

## MOSFET

OptiMOS™ 6 Power-Transistor, 40 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

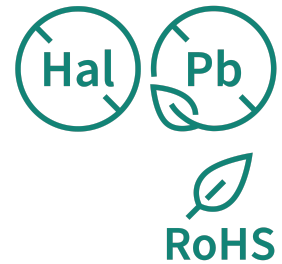
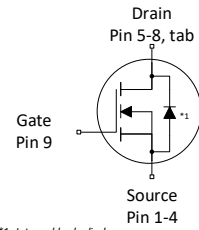
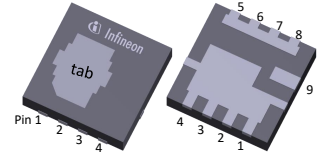
### Product validation

Qualified according to relevant JEDEC tests.

**Table 1** Key performance parameters

Parameter	Value	Unit
$V_{DS}$	40	V
$R_{DS(on),max}$	2.05	mΩ
$I_D$	166	A
$Q_{oss}$	27	nC
$Q_G$	25	nC

PG-WHTFN-9 (3x3)



Part number	Package	Marking	Related links
IQE020N04LM6CGSC	PG-WHTFN-9	V	-



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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>	$I_D$	-	-	166	A	$V_{GS}=10\text{ V}, T_C=25\text{ °C}$
				117		$V_{GS}=10\text{ V}, T_C=100\text{ °C}$
				99		$V_{GS}=4.5\text{ V}, T_C=100\text{ °C}$
				25		$V_{GS}=10\text{ V}, T_A=25\text{ °C}, R_{thJA}=60\text{ °C/W}^2)$
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	-	-	664	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	135	mJ	$I_D=20\text{ A}, R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	107	W	$T_C=25\text{ °C}$
				2.5		$T_A=25\text{ °C}, R_{thJA}=60\text{ °C/W}^2)$
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 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

## 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	$R_{thJC}$		2.3	-		
Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>5)</sup>	$R_{thJA}$		-	60		

<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 drain 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	$V_{(BR)DSS}$	40	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1.3	1.6	2.3	V	$V_{DS}=V_{GS}$ , $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.1	1	$\mu\text{A}$	$V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$
			10	100		$V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	1.8	2.05	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$
			2.4	2.9		$V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$
Gate resistance	$R_G$	-	1.3	-	$\Omega$	-
Transconductance	$g_{fs}$	55	110	-	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>6)</sup>	$C_{iss}$	-	1700	2200	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=20\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>6)</sup>	$C_{oss}$		570	740		
Reverse transfer capacitance <sup>6)</sup>	$C_{rss}$		19	33		
Turn-on delay time	$t_{d(on)}$	-	4	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$		1.6			
Turn-off delay time	$t_{d(off)}$		14.7			
Fall time	$t_f$		2.9			

<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	$Q_{gs}$	-	4.6	-	nC	$V_{DD}=20\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0$ to $4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	2.8	-	nC	
Gate to drain charge <sup>8)</sup>	$Q_{gd}$	-	3.1	4.7	nC	
Switching charge	$Q_{sw}$	-	4.9	-	nC	
Gate charge total <sup>8)</sup>	$Q_g$	-	12.1	15.1	nC	
Gate plateau voltage	$V_{plateau}$	-	2.6	-	V	
Gate charge total <sup>8)</sup>	$Q_g$	-	25	33	nC	$V_{DD}=20\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0$ to $10\text{ V}$
Output charge <sup>8)</sup>	$Q_{oss}$	-	27	36	nC	$V_{DS}=20\text{ V}$ , $V_{GS}=0\text{ V}$

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

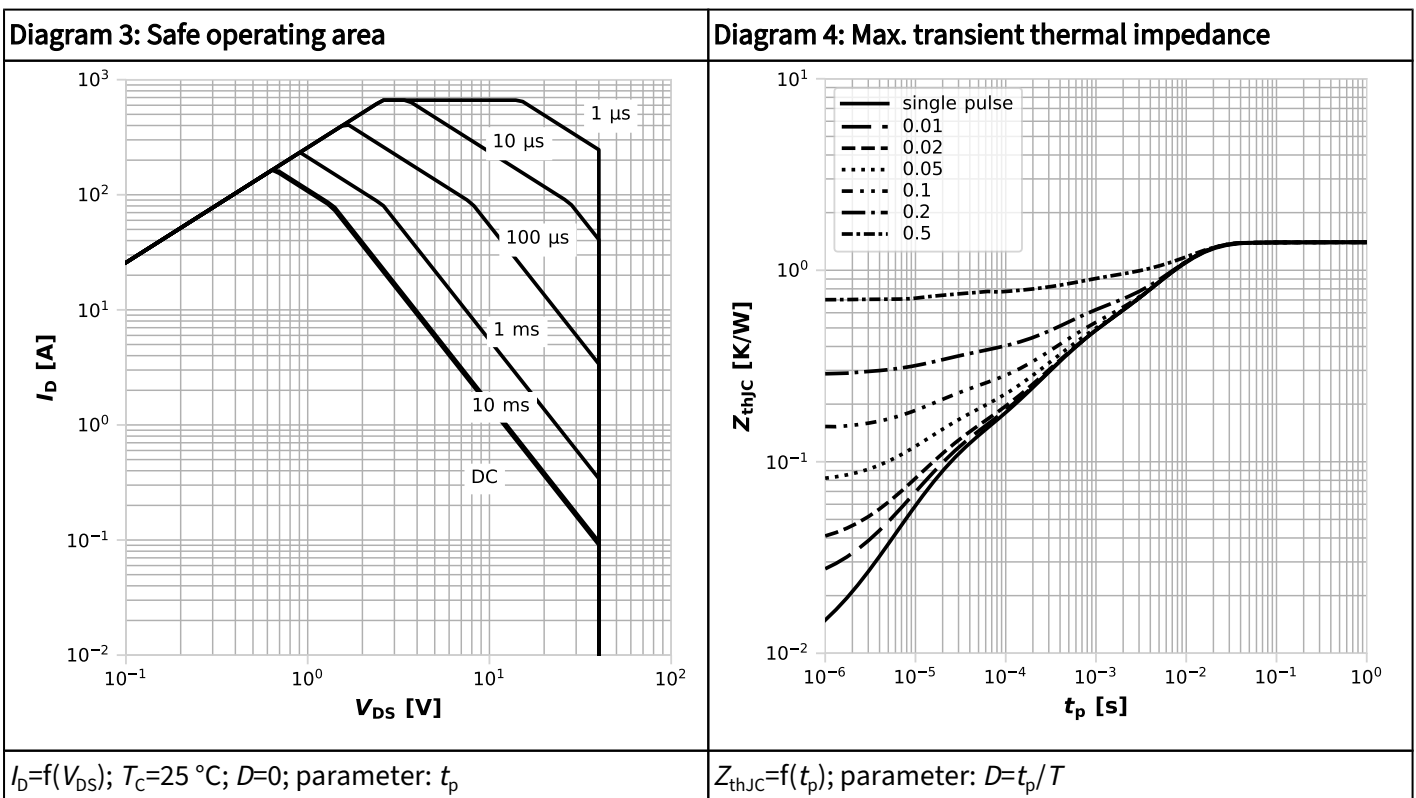
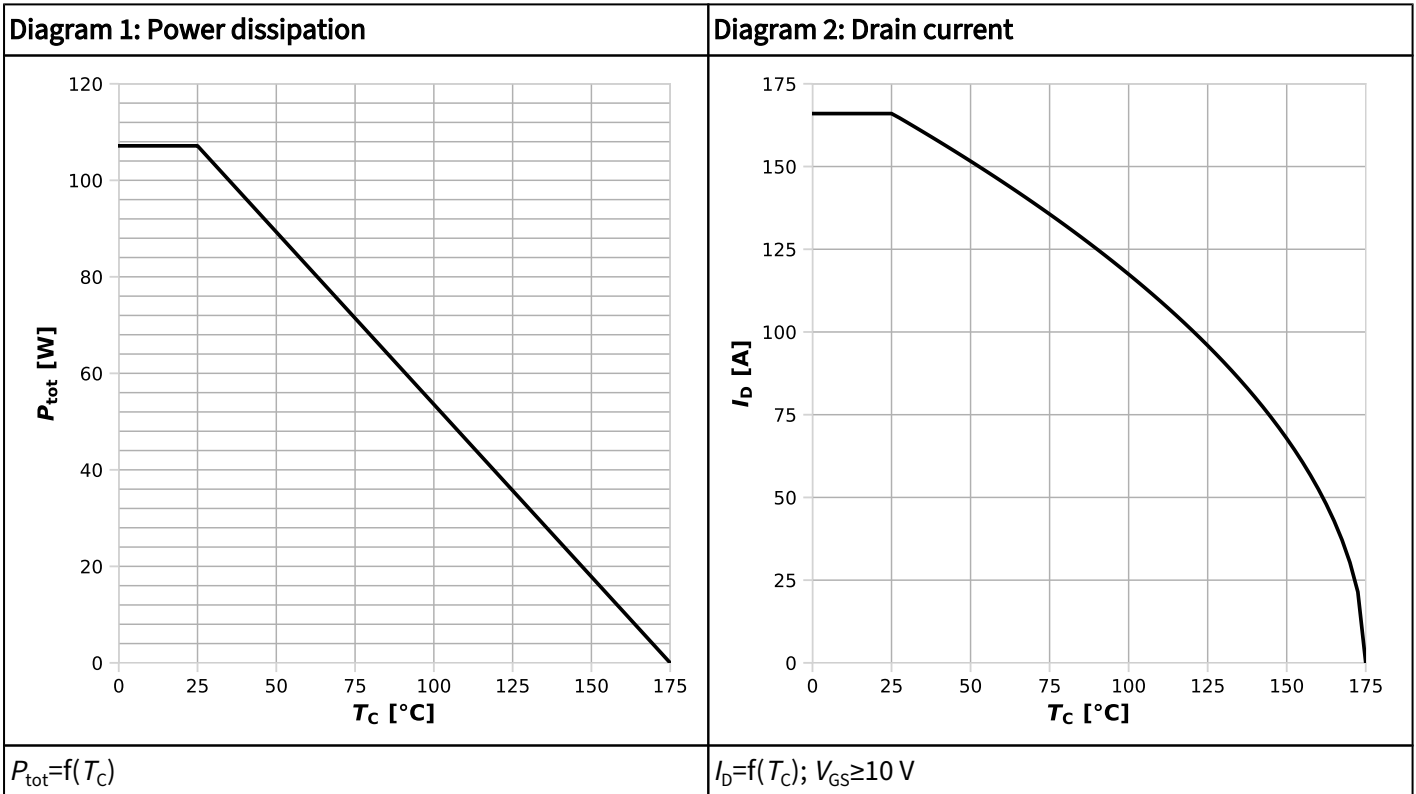
<sup>8)</sup> Defined by design. Not subject to production test.

**Table 7 Reverse diode**

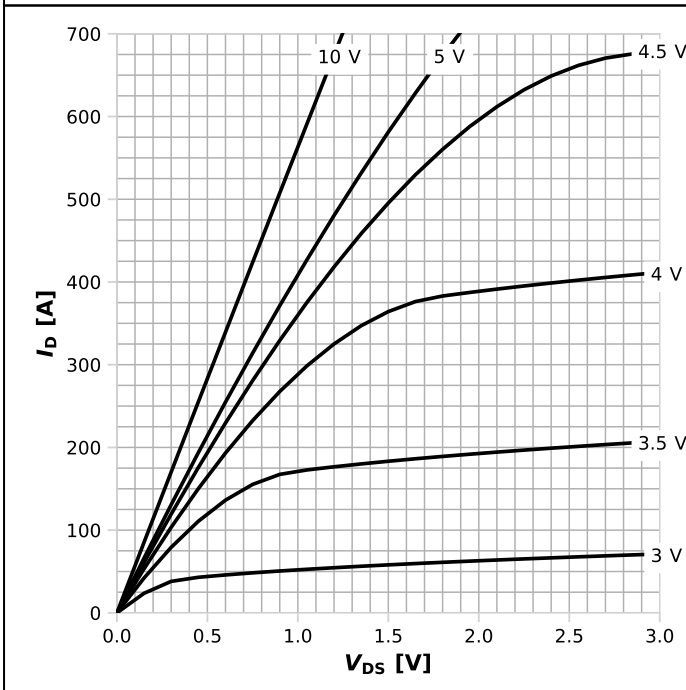
Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	89	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	664		
Diode forward voltage	$V_{SD}$	-	0.78	1.0	V	$V_{GS}=0\text{ V}$ , $I_F=20\text{ A}$ , $T_J=25\text{ °C}$
Reverse recovery time <sup>9)</sup>	$t_{rr}$	-	28	56	ns	$V_R=20\text{ V}$ , $I_F=20\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>9)</sup>	$Q_{rr}$	-	19	38	nC	
Reverse recovery time <sup>9)</sup>	$t_{rr}$	-	20	40	ns	$V_R=20\text{ V}$ , $I_F=20\text{ A}$ , $di_F/dt=500\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>9)</sup>	$Q_{rr}$	-	60	119	nC	

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

## 4 Electrical characteristics diagrams

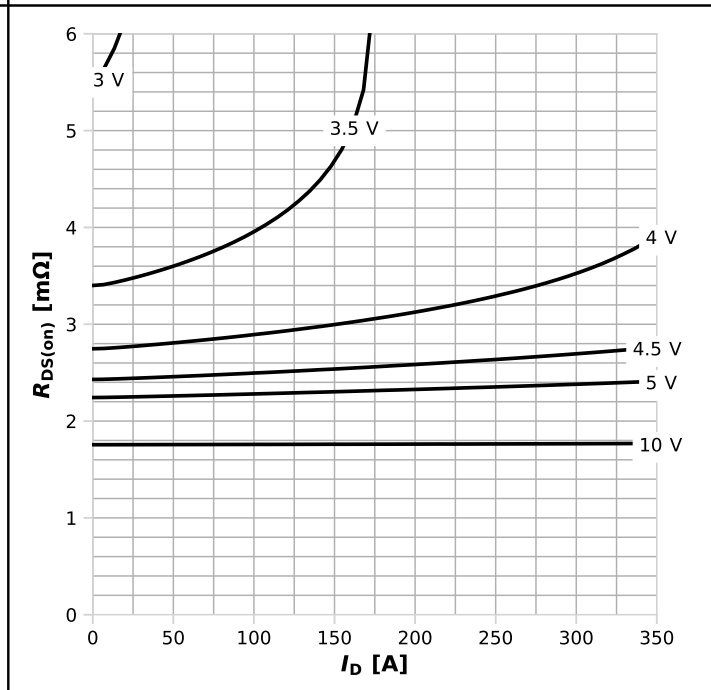


**Diagram 5: Typ. output characteristics**



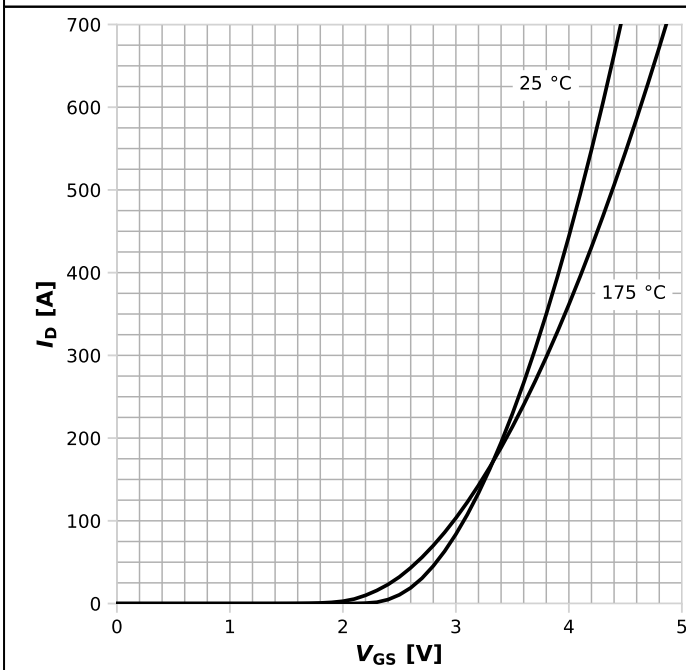
$I_D = f(V_{DS}), T_j = 25\text{ °C};$  parameter:  $V_{GS}$

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



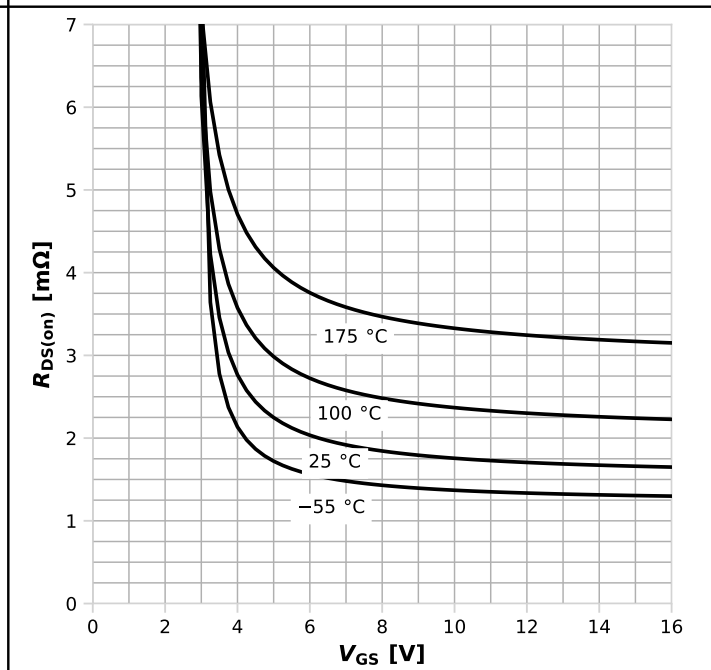
$R_{DS(on)} = f(I_D), T_j = 25\text{ °C};$  parameter:  $V_{GS}$

**Diagram 7: Typ. transfer characteristics**



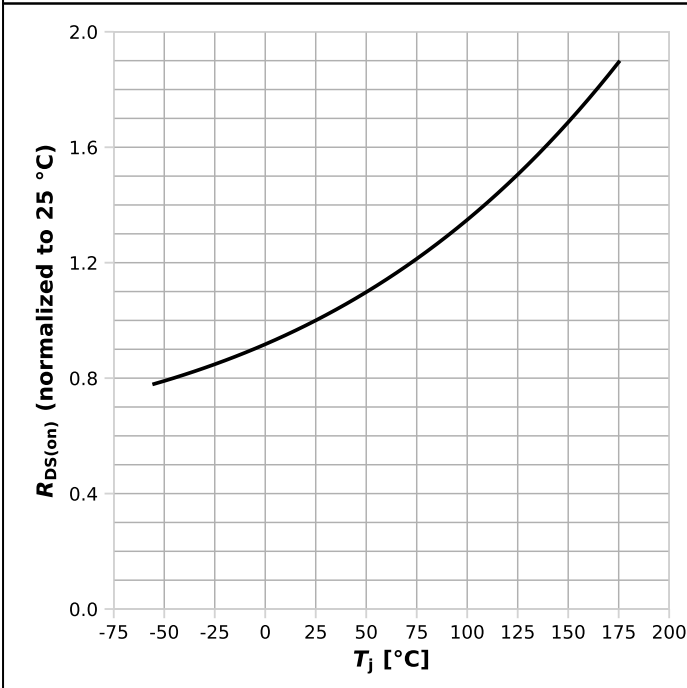
$I_D = f(V_{GS}), |V_{DS}| > 2|I_D|R_{DS(on)max};$  parameter:  $T_j$

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



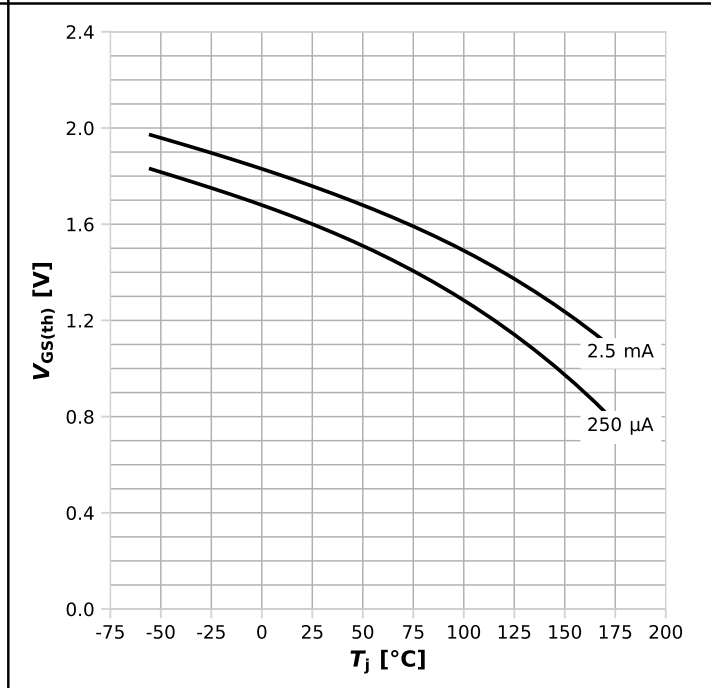
$R_{DS(on)} = f(V_{GS}), I_D = 20\text{ A};$  parameter:  $T_j$

**Diagram 9: Normalized drain-source on resistance**



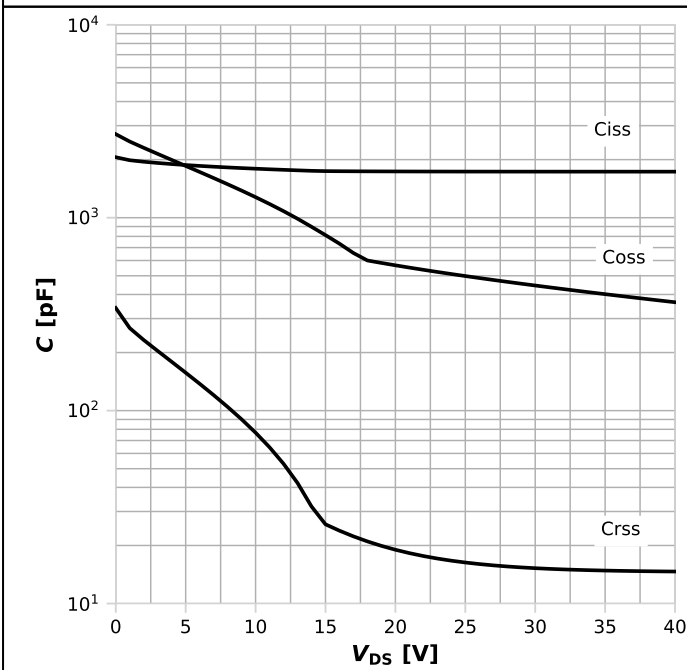
$R_{DS(on)}=f(T_j), I_D=20\text{ A}, V_{GS}=10\text{ V}$

**Diagram 10: Typ. gate threshold voltage**



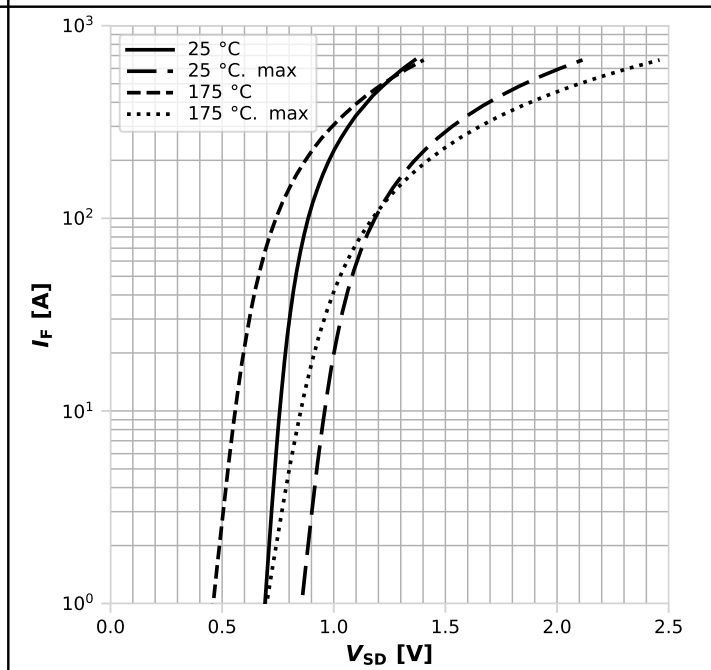
$V_{GS(th)}=f(T_j), V_{GS}=V_{DS};$  parameter:  $I_D$

**Diagram 11: Typ. capacitances**



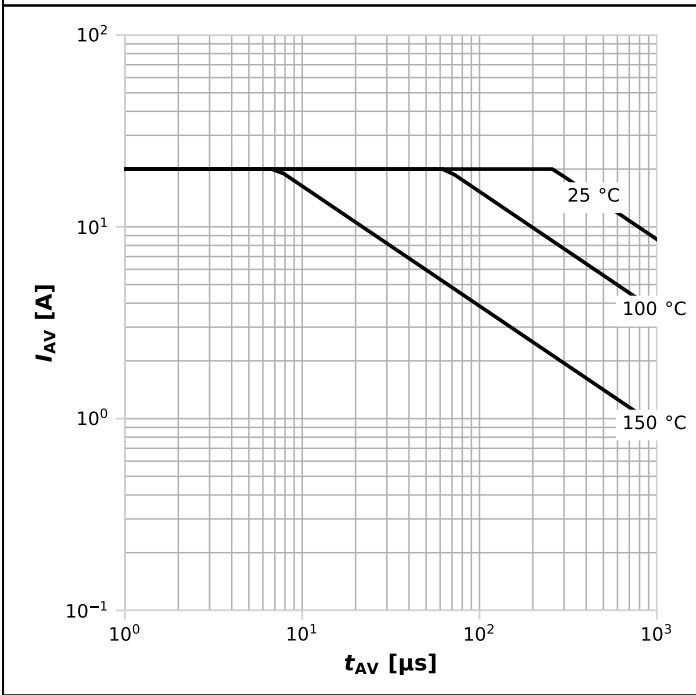
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$

**Diagram 12: Forward characteristics of reverse diode**



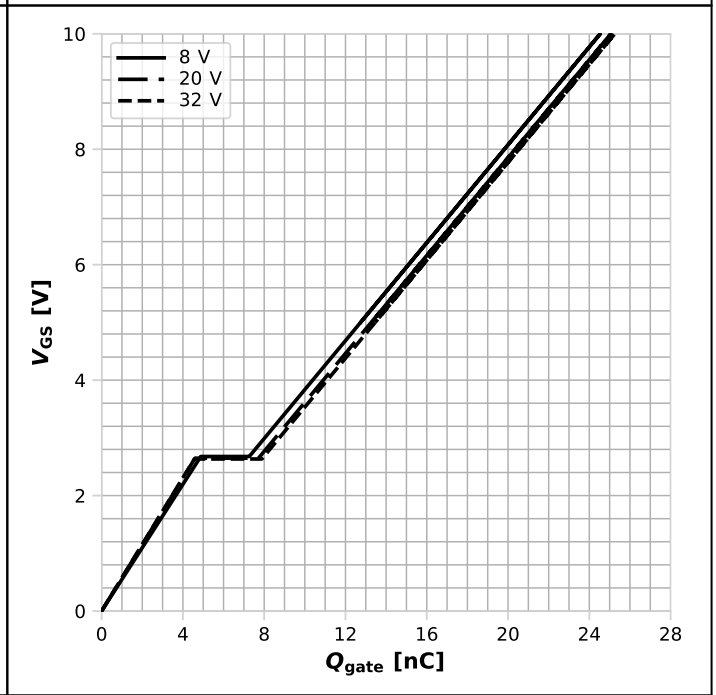
$I_F=f(V_{SD});$  parameter:  $T_j$

**Diagram 13: Avalanche characteristics**



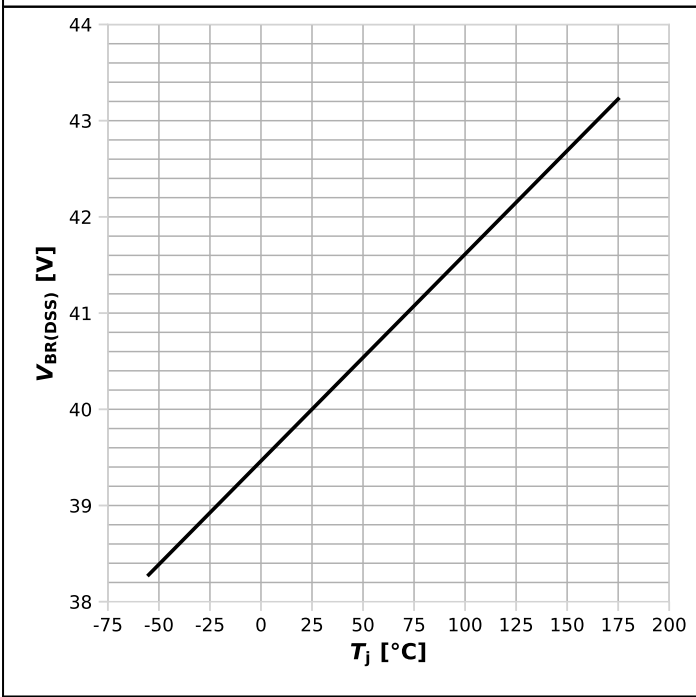
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j,start}$

**Diagram 14: Typ. gate charge**



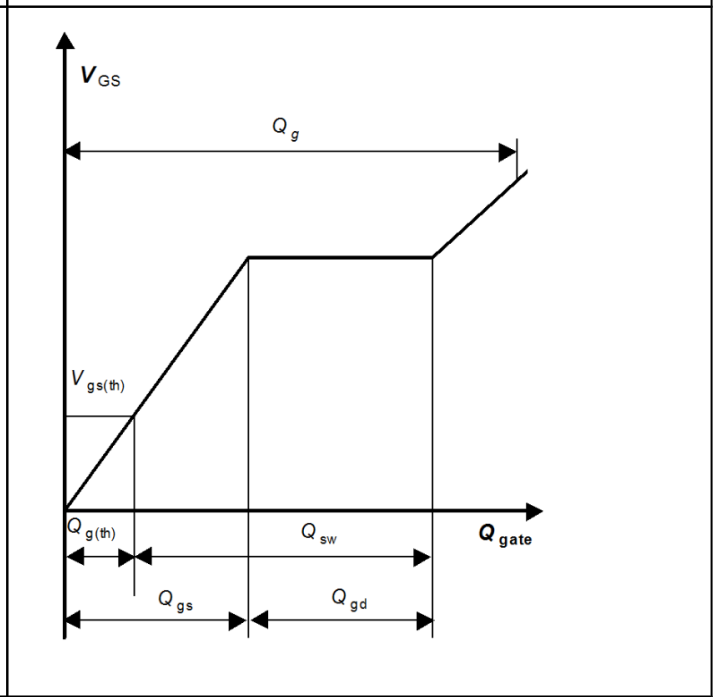
$V_{GS}=f(Q_{gate}), I_D=20 \text{ A pulsed}, T_j=25 \text{ °C}$ ; parameter:  $V_{DD}$

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



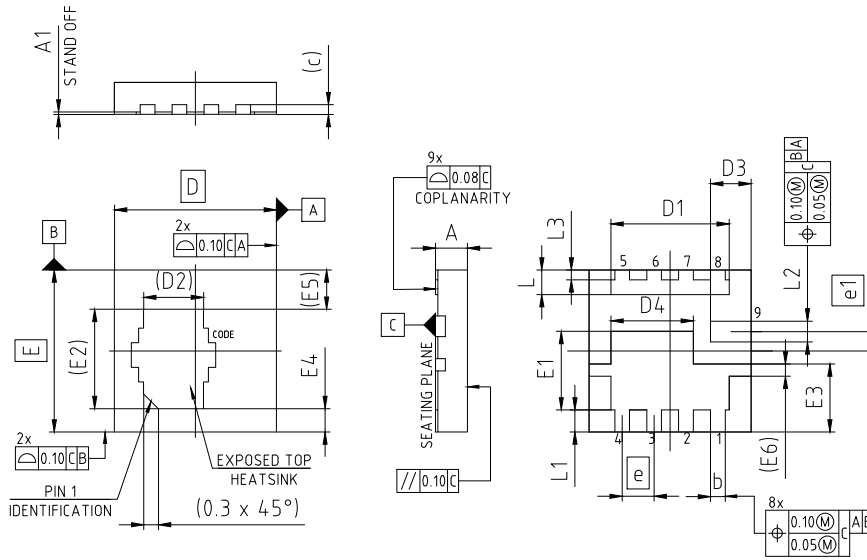
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$

**Gate charge waveforms**



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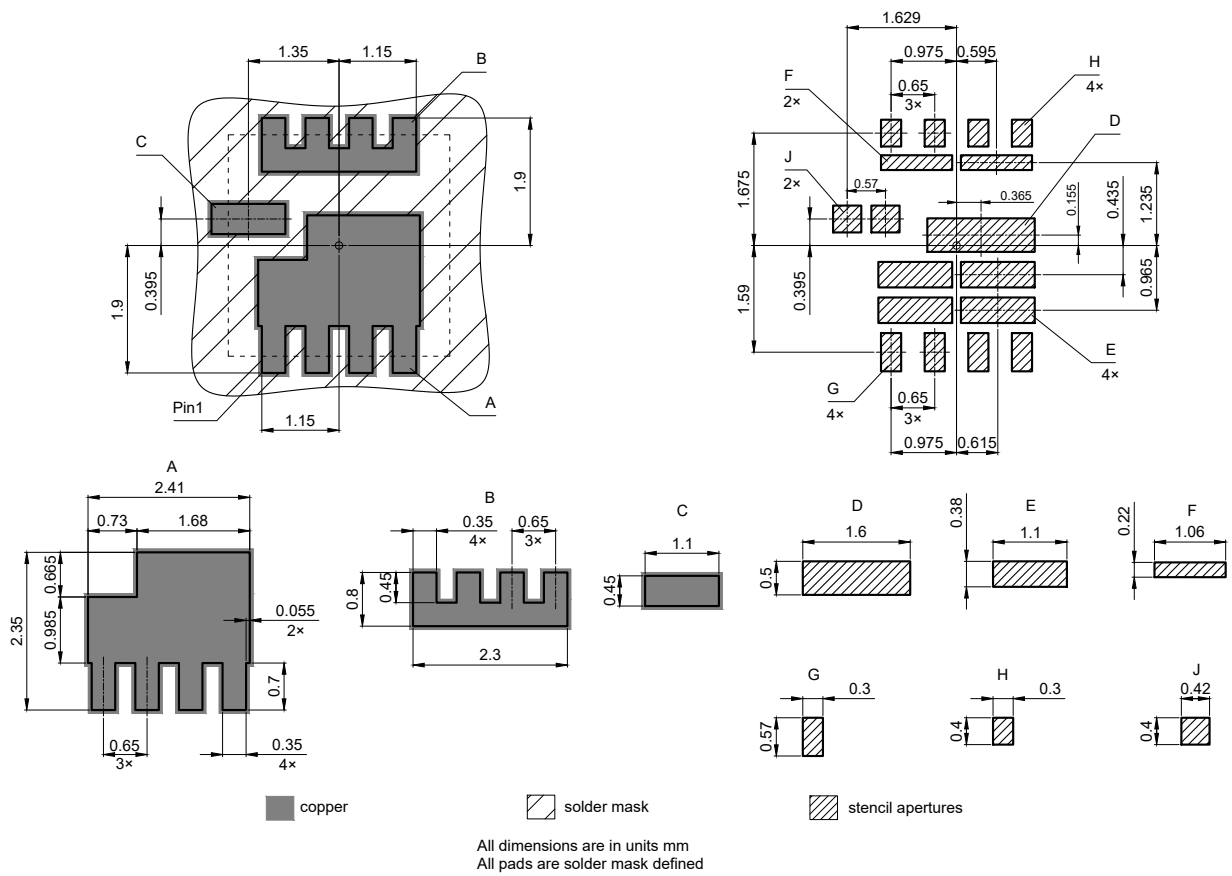
## 5 Package outlines



PACKAGE - GROUP NUMBER: PG-WHTFN-9-U03					
DIMENSIONS	MILLIMETERS		DIMENSIONS	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.55	0.75	E4	0.27	0.67
A1	---	0.05	E5	0.80	
b	0.20	0.40	E6	0.25	
c	0.20		e	0.65	
D	3.30		e1	0.395	
D1	2.31	2.51	L	0.40	0.60
D2	1.22		L1	0.35	0.55
D3	0.73	0.93	L2	0.32	0.52
D4	1.58	1.78	L3	0.10	0.30
E	3.30				
E1	1.50	1.70			
E2	2.03				
E3	1.285	1.485			

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

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



**Figure 2 Footprint drawing PG-WHTFN-9, dimensions in mm**



**Revision history**

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IQE020N04LM6CGSC

**Revision 2025-12-17, Rev. 1.0**

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Previous revisions

Revision	Date	Subjects (major changes since last revision)
1.0	2025-12-17	Release of final datasheet

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