

# MOSFET

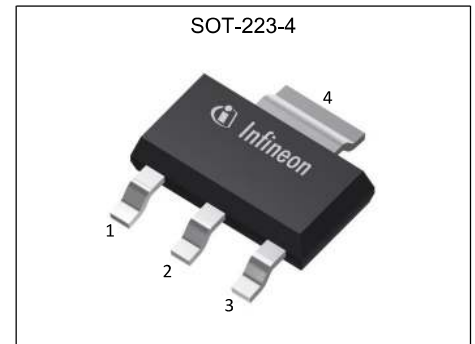
## Small-Signal Transistor

### Features

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

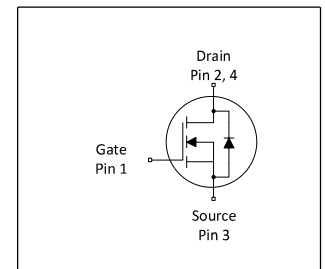
### Product validation

Fully qualified according to JEDEC for Industrial Applications



**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	600	V
$R_{DS(on),max}$	60	$\Omega$
$I_{DSS,min}$	0.02	A
ESD Sensitivity, JESD22-A114 (HBM)	Class1A (>250V, <500V)	



RoHS

Type / Ordering Code	Package	Marking	Related Links
BSP135I	PG-SOT223	SP135I	-

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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	$I_D$	-	-	0.12 0.10	A	$T_A=25\text{ °C}$ $T_A=70\text{ °C}$
Pulsed drain current	$I_{D,pulse}$	-	-	0.48	A	$T_A=25\text{ °C}$
Reverse diode dv/dt	dv/dt	-	-	6	kV/ $\mu$ s	$I_D=0.12\text{ A}$ , $V_{DS}=20\text{ V}$ , $di/dt=200\text{ A}/\mu\text{s}$ , $T_{j,max}=150\text{ °C}$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	1.8	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 - soldering point (pin 4)	$R_{thJS}$	-	-	25	K/W	-
SMD version, device on PCB, minimal footprint	$R_{thJA}$	-	-	115	K/W	-
SMD version, device on PCB, 6 cm <sup>2</sup> cooling area <sup>1)</sup>	$R_{thJA}$	-	-	70	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	$V_{(BR)DSS}$	600	-	-	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	$V_{DS}=3\text{ V}$ , $I_D=94\text{ }\mu\text{A}$
Drain-source cutoff current	$I_{D(off)}$	-	-	0.1 10	$\mu\text{A}$	$V_{DS}=600\text{ V}$ , $V_{GS}=-3\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=600\text{ V}$ , $V_{GS}=-3\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	-	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
On-state drain current	$I_{DSS}$	20	-	-	mA	$V_{GS}=0\text{ V}$ , $V_{DS}=10\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	30 25	60 45	$\Omega$	$V_{GS}=0\text{ V}$ , $I_D=0.01\text{ A}$ $V_{GS}=10\text{ V}$ , $I_D=0.12\text{ A}$
Transconductance	$g_{fs}$	0.08	0.16	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=0.1\text{ A}$

<sup>1)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (single layer, 70  $\mu$ m thick) copper area for

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	98	-	pF	$V_{GS}=-3\text{ V}$ , $V_{DS}=25\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$	-	8.5	-	pF	$V_{GS}=-3\text{ V}$ , $V_{DS}=25\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	-	3.4	-	pF	$V_{GS}=-3\text{ V}$ , $V_{DS}=25\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	5.4	-	ns	$V_{DD}=300\text{ V}$ , $V_{GS}=-3\text{ to }5\text{ V}$ , $I_D=0.1\text{ A}$ , $R_G=6\ \Omega$
Rise time	$t_r$	-	5.6	-	ns	$V_{DD}=300\text{ V}$ , $V_{GS}=-3\text{ to }5\text{ V}$ , $I_D=0.1\text{ A}$ , $R_G=6\ \Omega$
Turn-off delay time	$t_{d(off)}$	-	28	-	ns	$V_{DD}=300\text{ V}$ , $V_{GS}=-3\text{ to }5\text{ V}$ , $I_D=0.1\text{ A}$ , $R_G=6\ \Omega$
Fall time	$t_f$	-	182	-	ns	$V_{DD}=300\text{ V}$ , $V_{GS}=-3\text{ to }5\text{ V}$ , $I_D=0.1\text{ A}$ , $R_G=6\ \Omega$

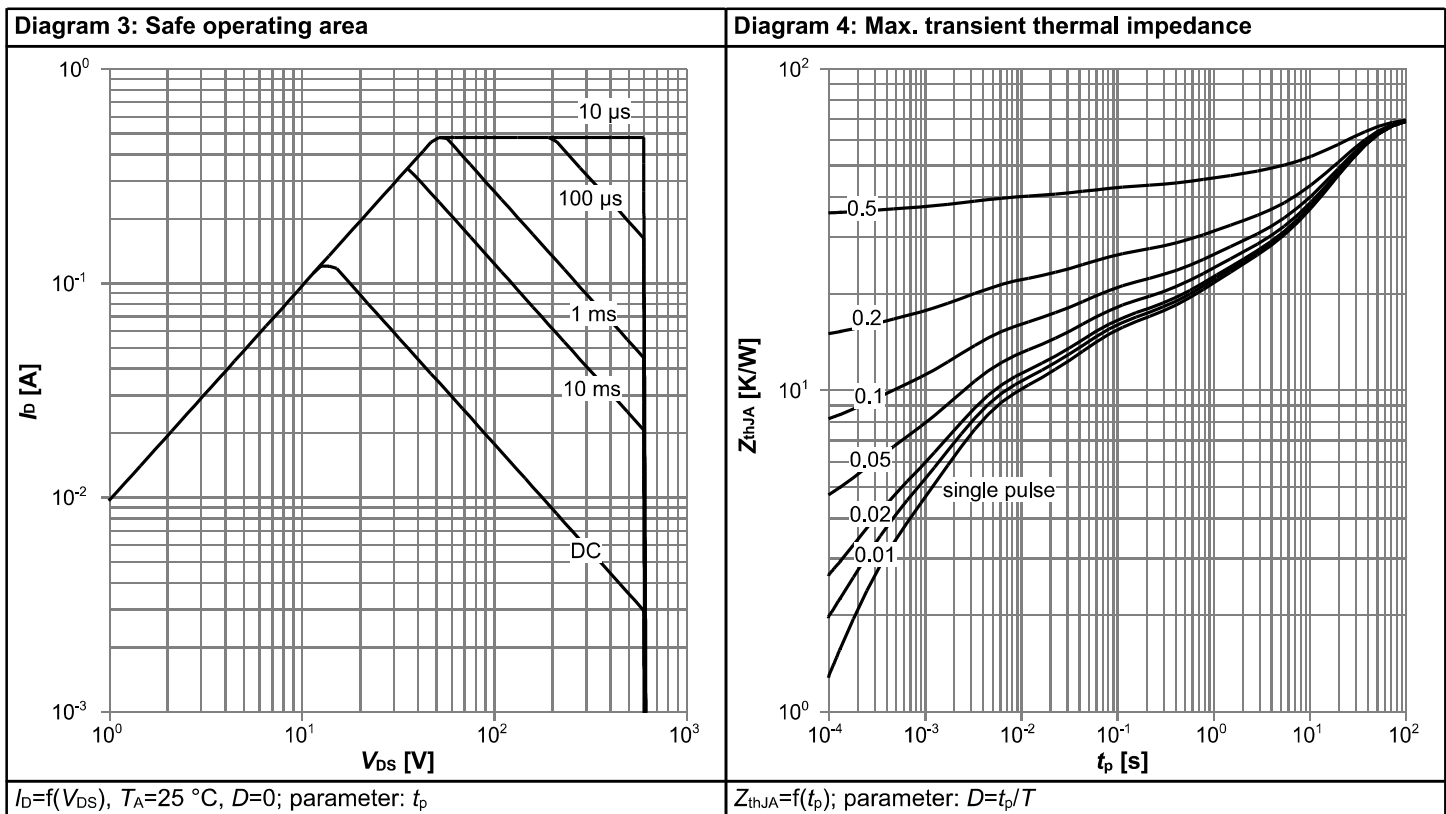
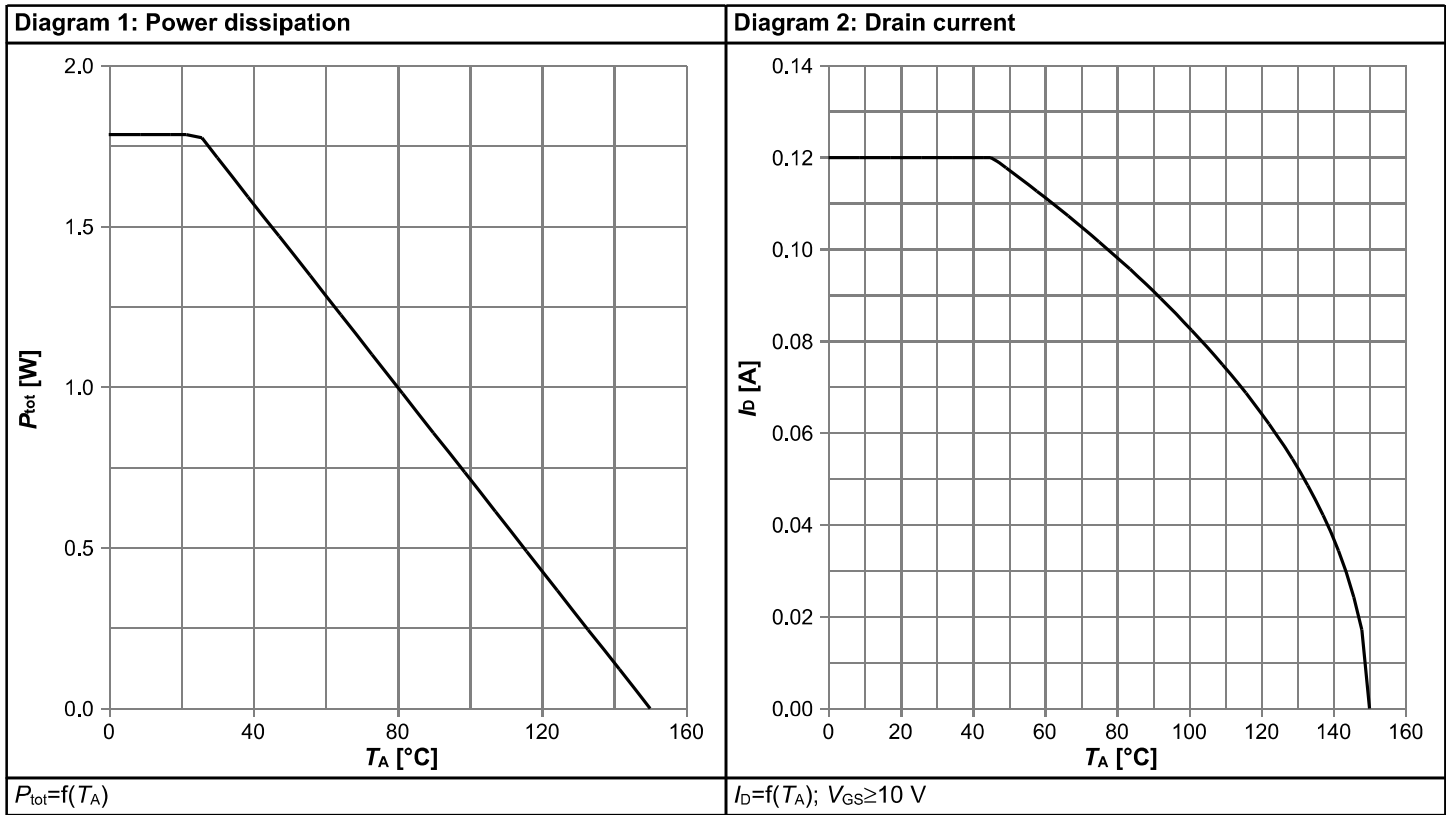
**Table 6 Gate charge characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	0.24	-	nC	$V_{DD}=400\text{ V}$ , $I_D=0.1\text{ A}$ , $V_{GS}=-3\text{ to }5\text{ V}$
Gate to drain charge	$Q_{gd}$	-	2.0	-	nC	$V_{DD}=400\text{ V}$ , $I_D=0.1\text{ A}$ , $V_{GS}=-3\text{ to }5\text{ V}$
Gate charge total	$Q_g$	-	3.7	-	nC	$V_{DD}=400\text{ V}$ , $I_D=0.1\text{ A}$ , $V_{GS}=-3\text{ to }5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	0.20	-	V	$V_{DD}=400\text{ V}$ , $I_D=0.1\text{ A}$ , $V_{GS}=-3\text{ to }5\text{ V}$

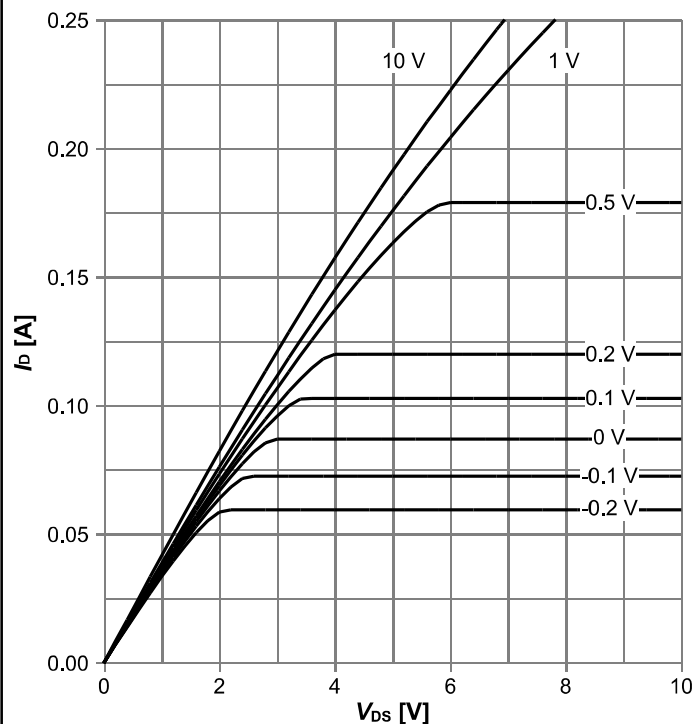
**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	0.12	A	$T_A=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	0.48	A	$T_A=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.78	1.2	V	$V_{GS}=-3\text{ V}$ , $I_F=0.12\text{ A}$ , $T_J=25\text{ °C}$
Reverse recovery time	$t_{rr}$	-	87	130	ns	$V_R=300\text{ V}$ , $I_F=0.1\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$	-	70	104	nC	$V_R=300\text{ V}$ , $I_F=0.1\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$

### 4 Electrical characteristics diagrams

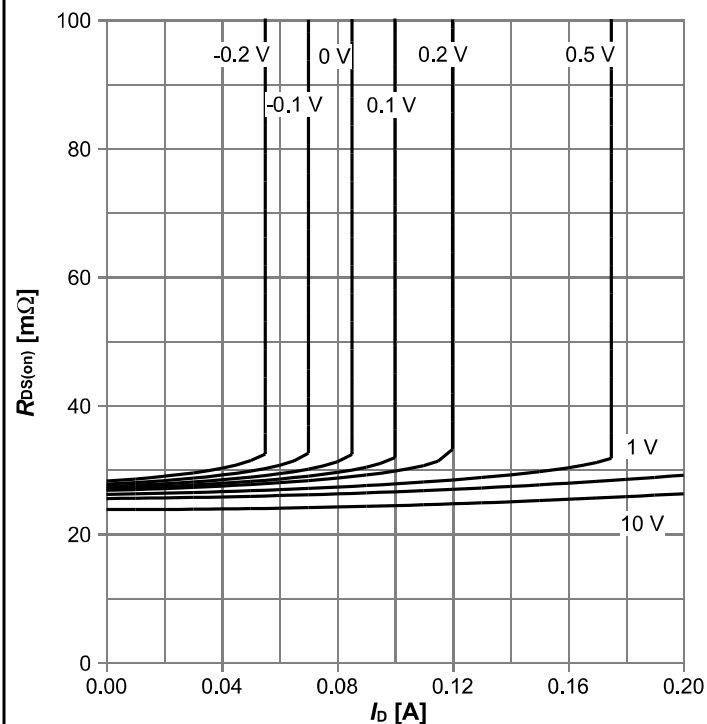


**Diagram 5: Typ. output characteristics**



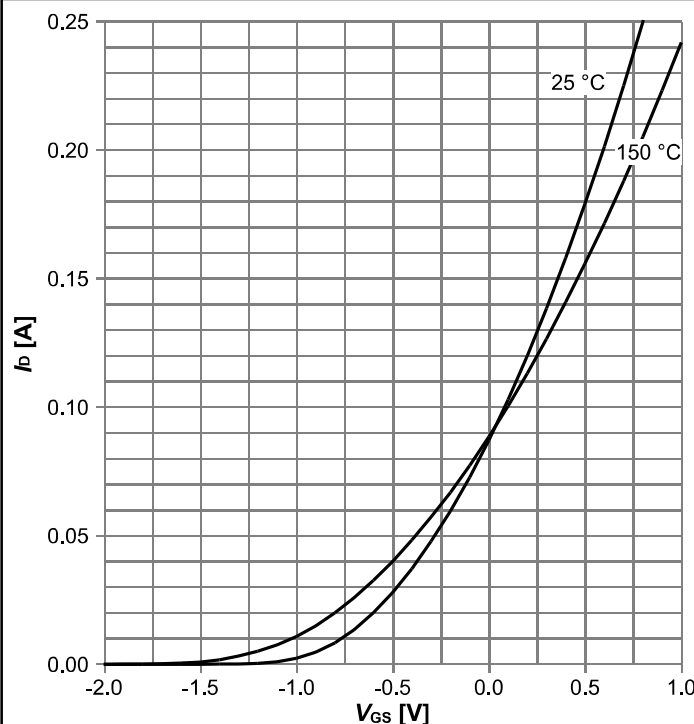
$I_D = f(V_{DS})$ ,  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

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



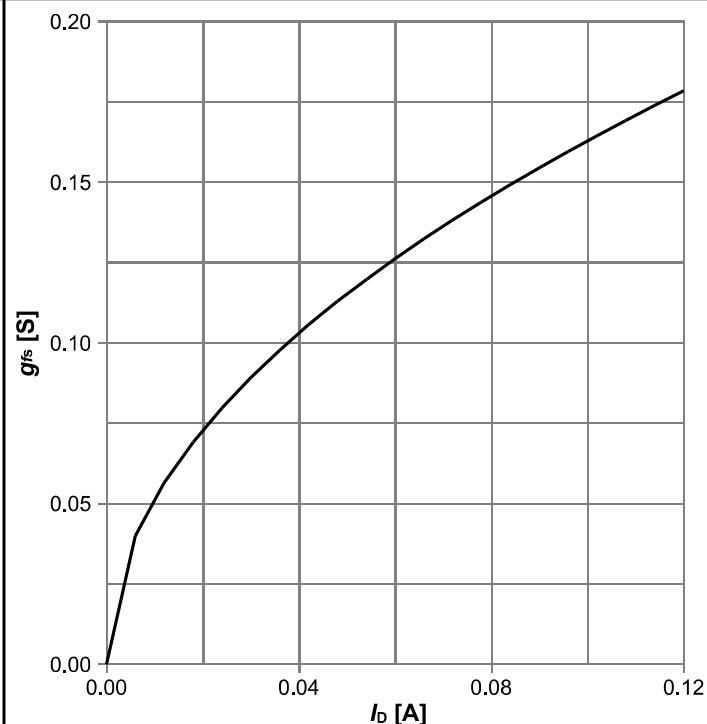
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

**Diagram 7: Typ. transfer characteristics**



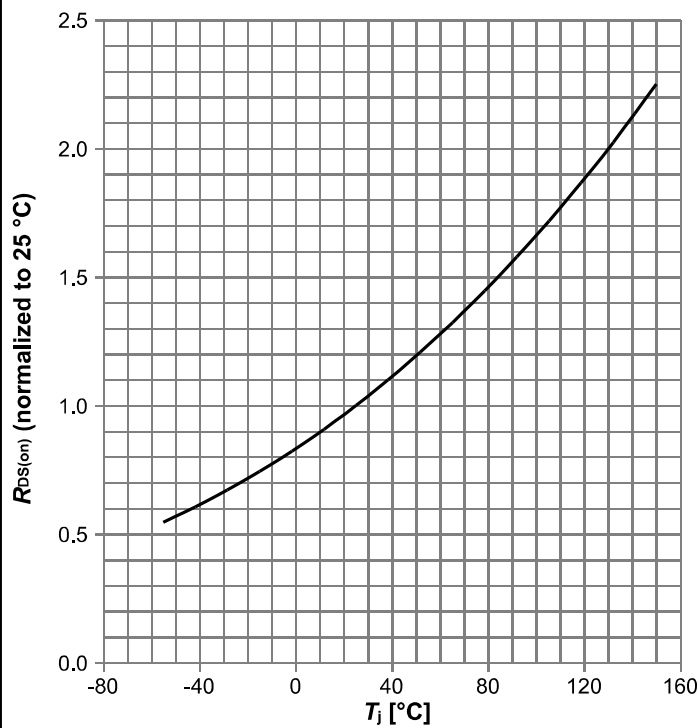
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$

**Diagram 8: Typ. transconductance**



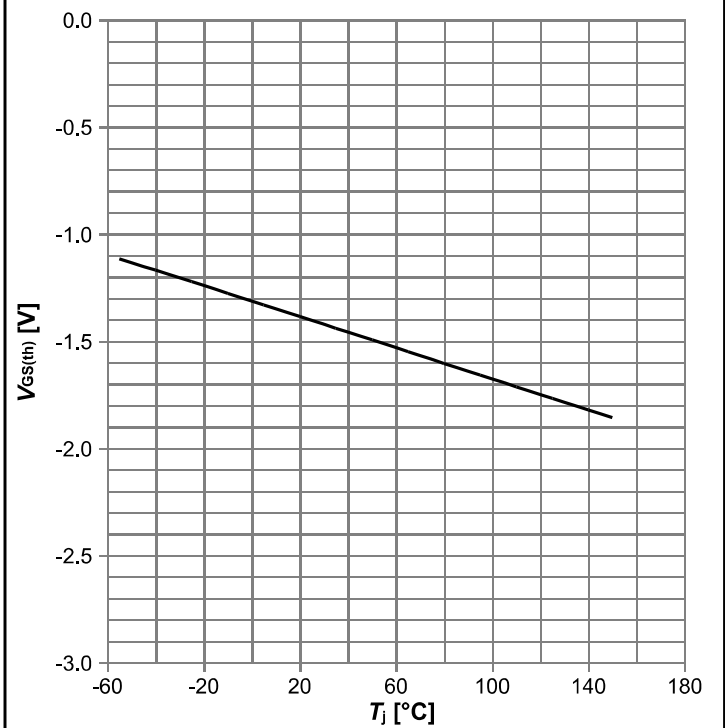
$g_{fs} = f(I_D)$

Diagram 9: Normalized drain-source on resistance



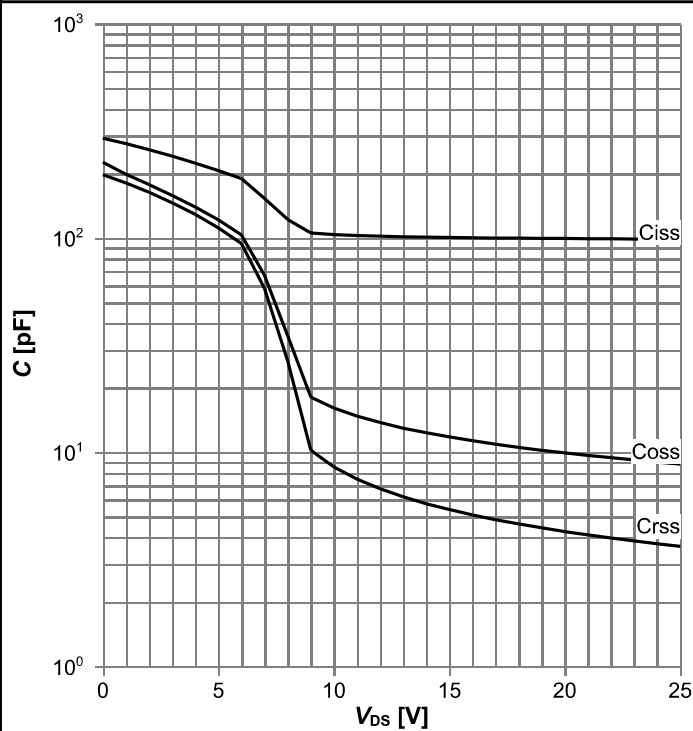
$R_{DS(on)}=f(T_j)$ ,  $I_D=0.01$  A,  $V_{GS}=0$  V

Diagram 10: Typ. gate threshold voltage



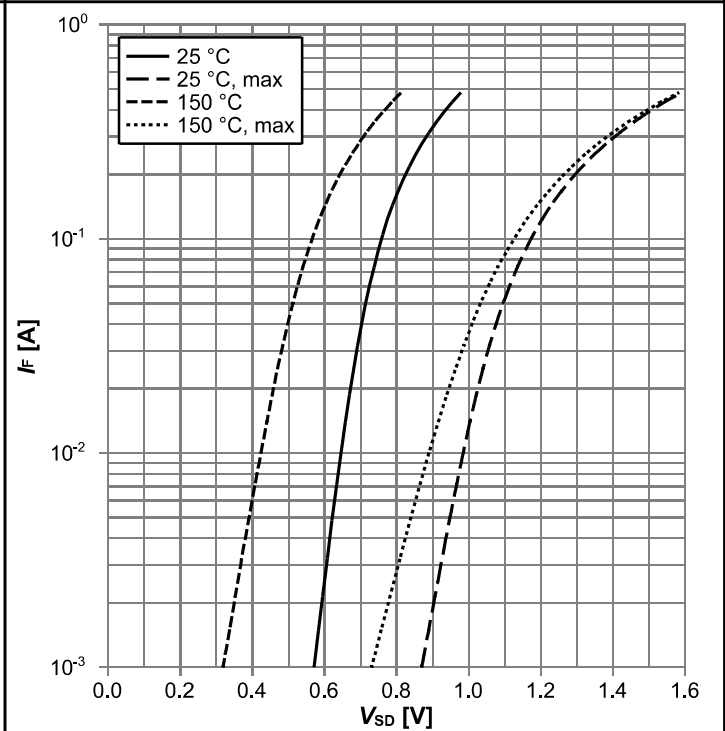
$V_{GS(th)}=f(T_j)$ ,  $V_{DS}=3$  V;  $I_D=94$   $\mu$ A

Diagram 11: Typ. capacitances



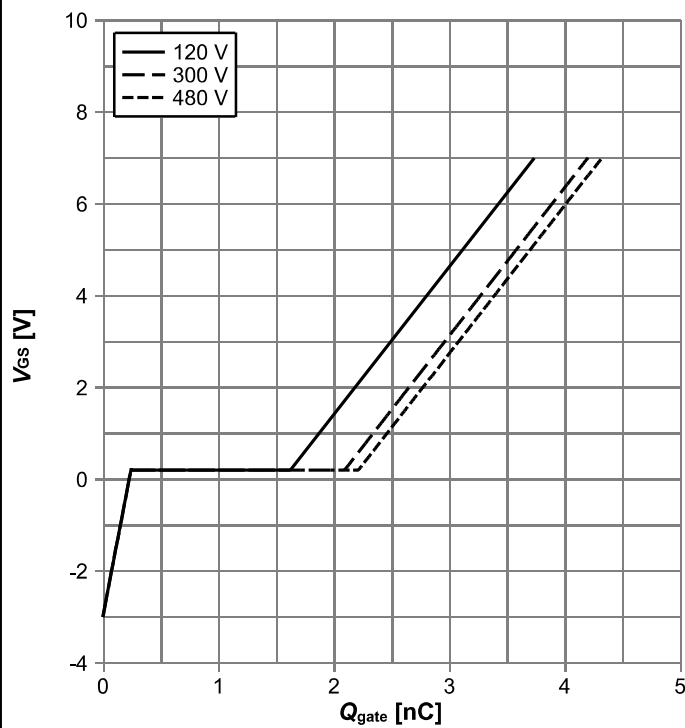
$C=f(V_{DS})$ ;  $V_{GS}=-3$  V;  $f=1$  MHz

Diagram 12: Forward characteristics of reverse diode



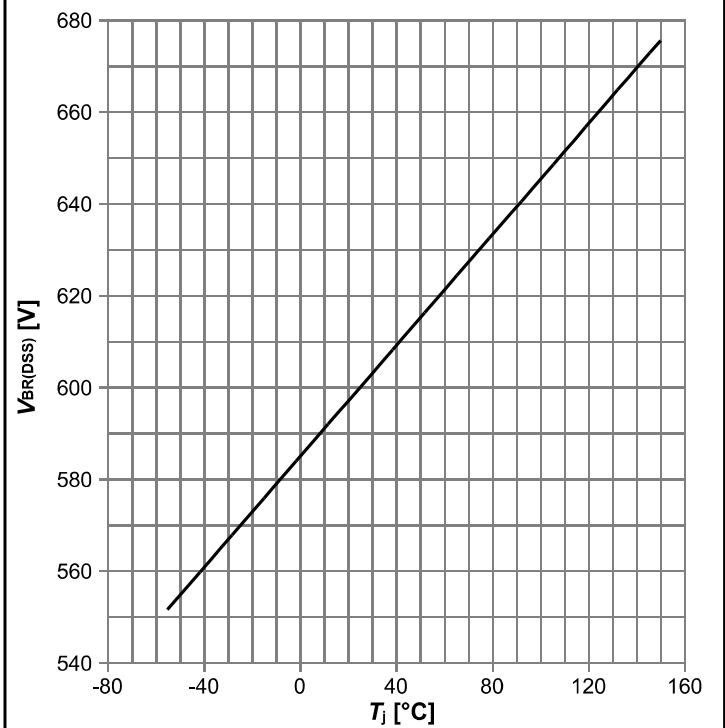
$I_F=f(V_{SD})$ ,  $V_{GS}=-3$  V; parameter:  $T_j$

**Diagram 13: Typ. gate charge**



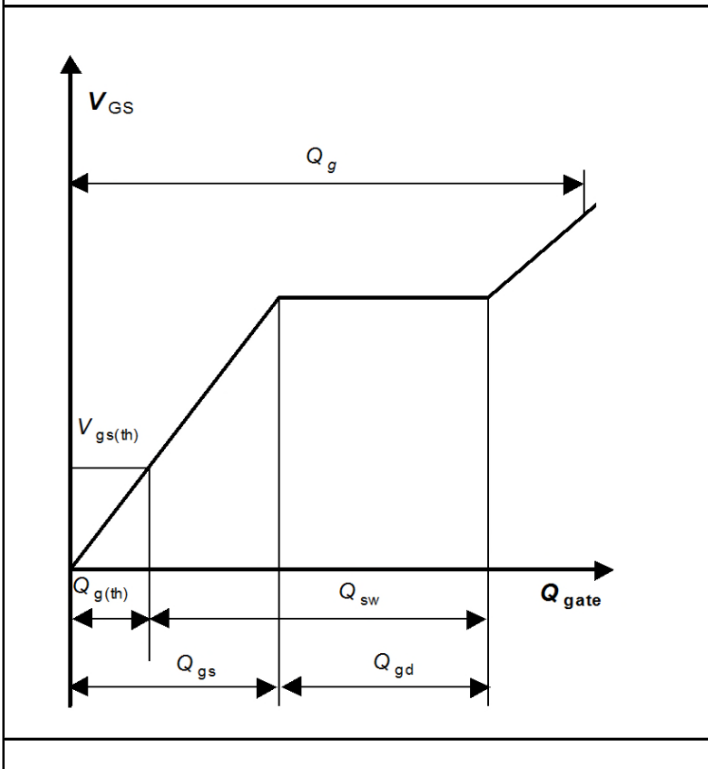
$V_{GS}=f(Q_{gate}); I_D=0.1 \text{ A pulsed}$

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



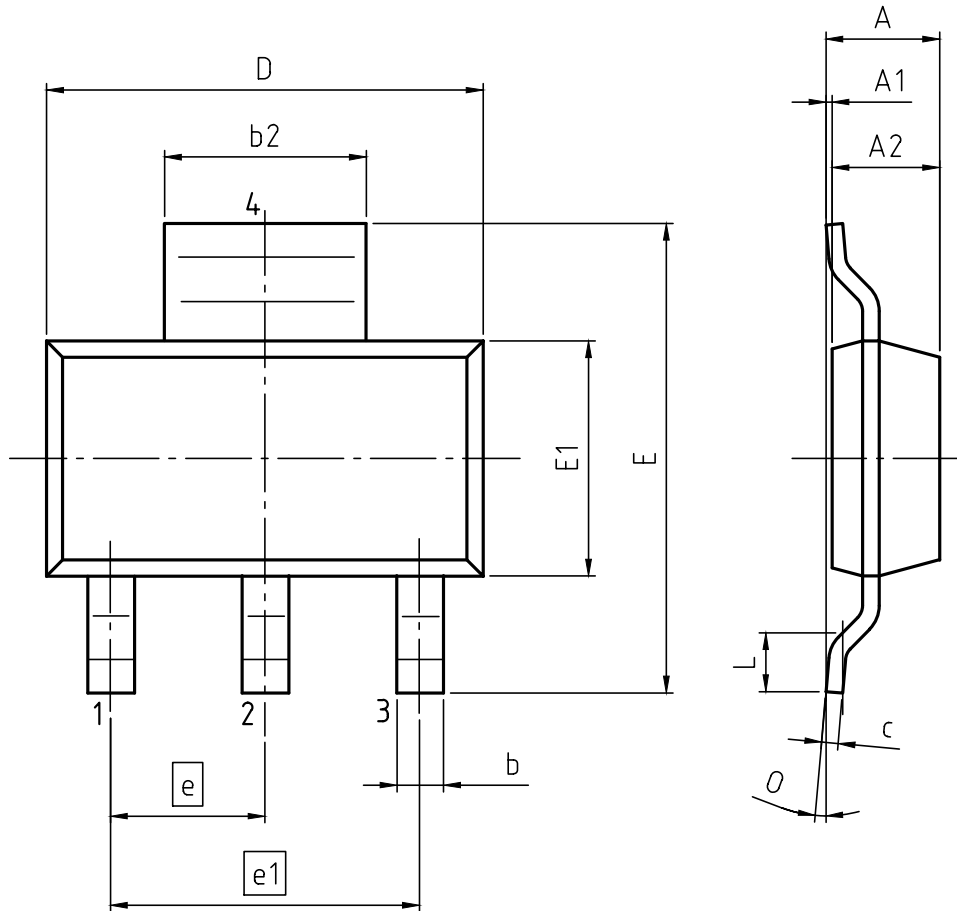
$V_{BR(DSS)}=f(T_j); I_D=250 \mu\text{A}, V_{GS}=-3\text{V}$

**Diagram Gate charge waveforms**





## 5 Package Outlines



PACKAGE - GROUP NUMBER:	<b>PG-SOT223-4-U01</b>	
REVISION: 01	DATE: 07.12.2020	
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	1.60	1.80
A1	-	0.10
A2	1.50	1.70
b	0.60	0.80
b1	0.61	1.45
b2	2.90	3.10
c	0.24	0.35
D	6.30	6.70
E	6.70	7.30
E1	3.30	3.70
e	2.30	
e1	4.60	
L	MIN. 0,75	
O	0°	10°

Figure 1 Outline PG-SOT223, dimensions in mm

## Revision History

BSP135I

**Revision: 2021-03-16, Rev. 2.1**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2021-01-25	Release of final version
2.1	2021-03-16	Update technology naming

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