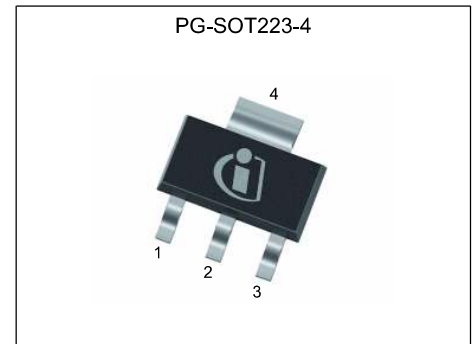


# MOSFET

## OptiMOS™ Power-Transistor, -150 V

### Features

- P-channel
- Very low on-resistance  $R_{DS(on)}$  @  $V_{GS}=4.5$  V
- Logic level
- 100% avalanche tested
- Enhancement mode
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

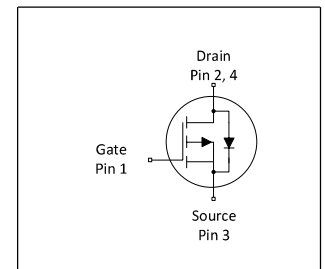


### Product validation

Fully qualified according to JEDEC for Industrial Applications

**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	-150	V
$R_{DS(on),max}$	1380	m $\Omega$
$I_D$	-1.29	A
$Q_{oss}$	-3.6	nC
$Q_G$	-11.6	nC



Type / Ordering Code	Package	Marking	Related Links
ISP14EP15LM	PG-SOT223-4	14EP15LM	-

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## 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>	$I_D$	-	-	-1.29 -0.82 -0.81 -0.77	A	$V_{GS}=-10\text{ V}, T_C=25\text{ °C}$ $V_{GS}=-10\text{ V}, T_C=100\text{ °C}$ $V_{GS}=-4.5\text{ V}, T_C=100\text{ °C}$ $V_{GS}=-10\text{ V}, T_A=25\text{ °C}, R_{thJA}=70\text{ °C/W}^2)$
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	-	-	-5.2	A	$T_A=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	90	mJ	$I_D=-0.8\text{ A}, R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	5.0 1.8	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}, R_{thJA}=70\text{ °C/W}^2)$
Operating and storage temperature	$T_j, T_{stg}$	-55	-	150	°C	IEC climatic category; DIN IEC 68-1: 55/150/56

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	25	°C/W	-
Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area	$R_{thJA}$	-	-	70	°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	$V_{(BR)DSS}$	-150	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=-1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	-1.0	-1.5	-2.0	V	$V_{DS}=V_{GS}$ , $I_D=-270\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	-0.1 -10	-1.0 -100	$\mu\text{A}$	$V_{DS}=-150\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=-150\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	-10	-100	nA	$V_{GS}=-20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	1133.6 1159.9	1380 1400	m $\Omega$	$V_{GS}=-10\text{ V}$ , $I_D=-0.8\text{ A}$ $V_{GS}=-4.5\text{ V}$ , $I_D=-0.7\text{ A}$
Gate resistance	$R_G$	-	5.3	-	$\Omega$	-
Transconductance	$g_{fs}$	-	2.9	-	S	$ V_{DS} \geq 2 I_D R_{DS(on)max}$ , $I_D=-0.8\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	410	530	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=-75\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	19	25	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=-75\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance <sup>1)</sup>	$C_{rss}$	-	6	11	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=-75\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	10.46	-	ns	$V_{DD}=-75\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-0.8\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	6.28	-	ns	$V_{DD}=-75\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-0.8\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	24.01	-	ns	$V_{DD}=-75\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-0.8\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	14.25	-	ns	$V_{DD}=-75\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-0.8\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$

<sup>1)</sup> Defined by design. Not subject to production test.

**Table 6 Gate charge characteristics<sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	-1.06	-	nC	$V_{DD}=-75\text{ V}$ , $I_D=-0.8\text{ A}$ , $V_{GS}=0\text{ to }-4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	-0.62	-	nC	$V_{DD}=-75\text{ V}$ , $I_D=-0.8\text{ A}$ , $V_{GS}=0\text{ to }-4.5\text{ V}$
Gate to drain charge <sup>2)</sup>	$Q_{gd}$	-	-3.0	-4.5	nC	$V_{DD}=-75\text{ V}$ , $I_D=-0.8\text{ A}$ , $V_{GS}=0\text{ to }-4.5\text{ V}$
Switching charge	$Q_{sw}$	-	-3.4	-	nC	$V_{DD}=-75\text{ V}$ , $I_D=-0.8\text{ A}$ , $V_{GS}=0\text{ to }-4.5\text{ V}$
Gate charge total <sup>2)</sup>	$Q_g$	-	-6.0	-7.5	nC	$V_{DD}=-75\text{ V}$ , $I_D=-0.8\text{ A}$ , $V_{GS}=0\text{ to }-4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	-2.6	-	V	$V_{DD}=-75\text{ V}$ , $I_D=-0.8\text{ A}$ , $V_{GS}=0\text{ to }-4.5\text{ V}$
Gate charge total	$Q_g$	-	-11.6	-	nC	$V_{DD}=-75\text{ V}$ , $I_D=-0.8\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$
Output charge <sup>2)</sup>	$Q_{oss}$	-	-3.6	-4.8	nC	$V_{DS}=-75\text{ V}$ , $V_{GS}=0\text{ V}$

**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	-1.29	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	-5.16	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	-0.79	-1.2	V	$V_{GS}=0\text{ V}$ , $I_F=-0.8\text{ A}$ , $T_J=25\text{ °C}$
Reverse recovery time <sup>2)</sup>	$t_{rr}$	-	32.46	64.92	ns	$V_R=-75\text{ V}$ , $I_F=-0.8\text{ A}$ , $di_F/dt=-100\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$	-	55.92	111.84	nC	$V_R=-75\text{ V}$ , $I_F=-0.8\text{ A}$ , $di_F/dt=-100\text{ A}/\mu\text{s}$

<sup>1)</sup> See "Gate charge waveforms" for parameter definition

<sup>2)</sup> Defined by design. Not subject to production test.

### 4 Electrical characteristics diagrams

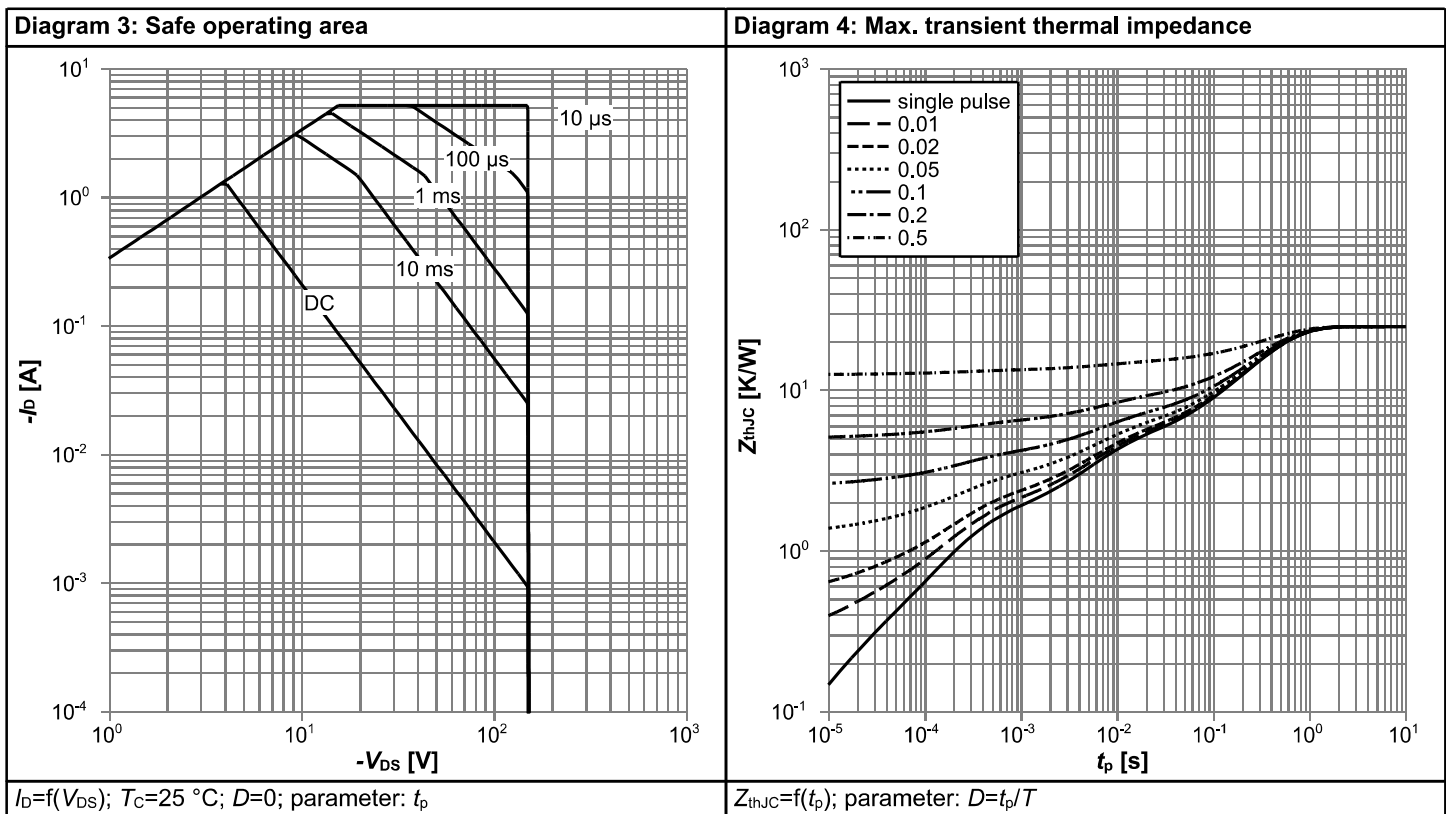
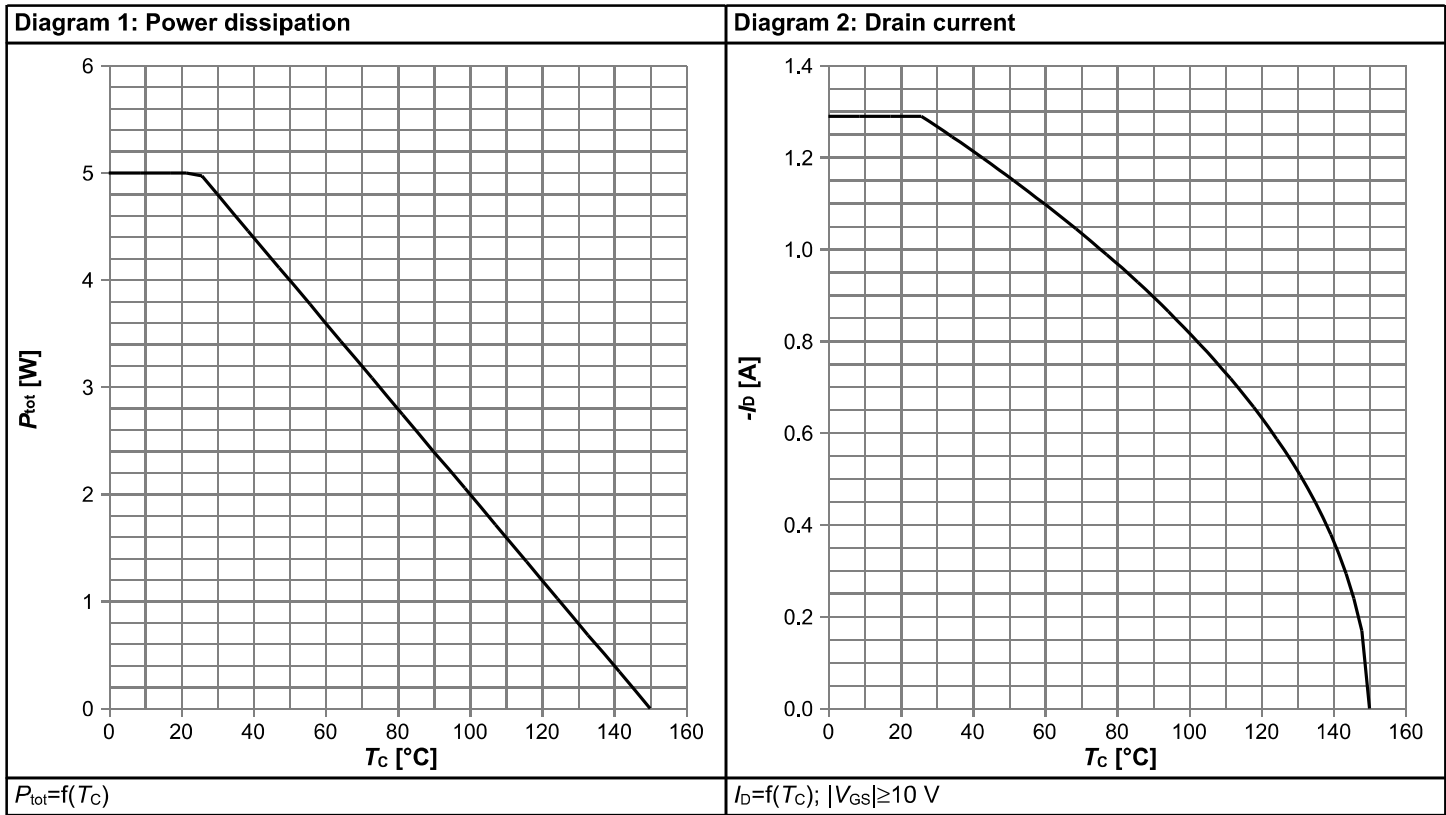
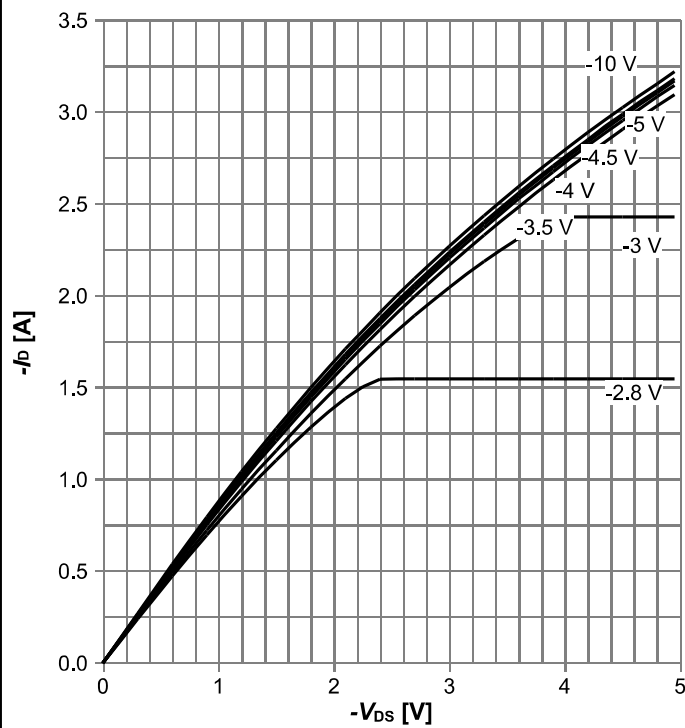
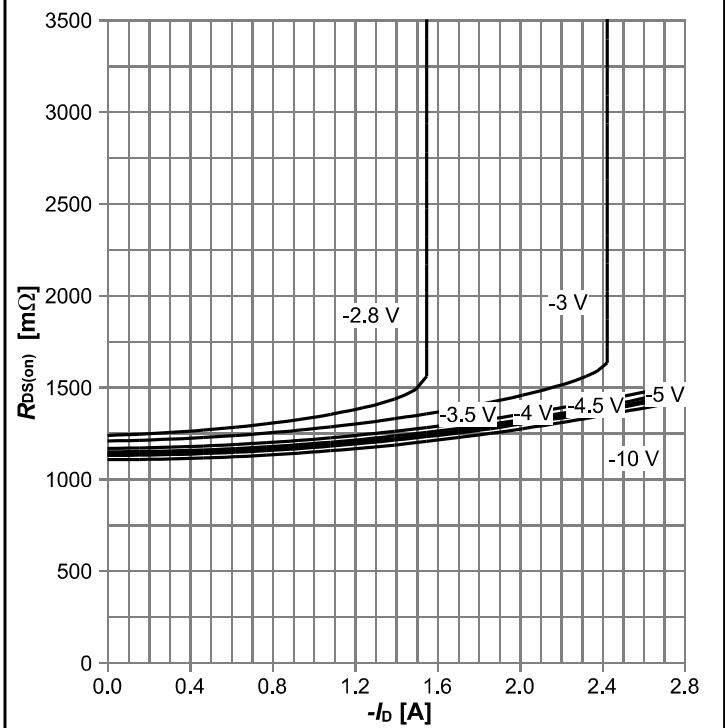


Diagram 5: Typ. output characteristics



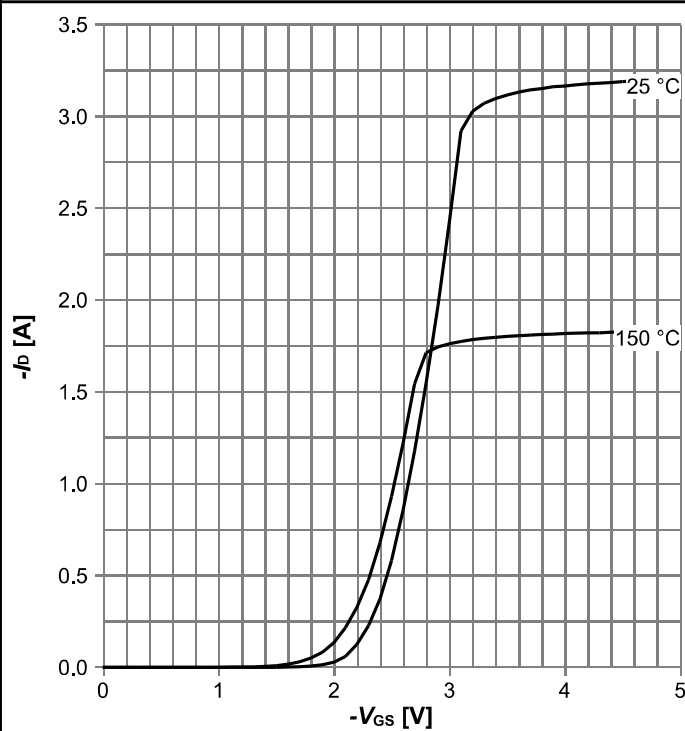
$I_D=f(V_{DS})$ ,  $T_j=25\text{ }^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



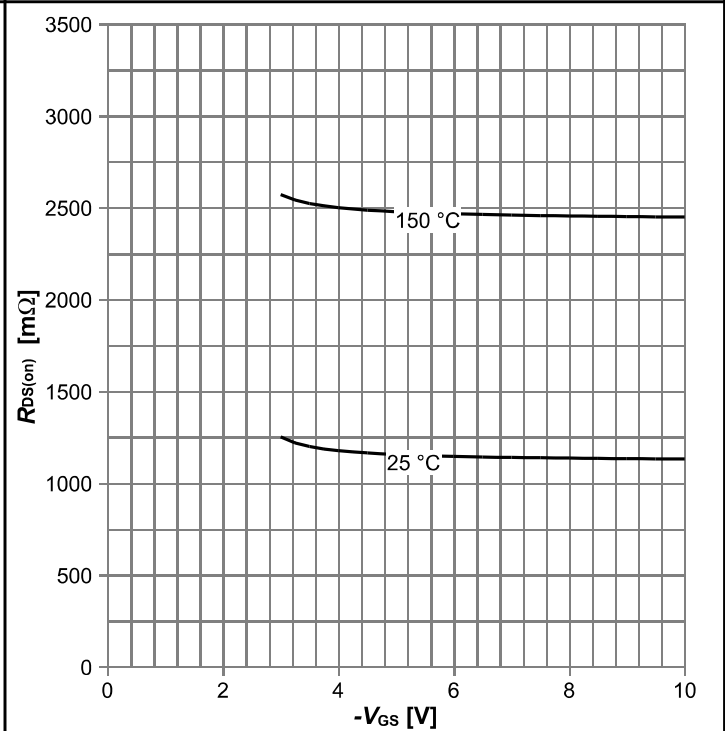
$R_{DS(on)}=f(I_D)$ ,  $T_j=25\text{ }^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



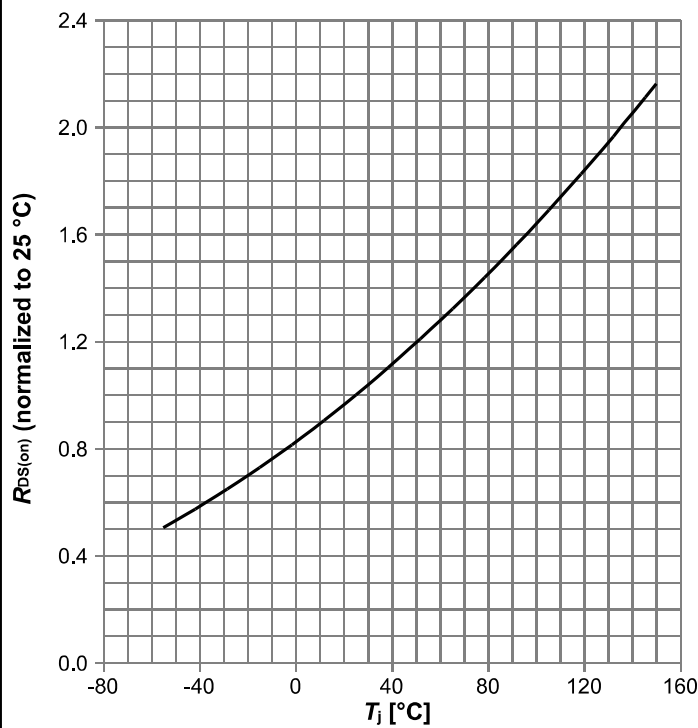
$I_D=f(V_{GS})$ ,  $|V_{DS}|>2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$

Diagram 8: Typ. drain-source on resistance



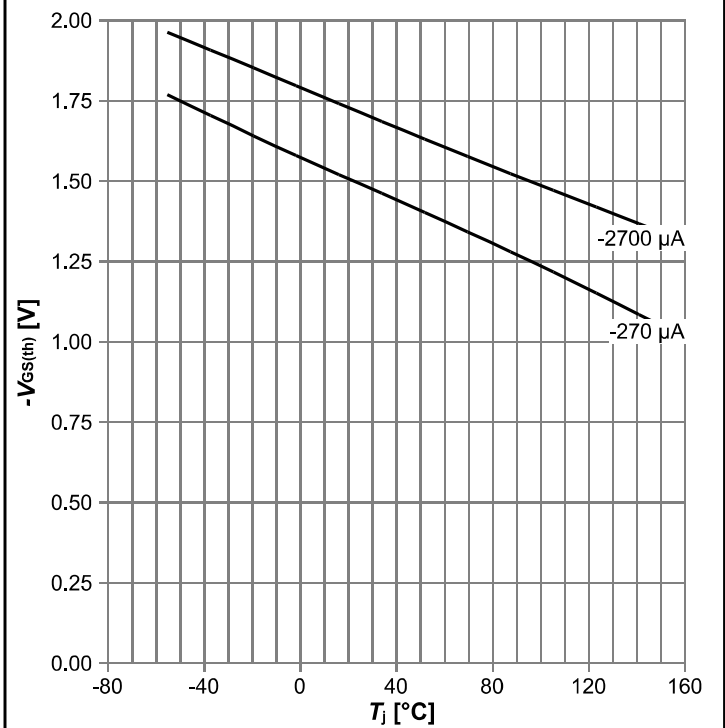
$R_{DS(on)}=f(V_{GS})$ ,  $I_D=-0.8\text{ A}$ ; parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



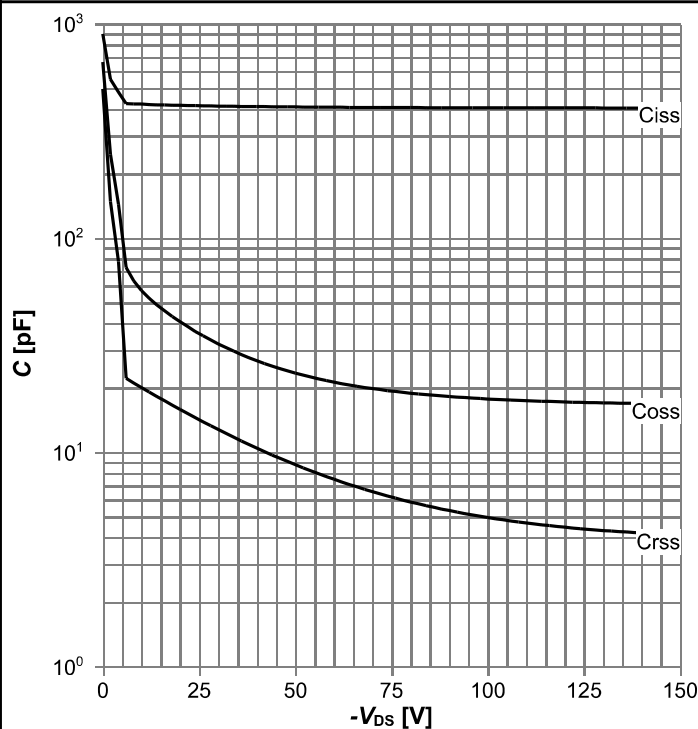
$R_{DS(on)}=f(T_j)$ ,  $I_D=-0.8$  A,  $V_{GS}=-10$  V

Diagram 10: Typ. gate threshold voltage



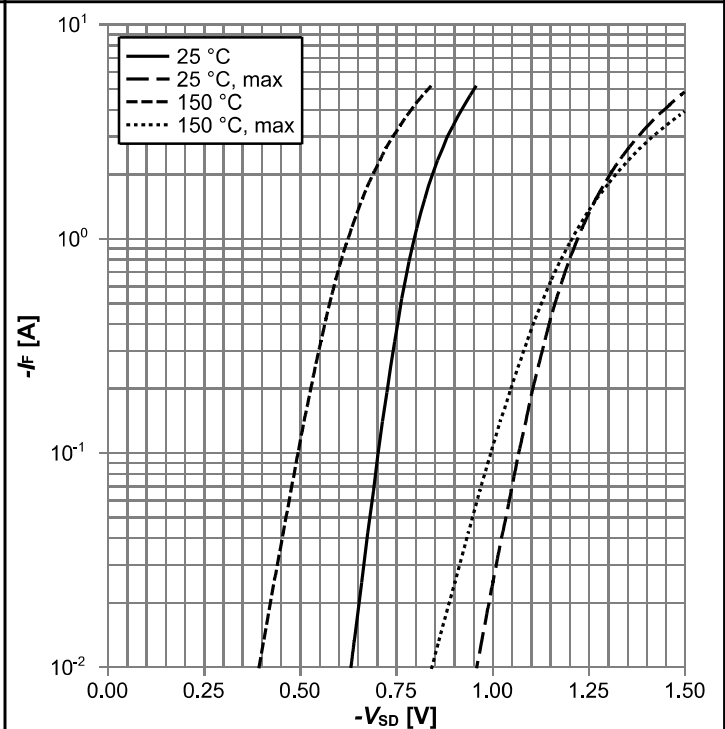
$V_{GS(th)}=f(T_j)$ ,  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



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

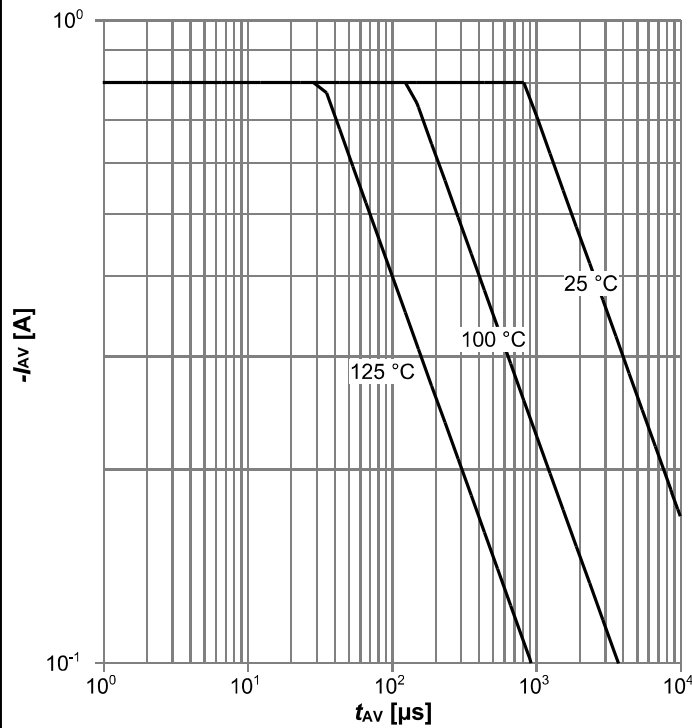
Diagram 12: Forward characteristics of reverse diode



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

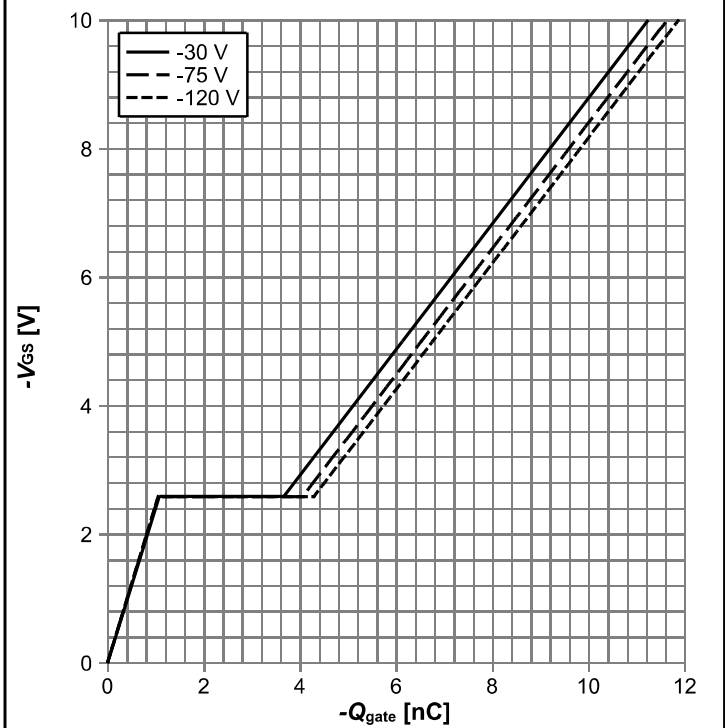


Diagram 13: Avalanche characteristics



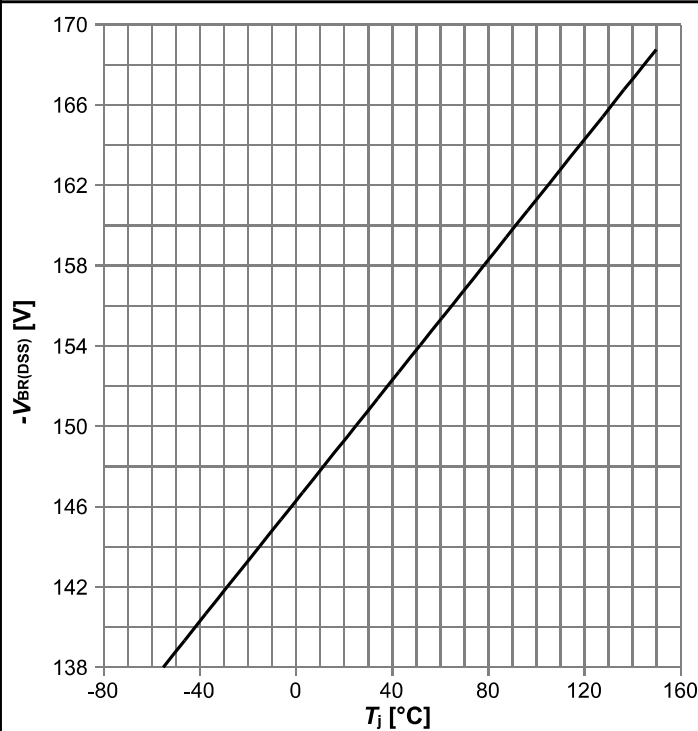
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



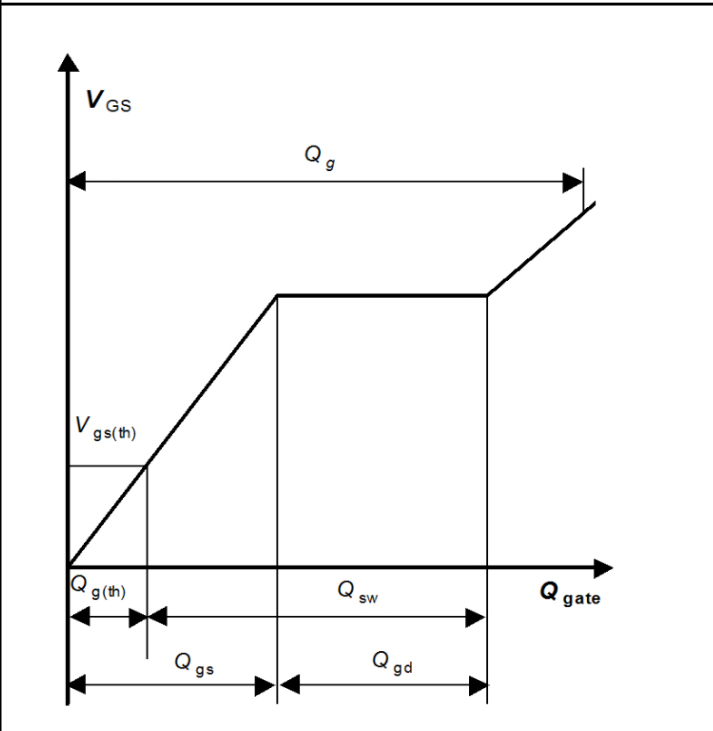
$V_{GS}=f(Q_{gate}), I_D=-0.8$  A pulsed,  $T_j=25$  °C; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

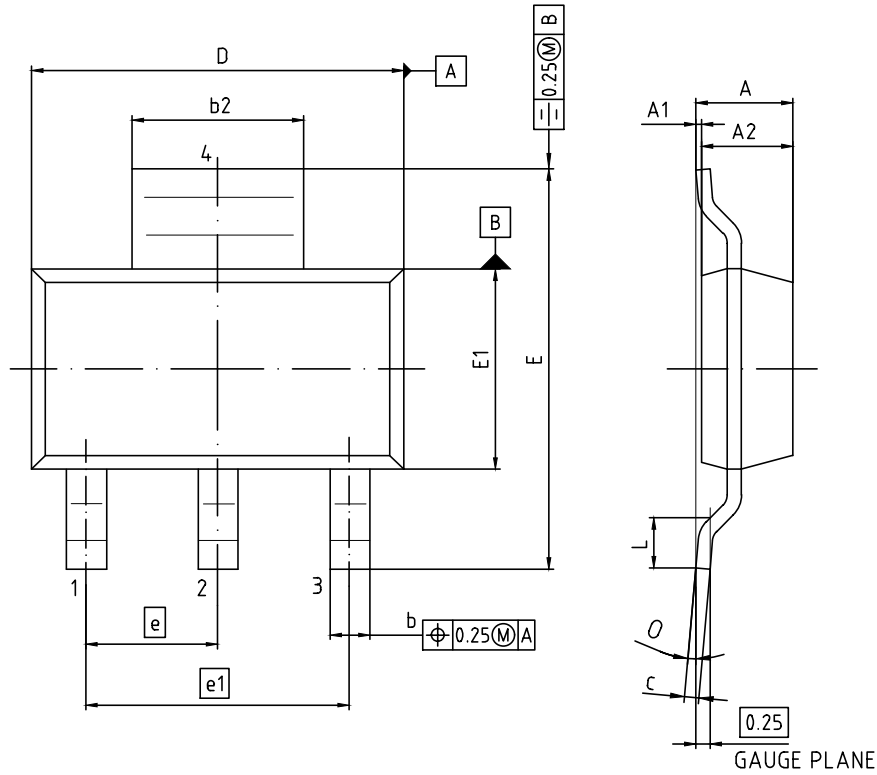


$V_{BR(DSS)}=f(T_j); I_D=-1$  mA

Diagram Gate charge waveforms



## 5 Package Outlines



DIMENSION	MILLIMETERS	
	MIN.	MAX.
A	1.60	1.80
A1	-	0.10
A2	1.50	1.70
b	0.60	0.80
b2	2.90	3.10
c	0.24	0.32
D	6.30	6.70
E	6.70	7.30
E1	3.30	3.70
e	2.30	
e1	4.60	
L	0.75	-
O	0°	10°

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Figure 1 Outline PG-SOT223-4, dimensions in mm

## Revision History

ISP14EP15LM

**Revision: 2021-05-10, Rev. 2.0**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2021-05-10	Release of final version

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