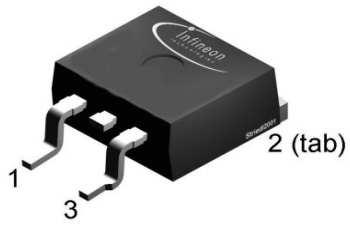
MOSFET

OptiMOS™FD Power-Transistor, 220 V

D²PAK



Features

- N-channel, normal level
- Fast Diode (FD) with reduced Q_{rr}
- Optimized for hard commutation ruggedness
- 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
- Halogen-free according to IEC61249-2-21

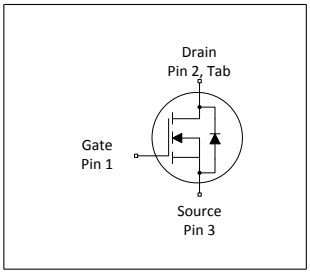


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	220	V
$R_{DS(on),max}$	15.6	mΩ
I_D	72	A

Type / Ordering Code	Package	Marking	Related Links
IPB156N22NFD	PG-TO 263-3	156N22NF	-

[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	- -	- -	72 56	A	T_C=25 °C T_C=100 °C
Pulsed drain current[1]	$I_{D,pulse}$	-	-	288	A	T_C=25 °C
Avalanche energy, single pulse[2]	E_{AS}	-	-	400	mJ	I_D=50 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	300	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	0.5	K/W	-
Thermal resistance, junction - ambient, minimal footprint	R_{thJA}	-	-	62	K/W	-
Thermal resistance, junction - ambient, 6 cm^2 cooling area[3]	R_{thJA}	-	-	40	K/W	-

3 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	220	-	-	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=270 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	1 100	µA	V_{DS}=176 V, V_{GS}=0 V, T_j=25 °C V_{DS}=176 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	$R_{DS(on)}$	-	12.9	15.6	mΩ	V_{GS}=10 V, I_D=50 A
Gate resistance	R_G	-	2.8	-	Ω	-
Transconductance	g_{fs}	60	119	-	S	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=72 A

[1] See Diagran 3 for more detailed information
[2] See Diagran 13 for more detailed information
[3] 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.

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance[1]	C_{iss}	-	5210	6930	pF	V_{GS}=0 V, V_{DS}=110 V, f=1 MHz
Output capacitance[1]	C_{oss}	-	343	456	pF	V_{GS}=0 V, V_{DS}=110 V, f=1 MHz
Reverse transfer capacitance	C_{rss}	-	6.2	-	pF	V_{GS}=0 V, V_{DS}=110 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	15	-	ns	V_{DD}=110 V, V_{GS}=10 V, I_D=36 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	15	-	ns	V_{DD}=110 V, V_{GS}=10 V, I_D=36 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	45	-	ns	V_{DD}=110 V, V_{GS}=10 V, I_D=36 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	15	-	ns	V_{DD}=110 V, V_{GS}=10 V, I_D=36 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}	-	25	-	nC	V_{DD}=110 V, I_D=72 A, V_{GS}=0 to 10 V
Gate to drain charge	Q_{gd}	-	9.4	-	nC	V_{DD}=110 V, I_D=72 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	19	-	nC	V_{DD}=110 V, I_D=72 A, V_{GS}=0 to 10 V
Gate charge total[1]	Q_g	-	66	87	nC	V_{DD}=110 V, I_D=72 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	4.8	-	V	V_{DD}=110 V, I_D=72 A, V_{GS}=0 to 10 V
Output charge[1]	Q_{oss}	-	153	203	nC	V_{DD}=110 V, V_{GS}=0 V

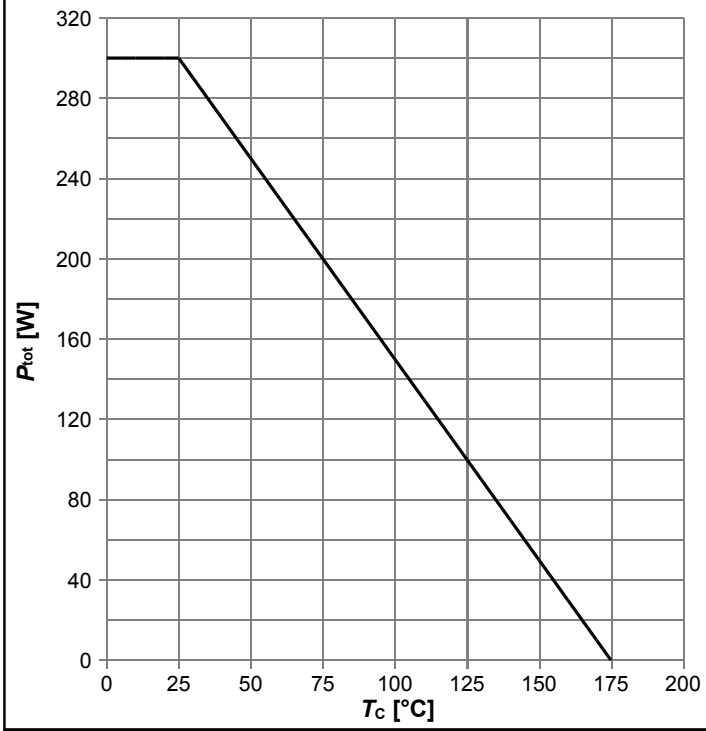
Table 7 Reverse diode[3]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continous forward current	I_S	-	-	72	A	T_C=25 °C
Diode pulse current[4]	$I_{S,pulse}$	-	-	288	A	T_C=25 °C
Diode hard commutation current[1]	$I_{S,hard}$	-	-	144	A	T_C=25 °C, di_F/dt=1500 A/µs
Diode forward voltage	V_{SD}	-	0.91	1.2	V	V_{GS}=0 V, I_F=72 A, T_j=25 °C
Reverse recovery time	t_{rr}	-	140	-	ns	V_R=100 V, I_F= 50 A, di_F/dt=100 A/µs
Reverse recovery charge	Q_{rr}	-	340	-	nC	V_R=100 V, I_F= 50 A, di_F/dt=100 A/µs

[1] Define by design. Not subject to production test
[2] See ″Gate charge waveforms″ for parameter definition
[3] Maximum allowed hard-commutated current through diode at di/dt=1500 A/µs
[4] Diode pulse current is defined by thermal and/or package limits

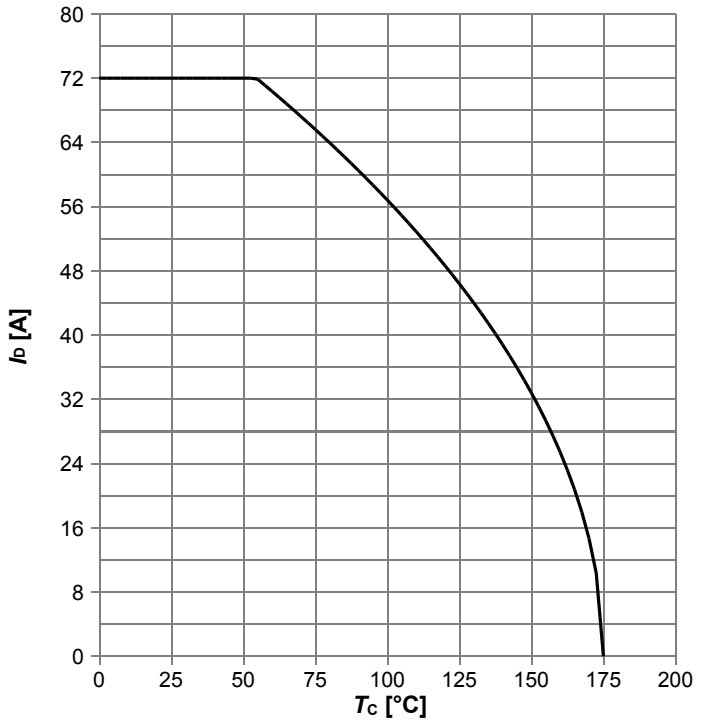
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



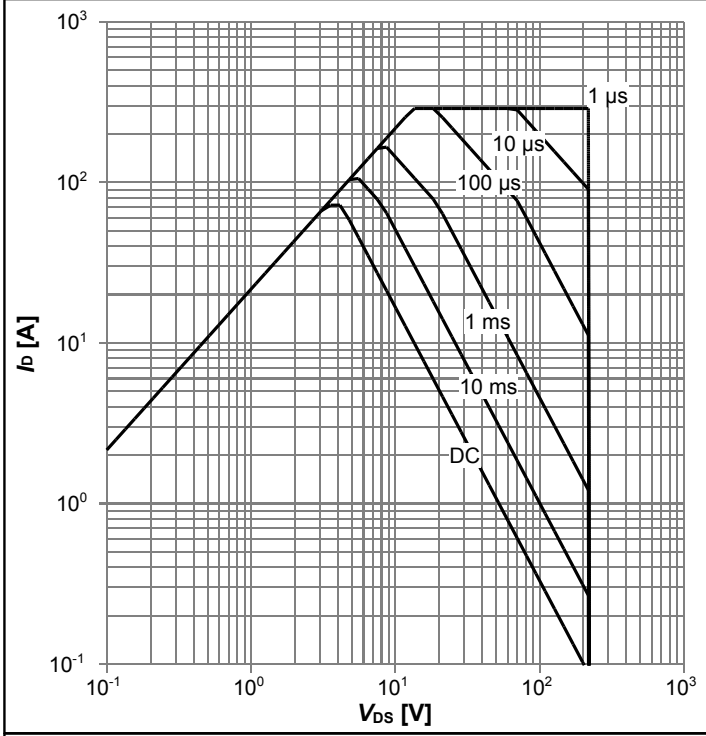
$P_{tot}=f(T_C)$

Diagram 2: Drain current



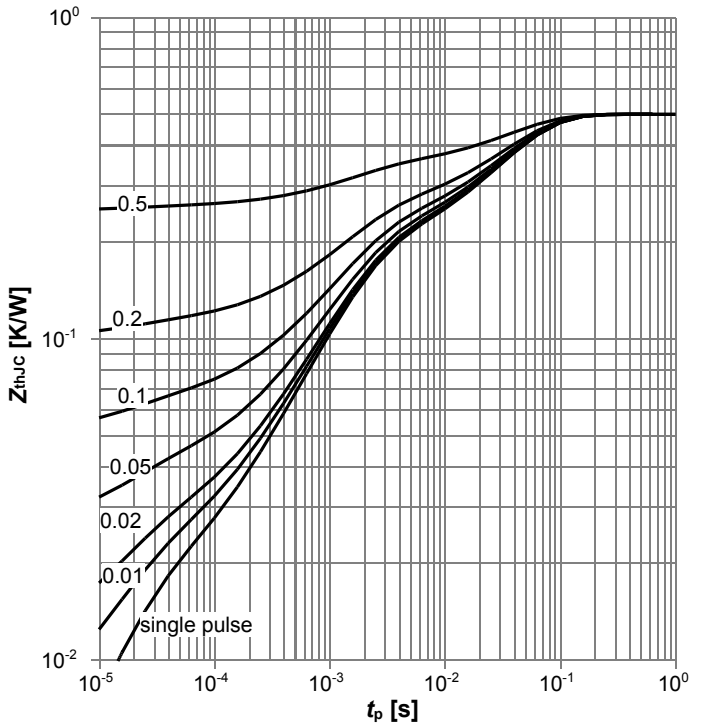
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



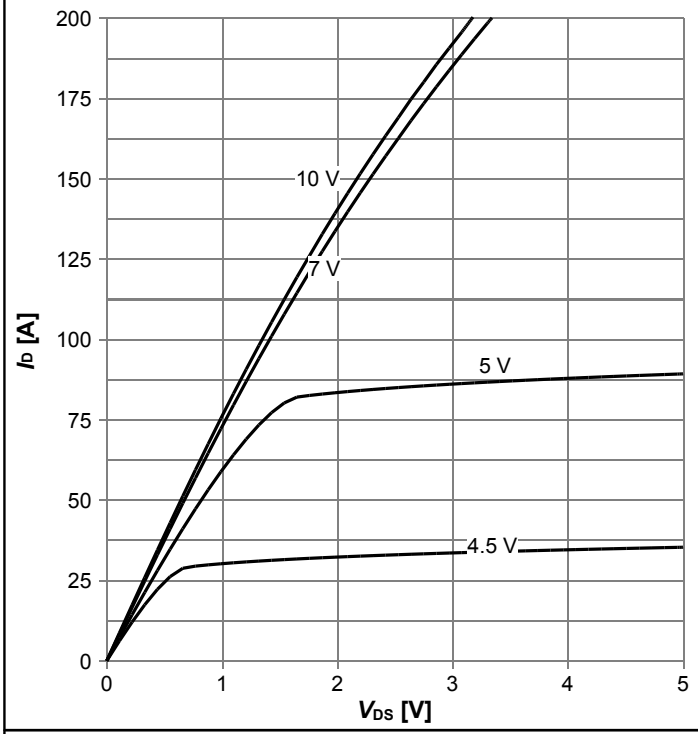
$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: t_p

Diagram 4: Max. transient thermal impedance



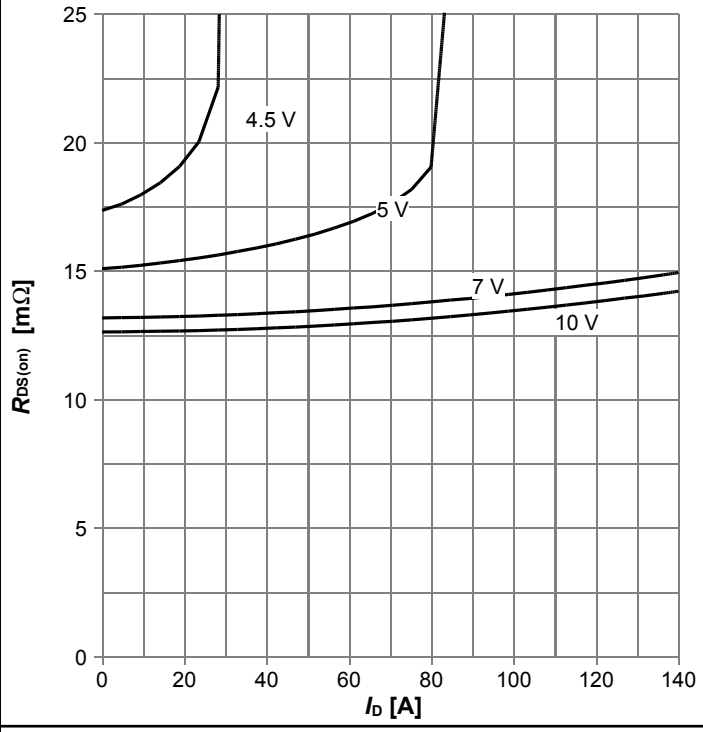
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



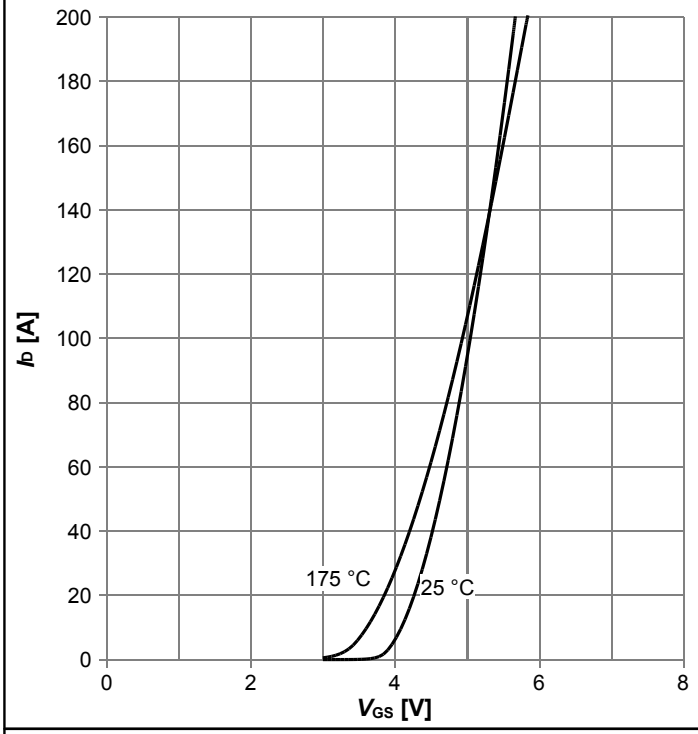
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



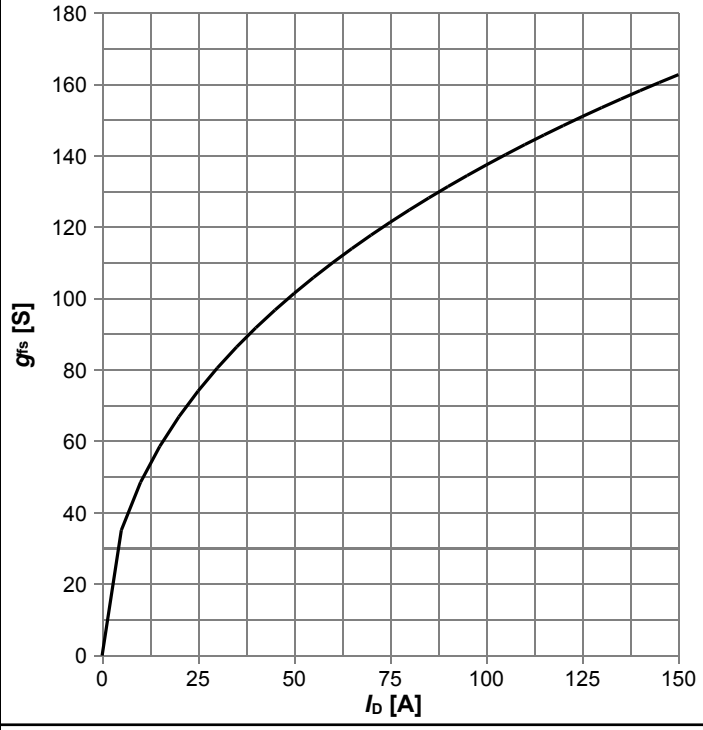
$R_{DS(on)}=f(I_D)$; $T_j=25$ °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



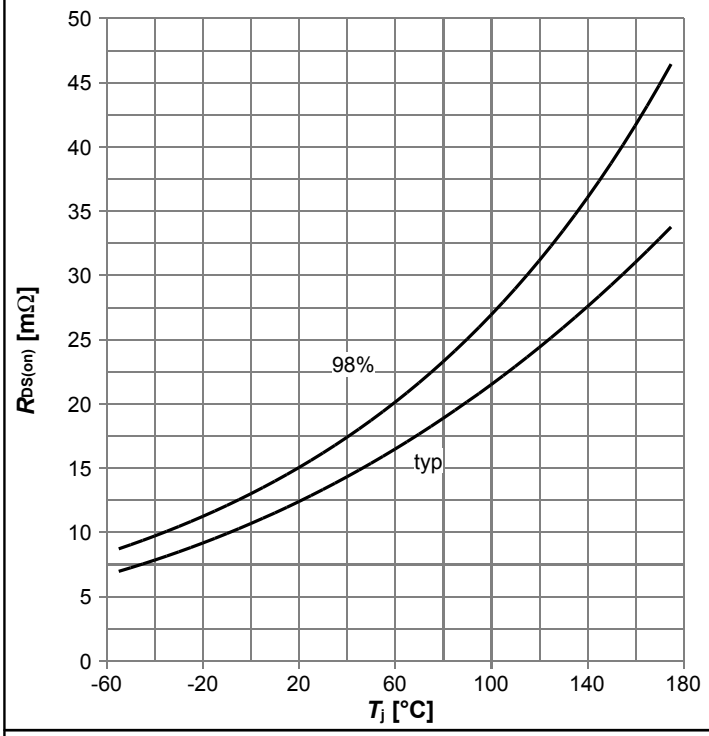
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. forward transconductance



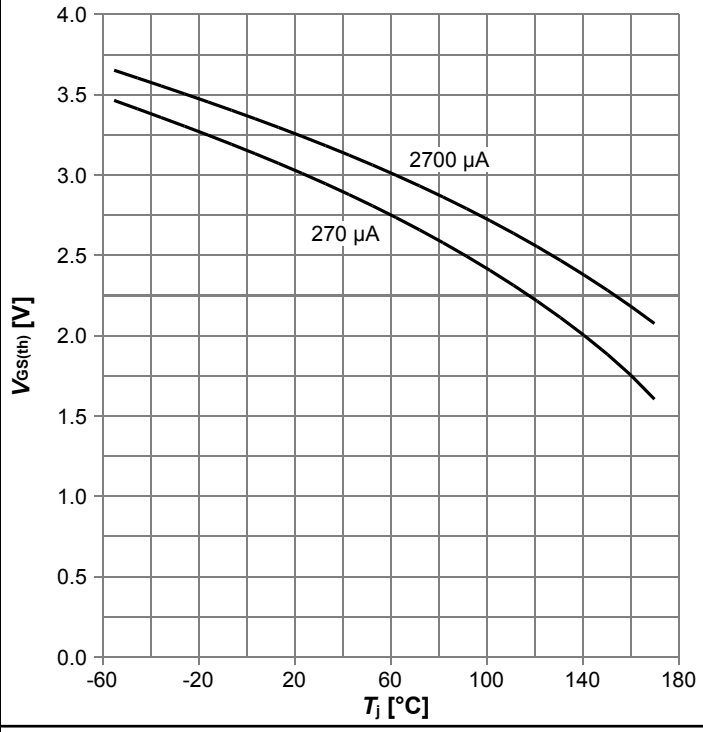
$g_{fs}=f(I_D)$; $T_j=25$ °C

Diagram 9: Drain-source on-state resistance



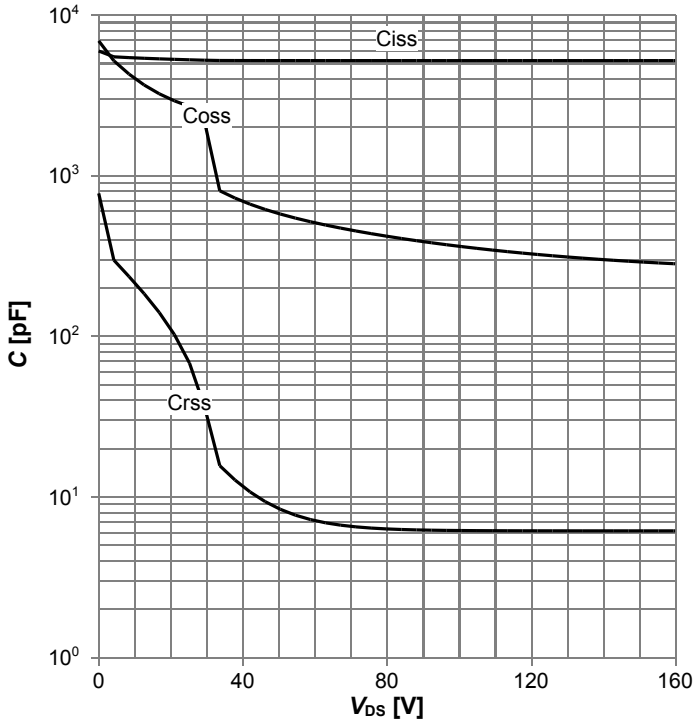
$R_{DS(on)}$=f(T_j); I_D=50 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



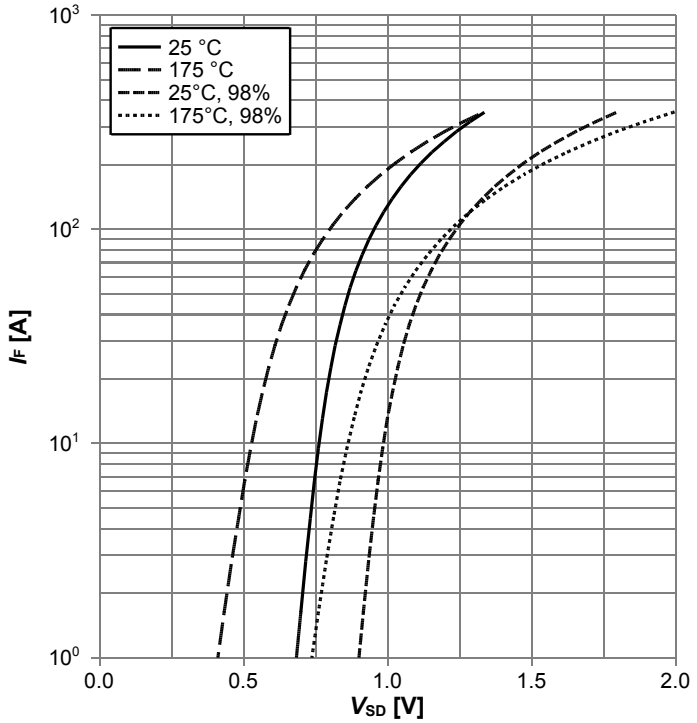
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; parameter: I_D

Diagram 11: Typ. capacitances



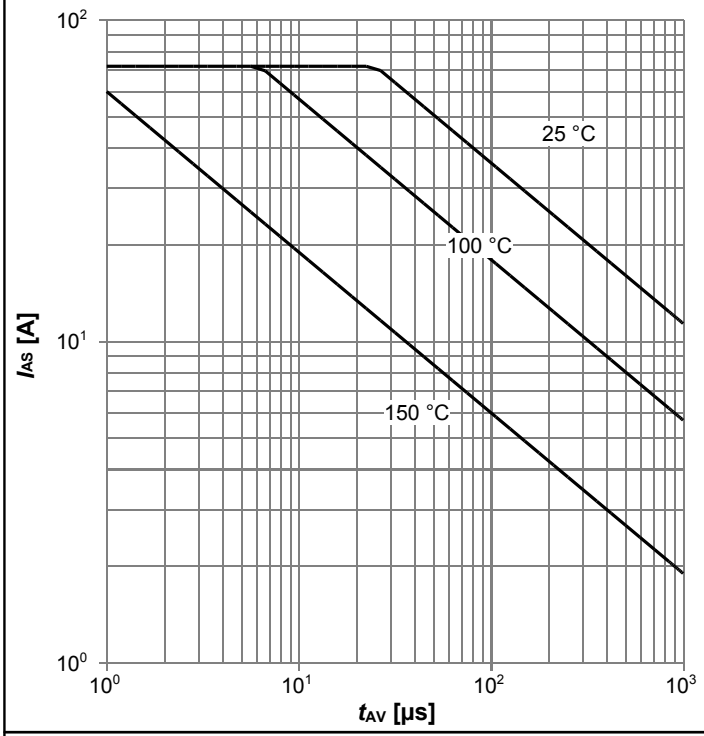
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



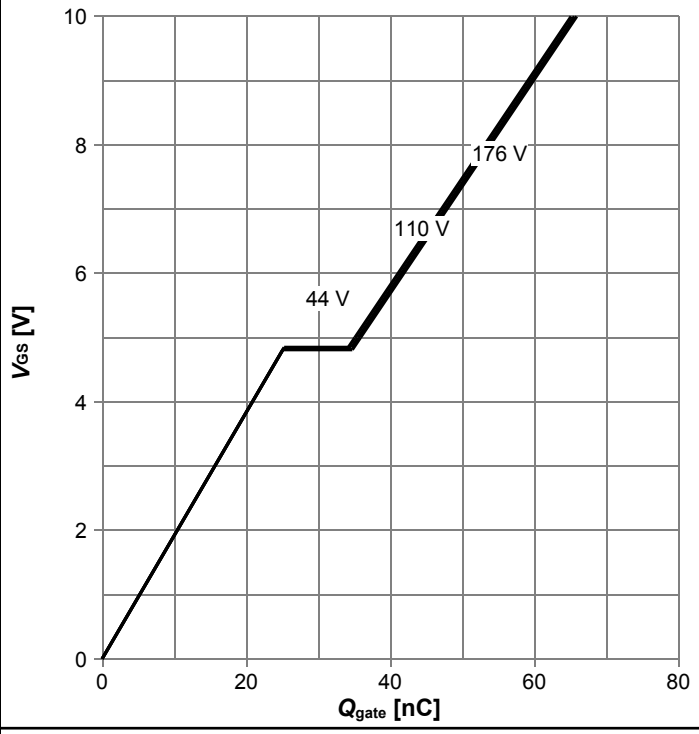
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



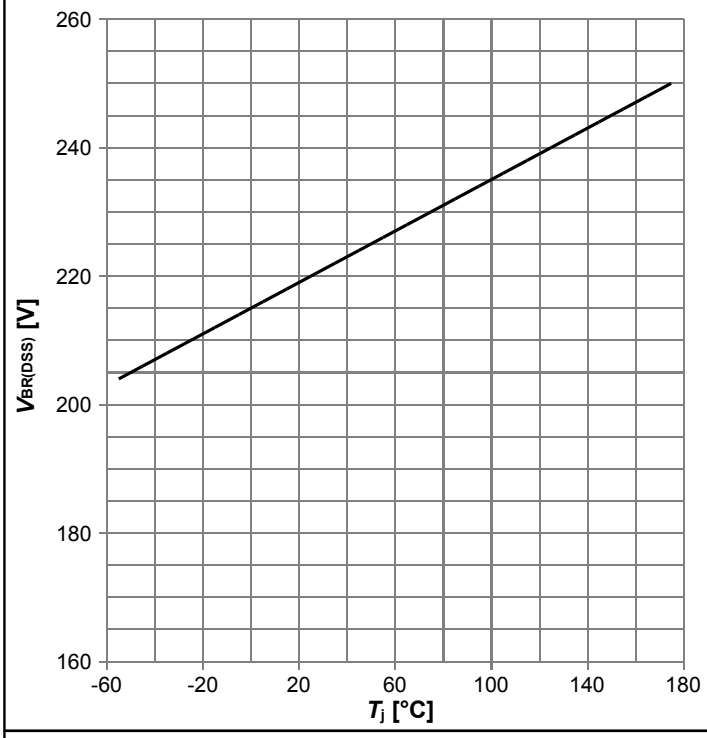
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



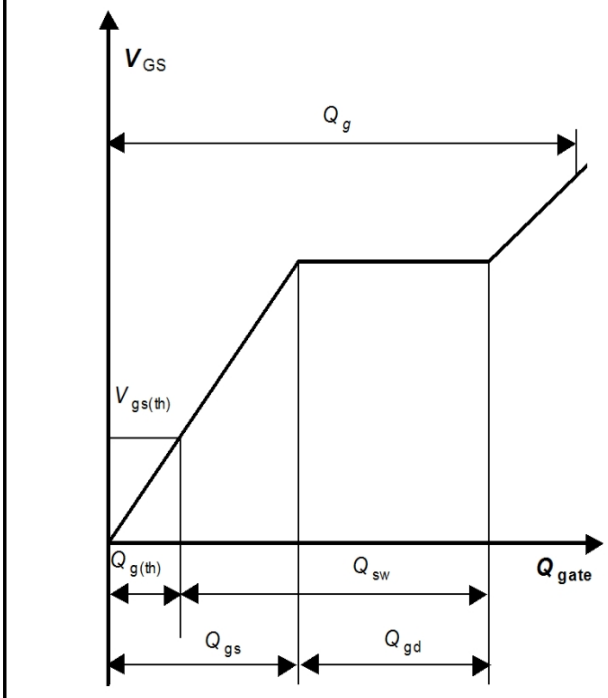
V_{GS}=f(Q_{gate}); I_D=72 A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

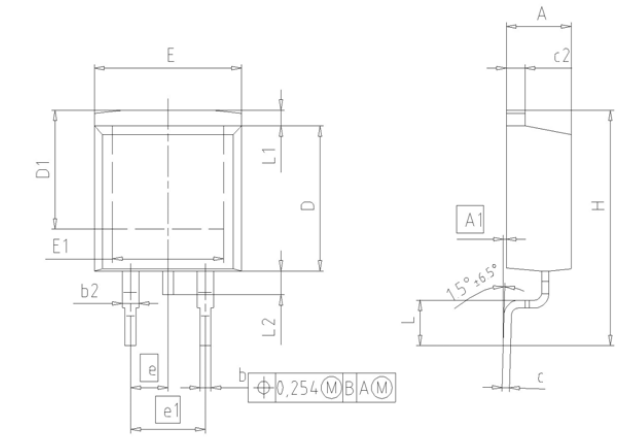


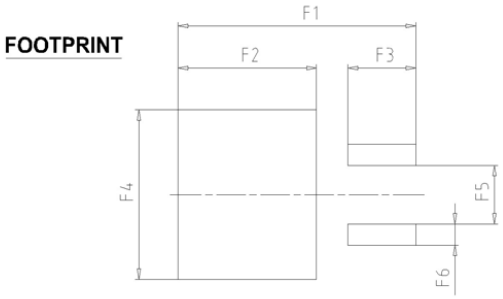
$V_{BR(DSS)}$=f(T_j); I_D=1 mA

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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SCALE 0 5 5 7.5mm

EUROPEAN PROJECTION

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REVISION
01

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

Revision History

IPB156N22NFD

Revision: 2017-06-19, Rev. 2.0

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2017-06-19	Release of final version

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