



**THE DATASHEET OF  
IPB048N06LGATMA1**





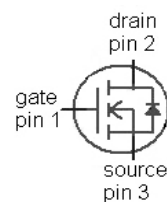
**OptiMOS® Power-Transistor**
**Features**

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

**Product Summary**

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

<b>Type</b>	IPP048N06L	IPB048N06L
		
<b>Package</b>	PG-TO220-3	PG-TO263-3
<b>Marking</b>	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	$E_{AS}$	$I_D=100\text{ A}$ , $R_{GS}=25\text{ Ω}$	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/ $\mu\text{s}$
Gate source voltage	$V_{GS}$		$\pm 20$	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	

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

<sup>2)</sup> 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 <sup>2</sup> cooling area <sup>3)</sup>	-	-	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	$\mu\text{A}$
		$V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$	-	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 $\Omega$
		$V_{GS}=4.5\text{ V}, I_D=66\text{ A}$	-	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	-	$\Omega$
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=100\text{ A}$	92	183	-	S

<sup>3)</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	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=30\text{ V},$ $f=1\text{ MHz}$	-	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 Characteristics<sup>4)</sup>**

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	

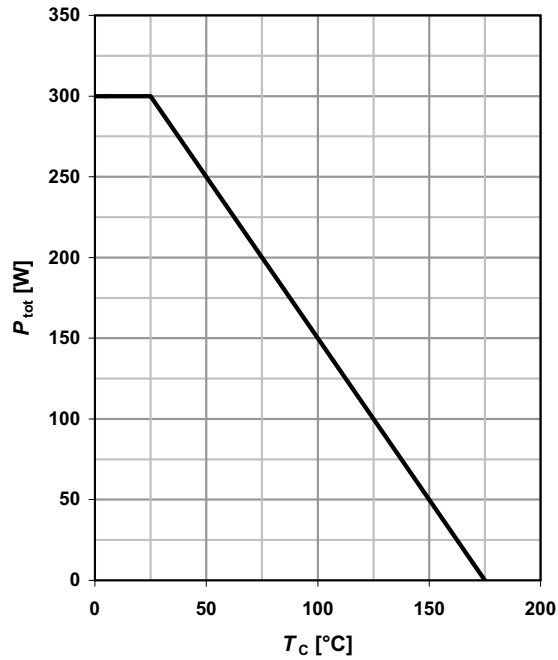
**Reverse Diode**

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	nC

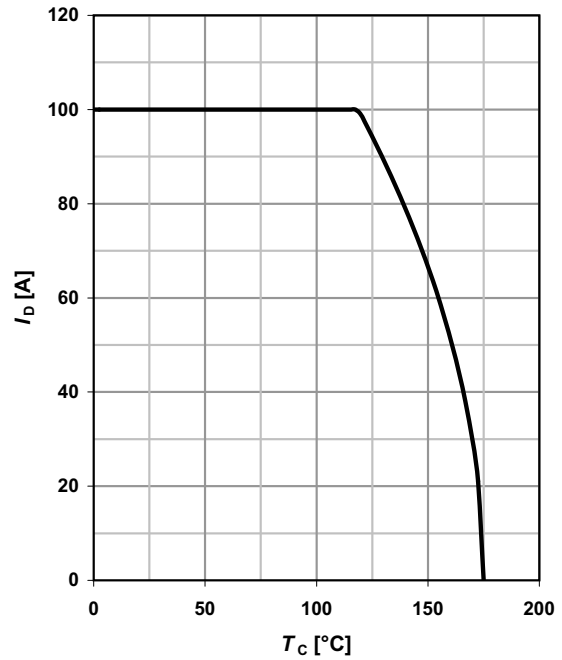
<sup>4)</sup> See figure 16 for gate charge parameter definition

**1 Power dissipation**

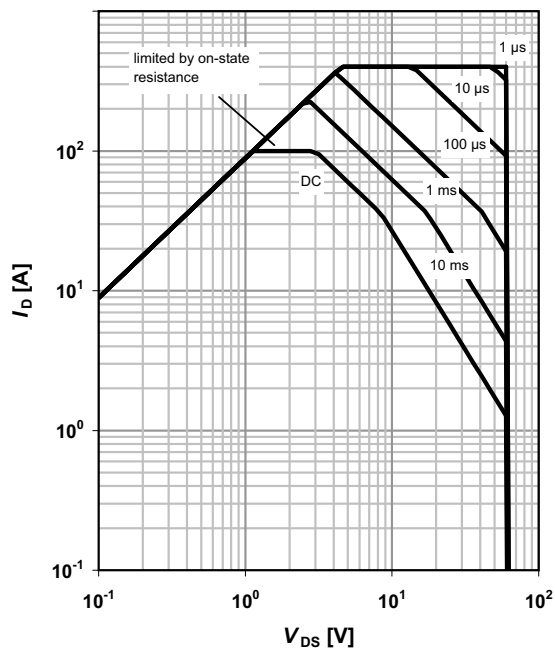
$$P_{\text{tot}} = f(T_C); V_{\text{GS}} \geq 6 \text{ V}$$


**2 Drain current**

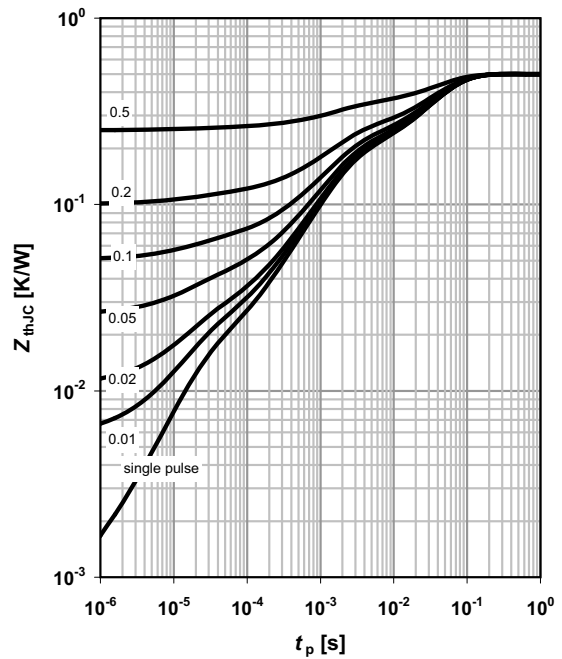
$$I_D = f(T_C); V_{\text{GS}} \geq 10 \text{ V}$$


**3 Safe operating area**

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

 parameter:  $t_p$ 

**4 Max. transient thermal impedance**

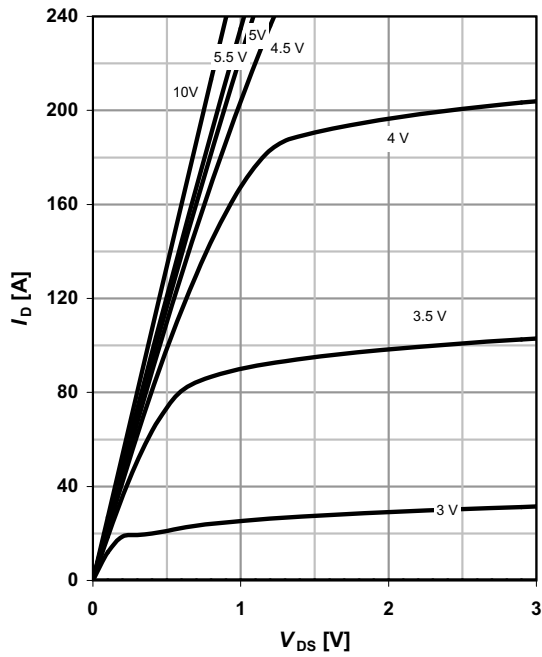
$$Z_{\text{thJC}} = f(t_p)$$

 parameter:  $D = t_p/T$ 


**5 Typ. output characteristics**

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

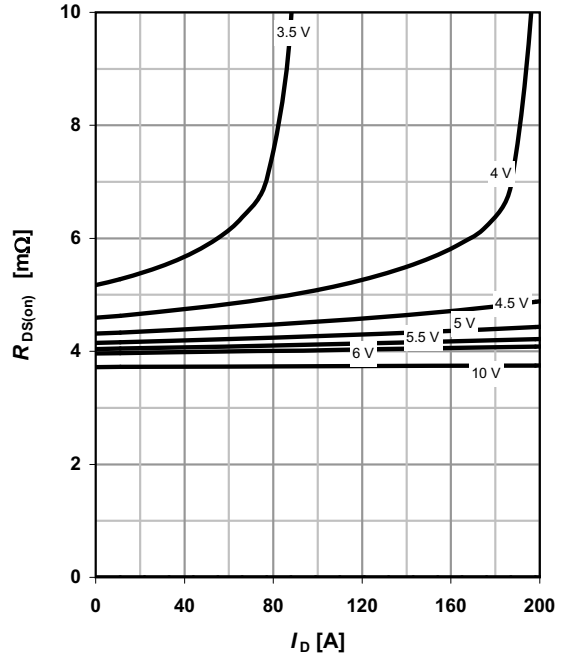
parameter:  $V_{GS}$



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

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

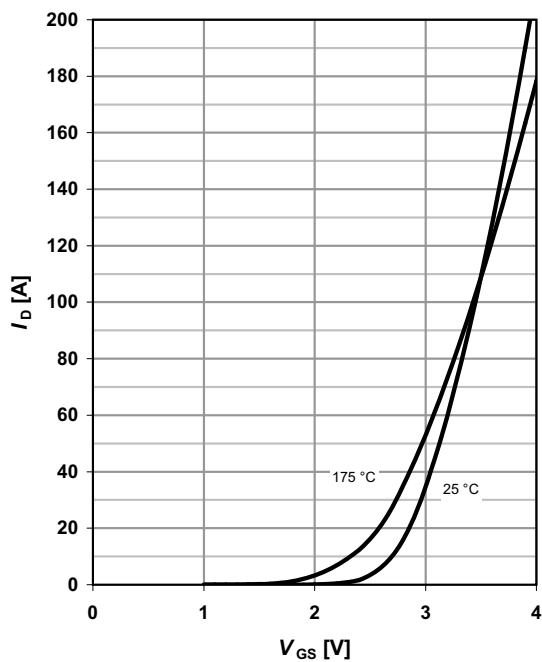
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

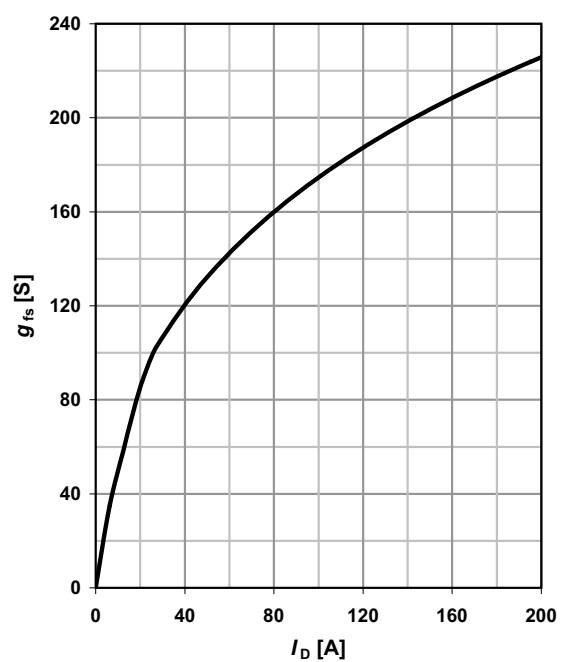
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter:  $T_j$



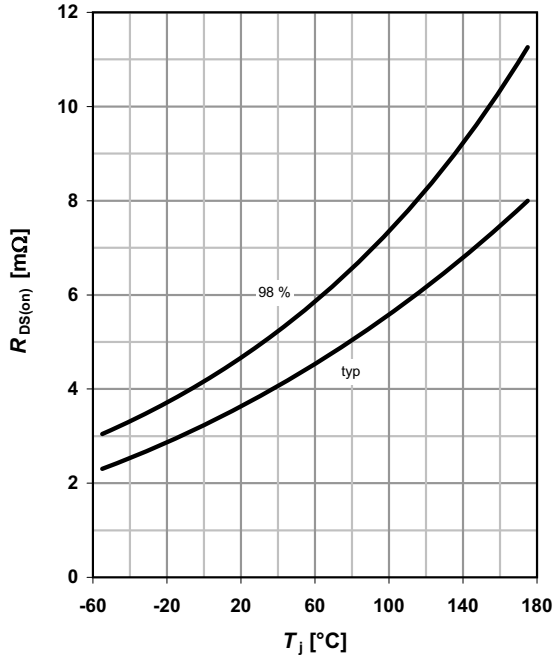
**8 Typ. forward transconductance**

$g_{fs} = f(I_D); T_j = 25\text{ °C}$



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

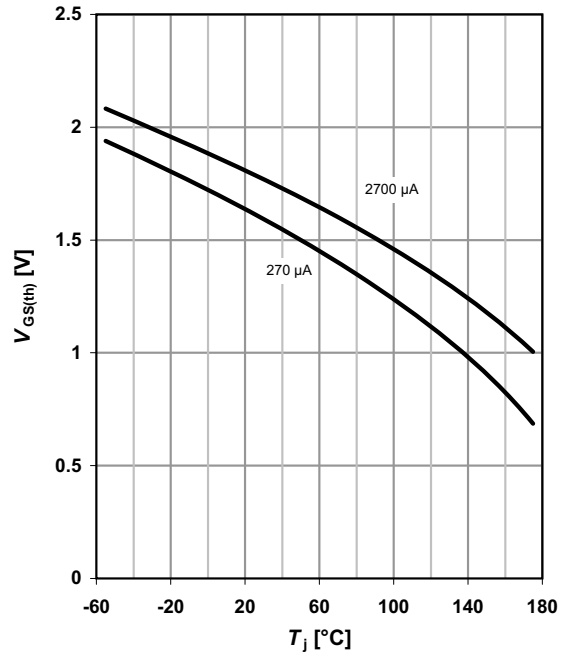
$R_{DS(on)} = f(T_j); I_D = 100 \text{ A}; V_{GS} = 10 \text{ V}$



**10 Typ. gate threshold voltage**

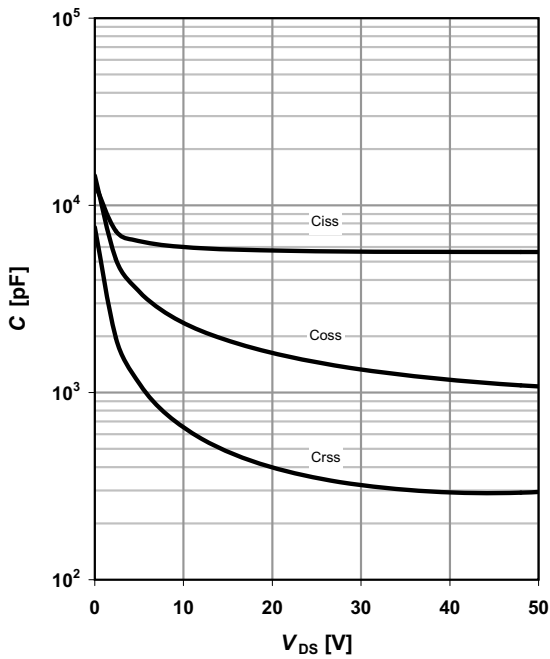
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**11 Typ. capacitances**

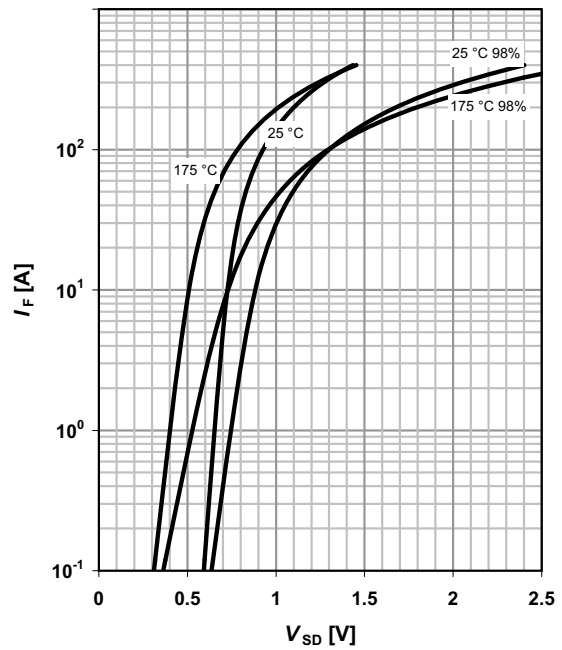
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



**12 Forward characteristics of reverse diode**

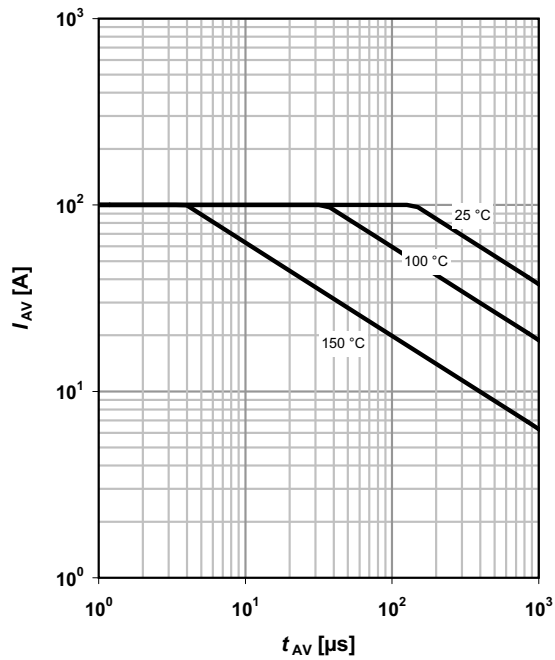
$I_F = f(V_{SD})$

parameter:  $T_j$

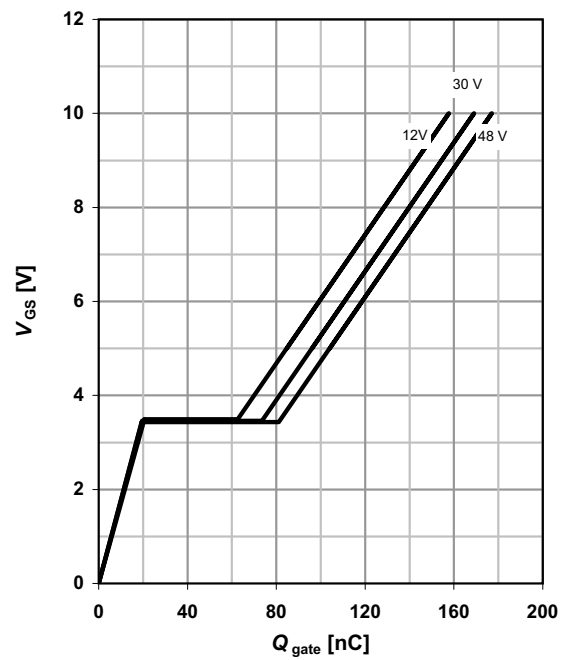


**13 Avalanche characteristics**

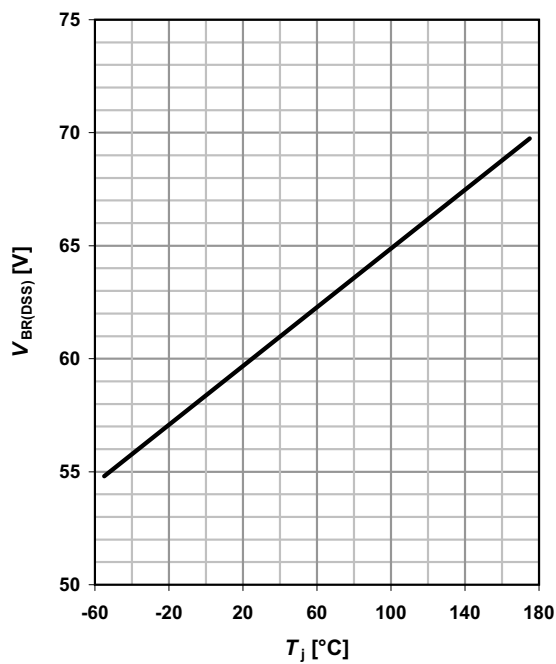
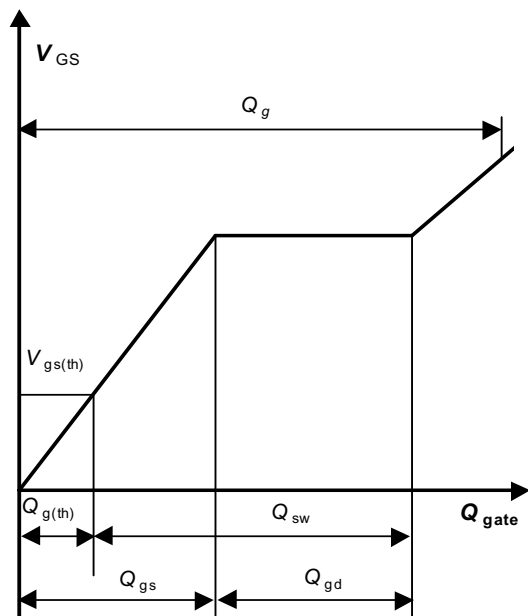
$$I_{AS} = f(t_{AV}); R_{GS} = 25 \Omega$$

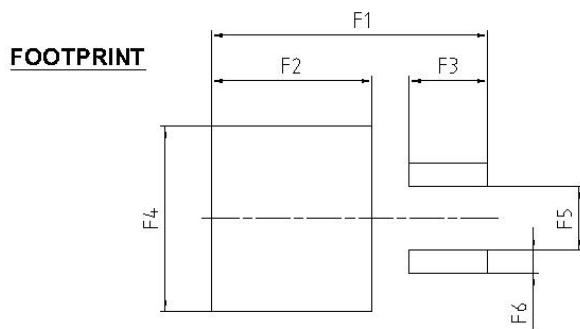
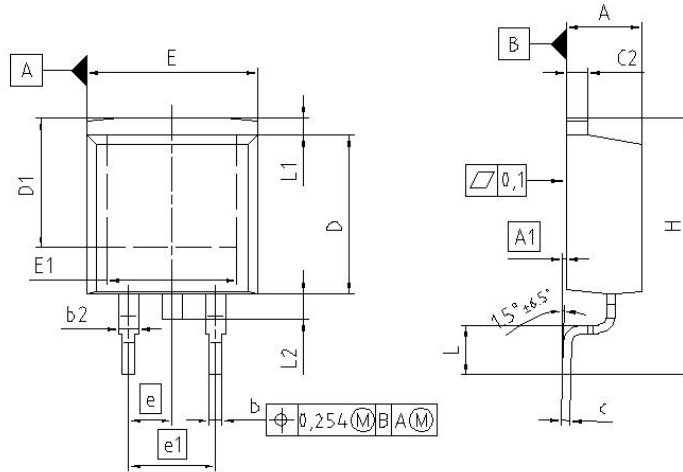
 parameter:  $T_{j(\text{start})}$ 

**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-263-3 (D<sup>2</sup>-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	0.650	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

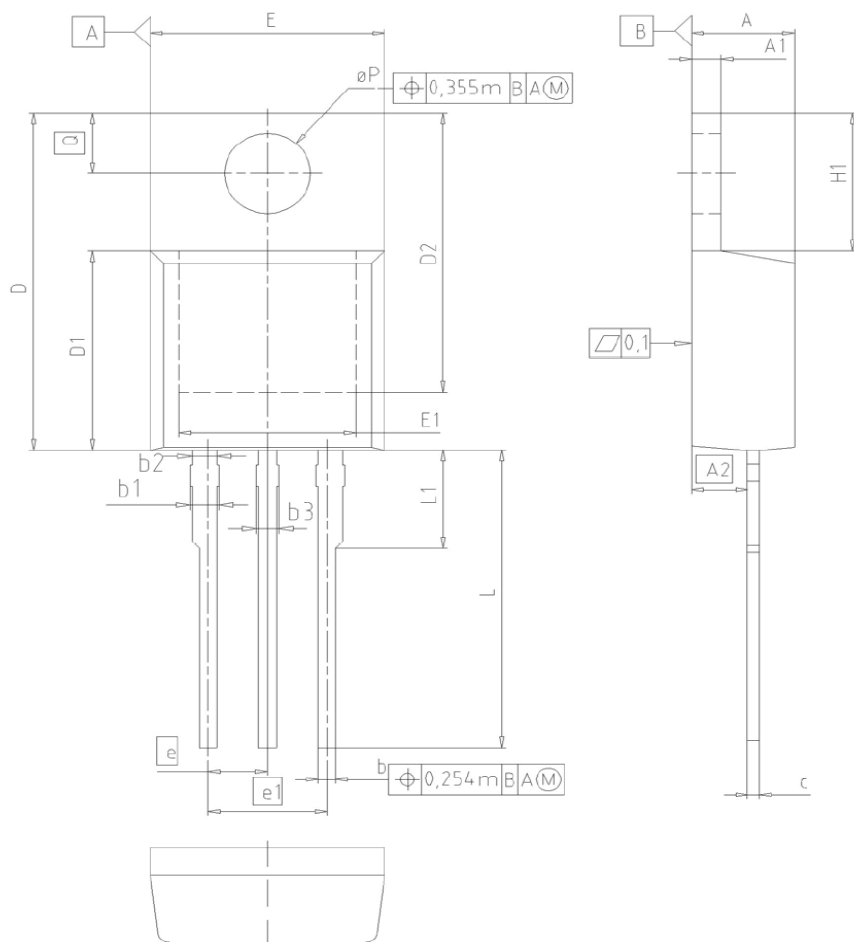
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TO263\_2

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
$\phi P$	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

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