

OptiMOS™ -6 Power-Transistor



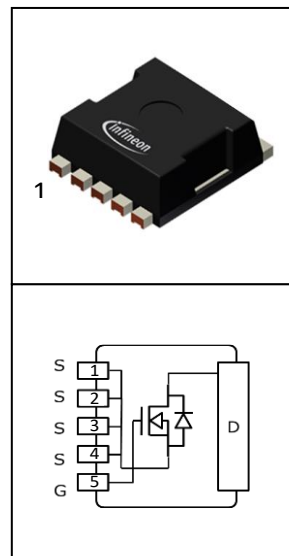
Features

- OptiMOS™ - power MOSFET for automotive applications
- N-channel - Enhancement mode - Normal Level
- AEC Q101 qualified
- MSL3 up to 260°C peak reflow
- 175°C operating temperature
- Green Product (RoHS compliant)
- 100% Avalanche tested

Product Summary

V_{DS}	40	V
$R_{DS(on),max}$	0.64	mΩ
I_D	250	A

PG-HSOF-5-4



Type	Package	Marking
IAUA250N04S6N006	PG-HSOF-5-4	6N04R6

Maximum ratings, at $T_J=25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Drain current	I_D	$V_{GS}=10\text{V}$, Chip Limitation ^{1,2)}	450	A
		$V_{GS}=10\text{V}$, DC current ³⁾	250	
		$T_a=85^\circ\text{C}$, $V_{GS}=10\text{V}$, R_{thJA} on 2s2p ^{4,5)}	57	
Pulsed drain current ⁵⁾	$I_{D,pulse}$	$T_C=25^\circ\text{C}$, $t_p=100\mu\text{s}$	1500	
Avalanche energy, single pulse ²⁾	E_{AS}	$I_D=125\text{A}$, $R_{G,min}=25\Omega$	450	mJ
Avalanche current, single pulse	I_{AS}	$R_{G,min}=25\Omega$	125	A
Gate source voltage	V_{GS}	-	± 20	V
Power dissipation	P_{tot}	$T_C=25^\circ\text{C}$	250	W
Operating and storage temperature	T_J, T_{stg}	-	-55 ... +175	°C

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics²⁾

Thermal resistance, junction - case	R_{thJC}	-	-	-	0.6	K/W
Thermal resistance, junction - ambient ⁴⁾	R_{thJA}	-	-	22.7	-	

Electrical characteristics, at $T_j=25^\circ\text{C}$, unless otherwise specified
Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=1mA$	40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=145\mu A$	2.2	2.6	3.0	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	-	1	μA
		$V_{DS}=40V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$	-	-	40	
Gate-source leakage current	I_{GSS}	$V_{GS}=20V, V_{DS}=0V$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=7V, I_D=100A$	-	0.54	0.70	$m\Omega$
		$V_{GS}=10V, I_D=100A$	-	0.47	0.64	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics²⁾

Input capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=25V,$ $f=1MHz$	-	8318	11064	pF
Output capacitance	C_{oss}		-	2503	3329	
Reverse transfer capacitance	C_{rss}		-	96	144	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20V, V_{GS}=10V,$ $I_D=125A, R_G=3.5\Omega$	-	14	-	ns
Rise time	t_r		-	9	-	
Turn-off delay time	$t_{d(off)}$		-	35	-	
Fall time	t_f		-	18	-	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD}=20V, I_D=125A,$ $V_{GS}=0 \text{ to } 10V$	-	35	47	nC
Gate to drain charge	Q_{gd}		-	24	36	
Gate charge total	Q_g		-	127	169	
Gate plateau voltage	$V_{plateau}$		-	4.2	-	V

Reverse Diode

Diode continuous forward current ⁵⁾	I_S	$T_C=25^\circ C$	-	-	325	A
Diode pulse current ⁵⁾	$I_{S,pulse}$	$T_C=25^\circ C, t_p=100\mu s$	-	-	1940	
Diode forward voltage	V_{SD}	$V_{GS}=0V, I_F=125A,$ $T_J=25^\circ C$	-	0.8	1.1	V
Reverse recovery time ²⁾	t_{rr}	$V_R=20V, I_F=50A,$ $di_F/dt=100A/\mu s$	-	70	-	ns
Reverse recovery charge ²⁾	Q_{rr}		-	87	-	nC

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

²⁾ The parameter is not subject to production test - verified by characterization.

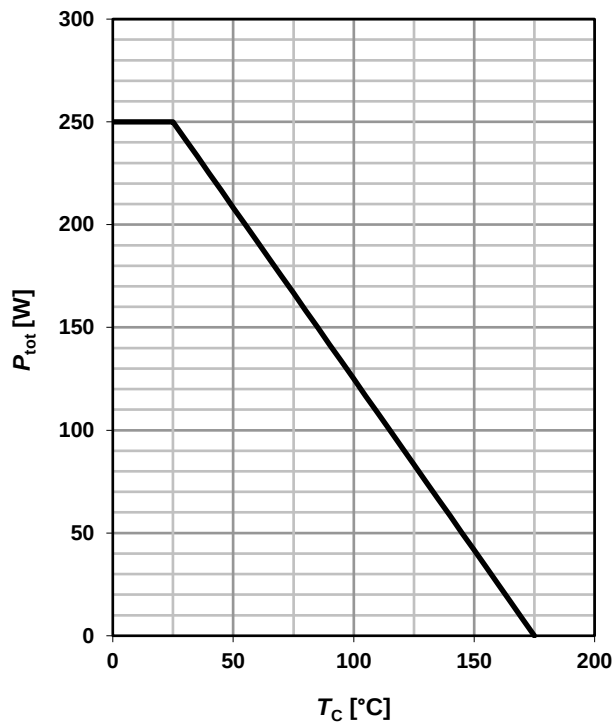
³⁾ The product can operate at specified current based on best practice to minimize electromigration at the solder joint. For rare events and inrush currents the value may be exceeded.

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

⁵⁾ The parameter is not subject to production test - verified by design.

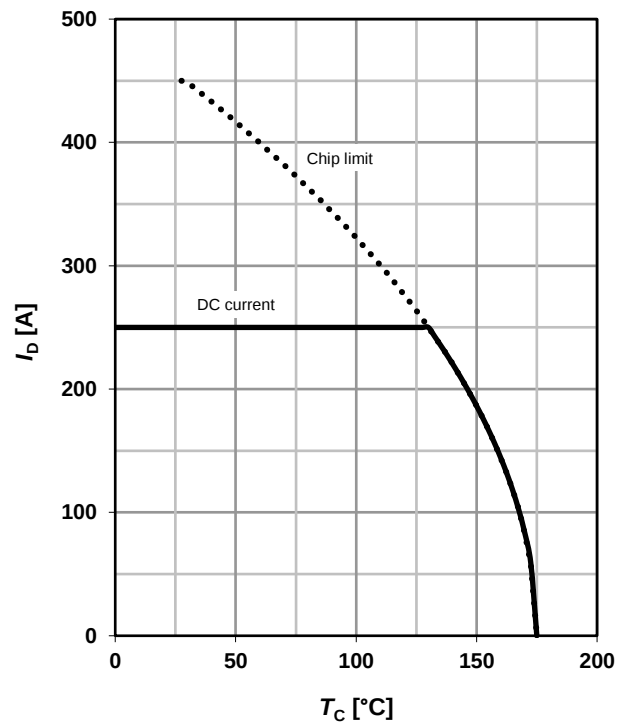
1 Power dissipation

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



2 Drain current

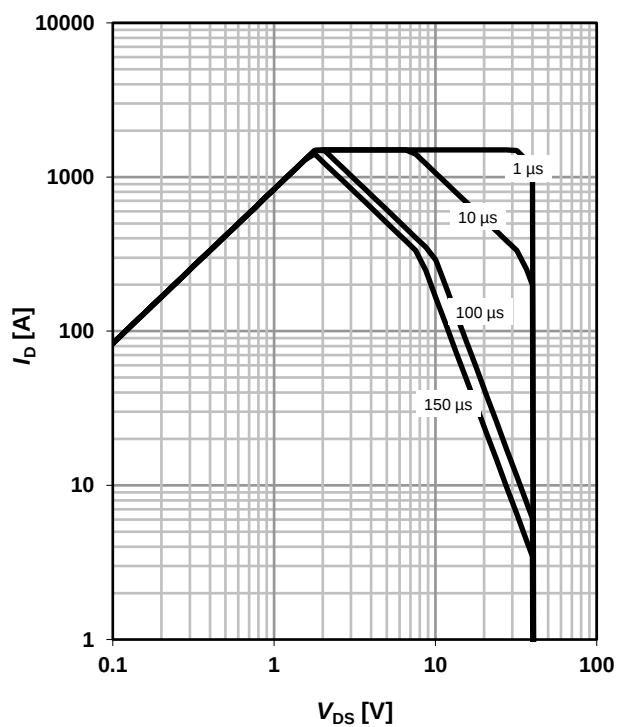
$$I_D = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



3 Safe operating area

$$I_D = f(V_{\text{DS}}); T_C = 25 \text{ °C}; D = 0$$

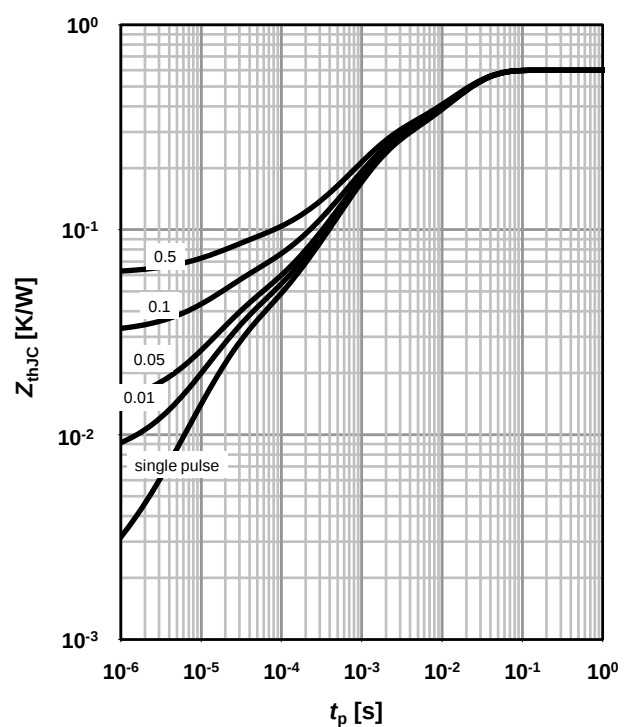
parameter: t_p



4 Max. transient thermal impedance

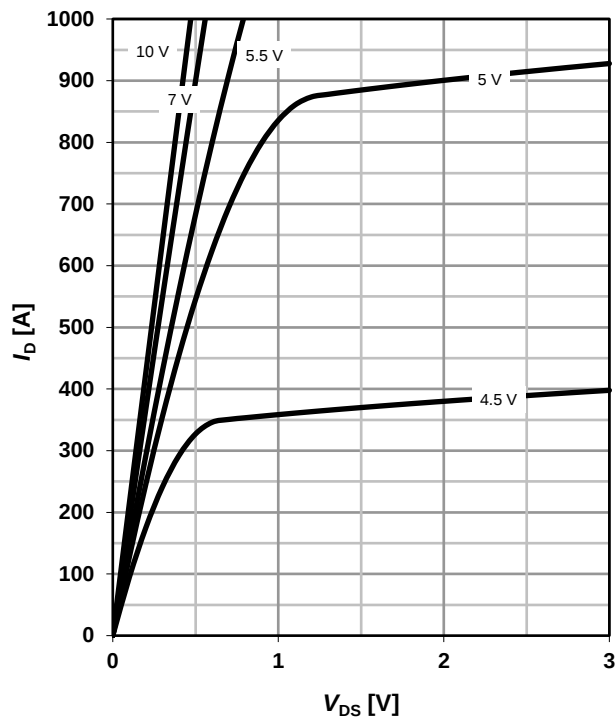
$$Z_{\text{thJC}} = f(t_p)$$

parameter: $D = t_p/T$



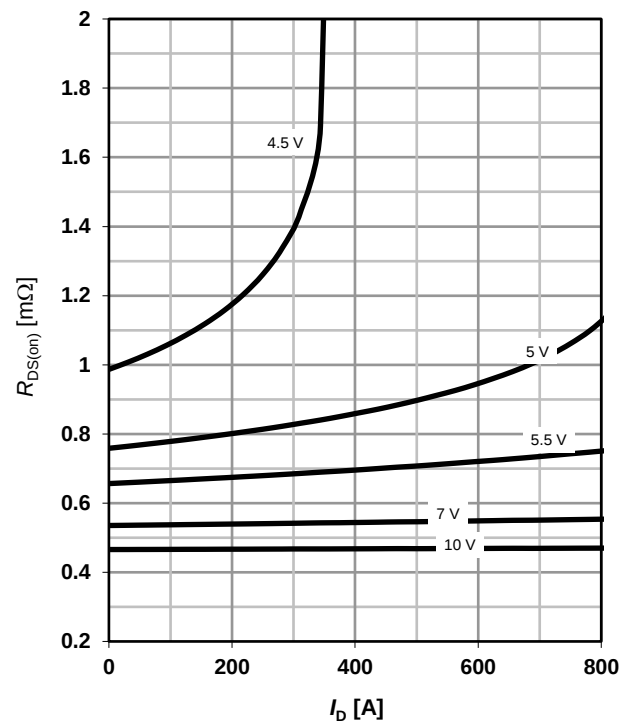
5 Typ. output characteristics

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

parameter: V_{GS}


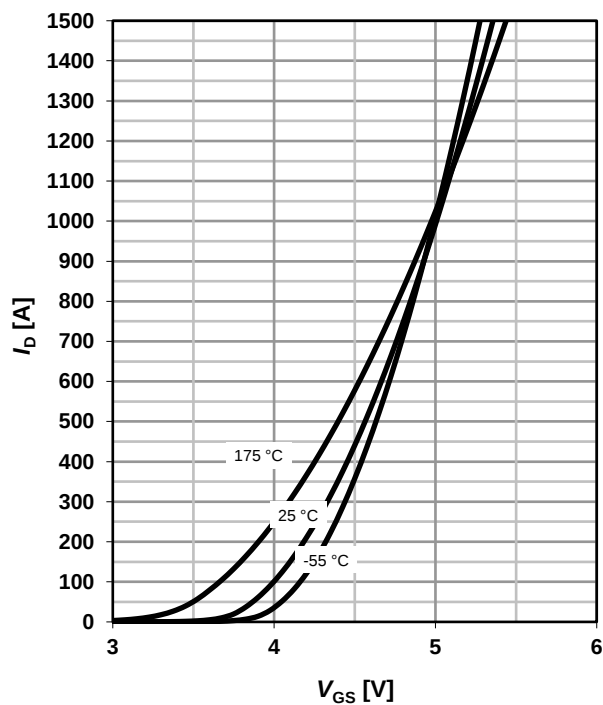
6 Typ. drain-source on-state resistance

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

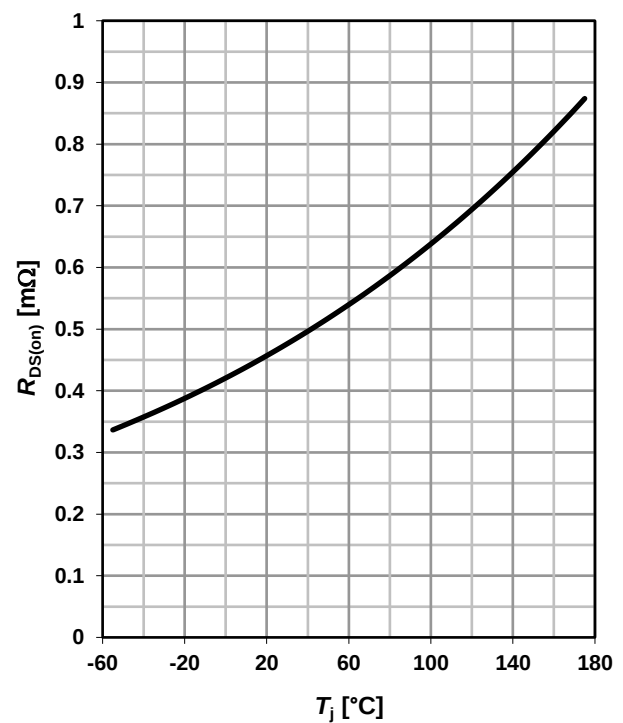
parameter: V_{GS}


7 Typ. transfer characteristics

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

parameter: T_j


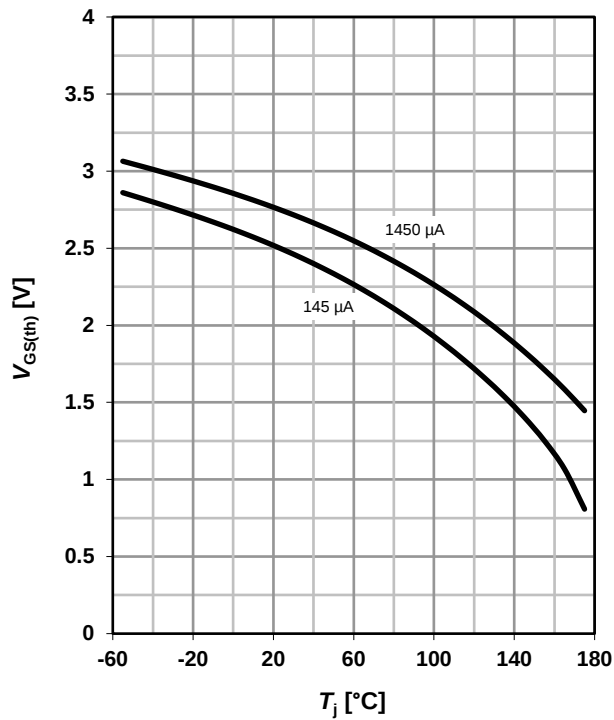
8 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 125\text{ A}; V_{GS} = 10\text{ V}$


9 Typ. gate threshold voltage

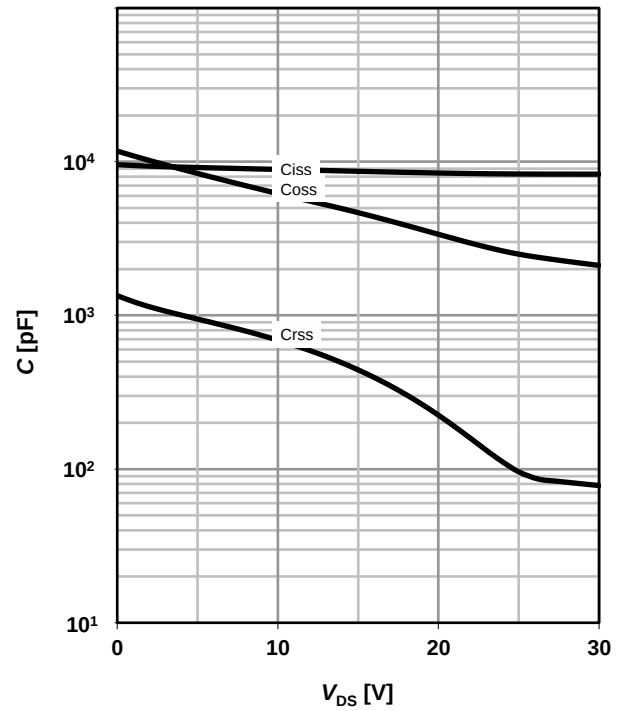
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter: I_D



10 Typ. capacitances

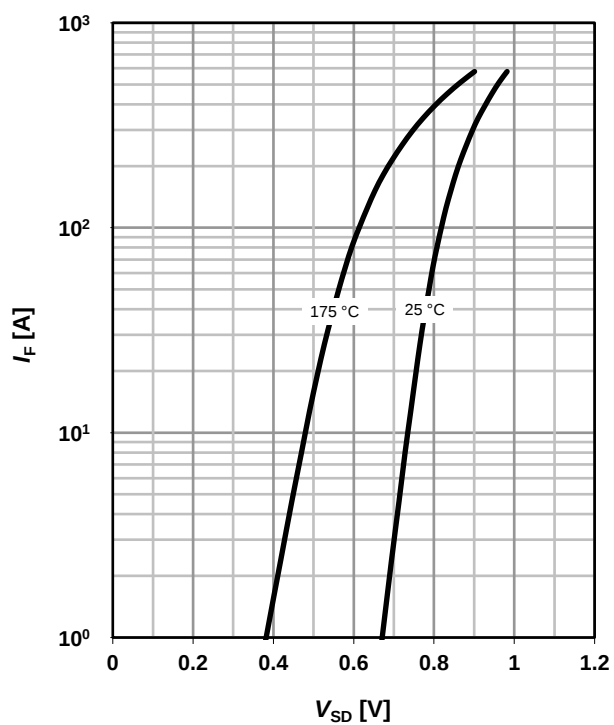
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



11 Typical forward diode characteristics

$$I_F = f(V_{SD})$$

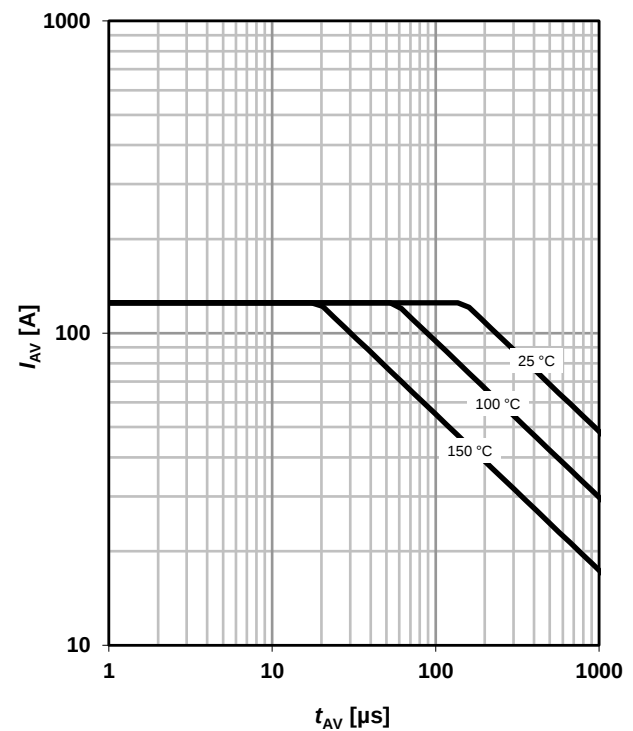
parameter: T_j



12 Avalanche characteristics

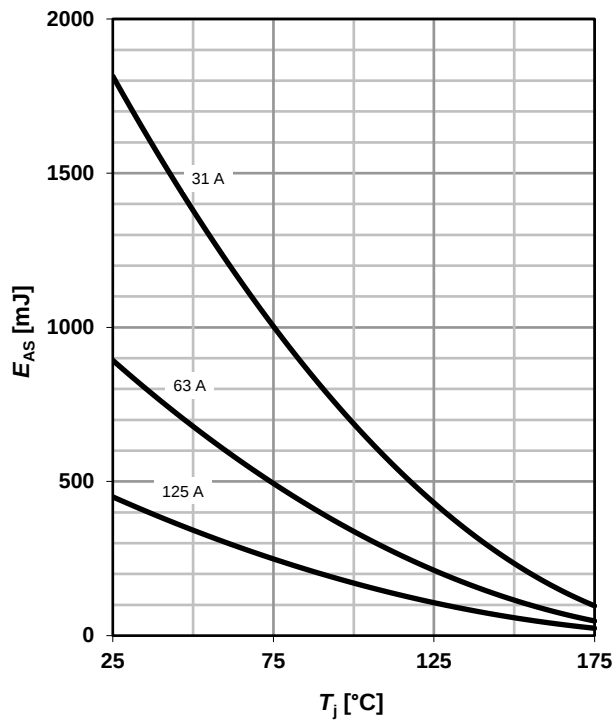
$$I_{AS} = f(t_{AV})$$

parameter: $T_{j(start)}$



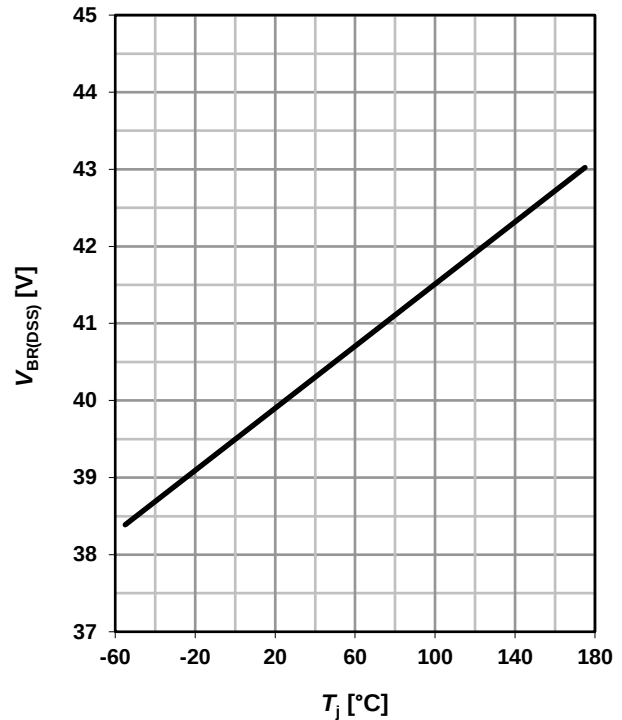
13 Avalanche energy

$$E_{AS} = f(T_j)$$



14 Drain-source breakdown voltage

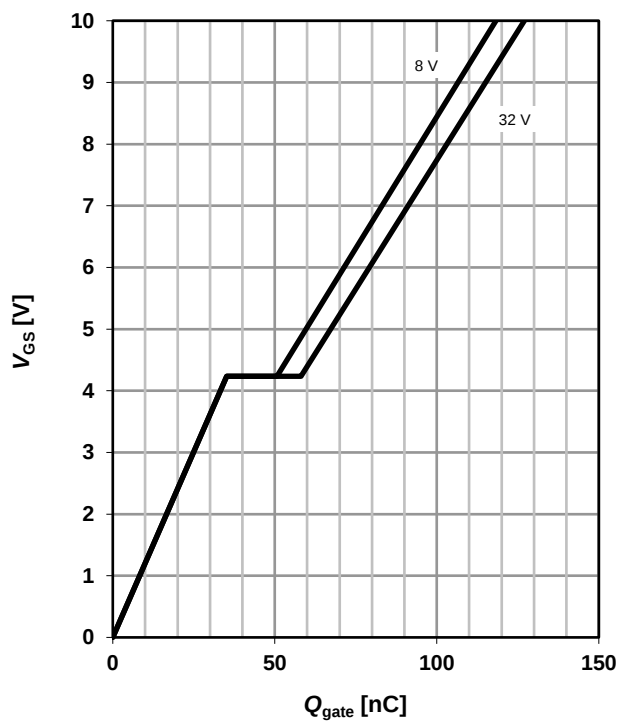
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



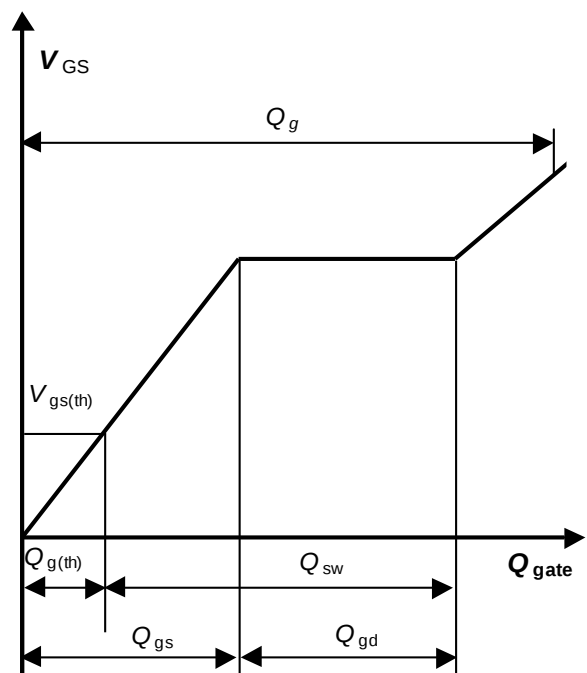
15 Typ. gate charge

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

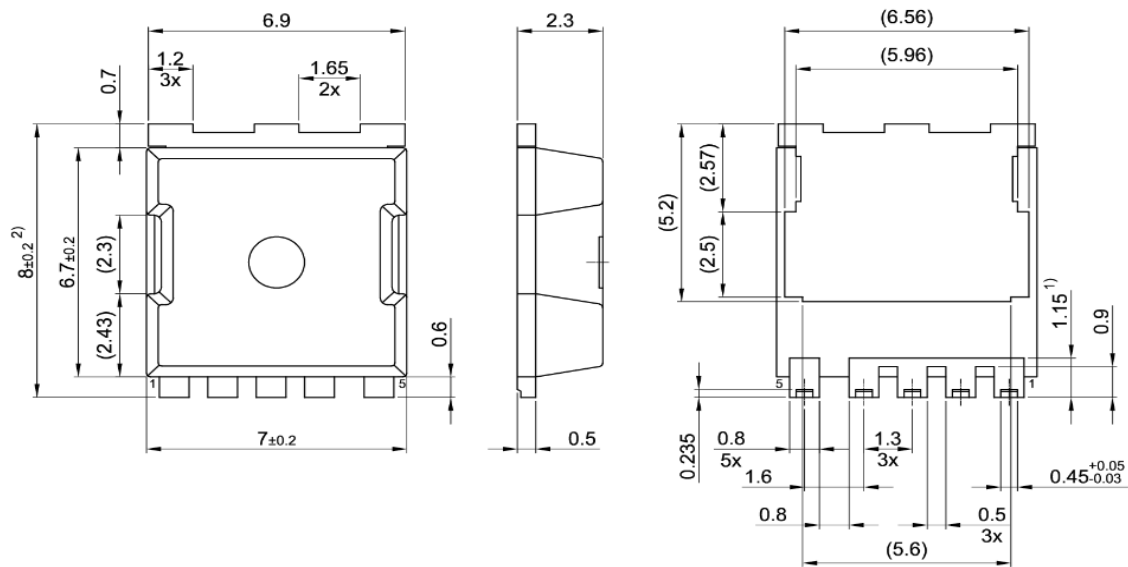
parameter: V_{DD}



16 Gate charge waveforms



PG-HSOF-5: Outline



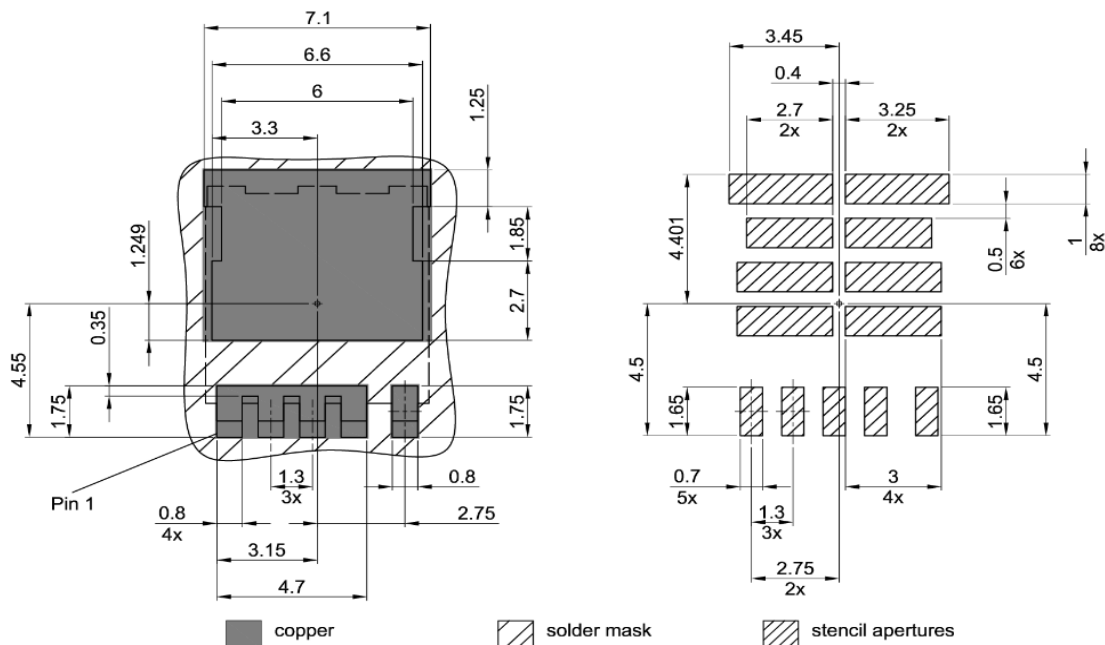
1) Lead length up to anti flash profile; mold flashes excluded

2) Excluding burr

All dimensions are in units mm

The drawing is in compliance with ISO 128-30, Projection Method 1

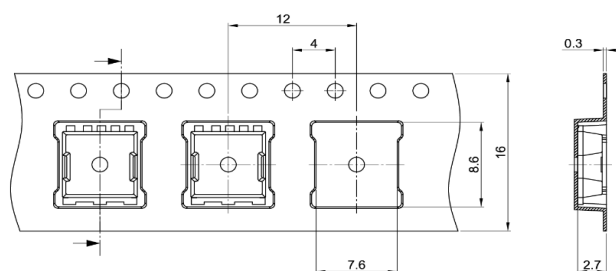
Footprint



All dimensions are in units mm

Dimensions in mm

Packaging



All dimensions are in units mm

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

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If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

Revision History

Version	Date	Changes
Revision 1.0	10.02.2020	Final Datasheet