

MOSFET

OptiMOS™ 5 Power-Transistor, 100 V

Features

- Ideal for high frequency switching and sync. rec.
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- N-channel, normal level
- 100% avalanche tested
- Pb-free plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target applications
- Halogen-free according to IEC61249-2-21

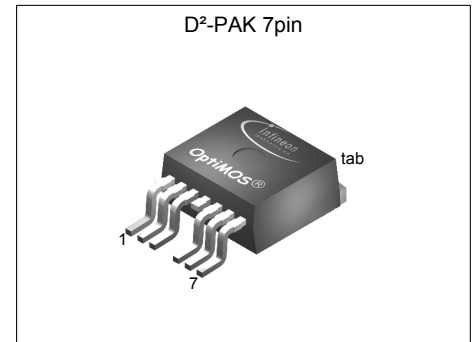
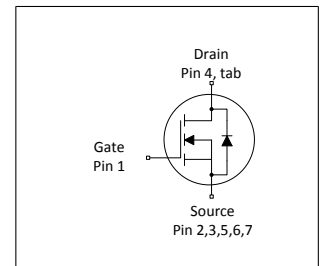


Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|-------------------------|-------|------------|
| V_{DS} | 100 | V |
| $R_{DS(on),max}$ | 2.4 | m Ω |
| I_D (silicon limited) | 217 | A |
| I_D (package limited) | 180 | A |
| Q_{oss} | 142 | nC |
| $Q_G(0V..10V)$ | 111 | nC |



| Type / Ordering Code | Package | Marking | Related Links |
|----------------------|------------|----------|---------------|
| IPB024N10N5 | PG-TO263-7 | 024N10N5 | - |

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 | I_D | - | - | 180 157 | A | $T_C=25\text{ °C}$ $T_C=100\text{ °C}$ |
| Pulsed drain current ¹⁾ | $I_{D,pulse}$ | - | - | 720 | A | $T_C=25\text{ °C}$ |
| Avalanche energy, single pulse | E_{AS} | - | - | 502 | mJ | $I_D=100\text{ A}$, $R_{GS}=25\text{ }\Omega$ |
| Gate source voltage | V_{GS} | -20 | - | 20 | V | - |
| Power dissipation | P_{tot} | - | - | 250 | 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 | 0.6 | K/W | - |
| Thermal resistance, junction - ambient, minimal footprint | R_{thJA} | - | - | 62 | K/W | - |
| Thermal resistance, junction - ambient, 6 cm ² cooling area ²⁾ | R_{thJA} | - | - | 40 | K/W | - |
| Soldering temperature and reflow soldering is allowed | T_{sold} | - | - | 260 | °C | reflow MSL1 |

¹⁾ see Diagram 3

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 Electrical characteristics

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 | $V_{DS}=V_{GS}$, $I_D=183\text{ }\mu\text{A}$ |
| Zero gate voltage drain current | I_{DSS} | - | 0.1 10 | 5 100 | μA | $V_{DS}=100\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=100\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ }^\circ\text{C}$ |
| Gate-source leakage current | I_{GSS} | - | 1 | 100 | nA | $V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 2.0 2.4 | 2.4 3.2 | m Ω | $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$ $V_{GS}=6\text{ V}$, $I_D=45\text{ A}$ |
| Gate resistance ¹⁾ | R_G | - | 1.2 | 1.8 | Ω | - |
| Transconductance | g_{fs} | 105 | 210 | - | S | $ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=90\text{ A}$ |

Table 5 Dynamic characteristics¹⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|------------------------------|--------------|--------|------|-------|------|--|
| | | Min. | Typ. | Max. | | |
| Input capacitance | C_{iss} | - | 7870 | 10200 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=1\text{ MHz}$ |
| Output capacitance | C_{oss} | - | 1200 | 1560 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=1\text{ MHz}$ |
| Reverse transfer capacitance | C_{rss} | - | 53 | 93 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=1\text{ MHz}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 20 | - | ns | $V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time | t_r | - | 12 | - | ns | $V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time | $t_{d(off)}$ | - | 42 | - | ns | $V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time | t_f | - | 13 | - | ns | $V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |

Table 6 Gate charge characteristics²⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|------------------------------------|---------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | Q_{gs} | - | 36 | - | nC | $V_{DD}=50\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge ¹⁾ | Q_{gd} | - | 23 | 34 | nC | $V_{DD}=50\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge | Q_{sw} | - | 35 | - | nC | $V_{DD}=50\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total ¹⁾ | Q_g | - | 111 | 138 | nC | $V_{DD}=50\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage | $V_{plateau}$ | - | 4.6 | - | V | $V_{DD}=50\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Output charge ¹⁾ | Q_{oss} | - | 142 | 188 | nC | $V_{DD}=50\text{ V}$, $V_{GS}=0\text{ V}$ |

¹⁾ Defined by design. Not subject to production test.

²⁾ 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 | - | - | 180 | A | $T_C=25\text{ °C}$ |
| Diode pulse current | $I_{S,pulse}$ | - | - | 720 | A | $T_C=25\text{ °C}$ |
| Diode forward voltage | V_{SD} | - | 0.9 | 1.2 | V | $V_{GS}=0\text{ V}, I_F=90\text{ A}, T_j=25\text{ °C}$ |
| Reverse recovery time ¹⁾ | t_{rr} | - | 65 | 130 | ns | $V_R=50\text{ V}, I_F=90, di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge ¹⁾ | Q_{rr} | - | 123 | 246 | nC | $V_R=50\text{ V}, I_F=90, di_F/dt=100\text{ A}/\mu\text{s}$ |

¹⁾ Defined by design. Not subject to production test.

4 Electrical characteristics diagrams

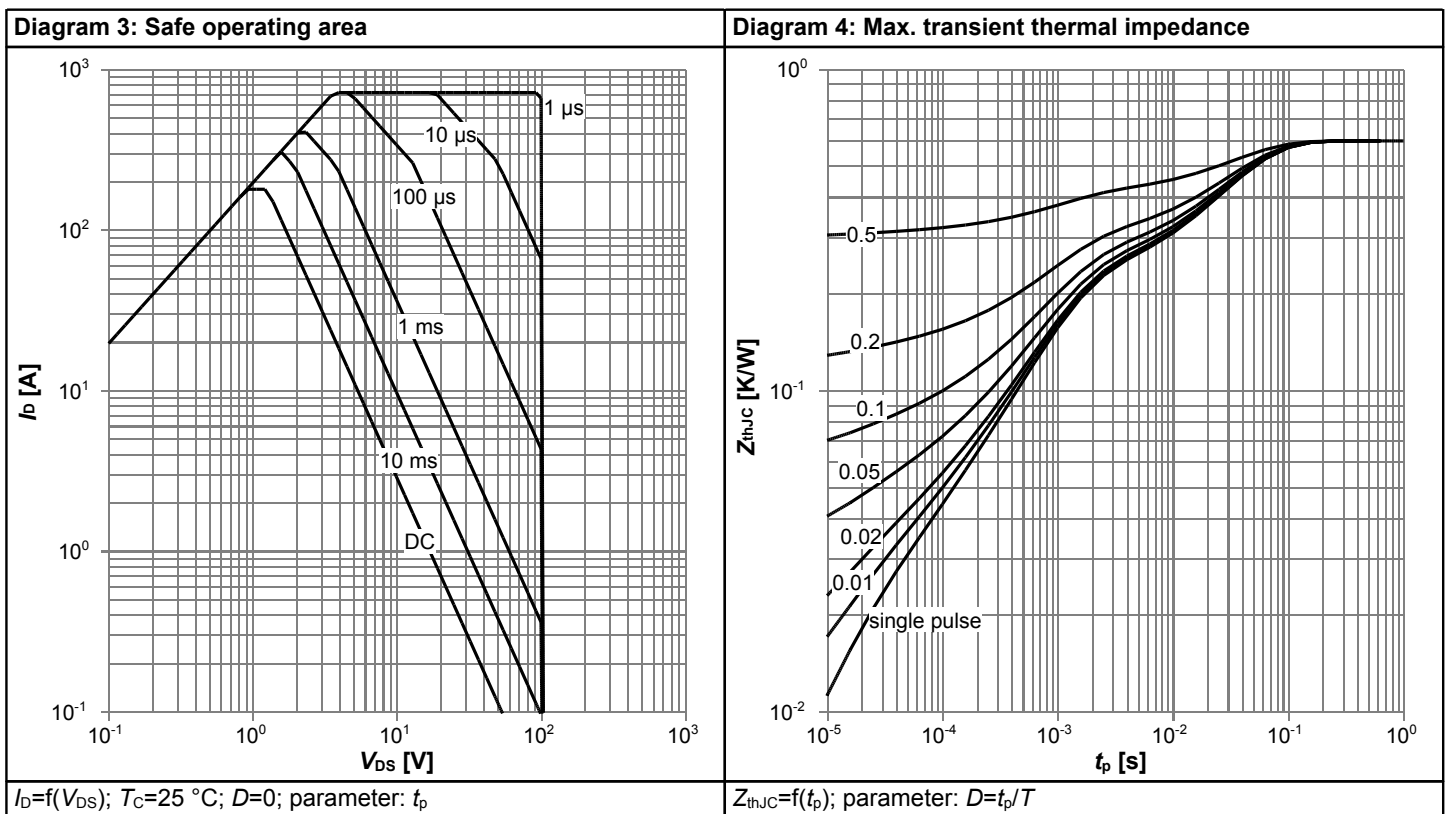
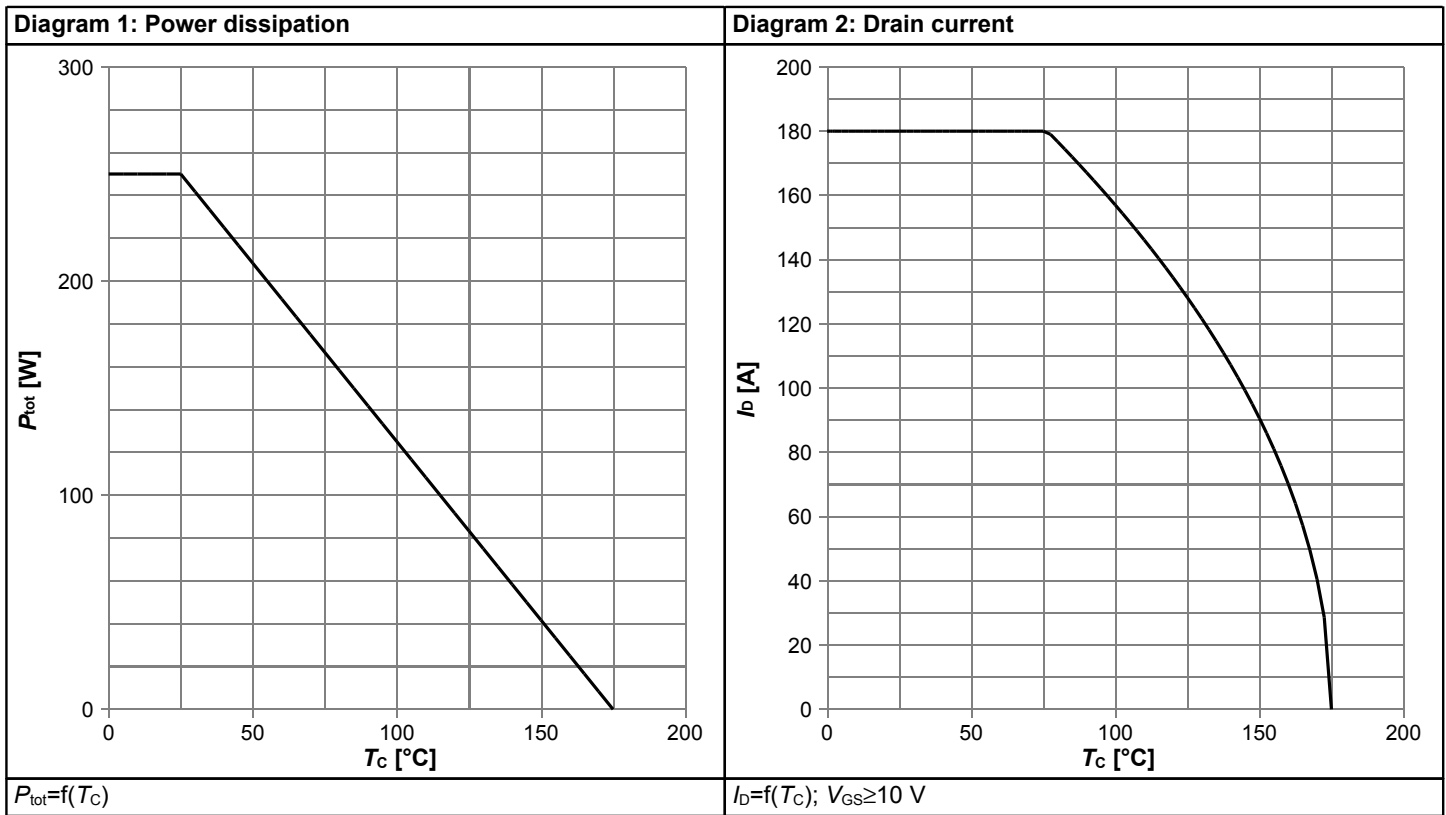
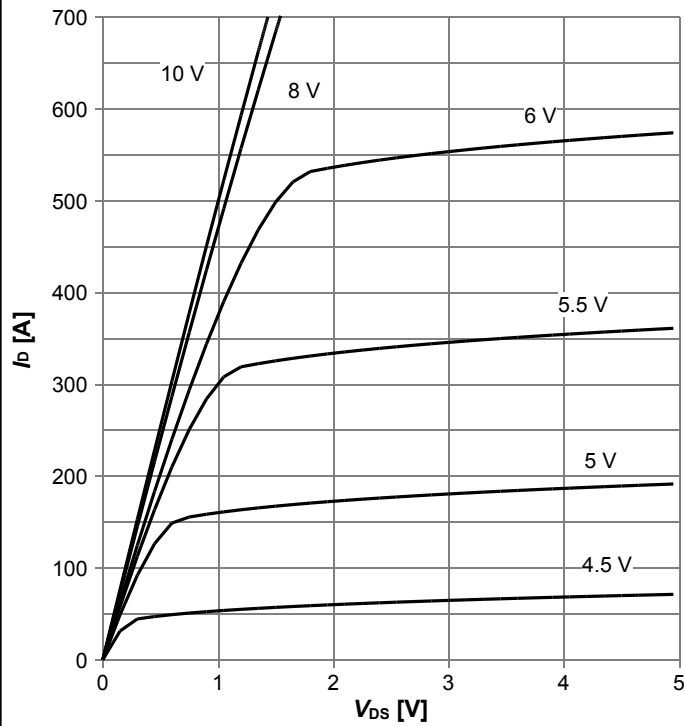
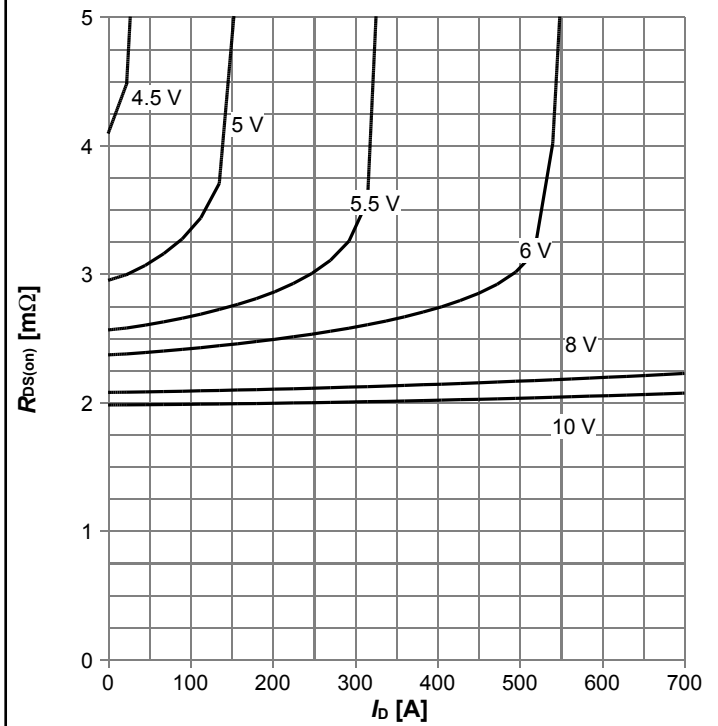


Diagram 5: Typ. output characteristics



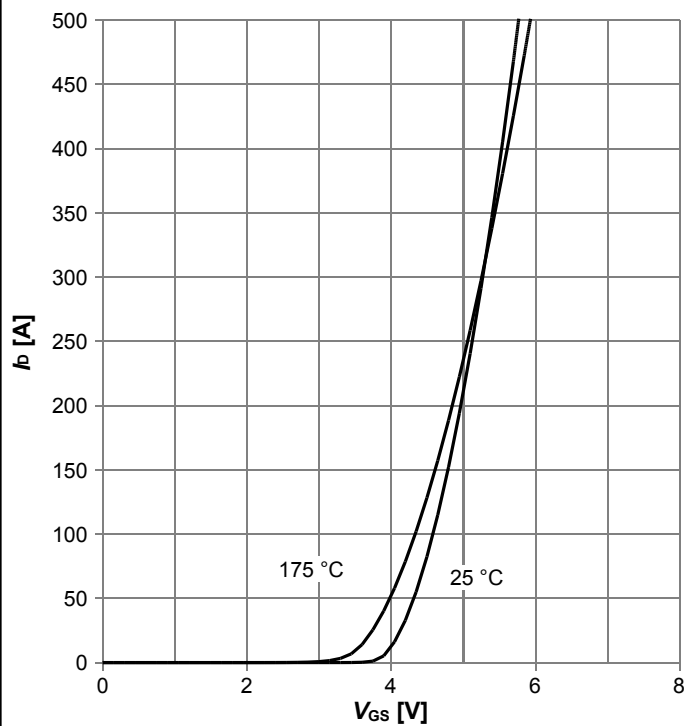
$I_D = f(V_{DS}); T_j = 25^\circ\text{C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



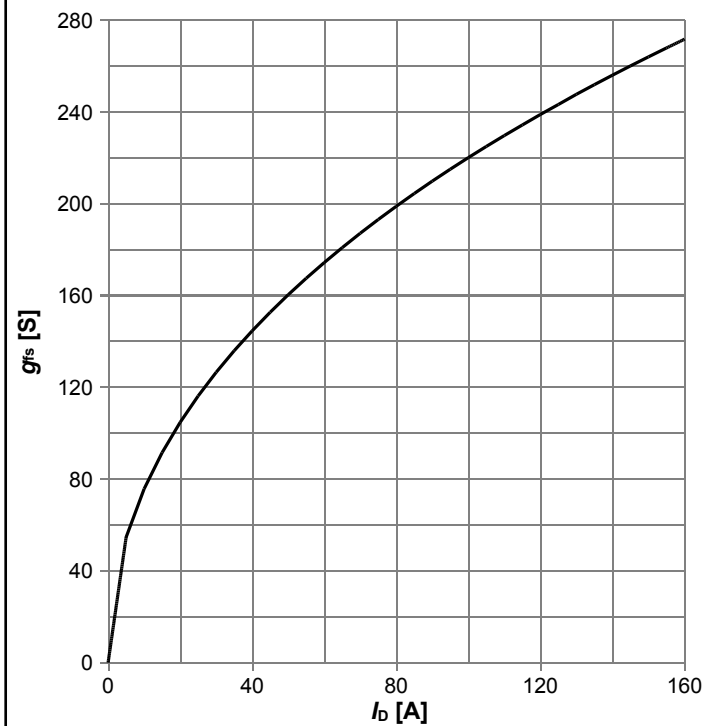
$R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



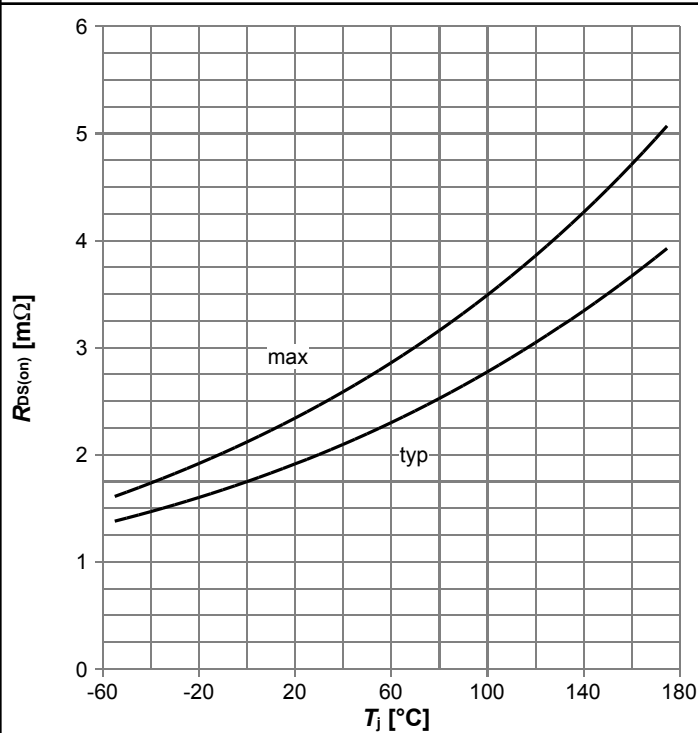
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. forward transconductance



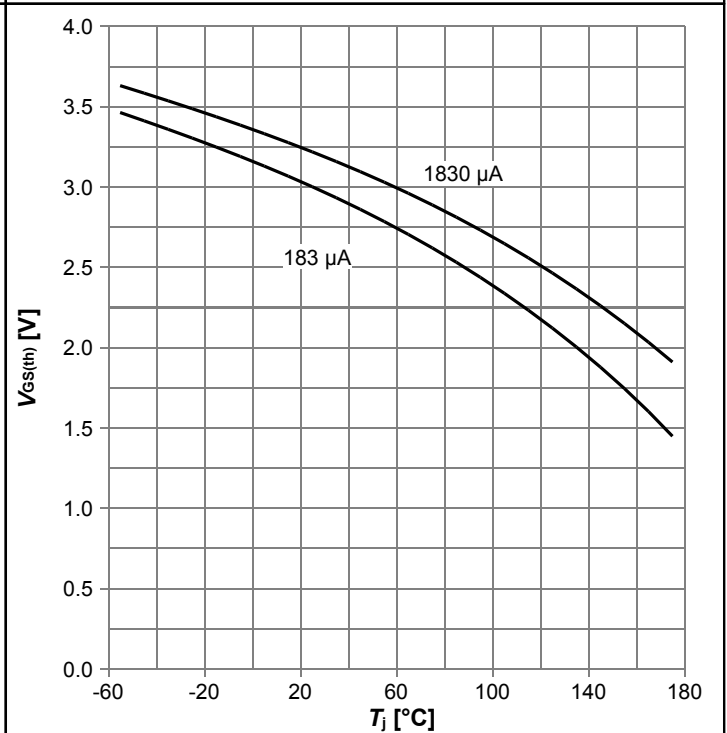
$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



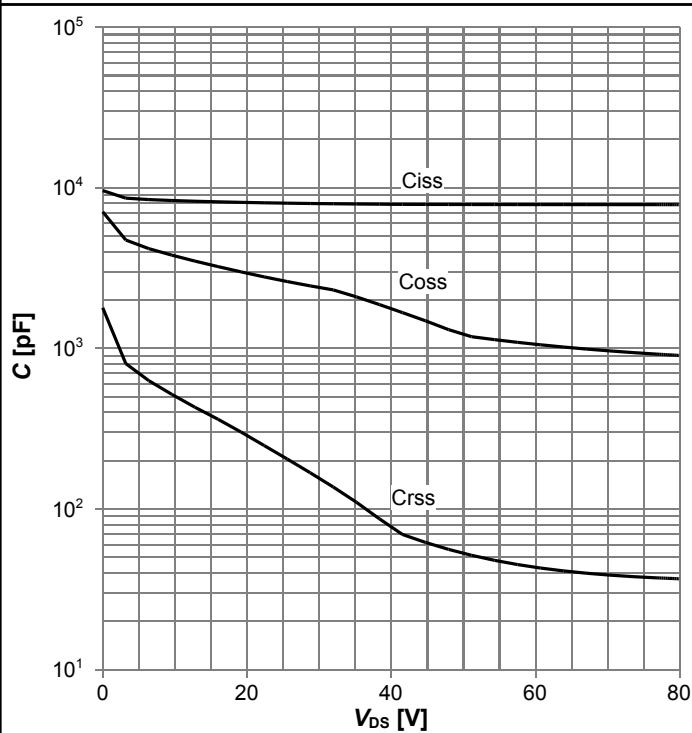
$R_{DS(on)}=f(T_j)$; $I_D=90\text{ A}$; $V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



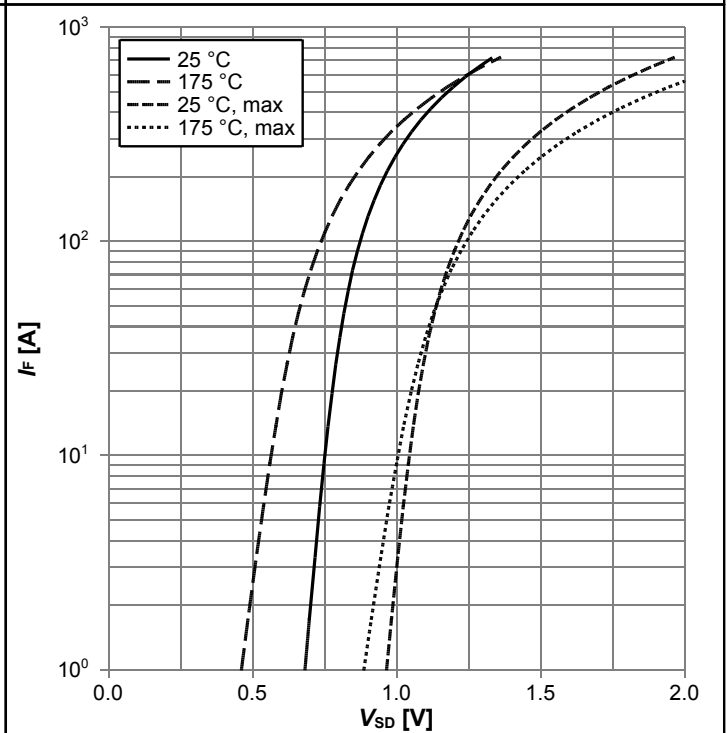
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



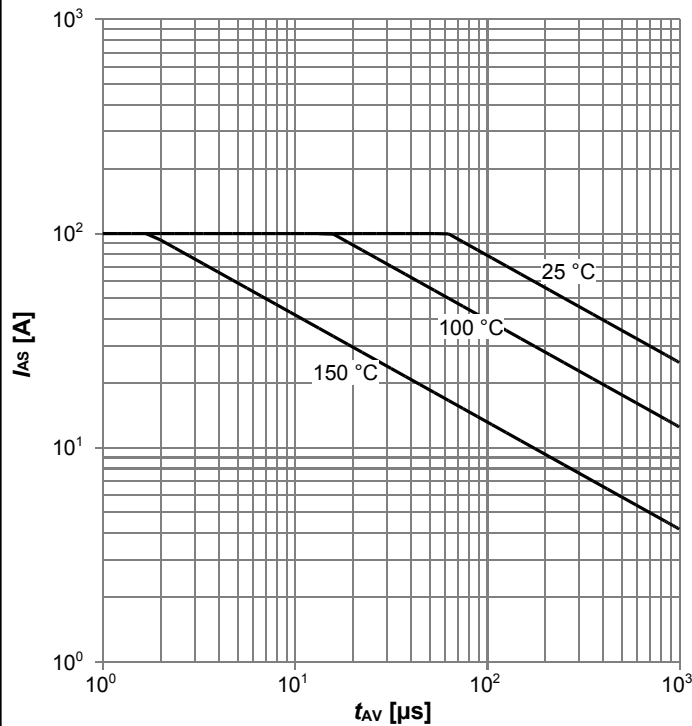
$C=f(V_{DS})$; $V_{GS}=0\text{ V}$; $f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



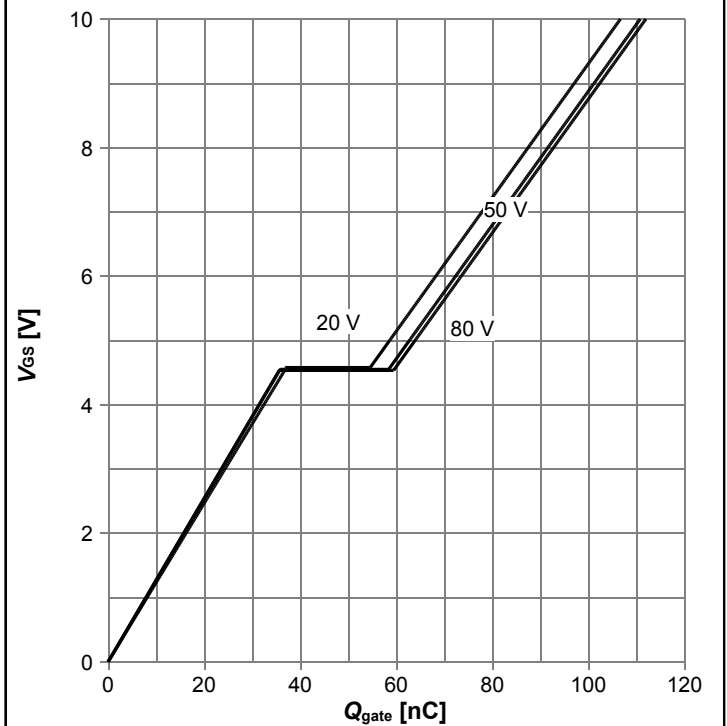
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



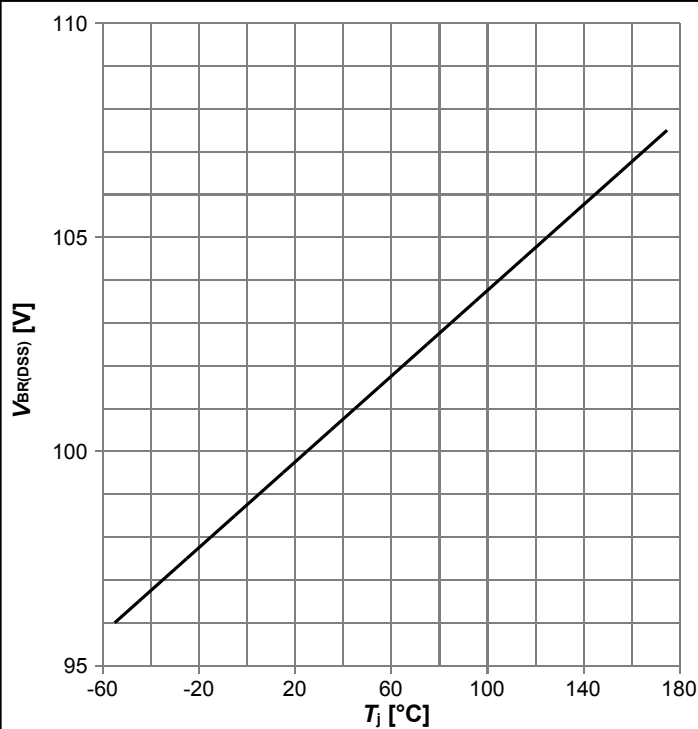
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



$V_{GS}=f(Q_{gate}); I_D=90$ A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

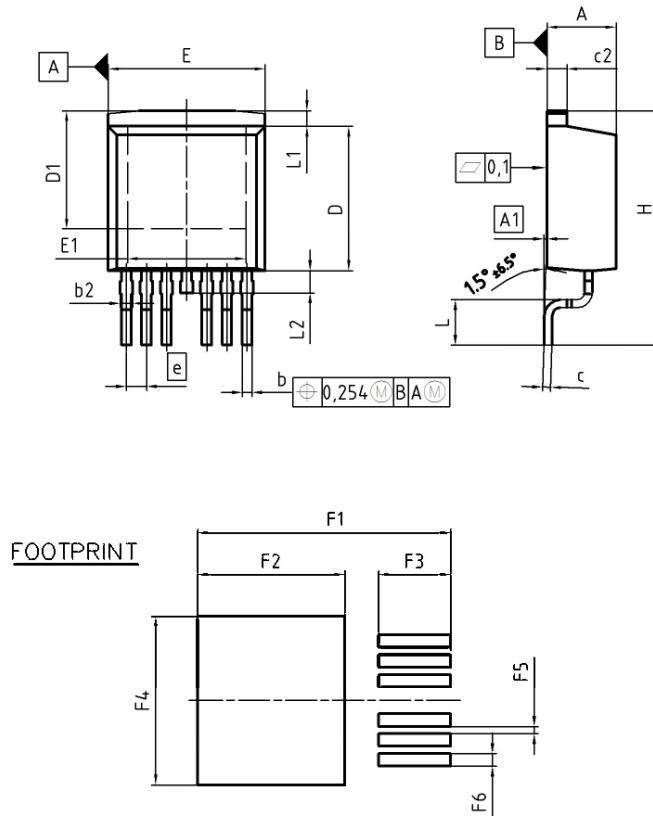


$V_{BR(DSS)}=f(T_j); I_D=1$ mA

Gate charge waveforms



5 Package Outlines



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.57 | 0.169 | 0.180 |
| A1 | 0.00 | 0.25 | 0.000 | 0.010 |
| b | 0.50 | 0.70 | 0.020 | 0.028 |
| b2 | 0.50 | 1.00 | 0.020 | 0.039 |
| c | 0.33 | 0.65 | 0.013 | 0.026 |
| c2 | 1.17 | 1.40 | 0.046 | 0.055 |
| D | 8.51 | 9.45 | 0.335 | 0.372 |
| D1 | 6.90 | 7.90 | 0.272 | 0.311 |
| E | 9.80 | 10.31 | 0.386 | 0.406 |
| E1 | 6.50 | 8.60 | 0.256 | 0.339 |
| e | 1.27 | | 0.050 | |
| N | 6 | | 6 | |
| H | 14.61 | 15.88 | 0.575 | 0.625 |
| L | 2.29 | 3.00 | 0.090 | 0.118 |
| L1 | 0.70 | 1.60 | 0.028 | 0.063 |
| L2 | 1.00 | 1.78 | 0.039 | 0.070 |
| F1 | 16.05 | 16.25 | 0.632 | 0.640 |
| F2 | 9.30 | 9.50 | 0.366 | 0.374 |
| F3 | 4.50 | 4.70 | 0.177 | 0.185 |
| F4 | 10.70 | 10.90 | 0.421 | 0.429 |
| F5 | 0.37 | 0.57 | 0.015 | 0.022 |
| F6 | 0.70 | 0.90 | 0.028 | 0.035 |

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REVISION
01

Figure 1 Outline PG-TO263-7, dimensions in mm/inches

Revision History

IPB024N10N5

Revision: 2016-10-03, Rev. 2.1

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.0 | 2016-04-11 | Release of final version |
| 2.1 | 2016-10-03 | Update Avalanche Energy |

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