

OptiMOS™3 Power-Transistor

Features

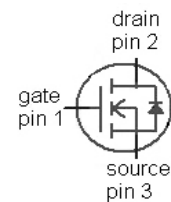
- N-channel, normal level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target application
- Ideal for high-frequency switching and synchronous rectification
- Halogen-free according to IEC61249-2-21



Product Summary

V_{DS}	100	V
$R_{DS(on),max}$ TO-263	18	mΩ
I_D	43	A

Type	IPP180N10N3 G	IPI180N10N3 G
		
Package	PG-TO220-3	PG-TO262-3
Marking	180N10N	180N10N



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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ °C}^{2)}$	43	A
		$T_C=100\text{ °C}$	30	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	172	
Avalanche energy, single pulse	E_{AS}	$I_D=33\text{ A}$, $R_{GS}=25\text{ Ω}$	50	mJ
Gate source voltage	V_{GS}		±20	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	71	W
Operating and storage temperature	T_j , T_{stg}		-55 ... 175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

¹⁾ J-STD20 and JESD22

²⁾ See figure 3

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	2.1	K/W
Thermal resistance, junction - ambient	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	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	100	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=33\text{ }\mu\text{A}$	2	2.7	3.5	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.1	1	μA
		$V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$	-	10	100	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=33\text{ A}$	-	15.5	18	m Ω
		$V_{GS}=6\text{ V}, I_D=16\text{ A}$	-	19.3	33	
Gate resistance	R_G		-	1.4	-	Ω
Transconductance	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=33\text{ A}$	20	40	-	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}	$V_{GS}=0\text{ V}, V_{DS}=50\text{ V},$ $f=1\text{ MHz}$	-	1350	1800	pF
Output capacitance	C_{oss}		-	237	315	
Reverse transfer capacitance	C_{rss}		-	11	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=50\text{ V}, V_{GS}=10\text{ V},$ $I_D=33\text{ A}, R_G=1.6\ \Omega$	-	12	-	ns
Rise time	t_r		-	12	-	
Turn-off delay time	$t_{d(off)}$		-	19	-	
Fall time	t_f		-	5	-	

Gate Charge Characteristics⁶⁾

Gate to source charge	Q_{gs}	$V_{DD}=50\text{ V}, I_D=33\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	7	-	nC
Gate to drain charge	Q_{gd}		-	4	-	
Switching charge	Q_{sw}		-	6	-	
Gate charge total	Q_g		-	19	25	
Gate plateau voltage	$V_{plateau}$		-	4.9	-	V
Output charge	Q_{oss}	$V_{DD}=50\text{ V}, V_{GS}=0\text{ V}$	-	25	33	nC

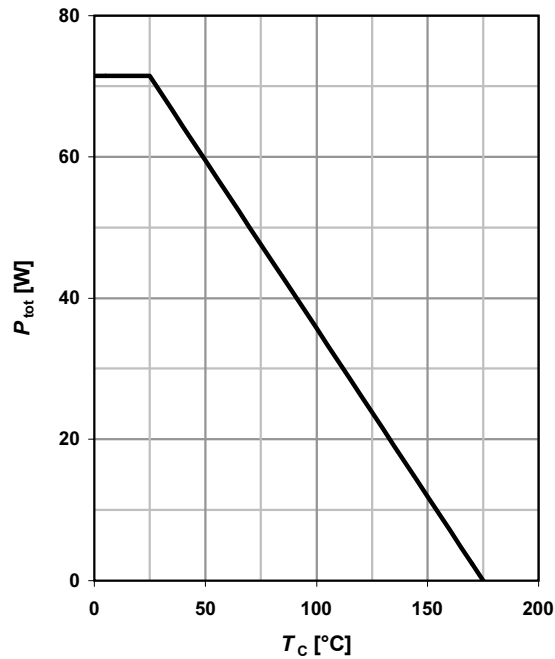
Reverse Diode

Diode continuous forward current	I_S	$T_C=25\text{ °C}$	-	-	43	A
Diode pulse current	$I_{S,pulse}$		-	-	172	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=33\text{ A},$ $T_j=25\text{ °C}$	-	1	1.2	V
Reverse recovery time	t_{rr}	$V_R=15\text{ V}, I_F=33\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	55	-	ns
Reverse recovery charge	Q_{rr}		-	92	-	nC

⁶⁾ See figure 16 for gate charge parameter definition

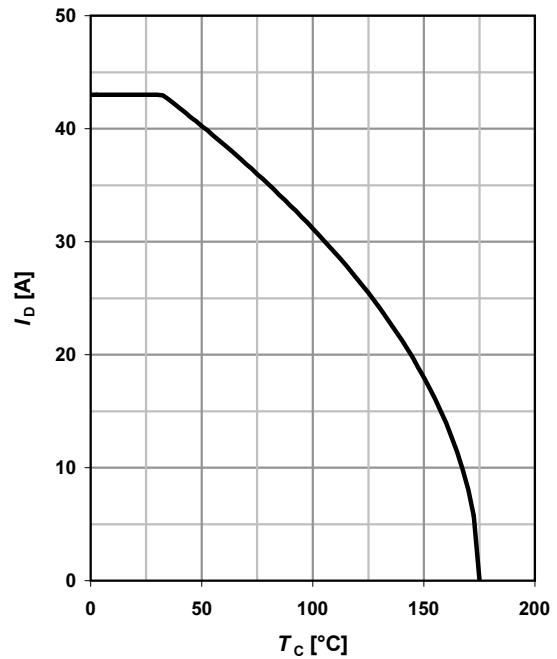
1 Power dissipation

$$P_{\text{tot}} = f(T_C)$$



2 Drain current

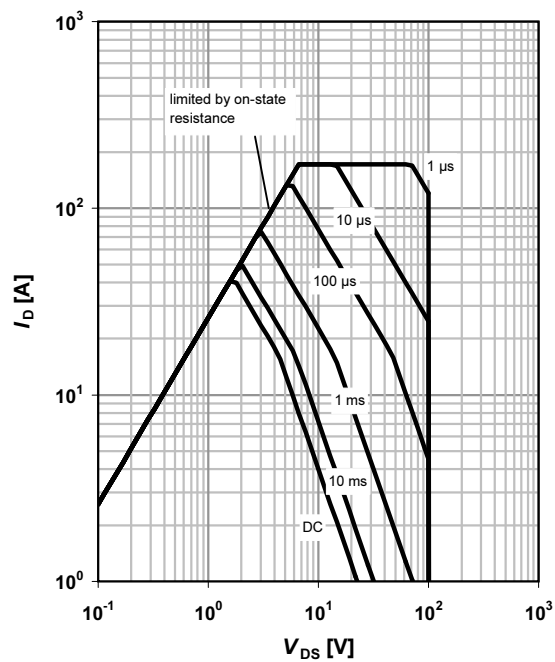
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



3 Safe operating area

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

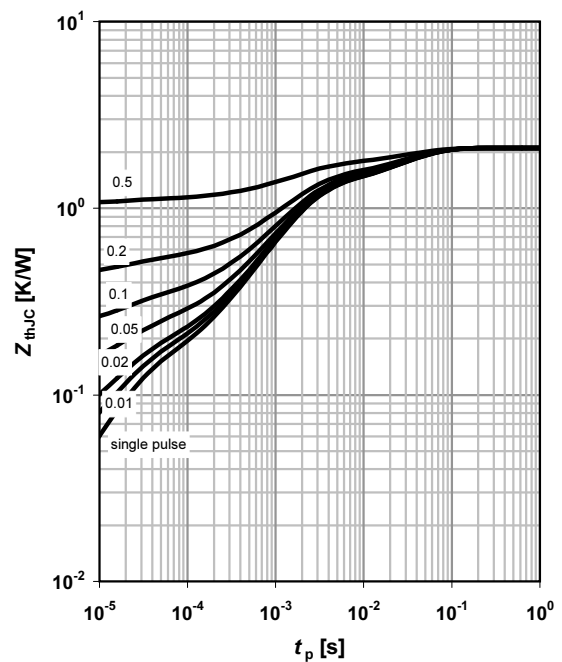
parameter: t_p



4 Max. transient thermal impedance

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

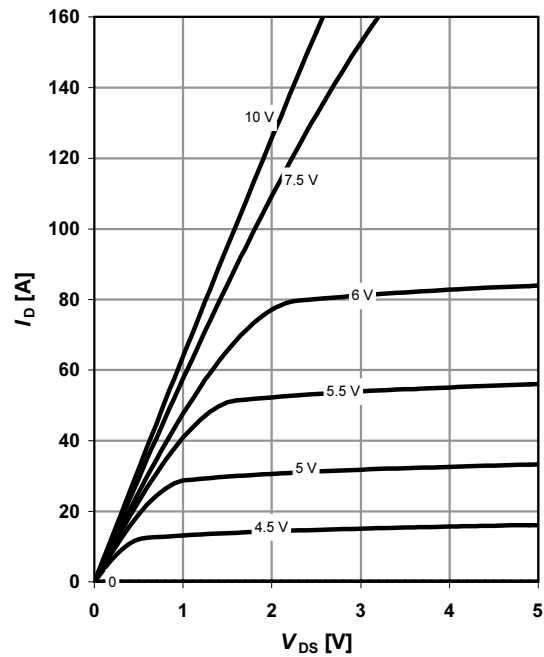
parameter: $D = t_p / T$



5 Typ. output characteristics

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

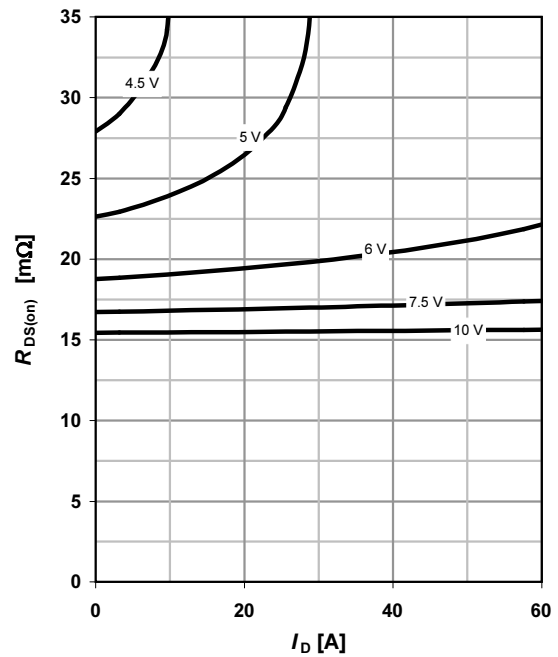
parameter: V_{GS}



6 Typ. drain-source on resistance

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

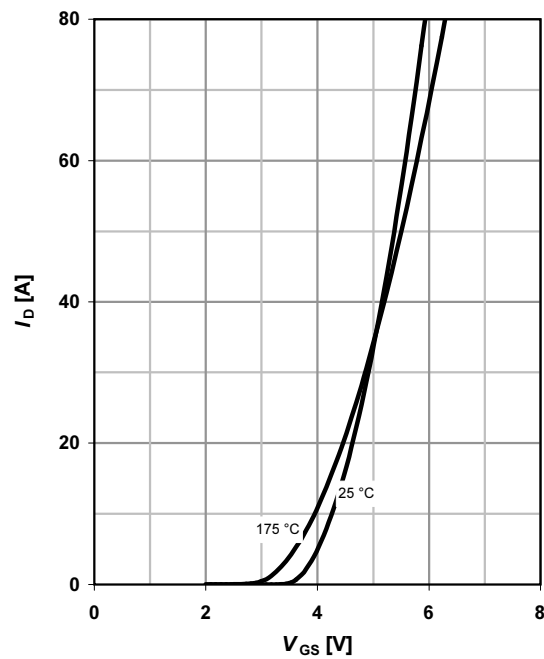
parameter: V_{GS}



7 Typ. transfer characteristics

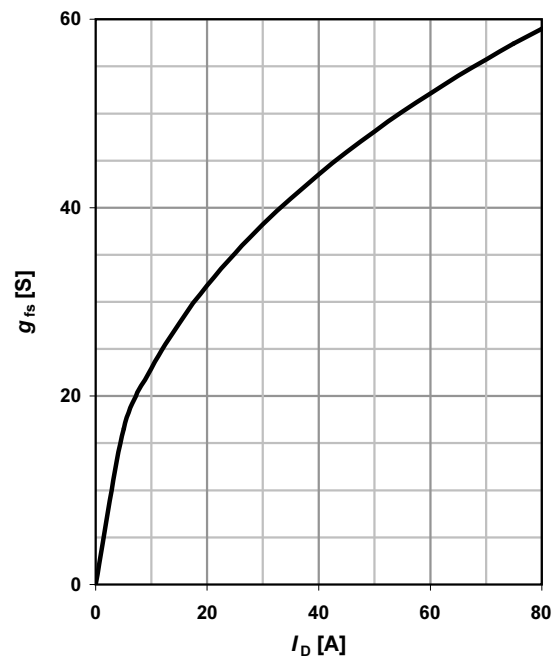
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

parameter: T_J



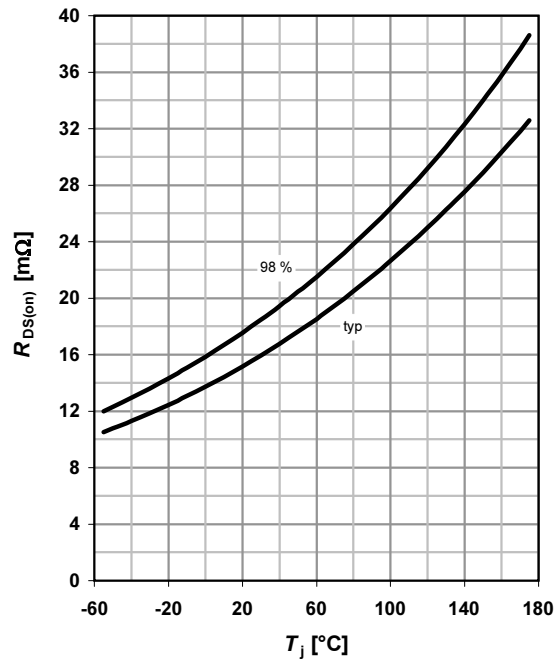
8 Typ. forward transconductance

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



9 Drain-source on-state resistance

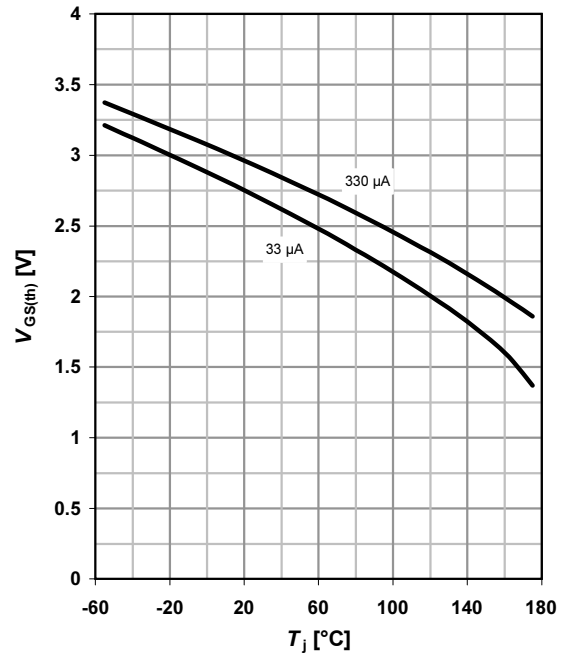
$$R_{DS(on)} = f(T_j); I_D = 33 \text{ A}; V_{GS} = 10 \text{ V}$$



10 Typ. gate threshold voltage

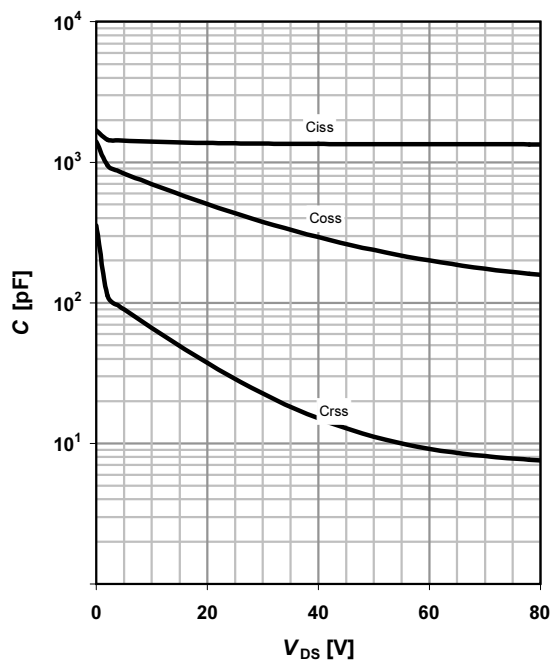
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter: I_D



11 Typ. capacitances

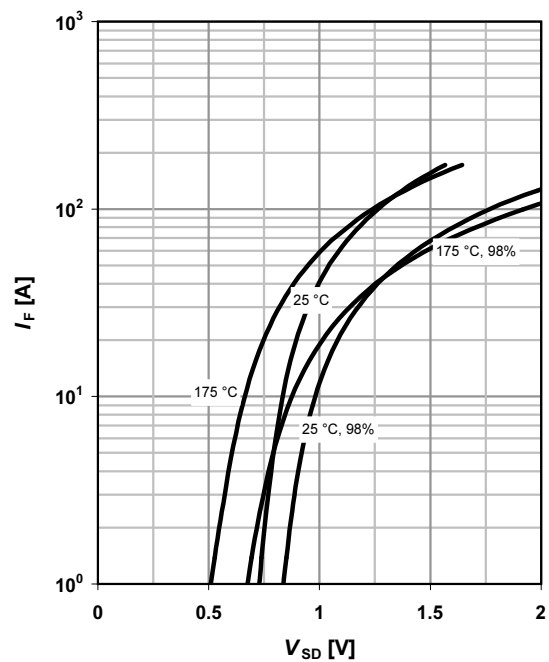
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



12 Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

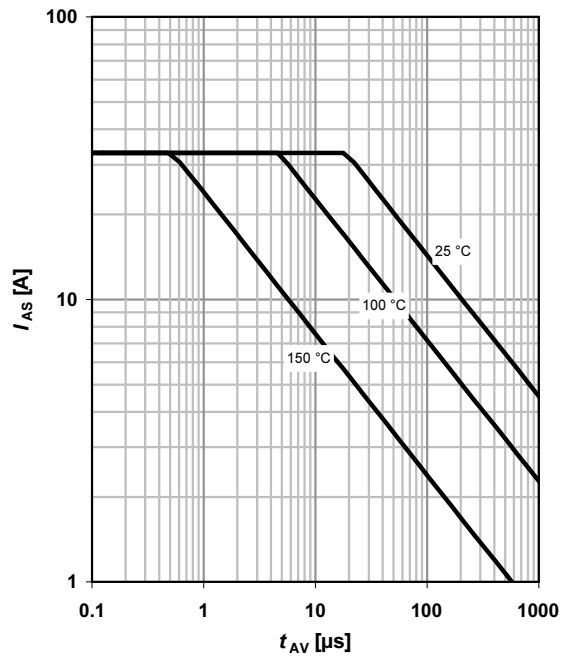
parameter: T_j



13 Avalanche characteristics

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

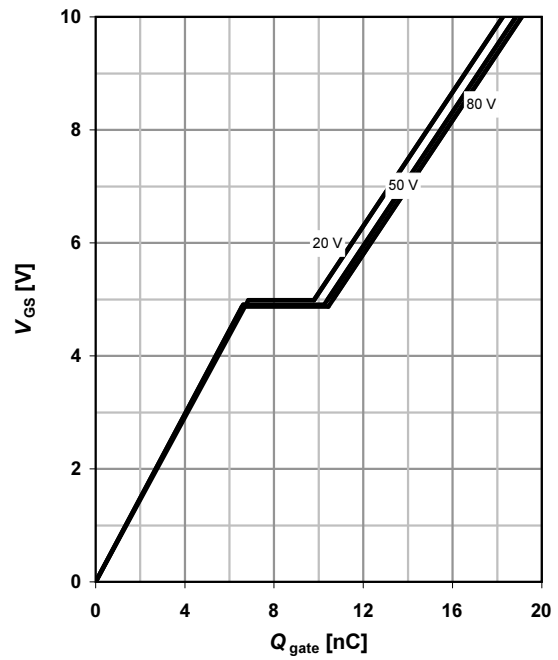
parameter: $T_{j(\text{start})}$



14 Typ. gate charge

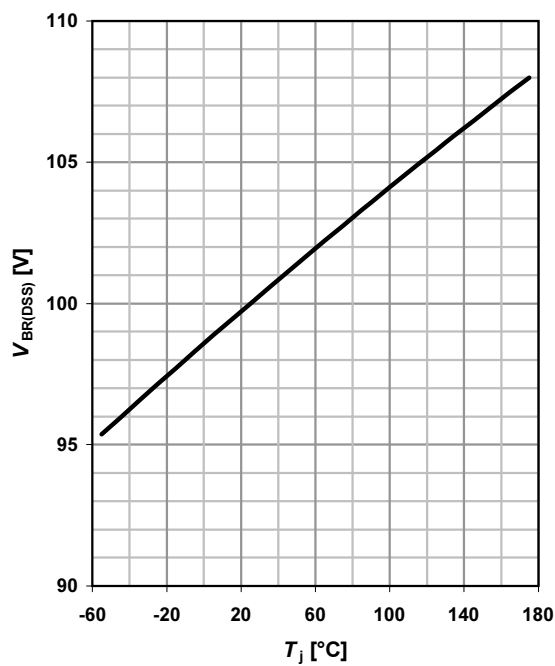
$$V_{GS}=f(Q_{\text{gate}}); I_D=33\ \text{A pulsed}$$

parameter: V_{DD}

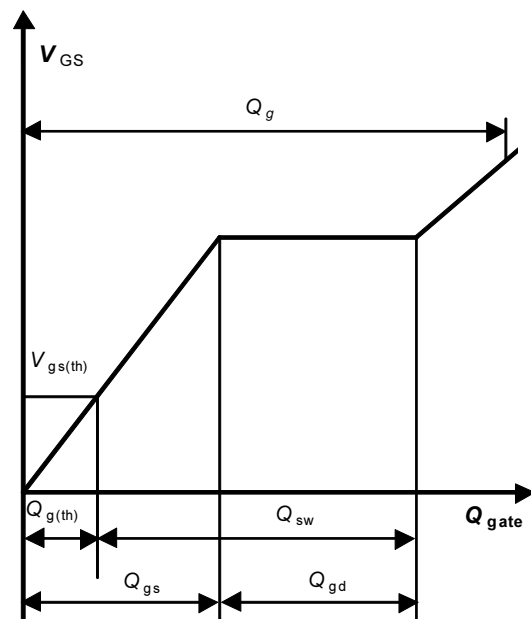


15 Drain-source breakdown voltage

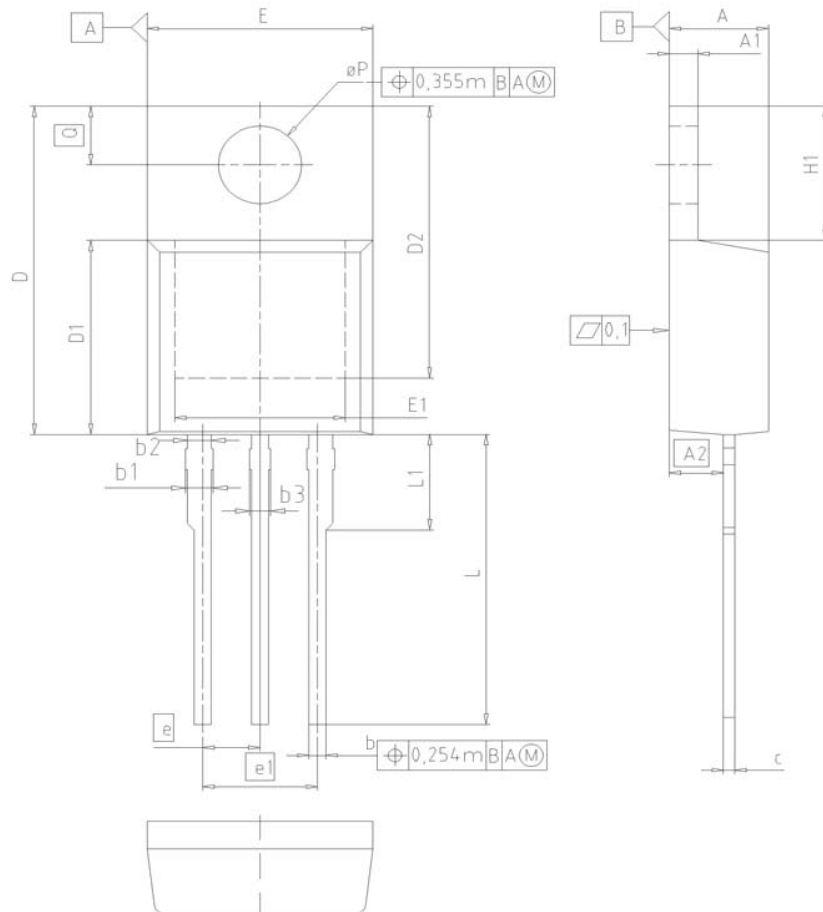
$$V_{BR(DSS)}=f(T_j); I_D=1\ \text{mA}$$



16 Gate charge waveforms

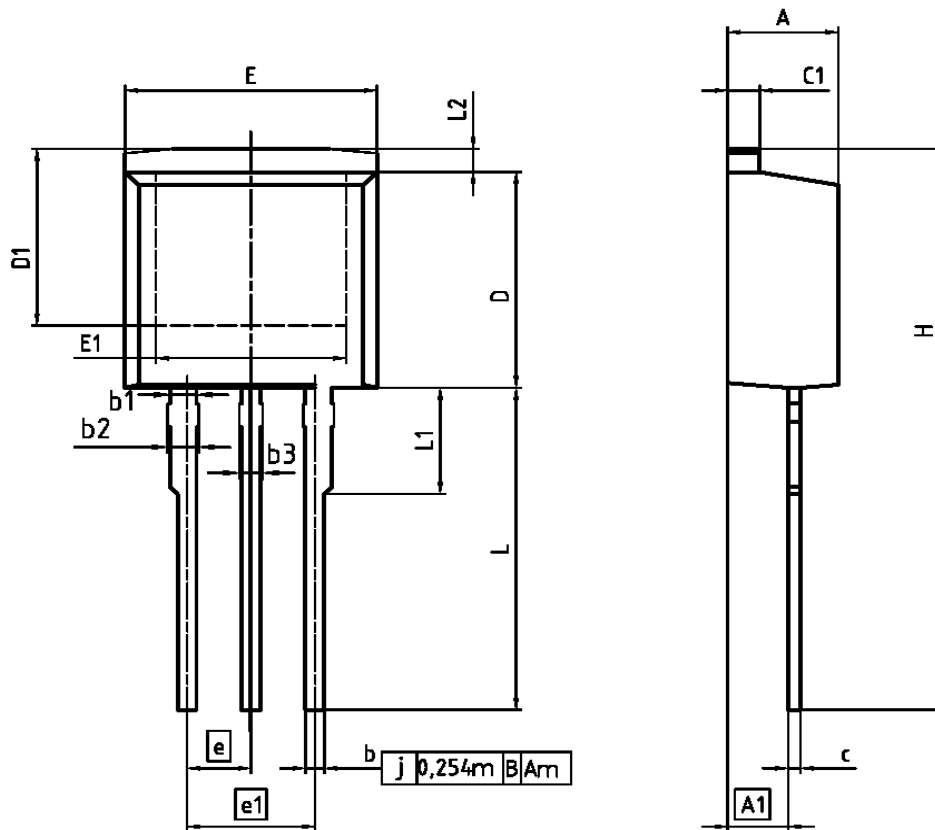


PG-TO-220

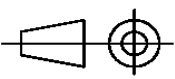


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	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
ϕP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

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REVISION 05



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.572	0.169	0.180
A1	2.150	2.718	0.085	0.107
b	0.650	0.864	0.026	0.034
b1	0.950	1.093	0.037	0.043
b2	0.950	1.400	0.037	0.055
b3	0.650	1.118	0.026	0.044
c	0.330	0.600	0.013	0.024
c1	1.170	1.400	0.046	0.055
D	8.509	8.450	0.335	0.372
D1	6.900	-	0.272	-
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	
L	13.000	14.000	0.512	0.551
L1	-	4.800	-	0.189
L2	-	1.727	-	0.068

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