

MOSFET

Small-Signal Transistor

Features

- N-channel
- Depletion mode
- dv/dt rated
- Halogen free according to IEC61249-2-21
- Pb-free lead-plating; RoHS compliant

Product validation

Fully qualified according to JEDEC for Industrial Applications

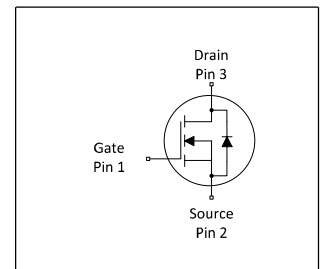
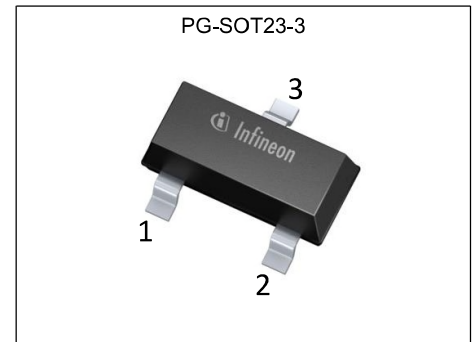


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	250	V
$R_{DS(on),max}$	30	Ω
$I_{DSS,min}$	0.03	A
ESD Sensitivity, JESD22-A114 (HBM)	Class 0 (<250V)	



RoHS

Type / Ordering Code	Package	Marking	Related Links
BSS139I	PG-SOT23	TIs	-

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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	I_D	-	-	0.10 0.08	A	$T_A=25\text{ °C}$ $T_A=70\text{ °C}$
Pulsed drain current	$I_{D,pulse}$	-	-	0.4	A	$T_A=25\text{ °C}$
Reverse diode dv/dt	dv/dt	-	-	6	kV/ μ s	$I_D=0.1\text{ A}$, $V_{DS}=200\text{ V}$, $di/dt=200\text{ A}/\mu\text{s}$, $T_{j,max}=150\text{ °C}$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	0.36	W	$T_A=25\text{ °C}$
Operating and storage temperature	T_j, T_{stg}	-55	-	150	$^{\circ}\text{C}$	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 - ambient, minimal footprint	R_{thJA}	-	-	350	K/W	-

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	$V_{(BR)DSS}$	250	-	-	V	$V_{GS}=-3\text{ V}$, $I_D=250\text{ }\mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	-2.1	-1.4	-1	V	$V_{DS}=3\text{ V}$, $I_D=56\text{ }\mu\text{A}$
Drain-source cutoff current	$I_{D(off)}$	-	-	0.1 10	μA	$V_{DS}=250\text{ V}$, $V_{GS}=-3\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=250\text{ V}$, $V_{GS}=-3\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	-	10	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
On-state drain current	I_{DSS}	30	-	-	mA	$V_{GS}=0\text{ V}$, $V_{DS}=10\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	12.5 7.8	30 14	Ω	$V_{GS}=0\text{ V}$, $I_D=15\text{ mA}$ $V_{GS}=10\text{ V}$, $I_D=0.1\text{ A}$
Transconductance	g_{fs}	0.060	0.13	-	S	$ V_{DS} >2 I_D /R_{DS(on)max}$, $I_D=0.08\text{ A}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	60	-	pF	$V_{GS}=-3\text{ V}$, $V_{DS}=25\text{ V}$, $f=1\text{ MHz}$
Output capacitance	C_{oss}	-	6.7	-	pF	$V_{GS}=-3\text{ V}$, $V_{DS}=25\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	2.6	-	pF	$V_{GS}=-3\text{ V}$, $V_{DS}=25\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	5.8	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=-3\text{ to }5\text{ V}$, $I_D=0.04\text{ A}$, $R_G=6\ \Omega$
Rise time	t_r	-	5.4	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=-3\text{ to }5\text{ V}$, $I_D=0.04\text{ A}$, $R_G=6\ \Omega$
Turn-off delay time	$t_{d(off)}$	-	29	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=-3\text{ to }5\text{ V}$, $I_D=0.04\text{ A}$, $R_G=6\ \Omega$
Fall time	t_f	-	182	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=-3\text{ to }5\text{ V}$, $I_D=0.04\text{ A}$, $R_G=6\ \Omega$

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	0.14	-	nC	$V_{DD}=200\text{ V}$, $I_D=0.04\text{ A}$, $V_{GS}=-3\text{ to }5\text{ V}$
Gate to drain charge	Q_{gd}	-	1.3	-	nC	$V_{DD}=200\text{ V}$, $I_D=0.04\text{ A}$, $V_{GS}=-3\text{ to }5\text{ V}$
Gate charge total	Q_g	-	2.3	-	nC	$V_{DD}=200\text{ V}$, $I_D=0.04\text{ A}$, $V_{GS}=-3\text{ to }5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	-0.28	-	V	$V_{DD}=200\text{ V}$, $I_D=0.04\text{ A}$, $V_{GS}=-3\text{ to }5\text{ V}$

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	0.10	A	$T_A=25\text{ }^\circ\text{C}$
Diode pulse current	$I_{S,pulse}$	-	-	0.4	A	$T_A=25\text{ }^\circ\text{C}$
Diode forward voltage	V_{SD}	-	0.81	1.2	V	$V_{GS}=-3\text{ V}$, $I_F=0.1\text{ A}$, $T_j=25\text{ }^\circ\text{C}$
Reverse recovery time	t_{rr}	-	8.6	12.9	ns	$V_R=50\text{ V}$, $I_F=0.04\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}	-	2.1	3.1	nC	$V_R=50\text{ V}$, $I_F=0.04\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$

4 Electrical characteristics diagrams

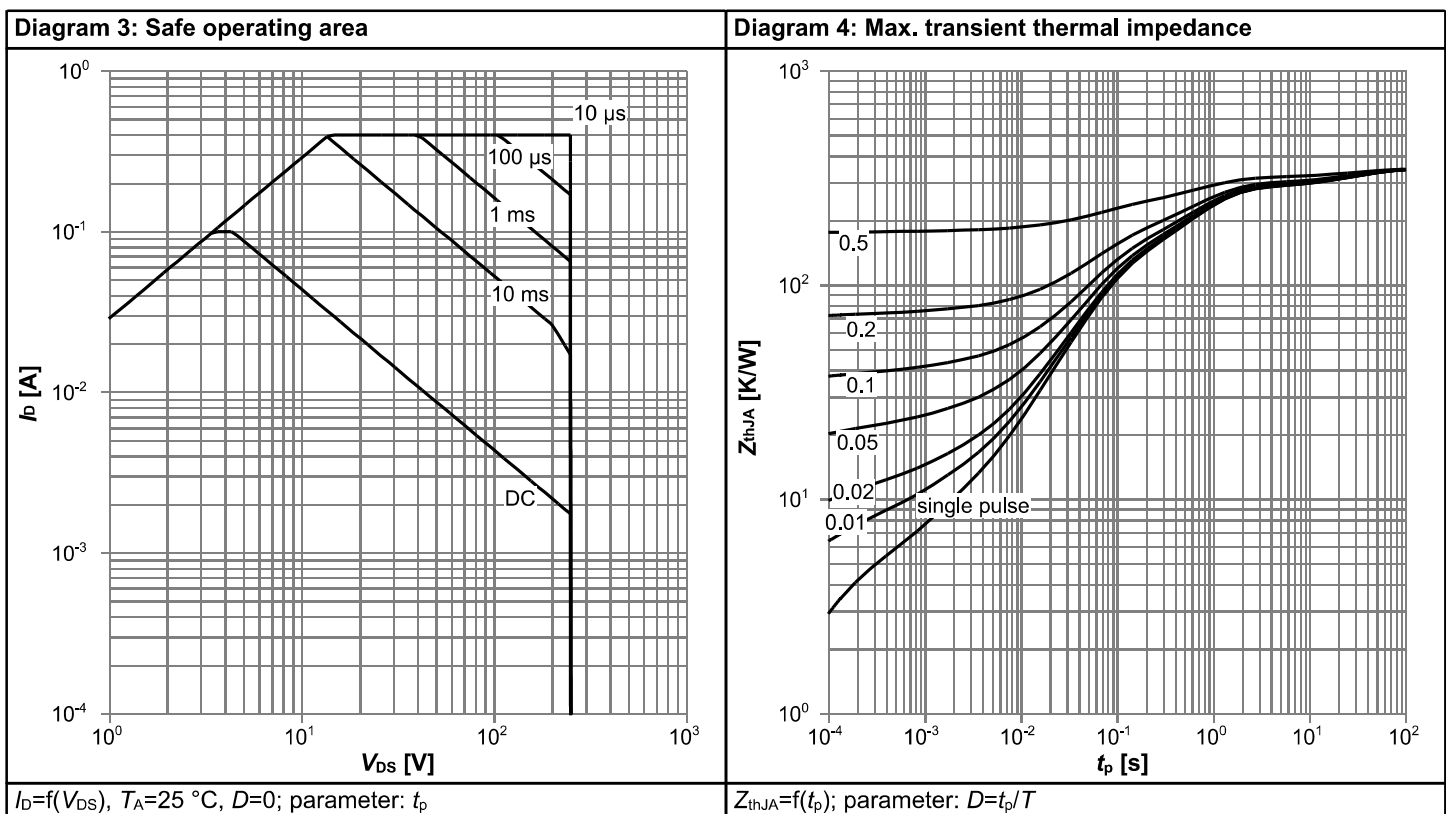
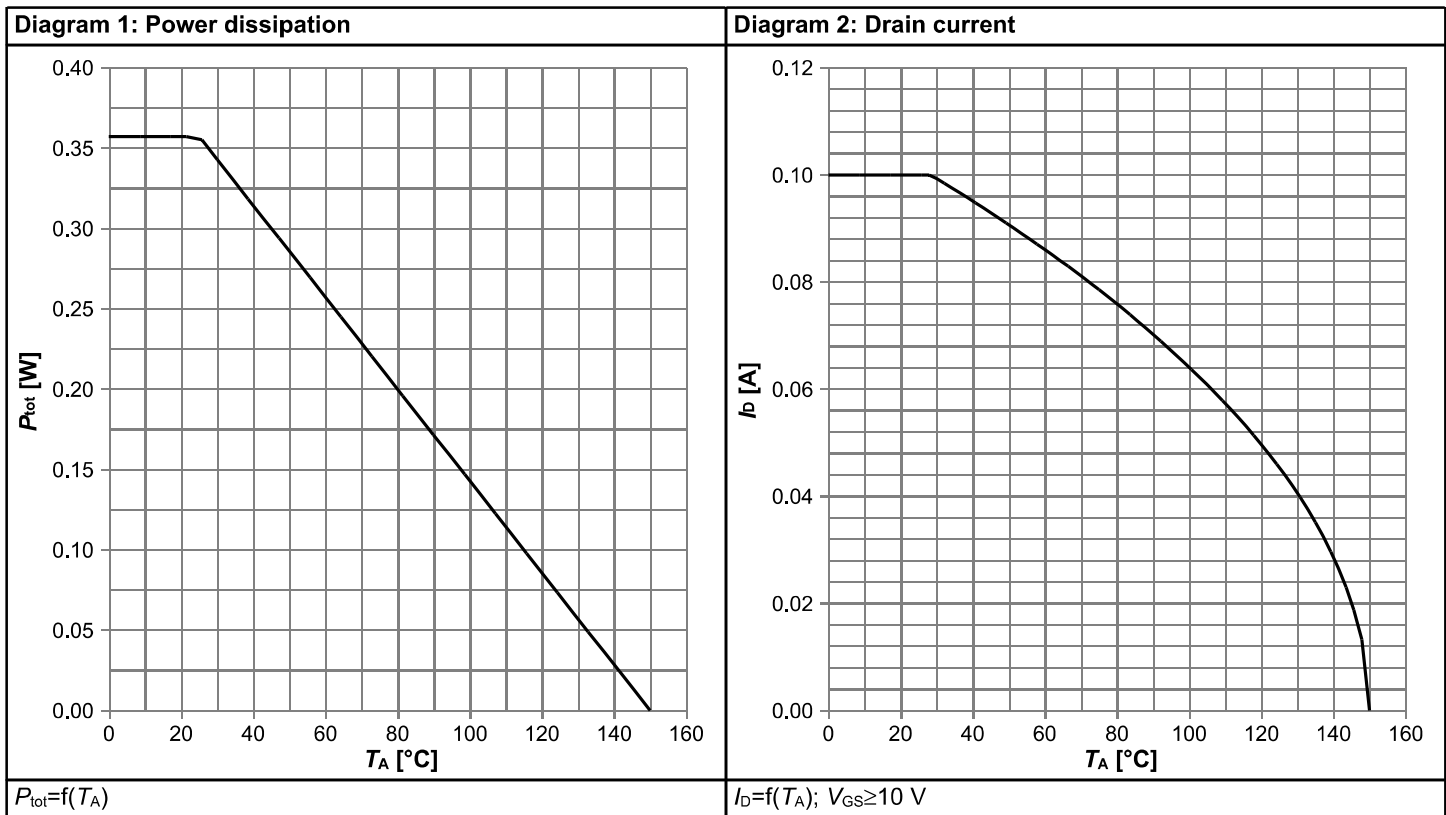
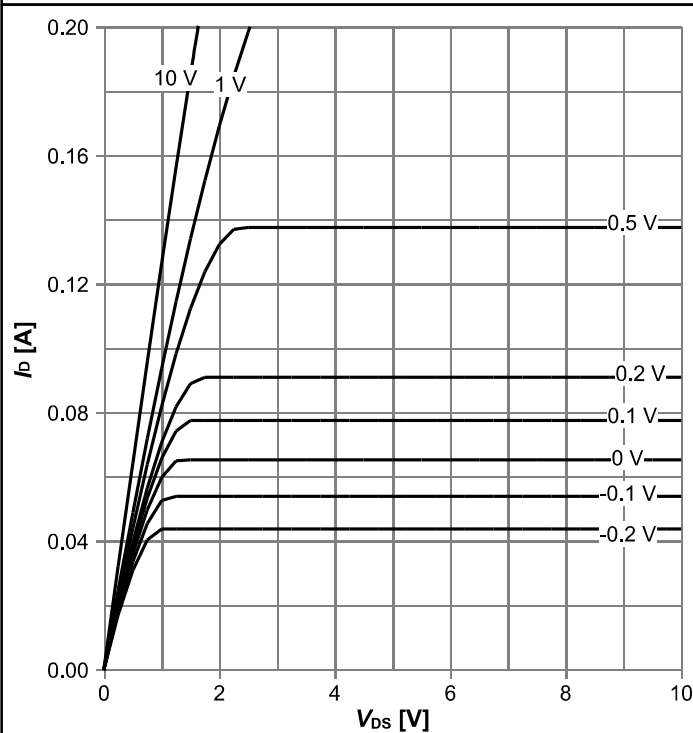
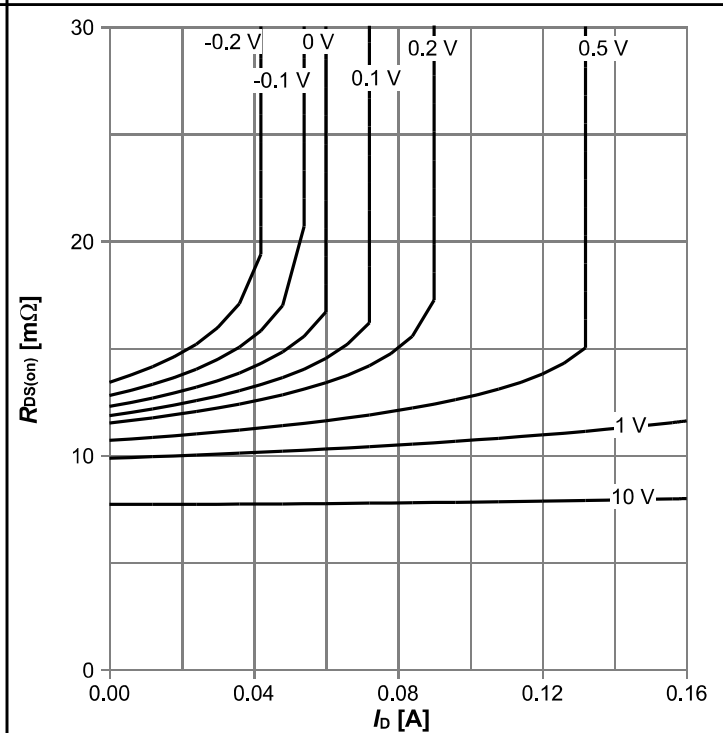


Diagram 5: Typ. output characteristics



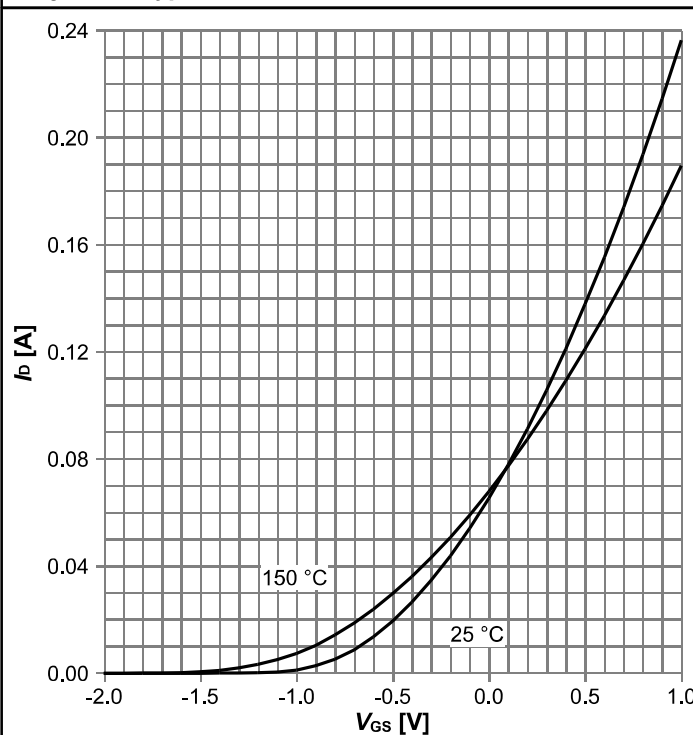
$I_D = f(V_{DS}), T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



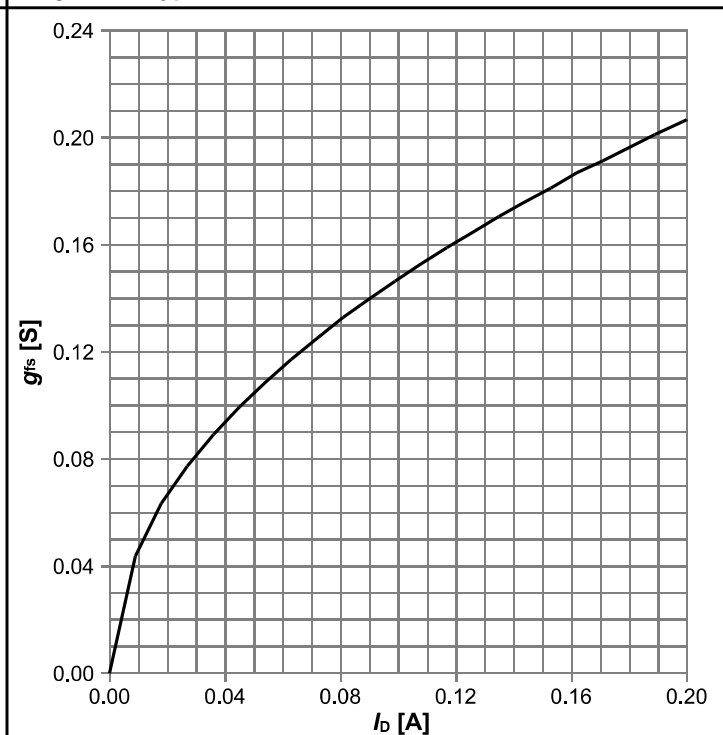
$R_{DS(on)} = f(I_D), T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



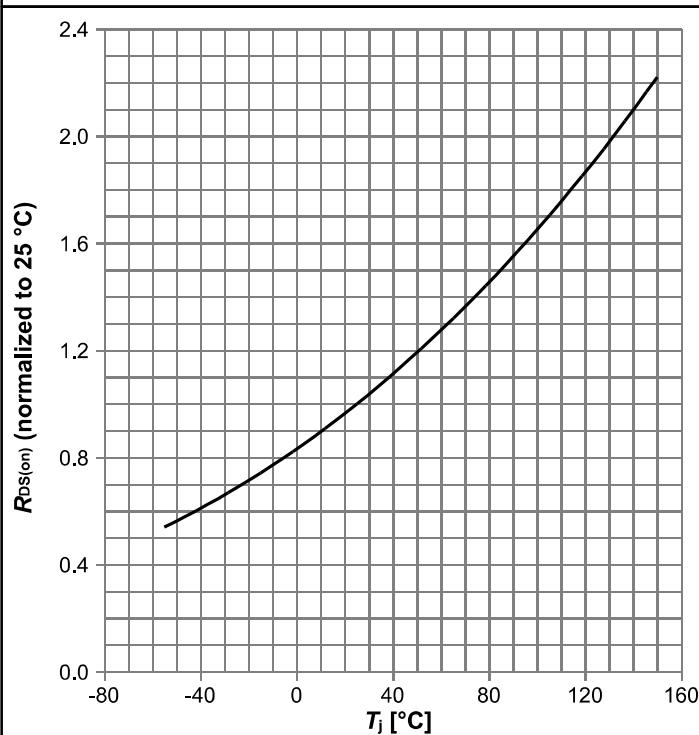
$I_D = f(V_{GS}), |V_{DS}| > 2|I_D|R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. transconductance



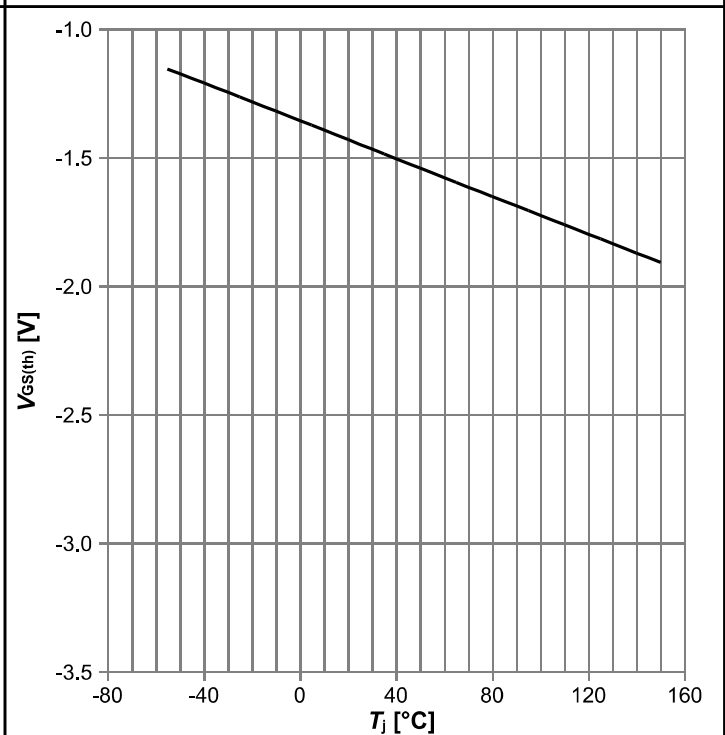
$g_{fs} = f(I_D), V_{DS} = 10\text{ V}, T_j = 25\text{ °C}$

Diagram 9: Normalized drain-source on resistance



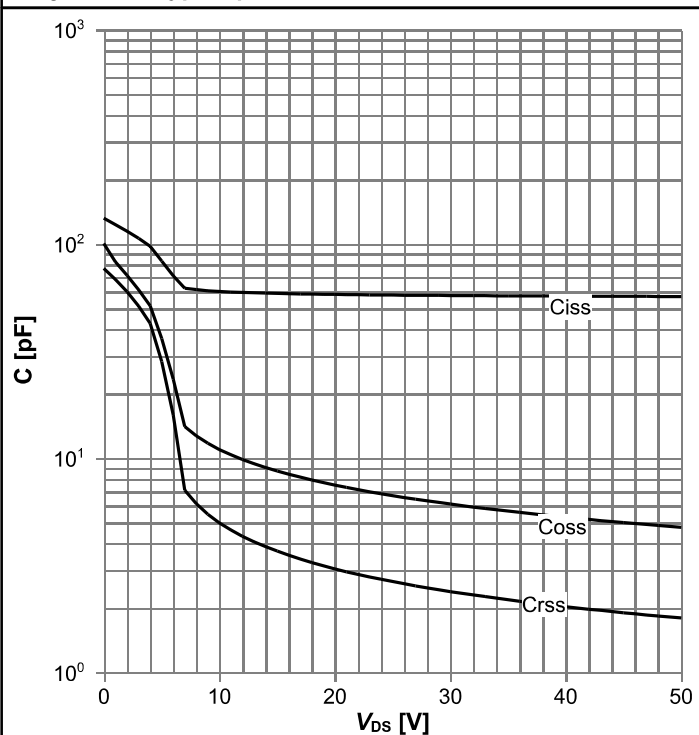
$R_{DS(on)}=f(T_j)$, $I_D=0.1$ A, $V_{GS}=10$ V

Diagram 10: Typ. gate threshold voltage



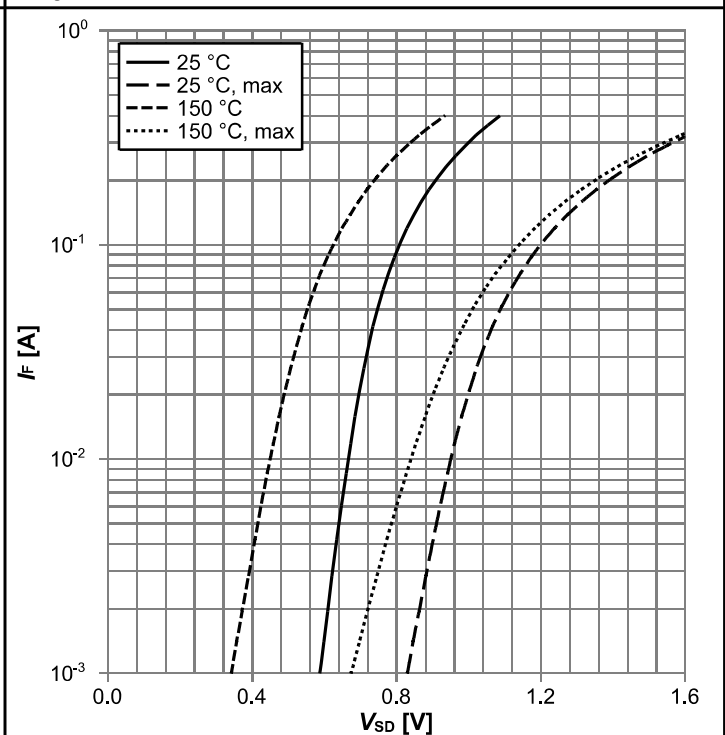
$V_{GS(th)}=f(T_j)$, $V_{DS}=3$ V, $I_D=56$ μ A

Diagram 11: Typ. capacitances



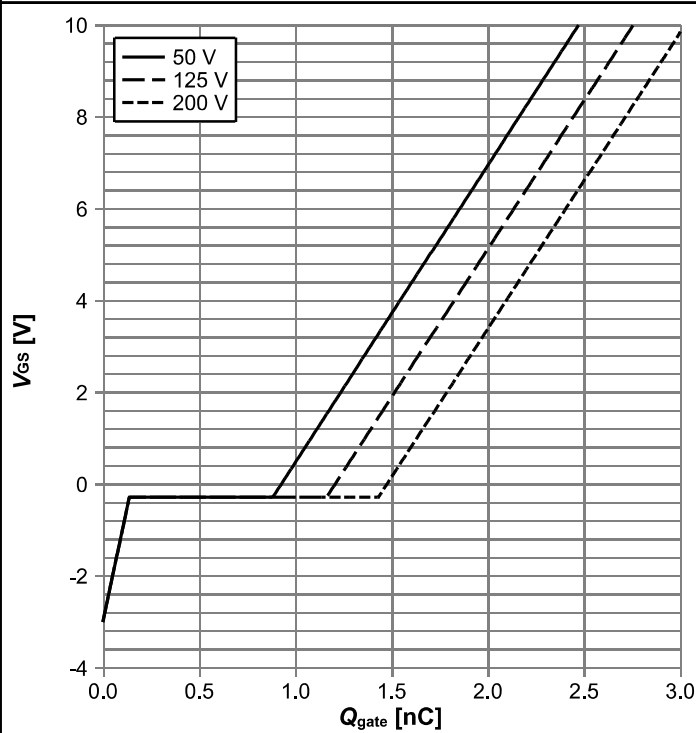
$C=f(V_{DS})$, $V_{GS}=-3$ V, $f=1$ MHz

Diagram 12: Forward characteristics of reverse diode



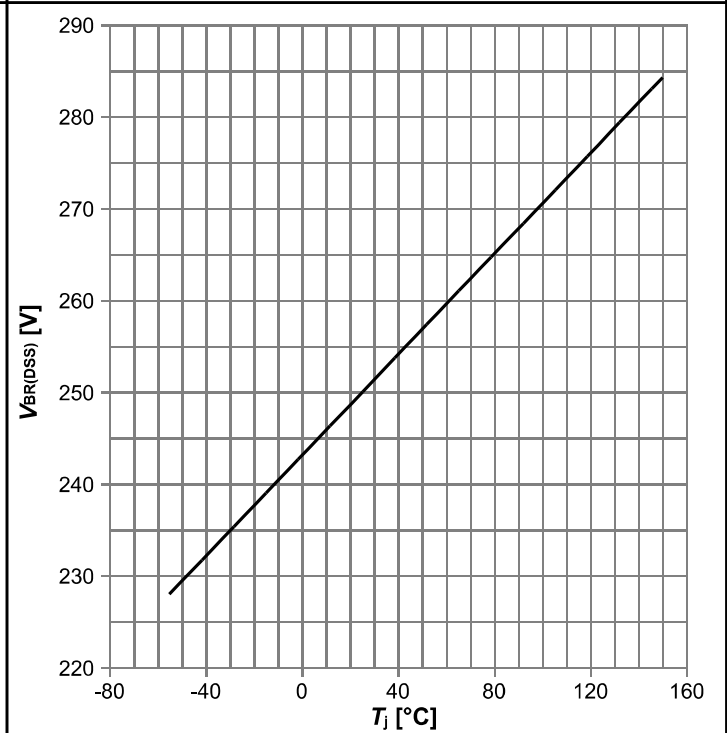
$I_F=f(V_{SD})$, $V_{GS}=-3$ V; parameter: T_j

Diagram 13: Typ. gate charge



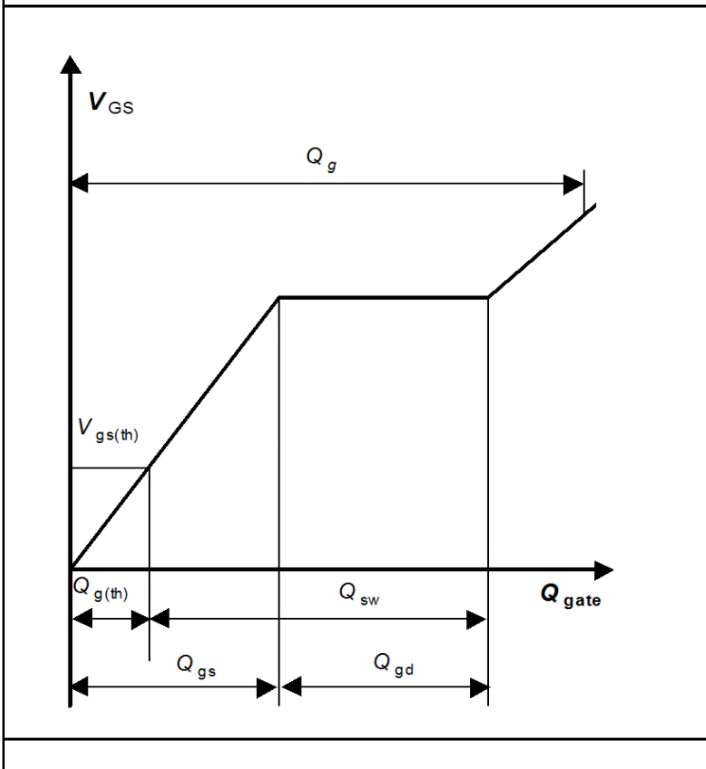
$V_{GS}=f(Q_{gate}), I_D=0.1 \text{ A pulsed}, T_j=25 \text{ }^\circ\text{C}$

Diagram 14: Drain-source breakdown voltage

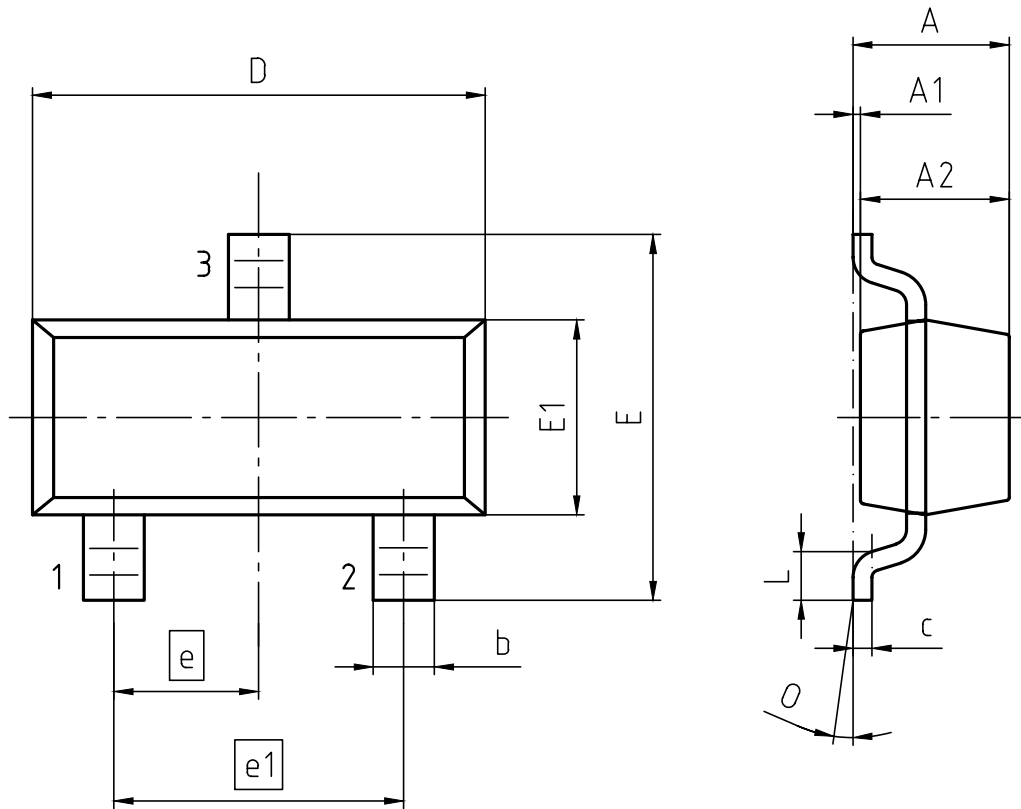


$V_{BR(DSS)}=f(T_j); I_D=250 \text{ } \mu\text{A}, V_{GS}=-3 \text{ V}$

Diagram Gate charge waveforms



5 Package Outlines



PACKAGE - GROUP NUMBER: PG-SOT23-3-U01		
REVISION: 01		DATE: 09.12.2020
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	0.89	1.12
A1	0.01	0.10
A2	0.88	1.02
b	0.30	0.50
c	0.08	0.20
D	2.80	3.04
E	2.10	2.64
E1	1.20	1.40
e	0.95	
e1	1.90	
L	0.15	0.60
O	0°	8°

Figure 1 Outline PG-SOT23, dimensions in mm

Revision History

BSS139I

Revision: 2021-03-17, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2021-01-25	Release of final version
2.1	2021-03-17	Update technology naming

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