

# MOSFET

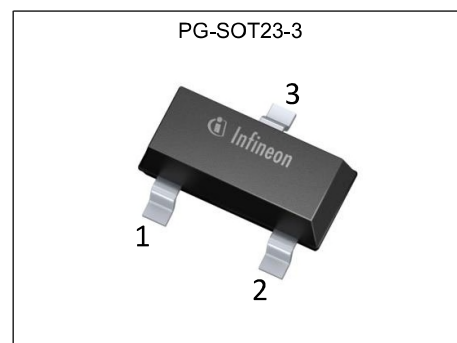
## Small-Signal Transistor

### Features

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

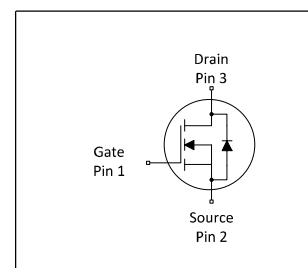
### Product validation

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	$\Omega$
$I_{DSS,min}$	0.03	A
ESD Sensitivity, JESD22-A114 (HBM)	Class 0 (<250V)	



RoHS

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

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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/ $\mu$ 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	°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	$\mu\text{A}$	$V_{DS}=250\text{ V}$ , $V_{GS}=-3\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=250\text{ V}$ , $V_{GS}=-3\text{ V}$ , $T_j=125\text{ °C}$
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	$\Omega$	$V_{GS}=0\text{ V}$ , $I_D=15\text{ mA}$ $V_{GS}=10\text{ V}$ , $I_D=0.1\text{ A}$
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	$T_A=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	0.4	A	$T_A=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.81	1.2	V	$V_{GS}=-3\text{ V}$ , $I_F=0.1\text{ A}$ , $T_j=25\text{ °C}$
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

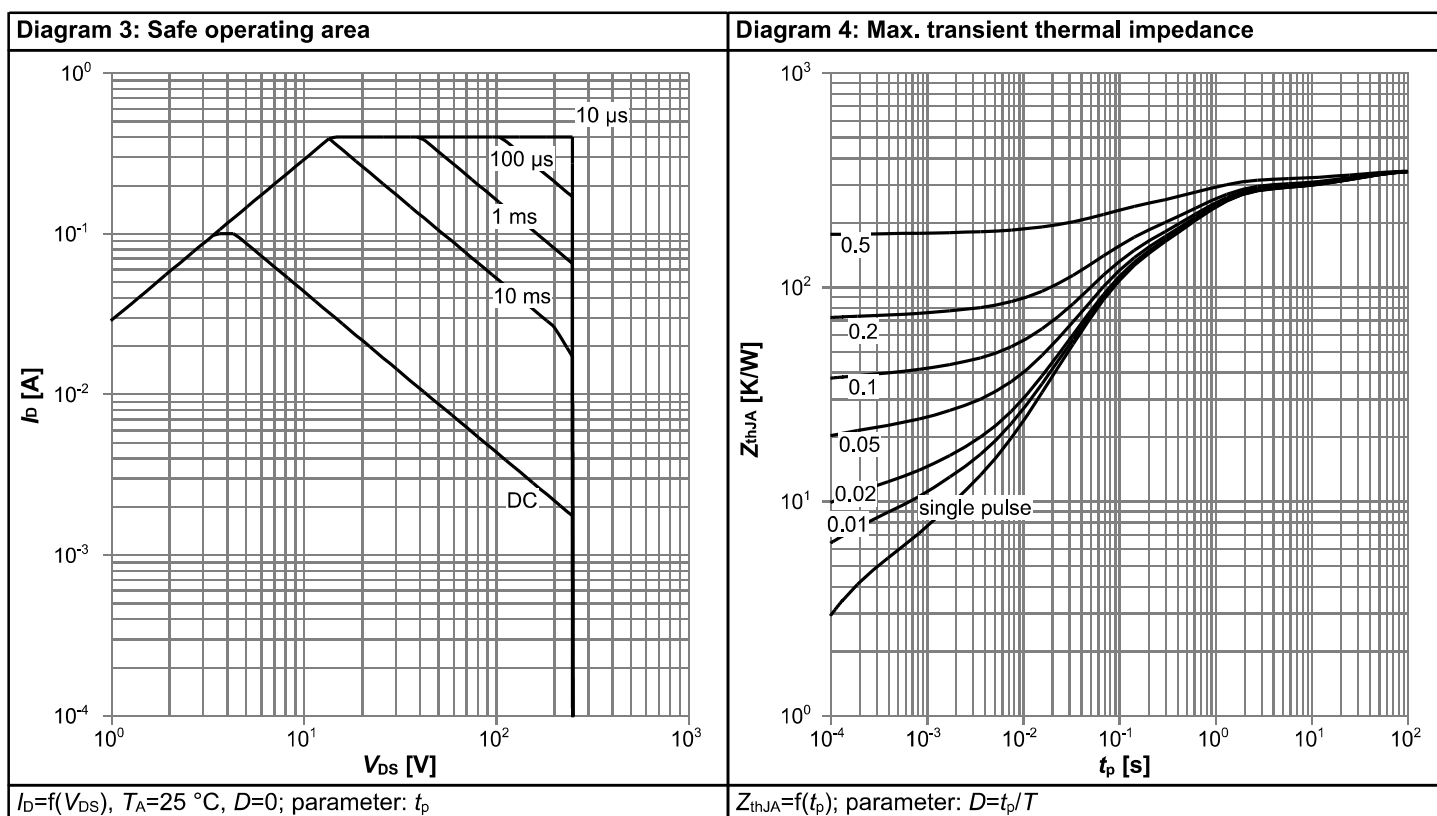
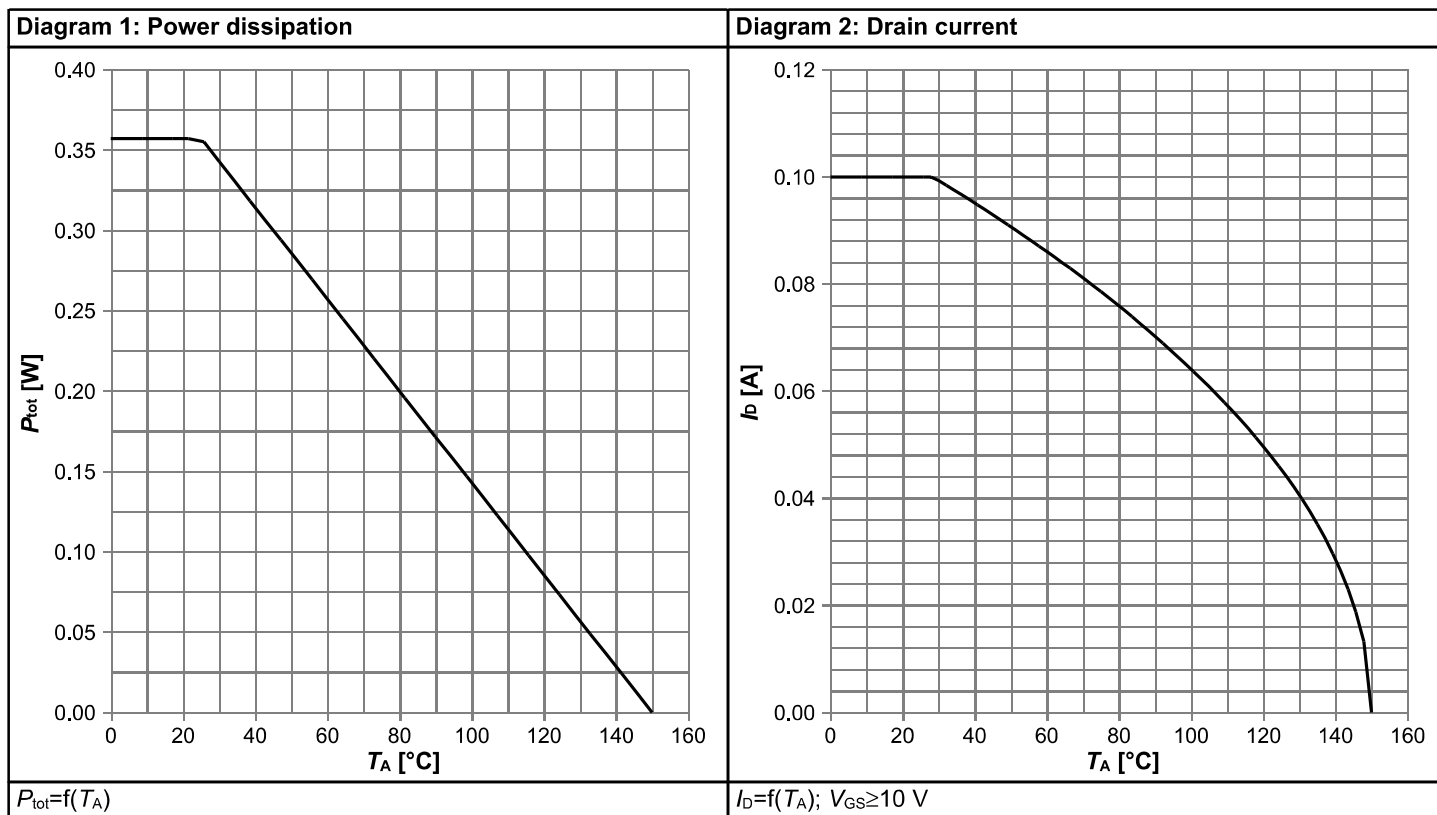
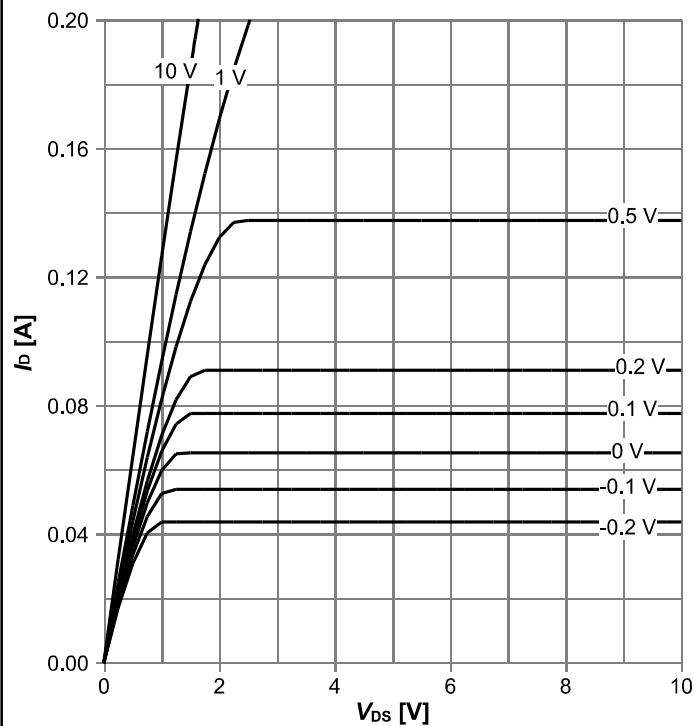
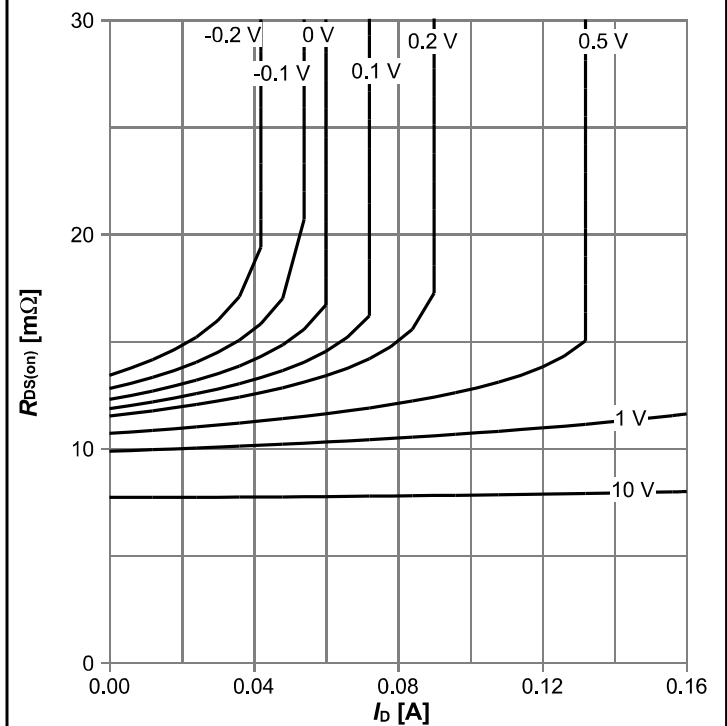


Diagram 5: Typ. output characteristics



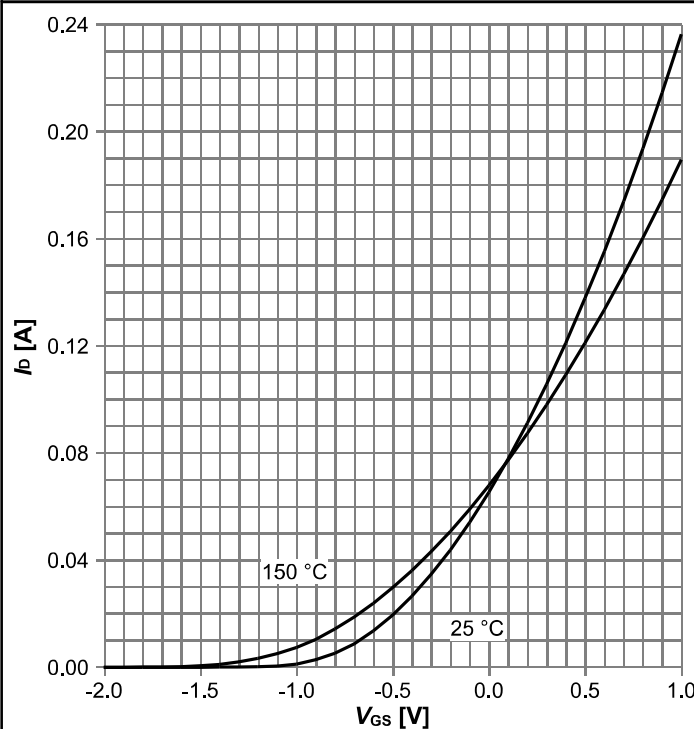
$I_D = f(V_{DS})$ ,  $T_J = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



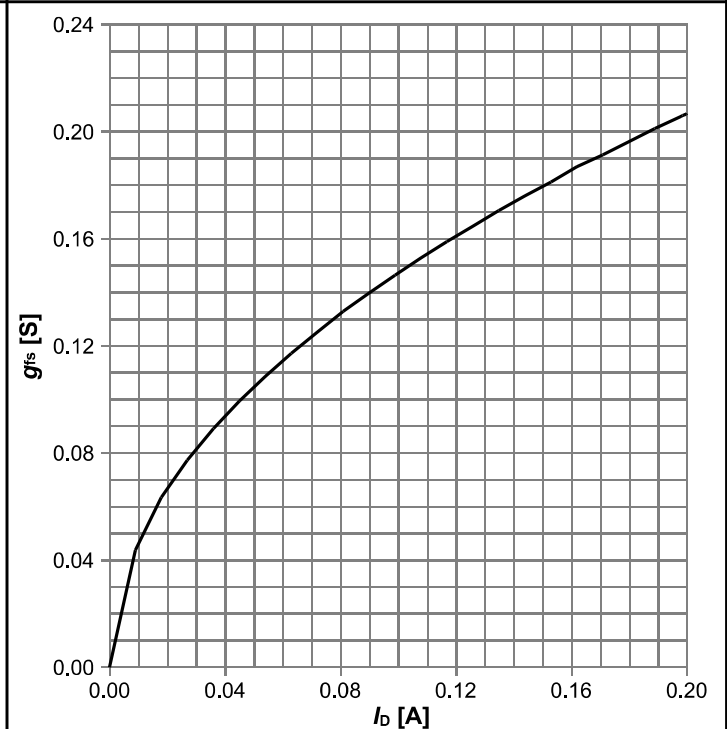
$R_{DS(on)} = f(I_D)$ ,  $T_J = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



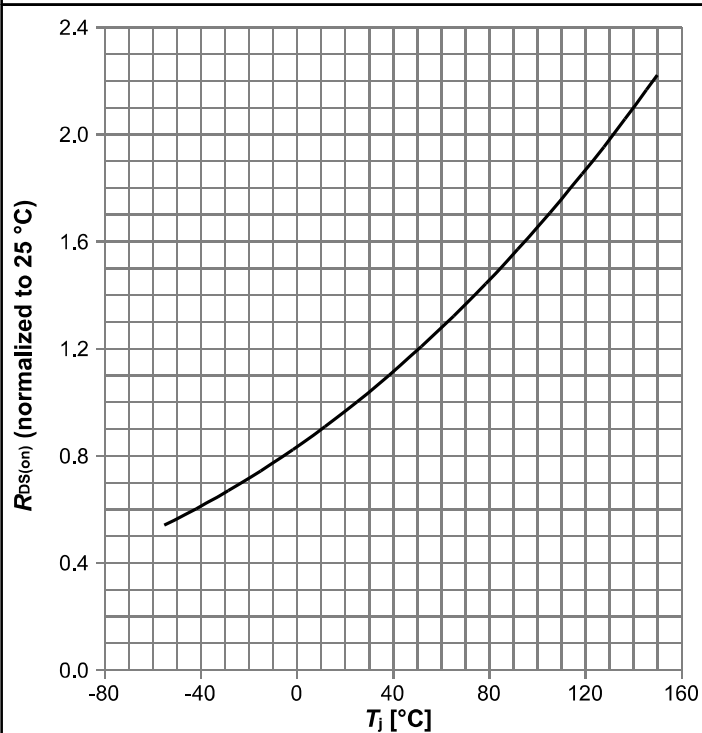
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_J$

Diagram 8: Typ. transconductance



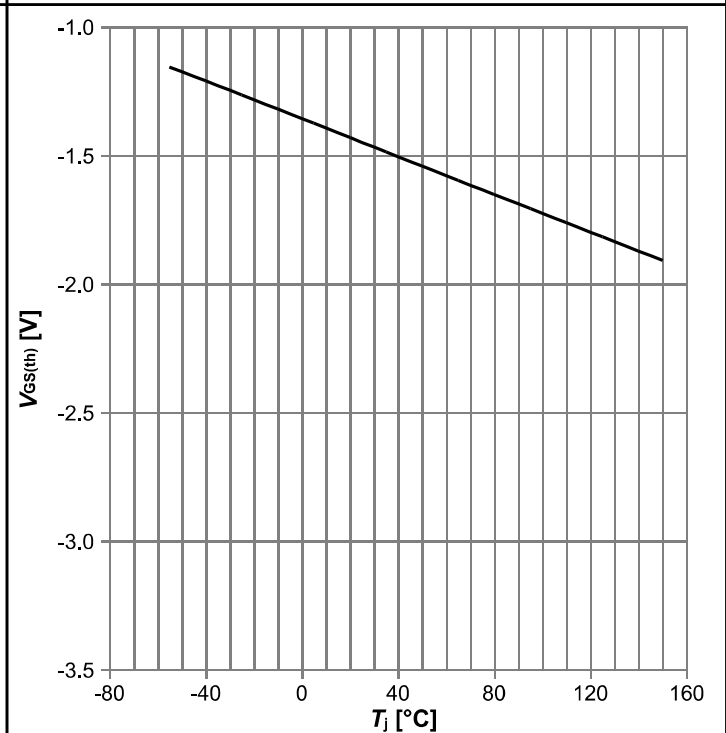
$g_{fs} = f(I_D)$ ,  $V_{DS} = 10\text{ V}$ ,  $T_J = 25^\circ\text{C}$

Diagram 9: Normalized drain-source on resistance



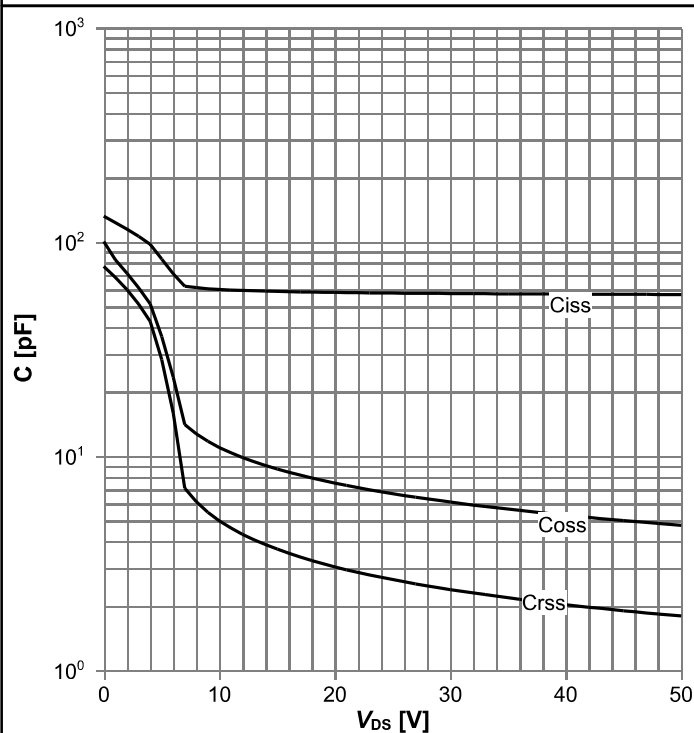
$R_{DS(on)} = f(T_j)$ ,  $I_D = 0.1$  A,  $V_{GS} = 10$  V

Diagram 10: Typ. gate threshold voltage



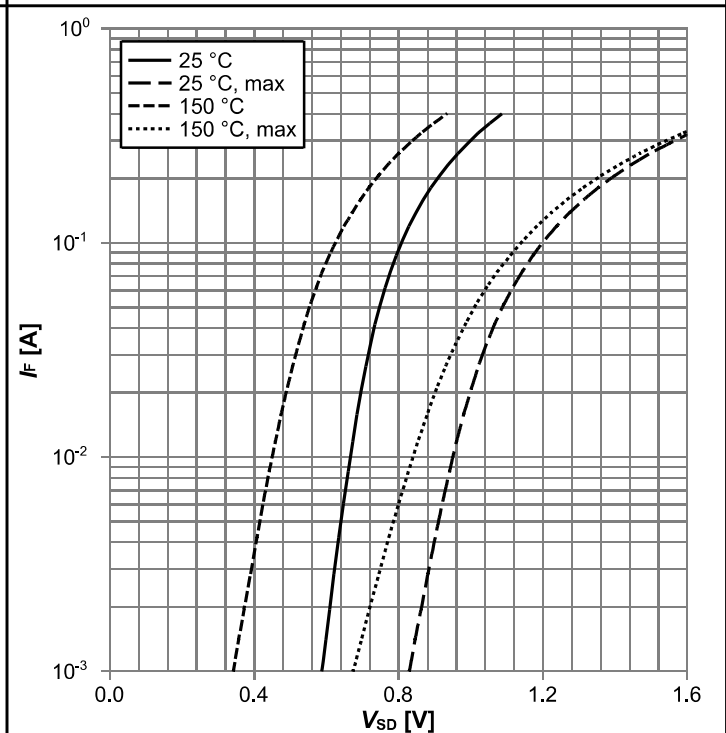
$V_{GS(th)} = f(T_j)$ ,  $V_{DS} = 3$  V,  $I_D = 56$   $\mu$ A

Diagram 11: Typ. capacitances



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

Diagram 12: Forward characteristics of reverse diode

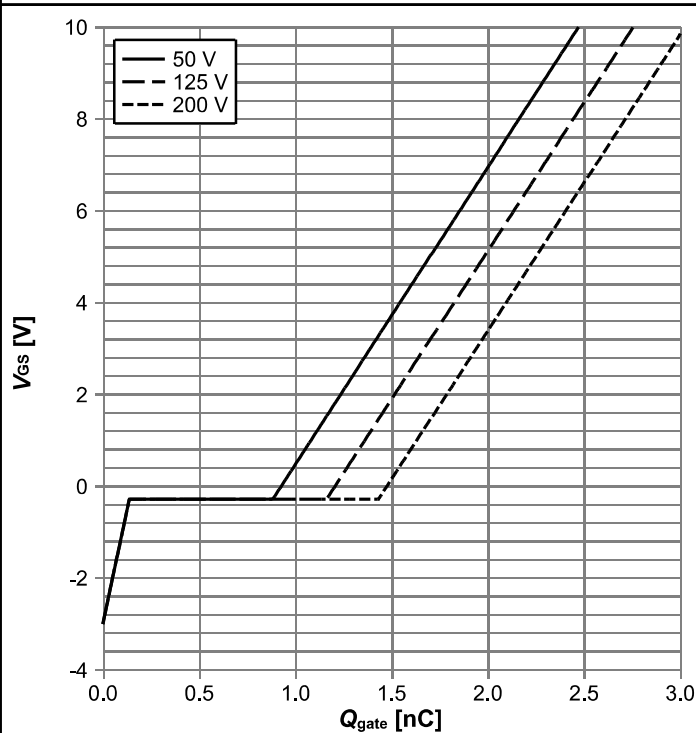


$I_F = f(V_{SD})$ ,  $V_{GS} = -3$  V; parameter:  $T_j$

# Small-Signal Transistor

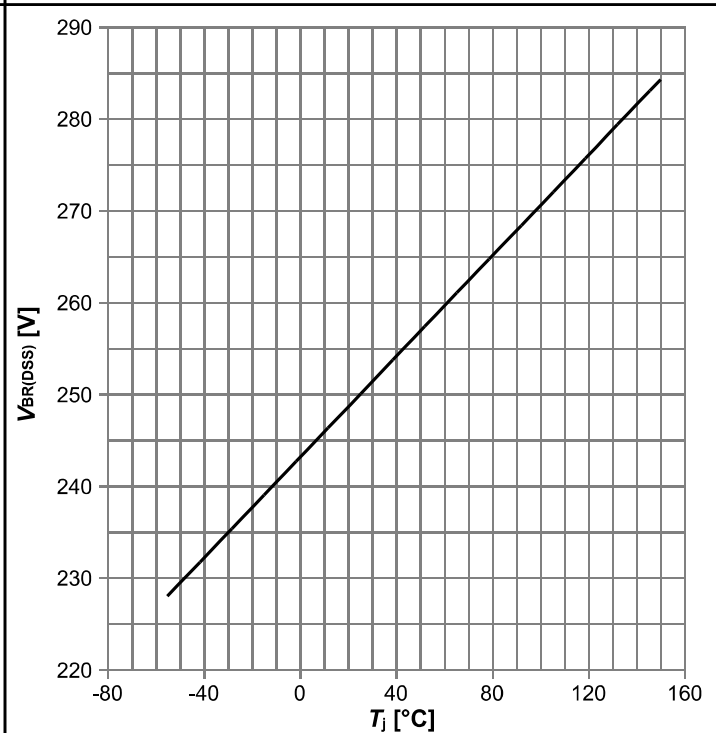
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Diagram 13: Typ. gate charge



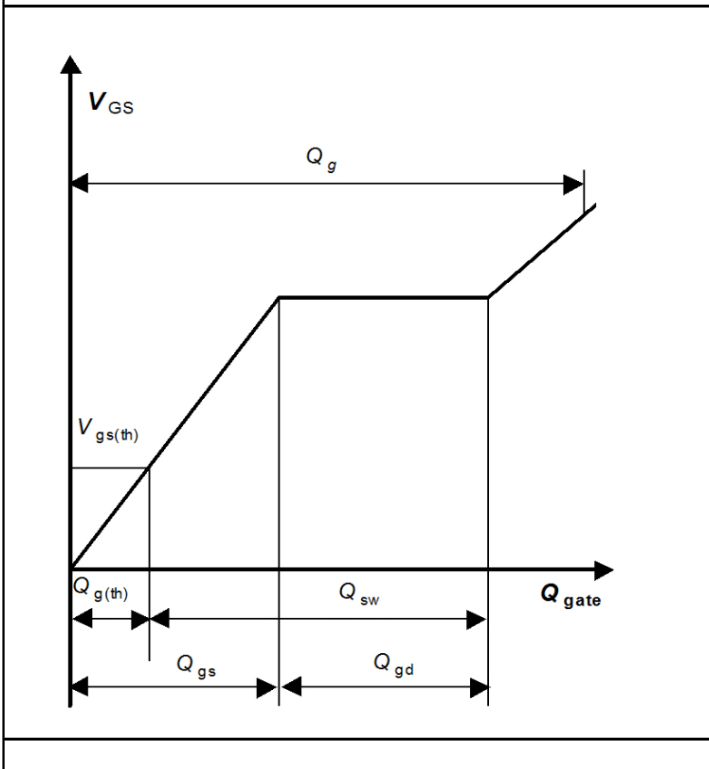
$V_{GS}=f(Q_{gate})$ ,  $I_D=0.1$  A pulsed,  $T_j=25$  °C

Diagram 14: Drain-source breakdown voltage



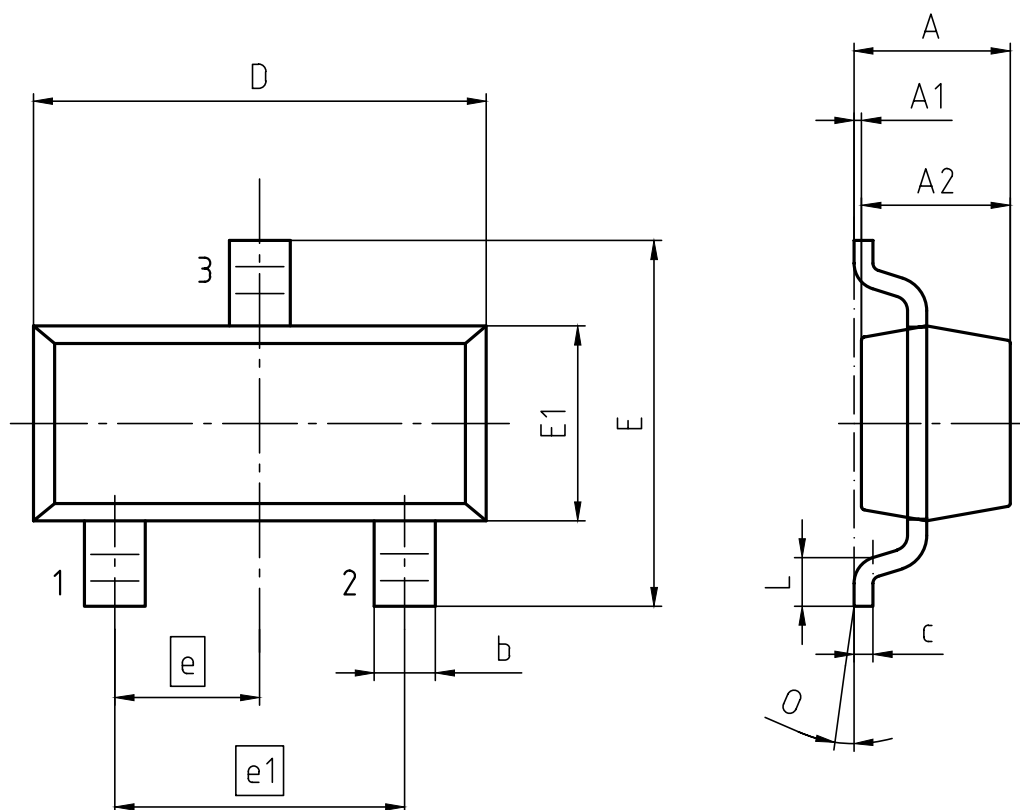
$V_{BR(DSS)}=f(T_j)$ ;  $I_D=250$  μA,  $V_{GS}=-3$  V

Diagram Gate charge waveforms





## 5 Package Outlines



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