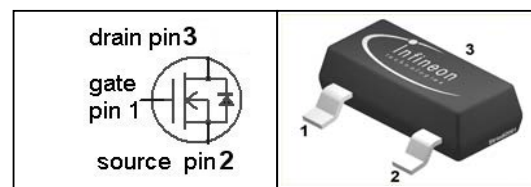


**SIPMOS® Small-Signal-Transistor**
**Features**

- 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	$^{\circ}\text{C}$
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	$t_{d(on)}$	$V_{DD}=125\text{ V},$ $V_{GS}=-3\dots 5\text{ V},$ $I_D=0.04\text{ A}, R_G=6\ \Omega$	-	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**

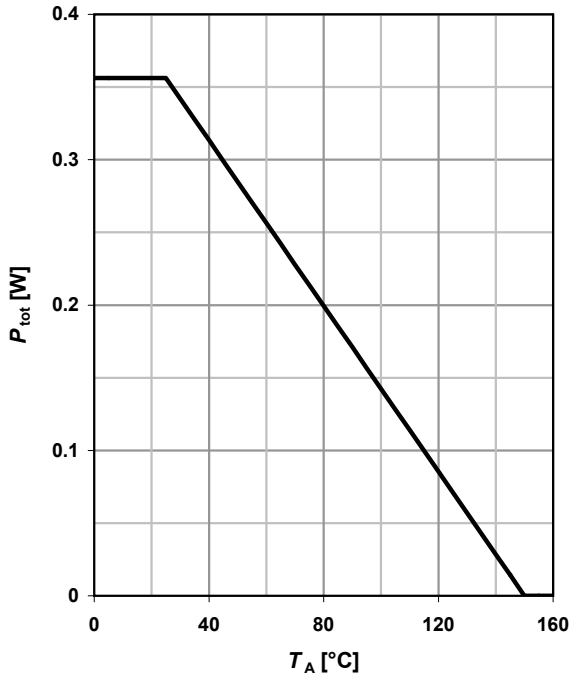
Gate to source charge	$Q_{gs}$	$V_{DD}=200\text{ V},$ $I_D=0.04\text{ A},$ $V_{GS}=-3\text{ to }5\text{ V}$	-	0.14	0.21	nC
Gate to drain charge	$Q_{gd}$		-	1.3	2.0	
Gate charge total	$Q_g$		-	2.3	3.5	
Gate plateau voltage	$V_{plateau}$		-	-0.28	-	V

**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	

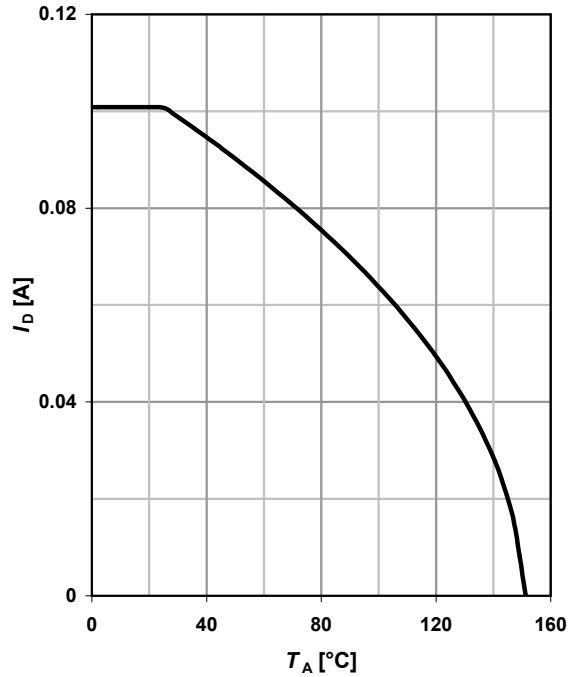
**1 Power dissipation**

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



**2 Drain current**

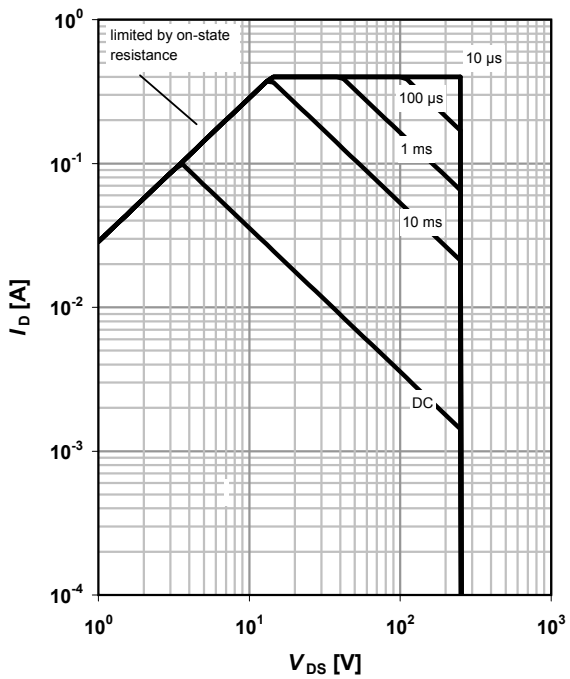
$$I_D = f(T_A); V_{\text{GS}} \geq 10 \text{ V}$$



**3 Safe operating area**

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

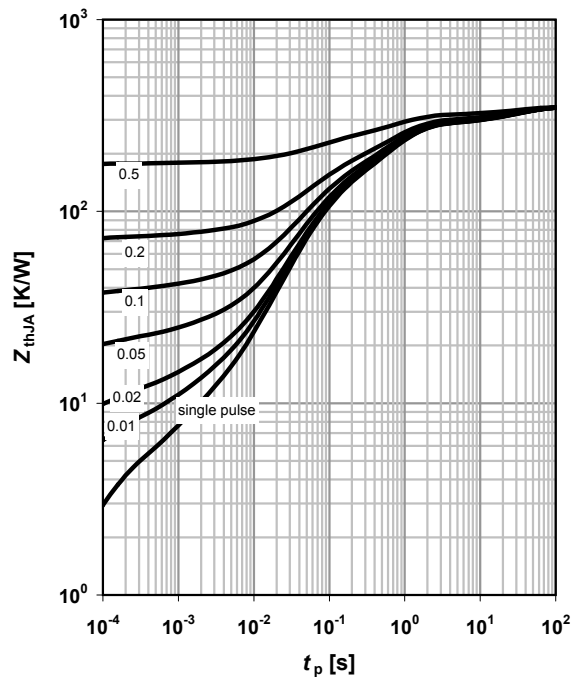
parameter:  $t_p$



**4 Max. transient thermal impedance**

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

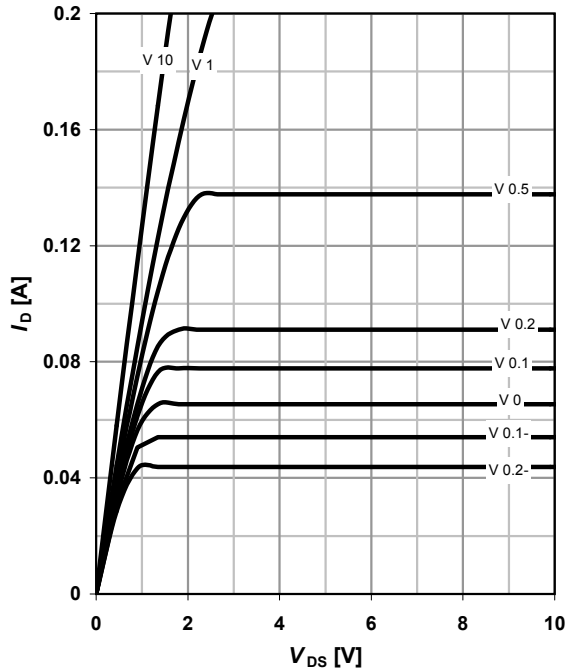
parameter:  $D = t_p / T$



**5 Typ. output characteristics**

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

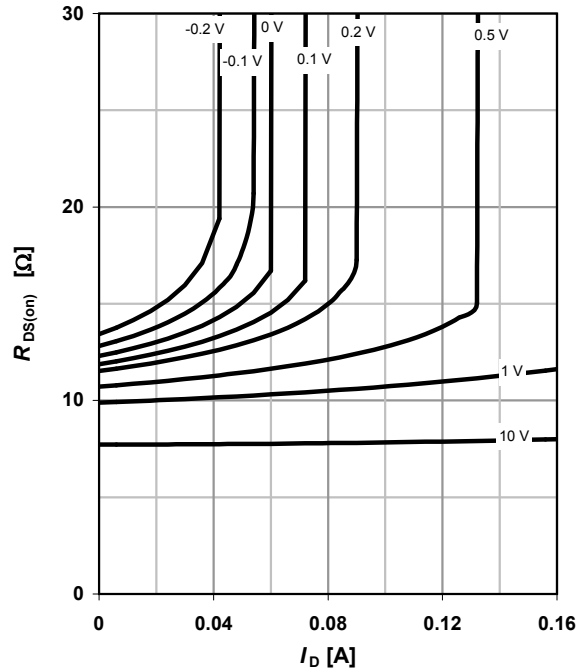
parameter:  $V_{GS}$



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

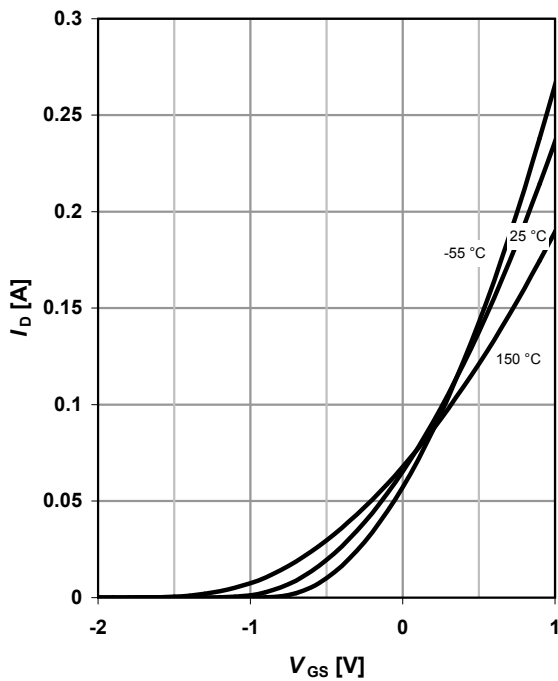
$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}$

parameter:  $V_{GS}$



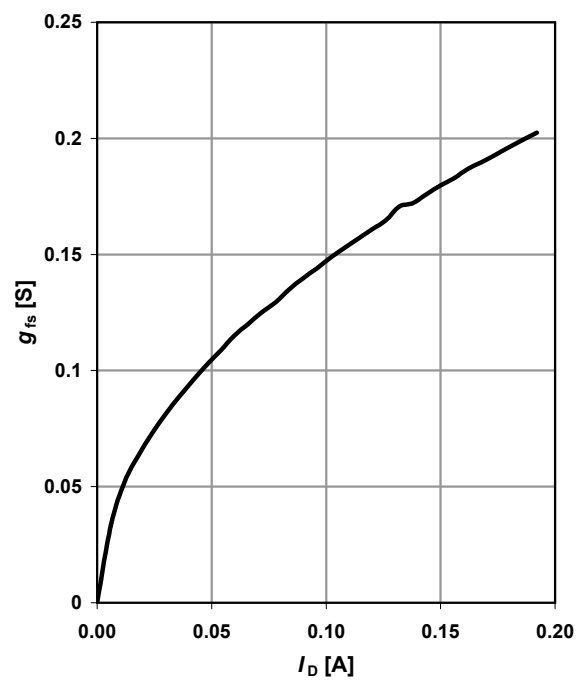
**7 Typ. transfer characteristics**

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



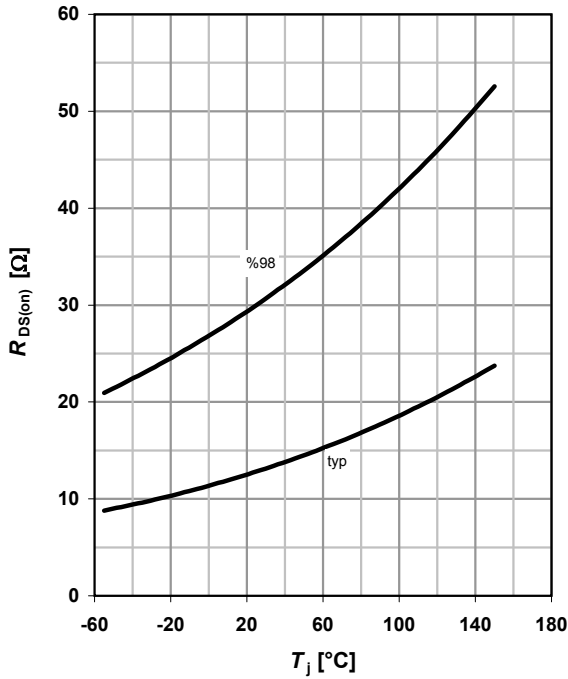
**8 Typ. forward transconductance**

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



**9 Drain-source on-state resistance**

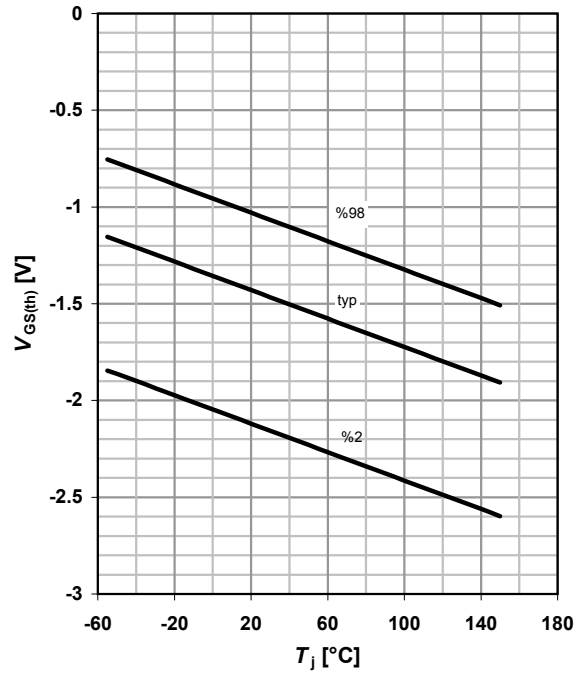
$R_{DS(on)}=f(T_j); I_D=0.015\text{ A}; V_{GS}=0\text{ V}$



**10 Typ. gate threshold voltage**

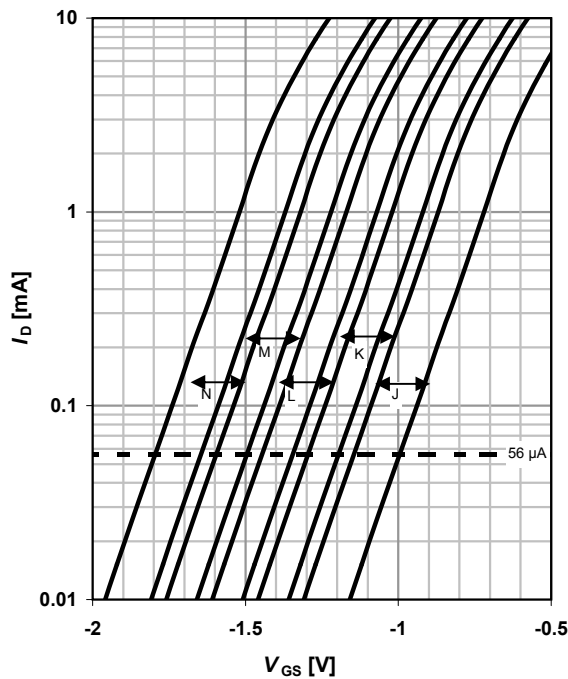
$V_{GS(th)}=f(T_j); V_{DS}=3\text{ V}; I_D=56\text{ μA}$

parameter:  $I_D$



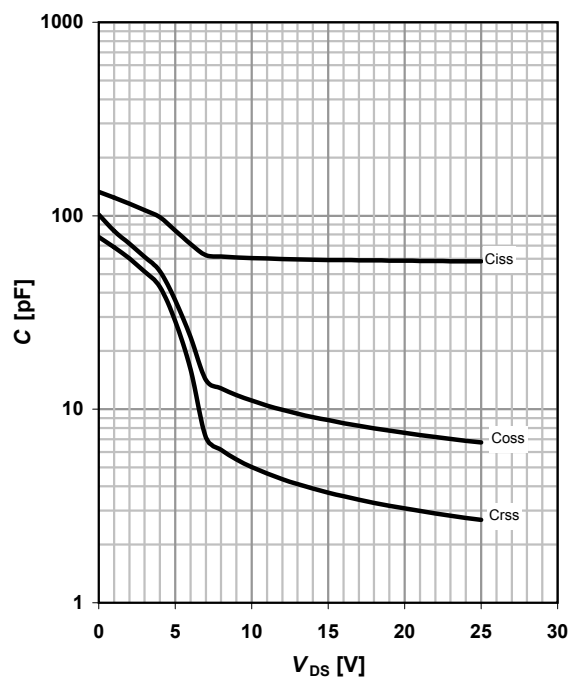
**11 Threshold voltage bands**

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



**12 Typ. capacitances**

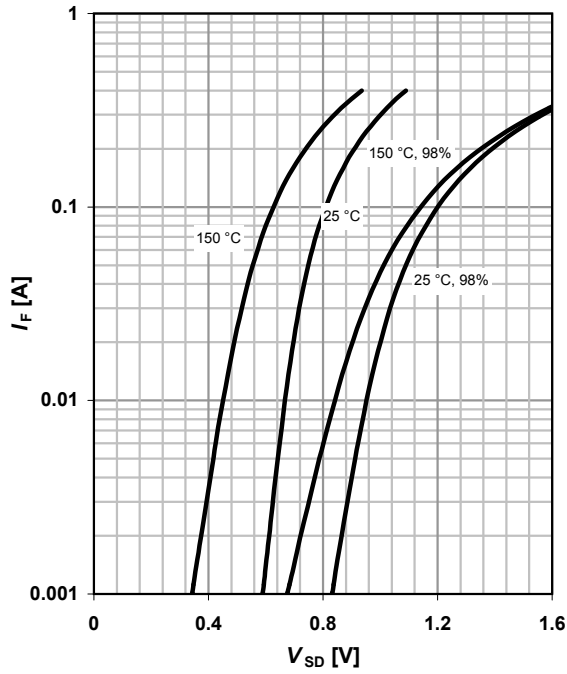
$C=f(V_{DS}); V_{GS}=-3\text{ V}; f=1\text{ MHz}$



**13 Forward characteristics of reverse diode**

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

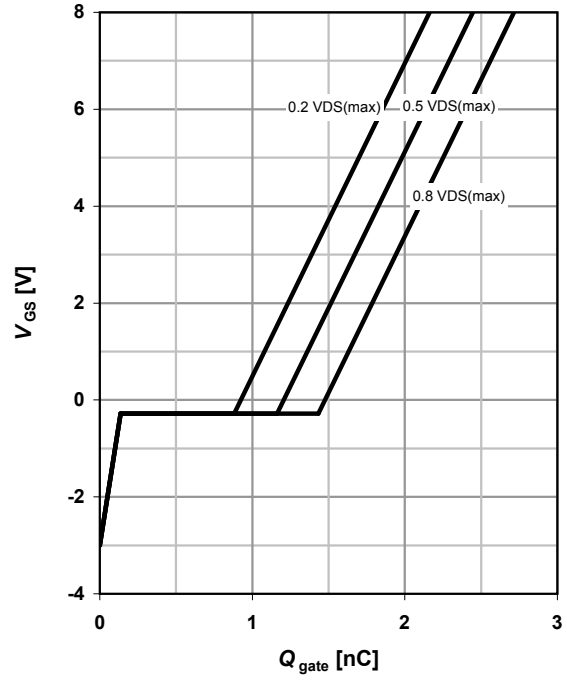
parameter:  $T_j$



**15 Typ. gate charge**

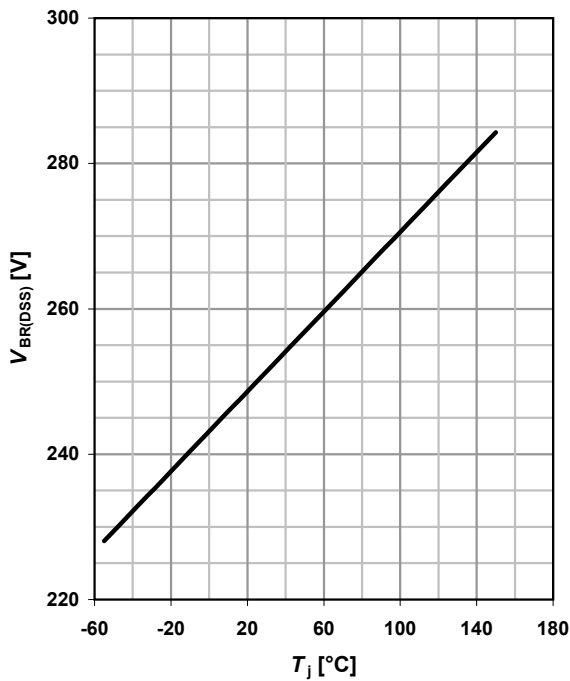
$$V_{GS} = f(Q_{gate}); I_D = 0.1 \text{ A pulsed}$$

parameter:  $V_{DD}$



**16 Drain-source breakdown voltage**

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







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