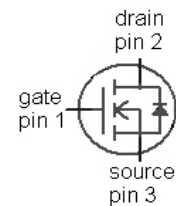
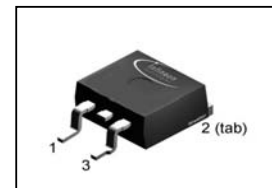


**OptiMOS<sup>®</sup> 2 Power-Transistor**
**Features**

- Ideal for high-frequency 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  $R_{DS(on)}$
- Superior thermal resistance
- 175 °C operating temperature
- $dv/dt$  rated
- Pb-free lead plating; RoHS compliant

**Product Summary**

$V_{DS}$	25	V
$R_{DS(on),max}$ (SMD version)	8.9	m $\Omega$
$I_D$	50	A

**PG-TO263-3-2**


Type	Package	Marking
IPB09N03LA G	PG-TO263-3-2	09N03LA

**Maximum ratings, at  $T_j=25$  °C, unless otherwise specified**

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25$ °C <sup>2)</sup>	50	A
		$T_C=100$ °C	46	
Pulsed drain current	$I_{D,pulse}$	$T_C=25$ °C <sup>3)</sup>	350	
Avalanche energy, single pulse	$E_{AS}$	$I_D=45$ A, $R_{GS}=25$ $\Omega$	75	mJ
Reverse diode $dv/dt$	$dv/dt$	$I_D=50$ A, $V_{DS}=20$ V, $di/dt=200$ A/ $\mu$ s, $T_{j,max}=175$ °C	6	kV/ $\mu$ s
Gate source voltage <sup>4)</sup>	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25$ °C	63	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> J-STD20 and JESD22

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics**

Thermal resistance, junction - case	$R_{thJC}$		-	-	2.4	K/W
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>5)</sup>	-	-	40	

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

**Static characteristics**

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	25	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=20\text{ }\mu\text{A}$	1.2	1.6	2	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.1	1	$\mu\text{A}$
		$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$	-	10	100	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	10	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=30\text{ A},$ SMD version	-	12.1	15.1	m $\Omega$
		$V_{GS}=10\text{ V}, I_D=30\text{ A},$ SMD version	-	7.4	8.9	
Gate resistance	$R_G$		-	1	-	$\Omega$
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=30\text{ A}$	22	45	-	S

<sup>2)</sup> Current is limited by bondwire; with an  $R_{thJC}=2.4\text{ K/W}$  the chip is able to carry 64

<sup>3)</sup> See figure 3

<sup>4)</sup>  $T_{j,max}=150\text{ °C}$  and duty cycle  $D<0.25$  for  $V_{GS}<-5\text{ V}$

<sup>5)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V},$ $f=1\text{ MHz}$	-	1235	1642	pF
Output capacitance	$C_{oss}$		-	474	630	
Reverse transfer capacitance	$C_{rss}$		-	61	92	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=15\text{ V}, V_{GS}=10\text{ V},$ $I_D=25\text{ A}, R_G=2.7\ \Omega$	-	8.9	13	ns
Rise time	$t_r$		-	73	109	
Turn-off delay time	$t_{d(off)}$		-	22	33	
Fall time	$t_f$		-	3.2	4.8	

**Gate Charge Characteristics<sup>6)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=15\text{ V}, I_D=25\text{ A},$ $V_{GS}=0\text{ to }5\text{ V}$	-	4.3	5.7	nC
Gate charge at threshold	$Q_{g(th)}$		-	2.0	2.6	
Gate to drain charge	$Q_{gd}$		-	2.8	4.3	
Switching charge	$Q_{sw}$		-	5.2	7.3	
Gate charge total	$Q_g$		-	10	13	
Gate plateau voltage	$V_{plateau}$		-	3.5	-	
Gate charge total, sync. FET	$Q_{g(sync)}$	$V_{DS}=0.1\text{ V},$ $V_{GS}=0\text{ to }5\text{ V}$	-	8.7	12	nC
Output charge	$Q_{oss}$	$V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$	-	10	14	

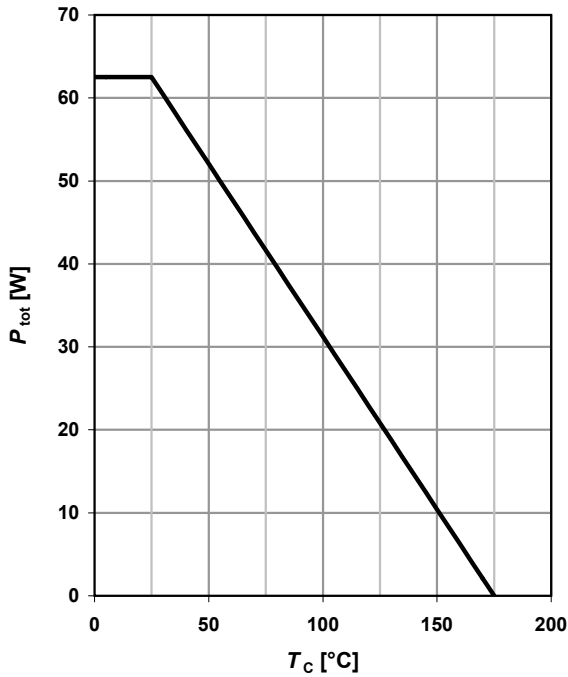
**Reverse Diode**

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	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=50\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.99	1.2	V
Reverse recovery charge	$Q_{rr}$	$V_R=15\text{ V}, I_F=I_S,$ $di_F/dt=400\text{ A}/\mu\text{s}$	-	-	10	nC

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

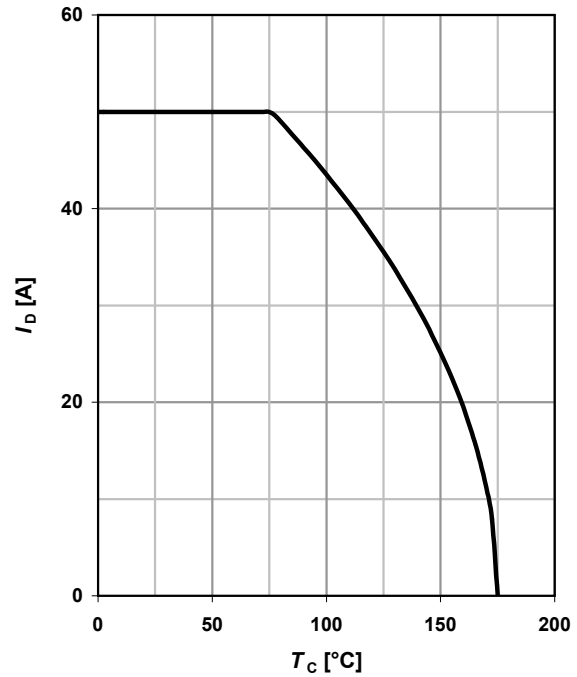
**1 Power dissipation**

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



**2 Drain current**

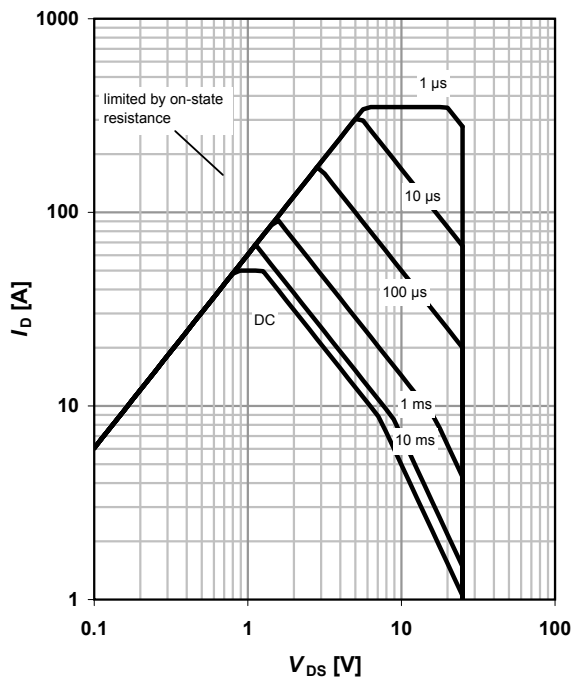
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



**3 Safe operating area**

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

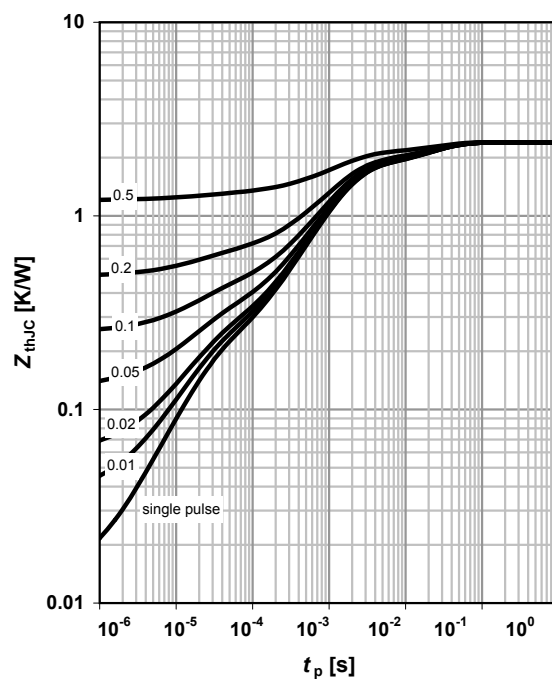
parameter:  $t_p$



**4 Max. transient thermal impedance**

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

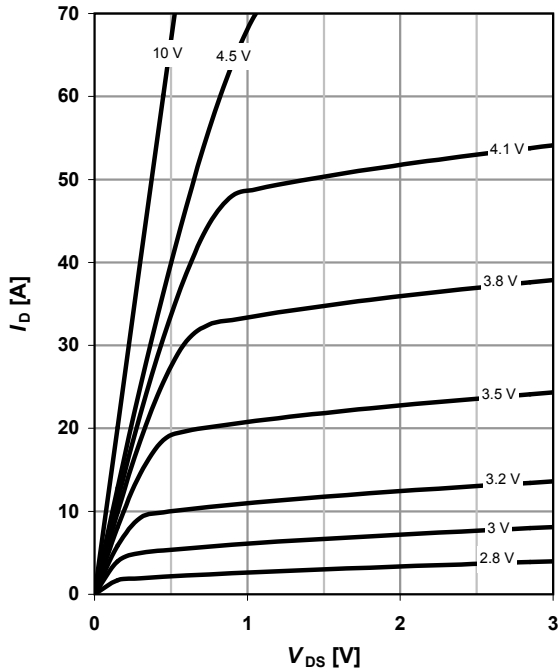
parameter:  $D = t_p / T$



**5 Typ. output characteristics**

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

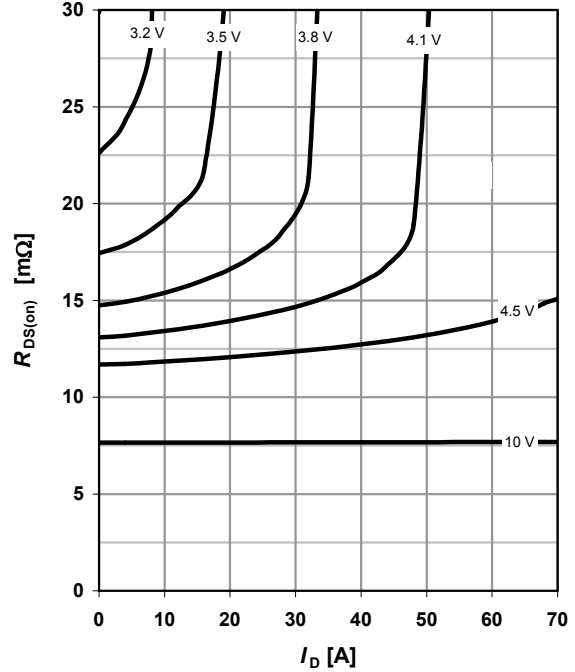
parameter:  $V_{GS}$



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

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

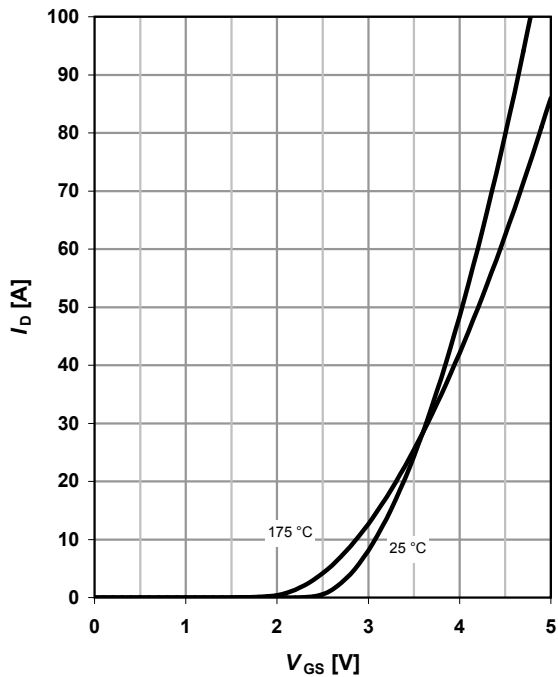
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

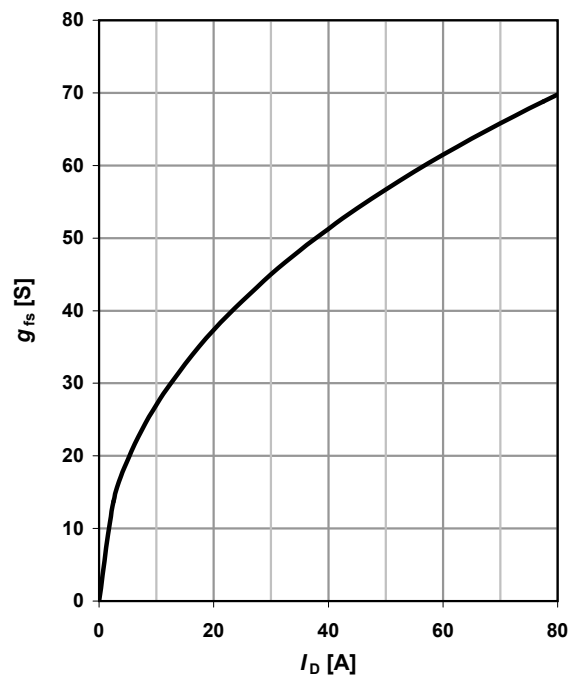
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

parameter:  $T_j$



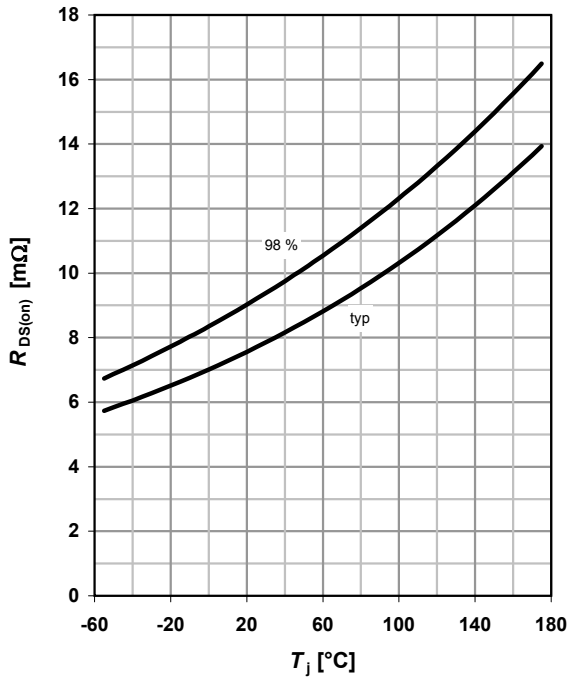
**8 Typ. forward transconductance**

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



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

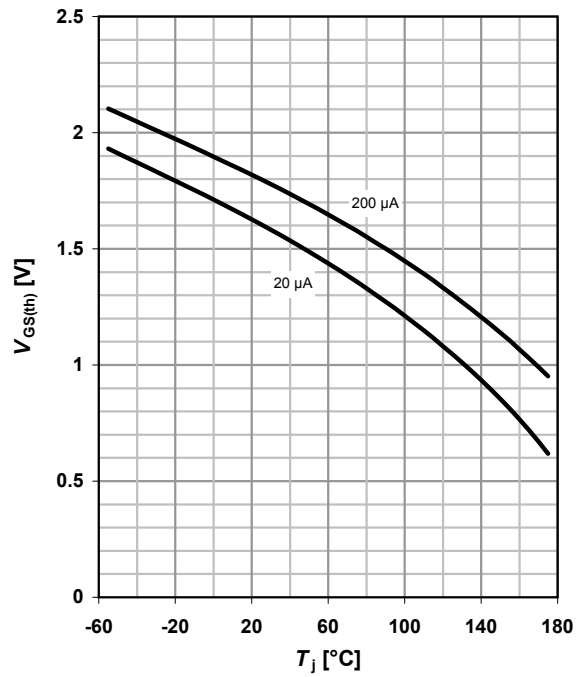
$$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$$



**10 Typ. gate threshold voltage**

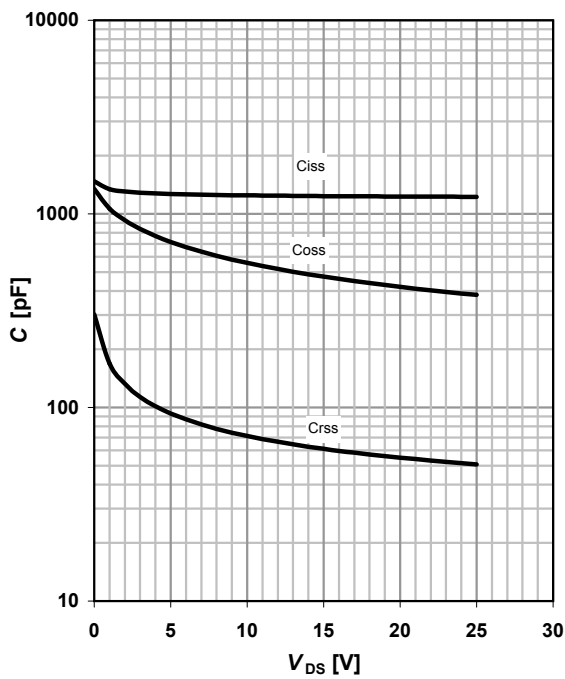
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



**11 Typ. Capacitances**

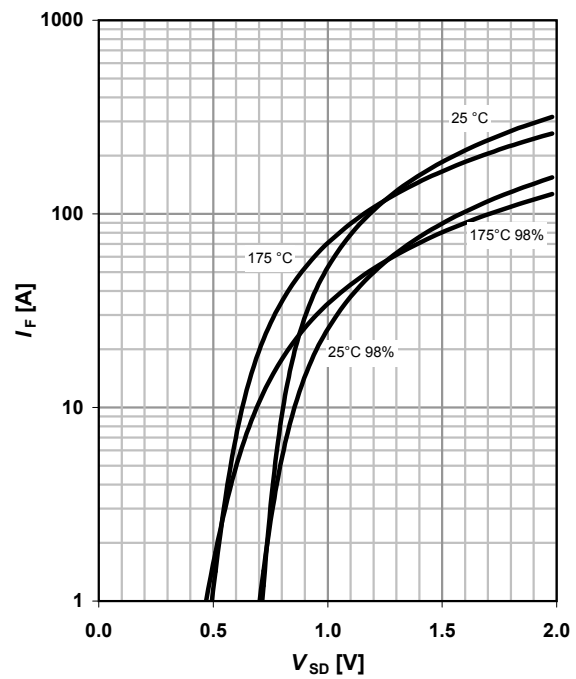
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



**12 Forward characteristics of reverse diode**

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

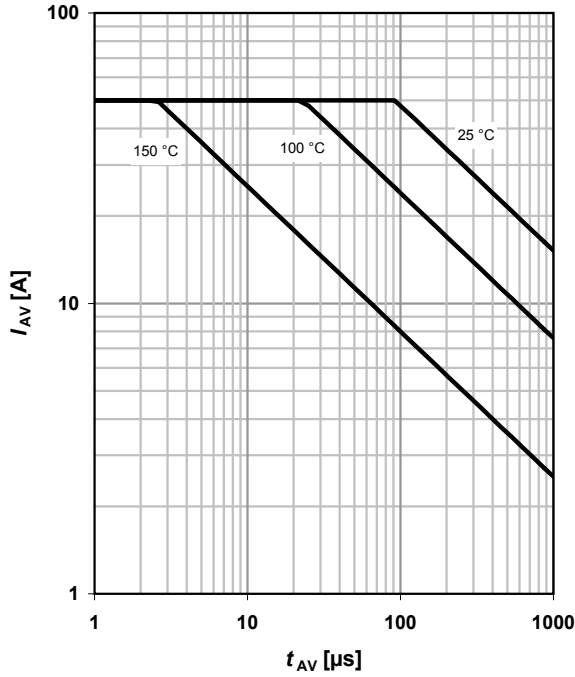
parameter:  $T_j$



**13 Avalanche characteristics**

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

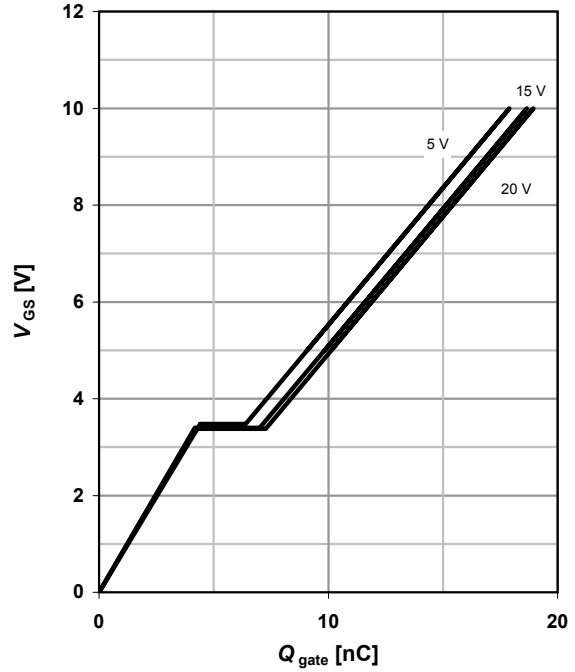
parameter:  $T_{j(start)}$



**14 Typ. gate charge**

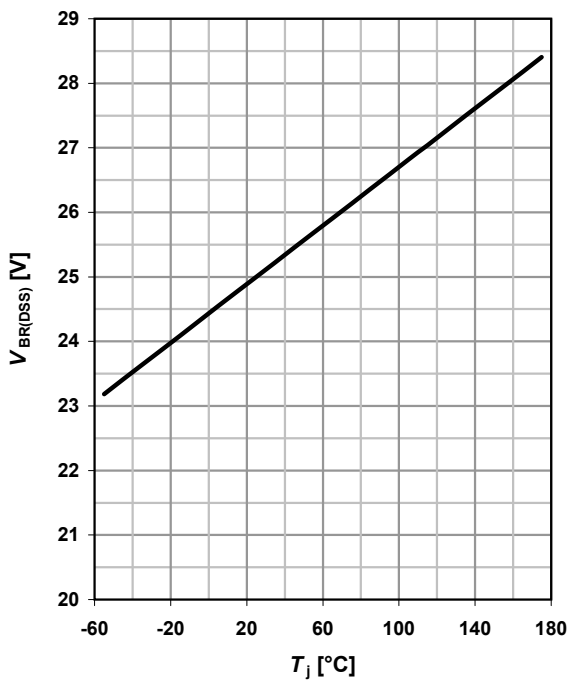
$V_{GS}=f(Q_{gate}); I_D=25 \text{ A pulsed}$

parameter:  $V_{DD}$



**15 Drain-source breakdown voltage**

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

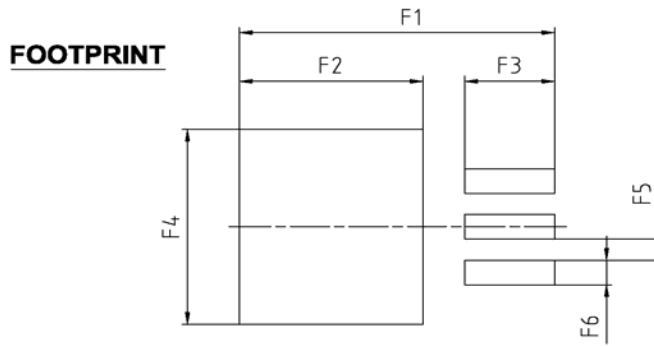
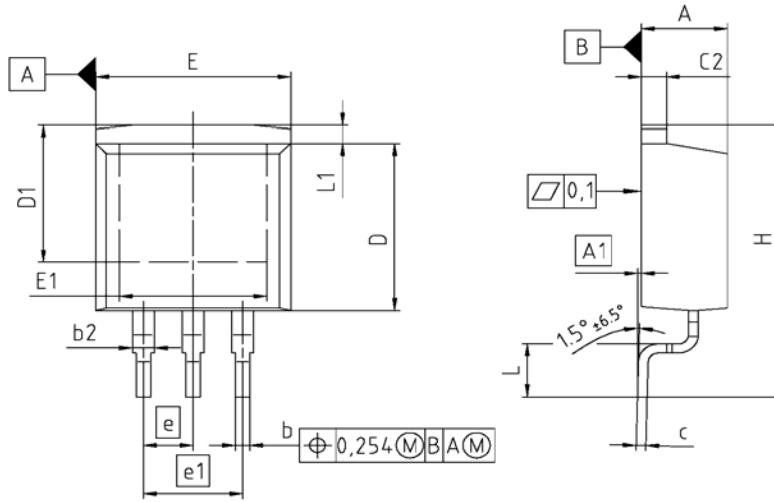


**16 Gate charge waveforms**



Package Outline

PG-TO263-3-2



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	0.650	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	3		3	
H	14.605	15.875	0.575	0.625
L	2.200	3.000	0.087	0.118
L1	-	1.600	-	0.063
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	1.250	1.450	0.049	0.057
F6	1.100	1.300	0.043	0.051

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