

Automotive MOSFET

OptiMOS™ 7 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
- MSL2 up to 260°C peak reflow
- 175°C operating temperature
- RoHS compliant
- 100% Avalanche tested

Potential Applications

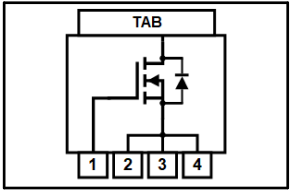
General automotive applications.

Product Validation

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

Product Summary

$V_{DS}$	40	V
$R_{DS(on)}$	0.86	mΩ
$I_D$ (chip limited)	390	A



Type	Package	Marking
IAUMN04S7N009G	PG-HSOG-4-1	7N04N009



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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$V_{GS} = 10\text{ V}$ , Chip limitation <sup>1,2)</sup>	390	A
		$V_{GS} = 10\text{ V}$ , DC current	200	
		$T_a = 100^\circ\text{C}$ , $V_{GS} = 10\text{ V}$ , $R_{thJA}$ on 2s2p <sup>2,3)</sup>	44	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C = 25^\circ\text{C}$ , $t_p = 100\text{ }\mu\text{s}$	1000	
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	$I_D = 87\text{ A}$	213	mJ
Avalanche current, single pulse	$I_{AS}$	–	175	A
Gate source voltage	$V_{GS}$	–	$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C = 25^\circ\text{C}$	161	W
Operating and storage temperature	$T_j, T_{stg}$	–	-55 ... +175	$^\circ\text{C}$

## Thermal Characteristics<sup>2)</sup>

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal resistance, junction - case	$R_{thJC}$	–	–	–	0.93	K/W
Thermal resistance, junction - ambient <sup>3)</sup>	$R_{thJA}$	–	–	23.4	–	

## Electrical Characteristics

at  $T_j = 25^\circ\text{C}$ , 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	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 80\text{ }\mu\text{A}$	2.2	2.6	3.0	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 40\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25^\circ\text{C}$	–	–	1	$\mu\text{A}$
		$V_{DS} = 40\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 100^\circ\text{C}^{2)}$	–	–	19	
Gate-source leakage current	$I_{GSS}$	$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$	–	–	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 7\text{ V}$ , $I_D = 50\text{ A}$	–	0.86	0.98	m $\Omega$
		$V_{GS} = 10\text{ V}$ , $I_D = 100\text{ A}$	–	0.76	0.86	
Gate resistance <sup>2)</sup>	$R_G$	–	–	0.7	–	$\Omega$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic Characteristics <sup>2)</sup>						
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 20 V, f = 1 MHz	–	5260	6838	pF
Output capacitance	C <sub>oss</sub>		–	3066	3986	
Reverse transfer capacitance	C <sub>rss</sub>		–	119	179	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 100 A, R <sub>G</sub> = 3.5 Ω	–	9	–	ns
Rise time	t <sub>r</sub>		–	7	–	
Turn-off delay time	t <sub>d(off)</sub>		–	24	–	
Fall time	t <sub>f</sub>		–	15	–	

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

Gate to source charge	$Q_{gs}$	$V_{DD} = 20\text{ V}, I_D = 100\text{ A},$ $V_{GS} = 0\text{ to }10\text{ V}$	–	22	29	nC
Gate to drain charge	$Q_{gd}$		–	15	23	
Gate charge total	$Q_g$		–	77	101	
Gate plateau voltage	$V_{plateau}$		–	4.2	–	V

**Reverse Diode**

Diode continuous forward current <sup>2)</sup>	$I_S$	$T_C = 25^\circ\text{C}$	–	–	200	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$	$T_C = 25^\circ\text{C}, t_p = 100\ \mu\text{s}$	–	–	1000	
Diode forward voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_F = 100\text{ A}, T_J = 25^\circ\text{C}$	–	0.8	0.95	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R = 40\text{ V}, I_F = 50\text{ A}$ $di_F/dt = 100\text{ A}/\mu\text{s}$	–	48	72	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		–	49	99	nC

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

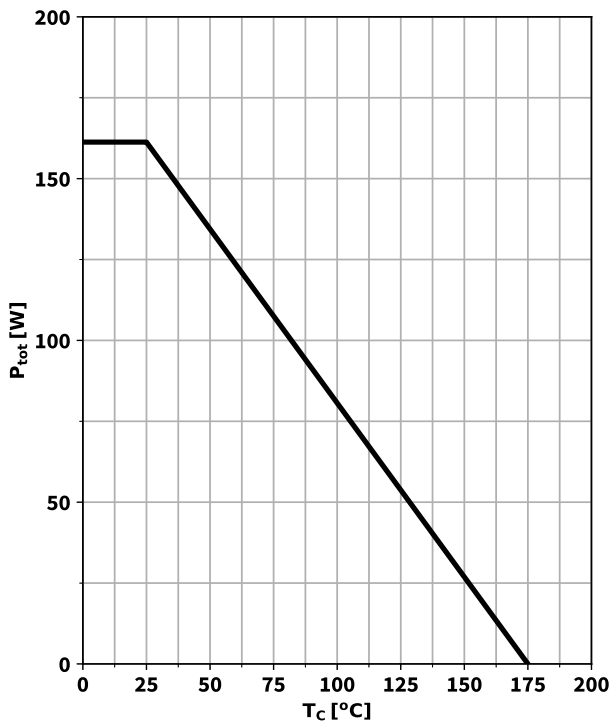
<sup>2)</sup> The parameter is not subject to production testing – specified by design.

<sup>3)</sup> Device on 2s2p FR4 PCB defined in accordance with JEDEC standards (JESD51-5, -7). PCB is vertical in still air.

## Electrical characteristics diagrams

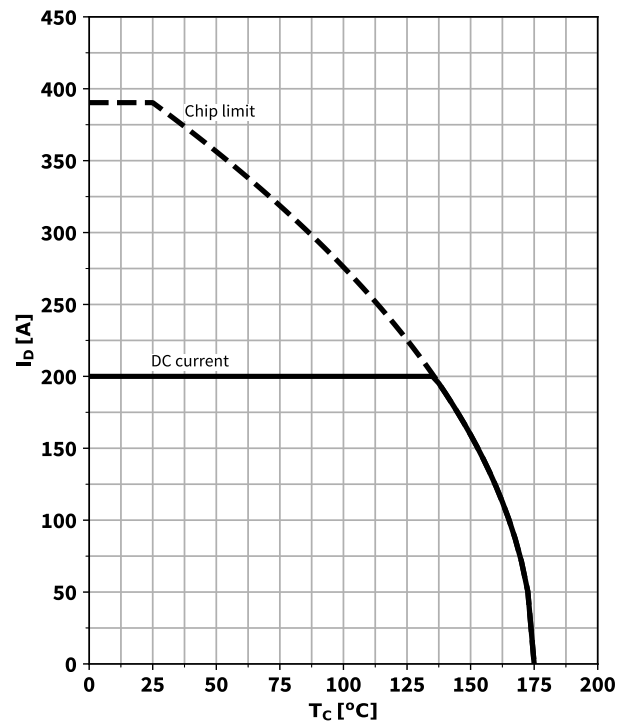
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C); V_{\text{GS}} \geq 6 \text{ V}$$



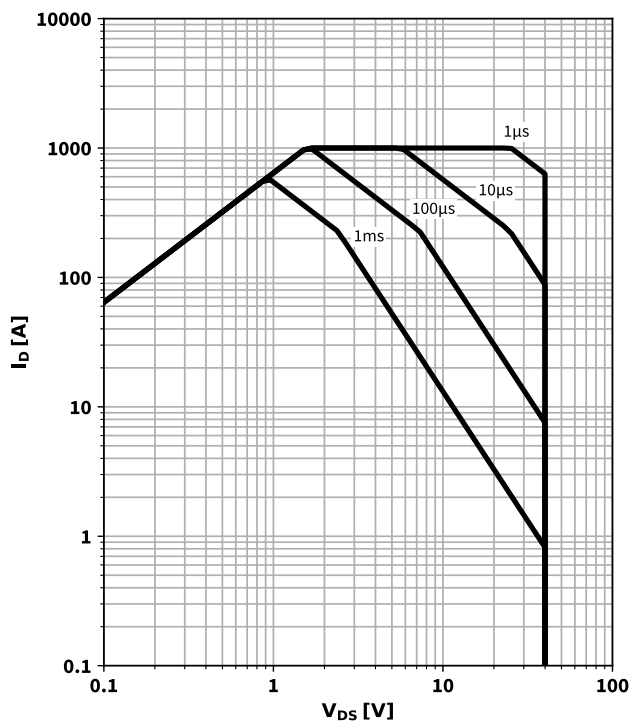
### 2 Drain current

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



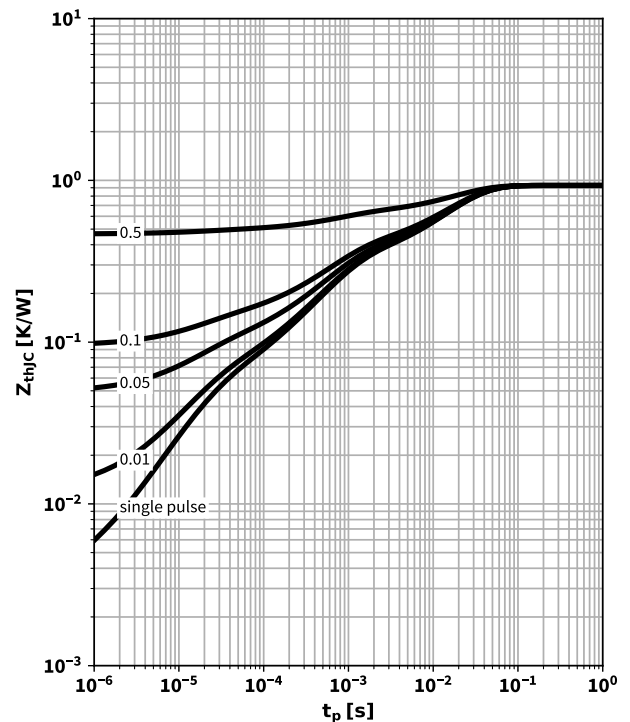
### 3 Safe operating area

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



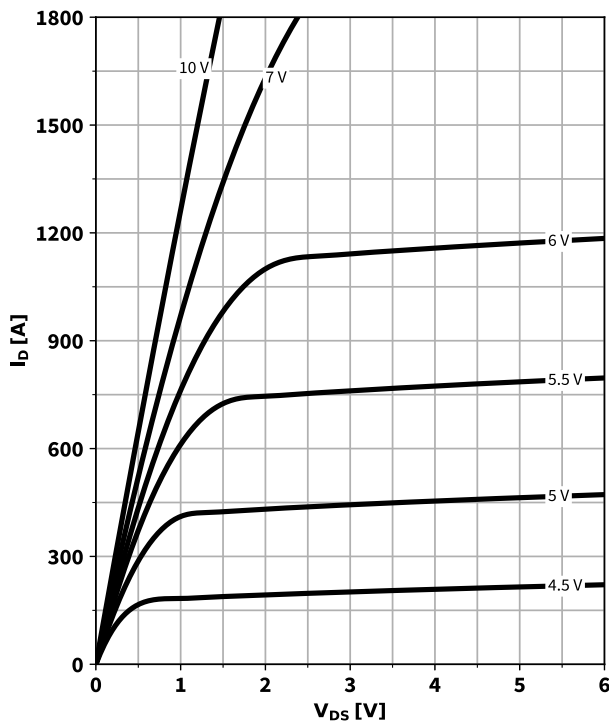
### 4 Max. transient thermal impedance

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



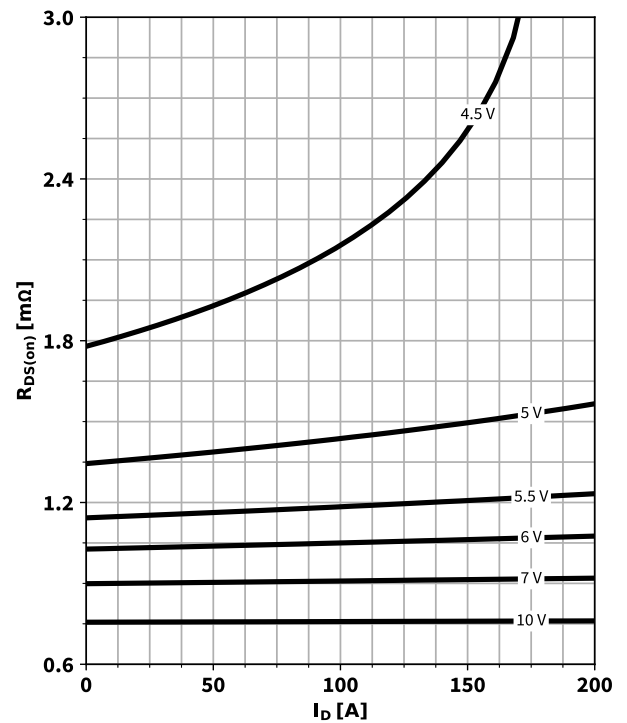
5 Typ. output characteristics

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



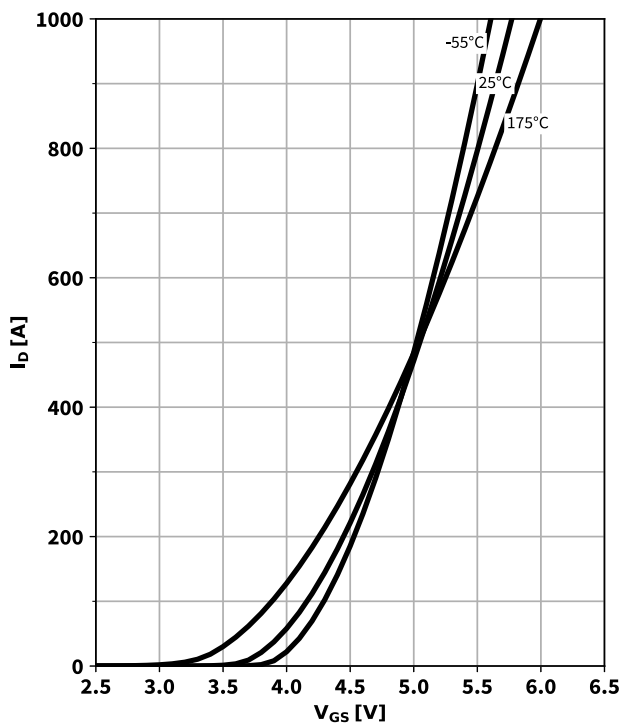
6 Typ. drain-source on-state resistance

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



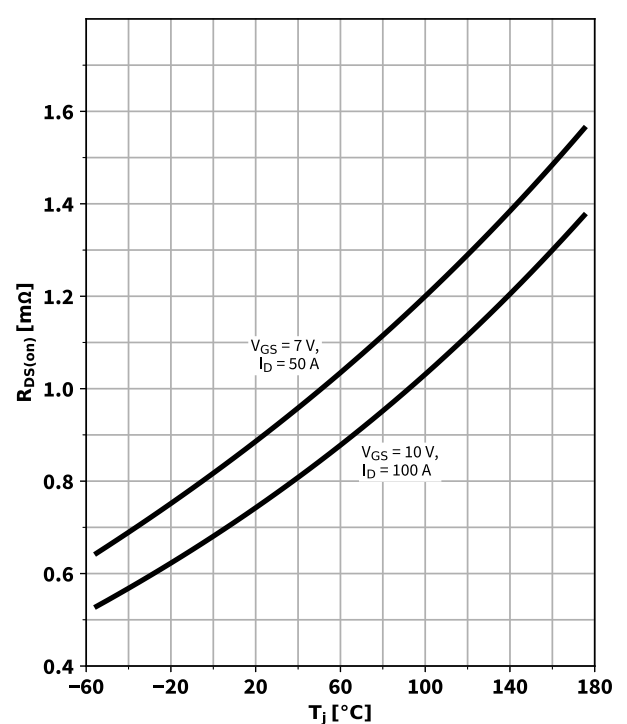
7 Typ. transfer characteristics

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



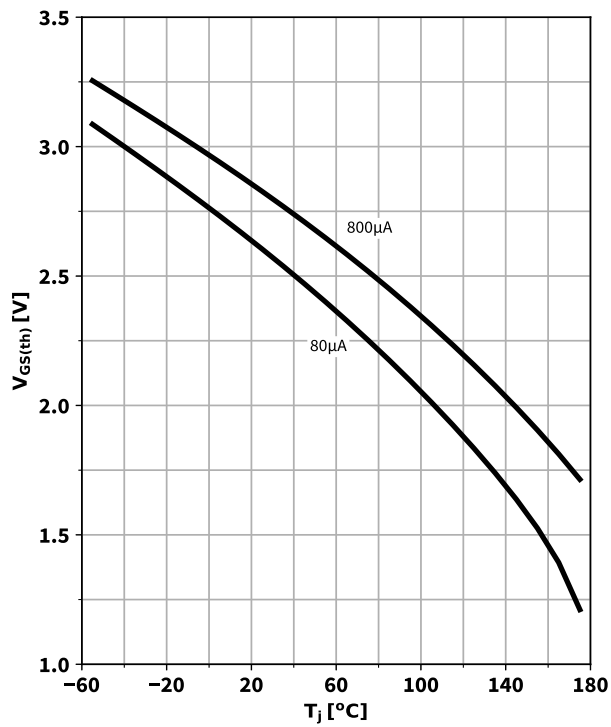
8 Typ. drain-source on-state resistance

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



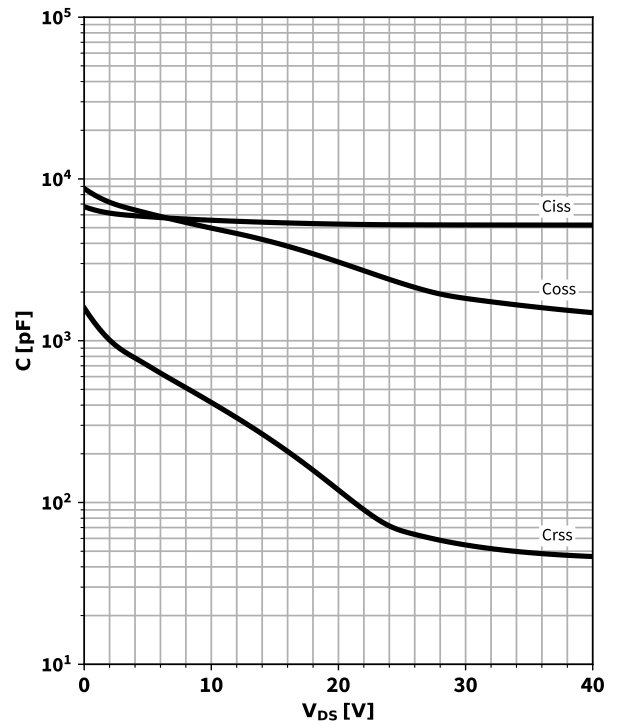
## 9 Typ. gate threshold voltage

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



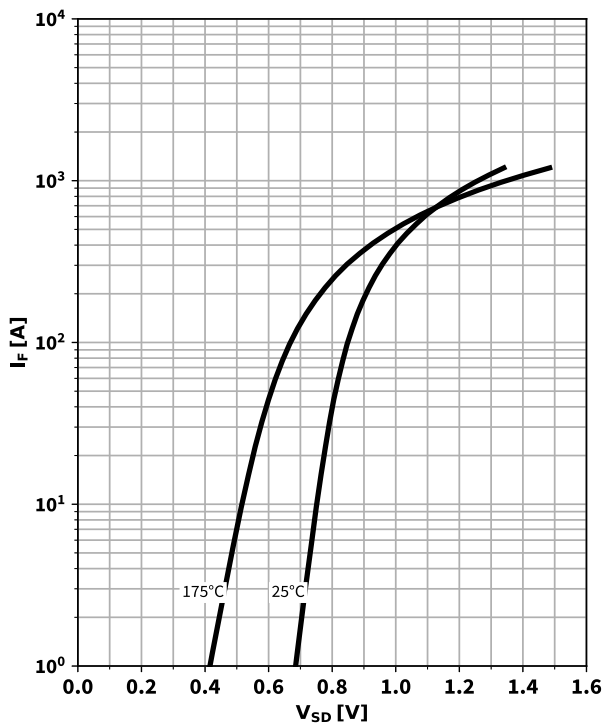
## 10 Typ. capacitances

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



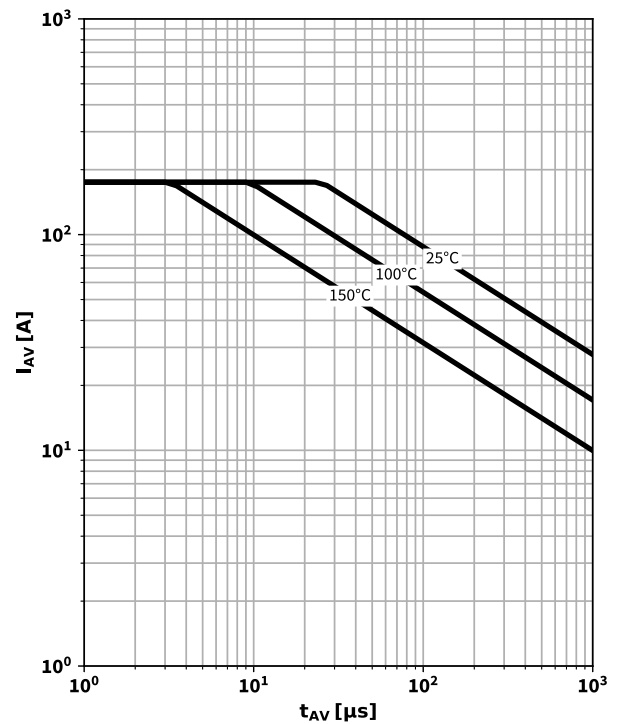
## 11 Typ. forward diode characteristics

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



## 12 Typ. avalanche characteristics

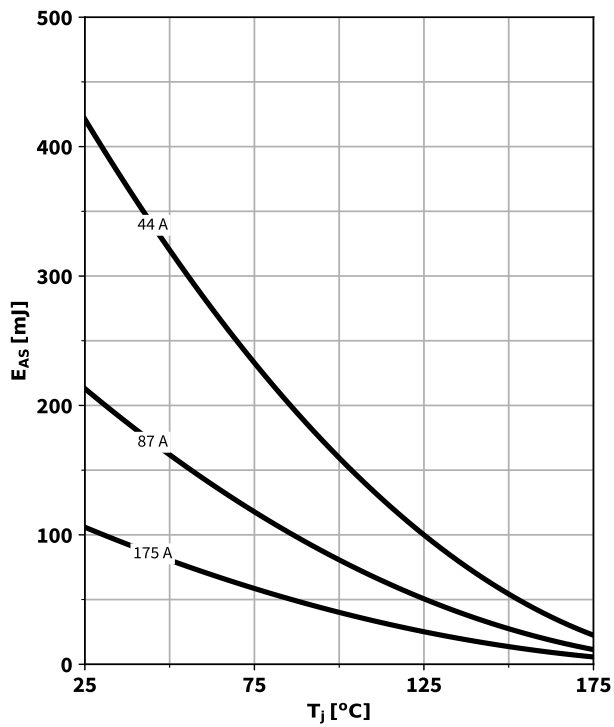
$I_{AS} = f(t_{AV})$ ; parameter:  $T_{j(start)}$





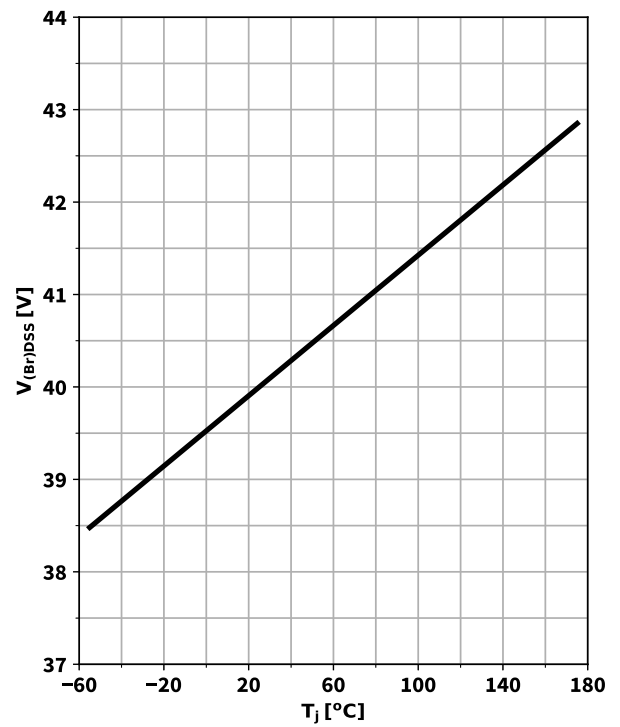
## 13 Typical avalanche energy

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



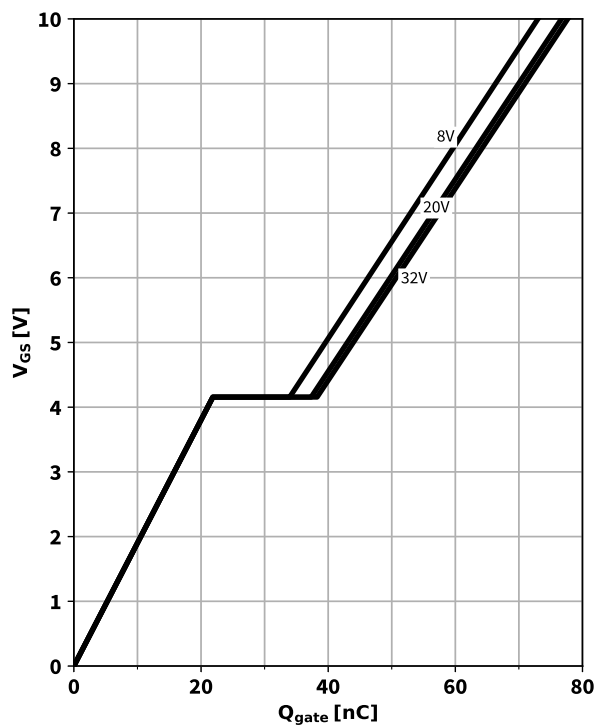
## 14 Drain-source breakdown voltage

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



## 15 Typ. gate charge

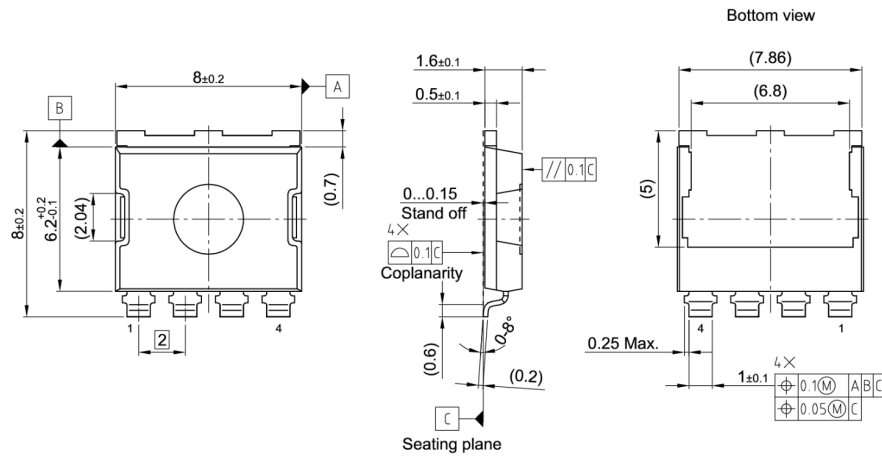
$V_{GS} = f(Q_{gate})$ ;  $I_D = 100$  A pulsed; parameter:  $V_{DD}$



## 16 Gate charge waveforms

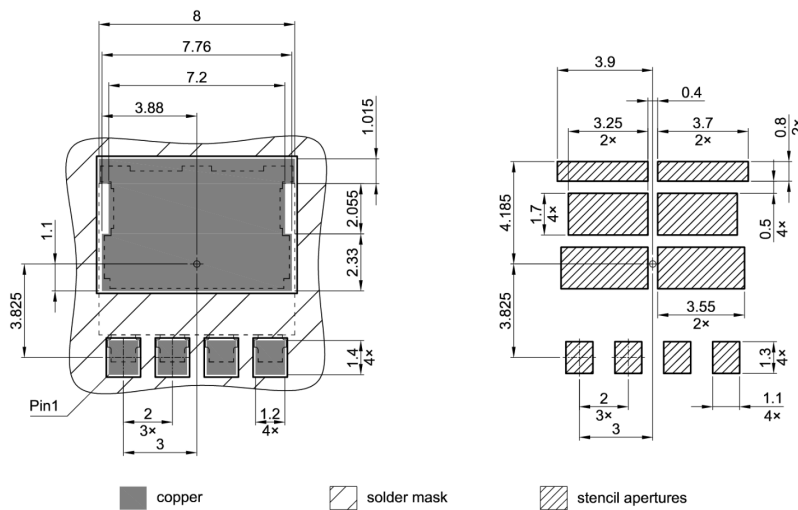


## Package Outline



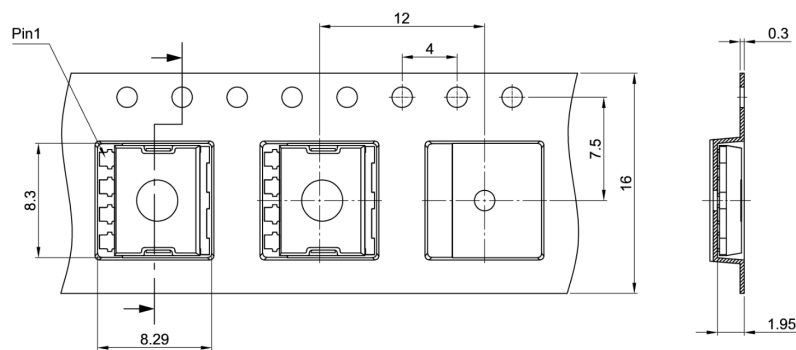
All dimensions are in units mm  
 The drawing is in compliance with ISO 128-30, Projection Method 1 [⊥] [⊕]  
 Drawing according to ISO 8015, general tolerances ISO 2768-mK

## Footprint



All dimensions are in units mm  
 All pads are non-solder mask defined

## 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	2024-04-05	Final Data Sheet

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**Document reference**

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