

# MOSFET

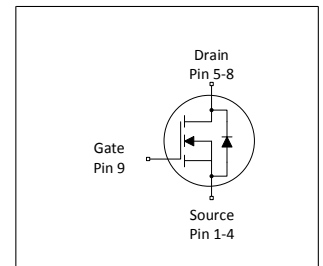
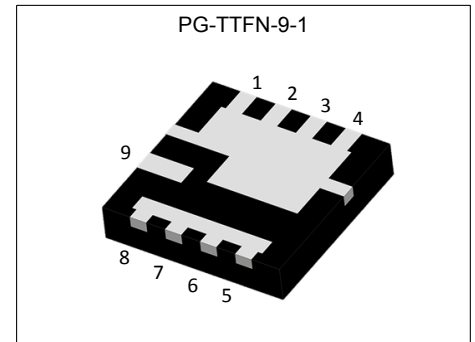
## OptiMOS™ 5 Power-Transistor, 25 V

### Features

- Very low on-resistance  $R_{DS(on)}$
- 100% avalanche tested
- Superior thermal resistance
- N-channel, logic level
- 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
$V_{DS}$	25	V
$R_{DS(on),max}$	0.65	mΩ
$I_D$	298	A
$Q_{oss}$	41	nC
$Q_G(0V..4.5V)$	29	nC

Type / Ordering Code	Package	Marking	Related Links
IQE006NE2LM5CG	PG-TTFN-9-1	006E2C5	-

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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>	$I_D$	-	-	298 188 41	A	$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$ , $T_A=25\text{ °C}$ , $R_{THJA}=60\text{ °C/W}^{2)}$
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	-	-	1192	A	$T_A=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	140	mJ	$I_D=20\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-16	-	16	V	-
Power dissipation	$P_{tot}$	-	-	89 2.1	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{THJA}=60\text{ °C/W}^{2)}$
Operating and storage temperature	$T_j$ , $T_{stg}$	-55	-	150	°C	IEC climatic category; DIN IEC 68-1: 55/150/56

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	1.4	°C/W	-
Device on PCB, 6 cm <sup>2</sup> cooling area	$R_{thJA}$	-	-	60	°C/W	-

<sup>1)</sup> Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature at 25°C. For higher case temperature 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	$V_{(BR)DSS}$	25	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1.2	1.6	2	V	$V_{DS}=V_{GS}$ , $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.1 10	1 100	$\mu\text{A}$	$V_{DS}=20\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=20\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=16\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.50 0.65	0.65 0.80	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$ $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$
Gate resistance <sup>1)</sup>	$R_G$	-	0.7	1.2	$\Omega$	-
Transconductance	$g_{fs}$	-	220	-	S	$ V_{DS} \geq 2 I_D /R_{DS(on)max}$ , $I_D=20\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	4100	5453	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=12\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	1700	2261	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=12\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance <sup>1)</sup>	$C_{rss}$	-	130	195	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=12\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	5.3	-	ns	$V_{DD}=12\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	2.6	-	ns	$V_{DD}=12\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	27.0	-	ns	$V_{DD}=12\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	5.3	-	ns	$V_{DD}=12\text{ V}$ , $V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$

**Table 6 Gate charge characteristics<sup>2)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	9.2	-	nC	$V_{DD}=12\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	5.8	-	nC	$V_{DD}=12\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge <sup>1)</sup>	$Q_{gd}$	-	5.6	8.4	nC	$V_{DD}=12\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	$Q_{sw}$	-	9.0	-	nC	$V_{DD}=12\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>1)</sup>	$Q_g$	-	28.5	37.9	nC	$V_{DD}=12\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.2	-	V	$V_{DD}=12\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>1)</sup>	$Q_g$	-	61.7	82.1	nC	$V_{DD}=12\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	60.4	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$
Output charge	$Q_{oss}$	-	41.3	-	nC	$V_{DD}=12\text{ V}$ , $V_{GS}=0\text{ V}$

<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	$I_S$	-	-	83	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	1192	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.75	1	V	$V_{GS}=0\text{ V}$ , $I_F=20\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery charge	$Q_{rr}$	-	25	-	nC	$V_R=12\text{ V}$ , $I_F=20\text{ A}$ , $di_F/dt=100\text{ A/}\mu\text{s}$

## 4 Electrical characteristics diagrams

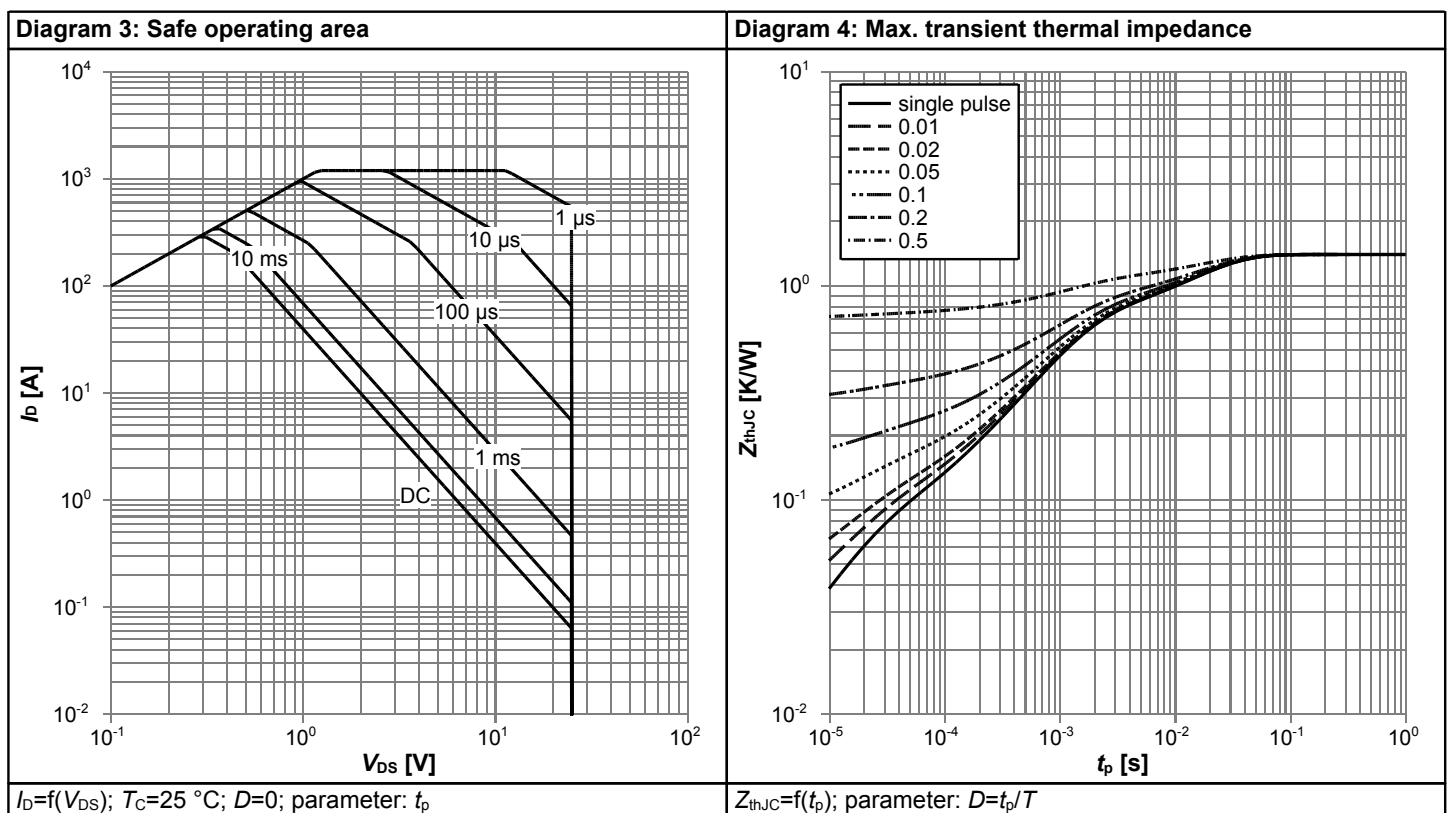
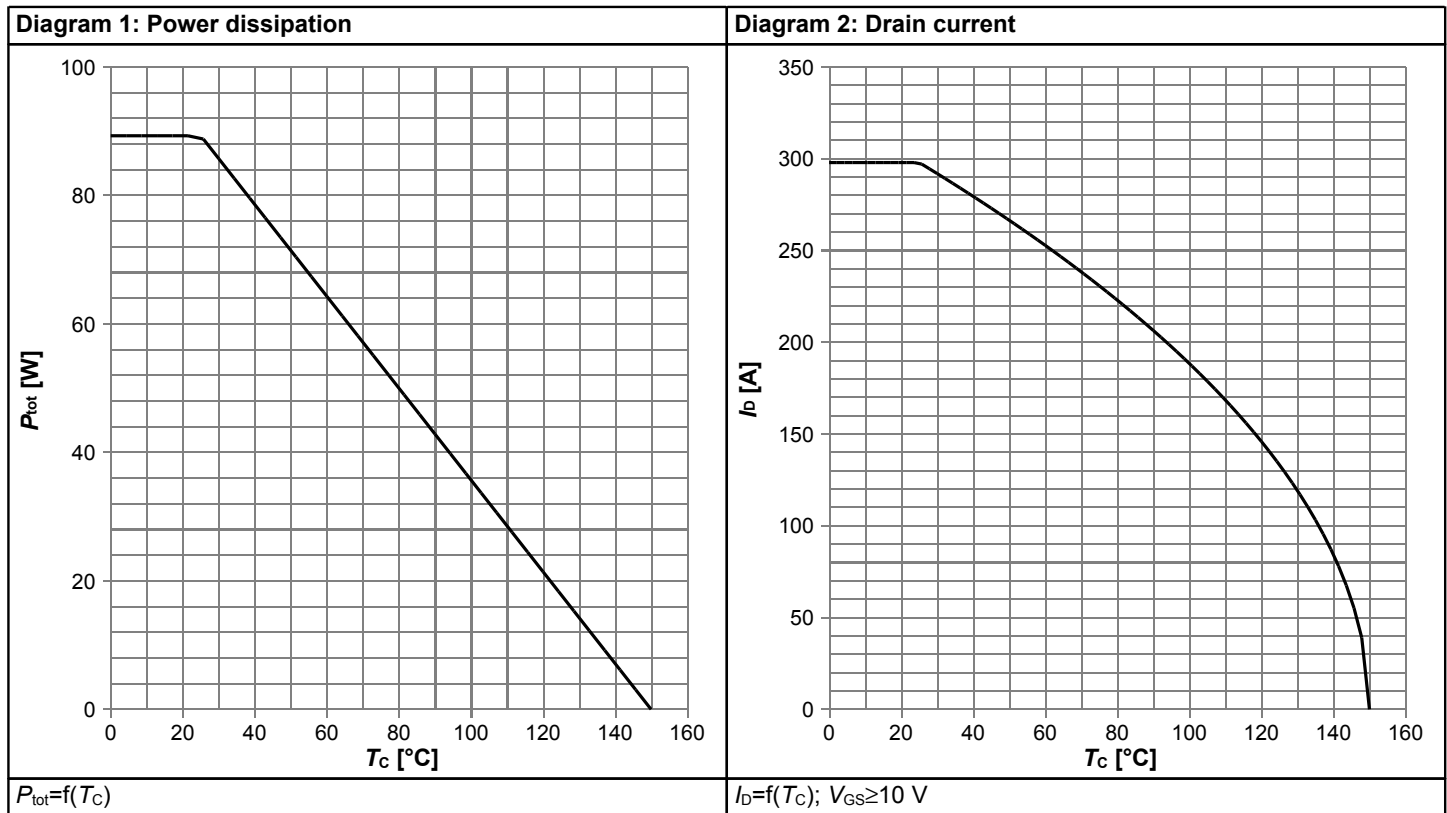
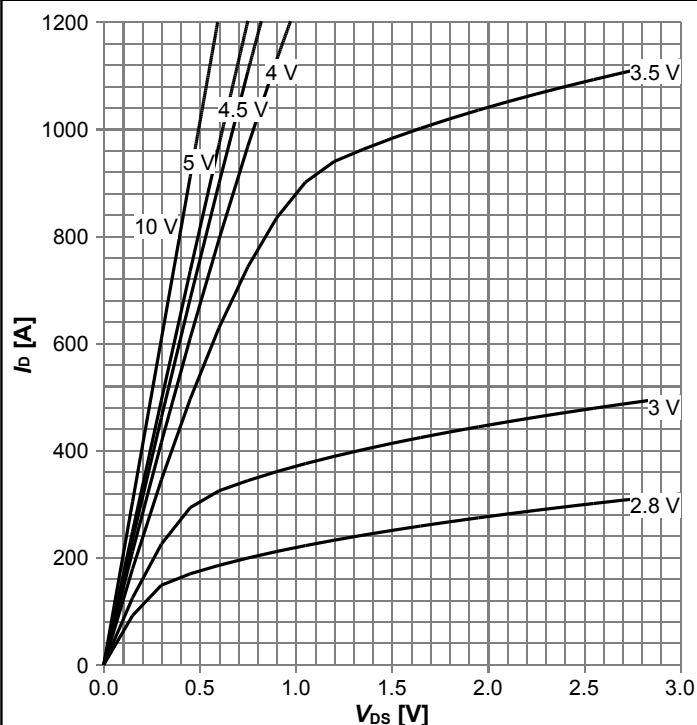
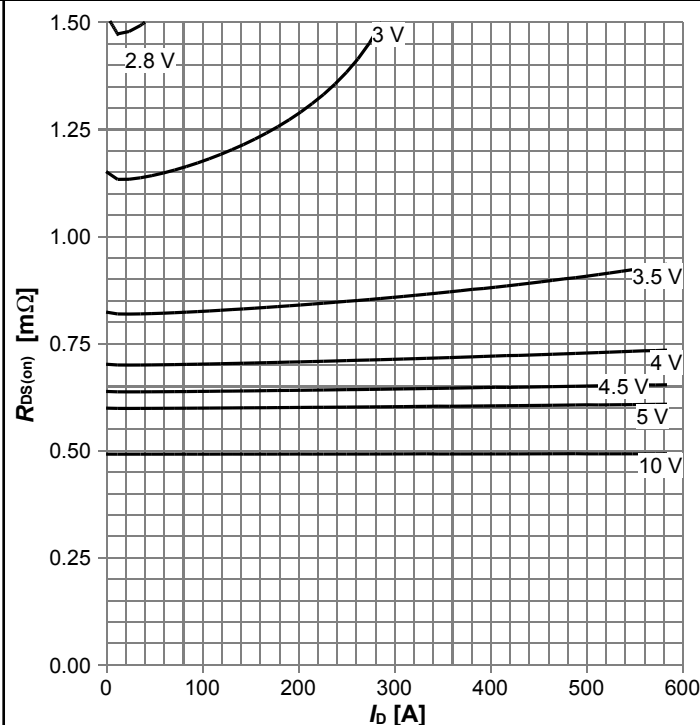


Diagram 5: Typ. output characteristics



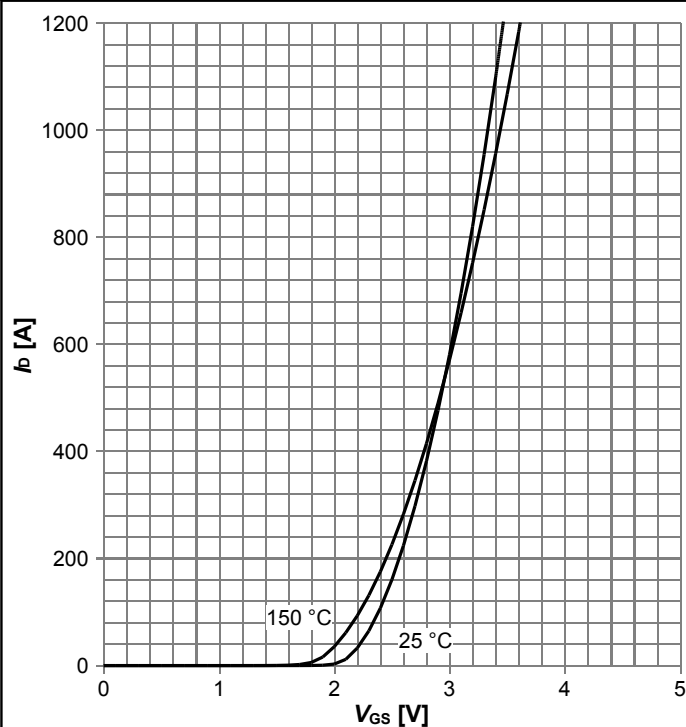
$I_D = f(V_{DS})$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



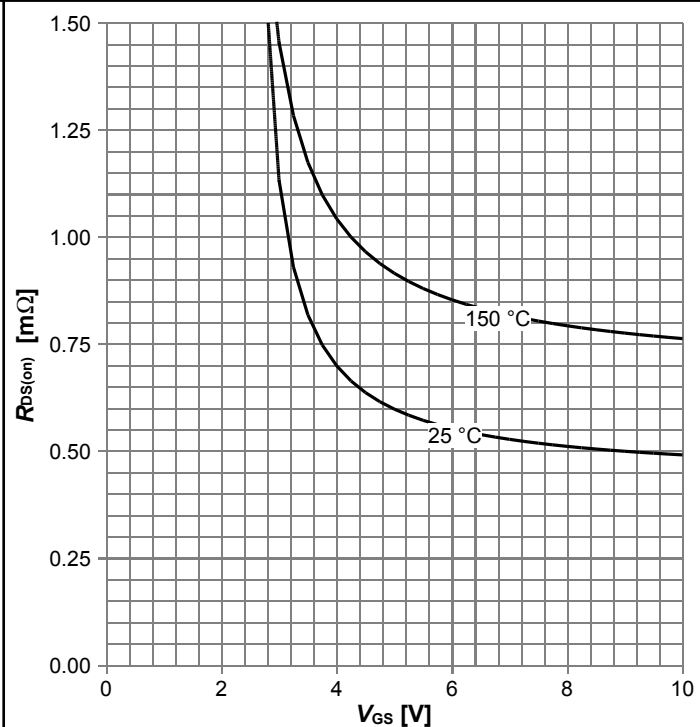
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



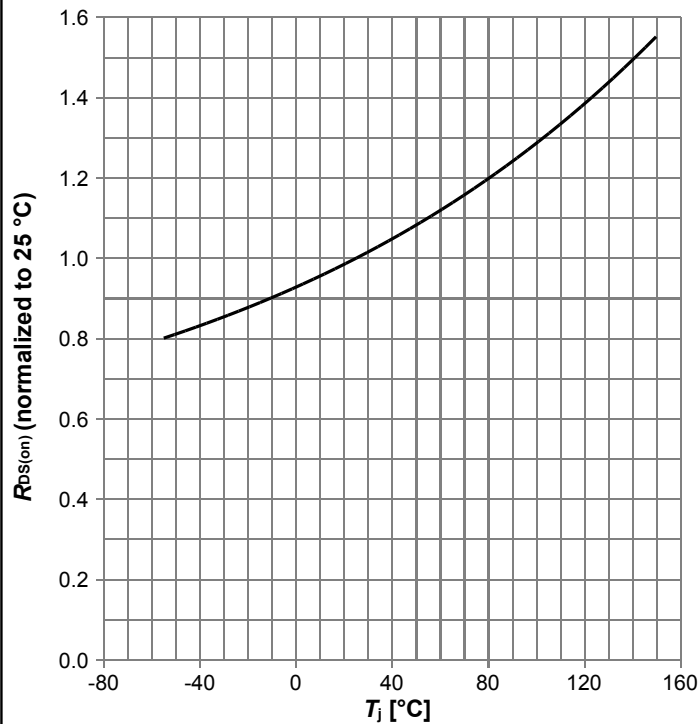
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)\text{max}}$ ; parameter:  $T_j$

Diagram 8: Typ. drain-source on resistance



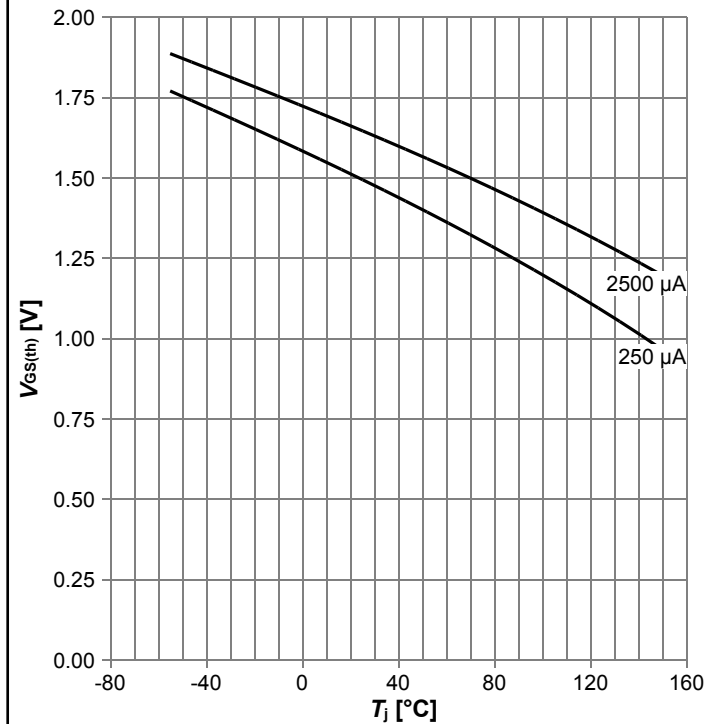
$R_{DS(on)} = f(V_{GS})$ ,  $I_D = 20\text{ A}$ ; parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



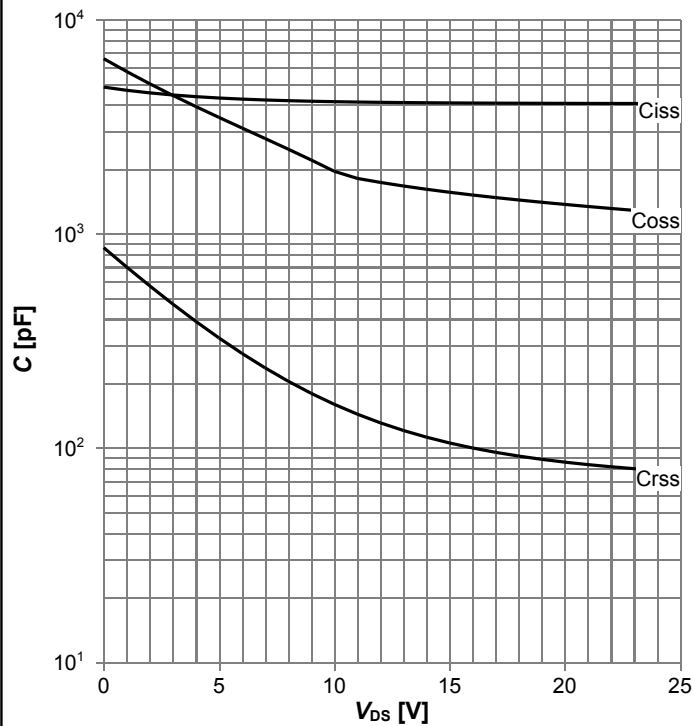
$R_{DS(on)} = f(T_j)$ ,  $I_D = 20$  A,  $V_{GS} = 10$  V

Diagram 10: Typ. gate threshold voltage



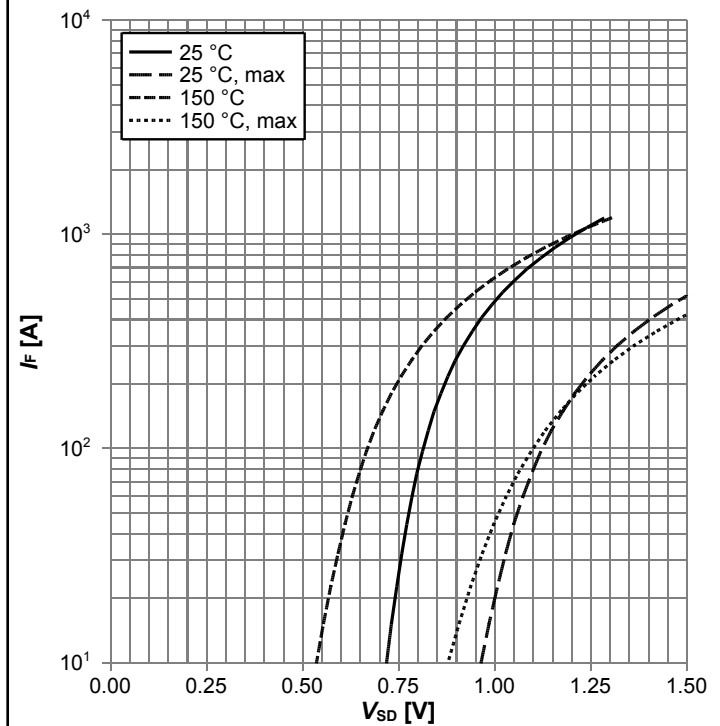
$V_{GS(th)} = f(T_j)$ ,  $V_{GS} = V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



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

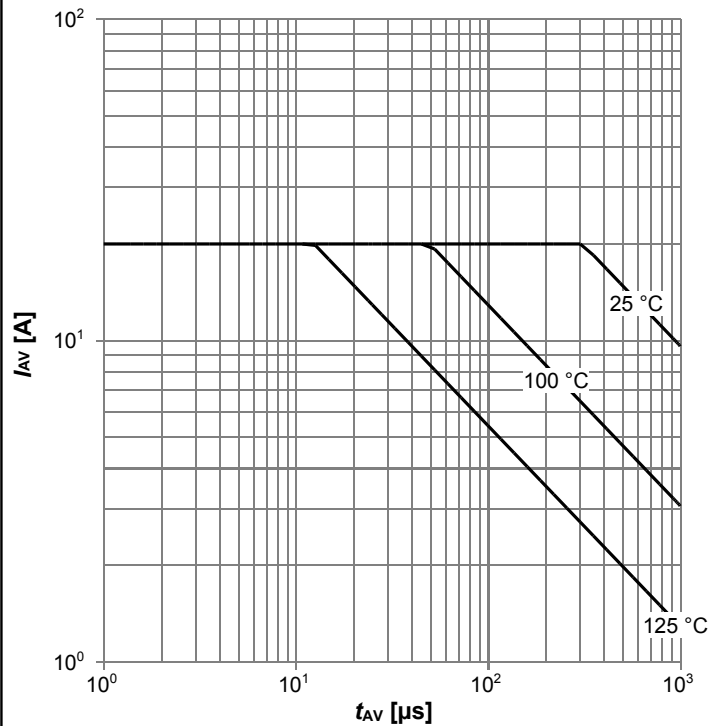
Diagram 12: Forward characteristics of reverse diode



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

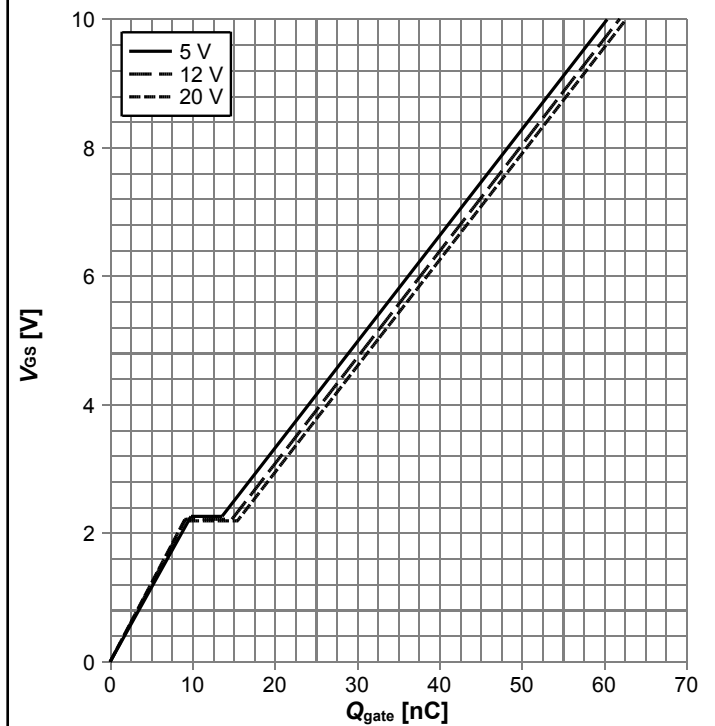


Diagram 13: Avalanche characteristics



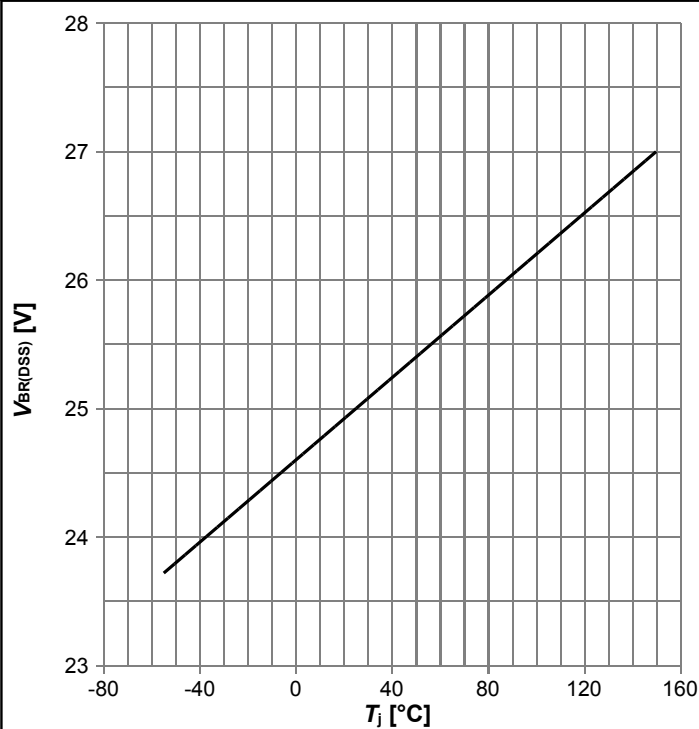
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25 \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



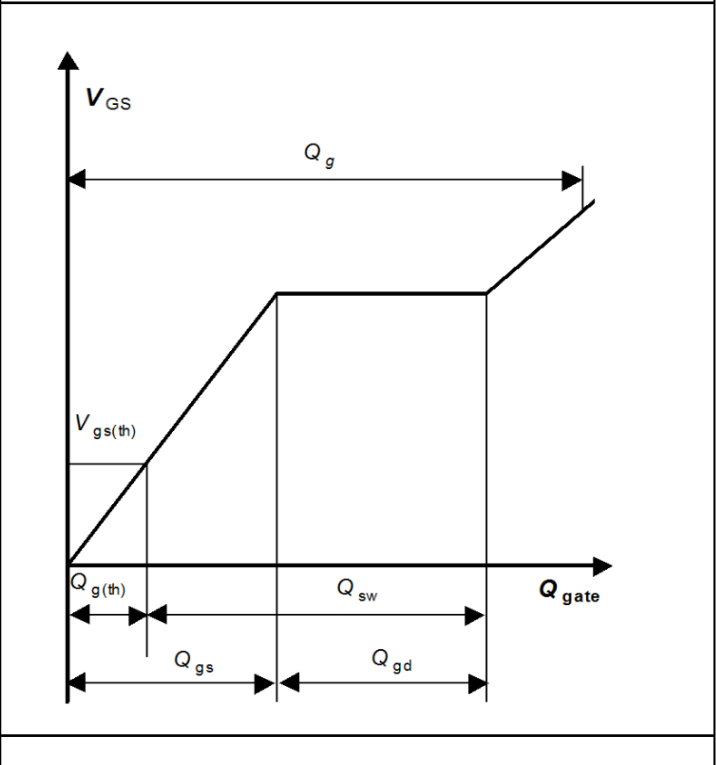
$V_{GS}=f(Q_{gate})$ ,  $I_D=20$  A pulsed,  $T_j=25$  °C; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

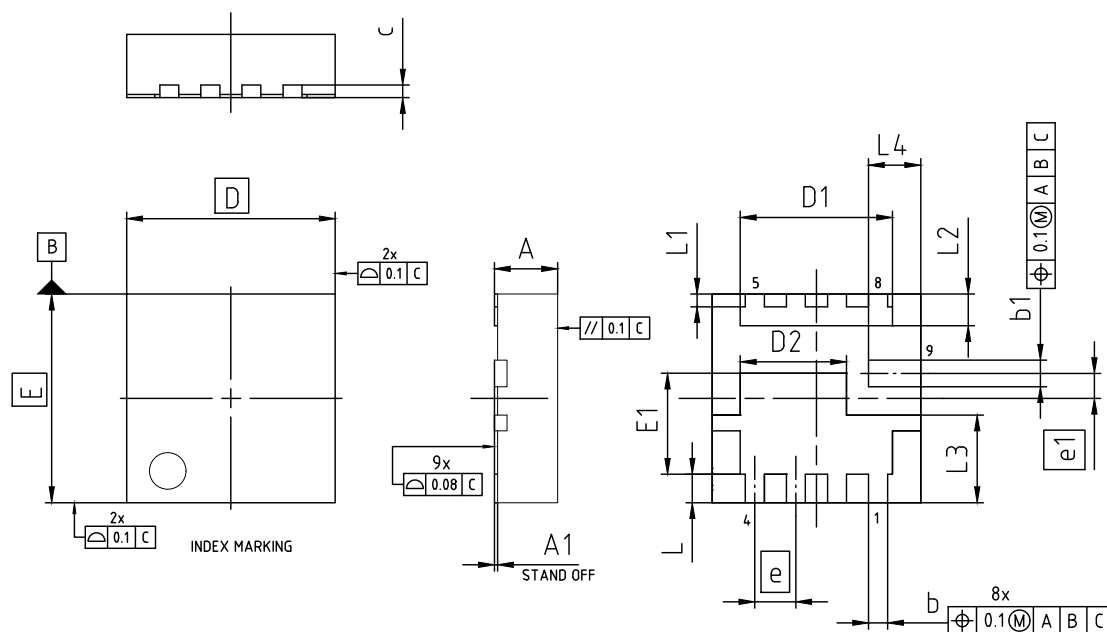


$V_{BR(DSS)}=f(T_j)$ ;  $I_D=1$  mA

Diagram Gate charge waveforms



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

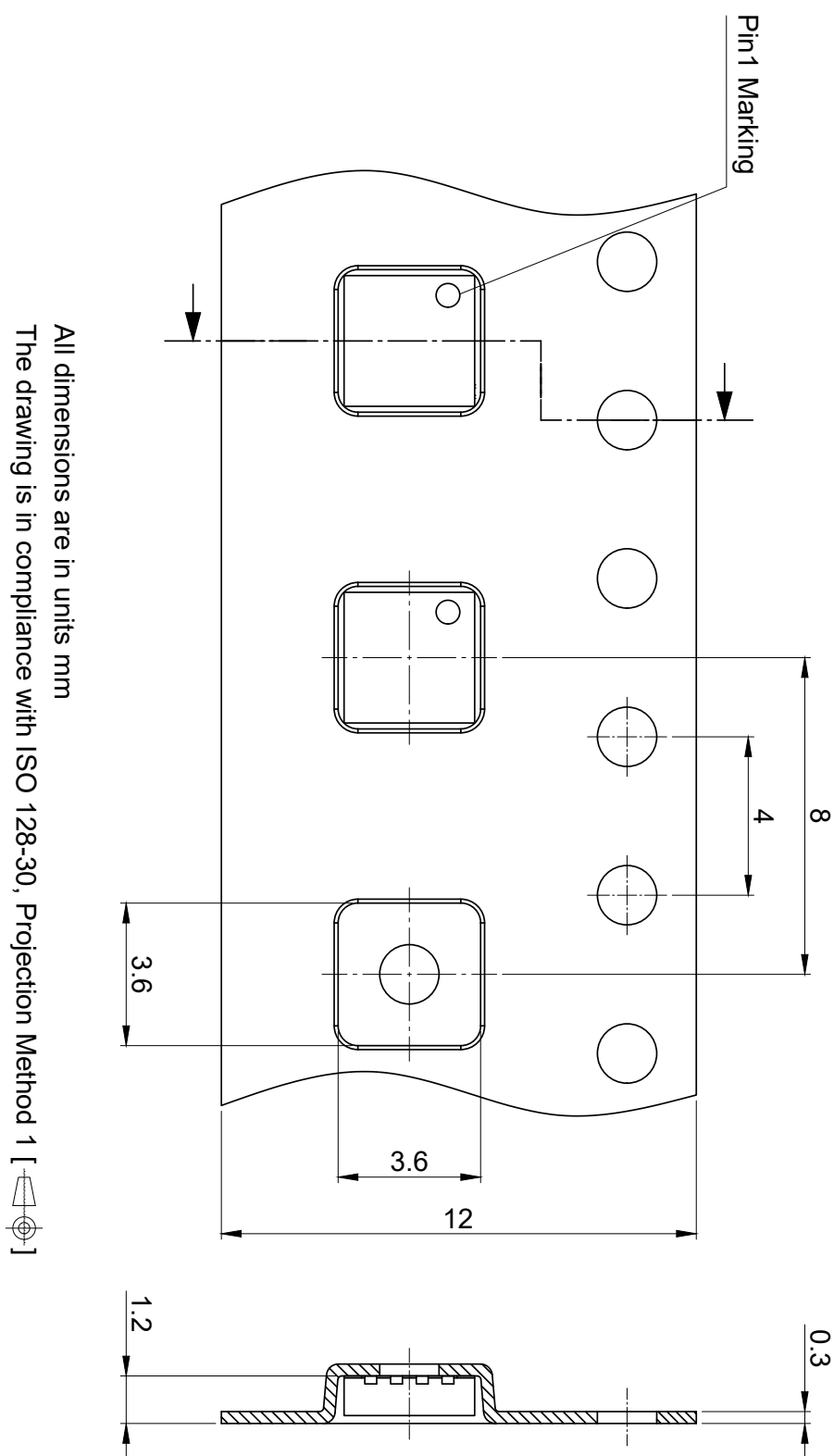


Figure 2 Outline Tape (PG-TTFN-9-1), dimensions in mm

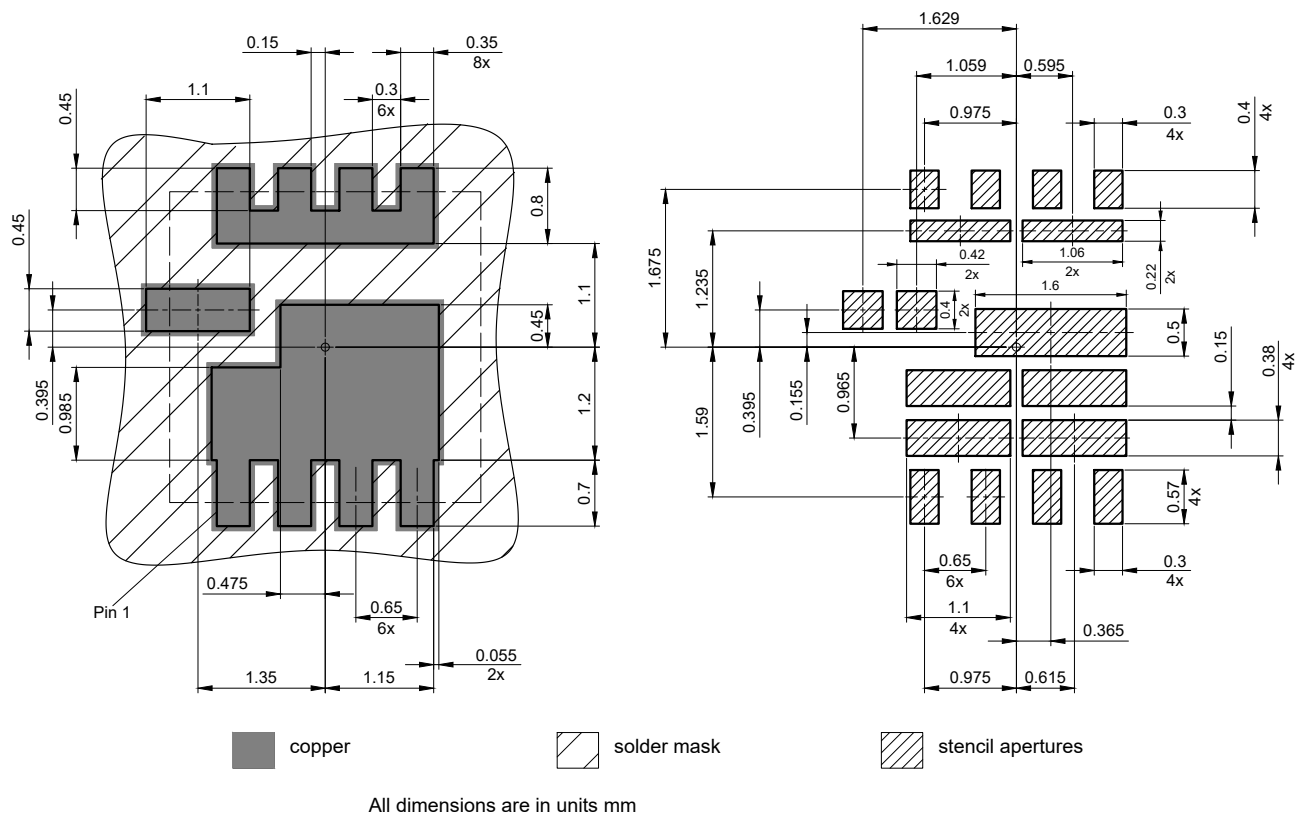


Figure 3 Outline Boardpad (PG-TTFN-9-1), dimensions in mm

## Revision History

IQE006NE2LM5CG

**Revision: 2020-03-16, Rev. 2.1**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2019-12-06	Release of final version
2.1	2020-03-16	Update footnotes and marking

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