

# MOSFET

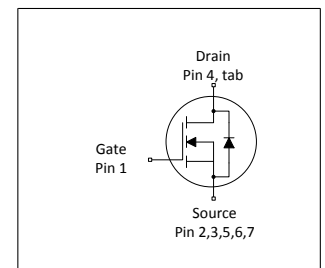
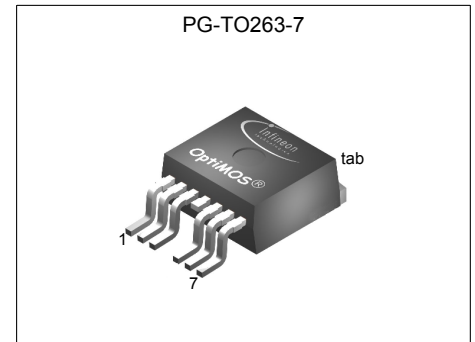
## StrongIRFET™ 2 Power-Transistor

### Features

- Optimized for a wide range of applications
- N-Channel, normal level
- 100% avalanche tested
- 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          |
| $R_{DS(on),max}$ | 4.25  | m $\Omega$ |
| $I_D$            | 139   | A          |
| $Q_{oss}$        | 74    | nC         |
| $Q_G$            | 57    | nC         |



RoHS

| Type / Ordering Code | Package    | Marking  | Related Links |
|----------------------|------------|----------|---------------|
| IPF042N10NF2S        | PG-TO263-7 | 042N10NS | -             |

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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>       | $I_D$             | -      | -    | 139<br>98<br>88<br>21 | A    | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=6\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=40\text{ °C/W}^2)$ |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$     | -      | -    | 556                   | A    | $T_A=25\text{ °C}$   |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$          | -      | -    | 105                   | mJ   | $I_D=82\text{ A}$ , $R_{GS}=25\text{ }\Omega$  |
| Gate source voltage                          | $V_{GS}$          | -20    | -    | 20                    | V    | -  |
| Power dissipation                            | $P_{tot}$         | -      | -    | 167<br>3.8            | W    | $T_C=25\text{ °C}$<br>$T_A=25\text{ °C}$ , $R_{thJA}=40\text{ °C/W}^2)$  |
| 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  | $R_{thJC}$ | -      | -    | 0.9  | °C/W | -                     |
| Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>2)</sup> | $R_{thJA}$ | -      | -    | 40   | °C/W | -                     |
| Thermal resistance, junction - ambient, minimal footprint                            | $R_{thJA}$ | -      | -    | 62   | °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           | $V_{GS(th)}$  | 2.2    | 3.0        | 3.8         | V             | $V_{DS}=V_{GS}$ , $I_D=93\text{ }\mu\text{A}$   |
| 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 | $R_{DS(on)}$  | -      | 3.7<br>4.5 | 4.25<br>5.3 | m $\Omega$    | $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$<br>$V_{GS}=6\text{ V}$ , $I_D=40\text{ A}$   |
| Gate resistance                  | $R_G$         | -      | 1.3        | -           | $\Omega$      | -   |
| Transconductance <sup>1)</sup>   | $g_{fs}$      | 71     | -          | -           | S             | $ V_{DS} \geq 2 I_D R_{DS(on)max}$ , $I_D=80\text{ A}$  |

**Table 5 Dynamic characteristics**

| Parameter                    | Symbol       | Values |      |      | Unit | Note / Test Condition  |
|------------------------------|--------------|--------|------|------|------|--|
|                              |              | Min.   | Typ. | Max. |      |  |
| Input capacitance            | $C_{iss}$    | -      | 4000 | -    | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                      |
| Output capacitance           | $C_{oss}$    | -      | 630  | -    | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                      |
| Reverse transfer capacitance | $C_{rss}$    | -      | 28   | -    | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                      |
| Turn-on delay time           | $t_{d(on)}$  | -      | 18   | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                    | $t_r$        | -      | 71   | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time          | $t_{d(off)}$ | -      | 27   | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                    | $t_f$        | -      | 8    | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$ ,<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           | $Q_{gs}$      | -      | 19   | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge at threshold        | $Q_{g(th)}$   | -      | 12   | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge            | $Q_{gd}$      | -      | 12   | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge                | $Q_{sw}$      | -      | 19   | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total <sup>1)</sup> | $Q_g$         | -      | 57   | 85   | nC   | $V_{DD}=50\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage            | $V_{plateau}$ | -      | 4.8  | -    | V    | $V_{DD}=50\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total, sync. FET    | $Q_{g(sync)}$ | -      | 49   | -    | nC   | $V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$                    |
| Output charge                   | $Q_{oss}$     | -      | 74   | -    | nC   | $V_{DS}=50\text{ V}$ , $V_{GS}=0\text{ V}$                                  |

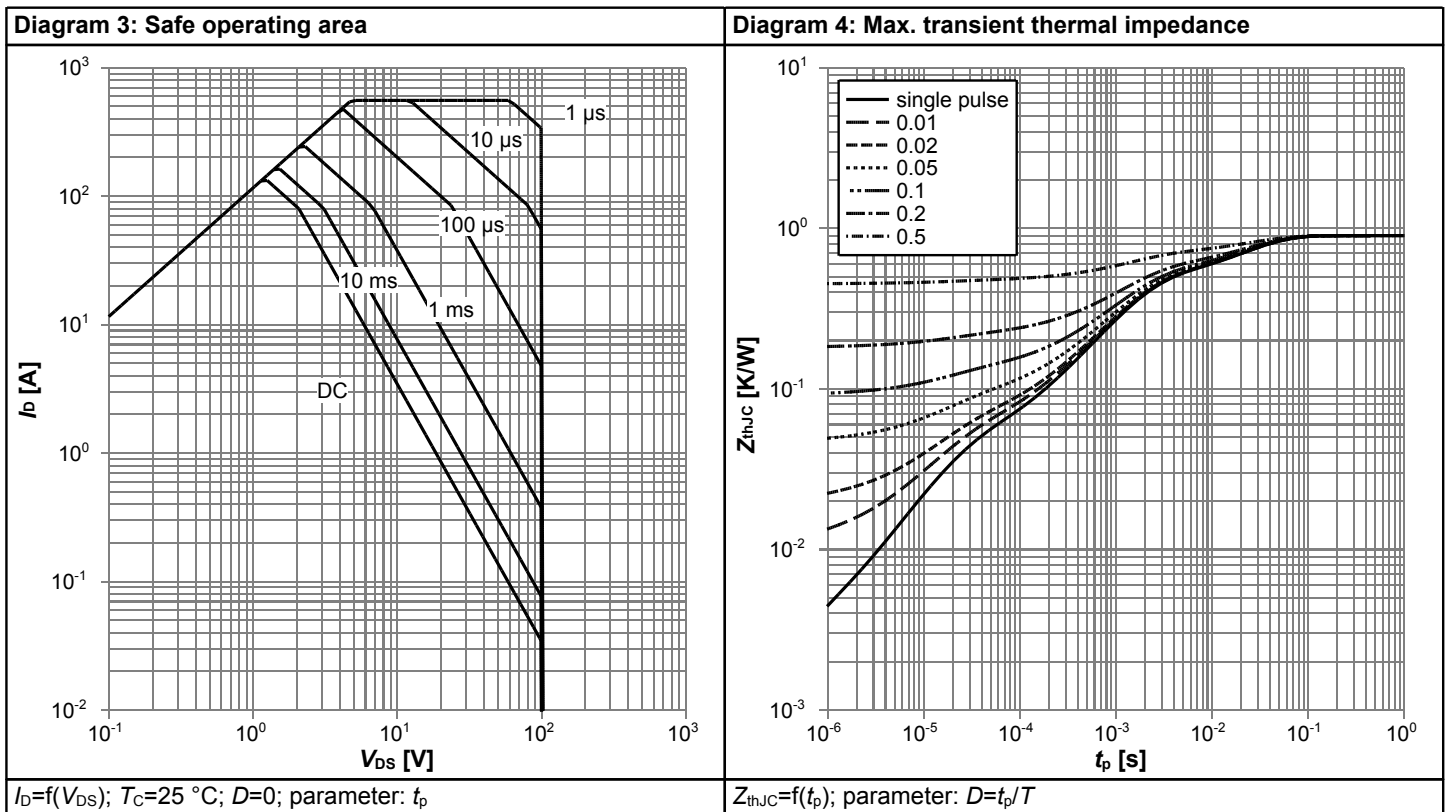
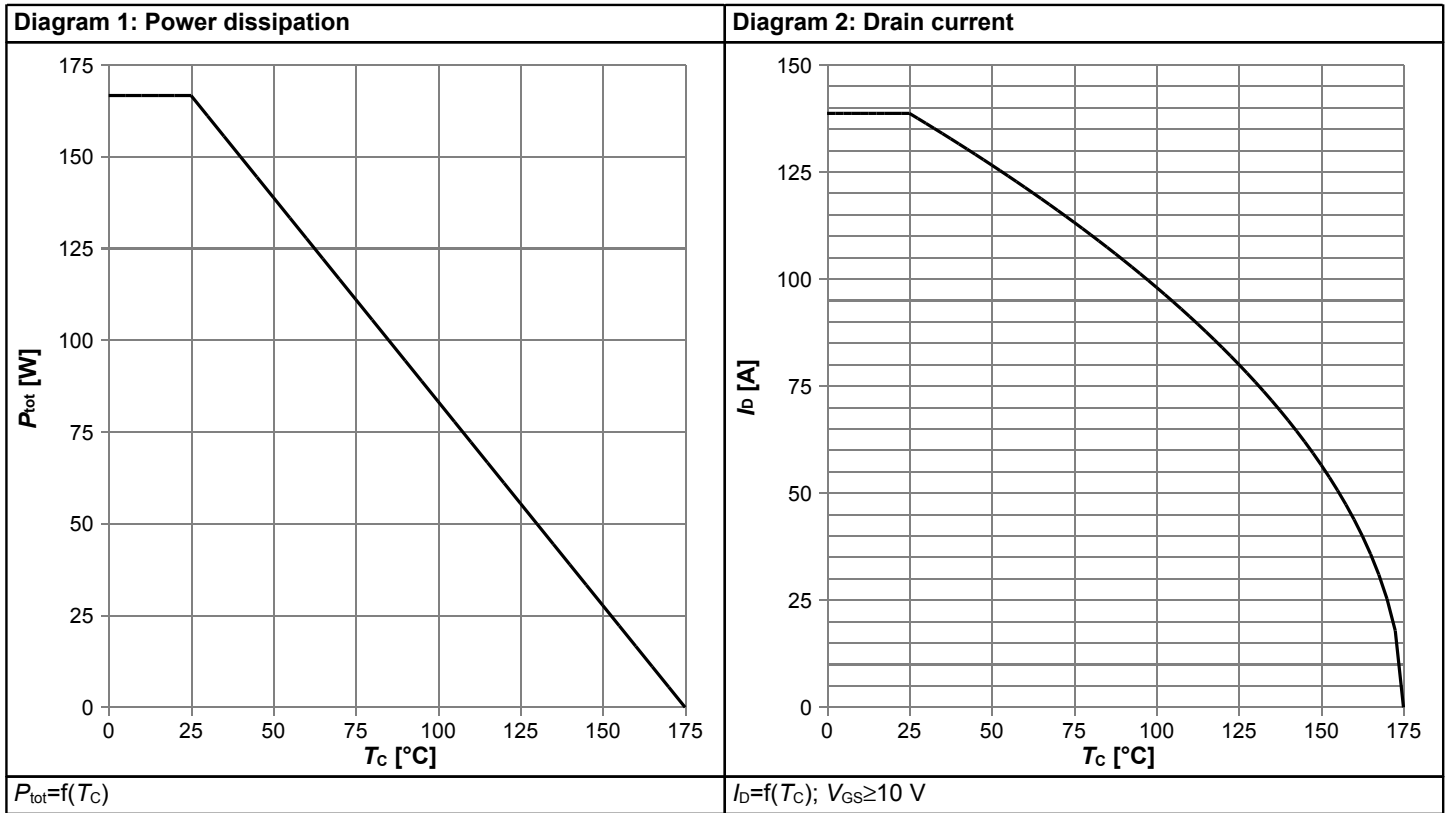
<sup>1)</sup> Defined by design. Not subject to production test.

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

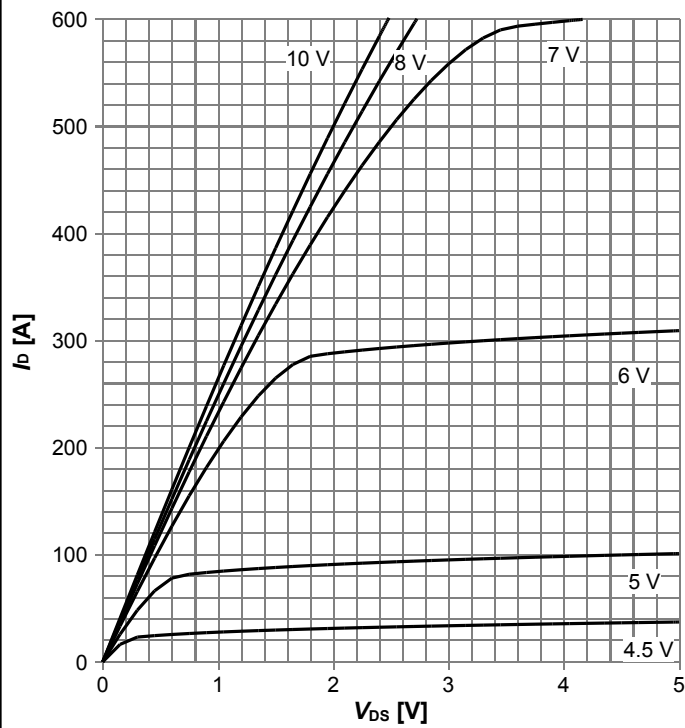
**Table 7 Reverse diode**

| Parameter                        | Symbol        | Values |      |      | Unit | Note / Test Condition  |
|----------------------------------|---------------|--------|------|------|------|--|
|                                  |               | Min.   | Typ. | Max. |      |  |
| Diode continuous forward current | $I_S$         | -      | -    | 123  | A    | $T_C=25\text{ °C}$   |
| Diode pulse current              | $I_{S,pulse}$ | -      | -    | 556  | A    | $T_C=25\text{ °C}$   |
| Diode forward voltage            | $V_{SD}$      | -      | 0.91 | 1.2  | V    | $V_{GS}=0\text{ V}, I_F=80\text{ A}, T_j=25\text{ °C}$               |
| Reverse recovery time            | $t_{rr}$      | -      | 40   | -    | ns   | $V_R=50\text{ V}, I_F=80\text{ A}, di_F/dt=500\text{ A}/\mu\text{s}$ |
| Reverse recovery charge          | $Q_{rr}$      | -      | 287  | -    | nC   | $V_R=50\text{ V}, I_F=80\text{ A}, di_F/dt=500\text{ A}/\mu\text{s}$ |

### 4 Electrical characteristics diagrams

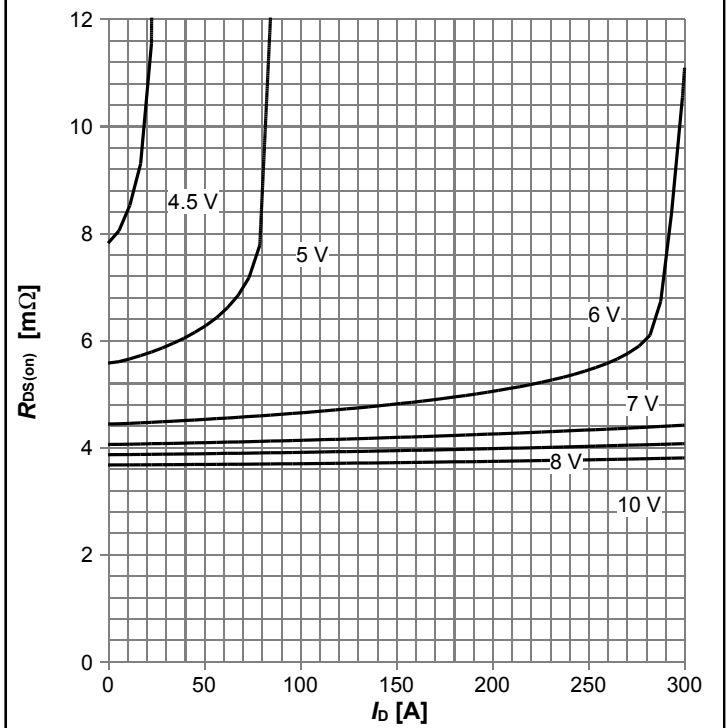


**Diagram 5: Typ. output characteristics**



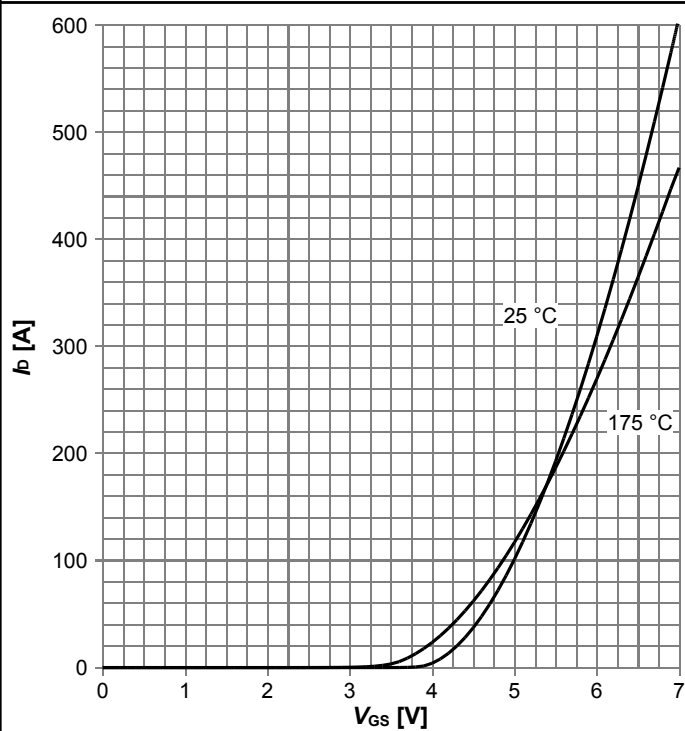
$I_D = f(V_{DS}), T_j = 25\text{ °C};$  parameter:  $V_{GS}$

**Diagram 6: Typ. drain-source on resistance**



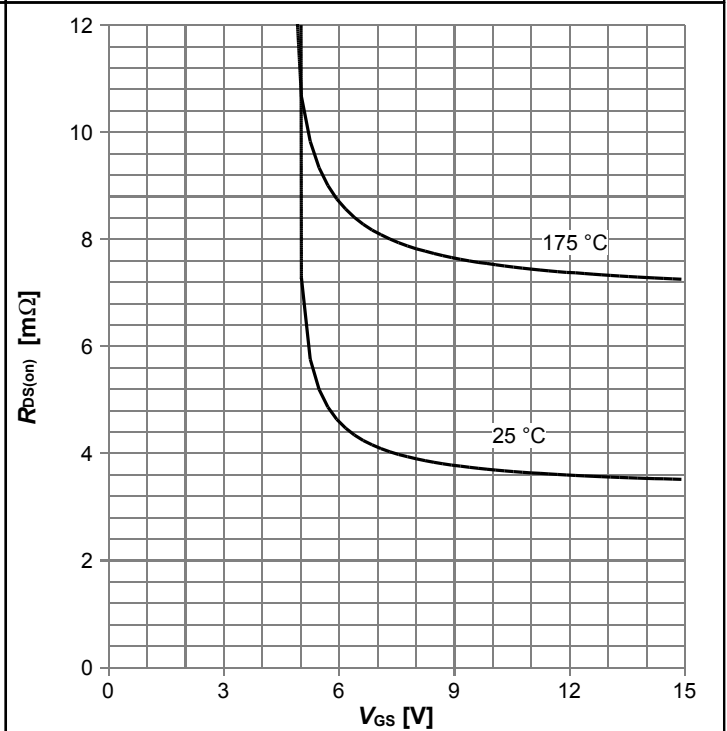
$R_{DS(on)} = f(I_D), T_j = 25\text{ °C};$  parameter:  $V_{GS}$

**Diagram 7: Typ. transfer characteristics**



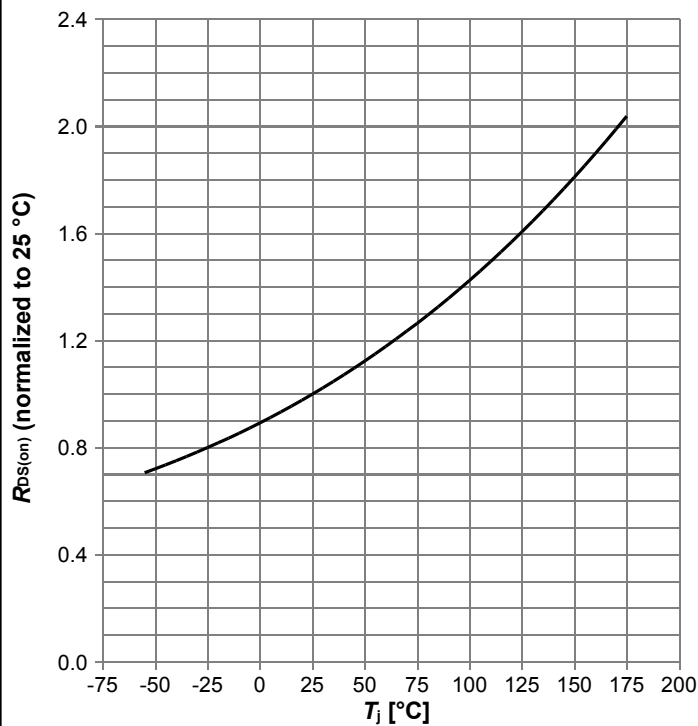
$I_D = f(V_{GS}), |V_{DS}| > 2|I_D|R_{DS(on)max};$  parameter:  $T_j$

**Diagram 8: Typ. drain-source on resistance**



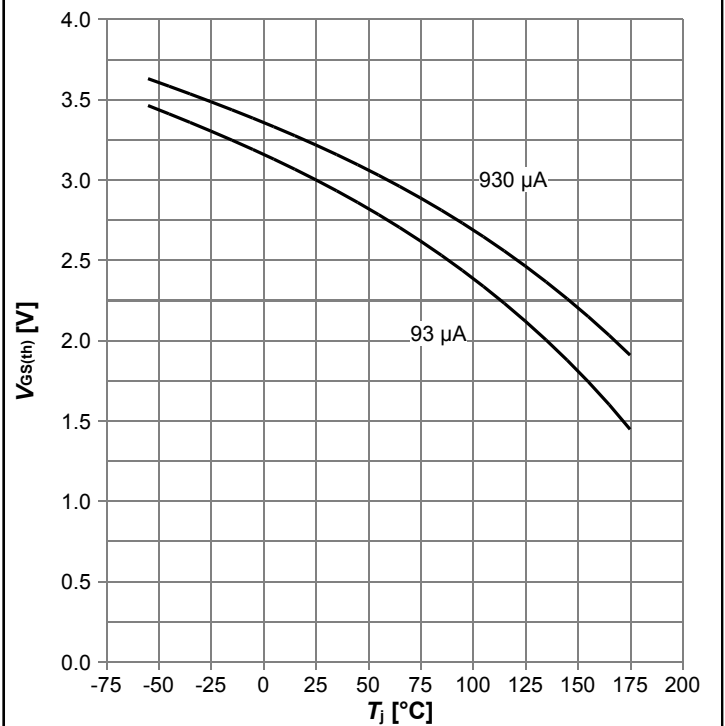
$R_{DS(on)} = f(V_{GS}), I_D = 80\text{ A};$  parameter:  $T_j$

**Diagram 9: Normalized drain-source on resistance**



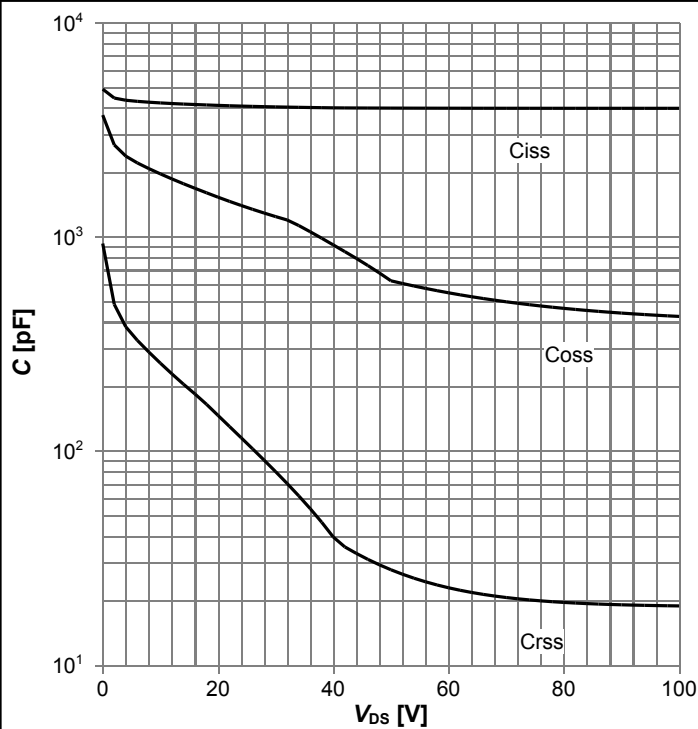
$R_{DS(on)}=f(T_j)$ ,  $I_D=80$  A,  $V_{GS}=10$  V

**Diagram 10: Typ. gate threshold voltage**



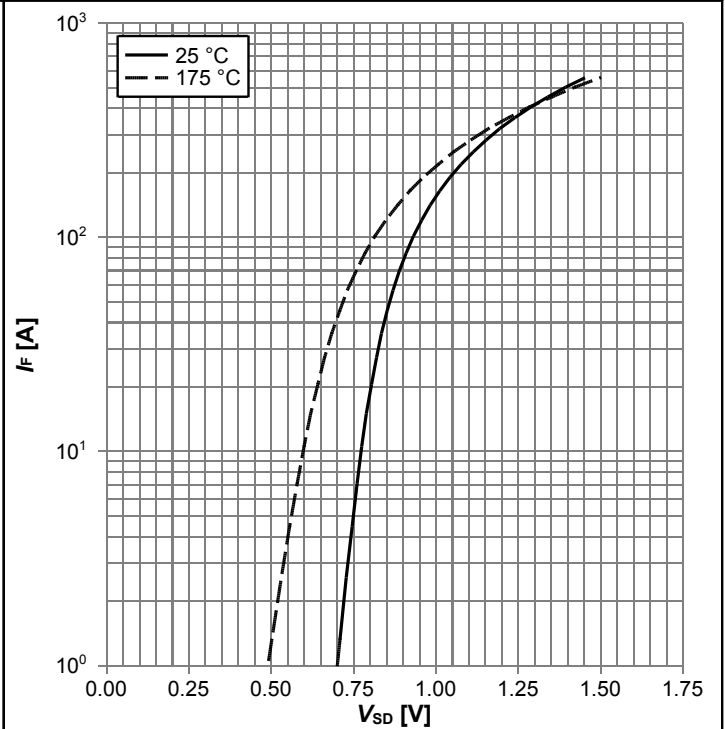
$V_{GS(th)}=f(T_j)$ ,  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

**Diagram 11: Typ. capacitances**



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

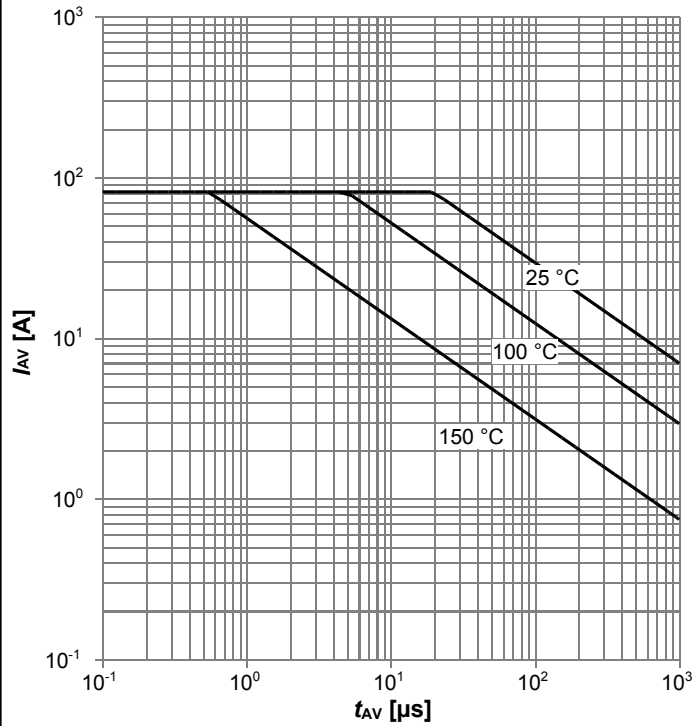
**Diagram 12: Typ. forward characteristics of reverse diode**



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

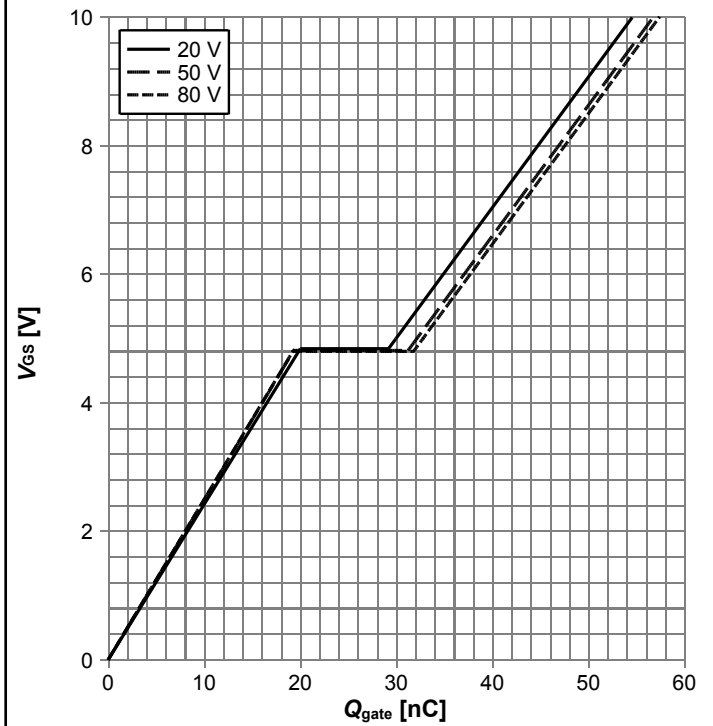


**Diagram 13: Avalanche characteristics**



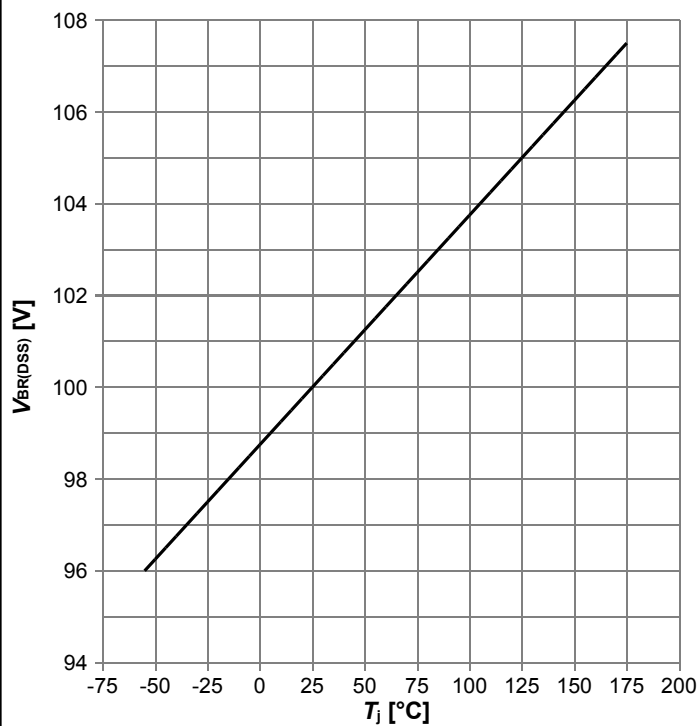
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25 \Omega$ ; parameter:  $T_{j,start}$

**Diagram 14: Typ. gate charge**



$V_{GS}=f(Q_{gate})$ ,  $I_D=80$  A pulsed,  $T_j=25$  °C; parameter:  $V_{DD}$

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

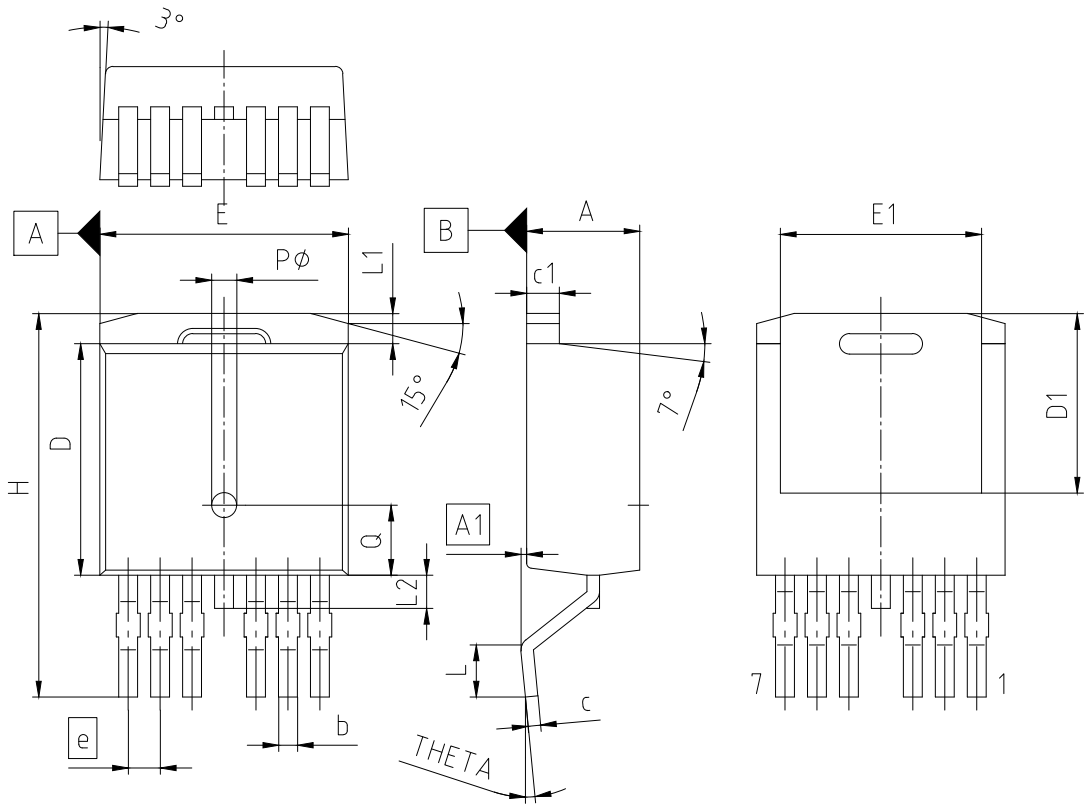


$V_{BR(DSS)}=f(T_j)$ ;  $I_D=1$  mA

**Diagram Gate charge waveforms**



**5 Package Outlines**



| PACKAGE - GROUP NUMBER: |             | <b>PG-TO263-7-U02</b> |  |
|-------------------------|-------------|-----------------------|--|
| DIMENSIONS              | MILLIMETERS |                       |  |
|                         | MIN.        | MAX.                  |  |
| <b>A</b>                | 4.30        | 4.70                  |  |
| <b>A1</b>               | 0.00        | 0.25                  |  |
| <b>b</b>                | 0.65        | 0.85                  |  |
| <b>c</b>                | 0.45        | 0.60                  |  |
| <b>c1</b>               | 1.25        | 1.40                  |  |
| <b>D</b>                | 9.00        | 9.40                  |  |
| <b>D1</b>               | 6.86        | 7.42                  |  |
| <b>E</b>                | 9.68        | 10.08                 |  |
| <b>E1</b>               | 7.70        | 8.30                  |  |
| <b>e</b>                | 1.27        |                       |  |
| <b>N</b>                | 7           |                       |  |
| <b>H</b>                | 14.61       | 15.88                 |  |
| <b>L</b>                | 1.78        | 2.79                  |  |
| <b>L1</b>               | 0.00        | 1.60                  |  |
| <b>L2</b>               | 0.00        | 1.78                  |  |
| <b>THETA</b>            | 0° - 8°     |                       |  |
| <b>PØ</b>               | 0.90        | 1.10                  |  |
| <b>Q</b>                | 2.78        |                       |  |

**Figure 1 Outline PG-TO263-7, dimensions in mm**

## Revision History

IPF042N10NF2S

**Revision: 2022-09-23, Rev. 2.0**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.0      | 2022-09-23 | Release of final version                     |

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