

Small-Signal Power-Transistor

Features

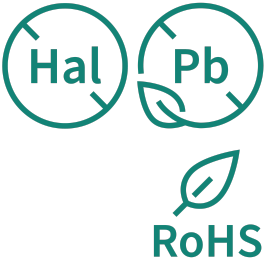
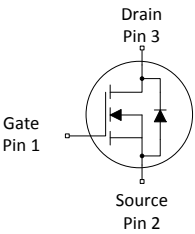
- N-channel
- Enhancement mode
- Logic level
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key performance parameters

Parameter	Value	Unit
V_{DS}	240	V
$R_{DS(on),max}$	14000	mΩ
I_D	0.121	A
ESD Sensitivity, JESD22-A114 (HBM)	Class 0 (<250V)	



Part number	Package	Marking	Related links
BSS131I	PG-SOT23-3	RI	-

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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 ¹⁾	I_D	-	-	0.121	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$
				0.076		$V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$
				0.064		$V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$
				0.109		$V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=350\text{ °C/W}$ ²⁾
Pulsed drain current ³⁾	$I_{D,pulse}$	-	-	0.48	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse ⁴⁾	E_{AS}	-	-	3.0	mJ	$I_D=0.12\text{ A}$, $R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	0.44	W	$T_C=25\text{ °C}$
				0.4		$T_A=25\text{ °C}$, $R_{thJA}=350\text{ °C/W}$ ²⁾
Operating and storage temperature	T_j, T_{stg}	-55	-	150	°C	-

¹⁾ Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature at 25°C. For higher case temperature please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.

²⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

³⁾ See Diagram 3 for more detailed information

⁴⁾ 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 - case	R_{thJC}	-	-	285	°C/W	-
Thermal resistance, junction - ambient, minimum footprint	R_{thJA}			350		

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	$V_{(BR)DSS}$	240	-	-	V	$V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	0.8	1.4	1.8	V	$V_{DS}=V_{GS}$, $I_D=56\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	-	0.1	μA	$V_{DS}=240\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$
				10		$V_{DS}=240\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	1	10	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	7790.3	14000	m Ω	$V_{GS}=10\text{ V}$, $I_D=0.12\text{ A}$
			9024.5	20000		$V_{GS}=4.5\text{ V}$, $I_D=0.06\text{ A}$
Gate resistance ⁵⁾	R_G	-	10	15	Ω	-
Transconductance	g_{fs}	0.08	0.16	-	S	$ V_{DS} \geq 2 I_D R_{DS(on)max}$, $I_D=0.12\text{ A}$

⁵⁾ Defined by design. Not subject to production test.

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Input capacitance ⁶⁾	C_{iss}	-	57	74	pF	$V_{GS}=0\text{ V}$, $V_{DS}=120\text{ V}$, $f=1\text{ MHz}$
Output capacitance ⁶⁾	C_{oss}		3.5	4.6		
Reverse transfer capacitance ⁶⁾	C_{rss}		1.2	2.1		
Turn-on delay time	$t_{d(on)}$	-	4.8	-	ns	$V_{DD}=120\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=0.12\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r		5.6			
Turn-off delay time	$t_{d(off)}$		14.8			
Fall time	t_f		99.6			

⁶⁾ Defined by design. Not subject to production test.

Table 6 Gate charge characteristics ⁷⁾

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	0.171	-	nC	$V_{DD}=120\text{ V}$, $I_D=0.12\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$		0.079	-	nC	
Gate to drain charge ⁸⁾	Q_{gd}		0.71	1.07	nC	
Switching charge	Q_{sw}		0.8	-	nC	
Gate charge total ⁸⁾	Q_g		1.11	1.39	nC	
Gate plateau voltage	$V_{plateau}$		3.0	-	V	
Gate charge total ⁸⁾	Q_g	-	1.96	2.6	nC	$V_{DD}=120\text{ V}$, $I_D=0.12\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Output charge ⁸⁾	Q_{oss}	-	0.95	1.26	nC	$V_{DS}=120\text{ V}$, $V_{GS}=0\text{ V}$

⁷⁾ See "Gate charge waveforms" for parameter definition

⁸⁾ 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	-	-	0.121	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$			0.48		
Diode forward voltage	V_{SD}	-	0.83	1.2	V	$V_{GS}=0\text{ V}$, $I_F=0.12\text{ A}$, $T_J=25\text{ °C}$
Reverse recovery time ⁹⁾	t_{rr}	-	18.1	36.2	ns	$V_R=120\text{ V}$, $I_F=0.12\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge ⁹⁾	Q_{rr}		13.6	27.2	nC	

⁹⁾ Defined by design. Not subject to production test.

4 Electrical characteristics diagrams

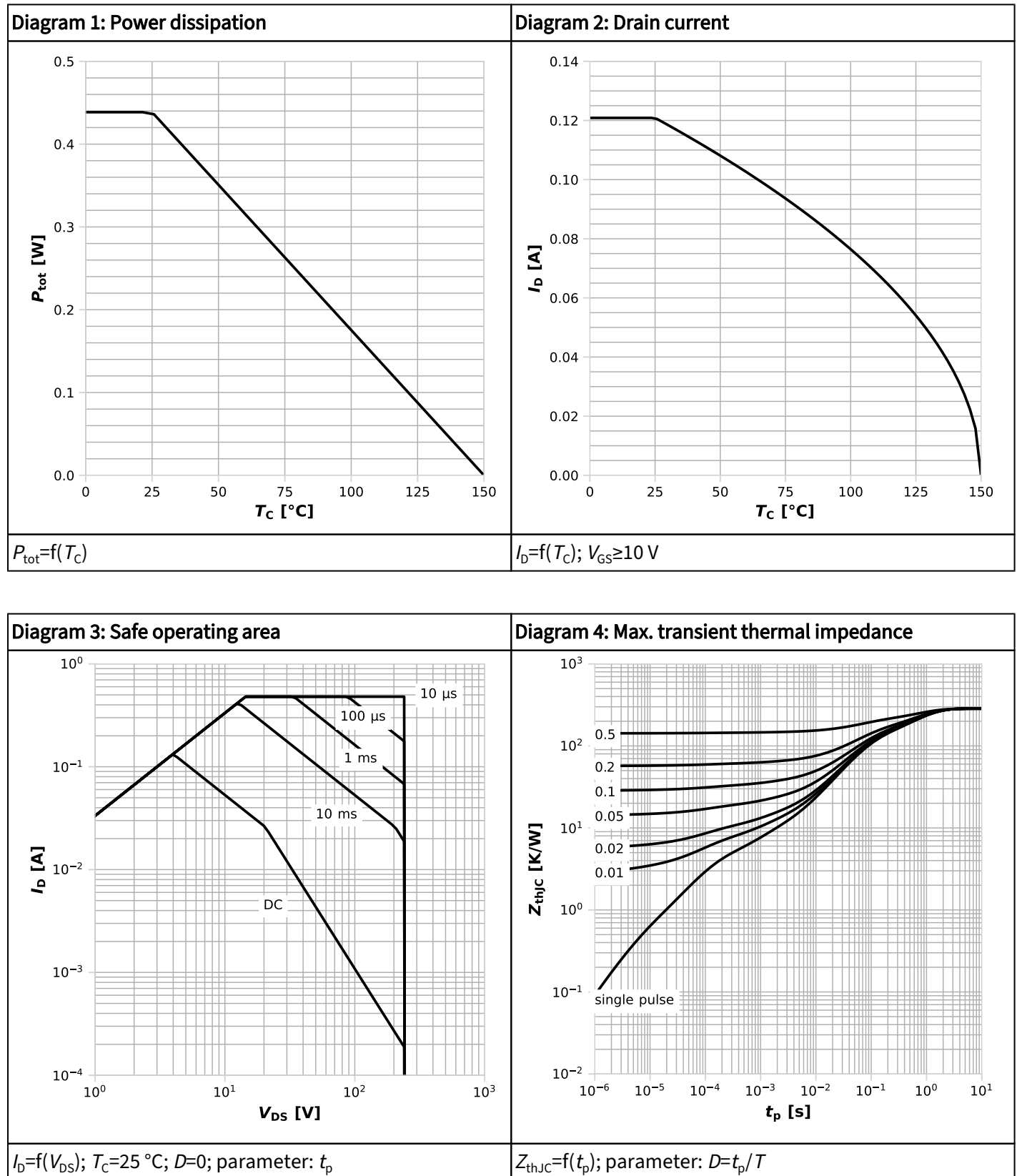
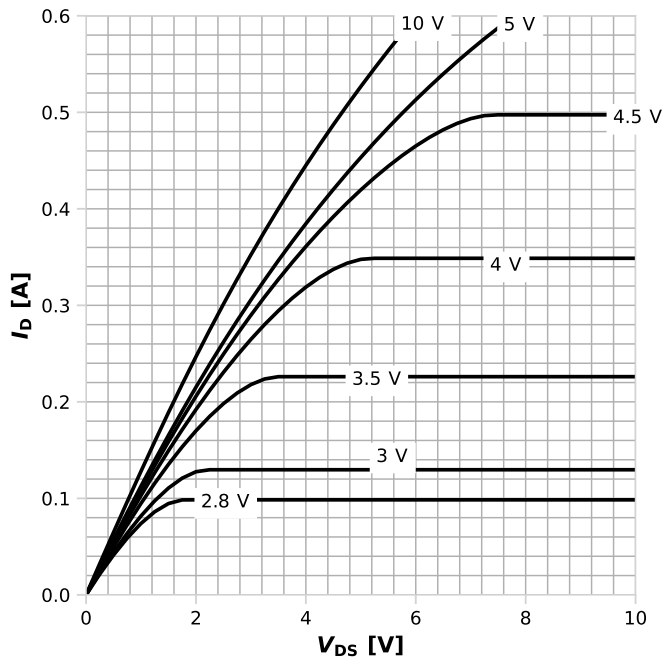
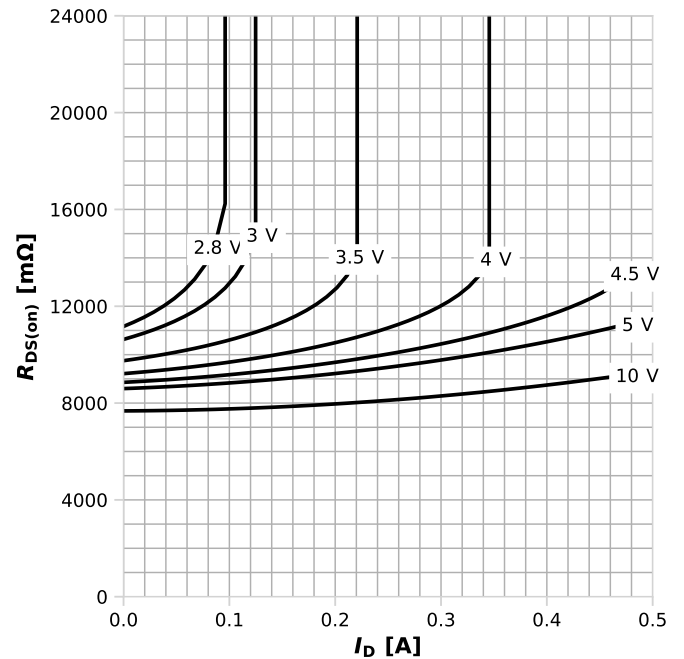


Diagram 5: Typ. output characteristics



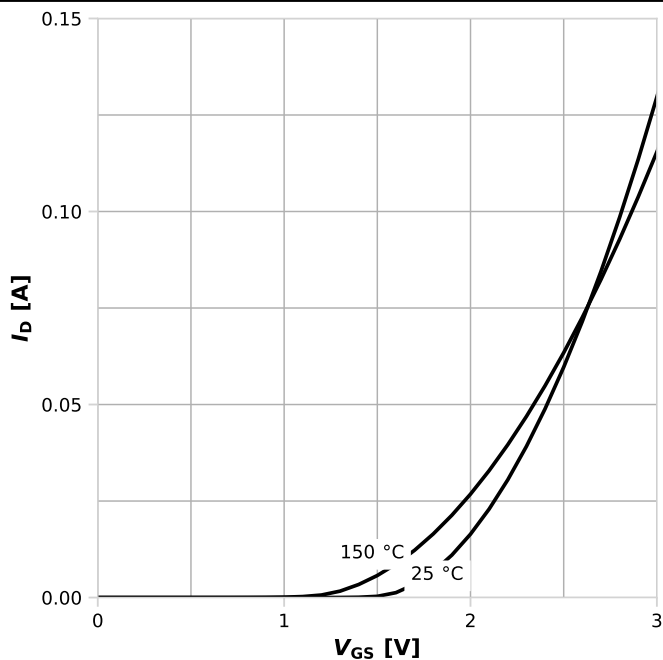
$I_D = f(V_{DS})$, $T_j = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



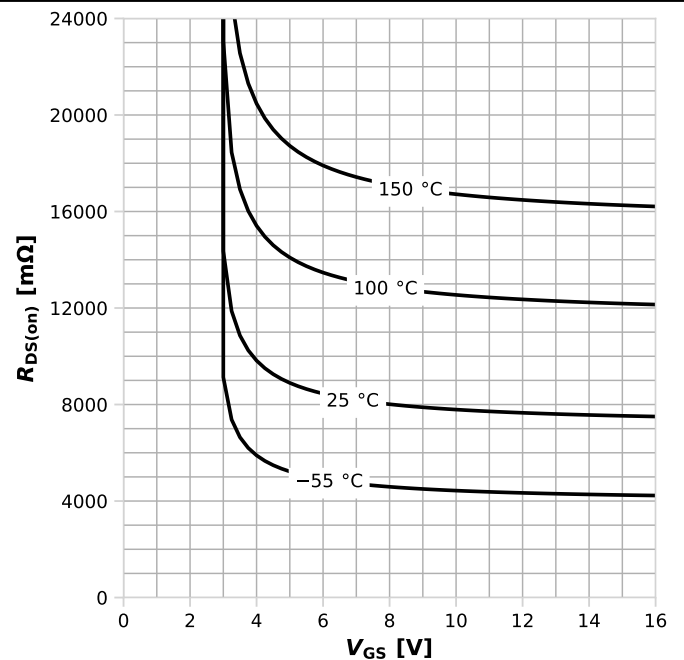
$R_{DS(on)} = f(I_D)$, $T_j = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



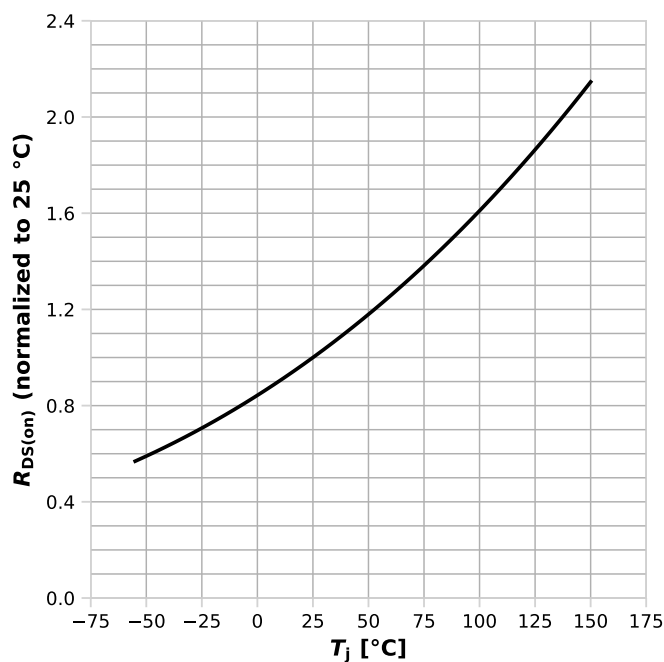
$I_D = f(V_{GS})$, $|V_{DS}| > 2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



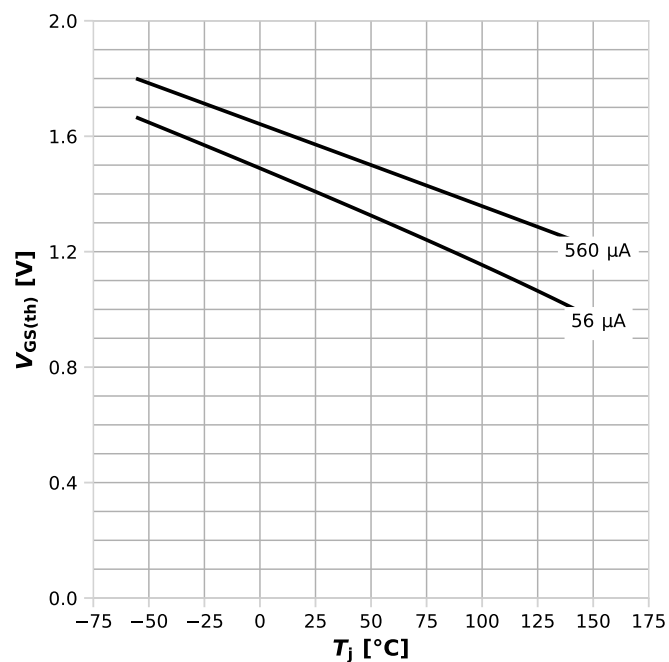
$R_{DS(on)} = f(V_{GS})$, $I_D = 0.12\text{ A}$; parameter: T_j

Diagram 9: Normalized drain-source on resistance



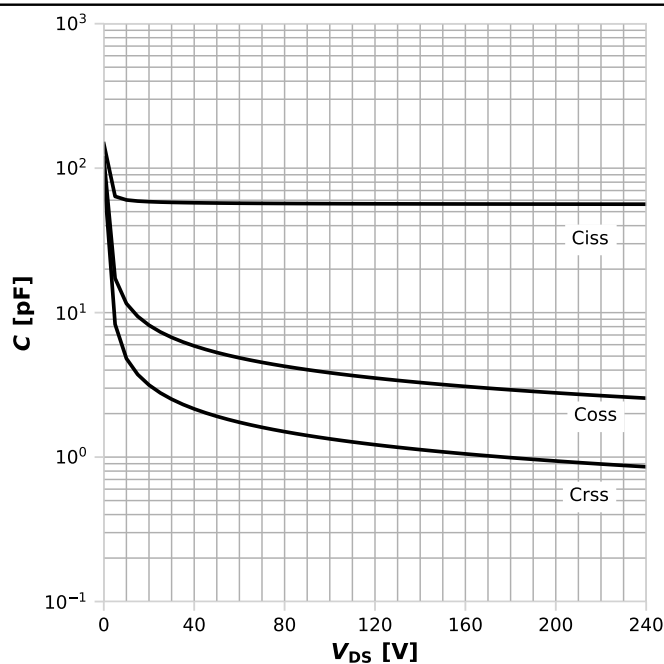
$$R_{DS(on)} = f(T_j), I_D = 0.12 \text{ A}, V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



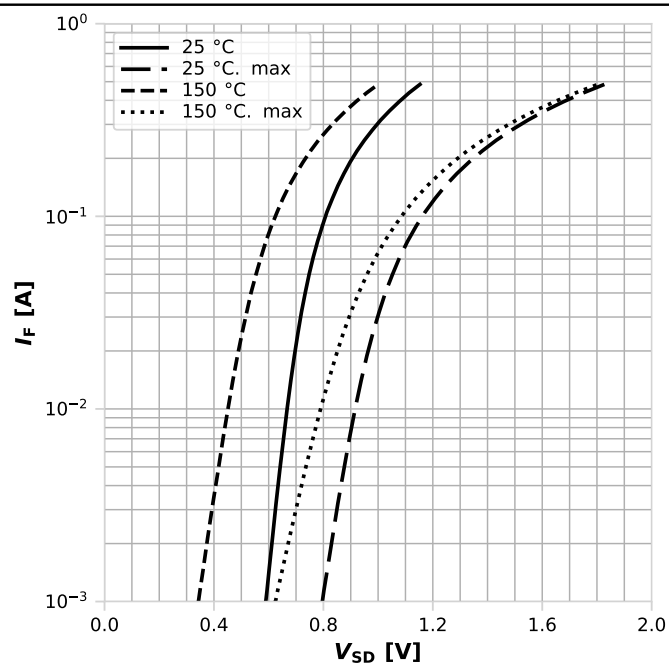
$$V_{GS(th)} = f(T_j), V_{GS} = V_{DS}; \text{ parameter: } I_D$$

Diagram 11: Typ. capacitances



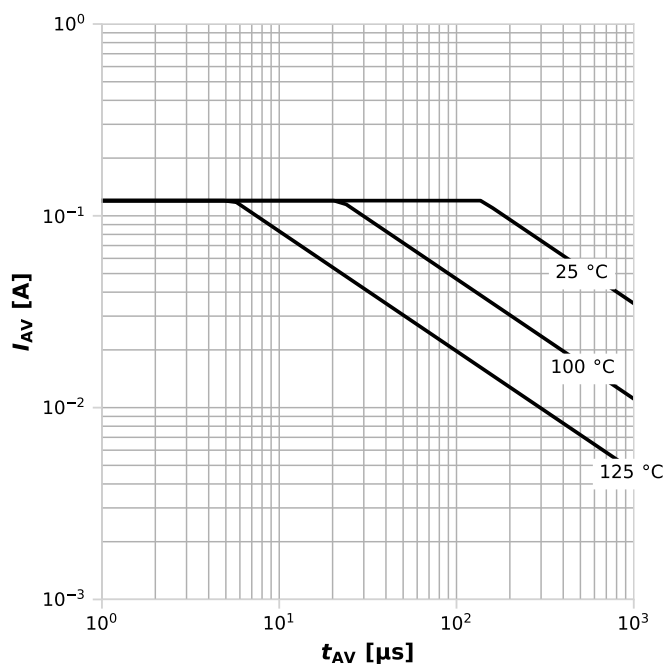
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

Diagram 12: Forward characteristics of reverse diode



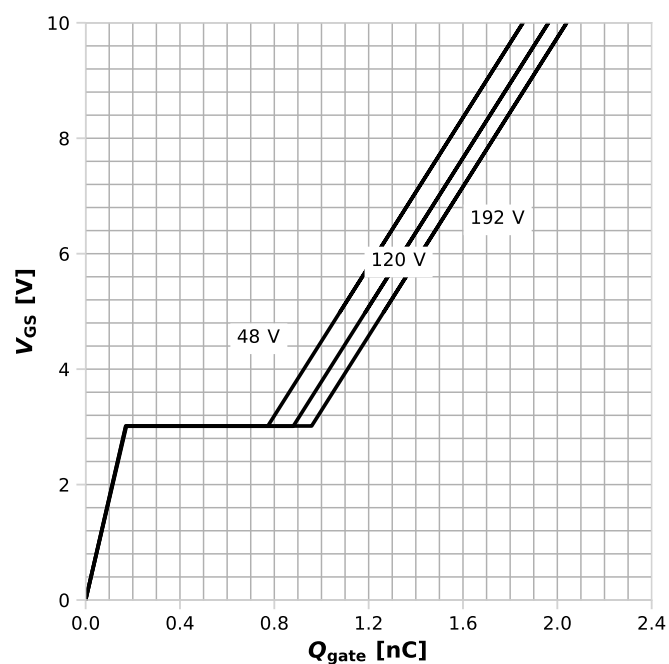
$$I_F = f(V_{SD}); \text{ parameter: } T_j$$

Diagram 13: Avalanche characteristics



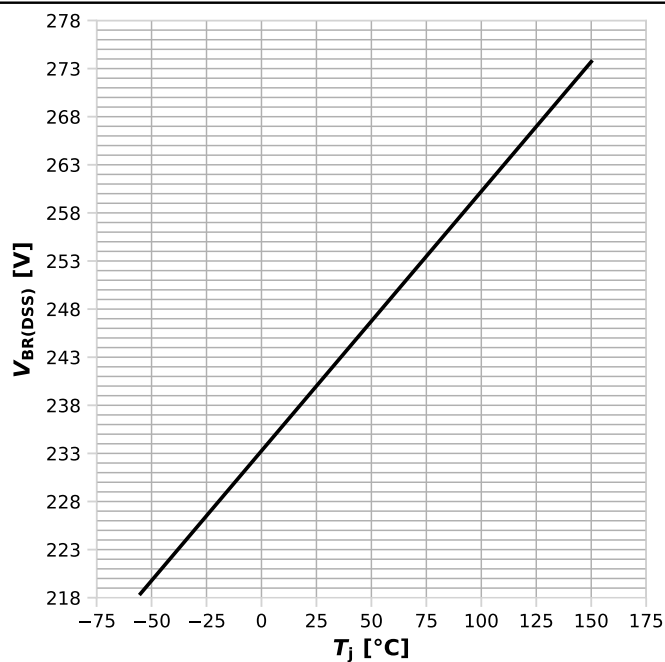
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



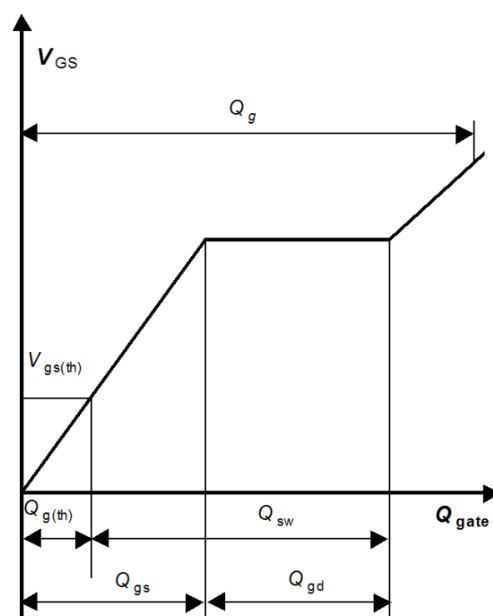
$V_{GS}=f(Q_{gate})$, $I_D=0.12\text{ A}$ pulsed, $T_j=25\text{ °C}$; parameter: V_{DD}

Diagram 15: Min. drain-source breakdown voltage



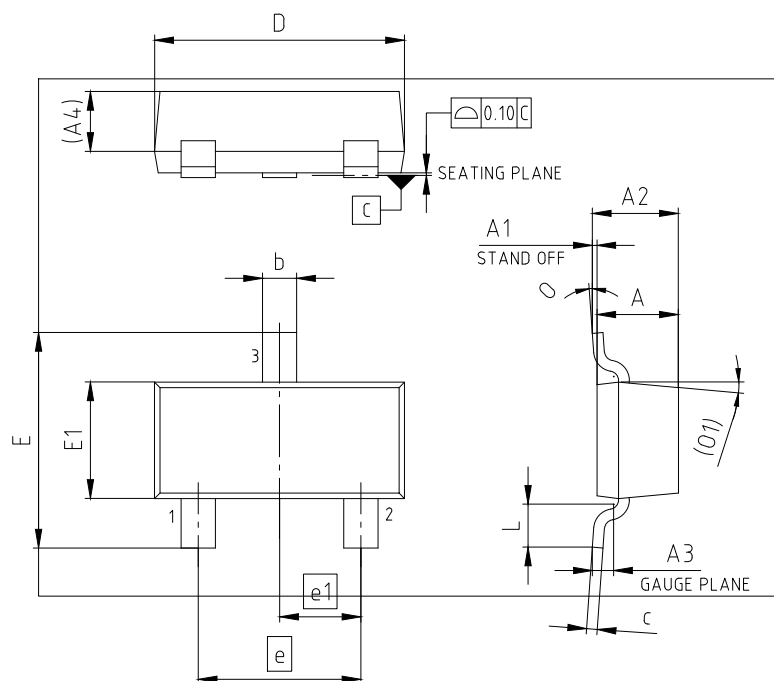
$V_{BR(DSS)}=f(T_j)$; $I_D=250\ \mu\text{A}$

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

BSS131I

Revision 2025-02-07, Rev. 2.0

Previous revisions

Revision	Date	Subjects (major changes since last revision)
2.0	2025-02-07	Release of final datasheet

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