

MOSFET

OptiMOS™ Power Transistor, -60 V

Features

- P-Channel
- Very low on-resistance $R_{DS(on)}$
- 100% avalanche tested
- Normal Level
- Enhancement mode
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product Validation:

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

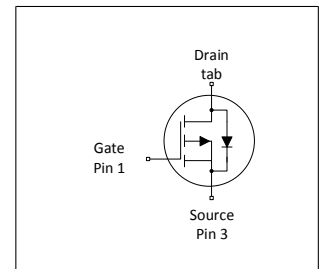


Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|------------------|-------|------------|
| V_{DS} | -60 | V |
| $R_{DS(on),max}$ | 65 | m Ω |
| I_D | -22 | A |

| Type / Ordering Code | Package | Marking | Related Links |
|----------------------|-------------|---------|---------------|
| IPD06P003N | PG-TO 252-3 | 06P003N | - |

Table of Contents

| | |
|---|----|
| Description | 1 |
| Maximum ratings | 3 |
| Thermal characteristics | 3 |
| Electrical characteristics | 3 |
| Electrical characteristics diagrams | 5 |
| Package Outlines | 9 |
| Revision History | 10 |
| Trademarks | 10 |
| Disclaimer | 10 |

1 Maximum ratings

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

Table 2 Maximum ratings

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|-------------------|--------|------|------------|------|---|
| | | Min. | Typ. | Max. | | |
| Continuous drain current | I_D | - | - | -22 -17 | A | $V_{GS}=-10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=-10\text{ V}$, $T_C=100\text{ °C}$ |
| Pulsed drain current ¹⁾ | $I_{D,pulse}$ | - | - | -88 | A | $T_C=25\text{ °C}$ |
| Avalanche energy, single pulse ²⁾ | E_{AS} | - | - | 329 | mJ | $I_D=-22\text{ A}$, $R_{GS}=25\text{ }\Omega$ |
| Gate source voltage | V_{GS} | -20 | - | 20 | V | - |
| Power dissipation | P_{tot} | - | - | 83 | 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, bottom | R_{thJC} | - | - | 1.8 | °C/W | - |
| Device on PCB, 6 cm ² cooling area ³⁾ | R_{thJA} | - | - | 75 | °C/W | - |

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 | $V_{GS}=0\text{ V}$, $I_D=-250\text{ }\mu\text{A}$ |
| Gate threshold voltage | $V_{GS(th)}$ | -2.1 | -3 | -4 | V | $V_{DS}=V_{GS}$, $I_D=-1040\text{ }\mu\text{A}$ |
| Zero gate voltage drain current | I_{DSS} | - | -0.1 -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 | $R_{DS(on)}$ | - | 52 | 65 | m Ω | $V_{GS}=-10\text{ V}$, $I_D=-22\text{ A}$ |
| Gate resistance | R_G | - | 5 | - | Ω | - |
| Transconductance | g_{fs} | - | 21 | - | S | $ V_{DS} \geq 2 I_D /R_{DS(on)max}$, $I_D=-22\text{ A}$ |

¹⁾ See Diagram 3 for more detailed information

²⁾ See Diagram 13 for more detailed information

³⁾ 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.

Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|------------------------------|--------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Input capacitance | C_{iss} | - | 1600 | - | pF | $V_{GS}=0\text{ V}$, $V_{DS}=-30\text{ V}$, $f=1\text{ MHz}$ |
| Output capacitance | C_{oss} | - | 220 | - | pF | $V_{GS}=0\text{ V}$, $V_{DS}=-30\text{ V}$, $f=1\text{ MHz}$ |
| Reverse transfer capacitance | C_{riss} | - | 54 | - | pF | $V_{GS}=0\text{ V}$, $V_{DS}=-30\text{ V}$, $f=1\text{ MHz}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 12 | - | ns | $V_{DD}=-30\text{ V}$, $V_{GS}=-10\text{ V}$, $I_D=-11\text{ A}$, $R_{G,ext}=1.6\ \Omega$ |
| Rise time | t_r | - | 14 | - | ns | $V_{DD}=-30\text{ V}$, $V_{GS}=-10\text{ V}$, $I_D=-11\text{ A}$, $R_{G,ext}=1.6\ \Omega$ |
| Turn-off delay time | $t_{d(off)}$ | - | 33 | - | ns | $V_{DD}=-30\text{ V}$, $V_{GS}=-10\text{ V}$, $I_D=-11\text{ A}$, $R_{G,ext}=1.6\ \Omega$ |
| Fall time | t_f | - | 12 | - | ns | $V_{DD}=-30\text{ V}$, $V_{GS}=-10\text{ V}$, $I_D=-11\text{ A}$, $R_{G,ext}=1.6\ \Omega$ |

Table 6 Gate charge characteristics¹⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--------------------------|---------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | Q_{gs} | - | -9 | - | nC | $V_{DD}=-30\text{ V}$, $I_D=-22\text{ A}$, $V_{GS}=0\text{ to }-10\text{ V}$ |
| Gate charge at threshold | $Q_{g(th)}$ | - | -5 | - | nC | $V_{DD}=-30\text{ V}$, $I_D=-22\text{ A}$, $V_{GS}=0\text{ to }-10\text{ V}$ |
| Gate to drain charge | Q_{gd} | - | -15 | - | nC | $V_{DD}=-30\text{ V}$, $I_D=-22\text{ A}$, $V_{GS}=0\text{ to }-10\text{ V}$ |
| Switching charge | Q_{sw} | - | -19 | - | nC | $V_{DD}=-30\text{ V}$, $I_D=-22\text{ A}$, $V_{GS}=0\text{ to }-10\text{ V}$ |
| Gate charge total | Q_g | - | -39 | - | nC | $V_{DD}=-30\text{ V}$, $I_D=-22\text{ A}$, $V_{GS}=0\text{ to }-10\text{ V}$ |
| Gate plateau voltage | $V_{plateau}$ | - | -5.5 | - | V | $V_{DD}=-30\text{ V}$, $I_D=-22\text{ A}$, $V_{GS}=0\text{ to }-10\text{ V}$ |
| Output charge | Q_{oss} | - | -28 | - | nC | $V_{DD}=-30\text{ V}$, $V_{GS}=0\text{ V}$ |

Table 7 Reverse diode

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|----------------------------------|---------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Diode continuous forward current | I_S | - | - | -22 | A | $T_C=25\text{ }^\circ\text{C}$ |
| Diode pulse current | $I_{S,pulse}$ | - | - | -88 | A | $T_C=25\text{ }^\circ\text{C}$ |
| Diode forward voltage | V_{SD} | - | -0.9 | -1.2 | V | $V_{GS}=0\text{ V}$, $I_F=-22\text{ A}$, $T_J=25\text{ }^\circ\text{C}$ |
| Reverse recovery time | t_{rr} | - | 39 | - | ns | $V_R=-30\text{ V}$, $I_F=-22\text{ A}$, $di_F/dt=-100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge | Q_{rr} | - | -83 | - | nC | $V_R=-30\text{ V}$, $I_F=-22\text{ A}$, $di_F/dt=-100\text{ A}/\mu\text{s}$ |

¹⁾ See Diagram "Gate charge waveforms" for gate charge parameter definition

4 Electrical characteristics diagrams

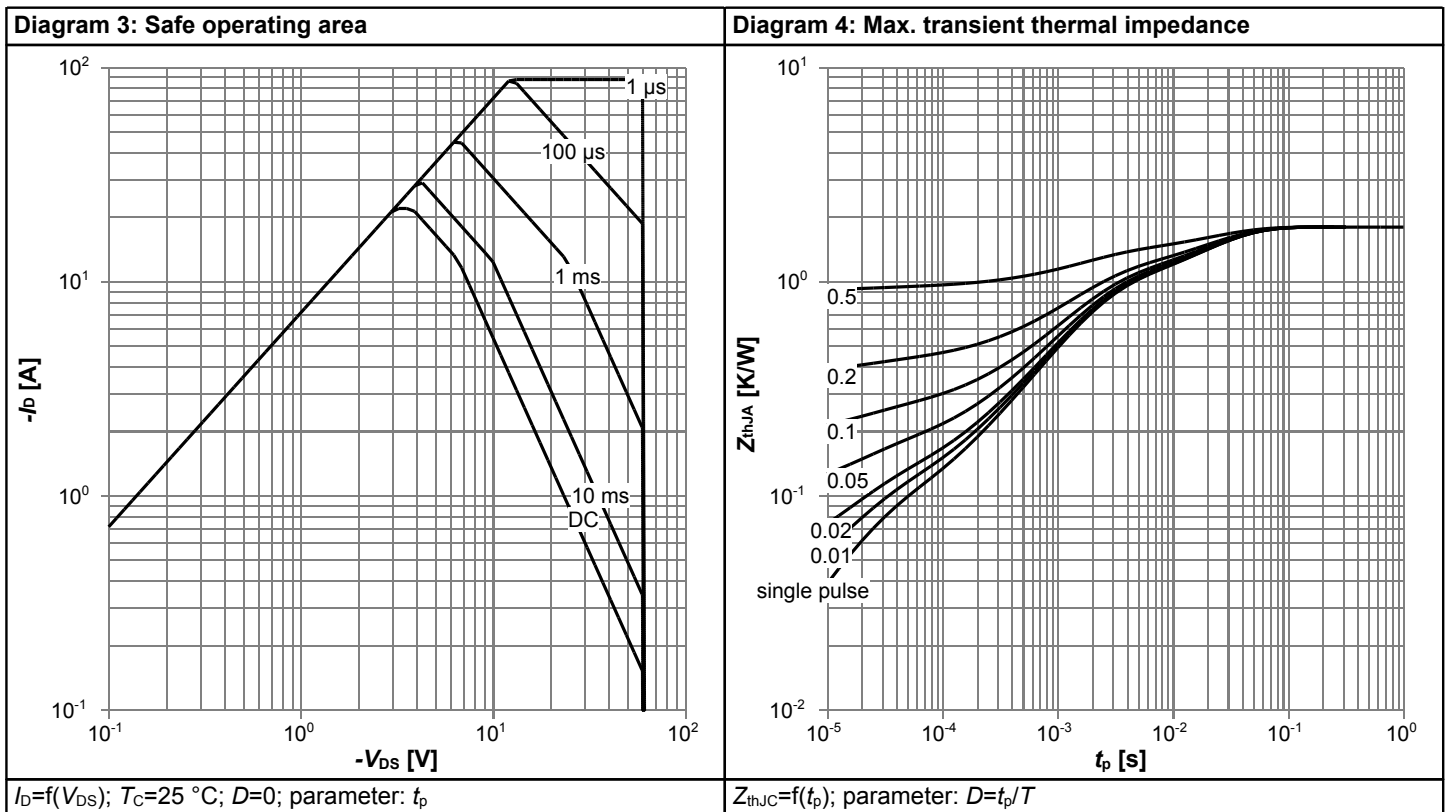
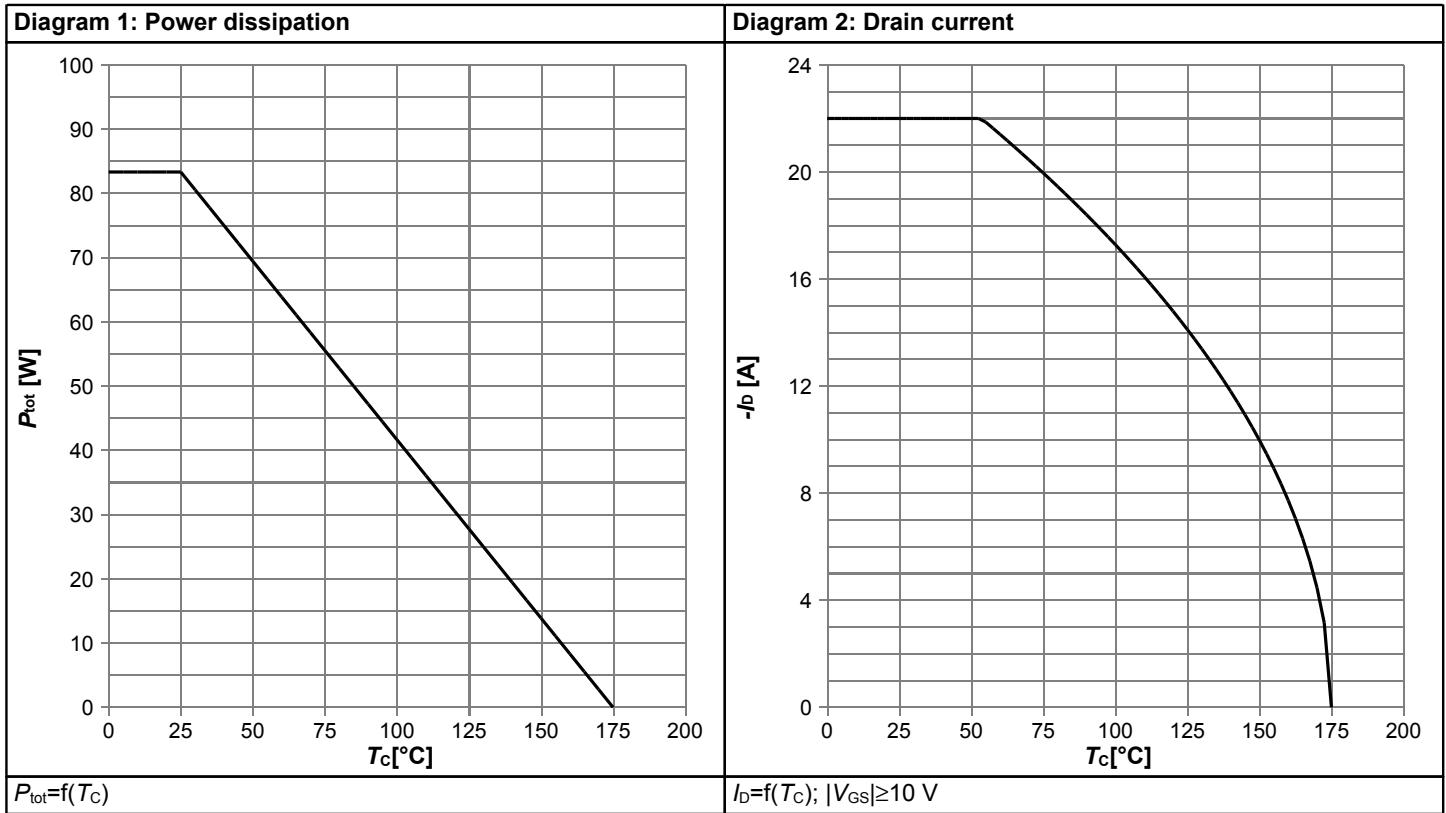
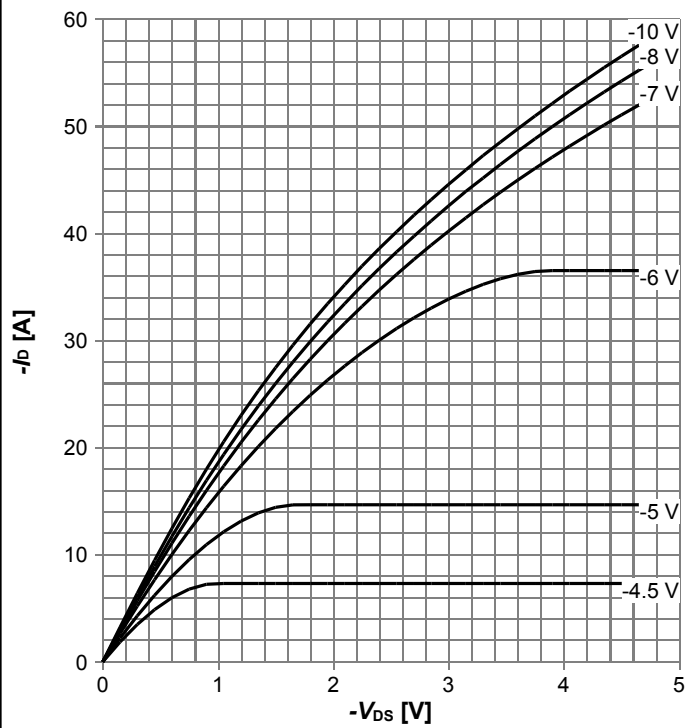
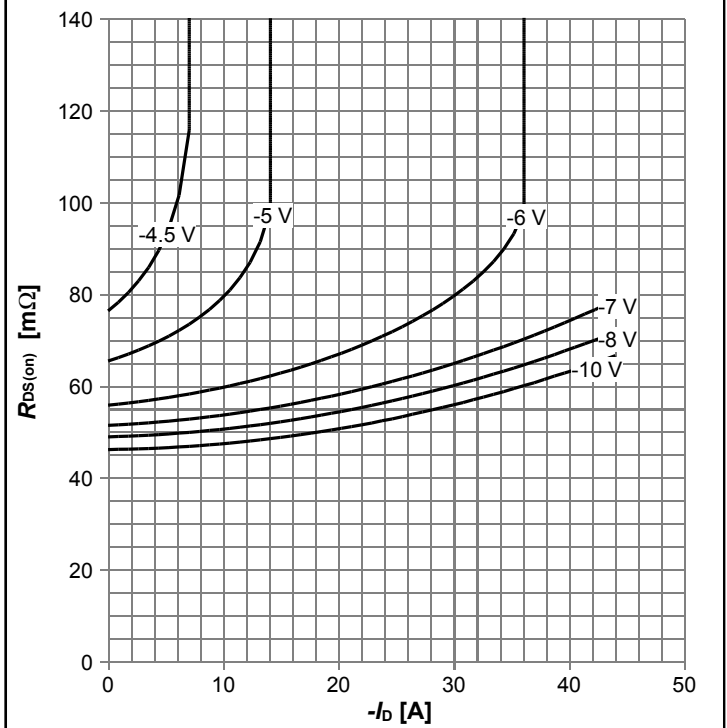


Diagram 5: Typ. output characteristics



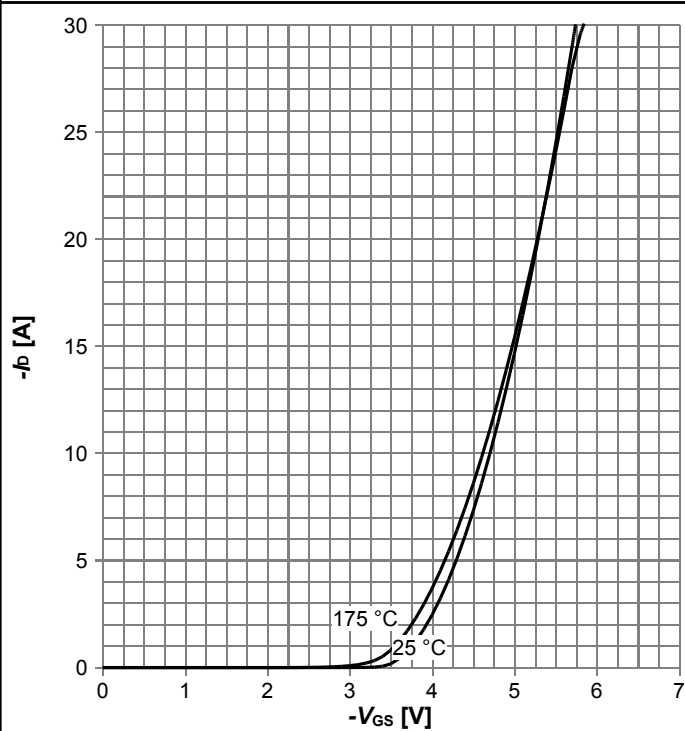
$I_D=f(V_{DS})$, $T_j=25\text{ }^\circ\text{C}$; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



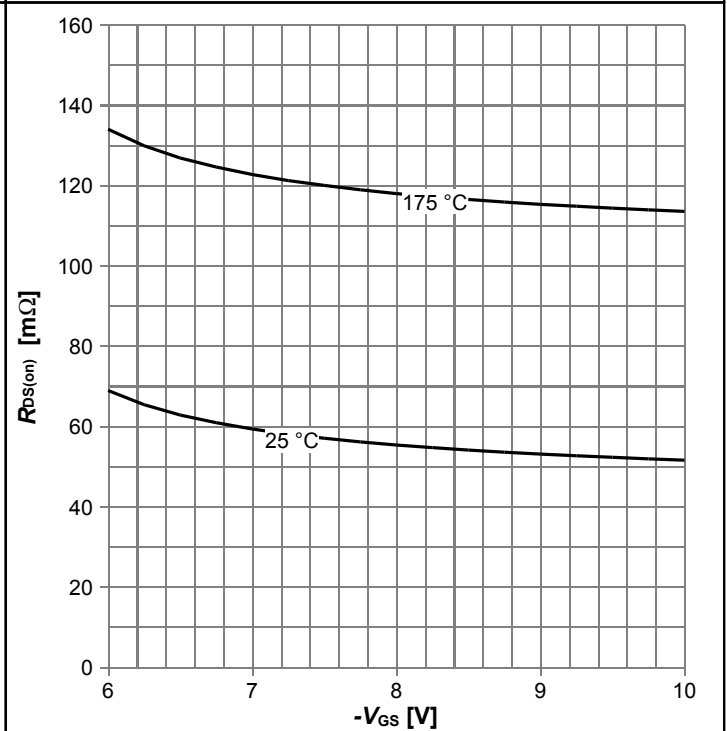
$R_{DS(on)}=f(I_D)$, $T_j=25\text{ }^\circ\text{C}$; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



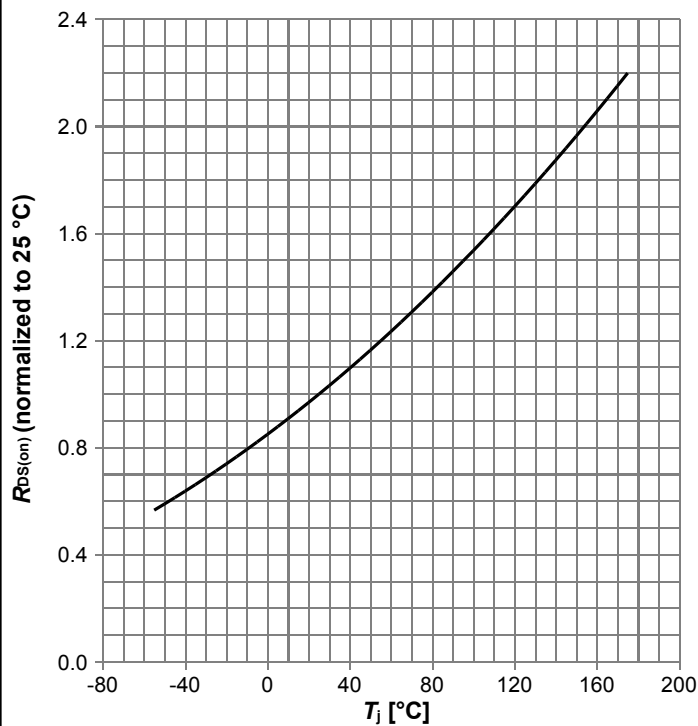
$I_D=f(V_{GS})$, $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



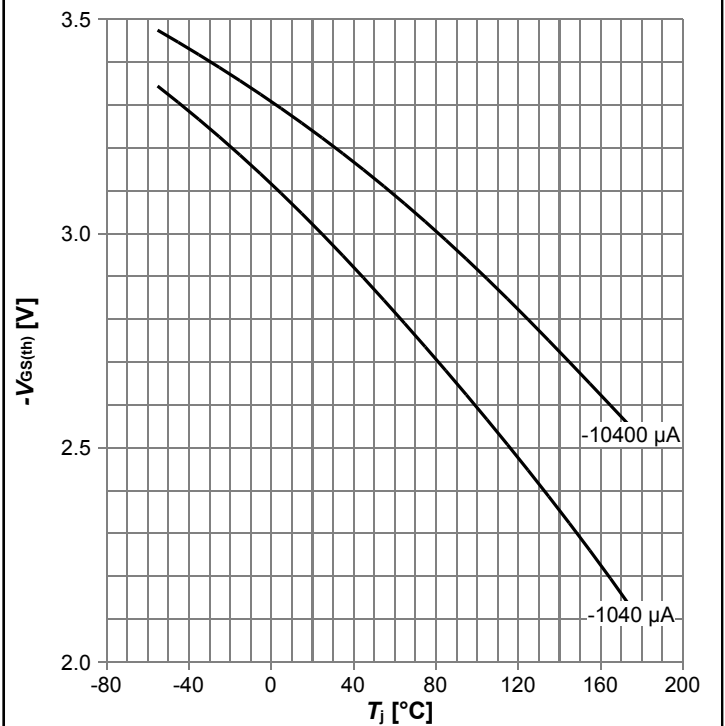
$R_{DS(on)}=f(V_{GS})$, $I_D=-22\text{ A}$; parameter: T_j

Diagram 9: Normalized drain-source on resistance



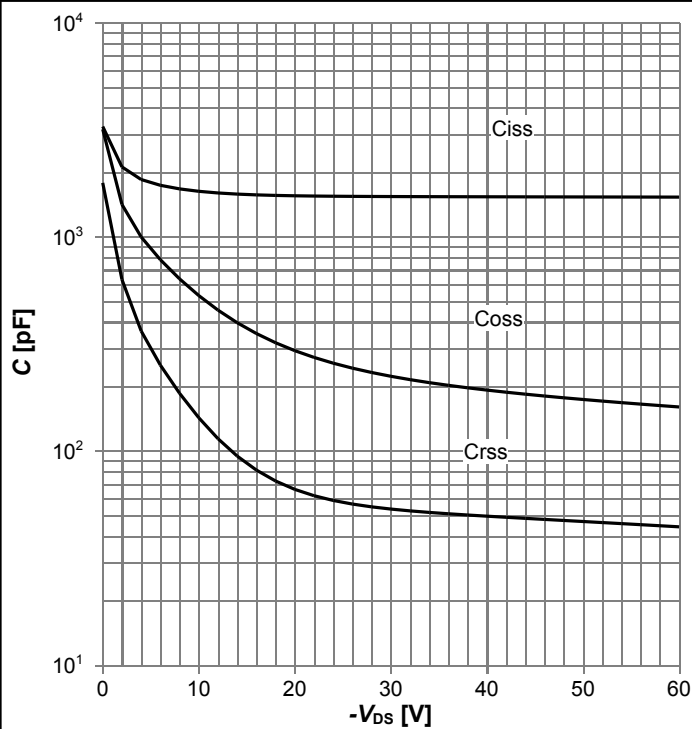
$R_{DS(on)}=f(T_j)$, $I_D=-22$ A, $V_{GS}=-10$ V

Diagram 10: Typ. gate threshold voltage



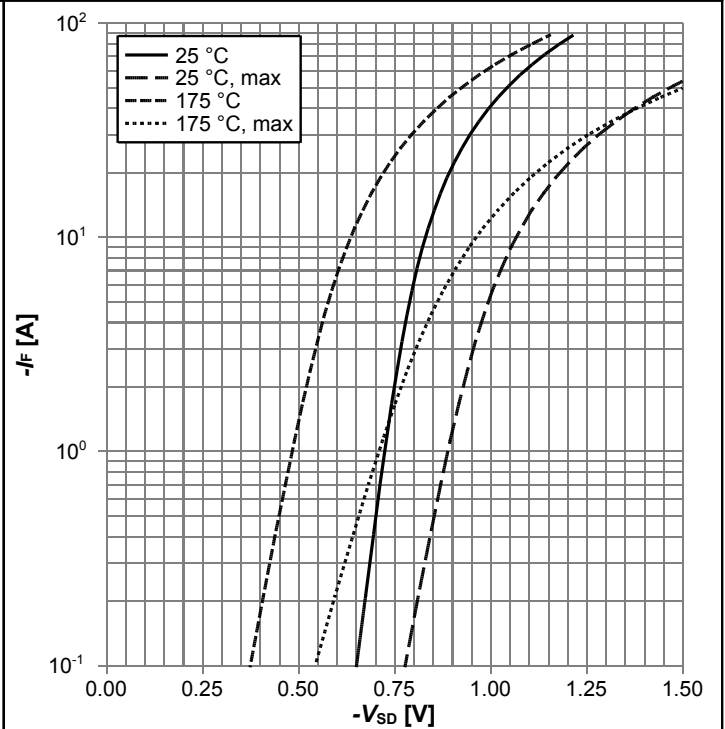
$V_{GS(th)}=f(T_j)$, $V_{GS}=V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



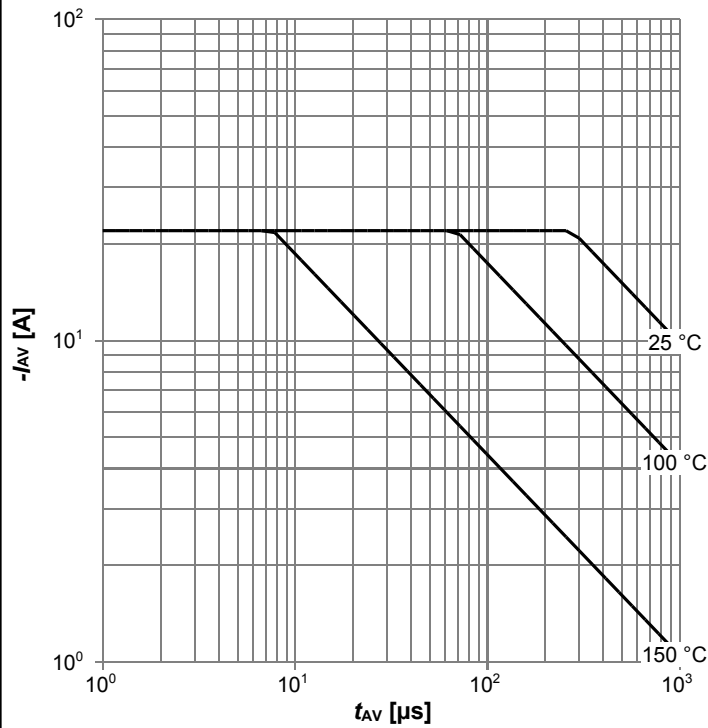
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz

Diagram 12: Forward characteristics of reverse diode



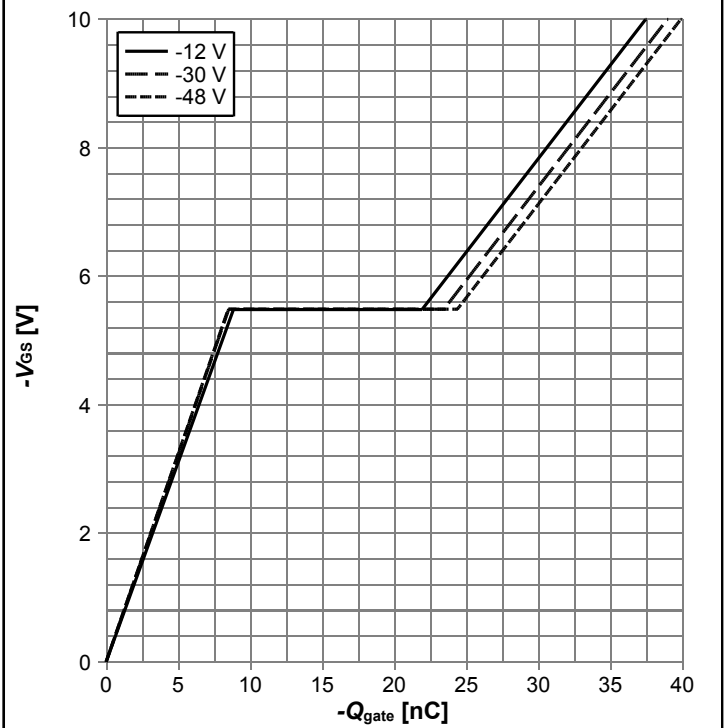
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



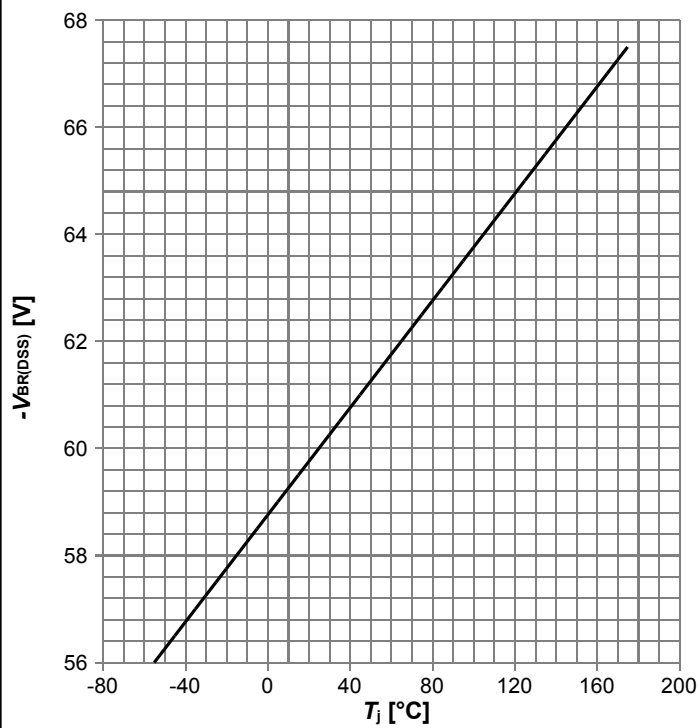
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



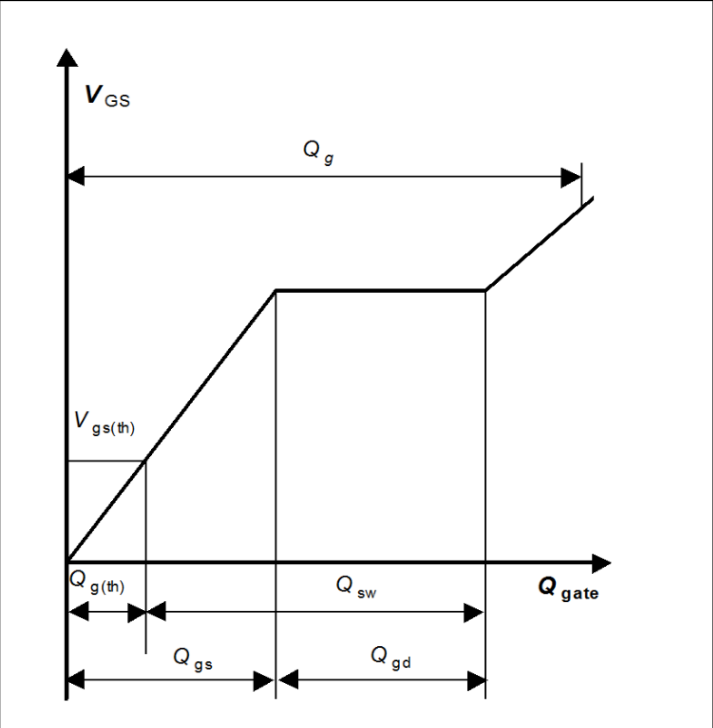
$V_{GS}=f(Q_{gate}), I_D=-22 \text{ A pulsed}, T_j=25 \text{ °C}$; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

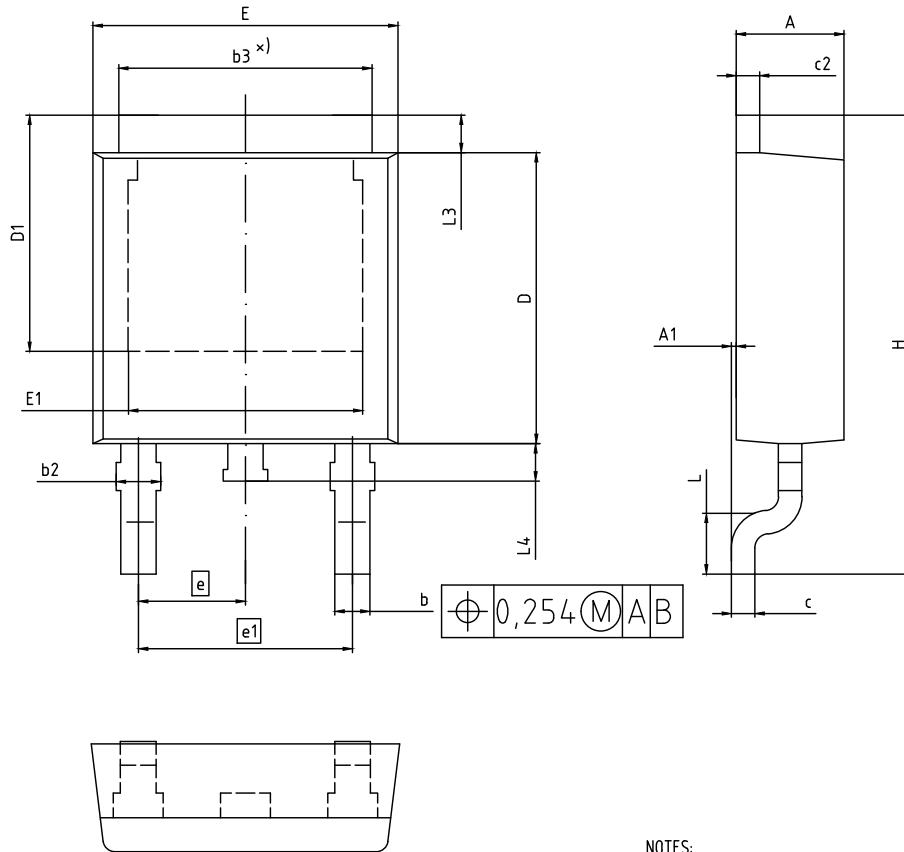


$V_{BR(DSS)}=f(T_j); I_D=-250 \mu\text{A}$

Diagram Gate charge waveforms



5 Package Outlines



NOTES:

1. INDUSTRIAL QUALITY GRADE
2. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 2.16 | 2.41 | 0.085 | 0.095 |
| A1 | 0.00 | 0.15 | 0.000 | 0.006 |
| b | 0.64 | 0.89 | 0.025 | 0.035 |
| b2 | 0.65 | 1.15 | 0.026 | 0.045 |
| b3 | 4.95 | 5.50 | 0.195 | 0.217 |
| c | 0.46 | 0.61 | 0.018 | 0.024 |
| c2 | 0.40 | 0.98 | 0.016 | 0.039 |
| D | 5.97 | 6.22 | 0.235 | 0.245 |
| D1 | 5.02 | 5.84 | 0.198 | 0.230 |
| E | 6.35 | 6.73 | 0.250 | 0.265 |
| E1 | 4.32 | 5.21 | 0.185 | 0.205 |
| e | 2.29 (BSC) | | 0.090 (BSC) | |
| e1 | 4.57 (BSC) | | 0.180 (BSC) | |
| N | 3 | | 3 | |
| H | 9.40 | 10.48 | 0.370 | 0.413 |
| L | 1.18 | 1.78 | 0.046 | 0.070 |
| L3 | 0.89 | 1.27 | 0.035 | 0.050 |
| L4 | 0.51 | 1.02 | 0.020 | 0.040 |

| |
|------------------------------------|
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| REVISION 06 |

Figure 1 Outline PG-TO 252-3, dimensions in mm/inches

Revision History

IPD06P003N

Revision: 2018-05-09, Rev. 2.0

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.0 | 2018-05-09 | Release of final version |

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