## OptiMOS®2 Power-Transistor

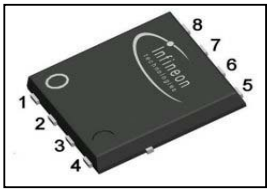
### Features

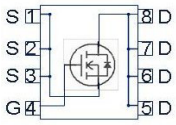
- Fast switching MOSFET for SMPS
- Optimized technology for notebook DC/DC converters
- Qualified according to JEDEC[1] for target applications
- N-channel
- Logic level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- Superior thermal resistance
- Avalanche rated
- Pb-free plating; RoHS compliant

### Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 30 | V |
| $R_{DS(on),max}$ | 9.4 | mΩ |
| $I_D$ | 35 | A |

PG-TDSON-8




| Type | Package | Marking |
|---|---|---|
| BSC094N03S G | PG-TDSON-8 | 94N03S |

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

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $T_C$=25 °C | 35 | A |
| | | $T_C$=100 °C | 35 | |
| | | $T_A$=25 °C, $R_{thJA}$=45 K/W[2] | 14.6 | |
| Pulsed drain current | $I_{D,pulse}$ | $T_C$=25 °C[3] | 140 | |
| Avalanche energy, single pulse | $E_{AS}$ | $I_D$=35 A, $R_{GS}$=25 Ω | 90 | mJ |
| Reverse diode d$v$/d$t$ | d$v$/d$t$ | $I_D$=40 A, $V_{DS}$=24 V, d$i$/d$t$=200 A/µs, $T_{j,max}$=150 °C | 6 | kV/µs |
| Gate source voltage | $V_{GS}$ | | ±20 | V |
| Power dissipation | $P_{tot}$ | $T_C$=25 °C | 52 | W |
| | | $T_A$=25 °C, $R_{thJA}$=45 K/W[2] | 2.8 | |
| 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 | $R_{thJC}$ | | - | - | 2.4 | K/W |
| Thermal resistance, junction - ambient | $R_{thJA}$ | minimal footprint | - | - | 62 | |
| | | 6 cm$^2$ cooling area[2)] | - | - | 45 | |
| **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 | 30 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=25 µA | 1.2 | 1.6 | 2 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=30 V, $V_{GS}$=0 V, $T_j$=25 °C | - | 0.1 | 1 | µA |
| | | $V_{DS}$=30 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 | $R_{DS(on)}$ | $V_{GS}$=4.5 V, $I_D$=30 A | - | 11.2 | 14 | mΩ |
| | | $V_{GS}$=10 V, $I_D$=35 A | - | 7.8 | 9.4 | |
| Gate resistance | $R_G$ | | - | 1 | - | Ω |
| Transconductance | $g_{fs}$ | $\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, $I_D$=35 A | 26 | 53 | - | S |

[1)] J-STD20 and JESD22

[2)] 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.

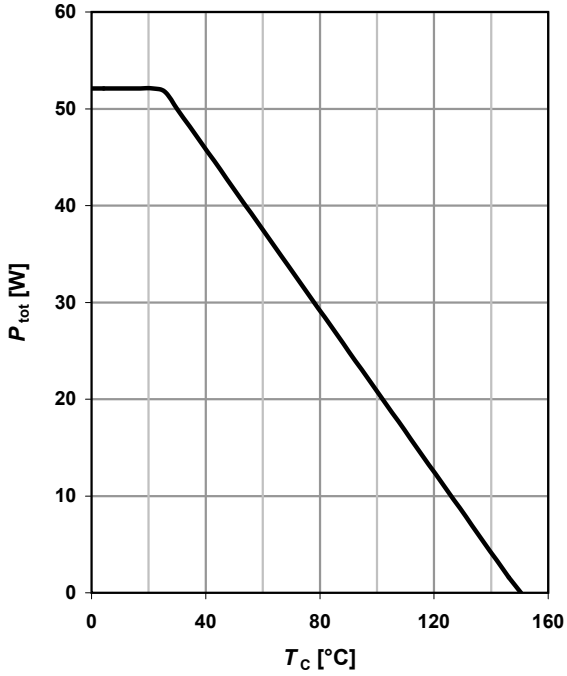
[2)] See figure 3

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=15 V, $f$=1 MHz | - | 1350 | 1800 | pF |
| Output capacitance | $C_{oss}$ | | - | 480 | 640 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 64 | 96 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=15 V, $V_{GS}$=10 V, $I_D$=17.5 A, $R_G$=2.7 Ω | - | 4.5 | 6.8 | ns |
| Rise time | $t_r$ | | - | 3.8 | 5.7 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 18 | 27 | |
| Fall time | $t_f$ | | - | 3.0 | 4.5 | |
| Gate Charge Characteristics[3)] | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=15 V, $I_D$=17.5 A, $V_{GS}$=0 to 5 V | - | 4.3 | 5.7 | nC |
| Gate charge at threshold | $Q_{g(th)}$ | | - | 2.2 | 2.9 | |
| Gate to drain charge | $Q_{gd}$ | | - | 2.8 | 4.2 | |
| Switching charge | $Q_{sw}$ | | - | 4.9 | 7.0 | |
| Gate charge total | $Q_g$ | | - | 10 | 14 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 3.2 | - | V |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}$=0.1 V, $V_{GS}$=0 to 5 V | - | 9 | 12 | nC |
| Output charge | $Q_{oss}$ | $V_{DD}$=15 V, $V_{GS}$=0 V | - | 11 | 14 | |
| **Reverse Diode** | | | | | | |
| Diode continous forward current | $I_S$ | $T_C$=25 °C | - | - | 35 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 140 | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=35 A, $T_j$=25 °C | - | 0.93 | 1.2 | V |
| Reverse recovery charge | $Q_{rr}$ | $V_R$=15 V, $I_F$=$I_S$, d$i_F$/d$t$=400 A/µs | - | - | 10 | nC |

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

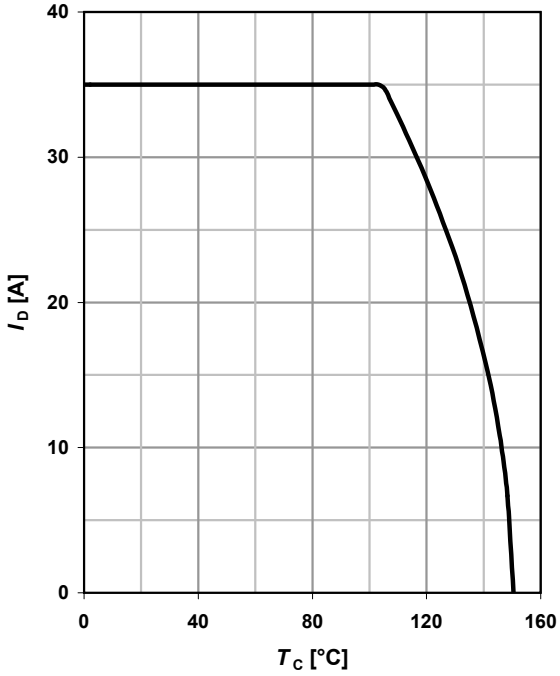
### 1 Power dissipation

$P_{tot}=f(T_C)$




### 2 Drain current

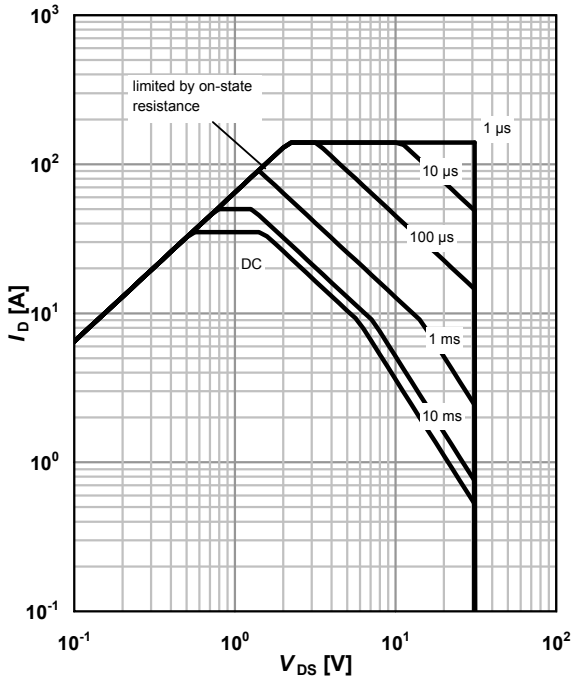
$I_D=f(T_C)$; $V_{GS}\geq 10$ V




### 3 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$

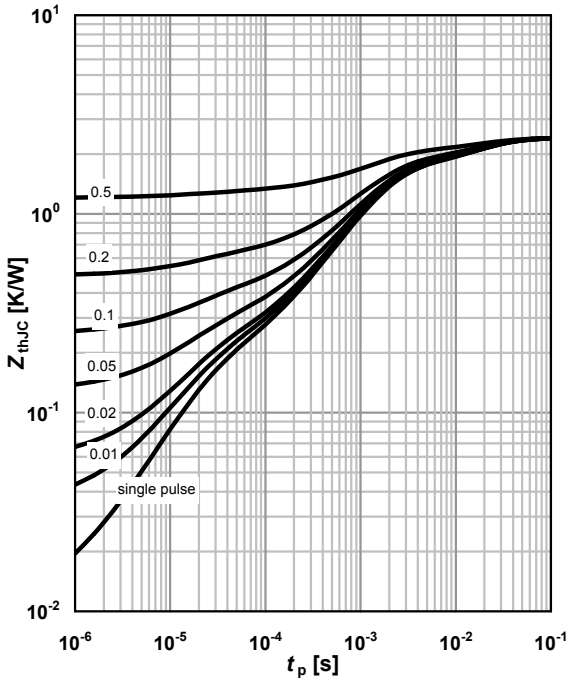
parameter: $t_p$




### 4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

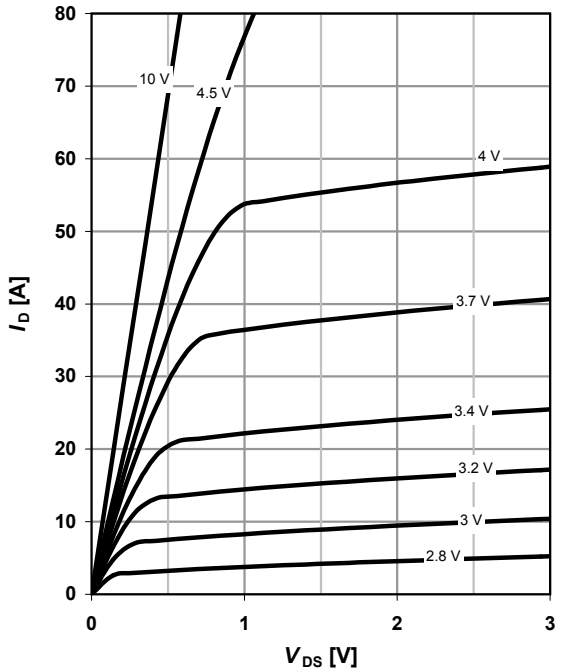
parameter: $D=t_p/T$



## 5 Typ. output characteristics

$I_D$=f($V_{DS}$); $T_j$=25 °C

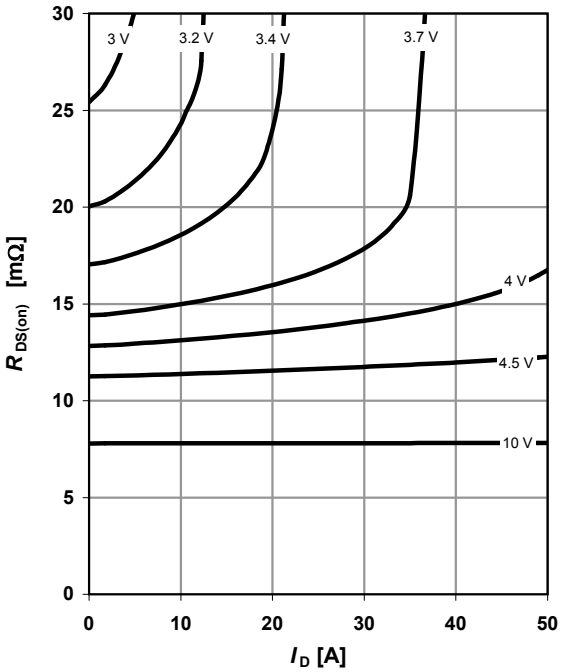
parameter: $V_{GS}$




## 6 Typ. drain-source on resistance

$R_{DS(on)}$=f($I_D$); $T_j$=25 °C

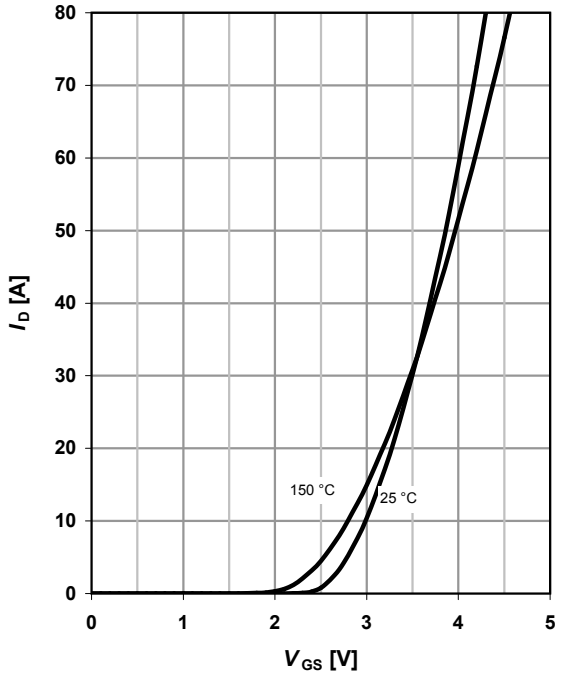
parameter: $V_{GS}$




## 7 Typ. transfer characteristics

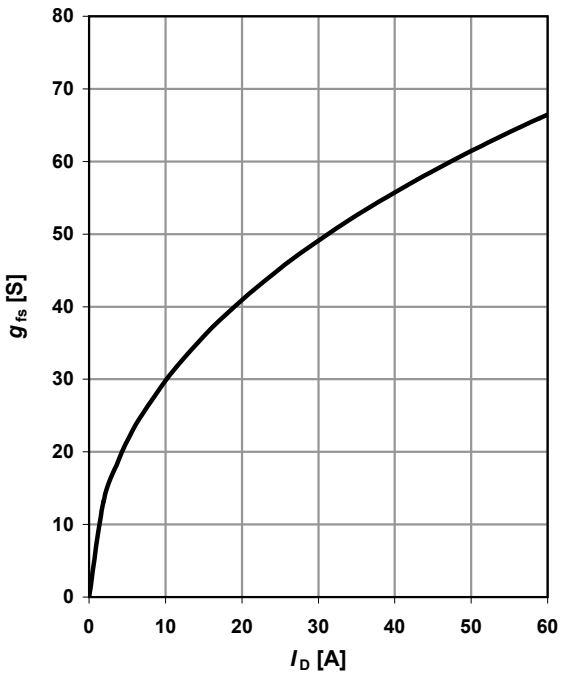
$I_D$=f($V_{GS}$); $|V_{DS}|>2|I_D|R_{DS(on)max}$

parameter: $T_j$



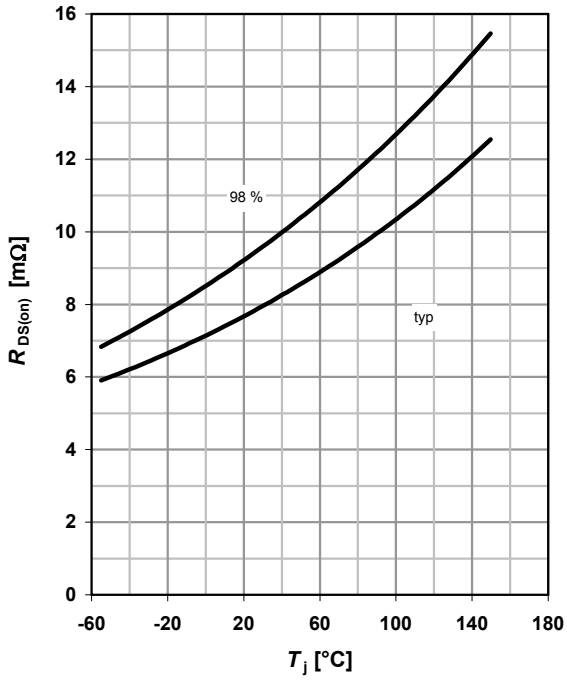

## 8 Typ. forward transconductance

$g_{fs}$=f($I_D$); $T_j$=25 °C



### 9 Drain-source on-state resistance

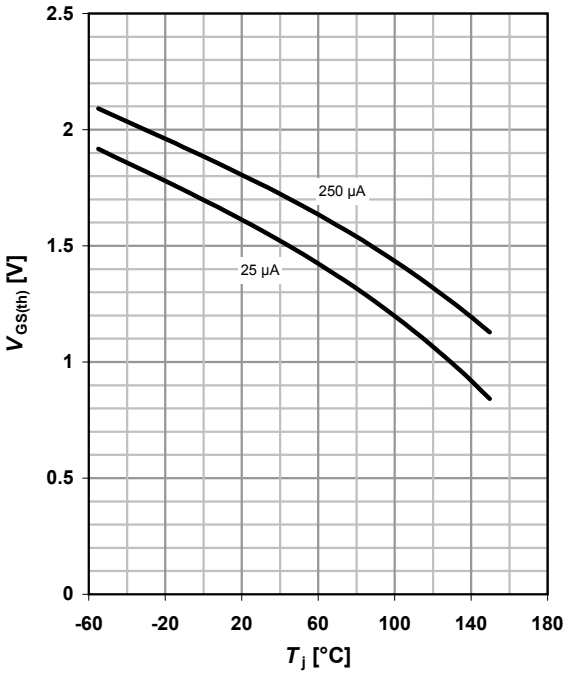
$R_{DS(on)}$=f($T_j$); $I_D$=35 A; $V_{GS}$=10 V




### 10 Typ. gate threshold voltage

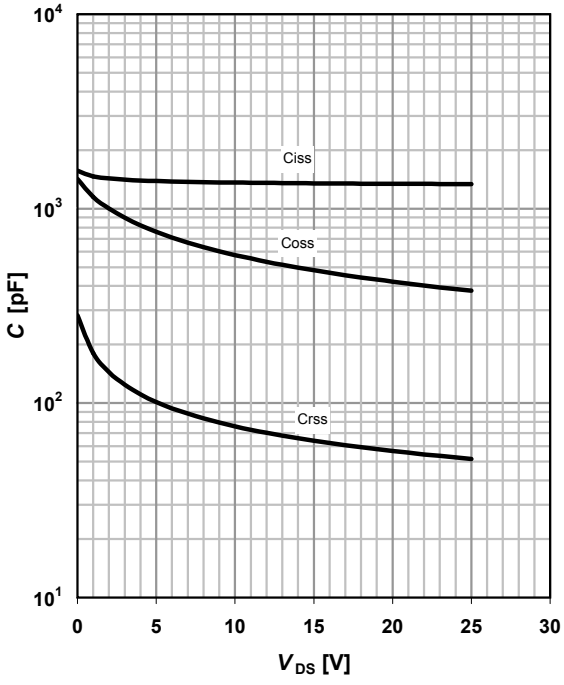
$V_{GS(th)}$=f($T_j$); $V_{GS}$=$V_{DS}$

parameter: $I_D$




### 11 Typ. capacitances

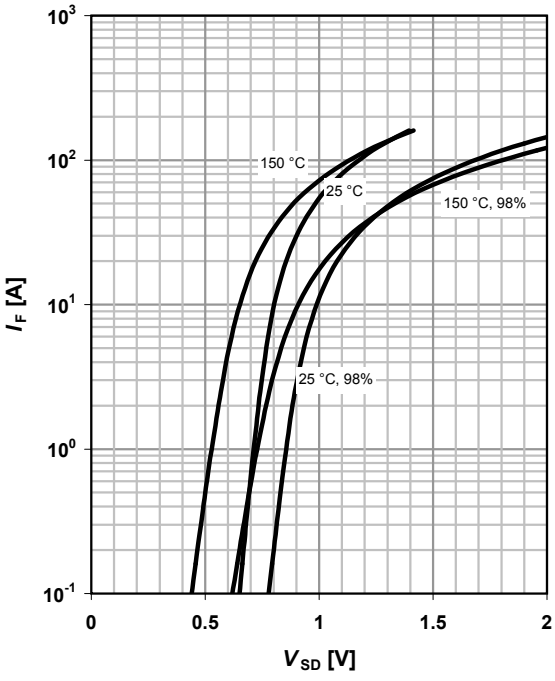
$C$=f($V_{DS}$); $V_{GS}$=0 V; $f$=1 MHz




### 12 Forward characteristics of reverse diode

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

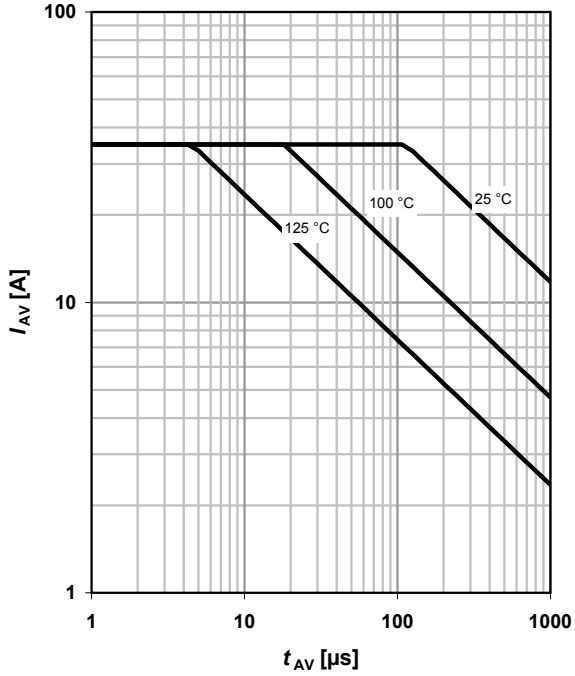
parameter: $T_j$



## 13 Avalanche characteristics

$I_{AS}$=f($t_{AV}$); $R_{GS}$=25 Ω

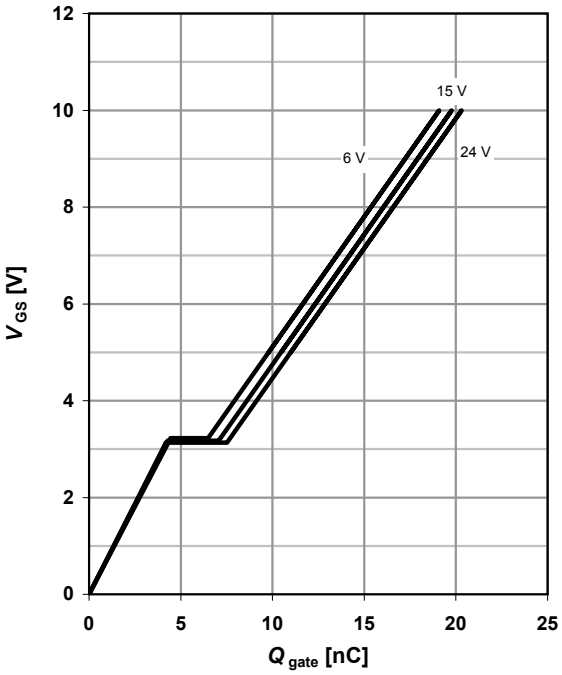
parameter: $T_{j(start)}$




## 14 Typ. gate charge

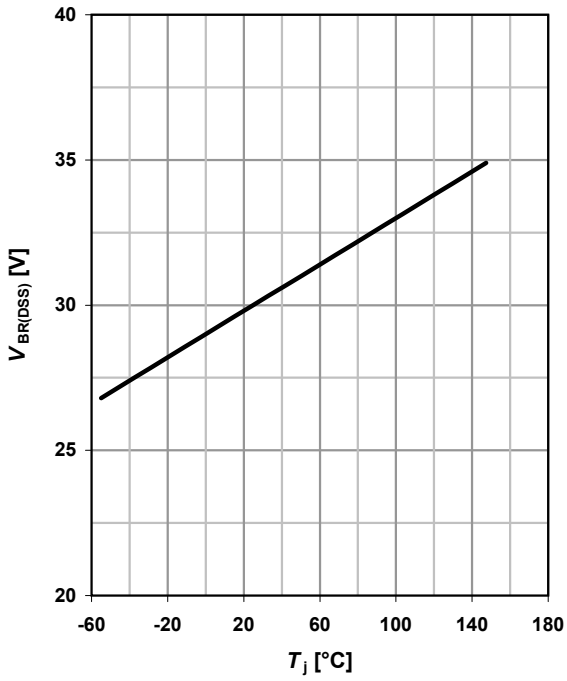
$V_{GS}$=f($Q_{gate}$); $I_D$=17.5 A pulsed

parameter: $V_{DD}$

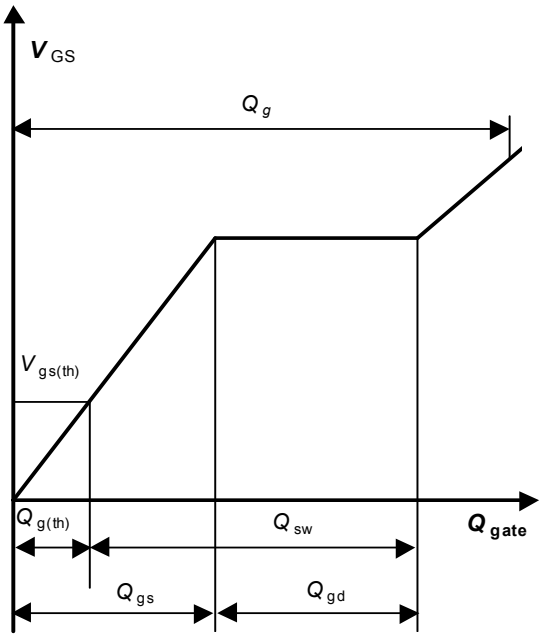



## 15 Drain-source breakdown voltage

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

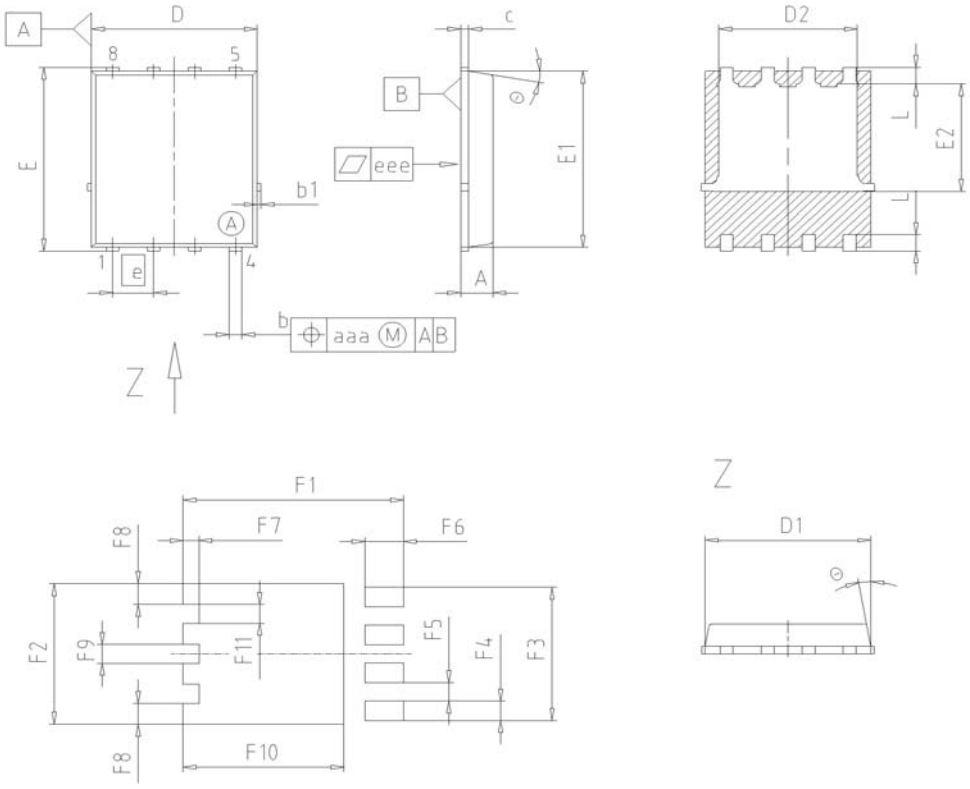



## 16 Gate charge waveforms



**Package Outline** **PG-TDSON-8**

**PG-TDSON-8: Outline**

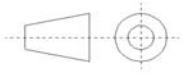



| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.90 | 1.10 | 0.035 | 0.043 |
| b | 0.34 | 0.54 | 0.013 | 0.021 |
| b1 | 0.02 | 0.22 | 0.001 | 0.008 |
| c | 0.15 | 0.35 | 0.006 | 0.014 |
| D=D1 | 4.95 | 5.35 | 0.195 | 0.211 |
| D2 | 4.20 | 4.40 | 0.165 | 0.173 |
| 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 |

**DOCUMENT NO.**
Z8B00003332

**SCALE**
0
2.5
0 2.5
5mm

**EUROPEAN PROJECTION**

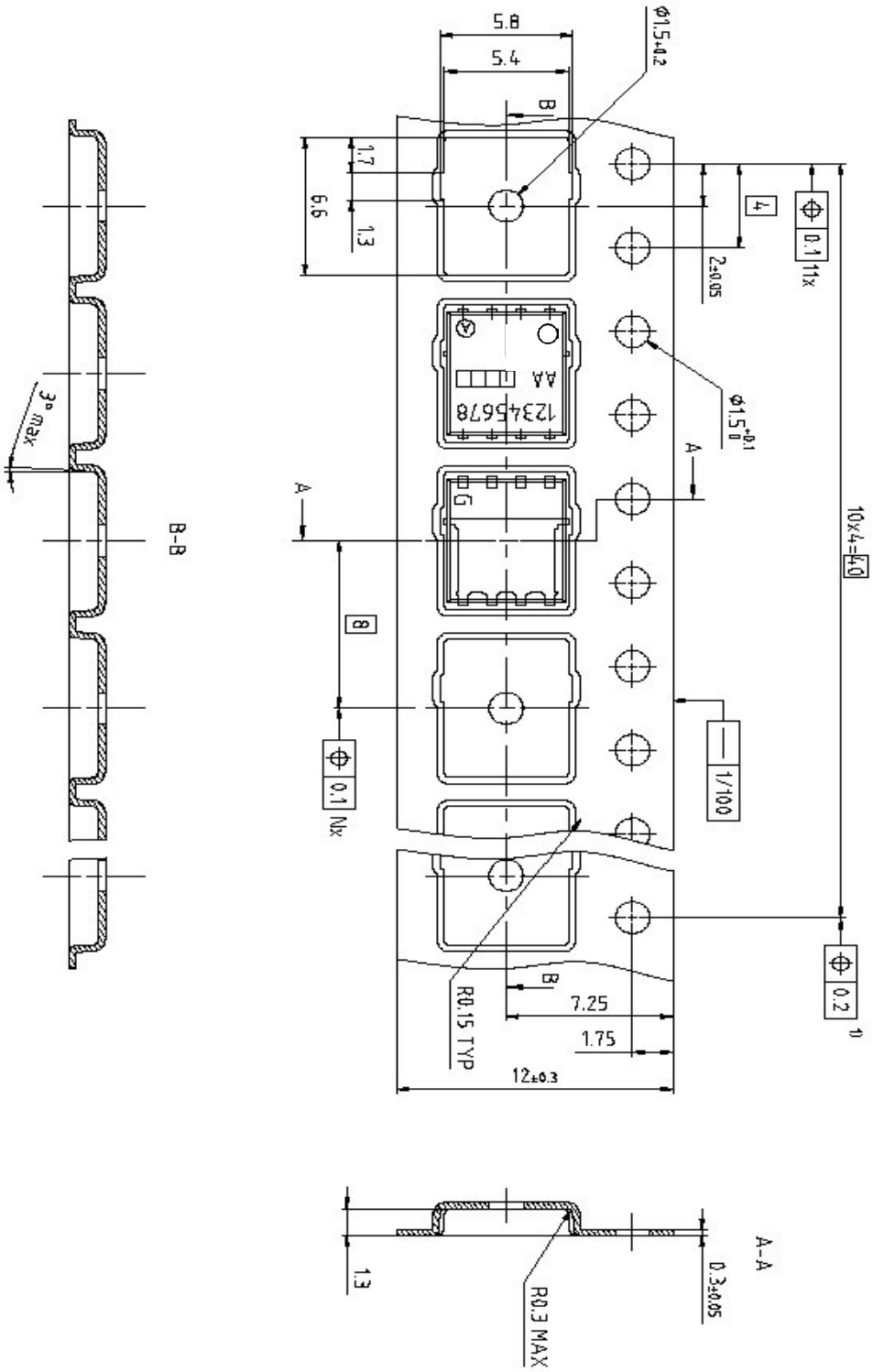


**ISSUE DATE**
08-03-2007

**REVISION**
03

**Package Outline**

**PG-TDSON-8: Tape**




Dimensions in mm

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