

SIPMOS® Small-Signal-Transistor

Features

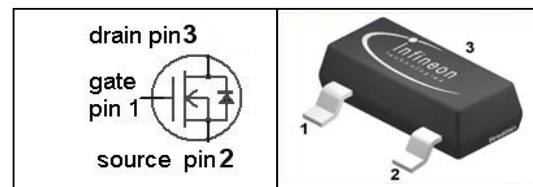
- N-channel
- Depletion mode
- dv/dt rated
- Available with $V_{GS(th)}$ indicator on reel
- Pb-free lead-plating; RoHS compliant
- ° Halogen free according to IEC61249-2-21
- ° Qualified according to AEC Q101



Product Summary

V_{DS}	250	V
$R_{DS(on),max}$	30	Ω
$I_{DSS,min}$	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 ¹⁾	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/ μs
Gate source voltage	V_{GS}		± 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	

¹⁾ 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	μA
		$V_{DS}=250\text{ V},$ $V_{GS}=-3\text{ V}, T_j=125\text{ °C}$	-	-	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	Ω
		$V_{GS}=10\text{ V}, I_D=0.1\text{ mA}$	-	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 bands²⁾

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	

²⁾ 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

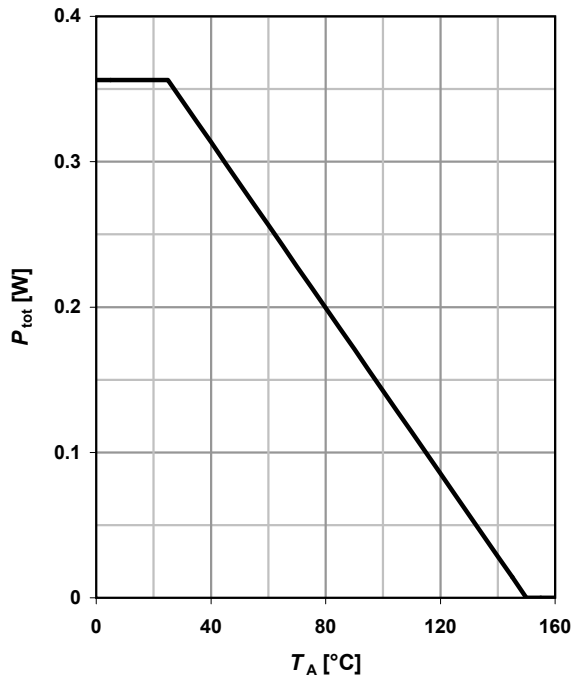
Gate to source charge	Q_{gs}	$V_{DD} = 200\text{ V},$ $I_D = 0.04\text{ A},$ $V_{GS} = -3\text{ to }5\text{ V}$	-	0.14	0.21	nC
Gate to drain charge	Q_{gd}		-	1.3	2.0	
Gate charge total	Q_g		-	2.3	3.5	
Gate plateau voltage	$V_{plateau}$		-	-0.28	-	V

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	

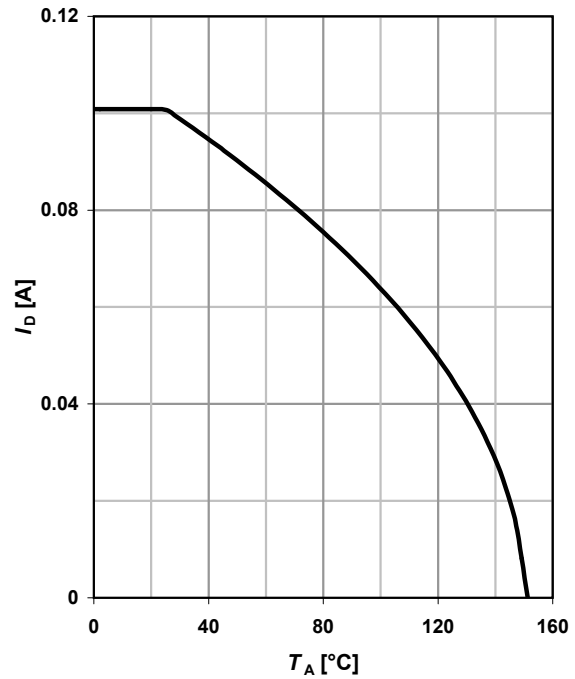
1 Power dissipation

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



2 Drain current

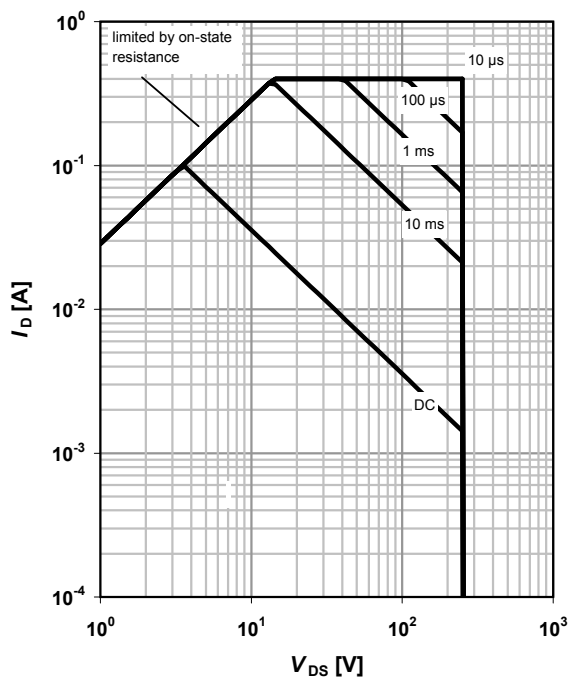
$$I_D = f(T_A); V_{GS} \geq 10 \text{ V}$$



3 Safe operating area

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

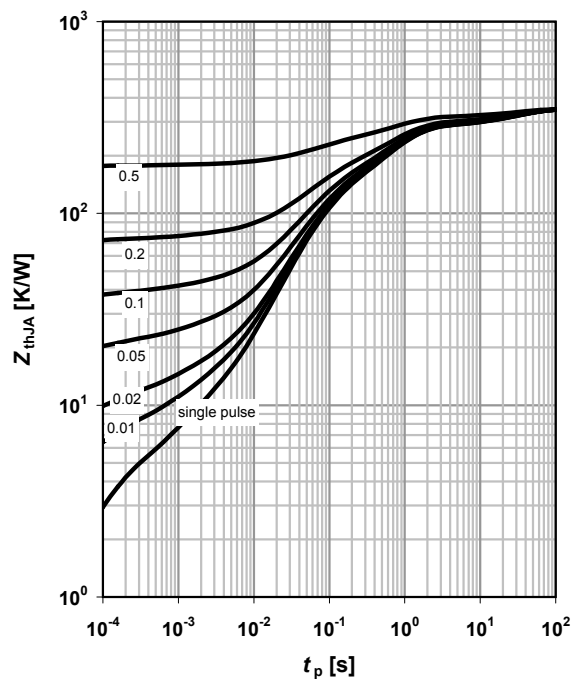
parameter: t_p



4 Max. transient thermal impedance

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

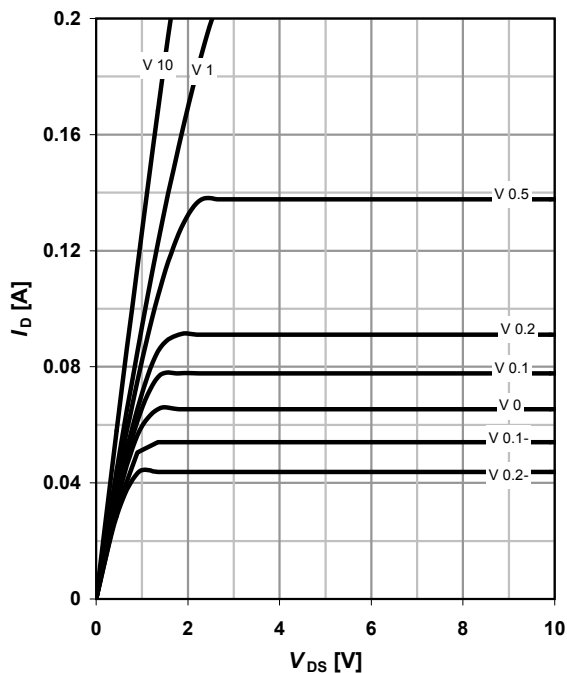
parameter: $D = t_p / T$



5 Typ. output characteristics

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

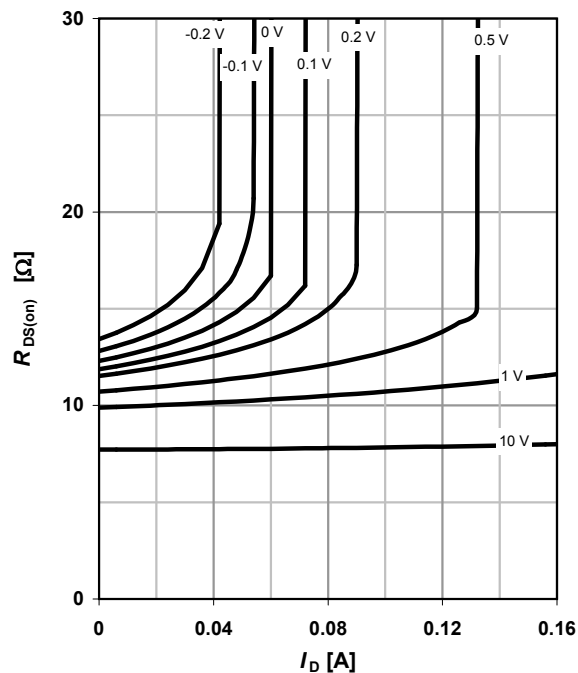
parameter: V_{GS}



6 Typ. drain-source on resistance

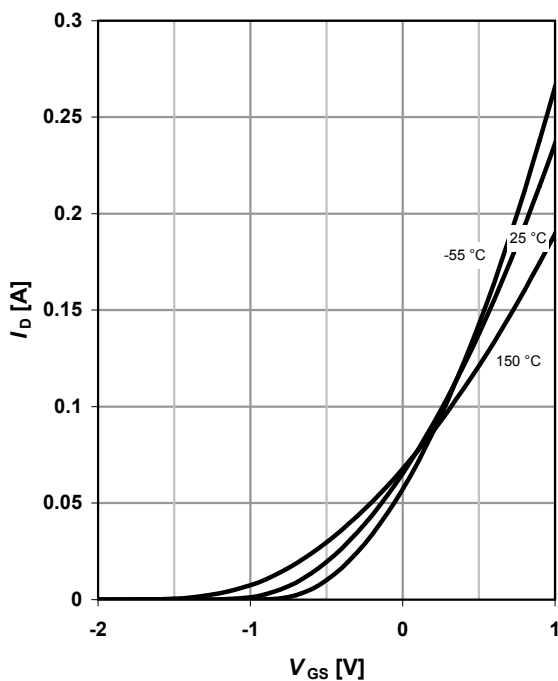
$$R_{DS(on)} = f(I_D); T_J = 25^\circ\text{C}$$

parameter: V_{GS}



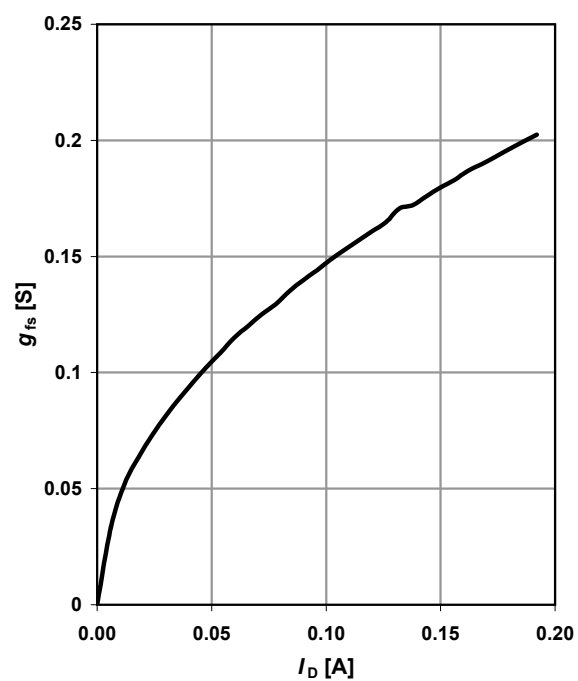
7 Typ. transfer characteristics

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



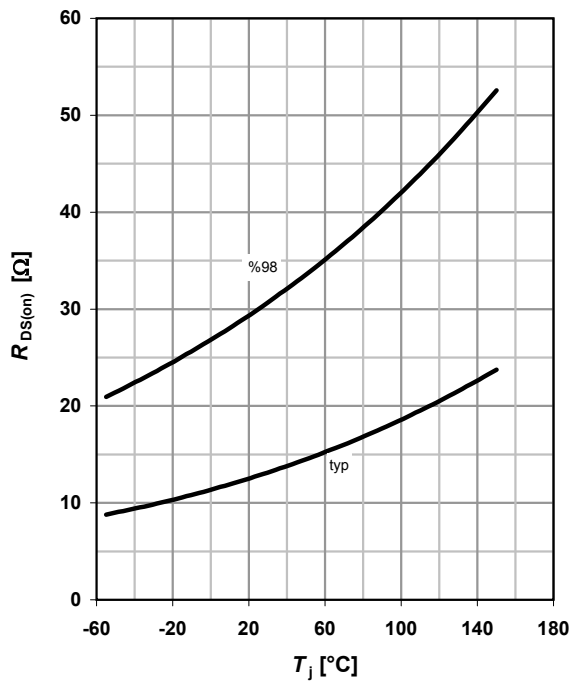
8 Typ. forward transconductance

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



9 Drain-source on-state resistance

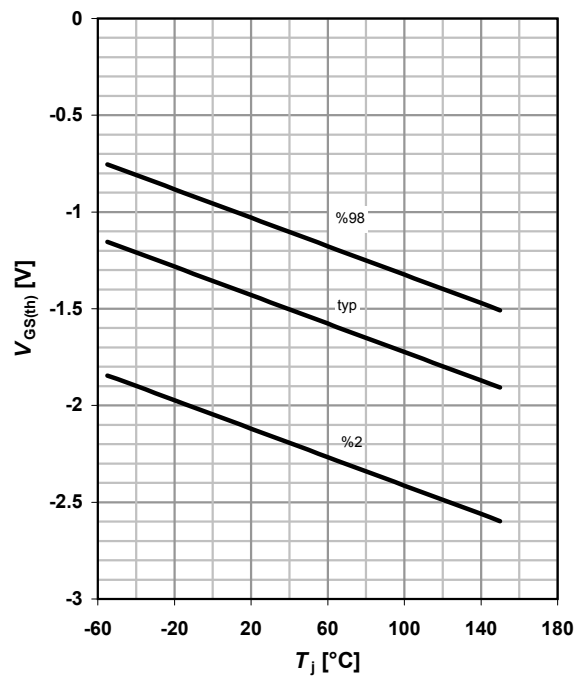
$$R_{DS(on)} = f(T_j); I_D = 0.015 \text{ A}; V_{GS} = 0 \text{ V}$$



10 Typ. gate threshold voltage

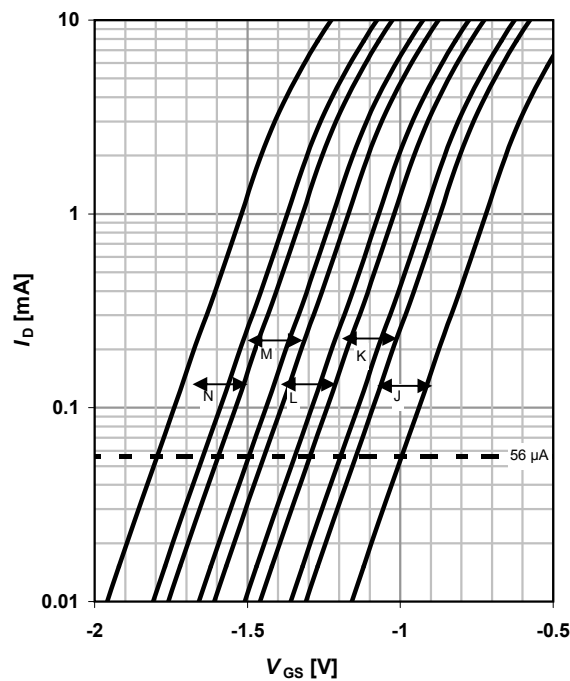
$$V_{GS(th)} = f(T_j); V_{DS} = 3 \text{ V}; I_D = 56 \text{ μA}$$

parameter: I_D



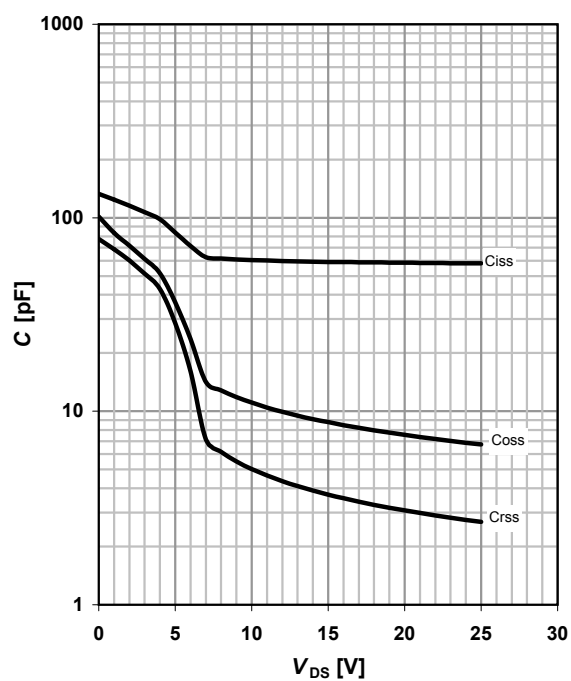
11 Threshold voltage bands

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



12 Typ. capacitances

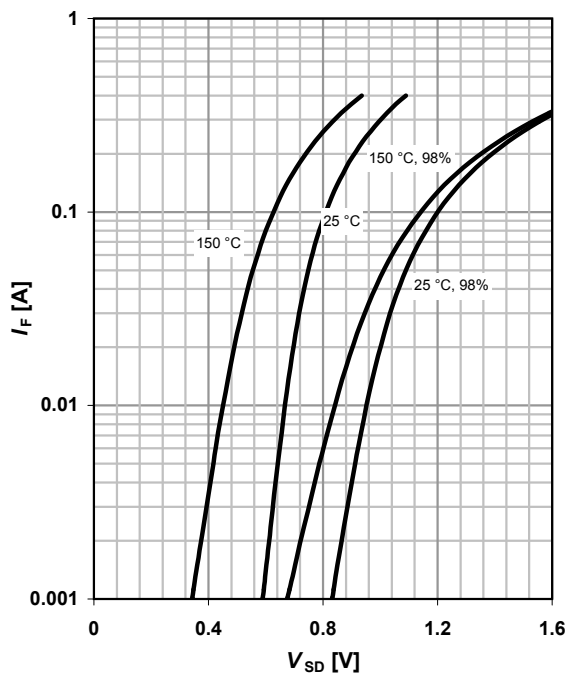
$$C = f(V_{DS}); V_{GS} = -3 \text{ V}; f = 1 \text{ MHz}$$



13 Forward characteristics of reverse diode

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

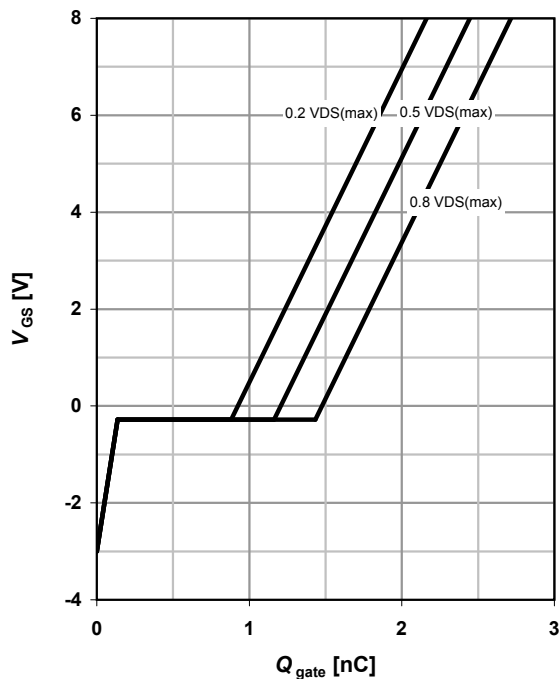
parameter: T_j



15 Typ. gate charge

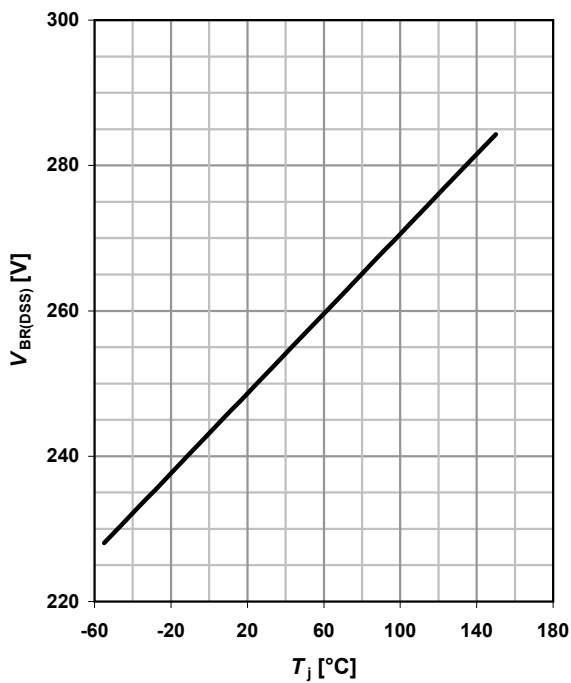
$$V_{GS} = f(Q_{gate}); I_D = 0.1 \text{ A pulsed}$$

parameter: V_{DD}



16 Drain-source breakdown voltage

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



Technical drawing of a DIN 6784 pin, showing two views: a front view (left) and a side view (right).

Front View (Left):

- Overall length: 2.9 ± 0.1
- Pin diameter: 3 ± 0.05
- Pin diameter tolerance: $+0.2$ acc. to DIN 6784
- Pin diameter tolerance: 0.4 ± 0.1
- Pin diameter tolerance: -0.05
- Pin diameter tolerance: 0.95
- Pin diameter tolerance: 1.9
- Pin diameter tolerance: 0.25
- Pin diameter tolerance: 0.20

Side View (Right):

- Overall width: 1.1 MAX.
- Pin diameter: 0.1 MAX.
- Pin diameter: 2.6 MAX.
- Pin diameter: 10° MAX.
- Pin diameter: 10° MAX.
- Pin diameter: $0.08 \dots 0.15$
- Pin diameter: $2^\circ \dots 30^\circ$
- Pin diameter: 1.3 ± 0.1

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