

MOSFET

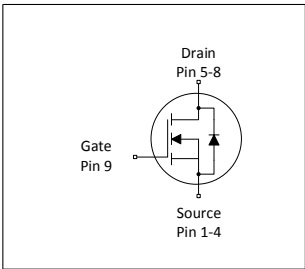
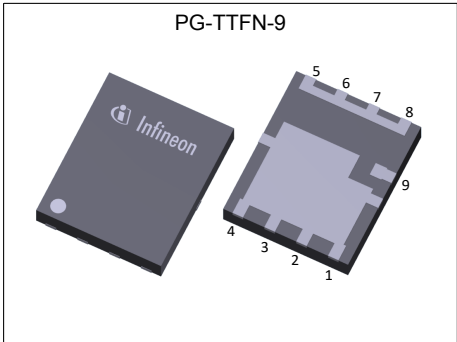
OptiMOS™ 5 Power-Transistor, 30 V

Features

- N-channel, logic level
- Very low on-resistance  $R_{DS(on)}$
- Superior thermal resistance
- 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



RoHS

Table 1 Key Performance Parameters

| Parameter        | Value | Unit |
|------------------|-------|------|
| $V_{DS}$         | 30    | V    |
| $R_{DS(on),max}$ | 0.35  | mΩ   |
| $I_D$            | 700   | A    |
| $Q_{oss}$        | 95    | nC   |
| $Q_G$            | 91    | nC   |

| Type / Ordering Code | Package   | Marking | Related Links |
|----------------------|-----------|---------|---------------|
| IQDH35N03LM5CG       | PG-TTFN-9 | H3503LC | -             |

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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>       | $I_D$             | -      | -    | 700<br>443<br>414<br>66 | A    | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=4.5\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ °C/W}^{2)}$ |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$     | -      | -    | 2800                    | A    | $T_C=25\text{ °C}$                                                                                                                                                                                                   |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$          | -      | -    | 1200                    | mJ   | $I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                                                                                                                        |
| Gate source voltage                          | $V_{GS}$          | -20    | -    | 20                      | V    | -                                                                                                                                                                                                                    |
| Power dissipation                            | $P_{tot}$         | -      | -    | 278<br>2.5              | W    | $T_C=25\text{ °C}$<br>$T_A=25\text{ °C}$ , $R_{thJA}=50\text{ °C/W}^{2)}$                                                                                                                                            |
| 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 | °C/W | -                     |
| Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>2)</sup> | $R_{thJA}$ | -      | -    | 50   | °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   | $V_{(BR)DSS}$ | 30     | -            | -           | V             | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                                                                             |
| Gate threshold voltage           | $V_{GS(th)}$  | 1.2    | 1.6          | 2.0         | V             | $V_{DS}=V_{GS}$ , $I_D=1460\text{ }\mu\text{A}$                                                                                     |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 0.1<br>10    | 1<br>100    | $\mu\text{A}$ | $V_{DS}=24\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$<br>$V_{DS}=24\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | 10           | 100         | nA            | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$                                                                                          |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 0.31<br>0.36 | 0.35<br>0.4 | m $\Omega$    | $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$<br>$V_{GS}=4.5\text{ V}$ , $I_D=50\text{ A}$                                               |
| Gate resistance <sup>1)</sup>    | $R_G$         | -      | 0.47         | -           | $\Omega$      | -                                                                                                                                   |
| Transconductance                 | $g_{fs}$      | 265    | 530          | -           | 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>1)</sup>            | $C_{iss}$    | -      | 14000 | 18000 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=15\text{ V}$ , $f=1\text{ MHz}$                                      |
| Output capacitance <sup>1)</sup>           | $C_{oss}$    | -      | 3300  | 4300  | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=15\text{ V}$ , $f=1\text{ MHz}$                                      |
| Reverse transfer capacitance <sup>1)</sup> | $C_{rss}$    | -      | 270   | 470   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=15\text{ V}$ , $f=1\text{ MHz}$                                      |
| Turn-on delay time                         | $t_{d(on)}$  | -      | 12    | -     | ns   | $V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                                  | $t_r$        | -      | 5     | -     | ns   | $V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time                        | $t_{d(off)}$ | -      | 70    | -     | ns   | $V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                                  | $t_f$        | -      | 14    | -     | ns   | $V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ ,<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              | $Q_{gs}$      | -      | 31   | -    | nC   | $V_{DD}=15\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge at threshold           | $Q_{g(th)}$   | -      | 22   | -    | nC   | $V_{DD}=15\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate to drain charge <sup>1)</sup> | $Q_{gd}$      | -      | 18   | 27   | nC   | $V_{DD}=15\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Switching charge                   | $Q_{sw}$      | -      | 27   | -    | nC   | $V_{DD}=15\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total <sup>1)</sup>    | $Q_g$         | -      | 91   | 114  | nC   | $V_{DD}=15\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate plateau voltage               | $V_{plateau}$ | -      | 2.3  | -    | V    | $V_{DD}=15\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total                  | $Q_g$         | -      | 197  | -    | nC   | $V_{DD}=15\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$  |
| Gate charge total, sync. FET       | $Q_{g(sync)}$ | -      | 86   | -    | nC   | $V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }4.5\text{ V}$                    |
| Output charge <sup>1)</sup>        | $Q_{oss}$     | -      | 95   | 126  | nC   | $V_{DS}=15\text{ V}$ , $V_{GS}=0\text{ V}$                                   |

<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      | $I_S$         | -      | -    | 236  | A    | $T_C=25\text{ °C}$                                                         |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -    | 2800 | A    | $T_C=25\text{ °C}$                                                         |
| Diode forward voltage                 | $V_{SD}$      | -      | 0.72 | 1.0  | V    | $V_{GS}=0\text{ V}$ , $I_F=50\text{ A}$ , $T_j=25\text{ °C}$               |
| Reverse recovery time <sup>1)</sup>   | $t_{rr}$      | -      | 49   | 98   | ns   | $V_R=15\text{ V}$ , $I_F=25\text{ A}$ , $di_F/dt=100\text{ A/}\mu\text{s}$ |
| Reverse recovery charge <sup>1)</sup> | $Q_{rr}$      | -      | 64   | 128  | nC   | $V_R=15\text{ V}$ , $I_F=25\text{ A}$ , $di_F/dt=100\text{ A/}\mu\text{s}$ |

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

## 4 Electrical characteristics diagrams

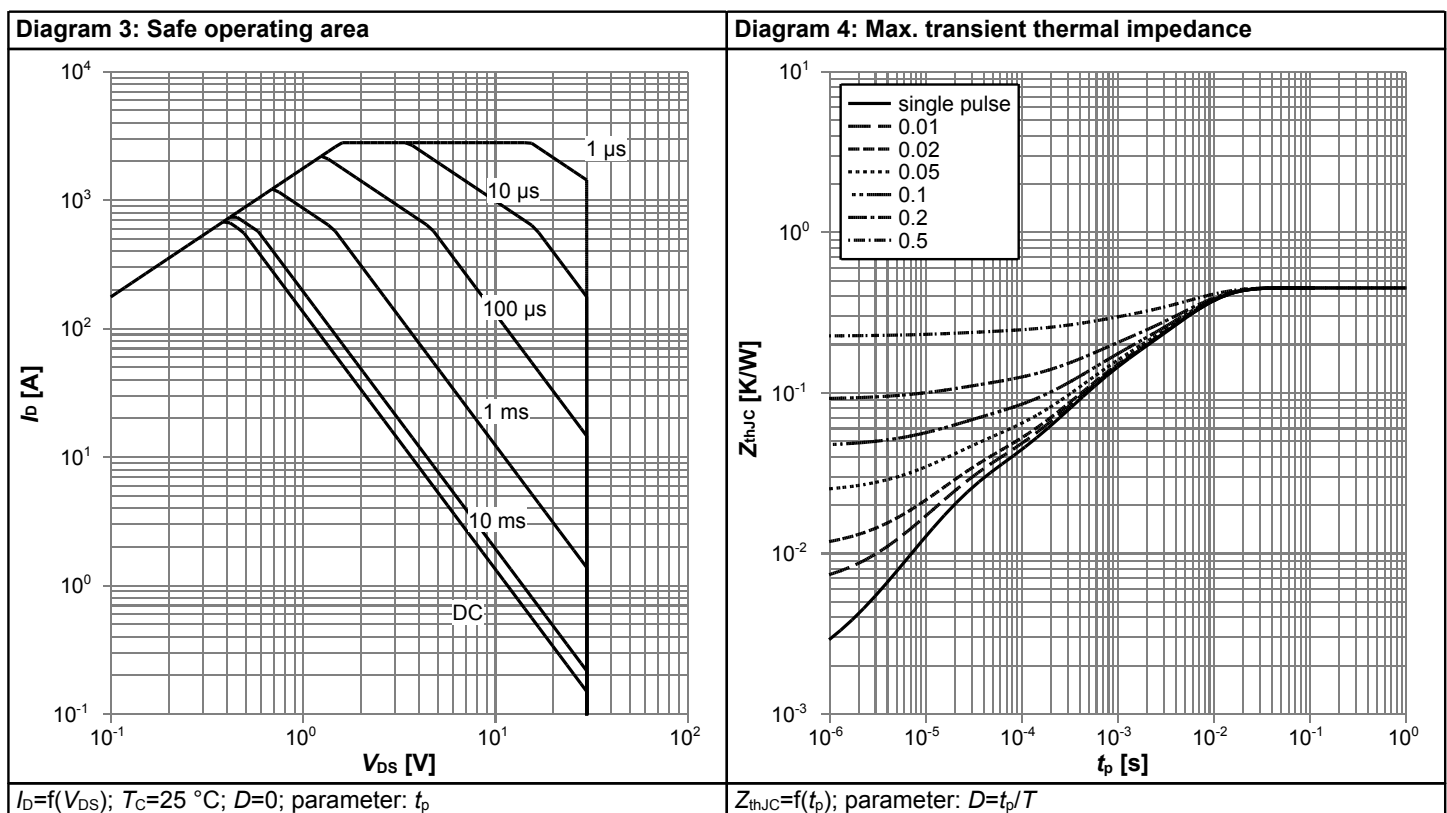
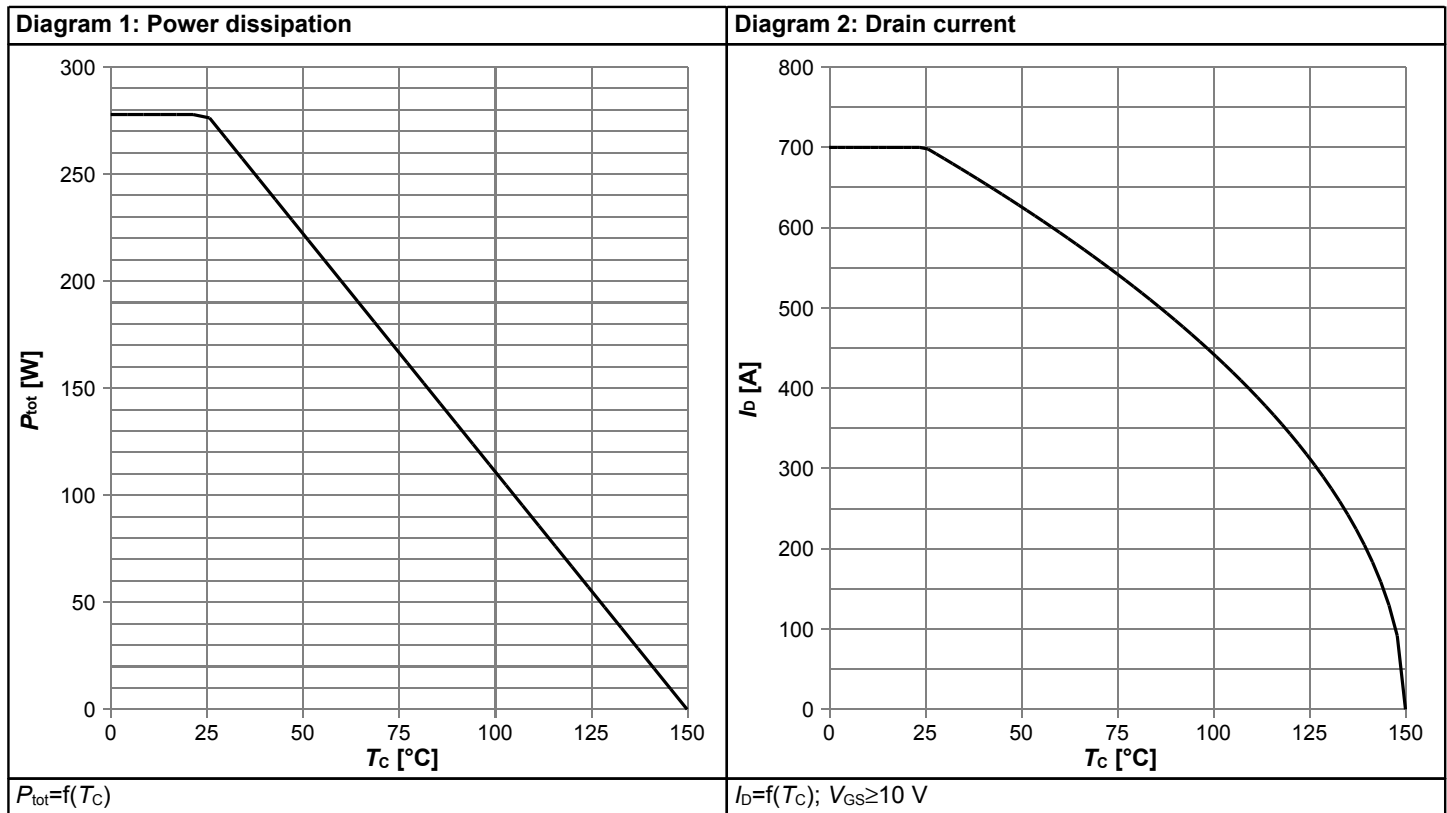
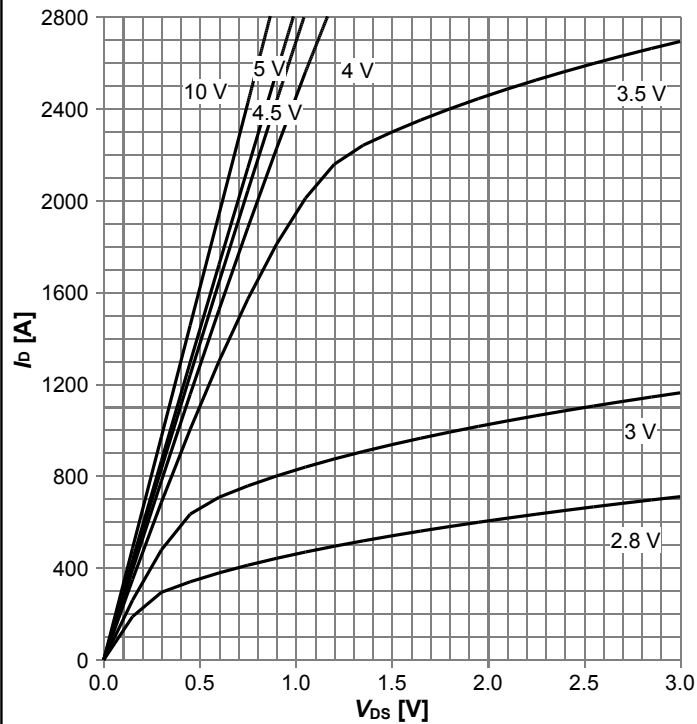
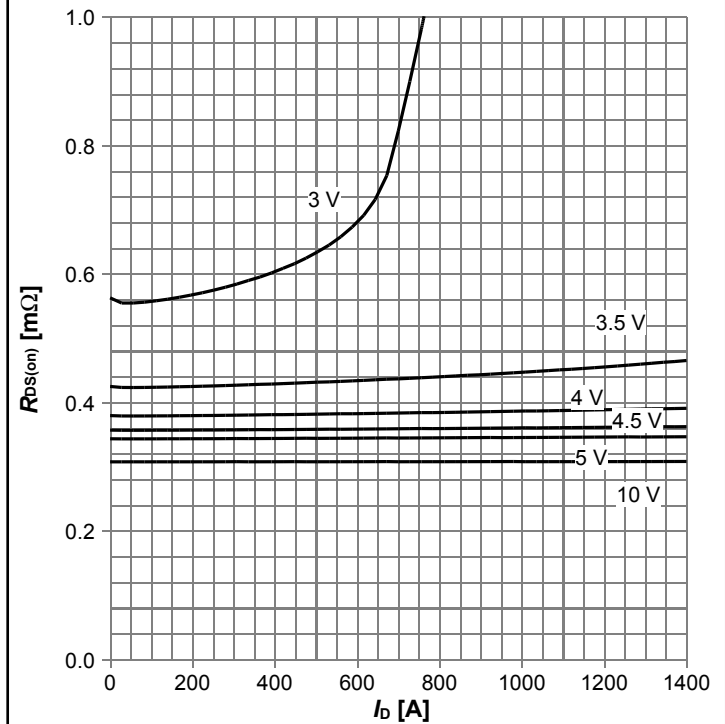


Diagram 5: Typ. output characteristics



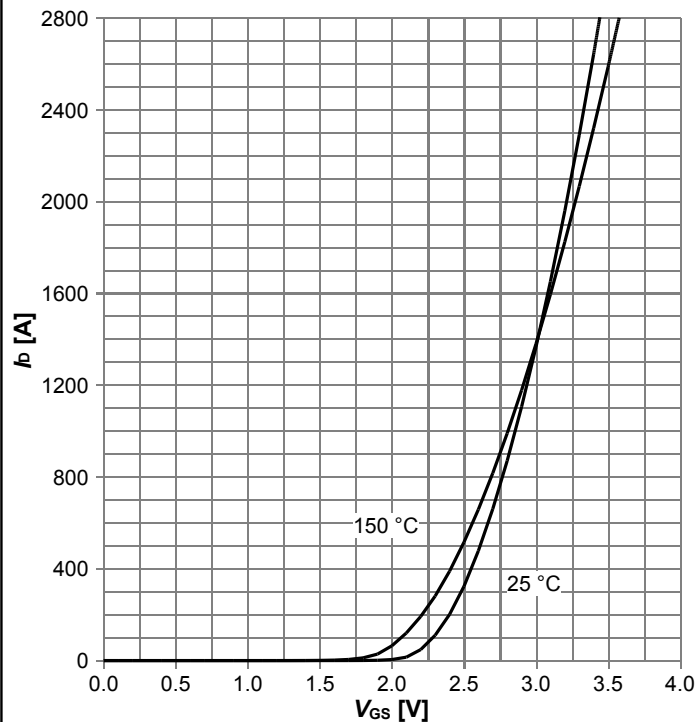
$I_D = f(V_{DS})$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



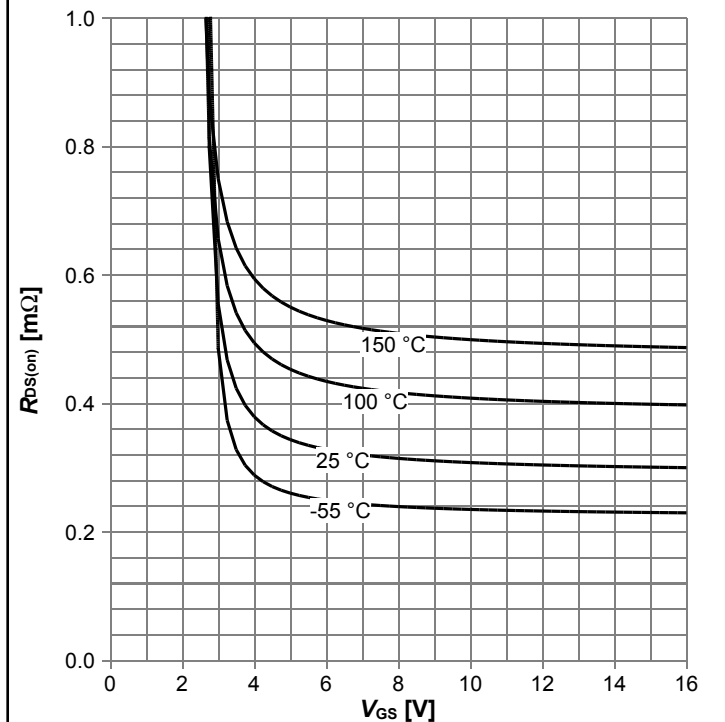
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

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

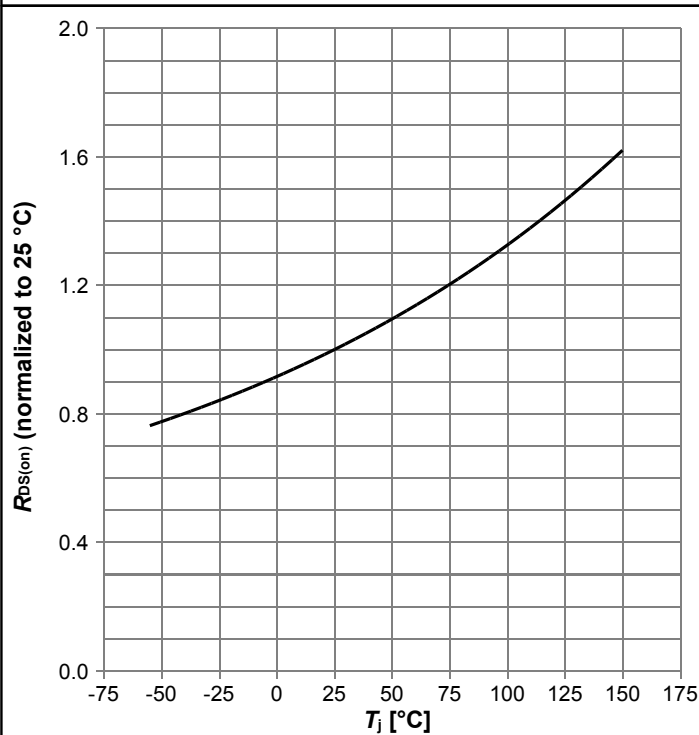


$R_{DS(on)} = f(V_{GS})$ ,  $I_D = 50\text{ A}$ ; parameter:  $T_j$

# OptiMOS™ 5 Power-Transistor, 30 V

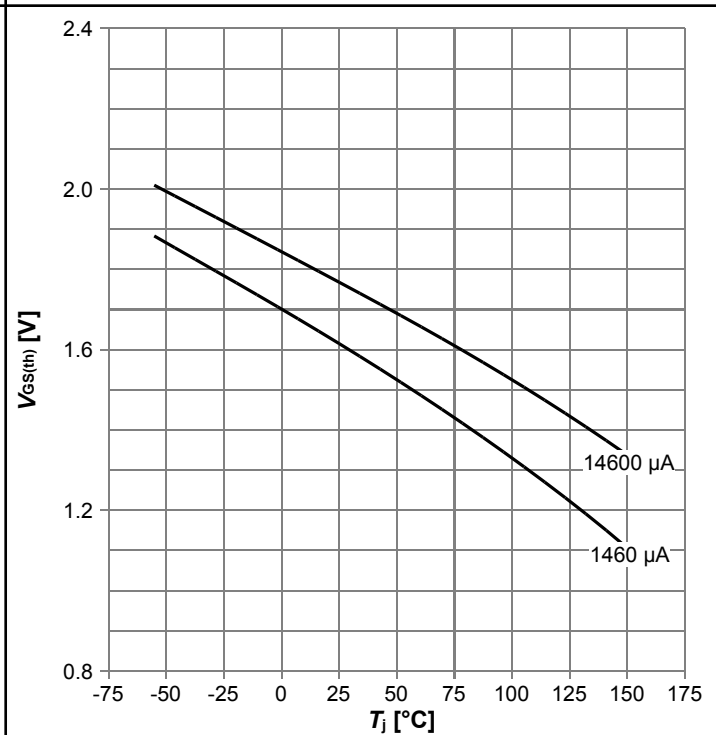
## IQDH35N03LM5CG

Diagram 9: Normalized drain-source on resistance



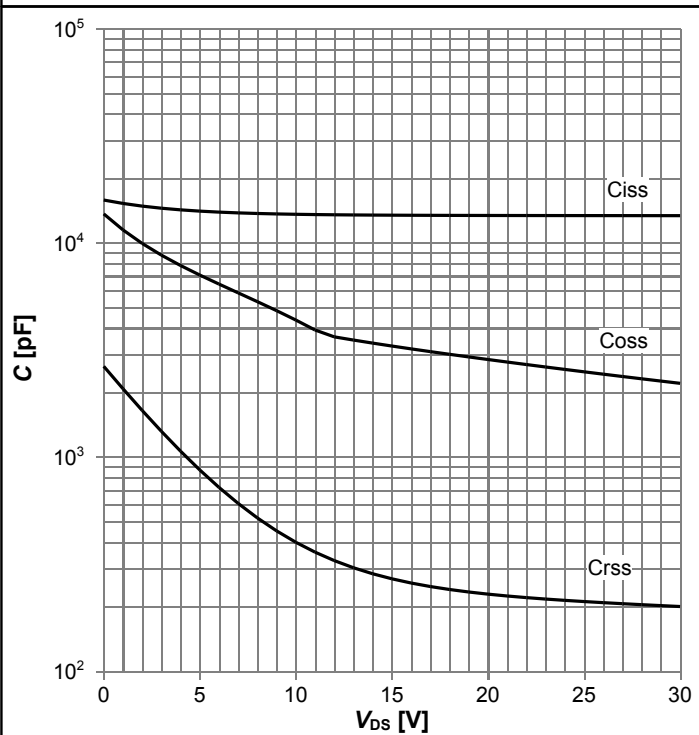
$$R_{DS(on)} = f(T_j), I_D = 50 \text{ A}, V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



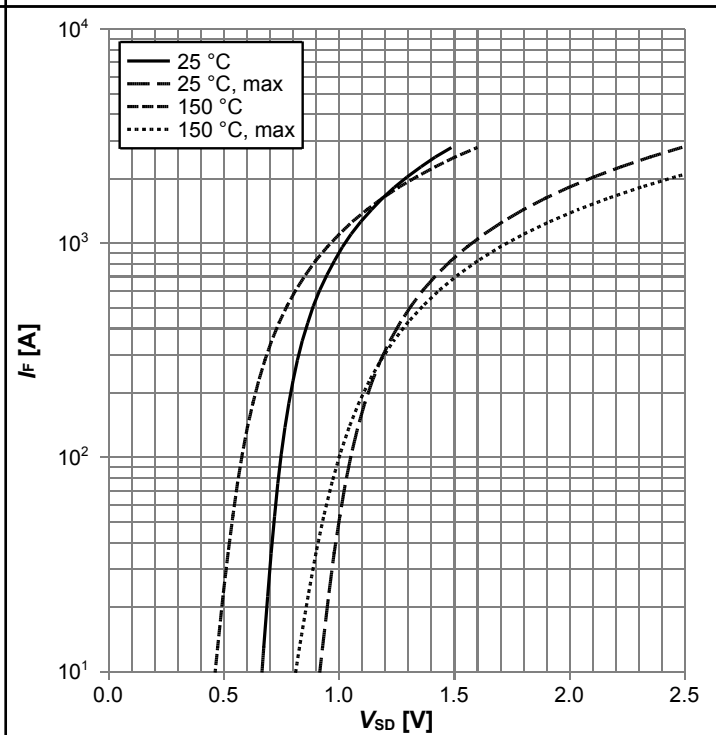
$$V_{GS(th)} = f(T_j), V_{GS} = V_{DS}; \text{ parameter: } I_D$$

Diagram 11: Typ. capacitances



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

Diagram 12: Forward characteristics of reverse diode

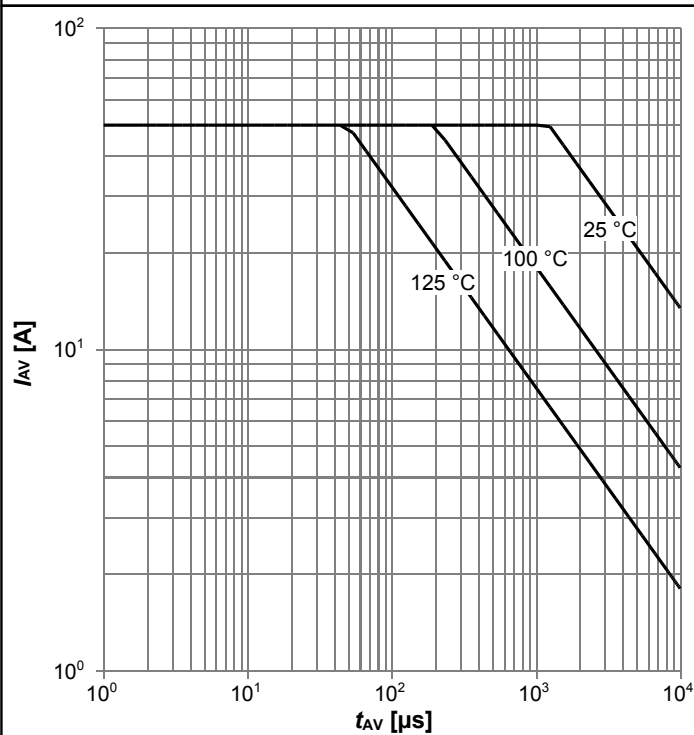


$$I_F = f(V_{SD}); \text{ parameter: } T_j$$

# OptiMOS™ 5 Power-Transistor, 30 V

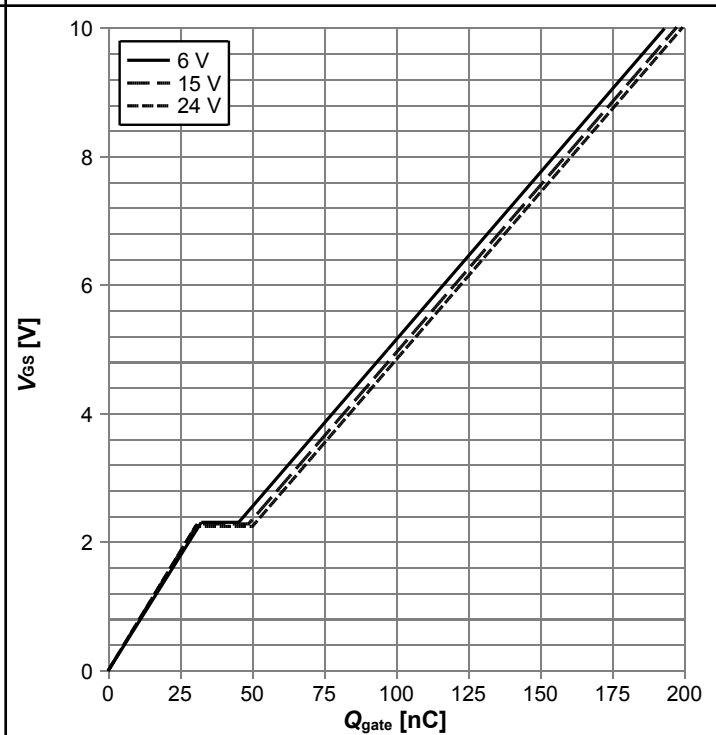
## IQDH35N03LM5CG

Diagram 13: Avalanche characteristics



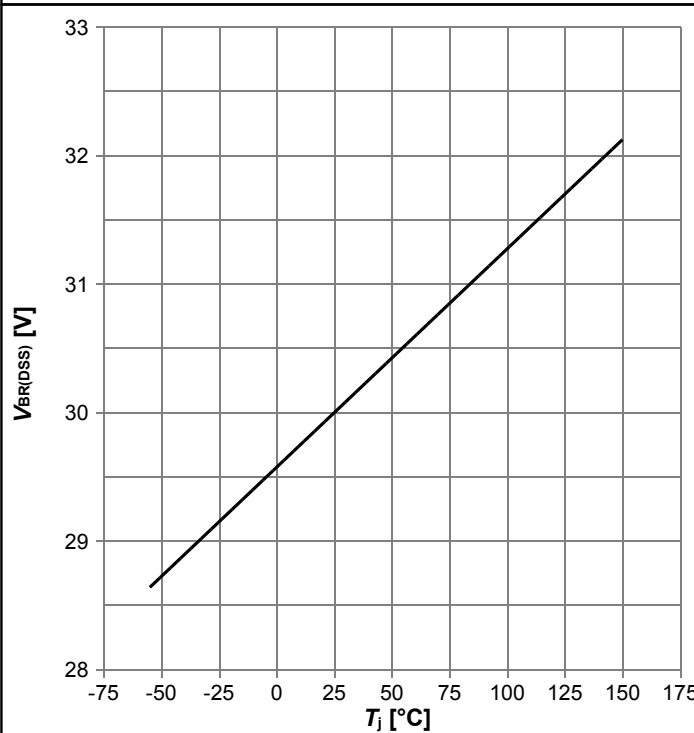
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25\ \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



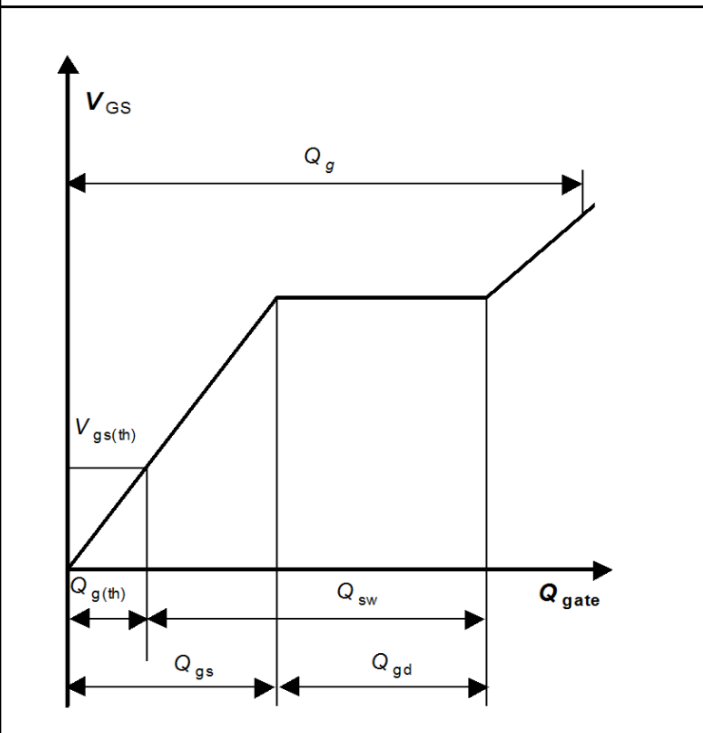
$V_{GS}=f(Q_{gate})$ ,  $I_D=50\text{ A}$  pulsed,  $T_j=25\text{ °C}$ ; parameter:  $V_{DD}$

Diagram 15: Min. drain-source breakdown voltage



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

Diagram Gate charge waveforms



# 5 Package Outlines

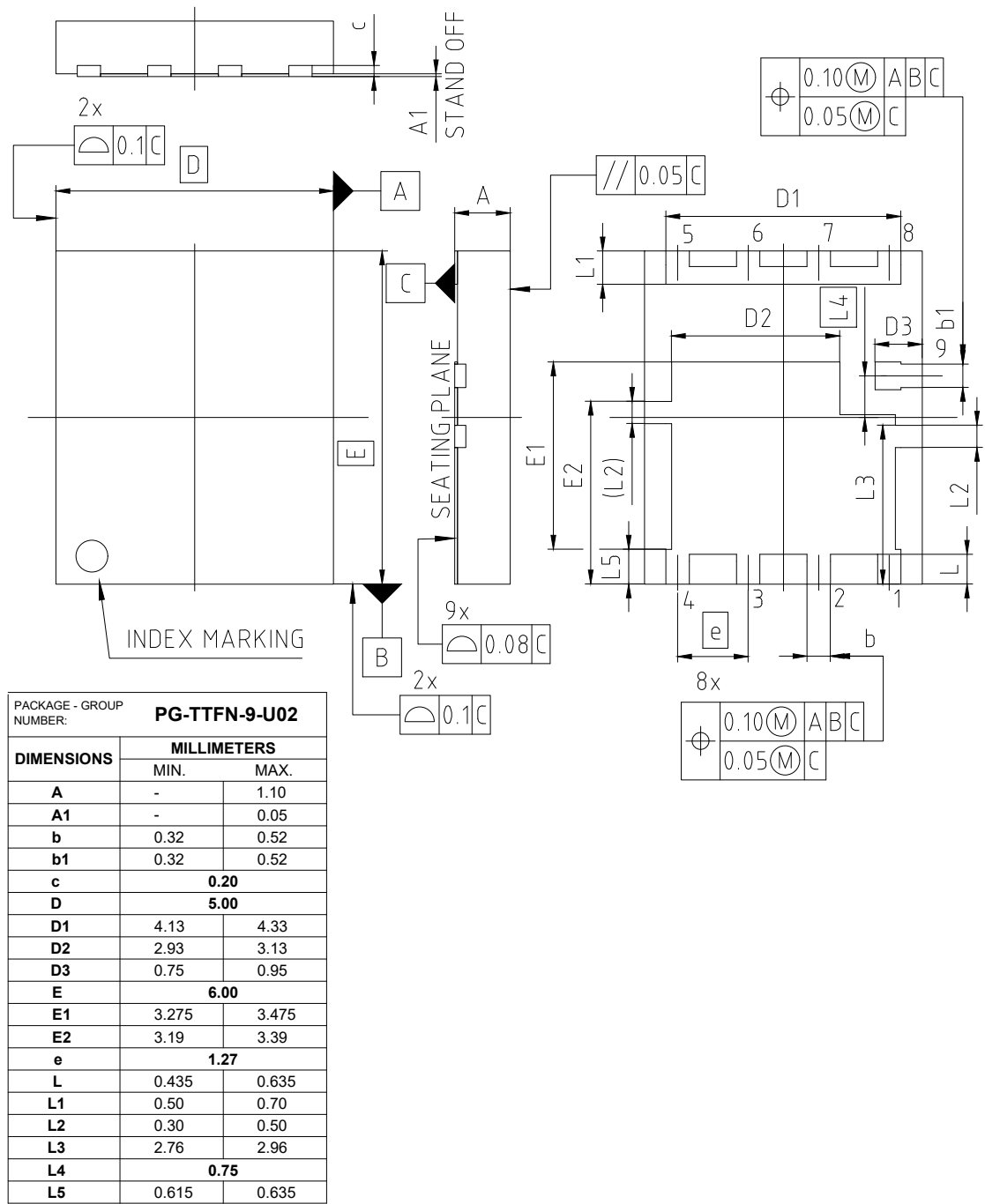


Figure 1 Outline PG-TTFN-9, dimensions in mm

## Revision History

IQDH35N03LM5CG

**Revision: 2023-03-29, Rev. 2.1**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2023-03-17 | Release of final version                     |
| 2.1      | 2023-03-29 | Update RG, ext for switching times           |

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