

**OptiMOS®2 Power-Transistor**
**Features**

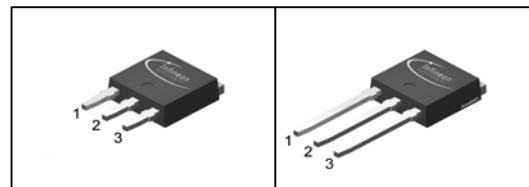
- Ideal for high-frequency dc/dc converters
- Qualified according to JEDEC<sup>1)</sup> for target applications
- N-channel - Logic level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- Superior thermal resistance
- 175 °C operating temperature
- $dv/dt$  rated
- Pb-free lead plating; RoHS compliant

**Product Summary**

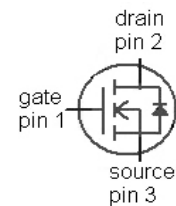
$V_{DS}$	30	V
$R_{DS(on),max}$	5.8	m $\Omega$
$I_D$	50	A

PG-TO251-3-11

PG-TO251-3



Type	Package	Marking
IPU06N03LB	PG-TO251-3	06N03LB
IPS06N03LB	PG-TO251-3-11	06N03LB


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}^{2)}$	50	A
		$T_C=100\text{ °C}$	50	
Pulsed drain current	$I_{D,pulse}$	$T_C=25\text{ °C}^{3)}$	200	
Avalanche energy, single pulse	$E_{AS}$	$I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$	210	mJ
Reverse diode $dv/dt$	$dv/dt$	$I_D=50\text{ A}$ , $V_{DS}=20\text{ V}$ , $di/dt=200\text{ A}/\mu\text{s}$ , $T_{j,max}=175\text{ °C}$	6	kV/ $\mu\text{s}$
Gate source voltage <sup>4)</sup>	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	94	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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics**

Thermal resistance, junction - case	$R_{thJC}$		-	-	1.6	K/W
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>5)</sup>	-	-	40	

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

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	30	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=40\text{ }\mu\text{A}$	1.2	1.6	2	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$	-	0.1	1	$\mu\text{A}$
		$V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^\circ\text{C}$	-	10	100	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	10	100	nA
	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=50\text{ A}$	-	7.3	9.1	m $\Omega$
		$V_{GS}=10\text{ V}, I_D=50\text{ A}$	-	4.9	5.8	
Gate resistance	$R_G$		-	1.2	-	$\Omega$
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=50\text{ A}$	41	83	-	S

<sup>2)</sup> Current is limited by bondwire; with an  $R_{thJC}=1.6\text{ K/W}$  the chip is able to carry 95 A.

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

<sup>4)</sup>  $T_{j,max}=150\text{ }^\circ\text{C}$  and duty cycle  $D<0.25$  for  $V_{GS}<-5\text{ V}$

<sup>5)</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	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V},$ $f=1\text{ MHz}$	-	2400	3200	pF
Output capacitance	$C_{oss}$		-	860	1150	
Reverse transfer capacitance	$C_{rss}$		-	110	170	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=15\text{ V}, V_{GS}=10\text{ V},$ $I_D=25\text{ A}, R_G=2.7\ \Omega$	-	7	10	ns
Rise time	$t_r$		-	6	9	
Turn-off delay time	$t_{d(off)}$		-	27	40	
Fall time	$t_f$		-	4.2	6.3	

**Gate Charge Characteristics<sup>6)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=15\text{ V}, I_D=25\text{ A},$ $V_{GS}=0\text{ to }5\text{ V}$	-	7.4	9.9	nC
Gate charge at threshold	$Q_{g(th)}$		-	3.9	5.1	
Gate to drain charge	$Q_{gd}$		-	4.9	7.3	
Switching charge	$Q_{sw}$		-	8.4	12	
Gate charge total	$Q_g$		-	19	25	
Gate plateau voltage	$V_{plateau}$		-	3.1	-	
Gate charge total, sync. FET	$Q_{g(sync)}$	$V_{DS}=0.1\text{ V},$ $V_{GS}=0\text{ to }5\text{ V}$	-	16	22	nC
Output charge	$Q_{oss}$	$V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$	-	19	26	

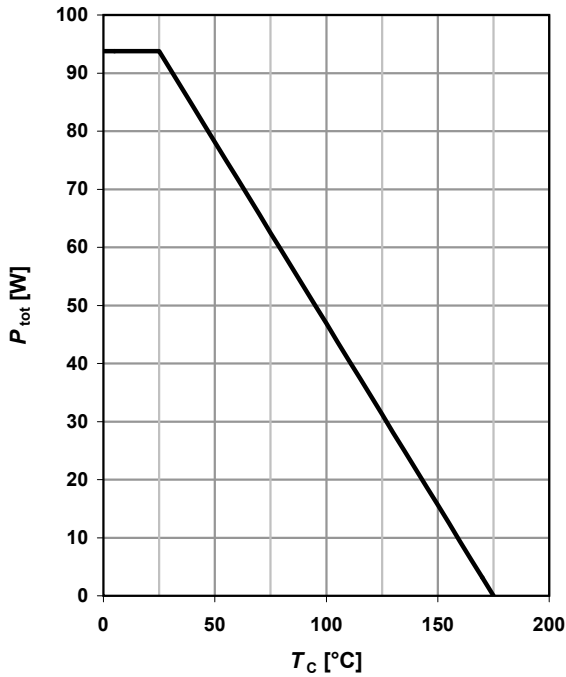
**Reverse Diode**

Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	50	A
Diode pulse current	$I_{S,pulse}$		-	-	200	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=50\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.92	1.2	V
Reverse recovery charge	$Q_{rr}$	$V_R=15\text{ V}, I_F=I_S,$ $di_F/dt=400\text{ A}/\mu\text{s}$	-	-	10	nC

<sup>6)</sup> See figure 16 for gate charge parameter definition

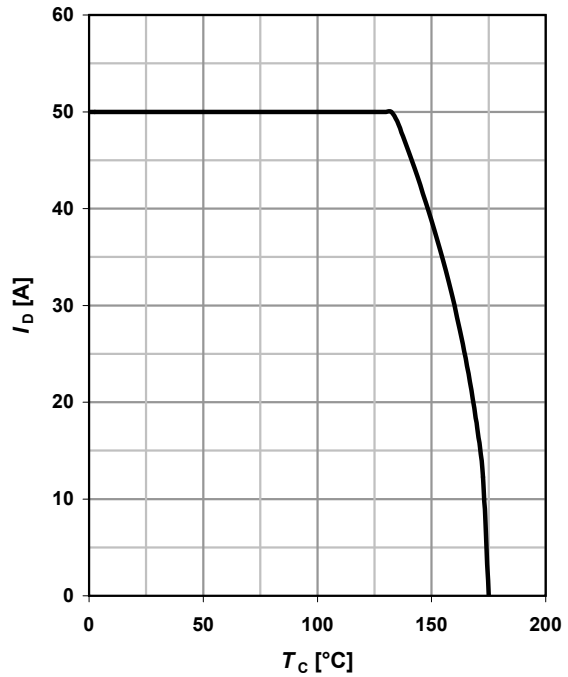
**1 Power dissipation**

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



**2 Drain current**

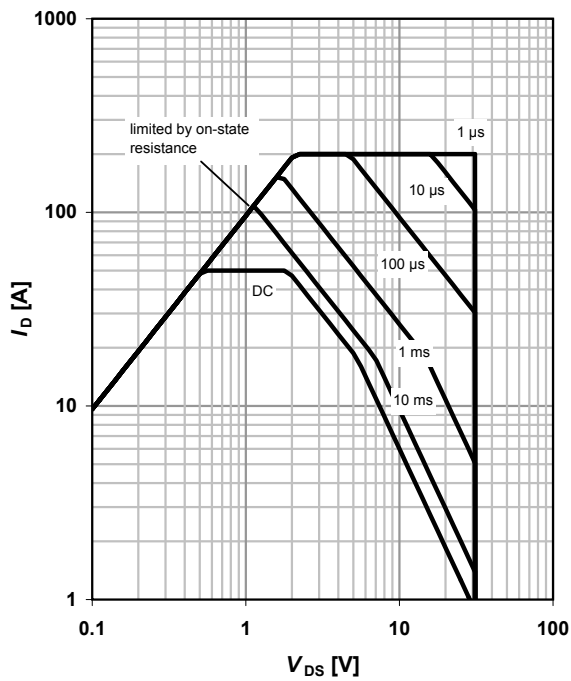
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



**3 Safe operating area**

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

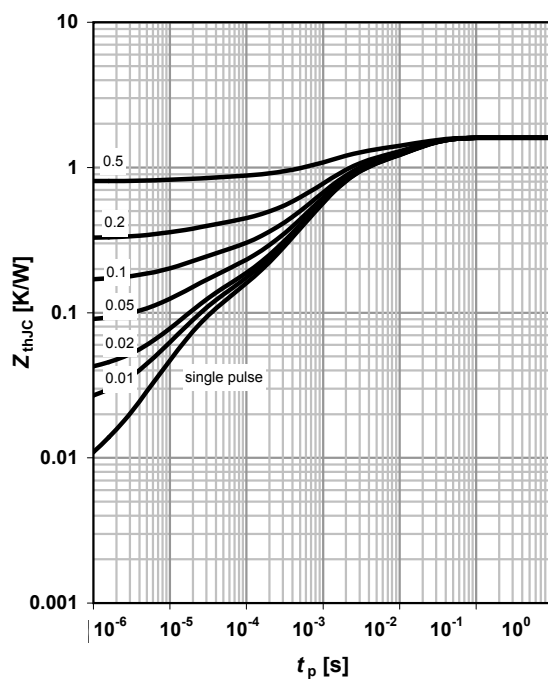
parameter:  $t_p$



**4 Max. transient thermal impedance**

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

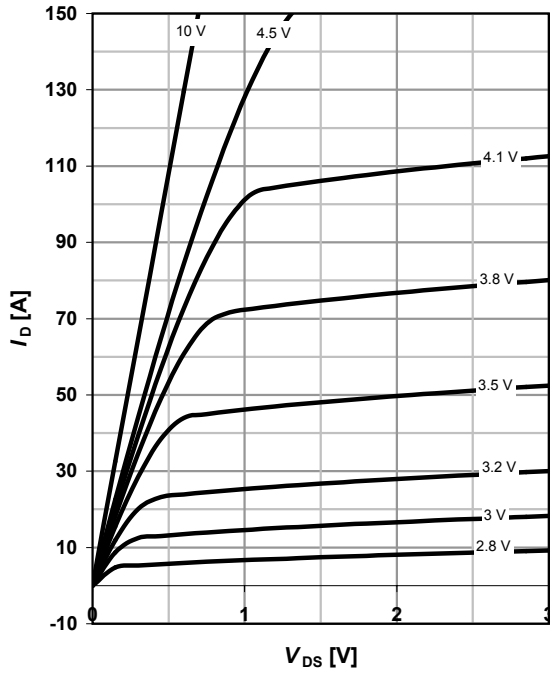
parameter:  $D = t_p / T$



**5 Typ. output characteristics**

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

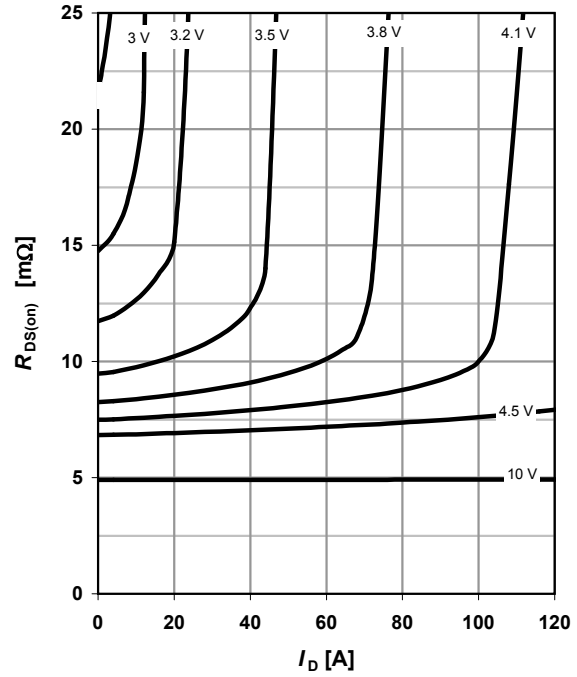
parameter:  $V_{GS}$



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

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

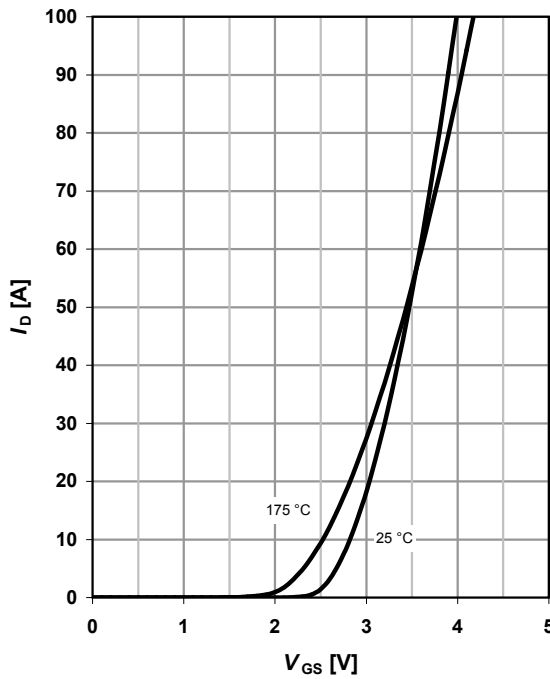
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

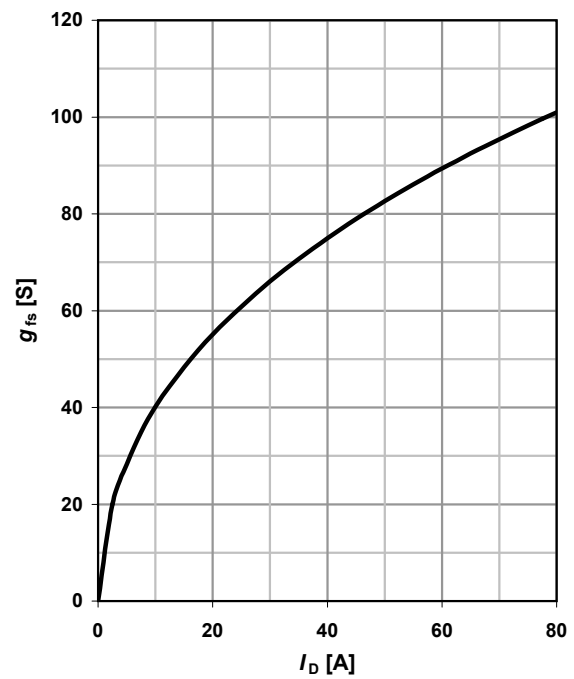
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter:  $T_j$



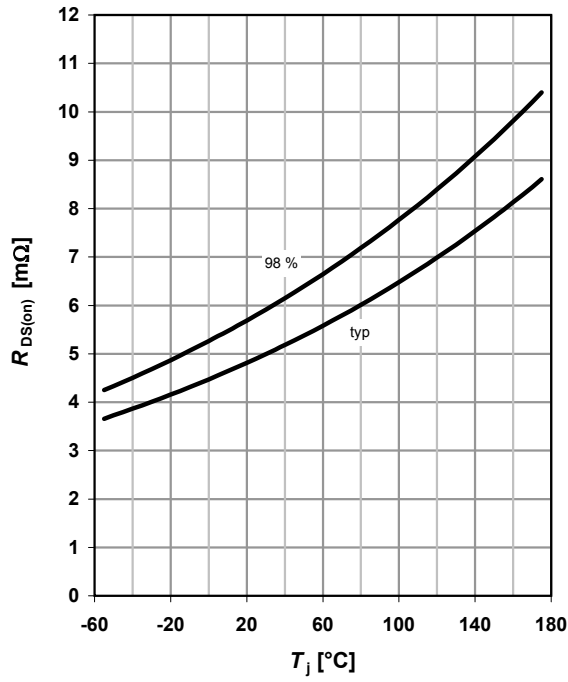
**8 Typ. forward transconductance**

$g_{fs} = f(I_D); T_j = 25\text{ °C}$



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

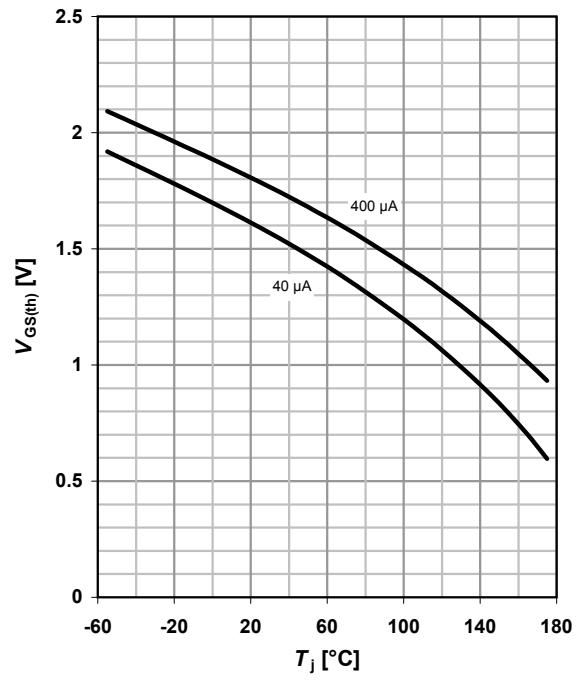
$$R_{DS(on)} = f(T_j); I_D = 50 \text{ A}; V_{GS} = 10 \text{ V}$$



**10 Typ. gate threshold voltage**

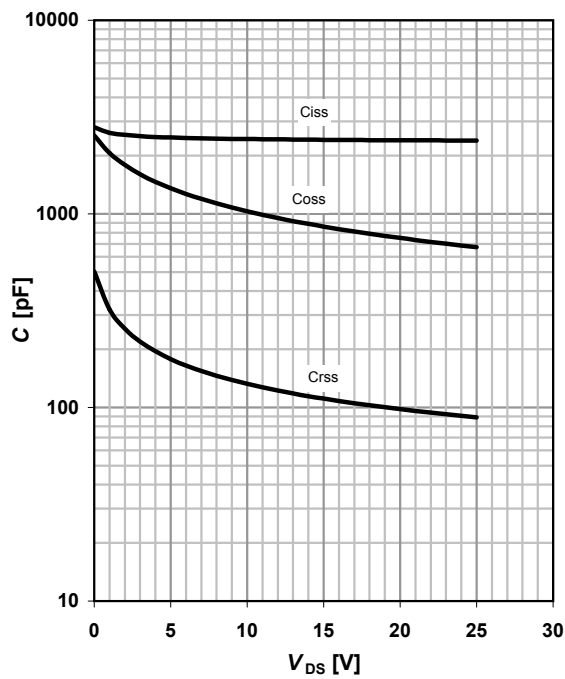
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



**11 Typ. Capacitances**

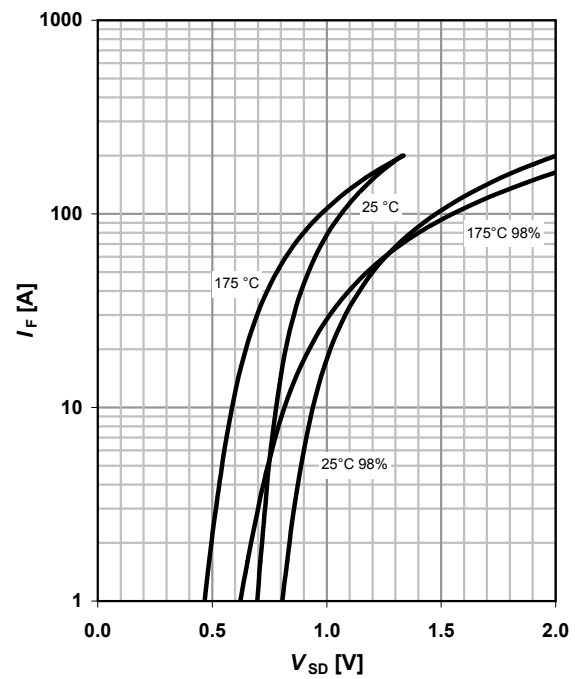
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



**12 Forward characteristics of reverse diode**

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

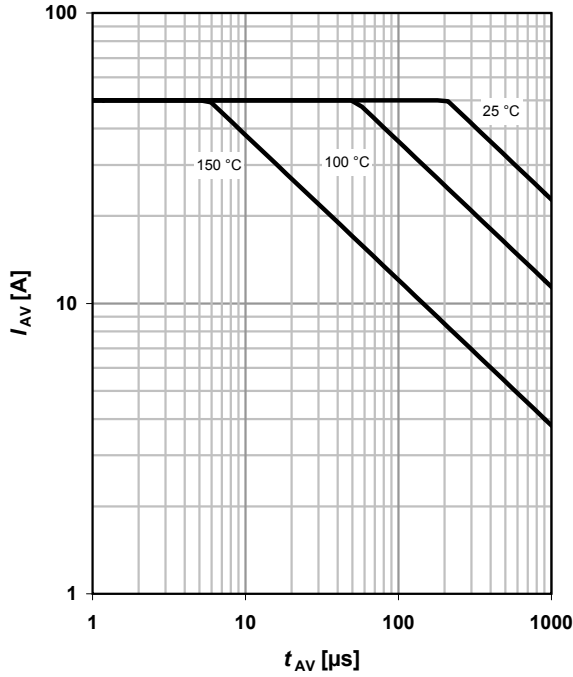
parameter:  $T_j$



**13 Avalanche characteristics**

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

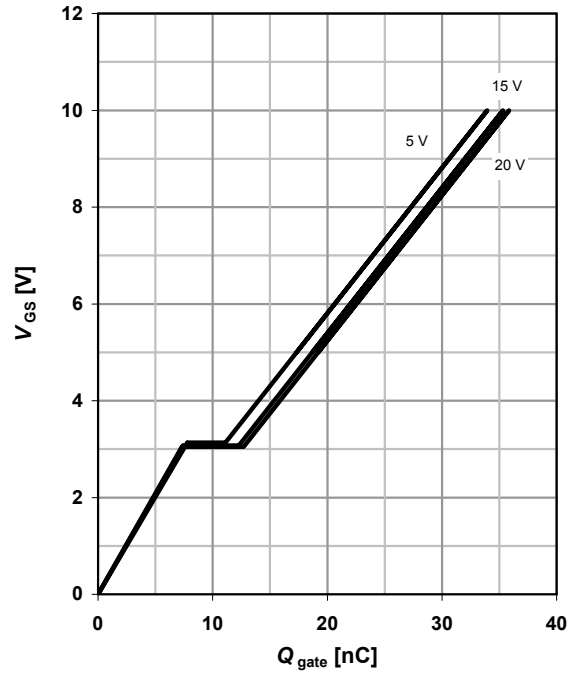
parameter:  $T_{j(start)}$



**14 Typ. gate charge**

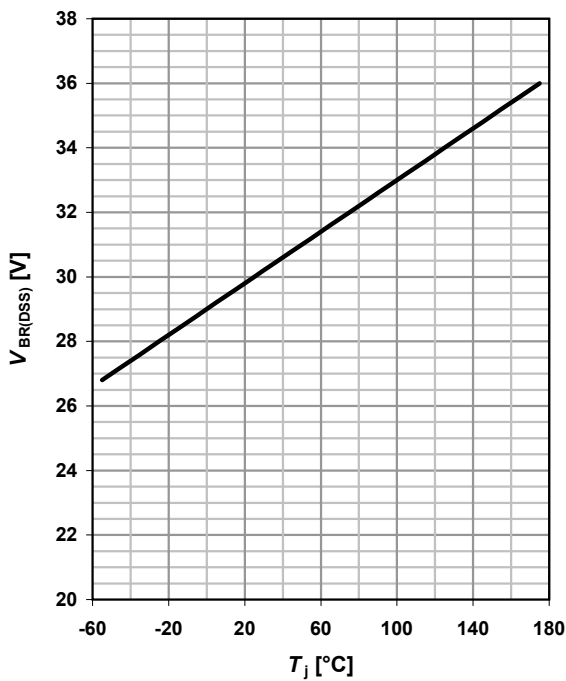
$V_{GS}=f(Q_{gate}); I_D=25 \text{ A pulsed}$

parameter:  $V_{DD}$



**15 Drain-source breakdown voltage**

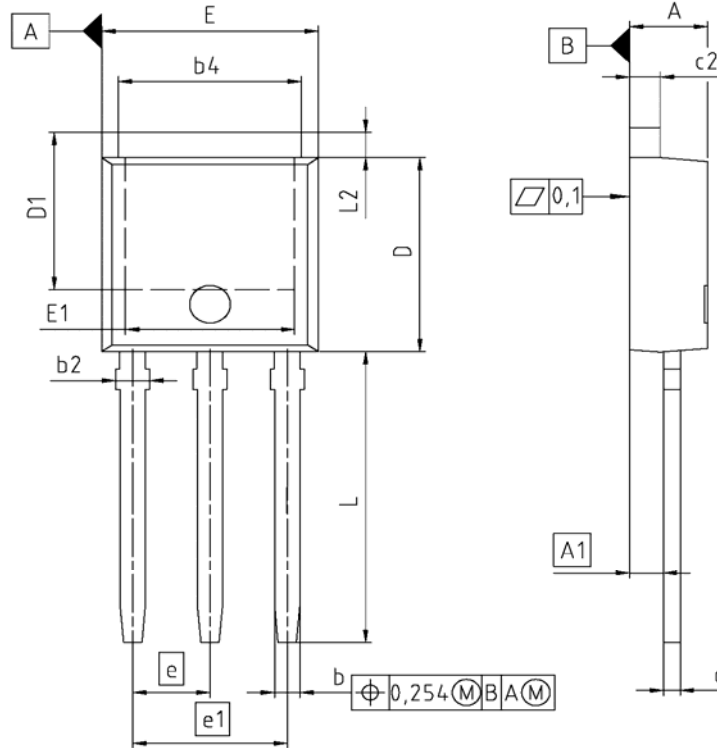
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$



**16 Gate charge waveforms**



PG-TO251-3: Outline



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.159	2.413	0.085	0.095
A1	0.900	1.118	0.035	0.044
b	0.650	0.850	0.026	0.033
b2	0.650	1.150	0.026	0.045
b4	5.004	5.500	0.197	0.217
c	0.457	0.580	0.018	0.023
c2	0.737	0.980	0.029	0.039
D	5.969	6.223	0.235	0.245
D1	5.100	6.121	0.201	0.241
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	
L	8.900	9.525	0.350	0.375
L1	0.900	1.143	0.035	0.045

**REFERENCE**  
JEDEC TO251

**SCALE**

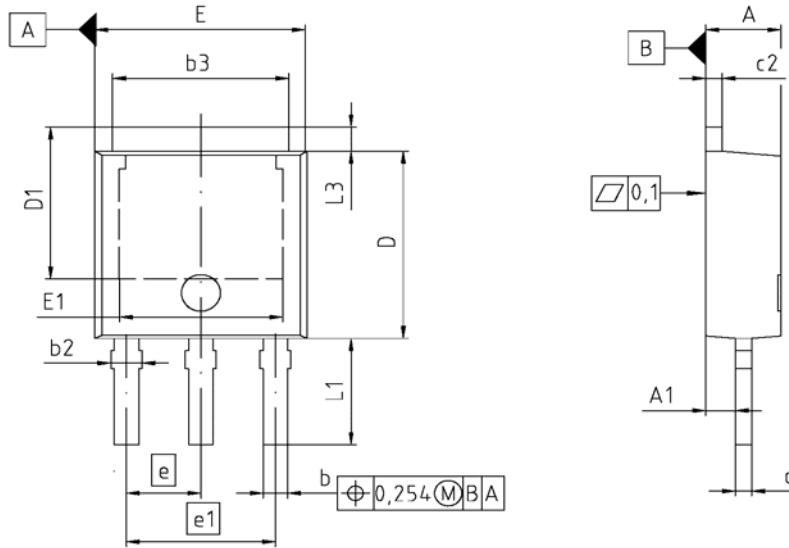
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**ISSUE DATE**  
01-08-2005

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TO251\_1



PG-TO251-3-11: Outline



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.184	2.388	0.086	0.094
A1	0.000	0.150	0.000	0.006
b	0.635	0.889	0.025	0.035
b2	0.650	1.150	0.025	0.045
b3	5.004	5.500	0.197	0.217
c	0.460	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	5.320	0.198	0.209
E	6.400	6.731	0.252	0.265
E1	4.900	5.100	0.193	0.201
e	2.286		0.090	
e1	4.572		0.180	
N	3		3	
L1	3.400	3.600	0.134	0.142
L3	0.900	1.118	0.035	0.044

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**SCALE**

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**ISSUE DATE**  
20-07-2005

**FILE**  
TO251\_2

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