

Dual Gate MOSFET 48 V switch board Quick introduction Board V2.2

IFAG ATV MOS 24.09.2024



SOA and RDSON comparison Dual Gate trench vs. Standard trench vs. Planar





	IAUTN08S5N012L Dual Gate 80 V OptiMOS™ 5 Trench technology	IAUT300N08S5N011 Standard 80 V OptiMOS™ 5 Trench technology	IPB80N08S2-07 Standard 80 V OptiMOS™ Planar technology
SOA 1 ms at max V_{DS} , $T_C = 25^{\circ}C$	14 A (Linear MOSFET)	1.7 A	14 A
R_{DSON} at V_{GS} = 10 V, T_{J} = 25°C	1.15 m Ω (Linear and On MOSFET)	1.10 mΩ	7.1 mΩ
Package footprint	TOLL (10x12x2.3 mm ³)	TOLL (10x12x2.3 mm ³)	D2PAK (15x11x4.4 mm ³)

Combining the best of 2 worlds with Dual Gate

Reaching levels of Planar MOSFET SOA, maintain low R_{DSON} and small solution size of trench technology

SOA comparison Standard OptiMOS[™] 5 vs. Dualgate Linear FET OptiMOS[™] 5





Dual Gate (Linear FET) OptiMOS[™] 5

Dual Gate (Linear FET) SOA significantly larger at high V_{DS}

Enabling new applications as e.g. in-rush current limitation, short circuit clamping and slow switching

Transfercharacteristics comparison Standard OptiMOS[™] 5 vs. Dualgate Linear FET OptiMOS[™] 5





Standard OptiMOS[™] 5

Dual Gate (Linear FET) OptiMOS[™] 5

Dual Gate (Linear FET) improved current accuracy due to low transconductance and process variation

Enabling paralleling in linear mode operation

Dual Gate MOSFET 80 V Application examples



Capacitor charging

- LINFET current limited via V_{GS} adjustment according to transfer-characteristics.
- Pulsed capacitor charging to limit self-heating.
- Flexible control of PWM and switching speed.
- ONFET can be turned on to minimize steady state losses after capacitor is fully charged.



Short circuit clamping

- D_C limits the V_{DS} voltage to avoid avalanche and instead the MOSFET operates in linear mode.
- LINFET allows higher currents in linear mode and paralleling for clamp circuit designs. Protection components (e.g. TVS diodes) can be saved.
- ONFET can be turned on to minimize steady state losses during normal operation.



Dual Gate MOSFET 80 V Capacitor pre-charging with power resistor vs. Dual Gate MOSFET

Reduction of system cost (no pre-charge circuit needed) and acceleration of capacitor charging



Dual Gate MOSFET 80 V 48 V switch board (uni-directional) overview





Main Board

Adapter Board

Linear mode operation Increased short circuit robustness **Components Dual Gate MOSFET 80V** IAUTN08S5N012L 48 V high-side driver: 2ED4820-EM



 For 48 V disconnect switch application

Summary of Features

- Acceleration of capacitor charging
- Reduction of system cost

Potential Applications



- Battery management
- Electrically heated catalyst

48V DISCONNECT SWITCH A 48V disconnect switch with 80V OptiMOS[™] 5 Dual Gate MOSFETs

The 48V switch evaluation board supports fast pulsed capacitor charging with Dual Gate MOSFETs, to **minimize system costs** (no separate pre-charging path needed). **NEW**

The board is active clamping capable to dissipate inductive energy from cable harness. The Dual Gate MOSFET operates in linear mode instead of avalanche to increase short circuit robustness.

Benefits









Simplified schematic Dual Gate 48V switch board





PCB stack and thermal design





Top case temperature thermal camera measurement

 $T_a = 25^{\circ}C$, natural convection, 35 minutes loading at $I_D = 250$ A





Dual Gate 48 V switch board with µC control





Capacitor charging setup – simplified schematic





Capacitor charging 33 mF measurement setup





Capacitor charging 33 mF (first three pulses)





Capacitor charging 33 mF (whole charging wave-form)





Short circuit clamping setup – simplified schematic





Short-circuit clamping measurement setup





Short-circuit clamping measurement





OneEye control suite – Dual Gate MOSFET part 1

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OneEye control suite – Dual Gate MOSFET part 2

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