OptiMOS®3 Power-Transistor

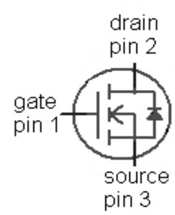
Product Summary

V_{DS}	40	V
$R_{DS(on),max}$	3.9	mΩ
I_D	80	A

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

Type	IPB039N04L G	IPP039N04L G
		
Package	PG-TO263-3	PG-TO220-3
Marking	039N04L	039N04L



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

Parameter	**Symbol**	**Conditions**	**Value**	**Unit**
Continuous drain current	I_D	V_{GS}=10 V, T_C=25 °C	80	A
		V_{GS}=10 V, T_C=100 °C	80	
		V_{GS}=4.5 V, T_C=25 °C	80	
		V_{GS}=4.5 V, T_C=100 °C	73	
Pulsed drain current[2)]	$I_{D,pulse}$	T_C=25 °C	400	
Avalanche current, single pulse[3)]	I_{AS}	T_C=25 °C	80	
Avalanche energy, single pulse	E_{AS}	I_D=80 A, R_{GS}=25 Ω	60	mJ
Gate source voltage	V_{GS}		±20	V

[1)] J-STD20 and JESD22

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

Parameter	Symbol	Conditions	Value	Unit
Power dissipation	P_{tot}	T_C=25 °C	94	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}		-	-	1.6	K/W
SMD version, device on PCB	R_{thJA}	minimal footprint	-	-	62	
		6 cm² cooling area[4)]	-	-	40	

Electrical characteristics, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
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=45 µA	1.2	-	2	
Zero gate voltage drain current	I_{DSS}	V_{DS}=40 V, V_{GS}=0 V, T_j=25 °C	-	0.1	1	µA
		V_{DS}=40 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	-	10	100	nA
Drain-source on-state resistance[5)]	$R_{DS(on)}$	V_{GS}=4.5 V, I_D=80 A	-	4.2	5.2	mΩ
		V_{GS}=10 V, I_D=80 A	-	3.1	3.9	
Gate resistance	R_G		-	1.6	-	Ω
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=80 A	75	151	-	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.

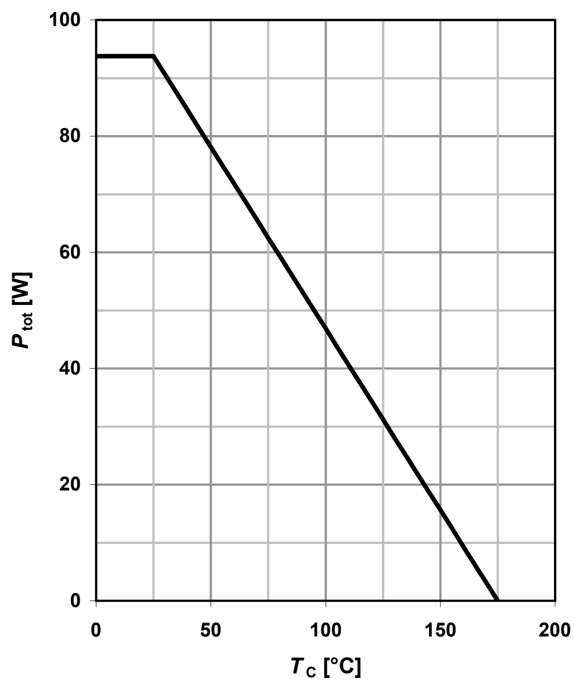
[5)] Measured from drain tab to source pin

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=25 V, f=1 MHz	-	4600	6100	pF
Output capacitance	C_{oss}		-	820	1100	
Reverse transfer capacitance	C_{rss}		-	39	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, R_G=1.6 Ω	-	10	-	ns
Rise time	t_r		-	5.4	-	
Turn-off delay time	$t_{d(off)}$		-	38	-	
Fall time	t_f		-	6.0	-	
Gate Charge Characteristics[6)]						
Gate to source charge	Q_{gs}	V_{DD}=20 V, I_D=30 A, V_{GS}=0 to 10 V	-	14	-	nC
Gate charge at threshold	$Q_{g(th)}$		-	7.4	-	
Gate to drain charge	Q_{gd}		-	6.1	-	
Switching charge	Q_{sw}		-	13	-	
Gate charge total	Q_g		-	59	78	
Gate plateau voltage	$V_{plateau}$		-	3.0	-	V
Gate charge total	Q_g	V_{DD}=20 V, I_D=30 A, V_{GS}=0 to 4.5 V	-	28	38	nC
Gate charge total, sync. FET	$Q_{g(sync)}$	V_{DS}=0.1 V, V_{GS}=0 to 10 V	-	55	-	
Output charge	Q_{oss}	V_{DD}=20 V, V_{GS}=0 V	-	42	-	
Reverse Diode						
Diode continuous forward current	I_S	T_C=25 °C	-	-	78	A
Diode pulse current	$I_{S,pulse}$		-	-	400	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=80 A, T_j=25 °C	-	0.92	1.2	V
Reverse recovery charge	Q_{rr}	V_R=20 V, I_F=I_S, di_F/dt=400 A/µs	-	50	-	nC

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

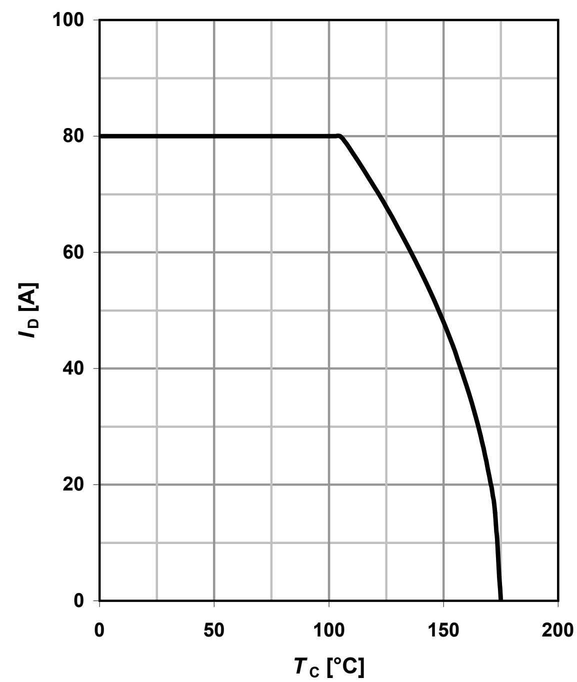
1 Power dissipation

P_{tot}=f(T_C)



2 Drain current

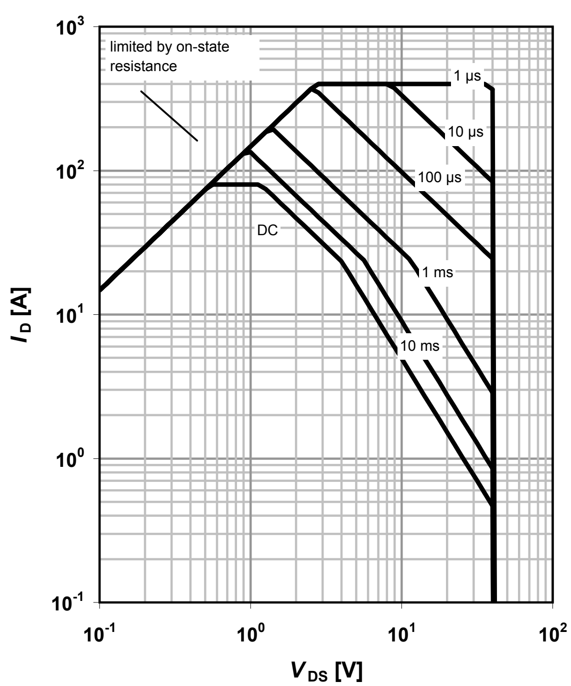
I_D=f(T_C); V_{GS}≥10 V



3 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

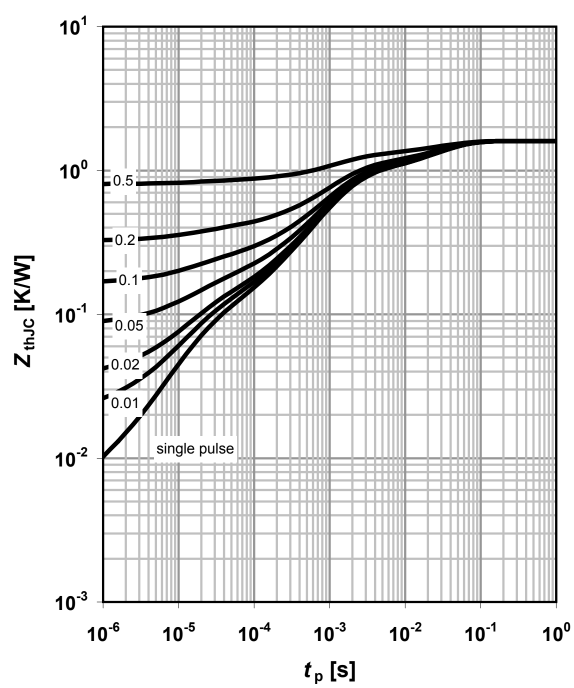
parameter: t_p



4 Max. transient thermal impedance

Z_{thJC}=f(t_p)

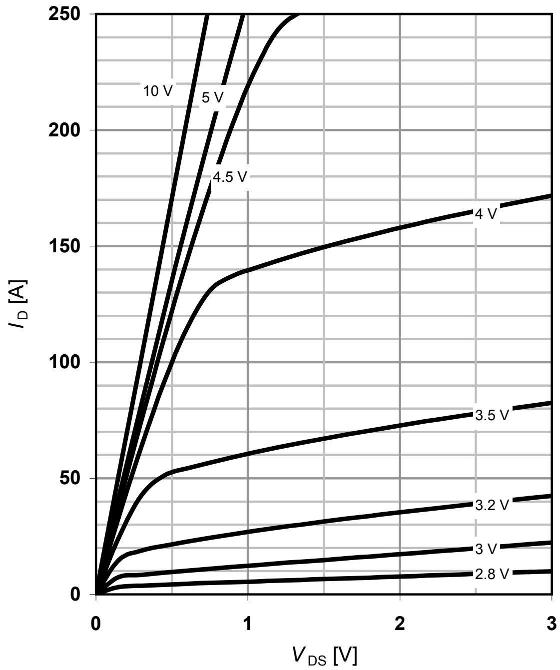
parameter: $D=t_p/T$



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

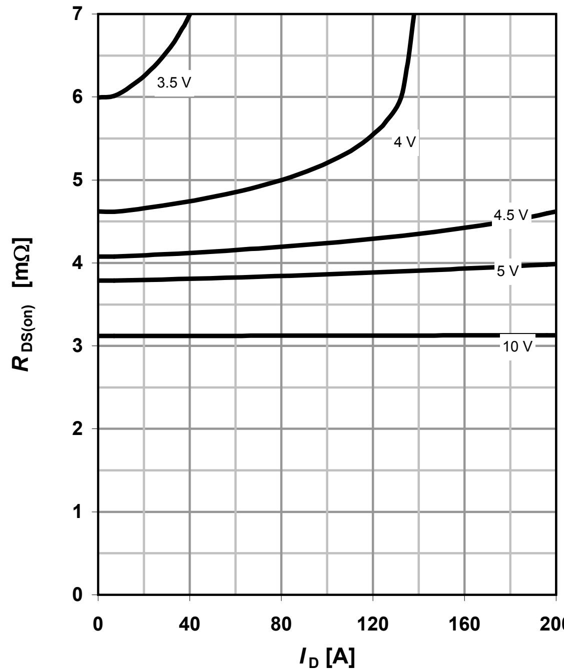
parameter: V_{GS}



6 Typ. drain-source on resistance

$R_{DS(on)}$=f(I_D); T_j=25 °C

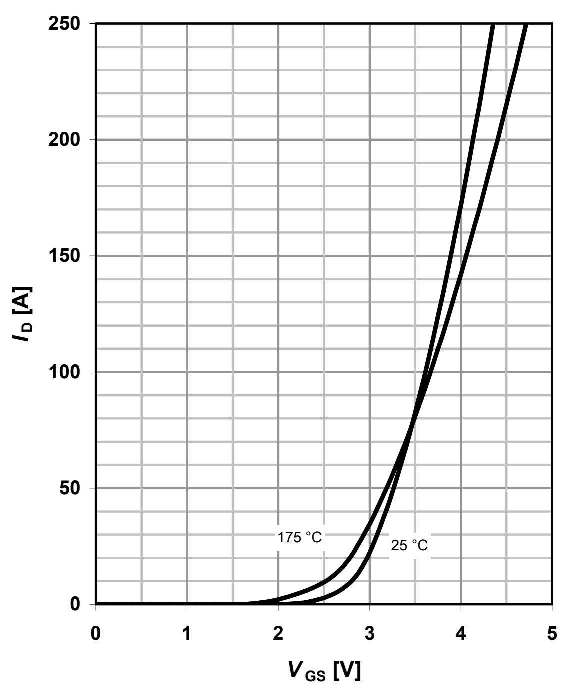
parameter: V_{GS}



7 Typ. transfer characteristics

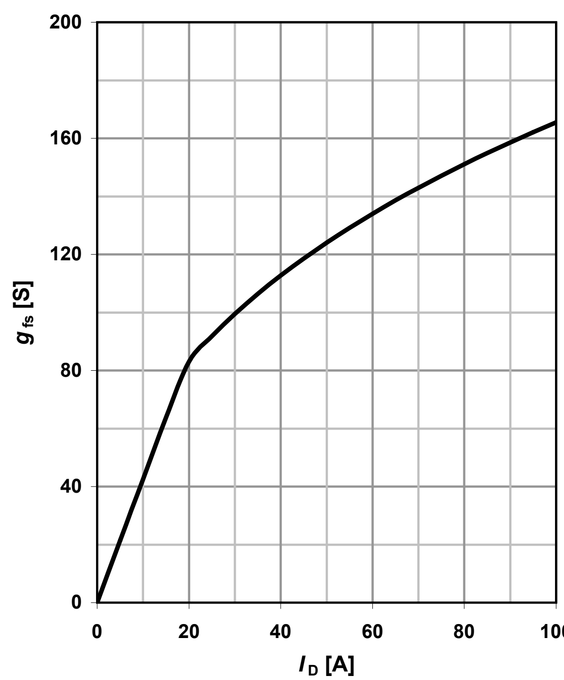
I_D=f(V_{GS}); $|V_{DS}|>2|I_D|R_{DS(on)max}$

parameter: T_j



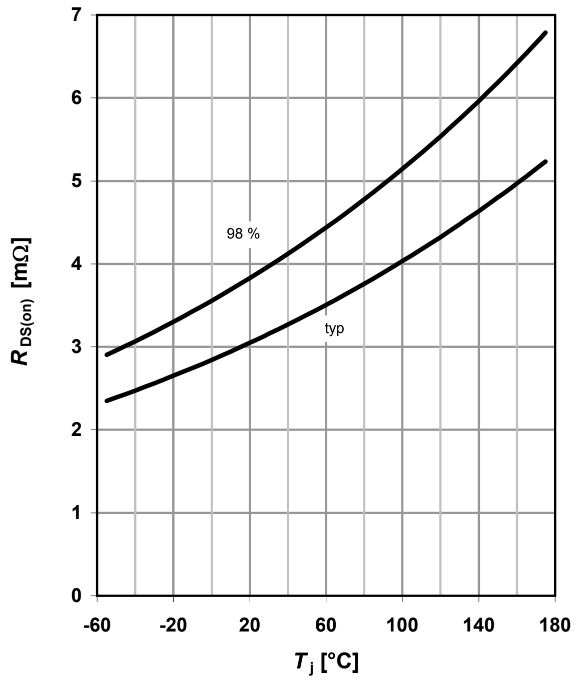
8 Typ. forward transconductance

g_{fs}=f(I_D); T_j=25 °C



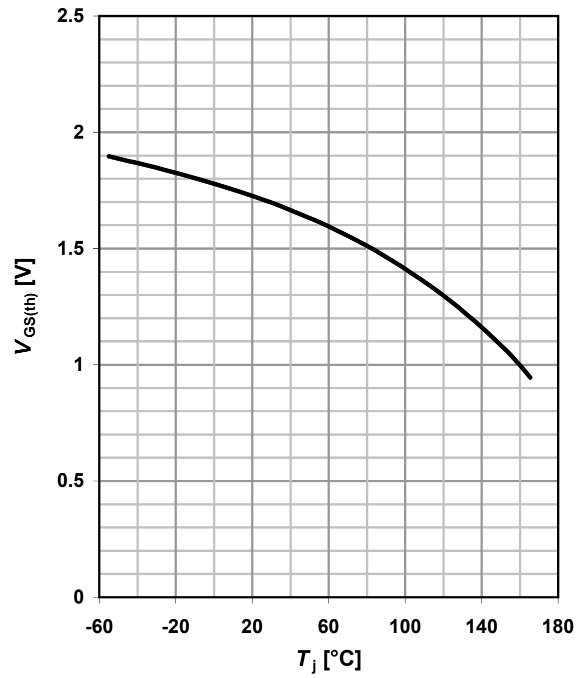
9 Drain-source on-state resistance

$R_{DS(on)}$=f(T_j); I_D=80 A; V_{GS}=10 V



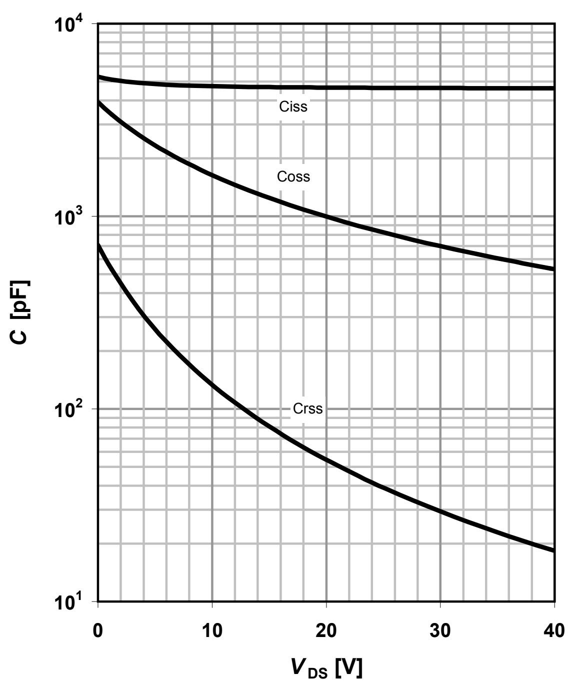
10 Typ. gate threshold voltage

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



11 Typ. capacitances

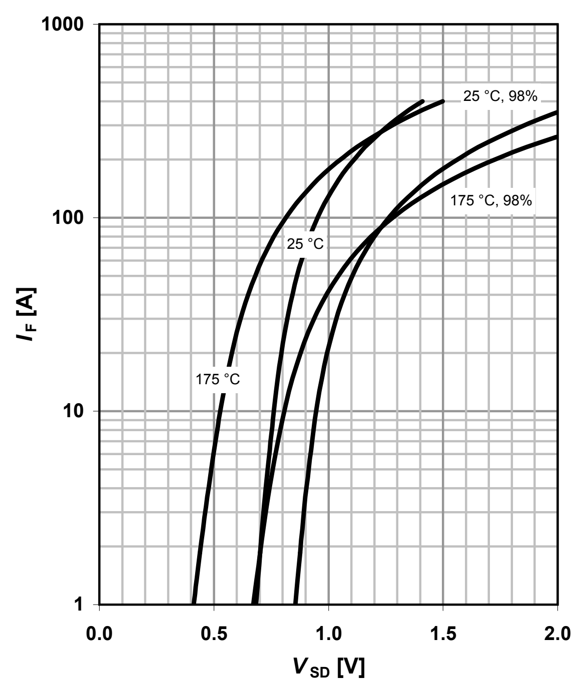
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz



12 Forward characteristics of reverse diode

I_F=f(V_{SD})

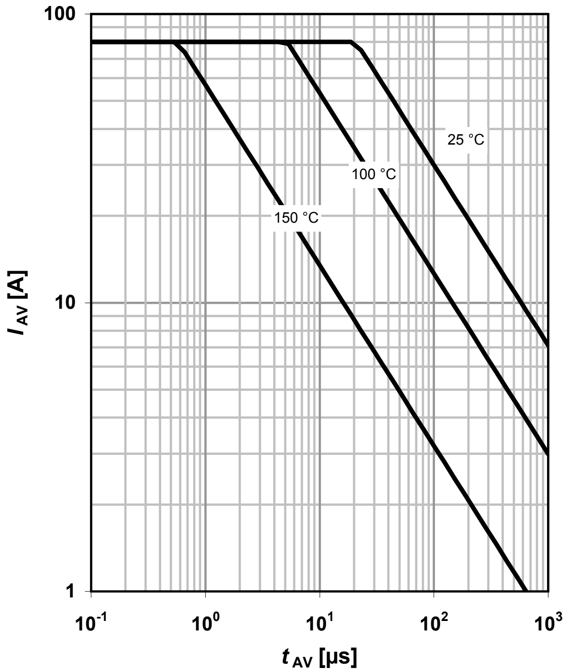
parameter: T_j



13 Avalanche characteristics

I_{AS}=f(t_{AV}); R_{GS}=25 Ω

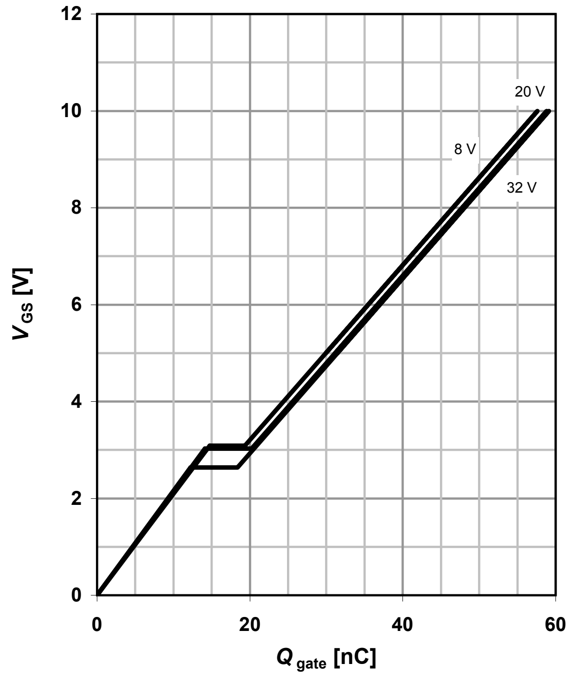
parameter: $T_{j(start)}$



14 Typ. gate charge

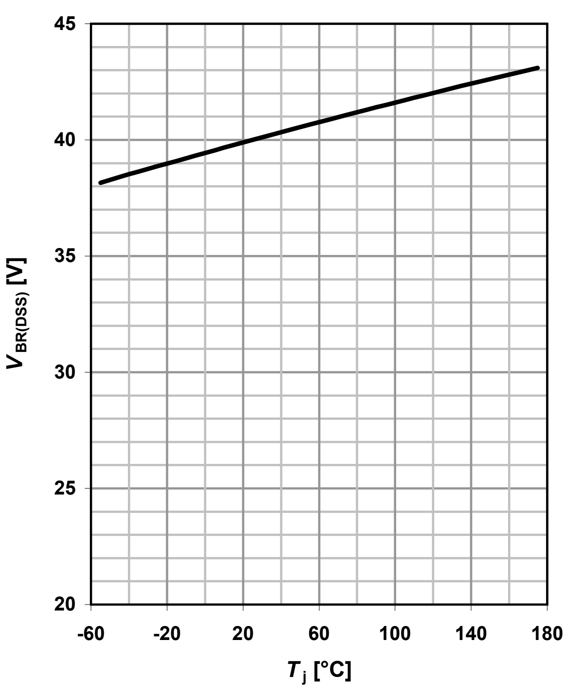
V_{GS}=f(Q_{gate}); I_D=30 A pulsed

parameter: V_{DD}

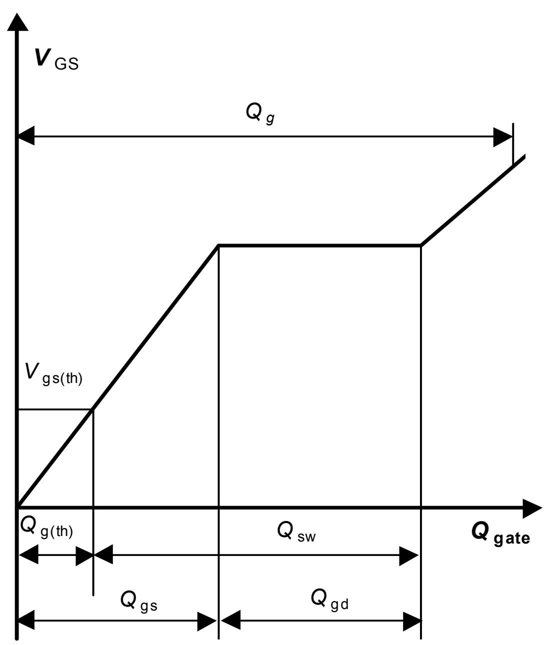


15 Drain-source breakdown voltage

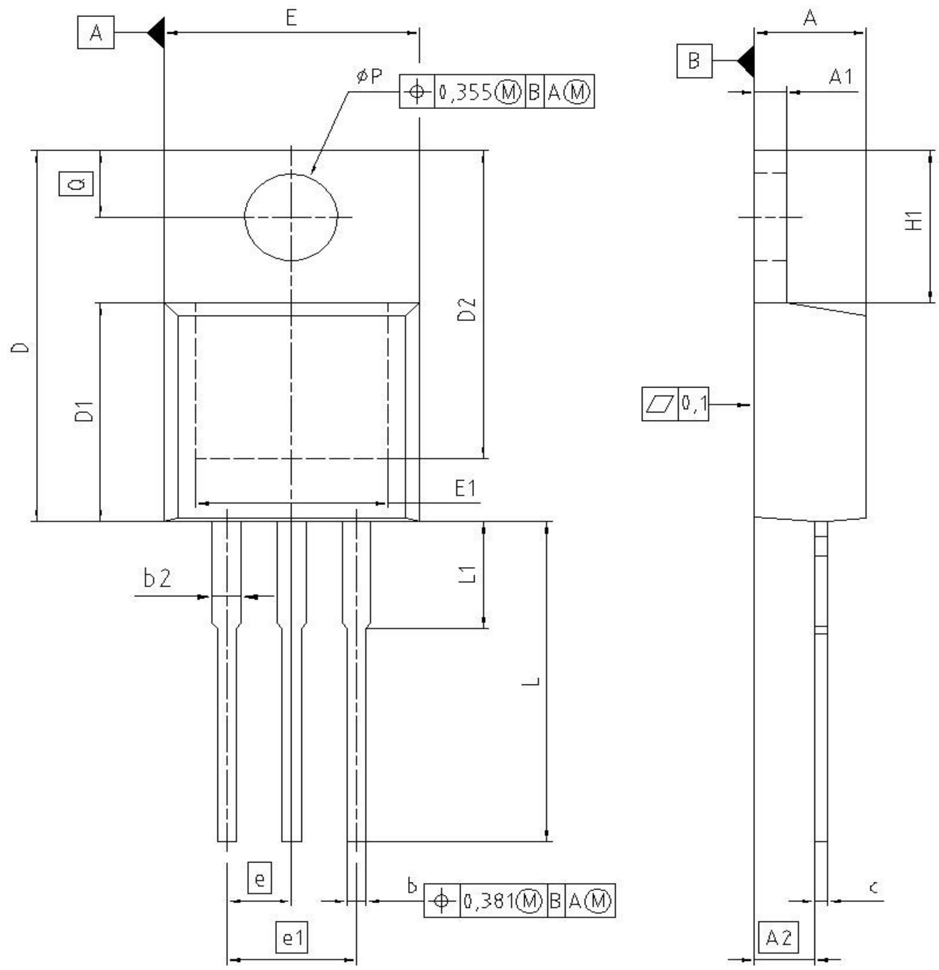
$V_{BR(DSS)}$=f(T_j); I_D=1 mA



16 Gate charge waveforms



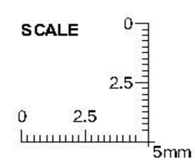
Package Outline PG-TO220-3-1



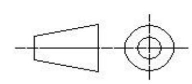
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.572	0.169	0.180
A1	1.170	1.400	0.046	0.055
A2	2.215	2.718	0.087	0.107
b	0.650	0.864	0.026	0.034
b2	0.635	1.778	0.025	0.070
c	0.330	0.600	0.013	0.024
D	14.808	15.950	0.583	0.628
D1	8.509	9.450	0.335	0.372
D2	12.850	13.100	0.506	0.516
E	9.700	10.363	0.382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



EUROPEAN PROJECTION



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01-06-2005

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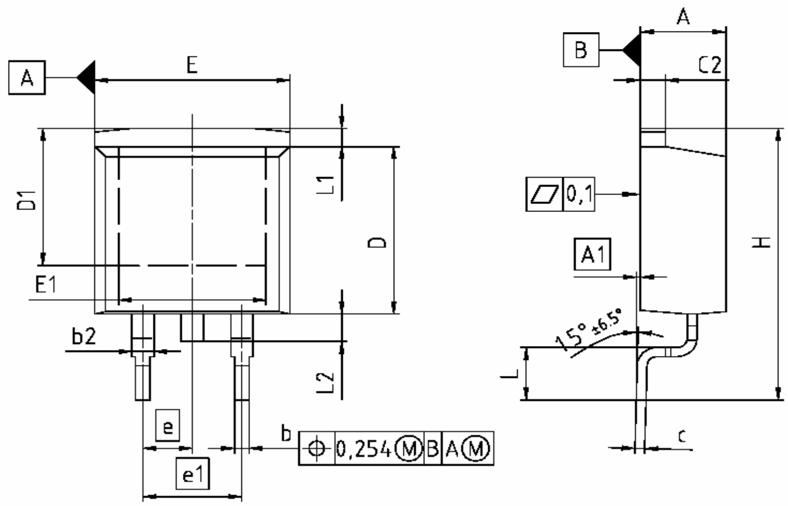
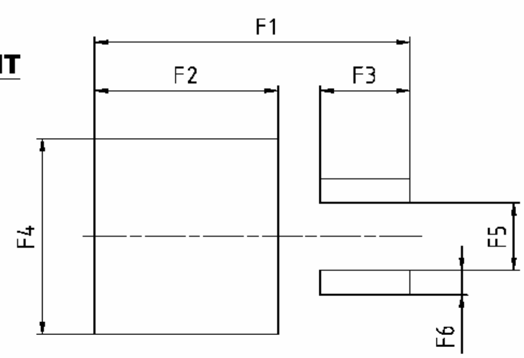
TO220_1

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

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JEDEC TO263

SCALE 0 5 7.5mm

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