OptiMOS™3 Power-Transistor

Features

- Fast switching MOSFET for SMPS
- Optimized technology for DC/DC converters
- Qualified according to JEDEC[1] for target applications
- N-channel, logic level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- 100% Avalanche tested
- Pb-free plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

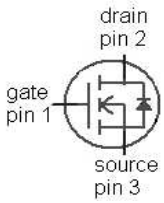
Product Summary

V_{DS}	40	V
$R_{DS(on),max}$	2.2	mΩ
I_D	90	A

RoHS

Halogen-Free

Type	IPB022N04L G
	
Package	PG-TO263-3
Marking	022N04L



Maximum ratings, at T_j=25 ℃, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	V_{GS}=10 V, T_C=25 ℃	90	A
		V_{GS}=10 V, T_C=100 ℃	90	
		V_{GS}=4.5 V, T_C=25 ℃	90	
		V_{GS}=4.5 V, T_C=100 ℃	90	
Pulsed drain current[2]	$I_{D,pulse}$	T_C=25 ℃	400	
Avalanche current, single pulse[3]	I_{AS}	T_C=25 ℃	90	
Avalanche energy, single pulse	E_{AS}	I_D=90 A, R_{GS}=25 Ω	150	mJ
Gate source voltage	V_{GS}		±20	V

[1] J-STD20 and JESD22

Maximum ratings, at T_j=25 ℃, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Power dissipation	P_{tot}	T_C=25 ℃	167	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 175	℃
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}		-	-	0.9	K/W
SMD version, device on PCB	R_{thJA}	minimal footprint	-	-	62	
		6 cm² cooling area[4)]	-	-	40	

Electrical characteristics, at T_j=25 ℃, unless otherwise specified

Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=1 mA	40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=95 µA	1.2	-	2	
Zero gate voltage drain current	I_{DSS}	V_{DS}=40 V, V_{GS}=0 V, T_j=25 ℃	-	0.1	1	µA
		V_{DS}=40 V, V_{GS}=0 V, T_j=125 ℃	-	10	100	
Gate-source leakage current	I_{GSS}	V_{GS}=20 V, V_{DS}=0 V	-	10	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=4.5 V, I_D=90 A	-	2.3	2.9	mΩ
		V_{GS}=10 V, I_D=90 A	-	1.8	2.2	
Gate resistance	R_G		-	1.9	-	Ω
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=90 A	110	220	-	S

[2)] See figure 3 for more detailed information

[3)] See figure 13 for more detailed information

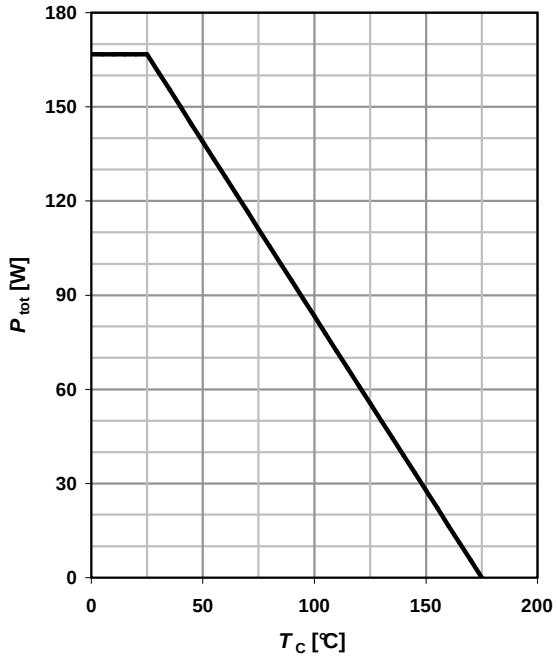
[4)] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz	-	9900	13000	pF
Output capacitance	C_{oss}		-	2000	2700	
Reverse transfer capacitance	C_{rss}		-	120	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, R_G=1.6 Ω	-	17	-	ns
Rise time	t_r		-	9	-	
Turn-off delay time	$t_{d(off)}$		-	66	-	
Fall time	t_f		-	11	-	
Gate Charge Characteristics[5)]						
Gate to source charge	Q_{gs}	V_{DD}=20 V, I_D=30 A, V_{GS}=0 to 10 V	-	28	-	nC
Gate charge at threshold	$Q_{g(th)}$		-	16	-	
Gate to drain charge	Q_{gd}		-	13	-	
Switching charge	Q_{sw}		-	25	-	
Gate charge total	Q_g		-	125	166	
Gate plateau voltage	$V_{plateau}$		-	2.9	-	V
Gate charge total	Q_g	V_{DD}=20 V, I_D=30 A, V_{GS}=0 to 4.5 V	-	60	80	nC
Gate charge total, sync. FET	$Q_{g(sync)}$	V_{DS}=0.1 V, V_{GS}=0 to 10 V	-	117	-	
Output charge	Q_{oss}	V_{DD}=20 V, V_{GS}=0 V	-	85	-	
Reverse Diode						
Diode continuous forward current	I_S	T_C=25 ℃	-	-	90	A
Diode pulse current	$I_{S,pulse}$		-	-	400	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=90 A, T_j=25 ℃	-	0.89	1.2	V
Reverse recovery charge	Q_{rr}	V_R=20 V, I_F=I_S, di_F/dt=400 A/µs	-	95	-	nC

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

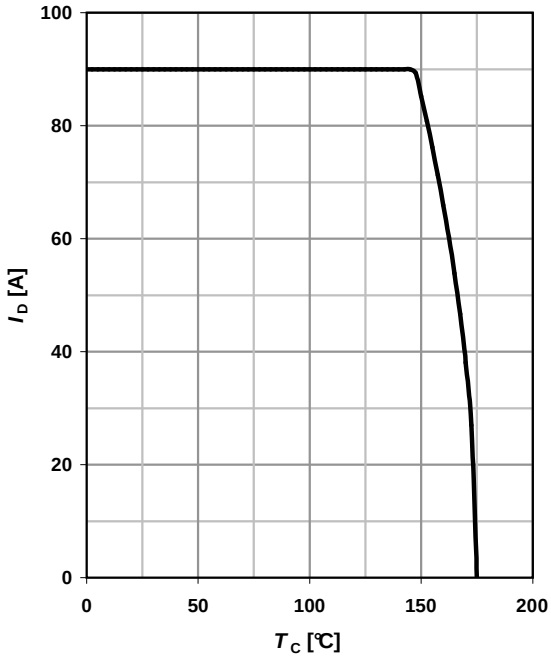
1 Power dissipation

$P_{tot}=f(T_C)$



2 Drain current

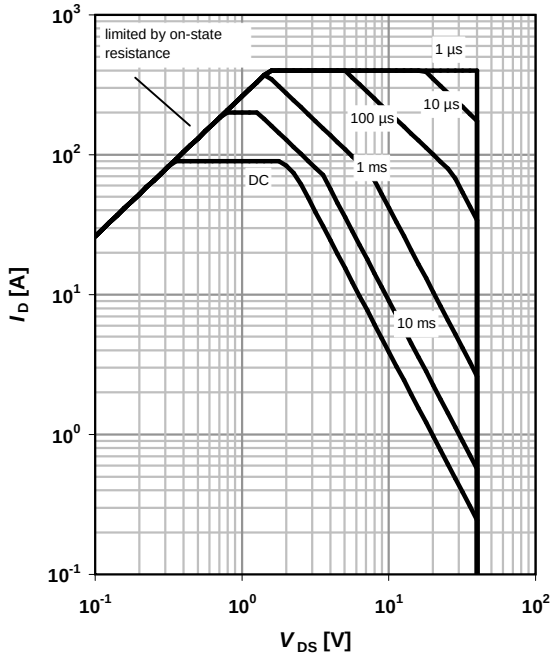
$I_D=f(T_C)$; $V_{GS}\geq 10$ V



3 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ ℃; $D=0$

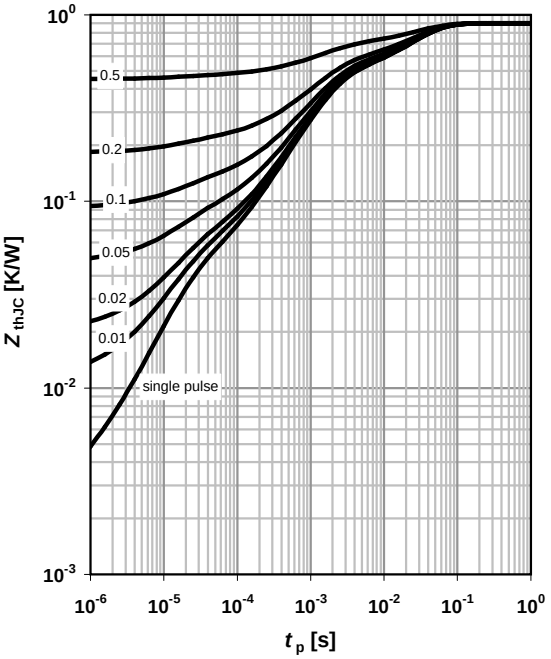
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

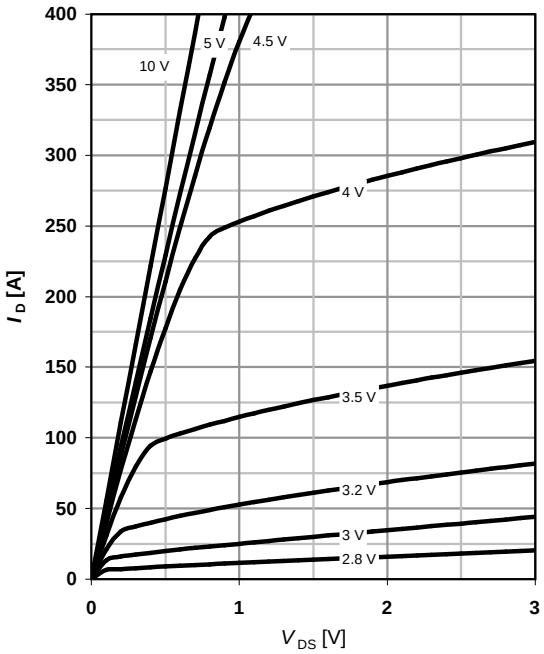
parameter: $D=t_p/T$



5 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ ℃

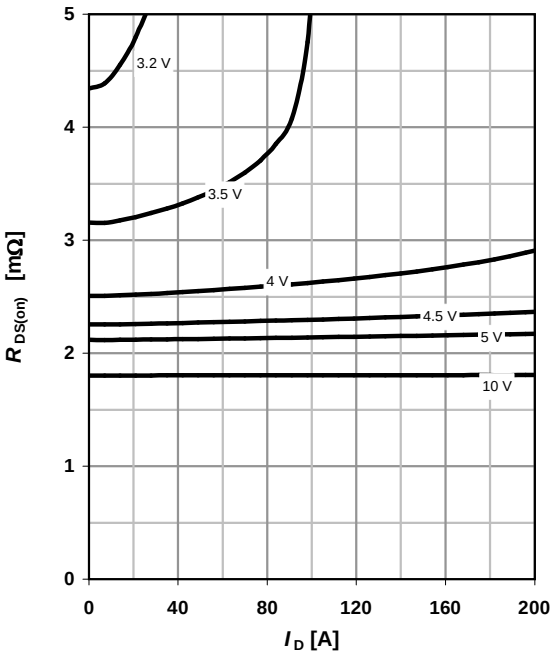
parameter: V_{GS}



6 Typ. drain-source on resistance

$R_{DS(on)}=f(I_D)$; $T_j=25$ ℃

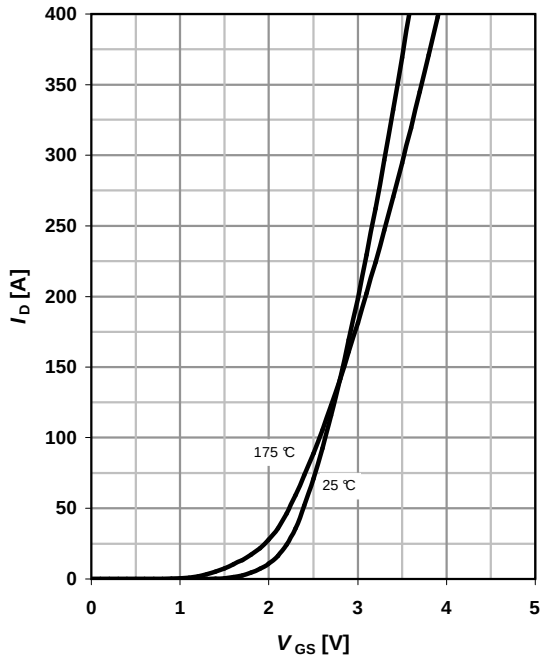
parameter: V_{GS}



7 Typ. transfer characteristics

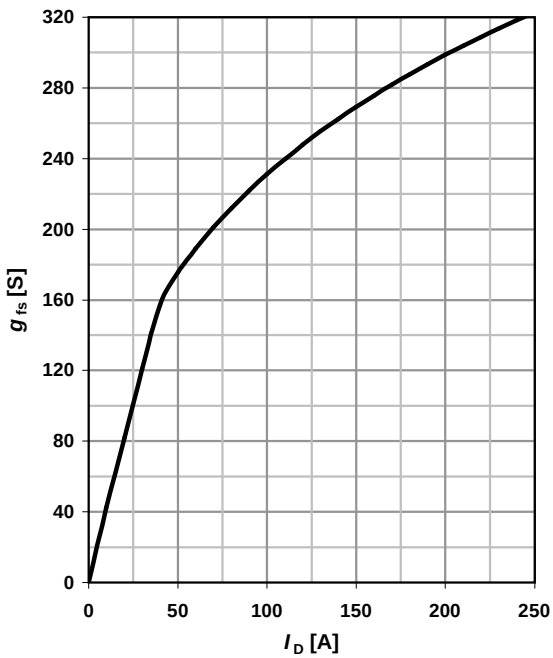
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$

parameter: T_j



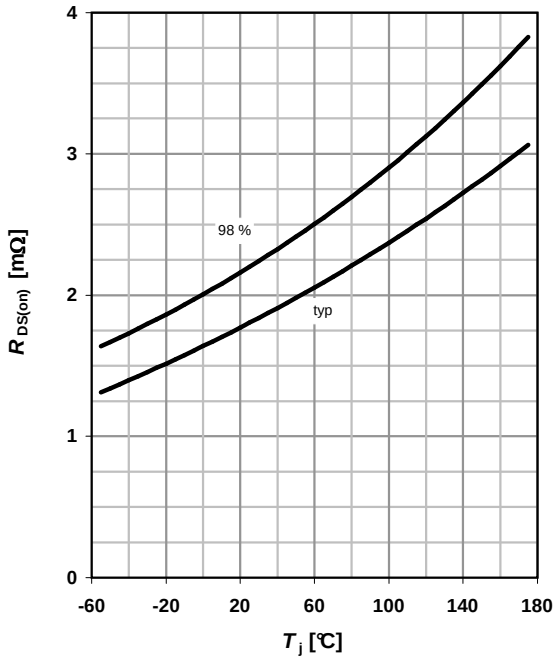
8 Typ. forward transconductance

$g_{fs}=f(I_D)$; $T_j=25$ ℃



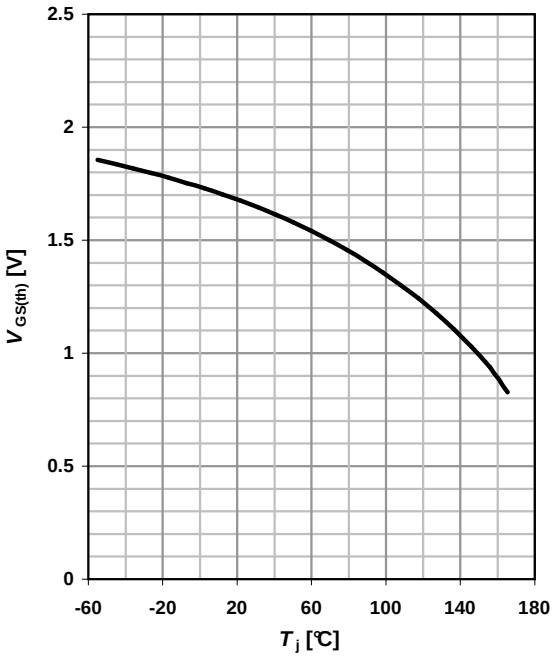
9 Drain-source on-state resistance

$R_{DS(on)}=f(T_j)$; $I_D=90$ A; $V_{GS}=10$ V



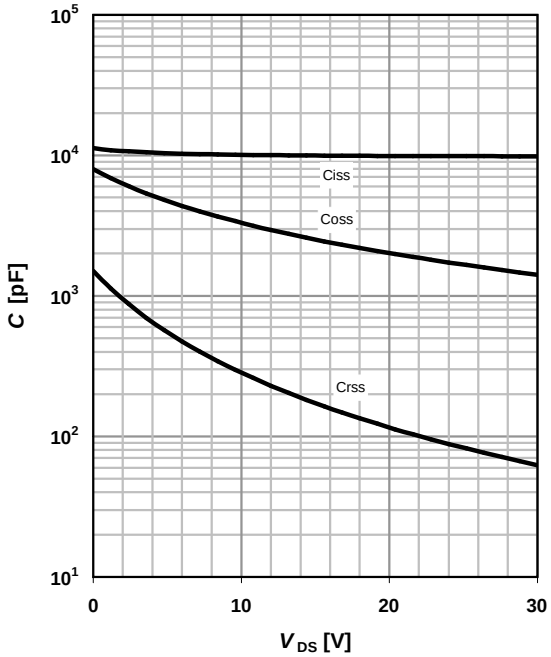
10 Typ. gate threshold voltage

$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; $I_D=250$ µA



11 Typ. capacitances

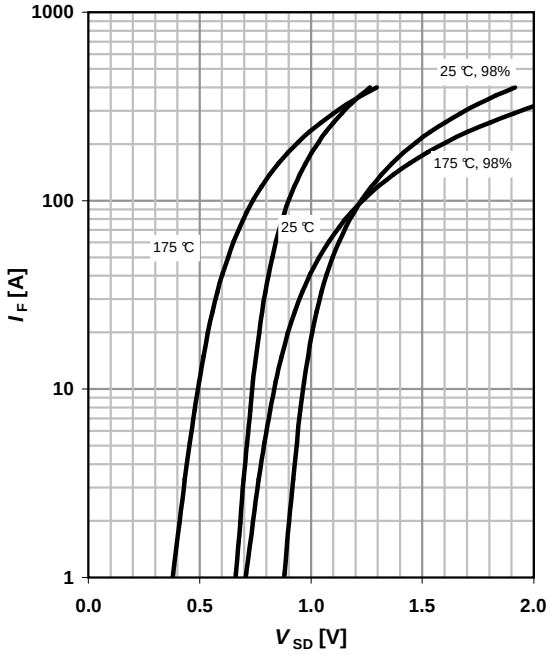
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz



12 Forward characteristics of reverse diode

$I_F=f(V_{SD})$

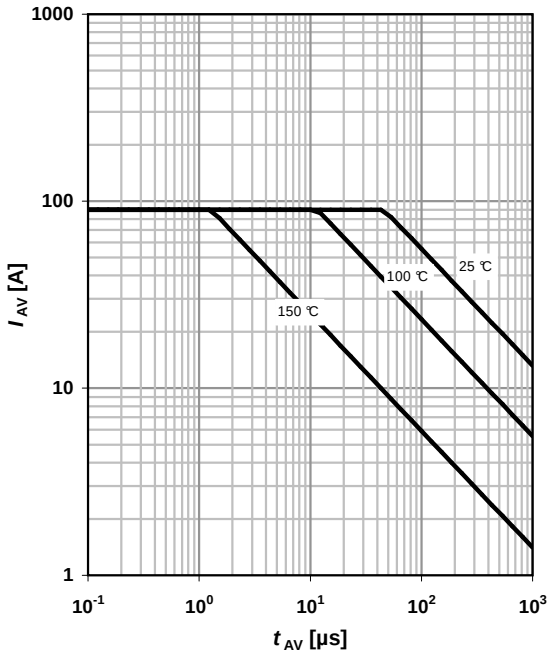
parameter: T_j



13 Avalanche characteristics

I_{AS}=f(t_{AV}); R_{GS}=25 Ω

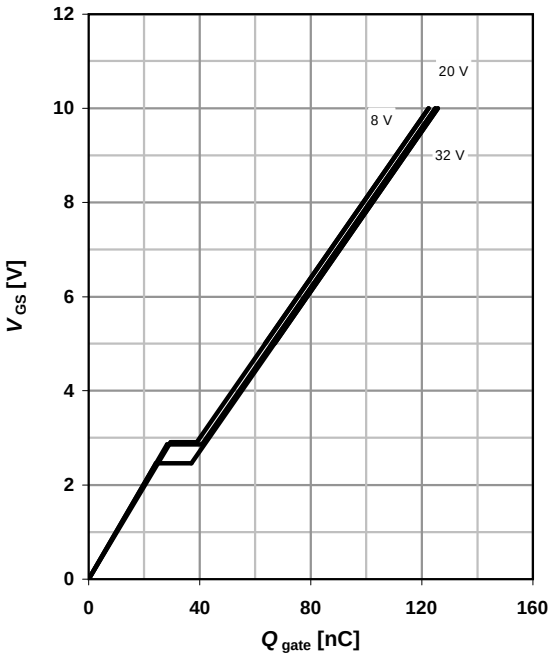
parameter: $T_{j(start)}$



14 Typ. gate charge

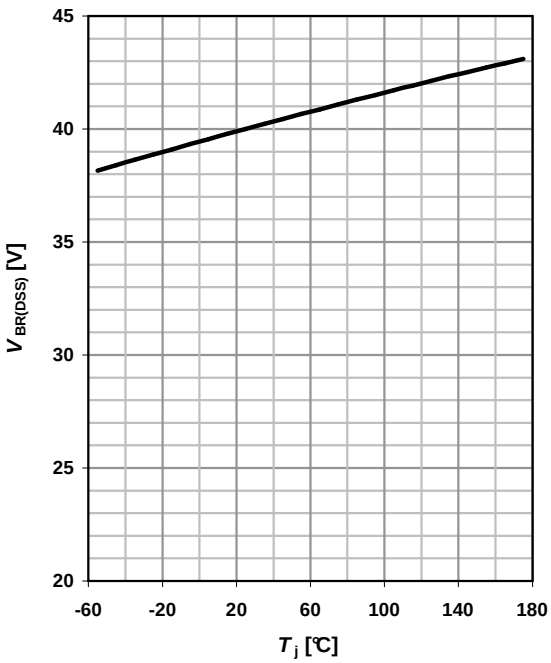
V_{GS}=f(Q_{gate}); I_D=30 A pulsed

parameter: V_{DD}

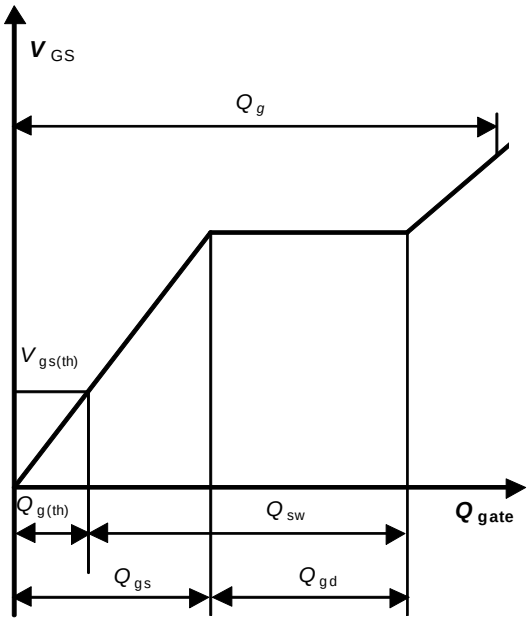


15 Drain-source breakdown voltage

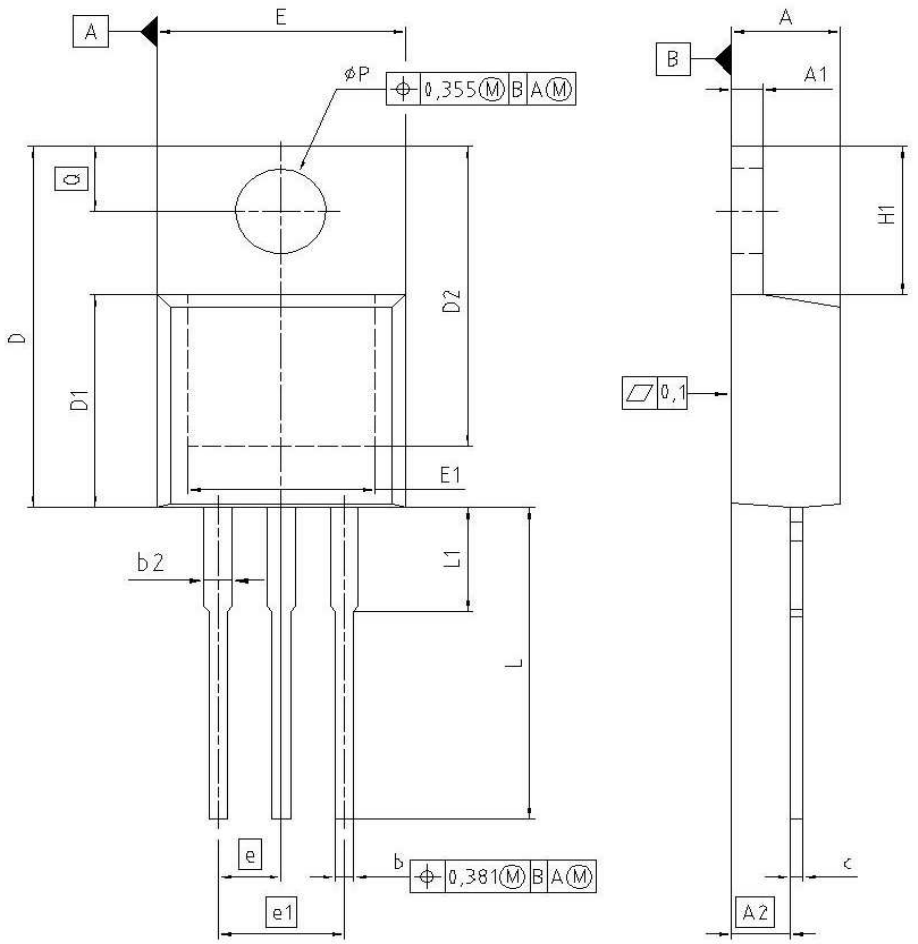
$V_{BR(DSS)}$=f(T_j); I_D=1 mA



16 Gate charge waveforms



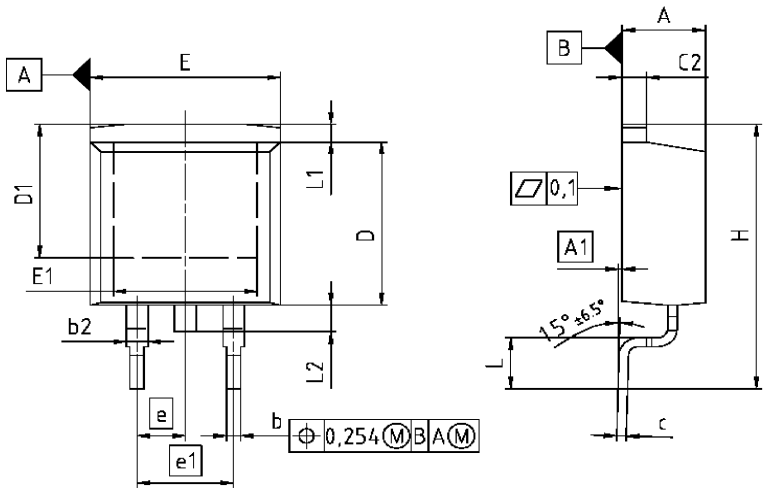
Package Outline **PG-TO220-3-1**



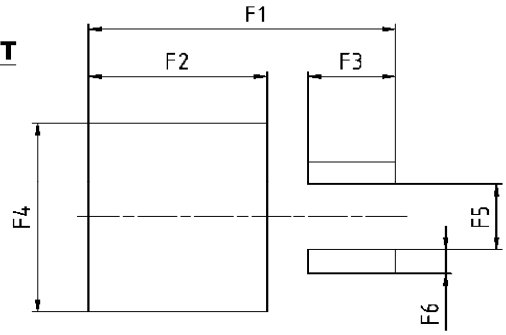
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.572	0.169	0.180
A1	1.170	1.400	0.046	0.055
A2	2.215	2.718	0.087	0.107
b	0.650	0.864	0.026	0.034
b2	0.635	1.778	0.025	0.070
c	0.330	0.600	0.013	0.024
D	14.808	15.950	0.583	0.628
D1	8.509	9.450	0.335	0.372
D2	12.850	13.100	0.506	0.516
E	9.700	10.363	0.382	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

Package Outline **PG-TO263-3**



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

REFERENCE JEDEC TO263
SCALE 0 5 5 7.5mm
EUROPEAN PROJECTION
ISSUE DATE 12-02-2006
FILE TO263_2

Published by
Infineon Technologies AG
81726 Munich, Germany

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