

MOSFET

OptiMOS™ 5 Power-Transistor, 80 V

Features

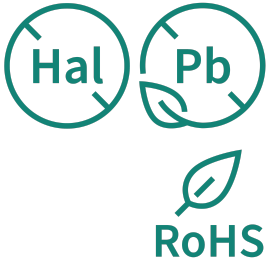
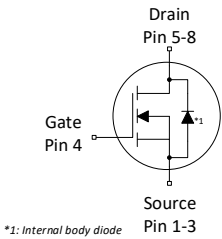
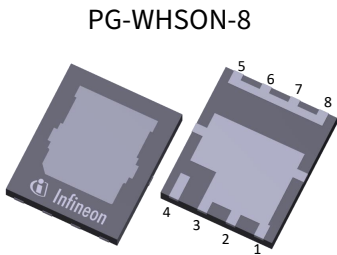
- N-channel, normal level
- Very low on-resistance  $R_{DS(on)}$
- Superior thermal resistance
- Optimized design for double side cooling
- 100% avalanche tested
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

| Parameter        | Value | Unit |
|------------------|-------|------|
| $V_{DS}$         | 80    | V    |
| $R_{DS(on),max}$ | 1.57  | mΩ   |
| $I_D$            | 323   | A    |
| $Q_{oss}$        | 123   | nC   |
| $Q_G$            | 106   | nC   |



| Type/Ordering Code | Package    | Marking | Related Links |
|--------------------|------------|---------|---------------|
| IQD016N08NM5SC     | PG-WHSON-8 | GA      | -             |



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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>       | $I_D$             | -      | -    | 323<br>229<br>188<br>31 | 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>$V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ °C/W}$ <sup>2)</sup> |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$     | -      | -    | 1292                    | A    | $T_C=25\text{ °C}$                                                                                                                                                                                                          |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$          | -      | -    | 802                     | mJ   | $I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                                                                                                                               |
| Gate source voltage                          | $V_{GS}$          | -20    | -    | 20                      | V    | -                                                                                                                                                                                                                           |
| Power dissipation                            | $P_{tot}$         | -      | -    | 333<br>3.0              | W    | $T_C=25\text{ °C}$<br>$T_A=25\text{ °C}$ , $R_{thJA}=50\text{ °C/W}$ <sup>2)</sup>                                                                                                                                          |
| Operating and storage temperature            | $T_j$ , $T_{stg}$ | -55    | -    | 175                     | °C   | -                                                                                                                                                                                                                           |

<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 source 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

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

| Parameter                                                                            | Symbol     | Values |      |      | Unit | Note/ Test Condition |
|--------------------------------------------------------------------------------------|------------|--------|------|------|------|----------------------|
|                                                                                      |            | Min.   | Typ. | Max. |      |                      |
| Thermal resistance, junction - case, bottom                                          | $R_{thJC}$ | -      | -    | 0.45 | °C/W | -                    |
| Thermal resistance, junction - case, top                                             | $R_{thJC}$ | -      | -    | 0.56 | °C/W | -                    |
| Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>5)</sup> | $R_{thJA}$ | -      | -    | 50   | °C/W | -                    |

<sup>5)</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 source connection. PCB is vertical in still air.

### 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   | $V_{(BR)DSS}$ | 80     | -          | -            | V             | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                                                                             |
| Gate threshold voltage           | $V_{GS(th)}$  | 2.2    | 3.0        | 3.8          | V             | $V_{DS}=V_{GS}$ , $I_D=159\text{ }\mu\text{A}$                                                                                      |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 0.1<br>10  | 1<br>100     | $\mu\text{A}$ | $V_{DS}=80\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$<br>$V_{DS}=80\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | 10         | 100          | nA            | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$                                                                                          |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 1.4<br>1.9 | 1.57<br>2.32 | m $\Omega$    | $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$<br>$V_{GS}=6\text{ V}$ , $I_D=50\text{ A}$                                                 |
| Gate resistance                  | $R_G$         | -      | 0.35       | -            | $\Omega$      | -                                                                                                                                   |
| Transconductance                 | $g_{fs}$      | -      | 140        | -            | S             | $ V_{DS} \geq 2 I_D  R_{DS(on)max}$ , $I_D=50\text{ A}$                                                                             |

**Table 5 Dynamic characteristics**

| Parameter                                  | Symbol       | Values |      |      | Unit | Note/ Test Condition                                                                            |
|--------------------------------------------|--------------|--------|------|------|------|-------------------------------------------------------------------------------------------------|
|                                            |              | Min.   | Typ. | Max. |      |                                                                                                 |
| Input capacitance <sup>6)</sup>            | $C_{iss}$    | -      | 7100 | 9200 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                   |
| Output capacitance <sup>6)</sup>           | $C_{oss}$    | -      | 1200 | 1600 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                   |
| Reverse transfer capacitance <sup>6)</sup> | $C_{rss}$    | -      | 56   | 98   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                   |
| Turn-on delay time                         | $t_{d(on)}$  | -      | 15   | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                                  | $t_r$        | -      | 7    | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time                        | $t_{d(off)}$ | -      | 29   | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                                  | $t_f$        | -      | 10   | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$ |

<sup>6)</sup> Defined by design. Not subject to production test.

**Table 6 Gate charge characteristics** <sup>7)</sup>

| Parameter                          | Symbol        | Values |      |      | Unit | Note/ Test Condition                                                        |
|------------------------------------|---------------|--------|------|------|------|-----------------------------------------------------------------------------|
|                                    |               | Min.   | Typ. | Max. |      |                                                                             |
| Gate to source charge              | $Q_{gs}$      | -      | 31   | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge at threshold           | $Q_{g(th)}$   | -      | 21   | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge <sup>8)</sup> | $Q_{gd}$      | -      | 25   | 38   | nC   | $V_{DD}=40\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge                   | $Q_{sw}$      | -      | 35   | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total <sup>8)</sup>    | $Q_g$         | -      | 106  | 133  | nC   | $V_{DD}=40\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage               | $V_{plateau}$ | -      | 4.4  | -    | V    | $V_{DD}=40\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total, sync. FET       | $Q_{g(sync)}$ | -      | 90   | -    | nC   | $V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$                    |
| Output charge <sup>8)</sup>        | $Q_{oss}$     | -      | 123  | 164  | nC   | $V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$                                  |

<sup>7)</sup> See "Gate charge waveforms" for parameter definition

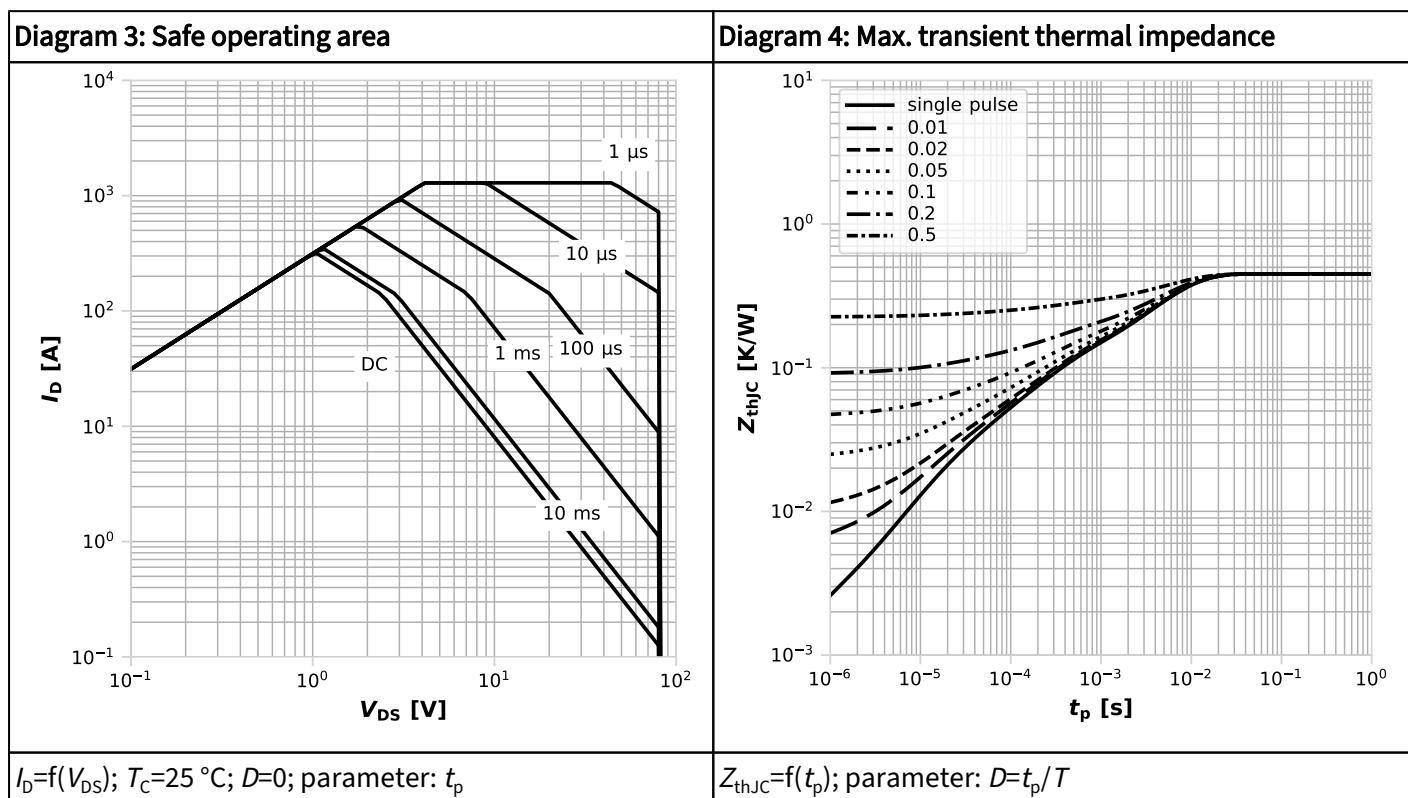
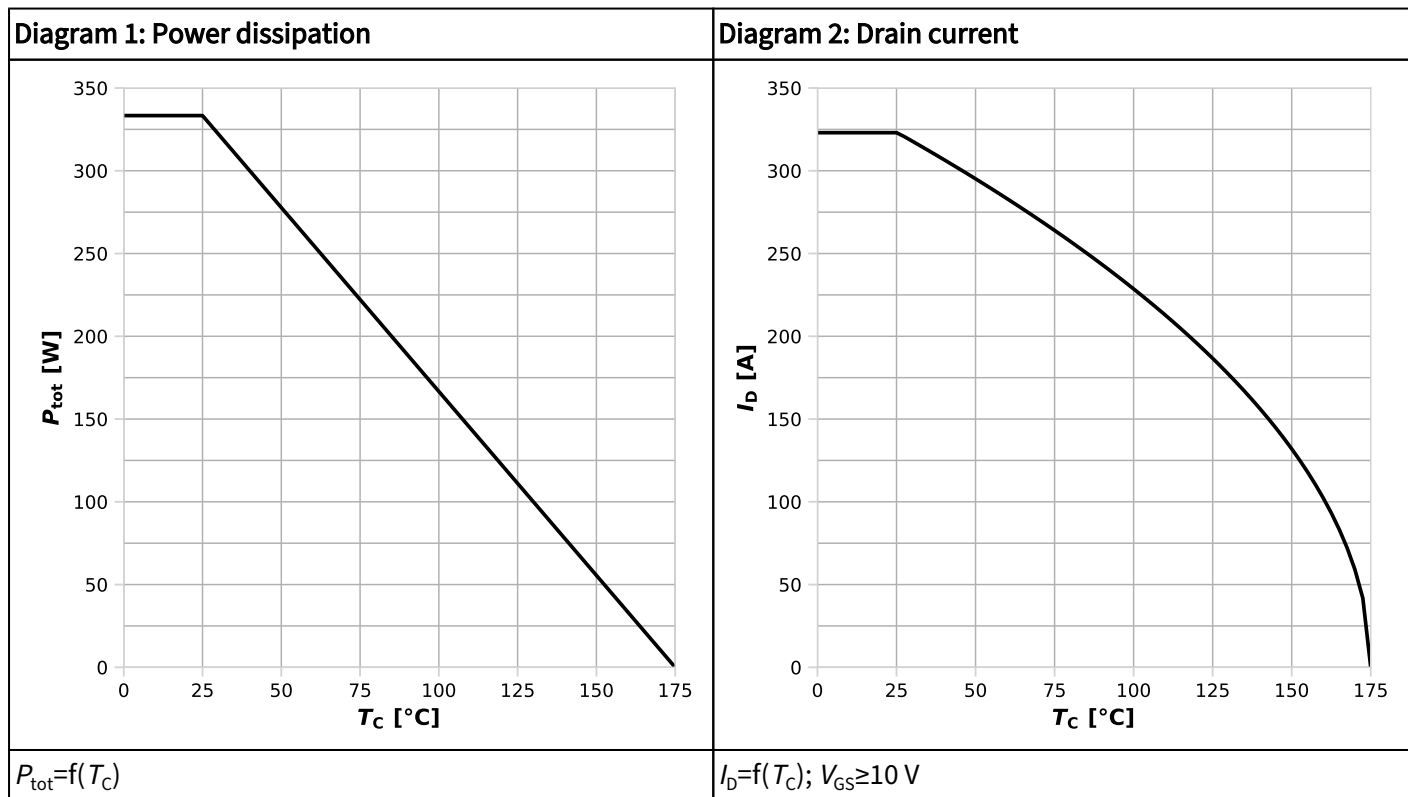
<sup>8)</sup> Defined by design. Not subject to production test.

**Table 7 Reverse diode**

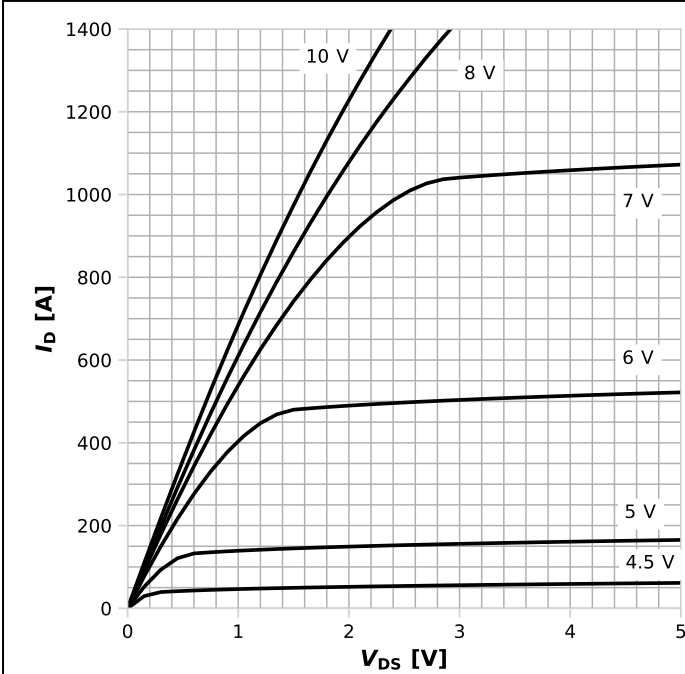
| Parameter                             | Symbol        | Values |      |      | Unit | Note/ Test Condition                                                        |
|---------------------------------------|---------------|--------|------|------|------|-----------------------------------------------------------------------------|
|                                       |               | Min.   | Typ. | Max. |      |                                                                             |
| Diode continuous forward current      | $I_S$         | -      | -    | 256  | A    | $T_C=25\text{ °C}$                                                          |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -    | 1292 | A    | $T_C=25\text{ °C}$                                                          |
| Diode forward voltage                 | $V_{SD}$      | -      | 0.82 | 1.0  | V    | $V_{GS}=0\text{ V}$ , $I_F=50\text{ A}$ , $T_j=25\text{ °C}$                |
| Reverse recovery time <sup>9)</sup>   | $t_{rr}$      | -      | 48   | 96   | ns   | $V_R=40\text{ V}$ , $I_F=25\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$  |
| Reverse recovery charge <sup>9)</sup> | $Q_{rr}$      | -      | 71   | 142  | nC   | $V_R=40\text{ V}$ , $I_F=25\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$  |
| Reverse recovery time <sup>9)</sup>   | $t_{rr}$      | -      | 29   | 58   | ns   | $V_R=40\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=1000\text{ A}/\mu\text{s}$ |
| Reverse recovery charge <sup>9)</sup> | $Q_{rr}$      | -      | 331  | 662  | nC   | $V_R=40\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=1000\text{ A}/\mu\text{s}$ |

<sup>9)</sup> Defined by design. Not subject to production test.

## 4 Electrical characteristics diagrams

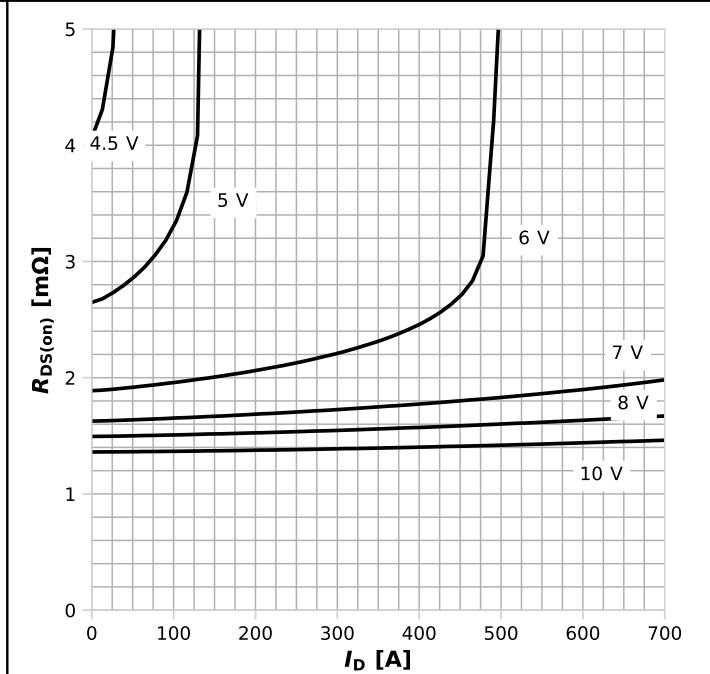


**Diagram 5: Typ. output characteristics**



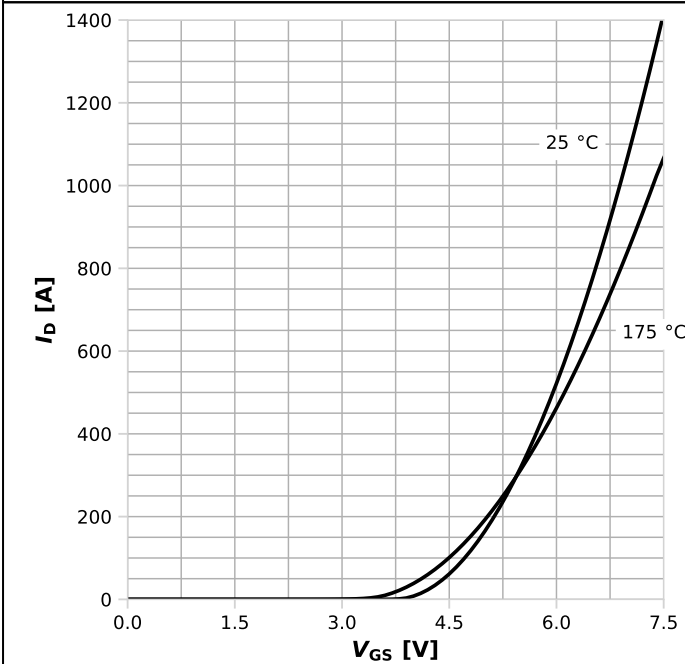
$I_D = f(V_{DS})$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

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



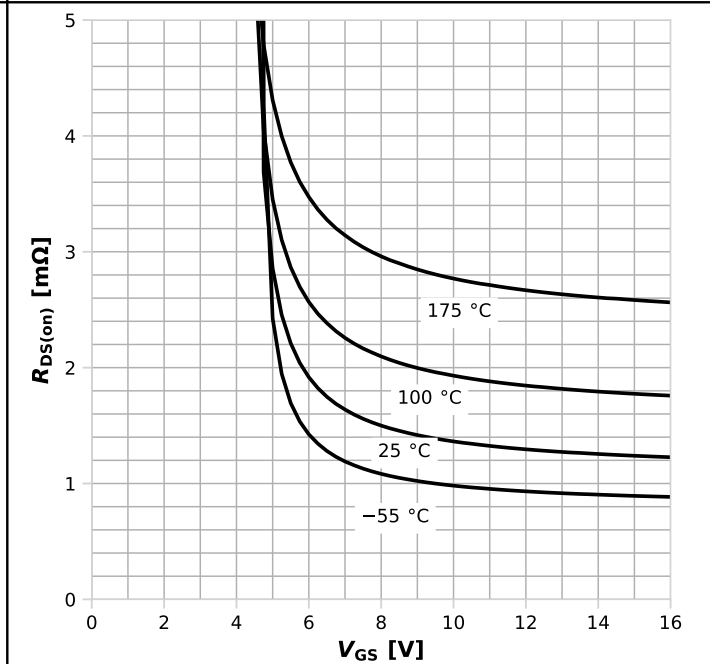
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

**Diagram 7: Typ. transfer characteristics**



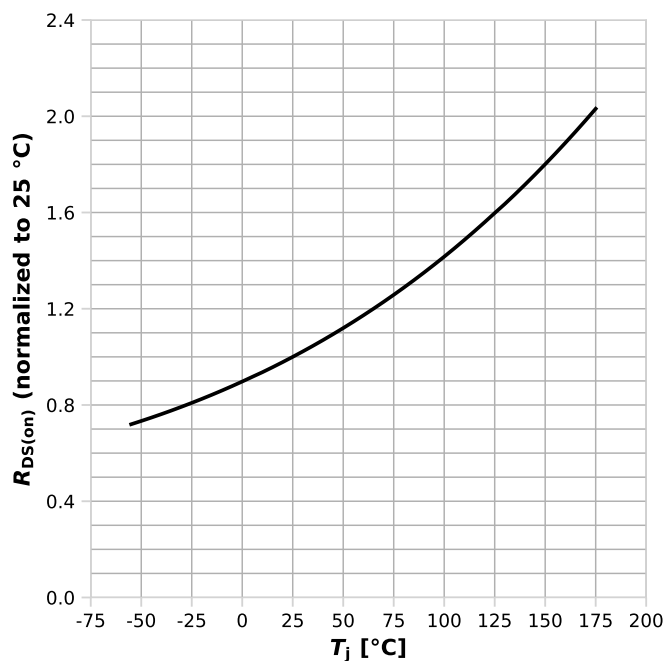
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)\max}$ ; parameter:  $T_j$

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



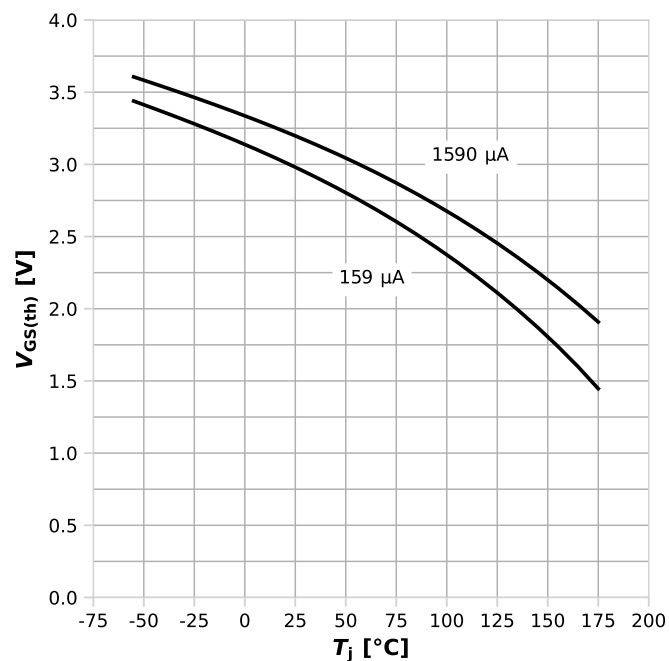
$R_{DS(on)} = f(V_{GS})$ ,  $I_D = 50\text{ A}$ ; parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



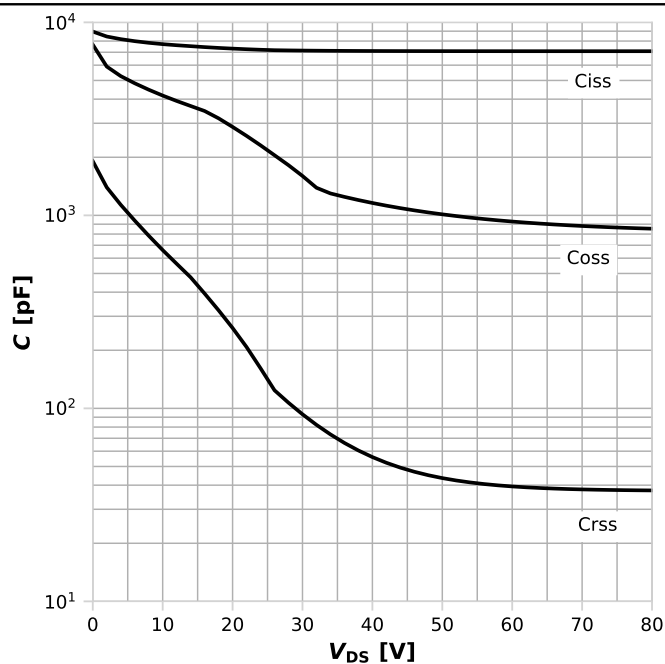
$$R_{DS(on)} = f(T_j), I_D = 50 \text{ A}, V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



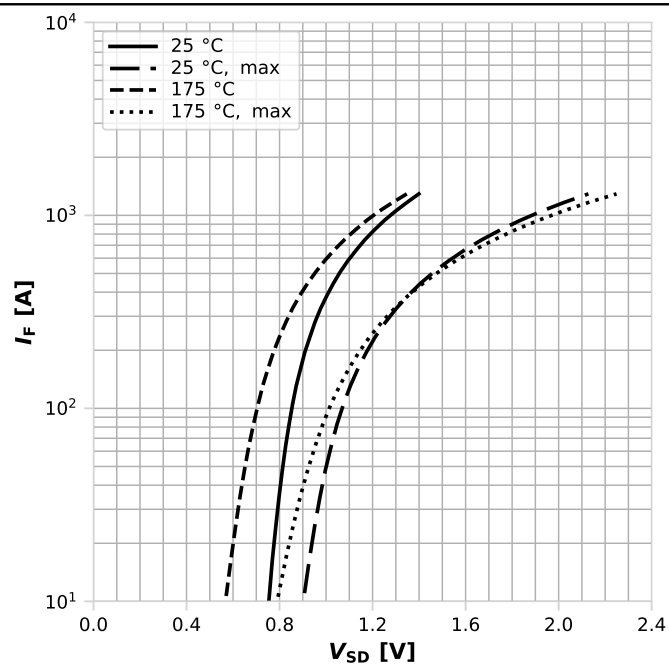
$$V_{GS(th)} = f(T_j), V_{GS} = V_{DS}; \text{ parameter: } I_D$$

Diagram 11: Typ. capacitances



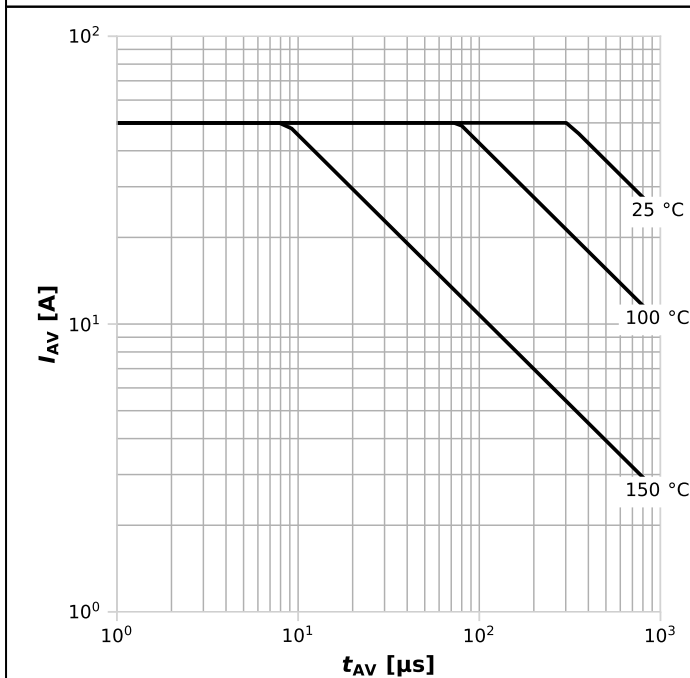
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

Diagram 12: Forward characteristics of reverse diode



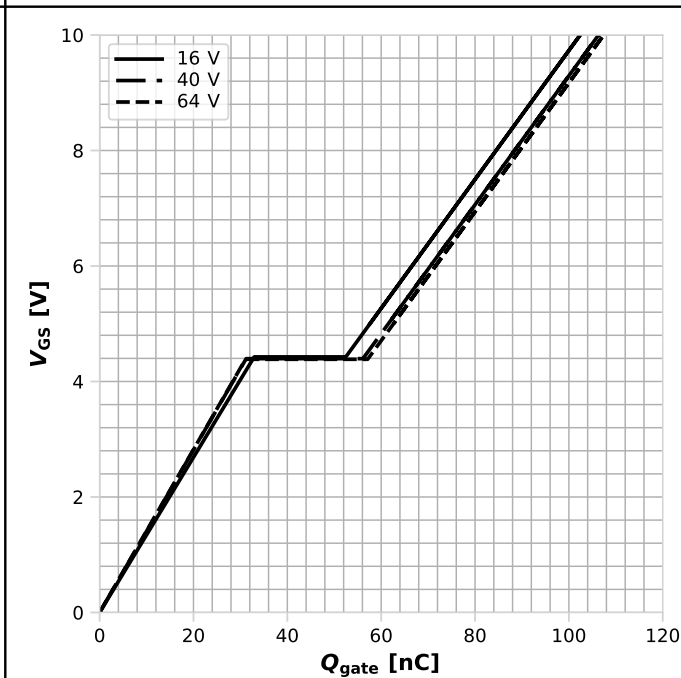
$$I_F = f(V_{SD}); \text{ parameter: } T_j$$

**Diagram 13: Avalanche characteristics**



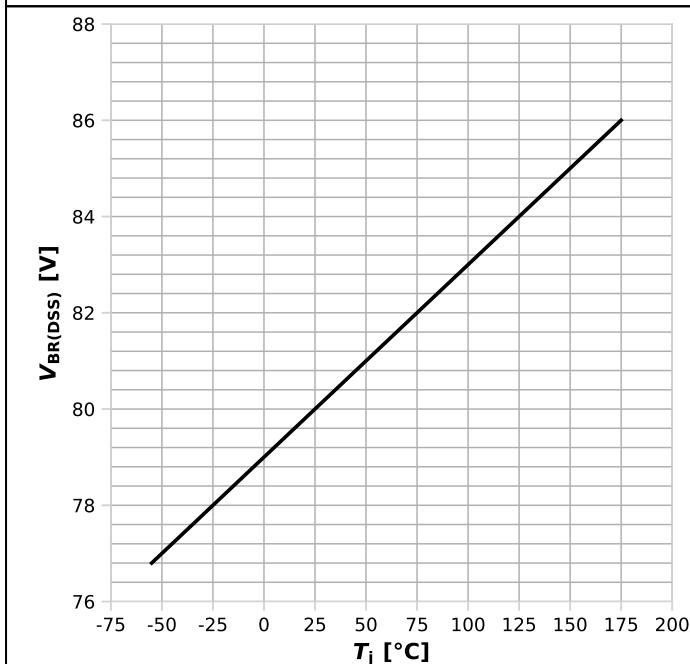
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25\ \Omega$ ; parameter:  $T_{j,start}$

**Diagram 14: Typ. gate charge**



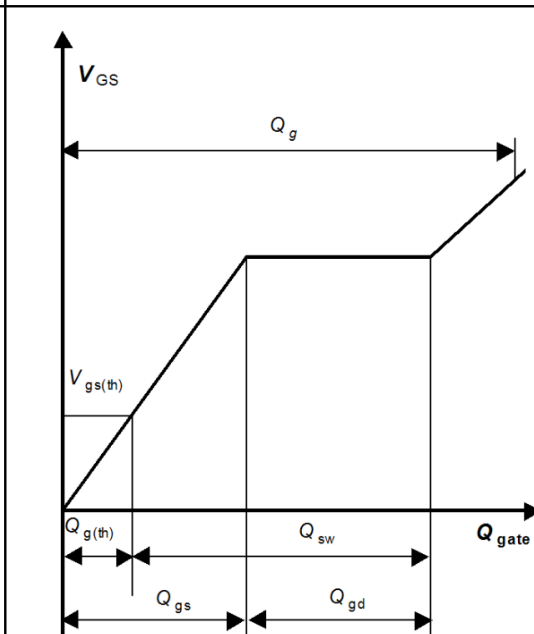
$V_{GS}=f(Q_{gate})$ ,  $I_D=50\text{ A}$  pulsed,  $T_j=25\text{ °C}$ ; parameter:  $V_{DD}$

**Diagram 15: Min. drain-source breakdown voltage**



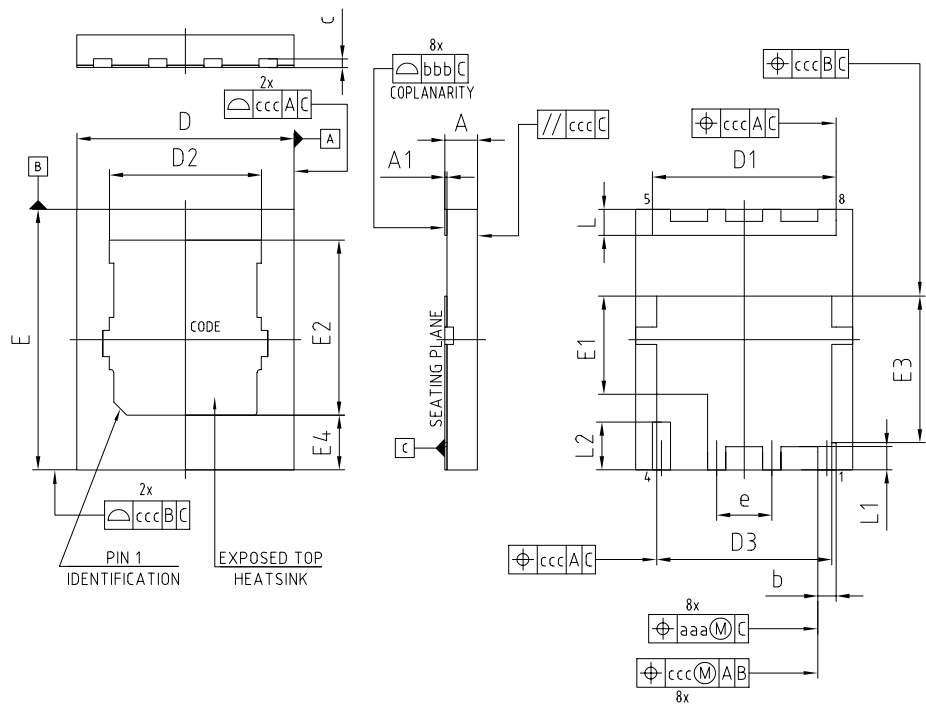
$V_{BR(DSS)}=f(T_j)$ ;  $I_D=1\text{ mA}$

**Gate charge waveforms**



-

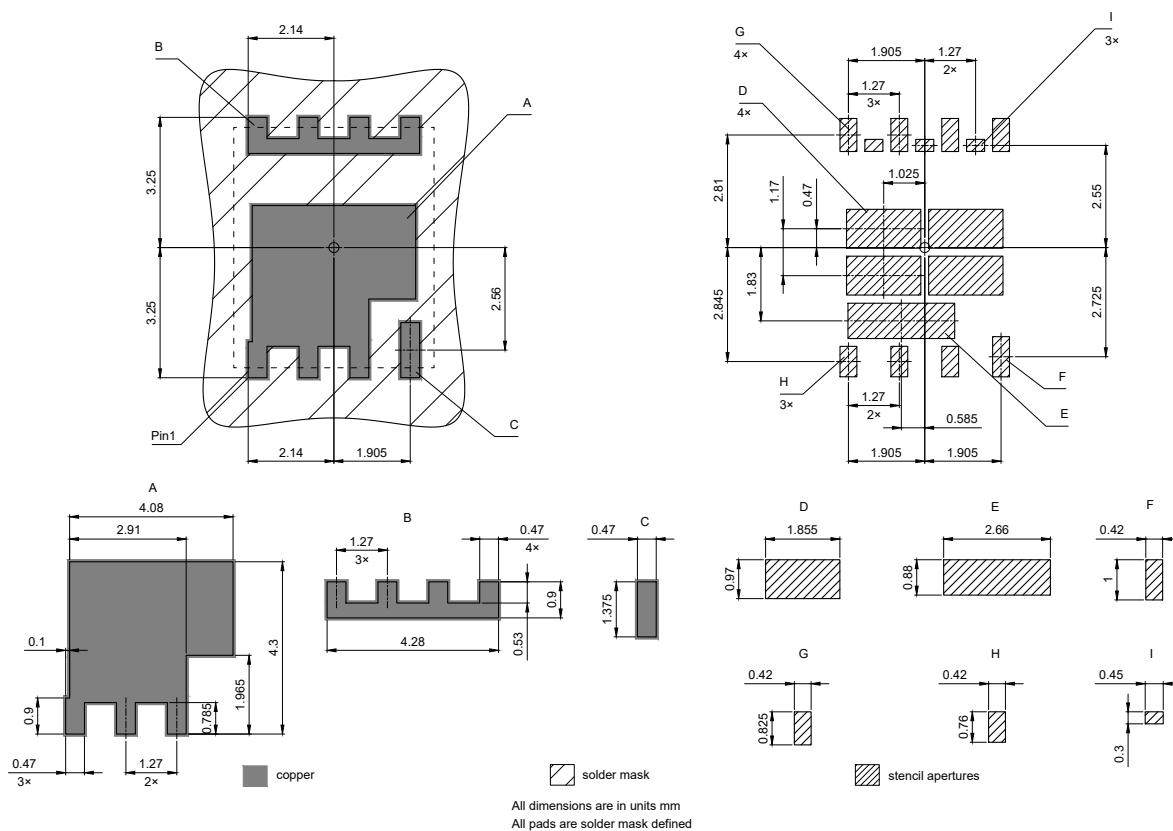
5 Package Outlines



| PACKAGE - GROUP NUMBER: PG-WHSON-8-U02 |             |      |            |             |      |
|----------------------------------------|-------------|------|------------|-------------|------|
| DIMENSIONS                             | MILLIMETERS |      | DIMENSIONS | MILLIMETERS |      |
|                                        | MIN.        | MAX. |            | MIN.        | MAX. |
| A                                      | 0.55        | 0.75 | e          | 1.27        |      |
| A1                                     | 0.00        | 0.05 | L          | 0.50        | 0.70 |
| b                                      | 0.32        | 0.52 | L1         | 0.44        | 0.64 |
| c                                      | 0.10        | 0.30 | L2         | 1.00        | 1.20 |
| D                                      | 5.00        |      | aaa        | 0.05        |      |
| D1                                     | 4.13        | 4.33 | bbb        | 0.08        |      |
| D2                                     | 3.40        | 3.60 | ccc        | 0.10        |      |
| D3                                     | 3.93        | 4.13 |            |             |      |
| E                                      | 6.00        |      |            |             |      |
| E1                                     | 2.16        | 2.36 |            |             |      |
| E2                                     | 3.93        | 4.13 |            |             |      |
| E3                                     | 3.28        | 3.48 |            |             |      |
| E4                                     | 1.16        | 1.36 |            |             |      |

NOTE: DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS

Figure 1 Outline PG-WHSON-8, dimensions in mm



**Figure 2** Outline PG-WHSON-8, dimensions in mm

## Revision History

IQD016N08NM5SC

### Revision 2024-06-14, Rev. 2.0

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2024-06-14 | Release of final                             |

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