

## SIPMOS® Small-Signal-Transistor

### Features

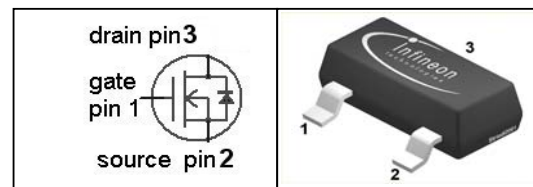
- N-channel
- Depletion mode
- $dv/dt$  rated
- Available with  $V_{GS(th)}$  indicator on reel
- Pb-free lead-plating; RoHS compliant
- ° Halogen free according to IEC61249-2-21
- ° Qualified according to AEC Q101



### Product Summary

$V_{DS}$	250	V
$R_{DS(on),max}$	30	$\Omega$
$I_{DSS,min}$	0.03	A

PG-SOT-23



Type	Package	Tape and Reel Information	Marking	Pb-free
BSS139	PG-SOT-23	H6327: 3000 pcs/reel	STs	Yes
BSS139	PG-SOT-23	H6906: 3000 pcs/reel sorted in $V_{S(th)}$ bands <sup>1)</sup>	STs	Yes

**Maximum ratings**, at  $T_j=25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_A=25\text{ °C}$	0.10	A
		$T_A=70\text{ °C}$	0.08	
Pulsed drain current	$I_{D,pulse}$	$T_A=25\text{ °C}$	0.4	
Reverse diode $dv/dt$	$dv/dt$	$I_D=0.1\text{ A}$ , $V_{DS}=200\text{ V}$ , $di/dt=200\text{ A}/\mu\text{s}$ , $T_{j,max}=150\text{ °C}$	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$		$\pm 20$	V
ESD class (JESD22-A114-HBM)			0 (<250V)	
Power dissipation	$P_{tot}$	$T_A=25\text{ °C}$	0.36	W
Operating and storage temperature	$T_j$ , $T_{stg}$		-55 ... 150	°C
IEC climatic category; DIN IEC 68-1			55/150/56	

<sup>1)</sup> see table on next page and diagram 11

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics**

Thermal resistance, junction - ambient	$R_{thJA}$	minimal footprint	-	-	350	K/W
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**Electrical characteristics, at  $T_j=25\text{ °C}$ , unless otherwise specified**
**Static characteristics**

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=-3\text{ V}, I_D=250\text{ }\mu\text{A}$	250	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=3\text{ V}, I_D=56\text{ }\mu\text{A}$	-2.1	-1.4	-1	
Drain-source cutoff current	$I_{D(off)}$	$V_{DS}=250\text{ V},$ $V_{GS}=-3\text{ V}, T_j=25\text{ °C}$	-	-	0.1	$\mu\text{A}$
		$V_{DS}=250\text{ V},$ $V_{GS}=-3\text{ V}, T_j=125\text{ °C}$	-	-	10	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	-	10	nA
On-state drain current	$I_{DSS}$	$V_{GS}=0\text{ V}, V_{DS}=10\text{ V}$	30	-	-	mA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=0\text{ V}, I_D=15\text{ mA}$	-	12.5	30	$\Omega$
		$V_{GS}=10\text{ V}, I_D=0.1\text{ mA}$	-	7.8	14	
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=0.08\text{ A}$	0.060	0.13	-	S

**Threshold voltage  $V_{GS(th)}$  sorted in bands<sup>2)</sup>**

J	$V_{GS(th)}$	$V_{DS}=3\text{ V}, I_D=56\text{ }\mu\text{A}$	-1.2	-	-1	V
K			-1.35	-	-1.15	
L			-1.5	-	-1.3	
M			-1.65	-	-1.45	
N			-1.8	-	-1.6	

<sup>2)</sup> Each reel contains transistors out of one band whose identifying letter is printed on the reel label. A specific band cannot be ordered separately.

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics**

Input capacitance	$C_{iss}$	$V_{GS} = -3\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	-	60	76	pF
Output capacitance	$C_{oss}$		-	6.7	8.4	
Reverse transfer capacitance	$C_{rss}$		-	2.6	3.3	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 125\text{ V}, V_{GS} = -3 \dots 5\text{ V}, I_D = 0.04\text{ A}, R_G = 6\text{ }\Omega$	-	5.8	8.7	ns
Rise time	$t_r$		-	5.4	8.1	
Turn-off delay time	$t_{d(off)}$		-	29	43	
Fall time	$t_f$		-	182	273	

**Gate Charge Characteristics**

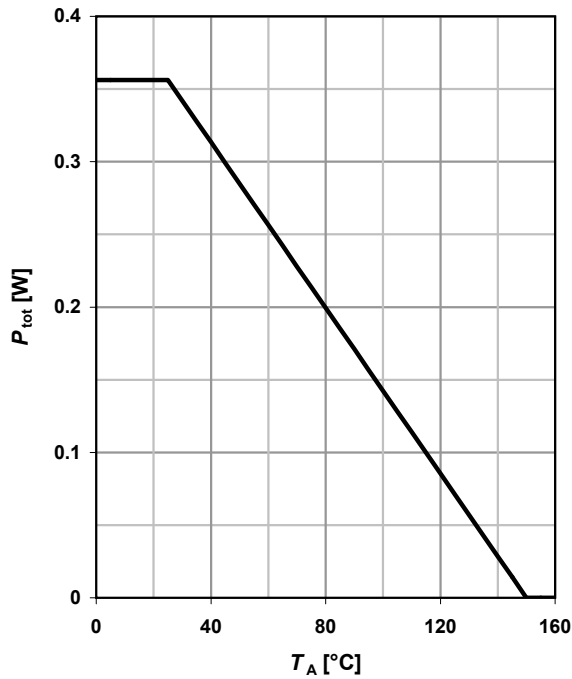
Gate to source charge	$Q_{gs}$	$V_{DD} = 200\text{ V}, I_D = 0.04\text{ A}, V_{GS} = -3\text{ to }5\text{ V}$	-	0.14	0.21	nC
Gate to drain charge	$Q_{gd}$		-	1.3	2.0	
Gate charge total	$Q_g$		-	2.3	3.5	
Gate plateau voltage	$V_{plateau}$		-	-0.28	-	V

**Reverse Diode**

Diode continuous forward current	$I_S$	$T_A = 25\text{ }^\circ\text{C}$	-	-	0.10	A
Diode pulse current	$I_{S,pulse}$		-	-	0.4	
Diode forward voltage	$V_{SD}$	$V_{GS} = -3\text{ V}, I_F = 0.1\text{ A}, T_j = 25\text{ }^\circ\text{C}$	-	0.81	1.2	V
Reverse recovery time	$t_{rr}$	$V_R = 50\text{ V}, I_F = 0.04\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}$	-	8.6	12.9	ns
Reverse recovery charge	$Q_{rr}$		-	2.1	3.1	nC

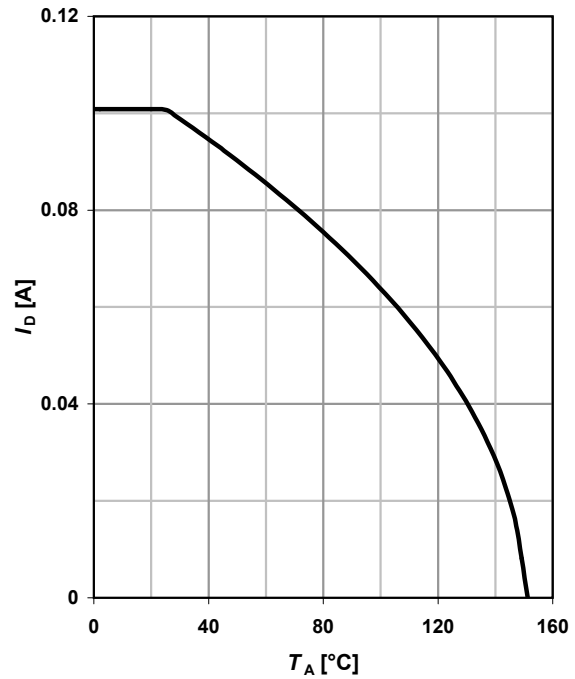
### 1 Power dissipation

$$P_{\text{tot}} = f(T_A)$$



### 2 Drain current

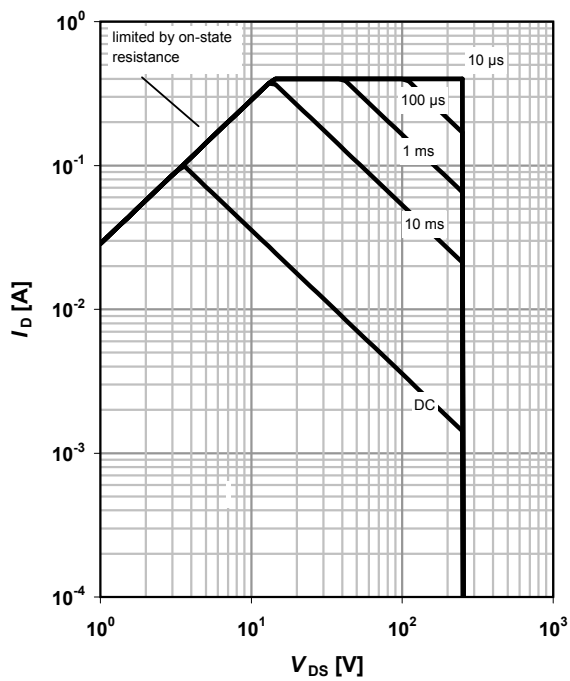
$$I_D = f(T_A); V_{GS} \geq 10 \text{ V}$$



### 3 Safe operating area

$$I_D = f(V_{DS}); T_A = 25 \text{ °C}; D = 0$$

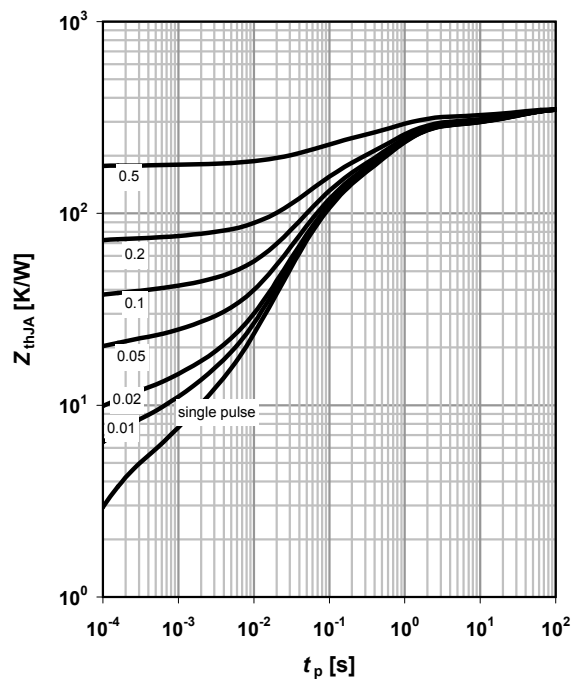
parameter:  $t_p$



### 4 Max. transient thermal impedance

$$Z_{\text{thJA}} = f(t_p)$$

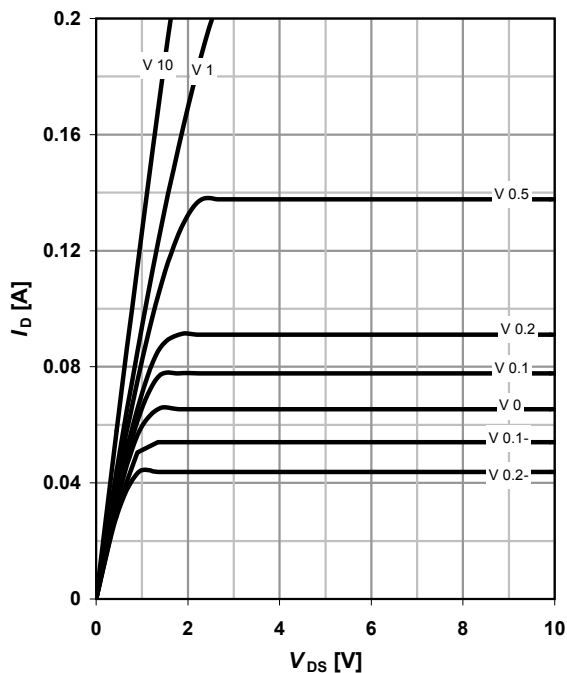
parameter:  $D = t_p / T$



### 5 Typ. output characteristics

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

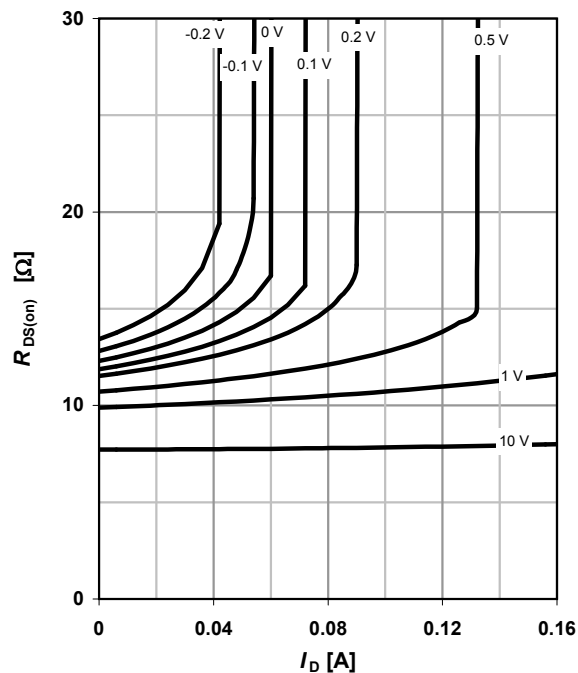
parameter:  $V_{GS}$



### 6 Typ. drain-source on resistance

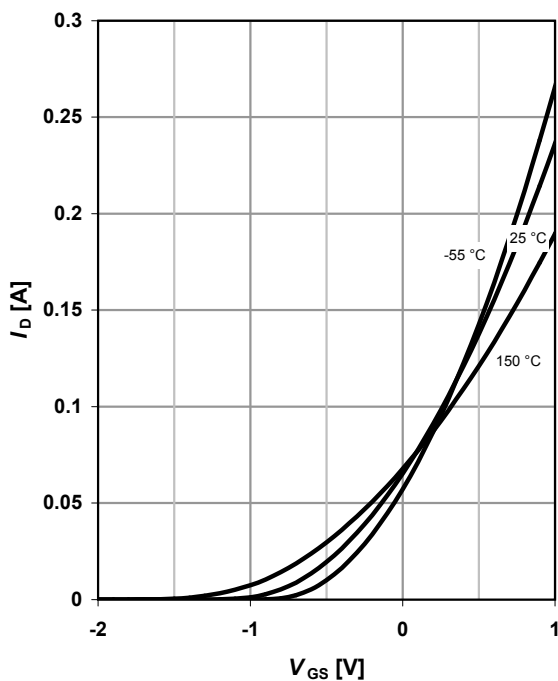
$$R_{DS(on)} = f(I_D); T_J = 25^\circ\text{C}$$

parameter:  $V_{GS}$



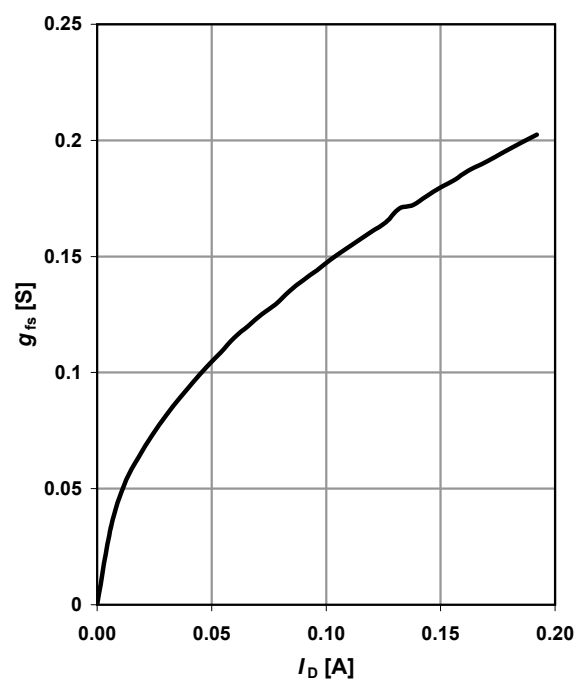
### 7 Typ. transfer characteristics

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



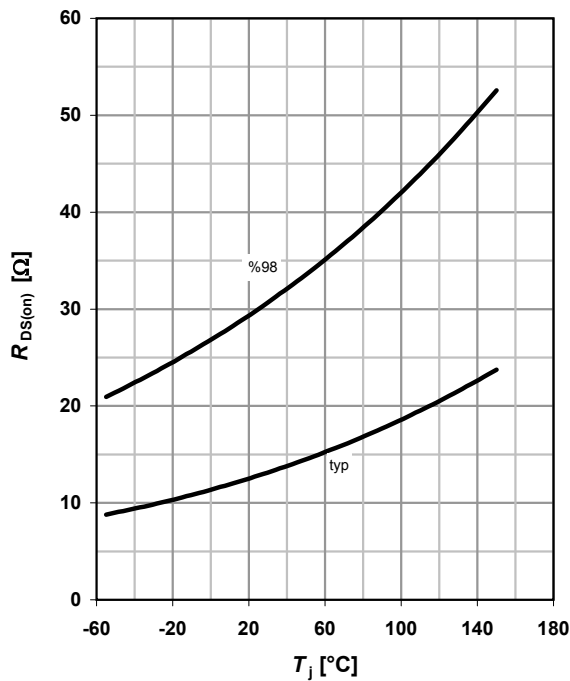
### 8 Typ. forward transconductance

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



### 9 Drain-source on-state resistance

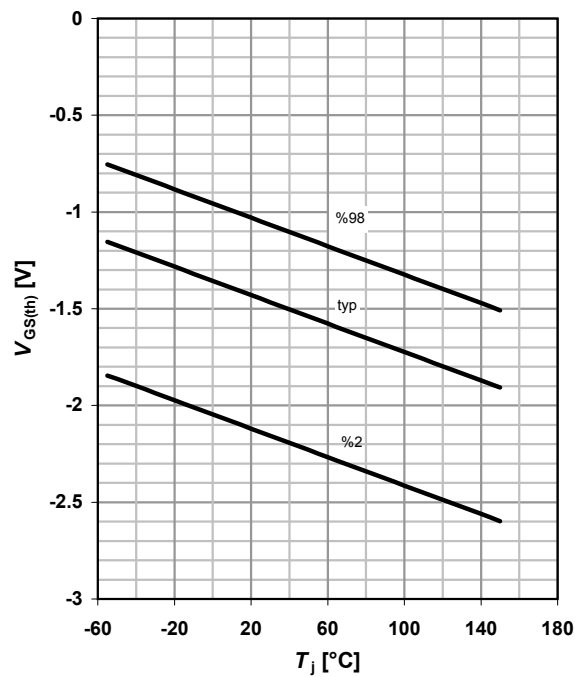
$$R_{DS(on)} = f(T_j); I_D = 0.015 \text{ A}; V_{GS} = 0 \text{ V}$$



### 10 Typ. gate threshold voltage

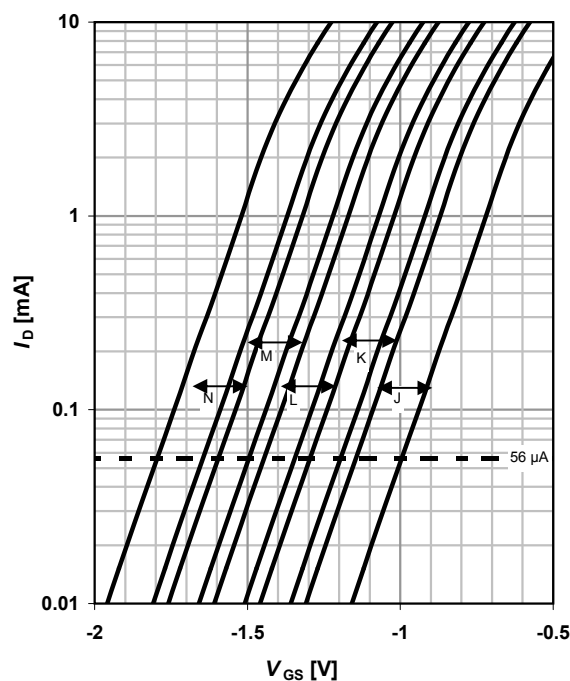
$$V_{GS(th)} = f(T_j); V_{DS} = 3 \text{ V}; I_D = 56 \text{ μA}$$

parameter:  $I_D$



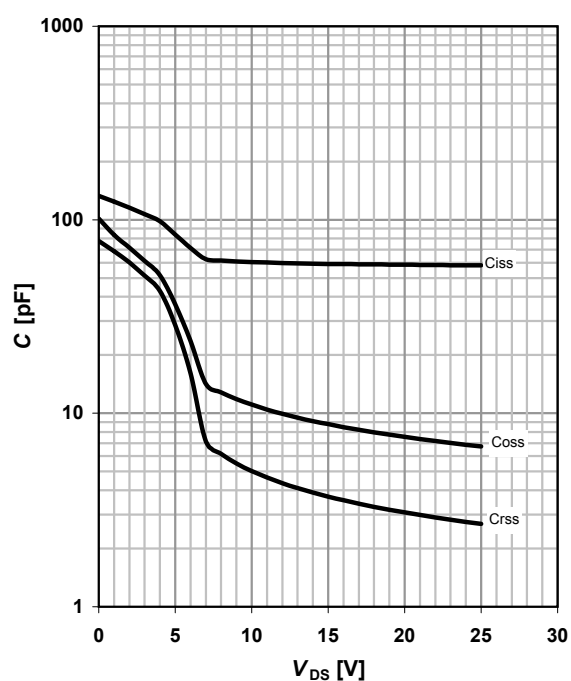
### 11 Threshold voltage bands

$$I_D = f(V_{GS}); V_{DS} = 3 \text{ V}; T_j = 25 \text{ °C}$$



### 12 Typ. capacitances

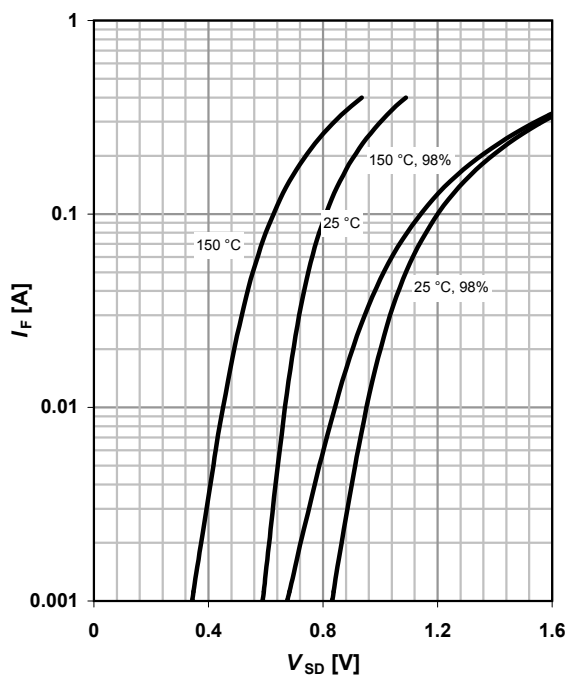
$$C = f(V_{DS}); V_{GS} = -3 \text{ V}; f = 1 \text{ MHz}$$



### 13 Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

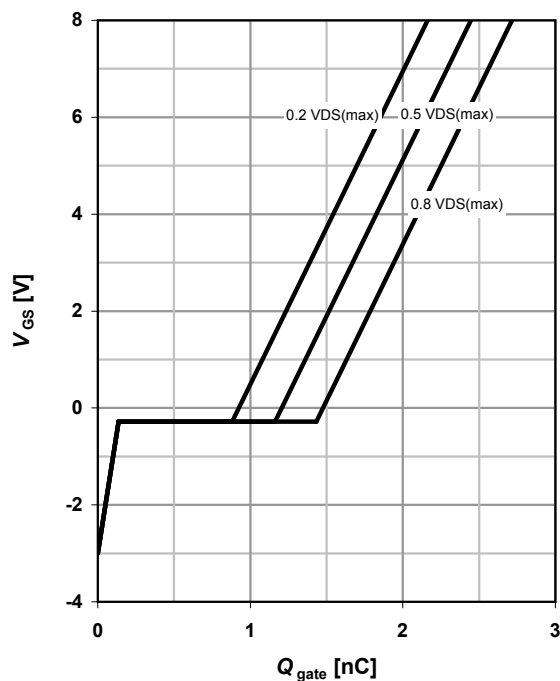
parameter:  $T_j$



### 15 Typ. gate charge

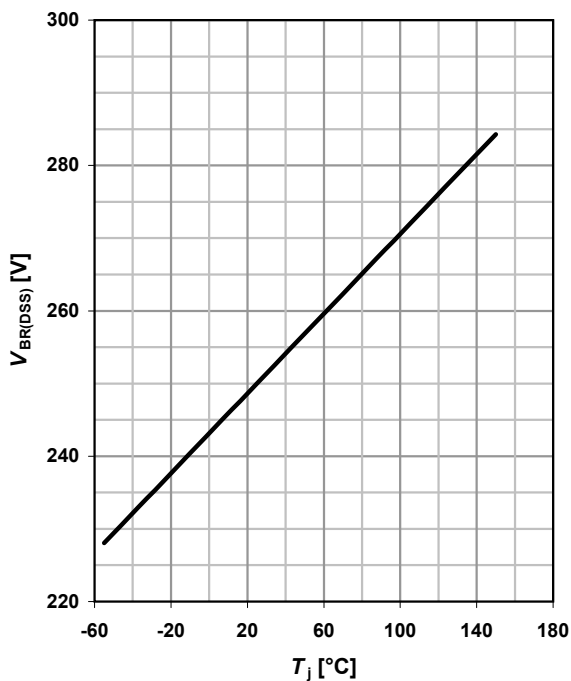
$$V_{GS} = f(Q_{gate}); I_D = 0.1 \text{ A pulsed}$$

parameter:  $V_{DD}$

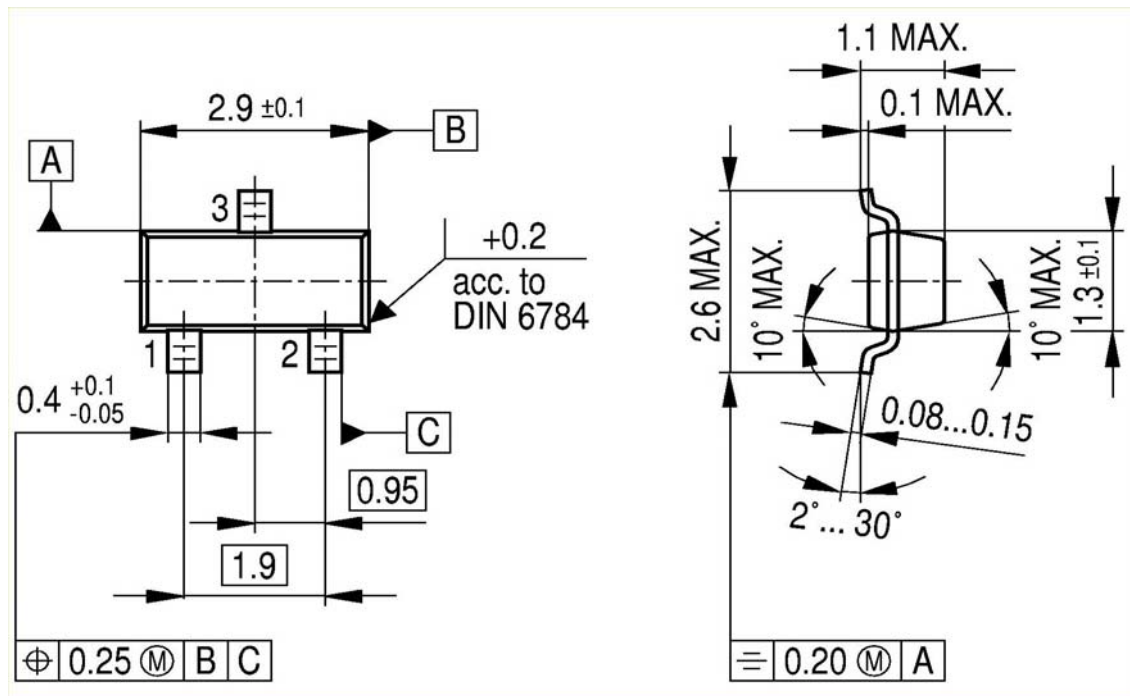


### 16 Drain-source breakdown voltage

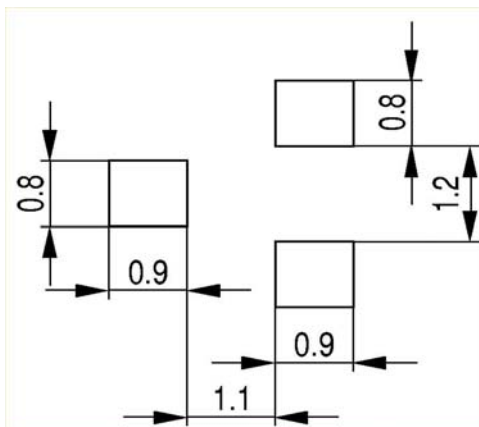
$$V_{BR(DSS)} = f(T_j); I_D = 250 \mu\text{A}$$



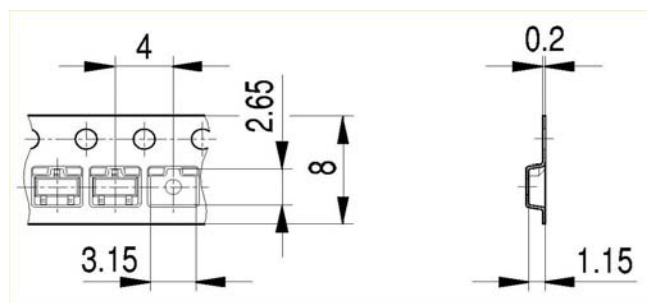
# Package Outline:



# Footprint:



# Packaging:



Dimensions in mm



**Published by**  
**Infineon Technologies AG**  
**81726 Munich, Germany**  
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