

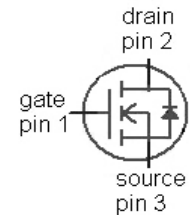
## OptiMOS<sup>®</sup> 2 Power-Transistor

### 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
- Qualified according to JEDEC<sup>1)</sup> for target application
- Ideal for high-frequency switching and synchronous rectification

### Product Summary

$V_{DS}$	100	V
$R_{DS(on),max}$ (TO252)	12.4	m $\Omega$
$I_D$	67	A



Type	IPB12CN10N G	IPD12CN10N G	IPI12CN10N G	IPP12CN10N G
Package	PG-TO263-3	PG-TO252-3	PG-TO262-3	PG-TO220-3
Marking	12CN10N	12CN10N	12CN10N	12CN10N

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}$	67	A
		$T_C=100\text{ °C}$	48	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	268	
Avalanche energy, single pulse	$E_{AS}$	$I_D=67\text{ A}$ , $R_{GS}=25\text{ }\Omega$	154	mJ
Reverse diode $dv/dt$	$dv/dt$	$I_D=67\text{ A}$ , $V_{DS}=80\text{ V}$ , $di/dt=100\text{ A}/\mu\text{s}$ , $T_{j,max}=175\text{ °C}$	6	kV/ $\mu\text{s}$
Gate source voltage <sup>3)</sup>	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	125	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>  $T_{j,max}=150\text{ °C}$  and duty cycle  $D=0.01$  for  $V_{gs}<-5\text{ V}$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

### Thermal characteristics

Thermal resistance, junction - case	$R_{thJC}$		-	-	1.2	K/W
Thermal resistance, junction - ambient (TO220, TO262, TO263)	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>4)</sup>	-	-	40	
Thermal resistance, junction - ambient (TO252)		minimal footprint	-	-	75	
		6 cm <sup>2</sup> cooling area <sup>4)</sup>	-	-	50	

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

#### Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	100	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=83\text{ }\mu\text{A}$	2	3	4	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=80\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$	-	0.1	1	$\mu\text{A}$
		$V_{DS}=80\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^\circ\text{C}$	-	10	100	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=67\text{ A},$ (TO252)	-	9.3	12.4	m $\Omega$
		$V_{GS}=10\text{ V}, I_D=67\text{ A},$ (TO263)	-	9.5	12.6	
		$V_{GS}=10\text{ V}, I_D=67\text{ A},$ (TO220, TO262)	-	9.8	12.9	
Gate resistance	$R_G$		-	1.5	-	$\Omega$
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=67\text{ A}$	39	77	-	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	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=50\text{ V},$ $f=1\text{ MHz}$	-	3250	4320	pF
Output capacitance	$C_{oss}$		-	489	650	
Reverse transfer capacitance	$C_{rss}$		-	29	44	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=50\text{ V}, V_{GS}=10\text{ V},$ $I_D=33.5\text{ A}, R_G=1.6\ \Omega$	-	17	26	ns
Rise time	$t_r$		-	21	32	
Turn-off delay time	$t_{d(off)}$		-	32	48	
Fall time	$t_f$		-	8	12	

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

Gate to source charge	$Q_{gs}$	$V_{DD}=50\text{ V}, I_D=67\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	18	24	nC
Gate to drain charge	$Q_{gd}$		-	12	18	
Switching charge	$Q_{sw}$		-	20	29	
Gate charge total	$Q_g$		-	49	65	
Gate plateau voltage	$V_{plateau}$		-	5.5	-	
Output charge	$Q_{oss}$	$V_{DD}=50\text{ V}, V_{GS}=0\text{ V}$	-	52	69	nC

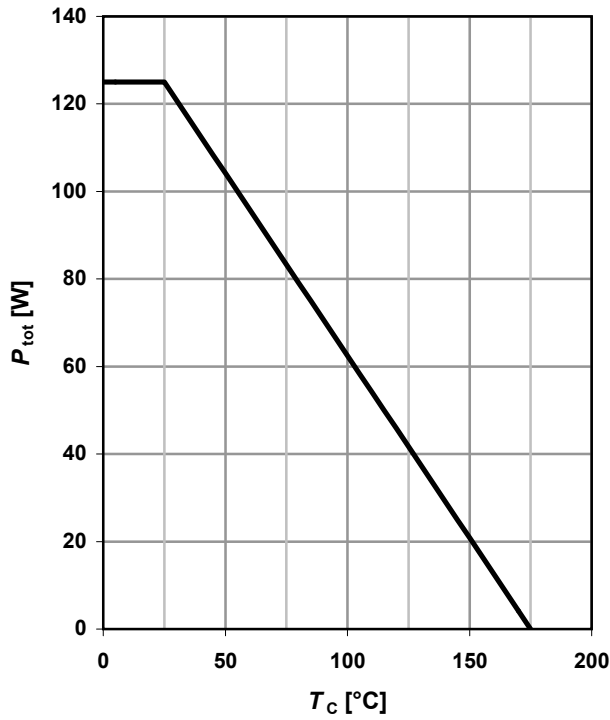
### Reverse Diode

Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	67	A
Diode pulse current	$I_{S,pulse}$		-	-	268	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=67\text{ A},$ $T_J=25\text{ }^\circ\text{C}$	-	1	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=50\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	105		ns
Reverse recovery charge	$Q_{rr}$		-	255	-	nC

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

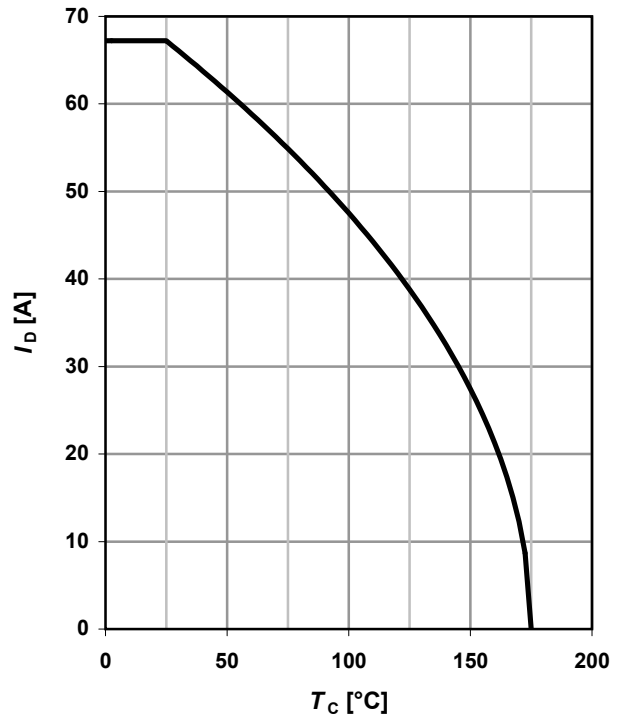
### 1 Power dissipation

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



### 2 Drain current

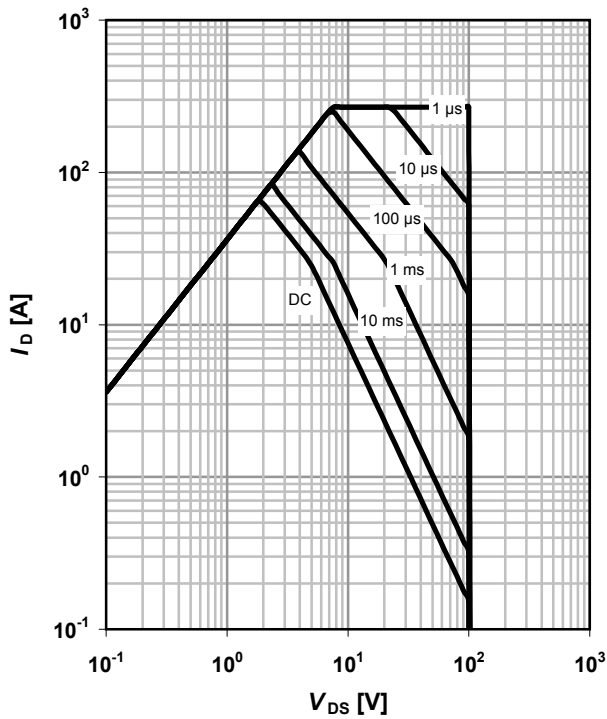
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



### 3 Safe operating area

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

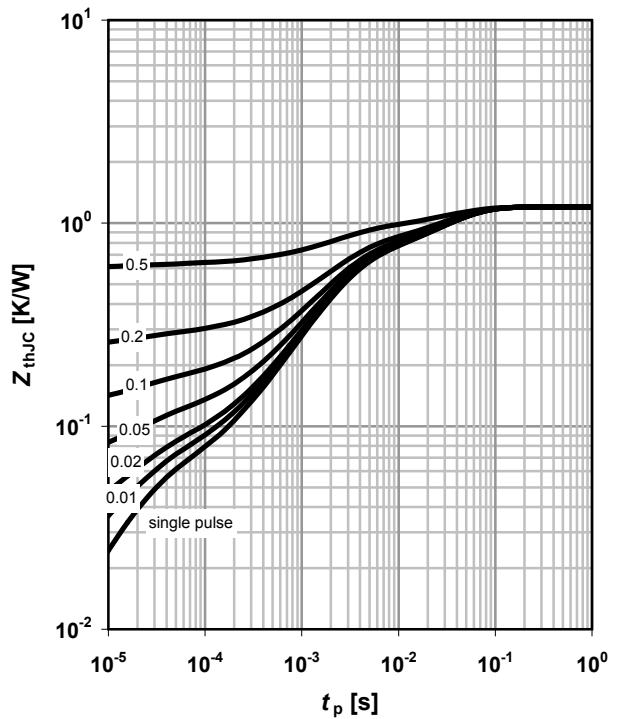
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

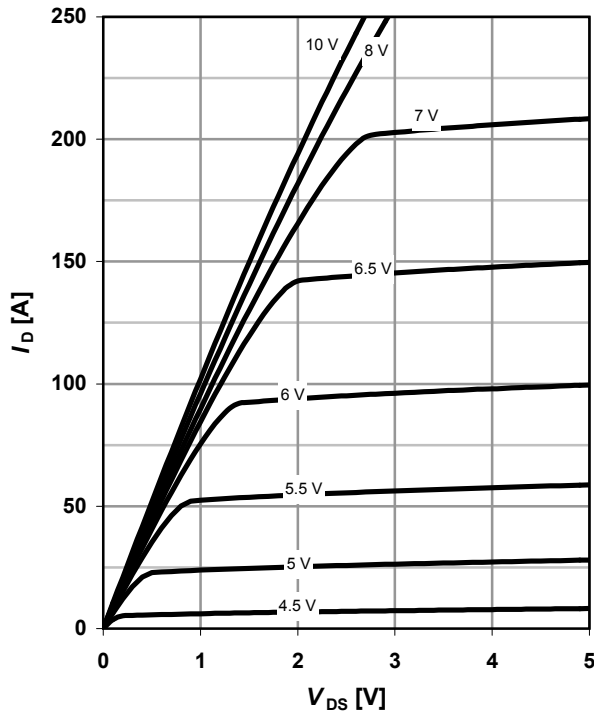
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

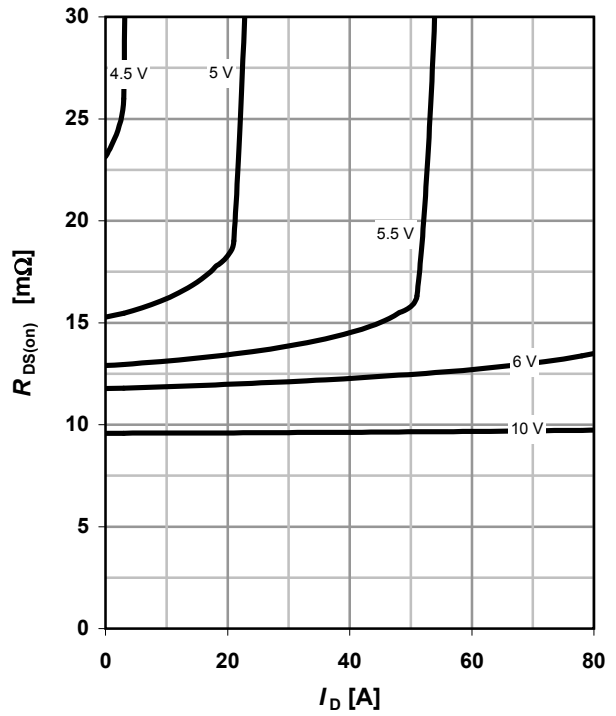
parameter:  $V_{GS}$



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

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

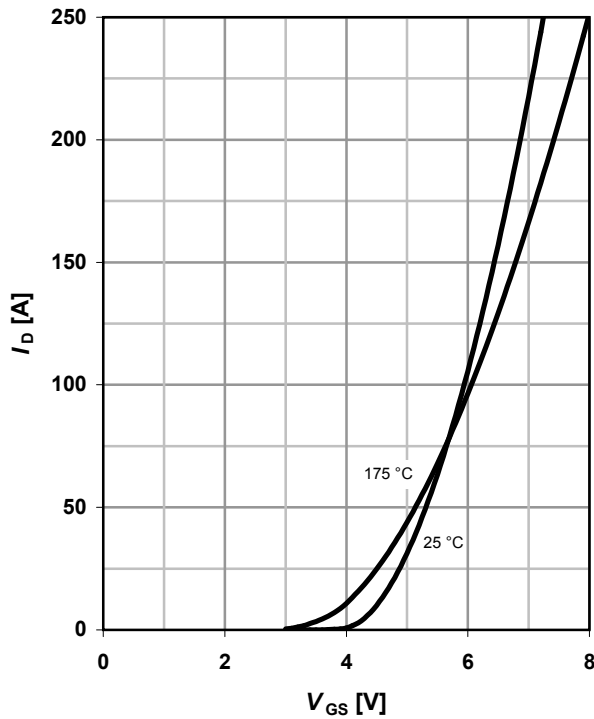
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

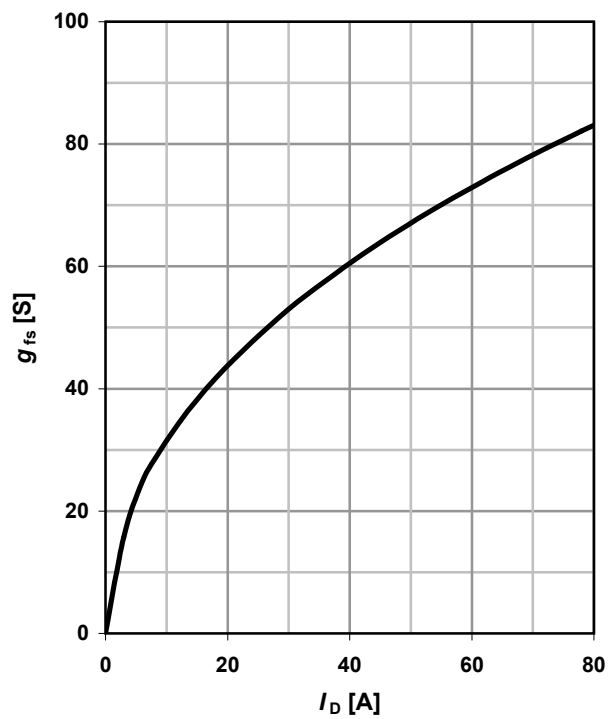
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter:  $T_j$



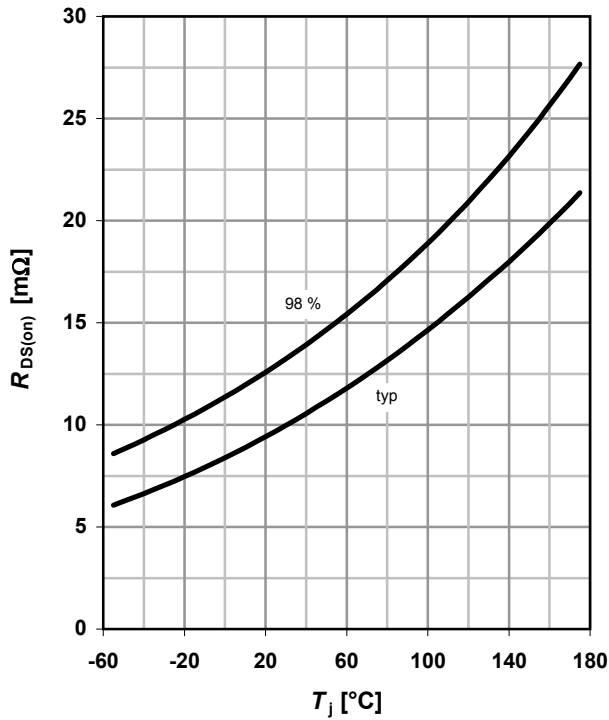
**8 Typ. forward transconductance**

$g_{fs} = f(I_D); T_j = 25\text{ °C}$



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

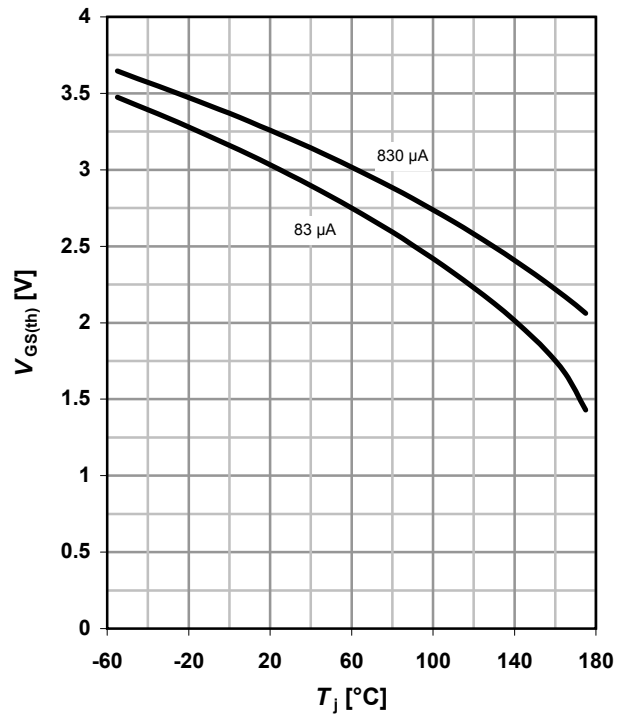
$R_{DS(on)}=f(T_j); I_D=67\text{ A}; V_{GS}=10\text{ V}$



**10 Typ. gate threshold voltage**

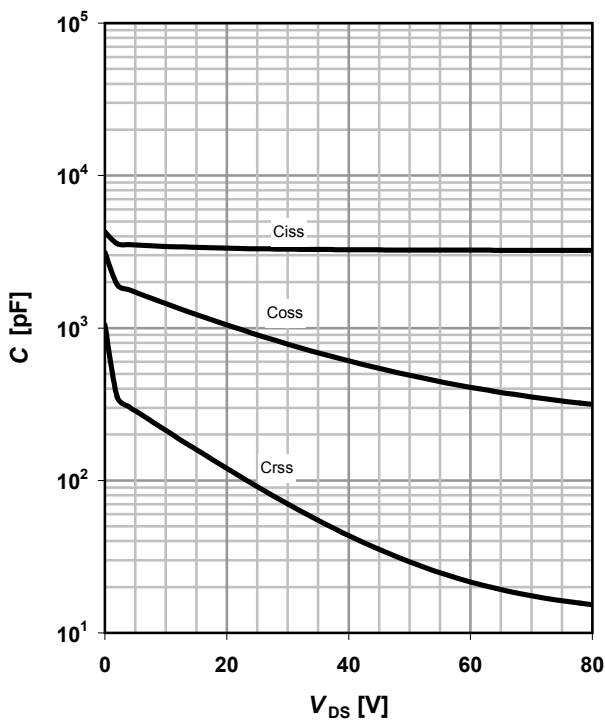
$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}$

parameter:  $I_D$



**11 Typ. capacitances**

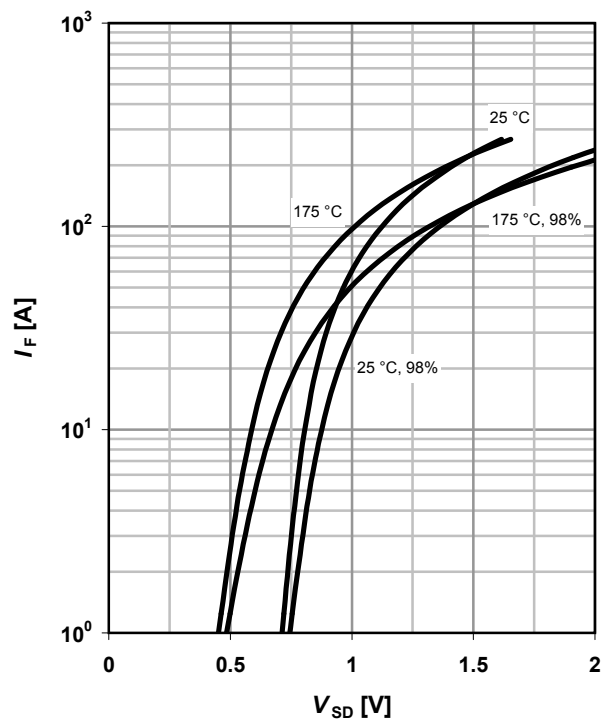
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$



**12 Forward characteristics of reverse diode**

$I_F=f(V_{SD})$

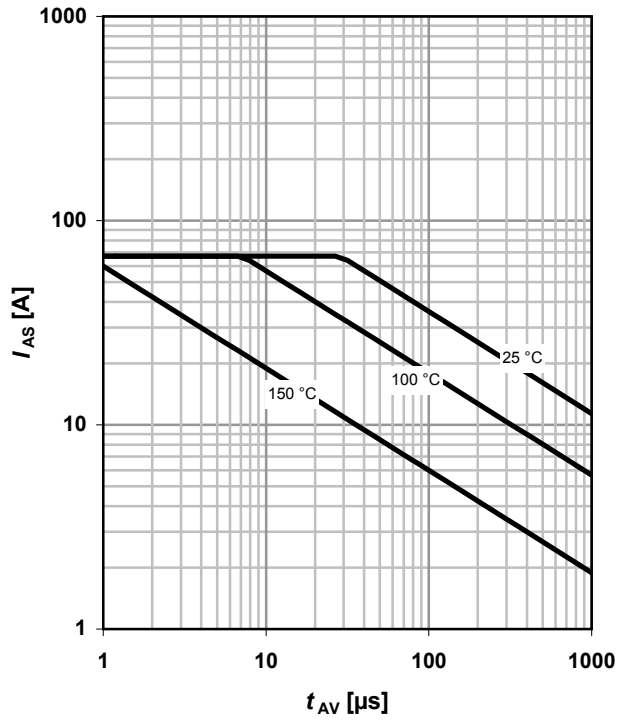
parameter:  $T_j$



### 13 Avalanche characteristics

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

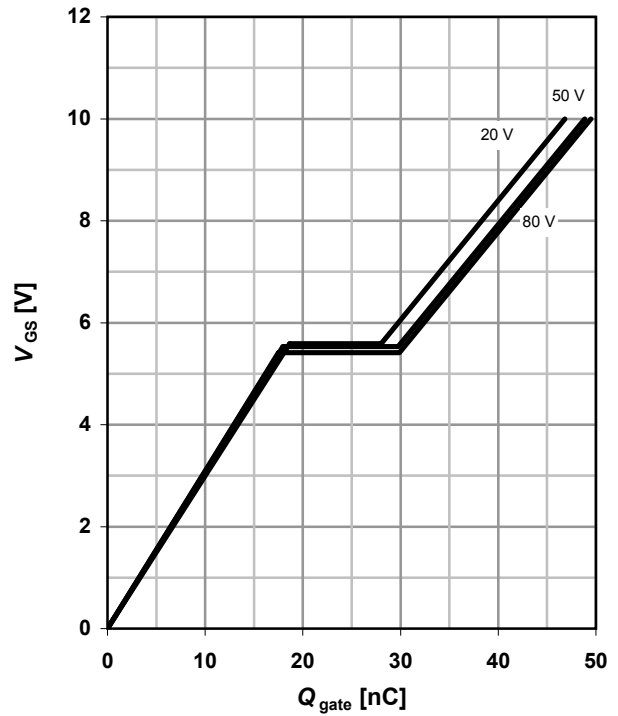
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

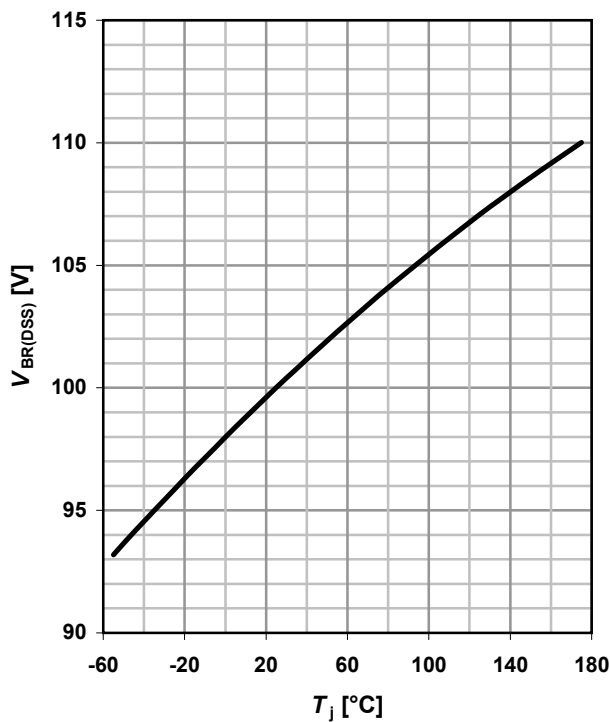
$V_{GS}=f(Q_{\text{gate}}); I_D=67 \text{ A pulsed}$

parameter:  $V_{DD}$

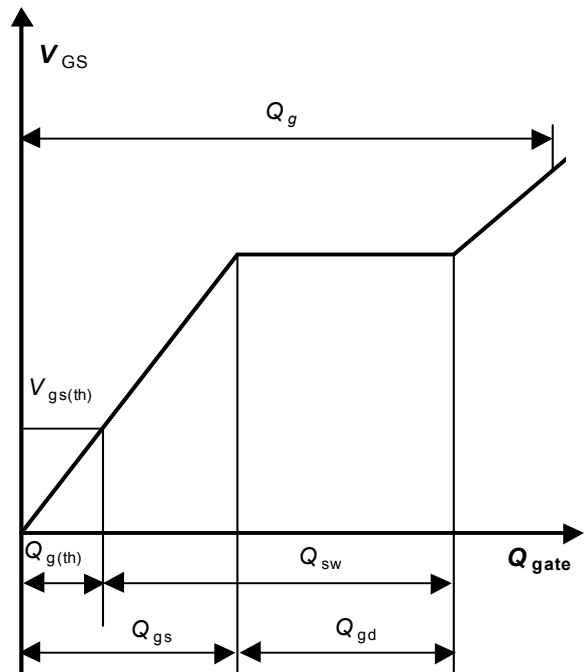


### 15 Drain-source breakdown voltage

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



### 16 Gate charge waveforms



PG-TO220-3: Outline



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
pP	3.700	3.886	0.146	0.153
Q	2.600	3.000	0.102	0.118

REFERENCE  
JEDEC TO220

SCALE

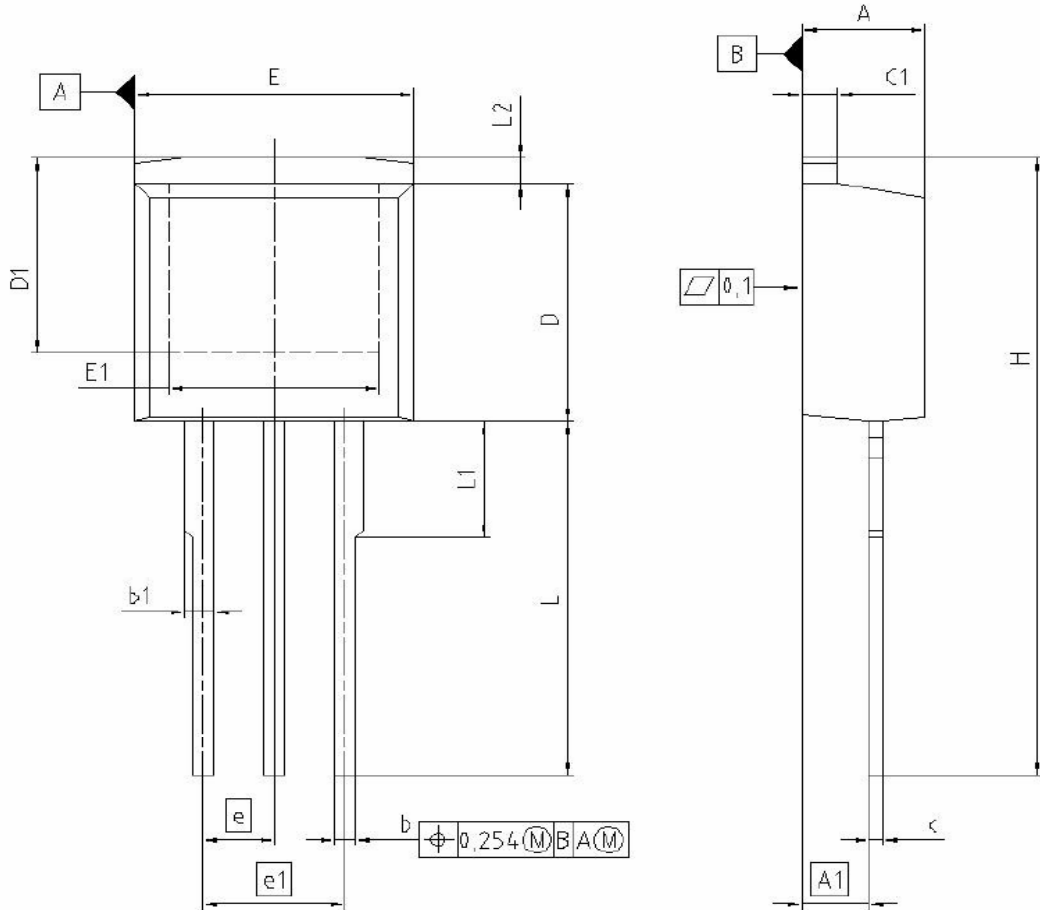
EUROPEAN PROJECTION

ISSUE DATE  
01-06-2005

FILE  
TO220\_1



PG-TO-262-3-1 (I<sup>2</sup>-PAK)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.500	0.169	0.177
A1	2.150	2.650	0.085	0.104
b	0.650	0.850	0.026	0.033
b1	0.635	1.400	0.025	0.055
c	0.400	0.600	0.016	0.024
c1	1.170	1.370	0.046	0.054
D	9.050	9.450	0.356	0.372
D1	8.900	7.650	0.272	0.301
E	9.800	10.200	0.386	0.402
E1	7.250	8.600	0.285	0.339
e	2.540		0.100	
e1	5.080		0.200	
N	3		3	
L	13.000	14.000	0.512	0.551
L1	4.350	4.750	0.171	0.187
L2	0.700	1.300	0.028	0.051

REFERENCE  
JEDEC TO262

SCALE

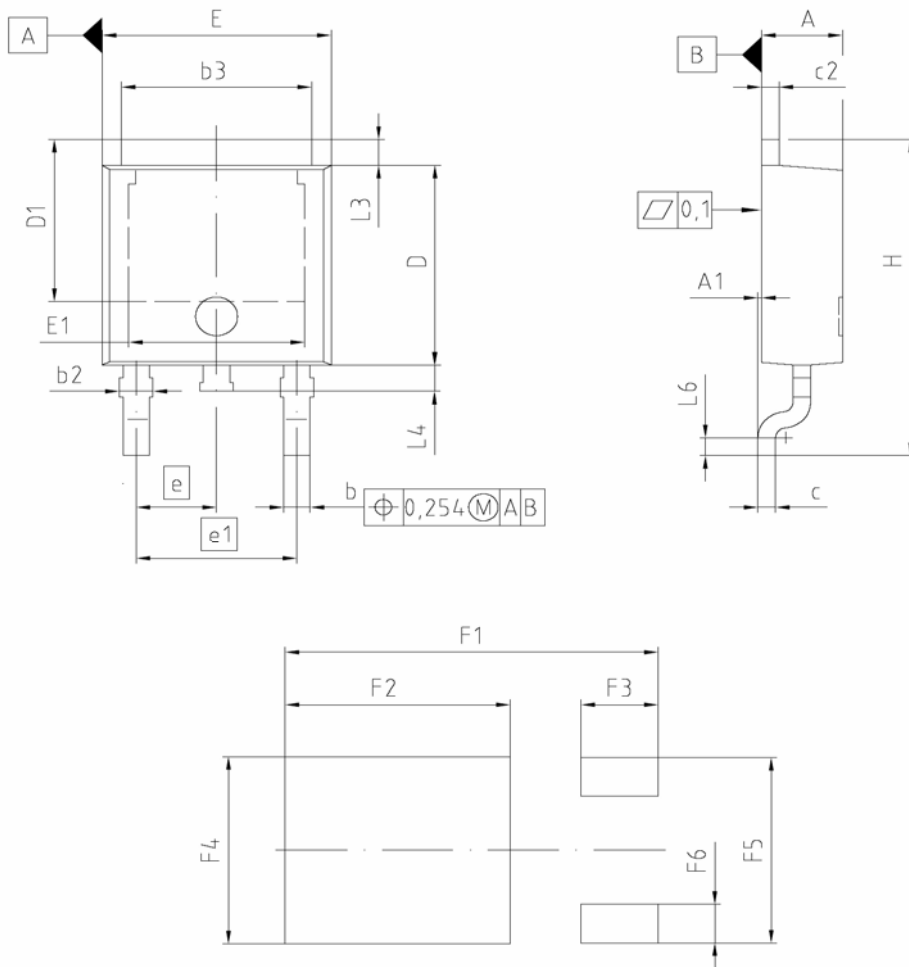
EUROPEAN PROJECTION

ISSUE DATE  
01-06-2005

FILE  
TO262\_1



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

**REFERENCE**  
JEDEC TO252

**SCALE**

**EUROPEAN PROJECTION**

**ISSUE DATE**  
21-09-2005

**FILE**  
TO252\_1

**Published by**  
Infineon Technologies AG  
81726 München, Germany  
© Infineon Technologies AG 2006.  
All Rights Reserved.

**Attention please!**

The information given in this data sheet shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

**Information**

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office ([www.infineon.com](http://www.infineon.com)).

**Warnings**

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.  
Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.