

Automotive MOSFET

OptiMOS™ 6 Power-Transistor



Features

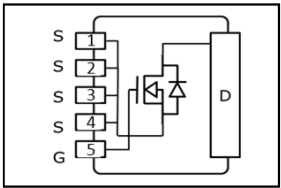
- OptiMOS™ power MOSFET for automotive applications
- N-channel – Enhancement mode – Normal Level
- Extended qualification beyond AEC-Q101
- Enhanced electrical testing
- Robust design
- MSL3 up to 260°C peak reflow
- 175°C operating temperature
- Green product (RoHS compliant)
- 100% Avalanche tested

Potential applications

General automotive applications.

Product validation

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



Product Summary

V_{DS}	40	V
$R_{DS(on),max}$	0.7	mΩ
I_D (chip limited)	380	A

Type	Package	Marking
IAUA250N04S6N007E	PG-HSOF-5-1	6N04R7E

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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)}	380	A
		$V_{GS} = 10\text{ V}$, DC current ³⁾	250	
		$T_a = 85\text{ °C}$, $V_{GS} = 10\text{ V}$, R_{thJA} on 2s2p ^{2,4)}	55	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C = 25\text{ °C}$, $t_p = 100\text{ }\mu\text{s}$	1300	
Avalanche energy, single pulse ²⁾	E_{AS}	$I_D = 55\text{ A}$, $R_{G,min} = 25\text{ }\Omega$	560	mJ
Avalanche current, single pulse	I_{AS}	$R_{G,min} = 25\text{ }\Omega$	110	A
Gate source voltage	V_{GS}	–	± 20	V
Power dissipation	P_{tot}	$T_C = 25\text{ °C}$	192	W
Operating and storage temperature	T_j, T_{stg}	–	-55 ... +175	°C

Thermal characteristics²⁾

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal resistance, junction - case	R_{thJC}	–	–	–	0.78	K/W
Thermal resistance, junction - ambient ⁴⁾	R_{thJA}	–	–	22.9	–	

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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	40	–	–	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 110\text{ }\mu\text{A}$	2.2	2.6	3.0	
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 40\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25\text{ °C}$	–	–	1	μA
		$V_{DS} = 40\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 125\text{ °C}^{2)}$	–	–	31	
Gate-source leakage current	I_{GSS}	$V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$	–	–	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 7\text{ V}$, $I_D = 100\text{ A}$	–	0.65	0.83	m Ω
		$V_{GS} = 10\text{ V}$, $I_D = 100\text{ A}$	–	0.55	0.70	
Gate resistance ²⁾	R_G	–	–	1	–	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics²⁾

Input capacitance	C_{iss}	$V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V},$ $f = 1 \text{ MHz}$	–	6444	8377	pF
Output capacitance	C_{oss}		–	1944	2528	
Reverse transfer capacitance	C_{rss}		–	94	124	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 32 \text{ V}, V_{GS} = 10 \text{ V},$ $I_D = 250 \text{ A}, R_G = 3.5 \Omega$	–	13	–	ns
Rise time	t_r		–	14	–	
Turn-off delay time	$t_{d(off)}$		–	27	–	
Fall time	t_f		–	19	–	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD} = 32 \text{ V}, I_D = 250 \text{ A},$ $V_{GS} = 0 \text{ to } 10 \text{ V}$	–	28	36	nC
Gate to drain charge	Q_{gd}		–	19	29	
Gate charge total	Q_g		–	94	128	
Gate plateau voltage	$V_{plateau}$		–	4.2	–	V

Reverse Diode

Diode continuous forward current ²⁾	I_S	$T_C = 25 \text{ °C}$	–	–	250	A
Diode pulse current ²⁾	$I_{S,pulse}$	$T_C = 25 \text{ °C}, t_p = 100 \mu\text{s}$	–	–	1300	
Diode forward voltage	V_{SD}	$V_{GS} = 0 \text{ V}, I_F = 125 \text{ A},$ $T_j = 25 \text{ °C}$	–	0.8	1.1	V
Reverse recovery time ²⁾	t_{rr}	$V_R = 20 \text{ V}, I_F = 50 \text{ A},$ $di_F/dt = 100 \text{ A}/\mu\text{s}$	–	60	–	ns
Reverse recovery charge ²⁾	Q_{rr}		–	73	–	nC

¹⁾ Current is limited by the overall system design and the customer-specific PCB.

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

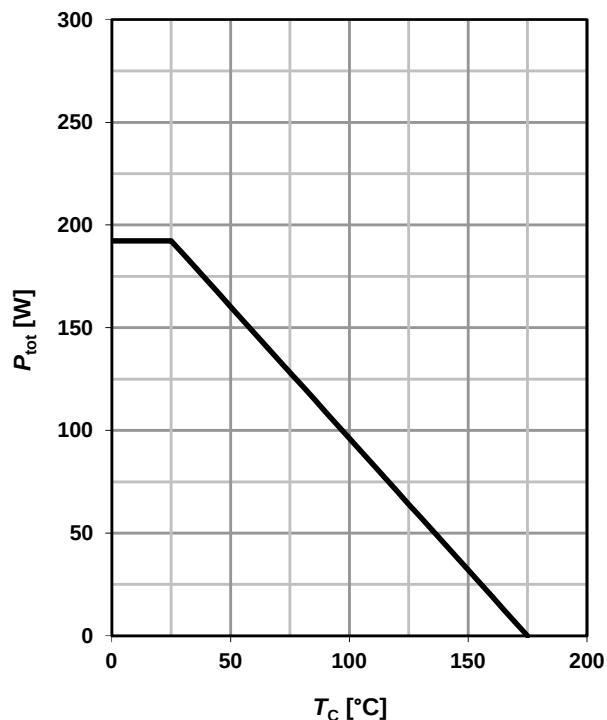
³⁾ Current is limited by the package.

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

Electrical characteristics diagrams

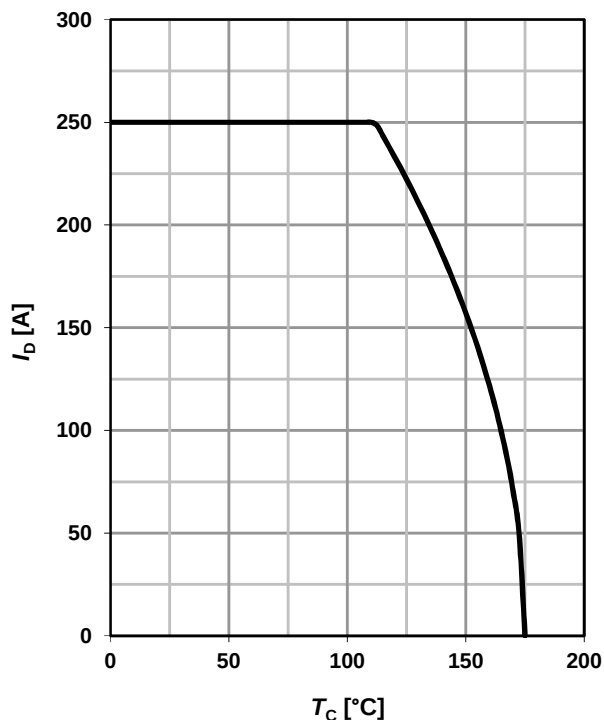
1 Power dissipation

$$P_{\text{tot}} = f(T_C); V_{\text{GS}} \geq 10 \text{ V}$$



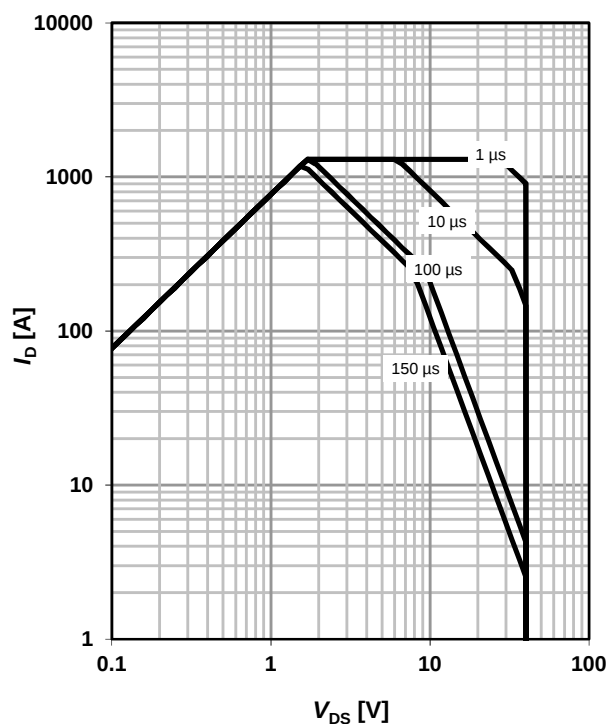
2 Drain current

$$I_D = f(T_C); V_{\text{GS}} \geq 10 \text{ V}$$



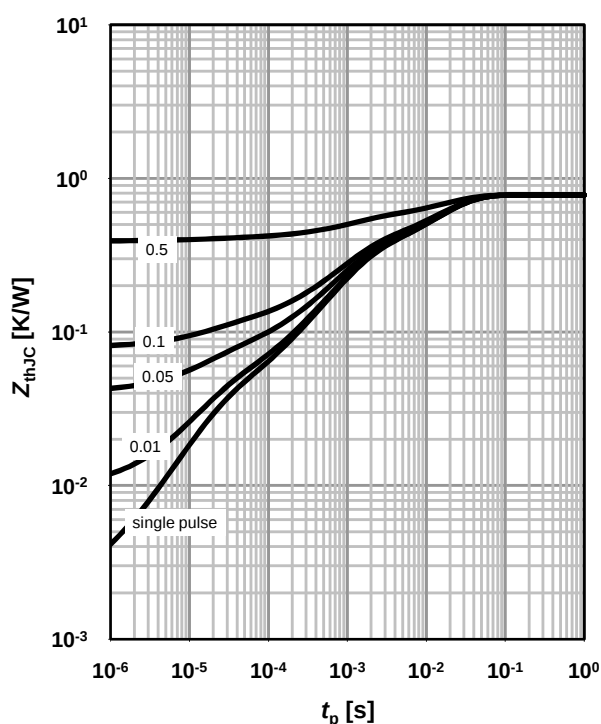
3 Safe operating area

$$I_D = f(V_{\text{DS}}); T_C = 25^\circ\text{C}; D = 0; \text{parameter: } t_p$$



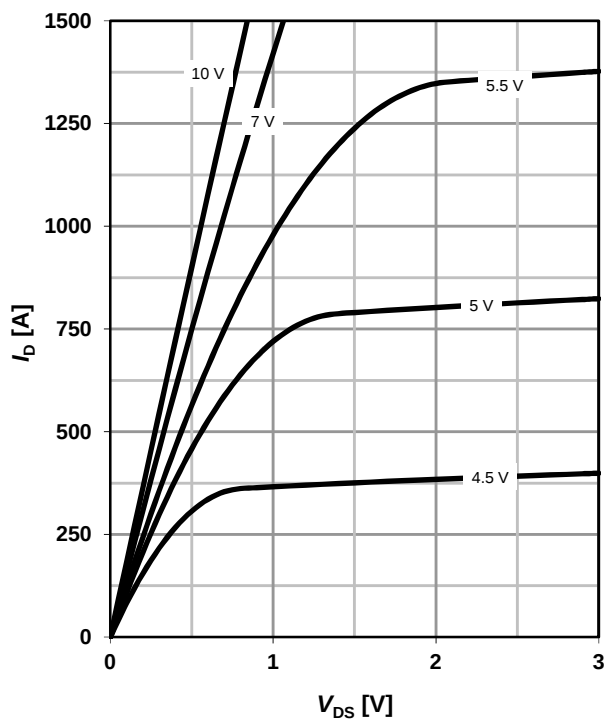
4 Max. transient thermal impedance

$$Z_{\text{thJC}} = f(t_p); \text{parameter: } D = t_p/T$$



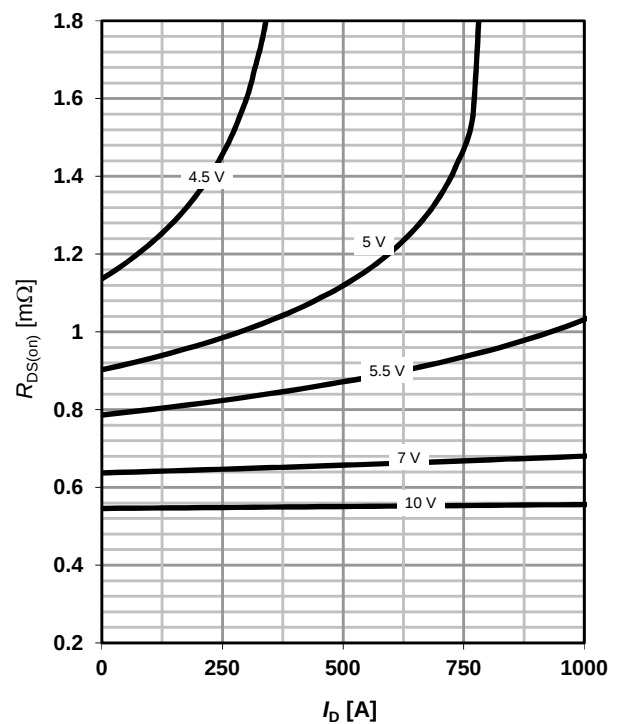
5 Typ. output characteristics

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



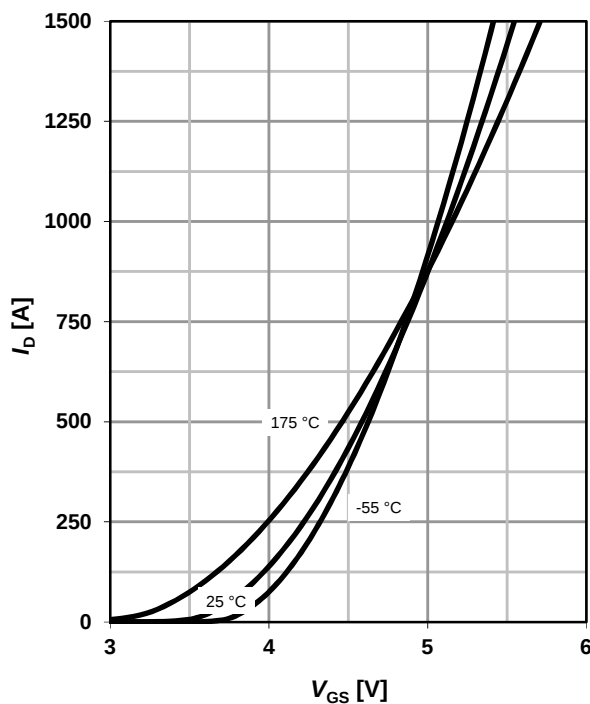
6 Typ. drain-source on-state resistance

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



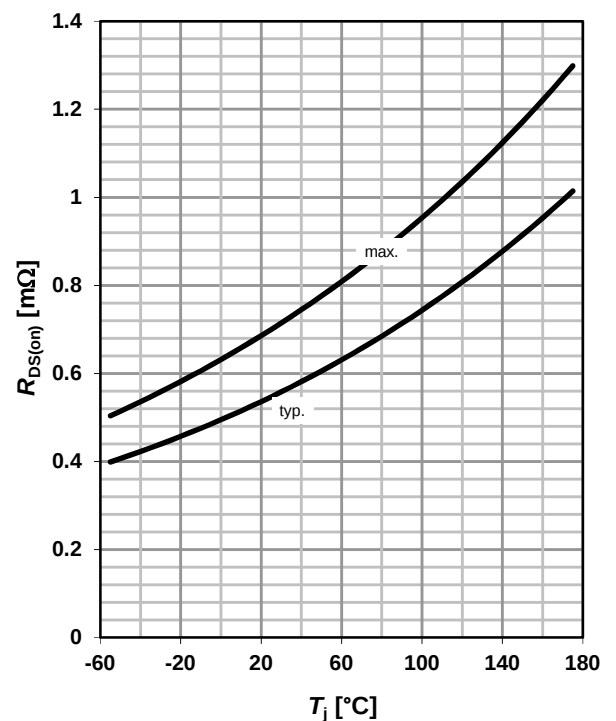
7 Typ. transfer characteristics

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



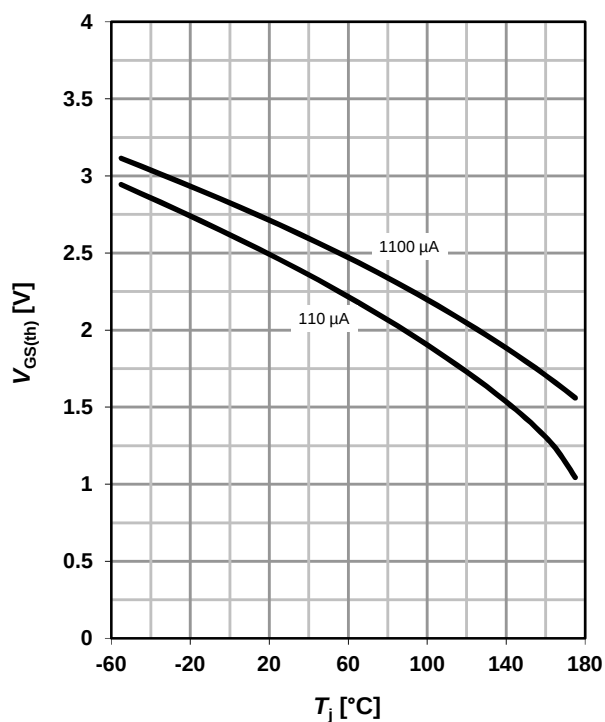
8 Typ. drain-source on-state resistance

$R_{DS(on)} = f(T_J); I_D = 100\text{A}, V_{GS} = 10\text{V}$



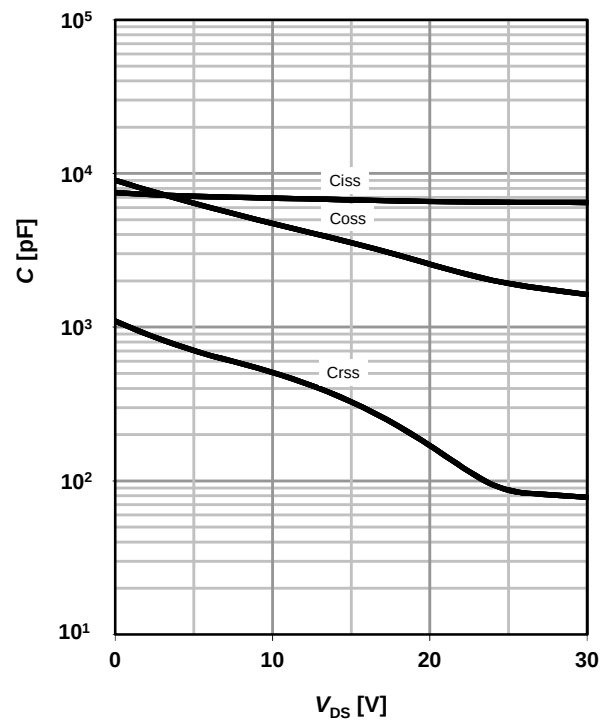
9 Typ. gate threshold voltage

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



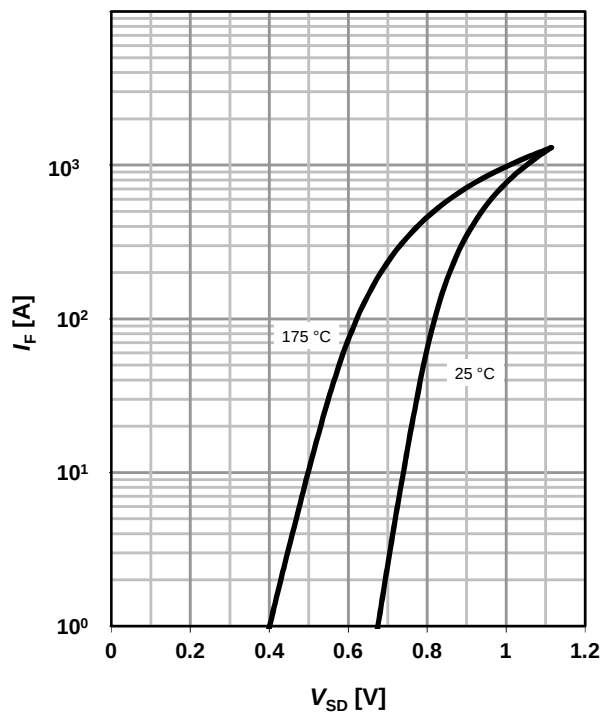
10 Typ. capacitances

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



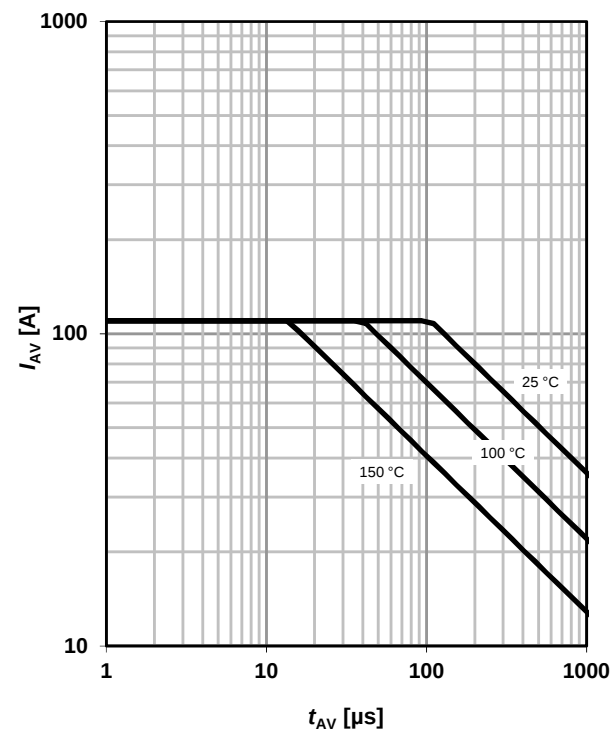
11 Typical forward diode characteristics

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



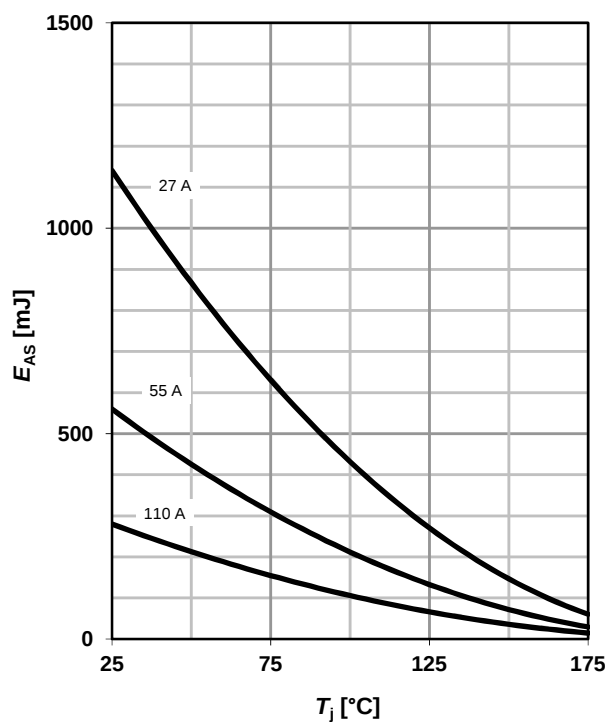
12 Typ. avalanche characteristics

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



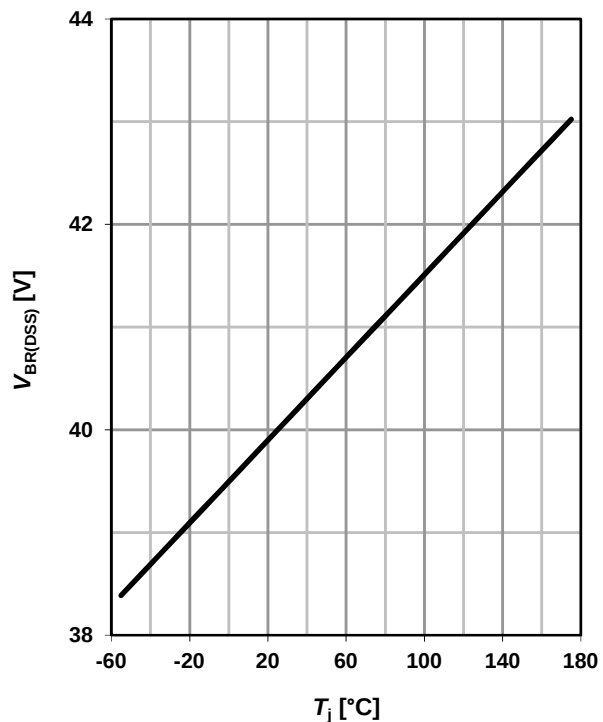
13 Typical avalanche energy

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



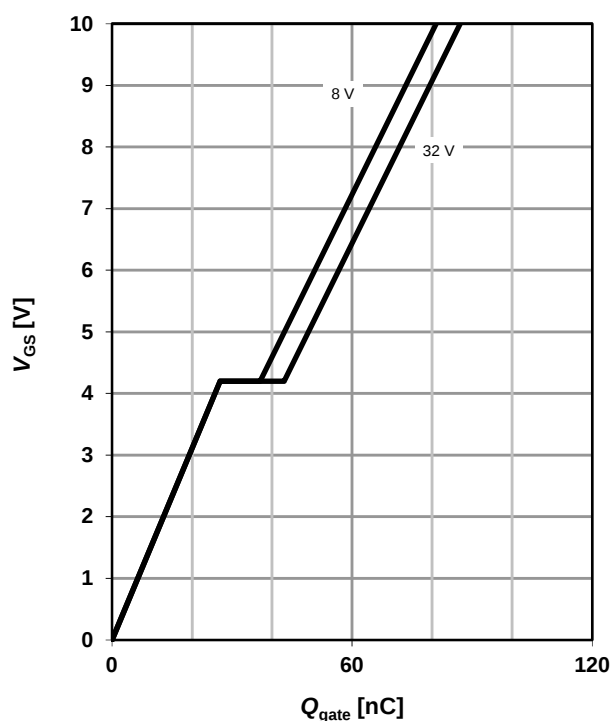
14 Drain-source breakdown voltage

$V_{BR(DSS)} = f(T_j)$; $I_{D_typ} = 1\text{ mA}$

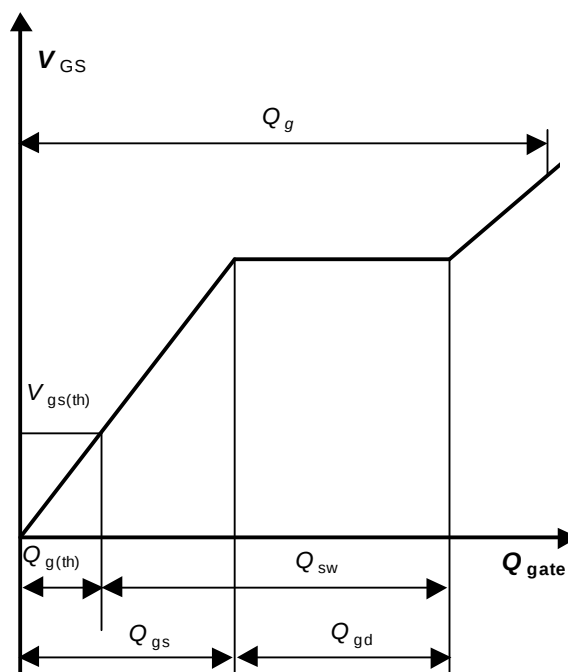


15 Typ. gate charge

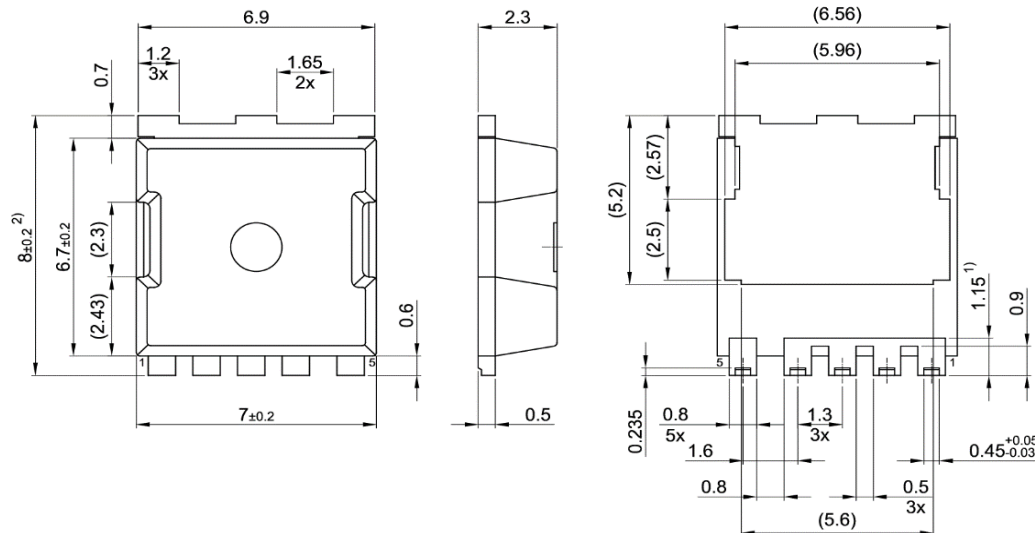
$V_{GS} = f(Q_{gate})$; $I_D = 250\text{ A}$ pulsed; parameter: V_{DD}



16 Gate charge waveforms



Package Outline



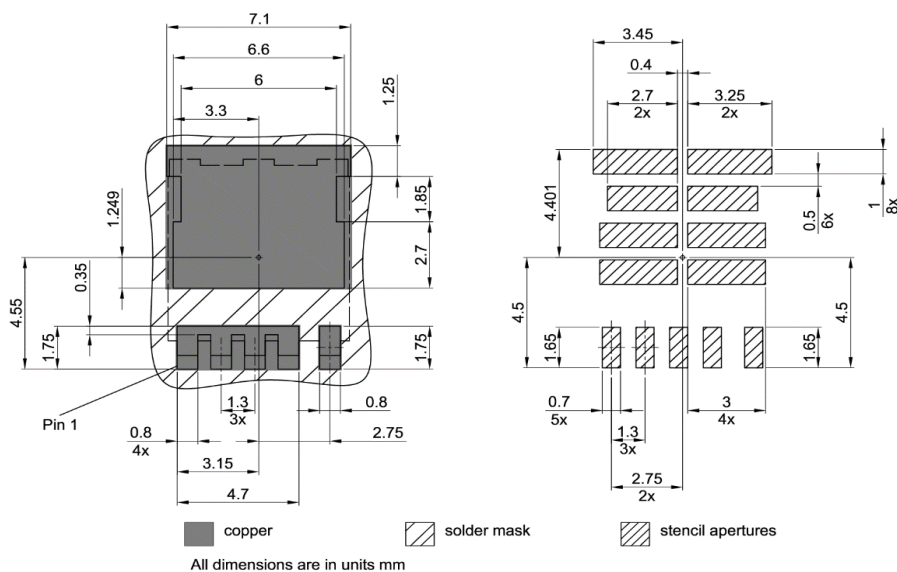
1) Lead length up to anti flash profile; mold flashes excluded

2) Excluding burr

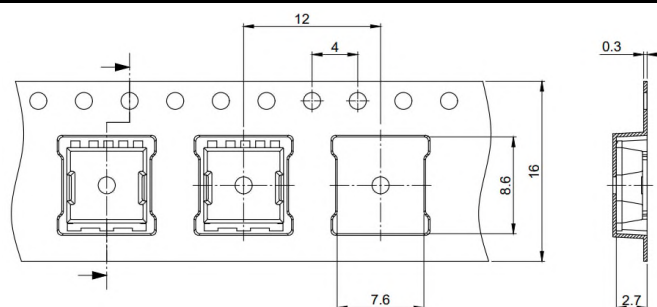
All dimensions are in units mm

The drawing is in compliance with ISO 128-30, Projection Method 1 [⊥ ⊕]

Footprint



Packaging



All dimensions are in units mm

The drawing is in compliance with ISO 128-30, Projection Method 1 [⊥ ⊕]

Revision History

Revision	Date	Changes
Revision 1.0	24.01.2022	Final Data Sheet

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Email: erratum@infineon.com

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