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**BSC0909NS**

## OptiMOS™ Power-MOSFET

### Features

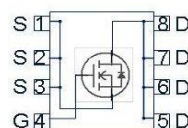
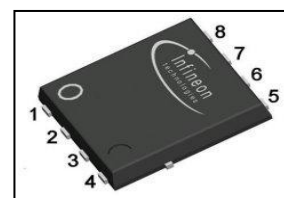
- Optimized for 5V driver application (Notebook, VGA, POL)
- Low FOM<sub>SW</sub> for High Frequency SMPS
- 100% Avalanche tested
- Improved switching behaviour
- N-channel
- Very low on-resistance  $R_{DS(on)}$  @  $V_{GS}=4.5\text{ V}$
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Superior thermal resistance
- Pb-free plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

| Type      | Package    | Marking |
|-----------|------------|---------|
| BSC0909NS | PG-TDSON-8 | 0909NS  |

### Product Summary

|                  |                       |      |    |
|------------------|-----------------------|------|----|
| $V_{DS}$         |                       | 34   | V  |
| $R_{DS(on),max}$ | $V_{GS}=10\text{ V}$  | 9.2  | mΩ |
|                  | $V_{GS}=4.5\text{ V}$ | 11.8 |    |
| $I_D$            |                       | 44   | A  |

PG-TDSON-8



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

| Parameter                                     | Symbol        | Conditions                                                                 | Value | Unit |
|-----------------------------------------------|---------------|----------------------------------------------------------------------------|-------|------|
| Continuous drain current                      | $I_D$         | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$                                  | 44    | A    |
|                                               |               | $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$                                 | 28    |      |
|                                               |               | $V_{GS}=4.5\text{ V}$ , $T_C=25\text{ °C}$                                 | 39    |      |
|                                               |               | $V_{GS}=4.5\text{ V}$ , $T_C=100\text{ °C}$                                | 24    |      |
|                                               |               | $V_{GS}=4.5\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ K/W}^{2)}$ | 12    |      |
| Pulsed drain current <sup>3)</sup>            | $I_{D,pulse}$ | $T_C=25\text{ °C}$                                                         | 176   |      |
| Avalanche current, single pulse <sup>4)</sup> | $I_{AS}$      | $T_C=25\text{ °C}$                                                         | 35    |      |
| Avalanche energy, single pulse                | $E_{AS}$      | $I_D=25\text{ A}$ , $R_{GS}=25\text{ Ω}$                                   | 10    | mJ   |
| Gate source voltage                           | $V_{GS}$      |                                                                            | ±20   | V    |

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



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

| Parameter                           | Symbol                | Conditions                                                   | Value       | Unit |
|-------------------------------------|-----------------------|--------------------------------------------------------------|-------------|------|
| Power dissipation                   | $P_{\text{tot}}$      | $T_C=25\text{ °C}$                                           | 27          | W    |
|                                     |                       | $T_A=25\text{ °C}$ ,<br>$R_{\text{thJA}}=50\text{ K/W}^{2)}$ | 2.5         |      |
| 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 | $R_{\text{thJC}}$ | bottom                                       | - | - | 4.6 | K/W |
|                                     |                   | top                                          | - | - | 20  |     |
| Device on PCB                       | $R_{\text{thJA}}$ | 6 cm <sup>2</sup> cooling area <sup>2)</sup> | - | - | 50  |     |

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

### Static characteristics

|                                  |                             |                                                                                       |     |     |      |               |
|----------------------------------|-----------------------------|---------------------------------------------------------------------------------------|-----|-----|------|---------------|
| Drain-source breakdown voltage   | $V_{(\text{BR})\text{DSS}}$ | $V_{\text{GS}}=0\text{ V}$ , $I_{\text{D}}=1\text{ mA}$                               | 34  | -   | -    | V             |
| Gate threshold voltage           | $V_{\text{GS(th)}}$         | $V_{\text{DS}}=V_{\text{GS}}$ , $I_{\text{D}}=250\text{ }\mu\text{A}$                 | 1.2 | -   | 2    |               |
| Zero gate voltage drain current  | $I_{\text{DSS}}$            | $V_{\text{DS}}=34\text{ V}$ , $V_{\text{GS}}=0\text{ V}$ ,<br>$T_j=25\text{ °C}$      | -   | 0.1 | 1    | $\mu\text{A}$ |
|                                  |                             | $V_{\text{DS}}=34\text{ V}$ , $V_{\text{GS}}=0\text{ V}$ ,<br>$T_j=125\text{ °C}$     | -   | 10  | 100  |               |
| Gate-source leakage current      | $I_{\text{GSS}}$            | $V_{\text{GS}}=16\text{ V}$ , $V_{\text{DS}}=0\text{ V}$                              | -   | 10  | 100  | nA            |
| Drain-source on-state resistance | $R_{\text{DS(on)}}$         | $V_{\text{GS}}=4.5\text{ V}$ , $I_{\text{D}}=15\text{ A}$                             | -   | 9.4 | 11.8 | m $\Omega$    |
|                                  |                             | $V_{\text{GS}}=10\text{ V}$ , $I_{\text{D}}=20\text{ A}$                              | -   | 7.7 | 9.2  |               |
| Gate resistance                  | $R_{\text{G}}$              |                                                                                       | 1.5 | 3   | 6.0  | $\Omega$      |
| Transconductance                 | $g_{\text{fs}}$             | $ V_{\text{DS}} >2 I_{\text{D}} R_{\text{DS(on)max}}$ ,<br>$I_{\text{D}}=30\text{ A}$ | 25  | 50  | -    | S             |

<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  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.

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



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

### Dynamic characteristics

|                              |              |                                                                                         |   |      |      |    |
|------------------------------|--------------|-----------------------------------------------------------------------------------------|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$                                 | - | 1100 | 1500 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                         | - | 390  | 520  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                         | - | 25   | -    |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=15\text{ V}, V_{GS}=4.5\text{ V}, I_D=30\text{ A}, R_{G,ext}=1.6\text{ }\Omega$ | - | 9.6  | -    | ns |
| Rise time                    | $t_r$        |                                                                                         | - | 4.4  | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                         | - | 8.9  | -    |    |
| Fall time                    | $t_f$        |                                                                                         | - | 5.4  | -    |    |

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

|                              |               |                                                                        |   |     |     |    |
|------------------------------|---------------|------------------------------------------------------------------------|---|-----|-----|----|
| Gate to source charge        | $Q_{gs}$      | $V_{DD}=15\text{ V}, I_D=30\text{ A}, V_{GS}=0\text{ to }4.5\text{ V}$ | - | 3.8 | 5.1 | nC |
| Gate charge at threshold     | $Q_{g(th)}$   |                                                                        | - | 1.7 | -   |    |
| Gate to drain charge         | $Q_{gd}$      |                                                                        | - | 1.8 | 2.3 |    |
| Switching charge             | $Q_{sw}$      |                                                                        | - | 3.8 | -   |    |
| Gate charge total            | $Q_g$         |                                                                        | - | 7.2 | 9.6 |    |
| Gate plateau voltage         | $V_{plateau}$ |                                                                        | - | 3.3 | -   | V  |
| Gate charge total            | $Q_g$         | $V_{DD}=15\text{ V}, I_D=30\text{ A}, V_{GS}=0\text{ to }10\text{ V}$  | - | 15  | 20  | nC |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}=0.1\text{ V}, V_{GS}=0\text{ to }4.5\text{ V}$                 | - | 6.2 | -   |    |
| Output charge                | $Q_{oss}$     | $V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$                                | - | 10  | 13  |    |

### Reverse Diode

|                                  |               |                                                                    |   |      |     |    |
|----------------------------------|---------------|--------------------------------------------------------------------|---|------|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ }^\circ\text{C}$                                     | - | -    | 25  | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                    | - | -    | 176 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=30\text{ A}, T_J=25\text{ }^\circ\text{C}$ | - | 0.92 | -   | V  |
| Reverse recovery charge          | $Q_{rr}$      | $V_R=15\text{ V}, I_F=I_S, di_F/dt=400\text{ A}/\mu\text{s}$       | - | -    | 10  | nC |

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

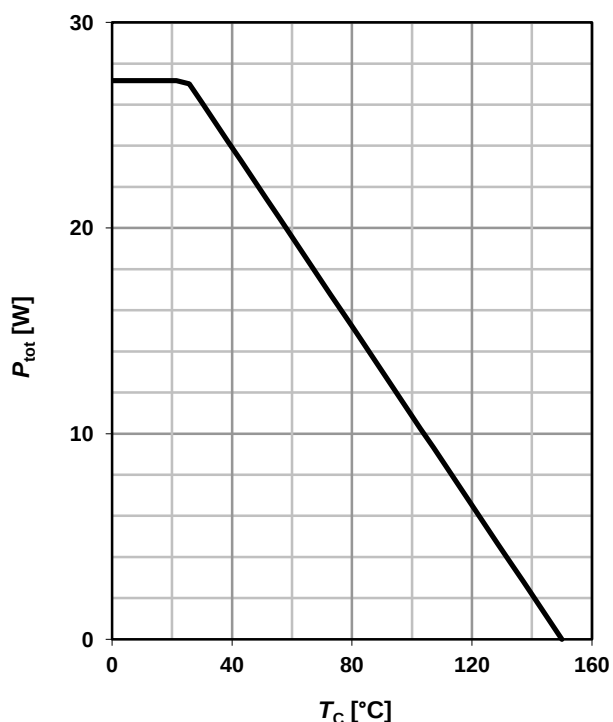
<sup>5)</sup> See figure 16 for gate charge parameter definition



**BSC0909NS**

### 1 Power dissipation

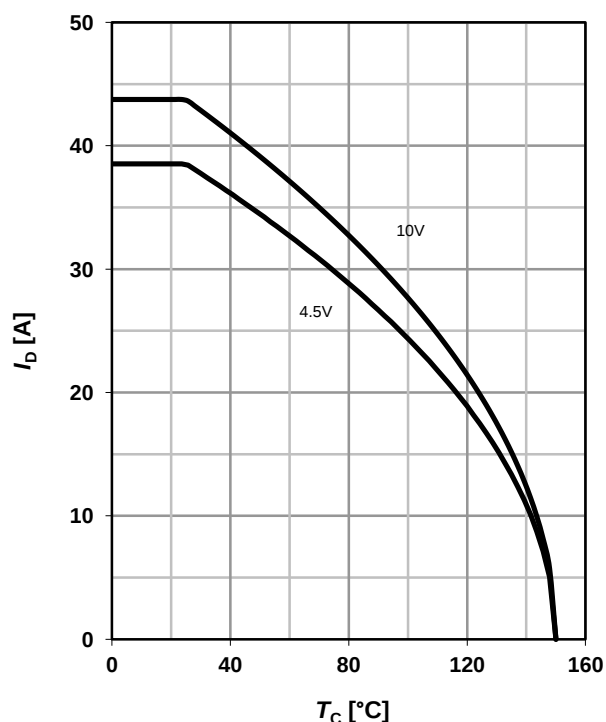
$$P_{\text{tot}} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

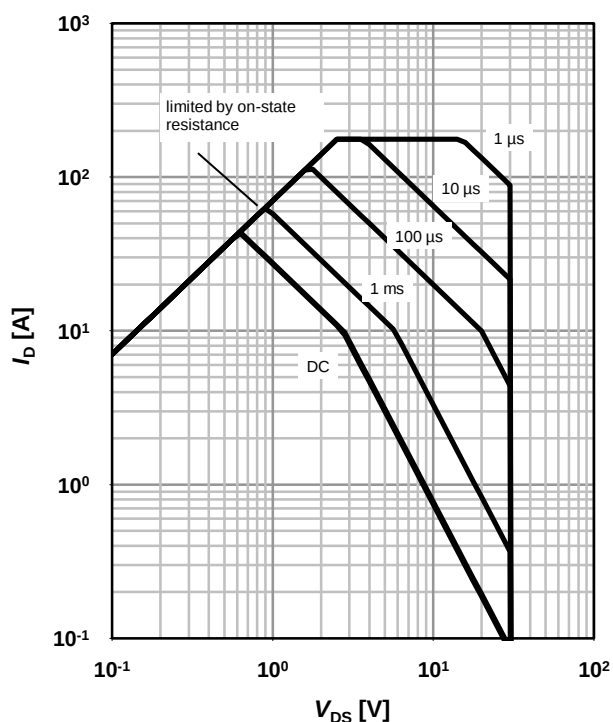
parameter:  $V_{GS}$



### 3 Safe operating area

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

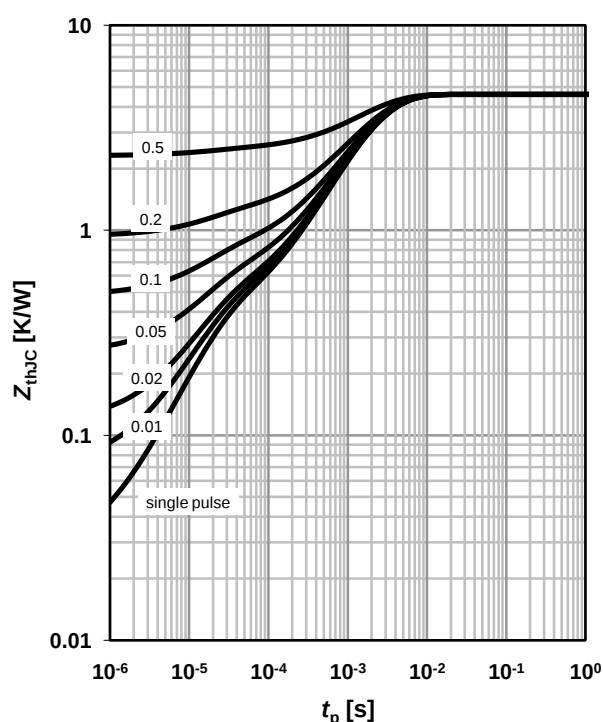
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

parameter:  $D = t_p/T$



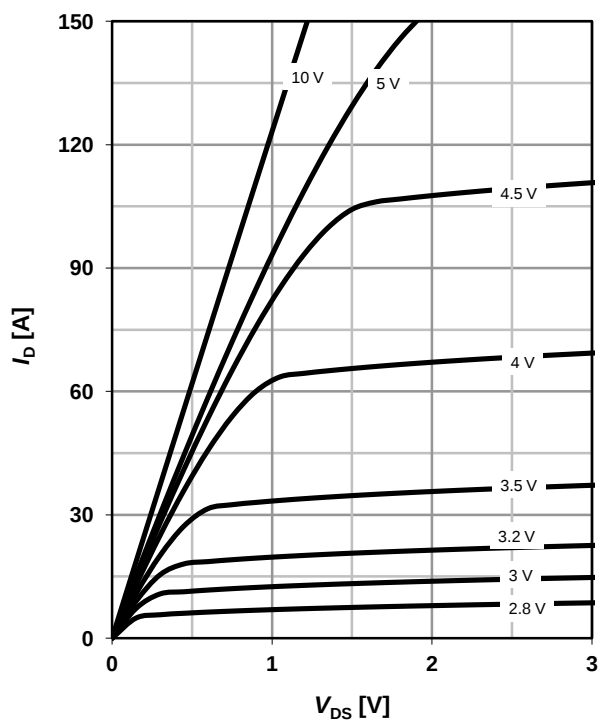


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### 5 Typ. output characteristics

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

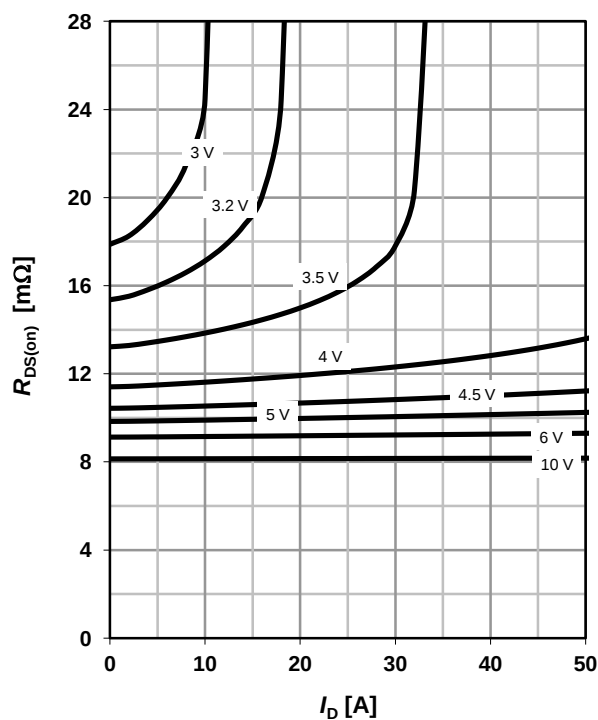
parameter:  $V_{GS}$



### 6 Typ. drain-source on resistance

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

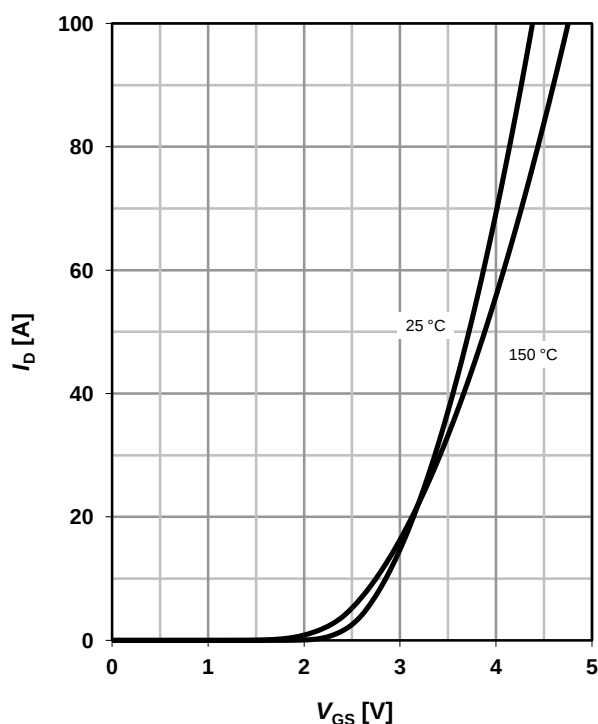
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

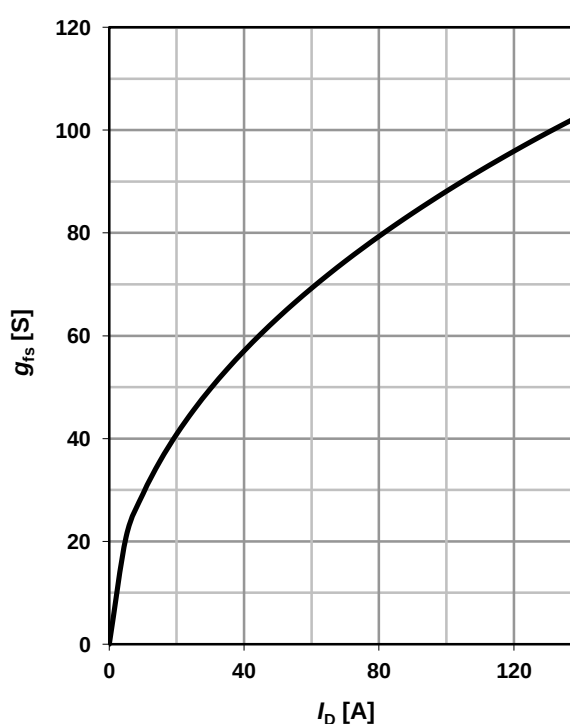
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)\max}$$

parameter:  $T_j$



### 8 Typ. forward transconductance

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

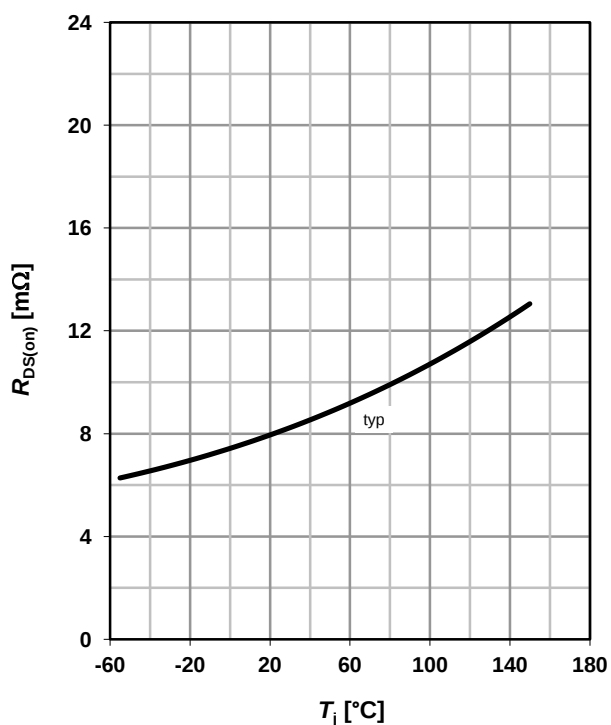




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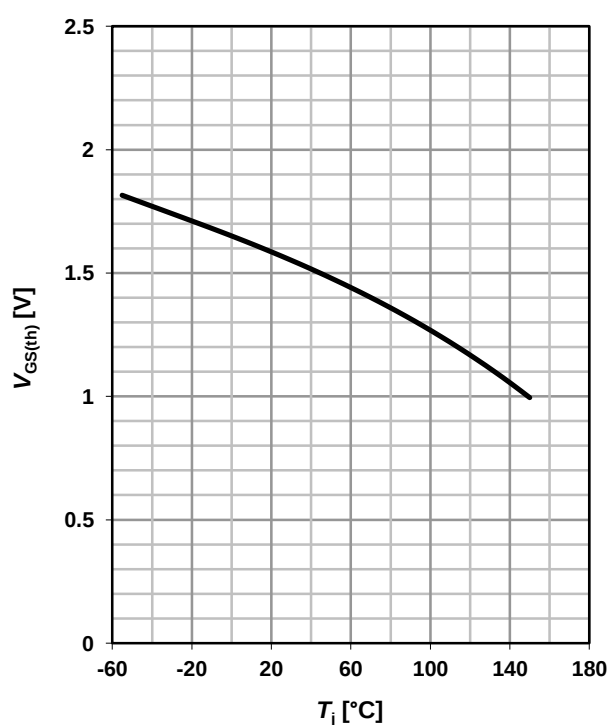
### 9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$$



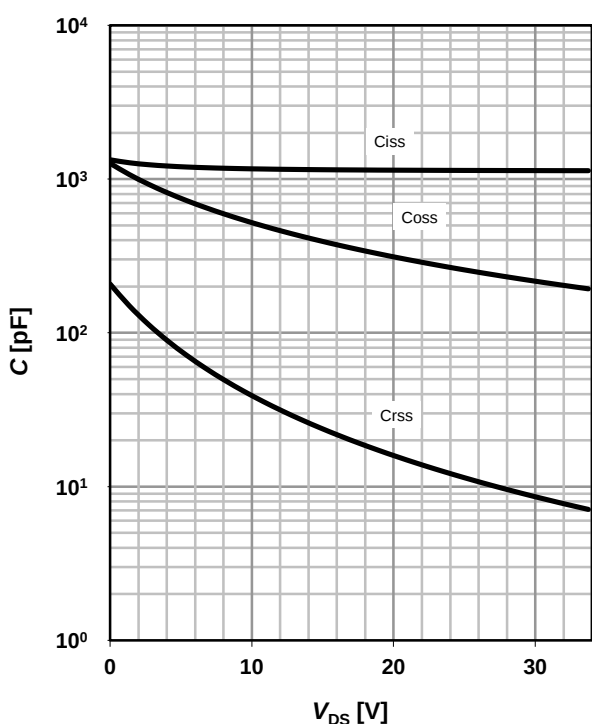
### 10 Typ. gate threshold voltage

$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = 250 \mu\text{A}$$



### 11 Typ. capacitances

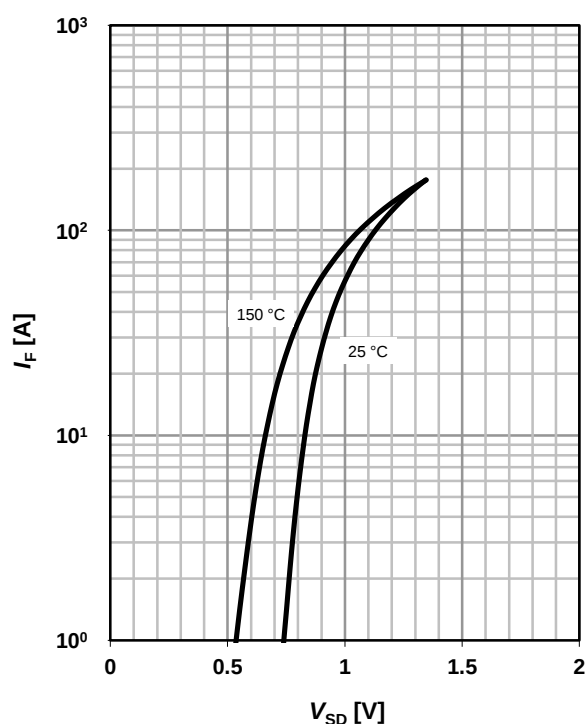
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 12 Forward characteristics of reverse diode

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

parameter:  $T_j$



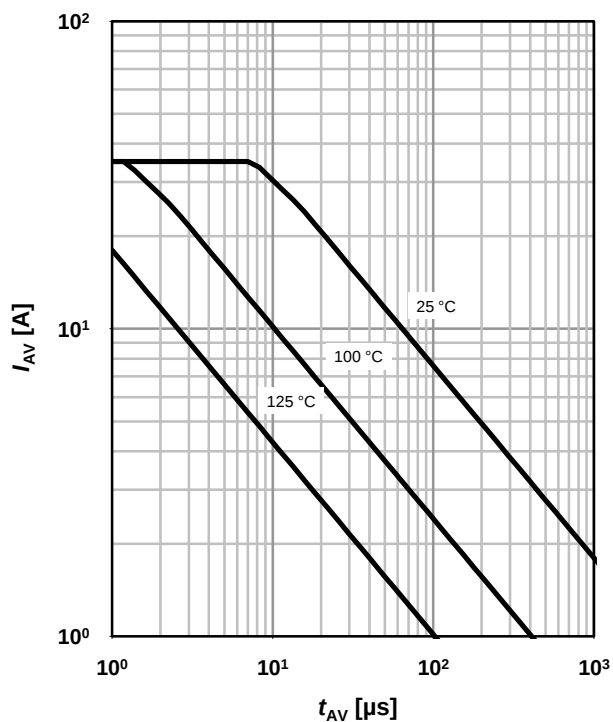


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### 13 Avalanche characteristics

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

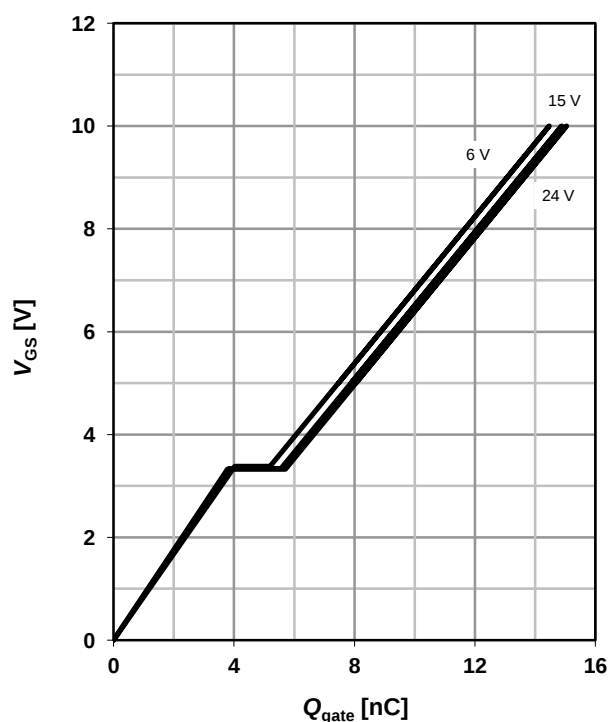
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

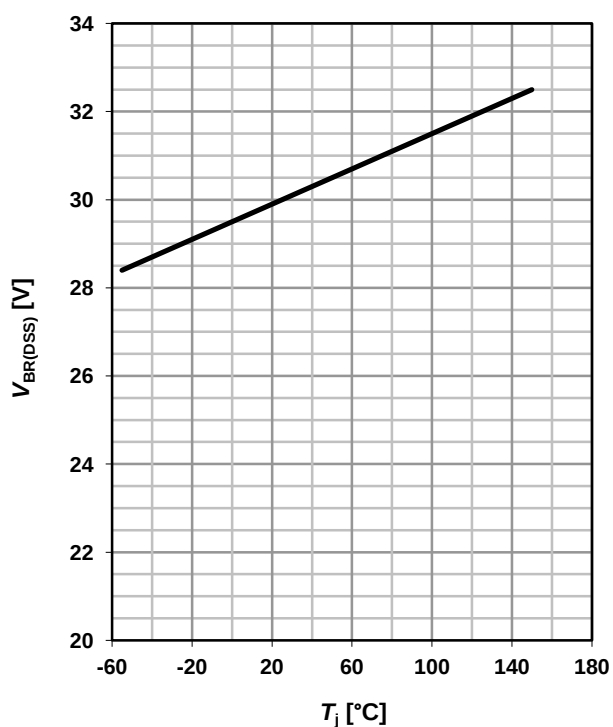
$$V_{GS}=f(Q_{\text{gate}}); I_D=30\ \text{A pulsed}$$

parameter:  $V_{DD}$

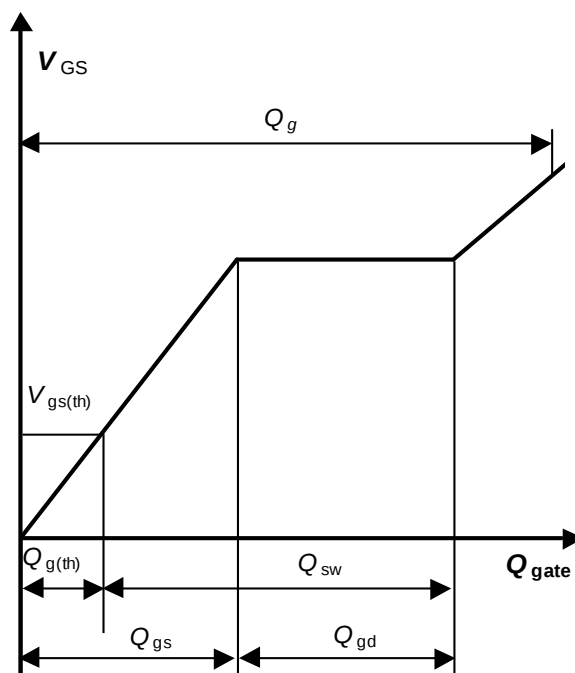


### 15 Drain-source breakdown voltage

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



### 16 Gate charge waveforms



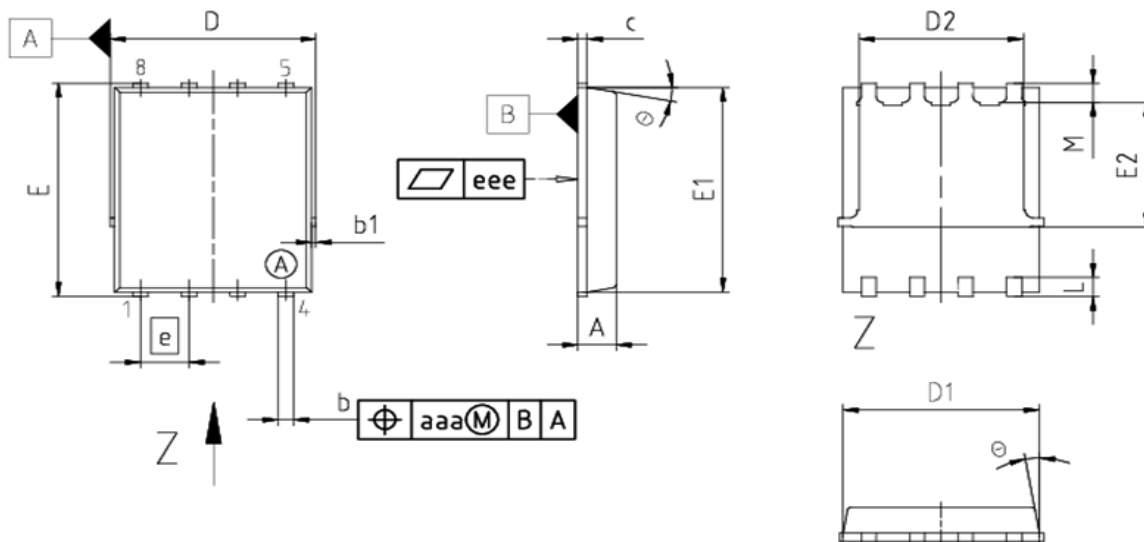


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**Package Outline**

**PG-TDSON-8**

**PG-TDSON-8-5: Outline**



| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.90        | 1.10 |
| b   | 0.31        | 0.54 |
| b1  | 0.02        | 0.22 |
| c   | 0.15        | 0.35 |
| D   | 5.15        | 5.49 |
| D1  | 4.95        | 5.35 |
| D2  | 3.70        | 4.40 |
| E   | 5.95        | 6.35 |
| E1  | 5.70        | 6.10 |
| E2  | 3.40        | 3.80 |
| e   | 1.27        |      |
| N   | 8           |      |
| L   | 0.45        | 0.71 |
| M   | 0.45        | 0.75 |
| θ   | 8.5°        | 12°  |
| aaa | 0.25        |      |
| eee | 0.08        |      |

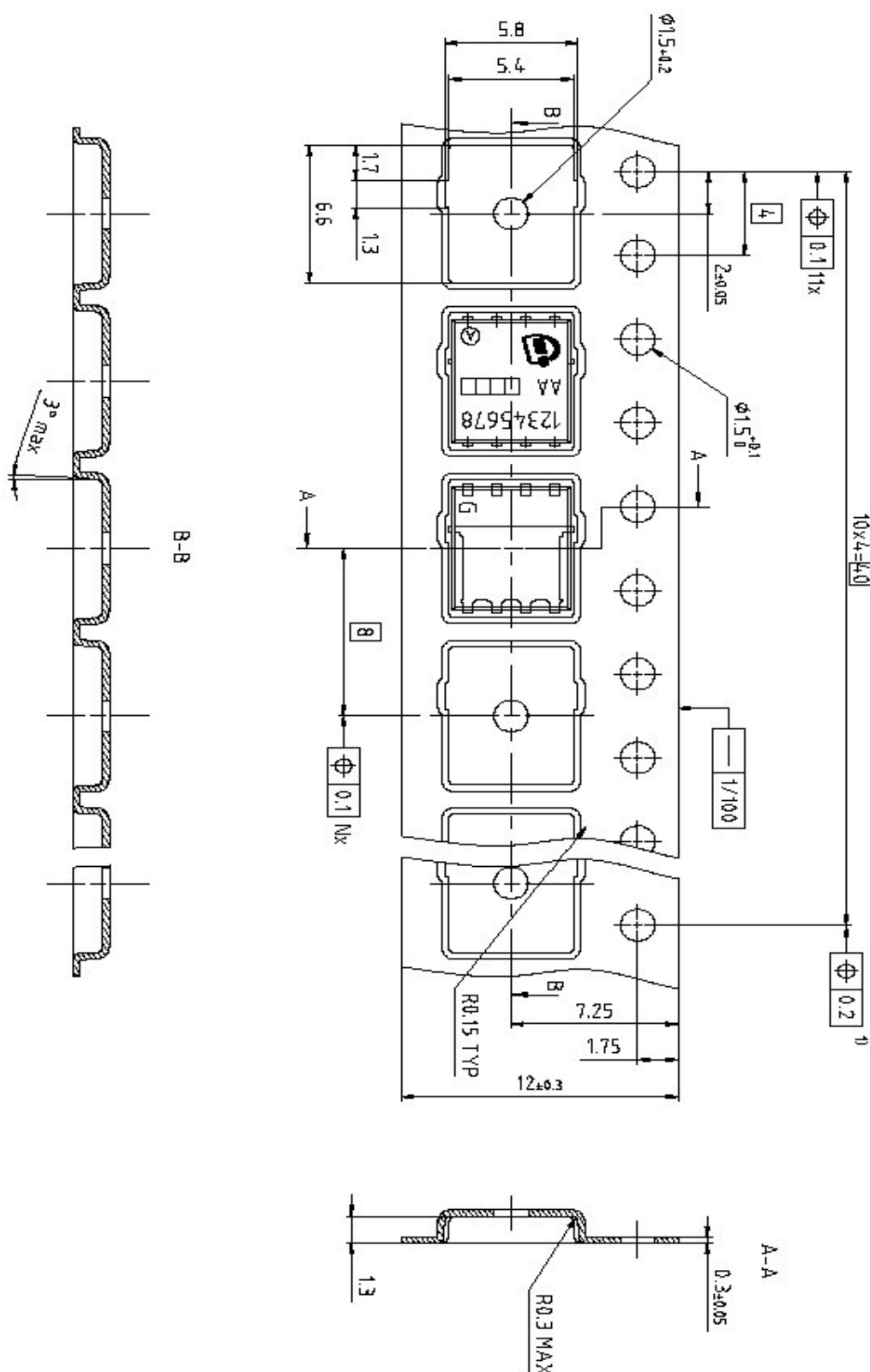
|                                    |
|------------------------------------|
| <b>DOCUMENT NO.</b><br>Z8B00003332 |
| <b>SCALE</b><br>0 2 4mm            |
| <b>EUROPEAN PROJECTION</b><br>     |
| <b>ISSUE DATE</b><br>10-04-2013    |
| <b>REVISION</b><br>04              |



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## Package Outline

## PG-TDSON-8: Tape



**Dimensions in mm**



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