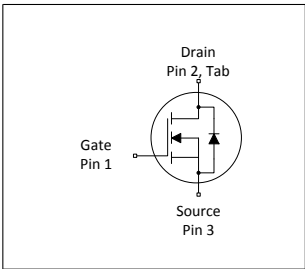
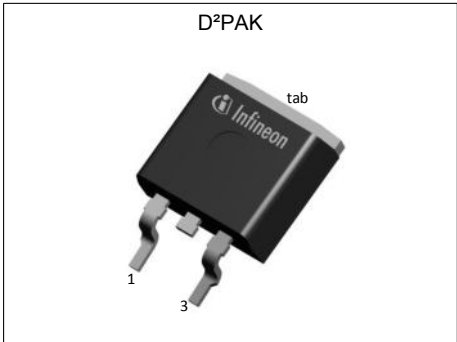


MOSFET

OptiMOS™ 5 Linear FET, 100 V

Features

- Ideal for hot-swap and e-fuse applications
- Very low on-resistance  $R_{DS(on)}$
- Wide safe operating area SOA
- N-channel, normal level
- 100% avalanche tested
- Pb-free plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Halogen-free according to IEC61249-2-21



RoHS

Table 1 Key Performance Parameters

| Parameter                                 | Value | Unit |
|-------------------------------------------|-------|------|
| $V_{DS}$                                  | 100   | V    |
| $R_{DS(on),max}$                          | 3.3   | mΩ   |
| $I_D$                                     | 159   | A    |
| $I_{pulse}$ ( $V_{DS}=56$ V, $t_p=10$ ms) | 7     | A    |

| Type / Ordering Code | Package    | Marking  | Related Links |
|----------------------|------------|----------|---------------|
| IPB033N10N5LF        | PG-TO263-3 | 033N10LF | -             |

<sup>1)</sup> 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 <sup>1)</sup>       | $I_D$          | -      | -    | 159<br>108<br>23 | A    | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ , $R_{thJA}=40\text{ K/W}^{2)}$ |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$  | -      | -    | 636              | A    | $T_C=25\text{ °C}$                                                                                                                                                   |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$       | -      | -    | 273              | mJ   | $I_D=100\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                                                                       |
| Gate source voltage                          | $V_{GS}$       | -20    | -    | 20               | V    | -                                                                                                                                                                    |
| Power dissipation                            | $P_{tot}$      | -      | -    | 179              | W    | $T_C=25\text{ °C}$                                                                                                                                                   |
| Operating and storage temperature            | $T_j, T_{stg}$ | -55    | -    | 150              | °C   | -                                                                                                                                                                    |

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

| Parameter                                                      | Symbol     | Values |      |      | Unit | Note / Test Condition |
|----------------------------------------------------------------|------------|--------|------|------|------|-----------------------|
|                                                                |            | Min.   | Typ. | Max. |      |                       |
| Thermal resistance, junction - case                            | $R_{thJC}$ | -      | 0.45 | 0.7  | K/W  | -                     |
| Device on PCB,<br>minimal footprint                            | $R_{thJA}$ | -      | -    | 62   | K/W  | -                     |
| Device on PCB,<br>6 cm <sup>2</sup> cooling area <sup>2)</sup> | $R_{thJA}$ | -      | -    | 40   | K/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           | $V_{GS(th)}$  | 2.5    | 3.3       | 4.1       | V                | $V_{DS}=V_{GS}$ , $I_D=150\text{ }\mu\text{A}$                                                                                        |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 1.0<br>10 | 10<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      | $I_{GSS}$     | -      | 2<br>-2   | 5<br>-5   | $\mu\text{A}$    | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$<br>$V_{GS}=-10\text{ V}$ , $V_{DS}=0\text{ V}$                                             |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 2.7       | 3.3       | $\text{m}\Omega$ | $V_{GS}=10\text{ V}$ , $I_D=100\text{ A}$                                                                                             |
| Gate resistance <sup>1)</sup>    | $R_G$         | -      | 40        | 60        | $\Omega$         | -                                                                                                                                     |
| Transconductance <sup>1)</sup>   | $g_{fs}$      | 23     | 46        | -         | S                | $ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=100\text{ A}$                                                                                   |

**Table 5 Dynamic characteristics**

| Parameter                        | Symbol       | Values |      |      | Unit | Note / Test Condition                                                                              |
|----------------------------------|--------------|--------|------|------|------|----------------------------------------------------------------------------------------------------|
|                                  |              | Min.   | Typ. | Max. |      |                                                                                                    |
| Input capacitance <sup>1)</sup>  | $C_{iss}$    | -      | 350  | 460  | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                      |
| Output capacitance <sup>1)</sup> | $C_{oss}$    | -      | 1100 | 1400 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                      |
| Reverse transfer capacitance     | $C_{rss}$    | -      | 13   | -    | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$                                      |
| Turn-on delay time               | $t_{d(on)}$  | -      | 8    | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                        | $t_r$        | -      | 32   | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time              | $t_{d(off)}$ | -      | 64   | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                        | $t_f$        | -      | 48   | -    | ns   | $V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ ,<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       | $Q_{gs}$      | -      | 3    | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge        | $Q_{gd}$      | -      | 72   | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total           | $Q_g$         | -      | 102  | -    | nC   | $V_{DD}=50\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage        | $V_{plateau}$ | -      | 6.9  | -    | V    | $V_{DD}=50\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Output charge <sup>1)</sup> | $Q_{oss}$     | -      | 116  | 155  | nC   | $V_{DD}=50\text{ V}$ , $V_{GS}=0\text{ V}$                                   |

<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 | $I_S$         | -      | -    | 133  | A    | $T_C=25\text{ °C}$                                                         |
| Diode pulse current              | $I_{S,pulse}$ | -      | -    | 636  | A    | $T_C=25\text{ °C}$                                                         |
| Diode forward voltage            | $V_{SD}$      | -      | 0.93 | 1.2  | V    | $V_{GS}=0\text{ V}$ , $I_F=100\text{ A}$ , $T_j=25\text{ °C}$              |
| Reverse recovery time            | $t_{rr}$      | -      | 58   | -    | ns   | $V_R=50\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge          | $Q_{rr}$      | -      | 94   | -    | nC   | $V_R=50\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$ |

## 4 Electrical characteristics diagrams

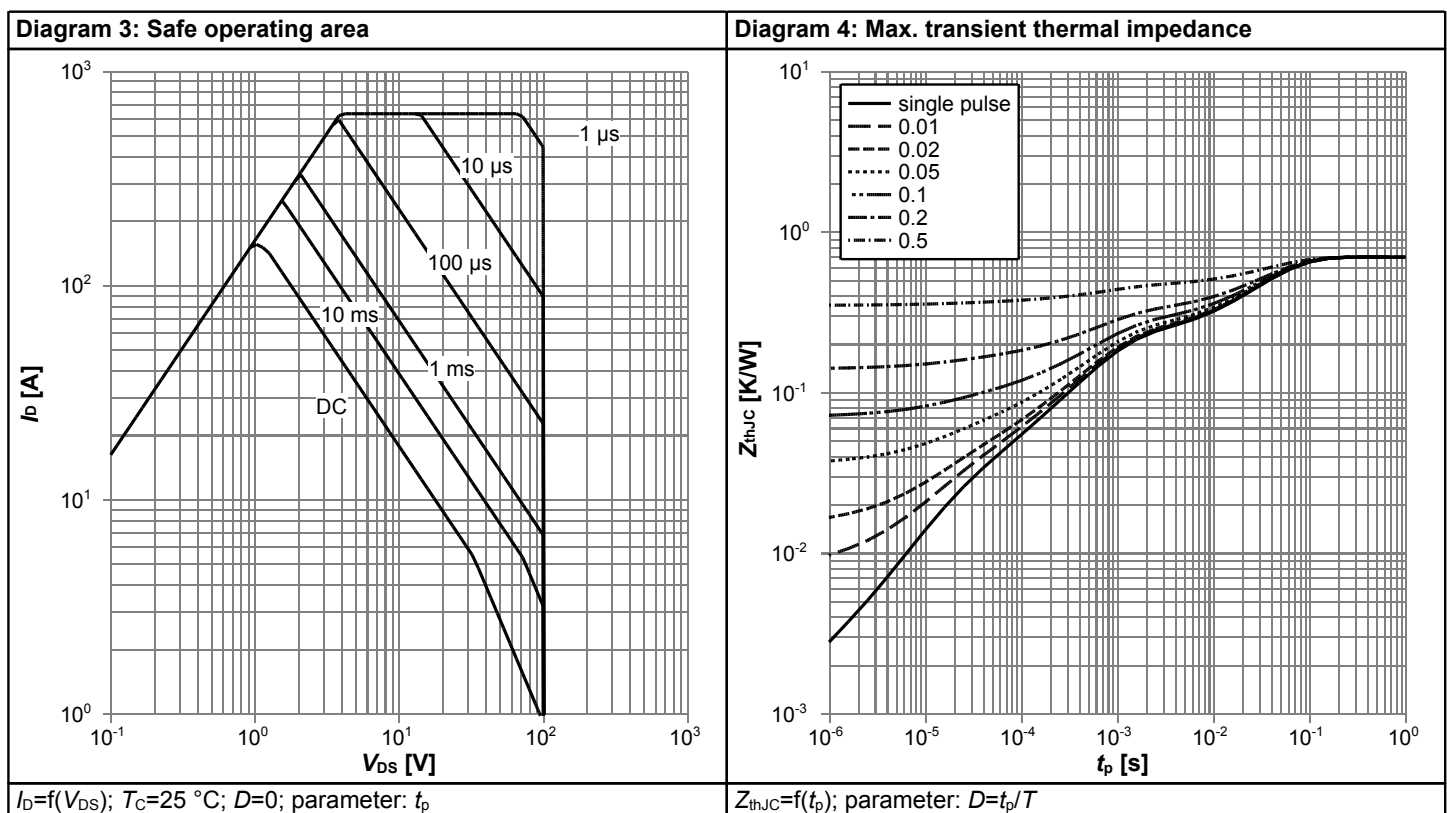
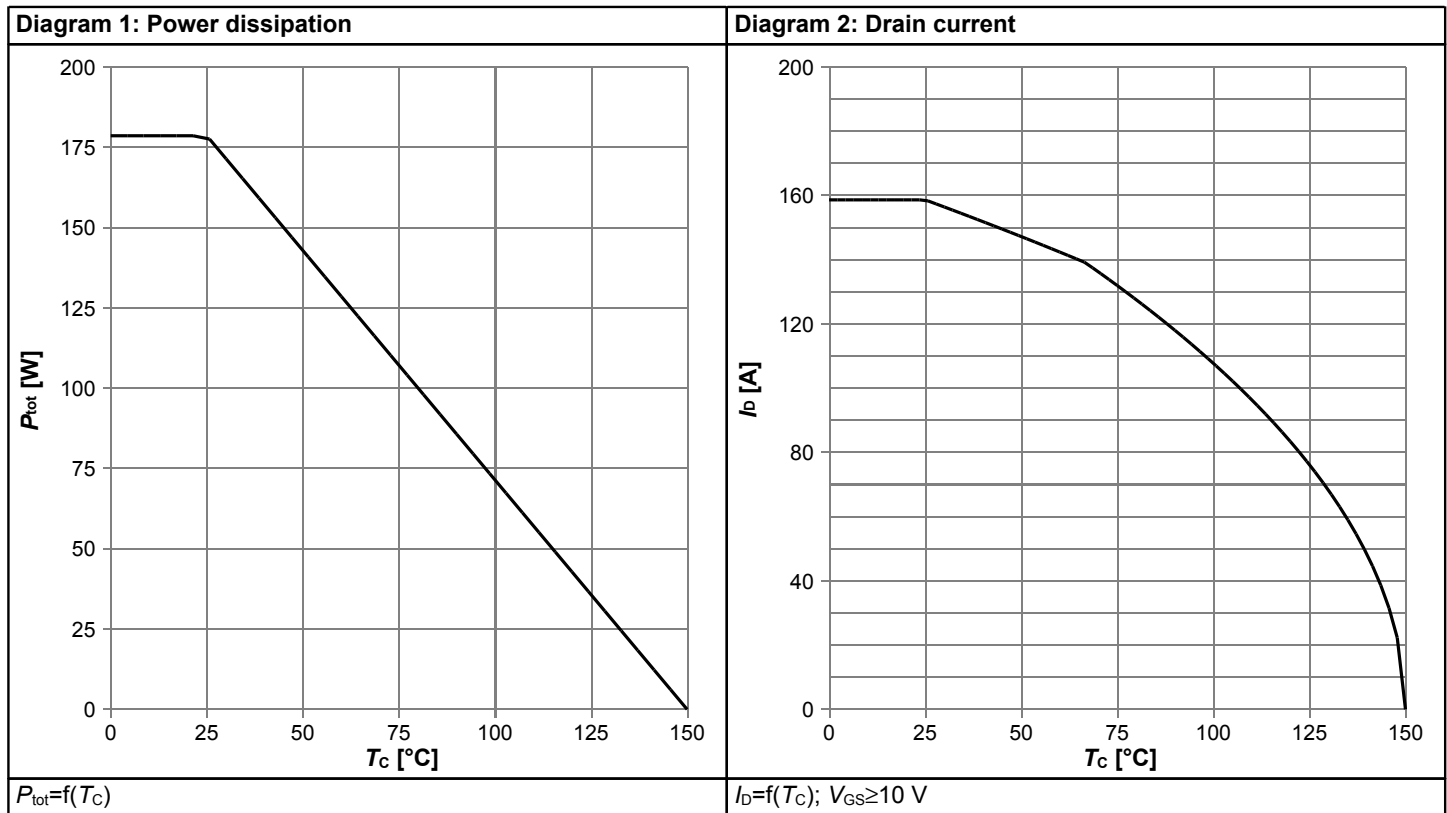
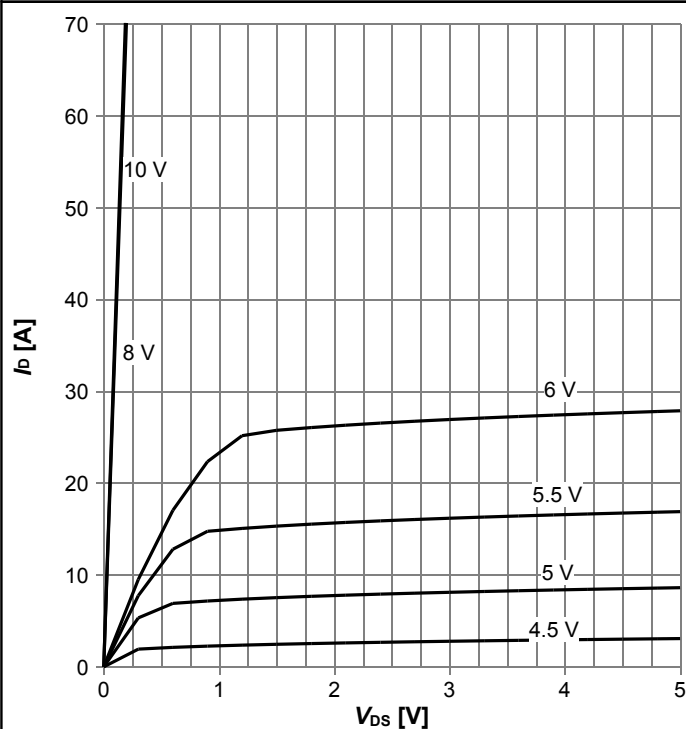
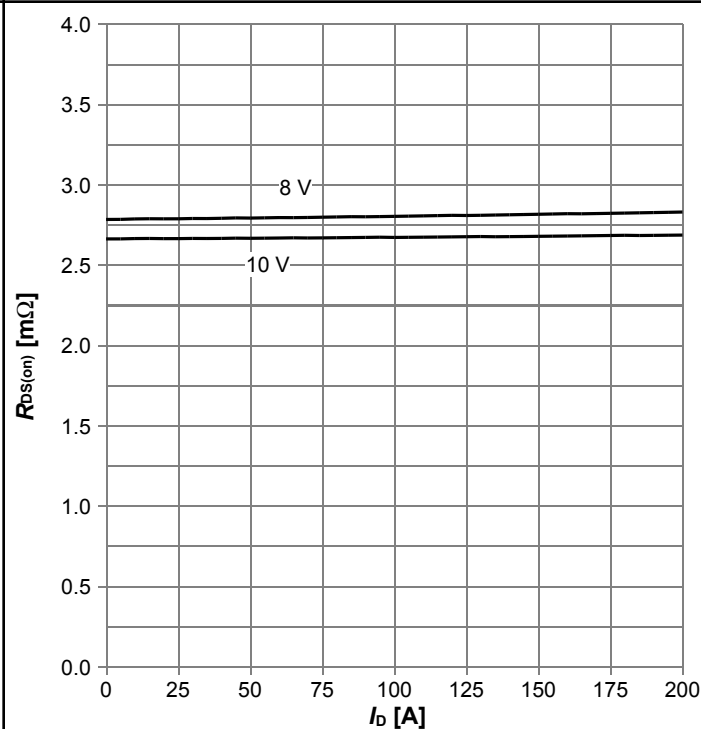


Diagram 5: Typ. output characteristics



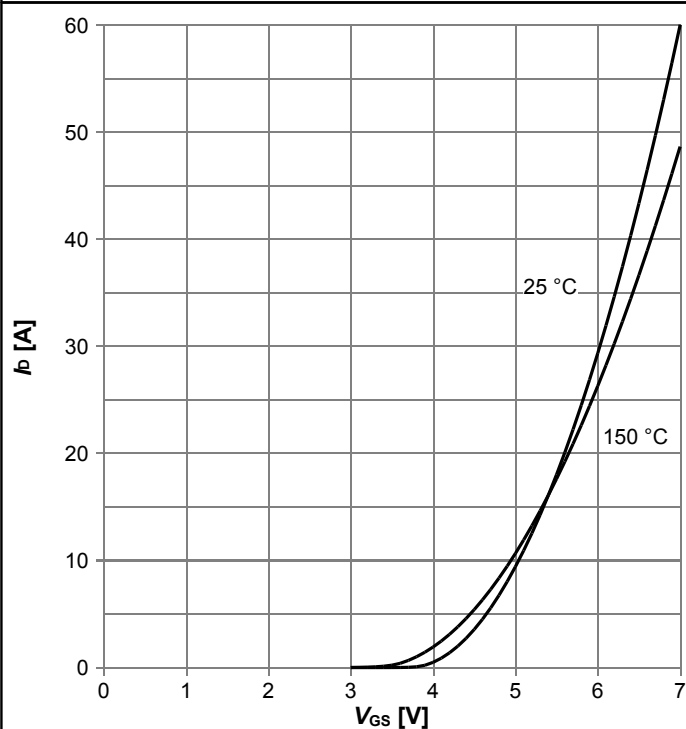
$I_D=f(V_{DS})$ ;  $T_j=25\text{ }^\circ\text{C}$ ,  $t_p=30\text{ }\mu\text{s}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



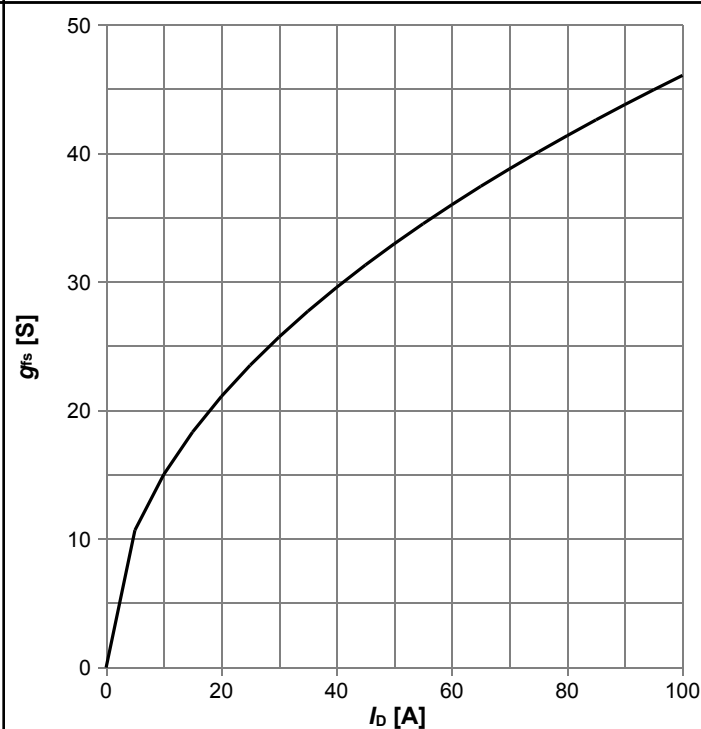
$R_{DS(on)}=f(I_D)$ ,  $T_j=25\text{ }^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



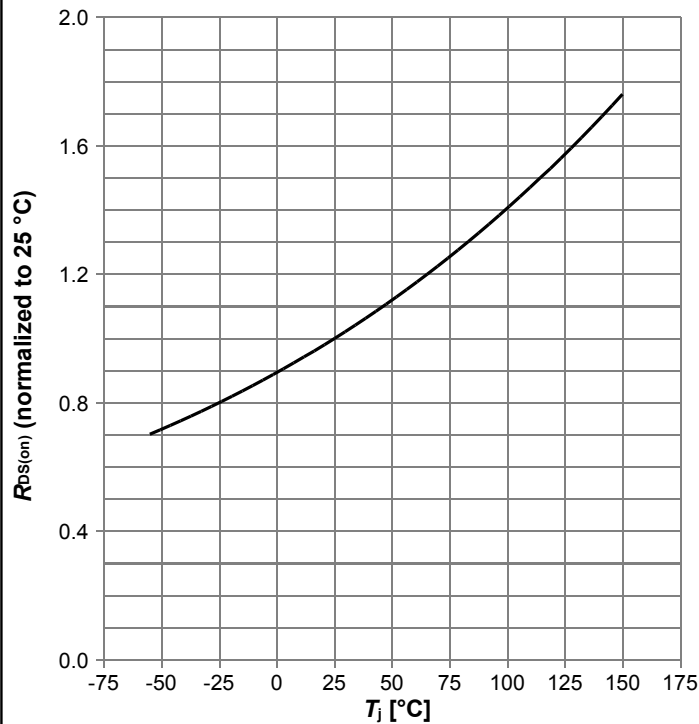
$I_D=f(V_{GS})$ ;  $V_{DS}=10\text{ V}$ ; parameter:  $T_j$

Diagram 8: Typ. forward transconductance



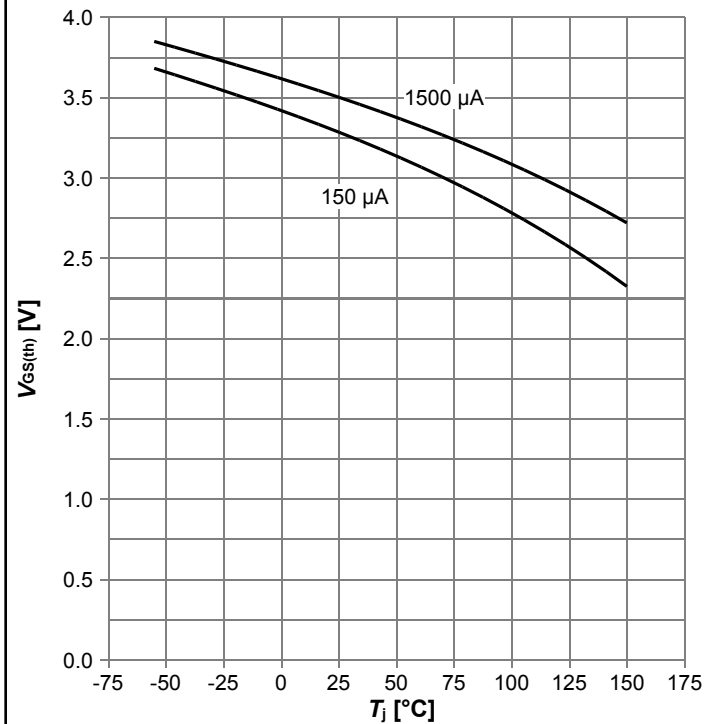
$g_{fs}=f(I_D)$ ;  $T_j=25\text{ }^\circ\text{C}$

Diagram 9: Normalized drain-source on resistance



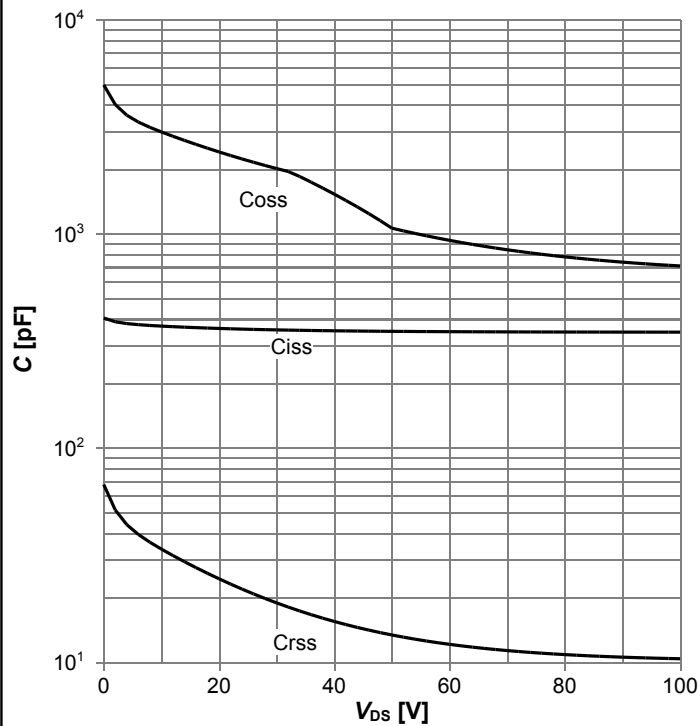
$R_{DS(on)} = f(T_j)$ ,  $I_D = 100$  A,  $V_{GS} = 10$  V

Diagram 10: Typ. gate threshold voltage



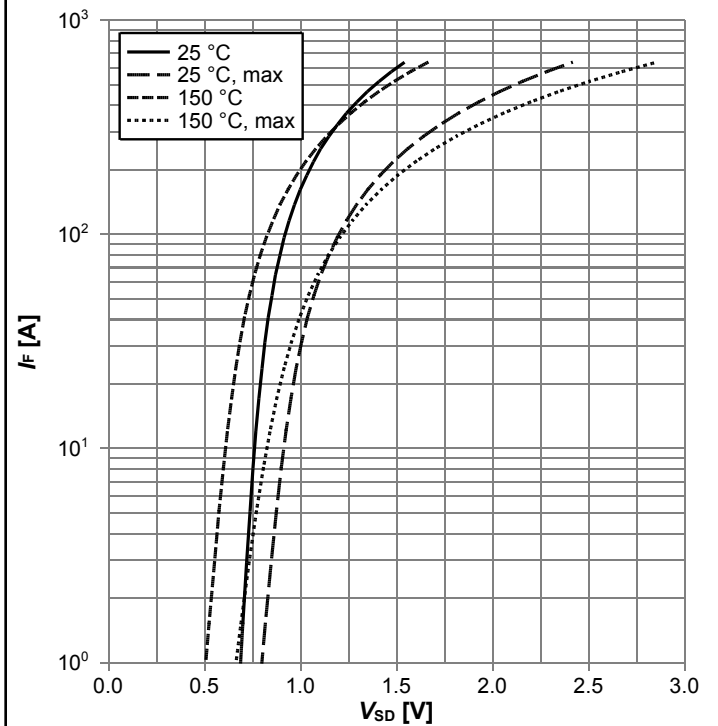
$V_{GS(th)} = f(T_j)$ ,  $V_{GS} = V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



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

Diagram 12: Forward characteristics of reverse diode

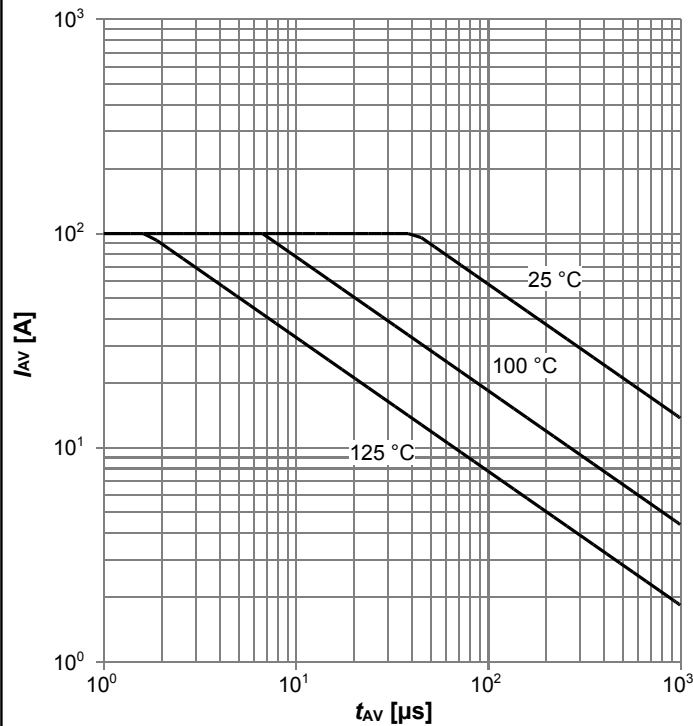


$I_F = f(V_{SD})$ ; parameter:  $T_j$

# OptiMOS™ 5 Linear FET, 100 V

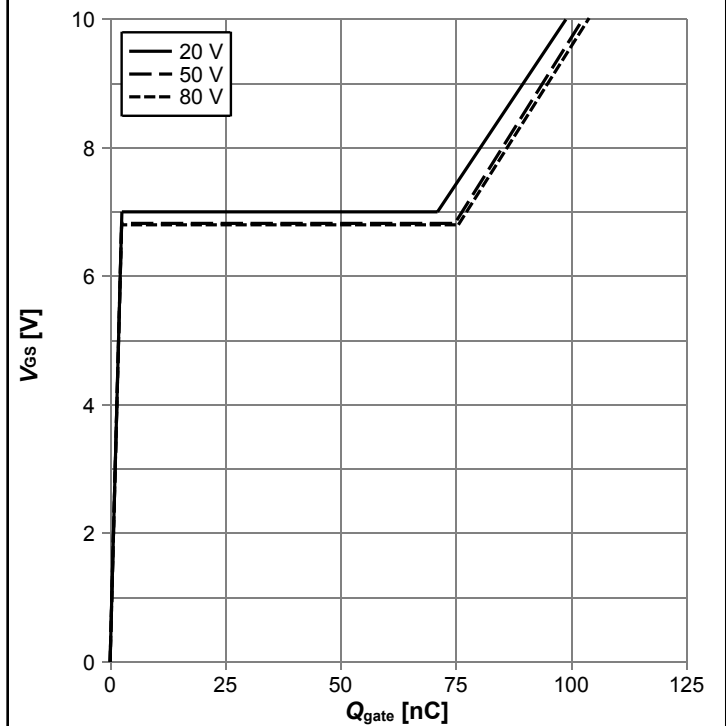
IPB033N10N5LF

Diagram 13: Avalanche characteristics



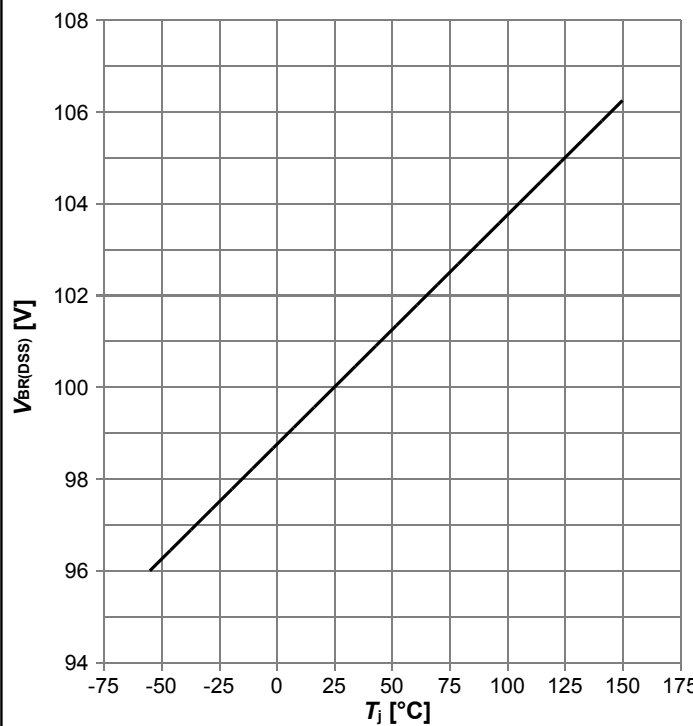
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25 \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



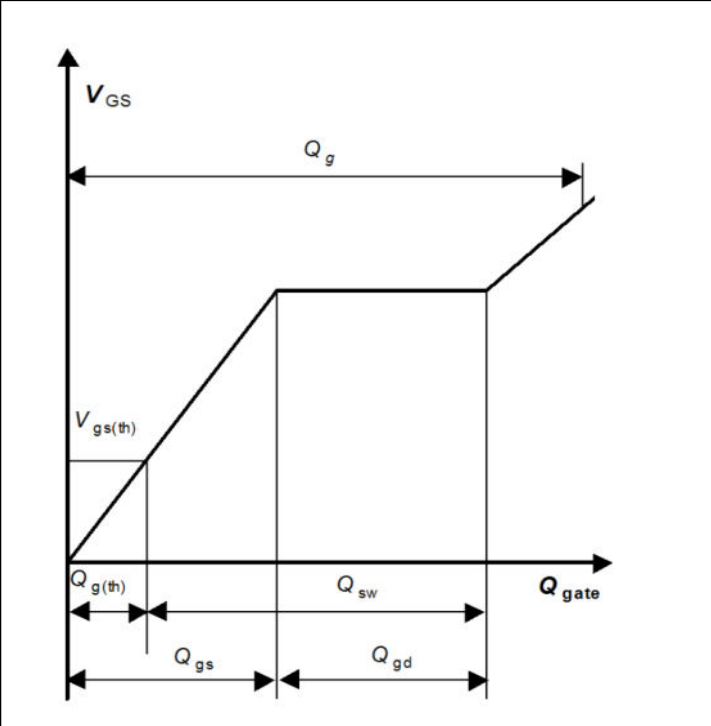
$V_{GS}=f(Q_{gate})$ ;  $I_D=100$  A pulsed, resistive load; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage



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

Diagram Gate charge waveforms



## 5 Package Outlines

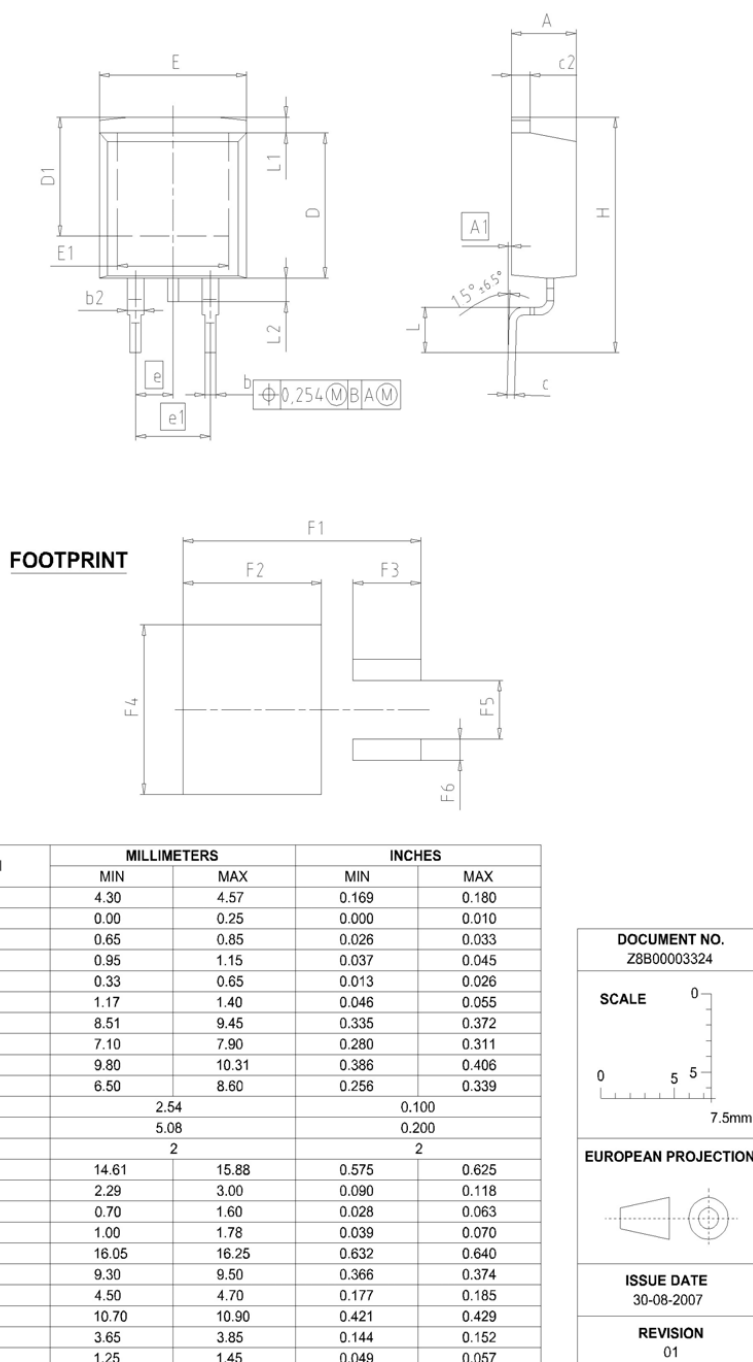


Figure 1 Outline PG-TO263-3, dimensions in mm/inches

## Revision History

IPB033N10N5LF

**Revision: 2022-06-23, Rev. 2.2**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision)                                            |
|----------|------------|-----------------------------------------------------------------------------------------|
| 2.0      | 2016-12-15 | Release of final version                                                                |
| 2.1      | 2017-02-16 | Update technology heading                                                               |
| 2.2      | 2022-06-23 | Update current rating, footnotes and skip "Operating and storage temperature" condition |

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