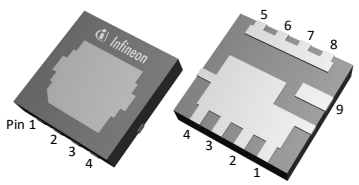
MOSFET

OptiMOS™ 7 Power-Transistor, 15 V

PG-WHTFN-9



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
- Optimized for high performance SMPS, e.g. synchronous rectification

Product validation

Fully qualified according to JEDEC for Industrial Applications

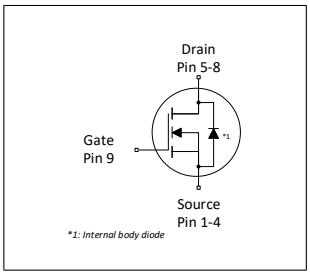


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	15	V
$R_{DS(on),max}$	0.45	mΩ
I_D	379	A
Q_{oss}	27	nC
Q_G	29	nC

Type / Ordering Code	Package	Marking	Related Links
IQE004NE1LM7CGSC	PG-WHTFN-9	H	-

Table of Contents

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	- - -	- - -	379 240 58	A	V_{GS}=7 V, T_C=25 °C V_{GS}=7 V, T_C=100 °C V_{GS}=7 V, T_A=25 °C, R_{thJA}=60 °C/W[2]
Pulsed drain current[3]	$I_{D,pulse}$	-	-	1516	A	T_A=25 °C
Avalanche energy, single pulse[4]	E_{AS}	-	-	859	mJ	I_D=20 A, R_{GS}=25 Ω
Recommended gate source voltage	V_{GS}	-7	-	7	V	-
Gate source voltage, transient	$V_{GS,AC}$	-8	-	8	V	t_{pulse}<20 ns
Power dissipation	P_{tot}	- -	- -	89 2.1	W	T_C=25 °C T_A=25 °C, R_{thJA}=60 °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, bottom	R_{thJC}	-	-	1.4	°C/W	-
Thermal resistance, junction - case, top	R_{thJC}	-	0.7	-	°C/W	-
Thermal resistance, junction - ambient, 6 cm² cooling area[5]	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 source connection. PCB is vertical in still air.
[3] See Diagram 3 for more detailed information
[4] See Diagram 13 for more detailed information
[5] 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 connection. PCB is vertical in still air.

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	$V_{(BR)DSS}$	15	-	-	V	V_{GS}=0 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	1.2	1.6	2.0	V	V_{DS}=V_{GS}, I_D=432 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	1 100	µA	V_{DS}=12 V, V_{GS}=0 V, T_j=25 °C V_{DS}=12 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	10	100	nA	V_{GS}=7 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	- -	0.37 0.47	0.45 0.57	mΩ	V_{GS}=7 V, I_D=30 A V_{GS}=4.5 V, I_D=20 A
Gate resistance	R_G	-	0.4	-	Ω	-
Transconductance	g_{fs}	85	170	-	S	|V_{DS}|≥2|I_D|$R_{DS(on)max}$, I_D=30 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	4800	6240	pF	V_{GS}=0 V, V_{DS}=7.5 V, f=1 MHz
Output capacitance[1)]	C_{oss}	-	2600	3380	pF	V_{GS}=0 V, V_{DS}=7.5 V, f=1 MHz
Reverse transfer capacitance[1)]	C_{rss}	-	260	455	pF	V_{GS}=0 V, V_{DS}=7.5 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	9	-	ns	V_{DD}=7.5 V, V_{GS}=7 V, I_D=30 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	2	-	ns	V_{DD}=7.5 V, V_{GS}=7 V, I_D=30 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	21	-	ns	V_{DD}=7.5 V, V_{GS}=7 V, I_D=30 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	4	-	ns	V_{DD}=7.5 V, V_{GS}=7 V, I_D=30 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[1)]	Q_{gs}	-	13	18.8	nC	V_{DD}=7.5 V, I_D=30 A, V_{GS}=0 to 4.5 V
Gate charge at threshold[1)]	$Q_{g(th)}$	-	7.6	11	nC	V_{DD}=7.5 V, I_D=30 A, V_{GS}=0 to 4.5 V
Gate to drain charge[1)]	Q_{gd}	-	5.7	5.5	nC	V_{DD}=7.5 V, I_D=30 A, V_{GS}=0 to 4.5 V
Switching charge	Q_{sw}	-	11.1	-	nC	V_{DD}=7.5 V, I_D=30 A, V_{GS}=0 to 4.5 V
Gate charge total[1)]	Q_g	-	29	36	nC	V_{DD}=7.5 V, I_D=30 A, V_{GS}=0 to 4.5 V
Gate plateau voltage	$V_{plateau}$	-	2.7	-	V	V_{DD}=7.5 V, I_D=30 A, V_{GS}=0 to 4.5 V
Gate charge total[1)]	Q_g	-	44	55	nC	V_{DD}=7.5 V, I_D=30 A, V_{GS}=0 to 7 V
Output charge[1)]	Q_{oss}	-	27	36	nC	V_{DS}=7.5 V, V_{GS}=0 V

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

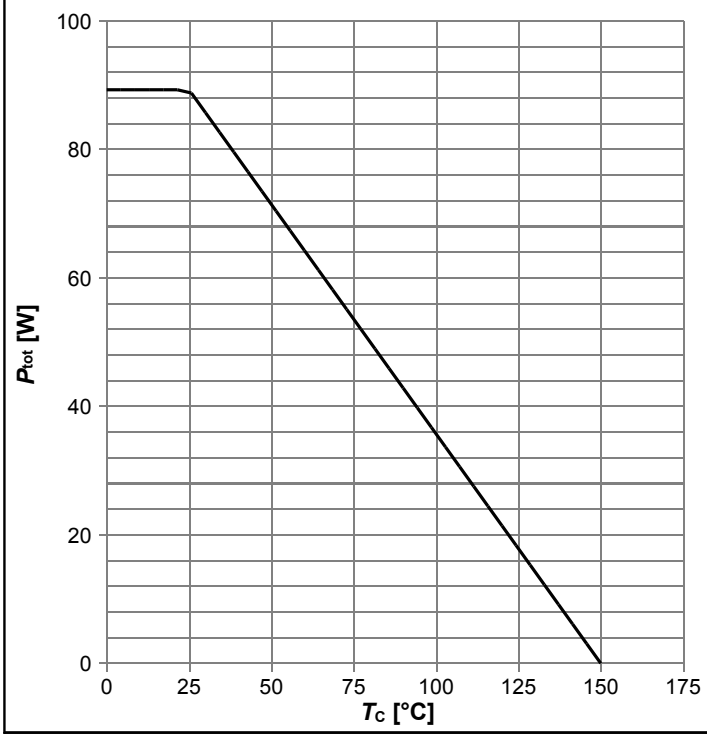
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	87	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	1516	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.76	1.0	V	V_{GS}=0 V, I_F=30 A, T_j=25 °C
Reverse recovery time[1)]	t_{rr}	-	31	62	ns	V_R=7.5 V, I_F=30 A, di_F/dt=100 A/µs
Reverse recovery charge[1)]	Q_{rr}	-	24	48	nC	V_R=7.5 V, I_F=30 A, di_F/dt=100 A/µs
Reverse recovery time[1)]	t_{rr}	-	25	50	ns	V_R=7.5 V, I_F=30 A, di_F/dt=300 A/µs
Reverse recovery charge[1)]	Q_{rr}	-	49	98	nC	V_R=7.5 V, I_F=30 A, di_F/dt=300 A/µs

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

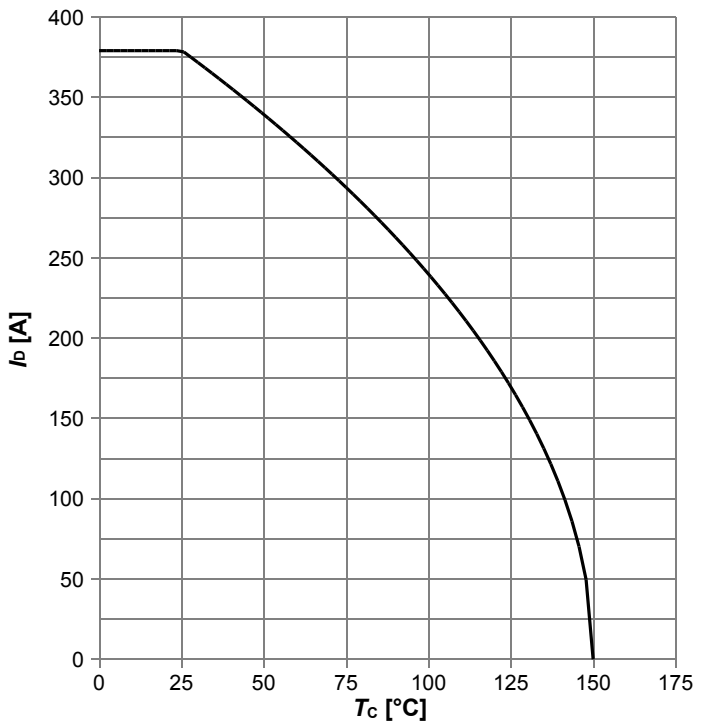
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



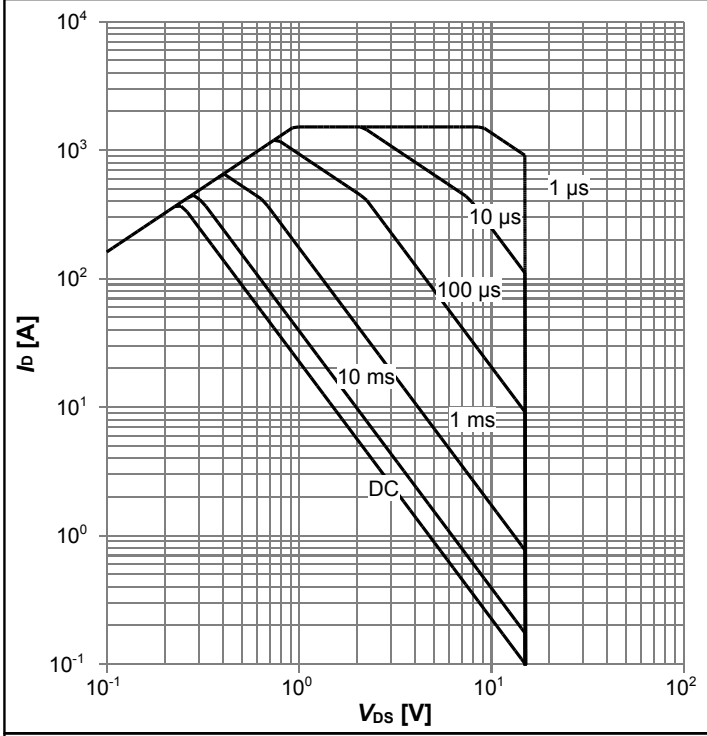
$P_{tot}=f(T_C)$

Diagram 2: Drain current



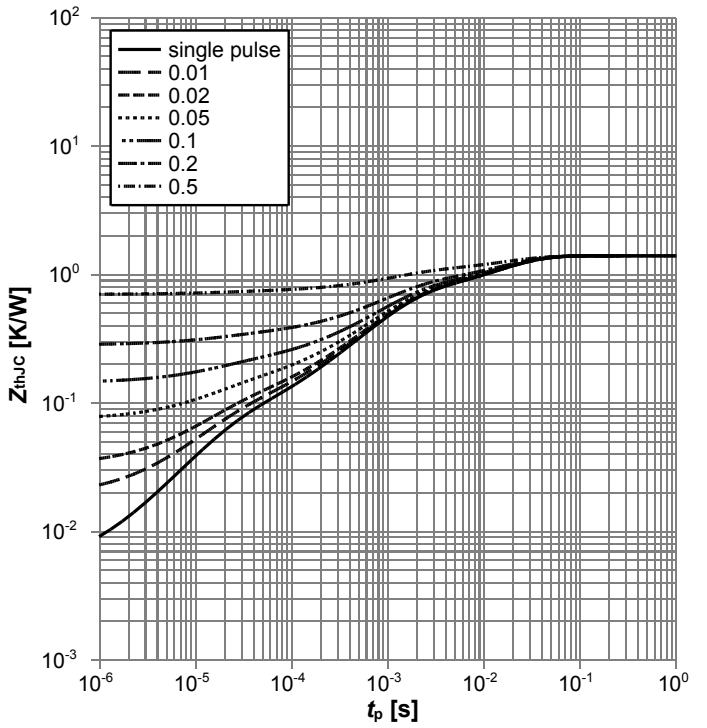
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



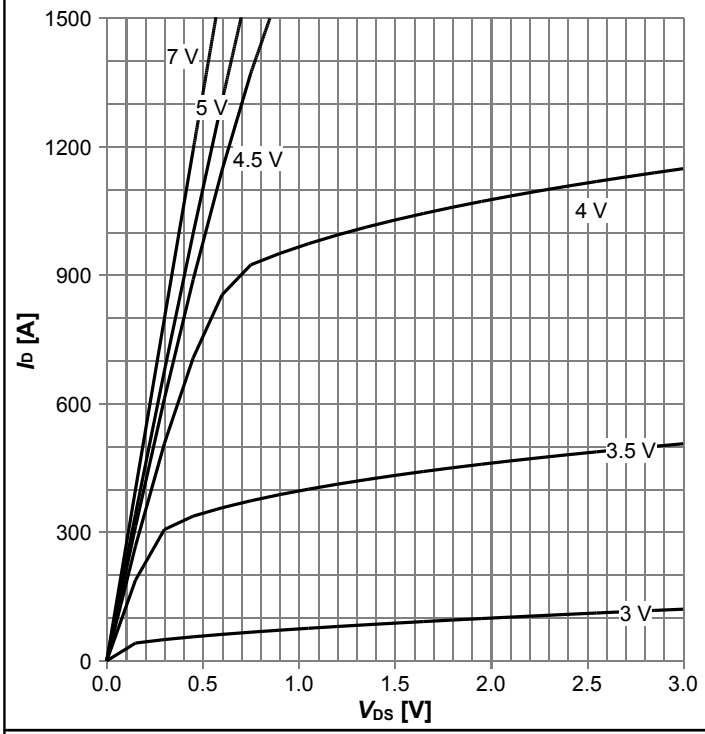
$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: t_p

Diagram 4: Max. transient thermal impedance



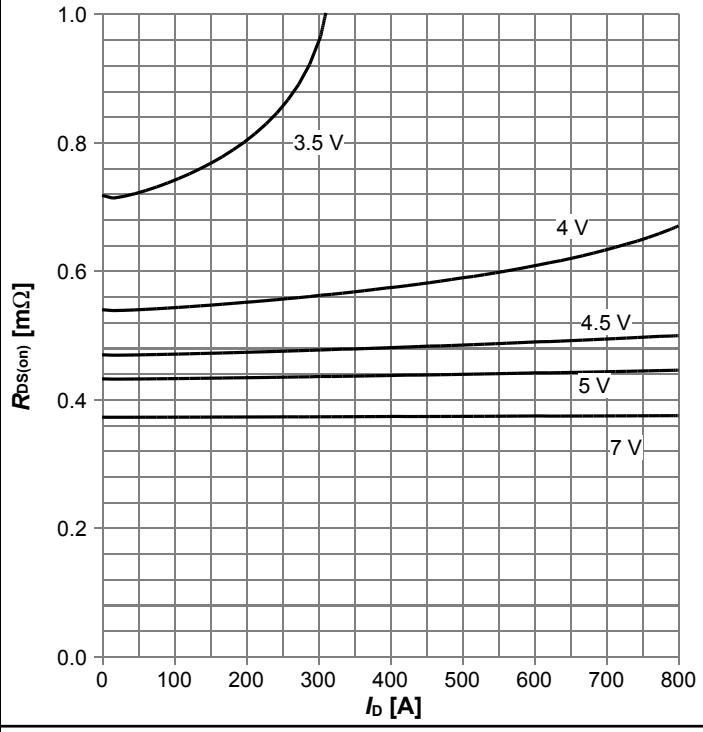
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



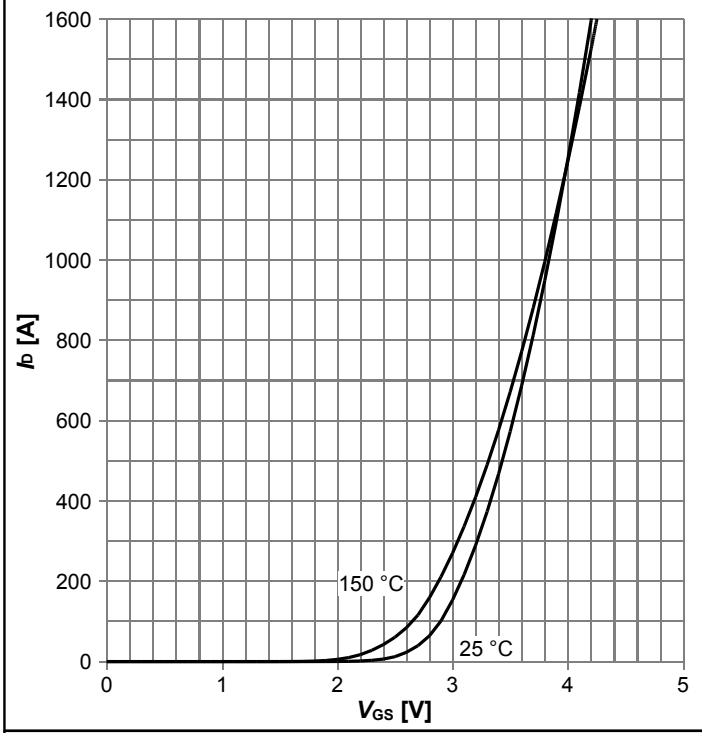
$I_D=f(V_{DS})$, $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



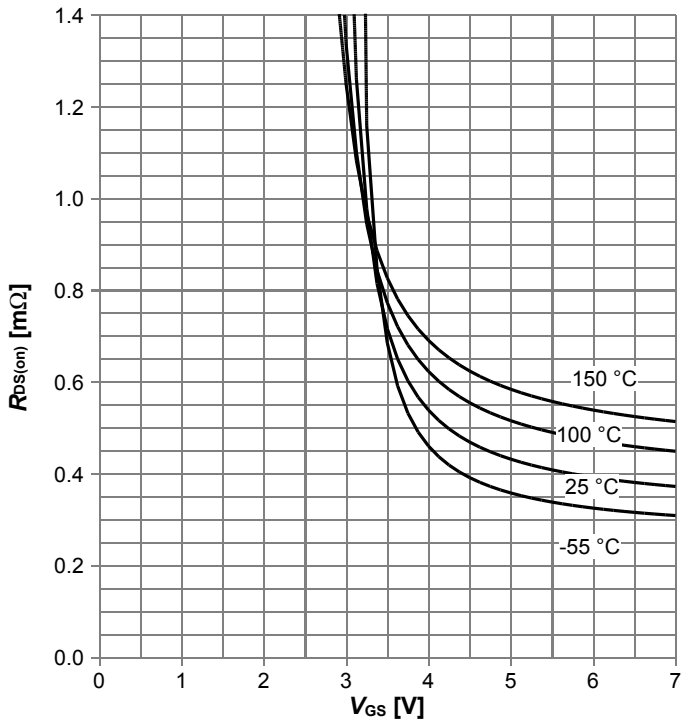
$R_{DS(on)}=f(I_D)$, $T_j=25$ °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



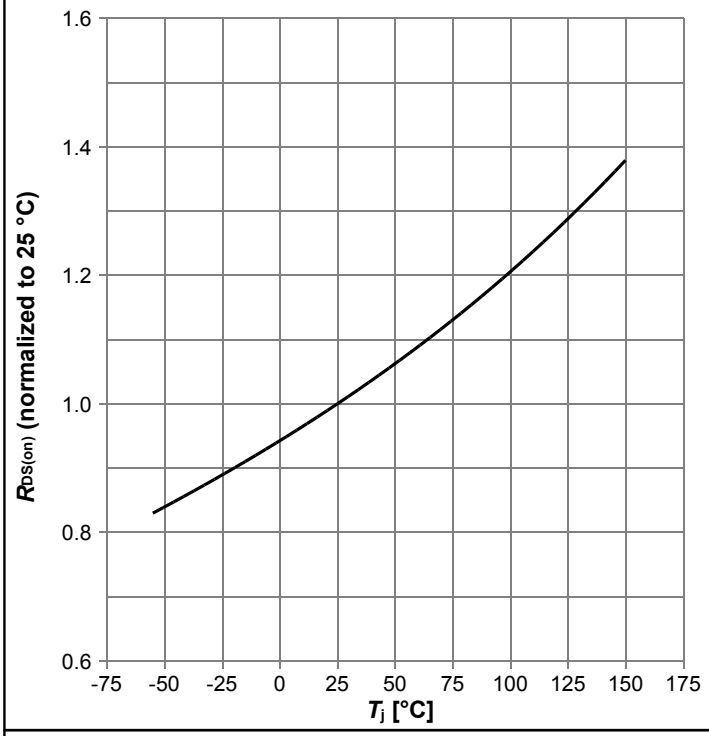
$I_D=f(V_{GS})$, $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



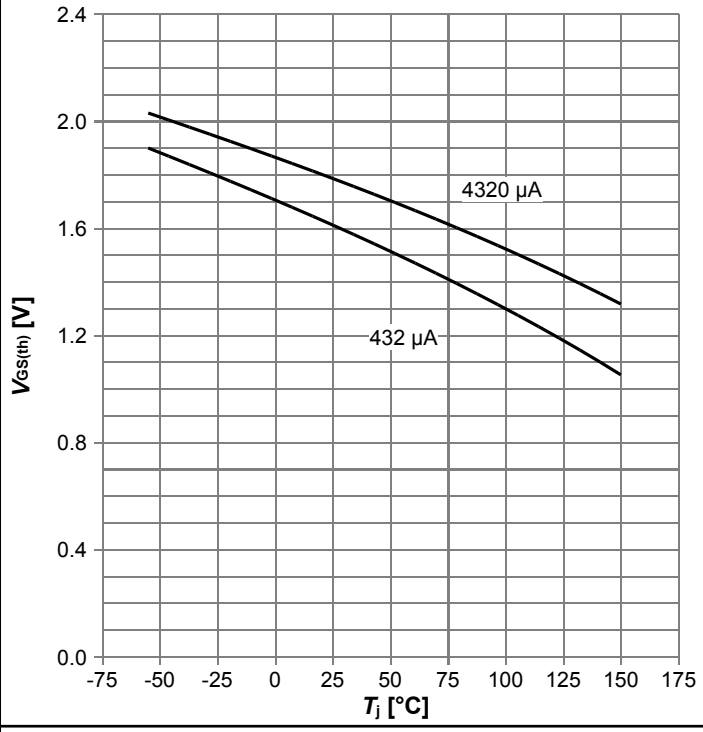
$R_{DS(on)}=f(V_{GS})$, $I_D=30$ A; parameter: T_j

Diagram 9: Normalized drain-source on resistance



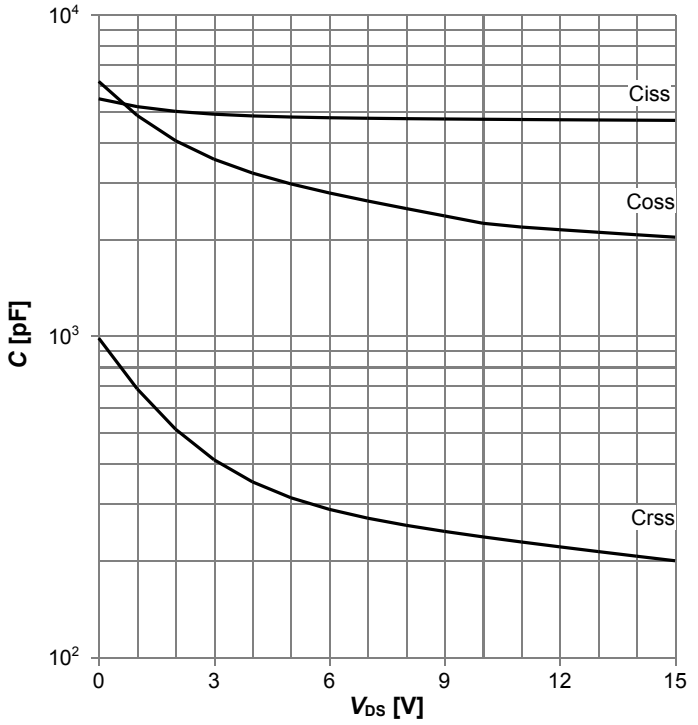
$R_{DS(on)}$=f(T_j), I_D=30 A; parameter: V_{GS}

Diagram 10: Typ. gate threshold voltage



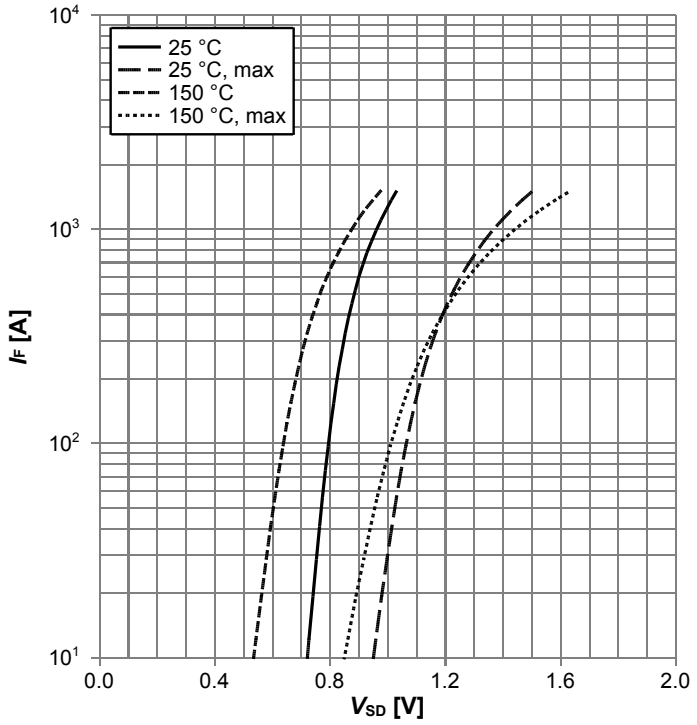
$V_{GS(th}$=f(T_j), V_{GS}=V_{DS}; parameter: I_D

Diagram 11: Typ. capacitances



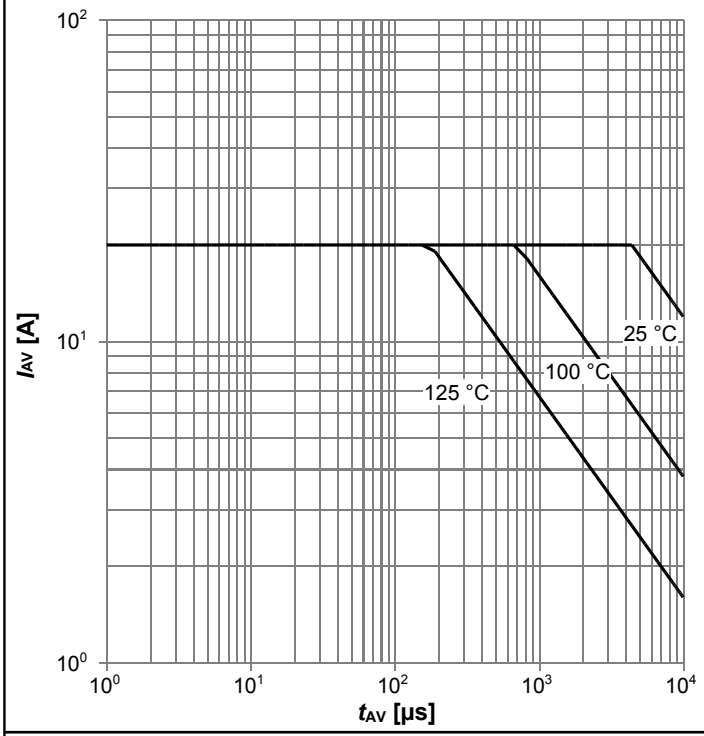
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



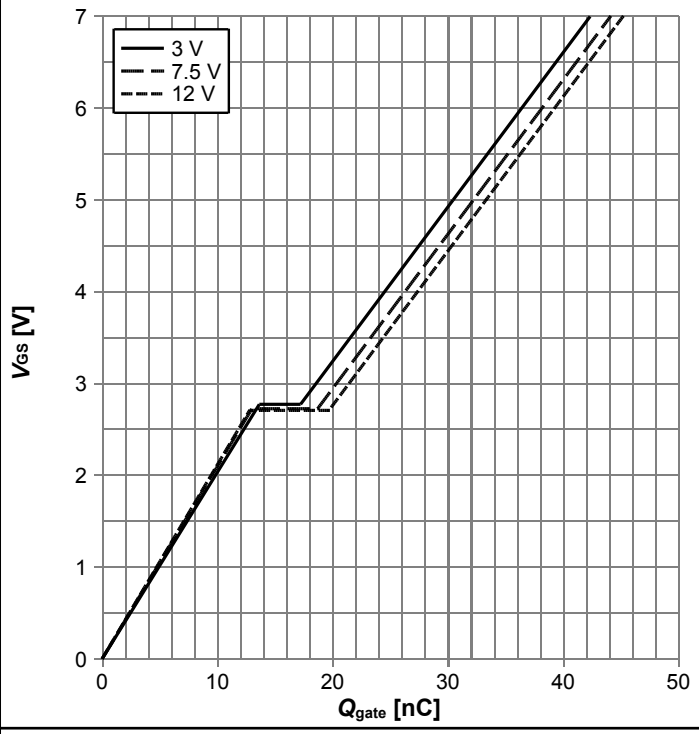
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



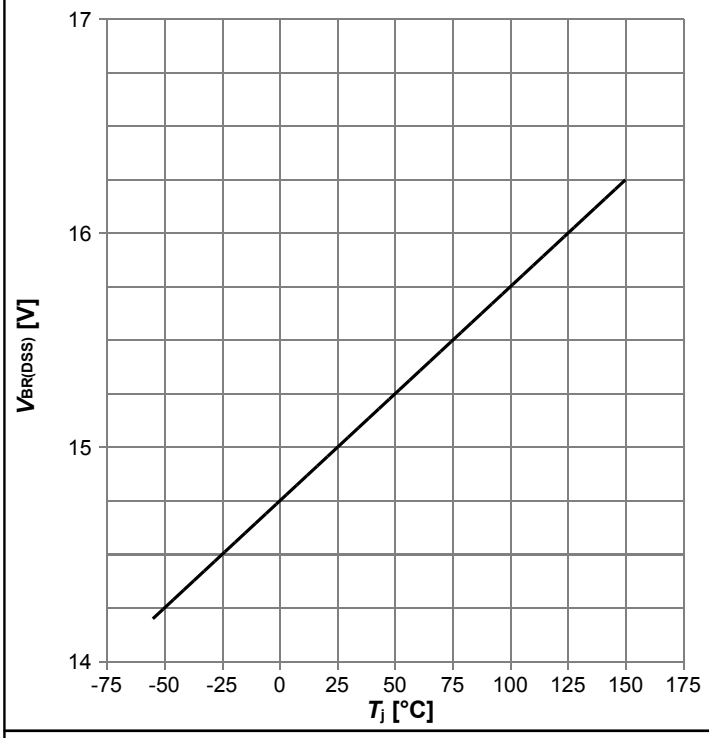
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



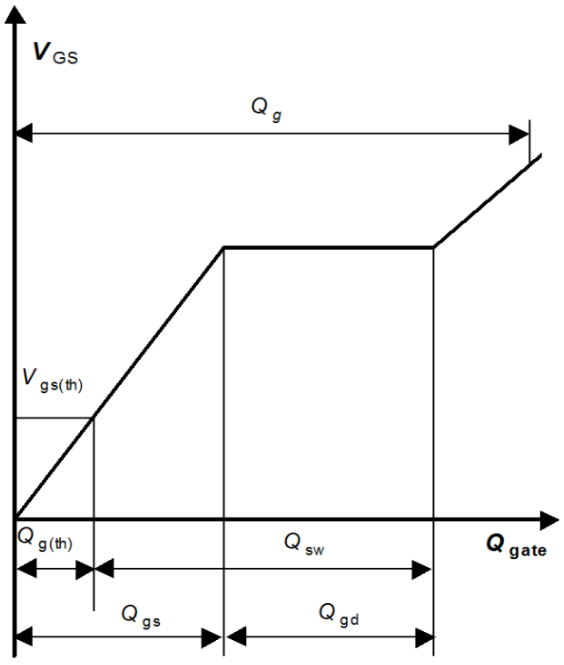
$V_{GS}=f(Q_{gate})$, $I_D=30$ A pulsed, $T_j=25$ °C; parameter: V_{DD}

Diagram 15: Min. drain-source breakdown voltage

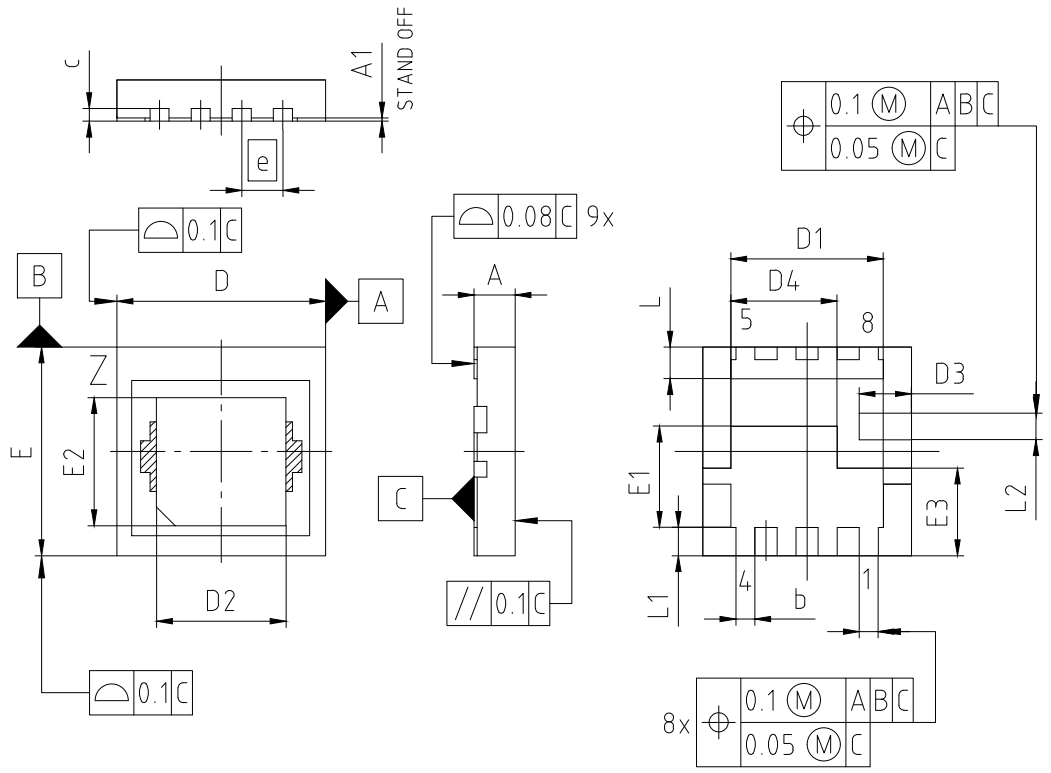


$V_{BR(DSS)}=f(T_j)$; $I_D=1$ mA

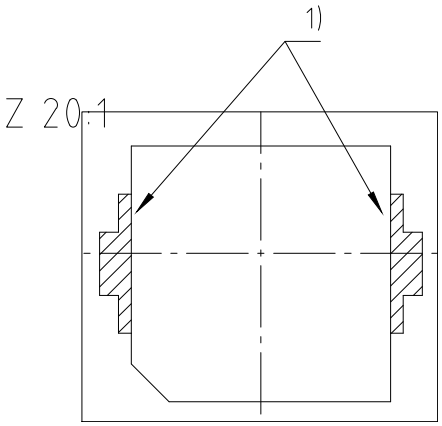
Diagram Gate charge waveforms



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



1) NOT PART OF SPECIFIED HEATSINK AREA -
SHAPE MIGHT VARY DEPENDING ON HEATSINK DESIGN

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

Revision History

IQE004NE1LM7CGSC

Revision: 2023-07-25, Rev. 2.0

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2023-07-25	Release of final version

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