

# MOSFET

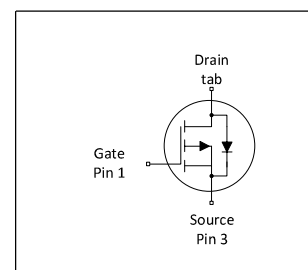
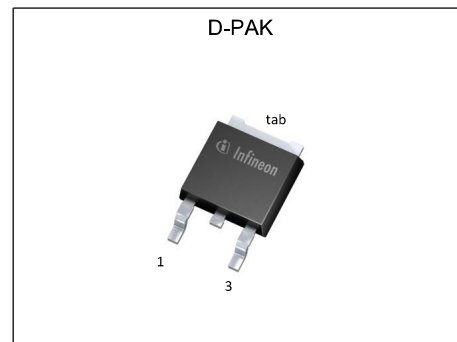
## OptiMOS™ Power-Transistor, -100 V

### Features

- P-channel
- 100% avalanche tested
- Normal level
- Enhancement mode
- 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 |
|------------------|-------|------|
| $V_{DS}$         | -100  | V    |
| $R_{DS(on),max}$ | 111   | mΩ   |
| $I_D$            | -22   | A    |
| $Q_{oss}$        | -21   | nC   |
| $Q_G$            | -59   | nC   |



RoHS

| Type / Ordering Code | Package    | Marking  | Related Links |
|----------------------|------------|----------|---------------|
| IPD11DP10NM          | PG-TO252-3 | 11DP10NM | -             |

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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>       | $I_D$             | -      | -    | -22<br>-15.4<br>-3.4 | A    | $V_{GS}=-10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=-10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=-10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{THJA}=50\text{ °C/W}^{2)}$ |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$     | -      | -    | -88                  | A    | $T_A=25\text{ °C}$                                                                                                                                                       |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$          | -      | -    | 540                  | mJ   | $I_D=-18\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                                                                           |
| Gate source voltage                          | $V_{GS}$          | -20    | -    | 20                   | V    | -                                                                                                                                                                        |
| Power dissipation                            | $P_{tot}$         | -      | -    | 125<br>3.0           | 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    | -    | 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                                     | $R_{thJC}$ | -      | -    | 1.2  | °C/W | -                     |
| Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area  | $R_{thJA}$ | -      | -    | 50   | °C/W | -                     |
| Thermal resistance, junction - ambient, minimal footprint <sup>2)</sup> | $R_{thJA}$ | -      | -    | 75   | °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           | $V_{GS(th)}$  | -2.1   | -3.0        | -4.0         | V             | $V_{DS}=V_{GS}$ , $I_D=-1700\text{ }\mu\text{A}$                                                                                        |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | -0.1<br>-10 | -1.0<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 | $R_{DS(on)}$  | -      | 88.9        | 111          | m $\Omega$    | $V_{GS}=-10\text{ V}$ , $I_D=-18\text{ A}$                                                                                              |
| Gate resistance                  | $R_G$         | -      | 5.0         | -            | $\Omega$      | -                                                                                                                                       |
| Transconductance                 | $g_{fs}$      | -      | 24          | -            | S             | $ V_{DS} \geq 2 I_D R_{DS(on)max}$ , $I_D=-18\text{ A}$                                                                                 |

**Table 5 Dynamic characteristics**

| Parameter                                  | Symbol       | Values |       |      | Unit | Note / Test Condition                                                                                 |
|--------------------------------------------|--------------|--------|-------|------|------|-------------------------------------------------------------------------------------------------------|
|                                            |              | Min.   | Typ.  | Max. |      |                                                                                                       |
| Input capacitance <sup>1)</sup>            | $C_{iss}$    | -      | 2500  | 3200 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=-50\text{ V}$ , $f=1\text{ MHz}$                                        |
| Output capacitance <sup>1)</sup>           | $C_{oss}$    | -      | 180   | 230  | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=-50\text{ V}$ , $f=1\text{ MHz}$                                        |
| Reverse transfer capacitance <sup>1)</sup> | $C_{rss}$    | -      | 36    | 63   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=-50\text{ V}$ , $f=1\text{ MHz}$                                        |
| Turn-on delay time                         | $t_{d(on)}$  | -      | 6.92  | -    | ns   | $V_{DD}=-50\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-18\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                                  | $t_r$        | -      | 14.89 | -    | ns   | $V_{DD}=-50\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-18\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time                        | $t_{d(off)}$ | -      | 51.25 | -    | ns   | $V_{DD}=-50\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-18\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                                  | $t_f$        | -      | 25.13 | -    | ns   | $V_{DD}=-50\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-18\text{ A}$ ,<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              | $Q_{gs}$      | -      | -12.3 | -    | nC   | $V_{DD}=-50\text{ V}$ , $I_D=-18\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$ |
| Gate charge at threshold           | $Q_{g(th)}$   | -      | -7.6  | -    | nC   | $V_{DD}=-50\text{ V}$ , $I_D=-18\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$ |
| Gate to drain charge <sup>1)</sup> | $Q_{gd}$      | -      | -18.9 | -28  | nC   | $V_{DD}=-50\text{ V}$ , $I_D=-18\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$ |
| Switching charge                   | $Q_{sw}$      | -      | -24   | -    | nC   | $V_{DD}=-50\text{ V}$ , $I_D=-18\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$ |
| Gate charge total <sup>1)</sup>    | $Q_g$         | -      | -59   | -74  | nC   | $V_{DD}=-50\text{ V}$ , $I_D=-18\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$ |
| Gate plateau voltage               | $V_{plateau}$ | -      | -4.8  | -    | V    | $V_{DD}=-50\text{ V}$ , $I_D=-18\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$ |
| Output charge <sup>1)</sup>        | $Q_{oss}$     | -      | -21   | -28  | 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      | $I_S$         | -      | -      | -22   | A    | $T_C=25\text{ °C}$                                                            |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -      | -88   | A    | $T_C=25\text{ °C}$                                                            |
| Diode forward voltage                 | $V_{SD}$      | -      | -0.87  | -1.2  | V    | $V_{GS}=0\text{ V}$ , $I_F=-18\text{ A}$ , $T_j=25\text{ °C}$                 |
| Reverse recovery time <sup>1)</sup>   | $t_{rr}$      | -      | 81.8   | 163.6 | ns   | $V_R=-50\text{ V}$ , $I_F=-18\text{ A}$ , $di_F/dt=-100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge <sup>1)</sup> | $Q_{rr}$      | -      | 318.55 | 637.1 | nC   | $V_R=-50\text{ V}$ , $I_F=-18\text{ A}$ , $di_F/dt=-100\text{ A}/\mu\text{s}$ |

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

## 4 Electrical characteristics diagrams

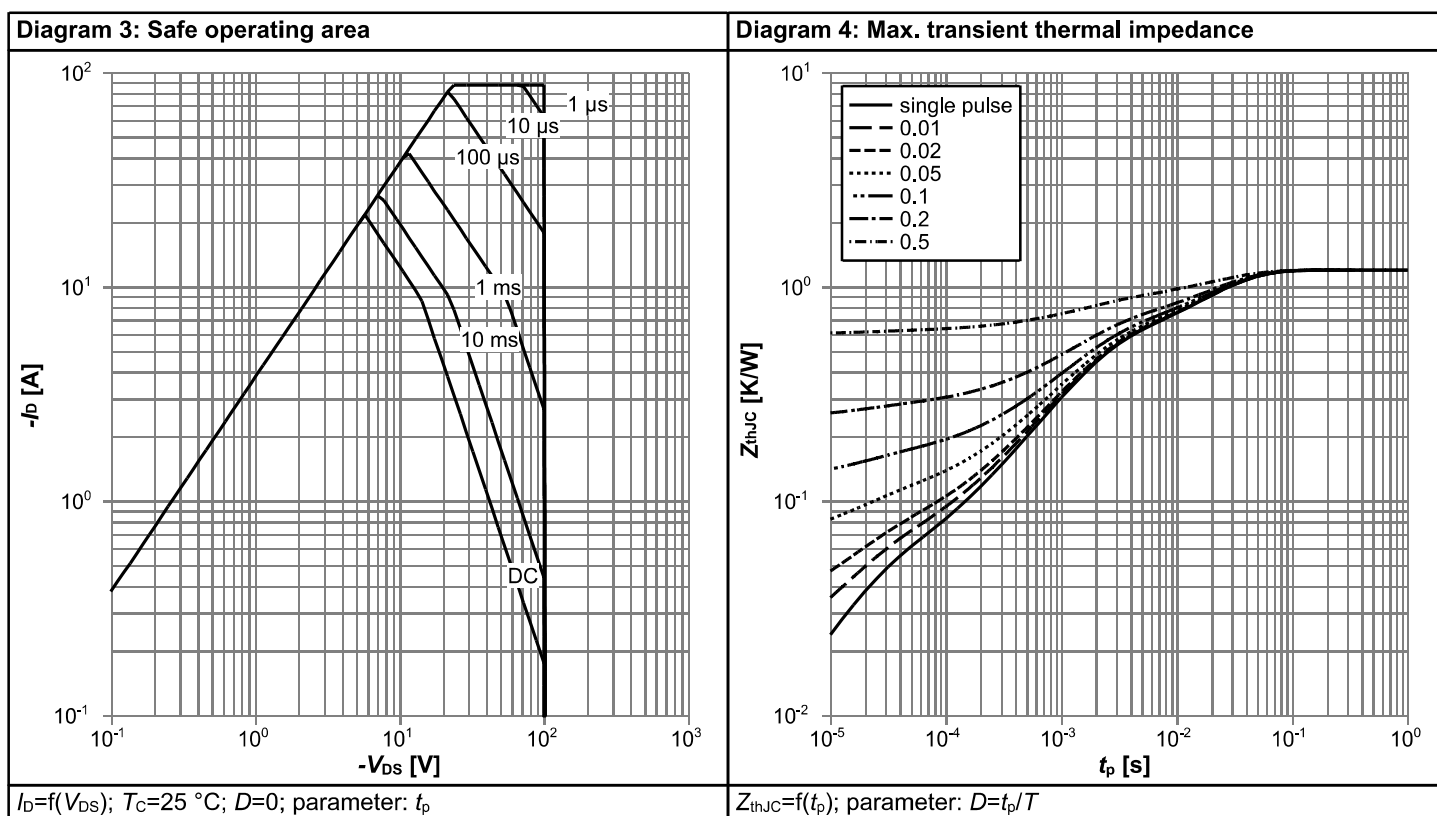
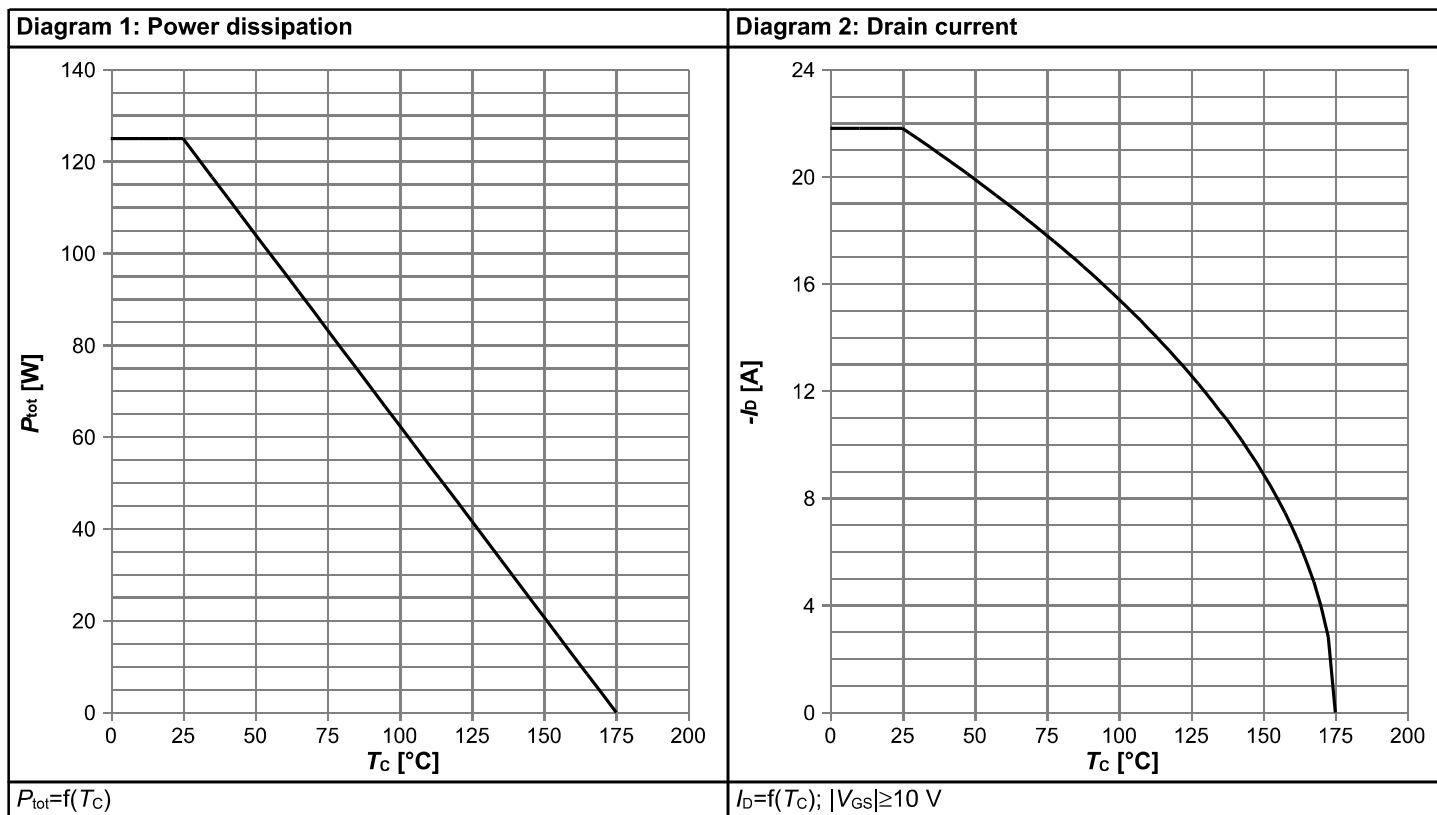
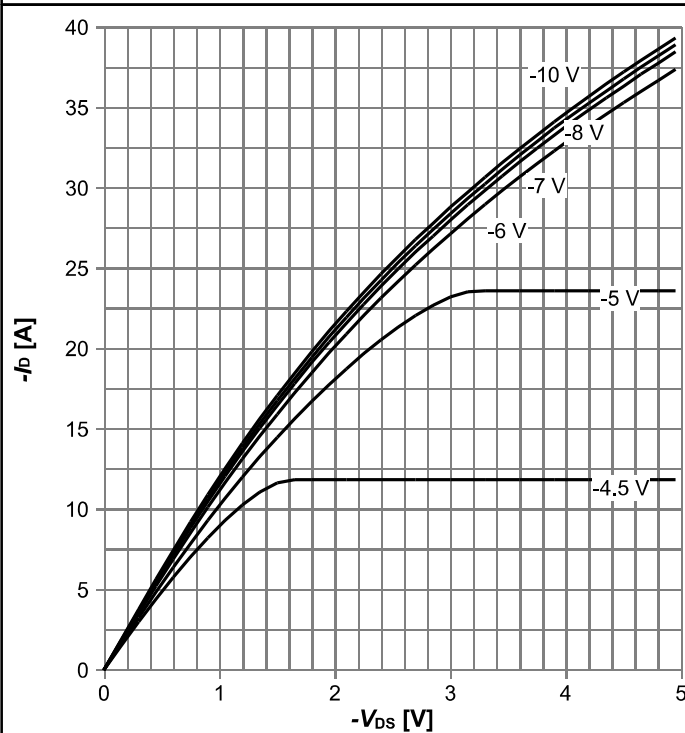
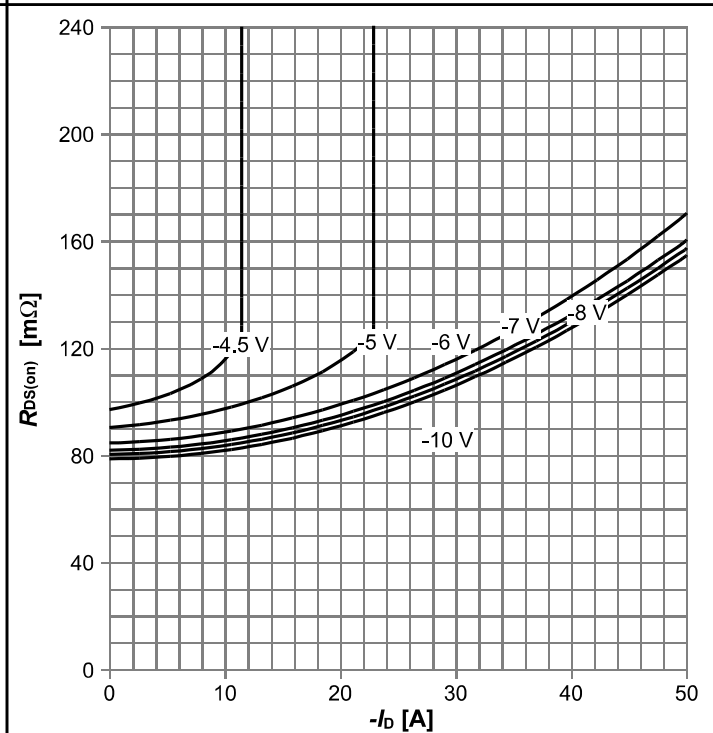


Diagram 5: Typ. output characteristics



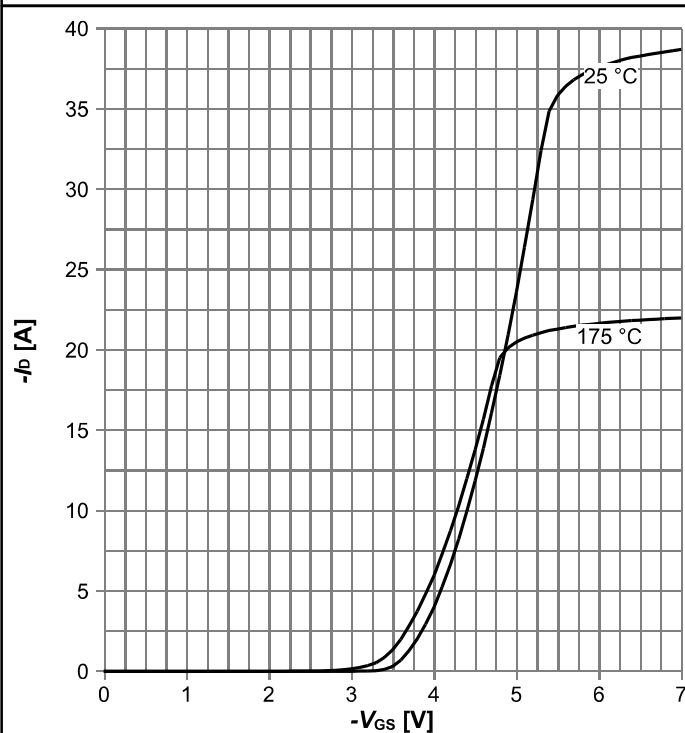
$I_D = f(V_{DS})$ ,  $T_J = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



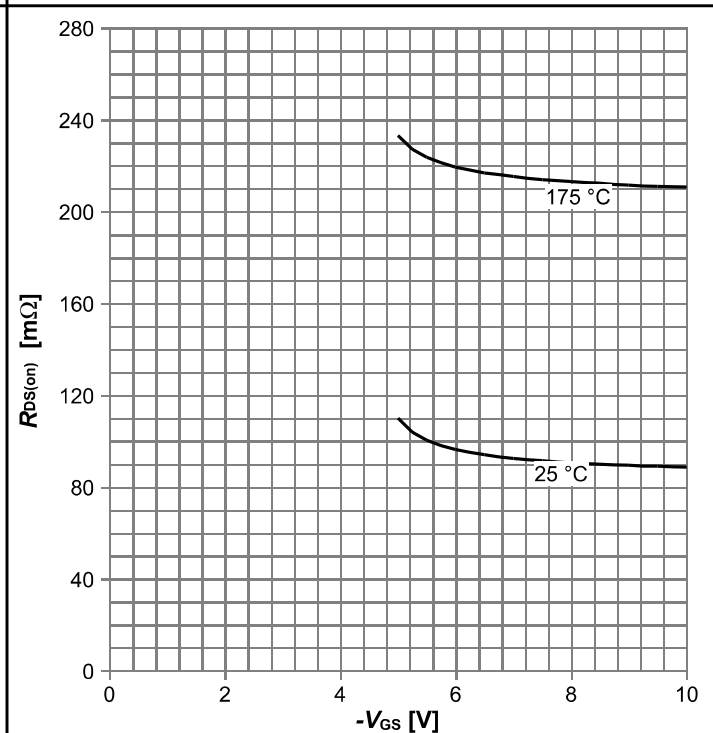
$R_{DS(on)} = f(I_D)$ ,  $T_J = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



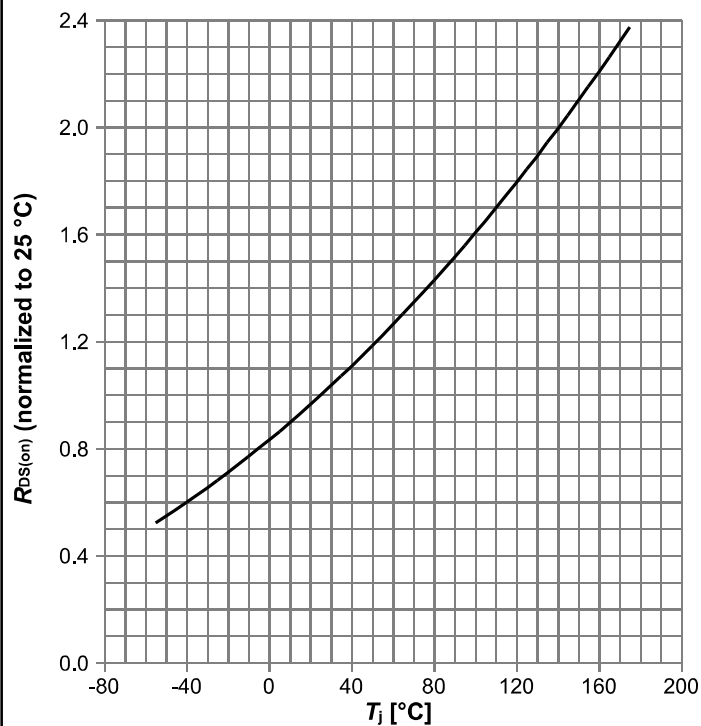
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_J$

Diagram 8: Typ. drain-source on resistance



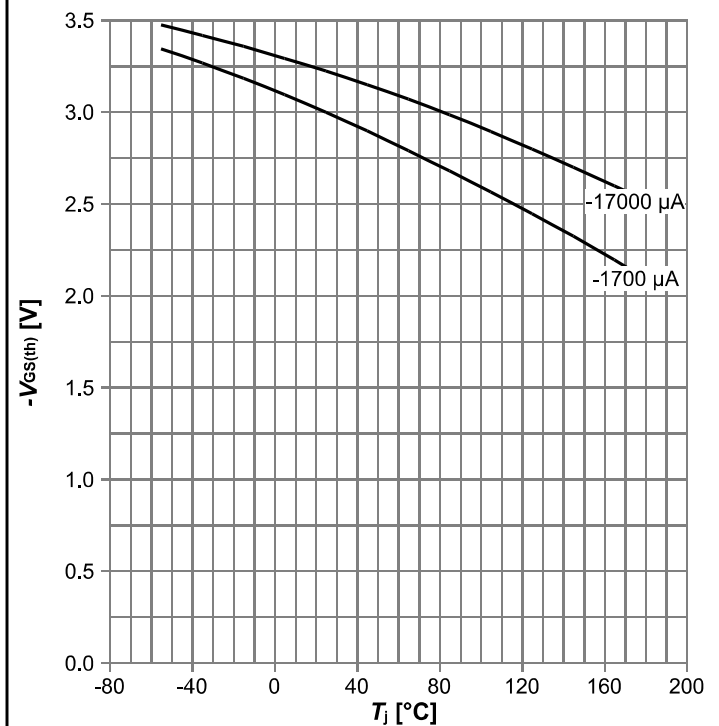
$R_{DS(on)} = f(V_{GS})$ ,  $I_D = -18$  A; parameter:  $T_J$

Diagram 9: Normalized drain-source on resistance



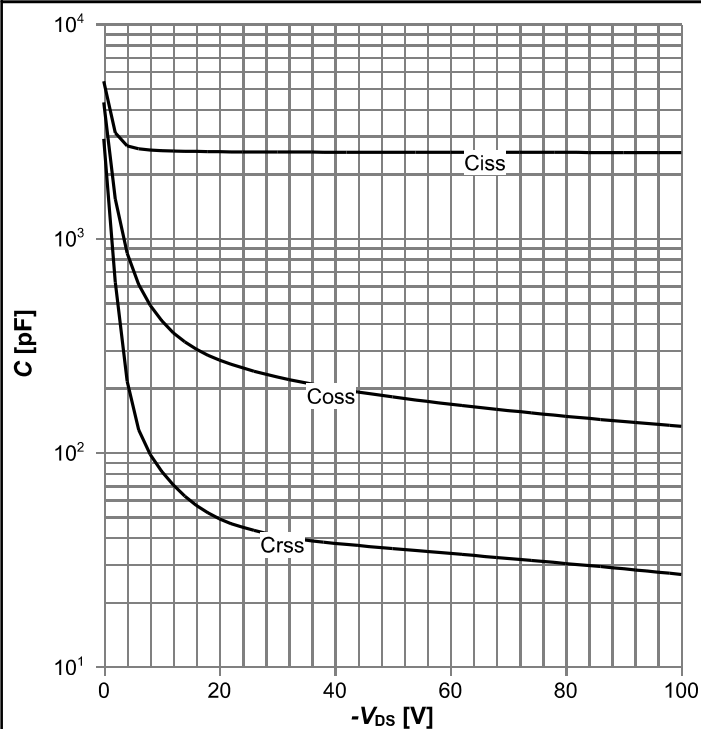
$R_{DS(on)} = f(T_j)$ ,  $I_D = -18$  A,  $V_{GS} = -10$  V

Diagram 10: Typ. gate threshold voltage



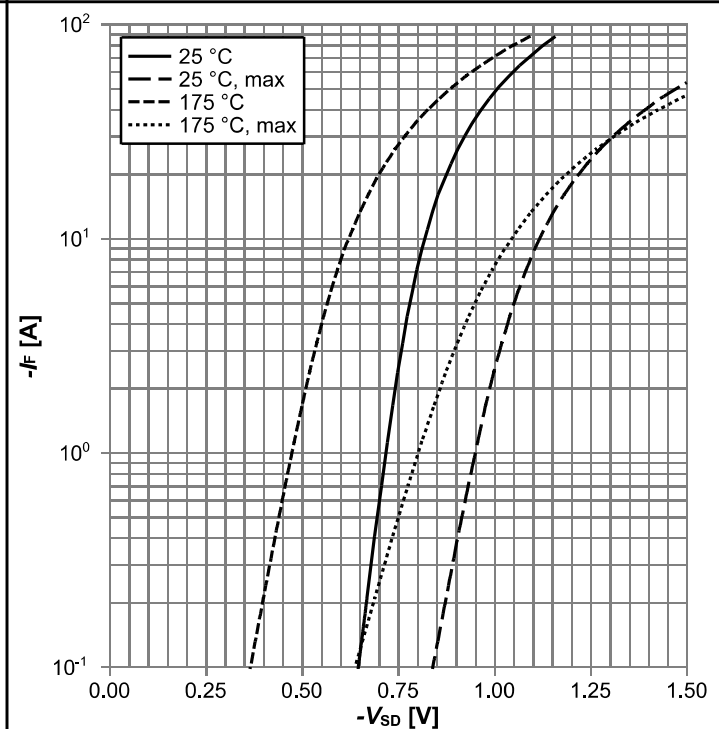
$V_{GS(th)} = f(T_j)$ ,  $V_{GS} = V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



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

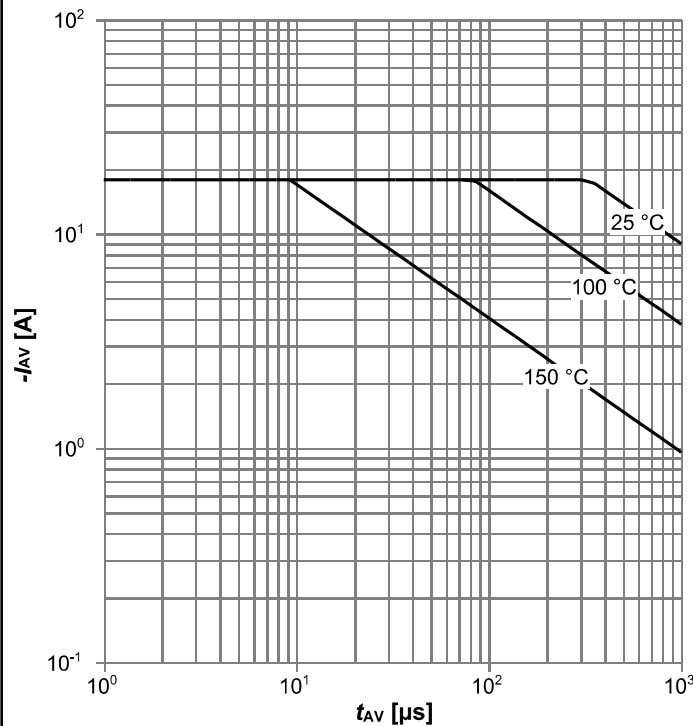
Diagram 12: Forward characteristics of reverse diode



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

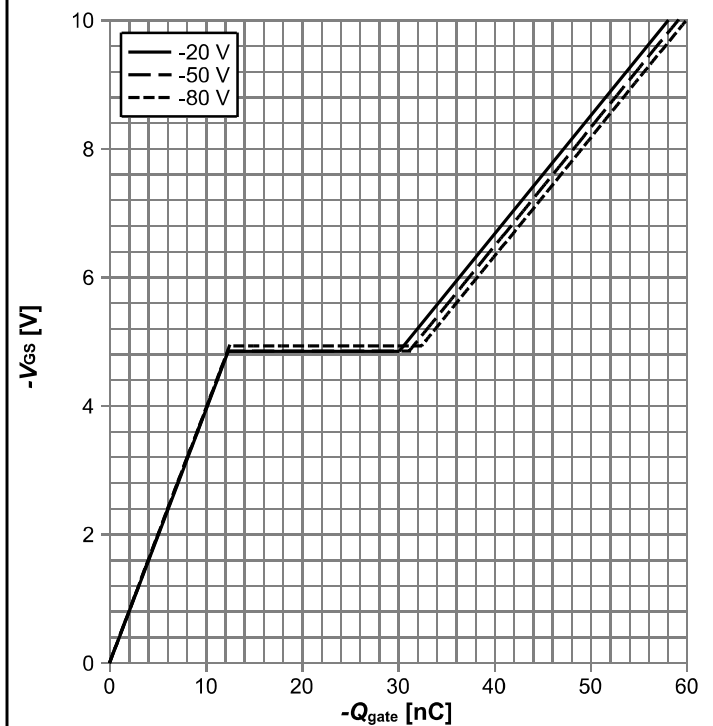


Diagram 13: Avalanche characteristics



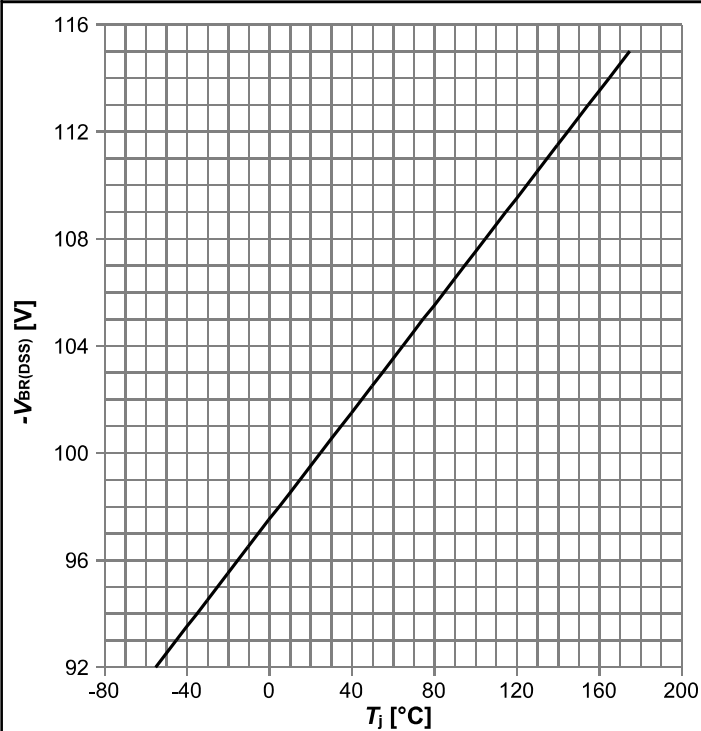
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25\ \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



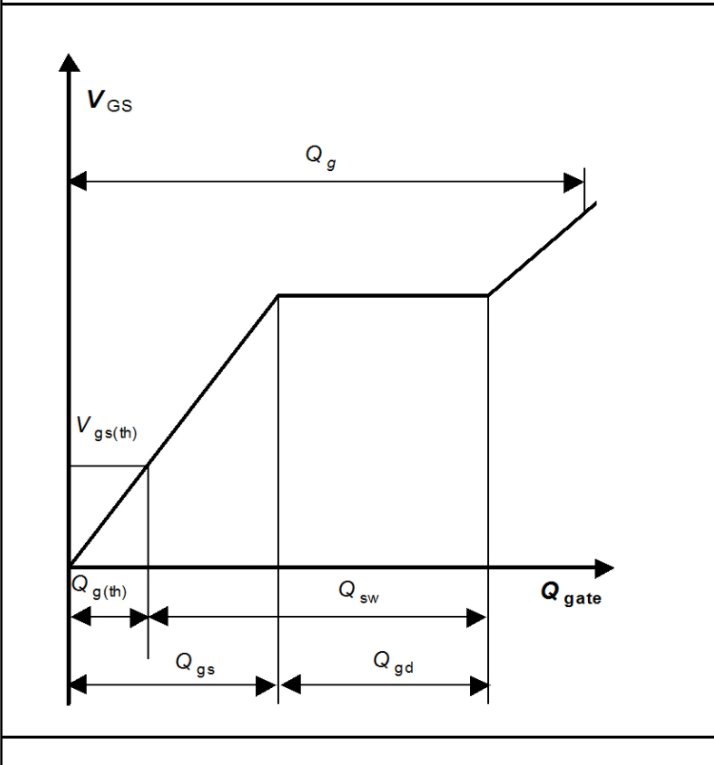
$V_{GS}=f(Q_{gate})$ ,  $I_D=-18\text{ A}$  pulsed,  $T_j=25\text{ °C}$ ; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

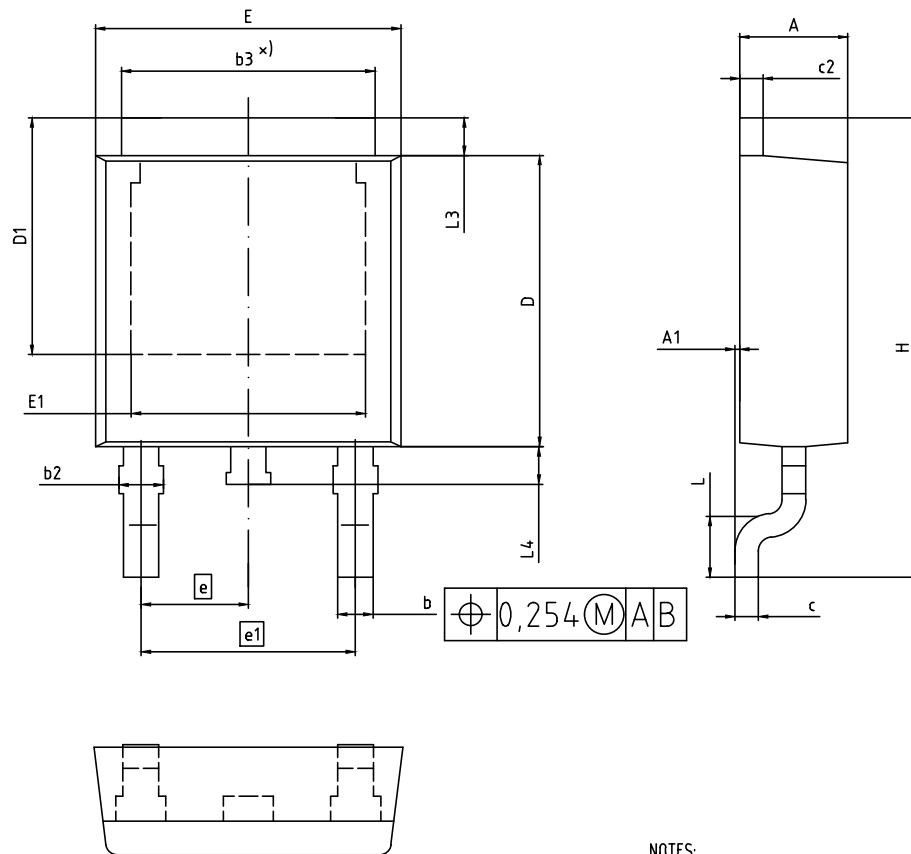


$V_{BR(DSS)}=f(T_j)$ ;  $I_D=-1\text{ mA}$

Diagram Gate charge waveforms



## 5 Package Outlines



### NOTES:

1. INDUSTRIAL QUALITY GRADE
2. ALL DIMENSIONS REFER TO JEDEC STANDARD T0-252 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<br>06              |  |

Figure 1 Outline PG-T0252-3, dimensions in mm/inches

## Revision History

IPD11DP10NM

**Revision: 2021-05-10, Rev. 2.0**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2021-05-10 | Release of final version                     |

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