

# MOSFET

## OptiMOS™5 Power-Transistor, 100 V

### Features

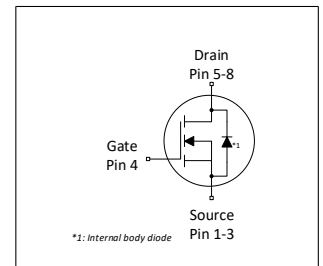
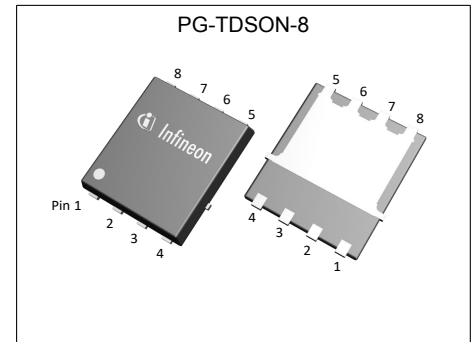
- Ideal for high-frequency switching
- Optimized for charger
- 100% avalanche tested
- Superior thermal resistance
- N-channel, logic level
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

### Product validation

Qualified according to JEDEC Standard

**Table 1 Key Performance Parameters**

| Parameter        | Value | Unit       |
|------------------|-------|------------|
| $V_{DS}$         | 100   | V          |
| $R_{DS(on),max}$ | 10.9  | m $\Omega$ |
| $I_D$            | 59    | A          |
| $Q_{oss}$        | 24    | nC         |
| $Q_G(0V..4.5V)$  | 9.2   | nC         |



RoHS

| Type / Ordering Code | Package    | Marking | Related Links |
|----------------------|------------|---------|---------------|
| ISC0804NLS           | PG-TDSON-8 | 0804NL  | -             |

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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>       | $I_D$          | -      | -    | 59<br>38<br>12 | A    | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ ,<br>$R_{thJA}=50\text{ °C/W}^2)$ |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$  | -      | -    | 236            | A    | $T_C=25\text{ °C}$                                                                                                                                                     |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$       | -      | -    | 50             | mJ   | $I_D=20\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                                                                          |
| Gate source voltage                          | $V_{GS}$       | -20    | -    | 20             | V    | -                                                                                                                                                                      |
| Power dissipation                            | $P_{tot}$      | -      | -    | 60<br>2.5      | W    | $T_C=25\text{ °C}$<br>$T_A=25\text{ °C}$ , $R_{thJA}=50\text{ °C/W}^2)$                                                                                                |
| Operating and storage temperature            | $T_j, T_{stg}$ | -55    | -    | 150            | °C   | IEC climatic category; DIN IEC 68-1:<br>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                 | $R_{thJC}$ | -      | 1.2  | 2.1  | °C/W | -                     |
| Thermal resistance, junction - case, top                    | $R_{thJC}$ | -      | -    | 20   | °C/W | -                     |
| Device on PCB, 6 cm <sup>2</sup> cooling area <sup>2)</sup> | $R_{thJA}$ | -      | -    | 50   | °C/W | -                     |

<sup>1)</sup> Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature as specified. For other case temperatures 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   | $V_{(BR)DSS}$ | 100    | -            | -            | V                | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                                                                               |
| Gate threshold voltage           | $V_{GS(th)}$  | 1.1    | 1.6          | 2.3          | V                | $V_{DS}=V_{GS}$ , $I_D=28\text{ }\mu\text{A}$                                                                                         |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 0.1<br>10    | 1<br>100     | $\mu\text{A}$    | $V_{DS}=100\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$<br>$V_{DS}=100\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | 10           | 100          | nA               | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$                                                                                            |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 10.3<br>13.3 | 10.9<br>14.9 | $\text{m}\Omega$ | $V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$<br>$V_{GS}=4.5\text{ V}$ , $I_D=10\text{ A}$                                                 |
| Gate resistance <sup>1)</sup>    | $R_G$         | -      | 1.3          | -            | $\Omega$         | -                                                                                                                                     |
| Transconductance                 | $g_{fs}$      | -      | 39           | -            | S                | $ V_{DS} \geq 2 I_D /R_{DS(on)max}$ , $I_D=20\text{ A}$                                                                               |

**Table 5 Dynamic characteristics**

| Parameter                                  | Symbol       | Values |      |      | Unit | Note / Test Condition                                                                               |
|--------------------------------------------|--------------|--------|------|------|------|-----------------------------------------------------------------------------------------------------|
|                                            |              | Min.   | Typ. | Max. |      |                                                                                                     |
| Input capacitance <sup>1)</sup>            | $C_{iss}$    | -      | 1200 | 1600 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                       |
| Output capacitance <sup>1)</sup>           | $C_{oss}$    | -      | 200  | 270  | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                       |
| Reverse transfer capacitance <sup>1)</sup> | $C_{rss}$    | -      | 10   | 13   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                       |
| Turn-on delay time                         | $t_{d(on)}$  | -      | 6.1  | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                                  | $t_r$        | -      | 6.8  | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time                        | $t_{d(off)}$ | -      | 12   | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                                  | $t_f$        | -      | 3.0  | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ ,<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           | $Q_{gs}$      | -      | 3.8  | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge at threshold        | $Q_{g(th)}$   | -      | 2.0  | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate to drain charge            | $Q_{gd}$      | -      | 3.3  | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Switching charge                | $Q_{sw}$      | -      | 5.0  | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total <sup>1)</sup> | $Q_g$         | -      | 9.2  | 12   | nC   | $V_{DD}=50\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate plateau voltage            | $V_{plateau}$ | -      | 3.1  | -    | V    | $V_{DD}=50\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total <sup>1)</sup> | $Q_g$         | -      | 18   | 24   | nC   | $V_{DD}=50\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$  |
| Output charge                   | $Q_{oss}$     | -      | 24   | -    | nC   | $V_{DS}=50\text{ V}$ , $V_{GS}=0\text{ V}$                                   |

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

<sup>2)</sup> See "Gate charge waveforms" for parameter definition

**Table 7 Reverse diode**

| Parameter                             | Symbol        | Values |      |      | Unit | Note / Test Condition                                                |
|---------------------------------------|---------------|--------|------|------|------|----------------------------------------------------------------------|
|                                       |               | Min.   | Typ. | Max. |      |                                                                      |
| Diode continuous forward current      | $I_S$         | -      | -    | 53   | A    | $T_C=25\text{ °C}$                                                   |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -    | 236  | A    | $T_C=25\text{ °C}$                                                   |
| Diode forward voltage                 | $V_{SD}$      | -      | 0.86 | 1    | V    | $V_{GS}=0\text{ V}, I_F=20\text{ A}, T_j=25\text{ °C}$               |
| Reverse recovery time <sup>1)</sup>   | $t_{rr}$      | -      | 30   | -    | ns   | $V_R=50\text{ V}, I_F=20\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge <sup>1)</sup> | $Q_{rr}$      | -      | 23   | -    | nC   | $V_R=50\text{ V}, I_F=20\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$ |

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

### 4 Electrical characteristics diagrams

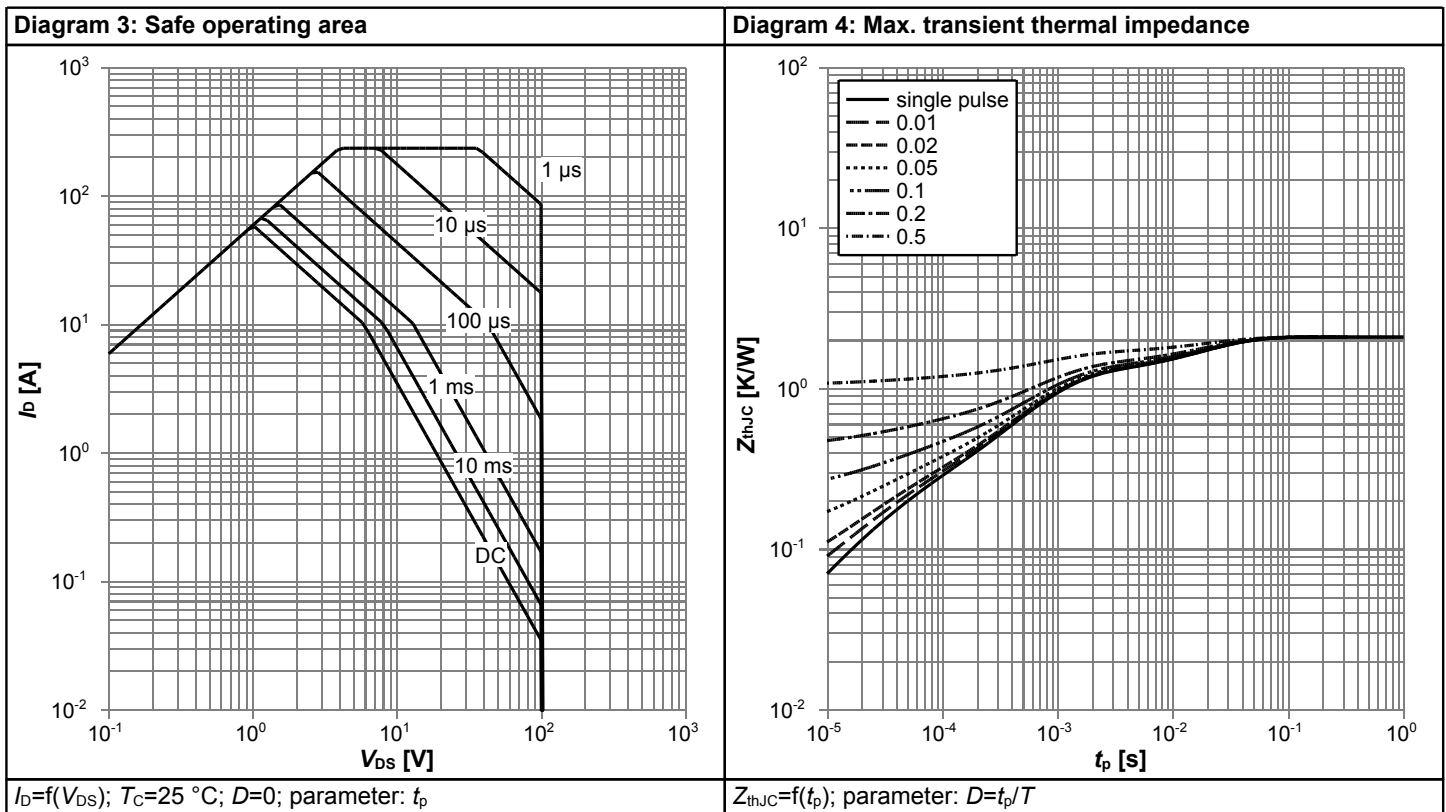
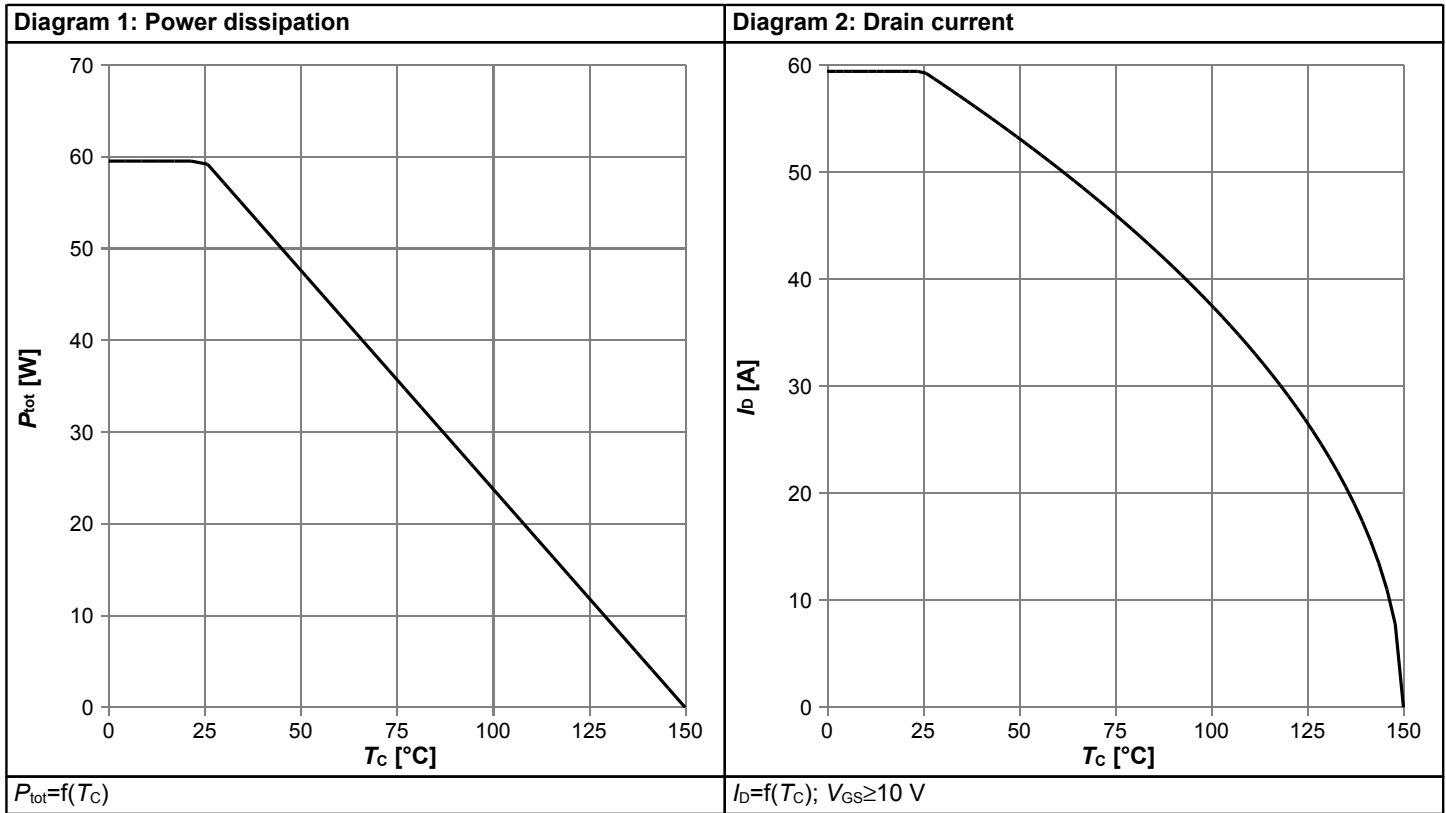
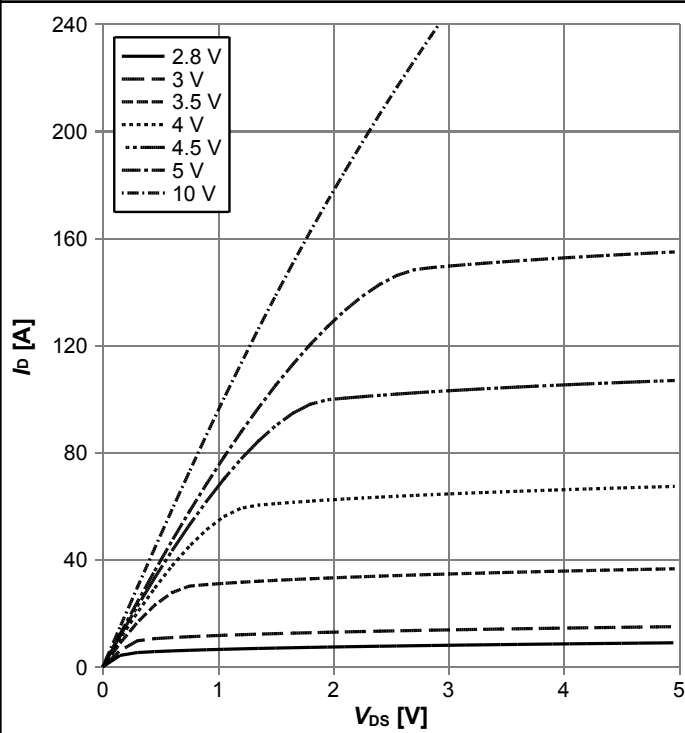
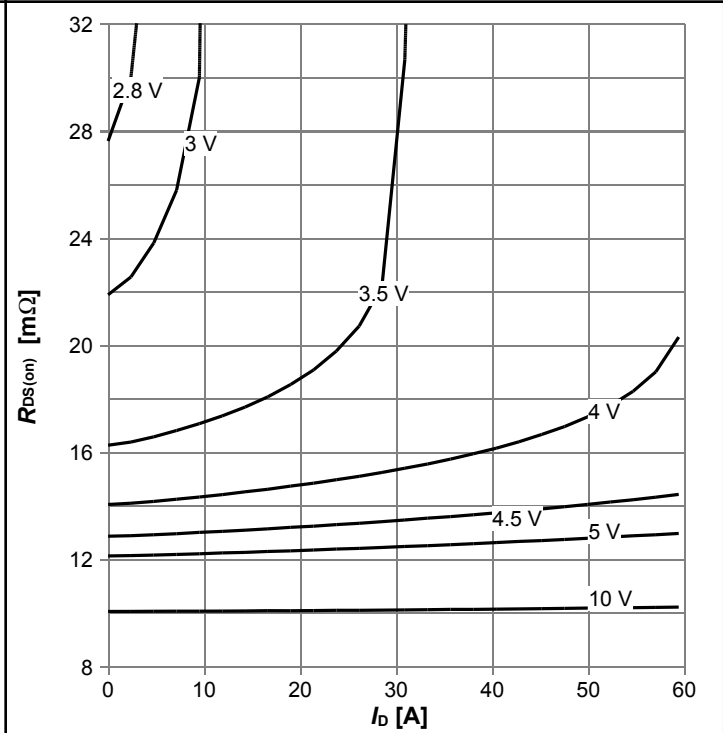


Diagram 5: Typ. output characteristics



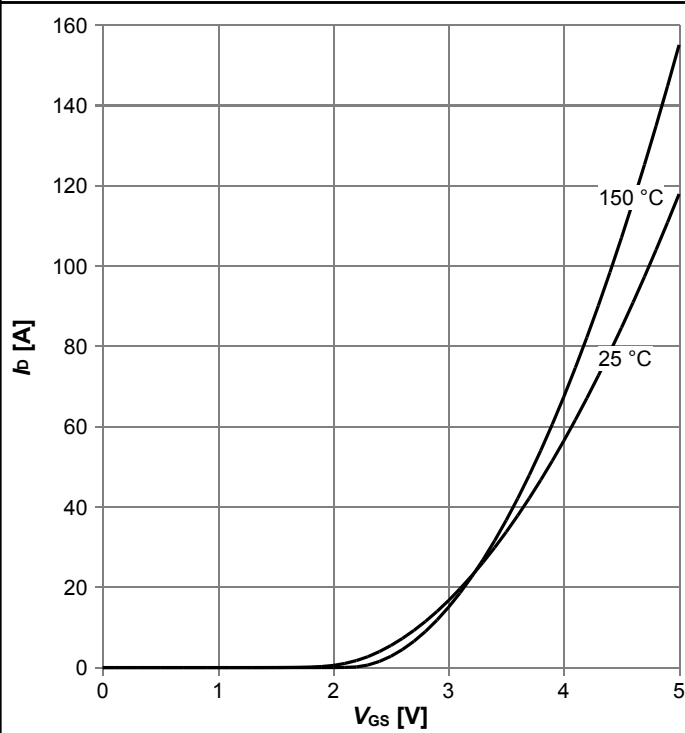
$I_D = f(V_{DS})$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



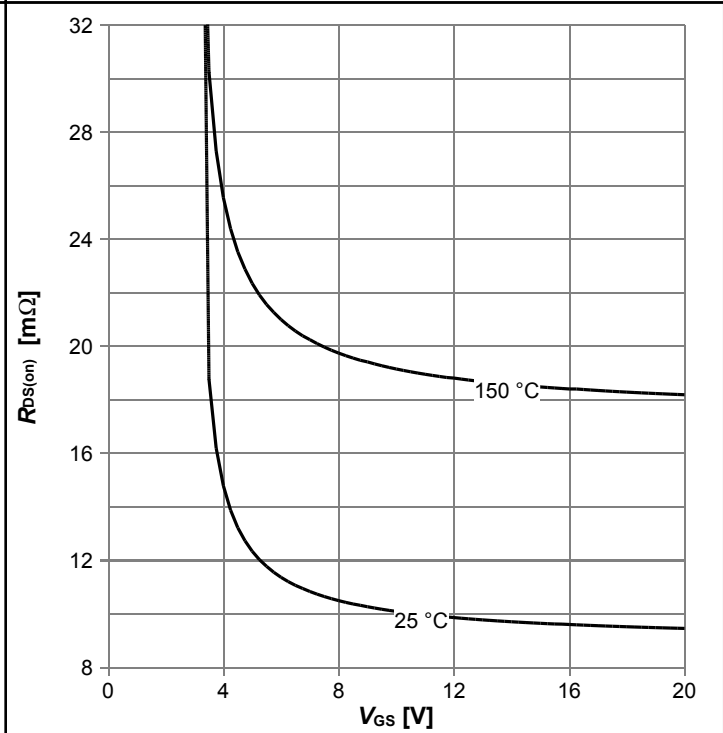
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



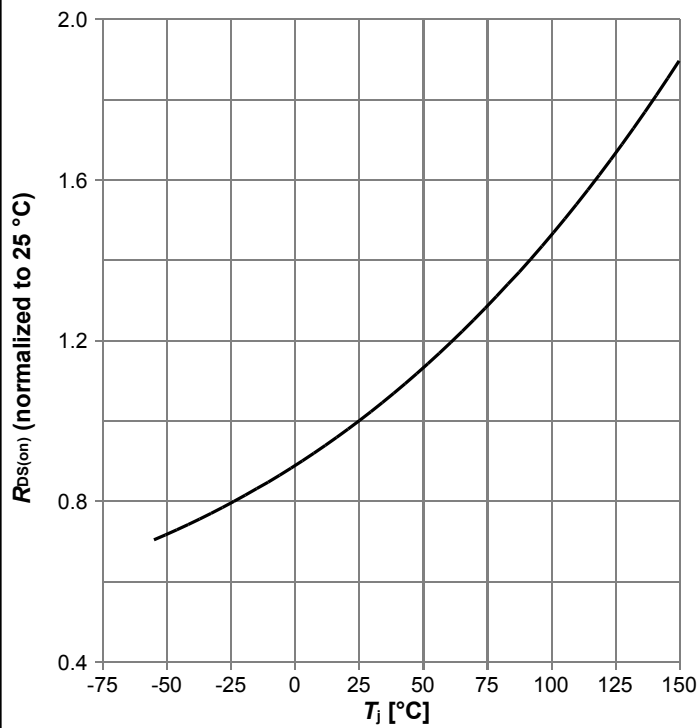
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$

Diagram 8: Typ. drain-source on resistance



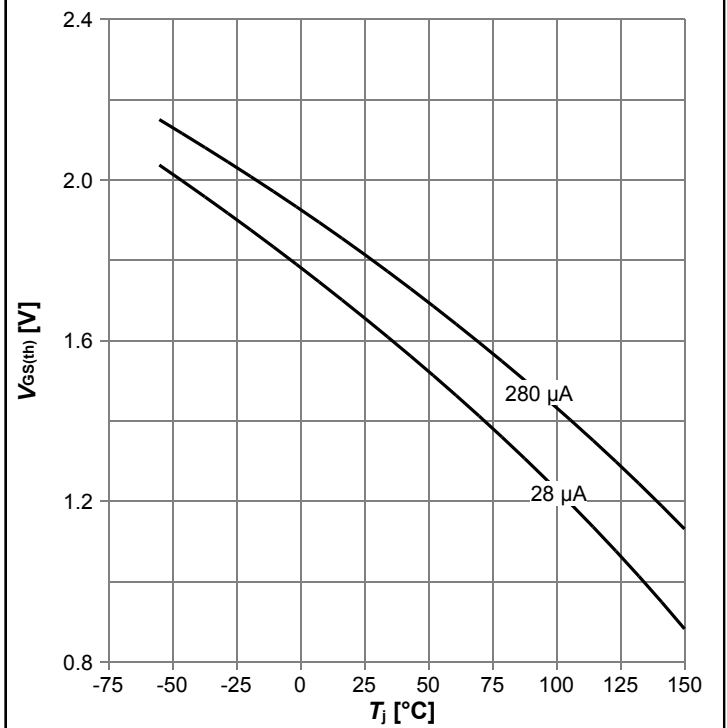
$R_{DS(on)} = f(V_{GS})$ ,  $I_D = 20\text{ A}$ ; parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



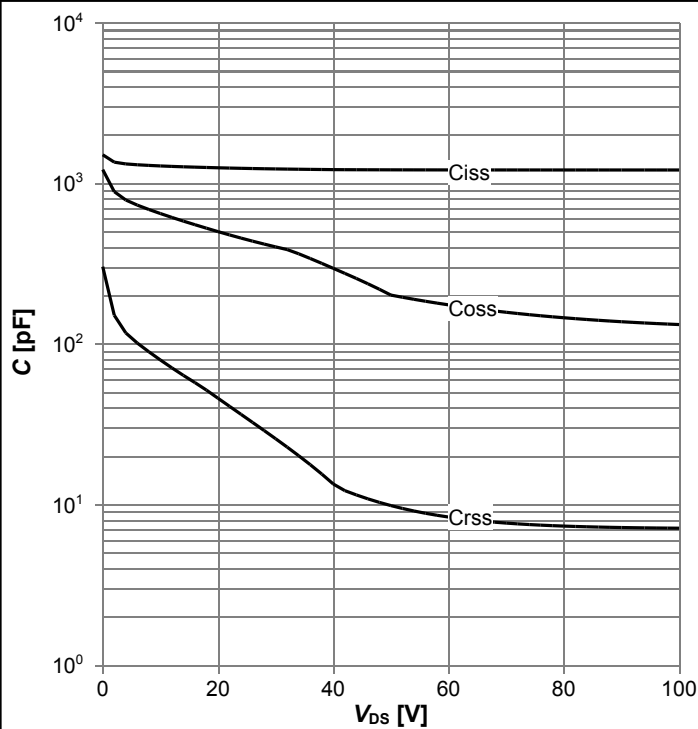
$R_{DS(on)}=f(T_j)$ ,  $I_D=20$  A,  $V_{GS}=10$  V

Diagram 10: Typ. gate threshold voltage



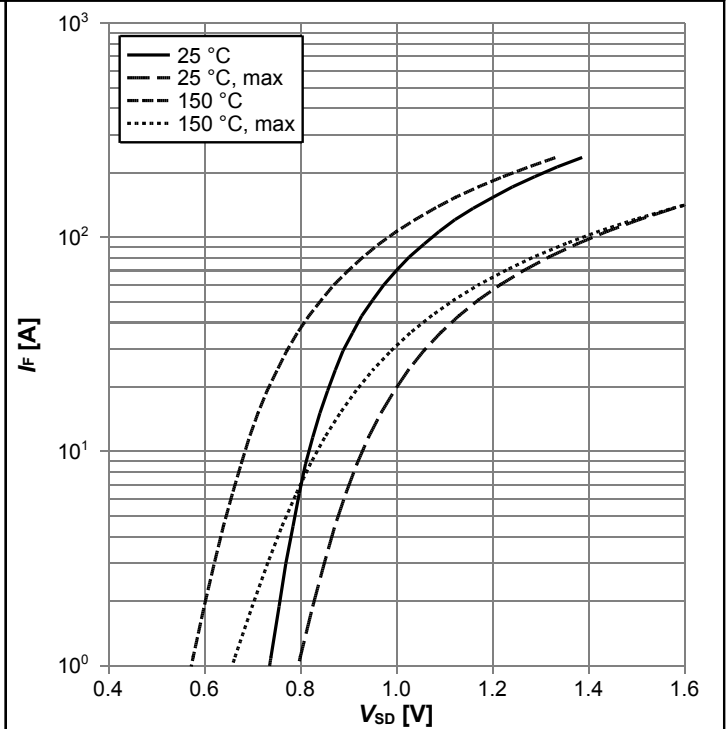
$V_{GS(th)}=f(T_j)$ ,  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



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

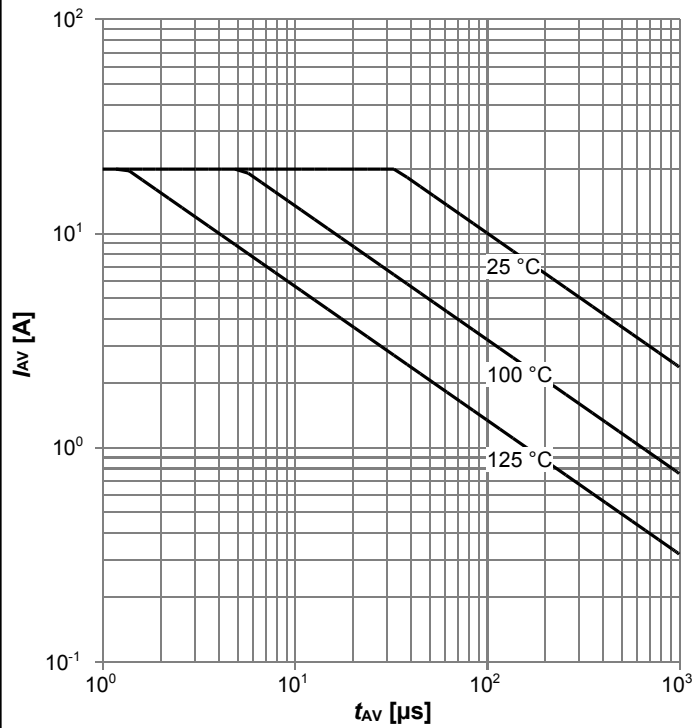
Diagram 12: Forward characteristics of reverse diode



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

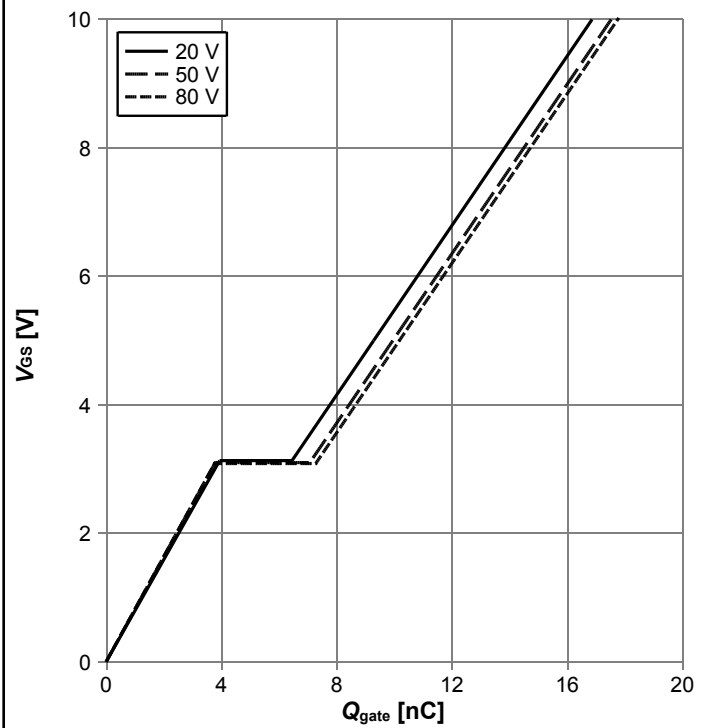


**Diagram 13: Avalanche characteristics**



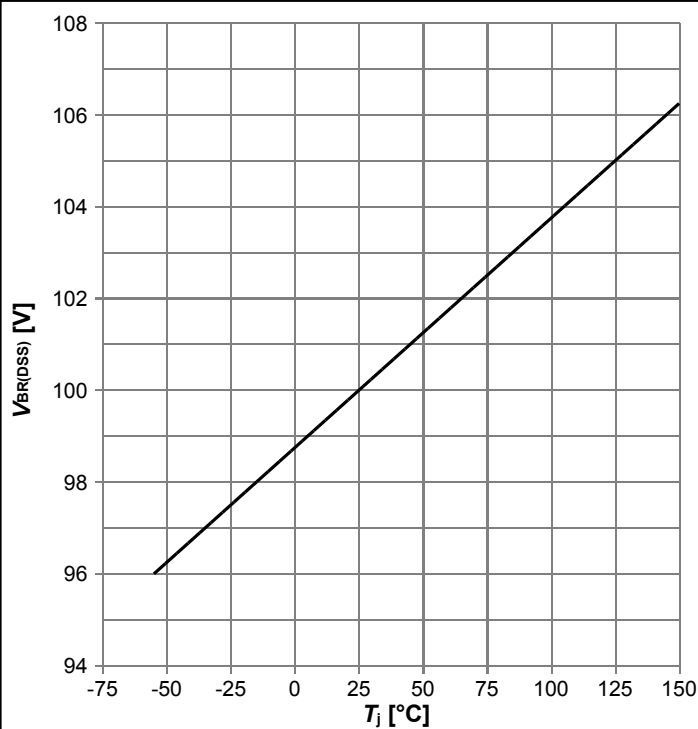
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j,start}$

**Diagram 14: Typ. gate charge**



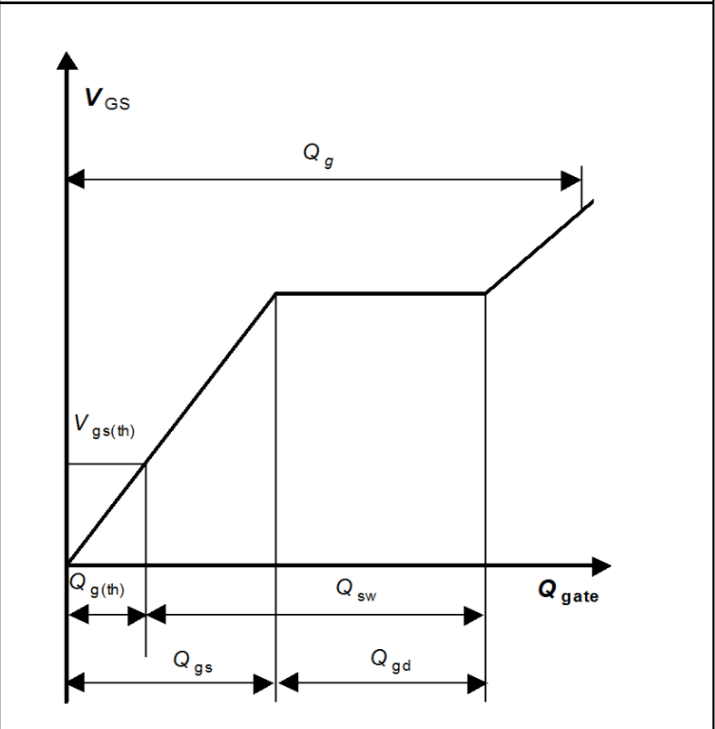
$V_{GS}=f(Q_{gate}), I_D=20$  A pulsed,  $T_j=25$  °C; parameter:  $V_{DD}$

**Diagram 15: Drain-source breakdown voltage**

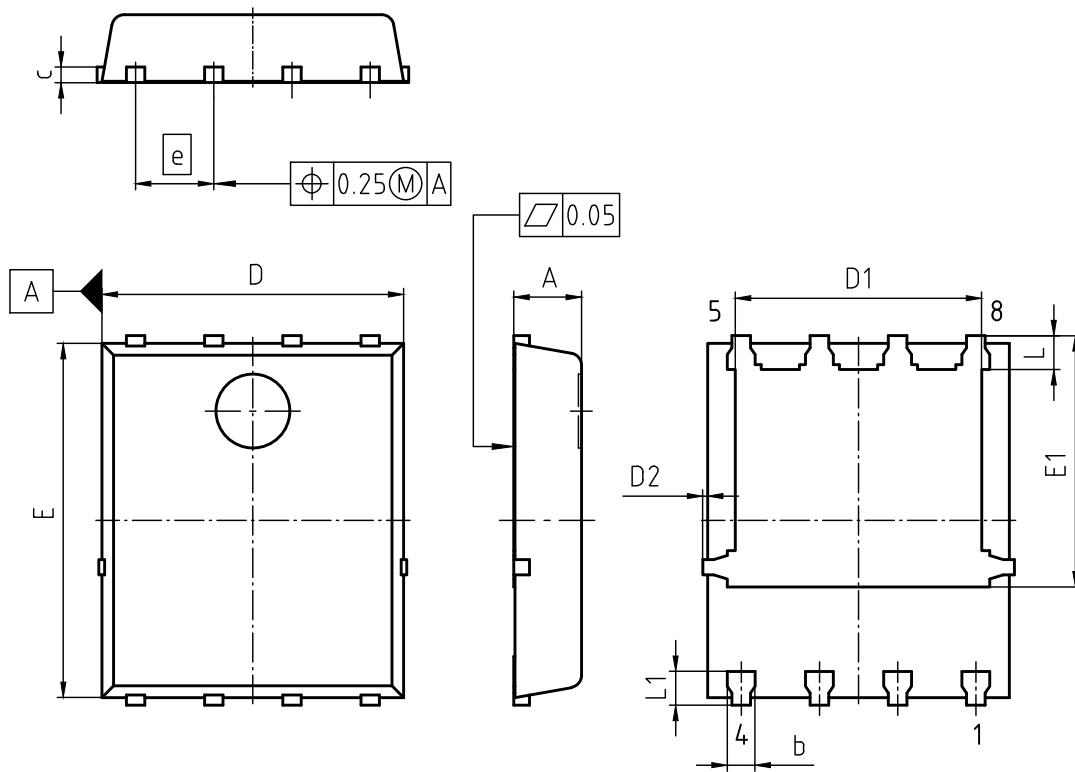


$V_{BR(DSS)}=f(T_j); I_D=1$  mA

**Diagram Gate charge waveforms**



## 5 Package Outlines



| PACKAGE - GROUP NUMBER: PG-TDSON-8-U08 |                  |      |
|----------------------------------------|------------------|------|
| REVISION: 01                           | DATE: 12.02.2021 |      |
| DIMENSIONS                             | MILLIMETERS      |      |
|                                        | MIN.             | MAX. |
| A                                      | 0.90             | 1.20 |
| b                                      | 0.34             | 0.54 |
| c                                      | 0.15             | 0.35 |
| D                                      | 4.80             | 5.35 |
| D1                                     | 3.90             | 4.40 |
| D2                                     | 0.00             | 0.22 |
| E                                      | 5.70             | 6.10 |
| E1                                     | 4.05             | 4.25 |
| e                                      | 1.27             |      |
| L                                      | 0.45             | 0.65 |
| L1                                     | 0.45             | 0.65 |

- 1) EXCLUDING MOLD FLASH
- 2) REMOVAL ON MOLD GATE  
INTRUSION 0.1 MM  
PROTRUSION 0.1 MM
- 3) ALL METAL SURFACES ARE PLATED,  
EXCEPT AREA OF CUT

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

## Revision History

ISC0804NLS

**Revision: 2021-04-01, Rev. 2.1**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2021-03-15 | Release of final version                     |
| 2.1      | 2021-04-01 | Update of features list                      |

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### Published by

**Infineon Technologies AG**

**81726 München, Germany**

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