OptiMOS®2 Power-Transistor

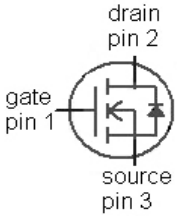
Features

- 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[1)] for target application
- Ideal for high-frequency switching and synchronous rectification

Product Summary

V_{DS}	100	V
$R_{DS(on),max\ (TO\ 263)}$	5.1	mΩ
I_D	100	A

Type	IPB05CN10N G	IPI05CN10N G	IPP05CN10N G
Package	PG-TO263-3	PG-TO262-3	PG-TO220-3
Marking	05CN10N	05CN10N	05CN10N



Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	**Symbol**	**Conditions**	**Value**	**Unit**
Continuous drain current	I_D	T_C=25 °C[2)]	100	A
		T_C=100 °C	100	
Pulsed drain current[3)]	$I_{D,pulse}$	T_C=25 °C	400	
Avalanche energy, single pulse	E_{AS}	I_D=100 A, R_{GS}=25 Ω	826	mJ
Reverse diode dv/dt	dv/dt	I_D=100 A, V_{DS}=80 V, di/dt=100 A/µs, $T_{j,max}$=175 °C	6	kV/µs
Gate source voltage [4)]	V_{GS}		±20	V
Power dissipation	P_{tot}	T_C=25 °C	300	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	0.5	K/W
Thermal resistance, junction - ambient	R_{thJA}	minimal footprint	-	-	62	
		6 cm^2 cooling area[5)]	-	-	40	
Electrical characteristics, at T_j=25 °C, unless otherwise specified						
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=1 mA	100	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250 µA	2	3	4	
Zero gate voltage drain current	I_{DSS}	V_{DS}=80 V, V_{GS}=0 V, T_j=25 °C	-	0.1	1	µA
		V_{DS}=80 V, V_{GS}=0 V, T_j=125 °C	-	10	100	
Gate-source leakage current	I_{GSS}	V_{GS}=20 V, V_{DS}=0 V	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10 V, I_D=100 A, TO220, TO262	-	4.1	5.4	mΩ
		V_{GS}=10 V, I_D=100 A, TO263	-	3.8	5.1	
Gate resistance	R_G		-	1.8	-	Ω
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=100 A	81	162	-	S

[1)] J-STD20 and JESD22

[2)] Current is limited by bondwire; with an R_{thJC}=0.5 K/W the chip is able to carry 161 A.

[3)] See figure 3

[4)] T_{jmax}=150 °C and duty cycle D=0.01 for V_{gs}<-5V

[5)] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

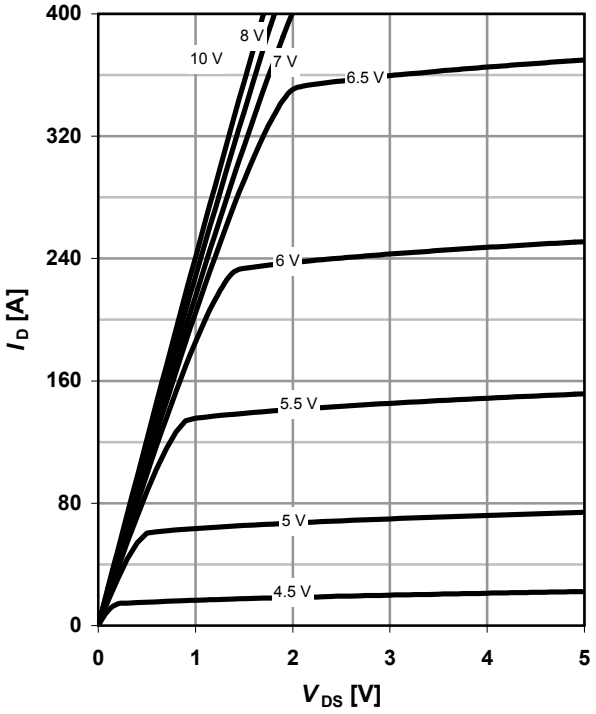
Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=50 V, f=1 MHz	-	9050	12000	pF
Output capacitance	C_{oss}		-	1370	1820	
Reverse transfer capacitance	C_{rss}		-	75	112	
Turn-on delay time	$t_{d(on)}$	V_{DD}=50 V, V_{GS}=10 V, I_D=50 A, R_G=1.6 Ω	-	28	42	ns
Rise time	t_r		-	42	63	
Turn-off delay time	$t_{d(off)}$		-	64	96	
Fall time	t_f		-	21	31	
Gate Charge Characteristics[6)]						
Gate to source charge	Q_{gs}	V_{DD}=50 V, I_D=100 A, V_{GS}=0 to 10 V	-	46	61	nC
Gate to drain charge	Q_{gd}		-	32	48	
Switching charge	Q_{sw}		-	51	73	
Gate charge total	Q_g		-	136	181	
Gate plateau voltage	$V_{plateau}$		-	5.1	-	V
Output charge	Q_{oss}	V_{DD}=50 V, V_{GS}=0 V	-	145	193	nC
Reverse Diode						
Diode continous forward current	I_S	T_C=25 °C	-	-	100	A
Diode pulse current	$I_{S,pulse}$		-	-	400	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=100 A, T_j=25 °C	-	1.0	1.2	V
Reverse recovery time	t_{rr}	V_R=50 V, I_F=I_S, di_F/dt=100 A/µs	-	110		ns
Reverse recovery charge	Q_{rr}		-	360	-	nC

[6)] See figure 16 for gate charge parameter definition

5 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

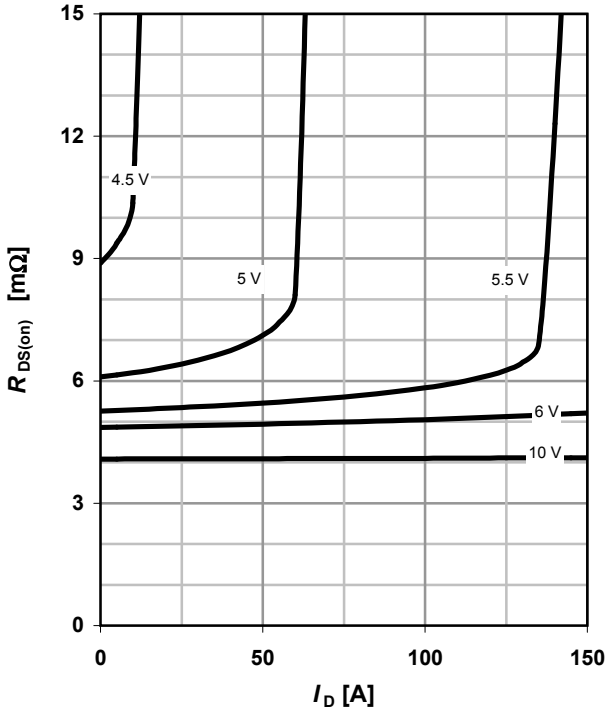
parameter: V_{GS}



6 Typ. drain-source on resistance

$R_{DS(on)}$=f(I_D); T_j=25 °C

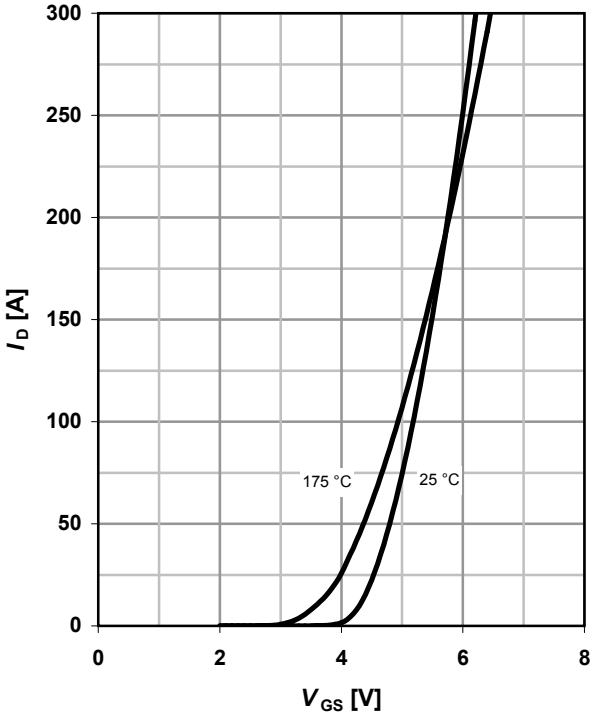
parameter: V_{GS}



7 Typ. transfer characteristics

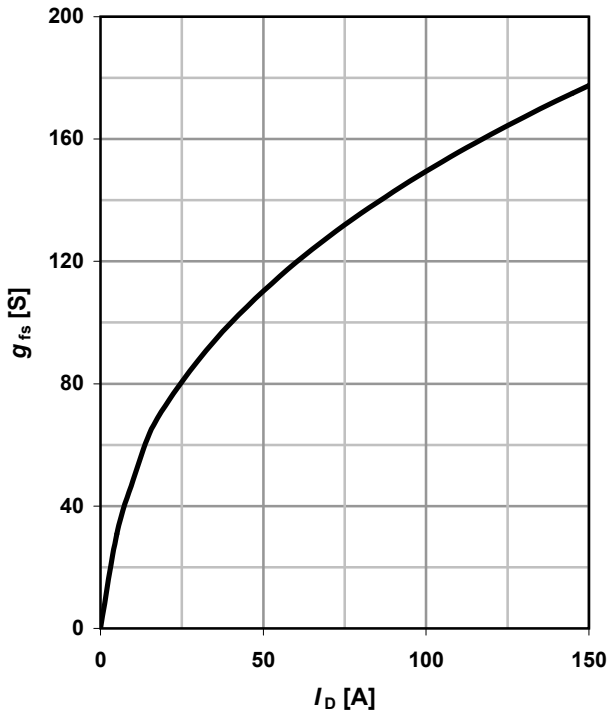
I_D=f(V_{GS}); $|V_{DS}|>2|I_D|R_{DS(on)max}$

parameter: T_j



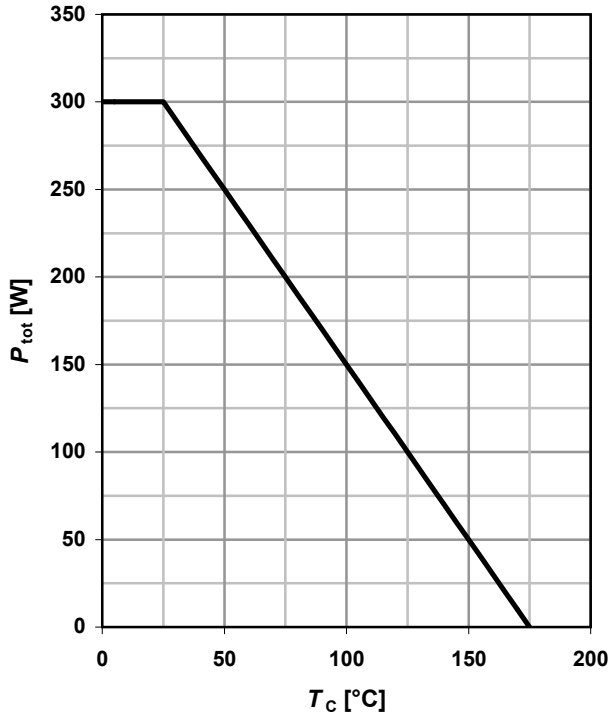
8 Typ. forward transconductance

g_{fs}=f(I_D); T_j=25 °C



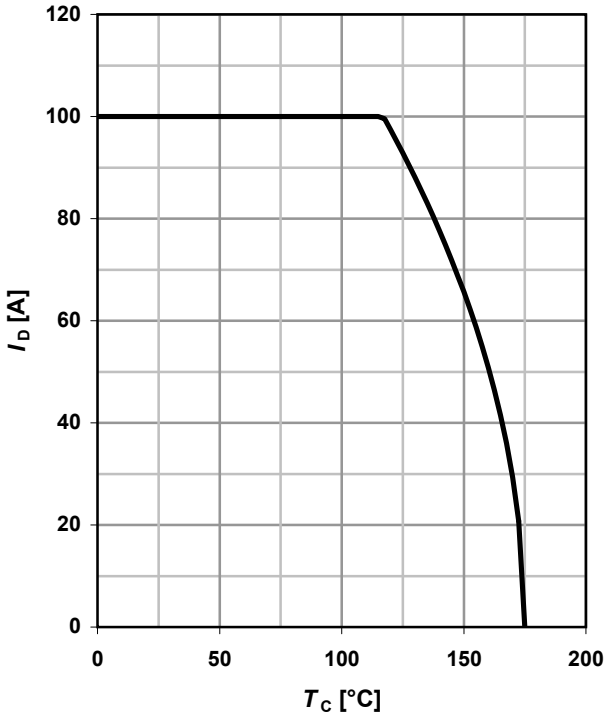
1 Power dissipation

$P_{tot}=f(T_C)$



2 Drain current

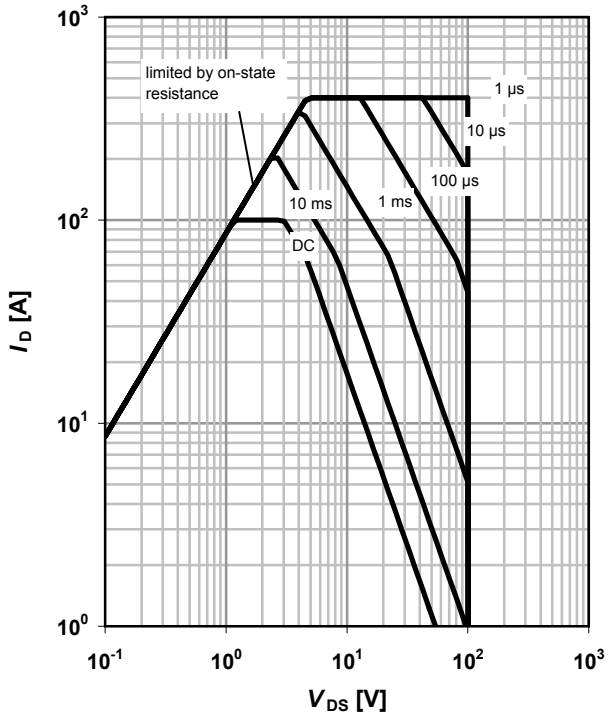
$I_D=f(T_C)$; $V_{GS}\geq 10$ V



3 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$

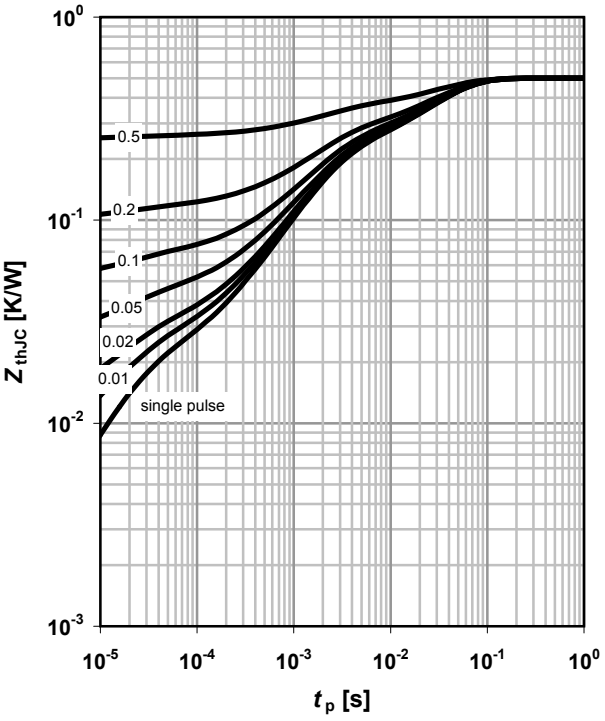
parameter: t_p



4 Max. transient thermal impedance

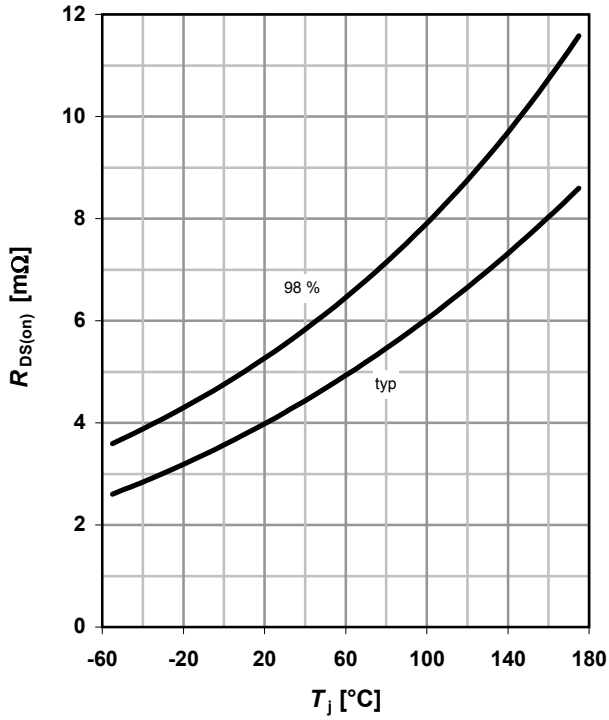
$Z_{thJC}=f(t_p)$

parameter: $D=t_p/T$



9 Drain-source on-state resistance

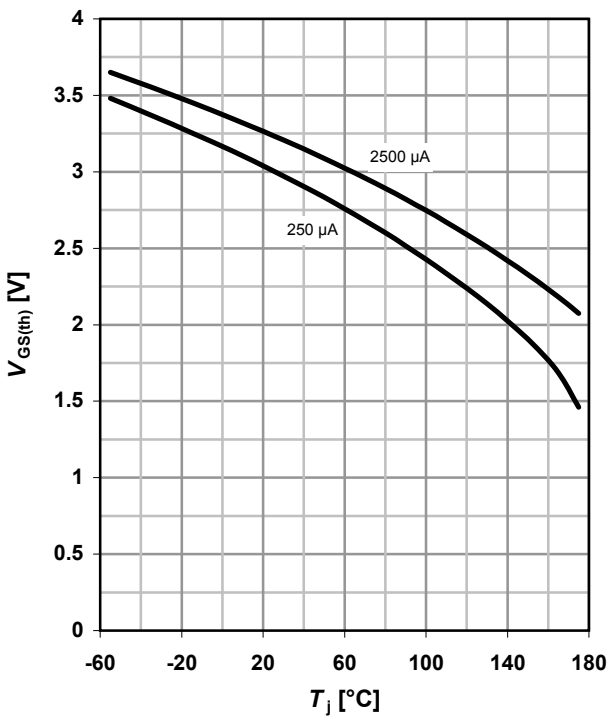
$R_{DS(on)}=f(T_j)$; $I_D=100$ A; $V_{GS}=10$ V



10 Typ. gate threshold voltage

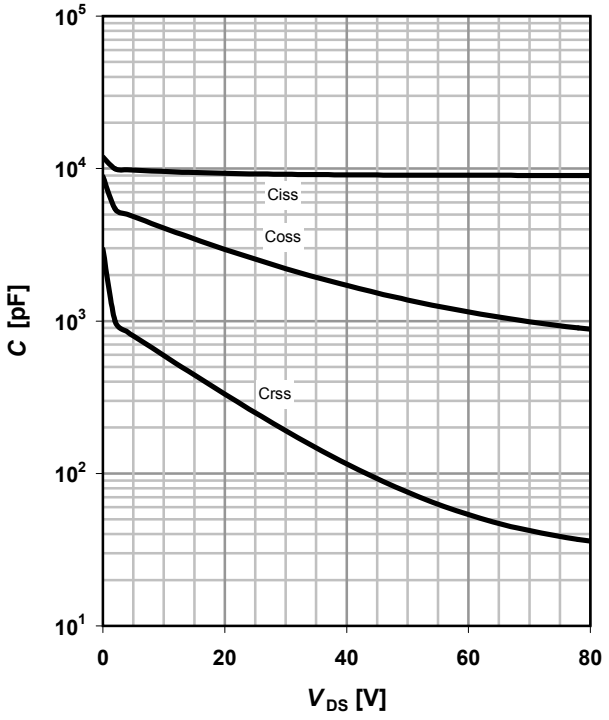
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$

parameter: I_D



11 Typ. capacitances

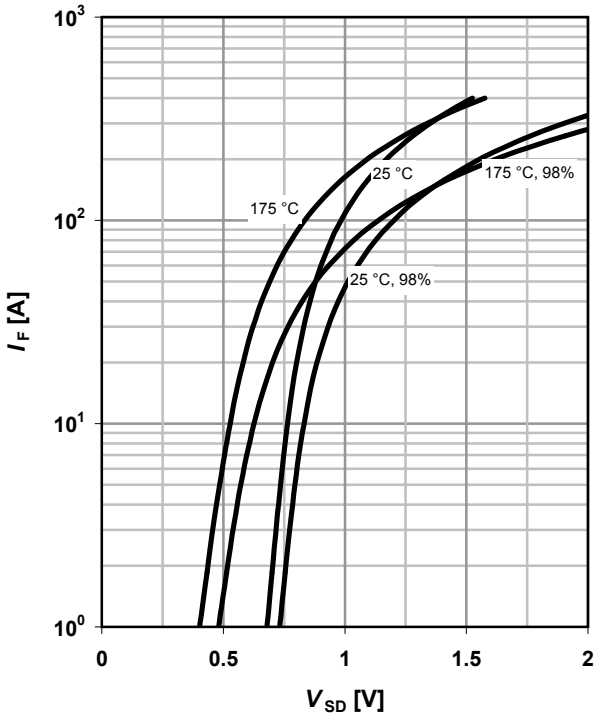
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz



12 Forward characteristics of reverse diode

$I_F=f(V_{SD})$

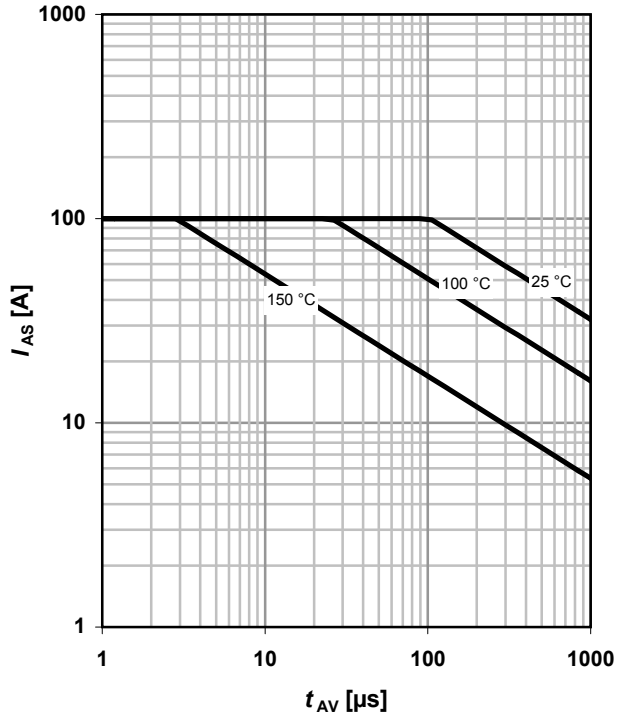
parameter: T_j



13 Avalanche characteristics

I_{AS}=f(t_{AV}); R_{GS}=25 Ω

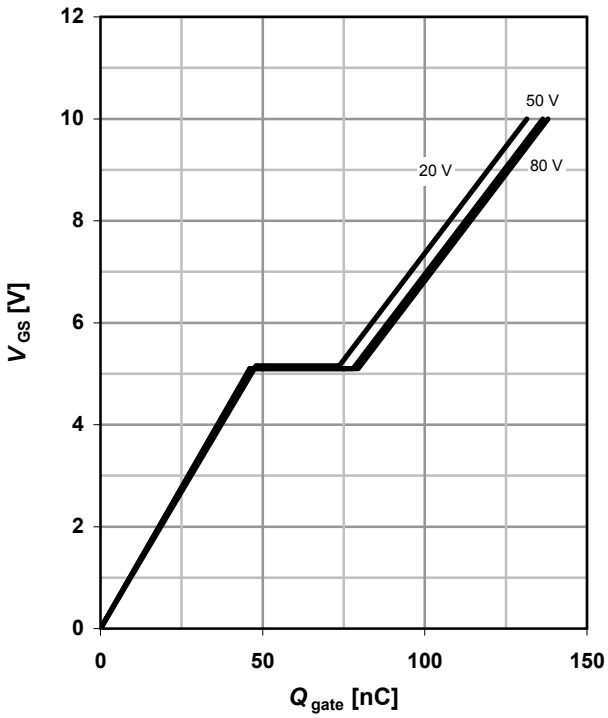
parameter: $T_{j(start)}$



14 Typ. gate charge

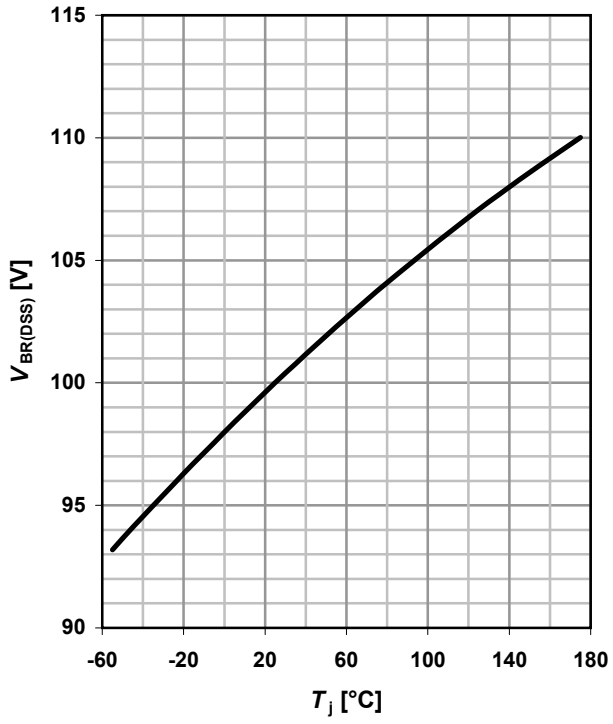
V_{GS}=f(Q_{gate}); I_D=100 A pulsed

parameter: V_{DD}

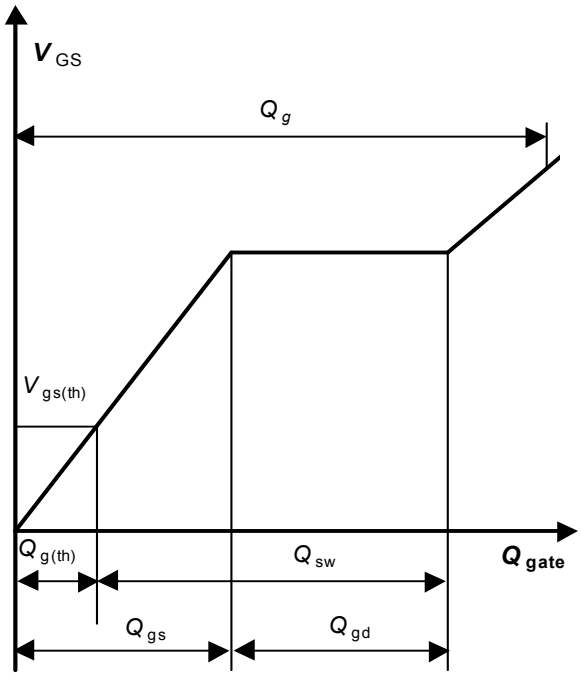


15 Drain-source breakdown voltage

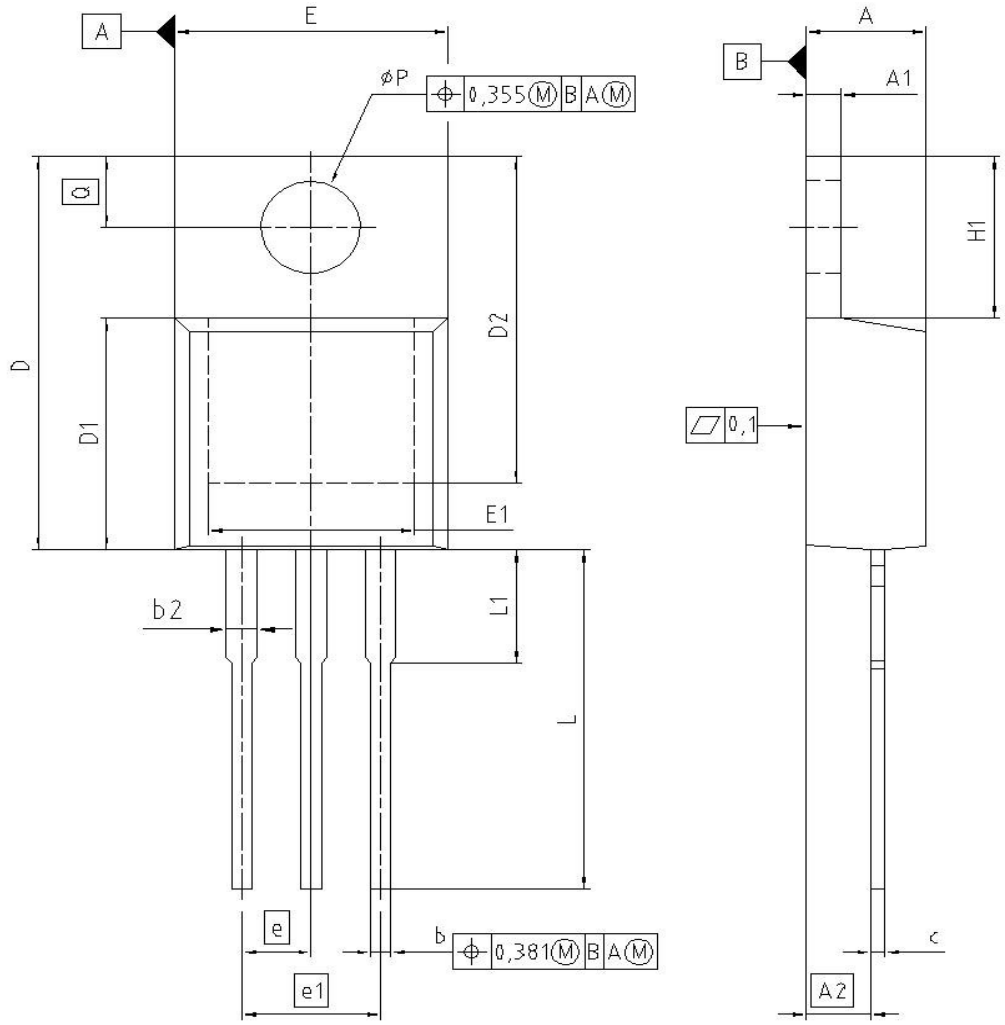
$V_{BR(DSS)}$=f(T_j); I_D=1 mA



16 Gate charge waveforms



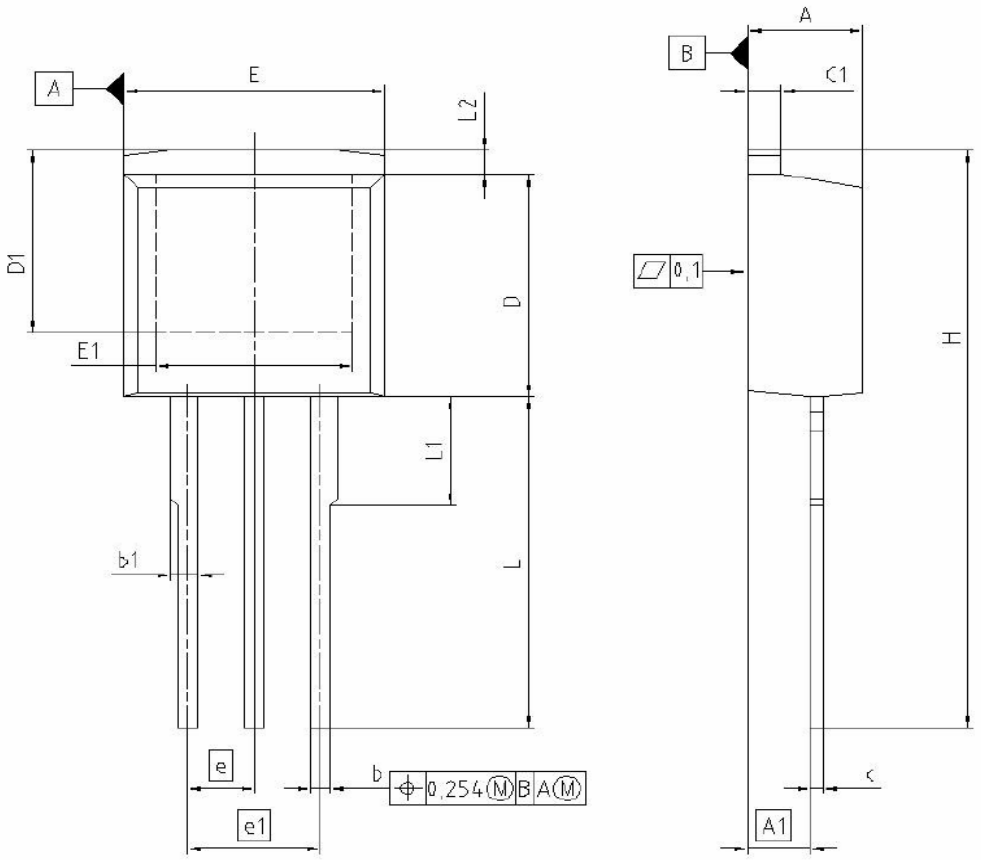
PG-TO220-3: Outline



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
øP	3.700	3.886	0.146	0.153
Q	2.600	3.000	0.102	0.118

REFERENCE	JEDEC TO220
SCALE	0 2.5 0 2.5 5mm
EUROPEAN PROJECTION	
ISSUE DATE	01-06-2005
FILE	TO220_1

PG-TO-262-3-1 (I²-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	6.900	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
0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
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FILE
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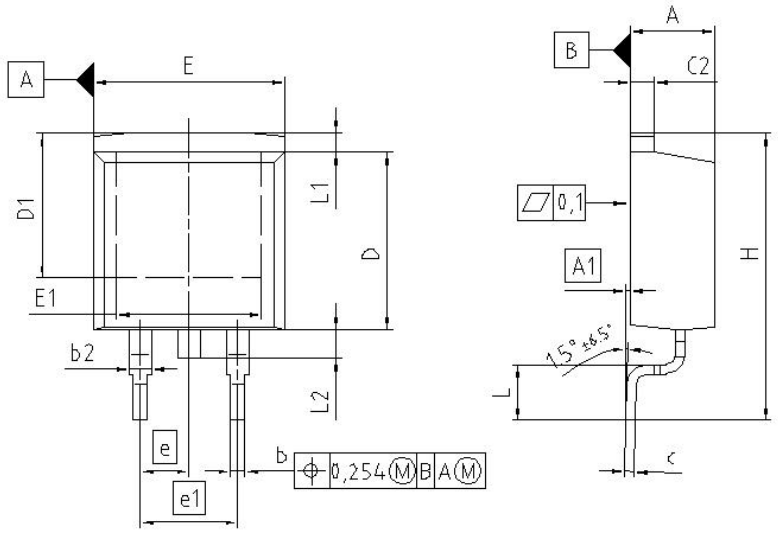
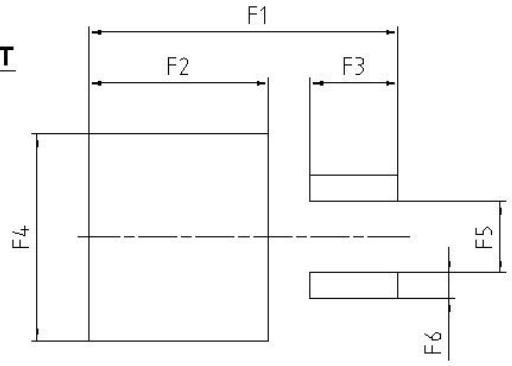
PG-TO-263 (D²-Pak)



FOOTPRINT



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.572	0.169	0.180
A1	0.000	0.254	0.000	0.010
b	0.650	0.850	0.026	0.033
b2	0.950	1.321	0.037	0.052
c	0.330	0.650	0.013	0.026
c2	0.170	1.400	0.046	0.055
D	8.509	9.450	0.335	0.372
D1	7.100	-	0.280	-
E	9.800	10.312	0.386	0.406
E1	6.500		0.256	
e	2.540		0.100	
e1	5.080		0.200	
N	2		2	
H	14.605	15.875	0.575	0.625
L	2.200	3.000	0.087	0.118
L1	-	1.600	-	0.063
L2	1.000	1.778	0.039	0.070
F1	16.050	16.250	0.632	0.640
F2	9.300	9.500	0.366	0.374
F3	4.500	4.700	0.177	0.185
F4	10.700	10.900	0.421	0.429
F5	3.630	3.830	0.143	0.151
F6	1.100	1.300	0.043	0.051

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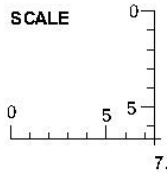
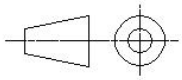
SCALE 
EUROPEAN PROJECTION 
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