------------|------------------|------------|--------|----------|----------------------------------|---------------------------|---------------------------|-----------------------------|----------------------|--------------|
| CYPM1011-24LQXI  | PMG1-S0      | Arm® Cortex®-M0  | 64         | 12     | 12       | -40 to 85                        | 2,7                       | 5,5                       | 2                           | Rd, Rd-db            | 1            |
| CYPM1011-24LQXIT | PMG1-S0      | Arm® Cortex®-M0  | 64         | 12     | 12       | -40 to 85                        | 2,7                       | 5,5                       | 2                           | Rd, Rd-db            | 1            |
| CYPM1111-40LQXI  | PMG1-S1      | Arm® Cortex®-M0  | 128        | 17     | 17       | -40 to 85                        | 2,7                       | 5,5                       | 4                           | Rp,Rd, Rd-db         | 1            |
| CYPM1111-40LQXIT | PMG1-S1      | Arm® Cortex®-M0  | 128        | 17     | 17       | -40 to 85                        | 2,7                       | 5,5                       | 4                           | Rp,Rd, Rd-db         | 1            |
| CYPM1115-48LQXI  | PMG1-B1      | Arm® Cortex®-M0  | 128        | 21     | 21       | -40 to 105                       | 4                         | 24                        | 3                           | Rp, Rd               | 1            |
| CYPM1115-48LQXIT | PMG1-B1      | Arm® Cortex®-M0  | 128        | 21     | 21       | -40 to 105                       | 4                         | 24                        | 3                           | Rp, Rd               | 1            |
| CYPM1116-48LQXI  | PMG1-B1      | Arm® Cortex®-M0  | 128        | 21     | 21       | -40 to 105                       | 4                         | 24                        | 3                           | Rp, Rd, Rd-db        | 1            |
| CYPM1116-48LQXIT | PMG1-B1      | Arm® Cortex®-M0  | 128        | 21     | 21       | -40 to 105                       | 4                         | 24                        | 3                           | Rp, Rd, Rd-db        | 1            |
| CYPM1211-40LQXI  | PMG1-S2      | Arm® Cortex®-M0  | 128        | 20     | 20       | -40 to 85                        | 2,7                       | 5,5                       | 4                           | Rp,Rd, Rd-db         | 1            |
| CYPM1211-40LQXIT | PMG1-S2      | Arm® Cortex®-M0  | 128        | 20     | 20       | -40 to 85                        | 2,7                       | 5,5                       | 4                           | Rp,Rd, Rd-db         | 1            |
| CYPM1211-42FNXI  | PMG1-S2      | Arm® Cortex®-M0  | 128        | 20     | 20       | -40 to 85                        | 2,7                       | 5,5                       | 4                           | Rp, Rd               | 1            |
| CYPM1211-42FNXIT | PMG1-S2      | Arm® Cortex®-M0  | 128        | 20     | 20       | -40 to 85                        | 2,7                       | 5,5                       | 4                           | Rp, Rd               | 1            |
| CYPM1311-48LDXI  | PMG1-S3      | Arm® Cortex®-M0+ | 256        | 26     | 26       | -40 to 85                        | 2,7                       | 5,5                       | 7                           | Rp,Rd, Rd-db         | 1            |
| CYPM1311-48LDXIT | PMG1-S3      | Arm® Cortex®-M0+ | 256        | 26     | 26       | -40 to 85                        | 2,7                       | 5,5                       | 7                           | Rp,Rd, Rd-db         | 1            |
| CYPM1321-97BZXI  | PMG1-S3      | Arm® Cortex®-M0+ | 256        | 50     | 50       | -40 to 85                        | 4                         | 30                        | 8                           | Rp, Rd, Rd-db        | 2            |
| CYPM1321-97BZXIT | PMG1-S3      | Arm® Cortex®-M0+ | 256        | 50     | 50       | -40 to 85                        | 4                         | 30                        | 8                           | Rp, Rd, Rd-db        | 2            |
| CYPM1322-97BZXI  | PMG1-S3      | Arm® Cortex®-M0+ | 256        | 50     | 50       | -40 to 85                        | 2,7                       | 5,5                       | 8                           | Rp,Rd, Rd-db         | 2            |
| CYPM1322-97BZXIT | PMG1-S3      | Arm® Cortex®-M0+ | 256        | 50     | 50       | -40 to 85                        | 2,7                       | 5,5                       | 8                           | Rp,Rd, Rd-db         | 2            |



## Boards

Once the preferred characteristics are identified, it is possible to get started with the product of choice by utilizing the available evaluation kits: they provide a USB Type-C receptacle to consume power from a charger and then supply it over a terminal block. A barrel connector can be attached to this block using wires to convert a barrel input to USB-C. In addition, all the GPIOs and serial interfaces (UART, I<sup>2</sup>C, SPI) are available on connectors to easily integrate external sensors and test the microcontroller functions.



# USB-C power delivery controllers

## Leading the industry with over one billion USB-C devices shipped

USB-C is the universal connector of choice and has gained rapid industry support thanks to its flexibility to transmit multiple data protocols such as USB4, Thunderbolt, HDMI, and simultaneously provide up to 240 Watts of power via USB PD, the possibility to enable slim industrial designs and its easy-to-use connectors and cables. Its adoption also has a significant impact on the environment, dramatically reducing the e-waste produced by the more than one million tons of proprietary chargers that get shipped every year. Infineon's EZ-PD™ portfolio is the industry's most complete portfolio of USB-C power delivery solutions, enabling more robust end-to-end power delivery and charging solutions for laptop and mobile devices. USB-C power delivery standard supports fast charging up to 240 watts, USB4 data speeds and DisplayPort connectivity over an industry-standard USB-C connector for transmitting both data and power on a single cable.

Infineon also offers AEC-Q100 certified versions of its controllers for automotive-grade performance.

As the leader in USB-C end-to-end solutions, Infineon also provides a comprehensive portfolio of solutions for [USB-C adapters and chargers](#).

### Features and benefits

| Key features   | Key benefits   |
|--|--|
| <ul style="list-style-type: none"> <li>– Supports latest USB-C power delivery protocols</li> <li>– Offers programmable USB-C PD solution</li> <li>– Offers firmware upgradability with in-built flash</li> <li>– Support secure firmware update with hardware crypto</li> <li>– Integrates high-voltage circuits</li> <li>– Integrates VBUS fault protections</li> <li>– Offered in QFN, BGA and WLCSP packages</li> </ul> | <ul style="list-style-type: none"> <li>– Interoperability</li> <li>– Easy customization using software development kit (SDK)</li> <li>– Easy integration into your application</li> <li>– Programmability for higher flexibility and shorter time to market</li> <li>– Highly integrated dual/single port USB-C PD controllers for optimized area and BOM</li> </ul> |

| Power source  | Power source (auto)  | Cable   | Dock   | Notebook/PC   | Broad market electronics                    |
|---|--|---|--|---|---|
| USB-PD controllers:<br>EZ-PD™ CCG3PA<br>EZ-PD™ CCG3PA-NFET              | EZ-PD™ CCG3PA USB-C PD controller<br>EZ-PD™ CCG7D Dual-port USB-C PD + DCDC controller | EZ-PD™ CCG2 USB-C port controller (active cable)  | EZ-PD™ CCG3 USB-C PD port controller<br><br>EZ-PD™ CCG4 Two-port USB-C & PD                                  | EZ-PD™ ACG1F Dual-single port USB-C PD<br><br>EZ-PD™ CCG5 Two-port USB-C & PD   | Move to USB-C:<br>EZ-PD™ BCR<br>EZ-PD™ PMG1 |
| USB-PD + DC-DC controllers:<br>EZ-PD™ CCG7DC<br>EZ-PD™ CCG7SC           | EZ-PD™ CCG7S Single-port USB-C PD + DCDC controller                                    | EZ-PD™ CMG1 USB-C EMCA controller<br>EZ-PD™ CMG2 USB-C EMCA controller with EPR (passive cable) | EZ-PD™ CCG5 Two-port USB-C PD  | EZ-PD™ CCG5C One-port USB-C PD  | Wireless charging:<br>WLCx                  |
| USB-PD + AC-DC controllers:<br>EZ-PD™ PAG1<br>EZ-PD™ PAG2 (coming soon) | Wireless charging:<br>WLC1515  |   | EZ-PD™ CCG5C One-port USB-C PD<br><br>EZ-USB™ HX3PD 10 Gbps hub controller with USB PD<br><br>EZ-PD™ PMG1-S3 | EZ-PD™ CCG6DF Dual-port USB-C PD<br><br>EZ-PD™ CCG6SF Single-port USB-C PD<br><br>EZ-PD™ CCG8 Dual-single port controller |   |

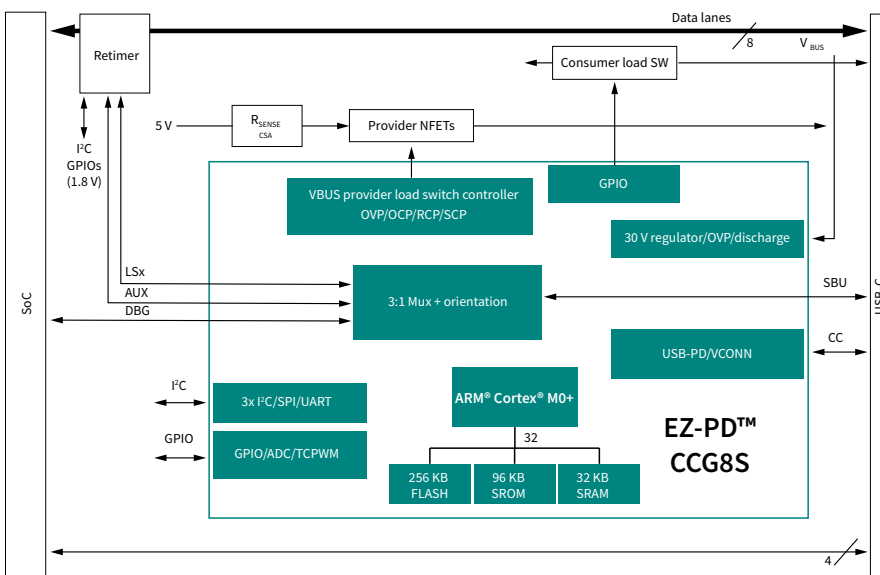


# EZ-PD™ CCG8 – USB-C controller

## USB-C power delivery solution for PC host with EPR

EZ-PD™ CCG8 is the first in the industry dual/single-port USB Type-C controller complying with the latest USB-C and power delivery (PD) specifications that offers a complete USB-C and PD port control solution for PCs and notebooks. It integrates a discrete N-channel field effect transistor (NFET) gate driver with fault protection and slew rate, a 32-bit 48 MHz Arm® Cortex®-M0 Plus processor and a complete Type-C transceiver including termination resistors Rp, Rd, and dead battery Rd. While EZ-PD™ CCG8D (dual port) is available in a 97-BGA package, EZ-PD™ CCG8S (single port) is only available in a 48-pin QFN package. Both can be requested in tray or tape and reel packing options, and support extended power range (EPR) up to 28 V without needing external components.

### Block diagram



### Features and benefits

#### Key features

- USB-C and PD 3.1 with EPR up to 28 V supporting USB3 and USB4, Thunderbolt, display port alternate mode platforms
- 32-bit, 48 MHz Arm® Cortex®-M0+ processor
- Integrates a complete Type-C transceiver and a load switch controller for driving NFETs on VBus provider path
- Slew rate controller to turn on the VBUS provider path
- Configurable hardware-controlled VBus overvoltage, undervoltage, overcurrent, short circuit, reverse current protection, and thermal shutdown
- Integrated 3:1 SBU Muxes for alternate modes and closed chassis debug
- Integrated digital and analog blocks

#### Key benefits

- Reduced area and BOM thanks to the high degree of integration
- Ideal for EPR-based DRP solutions
- Programmable solution which allows the implementation of custom features

[www.infineon.com/ez-pd-ccg8](http://www.infineon.com/ez-pd-ccg8)



Desktop



Notebook

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



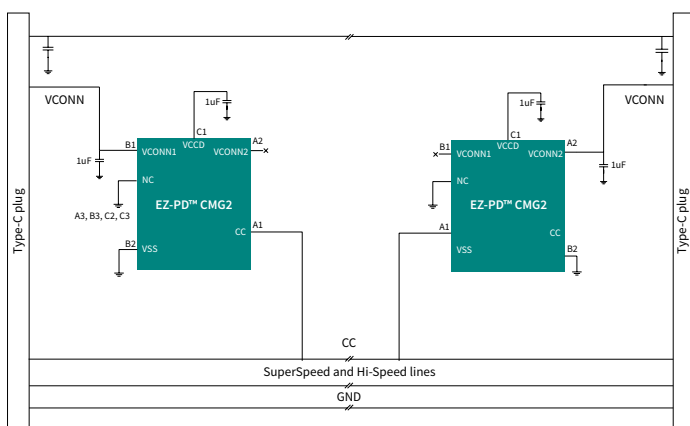
# EZ-PD™ CMG2 – USB-C EMCA controller

## EMCA controller with VBUS to CC short protection for passive USB-C cables

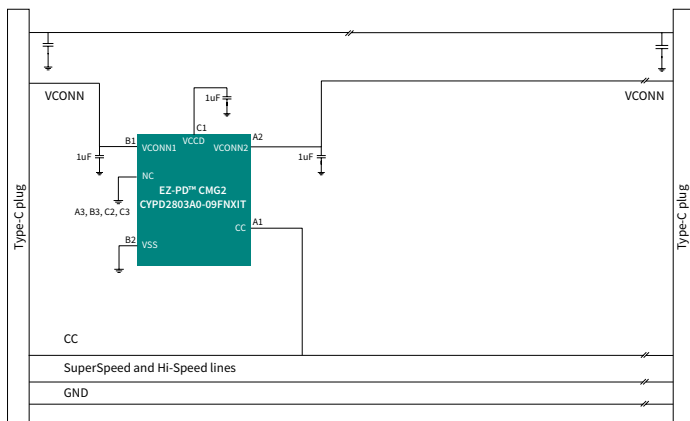
EZ-PD™ CMG2 is Infineon's dedicated electronically marked cable assembly (EMCA) controller targeting passive non-Thunderbolt and Thunderbolt Type-C cables. It offers integrated VBus-CC short protection up to 54 V, VBus-VCONN short protection up to 54 V, power delivery 3.1, Type-C 2.1, and ESD protection, all these in a compact 9-ball WLCSP package. EZ-PD™ CMG2 has a 47-byte storage space for vendor- and cable-specific configuration data and is designed to operate from a 2.7 to 5.5 V VCONN supply range.

### Block diagram

Passive EMCA application - Single EZ-PD™ CMG2 chip per plug:



Passive EMCA application - Single EZ-PD™ CMG2 chip per cable:



### Features and benefits

#### Key features

- Supports USB PD 3.1 specification and USB Type-C specification version 2.1
- Supports USB4, TBT4 and extended power range (EPR)
- PD protocol
- Integrated high-voltage protection on CC, VCONN1, and VCONN2 pins to protect against accidental shorts to the VBus pin on the Type-C connector up to 54 V
- Integrated 47 bytes for storing vendor- and cable-specific configuration data termination resistor RA on VCONN1 and VCONN2
- IEC ESD protection on VCONN and CC
- Package: 9-ball WLCSP

#### Key benefits

- No programming required
- Easy to use, faster design cycle
- Robust solution with short protection up to 54 V

[www.infineon.com/ez-pd-cmg2](http://www.infineon.com/ez-pd-cmg2)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# USB-C AC-DC and DC-DC charging solutions

## The one-stop shop for charger and adapter designs

Infiniteon offers a one-stop shop for a wide variety of USB PD AC-DC and DC-DC conversion solutions for charger adapters from 18 W to 140 W. The portfolio includes a scalable PD controller architecture to support both single-port and multi-port charger configurations. Our reference designs allow the quick and easy development of prototypes, meaning customers can benefit from new, fast-charging adapter technology while reducing development costs and time to market. Moreover, the high degree of programmability and the ability to support custom protocols and updates enables a high degree of flexibility for customers. With decades of experience in the electronics industry, Infineon drives the trend of adapter miniaturization without compromising product efficiency and performance.

As the leader in USB-C end-to-end solutions, Infineon also provides a comprehensive portfolio of solutions for **USB-C adapters and chargers**.

| Product           | Category                       | Product family | CPU              | Flash [kB] | SRAM [kB] | GPIOs | Serial communication blocks | #Type-C ports | Operating temperature range [°C] |
|-------------------|--------------------------------|----------------|------------------|------------|-----------|-------|-----------------------------|---------------|----------------------------------|
| CYPAP111A3-10SXQ  | Primary PWM startup controller | PAG1P          | N/A              | N/A        | N/A       | 0     | N/A                         | N/A           | -40 to 105                       |
| CYPAP111A3-10SXQT | Primary PWM startup controller | PAG1P          | N/A              | N/A        | N/A       | 0     | N/A                         | N/A           | -40 to 105                       |
| CYPAP112A3-10SXQ  | Primary PWM startup controller | PAG1P          | N/A              | N/A        | N/A       | 0     | N/A                         | N/A           | -40 to 105                       |
| CYPAP112A3-10SXQT | Primary PWM startup controller | PAG1P          | N/A              | N/A        | N/A       | 0     | N/A                         | N/A           | -40 to 105                       |
| CYPAS111A1-24LXQ  | USB-PD + SR + PWM controller   | PAG1S          | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPAS111A1-24LXQT | USB-PD + SR + PWM controller   | PAG1S          | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3184A1-24LXQ  | USB-PD + SR + PWM controller   | PAG1S          | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3184A1-24LXQT | USB-PD + SR + PWM controller   | PAG1S          | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3135-32LXQ    | USB-PD controller              | CCG3           | Arm® Cortex®- M0 | 128        | 8         | 14    | 4                           | 1             | -40 to 105                       |
| CYPD3135-32LXQT   | USB-PD controller              | CCG3           | Arm® Cortex®- M0 | 128        | 8         | 14    | 4                           | 1             | -40 to 105                       |
| CYPD3135-40LXQI   | USB-PD controller              | CCG3           | Arm® Cortex®- M0 | 128        | 8         | 20    | 4                           | 1             | -40 to 105                       |
| CYPD3135-40LXQIT  | USB-PD controller              | CCG3           | Arm® Cortex®- M0 | 128        | 8         | 20    | 4                           | 1             | -40 to 105                       |
| CYPD3135-40LXQ    | USB-PD controller              | CCG3           | Arm® Cortex®- M0 | 128        | 8         | 20    | 4                           | 1             | -40 to 105                       |
| CYPD3135-40LXQT   | USB-PD controller              | CCG3           | Arm® Cortex®- M0 | 128        | 8         | 20    | 4                           | 1             | -40 to 105                       |
| CYPD3171-24LXQ    | USB-PD controller              | CCG3PA         | Arm® Cortex®- M0 | 64         | 8         | 12    | 2                           | 1             | -40 to 105                       |
| CYPD3171-24LXQT   | USB-PD controller              | CCG3PA         | Arm® Cortex®- M0 | 64         | 8         | 12    | 2                           | 1             | -40 to 105                       |
| CYPD3172-24LXQ    | USB-PD controller              | CCG3PA-NFET    | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3172-24LXQT   | USB-PD controller              | CCG3PA-NFET    | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3172P-24LXQ   | USB-PD controller              | CCG3PA-NFET    | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3172P-24LXQT  | USB-PD controller              | CCG3PA-NFET    | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3173-24LXQ    | USB-PD controller              | CCG3PA-NFET    | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3173-24LXQT   | USB-PD controller              | CCG3PA-NFET    | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3173P-24LXQ   | USB-PD controller              | CCG3PA-NFET    | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3173P-24LXQT  | USB-PD controller              | CCG3PA-NFET    | Arm® Cortex®- M0 | 64         | 4         | 6     | 0                           | 1             | -40 to 105                       |
| CYPD3174-16SXQT   | USB-PD controller              | CCG3PA         | Arm® Cortex®- M0 | 64         | 8         | 6     | 1                           | 1             | -40 to 105                       |
| CYPD3174-24LXQ    | USB-PD controller              | CCG3PA         | Arm® Cortex®- M0 | 64         | 8         | 12    | 2                           | 1             | -40 to 105                       |
| CYPD3174-24LXQT   | USB-PD controller              | CCG3PA         | Arm® Cortex®- M0 | 64         | 8         | 12    | 2                           | 1             | -40 to 105                       |
| CYPD3175-24LXQ    | USB-PD controller              | CCG3PA         | Arm® Cortex®- M0 | 64         | 8         | 12    | 2                           | 1             | -40 to 105                       |
| CYPD3175-24LXQT   | USB-PD controller              | CCG3PA         | Arm® Cortex®- M0 | 64         | 8         | 12    | 2                           | 1             | -40 to 105                       |
| CYPD7271-68LXQ    | USB-PD + DCDC controller       | CCG7DC         | Arm® Cortex®- M0 | 128        | 16        | 19    | 4                           | 2             | -40 to 105                       |
| CYPD7271-68LXQT   | USB-PD + DCDC controller       | CCG7DC         | Arm® Cortex®- M0 | 128        | 16        | 19    | 4                           | 2             | -40 to 105                       |





# EZ-PD™ CCG7DC – USB-C PD and DC-DC controller

## Industry’s first dual-port PD and DC-DC integrated controller

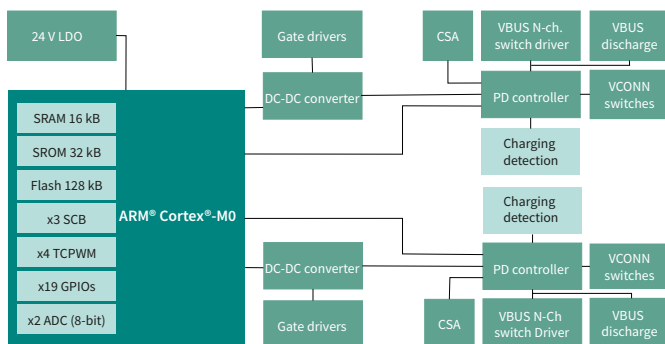
Infiniteon’s EZ-PD™ CCG7DC is a highly integrated dual-port USB Type-C power delivery (PD) solution with built-in buck-boost controller; it is designed for multi-port consumer charging applications and complies with the most recent USB Type-C and PD specifications. With an on-chip 32-bit Arm® Cortex®-M0 processor, 128 kB flash, 16 kB RAM, and 32 kB ROM, EZ-PD™ CCG7DC is the most programmable USB-PD solution, leaving the majority of flash available for user application’s use. Custom system management features, like dynamic load sharing and temperature monitoring, can be implemented thanks to the inclusion of this fully programmable MCU with analog and digital peripherals. EZ-PD™ CCG7DC also integrates gate drivers for VBus NFET on the provider path and hardware-controlled protection features on the VBus. The high degree of integration provided by EZ-PD™ CCG7DC not only lowers the BOM, but also provides a footprint-optimized solution to support higher power density designs. A single-port USB-C PD and DC-DC controller is also available: [EZ-PD™ CCG7SC](#).

### Features and benefits

| Key features   |
|--|
| – Two USB-C PD controllers + DC-DC controllers   |
| – Supports latest USB-C PD 3.0 with PPS, QC4+, Samsung AFC, Apple 2.4 A, BCv1.2  |
| – Arm® Cortex®-M0 with flash for custom features implementation  |
| – Integrated VBus NFET gate drivers, buck-boost NFET gate drivers, VCONN FETs and high-side current sense amplifier (HSCSA)  |
| – Protection features: OVP, UVP, SCP, OCP, OTP and VBus-CC short   |
| – DC-DC controller: configurable switching frequency of 150 kHz – 600 kHz, PSM/ FCCM mode of operation, wide input voltage range of 4 – 24 V (40 V tolerant), and programmable spread spectrum frequency for low EMI |
| – Advanced features: dynamic load sharing, signed field firmware upgrade, and optimized buck input voltage for higher efficiency   |

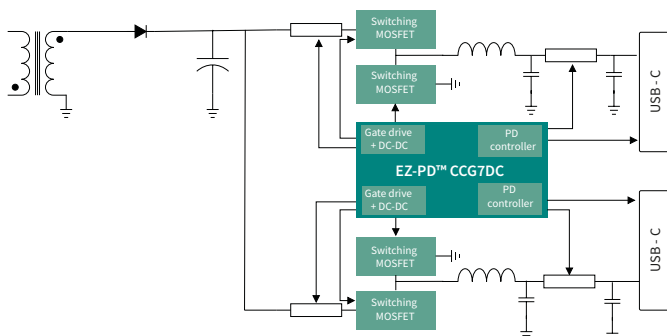
| Key benefits   |
|--|
| – Enables high power density designs by integrating two DC-DC controllers + two USB-C PD controllers in one single chip              |
| – Dynamic load sharing enables intelligent redistribution of power between two ports   |
| – Optimized buck input voltage using TL431 provides optimized efficiency for AC-DC designs   |
| – Supports USB-C PD3.0 with PPS and other legacy protocols including Apple 2.4A, Samsung AFC, QC4.0, BC1.2 at no additional BOM cost |

### Block diagram



### Application example

Two-port USB-C charger using EZ-PD™ CCG7DC



[www.infineon.com/ez-pd-ccg7dc](http://www.infineon.com/ez-pd-ccg7dc)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# EZ-PD™ PAG1 - USB-C PD, SR and PWM controller

## USB-C PD charger and adapter complete solution

EZ-PD™ PAG1 is a complete AC-DC charger and adapter solution with integrated USB PD. It is a dual-chip solution with EZ-PD™ PAG1P and EZ-PD™ PAG1S in a secondary side controlled quasi-resonant (QR) flyback topology with ZVS. This highly integrated dual-chip power adapter solution includes SR, PD and PWM controller, all necessary protection circuitry, and FET drivers to drive the primary, SR - primary and VBus switch. This allows a reduced BOM and a better-optimized area. EZ-PD™ PAG1 solution is built with Arm® Cortex™-M0 and offers the flexibility to program the device as per the customer's needs, configure the parameters across multiple platforms as well as upgrade the firmware on the field.

### EZ-PD™ PAG1P

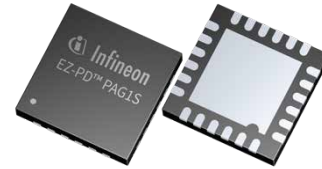


The PAG1P is a primary start-up controller for AC-DC applications. It is designed to work with PAG1S in a secondary side-controlled AC-DC flyback converter topology where the voltage and current regulation is performed by PAG1S, and PAG1P provides the start-up function, drives the primary switch and responds to the fault condition. The PAG1P switch supports both x-cap and non x-cap discharge mode.

#### Key features

- Works across universal AC main input  $85 V_{AC}$  to  $265 V_{AC}$
- Synchronizes to PWM from the secondary side using a pulse edge transformer
- Integrated low-side gate driver to drive primary side FET
- Integrated high-voltage start-up and shunt regulator
- Supports X-cap discharge mode for enhanced efficiency
- Integrated line UV, OCP, and secondary OVP
- Fixed auto-restart timer for fault recovery
- Programmable soft-start configurable with an external capacitor

### EZ-PD™ PAG1S



The PAG1S is a single-chip, secondary-side controller that integrates the synchronous rectification driver, PD controller, and PWM controller. The controller works as well secondary controlled flyback architecture by pairing with primary startup controller PAG1P.

#### Key features

- Works with both primary-side and secondary-side controlled flyback designs
- Integrates secondary-side regulation, synchronous rectifier (SR), and charging port controller
- Supports quasi-resonant (QR) or critical conduction mode (CrCM), valley switching, discontinuous conduction mode (DCM), and burst mode for light load operations
- Switching frequency range of 20 kHz to 150 kHz
- Higher efficiency across the line and load levels with independent CC/CV loop control
- Supports USB PD 3.0 with PPS (USB-IF certified, TID:1475), QC4+
- Supports legacy charging protocols: BC v1.2, AFC, and Apple charging
- Integrates low-side current sense amplifier and VBUS NFET gate drivers

[www.infineon.com/ez-pd-PAG1](http://www.infineon.com/ez-pd-PAG1)



Notebook



Communication



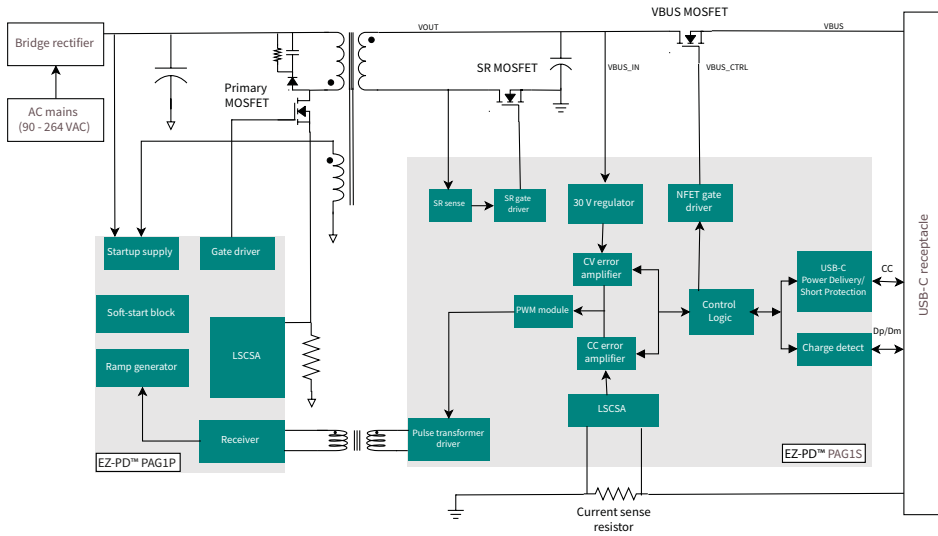
Charger

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

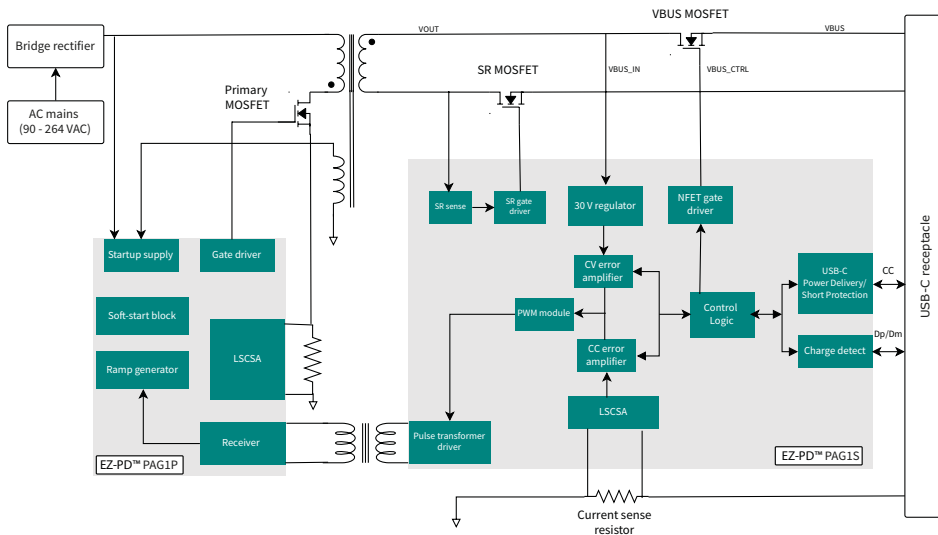


Application diagram

Design example using EZ-PD™ PAG1S - primary-controlled flyback solution:



Design example using EZ-PD™ PAG1 secondary-side controlled QR flyback solution



Primary PWM startup controller

| Product          | Product family | Fault protection        | High voltage startup | Gate driver | X-cap/non X-Cap mode |
|------------------|----------------|-------------------------|----------------------|-------------|----------------------|
| CYPAP111A3-10SXQ | PAG1P          | Line UV, VBUS, OVP, OCP | Yes                  | Low-side    | Non X-cap            |
| CYPAP112A3-10SXQ | PAG1P          | Line UV, VBUS, OVP, OCP | Yes                  | Low-side    | X-cap                |

Secondary USB-PD, SR, and PWM controller

| Product           | Product family | Fault protection                | Operating voltage [V] | SR gate driver | PWM controller type | PD compliance revision |
|-------------------|----------------|---------------------------------|-----------------------|----------------|---------------------|------------------------|
| CYPAP111A1-24LQXQ | PAG1S          | VBUS OCB, OVP, UVP, SCP and OTP | 3.3-21                | Low-side       | QR flyback          | PD3.0 PPS              |



# Peripheral controllers for USB 5Gbps

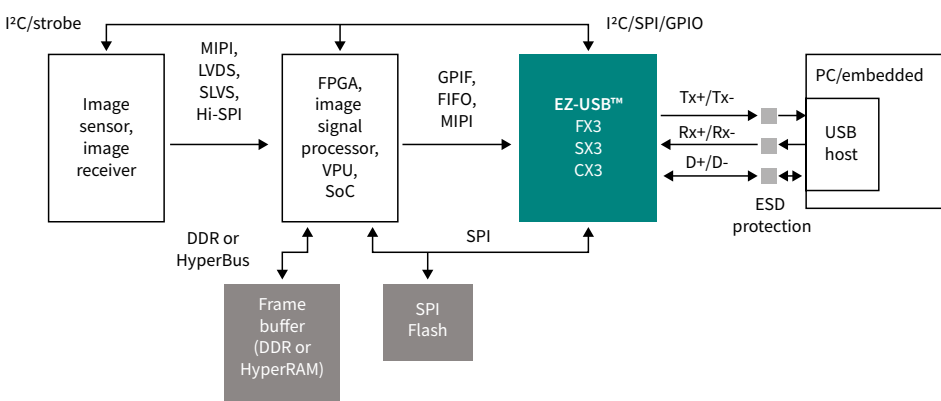
## From USB 1.1 to USB 5Gbps innovation, heading towards 20Gbps

Infinion’s EZ-USB™ peripheral controllers family offers the most comprehensive USB product portfolio in the industry. Since 1996, EZ-USB™ has set the industry’s standard by improving the capabilities of programmable USB peripheral controllers, enabling designers to build USB devices that can handle the most demanding performance requirements in industrial and medical imaging applications. Machine vision, medical imaging, 3D scanners, biometric scanners, and many other applications requiring safe and dependable high-speed plug-and-play connectivity can benefit from the high-performance EZ-USB™ 5 Gbps controllers.

Infinion’s EZ-USB™ peripheral controllers provide 5Gbps bandwidth today, and will soon move forward to 10 and then 20 Gbps.

|                              | EZ-USB™ FX3                                      | EZ-USB™ CX3               | EZ-USB™ SX3                         |
|------------------------------|--|---------------------------|-------------------------------------|
| <b>Function</b>              | Programmable peripheral                          | MIPI CSI-2 to USB3 bridge | FIFO-USB3 bridge                    |
| <b>Part numbers</b>          | CYUSB3011<br>CYUSB3012<br>CYUSB3013<br>CYUSB3014 | CYUSB3064<br>CYUSB3065    | CYUSB3015<br>CYUSB3016<br>CYUSB3017 |
| <b>Transfer rate</b>         | 5Gbps  | 5Gbps                     | 5Gbps                               |
| <b>System interface</b>      | 32-bit GPIF, 100 MHz                             | 4x MIPI CSI-2             | 32-bit FIFO, 100 MHz                |
| <b>USB-C Mux</b>             | -  | -                         | -                                   |
| <b>Processor</b>             | ARM9   | ARM9                      | ARM9                                |
| <b>RAM / flash</b>           | 512 KB / 0 KB                                    | 512 KB / 0 KB             | 512 KB / 0 KB                       |
| <b>USB endpoints</b>         | 32   | 2                         | 2                                   |
| <b>Hardware DVK</b>          | SuperSpeed Explorer Kit                          | CX3 Camera RDK            | SX3 Explorer it                     |
| <b>SDK</b>                   | EZ-USB™ FX3 SDK                                  | EZ-USB™ FX3 SDK           | -                                   |
| <b>Configuration utility</b> | -  | -                         | EZ-USB™ SX3 configuration utility   |

### Block diagram



The block diagram shows a typical USB3 Vision-based machine vision camera. An image sensor using one of many different interface standards is connected to an FPGA or an image signal processor (ISP), which processes and optimizes the image and translates data into parallel data (or MIPI CSI-2) connected to an EZ-USB™ controller (FX3, SX3 or CX3). The EZ-USB™ controllers transfer uncompressed video in USB3 Vision standard to a PC or an embedded system via a standard USB cable.

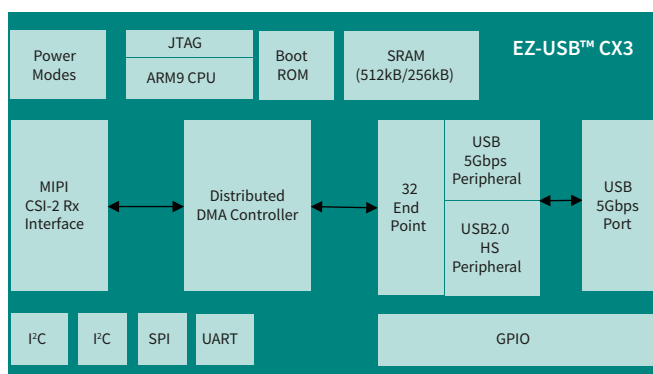


# EZ-USB™ CX3 - MIPI CSI-2 to USB 5Gbps camera controllers

## Adding USB 5Gbps connectivity to image sensors with MIPI CSI-2 interface

Infineon's EZ-USB™ CX3 enables USB 5Gbps connectivity to any image sensor compliant with the mobile industry processor interface (MIPI) camera serial interface Type 2 (CSI-2) standard. It is based on the proven EZ-USB™ FX3 platform and comes with a 200 MIPS fully accessible ARM9 CPU and 512 kB SRAM. For configuring image sensors, EZ-USB™ CX3 also supports camera control interface (CCI). Pan, tilt, and zoom functions, as well as other camera control functions, can be supported by programming the EZ-USB™ CX3's numerous peripheral interfaces, including I²C, SPI, and UART.

### Block diagram



### Features and benefits

#### Key features

- Capable of streaming uncompressed video, including:
  - 4K UHD video at 15 fps
  - 1080p video at 30 fps
  - 720p video at 60 fps
- Connectivity: MIPI CSI-2 to USB 5 Gbps bridge controller with an integrated USB 5 Gbps PHY
- Bandwidth: 4x CSI-2 lanes, 1 Gbps per lane
- Color format support: RAW8/10/12/141, YUV422/4442, RGB888/666/5653
- Camera protocol: UVC or proprietary
- Programmability: fully accessible ARM9 CPU with 200 MHz operation and 512 kB SRAM

#### Key benefits

- Adds USB 5Gbps connectivity to any MIPI CSI-2 based camera
- Turnkey solutions on industrial standards
- Quick time-to-market with low development costs

[www.infineon.com/ez-usb-cx3](http://www.infineon.com/ez-usb-cx3)



Automation



Security and surveillance



Retail

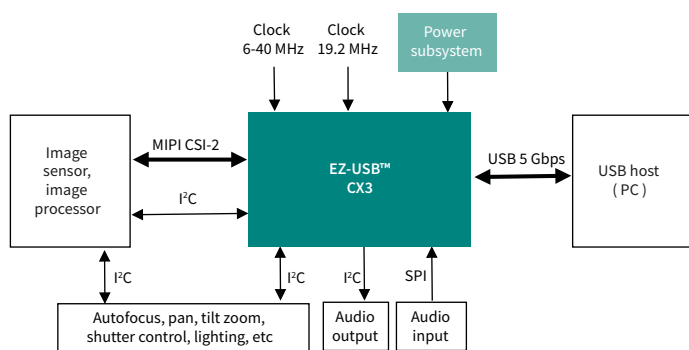


Medical and life sciences

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



### Application diagram



In the block diagram a typical EZ-USB™ CX3-based camera is depicted. The EZ-USB™ CX3 is connected to an image sensor with a MIPI CSI-2 (up to four lanes) interface. A standard USB cable is then used by the peripheral controller to transfer uncompressed video in compliance with the USB video class standard to a PC or an embedded system.

### Product portfolio

| Product        | USB standard | USB speed [Gbit/s] | I/O type  | Operating temperature range [°C] | Operating voltage min [V] | Operating voltage max [V] |
|----------------|--------------|--------------------|---|----------------------------------|---------------------------|---------------------------|
| CYUSB3064-BZXC | USB 3.0      | 5                  | 2/4-Lanes MIPI CSI-2, GPIO, I²C, SPI, I2S, UART | 0 to 70                          | 1.15                      | 1.25                      |
| CYUSB3064-BZXI | USB 3.0      | 5                  | 2/4-Lanes MIPI CSI-2, GPIO, I²C, SPI, I2S, UART | -40 to 85                        | 1.15                      | 1.25                      |
| CYUSB3065-BZXC | USB 3.0      | 5                  | 2/4-Lanes MIPI CSI-2, GPIO, I²C, SPI, I2S, UART | 0 to 70                          | 1.15                      | 1.25                      |
| CYUSB3065-BZXI | USB 3.0      | 5                  | 2/4-Lanes MIPI CSI-2, GPIO, I²C, SPI, I2S, UART | -40 to 85                        | 1.15                      | 1.25                      |



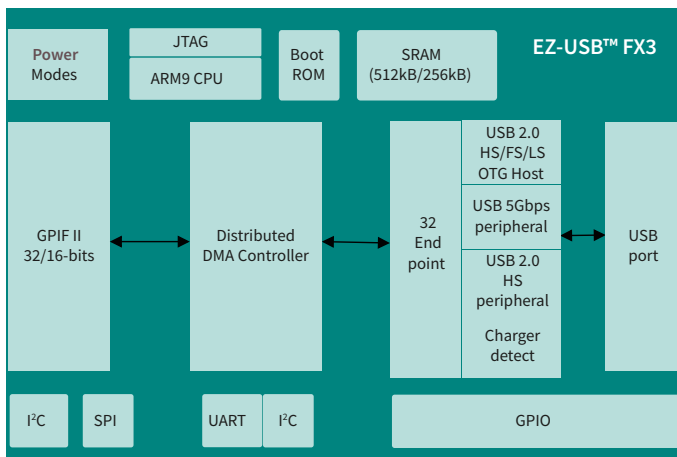
# EZ-USB™ FX3 - USB 5Gbps peripheral controllers

## USB 5Gbps to 32-bit data bus with ARM9

Infineon's EZ-USB™ FX3 is the industry's most adaptable USB peripheral controller which can add USB 5Gbps connectivity to any system. A processor, an image sensor, an FPGA, or an ASIC can all be connected using the EZ-USB™ FX3's second-generation general programmable interface (GPIF II). Users can configure the general programmable interface (GPIF) to operate like a FIFO, an asynchronous SRAM, an address/data multiplexed interface, a CompactFlash, or a custom interface.

EZ-USB™ FX3 will enable applications like machine vision and medical imaging to achieve higher quality at a lower cost because USB 5Gbps and USB-C are now standard connectivity in all PCs.

### Block diagram



### Features and benefits

#### Key features

- Full accessible 32-bits, 200 MHz, ARM9 core with up to 512 kB of embedded SRAM
- Hi-speed on-the-go (HS-OTG) host and peripheral compliant with on-the-go Supplement Version 2.0
- USB 2.0 OTG compliance
- Compliant with USB BC v1.1
- Additional connectivity to peripherals
- Improved battery charging capabilities

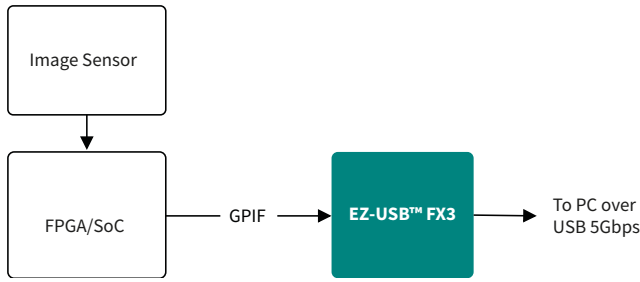
#### Key benefits

- Adds USB 5Gbps capability to any system
- Quick time-to-market with low development costs
- Turnkey solutions on industrial standards
- Easy code development and integration
- Easy connectivity to peripherals such as I²C, I2S, UART, SPI and GPIOs



Application diagram

EZ-USB™ FX3 HD video / 3D imaging






USB 3.0 provides 5Gbps bandwidth and supports the streaming of HD video without the need for compression. EZ-USB™ FX3 connects directly with a variety of image sensors, enabling USB 5 Gbps camera and 3D imaging designs while saving bill-of-material cost and PCB footprint.

Product portfolio

| Product          | USB standard | USB speed [GBit/s] | I/O type  | Operating temperature range [°C] | Operating voltage min [V] | Operating voltage max [V] |
|------------------|--------------|--------------------|---|----------------------------------|---------------------------|---------------------------|
| CYUSB3011-BZXC   | USB 3.0      | 5                  | 8/16-bit GPIF, DMA, GPIO, I <sup>2</sup> C, UART, I2S, SPI    | 0 to 70                          | 1.7                       | 3.6                       |
| CYUSB3012-BZXC   | USB 3.0      | 5                  | 8/16/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, UART, I2S, SPI | 0 to 70                          | 1.7                       | 3.6                       |
| CYUSB3013-BZXC   | USB 3.0      | 5                  | 8/16-bit GPIF, DMA, GPIO, I <sup>2</sup> C, UART, I2S, SPI    | 0 to 70                          | 1.7                       | 3.6                       |
| CYUSB3014-BZXC   | USB 3.0      | 5                  | 8/16/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, UART, I2S, SPI | 0 to 70                          | 1.7                       | 3.6                       |
| CYUSB3014-BZXCCT | USB 3.0      | 5                  | 8/16/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, UART, I2S, SPI | 0 to 70                          | 1.7                       | 3.6                       |
| CYUSB3014-BZXI   | USB 3.0      | 5                  | 8/16/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, UART, I2S, SPI | -40 to 85                        | 1.7                       | 3.6                       |
| CYUSB3014-BZXIT  | USB 3.0      | 5                  | 8/16/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, UART, I2S, SPI | -40 to 85                        | 1.7                       | 3.6                       |

Boards

| EZ-USB™ FX3 DEMO_FX3_U3V_CAM01   | EZ-USB™ FX3 CYRB4111   | EZ-USB™ FX3 CYUSB3KIT-003  |
|--|--|--|
|   |    |   |
| <p>The EZ-USB™ FX3 DEMO_FX3_U3V_CAM01 Camera Kit is based on the EZ-USB™ FX3. The kit includes a MIPI CSI-2 camera module connected to an FPGA on one PCB mounting on an updated EZ-USB™ FX3 Explorer kit.</p> | <p>The EZ-USB™ FX3 CYRB4111 USB3 vision solution demo kit is based on the EZ-USB™ FX3. This kit enables users to stream 4K 30 fps videos from an external HDMI source to PC via USB-C interface in USB3 Vision standard.</p> | <p>The EZ-USB™ FX3 CYUSB3KIT-003 is an easy-to-use and inexpensive development platform enabling developers to add USB 3.0 device functionality to any system.</p> |





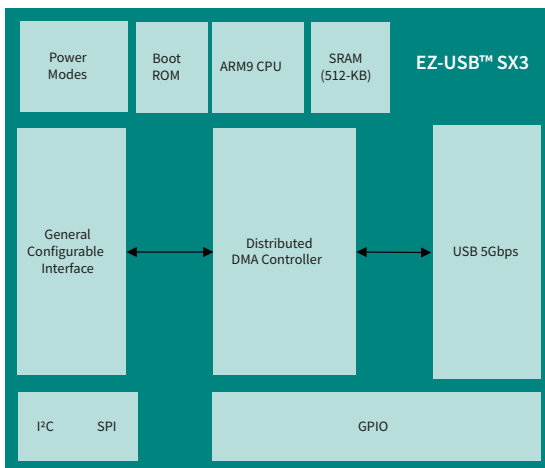
# EZ-USB™ SX3 - FIFO to USB 5 Gbps controllers

## USB 5Gbps easily configured for UVC/UAC or USB3 Vision applications

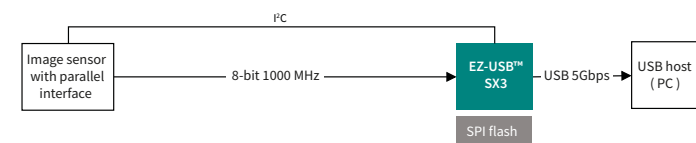
Infinion's EZ-USB™ SX3 can be configured by tuning a wide range of parameters such as VID/PID, product strings, serial numbers, FIFO settings, GPIOs, USB endpoints and auxiliary interface via its easy-to-use Graphic User Interface (GUI) utility. The utility can also produce USB video class (UVC) and USB audio class (UAC) configurations that are specification compliant without the need for firmware development, significantly shortening the time-to-market for end products. In addition to the configurable parameters, developers can also utilize the integrated 32-bit ARM9 processor to further customize their devices, differentiating in the market and gaining a competitive advantage.

Additionally, Infineon provides a wide range of USB Type-C port controllers that can be used with the EZ-USB™ SX3 to enhance cameras, video capturing, and other data acquisition applications with USB-C and USB power delivery features.

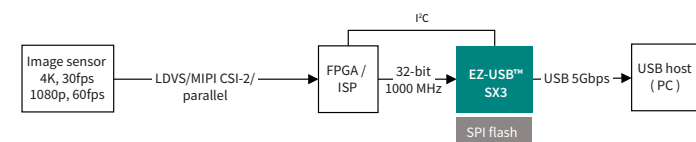
### Block diagram



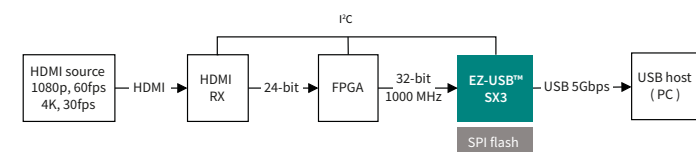
### Application diagram



Direct image sensor interface to EZ-USB™ SX3



USB 5Gbps Camera



4K HDMI USB 5Gbps capture card

[www.infineon.com/ez-usb-sx3](http://www.infineon.com/ez-usb-sx3)



Automation



Security and surveillance



Retail



Medical and life sciences

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Features and benefits

### Key features

- Universal Serial Bus (USB) integration
  - USB 3.2, Gen 1 and USB 2.0 peripherals compliant with USB 3.2 specification revision 1.0
  - 5 Gbps PHY compliant with USB 3.2 Gen 1
  - Three physical endpoints
  - Supports UVC, UAC, and USB vendor class protocol
- 32 bit CPU ARM926EJ core with 200 MHz operation with 512 kB embedded SRAM
- General configurable interface (supports up to 100 MHz; 8-, 16-, 24-, and 32 bit data bus; slave FIFO, parallel camera interface)
- Additional connectivity to SPI boot flash and I<sup>2</sup>C slaves at 100/400 kHz and 1 MHz
- Firmware ready for USB video class (UVC), USB3 Vision, and many standard USB class applications
- Less than 60  $\mu$ A with  $V_{BATT}$  on and 20  $\mu$ A with  $V_{BATT}$  off

### Key benefits

- Lowest total cost (bandwidth per dollar) solution for any high-speed system
- Turnkey solutions on industrial standards
- Quick time-to-market with low development costs
- Industry gold standard with highly integrated features
- Easy customization via configuration utility

## Product portfolio

| Product          | USB standard | USB speed [Gbit/s] | I/O type  | Operating temperature range [°C] | Operating voltage min [V] | Operating voltage max [V] |
|------------------|--------------|--------------------|---|----------------------------------|---------------------------|---------------------------|
| CYUSB3015-BZXC   | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | 0 to 70                          | 1,7                       | 3,6                       |
| CYUSB3015-BZXCCT | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | 0 to 70                          | 1,7                       | 3,6                       |
| CYUSB3015-BZXI   | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | -40 to 85                        | 1,7                       | 3,6                       |
| CYUSB3015-BZXIT  | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | -40 to 85                        | 1,7                       | 3,6                       |
| CYUSB3016-BZXC   | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | 0 to 70                          | 1,7                       | 3,6                       |
| CYUSB3016-BZXCCT | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | 0 to 70                          | 1,7                       | 3,6                       |
| CYUSB3016-BZXI   | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | -40 to 85                        | 1,7                       | 3,6                       |
| CYUSB3016-BZXIT  | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | -40 to 85                        | 1,7                       | 3,6                       |
| CYUSB3017-BZXC   | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | 0 to 70                          | 1,7                       | 3,6                       |
| CYUSB3017-BZXCCT | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | 0 to 70                          | 1,7                       | 3,6                       |
| CYUSB3017-BZXI   | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | -40 to 85                        | 1,7                       | 3,6                       |
| CYUSB3017-BZXIT  | USB 3.0      | 5                  | 8/16/24/32-bit GPIF, DMA, GPIO, I <sup>2</sup> C, SPI | -40 to 85                        | 1,7                       | 3,6                       |

## Boards

CY-SD4210 EZ-USB™ SX3 HDMI 4K to USB 5 Gbps demo kit



EZ-USB™ SX3 HDMI 4K to USB 5Gbps demonstration kit is based on Infineon's EZ-USB™ SX3. An FPGA captures a video stream from the HDMI interface and transfers it via USB 5Gbps connection to a PC. The kit can be configured as a USB video class (UVC) device or a USB3 Vision device easily via EZ-USB™ SX3 Configuration Utility and supports up to 4K 30 frame-per-second video stream.



# USB 2.0 peripheral controllers

## Solutions for low-speed, full-speed and high-speed devices

Since 1996, EZ-USB™ has been setting the standard for the industry by enhancing the capabilities of programmable USB peripheral controllers, this has enabled developers to design USB devices that can meet the most stringent performance requirements in industrial and imaging applications. More significantly, Infineon's first-rate customer service and long-term supply guarantee your successful product life cycles last for more than ten years. The complete portfolio of USB programmable peripheral controllers supports low-speed and full-speed options with EZ-USB™ encore and high-speed options with EZ-USB™ FX2LP and EZ-USB™ FX2G2.

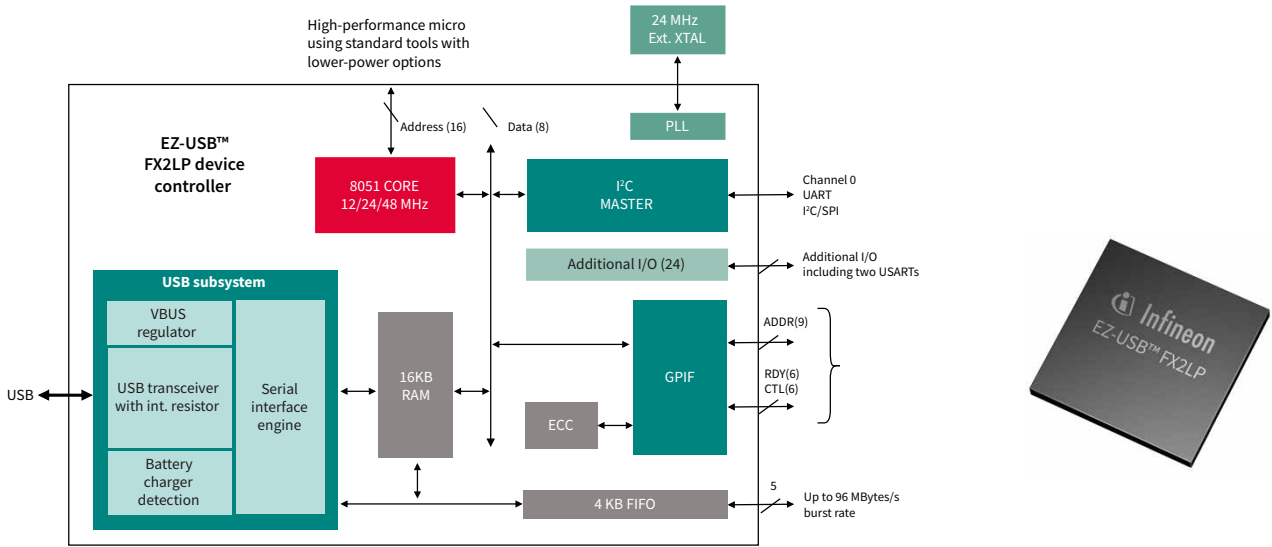
EZ-USB™ FX2LP/FX2G2 are highly integrated USB microcontrollers that serve as the basis for any USB high-speed peripheral device. To take full advantage of the USB 2.0 480-Mbps signaling rate, EZ-USB™ FX2LP and EZ-USB™ FX2G2 contain specialized hardware to buffer USB data and to connect seamlessly to a variety of high-bandwidth external devices such as MCUs, ASICs, and FPGAs.

EZ-USB™ encore is a family of full-speed USB controllers based on Infineon's flexible PSoC™ architecture. These USB controllers have configurable analog and digital blocks, allowing you to customize the part based on your target application. Moreover, EZ-USB™ encore also integrates components such as RAM, clock generator and USB termination resistors reducing the overall system cost and area.

|                         | EZ-USB™ encore                         | EZ-USB™ FX2LP   | EZ-USB™ FX2G2   |
|-------------------------|--|---|---|
| <b>Function</b>         | Device controller                      | Device controller   | Device controller   |
| <b>USB Spec (Speed)</b> | USB2.0 Full speed (12 Mbps)            | USB2.0 High speed (430 Mbps)                                | USB2.0 High speed (430 Mbps)                                      |
| <b>Interfaces</b>       | I <sup>2</sup> C, SPI, UART, PS/2, ADC | Parallel 8/16-bit GPIF* (48 MHz)<br>I <sup>2</sup> C, USART | Parallel 16/32-bit GPIF* (100 MHz)<br>I <sup>2</sup> C, UART, SIN |
| <b>MCU subsystem</b>    | M8C                                    | 8051  | ARM9  |
| <b>RAM</b>              | 1 kB                                   | 16 kB   | 512 kB  |
| <b>Hardware DVK</b>     | NA                                     | CY3539  | <a href="#">CYUSB3KIT-003</a>                                     |
| <b>Software SDK</b>     | SuiteUSB                               | SuiteUSB  | EZ-USB™ FX3 SDK   |
| <b>Package</b>          | 28-SOP/32-QFN/56-QFN/16-COLQFN         | 56-SSOP/VFBGA/QFN, 100-TQFP/128-TQFP                        | 121-BGA   |
| <b>Temperature</b>      | 0°C to 70°C -40°C to + 85°C            | 0°C to 70°C -40°C to + 105°C                                | 0°C to 70°C -40°C to + 85°C                                       |



Block diagram



Features and benefits

Key features

- USB 2.0 USB IF high speed certified (TID # 40460272)
- GPIF supports 8-bit/16-bit external data interface
- Ultra-low power: ICC no more than 85 mA in any mode
- Ideal for bus- and battery-powered applications
- Configurability for VID/PID using EPROM
- Single-chip integrated USB 2.0 transceiver, smart SIE, and enhanced 8051 microprocessor
- Integrated FIFOs, integrated I²C controller
- Commercial and industrial temperature grade

Key benefits

- Wide portfolio of peripheral controllers supporting low-speed, full-speed, and high-speed options
- Quick time-to-market with hardware and software development kit
- Market-proven solutions since 1996
- Premium customer support and long-term supply commitment



# EZ-USB™ serial bridge controller

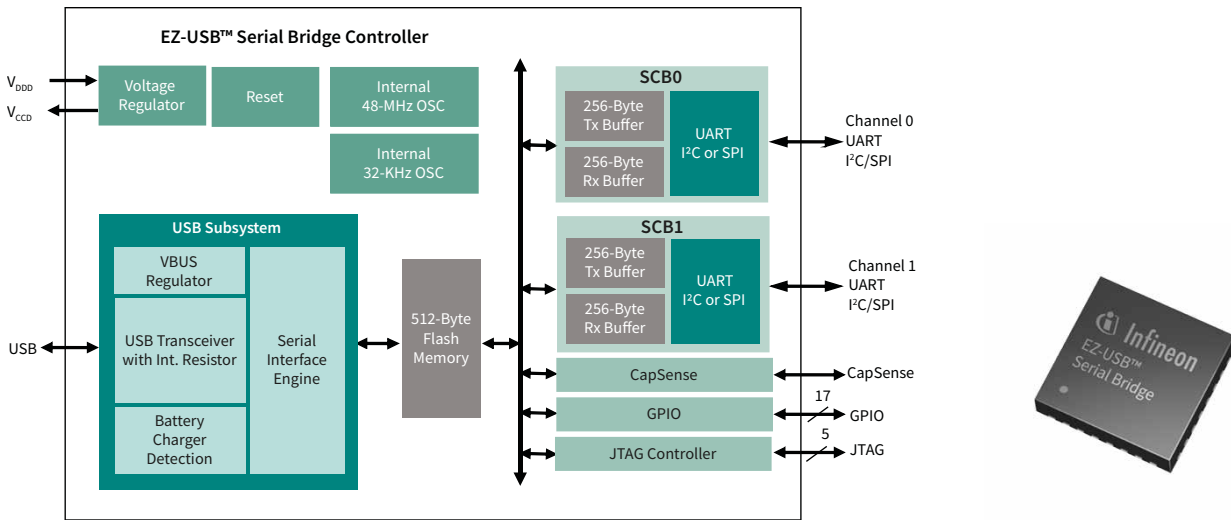
## Discover a wide portfolio of full-speed bridge controllers with configurable and fixed functions

EZ-USB™ serial bridge controller is a family of full-speed bridge controllers offering both configurable and fixed-function options that provides connectivity between USB and serial interfaces UART, SPI, I<sup>2</sup>C. With the lowest power consumption in standby mode (5 μA), these bridge controllers are the first in the market to offer programmable serial channels for UART/I<sup>2</sup>C/SPI interfaces. With the latest addition of fixed-function controllers, they can be easily configured to work as USB to UART, USB to I<sup>2</sup>C, or USB to SPI bridges without requiring any firmware development by the user. The EZ-USB™ Serial Bridge Controller family integrates the industry-leading CAPSENSE™ capacitive-touch sensing technology (for touch-sensitive key switches) and battery charger detection compliant with USB-IF battery charging specification ver. 1.2 to detect the source of power on the USB port.

| Features and part numbers            | USB-UART bridge controller  |                         | USB-I <sup>2</sup> C bridge controller | USB-SPI bridge controller | USB-Serial configurable bridge controller |   | USB-billboard controller |                        |
|--------------------------------------|---|-------------------------|--|---------------------------|---|---|--------------------------|------------------------|
|                                      | CY7C65213-28PVXI<br>CY7C652133-32LTXI<br>CY7C65213A-28PVXI<br>CY7C65213A-32LTXI | CY7C65223<br>CY7C65223D | CY7C65216<br>CY7C65216D                | CY7C652148<br>CY7C65214D  | CY7C65211<br>CY7C65211A                   | CY7C65215<br>CY7C6215A                  | CY7C65210<br>CY7C6210A   | CY7C65217<br>CY7C6217A |
| Function                             | USB UART  | USB UART                | USB I <sup>2</sup> C                   | USB SPI                   | USB UART, USB SPI, USB I <sup>2</sup> C   | USB UART, USB SPI, USB I <sup>2</sup> C | USB billboard            | USB billboard          |
| UART channels                        | 1   | 2                       |  |                           | 1   | 2                                       |                          | 2                      |
| UART protocols                       | RS232/RS422/<br>RS4852  | RS232/RS422/<br>RS485   |  |                           | RS232/RS422/<br>RS4852                    | RS232/RS422/<br>RS4852                  |                          | RS232/RS422            |
| UART pins                            | 8   | 4                       |  |                           | 2/4/2006                                  | 2/4/6/82                                |                          | 2                      |
| Speed/baud rate                      | 3 Mbps  | 3 Mbps                  |  |                           | 3 Mbps                                    | 3 Mbps                                  |                          | 3 Mbps                 |
| SPI channels                         | -   | -                       | -                                      | 1/1/2002                  | 1   | 2                                       | -                        | -                      |
| SPI width                            | -   | -                       | -                                      | 4Bit/8Bit/4Bit            | 4-16 bit                                  | 4-16 bit                                | -                        | -                      |
| SPI master/slave                     | -   | -                       | -                                      | Master                    | Master or slave                           | Master or slave                         | -                        | -                      |
| I <sup>2</sup> C master/slave        | -   | -                       | Slave/master                           | -                         | Master or slave                           | Master or slave                         | Master                   | Master                 |
| Battery charge detection (BCD)       | Yes   | Yes                     | Yes                                    | Yes                       | Yes                                       | Yes                                     | No                       | No                     |
| CAP SENSE buttons                    |   |                         |  |                           | 8   | 5                                       |                          |                        |
| GPIOs                                | 8   | 7                       | 6                                      | 8                         | 17  | 10                                      | 9/11                     | 7/9                    |
| JTAG                                 |   | No                      | No                                     | No                        | No  | Yes/No                                  |                          |                        |
| Software flow control                | No  | Yes                     |  |                           | No  | No                                      | No                       | No                     |
| USB suspend supply current (typical) | 5 μA  | 5 μA                    | 5 μA                                   | 5 μA                      | 5 μA                                      | 5 μA                                    | 5 μA                     | 5 μA                   |
| Packages                             | 32 QFN/28 SSOP  | 24 QFN/32 QFN           | 24 QFN/32 QFN                          | 24 QFN/24 QFN/<br>32 QFN  | 24 QFN/32 QFN                             | 24 QFN/32 QFN                           | 24 QFN                   | 24 QFN                 |
| Footprint                            | 5x5 mm/<br>10x7.5x1.65 mm   | 4x4 mm/5x5 mm           | 4x4 mm/5x5 mm                          | 4x4 mm/<br>4x4 mm/ 5x5 mm | 4x4 mm/5x5 mm                             | 4x4 mm/5x5 mm                           | 4x4 mm                   | 4x4 mm                 |



Block diagram



Features and benefits

| Key features   |
|--|
| - Dual-channel UART, I²C or SPI to USB bridge  |
| - Supports up to 8 CAPSENSE™ buttons   |
| - Configurable and fixed function options  |
| - BCD compliant to USB-IF battery charging revision 1.2                                  |
| - Integrated regulator, oscillator and termination resistors                             |
| - Driver support for major operating systems   |
| - Configuration utility for VID/PID and serial interfaces                                |
| - Support multiple USB device classes: CDC, PHDC, HID and vendor specific device classes |

| Key benefits  |
|---|
| - Easy to design, without firmware nor software development |
| - Industry's lowest power consumption in standby mode       |
| - Ideal for low-power devices                               |
| - Compatibility   |
| - Minimization of switching costs                           |

Boards

| EZ-USB™ serial bridge controller CYUSBS234  | EZ-USB™ serial bridge controller CYUSBS236  | EZ-USB™ serial bridge controller CYUSBS232  |
|---|---|---|
| <p>CYUSBS234 development kit (DVK) helps evaluate the features of the single-channel EZ-USB™ Serial Bridge Controller CY7C65211. The kit provides a copper pad on PCB to test CAPSENSE™ feature, a set of EEPROMs to test I²C and SPI interfaces, a RS232 line driver to test UART interfaces.</p> <p>Kit based on <a href="#">CY7C65211-24LTXI</a></p> | <p>CYUSBS236 development kit (DVK) helps evaluate the features of the dual-channel EZ-USB™ serial bridge controller CY7C65215. The kit provides two copper pads on the PCB to test CAPSENSE™ feature, two pairs of EEPROMs to test I²C and SPI interfaces, two RS232 line drivers to test UART interfaces.</p> <p>Kit based on <a href="#">CY7C65215-32LTXI</a></p> | <p>CYUSBS232 reference design kit (RDKit) is a low-cost kit to evaluate EZ-USB™ serial bridge controller CY7C65213. The kit, along with its hardware documentation, serves as a reference design for applications like USB-to-UART cables.</p> <p>Kit based on <a href="#">CY7C65213-32LTXI</a></p> |

# USB hubs and USB Type-C port controllers

## Robust interoperability, extensive charging support, and full configurability

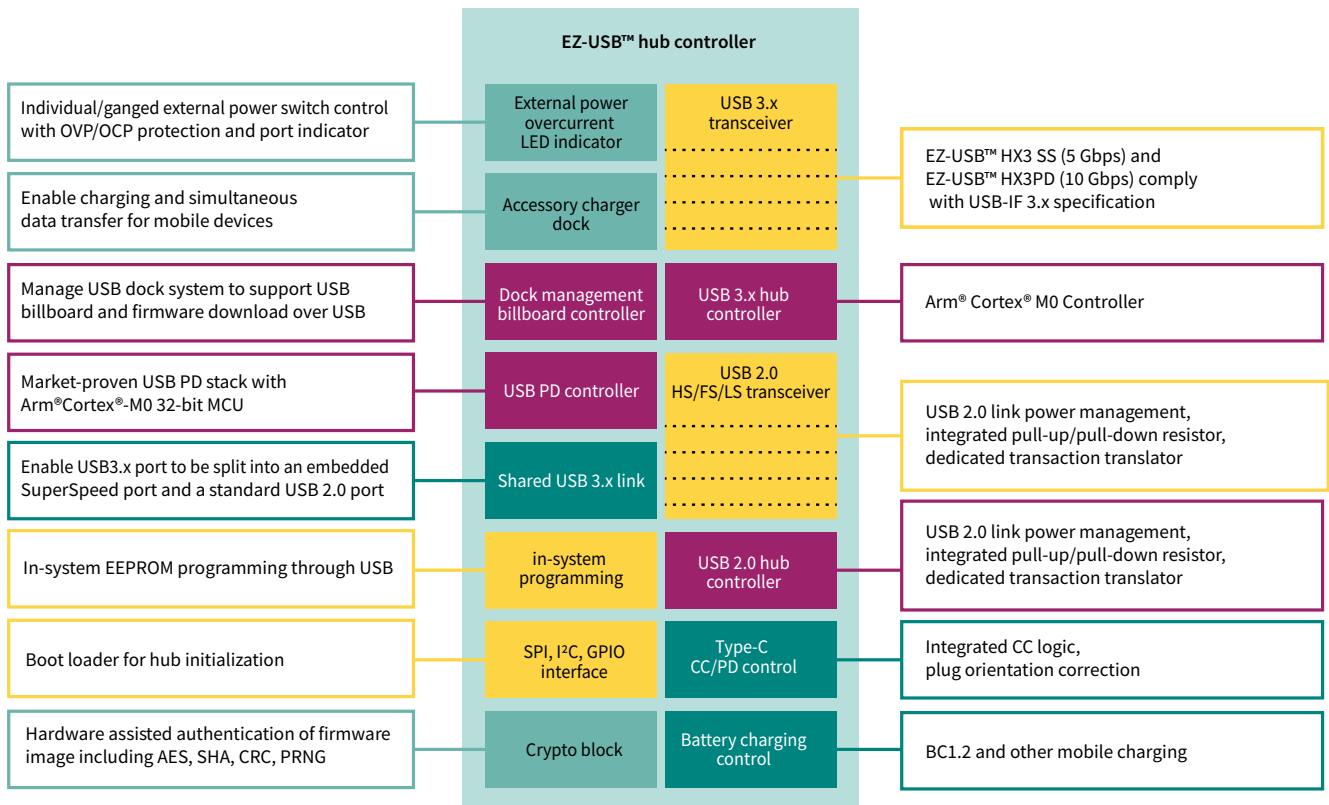
Infinion offers a wide portfolio of hub controllers supporting USB 2.0, USB 3.x 5 Gbps, 10 Gbps and USB Type-C ports with robust backwards interoperability with legacy USB speeds. The USB 3.x hub controllers provide advanced USB-PD and battery charging capabilities, featuring up to eight downstream ports for full configurability and flexible design.

The wide portfolio offers different combinations of features to address all possible needs for notebook PCs, docking stations, TV, STB, DVR, gaming, home gateways, Wi-Fi routers and automotive and industrial applications:

| USB hub family                   |            | EZ-USB™ HX2LP          | EZ-USB™ HX2VL          | EZ-USB™ HX3                                      | EZ-USB™ HX3 automotive* | EZ-USB™ HX3PD           |
|----------------------------------|------------|------------------------|------------------------|--|-------------------------|-------------------------|
| USB standard                     |            | USB 2.0 480 Mbps       | USB 2.0 480 Mbps       | USB 3.x 5 Gbps                                   | USB 3.x 5 Gbps          | USB 3.x 10 Gbps         |
| Part numbers                     |            | CY7C6562x<br>CY7C6563x | CY7C6563x<br>CY7C65642 | CYUSB330X<br>CYUSB331X<br>CYUSB332X<br>CYUSB230X | CYUSB332x<br>CYUSB330x  | CYUSB4347<br>CYUSB4357  |
| Nr. of downstream ports          |            | 2/4                    | 2/4                    | 2/4  | 2/4                     | 7 (5x SS, 2x USB 2.0)   |
| USB Type-C                       |            |                        |                        |  |                         | ✓                       |
| USB power delivery               |            |                        |                        |  |                         | 2 PD ports              |
| Battery charging v1.2            |            |                        |                        | ✓  | ✓                       | ✓                       |
| ACA-dock                         |            |                        |                        | ✓  | CYUSB3324               |                         |
| USB billboard                    |            |                        |                        |  |                         | ✓                       |
| Dock management controller (DMC) |            |                        |                        |  |                         | ✓                       |
| Multi-TT (one TT per port)       |            |                        | ✓                      | ✓  | ✓                       | ✓                       |
| Serial interface                 |            | SPI                    | SPI/I <sup>2</sup> C   | I <sup>2</sup> C                                 | I <sup>2</sup> C        | 2x I <sup>2</sup> C/SPI |
| MCU                              |            |                        |                        | Arm® Cortex®-M0                                  | Arm® Cortex®-M0         | Arm® Cortex®-M0         |
| Flash                            |            |                        |                        |  |                         | 2x 128KB                |
| Multi-TT (one TT per port)       |            |                        | ✓                      | ✓  | ✓                       | ✓                       |
| In system programming (ISP)      |            | ✓                      | ✓                      | ✓  | ✓                       | ✓                       |
| Configurable USB PHYs            |            |                        |                        | ✓  | ✓                       | ✓                       |
| Shared link                      |            |                        |                        | ✓  | ✓                       | ✓                       |
| Vendor command                   |            |                        |                        | ✓  | ✓                       |                         |
| External power switch control    | Individual |                        |                        | CYUSB3326  |                         | ✓                       |
|                                  | Ganged     |                        |                        | CYUSB330x  | CYUSB3304               |                         |
|                                  | Both       |                        |                        | CYUSB3324  | CYUSB3324               |                         |
| Pin-strap                        |            |                        |                        | CYUSB332x  | CYUSB3324               |                         |
| Port indicator                   |            |                        |                        | CYUSB3324  | CYUSB3324               |                         |
| Packages                         |            | 56QFN                  | 48TQFP, 28QFN          | 88QFN, 68QFN                                     | 100BGA                  | 192BGA                  |
| Temperature (-40°C - 85°C)       |            | ✓                      |                        | ✓  | Automotive              | ✓                       |



## Features





# EZ-USB™ HX3

## USB 3.x 5Gbps 4-port hub controller with SS/USB 2.0 PHY shared link, DS ports charging and automotive grade

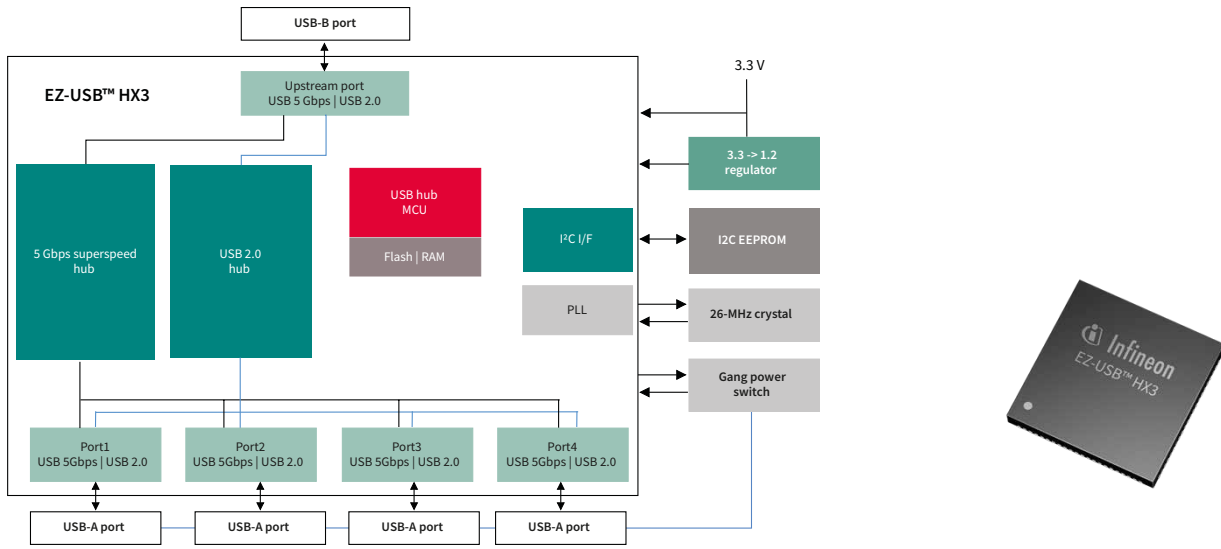
EZ-USB™ HX3 is Infineon's USB-IF-certified 4-port hub controller. It has been repeatedly tested at every USB plug-fest and in independent labs, demonstrating compatibility with all recognized host controllers, device classes, and operating systems. It supports most USB charging standards, including battery charging specification v1.2, Apple charging standard, YD/T 1591-2006 and ACA-dock. This last feature of the EZ-USB™ HX3 enables simultaneous use of USB devices connected to the downstream ports and charging of a smartphone or tablet that supports USB OTG. Without a host attached to the upstream port, it also supports battery charging on the downstream ports.

The configurable USB 5 Gbps and USB 2.0 PHY of the EZ-USB™ HX3 enhance signal quality, giving board designers more flexibility and simplifying USB-IF compliance. EZ-USB™ HX3 also supports shared USB link, a proprietary feature that doubles the number of USB ports, creating 8 ports from a 4-port hub controller.

| Features/Part                 | CYUSB3302                 | CYUSB3304                 | CYUSB3312                 | CYUSB3314                 | CYUSB3324                 | CYUSB3326                      | CYUSB3328                               | CYUSB2302                 | CYUSB2304                 |
|-------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|--------------------------------|---|---------------------------|---------------------------|
| Number of DS ports            | 2 (USB 3.0)               | 4 (USB 3.0)               | 2 (USB 3.0)               | 4 (USB 3.0)               | 4 (USB 3.0)               | 6 (2 USB 3.0, 2 SS, 2 USB 2.0) | 8 (4 SS, 4 USB 2.0)                     | 2 (USB 2.0)               | 4 (USB 2.0)               |
| Number of shared link ports   | 0                         | 0                         | 0                         | 0                         | 0                         | 2[1]                           | 4                                       | 0                         | 0                         |
| BC v1.2                       | Yes                       | Yes                       | Yes                       | Yes                       | Yes                       | Yes                            | Yes                                     | Yes                       | Yes                       |
| ACA-dock                      | No                        | No                        | No                        | No                        | Yes                       | No                             | Yes                                     | No                        | No                        |
| External power switch control | Ganged                    | Ganged                    | Individual and ganged     | Individual and ganged     | Individual and ganged     | Individual                     | Individual                              | Ganged                    | Ganged                    |
| Pin-strap support             | No                        | No                        | Yes                       | Yes                       | Yes                       | Yes                            | Yes                                     | No                        | No                        |
| I <sup>2</sup> C              | Yes                       | Yes                       | Yes                       | Yes                       | Yes                       | Yes                            | Yes                                     | Yes                       | Yes                       |
| Vendor command                | Yes                       | Yes                       | Yes                       | Yes                       | Yes                       | Yes                            | Yes                                     | Yes                       | Yes                       |
| Port indicators               | No                        | No                        | Yes                       | Yes                       | Yes                       | No                             | No                                      | No                        | No                        |
| Packages[2]                   | 68-QFN, 100-ball BGA      | 68-QFN, 100-ball BGA      | 88-QFN, 100-ball BGA      | 88-QFN, 100-ball BGA      | 88-QFN, 100-ball BGA      | 88-QFN, 100-ball BGA           | 88-QFN, 100-ball BGA                    | 68-QFN, 100-ball BGA      | 68-QFN, 100-ball BGA      |
| Temperature range             | Industrial and commercial | Industrial and commercial | Industrial and commercial | Industrial and commercial | Industrial and commercial | Industrial and commercial      | Industrial (88-QFN only) and commercial | Industrial and commercial | Industrial and commercial |



### Block diagram






### Features and benefits

- Key features**
- Compliance with USB 3.2 Gen 1 (USB-IF and WHQL certified)
  - Shared link feature (supports simultaneous USB 2.0 and SuperSpeed USB devices on the same port)
  - Enables USB charging while the hub is disconnected from a hub host
  - Supports BC v1.2 and Apple charging
  - Allows firmware upgrades using I<sup>2</sup>C EEPROM or an external I<sup>2</sup>C master
  - Integrated ARM® Cortex® M0 CPU
  - LED status indicators – suspend, SS, and USB 2.0 operation

- Key benefits**
- Supports up to 4 USB 3.0 compliant DS ports
  - Enables extra downstream (DS) ports for on-board connections in embedded applications
  - Enables charging of devices connected to the DS ports when no host is connected on the upstream (US) port
  - Easy-to-customize configuration parameters
  - High quality and reliability

### Boards

| EZ-USB™ HX3 CY4613  | EZ-USB™ HX3 CY4609   | EZ-USB™ CY4603   |
|---|--|--|
|    |                                 |               |
| <p>It's a development kit aimed to demonstrate EZ-USB™ HX3's shared link feature in a 6-port configuration supporting ACA-dock functionality.</p> | <p>It's a reference design kit that can be used as a reference design for standalone USB 3.0 hub applications.</p> | <p>It's a development kit that demonstrates EZ-USB™ HX3's application in a 4-port 3.0 USB hub.</p> |

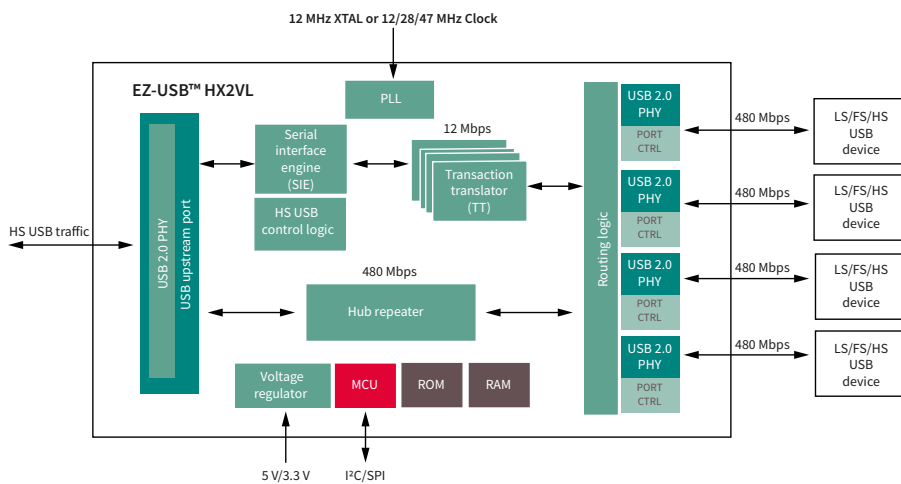


# EZ-USB™ HX2LP and HX2VL hub controllers

## 4-port single- and multi-TTs hub USB controllers

Infinion’s EZ-USB™ HX2LP and HX2VL are Infineon’s first-generation high-speed hub controllers available in 2-port and 4-port versions. These USB 2.0 hub controllers have integrated upstream and downstream transceivers, a USB serial interface engine (SIE), USB hub control and repeater logic, and TT logic. Many of its external passive components such as pull-ups and pull-down resistors are integrated into the chip, significantly reducing the overall bill of materials required to implement a hub design.

| Family        | Part number | Number of ports | Number of TTs | I/O options                 | Temperature grade      |
|---------------|-------------|-----------------|---------------|-----------------------------|------------------------|
| EZ-USB™ HX2VL | CY7C65634   | 2               | Single        | SPI, I <sup>2</sup> C, GPIO | Commercial             |
|               | CY7C65632   | 4               | Single        |                             |                        |
|               | CY7C65642   | 4               | Multi         |                             |                        |
| EZ-USB™ HX2LP | CY7C65620/1 | 2               | Single        | SPI                         | Commercial, industrial |
|               | CY7C65630/1 | 4               | Single        |                             |                        |



### Features and benefits

- Key features**
- Up to 4 downstream ports
  - Very low power consumption (82 mA)
  - Integrated internal regulator, pull-up and pull-down resistors for all downstream ports
  - Selectable XTAL/CLK inputs, power switch polarity, EEPROM interface
  - VID, PID configurable through external EEPROM
  - Integrated ARM® Cortex® M0 CPU
  - LED status indicators – suspend, SS, and USB 2.0 operation

- Key benefits**
- Reduced area
  - Reduced BOM

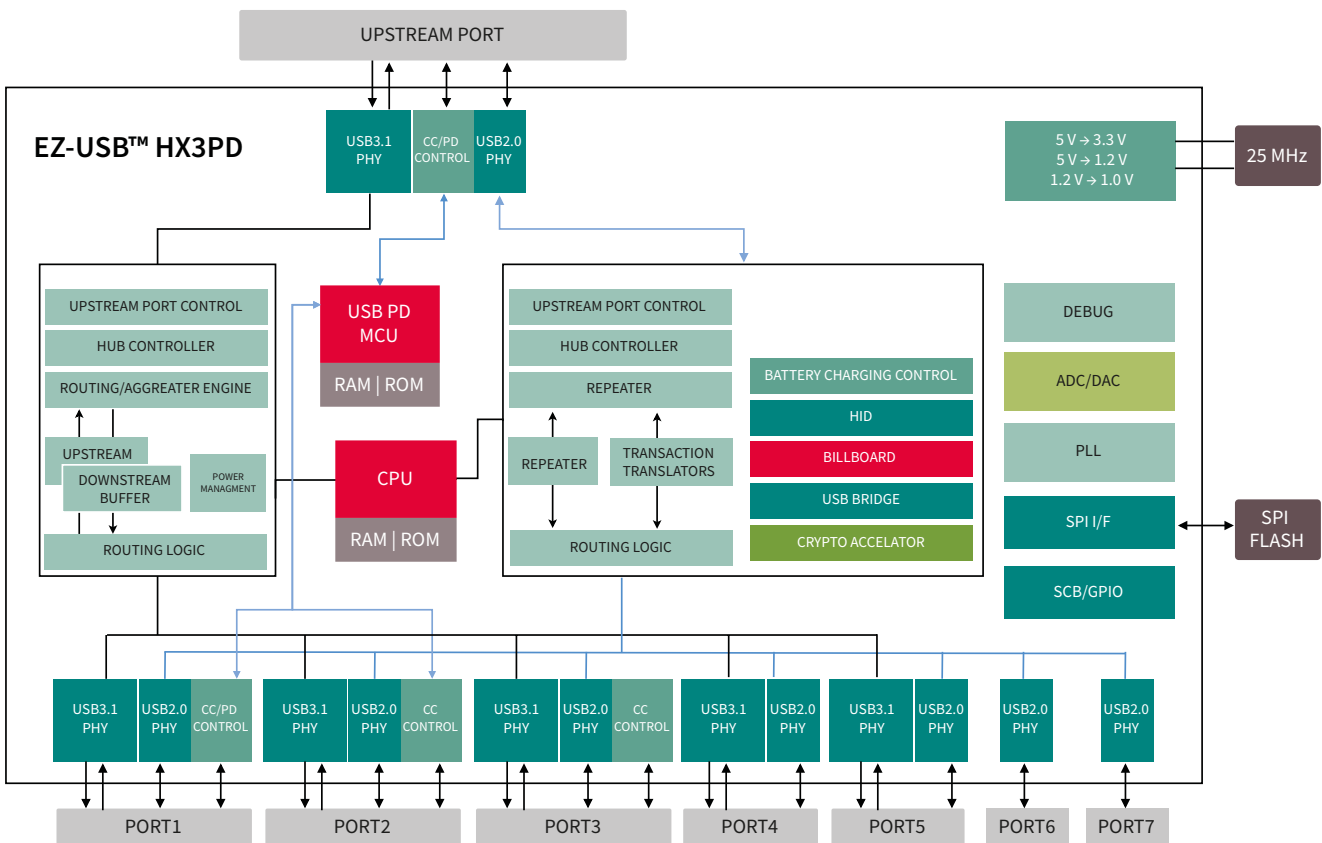
# EZ-USB™ HX3PD

## Industry's first 7-port USB 10Gbps hub controller with power delivery

EZ-USB™ HX3PD is the industry's first 7-port USB 10Gbps Type-C hub controller with power delivery, supporting two USB-C + PD ports (one upstream and one downstream), and five downstream USB 10Gbps ports.

With five chips (two 4-port USB hub controllers, two USB PD controllers, and a dock management controller) integrated into one, EZ-USB™ HX3PD is the most integrated USB 10Gbps hub in the market. This leads to a significant reduction of BOM component cost and PCB footprint, which makes EZ-USB™ HX3PD a perfect fit for USB-C dongles, docks, and monitors. Configurable shared USB 10 Gbps and USB 2.0 PHY functionality can improve USB 10Gbps signal transmission quality, allowing board designers more freedom and simplifying USB-IF compliance.

### Block diagram



## Features and benefits

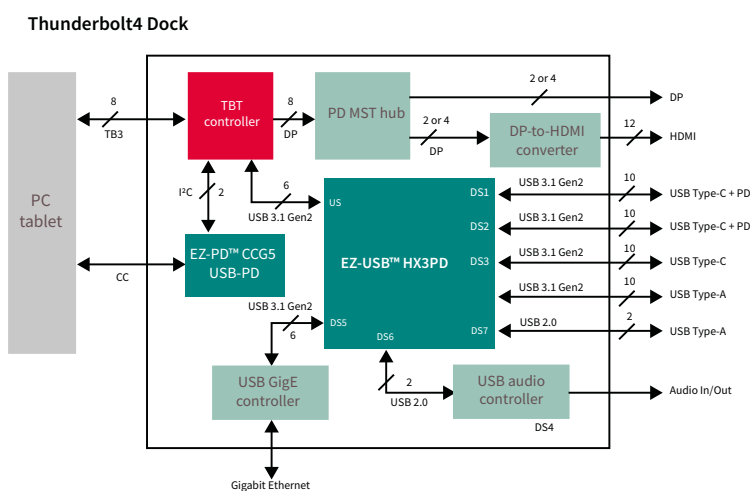
### Key features

- Compliant with USB 3.1 gen 2
  - Upstream (US): 10 Gbps; Type-A or Type-C plus PD
  - Downstream (DS): 7 ports; 5x 10 Gbps, 2x 480 Mbps; 1 Type-C Plus PD, 2 Type-C only and 4 Type-A ports
- Integrated DFP (RP) and UFP (RD) termination resistors
- Integrated billboard controller
- Charging support: BC v1.24, Apple Charging standard
- PD policy engine configures power profiles dynamically
- Charging DS without US connection
- Optional signed firmware upgradable via dock management controller (DMC)

### Key benefits

- USB-IF compliant 2x4-port USB hubs with 2x USB-PD 3.0
- Integrated total five chips into a single chip for BOM components and PCB board size reduction
- Integrated Crypto AES/SHA/CRC blocks for secured firmware upgrades via dock management controller
- Intel USB4 / Thunderbolt 4 Dock reference design available
- Support USB PD 3.0, BC1.2, Apple, Samsung, and QC 4.0 charging standards
- Provides USB PHY configurability to compensate signal loss over PCB traces

## Application diagram



EZ-USB™ HX3PD allows to solve several challenges in the development of Thunderbolt docs designs such as:

- Thunderbolt dock design is complex, requiring many discrete components
- Thunderbolt dock requires pre-approved USB-PD controller and a large BOM
- USB-C dock must support USB PD and all legacy charging standards
- USB 3.1 Gen2 signal integrity is difficult to handle at 10 Gbps
- USB 3.1 Gen2 and PD need FW upgrade to keep pace with USB spec changes

## Boards

### EZ-USB™ HX3PD CY6611

This evaluation kit is based on the **CYUSB4347-BZXC**, a 7-port evaluation kit designed to demonstrate the USB 3.1 Gen 2 hub, USB PD 3.0 and USB battery charging (BC 1.2) functionalities.



[www.infineon.com/ez-usb-hx3pd](http://www.infineon.com/ez-usb-hx3pd)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





# Infineon support for USB-C controllers and peripherals

Useful links and helpful information

Further information, datasheets and documents

[www.infineon.com/universal-serial-bus](http://www.infineon.com/universal-serial-bus)  
[community.infineon.com](http://community.infineon.com)  
[mycases.infineon.com](http://mycases.infineon.com)



Support



Evaluation board



Tools



## Power management ICs

- XDP™ SMPS controllers
- DC-DC digital multiphase controllers
- AC-DC power management ICs
- PFC controllers
- PWM controllers and climate saver systems
- Resonant LLC half-bridge controller ICs
- NFC tag-side controllers
- OptiMOS™ integrated power stages
- Switching regulators
- Voltage regulators
- Digital power controller
- Audio amplifier ICs
- AC-DC LED driver ICs
- DC-DC LED driver ICs
- iMOTION™ integrated motor control solutions
- MOTIX™ controllers and control ICs

# XDP™ SMPS

## IDP2308 and IDP2303A – digital multimode PFC+LLC combo controller

The IDP2308 and IDP2303A are high-performance digital combo controllers with integrated drivers and a 600 V depletion cell designed for boost PFC and half-bridge LLC targeting switched mode power supplies (SMPS) from 75 to 300 W.

- Support non-AUX operation with the lowest standby performance and start-up cell
- Support multimode PFC operation for optimized efficiency curve
- Configurable frequency setting for LLC soft-start and normal operation
- Synchronous PFC and LLC burst mode control with soft-start to prevent acoustic noise
- Excellent dynamic response by adaptive LLC burst mode
- Configurable and comprehensive protections for PFC/LLC/IC temperature
- IEC62368-1 certified active X-cap discharge function
- Flexible IC parameter setting with digital UART interface supports PSU platform approach

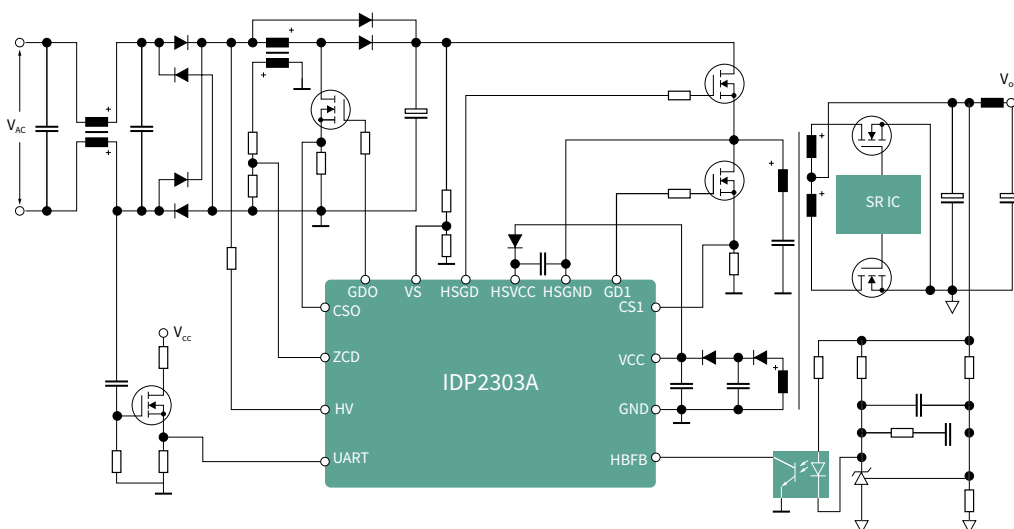
### Key benefits

- Low BOM count due to high integration of digital control
- No auxiliary power supply needed
- Easy design of system schematic and PCB layout
- Small form factor design
- Higher system reliability
- Shorter development cycles and higher design and production flexibility



| Product  | Target application    | Major difference  | Package                                     |
|----------|-----------------------|---|---|
| IDP2308  | TV embedded PSU       | 2 <sup>nd</sup> redundant PFC output overvoltage protection | DSO-14 (with enhanced HV creepage distance) |
| IDP2303A | Adapter, general SMPS | Constant output voltage                                     | DSO-16                                      |

### IDP2303A – power adapter



[www.infineon.com/xdp-smps](http://www.infineon.com/xdp-smps)

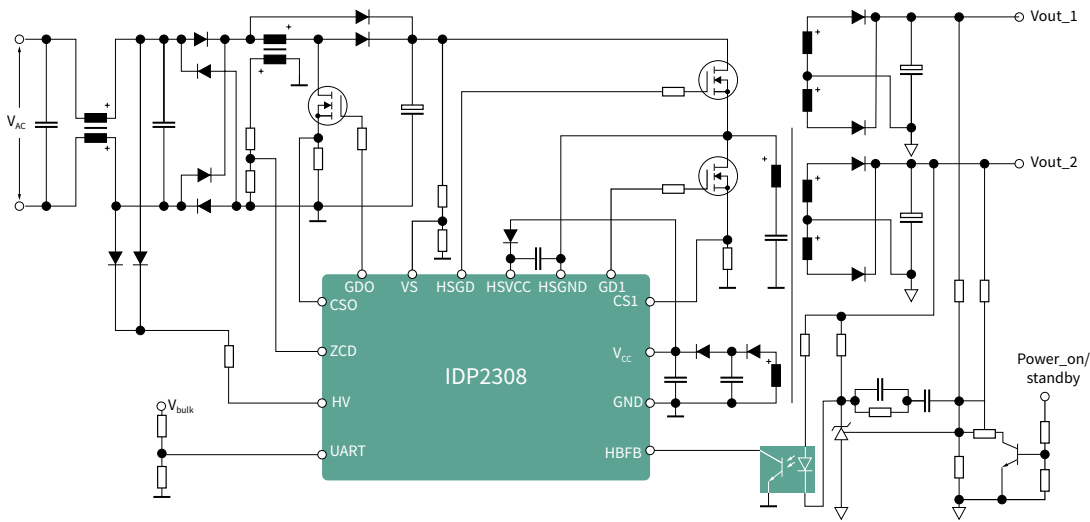
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).







### IDP2308 – embedded PSU



#### Target applications

- › LCD TV power supply
- › General SMPS
- › Power adapter

[www.infineon.com/xdp-smps](http://www.infineon.com/xdp-smps)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

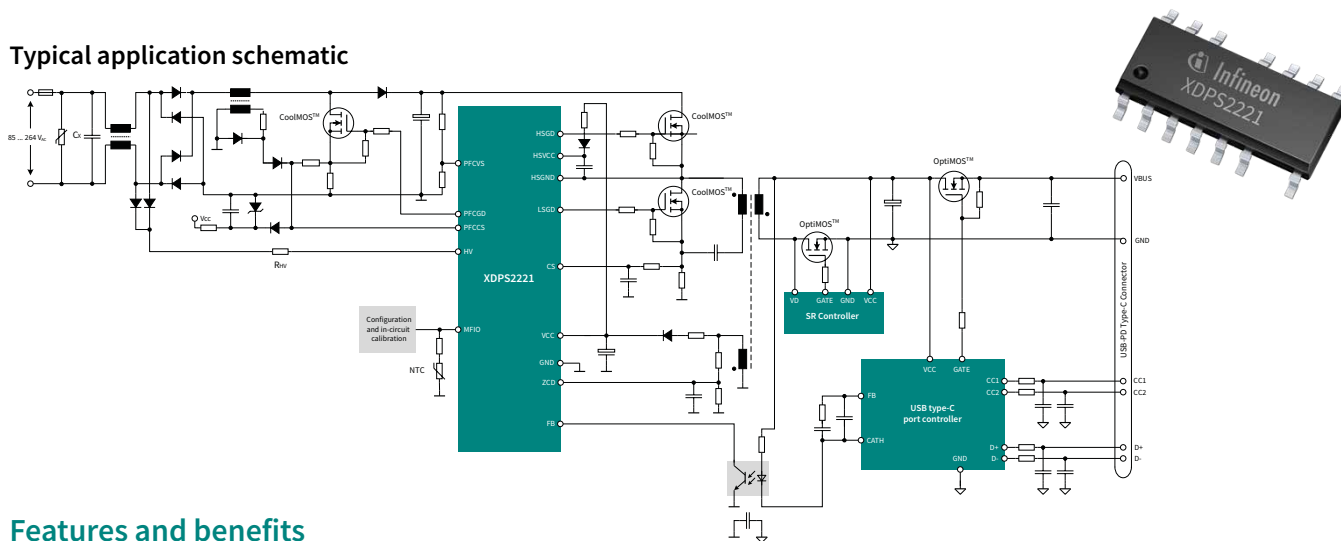


# XDP™ SMPS

## XDPS21081 – digital FQR flyback controller

The XDP™ digital power XDPS2221 is a highly integrated device combining both PFC boost and hybrid flyback (HFB) (asymmetrical half-bridge as from literature) conversion features. The high level of integration allows for seamless operation as well as optimal control of the two conversion stages, delivering class-leading performance. This innovative controller enables high power density designs and high system efficiency meeting international regulatory standards on power efficiency (such as EU CoC Version 5 Tier 2 and DoE Level VI) as well as an effective control of the wide output voltage for the latest USB-PD extended power range (EPR) standard V3.1. It is very well suited to drive GaN-based devices, such as Infineon's CoolGaN™ switches.

### Typical application schematic

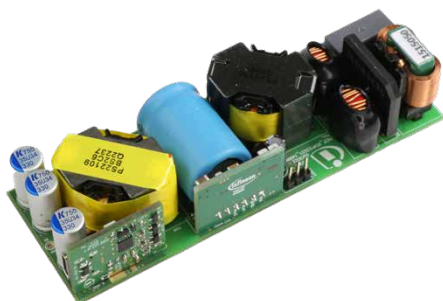


### Features and benefits

| Key features  |
|---|
| – IEC62368-1 certified active X-cap discharge function  |
| – High-performance multi-mode PFC with critical conduction mode operation   |
| – High efficiency multi-mode hybrid-flyback topology with adaptive resonant period  |
| – Supports USB-PD standard V3.1 extended power range (EPR) with wide output voltage up to 28 V (36 V/48 V to be covered by XDPS2222 available in Q2/2023) |
| – Highly integrated combo controller for the PFC and hybrid flyback topology, including a 600 V start-up cell with X-cap discharge functionality          |
| – DSO-14 (150-mil) package  |

| Key benefits  |
|---|
| – Low no-load input standby power performance                         |
| – Low BOM cost and count  |
| – Low standby and high efficiency across various line/load conditions |
| – High power density and high switching frequency                     |
| – Easily configurable   |
| – Optimization via GUI tools  |

### REF\_XDPS2221\_140W1



### 140 W reference design with PFC + hybrid flyback combo IC XDP™ XDPS2221 and CoolGaN™ GIT HEMTs:

This is a 140 W USB-PD type-C charger reference design. It demonstrates the high performance of the PFC + hybrid flyback combo controller XDP™ digital power XDPS2221 together with CoolGaN™ switches for wide input AC and wide output voltage applications. Besides the combo IC XDPS2221, it features three CoolGaN™ 600 V e-mode GIT HEMTs (IGLD60R190D1) as PFC and HFB main switches, OptiMOS™ BSC040N10NS5 as SR switch, the EZ-PD™ CCG3PA controller CYPD3175 serves as the USB-PD controller, and the HEXFET™ IRF7240 as load switch.

**Ordering code: REF XDPS2221140W1TOB01**

For design support material, please click here.

### Target applications:

- Adapters and chargers
  - with ultra-high power density
  - with extended power range (EPR)



[www.infineon.com/XDP](http://www.infineon.com/XDP)

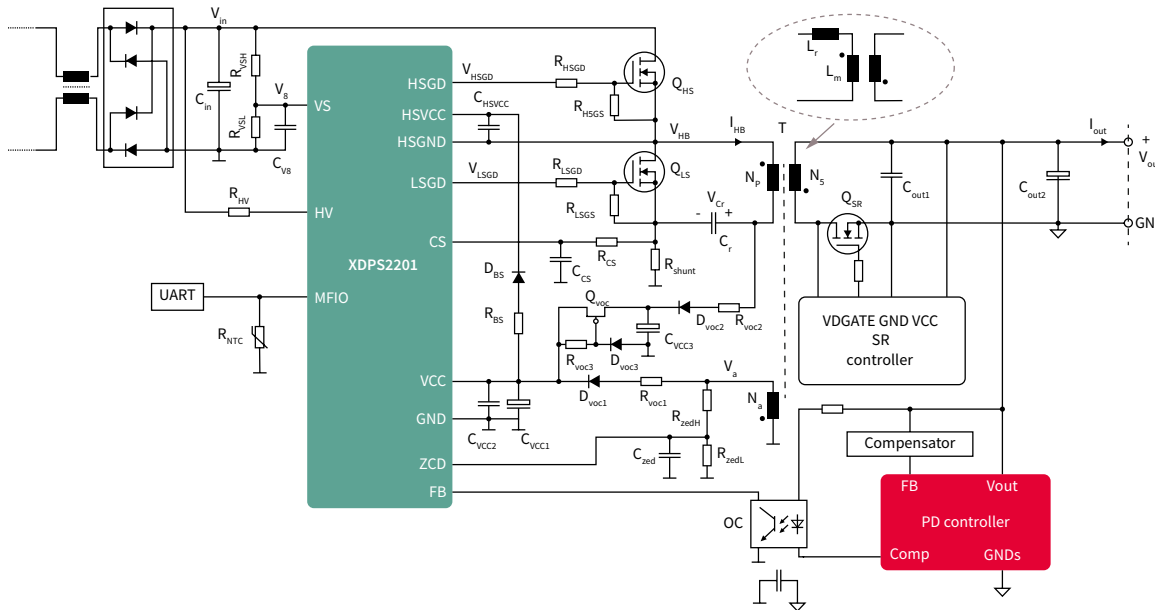
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# XDP™ SMPS

## XDPS2201 – digital hybrid flyback controller

XDPS2201 is a multimode, digital configurable hybrid flyback controller that combines the simplicity of a traditional flyback topology with the performance of a resonant converter. By utilizing two high-voltage MOSFETs, such as CoolMOS™, the controller can drive both high- and low-side MOSFETs in an asymmetric half-bridge flyback topology. Both zero voltage and current switching are achieved through means of regulating the polarity of the magnetizing current to increase efficiency. Also, transformer leakage energy is recycled, thereby further increasing efficiency.



### Features and benefits

| Key features  | Key benefits  |
|---|---|
| - Zero voltage and current switching across all line and load conditions      | - Reduce switching loss and achieve high efficiency                               |
| - Multimode operation (active burst mode, DCM, ZV-RCS, and CRM)               | - Optimize efficiency across various line/load conditions                         |
| - Integrated high-side driver and 600 V start-up cell                         | - Optimize light and no-load efficiency   |
| - Single auxiliary transformer winding and resonant cap to supply power to IC | - Save BOM count and cost with no messy external driver                           |
| - Comprehensive suite of protection feature sets                              | - Easy to drive, low cost, and widely available off the shelf 60 V MOSFET         |
| - Digital platform with configurable parameters                               | - Fail-safe mechanism to limit output power in the event of PD controller failure |
|   | - Avoid CCM operation and no potential of shoot-through with SR MOSFET            |

### DEMO\_XDPS2201\_65W1



65 W USB-PD PPS Type-C demo board in a miniature form factor based on XDPS2201.

- > Up to 65 W output power with 31 W/in<sup>3</sup> power density
- > Universal input range 90~264 V<sub>AC</sub>
- > Supported output: 5 V/3 A, 9 V/3 A, 12 V/3 A, 15 V/3 A and 20 V/3.25 A, 5~20 V/3 A
- > Peak efficiency of more than 93.8 percent
- > Low no-load standby input power of less than 75 mW OR Low no-load standby input power (less than 75 mW)

Ordering code: DEMOXDPS220165W1TOB01



# DC-DC digital multiphase controllers

## Point-of-load power management

Infiniteon's digital multiphase and multi-rail controllers provide power for today's medium- and high-current POL applications used in telecom/datacom, server, and storage environments. Infineon's digital controller family enables OEMs and ODMs to improve efficiency and total cost of ownership while increasing power density and optimizing the total system footprint of the voltage regulator. The products highlighted in the table below represent our fifth-generation digital controller family and support up to two rails with 1-6 phases on individual rails. The I<sup>2</sup>C/PMBus interface connects the digital controllers to the application system and provides real-time telemetry information, monitoring, and control capabilities. The digital controllers are fully configurable through our PowerCode and PowerClient graphical user interfaces that allow for easy-to-use and simplified design optimization.

### Multiphase configurations are supported for best power optimization

| Feature                     |                   | Controller family              |   |   |   |                               |                               |                                      |  |
|-----------------------------|-------------------|--------------------------------|---|---|---|-------------------------------|-------------------------------|--------------------------------------|--|
| Configurable output rails   |                   | Dual rail                      | Dual rail                                   | Dual/single rail                            | Dual/single rail                          | Dual rail                     | Dual/single rail              | Dual/single rail                     | Dual rail                              |
| Part number                 | PMBus             | PXE1610C*                      | IR35212                                     | XDPE10280B*                                 | XDPE10281B*                               | IR35204MTRPBF                 | IR35201MTRPBF                 | IR35223*                             | XDPE132G5C*                            |
| Phase configuration         | Main              | 7 ph                           | 7 ph  | 8 ph  | 8 ph                                      | 4 ph                          | 8 ph                          | 10 ph                                | 16 ph                                  |
|                             | Subconfigurations | 6+1                            | 6+1   | 8+0, 6+2, 4+4                               | 8+0, 6+2, 4+4                             | 3+1                           | 8+0, 7+1, 6+2                 | 10+0, 5+5                            | 8+8                                    |
| V <sub>out,max</sub>        |                   | 2.5 V                          | 3.3 V                                       | 3.04 V                                      | 3.04 V                                    | 3.3 V                         | 3.3 V                         | 3.3 V                                | 3.3 V                                  |
| Switching frequency         |                   | Up to 2 MHz                    | Up to 2 MHz                                 | Up to 2 MHz                                 | Up to 2 MHz                               | Up to 2 MHz                   | Up to 2 MHz                   | Up to 2 MHz                          | Up to 2 MHz                            |
| Operating temperature range |                   | -5°C to 85°C                   | -40°C to 85°C                               | -40°C to 85°C                               | -40°C to 85°C                             | -40°C to 85°C                 | -40°C to 85°C                 | -40°C to 85°C                        | -40°C to 120°C                         |
| VQFN package                |                   | 48-lead (6x6)<br>0.4 mm pitch  | 48-lead (6x6)<br>0.4 mm pitch               | 56-lead (7x7)<br>0.4 mm pitch               | 56-lead (7x7)<br>0.4 mm pitch             | 40-lead (5x5)<br>0.4 mm pitch | 56-lead (7x7)<br>0.4 mm pitch | 48-lead (6x6)<br>0.4 mm pitch        | 56-lead (7x7)<br>0.4 mm pitch          |
| Typical application         |                   | Intel server, high-end desktop | Intel server, workstation, high-end desktop | Intel server, workstation, high-end desktop | AMD server, workstation, high-end desktop | AMD server, memory and SOC    | AMD server, CPU               | Phase redundant based server systems | AMD server, GPU, ASIC, networking ASSP |

### Advantages of a digital controller

The protection features include a set of sophisticated overvoltage, undervoltage, overtemperature, and overcurrent protection. Each of the controllers in the table above also detects and protects against an open circuit on the remote sensing inputs. These attributes provide a complete and advanced protection feature set for microprocessor, DSP, FPGA, or ASIC power systems. Accurate current sense telemetry achieved through internal calibration that measures and corrects current sense offset error sources upon start-up. Programmable temperature compensation provides accurate current sense information even when using DCR current sense.

[www.infineon.com/digital-controller](http://www.infineon.com/digital-controller)

\*For more information on the product, contact our product support



Telecom

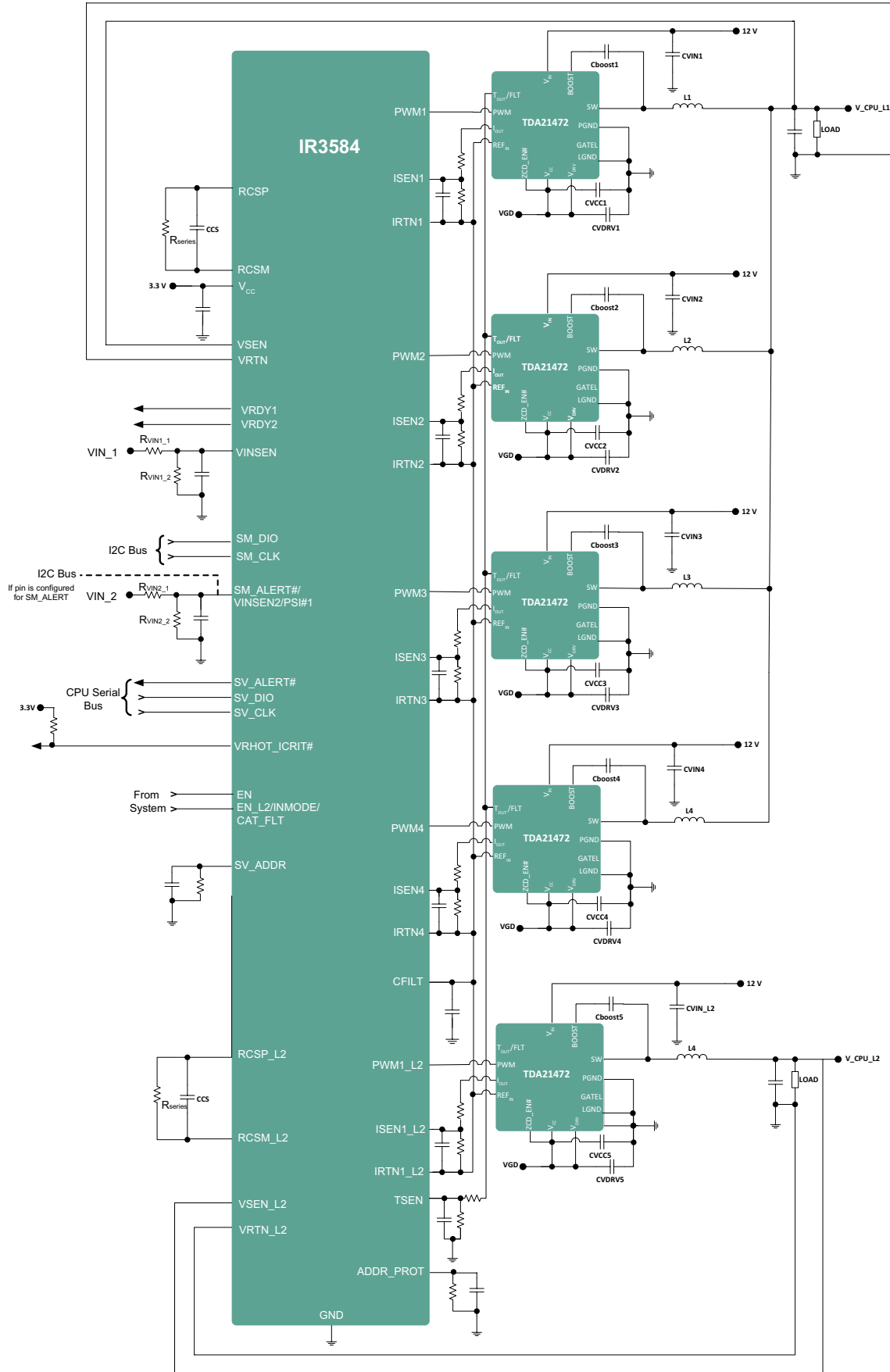


Server

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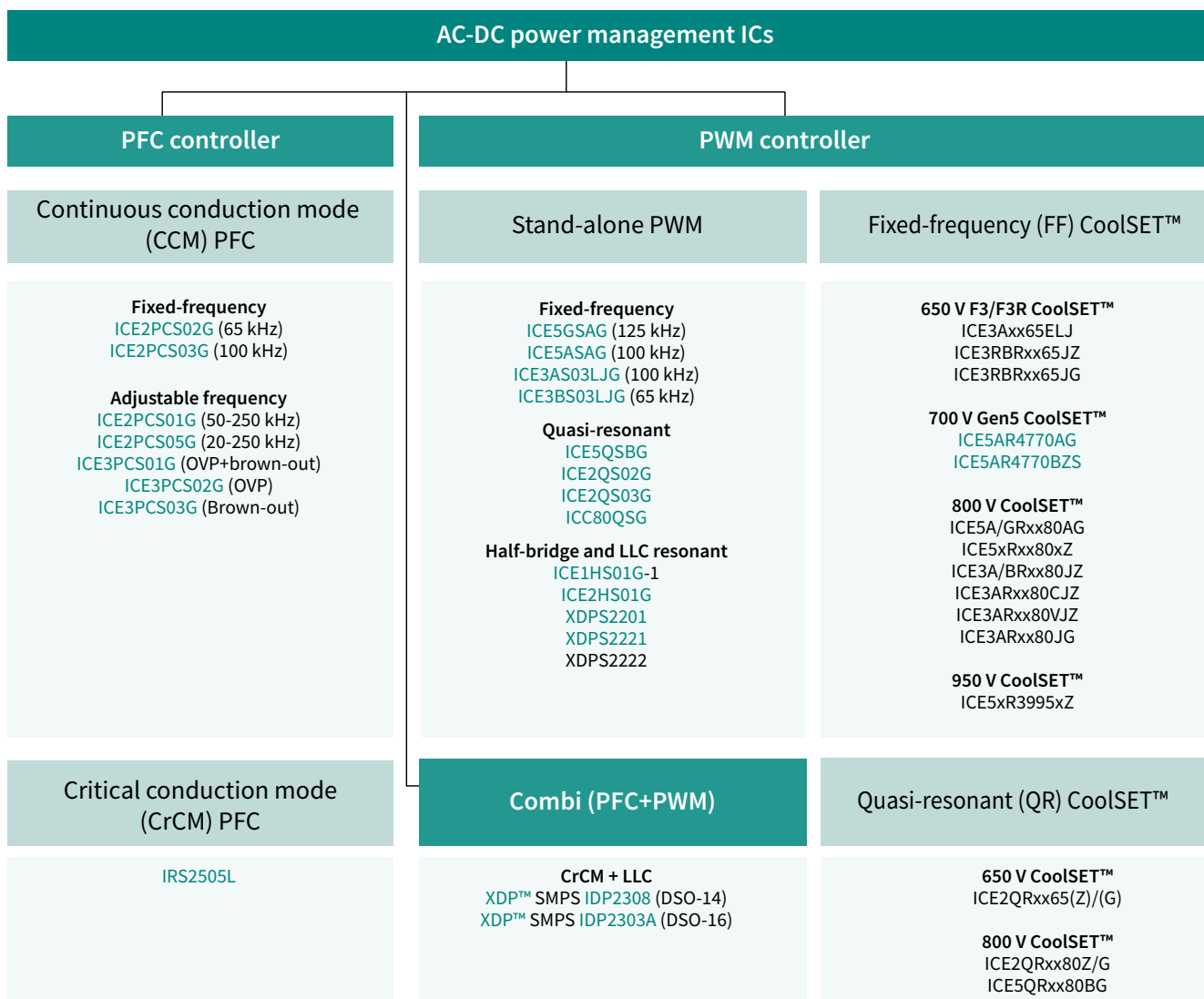
# Typical multiphase application circuit



# AC-DC power management ICs

## Technology leadership in power supply

By offering a wide variety of highly efficient control ICs, we enable our customers to meet new demands like PFC regulations and ultralow standby power requirements in a very cost-effective way. A comprehensive array of safety features helps to minimize the number of external components, reduces design in time, and improves the reliability of the SMPS.

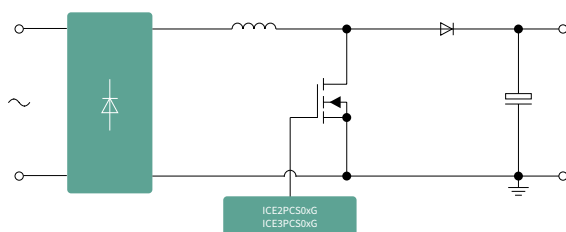


# Continuous conduction mode (CCM) PFC ICs

## High efficiency and very low system cost

Compared to the first generation of ICE1PCS01/02, the second generation of CCM PFC controller ICs, ICE2PCS01/02, have lower internal reference trimmed at 3 V. They also have other advantages such as wider  $V_{CC}$  operating range, an improved internal oscillator, and additional direct bulk capacitor overvoltage protection. Compared to the first and second generation of ICE1PCS0x and ICE2PCS0x, the third generation of CCM PFC has the lowest internal reference trimmed at 2.5 V and integrated digital control voltage loop. The third generation also features low peak current limit at 0.2 V, an adjustable gate switching frequency range from 21 kHz to 100 kHz, and is able to synchronize with an external frequency range from 50 kHz to 100 kHz. The third generation is now able to achieve 95 percent efficiency at full load for the entire input voltage range.

### Application diagram



### 2<sup>nd</sup> generation continuous conduction mode PFC IC features

- Fulfills class D requirements of IEC 61000-3-2
- Lowest count of external components
- Adjustable and fixed switching frequencies
- Frequency range from 20 to 250 kHz
- Versions with brown-out protection available
- Wide input range supported
- Enhanced dynamic response during load jumps
- Cycle-by-cycle peak current limiting
- Integrated protections OVP, OCP
- DIP-8 and DSO-8
- Lead-free, RoHS compliant

### 3<sup>rd</sup> generation continuous conduction mode PFC IC features

- Fulfills class D requirements of IEC 61000-3-2
- Integrated digital voltage loop compensation
- Boost follower function
- Bulk voltage monitoring signals, brown-out
- Multi protections such as double OVP
- Fast output dynamic response during load jump
- External synchronization
- Extra-low peak current limitation threshold
- SO8 and SO-14
- Lead-free, RoHS compliant

|                               | ICE2PCS01G<br>ICE2PCS05G | ICE2PCS02G<br>ICE2PCS03G | ICE3PCS03G | ICE3PCS02G | ICE3PCS01G |
|-------------------------------|--------------------------|--------------------------|------------|------------|------------|
| Digital control voltage loop  |                          | –                        | ✓          | ✓          | ✓          |
| Variable frequency            | ✓                        | –                        | ✓          | ✓          | ✓          |
| Synchronous frequency         |                          | –                        | ✓          | ✓          | ✓          |
| Open loop protection          | ✓                        | ✓                        | ✓          | ✓          | ✓          |
| Low peak current limit        | -1 V                     | -1 V                     | -0.4 V     | -0.4 V     | -0.2 V     |
| Brown-out protection          | –                        | ✓                        | ✓          | –          | ✓          |
| Overvoltage protection        | ✓                        | ✓                        | ✓          | ✓          | ✓          |
| Second overvoltage protection |                          | –                        |            | ✓          | ✓          |
| PFC enable function           |                          |                          | –          |            | ✓          |
| Boost follower mode           |                          |                          | –          |            | ✓          |
| 5 V regulator                 |                          |                          | –          |            | ✓          |

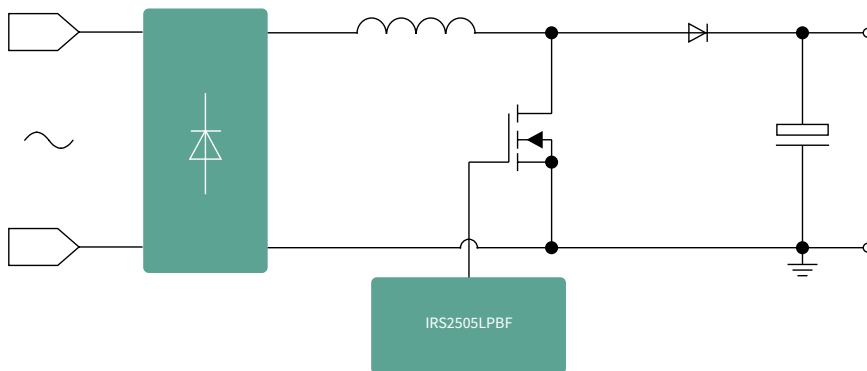


# Critical conduction mode (CrCM) PFC

## Easy design and lowest system cost

Fully compatible with the world standard, these devices are optimized to offer extremely compact and cost-effective PFC solutions for electronic ballast and offline SMPS.

### Application diagram



## IRS2505LPBF

- Critical conduction mode PFC control
- High power factor and ultralow THD
- Wide load and line range
- Regulated and programmable DC bus voltage
- No secondary winding required
- MOSFET cycle-by-cycle overcurrent protection
- DC bus overvoltage protection
- Low EMI gate drive
- Ultralow start-up current
- 20.8 V internal Zener clamp on  $V_{CC}$
- Excellent ESD and latch immunity
- RoHS compliant
- 5-pin SOT-23 package



SMPS



PC power



Desktop



Server



Adapter



Lighting



TV





# PFC controller portfolio

## Critical conduction mode (CrCM) PFC IC portfolio

| Product  | $V_{cc}$ min. | $V_{cc}$ max. | Package |
|----------|---------------|---------------|---------|
| IRS2505L | 9 V           | 20.8 V        | SOT-23  |

## Continuous conduction mode PFC ICs

### 2<sup>nd</sup> generation continuous conduction mode PFC IC product portfolio

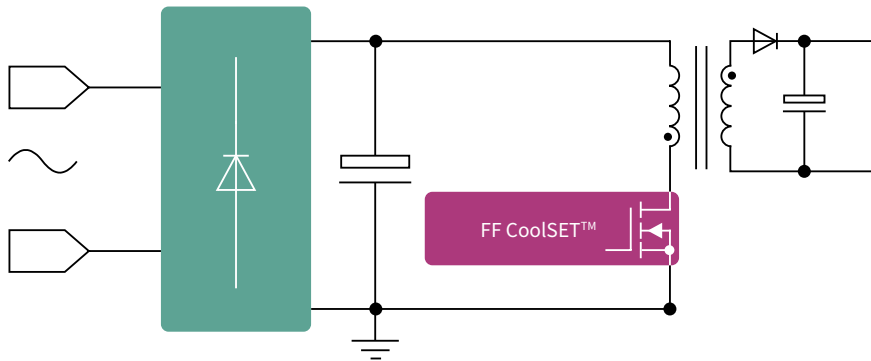
| Product    | Frequency – $f_{sw}$ | Current drives | Package |
|------------|----------------------|----------------|---------|
| ICE2PCS01G | 50-250 kHz           | 2.0 A          | DSO-8   |
| ICE2PCS02G | 65 kHz               | 2.0 A          |         |
| ICE2PCS03G | 100 kHz              | 2.0 A          |         |
| ICE2PCS05G | 20-250 kHz           | 2.0 A          |         |

### 3<sup>rd</sup> generation continuous conduction mode PFC IC product portfolio

| Product    | Frequency – $f_{sw}$ | Current drives | Features      | Package |
|------------|----------------------|----------------|---------------|---------|
| ICE3PCS01G | Adjustable           | 0.75 A         | OVP+brown-out | SO-14   |
| ICE3PCS02G |                      | 0.75 A         | OVP           | SO-8    |
| ICE3PCS03G |                      | 0.75 A         | Brown-out     | SO-8    |



# 5<sup>th</sup> generation fixed-frequency PWM IC and CoolSET™



- Integrated CoolMOS™ in 700 V, 800 V, and 950 V MOSFETs
- Cascode configuration for brown-in protection, fast and robust start-up
- Available in 65 kHz, 100 kHz, and 125 kHz fixed switching frequency
- Frequency reduction in tandem with load reduction to increase efficiency
- Selectable active burst mode entry/exit profile to optimize standby power and ability to disable
- Supports CCM flyback operation with built-in slope compensation
- Integrated error amplifier for direct feedback non-isolated flyback and buck
- Adjustable line input overvoltage protection (only ICE5xRxxxxAG and ICE5xRxxxxCZ)
- $V_{CC}$  pin short-to-ground protection
- Auto restart protection mode to minimize interruption of operation
- DSO-8 package (stand-alone controller), DIP-7 and DSO-12 package for CoolSET™



## 5<sup>th</sup> generation fixed-frequency CoolSET™

| Output power <sup>1)</sup><br>85 V <sub>AC</sub> ~ 300 V <sub>AC</sub><br>T <sub>J</sub> =50°C | 15 W   | 17 W   | 23 W   | 27 W                         | 40 W                         |
|--|--------|--|--------|------------------------------|------------------------------|
| R <sub>DS(on),max.</sub>   | 5.18 Ω | 4.05 Ω                                       | 2.35 Ω | 1.75 Ω                       | 0.80 Ω                       |
| 700 V  | DIP-7  | ICE5AR4770BZS                                |        |                              |                              |
|  | DSO-12 | ICE5AR4770AG                                 |        |                              |                              |
| 800 V  | DIP-7  | ICE5AR4780BZS<br>ICE5BR4780BZ                |        | ICE5AR2280CZ<br>ICE5BR2280BZ | ICE5AR0680BZS                |
|  | DSO-12 | ICE5GR4780AG                                 |        | ICE5GR2280AG                 | ICE5GR1680AG<br>ICE5AR0680AG |
| 950 V  | DIP-7  | ICE5AR3995BZ<br>ICE5BR3995BZ<br>ICE5BR3995CZ |        |                              |                              |

## 3<sup>rd</sup> generation fixed-frequency CoolSET™

| Output power <sup>1)</sup><br>85 V <sub>AC</sub> ~ 300 V <sub>AC</sub><br>T <sub>J</sub> =50°C | 10~15 W     | 19~21 W        | 23~26 W       | 30~34 W       | 37~41 W       |
|--|-------------|----------------|---------------|---------------|---------------|
| R <sub>DS(on),max.</sub>   | 11.1~5.44 Ω | 3.42~2.62 Ω    | 1.96~1.71 Ω   | 1.11~1.05 Ω   | 0.75~0.71 Ω   |
| 650 V  | DIP-7       | ICE3RBR4765JZ  |               | ICE3RBR1765JZ | ICE3RBR0665JZ |
|  | DIP-8       | ICE3BR4765J    | ICE3A1065ELJ  | ICE3BR1765J   | ICE3BR0665J   |
|  | DSO-12      | ICE3RBR4765JG  |               | ICE3RBR1765JG | ICE3RBR0665JG |
| 800 V  | DIP-7       | ICE3AR4780JZ   | ICE3AR2280JZ  | ICE3AR1580VJZ | ICE3AR0680JZ  |
|  |             | ICE3AR4780VJZ  | ICE3BR2280JZ  |               | ICE3BR0680JZ  |
|  |             | ICE3AR4780CJZ  | ICE3AR2280VJZ |               | ICE3AR0680VJZ |
|  |             | ICE3AR10080CJZ | ICE3AR2280CJZ |               |               |
|  | DSO-12      | ICE3AR4780JG   | ICE3AR2280JG  |               | ICE3AR1080JG  |



[www.infineon.com/coolset](http://www.infineon.com/coolset)

1) Calculated DCM maximum output power in an open-frame design based on T<sub>s</sub>=50°C and T<sub>J</sub>=125°C without copper area as heatsink

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





## Fixed-frequency PWM IC

| FF PWM IC                                      | Gen5                               |          | Gen3                |             |
|--|------------------------------------|----------|---------------------|-------------|
|  | ICE5ASAG                           | ICE5GSAG | ICE3AS03LJG         | ICE3BS03LJG |
| Package  | DSO-8                              |          | DSO-8               |             |
| Switching frequency                            | 100 kHz                            | 125 kHz  | 100 kHz             | 65 kHz      |
| Operating temperature                          | -40°C~129°C                        |          | -25°C~130°C         |             |
| Start-up cell                                  | Cascode                            |          | ✓                   |             |
| V <sub>cc</sub> on/off threshold               | 16 V/10 V                          |          | 18 V/10.5 V         |             |
| Soft-start time                                | 12 ms                              |          | 10 ms               | 20 ms       |
| Frequency jittering                            | ✓                                  |          | ✓                   |             |
| Modulated gate drive                           | ✓                                  |          | ✓                   |             |
| Active burst mode                              | ✓ (3-level selectable)             |          | ✓                   |             |
| Slope compensation for CCM                     | ✓                                  |          | -                   |             |
| Frequency reduction                            | ✓                                  |          | -                   |             |
| Integrated error amplifier for direct feedback | ✓                                  |          | -                   |             |
| Adjustable line input overvoltage protection   | ✓ with auto restart                |          | -                   |             |
| Adjustable brown-in protection                 | ✓ with auto restart                |          | -                   |             |
| V <sub>cc</sub> pin short-to-ground protection | ✓ (no start-up)                    |          | -                   |             |
| V <sub>cc</sub> undervoltage protection        | ✓ with auto restart                |          | ✓ with auto restart |             |
| V <sub>cc</sub> overvoltage protection         | ✓ with auto restart                |          | ✓ with latch-up     |             |
| Overload/open loop protection                  | ✓ with auto restart                |          | ✓ with auto restart |             |
| Overtemperature protection                     | ✓ with auto restart and hysteresis |          | ✓ with latch-up     |             |
| External blanking time extension               | -                                  |          | ✓ with auto restart |             |
| External protection enable pin                 | -                                  |          | ✓ with latch-up     |             |



Fixed-frequency CoolSET™

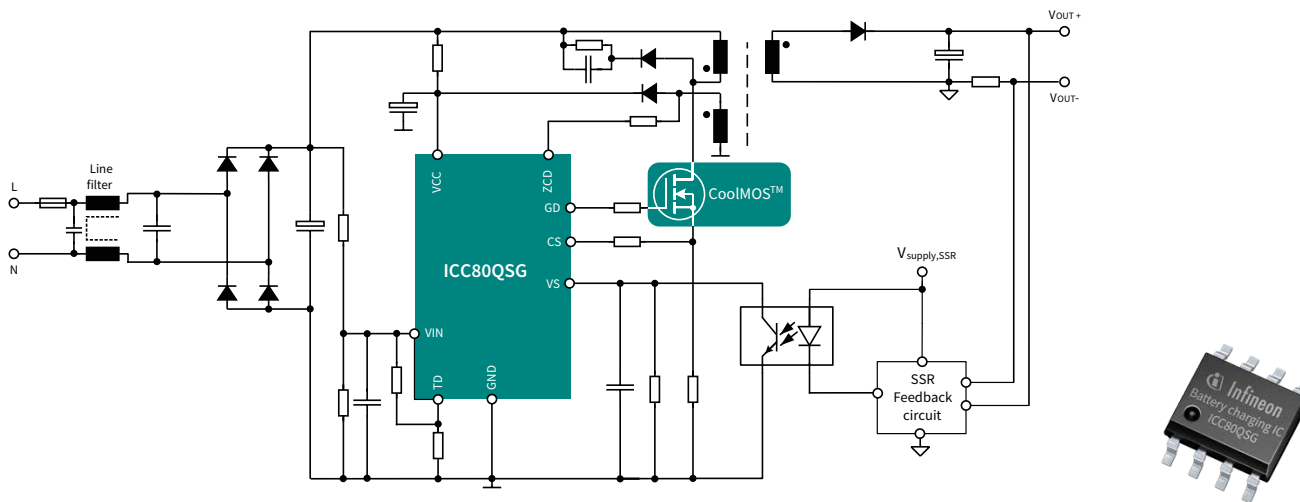
|  | 700 V CoolSET™                |                              | 650 V CoolSET™                            |  |
|--|-------------------------------|------------------------------|---|--|
|  | Gen5<br>ICE5ARxx70AG(BZS)     | Gen3<br>ICE3ARxx65ELJ        | Gen3R<br>ICE3BRxx65J                      | Gen3R<br>ICE3RBRxx65JZ(G)  |
| Package  | DIP-7, DSO-12                 |                              | DIP-8                                     |  |
| Output power range                             | 15 W                          | 19 W~34 W                    | 15 W~41 W                                 | 14 W~39 W  |
| Operating temperature range                    | -40°C~129°C                   |                              | -25°C~130°C                               |  |
| Switching frequency                            | 100 kHz                       | 100 kHz                      | 65 kHz                                    | 65 kHz   |
| Frequency reduction                            | ✓                             |                              | -   |  |
| Integrated error amplifier                     | ✓                             |                              | -   |  |
| Slope compensation for CCM mode                | ✓                             |                              | -   |  |
| V <sub>cc</sub> on/off threshold               | 16 V/10 V                     |                              | 18 V/10.5 V                               |  |
| Soft-start time                                | 12 ms                         |                              | 20 ms                                     |  |
| Active burst mode selection                    | 3 level                       |                              | 1 level                                   |  |
| V <sub>cc</sub> pin short-to-ground protection | No start-up                   |                              | -   |  |
| V <sub>cc</sub> overvoltage protection         | Auto restart                  |                              | Auto restart                              |  |
| Overtemperature protection                     | Auto restart with hysteresis  |                              | Auto restart                              |  |
| External protection enable pin                 | -                             |                              | Auto restart                              |  |
| Adjustable brown-in/-out protection            | Brown-in only                 |                              | -   |  |
| Adjustable line input overvoltage protection   | Only ICE5ARxx70AG             |                              | -   |  |
| Fast AC reset                                  |                               |                              | -   |  |
| Product available                              | ICE5AR4770AG<br>ICE5AR4770BZS | ICE3A1065ELJ<br>ICE3A2065ELJ | ICE3BR4765J<br>ICE3BR1765J<br>ICE3BR0665J | ICE3RBR4765JZ<br>ICE3RBR1765JZ<br>ICE3RBR0665JZ<br>ICE3RBR4765JG<br>ICE3RBR1765JG<br>ICE3RBR0665JG |

|  | 800 V CoolSET™  |  |  |   | 950 V CoolSET™               |  |  |                              |                      |   |
|--|---|--|--|---|------------------------------|--|--|------------------------------|----------------------|---|
|  | Gen3R<br>ICE3A(B)Rxx80JZ  | Gen3R<br>ICE3ARxx80CJZ                           | Gen3R<br>ICE3ARxx80JG                        | Gen3R<br>ICE3ARxx80VJZ  | Gen5<br>ICE5BRxx80BZ         | Gen5<br>ICE5ARxx80AG(BZS)                                      | Gen5<br>ICE5GRxx80AG                         | Gen5<br>ICE5BRxx95xZ         | Gen5<br>ICE5ARxx95xZ |   |
| Package  | DIP-7   |  |  |   | DIP-7                        | DIP-7, DSO-12  | DSO-12                                       | DIP-7                        |                      |   |
| Output power range                             | 10 W~40 W   | 11 W~23 W  | 14 W~30 W                                    | 15 W~39 W   | 15 W~22 W                    | 15 W~40 W  | 15 W~27 W                                    | 17 W                         |                      |   |
| Non-isolated buck output current range         |   |  |  |   | 450 mA~700 mA                |  |  | 550 mA                       | -                    |   |
| Operating temperature range                    | -25°C~130°C   |  | -40°C~130°C                                  |   | -40°C~129°C                  |  |  | -40°C~129°C                  |                      |   |
| Switching frequency                            | 100 kHz/65 kHz  | 100 kHz  | 100 kHz                                      |   | 65 kHz                       | 100 kHz  | 125 kHz                                      | 65 kHz                       | 100 kHz              |   |
| Frequency reduction                            | -   |  |  |   | ✓                            |  |  | ✓                            |                      |   |
| Integrated error amplifier                     | -   |  |  |   | ✓                            | ✓ (except ICE5ARxx80CZ)  |  | Only ICE5BRxx95BZ            | ✓                    |   |
| Slope compensation for CCM mode                | -   | ✓  | -  |   | ✓                            |  |  | ✓                            |                      |   |
| V <sub>cc</sub> on/off threshold               | 17 V/10.5 V   |  |  |   | 16 V/10 V                    |  |  | 16 V/10 V                    |                      |   |
| Soft-start time                                | 10 ms   |  |  |   | 12 ms                        |  |  | 12 ms                        |                      |   |
| Active burst mode selection                    | 4-level   | 3-level  | 4-level                                      |   | 3-level                      |  |  | 3-level                      |                      |   |
| V <sub>cc</sub> pin short-to-ground protection | -   |  |  |   | No start-up                  |  |  | No start-up                  |                      |   |
| V <sub>cc</sub> overvoltage protection         | Auto restart  |  |  |   | Auto restart                 |  |  | Auto restart                 |                      |   |
| Overtemperature protection                     | Auto restart with hysteresis  |  |  |   | Auto restart with hysteresis |  |  | Auto restart with hysteresis |                      |   |
| External protection enable pin                 | Auto restart  | Latch  | Auto restart                                 |   | -                            |  |  | -                            |                      |   |
| Adjustable brown-in/-out protection            | Auto restart  |  |  |   | -                            | Brown-in only  |  |                              | Brown-in             |   |
| Adjustable line input overvoltage protection   | -   |  |  |   | Auto restart                 | Yes (except ICE5ARxx80BZS)                                     |  | Auto restart                 | Only ICE5BRxx95CZ    | - |
| Fast AC reset                                  | -   | ✓  | -  |   | -                            |  |  | -                            |                      |   |
| Product available                              | ICE3AR10080JZ<br>ICE3AR4780JZ<br>ICE3AR2280JZ<br>ICE3AR0680JZ<br>ICE3BR2280JZ<br>ICE3BR0680JZ | ICE3AR10080CJZ<br>ICE3AR4780CJZ<br>ICE3AR2280CJZ | ICE3AR4780JG<br>ICE3AR2280JG<br>ICE3AR1080JG | ICE3AR4780VJZ<br>ICE3AR2280VJZ<br>ICE3AR1580VJZ<br>ICE3AR1080VJZ<br>ICE3AR0680VJZ | ICE5BR4780BZ<br>ICE5BR2280BZ | ICE5AR0680AG<br>ICE5AR4780BZS<br>ICE5AR2280CZ<br>ICE5AR0680BZS | ICE5GR4780AG<br>ICE5GR2280AG<br>ICE5GR1680AG | ICE5BR3995BZ<br>ICE5BR3995CZ | ICE5AR3995BZ         |   |

# ICC80QSG

## Single-stage flyback controller IC for battery charging

The **ICC80QSG** is a PWM controller for flyback topologies operating in quasi-resonant mode and valley-switching DCM, to achieve high efficiency of power transfer across wide operating range. For battery charging applications, the IC offers a wide power range as well as a comprehensive set of protections. The IC is easy to design in and requires a minimum number of external components. The gate driver current enables reasonable designs up to 130 W with state-of-the-art MOSFETs. The system performance and efficiency can be optimized using Infineon **CoolMOS™ P7** power MOSFETs.



### Features and benefits

| Key features   |
|--|
| – Quasi-resonant mode (QRM) operation with continuous conduction mode (CCM)-prevention and valley-switching discontinuous conduction mode (DCM) in mid to light load |
| – Secondary-side regulation (SSR)  |
| – Burst mode for very light loads  |
| – Adjustable maximum on-time   |
| – Comprehensive set of protections   |
| – Externally configurable hysteresis of brown-in and brown-out   |
| – Soft start   |

| Key benefits  |
|---|
| – Ideal for battery charging current control  |
| – BoM cost reduction  |
| – High efficiency and low electromagnetic interference (EMI)  |
| – Low power consumption in stand-by mode  |
| – Design flexibility with adjustable maximum switching frequency and configurability of brown-in and brown-out              |
| – Protection of primary components from overheating and saturation with higher brown-out level at higher input/output power |
| – Safe, robust, and reliable operation  |

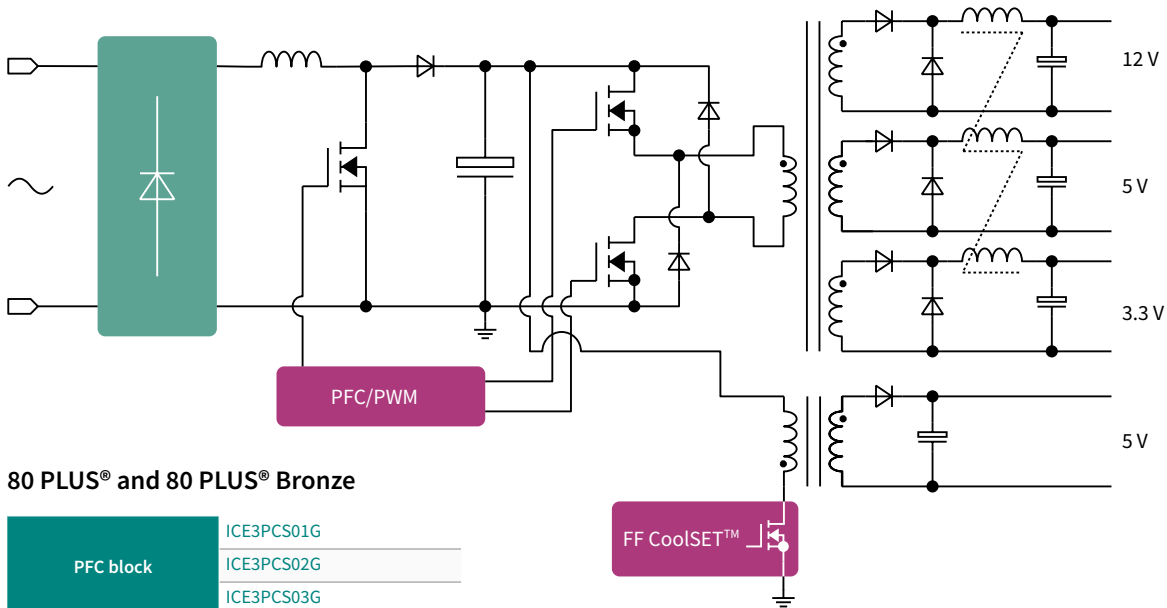
### Applications

The **ICC80QSG** is tailored for battery charger applications up to 130 W, such as cordless appliances, e-bike chargers, power tools, consumer drones, and gardening tools.



# Climate saver systems

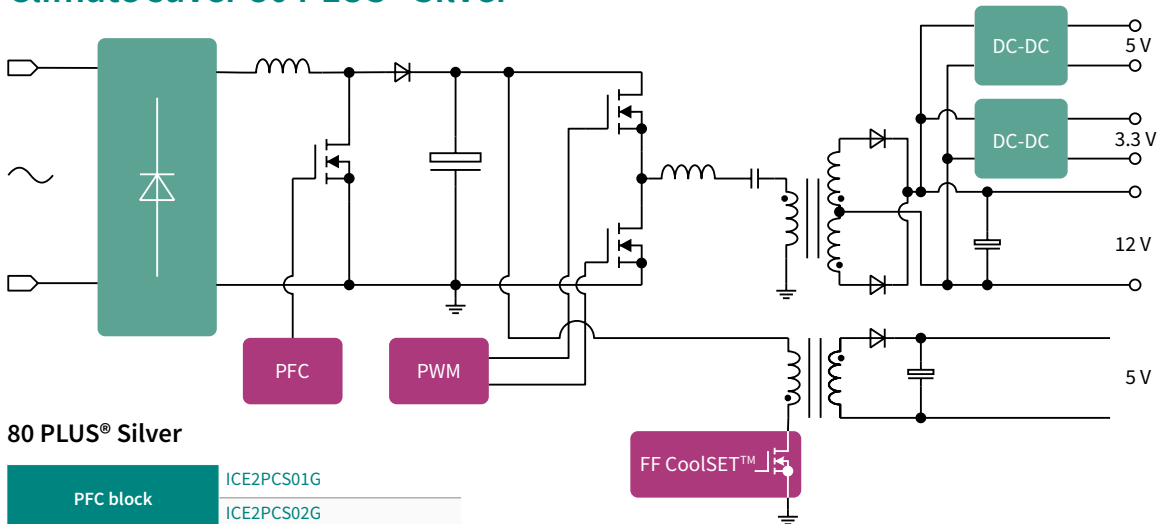
## Climate saver 80 PLUS® and 80 PLUS® Bronze



### 80 PLUS® and 80 PLUS® Bronze

|                              |              |
|------------------------------|--------------|
| PFC block                    | ICE3PCS01G   |
|                              | ICE3PCS02G   |
|                              | ICE3PCS03G   |
| PWM block                    | ICE2HS01G    |
|                              | ICE5GR4780AG |
| Standby block<br>FF CoolSET™ | ICE5GR2280AG |
|                              | ICE5GR1680AG |
|                              | ICE3AR1080JG |
|                              | ICE5AR0680AG |
|                              | ICE5AR0680AG |

## Climate saver 80 PLUS® Silver



### 80 PLUS® Silver

|                              |              |
|------------------------------|--------------|
| PFC block                    | ICE2PCS01G   |
|                              | ICE2PCS02G   |
| PWM block                    | ICE1HS01G-1  |
| Standby block<br>FF CoolSET™ | ICE5GR4780AG |
|                              | ICE5GR2280AG |
|                              | ICE5GR1680AG |
|                              | ICE3AR1080JG |
|                              | ICE5AR0680AG |

[www.infineon.com/pcpower](http://www.infineon.com/pcpower)

[www.infineon.com/acdc](http://www.infineon.com/acdc)

[www.infineon.com/coolset](http://www.infineon.com/coolset)

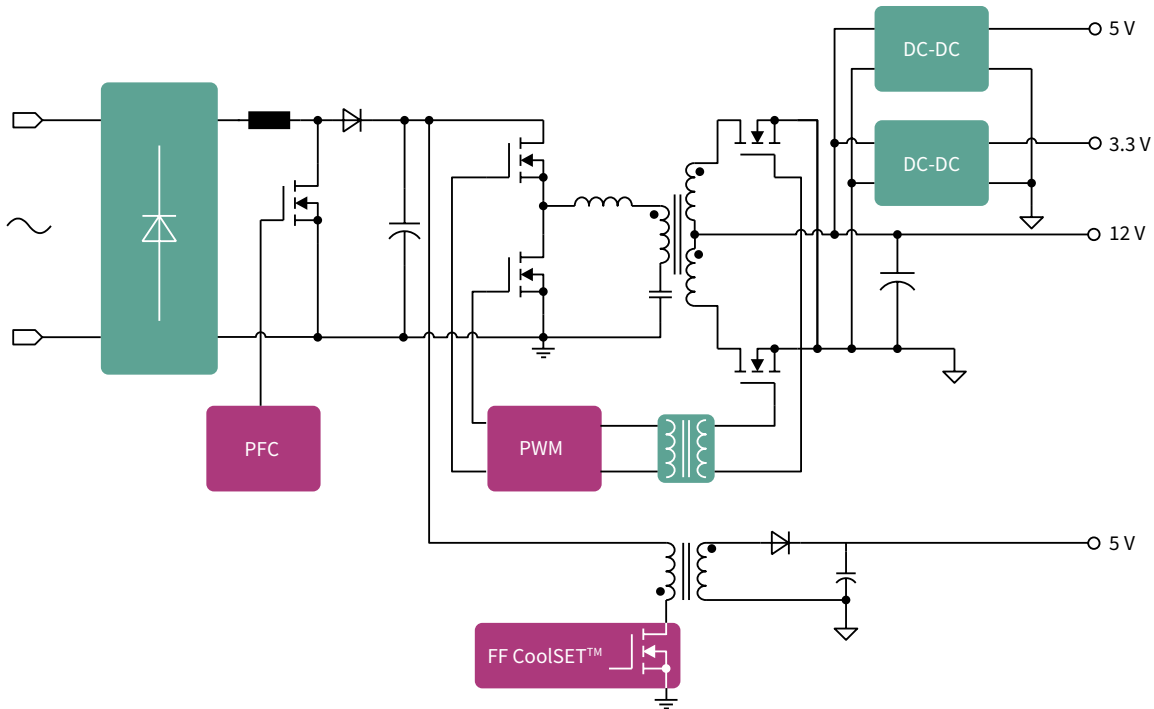
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Climate saver 80 PLUS® Gold

## Climate saver 80 PLUS® Platinum

Certification for Infineon's PC power reference design



### 80 PLUS® Gold

|                              |              |
|------------------------------|--------------|
| PFC block                    | ICE3PCS01G   |
|                              | ICE3PCS02G   |
|                              | ICE3PCS03G   |
| PWM block                    | ICE2HS01G    |
| Standby block<br>FF CoolSET™ | ICE5GR4780AG |
|                              | ICE5GR2280AG |
|                              | ICE5GR1680AG |
|                              | ICE3AR1080JG |
|                              | ICE5AR0680AG |

### 80 PLUS® Platinum

Certification for Infineon's PC power reference design

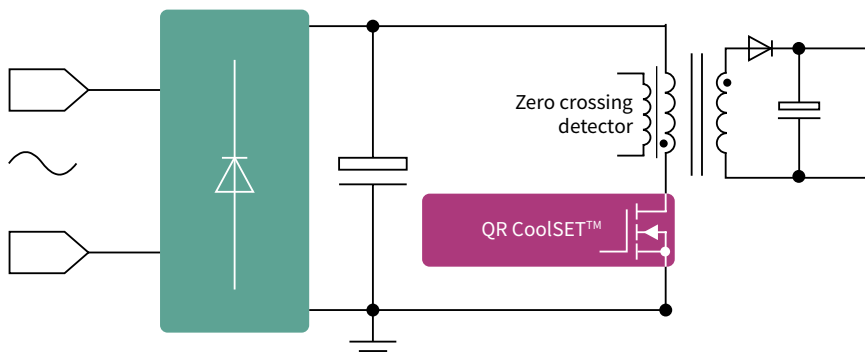
|                              |              |
|------------------------------|--------------|
| PFC block                    | ICE3PCS01G   |
|                              | ICE3PCS02G   |
|                              | ICE3PCS03G   |
| PWM block                    | ICE2HS01G    |
| Standby block<br>QR CoolSET™ | ICE5QR4780BG |
|                              | ICE5QR2280BG |
|                              | ICE5QR1680BG |
|                              | ICE2QR1080G  |
|                              | ICE5QR0680BG |

[www.infineon.com/pcpower](http://www.infineon.com/pcpower)  
[www.infineon.com/acdc](http://www.infineon.com/acdc)  
[www.infineon.com/coolset](http://www.infineon.com/coolset)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# 5<sup>th</sup> generation quasi-resonant PWM IC and CoolSET™



- Integrated CoolMOS™ in 800 V MOSFET with cascode configuration
- Digital frequency reduction with reduced load
- Novel quasi-resonant to minimize the spread of switching frequency between low- and high-line AC input
- Selectable active burst mode entry/exit profile
- Auto restart mode for line overvoltage protection
- Auto restart mode for brown-out protection
- Auto restart mode for  $V_{CC}$  under-/overvoltage protection
- Auto restart mode for open loop and output overload protection
- Auto restart mode for overtemperature protection with hysteresis
- Auto restart mode for output overvoltage
- Limited charging current during  $V_{CC}$  pin short-to-ground protection
- Peak power limitation with input voltage compensation
- Minimum switching frequency limitation (no audible noise on power units on/off)
- DSO package (controller) and DSO-12 (CoolSET™)



## 5<sup>th</sup> generation quasi-resonant CoolSET™

| Output power <sup>1)</sup><br>85 V <sub>AC</sub> ~ 300 V <sub>AC</sub><br>T <sub>s</sub> =50°C | 15 W         | 22 W         | 27 W         | 41 W~42 W    |
|--|--------------|--------------|--------------|--------------|
| R <sub>DS(on),max.</sub>   | 5.18 Ω       | 2.35 Ω       | 1.75 Ω       | 0.80 Ω       |
| 800 V DSO-12   | ICE5QR4780BG | ICE5QR2280BG | ICE5QR1680BG | ICE5QR0680BG |

## 2<sup>nd</sup> generation quasi-resonant CoolSET™

| Output power <sup>1)</sup><br>85 V <sub>AC</sub> ~ 300 V <sub>AC</sub><br>T <sub>s</sub> =50°C | 14 W~15 W     | 20 W~21 W   | 23 W~26 W                    | 31 W        | 38 W~42 W     |
|--|---------------|-------------|------------------------------|-------------|---------------|
| R <sub>DS(on),max.</sub>   | 5.44 Ω~5.18 Ω | 2.62 Ω      | 1.96 Ω                       | 1.11 Ω      | 0.75 Ω~0.71 Ω |
| 650 V  | DIP-7         | ICE2QR4765Z |                              | ICE2QR1765Z | ICE2QR0665Z   |
|  | DIP-8         | ICE2QR4765  |                              | ICE2QR1765  | ICE2QR0665    |
|  | DSO-12        | ICE2QR4765G |                              | ICE2QR1765G | ICE2QR0665G   |
| 800 V  | DIP-7         |             | ICE2QR2280Z                  |             | ICE2QR0680Z   |
|  | DSO-12        | ICE2QR4780G | ICE2QR2280G<br>ICE2QR2280G-1 |             | ICE2QR1080G   |

[www.infineon.com/coolset](http://www.infineon.com/coolset)

<sup>1)</sup> Calculated maximum output power in an open-frame design at T<sub>s</sub>=50°C, T<sub>j</sub>=125°C and without copper area as heat sink



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





### Quasi-resonant PWM IC

| Feature   | ICE5QSBG  | ICE2QS02G  | ICE2QS03G  |
|---|---|--|--|
| Package   | DSO-8   | DSO-8  | DSO-8  |
| Switching scheme  | Novel QR with 10 zero crossing counters   | QR with 7 zero crossing counters   | QR with 7 zero crossing counters   |
| Operating temperature                                   | -40°C~129°C   | -25°C~130°C  | -25°C~130°C  |
| Start-up cell   | Cascode   | -  | ✓  |
| V <sub>cc</sub> on/off                                  | 16 V/10 V   | 12 V/11 V  | 18 V/10.5 V  |
| Power saving during standby                             | ✓ active burst mode in QR switching<br>2-level selectable burst mode entry/exit level | -  | ✓ active burst mode 52 kHz   |
| Digital frequency reduction for high average efficiency | ✓   | ✓  | ✓  |
| OLP blanking time                                       | Fixed   | Adjustable   | Fixed  |
| Auto restart timer                                      | Through V <sub>cc</sub> charging/discharging  | Setting with external components   | Through V <sub>cc</sub> charging/discharging                                     |
| Maximum input power limitation                          | V <sub>in</sub> pin voltage dependent   | Adjustable through ZC resistor   | Adjustable through ZC resistor   |
| V <sub>cc</sub> undervoltage protection                 | ✓ with auto restart   | ✓ with latch   | ✓ with auto restart  |
| Adjustable output overvoltage protection                | ✓ with auto restart   | ✓ with latch   | ✓ with latch   |
| Adjustable line input overvoltage protection            | ✓   | -  | -  |
| Brown-out feature                                       | ✓   | ✓  | -  |
| V <sub>cc</sub> pin short-to-ground protection          | ✓   | -  | -  |
| Target application                                      | Home appliances, set-top-box, AUX SMPS  | AUX power supply to V <sub>cc</sub> , eg., LCD TV multi/main, audio main, PDP TV multi/address | Self-power supply to V <sub>cc</sub> , eg., smart meter, industrial applications |

### Quasi-resonant CoolSET™

| Feature                                      | 2 <sup>nd</sup> generation<br>ICE2QRxxxZ/G  | 2 <sup>nd</sup> generation<br>ICE2QRxx80G-1 | 5 <sup>th</sup> generation<br>ICE5QRxx80BG          |
|--|---|---|---|
| Switching scheme                             | QR with 7 zero crossing counters            |   | Novel QR with 10 zero crossing counters             |
| Integrated MOSFET                            | 650 V and 800 V                             | 800 V                                       | 800 V   |
| High-voltage start-up cell                   | ✓   |   | Cascode   |
| Power saving during standby                  | Active burst mode f <sub>sw</sub> at 52 kHz |   | 2 level selectable active burst mode quasi-resonant |
| V <sub>cc</sub> on/off threshold (typ.)      | 18 V/10.5 V                                 | 18 V/9.85 V                                 | 16 V/10 V   |
| Adjustable output overvoltage protection     | ✓ with latch                                |   | ✓ with auto restart                                 |
| V <sub>cc</sub> over/undervoltage protection | ✓ with auto restart                         |   | ✓ with auto restart                                 |
| Overload/open loop protection                | ✓ with auto restart                         |   | ✓ with auto restart                                 |
| Overtemperature protection                   | ✓ with auto restart                         |   | ✓ (Auto restart with hysteresis)                    |
| Adjustable line input overvoltage protection | -   |   | ✓ with auto restart                                 |
| Brown-out                                    | -   |   | ✓ with auto restart                                 |
| V <sub>cc</sub> pin short-to-ground          | -   |   | ✓ (No start-up)                                     |
| Package                                      | DIP-7<br>DIP-8<br>DSO-12                    | DIP-7<br>DSO-12                             | DSO-12  |



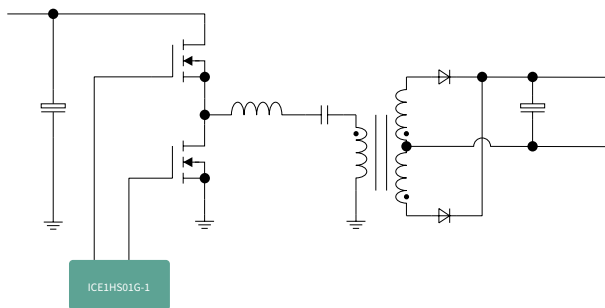
# Resonant LLC half-bridge controller ICs

## Best-in-class converters and controllers to support LLC HB resonant mode topology

Resonant mode power supplies are a variation over SMPS circuits where the switching losses are significantly reduced by adapting zero-voltage or zero-current switching techniques, also known as soft-switching techniques. In non-resonant mode SMPS circuits, the switches are subjected to hard switching. LLC HB resonant operates in ZVS mode, whereby switching loss is reduced to operate the converter at a higher switching frequency. In addition, the converter can be further optimized at a high input voltage. This topology allows to eliminate the secondary filter inductor, adopt better rectifier diodes, and reduce secondary conduction loss. The converter utilizes the leakage and magnetizing inductance of a transformer. With the magnetic integration concept, all the magnetic components can be built in one magnetic core.

### LLC resonant (no SR)

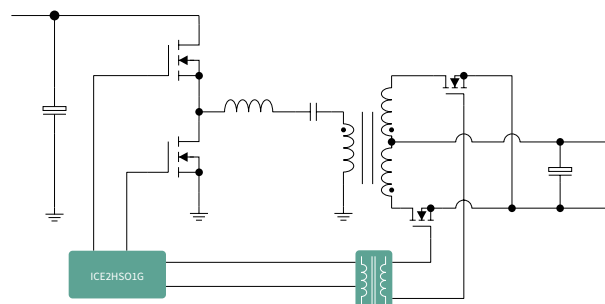
#### Application diagram – LLC resonant (no SR)



- Novel and simple design (12 components + HB driver)
- Minimum operating frequency is adjustable externally
- Burst mode operation for output voltage regulation during no load and/or bus overvoltage
- Multiple protections in case of fault
- Input voltage sense for brown-out protection
- Open loop/overload fault detection by FB pin with auto restart and adjustable blanking/restart time
- Frequency shift for overcurrent protection
- Lead-free, RoHS compliant package
- DSO-8 package

### Resonant LLC half-bridge controller IC with integrated synchronized rectifier control

#### LLC resonant + SR



- Novel LLC/SR operation mode and controlled by primary-side controller
- Multiple protections for SR operation
- Tight tolerance control
- Accurate setting of switching frequency and dead time
- Simple system design
- Optimized system efficiency
- Multiple converter protections: OTP, OLP, OCP, latch-off enable
- External disable for either SR switching or HB switching
- Lead-free, RoHS compliant package
- DSO-20 package



| LLC half-bridge controller IC                 | ICE1HS01G-1         | ICE2HS01G                |
|---|---------------------|--------------------------|
| Package                                       | DSO-8               | DSO-20                   |
| Switching frequency range                     | up to 600 kHz       | up to 1 MHz              |
| LLC soft-start                                | ✓                   | ✓                        |
| LLC burst mode                                | ✓                   | ✓                        |
| Adjustable minimum frequency                  | ✓                   | ✓                        |
| Overload/open loop protection                 | ✓                   | ✓                        |
| Mains undervoltage protection with hysteresis | ✓                   | ✓                        |
| Overcurrent protection                        | 2-level             | 3-level                  |
| Drive signal for synchronous rectification    | -                   | ✓                        |
| Adjustable dead time                          | -                   | ✓                        |
| External latch-off and OTP                    | -                   | ✓                        |
| Target application                            | LCD-TV, audio, etc. | Server, PC, LCD-TV, etc. |

|             | Product   | Frequency – $f_{sw}$ | Dead time      | Current drives | Package |
|-------------|---|----------------------|----------------|----------------|---------|
| ICE1HS01G-1 | LLC resonant (no SR)  | 30 kHz-600 kHz       | 380 ns         | 1.5 A          | DSO-8   |
| ICE2HS01G   | Resonant LLC half-bridge controller IC with integrated synchronized rectifier control (LLC resonant + SR) | 30 kHz-1 MHz         | 100 ns-1000 ns | 0.3 A          | DSO-20  |

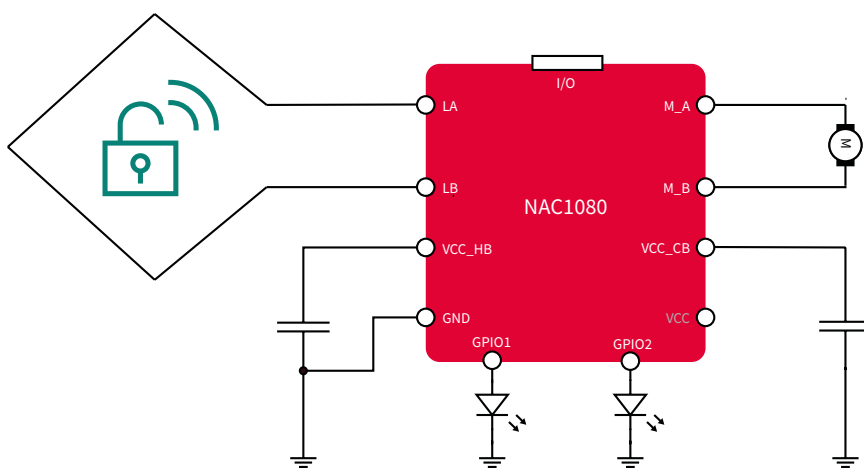


# NAC1080 – NFC smart actuation controller

The **NAC1080** is an NFC actuation controller with integrated half-bridge and energy harvesting modules, enabling cost effective development of passive smart actuators like passive locks. The low-power Arm® Cortex®-M0 based microcontroller with integrated NFC frontend, motor driver, and energy harvesting function enables customers to develop smart actuation devices with minimum system BOM requirement.

The flexible IC architecture and the smart partitioning between hardware and software enable customers to maximize software-defined functions. Furthermore, the **NAC1080** includes hardware security functions such as a secure area in flash, a 128 bit AES accelerator, and a true random generator. A separate secure element can be connected via the digital interface on demand.

Users can program this **NAC1080** with the industry-wide standard solutions for Cortex®-M0 processors. Especially for the smart lock application, SDK packages for firmware and mobile application development in Android and iOS systems are available to support a fast development cycle.



## Applications

- Passive/active NFC lock
- Emergency power source for battery devices
- NFC configuration of electronic devices

## Features and benefits

### Key features

- NFC interface compliant to ISO 14443 type A
- Arm® 32 bit Cortex®-M0 microcontroller core
- Dual-operation mode: passive or battery mode
- 60 kB NVM, 16 kB RAM, 16 kB boot ROM
- Integrated H-bridge
- Energy harvesting output
- 128-bit AES accelerator, true random number generator

### Key benefits

- A single-chip solution to build batteryless NFC actuators, like passive lock
- Batteryless IoT devices without battery exchange efforts and costs
- Intuitive connection via smartphone to enable cloud-based business models
- Minimum system BOM for easy and cost effective implementation

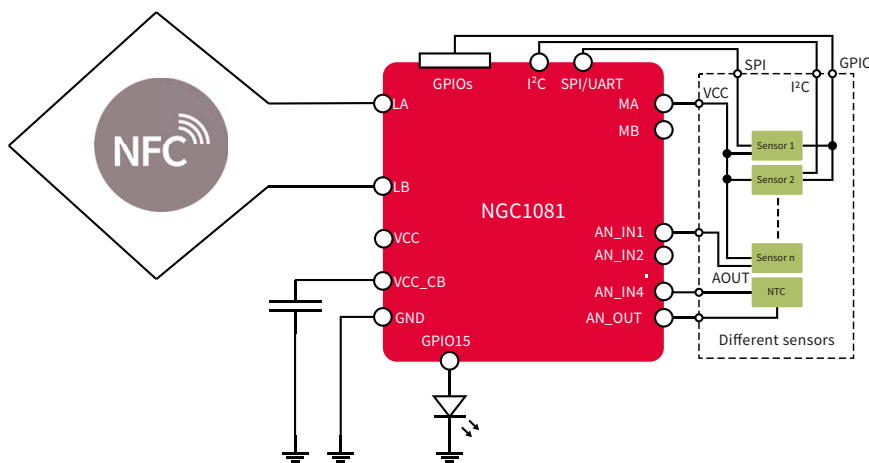


# NGC1081 – NFC smart sensing controller

The **NGC1081** is an NFC sensing controller with an integrated temperature sensor and ADC/DAC sensing unit in addition to the features provided by **NAC1080**. The low-power Arm® Cortex®-M0 based microcontroller with integrated NFC connectivity, sensing unit, and energy harvesting function in one device enables customers to develop miniaturized smart edge computing/sensing devices with minimum system BOM requirement.

**NGC1081** works in both passive mode and battery mode. In passive mode, it can communicate with a mobile phone wirelessly while at the same time harvesting energy from the NFC field to power the whole sensing system including the IC and its connected sensors. Working in battery mode, it simplifies the implementation of many sensing applications like temperature, humidity, and vibration tracking devices. With the smartphone as the human interaction interface, the system functions are widely extended to cloud functionalities, such as uploading data and data analysis on the cloud.

**NGC1081** has a 12-bit SAR ADC and a 10-bit DAC. It provides one analog output (DAC) and four analog inputs (ADC). The ADC has three sample and hold stages, which allow parallel signal sampling. A temperature sensor is integrated as well. Users can program the **NGC1081** with the industry-wide standard solutions for Cortex®-M0 processors.



## Applications

- Passive sensor device, inlay
- Medical, healthcare sensor patch
- Data logger, temperature logger
- Radiator thermostat
- Galvanic isolated sensor front end

## Features and benefits

### Key features

- NFC interface compliant to ISO 14443 type A
- Arm® 32-bit Cortex®-M0 microcontroller core
- Dual-operation mode: passive or battery mode
- 60 kB NVM, 16 kB RAM, 16kB boot ROM
- 12-bit SAR ADC, 10-bit DAC
- Integrated temperature sensor
- Integrated H-bridge
- Energy harvesting output
- 128-bit AES accelerator, true random number generator

### Key benefits

- A single-chip solution to build a batteryless smart sensor for miniaturized design with low BOM cost
- Multiple power supply options for sensors: GPIO for low current or energy harvesting output for high current
- Natural galvanic isolated sensing interface for applications with direct human body contact
- Intuitive connection via smartphone to enable cloud-based business models





# DC-DC converters

## Highest density end-to-end power management solutions

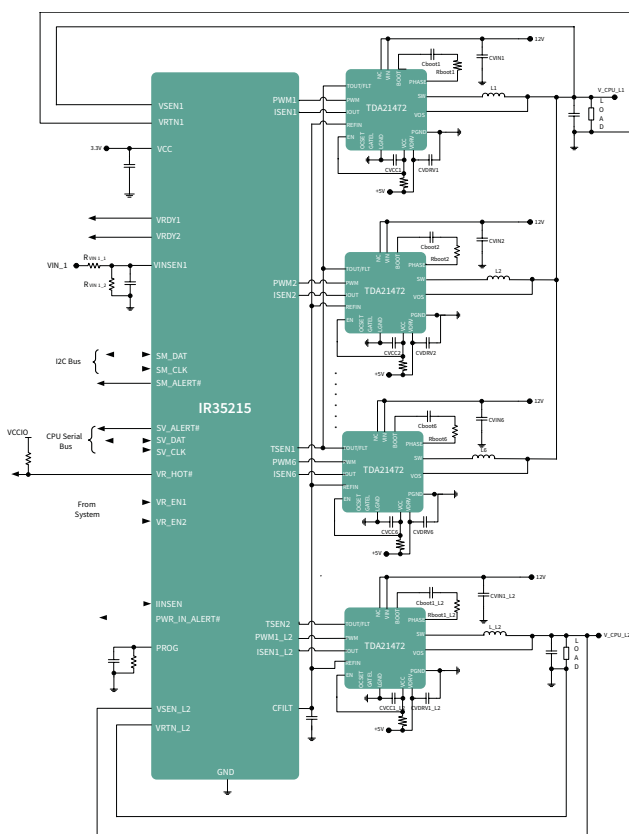
As the innovation leader for power semiconductor and energy efficiency technologies, we are continually developing and working on the best solutions for your applications. Our DC-DC converter portfolio includes integrated power stages, switching regulators, integrated POL converters and integrated POL voltage regulators, as well as digital multiphase controllers and digital power controllers (see XDPP1100 digital power controller family).

[www.infineon.com/power-stages](http://www.infineon.com/power-stages)

# OptiMOS™ power stage

## 60 A and 70 A integrated power stages with integrated current and temperature telemetry

Infiniteon's integrated OptiMOS™ power stage family contains a synchronous buck gate driver IC co-packed with control and synchronous MOSFETs and a Schottky diode to improve efficiency further. The package is optimized for PCB layout, heat transfer, driver/MOSFET control timing, and minimal switch node ringing when layout guidelines are followed. The paired gate driver and MOSFET combination enables higher efficiency at lower output voltages required by cutting-edge CPU, GPU, ASIC, and DDR memory designs. The TDA21472 integrated power stages internal MOSFET current sense algorithm, with integrated temperature compensation, achieves superior current sense accuracy versus best-in-class controller-based inductor DCR sense methods. Up to 1.0 MHz switching frequency enables high-performance transient response, allowing miniaturization of output inductors, as well as input and output capacitors, while maintaining industry-leading efficiency. The TDA21472 is optimized for CPU core power delivery in server applications. The ability to meet the stringent requirements of the server market also makes the TDA21472 ideally suited for powering GPU, ASIC, DDR memory, and other high current designs.



### Features

- Integrated driver, Schottky diode, control MOSFET and synchronous MOSFET
- 5 mV/A on-chip MOSFET current sensing with temperature compensated reporting
- Input voltage ( $V_{in}$ ) range of 4.5 to 15 V
- $V_{CC}$  and  $V_{DR}$  V supply of 4.5 to 7 V
- Output voltage range from 0.25 up to 5.5 V
- Output current capability of 70 A
- Operation up to 1.0 MHz
- $V_{CC}$  undervoltage lockout (UVLO)
- 8 mV/°C temperature analog output and thermal flag pull-up to 3.3 V
- Overtemperature protection (OTP)
- Cycle-by-cycle self-preservation overcurrent protection (OCP)
- MOSFET phase fault detection and flag
- Preliminary overvoltage protection (pre-OVP)
- Compatible with 3.3 V tri-state PWM input
- Body-Braking™ load transient support through PWM tri-state
- Diode emulation mode (DEM) for improved light-load efficiency
- Efficient dual-sided cooling
- Small 5.0 x 6.0 x 0.9 mm PQFN package

### Applications

- High-frequency, high-current, low-profile DC-DC converters
- Voltage regulators for CPUs, GPUs, ASICs, and DDR memory arrays

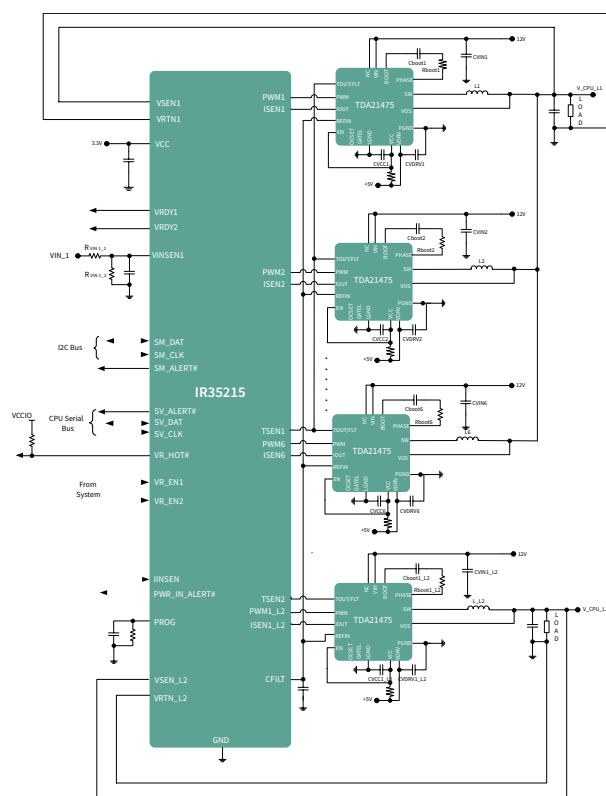
| Part type | Package           | $I_{out}$ [A] | $V_{in}$ [V] | $V_{out}$ [V] | Switching frequency [MHz] |
|-----------|-------------------|---------------|--------------|---------------|---------------------------|
| TDA21472  | 5x6 x 0.9 mm PQFN | 70            | 4.5 to 15    | 0.25 to 5.5   | 1.0                       |
| TDA21462* | 5x6 x 0.9 mm PQFN | 60            | 4.5 to 15    | 0.25 to 5.5   | 1.0                       |



# OptiMOS™ power stage

## 70 A power stage with exposed top for improved thermal performance

Infiniteon's TDA21475 exposed-top power stage contains a low quiescent-current synchronous buck gate driver IC co-packaged with high-side and low-side MOSFETs. The package is optimized for PCB layout, heat transfer, driver/MOSFET control timing, and minimal switch node ringing when layout guidelines are followed. The gate driver and MOSFET combination enables higher efficiency at the lower output voltages required by cutting-edge CPU, GPU, and DDR memory designs. The TDA21475 internal MOSFET current sense algorithm with temperature compensation achieves superior current sense accuracy versus best-in-class controller-based inductor DCR sense methods. Protection includes cycle-by-cycle overcurrent protection with programmable threshold,  $V_{CC}/V_{DRV}$  UVLO protection, bootstrap capacitor undervoltage protection, phase fault detection, IC temperature reporting, and thermal shutdown. The TDA21475 also features auto replenishment of the bootstrap capacitor to prevent over-discharge. The TDA21475 features a deep-sleep power-saving mode, which greatly reduces the power consumption when the multiphase system enters PS3/PS4 mode. Operation at switching frequency as high as 1.5 MHz enables high-performance transient response, allowing a reduction of output inductance and output capacitance while maintaining industry-leading efficiency. The TDA21475 is optimized for CPU core power delivery in server applications. The ability to meet the stringent requirements of the server market also makes the TDA21475 ideally suited for powering GPU and DDR memory designs.



### Features

- Co-packaged driver, high-side and low-side MOSFETs
- 5 mV/A on-chip MOSFET current sensing with temperature compensated reporting input voltage ( $V_{IN}$ ) range of 4.25 to 16 V
- $V_{CC}$  and  $V_{DRV}$  supply of 4.25 to 5.5 V
- Output voltage range from 0.25 up to 5.5 V output current capability of 70 A operation up to 1.5 MHz
- $V_{CC}/V_{DRV}$  undervoltage lockout (UVLO) bootstrap capacitor undervoltage protection 8 mV/°C temperature analog output
- Thermal shutdown and fault flag
- Cycle-by-cycle overcurrent protection with programmable threshold and fault flag MOSFET phase fault detection and flag
- Auto replenishment of bootstrap capacitor
- Deep-sleep mode for power saving
- Compatible with 3.3 V tri-state PWM input Body-Braking™ load transient support Small 5x6 x 0.65 mm PQFN package
- Lead-free RoHS compliant package
- Integrated driver, Schottky diode, control MOSFET and synchronous MOSFET

### Applications

- High-frequency, high-current, low-profile DC-DC converters
- Voltage regulators for CPUs, GPUs, ASICs, and DDR memory arrays

| Part type | Package           | $I_{out}$ [A] | $V_{in}$ [V] | $V_{out}$ [V] | Switching frequency [MHz] |
|-----------|-------------------|---------------|--------------|---------------|---------------------------|
| TDA21475  | 5x6 x 0.9 mm PQFN | 70            | 4.25 to 16   | 0.25 to 5.5   | 1.5                       |

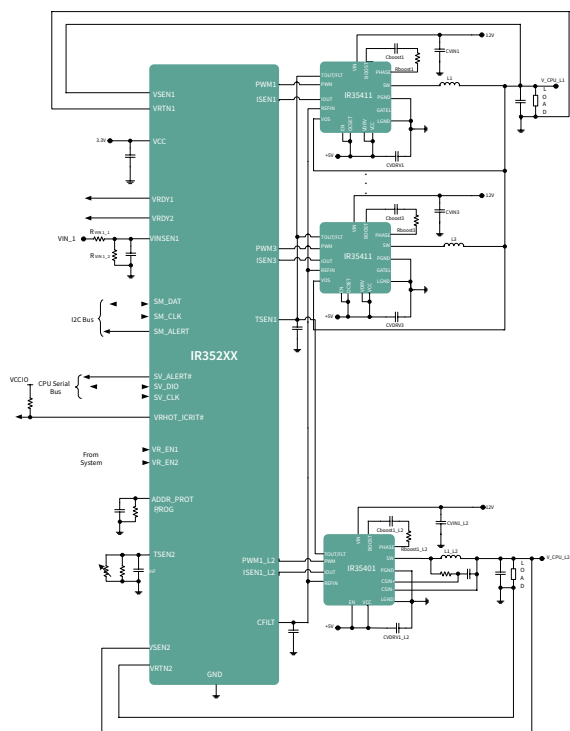




# OptiMOS™ power stage

## 20 A power stage with integrated current sense

Infineon's IR35401 integrated power stage contains a synchronous buck gate driver IC co-packaged with control and synchronous MOSFETs and a Schottky diode to improve efficiency further.. The package is optimized for PCB layout, heat transfer, driver/MOSFET control timing, and minimal switch node ringing when layout guidelines are followed. The paired gate driver and MOSFET combination enables higher efficiency at lower output voltages required by cutting-edge CPU, GPU and DDR memory designs. The IR35401 power stage features an integrated current sense amplifier to achieve superior current sense accuracy against best-in-class controller-based inductor DCR sense methods while delivering the clean and accurate current report information. The protection features inside IR35401 include  $V_{CC}$  UVLO and thermal flag. IR35401 also features an auto replenishment of the bootstrap capacitor to prevent the bootstrap capacitor from overdischarging. The IR35401 supports deep-sleep mode and consumes less than 100  $\mu A$   $V_{CC}$  bias current when the EN pin is pulled low. Up to 1.5 MHz switching frequency enables high-performance transient response, allowing miniaturization of output inductors, and input and output capacitors while maintaining industry-leading efficiency. When combined with Infineon's digital controllers, the IR35401 incorporates the Body-Braking™ feature through PWM tri-state which enables reduction of output capacitors. The IR35401 is optimized for low current CPU rails in server applications. The ability to meet the stringent requirements of the server market also makes the IR35401 ideally suited for powering GPU and DDR memory rails.



### Applications

- General purpose POL DC-DC converters
- Voltage regulators for CPUs, GPUs, ASICs, and DDR memory arrays

### Features

- Integrated driver, control MOSFET and synchronous MOSFET
- Integrated bootstrap synchronous PFET
- Inductor DCR current sensing with temperature compensation
- Input voltage ( $V_{IN}$ ) range from 4.25 to 16 V
- $V_{CC}$  supply of 4.25 to 5.5 V
- Output voltage range from 0.5 to 3 V or up to 5.5 V if the internal current sense amplifier is not used
- Local lossless inductor current sensing with improved noise immunity and accuracy
- Single reference based current reporting output
- Output current capability of 20 A
- Operation up to 1.5 MHz
- $V_{CC}$  undervoltage lockout
- Overtemperature and  $V_{CC}$  UVLO fault communication to controller via TOUT pin
- Compatible with 3.3 V tri-state PWM input
- Body-Braking™ load transient support through PWM tri-state
- Auto replenishment on BOOST pin
- Low operating quiescent current and <100  $\mu A$  when disabled
- Small 4 x 5 x 0.9 mm PQFN package
- Lead-free RoHS compliant package

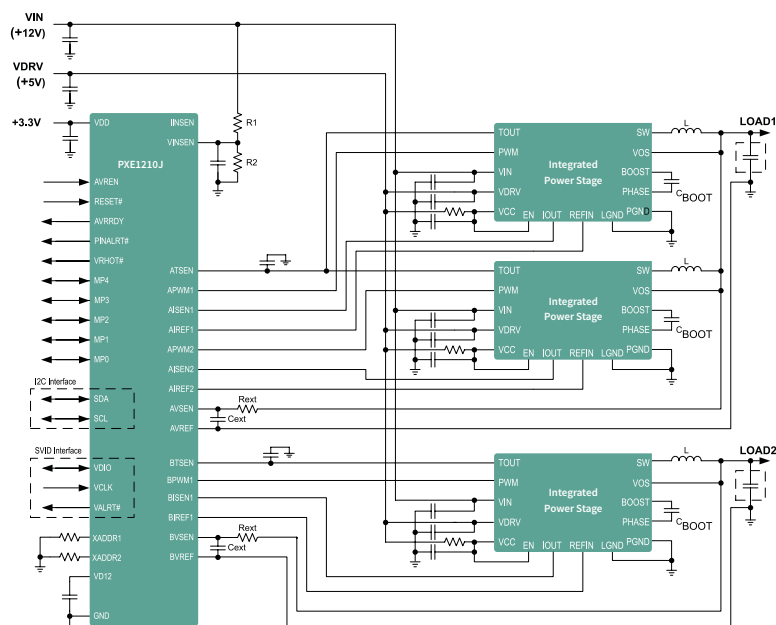
| Part type | Package             | $I_{out}$ [A] | $V_{in}$ [V] | $V_{out}$ [V] | Switching frequency [MHz] |
|-----------|---------------------|---------------|--------------|---------------|---------------------------|
| IR35401   | 4 x 5 x 0.9 mm PQFN | 20            | 4.25 to 16   | 0.5 to 5.5    | 1.5                       |



# OptiMOS™ power stage

## 25 A, 35 A, 40 A integrated power stages with highest efficiency on smallest form factor

Infineon's TDA21240 power stage is a multi-chip module that incorporates Infineon's premier MOSFET technology for a single high-side and a single low-side MOSFET coupled with a robust, high-performance, high switching frequency gate driver in a single PG-IQFN-30-2 package. The optimized gate timing allows for significant light-load efficiency improvements over discrete solutions. When combined with Infineon's family of digital multiphase controllers, the TDA21240 forms a complete core voltage regulator solution for advanced micro and graphics processors as well as point-of-load applications.



### Features

- For synchronous buck converter step down voltage applications
- Maximum average current of 40 A
- Input voltage range +4.5 V to +16 V
- Power MOSFETs rated 25 V
- Fast switching technology for improved performance at high switching frequencies (> 500 kHz)
- Remote driver disable function
- Includes bootstrap diode
- Undervoltage lockout
- Shoot through protection
- +5 V high-side and low-side MOSFETs driving voltage
- Compatible to standard +3.3 V PWM controller integrated circuits
- Tri-state PWM input functionality
- Small package: PG-IQFN-30-2 (4 x 4 x 1 mm)
- RoHS compliant
- Thermal warning

### Applications

- Desktop and server VR buck converter
- Single-phase and multiphase POL
- CPU/GPU regulation in notebook, desktop graphics cards, DDR memory, graphic memory
- High power density voltage regulator modules (VRM)
- Qualified for DC-DC industrial applications based on JEDEC (JESD47, JESD22, J-STD20)
- General purpose POL DC-DC converters

| Part type | Package           | I <sub>out</sub> [A] | V <sub>in</sub> [V] | Switching frequency [MHz] |
|-----------|-------------------|----------------------|---------------------|---------------------------|
| TDA21242  | 4 x 4 x 1 mm PQFN | 25                   | 4.5 to 16           | 1.0                       |
| TDA21241  | 4 x 4 x 1 mm PQFN | 35                   | 4.5 to 16           | 1.0                       |
| TDA21240  | 4 x 4 x 1 mm PQFN | 40                   | 4.5 to 16           | 1.0                       |

[www.infineon.com/integrated-powerstages](http://www.infineon.com/integrated-powerstages)



Desktop



Voltage regulators



DC-DC converter

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# Integrated POL voltage regulators

## Highest density high efficiency integrated POL (IPOL) for smart enterprise system

Infiniteon's integrated POL switching converters deliver benchmark efficiency and dramatically reduce system size. Solutions up to 35 A are available in compact PQFN packages. Target applications include server, storage, routers and switches, telecom base stations, digital home media, mobile computing, and embedded data processing. Solutions with and without PMBus digital communication are available in single output and multi-rail format.

### Point-of-load products – how to choose

DC-DC products  
1 to 35 A

PMBus digital IPOL

Constant on-time IPOL

IPOL with digital interface

Easy/light-load efficiency  
IR3883MTRPBF (3 A), IR3888MTRPBF (25 A),  
IR3889MTRPBF (30 A), IR3887MTRPBF\* (30 A)

- > Telemetry
- > Margining
- > Intel SVID support
- > Parallel VID
- > IR3806x: 6-35 A with PMBus
- > IR3816x: 15 A, 30 A with PMBus and Intel SVID
- > IR38263: 30 A with PVID and PMBus

Differential remote sense for optimum output accuracy

Digital mode: I2C/PMBus interface

**PMBus IC capabilities**

|               |   |
|---------------|---|
| Inventory     | Device ID   |
| Configuration | On/off configuration<br>fault/warnings                    |
| Control       | Sequencing delay/ramp<br>fault response                   |
| Telemetry     | $V_{out}$ , $I_{out}$ , power<br>temperature, peak values |
| Status        | Comms, data, temps  |

Ready-to-go reference designs and the on-line PowerDesk simulator simplify the task of designing regulated voltage rails. Different control topologies are available to meet an application's specific requirements.

[www.infineon.com/ipol](http://www.infineon.com/ipol)  
[www.infineon.com/analog-ipol](http://www.infineon.com/analog-ipol)

\*Coming soon



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# Integrated point-of-load converters

## IR3806x series (6 A/15 A/25 A/35 A)

### Digital interface IPOL voltage regulators

The digital interface IPOL devices are easy-to-use, fully integrated, and highly efficient DC-DC regulator offering I<sup>2</sup>C/PMBus, parallel VID, Intel SVID. The on-board PWM controller and MOSFETs make the family a space-efficient solution, providing accurate power delivery for low output voltage and high current applications.

The IR3806x family of PMBus enabled IR MOSFET™ IPOL based IR MOSFET™ IPOL voltage regulators offers:

- Compactness of integrated controller, driver, and MOSFETs
- High-performance analog voltage mode engine
- Flexibility of a rich PMBus interface

The IR381(2/3)6x family features OptiMOS™ 5 for the highest efficiency and adds Intel SVID support (IR381(/3)6x) for Intel based systems or parallel VID (IR3826x) for voltage scaling or 8 programmable output voltages booting options to avoid programming at start up. Pin compatible options with and without PMBus are available to allow the flexibility of using PMBus only during evaluation or easily upgrade a system to PMBus without re-layout.

### Features and benefits

#### Key features

- PMBus revision 1.2 compliant
- ≥ 66 PMBus commands
- Wide input voltage range and single 5 to 16 V input operations
- Differential remote sense
- Ultralow jitter voltage mode engine
- Operation temp: -40° to 125° C

#### Key benefits

- Only single-chip solution with extensive PMBus, parallel VID, Intel SVID support allows 50 percent space saving versus external power competition
- Intel SVID support for Intel-based systems
- Parallel VID or PMBus for voltage setting and margining
- Telemetry status via digital bus
- Remote monitoring and update
- Parameter changes by register
- Flexible sequencing
- High accuracy low ripple
- Integrated sequencing, margin, current and voltage monitoring

### Digital interface IPOL

| Part number   | Max. current [A] | Package size [mm] | Max. V <sub>in</sub> | Max. f <sub>sw</sub> | Distinctive features                    |
|---------------|------------------|-------------------|----------------------|----------------------|---|
| IR38064MTRPBF | 35               | 5 x 7             | 21 V                 | 1500 kHz             | PMBus                                   |
| IR38063M      | 25               | 5 x 7             | 21 V                 | 1500 kHz             |   |
| IR38062M      | 15               | 5 x 7             | 21 V                 | 1500 kHz             |   |
| IR38060M      | 6                | 5x6               | 16 V                 | 1500 kHz             |   |
| IR38163M      | 30               | 5 x 7             | 16 V                 | 1500 kHz             | OptiMOS™ 5, SVID + PMBus                |
| IR38165M      | 30               | 5 x 7             | 16 V                 | 1500 kHz             | OptiMOS™ 5, SVID                        |
| IR38363M      | 15               | 5 x 7             | 16 V                 | 1500 kHz             | OptiMOS™ 5, SVID + PMBus                |
| IR38365M      | 15               | 5 x 7             | 16 V                 | 1500 kHz             | OptiMOS™ 5, SVID                        |
| IR38263M      | 30               | 5 x 7             | 16 V                 | 1500 kHz             | OptiMOS™ 5, PVID + PMBus                |
| IR38265M      | 30               | 5 x 7             | 16 V                 | 1500 kHz             | OptiMOS™ 5, PVID                        |
| IR38164M      | 30               | 5 x 7             | 16 V                 | 1500 kHz             | OptiMOS™ 5, SVID + PMBus, enhanced Imon |
| IRPS5401M     | 4+4+2+2+0.5      | 7 x 7             | 14 V                 | 1500 kHz             | 5 output PMIC, PMBus                    |

[www.infineon.com/ipol](http://www.infineon.com/ipol)



DC-DC



Desktop



Telecom



Server

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

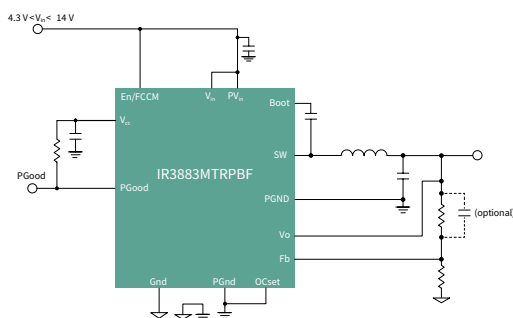


# OptiMOS™ IPOL voltage regulators with COT

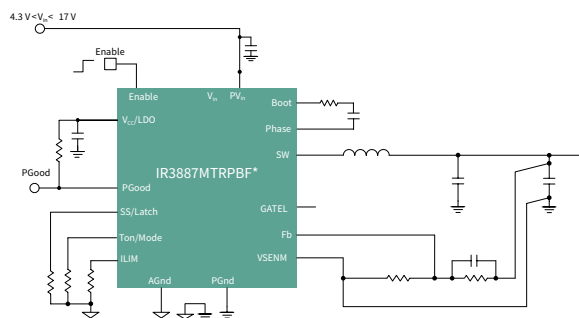
## Easy-to-use with no external compensation and smallest BOM

OptiMOS™ IR3883MTRPBF, IR3887MTRPBF\*, IR3889MTRPBF, and IR3888MTRPBF integrated point-of-load DC-DC devices are easy-to-use, fully integrated, and highly efficient DC-DC regulators that operate from a wide input voltage range and provide up to 30 A continuous current. The devices increase efficiency and power density and simplify design for POL applications in server, enterprise storage, netcom router and switches, datacom and telecom base stations.

### Block diagram IR3883M



### Block diagram IR3887M (30 A)



## Main benefits

### Main benefits

- Compensation free and stable with all ceramic caps
- Scalable solution from 3 A up to 40 A
- For designs requiring high density, low cost and easy design, the family includes a 3 A device with enhanced stability constant-on-time (COT) engine that does not require external compensation enabling easy designs and fast time to market.
- Quiescent current down to 5  $\mu$ A
- Overload, overtemperature, short circuit, and reverse-polarity protection
- Low current consumption
- Extended temperature range -40°C ... +125°C

## Analog interface IPOL

| Part number   | Max. current [A] | Package size [mm] | Max. $V_{in}$ | Max. $f_{sw}$ | Distinctive features   |
|---------------|------------------|-------------------|---------------|---------------|------------------------|
| IR3883MTRPBF  | 3                | 3 x 3             | 14 V          | 800 kHz       | Constant-on-time (COT) |
| IR3823AMTRPBF | 3                | 3.5 x 3.5         | 17 V          | 2000 kHz      |                        |
| IR3899AMTRPBF | 9                | 4 x 5             | 17 V          | 2000 kHz      |                        |
| TDA38820      | 20               | 4 x 5             | 17 V          | 2000 kHz      |                        |
| IR3888MTRPBF  | 25               | 5x6               | 17 V          | 2000 kHz      |                        |
| IR3447AMTRPBF | 25               | 5x6               | 17 V          | 600 kHz       |                        |
| IR3887MTRPBF  | 30               | 4 x 5             | 17 V          | 2000 kHz      |                        |
| IR3889MTRPBF  | 30               | 5x6               | 17 V          | 2000 kHz      |                        |
| TDA38840      | 40               | 5x6               | 17 V          | 2000 kHz      |                        |
| IR3846AMTRPBF | 40               | 5 x 7             | 17 V          | 600 kHz       |                        |

[www.infineon.com/ipol](http://www.infineon.com/ipol)

\*Coming soon



Datacom



Server



Storage



Telecom

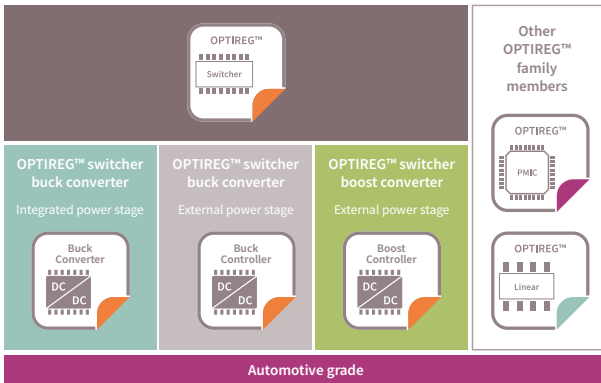
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# OPTIREG™ switcher power supply ICs

## High-efficiency solutions for harsh environments

Infiniteon offers optimized DC-DC converters that are designed specifically for harsh automotive environments. Wide input voltage range, optimized feature set, and extended qualification make our DC-DC converters perfectly suitable for multiple applications. Our DC-DC portfolio contains various products that operate in step-down (buck), step-up (boost), or a combination of those (buck-boost/sepic). High integration, efficiency, and flexibility are the main benefits of our products.



## Features and benefits

### Key features

- Input voltage up to 60 V
- Output currents going from 500 mA up to 10 A
- Switching frequencies ranging from 100 kHz to 2.2 MHz
- Shutdown quiescent current down to below 2  $\mu$ A
- Current limitation and overtemperature protection
- Enable feature

### Key benefits

- High-efficiency regulation
- Only a few external components needed for stable regulation
- Perfectly suited for regulation in pre-/post-regulation power supply architectures

## OPTIREG™ switcher

| Product name                              | Input voltage<br>$V_{in(oh)}$<br>[V] | Output current<br>[mA] | Quiescent<br>current<br>(EN = ON)<br>[mA] | Output voltage<br>$V_o$<br>[V] | Synchronous<br>topology | Accuracy<br>[%] | Switching<br>frequency PWM<br>$f_{sw}$<br>[kHz] | Enable | PFM operation | Reset           | Watchdog | Early warning | Package     |
|---|--------------------------------------|------------------------|---|--------------------------------|-------------------------|-----------------|---|--------|---------------|-----------------|----------|---------------|-------------|
| <b>Buck converter (integrated MOSFET)</b> |                                      |                        |   |                                |                         |                 |   |        |               |                 |          |               |             |
| TLE6365                                   | 8.00 ... 40.00                       | 400                    | 1500                                      | 5.00                           |                         | 2               | 100   |        |               | ●               |          |               | DSO-8       |
| TLE8366                                   | 4.75 ... 45.00                       | 1800                   | 7000                                      | Adj., 3.30, 5.00               |                         | 2(4)            | 200 ... 530                                     | ●      |               |                 |          |               | DSO-8 EP    |
| TLS4120D0                                 | 3.70 ... 36.00                       | 2000                   | 0.032                                     | Adj., 3.30, 5.00               | ●                       | 2               | 380 ... 2800                                    | ●      | ●             | ●               |          |               | TSDSO-14 EP |
| TLS4125D0                                 | 3.70 ... 36.00                       | 2500                   | 0.032                                     | Adj., 3.30, 5.00               | ●                       | 2               | 380 ... 2800                                    | ●      | ●             | ●               |          |               | TSDSO-14 EP |
| TLF50281                                  | 4.75 ... 45.00                       | 500                    | 0.045                                     | 5.00                           |                         | 2               | 800 ... 2200                                    | ●      | ●             | ●               | ●        |               | SSOP-14 EP  |
| TLF50251                                  | 4.75 ... 45.00                       | 500                    | 0.045                                     | 5.00                           |                         | 2               | 800 ... 2200                                    | ●      | ●             | ●               |          |               | SSOP-14 EP  |
| TLF50241                                  | 4.75 ... 45.00                       | 500                    | 0.045                                     | 5.00                           |                         | 2               | 800 ... 2200                                    |        | ●             | ●               |          |               | SSOP-14 EP  |
| TLF50211                                  | 4.75 ... 45.00                       | 500                    | 0.045                                     | 5.00                           |                         | 2               | 800 ... 2200                                    | ●      | ●             |                 |          |               | SSOP-14 EP  |
| TLF50201                                  | 4.75 ... 45.00                       | 500                    | 0.045                                     | 5.00                           |                         | 2               | 800 ... 2200                                    |        | ●             |                 |          |               | SSOP-14 EP  |
| <b>Buck controller (external MOSFET)</b>  |                                      |                        |   |                                |                         |                 |   |        |               |                 |          |               |             |
| TLE6389-2GV                               | 5.00 ... 60.00                       | 2300                   | 0.120                                     | Adj.                           |                         | 3               | 250 ... 530                                     | ●      | ●             | ●               |          | ●             | DSO-14      |
| TLE6389-2GV50                             | 5.00 ... 60.00                       | 2300                   | 0.120                                     | 5.00                           |                         | 3               | 250 ... 530                                     | ●      | ●             | ●               |          | ●             | DSO-14      |
| TLE6389-3GV50                             | 5.00 ... 60.00                       | 2300                   | 0.120                                     | 5.00                           |                         | 3               | 250 ... 530                                     | ●      | ●             | ● <sup>1)</sup> |          | ●             | DSO-14      |
| TLF51801                                  | 4.75 ... 45.00                       | Adj. max. 10,000       | < 2.000 $\mu$ A                           | 1.20– $D_{max} \cdot V_s$      | ●                       | 2               | 100 ... 700                                     | ●      |               |                 |          |               | SSOP-14 EP  |
| <b>Boost controller</b>                   |                                      |                        |   |                                |                         |                 |   |        |               |                 |          |               |             |
| TLE8386-2 <sup>2)</sup>                   | 4.75 ... 45.00                       | dep. on $V_o$          | 7000                                      | Adj. (max. 9-times of $V_s$ )  |                         | 4               | 100 ... 500                                     | ●      |               |                 |          |               | SSOP-14 EP  |

[www.infineon.com/optireg-switcher](http://www.infineon.com/optireg-switcher)

- 1) Different voltage reset hysteresis
- 2) LS-sense-booster

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

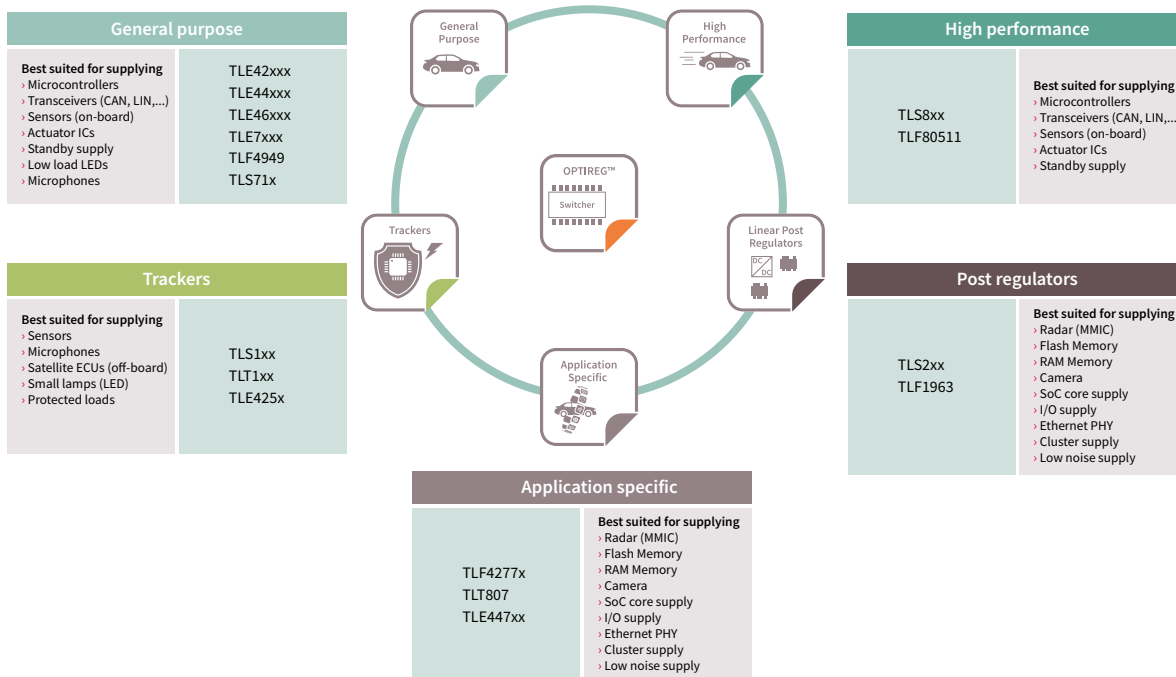


# OPTIREG™ linear voltage regulators

## Energy-efficient voltage regulators and trackers

Our linear voltage regulators and trackers help reduce energy consumption, extending operating time and minimizing operating costs across all systems. The wide supply voltage range, low quiescent current, rich protective feature set, and choice of packages make our devices the perfect fit across a broad application spectrum, apart from automation systems for health care, traffic, power tools, lighting, and many other multi-market systems. Our trackers are ideal as additional supplies for off-board loads to increase system reliability

### OPTIREG™ linear voltage regulators (selection tree)



## Features and benefits

### Key features

- Input voltage up to 60 V
- Output current up to 1.5 A
- Output voltage adjustable or fixed to specific values
- Quiescent current down to 5 µA
- Overload, overtemperature, short circuit, and reverse-polarity protection
- Low current consumption
- Extended temperature range -40°C ... +125°C

### Key benefits

- Pin-to-pin compatibility with industry-standard parts
- Very low dropout voltage trackers for optimized heat distribution and external protection
- Trackers for maximum system cost reduction
- Small robust packages

## Infinion's microcontroller families and industrial voltage regulators

| Microcontroller family | Input voltage [V]  | Input current (max.) [mA] | Voltage regulator                              |
|------------------------|--------------------|---------------------------|--|
| XMC1000 family         | 1.8 to 5.5         | <100                      | TLS810B1EJ, TLS810A1LD, TLE4266-2G, TLS820D3EL |
| XMC4000 family         | 3.3                | <500/300                  | TLF80511x, TLE42764D, TLS835D2EL, TLS850FxTA   |
| XC8xx                  | 3.3 to 5.0         | 200                       | TLS810A1LD, TLS810B1EJ, TLE42764D, TLE4296-2G  |
| XE166/XC2000           | 1.5 and 3.3 or 5.0 | 100                       | TLS810A1LD, TLS810B1EJ, TLE42764D, TLE4296-2G  |
| TriCore™               | 1.5 to 3.3         | >400                      | TLF80511TF/EJ/TC, TLE42764D, TLS850FxTA        |

[www.infineon.com/optireg-linear](http://www.infineon.com/optireg-linear)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# XDPP1100

## The smallest digital power controller with PMBus interface

The XDPP1100 is Infineon's highly integrated and programmable digital power supply controller. This device offers advanced power control solution for 48 V DC-DC power applications with isolated topologies. The XDPP1100 device features many optimized power-processing blocks and pre-programmed peripherals to enhance the performance of isolated DC-DC converters, reduce external components, and minimize firmware development effort. The controller also provides an accurate telemetry and power management bus (PMBus 1.3) interface for system communication, advance power conversion, and monitoring. Integrated current sensing capability and compact chip size (24-pin 4 mm<sup>2</sup>) can greatly reduce the solution size by eliminating various external components. A combination of high-performance AFE, state machine-based digital control loop, and an Arm® Cortex®-M0 integrated into a single chip makes the XDPP1100 a highly integrated, fully programmable, and fastest time-to-market technology for modern high-end power systems employed in telecom infrastructure, 48 V server motherboards, data center and industrial 4.0 applications.

### The XDPP1100 device can be configured to support different DCDC topologies including:

- Hard-switched full-bridge and half-bridge
- Phase shifted full-bridge
- Active clamp forward
- Interleaved FB, HB, and ACF
- Current-doubler
- Pre-buck or post-buck configuration

Infineon offers support tools such as a complementary graphical user interface (GUI) that allows customers to configure and monitor key parameters. In addition, developers have full control of their application and FW development process with commonly used Arm® based compilers.

### Typical applications

- Isolated DC-DC brick modules
- Telecom radio power
- 48 V point of loads
- Non-isolated buck boost converters
- 48 V server motherboard

### Features and benefits

| Key features  | Key benefits  |
|---|---|
| – State machine based digital control for up to 2 independent voltage loops                                   | – Ease of use thanks to firmware-based system configuration with GUI support              |
| – Configurable feedback control   | – User-specific customization and software-based design changes                           |
| – Arm® Cortex®-M0 processor   | – Enhanced control and excellent dynamic transient performance                            |
| – Up to 16 configurable GPIOs   | – Sophisticated system level fault handling   |
| – Up to 12 high resolution digital modulated PWM outputs  | – System housekeeping i.e., fan control, LED control, sequencing, with configurable GPIOs |
| – Input voltage feed-forward control scheme   | – High efficiency at light-load management  |
| – 3 high-speed voltage sense ADCs: 50 MHz 11-bit ADC with set point accuracy within ±1% overtemperature range |   |
| – 2 current sense ADCs: 25 MHz, 9-bit with 100 µV and 1.45 mV LSB   |   |
| – Communication: 1 MHz I <sup>2</sup> C/PMBus,  |   |
| – Operating temperature from -40° to 125°C  |   |

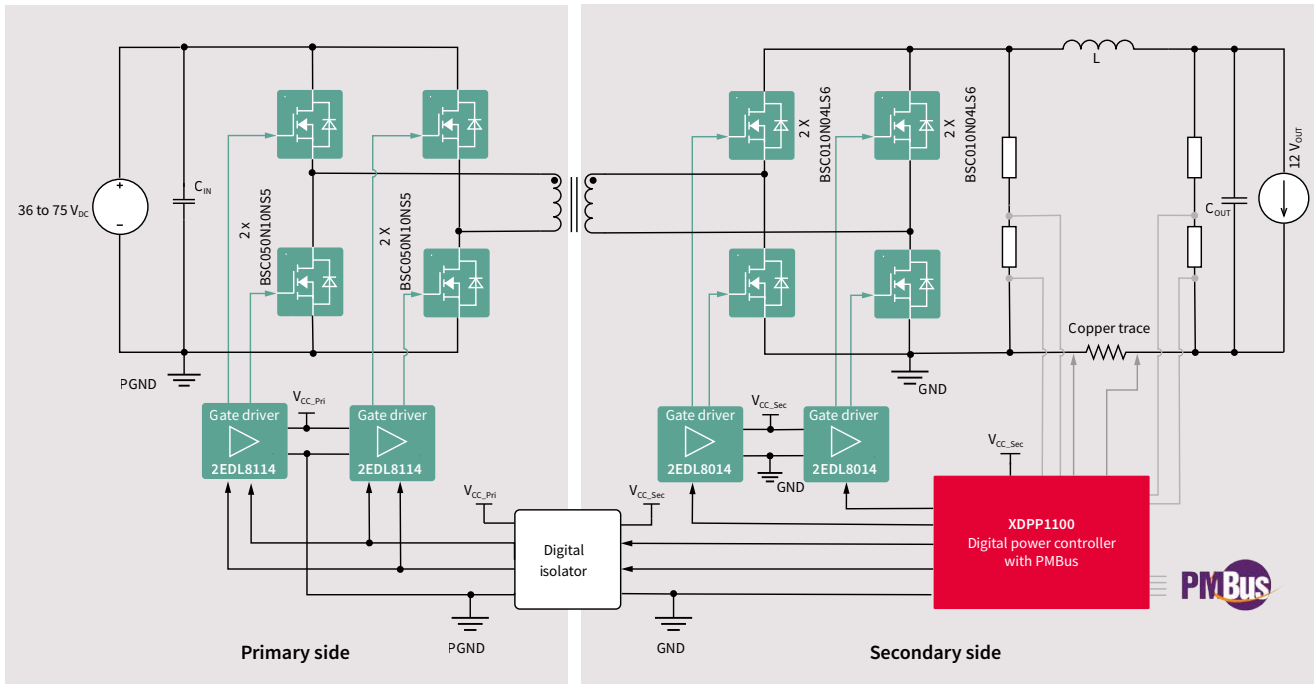
[www.infineon.com/xdpp1100](http://www.infineon.com/xdpp1100)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

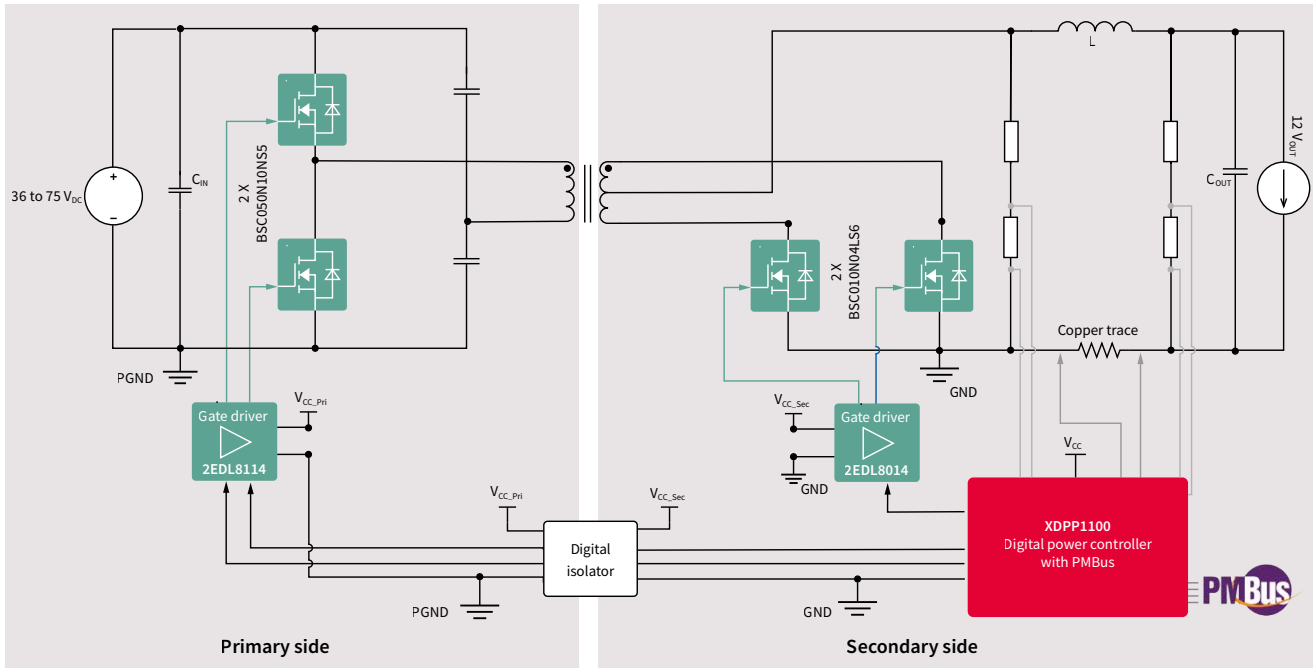




### XDPP1100 implementation in 48 to 12 V full-bridge isolated DC-DC converter



### XDPP1100 implementation in 48 V to 12 V full-bridge isolated DC-DC converter



The XDPP1100 device is offered in two packages

| VQFN 24-pin | VQFN 40-pin |
|-------------|-------------|
| 4 x 4 mm    | 6 x 6 mm    |
| 6 PWM       | 12 PWM      |
| Single loop | Dual loop   |



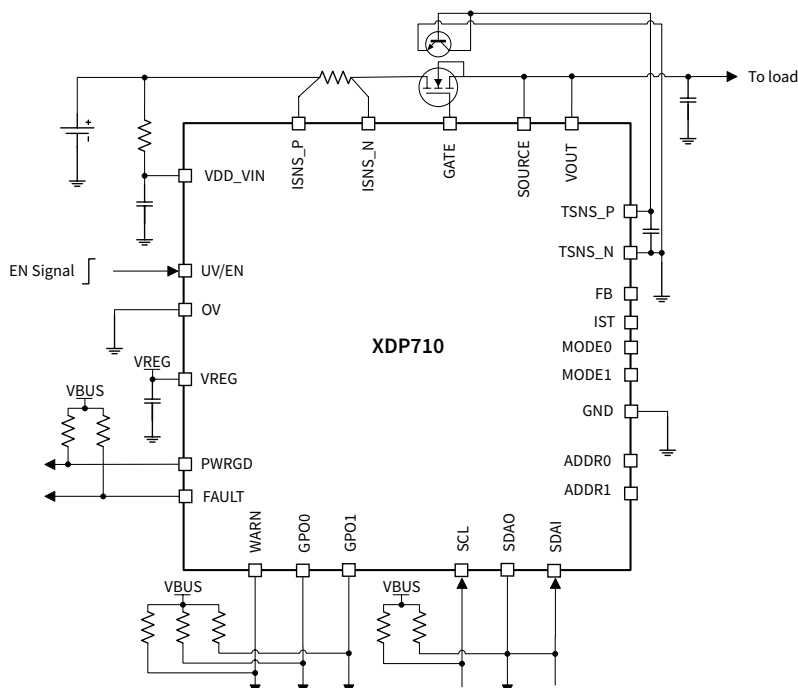
# XDP™ XDP710

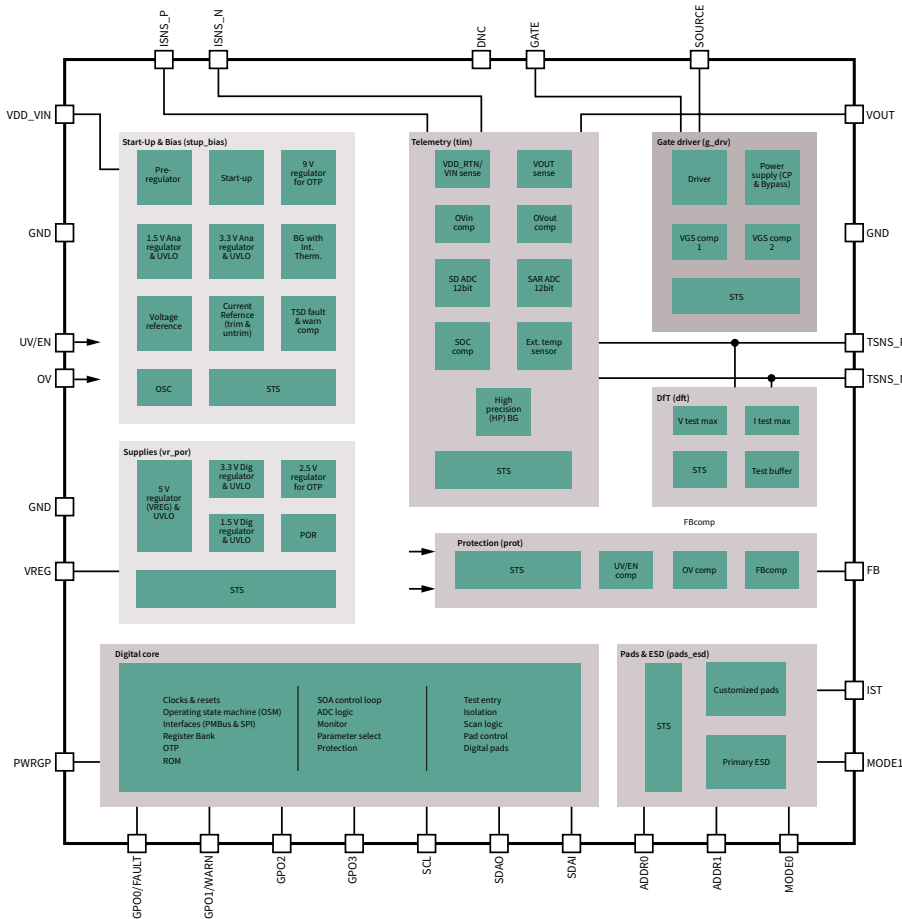
## 5.5 - 80 V hot swap controller with a programmable digital SOA

The XDP™ XDP710 is a wide input voltage hot-swap and system monitoring controller IC that drives a single or multiple parallel N-Channel MOSFETs. In addition to a controlled turn ON, XDP710 provides continuous system health monitoring and communication to the main MCU via PMBus interface. The high-speed communication through PMBus allows system designers to disable the downstream sub-systems fully or partially. It incorporates an extensive variety of system protections for safety operation and generates various protection responses depending on the severity of the incident. Latch off, reset, system shutdown, and retry are some examples of response types. Its SOA protection effectively ensures that the system FET always operates under safe condition.

### Features

- | Key features   |
|--|
| - Compatible with Infineon's OptiMOS™  |
| - Compatible with Infineon's Linear FET wide input voltage range: 5.5 to 80 V transient withstand: up to 100 V for 500 ms                              |
| - Option of external FET selection using resistor strapping  |
| - Boost mode   |
| - Dedicated current and voltage ADCs: 12-bit programmable and pre-set FET active SOA protection  |
| - Advanced closed-loop SOA control and the fully digital operating mode  |
| - Analog-Assisted Digital Mode for support of legacy systems   |
| - Integrated gate driver and charge pump for external N-Channel MOSFET configurable fast FET's shut down: two step turn-off or 1.5 A pull-down current |
| - PMBus interface: 1 MHz   |
| - Precision input and output voltage monitoring and reporting: ≤ 1% precision FET's current monitoring and reporting: ≤ 1%                             |
| - Precision input power monitoring and reporting: ≤ 2%   |
| - Energy monitoring and reporting  |
| - Programmable input OV and UV protections   |
| - Support for external temperature sensor and OT protection  |
| - Sequential turn-on capability  |
| - 29-lead (6 mm x 6 mm) VQFN package   |
| - -40° to 125°C junction temperature   |





### Key features

- Digital configuration reduces external components
- Analog-Assisted Digital Mode for support of legacy systems
- Multiple SOA configuration profiles in NVM reduces design time
- Input transient and MOSFET SOA protection enables the use of smaller FETs
- Small package

### Potential applications

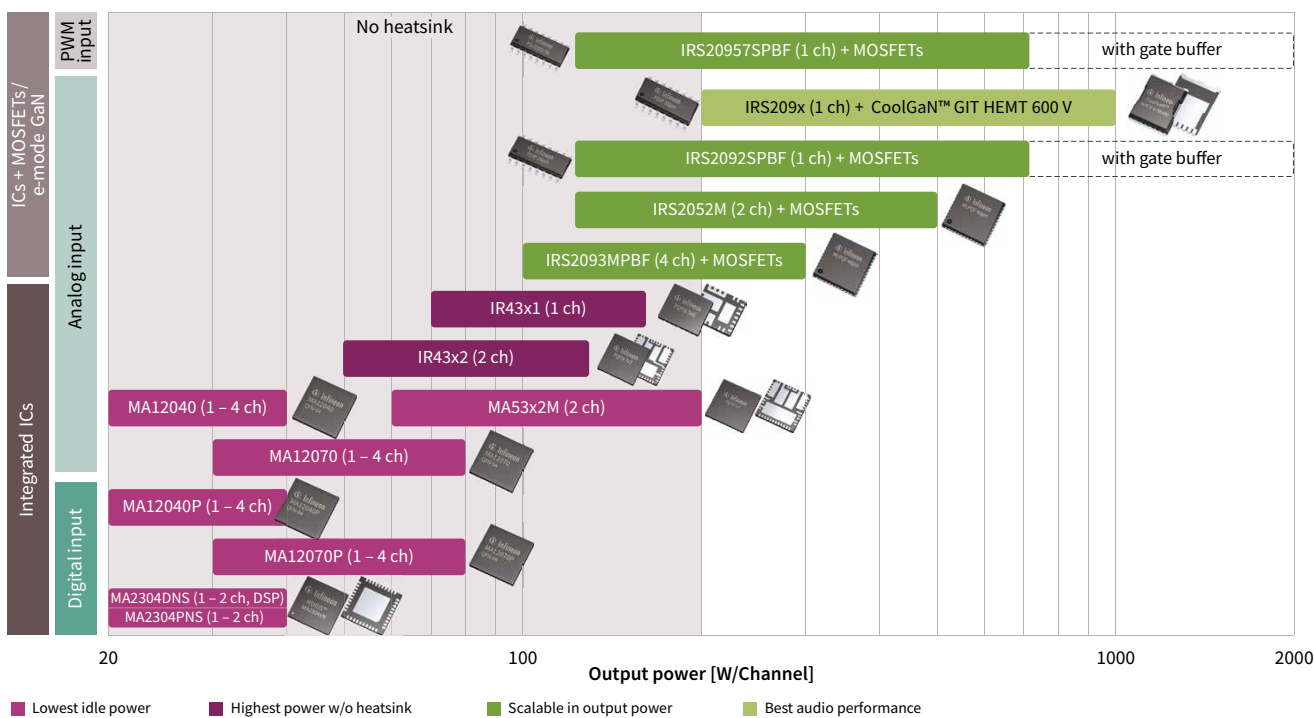
- AI, ML, GPU accelerator cards
- Network router and switches
- Intelligent e-fuse
- Power distribution systems
- 24 to 48 V Industrial system



# Integrated class D audio amplifier ICs

## Cooler, smaller, and lighter class D audio amplifiers for great sounding products

Infiniteon's MERUS™ audio solutions enable audio designers to improve the performance of their products while increasing efficiency and reducing solution size. Advances in semiconductor processes, in combination with new innovative architectures, are behind a portfolio of class D technologies that allow professional, commercial/home and portable audio applications to benefit from the unparalleled performance, power density, and reliability. The broad portfolio covers power ranges from 20 W to 2 kW per channel, from the smallest single-chip devices and multi-chip modules (MCMs) to highly scalable discrete audio amplifier solutions consisting of powerful MOSFET/CoolGa™ GIT HEMT and driver ICs combinations.



By combining our core principles, competencies, and leadership in groundbreaking power semiconductors with revolutionary audio amplifier technologies, such as MERUS™, we provide solutions that are smaller, lighter, more robust and flexible, running with less heat dissipation. In addition to outstanding quality and reliability, Infineon's amplifier solutions are designed to maximize power efficiency and dynamic range while providing best-in-class performance in product form factors that make them an optimal fit for any high-end application. These include portable/battery-powered applications, voice controlled active speakers, television sets, stereo HiFi, soundbars, monitors, power over ethernet (PoE), and multichannel systems.

### Design with Infineon's solutions to benefit from:

-   
 Exceptional audio performance
-   
 Maximized power efficiency
-   
 Maximized output power
-   
 Design freedom
-   
 Fast time to market

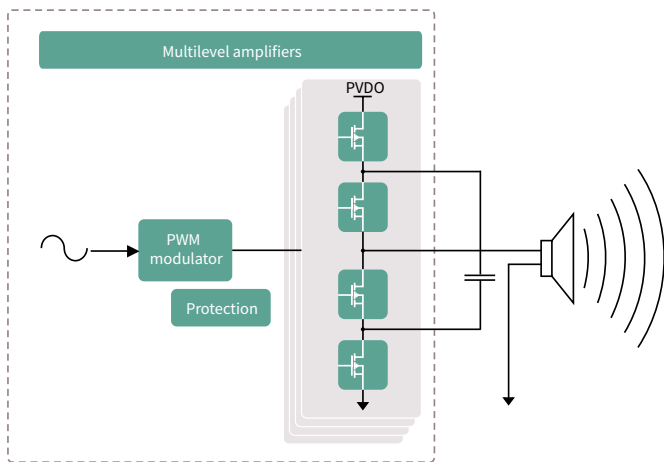


# Integrated MERUS™ multilevel amplifier ICs for class D audio solutions

## High power efficiency and density in small packages

With its revolutionary MERUS™ integrated multilevel class D audio amplifier ICs, Infineon is leading in efficiency and power density. Compared to traditional class D amplifier ICs, which produce only two voltage output levels, multilevel amplifier ICs use additional on-chip MOSFETs and capacitors to produce outputs with a higher signal granularity, i.e., higher switching frequencies and/or multiple output signal levels – typically up to five voltage levels

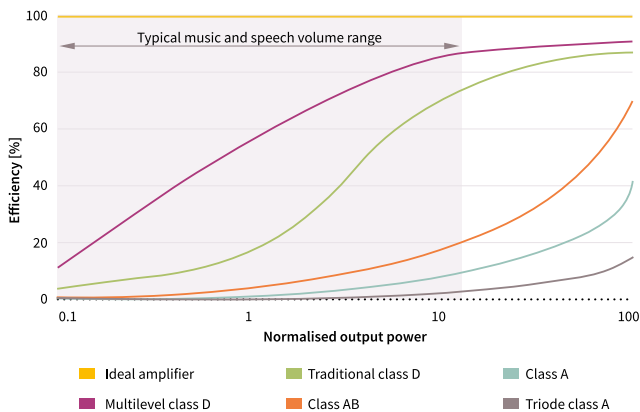
Filterless topology with “flying capacitor” of an integrated class D IC



### Features and benefits

| Key features                        | Key benefits  |
|-------------------------------------|---|
| – Multilevel switching technology   | – Highest efficiency and power density                |
| – Scalable signal “granularity”     | – Potential LC filter removal                         |
| – Proprietary circuits architecture | – Low THD+N   |
|                                     | – Cooler operation                                    |
|                                     | – Low power loss                                      |
|                                     | – Virtually no switching loss measurable in idle mode |

### Efficiency where it matters for audio reproduction



For MERUS™ integrated multilevel audio amplifier ICs, amplifier efficiency at average output power is key. As the graph on the left shows, MERUS™ multilevel amplifier is much more effective than the traditional class D amplifier, which translates into less power consumption in AC input and in battery-powered audio applications.

[www.infineon.com/merus](http://www.infineon.com/merus)



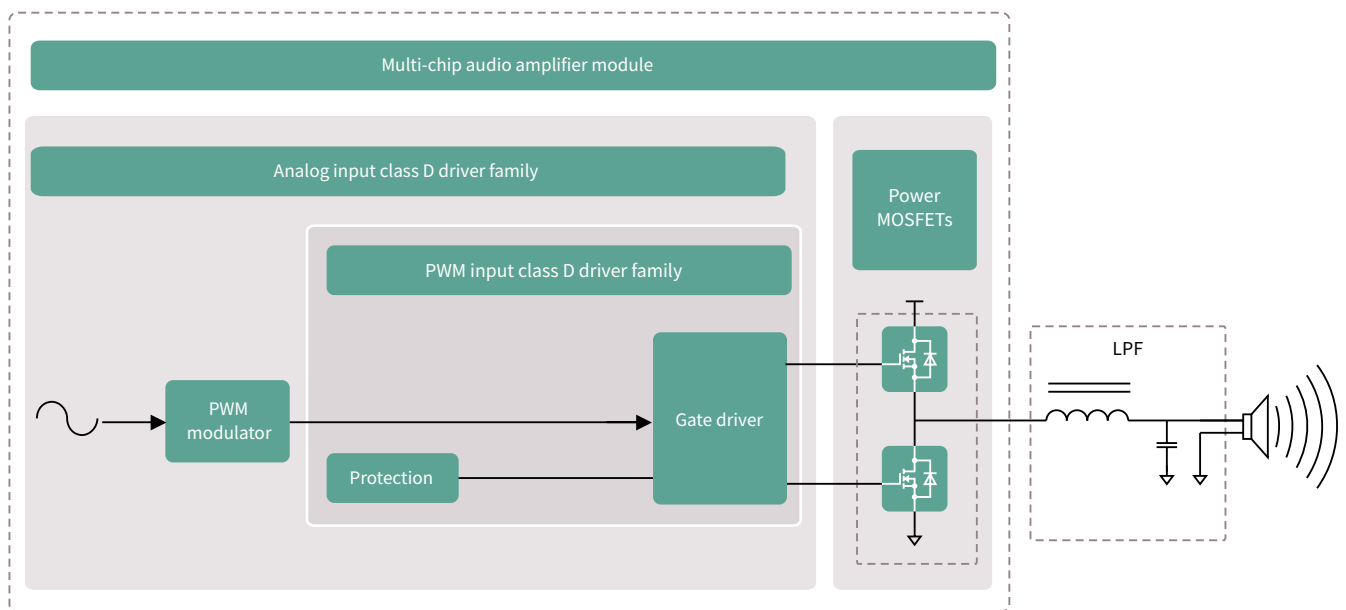
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

# MERUS™ integrated audio amplifier multi-chip modules (MCM)

Integrated components for scalable output power and superb audio performance

Multi-chip modules integrate PWM controller and power MOSFETs in a single package to offer a highly efficient, compact solution that reduces component count, shrinks PCB size up to 70 percent, and simplifies class D amplifier design.

## Multi-chip audio amplifier module



## Features and benefits

### Key features

- Single package with integrated PWM controller and audio-performance-optimized power MOSFET
- Overcurrent protection
- Thermal shutdown
- Floating differential input
- Clip detection
- Best-in-class power efficiency and audio performance
- Lower component count, leading to design simplification
- Compatible with single supply or split rail configuration
- Click noise reduction

### Key benefits

- Extended battery playback time
- Unrivalled audio performance
- Smaller solution size (BOM reduction, system level cost savings)
- Eliminated need for heatsink
- High noise immunity
- Reliable operation
- Thermal efficiency

[www.infineon.com/merus](http://www.infineon.com/merus)



Audio amplifier



Wireless audio



Audio



PoE



Audio

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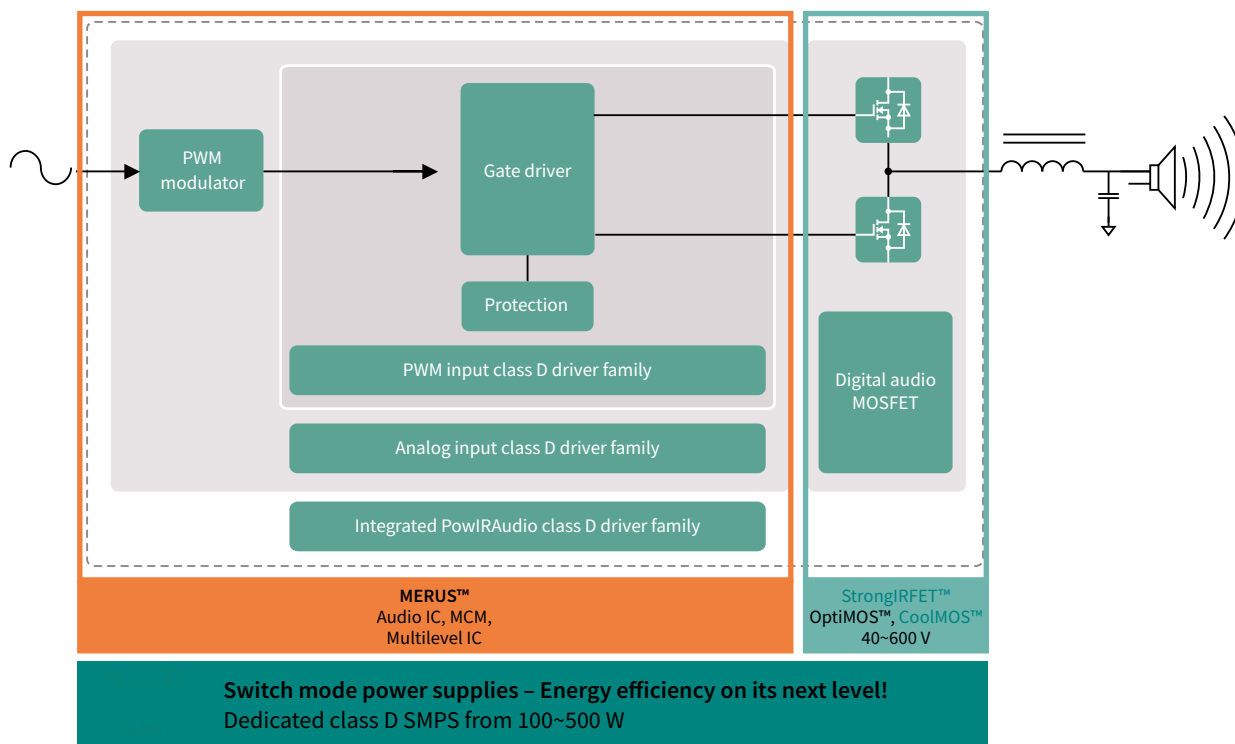


# Discrete MERUS™ audio amplifier driver ICs with MOSFET and gallium nitride CoolGaN™ GIT HEMT 400 V

## Scalable output power with a unified design platform

Infinion's discrete audio solutions are scalable to various output power levels, simply by replacing the external MOSFETs or CoolGaN™ GIT HEMTs of the driver-transistor combinations. Key parameters for the transistors used in discrete class D audio applications include on-state resistance ( $R_{DS(on)}$ ), gate charge ( $Q_G$ ), and reverse recovery charge ( $Q_{rr}$ ). Our products are specifically suitable for class D audio applications and optimized for these parameters to achieve maximized efficiency, THD, and EMI amplifier performance. The CoolGaN™ GIT HEMT 400 V portfolio is specifically built for class D audio requirements, with high-performing SMD packages to fully utilize the benefits of gallium nitride.

### Audio solution overview



### Features and benefits

#### Key benefits

- Unified design platform
- Scalable output power up to over 2 kW per channel
- Simple yet effective - exchange of external MOSFET triggers alteration in output power level
- Best-in-class power efficiency

#### Key advantages

- Superior audio performance
- Increased reliability
- Unique audio experience

[www.infineon.com/merus](http://www.infineon.com/merus)  
[www.infineon.com/gan](http://www.infineon.com/gan)



Audio amplifier



Wireless audio



Audio



PoE



Audio

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# Integrated class D audio amplifier IC portfolio

## MERUS™ Gen2 integrated multilevel audio amplifier IC product portfolio

|                          |  | MA2304DNS   | MA2304PNS            |
|--------------------------|--|---|----------------------|
| Specifications           | Number of audio channels   | 2xBTL   |                      |
|                          | Max. peak power at 4 Ω 10% THD                                   | 2x37 W  |                      |
|                          | Supply voltage   | 10-20 V   |                      |
|                          | 3-level and 5-level modulation                                   | √   | √                    |
|                          | Selectable power mode profiles:                                  | Low power consumption (LPC) or high audio performance (HAP) |                      |
|                          | Audio input  | Digital   |                      |
|                          | HiRes audio compliant  | I2S/TDM   |                      |
|                          | Integrated DSP   | √   |                      |
|                          | Volume and dynamic range control                                 | √   | √                    |
|                          | Idle power dissipation<br>Max. output and all channels switching | 52 mW (LPC mode)  |                      |
| Audio performance (PMP2) | 106 dB DNR 52 μV <sub>RMS</sub> output noise <0.03% THD+N        |   |                      |
| Features                 | Sample rates   | 32, 44.1, 48, 88.2, 96, 176.4, 192 kHz                      |                      |
|                          | Comprehensive protection scheme*                                 | √   | √                    |
|                          | Configurable for SE or PBTTL operation                           | √   | √                    |
|                          | I <sup>2</sup> C communication                                   | √   | √                    |
|                          | Filterless implementation  | √   | √                    |
|                          | Package type   | 40-pin QFN package with exposed thermal pad                 |                      |
|                          | Evaluation boards  | EVAL_AUDIO_MA2304DNS  | EVAL_AUDIO_MA2304PNS |

\*All ICs carry a full protection scheme comprising undervoltage lockout, overtemperature warning/error, short circuit/overload protection, power stage pin-to-pin short circuit, error reporting through serial interface (I<sup>2</sup>C), and DC protection

## MERUS™ integrated audio amplifier multi-chip modules (MCMs)

|                   |                          | IR4301M          | IR4321M          | IR4311M                  | IR4302M          | IR4322M          | IR4312M                               | MA5332MS         |
|-------------------|--------------------------|------------------|------------------|--------------------------|------------------|------------------|---------------------------------------|------------------|
| Specifications    | Number of audio channels | 1                | 1                | 1                        | 2                | 2                | 2                                     | 2                |
|                   | Max. power per channel   | 160 W            | 90 W             | 45 W                     | 130 W            | 100 W            | 40 W                                  | 200 W            |
|                   | Supply voltage           | ~ ± 31 V or 62 V | ~ ± 25 V or 50 V | ~ ± 15 V or 30 V         | ~ ± 31 V or 62 V | ~ ± 25 V or 50 V | ~ ± 16 V or 32 V                      | ~ ± 40 V or 80 V |
|                   | Max. PWM frequency       | 500 kHz          | 500 kHz          | 500 kHz                  | 500 kHz          | 500 kHz          | 500 kHz                               | 500 kHz          |
| Features          | Differential audio input | √                | √                | √                        | √                | √                | √                                     | √                |
|                   | Overcurrent protection   | √                | √                | √                        | √                | √                | √                                     | √                |
|                   | Integrated power MOSFET  | √                | √                | √                        | √                | √                | √                                     | √                |
|                   | Voltage                  | 80 V             | 60 V             | 40 V                     | 80 V             | 60 V             | 40 V                                  | 100 V            |
|                   | PWM controller           | √                | √                | √                        | √                | √                | √                                     | √                |
|                   | Thermal shutdown         | √                | √                | √                        | √                | √                | √                                     | √                |
|                   | Click noise reduction    | √                | √                | √                        | √                | √                | √                                     | √                |
|                   | Clip detection           |                  |                  |                          | √                | √                | √                                     | √                |
|                   | Package type             | 5x6 mm QFN       | 5x6 mm QFN       | 5x6 mm QFN               | 7 x 7 mm QFN     | 7 x 7 mm QFN     | 7 x 7 mm QFN                          | 7 x 7 mm QFN     |
| Evaluation boards | IRAUDAMP12<br>IRAUDAMP19 | IRAUDAMP21       | IRAUDAMP15       | IRAUDAMP16<br>IRAUDAMP17 | IRAUDAMP22       | IRAUDAMP18       | EVAL_AUDAMP25<br>REF_<br>MA5332BTLSPS |                  |





## MERUS™ discrete audio amplifier driver IC product portfolio

| Specifications    | Number of audio channels | IRS20965S               | IRS20957SPBF                                       | IRS2092SPBF        | IRS2052M  | IRS2093MPBF | IRS2452AM |
|-------------------|--------------------------|-------------------------|--|--------------------|-----------|-------------|-----------|
|                   | Max. power per channel   | 500 W                   | 500 W  | 500 W              | 300 W     | 300 W       | 500 W     |
|                   | Supply voltage           | ± 100 V                 | ± 100 V  | ± 100 V            | ± 100 V   | ± 100 V     | ± 200 V   |
|                   | Gate sink/source current | 2.0/2.0 A               | 1.2/1.0 A  | 1.2/1.0 A          | 0.6/0.5 A | 0.6/0.5 A   | 0.6/0.5 A |
| Features          | Overcurrent protection   | ✓                       | ✓  | ✓                  | ✓         | ✓           | ✓         |
|                   | Overcurrent flag         | ✓                       |  |                    |           |             |           |
|                   | PWM input                | ✓                       | ✓  |                    |           |             |           |
|                   | Floating input           | ✓                       | ✓  | ✓                  | ✓         | ✓           | ✓         |
|                   | Dead time                |                         | ✓  | ✓                  | ✓         | ✓           | ✓         |
|                   | Protection control logic | ✓                       | ✓  | ✓                  | ✓         | ✓           | ✓         |
|                   | PWM controller           |                         |  | ✓                  | ✓         | ✓           | ✓         |
|                   | Clip detection           |                         |  |                    | ✓         |             |           |
|                   | Click noise reduction    |                         |  | ✓                  | ✓         | ✓           | ✓         |
|                   | Temperature sensor input |                         |  |                    | ✓         |             | ✓         |
|                   | Thermal shutdown         |                         |  |                    | ✓         |             |           |
|                   | Clock input              |                         |  |                    | ✓         |             | ✓         |
|                   | Package type             | 16-pin SOIC narrow      | 16-pin SOIC narrow                                 | 16-pin SOIC narrow | MLPQ48    | MLPQ48      | MLPQ32    |
| Evaluation boards |                          | IRAUDAMP4A<br>IRAUDAMP6 | IRAUDAMP5<br>IRAUDAMP7S<br>IRAUDAMP7D<br>IRAUDAMP9 | IRAUDAMP10         | IRAUDAMP8 | IRAUDAMP23  |           |

## Recommended MOSFET (through-hole) product portfolio

| Output power | Recommended discrete audio driver IC | Speaker resistance |              |                |
|--------------|--------------------------------------|--------------------|--------------|----------------|
|              |                                      | 2 Ω                | 4 Ω          | 8 Ω            |
| 150 W        | IRS2093MPBF                          | IRFB4019           | IRFB4019     | IRFI4020H-117P |
| 200 W        | IRS2052M                             | IRFB5615           | IRFB4019     | IRFI4020H-117P |
| 300 W        | IRS2092SPBF                          | IRFB4228PBF        | IRFB4227     | IRFB4229       |
| 500 W        | IRS20957SPBF                         | IRFB4228PBF        | IRFB4227     | IRFB4229       |
| 750 W        |                                      | IRFB4227           | IRFB4229     |                |
| 1000 W       |                                      | IRFP4668           | IRFB4229 x 2 |                |

IRS2093MPBF works up to 150 W and IRS2052M works up to 300 W.  
IRS2092SPBF and IRS20957SPBF work with all power levels listed above.

## Recommended MOSFET (DirectFET™) product portfolio

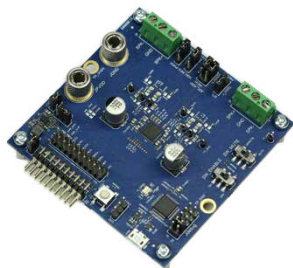
| Output power | Recommended discrete audio driver IC | Speaker resistance |          |          |
|--------------|--------------------------------------|--------------------|----------|----------|
|              |                                      | 2 Ω                | 4 Ω      | 8 Ω      |
| 150 W        | IRS2093MPBF                          | IRF6645            | IRF6665  | IRF6775M |
| 200 W        | IRS2052M                             | IRF6646            | IRF6775M | IRF6775M |
| 300 W        | IRS2092SPBF                          | IRF6644            | IRF6775M | IRF6785  |
| 500 W        | IRS20957SPBF                         | IRF6643            | IRF6641  |          |



# Recommended audio evaluation boards

Enabling fast time to market and device performance evaluation

## MERUS™ integrated multilevel audio amplifier IC evaluation boards



### EVAL\_AUDIO\_MA2304DNS\*

The demonstration board [EVAL\\_AUDIO\\_MA2304DNS](#) is an evaluation and demonstration board for MERUS™ audio [MA2304DNS](#). It contains a digital input and a variety of output and setup/selection features. It also contains an on-board power supply generator (selectable 1.8 or 3.3 V buck-converted) so only one external power supply (PVDD) is necessary. It can be controlled and programmed with its software GUI.

The board can be used for evaluating or demonstrating key features/advantages of the MERUS™ technology:

- Energy efficiency: power losses at typical audio listening levels/ultralow idle power consumption
- Adaptive power management system
- Minimum output filter components: significant cost and size reduction
- THD performance and audio quality
- Integrated MERUS™ DSP



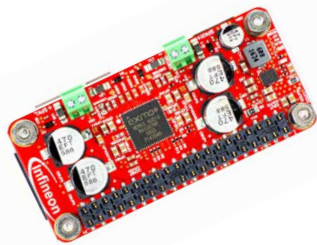
### EVAL\_AUDIO\_MA2304PNS\*

The demonstration board [EVAL\\_AUDIO\\_MA2304PNS](#) is an evaluation and demonstration board for MERUS™ audio [MA2304PNS](#). It contains a digital input and a variety of output and setup/selection features. It also contains an on-board power supply generator (selectable 1.8 or 3.3 V buck-converted) so only one external power supply (PVDD) is necessary. It can be controlled and programmed with its software GUI.

The board can be used for evaluating or demonstrating key features/advantages of the MERUS™ technology:

- Energy efficiency: power losses at typical audio listening levels/ultralow idle power consumption
- Adaptive power management system
- Minimum output filter components: significant cost and size reduction
- THD performance and audio quality
- Integrated volume and limiter processors



**KIT\_40W\_AMPHAT\_ZW**

Kit board - MERUS™ audio amplifier HAT ZW class D audio amplifier 40 W for Raspberry Pi Zero W featuring MA12070P

**Summary of features**

- Equipped with MERUS™ MA12070P proprietary multilevel amplifier
- Compatible with Raspberry Pi Zero and Raspberry Pi Zero wireless
- Power input: 5 V/2.5 A - sourced from the same single supply as the Raspberry Pi
- No need for external or extra power supplies
- Up to 40 W instantaneous peak output power with the Raspberry Pi official 5 V/2.5 A supply

**Benefits**

- Compatibility with major streaming applications for Raspberry Pi (Volumio, JustBoom Player, Max2Play)
- Up to 48 kHz of sample rate and 24-bit of music playback
- Full hardware control, customization, and error monitoring through Linux Alsa mixer

**Potential Applications**

- DIY on the go wireless speakers
- DIY intelligent home audio systems

**KIT\_ARDMKR\_AMP\_40W**

Kit board MA12070P audio amplifier - compatible with Arduino MKR boards

**Summary of features**

- Equipped with MERUS™ MA12070P proprietary multilevel amplifier
- Power input: 5 V/2.5 A - sourced from the same single USB-C power supply or battery pack
- No need for external or extra power supplies
- Up to 40 W instantaneous peak output power with a USB-C power supply or battery pack

**Benefits**

- Compatible with Arduino MKRZERO and MKR1000 WIFI
- Full hardware control and customization
- Error monitoring through Arduino programming framework

**EVAL\_AUDAMP25**

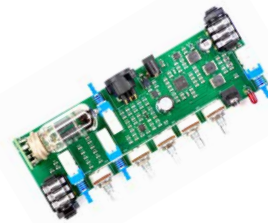
Number of audio channels: 2

Output power per channel [RMS]: 200 W

Featured class D IC: MA5332MS

Input: analog

OPN: EVALAUDAMP25TOBO1

**DEMO\_BASSAMP\_60W\_MA12070**

Reference design demoboard MERUS™ MA12070 as musical instrument bass amplifier

**Summary of features**

- 1 x 60 W at 4 Ω speaker output
- Powered by off-the-shelf regulated wall adapter
- 12AU7 vacuum-tube preamplifier
- Stereo 3.5 mm AUX input
- XLR D.I. output with ground lift switch
- Bright switch for slap-bass sound
- Low idle power consumption

**Benefits**

- Superior sound quality
- Modelled after classic bass amplifier topology
- Genuine vacuum-tube preamplifier
- Small size and scalable platform
- Excellent efficiency

**REF\_MA5332BTLSPS**

Number of audio channels: 1

Output power per channel [RMS]: 200 W

Featured class D IC: MA5332MS

Input: analog

OPN: REFMA5332BTLSPSTOBO1



## MERUS™ integrated audio amplifier multi-chip module (MCM) evaluation boards



### IRAUDAMP12

Number of audio channels: 2  
Output power per channel [RMS]: 130 W  
Featured class D IC: IR4301M  
Input: Analog  
OPN: IRAUDAMP12



### IRAUDAMP17

Number of audio channels: 2  
Output power per channel [RMS]: 100 W  
Featured class D IC: IR4302M  
Input: Analog  
OPN: IRAUDAMP17



### IRAUDAMP19

Number of audio channels: 2  
Output power per channel [RMS]: 100 W  
Featured class D IC: IR4301M  
Input: Analog  
OPN: IRAUDAMP19



### IRAUDAMP21

Number of audio channels: 2  
Output power per channel [RMS]: 135 W  
Featured class D IC: IR4321M  
Input: Analog  
OPN: IRAUDAMP21



### IRAUDAMP22

Number of audio channels: 2  
Output power per channel [RMS]: 100 W  
Featured class D IC: IR4322M  
Input: Analog  
OPN: IRAUDAMP22

## Discrete MERUS™ audio amplifier driver IC and MOSFET evaluation boards



### IRAUDAMP4A

Number of audio channels: 2  
Output power per channel [RMS]: 120 W  
Featured driver IC: IRS20957S  
Featured MOSFET: IRF6645TRPbF  
OPN: IRAUDAMP4A



### IRAUDAMP5

Number of audio channels: 2  
Output power per channel [RMS]: 120 W  
Featured driver IC: IRS2092S  
Featured MOSFET: IRF6645TRPbF  
OPN: IRAUDAMP5



### IRAUDAMP6

Number of audio channels: 2  
Output power per channel [RMS]: 250 W  
Featured driver IC: IRS20957S  
Featured MOSFET: IRF6785MTRPbF  
OPN: IRAUDAMP6



### IRAUDAMP7S

Number of audio channels: 2  
Output power per channel [RMS]: 500 W  
Featured driver IC: IR-S2452AM  
Featured MOSFET: IRFI4019H-117P  
OPN: IRAUDAMP7S



### IRAUDAMP9

Number of audio channels: 1  
Output power per channel [RMS]: 1700 W  
Featured driver IC: IRS2092S  
Featured MOSFET: IRFB4227PbF  
OPN: IRAUDAMP9



### IRAUDAMP10

Number of audio channels: 2  
Output power per channel [RMS]: 370 W  
Featured driver IC: IRS2052M  
Featured MOSFET: IRF6775MTRPbF  
OPN: IRAUDAMP10



### IRAUDAMP23

Number of audio channels: 2  
Output power per channel [RMS]: 500 W  
Featured driver IC: IRS2452AM  
Featured MOSFET: IPP60R180C7  
OPN: IRAUDAMP23

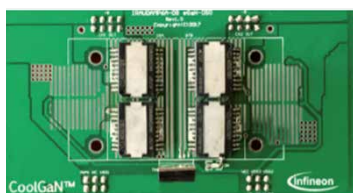
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## Discrete audio amplifier driver IC and CoolGaN™ GIT HEMT 400 V evaluation board



### EVAL\_AUDAMP24

Number of audio channels: 2  
 Output power per channel [RMS]: 300 W at 1%  
 Featured driver IC: IRS20957S  
 Featured HEMT:  
 IGOT40R070D1  
 IGT40R070D1  
 OPN: EVAL\_AUDAMP24

## Power supply units for audio evaluation boards



### IRAUDPS1

Input voltage: 12 V<sub>DC</sub>  
 Output voltage: ± 35 V  
 Output power per channel [RMS]: 100 W  
 Featured driver IC: IR2085  
 Description: 250-1000 W scalable audio power supply  
 OPN: IRAUDPS1



### IRAUDPS3

Input voltage: 110/220 V<sub>AC</sub>  
 Output voltage: ± 30 V  
 Output power per channel [RMS]: 200 W  
 Featured driver IC: IRS27952S  
 Description: Power supply for class D audio amplifier  
 OPN: IRAUDPS3

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# AC-DC LED driver ICs

## Digital and mixed-signal, single- and dual-stage high-voltage control ICs for LED drivers

### **XDP™ digital power – digital single- and dual-stage flyback combo controllers**

The XDP™ portfolio of high-performance digital power control ICs addresses today's challenges, such as smart or connected lighting, meeting demanding LED driver requirements with unique features.

### **Mixed-signal control ICs for solid-state lighting luminaires**

Infineon's mixed-signal control ICs for LED drivers deliver excellent power quality and high efficiency for LED lighting applications supporting dimming levels down to 1 percent. The integration of advanced functions saves external components and minimizes system cost. The wide variety of features and functions gives the option to choose the best fitting part for the application.

[www.infineon.com/offline-led-driver](http://www.infineon.com/offline-led-driver)



LEDs  
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LED



Lighting

Packages

Sensors

WBG semiconductors

Power management ICs

USB-C controllers and peripherals

Microcontrollers

Intelligent power switches and modules

IGBT discretes and silicon power diodes

Digital isolators

Gate-driver ICs

500-950 V MOSFETs

15-300 V MOSFETs

Applications

Solutions

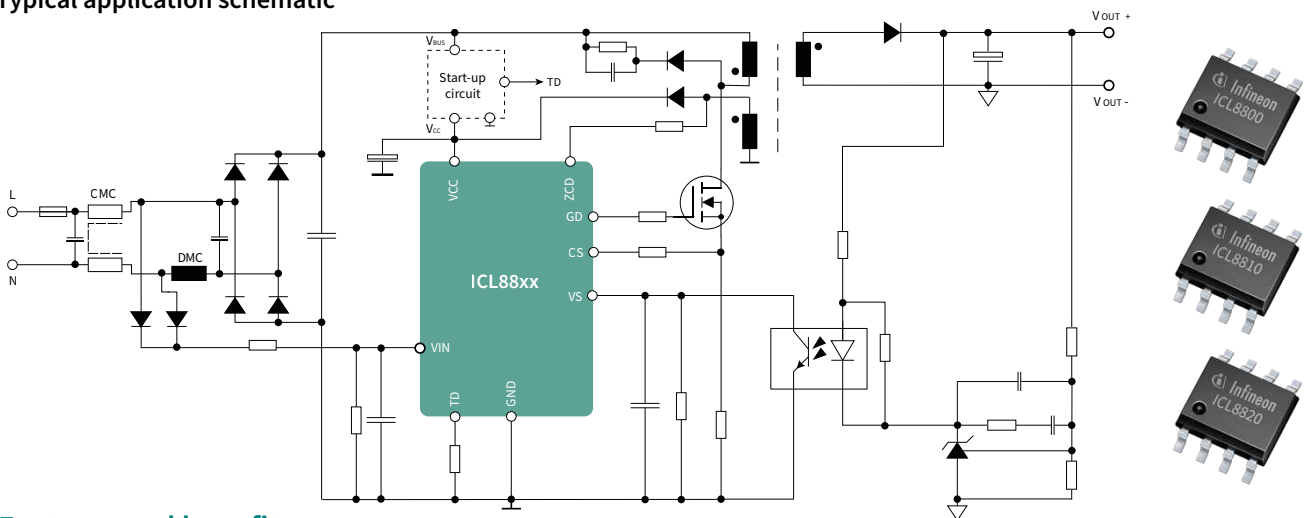
# ICL8800/ICL8810/ICL8820

## Single-stage flyback LED controllers for constant voltage output

The ICL88xx family of single-stage flyback controllers for constant voltage output is tailored for LED lighting applications to meet the required performance cost-effectively. All three ICs offer benchmarking performance for power factor correction and total harmonic distortion at full-load and at low-load conditions. Their comprehensive set of protection features (compare table below) and bottom-up design make them easy to design and require a minimum number of external components. The controllers are optimized as secondary-side regulated (SSR) constant voltage (CV) output flyback controllers and are also well suited for primary-side regulation (PSR).

Additionally, the controllers' low standby power due to the integrated BM (in **ICL8810**, **ICL8820**) is ideally suited for smart lighting systems' requirements. The jitter function (in **ICL8820**) eases the design of emergency lighting LED drivers without additional circuitry. It fulfills EMI requirements in DC operation and improves the EMI performance.

### Typical application schematic



### Features and benefits

#### Key benefits

- Optimized for SSR CV output flyback operation, additionally suited for PSR
- PF > 0.9 and THD < 10% across a wide load range (AC input up to 277 V<sub>RMS</sub>)
- CCM and QRM with smart valley hopping
- **ICL8810** also contains burst mode (BM) to ensure low standby power (< 100 mW)
- **ICL8820** also contains built-in jitter function

#### Key advantages

- Low BOM for wide range of applications with PFC functionality where dual-stage topologies are required
- Enables platform design and window drivers
- Optimum efficiency and low EMI at low BOM without compromising light quality
- **ICL8810 enables in addition:** smart lighting in connection with microcontrollers (standby power < 500mW, i.e., more power budget for additional components)
- **ICL8820 enables in addition:** Fulfillment complying with EMI regulations in DC operation at low cost and effort

### Order information for ICL88xx

| Board name              | Description  | Ordering code       |
|-------------------------|--|---------------------|
| ICL8800                 | Single-stage flyback controller for constant voltage output  | ICL8800XUMA1        |
| REF_ICL8800_LED_43W*    | Demoboard with <b>ICL8800</b>  | REFICL8800LED43W    |
| ICL8810                 | Single-stage flyback controller for constant voltage output with low standby power                     | ICL8810XUMA1        |
| REF_ICL8810_LED_43W_BM* | Demoboard with <b>ICL8810</b> with burst mode  | REFICL8810LED43WBM  |
| REF_ICL8810_LED_42W_PSR | Demoboard with <b>ICL8810</b> for primary side regulation  | REFICL8810LED42WPSR |
| ICL8820                 | Single-stage flyback controller for constant voltage output with low standby power and jitter function | ICL8820XUMA1        |
| REF_ICL8820_LED_43W_JT* | Demoboard with <b>ICL8820</b> with jitter function   | REFICL8820LED43WJT  |

[www.infineon.com/offline-led-driver](http://www.infineon.com/offline-led-driver)

\*See Plug & LEDs play, ideally to be combined with secondary-side boards



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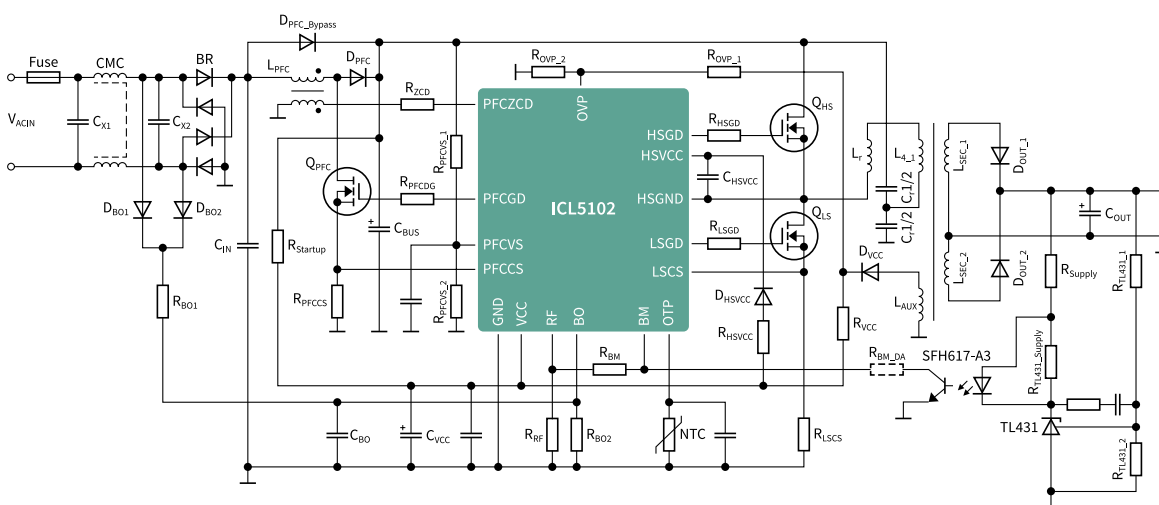


# ICL5102

## High-performance PFC + resonant controller for LCC and LLC

With **ICL5102**, Infineon offers a highly integrated combo controller IC with a universal input of 70 V to 325 V. This allows manufacturers to realize global designs, keeping the cost for product variety and stock low. The highest efficiency of up to 94 percent by resonant topology, a THD factor less than 3.5 percent, and a high power factor of more than 0.95 allow for more lumen output and less thermal load, enabling cost-effective designs and keeping the cost for LEDs and heat sink low. Thanks to the high integration, there is no need for additional expensive components in PFC and LLC stage, reducing the overall BOM cost. In addition, integrated protection features complement the **ICL5102** features.

### Typical application schematic



### Features and benefits

#### Key features and benefits

##### – Small form factor LED driver and low BOM

The high level of integration assures a low count of external components, enabling small form factor designs and making them ideal for compact and slimline power supplies for lighting, such as LED driver for indoor and outdoor applications

##### – High performance, digital PFC, and advanced HB driver

The high-performance digital PFC stage achieves power factor of 99 percent, through operation in CrCM and DCM mode, in a frequency range of 22 to 500 kHz. This supports stable operation even at low-load conditions down to 0.1 percent of the nominal power without audible noise

##### – Fast time-to-light and low standby

With a start-up current of less than 100  $\mu$ A the controller provides very fast time-to-light within less than 300 ms, while in standby the controller changes into active burst mode which reduces power consumption to less than 300 mW

##### – Safety first

The controller has a comprehensive set of protection features built in to increase the system safety. In run mode it monitors the complete system regarding bus over- and undervoltage, open loop, overcurrent of PFC and/or inverter, output overvoltage, overtemperature, and capacitive load operation



### Order information for ICL5102

| Type                   | Description  | Ordering code          |
|------------------------|--|------------------------|
| ICL5102                | PFC and resonant controller for LCC and LLC  | ICL5102XUMA2           |
| REF-ICL5102-U130W-CC   | PFC/LLC-CC constant current evaluation board 130 W LED driver                              | REFICL5102U130WCCTOBO1 |
| REF-ICL5102-U52W-CC    | Low-cost PFC/LCC reference design 52 W LED driver, non-dimmable                            | REFICL5102U52WCCTOBO1  |
| REF_ICL5102_U100W_LCC  | Low-cost PFC/LCC reference design 100 W, dimmable  | REFICL5102U100WLCC     |
| REF_LLC_BUCK_4CH_320W* | Scalable 320 W multichannel high-power LED driver (using ICL5102 board and ILD8150E board) | REFLLCBUCK4CH320WTOBO1 |

[www.infineon.com/icl5102](http://www.infineon.com/icl5102)

\*See Plug & LEDs play, ideally to be combined with secondary-side boards



LEDs  
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Smart city  
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Lighting

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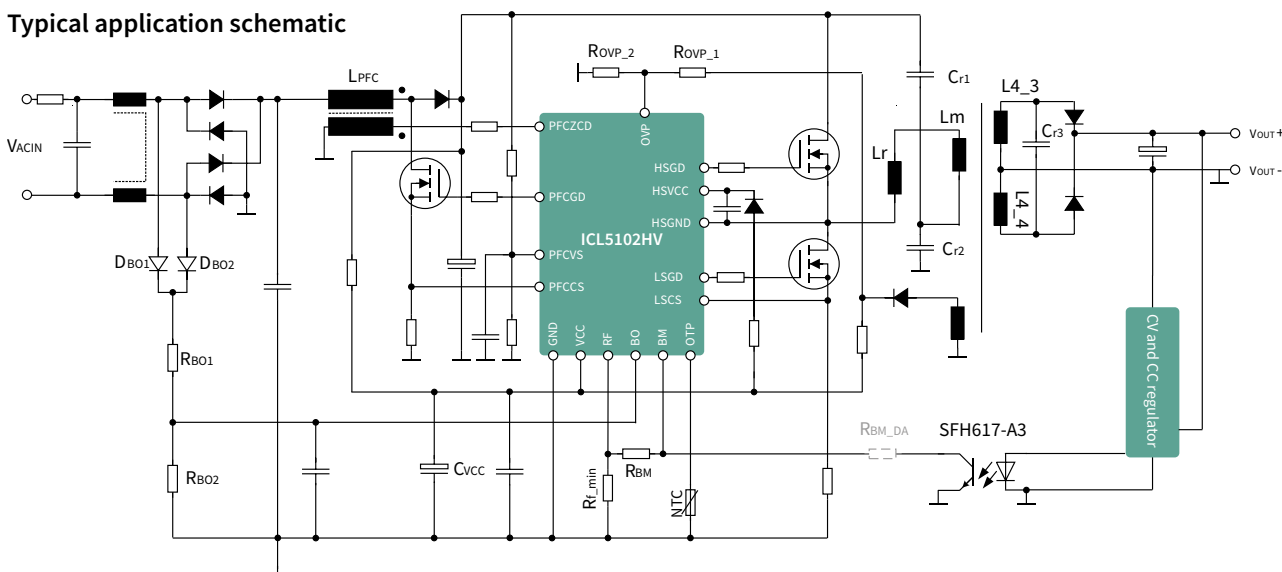


# ICL5102HV

## High-performance PFC + resonant controller for LCC and LLC, supporting 980 V high side

**ICL5102HV** control IC for LED drivers offers a unique one-package solution for lighting applications up to 350 W, supporting LLC/LCC topology. It is particularly designed to deliver best performance of total harmonic distortions (THD) and power factor (PF). Compared to level-shifter technology, the integrated coreless transformer not only further reduces the loss at high operation frequency, but also enhances the capability of handling a huge negative voltage (-600 V on HSGND). Reduce the number of external components to optimize the form factor and reduce the bill of materials (BOM) with the integrated two-stage combination controller (PFC + LLC/LCC) for lighting applications. Simplify your design and shorten time-to-market.

### Typical application schematic



### Features and benefits

#### Key features and benefits

- **Small form factor LED driver and low BOM**  
The high level of integration assures a low count of external components, enabling small form factor designs and making them ideal for compact and slimline power supplies for lighting, such as LED driver for indoor and outdoor applications
- **High performance, digital PFC, and advanced HB driver**  
The high-performance digital PFC stage achieves power factor of 99 percent, through operation in CrCM and DCM mode, in a frequency range of 22 to 500 kHz. This supports stable operation even at low-load conditions down to 0.1 percent of the nominal power without audible noise
- **Fast time-to-light and low standby**  
With a start-up current of less than 100  $\mu$ A the controller provides very fast time-to-light within less than 300 ms, while in standby the controller changes into active burst mode which reduces power consumption to less than 300 mW
- **Safety first**  
The controller has a comprehensive set of protection features built in to increase the system safety. In run mode it monitors the complete system regarding bus over- and undervoltage, open loop, overcurrent of PFC and/or inverter, output overvoltage, overtemperature, and capacitive load operation



### Order information for ICL5102HV

| Type                | Description                                   | Ordering code          |
|---------------------|---|------------------------|
| ICL5102HV           | PFC and resonant controller for LCC and LLC   | ICL5102HVXUMA1         |
| REF-ICL5102HV-U150W | PFC/LCC evaluation board 150 W, CC LED driver | REFICL5102HVU150WTOBO1 |

[www.infineon.com/icl5102hv](http://www.infineon.com/icl5102hv)



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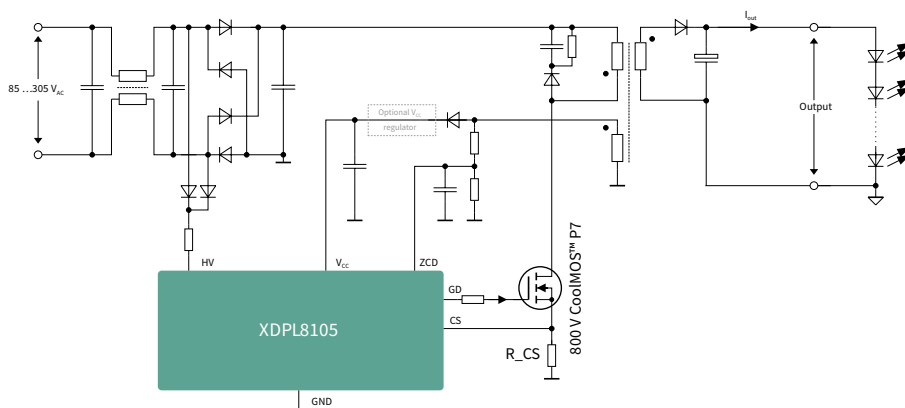
# XDP™ LED

The IC family XDP™ is the first all-in-one package solution combining a digital controller with key power peripherals. Such integration provides exceptional flexibility and performance. The XDP™ family addresses essential features for advanced LED driver.

## XDPL8105 – digital flyback controller IC for LED driver

The XDPL8105 is a digital, single-stage flyback controller with high power factor for constant current LED driver. The device offers versatile functions for different indoor and outdoor lighting applications. The IC is available in a DSO-8 package and provides a wide feature set, requiring a minimum of external components. The advanced control algorithms in the digital core of the XDPL8105 provide multimode operation for high efficiency. Configurable parameters allow last minute changes, shorten the product development time, and reduce hardware variants. The extensive set of configurable standard and sophisticated protection mechanisms ensure a safe, reliable, and robust LED driver device for diverse use cases.

### Typical application schematic



### Features and benefits

#### Key features and benefits

- Constant current with primary-side regulation
- Supports AC and DC input
- Nominal input voltage range 90-305 V<sub>AC</sub> or 120-350 V<sub>DC</sub>
- Integrated 600 V start-up cell
- Power factor > 0.9 and THD < 15 percent over wide load range
- Highly accurate primary-side control output current typ. ± 3 percent
- Reference board efficiency > 90 percent
- Internal temperature guard with adaptive thermal management
- Multimode operation
  - QRM (quasi-resonant mode)
  - DCM (discontinuous conduction mode)
  - ABM (active burst mode)
- Digital parameters
- Relevant error conditions are monitored and protected
  - Undervoltage
  - Overvoltage
  - Open load
  - Output shorted

### Order information for XDPL8105

| Type                | Description   | Ordering code          |
|---------------------|---|------------------------|
| XDPL8105            | Digital flyback constant current controller IC                        | XDPL8105XUMA1          |
| REF-XDPL8105-CDM10V | 40 W reference design with CDM10V isolated 0 V-10 V dimming interface | REFXDPL8105CDM10VTOB01 |



Lighting

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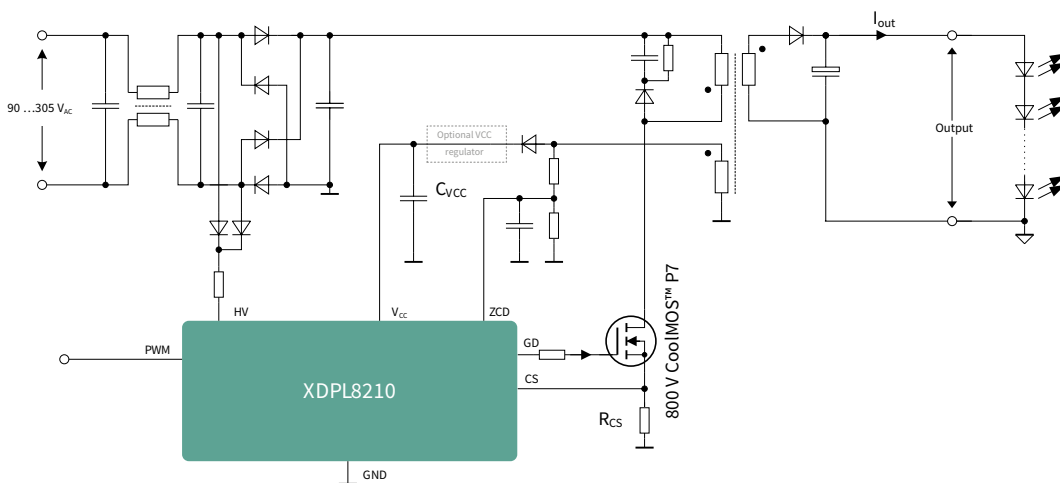
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## XDPL8210 – digital flyback constant current controller IC for LED driver with 1 percent dimming

The XDPL8210 is a digital, single-stage, quasi-resonant flyback controller with high power factor and high precision primary-side controlled constant current output. The IC is available in a DSO-8 package and provides a wide feature set, which requires only a small number of external components. Sophisticated algorithms provide flicker-free dimming below one percent. The driver fully supports IEC61000-3-2 class C designs. The limited power mode improves functional safety, while configurable parameters allow last minute changes, shorten the product development time, and reduce hardware variants. The extensive set of configurable standard and sophisticated protection mechanisms ensure a safe, reliable, and robust LED driver for a large set of use cases.

### Typical application schematic



### Features and benefits

#### Key features and benefits

- Constant current with primary-side regulation
- Supports AC and DC input
- Nominal input voltage range 90-305 V<sub>AC</sub> or 90-430 V<sub>DC</sub>
- Reference board efficiency > 90 percent
- Power factor > 0.9 and THD < 15 percent over wide load range
- Standby power < 100 mW
- Internal temperature guard with adaptive thermal management
- Multimode operation
  - QRM (quasi-resonant mode)
  - DCM (discontinuous conduction mode)
  - ABM (active burst mode)
- Digital parameters
- Relevant error conditions are monitored and protected
  - Undervoltage
  - Overvoltage
  - Open load
  - Output shorted



### Order information for XDPL8210

| Type              | Description   | Ordering code        |
|-------------------|---|----------------------|
| XDPL8210          | Digital flyback constant current controller IC                        | XDPL8210XUMA1        |
| REF-XDPL8210-U35W | 35 W reference design with CDM10V isolated 0 V-10 V dimming interface | REFXDPL8210U35WTOB01 |



Lighting

[www.infineon.com/xdpl8210](http://www.infineon.com/xdpl8210)

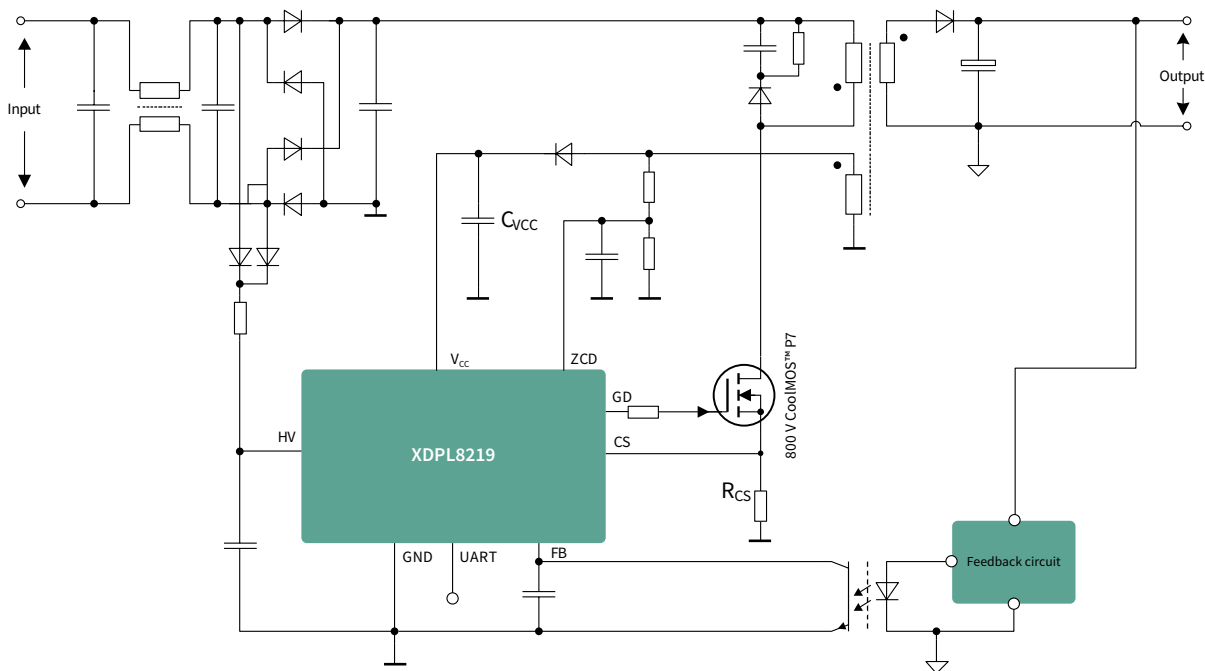
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## XDPL8219 – PFC/flyback controller with enhanced total harmonic distortion

The **XDPL8219** is a digital high-performance secondary-side regulated flyback controller with constant voltage output. With its high power factor, the controller is the perfect fit for cost-effective, dual-stage LED drivers and enables smart lighting applications. The device operates in quasi-resonant mode (QRM) to maximize the efficiency and minimize the electromagnetic interference (EMI) over a wide load range. It enters active burst mode (ABM) at light load to prevent audible noise from being heard while achieving no-load standby power as low as <math><100\text{mW}</math>. The **XDPL8219** is available in a DSO-8 package.

### Typical application schematic



### Features and benefits

#### Key benefits

- Secondary-side-regulated (SSR) constant voltage (CV) output
- Flyback controller with power factor correction
- Depending on load condition, either quasi-resonant, discontinuous conduction mode or active burst mode (ABM)
- Integrated 600 V start-up cell

#### Key benefits

- Supports wide load range and fast and stable reaction to dynamic load changes
- $\text{PF} > 0.9$  and  $\text{THD} < 10\%$  across a wide load range (AC input up to  $277 V_{\text{RMS}}$ )
- Optimal efficiency, power factor, and THD can be achieved by best-suited mode. In addition, DCM eases compliance with EMI at low-load condition
- Very low standby power  $< 100 \text{ mW}$  can be achieved
- Integrated start-up cell enables very high efficiency

### Order information for XDPL8218

| Type               | Description   | Ordering code       |
|--------------------|---|---------------------|
| XDPL8219           | Digital flyback CV output controller IC   | XDPL8219XUMA1       |
| REF-XDPL8219-U40W* | Efficient 40 W reference circuit design for XDPL8219 with high power factor and low THD. It is built for universal input voltage 120–277 V AC or 127–432 V DC | REFXDPL8219U40WTBO1 |

[www.infineon.com/xdpl8219](http://www.infineon.com/xdpl8219)

\*See Plug & LEDs play, ideally to be combined with secondary-side boards



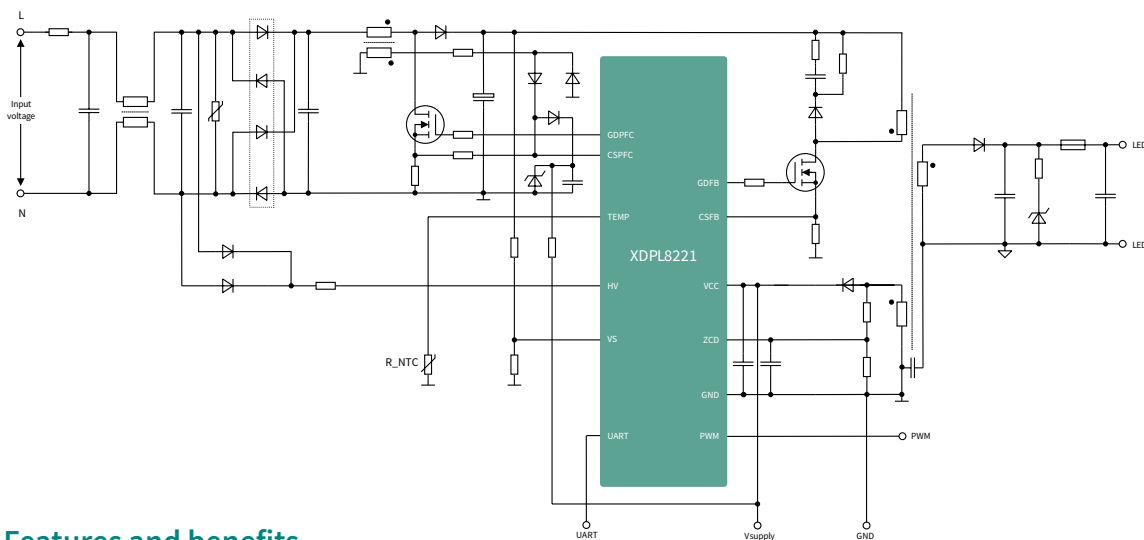
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## XDPL8221 - digital dual-stage multimode flyback controller for CC, CV, LP with 1 percent dimming and serial interface

The **XDPL8221** is a digital, highly integrated, future-proof device combining a quasi-resonant PFC with a quasi-resonant flyback controller with primary-side regulation. A serial communication interface supports direct communication with an external microcontroller unit (MCU). The **XDPL8221** is specially designed for advanced LED driver in smart lighting or IoT applications, featuring flicker-free dimming down to 1 percent of the nominal current. The device enables customizable LED driver and simplifies the generation and maintenance of different variants without increasing the number of stock keeping units. The IC is available in a DSO-16 package.

### Typical application schematic



### Features and benefits

#### Key features and benefits

- Nominal input voltage range 100-305 V<sub>AC</sub> or 90-430 V<sub>DC</sub>
- Reference board efficiency > 90 percent
- Power factor > 0.9 and THD < 15 percent over wide load range
- UART interface for control and real-time monitoring
- Constant current, constant voltage, limited power with primary-side regulation
- 1 percent dimming
- Dim-to-off with low standby power < 100 mW
- Internal temperature guard with adaptive thermal management
- The UART interface and the command set enable to control the function of the **XDPL8221** or inquire status information
- Multimode operation
  - QRM (quasi-resonant mode)
  - DCM (discontinuous conduction mode)
  - ABM (active burst mode)
- Digital parameters
  - Relevant error conditions are monitored and protected
  - Undervoltage
  - Overvoltage
  - Open load
  - Output shorted



### Order information for XDPL8221

| Type               | Description   | Ordering code         |
|--------------------|---|-----------------------|
| XDPL8221           | Digital dual-stage multimode flyback controller for CC, CV, LP with 1 percent dimming | XDPL8221XUMA1         |
| REF-XDPL8221-U50W  | 50 W reference board with CDM10V isolated 0 V-10 V dimming interface                  | REFXDPL8221U50WTOB01  |
| REF-XDPL8221-U100W | 100 W reference board with CDM10V isolated 0 V-10 V dimming interface                 | REFXDPL8221U100WTOB01 |

[www.infineon.com/xdpl8221](http://www.infineon.com/xdpl8221)



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## DC-DC LED driver ICs

DC-DC switch mode LED driver ICs with efficiencies up to 98 percent, dimming level down to 0.5 percent

Infineon offers highly integrated DC-DC LED driver ICs that support currents up to 1.5 A, making these drivers the ideal choice for high- and ultrahigh-power LEDs. These highly integrated DC to DC driver ICs achieve efficiency levels as high as 98 percent across a wide range of operation conditions. Integrated smart thermal protection, along with overvoltage and overcurrent protection, contribute to a longer LED lifetime.

### Go for quality with Infineon's cost-efficient linear LED driver ICs

Infineon's BCR linear driver ICs are the best choice for driving LED strings supplied by a DC voltage source. The BCR regulators are suitable for driving currents from 10 to 250 mA. That is why they are the best solution for low- and mid-power LEDs. For high-power LEDs, the linear controller ICs and an external power stage allow for the greatest design flexibility.

[www.infineon.com/cms/en/product/power/lighting-ics/dc-dc-led-driver-ic](http://www.infineon.com/cms/en/product/power/lighting-ics/dc-dc-led-driver-ic)  
[www.infineon.com/cms/en/product/power/lighting-ics/linear-led-driver-ic](http://www.infineon.com/cms/en/product/power/lighting-ics/linear-led-driver-ic)



Dimming



LEDs  
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LED



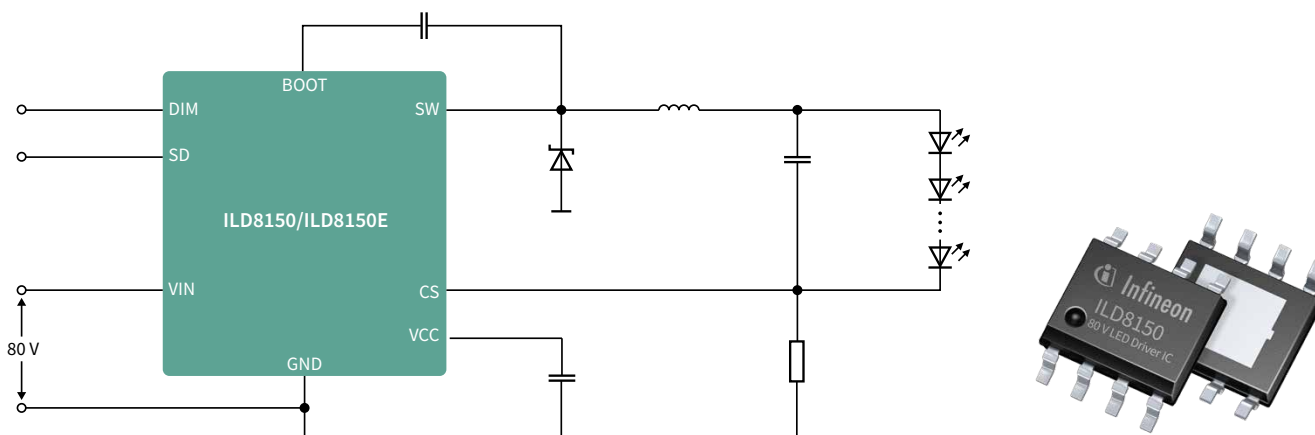
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## ILD8150/ILD8150E – 80 V DC-DC buck LED driver IC for high-power LEDs and high-performance hybrid dimming

The **ILD8150** is 80 V DC-DC converter IC, designed to be used in LED applications to drive high-power LEDs. For applications operating close to safe extra low voltage (SELV) limits, it provides a high safety voltage margin. The buck LED driver IC is tailored for LEDs in general lighting applications with average currents up to 1.5 A using a high-side integrated switch. Several performance and protection features provide the right fit for professional LED lighting.

The hysteretic current control provides an extremely fast regulation and stable LED current combined with good EMI performance. The efficiency of the LED driver IC is remarkably high, reaching more than 95 percent efficiency over a wide range. A PWM input signal between 250 Hz and 20 kHz controls dimming of the LEDs current in analog mode from 100 to 12.5 percent and 12.5 to 0.5 percent in PWM mode with flicker-free modulation frequency of 3.4 kHz.

Digital PWM dimming detection with high resolution makes **ILD8150/E** the perfect LED driver IC for use together with microcontrollers. Precise output current accuracy from device to device under all loads and input voltage conditions makes it perfect for tunable white and flat panel designs where the current must be identical string to string.



### Features and benefits

#### Key benefits

- Wide input voltage ranging from 8–80 V<sub>dc</sub>
- Up to 1.5 A average output current, adjustable via shunt resistor
- Efficiency > 95 percent
- Up to 2 MHz switching frequency
- Soft-start
- PWM dimming input, with 250 Hz to 20 kHz PWM dimming frequency

#### Key advantages

- Hybrid dimming for flicker-free light down to 0.5 percent
- Analog dimming 100 percent – 12.5 percent
- PWM dimming 12.5 percent – 0.5 percent with 3.4 kHz flicker-free modulation, dim-to-off
- Typical 3 percent output current accuracy
- Overtemperature protection
- Pull-down transistor to avoid LED glowing in dim-to-off
- DSO-8 package to enable wave soldering
- DSO-8 with exposed pad for higher thermal performance (ILD8150E)

| Type                     | Description  | Package                | Ordering code           |
|--------------------------|--|------------------------|-------------------------|
| ILD8150                  | 80 V DC-DC buck LED driver IC  | DSO-8                  | ILD8150XUMA1            |
| ILD8150E                 | 80 V DC-DC buck LED driver IC  | DSO-8 exposed pad      | ILD8150EXUMA1           |
| REF_ILD8150_DC_1.5A*     | Reference design board 1.5 A with through hole inductor                      | Board with ILD8150E    | REFILD8150DC15ATOBO1    |
| REF_ILD8150_DC_1.5A*     | Reference design board 1.5 A   | Board with ILD8150E    | REFILD8150DC15ATOBO1    |
| REF_TW_ILD8150E_60V_1A*  | Reference board for professional tunable white and multichannel applications | Board with 2x ILD8150E | REFTWILD8150E60V1ATOBO1 |
| REF_ILD8150_DC_1.5A_SMD* | Reference design board 1 A with SMD inductor                                 | Board with 2x ILD8150E | REFILD8150DC15ASMDTOBO1 |

[www.infineon.com/ild8150](http://www.infineon.com/ild8150)

\*See Plug & LEDs play, ideally to be combined with secondary-side boards



LEDs  
plug & play



LED



Lighting

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

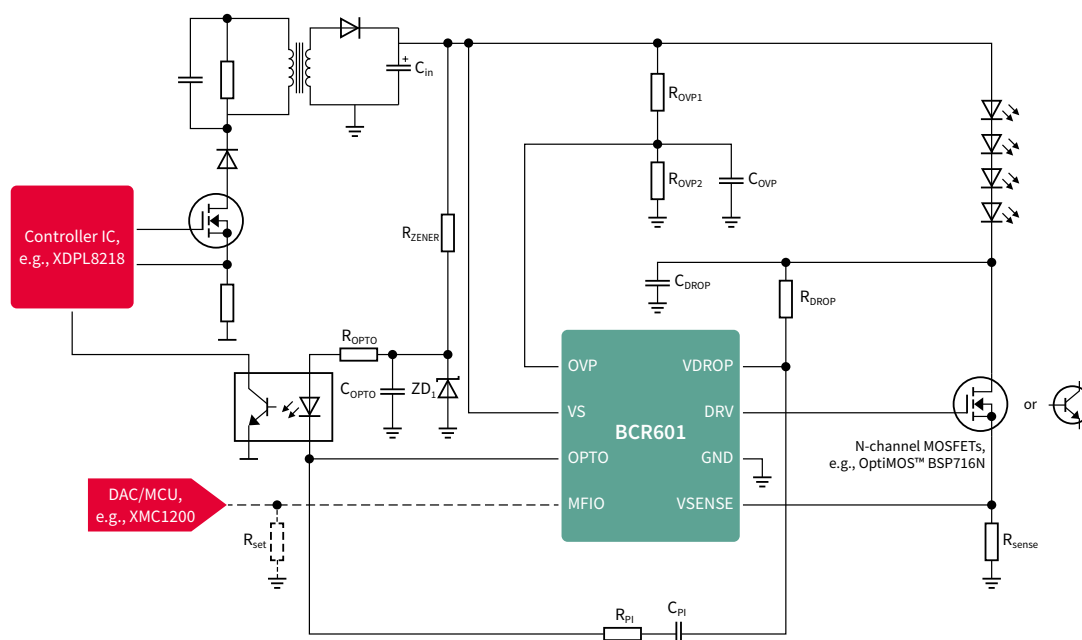


# Linear current regulators

## 60 V linear LED controller IC with active headroom control for power- and cost-efficient linear regulation on DC-DC side

A unique feature of BCR601 is to provide feedback to the primary side via an optocoupler to control the output voltage of the primary-side converter, e.g., XDPL8219 or ICL88xx. The integrated control loop minimizes the voltage overhead and power dissipation of the external driver transistor. This capability, coupled with the adjustment of voltage overhead by external configuration according to application needs, leads to power- and cost-efficient LED systems. AC line ripple suppression, analog dimming option, and various protection features round up this device for LED drivers allowing for flicker-free light and longevity of LEDs.

### Typical application schematic



### Features and benefits

#### Key features and benefits

- Active headroom control (supports an optocoupler feedback loop to primary side minimizing power losses)
- Dimming in pure analog mode down to 3%
- Suppresses the voltage ripple of the power supply driving a constant LED current for high light quality
- The embedded hot-plug protection allows plug in and plug out of any LED load during operation without damaging the LEDs
- Supports wide current range depending on external driver transistor
- Supply voltage range up to 60 V
- Gate driver current 10 mA
- LED current can be adjusted by  $R_{set}$  functionality
- Overtemperature protection and adjustable overvoltage protection

### Order information for BCR601

| Type                    | Description  | Ordering code            |
|-------------------------|--|--------------------------|
| BCR601                  | 60 V linear LED controller IC with voltage feedback to primary side  | BCR601XUMA1              |
| DEMO_BCR601_60V_IVCTRL* | Demonstration board BCR601 current and voltage control, 700 mA   | DEMOBCR60160VIVCTRLTOBO1 |
| REF_TW_BCR601_55V_0.5A* | Demoboard for design evaluation of tunable white applications with cost-effective linear LED controllers, 500 mA | REFTWBCR60155V05ATOBO1   |

[www.infineon.com/bcr601](http://www.infineon.com/bcr601)

\*See Plug & LEDs play, ideally to be combined with secondary-side boards



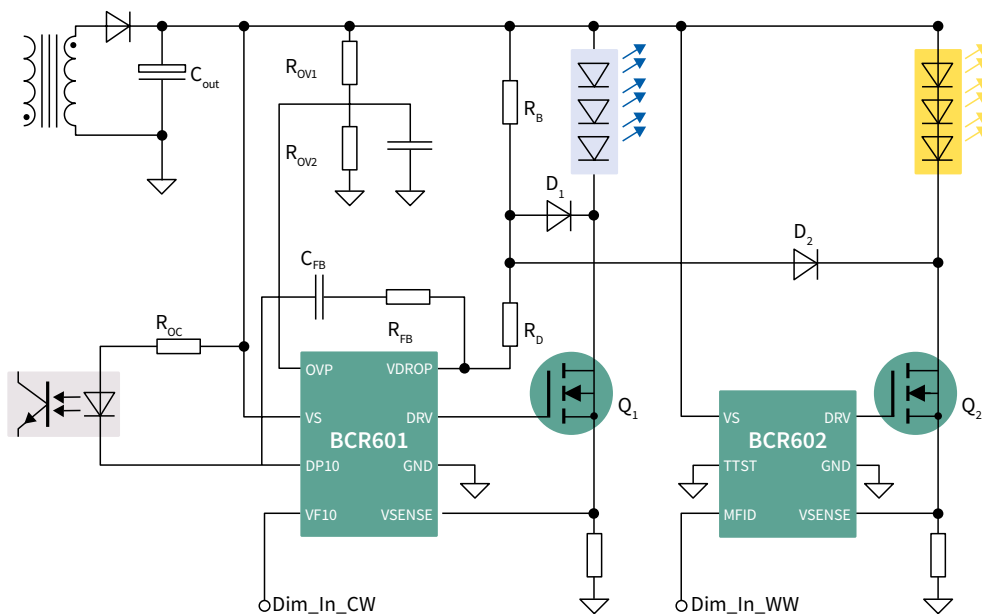
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





## BCR601/BCR602 – 60 V linear LED controller ICs for tunable white plus active headroom control and flexible dimming

**BCR601** is a linear controller that enables high efficiency at low cost as a second-stage LED controller to replace DC-DC buck converters especially in low- to mid-power LED drivers. The cost-effectiveness, especially in multichannel designs, can be further enhanced using **BCR602** in a tiny SOT-23-6 package regulating the LED current for flicker-free deep dimming performance.



### Features and benefits

#### Key benefits

- **BCR601**, as the master controller, controls the voltage overhead of both channels and the current of one channel
- **BCR602**, as slave controller, regulates current of second channel
- Input voltage up to 60 V
- Can be operated with either BJT or N-channel MOSFET
- Analog dimming down to 3%, PWM dimming down to 1% (**BCR602**)
- Current precision  $\pm 3\%$
- OTP, OVP, hot-plug protection

#### Key advantages

- Linear regulators give considerable cost advantage over buck topology
- Cost advantage increases with additional channels
- Efficiency can be on par with buck (depends on output ripple of first stage)
- Highest light quality, zero ripple
- Deep, full analog dimming
- Easy to extend to additional outputs (e.g., RGBW)

### Order information

| Type                    | Description  | Ordering code            |
|-------------------------|--|--------------------------|
| REF_TW_BCR601_55V_0.5A* | Demoboard for design evaluation of tunable white applications with cost-effective linear LED controllers <b>BCR601/BCR602</b> , 500 mA | REFTWBCR60155V05ATOB01   |
| BCR601                  | 60 V linear LED controller IC with voltage feedback to primary side  | BCR601XUMA1              |
| DEMO_BCR601_60V_IVCTRL* | Demonstration board <b>BCR601</b> current and voltage control, 700 mA  | DEMOBCR60160VIVCTRLTOB01 |
| BCR602                  | 60 V linear LED controller IC  | BCR602XTSA1              |
| DEMO_BCR602_60V_ICTRL*  | Demoboard for design evaluation of cost-efficient, highly reliable, dimmable LED engines/modules, 60 V, 200 mA                         | DEMOBCR60260VICTRLTOB01  |

[www.infineon.com/cms/en/product/evaluation-boards/ref\\_tw\\_bcr601\\_55v\\_0.5a](http://www.infineon.com/cms/en/product/evaluation-boards/ref_tw_bcr601_55v_0.5a)  
[www.infineon.com/cms/en/product/power/lighting-ics/linear-led-driver-ic/bcr601](http://www.infineon.com/cms/en/product/power/lighting-ics/linear-led-driver-ic/bcr601)  
[www.infineon.com/bcr602](http://www.infineon.com/bcr602)

\*See Plug & LEDs play, ideally to be combined with secondary-side boards



LEDs  
plug & play



Lighting

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## BCR43x linear LED driver ICs for low-power LEDs

The BCR3x family is the smallest and lowest-cost series of LED drivers. These products are perfectly suited for driving low-power LEDs in general lighting applications.

### The advantages over resistor biasing are:

- Long lifetime of LEDs due to constant current in each LED string
- Homogenous LED light output independent of LED forward voltage binning, temperature increase, and supply voltage variations

### The advantages over discrete semiconductors are:

- Reduced part count and assembly effort
- Pretested output current
- Defined negative temperature co-efficient protection

### Need more details on replacing resistors?



Download now the application note  
“Driving low power LEDs from  
10 to 65 mA LED driver ICs”

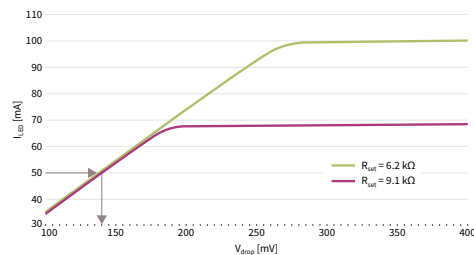
## Features and benefits

### Key features and benefits

- Output current from 8 to 100 mA (adjustable by external resistor)
- Supply voltage up to 40 V (BCR430U, BCR431U\*)
- Reduction of output current at high temperature, contributing to long lifetime LED systems
- Extra low voltage drop for more voltage headroom and flexibility in designs (BCR430U, BCR431U)
- Excellent ESD performance on device and system level for BCR43xU
- Very small form factor packages with up to 600 mW max. power handling capability



### LED current versus voltage drop ( $V_s = 24\text{ V}$ )



The voltage drop at the integrated LED driver stage can go down to 135 mV at 50 mA and less, improving the overall system efficiency and providing extra voltage headroom to compensate for tolerances of LED forward voltage or supply voltage. With the BCR430U and BCR431U, additional LEDs can be added to lighting designs, or longer LED strips can be created without changing the supply voltage.

### Low-power LED driver ICs (5-100 mA)

| Type      | Group                          | Topology | $V_s$ (min.) [V] | $V_s$ (max.) [V] | $I_{out}$ (typ.) [mA] | $I_{out}$ (max.) [mA] | Dimming                    | Package | $P_{tot}$ (max.) [mW] | Ordering code |
|-----------|--------------------------------|----------|------------------|------------------|-----------------------|-----------------------|----------------------------|---------|-----------------------|---------------|
| BCR430U*  | LED drivers for low-power LEDs | Linear   | 6                | 42               | Defined by $R_{set}$  | 100                   | PWM by external transistor | SOT-23  | 600                   | BCR430UXTSA2  |
| BCR431U** | LED drivers for low-power LEDs | Linear   | 6                | 42               | Defined by $R_{set}$  | 42                    |                            | SOT-23  | 600                   | BCR431UXTSA1  |

| Type                | Description                            | Ordering code          |
|---------------------|--|------------------------|
| BCR430U LED BOARD   | Low-power demoboard with 8 LEDs, 50 mA | BCR430ULEDBOARDTOBO11  |
| DEMO_BCR431U_LVDROP | Low-power demoboard with 8 LEDs, 15 mA | DEMOBCR431ULVDROPTOBO1 |

[www.infineon.com/bcr](http://www.infineon.com/bcr)

\* Ultralow voltage drop version BCR430U with only 135 mV at 50 mA  
\*\* Ultralow voltage drop version BCR431U with only 115 mV at 15 mA

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



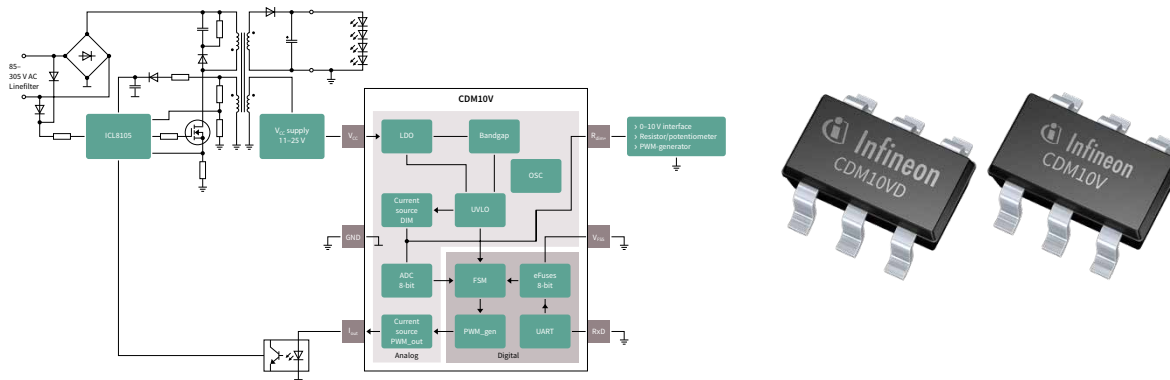
Lighting

# CDM10V and CDM10VD – most flexible dimming interface ICs for 0-10 V input

## Infineon's fully integrated dimming solutions

Infineon's **CDM10V** and **CDM10VD** are the industry's first single-chip lighting interface ICs. They are capable of transforming an analog 0–10 V input into a PWM or dimming input signal, required by a lighting controller IC. **CDM10V** and **CDM10VD** devices are dedicated for commercial and industrial LED lighting applications. The compact and highly integrated devices allow designers to replace up to 25 discrete components, used in conventional 0–10 V dimming schemes, with a single device. Supplied in an ultra-miniature 6-pin SOT package, the CDM10Vx and CDM10VDx perfectly match small PCBs with high component densities.

### Typical application schematic using CDM10V



### Features and benefits

#### Key benefits

- Active dimming (0–10 V) and passive dimming (resistor)
- Embedded digital signal processing which maintains minimum variations from device to device
- PWM input
- One-time configurable device: **CDM10V** and preconfigured devices with various feature sets

#### Key advantages

- Single-device solution leading to low BOM and PCB savings
- Dimming ICs in small SOT-23 package for high power density designs
- Granular portfolio for highest flexibility and easy design-in
- Wide input  $V_{cc}$  range 11–25 V, extended range down to 6 V for **CDM10V**
- Attractive pricing and faster time to market

| Product type | $I_{out}$ [mA] | Min. duty cycle [%] | PWM output frequency [kHz] | Dimmer/resistor bias current [ $\mu$ A] | Dimm-to-off      | Ordering code |
|--------------|----------------|---------------------|----------------------------|---|------------------|---------------|
| CDM10V       | 5              | 1/2/5/10            | 0.2/0.5/1/2                | 50/100/200/500                          | Disabled/enabled | CDM10VXTSA1   |
| CDM10V-2     | 5              | n.a.                | 1                          | 200                                     | Enabled          | CDM10V2XTSA1  |
| CDM10V-3     | 5              | 1                   | 1                          | 200                                     | Disabled         | CDM10V3XTSA1  |
| CDM10V-4     | 5              | n.a.                | 2                          | 100                                     | Enabled          | CDM10V4XTSA1  |
| CDM10VD      | 5              | 5                   | 1                          | 120                                     | Enabled          | CDM10VDXTSA1  |
| CDM10VD-2    | 5              | 10                  | 1                          | 120                                     | Enabled          | CDM10V2DXTSA1 |
| CDM10VD-3    | 1              | 5                   | 1                          | 120                                     | Enabled          | CDM10V3DXTSA1 |
| CDM10VD-4    | 1              | 10                  | 1                          | 120                                     | Enabled          | CDM10V4DXTSA1 |

| Board name          | Description  | Ordering code          |
|---------------------|--|------------------------|
| REF-XDPL8105-CDM10V | 40 W single-stage PFC FB digital power reference design with <b>CDM10V</b> | REFXDPL8105CDM10VTOB01 |

[www.infineon.com/cdm10V](http://www.infineon.com/cdm10V)



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

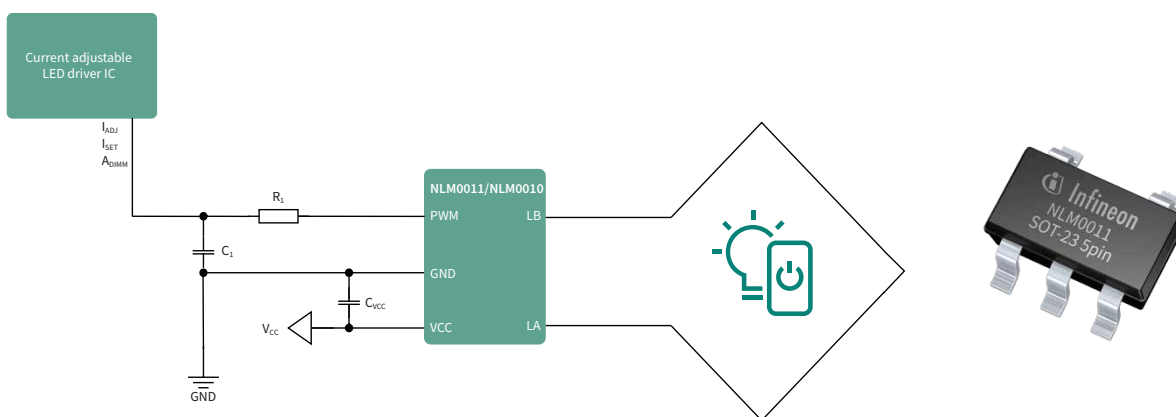


# NFC-PWM configuration ICs

## Dual-mode NFC wireless configuration ICs with CLO function and pulse-width modulation (PWM) output for lighting applications

The **NLM0011** is a dual-mode NFC wireless configuration IC with PWM output. It is compatible with existing analog LED driver designs and with the NFC-programming specification from the module-driver interface special interest group (MD-SIG). This device is primarily designed for LED applications to enable NFC programming. In addition, advanced features, such as the constant lumen output (CLO) and the on/off counting, are integrated, and there is no need for an additional microcontroller. Since the **NLM0011** is designed to work together with mainstream analog driver ICs, there are no firmware development efforts needed. It can be easily adapted into existing designs to replace the “plug-in resistor” current configuration concept. The **NLM0010** is a light version without CLO function.

### Typical example of NFC lighting application



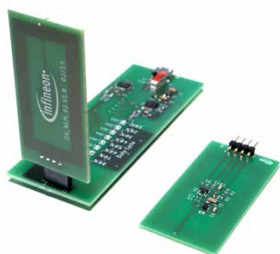
### Features and benefits

#### Key benefits

- Configurable pulse-width modulation (PWM) output
- NFC contactless interface compliant to ISO/IEC 18000-3 mode 1 (ISO/IEC 15963)
- Constant light output (CLO) with 8 configurable points
- Integrated operation-time counter (OTC) and on/off counter
- Non-volatile memory (NVM) including UID and 20 bytes free memory for user data

#### Key advantages

- Fast and cost-effective implementation of NFC programming and CLO without the need of an additional microcontroller
- Compatible with most analog LED driver designs using the „plug-in resistor“ method
- Stable PWM output with fixed 2.8 V amplitude and  $\pm 0.1\%$  duty cycle accuracy
- Internal voltage regulator (LDO) to avoid influence of instable external supply voltage



### EVAL\_NLM0011\_DC – evaluation board demo kit

This evaluation board not only enables fast demonstration of NFC-PWM configuration ICs with **NLM0011** through the NFC-PWM mobile app, but also accelerates the development of the NFC-reader software. **EVAL\_NLM0011\_DC** does not require a full system, but allows NFC configuration for existing LED driver boards.

**Ordering code:** EVALNLM0011DCTOB01

| Type    | Description  | Package  | Ordering code |
|---------|--|----------|---------------|
| NLM0011 | Dual-mode NFC configuration IC with PWM output and CLO function      | SOT-23-5 | NLM0011XTSA1  |
| NLM0010 | Dual-mode NFC configuration IC with PWM output, without CLO function | SOT-23-5 | NLM0010XTSA1  |





# iMOTION™ integrated motor control solutions

A family of highly integrated products for the control of a variable speed drive

iMOTION™ products are offered in several integration levels including hardware as well as software. The hardware integration comprises stand-alone motor controllers (iMOTION™ controller), motor controllers with integrated gate drivers (iMOTION™ driver), and fully integrated inverters-in-a-package (iMOTION™ IPM). In terms of software, Infineon offers full turnkey solutions as well as freely programmable modules.

Infineon's field-proven Motion Control Engine (MCE) eliminates software coding from the motor control development process reducing the effort to the configuration for the respective motor and power stage.

The MCE implements highly efficient control of the motor and an optional power factor correction (PFC) and integrates all necessary protections and a flexible scripting engine. Assisted by powerful tools like the iMOTION™ Solution Designer (iSD), it is possible to have the motor up and running in less than an hour. Integrated support for functional safety for home appliances paves the way to meet regulations in the global market

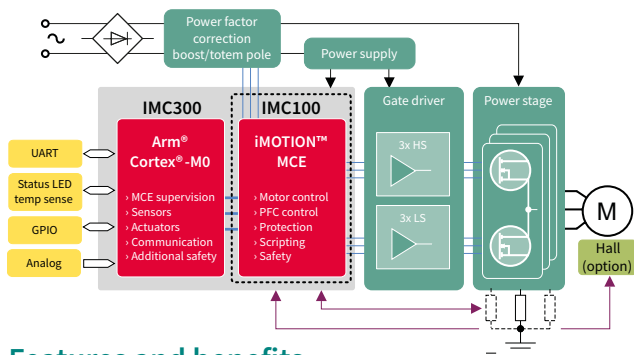
Infineon provides complete solutions for motor control with its combined offering of iMOTION™ together with **EiceDRIVER™** gate drivers, **TRENCHSTOP™** IGBTs, **CoolMOS™** MOSFETs, and **CIPOS™** IPMs.

# iMOTION™ controller

## Motor/PFC controller plus optional MCU for maximum flexibility

The iMOTION™ controllers consist of two different families: iMOTION™ IMC100 is a series of highly integrated ICs for the control of variable speed drives. By integrating both the required hardware and algorithm to perform control of a three-phase motor they provide the shortest time to market for any motor system at the lowest system and development cost. By combining the iMOTION™ IMC100 with an additional microcontroller based on the Arm® Cortex®-M0 core, iMOTION™ IMC300 series is the perfect fit for applications requiring application flexibility beyond pure motor and PFC control.

Infineon's field-proven Motion Control Engine (MCE) implements field-oriented control (FOC) using single or leg shunt current feedback and uses space vector PWM with sinusoidal signals to achieve highest energy efficiency. The MCE can run sensorless as well as using Hall sensors for low speed operation. It also integrates multiple protection features like over- and undervoltage, overcurrent, rotor lock etc. The integrated scripting engine grants flexibility for a wide range of applications. The IMC100/300 series are offered in several device variants. All devices can be used in applications requiring functional safety acc. to IEC/UL 60730 ('Class B'). With this wide application scope the iMOTION™ controller is the perfect choice for any highly efficient variable speed drive - from low to high voltage.



### Features and benefits

| Key features                                       |
|--|
| - Completely self-sustaining Motion Control Engine |
| - Option for boost or totem pole PFC               |
| - Integrated protection features                   |
| - Scripting engine for application flexibility     |
| - Additional independent microcontroller           |
| - Support for IEC 60335-1 ('Class B')              |

| Key benefits   |
|--|
| - Easy motor parametrization and tuning                  |
| - Low BOM cost for active PFC applications               |
| - Safeguard power stage and motor                        |
| - Maximum flexibility for customer functions             |
| - Full flexibility for custom functions or communication |
| - Support for functional safety integrated               |



The REF-VACUUM\_C101\_2ED is a reference design kit featuring IMC101T iMOTION™ controller, 2ED2304 SOI half-bridge gate driver, and BSC030N04NS OptiMOS™. It demonstrates our thin-film-SOI and advanced MCE technologies for low-voltage, permanent-magnet motor drives up to 120 KRPM speed, and inverter section rating of 30 V and 25 A. It is optimized for major low-voltage home appliances like vacuums, fans, pumps, and compressors.

[www.infineon.com/IMC](http://www.infineon.com/IMC)  
[www.infineon.com/iMOTION](http://www.infineon.com/iMOTION)



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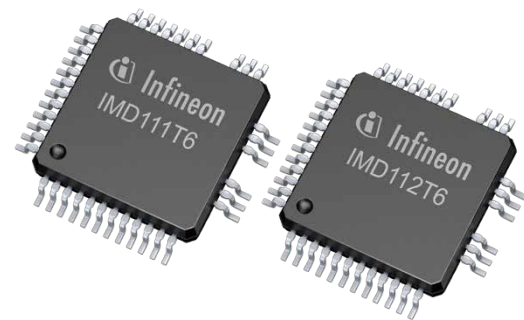
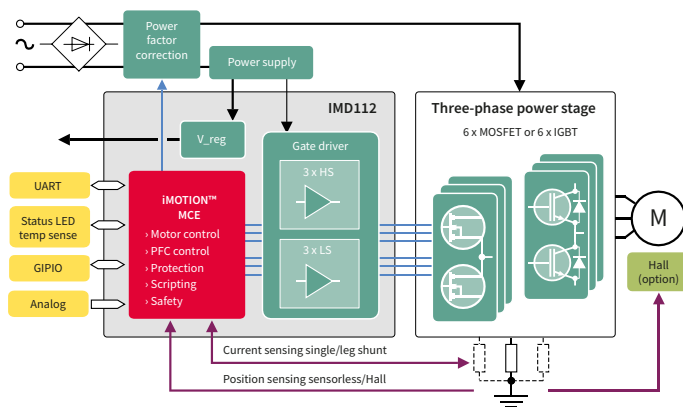
# iMOTION™ driver

## Motor/PFC controller with gate driver and voltage regulator

The iMOTION™ IMD110 is a series of highly integrated ICs for the control of three-phase motors. The IMD110 drivers are an optimal combination of a ready-to-use motor and (optional) PFC controller with a high-voltage three-phase SOI gate driver and a voltage regulator. They can be combined with almost any low- to high-voltage MOSFET or IGBT to create a very compact yet still highly flexible drive solution. The full set of protections, improved clearance, and creepage makes the IMD110 a highly robust and reliable driver family.

The family implements the identical field-proven Motion Control Engine (MCE) as the iMOTION™ controller family. The scripting engine that executes customer scripts with access to the MCE, a high number of GPIOs, analog inputs, and a configurable UART grants flexibility for a wide range of applications. Based on Infineon's latest SOI technology, the three-phase gate driver exhibits market-leading robustness and lowest failure rates. The very low level-shift losses reduce thermal stress and allow high-frequency operation, while the built-in bootstrap diodes help to reduce PCB space and cost. Protections like over- and undervoltage lockout and cross conduction prevention safeguard the power stage during erroneous conditions. All IMD110 devices support the functional safety requirements according to the IEC/UL 60730-1 ('Class B').

### Block diagram



### Features and benefits

#### Key features

- Completely self-sustaining Motion Control Engine with identical feature set as the IMC100 series
- Option for boost or totem pole PFC
- High-voltage three-phase gate driver and built-in bootstrap diodes
- Single layer design possible
- Support for IEC 60335-1 ('Class B')

#### Key benefits

- Fastest time to market with easy parametrization and tuning of motor and PFC control
- Low BOM cost for active PFC applications
- Reducing BOM and PCB space
- Reducing PCB and production costs
- Support for functional safety integrated



The REF\_FRIDGE\_D111T\_MOS board is a ready-to-use three-phase inverter designed for refrigerator compressors featuring the iMOTION™ driver. The 600 V CoolMOS™ PFD7 super junction MOSFET demonstrates market-leading light-load efficiency. The board provides a single-phase AC-connector, rectifier, and three-phase output for the motor. Targeting low-cost applications, the motor is run with sensorless field-oriented control (FOC) using single shunt current sensing. The direct sensing of all voltages and currents does not require any OpAmp.

[www.infineon.com/IMD](http://www.infineon.com/IMD)  
[www.infineon.com/iMOTION](http://www.infineon.com/iMOTION)

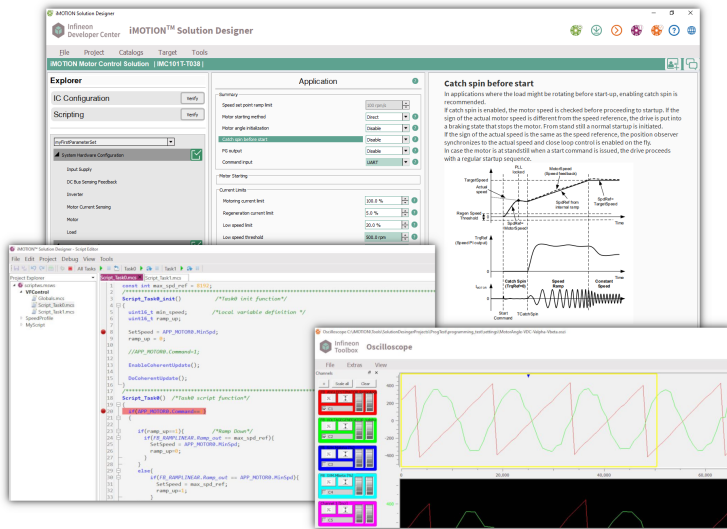


For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# iMOTION™ tools and development support

## The easy way to get started with motor control



The iMOTION™ Solution Designer is the new all-in-one PC tool supporting the iMOTION™ products in all stages of a motor control project. A new project can be started by choosing one of the preconfigured applications or by selecting an evaluation board or a specific device. Solution Designer offers individual views for all design steps from configuration up to the final tuning of the control loop.

Drive configuration is assisted by the integrated help describing all parameters in detail. After downloading the parameter sets into the iMOTION™ device, customer configurable dashboards help with starting and running the motor and tuning the control loop parameters to the desired behavior. All relevant parameters like voltages, currents, torque, speed can be visualized in real time on the 8-channel oscilloscope. Going one step beyond the configuration of the motor and PFC, the integrated editor, compiler, and debugger help develop scripts for the iMOTION™ script engine.

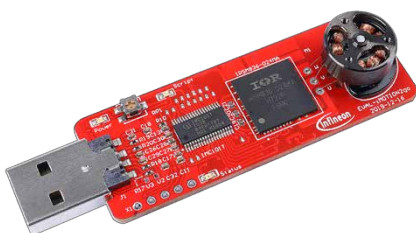
### Features and benefits

- | Key features   |
|--|
| – Integrated PC tool for all devices in all project phases   |
| – Configuration wizard for motor and PFC parameter sets      |
| – Dashboards for typical design steps, customer configurable |
| – Oscilloscope with 8 channels                               |
| – Full IDE for editing, compiling, and debugging of scripts  |
| – Programmer for firmware, parameter sets, and scripts       |
| – Catalogs for devices, boards, loads, and projects          |

- | Key benefits  |
|---|
| – One common tool and consistent workflow for all iMOTION™ products     |
| – Easy handling of parameter sets with fully integrated help system     |
| – Fully configurable for individual testing and tuning stages           |
| – Real-time insight into all motor and PFC parameters                   |
| – Assisted creation of scripts and live debugging including breakpoints |
| – Unified data handling from project to device                          |
| – Project centric work and ease of creating derived projects            |

## iMOTION2Go

### Getting familiar with iMOTION™ firmware, features and tools



The iMOTION2go kit contains a complete motor control system on a small form factor board and is powered via USB. It is particularly useful for a first evaluation of the iMOTION™ firmware and tools like the iMOTION™ Solution Designer. This combination of the IMC101 motor control IC with the Solution Designer supports all project stages from drive configuration up to optimization and tuning using dashboards and oscilloscope. Scripting can be practiced by downloading and debugging via the IDE integrated in the Solution Designer.

[www.infineon.com/iMOTION2go](http://www.infineon.com/iMOTION2go)  
[www.infineon.com/iMOTION-software](http://www.infineon.com/iMOTION-software)  
[www.infineon.com/MCE](http://www.infineon.com/MCE)





# iMOTION™ Modular Application Design Kit

Get a motor running in less than 1 hour!

**Power boards**  
(Examples)

5 V/1 W

1200 V/10 kW

**Controller boards**  
(Examples)

|  |  |  |
|--|--|--|
| EVAL-M1-101T<br>iMOTION™<br>IMC101T-T038 | EVAL-M3-302F<br>iMOTION™<br>IMC302A-F064 | EVAL-M7-D111T<br>iMOTION™<br>IMD111T-6F040 |
|--|--|--|

M1/3/7 platform interface - multiple different combinations are possible

The iMOTION™ Modular Application Design Kit (MADK) is an evaluation platform targeting variable speed-drive applications up to 10 kW. The platform offers a modular and scalable system solution with different control board options and a wide range of power boards. Using the iMOTION™ MADK standardized platform interfaces, different control and power boards can be combined into a system that perfectly meets the requirements of the final application. This modular approach allows developers the maximum flexibility and scalability during the evaluation and development phase at affordable costs.

While the M1 platform provides control of a permanent magnet synchronous motor (PMSM), the M3 platform additionally includes an active power factor correction (PFC) implemented as a CCM boost PFC. The M7 platform is based on the iMOTION™ driver series IMD110. The gate driver is contained on the control board, and the power boards use different types of discrete power devices, thus covering a wide voltage range from 20 to 600 V with either MOSFETs or IGBTs. Boards with M7 connector are available with and without active PFC.

## iMOTION™ Link

### Isolated debug interface for final application boards



iMOTION™ Link is an isolated debug probe for all iMOTION™ motor control products. It connects to the user's target board (final application board) or any other evaluation or reference board via a galvanically isolated interface. iMOTION™ Solution Designer is then used for configuring, parameterizing, and tuning of the respective iMOTION™ device. In addition to the serial interface iMOTION™ Link also provides a standard Arm® SWD debug connection for programming the MCU core in devices like the IMC300 series.

[www.infineon.com/imotion-link](http://www.infineon.com/imotion-link)  
[www.infineon.com/MADK](http://www.infineon.com/MADK)



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## BLDC motor control shield with IFX007T for Arduino

The BLDC motor control shield is a high-current motor control board compatible with Arduino and Infineon's XMC4700 boot kit. It is equipped with three smart IFX007T half-bridges. The BLDC motor control shield is capable to drive one BLDC motor. Alternatively, it can be used to drive one or two bidirectional DC motors (H-bridge configuration, cascaded to support second motor) or up to three unidirectional DC motors (half-bridge configuration). The implemented integrated NovalithIC™ IFX007T half-bridges can be controlled by a PWM via the IN-pin.

### Features

#### Key features

- Capable of high-frequency PWM, e.g., 30 kHz
- Adjustable slew rates for optimized EMI by changing external resistor
- Driver circuit with logic level inputs
- Diagnosis with current sense

### Target applications

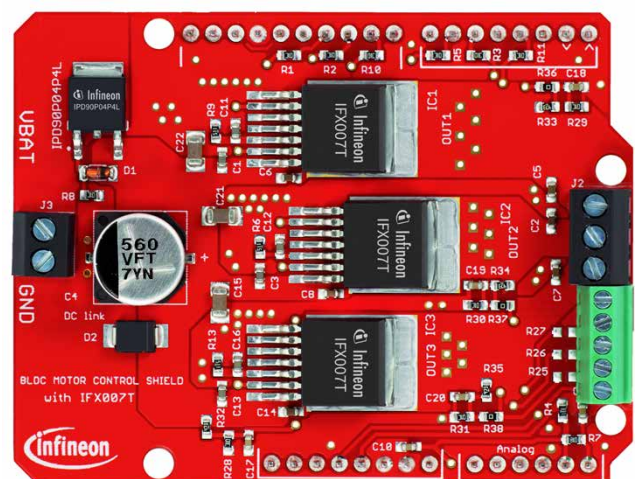
- Brushed DC motor control up to 250 W continuous load
- 24 V nominal input voltage (max. 6 - 40 V)
- Average motor current 30 A restricted due to PCB (IFX007T current limitation at 55 A min.)

## BLDC-SHIELD\_IFX007T

### BLDC motor control with half-bridge IFX007T

Infineon's shields for Arduino are compatible with microcontroller boards using the Arduino-compatible form factor, e.g., Infineon's XMC™ microcontroller kits.

Ordering code: BLDCSHIELDIFX007TTOB01



[www.infineon.com/bldc-shield-ifx007t](http://www.infineon.com/bldc-shield-ifx007t)  
[www.infineon.com/shields-for-arduino](http://www.infineon.com/shields-for-arduino)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

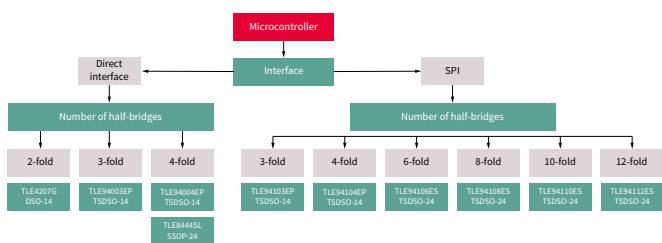


# MOTIX™ multi half-bridge ICs

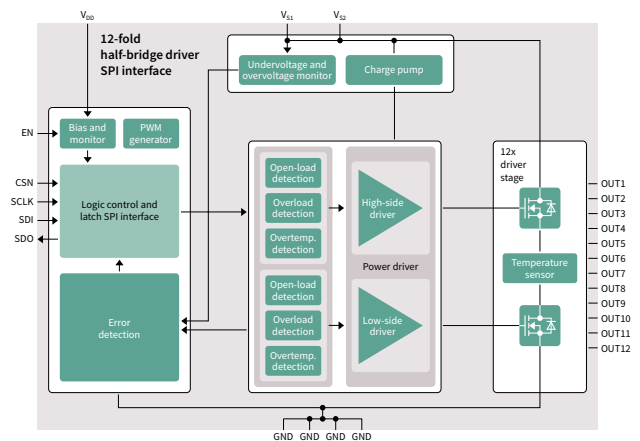
## Extensive offering ranging from two-fold half-bridge ICs to twelve-fold half-bridge ICs

The MOTIX™ TLE94xyz products are protected half-bridge drivers designed for 12 V motion control applications such as small DC motors for heating, ventilation, and air conditioning (HVAC), as well as automotive mirror adjustment and fold. The family offers two-, three-, four-, six-, eight-, ten-, and twelve-fold integrated half-bridge driver. All devices can drive DC motor loads up to 0.9 A per output, or the outputs can be used stand-alone or combined with increasing driving capability up to 3.6 A. They provide diagnosis of short circuit, open load, power supply failure, and overtemperature for each half-bridge to ensure safe operation in HVAC or other systems. The TLE94xyz offers enhanced EMC performance, which in combination with the low quiescent current and a small package, makes the product attractive for a wide range of 12 V automotive and industrial applications. In addition to TLE94xyz, Infineon's multi half-bridge offerings include a dual-half-bridge driver, TLE4207G.

### Infineon's portfolio of MOTIX™ multi half-bridge ICs



### Block diagram MOTIX™ TLE94112ES



### Features and benefits

- Key features and benefits**
- Three-, four-, six-, eight-, ten-, and twelve-fold half-bridges with integrated output stages and PWM
  - 16-bit SPI or direct inputs for control and diagnosis
  - Voltage supply range: 5.5–20 V
  - Variable driving schemes for up to 11 motors

### Key applications

- 12 V automotive and industrial applications
- Flap motors in HVAC systems
- Mirror adjustment and fold
- Small DC motors ( $\leq 0.9$  A/output)
- Bistable relays
- Bipolar stepper motors in full-step and half-step mode

| Product name | Config.          | $I_{L(NOM)}$ [A] | $I_{L(lim)}$ [A] | $I_g$ [ $\mu$ A] | $V_{S(OP)}$ [V] | Protection            | Diagnostic interface | Highlights   | $V_{FE(sat)}/R_{DS(on)}$ [m $\Omega$ ] | Package   |
|--------------|------------------|------------------|------------------|------------------|-----------------|-----------------------|----------------------|--|--|-----------|
| TLE94003EP   | 3 x half-bridge  | 3 x 0.30         | 3 x 0.90         | 0.6              | 5.5 to 20       | OC, OT, VS, UV/OV     | Error flag           | TLE94xyz family concept + small package                      | 850/switch                             | TSDSO-14- |
| TLE94103EP   | 3 x half-bridge  | 3 x 0.30         | 3 x 0.90         | 0.6              | 5.5 to 20       | OC, OT, OL, VS, UV/OV | 16-bit SPI           | TLE94xyz family concept + small package                      |  | TSDSO-14- |
| TLE94004EP   | 4 x half-bridge  | 4 x 0.30         | 4 x 0.90         | 0.6              | 5.5 to 20       | OC, OT, VS, UV/OV     | Error flag           | TLE94xyz family concept + small package                      |  | TSDSO-14- |
| TLE94104EP   | 4 x half-bridge  | 4 x 0.30         | 4 x 0.90         | 0.6              | 5.5 to 20       | OC, OT, OL, VS, UV/OV | 16-bit SPI           | TLE94xyz family concept + small package                      |  | TSDSO-14- |
| TLE94106ES   | 6 x half-bridge  | 6 x 0.30         | 6 x 0.90         | 0.6              | 5.5 to 20       | OC, OT, OL, VS, UV/OV | 16-bit SPI           | TLE94xyz family concept + backwards compatible to TLE84106EL |  | TSDSO-24  |
| TLE94108ES   | 8 x half-bridge  | 8 x 0.30         | 8 x 0.90         | 0.6              | 5.5 to 20       | OC, OT, OL, VS, UV/OV | 16-bit SPI           | TLE94xyz family concept                                      |  | TDSD-24   |
| TLE94110ES   | 10 x half-bridge | 10 x 0.30        | 10 x 0.90        | 0.6              | 5.5 to 20       | OC, OT, OL, VS, UV/OV | 16-bit SPI           | TLE94xyz family concept + backwards compatible to TLE84110   |  | TDSD-24   |
| TLE94112ES   | 12 x half-bridge | 12 x 0.30        | 12 x 0.90        | 0.6              | 5.5 to 20       | OC, OT, OL, VS, UV/OV | 16-bit SPI           | TLE94xyz family concept + 12 outputs in one package          |  | TDSD-24   |
| TLE4207G     | 2 x half-bridge  | 2 x 0.80         | 2 x 1.50         | 20               | 8 to 18         | OC, OT, VS, UV/OV     | Status flag          | Error detection  |  | DSO-14    |

[www.infineon.com/multi-half-bridge-ics](http://www.infineon.com/multi-half-bridge-ics)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

# DC motor control HAT with MOTIX™ TLE94112ES

## Complies with Raspberry Pi HAT specification

The Infineon motor control HAT with MOTIX™ TLE94112ES complies with Raspberry Pi HAT specification and provides you with unique evaluation experience. It is equipped with 12-fold half-bridge driver TLE94112ES and comes with a ready-to-use software library. The HAT is also equipped with an Infineon TLS4125D0EP V50, a synchronous step-down converter which can power the Raspberry Pi.

### Features and benefits

#### Key features

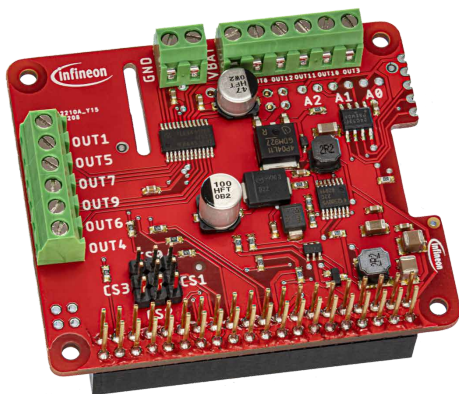
- Twelve half-bridge power outputs, 0.9 A each (combinable to up to 3.6 A)
- Wide input voltage range of 5.5 V to 20 V
- Powering of Raspberry Pi by TLS4125D0EP V50
- Reverse polarity protection
- Driver is protected against overtemperature, overcurrent, overvoltage, undervoltage, and enables diagnosis of overcurrent, overvoltage, undervoltage
- SPI interface with zero clock diagnosis
- Enhanced EMC performance
- Integrated PWM generator with 3 different frequencies (80 Hz, 100 Hz, 200 Hz)

#### Benefits

- Compact design for multi-motor applications
- Quick and easy setup for evaluation and demo applications
- Wide range of applications

### Target applications

- Automotive motor control: HVAC flap control
- Multi-motor applications
- DC motors and voltage controlled bipolar stepper motors
- Toys



Ordering code: TLE94112ESRPIHATTOB01

[www.infineon.com/makers](http://www.infineon.com/makers)

[www.infineon.com/raspTLE94112ES](http://www.infineon.com/raspTLE94112ES)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

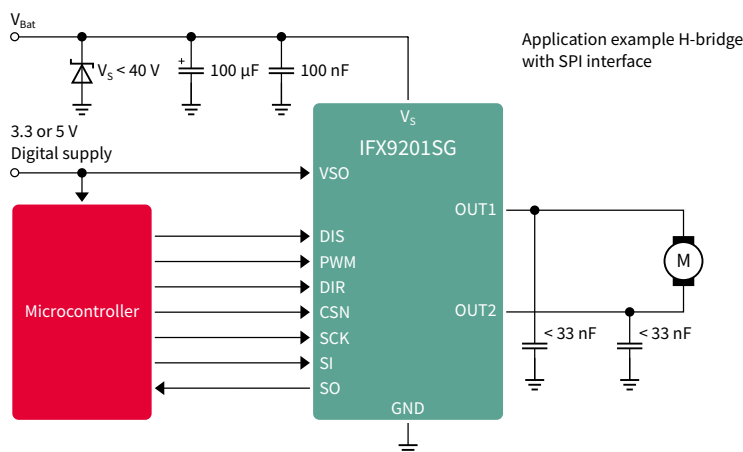


# MOTIX™ full-bridge ICs

## General purpose 6 A H-bridges

MOTIX™ IFX9201SG is a general-purpose 6 A H-bridge for industrial applications, home appliance and building automation, power tools battery management, and medical applications, designed to control small DC motors and inductive loads. The outputs can be pulse-width modulated at frequencies up to 20 kHz, which enables operation above the human sonic range by means of PWM/DIR control. While the signal at the DIR input defines the direction of the DC motor, the PWM signal controls the duty cycle. For load currents above the current limitation threshold (8 A typically), the H-bridges switch into chopper current limitation mode.

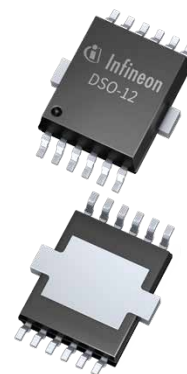
### Applications examples



### Features

#### Key features

- Up to nominal 36 V supply voltage
- Short circuit, overtemperature protection, and undervoltage shutdown
- Detailed SPI diagnosis or simple error flag
- Simple design with few external components
- Small and robust DSO-12-17 (IFX9201SG) and DSO-36-72 (IFX9202ED) packages



| Product number | Operating voltage | Current limit (min.) [A] | Quiescent current (typ.) [µA] | Operating range [V] | $R_{DS(on)}$ (typ./switch) [mΩ] | Package           | $R_{thJC}$ (max.) [K/W] |
|----------------|-------------------|--------------------------|-------------------------------|---------------------|---------------------------------|-------------------|-------------------------|
| IFX9201SG      | 4.5 to 36 V       | 6.0                      | 19.0                          | 5 to 36             | 100                             | PG-DSO-12 (power) | 2.0                     |



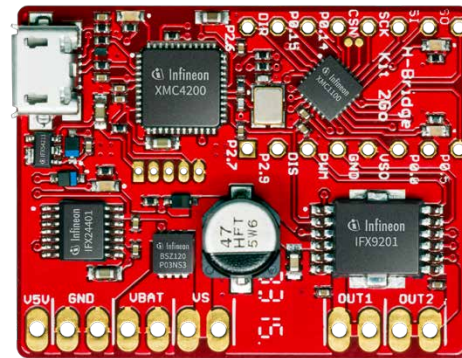
## H-BRIDGE KIT 2GO with MOTIX™ IFX9201SG

Build your own DC motor control with the H-bridge Kit 2GO, a ready-to-use evaluation kit. It is fully populated with all electronic components equipped with the H-bridge MOTIX™ IFX9201 combined with XMC1100 microcontroller based on Arm® Cortex®-M0 CPU. It is designed for the control of DC motors or other inductive loads up to 6 A or up to 36 V of supply.

### Target applications

- DC motor control for industrial applications
- Home and building automation
- Power tools battery management
- Industrial robotic applications
- Electric toys applications

Ordering code: HBRIDGEKIT2GOTOB01



## KIT\_XMC1300\_IFX9201

### Stepper motor control shield with MOTIX™ IFX9201SG and XMC1300 for Arduino

The stepper motor control shield from Infineon is one of the first high-current stepper motor control boards being compatible to Arduino as well as to Infineon's XMC1100 boot kit. The stepper motor control shield is capable to drive the two coils in a stepper motor featuring dual-half-bridge configuration. The implemented integrated MOTIX™ IFX9201 half-bridges can be controlled by a STEP-signal via the STEP pin. Interfacing to a microcontroller is made easy by the integrated XMC1300 microcontroller that holds the peripherals to allow high-speed current control. Microstepping of the stepper motor can be achieved using the internal comparators, while operational amplifiers are installed to adapt the motor current sense signal to the microcontroller's input levels.

### Features and benefits

#### Key features

- Compatible with microcontroller boards using the Arduino form factor, e.g., Infineon's XMC™ microcontroller kits
- Capable of high-frequency PWM, e.g., 30 kHz
- Adjustable slew rates for optimized EMI by changing external resistor
- Driver circuit with logic level inputs
- Diagnosis with current sense

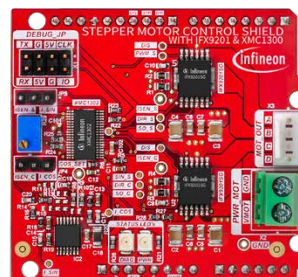
#### Key benefits

- Fast and inexpensive prototyping of stepper motor control
- Simple testing of microstepping algorithms
- Diagnose pin to allow hardware feedback during development
- Overtemperature shutdown with latch behavior and undervoltage shutdown of the power section

### Target applications

- Stepper motors up to 5 A phase current
- 24 V nominal input voltage for the power stage
- Average motor current 3 A without additional cooling effort, 5 A possible with proper cooling

Ordering code: KITXMC1300IFX9201TOB01



[www.infineon.com/h-bridge-kit-2go](http://www.infineon.com/h-bridge-kit-2go)

[www.infineon.com/kit-xmc1300-ifx9201](http://www.infineon.com/kit-xmc1300-ifx9201)

[www.infineon.com/makers](http://www.infineon.com/makers)

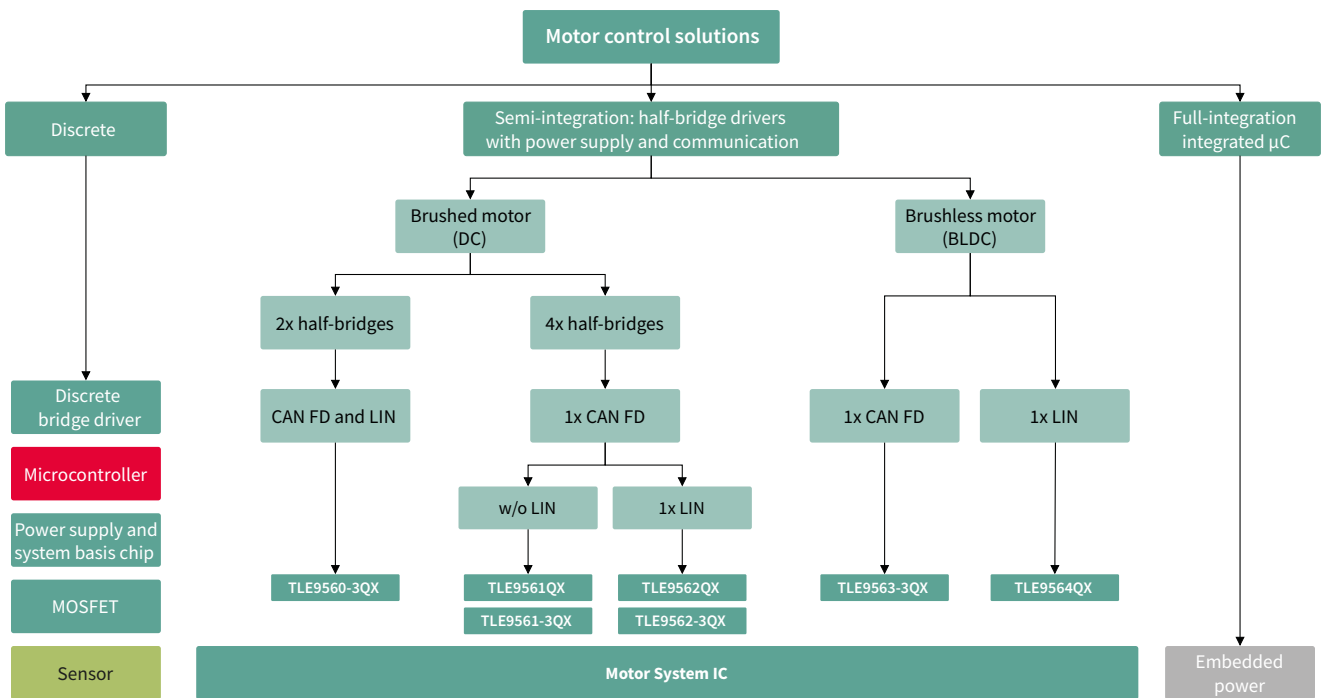
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# MOTIX™ SBC

## (BL)DC motor system IC combines power supply, communication, and multiple half-bridge MOSFET drivers

Infiniteon's MOTIX™ SBC family offers high integration and high performance with optimized system cost for DC and BLDC motor control applications. All devices of the motor system IC family feature a low-dropout voltage regulator with an output current of 250 mA/5 V. The communication interface incorporates a CAN FD transceiver up to 5 Mbit/s according to ISO 11898-2:2016 (including partial networking (PN) option) and/or a LIN transceiver.



### Features

- | Features  |
|---|
| - 5 V linear regulator up to 250 mA   |
| - CAN FD up to 5 Mbps CAN PN and FD tolerant ("–3" variants)  |
| - LIN2.2B/J2602   |
| - MOTIX™ TLE9560/1/2: up to 4 half-bridge gate drivers with adaptive MOSFET control up to 100 mA constant gate charge |
| - MOTIX™ TLE9563/4: three-phase gate driver with CSA and adaptive MOSFET control up to 150 mA constant gate charge    |
| - Up to 4 high-side switches (with 7 on-resistance) Up to 5 wake inputs   |
| - Up to 6 PWM inputs  |

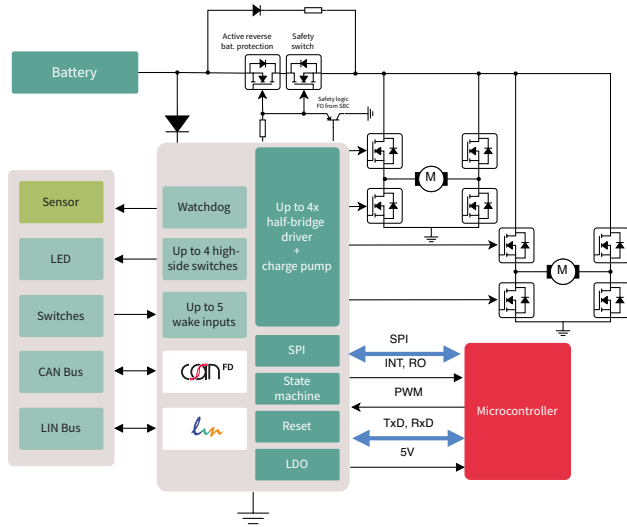
- | Benefits  |
|---|
| - PCB savings up to 50 percent due to unique integration approach   |
| - Lower switching losses and EMC optimization due to adaptive MOSFET control                              |
| - Automatic regulation of MOSFET pre-charge currents diminish need for production MOSFET calibration      |
| - VS monitoring in sleep mode activates MOSFET to prevent from ECU damage when motor is in generator mode |

[www.infineon.com/bldc-motor-system-ics](http://www.infineon.com/bldc-motor-system-ics)  
[www.infineon.com/bdc-motor-system-ics](http://www.infineon.com/bdc-motor-system-ics)

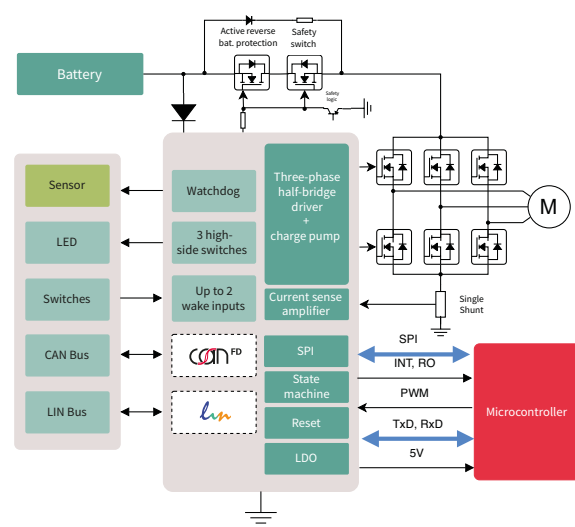
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



Application diagram MOTIX™ TLE9560/1/2 for DC motor control



Application diagram MOTIX™ TLE9563/4 for BLDC motor control



Product table

| Product variant | V <sub>CC1</sub> | CAN FD | CAN PN | LIN | HS switches | PWM input | Driver                          |
|-----------------|------------------|--------|--------|-----|-------------|-----------|---------------------------------|
| TLE9560-3QX     | 5 V up to 250 mA | ✓      | ✓      | ✓   | 4           | 1         | 2x half-bridges (100 mA const.) |
| TLE9561QX       | 5 V up to 250 mA | ✓      | -      | -   | 4           | 4         | 4x half-bridges (100 mA const.) |
| TLE9561-3QX     | 5 V up to 250 mA | ✓      | ✓      | -   | 4           | 4         | 4x half-bridges (100 mA const.) |
| TLE9562QX       | 5 V up to 250 mA | ✓      | -      | ✓   | 4           | 2         | 4x half-bridges (100 mA const.) |
| TLE9562-3QX     | 5 V up to 250 mA | ✓      | ✓      | ✓   | 4           | 2         | 4x half-bridges (100 mA const.) |
| TLE9563-3QX     | 5 V up to 250 mA | ✓      | ✓      | -   | 3           | 6         | 3x half-bridges (150 mA const.) |
| TLE9564QX       | 5 V up to 250 mA | -      | -      | ✓   | 3           | 6         | 3x half-bridges (150 mA const.) |



[www.infineon.com/bdc-motor-system-ics](http://www.infineon.com/bdc-motor-system-ics)  
[www.infineon.com/bldc-motor-system-ics](http://www.infineon.com/bldc-motor-system-ics)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





## DC and BLDC motor control shields and evaluation boards with MOTIX™ TLE9562-3QX and with MOTIX™ TLE9563-3QX

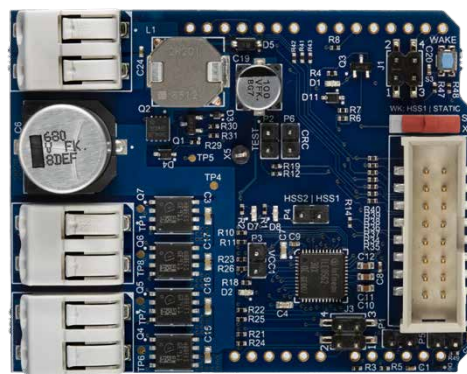
The purpose of these boards is to provide a quick evaluation solution for lab assessments. The evaluation boards offer a unique two-in-one solution: they can be connected via a UIO stick with the computer to evaluate features via config wizard (a graphical user interface) which can be found in the Infineon Developer Center. In addition, the evaluation boards feature an Arduino shield interface for rapid prototyping.

### Summary of features BLDC motor control shield with MOTIX™ TLE9563-3QX

- Operating voltage range 5.5-28 V with 5 V compatible logic input
- Integrated reverse polarity protection with on-board EMC filter
- Three integrated half-bridges MOSFET (2-in-1 MOSFET package)
- 5 mΩ low-side current sense
- High-power RGB LED driven by integrated high-side switches
- On-board back-EMF detection circuit and connector for Hall-sensor
- Arduino example codes available

**Sales product name:** BLDC SHIELD\_TLE956X

**Ordering code:** BLDCSHIELDTLE956XTOBO1



### Summary of features DC motor control shield with MOTIX™ TLE9562-3QX

- Operating voltage range 5.5-28 V with 5 V compatible logic input
- Integrated reverse polarity protection with on-board EMC filter
- Four integrated half-bridge MOSFETs (2 in 1 MOSFET package)
- Easy interfacing of CAN and LIN transceiver
- Miniaturization/shrink of the PCB area
- Arduino example codes available

**Sales product name:** DC SHIELD\_TLE956X

**Ordering code:** DCSHIELDTLE956XTOBO1

### Benefits of DC and BLDC motor control shields

- 2-in-1 board with GUI and Arduino interface for evaluation and rapid prototyping
- 50 percent reduced internal operating current consumption
- Simplified and cost efficient ground network
- Smaller package size for area savings
- Very low quiescent current in sleep-mode

[www.infineon.com/bldc-shield\\_tle956x](http://www.infineon.com/bldc-shield_tle956x)

[www.infineon.com/bdc-shield\\_tle956x](http://www.infineon.com/bdc-shield_tle956x)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# MOTIX™ 6EDL7141

## Three-phase smart gate drive controller IC

The MOTIX™ 6EDL7141 is Infineon's latest three-phase motor control gate driver IC that enables development of high-performance-battery-operated products using BLDC or PMSM motors. Ideal applications include cordless power tools, gardening products, and automated guided vehicles. With over 50 programmable parameters using built-in digital SPI interface, the MOTIX™ 6EDL7141 is fully configurable to drive a wide range of MOSFET's to yield the best possible system efficiency. The MOTIX™ 6EDL7141 is also designed for maximum flexibility. With an operating voltage from 5.5-70 V and configurable gate drive sink and source current up to 1.5 A, it can drive a wide range of MOSFETs effectively to best fit the application. It has an adjustable gate driver supply voltage setting between 7 V, 10 V, 12 V, and 15 V even at low battery voltage thanks to built-in dual charge pumps. The MOTIX™ 6EDL7141 also has adjustable gate driver parameters to enable control of the slew rate to minimize system EMI. All of the MOTIX™ 6EDL7141 settings can be quickly changed with the available easy-to-use GUI. The integrated buck regulator requires only an external capacitor and inductor to provide power for both the microcontroller and the Hall sensors in the motor, further reducing fault conditions.

### EVAL\_6EDL7141\_TRAP\_1SH

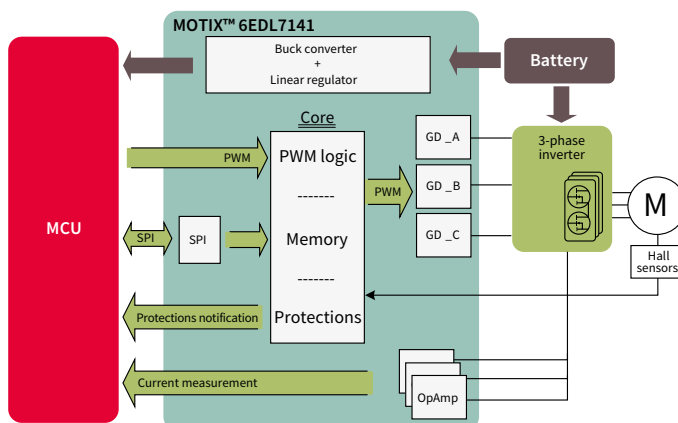
- Single shunt evaluation board for trapezoidal commutation of BLDC motors with 40 V OptiMOS™ 5 PQFN and XMC1404 MCU
- On-board programming dongle
- Featured IC: MOTIX™ 6EDL7141



## Features and benefits

| Key features  | Key benefits   |
|---|--|
| - Integrated power supplies                         | - Reduced external components and PCB area                       |
| - Adjustable slew rate                              | - Optimized efficiency and EMI                                   |
| - Programmable gate drive parameters                | - Maximum flexibility to use different inverter FETs             |
| - 3x current shunt amplifier                        | - Highly accurate current sense while saving external components |
| - Complete dedicated motor control protection suite | - Higher dynamic range to increase signal resolution             |
|   | - Improve reliability and fault detection                        |

## Block diagram



## Product portfolio

| Part number | Package       | Voltage [V] | $R_{DS(on),max}$ [mΩ] |
|-------------|---------------|-------------|-----------------------|
| 6EDL7141    | PG-VQFN-48-78 | 5.5 – 70 V  | 2.2                   |

[www.infineon.com/6edl7141](http://www.infineon.com/6edl7141)

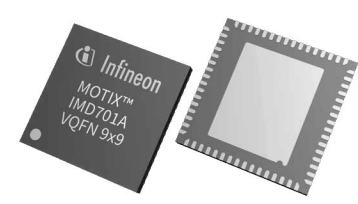
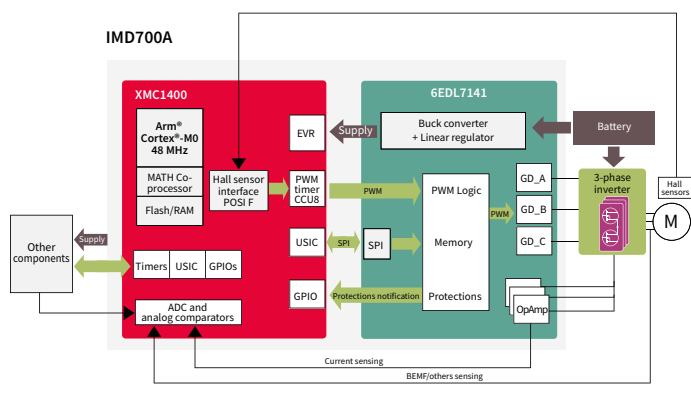
For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# MOTIX™ IMD700A/IMD701A integrated controller

## Fully programmable motor controller combining microcontroller and gate driver IC

Today's newest battery-operated motor drive applications require increased power density and longer run-time, which needs higher efficiency. MOTIX™ IMD700A and IMD701A are Infineon's latest fully programmable motor controllers integrating XMC1404 microcontroller with MOTIX™ 6EDL7141 3-phase gate driver IC in one package to enable the development of next-generation battery-operated products using BLDC or PMSM motors. These controllers are ideal for applications such as professional cordless power tools, gardening products, e-bikes, and automated guided vehicles. With integrated precision power supply and current shunt amplifiers, much of the peripheral circuitry is no longer necessary, reducing PCB space and improving system packaging possibilities. XMC1404, Arm® Cortex®-M0 based microcontroller incorporates dedicated features to improve motor drive control. A hardware MATH Co-Processor clocked at 96 MHz, enhances calculations including division and trigonometric functions commonly used in Field Oriented Control of PMSM. Additionally, XMC1404 inherits most of the high-end peripherals found in the XMC4000 family (ARM® Cortex®-M4), including PWM timers -CCU8 and CCU4-, position interface (POSIF) or serial communication modules including CAN, ensuring best in class control. The integrated 3-phase gate driver (6EDL7141) includes configurable gate drive sink and source currents up to 1.5 A, it enables the ability to drive a wide range of MOSFETs effectively to minimize losses and increase efficiency. It has adjustable gate driver supply voltage settings between 7 V, 10 V, 12 V, and 15 V even at low battery voltage thanks to built-in high and low side charge pumps. The 6EDL7141 also has dynamically adjustable gate driver parameters to enable control of the slew rate to minimize system EMI and voltage overshoots. In addition, with a full suite of system protection features such as OCP, UVLO, over-temperature, and locked rotor detection, this dedicated motor controller will increase reliability and robustness in severe operating fault conditions.



### Features and benefits

- Key features**
- Integrated power supplies
  - Adjustable slew rate
  - Programmable gate drive parameters
  - 3x current shunt amplifier
  - Complete dedicated motor control protection suite

- Key benefits**
- Reduced external component count and PCB area
  - Lower voltage overshoots and EMI reduction
  - Maximum flexibility to use different inverter MOSFETs
  - Highly accurate integrated current sense saves external components
  - Improved reliability and fault detection

| Part number         | Package               | Voltage [V] | D <sub>VDD</sub> regulator output [V] |
|---------------------|-----------------------|-------------|---------------------------------------|
| IMD700A-Q064X128-AA | PG-VQFN-64-8 9 x 9 mm | 5.5 – 60 V  | 3.3 V                                 |
| IMD701A-Q064X128-AA | PG-VQFN-64-8 9 x 9 mm | 5.5 – 60 V  | 5.0 V                                 |

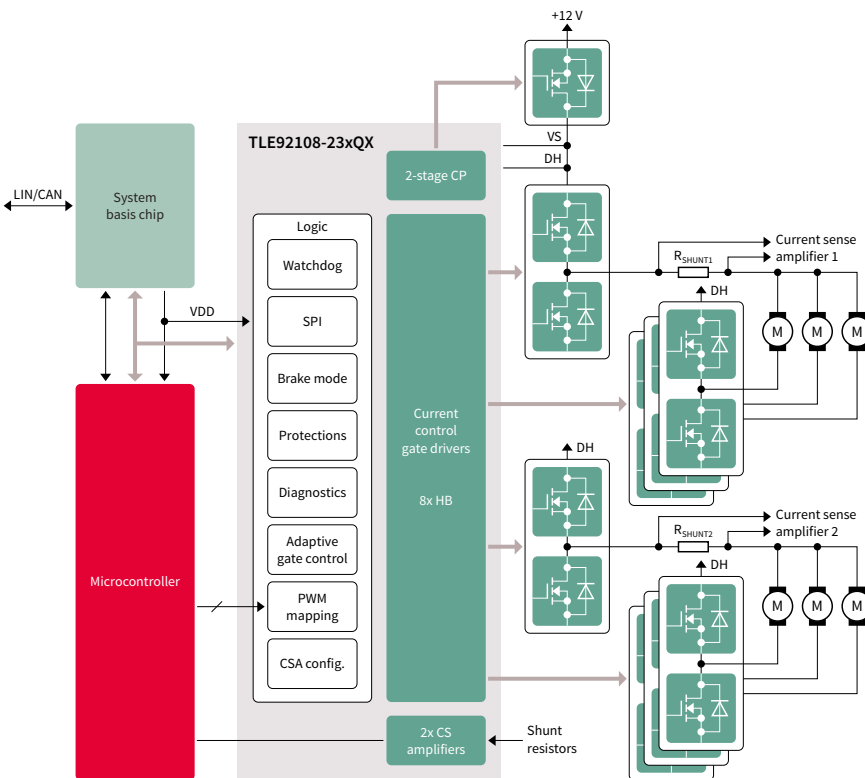


# MOTIX™ multi-MOSFET driver

## Multiple half-bridge drivers designed to control up to eight half-bridges

Infiniteon's MOTIX™ TLE9210x is a family of multi-MOSFET drivers, designed to control up to eight half-bridges (up to 16 N-channel MOSFETs) with one packaged device. Having only one device for several half-bridges enables further savings, such as less pick and place costs and less required PCB area compared to discrete solutions.

The MOTIX™ TLE92108 and MOTIX™ TLE92104 multiple MOSFET driver offer a reliable and cost-optimized solution with state-of-the-art diagnostic and protection. The devices of the MOTIX™ TLE9210x family are pin and software compatible. Furthermore, the product family allows motor cascading: with TLE92108 (8 half-bridges), up to 7 bidirectional DC motors can be driven.



### Product table

| Type           | Description                   | Brake mode | Package    | Ordering code      |
|----------------|-------------------------------|------------|------------|--------------------|
| TLE92108-231QX | 8-fold multi-MOSFET driver IC | No         | PG-VQFN-48 | TLE92108231QXXUMA1 |
| TLE92108-232QX | 8-fold multi-MOSFET driver IC | Yes        | PG-VQFN-48 | TLE92108232QXXUMA1 |
| TLE92104-131QX | 4-fold multi-MOSFET driver IC | No         | PG-VQFN-48 | TLE92104131QXXUMA1 |
| TLE92104-232QX | 4-fold multi-MOSFET driver IC | Yes        | PG-VQFN-48 | TLE92104232QXXUMA1 |



# MOTIX™ TLE92104-23QX APPKIT and MOTIX™ TLE92108-23QX APPKIT

Infineon's evaluation boards to measure and evaluate the hardware and software functionalities of the MOTIX™ multi-MOSFET driver family

The TLE92104-23QX APPKIT contains the multi-MOSFET driver IC TLE92104-232QX, and a typical application circuit, including 4 MOSFET half-bridges (OptiMOS™ 40 V MOSFETs in S308 package) to drive up to 3 bidirectional DC motors.

The TLE92108-23QX APPKIT contains the multi-MOSFET driver IC the TLE92108-232QX and a typical application circuit, including 8 MOSFET half-bridges (OptiMOS™ 40 V in S308 package) to drive up to 7 bidirectional DC motors.

The application boards can be connected via a UIO stick with the computer to evaluate their features via config wizard (a graphical user interface) which can be found in the Infineon Developer Center.

**Ordering code:** TLE9210423QXAPPKITTOB01

**Ordering code:** TLE9210823QXAPPKITTOB01



[www.infineon.com/tle92104-23qx-appkit](http://www.infineon.com/tle92104-23qx-appkit)  
[www.infineon.com/tle92108-23qx-appkit](http://www.infineon.com/tle92108-23qx-appkit)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

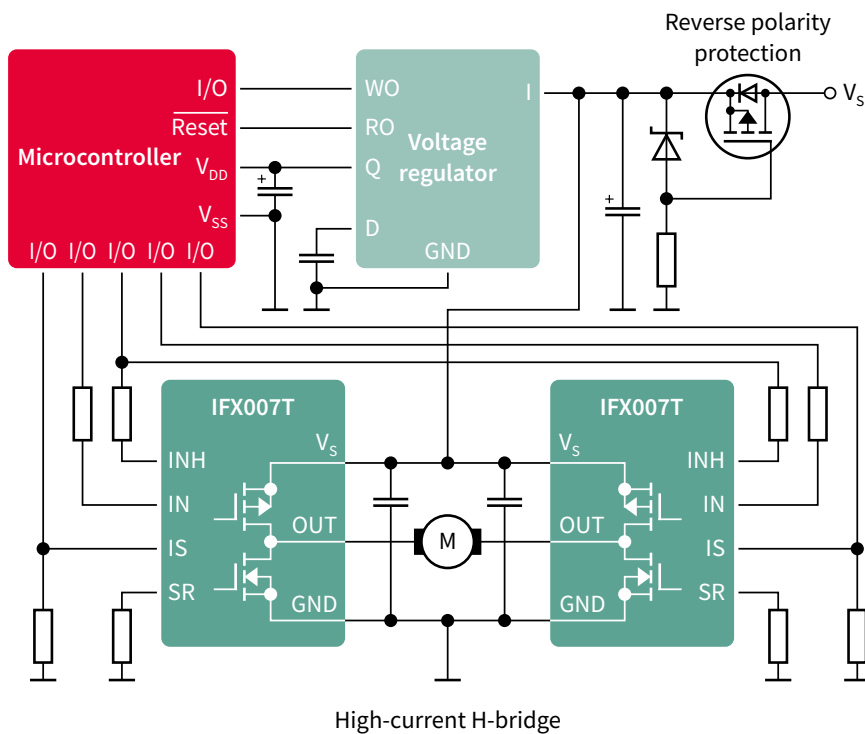


# Single half-bridge IC

## Protected high-current half-bridge for industrial applications

The NovalithIC™ provides a complete, low-ohmic protected half-bridge in a single package (typical path resistance at 25°C down to 10 mΩ). It can also be combined with an additional NovalithIC™ to create an H-bridge or three-phase bridge. The NovalithIC™ family has the capability to switch high-frequency PWM while providing overcurrent, overvoltage, and overtemperature protection. The NovalithIC™ family offers cost-optimized, scalable solutions for protected high-current PWM motor drives with very restrictive board space. Due to the P-channel high-side switch the need for a charge pump is eliminated thus minimizing EMI. The latest addition to the NovalithIC™ family is the IFX007T, which is optimized for industrial applications.

### Application example for high-current PWM motor drives



### Features

| Basic features                   | Protection features        | Diagnostic features        |
|----------------------------------|----------------------------|----------------------------|
| – Low quiescent current          | – Overtemperature shutdown | – Overtemperature          |
| – Capable for high PWM frequency | – Overvoltage shutdown     | – Overvoltage              |
| – Logic level input              | – Undervoltage             | – Current sense and status |
| – Adjustable slew rate           | – Overcurrent              |                            |
| – Cross-current protection       |                            |                            |

| Product number | Operating range [V] | $R_{DS(on)}$ path (typ.) [mΩ] | $I_{D(lim)}$ (typ.) [A] | $I_q$ (typ.) [μA] | Switch time (typ.) [μs] | Diagnosis  | Protection | Package     | Qualification |
|----------------|---------------------|-------------------------------|-------------------------|-------------------|-------------------------|------------|------------|-------------|---------------|
| IFX007T        | 5.5 ... 40.0        | 10.0                          | 70                      | 7                 | 0.25                    | OT, OC, CS | UV, OT, OC | PG-TO-263-7 | JESD471       |



# Infineon support for power ICs

## Useful links and helpful information

### Further information, datasheets and documents

[www.infineon.com/acdc](http://www.infineon.com/acdc)

[www.infineon.com/coolset](http://www.infineon.com/coolset)

[www.infineon.com/integrated-powerstages](http://www.infineon.com/integrated-powerstages)

[www.infineon.com/digital-controller](http://www.infineon.com/digital-controller)

[www.infineon.com/lighting-ics](http://www.infineon.com/lighting-ics)

[www.infineon.com/isoface](http://www.infineon.com/isoface)

[www.infineon.com/eicedriver](http://www.infineon.com/eicedriver)

[www.infineon.com/novalithic](http://www.infineon.com/novalithic)

[www.infineon.com/shields-for-arduino](http://www.infineon.com/shields-for-arduino)

[www.infineon.com/ipol](http://www.infineon.com/ipol)

[www.infineon.com/analog-ipol](http://www.infineon.com/analog-ipol)

[www.infineon.com/xdp](http://www.infineon.com/xdp)

[www.infineon.com/motix](http://www.infineon.com/motix)

[www.infineon.com/madk](http://www.infineon.com/madk)

[www.infineon.com/optireg-linear](http://www.infineon.com/optireg-linear)

[www.infineon.com/optireg-switcher](http://www.infineon.com/optireg-switcher)

[www.infineon.com/motor-control-ics](http://www.infineon.com/motor-control-ics)

[www.infineon.com/imotion](http://www.infineon.com/imotion)



Support



Evaluation board



Tools



Simulation



## Wide bandgap semiconductors

### Gallium nitride (GaN)

- CoolGaN™ GIT HEMTs
- CoolGaN™ GIT HEMTs 600 V
- CoolGaN™ IPS half-bridge 600 V
- CoolGaN™ product portfolio

### Silicon carbide (SiC)

- CoolSiC™ MOSFETs 650 V overview and portfolio
- CoolSiC™ MOSFETs 1200 V overview and portfolio
- CoolSiC™ MOSFETs 1700 V overview and portfolio
- CoolSiC™ MOSFETs 2000 V overview and portfolio
- CoolSiC™ Schottky diodes
- CoolSiC™ Schottky diodes 650 V
- CoolSiC™ Schottky diodes 1200 V
- CoolSiC™ diodes product portfolio
- CoolGaN™ and CoolSiC™ nomenclature

Please click [here](#) to discover **CoolSiC™ hybrid devices**.



# Wide bandgap semiconductors

## Gallium nitride (GaN) and silicon carbide (SiC)

The key to the next essential step towards an energy-efficient world is the use of new materials, such as wide bandgap semiconductors that allow for greater power efficiency, smaller size, lighter weight, lower overall cost – or all of these together. As the leading and trusted power supplier, Infineon offers the broadest product and technology portfolio of silicon (Si) and wide bandgap (WBG) solutions with more than 40 years of heritage in silicon, and several decades of heritage in wide bandgap technology development.

### CoolGaN™ – ultimate efficiency and reliability

Compared to silicon (Si) MOSFETs, the breakdown field of Infineon's CoolGaN™ gate injection transistor (GIT) enhancement mode (e-mode) HEMTs is ten times higher, and the electron mobility is double. Both the output charge and gate charge are ten times lower than with Si and the reverse recovery charge is almost zero, which is key to high-frequency operations. GaN is the best-suited technology in hard-switching and resonant topologies, enabling new approaches in current modulation. Infineon's GaN solution is based on the market's most robust and performing concept in – the enhancement-mode concept - offering fast turn-on and turn-off speed. CoolGaN™ products focus on high performance and robustness, and add significant value to a wide variety of systems across many applications such as server, telecom, hyperscale data centers, wireless charging, adapter/charger, and audio. CoolGaN™ switches are easy to design-in with the matching EiceDRIVER™ gate driver ICs optimized for CoolGaN™ 600 V from Infineon.

### CoolSiC™ - revolution to rely on

Silicon carbide (SiC) has a wide bandgap of 3 electronvolts (eV) and a much higher thermal conductivity compared to silicon. SiC-based MOSFETs are best-suited for high-breakdown, high-power applications that operate at higher frequencies compared to traditional IGBTs. CoolSiC™ MOSFETs come along with a fast internal freewheeling diode, thus making hard commutation without additional diode chips possible. Due to its unipolar character, the MOSFETs show very low temperature-independent switching and low conduction losses, especially under partial load conditions. Based on proven, high-quality volume manufacturing, Infineon's silicon carbide solutions combine revolutionary technology with benchmark reliability – for our customers' success today and tomorrow. The offering is completed by EiceDRIVER™ SiC MOSFET gate driver ICs based on Infineon's successful coreless transformer technology.



# CoolGaN™ GIT HEMTs

## Tailor-made for the highest efficiency and power density in switch-mode power supplies

Compared to the next best silicon alternative, CoolGaN™ enables higher power density and the highest efficiency, especially in the partial load range, through novel topologies such as the CCM totem-pole PFC stage. GaN e-mode HEMT performance features a low reverse recovery charge and excellent dynamic performance in reverse conduction compared to silicon FET solutions. This characteristic enables more efficient operation at established frequencies and much higher frequency operation, improving power density by shrinking the size of passive components. CoolGaN™ enables doubled output power in a given energy storage slot size, freeing up space and realizing higher efficiency simultaneously. Infineon's CoolGaN™ comes with industry-leading reliability. During the quality management process, it is not only the device that is thoroughly tested but also its behavior in the application environment. The performance of CoolGaN™ goes beyond other GaN products in the market.

### Features

- › Low output charge and gate charge
- › No reverse recovery charge

### Design benefits

- › High power density, small and light design
- › High efficiency in resonant circuits
- › New topologies and current modulation
- › Fast and (near-)lossless switching

### Advantages

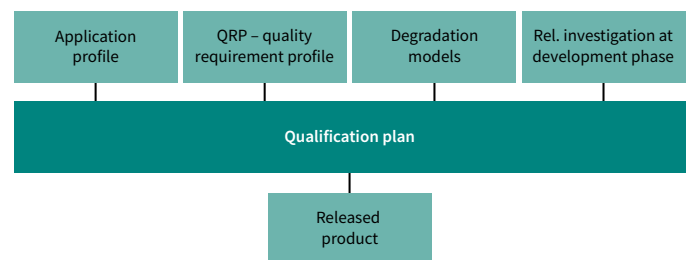
- › Operational expenses (OPEX) and capital expenditure (CAPEX) reduction
- › BOM and overall cost savings

Infineon's high- and low-voltage MOSFETs, gate-driver ICs and digital controllers complement the CoolGaN™ offering to fully exploit the benefits of GaN technology in systems.

### The highest quality

The qualification of GaN switches requires a dedicated approach, well above existing silicon standards

- › Infineon qualifies GaN devices well beyond industry standards
- › Application profiles are an integral part of the qualification process
- › Failure models, based on accelerated test conditions, ensure target lifetime and quality are met
- › Infineon sets the next level of wide bandgap quality



### CoolGaN™ GIT HEMTs overview

| GIT HEMTs   |                                       |
|---|---------------------------------------|
| CoolGaN™ GIT HEMTs 600 V                              | CoolGaN™ Integrated Power Stage (IPS) |
| Dedicated gate driver ICs for CoolGaN™ GIT HEMTs      | CoolGaN™ IPS half-bridge 600 V        |
| EiceDRIVER™ 1 EDi-G1                                  |                                       |
| Standard gate driver for flexible design              | CoolGaN™ IPS single-channel 600 V     |
| EiceDRIVER™ 2EDi family, 1EDB family, 1EDN-TDi family |                                       |

[www.infineon.com/gan](http://www.infineon.com/gan)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



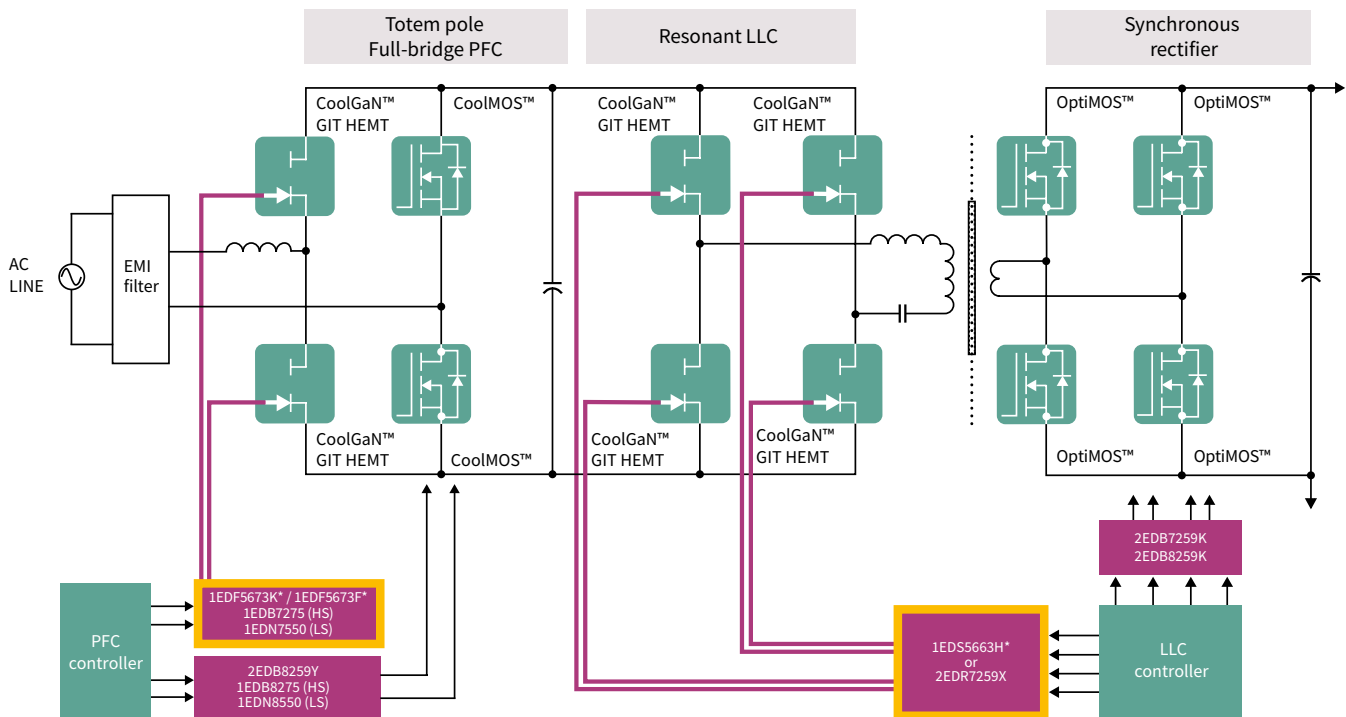
## CoolGaN™ GIT HEMTs – bringing GaN technology to the next level

Infineon's CoolGaN™ GIT e-mode HEMTs enable more than 98 percent system efficiency and help customers make their end products smaller and lighter. Driving enhancement-mode devices requires additional features when choosing the correct gate driver IC. With the EiceDRIVER™ 1EDx56x3x family, Infineon offers dedicated single-channel galvanically isolated gate driver ICs, which are a perfect fit for e-mode GaN HEMTs with non-isolated gate (diode input characteristic) and low threshold voltage, such as CoolGaN™. However, CoolGaN™ technology does not require customized ICs, and in many applications, CoolGaN™ can be driven by standard gate drivers when coupled to an RC interface.

### Complete support of all requirements specific to e-mode GaN HEMTs operation:

- › Low driving impedance (on-resistance 0.85 Ω source, 0.35 Ω sink)
- › Resistor programmable gate current for steady on-state (typically 10 mA)
- › Programmable negative gate voltage to completely avoid spurious turn-on in half-bridges

### Block diagram: high-efficiency GaN switched-mode power supply (SMPS)



\*Single-channel EiceDRIVER™ ICs dedicated for CoolGaN™ GIT HEMTs



# CoolGaN™ GIT HEMTs 600 V

## The highest efficiency and power density with reduced system costs

The e-mode concept offers fast turn-on and turn-off speed, as well as a better path towards integration. CoolGaN™ GIT HEMTs 600 V enable simpler and more cost-effective half-bridge topologies. As e-mode based products reach maturity, CoolGaN™ GIT HEMTs 600 V are gaining growing prominence thanks to their potential. Infineon manufactures their CoolGaN™ 600 V series according to a specific, GaN-tailored qualification process that goes far beyond the standard for silicon power devices. CoolGaN™ GIT HEMT 600 V is designed for datacom and server SMPS, telecom rectifiers, as well as mobile chargers and adapters, and can be used as a general switch in many other industrial and consumer applications. It is the most rugged and reliable solution in the market. The CoolGaN™ portfolio is built around high-performing SMD packages to fully exploit the benefits of GaN.

### CoolGaN™ GIT HEMTs for PFC

CoolGaN™ enables the adoption of simpler half-bridge topologies (including the elimination of the lossy input bridge rectifier). The result is record efficiency (>99%) with a potential for BOM savings.

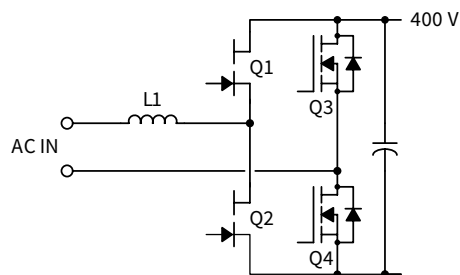
### CoolGaN™ GIT HEMTs for resonant topologies

- › In resonant applications, ten times lower  $Q_{oss}$  and  $Q_g$  enables high-frequency operations (>1 MHz) at the highest efficiency levels
- › Linear output capacitance leads to 8 to 10 times lower dead time
- › Devices can be easily paralleled
- › Power density can be pushed even further by optimizing the thermal performance
- › CoolGaN™ enables to push the efficiency forward, thus enabling high power density e.g., in low-power chargers/adapters

### Applications

- › Telecom
- › Server
- › Datacom
- › Adapter and charger
- › Wireless charging
- › SMPS

### Full-bridge totem pole



### Demonstration board

2.5 kW totem-pole PFC board:  
[EVAL\\_2500W\\_PFC\\_GAN\\_A](#)



- › 2 x 70 mΩ CoolGaN™ GIT HEMT in DSO-20-85
- › 2 x 33 mΩ CoolMOS™



# CoolGaN™ IPS half-bridge 600 V

## Ease of use with integrated drivers for highest efficiency and power density

The CoolGaN™ IPS half-bridge 600 V combines a half-bridge power stage consisting of two CoolGaN™ GIT HEMTs and a dedicated gate driver IC in one thermally enhanced 8 x 8 mm QFN-28 package. The CoolGaN™ IPS HB family is available in  $R_{DS(on),typ}$  of in 2x 140/200/270/500 mΩ, in a thermally enhanced 8 x 8 mm QFN-28 package and 2x500 mΩ in 6x8 mm TFLGA-27 package. It is thus ideally suited to support the design of compact appliances in the low-to-medium power area. Infineon's CoolGaN™ power switches provide a very robust gate structure. When driven by a continuous gate current of a few mA in the on-state, a minimum on-resistance  $R_{DS(on)}$  is always guaranteed, independent of temperature and parameter variations.

Due to the GaN-specific low threshold voltage and the fast switching transients, a negative-gate drive voltage is required in certain applications to avoid spurious turn-on effects. This can be achieved by the well-known RC interface between the driver and the switch. A few external SMD resistors and capacitors allow for easy adaptation to different applications (low/medium power, hard/soft switching).

The built-in driver utilizes an on-chip coreless transformer (CT) technology to achieve level-shifting to the high side. Besides, CT technology guarantees excellent robustness even for extremely fast switching transients above 150 V/ns.

The CoolGaN™ IPS 600 V family, is available in various configurations such as half-bridge and single-channel.

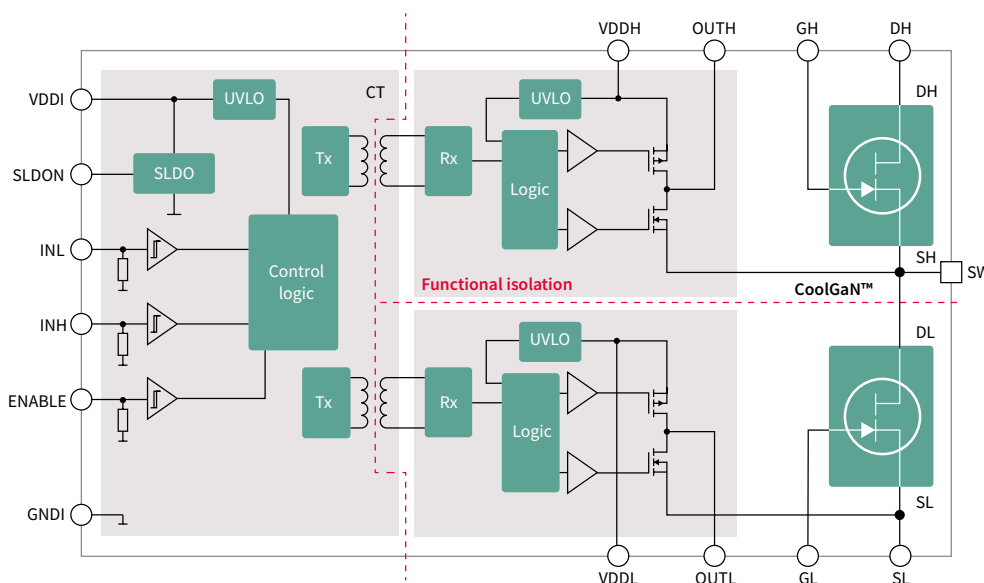
### Features and benefits

#### Key features

- Digital-in, power-out building block
- Application configurable switching behavior
- Highly accurate and stable timing
- Thermally enhanced 8 x 8 mm QFN-28 and 6 x 8 mm TFLGA-27 package

#### Key benefits

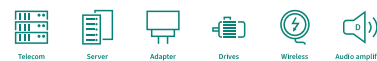
- Easy to drive with 2x digital PWM input
- Low system BOM
- Configurability of gate path with low inductance loop on PCB
- Allows short dead-time setting in order to maximize system efficiency
- Small package for compact system designs



## CoolGa™ GIT HEMTs 600 V



| Package<br>$R_{DS(on),max.}$ | DSO-20-85<br>Bottom-side cooling | DSO-20-87<br>Top-side cooling | HSOF-8-3<br>TO-Leadless | LSON-8-1<br>DFN 8x8 | TSON-8-3<br>ThinPAK 5x6 |
|------------------------------|----------------------------------|-------------------------------|-------------------------|---------------------|-------------------------|
| 42 mΩ                        | IGO60R042D1                      | IGOT60R042D1                  | IGT60R042D1             |                     |                         |
| 70 mΩ                        | IGO60R070D1                      | IGOT60R070D1                  | IGT60R070D1             | IGLD60R070D1        |                         |
| 190 mΩ                       |                                  |                               | IGT60R190D1             | IGLD60R190D1        | IGLR60R190D1            |
| 260 mΩ                       |                                  |                               |                         |                     | IGLR60R260D1            |
| 340 mΩ                       |                                  |                               |                         |                     | IGLR60R340D1            |

EiceDRIVER™ family optimized for  
CoolGa™ GIT HEMTs 600 V

| Product   | Package              | Input to output isolation |  |                                 |                      | Propagation delay accuracy | Typ. high level (sourcing) output resistance | Typ. low level (sinking) output resistance |
|-----------|----------------------|---------------------------|--|---------------------------------|----------------------|----------------------------|--|--|
|           |                      | Isolation class           | Rating   | Surge testing                   | Certification        |                            |  |  |
| 1EDF5673K | LGA, 13-pin, 5x5 mm  | functional                | $V_{IO} = 1.5 \text{ kV}_{DC}$                                     | n.a.                            | n.a.                 | -6 ns/+7ns                 | 0.85 Ω                                       | 0.35 Ω                                     |
| 1EDF5673F | DSO, 16-pin, 150 mil | functional                | $V_{IO} = 1.5 \text{ kV}_{DC}$                                     | n.a.                            | n.a.                 | -6 ns/+7ns                 | 0.85 Ω                                       | 0.35 Ω                                     |
| 1EDS5663H | DSO, 16-pin, 300 mil | reinforced                | $V_{IOTM} = 8 \text{ kV}_{pk}$<br>$V_{ISO} = 5.7 \text{ kV}_{RMS}$ | $V_{ISOM} > 10 \text{ kV}_{pk}$ | EN 62368-1<br>UL1577 | -6 ns/+7ns                 | 0.85 Ω                                       | 0.35 Ω                                     |

## EiceDRIVER™ standard gate drivers



| Product                 | Package              | Input to output isolation |  |                        | Output UVLO <sup>1)</sup> | Output peak source/sink current | CMTI (min.) | Propagation delay (typ.) | Propagation delay accuracy |
|-------------------------|----------------------|---------------------------|--|------------------------|---------------------------|---------------------------------|-------------|--------------------------|----------------------------|
|                         |                      | Isolation class           | Rating   | Certification          |                           |                                 |             |                          |                            |
| 2EDR7259X               | DSO, 14-pin, 300 mil | reinforced                | $V_{ISO} = 5.7 \text{ kV}_{RMS}$<br>$V_{IOTM} = 8 \text{ kV}_{pk}$ | UL1577,<br>VDE 0884-11 | 4 V                       | 5 A/9 A                         | 150 V/ns    | 38 ns                    | -5 ns/+9 ns                |
| 2EDR8259X <sup>2)</sup> |                      |                           |  |                        | 8 V                       |                                 |             |                          |                            |
| 2EDB7259Y               | DSO, 14-pin, 150 mil | single protection         | $V_{ISO} = 3.0 \text{ kV}_{RMS}$                                   | UL1577                 | 4 V                       | 300 V/ns                        | 45 ns       | -4 ns/+6 ns              |                            |
| 2EDB8259Y               |                      |                           |  |                        | 8 V                       |                                 |             |                          |                            |
| 1EDB7275F               | DSO, 8-pin, 150 mil  | single protection         | $V_{ISO} = 3.0 \text{ kV}_{RMS}$                                   | UL1577                 | 4 V                       | n.a.                            | 45 ns       | -7 ns/+10 ns             |                            |
| 1EDB8275F               |                      |                           |  |                        | 8 V                       |                                 |             |                          |                            |
| 1EDN7550B               | SOT23, 6-pin         | non-isolated              | n.a.   | n.a.                   | 4 V                       | n.a.                            | 45 ns       | -7 ns/+10 ns             |                            |
| 1EDN8550B               |                      |                           |  |                        | 8 V                       |                                 |             |                          |                            |

## CoolGa™ IPS 600 V half-bridge/single-channel



| Package<br>$R_{DS(on),max.}$ | 8x8 mm<br>QFN-28 | 8x8 mm<br>QFN-21 | 6x8 mm<br>LGA-27 |
|------------------------------|------------------|------------------|------------------|
| 100 mΩ                       |                  | IGI60F100A1L*    |                  |
| 140 mΩ                       | IGI60F1414A1L    | IGI60F140A1L*    |                  |
| 200 mΩ                       | IGI60F2020A1L    | IGI60F200A1L*    |                  |
| 270 mΩ                       | IGI60F2727A1L    | IGI60F270A1L*    |                  |
| 500 mΩ                       | IGI60F5050A1L    |                  | IGI60L5050A1M    |

[www.infineon.com/hemt](http://www.infineon.com/hemt)

[www.infineon.com/gan-ips](http://www.infineon.com/gan-ips)

[www.infineon.com/driver-gan](http://www.infineon.com/driver-gan)

\* Coming soon

1) 8 V UVLO parts recommended for bipolar driving or for unipolar driving with  $V_{DD} \geq 10 \text{ V}$   
2) 2EDR8258X with ENABLE function also available

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





# Silicon carbide

## Revolution to rely on

Silicon carbide (SiC) devices belong to the so-called wide bandgap semiconductor group, which offers many attractive characteristics for high voltage power semiconductors compared to commonly used silicon (Si). In particular, the much higher breakdown field strength and thermal conductivity of silicon carbide allow developing devices which by far outperform the corresponding silicon-based ones, and enable efficiency levels unattainable otherwise. Infineon's portfolio of SiC devices covers 600 V to 1200 V Schottky diodes as well as the revolutionary CoolSiC™ MOSFETs 650 V, 750 V, 1200 V, 1700 V and 2000 V.

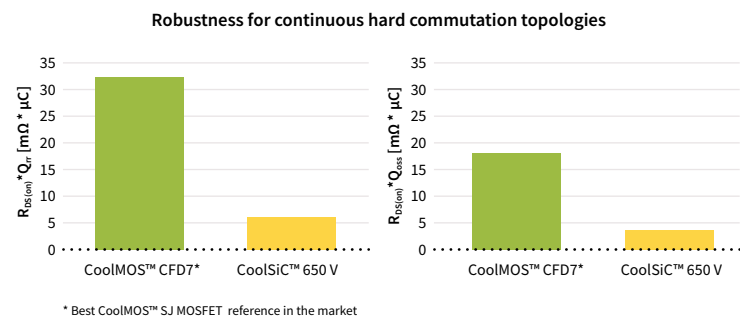
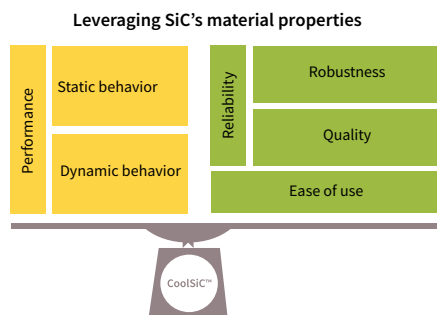
EiceDRIVER™ SiC MOSFET gate-driver ICs are well-suited to drive SiC MOSFETs, especially Infineon's ultra-fast switching CoolSiC™ SiC MOSFETs. These gate drivers incorporate the most important key features and parameters for driving SiC, such as tight propagation delay matching, precise input filters, wide output-side supply range, negative gate voltage capability, active Miller clamp, DESAT protection, and extended CMTI capability.



# CoolSiC™ MOSFETs discrete 650 V

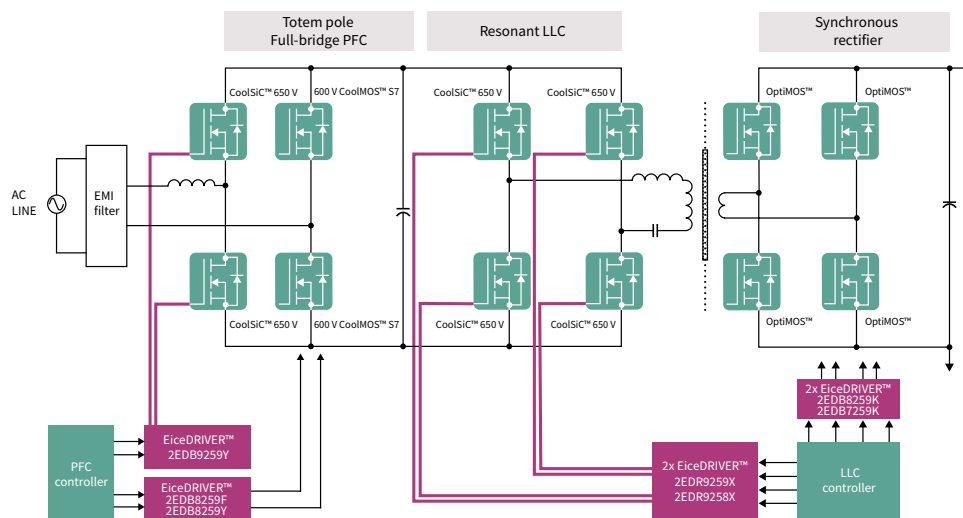
## Delivering reliable and cost-effective top performance

Silicon carbide physical characteristics, from wide bandgap to electron mobility and thermal conductivity, provide the basis to engineer high-performance semiconductor technologies and products. The CoolSiC™ MOSFETs from Infineon maximize the advantages of silicon carbide, offering a high-performance product that also meets power electronics design requirements, like reliability and ease of use. As per performance, the CoolSiC™ MOSFETs show low  $R_{DS(on)}$  dependency with temperature and low switching losses. The reliability is built on technological strengths and on flawless quality processes. Some aspects of Infineon's SiC technology, like superior gate oxide reliability, excellent thermal behavior, advanced avalanche ruggedness and short circuit capabilities, contribute to the robustness of the device. Infineon's benchmark quality was further improved for silicon carbide, with an application-focused qualification scope exceeding standards, complemented by SiC-specific screening measures. Additional unique features, like 0 V turn-off  $V_{GS}$ , wide  $V_{GS}$  range, and the use of silicon MOSFET drivers and driving schemas make CoolSiC™ MOSFETs 650 V easy to integrate and use.



CoolSiC™ MOSFETs can enable streamlined and cost-optimized system designs with fewer components, weight and size, reaching high energy efficiency and power density. For instance, the CoolSiC™ MOSFETs boast a low level of  $Q_{rr}$ , roughly 80% less of the best CoolMOS™ reference in the market, the CoolMOS™ CFD7. This ensures the robustness of the body diode, making the CoolSiC™ MOSFETs suitable for topologies with continuous hard commutation, like the high-efficiency totem-pole PFC, a topology that enables > 99% of efficiency.

### High-efficiency CoolSiC™ totem-pole PFC in server SMPS (switched-mode power supply)



[www.infineon.com/coolbic-mosfet-discretes](http://www.infineon.com/coolbic-mosfet-discretes)  
[www.infineon.com/SiCgd](http://www.infineon.com/SiCgd)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





## CoolSiC™ MOSFET 650 V/750 V



| $R_{DS(on)}$ max. [mΩ] | $R_{DS(on)}$ typ. [mΩ] | TO-247 4-pin  | TO-247       | D <sup>2</sup> PAK-7 | TOLL         | QDPAK TSC       |
|------------------------|------------------------|---------------|--------------|----------------------|--------------|-----------------|
| 11                     | 8                      |               |              |                      |              | IMDQ75R008M1H*  |
| 22                     | 16                     |               |              |                      |              | IMDQ75R016M1H*  |
| 30/34                  | 22/27                  | IMZA65R027M1H | IMW65R027M1H | IMBG65R022M1H        | IMT65R022M1H |                 |
| 52                     | 40                     |               |              |                      |              | IMDQ75R040M1H*  |
| 42                     | 30                     | IMZA65R030M1H | IMW65R030M1H | IMBG65R030M1H        | IMT65R030M1H |                 |
| 50                     | 39                     | IMZA65R039M1H | IMW65R039M1H | IMBG65R039M1H        | IMT65R039M1H |                 |
| 64                     | 48                     | IMZA65R048M1H | IMW65R048M1H | IMBG65R048M1H        | IMT65R048M1H |                 |
| 74                     | 57                     | IMZA65R057M1H | IMW65R057M1H | IMBG65R057M1H        | IMT65R057M1H |                 |
| 94                     | 72                     | IMZA65R072M1H | IMW65R072M1H | IMBG65R072M1H        | IMT65R072M1H |                 |
| 111                    | 83                     | IMZA65R083M1H | IMW65R083M1H | IMBG65R083M1H        | IMT65R083M1H |                 |
| 141                    | 107                    | IMZA65R107M1H | IMW65R107M1H | IMBG65R107M1H        | IMT65R107M1H |                 |
| 182                    | 140                    |               |              |                      |              | IMDQ75R140 M1H* |
| 217                    | 163                    |               |              | IMBG65R163M1H        | IMT65R163M1H |                 |
| 346                    | 260                    |               |              | IMBG65R260M1H        | IMT65R260M1H |                 |

## CoolSiC™ Automotive MOSFET 750 V



| $R_{DS(on)}$ max. [mΩ] | $R_{DS(on)}$ typ. [mΩ] | QDPAK TSC       | D <sup>2</sup> PAK-7 |
|------------------------|------------------------|-----------------|----------------------|
| 11                     | 8                      | AIMDQ75R008M1H* |                      |
| 22                     | 16                     | AIMDQ75R016M1H* | AIMBG75R016M1H       |
| 52                     | 40                     | AIMDQ75R040M1H* | AIMBG75R040M1H       |
| 182                    | 140                    | AIMDQ75R140M1H* | AIMBG75R140M1H       |

[www.infineon.com/coolbic-mosfet-discretes](http://www.infineon.com/coolbic-mosfet-discretes)

[www.infineon.com/SiCgd](http://www.infineon.com/SiCgd)

\* Coming soon

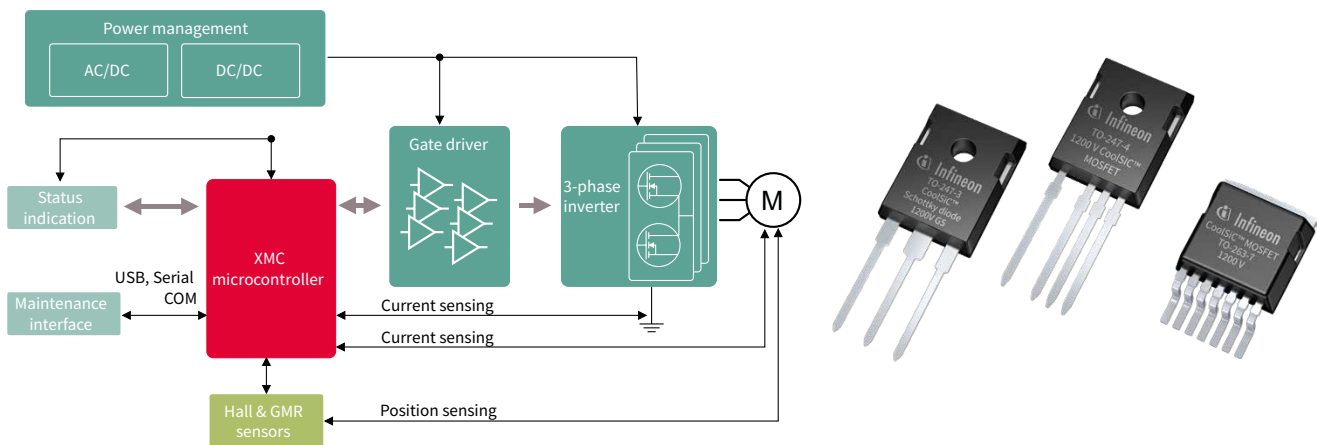
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# CoolSiC™ MOSFETs discrete 1200 V

## Infineon's CoolSiC™ technology enables radically new product designs

Silicon carbide (SiC) opens up new degrees of freedom for designers to harness unseen levels of efficiency and system flexibility. Compared to traditional silicon-based switches like IGBTs and MOSFETs, SiC MOSFETs offer many advantages. These include the low switching losses, the very low reverse recovery losses of the internal commutation-proof body diode, temperature-independent low switching losses, and threshold-free on-state characteristics. Based on volume experience and compatibility know-how, Infineon presents the revolutionary CoolSiC™ technology which enables radically new product designs with high performance and high reliability. CoolSiC™ MOSFET products are targeted for automotive, photovoltaic inverters, battery charging, EV-charging, industrial drives, UPS, SMPS, and energy storage.



### Features and benefits

#### Key features

- Very low switching losses
- Superior gate-oxide reliability
- Threshold-free on-state characteristic
- Wide gate-source voltage range
- Benchmark gate threshold voltage,  $V_{GS(th)} = 4.5\text{ V}$
- Fully controllable  $dV/dt$
- Commutation robust body diode, ready for synchronous rectification

#### Key benefits

- Best-in-class system performance
- Efficiency improvement and reduced cooling effort
- Longer lifetime and higher reliability
- Enables higher frequency operation, allowing the increase in power density
- Reduction in system cost
- Ease of use



The TO-247 4-pin package contains an additional connection to the source (Kelvin connection) used as a reference potential for the gate driving voltage, thereby eliminating the effect of voltage drops over the source inductance. The result is even lower switching losses than for the TO-247 3-pin version, especially at higher currents and higher switching frequencies.

The gate-source pin of the TO-263 7-pin package, similar to the TO-247 4-pin, eliminates the effect of voltage drops over the source inductance, further reducing turn-on switching loss. TO-263 7-pin package minimizes the leakage inductance between drain and source, reducing the risk of high turn-off voltage overshoot.

## CoolSiC™ MOSFET 1200 V



| $R_{DS(on)}$ / Package | TO-247        | TO-247-4                        | D <sup>2</sup> PAK 7-pin<br>TO-263 7-pin | Gate-driver ICs for CoolSiC™  |  |
|------------------------|---------------|---------------------------------|--|---|--|
| 7 mΩ                   | IMW120R007M1H | IMZA120R007M1H                  |  | <b>EiceDRIVER™ Compact:</b><br>1ED120I12MF<br>1EDI60I12AF<br>1ED3124MU12F<br>1ED3125MU12F<br>1ED3122MC12H<br>1ED3124MC12H<br>1ED3241MC12H | <b>EiceDRIVER™ Enhanced:</b><br>1ED3322MC12N<br>1ED3491MC12M<br>1ED3890MC12M<br>2ED020I12-F2 |
| 14 mΩ                  | IMW120R014M1H | IMZA120R014M1H                  |  |   |  |
| 20 mΩ                  | IMW120R020M1H | IMZA120R020M1H                  |  |   |  |
| 30 mΩ                  | IMW120R030M1H | IMZ120R030M1H<br>IMZA120R030M1H | IMBG120R030M1H                           |   |  |
| 40/45 mΩ               | IMW120R040M1H | IMZA120R040M1H                  | IMBG120R045M1H                           |   |  |
| 60 mΩ                  | IMW120R060M1H | IMZ120R060M1H                   | IMBG120R060M1H                           |   |  |
| 90 mΩ                  | IMW120R090M1H | IMZ120R090M1H                   | IMBG120R090M1H                           |   |  |
| 140 mΩ                 | IMW120R140M1H | IMZ120R140M1H                   | IMBG120R140M1H                           |   |  |
| 220 mΩ                 | IMW120R220M1H | IMZ120R220M1H                   | IMBG120R220M1H                           |   |  |
| 350 mΩ                 | IMW120R350M1H | IMZ120R350M1H                   | IMBG120R350M1H                           |   |  |



# CoolSiC™ MOSFETs discrete 1700 V

## Best efficiency and reduced complexity for high voltage auxiliary power supplies

The CoolSiC™ 1700 V MOSFET in a TO-263-7 high-creepage package is optimized for flyback topologies that are used in auxiliary power supplies connected to DC-link voltages ranging from 600 V up to 1000 C. This makes it ideal for numerous power applications.

### Features and benefits

#### Key features

- Optimized for flyback topologies
- Extremely low switching loss
- 12 V/0 V gate source voltage compatible with fly-back controllers
- Fully controllable dV/dt for EMI optimization
- SMD package with enhanced creepage and clearance distances, >7 mm

#### Key benefits

- The CoolSiC™ 1700 V MOSFET enables simple single-ended flyback topology at high efficiency level for use in auxiliary power supplies
- SMD package enables direct integration into PCB, with natural convection cooling without extra heatsink
- Reduced isolation efforts due to extended creepage and clearance distance of package
- Reduced system complexity
- High power density

### CoolSiC™ MOSFET 1700 V



| Package                       | D <sup>2</sup> PAK 7-pin<br>TO-263-7 |
|-------------------------------|--------------------------------------|
| R <sub>DS(on)</sub><br>450 mΩ | IMBF170R450M1                        |
| 650 mΩ                        | IMBF170R650M1                        |
| 1000 mΩ                       | IMBF170R1K0M1                        |



# CoolSiC™ MOSFETs discrete 2000 V in TO-247-PLUS-4-HCC package

The CoolSiC™ 2000 V MOSFET in TO-247-4-PLUS-HCC package has been designed to offer increased power density without compromising the system's reliability even under demanding high voltage and switching frequency conditions. The low power losses of CoolSiC™ technology provide increased reliability thanks to the .XT interconnection technology in a 2000 V optimized package, enabling top efficiency in applications such as string inverters, solar power optimizer, EV-charging and energy storage systems. The CoolSiC™ MOSFET 2000 V product family will be accompanied by the matching CoolSiC™ Schottky diodes 2000 V in TO-247PLUS-4-HCC (10 A - 80 A).

## Features and benefits

### Key features

- $V_{DSS} = 2000$  V for high DC-link systems up to  $1500 V_{DC}$
- Very low switching losses
- Innovative HCC package with 14 mm creepage and 5.5 mm clearance distances
- Benchmark gate threshold voltage,  $V_{GS(th)} = 4.5$  V
- Robust body diode for hard commutation
- .XT interconnection technology for best-in-class thermal performance
- Improved humidity robustness proved through H3HVTRB stress tests

### Key benefits

- High power density
- Excellent reliability
- Highest efficiency
- Ease of design

## CoolSiC™ MOSFET 2000 V



| Package      | TO-247PLUS-4-HCC |
|--------------|------------------|
| $R_{DS(on)}$ |                  |
| 12 mΩ        | IMYH200R012M1H   |
| 24 mΩ        | IMYH200R024M1H   |
| 50 mΩ        | IMYH200R050M1H   |
| 75 mΩ        | IMYH200R075M1H   |
| 100 mΩ       | IMYH200R100M1H   |

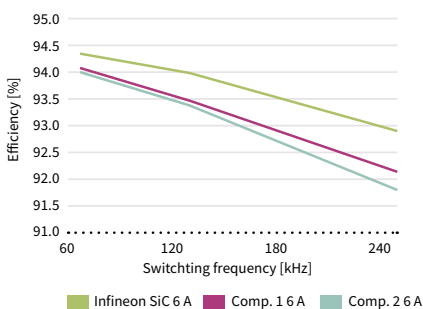
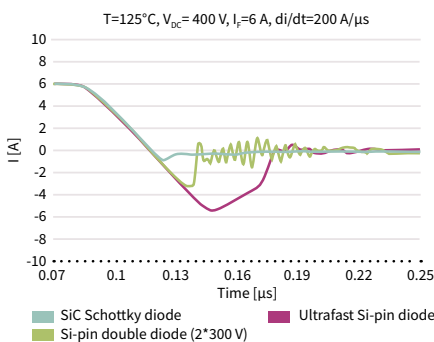


# CoolSiC™ Schottky diodes

The differences in material properties between silicon carbide and silicon limit the fabrication of practical silicon unipolar diodes (Schottky diodes) to a range up to 100-150 V, with a relatively high on-state resistance and leakage current. With SiC, Schottky diodes can reach a much higher breakdown voltage. With more than 20 years of field experience in SiC, Infineon is the world's first SiC discrete power supplier. Infineon offers products up to 1700 V in discrete packages and up to 2000 V in modules.

The long market presence and experience enable Infineon to deliver highly reliable, industry-leading SiC performance. With over ten years of pioneering experience in developing and manufacturing SiC diodes, Infineon's latest CoolSiC™ Schottky diode generation 6 family sets a benchmark in quality, efficiency and reliability.

| Features   | Advantages   | Benefits  | Applications  |
|--|--|---|---|
| <ul style="list-style-type: none"> <li>› No reverse recovery charge</li> <li>› Purely capacitive switching</li> <li>› High operating temperature (<math>T_{j, \max}</math> 175°C)</li> </ul> | <ul style="list-style-type: none"> <li>› Low turn-off losses</li> <li>› Reduction of CoolMOS™ or IGBT turn-on loss</li> <li>› Switching losses independent from load current, switching speed and temperature</li> </ul> | <ul style="list-style-type: none"> <li>› System efficiency improvement compared to Si diodes</li> <li>› Reduced cooling requirements</li> <li>› Enabling higher frequency/increased power density</li> <li>› Higher system reliability due to lower operating temperature</li> <li>› Reduced EMI</li> </ul> | <ul style="list-style-type: none"> <li>› Server</li> <li>› Telecom</li> <li>› Solar</li> <li>› UPS</li> <li>› EV-charging</li> <li>› Energy storage</li> <li>› PC power</li> <li>› Motor drives</li> <li>› Lighting</li> <li>› CAV</li> </ul> |



## Reverse-recovery charge of SiC Schottky diodes versus Si-pin diodes

The majority of carrier characteristics imply no reverse recovery charge and the only contribution to the switching losses comes from the tiny displacement charge of capacitive nature. In the same voltage range, silicon devices have a bipolar component resulting in much higher switching losses. The graph shows the comparison between various 600 V devices.

## Improved system efficiency (PFC in CCM mode operation, full load, low line)

The fast switching characteristics of the SiC diodes provide clear efficiency improvements at a system level. The performance gap between SiC and high-end silicon devices increases with the operating frequency.



# CoolSiC™ Schottky diodes 650 V

## CoolSiC™ Schottky diodes 650 V G6 and G5

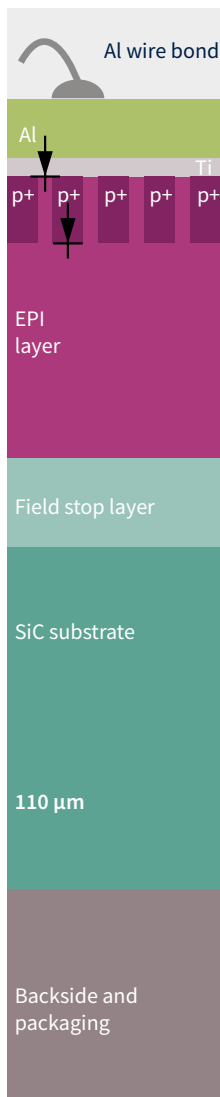
The CoolSiC™ Schottky diode 650 V G6 product family is built over the strong characteristics of the previous G5 generation, fully leveraging technology and process innovation to propose the best efficiency and price/performance products to date.

### Foundation technology – CoolSiC™ Schottky diodes 650 V G5

The established CoolSiC™ Schottky diodes G5 product family has been optimized after all key aspects including junction structure, substrate and die attach. It represents a well-balanced product family which offers state-of-the-art performance and high surge current capability at a competitive cost level.

#### Innovation: optimized junction, substrate and die attach

Infinion's SiC Schottky diode generation 5 is optimized with regard to all key aspects relevant for high-power and high-efficiency SMPS applications.



#### Junction: merged PN structure

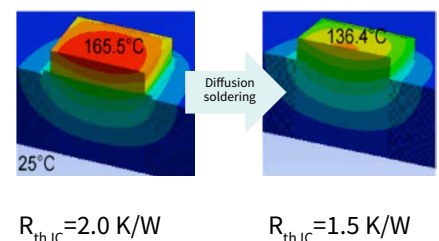
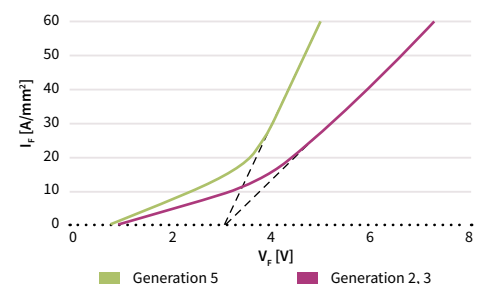
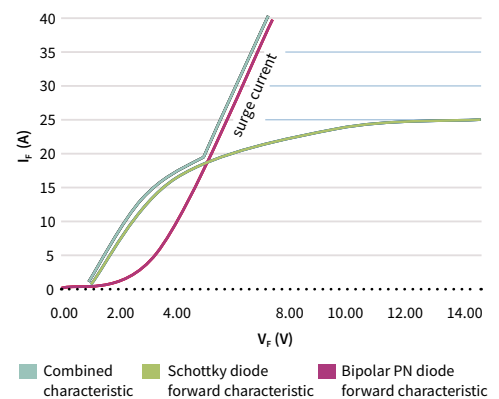
On the junction level, it has an optimized merged PN structure. Compared to competitors, Infineon's SiC diode has an additional P-doped area, which, together with the N-doped EPI layer, forms a PN junction diode. Thus, it is a combination of Schottky diode and PN junction diode. Under normal conditions it works like a standard Schottky diode. Under abnormal conditions such as lighting, AC line drop-out, it works like a PN junction diode. At high current level, the PN junction diode has a significantly lower forward voltage ( $V_f$ ) than the Schottky diode, which leads to less power dissipation, thus significantly improving the surge current capability.

#### Substrate: thin wafer technology

On the substrate level, Infineon introduced the thin wafer technology. At the later stage of our SiC diode production, the thin wafer process is used to reduce the wafer thickness by about two-thirds, which significantly reduces the substrate resistance contribution, thus, improving both forward voltage ( $V_f$ ) and thermal performance.

#### Die attach: diffusion soldering

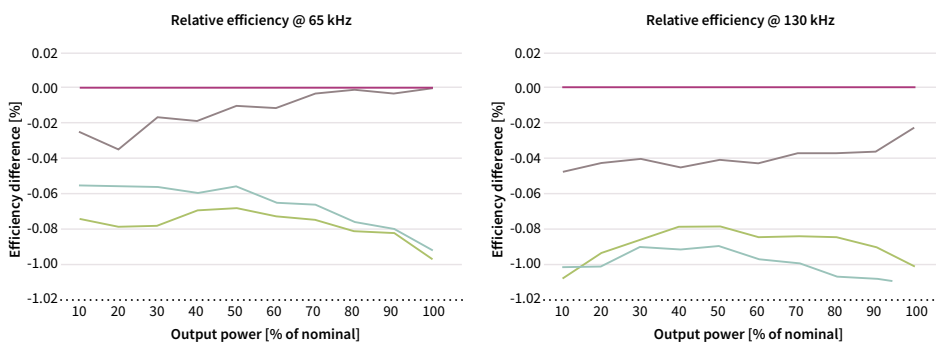
On the backside, package level diffusion soldering is introduced, which significantly improves the thermal path between the lead frame and the diode, enhancing the thermal performance. With the same chip size and power dissipation, the junction temperature is reduced by 30°C.



## Latest development - CoolSiC™ Schottky diodes 650 V G6

The CoolSiC™ Schottky diodes G6 product family introduces a novel and proprietary Schottky metal system. This contributes to reducing the forward voltage (VF) to challenging levels, determining a measurable decrease of conduction losses. Infineon's CoolSiC™ Schottky diodes enable optimum efficiency and ruggedness. Lower forward voltage ( $V_F$ ) means lower conduction loss, and lower capacitive charge ( $Q_c$ ) means lower switching loss.  $Q_c \times V_F$  is the figure of merit for efficiency, and comparison indicates that the latest generation 6 products have the lowest  $Q_c \times V_F$  on the market. Infineon's CoolSiC™ Schottky diodes offer a surge current robustness far better than the one offered by the most efficient products. Thus, under abnormal conditions, this surge current capability offers excellent device robustness.

### Efficiency comparison



In terms of efficiency, the 8 A G6 device has been tested in CCM PFC. The maximum output power is 3.5 kW. The left figure shows the relative efficiency at 65 kHz, while the figure on the right shows the relative efficiency at 130 kHz. This shows that Infineon's CoolSiC™ Schottky diode G6 delivers better efficiency over the full load range, keeping this advantage even at 130 kHz, therefore meeting the needs of designers who want to increase the switching frequencies in their designs to attain more power density.

### The best price performance

CoolSiC™ Schottky diodes G6 are the outcome of Infineon's continuous technological and process improvements, which enable the design and development of SiC-based products, making them more price-competitive and increasing performance across generations. As a result, G6 is Infineon's best price/performance CoolSiC™ Schottky diode generation, offering the highest efficiency. In addition, Infineon offers the reliability of collaborating with the industry leader. Customers can leverage Infineon's proven quality and supply chain reliability. They can benefit from "one-stop-shop" advantages and maximize system performance, combining CoolSiC™ Schottky diodes with the SJ MOSFETs of the CoolMOS™ 7 family, such as 600 V C7, 650 V C7, 600 V G7, 650 V G7 and 600 V P7.



### A comprehensive portfolio

The combined G6 and G5 CoolSiC™ Schottky diode 650 V diode portfolio offers a wide choice of packages and ampere class granularity to allow the best fit to applications. G6 comes in double DPAK, the first top-side cooled surface mount package, which allows thermal decoupling of PCB to chip junction and enables higher power dissipation and improved system lifetime thanks to the reduced board temperature.

[www.infineon.com/sic-diodes](http://www.infineon.com/sic-diodes)



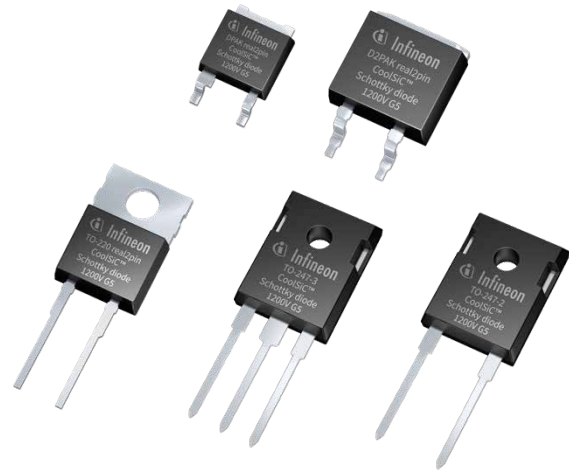
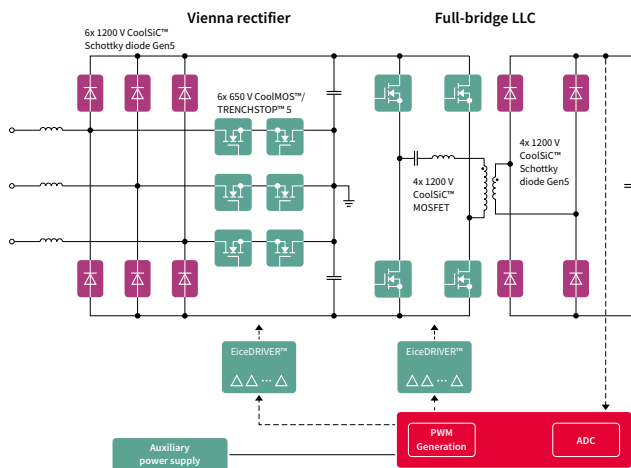


# CoolSiC™ Schottky diodes 1200 V

## A new level of system efficiency and reliability

By using hybrid Si power switch/SiC diode sets, industrial application designers will gain flexibility for system optimization compared to purely silicon-based solutions. SiC diodes enable system improvements such as higher output power, greater efficiency or higher switching frequency. By implementing CoolSiC™ diodes generation 5, for example, in Vienna rectifier topology, in combination with Infineon's 650 V TRENCHSTOP™ IGBTs and 650 V CoolMOS™ MOSFETs, designers can achieve outstanding system-level performance and reliability.

### One of the most commonly used topologies for EV DC charging



## Features and benefits

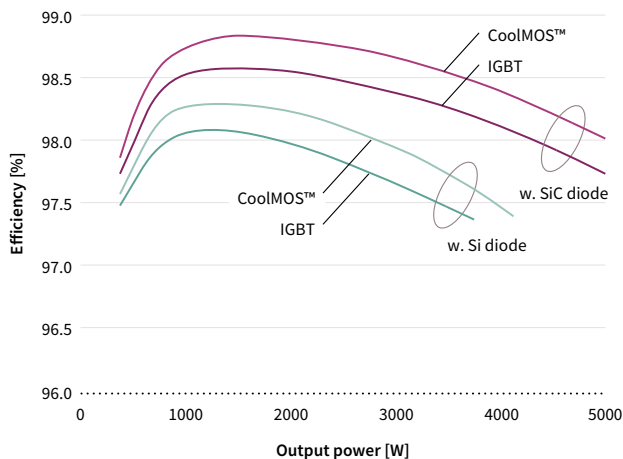
### Key features

- Zero  $Q_{rr}$  leading to no reverse recovery losses
- High surge current capability up to fourteen times of the nominal current
- Tight forward voltage distribution
- Temperature-independent switching behavior
- Low forward voltage ( $V_F = 1.4$  V) even at high operating temperature
- Available in both through-hole and SMD packages
- Up to 40 A rated diode

### Key benefits

- System efficiency improvement over Si-based diodes
- Enabling higher frequency/increased power density solutions
- High system reliability by extended surge current
- Reduced cooling requirements through lower diode losses and lower case temperatures
- System size/cost saving due to reduced heatsink requirements and smaller magnetics

### 650 V Si IGBT/Si SJ MOSFET and 1200 V SiC diode/ultrafast Si diode in a Vienna rectifier topology, $f_{sw} = 48$ kHz



- 650 V SJ MOSFET + 1200 V SiC diode (IPW65R045C7 + IDW15G120C5B)
- 650 V IGBT + 1200 V SiC diode (IKW50N65EH5 + IDW15G120C5B)
- 650 V SJ MOSFET + 1200 V Si diode (IPW65R045C7 + Vendor A)
- 650 V IGBT + 1200 V Si diode (IKW50N65EH5 + Vendor A)

### SiC vs. Si diode

- > +0.8% higher efficiency
- > Increased output power is possible

[www.infineon.com/sicdiodes1200v](http://www.infineon.com/sicdiodes1200v)



EV charging



SMPS



Solar



Drives

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





### CoolSiC™ Schottky diodes 650 V G6



| $I_F$ [A] | TO-220 R2L | Double DPAK |
|-----------|------------|-------------|
| 4         | IDH04G65C6 |             |
| 6         | IDH06G65C6 |             |
| 8         | IDH08G65C6 | IDDD08G65C6 |
| 10        | IDH10G65C6 |             |
| 12        | IDH12G65C6 | IDDD12G65C6 |
| 16        | IDH16G65C6 | IDDD16G65C6 |
| 20        | IDH20G65C6 |             |

### CoolSiC™ Schottky diodes 650 V G5

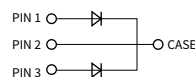


| $I_F$ [A] | TO-220 R2L | TO-247 Dual Die | TO-247     | D <sup>2</sup> PAK R2L | ThinPAK 8x8 |
|-----------|------------|-----------------|------------|------------------------|-------------|
| 2         | IDH02G65C5 |                 |            | IDK02G65C5             |             |
| 4         | IDH04G65C5 |                 |            | IDK04G65C5             | IDL04G65C5  |
| 6         | IDH06G65C5 |                 |            | IDK06G65C5             | IDL06G65C5  |
| 8         | IDH08G65C5 |                 |            | IDK08G65C5             | IDL08G65C5  |
| 10        | IDH10G65C5 |                 | IDW10G65C5 | IDK10G65C5             | IDL10G65C5  |
| 12        | IDH12G65C5 |                 | IDW12G65C5 | IDK12G65C5             | IDL12G65C5  |
| 16        | IDH16G65C5 |                 | IDW16G65C5 |                        |             |
| 20        | IDH20G65C5 | IDW20G65C5B     | IDW20G65C5 |                        |             |
| 24        |            |                 |            |                        |             |
| 30/32     |            | IDW32G65C5B     | IDW30G65C5 |                        |             |
| 40        |            | IDW40G65C5B     | IDW40G65C5 |                        |             |

[www.infineon.com/cool-sic-diodes](http://www.infineon.com/cool-sic-diodes)

\*For more information on the product, contact our product support

„B“ in product name refers to dual die with the common-cathode configuration.



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



### CoolSiC™ Schottky diodes 600 V G3



| $I_F$<br>[A] | TO-220 R2L | DPAK R2L   |
|--------------|------------|------------|
| 3            |            | IDD03SG60C |
| 4            | IDH04SG60C | IDD04SG60C |
| 6            | IDH06SG60C | IDD06SG60C |
| 8            | IDH08SG60C | IDD08SG60C |
| 10           | IDH10SG60C | IDD10SG60C |
| 12           | IDH12SG60C |            |

### CoolSiC™ Schottky diodes 1200 V G5



| $I_F$<br>[A] | TO-220 R2L  | TO-247<br>Dual Die | TO-247 R2L   | DPAK R2L    | D <sup>2</sup> PAK R2L |
|--------------|-------------|--------------------|--------------|-------------|------------------------|
| 2            | IDH02G120C5 |                    |              | IDM02G120C5 | IDK02G120C5            |
| 5            | IDH05G120C5 |                    |              | IDM05G120C5 | IDK05G120C5            |
| 8            | IDH08G120C5 |                    |              | IDM08G120C5 | IDK08G120C5            |
| 10           | IDH10G120C5 | IDW10G120C5B       | IDWD10G120C5 | IDM10G120C5 | IDK10G120C5            |
| 15/16        | IDH16G120C5 | IDW15G120C5B       | IDWD15G120C5 |             | IDK16G120C5            |
| 20           | IDH20G120C5 | IDW20G120C5B       | IDWD20G120C5 |             | IDK20G120C5            |
| 30           |             | IDW30G120C5B       | IDWD30G120C5 |             |                        |
| 40           |             | IDW40G120C5B       | IDWD40G120C5 |             |                        |

### CoolSiC™ Schottky diodes 2000 V G5

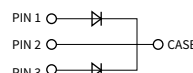


| $I_F$<br>[A] | TO-247PLUS-4 HCC |
|--------------|------------------|
| 10           | IDYH10G200C5*    |
| 25           | IDYH25G200C5*    |
| 40           | IDYH40G200C5*    |
| 50           | IDYH50G200C5*    |
| 80           | IDYH80G200C5*    |

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\*For more information on the product, contact our product support

„B“ in product name refers to dual die with the common-cathode configuration.

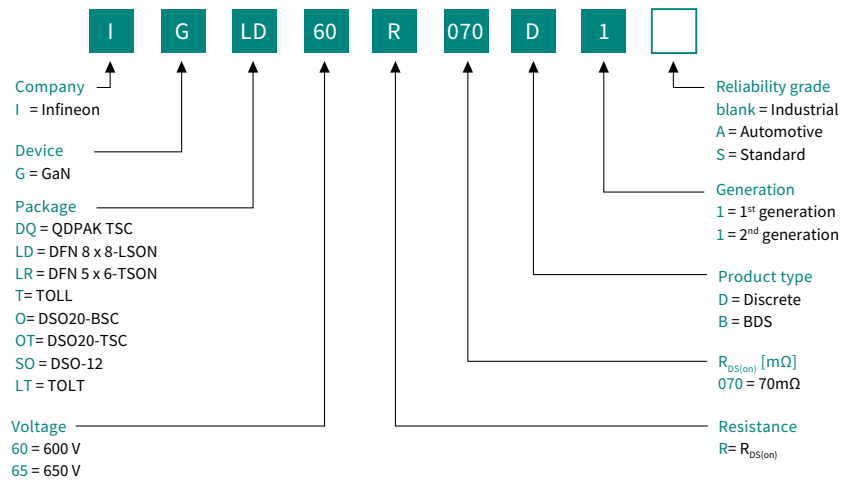


For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

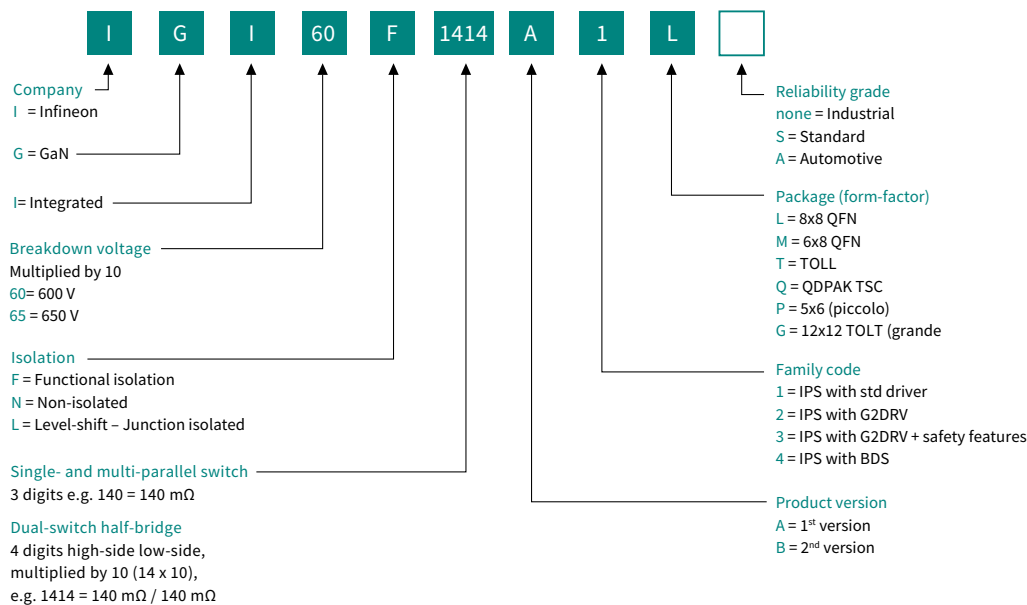


# Nomenclature

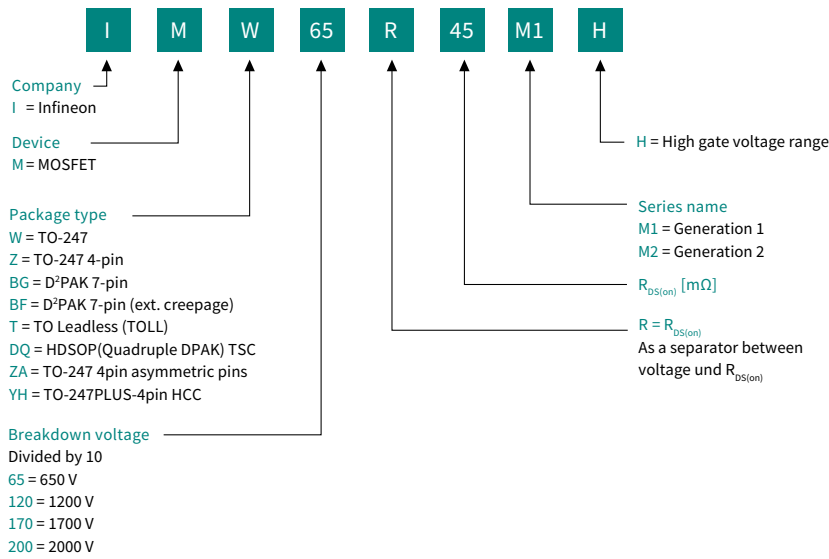
## CoolGaN™ GIT HEMTs



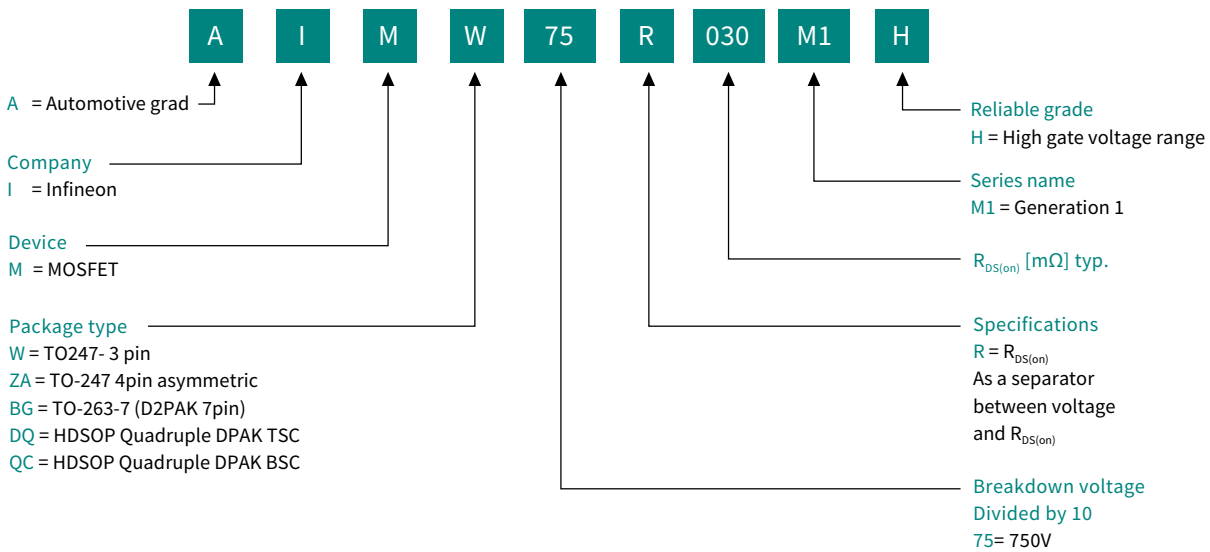
## CoolGaN™ IPS



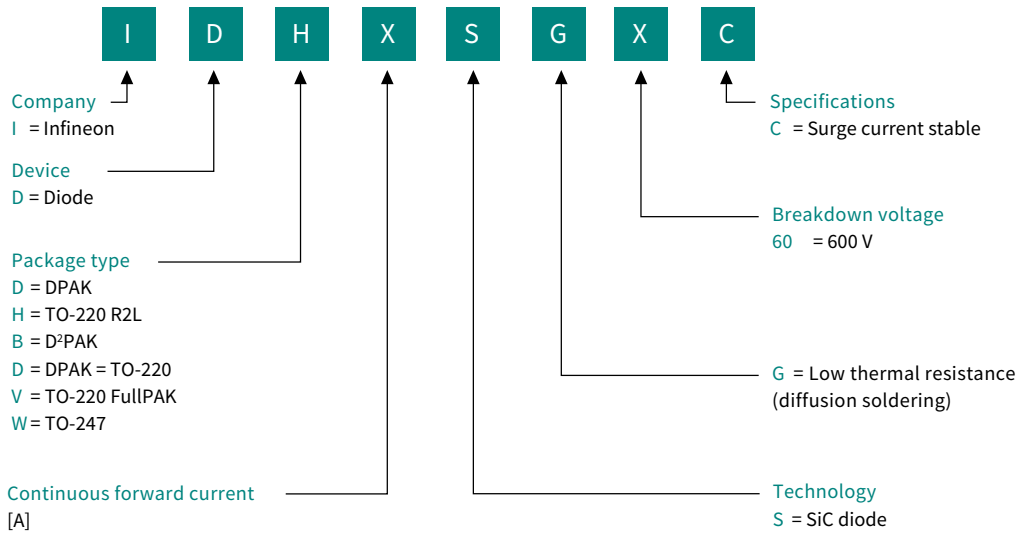
## CoolSiC™ MOSFET nomenclature



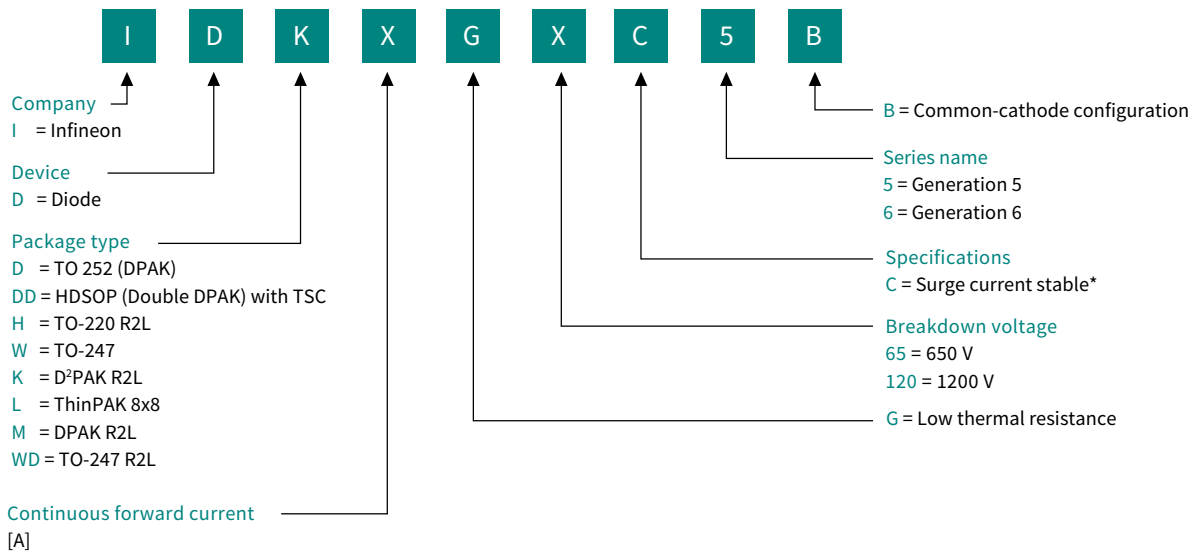
## CoolSiC™ Automotive MOSFET discrete 750 V nomenclature



## CoolSiC™ Schottky diodes G2 and G3



## CoolSiC™ Schottky diodes G5 and G6





# Infineon support for wide bandgap semiconductors

## Useful links and helpful information

### Further information, datasheets and documents

[www.infineon.com/wbg](http://www.infineon.com/wbg)  
[www.infineon.com/gan](http://www.infineon.com/gan)  
[www.infineon.com/gan-ips](http://www.infineon.com/gan-ips)  
[www.infineon.com/driver-gan](http://www.infineon.com/driver-gan)

[www.infineon.com/sic](http://www.infineon.com/sic)  
[www.infineon.com/sic-diodes](http://www.infineon.com/sic-diodes)  
[www.infineon.com/SiCgd](http://www.infineon.com/SiCgd)  
[community.infineon.com](http://community.infineon.com)



Support



Evaluation board



Tools



Simulation



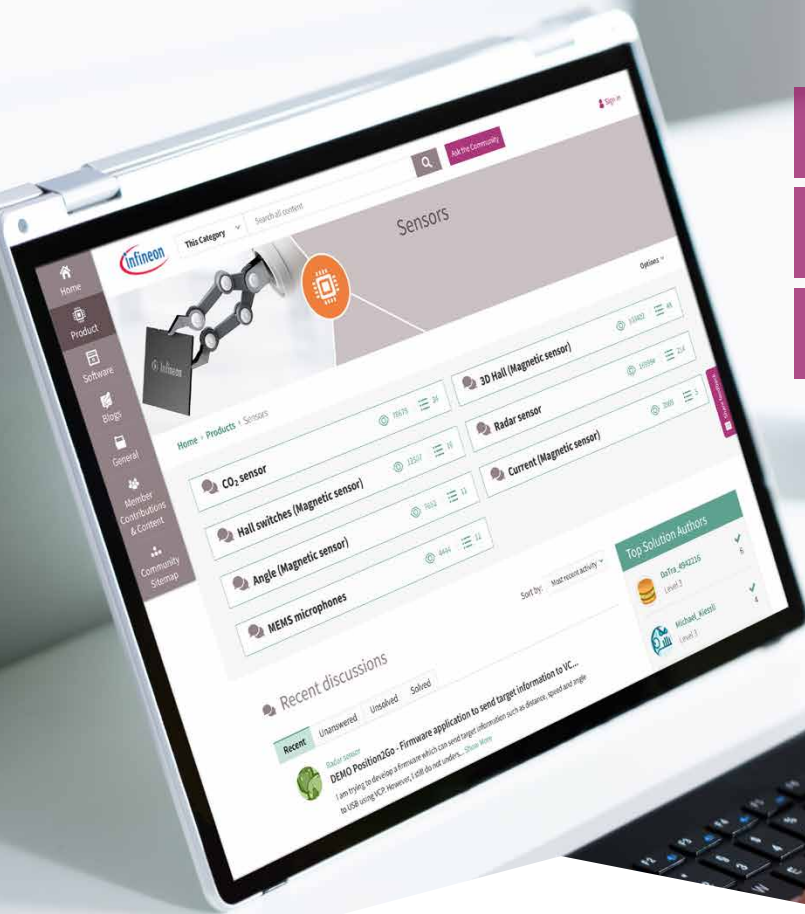
# XENSIV™ sensor technologies for automotive, industrial, consumer and IoT applications

- Infineon Developer Community
- Barometric (BAP) and Manifold (MAP) sensors
- Current sensors
- Magnetic position sensors
- Magnetic speed sensors
- MEMS microphones for automotive
- Intuitive sensing
- MEMS microphone for consumer applications
- Pressure sensors for IoT
- PAS CO2 sensor
- 60 GHz radar sensor ICs
- 24 GHz radar sensor ICs

## Design support

- Connected sensor kit
- Shield2Go
- Sensor 2GO kits
- Add ons for Sensor 2GO kits and Shield2Go





# XENSIV™ sensors – part of the Infineon Developer Community

## Join the XENSIV™ Developer Community

The Infineon Developer Community offers 24/7 self-service and lightning fast responses to customer demands. Any user, anywhere, anytime – any subject. The community is well-organized due to its multi-channel strategy. Unlike unmoderated forums, the developer community is based on high quality content that is professionally moderated and reviewed.

Check it out and be part of the  
**XENSIV™ sensor community.**



For more details on the product, click on the part number, visit [infineon.com](https://www.infineon.com) or contact our [product support](#).





## Infineon XENSIV™ – sensing the world

From a world leader in sensing technology, XENSIV™ sensors smartify lives by enabling things to “see”, “hear”, “feel”, and “smell” and therefore intuitively “understand” their environment. As a result of proven quality and outstanding reliability, customers can count on XENSIV™ for system stability, durability and integrity. Providing high accuracy and best-in-class measurement performance, XENSIV™ sensors add great value to customer applications. More than 40 years of experience in sensing solutions and a deep-rooted system understanding result in the broadest portfolio of ready-to-use sensor solutions on the market. Ecosystem partners and our customers partner with us for leading technologies, perfect-fit solutions and continuous innovation.

In the Internet of Things, sensors are omnipresent and mark the starting point of each and every IoT system. They collect all kinds of data on their surroundings, providing the entry point for all subsequent functions and features. Building on its well-founded systems expertise, Infineon’s broad portfolio in the XENSIV™ family contains ready-to-use solutions to enable a fast time-to-market and reliable functionality for applications in the area of smart home and smart building, smart things, smart factory or smart cars.

We inspire the next generation of smart environments, capable of understanding and responding to human communication. Infineon’s semiconductors are at the very heart of machine-to-machine (M2M), human-machine interface (HMI), mobile and wireless infrastructure technologies. As the technological boundary between humans and machines gradually disappears, these devices need even more advanced intelligence, enriched with voice assistance capabilities and the latest sensor fusion innovations, not to mention robust security technologies to protect personal data. Infineon’s sensors and microphones already deliver this intelligent functionality and inspiring the next step in mobile connectivity.

# Barometric (BAP) and Manifold (MAP) sensors

Infinion's pressure sensors offer the highest quality and accuracy for automotive, industrial, or consumer applications. Our XENSIV™ family includes integrated pressure sensors that tick all these boxes with analog or digital SPI interface. Our absolute pressure sensors (MAP and BAP) provide highest accuracy and precision on the smallest footprint and energy bill.

## KP21x/KP22x – Analog manifold air pressure sensor family (MAP + turbo MAP)

### Features

- Manifold air pressure measurement – MAP and turbo MAP
- Excellent accuracy of up to 1.0 kPa over a large temperature range
- Ratiometric analog voltage output proportional to the applied pressure
- Output signal fully compensated over pressure and temperature
- Pressure range from 10 to 400 kPa
- Temperature range from -40 to +140°C
- Output clamping (optional)
- Complete product family available with multiple transfer functions
- Reverse polarity protection
- Green SMD package

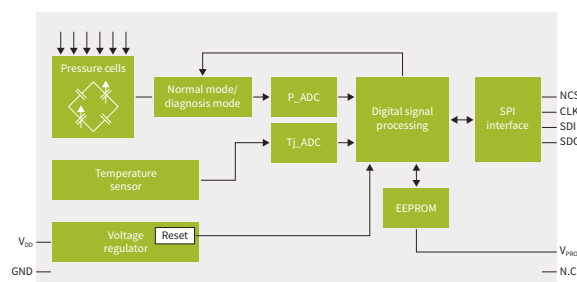
## KP464/KP464E and KP466/KP466P – Digital barometric air pressure (BAP) sensor family

### Features

- High-accuracy pressure sensing
- Integrated and highly accurate temperature sensor (chip temperature)
- 10-, 12- or 14-bit resolution pressure and temperature values via SPI Interface
- SPI interface with 4-wire full-duplex SPI
- Self-diagnosis features
- Low power consumption: supply current down to 3.5 mA without SPI communication, in power down mode: 10 µA)
- Green and small 8-pin DFN package (4.5 x 5.1 x 1.75 mm<sup>3</sup>)
- Small five holes to prevent intrusion of small parts or animals
- High operating temperature range from -40°C to 125°C
- Pressure range from 40 to 165 kPa (wider ranges technically possible)
- AEC-Q103-002 qualified
- Backwards compatible to existing BAP
- Temperature transfer function from -40°C to 125°C
- KP466P with increased accuracy and faster start-up time



### Block diagram



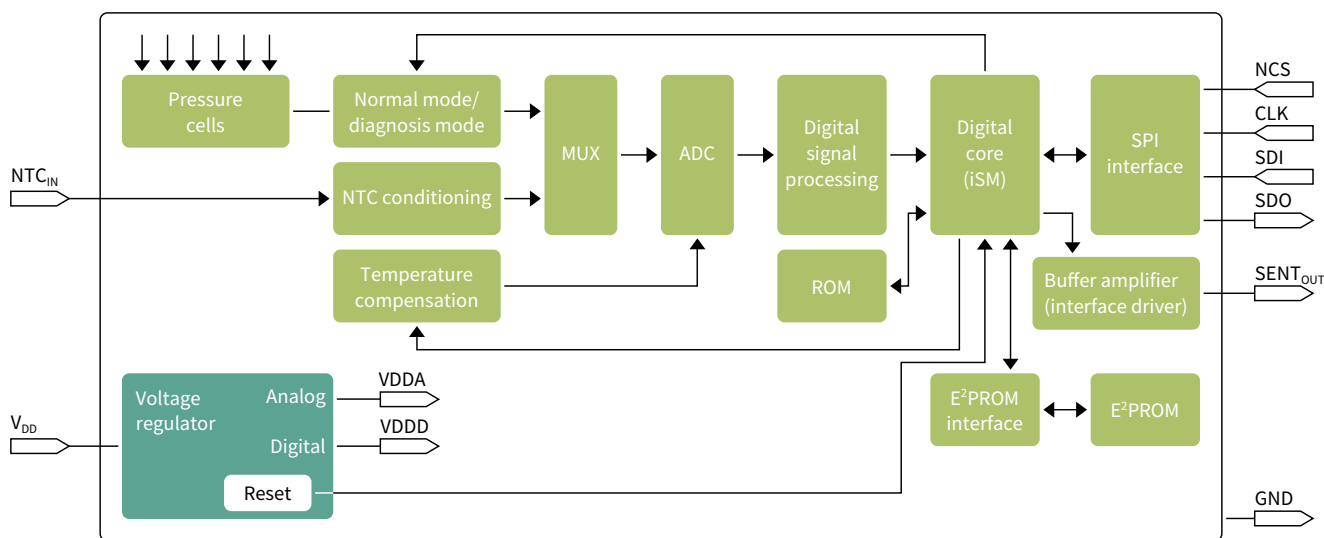
# KP276

## Media robust MAP sensor with digital interface

### Features

- › Media robustness for current automotive requirements
- › Digital single edge nibble transmission (SENT) interface (282 clock ticks)
- › Excellent accuracy of up to of  $\pm 0.77$  percent FSS
- › Green SMD package
- › Temperature range -40 to +170°C
- › Integrated NTC temperature sensor functionality with fast start up time (typ. 10ms)

### Block diagram



### Integrated pressure sensors for manifold and barometric air pressure

| Product    | Max. accuracy [kPa] | Max. operating temperature [°C] | Automotive | Industrial | ISO 26262 | Pressure range [kPa] |
|------------|---------------------|---------------------------------|------------|------------|-----------|----------------------|
| KP21x      | 1.0                 | 140                             | ✓          | ✓          | -         | 10...150             |
| KP22x      | 2.5                 | 140                             | ✓          | ✓          | -         | 10...400             |
| KP23x      | 1.0                 | 125                             | ✓          | ✓          | -         | 15...115             |
| KP236N6165 | 1.0                 | 125                             | ✓          | ✓          | -         | 60...165             |
| KP276x     | 3.0                 | 150 (170 time limited)          | ✓          | ✓          | -         | 10...400             |

| Product              | Max. accuracy [kPa] | Max. operating temperature [°C] | Automotive | Industrial | Pressure range [kPa]                    |
|----------------------|---------------------|---------------------------------|------------|------------|---|
| KP464                | Digital SPI         | 40...115                        | -40 to 125 | ±1         | powertrain                              |
| KP464E               |                     |                                 |            |            | seat comfort                            |
| KP466                |                     | 60...165                        |            |            | advanced seat comfort and BMS satellite |
| KP466P <sup>1)</sup> |                     |                                 |            |            |   |

1) Faster start-up time (3 ms max.), improved accuracy for high and low temperatures





## XENSIV™ – high-precision coreless current sensors for automotive and industrial

Used to measure both AC and/or DC currents, Infineon's current sensors provide accurate and stable current measurement up to 120 A or 31 mT respectively. Our magnetic current sensors include either an integrated current rail in the package for low currents or measure the magnetic field of an external current rail for medium to high currents. The products are intended for use in 48 V, as well as high voltage and/or wide bandgap applications such as traction inverters, industrial drives, photovoltaic inverters, or EV-charging systems.

Infineon's XENSIV™ family of high-precision coreless open-loop current sensors are less bulky, and cost less compared to core-based current sensors. Based on Infineon's precise and stable Hall effect current sensor IC technology, the current sensor analog output signal is highly linear over temperature and lifetime. Due to lacking an iron core or a flux concentrator, the sensor signal shows neither hysteresis nor does it suffer from saturation.

The differential current sensor measurement with two Hall cells ensures high accuracy even in a noisy environment like crosstalk from adjacent current lines or magnetic stray fields. System designers can program the sensitivity of the sensor as well as the threshold levels

of the two dedicated overcurrent signals and therefore adapt them to individual requirements without any external components. The contactless current sensor IC also provides a warning signal in case of an over- or under-voltage condition for the supply voltage.

### Product Portfolio

Infineon's product portfolio includes wide bandgap current sensors for both industrial and automotive application needs. Our current sensors achieve high accuracy using the Hall effect, which enables current measurements from DC to AC with an internal bandwidth of up to 240 kHz without being disturbed by external magnetic fields.

On the one hand, we have the current sensors with an integrated current rail. The sensors in the TISON package allow the accurate measurement with high frequencies and small impact on the phase shift of the current signal. On the other hand, our current sensors for external current rails are non-invasive Hall effect current sensors and provide safe and reliable solutions for power electronics since there is no additional power dissipation. Our selection of isolated, non-contact current sensors can be used for current detection and monitoring in SiC and GaN applications, including motor control applications.

# TLI4971

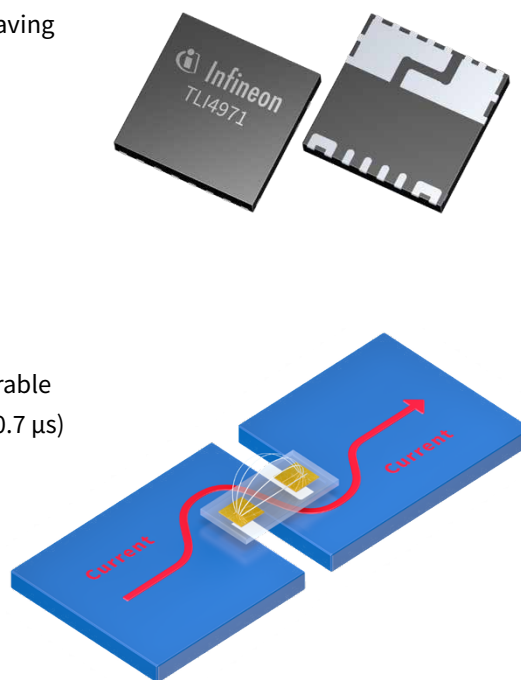
## High-precision coreless sensors for industrial applications

### Features

- Integrated current rail with typical  $220 \mu\Omega$  insertion resistance enables ultralow power loss
- Small form factor, 8x8 mm SMD, for easy integration and board area saving
- Highly accurate, scalable, DC and AC current sensing
- Bandwidth of 240 kHz enables wide range of applications
- Very low sensitivity error over temperature ( $< 2.0\%$ )
- Excellent stability of offset over temperature and lifetime
- Galvanic functional isolation up to 1150 V peak VIORM, partial discharge  $3500 V_{RMS}$ , 4 mm clearance and creepage
- Differential sensor principle ensures superior magnetic stray field suppression
- Two independent fast over-current detection (OCD) pins with configurable thresholds enable protection mechanisms for power circuitry (typical  $0.7 \mu s$ )
- Pre-calibrated sensor

### Applications

- Energy storage systems
- Electrical drives (up to 975 Vpk)
- Photovoltaic inverter
- General purpose & GaN-based inverters
- Chargers
- Power supplies

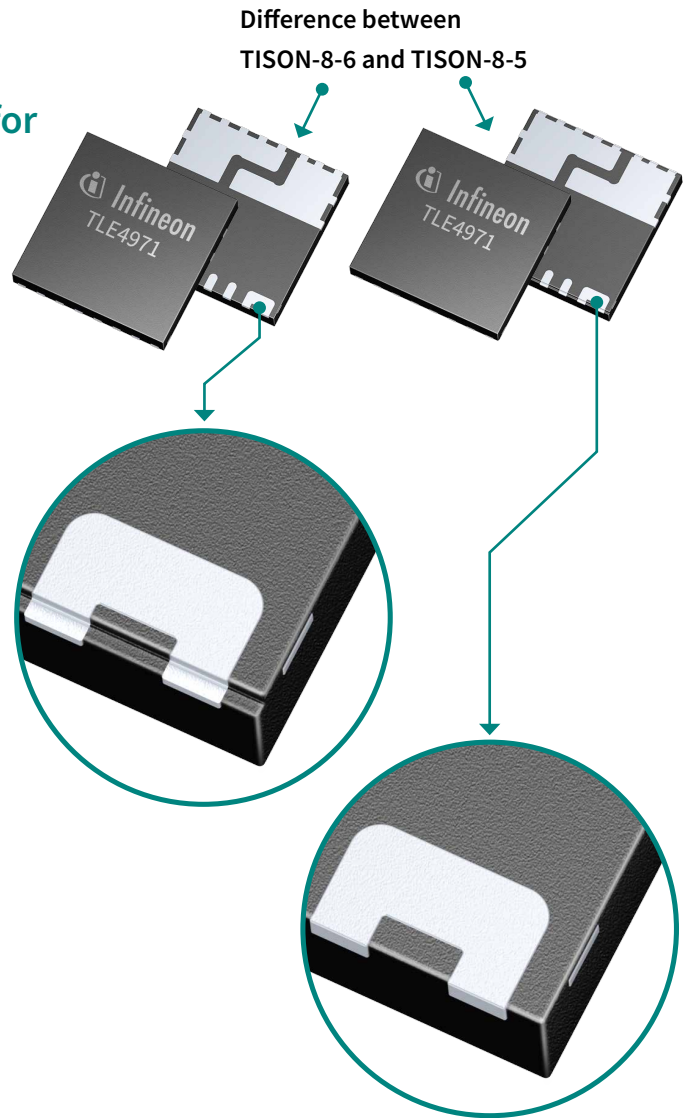


# TLE4971

## High-precision coreless current sensor for automotive and industrial applications

The Infineon TLE4971 is a high-precision current sensor for bi-directional AC and DC measurements. The device has an analog interface and two fast overcurrent detection outputs that support the power circuitry's protection. Galvanic isolation is provided due to magnetic sensing principle.

Infineon's well-established and robust monolithic Hall technology enables accurate and highly linear measurement of currents with a full scale up to 120 A. Negative effects, like saturation and hysteresis, commonly known from core-based sensor techniques, are not present in the Infineon open loop, coreless sensors principle. The smart current rail design (double U-shape) combined with a differential signal sensing makes the current sensor robust against stray fields. The sensor is shipped as a fully calibrated product without requiring any customer end-of-line calibration. It comes in a small 8x8 mm TISON-8 leadless package, which allows standard SMD assembly. The sensor can be reprogrammed for many parameters enabling the customer to achieve maximal adaption for his application requirements, such as industrial drives, xEV auxiliary drives, PV inverter, DC fast charger and on-board-charger (OBC).

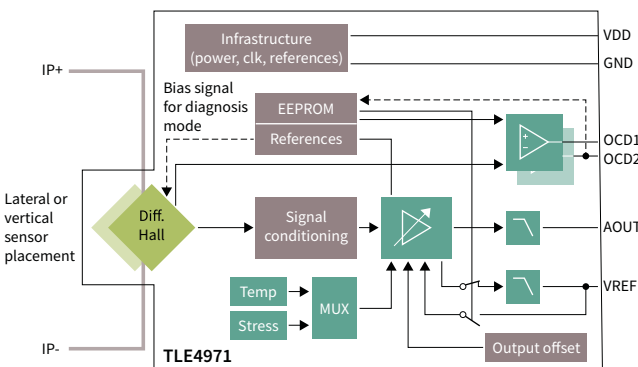


### Features and benefits

| Key features   |
|--|
| - Measurement up to 70 A <sub>RMS</sub> at 690 V <sub>RMS</sub>            |
| - Typical error at 25°C < 2 percent  |
| - Current rail resistance at 220 µΩ and inductance <1 nH specified typical |
| - Analog output signal (with typ. 210 kHz) bandwidth                       |
| - Fast (<0.7 µs) overcurrent detection up to 2 x IFSR                      |
| - AEC-Q100 Grade 1 qualified   |

| Key benefits   |
|--|
| - Ultra-low power loss due to minimal resistance of current rail |
| - Reliable current measurement over lifetime (no re-calibration) |
| - Functional isolation for high-voltage application              |
| - Easy and compact package allows high-power density design      |
| - Pre-programmed variants for 25 A, 50 A, 75 A and 120 A         |
| - High accuracy, low noise analog output                         |

### Block diagram



The integrated primary conductor (current rail) with very low insertion resistance and inductance minimizes the power loss and enables miniaturization of the sensing circuit. The analog output (AOUT) can be configured in single-ended, semi-differential, and fully-differential mode together with the voltage reference pin (VREF). Two separate overcurrent pins (OCD1/OCD2) provide a fast output signal in case the current exceeds a pre-set threshold.

[www.infineon.com/current-sensors](http://www.infineon.com/current-sensors)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

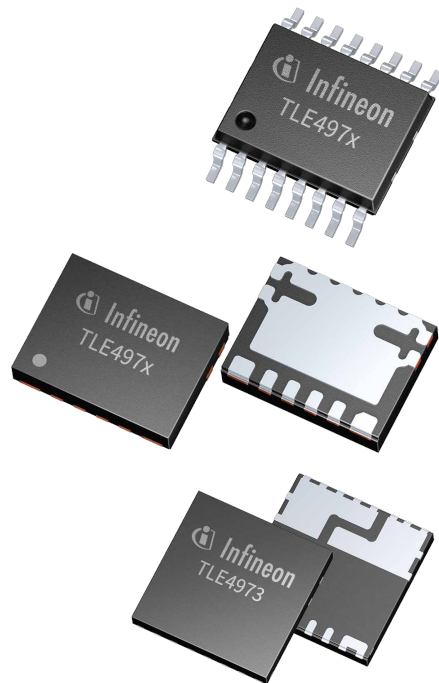


# TLE4972/TLE4973

## High-precision coreless current sensors for automotive and industrial applications

The Infineon TLE4972 product family of coreless magnetic current sensors specifically addresses requirements for current sensing in automotive applications. The well-established and robust Hall technology enables accurate and highly linear current measurements of the magnetic field induced by the current. With its compact design and diagnosis modes, the TLE4972 is ideal for xEV applications like traction inverters used in hybrid and battery-driven vehicles, as well as for battery main switches.

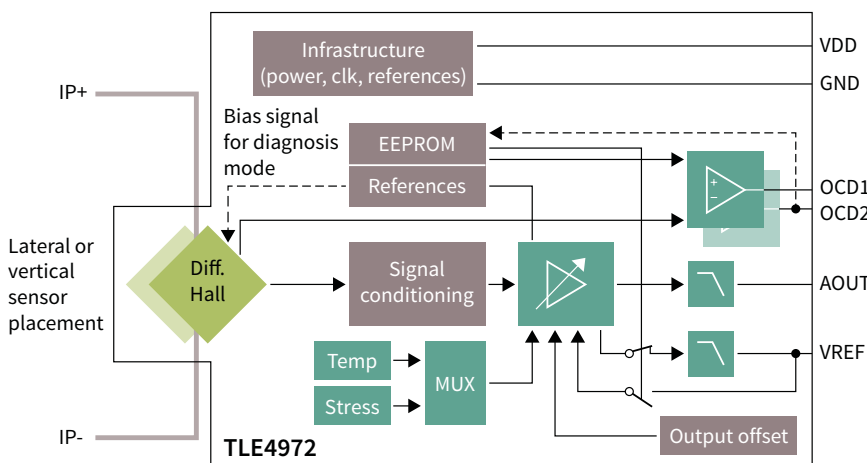
Infineon will expand the sensor portfolio with a new family of 5 V current sensors TLE4973. The new sensors will be available in three different packages to cover a wide range of applications in the automotive and industrial market. Target applications include traction inverter for xEV, auxiliary drives, PV inverter and on-board-charger (OBC).



### Features and benefits

| Key features                                   |
|--|
| - Hall based coreless magnetic current sensor  |
| - AC and DC sensing                            |
| - Two dedicated pins for overcurrent detection |
| - Scalable sensitivity                         |
| - ISO 26262 compliant                          |
| - ASIL B as SEoC                               |
| - Typical bandwidth of 210 kHz                 |

| Key benefits  |
|---|
| - High accuracy up to 2 kA  |
| - Very low error over temperature and lifetime                                    |
| - Protection against overcurrent events for fast switching technologies, e.g. SiC |
| - No saturation or hysteresis effects   |
| - Very low power losses through sensing structure                                 |
| - Ideal for platform designs  |
| - Fast reaction time of analog sensor output                                      |
| - Simplified functional safety assessment   |





# Current sensors – overview

| Product                | Current range [A] | Bandwidth typ. [kHz] | Sensitivity [mV/A] | Accuracy [%] | Output noise density [ $\mu\text{A}/\sqrt{\text{Hz}}$ ] | Certification                       | Industrial | ATV | Supply voltage [V] | Current rail | Package   |
|------------------------|-------------------|----------------------|--------------------|--------------|---|-------------------------------------|------------|-----|--------------------|--------------|-----------|
| TLI4971 family →       |                   |                      |                    |              |   |                                     |            |     |                    |              |           |
| TLI4971-A025T5-U-E0001 | 25                | 240                  | 48                 | < 2          | 350   | UL1577/<br>IEC 62368-1              | ✓          | –   | 3.3                | Internal     | TISON-8-5 |
| TLI4971-A025T5-E0001   | 25                | 240                  | 48                 | < 2          | 350   | IEC 62368-1                         | ✓          | –   | 3.3                | Internal     | TISON-8-5 |
| TLI4971-A050T5-U-E0001 | 50                | 240                  | 24                 | < 2          | 350   | UL1577/<br>IEC 62368-1              | ✓          | –   | 3.3                | Internal     | TISON-8-5 |
| TLI4971-A050T5-E0001   | 50                | 240                  | 24                 | < 2          | 350   | IEC 62368-1                         | ✓          | –   | 3.3                | Internal     | TISON-8-5 |
| TLI4971-A075T5-U-E0001 | 75                | 240                  | 16                 | < 2          | 350   | UL1577/<br>IEC 62368-1              | ✓          | –   | 3.3                | Internal     | TISON-8-5 |
| TLI4971-A075T5-E0001   | 75                | 240                  | 16                 | < 2          | 350   | IEC 62368-1                         | ✓          | –   | 3.3                | Internal     | TISON-8-5 |
| TLI4971-A120T5-U-E0001 | 120               | 240                  | 10                 | < 2          | 350   | UL1577/<br>IEC 62368-1              | ✓          | –   | 3.3                | Internal     | TISON-8-5 |
| TLI4971-A120T5-E0001   | 120               | 240                  | 10                 | < 2          | 350   | IEC 62368-1                         | ✓          | –   | 3.3                | Internal     | TISON-8-5 |
| TLE4971 family →       |                   |                      |                    |              |   |                                     |            |     |                    |              |           |
| TLE4971-A025N5-U-E0001 | 25                | 210                  | 48                 | < 2          | 260   | AEC-Q100/<br>UL1577/<br>IEC 62368-1 | ✓          | ✓   | 3.3                | Internal     | TISON-8-5 |
| TLE4971-A025N5-E0001   | 25                | 210                  | 48                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-5 |
| TLE4971-A050N5-U-E0001 | 50                | 210                  | 24                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-5 |
| TLE4971-A050N5-E0001   | 50                | 210                  | 24                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-5 |
| TLE4971-A075N5-U-E0001 | 75                | 210                  | 16                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-5 |
| TLE4971-A075N5-E0001   | 75                | 210                  | 16                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-5 |
| TLE4971-A120N5-U-E0001 | 120               | 210                  | 10                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-5 |
| TLE4971-A120N5-E0001   | 120               | 210                  | 10                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-5 |
| TLE4971-A025T5-U-E0001 | 25                | 210                  | 48                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-6 |
| TLE4971-A025T5-E0001   | 25                | 210                  | 48                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-6 |
| TLE4971-A050T5-U-E0001 | 50                | 210                  | 24                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-6 |
| TLE4971-A050T5-E0001   | 50                | 210                  | 24                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-6 |
| TLE4971-A075T5-U-E0001 | 75                | 210                  | 16                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-6 |
| TLE4971-A075T5-E0001   | 75                | 210                  | 16                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-6 |
| TLE4971-A120T5-U-E0001 | 120               | 210                  | 10                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-6 |
| TLE4971-A120T5-E0001   | 120               | 210                  | 10                 | < 2          | 260   |                                     | ✓          | ✓   | 3.3                | Internal     | TISON-8-6 |



# Current sensors – overview

| Product                | Current range | Bandwidth typ. [kHz] | Sensitivity              | Accuracy [%] | Output noise density       | Certification       | Industrial | Automotive | Supply voltage [V] | Current rail | Package   |
|------------------------|---------------|----------------------|--------------------------|--------------|----------------------------|---------------------|------------|------------|--------------------|--------------|-----------|
| TLE4973-A025T5-S0001   | 27.5 [A]      | 210                  | 65.5 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-A050T5-S0001   | 55 [A]        | 210                  | 32.8 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-A075T5-S0001   | 82.5 [A]      | 210                  | 21.8 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-A120T5-S0001   | 132 [A]       | 210                  | 13.7 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R025T5-S0001   | 27.5 [A]      | 210                  | 65.5 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R050T5-S0001   | 55 [A]        | 210                  | 32.8 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R075T5-S0001   | 82.5 [A]      | 210                  | 21.8 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R120T5-S0001   | 132 [A]       | 210                  | 13.7 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R025T5-S0010   | 27.5 [A]      | 210                  | 65.5 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R050T5-S0010   | 55 [A]        | 210                  | 32.8 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R075T5-S0010   | 82.5 [A]      | 210                  | 21.8 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R120T5-S0010   | 132 [A]       | 210                  | 13.7 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100            | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R025T5-U-S0010 | 27.5 [A]      | 210                  | 65.5 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100<br>UL 1577 | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R050T5-U-S0010 | 55 [A]        | 210                  | 32.8 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100<br>UL 1577 | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R075T5-U-S0010 | 82.5 [A]      | 210                  | 21.8 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100<br>UL 1577 | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-R120T5-U-S0010 | 132 [A]       | 210                  | 13.7 mV/A                | < 2          | 290 [ $\mu$ A/ $\sqrt$ Hz] | AEC-Q100<br>UL 1577 | ✓          | ✓          | 5.0                | Internal     | TISON-8-6 |
| TLE4973-AE35D5-S0001   | 34 [mT]       | 210                  | 53 <sup>1)</sup> [mV/mT] | 1            | 70 [nT/ $\sqrt$ Hz]        | AEC-Q100            | ✓          | ✓          | 5.0                | external     | TDSO-16   |
| TLE4973-RE35D5-S0001   | 34 [mT]       | 210                  | 53 <sup>1)</sup> [mV/mT] | 1            | 70 [nT/ $\sqrt$ Hz]        | AEC-Q100            | ✓          | ✓          | 5.0                | external     | TDSO-16   |
| TLE4973-RE35D5-S0010   | 34 [mT]       | 210                  | 53 <sup>1)</sup> [mV/mT] | 1            | 70 [nT/ $\sqrt$ Hz]        | AEC-Q100            | ✓          | ✓          | 5.0                | external     | TDSO-16   |
| TLE4973-AE35S5-S0001   | 34 [mT]       | 210                  | 53 <sup>1)</sup> [mV/mT] | 1            | 70 [nT/ $\sqrt$ Hz]        | AEC-Q100            | ✓          | ✓          | 5.0                | external     | VSON-6    |
| TLE4973-RE35S5-S0001   | 34 [mT]       | 210                  | 53 <sup>1)</sup> [mV/mT] | 1            | 70 [nT/ $\sqrt$ Hz]        | AEC-Q100            | ✓          | ✓          | 5.0                | external     | VSON-6    |
| TLE4973-RE35S5-S0010   | 34 [mT]       | 210                  | 53 <sup>1)</sup> [mV/mT] | 1            | 70 [nT/ $\sqrt$ Hz]        | AEC-Q100            | ✓          | ✓          | 5.0                | external     | VSON-6    |



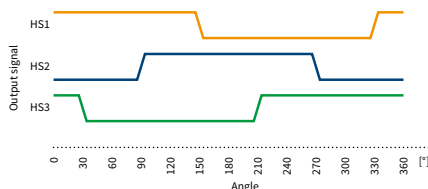
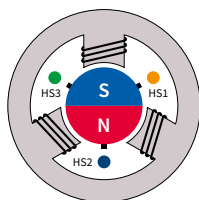
# Magnetic switches

Broadest energy saving portfolio of high precision magnetic switches for automotive, industrial and consumer applications

TLE/TLI/TLV4961, TLE/TLI/TLV4964, TLE/TLI/TLV4968  
Energy-efficient magnetic switches family for up to 32 V

The TLE/TLI/TLV496x-xM/L family of magnetic switches saves energy and enables designers to create precise and compact systems. With an operational current consumption of just 1.6 mA, TLE/TLI/TLV496x-xM/L products can cut energy consumption by up to 50 percent, compared with similar competitor products. Thanks to its small magnetic hysteresis, the family paves the way for precise switching points in systems. The integrated temperature profile compensates magnetic drifts and enables stable performance over temperature and lifetime.

TLE/TLI/TLV496x-xM products come in the smallest SOT23 package, thus reducing height by 10 percent compared with predecessor products. The sensors also feature an integrated functionality test for better system control.



## Features

- Current consumption of just 1.6 mA
- 3 to 32 V supply voltage range (over voltage up to 42 V)
- 7 kV ESD protection (HBM)
- Overtemperature and overcurrent protection
- Temperature compensation
- Smallest SOT23 package
- Dedicated products for industrial applications (TLI496x) and consumer applications (TLV496x)
- AEC-Q100 qualified

## Applications

- Window lifter
- Power closing
- Gear stick
- Seat belt
- BLDC commutation (e.g. wiper, seat belt pretensioner, pump, seating)
- Service robots
- Power tools
- White goods

| Product      | Type    | Operating point $B_{OP}$ [mT] | Release point $B_{RP}$ [mT] | Hysteresis $\Delta B_{HY}$ [mT] | Automotive | Industrial | Consumer | Package       |
|--------------|---------|-------------------------------|-----------------------------|---------------------------------|------------|------------|----------|---------------|
| TLE4961-1M/L | Latch   | 2.0                           | -2.0                        | 4.0                             | ✓          | ✓          | ✓        | SOT23/SSO-3-2 |
| TLE4961-2M   | Latch   | 5.0                           | -5.0                        | 10.0                            | ✓          | ✓          | ✓        | SOT23         |
| TLE4961-3M/L | Latch   | 7.5                           | -7.5                        | 15.0                            | ✓          | ✓          | ✓        | SOT23/SSO-3-2 |
| TLE4961-4M   | Latch   | 10.0                          | -10.0                       | 20.0                            | ✓          | ✓          | ✓        | SOT23         |
| TLE4961-5M   | Latch   | 15.0                          | -15.0                       | 30.0                            | ✓          | ✓          | ✓        | SOT23         |
| TLE4964-1M   | Switch  | 18.0                          | 12.5                        | 5.5                             | ✓          | ✓          | ✓        | SOT23         |
| TLE4964-2M   | Switch  | 28.0                          | 22.5                        | 5.5                             | ✓          | ✓          | ✓        | SOT23         |
| TLE4964-3M   | Switch  | 12.5                          | 9.5                         | 3.0                             | ✓          | ✓          | ✓        | SOT23         |
| TLE4964-4M   | Switch  | 10.0                          | 8.5                         | 1.5                             | ✓          | ✓          | ✓        | SOT23         |
| TLE4964-6M   | Switch  | 3.5                           | 2.5                         | 1.0                             | ✓          | ✓          | ✓        | SOT23         |
| TLE4964-5M   | Switch  | 7.5                           | 5.0                         | 2.5                             | ✓          | ✓          | ✓        | SOT23         |
| TLE4968-1M/L | Bipolar | 1.0                           | -1.0                        | 2.0                             | ✓          | ✓          | ✓        | SOT23/SSO-3-2 |
| TLI4961-1M   | Latch   | 2.0                           | -2.0                        | 4.0                             | –          | ✓          | ✓        | SOT23/SSO-3-2 |
| TLV4961-1M   | Latch   | 2.0                           | -2.0                        | 4.0                             | –          | –          | ✓        | SOT23         |
| TLV4961-3M   | Latch   | 7.5                           | -7.0                        | 15.0                            | –          | –          | ✓        | SOT23         |
| TLV4964-1M   | Switch  | 18.0                          | 12.5                        | 5.5                             | –          | –          | ✓        | SOT23         |
| TLV4964-2M   | Switch  | 28.0                          | 22.5                        | 5.5                             | –          | –          | ✓        | SOT23         |

[www.infineon.com/magnetic-switches](http://www.infineon.com/magnetic-switches)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## TLE/TLI4963/65-xM

### 5 V high-precision harsh environment/industrial Hall-effect sensors

By offering an excellent magnetic behavior Infineon's switches are ideally suited for:

- › Index counting application with a pole wheel
- › Rotor position detection (BLDC motors)
- › Open/close detection

#### Features

- › 3.0 to 5.5 V operating supply voltage
- › Low current consumption 1.4 mA
- › ESD protection 4 kV HBM
- › Active error compensation (chopped)
- › High stability of magnetic thresholds
- › Low jitter (typ. 0.35  $\mu$ s)
- › Operating temperature range:
  - from -40 to +170°C (TLE496x-xM)
  - from -40 to +125°C (TLI496x-xM)
- › Small SMD package SOT23
- › TLE: AEC-Q100 qualified
- › TLI: JESD47 qualified



| Product    | Type            | Operating point<br>$B_{OP}$ [mT] | Release point<br>$B_{RP}$ [mT] | Hysteresis<br>$\Delta B_{HY}$ [mT] | Harsh environment | Industrial | Package |
|------------|-----------------|----------------------------------|--------------------------------|------------------------------------|-------------------|------------|---------|
| TLE4963-1M | Latch           | 2.0                              | -2.0                           | 4.0                                | ✓                 | ✓          | SOT23   |
| TLE4963-2M | Latch           | 5.0                              | -5.0                           | 10.0                               | ✓                 | ✓          | SOT23   |
| TLE4965-5M | Unipolar switch | 7.5                              | 5.0                            | 2.5                                | ✓                 | ✓          | SOT23   |
| TLI4963-1M | Latch           | 2.0                              | -2.0                           | 4.0                                | -                 | ✓          | SOT23   |
| TLI4963-2M | Latch           | 5.0                              | -5.0                           | 10.0                               | -                 | ✓          | SOT23   |
| TLI4965-5M | Unipolar switch | 7.5                              | 5.0                            | 2.5                                | -                 | ✓          | SOT23   |

## TLV496x-xTA/B

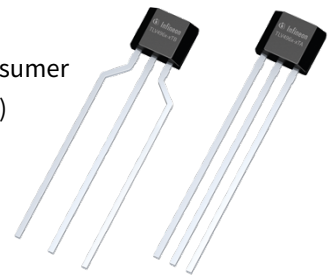
### Precision Hall-effect sensor for consumer applications in leaded package

#### Features

- › 3.0 to 26 V operating supply voltage
- › Low current consumption 1.6 mA
- › ESD protection 4 kV HBM
- › Operating temperature range from -40 to +125 °C
- › Leaded package TO92S

#### Applications

- › BLDC motor commutation for consumer devices (e.g. e-bikes, fans, aircons)
- › Position detection e.g. flaps and control buttons



| Product     | Type            | Operating point<br>$B_{OP}$ [mT] | Release point<br>$B_{RP}$ [mT] | Hysteresis<br>$\Delta B_{HY}$ [mT] | Consumer | Package   |
|-------------|-----------------|----------------------------------|--------------------------------|------------------------------------|----------|-----------|
| TLV4961-1TA | Latch           | 2.0                              | -2.0                           | 4.0                                | ✓        | TO92S-3-1 |
| TLV4961-1TB | Latch           | 2.0                              | -2.0                           | 4.0                                | ✓        | TO92S-3-2 |
| TLV4961-3TA | Latch           | 7.5                              | -7.5                           | 15.0                               | ✓        | TO92S-3-1 |
| TLV4961-3TB | Latch           | 7.5                              | -7.5                           | 15.0                               | ✓        | TO92S-3-2 |
| TLV4964-4TA | Unipolar switch | 10.0                             | 8.5                            | 1.5                                | ✓        | TO92S-3-1 |
| TLV4964-4TB | Unipolar switch | 10.0                             | 8.5                            | 1.5                                | ✓        | TO92S-3-2 |
| TLV4964-5TA | Unipolar switch | 7.5                              | 5.0                            | 2.5                                | ✓        | TO92S-3-1 |
| TLV4964-5TB | Unipolar switch | 7.5                              | 5.0                            | 2.5                                | ✓        | TO92S-3-2 |
| TLV4968-1TA | Latch           | 1.0                              | -1.0                           | 2.0                                | ✓        | TO92S-3-1 |
| TLV4968-1TB | Latch           | 1.0                              | -1.0                           | 2.0                                | ✓        | TO92S-3-2 |



## TLx4966

### Two-in-one double Hall sensor

#### Features

- › Two Hall probes for information on speed and direction
- › Excellent matching between the two Hall probes
- › Hall plate distance of 1.45 mm
- › High resistance to mechanical stress by Active Error Compensation
- › TSOP6 package
- › TLE: AEC-Q100 qualified
- › TLI: JESD47 qualified

#### Applications

- › Window lift
- › Sunroof
- › Automatic tailgate
- › Automated doors
- › Sun blinds
- › Garage doors

| Product     | Type   | Output              | Operating point $B_{OP}$ [mT] | Release point $B_{RP}$ [mT] | Hysteresis $\Delta B_{HY}$ [mT] | Automotive | Industrial | Consumer | Package       |
|-------------|--|---------------------|-------------------------------|-----------------------------|---------------------------------|------------|------------|----------|---------------|
| TLE4966G    | Double Hall, speed and direction output          | Speed and direction | 7.5                           | -7.5                        | 15                              | ✓          | ✓          | ✓        | TSOP6/SSO-4-1 |
| TLE4966L    | Double Hall, speed and direction output          | Speed and direction | 7.5                           | -7.5                        | 15                              | ✓          | ✓          | ✓        | TSOP6/SSO-4-1 |
| TLE4966-2G  | Double Hall, two independent outputs             | 2 x speed           | 7.5                           | -7.5                        | 15                              | ✓          | ✓          | ✓        | TSOP6         |
| TLE4966-3G  | Double Hall, speed and direction output          | Speed and direction | 2.5                           | -2.5                        | 5                               | ✓          | ✓          | ✓        | TSOP6         |
| TLE4966V-1G | Vertical double Hall, speed and direction output | Speed and direction | 2.5                           | -2.5                        | 5                               | ✓          | ✓          | ✓        | TSOP6         |
| TLI4966G    | Double Hall, speed and direction output          | Speed and direction | 7.5                           | -7.5                        | 15                              | -          | ✓          | ✓        | TSOP6         |

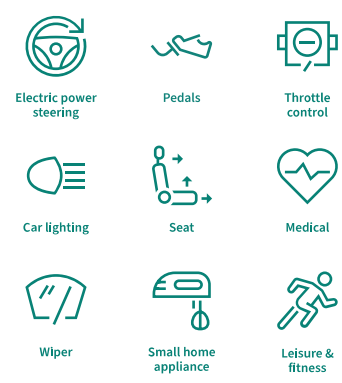
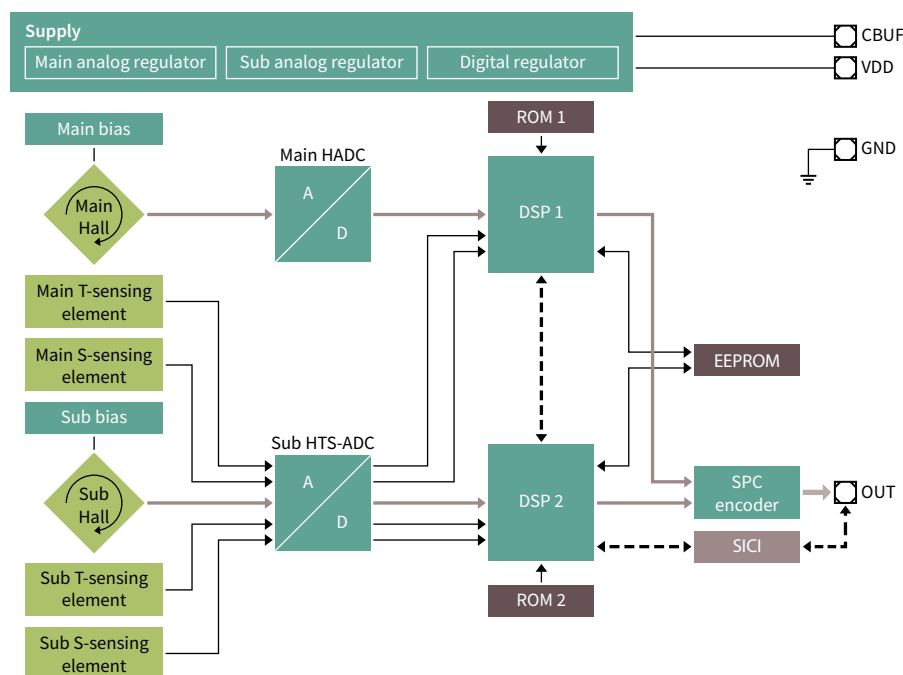


# Linear sensors

## Programmable dual-channel linear Hall sensor with fast SPC interface for high-precision applications

Infineon's TLE4999C8 is a programmable dual channel linear Hall sensor designed to meet the requirements of safety critical automotive and industrial applications. It is developed in full compliance with ISO 26262 by means of two sensor elements included within one monolithic silicon design. In order to fulfill the state-of-the-art safety requirements on system level and enable ASIL D system developments the sensor cells are designed in a complementary way. Their signals follow two independent analog paths. Each signal path has its own digital signal processing unit to ensure maximum independency - redundancy, respectively. The sensor offers a multi-point calibration with up to 9 selectable set points for enhanced linearization of the output signal. For an easy and flexible adaptation to non-linearity of magnetic circuit design, the chip provides 5 different calibration characteristics.

TLE4999C features a digital Short-PWM-Code (SPC) interface, with a bus-capability for up to 4 sensor ICs on a single data output. The communication interface with min. 0.5  $\mu$ s unit time guarantees a fast transmission of complete 2 channel data signal in less than 500  $\mu$ s. The additionally implemented frame holder circuit enables the synchronicity of multiple sensors (e.g., in combination of angle sensors) via a SPC bus. The chip offers a 12, 14 and 16-Bit resolution of the output signal, ensuring highest flexibility and superior noise performance. Highest accuracy over a wide temperature range and lifetime is achieved by an integrated digital temperature- and stress-compensation. The chip is available in a thin 8-pin SMD single sensor package.



**Features**

- Fully ISO 26262 compliant, supports ASIL D systems
- < 2% sensitivity drift, < 100 μT offset drift over temperature and life time
- Integrated digital temperature- and stress-compensation
- Fast digital SPC interface (unit time 0.5 – 3.0 μs)
- Multi-point calibration with up to 9 linearization set points

**Key benefits**

- High diagnostic coverage, ISO 26262-compliance and dual sensor cell integration enable development of fail operational systems
- Multi-point calibration for better fit into various magnetic circuit designs
- Easy system integration due to programmability of several sensor parameters

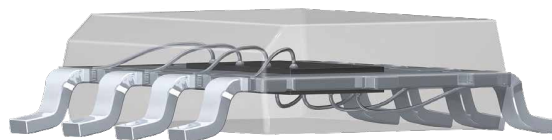
**Applications**

**Automotive safety critical applications**

- Electric power steering
- Linear movement position sensing
- Pedal position
- Electric throttle control
- Seat rail adjustment
- Headlight adjustment

**Industrial applications**

- Small home appliances
- Joystick applications



| Sales name                  | Interface              | Magnetic linear range [mT] | Sensitivity   | Sensitivity drift [%] | Gain | Magnetic offset drift [μT] <sup>1)</sup> | ISO 26262                 | Ordering code             | Package |
|-----------------------------|------------------------|----------------------------|---|-----------------------|------|--|---------------------------|---------------------------|---------|
| TLE4997A8D                  | Analog ratiometric     | 50, 100, 200               | ±60 mV/mT default for 100 mT range, with gain 1.5                       | ±3                    | ±4   | < ±400                                   | Ready                     | SP000902760               | TDSO-8  |
| TLE4998P8D                  | Digital interface PWM  | 50, 100, 200               | ±48 LSB <sub>12</sub> /mT default for 100 mT range, with gain 1.5       | ±2                    | ±4   | < ±400                                   | Ready                     | SP000902776               | TDSO-8  |
| TLE4998S8D                  | Digital interface SENT | 50, 100, 200               | ±48 LSB <sub>12</sub> /mT default for 100 mT range, with gain 1.5       | ±2                    | ±4   | < ±400                                   | Ready                     | SP000902784               | TDSO-8  |
| TLE4998C8D                  | Digital interface SPC  | 50, 100, 200               | ±48 LSB <sub>12</sub> /mT default for 100 mT range, with gain 1.5       | ±2                    | ±4   | < ±400                                   | Ready                     | SP000902768               | TDSO-8  |
| TLE4999I3                   | Digital interface PSIS | 12.5, 25                   | ±147.5 LSB <sub>13</sub> /mT default for 25 mT range, with gain 1.5     | ±2                    | ±5   | < ±100/<br>< ±200 <sup>2)</sup>          | Compliant                 | SP001689862               | SSO-3   |
| TLE4999C8 (TLE4999C8-S0001) | Digital interface SPC  | 25, 50                     | ±36.875 LSB <sub>12</sub> /mT default for in 50 mT range, with gain 1.0 | ±2                    | ±5   | < ±100/<br>< ±200 <sup>2)</sup>          | Compliant ASIL D (ASIL C) | SP002662500 (SP005727371) | TDSO-8  |
| TLE4999C4 (TLE4999C4-S0001) | Digital interface SPC  | 25, 50                     | ±36.875 LSB <sub>12</sub> /mT default for in 50 mT range, with gain 1.0 | ±2                    | ±5   | < ±100/<br>< ±200 <sup>2)</sup>          | Compliant ASIL D (ASIL C) | SP003420076 (SP005727375) | SSO-4   |

1) Maximum drift over temperature and life time  
 2) Main channel/sub channel



# TLE499x family

## Programmable analog/digital single-channel linear Hall sensor family

Infiniteon's family of TLE499x linear Hall ICs is tailored to the needs of highly accurate angular and linear position detection and current measurement applications. Each product measures the vertical component of a magnetic field and outputs a signal that is directly proportional to the magnetic field. These programmable linear Hall sensors come with different interface options: TLE4997 features ratiometric analog output, while TLE4998P comes with pulse width modulation (PWM), TLE4998S with single edge nibble transmission (SENT), and TLE4998C with short PWM codes (SPC). These high-precision 12-bit resolution linear Hall sensors feature EEPROM memory for flexible programming across a wide range of parameters. Thanks to digital signal processing based on a 20-bit DSP architecture plus digital temperature compensation, these sensors deliver outstanding temperature stability compared with similar compensation methods. TLE4998 also includes stress compensation to withstand stress effects from the package, such as moisture, thus ensuring best-in-class accuracy over the device's lifetime.

### Features

- › Best-in-class accuracy with low drift of output signal (including stress compensation in TLE4998)
- › Programmable transfer function (gain, offset), clamping, bandwidth, and temperature characteristics
- › AEC-Q100 qualified
- › Available in various packages including SSO-3-9 with two integrated capacitors to improve ESD and ESC behavior
- › TLE4997, TLE4998 ISO 26262 ready

### Applications

- › Detecting linear and angular position
- › Detecting pedal and throttle position
- › Steering torque measurement
- › Headlight leveling
- › High-current sensing
- › Seat position and occupant detection
- › Suspension control
- › Detecting gear stick/lever positions
- › Detecting fuel tank levels
- › Current sensing e.g. for battery management

| Product  | Programmable | Number of pins       | Sensitivity (programmable range)   | Magnetic offset | Supply voltage (extended range) | Automotive | ISO 26262 | Interface | Package  |
|----------|--------------|----------------------|------------------------------------|-----------------|---------------------------------|------------|-----------|-----------|--|
| TLE4997  | EEPROM       | 3/Single die SMD 8   | ±12.5 to ±300 mV/mT                | < ±400 μT       | 5 V ±10% (7 V)                  | ✓          | –         | Analog    | SSO-3-10 TDSO-8                                  |
| TLE4998P | EEPROM       | 3/4/Single die SMD 8 | ±0.2 to ±6%/mT                     | < ±400 μT       | 5 V ±10% (16 V)                 | ✓          | Ready     | PWM       | SSO-3<br>SSO-4<br>SSO-3 (2 capacitors)<br>TDSO-8 |
| TLE4998S | EEPROM       | 3/4/Single die SMD 8 | ±8.2 to ±245 LSB <sub>12</sub> /mT | < ±400 μT       | 5 V ±10% (16 V)                 | ✓          | Ready     | SENT      | SSO-3<br>SSO-4<br>SSO-3 (2 capacitors)<br>TDSO-8 |
| TLE4998C | EEPROM       | 3/4/Single die SMD 8 | ±8.2 to ±245 LSB <sub>12</sub> /mT | < ±400 μT       | 5 V ±10% (16 V)                 | ✓          | Ready     | SPC       | SSO-3<br>SSO-4<br>SSO-3 (2 capacitors)<br>TDSO-8 |

1) 147.44 LSB<sub>13</sub> converts to 294.88 LSB<sub>12</sub>





# Angle sensors

## Compact designs in small outline packages

### Highest variety - low-end to high-end, standardized and specialized in all four magnetic technologies: Hall, GMR, AMR and TMR

Infiniteon's magnetic sensor products TLE5501, are fast analog TMR-based angle sensors dedicated to automotive applications. Their fields of use range from steering angle applications, with the highest functional safety requirements, to motors for wipers, pumps and actuators, and electric motors in general. They are also ready to be used in industrial and consumer applications like robotics or gimbal. Angle sensors detect the orientation of an applied magnetic field by measuring sine and cosine angle components with monolithically integrated magnetoresistive elements.

Infiniteon's iGMR sensors are ideal for applications with a wide-angle range, such as BLDC motors or steering sensors. They are pre-calibrated and ready to use. Different levels of signal processing integration enable designers to optimize system partitioning. The XENSIV™ iAMR sensors also perfectly fit applications with the highest accuracy requirements, as they offer the best performance over temperature, lifetime, and magnetic field range.

### iGMR, iAMR and iTMR based angle sensors

Diverse redundant sensor with analog and digital interface

| Product        | Technology | Die configuration | Sin/cos output | Angle output | Second interface | Accuracy           | ISO 26262    | Package       |
|----------------|------------|-------------------|----------------|--------------|------------------|--------------------|--------------|---------------|
| TLE5009        | GMR        | Single die        | Analog sin/cos | -            | -                | 0.9°               | Ready        | DSO-8         |
| TLE5009A16(D)  | GMR        | Dual die          | Analog sin/cos | -            | -                | 1.0°               | Ready        | TDSO-16       |
| TLE5011        | GMR        | Single die        | SSC (SPI)      | -            | -                | 1.6°               | Ready        | DSO-8         |
| TLI5012B       | GMR        | Single die        | SSC (SPI)      | SSC (SPI)    | PWM/IIF/SPC/HSM  | 1.9°               | QM           | DSO-8         |
| TLE5012B(D)    | GMR        | Single & dual die | SSC (SPI)      | SSC (SPI)    | PWM/IIF/SPC/HSM  | 1.0°               | Ready        | DSO-8/TDSO-16 |
| TLE5014C16(D)  | GMR        | Single & dual die | -              | SPC          | -                | 1.0°               | Compliant    | TDSO-16       |
| TLE5014P16(D)  | GMR        | Single & dual die | -              | PWM          | -                | 1.0°               | Compliant    | TDSO-16       |
| TLE5014S16(D)  | GMR        | Single & dual die | -              | SENT         | -                | 1.0°               | Compliant    | TDSO-16       |
| TLE5014SP16(D) | GMR        | Single & dual die | -              | SPI          | -                | 1.0°               | QM/Compliant | TDSO-16       |
| TLE5109A16(D)  | AMR        | Single & dual die | Analog sin/cos | -            | -                | 0.5°               | Ready        | TDSO-16       |
| TLE5309D       | AMR + GMR  | Dual die          | Analog sin/cos | -            | -                | AMR 0.5°, GMR 1.0° | Ready        | TDSO-16       |
| TLE5501        | TMR        | Single die        | Analog sin/cos | -            | -                | 1.0°               | Compliant    | DSO-8         |

SPI = Serial peripheral interface  
 IIF = Incremental interface  
 PWM = Pulse width modulation  
 SENT = Single Edge Nibble Transmission  
 HSM = Hall Switch Mode



## iTMR based angle sensors

Tunneling Magneto Resistive (iTMR) technology is offering high sensing sensitivity with a high output voltage, reducing the need for an internal amplifier. Thus, the sensor can be connected directly to the microcontroller without any further amplification. In addition, iTMR technology shows a very low temperature drift, reducing external calibration and compensation efforts. The iTMR technology is also well known for its low current consumption.

### TLE5501

With the TLE5501 products, Infineon is currently launching the first angle sensor products based on iTMR technology. TLE5501 is available in two versions.

#### TLE5501 - product versions with different pinout:

- TLE5501 E0001: pin-compatible to TLE5009 automotive qualified acc. AEC-Q100
- TLE5001 E0002: decoupled bridges for redundant external angle calculation and highest diagnostic coverage, realizing ISO 26262-compliant development ASIL D



#### Features

- Large output signals of up to 0.37 V/V for direct microcontroller connection
- Discrete bridge with differential sine and cosine output
- Very low supply current: ~2 mA
- Magnetic field range (20-100 mT)
- Typ. angle error ~ 1.0° (over temperature and lifetime)
- DSO-8 package
- AEC-Q100, grade 0: TA = -40°C to 150°C (ambient temperature)
- For TLE5501 E0002:
  - Reaching ASIL D with just one single sensor chip
  - ISO 26262-compliant development ASIL D

#### Applications

- Steering angle sensor
- BLDC motor commutation e.g. wipers, pumps and actuators
- Angular position sensing for e.g. robotics or gimbal
- Electric motors
- Industrial automation
- Safety applications



## iGMR based angle sensors TLE5014(D)

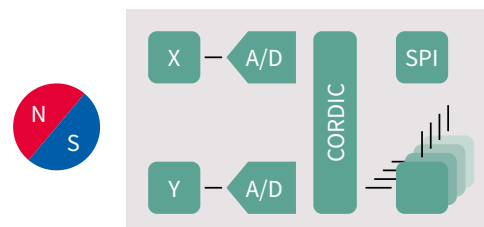


Digital iGMR sensor with an easy-to-use plug-and-play concept for the highest functional safety applications

All XENSIV™ TLE5014 angle sensors are available as single and dual die products. The products come pre-configured and pre-calibrated as plug-and-play sensors and are easy to use. Customers can choose between the interfaces SENT, PWM, SPC, and SPI. On top of those protocol options, the sensors can be adapted to any kind of application setup via their programmable E<sup>2</sup>PROM interfaces. TLE5014 magnetic angle sensors meet ISO 26262 ASIL C for the single die and ISO 26262 ASIL D for the dual die versions. All products are ready for applications with the highest functional safety requirements. The sensors show an extremely small angle error of less than 1° across the entire temperature profile and lifetime. This is particularly helpful in applications with the need for very accurate position sensing such as steering angle sensing or motor commutation. Further application areas range from rotor position measurement, electric power steering (EPS), pedal position to any other kind of position measurement.

### Features

- Easy-to-use, plug-and-play sensors, pre-configured and pre-calibrated
- Offering high flexibility:
  - Available as single and dual die products
  - 12 bit digital interface with protocol options PWM, SENT, SPC and SPI
  - E2 PROM and look-up table for customer configuration and calibration
- High angle accuracy: max. 1.0° over temperature and lifetime
- High voltage capability up to 26 V
- Development fully compliant with ISO 26262
  - Developed acc. ASIL D level
  - Dual die sensors reaching ASIL D, single die sensors ASIL C metrics
- Safety manual and safety analysis summary report available on request
- Applications
  - Steering angle sensing (SAS)
  - Motor commutation
  - Rotor position measurement
  - Pedal position
  - Safety applications
  - Any other kind of high-accuracy position measurement



# iGMR based angle sensors

## TLE5012B, TLE5012B(D)

iGMR sensor with integrated angle calculation and multiple interfaces

### Features

- Integrated angle calculation with CORDIC algorithm
- 15-bit representation of calculated angle value
- High update rate up to 43  $\mu$ s (23 kHz)
- Range of selectable interfaces
- SPI compatible Synchronous Serial Communication (SSC)
- Bi-directional communication up to 8 Mbit/s
- Pulse Width Modulation (PWM)
- Hall Switch Mode (HSM) for motor commutation
- Incremental Interface (IIF)
- Temperature compensation and auto-calibration algorithm
- Diagnostic function for sensor elements and circuitry with PRO-SIL™ support
- Dual die SMD package (redundancy)
- ISO 26262 ready
- Available as single and dual die product

### Applications

- Steering angle
- Brushless DC motor commutation (for example electric power steering (EPS))
- Rotary switches
- General angular sensing
- Incremental or absolute magnetic encoders
- Gimbals, drones, robots

## iAMR based angle sensors

### TLE5109A16(D)

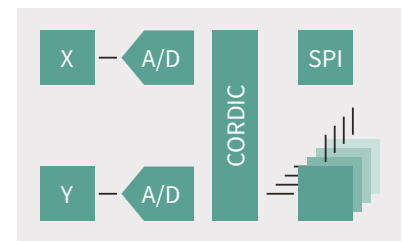
Analog iAMR sensor with temperature compensation

### Features

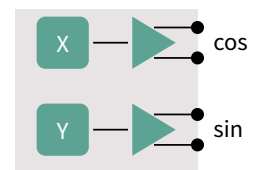
- › Features a differential or single-ended analog interface for sine and cosine values
- › Internal temperature drift compensation for gain and offset
- › Also available as a dual-sensor package
- › ISO 26262-ready
- › Typical 0.1° angle error over lifetime and temperature range after compensation (max 0.5°)
- › Available as single and dual die product

[www.infineon.com/angle-sensors](http://www.infineon.com/angle-sensors)

# iGMR



# iAMR

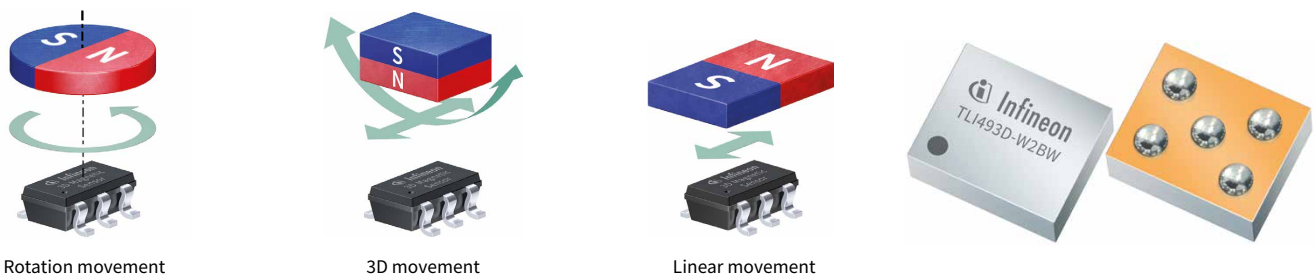


For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# 3D magnetic sensors for industrial and consumer markets

The TLx493D-x2Bx sensor realizes accurate three-dimensional sensing with extremely low power consumption in a small package. Capable of detecting the magnetic field in the x, y, and z-direction, the sensor is ideally suited for the measurement of linear, rotation, or 3-dimensional movements. Thanks to its small package and low power consumption, the TLx493D-x2Bx can be used in new applications, replacing potentiometer and optical solutions. Featuring contactless position sensing and high-temperature stability of the magnetic measurement, the sensor allows systems to get smaller, more accurate, and more robust.



## Features

- 3D magnetic sensing
- Integrated temperature sensing
- Low current consumption
  - 7 nA in power-down mode
- 2.8 to 3.5 V operating supply voltage
- Digital output via a 2-wire standard I<sup>2</sup>C interface
- B<sub>x</sub>, B<sub>y</sub> and B<sub>z</sub> linear field measurement up to ±160 mT
- JESD47 qualified
- 12-bit data resolution for each measurement direction
- Various resolution options from 32 μT/LSB to 130 μT
- Operating temperature range from -40 to +125°C

| Product  | Temperature range | Classification | Linear magnetic range          | Sensitivity                             | I <sub>DB</sub> | Update rate        | Package | Ordering code  |
|--|-------------------|----------------|--------------------------------|---|-----------------|--------------------|---------|--|
| TLI493D-A2B6   | -40...105°C       | JESD47         | ±160 mT (min)<br>±100 mT (min) | 7.7 or 15.4 LSB <sub>12</sub> /mT       | 7 nA - 3.4 mA   | 10 Hz - 8.4 kHz    | TSOP6   | SP001689844  |
| TLI493D-W2BW A0<br>TLI493D-W2BW A1<br>TLI493D-W2BW A2<br>TLI493D-W2BW A3 | -40...125°C       | JESD47         | ±50, ±100 or<br>±160 mT        | 7.7, 15.4 or 30.8 LSB <sub>12</sub> /mT | 7 nA - 3.4 mA   | 0.05 Hz - 11.6 kHz | WLB-5   | SP005409964<br>SP005409966<br>SP005409968<br>SP005409970 |
| TLV493D-A1B6   | -40...125°C       | JESD47         | ±130 mT (typ)                  | 10.2 LSB <sub>12</sub> /mT              | 7 nA - 3.7 mA   | 10 Hz - 3.3 kHz    | TSOP6   | SP001286056  |
| TLV493D-A2BW   | -20°C...85°C      | JESD47         | ±50, ±100 or ±160 mT           | 7.7, 15.4 or 30.8 LSB <sub>12</sub> /mT | 7 nA - 3.4 mA   | 6 Hz - 11,6 kHz    | WLB-5   | SP005542151  |

## New features

- Advanced operation modes to provide high flexibility
- Short mode range setting, focusing on the half of the magnetic range, ensuring higher accuracy
- Higher update frequency allows for an application field that requires faster update speed
- Angular mode (for x and y read-out only)

## Applications

- Anti tempering protection in smart meters
- Joysticks
- Control elements e.g. white goods multifunction knobs
- Ergonomic push and control buttons on domestic appliances and power tools
- Position control in robotics
- Smart lock position detection



# 3D magnetic sensors for automotive applications

Infineon's XENSIV™ TLE493D-x2B6 enables all kind of automotive control element applications within the passenger compartment or under the hood with a temperature range of -40 to +125°C, with linear magnetic range requirements up to ±160 mT.



## Features

- 3D magnetic sensing
- Integrated temperature sensing
- 2.8 to 3.5 V operating supply voltage
- Low current consumption
  - 0.007 µA in power-down mode
  - 10 µA in ultralow power mode
  - Up to 10 power modes
- Digital output via a 2-wire standard I<sup>2</sup>C interface
- B<sub>x</sub>, B<sub>y</sub> and B<sub>z</sub> linear field measurement ±160 mT
- AEC-Q100 qualified/ISO 26262-ready
- 12-bit data resolution for each measurement direction
- Various resolution options from 65 µT/LSB to 130 µT
- Operating temperature range from -40 to +125°C

| Product  | Temperature range | Qualification                | Linear magnetic range | Resolution                            | I <sub>DD</sub> | Update rate XYZ measurements | Wake-up | Package | Ordering code  |
|--|-------------------|------------------------------|-----------------------|---------------------------------------|-----------------|------------------------------|---------|---------|--|
| TLE493D-A2B6   | -40 ... 125°C     | AEC-Q100                     | ±160 mT<br>±100 mT    | 130 µT/LSB<br>65 µT/LSB <sup>1)</sup> | 7 nA – 3.4 mA   | up to 7.8 kHz                | No      | TSOP6   | SP001689848  |
| TLE493D-W2B6 A0<br>TLE493D-W2B6 A1<br>TLE493D-W2B6 A2<br>TLE493D-W2B6 A3 | -40 ... 125°C     | AEC-Q100<br>ISO 26262 ready  | ±160 mT<br>±100 mT    | 130 µT/LSB<br>65 µT/LSB <sup>1)</sup> | 7 nA – 3.4 mA   | up to 7.8 kHz                | Yes     | TSOP6   | SP001655334<br>SP001655340<br>SP001655344<br>SP001655348 |
| TLE493D-P2B6 A0<br>TLE493D-P2B6 A1<br>TLE493D-P2B6 A2<br>TLE493D-P2B6 A3 | -40 ... 125°C     | AEC-Q100/<br>ISO 26262 ready | ±160 mT<br>±100 mT    | 130 µT/LSB<br>65 µT/LSB <sup>1)</sup> | 7 nA – 3.4 mA   | up to 7.8 kHz                | Yes     | TSOP6   | SP005557415<br>SP005557413<br>SP005557411<br>SP005557408 |

1) Short range mode

The XENSIV™ sensor **TLE493D-A2B6** features include a sensor address read-back feature for additional communication verification, a half-range mode focusing to half of the magnetic range, ensuring higher accuracy, and an angular mode (for x and y readout only).

With the TLE493D-W2B6/P2B6 A0-A3, a 3D sensor family with an enhanced dynamic wake-up feature was developed. Four pre-programmed address options (A0-A3) are available, enabling for a fast start-up initialization when used in I<sup>2</sup>C bus configurations. Our sensors include enhanced test options, and safety documentation is available to enable the usage of this sensor in the context of ASIL B systems.

Compared to the previous products of this family the new **TLE493D-P2B6 A0-A3** family offers enhance precision in x-, y-, z- sensing direction, while otherwise featuring the same dynamic wake-up features, programmability, and test options like **TLE493D-W2B6 A0-A3**. We provide safety documentation on request for usage of the sensor in the context of ASIL B systems.

## Applications

- Control elements for infotainment/navigation systems, air conditioners, multifunctional steering wheels, seat controls
- Top column modules e.g. direction indicator, wiper control
- Gear stick position sensing
- Multi-function knobs
- Pedal/valve position sensing

[www.infineon.com/3d-magnetics](http://www.infineon.com/3d-magnetics)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# Magnetic speed sensors

## Easy-to-use, robust and cost-effective sensors for speed measurement

Infiniteon's Hall and GMR-based magnetic speed sensors are designed to measure speed in safety and powertrain applications such as speedometers, ABS, camshafts, crankshafts, and automatic transmissions. They are also used in similar applications in the industrial sector. The sensors use a ferromagnetic gear tooth or encoder structure to measure linear or rotational speed and position. Hall sensor measuring rotational speed with a gear tooth and a magnetic encoder wheel. The majority of sensors also feature additional benefits such as integrated capacitors for high EMC robustness and the highest levels of ESD protection.

### TLE4922

## Highly robust, easy-to-use mono-Hall speed sensor with twist-independent mounting

This sensor is specially designed to provide an easy-to-use, robust and cost-effective solution for vehicle or industrial speed sensing applications. The TLE4922 can, therefore, be back-biased using a simple, low-cost bulk magnet, while providing a good air gap performance and switching accuracy. Its hidden adaptive hysteresis and calibration algorithm enable good accuracy over air gap jumps and immunity to vibration and run-out events.

#### Features

- Large operating air gap capability
- Flexible mounting (also known as Twist-independent mounting)
- Hidden adaptive hysteresis
- Low current consumption
- Reverse magnetic polarity capability
- Advanced protection technology
  - Reverse voltage protection at VS-pin
  - Short-circuit protection
  - Overtemperature protection
- Wide operating temperature ranges of  $-40^{\circ}\text{C} \leq T_j \leq \pm 150^{\circ}\text{C}$
- High ESD robustness up to  $\pm 4$  kV HBM
- 3-wire PWM voltage interface

#### Applications

- Industrial applications
- Two-wheeler and automotive vehicle speed



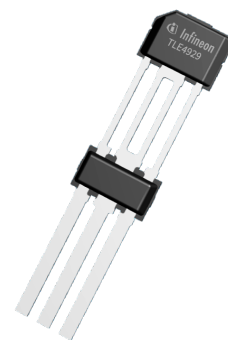
## TLE4929

### Fully programmable crankshaft sensor

The TLE4929 is an active differential Hall sensor ideally suited for crankshaft applications and similar industrial applications, such as a speedometer or any speed sensor with excellent accuracy and low jitter capabilities. It as well addresses new requirements for crankshaft speed sensing from hybrid powertrains. An advanced vibration detection algorithm ensures valid sensor data for any hybrid powertrain traction. This improves efficiency of the engine start and helps to avoid misfiring or ECU error messages caused by wrongly calibrated sensor data. Also, the compatible 3-pin-package allows a one-to-onereplacement of the former generation of crankshaft sensors without direction detection, TLE4924/25/26/27/28, widely backward compatible functionality through flexible EEPROM configuration of parameters, means former TLE492x-family can be mimicked.

#### Features

- Differential Hall speed sensor to measure speed and position of tooth/pole wheels
- Ease of use single chip solution in SSO-3-52
- Switching point in the middle of the tooth enables backward compatibility
- Robustness over magnetic stray-field due to the differential sensing principle
- Precise miss fire detection through excellent jitter performance
- Dedicated hybrid engine algorithm keeps combustion engine calibrated during an electric drive cycle
- Digital output signal with programmable output-protocol including diagnosis interface
- Direction detection and stop-start-algorithm
- High accuracy and low jitter
- High sensitivity enables large air gap
- End-of-line programmable to adapt engine parameters
- Can be used as a differential camshaft sensor
- Pre-programmed version TLE4929C-XAN available, TLE4929C-X2A available for 2-wheeler applications
- Automotive operating temperature range



| Product | Sensor technology | AEC-Q100 qualified | Direction detection | Automotive | Industrial | Protocol          | RoHS |
|---------|-------------------|--------------------|---------------------|------------|------------|-------------------|------|
| TLE4922 | Mono-Hall         | ✓                  | –                   | ✓          | ✓          | Single pulse      | ✓    |
| TLE4929 | Differential Hall | ✓                  | ✓                   | ✓          | ✓          | PWM, Single pulse | ✓    |



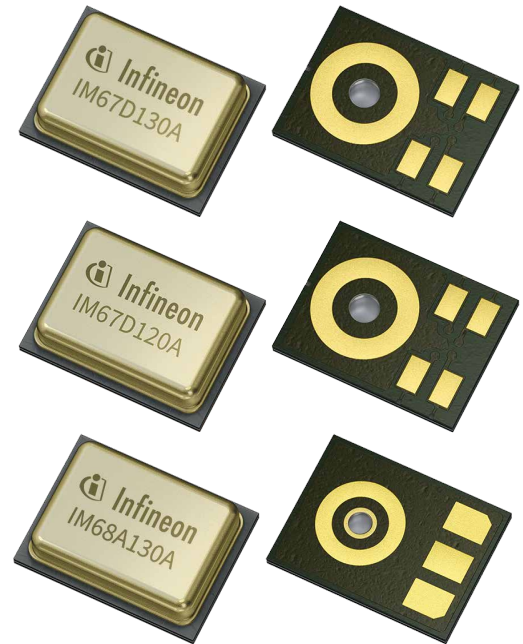


# MEMS microphones for automotive applications

## Qualified according to automotive standard, AEC-Q103-003

As part of our comprehensive XENSIV™ sensor family, we also offer high-performance MEMS microphones, qualified according to the state-of-the-art automotive quality standard AEC-Q103-003. These microphones close the gap in the automotive industry, providing the best possible fit for automotive applications.

These automotive XENSIV™ MEMS microphones combine our proven expertise in the automotive industry with our technical leadership in high-end MEMS microphones. They are suited to all applications inside and outside the car, where the best audio performance in harsh automotive environments is required.



### Customer benefit

- Automotive qualification according to AEC-Q103, together with long term availability reduces design-in risk and effort
- Increased operating temperature range allows flexible usage in automotive environment up to +105°C
- Best in class audio performance (SNR, AOP, THD) for optimum speech quality and capture of distortion-free audio signals in loud environments such as inside a car
- Narrow sensitivity matching for enhanced performance of beam-forming (noise suppression) arrays
- Flat frequency and stable phase response to < 10 Hz for optimal fit in acoustic noise cancellation use cases (for IM66D130A and IM68A130A, best fit for ANC/RNC automotive applications)

| Parametrics             | IM66D130A   | IM67D120A   | IM67D130A   | IM68A130A                  |
|-------------------------|-------------|-------------|-------------|----------------------------|
| Acoustic overload point | 130 dB SPL  | 120 dB SPL  | 130 dB SPL  | 130 dB SPL                 |
| Current consumption     | 1.300 µA    | 980 µA      | 980 µA      | 105 µA                     |
| Interfaces              | PDM         | PDM         | PDM         | Analog single-ended output |
| Sensitivity             | -36 dBFS    | -26 dBFS    | -36 dBFS    | -39 dBFS                   |
| Signal to noise         | 66 dB(A)    | > 67 dB(A)  | > 67 dB(A)  | 68 dB(A)                   |
| Supply voltage          | -           | 1.62–3.6 V  | 1.62–3.6 V  | -                          |
| LFRO                    | < 10 Hz     | 28 Hz       | 28 Hz       | < 10 Hz                    |
| Ordering code           | Coming soon | SP005550431 | SP005582032 | SP005738297                |



## Typical applications for automotive MEMS microphones in-cabin and outside of the vehicle



### Speech: Hands free/e-call/ICC

Enabling distortion free audio capturing for all speech related application thanks to their high SNR and low distortions.

Interior



### Speech: Microphone arrays – beamforming voice command

Making possible to operate infotainment systems with voice commands due to their narrow sensitivity matching for enhanced performance of beam-forming arrays .

Interior



### Active and road noise cancellation

Enabling a quiet environment for comfortable travels, the microphones are a good fit for ANC applications thanks to their flat frequency and stable phase response. IM68A130A and IM66D130A: dedicated product family for ANC with superior performance with analog and digital interface.

Interior



- Event sound detection/sirens detection/contact detection
- Road condition detection

Contributing to road safety, by detecting sounds like sirens from emergency vehicles or even dangerous road conditions thanks their large dynamic range and acoustic overload point.

Exterior



### Voice recognition/external interaction

Allowing external interaction e.g. for controlling certain functions via voice commands due to their good suitability for voice recognition use cases.

Exterior



# XENSIV™ sensors for consumer and IoT applications

## Intuitive sensing: Giving things human-like senses for a better contextual awareness

Imagine a world where technology is unobtrusive and seamlessly integrated into our lives. Where intentional and deliberate communication between people and devices is no longer necessary. In this world, there is no need to push buttons or issue commands in order to activate devices because technology is capable of interpreting implicit intentions and context. This enhances the user experience and makes it more natural – it would seem as if the devices around us intuitively understand what we want them to do. At Infineon, this future is already becoming reality. We develop sensor solutions that enable simple and effortless user interactions with all kinds of smart devices. Bridging the gap between the real and digital worlds, our technology

is developed to make life easier, safer, greener and more efficient. Our intuitive sensing solutions are at the very core of this mission. Reflecting our belief that the essential value of sensor technology lies in making our lives more convenient through seamless, natural interactions between people and sensing devices, our aim is to leave you free to focus on what really matters in life.

### Choose your type of sense

Thanks to industry-leading technologies Infineon, XENSIV™ sensors are exceptionally precise. They are the perfect fit for various customer applications in automotive, industrial and consumer markets.

#### Pressure sensors

Our digital barometric pressure sensors give designers the best choice when it comes to small form factors, highest precision and accuracy over a wide temperature range, fast read-out speeds and low power consumption.

#### Radar sensors

Radar supports existing applications while providing features that enable completely new use cases. It measures velocity, range and angle, both horizontal and vertical, for precise position mapping and 3D tracking.

#### MEMS microphones

MEMS microphones overcome existing audio chain limitations and are designed for applications where low self-noise (high SNR), wide dynamic range, low distortions and a high acoustic overload point are required.

#### PAS CO2 sensor

Leveraging photoacoustic spectroscopy (PAS), Infineon has developed an exceptionally small CO<sub>2</sub> sensor that overcomes existing size, cost and performance challenges.

## Today, sensors already enable interactions between people and devices

This interaction often depends on the interpretation and merging of information from different sources. Machines cannot yet read our minds and do not always have the information necessary to correctly evaluate a given situation. So, we sometimes have to explicitly tell devices what we want them to do. This can be inconvenient and time-consuming. Inspired by human nature, Infineon intuitive sensing solutions are designed to take the complexity out of our interaction with devices.

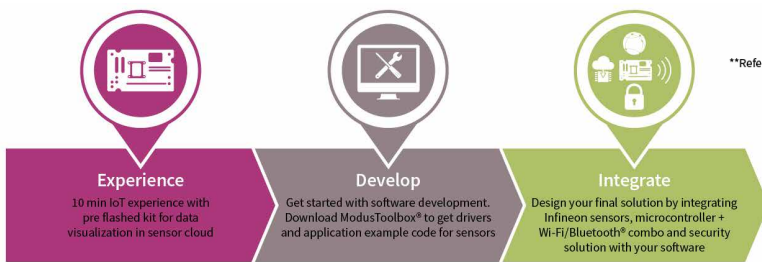
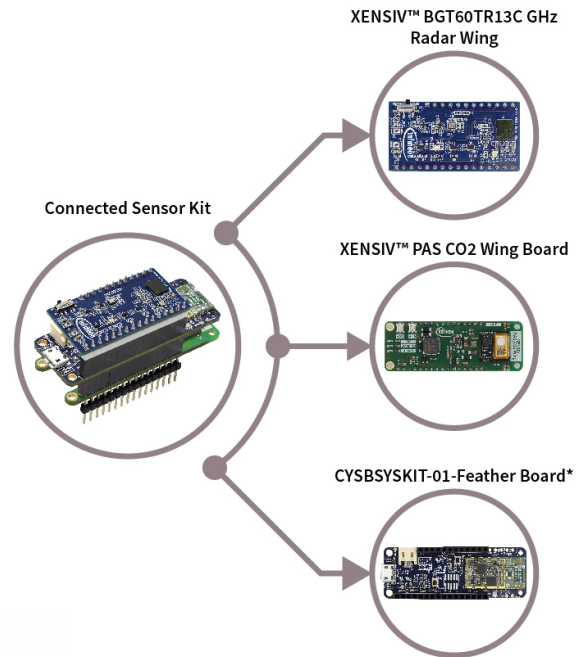
Reflecting a holistic approach, we combine different sensors with state-of-the-art software to create a comprehensive picture of the world around us. By fusing several smart sensors into one coherent intelligent system, our intuitive sensing solutions simplify complex technical processes and enable people to effortlessly interact with devices. These smart devices intuitively sense the world around them, determining what is expected and needed from them.



# XENSIV™ connected sensor kit

## Rapid IoT prototyping experience enabled by XENSIV™ sensors

The XENSIV™ connected sensor kit enables rapid development of a custom solution built on Infineon products. The CSK supports customers in testing sensor-driven IoT products and use cases as well as in prototyping. It offers a real-time sensor evaluation with custom configurations and cloud-based sensor data visualization with sensor fusion. The development kit supports use cases based on XENSIV™ 60 GHz radar and PAS CO2 with DPS368 pressure sensor (Sense), PSoC™ 6 microcontroller embedded processing (Compute), connectivity via Infineon AIROC™ CYW43012 Wi-Fi and Bluetooth® Combo (Connect) and hardware security with OPTIGA™ Trust M (Secure). Code examples and sensor libraries are available in the Infineon software ecosystem ModusToolbox™ to help customers create use case-specific application codes for new product offerings.

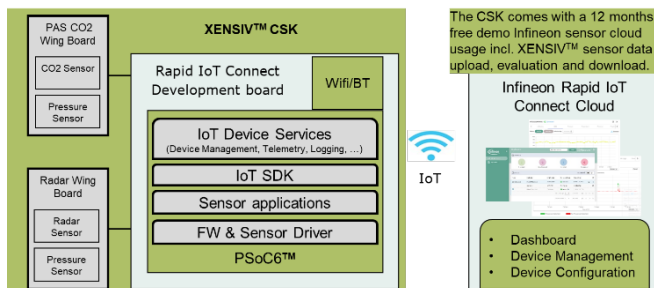


\*\*Refer to CYSBSYSKIT-02 User Code

### Features and benefits

- Key features**
- Small form-factor (22.5 mm x 63 mm x 30 mm) Adafruit feather compatible design
  - Wi-Fi and Bluetooth 5.0-compliant combo radio module
  - Power optimized design, deployable with battery
  - Interchangeable sensor wings – 60 GHz radar, PAS CO2
  - Seamless integration into ModusToolbox™
  - FCC and CE certified

- Key benefits**
- Ideal for prototyping battery-powered IoT devices due to optimized power consumption. Suited for customer field trials.
  - Rapid development and deployment via code examples in ModusToolbox™ for presence detection, entrance counter, air quality measurements. Enabler for Multi-sensor data fusion.
  - Secure cloud device onboarding and management with OPTIGA™ Trust M. Secure kit provisioning (unique user ID).



The Infineon Rapid IoT Connect SOM platform deployed on the XENSIV™ CSK provides hardware, firmware, and cloud artifacts to enable rapid onboarding to the Internet of Things. Bidirectional XENSIV™ sensor to cloud data communication is securely enabled. The XENSIV™ CSK is a pre-implemented Infineon Prototyping Sensor System that makes it possible to provision, monitor and manage Infineon hardware remotely. Sensor2cloud kit set up takes 10 minutes with 12 months free user access to a dedicated cloud demo platform for sensor data collection and interpretation as well as sensor data download.

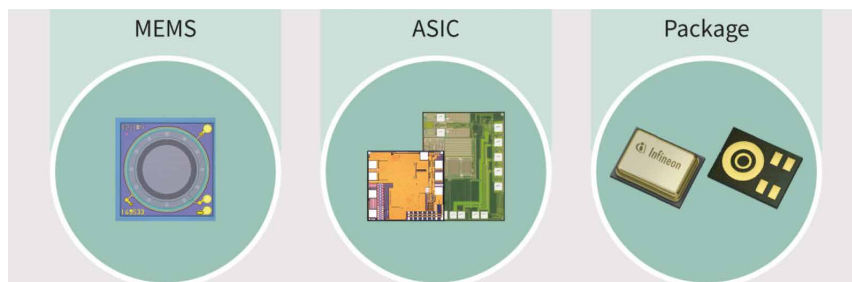
[www.infineon.com/connectedsensorkit](http://www.infineon.com/connectedsensorkit)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

# XENSIV™ MEMS microphones for consumer

## High-performance analog and digital MEMS microphones for consumer electronics

Infineon's XENSIV™ MEMS microphones are designed for capturing audio signals with unprecedented precision and quality. The microphones are comprised of Infineon's MEMS microphone chips and ASICs which are not without reason the world's best-selling microphone components.

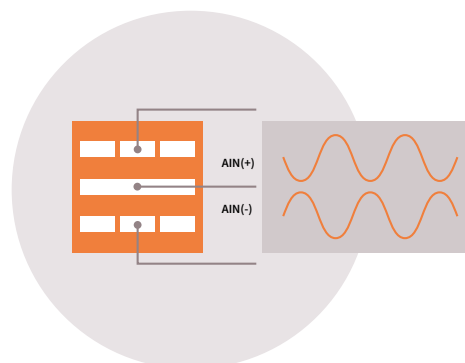


XENSIV™ MEMS microphones feature ultra-low self-noise (high SNR), extremely low distortions (THD) even at high sound pressure levels (SPL), very tight part-to-part phase and sensitivity matching, a flat frequency response with a low LFRO (low frequency roll-off) and an ultra-low group delay. Combined with selectable power modes and their very small package size, Infineon XENSIV™ MEMS microphones are a perfect match for consumer electronics with excellent audio capturing functionalities and also for selected industrial applications such as predictive maintenance and security.

|  |          |                    |  |  |                              |  |
|--|----------|--------------------|--|--|------------------------------|--|
| Low-noise capturing of the faintest sounds   | High SNR | Wide dynamic range |  |  | <b>Robustness</b>            | Integrated ingress protection and filters for RF suppression ensure stable performance in challenging environments |
| Enables best-in-class transparent hearing and active noise cancelling functionality            |          |                    |  |  | <b>Low power consumption</b> | Selectable power modes for long-lasting battery life   |
| Low signal distortions even at high sound pressure levels                                      | High AOP |                    |  |  | <b>Low part variability</b>  | Better manufacturability and performance with low group delay for multi-mic applications                           |
| Handling of high signal peaks for reliable ANC performance (e.g. concerts, traffic, tap noise) |          |                    |  |  | <b>Quality</b>               | Highest qualification standards and 100% test coverage during manufacturing  |

## Infineon's Sealed Dual Membrane (SDM) MEMS technology

Infineon's latest Sealed Dual Membrane MEMS technology delivers high ingress protection (IP57) at a microphone level. The sealed MEMS design prevents water or dust from entering between membrane and backplate, preventing mechanical blockage or electric leakage issues commonly observed in MEMS microphones. Microphones built with the Sealed Dual Membrane technology can be used to create IP68 devices, requiring only minimal mesh protection.



[www.infineon.com/mems](http://www.infineon.com/mems)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Product portfolio

|         | Infineon Model | Main Features                  | Interface    | Package size          | SNR      | AOP (1/10%THD) | Current            | Sensitivity | LFRO  |
|---------|----------------|--------------------------------|--------------|-----------------------|----------|----------------|--------------------|-------------|-------|
| Digital | IM69D130       | High SNR and high AOP          | PDM          | 4.00 x 3.00 x 1.20 mm | 69 dB(A) | 128/130 dBSPL  | 980 µA @ 3.072 MHz | -36 dBFS    | 28 Hz |
|         | IM69D120       | High SNR and sensitivity       | PDM          | 4.00 x 3.00 x 1.20 mm | 69 dB(A) | 118/120 dBSPL  | 980 µA @ 3.072 MHz | -26 dBFS    | 28 Hz |
|         | IM69D127       | High performance in small size | PDM          | 3.60 x 2.50 x 1.00 mm | 69 dB(A) | 123/127 dBSPL  | 980 µA @ 3.072 MHz | -34 dBFS    | 40 Hz |
|         | IM69D128S NEW  | Ultra-low current consumption  | PDM          | 3.50 x 2.65 x 1.00 mm | 69 dB(A) | 125/128 dBSPL  | 520 µA @ 3.072MHz  | -37 dBFS    | 30 Hz |
|         | IM70D122 NEW   | High SNR and sensitivity       | PDM          | 3.50 x 2.65 x 1.00 mm | 70 dB(A) | 120/122 dBSPL  | 980 µA @ 3.072MHz  | -26 dBFS    | 30 Hz |
|         | IM72D128 NEW   | Ultra-high SNR                 | PDM          | 4.00 x 3.00 x 1.20 mm | 72 dB(A) | 126/128 dBSPL  | 980 µA @ 3.072MHz  | -36 dBFS    | 20 Hz |
|         | IM73D122 NEW   | Ultra-high SNR & sensitivity   | PDM          | 4.00 x 3.00 x 1.20 mm | 73 dB(A) | 120/122 dBSPL  | 980 µA @ 3.072MHz  | -26 dBFS    | 20 Hz |
| Analog  | IM68A130 NEW   | Small package and low LFRO     | Single Ended | 3.35 x 2.50 x 0.98 mm | 68 dB(A) | 118/130 dBSPL  | 110 µA @ 2.75 V    | -38 dBV     | 10 Hz |
|         | IM70A135 NEW   | High SNR & high AOP            | Differential | 3.50 x 2.65 x 1.00 mm | 70 dB(A) | 132/135 dBSPL  | 170 µA @ 2.75 V    | -38 dBV     | 37 Hz |
|         | IM73A135 NEW   | Ultra-high SNR & high AOP      | Differential | 4.00 x 3.00 x 1.20 mm | 73 dB(A) | 132/135 dBSPL  | 170 µA @ 2.75 V    | -38 dBV     | 20 Hz |

All XENSIV™ consumer microphones have bottom port. Due to SDM (Sealed Dual Membrane) XENSIV™ microphone deliver IP57 ingress protection on the component level for better manufacturability and robustness against water and dust.

## Features, applications and use cases

### Features

- Ultra-low self-noise / ultra-high SNR
- Selectable power modes for longer battery life
- Sealed Dual Membrane (SDM) technology with ingress protection at microphone level
- Extremely low distortions (THD) even at high sound pressure levels
- High dynamic range and very high acoustic overload points (AOP)
- Very tight part-to-part phase and sensitivity matching
- Flat frequency response with a low LFRO (low frequency roll-off)
- Ultra-low group delay for multi-mic applications
- Very small package sizes for various applications

### Typical applications

- TWS earbuds
- ANC headphones
- Smart speakers
- Conference speakers
- Laptops / tablets
- Wearables
- AR/VR devices

### Emerging applications

- Cameras
- Video doorbells
- Smart home
- Smart infrastructure
- Home appliances
- Industrial applications
- Medical applications

### Typical use cases

- Studio quality audio capturing for communication devices
- Low latency wide band audio signal capturing for Active Noise Cancellation (ANC) and transparent hearing functionality
- Small form factor & current consumption for battery and size constraint devices
- Multi-microphone (array) based beamforming and source separation for audio zoom features and multi user audio capturing
- High range, far field voice pickup for multi room applications
- Capturing of audio signals in loud environments, such as outdoor
- Audio pattern detection for predictive and preventive maintenance and security



| Product   | Description   |
|---|---|
| <p>IM69D130</p>    | <p>IM69D130 is a high-performance digital MEMS microphone making use of Infineon's Dual Backplate MEMS technology to deliver 105 dB dynamic range and high output linearity up to 130 dB SPL. The application benefits are crystal clear audio signals, extended pick-up distance and sensitivity to both soft and loud signals - from whispered speech to rock concerts.</p>   |
| <p>IM69D120</p>    | <p>IM69D120 is a high-performance digital MEMS microphone making use of Infineon's Dual Backplate MEMS technology to deliver 95 dB dynamic range and high output linearity up to 120 dB SPL. If IM69D130 is used in a 16 bit audio signal chain, the full SNR performance would not be realized as the noise floor will be limited by the system dynamic range. IM69D120 has been specifically designed to preserve 69 dB(A) SNR in a 16 bit system. This is achieved by increasing the microphone sensitivity to -26 dBFS, and reducing the acoustic overload point to 120 dB SPL.</p>   |
| <p>IM69D127</p>    | <p>IM69D127 is a digital high-performance MEMS microphone based on Infineon's new Sealed Dual Membrane MEMS technology which delivers high ingress protection (IP57) at a microphone level. Its small size of only 3.60 x 2.50 x 1.00 mm<sup>3</sup> makes it a perfect match for compact audio devices, such as TWS earbuds.</p>   |
| <p>IM69D128S</p>   | <p>Great signal-to-noise ratio (SNR) of 69 dB(A) enables crystal clear audio experience without compromising on battery life. Enabled by a revolutionary digital microphone ASIC, the IM69D128S sets a new benchmark by cutting current consumption to 520 µA - almost the half of what models with similar performance on the market can offer. Additionally, IM69D128S masters the art of switching between different power &amp; performance profiles without any audible artifacts, i.e. glitches that the user can hear.</p>   |
| <p>IM70D122</p>   | <p>High performance digital XENSIV™ MEMS microphone IM70D122 makes the most out of Infineon's Sealed Dual Membrane technology to meet a very high signal-to-noise ratio of 70 dB(A) and a very high sensitivity of -26 dBFS. Especially thanks to its high sensitivity and high SNR the IM70D122 is perfectly tailored for advanced audio capturing which can uplift the audio experience for laptops, tablets, cameras and conference systems.</p>   |
| <p>IM72D128</p>  | <p>The IM72D128V01 is an ultra-high-performance digital microphone designed for applications which require a very high SNR (low self-noise) and low distortions (high AOP). The flat frequency response (20 Hz low-frequency roll-off) and tight manufacturing tolerance improve performance of multi-microphone (array) applications. The digital microphone ASIC contains an extremely low-noise preamplifier and a high-performance sigma-delta ADC. Different power modes can be selected in order to suit clock frequency and current consumption requirements.</p>  |
| <p>IM73D122</p>  | <p>Ultra-low noise digital XENSIV™ MEMS microphone IM73D122 is designed for applications which require a very high SNR (low self-noise) and a high sensitivity. The flat frequency response (20 Hz low-frequency roll-off) and tight manufacturing tolerance improve performance of multi-microphone (array) applications. The powerful mix of ultra-high SNR and high sensitivity empowers high quality audio capturing for voice user interface applications in laptops, tablets or conferencing devices.</p>   |
| <p>IM68A130</p>  | <p>The IM68A130 is a high performance, single-ended, analog MEMS microphone designed for applications which require a low LFRO (10 Hz), a high SNR (low self-noise), and low distortion (high AOP). The high signal-to-noise ratio (SNR) of 68 dB(A) enables far field and low volume audio pick-up. The flat frequency response and tight manufacturing tolerance improve the performance of Active Noise Cancellation (ANC) and multi-microphone array applications.</p>  |
| <p>IM70A135</p>  | <p>Infineon's XENSIV™ MEMS analog microphone IM70A135 is a compact high performance microphone with a very high acoustic overload point of 135 dB SPL and a size of only 3.50 x 2.65 x 1.00 mm<sup>3</sup>. This microphone is based on Infineon's new Sealed Dual Membrane MEMS technology which delivers high ingress protection (IP57) at a microphone level. The small size makes this microphone especially suited for TWS earbud applications.</p>  |
| <p>IM73A135</p>  | <p>Infineon's XENSIV™ MEMS analog microphone IM73A135 sets a new performance benchmark in MEMS microphones. A best-in-class signal to noise ratio (SNR) of 73 dB and a high acoustic overload point of 135 dB SPL enable clear audio pick up of the quietest and the loudest sounds. This microphone is based on Infineon's new Sealed Dual Membrane MEMS technology which delivers high ingress protection (IP57) at a microphone level. The IM73A135 allows designers to reach a level of high audio performance that was previously only achievable by ECMs while at the same time reaping the benefits inherent in MEMS technology.</p> |



## XENSIV™ MEMS microphone partners

Building upon the superior XENSIV™ MEMS microphone performance, Infineon’s extensive network of global partners offers customers a comprehensive portfolio of XENSIV™ MEMS microphone-based reference designs, as well as Infineon inside MEMS microphones that will propel audio performance to the next level even for the most demanding applications. Click on the buttons below to learn more about our partner solutions.



## Microphone flex evaluation kits

The flex evaluation kits allow simple and easy evaluation of XENSIV™ MEMS microphones. One microphone of the respective type is mounted on each flex board. A flex board can be easily connected to an audio testing setup with the included adapter board via a 6-position ZIF connector. Each kit includes five flex boards and one adapter board.

| Product | Kit  | Features  |
|---------|--|---|
|         | <a href="#">EVAL_IM69D130_FLEXXIT</a><br>SP: SP002153022 | <ul style="list-style-type: none"> <li>– Quick and easy connection to evaluation system</li> <li>– Small size: 25 mm x 4.5 mm</li> <li>– Pre-soldered MEMS microphone</li> <li>– Configurable select pin configuration for digital microphones</li> </ul> |
|         | <a href="#">EVAL_IM69D120_FLEXXIT</a><br>SP: SP002153026 |   |
|         | <a href="#">KIT_IM69D127V11_FLEX</a><br>SP: SP005403891  |   |
|         | <a href="#">KIT_IM73A135V01_FLEX</a><br>SP: SP005415695  |   |
|         | <a href="#">KIT_IM72D128V01_FLEX</a><br>SP: SP005429924  |   |
|         | <a href="#">KIT_IM70A135V10_FLEX</a><br>SP: SP005728204  |   |
|         | <a href="#">KIT_IM68A130V01_FLEX</a><br>SP: SP005728206  |   |
|         | <a href="#">KIT_IM69D128SV01_FLEX</a><br>SP: SP005744505 |   |
|         | <a href="#">KIT_IM70D122V01_FLEX</a><br>SP: SP005826638  |   |

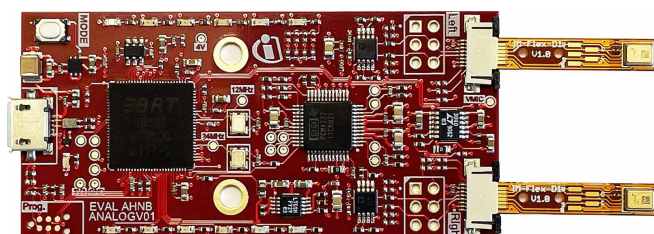


## The Infineon Audiohub Nano

The Infineon Audiohub Nano enables better the evaluation of Infineon microphones. The kit includes an Infineon Audiohub Nano and four microphones on flex board. Up to two additional Infineon XENSIV™ MEMS microphones can be connected to the evaluation board in mono or stereo output. The evaluation board provides a USB audio interface to stream audio data from the microphone with any audio recording and editing software. Board comes in two different interfaces – analog and digital.

### Eval AHNB ANALOGV01

Analog XENSIV™ MEMS microphones evaluation board  
SP: SP005568087



#### Summary of features

- Audio interface for analog XENSIV™ MEMS microphones
- Audio streaming over USB interface
- 48 kHz sampling rate
- 24-bit audio data (stereo)
- Dynamic range 120 dB
- LED indication for the configured gain level in normal mode and low power mode
- Volume unit meter display with onboard LEDs
- Powered through Micro-USB

### Eval AHNB IM69D130V01

Analog XENSIV™ MEMS microphones evaluation board  
SP: SP005285852



#### Summary of features

- Audio streaming over USB interface
- 48 kHz sampling rate
- 24-bit audio data (stereo)
- Mode switch for toggling between normal mode and low power mode with 4 pre-defined gain configurations
- LEDs indication for the configured gain level in normal mode and low power mode
- Volume unit meter display with on board LEDs
- Powered through Micro-USB

# XENSIV™ digital barometric pressure sensor for mobile and wearable devices

Infinion's digital barometric pressure sensor family is the best choice for mobile and wearable devices due to its small form factor, high precision, and low power consumption. Pressure sensing is based on capacitive technology, which guarantees ultra-high precision ( $\pm 2$  cm) and excellent relative accuracy ( $\pm 0.06$  hPa) over a wide temperature range. The sensor's internal signal processor converts the output from the pressure and temperature sensor elements to 24-bit results. Each pressure sensor has been calibrated individually and contains calibration coefficients. The coefficients are used in the application to convert the measurement results to true pressure and temperature values. All sensors have a FIFO that can store the last 32 measurements. Since the host processor can remain in a sleep mode for a longer period between readouts, a FIFO can reduce the system power consumption. Sensor measurements and calibration coefficients are available via the serial I<sup>2</sup>C/SPI interface.

## DPS310

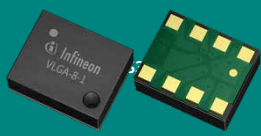
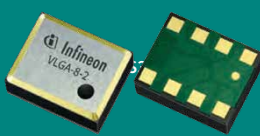
A barometric pressure sensor with very low power consumption is recommended for applications where power consumption is critical and the highest precision in pressure metering is required.

## DPS368

DPS368 offers the best-in-class resolution ( $\pm 2$  cm), a very fast read-out speed, and low current consumption. The sensor can be used in harsh environments, as it is robust against water (IPx8 - 50 m underwater for 1 hour), dust and humidity. The small package size saves up to 80 percent of the space and makes the DPS368 ideal for mobile applications and wearable devices.

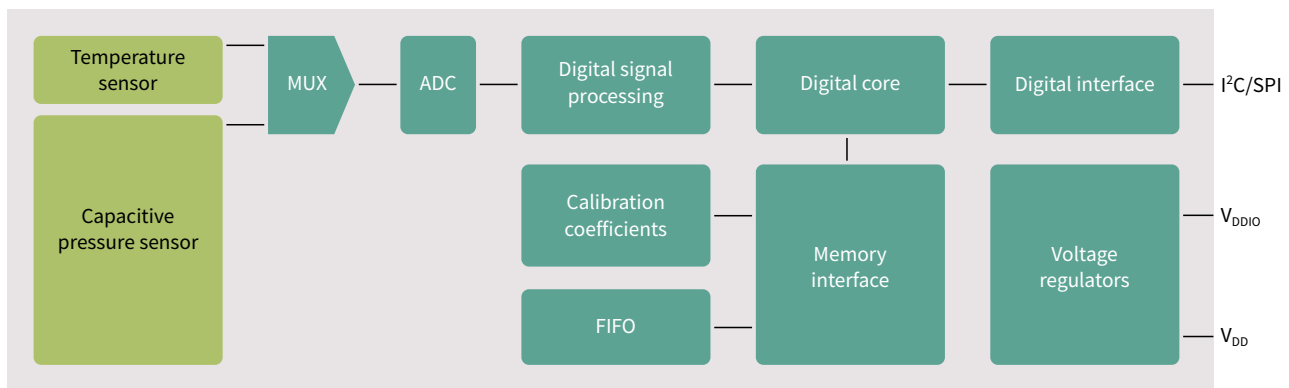
## Typical applications

- Drones: altitude detection and height stability
- Health and fitness: accurate elevation gain and step counting (e.g. for smartwatches)
- Outdoor Navigation: GPS start-up time/accuracy improvement; dead reckoning (e.g. in tunnels)
- Indoor navigation: floor detection e.g. in shopping malls and parking garages
- Smart home: micro weather forecasting; room temperature control; intruder detection
- Airflow control: Smart filter replacement alarm (e.g. in home appliances); predictive maintenance
- Health care: fall detection; respiratory devices; smart inhalers

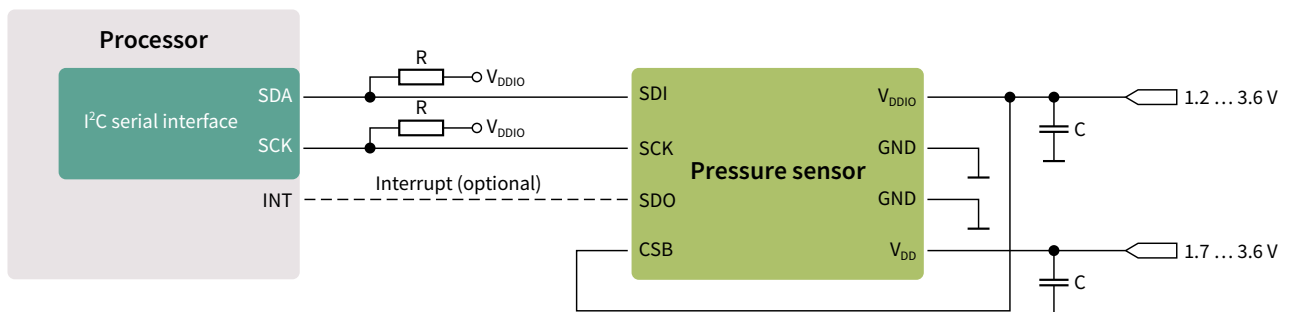
| Key product features                             |   |  |
|--|--|---|
| Package size                                     | 2.0 x 2.5 x 1.0 mm <sup>3</sup>  | 2.0 x 2.5 x 1.1 mm <sup>3</sup>   |
| Operating pressure range                         | 300 ... 1200 hPa   |   |
| Operating temperature range                      | -40 ... 85°C   |   |
| Pressure level precision                         | $\pm 0.002$ hPa (or $\pm 0.02$ m)  |   |
| Relative accuracy                                | $\pm 0.06$ hPa (or $\pm 0.5$ m)  |   |
| Absolute accuracy                                | $\pm 1$ hPa (or $\pm 8$ m)   |   |
| Temperature accuracy                             | 0.5°C  |   |
| Pressure temperature sensitivity                 | 0.5 Pa/K   |   |
| Measurement time                                 | 3.6 ms (low precision); 27.6 ms (standard mode)                                      |   |
| Average current consumption @ 1 Hz sampling rate | 1.7 $\mu$ A pressure measurement, 1.5 $\mu$ A temp. measurement, standby 0.5 $\mu$ A |   |
| Supply voltage                                   | V <sub>DDIO</sub> : 1.2 – 3.6 V; V <sub>DD</sub> : 1.7 – 3.6 V                       |   |
| Operating modes                                  | Command (manual), background (automatic), standby                                    |   |
| Interface  | I <sup>2</sup> C and SPI, both with optional interrupt                               |   |



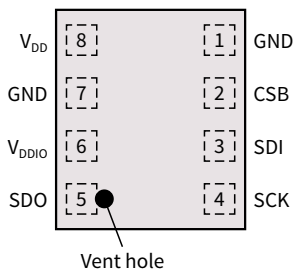
### Functional block diagram



### Application circuit example (in I²C configuration)



### Pin configuration (top view)



| Pin | Name              | Function                 |
|-----|-------------------|--------------------------|
| 1   | GND               | Ground                   |
| 2   | CSB               | Chip select              |
| 3   | SDI               | Serial data in/out       |
| 4   | SCK               | Serial clock             |
| 5   | SDO               | Serial data out          |
| 6   | V <sub>DDIO</sub> | Digital interface supply |
| 7   | GND               | Ground                   |
| 8   | V <sub>DD</sub>   | Analog supply            |

## Infineon inside pressure sensor partners

Building upon its best-in-class technology, Infineon offers a full range of barometric pressure sensors as chipsets. Infineon's network of global partners offers customers a comprehensive portfolio of Infineon inside pressure sensors that will propel performance to the next level even for the most demanding applications.

Visit [www.infineon.com/pressure-sensor-partners](http://www.infineon.com/pressure-sensor-partners) to learn more and purchase our partner solutions.

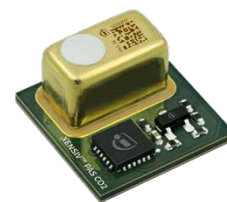


[www.infineon.com/pressure-sensors-iot](http://www.infineon.com/pressure-sensors-iot)

# XENSIV™ PAS CO<sub>2</sub>

## High performance, small size and compliance with air quality standards - Introducing a disruptive CO<sub>2</sub> sensor based on photoacoustic spectroscopy (PAS)

Infineon's XENSIV™ PAS CO<sub>2</sub> breaks the boundaries of CO<sub>2</sub> sensing with its exceptionally small form factor, state-of-the-art accuracy and compliance with the requirements of the international green building certification systems WELL and LEED.



### Measure what matters with our XENSIV™ PAS CO<sub>2</sub> sensor

CO<sub>2</sub> measurement contributes to improvements in health, comfort and productivity as well as energy efficiency. Even at moderate levels, CO<sub>2</sub> can have a negative impact on health and productivity, causing drowsiness and headaches. Fortunately, smart indoor air quality sensors can “smell” rising levels of CO<sub>2</sub> and either alert the user or trigger a system response. Given the correlation between CO<sub>2</sub> and aerosol concentration, CO<sub>2</sub> sensors can contribute to mitigating the transmission of not only COVID-19 but also other airborne illnesses such as the common cold and influenza. Moreover, as part of the global effort to pursue decarbonization, methods for improving the energy efficiency of buildings are being widely adopted. Continuous and accurate measurement of CO<sub>2</sub> concentrations are key to ensure compliance with the highest air quality standards such as WELL, LEED and ASHRAE and to enable significant reductions in energy demand and utility costs through Demand Control Ventilation (DCV).

### Accurate, real-time CO<sub>2</sub> measurement thanks to superior MEMS technology

Widespread adoption of real CO<sub>2</sub> sensors has so far been hampered by size, performance and cost constraints. Infineon's XENSIV™ PAS CO<sub>2</sub> sensor leverages photoacoustic spectroscopy (PAS) technology to provide an exceptionally small, real CO<sub>2</sub> sensor that is both highly accurate and cost-effective. Infineon's leading position in MEMS technology is the foundation for this unique and accurate CO<sub>2</sub> detection approach. Reliable CO<sub>2</sub> measurement enables smart monitoring of indoor air quality, facilitating improvements in health, productivity and overall well-being. These features make the XENSIV™ PAS CO<sub>2</sub> sensor ideal for demand-controlled ventilation and air conditioning applications (HVAC) as well as for integration into consumer IoT devices such as air purifiers, thermostats, baby monitoring devices, wake-up alarms and smart speakers.

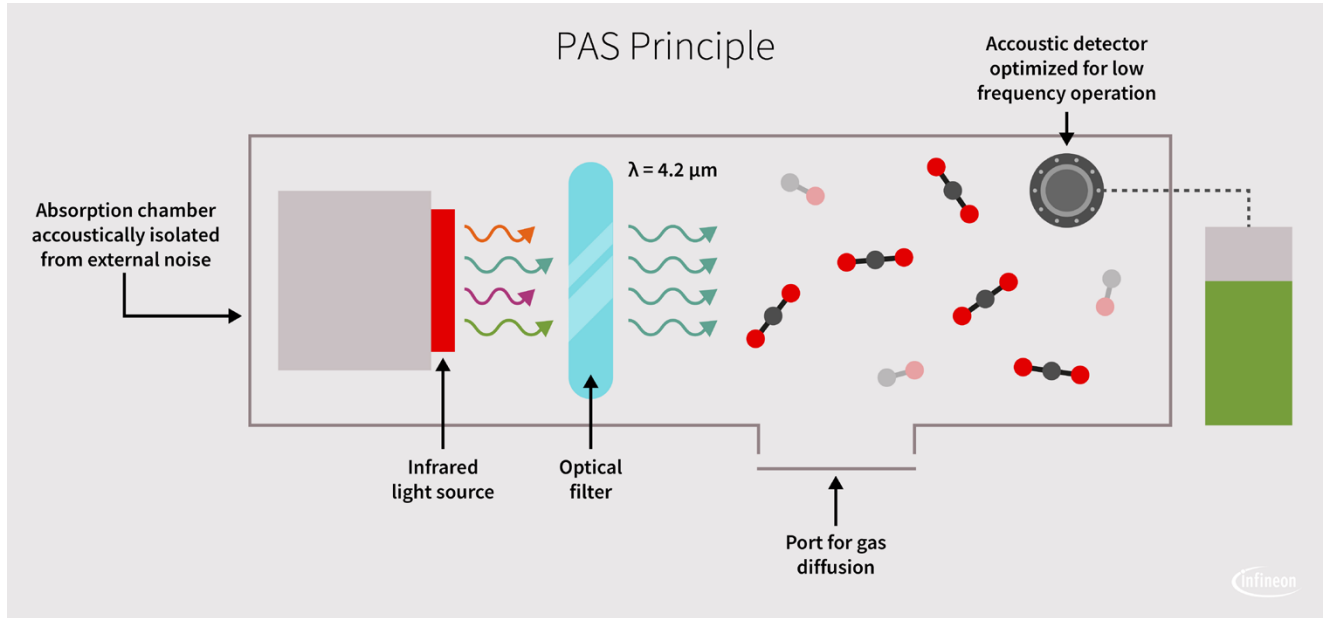
### Disruptive environmental sensor technology from Infineon

XENSIV™ PAS CO<sub>2</sub> integrates on the PCB a photoacoustic transducer, including an acoustic detector, infrared source and optical filter; a microcontroller for signal processing and a MOSFET chip to drive the infrared source. The exceptional sensitivity of the acoustic detector coupled with the integrated PCB design reduce space requirements by more than 75 percent compared to nowadays state-of-the-art NDIR CO<sub>2</sub> sensors.

[www.infineon.com/CO2](http://www.infineon.com/CO2)

### The PAS (photoacoustic spectroscopy) principle

The sensor is characterized by a disruptive measurement principle called PAS (photoacoustic spectroscopy). It works as follows: pulses of infrared light pass through an optical filter tuned to the CO<sub>2</sub> absorption wavelength. The CO<sub>2</sub> molecules absorb the filtered light, causing them to shake and generate a pressure wave with each pulse. This is called the photoacoustic effect. The sound is then detected by an acoustic detector optimized for low frequency operation and converted to a CO<sub>2</sub> concentration reading by the microcontroller.



### Features and benefits

| Key features  |
|---|
| – Exceptionally small form factor (14 x 13.8 x 7.5 mm <sup>3</sup> )  |
| – High accuracy (±30 ppm ±3% of reading)  |
| – SMD package delivered in tape and reel  |
| – Advanced compensation and self-calibration algorithms   |
| – Various configuration options (e.g. sampling rate, baseline calibration) and interfaces (UART, I <sup>2</sup> C, PWM) |

| Key benefits   |
|--|
| – Space savings in customers' end products   |
| – High quality data, energy and cost savings, compliance with green building standards |
| – Cost-effective high-volume assembly and easy system integration                      |
| – Plug & play for fast design-to-market  |
| – Customer flexibility   |

### Applications

- HVAC (Heating, Ventilation and Air Conditioning) systems
- Smart home appliances such as thermostats, air conditioners and air purifiers
- Consumer devices for air quality monitoring such as smart speakers, personal assistants and CO<sub>2</sub> traffic lights
- Smart indoor lighting and conference systems

[www.infineon.com/CO2](http://www.infineon.com/CO2)



For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).

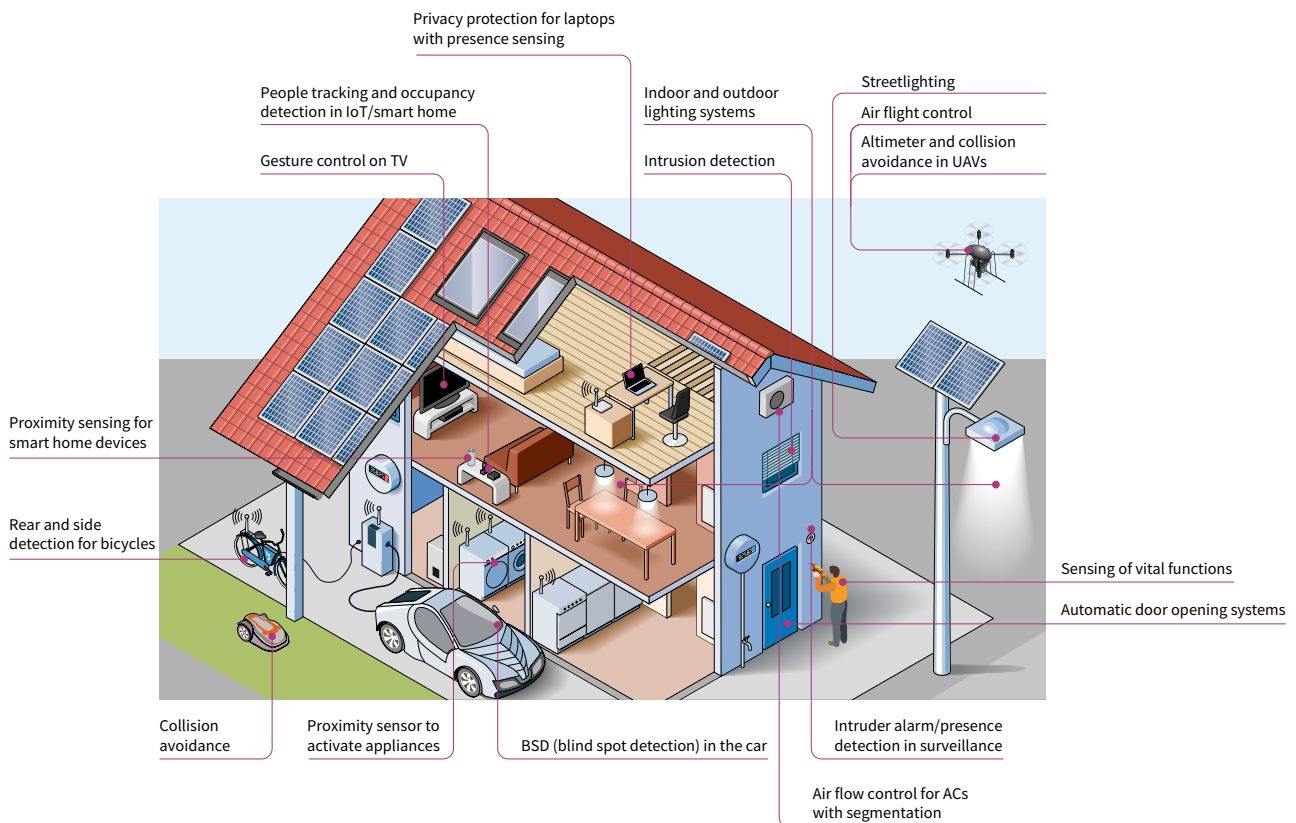
# XENSIV™ radar sensors for consumer and IoT applications

As market leader in radar chips, we offer a wide portfolio of mmWave radar sensors as part of our XENSIV™ sensor family – including Doppler radar as well as FMCW radar systems. This portfolio includes the smallest 24 GHz MMIC in the market as well as the most integrated and largest 24 GHz radar transceiver family currently available. These radar chips are designed to support different industrial, smart home, and consumer applications. In addition, we also offer radar sensors in the 60 GHz range, which are used in consumer products such as the Google Pixel 4 smartphone.

## Motion detection with radar offers significant advantages over PIR and other motion-sensing technologies

With our 24 and 60 GHz radar sensors, we cover a wide range of applications. Many of them are based on motion detection triggering systems like lighting solutions, automatic doors, camera and security systems, or smart home devices. In contrast to other motion detection technologies like PIR, radar technology offers significant advantages. These include smaller system sizes, greater accuracy, and more precise measurements of detected objects. In addition, radar can also determine the direction of a moving object, speed of an object, distance, and depending on the antenna configuration, even the position of a moving object.

## Applications for Infineon’s radar sensors



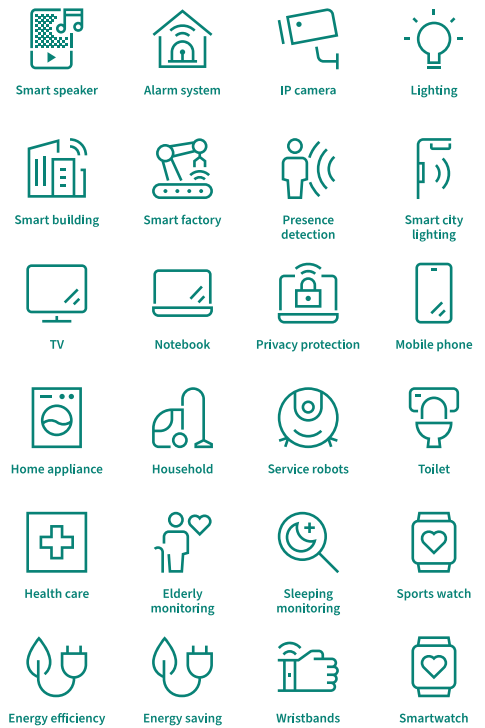
### Key benefits of radar sensing

- Direction, proximity, and speed detection
- Segmentation and tracking functionalities
- Target positioning
- Detection through non-conductive materials
  - Product design flexibility
  - Anonymous sensing
- Maintains operation through harsh environmental conditions such as rain, snow, fog, dust, etc.
- Sensitive enough to capture breathing and heartbeat
  - Radar can feel presence & vital functions
- Radar performance parameters can be adjusted
  - Adaptable to different application requirements

### New application or simple PIR replacement? Radar has it covered.

Radar, used in motion detection applications, increases accuracy when compared to passive infrared (PIR) technology, allowing more precise measurement of object detection, and providing new capabilities such as the detection of speed and the direction of moving objects. Radar is also superior to camera-based systems by allowing detection of the objects while keeping identities anonymous.

### Applications



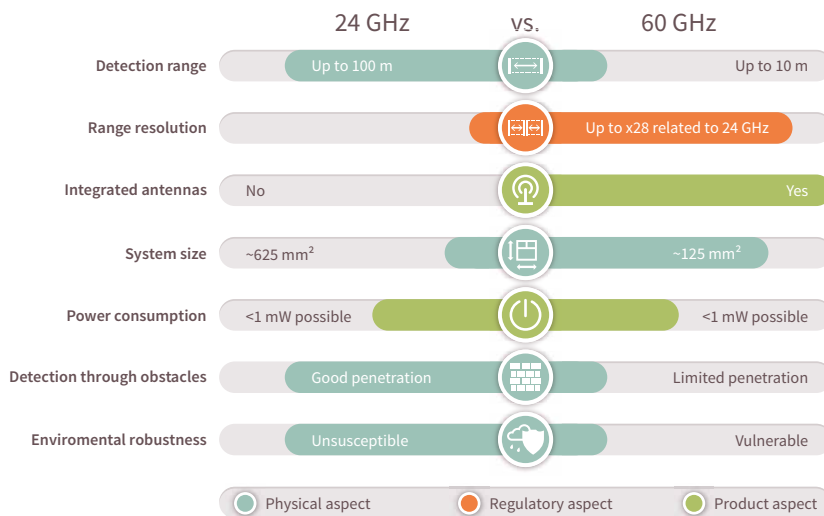
### Example applications that can benefit from radar technology

|   |   |  |   |   |
|---|---|--|---|---|
| <p><b>Smart home</b></p> <p>Robust, discreet, small</p>                         | <p><b>Door opening</b></p> <p>Direction of travel to remove false opening</p>         | <p><b>Security</b></p> <p>Privacy protection, and increased accuracy</p> | <p><b>Lighting</b></p> <p>Indoor and outdoor<br/>Resistant to harsh weather</p> | <p><b>Monitors and laptops</b></p> <p>Small, hidden, sensitive</p>        |
| <p><b>Home appliances</b></p> <p>Activate displays based on presence around</p> | <p><b>Air conditioners</b></p> <p>Track people to move the airflow away from them</p> | <p><b>Smart speaker</b></p> <p>Eliminate keyword based activation</p>    | <p><b>TV</b></p> <p>Safe energy &amp; OLED lifetime by turning off</p>          | <p><b>Gaming and VR</b></p> <p>Enhance gaming experience</p>              |
| <p><b>Gesture control</b></p> <p>Additional gesture package available</p>       | <p><b>Material detection</b></p> <p>Object recognition and classification</p>         | <p><b>Service robots</b></p> <p>Robust, small footprint, accurate</p>    | <p><b>Robotics</b></p> <p>Safety, accuracy and efficiency</p>                   | <p><b>Vital sensing</b></p> <p>Breathing &amp; heart rate measurement</p> |

## When to use 24 GHz or 60 GHz radar technology

In the 24 GHz range, the bandwidth for FMCW radar operations covers 250 MHz within the regulated ISM band. In the 60 GHz regime, an unlicensed ultra-wideband of up to 7 GHz can be used for short-range applications. Consequently, 60 GHz FMCW radar systems can offer a better resolution and therefore allow additional use cases such as human tracking and segmentation. Even gesture control, material classification, or the monitoring of various vital functions (respiration, heartbeat, or even blood pressure) is possible with radar technology due to micromotion detection.

### XENSIV™ radar sensors for industrial and consumer applications



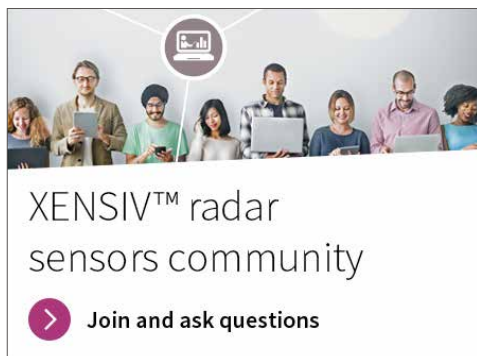
## Partners

Click this link to view our network of partners who provide modules and design support for all 24 GHz industrial applications:



## Have questions?

Visit our Community to inquire, share, and connect:



[www.infineon.com/radar-for-iot](http://www.infineon.com/radar-for-iot)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).





# XENSIV™ 60 GHz radar sensor ICs

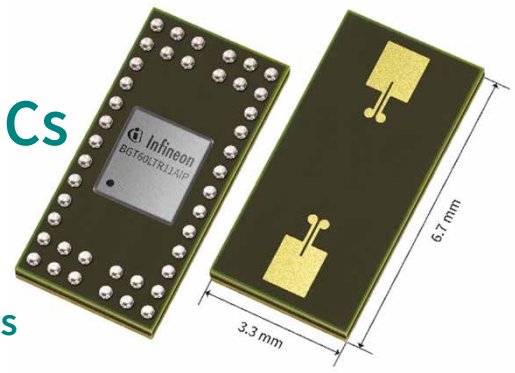
Infineon's innovative XENSIV™ 60 GHz radar chip enables things to see and revolutionizes the human-machine interface.

## BGT60LTR11AIP for consumer and IoT applications

The BGT60LTR11AIP is a fully integrated microwave motion sensor including Antennas in Package (AIP) as well as built-in detectors for motion and direction of motion. A state machine enables operation of the device without any external microcontroller. In this autonomous mode, it detects a human target up to 7 m with a low power consumption of less than 2 mW. The BGT60LTR11AIP enables radar technology for everyone, since it does not require know-how in RF, antenna design, or radar signal processing. These features make the small-sized radar solution a compelling smart and cost-effective replacement for conventional PIR sensors in low power or battery-powered applications. Also, with its small form factor, Infineon's highly integrated radar sensor solutions bring innovative, intuitive sensing capabilities to many applications.

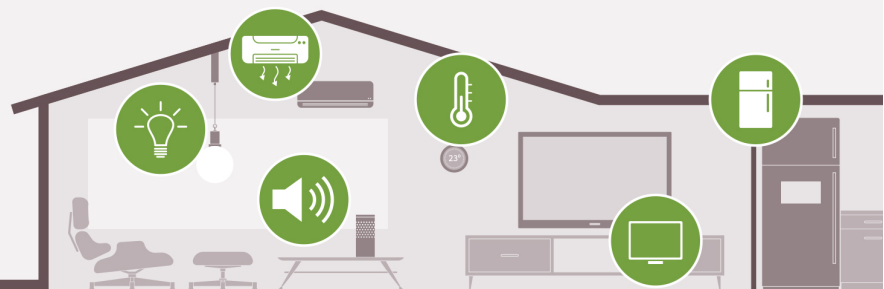
Radar has been demonstrated to be a powerful sensor for short-range motion detection. Through reliable presence and absence detection, smart devices equipped with radar sensors become more energy efficient and therefore smart and more sustainable. Users can also benefit from vacancy detection in applications such as televisions. For example BGT60LTR11AIP has been implemented in Samsung's Frame TV 2021, which puts the TV from art mode into sleep mode when there is no person nearby for a user-specified time. This function not only saves energy, but also displays lifetime. BGT60LTR11AIP has a high sensitivity and can detect if a person is present and if the device needs to be ready – similar to a screensaver that deactivates the PC monitor after a certain time without mouse or keyboard input and reactivates it as soon as new input is noticed.

Through this reliable presence and absence detection, Infineon's 60 GHz radar powers the design of truly smart, energy-saving devices. Find out more at: [www.infineon.com/green-energy](http://www.infineon.com/green-energy)

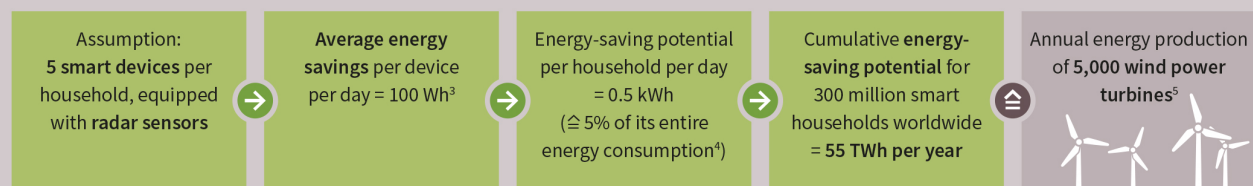


## Radar sensor for smart devices – huge energy-saving potential

By using highly sensitive Infineon radar sensors<sup>1</sup>, smart devices are able to detect the presence and absence of people. Thus, radar-supported smart devices can automatically switch between on mode and energy-saving deep sleep mode.



300 million smart home households worldwide in 2022<sup>2</sup>



1 Infineon XENSIV™ 60 GHz radar sensor, [www.infineon.com/60GHz](http://www.infineon.com/60GHz)

2 Source: Statista

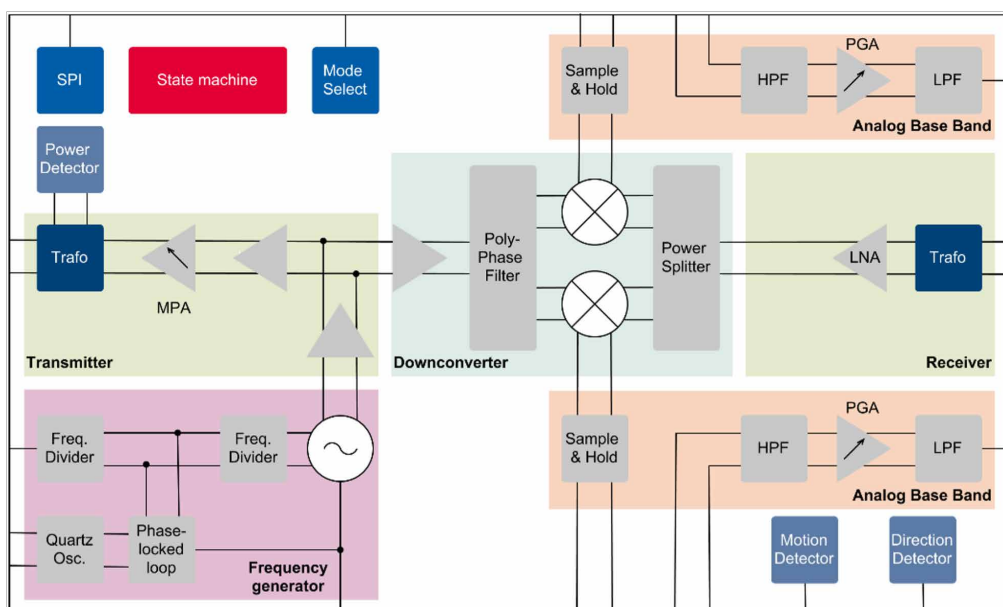
3 Average out of a wide saving range. From a single watt (e.g. putting a device from stand-by to a deeper sleeping mode) to 100 watts and more (e.g. turning off a TV while nobody is in the room)

4 Assumption: 3-person household with 3,500 kWh energy consumption per year

5 Assumption: Average energy production of a wind turbine = 10 GWh



## Block diagram of the BGT60LTR11AIP



## Key features

- 3.3 x 6.7 x 0.56 mm<sup>3</sup> package size
- 1Tx 1Rx Antennas in Package (AIP) with 80 ° field of view
- Built-in motion detector
- Built-in direction of motion detector
- Multiple modes of operation including a completely autonomous mode
- Adjustable performance parameters: detection sensitivity, hold time and frequency of operation
- FR4 material for PCB design is sufficient

## Target application

- Smart building and smart home
- Home appliances
- Smart home security
- Room air conditioners
- Automated door openers
- Smart entrance counter solution
- Displays such as TVs, monitors, laptops or tablets
- Lighting systems and lighting control

## Key benefits

- Autonomous mode:
  - Up to 7 m detection range
  - Less than 2 mW power consumption
  - Requires minimal external circuitry incl. crystal, LDO and some resistors capacitors

## Adding a M0 MCU extends flexibility

- Up to 14 m detection range (SPI mode)
- Less than 2 mW power consumption possible



## Product portfolio

| Product                               | SP          | OPN                      | Package        | Description   | Status    |
|---------------------------------------|-------------|--------------------------|----------------|---|-----------|
| <a href="#">BGT60LTR11AIP</a>         | SP005537624 | BGT60LTR11AIP6327XUMA2   | PG-UF2BGA-42-1 | Chip samples  | Available |
| <a href="#">DEMO BGT60LTR11AIP</a>    | SP005422969 | DEMOBGT60LTR11AIPTOBO1   |                | Demonstration Kit (Shield + 60 GHz baseboard)   | Available |
| <a href="#">SHIELD_BGT60LTR11AIP</a>  | SP005422968 | SHIELDBGT60LTR11AIPTOBO1 |                | Shield fitting on 60 GHz baseboard  | Available |
| <a href="#">SHIELD_AUTONOM_BGT60</a>  | SP005630363 | SHIELDAUTONOMBGT60TOBO1  |                | Shield for autonomous operation of <a href="#">BGT60LTR11AIP</a> ; directly fits on Arduino MKR board | Available |
| <a href="#">REF_60LTR11_AUTO</a>      | SP005636053 | REFBGT60LTR11AIPTOBO1    |                | Reference design (autonomous mode)  | Upcoming  |
| <a href="#">S2GO RADAR BGT60LTR11</a> | SP005594890 | S2GORADARBGT60LTR11TOBO1 |                | Shield2Go version   | Upcoming  |
| <a href="#">REF_BGT60LTR11AIP_M0</a>  | SP005894766 | REFBGT60LTR11AIPM0TOBO1  |                | Reference design (with M0 MCU)  | Upcoming  |

## DEMO BGT60LTR11AIP

### For evaluation of the completely autonomous 60 GHz radar sensor MMIC for motion sensing

This demo features Infineon's first completely autonomous radar sensor – the [BGT60LTR11AIP](#). The 60 GHz radar MMIC is a fully integrated microwave motion sensor including Antennas in Package (AIP) as well as integrated detectors for motion and direction of motion. A state machine enables operation of the device without any external microcontroller. In this autonomous mode, it detects a human target up to 7 m with a low-power consumption of less than 2 mW. These features make the small-sized radar solution a compelling, smart and cost-effective replacement for conventional PIR sensors in low-power or battery-powered applications.

For evaluation of the [BGT60LTR11AIP](#) MMIC, this demo includes the [BGT60LTR11AIP](#) shield as well as the Infineon Radar Baseboard MCU7.

The [BGT60LTR11AIP](#) shield can be attached to an Arduino MKR board or the included Infineon Radar Baseboard MCU7. Infineon's Toolbox supports this platform with a demonstration software and a Radar GUI to display and analyze acquired data in time and frequency domain. It further enables to change various performance parameters of the [BGT60LTR11AIP](#) in order to evaluate this radar sensor.



## BGT60TR13C – XENSIV™ 60 GHz radar sensor for advance sensing

### Enablement of horizontal and vertical angular measurement

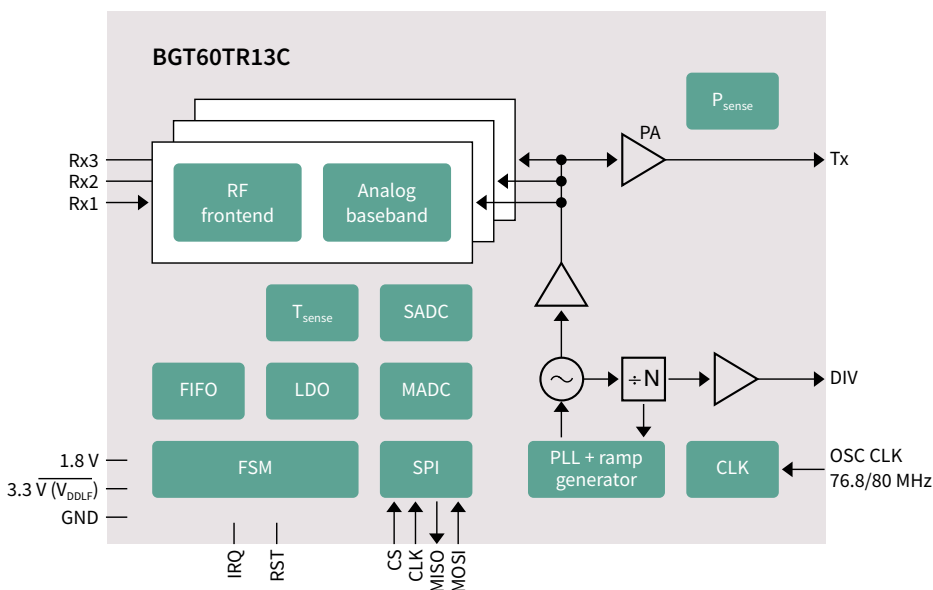
The BGT60TR13C MMIC is a 60 GHz radar sensor with integrated antennas and comes with one transmitting and three receiving antennas. Thanks to the Antennas in Package (AIP) concept, the antenna design complexity at the user end can be eliminated and the PCB designed with standard FR4 materials.

### BGT60TR13C offers innovative and intuitive sensing capabilities

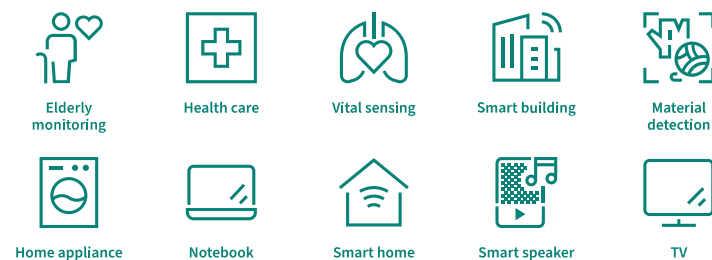
With its small form factor and low power consumption, BGT60TR13C MMIC brings innovative, intuitive sensing capabilities to many applications. Based on the developed algorithm the MMIC can serve established as well as new applications and use cases without intruding on privacy. Thanks to its feature-set, the MMIC can measure velocity, angle, horizontal as well as vertical.

BGT60TR13C has been demonstrated to be a powerful sensor for:

- Presence detection/segmentation/tracking: BGT60TR13C enables human presence detection, tracking, and segmentation while providing extremely high accuracy in detecting micro and macro motions
- Gesture Sensing: BGT60TR13C ensures detection of submillimeter motions
- Vital sensing: BGT60TR13C is able to track vital signs in consumer electronics, healthcare as well as industrial applications



### Target applications



[www.infineon.com/BGT60TR13C](http://www.infineon.com/BGT60TR13C)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Features and benefits

| Key features   | Key benefits  |
|--|---|
| <ul style="list-style-type: none"> <li>– Integrated Finite-State-Machine (FSM)</li> </ul>                    | <ul style="list-style-type: none"> <li>– FSM for flexible configuration of the radar sensor to manage modulation and power modes</li> </ul>   |
| <ul style="list-style-type: none"> <li>– Ramp up speed of 400 MHz/<math>\mu</math>s</li> </ul>               | <ul style="list-style-type: none"> <li>– Achievement of higher doppler velocity</li> </ul>  |
| <ul style="list-style-type: none"> <li>– High Signal-To-Noise Ratio (SNR)</li> </ul>                         | <ul style="list-style-type: none"> <li>– Detection of people up to 15 m (front facing)</li> </ul>   |
| <ul style="list-style-type: none"> <li>– High bandwidth &gt;5 GHz</li> </ul>                                 | <ul style="list-style-type: none"> <li>– Very good range resolution of down to ~3 cm</li> </ul>   |
| <ul style="list-style-type: none"> <li>– High sensitivity</li> </ul>   | <ul style="list-style-type: none"> <li>– Detection of sub-millimeter movements</li> </ul>   |
| <ul style="list-style-type: none"> <li>– Package: 6.5 x 5.0 x 0.9 mm<sup>3</sup></li> </ul>                  | <ul style="list-style-type: none"> <li>– Thanks to the small package size, PCB area can be saved and the design-in process simplified</li> </ul>  |
| <ul style="list-style-type: none"> <li>– &lt;5 mW (duty cycling according to released FCC waiver)</li> </ul> | <ul style="list-style-type: none"> <li>– Lowest power consumption, thanks to optimized power modes during sensor operation. Further reduction of average power consumption ensured via DC duty cycling</li> </ul> |

## Product portfolio

| Product         | SP No.      | OPN No.              |
|-----------------|-------------|----------------------|
| DEMO BGT60TR13C | SP005728718 | DEMOBGT60TR13CTOBO1  |
| BGT60TR13C      | SP002262606 | BGT60TR13CE6327XUMA1 |

## DEMO BGT60TR13C

### Getting started with the XENSIV™ 60 GHz demo board for advanced sensing

#### BGT60TR13C offers innovative and intuitive sensing capabilities

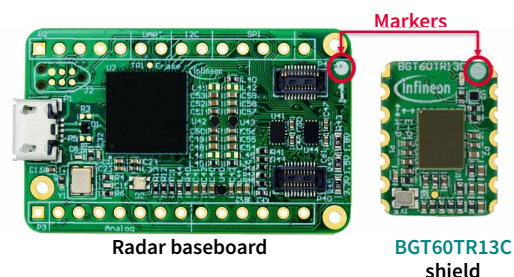
This demo board features Infineon's XENSIV™ 60 GHz radar sensor BGT60TR13C and consists of a radar baseboard as well as a BGT60TR13C shield.

The radar baseboard is a 40.64 x 25.4 mm<sup>2</sup> printed circuit board (PCB). Its main purpose is to provide a generic sensor interface for BGT60TR13C MMIC. The central microcontroller unit (MCU) can perform radar data processing or forward the sensor data to a USB interface or an Arduino MKR interface.

The BGT60TR13C shield presents a minimized form factor of 17 x 12.7 mm<sup>2</sup> and comes with an integrated BGT60TR13C Antenna-in-Package (AIP) radar chip of 6.5 x 5.0 x 0.85 mm<sup>3</sup>. Moreover, the shield contains a digital interface for configuration and transfer of the acquired radar data to a microcontroller board. The shield is optimized for fast prototyping designs and system integrations as well as initial product feature evaluations. In addition, it offers developers the flexibility to choose their own platform depending on their preferred use cases.

#### Several benefits come along with the BGT60TR13C demoboard:

- Flexible platform selection
- Variable connector options, and option to solder onto other PCBs
- Highly flexible configuration on FMCW modulation
- Power consumption can be optimized according to use case



[www.infineon.com/BGT60TR13C](http://www.infineon.com/BGT60TR13C)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



# Automotive radar 60 GHz

## XENSIV™ 60 GHz radar sensor for automotive enables highly reliable in-cabin monitoring systems

XENSIV™ BGT60ATR24C, an automotive 60 GHz radar sensor, enables ultra-wide bandwidth FMCW operation in a small package. Sensor configuration and data acquisition are enabled with a digital interface and the integrated state machine enables independent data acquisition with power mode optimization for lowest power consumption.

### Summary of features

- 60 GHz radar sensor for FMCW operation
- 4 GHz bandwidth
- 2Tx/4Rx channels
- Digital interface for chip configuration and radar data acquisition
- Optimized power modes for low-power operation
- Integrated state machine for independent operation
- AEC-Q100/101 qualified

### Benefits

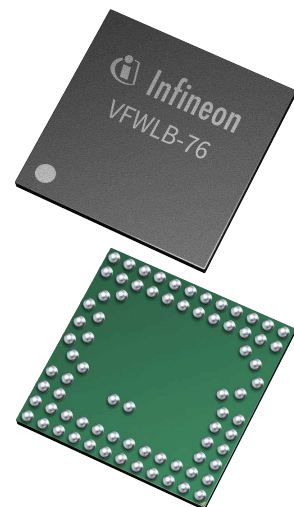
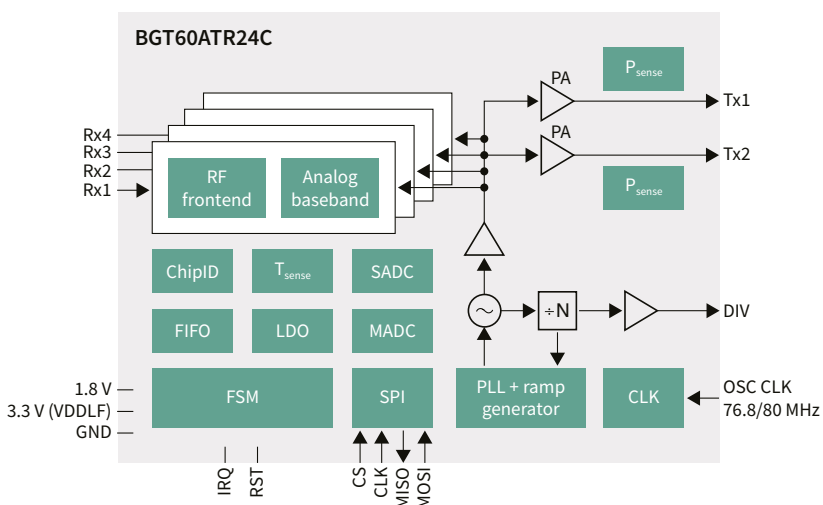
- Low power consumption
- Accurate and robust performance
- Excellent thermal management
- Size and space optimized solution

### Potential applications

- Radar frontend for gesture sensing
- High resolution FMCW radars
- Short range sensing operations
- Hidden sensing applications behind radome

### 60 GHz – Product overview

| Product             | Frequency [GHz] | SP number   | Packages   |
|---------------------|-----------------|-------------|------------|
| BGT60ATR24C         | 58 – 62         | SP005350514 | VFWLB-76-1 |
| SHIELD_60ATR24ES_01 | 58 – 62         | SP005448216 | VFWLB-76-1 |



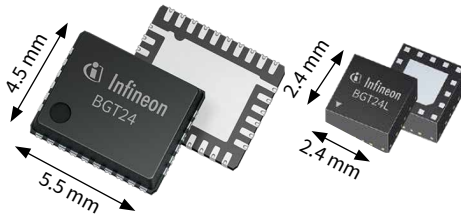
# XENSIV™ 24 GHz radar sensor ICs

## Infineon BGT24M/L family of MMIC chips

Infineon's range of 24 GHz industrial radar chips provides five configurations of transmit and receiver channels, ensuring that there is a chip to support your specific application. From basic applications such as motion detection in security systems, which only requires one transmit and one receive channel, to more complex applications like 3D positioning, which requires two or more receive channels, our range of radar chips supports all of your requirements.

| Features | Infineon MMIC | Benefits |
|----------|---------------|----------|
|----------|---------------|----------|

- 24 GHz ISM band operation for motion, speed, direction movement and distance measurements
- Five 24 GHz chips available
- Highly integrated MMICs

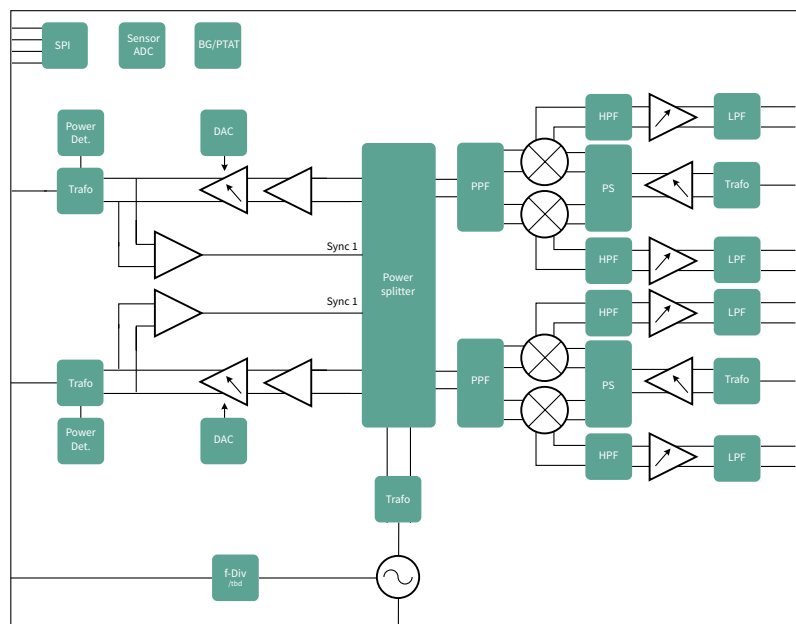


- Long-range distance detection of moving objects up to 50 m
- Wide range speed detection up to ±100 km/h
- Low BOM costs

| Product       | Configuration | Features   |
|---------------|---------------|--|
| BGT24MTR11    | 1Tx + 1Rx     | <ul style="list-style-type: none"> <li>– Measures, not just motion, but also speed, direction, and distance</li> <li>– Small form factor</li> <li>– Resistance to moisture, dirt, and temperature</li> <li>– Increased area coverage</li> <li>– Discrete design</li> <li>– Low power MMICs for energy saving</li> <li>– Privacy protection</li> <li>– Adaptable to different application requirements</li> <li>– Highly integrated chips eliminating costly external components</li> </ul> |
| BGT24MR2      | 2Rx           |  |
| BGT24MTR12    | 1Tx + 2Rx     |  |
| BGT24LTR11N16 | 1Tx + 1Rx     |  |
| BGT24LTR22    | 2Tx + 2Rx     |  |

### The BGT24LTR22 key features

- 24 GHz transceiver MMIC
- Fully integrated low phase noise VCO
- Integrated analog base band stage with programmable gain and filter settings
- Bi-directional pin for synchronization
- Built in temperature compensation circuit for VCO stabilization, no PLL needed
- Low power consumption
- Fully ESD protected device
- Single ended RF and IF terminals
- Single supply voltage 1.5 V

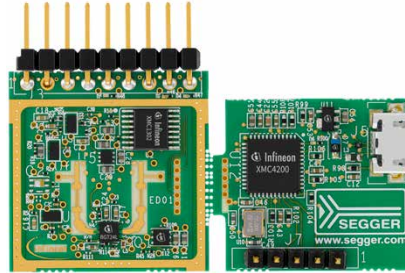


## 24 GHz evaluation and demonstration boards

In addition to the BGT24M/L family of MMIC chips, Infineon provides a continuously expanding range of evaluation and demonstration boards to support the testing and development of radar in multiple applications of our customers. All boards are provided with base-level software to support the ease of use and faster time-to-market integration.

| Features | Infineon development kit | Benefits |
|----------|--------------------------|----------|
|----------|--------------------------|----------|

- Four system boards available
- All include 24 GHz radar chip and XMC™ microcontroller
- Kit contains user manual, GUI, MATLAB compiler and Gerber files
- Software available via Infineon Toolbox



Demonstrator with SW support

- Capability to detect motion, speed and direction of movement (approaching or retreating) distance and angle of arrival based on hardware
- Fast prototyping with available software

| Sense2GoL Pulse (BGT24LTR11 + )   | Distance2GoL (BGT24LTR11 + )  |
|---|---|
| <ul style="list-style-type: none"> <li>– Capability to detect motion, speed, and direction of movement (approaching or retreating)</li> <li>– Detection range of 18 m for a human target at a power consumption &lt; 5 mW</li> <li>– High sensitivity of detection in comparison to PIR</li> <li>– Arduino compatible microcontroller board (Arduino standard connectors)</li> <li>– Modulation parameters can be changed to suit the application requirements</li> <li>– Multiple current sensors for current consumption monitoring and optimization</li> <li>– Integrated multiple-element patch antennas</li> </ul> | <ul style="list-style-type: none"> <li>– Capability to detect the distance of the closest human target</li> <li>– Capability to detect motion, speed, and direction of movement (approaching or retreating)</li> <li>– Very low power consumption due to duty cycling options</li> <li>– Operates in harsh environments and detects through non-metallic materials</li> <li>– BGT24LTR11 – 24 GHz highly integrated RF MMIC</li> <li>– XMC4700 Arm® Cortex®-M4 –32-bit industrial microcontroller</li> <li>– Debug over Cortex 10 pin debug connector</li> <li>– Microstrip patch antennas with</li> <li>– 10 dBi gain and 29°/80° field of view</li> </ul> |
| <ul style="list-style-type: none"> <li>– Main applications</li> <li>– Security</li> <li>– Indoor and outdoor lighting</li> <li>– Smart home</li> <li>– Automatic door opener</li> <li>– Intelligent switches</li> <li>– Speed measurement</li> </ul>  | <ul style="list-style-type: none"> <li>– Main applications</li> <li>– Smart Home devices</li> <li>– Indoor and outdoor lighting systems</li> <li>– Unmanned aerial vehicles (UAV)</li> <li>– Security systems from commercial surveillance to low-power IP cameras</li> <li>– HVAC products like smart air conditioners</li> <li>– Smart sanitary facilities (eg Smart Toilets)</li> </ul>  |
| <ul style="list-style-type: none"> <li>– Board dimensions</li> <li>– Board 55 mm x 85 mm</li> <li>– Shield: 55 mm x 66 mm</li> </ul>  | <ul style="list-style-type: none"> <li>– Board dimensions</li> <li>– Board 55 mm x 85 mm</li> <li>– Shield: 55 mm x 66 mm</li> </ul>  |
| <ul style="list-style-type: none"> <li>– Kit contents</li> <li>– RF radar shield: SHIELD_BGT24LTR11</li> <li>– Programmed controller board: RADAR BB XMC4700</li> <li>– Micro USB cable</li> <li>– SW GUI to operate kit</li> <li>– Doppler FW and SW<sup>1)</sup></li> <li>– Schematic and bill-of-materials of module</li> </ul>  | <ul style="list-style-type: none"> <li>– Kit contents</li> <li>– RF radar shield: SHIELD_BGT24LTR11</li> <li>– Programmed controller board: RADAR BB XMC4700</li> <li>– Micro USB cable</li> <li>– SW GUI to operate kit</li> <li>– Doppler FW and SW<sup>1)</sup></li> </ul>   |

1) Usage of the FMCW and/or Doppler FW and SW requires agreeing to Infineon's user's agreement and licensing terms.





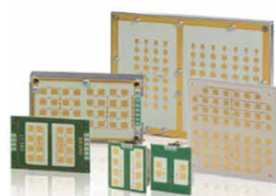
## 24 GHz modules

Partnering with the leading radar solution providers enables Infineon to connect our customers looking for turnkey solutions and design support for a complete range of applications. Utilizing our strong network of partners, the radar portfolio is extended to include a range of easy-to-integrate modules. Each of them contains Infineon's 24 GHz MMIC.

### Features

- Complete module, including radar MMIC, antenna options, MCU signal processing options, and SW options (Doppler, FSK and FMCW versions available)

### Partner modules using Infineon chips



Module (RF module; RF module + MCU including SW)

### Benefits

- Ease of design
- Turnkey solution, no need for test and certification

By integrating Infineon's 24GHz MMIC chip into the partners easy-to-use and simple-to-integrate modules the complexity and time to market for a range of applications such as smart home automation, camera & security systems, air conditioners, UAVs, robotics, and smart lighting, are reduced.



# Smallest, fully featured, budget-priced evaluation boards

## Shield2Go

### Security

**Product name:** OPTIGA™ Trust E Security Shield2Go  
**Sales name:** S2GO\_Security\_OPTIGA\_E  
**Ordering code:** SP001820138

Product information



**Product name:** OPTIGA™ Trust X Security Shield2Go  
**Sales name:** S2GO SECURITY OPTIGA X  
**Ordering code:** SP002349576

Product information



### Sensors

**Product name:** IM69D130 Microphone Shield2Go  
**Sales name:** S2GO MEMSMIC IM69D  
**Ordering code:** SP002851544

Product information



**Product name:** PASCO2V01 Shield2Go  
**Sales name:** SHIELD PASCO2 SENSOR  
**Ordering code:** SP002851544

Product information



**Product name:** S2GO Pressure Sensor DPS310  
**Sales name:** S2GO\_PRESSURE\_DPS310  
**Ordering code:** SP001777630

Product information



**Product name:** S2GO Pressure Sensor DPS368  
**Sales name:** S2GO PRESSURE DPS368  
**Ordering code:** SP005338022

Product information



**Product name:** TLE493DW2B6 3DSense Shield2Go  
**Sales name:** S2GO\_3D\_TLE493DW2B6-A0  
**Ordering code:** SP004308594

Product information



**Product name:** TLE4964-3M Hall Sense Shield2Go  
**Sales name:** S2GO\_HALL\_TLE4964-3M  
**Ordering code:** SP004308590

Product information



[www.infineon.com/sensors2go](http://www.infineon.com/sensors2go)  
[www.infineon.com/makers](http://www.infineon.com/makers)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Shield2Go

### Sensors

**Product name:** TLE4966K Double Hall Shield2Go  
**Sales name:** S2GO\_2\_HALL\_TLE4966K  
**Ordering code:** SP004308598

Product information



**Product name:** TLI4971 Current Sense Shield2Go  
**Sales name:** S2GO\_CUR-SENSE\_TLI4971  
**Ordering code:** SP005345472

Product information



**Product name:** TLI493D-W2BW 3D Sense Shield2Go in small WLB-5 package (1.13 mm x 0.93 mm x 0.59 mm)  
**Sales name:** S2GO\_3D\_TLI493DW2BW-A0  
**Ordering code:** SP005410385

Product information



**Product name:** TLV493D 3D Sense Shield2Go  
**Sales name:** S2GO\_3D-SENSE\_TLV493D  
**Ordering code:** SP001823678

Product information



### Microcontroller

**Product name:** XMC 2Go Kit  
**Sales name:** KIT\_XMC\_2GO\_XMC1100\_V1  
**Ordering code:** SP001199544

Product information



### MyIoT – Adapter

**Product name:** MyIoT Adapter  
**Sales name:** MYIOTADAPTERTOBO1  
**Ordering code:** SP002434972

Product information



[www.infineon.com/sensors2go](http://www.infineon.com/sensors2go)  
[www.infineon.com/makers](http://www.infineon.com/makers)

For more details on the product, click on the part number, visit [infineon.com](http://infineon.com) or contact our [product support](#).



## Sensor 2GO kits

### Automotive pressure sensor 2GO kit

**Product name:** KP215F1701-PS2GO-KIT/  
 KP229E3518-PS2GO-KIT/  
 KP236-PS2GO-KIT/KP254-PS2GO-KIT/  
 KP275-PS2GO-KIT  
**Ordering code:** SP002676652/SP002676656/  
 SP002676664/SP002676664/  
 SP002676648

Product information



### TLI4971 current sensor 2GO kit

**Product name:** TLI4971\_MS2GO  
**Ordering code:** SP005345474

Product information



### Angle sensor 2GO kit

**Product name:** TLE5012B\_E1000\_MS2GO/  
 TLI5012B\_E1000\_MS2GO/  
 TLE5012B\_E5000\_MS2GO/  
 TLE5012B\_E9000\_MS2GO  
**Ordering code:** SP002133956/  
 SP002133960/  
 SP002133964/  
 SP002133968

Product information



### XENSIV™ – TLE4966 Hall switches 2GO kit

**Product name:** TLE4966 MS2GO  
**Ordering code:** SP005406992

Product information



### 3D magnetic sensor 2GO kit

**Product name:** TLE493D-A2B6 MS2GO/  
 TLE493D-W2B6 MS2GO/  
 TLV493D-A1B6 MS2GO  
**Ordering code:** SP001707582/SP001707578/  
 SP001707574

Product information



### Speed sensor 2GO kit

**Product name:** TLE4922 MS2GO  
**Ordering code:** SP003029974

Product information



### Microphone flex evaluation kits

**Product name:** EVAL\_IM69D130\_FLEXKIT/  
 EVAL\_IM69D120\_FLEXKIT/  
 EVAL\_IM69D127\_FLEXKIT/  
 EVAL\_IM73D135\_FLEXKIT/  
 EVAL\_IM72D128\_FLEXKIT/  
 EVAL\_IM70A135\_FLEXKIT/  
 EVAL\_IM67D120\_FLEXKIT/  
 EVAL\_IM67D130\_FLEXKIT  
**Ordering code:** SP002153022/SP002153026/SP005403891/  
 SP005415695/SP005429924/SP005728204/  
 SP005560671/SP005537489

Product information



# Add ons for Sensor 2GO kits and Shield2Go

Joystick for all 3D Magnetic Sensor 2GO kits and Shield2Go

Product name: JOYSTICK FOR 3D 2 GO KIT  
Ordering code: SP001491834

Product information



Linear slider for all 3D Magnetic Sensor 2GO kits and Shield2Go

Product name: LINEAR-SLIDER 2GO  
Ordering code: SP002043034

Product information



Linear control trigger for all 3D magnetic Sensor 2GO Kits and Shield2Go

Product name: POWER\_DRILL2GO  
Ordering code: SP005350194

Product information



HMI mini control with 4 directions and 360° rotation for all 3D magnetic sensor 2GO Kits and Shield2Go

Product name: MINI\_CONTROL2GO  
Ordering code: SP005350192

Product information



Play2Go for 3D magnetic sensor

Product name: PLAY2GO  
Ordering code: SP005731811

Product information



Rotate knob for all 3D Magnetic Sensor 2GO kits, Angle Sensor 2GO kits and 3D Magnetic Sensor Shield2Go

Product name: ROTATE KNOB 3D 2 GO KIT  
Ordering code: SP001504602

Product information



Out of shaft adapter for all 3D magnetic sensor 2GO kits and Shield2Go

Product name: OUT OF SHAFT FOR 3D 2 GO  
Ordering code: SP003475178

Product information



Human Machine Interface (HMI) direction indicator for all 3D magnetic sensor 2GO Kits and Shield2Go

Product name: DIR\_INDICATOR2GO  
Ordering code: SP005350196

Product information



OpenClose Adapter for Hall switch Shield2Go

Product name: OPENCLOSE2GOHSTOB01

Product information



Contactless switch array for all 3D magnetic sensor 2GO kits and Shield2Go

Product information





# Infineon support for sensors

## Useful links and helpful information

### Further information, datasheets and documents

[www.infineon.com/sensors](http://www.infineon.com/sensors)

[www.infineon.com/microphones](http://www.infineon.com/microphones)

[www.infineon.com/magnetic-sensors](http://www.infineon.com/magnetic-sensors)

[www.infineon.com/current-sensor](http://www.infineon.com/current-sensor)

[www.infineon.com/hall-switches](http://www.infineon.com/hall-switches)

[www.infineon.com/angle-sensors](http://www.infineon.com/angle-sensors)

[www.infineon.com/3dmagnetic](http://www.infineon.com/3dmagnetic)

[www.infineon.com/pressuresensor](http://www.infineon.com/pressuresensor)

[www.infineon.com/24GHz](http://www.infineon.com/24GHz)

[www.infineon.com/60GHz](http://www.infineon.com/60GHz)

[www.infineon.com/pressure](http://www.infineon.com/pressure)

[www.infineon.com/CO2](http://www.infineon.com/CO2)

### 2GO evaluation kits

[www.infineon.com/sensors2go](http://www.infineon.com/sensors2go)

### Online simulation tools

[www.infineon.com/cms/en/product/sensor/#!simulation](http://www.infineon.com/cms/en/product/sensor/#!simulation)



Info



Document



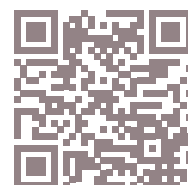
Evaluation board



Tools



Play





## Packages

- Surface mount device (SMD) technology
- Through-hole device (THD) technology

# Packages



































## Surface mount device (SMD) technology

|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
|--------------------|-------------------|-------------------------|-------------------|----------------------------------|-------------------|---------------------|-------------------------|---------------------------|--------------------|-------------------------|--------------------|
| DPAK (TO-252-2)    |                   | DPAK (TO-252)           |                   | DPAK 5-pin (TO-252)              |                   | DDPAK (TO-252)      |                         | QDPAK TSC                 |                    | QDPAK BSC               |                    |
| 2                  | 9.9 x 6.5 x 2.3   | 3                       | 9.9 x 6.5 x 2.3   | 5                                | 9.9 x 6.5 x 2.3   | 10                  | 20.96 x 6.5 x 2.3       | 22                        | 20.96 x 15.0 x 2.3 | 22                      | 0.96 x 15.0 x 2.3  |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| D2PAK (TO-263)     |                   | D2PAK (TO-263-2)        |                   | TO263-7-11                       |                   | TO263-7-12          |                         | TO263-7-13                |                    | D2PAK 7-pin (TO-263)    |                    |
| 3                  | 15.0 x 10.0 x 4.4 | 2                       | 15.0 x 10.0 x 4.4 | 7                                | 15.0 x 10.0 x 4.4 | 7                   | 15.0 x 10.0 x 4.4       | 7                         | 15.0 x 10.0 x 4.4  | 7                       | 15.0 x 10.0 x 4.4  |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| TO-Leadless (TOLL) |                   | TOLT (top-side cooling) |                   | TOLG (Gullwing leads)            |                   | sTOLL               |                         | SC59                      |                    | SOT-23                  |                    |
| 8                  | 11.7 x 9.9 x 2.3  | 16                      | 15.0 x 9.9 x 2.3  | 8                                | 11.7 x 9.9 x 2.3  | 5                   | 8.0 x 7.0 x 2.3         | 3                         | 3.0 x 2.8 x 1.1    | 3                       | 2.9 x 2.4 x 1.0    |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| SOT-23-5           |                   | SOT-23-6                |                   | SOT-89                           |                   | SOT-223             |                         | SOT223-3-1                |                    | SOT-323                 |                    |
| 5                  | 2.9 x 1.6 x 1.3   | 6                       | 2.9 x 1.6 x 1.3   | 3                                | 4.5 x 4.0 x 1.5   | 4                   | 6.5 x 7.0 x 1.6         | 3                         | 7.0 x 6.5 x 1.6    | 3                       | 2.0 x 2.1 x 0.9    |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| SOT-363            |                   | TSOP6                   |                   | PQFN 2x2                         |                   | PQFN 2x2 dual       |                         | PQFN 3.3x3.3              |                    | SuperS08                |                    |
| 6                  | 2.0 x 2.1 x 0.9   | 6                       | 2.9 x 2.5 x 1.1   | 6                                | 2.0 x 2.0 x 0.9   | 6                   | 2.0 x 2.0 x 0.9         | 8                         | 3.3 x 3.3 x 1.0    | 8                       | 5.15 x 6.15 x 1.0  |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| SuperS08 dual      |                   | SuperS08 fused leads    |                   | SuperS08 DSC (dual-side cooling) |                   | LSON-8-1            |                         | TDSON-8-47                |                    | TDSON-10-2              |                    |
| 8                  | 5.15x6.15 x 1.0   | 8                       | 5.15 x 6.15 x 1.0 | 8                                | 6.0 x 5.0 x 0.75  | 8                   | 8.0 x 8.0 x 1.35 (max.) | 8                         | 5.15 x 6.15 x 1.0  | 10                      | 3.0 x 3.0 x 0.9    |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| TDSON-10-7         |                   | TSDSON-8-25 fused leads |                   | TISON-8                          |                   | TISON-8-5/TISON-8-6 |                         | TISON-8 (power stage 5x6) |                    | TISON-8-4 (Power Block) |                    |
| 10                 | 3.0 x 3.0 x 0.9   | 8                       | 3.3 x 3.3 x 1.0   | 8                                | 7.0 x 7.0 x 1.0   | 8                   | 8.0 x 8.0 x 1.0         | 8                         | 5.0 x 6.0 x 1.0    | 8                       | 5.0 x 6.0 x 1.0    |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| TSON-8-1           |                   | TSON-8-3                |                   | ThinPAK 5x6 (TSON-8)             |                   | LLGA-5-4            |                         | TSON-10                   |                    | TDSO-16-30              |                    |
| 8                  | 3.0 x 3.0 x 1.0   | 8                       | 5.0 x 6.0 x 1.0   | 8                                | 6.15 x 5.33 x 1.0 | 5                   | 4.0 x 3.0 x 1.2         | 10                        | 3.3 x 3.3 x 1.0    | 16                      | 5.0 x 6.0 x 1.2    |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| PG-TDSON-08-31     |                   | TSNP-6-13               |                   | ThinPAK 8x8 (VSON-4)             |                   | VDSON-8             |                         | DSOF-8-16                 |                    | DSOF-8-164              |                    |
| 8                  | 4.9 x 1.15 x 3.9  | 6                       | 1.5 x 1 x 0.375   | 4                                | 8.0 x 8.0 x 1.0   | 8                   | 4.0 x 4.0 x 0.9         | 8                         | 7.0 x 7.0 x 2.8    | 8                       | 7.0 x 7.0 x 2.8    |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |
| DFN-8-1            |                   | DSOSP-14-82             |                   | WSN-6-1                          |                   | WSN-8-3             |                         | WSN-10                    |                    | WFWLB-5-2               |                    |
| 8                  | 4.5 x 4.3 x 1.55  | 14                      | 5.4 x 5.7 x 3.4   | 6                                | 3 x 3 x 0.75      | 8                   | 3 x 3 x 0.75            | 10                        | 4.0 x 4.0 x 0.8    | 5                       | 1.13 x 0.59 x 0.93 |
|                    |                   |                         |                   |                                  |                   |                     |                         |                           |                    |                         |                    |



|                 |                    |  |                    |                     |                          |                     |                       |                  |                   |                     |                    |
|-----------------|--------------------|--|--------------------|---------------------|--------------------------|---------------------|-----------------------|------------------|-------------------|---------------------|--------------------|
| HSOF-8-1 (TOLL) |                    | IQFN-27-2  |                    | IQFN-30 (DrMOS 4x4) |                          | IQFN-31 (DrMOS 5x5) |                       | IQFN-36          |                   | IQFN-39             |                    |
| 8               | 10.375 x 9.9 x 2.3 | 27   | 3.3 x 6.0 x 0.9    | 30                  | 4.0 x 4.0 x 1.0          | 31                  | 5.0 x 5.0 x 0.8       | 36               | 7.5 x 6.0 x 0.9   | 39                  | 5.0 x 6.0 x 0.9    |
|                 |                    |  |                    |                     |                          |                     |                       |                  |                   |                     |                    |
| IQFN-40         |                    | TIQFN-21-1   |                    | TIQFN-28-1          |                          | SO8/SO8 dual        |                       | SO-16/12         |                   | SO-14               |                    |
| 40              | 6.0 x 6.0 x 0.8    | 21   | 8.0 x 8.0 x 1.15   | 28                  | 8.0 x 8.0 x 1.15         | 8                   | 5.0 x 6.0 x 1.75      | 12               | 10.0 x 6.0 x 1.75 | 14                  | 8.75 x 6.0 x 1.75  |
|                 |                    |  |                    |                     |                          |                     |                       |                  |                   |                     |                    |
| SO-16           |                    | SO-18  |                    | DSO-12              |                          | DSO-14 150 mil      |                       | DSO-14 300 mil   |                   | DSO-16-30 (300 mil) |                    |
| 16              | 10.0 x 6.0 x 1.75  | 18   | 12.8 x 10.3 x 2.65 | 12                  | 10.3 x 7.8 x 2.6 (max)   | 14                  | 9.9 x 3.9 x 1.75      | 14               | 10.3 x 7.5 x 2.65 | 16                  | 10.3 x 7.5 x 2.35  |
|                 |                    |  |                    |                     |                          |                     |                       |                  |                   |                     |                    |
| DSO-20-85       |                    | DSO-20-87  |                    | DSO-24              |                          | SSOP-24             |                       | TDSO-16          |                   | SO-19               |                    |
| 20              | 15.9 x 11.0 x 3.25 | 20   | 15.9 x 11.0 x 3.25 | 24                  | 10.5 x 15.6 x 2.65 (max) | 24                  | 6 x 8.65 x 1.75 (max) | 16               | 5.0 x 6.0 x 1.2   | 19                  | 12.8 x 10.3 x 2.65 |
|                 |                    |  |                    |                     |                          |                     |                       |                  |                   |                     |                    |
| SO-20           |                    | DSO-28   |                    | SO-36               |                          | TSSOP-28            |                       | TSSOP-48         |                   | LFBGA-516-5         |                    |
| 20              | 12.8 x 10.3 x 2.65 | 28   | 18.1 x 10.3 x 2.65 | 36                  | 15.9 x 11.0 x 3.5        | 28                  | 9.7 x 6.4 x 1.2       | 48               | 12.5 x 6.1 x 1.1  | 516                 | 25.3 x 25.3 x 2.8  |
|                 |                    |  |                    |                     |                          |                     |                       |                  |                   |                     |                    |
| LFBGA-292-6     |                    | BGA-416-26   |                    | TFLGA-13-1          |                          | LQFP-176-22         |                       | LQFP-144-22      |                   | TQFP-144-27         |                    |
| 292             | 17.3 x 17.3 x 2.35 | 416  | 27.3 x 27.3 x 3.2  | 13                  | 5 x 5 x 0.96             | 176                 | 26.7 x 26.7 x 2.1     | 144              | 22.4 x 22.4 x 2.2 | 144                 | 18.7 x 18.7 x 1.6  |
|                 |                    |  |                    |                     |                          |                     |                       |                  |                   |                     |                    |
| TQFP-100-23     |                    | TQFP-80-7  |                    | VQFN-40-13          |                          | VQFN-48-60          |                       | VQFN-48-78 (LTI) |                   | VQFN-56-5/-6        |                    |
| 100             | 14.5 x 14.5 x 1.5  | 80   | 12.6 x 12.6 x 1.5  | 40                  | 5 x 5 x 0.85             | 48                  | 6 x 6 x 0.85          | 48               | 7 x 7 x 0.85      | 56                  | 7 x 7 x 0.9        |
|                 |                    |  |                    |                     |                          |                     |                       |                  |                   |                     |                    |
| VFWLB-76-1      |                    | Package (JEITA-code)   |                    |                     |                          |                     |                       |                  |                   |                     |                    |
| 4217x2315       |                    | X  | L x W x H          |                     |                          |                     |                       |                  |                   |                     |                    |
|                 |                    | <br>pin-count<br>V = Variable number of pins<br>All dimensions in mm |                    |                     |                          |                     |                       |                  |                   |                     |                    |

## Through-hole device (THD) technology

|   |                   |   |                    |   |                    |   |  |   |                    |   |                   |
|---|-------------------|---|--------------------|---|--------------------|---|--|---|--------------------|---|-------------------|
| IPAK (TO251)  |                   | IPAK SL (TO251 SL)  |                    | IPAK short lead with ISO standoff   |                    | I2PAK (TO262)   |  | TO-220 real 2-pin   |                    | TO-220 2-pin  |                   |
| 3   | 16.5x6.5 x 2.3    | 3   | 10.5x6.5 x 2.3     | 3   | 9.5x6.6 x 2.3      | 3   | 23.3 x 10 x 4.4                            | 2   | 29.15 x 10.0 x 4.4 | 2   | 29.1 x 9.9 x 4.4  |
|    |                   |    |                    |    |                    |    |  |    |                    |    |                   |
| TO-220 3-pin  |                   | TO-220 FullPAK  |                    | TO-220 FullPAK Narrow Lead  |                    | TO-220 FullPAK Wide Creepage  |  | TO-220-6-46   |                    | TO-220-6-47   |                   |
| 3   | 28.8 x 10 x 4.4   | 3   | 29.2 x 10.3 x 4.7  | 3   | 29.6 x 10.5 x 4.7  | 3   | 28.85 x 11 x 4.7                           | 6   | 21.7 x 9.9 x 4.4   | 6   | 26.1 x 9.9 x 4.4  |
|    |                   |    |                    |    |                    |    |  |    |                    |    |                   |
| TO-247  |                   | TO-247-3-AI   |                    | TO-247 4-pin  |                    | DIP-7   |  | DIP-8   |                    | DIP-14  |                   |
| 3   | 41 x 16 x 5       | 3   | 41.3 x 10.9 x 5.18 | 4   | 40.15 x 15.9 x 5.0 | 7   | 9.52 x 8.9 x 4.37                          | 8   | 9.52 x 8.9 x 4.37  | 14  | 19.5 x 8.9 x 4.37 |
|    |                   |    |                    |    |                    |    |  |    |                    |    |                   |
| DIP-20  |                   | Super220  |                    | Super247  |                    | SSO-3-9   |  | SSO-3-9   |                    | SSO-3-10  |                   |
| 20  | 24.6 x 9.9 x 4.2  | 3   | 28.25 x 10.5 x 4.5 | 3   | 34.6 x 15.6 x 5    | 3   | A: 3.71 x 5.34 x 1<br>B: 2.68 x 5.34 x 1.2 | 3   | 5.34 x 1.0 x 3.71  | 3   | 4.06 x 1.5 x 4.05 |
|   |                   |   |                    |   |                    |  |  |   |                    |   |                   |
| SSO-4-1   |                   | TO92S-3-1   |                    | TO92S-3-2   |                    | SSO-2-1   |  | SSO-2-51  |                    | SSO-2-53  |                   |
| 4   | 5.34 x 1.0 x 3.71 | 3   | 4.0 x 1.52 x 3.15  | 3   | 4.0 x 1.52 x 3.15  | 5.34 x 1.0 x 3.71   |  | 5.34 x 1.0 x 3.71   |                    | 5.34 x 1.0 x 3.71   |                   |
|  |                   |  |                    |  |                    |  |  |  |                    |  |                   |
| SSO-2-4   |                   | SSOA22-2-51   |                    | SSOA32-2-51   |                    | SSO-3-41  |  | Package (JEITA-code)  |                    |   |                   |
| 5.34 x 1.0 x 3.71   |                   | 6 x 4 x 7.85  |                    | 7 x 5.4 x 4.4   |                    | 6 x 1.2 x 7   |  | X   |                    | L x W x H   |                   |
|  |                   |  |                    |  |                    |  |  | <br>pin-count<br>V = Variable number of pins<br>All dimensions in mm                  |                    |   |                   |



# Infineon support for packages

## Useful links and helpful information

Further information, datasheets and documents

[www.infineon.com/packages](http://www.infineon.com/packages)



# Infineon powerful support

## Useful links and helpful information

### General support

[www.infineon.com/support](http://www.infineon.com/support)  
[www.infineon.com/wheretobuy](http://www.infineon.com/wheretobuy)  
[www.infineon.com/quality](http://www.infineon.com/quality)  
[www.infineon.com/packages](http://www.infineon.com/packages)  
[www.infineon.com/green](http://www.infineon.com/green)  
[www.infineon.com/opn](http://www.infineon.com/opn)

### Request reliability (FIT) data

[http://infineon-community.com/FIT\\_1](http://infineon-community.com/FIT_1)

### Tools, desks and more

[www.infineon.com/solutionfinder](http://www.infineon.com/solutionfinder)  
[www.infineon.com/lightdesk](http://www.infineon.com/lightdesk)  
[www.infineon.com/evaluationboards](http://www.infineon.com/evaluationboards)  
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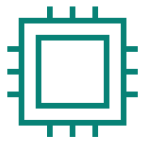


# The Infineon Partner Program

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Additionally, use the "partner tab" on our product and application pages to find out more about Infineon's partner solutions.

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[www.infineon.com/wheretobuy](http://www.infineon.com/wheretobuy)

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Infiniteon offers its toll-free 0800/4001 service hotline as one central number, available 24/7 in English, Mandarin and German.

- Germany 0800 951 951 951 (German/English)
- China, mainland 4001 200 951 (Mandarin/English)
- India 000 800 4402 951 (English)
- USA 1-866 951 9519 (English/German)
- Other countries 00\* 800 951 951 951 (English/German)
- Direct access +49 89 234-0 (interconnection fee, German/English)

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