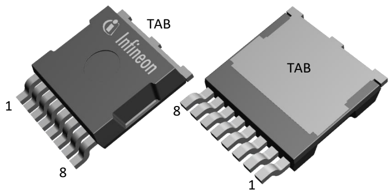
MOSFET

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

PG-HSOG-8-1



Product validation

Fully qualified according to JEDEC for Industrial Applications

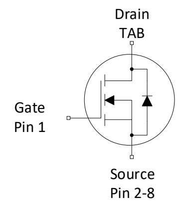


Table 1 Key Performance Parameters

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	-

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	- - -	- - -	77 54 7.7	A	V_{GS}=10 V, T_C=25 °C V_{GS}=10 V, T_C=100 °C V_{GS}=10 V, T_A=25°C, R_{THJA}=40°C/W[2]
Pulsed drain current[3]	$I_{D,pulse}$	-	-	308	A	T_A=25 °C
Avalanche energy, single pulse[4]	E_{AS}	-	-	610	mJ	I_D=37 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	- -	- -	375 3.8	W	T_C=25 °C T_A=25 °C, R_{THJA}=40 °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 cm² 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 cm^2 (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 °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 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	2	3	4	V	V_{DS}=V_{GS}, I_D=267 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	1 100	µA	V_{DS}=200 V, V_{GS}=0 V, T_j=25 °C V_{DS}=200 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	1	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	-	18.2	21.0	mΩ	V_{GS}=10 V, I_D=69 A
Gate resistance[1]	R_G	-	2.8	4.2	Ω	-
Transconductance	g_{fs}	70	140	-	S	$\lvert V_{DS}\rvert \geq 2\lvert I_D\rvert R_{DS(on)max}$, I_D=69 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 V, V_{DS}=125 V, f=1 MHz
Output capacitance[1]	C_{oss}	-	300	390	pF	V_{GS}=0 V, V_{DS}=125 V, f=1 MHz
Reverse transfer capacitance[1]	C_{rss}	-	6	11	pF	V_{GS}=0 V, V_{DS}=125 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	13	-	ns	V_{DD}=125 V, V_{GS}=10 V, I_D=34.5 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	13	-	ns	V_{DD}=125 V, V_{GS}=10 V, I_D=34.5 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	43	-	ns	V_{DD}=125 V, V_{GS}=10 V, I_D=34.5 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	13	-	ns	V_{DD}=125 V, V_{GS}=10 V, I_D=34.5 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	Q_{gs}	-	24	-	nC	V_{DD}=125 V, I_D=69 A, V_{GS}=0 to 10 V
Gate charge at threshold	$Q_{g(th)}$	-	16	-	nC	V_{DD}=125 V, I_D=69 A, V_{GS}=0 to 10 V
Gate to drain charge[1]	Q_{gd}	-	7.5	11.3	nC	V_{DD}=125 V, I_D=69 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	15.7	-	nC	V_{DD}=125 V, I_D=69 A, V_{GS}=0 to 10 V
Gate charge total[1]	Q_g	-	65	81	nC	V_{DD}=125 V, I_D=69 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	4.5	-	V	V_{DD}=125 V, I_D=69 A, V_{GS}=0 to 10 V
Output charge[1]	Q_{oss}	-	144	192	nC	V_{DS}=125 V, V_{GS}=0 V

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

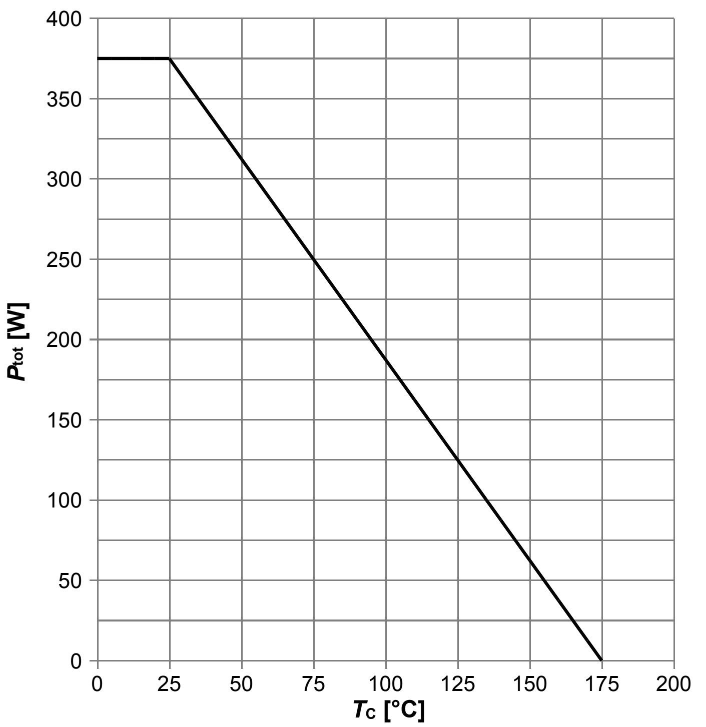
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	77	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	308	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.90	1.2	V	V_{GS}=0 V, I_F=69 A, T_j=25 °C
Reverse recovery time[1]	t_{rr}	-	134	268	ns	V_R=125 V, I_F=69 A, di_F/dt=100 A/µs
Reverse recovery charge[1]	Q_{rr}	-	406	-	nC	V_R=125 V, I_F=69 A, di_F/dt=100 A/µs

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

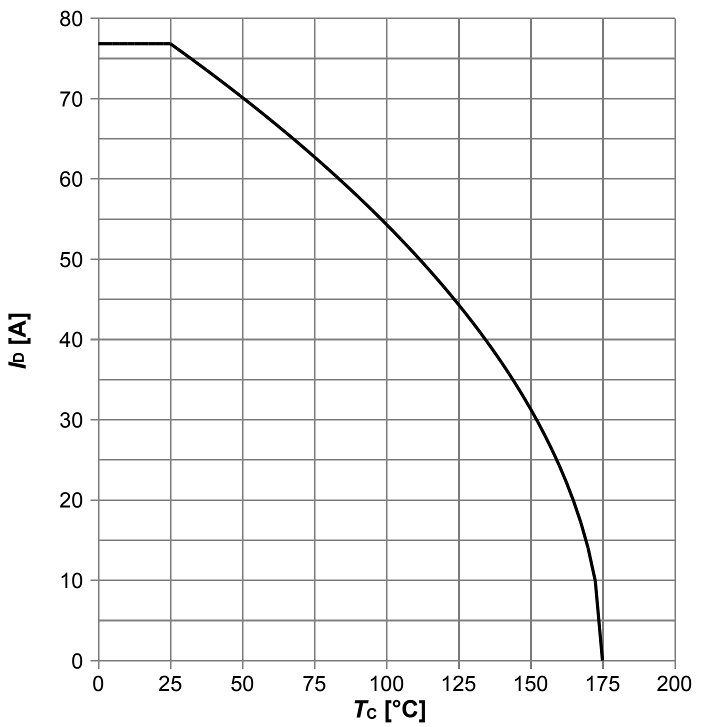
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



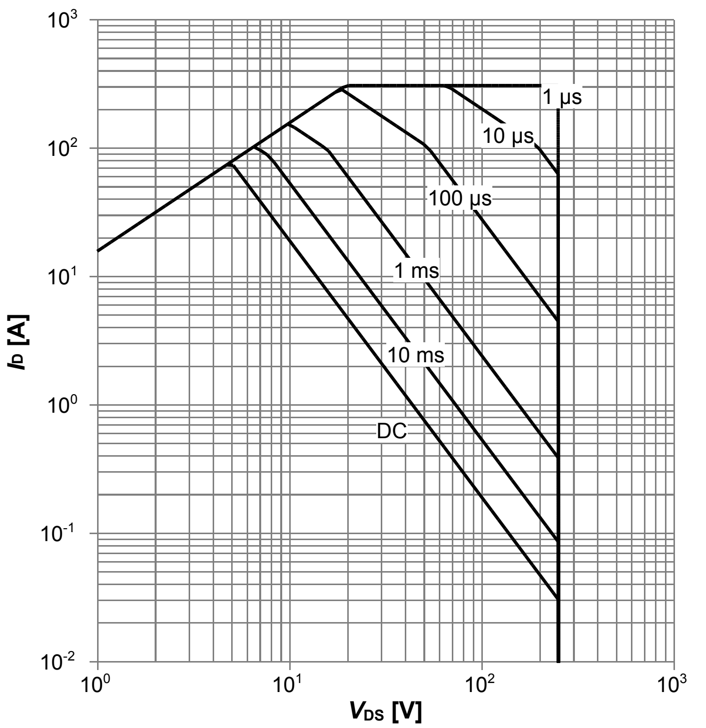
P_{tot}=f(T_C)

Diagram 2: Drain current



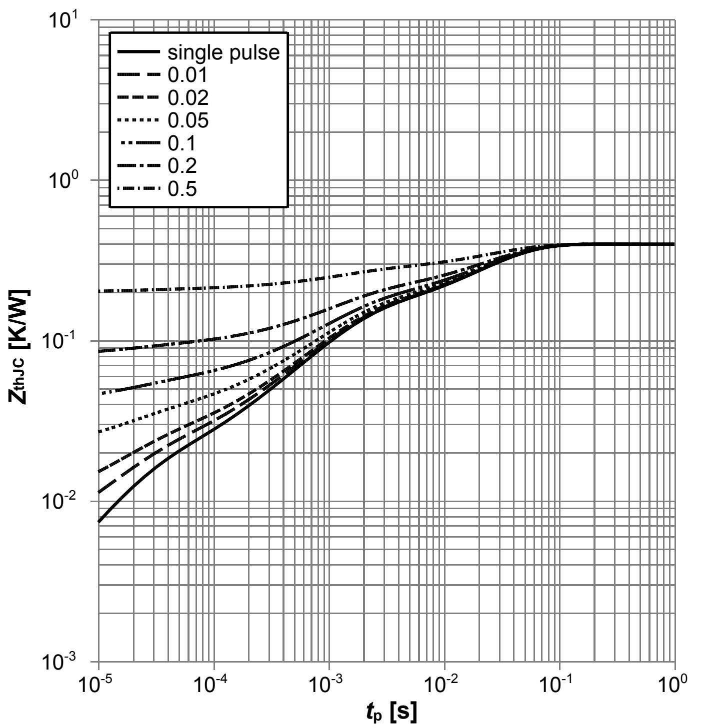
I_D=f(T_C); $|V_{GS}|$≥10 V

Diagram 3: Safe operating area



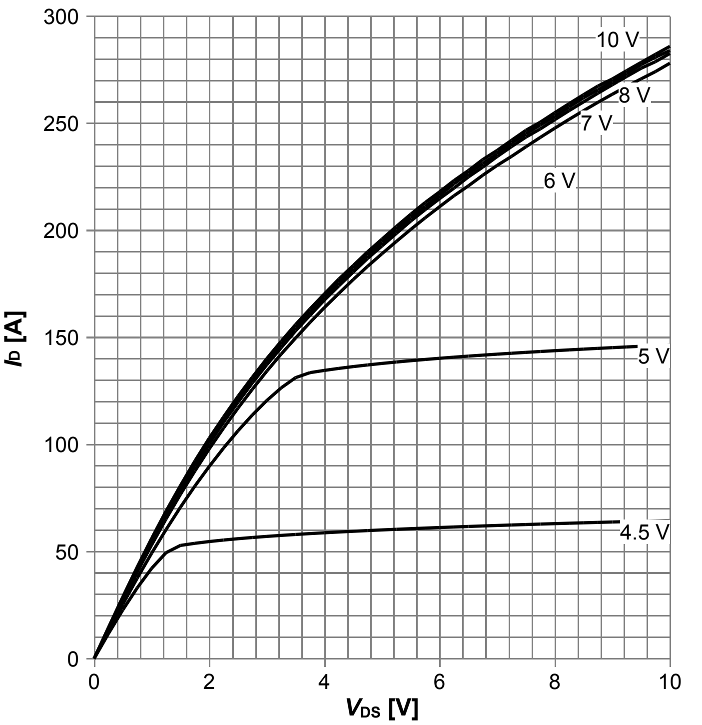
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



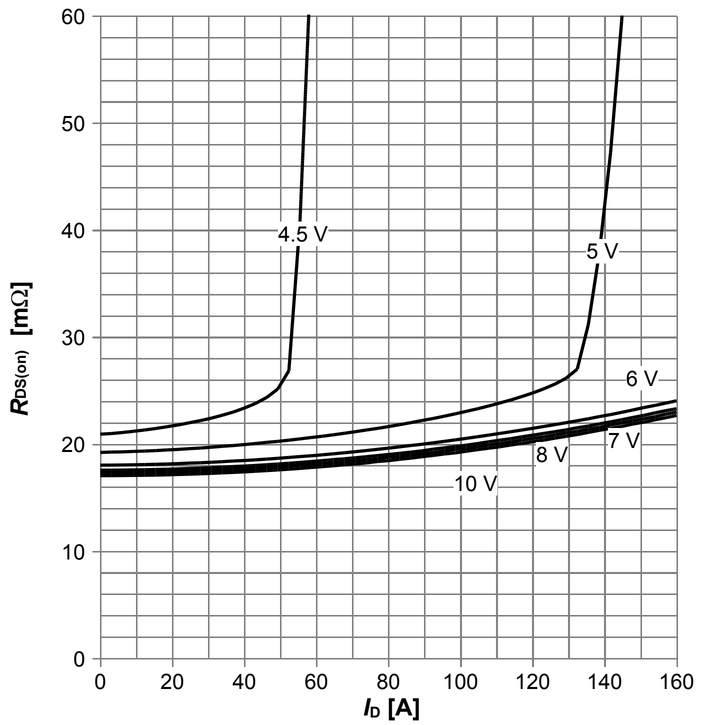
Z_{thJC}=f(t_p); parameter: D=t_p/T

Diagram 5: Typ. output characteristics



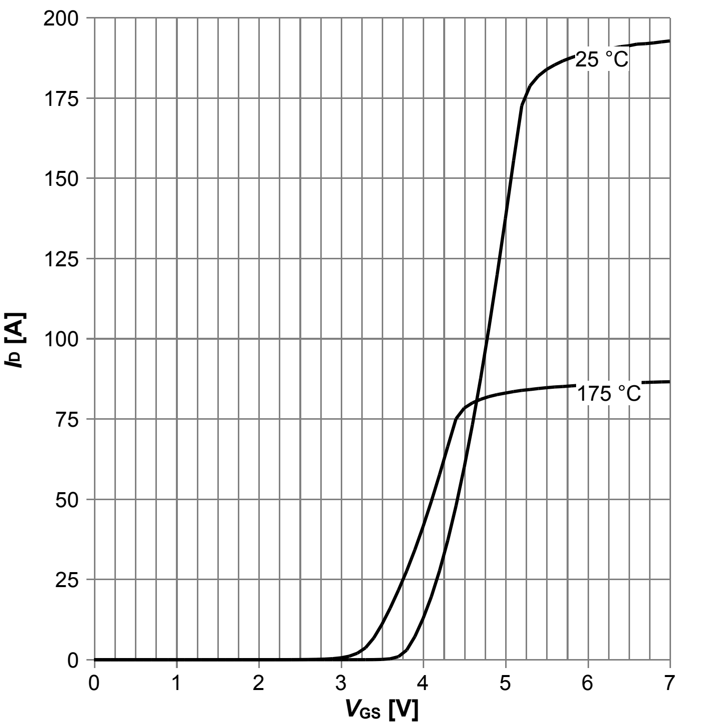
I_D=f(V_{DS}), T_j=25 °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



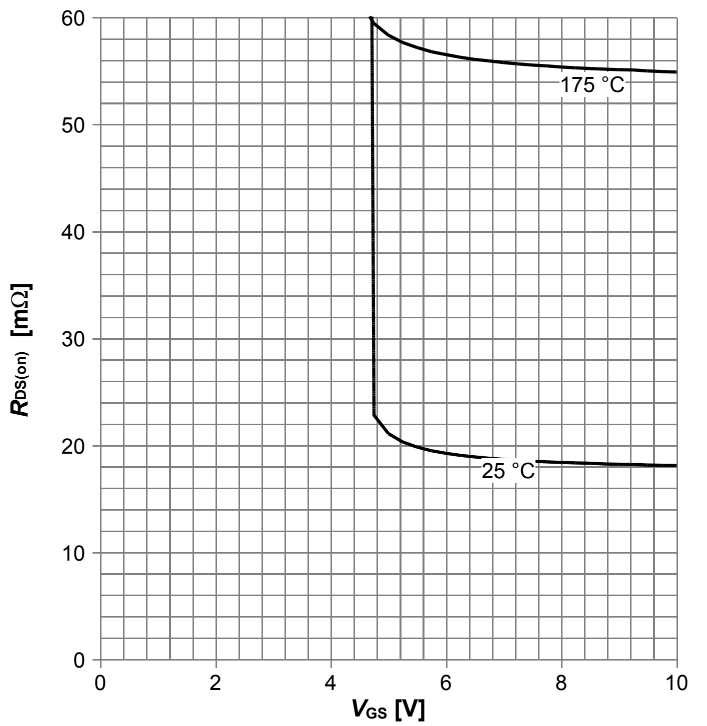
$R_{DS(on)}$=f(I_D), T_j=25 °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



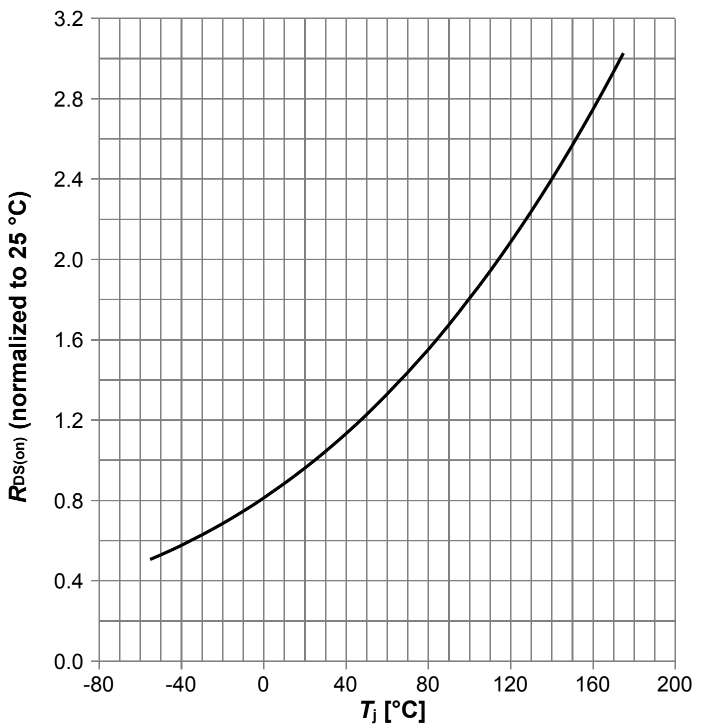
I_D=f(V_{GS}), |V_{DS}|>2|I_D|$R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



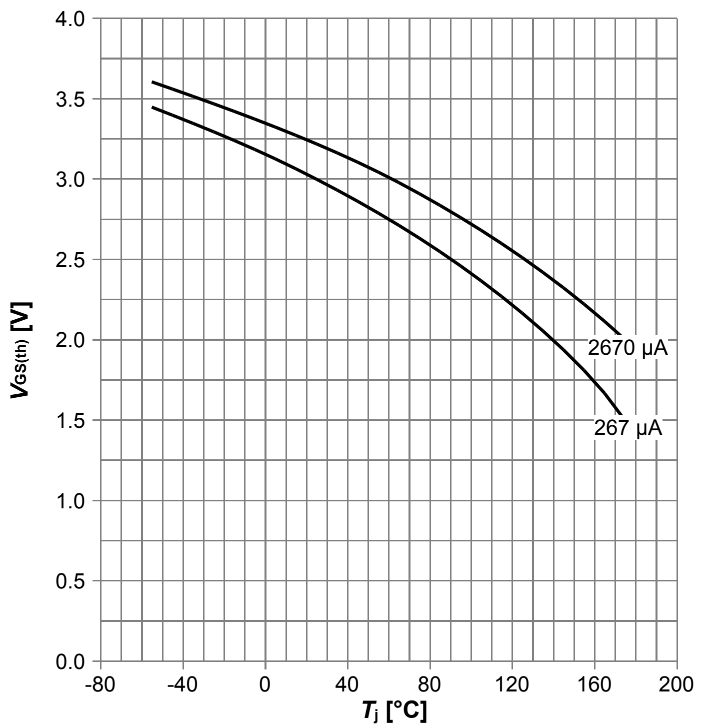
$R_{DS(on)}$=f(V_{GS}), I_D=69 A; parameter: T_j

Diagram 9: Normalized drain-source on resistance



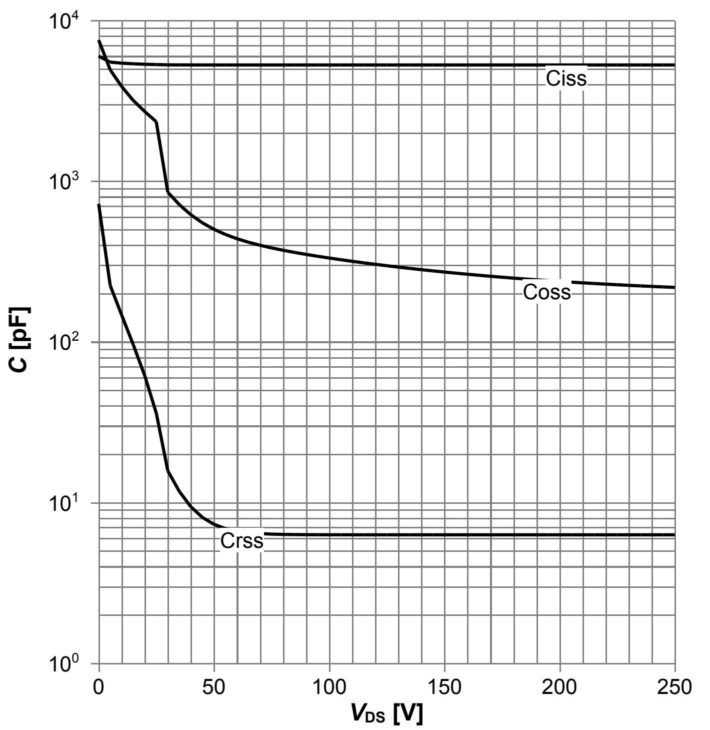
$R_{DS(on)}$=f(T_j), I_D=69 A, V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



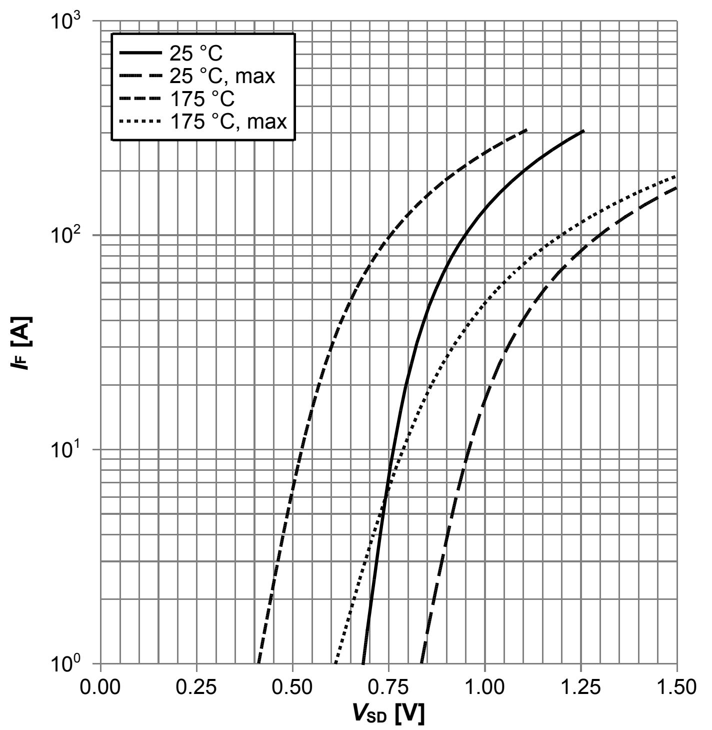
$V_{GS(th)}$=f(T_j), V_{GS}=V_{DS}; parameter: I_D

Diagram 11: Typ. capacitances



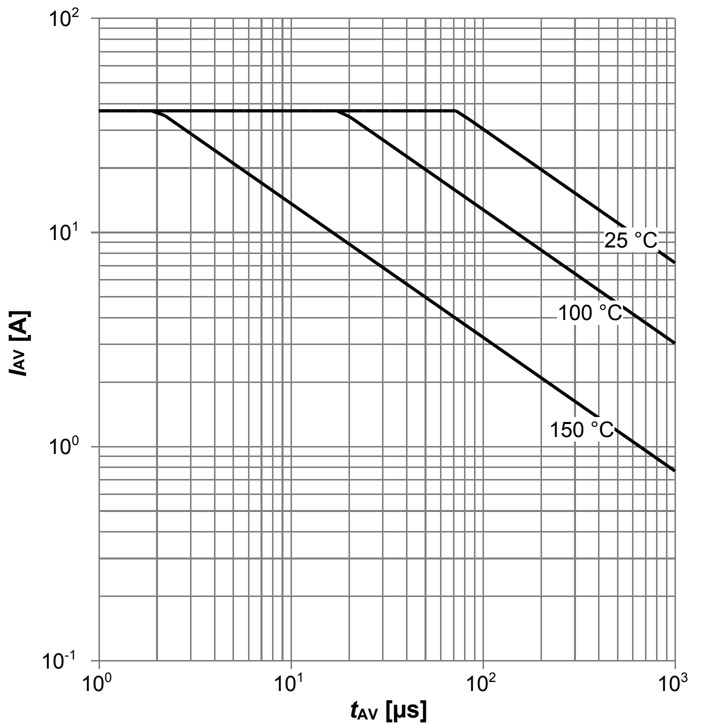
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



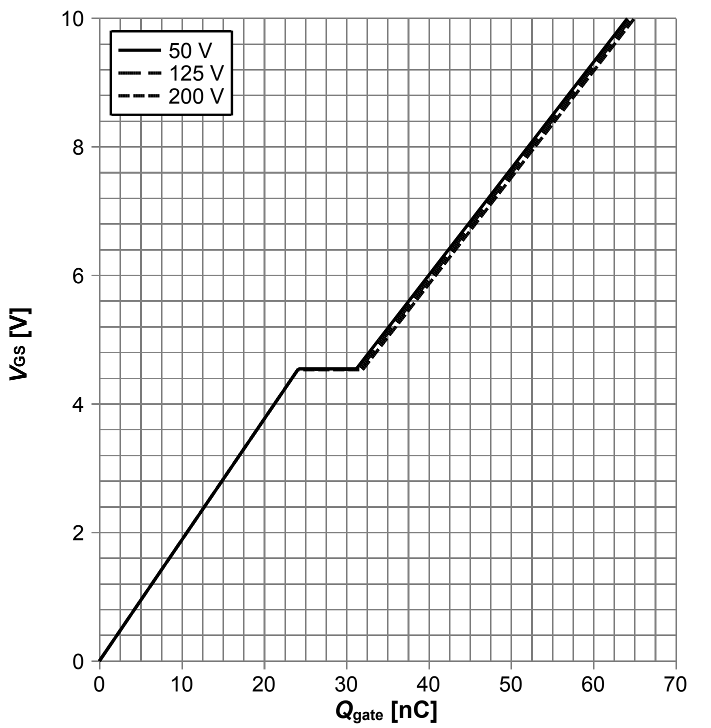
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



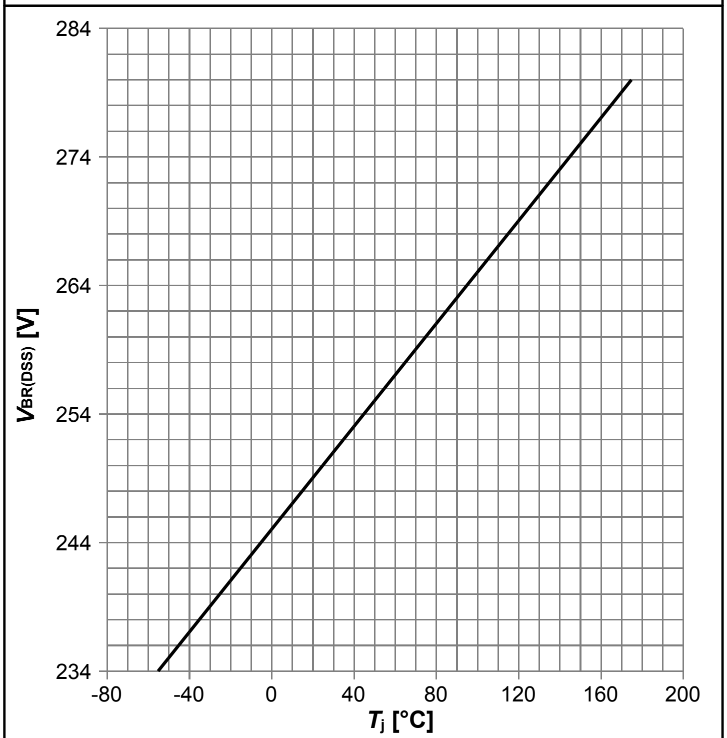
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



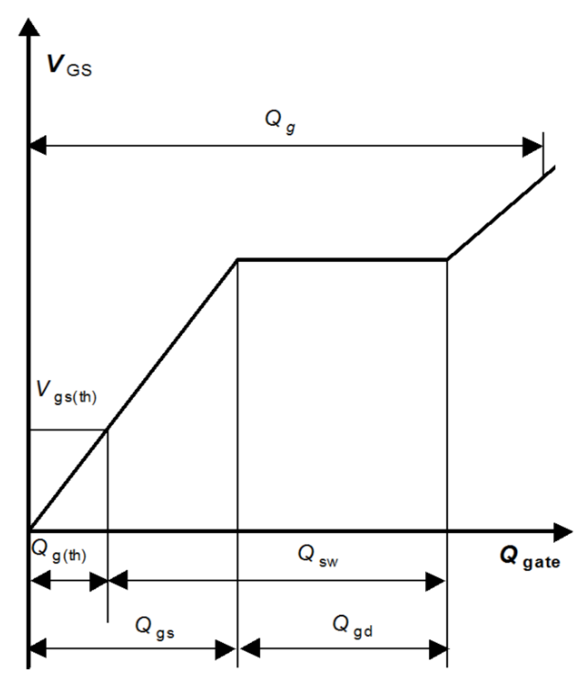
V_{GS}=f(Q_{gate}), I_D=69 A pulsed, T_j=25 °C; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

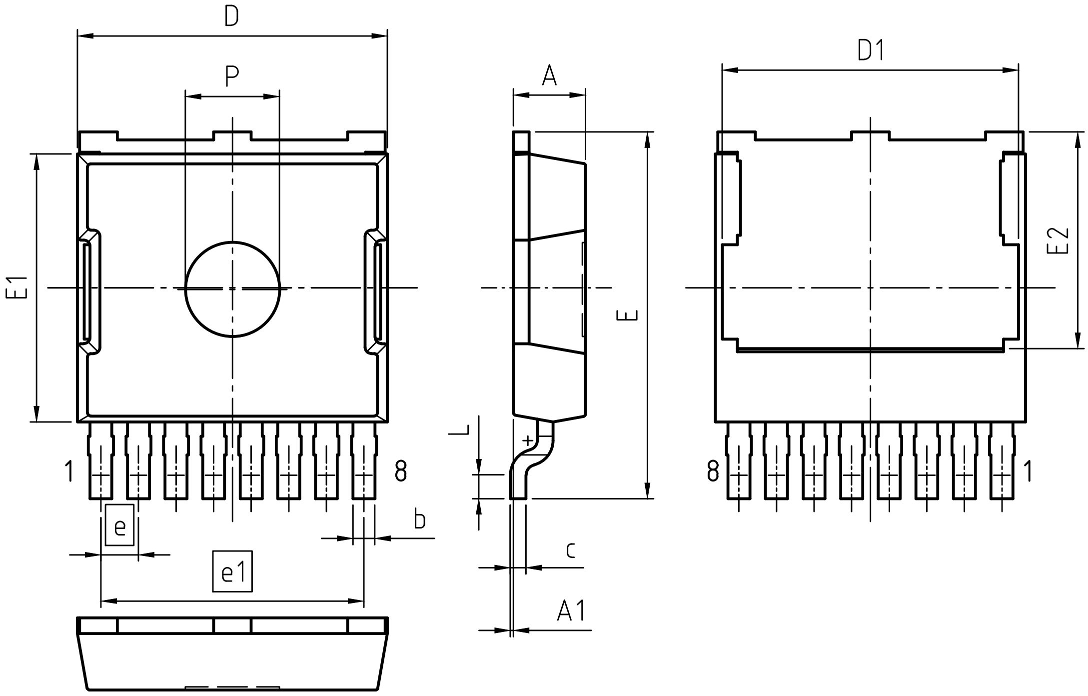


$V_{BR(DSS)}$=f(T_j); I_D=1 mA

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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Infineon Technologies AG
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