

## Automotive MOSFET

## OptiMOS™ 7 Power-Transistor



## Features

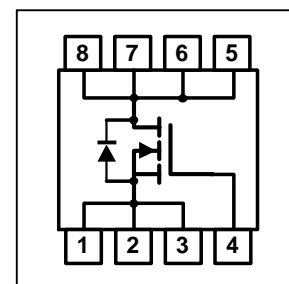
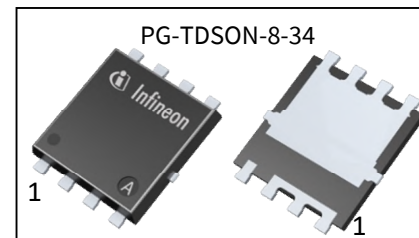
- OptiMOS™ power MOSFET for automotive applications
- N-channel – Enhancement mode – Normal Level
- Extended qualification beyond AEC-Q101
- Enhanced electrical testing
- Robust design
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- RoHS compliant
- 100% Avalanche tested

## Potential applications

General automotive applications.

## Product validation

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



## Product Summary

$V_{DS}$	40	V
$R_{DS(on)}$	0.96	m $\Omega$
$I_D$ (chip limited)	268	A

Type	Package	Marking
IAUCN04S7N009	PG-TDSON-8-34	7N04N009



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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 <sup>1,2)</sup>	268	A
		$V_{GS}=10\text{V}$ , DC current	175	
		$T_a=100\text{ °C}$ , $V_{GS}=10\text{ V}$ , $R_{thJA}$ on 2s2p <sup>2,3)</sup>	39	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$ , $t_p=100\text{ }\mu\text{s}$	820	
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	$I_D=67\text{ A}$	145	mJ
Avalanche current, single pulse	$I_{AS}$	–	133	A
Gate source voltage	$V_{GS}$	–	$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	129	W
Operating and storage temperature	$T_j, T_{stg}$	–	-55 ... +175	°C

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal resistance, junction - case	$R_{thJC}$	–	–	0.6	1.2	K/W
Thermal resistance, junction - ambient <sup>3)</sup>	$R_{thJA}$	–	–	27	–	

## 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	$V_{GS(th)}$	$V_{DS}=V_{GS}$ , $I_D=60\text{ }\mu\text{A}$	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	$\mu\text{A}$
		$V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=100\text{ °C}^{2)}$	–	–	14	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$	–	–	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=7\text{ V}$ , $I_D=44\text{ A}$	–	1.05	1.20	m $\Omega$
		$V_{GS}=10\text{ V}$ , $I_D=88\text{ A}$	–	0.86	0.96	
Gate resistance <sup>2)</sup>	$R_G$	–	–	1.2	–	$\Omega$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

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

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=20\text{ V}, f=1\text{ MHz}$	-	3892	5060	pF
Output capacitance	$C_{oss}$		-	2264	2940	
Reverse transfer capacitance	$C_{rss}$		-	75	113	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20\text{ V}, V_{GS}=10\text{ V}, I_D=88\text{ A}, R_G=3.5\ \Omega$	-	8	-	ns
Rise time	$t_r$		-	6	-	
Turn-off delay time	$t_{d(off)}$		-	22	-	
Fall time	$t_f$		-	13	-	

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

Gate to source charge	$Q_{gs}$	$V_{DD}=20\text{ V}, I_D=88\text{ A}, V_{GS}=0\text{ to }10\text{ V}$	-	16	21	nC
Gate to drain charge	$Q_{gd}$		-	11	17	
Gate charge total	$Q_g$		-	57	74	
Gate plateau voltage	$V_{plateau}$		-	4.2	-	V

**Reverse Diode**

Diode continuous forward current <sup>2)</sup>	$I_S$	$T_C=25\text{ °C}$	-	-	175	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$	$T_C=25\text{ °C}, t_p=100\ \mu\text{s}$	-	-	820	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=88\text{ A}, T_j=25\text{ °C}$	-	0.8	0.95	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R=20\text{ V}, I_F=50\text{ A}, di_f/dt=100\text{ A}/\mu\text{s}$	-	40	60	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		-	31	63	

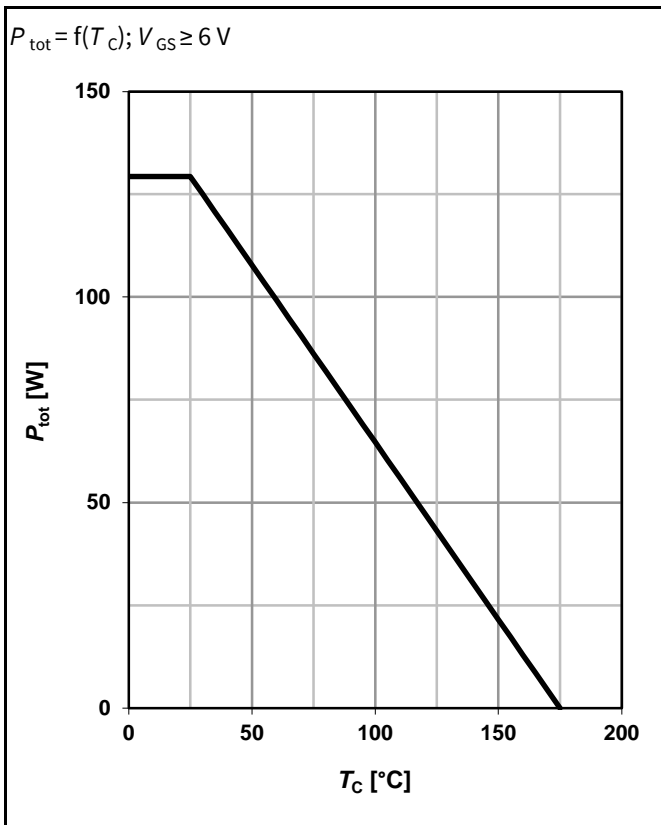
<sup>1)</sup> Practically the current is limited by the overall system design including the customer-specific PCB.

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

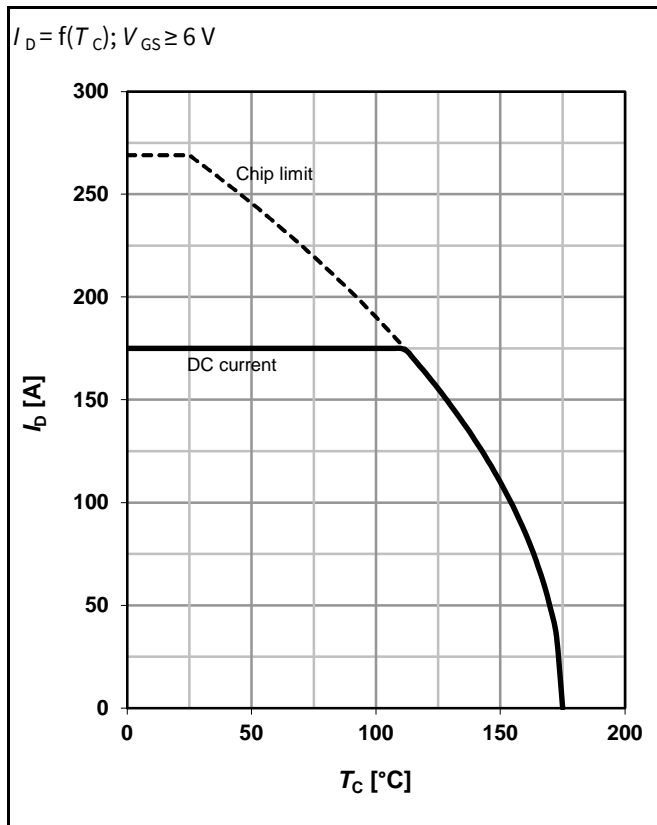
<sup>3)</sup> Device on 2s2p FR4 PCB defined in accordance with JEDEC standards (JESD51-5, -7). PCB is vertical in still air.

## Electrical characteristics diagrams

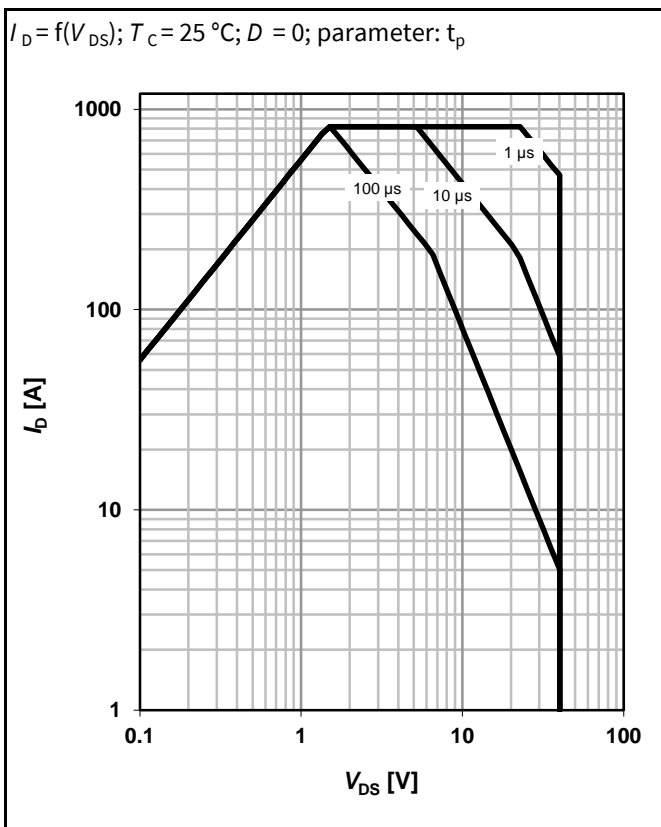
### 1 Power dissipation



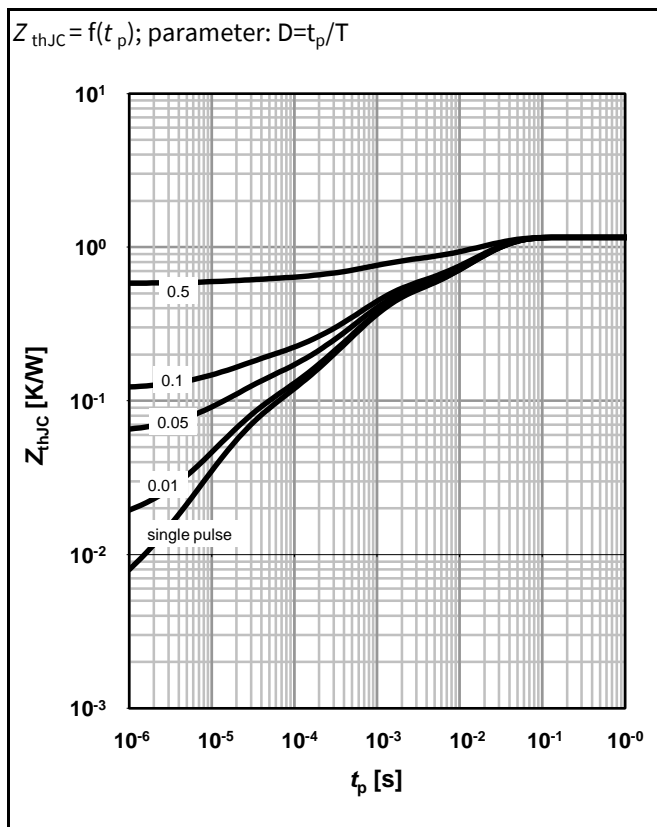
### 2 Drain current



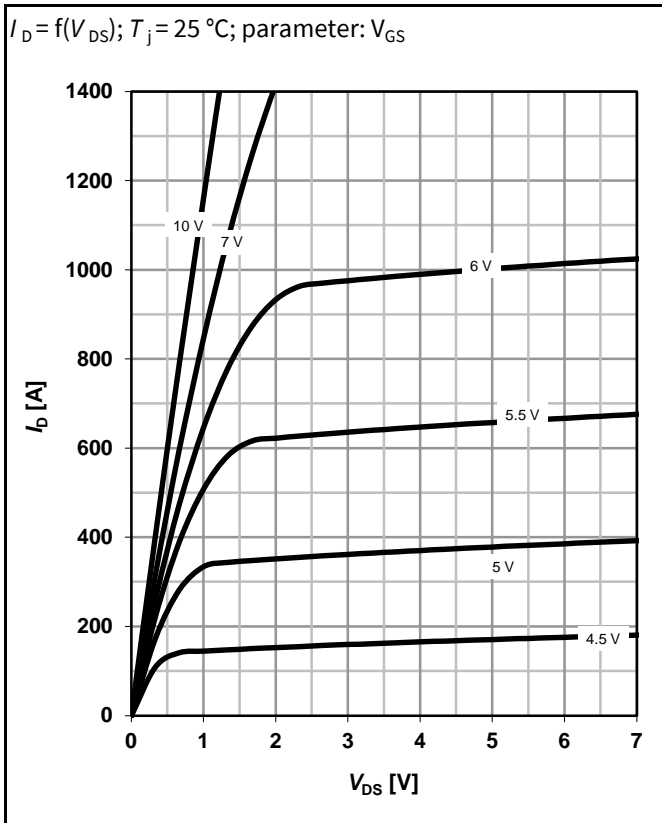
### 3 Safe operating area



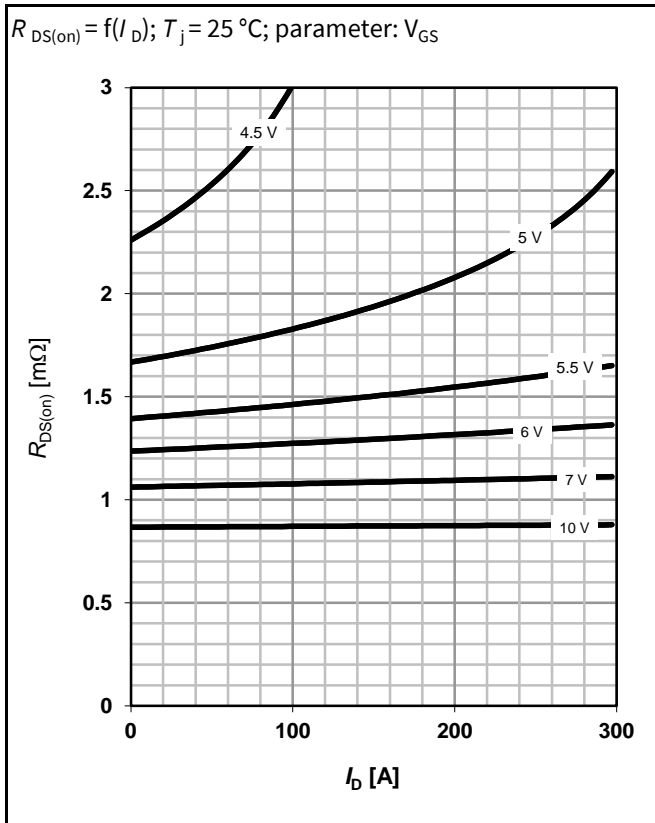
### 4 Max. transient thermal impedance



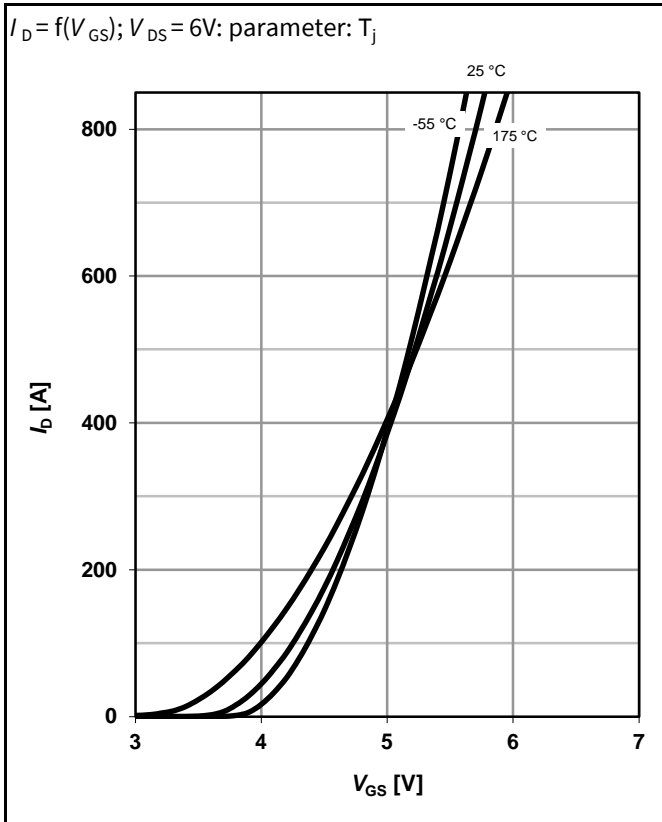
5 Typ. output characteristics



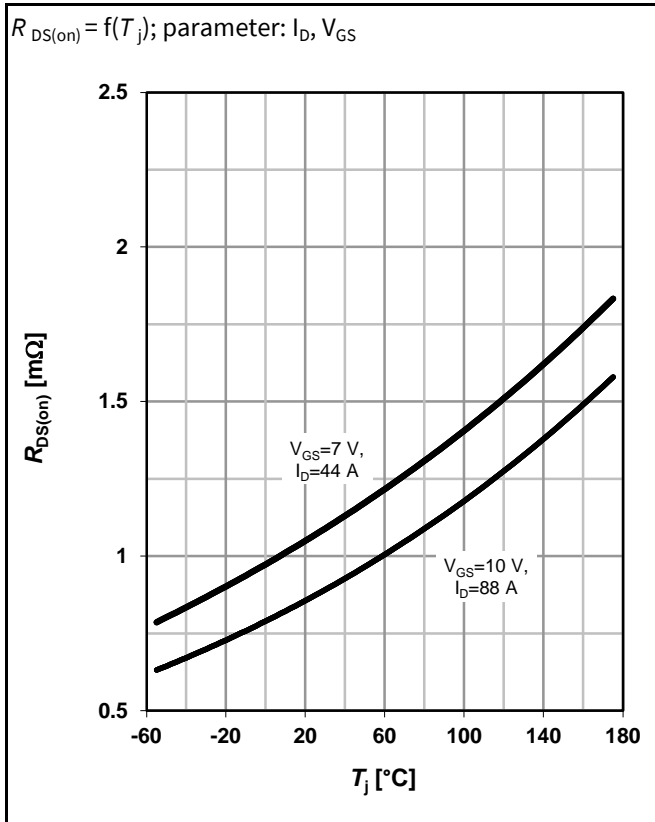
6 Typ. drain-source on-state resistance



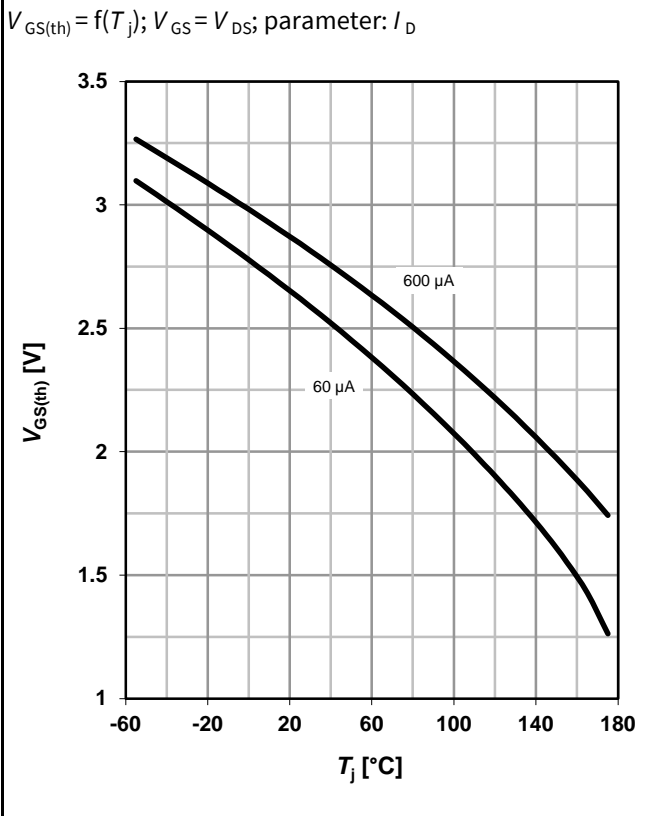
7 Typ. transfer characteristics



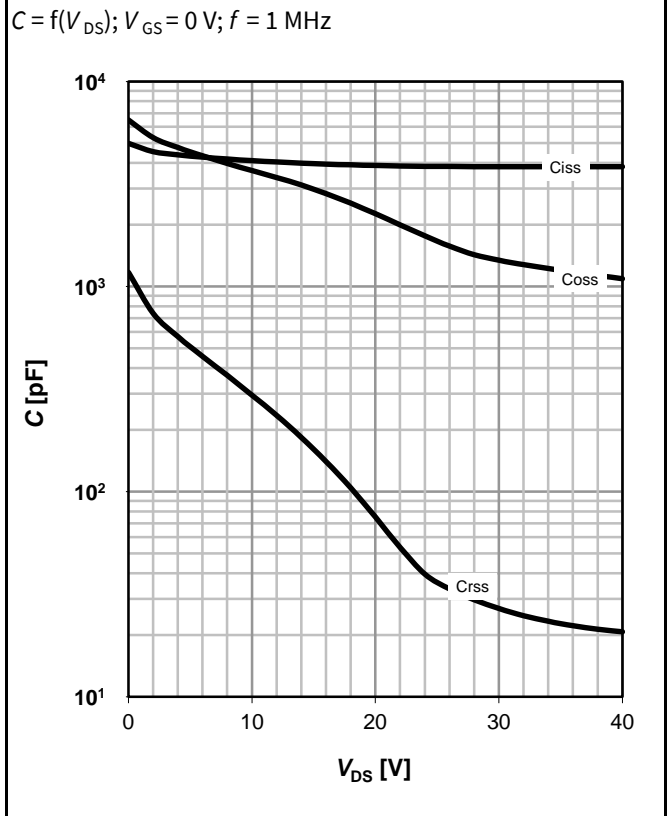
8 Typ. drain-source on-state resistance



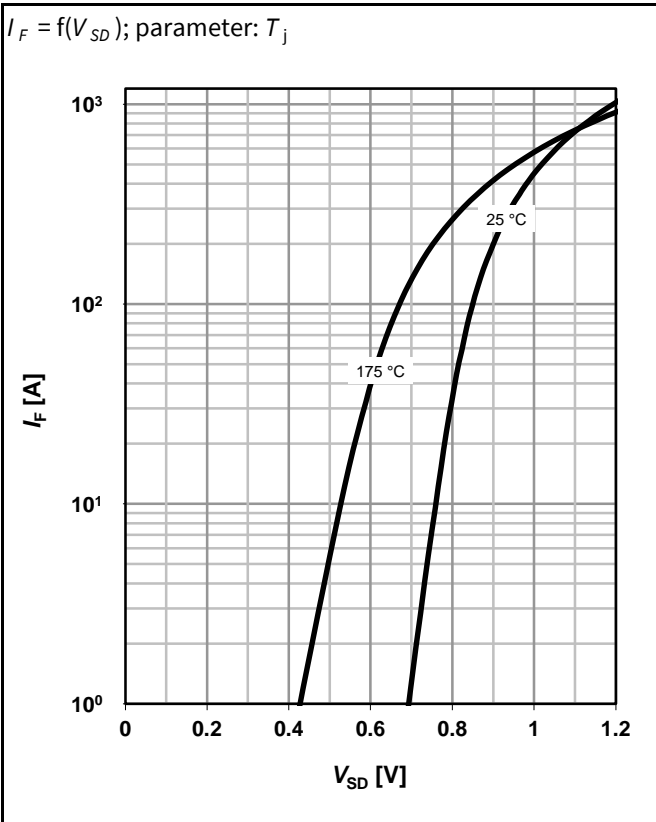
9 Typ. gate threshold voltage



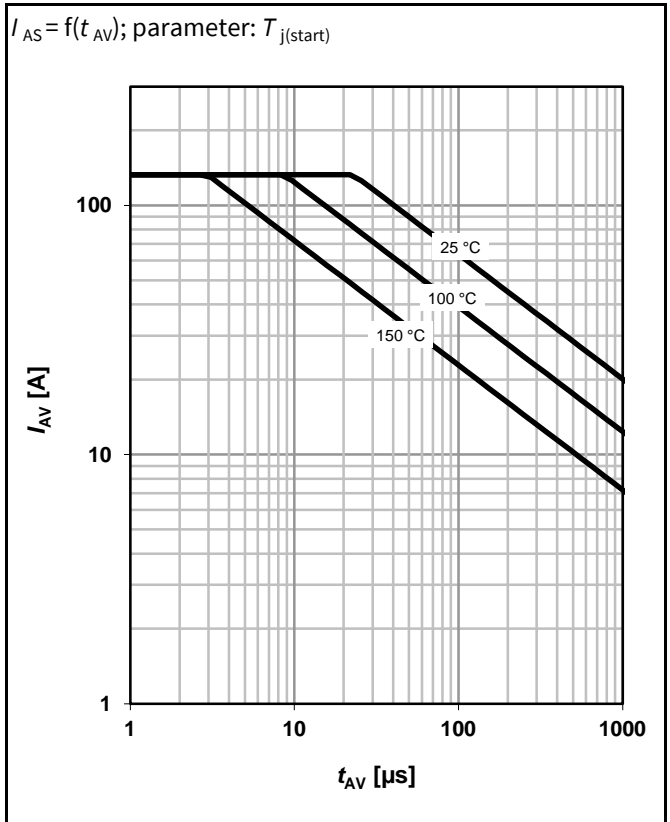
10 Typ. capacitances



11 Typical forward diode characteristics



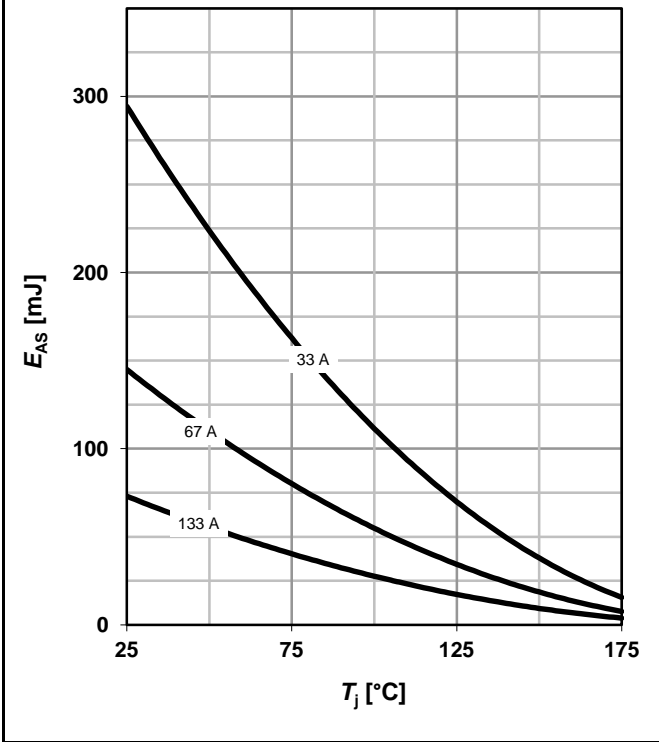
12 Typ. avalanche characteristics





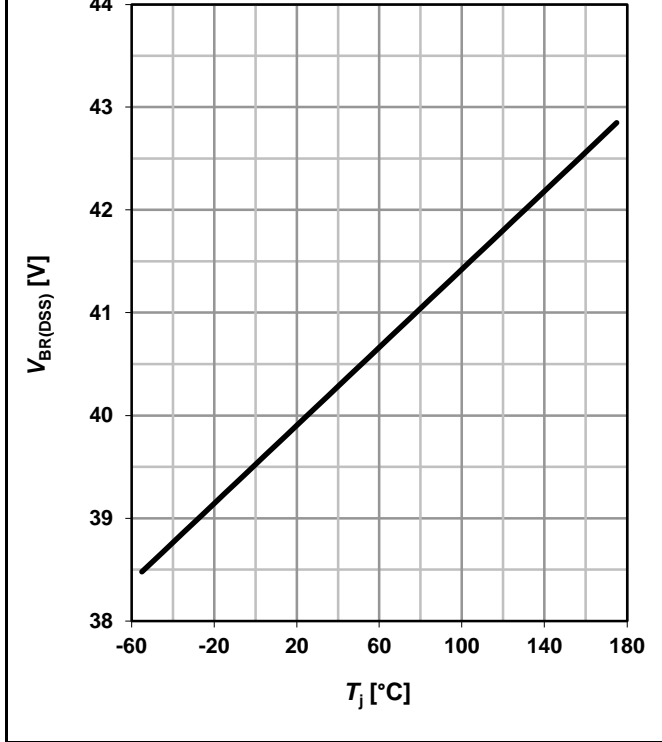
13 Typical avalanche energy

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



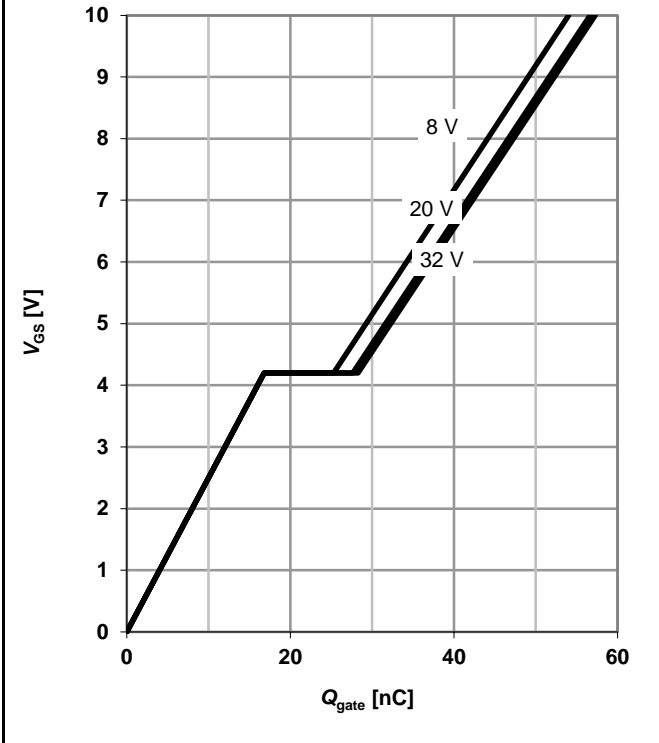
14 Drain-source breakdown voltage

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

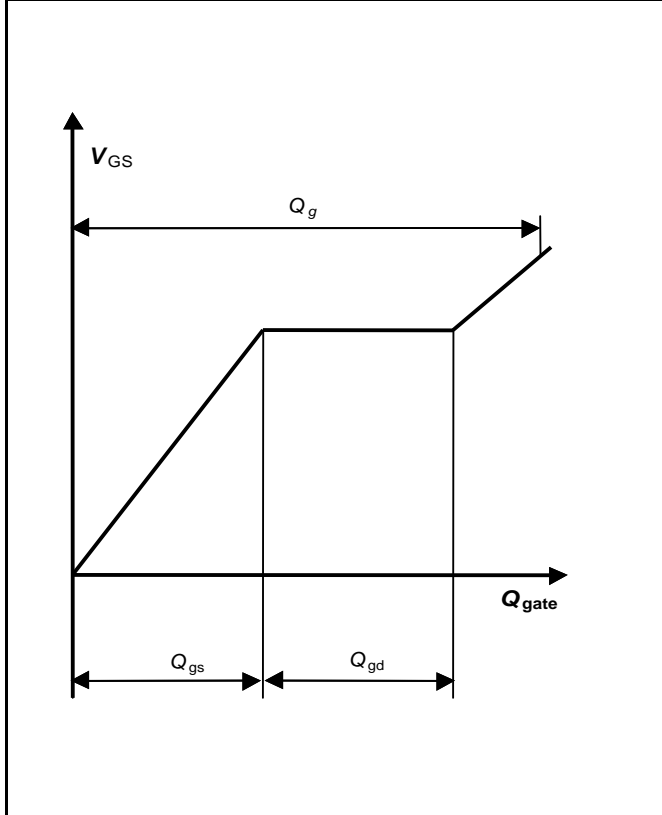


15 Typ. gate charge

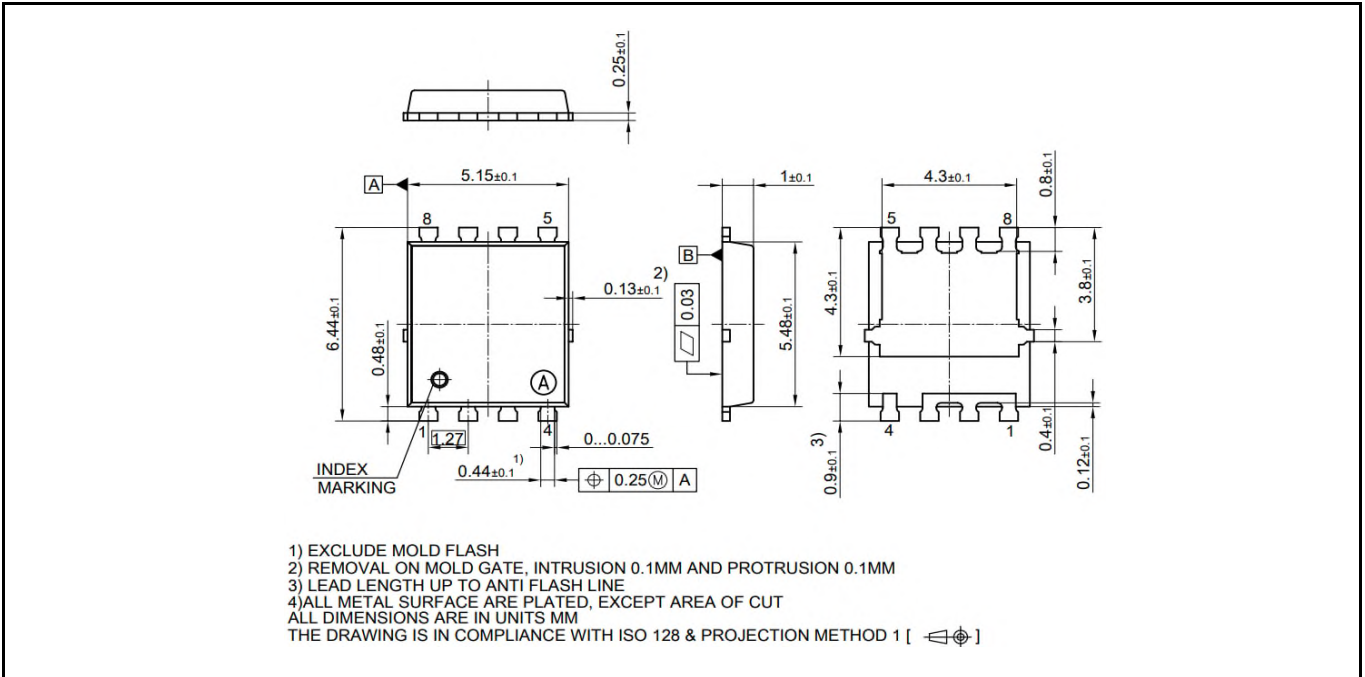
$V_{GS} = f(Q_{gate})$ ;  $I_D = 88 \text{ A}$  pulsed; parameter:  $V_{DD}$



16 Gate charge waveforms

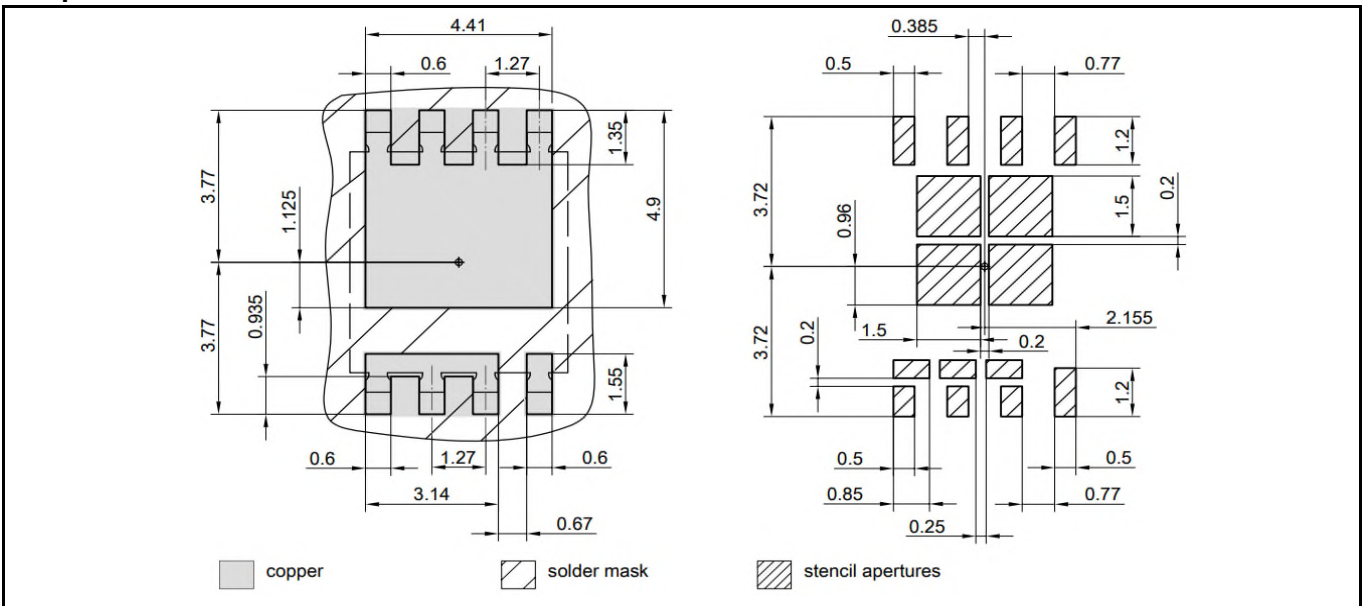


## Package Outline



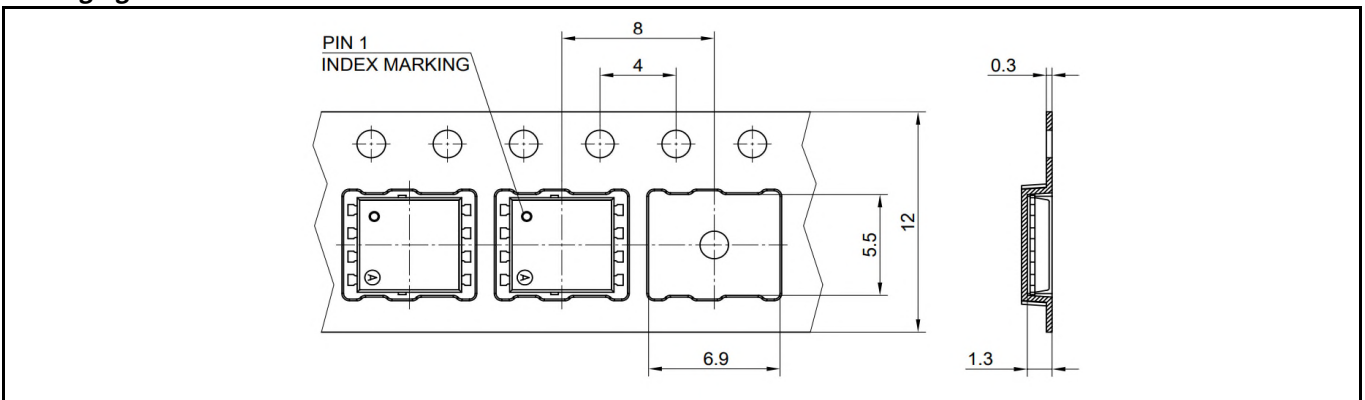
All dimensions are in units mm

## Footprint



All dimensions are in units mm

## Packaging



All dimensions are in units mm



**Revision History**

<b>Revision</b>	<b>Date</b>	<b>Changes</b>
Revision 1.0	15.11.2023	Final Data Sheet

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