

MOSFET

OptiMOS™ 6 Power-Transistor, 120 V

Features

- N-channel, normal level
- Very low on-resistance $R_{DS(on)}$
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low reverse recovery charge (Q_{rr})
- High avalanche energy rating
- 175°C operating temperature
- Optimized for high frequency switching and synchronous rectification
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- MSL 1 classified according to J-STD-020

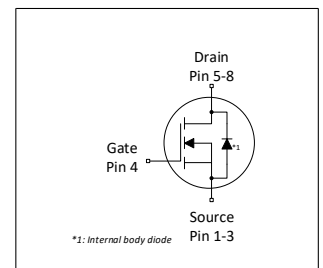
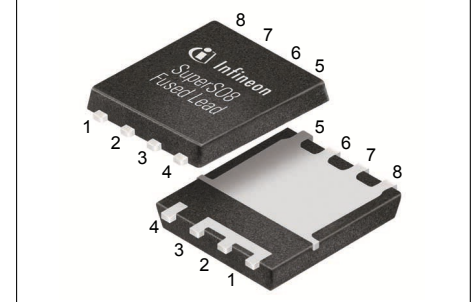
Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|----------------------------|-------|------------|
| V_{DS} | 120 | V |
| $R_{DS(on),max}$ | 3.7 | m Ω |
| I_D | 163 | A |
| Q_{oss} | 110 | nC |
| Q_G | 46 | nC |
| Q_{rr} (1000 A/ μ s) | 256 | nC |

TDSON-8 FL (enlarged source interconnection)



RoHS

| Type / Ordering Code | Package | Marking | Related Links |
|----------------------|---------------|----------|---------------|
| ISC037N12NM6 | PG-TDSON-8 FL | 037N12N6 | - |

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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 | - | - | 163 115 105 19.2 | A | $V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=8\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=50\text{ °C/W}^2)$ |
| Pulsed drain current ³⁾ | $I_{D,pulse}$ | - | - | 652 | A | $T_A=25\text{ °C}$ |
| Avalanche current, single pulse ⁴⁾ | I_{AS} | - | - | 50 | A | $T_C=25\text{ °C}$ |
| Avalanche energy, single pulse | E_{AS} | - | - | 1032 | mJ | $I_D=16\text{ A}$, $R_{GS}=25\text{ }\Omega$ |
| Gate source voltage | V_{GS} | -20 | - | 20 | V | - |
| Power dissipation | P_{tot} | - | - | 214 3.0 | W | $T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=50\text{ °C/W}^2)$ |
| 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} | - | - | 0.7 | °C/W | - |
| Thermal resistance, junction - case, top | R_{thJC} | - | - | 20 | °C/W | - |
| Thermal resistance, junction - ambient, 6 cm ² cooling area ²⁾ | R_{thJA} | - | - | 50 | °C/W | - |

¹⁾ 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.

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 | $V_{(BR)DSS}$ | 120 | - | - | V | $V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$ |
| Gate threshold voltage | $V_{GS(th)}$ | 2.6 | 3.1 | 3.6 | V | $V_{DS}=V_{GS}$, $I_D=111\text{ }\mu\text{A}$ |
| Zero gate voltage drain current | I_{DSS} | - | 0.1 10 | 1 100 | μA | $V_{DS}=100\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=100\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$ |
| Gate-source leakage current | I_{GSS} | - | 10 | 100 | nA | $V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 3.1 3.6 | 3.7 4.4 | $\text{m}\Omega$ | $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$ $V_{GS}=8\text{ V}$, $I_D=25\text{ A}$ |
| Gate resistance | R_G | 0.4 | 0.8 | 1.2 | Ω | - |
| Transconductance | g_{fs} | 47 | 94 | - | S | $ V_{DS} \geq 2 I_D R_{DS(on)max}$, $I_D=50\text{ A}$ |

Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|--------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Input capacitance | C_{iss} | - | 3300 | 4300 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=60\text{ V}$, $f=1\text{ MHz}$ |
| Output capacitance ¹⁾ | C_{oss} | - | 980 | 1300 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=60\text{ V}$, $f=1\text{ MHz}$ |
| Reverse transfer capacitance ¹⁾ | C_{rss} | - | 20 | 35 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=60\text{ V}$, $f=1\text{ MHz}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 12 | - | ns | $V_{DD}=60\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=25\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time | t_r | - | 5.6 | - | ns | $V_{DD}=60\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=25\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time | $t_{d(off)}$ | - | 17 | - | ns | $V_{DD}=60\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=25\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time | t_f | - | 7.2 | - | ns | $V_{DD}=60\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=25\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |

Table 6 Gate charge characteristics²⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|---------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Gate to source charge ¹⁾ | Q_{gs} | - | 16 | 21 | nC | $V_{DD}=60\text{ V}$, $I_D=25\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge at threshold ¹⁾ | $Q_{g(th)}$ | - | 10.2 | 13 | nC | $V_{DD}=60\text{ V}$, $I_D=25\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge ¹⁾ | Q_{gd} | - | 10.1 | 15 | nC | $V_{DD}=60\text{ V}$, $I_D=25\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge | Q_{sw} | - | 16 | - | nC | $V_{DD}=60\text{ V}$, $I_D=25\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total ¹⁾ | Q_g | - | 46 | 58 | nC | $V_{DD}=60\text{ V}$, $I_D=25\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage | $V_{plateau}$ | - | 4.9 | - | V | $V_{DD}=60\text{ V}$, $I_D=25\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Output charge ¹⁾ | Q_{oss} | - | 110 | 138 | nC | $V_{DS}=60\text{ V}$, $V_{GS}=0\text{ V}$ |

¹⁾ Defined by design. Not subject to production test.

²⁾ 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 | - | - | 163 | A | $T_C=25\text{ °C}$ |
| Diode pulse current | $I_{S,pulse}$ | - | - | 652 | A | $T_C=25\text{ °C}$ |
| Diode forward voltage | V_{SD} | - | 0.83 | 1.0 | V | $V_{GS}=0\text{ V}, I_F=50\text{ A}, T_j=25\text{ °C}$ |
| Reverse recovery time ¹⁾ | t_{rr} | - | 30 | 60 | ns | $V_R=60\text{ V}, I_F=25\text{ A}, di_F/dt=300\text{ A}/\mu\text{s}$ |
| Reverse recovery charge ¹⁾ | Q_{rr} | - | 64 | 128 | nC | $V_R=60\text{ V}, I_F=25\text{ A}, di_F/dt=300\text{ A}/\mu\text{s}$ |
| Reverse recovery time ¹⁾ | t_{rr} | - | 27 | 54 | ns | $V_R=60\text{ V}, I_F=25\text{ A}, di_F/dt=1000\text{ A}/\mu\text{s}$ |
| Reverse recovery charge ¹⁾ | Q_{rr} | - | 256 | 512 | nC | $V_R=60\text{ V}, I_F=25\text{ A}, di_F/dt=1000\text{ A}/\mu\text{s}$ |

¹⁾ Defined by design. Not subject to production test.

4 Electrical characteristics diagrams

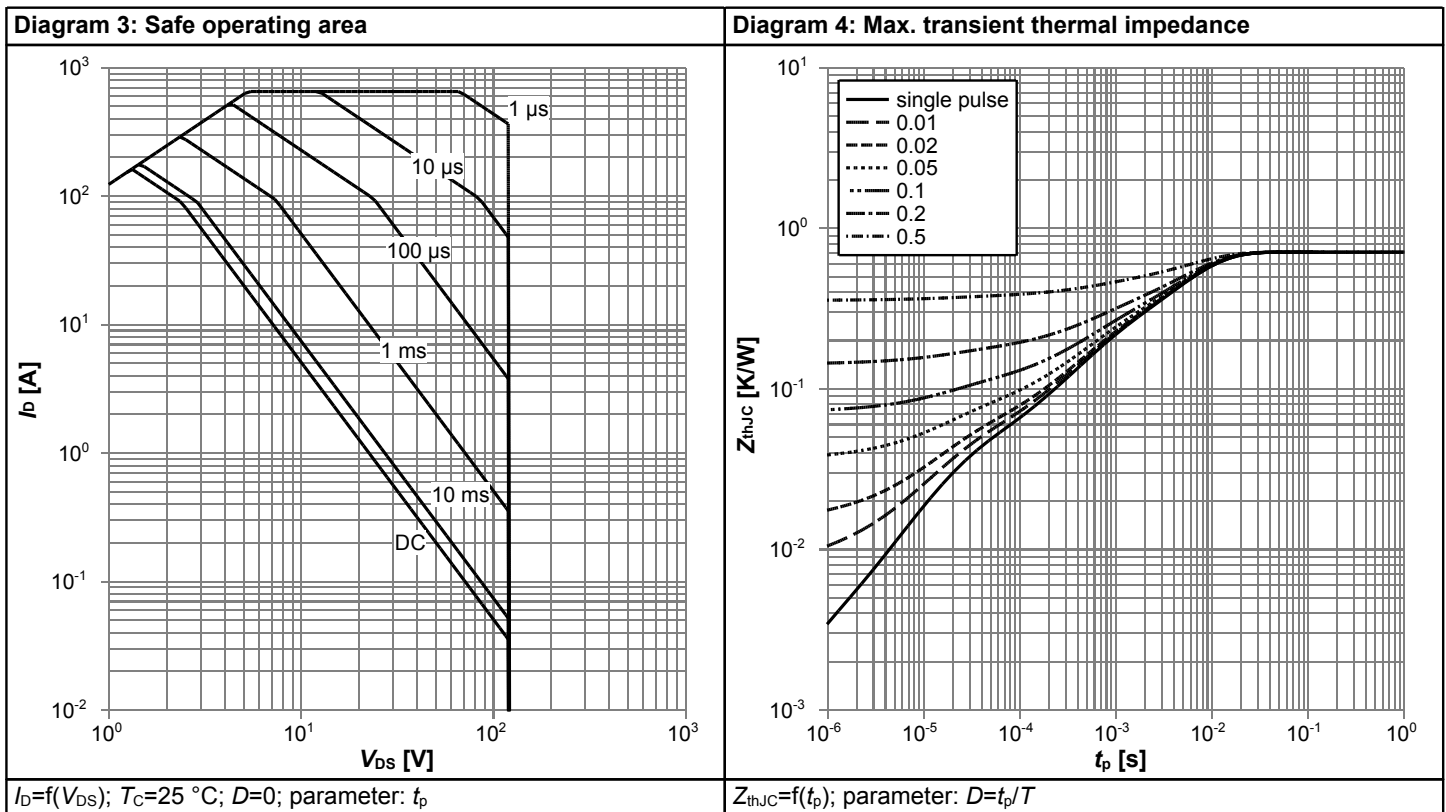
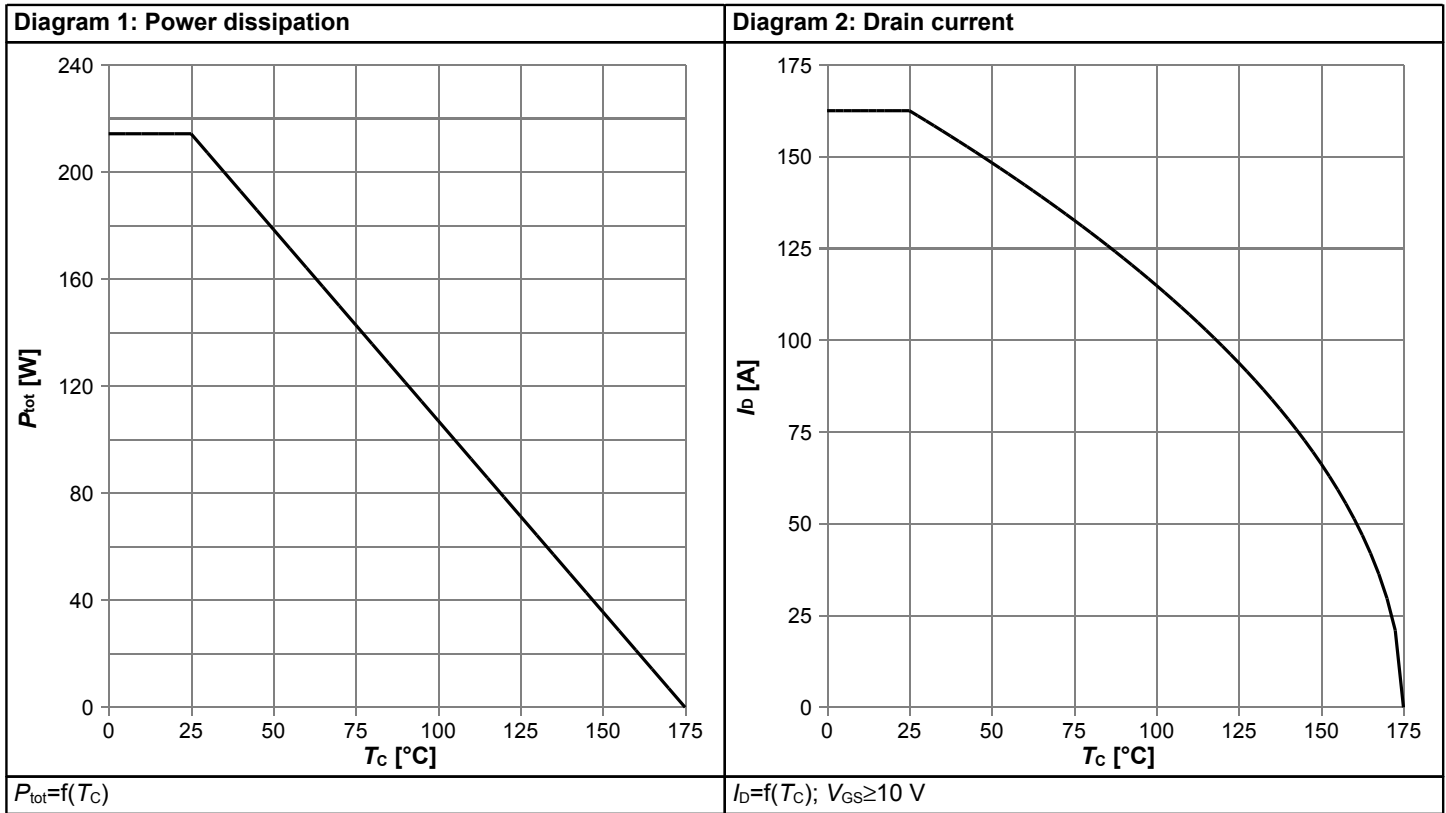
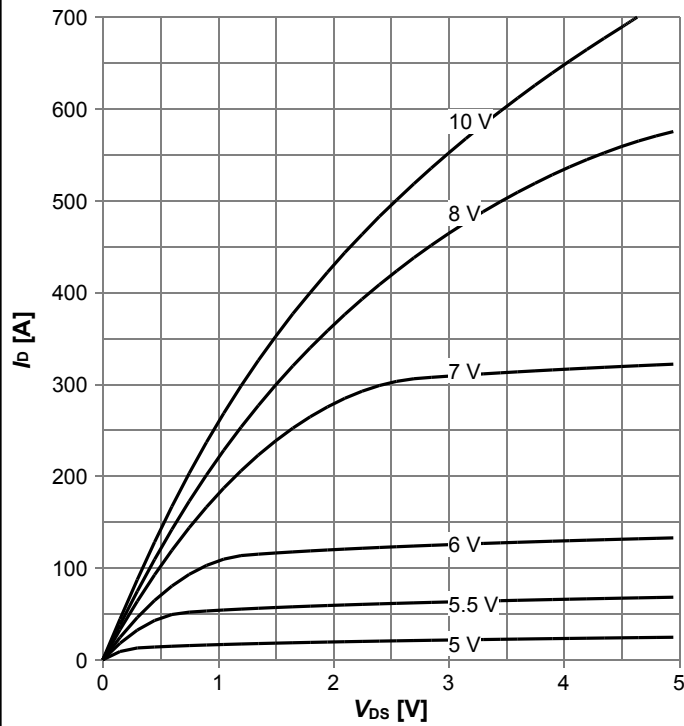
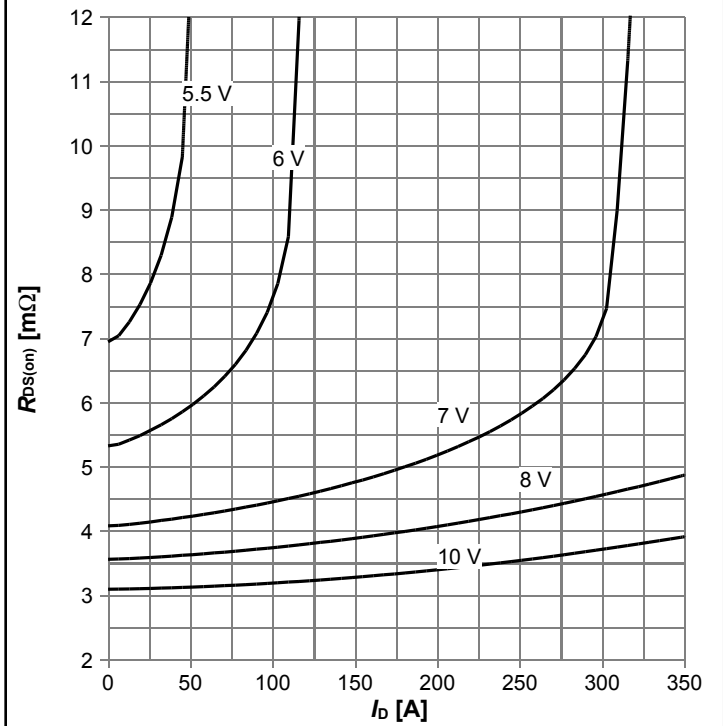


Diagram 5: Typ. output characteristics



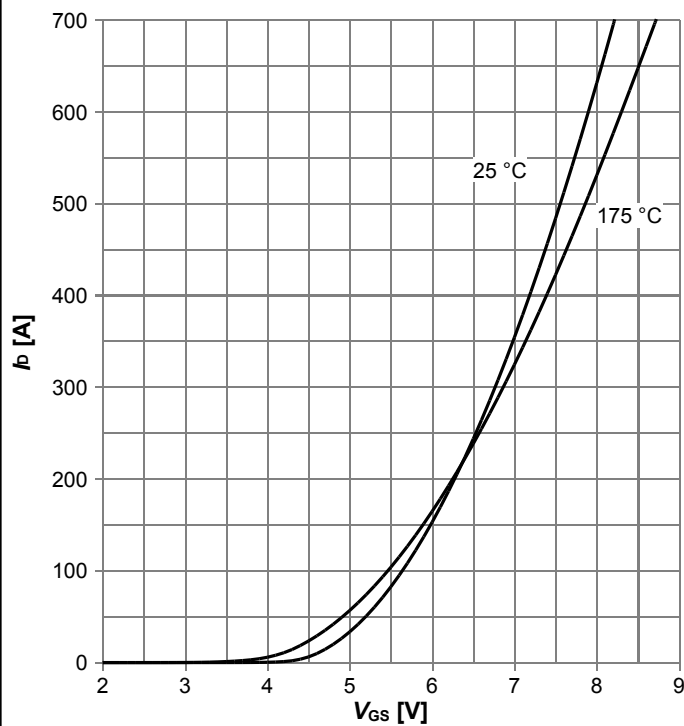
$I_D = f(V_{DS}), T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



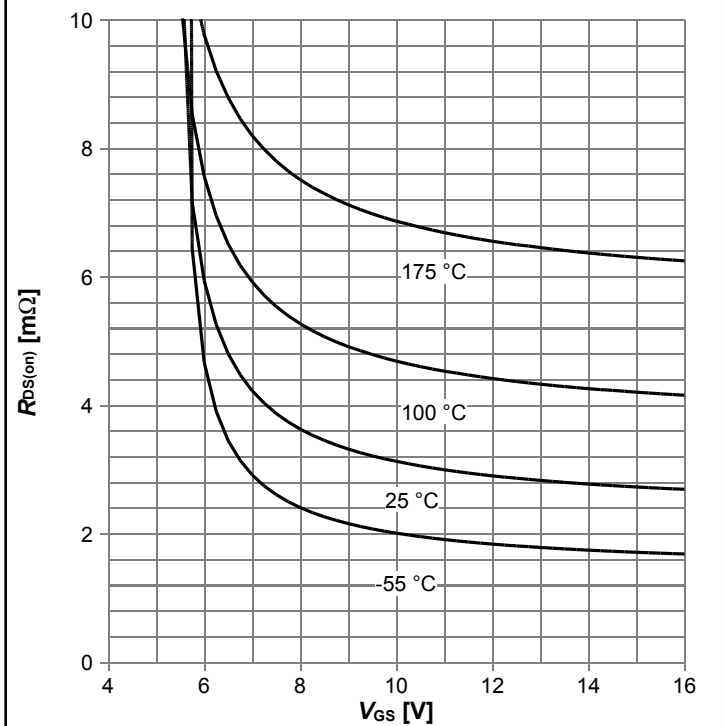
$R_{DS(on)} = f(I_D), T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



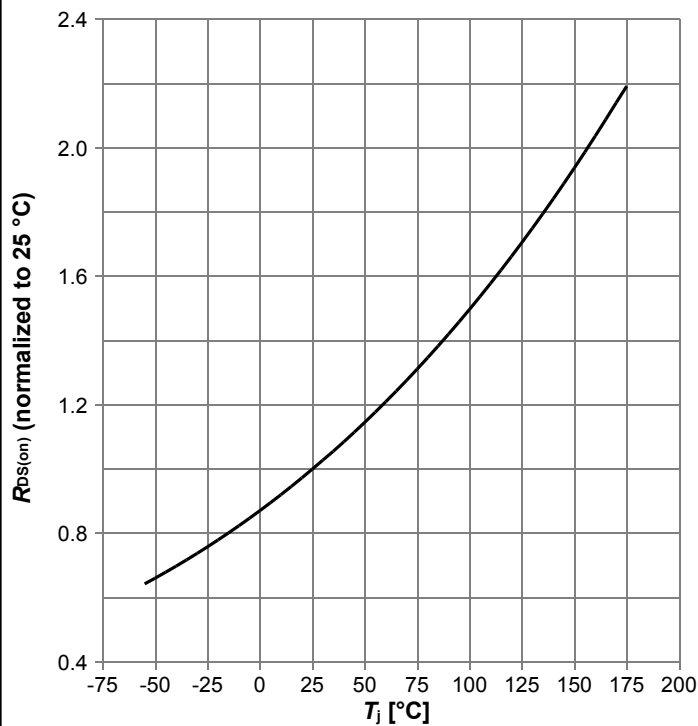
$I_D = f(V_{GS}), |V_{DS}| > 2|I_D|R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. drain-source on resistance



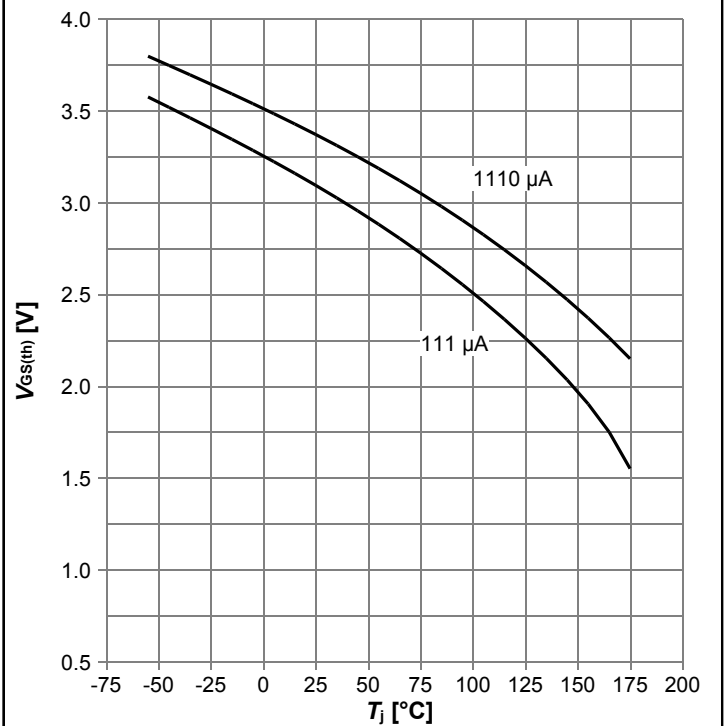
$R_{DS(on)} = f(V_{GS}), I_D = 50\text{ A};$ parameter: T_j

Diagram 9: Normalized drain-source on resistance



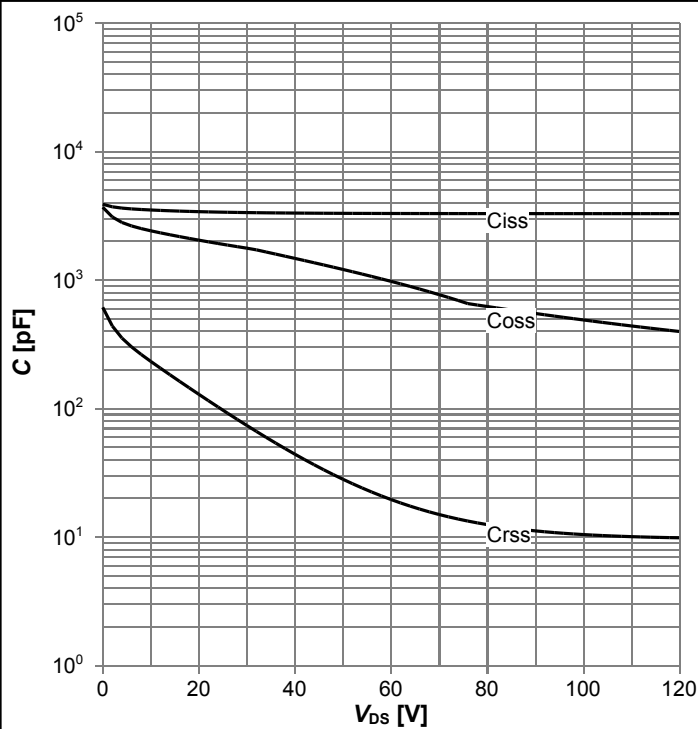
$R_{DS(on)}=f(T_j)$, $I_D=50$ A, $V_{GS}=10$ V

Diagram 10: Typ. gate threshold voltage



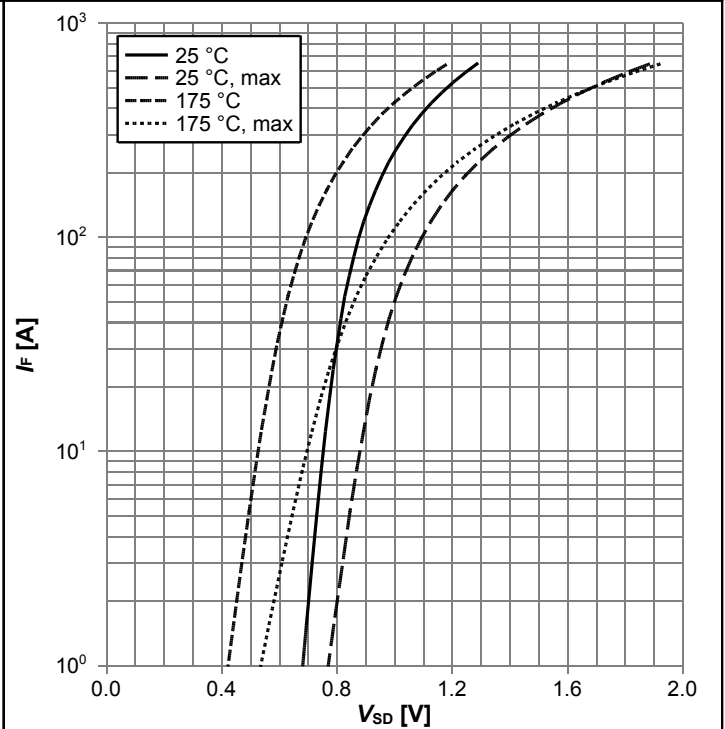
$V_{GS(th)}=f(T_j)$, $V_{GS}=V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



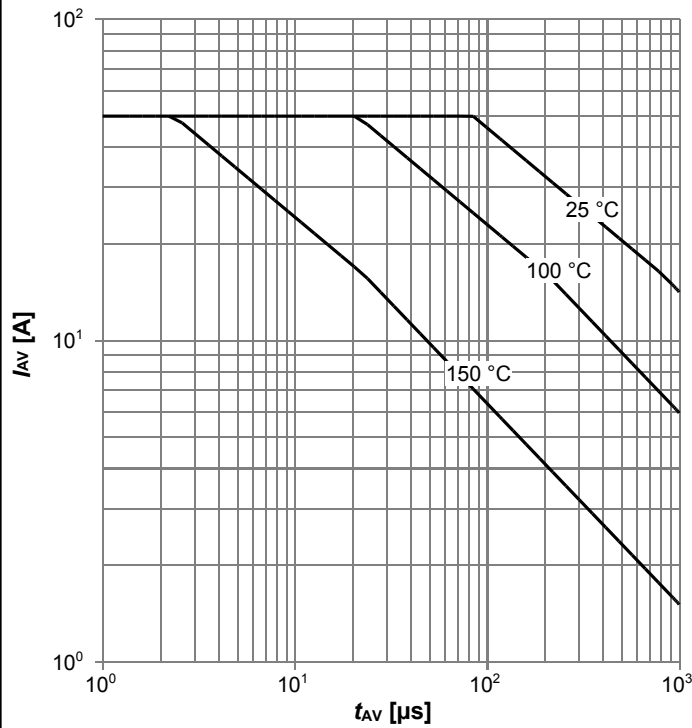
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz

Diagram 12: Forward characteristics of reverse diode



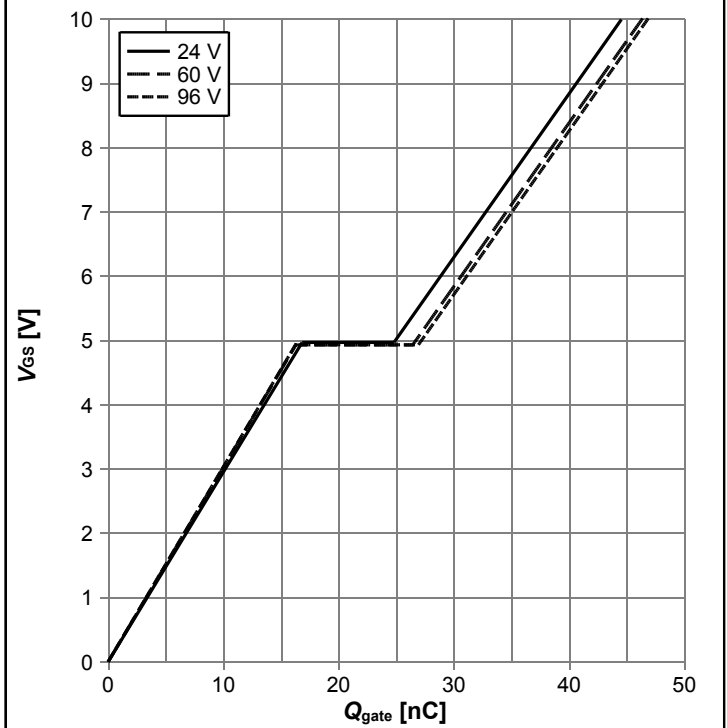
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



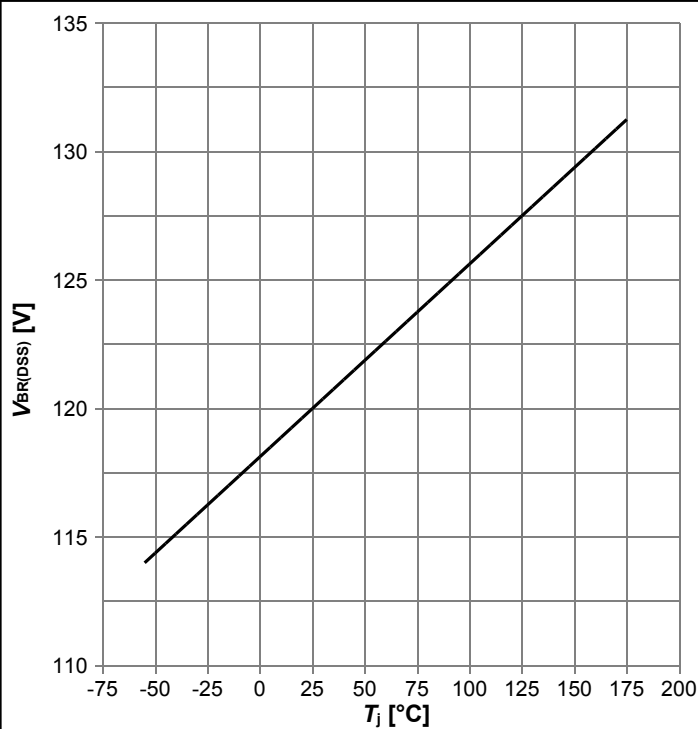
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



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

Diagram 15: Min. drain-source breakdown voltage

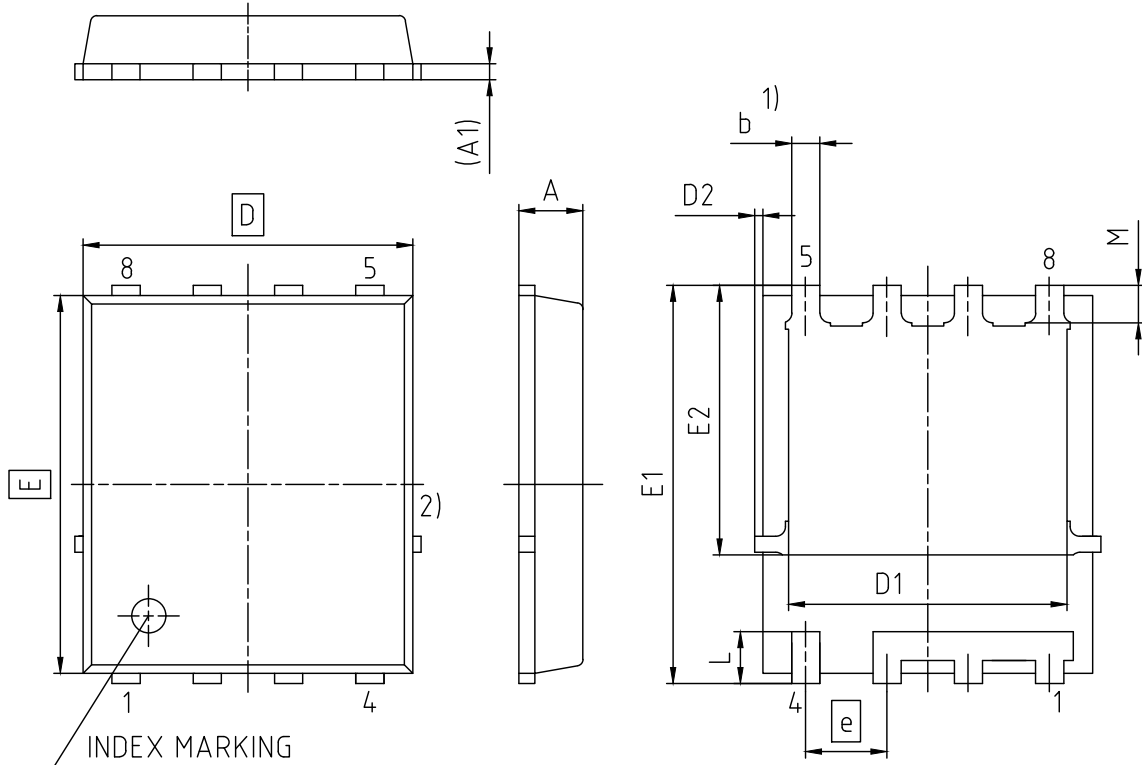


$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$

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 | 0.00 | 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. Z8B000193699 |
| REVISION 04 |
| SCALE 10:1 0 1 2 3mm |
| EUROPEAN PROJECTION |
| ISSUE DATE 05.11.2019 |

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

Revision History

ISC037N12NM6

Revision: 2022-12-13, Rev. 2.0

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.0 | 2022-12-13 | Release of final version |

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