

**2N7002****OptiMOS™ Small-Signal-Transistor****Features**

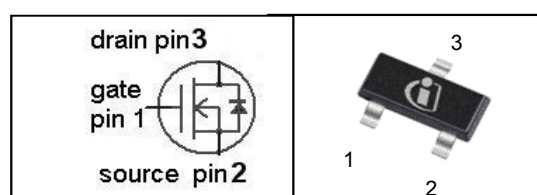
- N-channel
- Enhancement mode
- Logic level
- Avalanche rated
- fast switching
- Pb-free lead-plating; RoHS compliant
- Halogen-free according to IEC61249-2-21



Halogen-Free

Product Summary

V_{DS}	60	V
$R_{DS(on),max}$	$V_{GS}=10\text{ V}$	3 Ω
	$V_{GS}=4.5\text{ V}$	4
I_D	0.3	A

PG-SOT23

Type	Package	Tape and Reel Information	Marking	HalogenFree	Packing
2N7002	PG-SOT-23	H6327: 3000 pcs/reel	72s	Yes	Non Dry

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_A=25\text{ °C}$	0.30	A
		$T_A=70\text{ °C}$	0.24	
Pulsed drain current	$I_{D,pulse}$	$T_A=25\text{ °C}$	1.2	
Avalanche energy, single pulse	E_{AS}	$I_D=0.3\text{ A}$, $R_{GS}=25\text{ }\Omega$	1.3	mJ
Reverse diode dv/dt	dv/dt	$I_D=0.3\text{ A}$, $V_{DS}=48\text{ V}$, $di/dt=200\text{ A}/\mu\text{s}$, $T_{j,max}=150\text{ °C}$	6	kV/ μs
Gate source voltage	V_{GS}		± 20	V
ESD class		JESD22-A114 (HBM)	class 0 (<250V)	
Power dissipation	$P_{tot}^{(2)}$	$T_A=25\text{ °C}$	0.5	W
Operating and storage temperature	T_j , T_{stg}		-55 ... 150	°C
IEC climatic category; DIN IEC 68-1			55/150/56	

⁽¹⁾ J-STD20 and JESD22

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - minimal footprint ⁽²⁾	R_{thJA}		-	-	250	K/W
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Electrical characteristics, at $T_j=25\text{ }^{\circ}\text{C}$, 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	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\text{ }\mu\text{A}$	1.5	2.1	2.5	
Drain-source leakage current	$I_{D(off)}$	$V_{DS}=60\text{ V},$ $V_{GS}=0\text{ V}, T_j=25\text{ }^{\circ}\text{C}$	-	-	0.1	μA
		$V_{DS}=60\text{ V},$ $V_{GS}=0\text{ V}, T_j=150\text{ }^{\circ}\text{C}$	-	-	5	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	1	10	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=0.25\text{ A}$	-	2.0	4	Ω
		$V_{GS}=10\text{ V}, I_D=0.5\text{ A}$	-	1.6	3	
Transconductance	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=0.24\text{ A}$	0.2	0.36	-	S

⁽²⁾ Performed on a 40x40mm² FR4 PCB with both sided Cu sense-force traces, each 1mm wide, 70 μm thick and 20mm long.



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Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	13	20	pF
Output capacitance	C_{oss}		-	4.1	6	
Reverse transfer capacitance	C_{rss}		-	2.0	3	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$ $I_D=0.5\text{ A}, R_G=6\ \Omega$	-	3.0	4.5	ns
Rise time	t_r		-	3.3	5	
Turn-off delay time	$t_{d(off)}$		-	5.5	9	
Fall time	t_f		-	3.1	5	

Gate Charge Characteristics

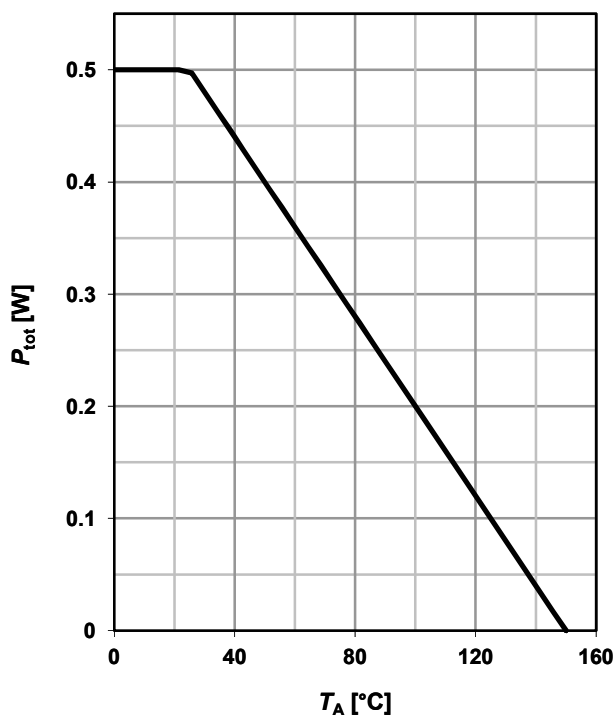
Gate to source charge	Q_{gs}	$V_{DD}=48\text{ V}, I_D=0.5\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	0.05	0.1	nC
Gate to drain charge	Q_{gd}		-	0.2	0.4	
Gate charge total	Q_g		-	0.4	0.6	
Gate plateau voltage	$V_{plateau}$		-	4.0	-	V

Reverse Diode

Diode continuous forward current	I_S	$T_A=25\text{ °C}$	-	-	0.3	A
Diode pulse current	$I_{S,pulse}$		-	-	1.2	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=0.5\text{ A},$ $T_J=25\text{ °C}$	-	0.96	1.2	V
Reverse recovery time	t_{rr}	$V_R=30\text{ V}, I_F=0.5\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	8.5	13	ns
Reverse recovery charge	Q_{rr}		-	2.4	4	nC

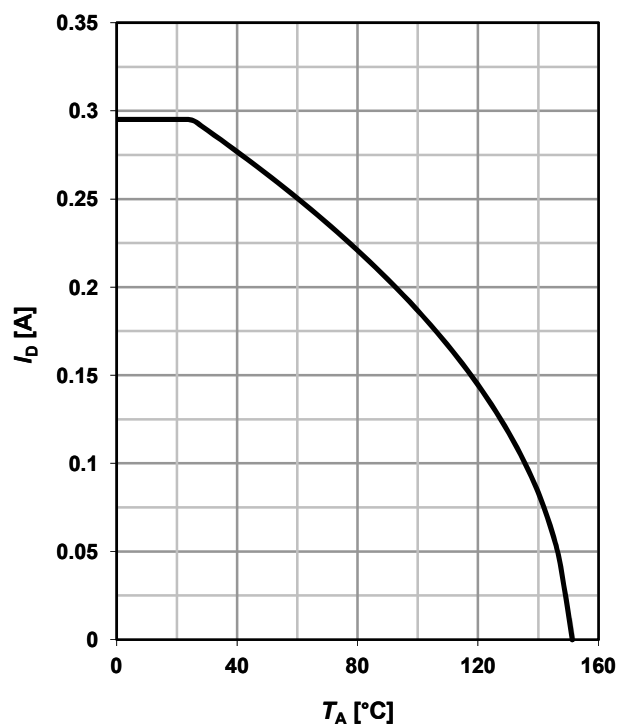
1 Power dissipation

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



2 Drain current

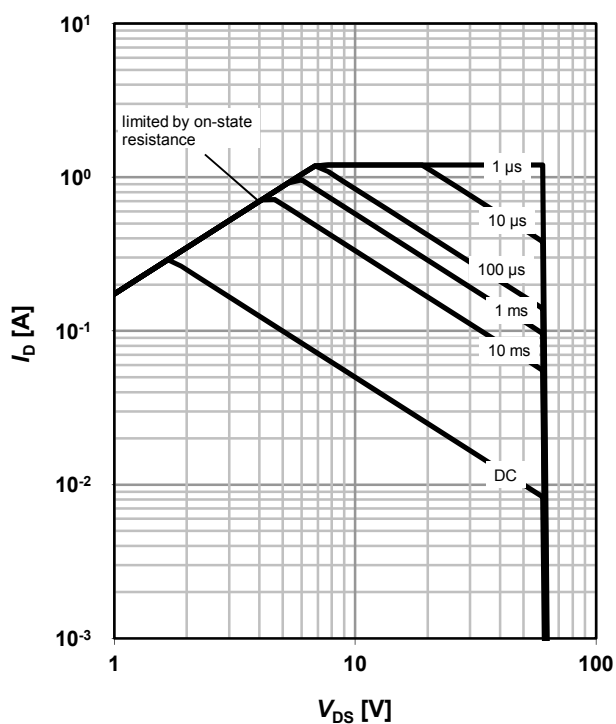
$$I_D = f(T_A); V_{GS} \geq 10 \text{ V}$$



3 Safe operating area

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

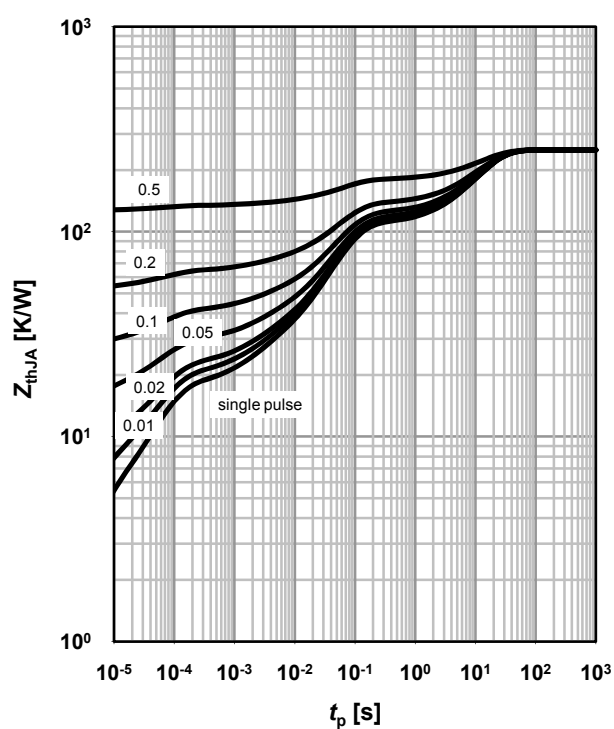
parameter: t_p

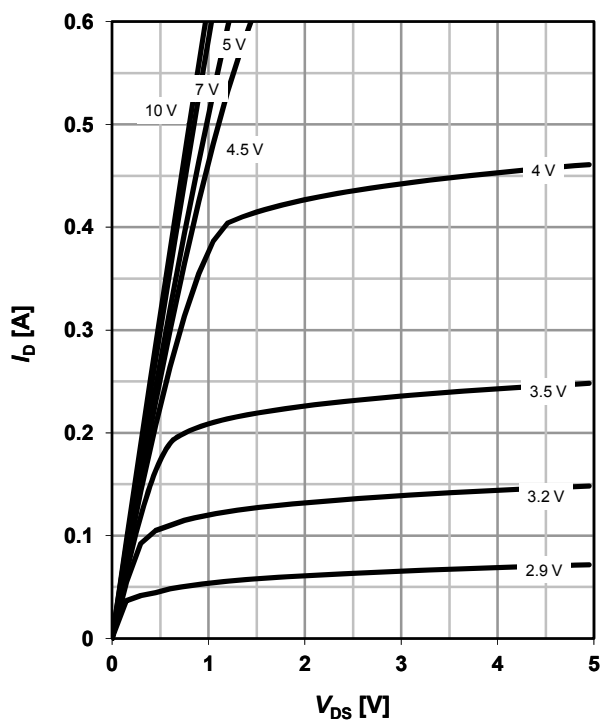
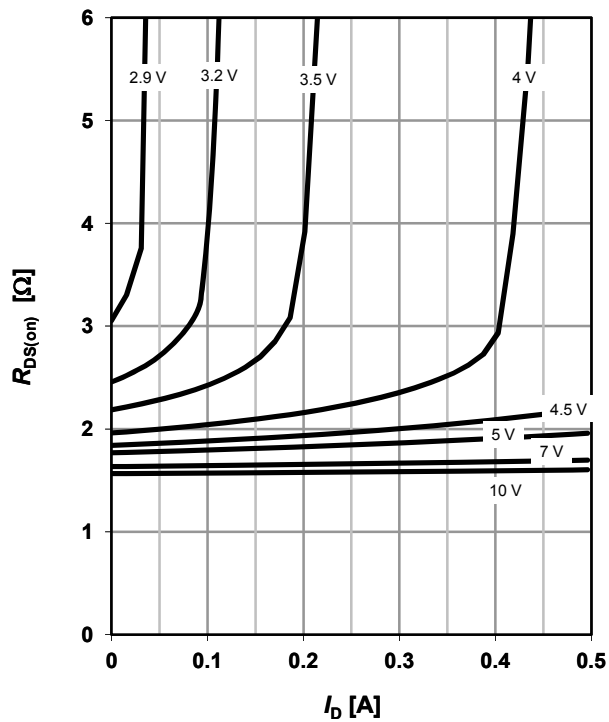
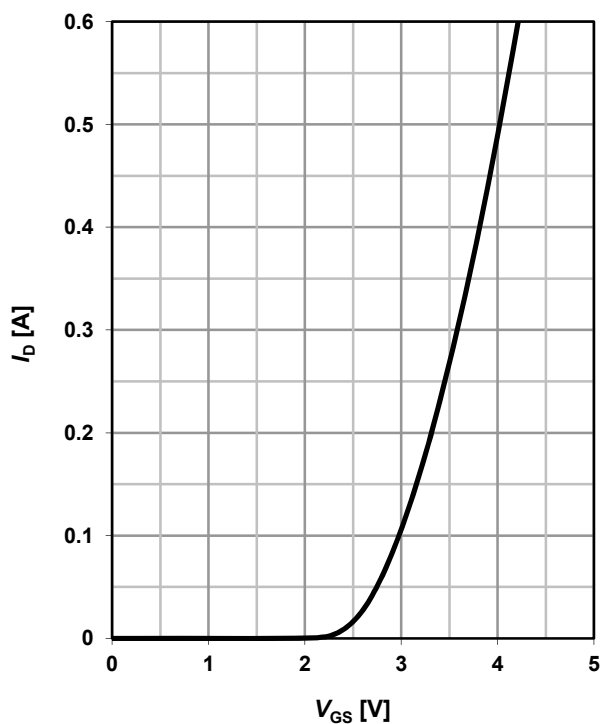
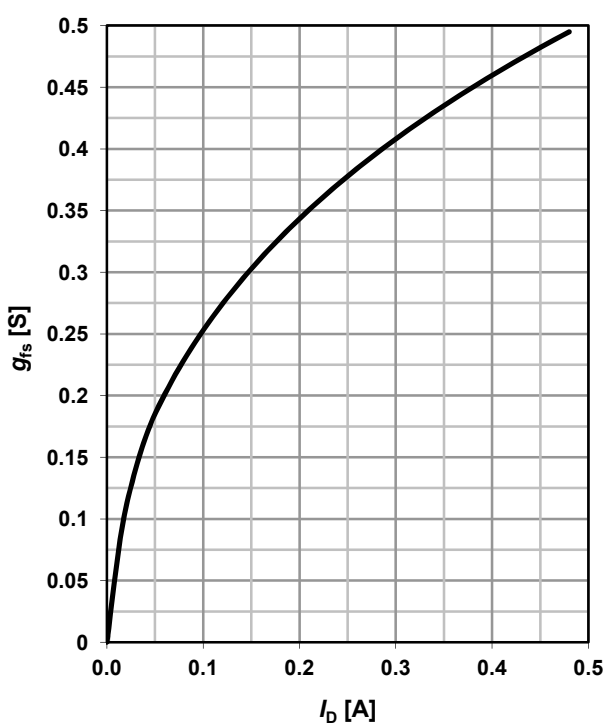


4 Max. transient thermal impedance

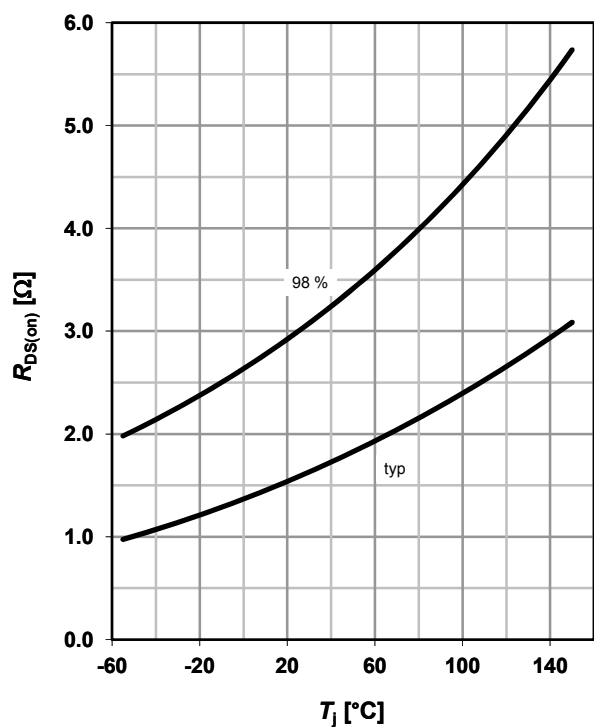
$$Z_{\text{thJA}} = f(t_p)$$

parameter: $D = t_p / T$



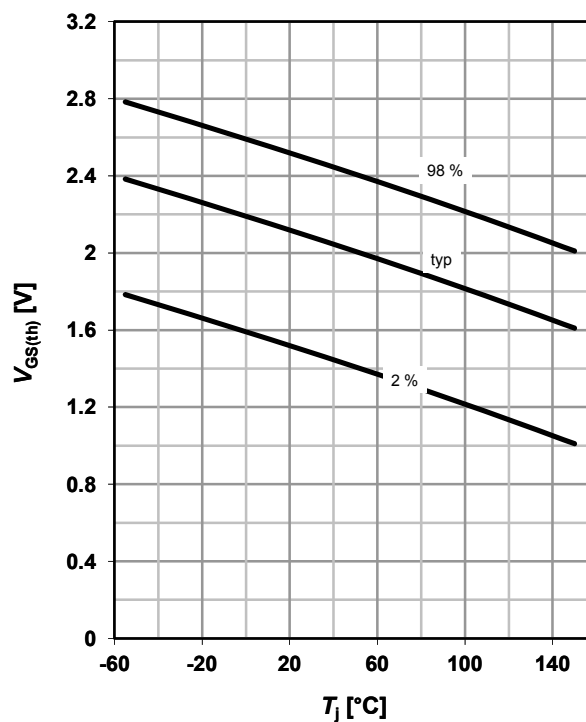
5 Typ. output characteristics $I_D = f(V_{DS}); T_j = 25^\circ\text{C}$ parameter: V_{GS} **6 Typ. drain-source on resistance** $R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}$ parameter: V_{GS} **7 Typ. transfer characteristics** $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$ **8 Typ. forward transconductance** $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$ 

9 Drain-source on-state resistance

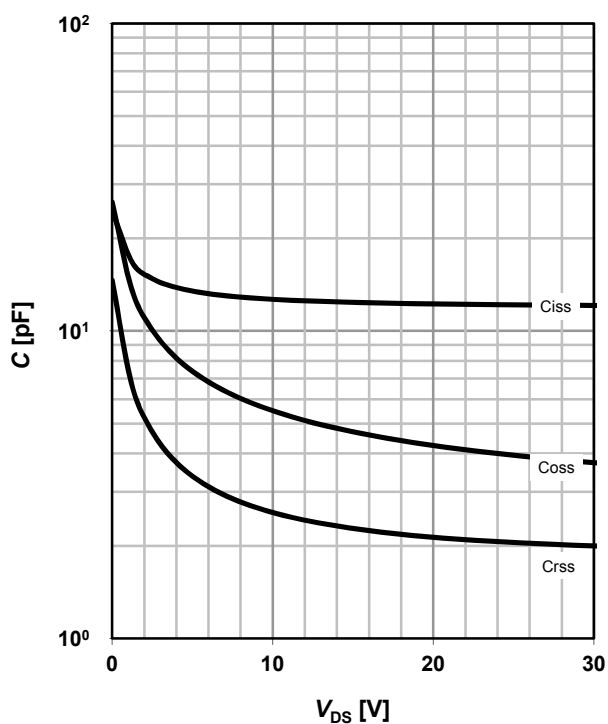
 $R_{DS(on)} = f(T_j); I_D = 0.3 \text{ A}; V_{GS} = 10 \text{ V}$


10 Typ. gate threshold voltage

 $V_{GS(th)} = f(T_j); V_{DS} = V_{GS}; I_D = 250 \text{ μA}$

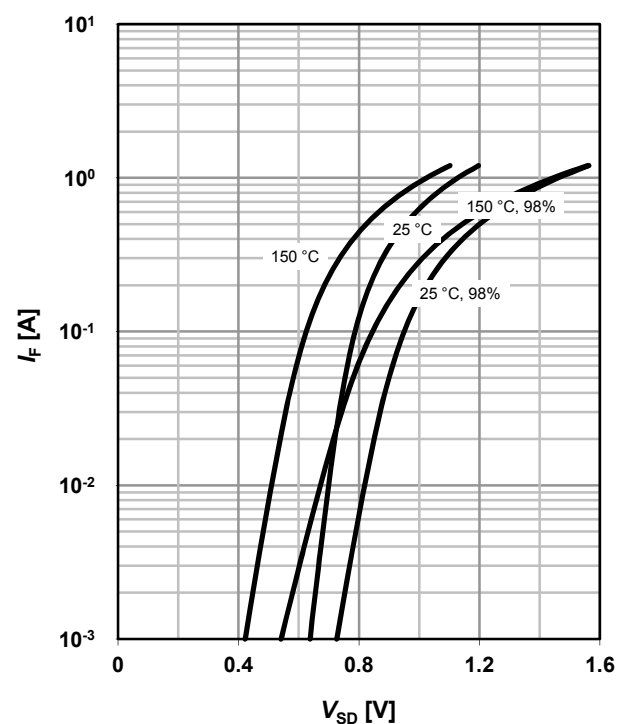
parameter: I_D


11 Typ. capacitances

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


12 Forward characteristics of reverse diode

 $I_F = f(V_{SD})$

parameter: T_j


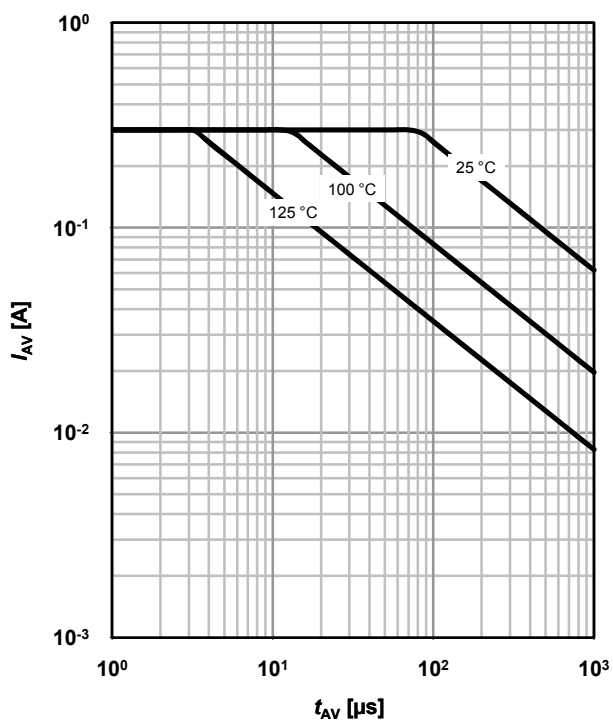


2N7002

13 Avalanche characteristics

$$I_{AS} = f(t_{AV}); R_{GS} = 25 \Omega$$

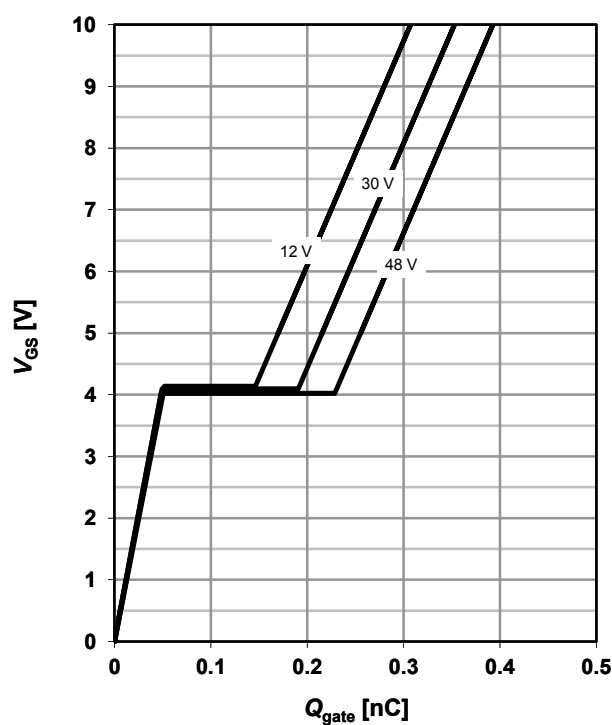
parameter: $T_{j(\text{start})}$



14 Typ. gate charge

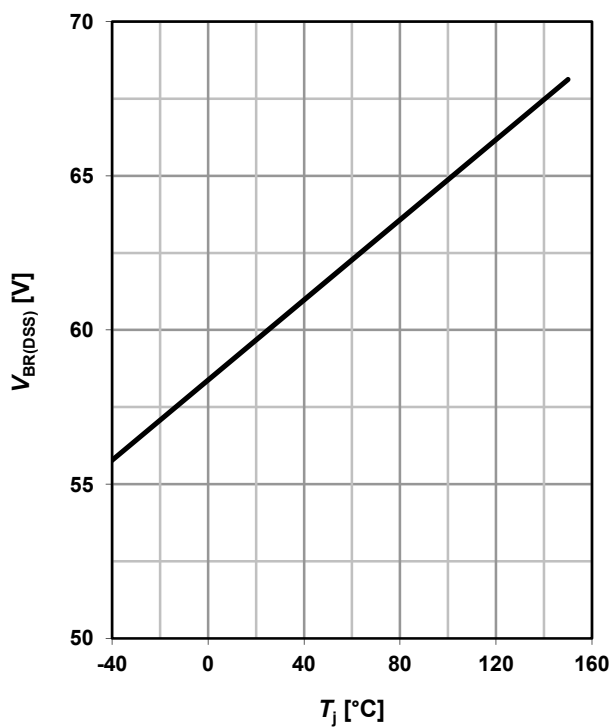
$$V_{GS} = f(Q_{gate}); I_D = 0.5 \text{ A pulsed}$$

parameter: V_{DD}

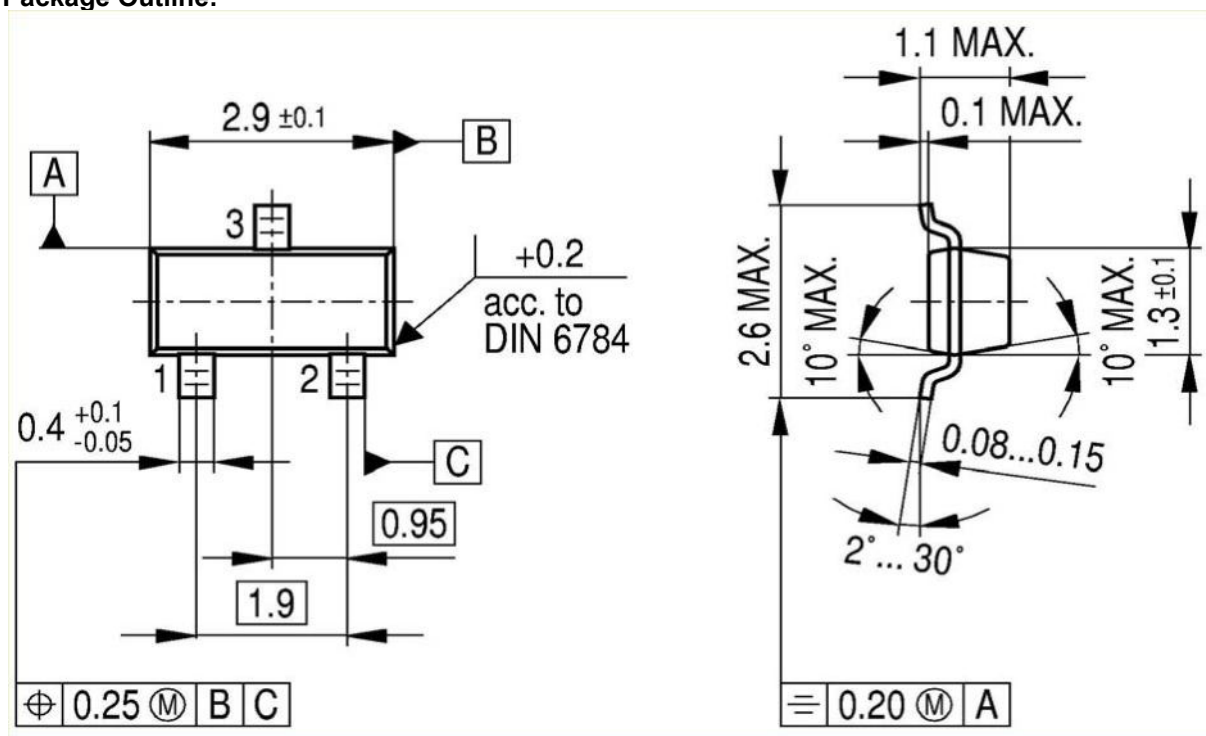


15 Drain-source breakdown voltage

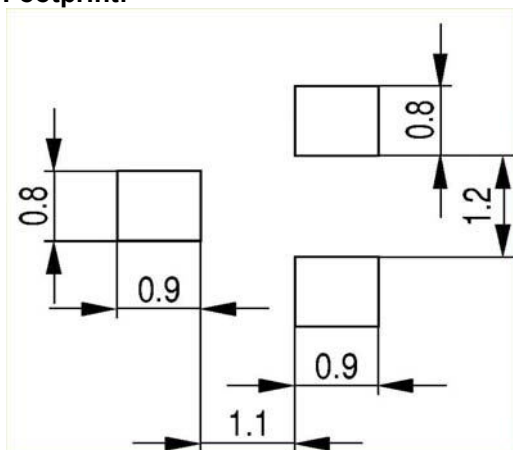
$$V_{BR(DSS)} = f(T_j); I_D = 250 \mu A$$



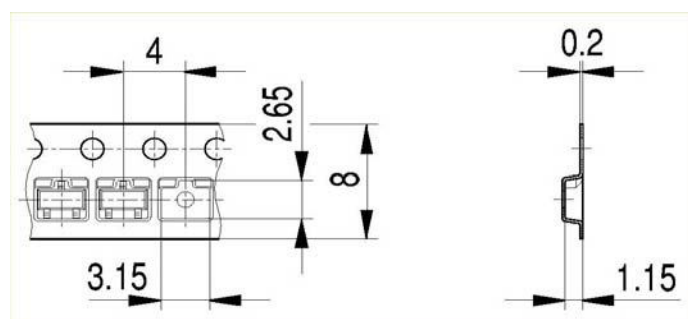
Package Outline:



Footprint:



Packing:



Dimensions in mm



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