

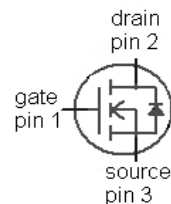
OptiMOS™ Power-Transistor
Features

- For fast switching converters and sync. rectification
- N-channel enhancement - logic level
- 175 °C operating temperature
- Avalanche rated
- Pb-free lead plating, RoHS compliant
- Halogen-free according to IEC61249-2-21


Product Summary

V_{DS}	60	V
$R_{DS(on),max}$ SMDversion	4.4	mΩ
I_D	100	A

Type	IPP048N06L	IPB048N06L
Package	P-TO220-3-1	P-TO263-3-2
Marking	048N06L	048N06L


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ °C}^{1)}$	100	A
		$T_C=100\text{ °C}$	100	
Pulsed drain current	$I_{D,pulse}$	$T_C=25\text{ °C}^{2)}$	400	
Avalanche energy, single pulse	E_{AS}	$I_D=100\text{ A}, R_{GS}=25\text{ }\Omega$	810	mJ
Reverse diode dv/dt	dv/dt	$I_D=100\text{ A}, V_{DS}=48\text{ V},$ $di/dt=200\text{ A}/\mu\text{s},$ $T_{j,max}=175\text{ °C}$	6	kV/ μs
Gate source voltage	V_{GS}		± 20	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	300	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

¹⁾ Current is limited by bondwire; with an $R_{thJC}=0.5$ the chip is able to carry 161A

²⁾ See figure 3

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	0.5	K/W
SMD version, device on PCB	R_{thJA}	minimal footprint	-	-	62	
		6 cm ² cooling area ³⁾	-	-	40	

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

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	60	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=270\text{ }\mu\text{A}$	1.2	1.6	2	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.01	1	μA
		$V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$	-	1	100	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	10	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=100\text{ A}$	-	3.7	4.7	m Ω
		$V_{GS}=4.5\text{ V}, I_D=66\text{ A}$	-	4.4	5.7	
		$V_{GS}=10\text{ V}, I_D=100\text{ A},$ SMD version		3.4	4.4	
		$V_{GS}=4.5\text{ V}, I_D=66\text{ A},$ SMD version		4.1	5.4	
Gate resistance	R_G		-	1.9	-	Ω
Transconductance	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=100\text{ A}$	92	183	-	S

³⁾ 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}	$V_{GS}=0\text{ V}, V_{DS}=30\text{ V}, f=1\text{ MHz}$	-	5700	7600	pF
Output capacitance	C_{oss}		-	1500	2000	
Reverse transfer capacitance	C_{rss}		-	350	525	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=30\text{ V}, V_{GS}=4.5\text{ V}, I_D=100\text{ A}, R_G=1.3\ \Omega$	-	18	27	ns
Rise time	t_r		-	25	38	
Turn-off delay time	$t_{d(off)}$		-	98	150	
Fall time	t_f		-	24	36	

Gate Charge Characteristics⁴⁾

Gate to source charge	Q_{gs}	$V_{DD}=30\text{ V}, I_D=100\text{ A}, V_{GS}=0\text{ to }10\text{ V}$	-	20	26	nC
Gate charge at threshold	$Q_{g(th)}$		-	9.1	12	
Gate to drain charge	Q_{gd}		-	54	81	
Switching charge	Q_{sw}		-	64	95	
Gate charge total	Q_g		-	169	225	
Gate plateau voltage	$V_{plateau}$		-	3.5	-	V
Output charge	Q_{oss}	$V_{DD}=30\text{ V}, V_{GS}=0\text{ V}$	-	47	63	

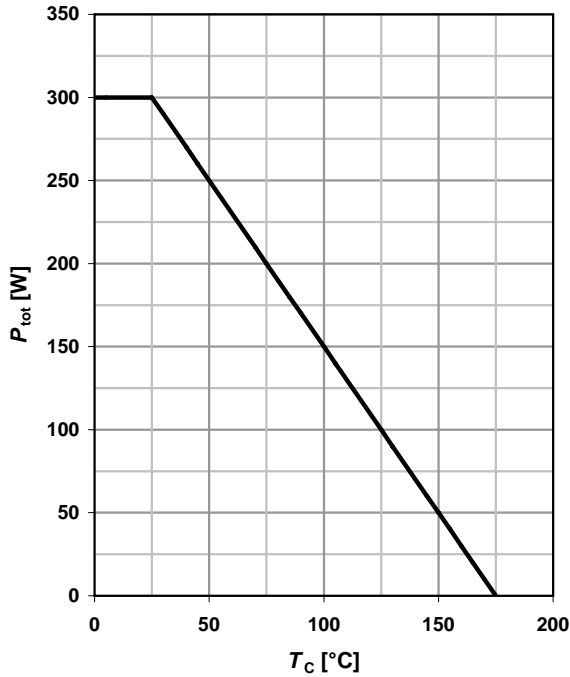
Reverse Diode

Diode continuous forward current	I_S	$T_C=25\text{ }^\circ\text{C}$	-	-	100	A
Diode pulse current	$I_{S,pulse}$		-	-	400	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=100\text{ A}, T_J=25\text{ }^\circ\text{C}$	-	0.93	1.3	V
Reverse recovery time	t_{rr}	$V_R=30\text{ V}, I_F=I_S, di_F/dt=100\text{ A}/\mu\text{s}$	-	65	80	ns
Reverse recovery charge	Q_{rr}		-	125	160	

⁴⁾ See figure 16 for gate charge parameter definition

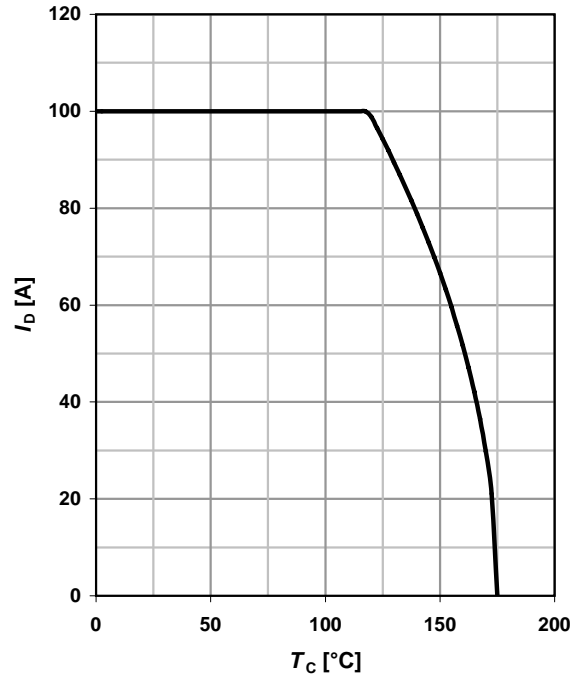
1 Power dissipation

$P_{tot}=f(T_C); V_{GS} \geq 6 \text{ V}$



2 Drain current

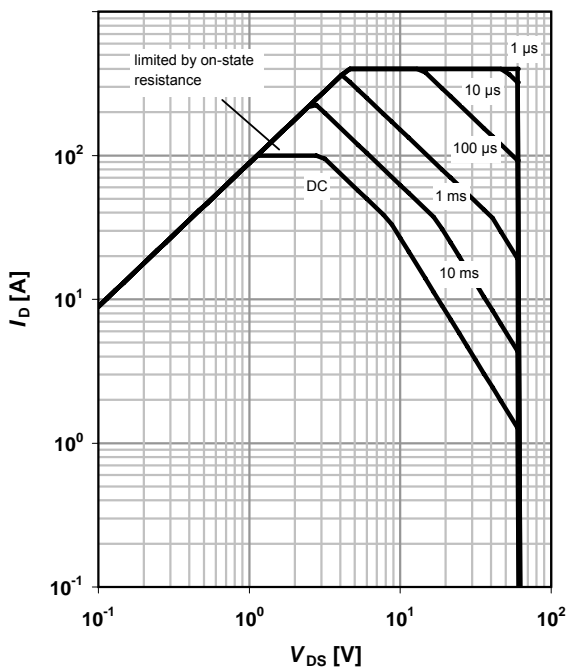
$I_D=f(T_C); V_{GS} \geq 10 \text{ V}$



3 Safe operating area

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

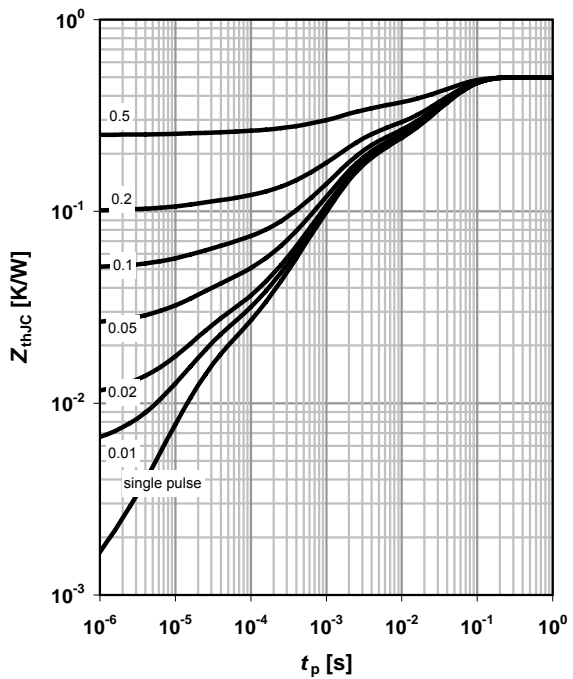
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

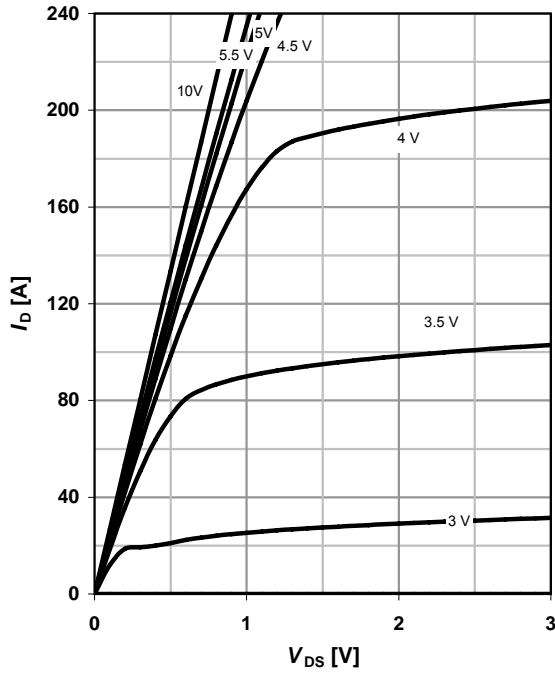
parameter: $D=t_p/T$



5 Typ. output characteristics

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

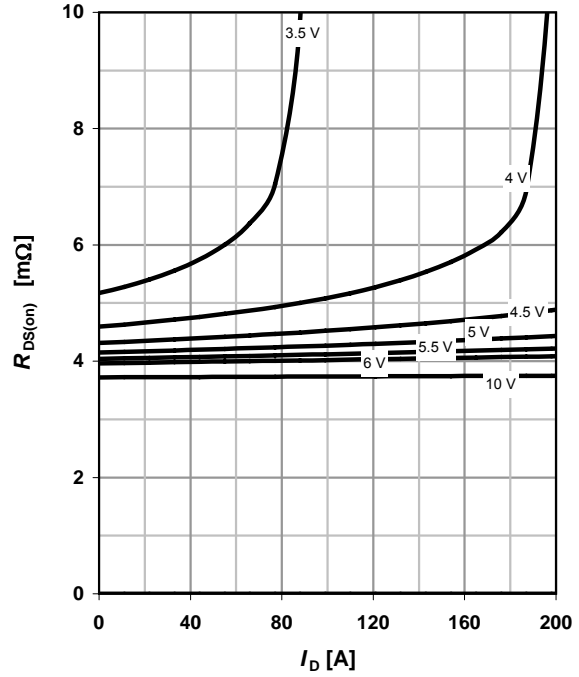
parameter: V_{GS}



6 Typ. drain-source on resistance

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

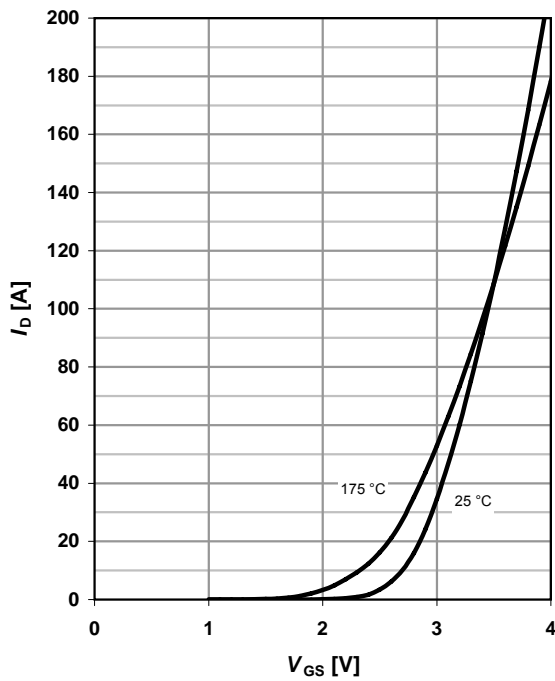
parameter: V_{GS}



7 Typ. transfer characteristics

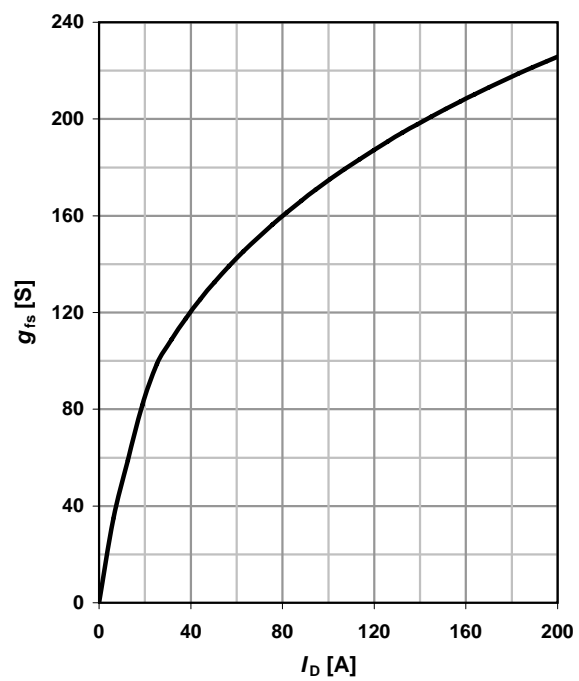
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



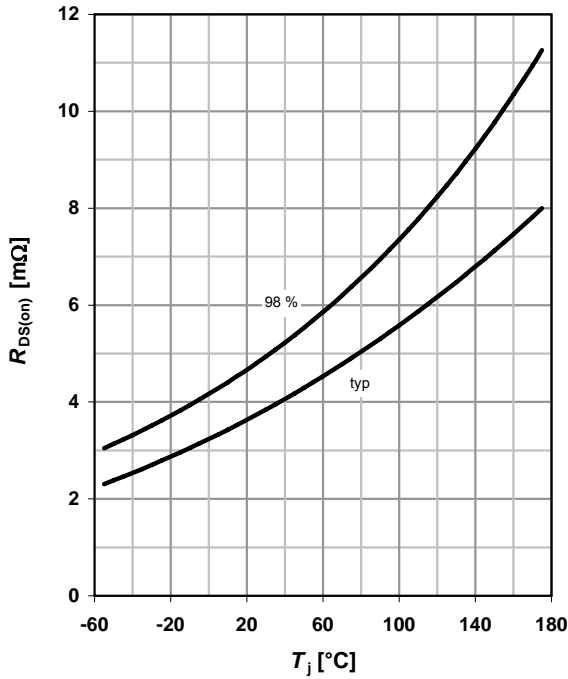
8 Typ. forward transconductance

$g_{fs} = f(I_D); T_j = 25\text{ }^\circ\text{C}$



9 Drain-source on-state resistance

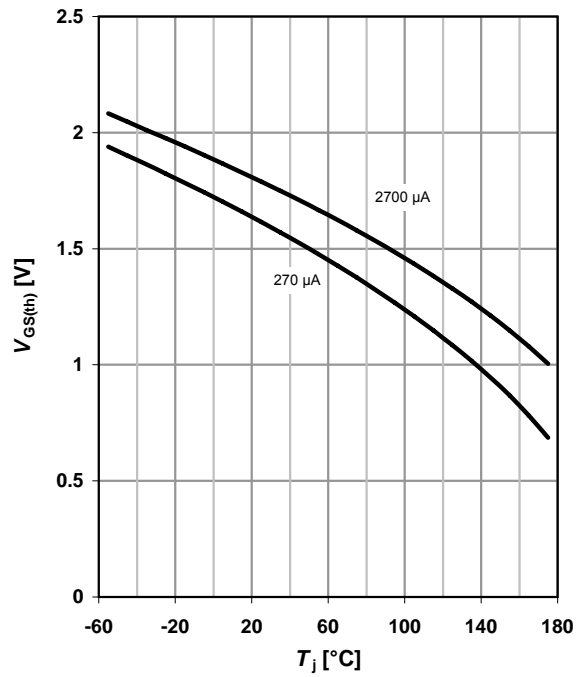
$R_{DS(on)} = f(T_j); I_D = 100 \text{ A}; V_{GS} = 10 \text{ V}$



10 Typ. gate threshold voltage

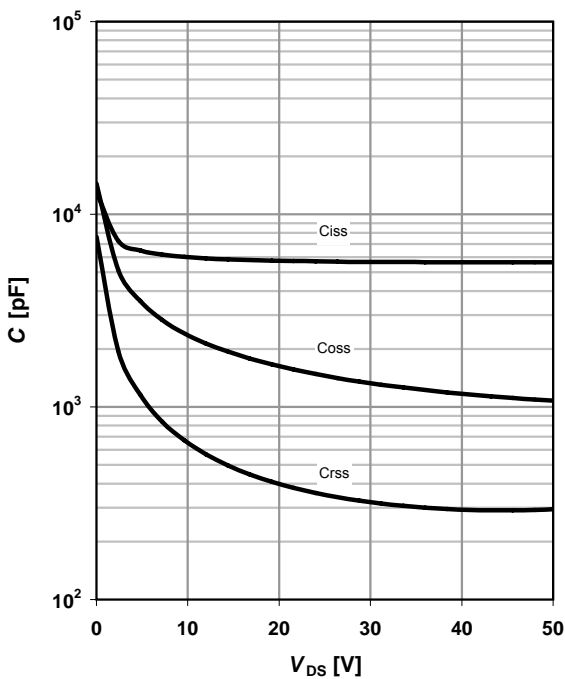
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



11 Typ. capacitances

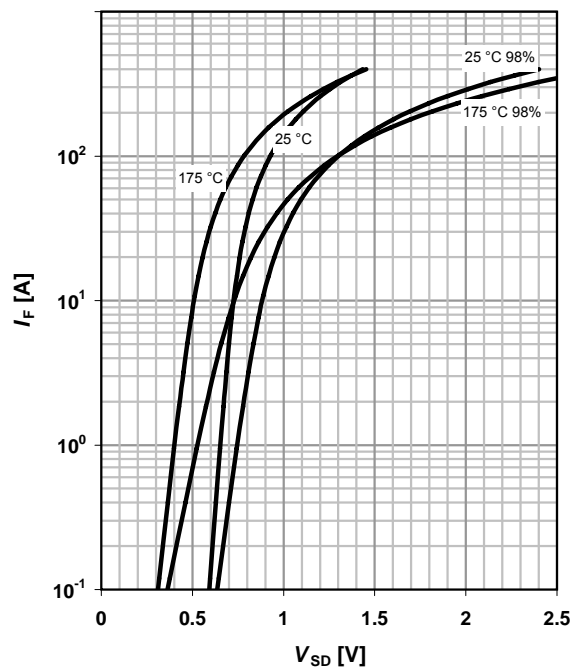
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



12 Forward characteristics of reverse diode

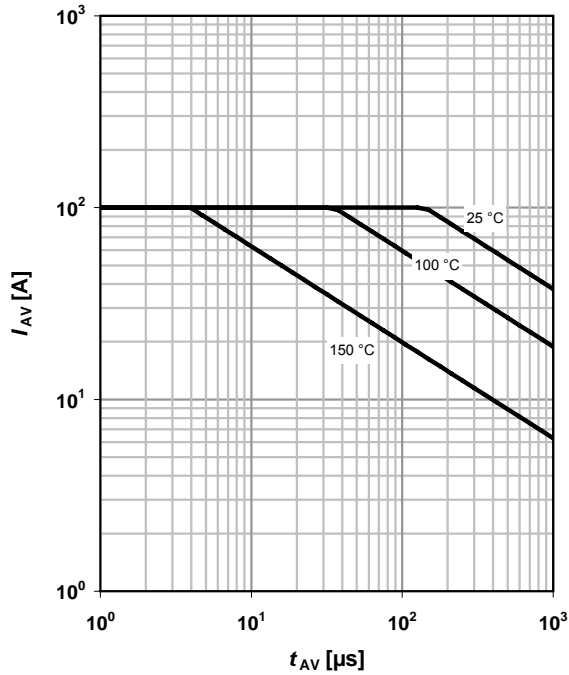
$I_F = f(V_{SD})$

parameter: T_j

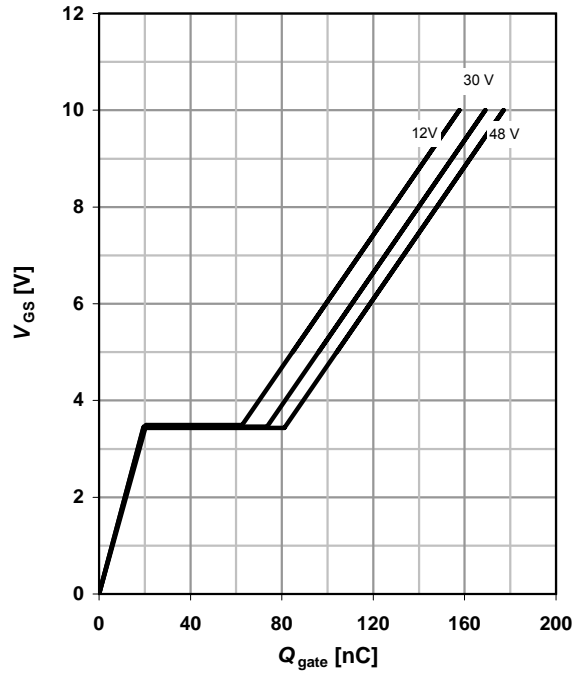


13 Avalanche characteristics

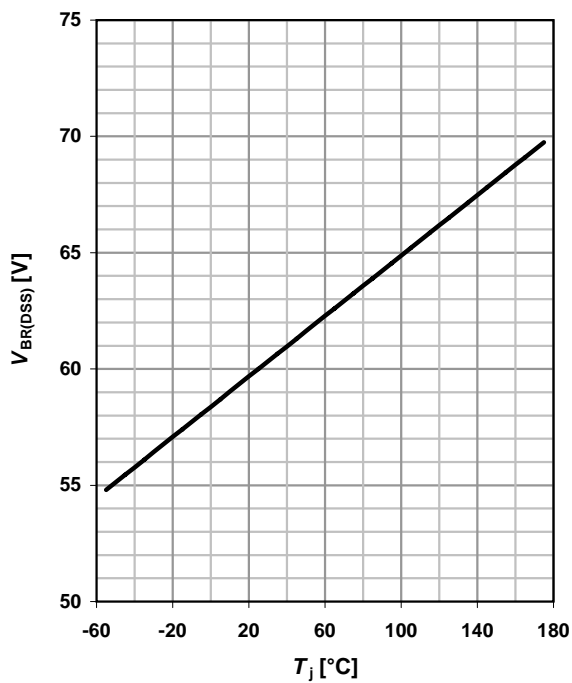
$$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$$

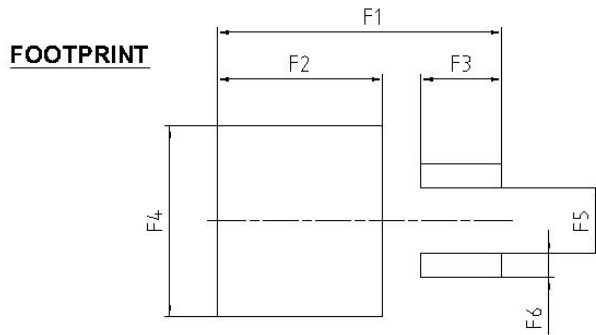
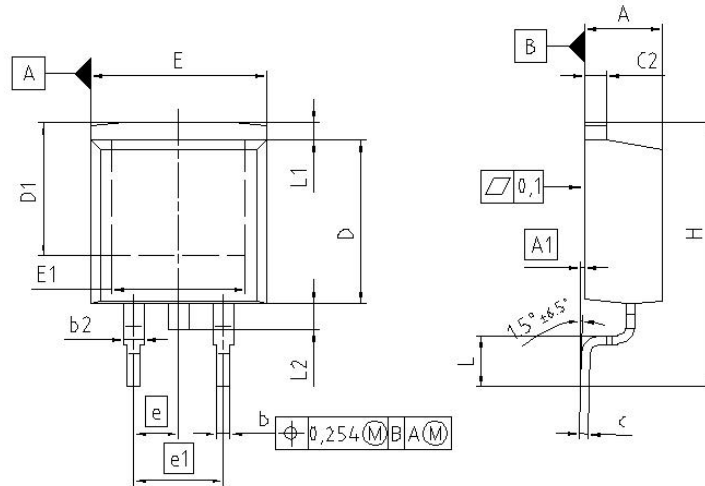
 parameter: $T_{j(\text{start})}$

14 Typ. gate charge

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

 parameter: V_{DD}

15 Drain-source breakdown voltage

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


16 Gate charge waveforms


PG-TO-263 (D²-Pak)


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	0.850	0.850	0.026	0.033
b2	0.950	1.321	0.037	0.052
c	0.330	0.850	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

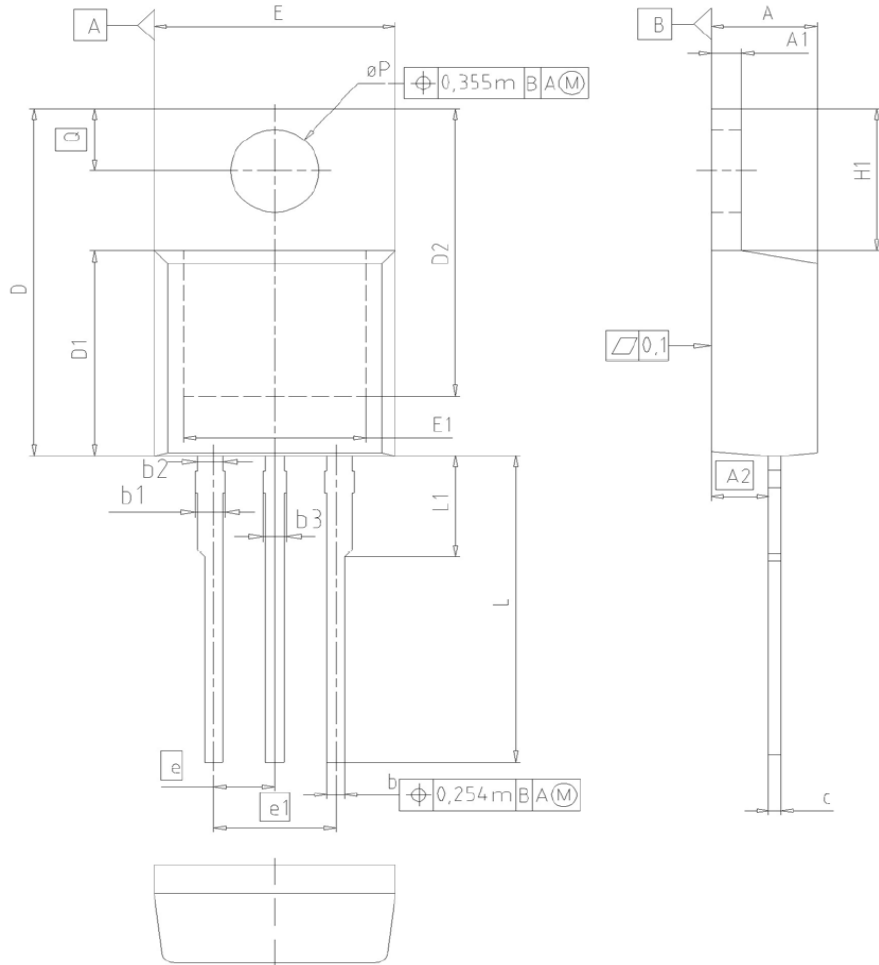
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PG-TO220-3: Outline



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.80	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
øP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

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