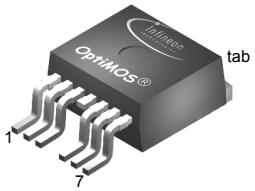
MOSFET

OptiMOS™ Power-Transistor, 60 V

D²-PAK 7pin

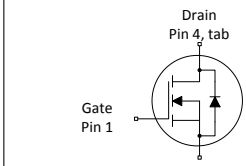


Features

- Optimized for synchronous rectification
- 100% avalanche tested
- Superior thermal resistance
- N-channel, normal level
- Qualified according to JEDEC[1] for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	60	V
$R_{DS(on),max}$	1.0	mΩ
I_D	180	A
Q_{oss}	228	nC
Q_G(0V..10V)	208	nC



Type / Ordering Code	Package	Marking	Related Links
IPB010N06N	PG-TO263-7	010N06N	-

[1] J-STD20 and JESD22

Table of Contents

1 Maximum ratings

at T_j = 25 °C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	- - -	- - -	180 180 45	A	V_{GS}=10 V, T_C=25 °C V_{GS}=10 V, T_C=100 °C V_{GS}=10 V, T_C=25 °C, R_{thJA} =40 K/W[1)]
Pulsed drain current[2)]	$I_{D,pulse}$	-	-	720	A	T_C=25 °C
Avalanche energy, single pulse[3)]	E_{AS}	-	-	1600	mJ	I_D=100 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	-
Device on PCB, minimal footprint	R_{thJA}	-	-	62	K/W	-
Device on PCB, 6 cm² cooling area[1)]	R_{thJA}	-	-	40	K/W	-
Soldering temperature, wave and reflow soldering are allowed	T_{sold}	-	-	260	°C	Reflow MSL1

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

3 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	60	-	-	V	V_{GS}=0 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	2.1	2.8	3.3	V	V_{DS}=V_{GS}, I_D=280 µA
Zero gate voltage drain current	I_{DSS}	- -	0.5 10	1 100	µA	V_{DS}=60 V, V_{GS}=0 V, T_j=25 °C V_{DS}=60 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	10	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	- -	0.8 1.0	1.0 1.5	mΩ	V_{GS}=10 V, I_D=100 A V_{GS}=6 V, I_D=25 A
Gate resistance[1)]	R_G	-	1.8	2.7	Ω	-
Transconductance	g_{fs}	160	310	-	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}	-	15000	18750	pF	V_{GS}=0 V, V_{DS}=30 V, f=1 MHz
Output capacitance	C_{oss}	-	3400	4250	pF	V_{GS}=0 V, V_{DS}=30 V, f=1 MHz
Reverse transfer capacitance	C_{rss}	-	130	260	pF	V_{GS}=0 V, V_{DS}=30 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	37	-	ns	V_{DD}=30 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=3 Ω
Rise time	t_r	-	36	-	ns	V_{DD}=30 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=3 Ω
Turn-off delay time	$t_{d(off)}$	-	74	-	ns	V_{DD}=30 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=3 Ω
Fall time	t_f	-	23	-	ns	V_{DD}=30 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=3 Ω

Table 6 Gate charge characteristics[2)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	65	-	nC	V_{DD}=30 V, I_D=100 A, V_{GS}=0 to 10 V
Gate charge at threshold	$Q_{g(th)}$	-	46	-	nC	V_{DD}=30 V, I_D=100 A, V_{GS}=0 to 10 V
Gate to drain charge[1)]	Q_{gd}	-	37	49	nC	V_{DD}=30 V, I_D=100 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	56	-	nC	V_{DD}=30 V, I_D=100 A, V_{GS}=0 to 10 V
Gate charge total[1)]	Q_g	-	208	243	nC	V_{DD}=30 V, I_D=100 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	4.2	-	V	V_{DD}=30 V, I_D=100 A, V_{GS}=0 to 10 V
Gate charge total, sync. FET	$Q_{g(sync)}$	-	184	-	nC	V_{DS}=0.1 V, V_{GS}=0 to 10 V
Output charge[1)]	Q_{oss}	-	228	285	nC	V_{DD}=30 V, V_{GS}=0 V

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

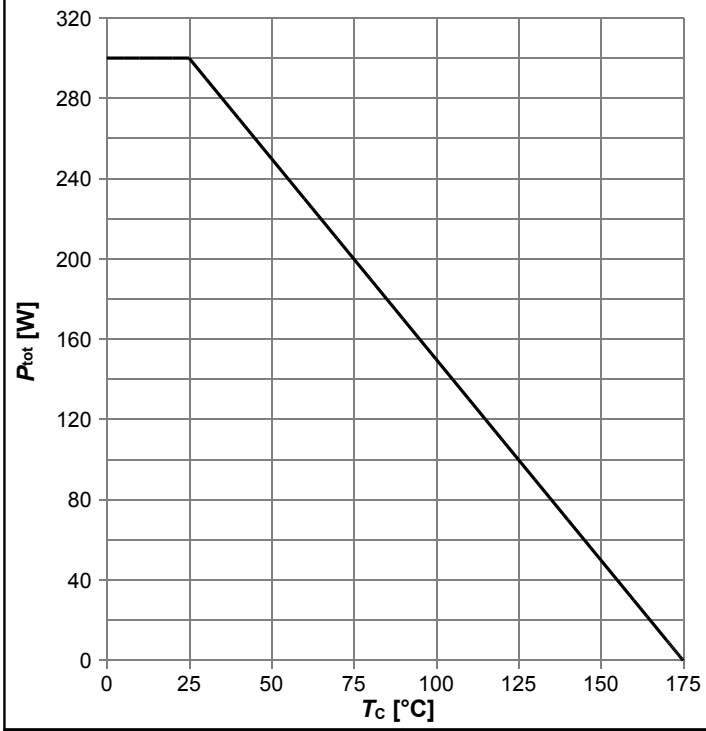
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	180	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	720	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}	-	87	139	ns	V_R=30 V, I_F=100A, di_F/dt=100 A/µs
Reverse recovery charge	Q_{rr}	-	144	-	nC	V_R=30 V, I_F=100A, di_F/dt=100 A/µs

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

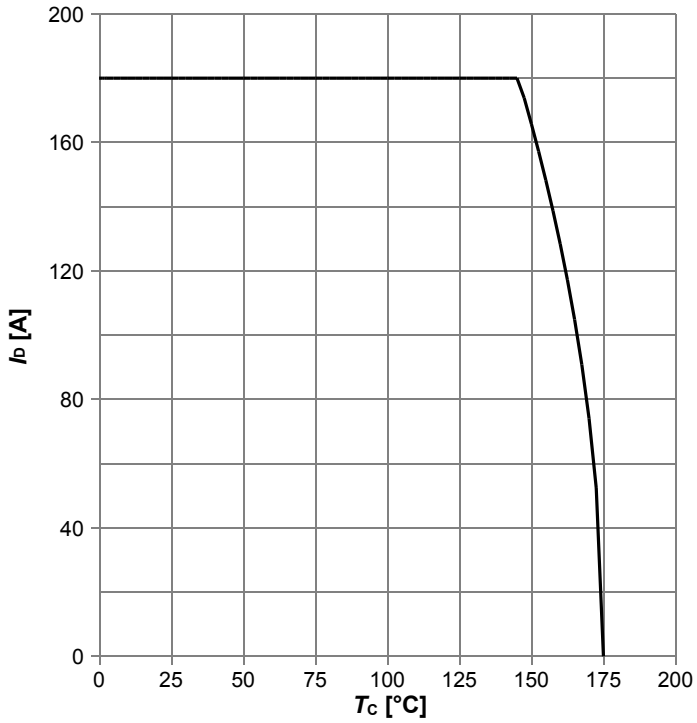
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



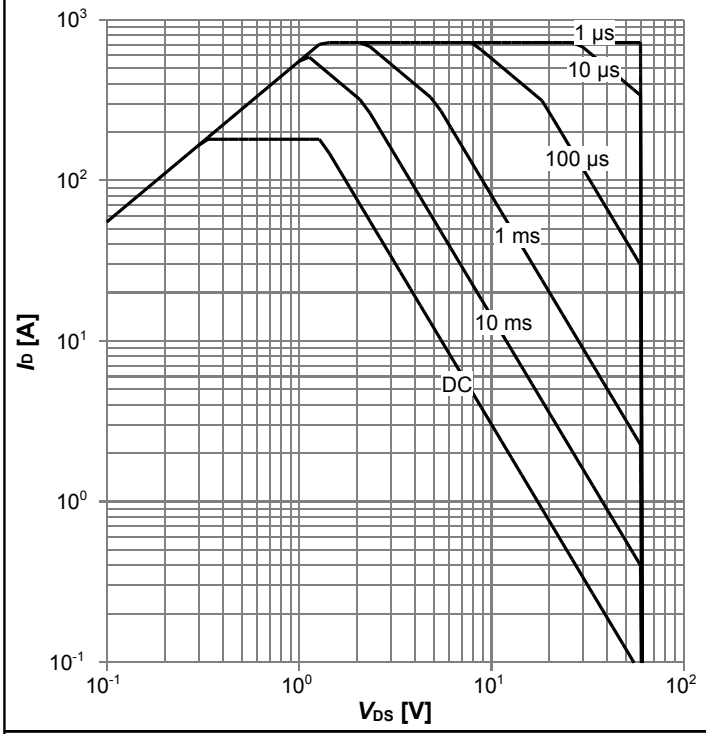
$P_{tot}=f(T_C)$

Diagram 2: Drain current



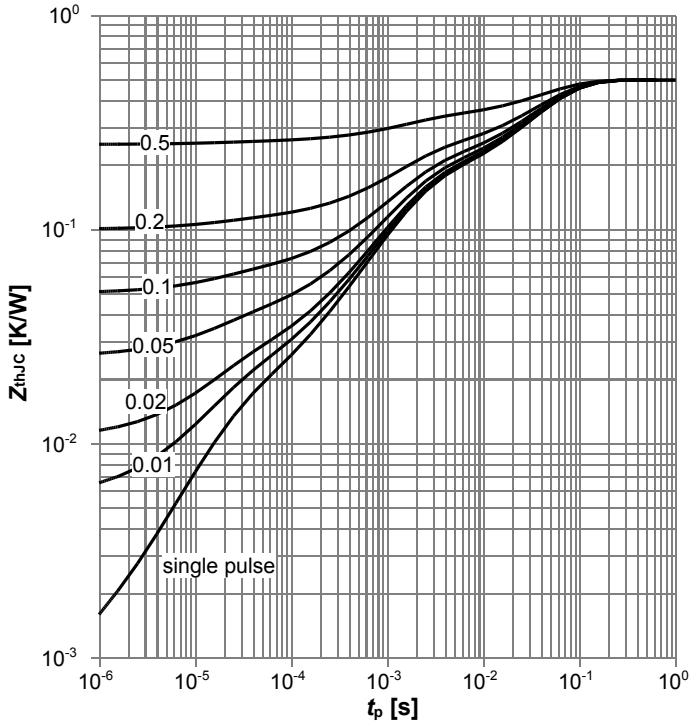
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



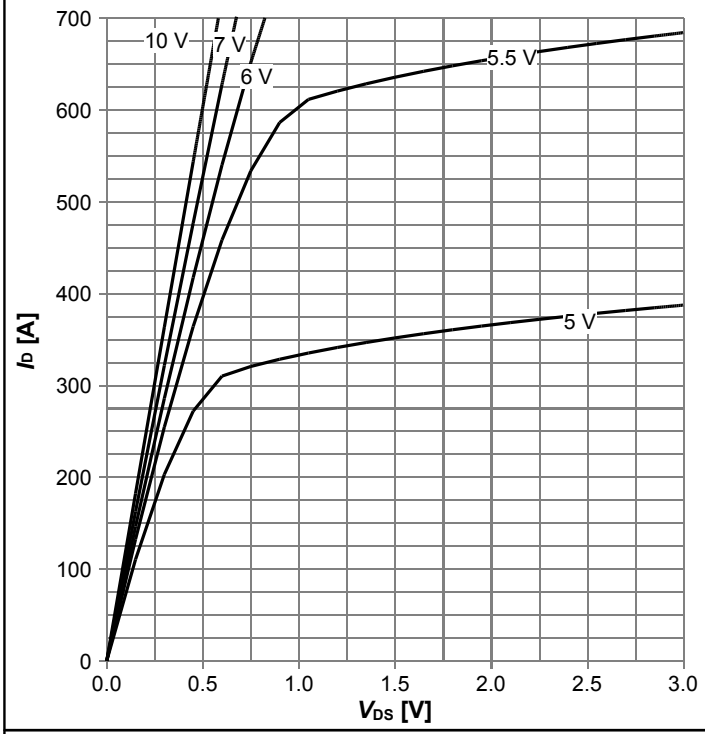
$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: t_p

Diagram 4: Max. transient thermal impedance



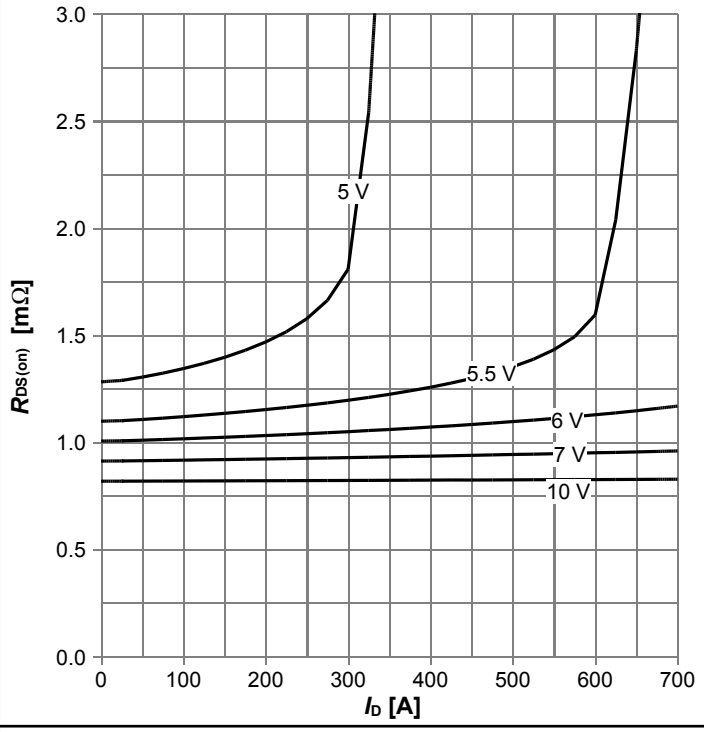
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



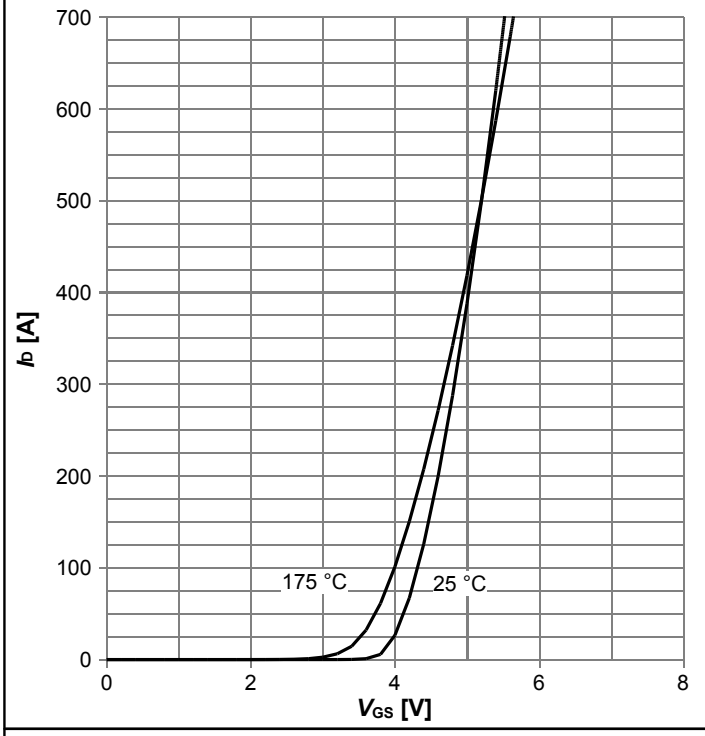
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



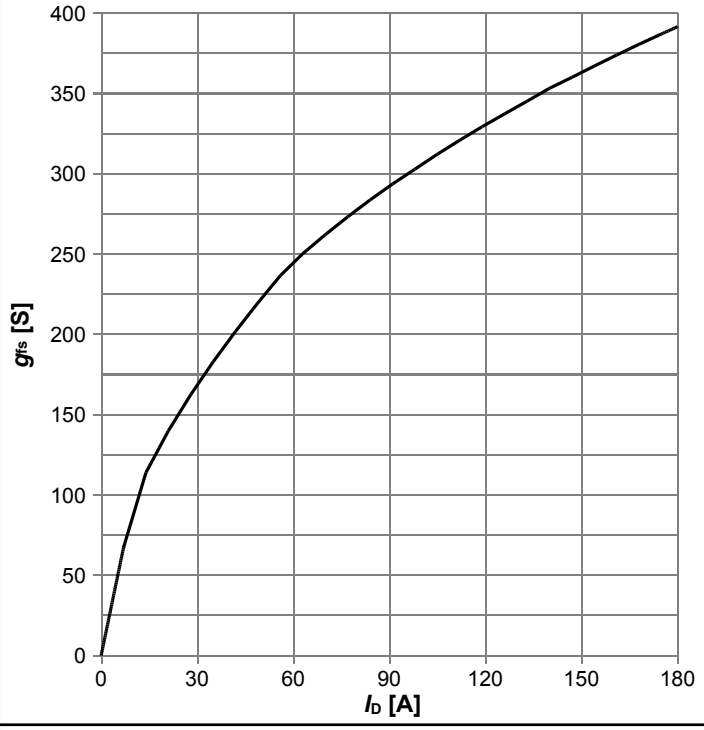
$R_{DS(on)}=f(I_D)$; $T_j=25$ °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



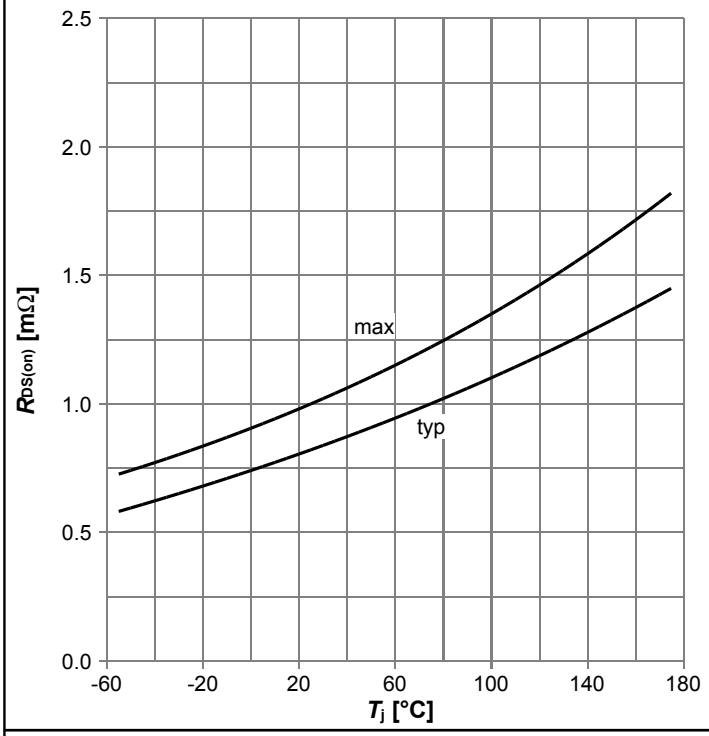
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. forward transconductance



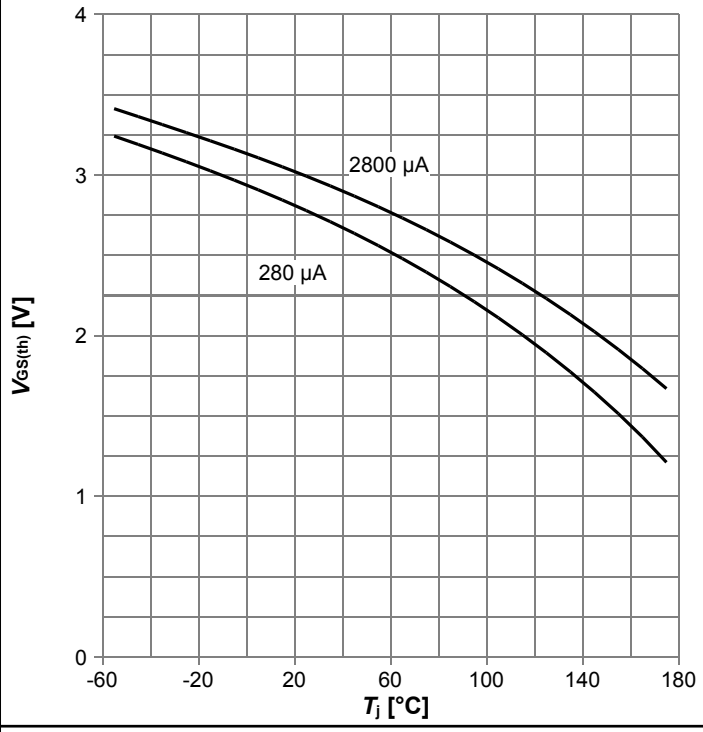
$g_{fs}=f(I_D)$; $T_j=25$ °C

Diagram 9: Drain-source on-state resistance



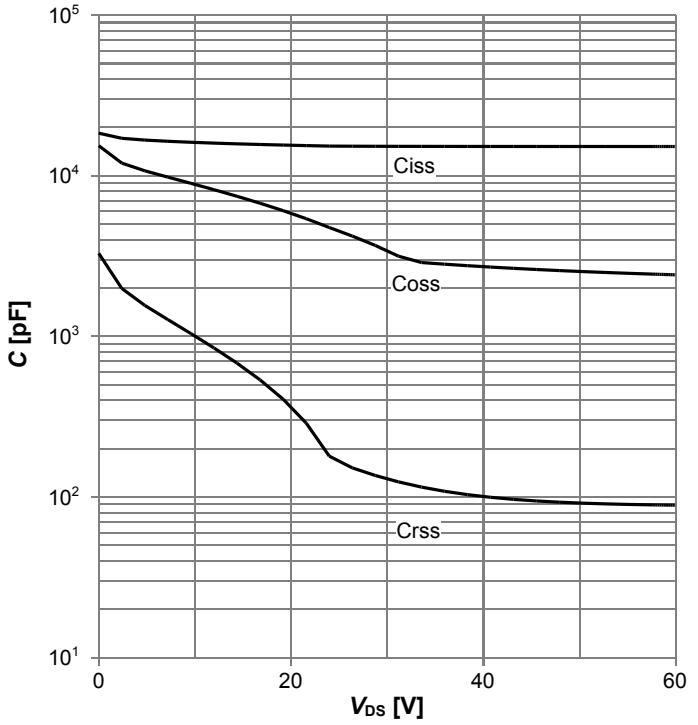
$R_{DS(on)}$=f(T_j); I_D=100 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



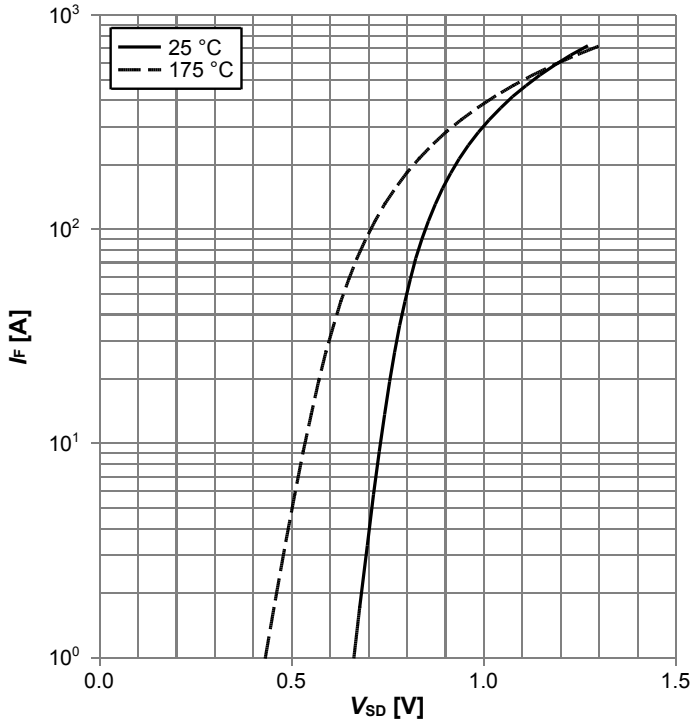
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}

Diagram 11: Typ. capacitances



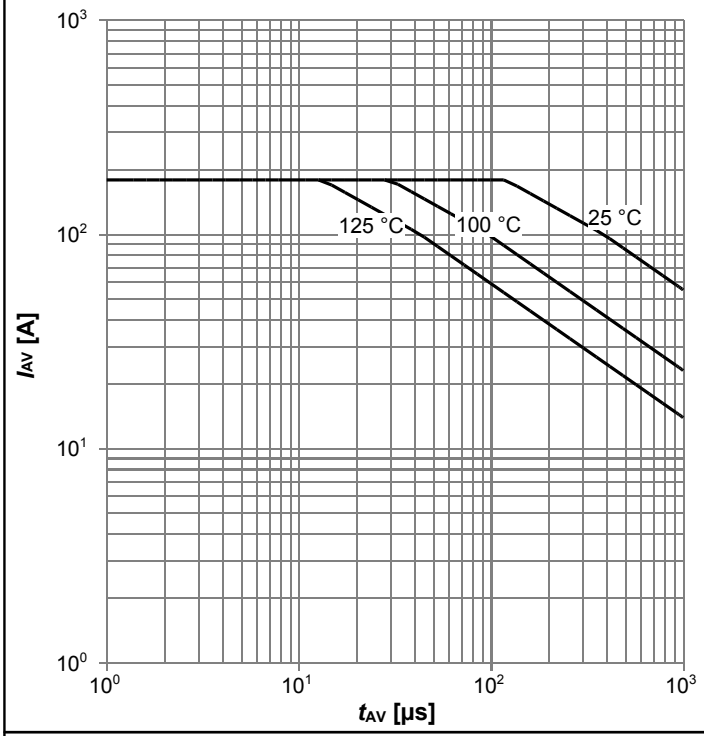
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



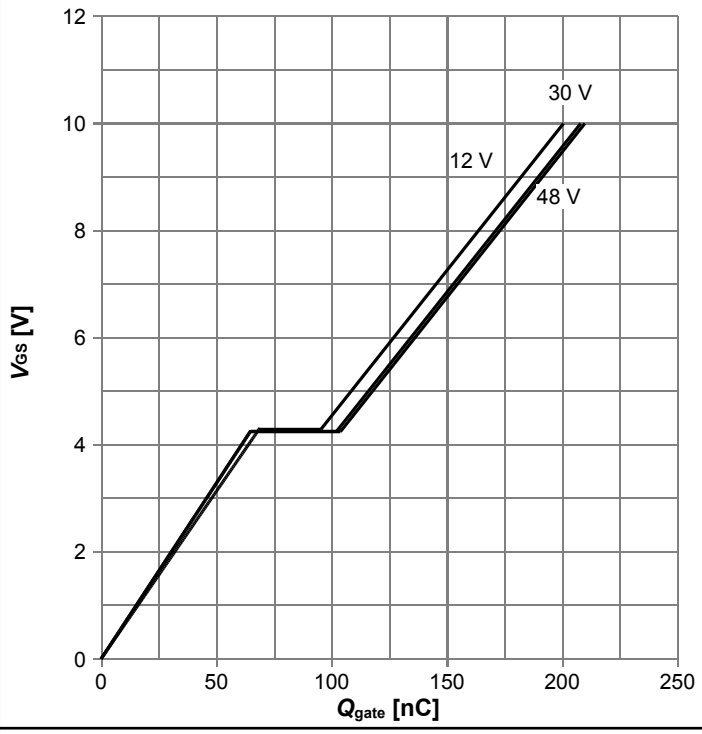
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



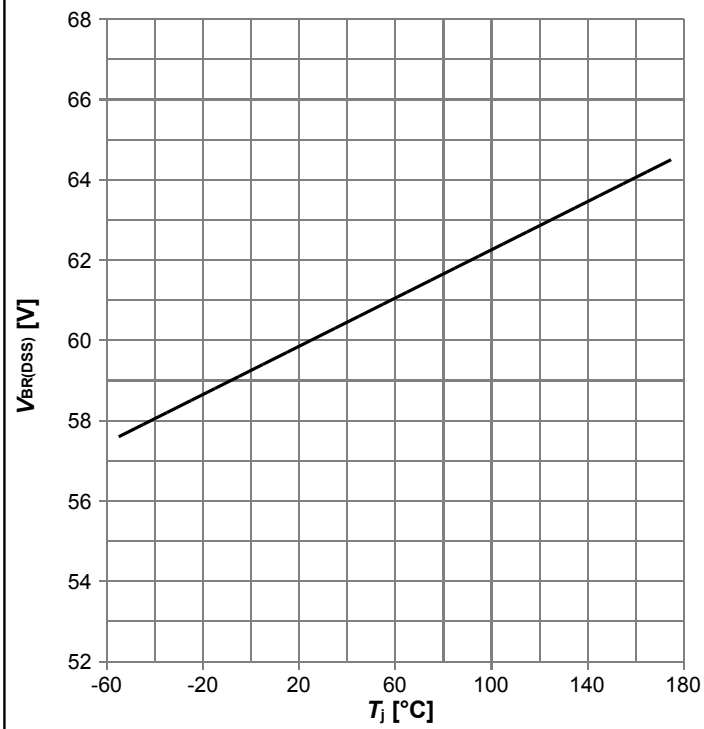
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



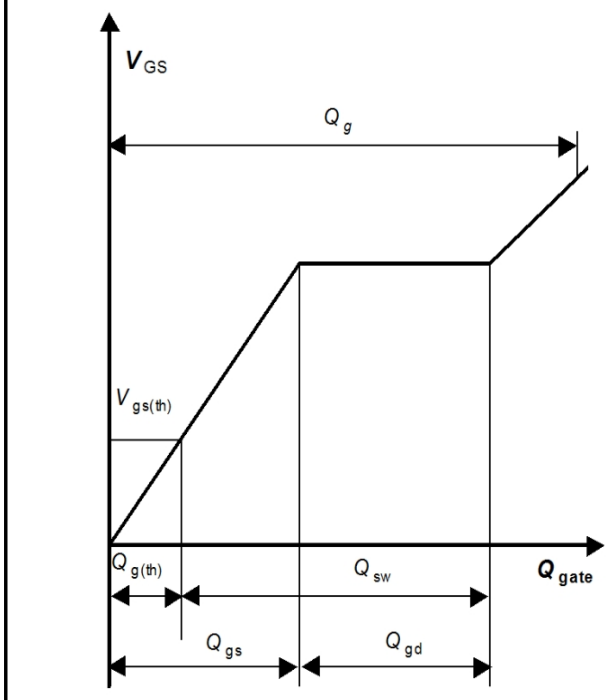
V_{GS}=f(Q_{gate}); I_D=100 A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

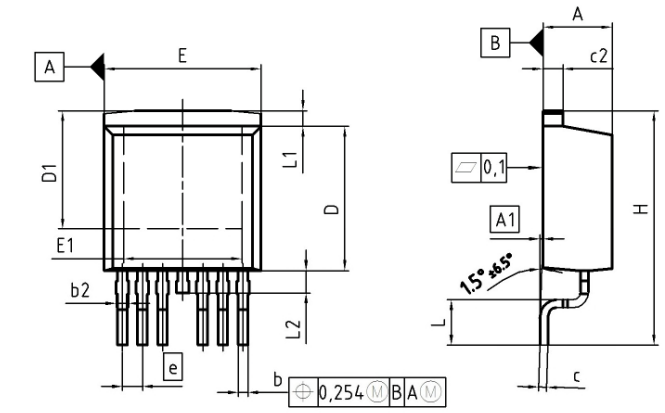


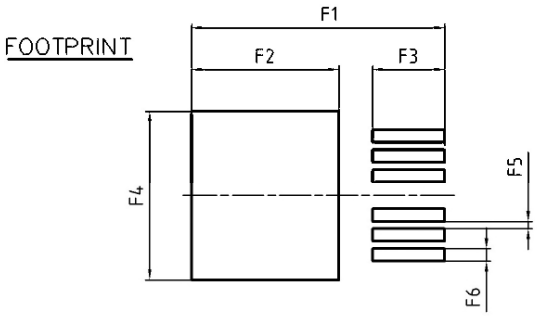
$V_{BR(DSS)}$=f(T_j); I_D=1 mA

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	0.50	0.70	0.020	0.028
b2	0.50	1.00	0.020	0.039
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	6.90	7.90	0.272	0.311
E	9.80	10.31	0.386	0.406
E1	6.50	8.60	0.256	0.339
e	1.27		0.050	
N	6		6	
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	0.37	0.57	0.015	0.022
F6	0.70	0.90	0.028	0.035

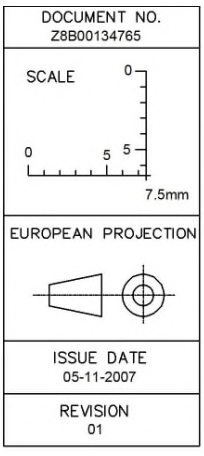


Figure 1 Outline PG-TO263-7, dimensions in mm/inches

Revision History

IPB010N06N

Revision: 2016-01-18, Rev. 2.4

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.3	2014-10-03	Rev. 2.3
2.4	2016-01-18	Update package outline

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