

**OptiMOS™3 Power-Transistor**
**Features**

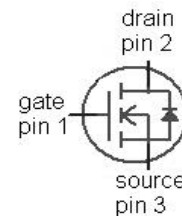
- N-channel, normal level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating; RoHS compliant; halogen free
- Qualified according to JEDEC<sup>1)</sup> for target application
- Halogen free according to IEC61249-2-21 \*
- Ideal for high-frequency switching and synchronous rectification

**Product Summary**

$V_{DS}$	120	V
$R_{DS(on) max}$	11	mΩ
$I_D$	75	A



Type	IPS110N12N3 G	IPD110N12N3 G
<b>Package</b>	PG-TO251-3	PG-TO252-3
<b>Marking</b>	110N12N	110N12N


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}$	75	A
		$T_C=100\text{ °C}$	54	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	300	
Avalanche energy, single pulse	$E_{AS}$	$I_D=75\text{ A}$ , $R_{GS}=25\text{ }\Omega$	120	mJ
Gate source voltage <sup>3)</sup>	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	136	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>J-STD20 and JESD22

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

<sup>3)</sup>  $T_{jmax}=150\text{ °C}$  and duty cycle  $D=0.01$  for  $V_{gs}<-5\text{ V}$ 

\* Except package TO251-3

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics**

Thermal resistance, junction - case	$R_{thJC}$		-	-	1.1	K/W
Thermal resistance, junction - ambient	$R_{thJA}$	minimal footprint	-	-	75	
		6 cm <sup>2</sup> cooling area <sup>4)</sup>	-	-	50	

**Electrical characteristics, at  $T_j=25\text{ °C}$ , unless otherwise specified**
**Static characteristics**

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	120	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=83\text{ }\mu\text{A}$		3		
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.1	1	$\mu\text{A}$
		$V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$	-	10	100	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=75\text{ A}$	-	9.2	11	m $\Omega$
Gate resistance	$R_G$		-	1.5	-	$\Omega$
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=75\text{ A}$	42	83	-	S

<sup>4)</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	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=60\text{ V},$ $f=1\text{ MHz}$	-	3240	4310	pF
Output capacitance	$C_{oss}$		-	408	543	
Reverse transfer capacitance	$C_{rss}$		-	22	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=60\text{ V}, V_{GS}=10\text{ V},$ $I_D=75\text{ A}, R_{G,ext}=1.6\ \Omega$	-	16	-	ns
Rise time	$t_r$		-	16	-	
Turn-off delay time	$t_{d(off)}$		-	24	-	
Fall time	$t_f$		-	8	-	

**Gate Charge Characteristics<sup>5)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=60\text{ V}, I_D=75\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	18	-	nC
Gate to drain charge	$Q_{gd}$		-	12	-	
Switching charge	$Q_{sw}$		-	20	-	
Gate charge total	$Q_g$		-	49	65	
Gate plateau voltage	$V_{plateau}$		-	5.6	-	
Output charge	$Q_{oss}$	$V_{DD}=60\text{ V}, V_{GS}=0\text{ V}$	-	56	75	nC

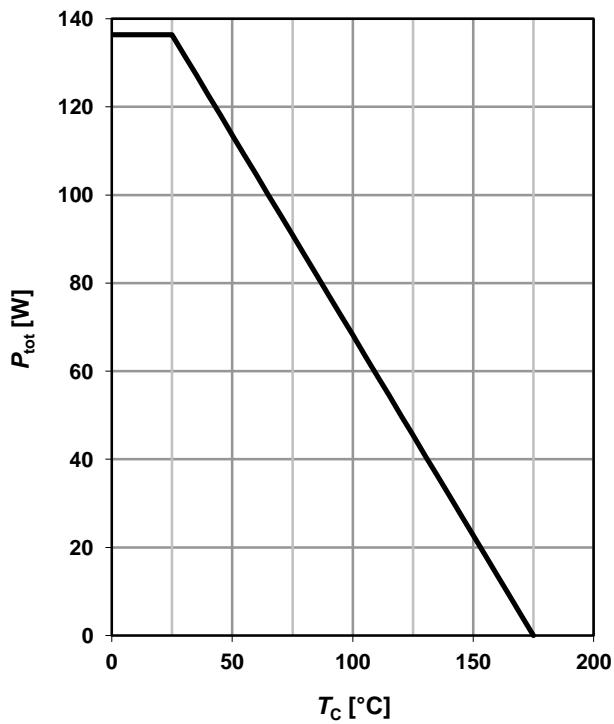
**Reverse Diode**

Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	75	A
Diode pulse current	$I_{S,pulse}$		-	-	300	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=75\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	1	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=60\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	90		ns
Reverse recovery charge	$Q_{rr}$		-	249		nC

<sup>5)</sup> See figure 16 for gate charge parameter definition

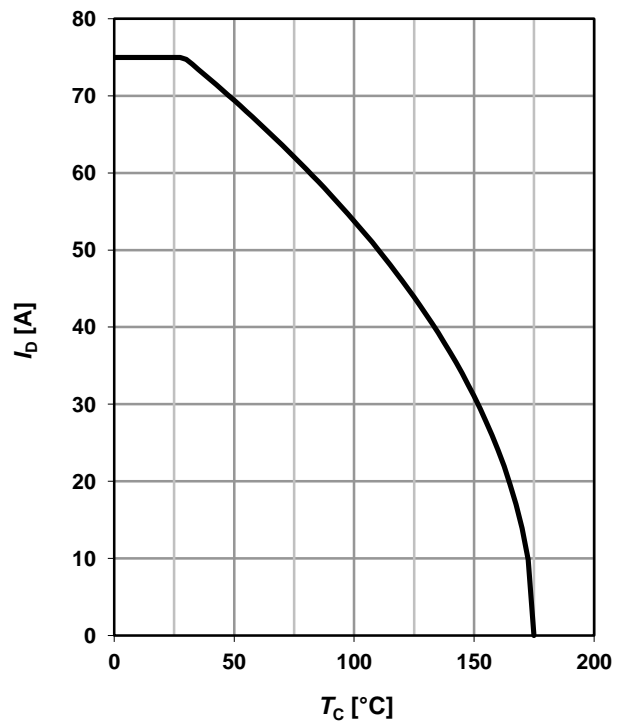
### 1 Power dissipation

$$P_{tot}=f(T_C)$$



### 2 Drain current

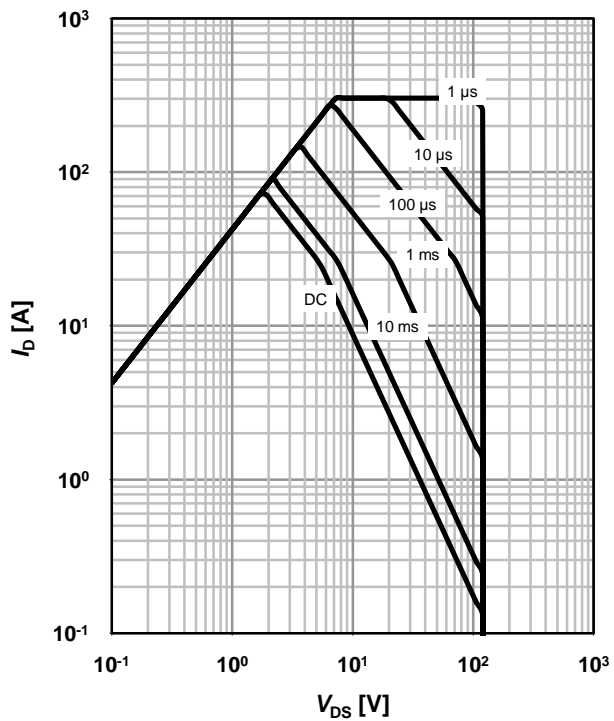
$$I_D=f(T_C); V_{GS} \geq 10 \text{ V}$$



### 3 Safe operating area

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

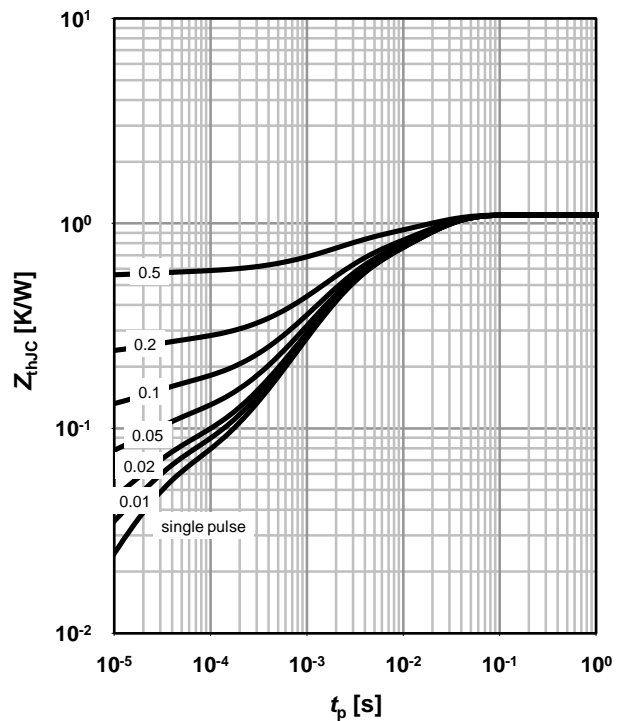
parameter:  $t_p$



### 4 Max. transient thermal impedance

$$Z_{thJC}=f(t_p)$$

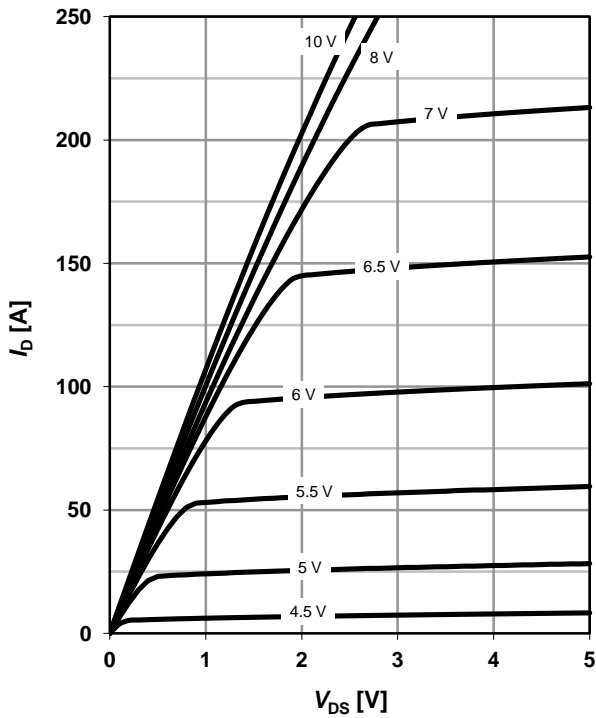
parameter:  $D=t_p/T$



**5 Typ. output characteristics**

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

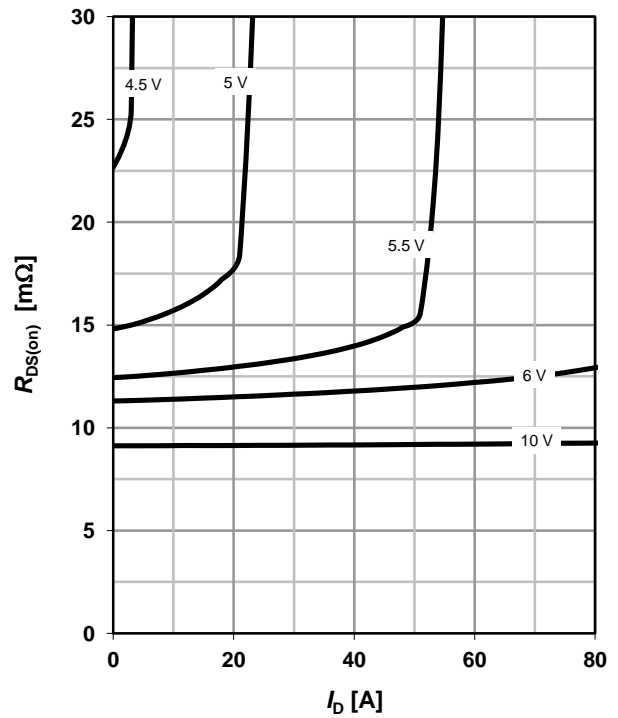
parameter:  $V_{GS}$



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

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

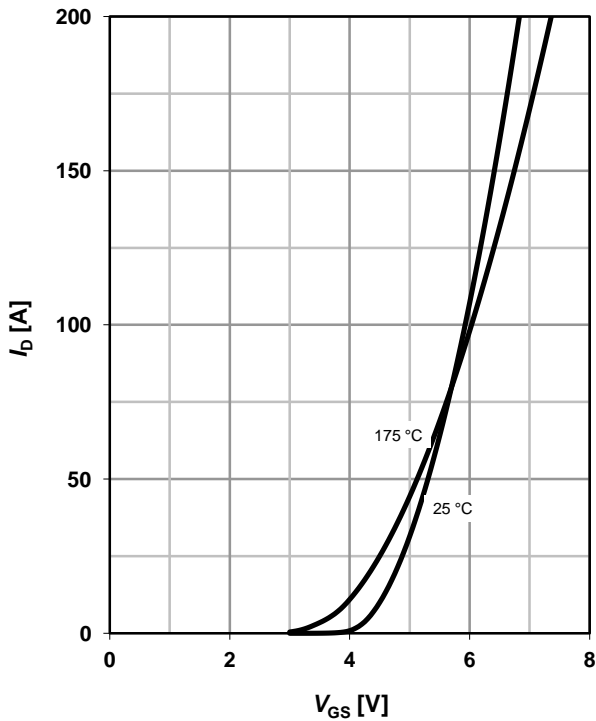
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

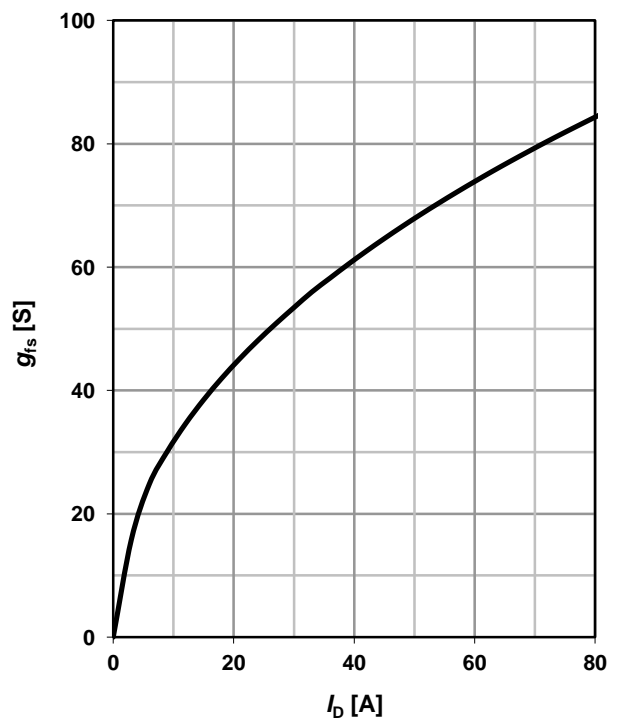
$I_D=f(V_{GS}); |V_{DS}|>2|I_D|R_{DS(on)max}$

parameter:  $T_j$



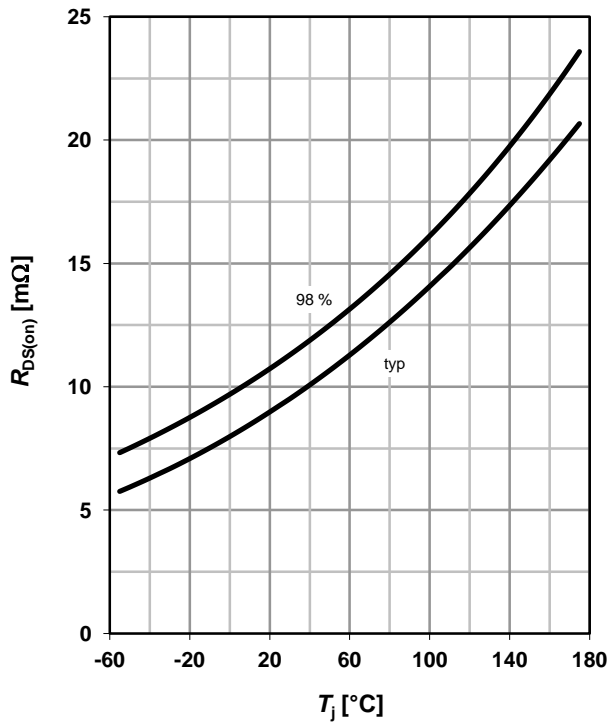
**8 Typ. forward transconductance**

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



### 9 Drain-source on-state resistance

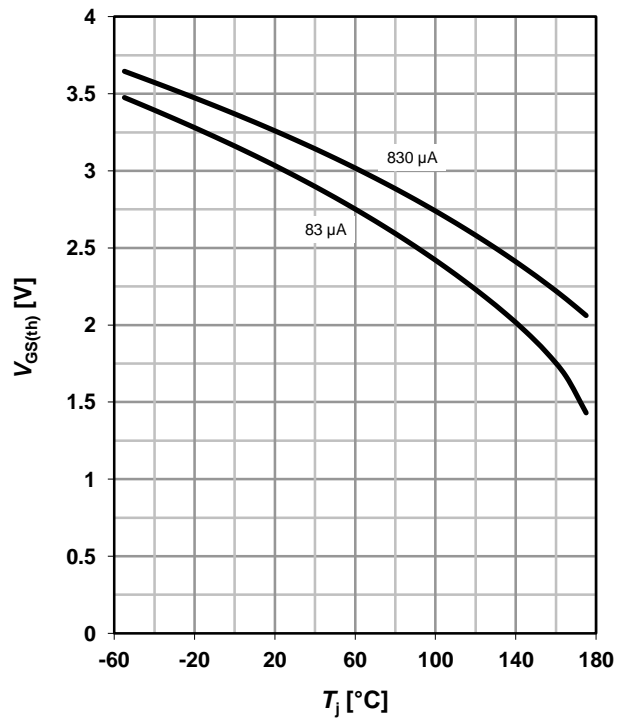
$$R_{DS(on)} = f(T_j); I_D = 75 \text{ A}; V_{GS} = 10 \text{ V}$$



### 10 Typ. gate threshold voltage

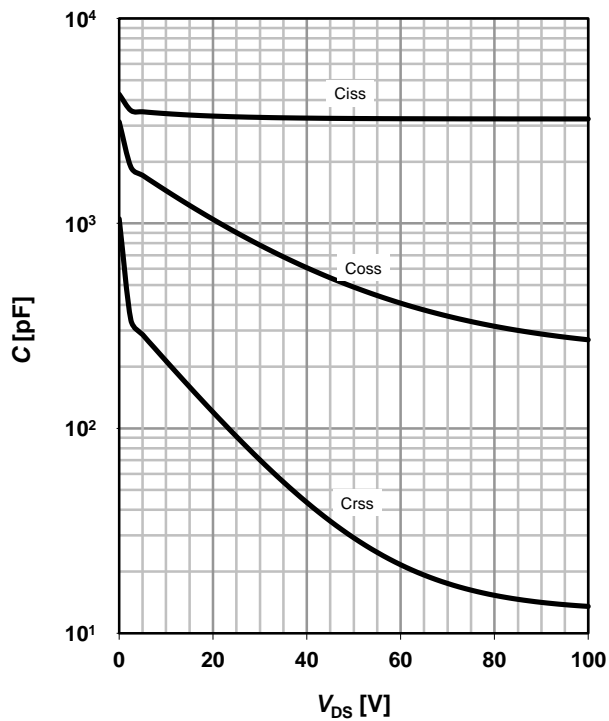
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



### 11 Typ. capacitances

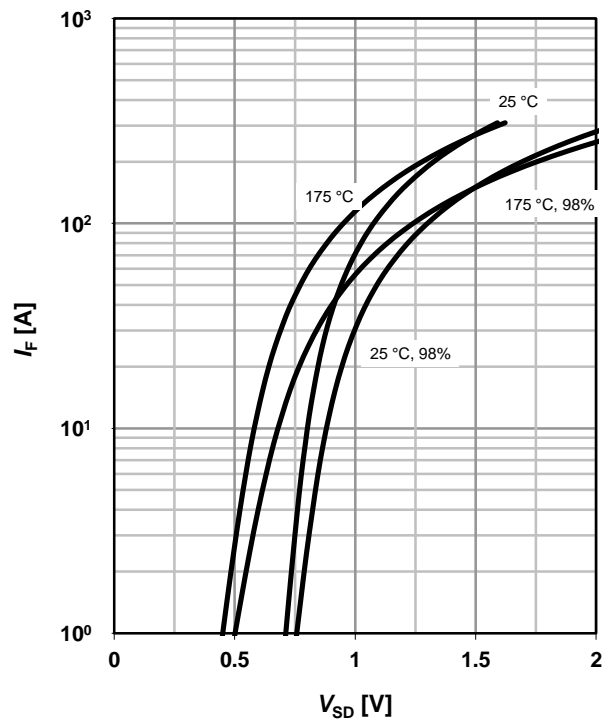
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 12 Forward characteristics of reverse diode

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

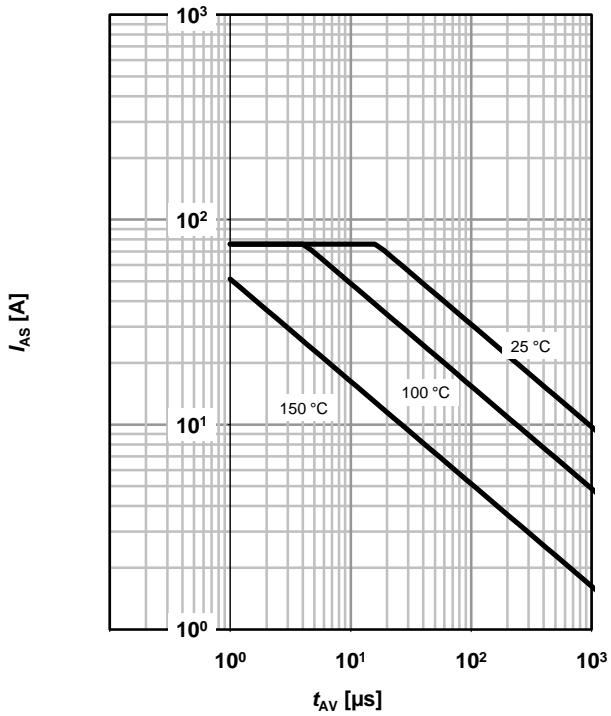
parameter:  $T_j$



### 13 Avalanche characteristics

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

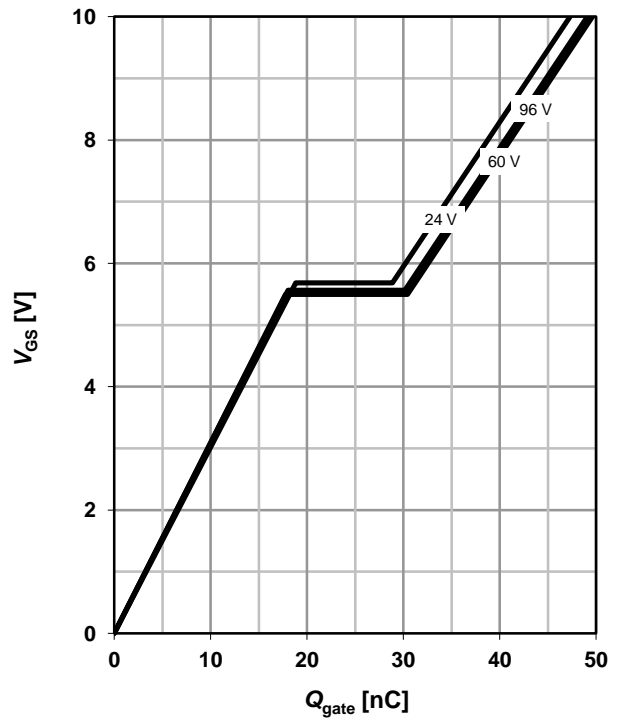
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

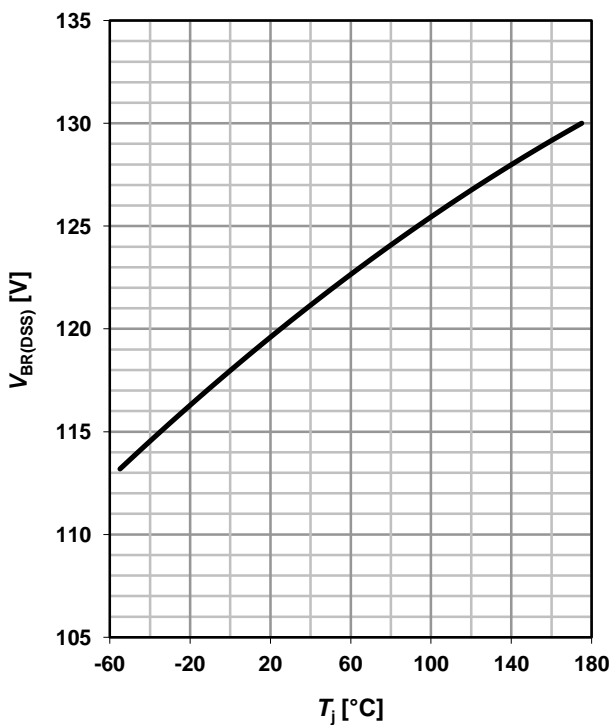
$V_{GS}=f(Q_{\text{gate}}); I_D=67 \text{ A pulsed}$

parameter:  $V_{DD}$



### 15 Drain-source breakdown voltage

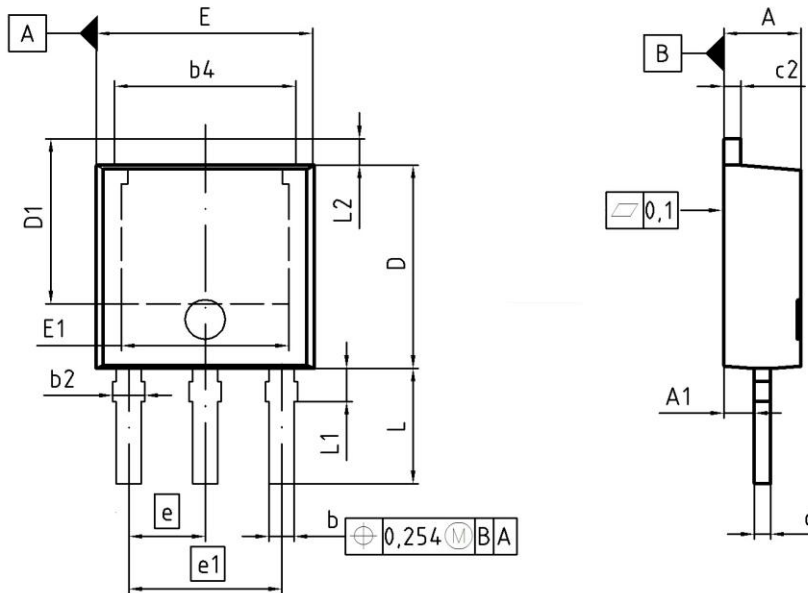
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$



### 16 Gate charge waveforms



PG-TO-251SL : Outline



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.18	2.39	0.086	0.094
A1	0.80	1.14	0.031	0.045
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b4	4.95	5.50	0.195	0.217
c	0.46	0.58	0.018	0.023
c2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.04	5.44	0.198	0.214
E	6.35	6.73	0.250	0.265
E1	4.90	5.10	0.193	0.201
e	2.29		0.090	
e1	4.57		0.180	
N	3		3	
L	3.40	3.60	0.134	0.142
L1	0.90	1.10	0.035	0.043
L2	0.90	1.10	0.035	0.043

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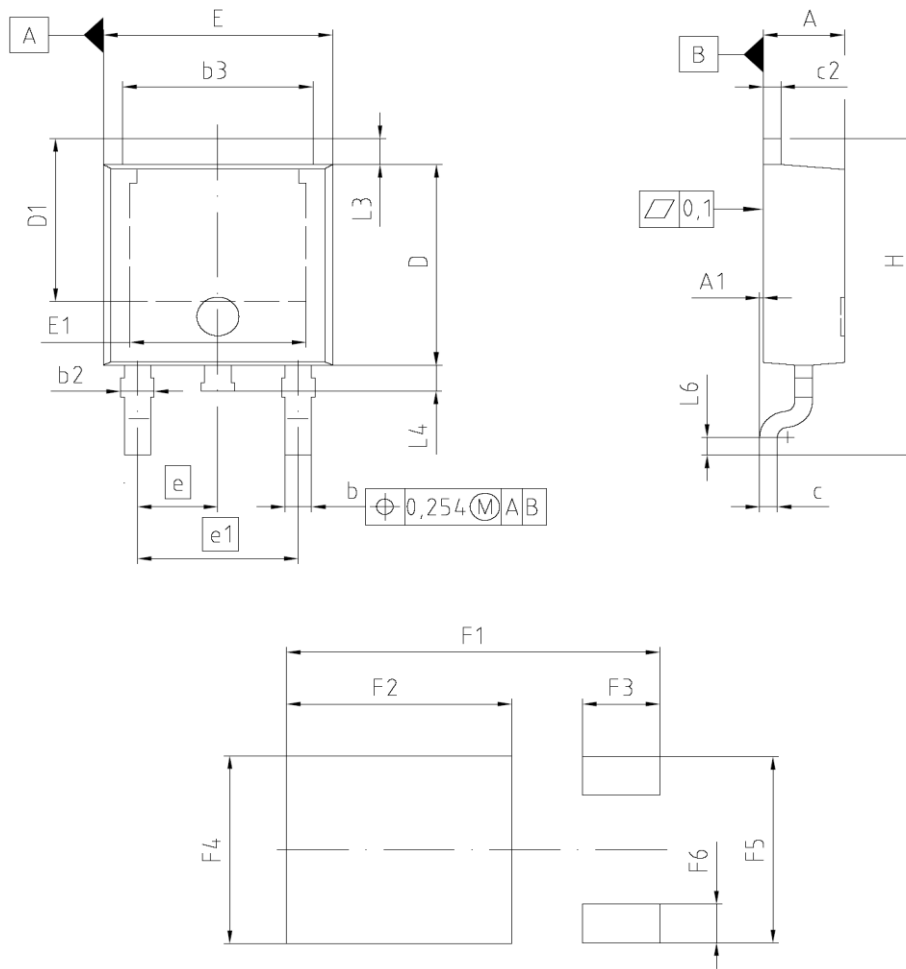
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03



PG-TO252-3: Outline



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.159	2.413	0.085	0.095
A1	0.000	0.150	0.000	0.006
b	0.635	0.889	0.025	0.035
b2	0.650	1.150	0.026	0.045
b3	5.004	5.500	0.197	0.217
c	0.457	0.580	0.018	0.023
c2	0.460	0.980	0.018	0.039
D	5.969	6.223	0.235	0.245
D1	5.020	5.842	0.198	0.230
E	6.400	6.731	0.252	0.265
E1	4.850	5.207	0.191	0.205
e	2.286		0.090	
e1	4.572		0.180	
N	3		3	
H	9.400	10.480	0.370	0.413
L3	0.900	1.143	0.035	0.045
L4	0.584	0.950	0.023	0.037
L6	0.510	0.686	0.020	0.027
F1	10.500	10.700	0.413	0.421
F2	6.300	6.500	0.248	0.256
F3	2.100	2.300	0.083	0.091
F4	5.700	5.900	0.224	0.232
F5	5.660	5.860	0.222	0.231
F6	1.100	1.300	0.043	0.051

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