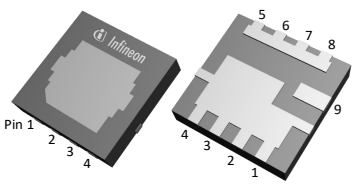
# MOSFET

## OptiMOS™ 5 Power-Transistor, 100 V

PG-WHTFN-9

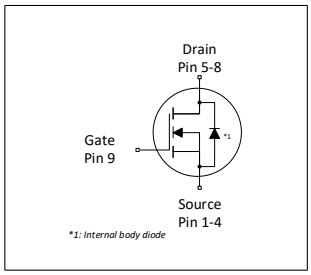



### Features

- Optimized for high performance SMPS, e.g. syncronous rectification
- N-channel
- 100% avalanche tested
- Superior thermal resistance
- 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 |
| $R_{DS(on),max}$ | 6.5 | mΩ |
| $I_D$ | 85 | A |
| $Q_{oss}$ | 40 | nC |
| $Q_G$(0V...10V) | 34 | nC |

| Type / Ordering Code | Package | Marking | Related Links |
|---|---|---|---|
| IQE065N10NM5CGSC | PG-WHTFN-9 | S | - |



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# 1 Maximum ratings

at $T_A$=25 °C, unless otherwise specified

## Table 2 Maximum ratings

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Continuous drain current[1] | $I_D$ | -<br>-<br>-<br>- | -<br>-<br>-<br>- | 85<br>60<br>46<br>13 | A | $V_{GS}$=10 V, $T_C$=25 °C<br>$V_{GS}$=10 V, $T_C$=100 °C<br>$V_{GS}$=6 V, $T_C$=100 °C<br>$V_{GS}$=10V, $T_A$=25°C,$R_{thJA}$=60°C/W[2] |
| Pulsed drain current[3] | $I_{D,pulse}$ | - | - | 340 | A | $T_A$=25 °C |
| Avalanche energy, single pulse[4] | $E_{AS}$ | - | - | 147 | mJ | $I_D$=20 A, $R_{GS}$=25 Ω |
| Gate source voltage | $V_{GS}$ | -20 | - | 20 | V | - |
| Power dissipation | $P_{tot}$ | -<br>- | -<br>- | 100<br>2.5 | W | $T_C$=25 °C<br>$T_A$=25 °C, $R_{thJA}$=60 °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, bottom | $R_{thJC}$ | - | 0.8 | 1.5 | °C/W | - |
| Thermal resistance, junction - case, top | $R_{thJC}$ | - | 0.7 | - | °C/W | - |
| Thermal resistance, junction - ambient, 6 cm² cooling area[2] | $R_{thJA}$ | - | - | 60 | °C/W | - |

[1] 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.
[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] See Diagram 3 for more detailed information
[4] See Diagram 13 for more detailed information



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# 3 Electrical characteristics

at $T_j$=25 °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 V, $I_D$=1 mA |
| Gate threshold voltage | $V_{GS(th)}$ | 2.2 | 3.0 | 3.8 | V | $V_{DS}$=$V_{GS}$, $I_D$=48 µA |
| Zero gate voltage drain current | $I_{DSS}$ | -<br>- | 0.1<br>10 | 1.0<br>100 | µA | $V_{DS}$=100 V, $V_{GS}$=0 V, $T_j$=25 °C<br>$V_{DS}$=100 V, $V_{GS}$=0 V, $T_j$=125 °C |
| Gate-source leakage current | $I_{GSS}$ | - | 10 | 100 | nA | $V_{GS}$=20 V, $V_{DS}$=0 V |
| Drain-source on-state resistance | $R_{DS(on)}$ | -<br>- | 5.7<br>7.2 | 6.5<br>11 | mΩ | $V_{GS}$=10 V, $I_D$=20 A<br>$V_{GS}$=6 V, $I_D$=10 A |
| Gate resistance | $R_G$ | - | 0.7 | - | Ω | - |
| Transconductance | $g_{fs}$ | - | 55 | - | S | $\|V_{DS}\|\geq 2\|I_D\|R_{DS(on)max}$, $I_D$=20 A |

## Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance[1)] | $C_{iss}$ | - | 2300 | 3000 | pF | $V_{GS}$=0 V, $V_{DS}$=50 V, $f$=1 MHz |
| Output capacitance[1)] | $C_{oss}$ | - | 340 | 440 | pF | $V_{GS}$=0 V, $V_{DS}$=50 V, $f$=1 MHz |
| Reverse transfer capacitance[1)] | $C_{rss}$ | - | 18 | 32 | pF | $V_{GS}$=0 V, $V_{DS}$=50 V, $f$=1 MHz |
| Turn-on delay time | $t_{d(on)}$ | - | 8.9 | - | ns | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=20 A, $R_{G,ext}$=1.6 Ω |
| Rise time | $t_r$ | - | 3.8 | - | ns | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=20 A, $R_{G,ext}$=1.6 Ω |
| Turn-off delay time | $t_{d(off)}$ | - | 21.1 | - | ns | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=20 A, $R_{G,ext}$=1.6 Ω |
| Fall time | $t_f$ | - | 7.5 | - | ns | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=20 A, $R_{G,ext}$=1.6 Ω |

## Table 6 Gate charge characteristics[2)]

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | $Q_{gs}$ | - | 10.1 | - | nC | $V_{DD}$=50 V, $I_D$=20 A, $V_{GS}$=0 to 10 V |
| Gate charge at threshold | $Q_{g(th)}$ | - | 6.8 | - | nC | $V_{DD}$=50 V, $I_D$=20 A, $V_{GS}$=0 to 10 V |
| Gate to drain charge[1)] | $Q_{gd}$ | - | 7.4 | 11.1 | nC | $V_{DD}$=50 V, $I_D$=20 A, $V_{GS}$=0 to 10 V |
| Switching charge | $Q_{sw}$ | - | 10.7 | - | nC | $V_{DD}$=50 V, $I_D$=20 A, $V_{GS}$=0 to 10 V |
| Gate charge total[1)] | $Q_g$ | - | 34 | 43.0 | nC | $V_{DD}$=50 V, $I_D$=20 A, $V_{GS}$=0 to 10 V |
| Gate plateau voltage | $V_{plateau}$ | - | 4.4 | - | V | $V_{DD}$=50 V, $I_D$=20 A, $V_{GS}$=0 to 10 V |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | - | 29 | - | nC | $V_{DS}$=0.1 V, $V_{GS}$=0 to 10 V |
| Output charge[1)] | $Q_{oss}$ | - | 40 | 53 | nC | $V_{DS}$=50 V, $V_{GS}$=0 V |

[1)] Defined by design. Not subject to production test.
[2)] See ″Gate charge waveforms″ for parameter definition



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## Table 7 Reverse diode

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Diode continuous forward current | $I_S$ | - | - | 74 | A | $T_C$=25 °C |
| Diode pulse current | $I_{S,pulse}$ | - | - | 340 | A | $T_C$=25 °C |
| Diode forward voltage | $V_{SD}$ | - | 0.83 | 1.1 | V | $V_{GS}$=0 V, $I_F$=20 A, $T_j$=25 °C |
| Reverse recovery time[1)] | $t_{rr}$ | - | 36 | 72 | ns | $V_R$=50 V, $I_F$=20 A, d$i_F$/d$t$=100 A/µs |
| Reverse recovery charge[1)] | $Q_{rr}$ | - | 40 | 80 | nC | $V_R$=50 V, $I_F$=20 A, d$i_F$/d$t$=100 A/µs |

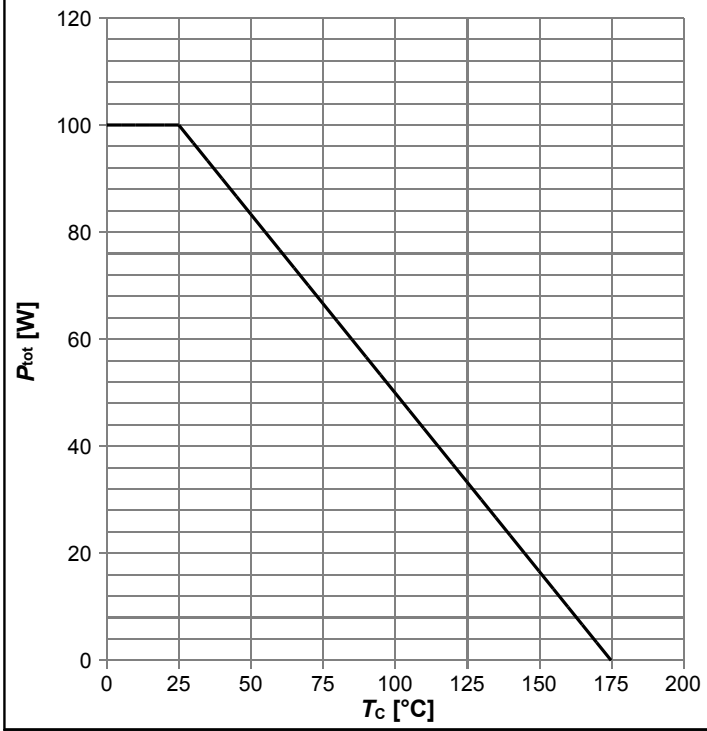
[1)] Defined by design. Not subject to production test.



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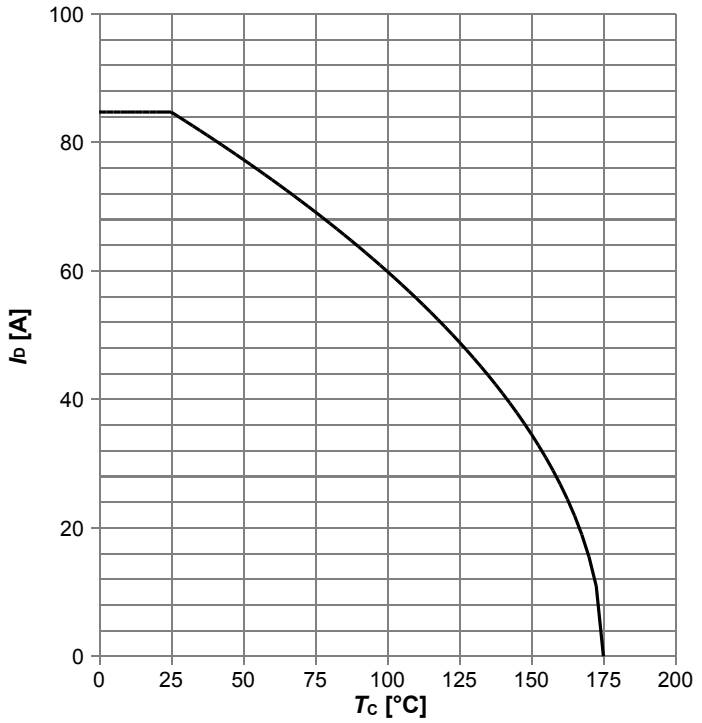
# 4 Electrical characteristics diagrams

**Diagram 1: Power dissipation**



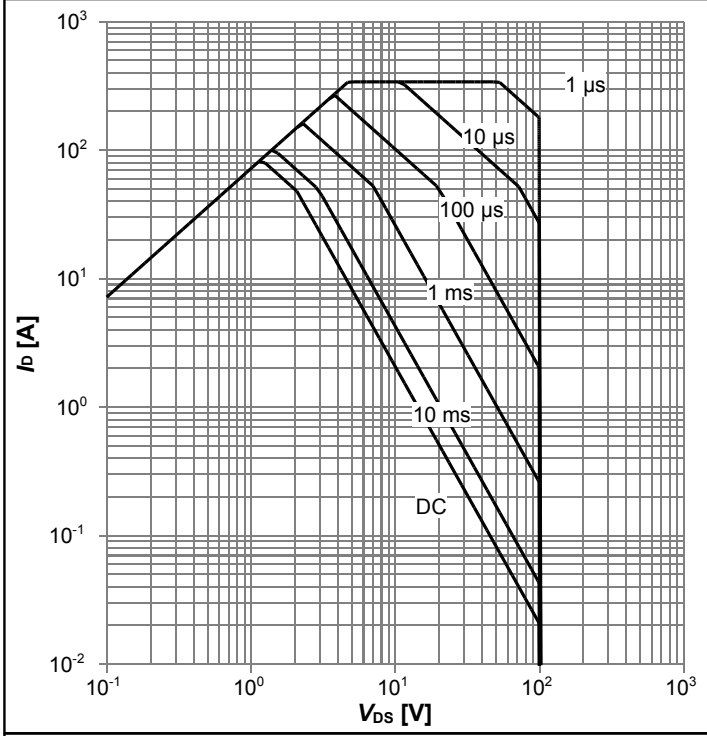

$P_{tot}=f(T_C)$

**Diagram 2: Drain current**



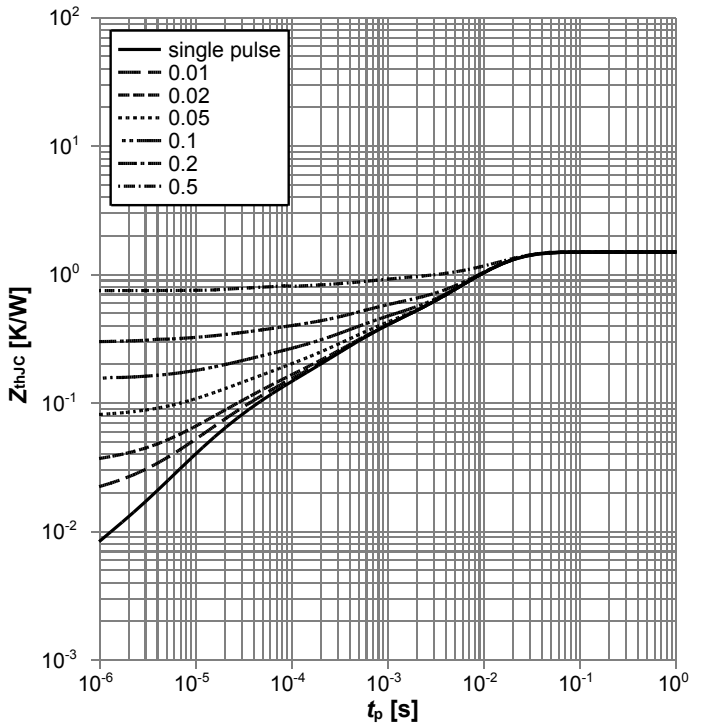

$I_D=f(T_C)$; $V_{GS}\geq 10$ V

**Diagram 3: Safe operating area**




$I_D=f(V_{DS})$; $T_C$=25 °C; $D$=0; parameter: $t_p$

**Diagram 4: Max. transient thermal impedance**

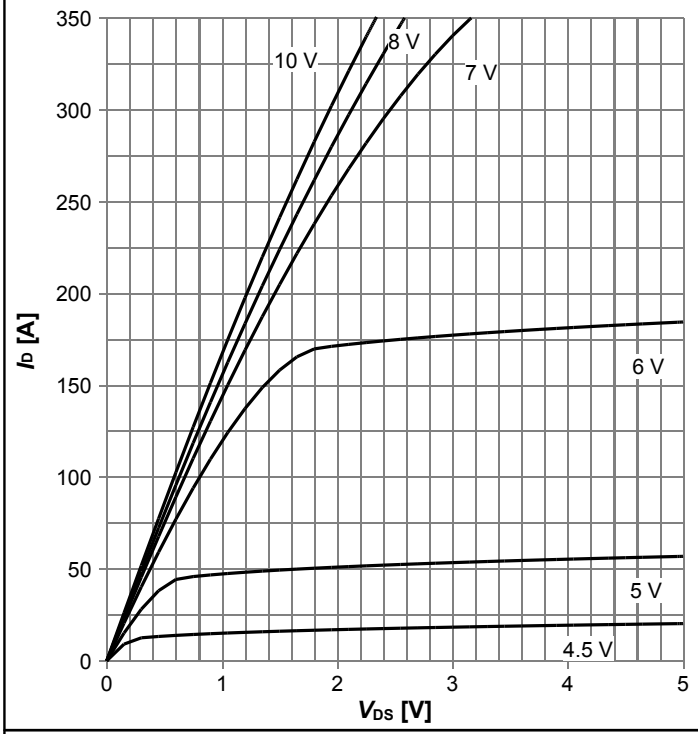



$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$



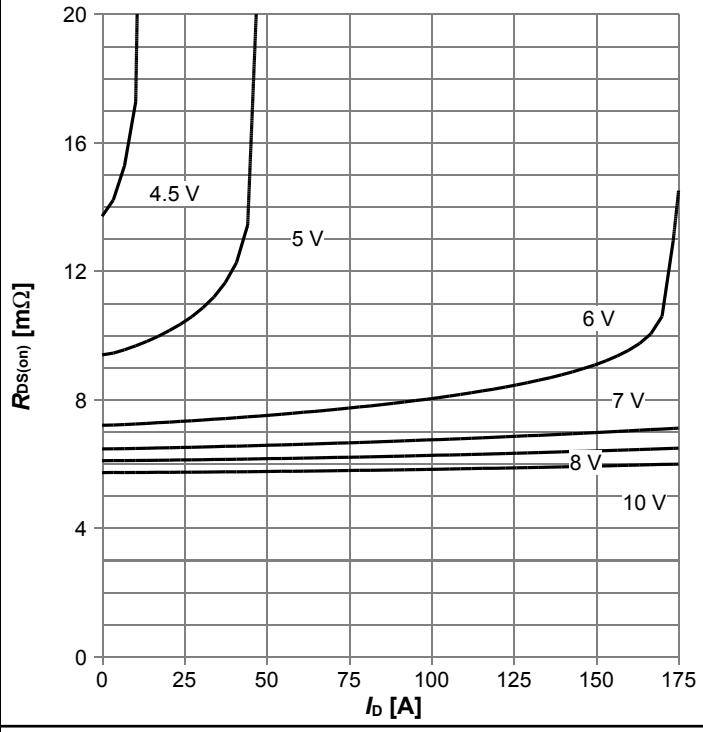
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**Diagram 5: Typ. output characteristics**



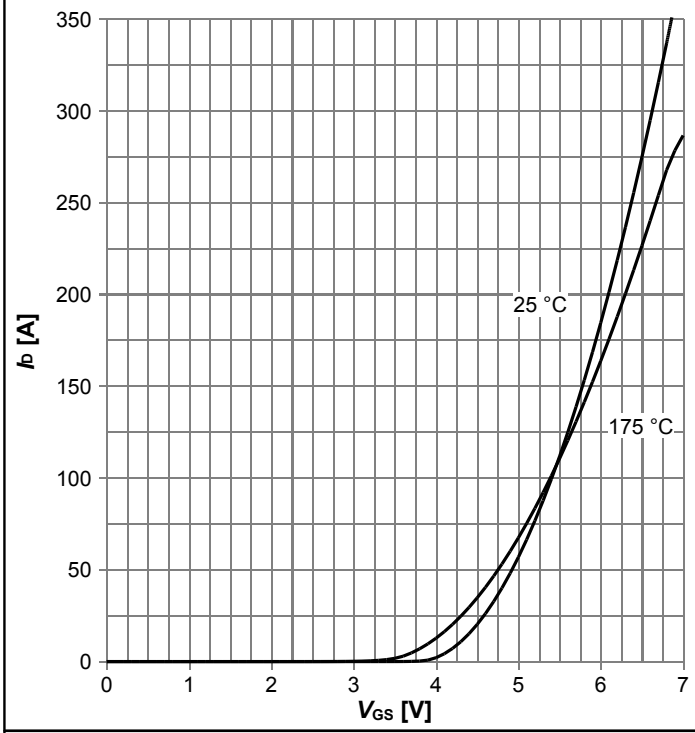

$I_D=f(V_{DS})$, $T_j=25$ °C; parameter: $V_{GS}$

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



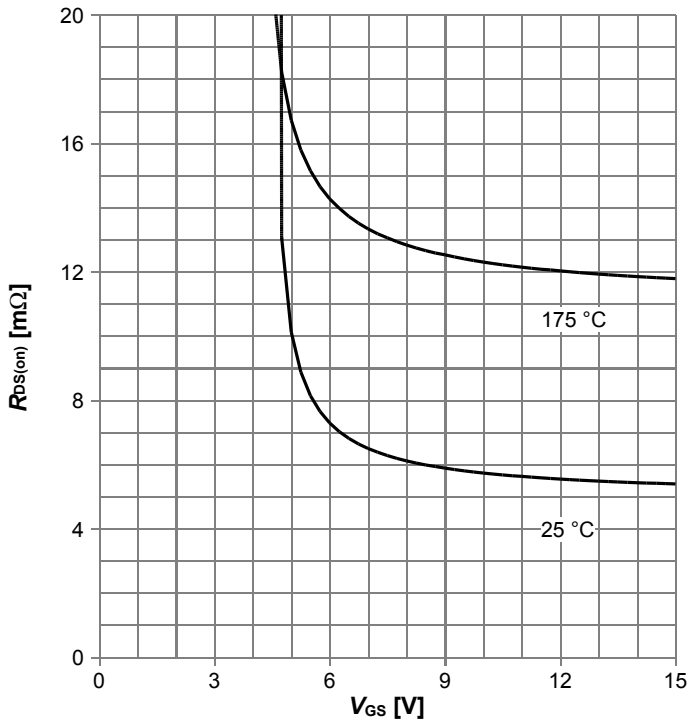

$R_{DS(on)}=f(I_D)$, $T_j=25$ °C; parameter: $V_{GS}$

**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**

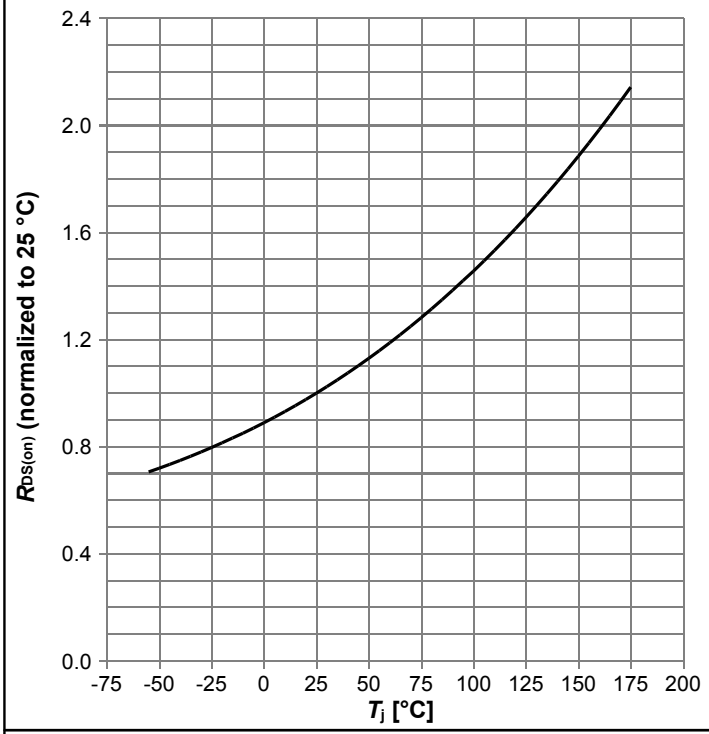



$R_{DS(on)}=f(V_{GS})$, $I_D=20$ A; parameter: $T_j$



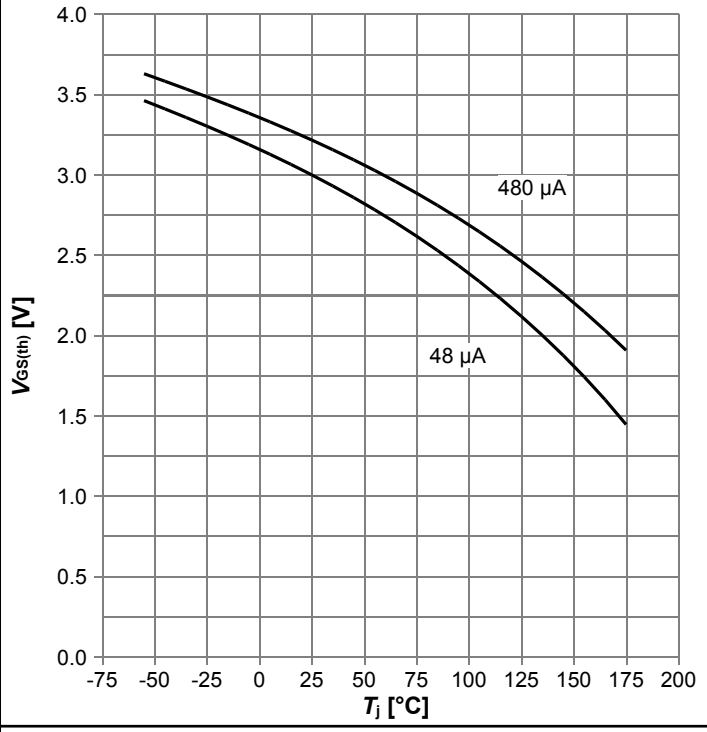
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**Diagram 9: Normalized drain-source on resistance**



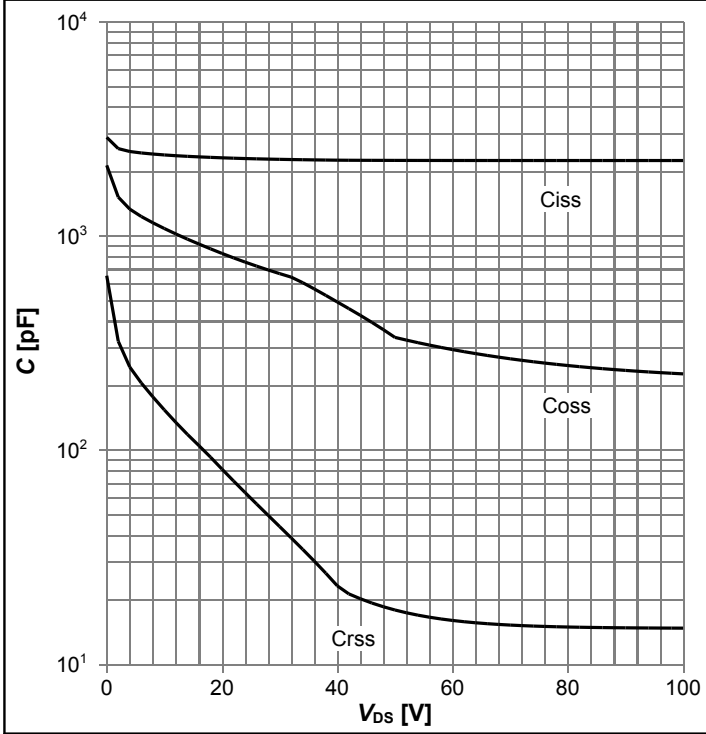

$R_{DS(on)}$=f($T_j$), $I_D$=20 A, $V_{GS}$=10 V

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



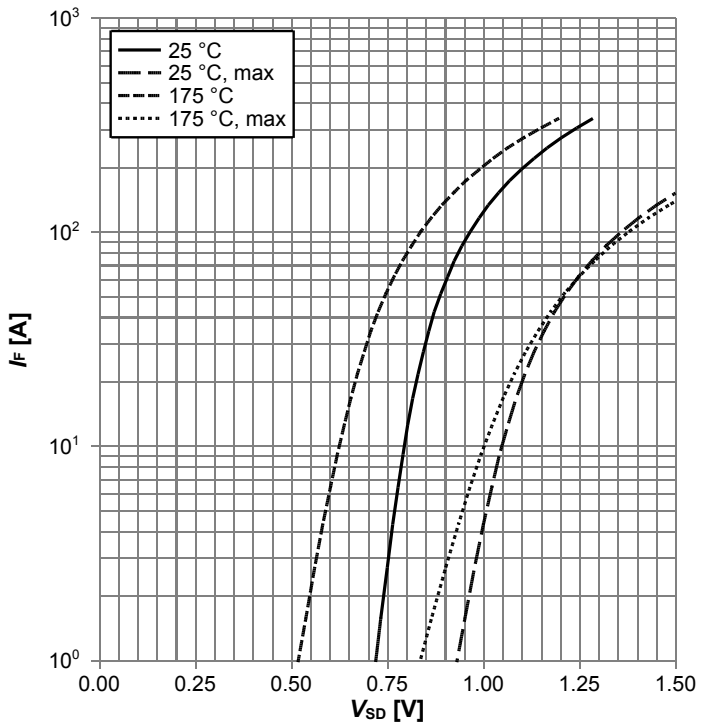

$V_{GS(th)}$=f($T_j$), $V_{GS}$=$V_{DS}$; parameter: $I_D$

**Diagram 11: Typ. capacitances**




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

**Diagram 12: Forward characteristics of reverse diode**

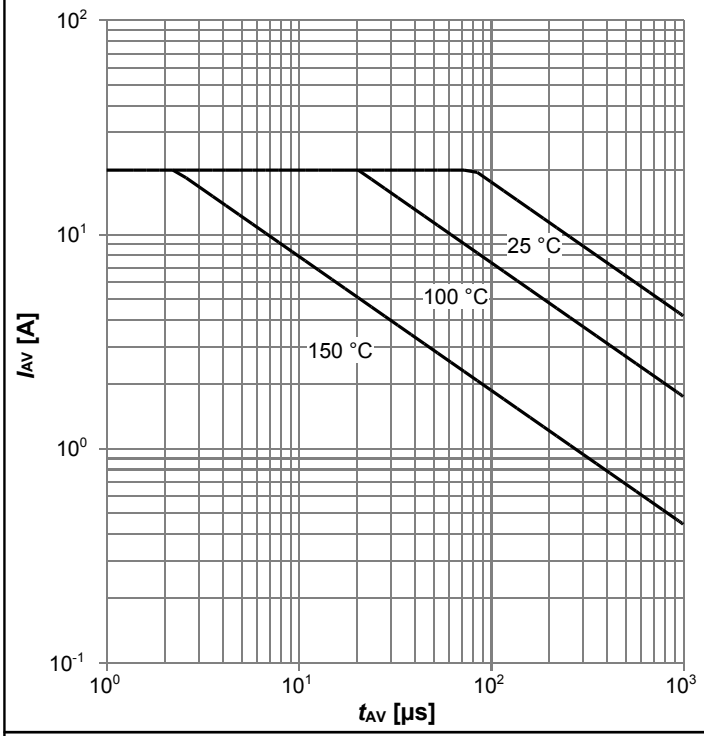



$I_F$=f($V_{SD}$); parameter: $T_j$



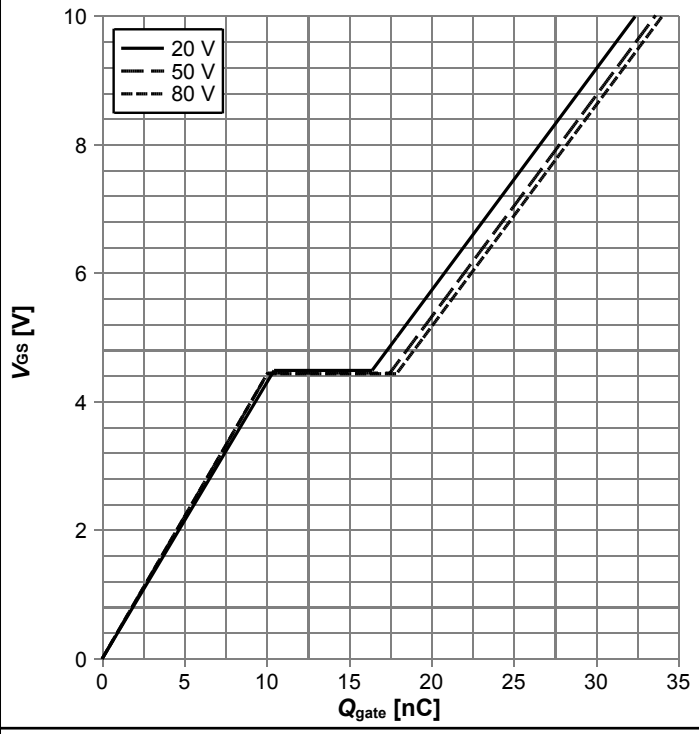
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**Diagram 13: Avalanche characteristics**



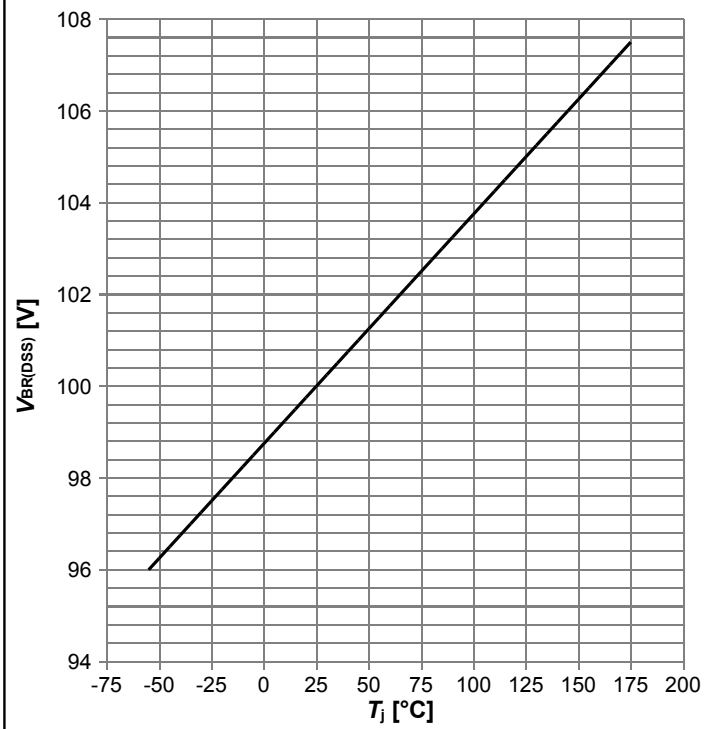

$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j,start}$

**Diagram 14: Typ. gate charge**



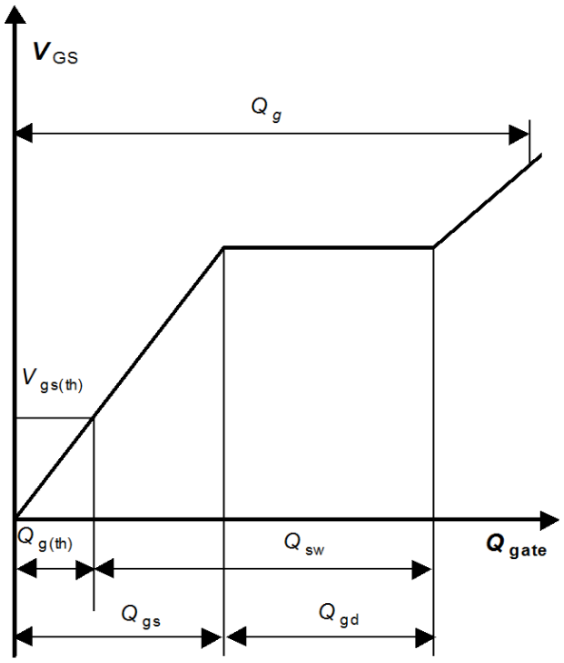

$V_{GS}=f(Q_{gate})$, $I_D=20$ A pulsed, $T_j=25$ °C; parameter: $V_{DD}$

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




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

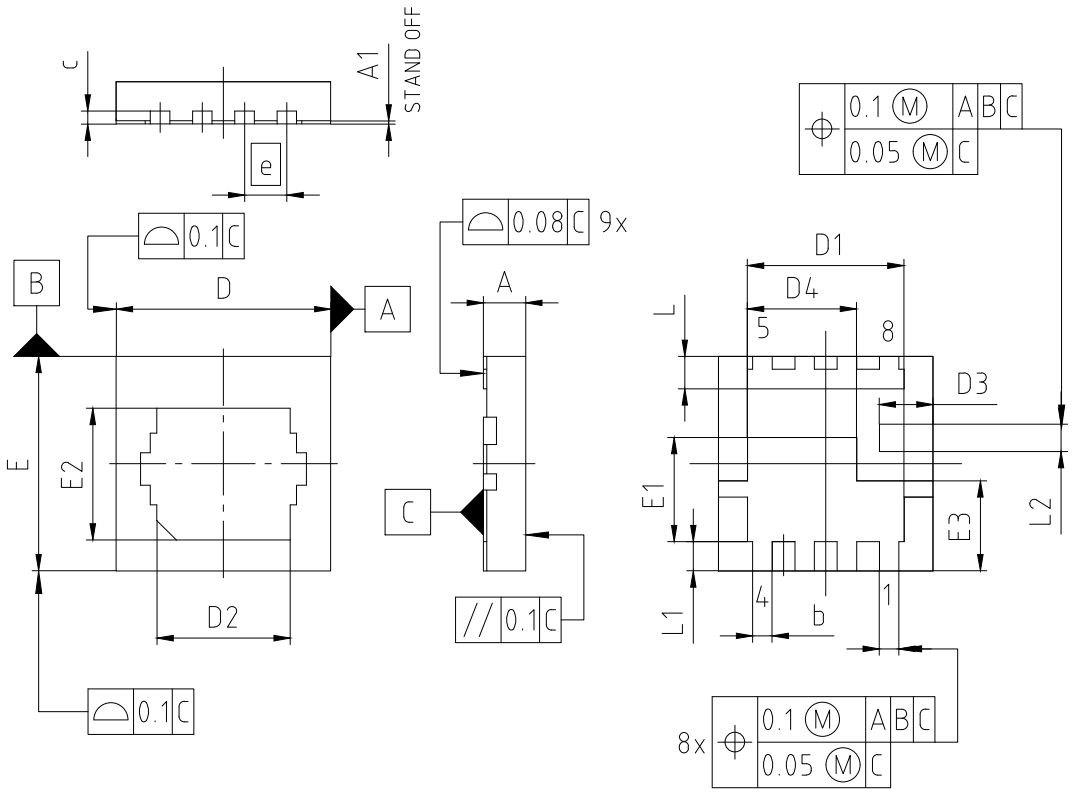
**Diagram Gate charge waveforms**






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# 5 Package Outlines




| PACKAGE - GROUP NUMBER: | PG-WHTFN-9-U01 | |
|---|---|---|
| **DIMENSIONS** | **MILLIMETERS** | |
| | MIN. | MAX. |
| **A** | --- | 0.75 |
| **A1** | 0 | 0.05 |
| **b** | 0.20 | 0.40 |
| **c** | 0.10 | 0.30 |
| **D** | 3.20 | 3.40 |
| **D1** | 2.31 | 2.51 |
| **D2** | 1.95 | 2.25 |
| **D3** | 0.73 | 0.93 |
| **D4** | 1.58 | 1.78 |
| **E** | 3.20 | 3.40 |
| **E1** | 1.50 | 1.70 |
| **E2** | 1.93 | 2.23 |
| **E3** | 1.285 | 1.485 |
| **e** | 0.65 | |
| **L** | 0.40 | 0.60 |
| **L1** | 0.35 | 0.55 |
| **L2** | 0.32 | 0.52 |

**Figure 1 Outline PG-WHTFN-9, dimensions in mm**



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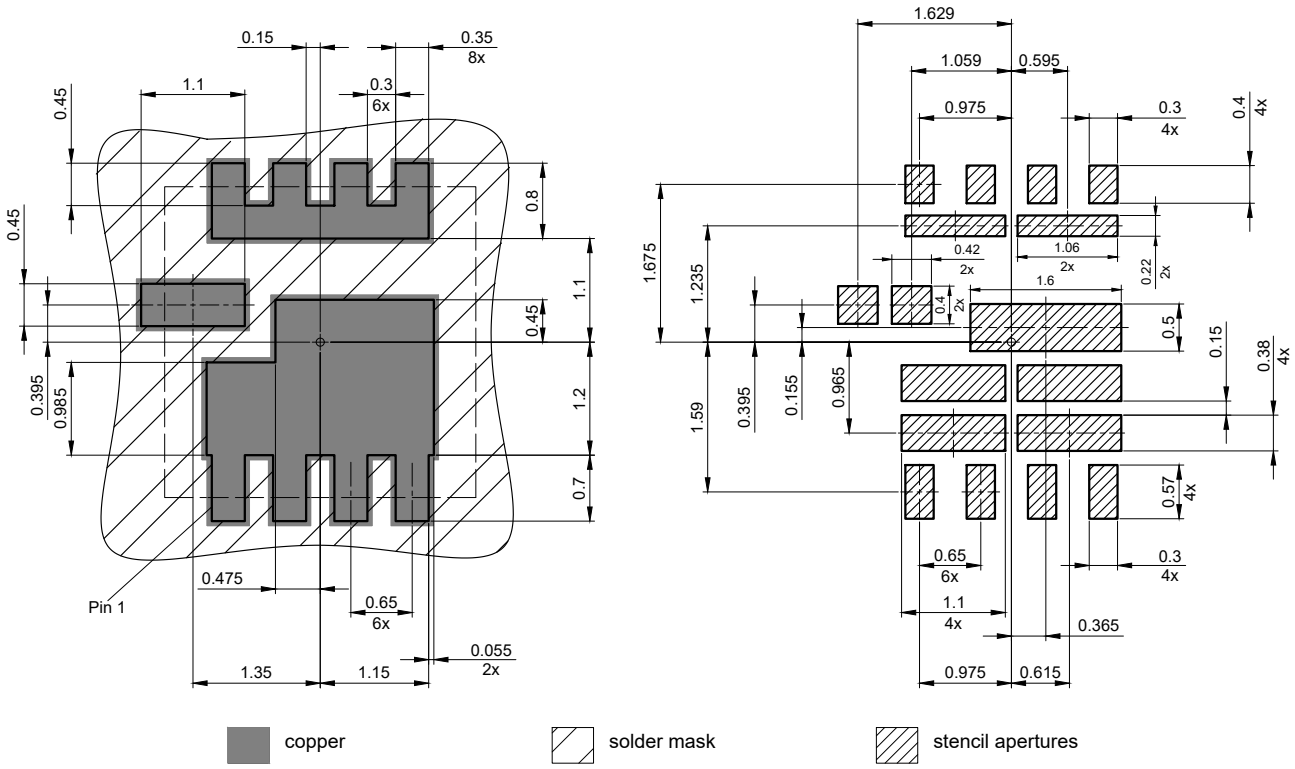



**Figure 2 Outline Footprint (PG-WHTFN-9-1), dimensions in mm**



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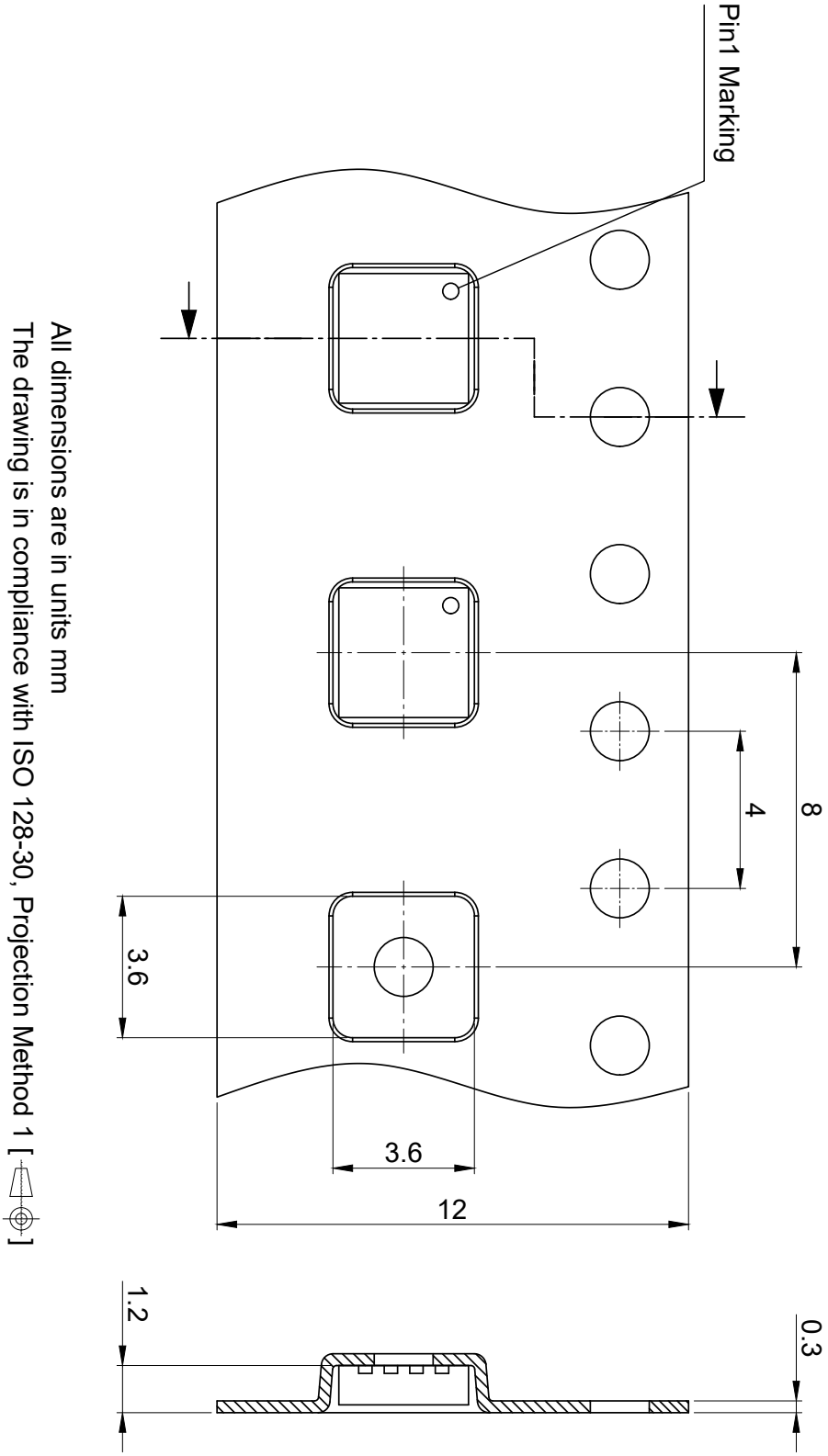



**Figure 3 Outline Tape (PG-WHTFN-9-1), dimensions in mm**



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## Revision History

IQE065N10NM5CGSC

**Revision: 2022-05-02, Rev. 2.0**

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|---|---|---|
| 2.0 | 2022-05-02 | Release of final version |

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