## OptiMOS™3 Power-Transistor

### Features

- Ideal for high frequency switching and DC/DC converters
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- N-channel, normal level
- 100% avalanche tested
- Pb-free plating; RoHS compliant
- Qualified according to JEDEC[1] for target applications
- Halogen-free according to IEC61249-2-21

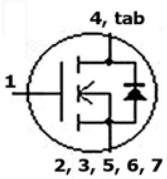
### Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 120 | V |
| $R_{DS(on),max}$ | 3.6 | mΩ |
| $I_D$ | 180 | A |

RoHS

Halogen-Free

| | |
|---|---|
| **Type** | IPB036N12N3 G |
| |   |
| **Package** | PG-TO263-7 |
| **Marking** | 036N12N |




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

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $T_C$=25 °C[2] | 180 | A |
| | | $T_C$=100 °C | 139 | |
| Pulsed drain current[2] | $I_{D,pulse}$ | $T_C$=25 °C | 720 | |
| Avalanche energy, single pulse[3] | $E_{AS}$ | $I_D$=100 A, $R_{GS}$=25 Ω | 900 | mJ |
| Gate source voltage | $V_{GS}$ | | ±20 | V |
| Power dissipation | $P_{tot}$ | $T_C$=25 °C | 300 | 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 for more detailed information
[3] See figure 13 for more detailed information

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Thermal characteristics** | | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | | - | - | 0.5 | K/W |
| Thermal resistance, junction - ambient | $R_{thJA}$ | minimal footprint | - | - | 62 | |
| | | 6 cm$^2$ cooling area[4)] | - | - | 40 | |
| **Electrical characteristics,** at $T_j$=25 °C, unless otherwise specified | | | | | | |
| **Static characteristics** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0 V, $I_D$=1 mA | 120 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=270 µA | 2 | 3 | 4 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=100 V, $V_{GS}$=0 V, $T_j$=25 °C | - | 0.1 | 1 | µA |
| | | $V_{DS}$=100 V, $V_{GS}$=0 V, $T_j$=125 °C | - | 10 | 100 | |
| Gate-source leakage current | $I_{GSS}$ | $V_{GS}$=20 V, $V_{DS}$=0 V | - | 1 | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$=10 V, $I_D$=100 A | - | 2.9 | 3.6 | mΩ |
| Gate resistance | $R_G$ | | - | 1.4 | - | Ω |
| Transconductance | $g_{fs}$ | $\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, $I_D$=100 A | 98 | 195 | - | S |

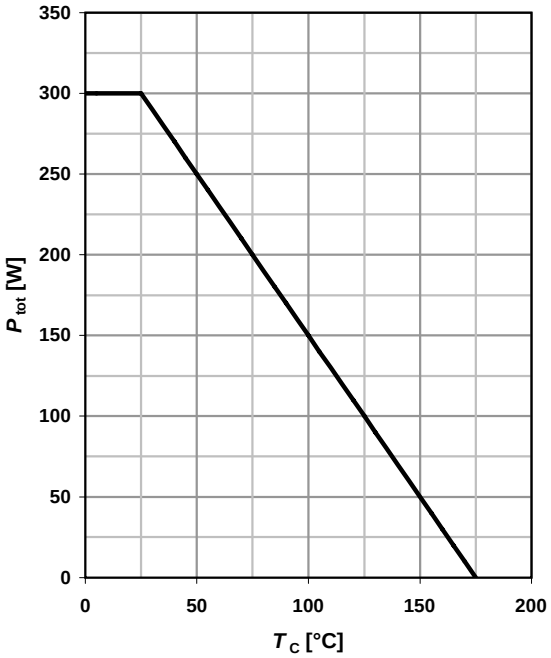
[4)] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm$^2$ (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=60 V, $f$=1 MHz | - | 10400 | 13800 | pF |
| Output capacitance | $C_{oss}$ | | - | 1320 | 1760 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 61 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=60 V, $V_{GS}$=10 V, $I_D$=100 A, $R_G$=1.6 Ω | - | 35 | - | ns |
| Rise time | $t_r$ | | - | 52 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 76 | - | |
| Fall time | $t_f$ | | - | 21 | - | |
| Gate Charge Characteristics[5)] | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=60 V, $I_D$=100 A, $V_{GS}$=0 to 10 V | - | 52 | - | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 37 | - | |
| Switching charge | $Q_{sw}$ | | - | 57 | - | |
| Gate charge total | $Q_g$ | | - | 158 | 211 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 5.0 | - | V |
| Output charge | $Q_{oss}$ | $V_{DD}$=60 V, $V_{GS}$=0 V | - | 182 | 242 | nC |
| **Reverse Diode** | | | | | | |
| Diode continous forward current | $I_S$ | $T_C$=25 °C | - | - | 180 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 720 | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=100 A, $T_j$=25 °C | - | 0.9 | 1.2 | V |
| Reverse recovery time | $t_{rr}$ | $V_R$=37.5 V, $I_F$=$I_S$, $di_F/dt$=100 A/µs | - | 123 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 356 | - | nC |

[5)] See figure 16 for gate charge parameter definition

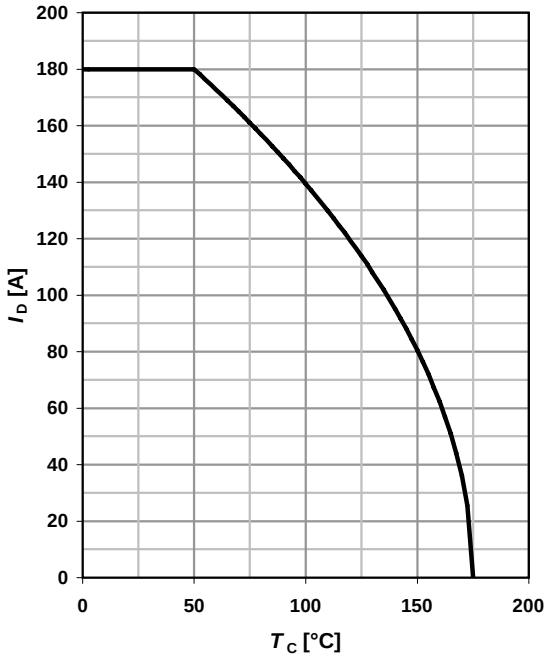
### 1 Power dissipation

$P_{tot}=f(T_C)$




### 2 Drain current

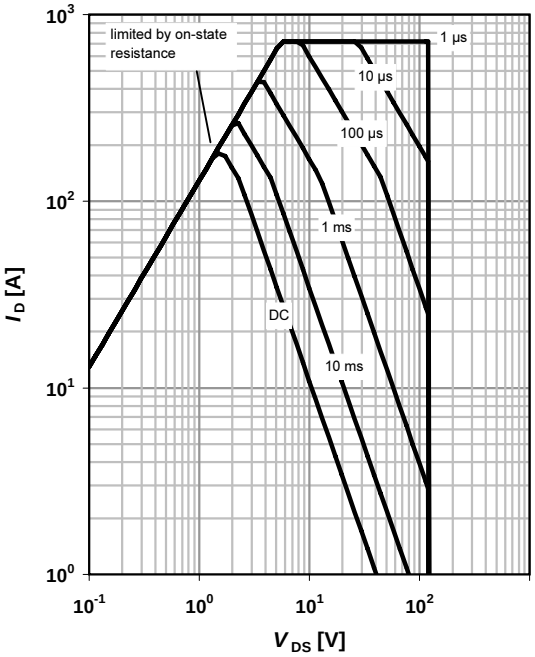
$I_D=f(T_C)$; $V_{GS}\geq 10$ V




### 3 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$

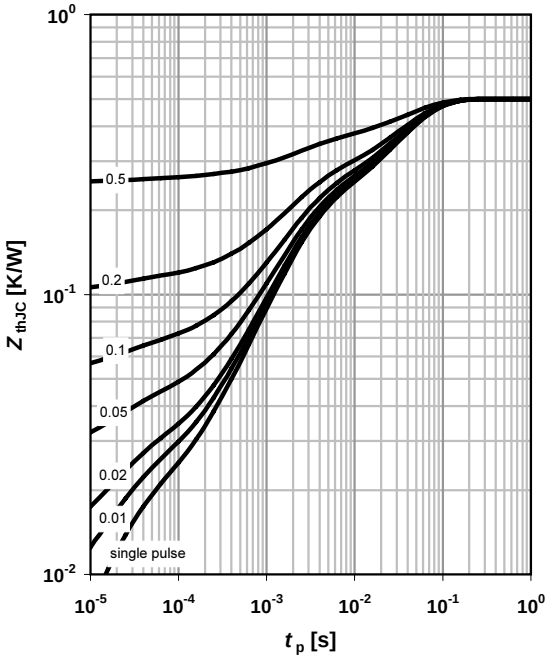
parameter: $t_p$




### 4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

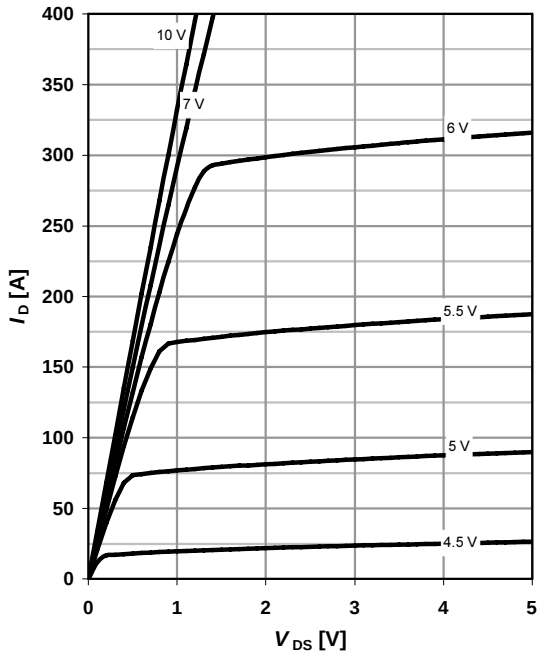
parameter: $D=t_p/T$



### 5 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ °C

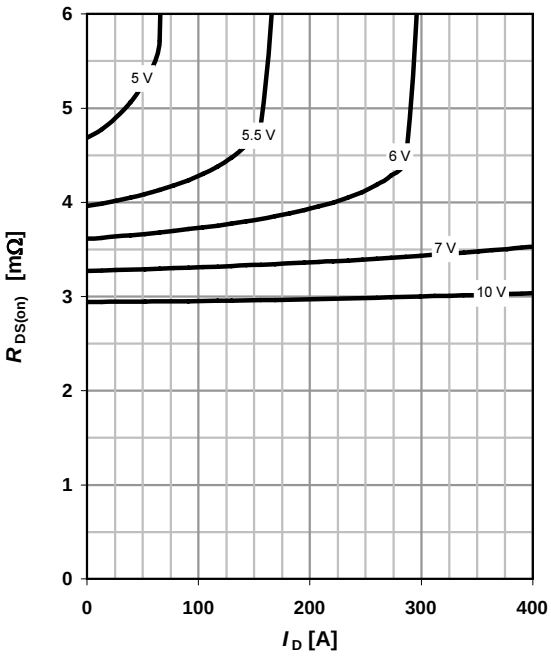
parameter: $V_{GS}$




### 6 Typ. drain-source on resistance

$R_{DS(on)}=f(I_D)$; $T_j=25$ °C

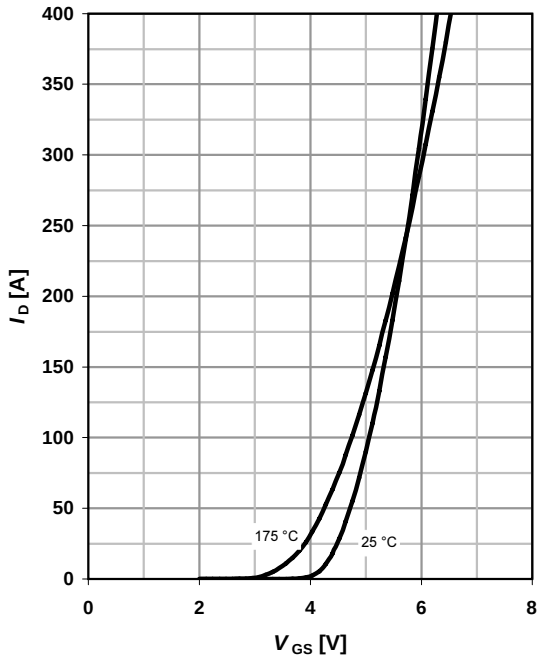
parameter: $V_{GS}$




### 7 Typ. transfer characteristics

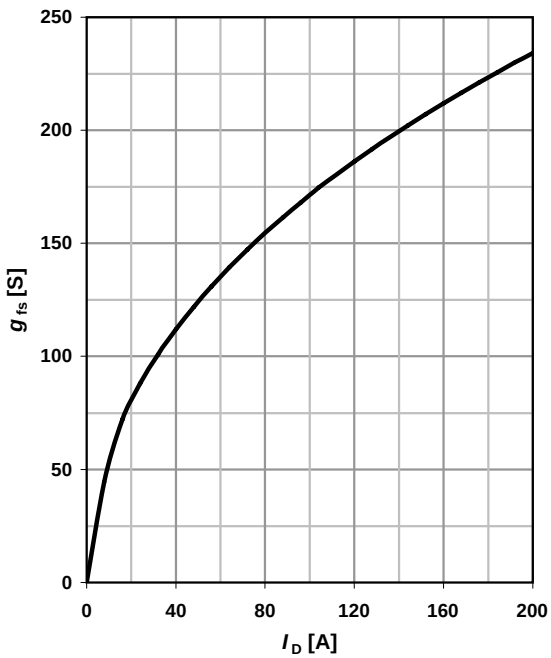
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$

parameter: $T_j$



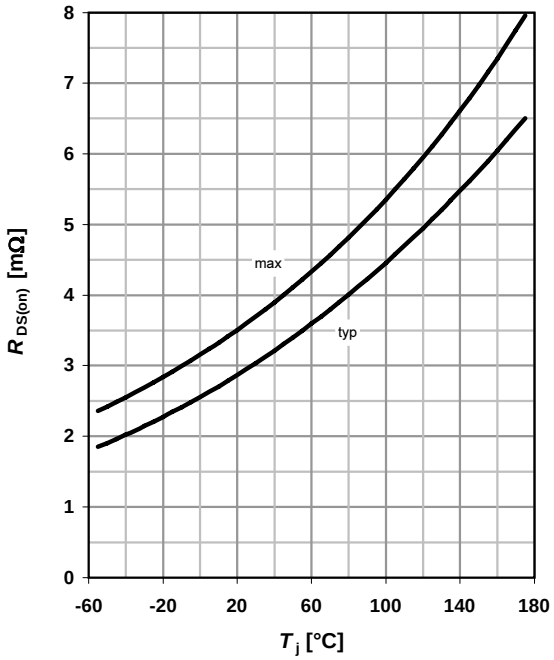

### 8 Typ. forward transconductance

$g_{fs}=f(I_D)$; $T_j=25$ °C



### 9 Drain-source on-state resistance

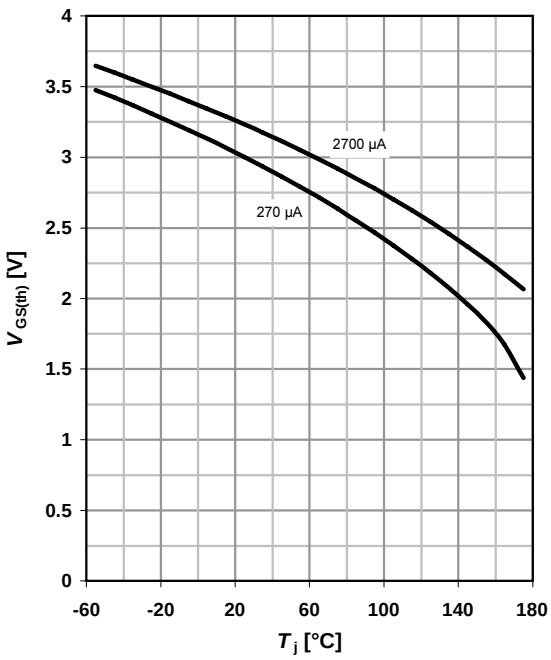
$R_{DS(on)}=f(T_j)$; $I_D=100$ A; $V_{GS}=10$ V




### 10 Typ. gate threshold voltage

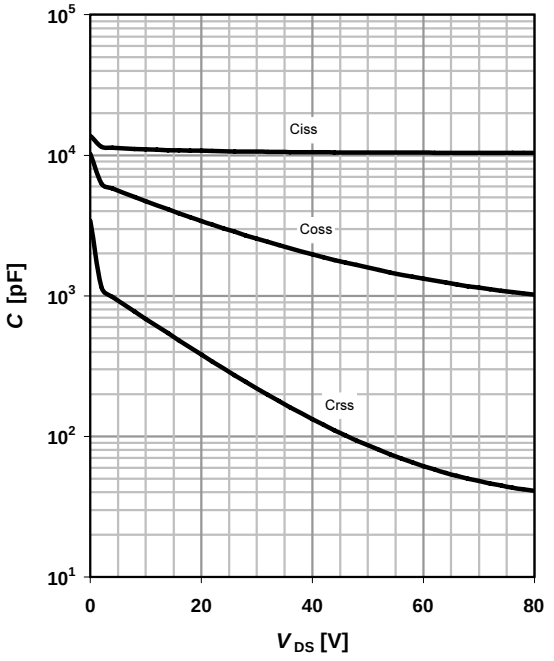
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$

parameter: $I_D$




### 11 Typ. capacitances

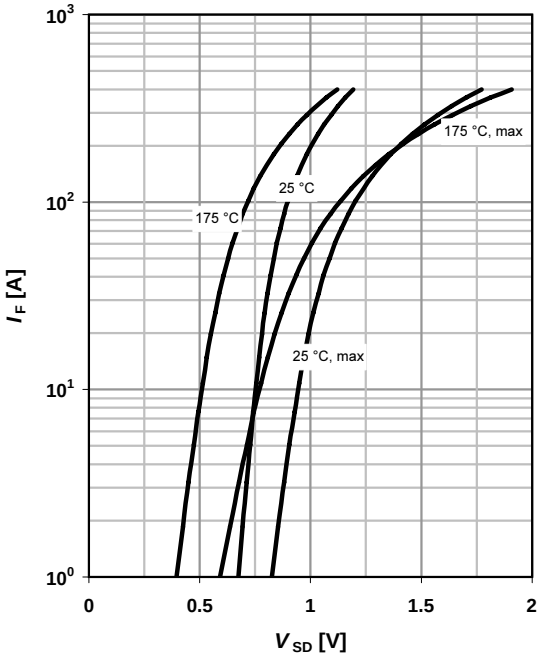
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz




### 12 Forward characteristics of reverse diode

$I_F=f(V_{SD})$

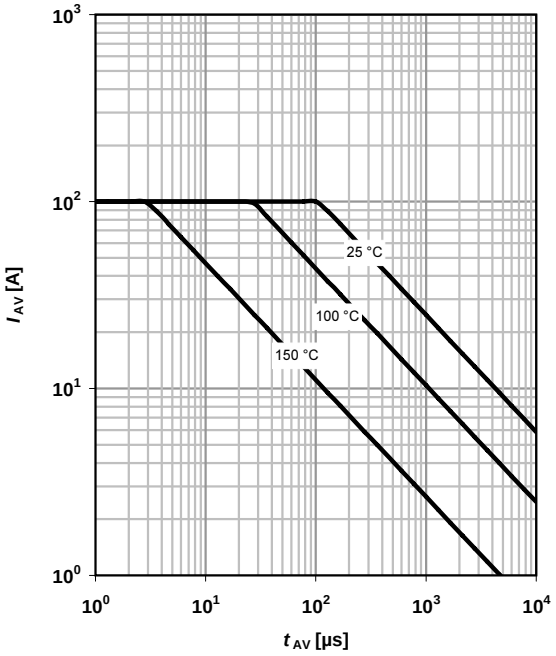
parameter: $T_j$



## 13 Avalanche characteristics

$I_{AS}$=f($t_{AV}$); $R_{GS}$=25 Ω

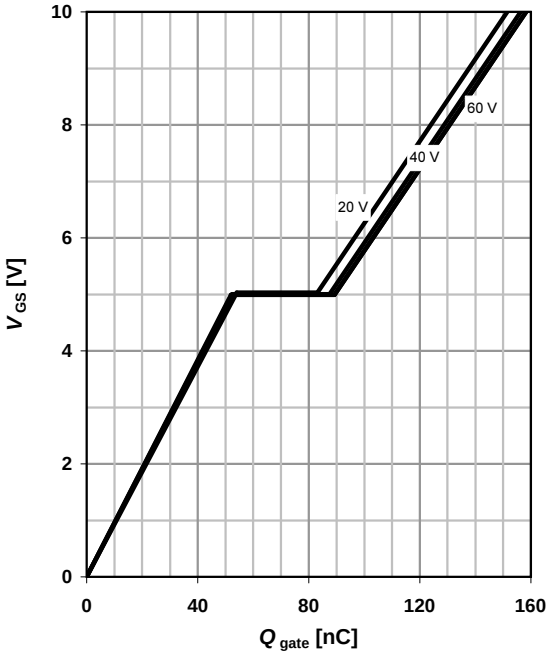
parameter: $T_{j(start)}$




## 14 Typ. gate charge

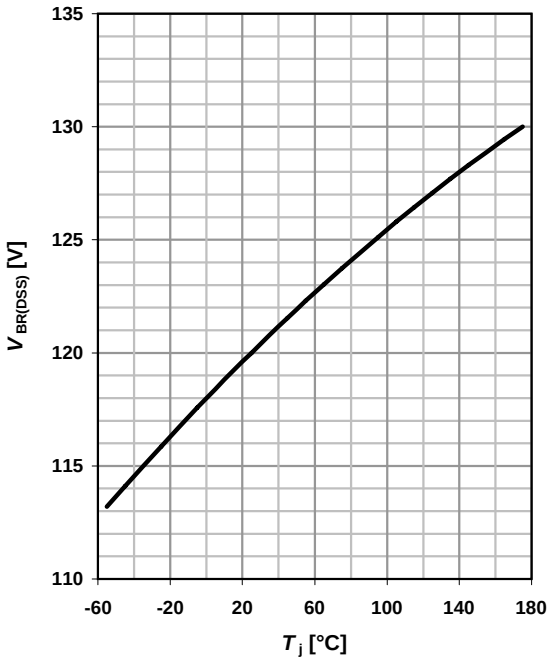
$V_{GS}$=f($Q_{gate}$); $I_D$=100 A pulsed

parameter: $V_{DD}$

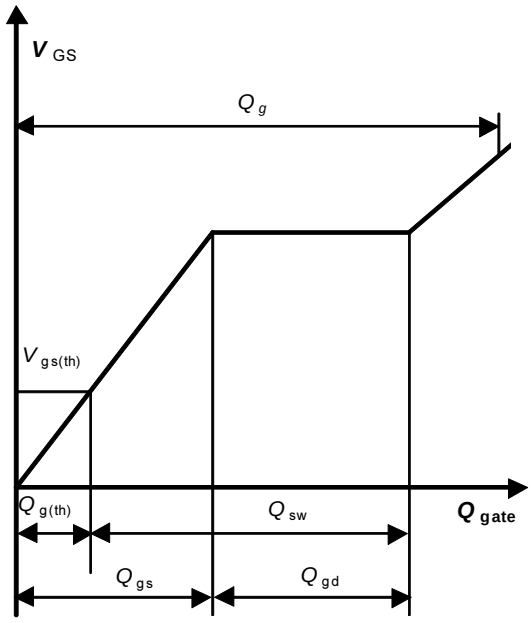



## 15 Drain-source breakdown voltage

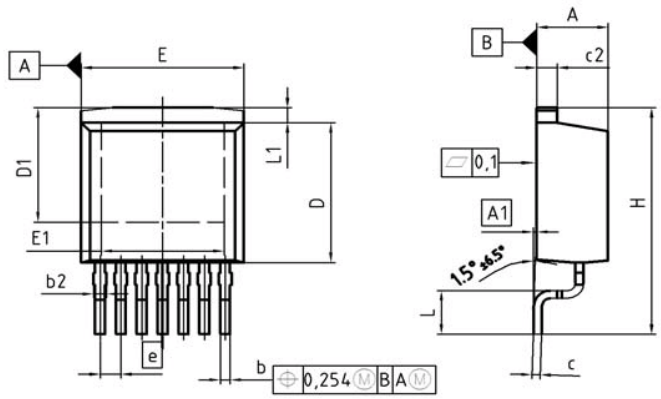
$V_{BR(DSS)}$=f($T_j$); $I_D$=1 mA

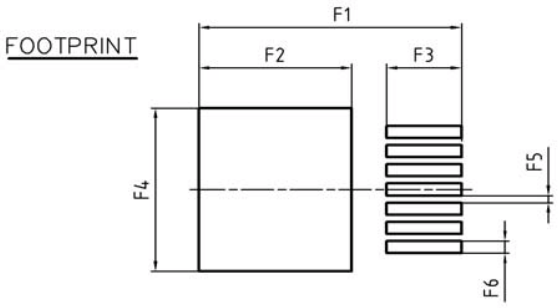



## 16 Gate charge waveforms



**PG-TO263-7**



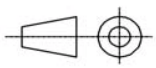




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.57 | 0.169 | 0.180 |
| A1 | 0.00 | 0.25 | 0.000 | 0.010 |
| b | 0.50 | 0.70 | 0.020 | 0.028 |
| b2 | 0.50 | 1.00 | 0.020 | 0.039 |
| c | 0.33 | 0.65 | 0.013 | 0.026 |
| c2 | 1.17 | 1.40 | 0.046 | 0.055 |
| D | 8.51 | 9.45 | 0.335 | 0.372 |
| D1 | 6.90 | 7.90 | 0.272 | 0.311 |
| E | 9.80 | 10.31 | 0.386 | 0.406 |
| E1 | 6.50 | 8.60 | 0.256 | 0.339 |
| e | 1.27 | | 0.050 | |
| N | 7 | | 7 | |
| H | 14.61 | 15.88 | 0.575 | 0.625 |
| L | 2.29 | 3.00 | 0.090 | 0.118 |
| L1 | 0.70 | 1.60 | 0.028 | 0.063 |
| F1 | 16.05 | 16.25 | 0.632 | 0.640 |
| F2 | 9.30 | 9.50 | 0.366 | 0.374 |
| F3 | 4.50 | 4.70 | 0.177 | 0.185 |
| F4 | 10.70 | 10.90 | 0.421 | 0.429 |
| F5 | 0.37 | 0.57 | 0.015 | 0.022 |
| F6 | 0.70 | 0.90 | 0.028 | 0.035 |

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EUROPEAN PROJECTION



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