

MOSFET  
OptiMOS™ 3 Power-Transistor, 40 V

PG-DSO-8

Features

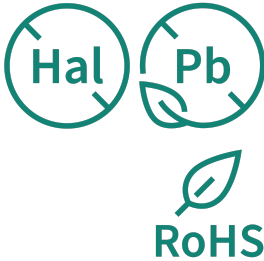
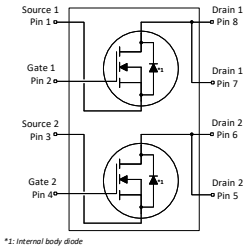
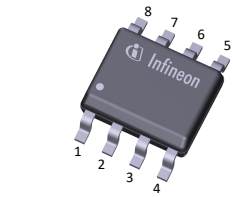
- Dual N-channel, logic level
- Very low on-resistance  $R_{DS(on)}$
- Superior thermal resistance
- 100% avalanche tested
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product validation

Qualified according to JEDEC Standard

Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS}$	40	V
$R_{DS(on),max}$	17	mΩ
$I_D$	9.6	A
$Q_{oss}$	7.8	nC
$Q_G$	6.0	nC



Type/Ordering Code	Package	Marking	Related Links
ISA170170N04LMDS	PG-DSO-8	1717N04L	-



Table of Contents

Description ..... 1

Maximum ratings ..... 3

Thermal characteristics ..... 4

Electrical characteristics ..... 5

Electrical characteristics diagrams ..... 7

Package Outlines ..... 11

Revision History ..... 12

Trademarks ..... 12

Disclaimer ..... 12

## 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>	$I_D$	-	-	9.6 6.1 5.2 7.2	A	$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=90\text{ °C/W}$ <sup>2)</sup>
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	-	-	38	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	36	mJ	$I_D=9.6\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	2.5 1.4	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{thJA}=90\text{ °C/W}$ <sup>2)</sup>
Operating and storage temperature	$T_j$ , $T_{stg}$	-55	-	150	°C	-

<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

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - solder point	$R_{thJC}$	-	-	50	°C/W	-
Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>5)</sup>	$R_{thJA}$	-	-	90	°C/W	-
Thermal resistance, junction - ambient, minimum footprint	$R_{thJA}$	-	-	150	°C/W	-

<sup>5)</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.

### 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	$V_{(BR)DSS}$	40	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1.1	-	2.7	V	$V_{DS}=V_{GS}$ , $I_D=1000\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.1 10	1 100	$\mu\text{A}$	$V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	13 18	17 23.6	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=9.6\text{ A}$ $V_{GS}=4.5\text{ V}$ , $I_D=8.5\text{ A}$
Gate resistance	$R_G$	-	1.1	-	$\Omega$	-
Transconductance <sup>6)</sup>	$g_{fs}$	12	25	-	S	$ V_{DS} \geq 2 I_D R_{DS(on)max}$ , $I_D=9.6\text{ A}$

<sup>6)</sup> Defined by design. Not subject to production test.

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>7)</sup>	$C_{iss}$	-	880	1100	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=20\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>7)</sup>	$C_{oss}$	-	220	290	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=20\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance <sup>7)</sup>	$C_{rss}$	-	15	26	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=20\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	6.7	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=9.6\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	5.0	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=9.6\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	4.6	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=9.6\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	4.0	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=9.6\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$

<sup>7)</sup> Defined by design. Not subject to production test.

**Table 6 Gate charge characteristics** <sup>8)</sup>

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	2.7	-	nC	$V_{DD}=20\text{ V}$ , $I_D=9.6\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	1.5	-	nC	$V_{DD}=20\text{ V}$ , $I_D=9.6\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge	$Q_{gd}$	-	1.6	-	nC	$V_{DD}=20\text{ V}$ , $I_D=9.6\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	$Q_{sw}$	-	2.8	-	nC	$V_{DD}=20\text{ V}$ , $I_D=9.6\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>9)</sup>	$Q_g$	-	6.0	9.0	nC	$V_{DD}=20\text{ V}$ , $I_D=9.6\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	3.1	-	V	$V_{DD}=20\text{ V}$ , $I_D=9.6\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>9)</sup>	$Q_g$	-	13	19.5	nC	$V_{DD}=20\text{ V}$ , $I_D=9.6\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Output charge	$Q_{oss}$	-	7.8	-	nC	$V_{DS}=20\text{ V}$ , $V_{GS}=0\text{ V}$

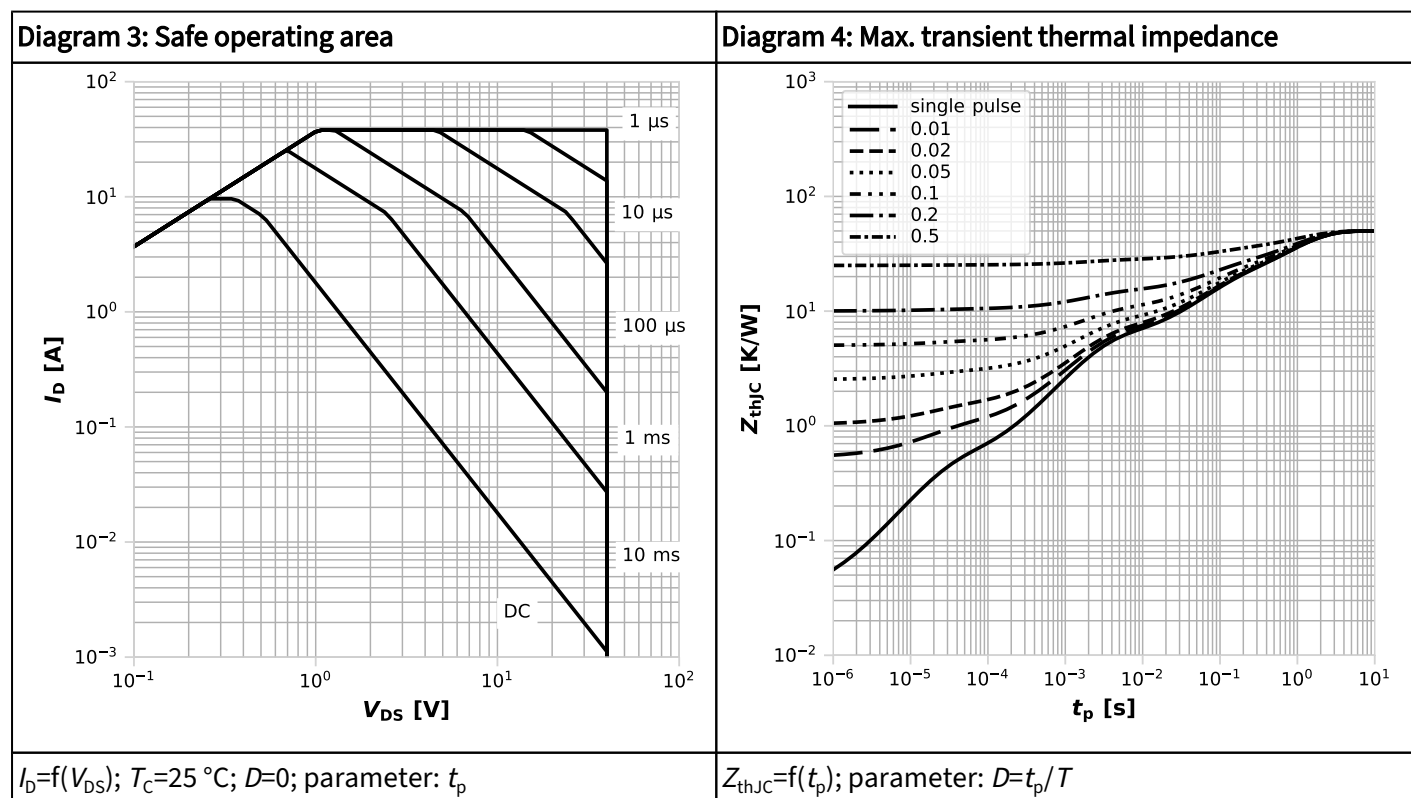
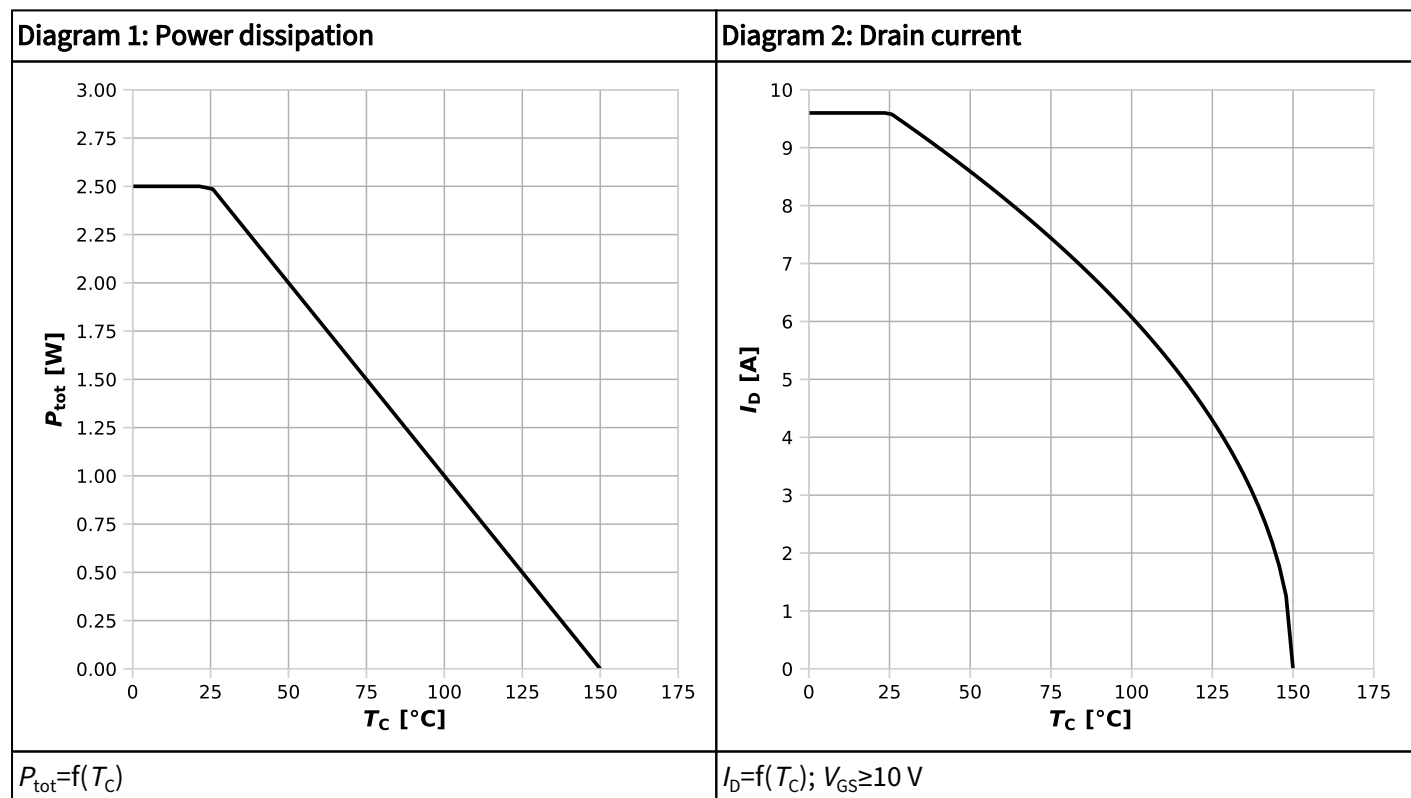
<sup>8)</sup> See "Gate charge waveforms" for parameter definition

<sup>9)</sup> Defined by design. Not subject to production test.

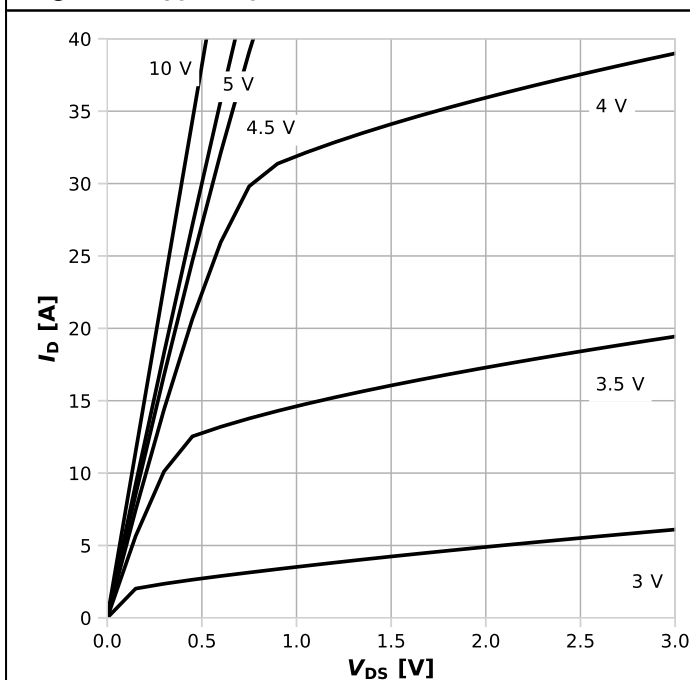
**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	3.1	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	38	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.86	1.0	V	$V_{GS}=0\text{ V}$ , $I_F=9.6\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery time	$t_{rr}$	-	13	-	ns	$V_R=20\text{ V}$ , $I_F=9.6\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$	-	4.3	-	nC	$V_R=20\text{ V}$ , $I_F=9.6\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$

## 4 Electrical characteristics diagrams

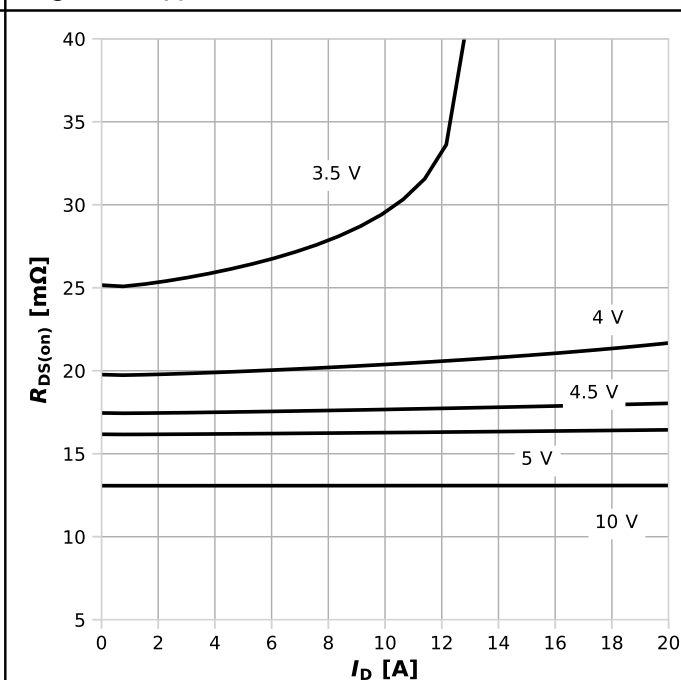


**Diagram 5: Typ. output characteristics**



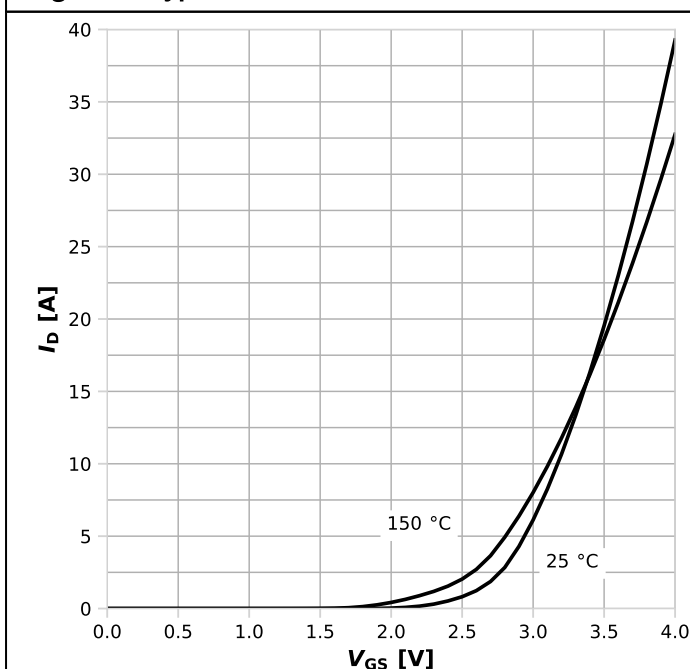
$I_D = f(V_{DS}), T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

**Diagram 6: Typ. drain-source on resistance**



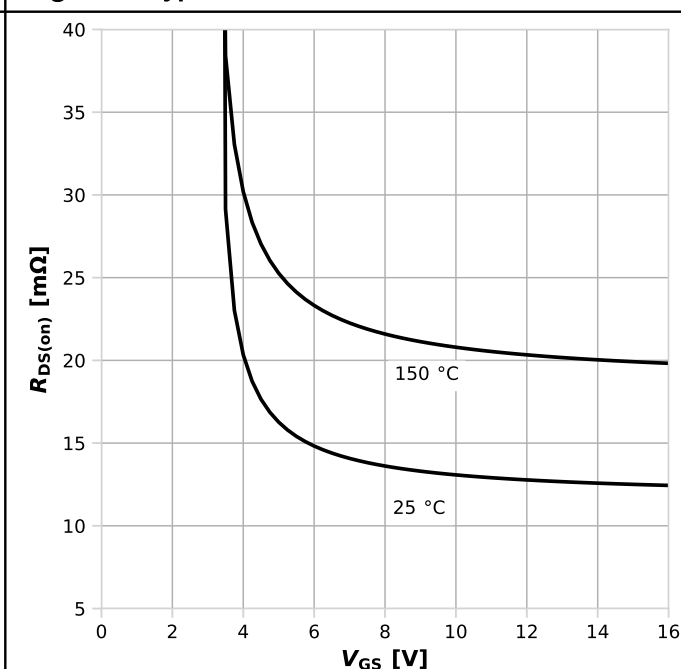
$R_{DS(on)} = f(I_D), T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

**Diagram 7: Typ. transfer characteristics**



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

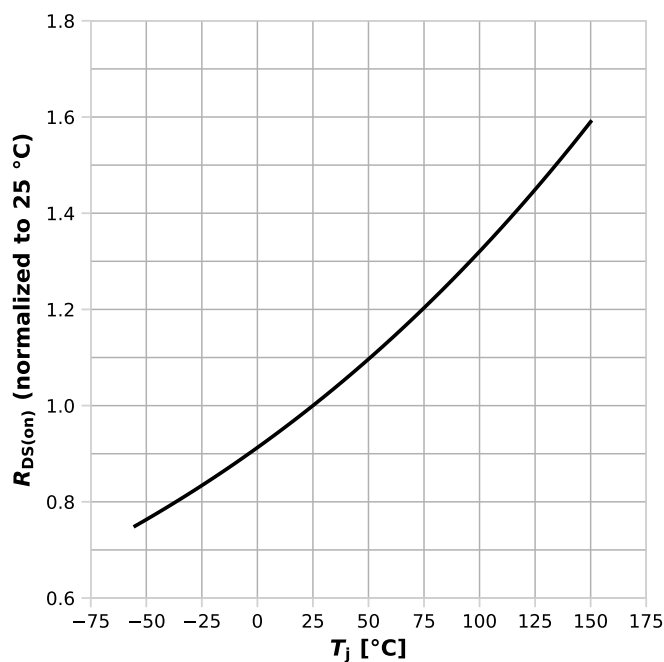
**Diagram 8: Typ. drain-source on resistance**



$R_{DS(on)} = f(V_{GS}), I_D = 9.6 \text{ A}; \text{parameter: } T_j$

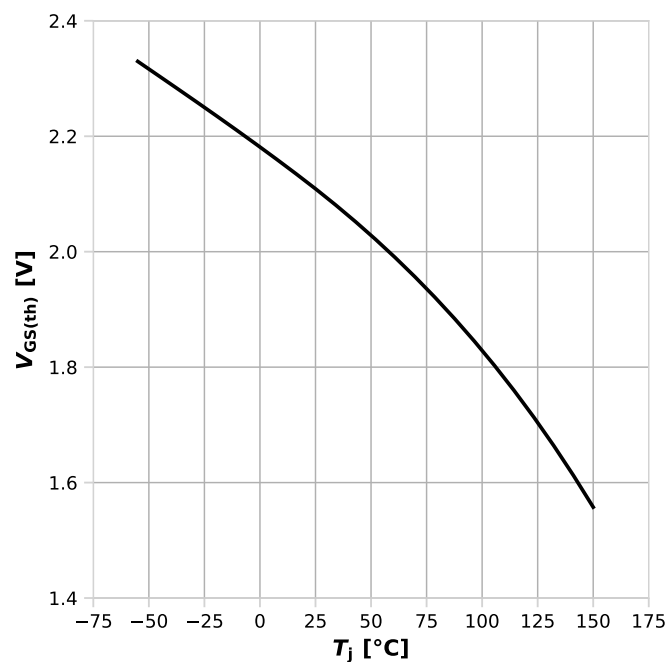


Diagram 9: Normalized drain-source on resistance



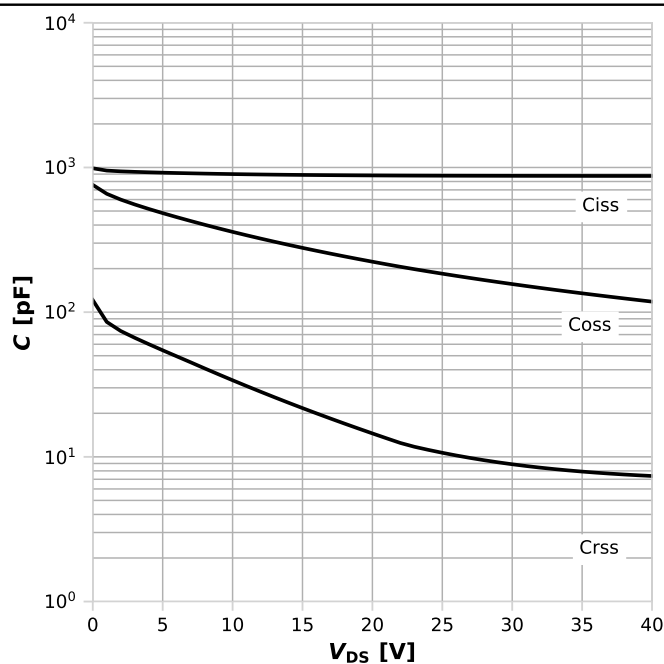
$R_{DS(on)} = f(T_j)$ ,  $I_D = 9.6$  A,  $V_{GS} = 10$  V

Diagram 10: Typ. gate threshold voltage



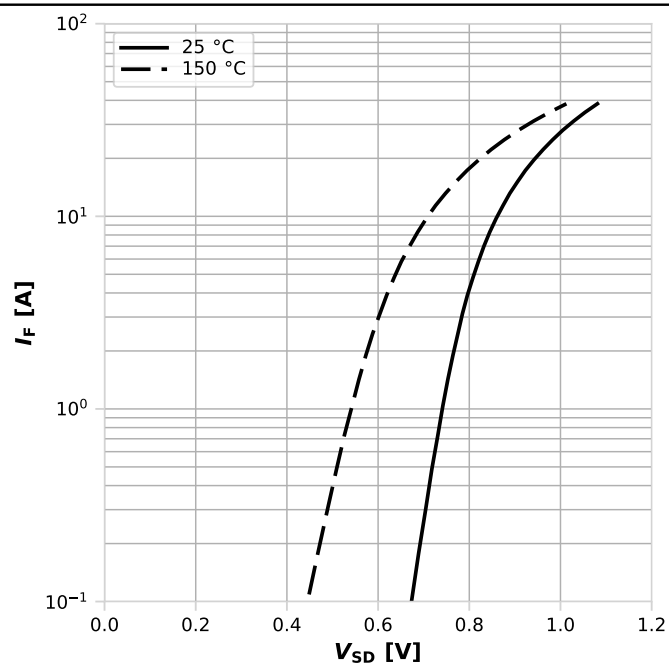
$V_{GS(th)} = f(T_j)$ ,  $V_{GS} = V_{DS}$ ; parameter:  $I_D = 1000 \mu A$

Diagram 11: Typ. capacitances



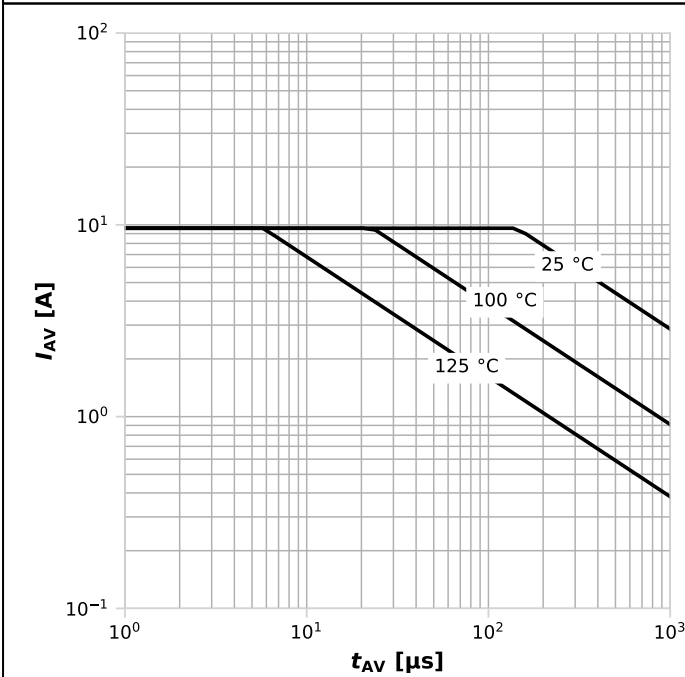
$C = f(V_{DS})$ ;  $V_{GS} = 0$  V;  $f = 1$  MHz

Diagram 12: Forward characteristics of reverse diode



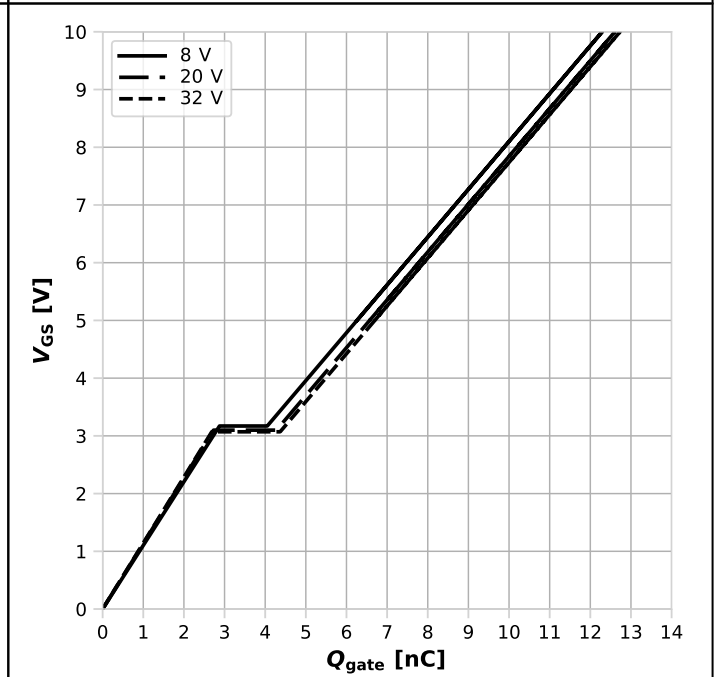
$I_F = f(V_{SD})$ ; parameter:  $T_j$

Diagram 13: Avalanche characteristics



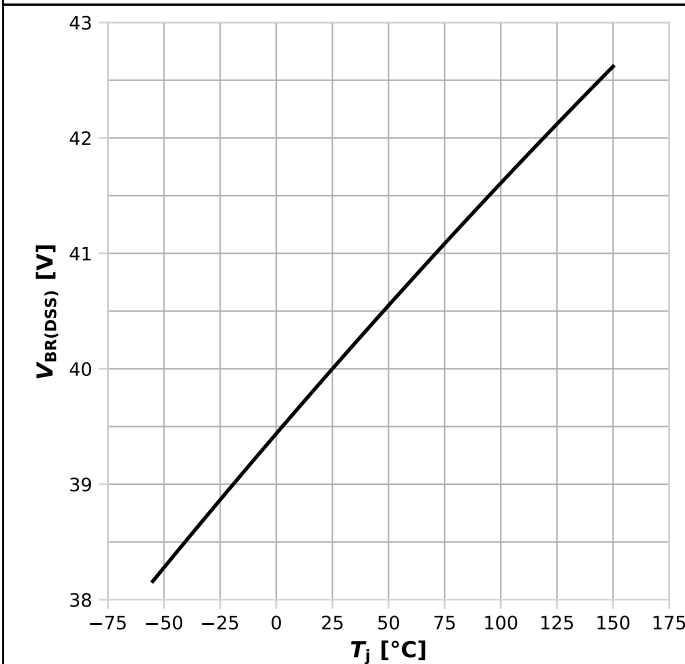
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25\ \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



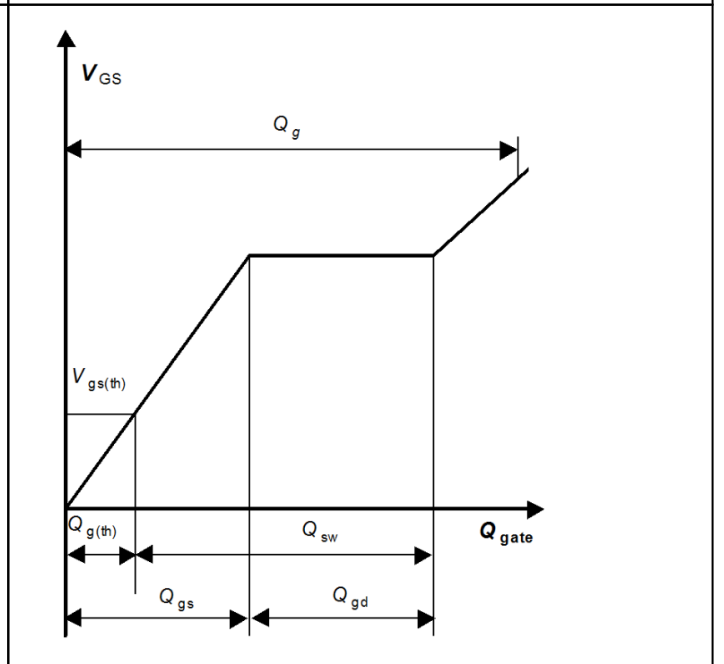
$V_{GS}=f(Q_{gate})$ ,  $I_D=9.6\text{ A}$  pulsed,  $T_j=25\text{ °C}$ ; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage



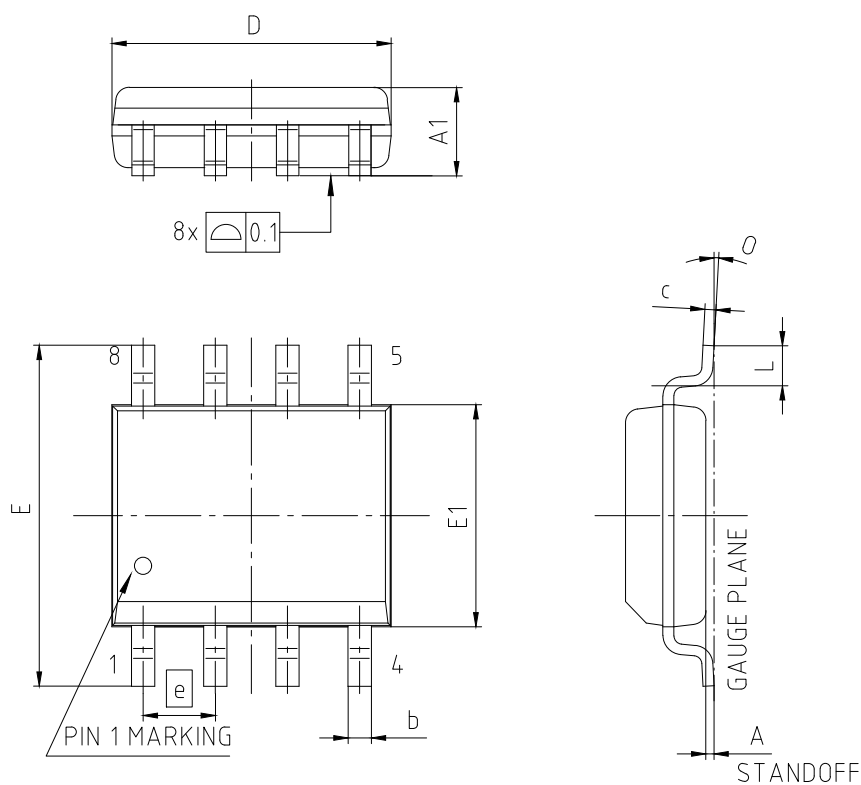
$V_{BR(DSS)}=f(T_j)$ ;  $I_D=1\text{ mA}$

Gate charge waveforms



-

## 5 Package Outlines



PACKAGE - GROUP NUMBER: <b>PG-DSO-8-U02</b>		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
<b>A</b>	0.18	0.25
<b>A1</b>	1.35	1.75
<b>b</b>	0.38	0.51
<b>c</b>	0.254	
<b>D</b>	4.80	5.00
<b>E</b>	5.80	6.20
<b>E1</b>	3.80	4.00
<b>e</b>	1.27	
<b>L</b>	0.48	0.91
<b>O</b>	4°	
<b>N</b>	8	

NOTE:  
DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS

**Figure 1** Outline PG-DSO-8, dimensions in mm

## Revision History

ISA170170N04LMDS

### Revision 2024-10-02, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2024-10-02	Release of final datasheet

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