

NPB4N60F



N-Channel Enhancement Mode Power MOSFET

Voltage: 600 Volts

Current: 4.0 Ampers

Package: TO-220F

Features

- NH'S Advanced Planar DMOS Technology
- Low Rds(on) For Low On-State Loss
- High EAS For High Reliability
- Qualified According To JEDEC Criteria

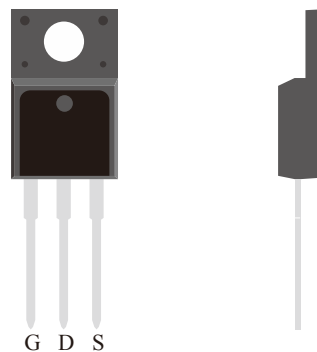
Typical Applications

- AC/DC Converter
- Adaptor And Charger
- PC Power
- LED Drives And LED Lighting

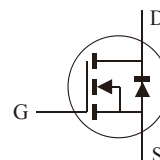
Product Summary

VDS Min.@Tj	600	V
Id Min.@Ta	4.0	A
RDS(ON)(TYP)@10V	2.1	Ω

Diagram:



Polarity:



***100% UIS TESTED**

***100% ΔVDS TESTED**

Absolute Maximum Ratings (Ta=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		V _{DS}	600	V
Gate-Source Voltage		V _{GS}	±30	V
Continuous Drain Current (Note 1)	Ta= 25 ℃	I _D	4.0	A
	Ta= 100 ℃		2.6	
Drain Current-Pulse (Note 1)	Tj< 150 ℃	I _{DM}	16	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25℃	Ta= 25 ℃	P _D	30.5	W
	Ta= 100 ℃		12	
Derating Factor		D _F	0.24	W/℃
Avalanche Current,Single Pulse (Note 1)	L= 10.0 mH	I _{AS}	7.1	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 10.0 mH IAS= 7.1 A, RG= 10.0 Ω Starting Tj=25 ℃, VG = 10.0 V	E _{AS}	252	mJ

Thermal Characteristics (Ta=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Junction Temperature		T _J	-55 to 150	℃
Storage Temperature Range		T _{STD}	-55 to 150	℃
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With Ta=25℃	R _{θJA}	62.5	℃/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 75mm x 45mm x 2.5mm Alu. Heat.	R _{θJC}	4.1	

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig. 13).

NPB4N60F

N-Channel Enhancement Mode Power MOSFET
Electrical Characteristics (Ta=25°C Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Static Off Characteristics						
Drain-Source Breakdown Voltage	VGS=0V,ID=250uA	BV _{DSS}	600	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	ΔBV _{DSS} /ΔT _J	--	0.71	--	V/℃
Drain-Source Leakage Current	VDS= 600 V,VGS=0V	I _{DSS}	--	--	1	uA
Gate-Body Leakage Current	VGS= ±30 V,VDS=0V	I _{GSS}	--	--	±100	nA
Forward Transconductance	ID= 2.0 A,VDS= 15 V	g _{fs}	--	3.5	--	S
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	V _{GS(TH)}	2.0	3.0	4.0	V
Drain-Source On Resistance	ID= 2.0 A,VGS= 10.0 V	R _{DS(ON)}	--	2.1	2.5	Ω
	ID= 2.0 A,VGS= 4.5 V		--	2.4	3.4	
Dynamic Characteristics						
Input Capacitance	VDS= 50 V	C _{iss}	--	590.0	--	pF
Output Capacitance	VGS= 0 V	C _{oss}	--	55.0	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C _{rss}	--	4.0	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 300 V	t _{d(on)}	--	14.0	--	ns
Turn-On Rise Time	VGS= 10.0 V	t _r	--	15.0	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	t _{d(off)}	--	34.0	--	ns
Turn-Off Rise Time		t _f	--	13.0	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 300 V	Q _g	--	14.5	--	nC
Gate-Source Charge	VGS= 10.0 V	Q _{gs}	--	2.6	--	nC
Gate-Drain Charge	ID= 2.0 A	Q _{gd}	--	6.5	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I _S	--	--	4.0	A
Max. Pulsed Forward Cuurent		I _{SM}	--	--	16	A
Diode Forward Voltage	ID= 2.0 A,VGS=0V	V _{SD}	--	0.85	1.5	V
Reverse Recovery Time	ID= 2.0 A,di/dt= 100 A/us	t _{rr}	--	250	--	ns
Reverse Recovery Charge	VGS= 10.0 V,VDD= 300 V	Q _{rr}	--	1000	--	nC

NPB4N60F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

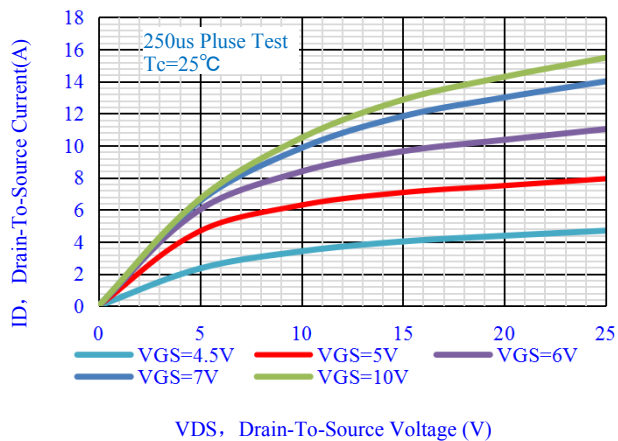


Fig.1-Output Characteristics

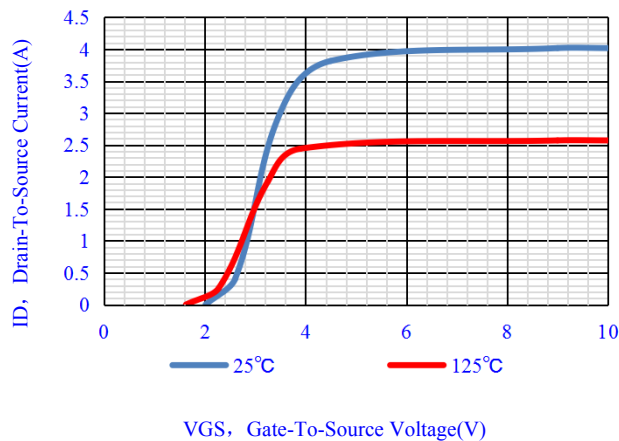


Fig.2- Transfer Characteristics

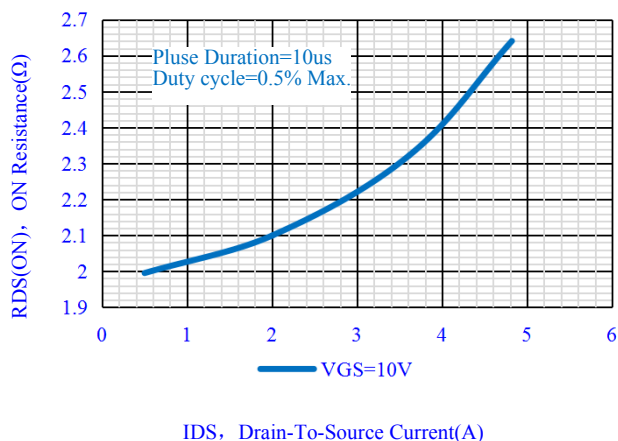


Fig.3- On Resistance vs. Drain Current

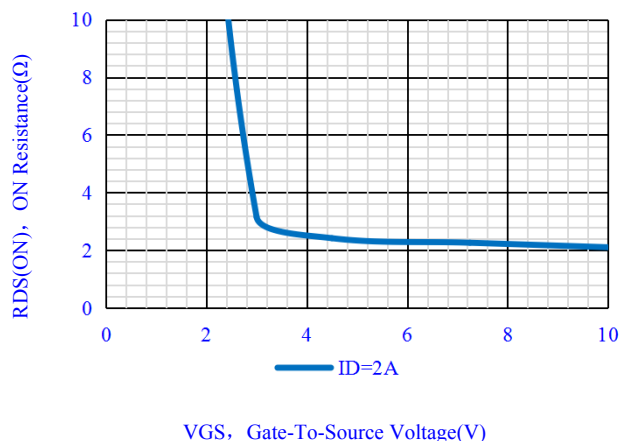


Fig.4- On Resistance vs. Gate Source Voltage

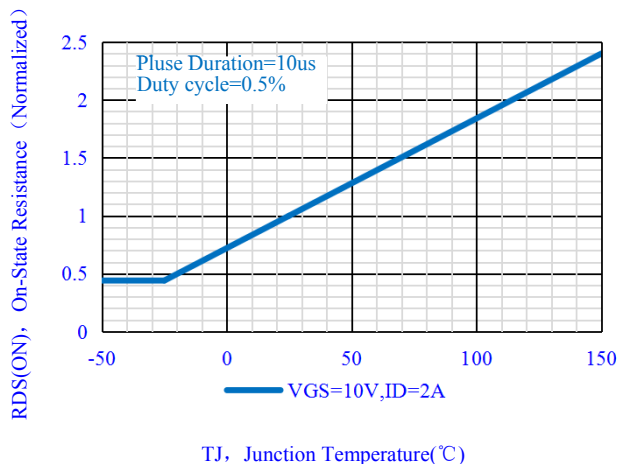


Fig.5- On Resistance vs. Junction Temperature

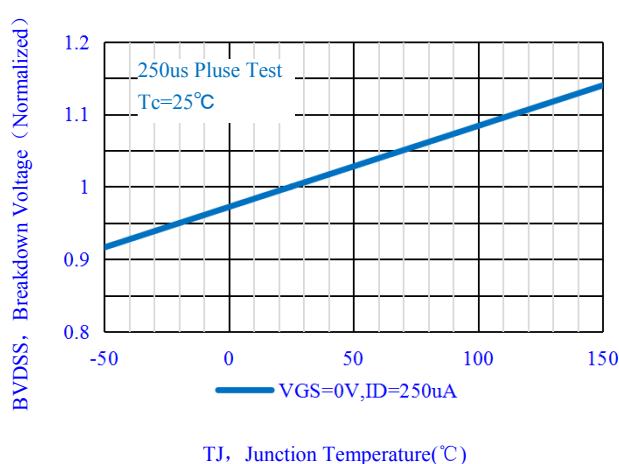


Fig.6- Breakdown Voltage vs. Junction Temperature

NPB4N60F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

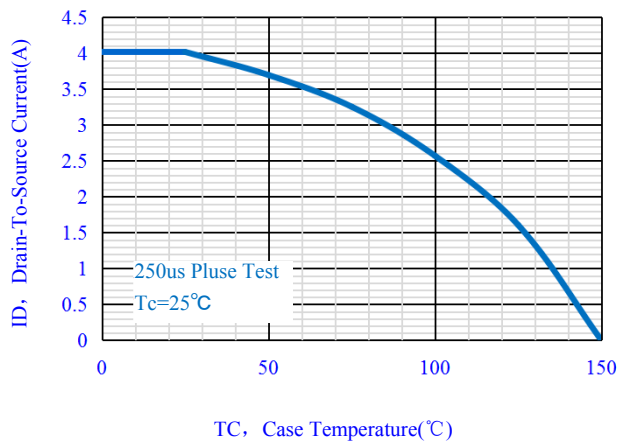


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

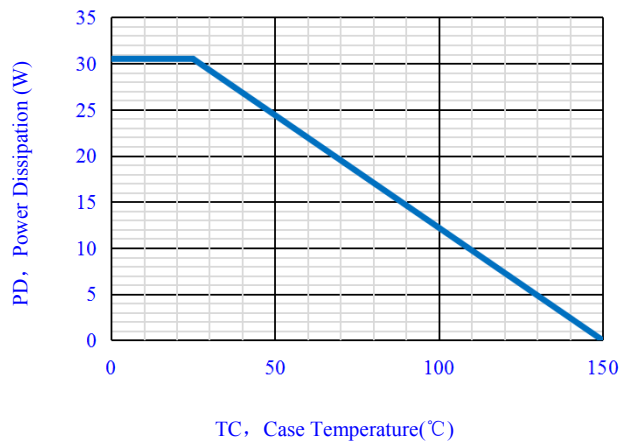


Fig.8-Maximum Power Dissipation vs. Case Temperature

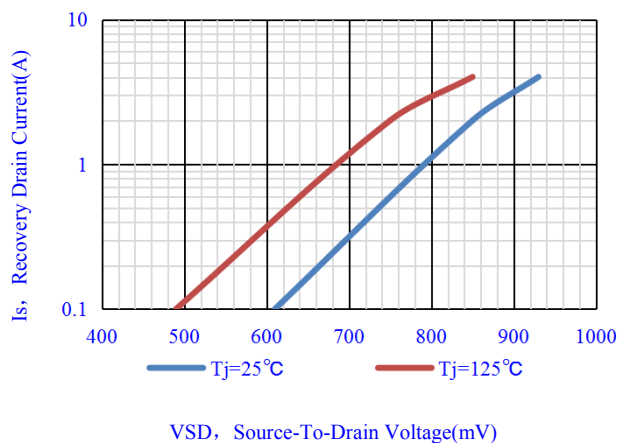


Fig.9- Source-To-Drain Diode Forward Voltage

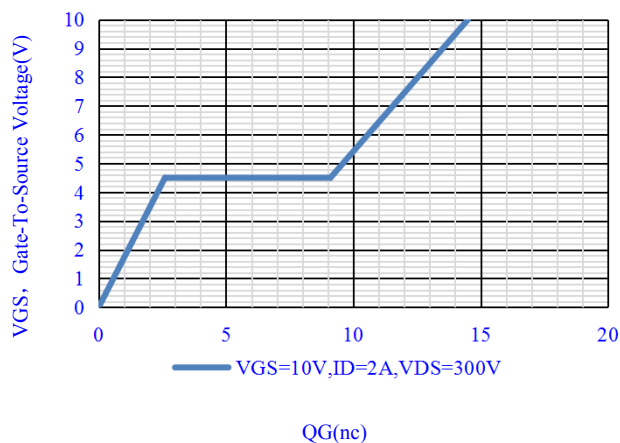


Fig.10-Gate Charge Waveform

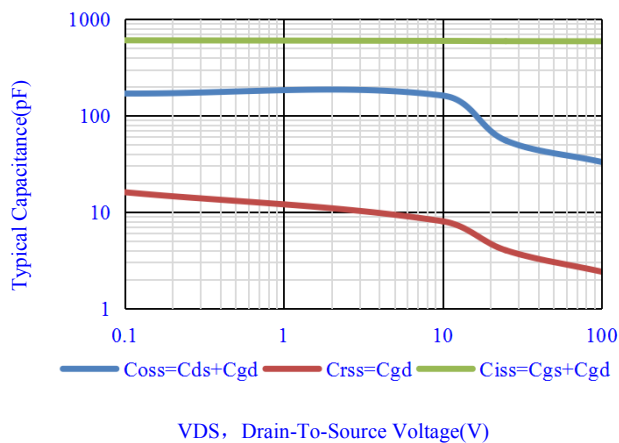


Fig.11-Typical Capacitance vs. Drain-To-Source Voltage

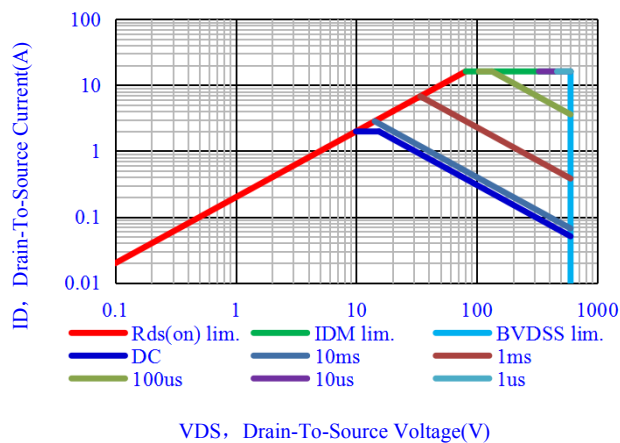


Fig.12-Maximum Safe Operating Area(SOA)

NPB4N60F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

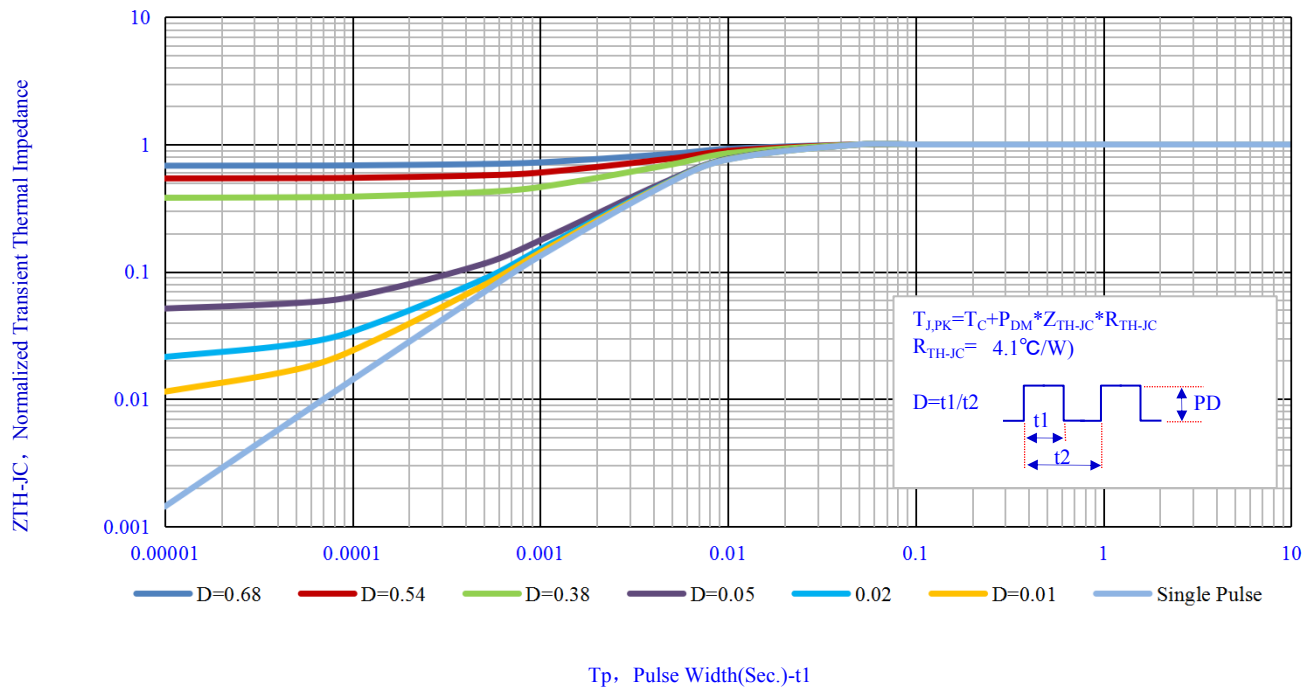


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform

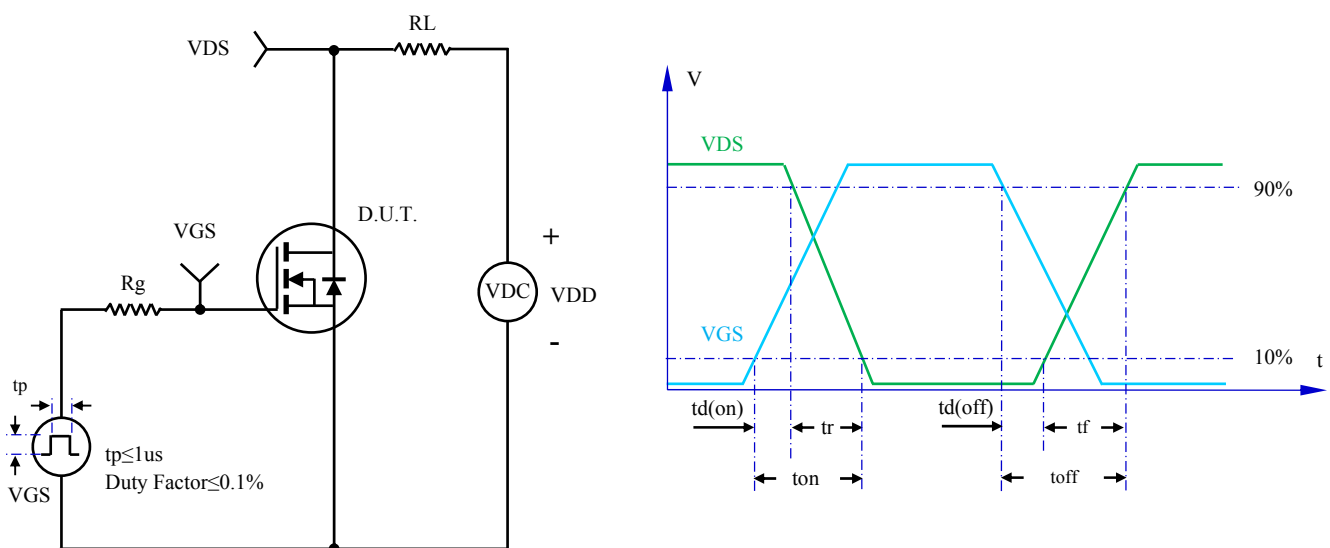


Fig.14- Resistive Switching Test Circuit & Waveform

N-Channel Enhancement Mode Power MOSFET

Test Circuit & Waveform

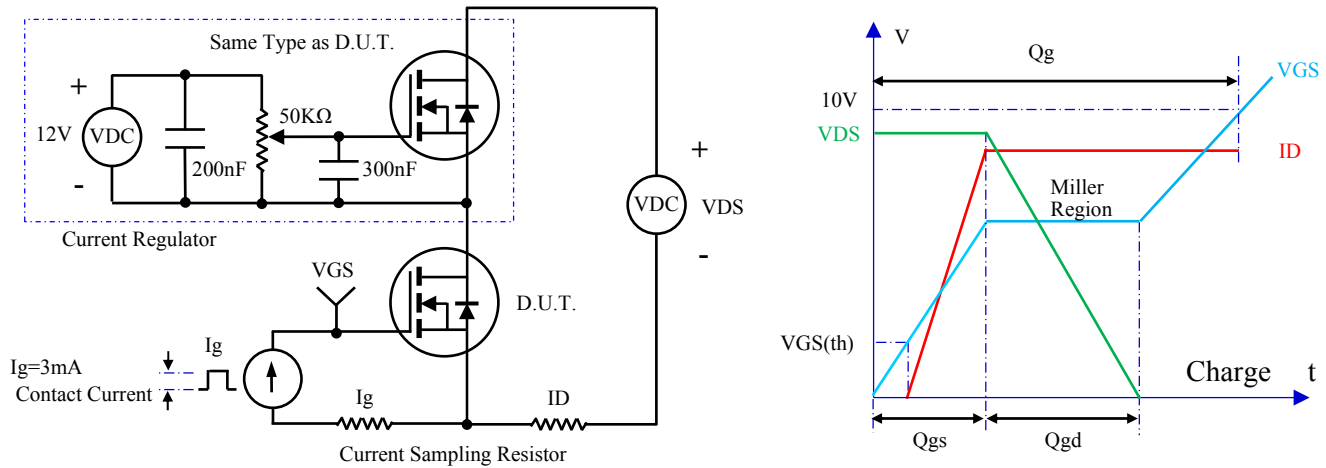


Fig.15-Gate Charge Test Circuit & Waveform

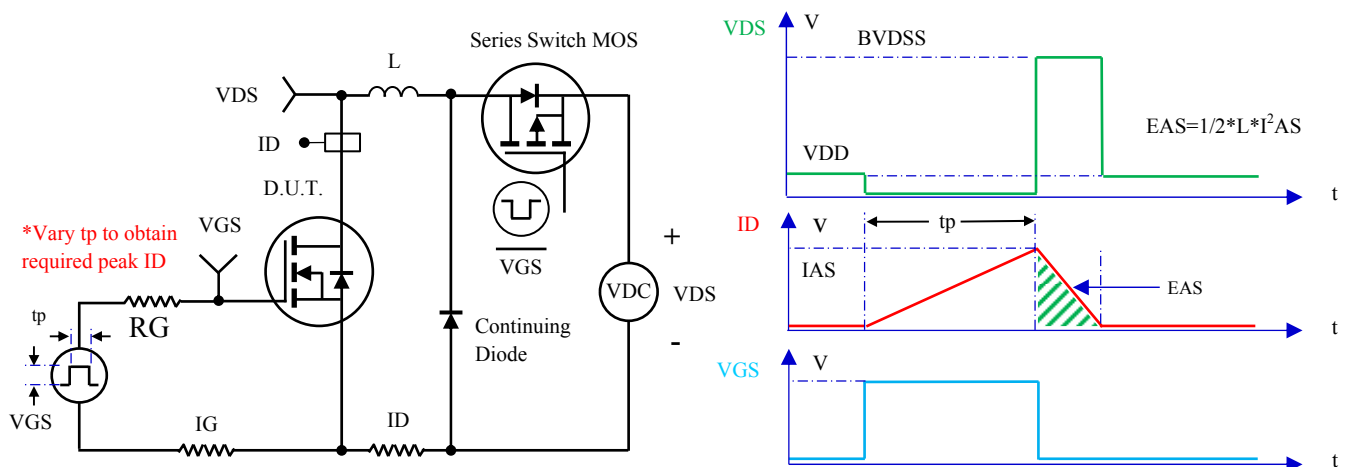


Fig.16- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

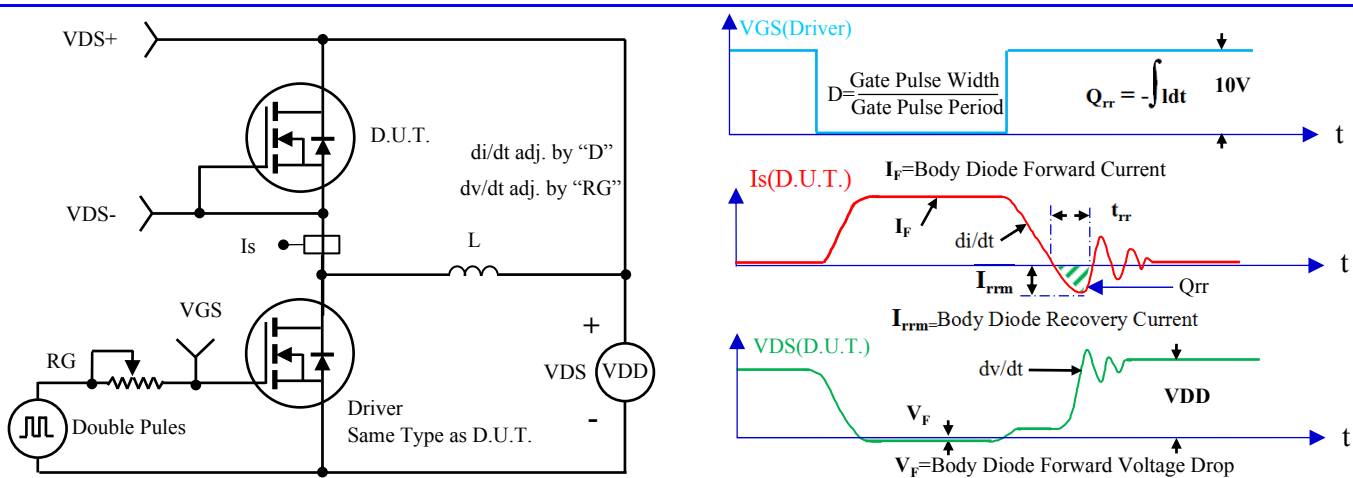


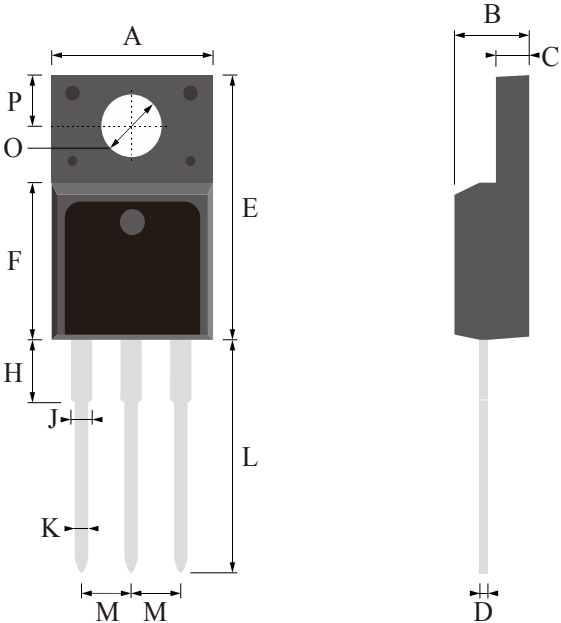
Fig.17- Diode Recovery Test Circuit & Waveform

NPB4N60F

N-Channel Enhancement Mode Power MOSFET



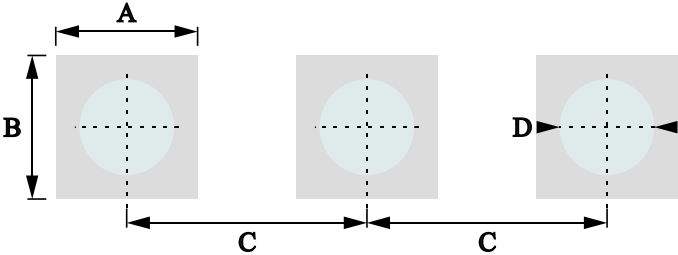
OUTLINE DRAWINGS



TO-220F

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	9.25	-	10.75	0.3642	-	0.4232
B	4.20	-	5.20	0.1654	-	0.2047
C	2.30	-	2.90	0.0906	-	0.1142
D	0.35	-	0.75	0.0138	-	0.0295
E	14.80	-	16.80	0.5827	-	0.6614
F	8.25	-	9.75	0.3248	-	0.3839
L	12.15	-	14.15	0.4783	-	0.5571
H	2.40	-	3.00	0.0945	-	0.1181
J	1.10	-	1.50	0.0433	-	0.0591
K	0.60	-	1.00	0.0236	-	0.0394
M	2.20	-	3.00	0.0866	-	0.1181
O	2.70	-	3.50	0.1063	-	0.1378
P	2.25	-	2.85	0.0886	-	0.1122

RECOMMEDND LAYOUT DRAWINGS



TO-220F

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	1.60	-	-	0.0630	-
B	-	1.60	-	-	0.0630	-
C	-	2.54	-	-	0.1000	-
D	-	1.00	-	-	0.0394	-

NPB4N60F

N-Channel Enhancement Mode Power MOSFET



MARKING INFORMATION



MARKING INSTRUCTIONS

NH=Niuhang Trademark
FF=Product Line Code,According To Actual Changes
YWW=Date Code,According To Actual Changes
LLWWF=Inernal Code,According To Actual Changes
NPB4N60F=Model

PACKING INFORMATION

Package Type	Package Code	Product Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
TO-220F	P1	2.048	Tube	50	1000	5000

NPB4N60F

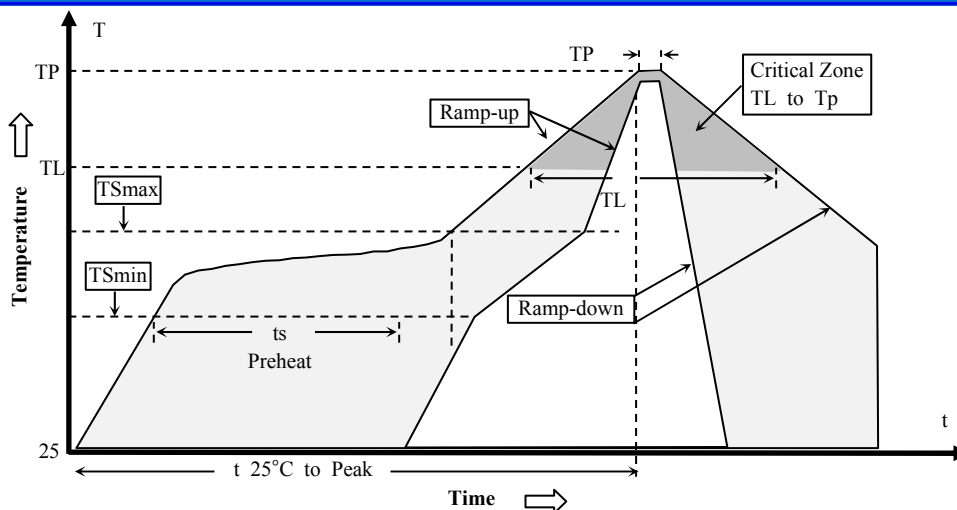
N-Channel Enhancement Mode Power MOSFET



Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3°C/second max.
Preheat -Temperature Min(TS min) -Temperature Max(TS max) -Time(ts min to ts max)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: -Temperature (TL) - Time (tL)	183°C 60-150 seconds	217°C 60-150 seconds
Peak Temperature(TP)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

NPB4N60F

N-Channel Enhancement Mode Power MOSFET



Disclaimer

- Reproducing and modifying information of the document is prohibited without permission from Niuhan Electronics Technology Co., LTD
- Niuhan Electronics Technology Co., LTD. reserves the rights to make changes of the content herein the document anytime without notification.
- Niuhan Electronics Technology Co., LTD. disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.
- Niuhan Electronics Technology Co., LTD. does not assume any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.
- Applications shown on the herein document are examples of standard use and operation. Customers are responsible in comprehending the suitable use in particular applications. Niuhan Electronics Technology Co., LTD. makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.
- The products shown herein are not designed and authorized for equipments requiring high level of reliability or relating to human life and for any applications concerning life-saving or life-sustaining, such as medical instruments, transportation equipment, aerospace machinery et cetera. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Niuhan Electronics Technology Co., LTD. for any damages resulting from such improper use or sale.
- When the appearance of the product and chip size does not change, in order to product the customer. quality, change the internal structure and the production process Niuhan can not notify