# MOSFET

Metal Oxide Semiconductor Field Effect Transistor

## OptiMOS™

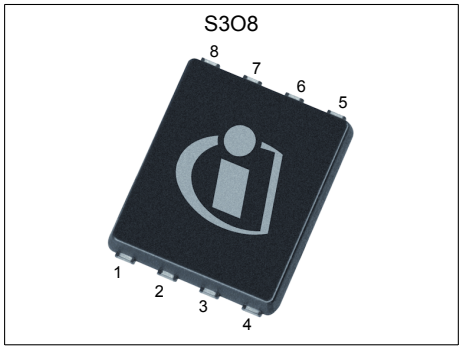
OptiMOS™3 Power-Transistor, 100 V
BSZ440N10NS3 G

## Data Sheet

Rev. 2.1
Final

Power Management & Multimarket

# 1 Description




## Features

- Very low gate charge for high frequency applications
- Optimized for dc-dc conversion
- N-channel, normal level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC[1)] for target application
- Halogen-free according to IEC61249-2-21

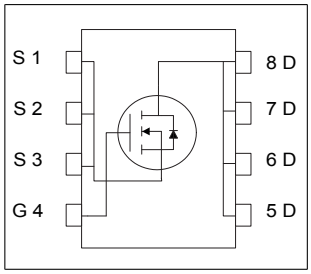



**Table 1 Key Performance Parameters**

| Parameter | Value | Unit |
|---|---|---|
| $V_{DS}$ | 100 | V |
| $R_{DS(on),max}$ | 44 | mΩ |
| $I_D$ | 18 | A |

| Type / Ordering Code | Package | Marking | Related Links |
|---|---|---|---|
| BSZ440N10NS3 G | PG-TSDSON-8 | 440N10N | - |

[1)] J-STD20 and JESD22

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## 2 Maximum ratings

at $T_j$ = 25 °C, unless otherwise specified

### Table 2 Maximum ratings

at 25 °C

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Continuous drain current | $I_D$ | -<br>-<br>- | -<br>-<br>- | 18<br>11<br>5.3 | A | $T_C$=25 °C<br>$T_C$=100 °C<br>$T_A$=25 °C, $R_{thJA}$=50 K/W[1)] |
| Pulsed drain current[2)] | $I_{D,pulse}$ | - | - | 72 | A | $T_C$=25 °C |
| Avalanche energy, single pulse | $E_{AS}$ | - | - | 17 | mJ | $I_D$=12 A, $R_{GS}$=25 Ω |
| Gate source voltage | $V_{GS}$ | -20 | - | 20 | V | - |
| Power dissipation | $P_{tot}$ | - | - | 29 | W | $T_C$=25 °C |
| Operating and storage temperature | $T_j$, $T_{stg}$ | -55 | - | 150 | °C | IEC climatic category;<br>DIN IEC 68-1: 55/150/56 |

## 3 Thermal characteristics

### Table 3 Thermal characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | - | 4.3 | K/W | - |
| Thermal resistance, junction - ambient, 6 cm$^2$ cooling area[1)] | $R_{thJA}$ | - | - | 50 | K/W | - |

[1)] 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

# 4 Electrical characteristics

## Table 4 Static characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | 100 | - | - | V | $V_{GS}$=0 V, $I_D$=1 mA |
| Gate threshold voltage | $V_{GS(th)}$ | 2 | 2.7 | 3.5 | V | $V_{DS}$=$V_{GS}$, $I_D$=12 µA |
| Zero gate voltage drain current | $I_{DSS}$ | -<br>- | 0.01<br>10 | 1<br>100 | µA | $V_{DS}$=100 V, $V_{GS}$=0 V, $T_j$=25 °C<br>$V_{DS}$=100 V, $V_{GS}$=0 V, $T_j$=125 °C |
| Gate-source leakage current | $I_{GSS}$ | - | 1 | 100 | nA | $V_{GS}$=20 V, $V_{DS}$=0 V |
| Drain-source on-state resistance | $R_{DS(on)}$ | -<br>- | 38<br>48 | 44<br>86 | mΩ | $V_{GS}$=10 V, $I_D$=12 A<br>$V_{GS}$=6 V, $I_D$=6 A |
| Gate resistance | $R_G$ | - | 1.5 | - | Ω | - |
| Transconductance | $g_{fs}$ | 8 | 15 | - | S | \|$V_{DS}$\|>2\|$I_D$\|$R_{DS(on)max}$, $I_D$=12 A |

## Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance[1)] | $C_{iss}$ | - | 480 | 640 | pF | $V_{GS}$=0 V, $V_{DS}$=50 V, $f$=1 MHz |
| Output capacitance[1)] | $C_{oss}$ | - | 87 | 120 | pF | $V_{GS}$=0 V, $V_{DS}$=50 V, $f$=1 MHz |
| Reverse transfer capacitance | $C_{rss}$ | - | 6 | - | pF | $V_{GS}$=0 V, $V_{DS}$=50 V, $f$=1 MHz |
| Turn-on delay time | $t_{d(on)}$ | - | 4.3 | - | ns | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=6 A, $R_G$=1.6 Ω |
| Rise time | $t_r$ | - | 1.8 | - | ns | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=6 A, $R_G$=1.6 Ω |
| Turn-off delay time | $t_{d(off)}$ | - | 9.1 | - | ns | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=6 A, $R_G$=1.6 Ω |
| Fall time | $t_f$ | - | 2.0 | - | ns | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=6 A, $R_G$=1.6 Ω |

## Table 6 Gate charge characteristics[2)]

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | $Q_{gs}$ | - | 2.2 | - | nC | $V_{DD}$=50 V, $I_D$=6 A, $V_{GS}$=0 to 10 V |
| Gate to drain charge | $Q_{gd}$ | - | 1.3 | - | nC | $V_{DD}$=50 V, $I_D$=6 A, $V_{GS}$=0 to 10 V |
| Switching charge | $Q_{sw}$ | - | 2.0 | - | nC | $V_{DD}$=50 V, $I_D$=6 A, $V_{GS}$=0 to 10 V |
| Gate charge total[1)] | $Q_g$ | - | 6.8 | 9.1 | nC | $V_{DD}$=50 V, $I_D$=6 A, $V_{GS}$=0 to 10 V |
| Gate plateau voltage | $V_{plateau}$ | - | 4.5 | - | V | $V_{DD}$=50 V, $I_D$=6 A, $V_{GS}$=0 to 10 V |
| Output charge[1)] | $Q_{oss}$ | - | 9.0 | 12 | nC | $V_{DD}$=50 V, $V_{GS}$=0 V |

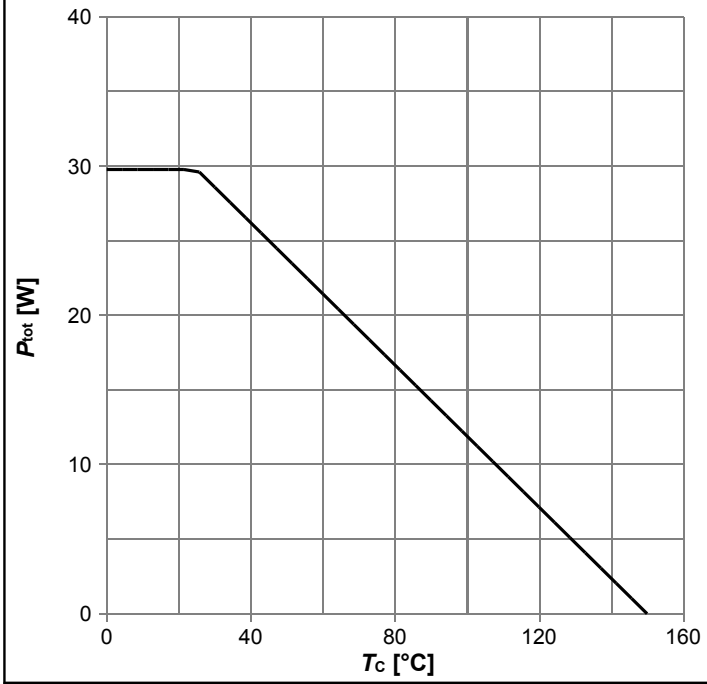
[1)] Defined by design. Not subject to production test.
[2)] See ″Gate charge waveforms″ for parameter definition

**Table 7 Reverse diode**

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Diode continous forward current | $I_S$ | - | - | 18 | A | $T_C$=25 °C |
| Diode pulse current | $I_{S,pulse}$ | - | - | 72 | A | $T_C$=25 °C |
| Diode forward voltage | $V_{SD}$ | - | 1 | 1.2 | V | $V_{GS}$=0 V, $I_F$=18 A, $T_j$=25 °C |
| Reverse recovery time | $t_{rr}$ | - | 44 | - | ns | $V_R$=50 V, $I_F$=6 A, d$i_F$/d$t$=100 A/µs |
| Reverse recovery charge | $Q_{rr}$ | - | 61 | - | nC | $V_R$=50 V, $I_F$=6 A, d$i_F$/d$t$=100 A/µs |

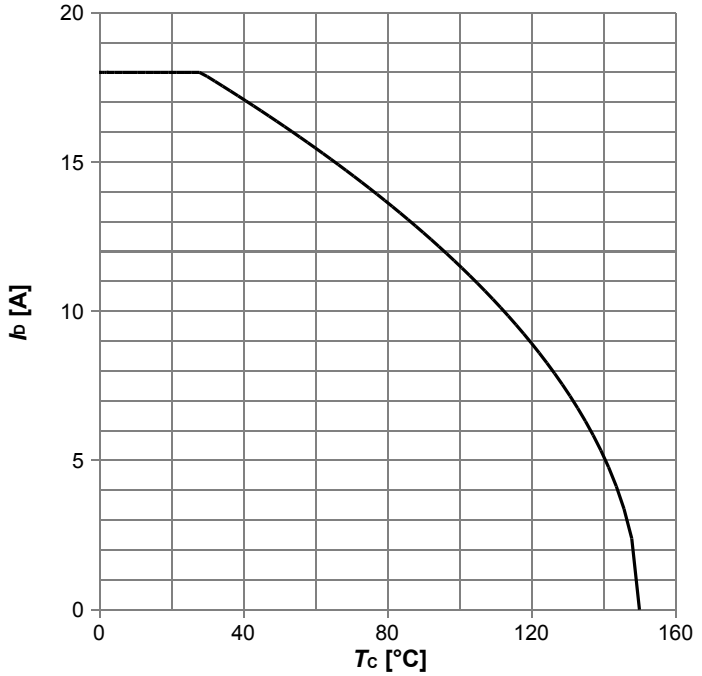
## 5 Electrical characteristics diagrams

**Diagram 1: Power dissipation**



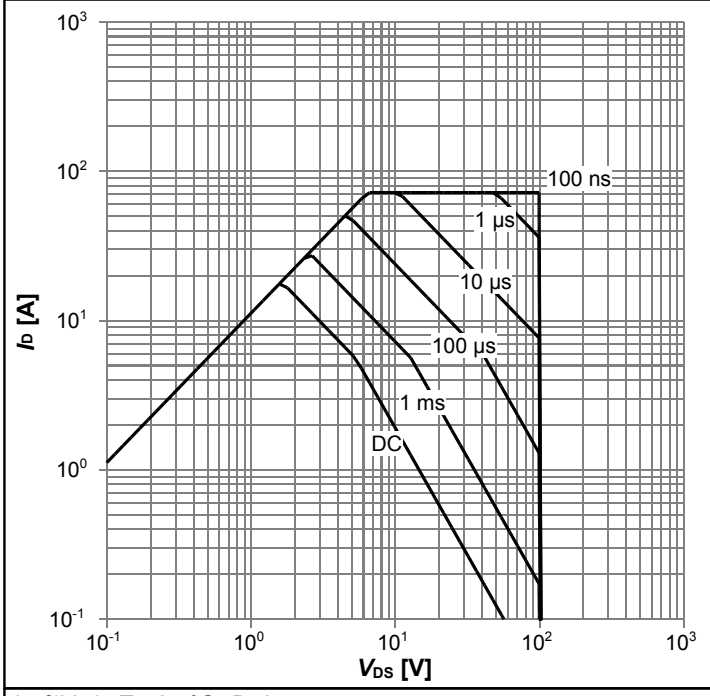

$P_{tot}=f(T_C)$

**Diagram 2: Drain current**



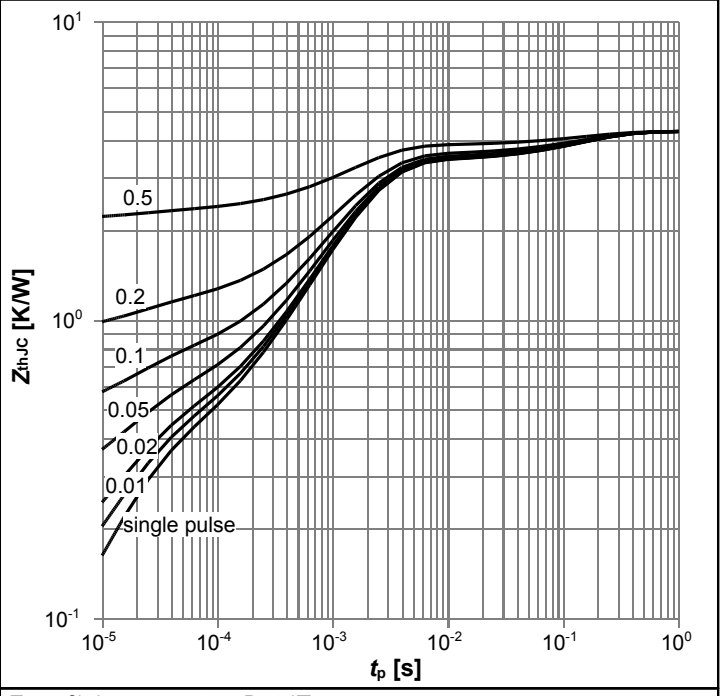

$I_D=f(T_C)$; $V_{GS}\geq 10$ V

**Diagram 3: Safe operating area**



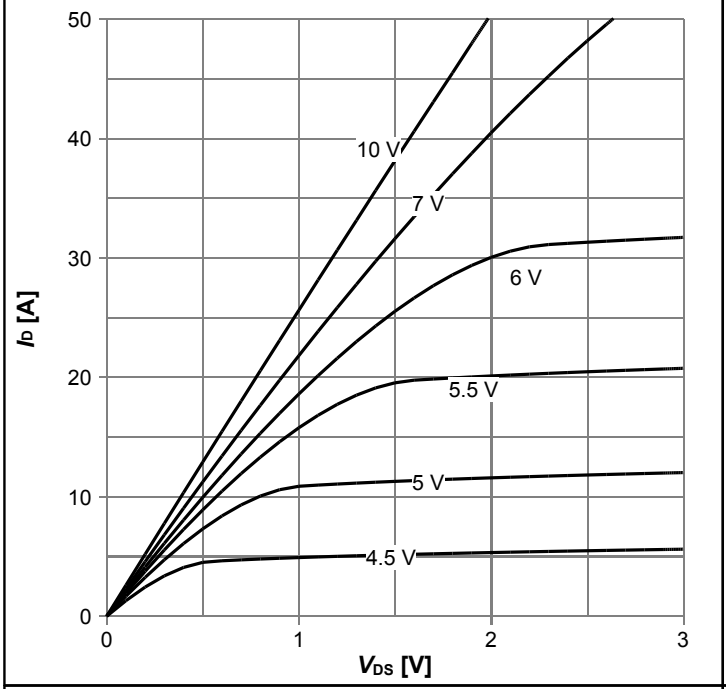

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: $t_p$

**Diagram 4: Max. transient thermal impedance**



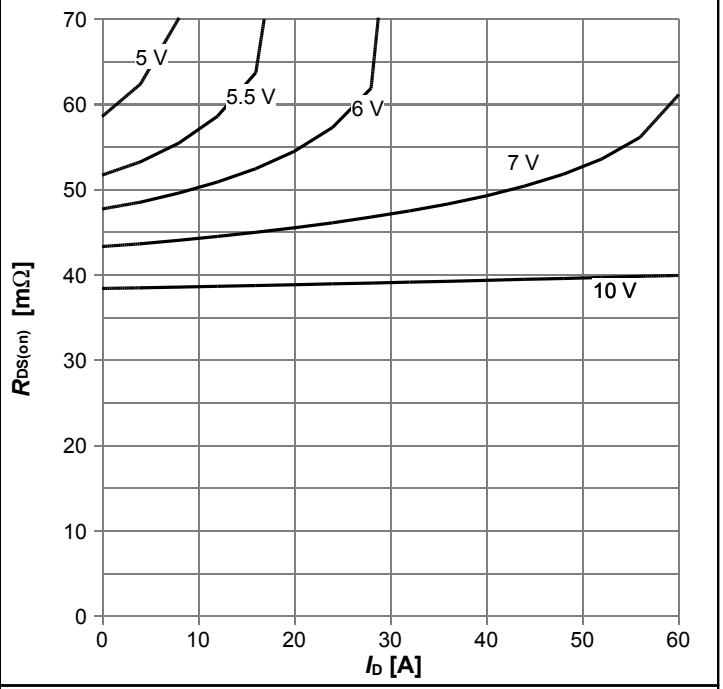

$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

**Diagram 5: Typ. output characteristics**



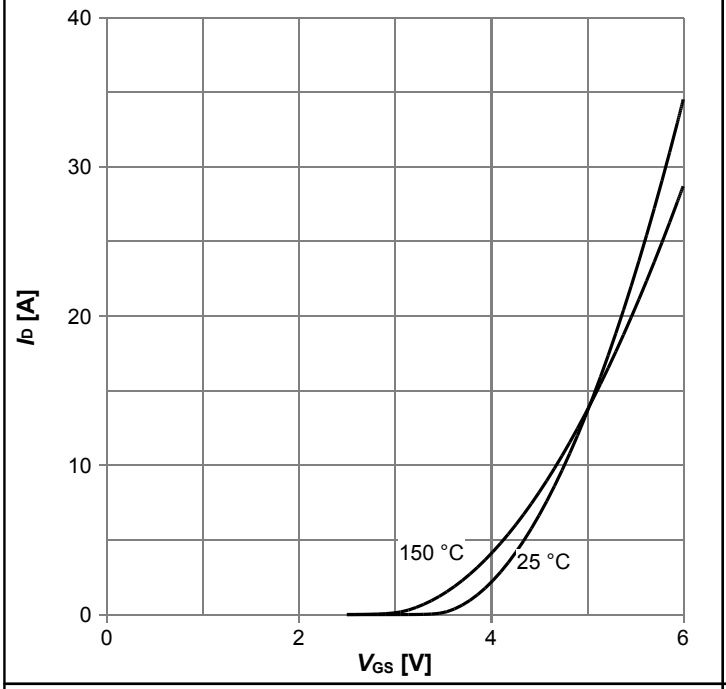

$I_D$=f($V_{DS}$); $T_j$=25 °C; parameter: $V_{GS}$

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



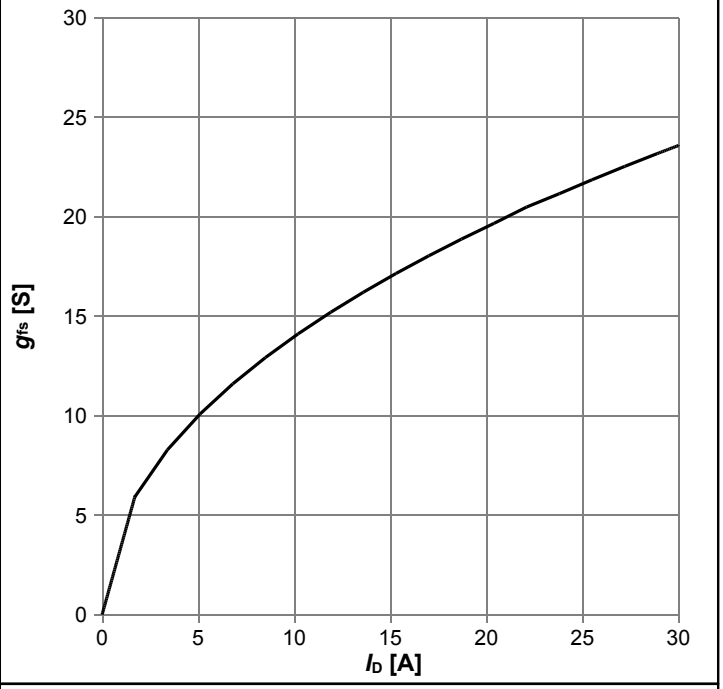

$R_{DS(on)}$=f($I_D$); $T_j$=25 °C; parameter: $V_{GS}$

**Diagram 7: Typ. transfer characteristics**



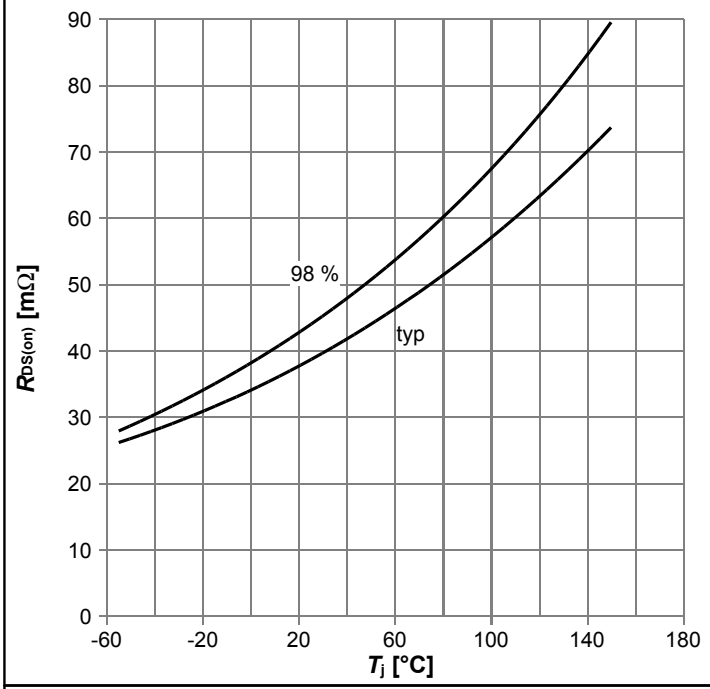

$I_D$=f($V_{GS}$); |$V_{DS}$|>2|$I_D$|$R_{DS(on)max}$; parameter: $T_j$

**Diagram 8: Typ. forward transconductance**



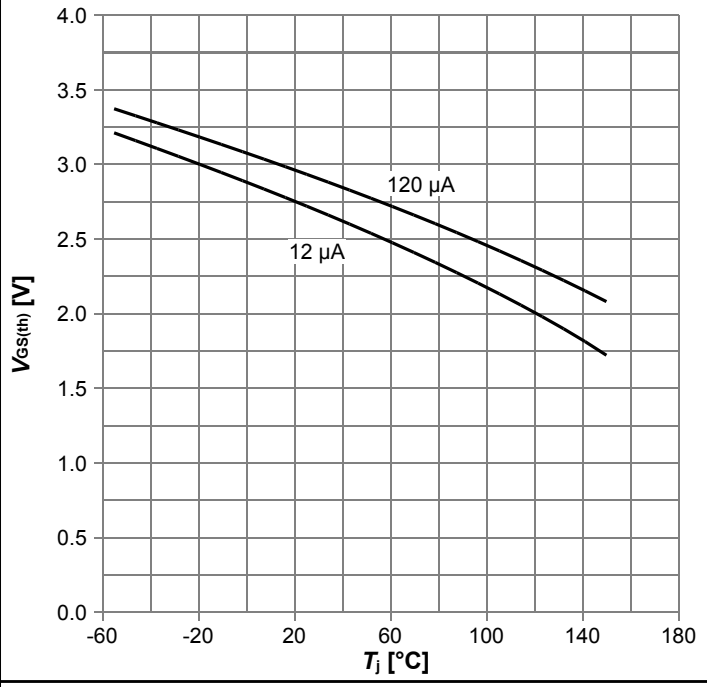

$g_{fs}$=f($I_D$); $T_j$=25 °C

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



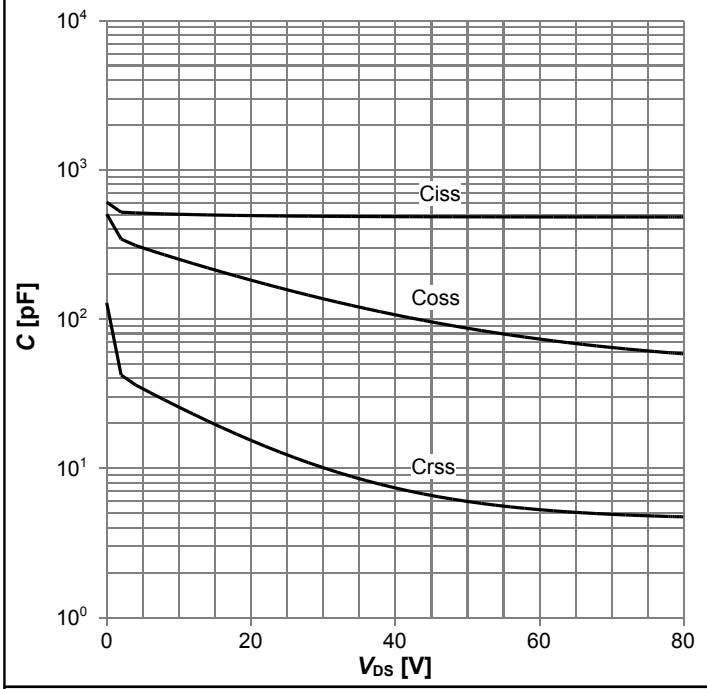

$R_{DS(on)}$=f($T_j$); $I_D$=12 A; $V_{GS}$=10 V

**Diagram 10: Typ. gate threshold voltage**



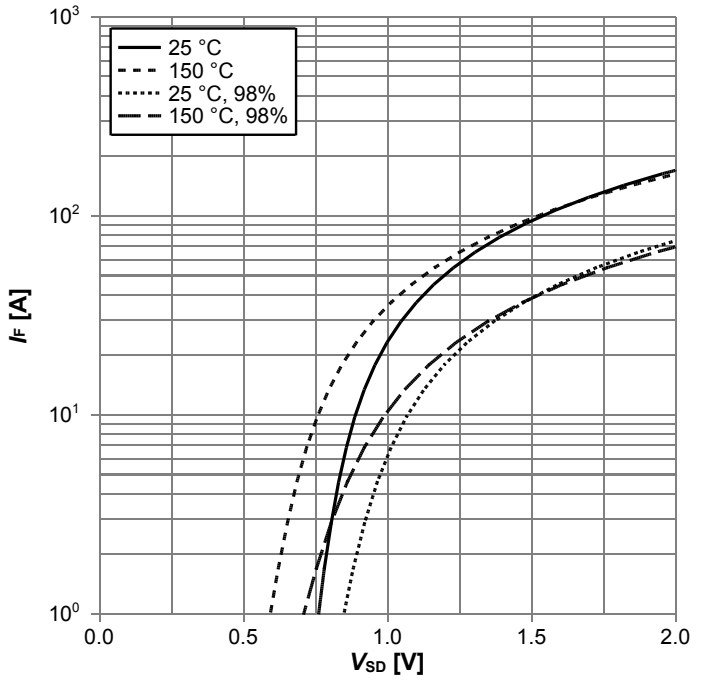

$V_{GS(th)}$=f($T_j$); $V_{GS}$=$V_{DS}$; parameter: $I_D$

**Diagram 11: Typ. capacitances**



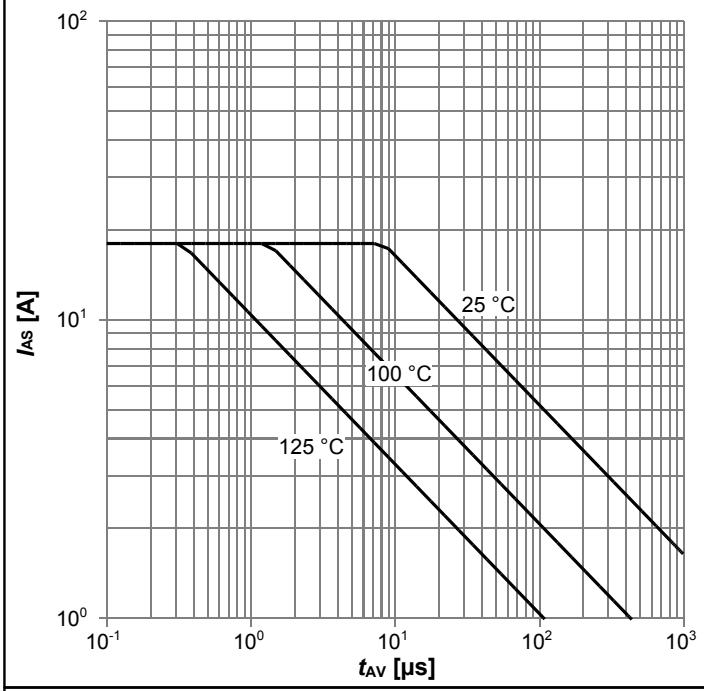

$C$=f($V_{DS}$); $V_{GS}$=0 V; $f$=1 MHz

**Diagram 12: Forward characteristics of reverse diode**



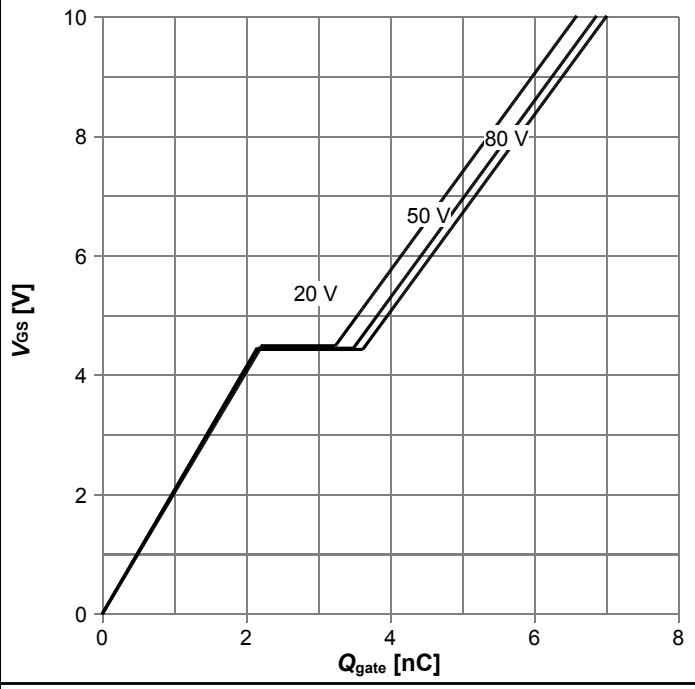

$I_F$=f($V_{SD}$); parameter: $T_j$

**Diagram 13: Avalanche characteristics**



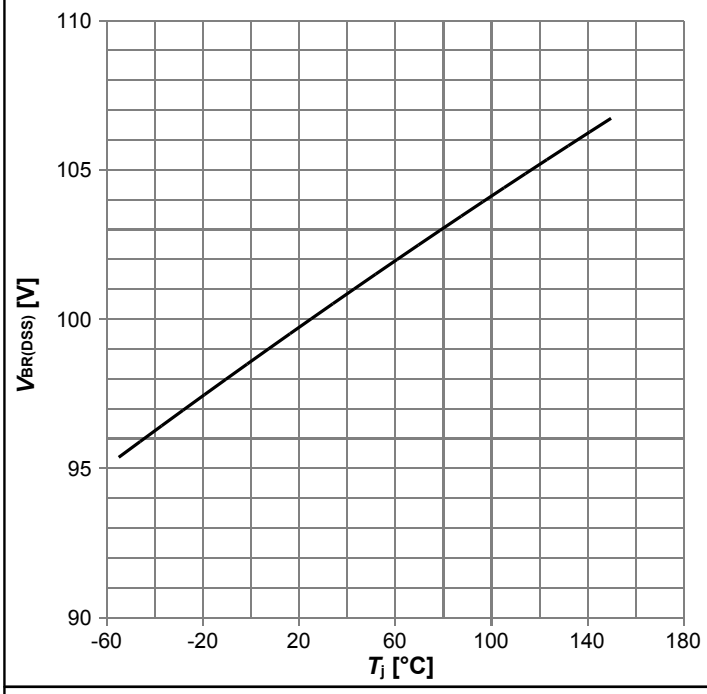

$I_{AS}$=f($t_{AV}$); $R_{GS}$=25 Ω; parameter: $T_{j(start)}$

**Diagram 14: Typ. gate charge**



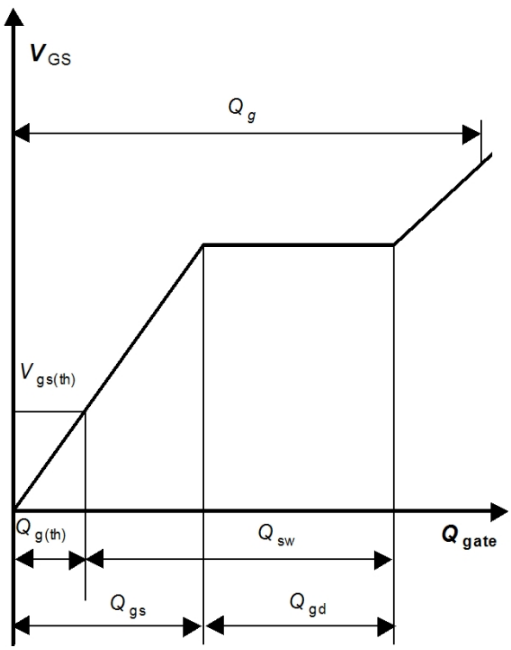

$V_{GS}$=f($Q_{gate}$); $I_D$=6 A pulsed; parameter: $V_{DD}$

**Diagram 15: Drain-source breakdown voltage**

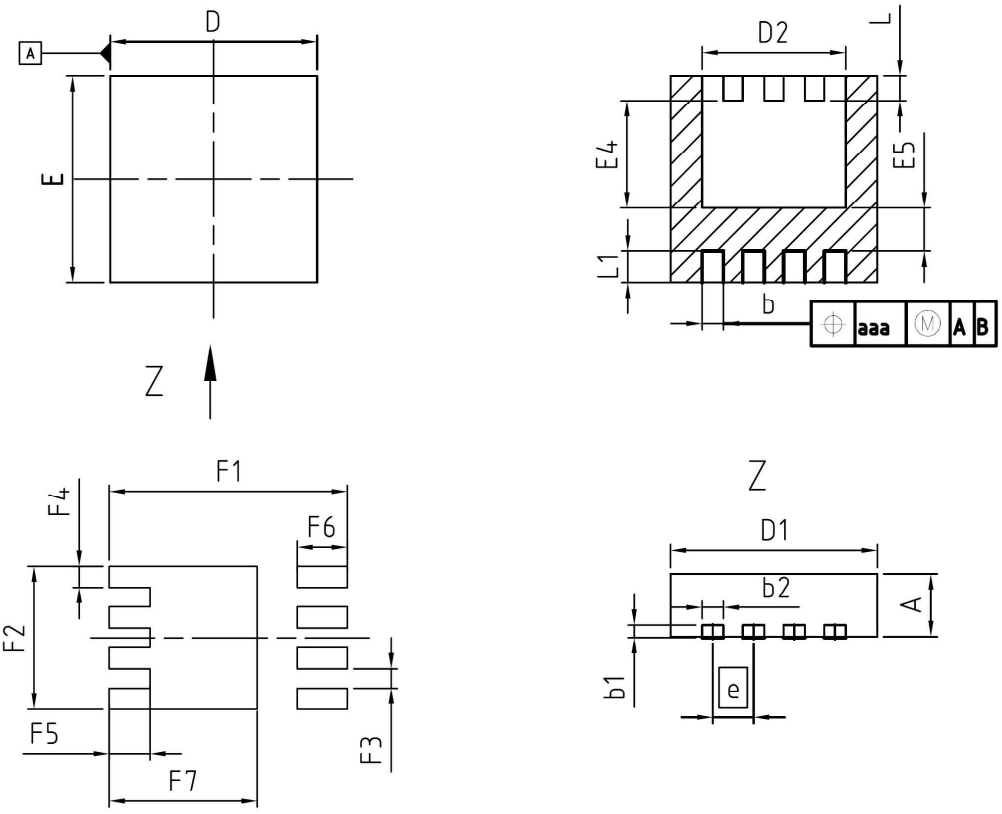



$V_{BR(DSS)}$=f($T_j$); $I_D$=1 mA

Gate charge waveforms



## 6 Package Outlines




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.90 | 1.10 | 0.035 | 0.043 |
| b | 0.24 | 0.44 | 0.009 | 0.017 |
| b1 | 0.10 | 0.30 | 0.004 | 0.012 |
| b2 | 0.20 | 0.44 | 0.008 | 0.017 |
| D=D1 | 3.20 | 3.40 | 0.126 | 0.134 |
| D2 | 2.15 | 2.45 | 0.085 | 0.096 |
| E | 3.20 | 3.40 | 0.126 | 0.134 |
| E4 | 1.60 | 1.81 | 0.063 | 0.071 |
| E5 | 0.59 | 0.86 | 0.023 | 0.034 |
| e | 0.65 | | 0.026 | |
| N | 8 | | 8 | |
| L | 0.30 | 0.56 | 0.012 | 0.022 |
| L1 | 0.33 | 0.60 | 0.013 | 0.024 |
| aaa | 0.25 | | 0.010 | |
| F1 | 3.80 | | 0.150 | |
| F2 | 2.29 | | 0.090 | |
| F3 | 0.31 | | 0.012 | |
| F4 | 0.34 | | 0.013 | |
| F5 | 0.65 | | 0.026 | |
| F6 | 0.80 | | 0.031 | |
| F7 | 2.36 | | 0.093 | |

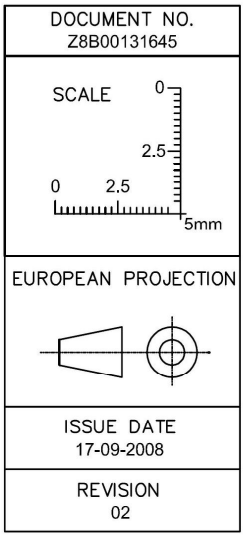



**Figure 1 Outline PG-TSDSON-8, dimensions in mm/inches**

## Revision History

BSZ440N10NS3 G

**Revision: 2015-02-06, Rev. 2.1**

| Previous Revision | | |
|---|---|---|
| Revision | Date | Subjects (major changes since last revision) |
| 2.1 | 2015-02-06 | Insert pin numbered package drawing and trr and Qrr values |

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