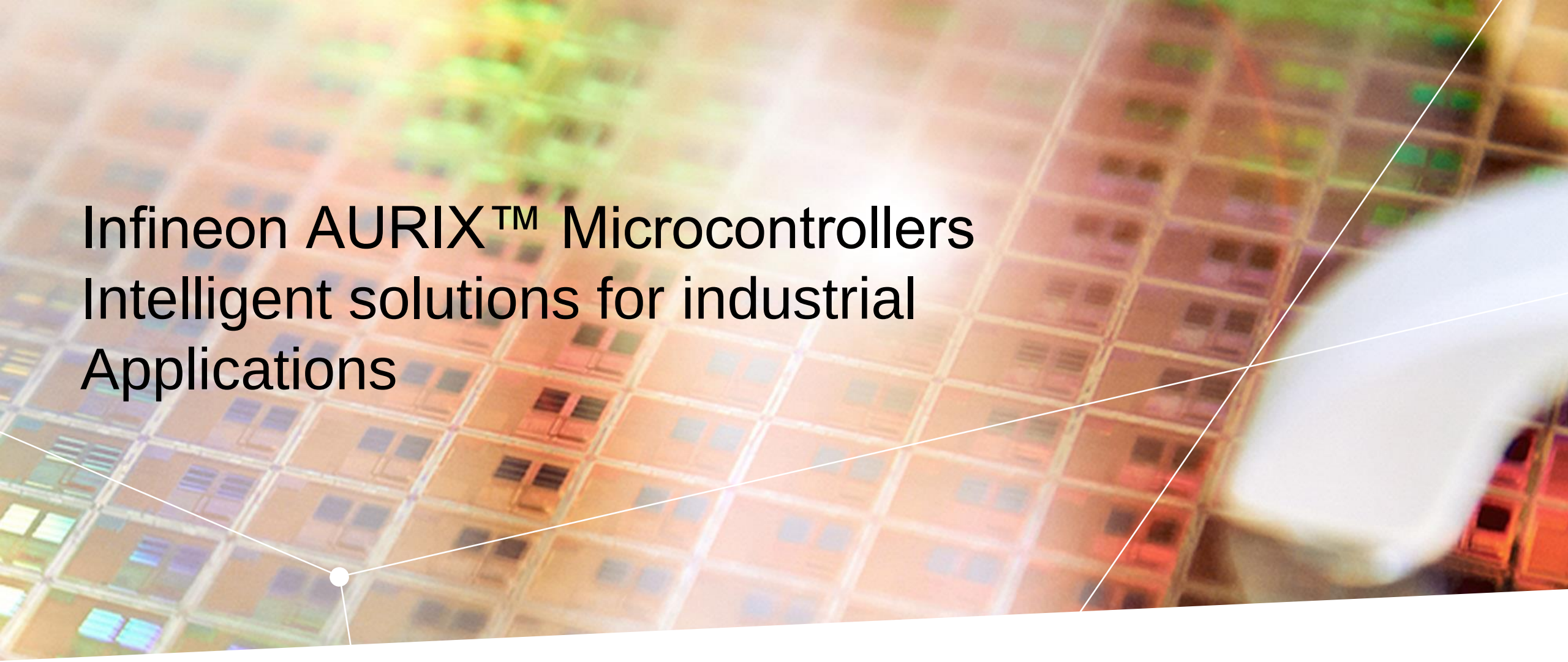
Infineon AURIX™ Microcontrollers Intelligent solutions for industrial Applications



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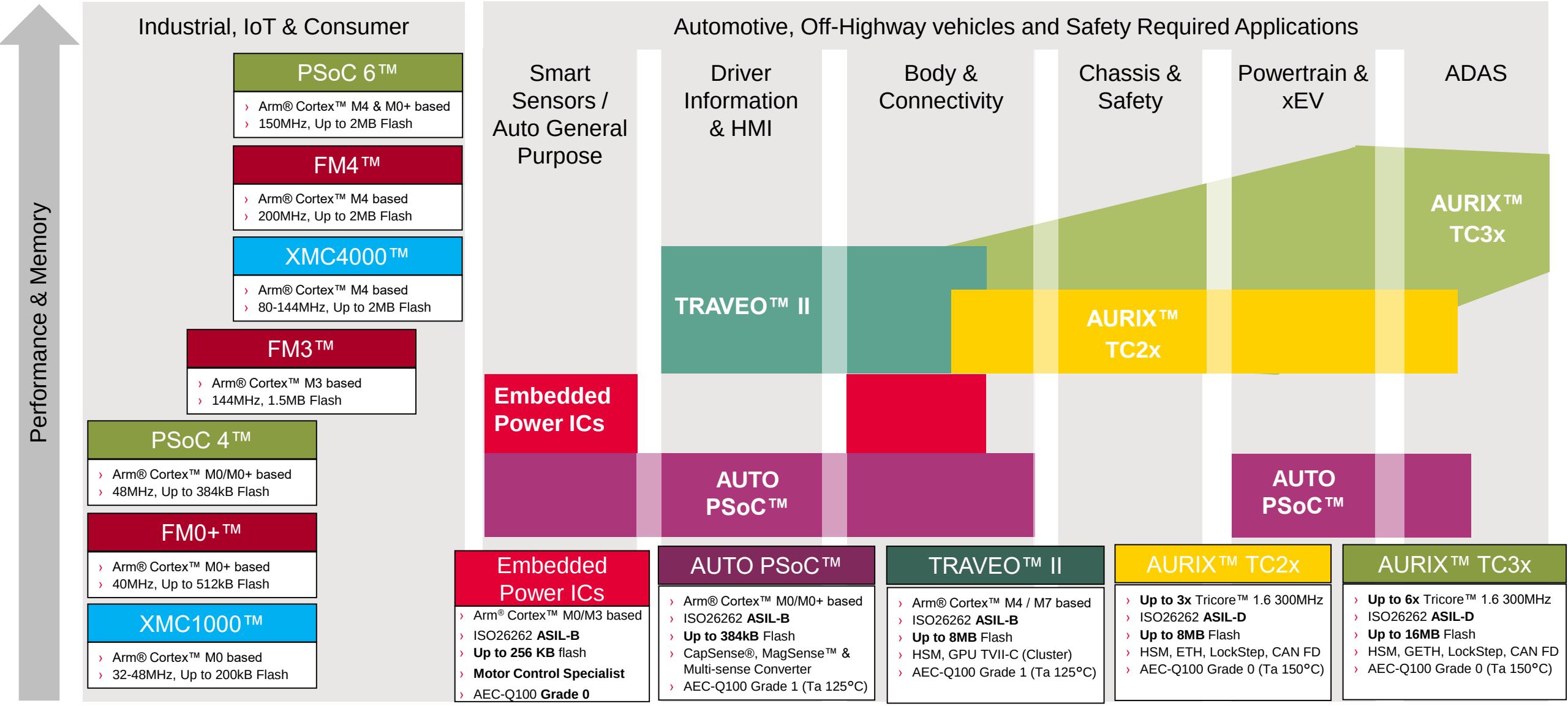
Infineon MCU Portfolio & Roadmap – Industrial, Consumer & Automotive



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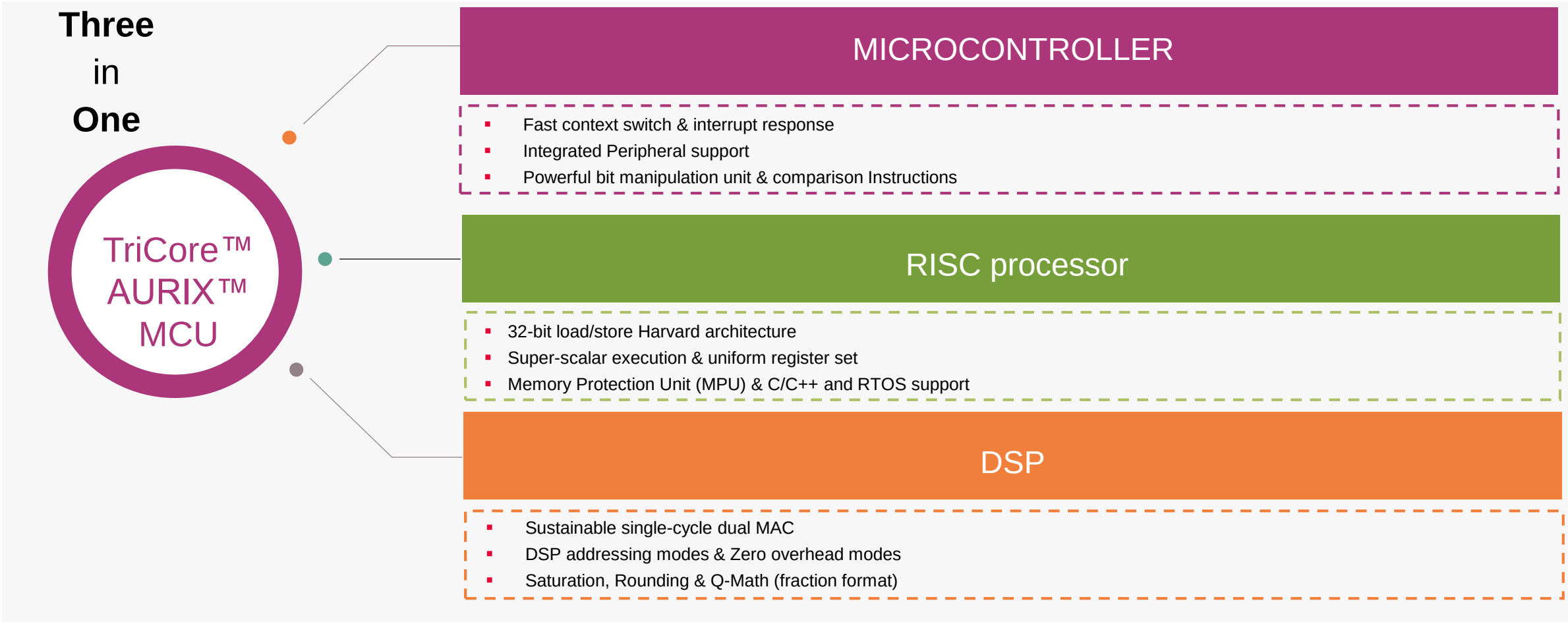
AURIX™: Infineon's TriCore Processor



AURIX™ TriCore unites the elements of a RISC processor core, a microcontroller and a DSP in one **single** MCU!

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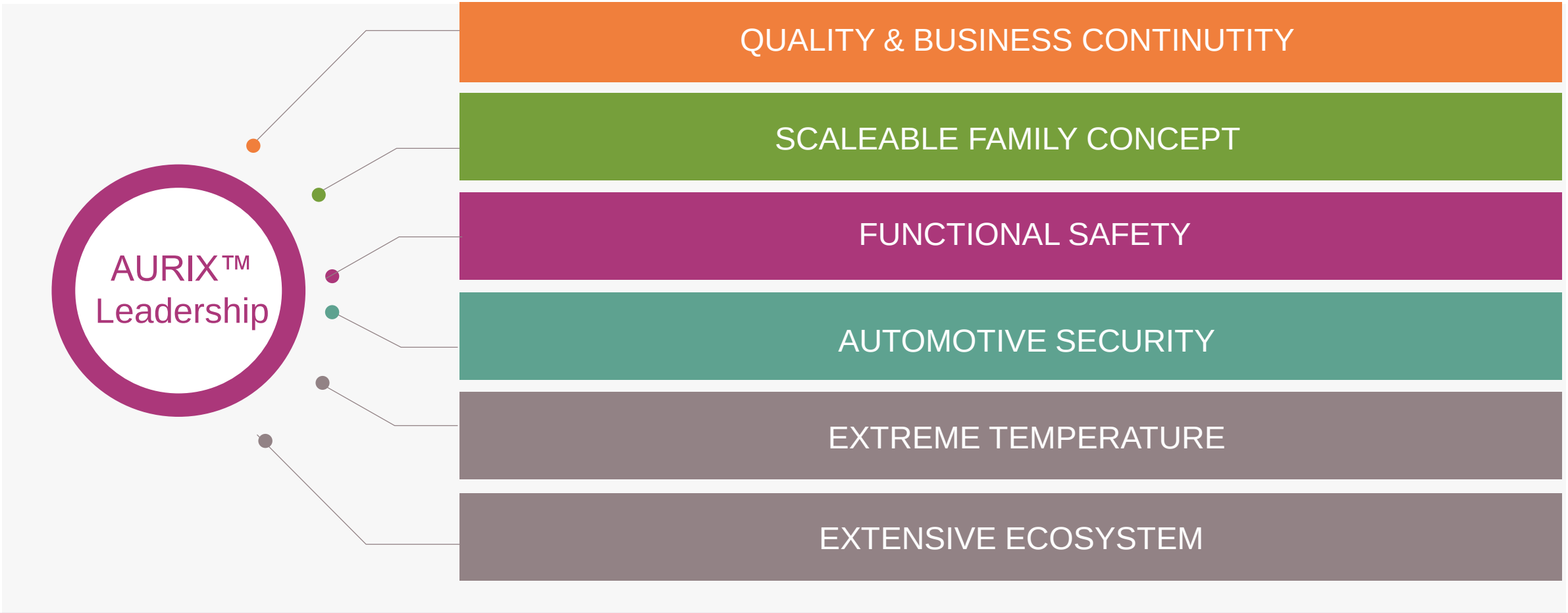
AURIX™ - One-stop-shop for Industrial & Safety



No other MCU family can offer this **combination** of functionality across multiple compatible products

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AURIX™ Industrial Target Applications
safety, scalability, connectivity

AURIX™ for industrial applications: one product family, multiple use cases!

Power & Energy

- Solar Inventer
- Wind Inverter
- Renewable Energies
- Off board charger
- Wireless charging infrastructure

CAV + Off High Way vehicles

- Bus/ Trucks
- Agriculture vehicles
- Earth moving vehicle
- Construction Vehicle
- Special Vehicles
- Crane Systems
- Train Systems
- Avionics/Drone
- Boats
- Drones
- Fun Vehicles

Factory Automation

- PLC, µPLC
- Servo Drives
- Robotics/eRobotics
- In factory vehicles
- RTOS & Cloud connectivity

Others

- Radar Applications
- Medical
- Elevators / Escalators
- Wheel Chair

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AURIX™ Transforming dependability into customer value

"The quality of being trustworthy and reliable."

Dependability		Customer value
Robustness	▪ Functional Availability ▪ Component Reliability	**High Quality**
Scalability	▪ Design Flexibility ▪ Hardware & Software Reusability	**Cost optimized**
Safety and Security	▪ Holistic Safety and Security Architecture ▪ Application know-how	**Risk control**
Trustworthy partnerships	▪ Partner reliability ▪ Experience and know-how ▪ Trust and long-term commitment	**Continuous support**

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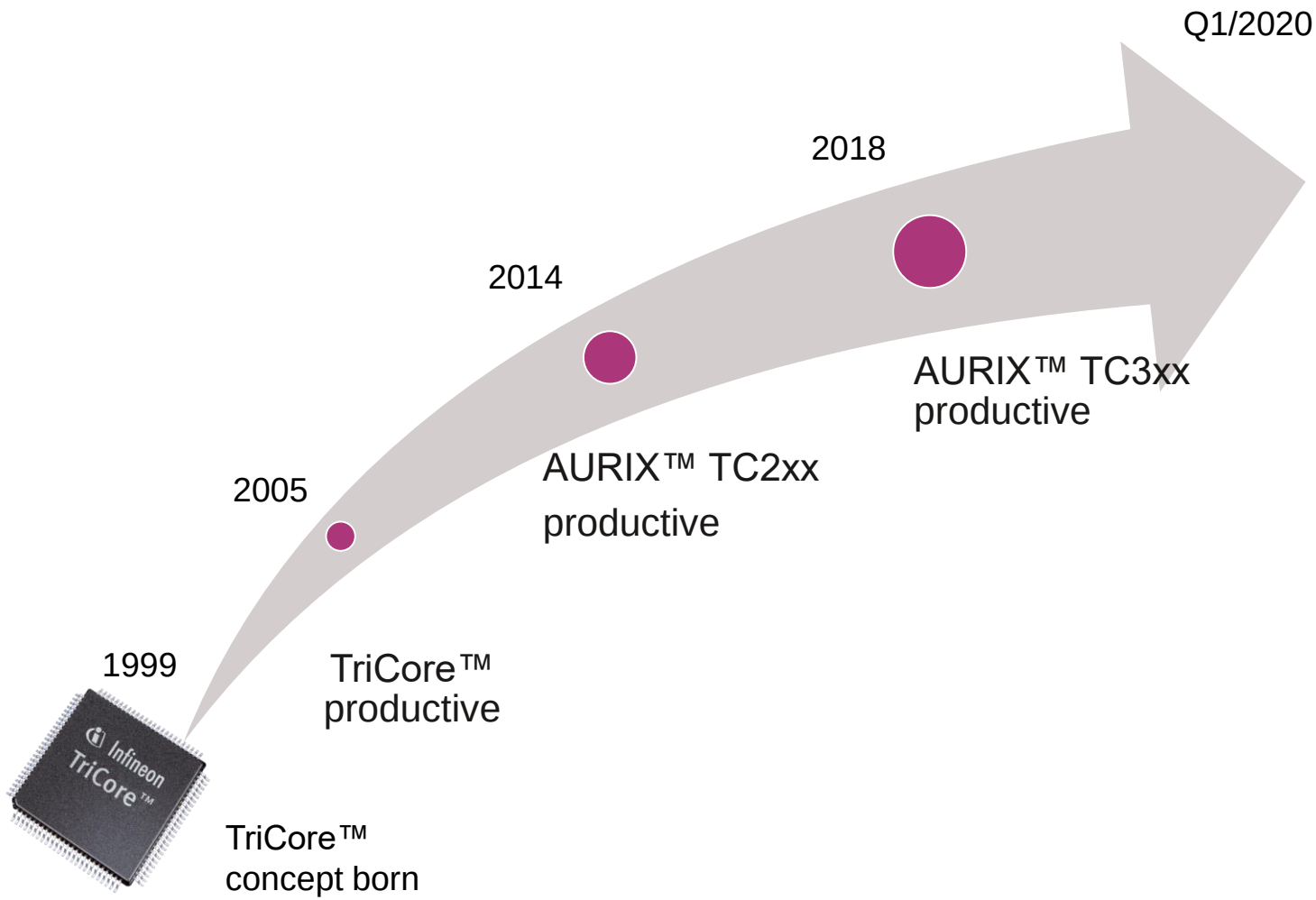
TriCore™ based Infineon MCUs



What is TriCore™?

TriCore™ integrates three functions:
DSP, RISC & MCU

TriCore™ is designed for Safety

used in >50 car brands

Committed to Zero Defect, high quality track record

600,000,000 TriCore™ &

150,000,000 AURIX™
shipped!

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AURIX™:
Quality & Business Continuity Leadership

AURIX™: Quality Leadership by design

1 Development Process Flow	2 Product Design Measures	3 Qualification Approach	4 Production measures
Quality gates	Design for Reliability	AEC Q100	Tool & Process control
	Design for Manufacturability	Robustness: ▪ full temp profile ▪ AEC Q006 for Cu Wire bond ▪ Characterization of Functional Robustness	Risk Management
Secure maturity of the product along its life cycle ISO 26262 Compliance	Design for test		Monitoring
			Test / Burn In
			Quality screening PAT / Scrap limit

The **Next Level of Zero Defect** program ensures **Quality** throughout the Product Life Cycle, with Infineon 32-bit MCUs already reaching **< 1ppm**

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AURIX™: Supply Security Leadership

THREATS

- FIRE
- ACCIDENT
- NATURAL DISASTERS
- OTHER PERILS

Infineon DELIVERS

Dual Fab Concept	3 Month Supply Chain Buffer	Preparedness
TSMC Hsinchu, Fab12 TSMC Tainan, Fab14	› ~3 months delivery possible from available WIP within supply chain	› **EDDIE: Early Detection System** of Natural Hazards & Critical Incidents › **Business Continuity Plan -** in Place

Continuity of supply is critical for our customers. AURIX™ delivers.

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AURIX™:
Scalable Family Concept

AURIX™: TC2xx Scalable Family
From low cost to high performance applications

Devices with HSM

Upgrade/Downgrade path with pin compatible packages

Single Core (S)
Single Lockstep Core (L),
Dual Core (D)
Triple Core (T)

PRO-SIL™: Safety supporting features

Flash	Package							
		TQFP 80	TQFP 100	T/LQFP 144	LQFP 176	LFBGA 292	BGA 416	LFBGA 516
TC29x 8 MB						TC297T 300MHz	TC298T 300MHz	TC299T 300MHz
TC27x 4 MB					TC275T 200 MHz	TC277T 200MHz		
TC26x 2.5 MB				TC264D 200 MHz	TC265D 200 MHz	TC267D 200 MHz		
TC23x 2 MB			TC233L 200 MHz	TC234L 200 MHz		TC237L 200 MHz		
TC22x 1 MB		TC222L/S 133 MHz	TC223L/S 133 MHz	TC224L/S 133 MHz				
TC21x 512 kB		TC212L/S 133 MHz	TC213L 133 MHz	TC214L/S 133 MHz				

MCU Scalability
- Performance & Flash
- Software compatibility
- Pin-compatibility
- Diverse timer architecture

Power Consumption
- On-chip DC/DC high-efficiency power supply

Safety Concept
- PRO-SIL™ ISO26262/ IEC61508 compliance
- HW redundancy options

Security Concept
- Selected devices with Hardware Security Module (HSM)

Availability
- All devices are in mass production

Tools & Boards
- Multiple options available

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AURIX™ Getting Started with TC2xx: Product Selector

[AURIX™ product selector](#) to order samples today!

Brand | Device | Primary Option | Secondary Option

SA K – TC 2 7 5 T – 64 F 200 N

Infineon product identifier	Temperature range	TriCore	Architecture	Series	Package Class	Core Architecture	Feature Package	Memory Size	Memory Type	Frequency	Special Type
SA	K	TC	2	7	5	T	F	200	N		

Temp. Range
K -40°C - +125°C
L -40°C - +150°C

Package Class
9 LFBGA-516
8 BGA-416
7 LFBGA-292
5 LQFP-176
4 L/TQFP-144
3 TQFP-100
2 TQFP-80
0 Bare Die

Core Architecture
T Triple Core
D Dual Core
S Single Core
L Single Core with Lockstep

Feature packages
- Production Dev., No HSM
P Prod. Dev., HSM enabled
E Emulation Dev., no HSM
F Emulation Dev., HSM enabled
A ADAS enhanced, HSM enabled
X Feature ext., HSM enabled
C Customer specific

Flash size code

8	0.5MB
16	1 MB
24	1.5 MB
32	2 MB
40	2.5 MB
64	4 MB
96	6 MB
128	8 MB

Special Type Code
N CAN FD ISO frame
W LQFP 0.5mm pitch
F TQFP 0.4mm pitch
L BGA 1.0 mm pitch
S LFBGA 0.8mm pitch
Q Fusion Quad QFP 0.5 mm pitch

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AURIX™: TC29x Series – Performance Device

AURIX™: TC29x Series

The AURIX™ family addresses applications, where more performance, connectivity, safety and security are needed.

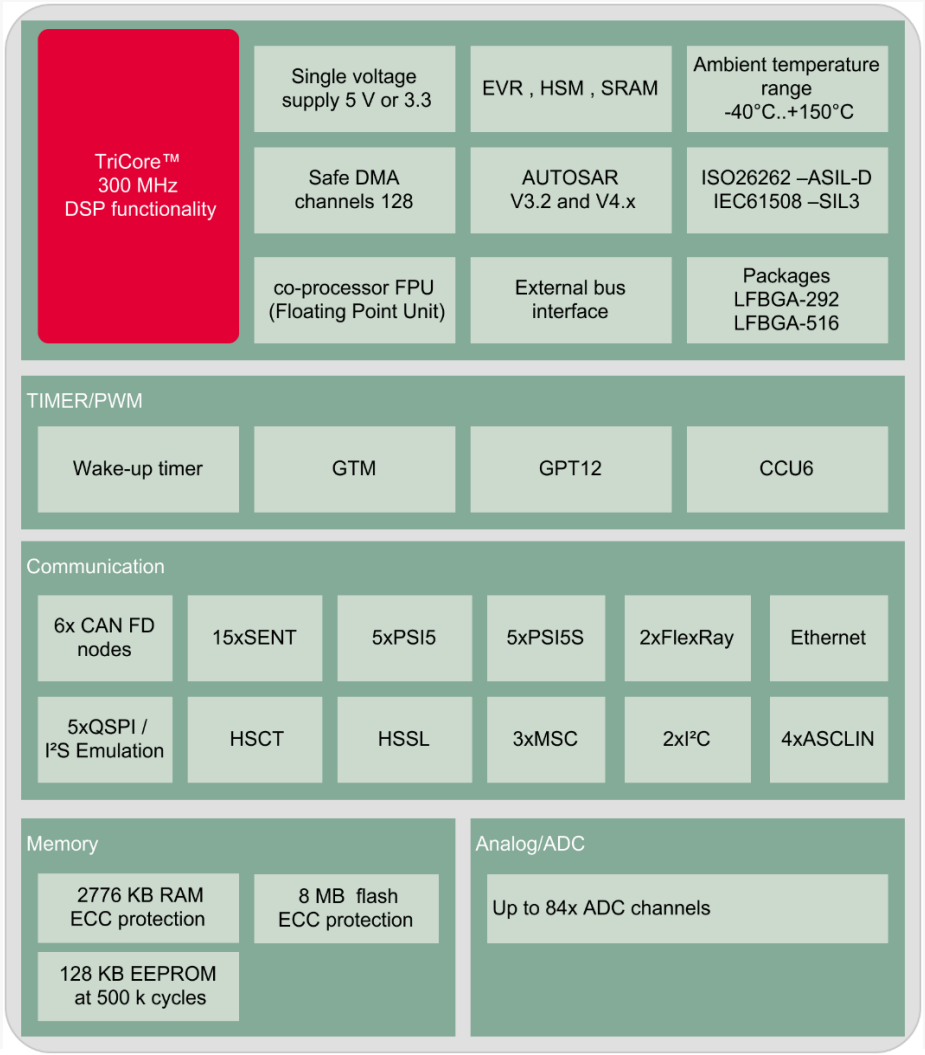
AURIX™ TC2xx microcontrollers serve the precise needs of the automotive and industrial market in terms of performance and safety

Most innovative safety:

- Diverse Lockstep Core with clock delay
- Redundant and diverse timer modules (GTM, CCU6, GPT12)
- Access permission system
- Safety management unit
- DMA
- I/O, clock, voltage monitor
- Developed and documented following ISO 26262 to support safety requirements up to ASIL-D
- AUTOSAR V3.2 and V4.x

System benefits :

- Diverse Lockstep architecture to reduce development effort for ASIL-D systems .
- High integration for reduced complexity and significant cost savings .
- Delta-sigma analog-to-digital converters for fast and accurate measurements .
- Innovative single supply concept for best-in-class power consumption and cost savings in external supply .
- Scalability in terms of performance, packages, memory and peripherals for flexibility across platform concepts .
- Available as single and lockstep core .
- Latest connectivity CAN FD (flexible data rate) .
- Scalable safety from QM to ASIL D for Industrial and Automotive Applications .
- Dedicated emulation device chip (ED) for multicore debugging, tracing and calibration .
- Hot package options for extended temperature range



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AURIX™: TC21x Series – Low-end Device

AURIX™: TC22x Series

The AURIX™ family addresses applications, where more performance, connectivity, safety and security are needed.

AURIX™ TC2xx microcontrollers serve the precise needs of the automotive and industrial market in terms of performance and safety

Most innovative safety:

- Diverse Lockstep Core with clock delay
- Redundant and diverse timer modules (GTM, CCU6, GPT12)
- Access permission system
- Safety management unit
- DMA
- I/O, clock, voltage monitor
- Developed and documented following ISO 26262 to support safety requirements up to ASIL-D
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System benefits :

- Diverse Lockstep architecture to reduce development effort for ASIL-D systems .
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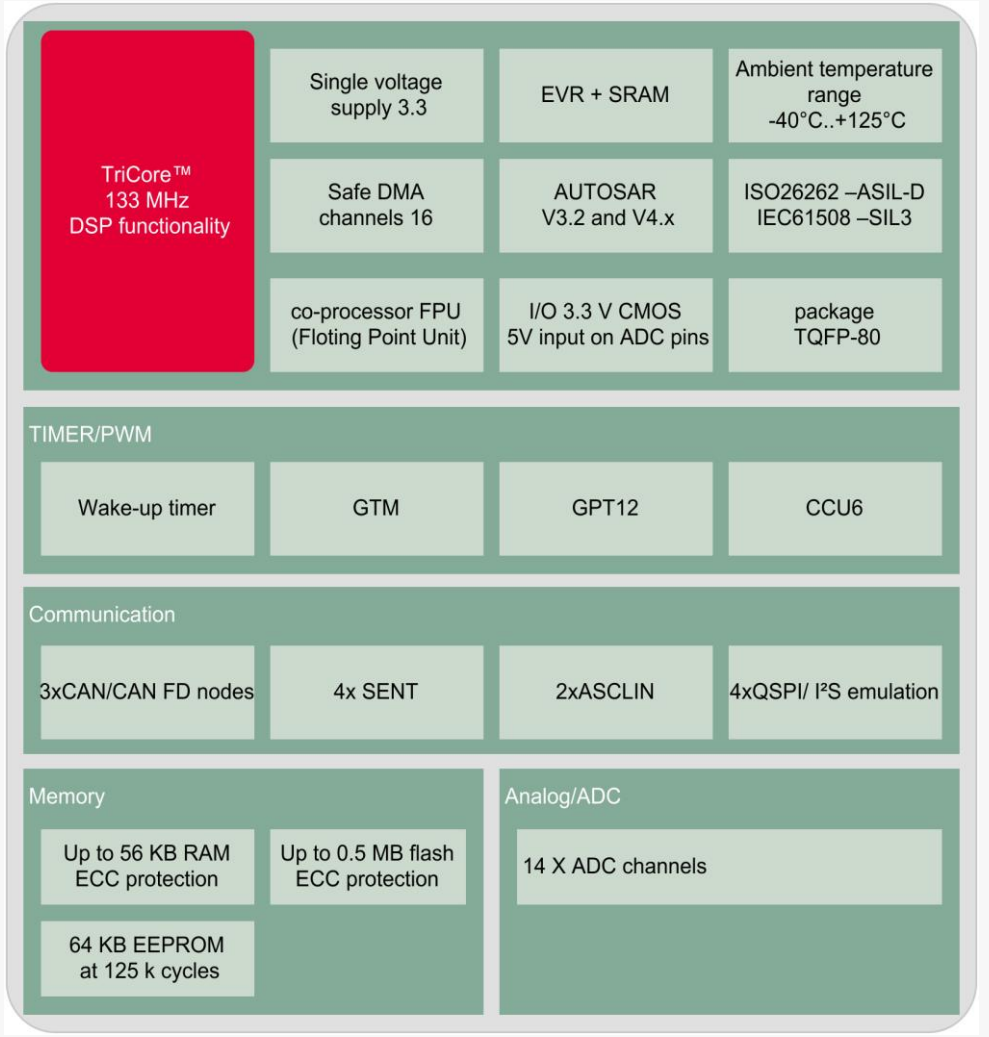
- Latest connectivity CAN FD (flexible data rate) .
- Scalable safety from QM to ASIL D for Industrial and Automotive Applications .
- Dedicated emulation device chip (ED) for multicore debugging, tracing and calibration .
- Hot package options for extended temperature range



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AURIX™ TC2xx: Standard devices in mass production

Feature Set		9x Series	7x Series	6x Series	3x Series	2x Series	1x Series
TriCore 1.6P	# Cores / Checker	3 / 1	2 / 1	1 / 1	- / -	- / -	- / -
	Frequency	2x300 / 1x200 MHz	200 MHz	200 MHz	-	-	-
TriCore 1.6E	# Cores / Checker	- / -	1 / 1	1 / -	1 / 1	1 / 1 (1 / 0)	1 / 1 (1 / 0)
	Frequency	-	200 MHz	200 MHz	200 MHz	133 MHz	133 MHz
Flash	Program Flash	8 MB	4 MB	2.5 MB	2 MB	1 MB	512 KB
	EEProm @ w/e cycles	128 KB @ 500k	64 KB @ 500k	16 KB @ 500k	128k @ 125 k cycles	96k @ 125k cycles	64k @ 125k cycles
SRAM	Total (DMI , PMI, LMU)	728 KB	472 KB	240 KB	192 KB	96 KB	56 KB
DMA	Channels	128	64	48	16	16	16
ADC	Modules 12bit / DS	11 / 10	8 / 6	4 / 3	2 / -	2 / -	2 / -
	Channels 12bit / DS	84 / 10 diff	60 / 6 diff	50 / 3 diff	24 / -	/ -	24 / -
Timer	GTM Input / Output	48 / 152 channels	32 / 88 channels	24 / 64 channels	8 / 32	8 / 32	8 / 32
	CCU / GPT modules	2 / 1	2 / 1	2 / 1	2 / 1	2 / 1	2 / 1
Interfaces	FlexRay (#/ch.)	2 / 4	1 / 2	1 / 2	1 / 2	-	-
	CAN FD[3] (nodes/obj)	6 / 384	4 / 256	5 / 256	6 / 256	3 / 128	3 / 128
	QSPI / ASCLIN / I2C	6 / 4 / 2	4 / 4 / 1	4 / 4 / 1	4 / 2 / -	4 / 2 / -	4 / 2 / -
	SENT / PSI5 / PSI5S	15 / 5 / 1	10 / 3 / 1	6 / 2 / 1	4 / -	4 / -	4 / -
	HSCT / MSC / EBU	1 / 3 diff LVDS / 1	1 / 2 diff LVDS / -	1 / 2 diff LVDS / -	- / - / -	- / - / -	- / - / -
	Other	Ethernet	Ethernet	Ethernet	-	-	-
Safety	SIL Level	ASIL-D	ASIL-D	ASIL-D	ASIL-D	ASIL-D	ASIL-D
Security	HSM	Yes	Optional	No	Optional	No	No
Power	EVR	Yes	Yes	Yes	Yes	Yes	Yes

AURIX™ family concept offers both **scalable** feature-sets and pin-outs for **optimal flexibility**

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AURIX™: TC3xx

AURIX™ TC3xx Architecture Evolution (enhancements vs. AURIX™)

Performance

- New TriCore™ 162 generation
- New instructions
- up to 6 CPUs @300MHz
- New direct Flash access path

Memories

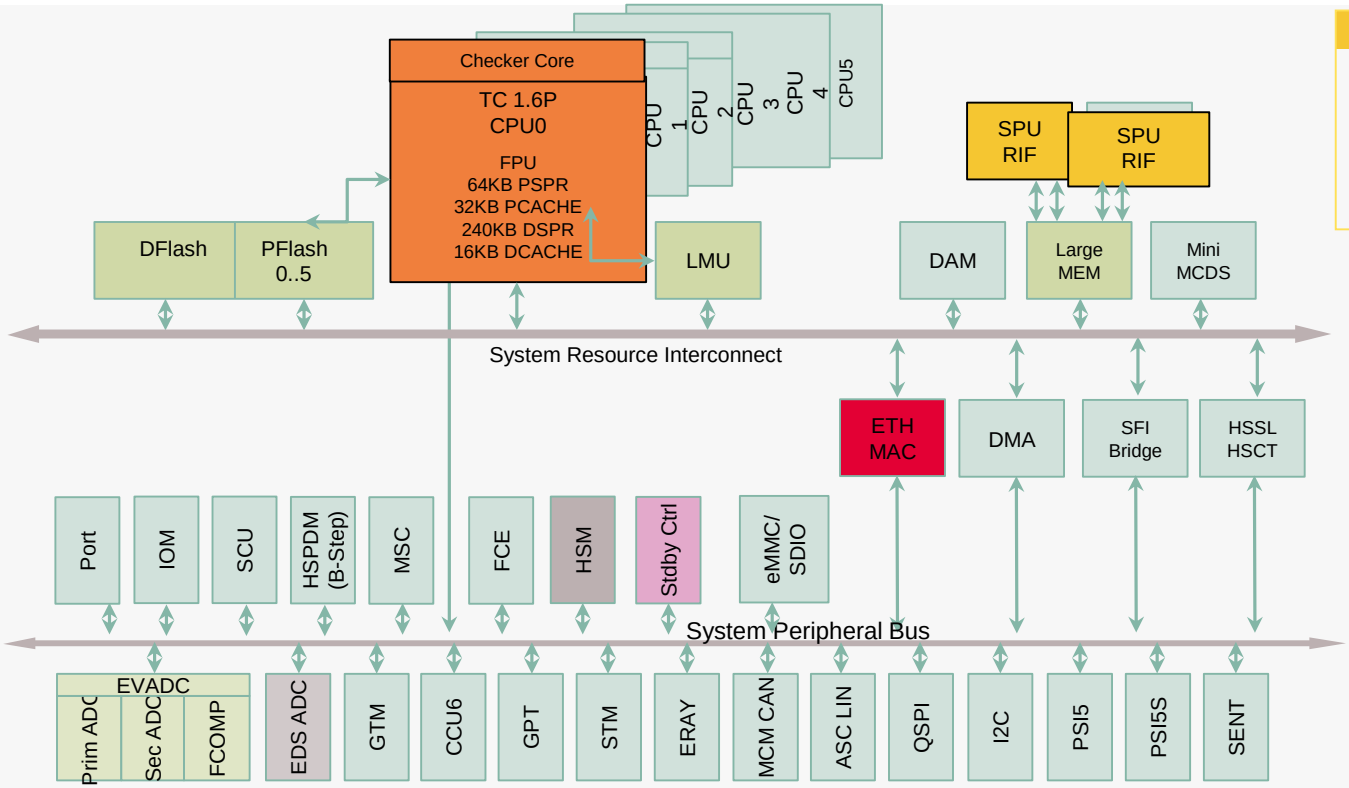
- Larger SRAM
- SRAM/Flash ratio increased
- enhanced MPU

ADC

- Improvement of existing ADC
- Reduction of capacitive load

Delta-Sigma:

- enhanced concept



HSM: Full Evita compliance

- New accelerators ECC256 / SHA256
- Available on all devices

Standby Control Unit

- Low power modes

ADAS

- New SPU concept

Safety

- LBIST
- MBIST upgrade

Ethernet

- 1GBit/s ETH
- QoS services

IO Pads

- all 5V/3.3V

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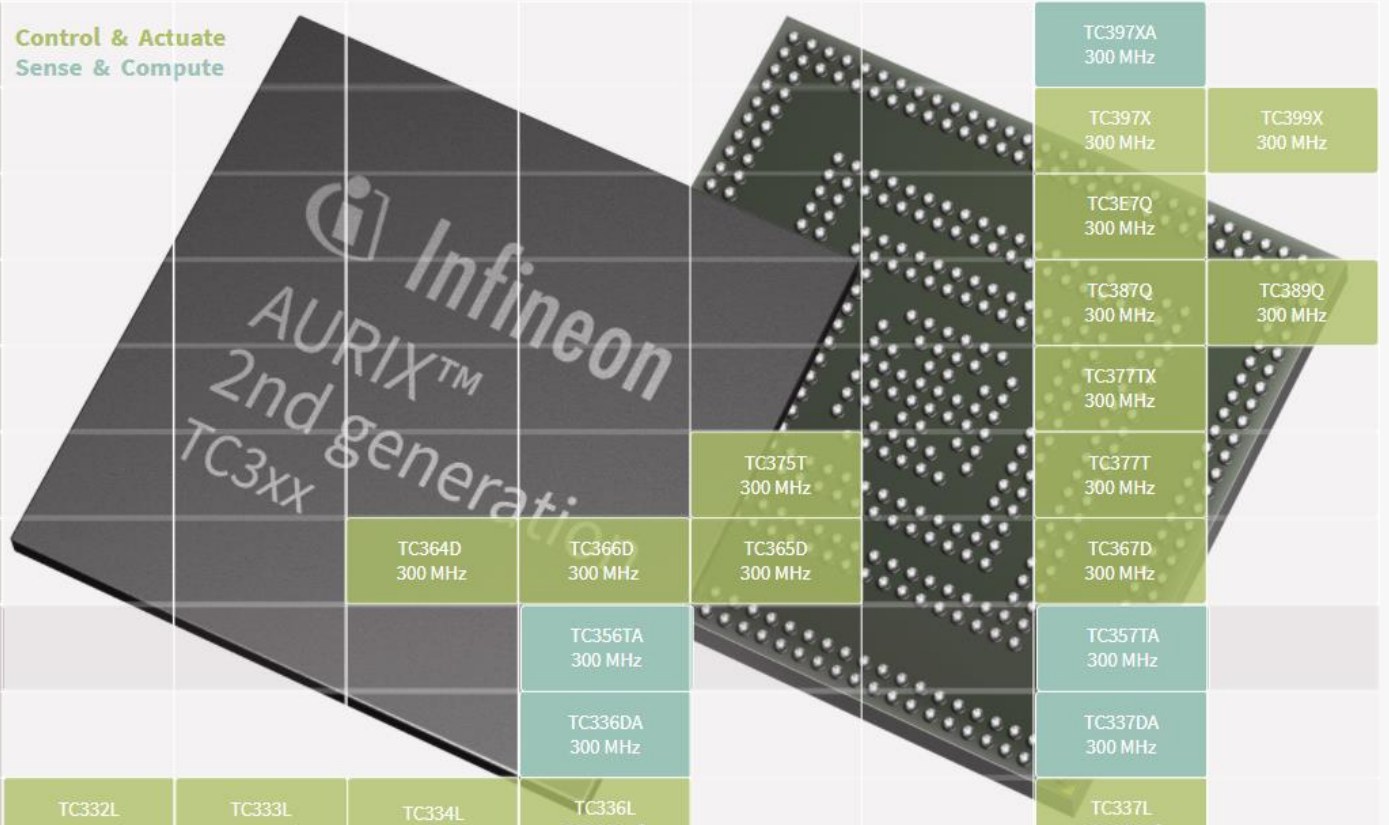
AURIX™: TC3xx Scalable Family
From low cost to high performance applications

Devices with HSM

Upgrade/Downgrade path with pin compatible packages

Single Core (**S**)
Single Lockstep Core (**L**),
Dual Core (**D**)
Triple Core (**T**)

PRO-SIL™: Safety supporting features



Flash	Package	TQFP-80	TQFP-100	T/LQFP-144	BGA-180	LQFP-176	BGA-216	LFBGA-292	LFBGA-516
6x 300 MHz	9xA Series 16 MB							TC397XA 300 MHz	
6x 300 MHz	9x Series 16 MB							TC397X 300 MHz	TC399X 300 MHz
4x 300 MHz	Ex Series 12 MB							TC3E7Q 300 MHz	
4x 300 MHz	8x Series 10 MB							TC387Q 300 MHz	TC389Q 300 MHz
3x 300 MHz	7xX Series 6 MB							TC377TX 300 MHz	
3x 300 MHz	7x Series 6 MB					TC375T 300 MHz		TC377T 300 MHz	
2x 300 MHz	6x Series 4 MB			TC364D 300 MHz	TC366D 300 MHz	TC365D 300 MHz		TC367D 300 MHz	
3x 300 MHz	5xA Series 4 MB				TC356TA 300 MHz			TC357TA 300 MHz	
2x 300 MHz	3xA Series 2 MB				TC336DA 300 MHz			TC337DA 300 MHz	
1x 200 MHz *	3x Series 2 MB	TC332L 200MHz *	TC333L 200MHz *	TC334L 200 MHz *	TC336L 200 MHz *			TC337L 200 MHz *	
1x 160 MHz	2x Series 1 MB	TC322L 160 MHz	TC323L 160 MHz	TC324L 160 MHz				TC327L 160 MHz	

MCU Scalability

- Performance & Flash
- Software compatibility
- Pin-compatibility
- Diverse timer architecture

Power Consumption

- On-chip DC/DC high-efficiency power supply

Safety Concept

- PRO-SIL™ ISO26262/ IEC61508 compliance
- HW redundancy options

Security Concept

- Selected devices with Hardware Security Module (HSM)

Availability

- All devices are in mass production

Tools & Boards

- Multiple options available

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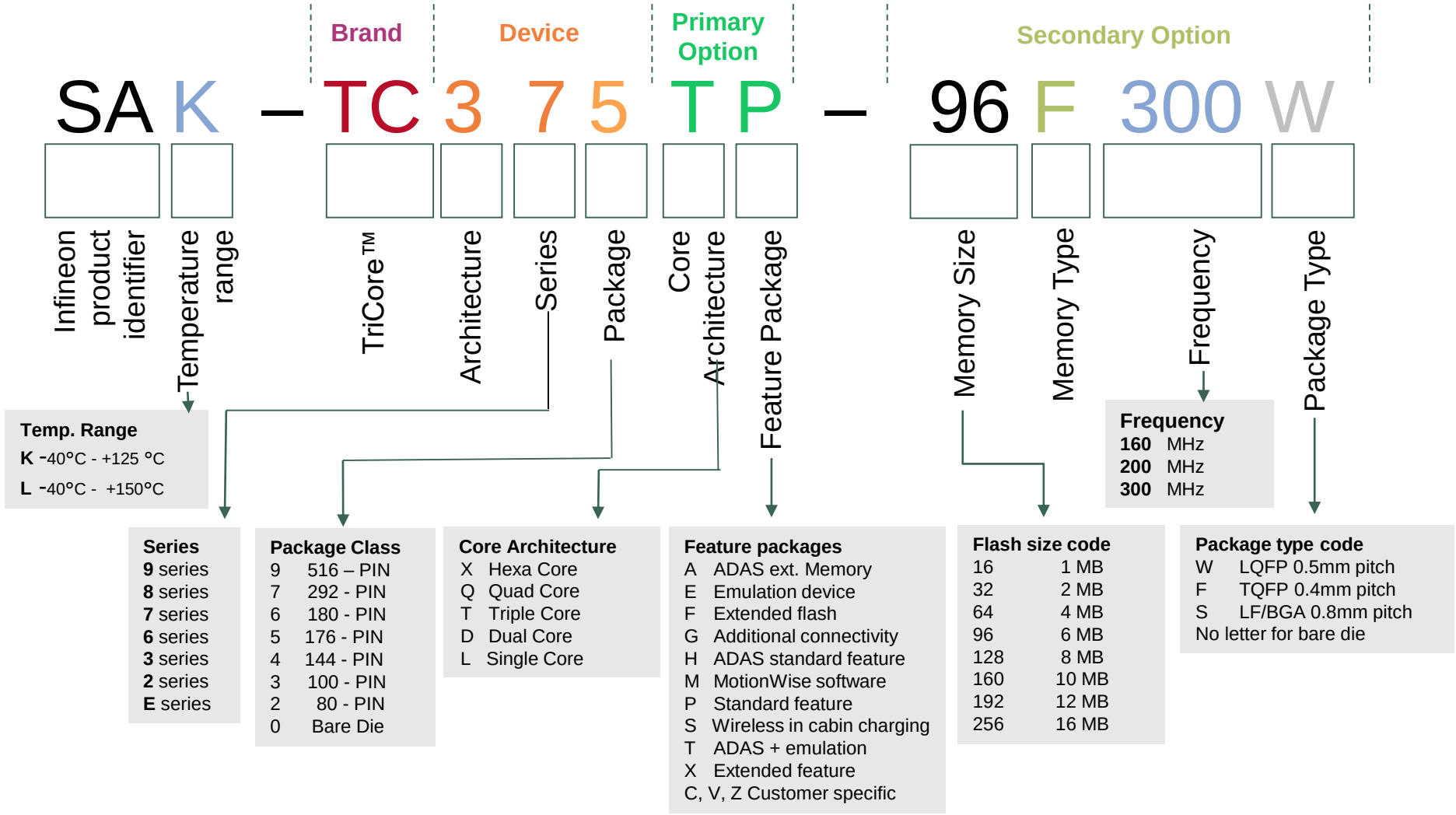
Getting Started with AURIX™ TC3xx

Product Nomenclature NOT Legos



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AURIX™– TC3xx
Terminology

Term	Description
DFlash	Data flash for persistent storage of varying data
PFlash	Program flash where code and constants reside
DSPR	Data Scratch Pad RAM, essentially RAM for variable storage, stack, etc.
PSPR	Program Scratch Pad RAM, for buffering code fetched from PFlash, running code from RAM, etc
dLMU	Distributed Local Memory Unit: additional RAM available on the SRI, with direct connection from each block to a certain core to avoid SRI congestion
Global LMU	Similar to dLMU, except that all requests must go through SRI
DAM	Default Application Memory, additional RAM on SRI
EMEM	Extension Memory, additional RAM on SRI
MCDS	Multi Core Debug Solution, the debug system
EBU	External Bus Unit for connecting certain external memories and peripherals
ETH MAC	Ethernet controller
DMA	Direct Memory Access for transferring data from flash, peripherals, and RAM to peripherals and RAM
SFI Bridge	A bridge connecting SRI and SPB
HSSL	High speed serial link, typically used to connect with another AURIX MCU, FPGA, or SoC
HSCT	High Speed Communication Tunnel, companion to HSSL

Term	Description
Port	Allows for pin configuration, pad strength, etc
IOM	Input Output Monitor, a powerful HW based smart IO comparison unit
SCU	System Control Unit, a cluster of system units handling reset, traps, system registers, watchdog, etc.
HSPDM	High Speed Pulse Density Modulation Module, generates bit streams that can be low pass filtered externally to generate analog voltage
MSC	Micro Second Channel, a serial interface that is especially designed to connect external power devices
FCE	Flexible CRC Engine that can generate CRCs of different polynomials
HSM	Hardware Security Module containing accelerators for cryptography and providing a secure execution environment and key storage
Stdby Ctrl	Standby Controller that can be operated under low power conditions
eMMC/SDIO	An interface to external eMMC or SDIO memories
SMU	Safety Management Unit, a central area for configuration of safety alarms
EVADC	Enhanced Versatile ADC, a traditional SAR ADC with primary, secondary, and fast compare engines
EDSADC	Enhanced Delta-Sigma ADC, an ADC based on Delta-Sigma conversion principle

Term	Description
GTM	Generic Timer Module, a powerful timing module for analyzing and generating PWM signals, and several other functions
CCU6	Capture Compare Unit 6, high-resolution 16-bit capture and compare unit with application-specific modes, mainly for AC drive control
GPT	General Purpose Timer, a flexible timing module which may be used for timing, event counting, pulse width measurement, pulse generation, frequency multiplication, and other purposes
STM	System Timer Module, provides free running high precision timers typically used for OS tick generation
ERAY	FlexRay controller
MCMCAN	CAN controller
ASC_LIN	Asynchronous/Synchronous Local Interconnect Network, a flexible communication controller that provides SPI, UART, and LIN interface
QSPI	Queued Synchronous Peripheral Interface, a powerful SPI serial communication controller
I2C	Inter-Integrated Circuit, an I2C serial communication controller
PSI5	Peripheral Sensor Interface, for communication with the external devices (typically sensors) via one I/O line for each channel using PSI5 communication protocol
SENT	Single Edge Nibble Transmission, for communication with the external devices (typically sensors) via one I/O line for each channel using SENT communication protocol

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AURIX™: TC39x Series – Super set Device

AURIX™: TC39Xx Series

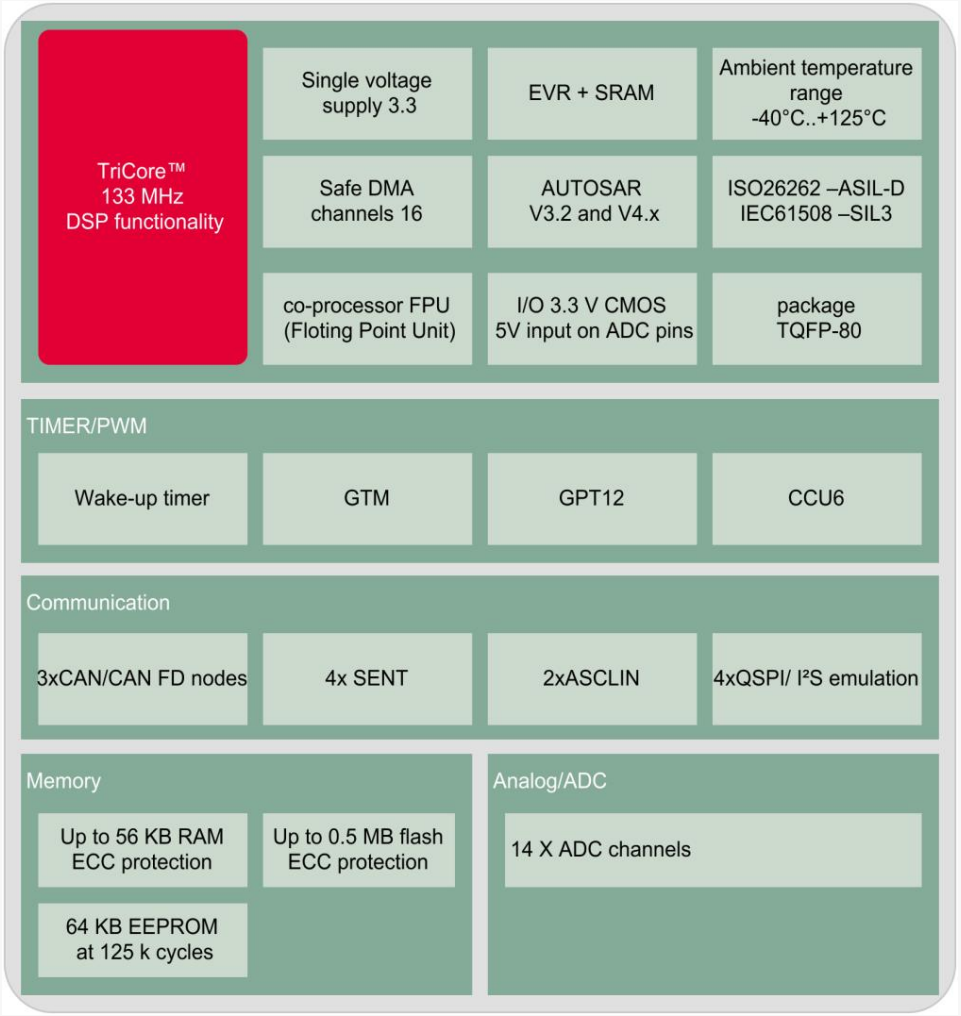
This family has more than 20 products to provide the most scalable portfolio of safety microcontroller. In terms of performance, the highest end product TC39x offers 6 cores running at 300 MHz and up to 6.9 MBytes embedded RAM, and consuming below 2 W. Its mirrored embedded flash banks offers A/B swap capabilities.

Most innovative safety:

- Best-in-class performance enabling ASIL-D designs
- Downward scalable to lower cost AURIX™ TC3xx microcontrollers
- A/B swap software update over the air support
- Easy migration from AURIX™ first generation thanks to the software and hardware compatibility

Key features

- 6 TriCore™ running at 300 MHz (with 4 additional checker cores delivering 4000 DMIPS)
- Supporting floating point and fix point with all cores
- 16 MB flash/ ECC protection
- Up to 6.9 MB SRAM/ ECC protection
- 1 Gbit Ethernet
- 12x CAN FD, 2x FlexRay, 12x ASCLIN, 6x QSPI, 2x I²C, 25x SENT, 4x PSI5, 1x PSI5S, 2x HSSL, 4x MSC, 1x eMMC/SDIOT, **1**x I²S emulation
- Redundant and diverse timer modules (GTM , CCU6 , GPT12)
- EVITA Full HSM (ECC256 and SHA2)
- LFBGA-292 package
- LFBGA-516 package
- Developed and documented following ISO 26262/IEC61508 to support safety requirements up to ASIL-D/SIL3
- AUTOSAR 4.2 support
- Single voltage supply 5 V or 3.3 V
- 165°C junction temperature



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AURIX™– TC39xXA (ADAS)

AURIX™: TC39Xx Series

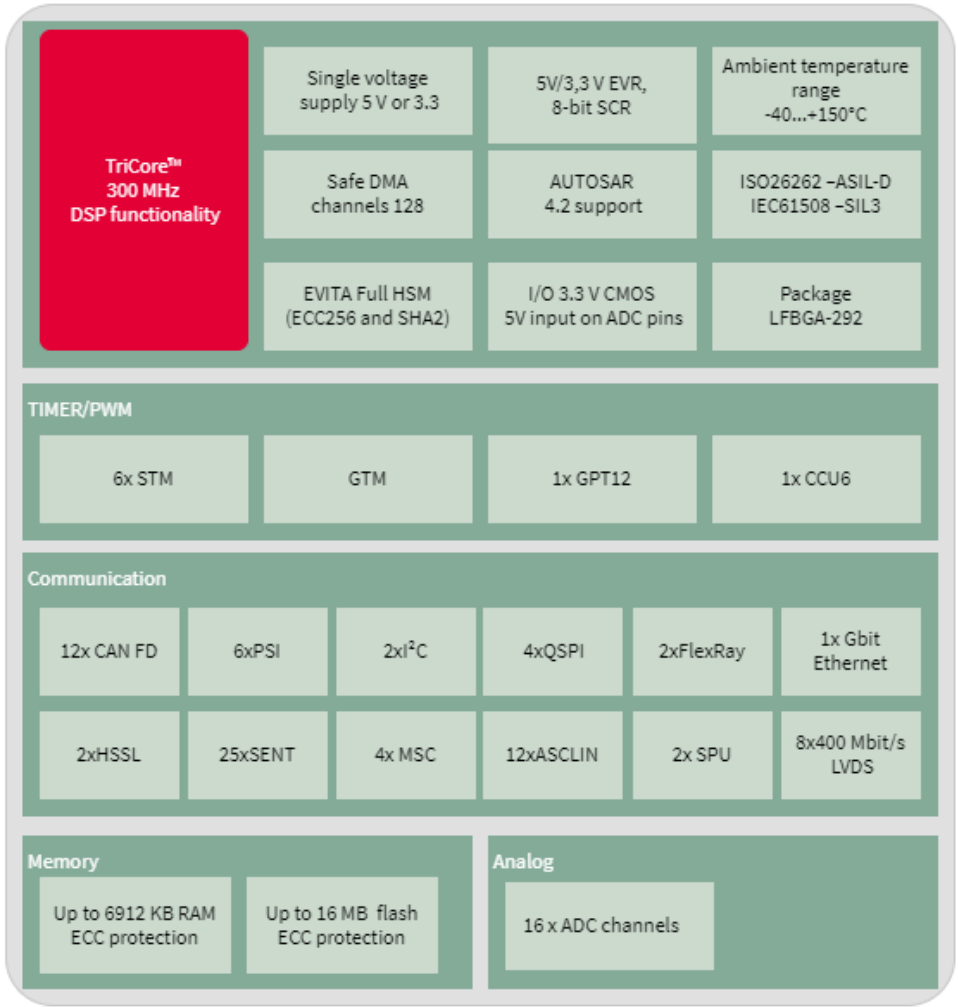
This family has more than 20 products to provide the most scalable portfolio of safety microcontroller. In terms of performance, the highest end product TC39x offers 6 cores running at 300 MHz and up to 6.9 MBytes embedded RAM, and consuming below 2 W. Its mirrored embedded flash banks offers A/B swap capabilities.

Most innovative safety:

- Complete Infineon chipset: MCU, front-end MMIC and safe power supply
- Highly integrated solution for performance demanding **radar applications**
- Fully compatible with **TC357TA** for more cost effective solutions
- **Radar cluster:**
- LVDS radar interface
- Lock-stepped radar processor
- High bandwidth radar SRAM

Key features

- 16 MB flash / ECC protection
- up to 6.9 MB SRAM / ECC protection
- 1 Gbit **Ethernet**
- 12xCAN FD , 2x**FlexRay**, 12xLINs, 4xQSP , 2x**I²C** , 25x**SENT**, 6xPSI, 2x**HSSL**, 4x**MSC** , 1x eMMC/SDIO
- **8x400 Mbit/s LVDS Radar Interface**
- 2x SPU (Signal Processing Unit) for Radar signal procesing
- Redundant and diverse timer modules (GTM, CCU6, GPT12)
- EVITA Full HSM (ECC256 and SHA2)
- BGA-292 package
- Developed and documented following ISO 26262/IEC61508 to support safety requirements up to ASIL-D/SIL3
- AUTOSAR 4.2 support
- Single voltage supply 5 V or 3.3 V
- 165°C junction temperature



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AURIX™– TC35xTA (ADAS)
High performance radar and autonomous driving microcontroller

AURIX™: TC39Xx Series

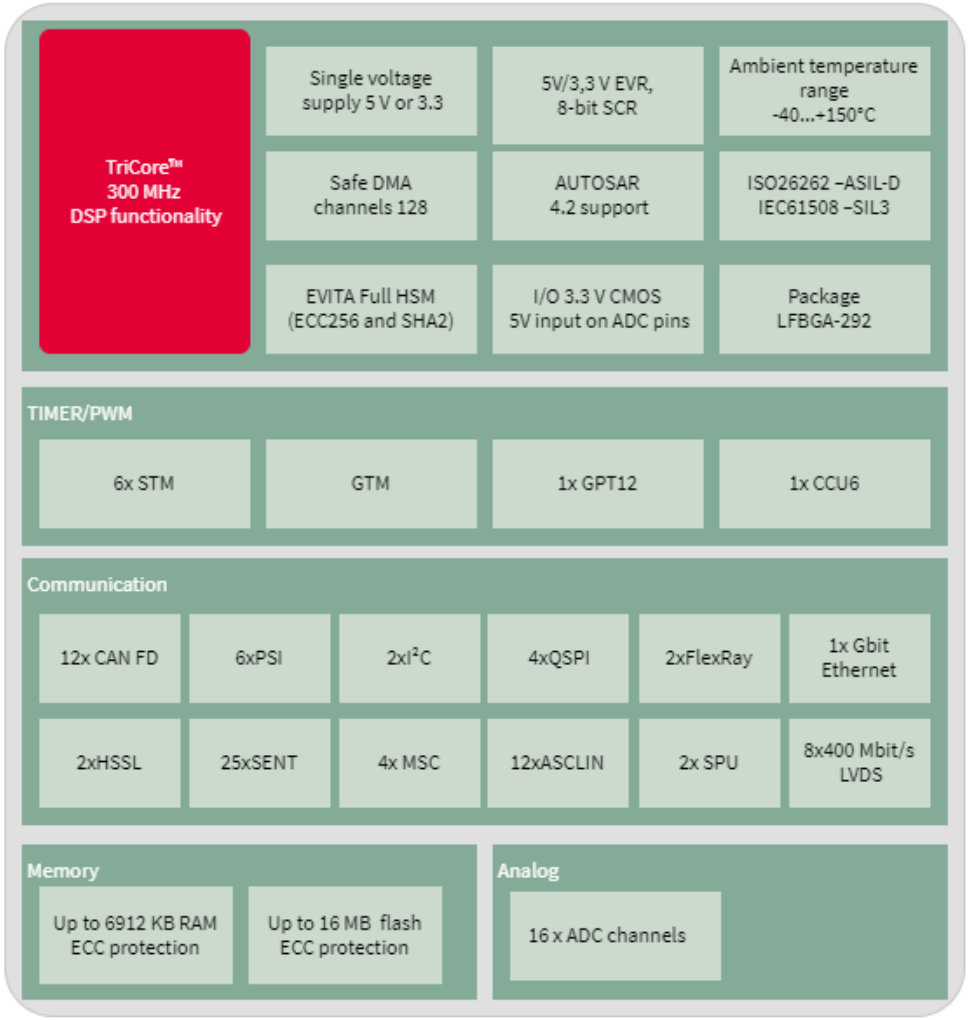
AURIX™ TC3xx family comes with an increase in performance, memory sizes, connectivity and scalability to address the new automotive trends and challenges.
In terms of performance, the radar application high-runner TC35xTA offers 3 cores at 300 MHz, up to 3.6 MBytes embedded RAM, and consumption below 2 W. Its mirrored embedded flash banks (2x 2 MB) support A/B swap capabilities.

Most innovative safety:

- Complete Infineon chipset: MCU, front-end MMIC and safe power supply
- Highly integrated solution for performance demanding **radar applications**
- Fully compatible with **TC357TA** for more cost effective solutions
- **Radar cluster:**
- LVDS radar interface
- Lock-stepped radar processor
- High bandwidth radar SRAM

Key features

- 3 TriCore™ running at 300 MHz (with 2 additional checker cores delivering 2100 DMIPS)
- Up to 4 MB flash/ECC protection
- Up to 3.6 MB SRAM/ECC protection
- 1 Gbit Ethernet
- 8xCAN FD 1xI²C 4xASCLIN ,1xFlexRay ,Radar/ext. ADC IF (RIF),4xQSPI
- **8x400 Mbit/s LVDS Radar Interface**;
- 2x SPU (Signal Processing Unit) for Radar signal processing
- EVITA Full HSM (ECC256 and SHA2)
- BGA-292 package and BGA-180 package
- Developed and documented following ISO 26262/IEC61508 to support safety requirements up to ASIL-D/SIL3
- AUTOSAR 4.2 support
- Single voltage supply 5 V or 3.3 V
- 165°C junction temperature
- Standby mode controller



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AURIX™– TC37xTX

AURIX™: TC39Xx Series

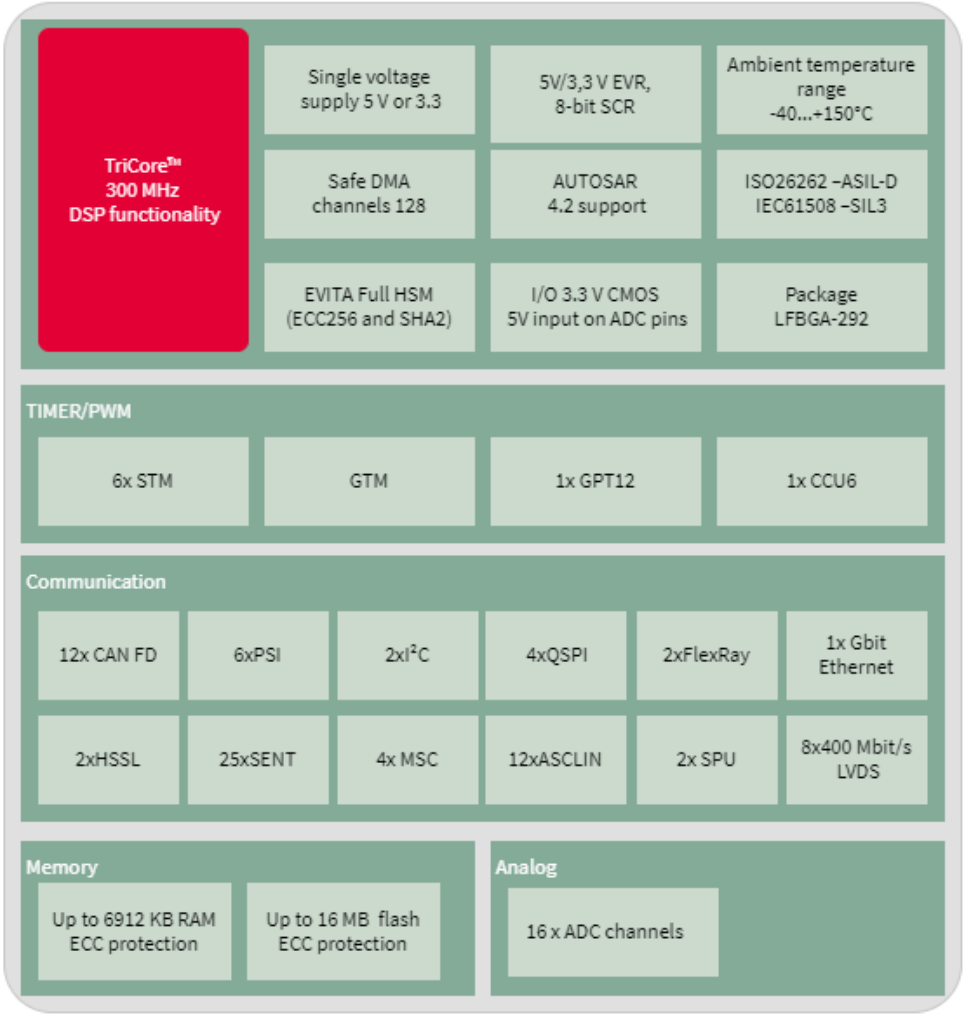
This family has more than 20 products to provide the most scalable portfolio of safety microcontrol¬ler. In terms of performance, T37xTX offers 3 cores running at 300 MHz and up to 4.3 MBytes embedded RAM, and consuming below 2 W. Its mirrored embedded flash banks offers A/B swap capabilities.

Most innovative safety:

- Best-in-class performance enabling ASIL-D designs
- Upward and downward scalable to the rest of **AURIX™ TC3xx** family
- A/B swap software update over the air support
- Easy migration from **AURIX™ TC2xx** thanks to high software and hardware compatibility

Key features

- 3 TriCore™ running at 300 MHz
- Supporting floating point and fix point with all cores
- 6 MB flash/ECC protection
- 4.3 MB SRAM / ECC protection
- **128x DMA** channels
- **2**x Gbit Ethernet
- **12**x CAN FD, **1**x **FlexRay**, **12**x LINs, **6**x **QSPI**, **1**x I²C, **15**x **SENT**, **5**x PSI, **1**x HSSL, **2**x **MSC**, **1**x eMMC
- eVita full **HSM** (ECC256 and SHA2)
- **LFBGA-292 package**
- Developed and documented following ISO 26262/IEC61508 to support safety requirements up to ASIL-D/SIL3
- **AUTOSAR** 4.2 support
- Single voltage supply 5 V or 3.3 V
- Standby mode controller
- Temperature: -40°C to 150°C



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AURIX™– TC33xLP

AURIX™: TC33xLP Series

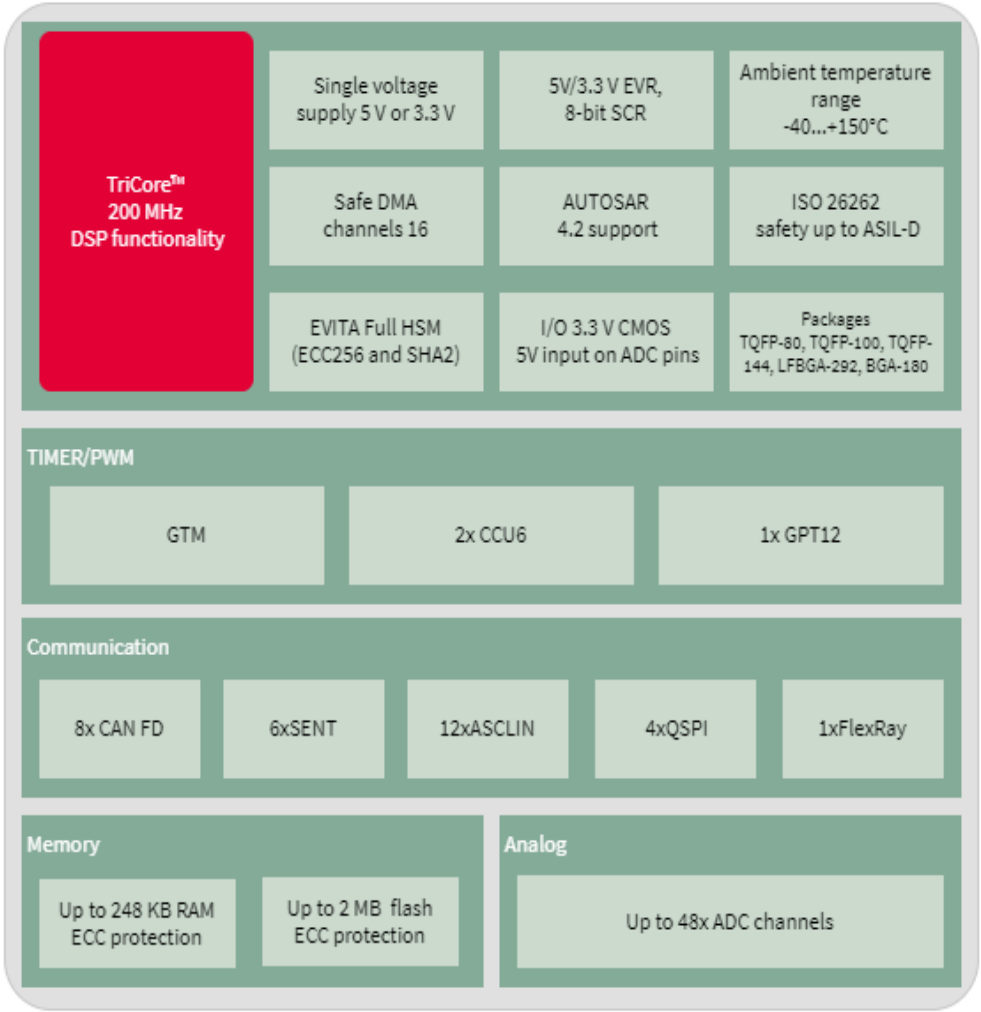
Infineon releases its second generation AURIX™ microcontroller in embedded flash 40 nm technology. It comes back with an increase in performance, memory sizes, connectivity and more scalability to address the new automotive trends and challenges. In terms of performance, T33xLP offers 1 core running at 200 MHz (300 MHz*) and up to 248 KBytes embedded RAM, and consuming below 1 W.

Most innovative safety:

- Best-in-class performance enabling ASIL-D designs
- Upward and downward scalable to the rest of AURIX™ TC3xx family
- Easy migration from AURIX™ TC2xx thanks to high software and hardware compatibility

Key features

- 1 TriCore™ running at 200 MHz (300 MHz*)
- Supporting floating point and fix point with all cores
- 2 MB flash/ ECC protection
- 248 KB SRAM / ECC protection
- **16x** DMA channels
- Redundant and diverse timer modules (GTM, CCU6, GPT12)
- **1x**FlexRay,
- 8**x** CANFD, **12**x ASCLIN, **4**x QSPI, **6**x SENT, **1**x I²S emulation
- eVita full HSM (ECC256 and SHA2)
- LFBGA-292 package
- TQFP-144 package
- TQFP-100 package
- TQPF 80 package
- BGA 180 package
- ISO 26262 ASIL-D support
- AUTOSAR 4.2 support
- Single voltage supply 5 V or 3.3 V
- Standby mode controller
- Temperature : -40°C to 150°C



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AURIX™:
Functional Safety Leadership

AURIX™ TC3xx Feature Table

This is an overview and not the full list. Please refer to datasheet variants addendums for full details.

* 300MHz Option

Feature Set		9xA Series +eXtension (16MB)	9x Series (16MB)	Ex Series (12MB)	8x Series (10MB)	7x Series eXtended (6MB)	7x Series (6MB)	6x Series (4MB)	5xA Series (4MB)	3xA Series (2MB)	3x Series (2MB)	2x Series (1MB)
TriCore 1.6	# Cores / Checker	6/4	6/4	4/2	4/2	3/3	3/2	2/2	3/2	2/1	1/1	1/1
	Frequency	300MHz	300MHz	300MHz	300MHz	300MHz	300MHz	300MHz	300MHz	200MHz*	200MHz*	160MHZ
Accel	Signal Processing Unit (SPU)	2xSPU							2xSPU	1xSPU		
Flash	Program Flash	16MB	16MB	12MB	10MB	6MB	6MB	4MB	4MB	2MB	2MB	1MB
	Data Flash	1024kB	1024kB	1024kB	512kB	256kB	256kB	128kB	128kB	128kB	128kB	96kB
SRAM	Total (DSPR, PSPR, LMU, AMU, EMEM) w/o Cache	6624kB	2528kB	1504kB	1376kB	4064kB	992kB	576kB	3520kB	1480kB	208kB	104kB
DMA	Channels	128	128	128	128	128	128	64	64	64	64	64
ADC	Modules Primary / Sec / FC / DS	8/4/8/14	8/4/8/14	8/4/4/10	8/4/4/10	4/4/4/6	4/4/4/6	4/2/2/4	2/0/0/0	6/0/0/0	2/2/0/0	2/2/0/0
	Channels Primary / Sec / FC /DS	64/60/8/14	64/60/8/14	64/60/4/10	64/60/4/6	32/60/4/6	32/60/4/6	32/32/2/4	16/0/0/0	40/0/0/0	16/28/0/0	16/28/0/0
Timer	GTM TIM / (A)TOM / MCS	64/192/10	64/192/10	56/152/7	56/152/7	40/96/5	40/96/5	24/64/3	-	-	16/40/0	16/40/0
	CCU / GPT modules / bit streaming	2/1/1	2/1/1	2/1/0	2/1/0	2/1/0	2/1/-	2/1/0	2/1/1	2/1/1	2/1/0	2/1/0
Interfaces	FlexRay (mod / channels)	2/4	2/4	2/4	2/4	1/2	1/2	1/2	1/2	0/0	1/2	0/0
	CAN-FD / TT	12/1	12/1	20/1	12/1	12/1	8/1	8/1	8/0	4/0	8/0	6/0
	QSPI / ASCLIN / I2C / I2S(emulation)	6/12/2/1	6/12/2/1	5/24/2/1	5/24/2/1	5/12/1/1	5/12/1/1	4/12/1/1	4/4/1/1	4/6/0/1	4/12/0/1	4/6/0/1
	SENT / PSI5 / PSI5S	25/4/1	25/4/1	25/4/1	25/4/1	15/2/1	15/2/1	10/2/1	0/0/0	6/0/0	6/0/0	6/0/0
	HSSL / MSC / EBU	2/4/1	2/4/1	1/3/0	1/3/0	1/2/0	1/2/0	1/1/0	0/0/0	0/0/0	0/0/0	0/0/0
	Ethernet (100Mbps/1Gbps)	1	1	1	1	2	1	1	1	1	-	-
	SDMMC (eMMC / SDIO)	1	1	1		1				1		
	Radar / ext. ADC IF (RIF)	8x400Mbps LVDS	-	-	-	-	-	-	8x400Mbps LVDS	4x400Mbps LVDS	-	-
	Camera IF (CIF)	-	-	-	-	1	-	-	-	-	-	-
Security	HSM (AES128, ECC256, and SHA2)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Safety	SIL Level	ASIL D	ASIL D	ASIL D	ASIL D	ASIL D	ASIL D	ASIL D	ASIL D	ASIL D	ASIL D	ASIL D
Power	EVR (3.3V / 5V)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	Standby Control Unit	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

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AURIX™ TC3xx to AURIX™ TC2xx

SRAM Overview

	16MB	12MB	10MB	8MB	6MB		4MB			2.5MB	2MB			1MB	
	39xXX	3E7Qx	38xQ	29xT	37xTX	37xT	27xT	36xD	35xTA	26xD	33xDA	33xL	23xL	32xL	22xL
PSPR	6x64	4x64	4x64	32+32+32	3x64	3x64	24+32+32	2x32	3x64	16+32	32+64	8	8	8	8
P-Cache	6x32	4x32	4x32	16+32+32	3x32	3x32	8+16+16	2x32	3x32	8+16	2x32	32	8	32	8
dLMU	6x64	4x64	4x64	-	3x64	3x64	-	2x64	3x64	-	8+64	8	-	-	-
DSPR CPU 0/1	2x240	2x240	2x240	120+240	2x240	2x240	112+120	2x192	2x240	72+120	192+96	192	184	96	88
DSPR CPU 2-5	4x96	2x96	2x96	240	1x96	1x96	120	-	1x96		-	-		-	
D-Cache	6x16	4x16	4x16	3x8	3x16	3x16	0+8+8	2x16	3x16	0+8	2x16	16	-	16	-
Global LMU	768	256	128	32	-	-	32	-	512	-	-	-	-	-	-
DAM	128	64	64		32	32	-	-	-	-	-	-	-	-	-
EMEM	4096	-	-		3072	-		-	2048		1024	-	-	-	-
All SRAM w/cache	6912	1696	1568	832	4208	1136	728	672	3664	296	1576	252	200	152	104
All SRAM w/o cache	6624	1504	1504	712	4064	992	576	576	3520	240	1480	208	192	104	96

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AURIX™:
Safety Leadership

AURIX™ Key features for Industrial Applications

Small BGA packages

Space Reduction

Pin2Pin compatible
Platform concept

Scalability

Packages: QFP-80 to BGA-516
*Memory: 512KB to **16MB***

Safety

IEC 61508 SIL3 for industry

Security

HSM in the era of Industry 4.0

Connectivity

GETH + 12x CAN
TSN as next Industrial Fieldbus
EtherCAT Master
CANopen Stack ported
FreeRTOS support for Cloud capability – e.g. AWS

Performance

Up to 6x 300MHz
7k DMIPs (TC39xx)
For SIL3 applications, up to 4k DMIPs

Long term availability

Min. 2034

Infineon application expert support

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AURIX™ TC3xx Leading the way

1st Microcontroller to receive TÜV ISO 26262:2018 certification!

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NEW!!! AURIX™ gets IEC61508 Certified

1st Microcontroller to receive TÜV ISO 26262:2018 certification!

IEC 61508 compliance certified by TÜV SAAR for **TC39xBC** – baseline for the certificate

Certificate available since 30.06.2021

All documents released on MyICP

More on the topic could be found in

Where AURIX™ stands for Safety?

Probability of Dangerous Failure per Hour (PFHd) 10e-9	SIL IEC 61508	SIL EN 62061	PL EN ISO 13849	AgPL ISO 25119	ASIL ISO 26262
10e-8	4	-	-	-	-
10e-7	3	3	e	e	D
10e-6	2	2	d	d	C
					B
3x10e-6	1	1	c	c	A
10e-5			b	b	
1,00E-03	-	-	a	a	QM
	-	-	-	QM	

Risk of Failure

Equivalency within multiple IEC 61508 standards across several applications

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AURIX™: Hardware Functional Safety Leadership

IEC 61508

Automotive	➔	ISO 26262
Machinery	➔	IEC 62061
Railway	➔	EN 50129
Nuclear Power	➔	IEC 61513
Process Industry	➔	IEC 61511
Household Appliances	➔	IEC 60335
Furnaces	➔	IEC 50156
Agriculture	➔	ISO 25119
Aviation	➔	DO-178

AURIX ™ full support

The AURIX™ architecture is developed to allow compliance with multiple IEC 61508 across several applications

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AURIX™ Functional Safety concept
Holistic approach with a multitude of hardware measures

HW designed for functional safety

Superior Lockstep CPU with Anti-core in inverse logic

Core

CPU

CЬN

Anti-Core

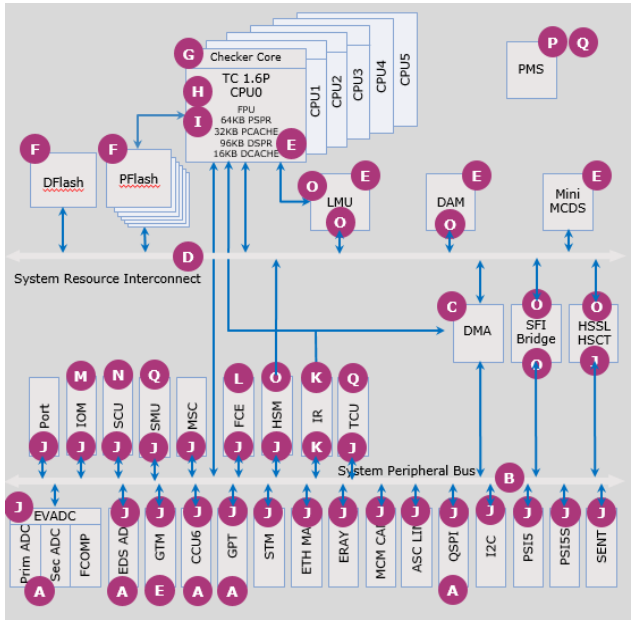
Holistic safety concept in core, memories, peripherals, buses

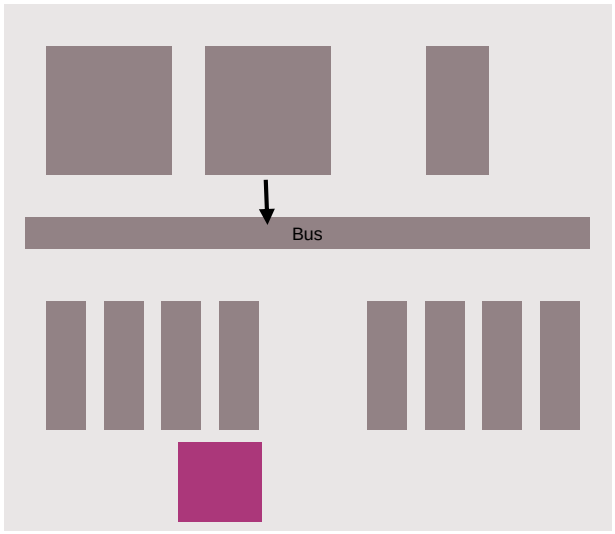
SMU for alarm and fault management in one control point

3-layer access protection:

- Memories
- Peripherals
- Global registers

Much more than just a safety island!!



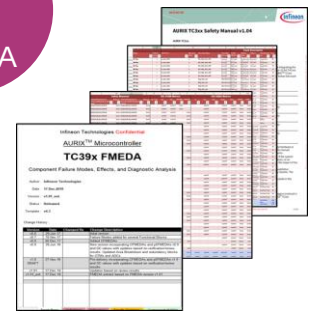


Safety measures

- A Redundant, spatial separated peripherals
- B Safe SPB
- C Safe DMA
- D Safe SRI
- E SRAM ECC
- F Flash ECC
- G Lockstep core
- H CPU self tests (90% Latent Fault Metric)
- I Memory protection core
- J Register access protection
- K Safe Interrupt Processing
- L Flexible CRC Engine (FCE)
- M IO Monitor
- N Clock Monitoring
- O E2E protection
- P Power Supply Monitoring
- Q Self Test

Everything documented

50k lines FMEDA



Comprehensive safety manual & Fully Configurable FMEDA

- Provides all relevant information necessary for safety analysis
- Can by tailored to match the user configurations

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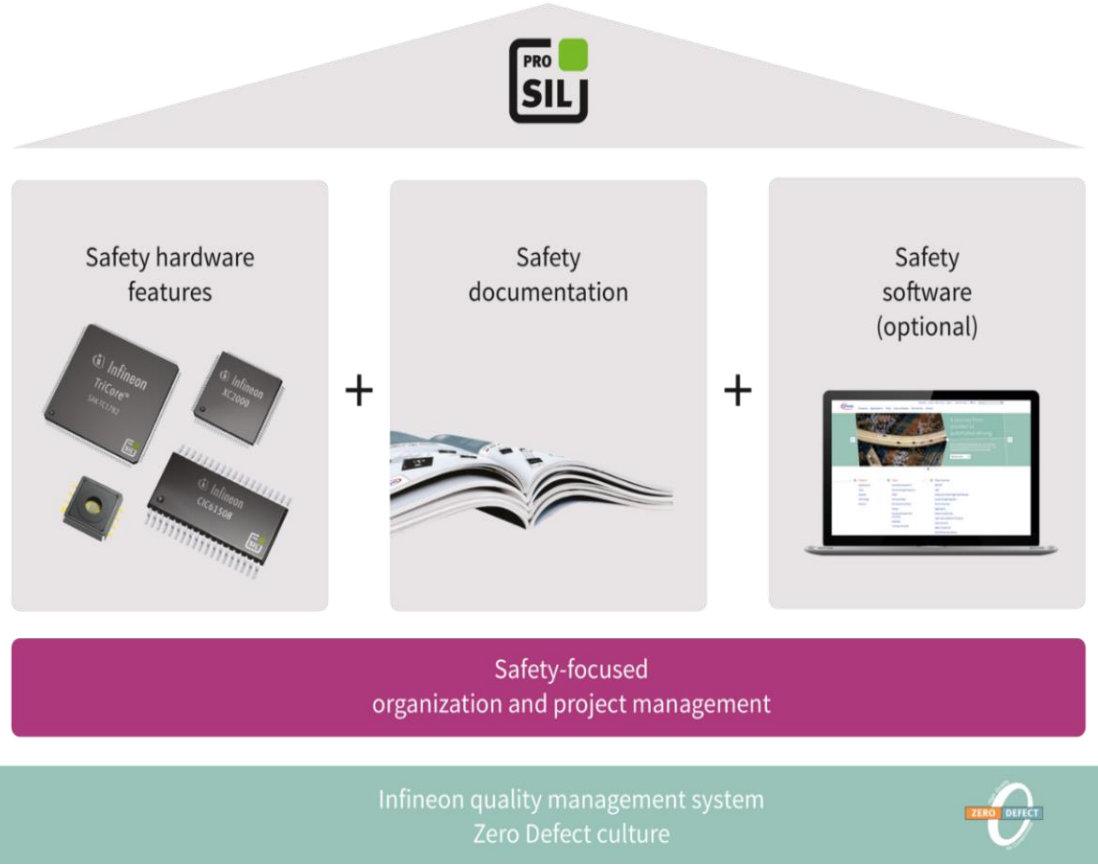
AURIX™: Hardware Functional Safety Leadership

What is PRO-SIL™?

- PRO-SIL™ shows where an Infineon product has SIL (Safety Integrity Level) features
- Allows Infineon products to attain SIL (IEC 61508) and ASI ISO 26262) level for safety systems



Safety concept training can be found here

More about PRO-SIL ™ can be found here

The AURIX™ is PRO-SIL™ compliant with safety hardware features throughout. Documentation may require an NDA. PRO-SIL™ SafeTlib Safety Software is available.

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AURIX™ TC2xx / TC3xx Infineon embedded software offer

AUTOSAR MCAL	MC ISAR AUTOSAR-compliant MCAL including: ▪ Standard AUTOSAR drivers for initialization, input/output (e.g. DIO, PWM, ADC…), communication (CAN, LIN, FlexRay, Ethernet), memory abstraction (FEE FLASH EEPROM Emulation), libraries (e.g. CRC…) ▪ Additional complex drivers (e.g. DMA, UART…)
SAFETY SW	AURIX™ TC2xx “SafeTlib”: ▪ Set of SW tests to support applications with functional safety requirements including “Software Based Self Test” (SBST) for the CPU core ▪ Support of system integration with application-dependent tests ▪ Handling of internal and external watchdogs (SafeWDG) AURIX™ TC3xx: ▪ Most SafeTlib test merged into the Hardware ▪ SBST for the CPU core and SPU
Security SW	▪ The crypto libraries and software stack is provided via 3rd party partners (Elektrobit, ETAS/Escrypt, Vector, Integrity Security Services ISS) including ▪ SHE+, key management/storage, secure boot, secure SW update (incl. SOTA), secure onboard communication, etc.
Infineon Low Level Drivers (ILLD)	▪ Free of charge Drivers to abstract the basic functionality of the peripherals
Virtual prototype	▪ Virtual representation (model) of the Silicon
Customization	▪ Optimization of available MCAL and SafeTlib for e.g. different compiler versions or customer specific requirements

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AURIX™ TC2xx / TC3xx tool, software, service partner

Embedded Software Solutions

- AUTOSAR suites
- Operating systems
- Hypervisor
- Middleware and stacks
- Libraries and driver
- Security and safety

Hardware and Software Development Tools

- Compiler toolchains
- Debugger and test tools
- Software automation
- Timing and program analysis
- Simulation and modelling
- Virtual prototyping
- Calibration and data measurement
- Rapid prototyping
- Verification and rule checker
- Flash programer

Training and Services

- Soft. and hardware coaching
- Flash programming services
- Engineering services and training

Free Tools

- Compiler and debugger toolchains
- Configuration and pin mapper
- Flash programmer

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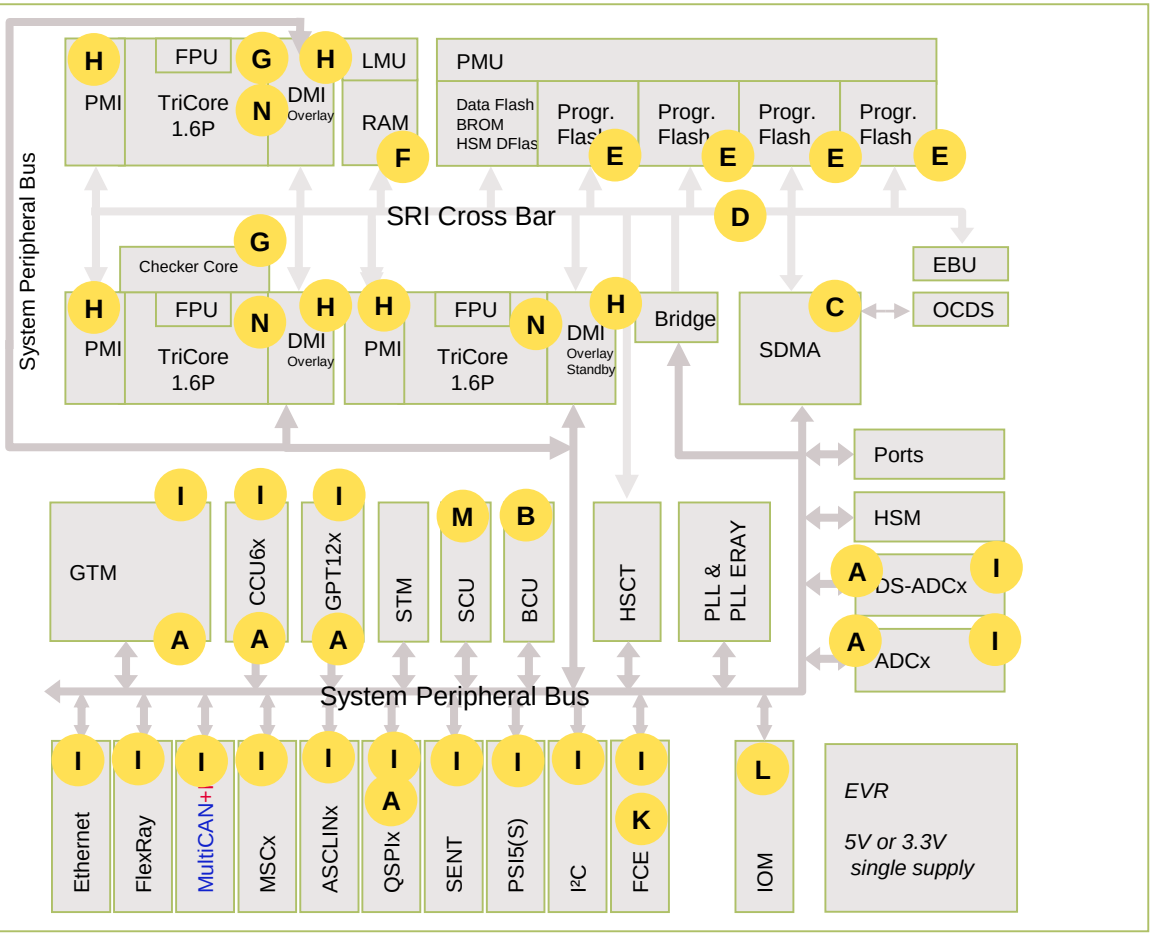
AURIX™: Hardware Functional Safety Leadership



- A Redundant, spatially separated peripherals
- B Bus Monitoring Unit
- C Safe DMA
- D Safe SRI
- E FLASH ECC (detects multi bit failures)
- F SRAM ECC (detects multi bit failures)
- G Lockstep core
- H Memory protection core
- I Memory protection peripherals
- J Safe Interrupt Processing
- K Flexible CRC Engine (FCE)
- L IO Monitor
- M Clock Monitoring
- N CPU self tests (90% Latent Fault Metric)

SAFETY is more than just a lockstep core.
AURIX™ is designed with Pro-SIL™ (Safety Integrity Level) features throughout

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AURIX™:
Security Leadership

Infineon is a key player in security standardisation

E-safety Vehicle Intrusion proTected Applications

Infineon was a project partner in the Evita organisation which specified the design, verification and prototyping processes required to implement a secure architecture for automotive on-board electronics networks.

SHE
In production

- HIS Compliant
- Pre-curser to EVITA

AURIX™ HSM
SoP 2015+

- Medium Evita

On Board Comms

AURIX™ TC3xx HSM
SoP 2019+

- Full Evita for V2V /V2X

On Board Comms

External Comms

AUDOMAX → AURIX™ TC2xx → AURIX™ TC3xx

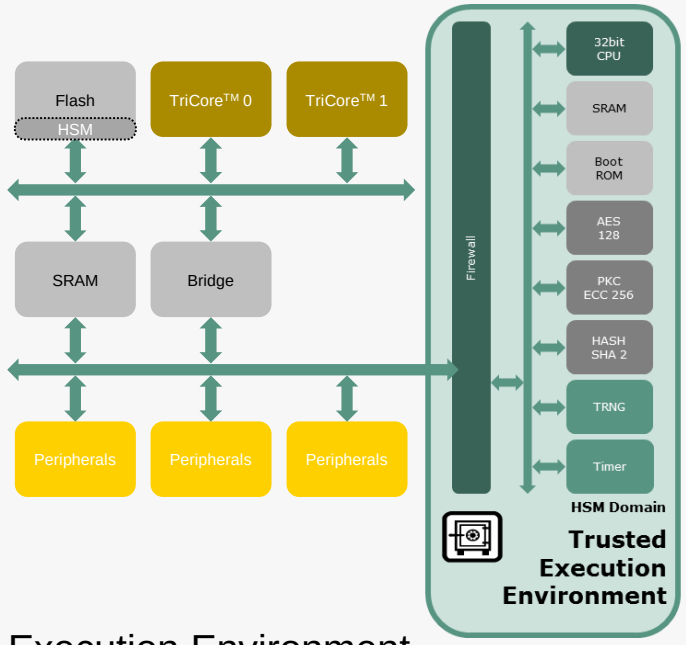
AURIX™ TC2xx to AURIX™ TC3xx: Security Concept Evolution

AURIX™ TC2xx Security Features	AURIX™ TC3xx Security Features
HSM Crypto Engine Symmetric	**HSM Crypto Engine** Symmetric & Asymmetric encryption
SOTA updates From central & local storage	**SOTA updates** Includes double program flash (A/B swap)
Security Standards Medium EVITA	**Security Standards** Full EVITA
Security Software Infineon SHE+ and partner solutions	**Security Software** Via Partnership with industry security experts

AURIX™ TC3xx now provides automotive security as standard across the whole family

AURIX™ TC3xx HSM: Automotive Security Leadership

What is the AURIX™ TC3xx Hardware Security Module (HSM)?



- Trusted Execution Environment
- 32-bit ARM MCU separated by firewall
- Reserved access to shared NVM to host OEM application SW

AURIX™ TC3xx HSM Use Cases

- On Board and external Communications

AURIX™ HSM Crypto Accelerators

- **On-chip Symmetric:** HW AES-128
- **Asymmetric:** HW ECC 256, SHA2

AURIX™ HSM Security Level

- EVITA Full

AURIX™ TC3xx provides security leadership by enabling secure on-board communications.
HSM is available as standard on all AURIX™ TC3xx devices.

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AURIX™:
Extreme Temperature Leadership

AURIX™: Extreme Temperature Leadership

Standard Automotive Temp (SAK)

- Standard Auto Temp range
  - -40 to + 125°C

Infineon HOT Package (SAL)

- Upgraded to
  - -40 to + 150°C

Potential Application

- Anywhere where extreme temperatures are required
- Examples include, transmissions, All wheel drive, starter generator….

No other scalable Automotive MCU family can offer HOT package, SAFETY and SECURITY across the entire product range

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AURIX™: tools and software ecosystem

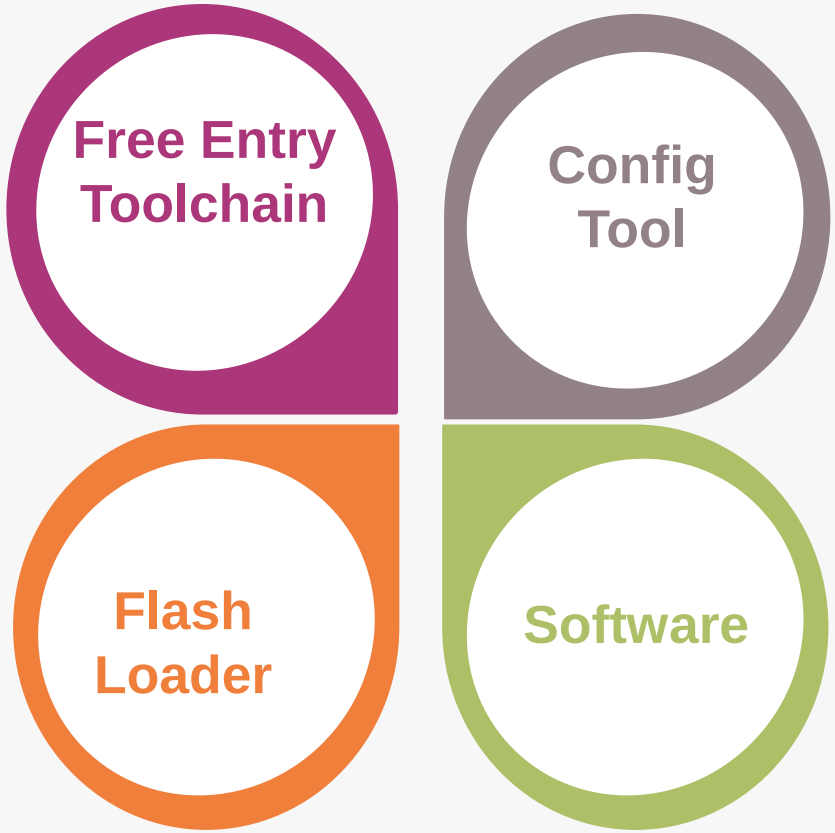
AURIX™ Getting Started: Free Tools

AURIX™ Free Tool Chain

- **Provider:** HighTec
- Eclipse based IDE
- GNU C compiler
- On-chip flash programming

AURIX™ Free Flash Loader

- **Provider:** Infineon Mem Tool
- Flash Programmer
- Data Communication



AURIX™ Configuration

- **Provider:** Altium Tasking
- AURIX™ TC3xx™ ACT pin mapping
- Drivers files + OS
- Compiler and debugger

AURIX™ Software

- **Provider:** Infineon
- Mem Tool – on chip flash programming
- DAS (Device Access Server) tool interface

It's easier than ever to get started with AURIX™ free Tools

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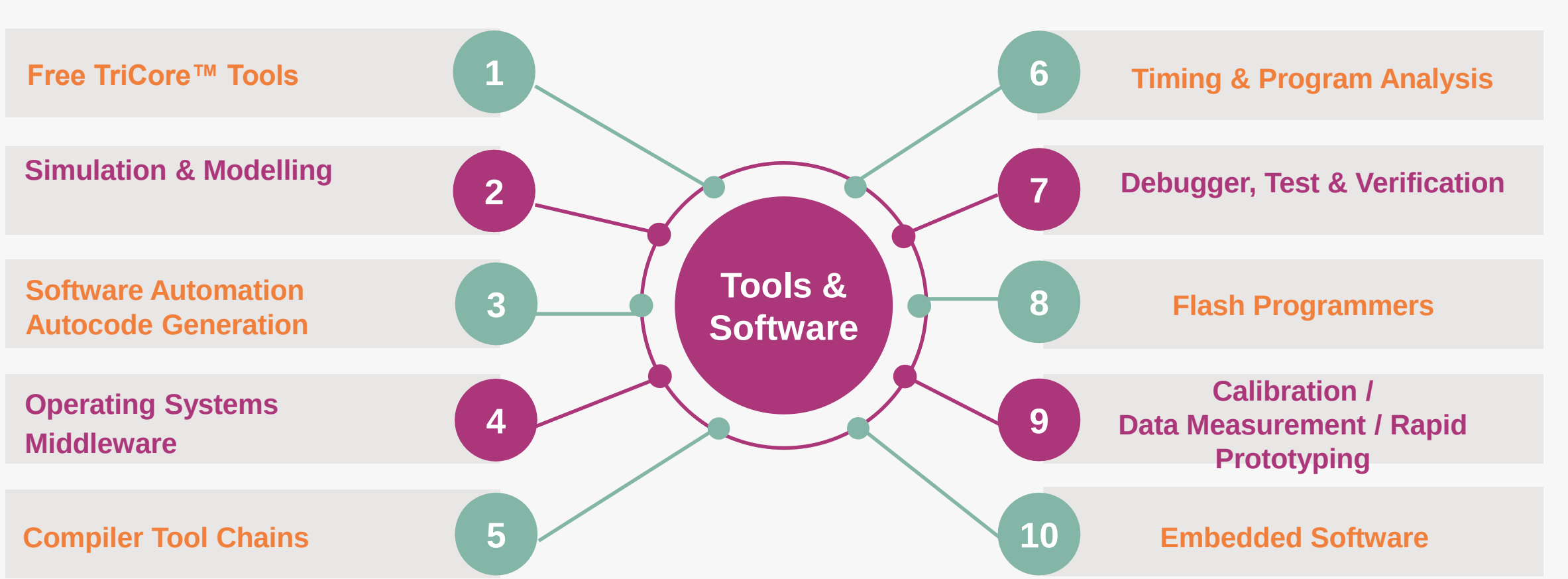
AURIX™ Tools & Software Ecosystem



Infineon, together with our partners, has created an extensive AURIX™ Tools and Software Ecosystem.
Find the solution that works for you!

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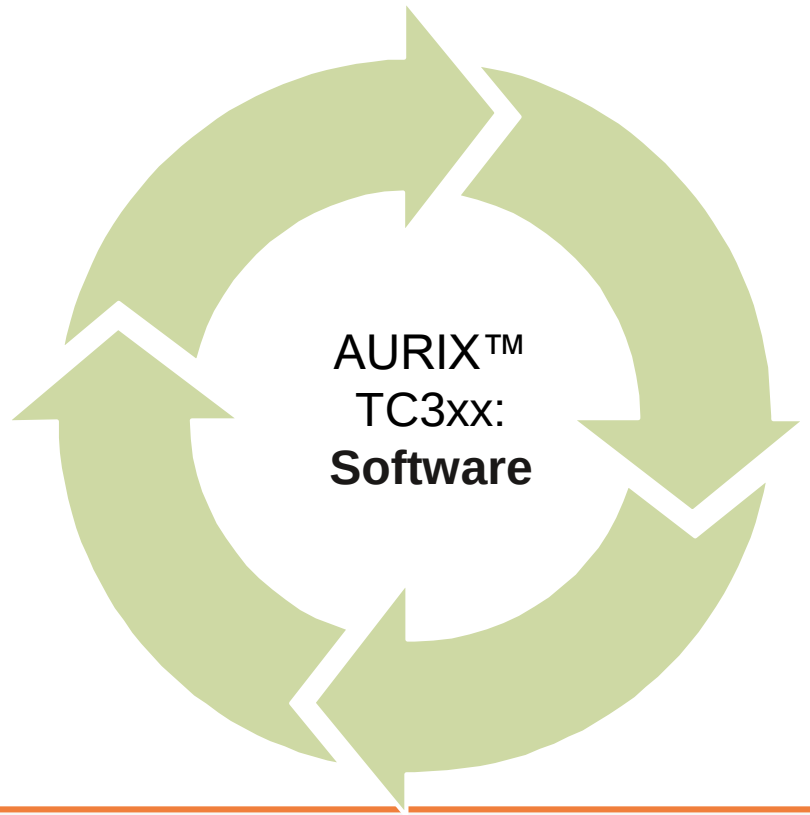
Infineon AURIX™ TC3xx: Software portfolio



Infineon and partners deliver high quality, hardware optimized, software

Basic AUTOSAR Package

- AUTOSAR MCAL: v4.2.2, TC4.3 x (on request)
  - MC-ISAR Basic (Base, MEM, COM Basic)
  - MC-ISAR COM Enhanced
  - MCAL Complex Driver MCD and Demo code

Infineon Basic Safety Software

- SBST Software Based Self Test for ASIL-B non lockstep core
- SBST for Radar ASIL-C SPU
- External watchdog driver for external watchdog device (TLF 3x) in development with external partner (Hitex)
  - SafeTlib made obsolete by self-test functionality in HW

Security Software via Parters

- SHE+ driver
- AUTOSAR v4.3 crypto driver
- Intrusion detection

Software Libraries

- Infineon DSP Lib
- LAPACK via partner

Getting Started Software

- iLLD Infineon low level driver

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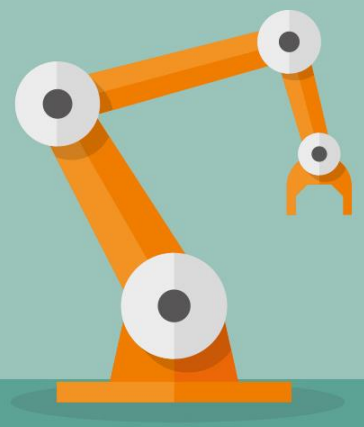
Safety software for industrial applications

AUTOSAR

- Excellent for most of Automotive applications
- Expensive and complex if not required
- Not necessary for many industrial / CAV apps. and also some automotive apps.

How to achieve safety compliant solutions for industrial / CAV app. without *AUTOSAR*?



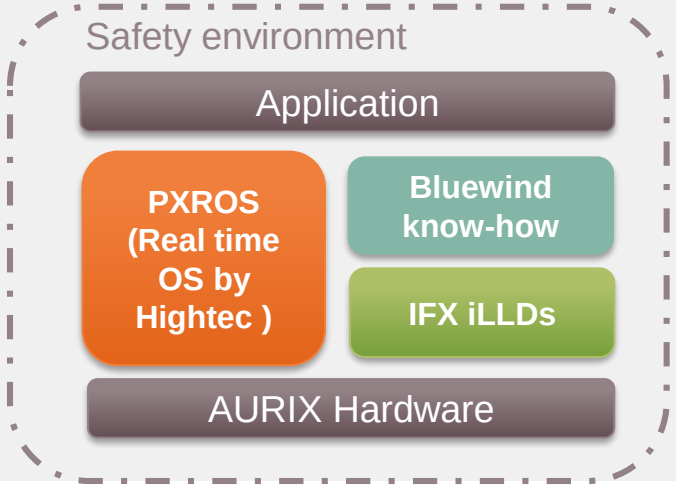
Infineon ILLDs are the answer!

- Free of charge low level drivers for AURIX
- ILLDs certification for IEC61508 under consideration
- Partnership IFX and Bluewind for support on ongoing projects

Infineon + bluewind

More Info: www.bluewind.it/aurix_industrial

Bluewind approach: Encapsulate ILLDs drivers in PXROS tasks to guarantee safety



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AURIX™ TC3xx: Embedded Software Solution MC-ISAR

Why Infineon MC-ISAR Software?

1. MC-ISAR low-level drivers based are on the AUTOSAR MCAL layer, the standard in automotive
2. Customer gets optimized software based on IFX hardware expertise.
3. Infineon saves the opportunity cost of SW developers
4. Leaves more time to differentiate with systems level software

A solution you can trust

Infineon has offered AUTOSAR in production since 2009!

To find our how to license MC-ISAR software, please contact tac@infineon.com

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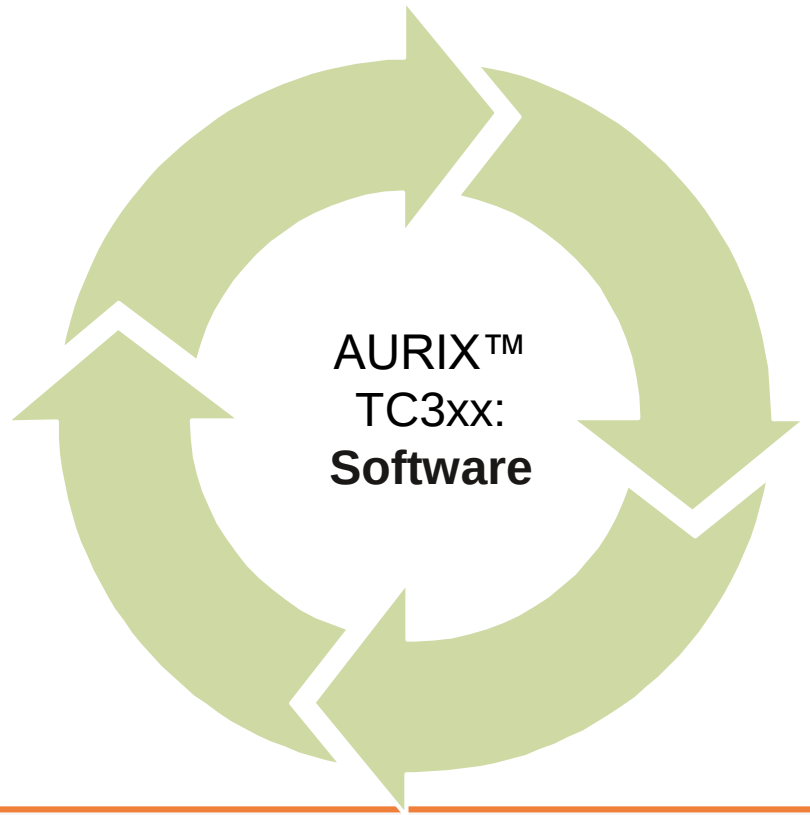
Infineon AURIX™ TC3xx: Software portfolio



Infineon and partners deliver high quality, hardware optimized, software

Basic AUTOSAR Package

- AUTOSAR MCAL: v4.2.2, TC4.3 x (on request)
  - MC-ISAR Basic (Base, MEM, COM Basic)
  - MC-ISAR COM Enhanced
  - MCAL Complex Driver MCD and Demo code

Infineon Basic Safety Software

- SBST Software Based Self Test for ASIL-B non lockstep core
- SBST for Radar ASIL-C SPU
- External watchdog driver for external watchdog device (TLF 3x) in development with external partner (Hitex)
  - SafeTlib made obsolete by self-test functionality in HW

Security Software via Parters

- SHE+ driver
- AUTOSAR v4.3 crypto driver
- Intrusion detection

Software Libraries

- Infineon DSP Lib
- LAPACK via partner

Getting Started Software

- iLLD Infineon low level driver

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AURIX™: Extensive Ecosystem

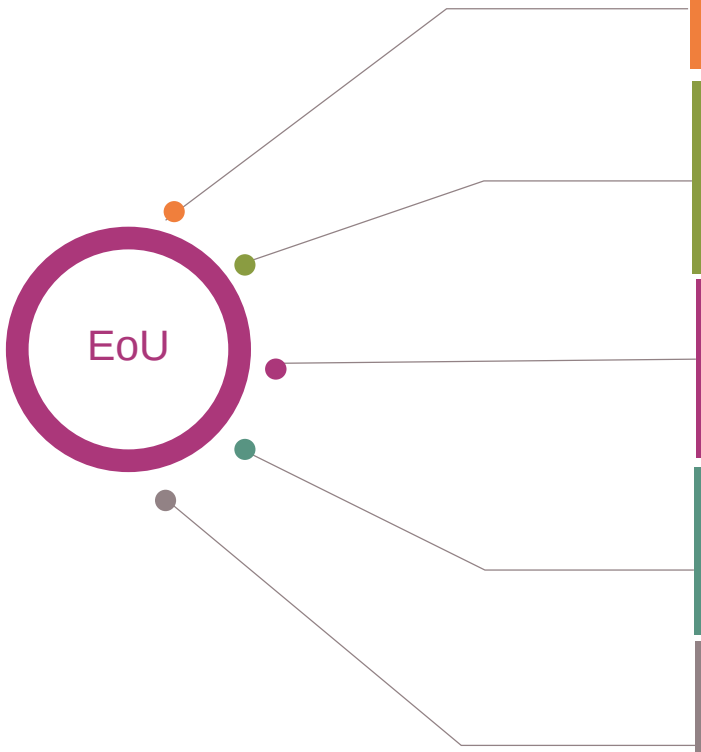
AURIX™ : Ease-of-Use (EoU) - More than just one MCU

Not Only:

- Safe and secure campanion chip (ISO fuctional safety standard and EVITA FULL security standars
- Highest scalability in performance, memory& peripherals across applicatios

But also:

- A solution with fully fuctioning supported ecosystem



Full documentation available online for AURIX™ in order to support our customers

- High quality web pages and content including:
  - Product pages, Trainings, documentation
  - New tools and software ecosystem
  - New partner ecosystem

- AURIX™ Development Studio
  - New IDE Free off charge
  - Expert trainings
  - Code examples

- AURIX™ Forum
  - Customers can find answers by themselves
  - Increase the traffic in the forum
  - A maintained forum as first support

- Buy online & New kits
  - Aurix Lite kit for AURIX™ TC2xx & TC3xx
  - Stock availability for buy online (kits and devices)

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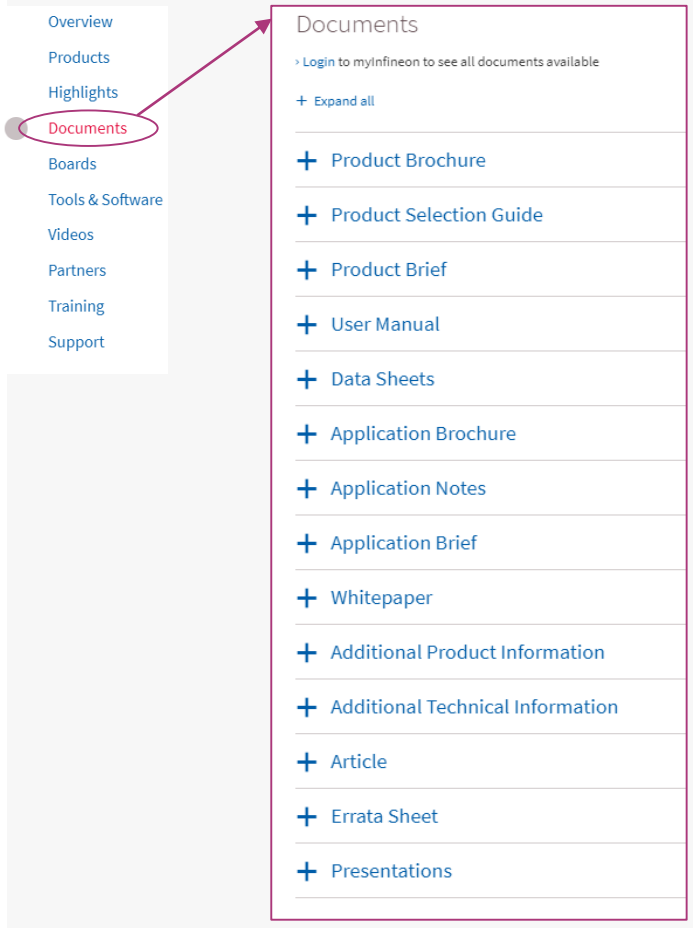
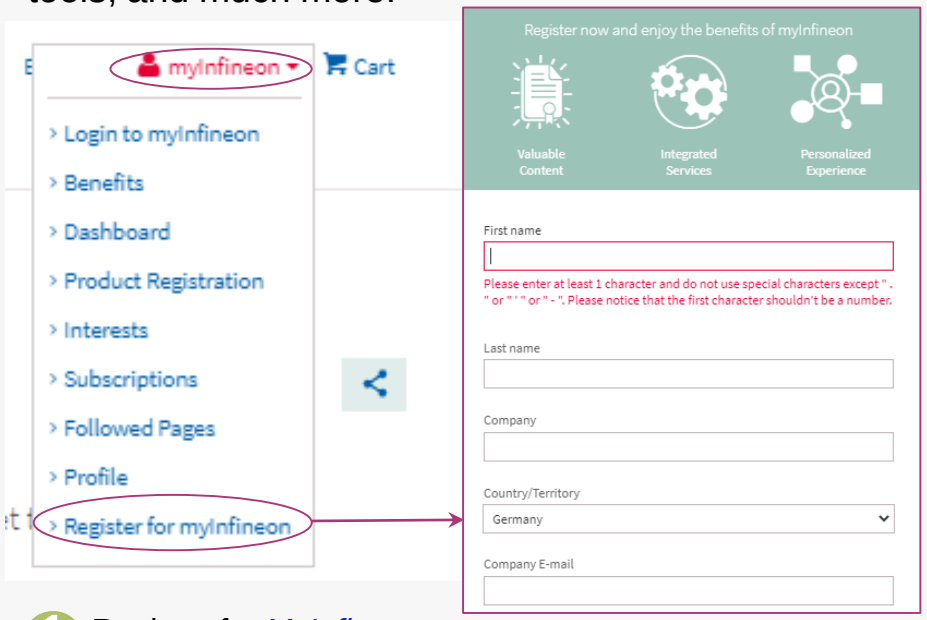
Infineon MCU Documentation: Multiple options of access

Access to public documentation



Access to additional confidential documentation

Collaboration Platform you can get access to additional add-on technical documentation, trainings, tools, and much more.



1. Register for *MyInfineon*
2. Send an email to AURIX@infineon.com
3. You will receive a confirmation which explains how to use your new access

For more guidance on available documentation and MyICP process Please visit our

MCU documentation Platform

- AURIX™ documentation
- PSoC™ 4 documentation
- TRAVEO™ II documentation

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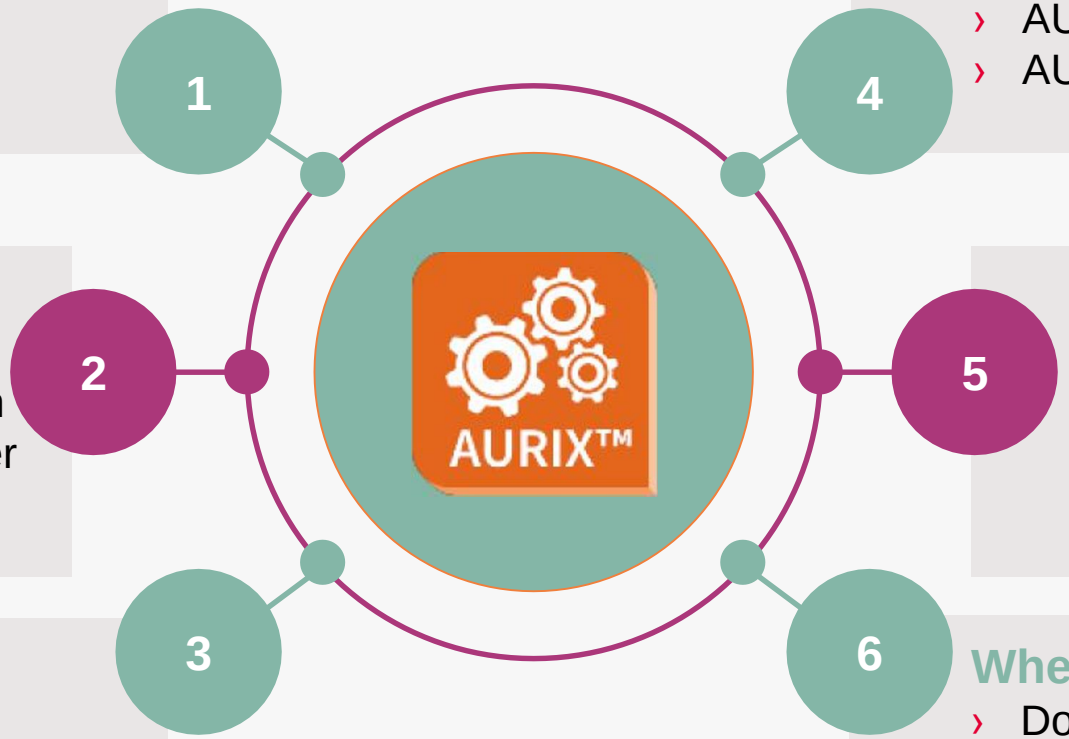
AURIX™ Development Studio (ADS) - Overview

Eclipse base IDE (06/2020)
- Editor
- TASKING Compiler
- TASKING Debugger

Usage
- Free-of-charge
- No code size or time limitation
- TASKING Compiler&Debugger for non-productive use only

Integrated Tools
- Serial Monitor
- Flash Programmer
- TASKING Pin Mapper
- Project Creator with iLLDs



Device Support
- AURIX TC2xx
- AURIX TC3xx

Ease-of-Use
- Download and installation in one go
- Get project running within a few minutes

Where to get it?
- Download within the Infineon Toolbox

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AURIX™ TC2xx kits – Evaluation and starter Kits

Lets get started!

Supported by ADS

AURIX™TC275 Lite Kit

- AURIX™ TC275 Device in LQFP-176 package
- FTDI based Debugger with micro USB
- Use of Arduino Uno/ compatible platform

KIT_AURIX_TC275_LITE Infineon Technologies

Supported by ADS

Arduino Shield Buddy

- The Hitex TC275 ShieldBuddy follows the Arduino standard
- Compatible with 100's of Arduino application shields
- Evaluation licenses available

KIT_AURIX_TC275_ARD_SB

Partially Supported by ADS

AURIX™ TFT

- Low cost board for early evaluation with limited access to signals
- Additional touchscreen display for convenient handling
- TFT board available for every silicon

KIT_AURIX_TC2xx_TFT

Partially Supported by ADS

AURIX™ TriBoard

- Full evaluation board for development to write and debug your 1st programs
- Includes Getting Started advice, free TriCore™ Entry Tool Chain , technical documentation, compiler and debugger.
- TriBoard available for every silicon

KIT_AURIX_TC2xx_TRB

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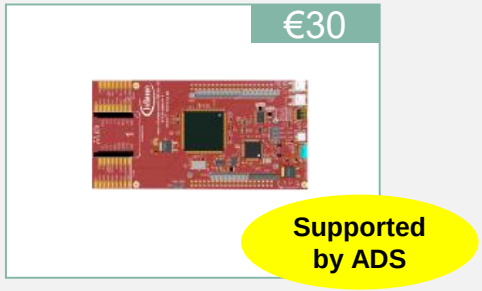
AURIX™ TC3xx kits – Evaluation and starter Kits

Lets get started!

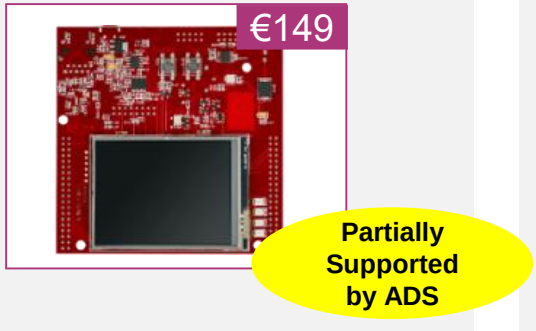


AURIX™TC375 Lite Kit

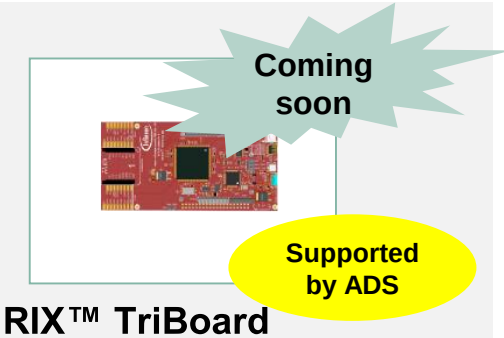
- AURIX™ TC375 Device
- **Ethernet PHY**
- FTDI based Debugger with micro USB
- Use of Arduino Uno/ compatible platform
- KIT_A2G_TC375_LITE - Infineon Technologies

Arduino Shield Buddy

- The Hitex TC375
- ShieldBuddy follows the Arduino standard
- Compatible with 100's of Arduino application shields
- Evaluation licenses available
- KIT_A2G_TC375_ARD_SB - Infineon Technologies



- Low cost board for early Low cost board for early evaluation with limited access to signals
- Additional touchscreen display for convenient handling
- TFT board available for every silicon
- 32-bit TriCore™ AURIX™– TC3xx - Infineon Technologies



AURIX™ TriBoard

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- TriBoard available for every silicon

KIT_AURIX_TC3xx_TRB

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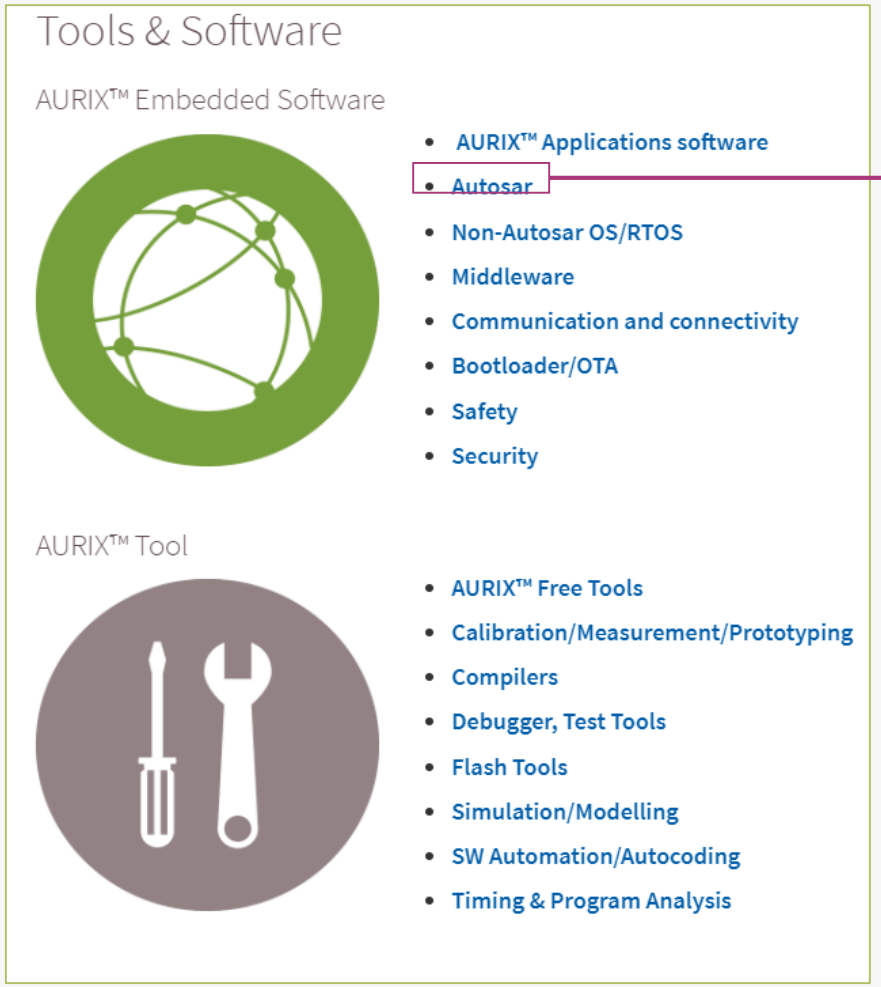
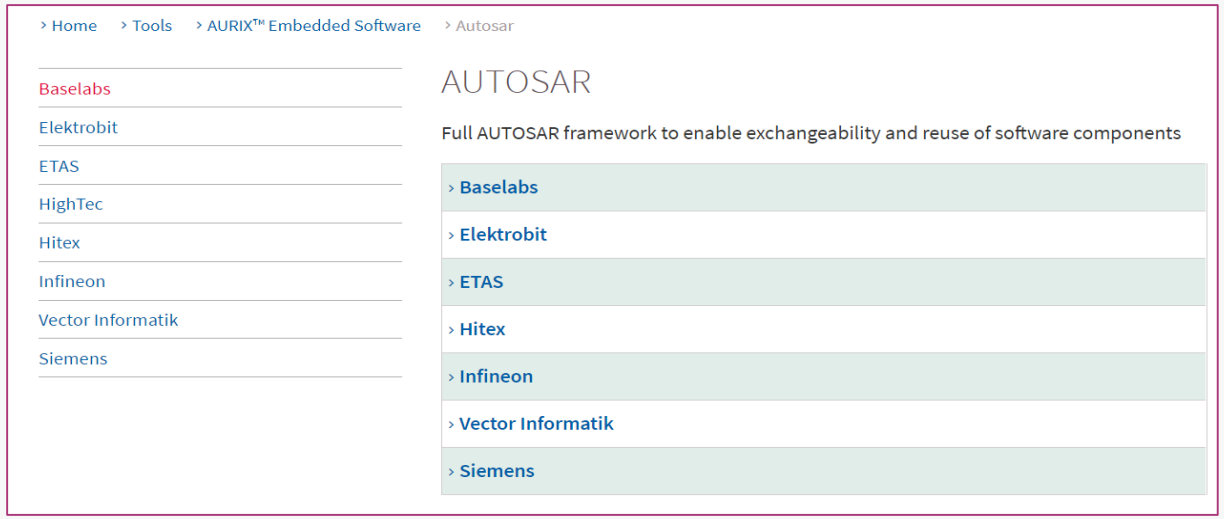
Easy to reach Tools and Software ecosystem

1 Find what you need in a glace



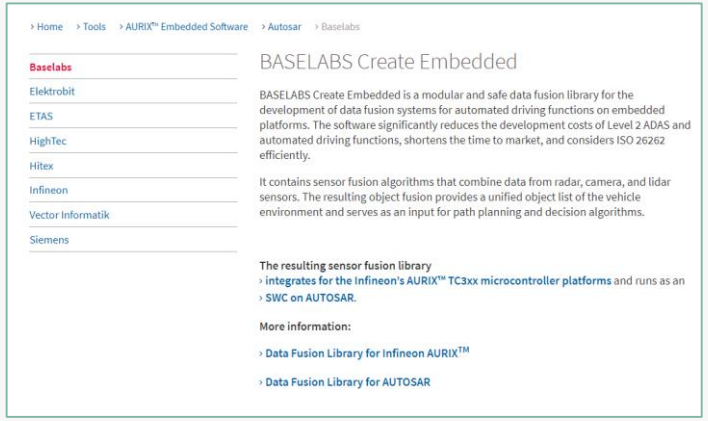
2 Go directly to the category that interests you



3 Within a click, see all our partners offerings in the different sections

www.infineon.com/aurix embeddedsoftware

www.infineon.com/aurix tools



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Video and eLearning Platform for more support you

AURIX™ Video Hub Video

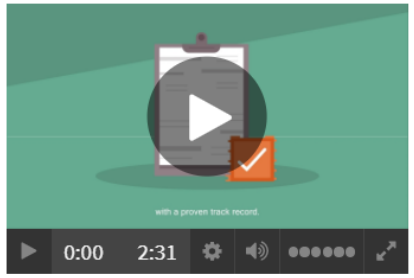
- Get Started with AURIX™
- AURIX™ Microcontroller and its applications
- AURIX™ Microcontrollers for makers
- Discover AURIX™ Starter Kits with our Engineers
- AURIX™ trainings and E-learnings

AURIX™ Video Hub

Welcome to Infineon AURIX™ Video Hub!

Want to learn how AURIX™ is the ideal platform for a wide range of automotive and industrial applications, as well as, how it can also be used for a diversified variety of projects and environments? Our Video Hub aims to assist you in getting all the fundamental knowledge about AURIX™ and its product families.

From an overview of the features and softwares of AURIX™ kits, to use cases of AURIX™ Microcontrollers for different applications - Find all AURIX™ related videos with just a click!



Introducing AURIX™, Infineon's MCU solution.

Take a look at AURIX™ microcontoller. The chip that fulfils all your needs, with a proven track record.

Special section to our E-Learning

- Get Started with AURIX™
- AURIX™ Microcontroller and its applications
- AURIX™ Microcontroller for makers
- Discover AURIX™ Starter Kits with our Engineers
- AURIX™ trainings and E-learnings

Our Trainings and E-Learnings

AURIX™ Ease of Use

- Easily navigate through our website infrastructure and indicate where to find AURIX™ easy-to-reach sources of information and documentation
- Easily identify our tools and software platform, our partner ecosystem as well as our kits platform and its support ecosystem

› Watch eLearning

Basics of software over-the-air concept using AURIX™

- Get to know why systems require frequent updates, how this is done and how automotive systems try to ensure their security when they are updated
- Learn how AURIX™ families of microcontrollers support over-the-air software updates

› Watch eLearning

https://www.infineon.com/aurixvideohub

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Part of your life. Part of tomorrow.