



**THE DATASHEET OF  
ISC009N06LM5ATMA1**

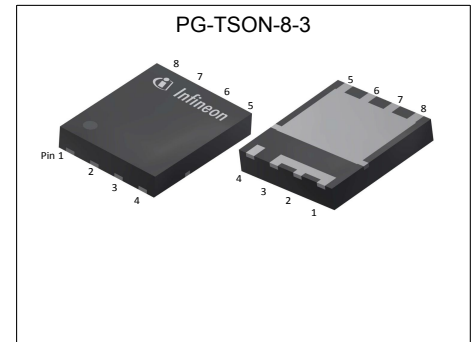


# MOSFET

## OptiMOS™5 Power-Transistor, 60 V

### Features

- Optimized for synchronous rectification
- 100% avalanche tested
- Superior thermal performance
- N-channel
- 175°C rated
- Pb-free lead plating : RoHS compliant
- Halogen-free according to EC61249-2-21
- Higher solder joint reliability due to enlarged source interconnection

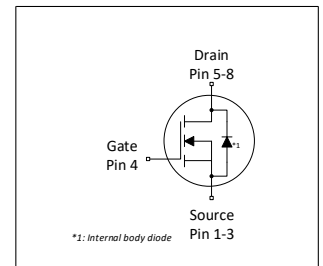


### Product validation

Fully qualified according to JEDEC for Industrial Applications

**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	60	V
$R_{DS(on),max}$	0.9	m $\Omega$
$I_D$	348	A
$Q_{oss}$	127	nC
$Q_G(0V..4.5V)$	77	nC



RoHS

Type / Ordering Code	Package	Marking	Related Links
ISC009N06LM5	PG-TSON-8-3	009N06L	-

## Table of Contents

Description .....	1
Maximum ratings .....	3
Thermal characteristics .....	3
Electrical characteristics .....	4
Electrical characteristics diagrams .....	6
Package Outlines .....	10
Revision History .....	11
Trademarks .....	11
Disclaimer .....	11

## 1 Maximum ratings

at  $T_A=25\text{ °C}$ , unless otherwise specified

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current <sup>1)</sup>	$I_D$	-	-	348 246 41	A	$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ °C/W}^2)$
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	-	-	1392	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	900	mJ	$I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	214 3.0	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ °C/W}^2)$
Operating and storage temperature	$T_j, T_{stg}$	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case, bottom	$R_{thJC}$	-	0.5	0.7	°C/W	-
Thermal resistance, junction - case, top	$R_{thJC}$	-	-	20	°C/W	-
Device on PCB, 6 cm <sup>2</sup> cooling area <sup>2)</sup>	$R_{thJA}$	-	-	50	°C/W	-

<sup>1)</sup> Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature as specified. For other case temperatures please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.

<sup>2)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

<sup>3)</sup> See Diagram 3 for more detailed information

<sup>4)</sup> See Diagram 13 for more detailed information

### 3 Electrical characteristics

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

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	60	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1.1	-	2.3	V	$V_{DS}=V_{GS}$ , $I_D=147\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.1 10	1 100	$\mu\text{A}$	$V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.75 0.9	0.90 1.1	$\text{m}\Omega$	$V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ $V_{GS}=4.5\text{ V}$ , $I_D=25\text{ A}$
Gate resistance <sup>1)</sup>	$R_G$	-	2.5	-	$\Omega$	-
Transconductance	$g_{fs}$	-	260	-	S	$ V_{DS} \geq 2 I_D /R_{DS(on)max}$ , $I_D=50\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	10000	13000	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	2000	2700	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance <sup>1)</sup>	$C_{rss}$	-	83	110	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	7	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	12	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	104	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	45	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$

**Table 6 Gate charge characteristics<sup>2)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	25	-	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	17	-	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge	$Q_{gd}$	-	22	-	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	$Q_{sw}$	-	30	-	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>1)</sup>	$Q_g$	-	77	103	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.4	-	V	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>1)</sup>	$Q_g$	-	157	209	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	145	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$
Output charge	$Q_{oss}$	-	127	-	nC	$V_{DS}=30\text{ V}$ , $V_{GS}=0\text{ V}$

<sup>1)</sup> See Diagram 13 for more detailed information

<sup>2)</sup> See "Gate charge waveforms" for parameter definition

**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	173	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	1392	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.79	1.1	V	$V_{GS}=0\text{ V}, I_F=50\text{ A}, T_j=25\text{ °C}$
Reverse recovery time <sup>1)</sup>	$t_{rr}$	-	38	-	ns	$V_R=30\text{ V}, I_F=50\text{ A}, di_F/dt=400\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>1)</sup>	$Q_{rr}$	-	140	-	nC	$V_R=30\text{ V}, I_F=50\text{ A}, di_F/dt=400\text{ A}/\mu\text{s}$

<sup>1)</sup> See Diagram 13 for more detailed information

### 4 Electrical characteristics diagrams

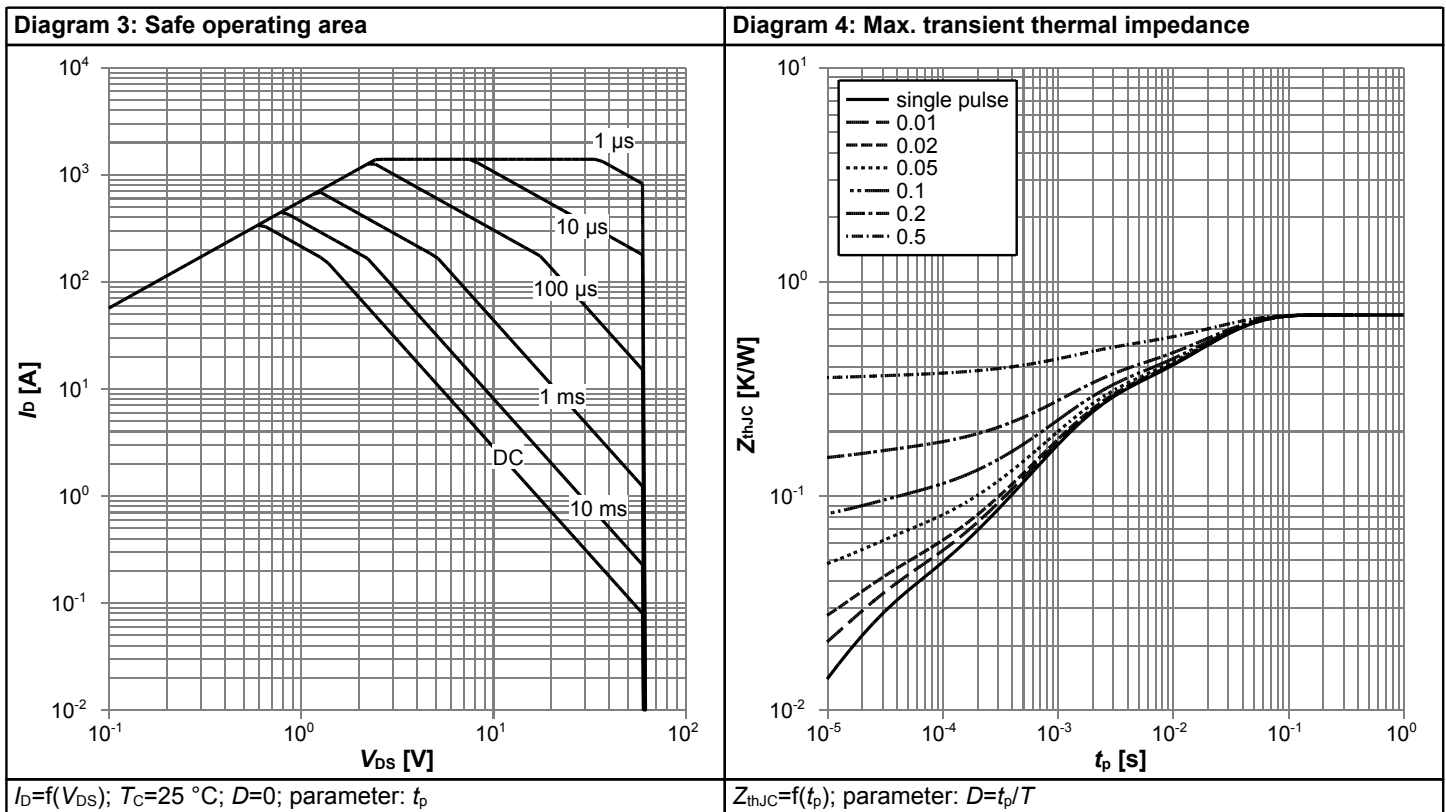
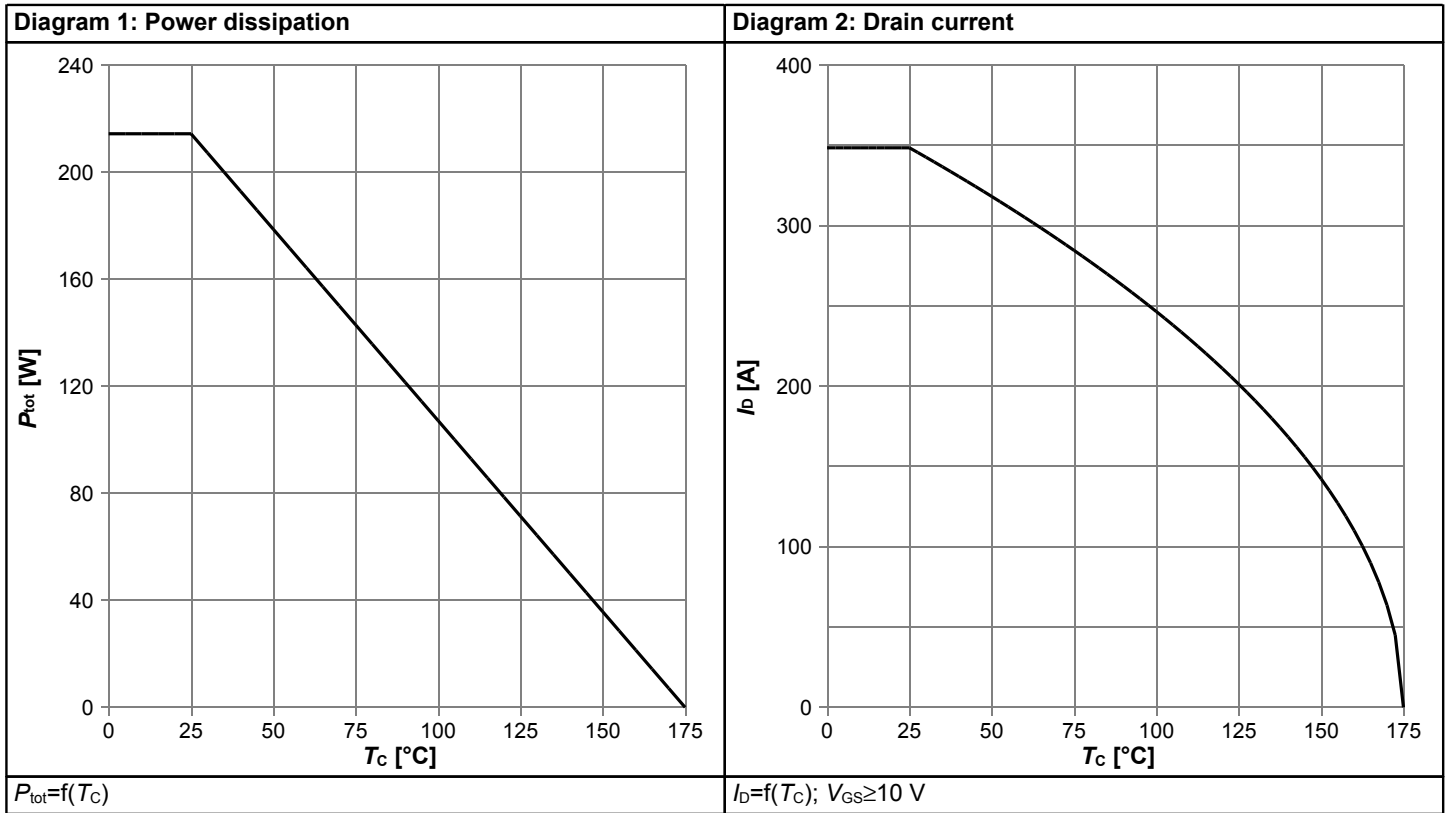
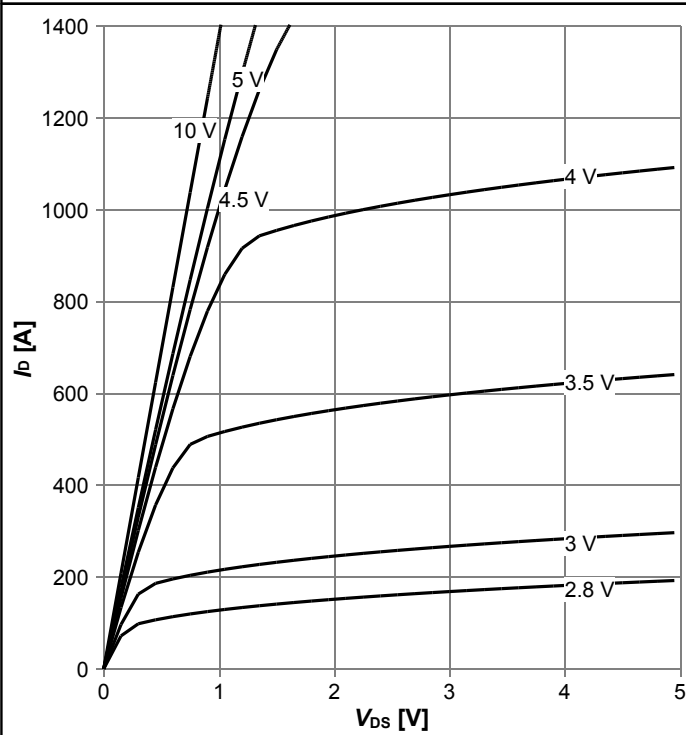
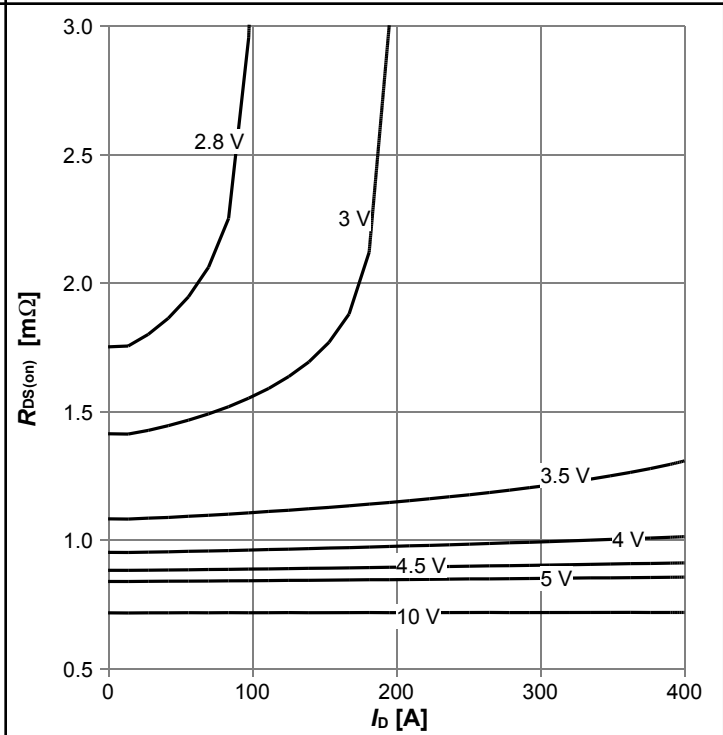


Diagram 5: Typ. output characteristics



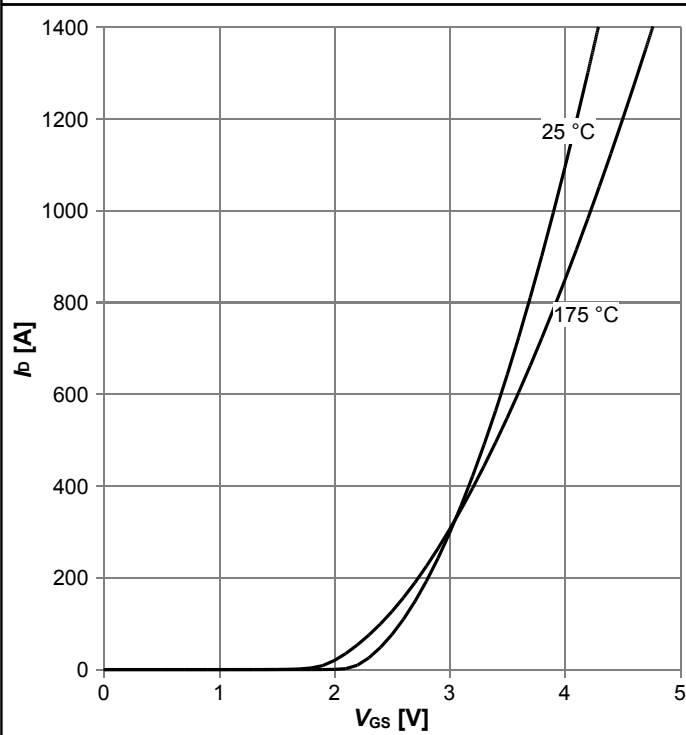
$I_D = f(V_{DS})$ ,  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



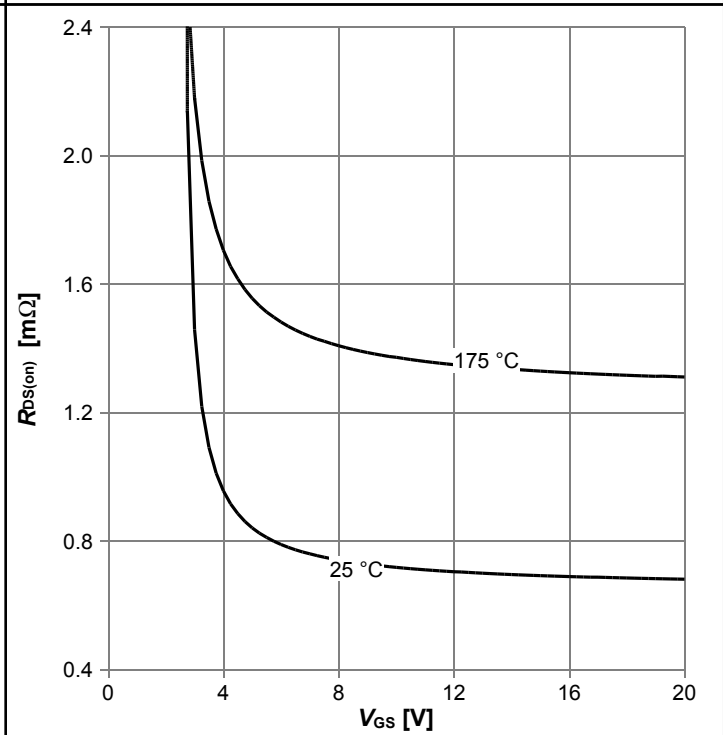
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



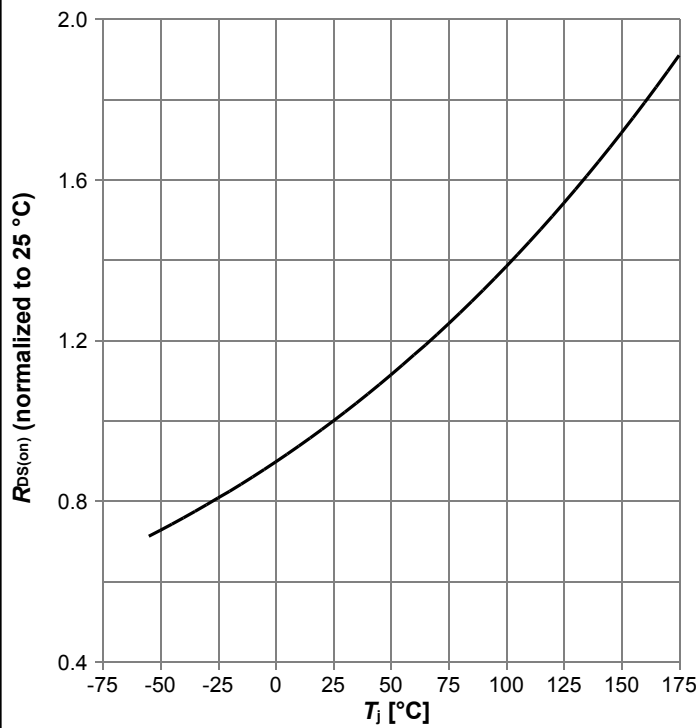
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$

Diagram 8: Typ. drain-source on resistance



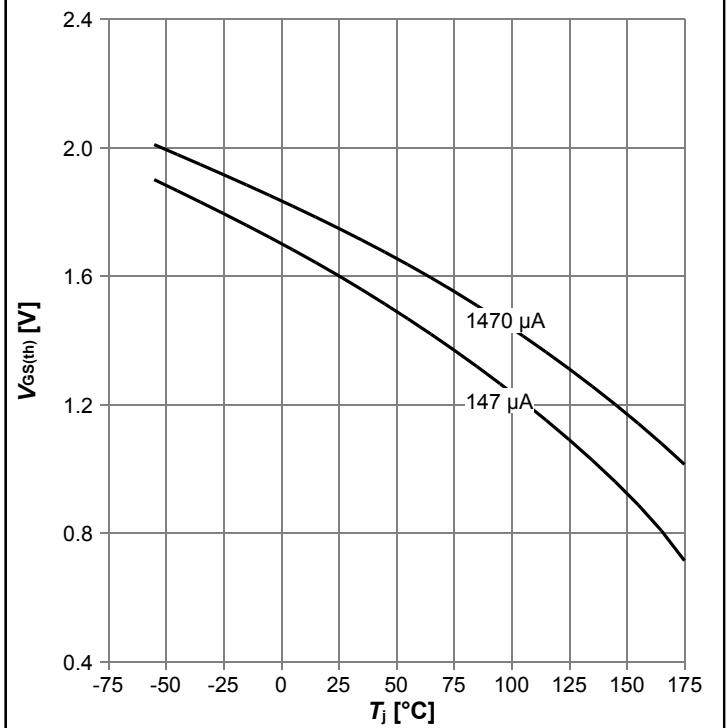
$R_{DS(on)} = f(V_{GS})$ ,  $I_D = 50\text{ A}$ ; parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



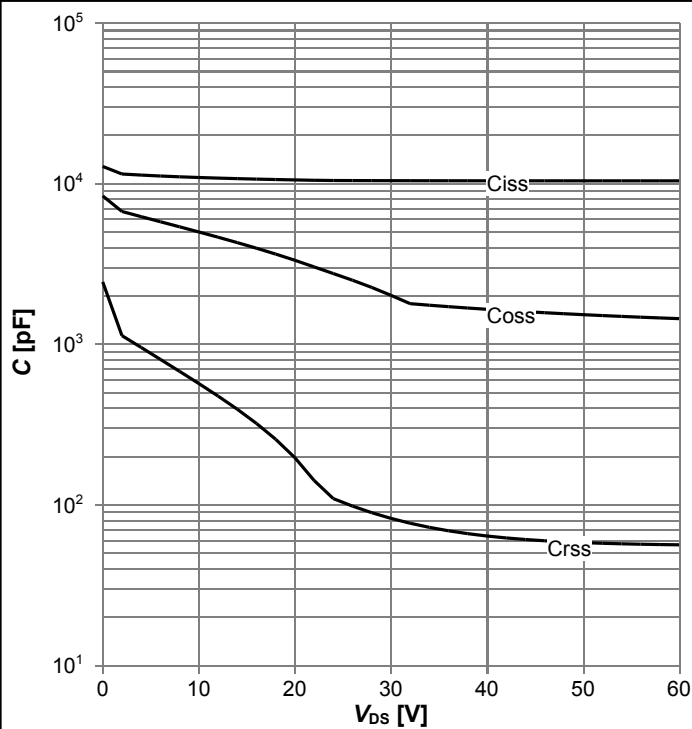
$R_{DS(on)}=f(T_j)$ ,  $I_D=50$  A,  $V_{GS}=10$  V

Diagram 10: Typ. gate threshold voltage



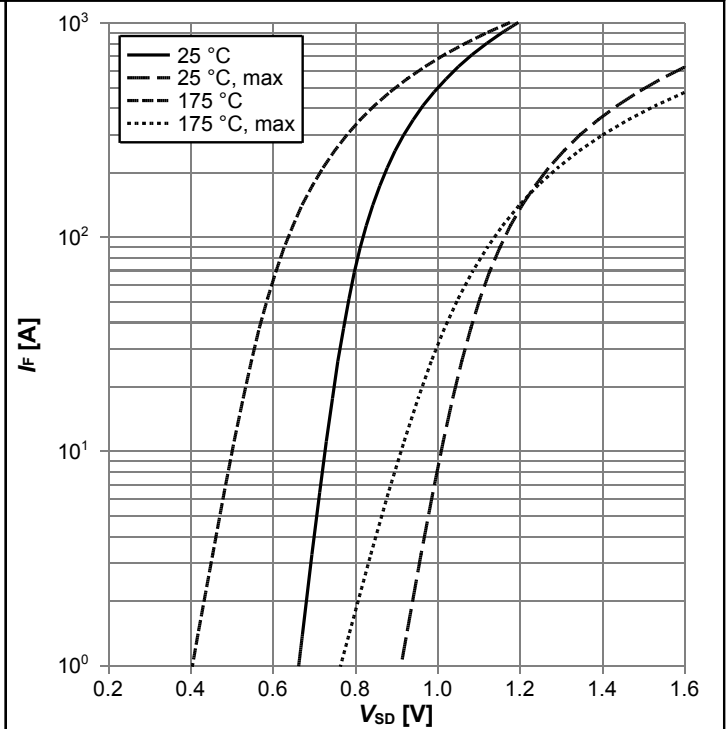
$V_{GS(th)}=f(T_j)$ ,  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



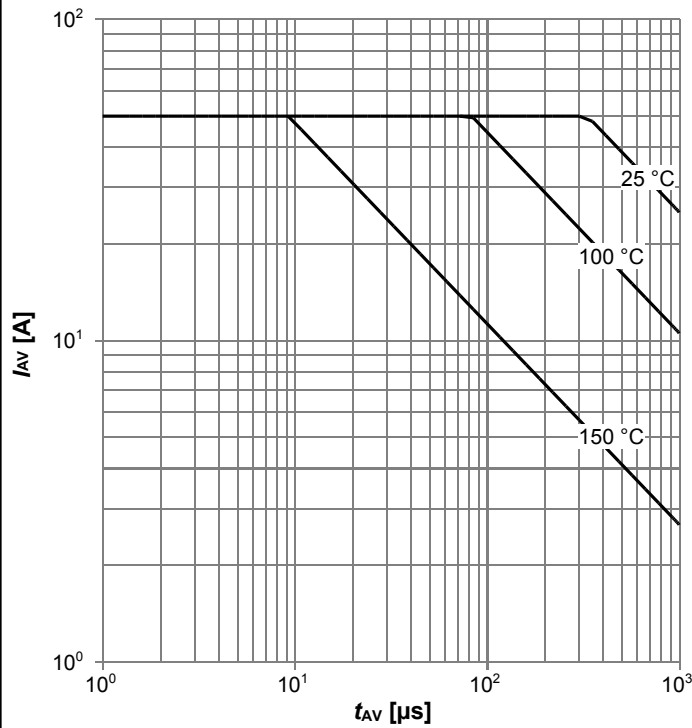
$C=f(V_{DS})$ ;  $V_{GS}=0$  V;  $f=1$  MHz

Diagram 12: Forward characteristics of reverse diode



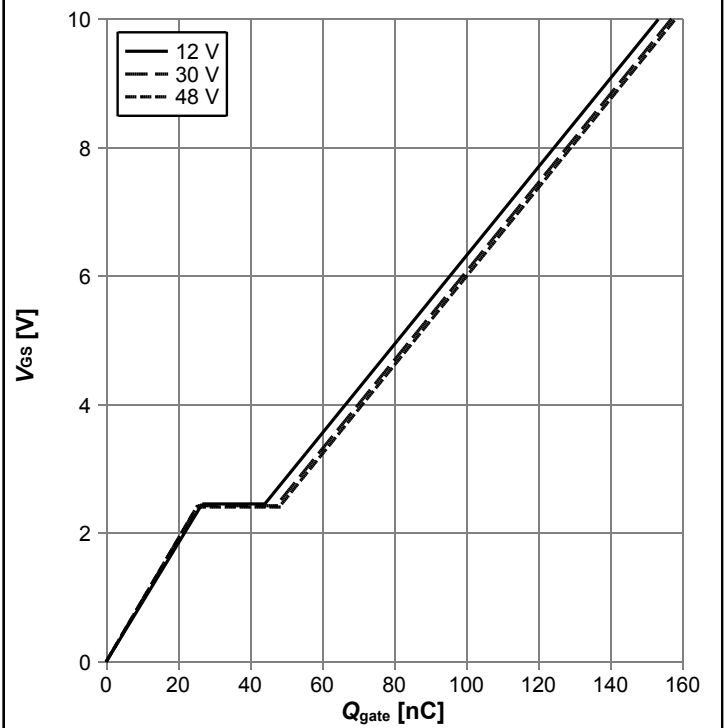
$I_F=f(V_{SD})$ ; parameter:  $T_j$

Diagram 13: Avalanche characteristics



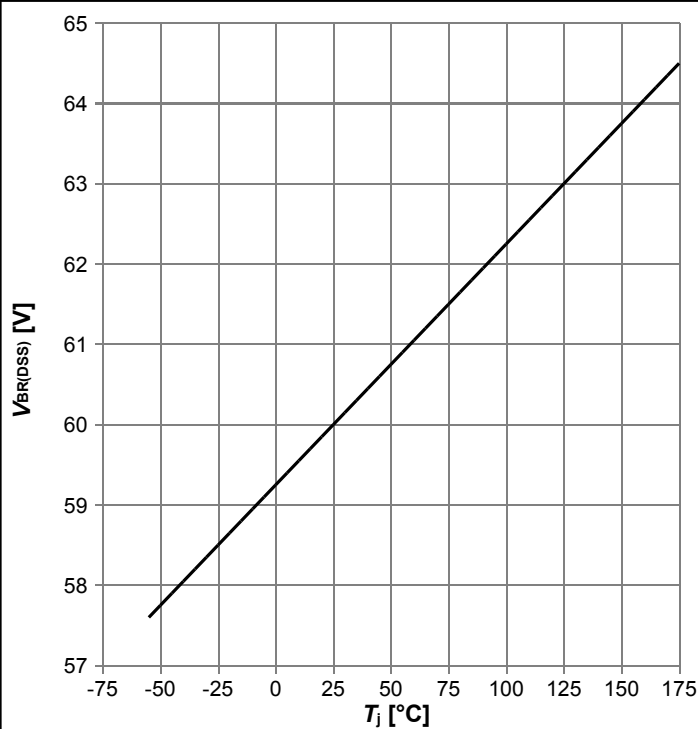
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25 \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



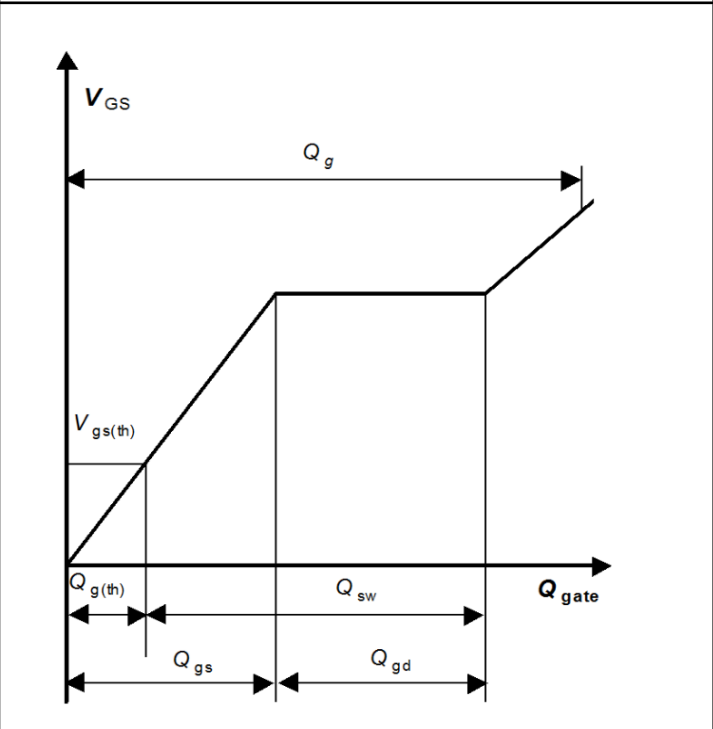
$V_{GS}=f(Q_{gate})$ ,  $I_D=50$  A pulsed,  $T_j=25$  °C; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

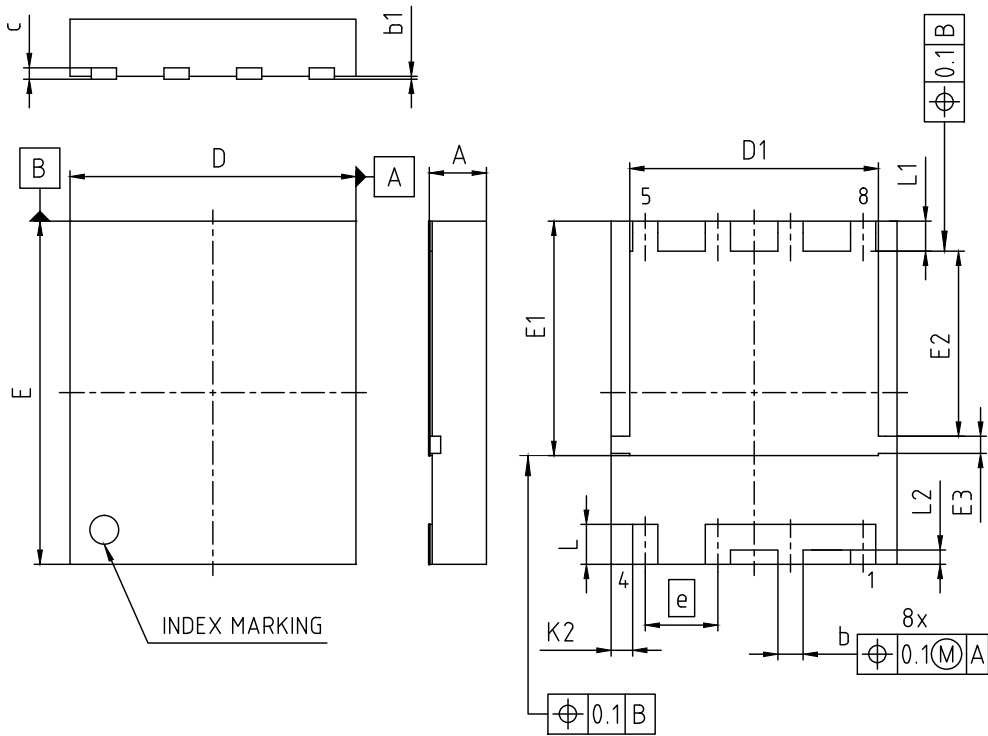


$V_{BR(DSS)}=f(T_j)$ ;  $I_D=1$  mA

Diagram Gate charge waveforms



## 5 Package Outlines



DIMENSION	MILLIMETERS	
	MIN.	MAX.
A	-	1.10
b	0.34	0.54
b1	-	0.05
c	0.20	
D	4.90	5.10
D1	4.25	4.45
E	5.90	6.10
E1	4.00	4.20
E2	3.14	3.34
E3	0.20	0.40
e	1.27 (0.37)	
K2	(0.37)	
L	0.60	0.80
L1	0.43	0.63
L2	(0.25)	

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Figure 1 Outline PG-TSON-8-3, dimensions in mm/inches

## Revision History

ISC009N06LM5

**Revision: 2021-03-08, Rev. 2.0**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2021-03-08	Release of final version

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