

MOSFET

OptiMOS™5 Power-MOSFET, 30 V

Features

- Optimized for high performance buck converters
- Monolithic integrated Schottky-like diode
- Very low on-resistance $R_{DS(on)}$ @ $V_{GS}=4.5$ V
- 100% avalanche tested
- N-channel
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

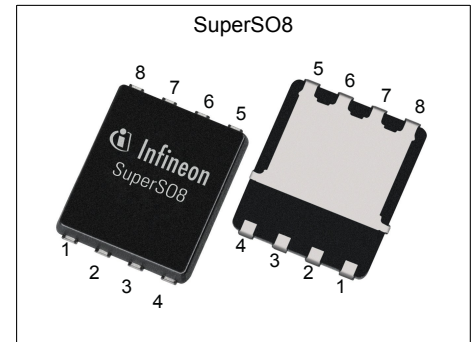
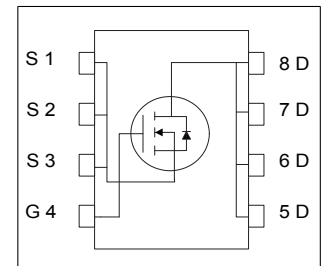


Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|------------------|-------|------------|
| V_{DS} | 30 | V |
| $R_{DS(on),max}$ | 1.9 | m Ω |
| I_D | 130 | A |
| Q_{OSS} | 17 | nC |
| $Q_G(0V..4.5V)$ | 11.4 | nC |



RoHS

| Type / Ordering Code | Package | Marking | Related Links |
|----------------------|------------|---------|---------------|
| BSC0501NSI | PG-TDSON-8 | 0501NSI | - |

¹⁾ J-STD20 and JESD22

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1 Maximum ratings

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

Table 2 Maximum ratings

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|-------------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Continuous drain current ¹⁾ | I_D | - | - | 130 | A | $V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=50\text{ K/W}^2)$ |
| | | - | - | 82 | | |
| | | - | - | 116 | | |
| | | - | - | 73 | | |
| | | - | - | 29 | | |
| Pulsed drain current ³⁾ | $I_{D,pulse}$ | - | - | 520 | A | $T_C=25\text{ °C}$ |
| Avalanche current, single pulse ⁴⁾ | I_{AS} | - | - | 50 | A | $T_C=25\text{ °C}$ |
| Avalanche energy, single pulse | E_{AS} | - | - | 20 | mJ | $I_D=50\text{ A}$, $R_{GS}=25\text{ }\Omega$ |
| Gate source voltage | V_{GS} | -20 | - | 20 | V | - |
| Power dissipation | P_{tot} | - | - | 50 | W | $T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=50\text{ K/W}^2)$ |
| | | - | - | 2.5 | | |
| Operating and storage temperature | T_j , T_{stg} | -55 | - | 150 | °C | IEC climatic category; DIN IEC 68-1: 55/150/56 |

2 Thermal characteristics

Table 3 Thermal characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|------------|--------|------|------|------|-----------------------|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case, bottom | R_{thJC} | - | - | 2.5 | K/W | - |
| Thermal resistance, junction - case, top | R_{thJC} | - | - | 20 | K/W | - |
| Device on PCB, 6 cm ² cooling area ²⁾ | R_{thJA} | - | - | 50 | K/W | - |

¹⁾ Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature at 25°C. For higher case temperature please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.

²⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

³⁾ See Diagram 3 for more detailed information

⁴⁾ See Diagram 13 for more detailed information

3 Electrical characteristics

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

Table 4 Static characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---------------------|--------|------|------|------------|--|
| | | Min. | Typ. | Max. | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | 30 | - | - | V | $V_{GS}=0\text{ V}$, $I_D=10\text{ mA}$ |
| Breakdown voltage temperature coefficient | $dV_{(BR)DSS}/dT_j$ | - | 15 | - | mV/K | $I_D=10\text{ mA}$, referenced to 25 °C |
| Gate threshold voltage | $V_{GS(th)}$ | 1.2 | - | 2 | V | $V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$ |
| Zero gate voltage drain current | I_{DSS} | - | - | 0.5 | mA | $V_{DS}=24\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ |
| | | - | 0.5 | - | | $V_{DS}=24\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$ |
| Gate-source leakage current | I_{GSS} | - | 10 | 100 | nA | $V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 2.0 | 2.4 | m Ω | $V_{GS}=4.5\text{ V}$, $I_D=30\text{ A}$ |
| | | - | 1.5 | 1.9 | | $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$ |
| Gate resistance | R_G | - | 1.4 | 2.3 | Ω | - |
| Transconductance | g_{fs} | 75 | 150 | - | S | $ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=30\text{ A}$ |

Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|----------------------------------|--------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Input capacitance ¹⁾ | C_{iss} | - | 1600 | 2200 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$ |
| Output capacitance ¹⁾ | C_{oss} | - | 530 | 720 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$ |
| Reverse transfer capacitance | C_{rss} | - | 54 | - | pF | $V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 4 | - | ns | $V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time | t_r | - | 4 | - | ns | $V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time | $t_{d(off)}$ | - | 22 | - | ns | $V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time | t_f | - | 3 | - | ns | $V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |

¹⁾ Defined by design. Not subject to production test

Table 6 Gate charge characteristics¹⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---------------------------------|---------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | Q_{gs} | - | 3.9 | - | nC | $V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge at threshold | $Q_{g(th)}$ | - | 2.5 | - | nC | $V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate to drain charge | Q_{gd} | - | 2.9 | - | nC | $V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Switching charge | Q_{sw} | - | 4.2 | - | nC | $V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total | Q_g | - | 11.4 | 15.4 | nC | $V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate plateau voltage | $V_{plateau}$ | - | 2.5 | - | V | $V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total ²⁾ | Q_g | - | 24 | 33 | nC | $V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | - | 10.5 | - | nC | $V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Output charge ²⁾ | Q_{oss} | - | 17 | 23 | nC | $V_{DD}=15\text{ V}$, $V_{GS}=0\text{ V}$ |

Table 7 Reverse diode

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|----------------------------------|---------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Diode continuous forward current | I_S | - | - | 50 | A | $T_C=25\text{ °C}$ |
| Diode pulse current | $I_{S,pulse}$ | - | - | 520 | A | $T_C=25\text{ °C}$ |
| Diode forward voltage | V_{SD} | - | 0.55 | 0.65 | V | $V_{GS}=0\text{ V}$, $I_F=7\text{ A}$, $T_j=25\text{ °C}$ |
| Reverse recovery charge | Q_{rr} | - | 20 | - | nC | $V_R=15\text{ V}$, $I_F=I_S$, $di_F/dt=400\text{ A}/\mu\text{s}$ |

¹⁾ See "Gate charge waveforms" for parameter definition

²⁾ Defined by design. Not subject to production test

4 Electrical characteristics diagrams

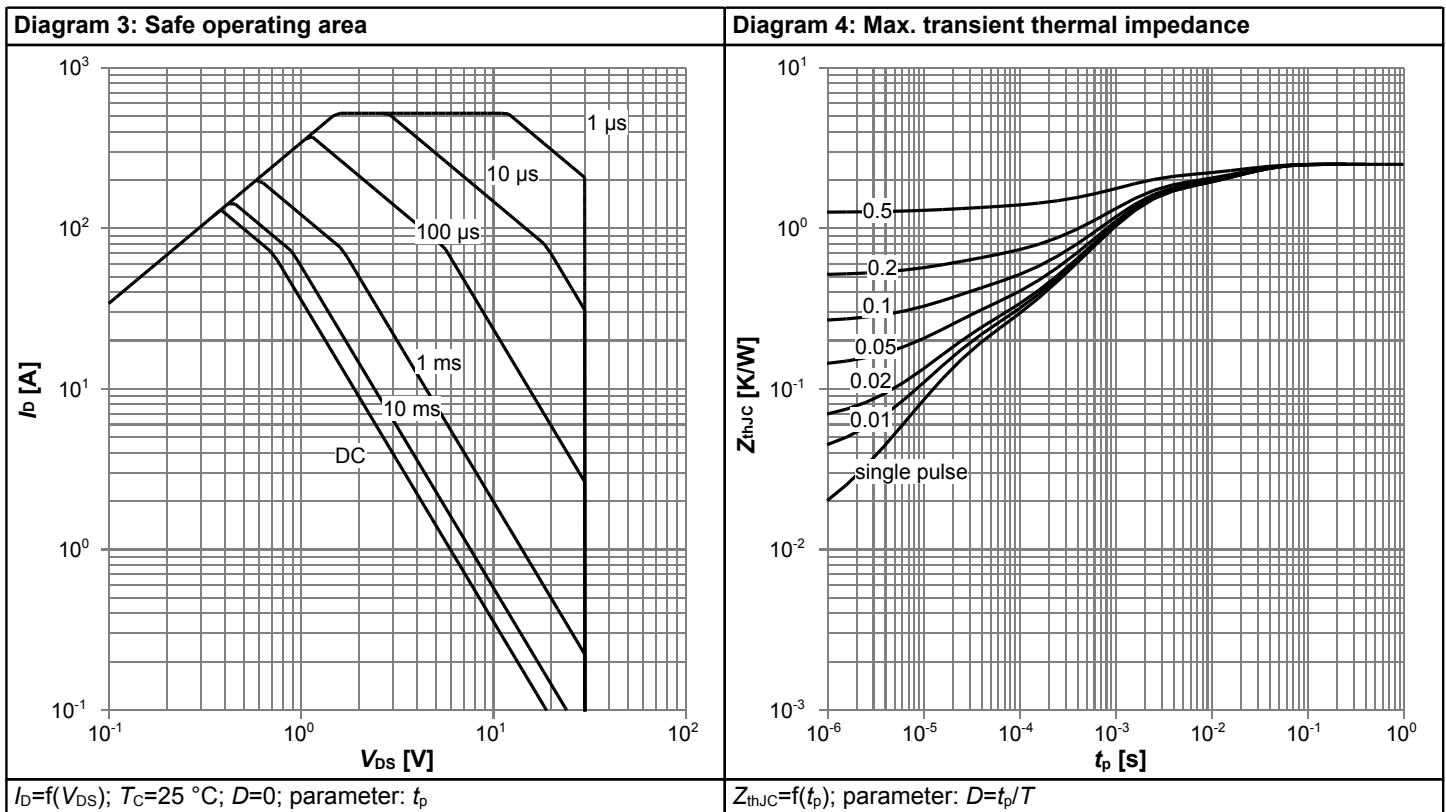
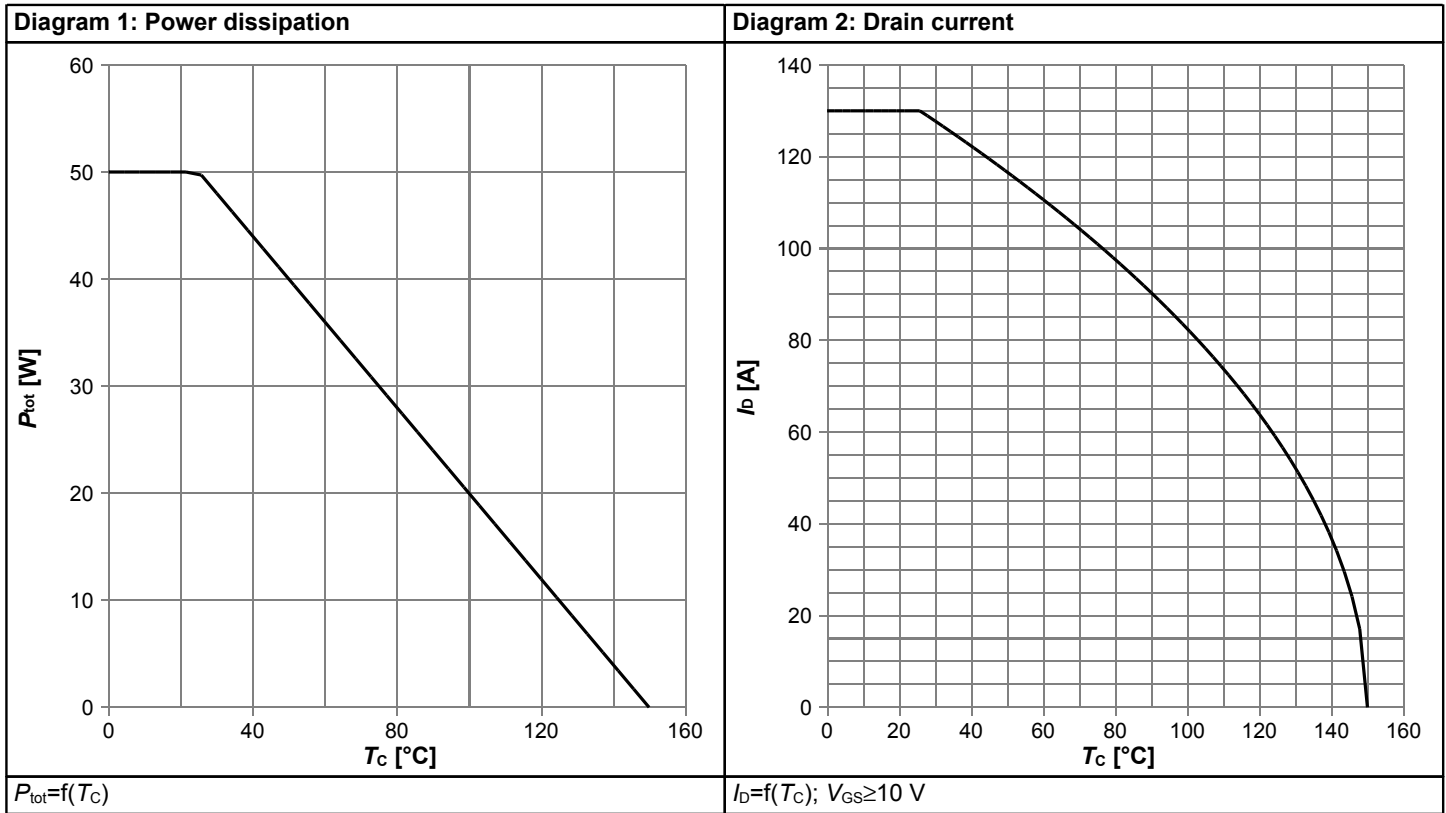
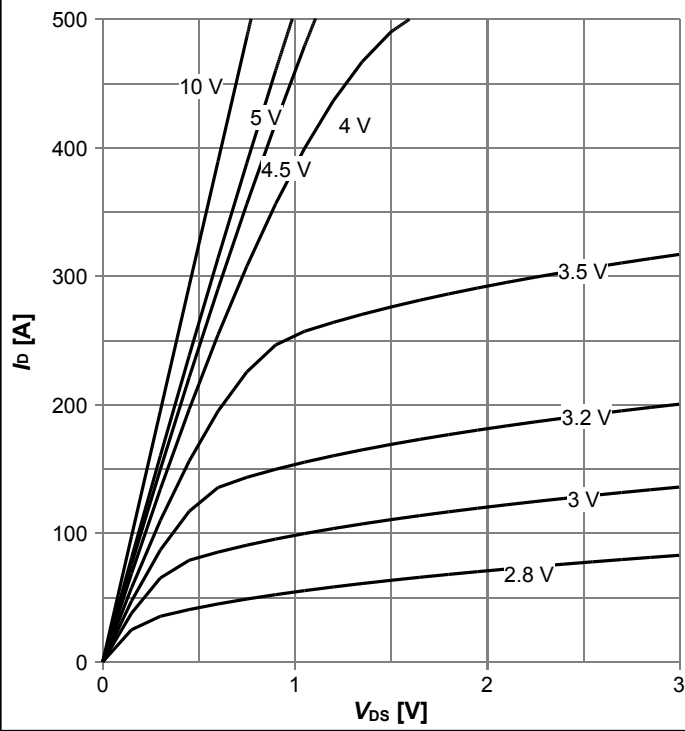
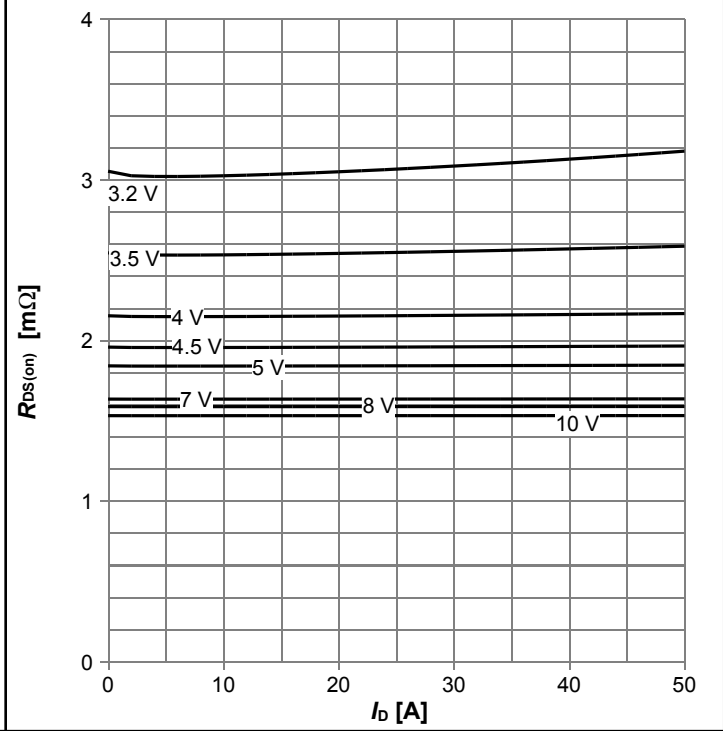


Diagram 5: Typ. output characteristics



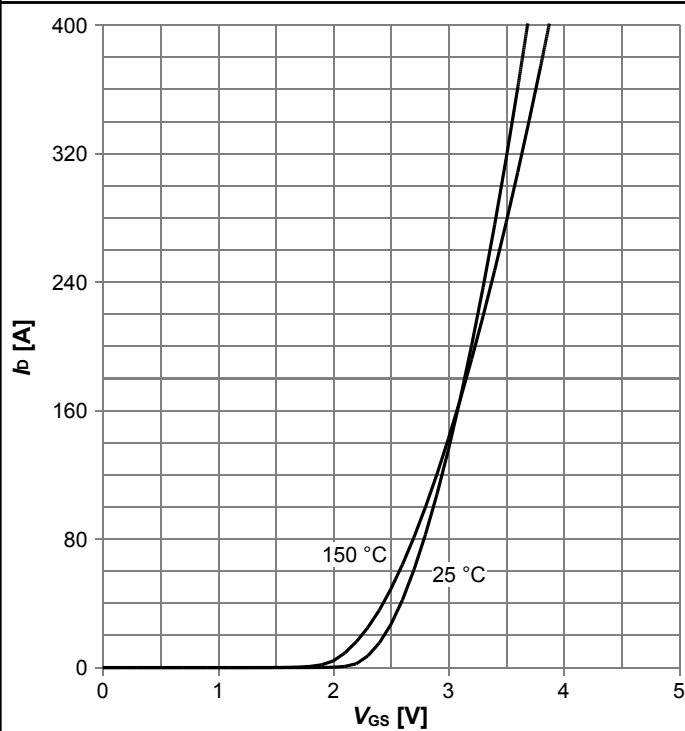
$I_D = f(V_{DS}); T_j = 25\text{ °C}; \text{parameter: } V_{GS}$

Diagram 6: Typ. drain-source on resistance



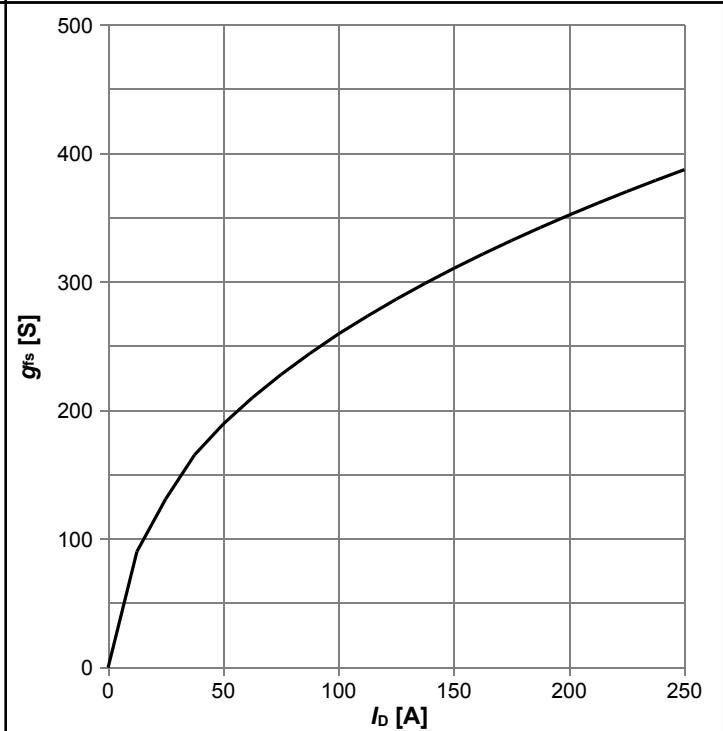
$R_{DS(on)} = f(I_D); T_j = 25\text{ °C}; \text{parameter: } V_{GS}$

Diagram 7: Typ. transfer characteristics



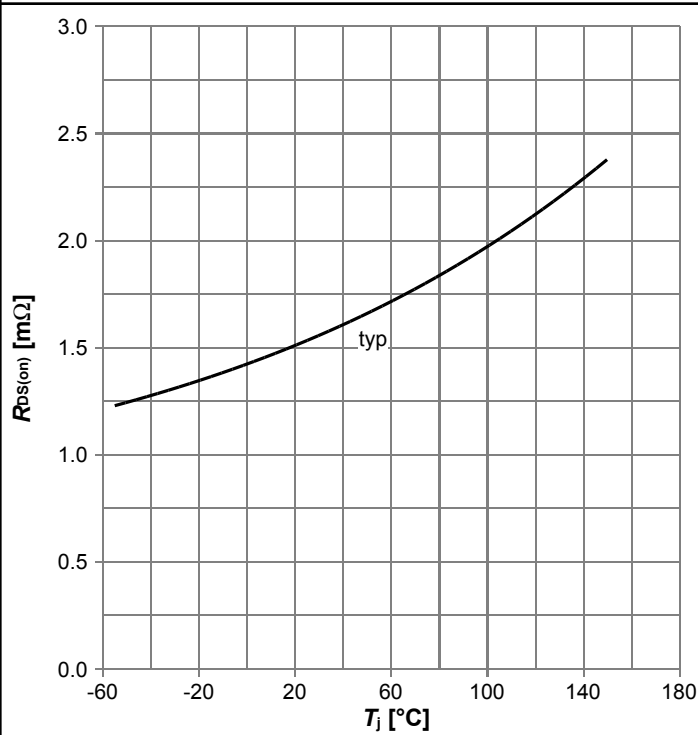
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}; \text{parameter: } T_j$

Diagram 8: Typ. forward transconductance



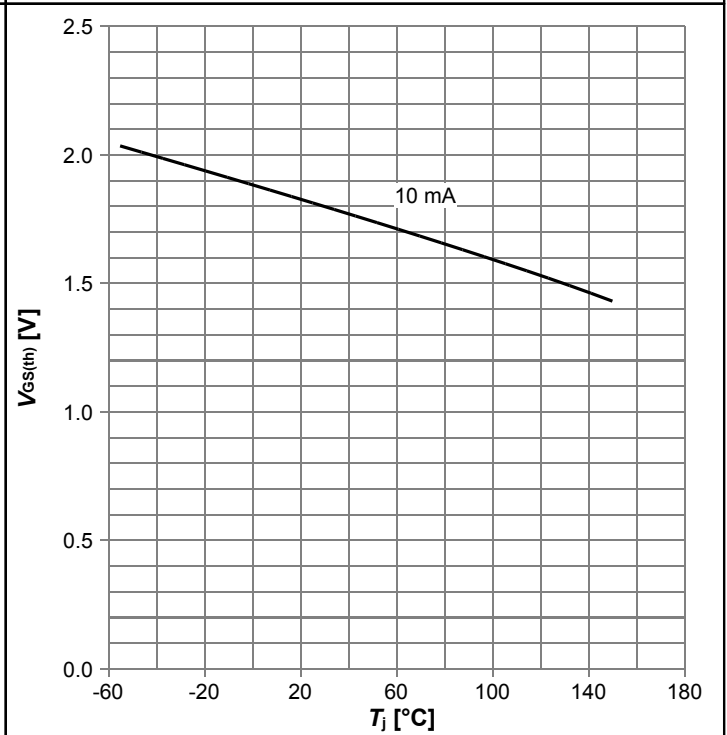
$g_{fs} = f(I_D); T_j = 25\text{ °C}$

Diagram 9: Drain-source on-state resistance



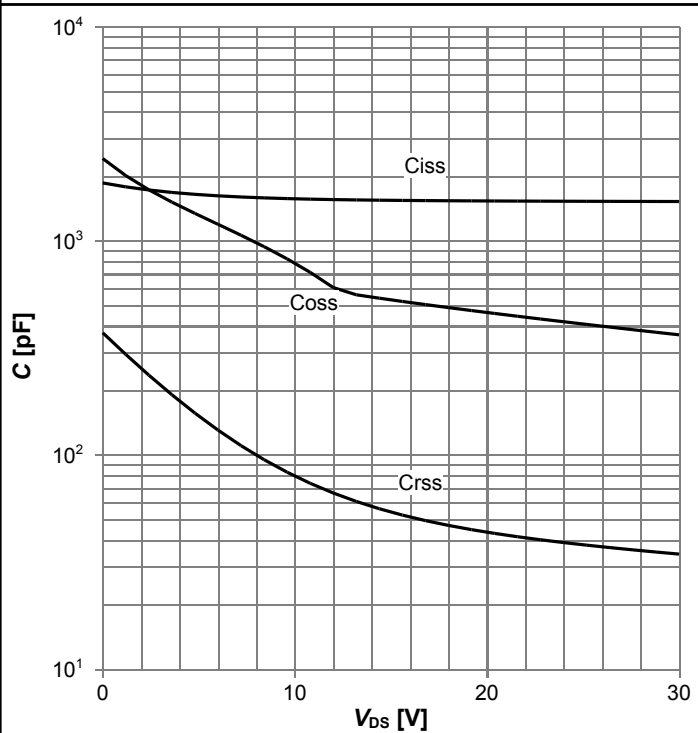
$R_{DS(on)}=f(T_j)$; $I_D=30\text{ A}$; $V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



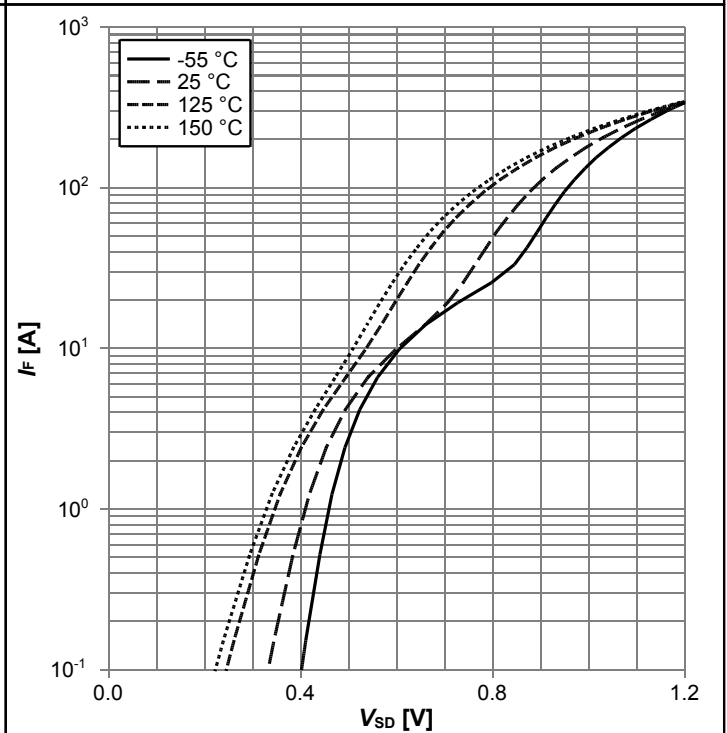
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$

Diagram 11: Typ. capacitances



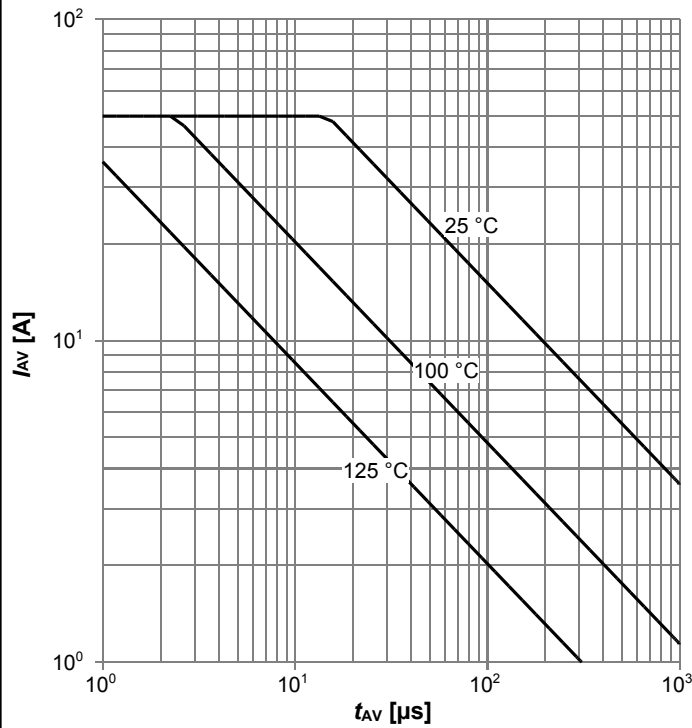
$C=f(V_{DS})$; $V_{GS}=0\text{ V}$; $f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



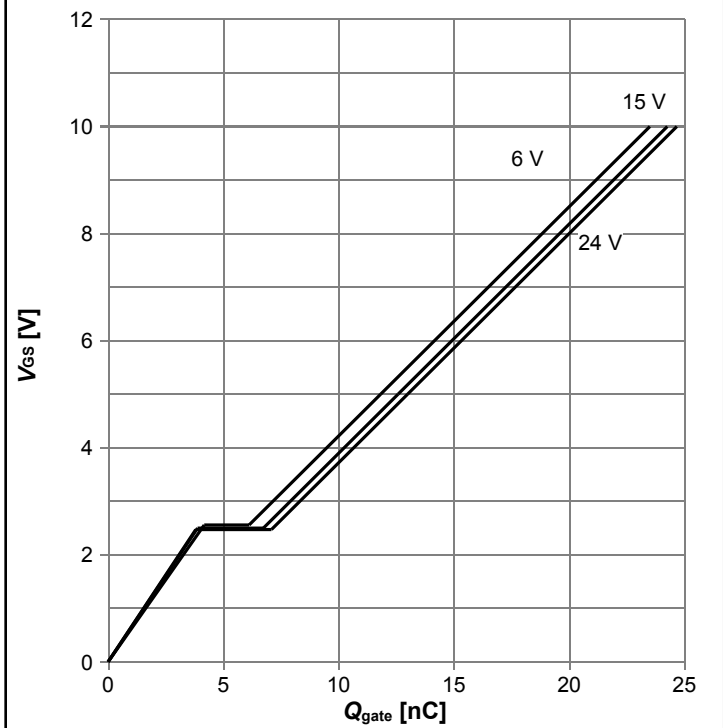
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



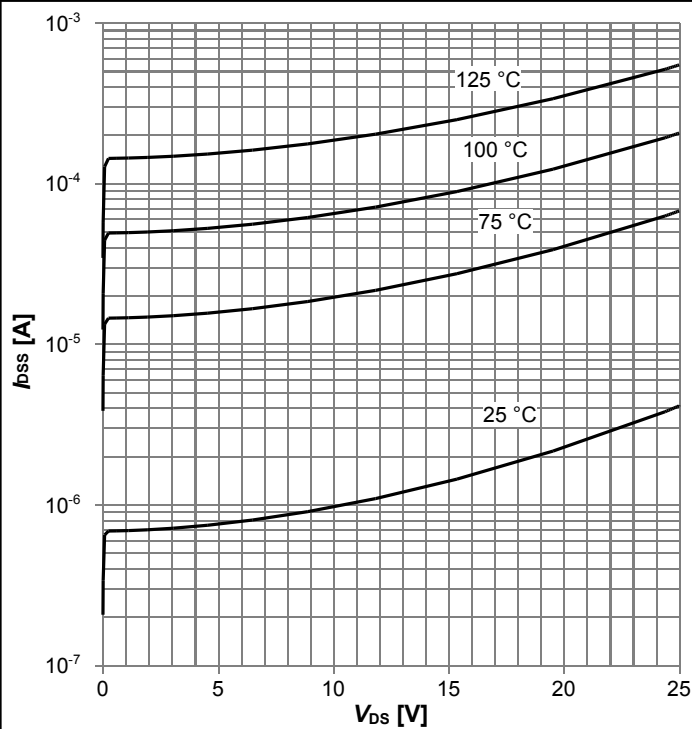
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



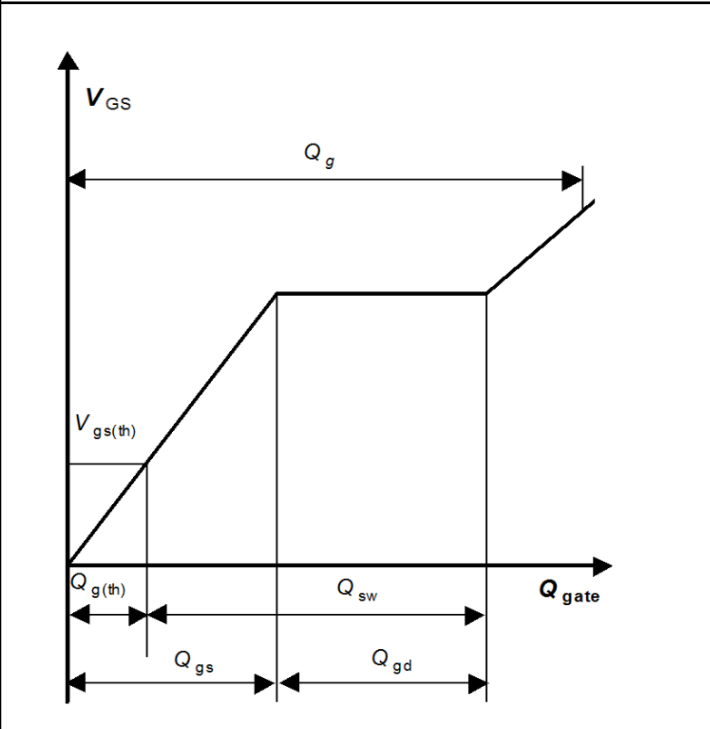
$V_{GS}=f(Q_{gate}); I_D=30 \text{ A pulsed}$; parameter: V_{DD}

Diagram 15: Typ. drain-source leakage current

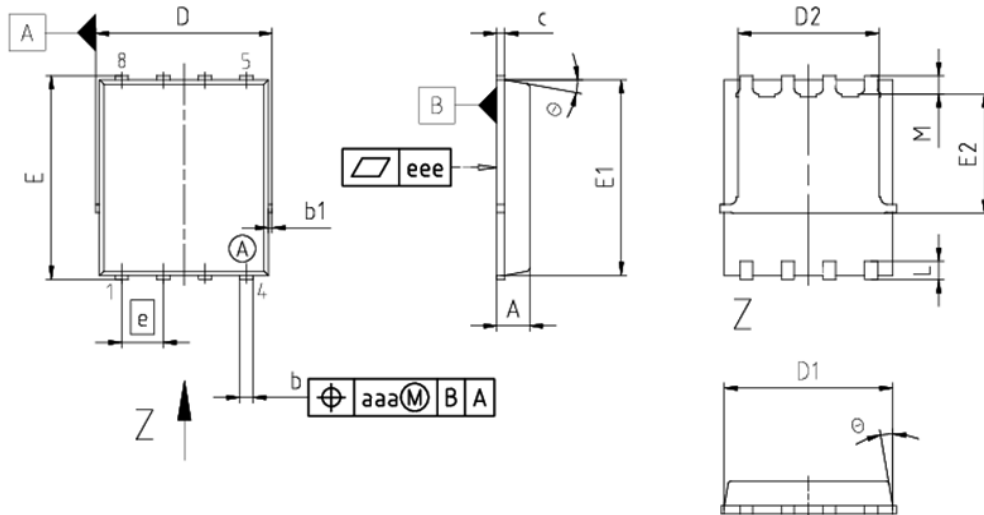


$I_{BSS}=f(V_{DS}); V_{GS}=0 \text{ V}$; parameter: T_j

Diagram Gate charge waveforms



5 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 |
| θ | 8.5° | 12° |
| aaa | 0.25 | |
| eee | 0.08 | |

| |
|------------------------------------|
| DOCUMENT NO. Z8B00003332 |
| SCALE 0 2 4mm |
| EUROPEAN PROJECTION |
| ISSUE DATE 10-04-2013 |
| REVISION 04 |

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

Revision History

BSC0501NSI

Revision: 2020-07-06, Rev. 2.1

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.0 | 2015-07-13 | Release of final version |
| 2.1 | 2020-07-06 | Update current rating |

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