

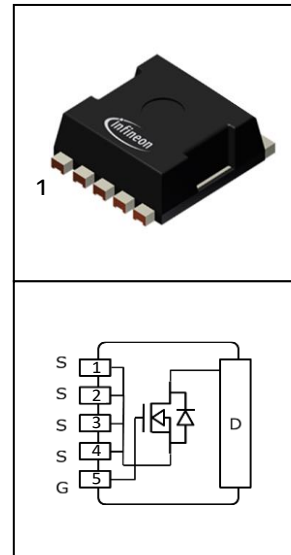
**OptiMOS™ -6 Power-Transistor**

**Product Summary**

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

**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

**PG-HSOF-5-4**


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

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

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
<b>Thermal characteristics<sup>2)</sup></b>						
Thermal resistance, junction - case	$R_{thJC}$	-	-	-	0.6	K/W
Thermal resistance, junction - ambient <sup>4)</sup>	$R_{thJA}$	-	-	22.7	-	

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

**Static characteristics**

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics<sup>2)</sup>**

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 Characteristics<sup>2)</sup>**

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 <sup>5)</sup>	$I_S$	$T_C=25^\circ C$	-	-	325	A
Diode pulse current <sup>5)</sup>	$I_{S,pulse}$	$T_C=25^\circ C, t_p=100\mu s$	-	-	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 <sup>2)</sup>	$t_{rr}$	$V_R=20V, I_F=50A,$ $di_F/dt=100A/\mu s$	-	70	-	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		-	87	-	nC

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

<sup>2)</sup> The parameter is not subject to production test - verified by characterization.

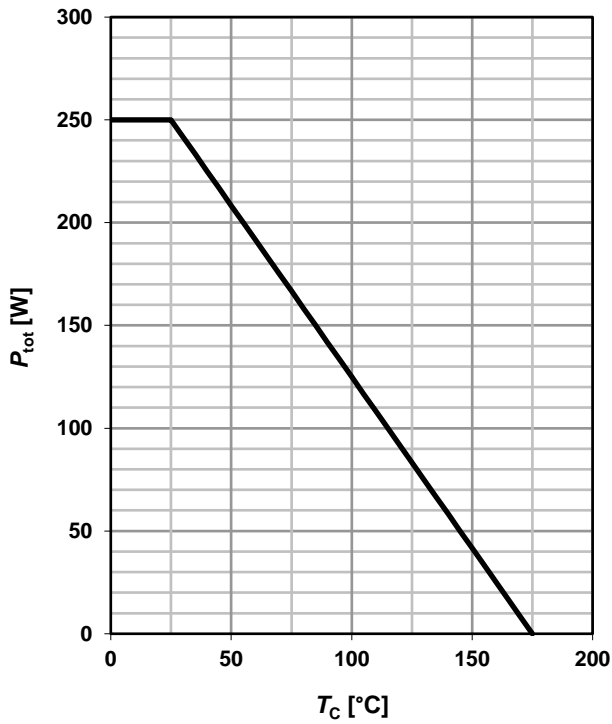
<sup>3)</sup> The product can operate at specified current based on best practice to minimize electromigration at the solder joint. For rare events and inrush currents the value may be exceeded.

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

<sup>5)</sup> The parameter is not subject to production test - verified by design.

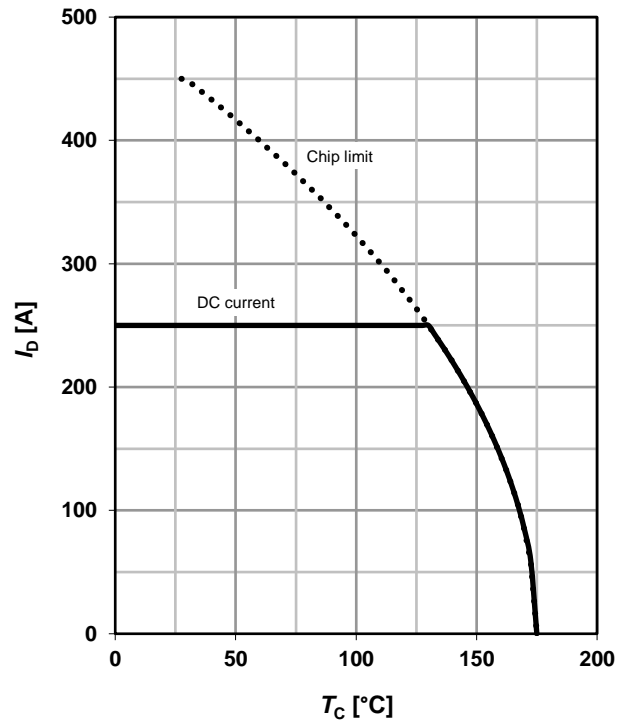
**1 Power dissipation**

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



**2 Drain current**

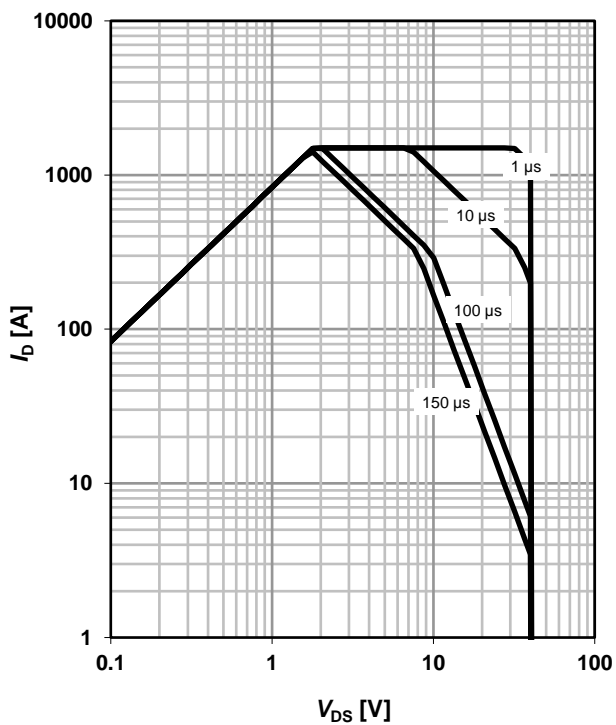
$I_D = f(T_C); V_{GS} = 10\text{ V}$



**3 Safe operating area**

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

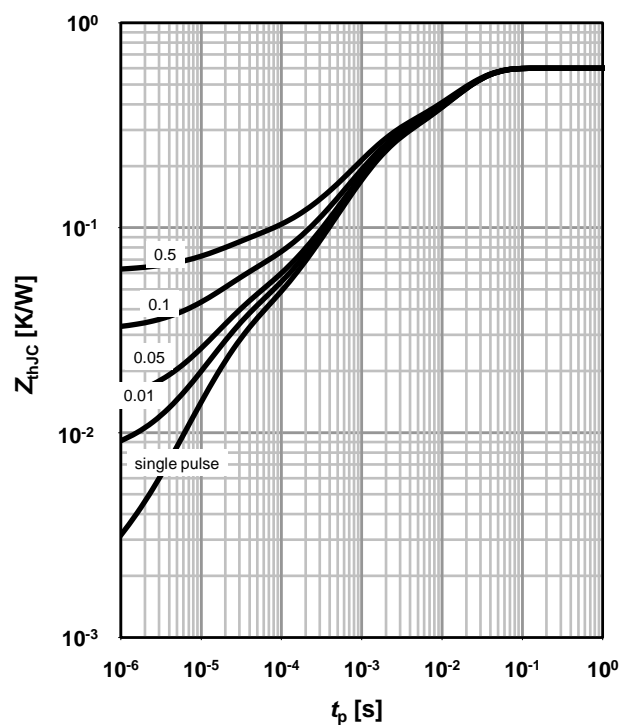
parameter:  $t_p$



**4 Max. transient thermal impedance**

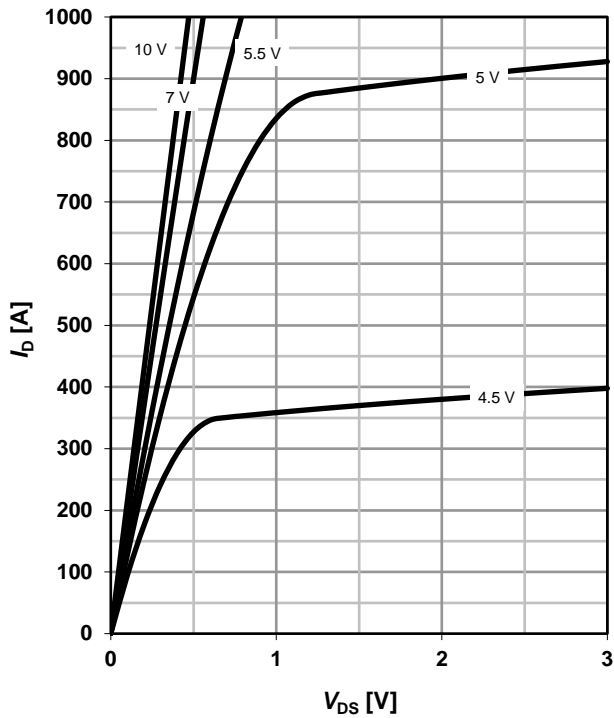
$Z_{thJC} = f(t_p)$

parameter:  $D = t_p/T$

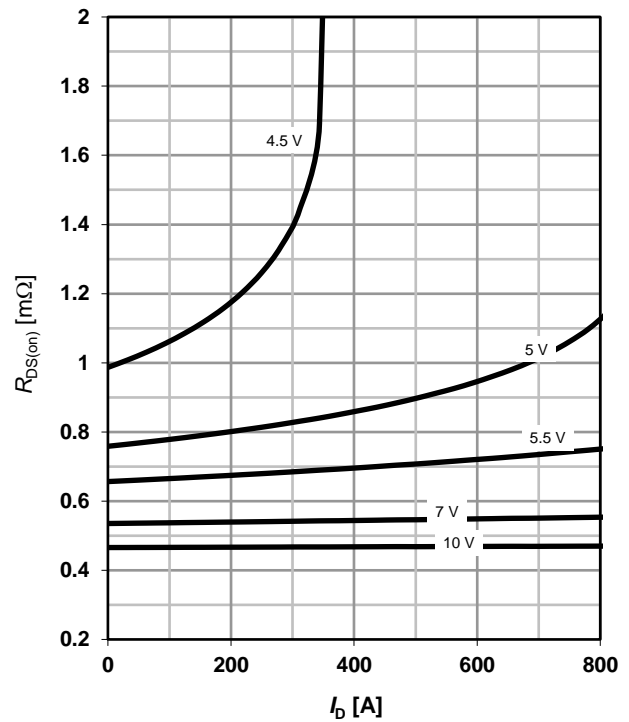


**5 Typ. output characteristics**

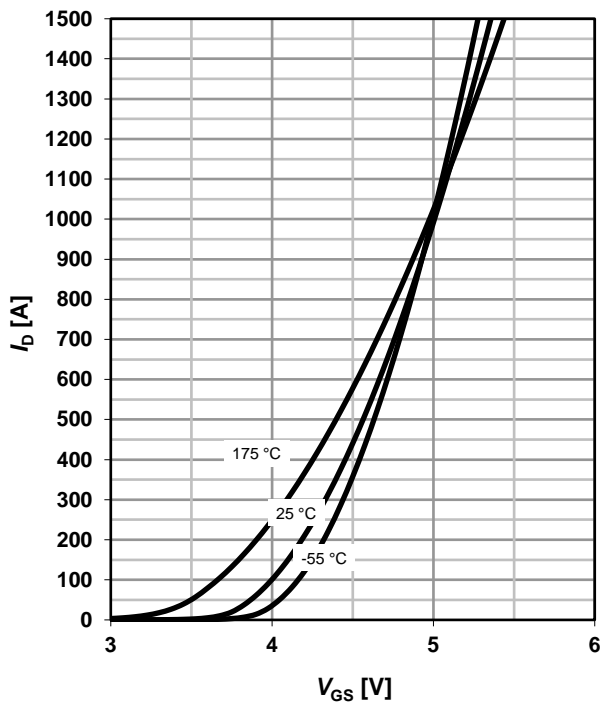
$$I_D = f(V_{DS}); T_j = 25\text{ }^\circ\text{C}$$

 parameter:  $V_{GS}$ 

**6 Typ. drain-source on-state resistance**

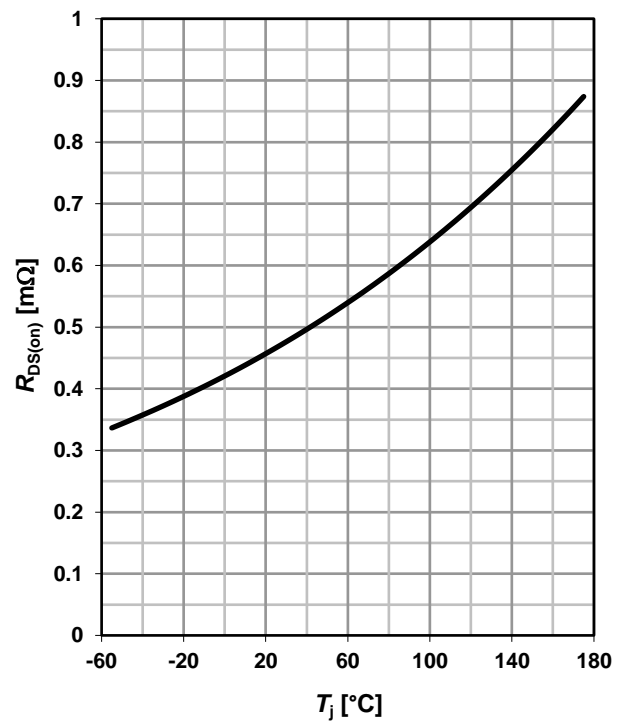
$$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}$$

 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**

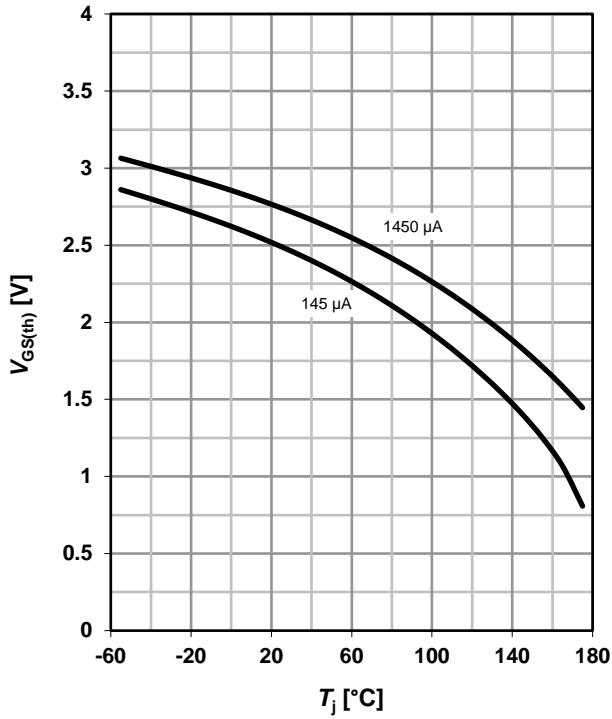
$$R_{DS(on)} = f(T_j); I_D = 125\text{ A}; V_{GS} = 10\text{ V}$$



**9 Typ. gate threshold voltage**

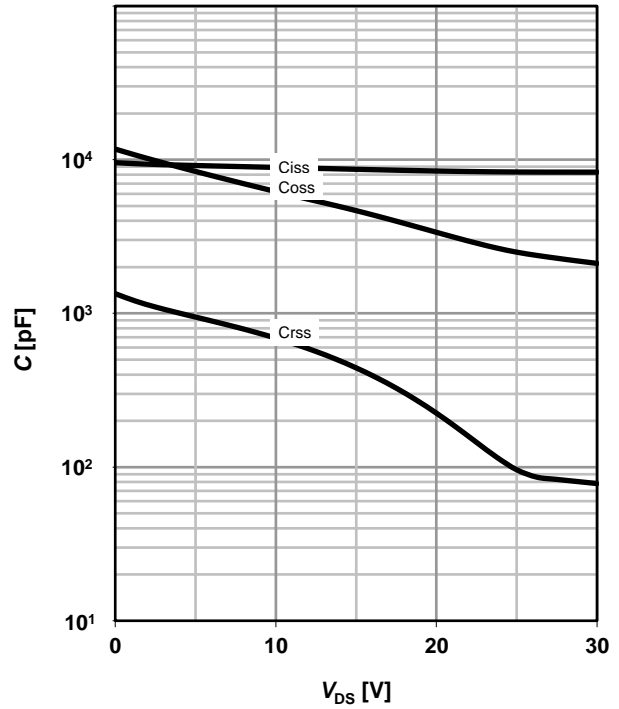
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**10 Typ. capacitances**

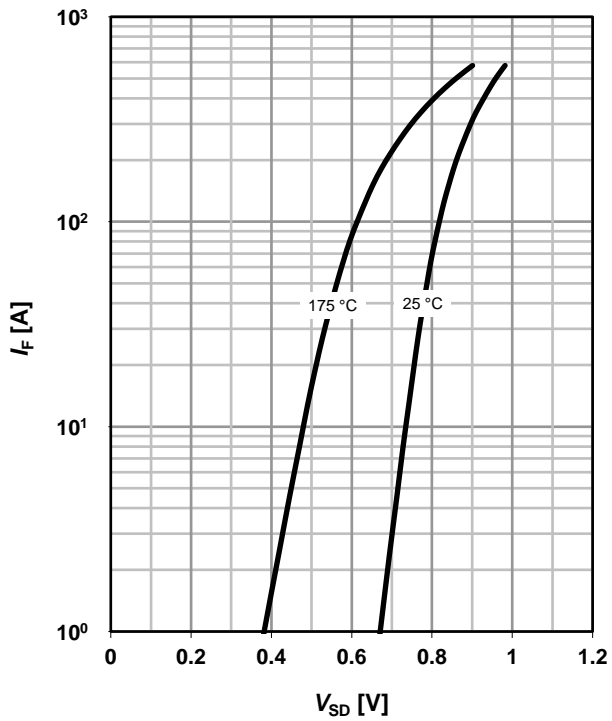
$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$



**11 Typical forward diode characteristics**

$I_F = f(V_{SD})$

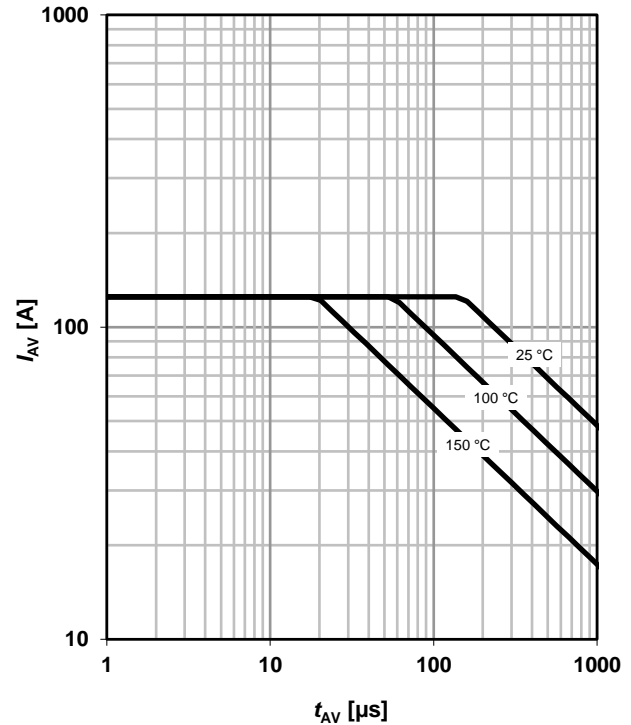
parameter:  $T_j$



**12 Avalanche characteristics**

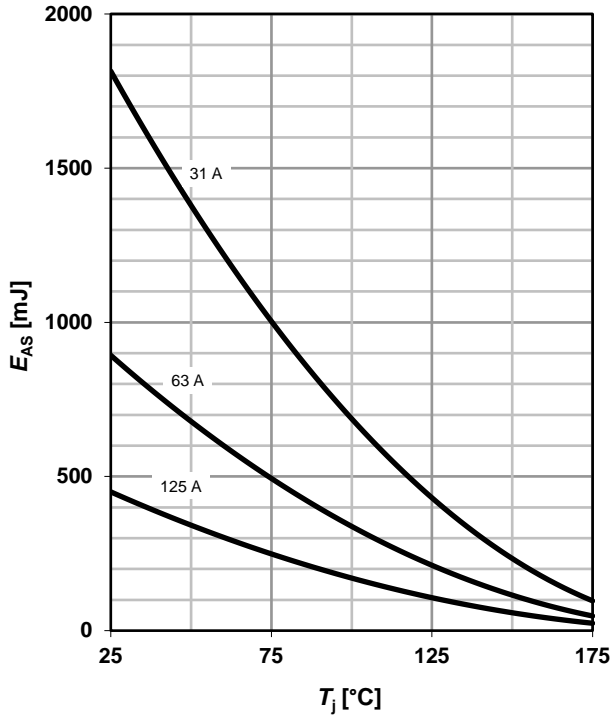
$I_{AS} = f(t_{AV})$

parameter:  $T_{j(start)}$



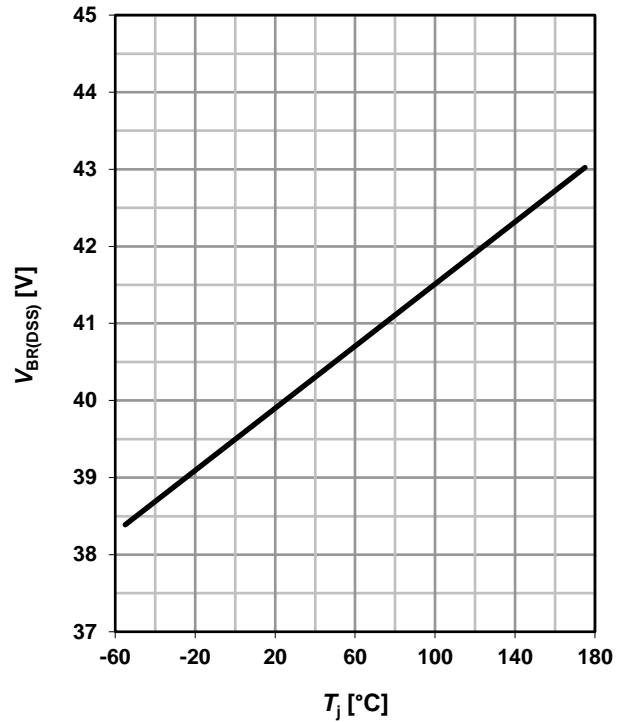
**13 Avalanche energy**

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



**14 Drain-source breakdown voltage**

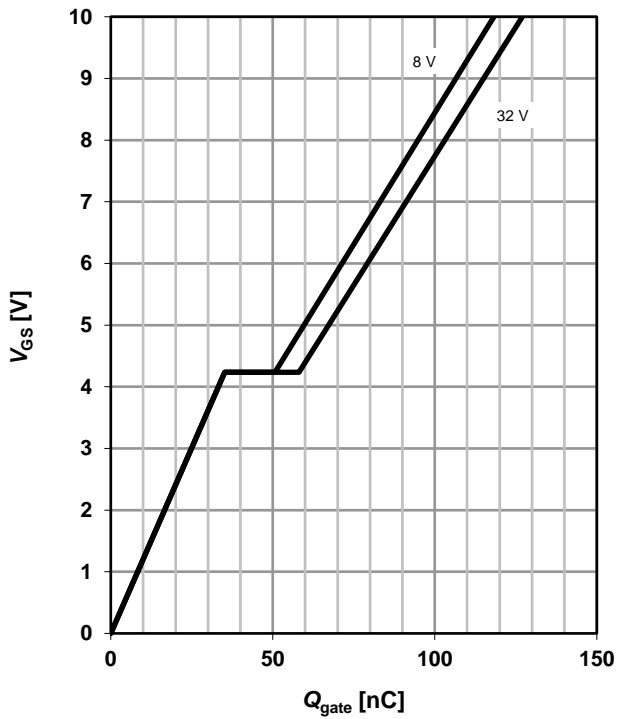
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



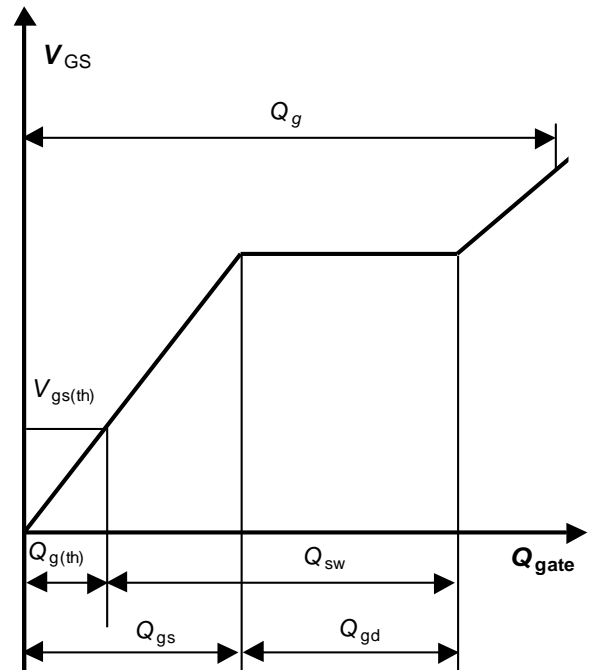
**15 Typ. gate charge**

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

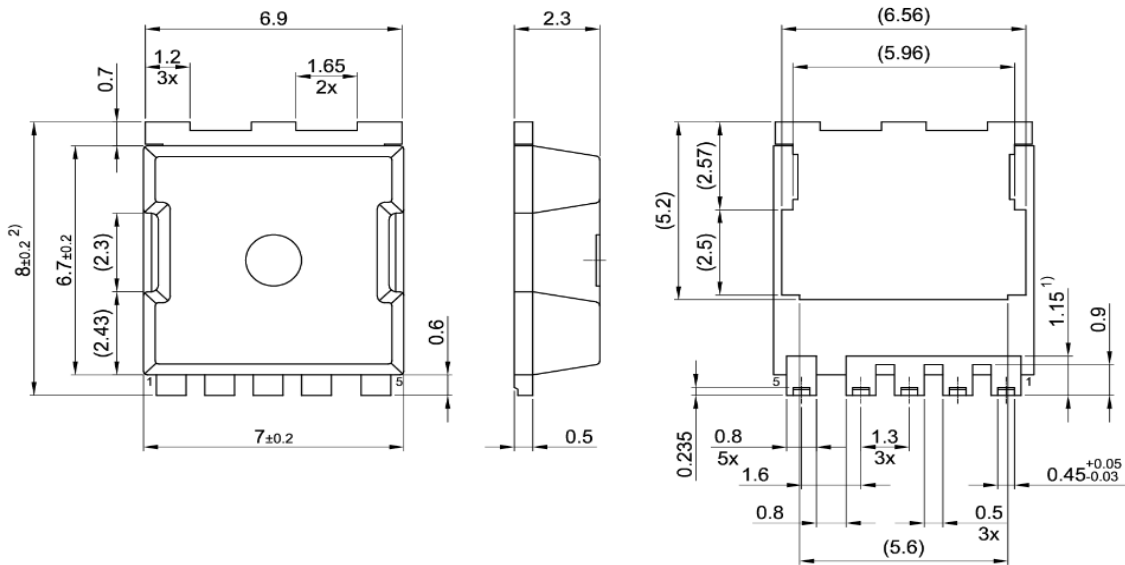
parameter:  $V_{DD}$



**16 Gate charge waveforms**

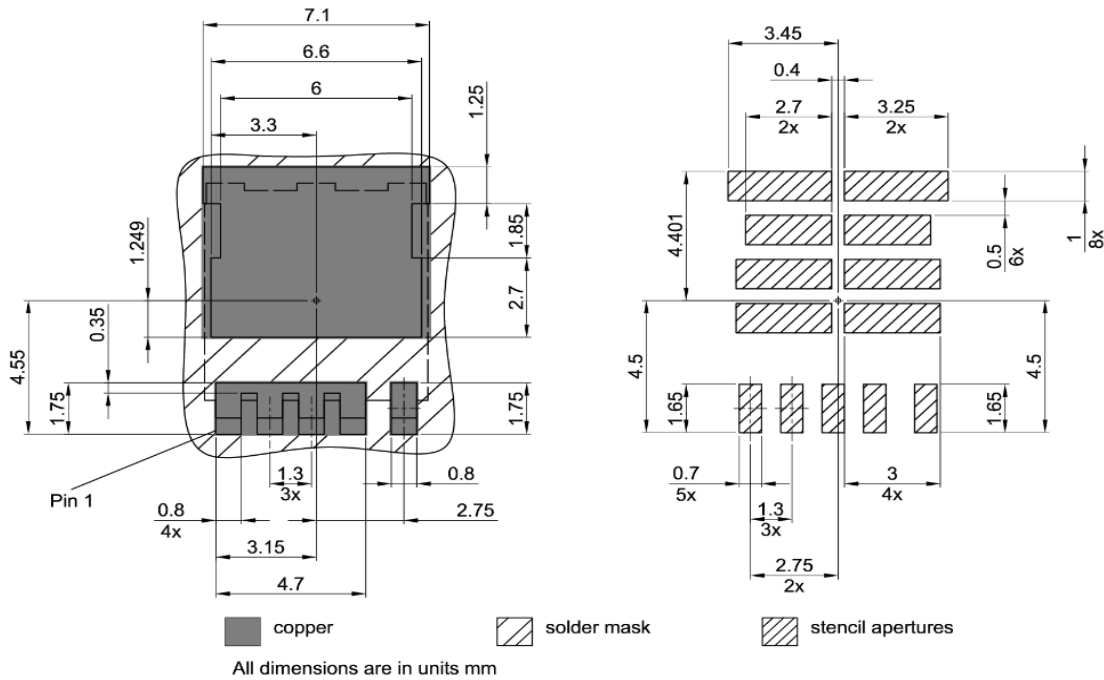


**PG-HSOF-5: Outline**



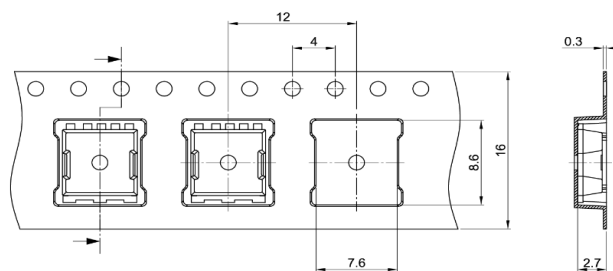
1) Lead length up to anti flash profile; mold flashes excluded  
 2) Excluding burr  
 All dimensions are in units mm  
 The drawing is in compliance with ISO 128-30, Projection Method 1 [ ]

**Footprint**



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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Revision History

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Version	Date	Changes
Revision 1.0	10.02.2020	Final Datasheet