

# MOSFET

Metal Oxide Semiconductor Field Effect Transistor

## OptiMOS™

OptiMOS™5 Power-Transistor, 80 V  
BSC052N08NS5

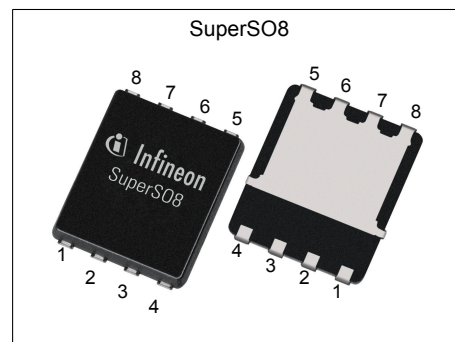
## Data Sheet

Rev. 2.0  
Final

## 1 Description

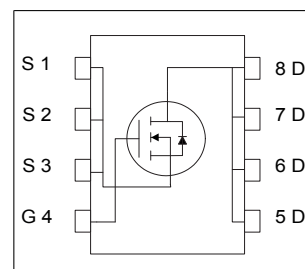
### Features

- Optimized for high performance SMPS, e.g. sync. rec.
- 100% avalanche tested
- Superior thermal resistance
- N-channel
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21



**Table 1 Key Performance Parameters**

| Parameter        | Value | Unit |
|------------------|-------|------|
| $V_{DS}$         | 80    | V    |
| $R_{DS(on),max}$ | 5.2   | mΩ   |
| $I_D$            | 95    | A    |
| $Q_{oss}$        | 39    | nC   |
| $Q_G(0V..10V)$   | 32    | nC   |



| Type / Ordering Code | Package    | Marking  | Related Links |
|----------------------|------------|----------|---------------|
| BSC052N08NS5         | PG-TDSON-8 | 052N08NS | -             |

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

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## 2 Maximum ratings

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

**Table 2 Maximum ratings**

| Parameter                                     | Symbol         | Values |      |                | Unit | Note / Test Condition                                                                                                                                                |
|-----------------------------------------------|----------------|--------|------|----------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                               |                | Min.   | Typ. | Max.           |      |                                                                                                                                                                      |
| Continuous drain current                      | $I_D$          | -      | -    | 95<br>60<br>19 | A    | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ , $R_{thJA}=50\text{K/W}^{(1)}$ |
| Pulsed drain current <sup>(2)</sup>           | $I_{D,pulse}$  | -      | -    | 380            | A    | $T_C=25\text{ °C}$                                                                                                                                                   |
| Avalanche energy, single pulse <sup>(3)</sup> | $E_{AS}$       | -      | -    | 70             | mJ   | $I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                                                                        |
| Gate source voltage                           | $V_{GS}$       | -20    | -    | 20             | V    | -                                                                                                                                                                    |
| Power dissipation                             | $P_{tot}$      | -      | -    | 83<br>2.5      | W    | $T_C=25\text{ °C}$<br>$T_A=25\text{ °C}$ , $R_{thJA}=50\text{ K/W}^{(1)}$                                                                                            |
| 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, bottom                  | $R_{thJC}$ | -      | 0.9  | 1.5  | K/W  | -                     |
| Thermal resistance, junction - case, top                     | $R_{thJC}$ | -      | -    | 20   | K/W  | -                     |
| Device on PCB, 6 cm <sup>2</sup> cooling area <sup>(1)</sup> | $R_{thJA}$ | -      | -    | 50   | K/W  | -                     |

<sup>(1)</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>(2)</sup> See figure 3 for more detailed information

<sup>(3)</sup> See figure 13 for more detailed information

## 4 Electrical characteristics

**Table 4 Static characteristics**

| Parameter                        | Symbol        | Values |            |            | Unit          | Note / Test Condition                                                                                                                                       |
|----------------------------------|---------------|--------|------------|------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  |               | Min.   | Typ.       | Max.       |               |                                                                                                                                                             |
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | 80     | -          | -          | V             | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                                                                                                     |
| Gate threshold voltage           | $V_{GS(th)}$  | 2.2    | 3.0        | 3.8        | V             | $V_{DS}=V_{GS}$ , $I_D=49\text{ }\mu\text{A}$                                                                                                               |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 0.1<br>10  | 1<br>100   | $\mu\text{A}$ | $V_{DS}=80\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_J=25\text{ }^\circ\text{C}$<br>$V_{DS}=80\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_J=125\text{ }^\circ\text{C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | 10         | 100        | nA            | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$                                                                                                                  |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 4.4<br>6.3 | 5.2<br>7.6 | m $\Omega$    | $V_{GS}=10\text{ V}$ , $I_D=47.5\text{ A}$<br>$V_{GS}=6\text{ V}$ , $I_D=23.8\text{ A}$                                                                     |
| Gate resistance <sup>1)</sup>    | $R_G$         | -      | 1.1        | 1.7        | $\Omega$      | -                                                                                                                                                           |
| Transconductance                 | $g_{fs}$      | 38     | 76         | -          | S             | $ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=47.5\text{ A}$                                                                                                        |

**Table 5 Dynamic characteristics**

| Parameter                                  | Symbol       | Values |      |      | Unit | Note / Test Condition                                                                              |
|--------------------------------------------|--------------|--------|------|------|------|----------------------------------------------------------------------------------------------------|
|                                            |              | Min.   | Typ. | Max. |      |                                                                                                    |
| Input capacitance <sup>1)</sup>            | $C_{iss}$    | -      | 2200 | 2900 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Output capacitance <sup>1)</sup>           | $C_{oss}$    | -      | 370  | 480  | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Reverse transfer capacitance <sup>1)</sup> | $C_{rss}$    | -      | 18   | 32   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Turn-on delay time                         | $t_{d(on)}$  | -      | 12   | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=47.5\text{ A}$ ,<br>$R_{G,ext}=3\text{ }\Omega$ |
| Rise time                                  | $t_r$        | -      | 7    | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=47.5\text{ A}$ ,<br>$R_{G,ext}=3\text{ }\Omega$ |
| Turn-off delay time                        | $t_{d(off)}$ | -      | 19   | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=47.5\text{ A}$ ,<br>$R_{G,ext}=3\text{ }\Omega$ |
| Fall time                                  | $t_f$        | -      | 5    | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=47.5\text{ A}$ ,<br>$R_{G,ext}=3\text{ }\Omega$ |

<sup>1)</sup> Defined by design. Not subject to production test.

**Table 6 Gate charge characteristics<sup>1)</sup>**

| Parameter                          | Symbol        | Values |      |      | Unit | Note / Test Condition                                                         |
|------------------------------------|---------------|--------|------|------|------|-------------------------------------------------------------------------------|
|                                    |               | Min.   | Typ. | Max. |      |                                                                               |
| Gate to source charge              | $Q_{gs}$      | -      | 11   | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=47.5\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge at threshold           | $Q_{g(th)}$   | -      | 6.2  | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=47.5\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge <sup>2)</sup> | $Q_{gd}$      | -      | 7.1  | 11   | nC   | $V_{DD}=40\text{ V}$ , $I_D=47.5\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge                   | $Q_{sw}$      | -      | 12   | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=47.5\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total <sup>2)</sup>    | $Q_g$         | -      | 32   | 40   | nC   | $V_{DD}=40\text{ V}$ , $I_D=47.5\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage               | $V_{plateau}$ | -      | 4.9  | -    | V    | $V_{DD}=40\text{ V}$ , $I_D=47.5\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total, sync. FET       | $Q_{g(sync)}$ | -      | 27   | -    | nC   | $V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$                      |
| Output charge <sup>2)</sup>        | $Q_{oss}$     | -      | 39   | 52   | nC   | $V_{DD}=40\text{ V}$ , $V_{GS}=0\text{ V}$                                    |

**Table 7 Reverse diode**

| Parameter                             | Symbol        | Values |      |      | Unit | Note / Test Condition                                                        |
|---------------------------------------|---------------|--------|------|------|------|------------------------------------------------------------------------------|
|                                       |               | Min.   | Typ. | Max. |      |                                                                              |
| Diode continuous forward current      | $I_S$         | -      | -    | 76   | A    | $T_C=25\text{ °C}$                                                           |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -    | 380  | A    | $T_C=25\text{ °C}$                                                           |
| Diode forward voltage                 | $V_{SD}$      | -      | 0.89 | 1.1  | V    | $V_{GS}=0\text{ V}$ , $I_F=47.5\text{ A}$ , $T_J=25\text{ °C}$               |
| Reverse recovery time <sup>2)</sup>   | $t_{rr}$      | -      | 37   | 74   | ns   | $V_R=40\text{ V}$ , $I_F=47.5\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge <sup>2)</sup> | $Q_{rr}$      | -      | 35   | 70   | nC   | $V_R=40\text{ V}$ , $I_F=47.5\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$ |

<sup>1)</sup> See "Gate charge waveforms" for parameter definition

<sup>2)</sup> Defined by design. Not subject to production test.

## 5 Electrical characteristics diagrams

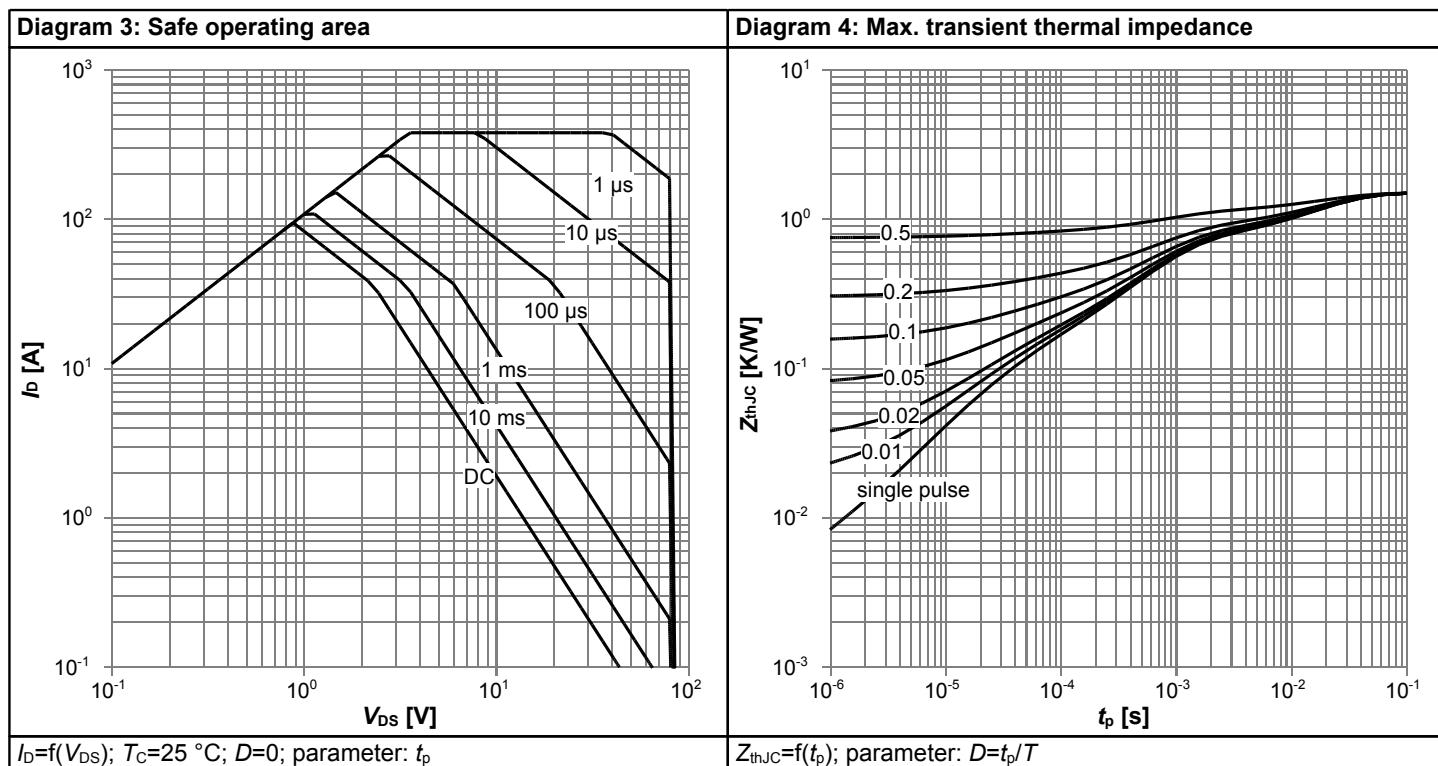
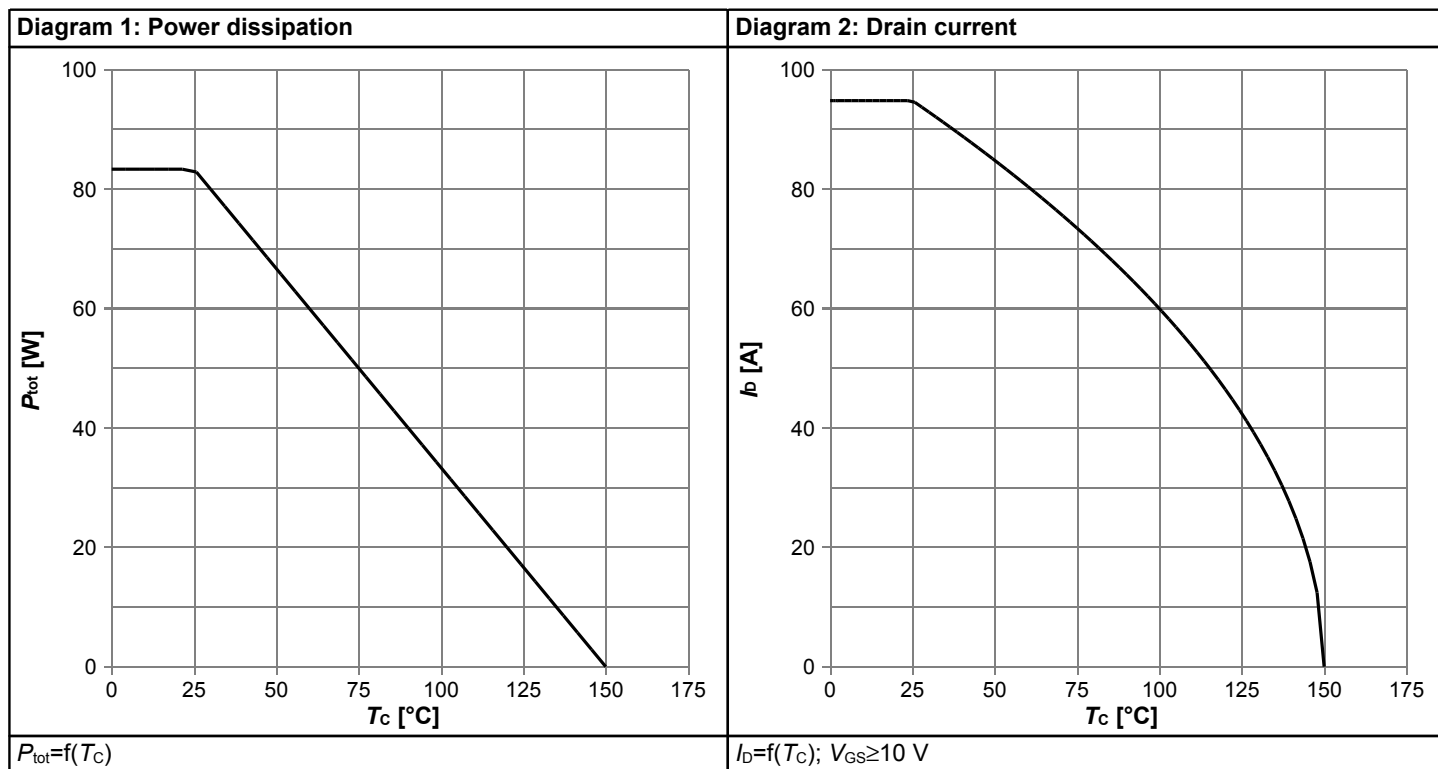


Diagram 5: Typ. output characteristics

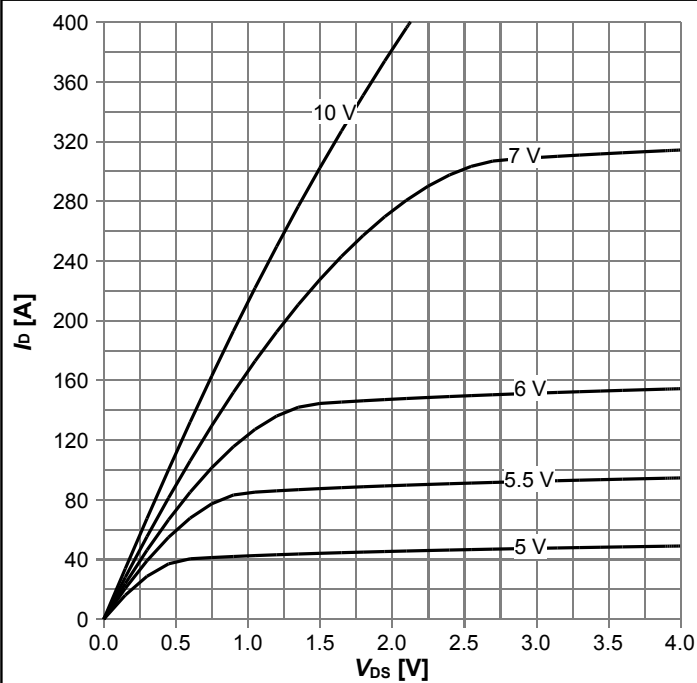

 $I_D = f(V_{DS})$ ;  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$ 

Diagram 6: Typ. drain-source on resistance

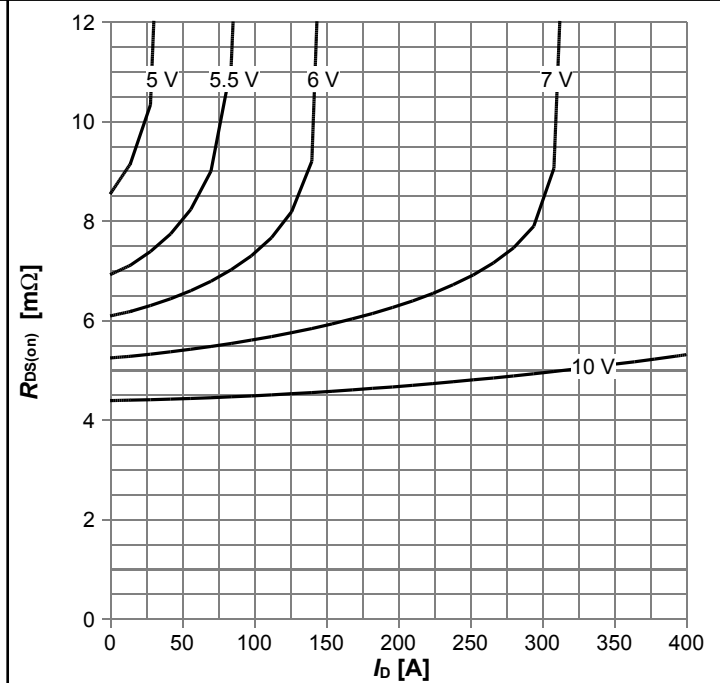

 $R_{DS(on)} = f(I_D)$ ;  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$ 

Diagram 7: Typ. transfer characteristics

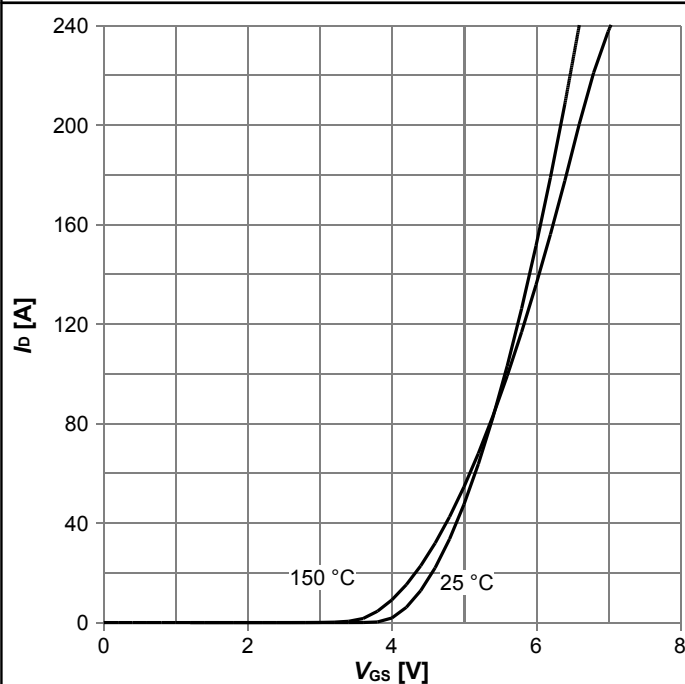

 $I_D = f(V_{GS})$ ;  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$ 

Diagram 8: Typ. forward transconductance

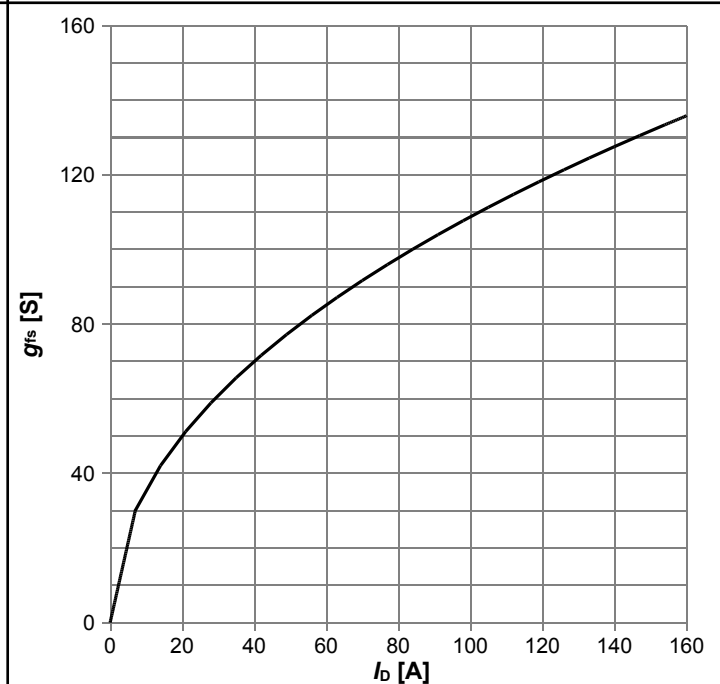
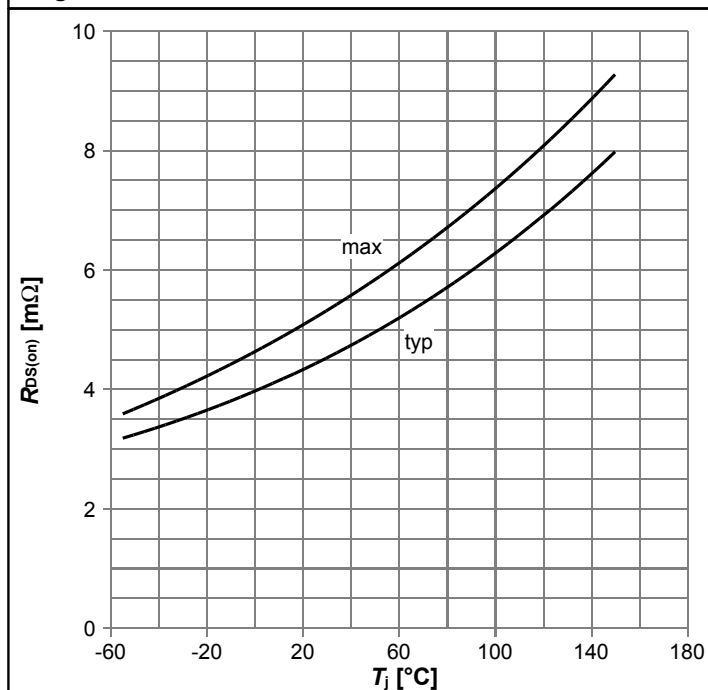
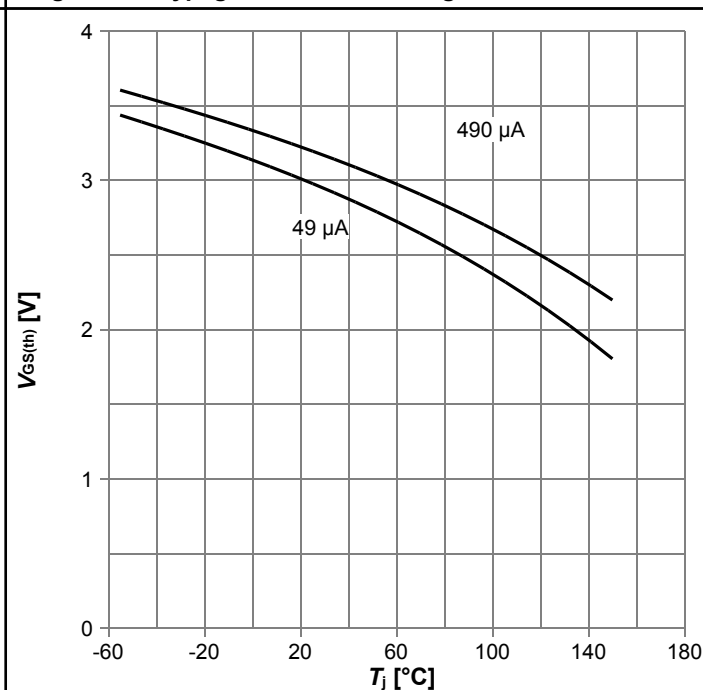

 $g_{fs} = f(I_D)$ ;  $T_j = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



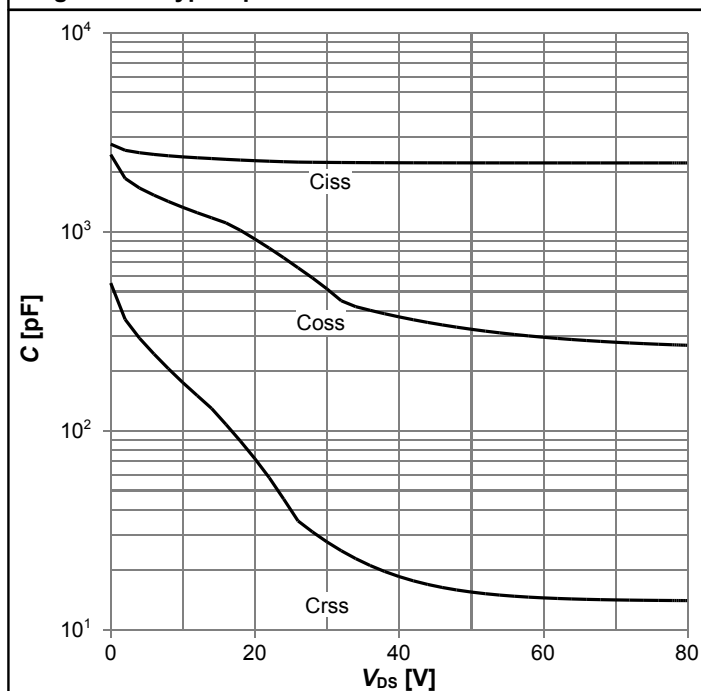
$$R_{DS(on)} = f(T_j); I_D = 47.5 \text{ A}; V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



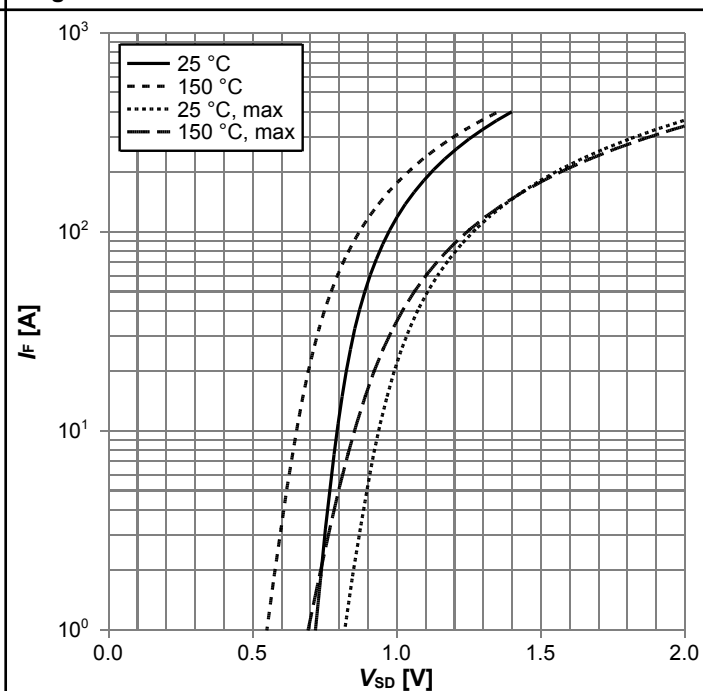
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

Diagram 11: Typ. capacitances



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

Diagram 12: Forward characteristics of reverse diode



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

Diagram 13: Avalanche characteristics

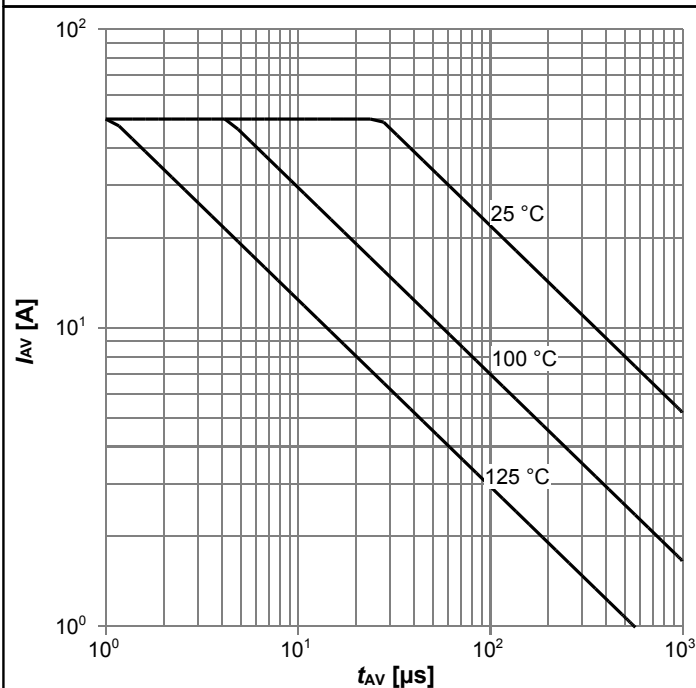

 $I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega; \text{parameter: } T_{j(\text{start})}$ 

Diagram 14: Typ. gate charge

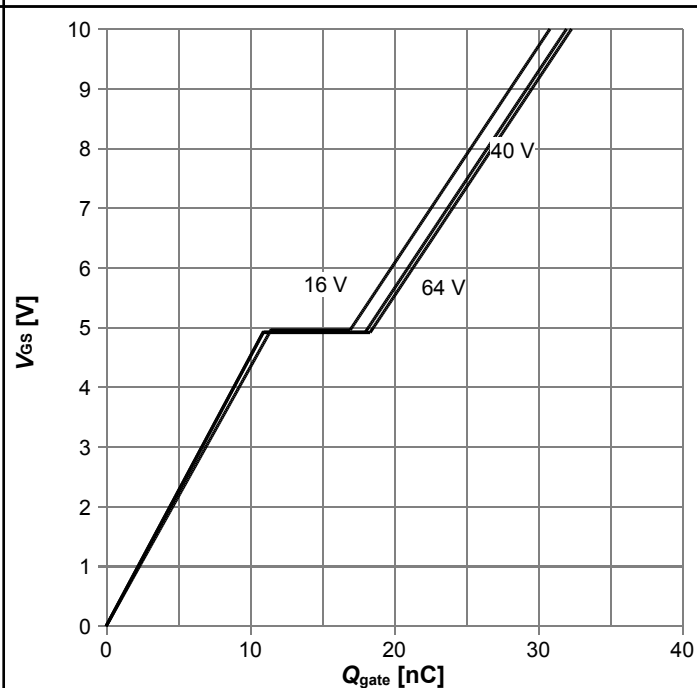
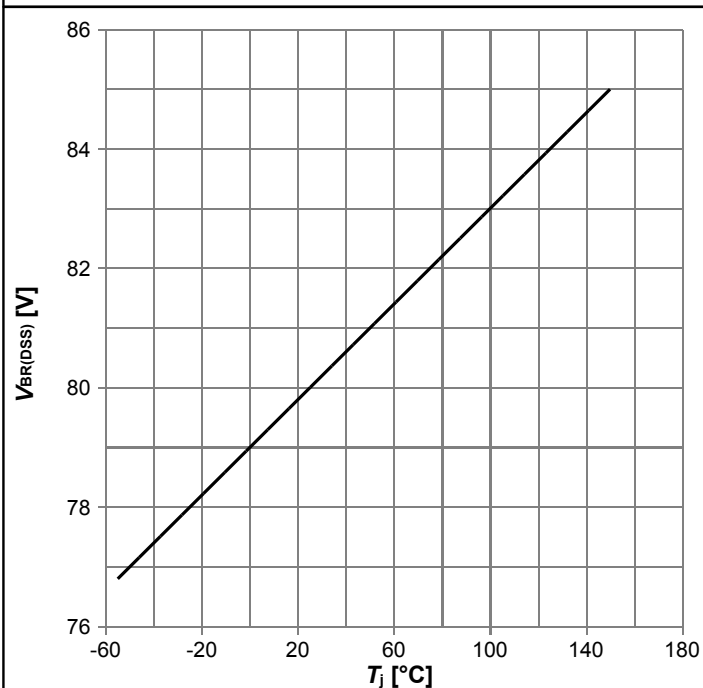
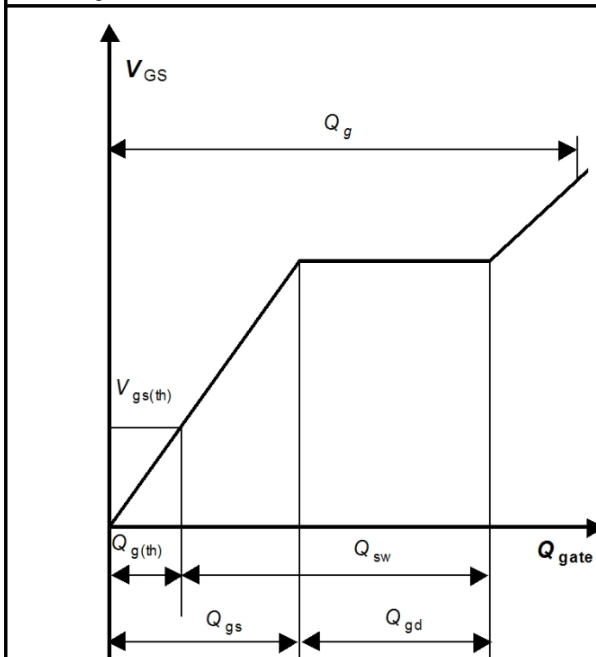

 $V_{GS}=f(Q_{\text{gate}}); I_D=47.5\ \text{A pulsed}; \text{parameter: } V_{DD}$ 

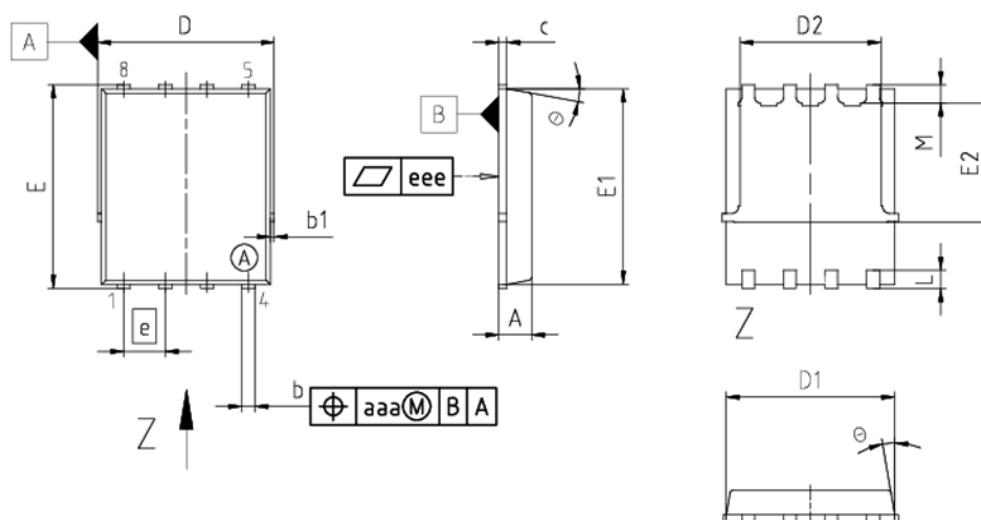
Diagram 15: Drain-source breakdown voltage


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

Gate charge waveforms



## 6 Package Outlines



| 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 |
| ø   | 8.5°        | 12°  |
| aaa | 0.25        |      |
| eee | 0.08        |      |

|                                                                                                              |
|--------------------------------------------------------------------------------------------------------------|
| DOCUMENT NO.<br>Z8B00003332                                                                                  |
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| EUROPEAN PROJECTION<br> |
| ISSUE DATE<br>10-04-2013                                                                                     |
| REVISION<br>04                                                                                               |

Figure 1 Outline PG-TDSON-8, dimensions in mm

## Revision History

BSC052N08NS5

**Revision: 2014-12-27, Rev. 2.0**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2014-12-27 | Release of final version                     |

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