

OptiMOS™3 Power-Transistor

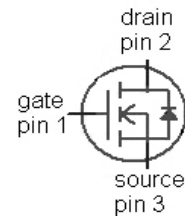
Features

- 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; halogen free
- Qualified according to JEDEC¹⁾ for target application
- Ideal for high-frequency switching and synchronous rectification

Type	IPP114N12N3 G
	
Package	PG-TO220-3
Marking	114N12N

Product Summary

V_{DS}	120	V
$R_{DS(on)max}$	11.4	mΩ
I_D	75	A



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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ °C}$	75	A
		$T_C=100\text{ °C}$	53	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	300	
Avalanche energy, single pulse	E_{AS}	$I_D=75\text{ A}$, $R_{GS}=25\text{ Ω}$	120	mJ
Gate source voltage ³⁾	V_{GS}		±20	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	136	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

³⁾ $T_{jmax}=150\text{ °C}$ and duty cycle $D=0.01$ for $V_{gs}<-5\text{ V}$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	1.1	K/W
Thermal resistance, junction - ambient	R_{thJA}	minimal footprint	-	-	62	
		6 cm ² cooling area ⁴⁾	-	-	40	

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

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	120	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=83\text{ }\mu\text{A}$	2	3	4	
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	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=75\text{ A}$	-	9.8	11.4	
Gate resistance	R_G		-	1.5	-	Ω
Transconductance	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=75\text{ A}$	40	80	-	S

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}	$V_{GS}=0\text{ V}, V_{DS}=60\text{ V},$ $f=1\text{ MHz}$	-	3240	4310	pF
Output capacitance	C_{oss}		-	408	543	
Reverse transfer capacitance	C_{rss}		-	22	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=60\text{ V}, V_{GS}=10\text{ V},$ $I_D=37\text{ A}, R_G=1.6\ \Omega$	-	19	-	ns
Rise time	t_r		-	36	-	
Turn-off delay time	$t_{d(off)}$		-	30	-	
Fall time	t_f		-	7	-	

Gate Charge Characteristics⁵⁾

Gate to source charge	Q_{gs}	$V_{DD}=60\text{ V}, I_D=75\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	18	-	nC
Gate to drain charge	Q_{gd}		-	12	-	
Switching charge	Q_{sw}		-	20	-	
Gate charge total	Q_g		-	49	65	
Gate plateau voltage	$V_{plateau}$		-	5.6	-	V
Output charge	Q_{oss}	$V_{DD}=60\text{ V}, V_{GS}=0\text{ V}$	-	56	75	nC

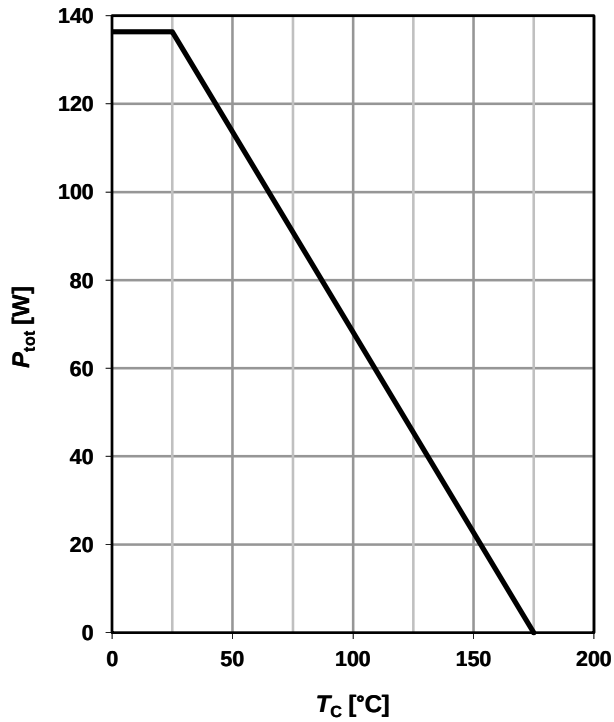
Reverse Diode

Diode continuous forward current	I_S	$T_C=25\text{ °C}$	-	-	75	A
Diode pulse current	$I_{S,pulse}$		-	-	300	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=75\text{ A},$ $T_J=25\text{ °C}$	-	1	1.2	V
Reverse recovery time	t_{rr}	$V_R=60\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	116		ns
Reverse recovery charge	Q_{rr}		-	232		nC

⁵⁾ See figure 16 for gate charge parameter definition

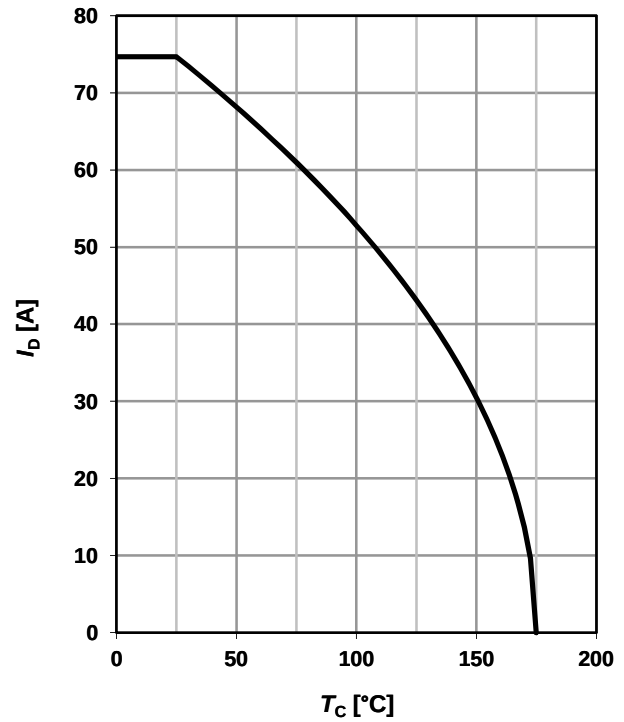
1 Power dissipation

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



2 Drain current

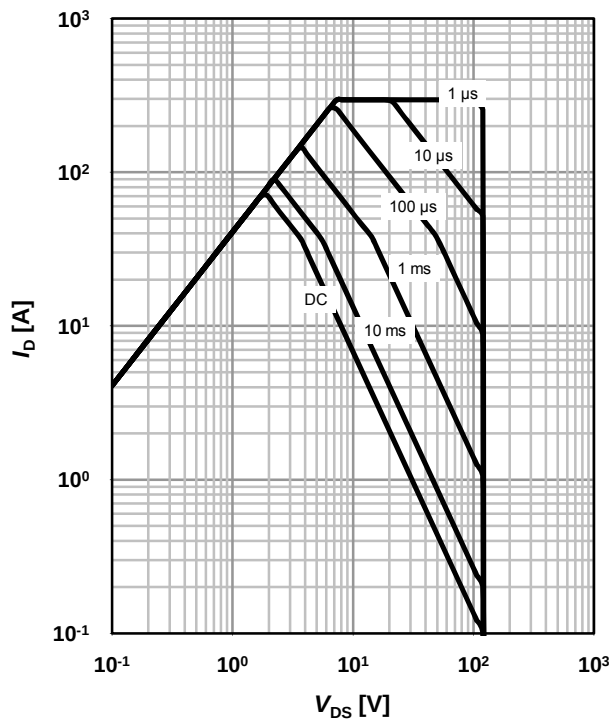
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



3 Safe operating area

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

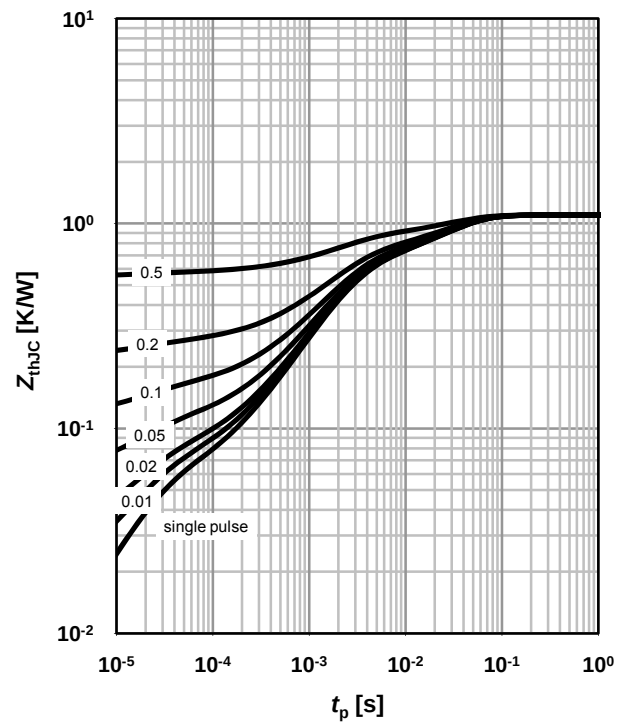
parameter: t_p



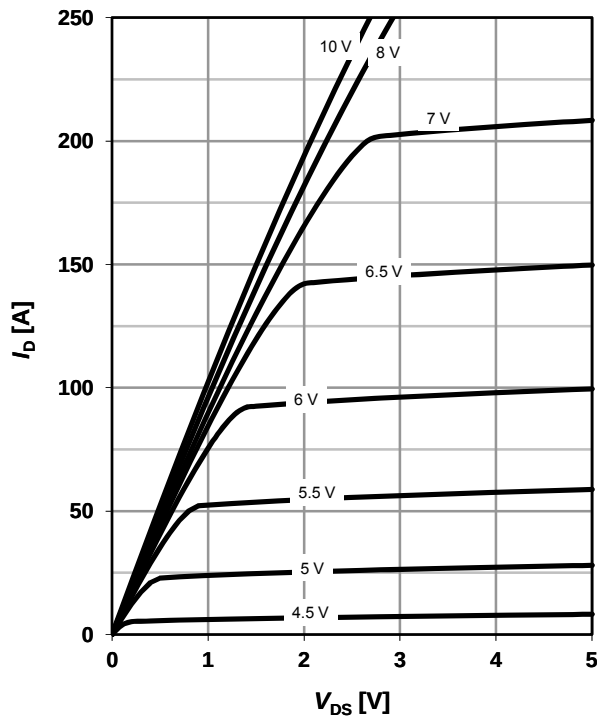
4 Max. transient thermal impedance

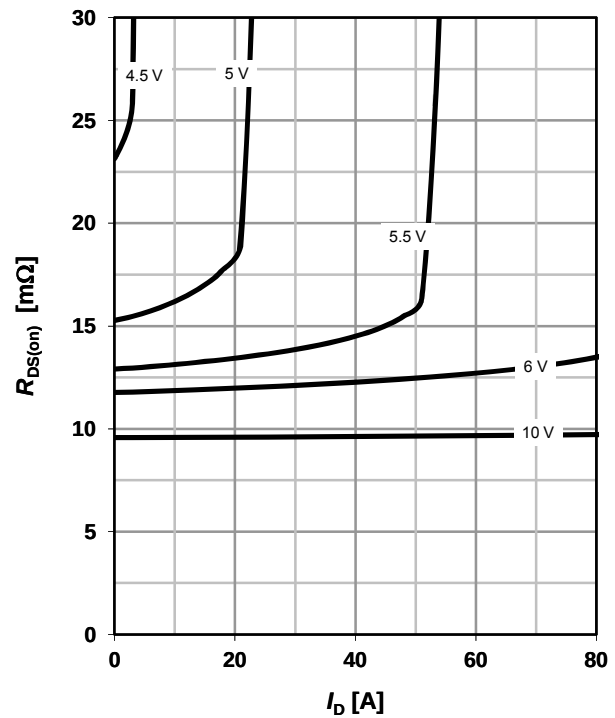
$$Z_{\text{thJC}} = f(t_p)$$

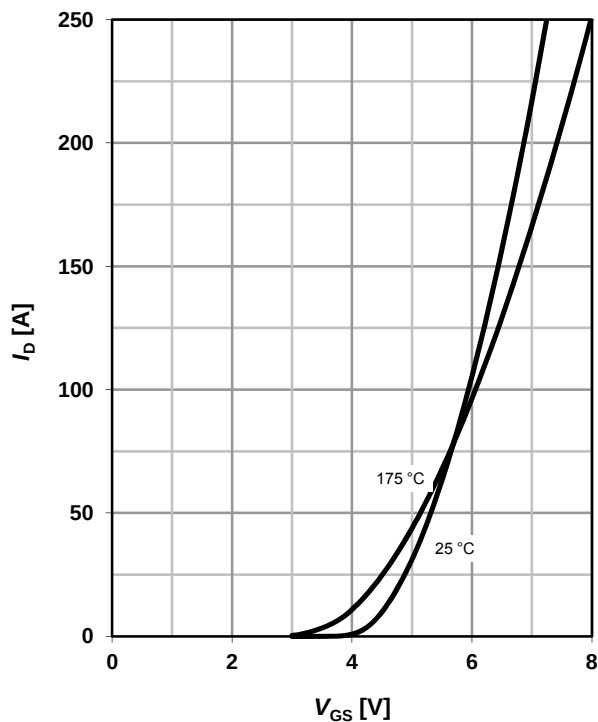
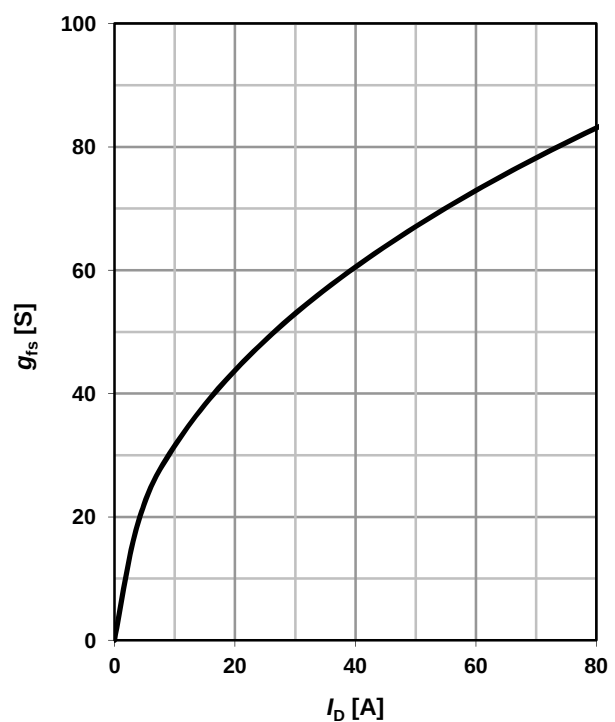
parameter: $D = t_p/T$



5 Typ. output characteristics
 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}$

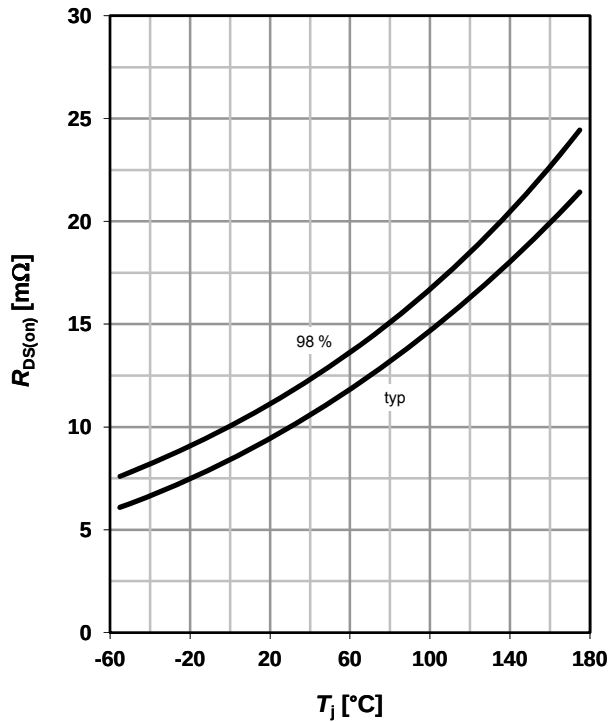
 parameter: V_{GS}

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


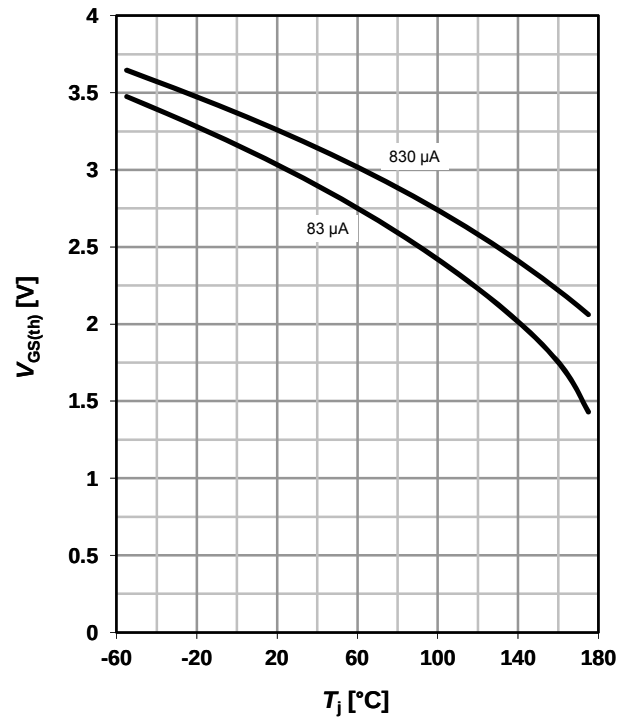
9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j); I_D = 75 \text{ A}; V_{GS} = 10 \text{ V}$$

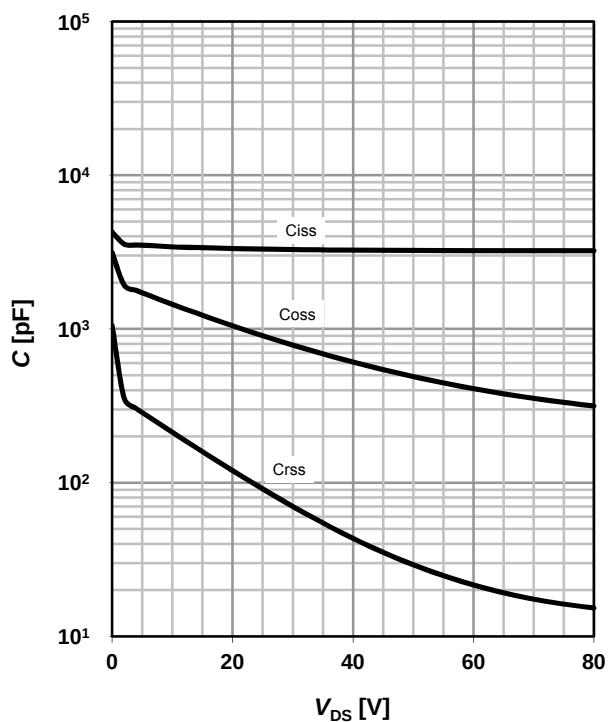

10 Typ. gate threshold voltage

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

parameter: I_D

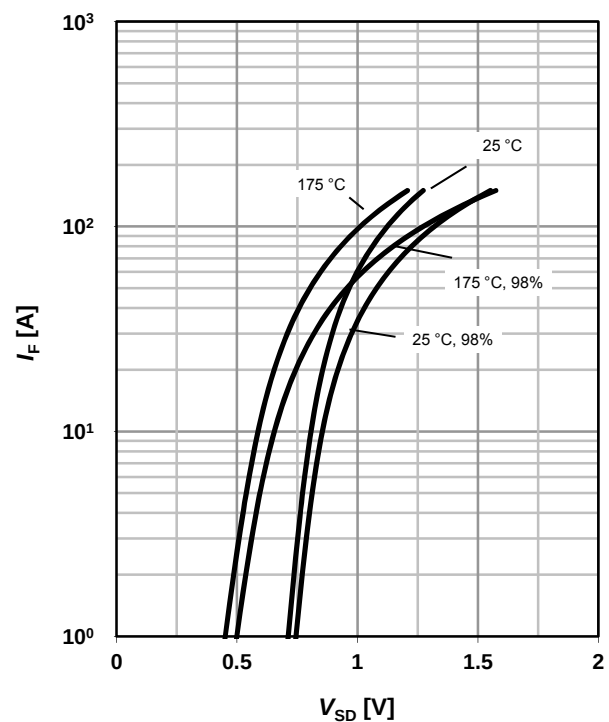

11 Typ. capacitances

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


12 Forward characteristics of reverse diode

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

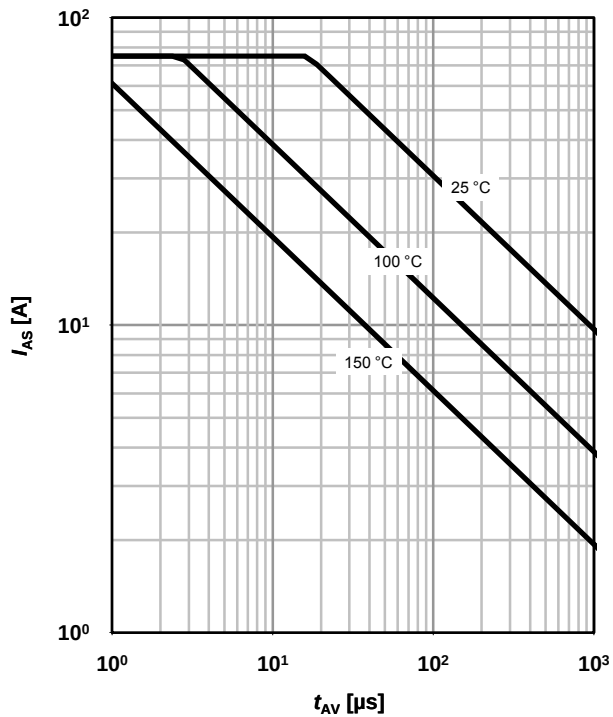
parameter: T_j



13 Avalanche characteristics

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

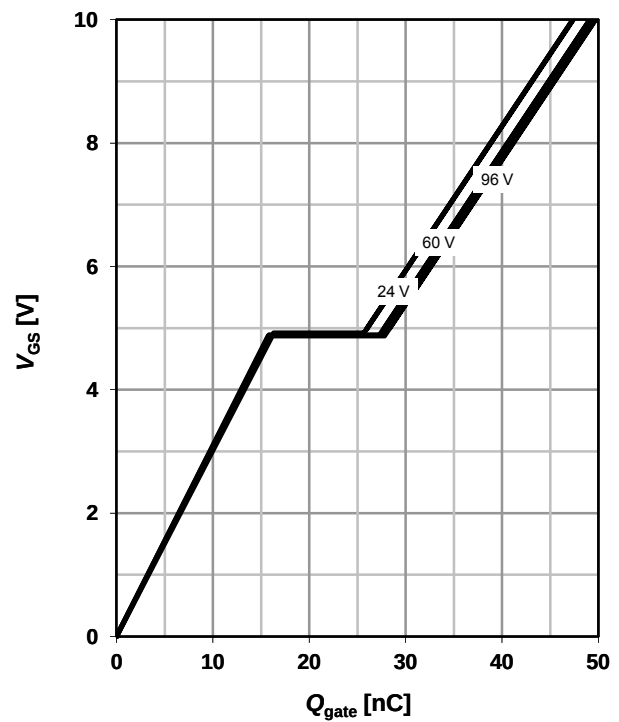
parameter: $T_{j(\text{start})}$



14 Typ. gate charge

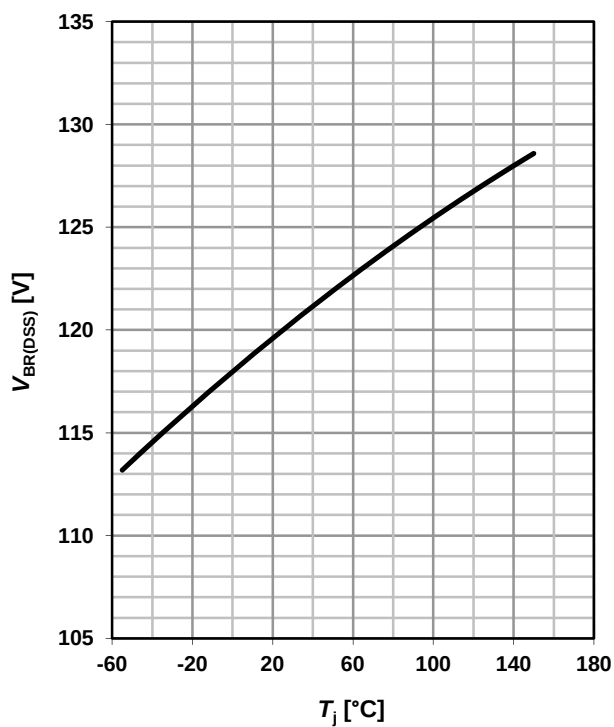
$$V_{GS}=f(Q_{\text{gate}}); I_D=75\ \text{A pulsed}$$

parameter: V_{DD}

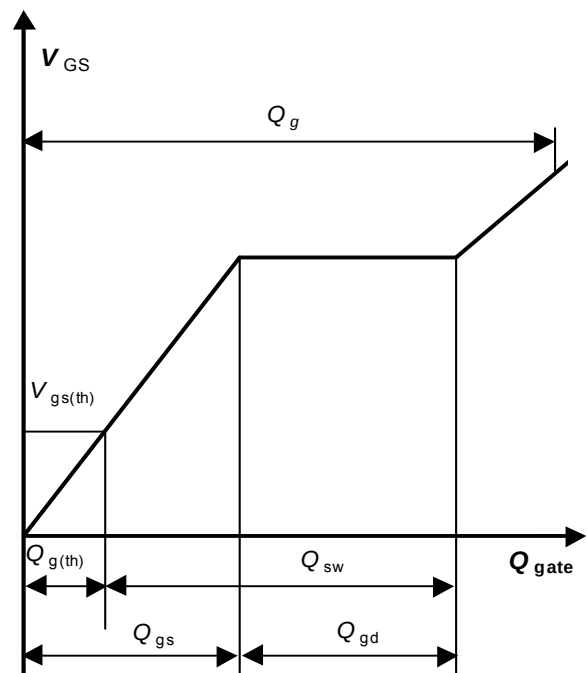


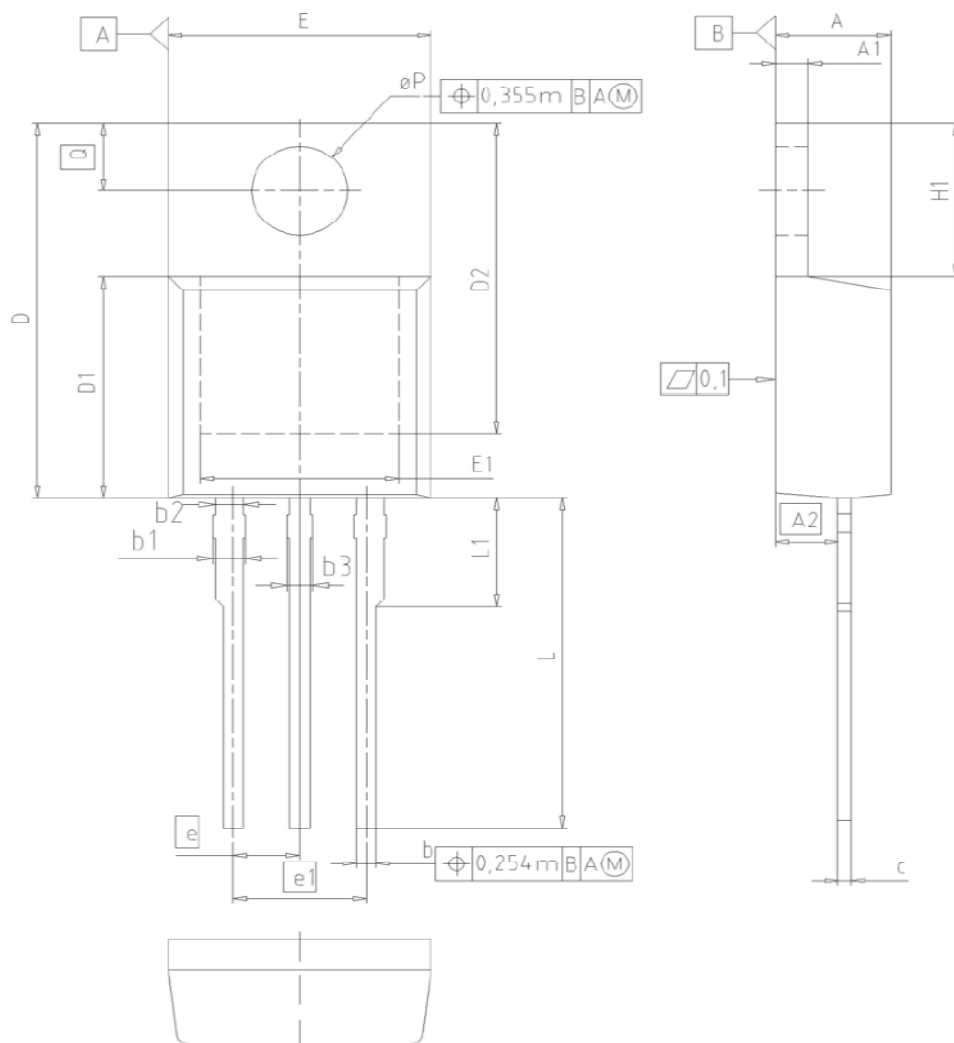
15 Drain-source breakdown voltage

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



16 Gate charge waveforms



PG-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	0.60	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
øP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

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