

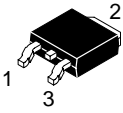
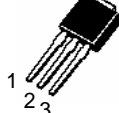
**Power-Transistor**

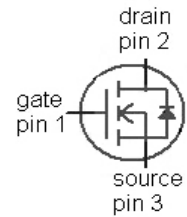
**Features**

- For fast switching converters and sync. rectification
- N-channel enhancement - normal level
- 175 °C operating temperature
- Avalanche rated
- Pb-free lead plating, RoHS compliant

**Product Summary**

$V_{DS}$	60	V
$R_{DS(on),max}$ SMDversion	15	mΩ
$I_D$	50	A

Type	50N06	50N06
		
<b>Package</b>	TO-251	TO-252
<b>Marking</b>	50N06	50N06



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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}^1)$	50	A
Pulsed drain current	$I_{D,pulse}$	$T_C=25\text{ °C}^2)$	400	
Avalanche energy, single pulse	$E_{AS}$	$I_D=50\text{ A}, R_{GS}=25\text{ }\Omega$	810	mJ
Reverse diode $dv/dt$	$dv/dt$	$I_D=50\text{ A}, V_{DS}=48\text{ V},$ $di/dt\cong 100\text{ A}/\mu\text{s},$ $T_{j,max}=175\text{ °C}$	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	300	W
Operating and storage temperature	$T_j, T_{stg}$		-55 ... 175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC}=0.5$  the chip is able to carry 160A

<sup>2)</sup> See figure 3



Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
<b>Thermal characteristics</b>						
Thermal resistance, junction - case	$R_{thJC}$		-	-	0.5	K/W
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>3)</sup>	-	-	40	

Electrical characteristics, at  $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified

**Static characteristics**

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_{\bar{D}}=250\mu\text{A}$	60	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_{\bar{D}}=250\ \mu\text{A}$	2.1	3	4	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}^j=48\text{ V}, V_{GS}=0\text{ V}, T=25\text{ }^\circ\text{C}$	-	0.01	1	$\mu\text{A}$
Gate-source leakage current	$I_{GSS}$	$V_{GS}=\pm 20\text{ V}, V_{DS}=0\text{ V}$	-		$\pm 50$	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=50\text{ A}$			15	m $\Omega$
Gate resistance	$R_G$		-	1.9	-	$\Omega$
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=50\text{ A}$	74	148	-	S

<sup>3)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.



Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=30\text{ V},$ $f=1\text{ MHz}$	-	4600	6100	pF
Output capacitance	$C_{oss}$		-	1500	2000	
Reverse transfer capacitance	$C_{rss}$		-	350	525	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$ $I_D=50\text{ A}, R_{\theta G}=2.2\ \Omega$	-	21	32	ns
Rise time	$t_r$		-	31	47	
Turn-off delay time	$t_{d(off)}$		-	59	88	
Fall time	$t_f$		-	30	45	

**Gate Charge Characteristics<sup>4)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=30\text{ V}, I_{\bar{D}}=50\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	24	32	nC
Gate charge at threshold	$Q_{g(th)}$		-	9.7	13	
Gate to drain charge	$Q_{gd}$		-	51	76	
Switching charge	$Q_{sw}$		-	65	95	
Gate charge total	$Q_g$		-	126	167	
Gate plateau voltage	$V_{plateau}$		-	5.2	-	V
Output charge	$Q_{oss}$	$V_{DD}=30\text{ V}, V_{GS}=0\text{ V}$	-	47	62	

**Reverse Diode**

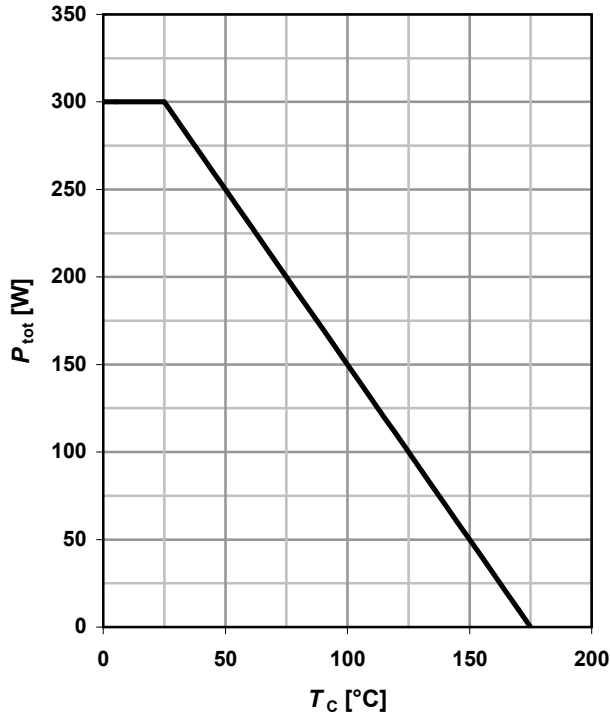
Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	100	A
Diode pulse current	$I_{S,pulse}$		-	-	400	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_{\bar{F}}=50\text{ A},$ $T_J=25\text{ }^\circ\text{C}$	-	0.93	1.3	V
Reverse recovery time	$t_{rr}$	$V_R=30\text{ V}, I_F=I_S,$ $di_F/dt=50\text{ A}/\mu\text{s}$	-	60	75	ns
Reverse recovery charge	$Q_{rr}$		-	130	160	nC

<sup>4)</sup> See figure 16 for gate charge parameter definition



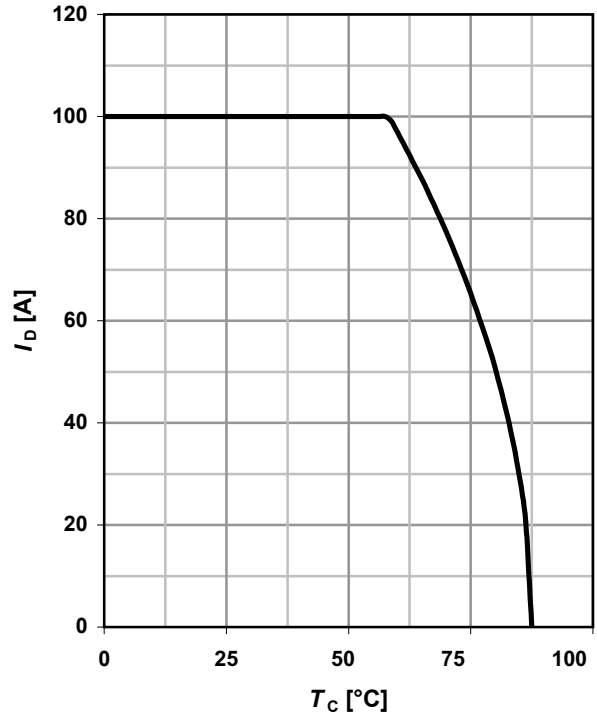
**1 Power dissipation**

$P_{tot}=f(T_C); V_{GS} \geq 6\text{ V}$



**2 Drain current**

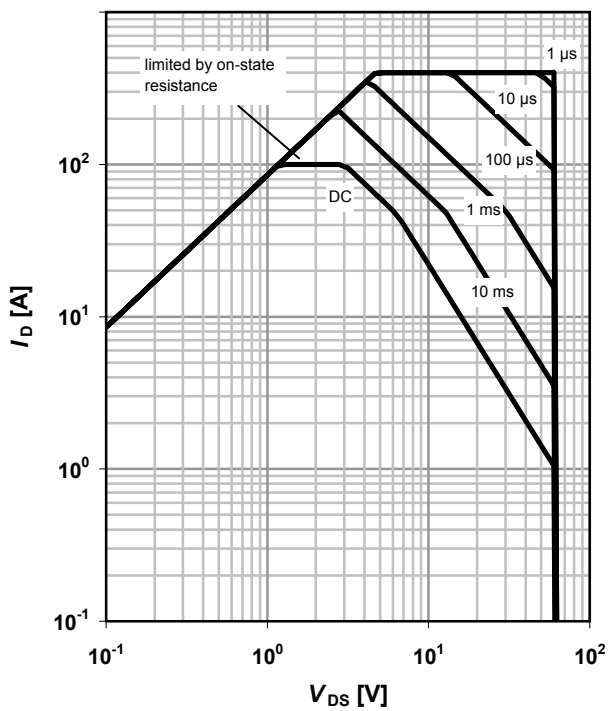
$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



**3 Safe operating area**

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

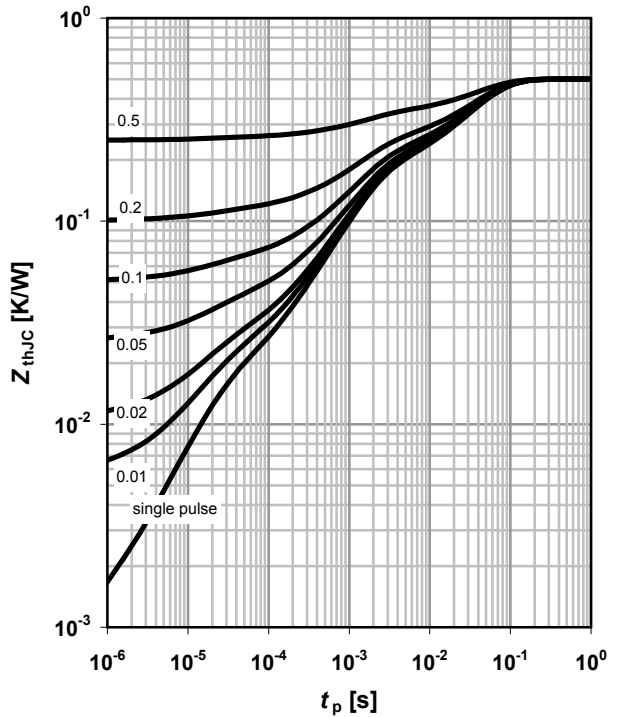
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC}=f(t_p)$

parameter:  $D=t_p/T$

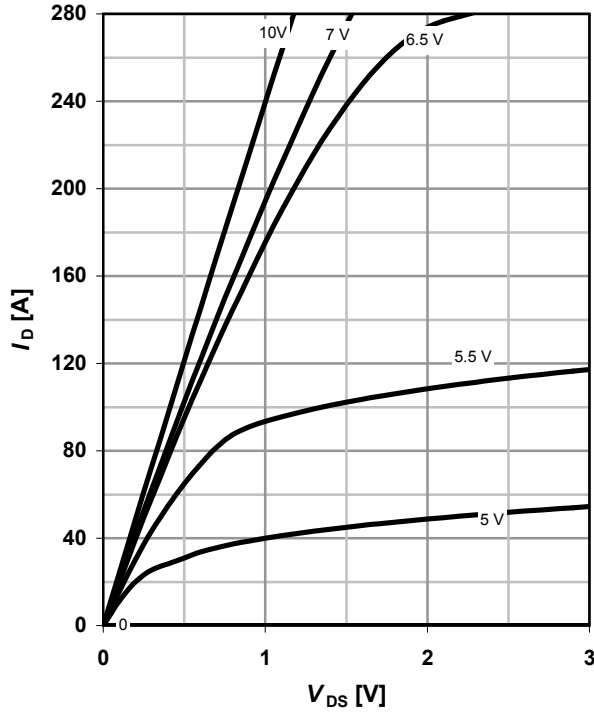




**5 Typ. output characteristics**

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

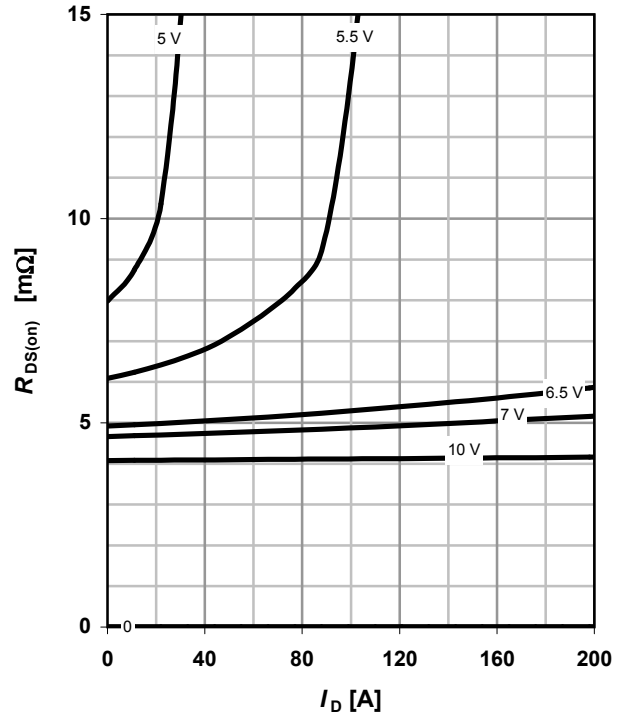
parameter:  $V_{GS}$



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

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

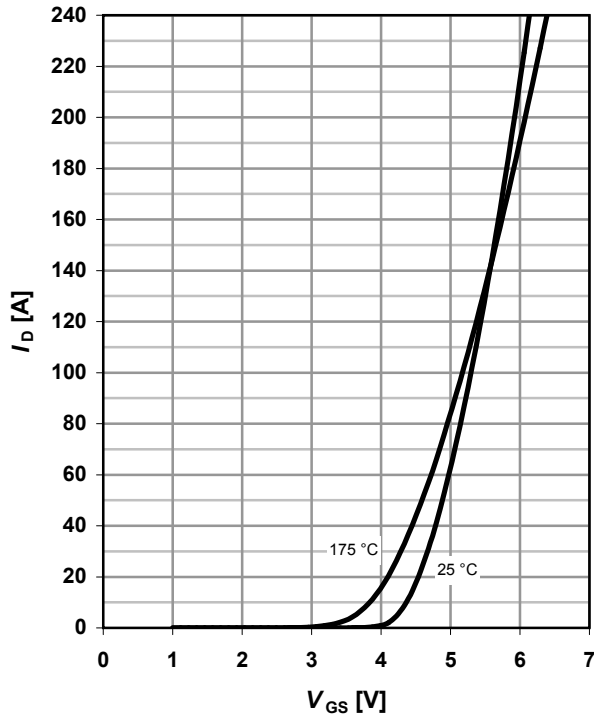
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

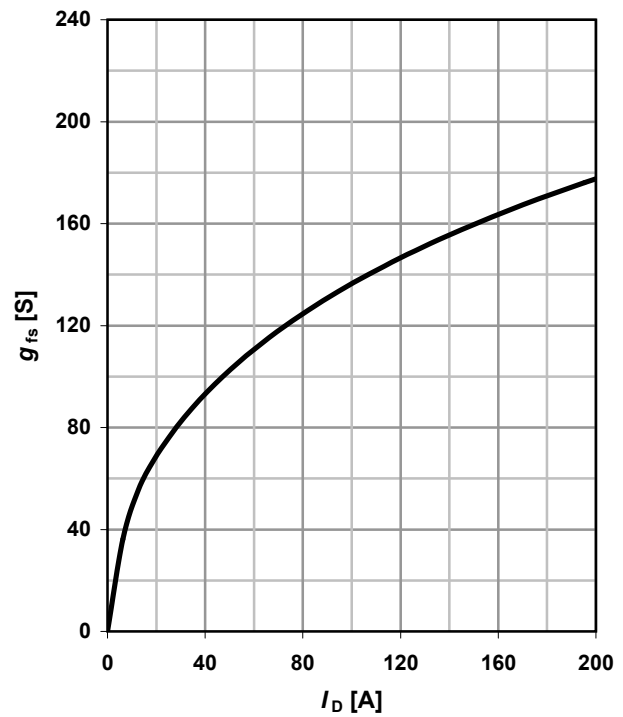
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter:  $T_j$



**8 Typ. forward transconductance**

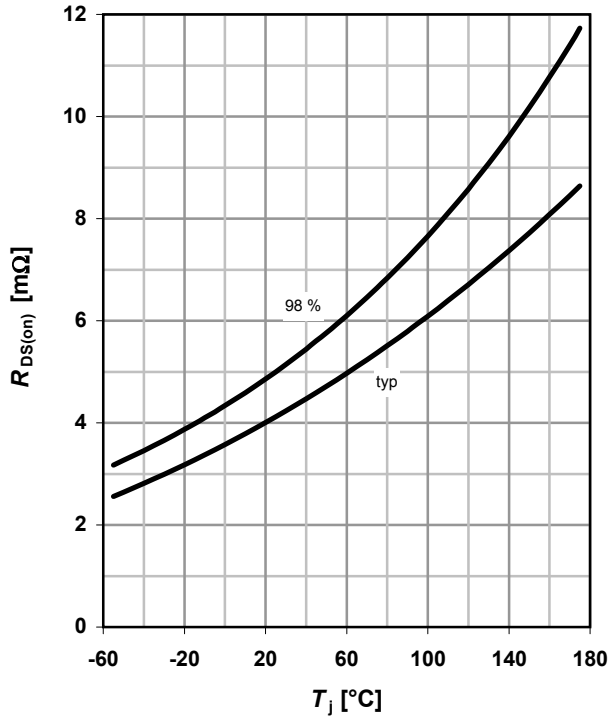
$g_{fs} = f(I_D); T_j = 25\text{ }^\circ\text{C}$





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

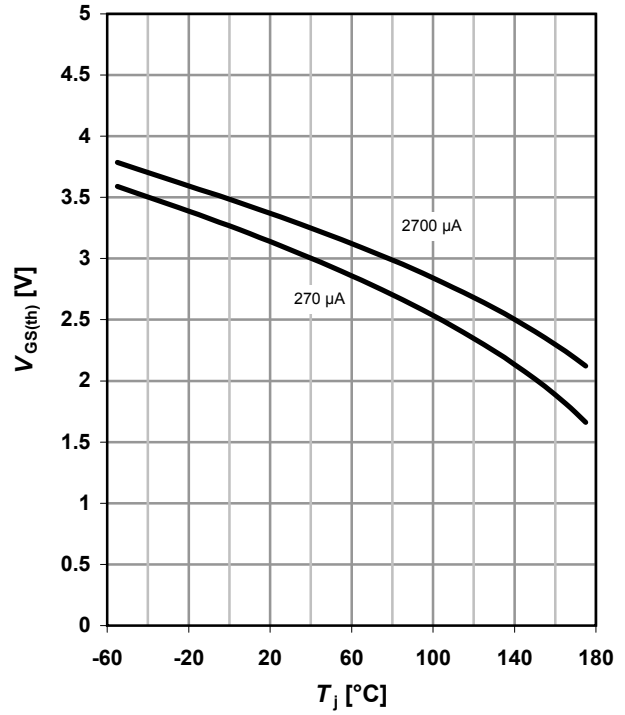
$R_{DS(on)}=f(T_j); I_D=50\text{ A}; V_{GS}=10\text{ V}$



**10 Typ. gate threshold voltage**

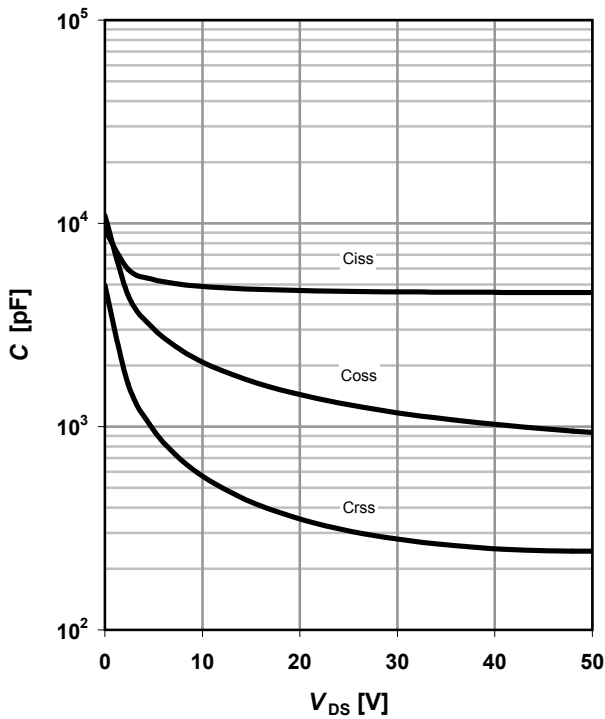
$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}$

parameter:  $I_D$



**11 Typ. capacitances**

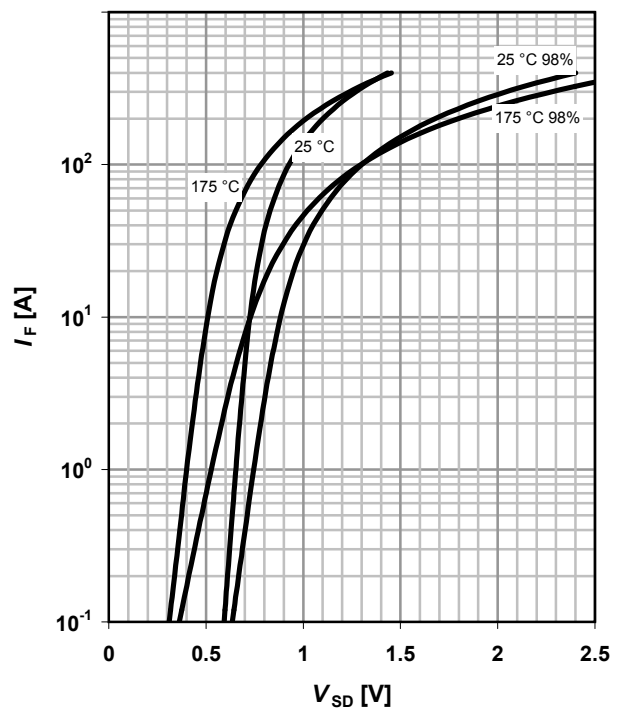
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$



**12 Forward characteristics of reverse diode**

$I_F=f(V_{SD})$

parameter:  $T_j$

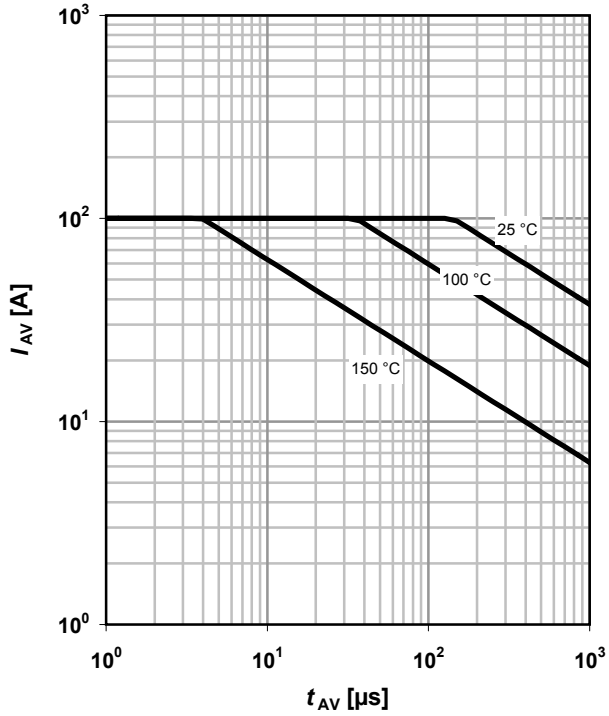




13 Avalanche characteristics

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

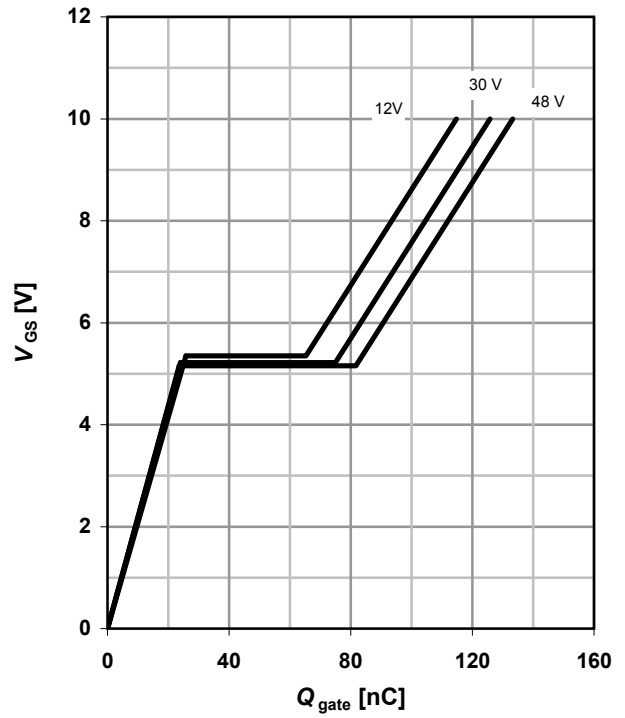
parameter:  $T_{j(start)}$



14 Typ. gate charge

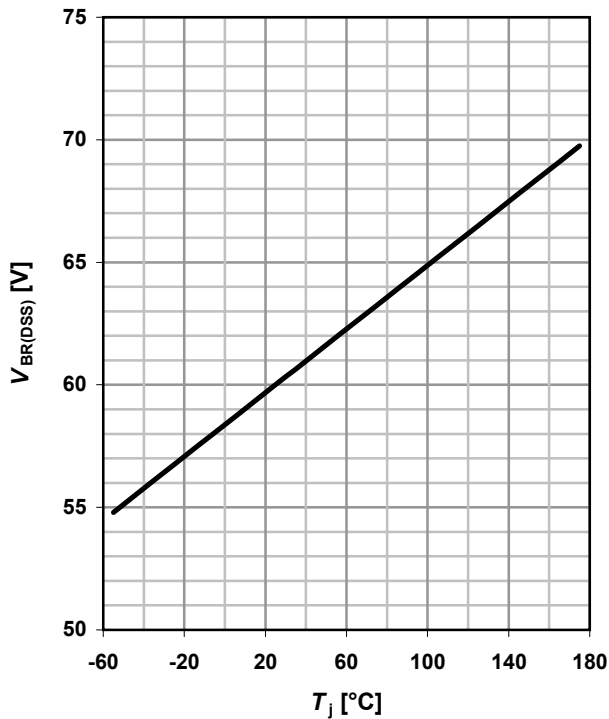
$V_{GS}=f(Q_{gate}); I_D=50 \text{ A pulsed}$

parameter:  $V_{DD}$

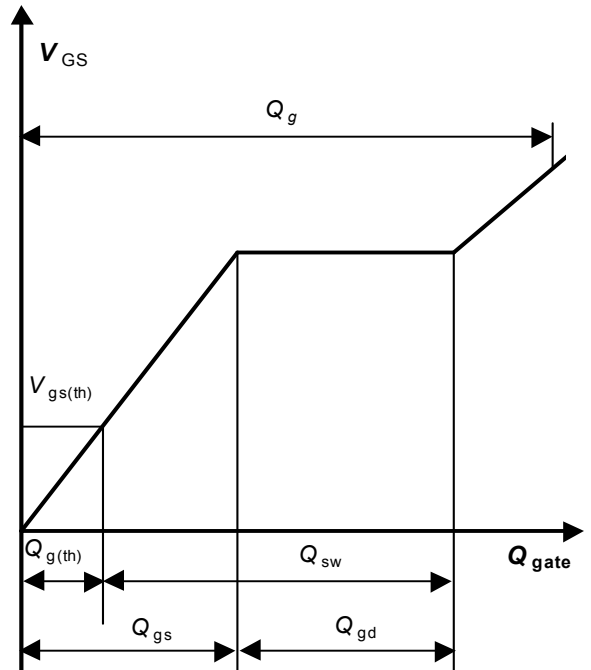


15 Drain-source breakdown voltage

$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$



16 Gate charge waveforms

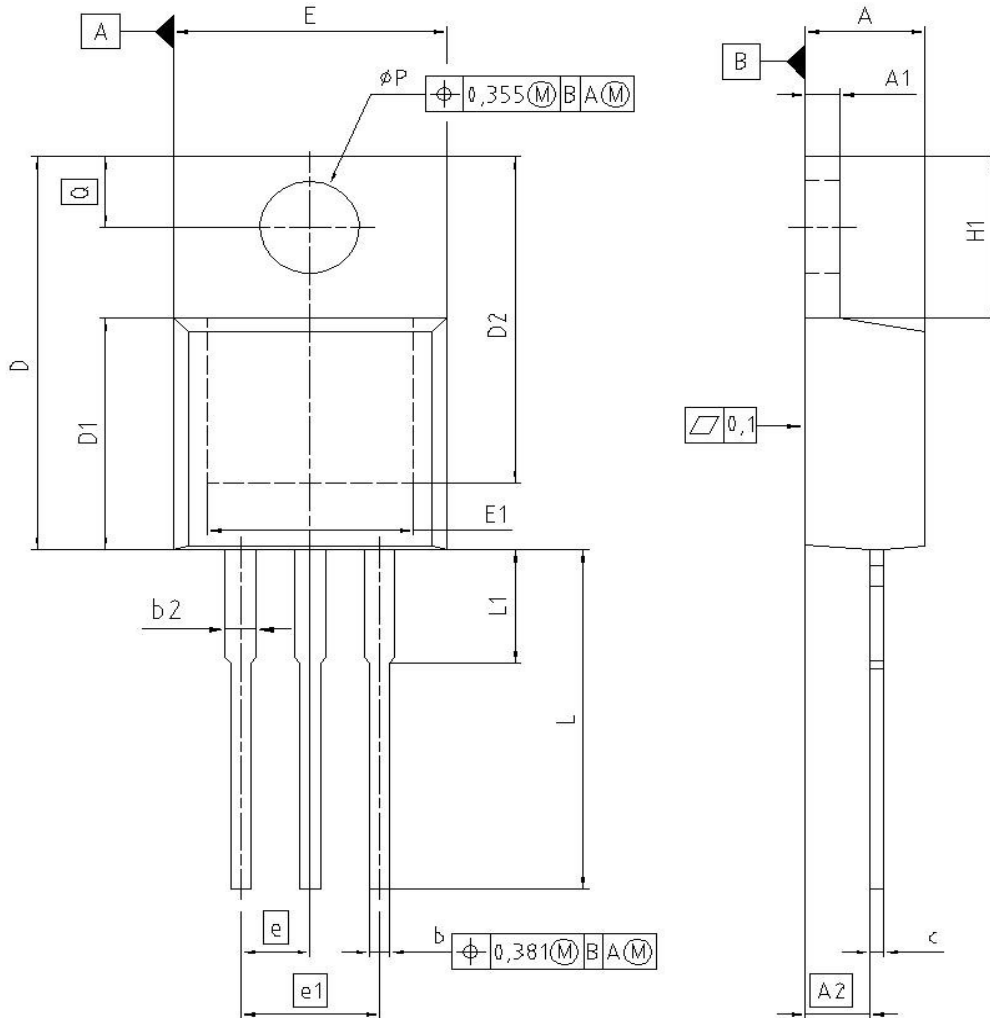








TO-251



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.572	0.169	0.180
A1	1.170	1.400	0.046	0.055
A2	2.215	2.718	0.087	0.107
b	0.650	0.864	0.026	0.034
b2	0.635	1.778	0.025	0.070
c	0.330	0.600	0.013	0.024
D	14.808	15.950	0.583	0.628
D1	8.509	9.450	0.335	0.372
D2	12.850	13.100	0.506	0.516
E	9.700	10.363	0.382	0.408
E1	6.500	8.600	0.256	0.339
e	2.540		0.100	
e1	5.080		0.200	
N	3		3	
H1	5.900	6.900	0.232	0.272
L	13.000	14.000	0.512	0.551
L1	-	4.800	-	0.189
$\phi P$	3.700	3.886	0.146	0.153
Q	2.600	3.000	0.102	0.118

REFERENCE  
JEDEC TO220

SCALE

EUROPEAN PROJECTION

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FILE  
TO220\_1