Small-Signal Transistor

PG-SOT23-3

Features

- N-channel
- Depletion mode
- d*v*/d*t* rated
- Halogen free according to IEC61249-2-21
- Pb-free lead-plating; RoHS compliant

Product validation

Fully qualified according to JEDEC for Industrial Applications

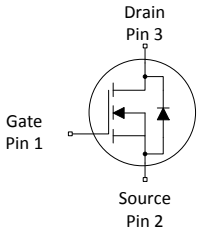
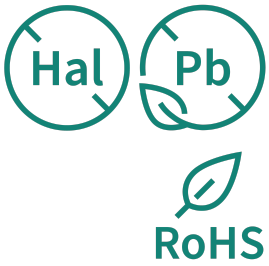


Table 1 Key performance parameters

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)	



Part number	Package	Marking	Related links
BSS139I	PG-SOT23-3	Tls	-

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 12
Disclaimer 12

1 Maximum ratings

at T_A=25 °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	A	T_A=25 °C
				0.08		T_A=70 °C
Pulsed drain current	$I_{D,pulse}$	-	-	0.4	A	T_A=25 °C
Reverse diode dv/dt	dv/dt	-	-	6	kV /µs	I_D=0.1 A, V_{DS}=200 V, di/dt=200 A/µs, $T_{j,max}$=150 °C
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	0.36	W	T_A=25 °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 °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 V, I_D=250 µA
Gate threshold voltage	$V_{GS(th)}$	-2.1	-1.4	-1	V	V_{DS}=3 V, I_D=56 µA
Drain-source cutoff current	$I_{D(off)}$	-	-	0.1	µA	V_{DS}=250 V, V_{GS}=-3 V, T_j=25 °C
				10		V_{DS}=250 V, V_{GS}=-3 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	-	10	nA	V_{GS}=20 V, V_{DS}=0 V
On-state drain current	I_{DSS}	30	-	-	mA	V_{GS}=0 V, V_{DS}=10 V
Drain-source on-state resistance	$R_{DS(on)}$	-	12.5	30	Ω	V_{GS}=0 V, I_D=15 mA
			7.8	14		V_{GS}=10 V, I_D=0.1 A
Transconductance	g_{fs}	0.060	0.13	-	S	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=0.08 A

Table 5 Dynamic characteristics

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

Table 6 Gate charge characteristics

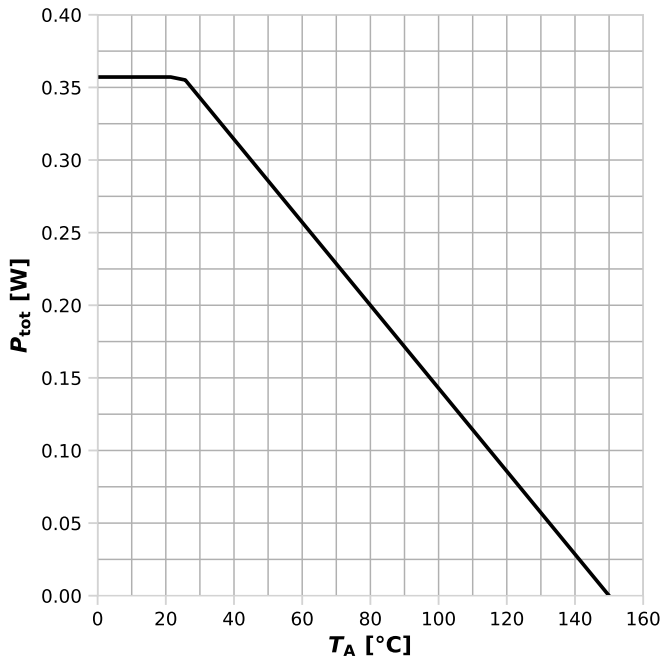
Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	0.14	-	nC	V_{DD}=200 V, I_D=0.04 A, V_{GS}=-3 to 5 V
Gate to drain charge	Q_{gd}		1.3		nC	
Gate charge total	Q_g		2.3		nC	
Gate plateau voltage	$V_{plateau}$		-0.28		V	

Table 7 Reverse diode

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

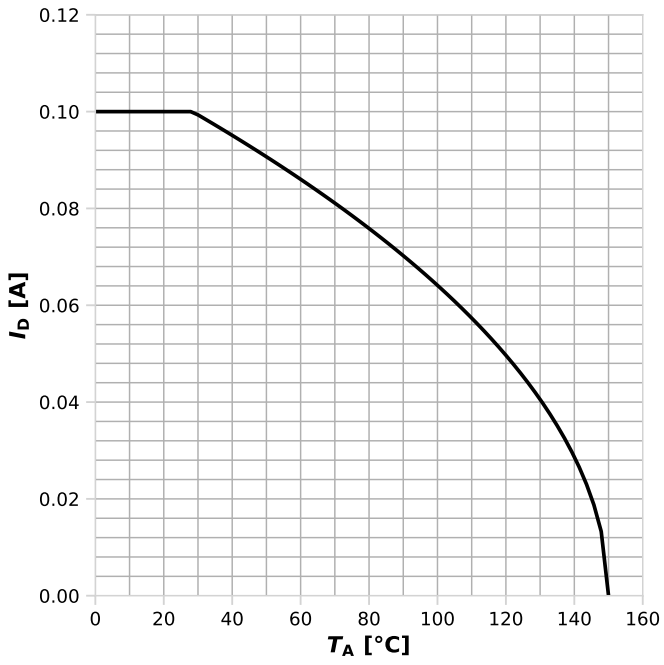
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



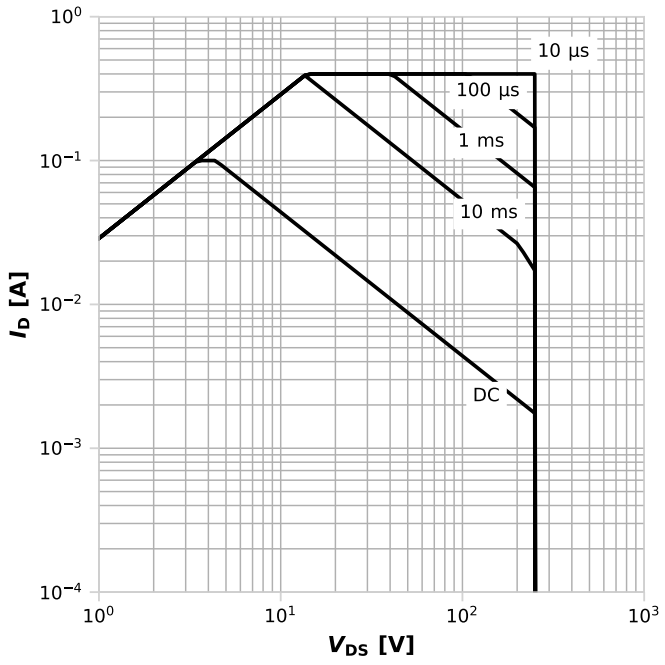
P_{tot}=f(T_A)

Diagram 2: Drain current



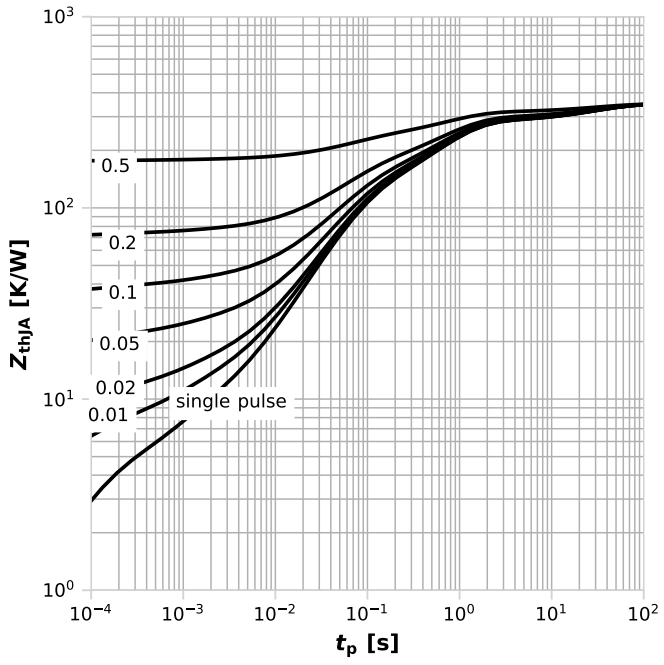
I_D=f(T_A); V_{GS}≥10 V

Diagram 3: Safe operating area



I_D=f(V_{DS}), T_A=25 °C, D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



Z_{thJA}=f(t_p); parameter: D=t_p/T

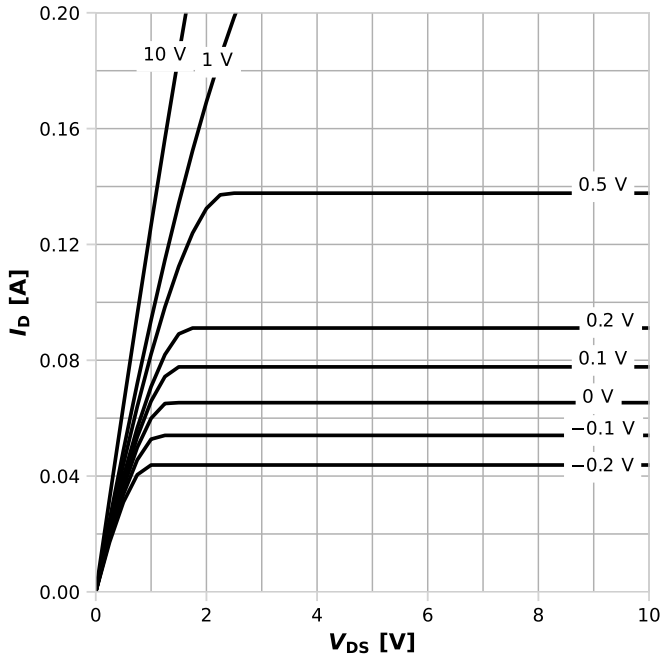
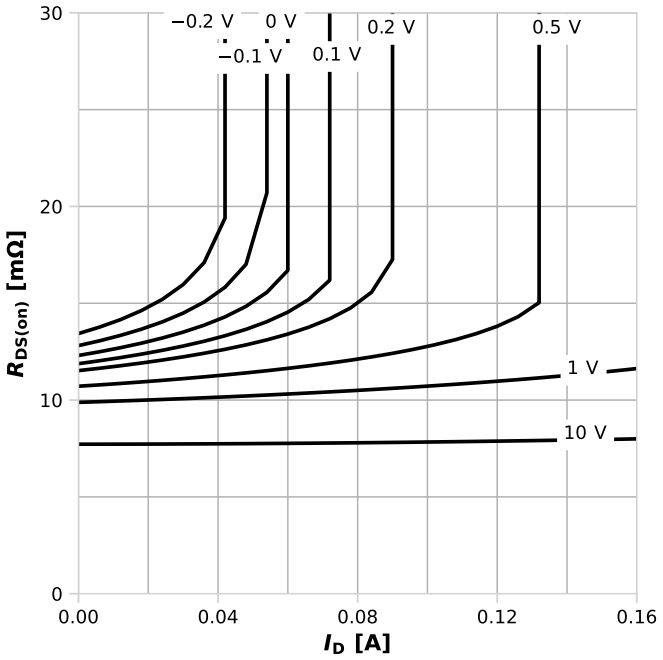
Diagram 5: Typ. output characteristics	Diagram 6: Typ. drain-source on resistance
	
I_D=f(V_{DS}), T_j=25 °C; parameter: V_{GS}	$R_{DS(on)}$=f(I_D), T_j=25 °C; parameter: V_{GS}

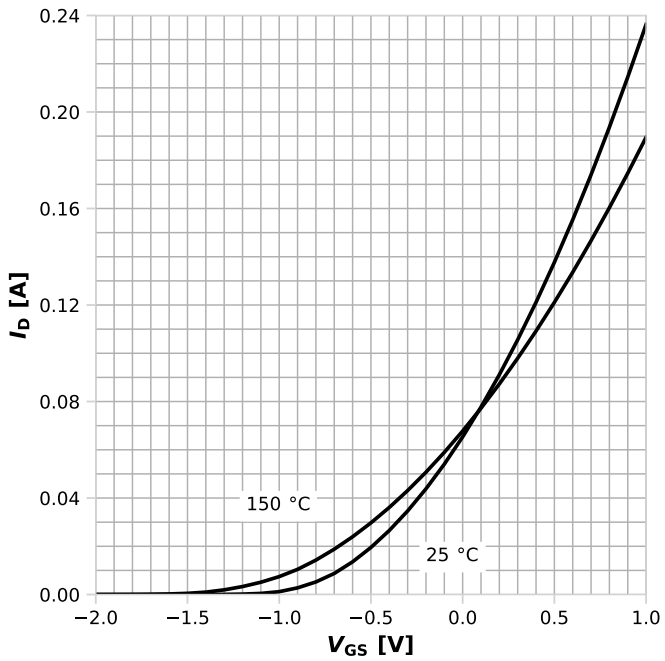
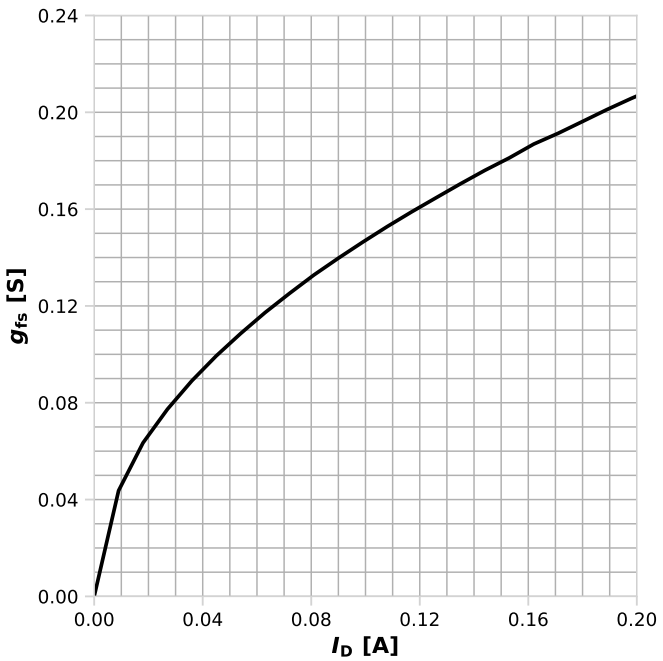
Diagram 7: Typ. transfer characteristics	Diagram 8: Typ. transconductance
	
I_D=f(V_{GS}), $\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$; parameter: T_j	g_{fs}=f(I_D), V_{DS}=10 V, T_j=25 °C

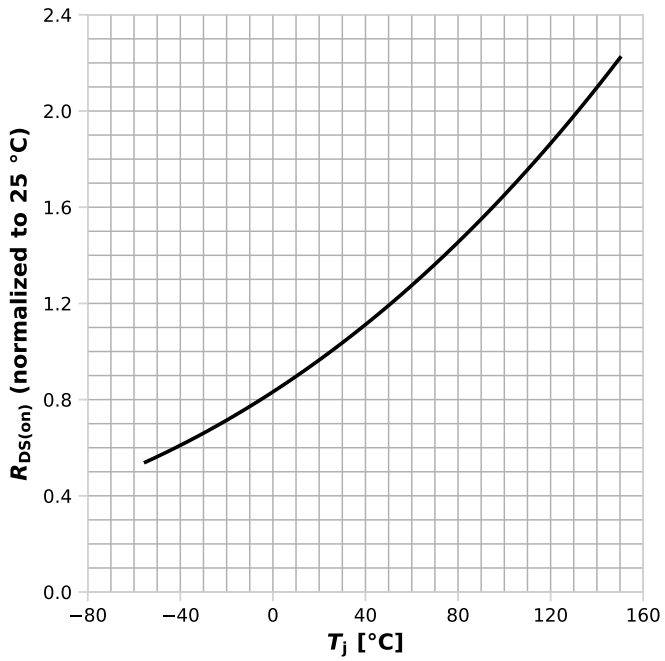
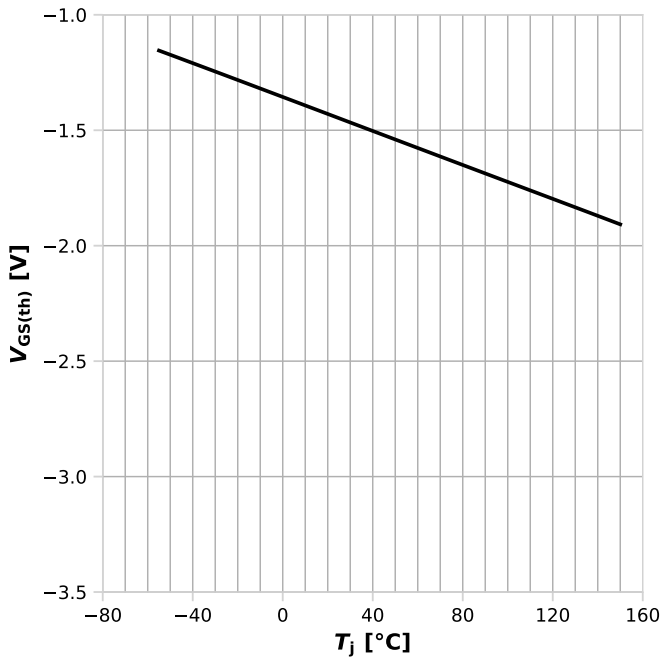
Diagram 9: Normalized drain-source on resistance	Diagram 10: Typ. gate threshold voltage
	
$R_{DS(on)}$=f(T_j), I_D=0.1 A, V_{GS}=10 V	$V_{GS(th)}$=f(T_j), V_{DS}=3 V, I_D=56 µA

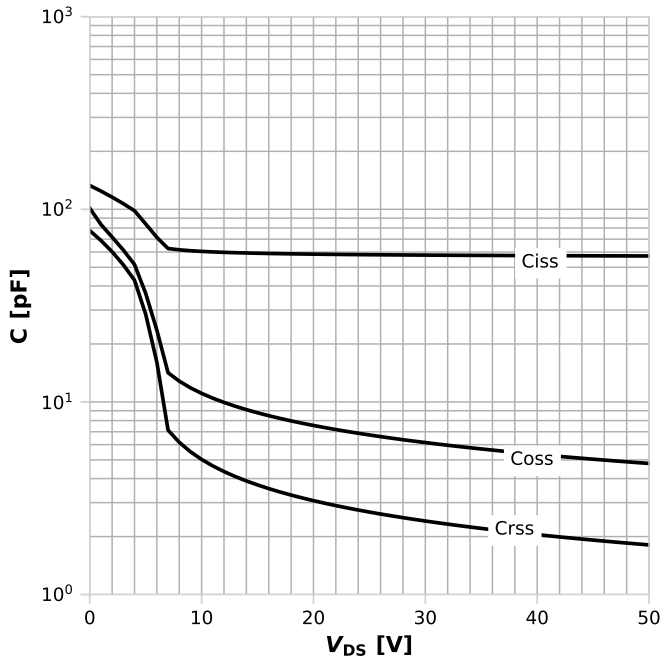
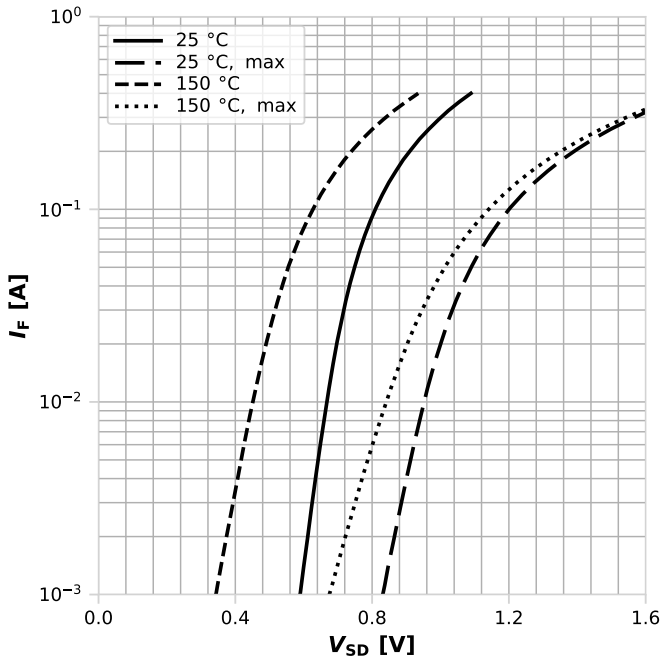
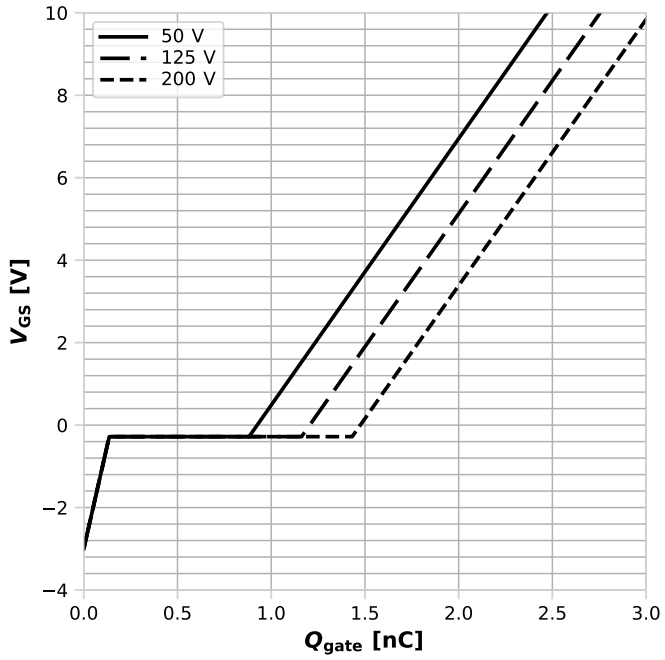
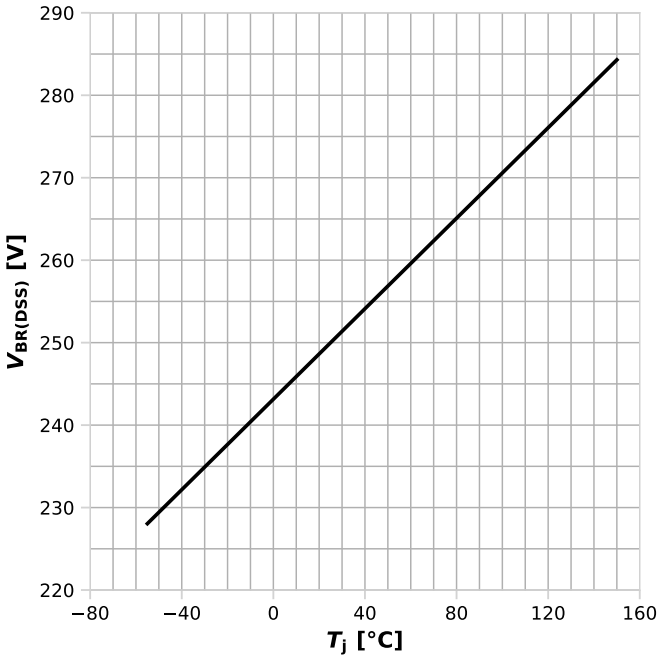
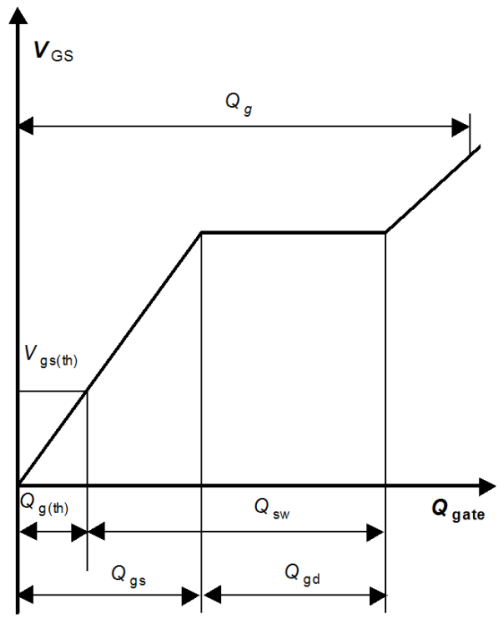
Diagram 11: Typ. capacitances	Diagram 12: Forward characteristics of reverse diode
	
C=f(V_{DS}), V_{GS}=-3 V, f=1 MHz	I_F=f(V_{SD}), V_{GS}=-3 V; parameter: T_j

Diagram 13: Typ. gate charge	Diagram 14: Drain-source breakdown voltage
	
V_{GS}=f(Q_{gate}), I_D=0.1 A pulsed, T_j=25 °C	$V_{BR(DSS)}$=f(T_j); I_D=250 µA, V_{GS}=-3 V

Gate charge waveforms

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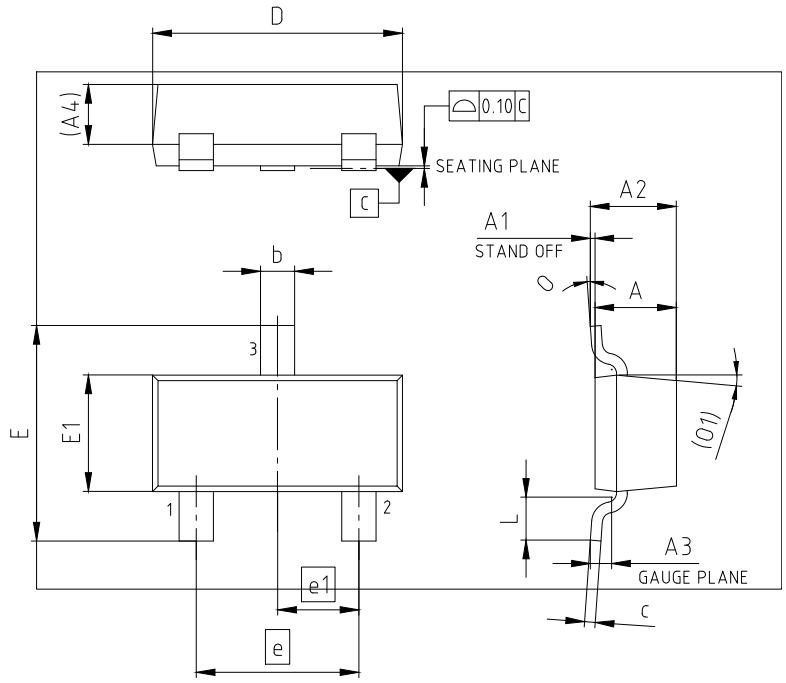
5 Package outlines



PACKAGE - GROUP NUMBER:	PG-SOT23-3-U03				
DIMENSIONS	MILLIMETERS		DIMENSIONS	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.88	1.02	e	1.90	
A1	0.01	0.10	e1	0.95	
A2	0.89	1.12	L	0.40	0.60
A3	0.15	0.35	N	3	
A4	0.70		O	3°	8°
b	0.32	0.47	O1	6°	8°
c	0.08	0.18			
D	2.80	3.04			
E	2.40	2.64			
E1	1.32	1.40			

NOTE: ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

Figure 1 Outline PG-SOT23-3mm

Revision history

BSS139I

Revision 2025-03-13, Rev. 2.2

Previous revisions

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
2.2	2025-03-13	Update package outline drawing

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