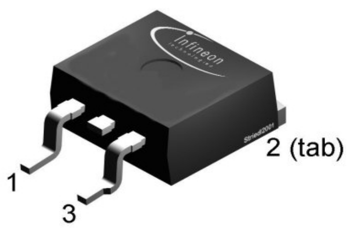
MOSFET

OptiMOS™5 Power-Transistor, 100 V

D²PAK

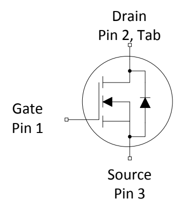


Features

- N-channel, normal level
- Optimized for FOM_{OSS}
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC[1] for target application
- Ideal for high-frequency switching and synchronous rectification

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	100	V
$R_{DS(on),max}$	2.0	mΩ
I_D	176	A



Type / Ordering Code	Package	Marking	Related Links
IPB020N10N5	PG-TO 263-3	020N10N5	-

[1] J-STD20 and JESD22

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	I_D	- -	- -	176 135	A	T_C=25 °C T_C=100 °C
Pulsed drain current[1)]	$I_{D,pulse}$	-	-	704	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	1166	mJ	I_D=50 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	375	W	T_C=25 °C
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}	-	0.3	0.4	K/W	-
Thermal resistance, junction - ambient, minimal footprint	R_{thJA}	-	-	62	K/W	-
Thermal resistance, junction - ambient, 6 cm² cooling area[2)]	R_{thJA}	-	-	40	K/W	-
Soldering temperature, wave and reflow soldering are allowed	T_{sold}	-	-	260	°C	reflow MSL1

[1)] see Diagram 3
[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 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	100	-	-	V	V_{GS}=0 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	2.2	3	3.8	V	V_{DS}=V_{GS}, I_D=270 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	7 100	µA	V_{DS}=100 V, V_{GS}=0 V, T_j=25 °C V_{DS}=100 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	$R_{DS(on)}$	- -	1.7 2.0	2.0 2.5	mΩ	V_{GS}=10 V, I_D=100 A V_{GS}=6 V, I_D=50 A
Gate resistance[1]	R_G	-	1.3	2	Ω	-
Transconductance	g_{fs}	124	248	-	S	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=100 A

Table 5 Dynamic characteristics[1]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	12000	15600	pF	V_{GS}=0 V, V_{DS}=50 V, f=1 MHz
Output capacitance	C_{oss}	-	1810	2353	pF	V_{GS}=0 V, V_{DS}=50 V, f=1 MHz
Reverse transfer capacitance	C_{rss}	-	80	140	pF	V_{GS}=0 V, V_{DS}=50 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	33	-	ns	V_{DD}=50 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	26	-	ns	V_{DD}=50 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	77	-	ns	V_{DD}=50 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	29	-	ns	V_{DD}=50 V, V_{GS}=10 V, I_D=100 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}	-	54	-	nC	V_{DD}=50 V, I_D=100 A, V_{GS}=0 to 10 V
Gate to drain charge[1]	Q_{gd}	-	34	51	nC	V_{DD}=50 V, I_D=100 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	52	-	nC	V_{DD}=50 V, I_D=100 A, V_{GS}=0 to 10 V
Gate charge total[1]	Q_g	-	168	210	nC	V_{DD}=50 V, I_D=100 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	4.5	-	V	V_{DD}=50 V, I_D=100 A, V_{GS}=0 to 10 V
Output charge[1]	Q_{oss}	-	213	283	nC	V_{DD}=50 V, V_{GS}=0 V

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

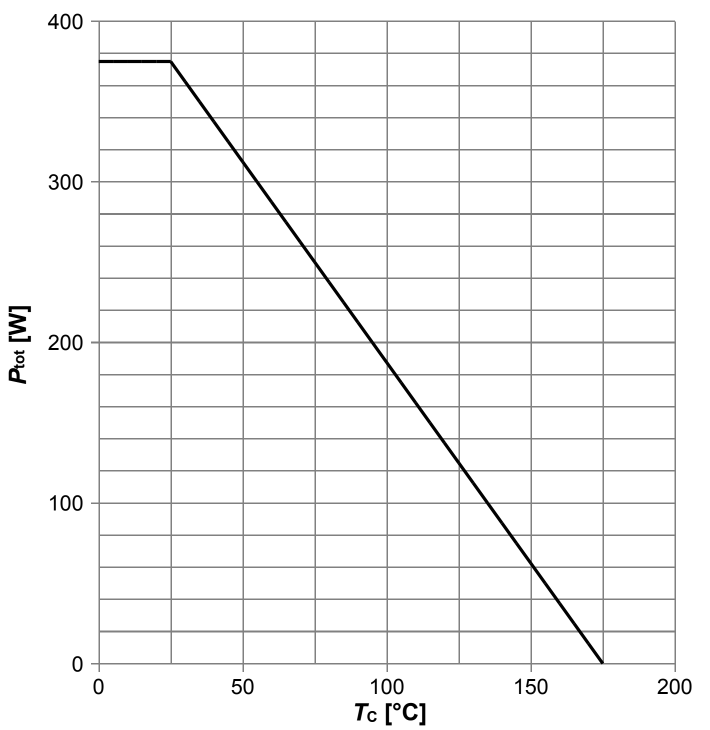
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continous forward current	I_S	-	-	155	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	704	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.9	1.2	V	V_{GS}=0 V, I_F=100 A, T_j=25 °C
Reverse recovery time[1)]	t_{rr}	-	99	198	ns	V_R=50 V, I_F=I_S, di_F/dt=100 A/µs
Reverse recovery charge[1)]	Q_{rr}	-	287	574	nC	V_R=50 V, I_F=I_S, di_F/dt=100 A/µs

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

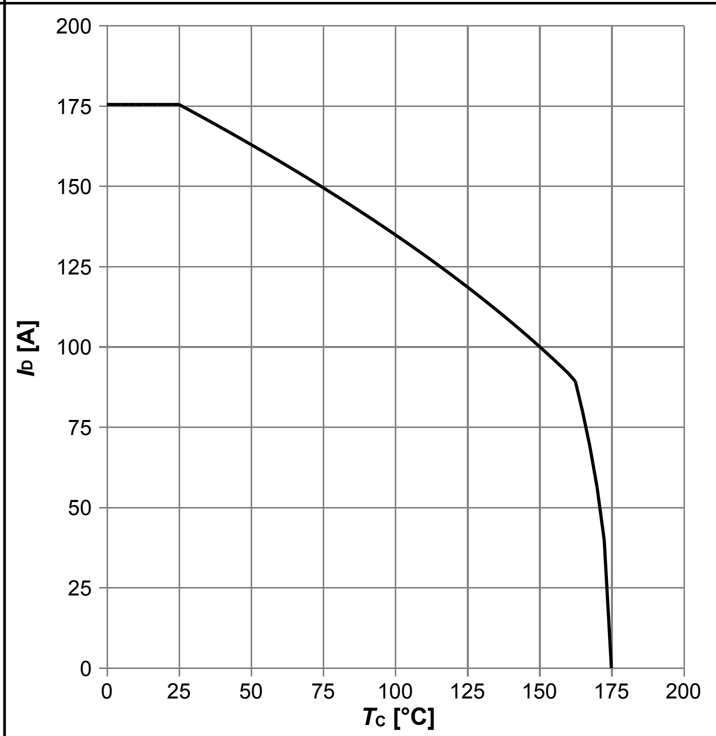
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



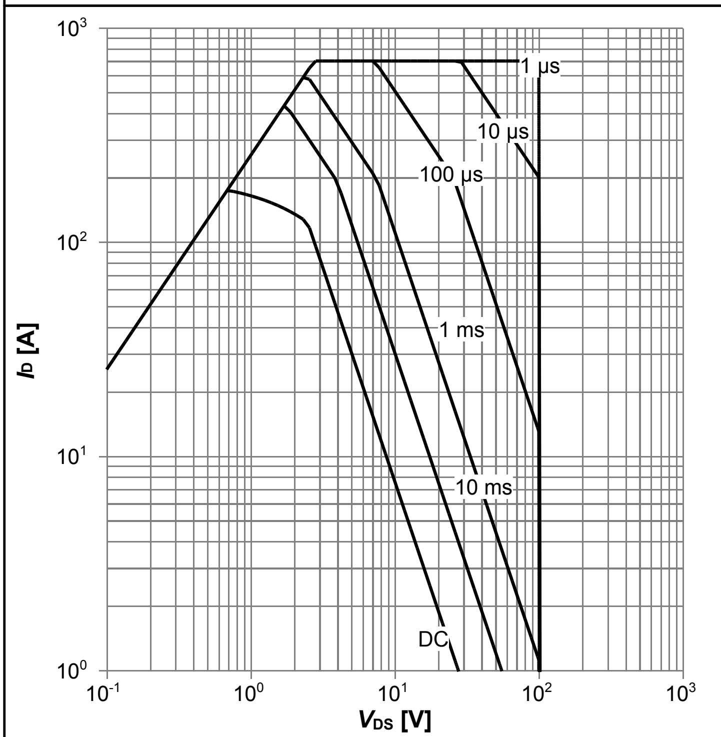
P_{tot}=f(T_C)

Diagram 2: Drain current



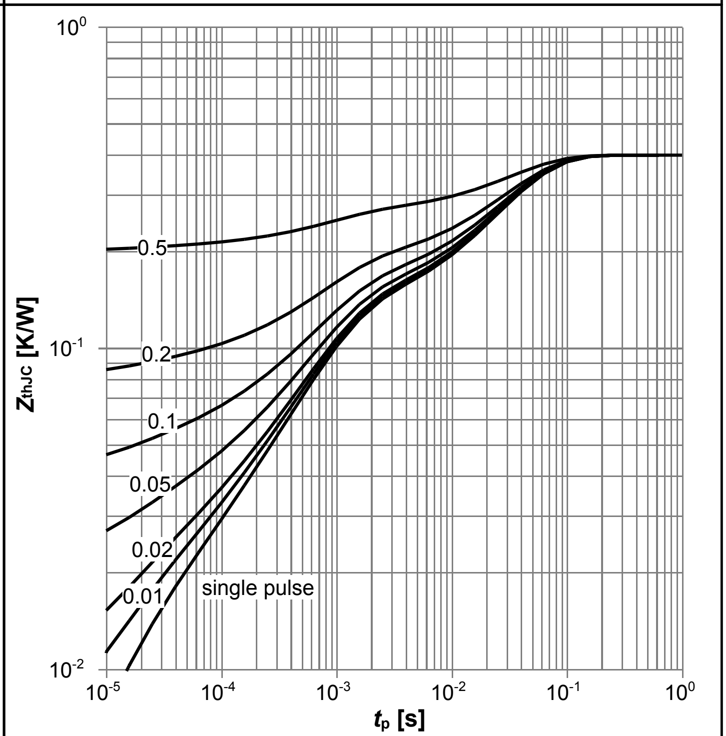
I_D=f(T_C); V_{GS}≥10 V

Diagram 3: Safe operating area



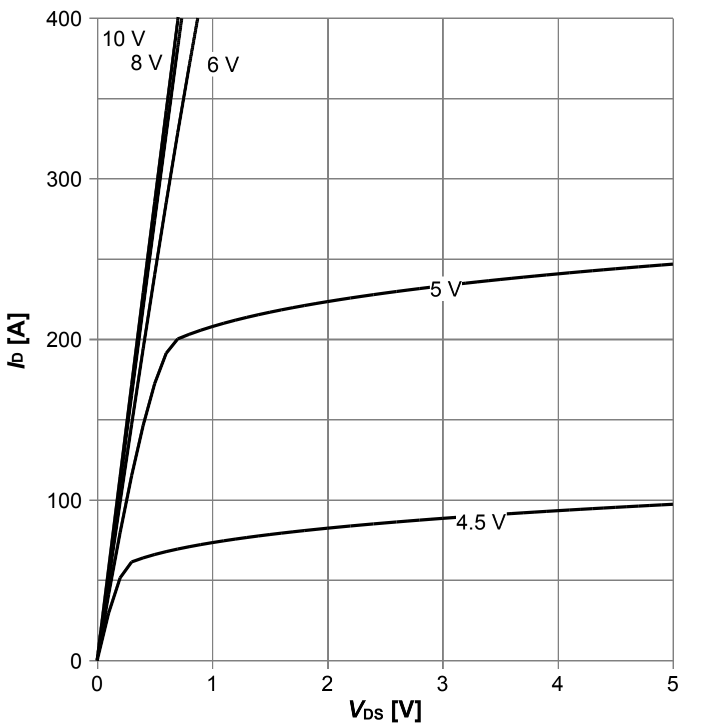
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



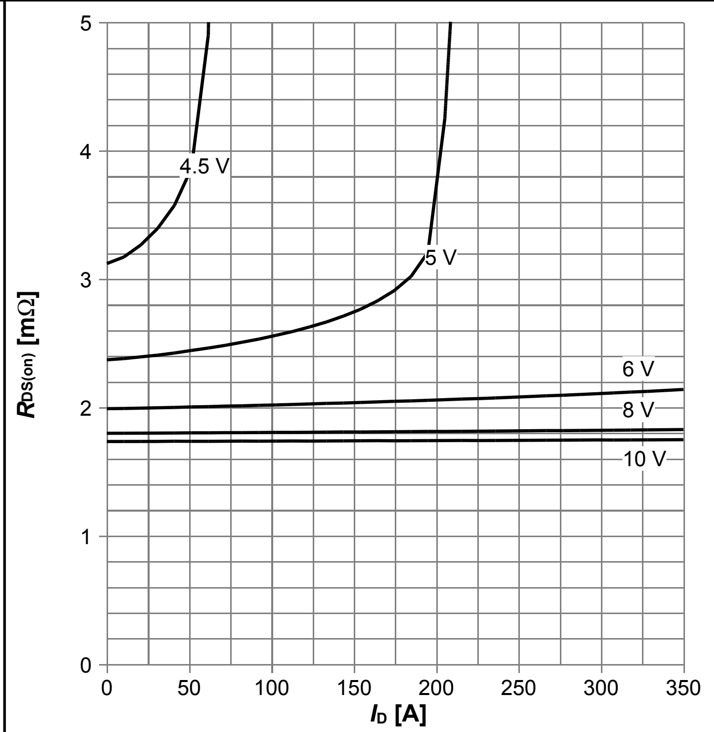
Z_{thJC}=f(t_p); parameter: D=t_p/T

Diagram 5: Typ. output characteristics



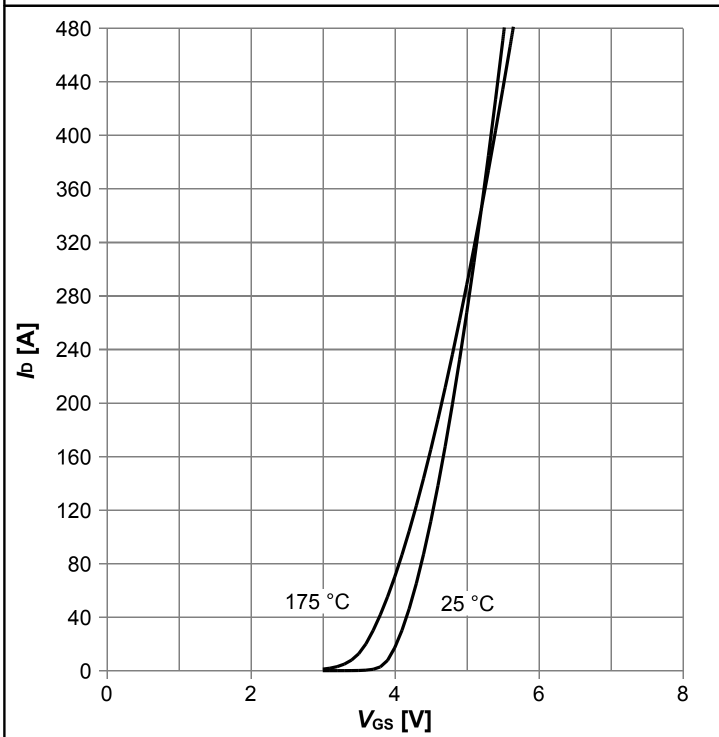
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



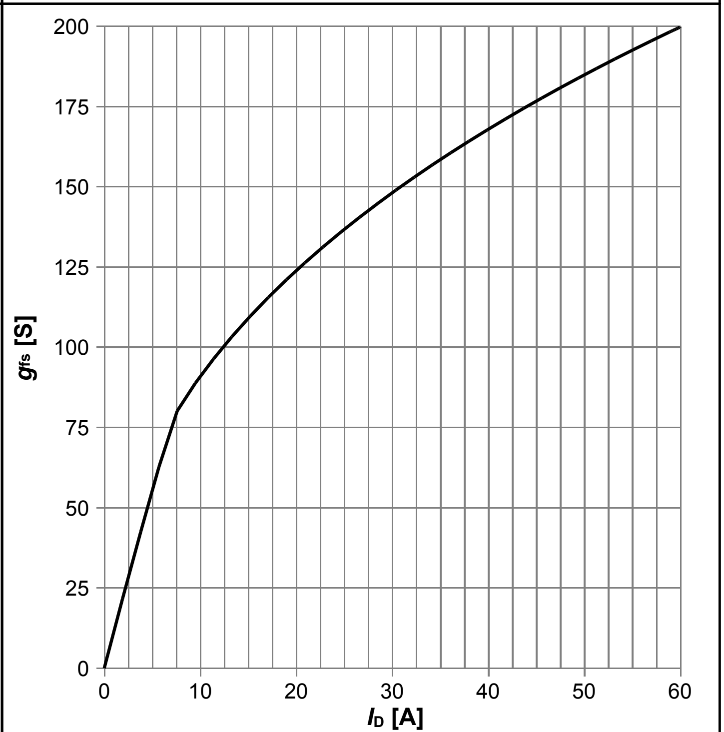
$R_{DS(on)}$=f(I_D); T_j=25 °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



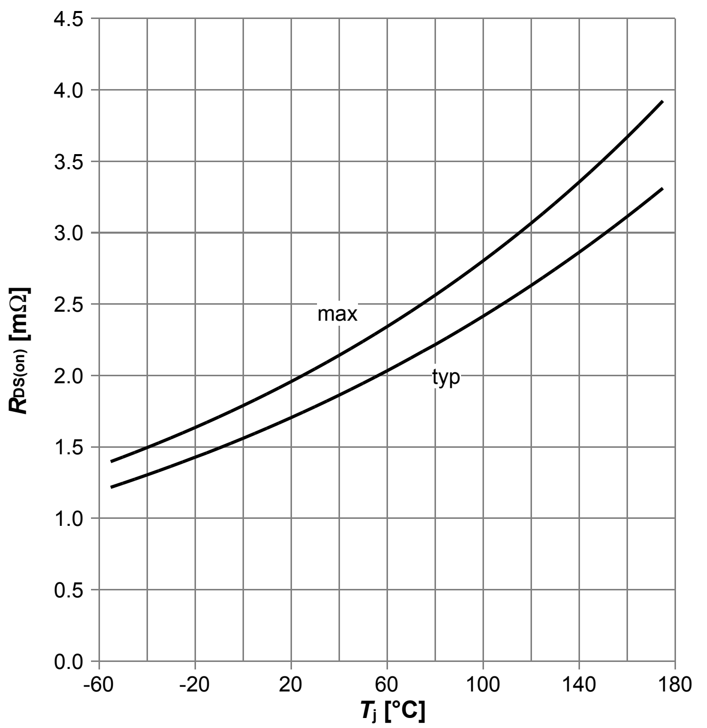
I_D=f(V_{GS}); $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. forward transconductance



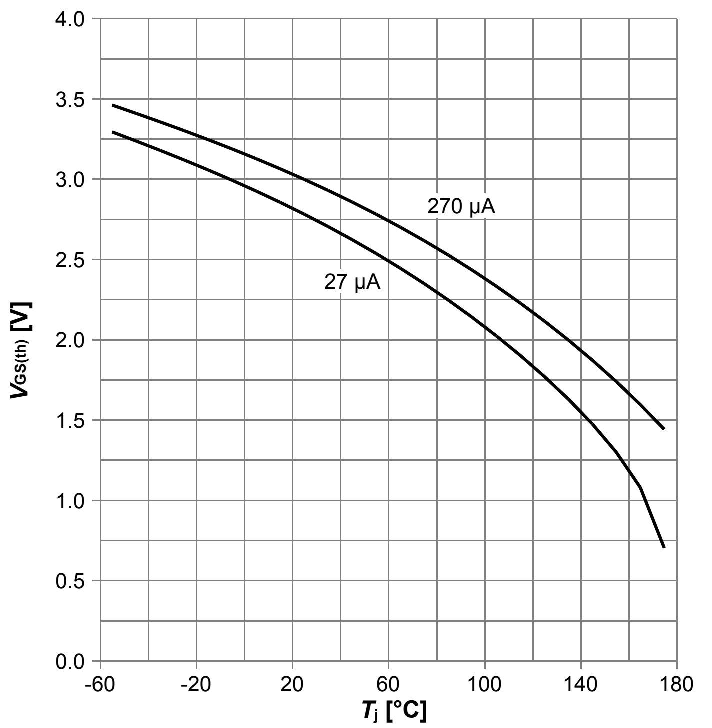
g_{fs}=f(I_D), V_{DS}=5 V, T_j=25 °C

Diagram 9: Drain-source on-state resistance



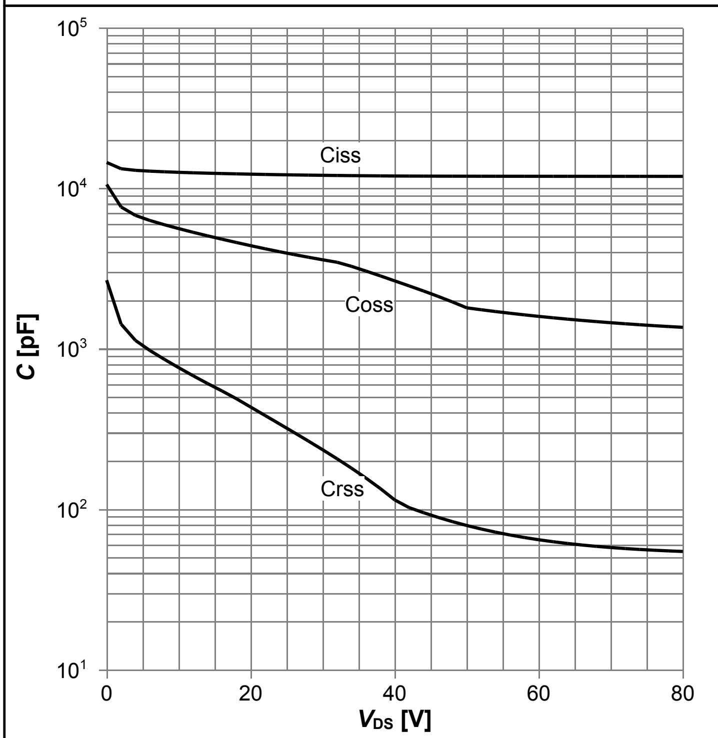
$R_{DS(on)}$=f(T_j); I_D=100 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



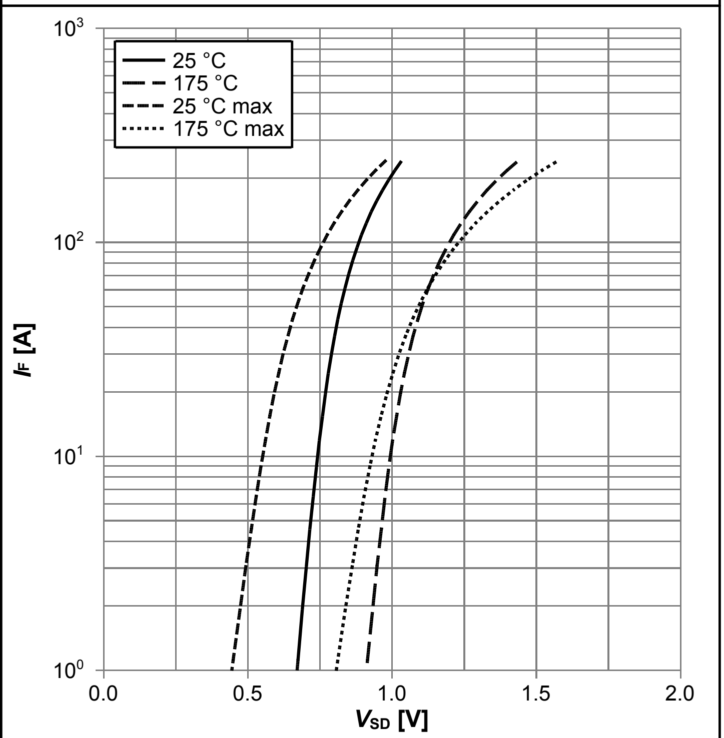
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; parameter: I_D

Diagram 11: Typ. capacitances



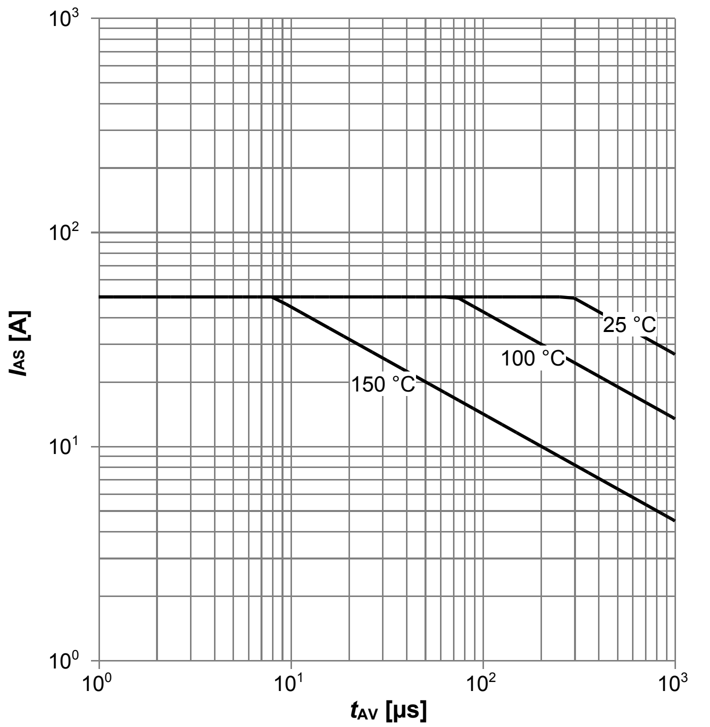
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



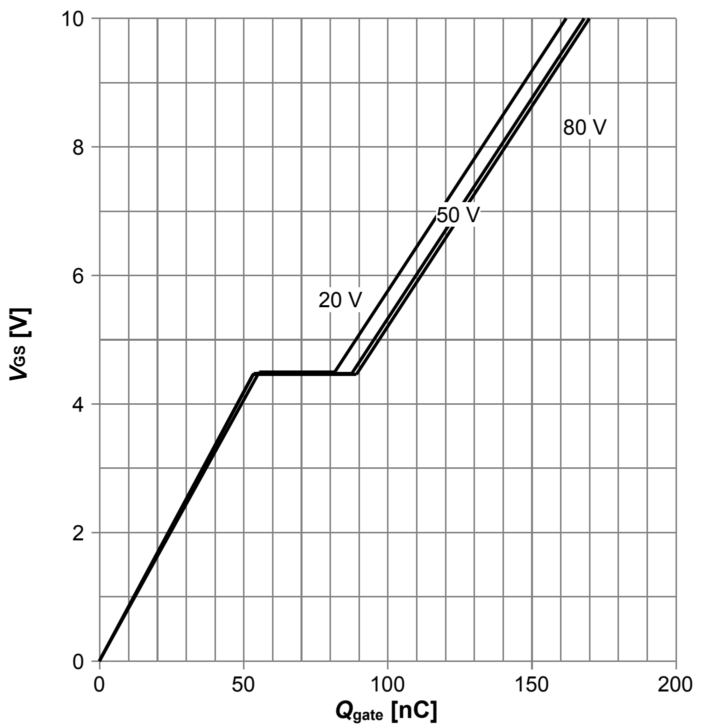
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



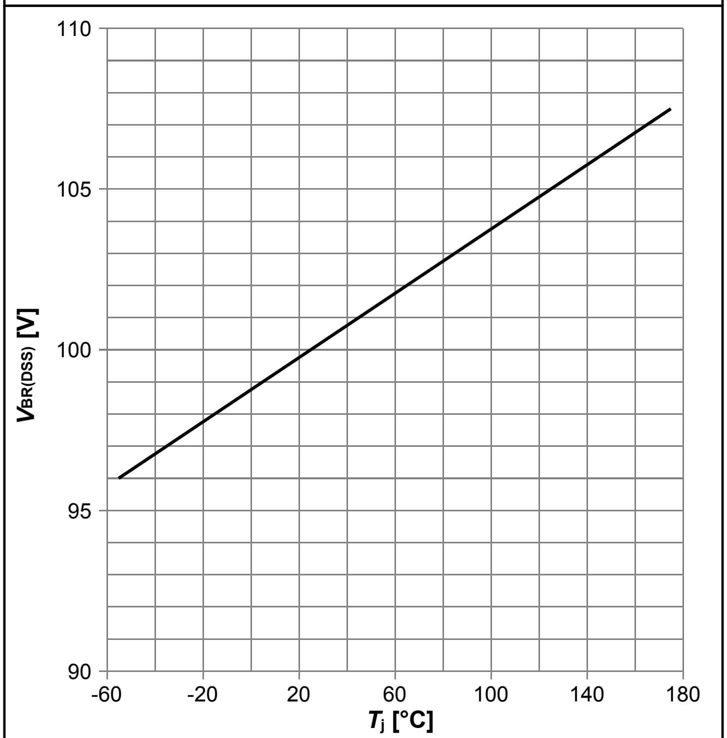
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



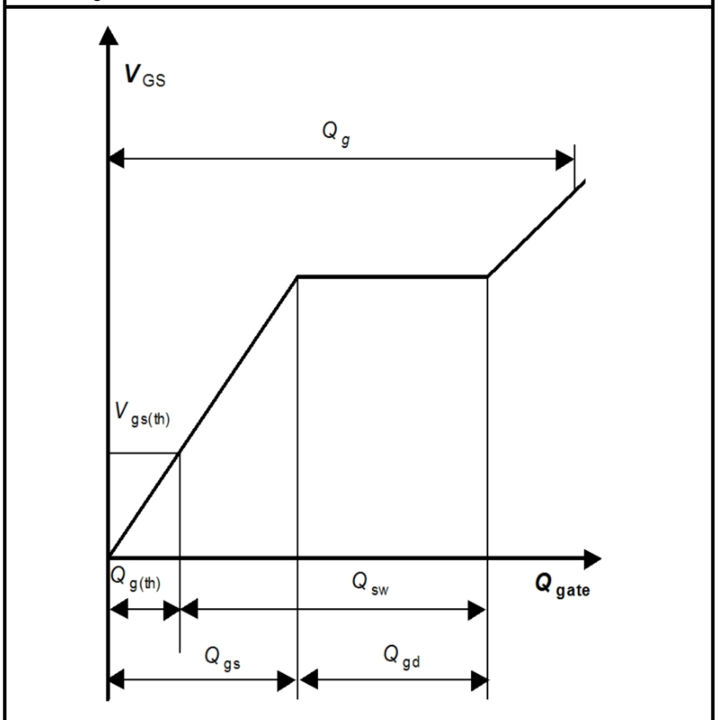
V_{GS}=f(Q_{gate}); I_D=100 A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

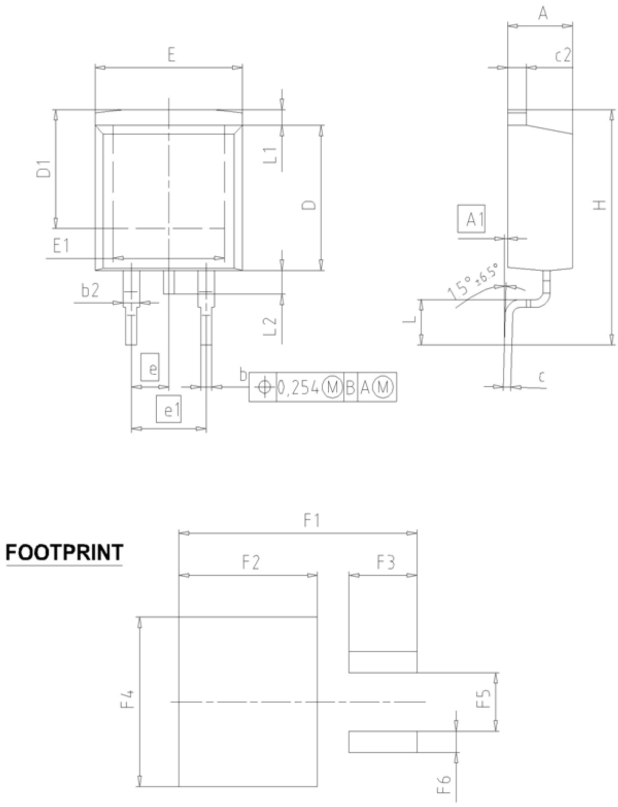


$V_{BR(DSS)}$=f(T_j); I_D=1 mA

Gate charge waveforms



5 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	0.00	0.25	0.000	0.010
b	0.65	0.85	0.026	0.033
b2	0.95	1.15	0.037	0.045
c	0.33	0.65	0.013	0.026
c2	1.17	1.40	0.046	0.055
D	8.51	9.45	0.335	0.372
D1	7.10	7.90	0.280	0.311
E	9.80	10.31	0.386	0.406
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	2		2	
H	14.61	15.88	0.575	0.625
L	2.29	3.00	0.090	0.118
L1	0.70	1.60	0.028	0.063
L2	1.00	1.78	0.039	0.070
F1	16.05	16.25	0.632	0.640
F2	9.30	9.50	0.366	0.374
F3	4.50	4.70	0.177	0.185
F4	10.70	10.90	0.421	0.429
F5	3.65	3.85	0.144	0.152
F6	1.25	1.45	0.049	0.057

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REVISION 01

Figure 1 Outline PG-TO 263-3, dimensions in mm/inches

Revision History

IPB020N10N5

Revision: 2017-07-11, Rev. 2.3

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2014-05-05	Release of Final Version
2.2	2016-09-07	Update Avalanche Energy
2.3	2017-07-11	Update product current

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