

**OptiMOS™ 3 Power-Transistor**
**Features**

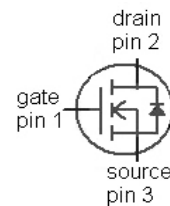
- Fast switching MOSFET for SMPS
- Optimized technology for DC/DC converters
- Qualified according to JEDEC<sup>1)</sup> for target applications
- N-channel, logic level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- Avalanche rated
- Pb-free plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

**Product Summary**

$V_{DS}$	30	V
$R_{DS(on),max}$	5.5	m $\Omega$
$I_D$	50	A



Type	IPP055N03L G	IPB055N03L G
<b>Package</b>	PG-TO220-3-1	PG-TO263-3
<b>Marking</b>	055N03L	055N03L


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$V_{GS}=10\text{ V}, T_C=25\text{ }^\circ\text{C}$	50	A
		$V_{GS}=10\text{ V}, T_C=100\text{ }^\circ\text{C}$	50	
		$V_{GS}=4.5\text{ V}, T_C=25\text{ }^\circ\text{C}$	50	
		$V_{GS}=4.5\text{ V}, T_C=100\text{ }^\circ\text{C}$	50	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25\text{ }^\circ\text{C}$	350	
Avalanche current, single pulse <sup>3)</sup>	$I_{AS}$	$T_C=25\text{ }^\circ\text{C}$	50	
Avalanche energy, single pulse	$E_{AS}$	$I_D=35\text{ A}, R_{GS}=25\text{ }\Omega$	60	mJ
Reverse diode $dv/dt$	$dv/dt$	$I_D=50\text{ A}, V_{DS}=24\text{ V}, di/dt=200\text{ A}/\mu\text{s}, T_{j,max}=175\text{ }^\circ\text{C}$	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$		$\pm 20$	V

<sup>1)</sup> J-STD20 and JESD22

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

Parameter	Symbol	Conditions	Value	Unit
Power dissipation	$P_{\text{tot}}$	$T_C=25\text{ °C}$	68	W
Operating and storage temperature	$T_j, T_{\text{stg}}$		-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	$R_{\text{thJC}}$		-	-	2.2	K/W
SMD version, device on PCB	$R_{\text{thJA}}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>4)</sup>	-	-	40	

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

### Static characteristics

Drain-source breakdown voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}}=0\text{ V}, I_{\text{D}}=1\text{ mA}$	30	-	-	V
Gate threshold voltage	$V_{\text{GS(th)}}$	$V_{\text{DS}}=V_{\text{GS}}, I_{\text{D}}=250\text{ }\mu\text{A}$	1	-	2.2	
Zero gate voltage drain current	$I_{\text{DSS}}$	$V_{\text{DS}}=30\text{ V}, V_{\text{GS}}=0\text{ V}, T_j=25\text{ °C}$	-	0.1	1	$\mu\text{A}$
		$V_{\text{DS}}=30\text{ V}, V_{\text{GS}}=0\text{ V}, T_j=125\text{ °C}$	-	10	100	
Gate-source leakage current	$I_{\text{GSS}}$	$V_{\text{GS}}=20\text{ V}, V_{\text{DS}}=0\text{ V}$	-	10	100	nA
Drain-source on-state resistance <sup>5)</sup>	$R_{\text{DS(on)}}$	$V_{\text{GS}}=4.5\text{ V}, I_{\text{D}}=30\text{ A}$	-	6.2	7.8	m $\Omega$
		$V_{\text{GS}}=10\text{ V}, I_{\text{D}}=30\text{ A}$	-	4.6	5.5	
Gate resistance	$R_{\text{G}}$		-	1.5	-	$\Omega$
Transconductance	$g_{\text{fs}}$	$ V_{\text{DS}} >2 I_{\text{D}} R_{\text{DS(on)max}}, I_{\text{D}}=30\text{ A}$	38	75	-	S

<sup>2)</sup> See figure 3 for more detailed information

<sup>3)</sup> See figure 13 for more detailed information

<sup>4)</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.

<sup>5)</sup> Measured from drain tab to source pin

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V},$ $f=1\text{ MHz}$	-	2400	3200	pF
Output capacitance	$C_{oss}$		-	920	1200	
Reverse transfer capacitance	$C_{rss}$		-	49	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=15\text{ V}, V_{GS}=10\text{ V},$ $I_D=30\text{ A}, R_G=1.6\ \Omega$	-	6.7	-	ns
Rise time	$t_r$		-	5.2	-	
Turn-off delay time	$t_{d(off)}$		-	25	-	
Fall time	$t_f$		-	4.0	-	

**Gate Charge Characteristics<sup>5)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=15\text{ V}, I_D=30\text{ A},$ $V_{GS}=0\text{ to }4.5\text{ V}$	-	7.5	-	nC
Gate charge at threshold	$Q_{g(th)}$		-	3.8	-	
Gate to drain charge	$Q_{gd}$		-	3.5	-	
Switching charge	$Q_{sw}$		-	7.1	-	
Gate charge total	$Q_g$		-	15	-	
Gate plateau voltage	$V_{plateau}$		-	3.1	-	
Gate charge total	$Q_g$	$V_{DD}=15\text{ V}, I_D=30\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	31	-	nC
Gate charge total, sync. FET	$Q_{g(sync)}$	$V_{DS}=0.1\text{ V},$ $V_{GS}=0\text{ to }4.5\text{ V}$	-	13	-	
Output charge	$Q_{oss}$	$V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$	-	24	-	

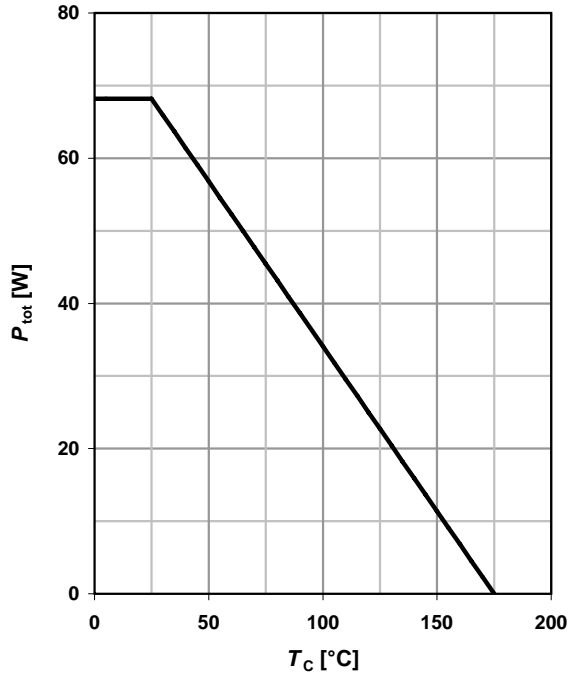
**Reverse Diode**

Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	50	A
Diode pulse current	$I_{S,pulse}$		-	-	350	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=30\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.88	1.1	V
Reverse recovery charge	$Q_{rr}$	$V_R=15\text{ V}, I_F=I_S,$ $di_F/dt=400\text{ A}/\mu\text{s}$	-	-	20	nC

<sup>6)</sup> See figure 16 for gate charge parameter definition

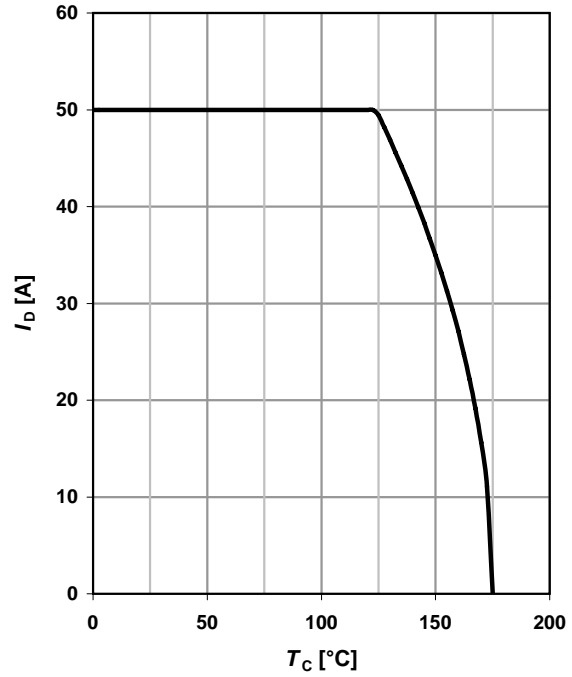
**1 Power dissipation**

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



**2 Drain current**

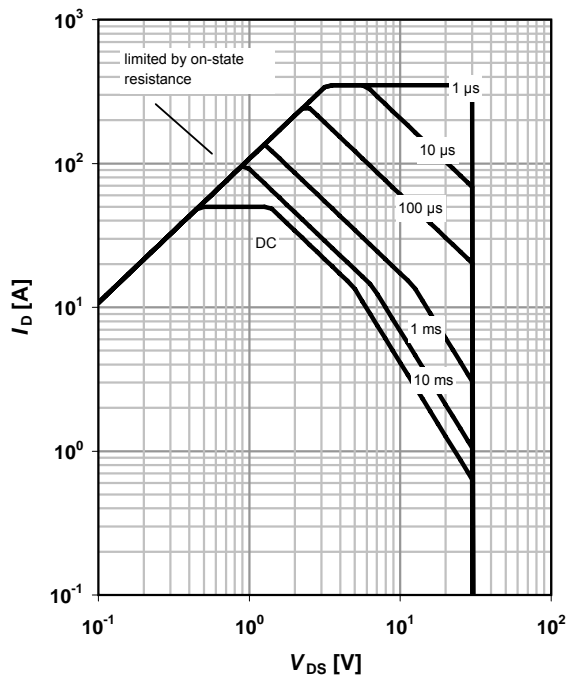
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



**3 Safe operating area**

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

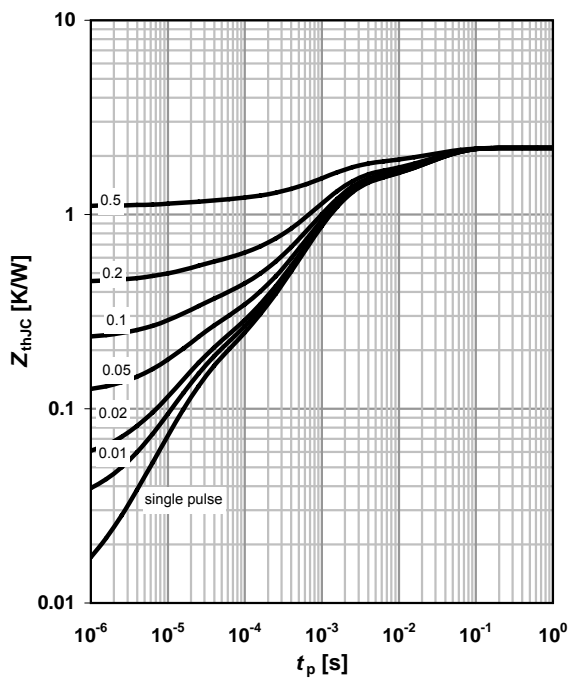
parameter:  $t_p$



**4 Max. transient thermal impedance**

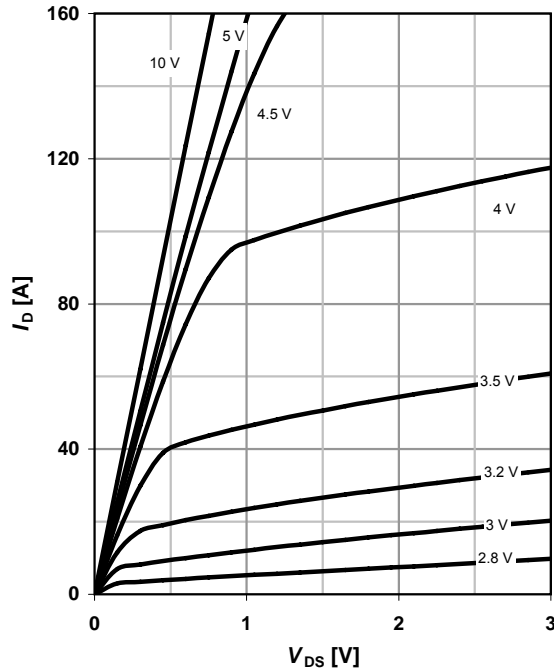
$$Z_{thJC} = f(t_p)$$

parameter:  $D = t_p / T$

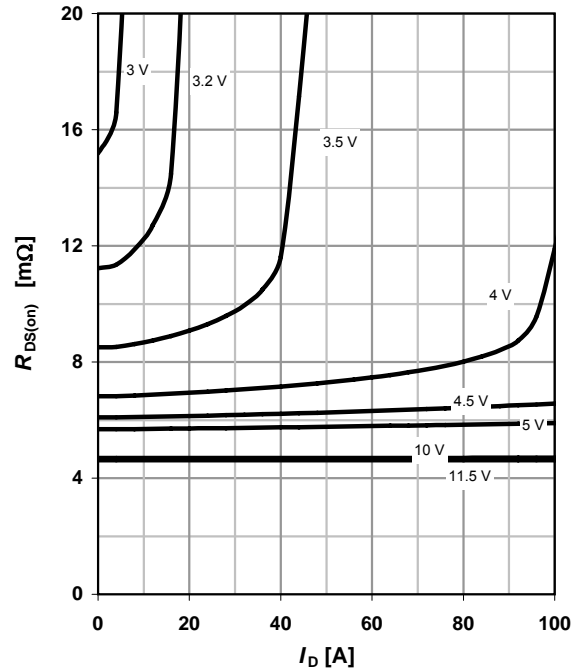


**5 Typ. output characteristics**

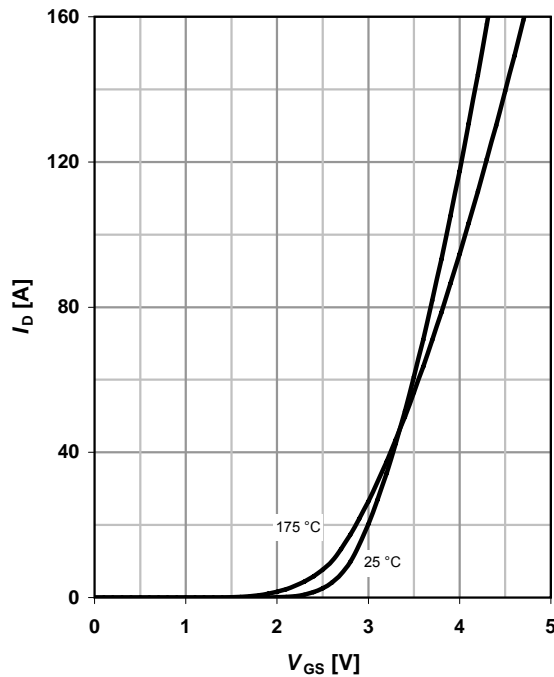
$$I_D = f(V_{DS}); T_j = 25\text{ }^\circ\text{C}$$

 parameter:  $V_{GS}$ 

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

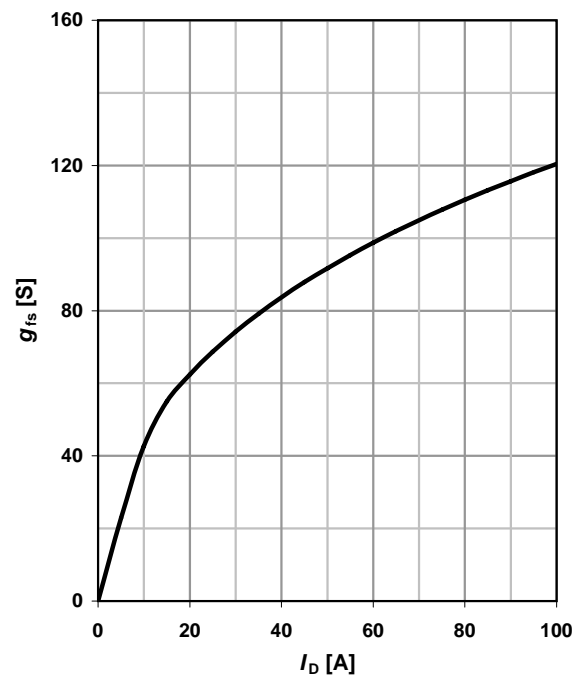
$$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}$$

 parameter:  $V_{GS}$ 

**7 Typ. transfer characteristics**

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

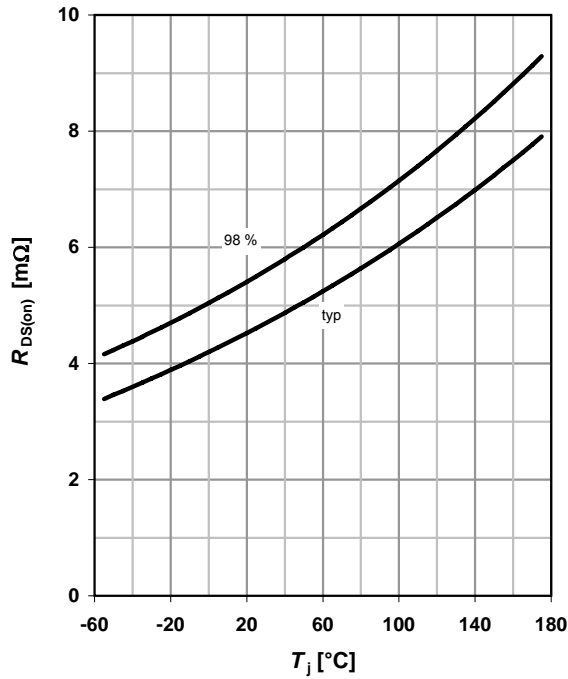
 parameter:  $T_j$ 

**8 Typ. forward transconductance**

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



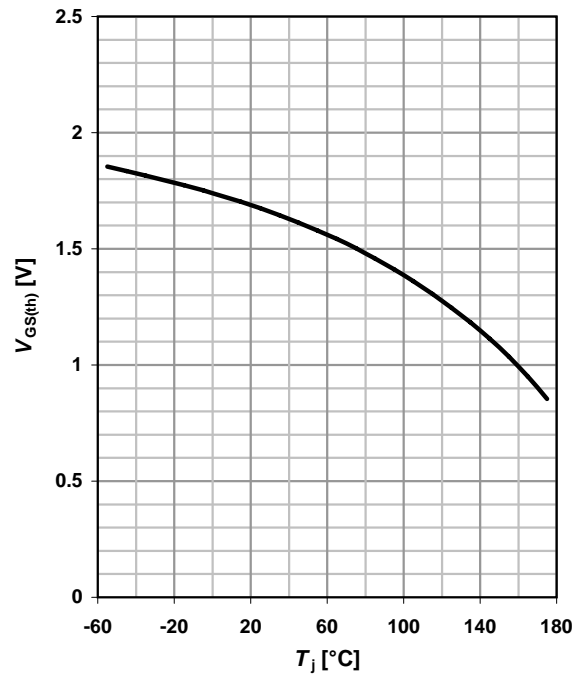
**9 Drain-source on-state resistance**

$$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$$



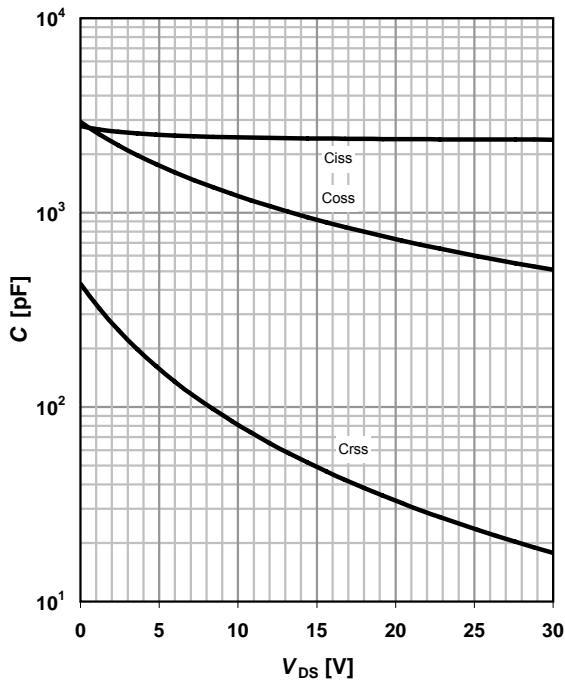
**10 Typ. gate threshold voltage**

$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = 250 \mu\text{A}$$



**11 Typ. capacitances**

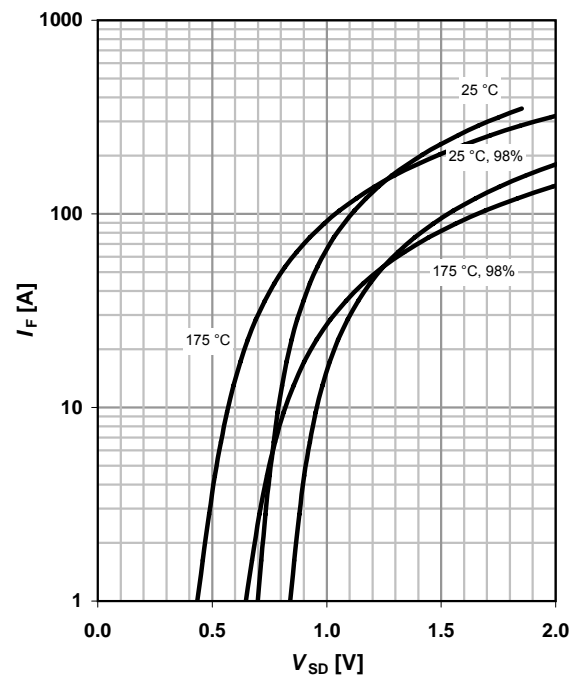
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



**12 Forward characteristics of reverse diode**

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

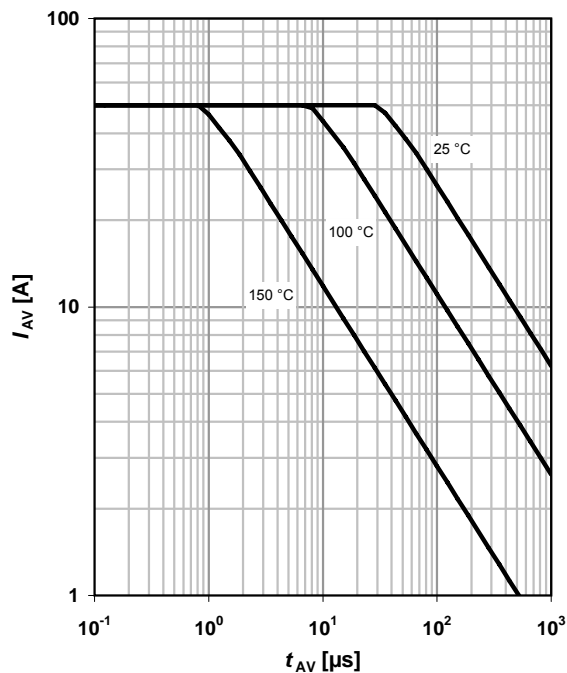
parameter:  $T_j$



### 13 Avalanche characteristics

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

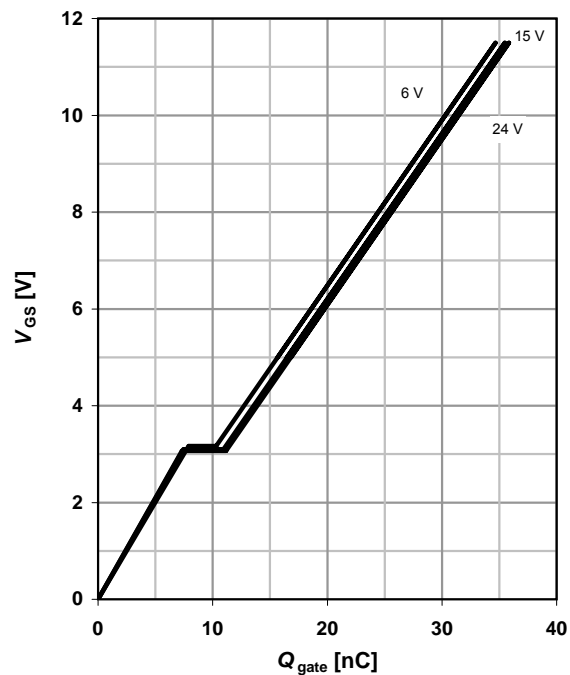
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

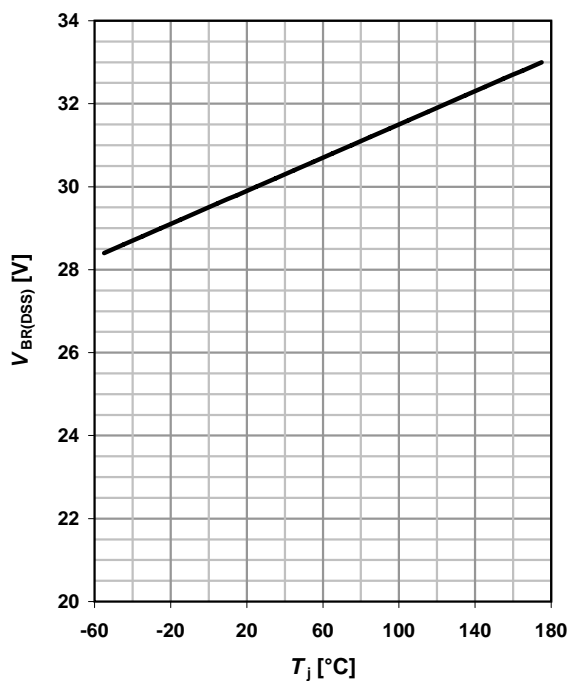
$$V_{GS} = f(Q_{\text{gate}}); I_D = 30 \text{ A pulsed}$$

parameter:  $V_{DD}$

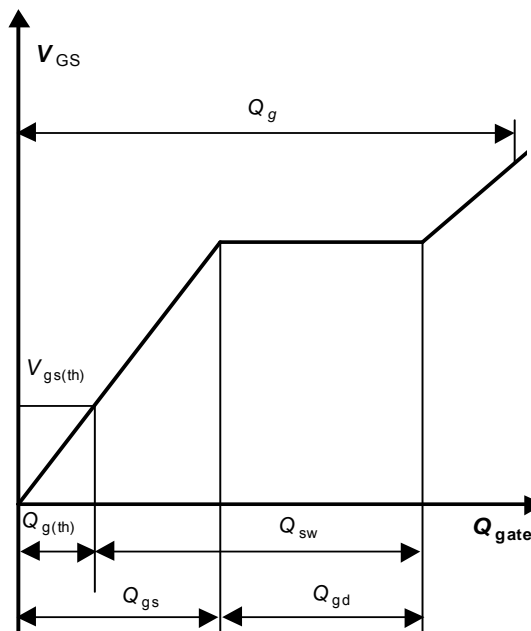


### 15 Drain-source breakdown voltage

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

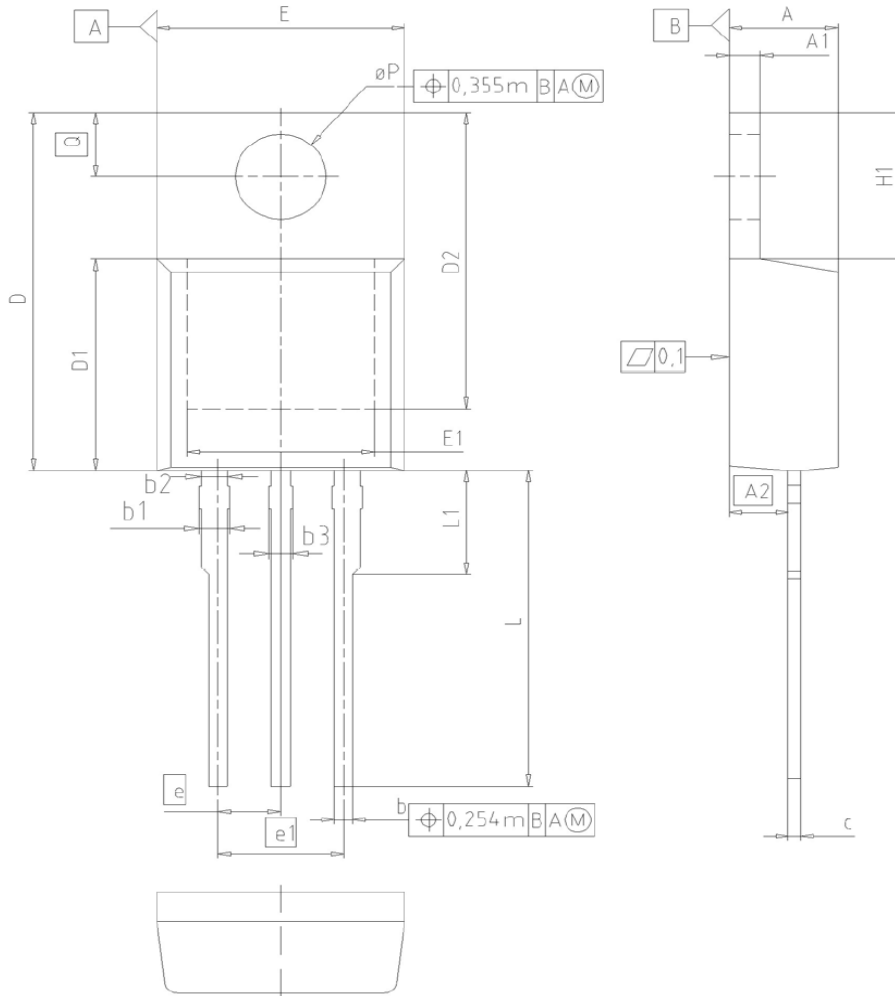


### 16 Gate charge waveforms



Package Outline

PG-TO220-3-1



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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