## OptiMOS™3 Power-Transistor

### Features

- Ideal for high frequency switching and sync. rec.
- Optimized technology for DC/DC converters
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Superior thermal resistance
- 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

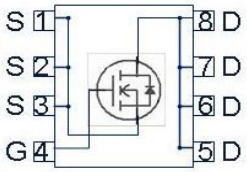
### Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 80 | V |
| $R_{DS(on),max}$ | 12.3 | mΩ |
| $I_D$ | 55 | A |

RoHS

Halogen-Free

| | |
|---|---|
| **Type** | BSC123N08NS3 G |
| |  |
| **Package** | PG-TDSON-8 |
| **Marking** | 123N08NS |




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

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $V_{GS}$=10 V, $T_C$=25 °C | 55 | A |
| | | $V_{GS}$=10 V, $T_C$=100 °C | 35 | |
| | | $V_{GS}$=10 V, $T_A$=25 °C, $R_{thJA}$=50 K/W[2] | 11 | |
| Pulsed drain current[3] | $I_{D,pulse}$ | $T_C$=25 °C | 220 | |
| Avalanche energy, single pulse | $E_{AS}$ | $I_D$=33 A, $R_{GS}$=25 Ω | 70 | mJ |
| Gate source voltage | $V_{GS}$ | | ±20 | V |

[1] J-STD20 and JESD22

[2] 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.

[3] See figure 3 for more detailed information

[4] See figure 13 for more detailed information

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

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Power dissipation | $P_{tot}$ | $T_C$=25 °C | 66 | W |
| | | $T_A$=25 °C, $R_{thJA}$=50 K/W[2)] | 2.5 | |
| Operating and storage temperature | $T_j$, $T_{stg}$ | | -55 ... 150 | °C |
| IEC climatic category; DIN IEC 68-1 | | | 55/150/56 | |

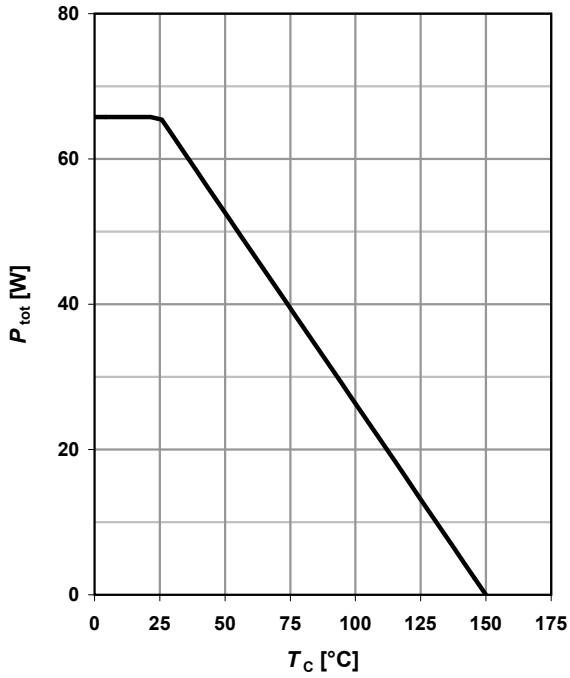
| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Thermal characteristics** | | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | bottom | - | - | 1.9 | K/W |
| | | top | | | 18 | |
| Device on PCB | $R_{thJA}$ | minimal footprint | - | - | 62 | |
| | | 6 cm$^2$ cooling area[2)] | - | - | 50 | |
| **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 | 80 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=33 µA | 2 | 2.8 | 3.5 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=80 V, $V_{GS}$=0 V, $T_j$=25 °C | - | 0.1 | 1 | µA |
| | | $V_{DS}$=80 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 | - | 10 | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$=10 V, $I_D$=33 A | - | 10.3 | 12.3 | mΩ |
| | | $V_{GS}$=6 V, $I_D$=16 A | - | 14.1 | 24 | |
| Gate resistance | $R_G$ | | - | 2 | - | Ω |
| Transconductance | $g_{fs}$ | $\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, $I_D$=33 A | 22 | 44 | - | S |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=40 V, $f$=1 MHz | - | 1430 | 1870 | pF |
| Output capacitance | $C_{oss}$ | | - | 385 | 517 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 15 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=40 V, $V_{GS}$=10 V, $I_D$=20 A, $R_G$=1.6 Ω | - | 12 | - | ns |
| Rise time | $t_r$ | | - | 18 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 19 | - | |
| Fall time | $t_f$ | | - | 4 | - | |
| Gate Charge Characteristics[5)] | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=40 V, $I_D$=20 A, $V_{GS}$=0 to 10 V | - | 6.3 | - | nC |
| Gate charge at threshold | $Q_{g(th)}$ | | - | 3.6 | - | |
| Gate to drain charge | $Q_{gd}$ | | - | 3.8 | - | |
| Switching charge | $Q_{sw}$ | | - | 6.5 | - | |
| Gate charge total | $Q_g$ | | - | 19 | 25 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.9 | - | V |
| Output charge | $Q_{oss}$ | $V_{DD}$=40 V, $V_{GS}$=0 V | - | 25 | 34 | |
| **Reverse Diode** | | | | | | |
| Diode continuous forward current | $I_S$ | $T_C$=25 °C | - | - | 55 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 220 | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=33 A, $T_j$=25 °C | - | 0.9 | 1.2 | V |
| Reverse recovery time | $t_{rr}$ | $V_R$=40 V, $I_F$=20A, d$i_F$/d$t$=100 A/µs | - | 45 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 54 | - | nC |

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

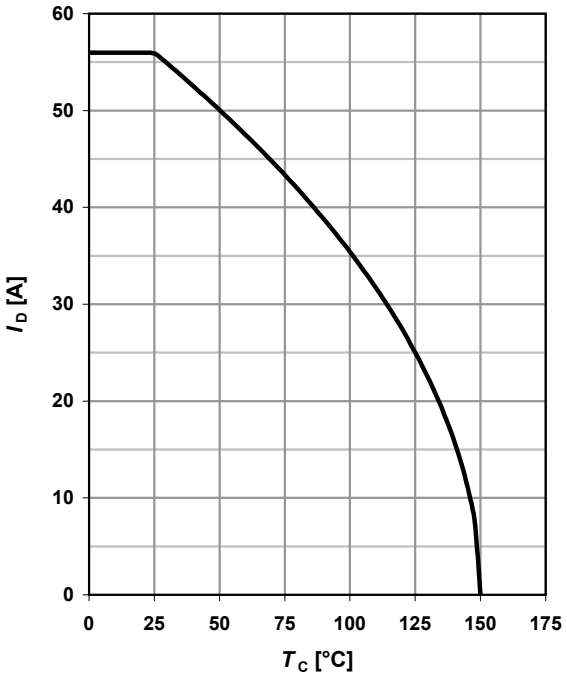
### 1 Power dissipation

$P_{tot}=f(T_C)$




### 2 Drain current

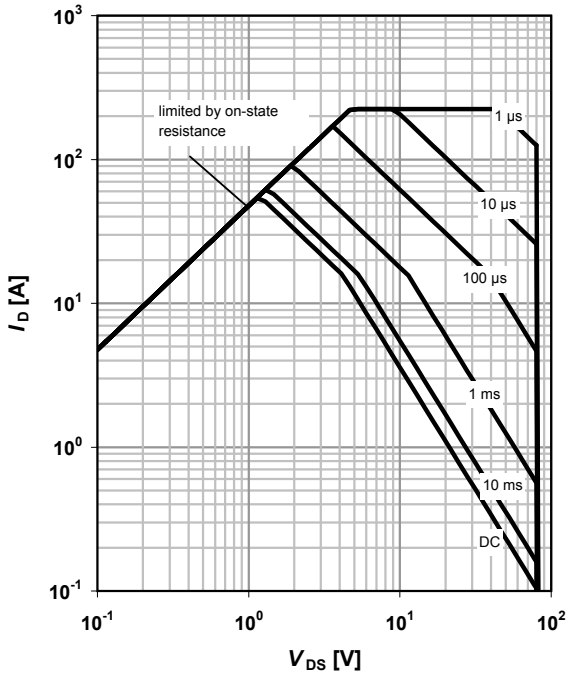
$I_D=f(T_C)$; $V_{GS}\geq 10$ V




### 3 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$

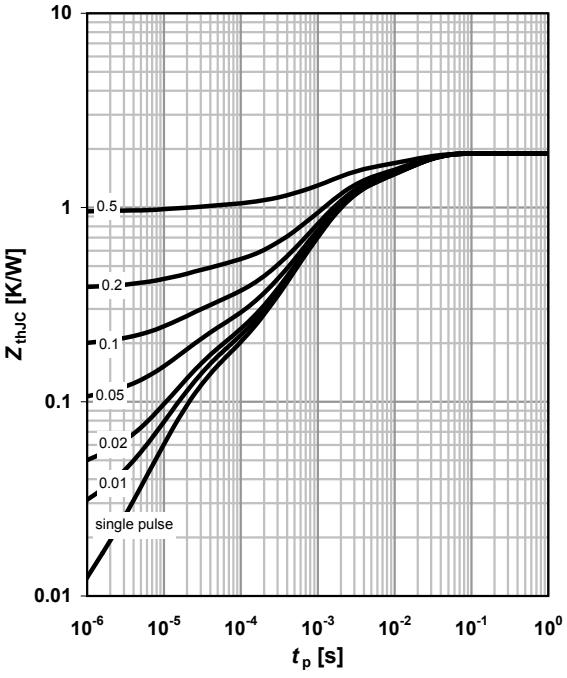
parameter: $t_p$




### 4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

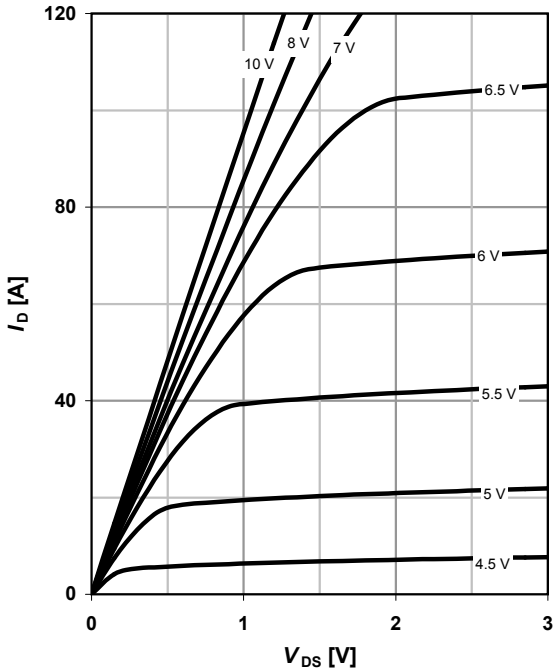
parameter: $D=t_p/T$



## 5 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ °C

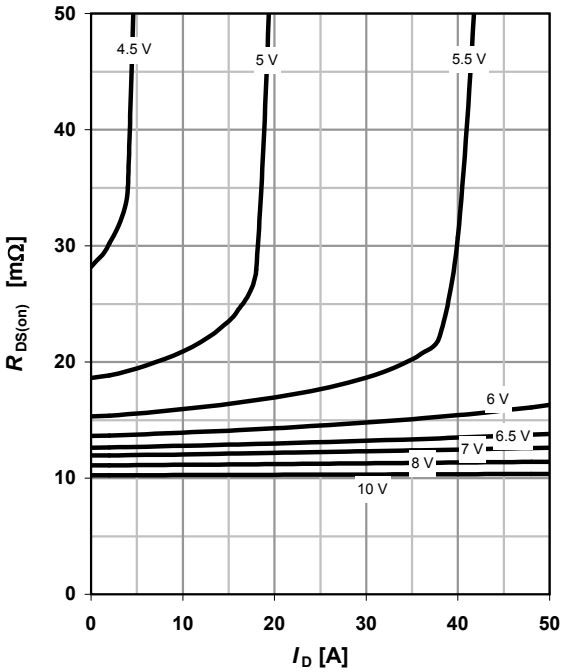
parameter: $V_{GS}$




## 6 Typ. drain-source on resistance

$R_{DS(on)}=f(I_D)$; $T_j=25$ °C

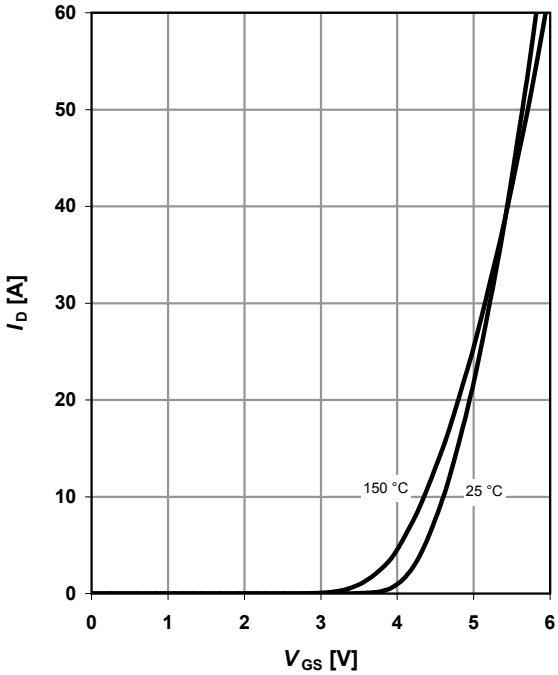
parameter: $V_{GS}$




## 7 Typ. transfer characteristics

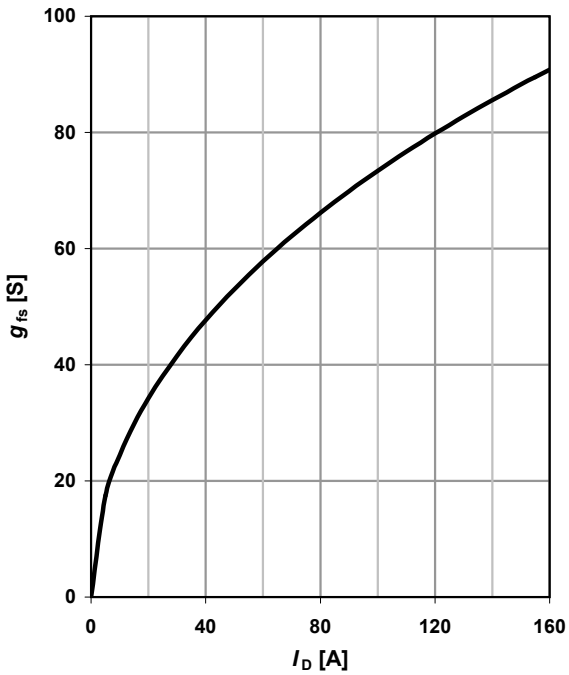
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$

parameter: $T_j$



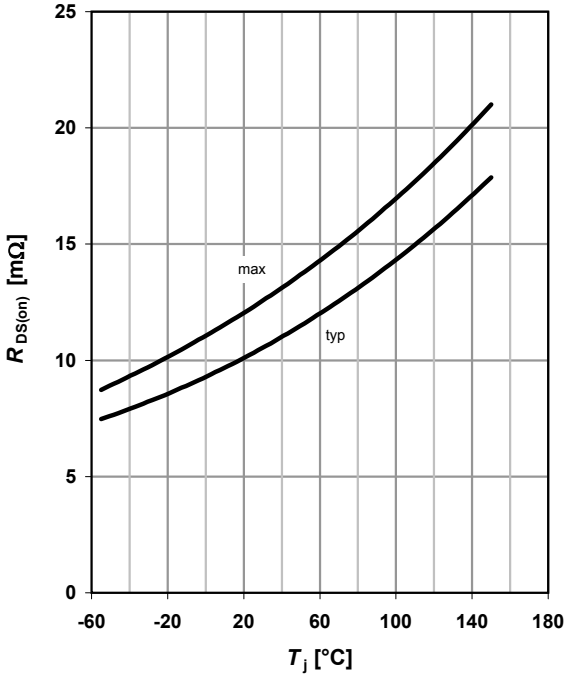

## 8 Typ. forward transconductance

$g_{fs}=f(I_D)$; $T_j=25$ °C



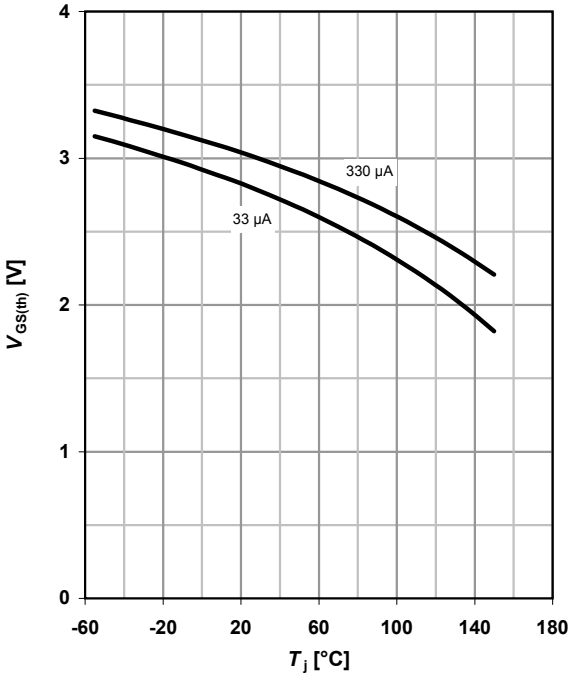
### 9 Drain-source on-state resistance

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



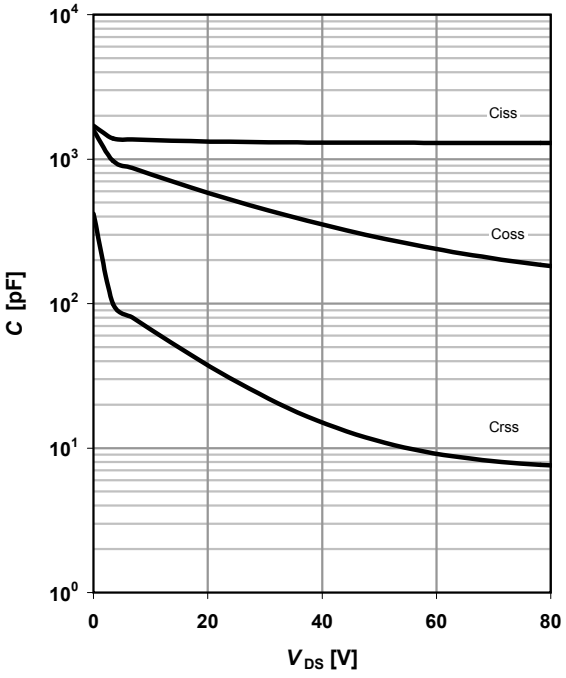

### 10 Typ. gate threshold voltage

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




### 11 Typ. capacitances

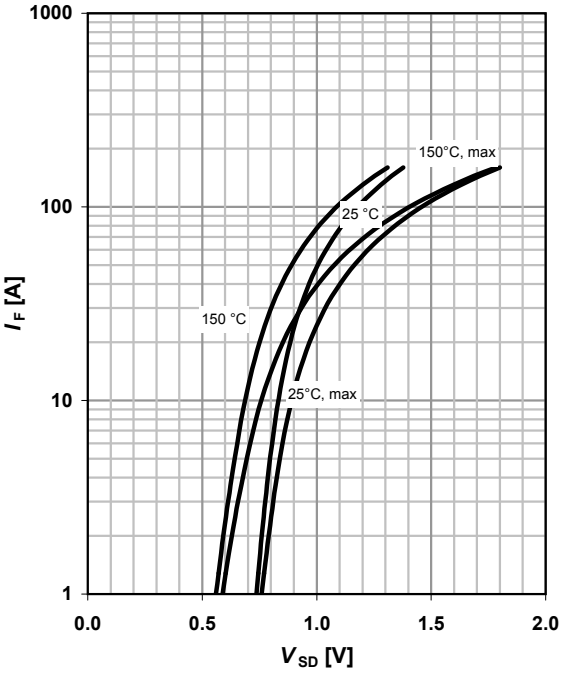
$C$=f($V_{DS}$); $V_{GS}$=0 V; $f$=1 MHz




### 12 Forward characteristics of reverse diode

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

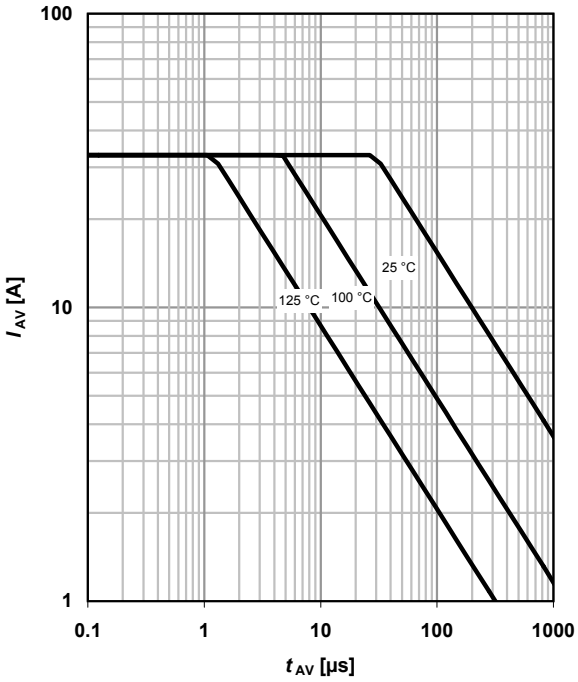
parameter: $T_j$



## 13 Avalanche characteristics

$I_{AS}$=f($t_{AV}$); $R_{GS}$=25 Ω

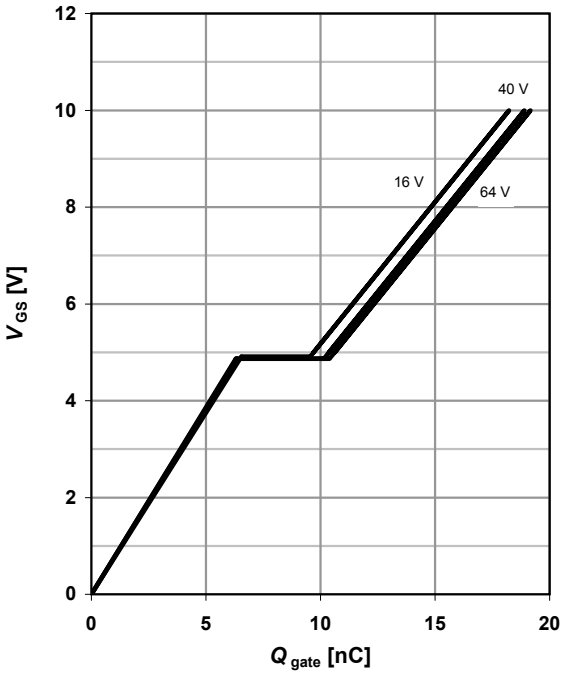
parameter: $T_{j(start)}$




## 14 Typ. gate charge

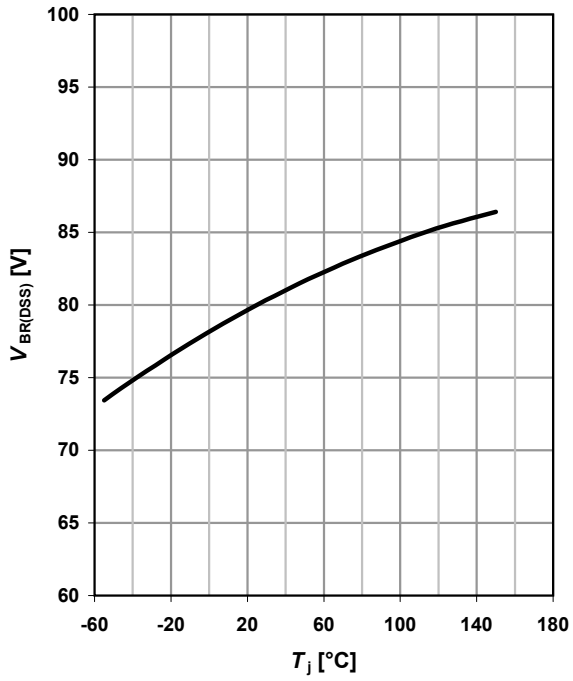
$V_{GS}$=f($Q_{gate}$); $I_D$=20 A pulsed

parameter: $V_{DD}$

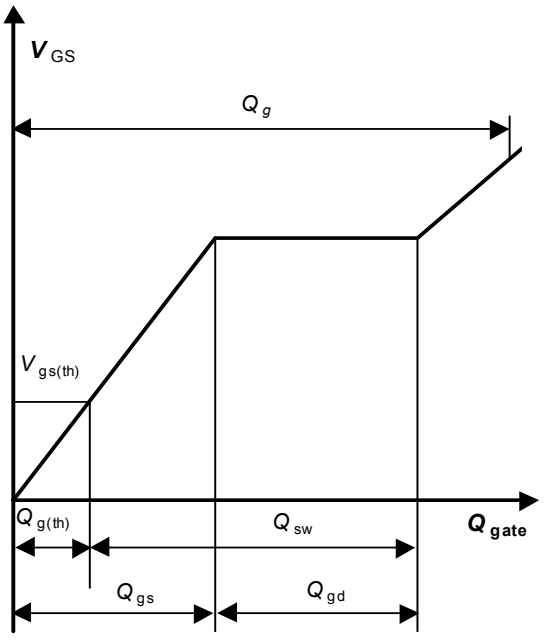



## 15 Drain-source breakdown voltage

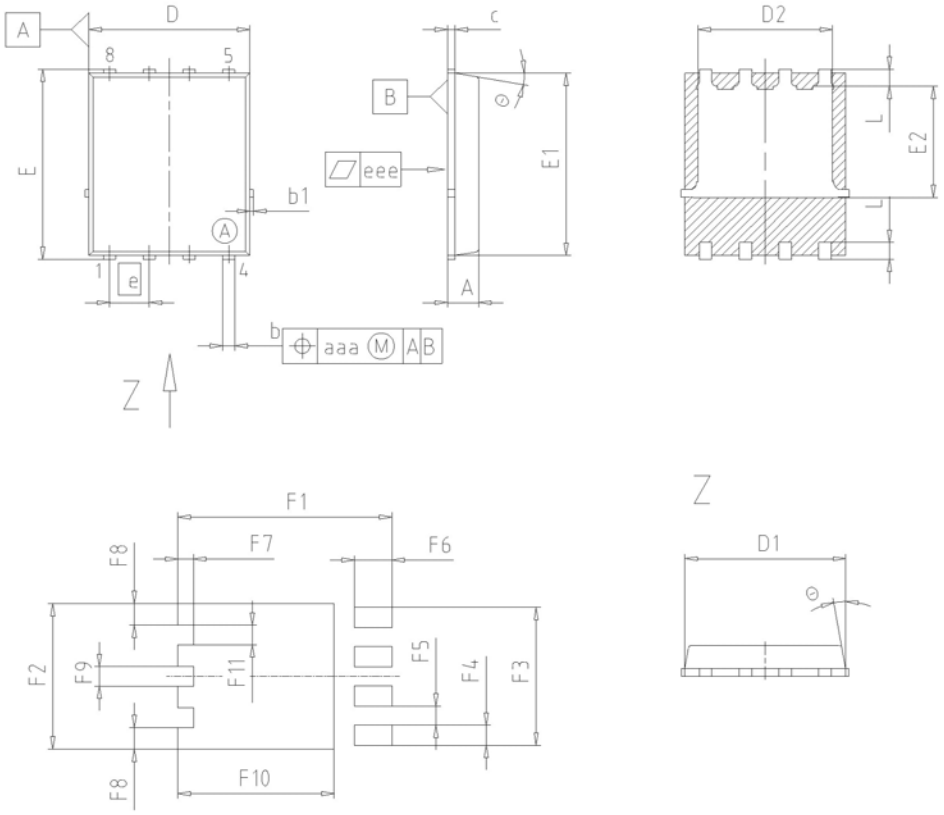
$V_{BR(DSS)}$=f($T_j$); $I_D$=1 mA




## 16 Gate charge waveforms



**PG-TDSON-8**




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| **A** | 0.90 | 1.10 | 0.035 | 0.043 |
| **b** | 0.34 | 0.54 | 0.013 | 0.021 |
| **b1** | 0.02 | 0.22 | 0.001 | 0.008 |
| **c** | 0.15 | 0.35 | 0.006 | 0.014 |
| **D=D1** | 4.95 | 5.35 | 0.195 | 0.211 |
| **D2** | 4.20 | 4.40 | 0.165 | 0.173 |
| **E** | 5.95 | 6.35 | 0.234 | 0.250 |
| **E1** | 5.70 | 6.10 | 0.224 | 0.240 |
| **E2** | 3.40 | 3.80 | 0.134 | 0.150 |
| **e** | 1.27 | | 0.050 | |
| **N** | 8 | | 8 | |
| **L** | 0.45 | 0.65 | 0.018 | 0.026 |
| **□** | 8.5° | 11.5° | 8.5° | 11.5° |
| **aaa** | 0.25 | | 0.010 | |
| **eee** | 0.05 | | 0.002 | |
| **F1** | 6.75 | 6.95 | 0.266 | 0.274 |
| **F2** | 4.60 | 4.80 | 0.181 | 0.189 |
| **F3** | 4.36 | 4.56 | 0.172 | 0.180 |
| **F4** | 0.55 | 0.75 | 0.022 | 0.030 |
| **F5** | 0.52 | 0.72 | 0.020 | 0.028 |
| **F6** | 1.10 | 1.30 | 0.043 | 0.051 |
| **F7** | 0.40 | 0.60 | 0.016 | 0.024 |
| **F8** | 0.60 | 0.80 | 0.024 | 0.031 |
| **F9** | 0.53 | 0.73 | 0.021 | 0.029 |
| **F10** | 4.90 | 5.10 | 0.193 | 0.201 |
| **F11** | 0.53 | 0.73 | 0.021 | 0.029 |

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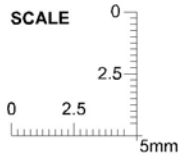
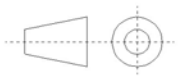
**SCALE**




**EUROPEAN PROJECTION**



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