

Automotive MOSFET

OptiMOS™ 5 Power-Transistor



Features

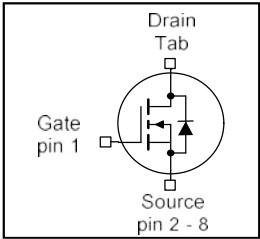
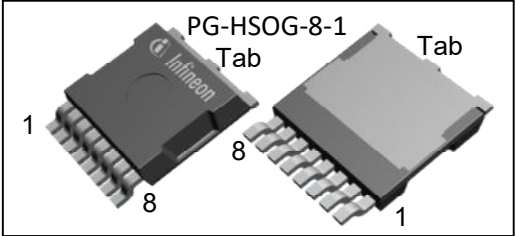
- OptiMOS™ power MOSFET for automotive applications
- N-channel – enhancement mode – normal level
- Extended qualification beyond AEC-Q101
- Enhanced electrical testing
- Robust design
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- RoHS compliant
- 100% avalanche tested
- Very low reverse recovery charge (Q_{rr})

Potential applications

General automotive applications.

Product validation

Qualified for automotive applications. Product validation according to AEC-Q101.



Product Summary

V_{DS}	120	V
$R_{DS(on)}$	1.8	mΩ
I_D (chip limited)	310	A

Type	Package	Marking
IAUTN12S5N018G	PG-HSOG-8-1	5N12N018

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Maximum ratings

at $T_j=25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$V_{GS}=10\text{ V}$, Chip limitation ^{1,2)}	310	A
		$V_{GS}=10\text{ V}$, DC current ³⁾	300	
		$T_a=100\text{ °C}$, $V_{GS}=10\text{ V}$, R_{thJA} on 2s2p ^{2,4)}	37	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_c=25\text{ °C}$, $t_p=100\text{ }\mu\text{s}$	1160	
Avalanche energy, single pulse ²⁾	E_{AS}	$I_D=150\text{ A}$	510	mJ
Avalanche current, single pulse	I_{AS}	–	300	A
Gate source voltage	V_{GS}	–	± 20	V
Power dissipation	P_{tot}	$T_c=25\text{ °C}$	358	W
Operating and storage temperature	T_j, T_{stg}	–	-55 ... +175	°C
IEC climatic category; DIN IEC 68-1	–	–	55/175/56	

Thermal characteristics²⁾

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal resistance, junction - case	R_{thJC}	–	–	–	0.42	K/W
Thermal resistance, junction - ambient ⁴⁾	R_{thJA}	–	–	14.8	–	

Electrical characteristics

at $T_j=25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Static characteristics

Drain-source breakdown voltage	$V_{(Br)DSS}$	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$	120	–	–	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$, $I_D=270\text{ }\mu\text{A}$	2.6	3.1	3.6	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=120\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$	–	0.3	3	μA
		$V_{DS}=120\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=100\text{ °C}^{2)}$	–	10	100	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$	–	–	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=7\text{ V}$, $I_D=50\text{ A}$	–	1.9	2.8	m Ω
		$V_{GS}=10\text{ V}$, $I_D=100\text{ A}$	–	1.5	1.8	
Gate resistance ²⁾	R_G	–	–	1.1	–	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics ²⁾						
Input capacitance	C _{iss}	V _{GS} =0 V, V _{DS} =60 V, f=1 MHz	–	8260	10740	pF
Output capacitance	C _{oss}		–	2369	3080	
Reverse transfer capacitance	C _{rss}		–	45	68	
Turn-on delay time	t _{d(on)}	V _{DD} =60 V, V _{GS} =10 V, I _D =100 A, R _G =3.5 Ω	–	27	–	ns
Rise time	t _r		–	47	–	
Turn-off delay time	t _{d(off)}		–	43	–	
Fall time	t _f		–	47	–	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD}=60\text{ V}, I_D=100\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	–	43	55	nC
Gate to drain charge	Q_{gd}		–	23	35	
Gate charge total	Q_g		–	111	145	
Gate plateau voltage	$V_{plateau}$		–	5.2	–	V

Reverse Diode

Diode continuous forward current ²⁾	I_S	$T_C=25\text{ °C}$	–	–	310	A
Diode pulse current ²⁾	$I_{S,pulse}$	$T_C=25\text{ °C}, t_p=100\ \mu\text{s}$	–	–	1160	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=100\text{ A}, T_j=25\text{ °C}$	–	0.85	0.95	V
Reverse recovery time ²⁾	t_{rr}	$V_R=60\text{ V}, I_F=50\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$	–	45	67	ns
Reverse recovery charge ²⁾	Q_{rr}		–	34	68	nC

¹⁾ Practically the current is limited by the overall system design including the customer-specific PCB.

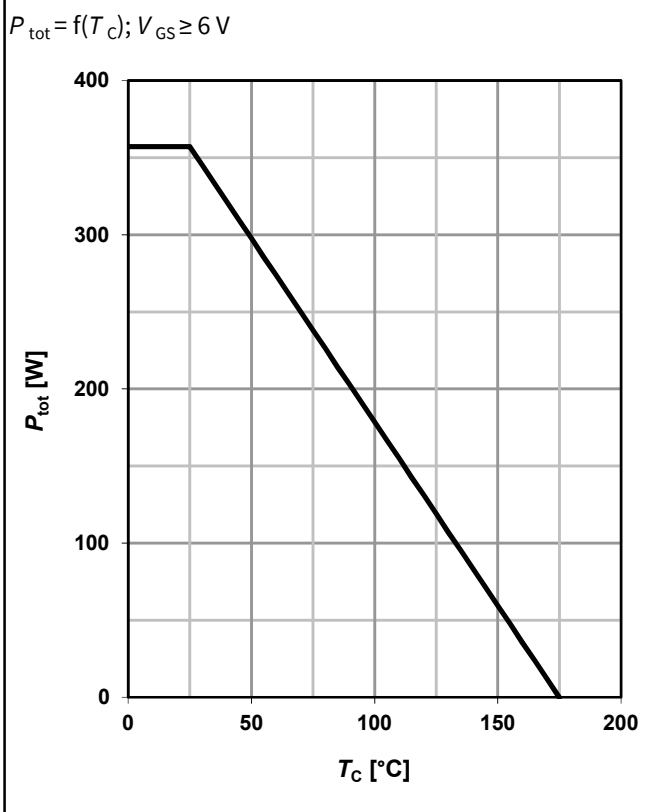
²⁾ The parameter is not subject to production testing – specified by design.

³⁾ Current is limited by package.

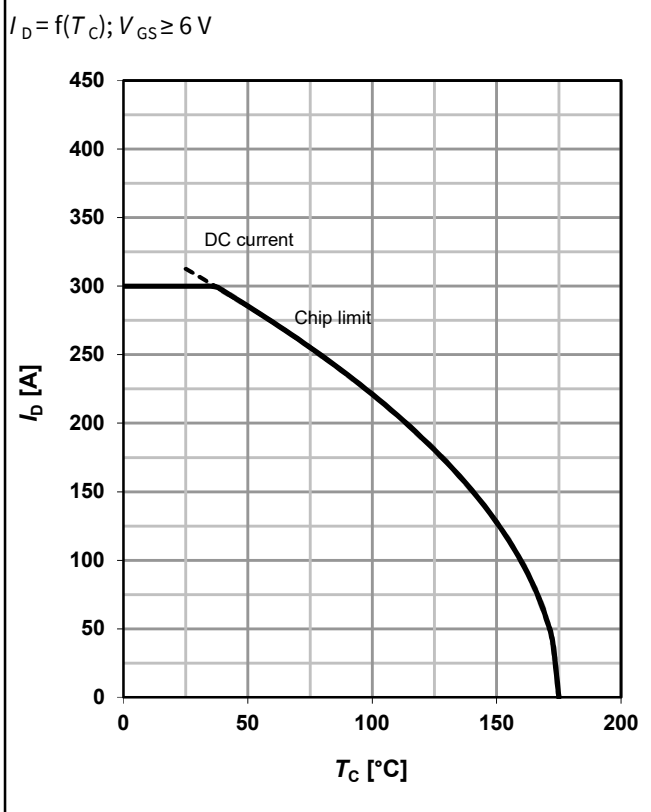
⁴⁾ Device on 2s2p FR4 PCB defined in accordance with JEDEC standards (JESD51-5, -7). PCB is vertical in still air.

Electrical characteristics diagrams

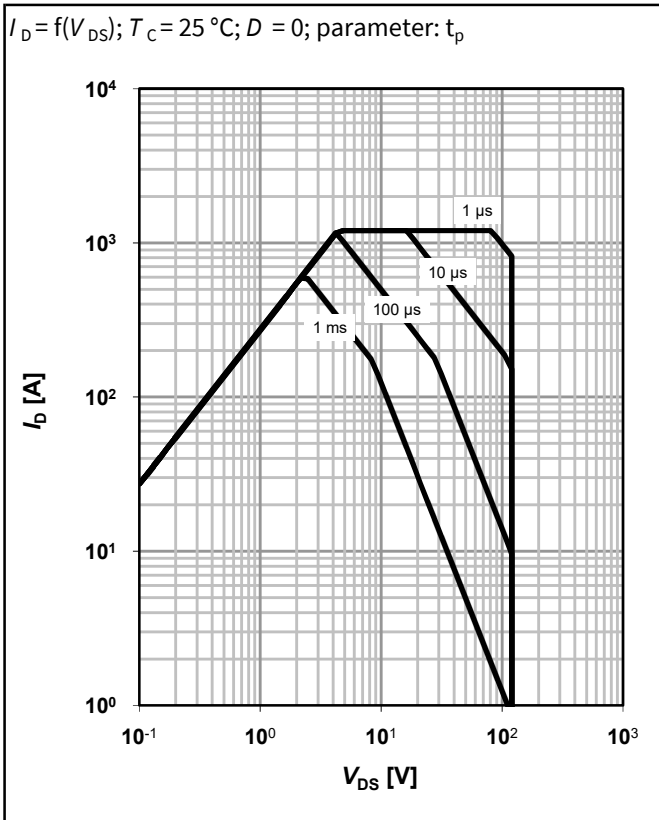
1 Power dissipation



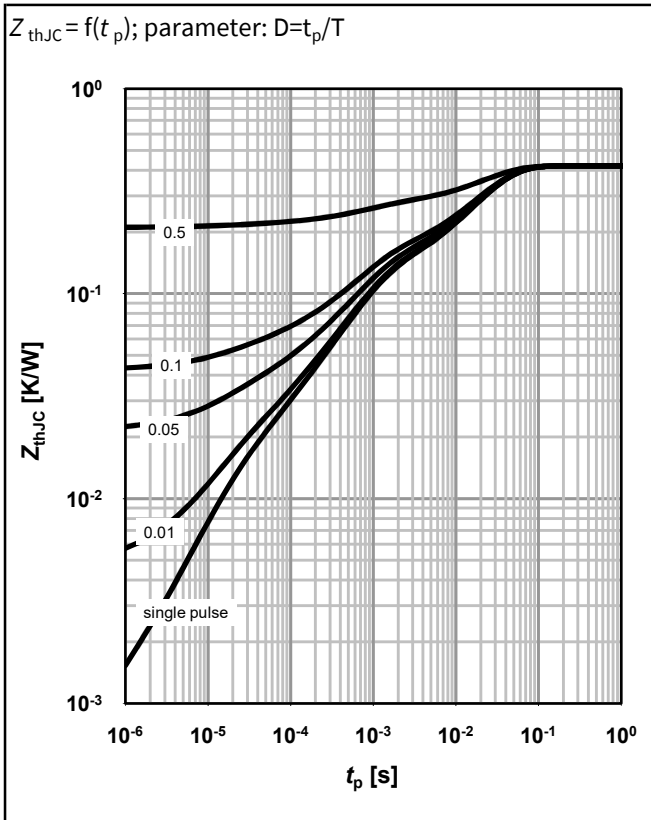
2 Drain current



3 Safe operating area

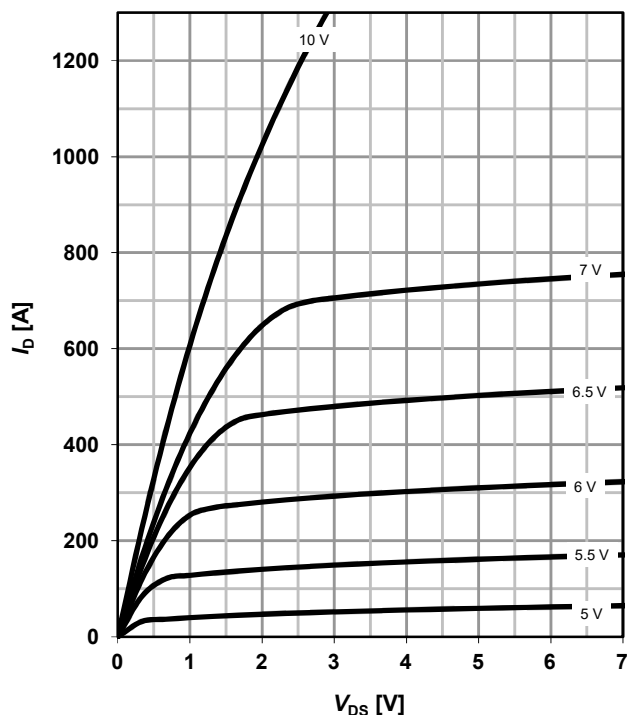


4 Max. transient thermal impedance



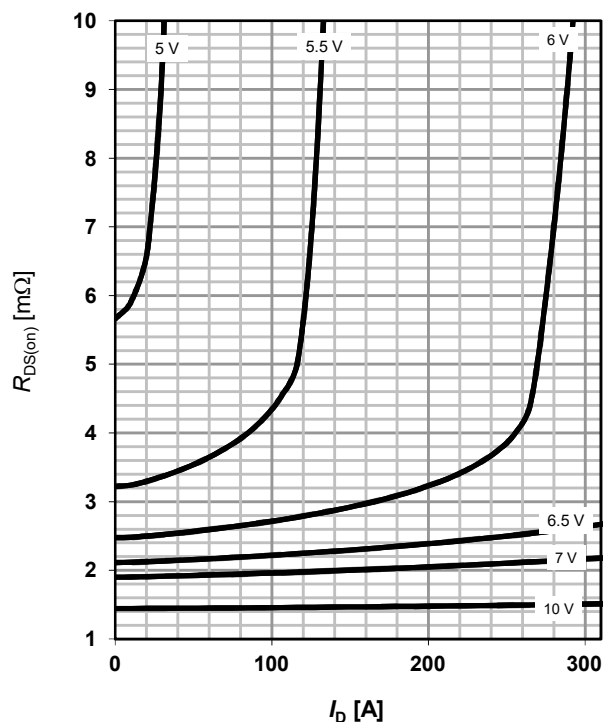
5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$



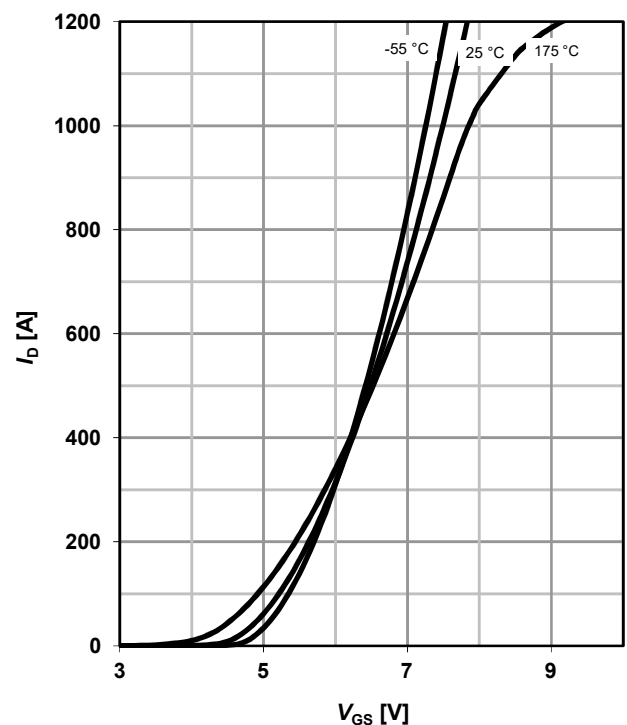
6 Typ. drain-source on-state resistance

$R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$



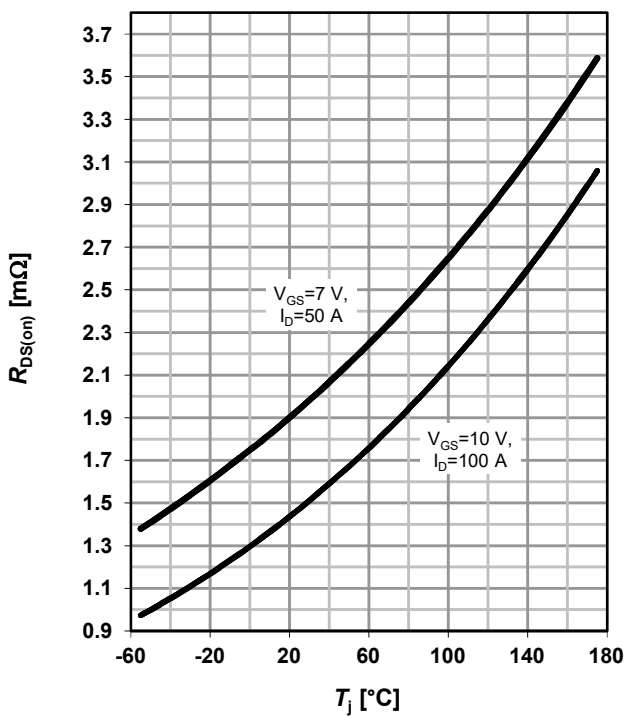
7 Typ. transfer characteristics

$I_D = f(V_{GS}); V_{DS} = 6\text{V}; \text{parameter: } T_j$



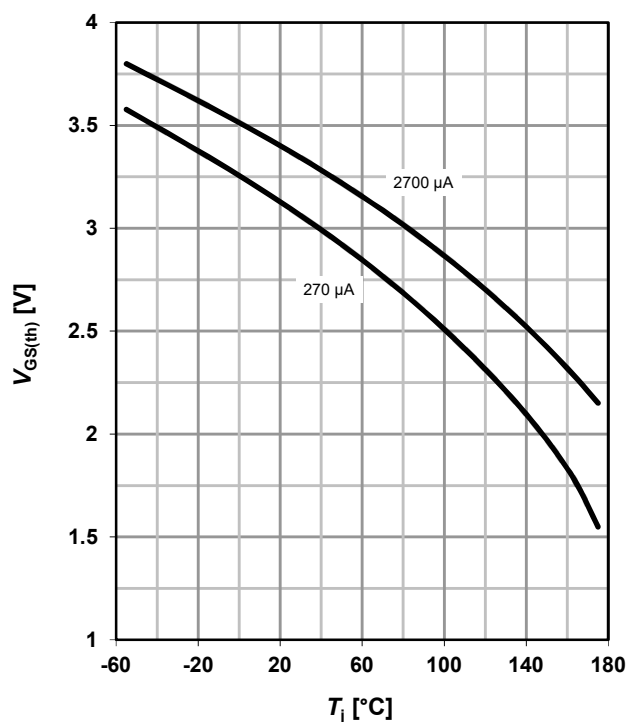
8 Typ. drain-source on-state resistance

$R_{DS(on)} = f(T_j); \text{parameter: } I_D, V_{GS}$



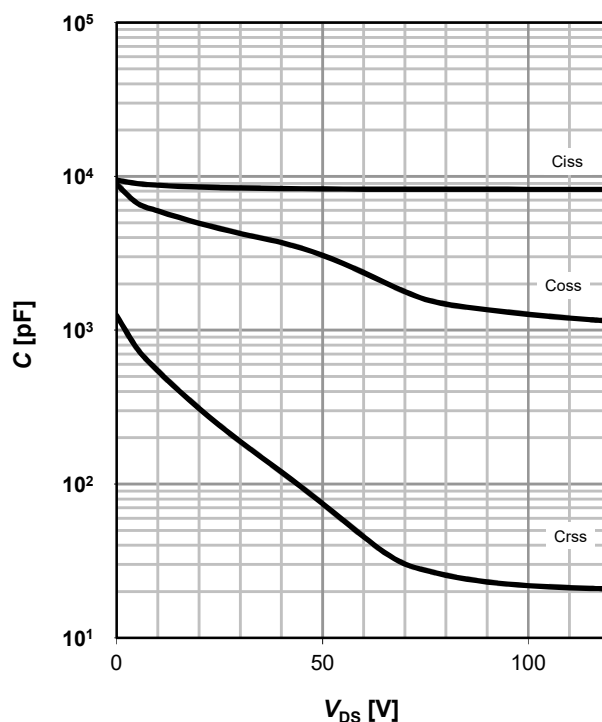
9 Typ. gate threshold voltage

$V_{GS(th)} = f(T_j)$; $V_{GS} = V_{DS}$; parameter: I_D



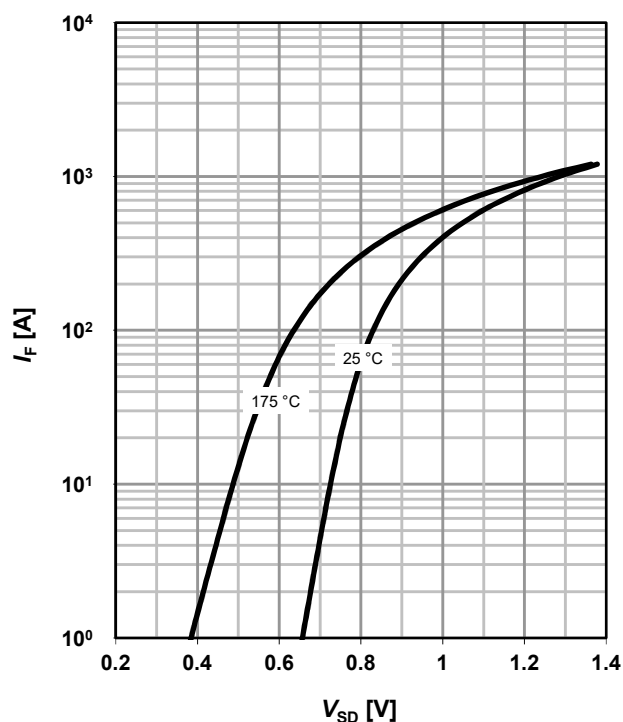
10 Typ. capacitances

$C = f(V_{DS})$; $V_{GS} = 0 V$; $f = 1 MHz$



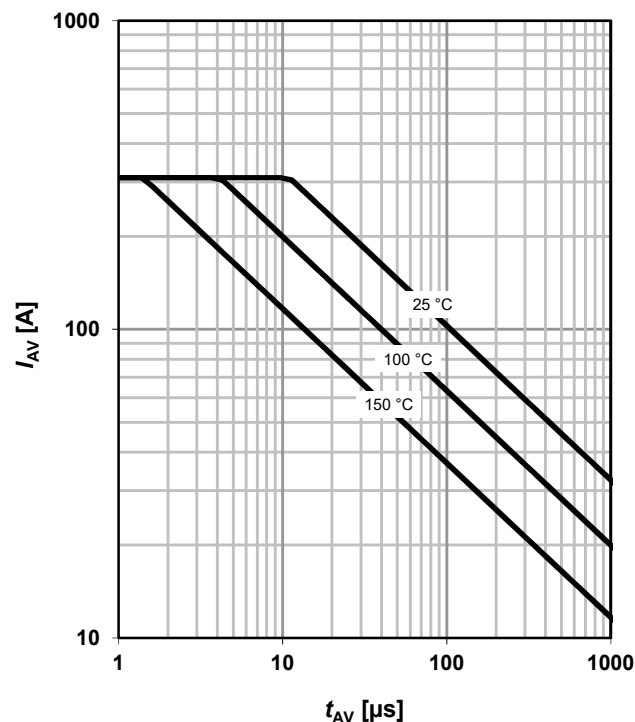
11 Typical forward diode characteristics

$I_F = f(V_{SD})$; parameter: T_j



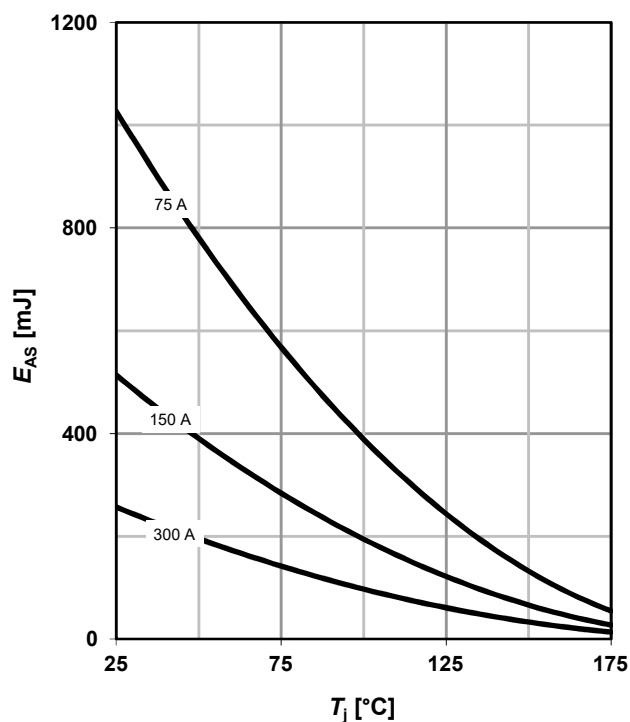
12 Typ. avalanche characteristics

$I_{AS} = f(t_{AV})$; parameter: $T_{j(start)}$



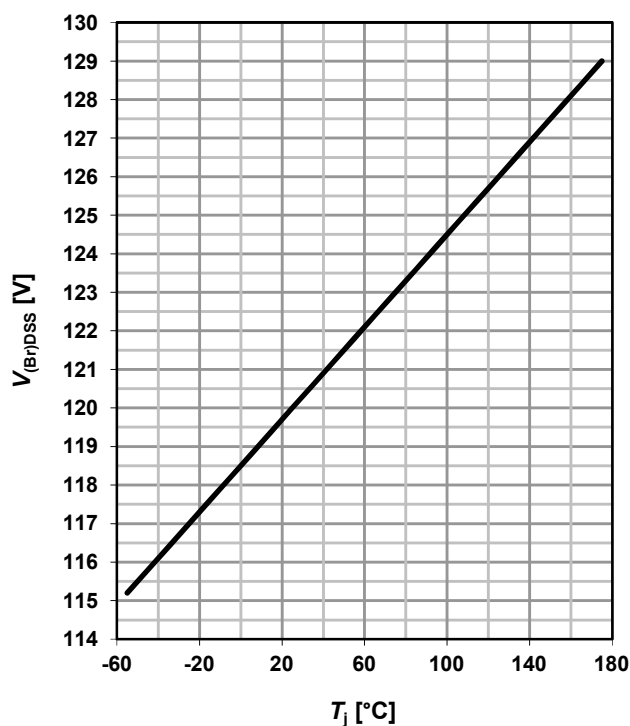
13 Typical avalanche energy

$E_{AS} = f(T_j)$; parameter: I_D



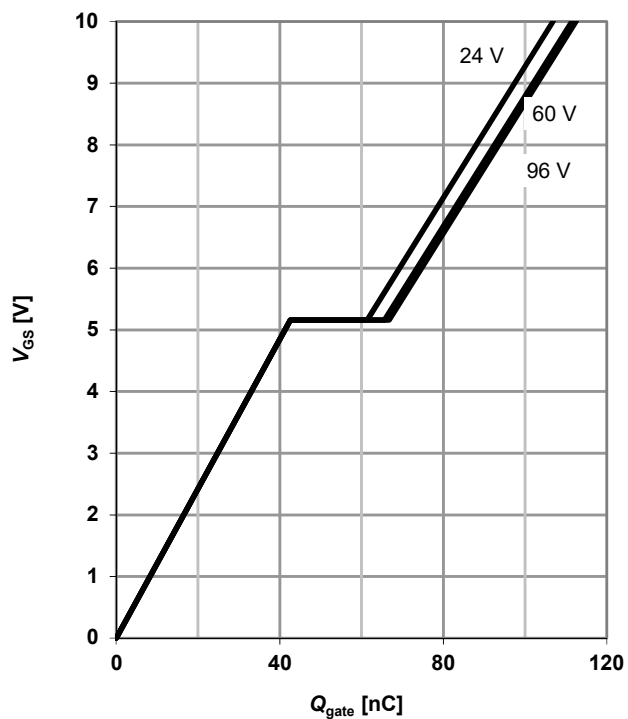
14 Drain-source breakdown voltage

$V_{(Br)DSS} = f(T_j)$; $I_D = 1\text{ mA}$

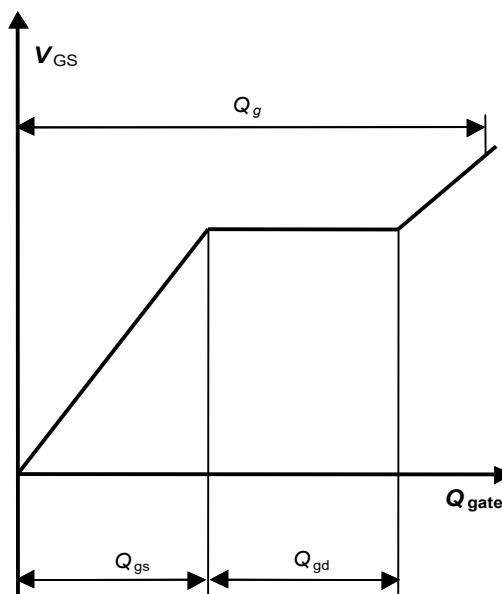


15 Typ. gate charge

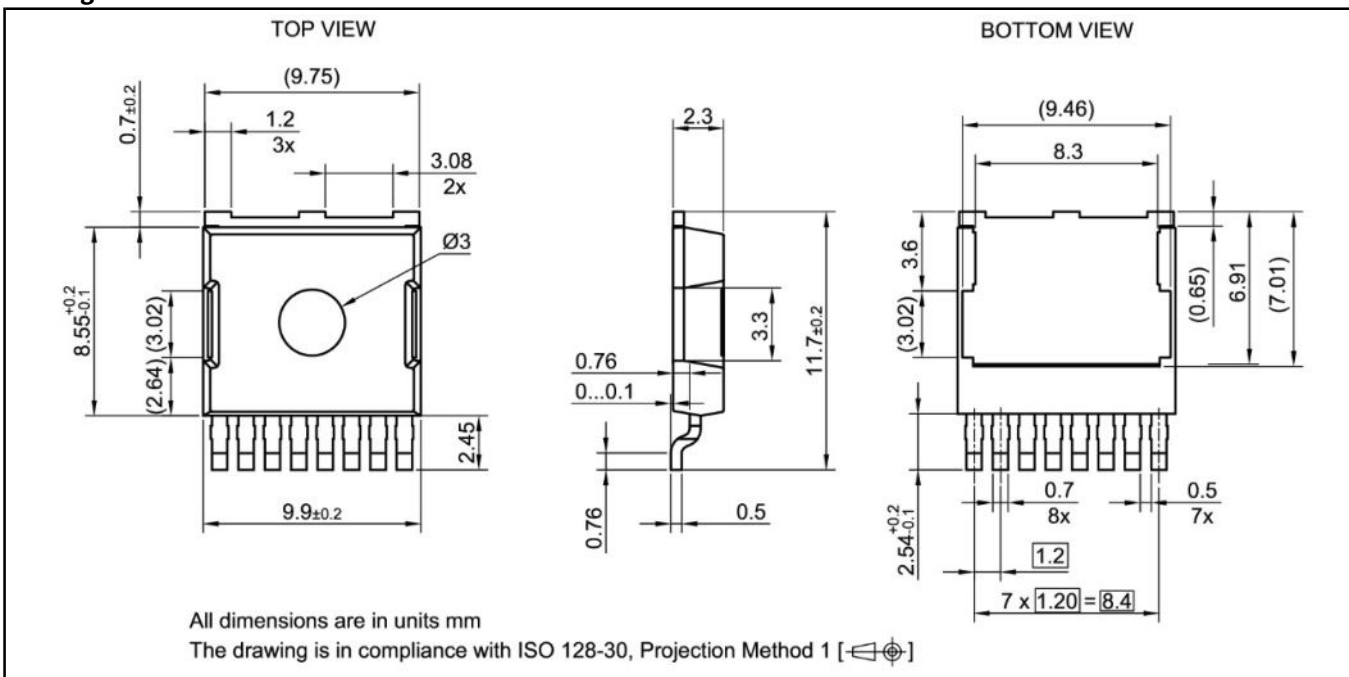
$V_{GS} = f(Q_{gate})$; $I_D = 100\text{ A}$ pulsed; parameter: V_{DD}



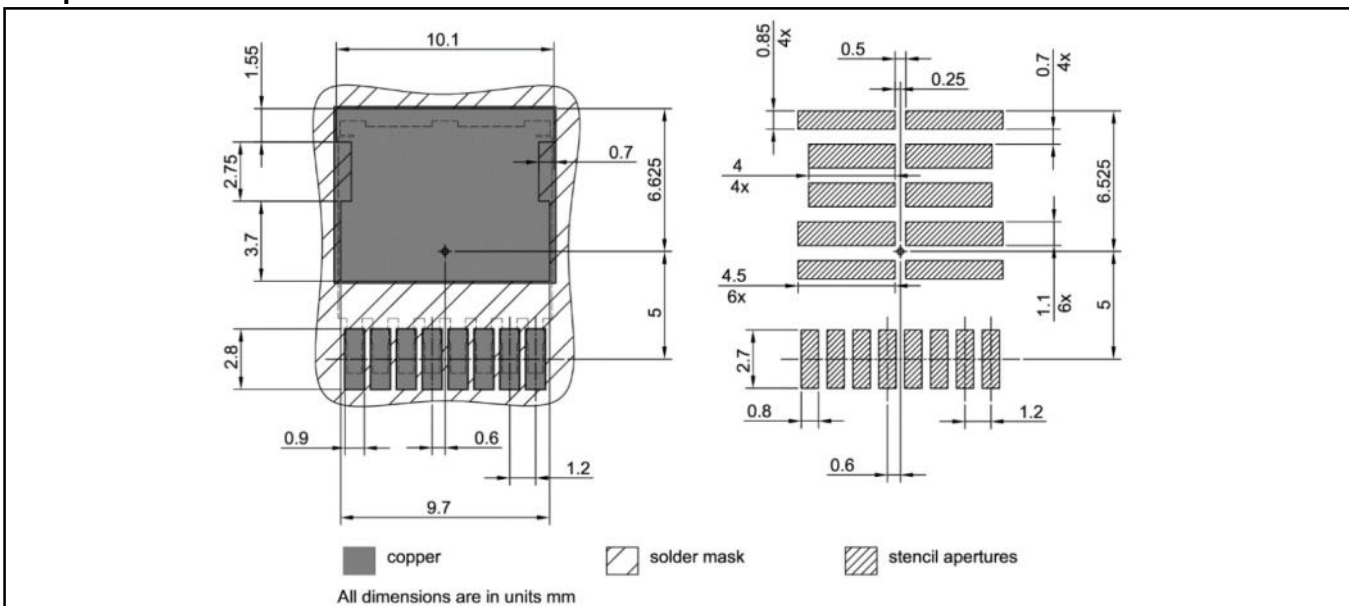
16 Gate charge waveforms



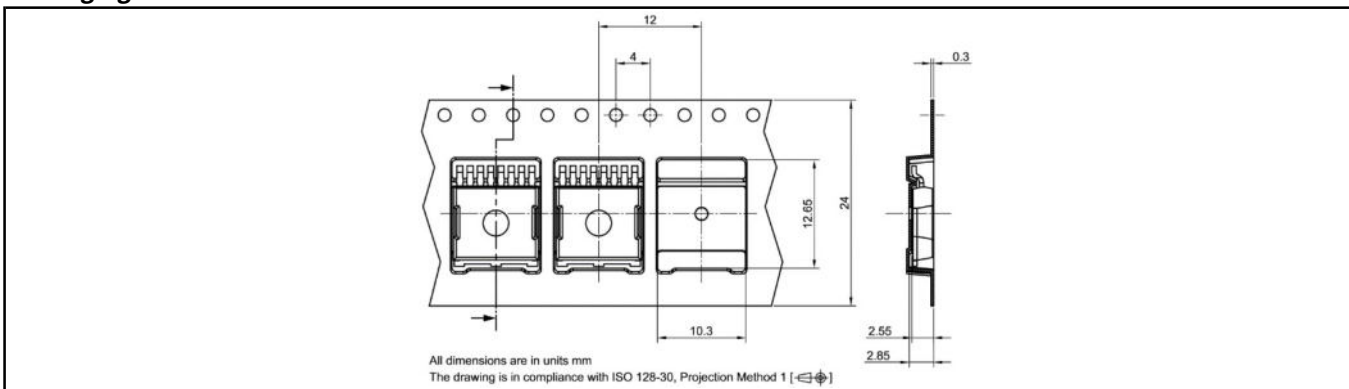
Package Outline



Footprint



Packaging



Revision History

Revision	Date	Changes
Revision 1.0	2022-12-19	Final data sheet
Revision 1.01	2023-08-29	Reduced typical on-state resistance

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