

MOSFET

OptiMOS™ Power-Transistor, 60 V

Features

- 100% avalanche tested
- Superior thermal resistance
- N-channel
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product validation

Fully qualified according to JEDEC for Industrial Applications

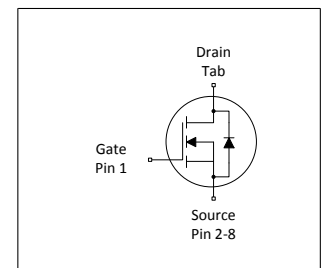


Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|------------------|-------|------------|
| V_{DS} | 60 | V |
| $R_{DS(on),max}$ | 1.2 | m Ω |
| I_D | 313 | A |
| Q_{oss} | 119 | nC |
| $Q_G(0V..10V)$ | 106 | nC |



| Type / Ordering Code | Package | Marking | Related Links |
|----------------------|-----------|---------|---------------|
| IPT012N06N | PG-HSOF-8 | 012N06N | - |

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 | - | - | 313 221 41 | A | $V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$, $R_{thJA}=40\text{ K/W}^2)$ |
| Pulsed drain current ³⁾ | $I_{D,pulse}$ | - | - | 1252 | A | $T_C=25\text{ °C}$ |
| Avalanche energy, single pulse ⁴⁾ | E_{AS} | - | - | 420 | mJ | $I_D=100\text{ A}$, $R_{GS}=25\text{ }\Omega$ |
| Gate source voltage | V_{GS} | -20 | - | 20 | V | - |
| Power dissipation | P_{tot} | - | - | 214 | W | $T_C=25\text{ °C}$ |
| Operating and storage temperature | T_j , T_{stg} | -55 | - | 175 | °C | IEC climatic category; DIN IEC 68-1: 55/175/56 |

2 Thermal characteristics

Table 3 Thermal characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|------------|--------|------|------|------|-----------------------|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case | R_{thJC} | - | 0.4 | 0.7 | K/W | - |
| Device on PCB, minimal footprint | R_{thJA} | - | - | 62 | K/W | - |
| Device on PCB, 6 cm ² cooling area ²⁾ | R_{thJA} | - | - | 40 | K/W | - |

¹⁾ Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature at 25°C. For higher Tcase 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 | $V_{(BR)DSS}$ | 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 | $V_{DS}=V_{GS}$, $I_D=143\text{ }\mu\text{A}$ |
| Zero gate voltage drain current | I_{DSS} | - | 0.5 10 | 1 100 | μA | $V_{DS}=60\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=60\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$ |
| Gate-source leakage current | I_{GSS} | - | 10 | 100 | nA | $V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 1.0 1.4 | 1.2 2.0 | m Ω | $V_{GS}=10\text{ V}$, $I_D=100\text{ A}$ $V_{GS}=6\text{ V}$, $I_D=50\text{ A}$ |
| Gate resistance ¹⁾ | R_G | - | 1.6 | 2.4 | Ω | - |
| Transconductance | g_{fs} | 120 | 240 | - | S | $ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=100\text{ A}$ |

Table 5 Dynamic characteristics²⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|------------------------------|--------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance | C_{iss} | - | 7800 | 9750 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$ |
| Output capacitance | C_{oss} | - | 1800 | 2250 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$ |
| Reverse transfer capacitance | C_{rss} | - | 69 | 138 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 16 | - | ns | $V_{DD}=30\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=100\text{ A}$, $R_{G,ext}=1.8\text{ }\Omega$ |
| Rise time | t_r | - | 27 | - | ns | $V_{DD}=30\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=100\text{ A}$, $R_{G,ext}=1.8\text{ }\Omega$ |
| Turn-off delay time | $t_{d(off)}$ | - | 48 | - | ns | $V_{DD}=30\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=100\text{ A}$, $R_{G,ext}=1.8\text{ }\Omega$ |
| Fall time | t_f | - | 23 | - | ns | $V_{DD}=30\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=100\text{ A}$, $R_{G,ext}=1.8\text{ }\Omega$ |

Table 6 Gate charge characteristics³⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|------------------------------------|---------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | Q_{gs} | - | 35 | - | nC | $V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge at threshold | $Q_{g(th)}$ | - | 22 | - | nC | $V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge ²⁾ | Q_{gd} | - | 19 | 25 | nC | $V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge | Q_{sw} | - | 32 | - | nC | $V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total ²⁾ | Q_g | - | 106 | 124 | nC | $V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage | $V_{plateau}$ | - | 4.5 | - | V | $V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | - | 94 | - | nC | $V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Output charge ²⁾ | Q_{oss} | - | 119 | 149 | nC | $V_{DD}=30\text{ V}$, $V_{GS}=0\text{ V}$ |

¹⁾ See figure 16 for gate charge parameter definition

²⁾ Defined by design. Not subject to production test

³⁾ 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 | - | - | 179 | A | $T_C=25\text{ °C}$ |
| Diode pulse current | $I_{S,pulse}$ | - | - | 1252 | A | $T_C=25\text{ °C}$ |
| Diode forward voltage | V_{SD} | - | 0.9 | 1.2 | V | $V_{GS}=0\text{ V}, I_F=100\text{ A}, T_j=25\text{ °C}$ |
| Reverse recovery time ¹⁾ | t_{rr} | - | 90 | 180 | ns | $V_R=30\text{ V}, I_F=100\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge ¹⁾ | Q_{rr} | - | 237 | 474 | nC | $V_R=30\text{ V}, I_F=100\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$ |

¹⁾ Defined by design. Not subject to production test

4 Electrical characteristics diagrams

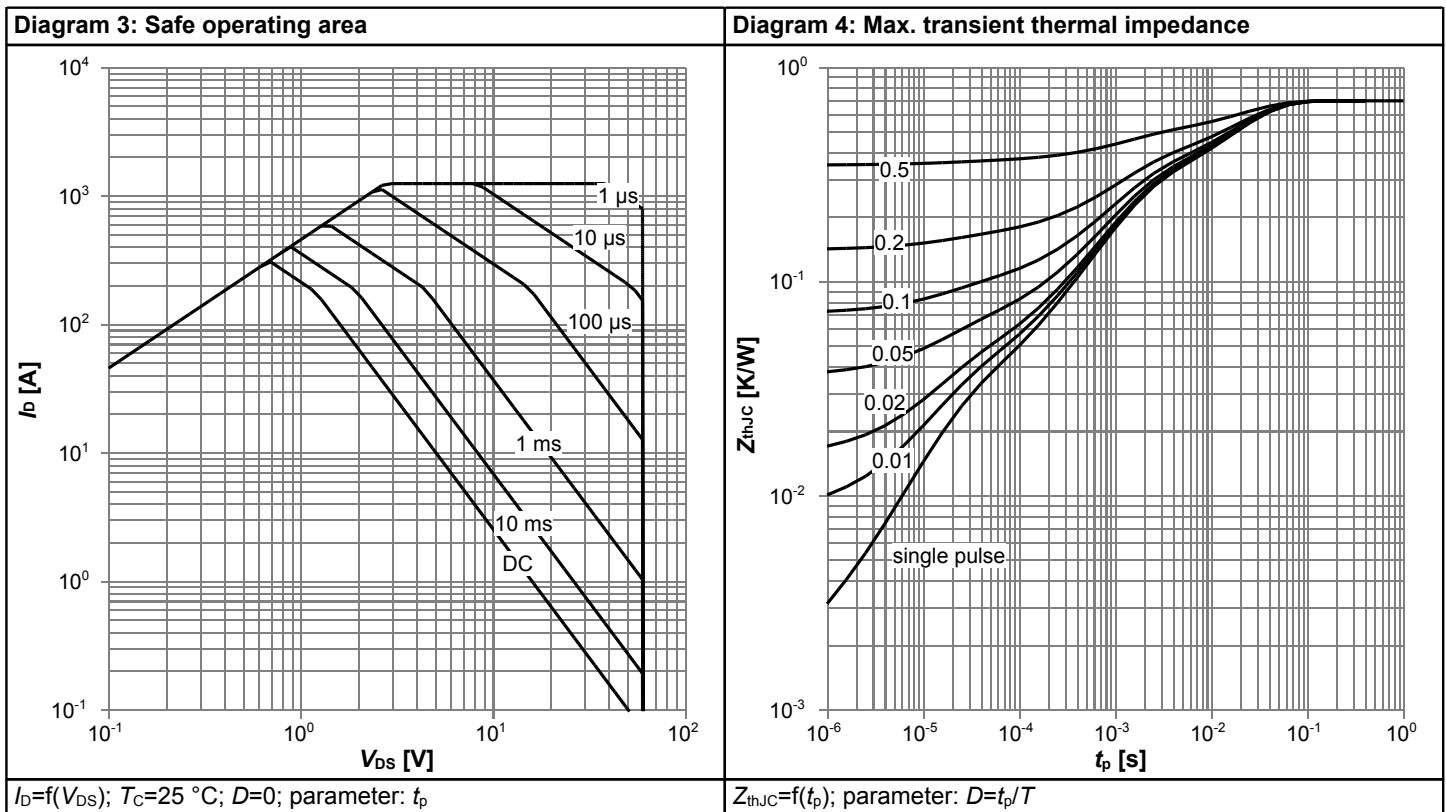
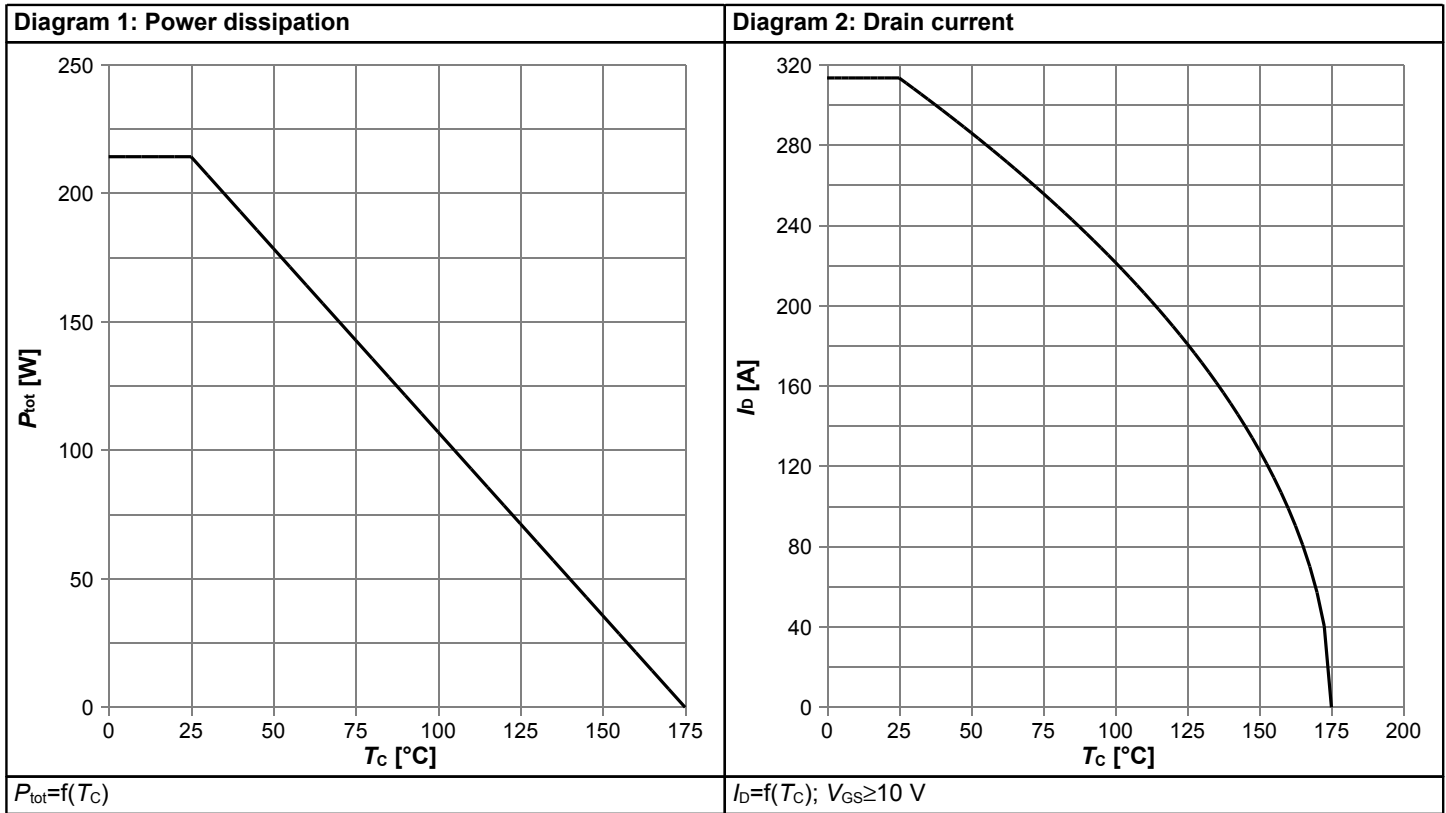
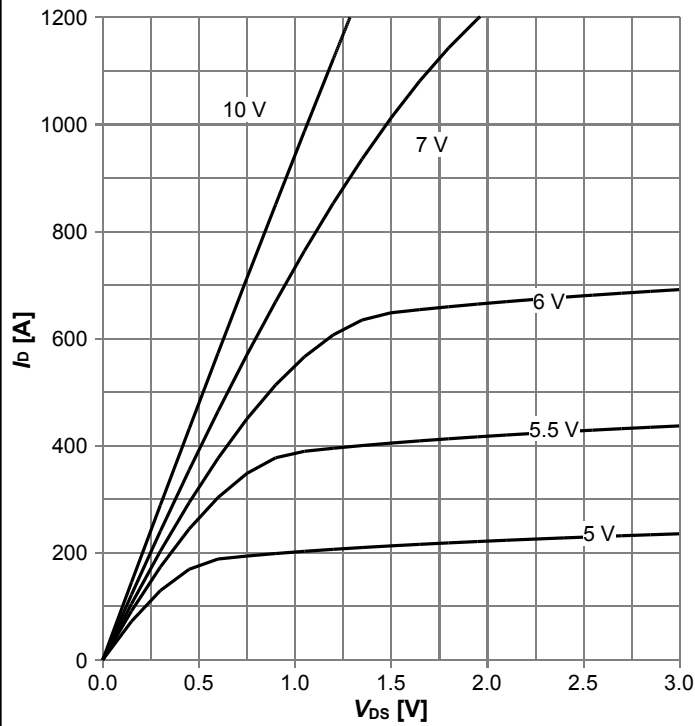
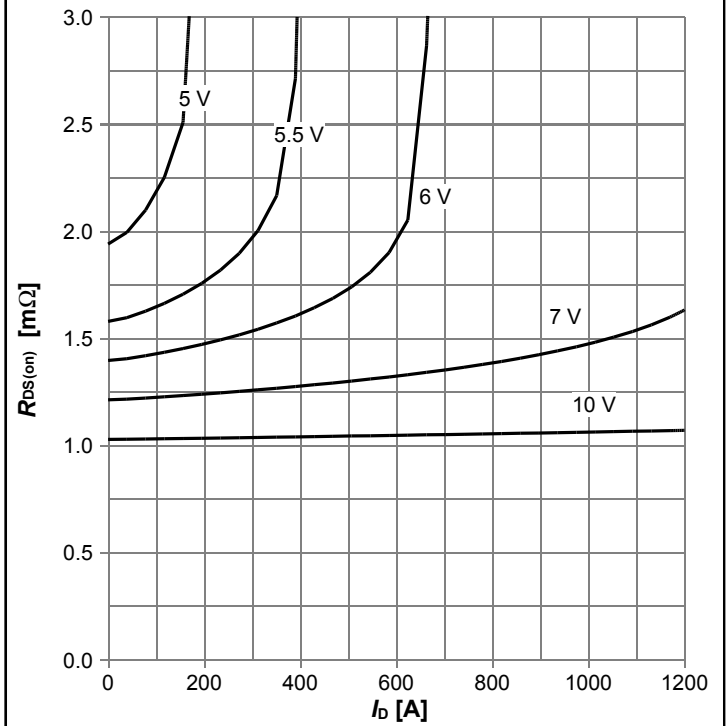


Diagram 5: Typ. output characteristics



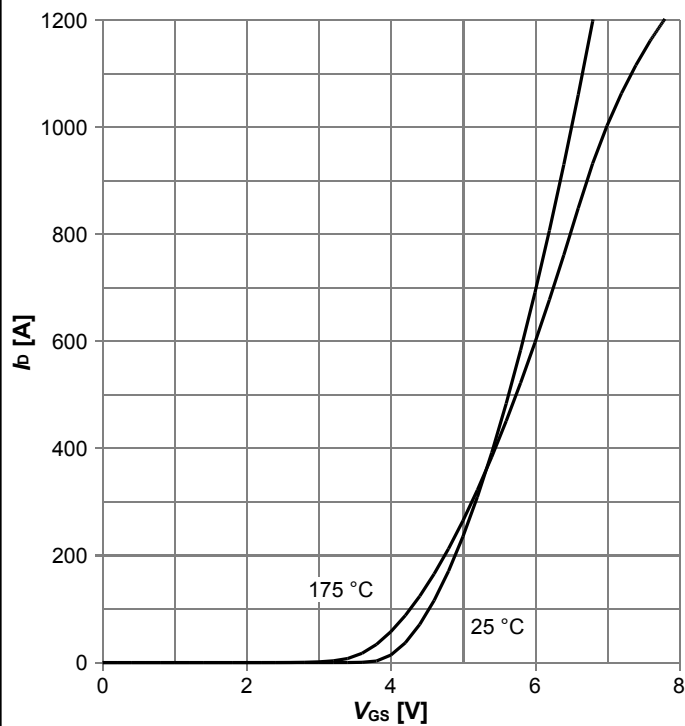
$I_D = f(V_{DS}); T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



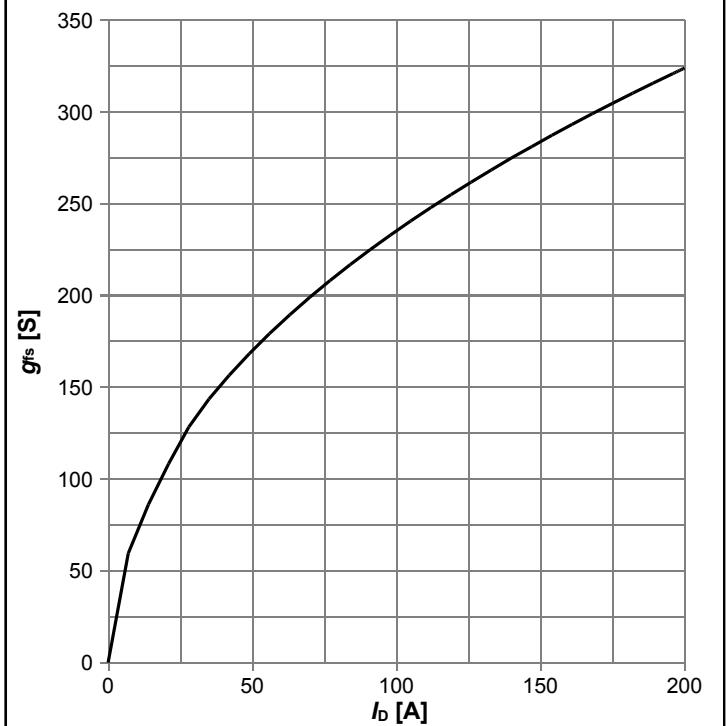
$R_{DS(on)} = f(I_D); T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



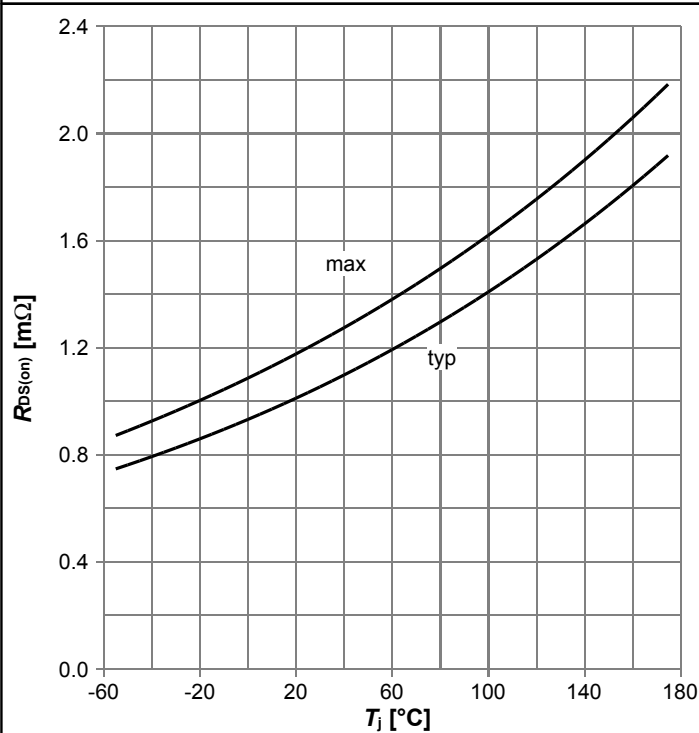
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. forward transconductance



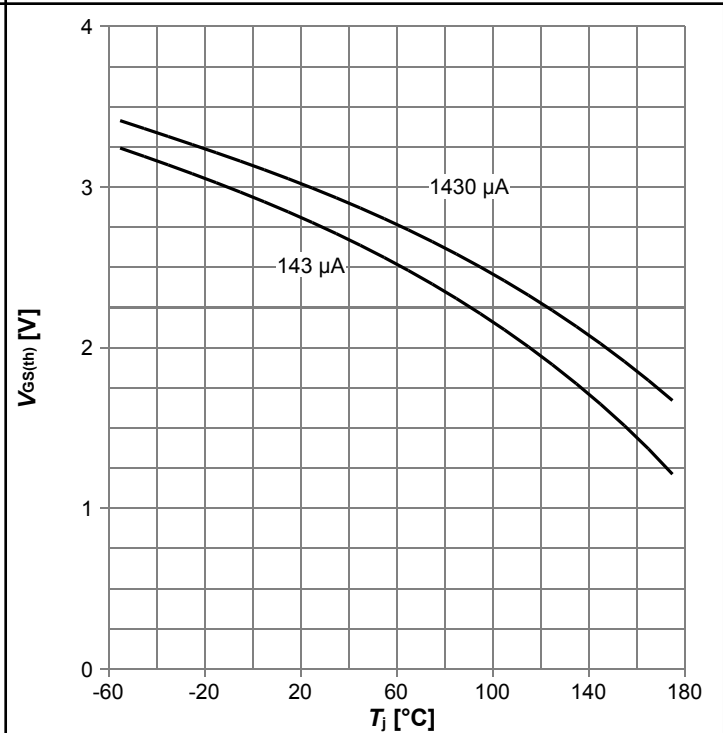
$g_{fs} = f(I_D); T_j = 25\text{ °C}$

Diagram 9: Drain-source on-state resistance



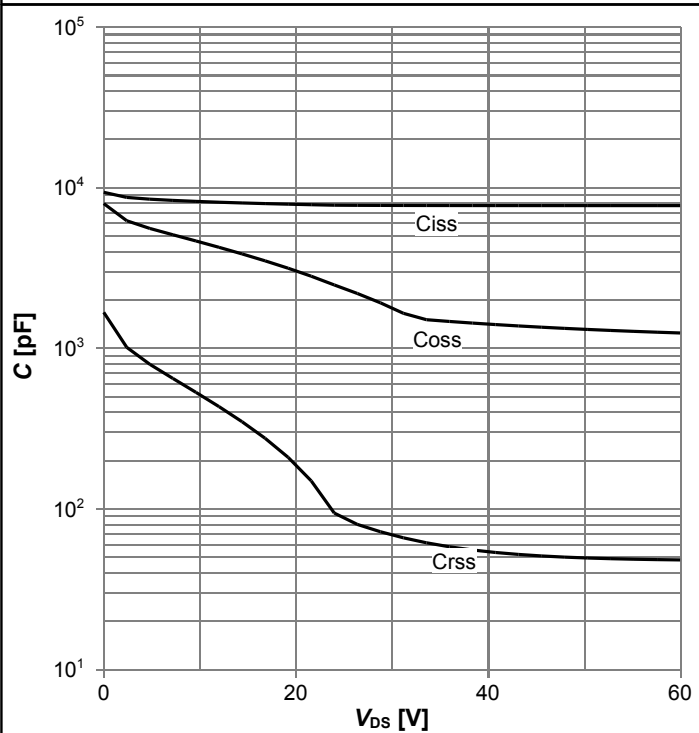
$R_{DS(on)}=f(T_j)$; $I_D=100\text{ A}$; $V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



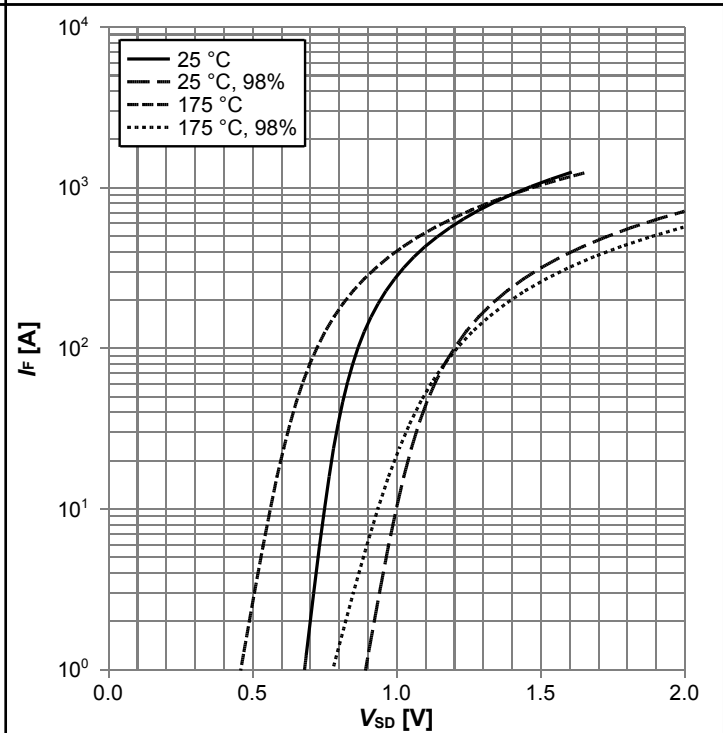
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$

Diagram 11: Typ. capacitances



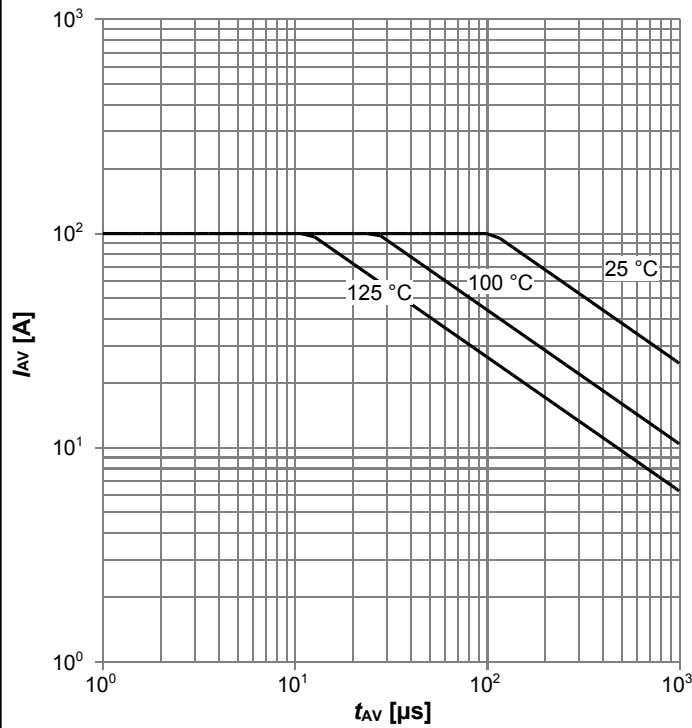
$C=f(V_{DS})$; $V_{GS}=0\text{ V}$; $f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



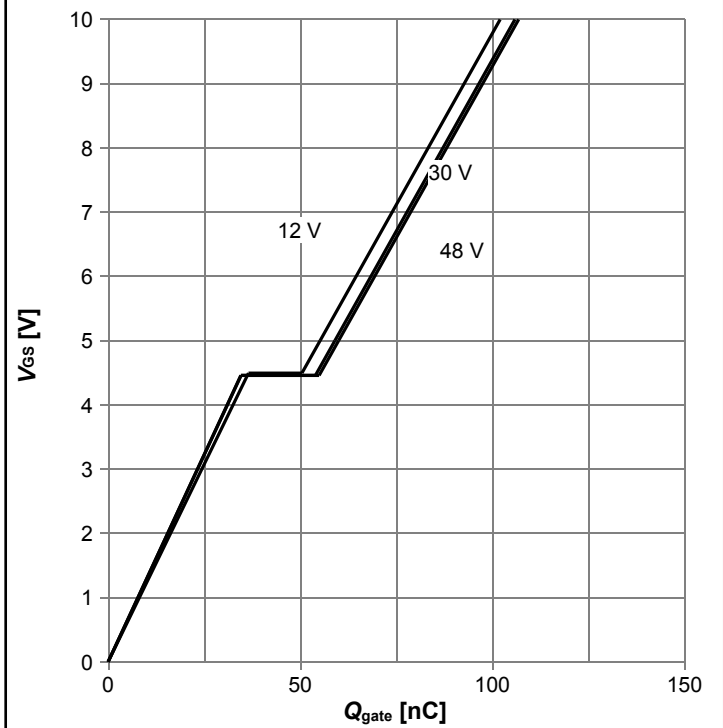
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



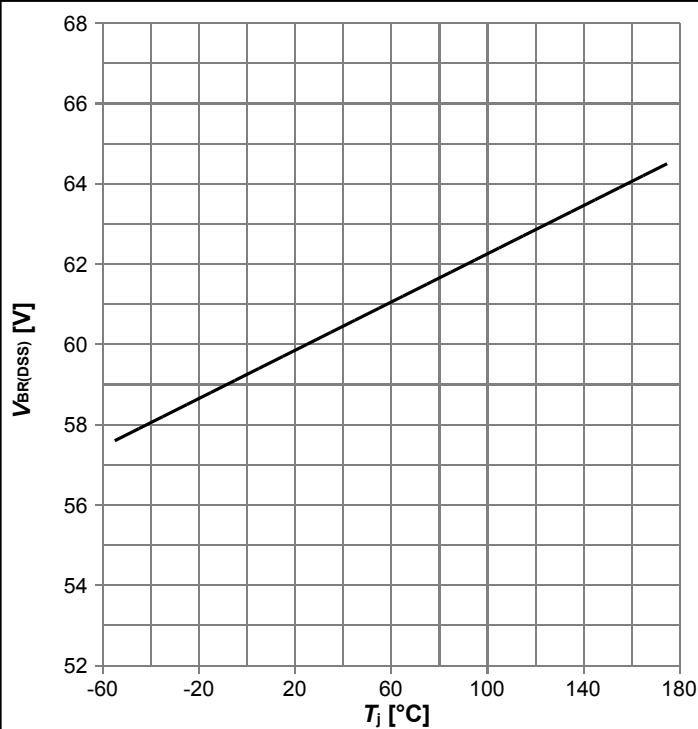
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



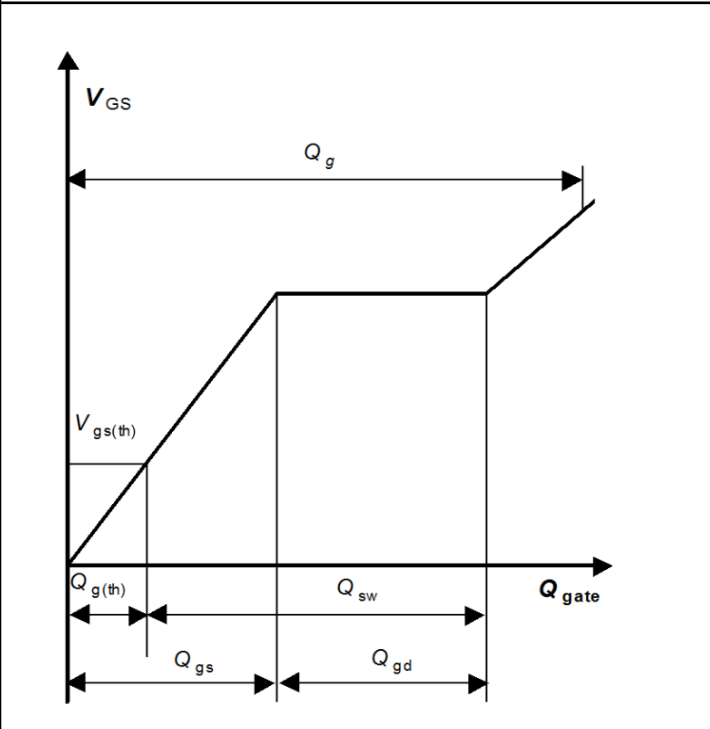
$V_{GS}=f(Q_{gate}); I_D=100$ A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

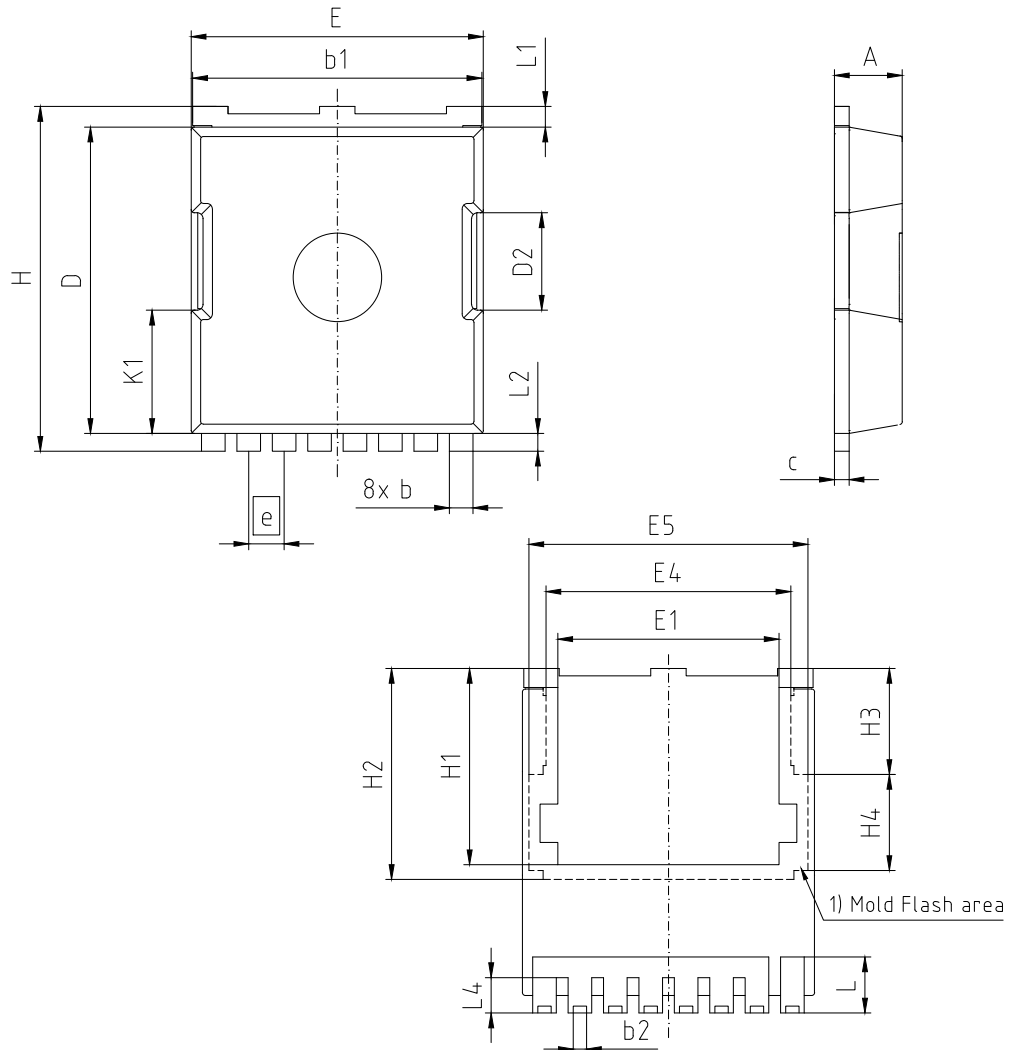


$V_{BR(DSS)}=f(T_j); I_D=1$ mA

Diagram Gate charge waveforms



5 Package Outlines



1) partially covered with Mold Flash

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 2.20 | 2.40 | 0.087 | 0.094 |
| b | 0.70 | 0.90 | 0.028 | 0.035 |
| b1 | 9.70 | 9.90 | 0.382 | 0.390 |
| b2 | 0.42 | 0.50 | 0.017 | 0.020 |
| c | 0.40 | 0.60 | 0.016 | 0.024 |
| D | 10.28 | 10.58 | 0.405 | 0.416 |
| D2 | 3.30 | | 0.130 | |
| E | 9.70 | 10.10 | 0.382 | 0.398 |
| E1 | 7.50 | | 0.295 | |
| E4 | 8.50 | | 0.335 | |
| E5 | 9.46 | | 0.372 | |
| e | 1.20 (BSC) | | 0.047 (BSC) | |
| H | 11.48 | 11.88 | 0.452 | 0.468 |
| H1 | 6.55 | 6.75 | 0.258 | 0.266 |
| H2 | 7.15 | | 0.281 | |
| H3 | 3.59 | | 0.141 | |
| H4 | 3.26 | | 0.128 | |
| N | 8 | | 8 | |
| K1 | 4.18 | | 0.165 | |
| L | 1.60 | 2.10 | 0.063 | 0.083 |
| L1 | 0.70 | | 0.028 | |
| L2 | 0.60 | | 0.024 | |
| L4 | 1.00 | 1.30 | 0.039 | 0.051 |

| |
|------------------------------------|
| DOCUMENT NO. Z8B00169619 |
| SCALE 0 2 4mm |
| EUROPEAN PROJECTION |
| ISSUE DATE 20-02-2014 |
| REVISION 02 |

Figure 1 Outline PG-HSOF-8, dimensions in mm/inches

Revision History

IPT012N06N

Revision: 2019-07-15, Rev. 2.1

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.0 | 2016-12-09 | Release of final version |
| 2.1 | 2019-07-15 | Update Continuous Current |

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