

MOSFET

OptiMOS™ 6 Power-Transistor, 80 V

Features

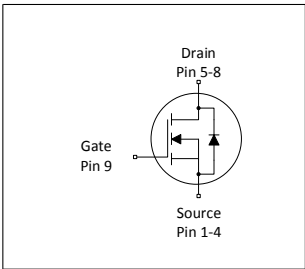
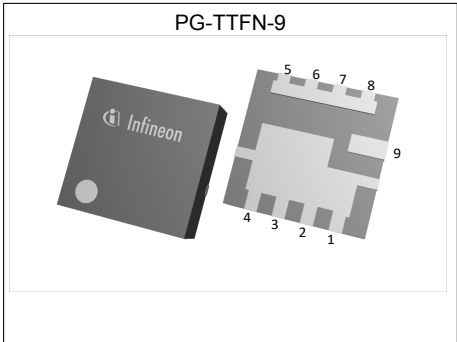
- N-channel, normal level
- Very low on-resistance  $R_{DS(on)}$
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low reverse recovery charge ( $Q_{rr}$ )
- High avalanche energy rating
- 175°C operating temperature
- Optimized for high frequency switching and synchronous rectification
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- MSL 1 classified according to J-STD-020

Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

| Parameter            | Value | Unit |
|----------------------|-------|------|
| $V_{DS}$             | 80    | V    |
| $R_{DS(on),max}$     | 3.6   | mΩ   |
| $I_D$                | 118   | A    |
| $Q_{oss}$            | 57    | nC   |
| $Q_G(0V...10V)$      | 30    | nC   |
| $Q_{rr}(100A/\mu s)$ | 30    | nC   |



RoHS

| Type / Ordering Code | Package   | Marking | Related Links |
|----------------------|-----------|---------|---------------|
| IQE036N08NM6CG       | PG-TTFN-9 | 036N6CG | -             |

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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>       | $I_D$             | -      | -    | 118<br>84<br>70<br>16.7 | A    | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=8\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=60\text{ °C/W}^{2)}$ |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$     | -      | -    | 472                     | A    | $T_C=25\text{ °C}$                                                                                                                                                                                                 |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$          | -      | -    | 195                     | mJ   | $I_D=20\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                                                                                                                      |
| Gate source voltage                          | $V_{GS}$          | -20    | -    | 20                      | V    | -                                                                                                                                                                                                                  |
| Power dissipation                            | $P_{tot}$         | -      | -    | 125<br>2.5              | W    | $T_C=25\text{ °C}$<br>$T_A=25\text{ °C}$ , $R_{thJA}=60\text{ °C/W}^{2)}$                                                                                                                                          |
| 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                                                  | $R_{thJC}$ | -      | -    | 1.2  | °C/W | -                     |
| Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>2)</sup> | $R_{thJA}$ | -      | -    | 60   | °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   | $V_{(BR)DSS}$ | 80     | -          | -          | V             | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                                                                             |
| Gate threshold voltage           | $V_{GS(th)}$  | 2.4    | 3.0        | 3.5        | V             | $V_{DS}=V_{GS}$ , $I_D=49.8\text{ }\mu\text{A}$                                                                                     |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 0.1<br>10  | 1<br>100   | $\mu\text{A}$ | $V_{DS}=64\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$<br>$V_{DS}=64\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | 10         | 100        | nA            | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$                                                                                          |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 3.1<br>3.8 | 3.6<br>4.4 | m $\Omega$    | $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$<br>$V_{GS}=8\text{ V}$ , $I_D=15\text{ A}$                                                 |
| Gate resistance                  | $R_G$         | 0.4    | 1.0        | 1.7        | $\Omega$      | -                                                                                                                                   |
| Transconductance                 | $g_{fs}$      | 29     | 58         | -          | S             | $ V_{DS} \geq 2 I_D /R_{DS(on)max}$ , $I_D=30\text{ A}$                                                                             |

**Table 5 Dynamic characteristics**

| Parameter                                  | Symbol       | Values |      |      | Unit | Note / Test Condition                                                                              |
|--------------------------------------------|--------------|--------|------|------|------|----------------------------------------------------------------------------------------------------|
|                                            |              | Min.   | Typ. | Max. |      |                                                                                                    |
| Input capacitance                          | $C_{iss}$    | -      | 2000 | 2600 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Output capacitance <sup>1)</sup>           | $C_{oss}$    | -      | 700  | 910  | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Reverse transfer capacitance <sup>1)</sup> | $C_{rss}$    | -      | 41   | 72   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Turn-on delay time                         | $t_{d(on)}$  | -      | 6.5  | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=15\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                                  | $t_r$        | -      | 2.3  | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=15\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time                        | $t_{d(off)}$ | -      | 11.4 | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=15\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                                  | $t_f$        | -      | 4.0  | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=15\text{ A}$ ,<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              | $Q_{gs}$      | -      | 10   | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=15\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge at threshold           | $Q_{g(th)}$   | -      | 6.1  | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=15\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge <sup>1)</sup> | $Q_{gd}$      | -      | 6.8  | 10.2 | nC   | $V_{DD}=40\text{ V}$ , $I_D=15\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge                   | $Q_{sw}$      | -      | 10.7 | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=15\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total <sup>1)</sup>    | $Q_g$         | -      | 30   | 38   | nC   | $V_{DD}=40\text{ V}$ , $I_D=15\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage               | $V_{plateau}$ | -      | 4.9  | -    | V    | $V_{DD}=40\text{ V}$ , $I_D=15\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total, sync. FET       | $Q_{g(sync)}$ | -      | 25   | -    | nC   | $V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$                    |
| Output charge <sup>1)</sup>        | $Q_{oss}$     | -      | 57   | 76   | nC   | $V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$                                  |

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

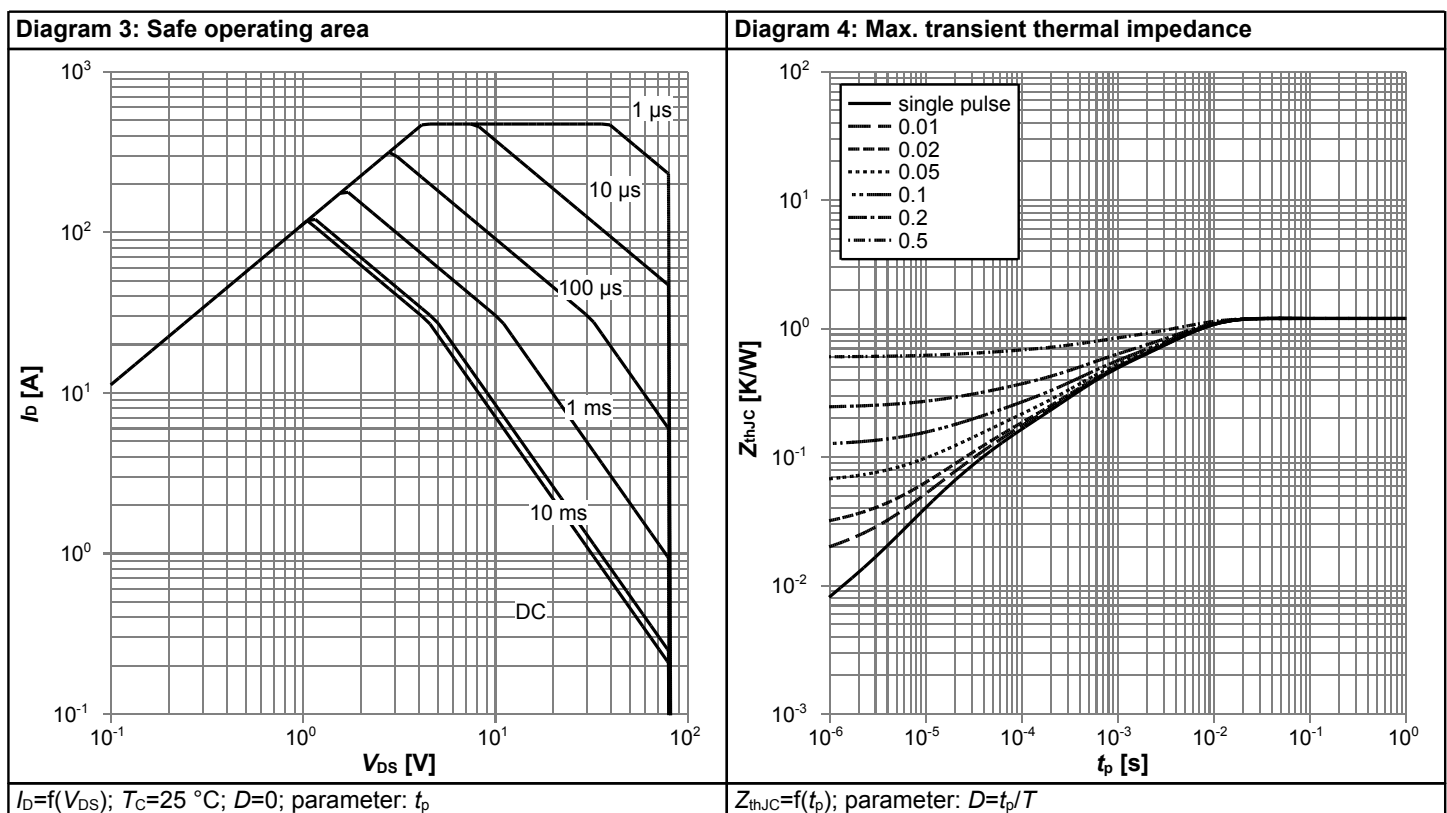
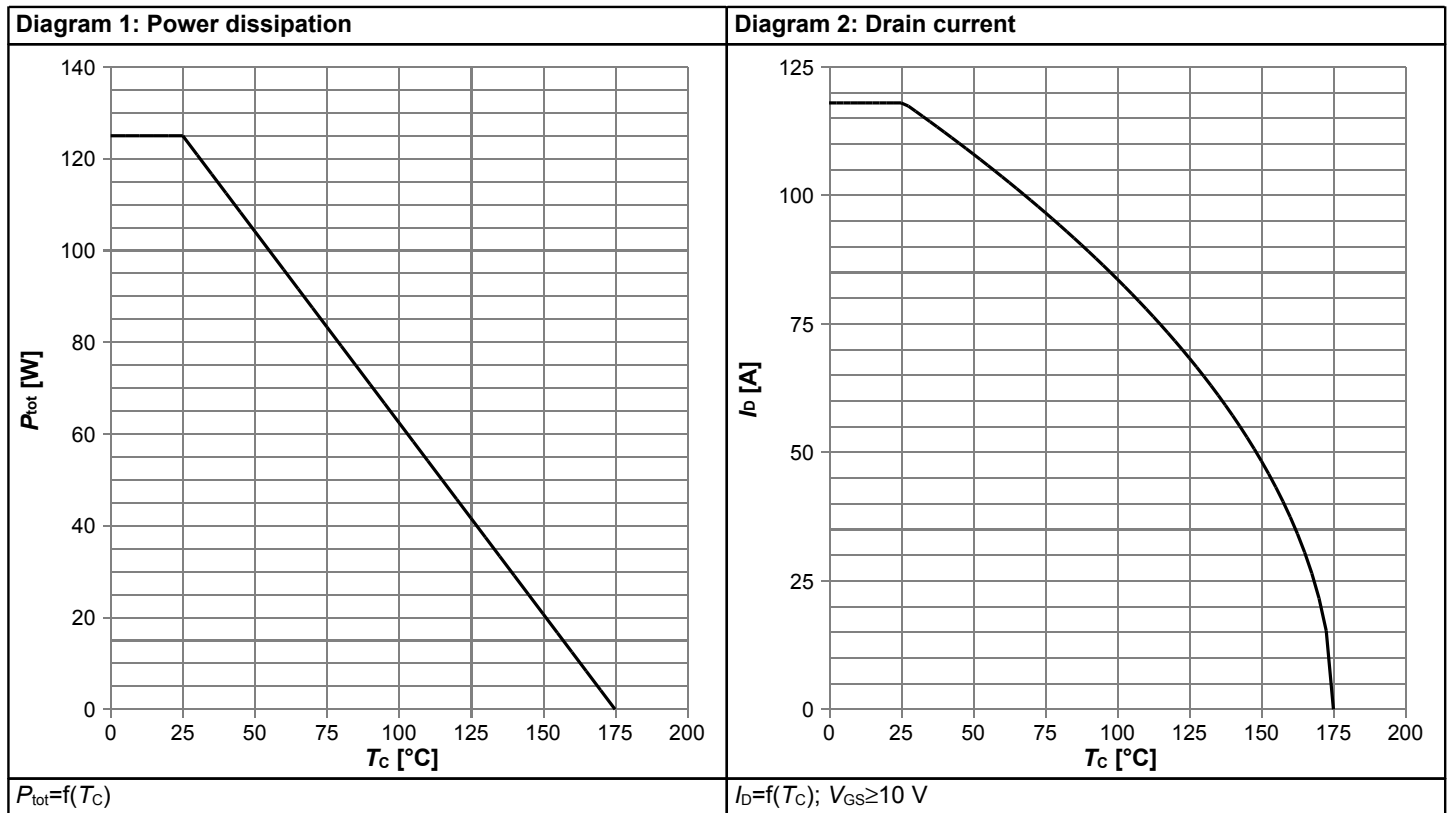
<sup>2)</sup> See "Gate charge waveforms" for parameter definition

**Table 7 Reverse diode**

| Parameter                             | Symbol        | Values |      |      | Unit | Note / Test Condition                                                       |
|---------------------------------------|---------------|--------|------|------|------|-----------------------------------------------------------------------------|
|                                       |               | Min.   | Typ. | Max. |      |                                                                             |
| Diode continuous forward current      | $I_S$         | -      | -    | 118  | A    | $T_C=25\text{ °C}$                                                          |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -    | 472  | A    | $T_C=25\text{ °C}$                                                          |
| Diode forward voltage                 | $V_{SD}$      | -      | 0.81 | 1.0  | V    | $V_{GS}=0\text{ V}$ , $I_F=30\text{ A}$ , $T_J=25\text{ °C}$                |
| Reverse recovery time <sup>1)</sup>   | $t_{rr}$      | -      | 32   | 64   | ns   | $V_R=40\text{ V}$ , $I_F=15\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$  |
| Reverse recovery charge <sup>1)</sup> | $Q_{rr}$      | -      | 30   | 60   | nC   | $V_R=40\text{ V}$ , $I_F=15\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$  |
| Reverse recovery time <sup>1)</sup>   | $t_{rr}$      | -      | 21   | 42   | ns   | $V_R=40\text{ V}$ , $I_F=15\text{ A}$ , $di_F/dt=1000\text{ A}/\mu\text{s}$ |
| Reverse recovery charge <sup>1)</sup> | $Q_{rr}$      | -      | 173  | 346  | nC   | $V_R=40\text{ V}$ , $I_F=15\text{ A}$ , $di_F/dt=1000\text{ A}/\mu\text{s}$ |

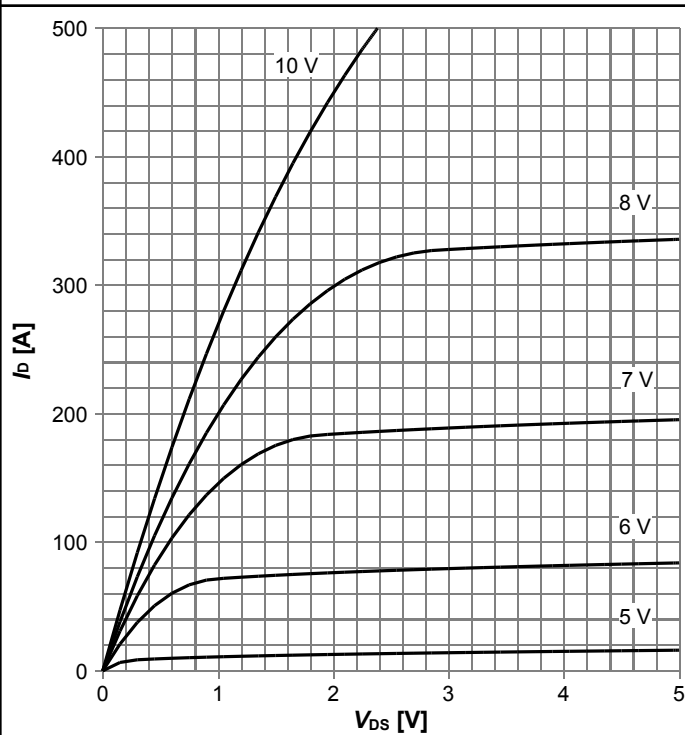
<sup>1)</sup> Defined by design. Not subject to production test.

## 4 Electrical characteristics diagrams



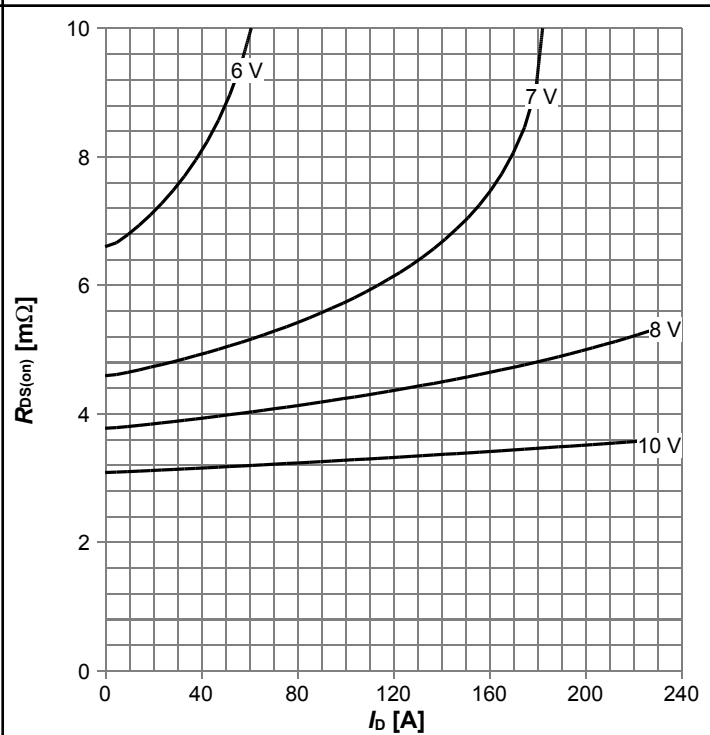
OptiMOS™ 6 Power-Transistor, 80 V  
IQE036N08NM6CG

Diagram 5: Typ. output characteristics



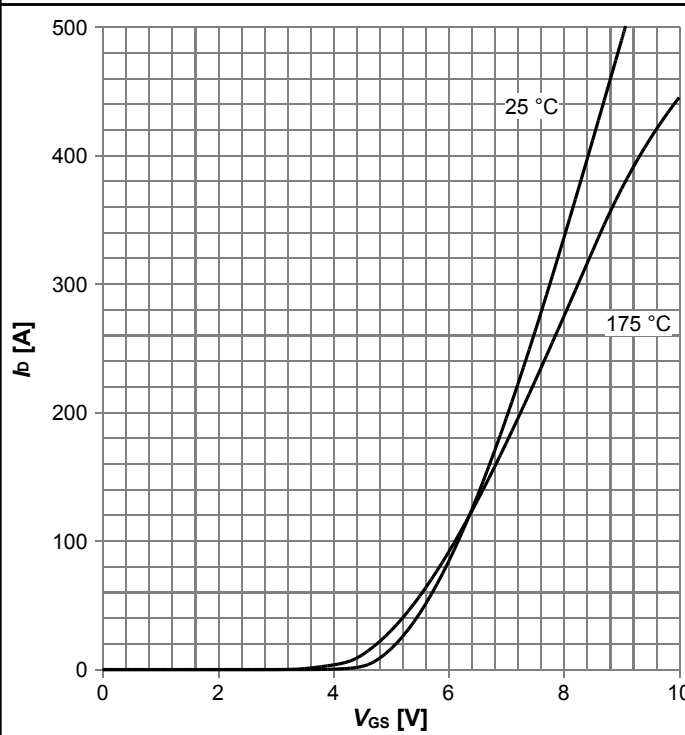
$I_D = f(V_{DS})$ ,  $T_j = 25\text{ }^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



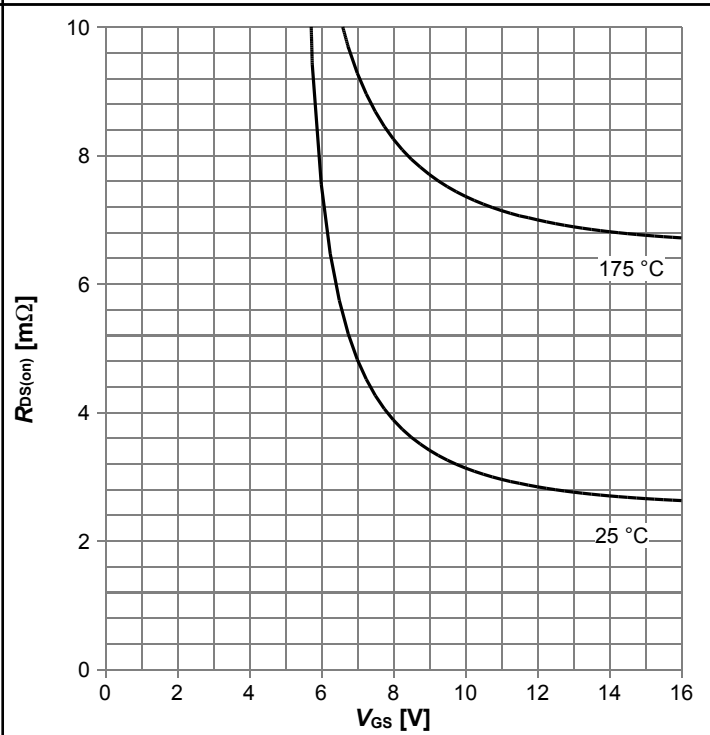
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25\text{ }^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



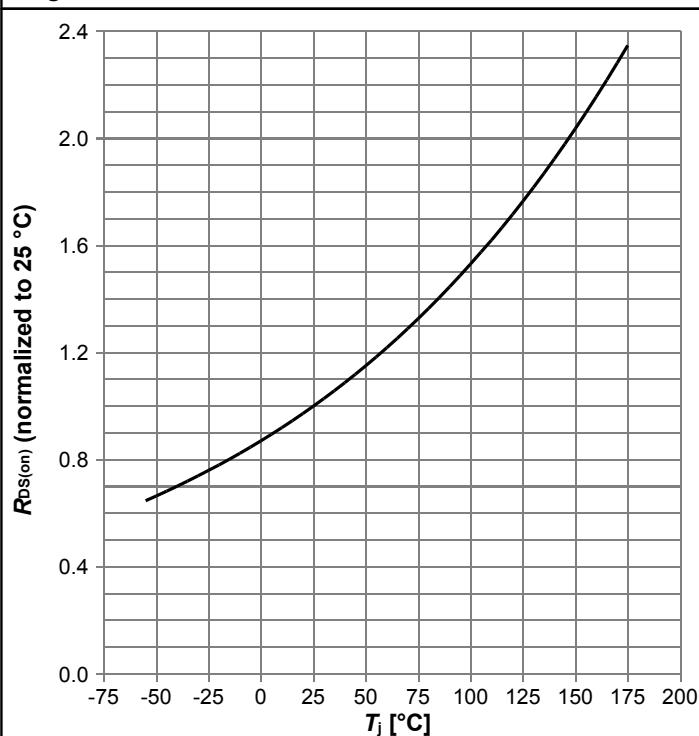
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)\text{max}}$ ; parameter:  $T_j$

Diagram 8: Typ. drain-source on resistance



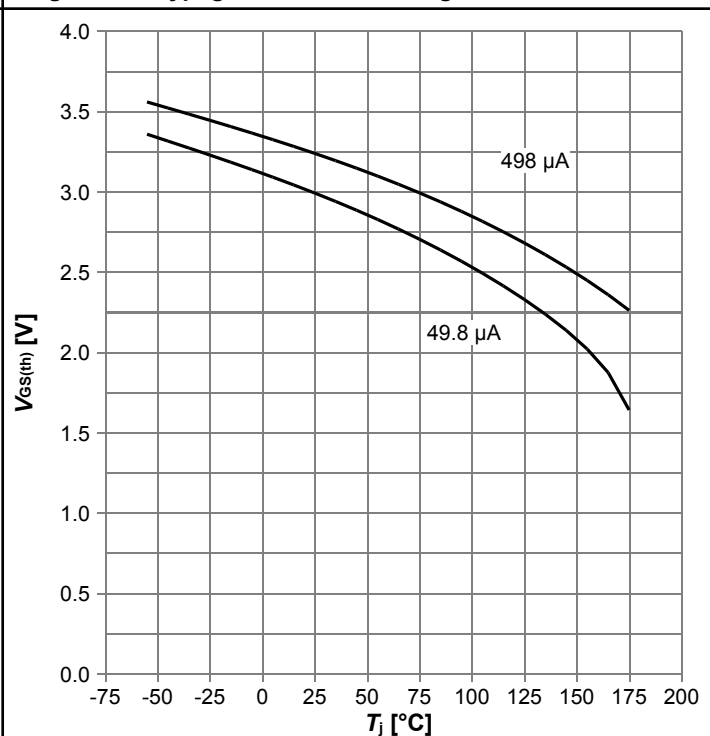
$R_{DS(on)} = f(V_{GS})$ ,  $I_D = 30\text{ A}$ ; parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



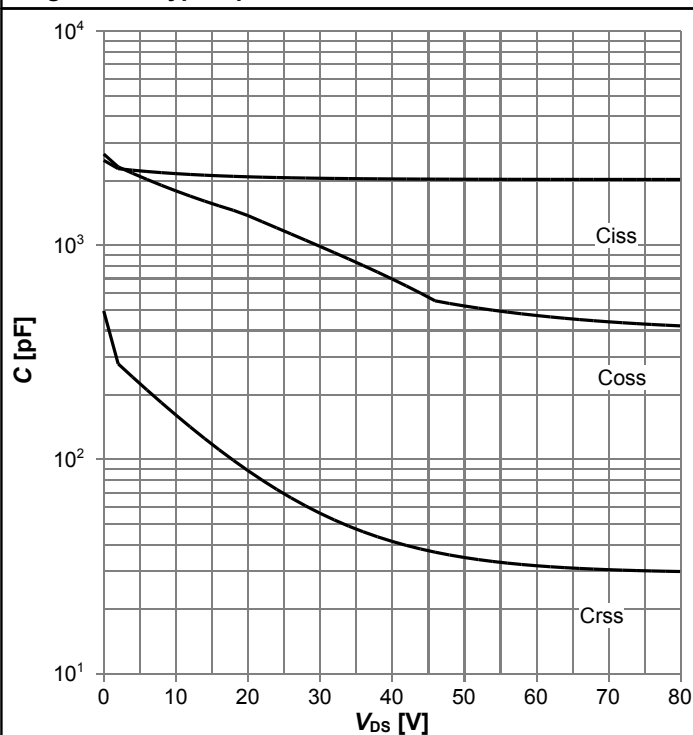
$R_{DS(on)}=f(T_j)$ ,  $I_D=30$  A,  $V_{GS}=10$  V

Diagram 10: Typ. gate threshold voltage



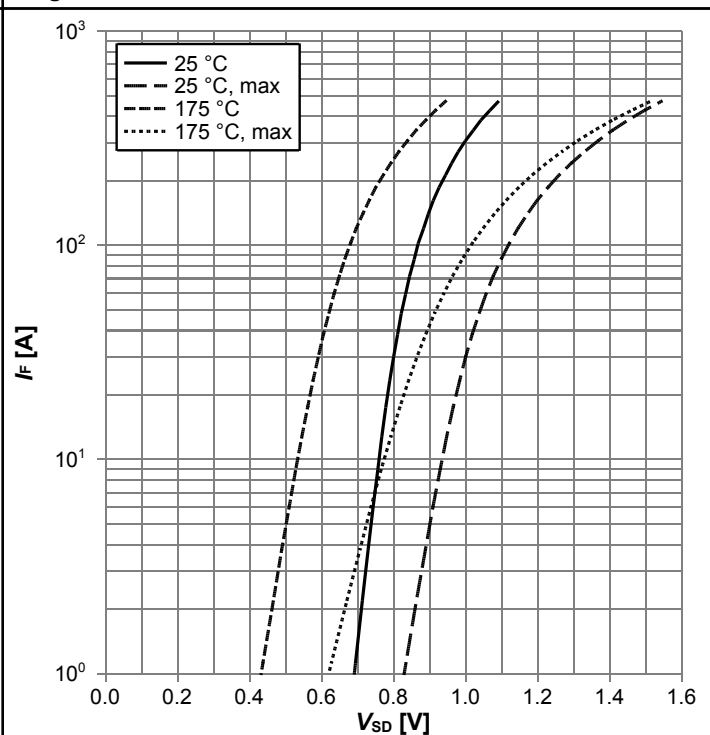
$V_{GS(th)}=f(T_j)$ ,  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



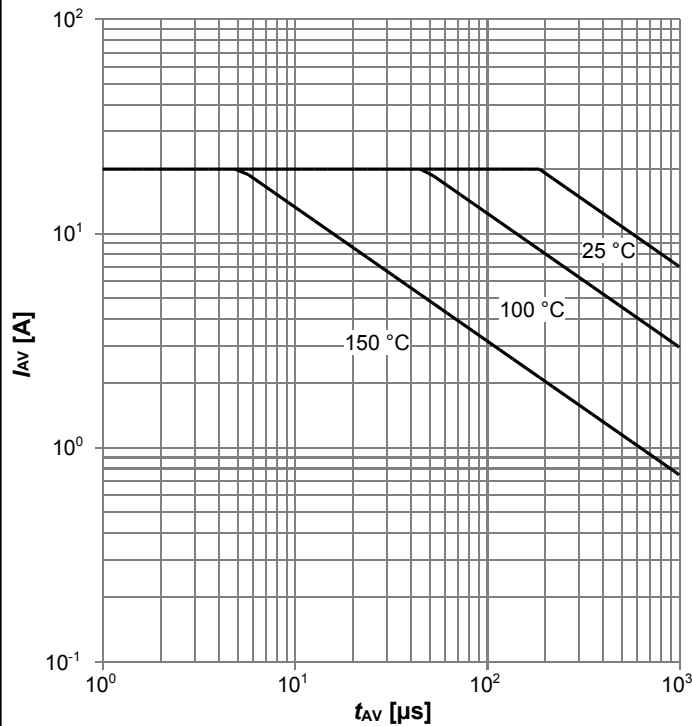
$C=f(V_{DS})$ ;  $V_{GS}=0$  V;  $f=1$  MHz

Diagram 12: Forward characteristics of reverse diode



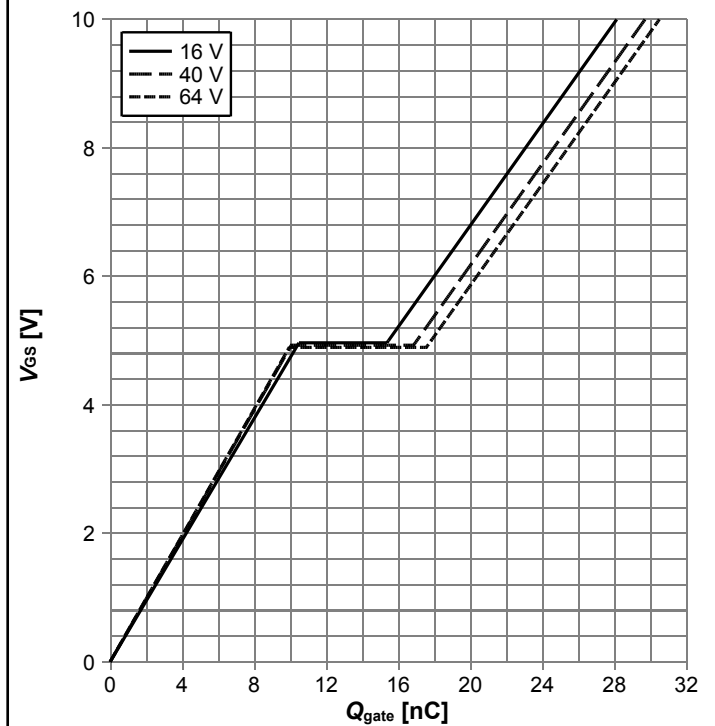
$I_F=f(V_{SD})$ ; parameter:  $T_j$

Diagram 13: Avalanche characteristics



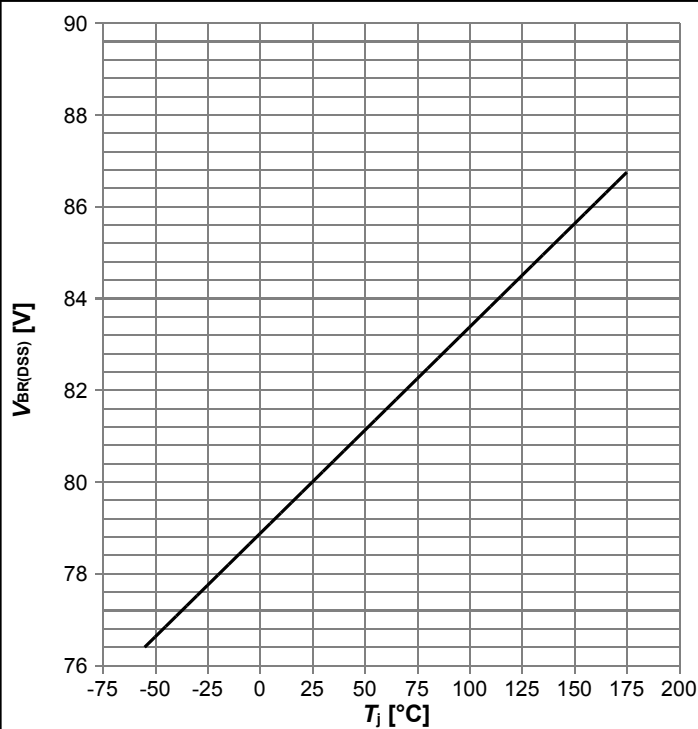
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25\ \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



$V_{GS}=f(Q_{gate})$ ,  $I_D=15\text{ A}$  pulsed,  $T_j=25\text{ °C}$ ; parameter:  $V_{DD}$

Diagram 15: Min. drain-source breakdown voltage

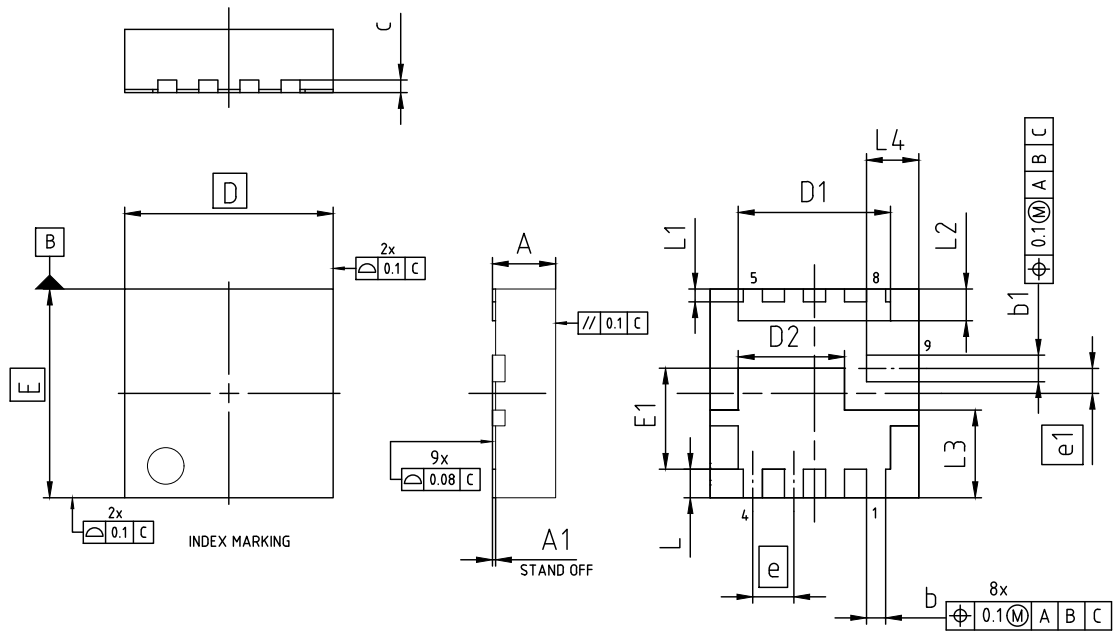


$V_{BR(DSS)}=f(T_j)$ ;  $I_D=1\text{ mA}$

Diagram Gate charge waveforms



# 5 Package Outlines



| DIMENSION | MILLIMETERS |       |
|-----------|-------------|-------|
|           | MIN.        | MAX.  |
| A         | -           | 1.10  |
| A1        | -           | 0.05  |
| b         | 0.20        | 0.40  |
| b1        | 0.32        | 0.52  |
| c         | 0.20        |       |
| D         | 3.30        |       |
| D1        | 2.31        | 2.51  |
| D2        | 1.58        | 1.78  |
| E         | 3.30        |       |
| E1        | 1.50        | 1.70  |
| e         | 0.65        |       |
| e1        | 0.395       |       |
| L         | 0.35        | 0.55  |
| L1        | 0.10        | 0.30  |
| L2        | 0.40        | 0.60  |
| L3        | 1.285       | 1.485 |
| L4        | 0.73        | 0.93  |

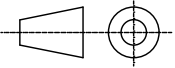
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| DOCUMENT NO.<br>Z8B00192161                                                                                  |
| REVISION<br>03                                                                                               |
| SCALE 10:1<br>0 1 2mm                                                                                        |
| EUROPEAN PROJECTION<br> |
| ISSUE DATE<br>08.11.2019                                                                                     |

Figure 1 Outline PG-TTFN-9, dimensions in mm

## Revision History

IQE036N08NM6CG

**Revision: 2023-09-22, Rev. 2.0**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2023-09-22 | Release of final version                     |

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### Published by

**Infineon Technologies AG**

**81726 München, Germany**

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