

# MOSFET

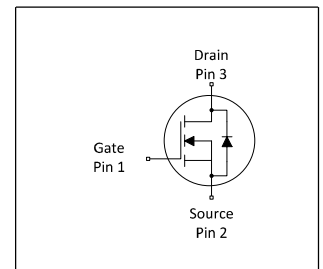
## Small-Signal Transistor

### Features

- N-channel
- Enhancement mode
- Logic level
- $dv/dt$  rated
- 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
$V_{DS}$	60	V
$R_{DS(on),max}$	3.5	$\Omega$
$I_D$	0.23	A
ESD Sensitivity, JESD22-A114 (HBM)	Class 0 (<250V)	



Type / Ordering Code	Package	Marking	Related Links
BSS138I	PG-SOT23	KIs	-

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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	$I_D$	-	-	0.23 0.18	A	$T_A=25\text{ °C}$ $T_A=70\text{ °C}$
Pulsed drain current	$I_{D,pulse}$	-	-	0.92	A	$T_A=25\text{ °C}$
Reverse diode dv/dt	dv/dt	-	-	6	kV/ $\mu$ s	$I_D=0.23\text{ A}$ , $V_{DS}=48\text{ V}$ , $di/dt=200\text{ A}/\mu\text{s}$ , $T_{j,max}=150\text{ °C}$
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 - 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	$V_{(BR)DSS}$	60	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=250\text{ }\mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	0.6	1.0	1.4	V	$V_{GS}=V_{DS}$ , $I_D=26\text{ }\mu\text{A}$
Drain-source leakage current	$I_{D(off)}$	-	-	0.1 5	$\mu\text{A}$	$V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	1	10	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	3.3 3.5 2.2	4.0 6.0 3.5	$\Omega$	$V_{GS}=4.5\text{ V}$ , $I_D=0.03\text{ A}$ $V_{GS}=4.5\text{ V}$ , $I_D=0.19\text{ A}$ $V_{GS}=10\text{ V}$ , $I_D=0.23\text{ A}$
Transconductance	$g_{fs}$	0.1	0.2	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=0.18\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	32	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=25\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$	-	7.2	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=25\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	-	2.8	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=25\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	2.3	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=0.23\text{ A}$ , $R_G=6\ \Omega$
Rise time	$t_r$	-	3.0	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=0.23\text{ A}$ , $R_G=6\ \Omega$
Turn-off delay time	$t_{d(off)}$	-	6.7	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=0.23\text{ A}$ , $R_G=6\ \Omega$
Fall time	$t_f$	-	8.2	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=0.23\text{ A}$ , $R_G=6\ \Omega$

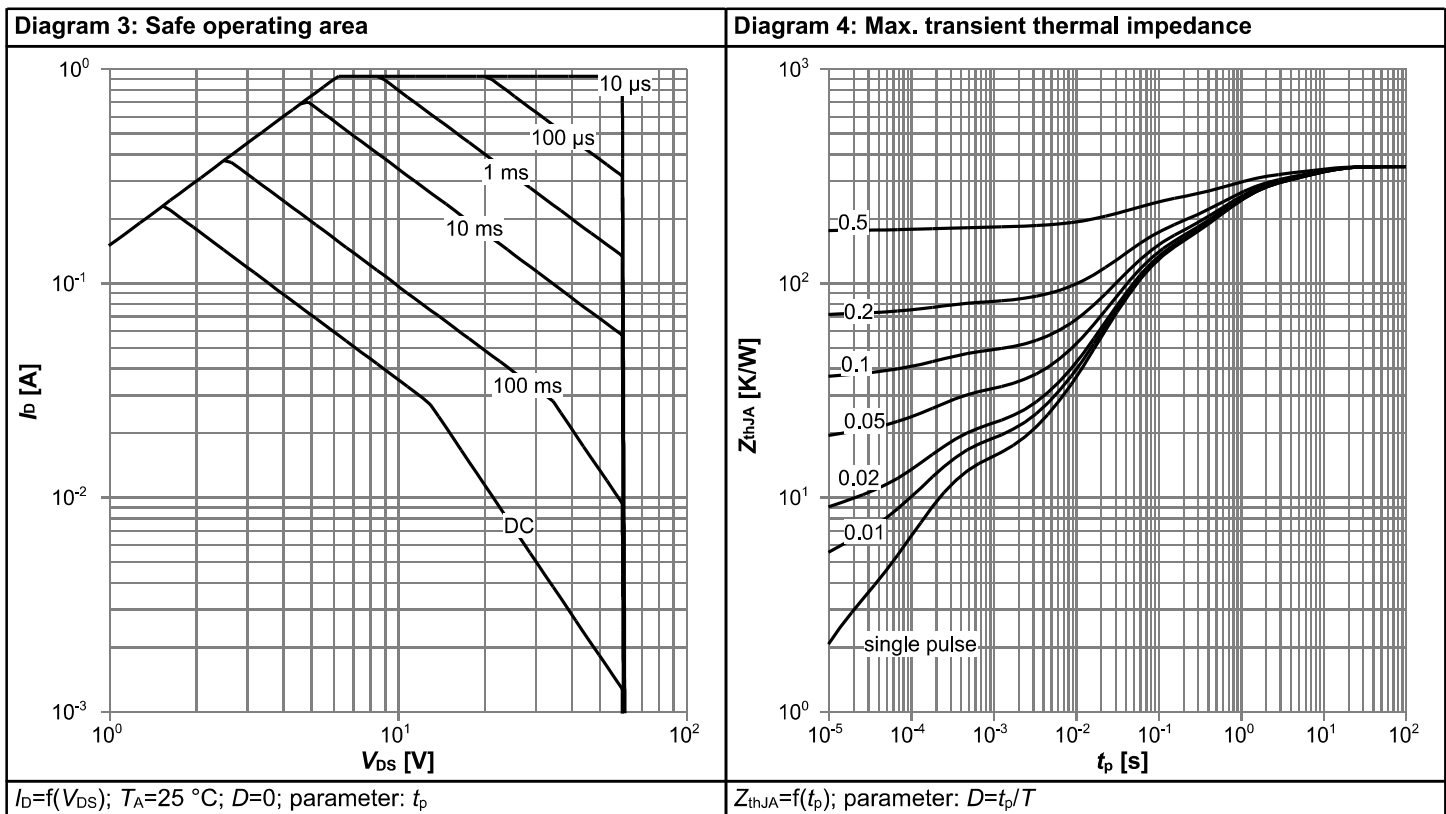
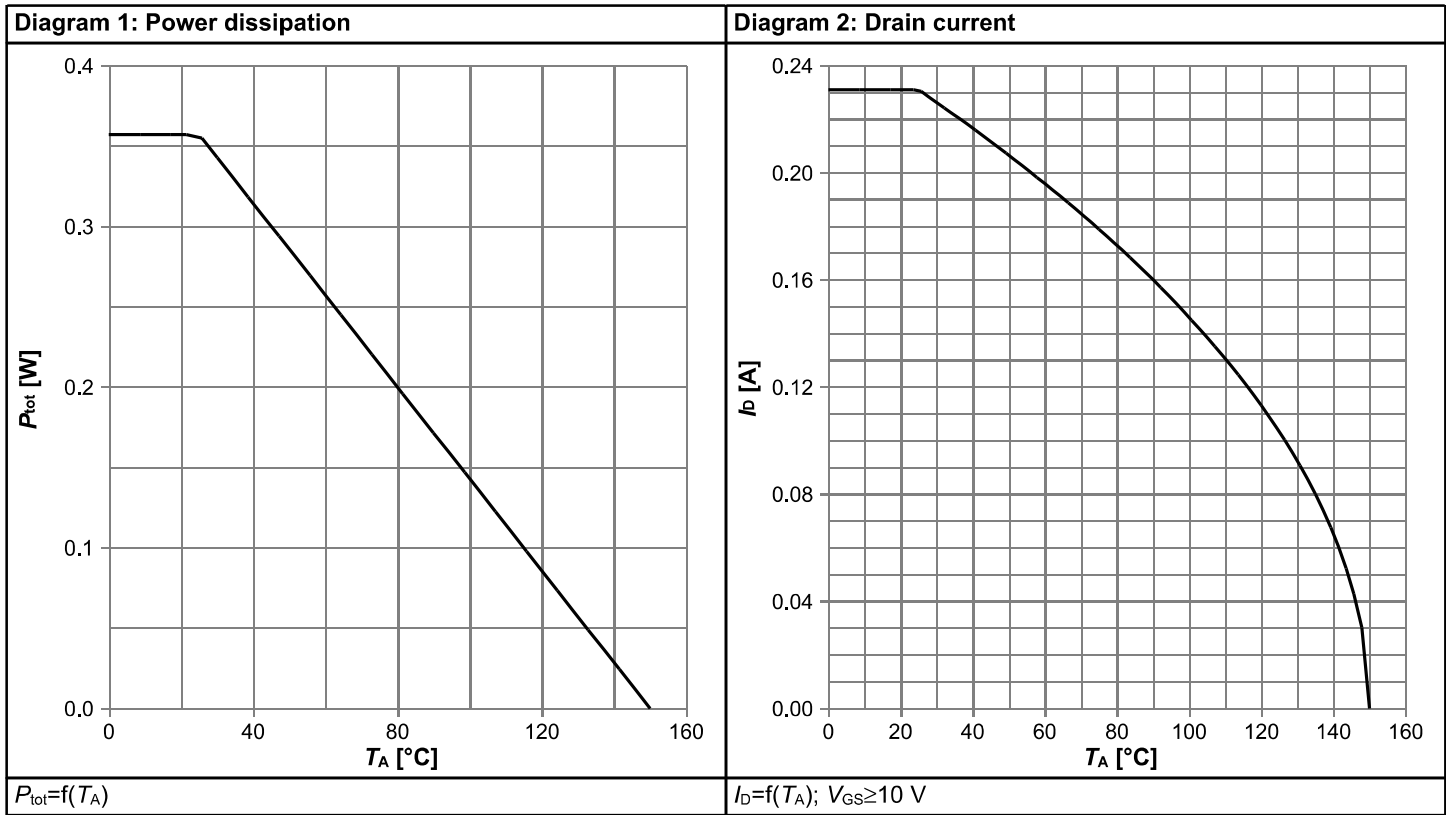
**Table 6 Gate charge characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	0.10	-	nC	$V_{DD}=48\text{ V}$ , $I_D=0.23\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	$Q_{gd}$	-	0.3	-	nC	$V_{DD}=48\text{ V}$ , $I_D=0.23\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	$Q_g$	-	1.0	-	nC	$V_{DD}=48\text{ V}$ , $I_D=0.23\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	3.3	-	V	$V_{DD}=48\text{ V}$ , $I_D=0.23\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$

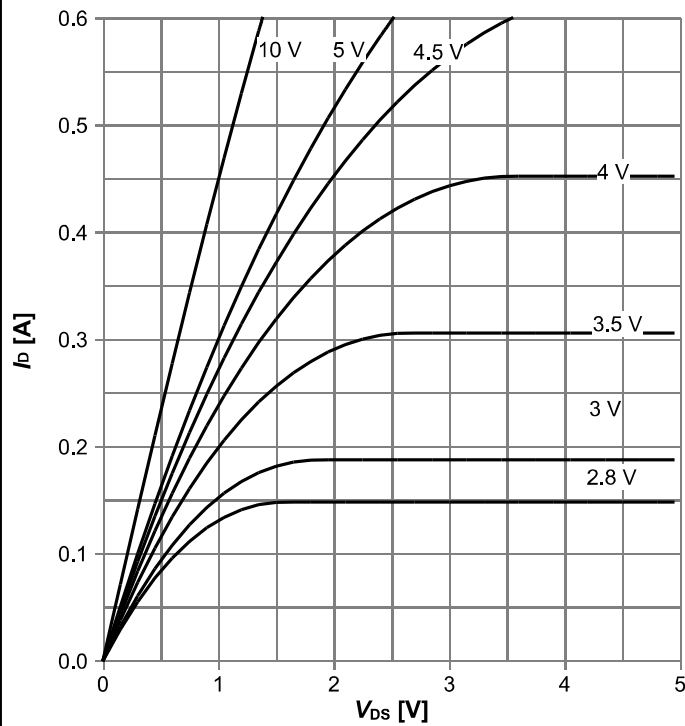
**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	0.23	A	$T_A=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	0.92	A	$T_A=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.83	1.2	V	$V_{GS}=0\text{ V}$ , $I_F=0.23\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery time	$t_{rr}$	-	9.1	14.5	ns	$V_R=30\text{ V}$ , $I_F=0.23\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$	-	3.3	5	nC	$V_R=30\text{ V}$ , $I_F=0.23\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$

## 4 Electrical characteristics diagrams

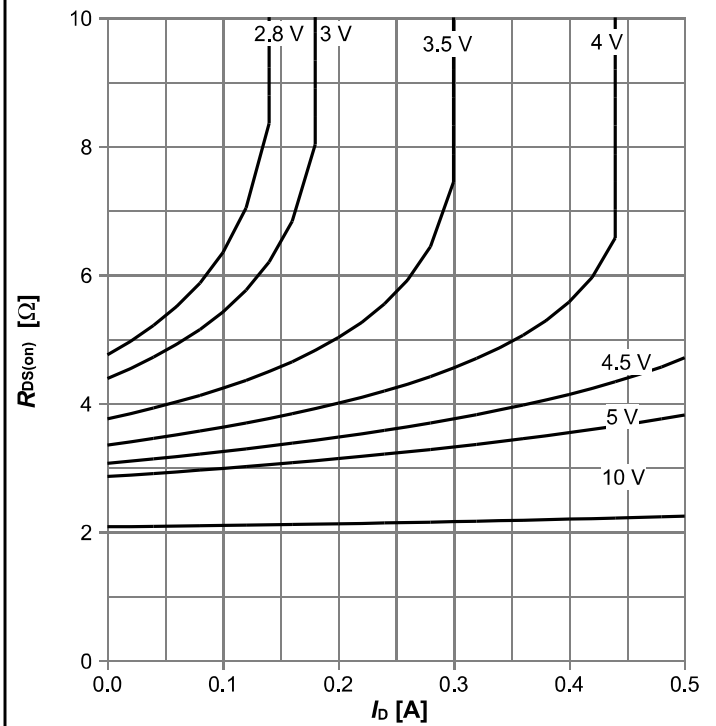


**Diagram 5: Typ. output characteristics**



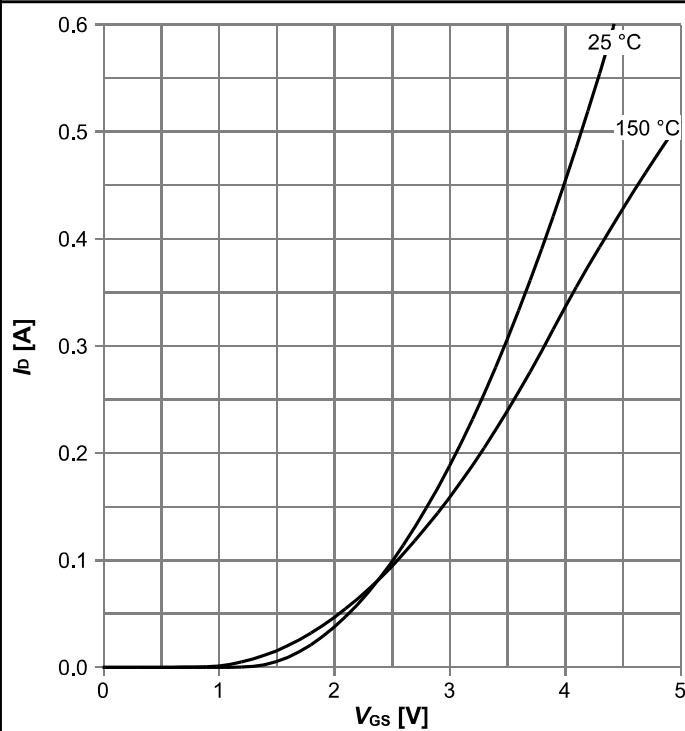
$I_D = f(V_{DS}); T_j = 25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

**Diagram 6: Typ. drain-source on resistance**



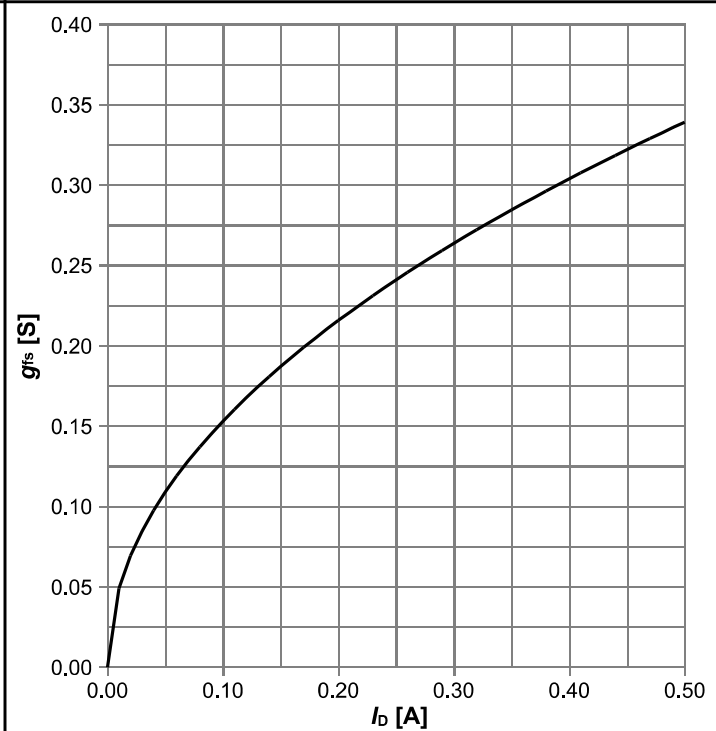
$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

**Diagram 7: Typ. transfer characteristics**



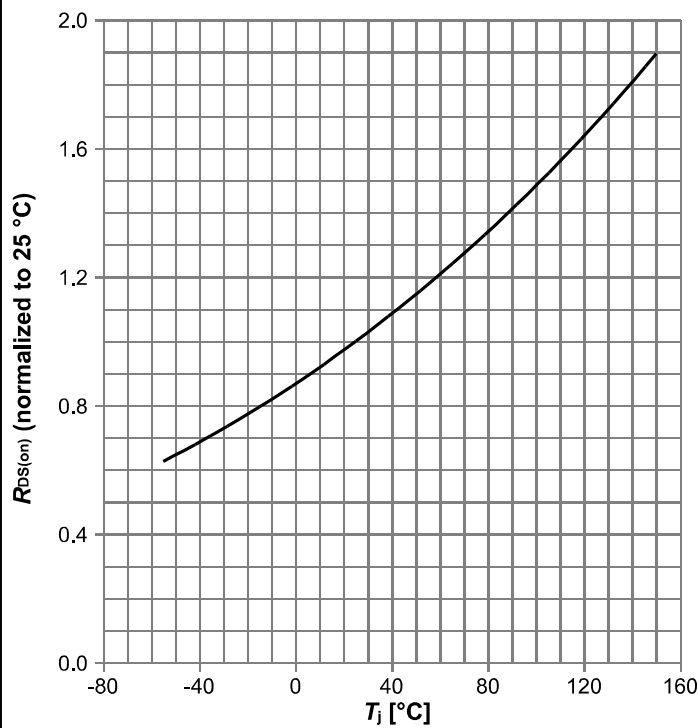
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

**Diagram 8: Typ. forward transconductance**



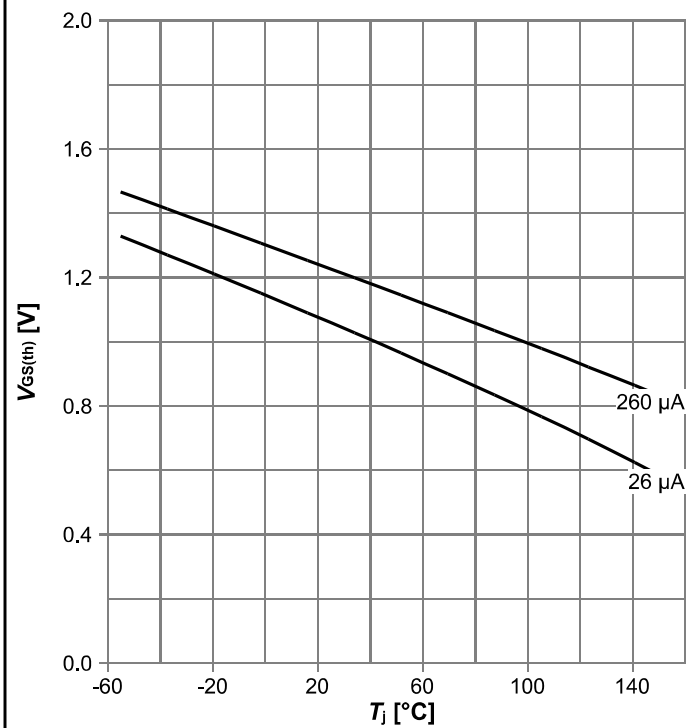
$g_{fs} = f(I_D); T_j = 25\text{ }^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



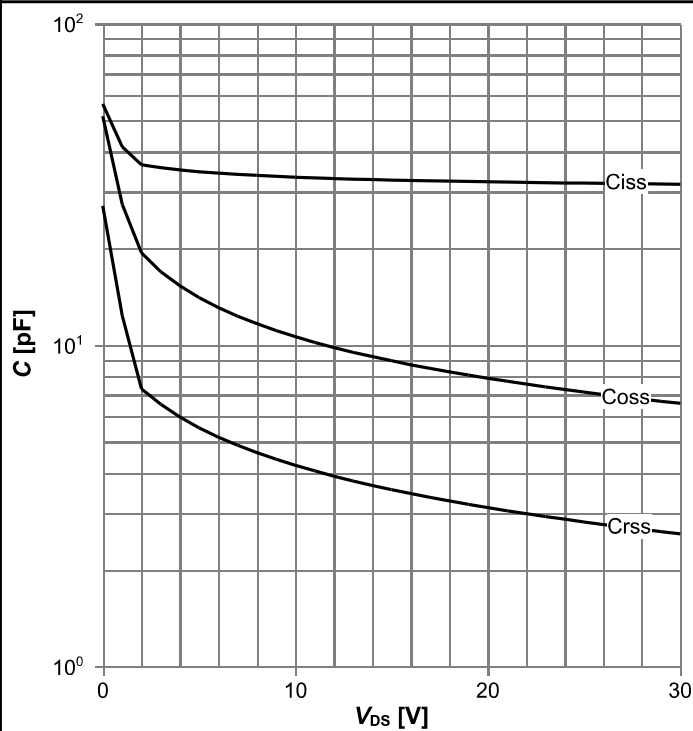
$R_{DS(on)}=f(T_j)$ ;  $I_D=0.03$  A,  $V_{GS}=10$  V

Diagram 10: Typ. gate threshold voltage



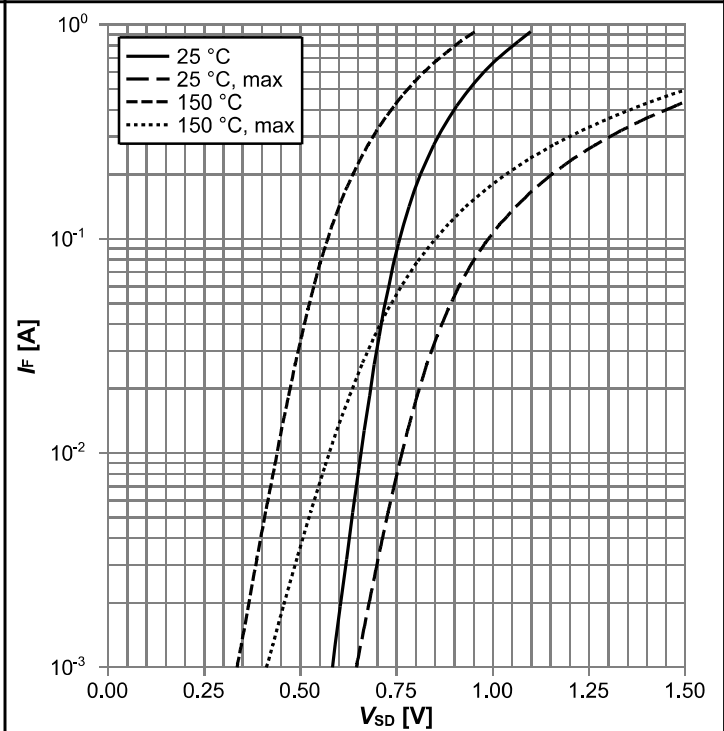
$V_{GS(th)}=f(T_j)$ ;  $V_{DS}=V_{GS}$ ;  $I_D=26$  μA; parameter:  $I_D$

Diagram 11: Typ. capacitances



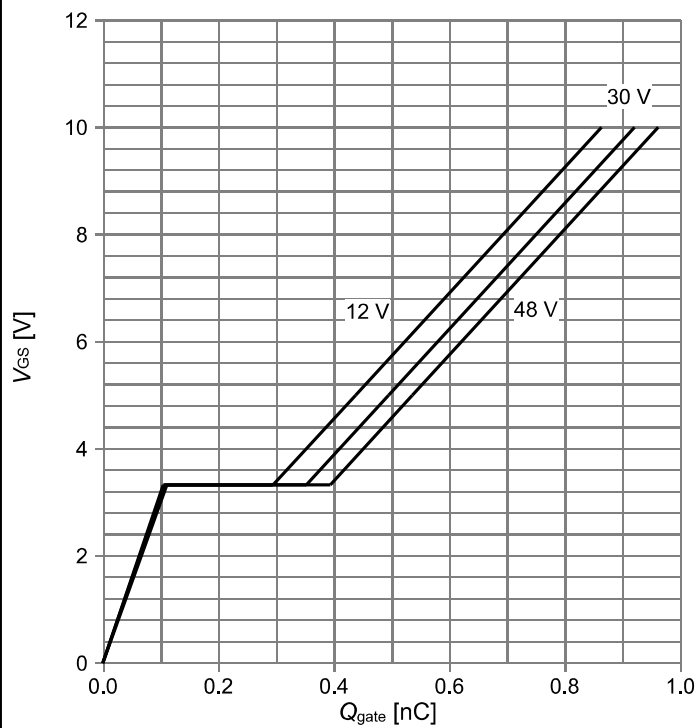
$C=f(V_{DS})$ ;  $V_{GS}=0$  V;  $f=1$  MHz;  $T_j=25$  °C

Diagram 12: Forward characteristics of reverse diode



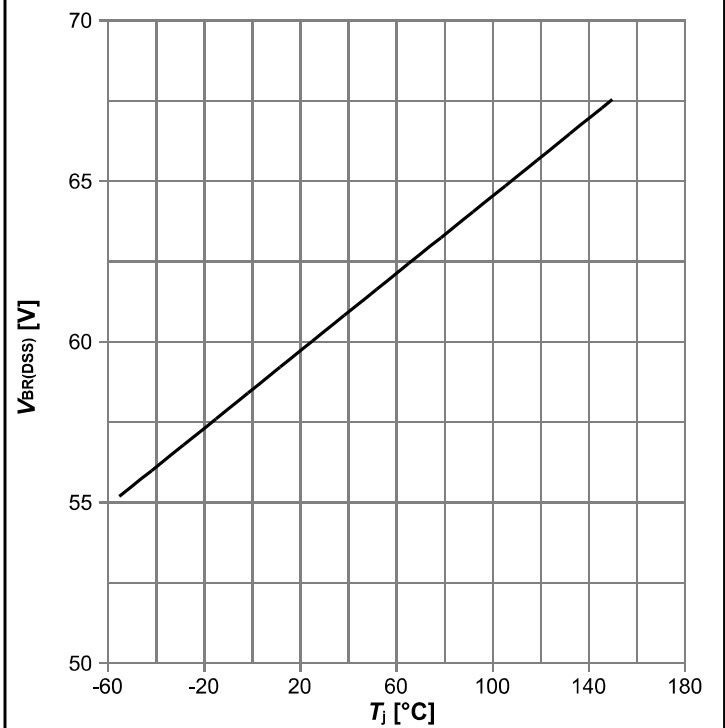
$I_F=f(V_{SD})$ ; parameter:  $T_j$

**Diagram 13: Typ. gate charge**



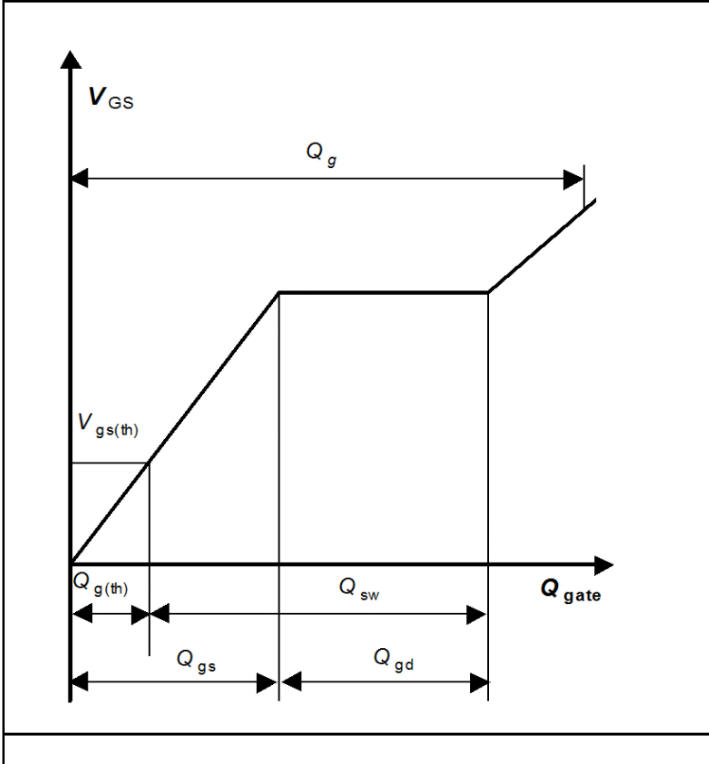
$V_{GS}=f(Q_{gate})$ ;  $I_D=0.23$  A pulsed; parameter:  $V_{DD}$

**Diagram 14: Drain-source breakdown voltage**



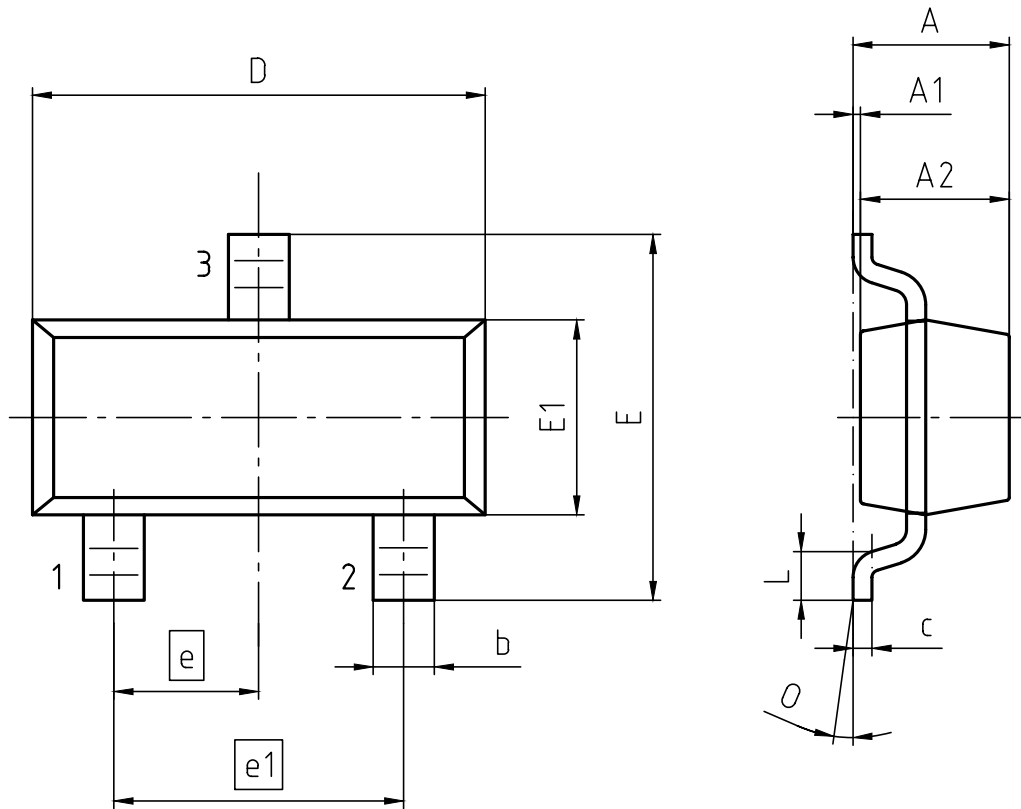
$V_{BR(DSS)}=f(T_j)$ ,  $I_D=250$   $\mu$ A

**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

BSS138I

**Revision: 2021-03-17, Rev. 2.1**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2021-01-26	Release of final version
2.1	2021-03-17	Update technology naming

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