

SIPMOS® Small-Signal-Transistor

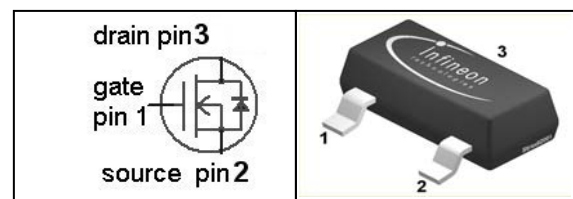
Features

- N-channel
- Enhancement mode
- Logic level
- dv/dt rated

Product Summary

V_{DS}	60	V
$R_{DS(on),max}$	3.5	Ω
I_D	0.23	A

SOT-23



Type	Package	Ordering Code	Tape and Reel Information	Marking
BSS138N	SOT-23	Q67042-S4184	E6327: 3000 pcs/reel	SKs
BSS138N	SOT-23	Q67042-S4190	E6433: 10000 pcs/reel	SKs

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_A=25\text{ °C}$	0.23	A
		$T_A=70\text{ °C}$	0.18	
Pulsed drain current	$I_{D,pulse}$	$T_A=25\text{ °C}$	0.92	
Reverse diode dv/dt	dv/dt	$I_D=0.23\text{ A}$, $V_{DS}=48\text{ V}$, $di/dt=200\text{ A}/\mu\text{s}$, $T_{j,max}=150\text{ °C}$	6	kV/ μs
Gate source voltage	V_{GS}		± 20	V
ESD sensitivity (HBM) as per MIL-STD 883			Class 1	
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	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

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

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=250\text{ }\mu\text{A}$	60	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=26\text{ }\mu\text{A}$	0.6	1.0	1.4	
Drain-source leakage current	$I_{D(off)}$	$V_{DS}=60\text{ V},$ $V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	-	0.1	μA
		$V_{DS}=60\text{ V},$ $V_{GS}=0\text{ V}, T_j=150\text{ °C}$	-	10	100	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	1	10	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=0.03\text{ A}$	-	3.3	4.0	Ω
		$V_{GS}=4.5\text{ V}, I_D=0.19\text{ A}$	-	3.5	6.0	
		$V_{GS}=10\text{ V}, I_D=0.23\text{ A}$	-	2.2	3.5	
Transconductance	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=0.18\text{ A}$	0.1	0.2	-	S

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	32	43	pF
Output capacitance	C_{oss}		-	7.2	10	
Reverse transfer capacitance	C_{rss}		-	2.8	4.2	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$ $I_D=0.23\text{ A}, R_G=6\ \Omega$	-	2.3	3.5	ns
Rise time	t_r		-	3.0	4.5	
Turn-off delay time	$t_{d(off)}$		-	6.7	10	
Fall time	t_f		-	8.2	12	

Gate Charge Characteristics

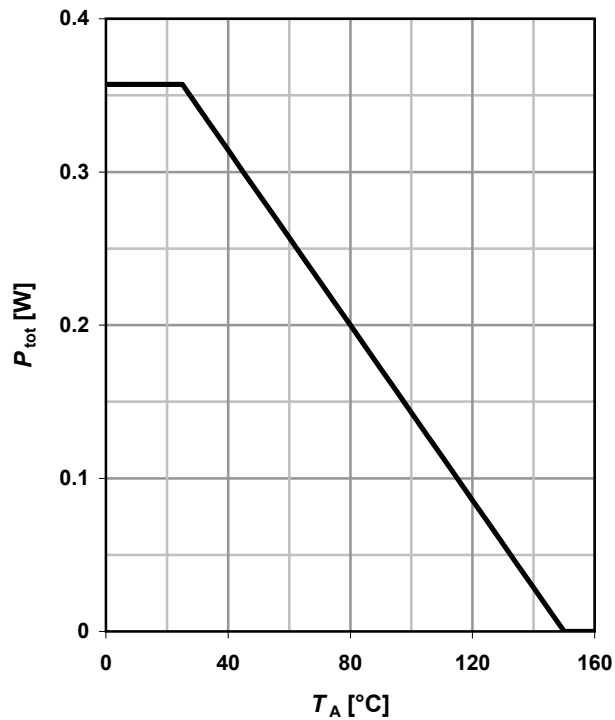
Gate to source charge	Q_{gs}	$V_{DD}=48\text{ V}, I_D=0.23\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	0.10	0.14	nC
Gate to drain charge	Q_{gd}		-	0.3	0.4	
Gate charge total	Q_g		-	1.0	1.4	
Gate plateau voltage	$V_{plateau}$		-	3.3	-	V

Reverse Diode

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

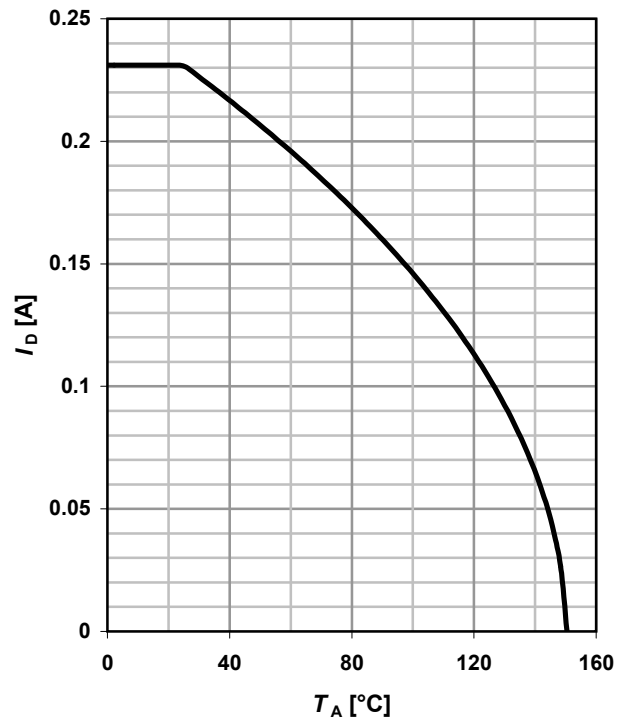
1 Power dissipation

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



2 Drain current

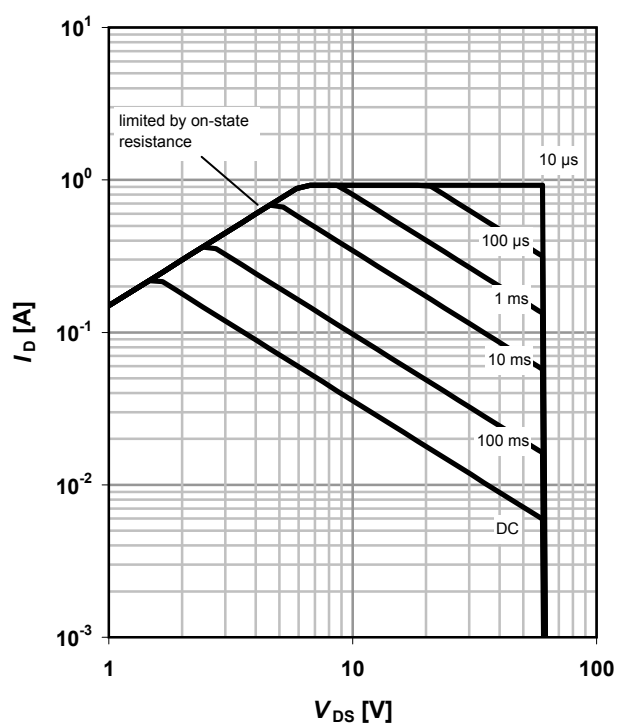
$$I_D = f(T_A); V_{GS} \geq 10 \text{ V}$$



3 Safe operation area

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

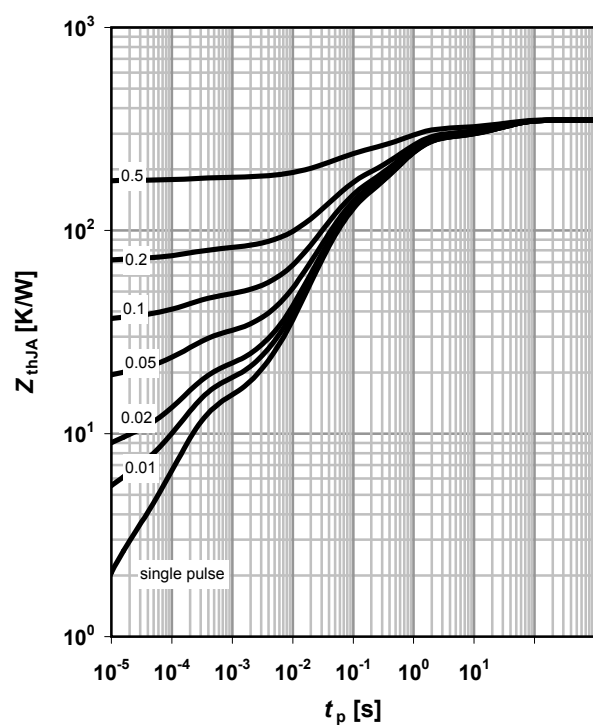
parameter: t_p



4 Max. transient thermal impedance

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

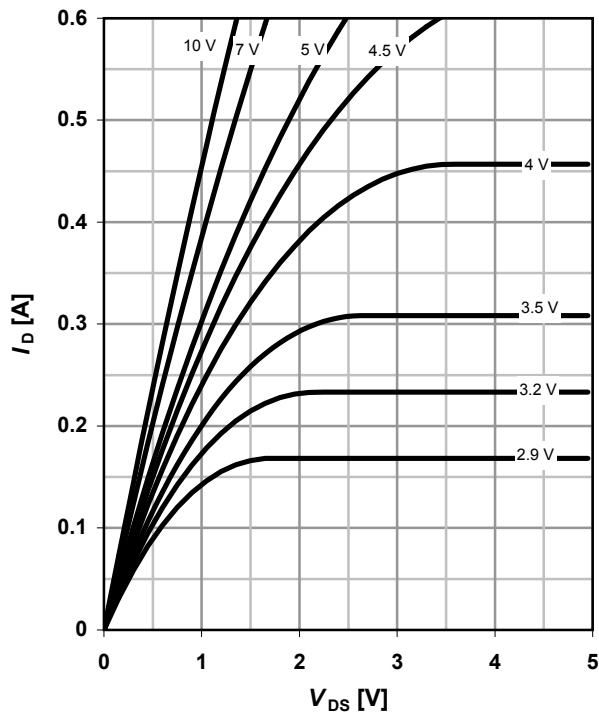
parameter: $D = t_p / T$



5 Typ. output characteristics

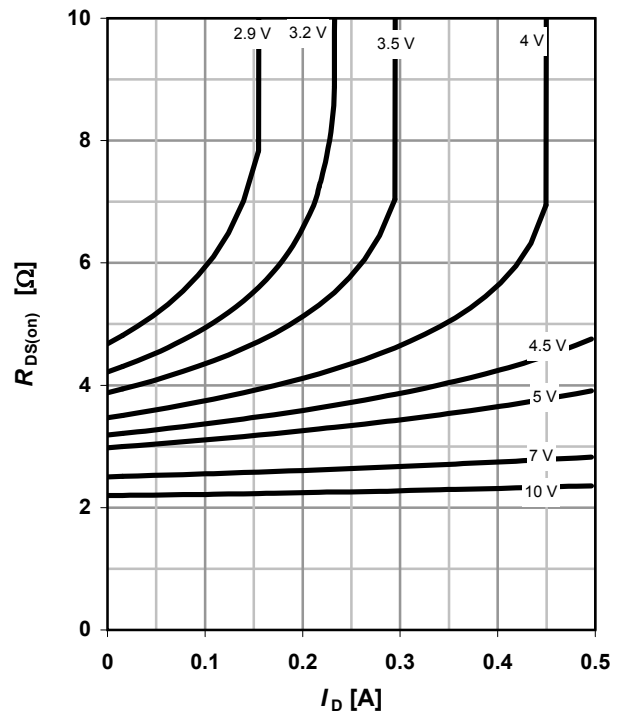
$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

parameter: V_{GS}

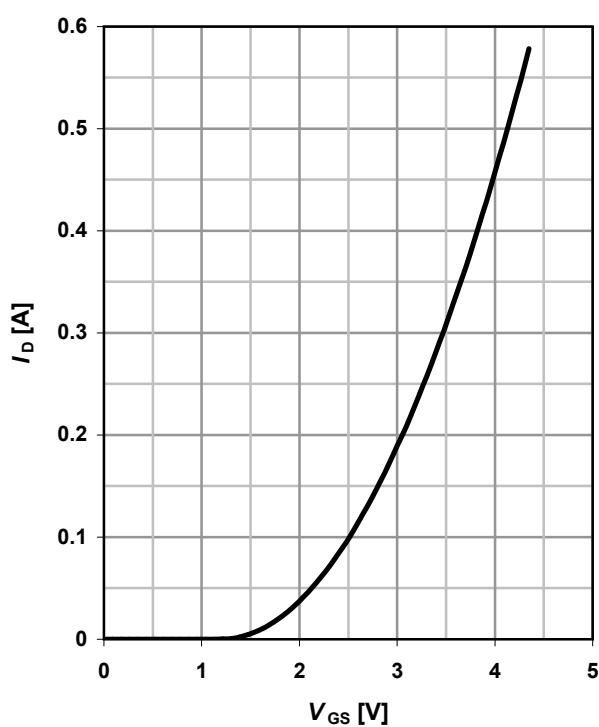

6 Typ. drain-source on resistance

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

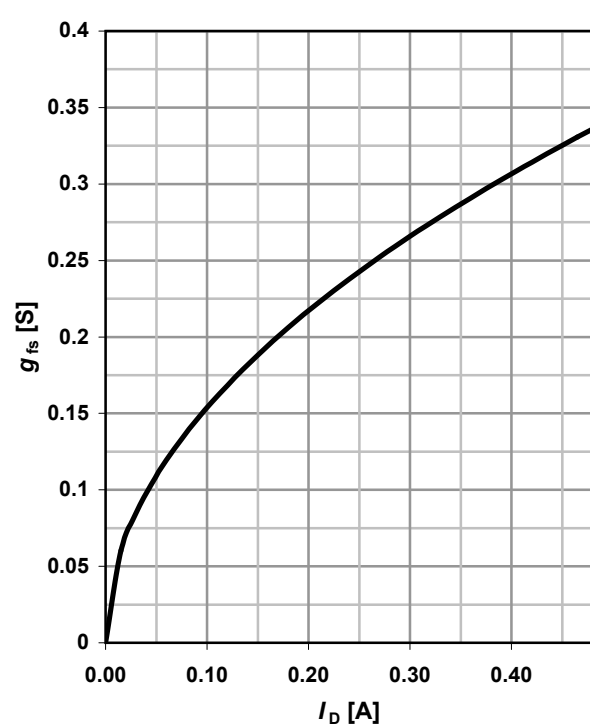
parameter: V_{GS}


7 Typ. transfer characteristics

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

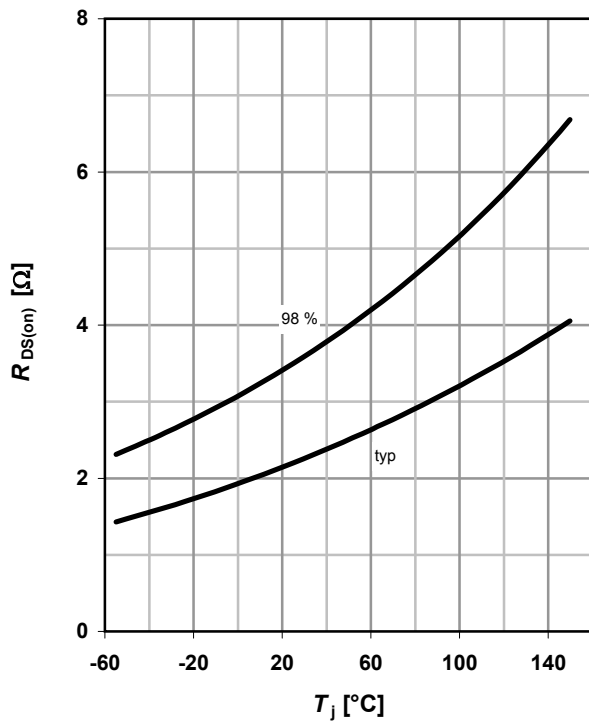

8 Typ. forward transconductance

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



9 Drain-source on-state resistance

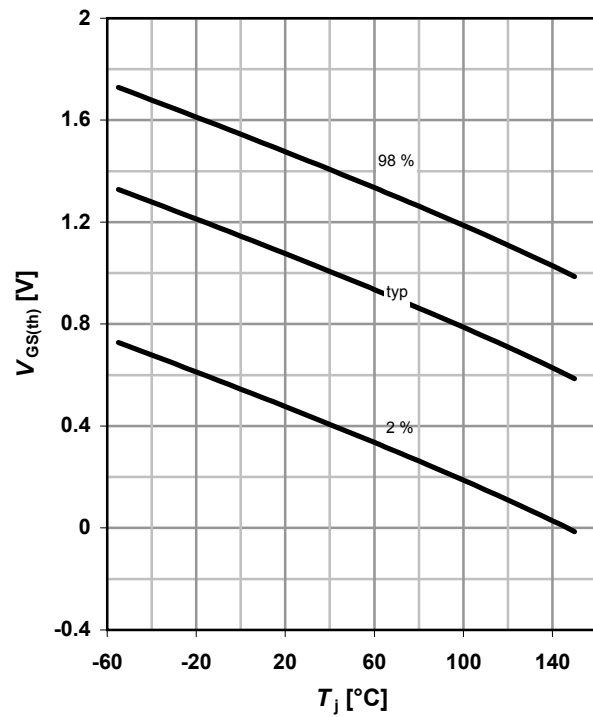
$$R_{DS(on)} = f(T_j); I_D = 0.23 \text{ A}; V_{GS} = 10 \text{ V}$$



10 Typ. gate threshold voltage

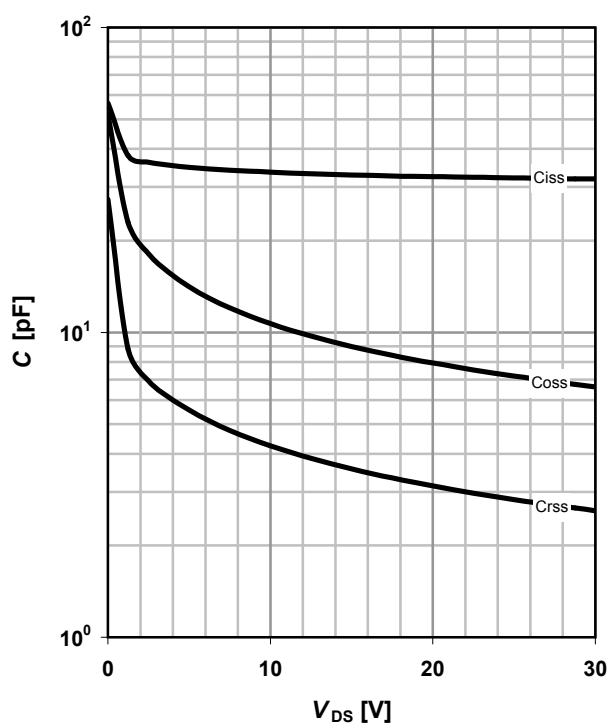
$$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}; I_D = 26 \mu\text{A}$$

parameter: I_D



11 Typ. capacitances

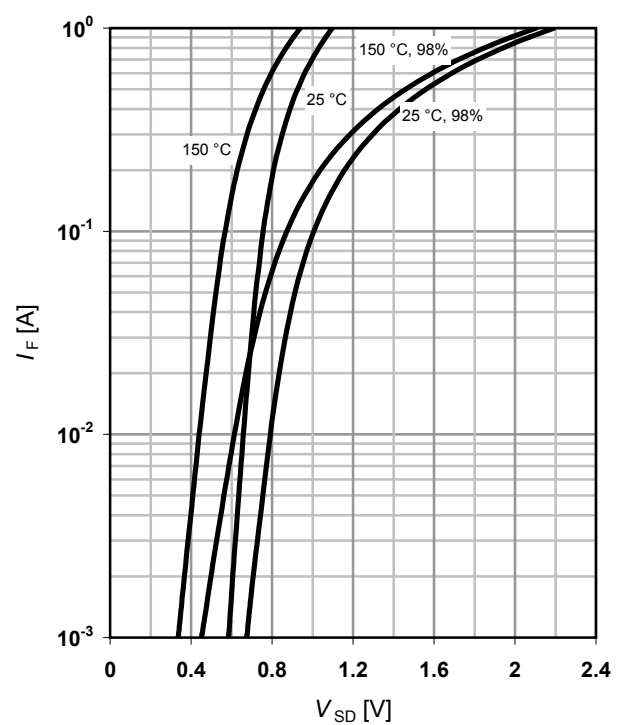
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25^\circ\text{C}$$



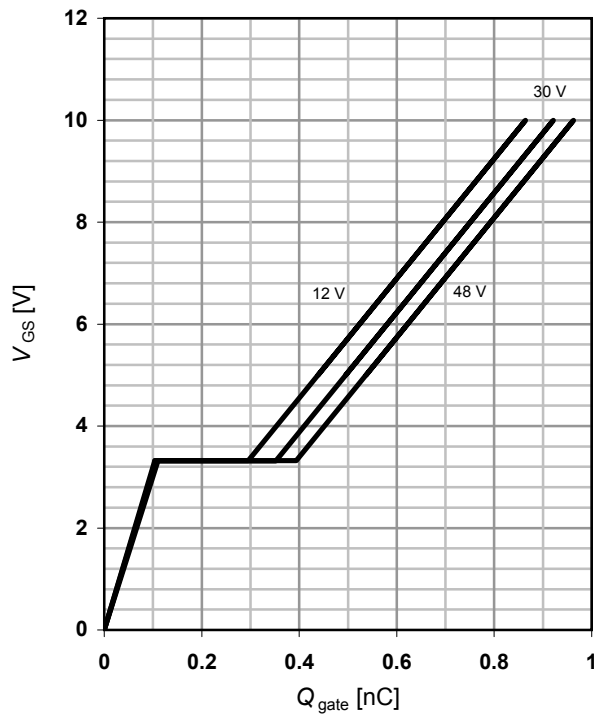
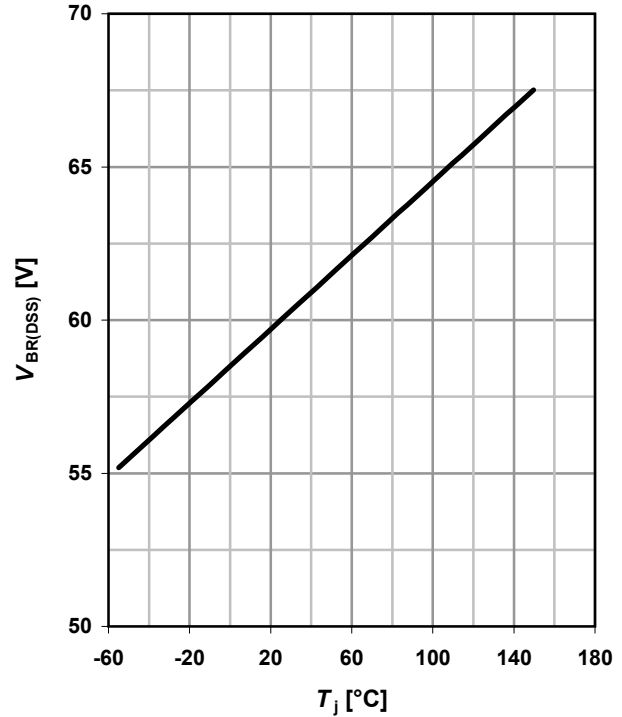
12 Forward characteristics of reverse diode

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

parameter: T_j



13 Typ. gate charge
 $V_{GS}=f(Q_{gate}); I_D=0.23\text{ A pulsed}$

parameter: V_{DD}

14 Drain-source breakdown voltage
 $V_{BR(DSS)}=f(T_j); I_D=250\text{ }\mu\text{A}$


2004-04-15

Published by
Infineon Technologies AG
Bereich Kommunikation
St.-Martin-Straße 53
D-81541 München
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