

# MOSFET

Metal Oxide Semiconductor Field Effect Transistor

## OptiMOS™ Power-Transistor, 100V

OptiMOS™ 3 Power Transistor  
BSZ160N10NS3

## Data Sheet

Rev. 2.1  
Final

## OptiMOS™3 Power-Transistor

### Features

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

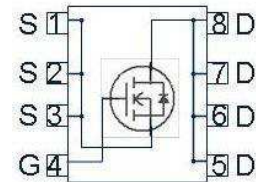


| Type           | Package     | Marking |
|----------------|-------------|---------|
| BSZ160N10NS3 G | PG-TSDSON-8 | 160N10N |

### Product Summary

|                  |     |    |
|------------------|-----|----|
| $V_{DS}$         | 100 | V  |
| $R_{DS(on),max}$ | 16  | mΩ |
| $I_D$            | 40  | A  |

PG-TSDSON-8



**Maximum ratings**, at  $T_A=25\text{ °C}$ , unless otherwise specified

| Parameter                                    | Symbol        | Conditions                                                                   | Value | Unit |
|----------------------------------------------|---------------|------------------------------------------------------------------------------|-------|------|
| Continuous drain current                     | $I_D$         | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$                                    | 40    | A    |
|                                              |               | $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$                                   | 28    |      |
|                                              |               | $V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ ,<br>$R_{thJA}=60\text{ K/W}^{2)}$ | 8     |      |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$ | $T_C=25\text{ °C}$                                                           | 160   | mJ   |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$      | $I_D=20\text{ A}$ , $R_{GS}=25\text{ Ω}$                                     | 80    |      |
| Gate source voltage                          | $V_{GS}$      |                                                                              | ±20   | V    |

<sup>1)</sup> J-STD20 and JESD22

<sup>2)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

<sup>3)</sup> See Diagram 3 for more detailed information

<sup>4)</sup> See Diagram 13 for more detailed information

**Maximum ratings**, at  $T_A=25\text{ °C}$ , unless otherwise specified

| Parameter                           | Symbol                | Conditions                                                    | Value       | Unit |
|-------------------------------------|-----------------------|---------------------------------------------------------------|-------------|------|
| Power dissipation                   | $P_{\text{tot}}$      | $T_C=25\text{ °C}$                                            | 63          | W    |
|                                     |                       | $T_A=25\text{ °C}$ ,<br>$R_{\text{thJA}}=60\text{ K/W}^{(2)}$ | 2.1         |      |
| Operating and storage temperature   | $T_j, T_{\text{stg}}$ |                                                               | -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 | $R_{\text{thJC}}$ |                                               | - | - | 2.1 | K/W |
| Device on PCB                       | $R_{\text{thJA}}$ | minimal footprint                             | - | - | 62  |     |
|                                     |                   | 6 cm <sup>2</sup> cooling area <sup>(2)</sup> | - | - | 60  |     |

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

#### Static characteristics

|                                  |                             |                                                                                       |     |     |     |               |
|----------------------------------|-----------------------------|---------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| Drain-source breakdown voltage   | $V_{(\text{BR})\text{DSS}}$ | $V_{\text{GS}}=0\text{ V}$ , $I_{\text{D}}=1\text{ mA}$                               | 100 | -   | -   | V             |
| Gate threshold voltage           | $V_{\text{GS(th)}}$         | $V_{\text{DS}}=V_{\text{GS}}$ , $I_{\text{D}}=33\text{ }\mu\text{A}$                  | 2   | 2.8 | 3.5 |               |
| Zero gate voltage drain current  | $I_{\text{DSS}}$            | $V_{\text{DS}}=100\text{ V}$ , $V_{\text{GS}}=0\text{ V}$ ,<br>$T_j=25\text{ °C}$     | -   | 0.1 | 1   | $\mu\text{A}$ |
|                                  |                             | $V_{\text{DS}}=100\text{ V}$ , $V_{\text{GS}}=0\text{ V}$ ,<br>$T_j=125\text{ °C}$    | -   | 10  | 100 |               |
| Gate-source leakage current      | $I_{\text{GSS}}$            | $V_{\text{GS}}=20\text{ V}$ , $V_{\text{DS}}=0\text{ V}$                              | -   | 10  | 100 | nA            |
| Drain-source on-state resistance | $R_{\text{DS(on)}}$         | $V_{\text{GS}}=10\text{ V}$ , $I_{\text{D}}=20\text{ A}$                              | -   | 14  | 16  | mΩ            |
|                                  |                             | $V_{\text{GS}}=6\text{ V}$ , $I_{\text{D}}=10\text{ A}$                               | -   | 18  | 33  |               |
| Gate resistance                  | $R_{\text{G}}$              |                                                                                       | -   | 1.4 | -   | Ω             |
| Transconductance                 | $g_{\text{fs}}$             | $ V_{\text{DS}} >2 I_{\text{D}} R_{\text{DS(on)max}}$ ,<br>$I_{\text{D}}=20\text{ A}$ | 16  | 33  | -   | S             |

| Parameter | Symbol | Conditions | Values |      |      | Unit |
|-----------|--------|------------|--------|------|------|------|
|           |        |            | min.   | typ. | max. |      |

**Dynamic characteristics**

|                              |              |                                                                                       |   |      |      |    |
|------------------------------|--------------|---------------------------------------------------------------------------------------|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=50\text{ V},$<br>$f=1\text{ MHz}$                          | - | 1300 | 1700 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                       | - | 240  | 320  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                       | - | 11   | -    |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=50\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=10\text{ A}, R_{G,ext}=1.6\ \Omega$ | - | 13.0 | -    | ns |
| Rise time                    | $t_r$        |                                                                                       | - | 10.0 | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                       | - | 22.0 | -    |    |
| Fall time                    | $t_f$        |                                                                                       | - | 5.0  | -    |    |

**Gate Charge Characteristics<sup>5)</sup>**

|                          |               |                                                                            |   |     |    |    |
|--------------------------|---------------|----------------------------------------------------------------------------|---|-----|----|----|
| Gate to source charge    | $Q_{gs}$      | $V_{DD}=50\text{ V}, I_D=10\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 5.7 | -  | nC |
| Gate charge at threshold | $Q_{g(th)}$   |                                                                            | - | 3.8 | -  |    |
| Gate to drain charge     | $Q_{gd}$      |                                                                            | - | 3.4 | -  |    |
| Switching charge         | $Q_{sw}$      |                                                                            | - | 5.3 | -  |    |
| Gate charge total        | $Q_g$         |                                                                            | - | 19  | 25 |    |
| Gate plateau voltage     | $V_{plateau}$ |                                                                            | - | 4.2 | -  | V  |
| Output charge            | $Q_{oss}$     | $V_{DD}=40\text{ V}, V_{GS}=0\text{ V}$                                    | - | 25  | 33 | nC |

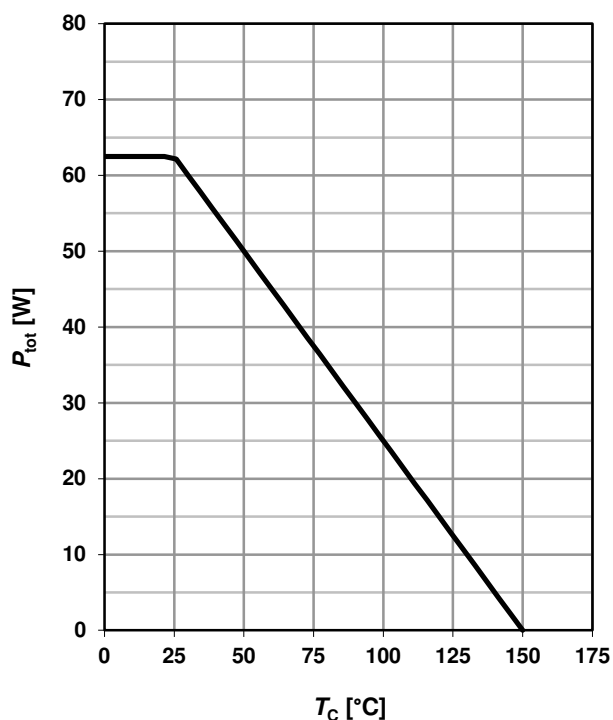
**Reverse Diode**

|                                  |               |                                                                           |   |     |     |    |
|----------------------------------|---------------|---------------------------------------------------------------------------|---|-----|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ °C}$                                                        | - | -   | 40  | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                           | - | -   | 160 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=20\text{ A},$<br>$T_J=25\text{ °C}$               | - | 0.9 | 1.2 | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=50\text{ V}, I_F=10\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 73  | -   | ns |
| Reverse recovery charge          | $Q_{rr}$      |                                                                           | - | 52  | -   | nC |

<sup>5)</sup> See figure 16 for gate charge parameter definition

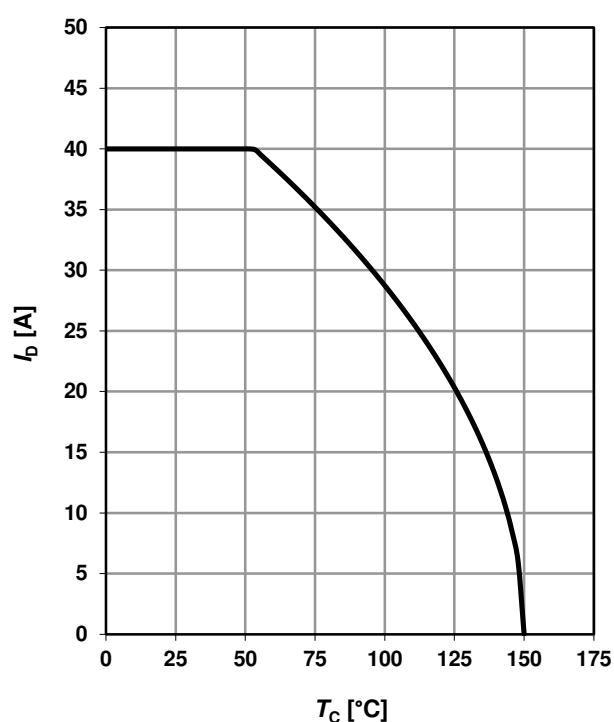
## 1 Power dissipation

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



## 2 Drain current

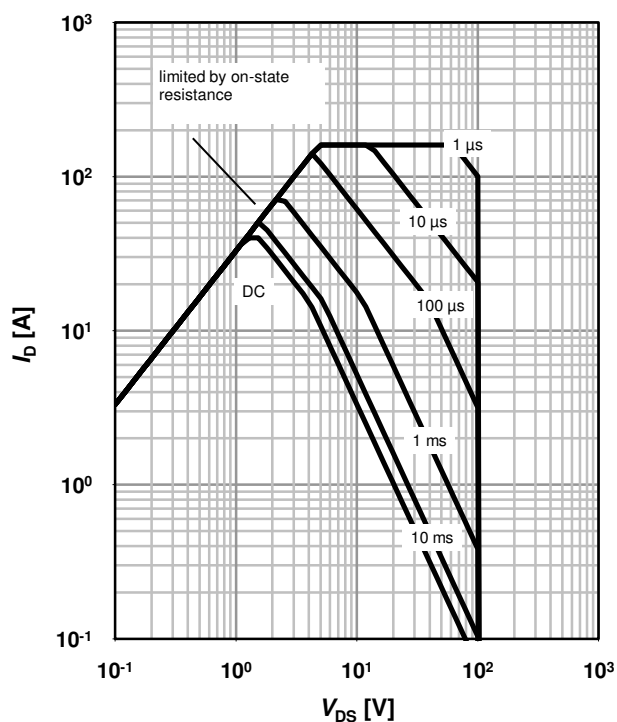
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



## 3 Safe operating area

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

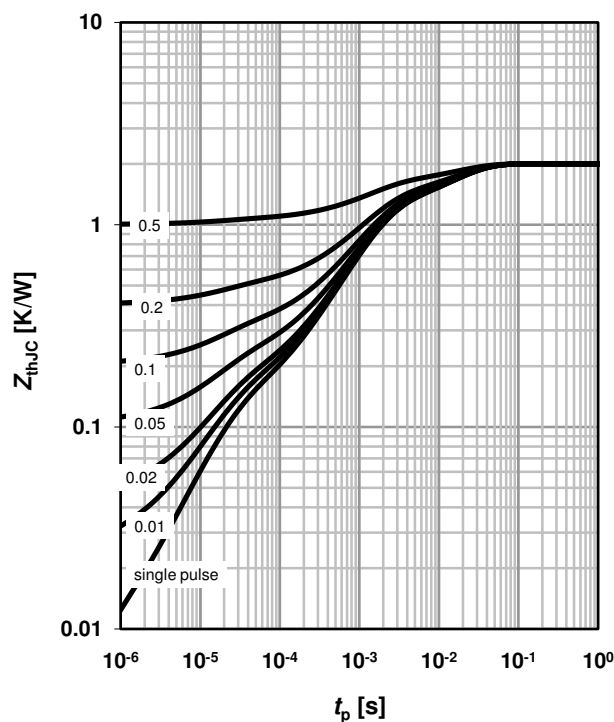
parameter:  $t_p$



## 4 Max. transient thermal impedance

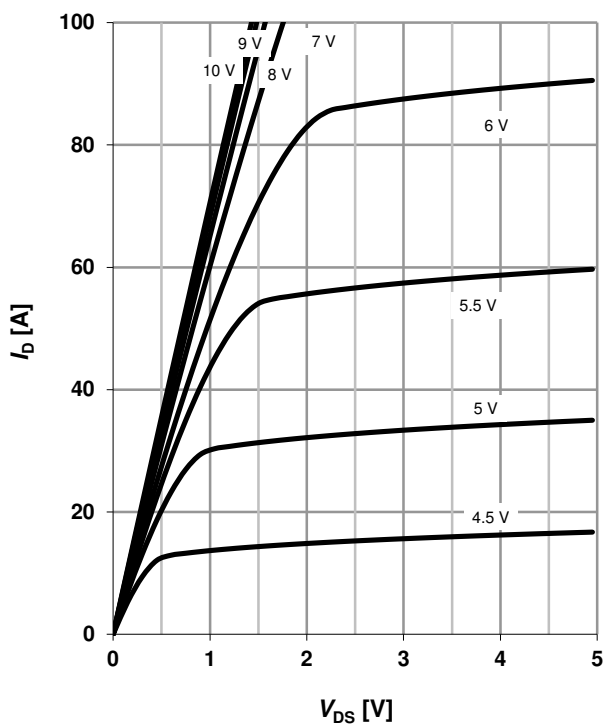
$$Z_{\text{thJC}} = f(t_p)$$

parameter:  $D = t_p / T$



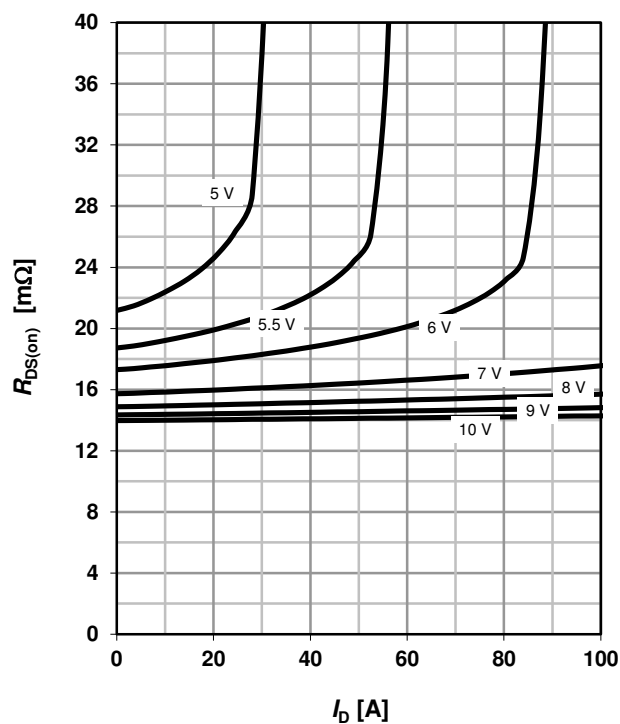
### 5 Typ. output characteristics

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

parameter:  $V_{GS}$ 


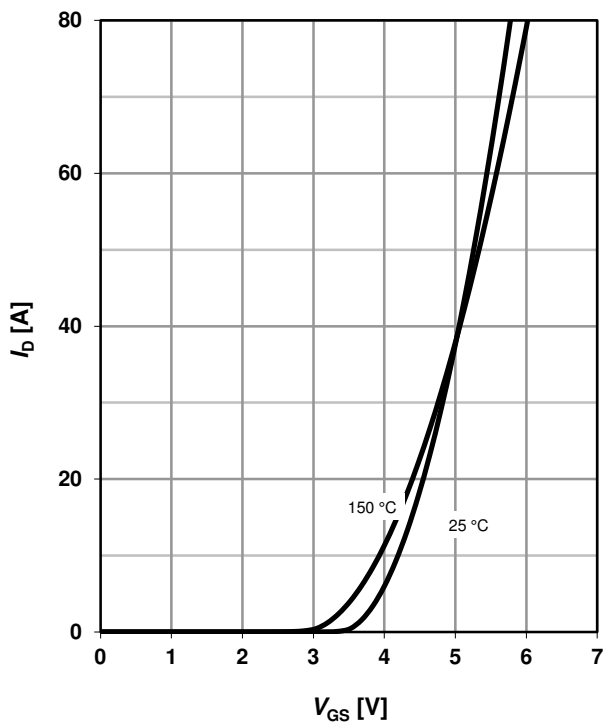
### 6 Typ. drain-source on resistance

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

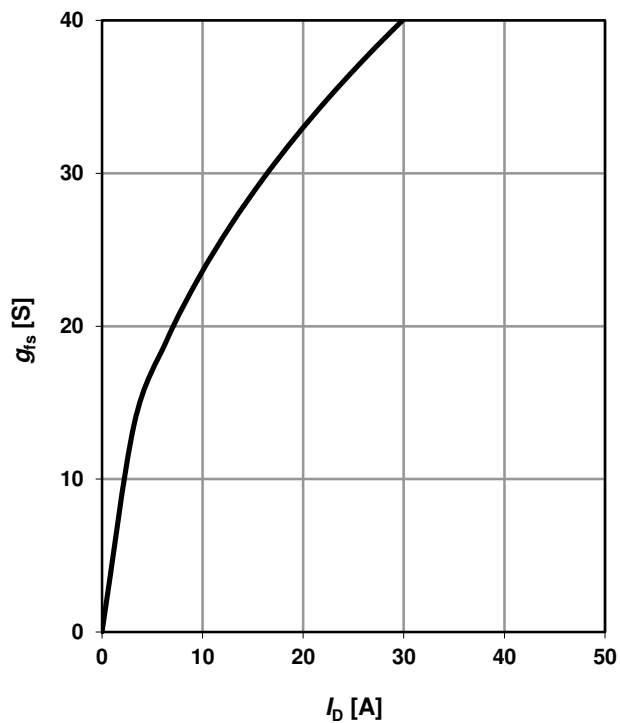
parameter:  $V_{GS}$ 


### 7 Typ. transfer characteristics

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

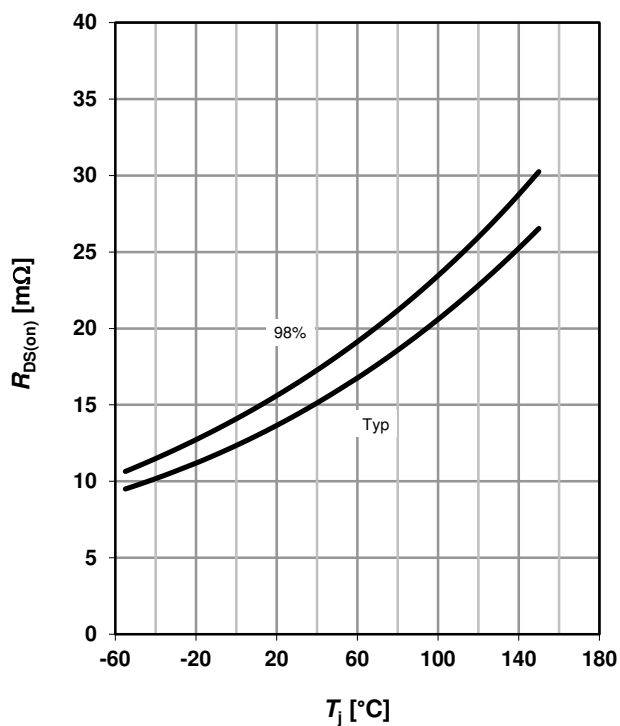
parameter:  $T_j$ 


### 8 Typ. forward transconductance

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


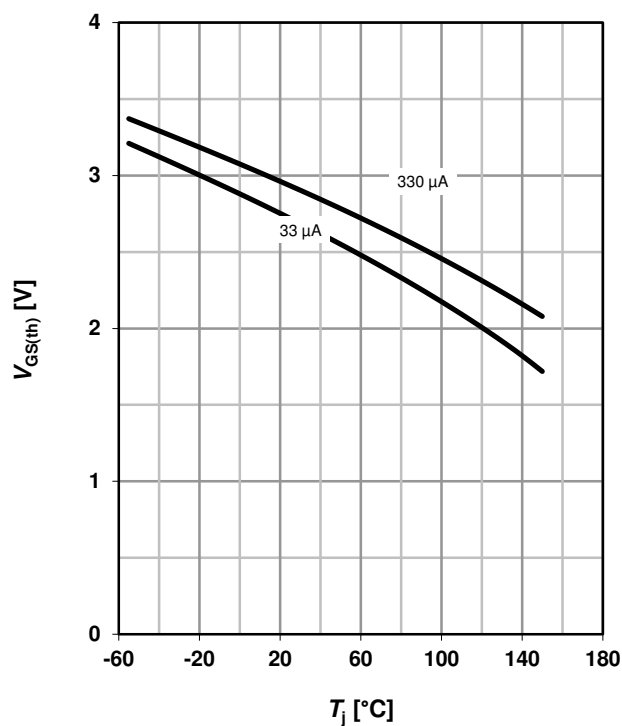
## 9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j); I_D = 20 \text{ A}; V_{GS} = 10 \text{ V}$$



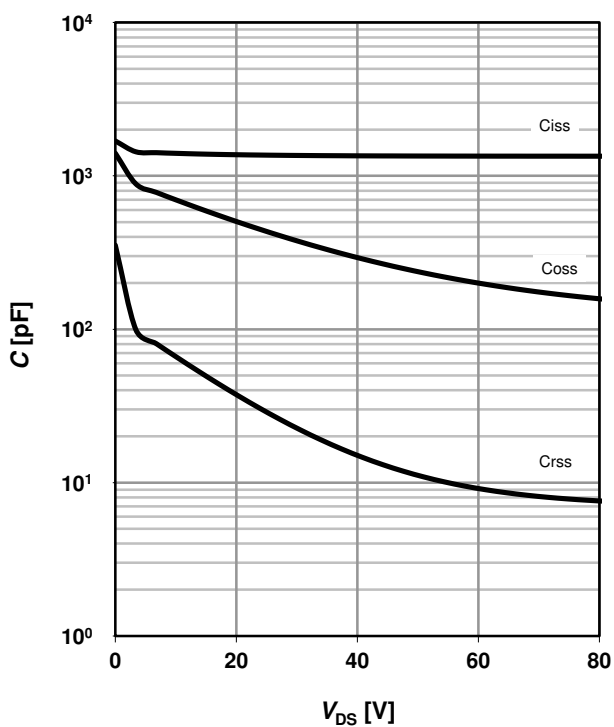
## 10 Typ. gate threshold voltage

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



## 11 Typ. capacitances

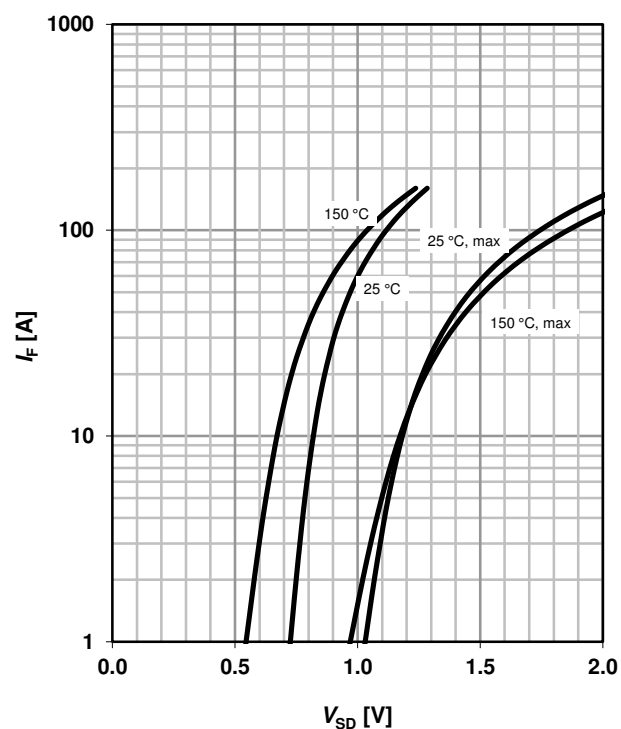
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



## 12 Forward characteristics of reverse diode

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

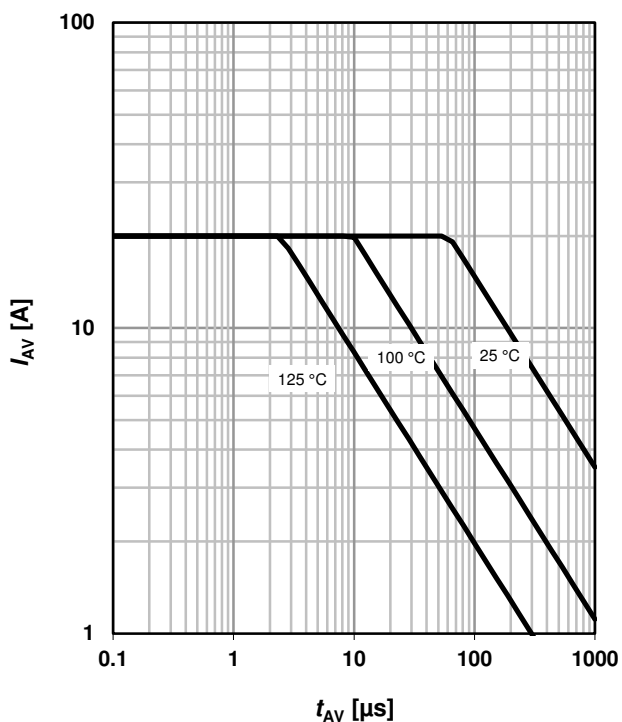
parameter:  $T_j$



### 13 Avalanche characteristics

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

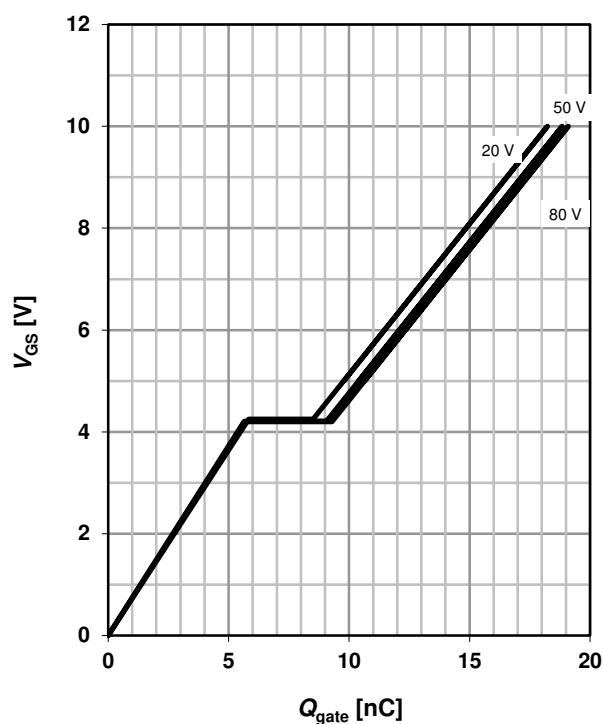
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

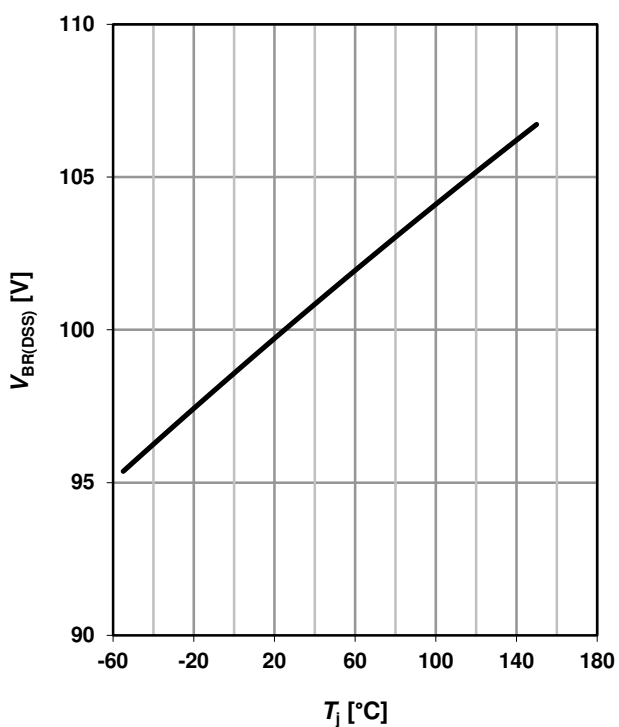
$$V_{GS}=f(Q_{\text{gate}}); I_D=10\ \text{A pulsed}$$

parameter:  $V_{DD}$

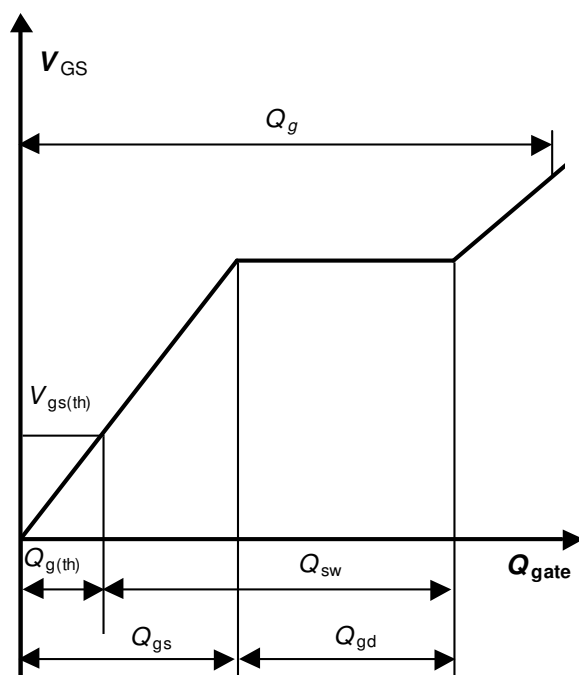


### 15 Drain-source breakdown voltage

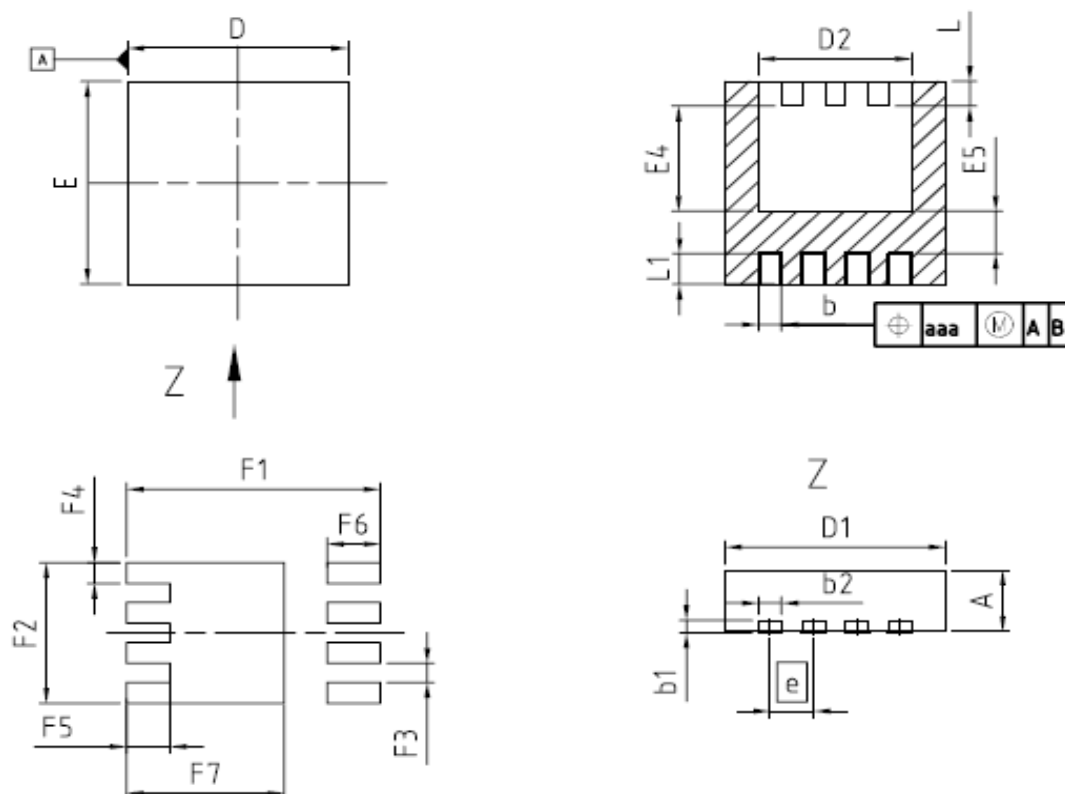
$$V_{BR(DSS)}=f(T_j); I_D=1\ \text{mA}$$



### 16 Gate charge waveforms



## Package Outline: PG-TSDSON-8



| 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  |       |

|                             |
|-----------------------------|
| DOCUMENT NO.<br>Z8B00131645 |
| SCALE<br>0 2,5 5mm          |
| EUROPEAN PROJECTION         |
| ISSUE DATE<br>17-09-2008    |
| REVISION<br>02              |

## Footprint

Dimensions in mm

## Revision History

BSZ160N10NS3

**Revision: 2015-10-05, Rev. 2.1**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision)                                 |
|----------|------------|------------------------------------------------------------------------------|
| 2.1      | 2015-10-05 | Update Id condition for Vgs(th) and Tj to Ta condition for "Maximum ratings" |

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