

MOSFET

OptiMOS™ 3 Power-Transistor, 250 V

Features

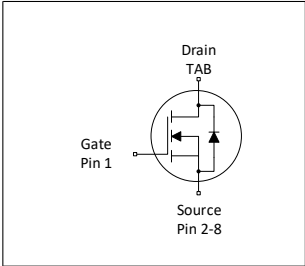
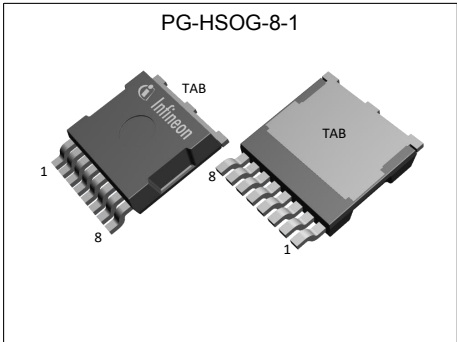
- N-channel, normal level
- Very low on-resistance $R_{DS(on)}$
- Fast diode (FD) with reduced Q_{rr}
- 175°C operating temperature
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- Optimized for hard commutation ruggedness

Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	250	V
$R_{DS(on),max}$	21.0	mΩ
I_D	77	A
Q_{oss}	144	nC
Q_G	65	nC



RoHS

Type / Ordering Code	Package	Marking	Related Links
IPTG210N25NM3FD	PG-HSOG-8-1	210N25NF	-

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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 ¹⁾	I_D	-	-	77 54 7.7	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{THJA}=40\text{ °C/W}^{2)}$
Pulsed drain current ³⁾	$I_{D,pulse}$	-	-	308	A	$T_A=25\text{ °C}$
Avalanche energy, single pulse ⁴⁾	E_{AS}	-	-	610	mJ	$I_D=37\text{ A}$, $R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	375 3.8	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{THJA}=40\text{ °C/W}^{2)}$
Operating and storage temperature	T_j , T_{stg}	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	0.2	0.4	K/W	-
Thermal resistance, junction - ambient, 6 cm ² cooling area	R_{thJA}	-	-	40	K/W	-
Thermal resistance, junction - ambient, minimal footprint ²⁾	R_{thJA}	-	-	62	K/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 drain connection. PCB is vertical in still air.

³⁾ See Diagram 3 for more detailed information

⁴⁾ 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	$V_{(BR)DSS}$	250	-	-	V	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2	3	4	V	$V_{DS}=V_{GS}$, $I_D=267\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1 100	μA	$V_{DS}=200\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=200\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	1	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	18.2	21.0	m Ω	$V_{GS}=10\text{ V}$, $I_D=69\text{ A}$
Gate resistance ¹⁾	R_G	-	2.8	4.2	Ω	-
Transconductance	g_{fs}	70	140	-	S	$ V_{DS} \geq 2 I_D /R_{DS(on)max}$, $I_D=69\text{ A}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance ¹⁾	C_{iss}	-	5300	7000	pF	$V_{GS}=0\text{ V}$, $V_{DS}=125\text{ V}$, $f=1\text{ MHz}$
Output capacitance ¹⁾	C_{oss}	-	300	390	pF	$V_{GS}=0\text{ V}$, $V_{DS}=125\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance ¹⁾	C_{rss}	-	6	11	pF	$V_{GS}=0\text{ V}$, $V_{DS}=125\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	13	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=34.5\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	13	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=34.5\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	43	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=34.5\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	13	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=34.5\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$

Table 6 Gate charge characteristics²⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	24	-	nC	$V_{DD}=125\text{ V}$, $I_D=69\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	16	-	nC	$V_{DD}=125\text{ V}$, $I_D=69\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge ¹⁾	Q_{gd}	-	7.5	11.3	nC	$V_{DD}=125\text{ V}$, $I_D=69\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	Q_{sw}	-	15.7	-	nC	$V_{DD}=125\text{ V}$, $I_D=69\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total ¹⁾	Q_g	-	65	81	nC	$V_{DD}=125\text{ V}$, $I_D=69\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	4.5	-	V	$V_{DD}=125\text{ V}$, $I_D=69\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Output charge ¹⁾	Q_{oss}	-	144	192	nC	$V_{DS}=125\text{ V}$, $V_{GS}=0\text{ V}$

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	-	-	77	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	308	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.90	1.2	V	$V_{GS}=0\text{ V}$, $I_F=69\text{ A}$, $T_j=25\text{ °C}$
Reverse recovery time ¹⁾	t_{rr}	-	134	268	ns	$V_R=125\text{ V}$, $I_F=69\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge ¹⁾	Q_{rr}	-	406	-	nC	$V_R=125\text{ V}$, $I_F=69\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$

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

4 Electrical characteristics diagrams

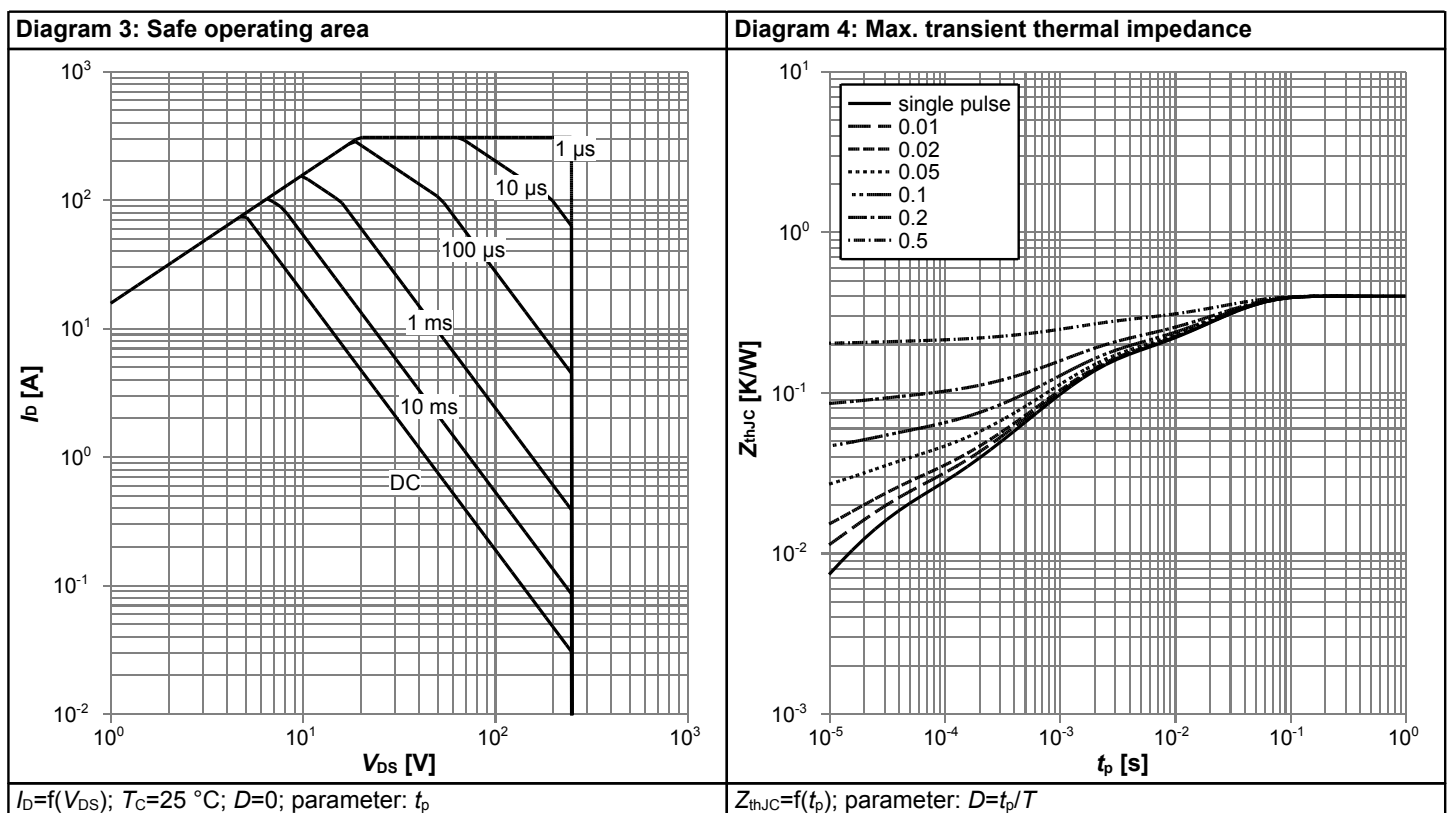
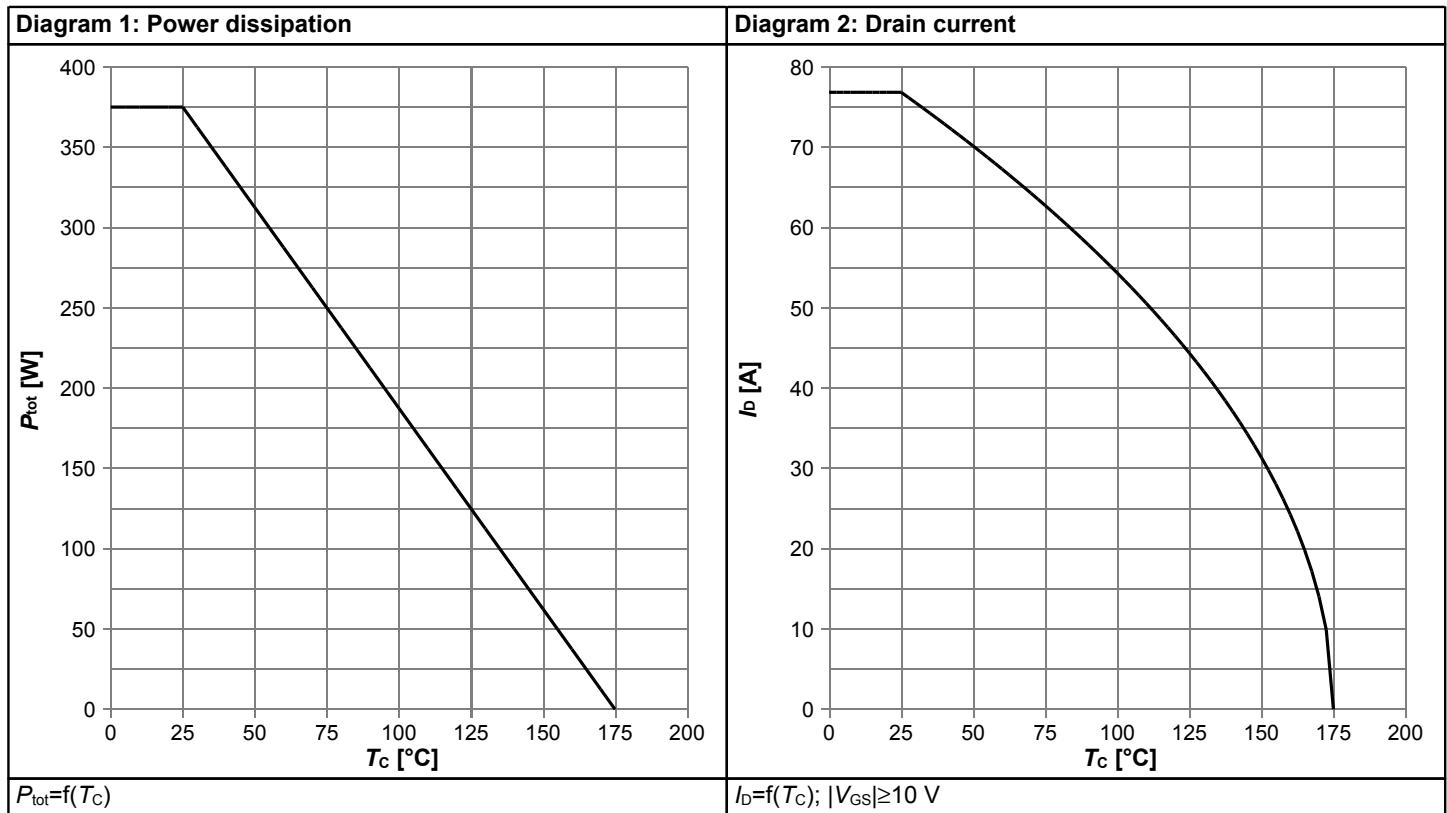
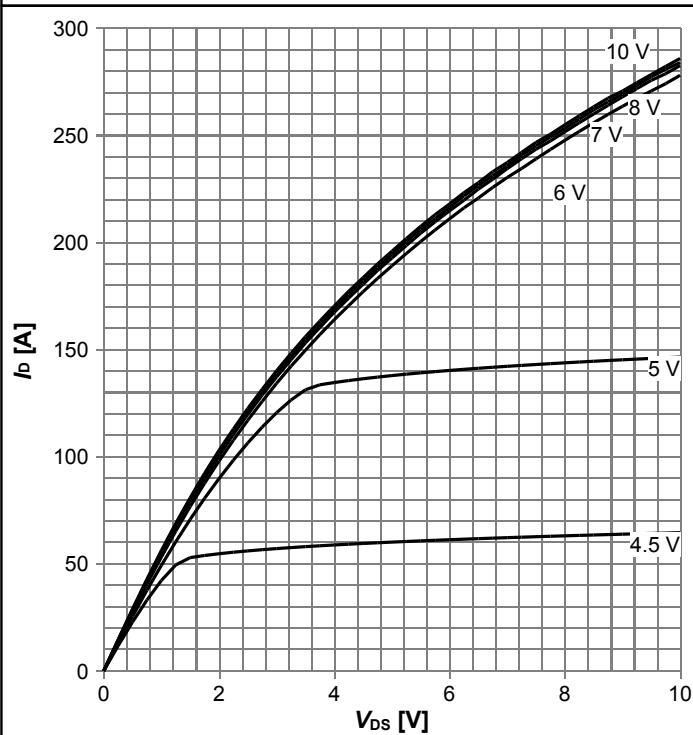
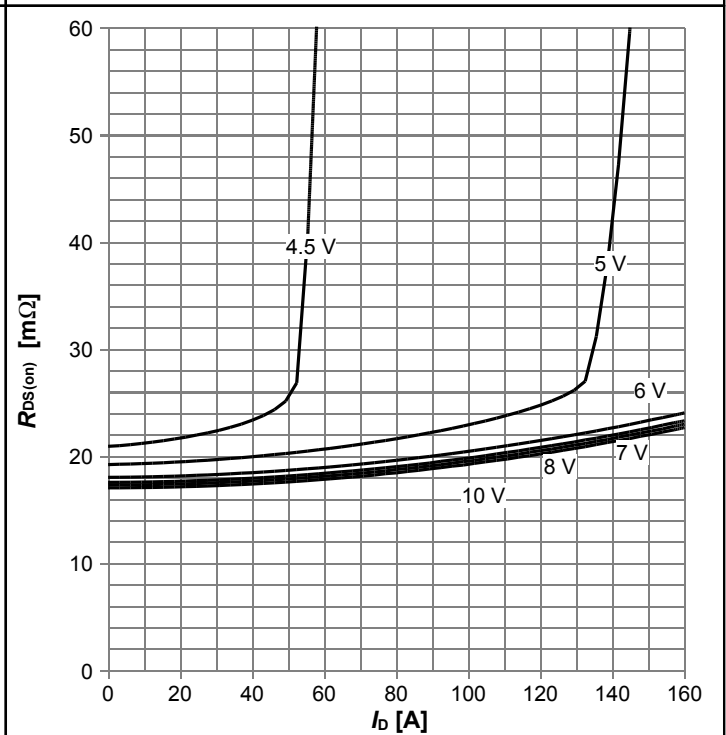


Diagram 5: Typ. output characteristics



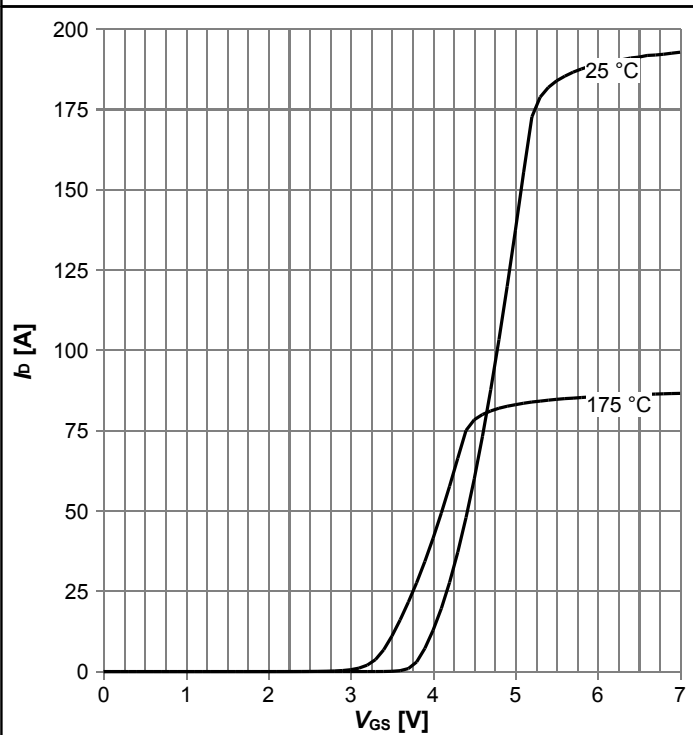
$I_D = f(V_{DS})$, $T_j = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



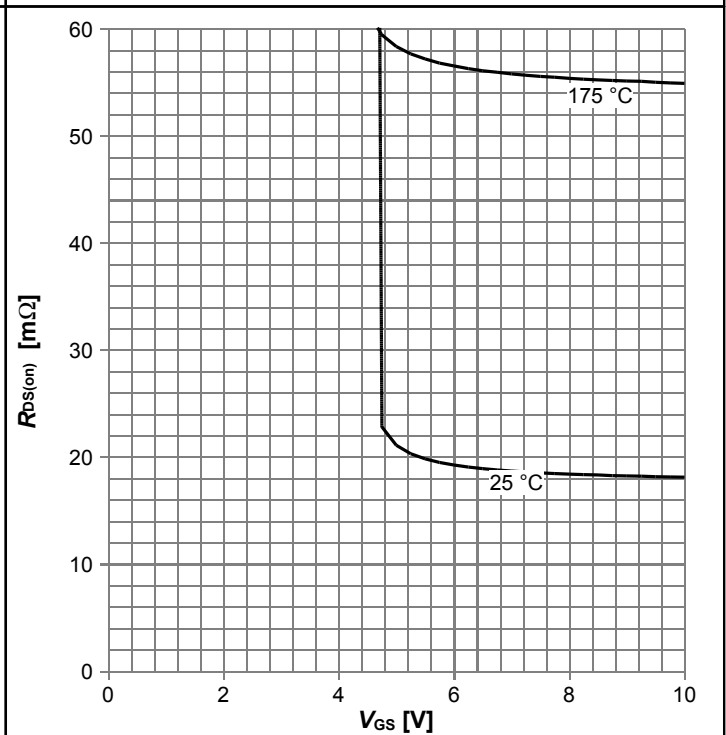
$R_{DS(on)} = f(I_D)$, $T_j = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



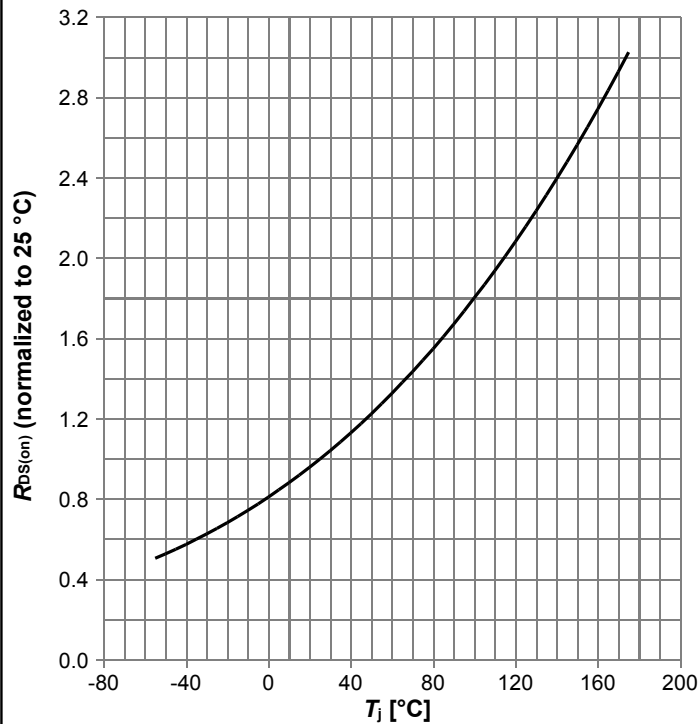
$I_D = f(V_{GS})$, $|V_{DS}| > 2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



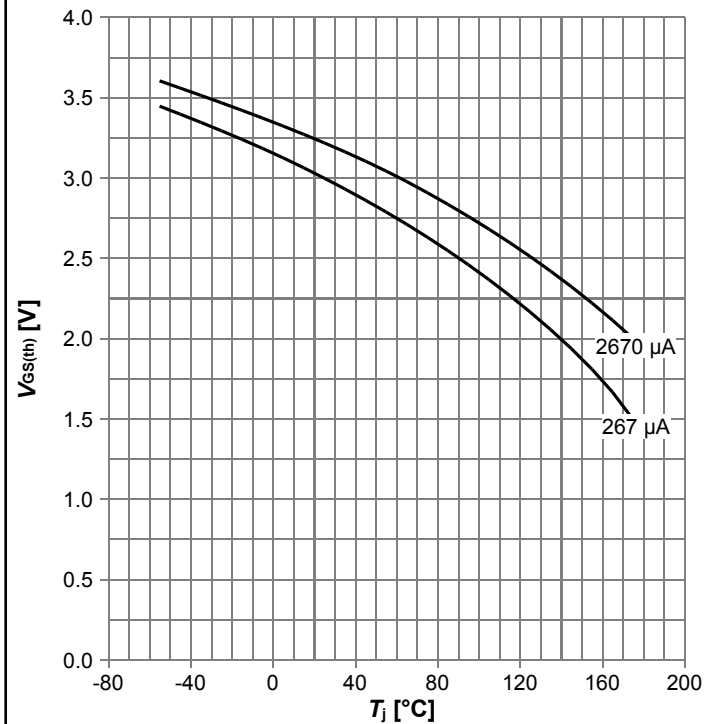
$R_{DS(on)} = f(V_{GS})$, $I_D = 69\text{ A}$; parameter: T_j

Diagram 9: Normalized drain-source on resistance



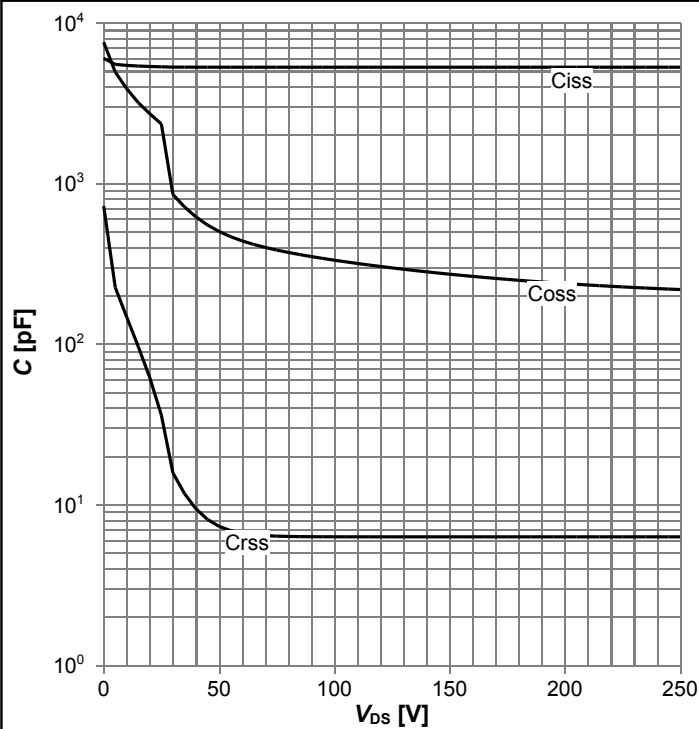
$$R_{DS(on)} = f(T_j), I_D = 69 \text{ A}, V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



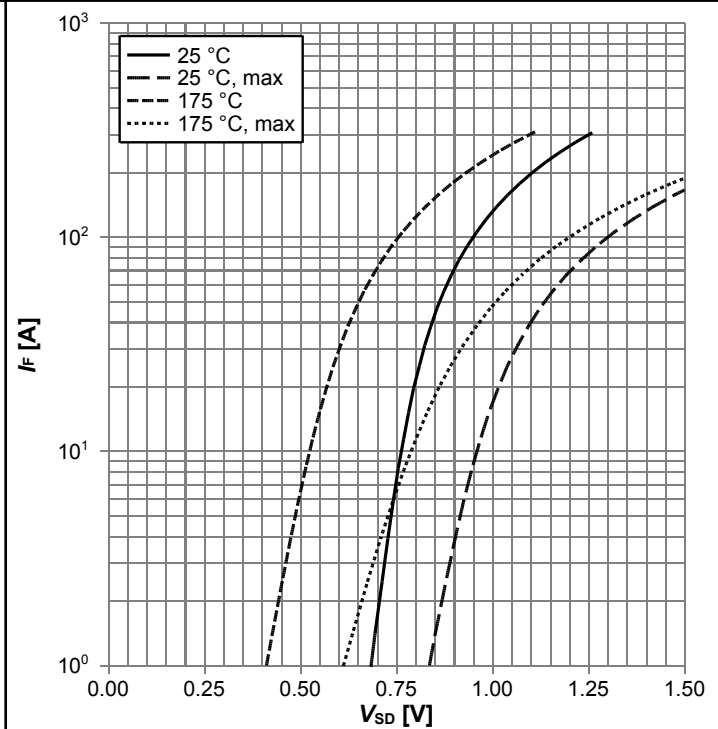
$$V_{GS(th)} = f(T_j), V_{GS} = V_{DS}; \text{ parameter: } I_D$$

Diagram 11: Typ. capacitances



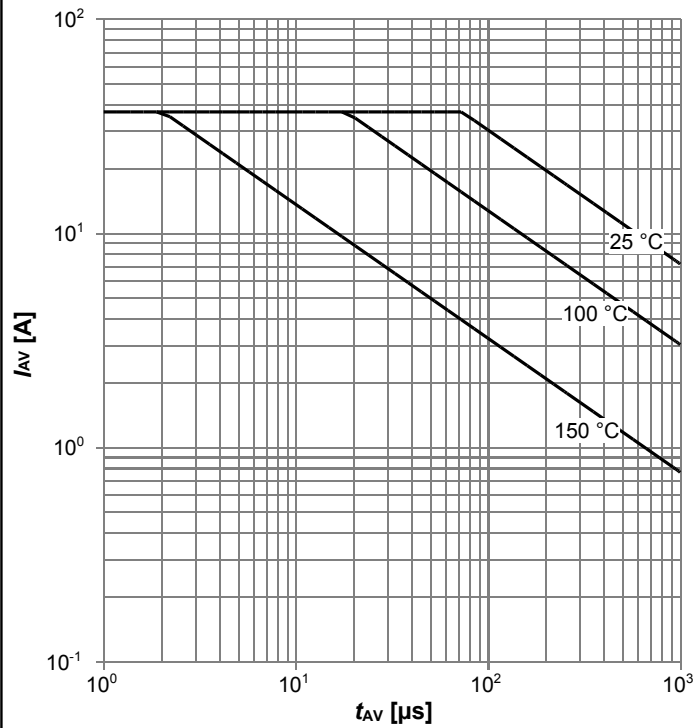
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

Diagram 12: Forward characteristics of reverse diode



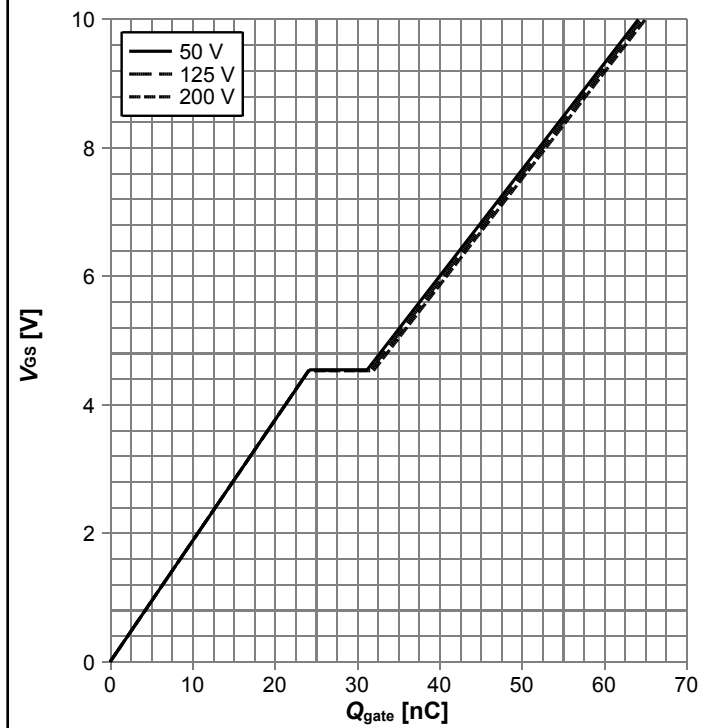
$$I_F = f(V_{SD}); \text{ parameter: } T_j$$

Diagram 13: Avalanche characteristics



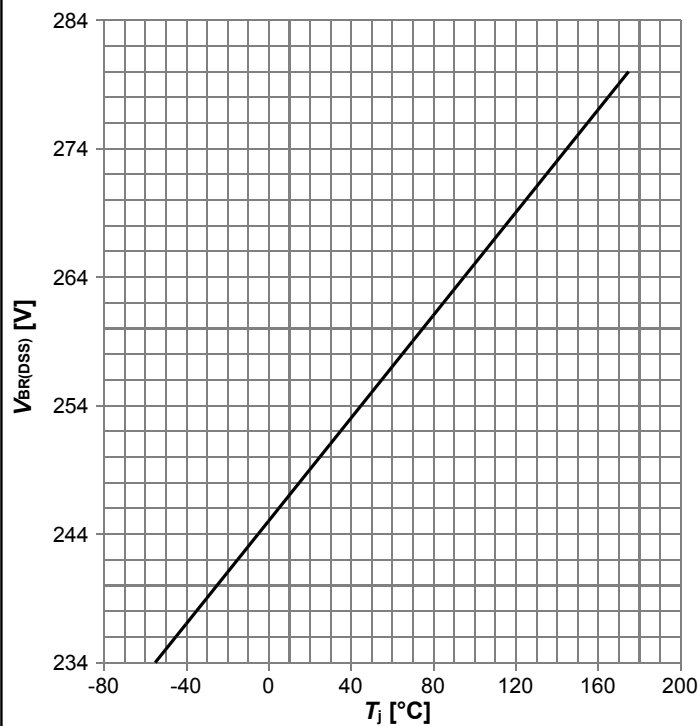
$I_{AS}=f(t_{AV})$; $R_{GS}=25 \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



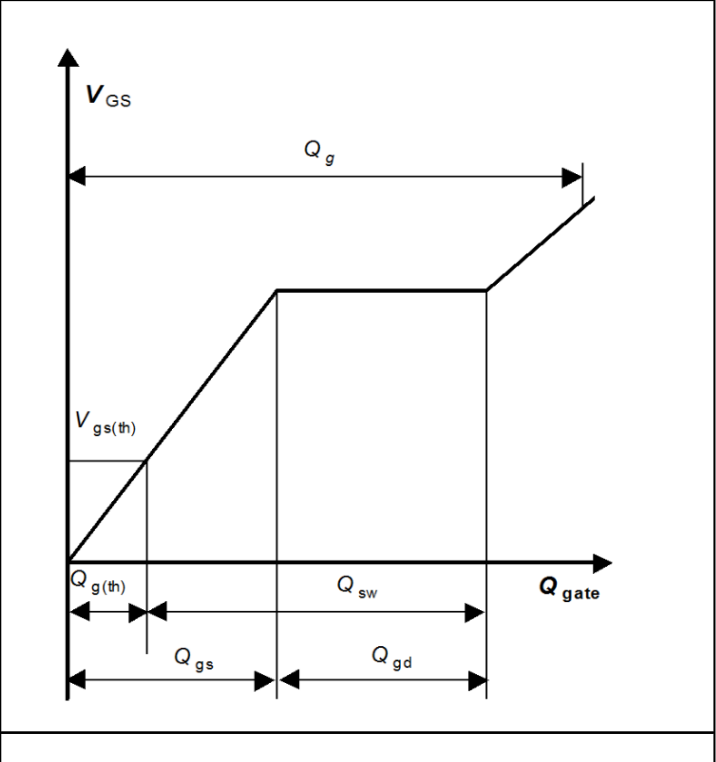
$V_{GS}=f(Q_{gate})$, $I_D=69$ A pulsed, $T_j=25$ °C; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

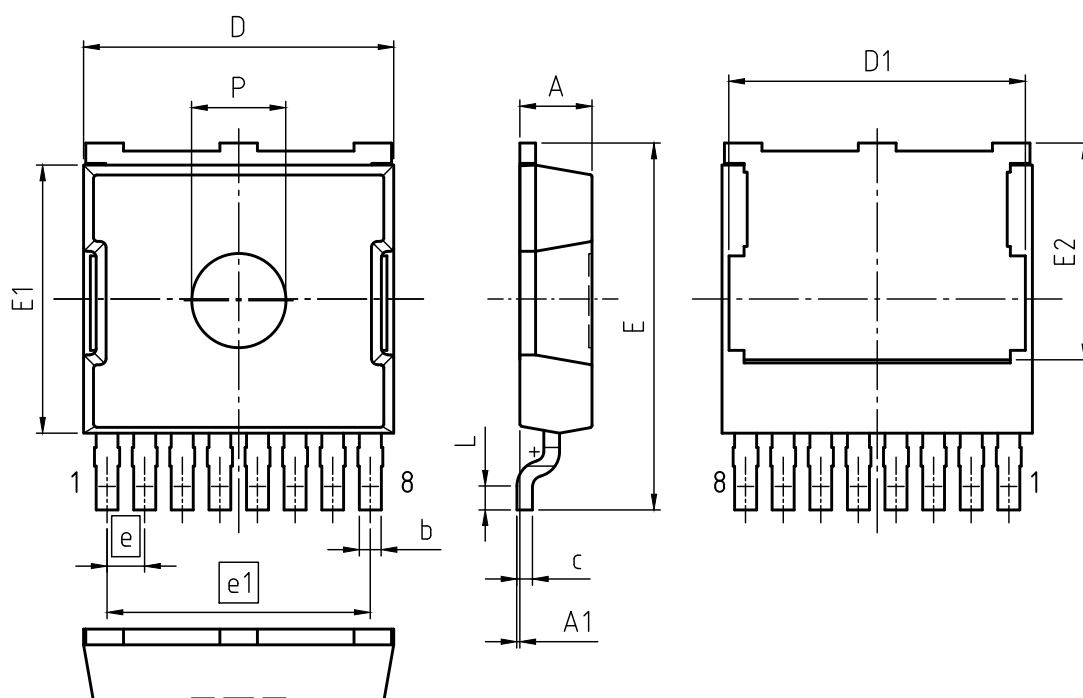


$V_{BR(DSS)}=f(T_j)$; $I_D=1$ mA

Diagram Gate charge waveforms



5 Package Outlines



PACKAGE - GROUP NUMBER: PG-HSOG-8-U01		
REVISION: 01		DATE: 08.02.2021
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	2.20	2.40
A1	0.00	0.10
b	0.60	0.80
c	0.40	0.60
D	9.70	10.10
D1	9.36	9.56
E	11.50	11.90
E1	8.45	8.75
E2	6.81	7.01
e	1.20	
e1	8.40	
L	0.66	0.86
P	2.90	3.10

Figure 1 Outline PG-HSOG-8-1, dimensions in mm

Revision History

IPTG210N25NM3FD

Revision: 2021-02-11, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2021-02-11	Release of final version

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