

# MOSFET

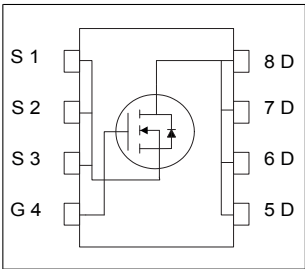
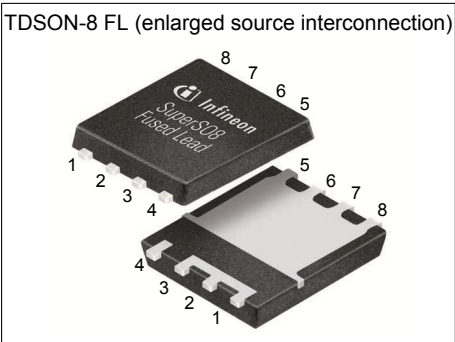
## OptiMOS™ Power-MOSFET, 60 V

### Features

- Optimized for synchronous rectification
- 175 °C rated
- 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
- Higher solder joint reliability due to enlarged source interconnection

Table 1 Key Performance Parameters

| Parameter        | Value | Unit |
|------------------|-------|------|
| $V_{DS}$         | 60    | V    |
| $R_{DS(on),max}$ | 1.6   | mΩ   |
| $I_D$            | 234   | A    |
| $Q_{OSS}$        | 81    | nC   |
| $Q_G(0V..10V)$   | 71    | nC   |



RoHS

| Type / Ordering Code | Package       | Marking  | Related Links |
|----------------------|---------------|----------|---------------|
| BSC016N06NST         | PG-TDSON-8 FL | 016N06NT | -             |

<sup>1)</sup> 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 <sup>1)</sup>       | $I_D$             | -      | -    | 234<br>164<br>31 | A    | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ K/W}^2)$ |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$     | -      | -    | 936              | A    | $T_C=25\text{ °C}$                                                                                                                                                 |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$          | -      | -    | 380              | mJ   | $I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                                                                      |
| Gate source voltage                          | $V_{GS}$          | -20    | -    | 20               | V    | -                                                                                                                                                                  |
| Power dissipation                            | $P_{tot}$         | -      | -    | 167<br>3.0       | W    | $T_C=25\text{ °C}$<br>$T_A=25\text{ °C}$ , $R_{thJA}=50\text{ K/W}$                                                                                                |
| Operating and storage temperature            | $T_j$ , $T_{stg}$ | -55    | -    | 175              | °C   | -                                                                                                                                                                  |

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

| Parameter                                                   | Symbol     | Values |      |      | Unit | Note / Test Condition |
|-------------------------------------------------------------|------------|--------|------|------|------|-----------------------|
|                                                             |            | Min.   | Typ. | Max. |      |                       |
| Thermal resistance, junction - case, bottom                 | $R_{thJC}$ | -      | 0.5  | 0.9  | K/W  | -                     |
| Thermal resistance, junction - case, top                    | $R_{thJC}$ | -      | -    | 20   | K/W  | -                     |
| Device on PCB, 6 cm <sup>2</sup> cooling area <sup>2)</sup> | $R_{thJA}$ | -      | -    | 50   | K/W  | -                     |

<sup>1)</sup> 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.

<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

### 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   | $V_{(BR)DSS}$ | 60     | -          | -          | V             | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                                                                             |
| Gate threshold voltage           | $V_{GS(th)}$  | 2.1    | 2.8        | 3.3        | V             | $V_{DS}=V_{GS}$ , $I_D=95\text{ }\mu\text{A}$                                                                                       |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 0.5<br>10  | 1<br>100   | $\mu\text{A}$ | $V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$<br>$V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | 10         | 100        | nA            | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$                                                                                          |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 1.4<br>1.9 | 1.6<br>2.4 | m $\Omega$    | $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$<br>$V_{GS}=6\text{ V}$ , $I_D=12.5\text{ A}$                                               |
| Gate resistance <sup>1)</sup>    | $R_G$         | -      | 1.9        | 2.9        | $\Omega$      | -                                                                                                                                   |
| Transconductance                 | $g_{fs}$      | 70     | 140        | -          | S             | $ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=50\text{ A}$                                                                                  |

**Table 5 Dynamic characteristics<sup>1)</sup>**

| Parameter                    | Symbol       | Values |      |      | Unit | Note / Test Condition                                                                              |
|------------------------------|--------------|--------|------|------|------|----------------------------------------------------------------------------------------------------|
|                              |              | Min.   | Typ. | Max. |      |                                                                                                    |
| Input capacitance            | $C_{iss}$    | 3900   | 5200 | 6500 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$                                      |
| Output capacitance           | $C_{oss}$    | 900    | 1200 | 1500 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$                                      |
| Reverse transfer capacitance | $C_{rss}$    | 14     | 48   | 96   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$                                      |
| Turn-on delay time           | $t_{d(on)}$  | -      | 19   | 38   | ns   | $V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                    | $t_r$        | -      | 9    | 18   | ns   | $V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time          | $t_{d(off)}$ | -      | 35   | 70   | ns   | $V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                    | $t_f$        | -      | 9    | 18   | ns   | $V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |

**Table 6 Gate charge characteristics<sup>2)</sup>**

| Parameter                    | Symbol        | Values |      |      | Unit | Note / Test Condition                                                       |
|------------------------------|---------------|--------|------|------|------|-----------------------------------------------------------------------------|
|                              |               | Min.   | Typ. | Max. |      |                                                                             |
| Gate to source charge        | $Q_{gs}$      | 16     | 22   | 30   | nC   | $V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge at threshold     | $Q_{g(th)}$   | 10     | 14   | 19   | nC   | $V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge         | $Q_{gd}$      | 8.8    | 13   | 20   | nC   | $V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge             | $Q_{sw}$      | 14     | 21   | 30   | nC   | $V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total            | $Q_g$         | 58     | 71   | 95   | nC   | $V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage         | $V_{plateau}$ | 3.7    | 4.3  | 4.9  | V    | $V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | 49     | 62   | 86   | nC   | $V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$                    |
| Output charge                | $Q_{oss}$     | 60     | 81   | 102  | nC   | $V_{DD}=30\text{ V}$ , $V_{GS}=0\text{ V}$                                  |

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

<sup>2)</sup> See "Gate charge waveforms" for parameter definition. Defined by design, not subject to production test

**Table 7 Reverse diode**

| Parameter                             | Symbol        | Values |      |      | Unit | Note / Test Condition                                                      |
|---------------------------------------|---------------|--------|------|------|------|----------------------------------------------------------------------------|
|                                       |               | Min.   | Typ. | Max. |      |                                                                            |
| Diode continuous forward current      | $I_S$         | -      | -    | 167  | A    | $T_C=25\text{ °C}$                                                         |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -    | 936  | A    | $T_C=25\text{ °C}$                                                         |
| Diode forward voltage                 | $V_{SD}$      | -      | 0.9  | 1.2  | V    | $V_{GS}=0\text{ V}$ , $I_F=50\text{ A}$ , $T_j=25\text{ °C}$               |
| Reverse recovery time <sup>1)</sup>   | $t_{rr}$      | 24     | 61   | 98   | ns   | $V_R=30\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge <sup>1)</sup> | $Q_{rr}$      | 39     | 78   | 156  | nC   | $V_R=30\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$ |

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

## 4 Electrical characteristics diagrams

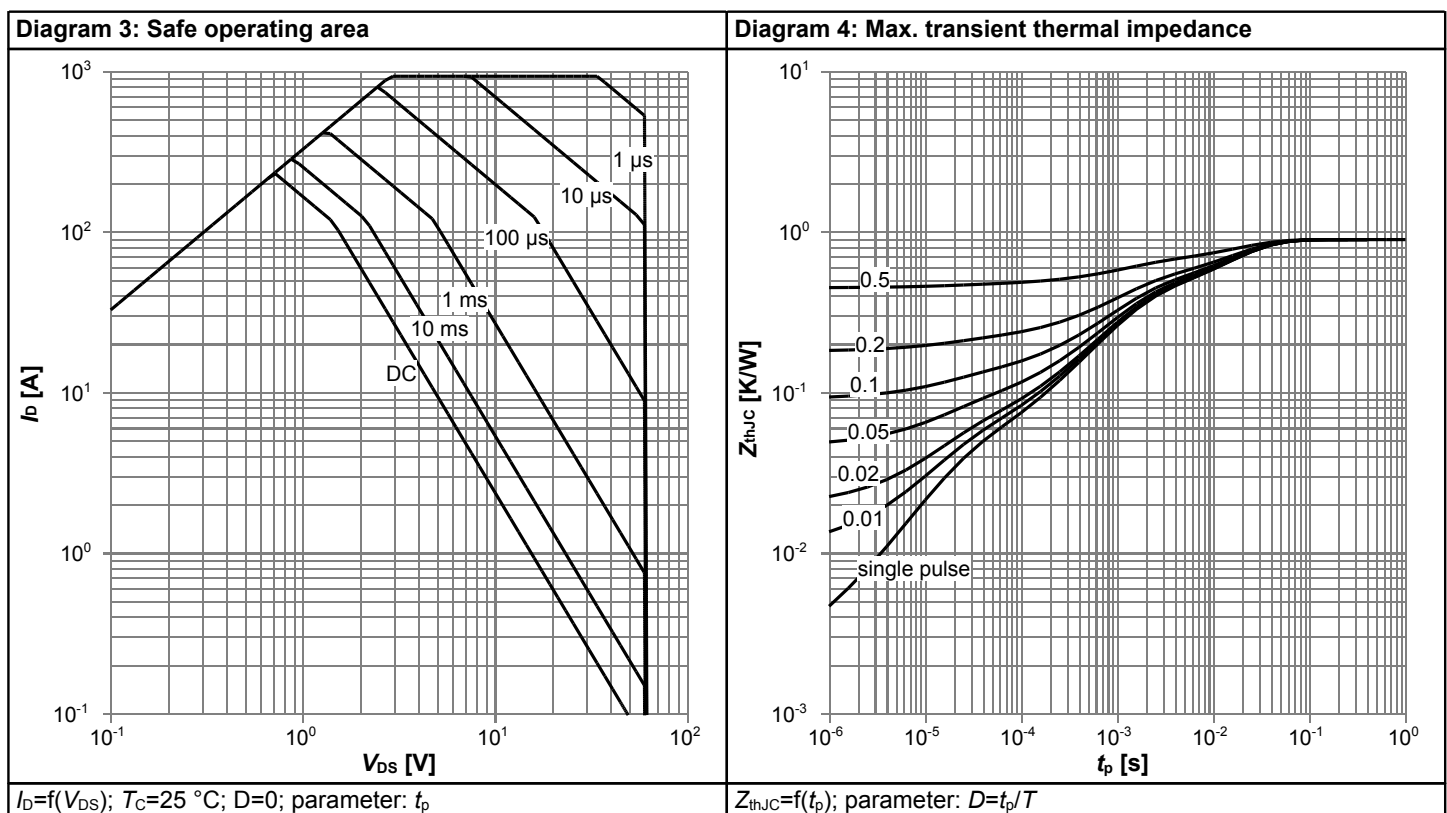
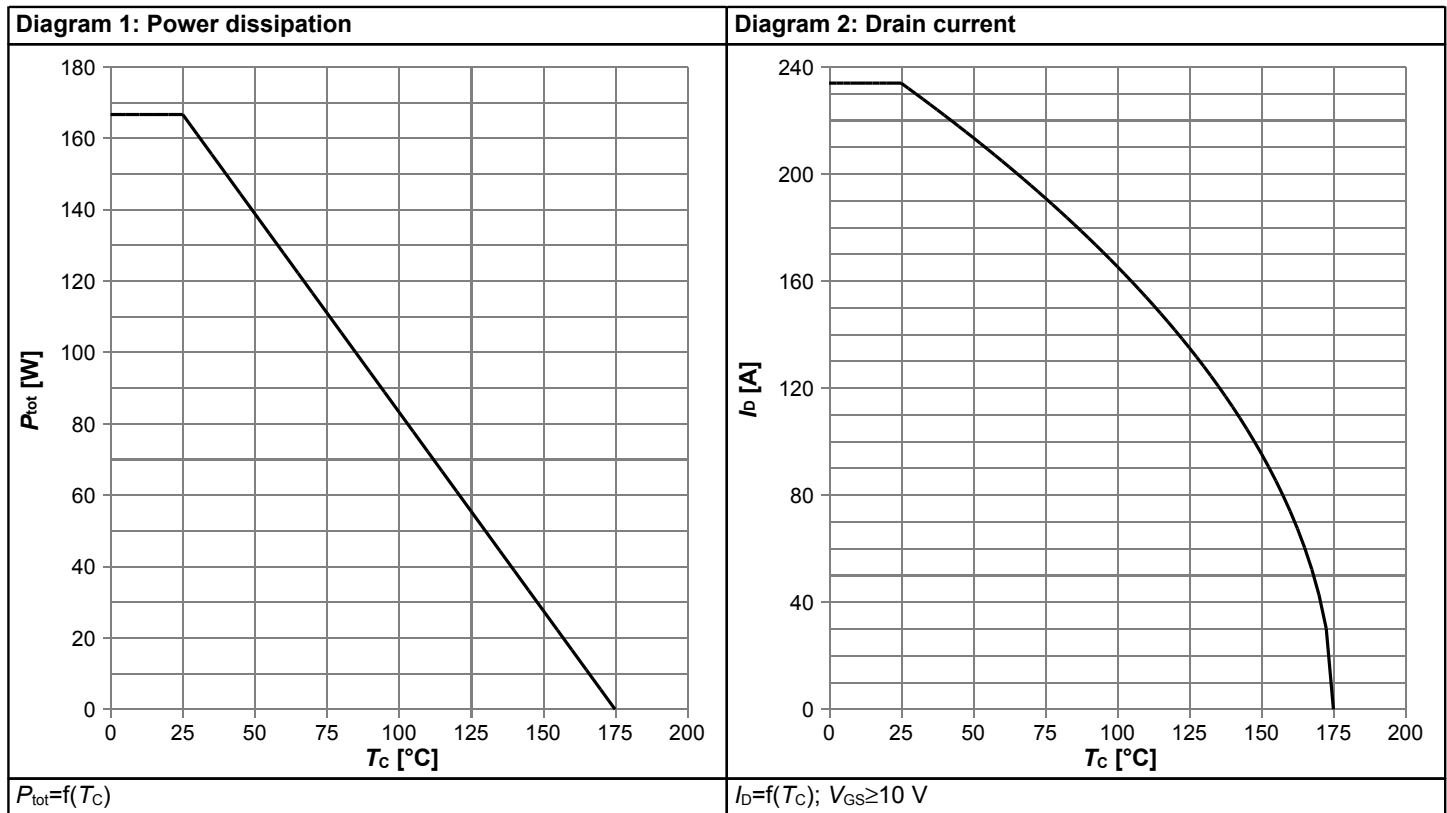
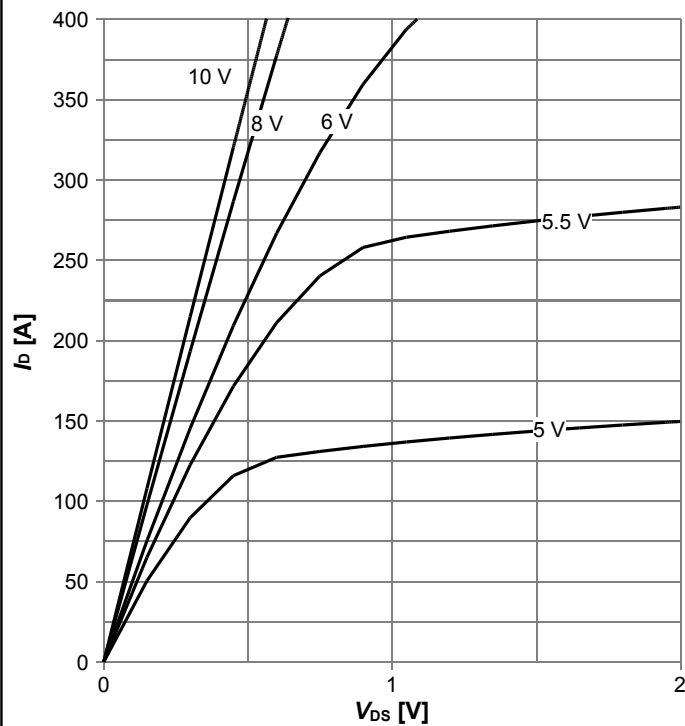
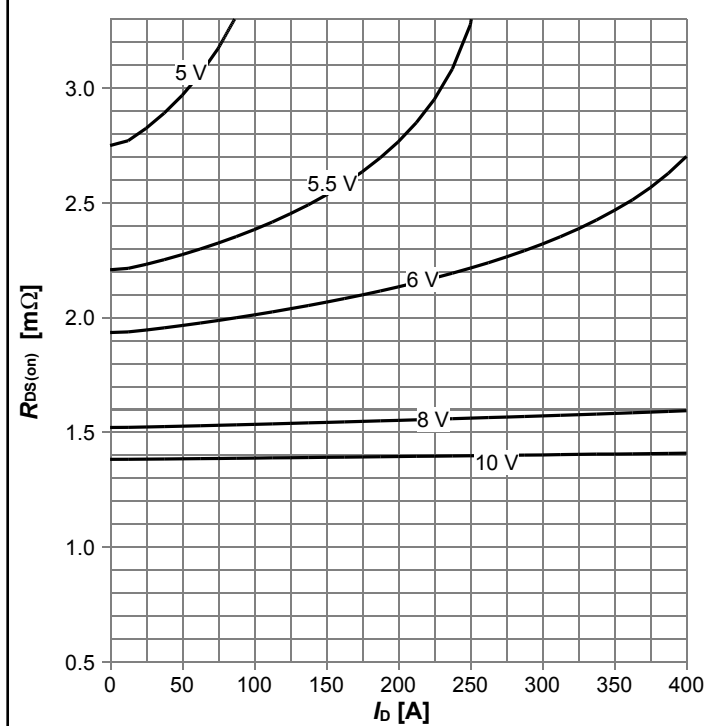


Diagram 5: Typ. output characteristics



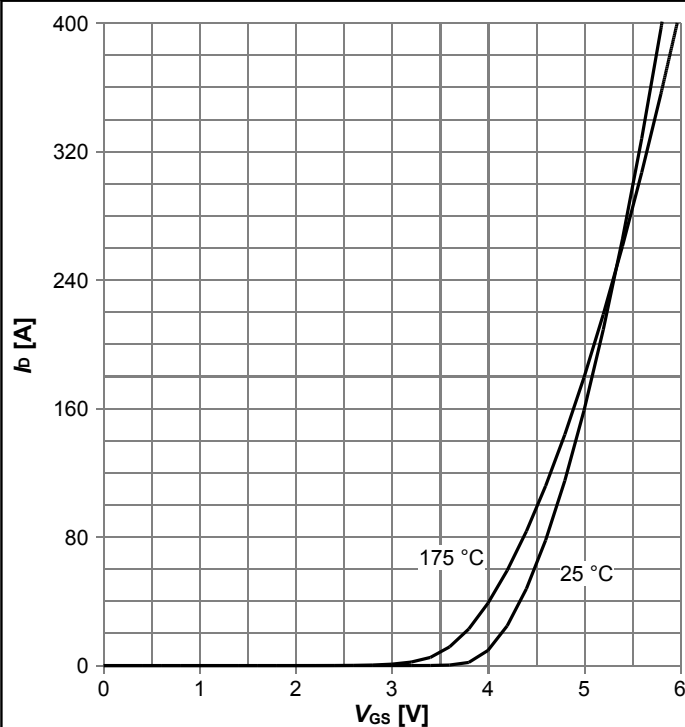
$I_D = f(V_{DS})$ ;  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



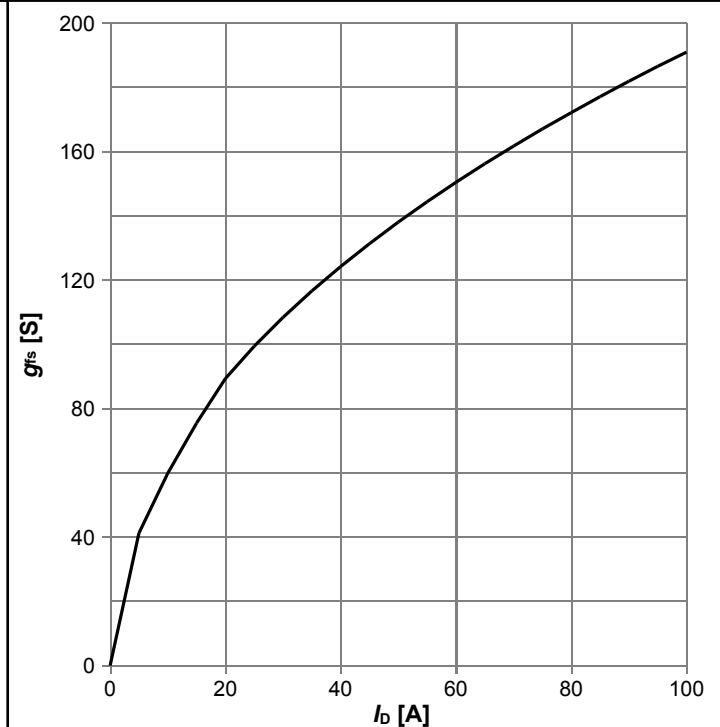
$R_{DS(on)} = f(I_D)$ ;  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



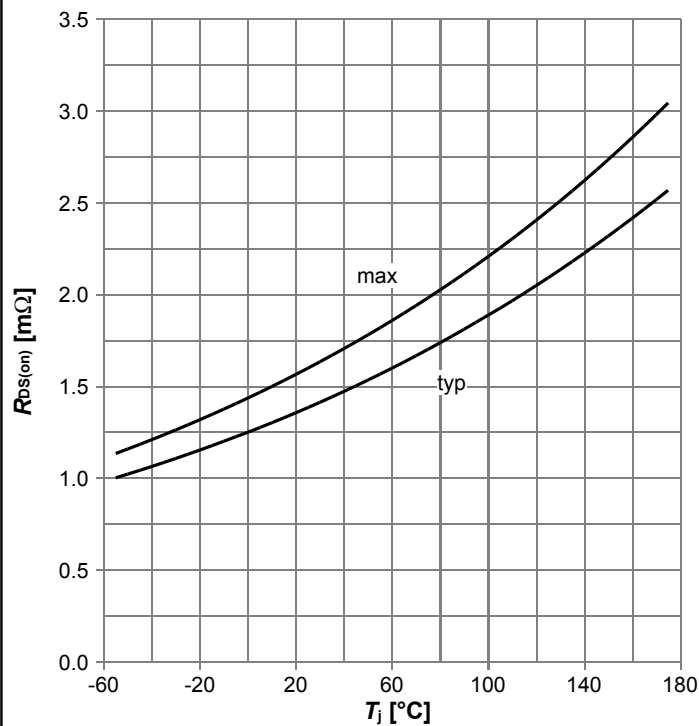
$I_D = f(V_{GS})$ ;  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$

Diagram 8: Typ. forward transconductance



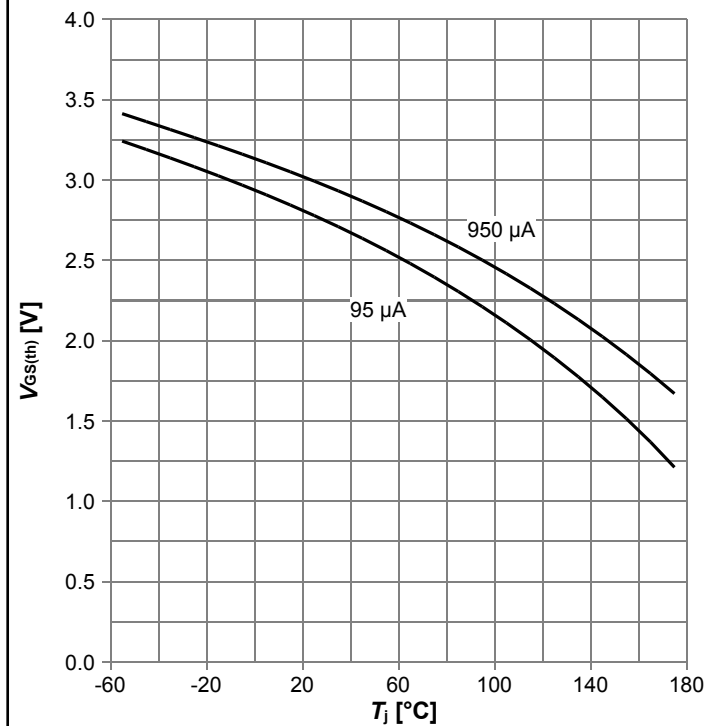
$g_{fs} = f(I_D)$ ;  $T_j = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



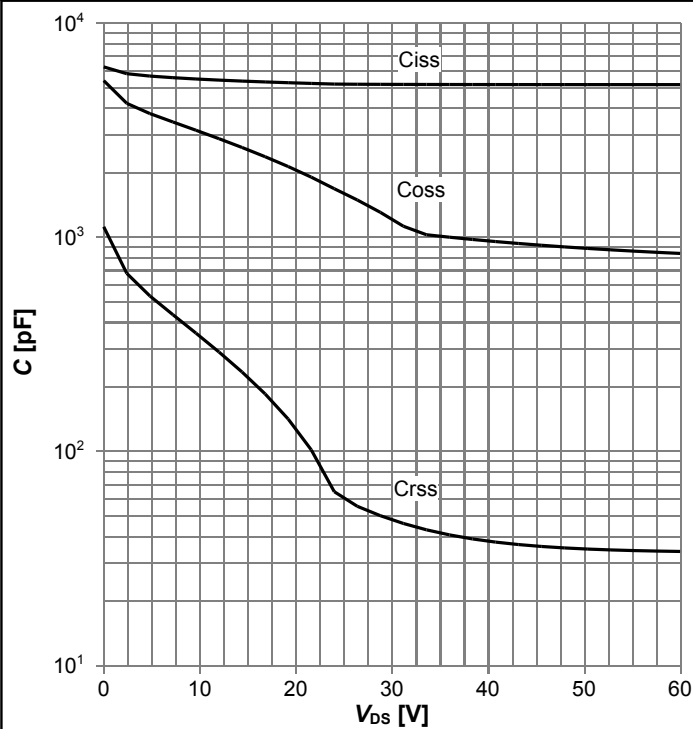
$R_{DS(on)} = f(T_j)$ ;  $I_D = 50 \text{ A}$ ;  $V_{GS} = 10 \text{ V}$

Diagram 10: Typ. gate threshold voltage



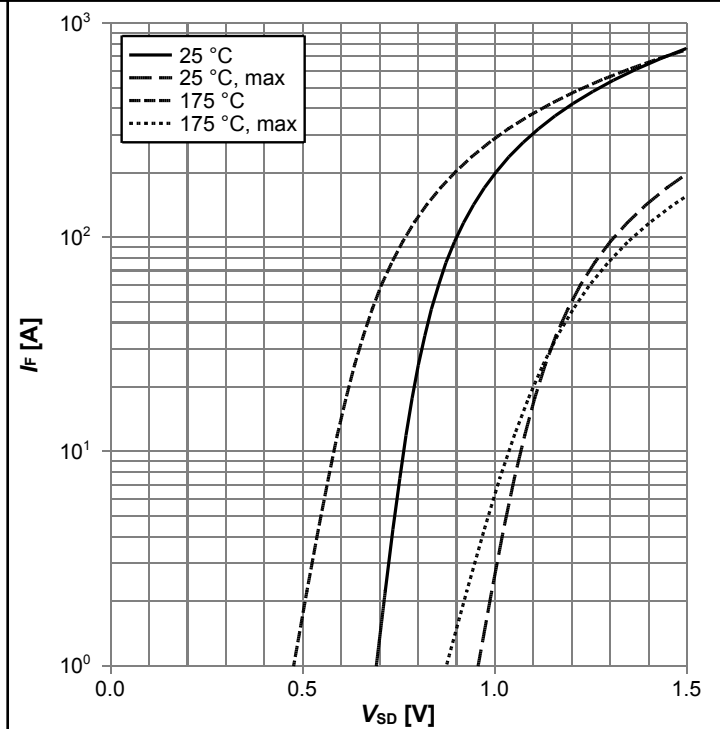
$V_{GS(th)} = f(T_j)$ ;  $V_{GS} = V_{DS}$

Diagram 11: Typ. capacitances



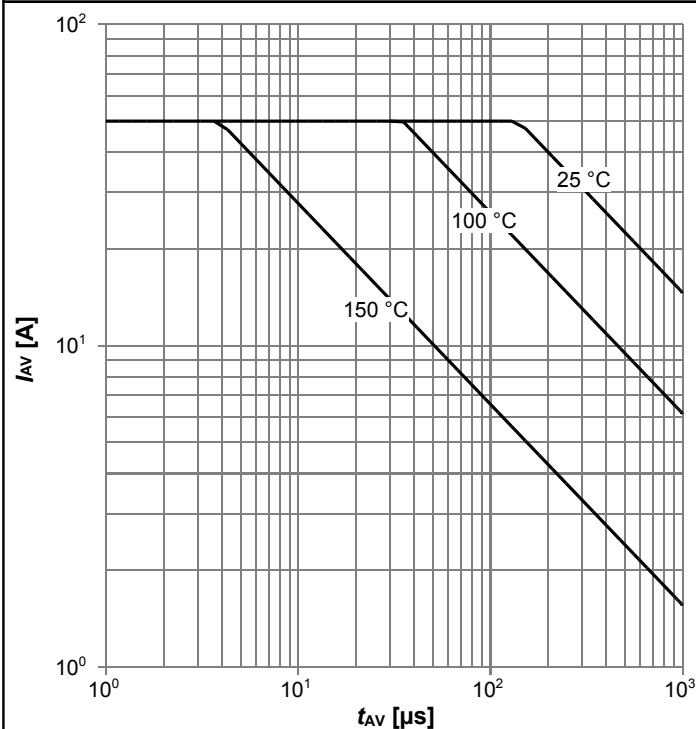
$C = f(V_{DS})$ ;  $V_{GS} = 0 \text{ V}$ ;  $f = 1 \text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



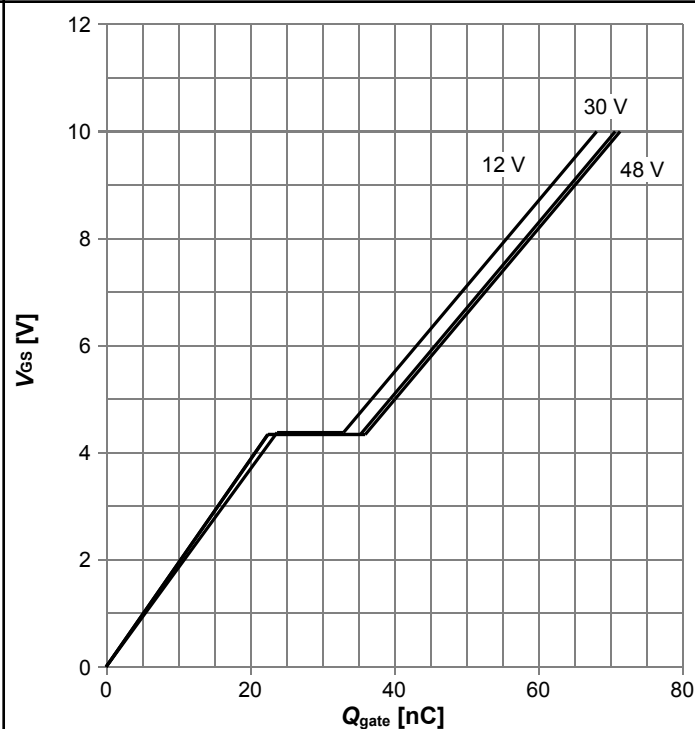
$I_F = f(V_{SD})$ ; parameter:  $T_j$

Diagram 13: Avalanche characteristics



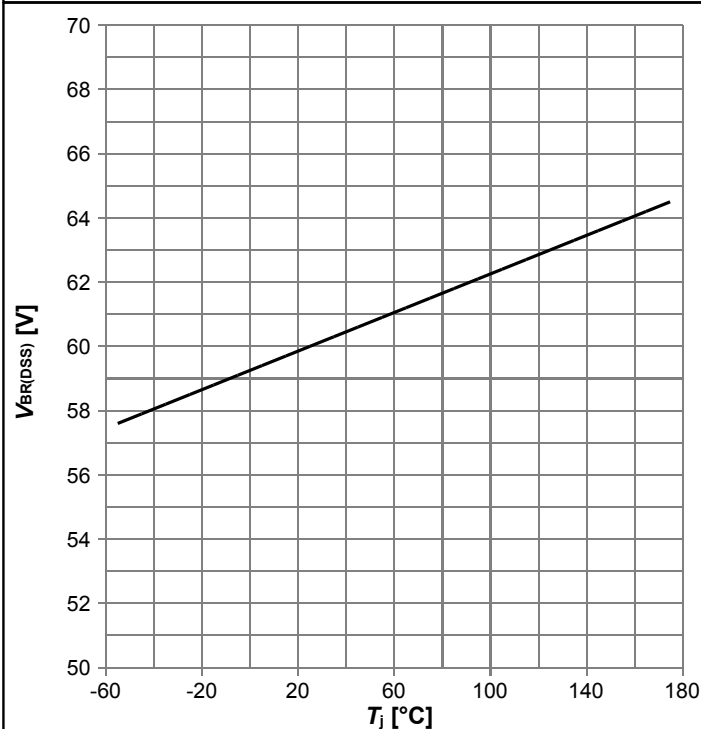
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25\ \Omega$ ; parameter:  $T_{j(start)}$

Diagram 14: Typ. gate charge



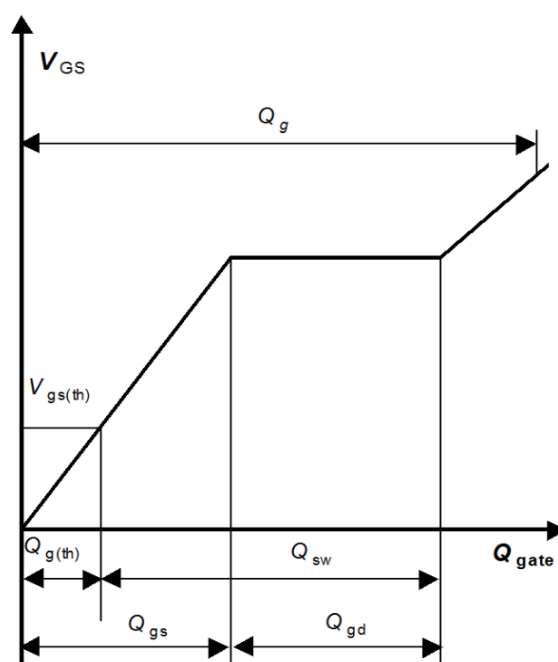
$V_{GS}=f(Q_{gate})$ ;  $I_D=50\text{ A}$  pulsed; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

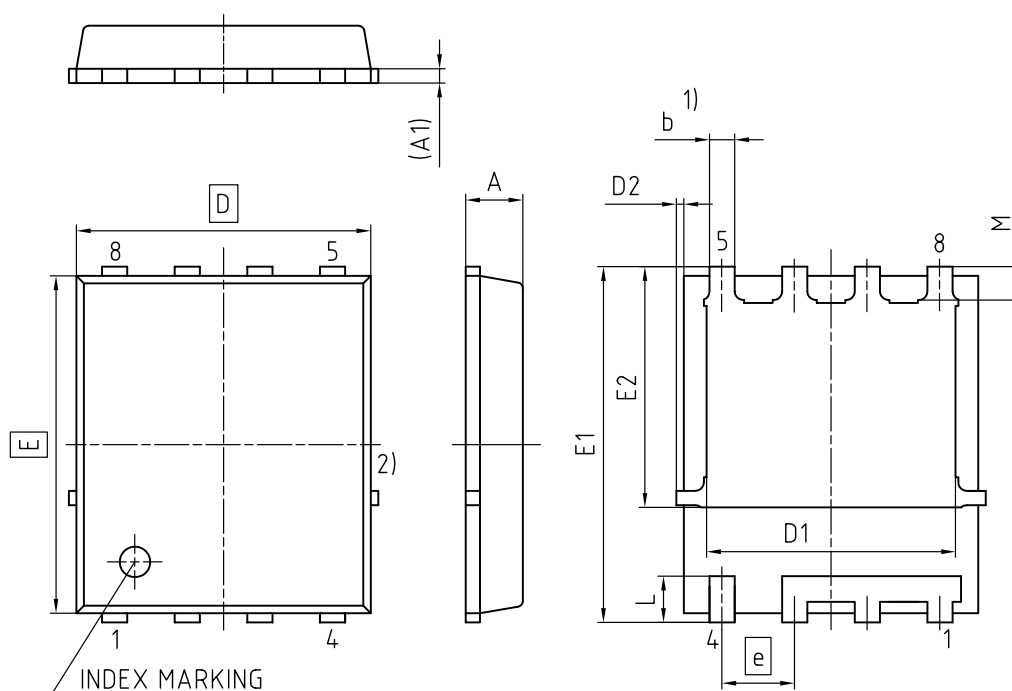


$V_{BR(DSS)}=f(T_J)$ ;  $I_D=1\text{ mA}$

Diagram Gate charge waveforms



## 5 Package Outlines



- 1) EXCLUDING MOLD FLASH  
2) REMOVAL ON MOLD GATE  
INTRUSION 0.1 MM  
PROTRUSION 0.1 MM  
LEAD LENGTH UP TO ANTI FLASH LINE  
ALL METAL SURFACES ARE PLATED, EXCEPT AREA OF CUT

| DIMENSION | MILLIMETERS |      |
|-----------|-------------|------|
|           | MIN.        | MAX. |
| A         | 0.90        | 1.20 |
| A1        | 0.15        | 0.35 |
| b         | 0.26        | 0.54 |
| D         | 4.80        | 5.35 |
| D1        | 3.70        | 4.40 |
| D2        | 0.02        | 0.23 |
| E         | 5.70        | 6.10 |
| E1        | 5.90        | 6.42 |
| E2        | 3.88        | 4.42 |
| e         | 1.27        |      |
| L         | 0.69        | 0.90 |
| M         | 0.45        | 0.69 |

|                              |
|------------------------------|
| DOCUMENT NO.<br>Z8B000193699 |
| REVISION<br>03               |
| SCALE 10:1<br>0 1 2 3mm      |
| EUROPEAN PROJECTION<br>      |
| ISSUE DATE<br>19.06.2019     |

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

PG-TDSON-8-FL: Recommended Boardpads & Apertures

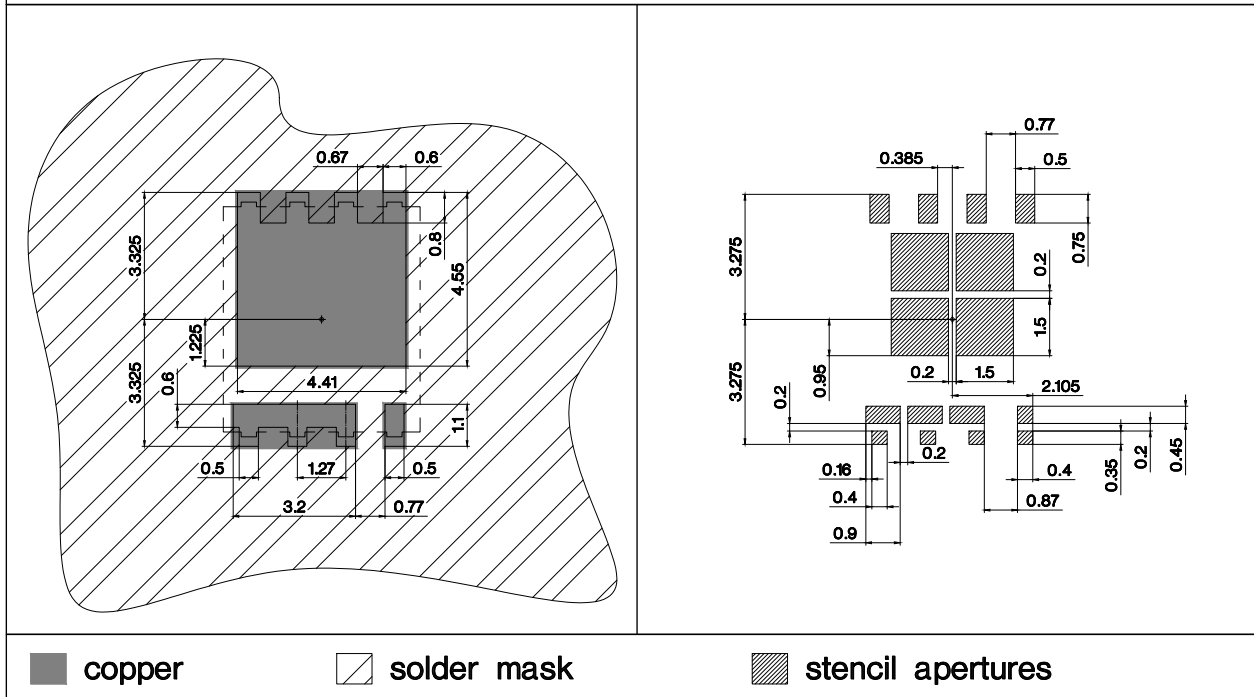


Figure 2 Outline Boardpads (TDSON-8 FL)



## Revision History

BSC016N06NST

Revision: 2020-08-13, Rev. 2.2

### Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2017-03-01 | Release of final version                     |
| 2.1      | 2019-10-22 | Update package drawings                      |
| 2.2      | 2020-08-13 | Update current rating                        |

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