

NPB4N65F

N-Channel Enhancement Mode Power MOSFET



Voltage: 650 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

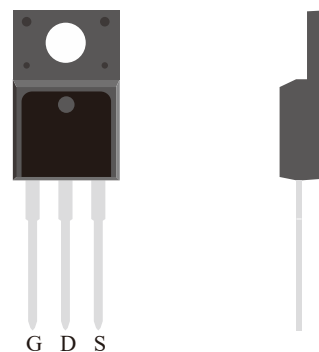
Typical Applications

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

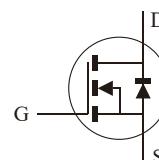
Product Summary

VDS Min.@Tj	650	V
Id Min.@Ta	4.0	A
RDS(ON)(TYP)@10V	1.2	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}	650	V
Gate-Source Voltage		V _{GS}	±30	V
Continuous Drain Current (Note 1)	Ta= 25 ℃	I _D	4.0	A
	Ta= 100 ℃		2.5	
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	W
	Ta= 100 ℃		12	
Derating Factor		D _F	0.24	W/℃
Avalanche Current,Single Pulse (Note 1)	L= 10.0 mH	I _{AS}	6.3	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 10.0 mH IAS= 6.3 A, RG= 10.0 Ω Starting Tj=25 ℃, VG= 10.0 V	E _{AS}	198	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}	4.17	

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

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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}	650	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	ΔBV _{DSS} /ΔT _J	--	0.77	--	V/℃
Drain-Source Leakage Current	VDS= 650 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)}	--	1.2	1.4	Ω
	ID= 2.0 A,VGS= 4.5 V		--	1.4	1.9	
Dynamic Characteristics						
Input Capacitance	VDS= 50 V	C _{iss}	--	600	--	pF
Output Capacitance	VGS= 0 V	C _{oss}	--	50	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C _{rss}	--	3.5	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 325 V	t _{d(on)}	--	14	--	ns
Turn-On Rise Time	VGS= 10.0 V	t _r	--	16	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	t _{d(off)}	--	32	--	ns
Turn-Off Rise Time		t _f	--	11	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 325 V	Q _g	--	15	--	nC
Gate-Source Charge	VGS= 10.0 V	Q _{gs}	--	3	--	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}	--	1.08	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= 325 V	Q _{rr}	--	1200	--	nC

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Typical Characteristics Curves

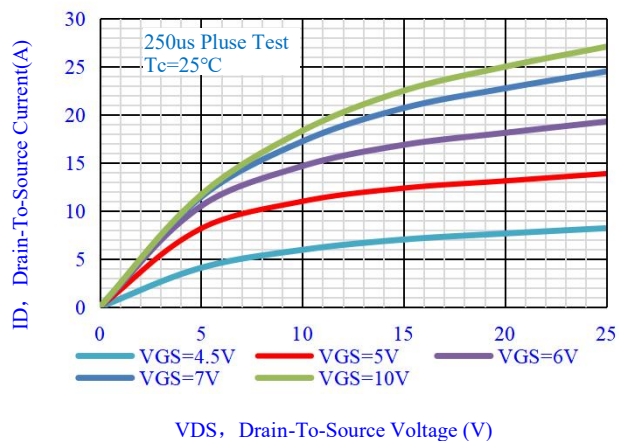


Fig.1-Output Characteristics

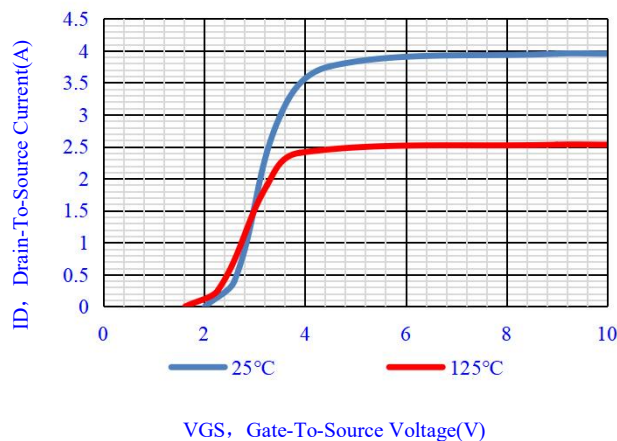


Fig.2- Transfer Characteristics

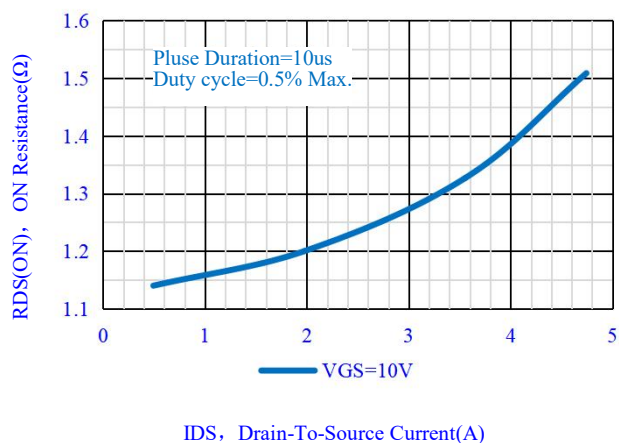


Fig.3- On Resistance vs. Drain Current

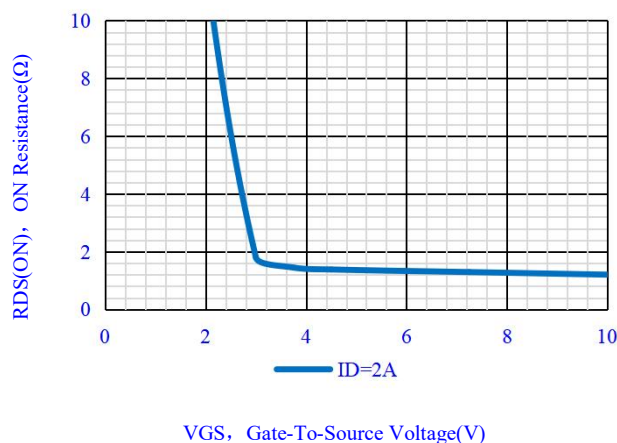


Fig.4- On Resistance vs. Gate Source Voltage

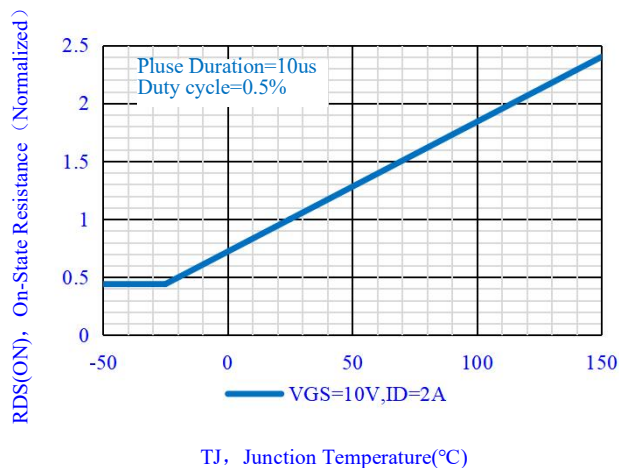


Fig.5- On Resistance vs. Junction Temperature

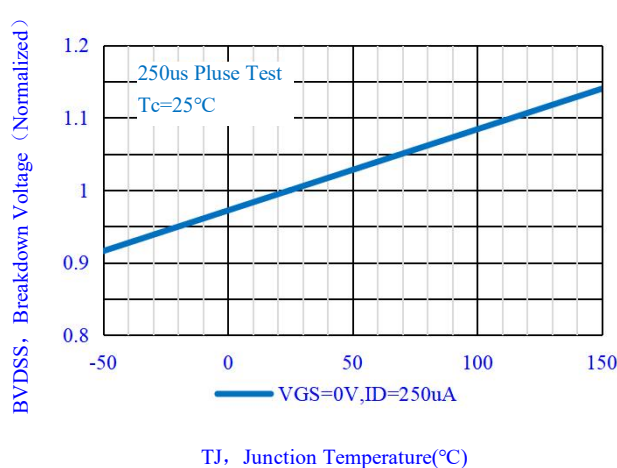


Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

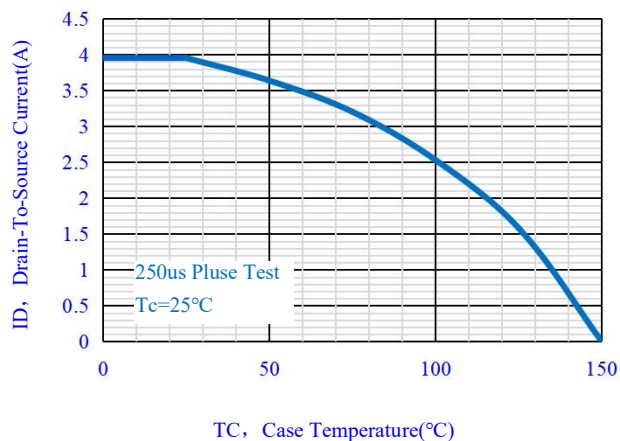


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

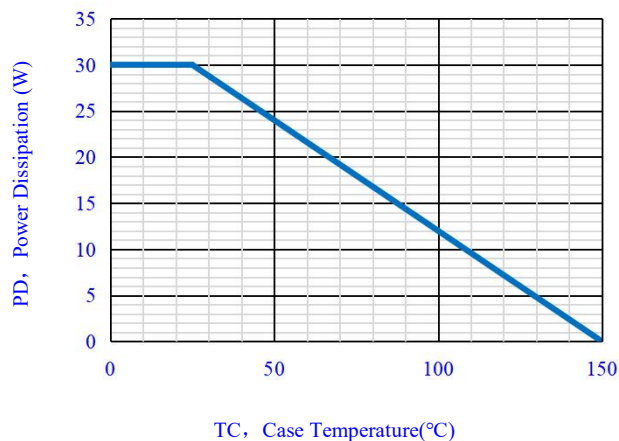


Fig.8-Maximum Power Dissipation vs. Case Temperature

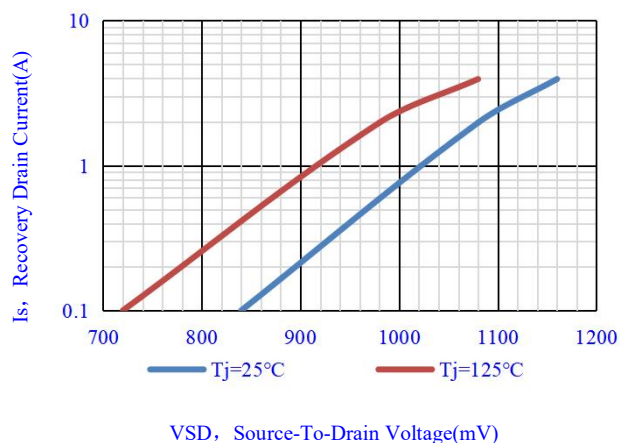


Fig.9- Source-To-Drain Diode Forward Voltage

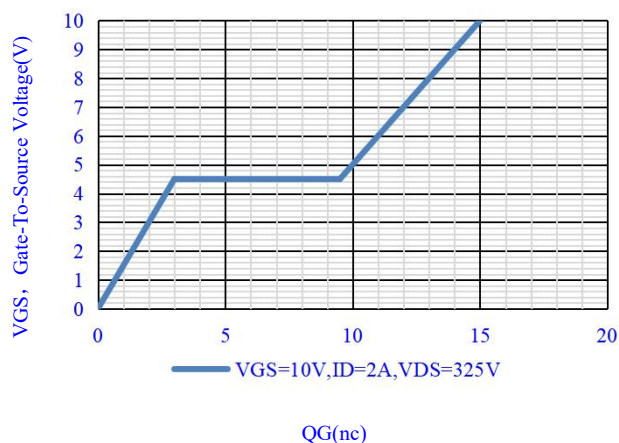


Fig.10-Gate Charge Waveform

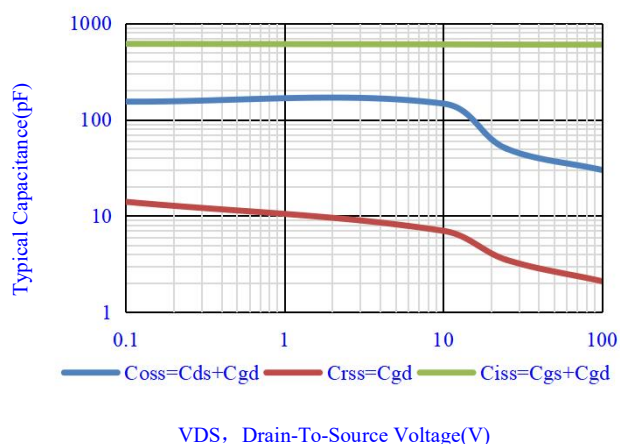


Fig.11-Typical Capacitance vs. Drain-To-Source Voltage

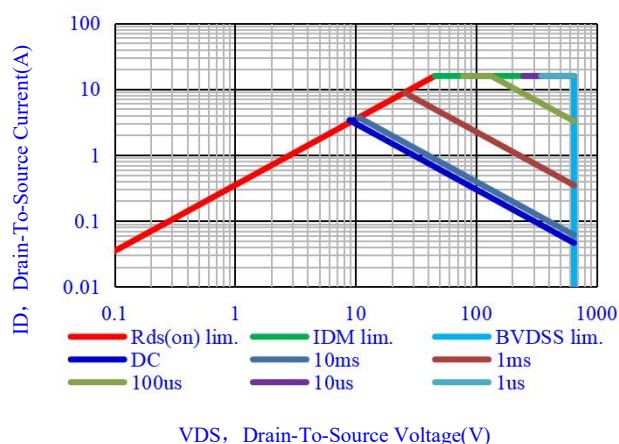


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

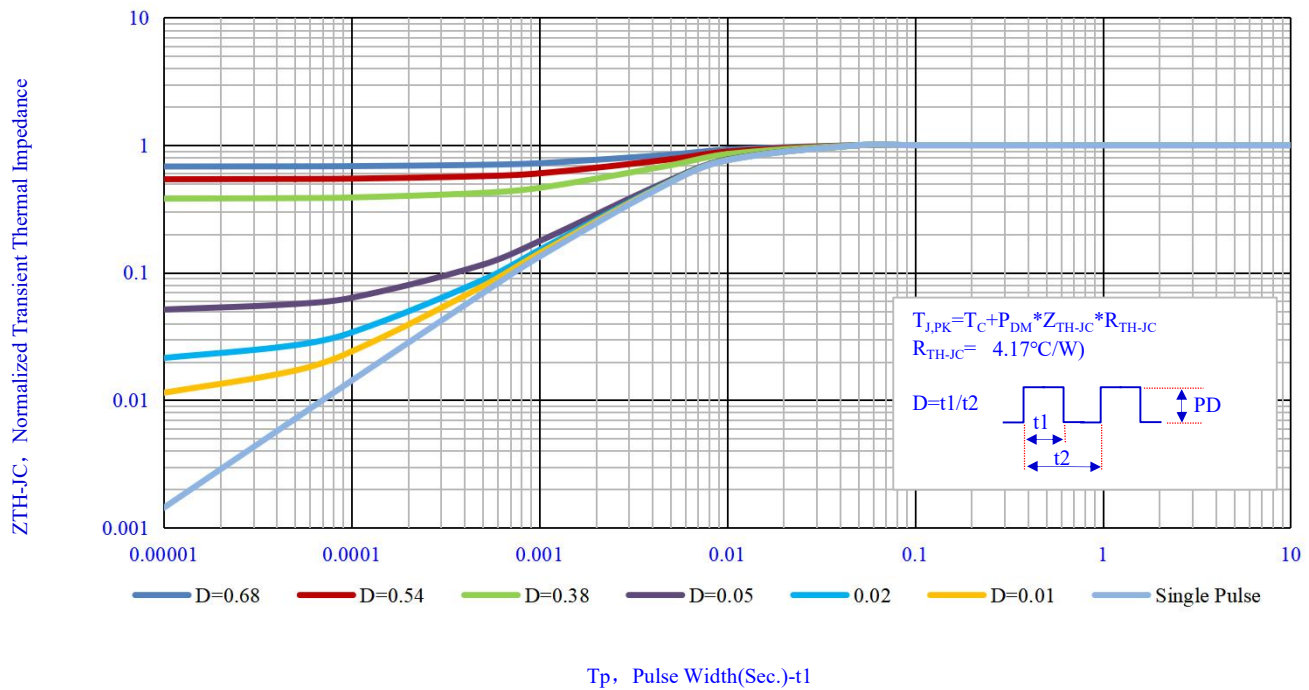


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform



Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

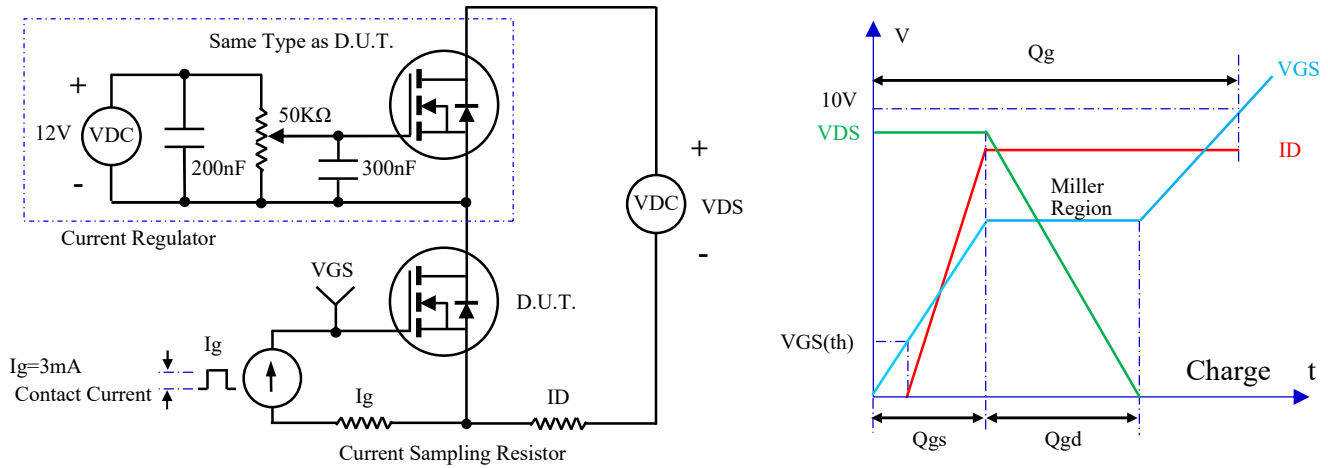


Fig.15- Gate Charge Test Circuit & Waveform

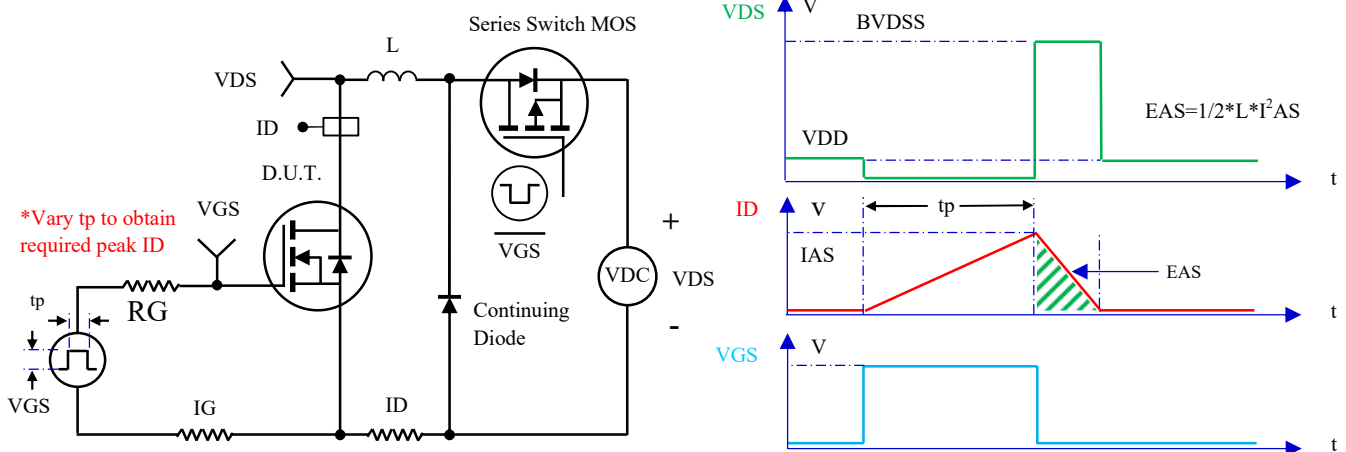


Fig.16- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

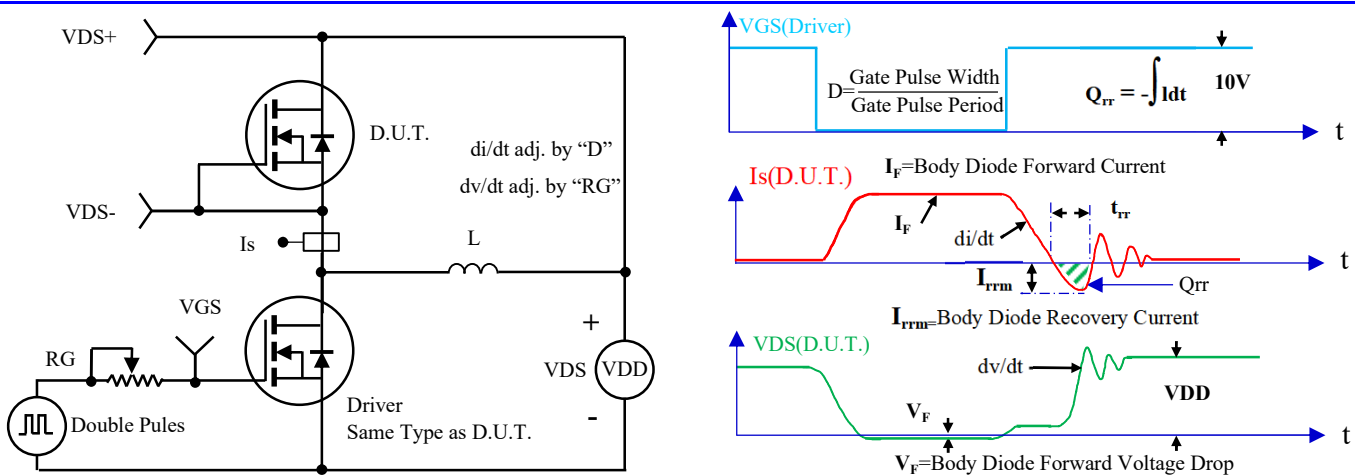


Fig.17- Diode Recovery Test Circuit & Waveform

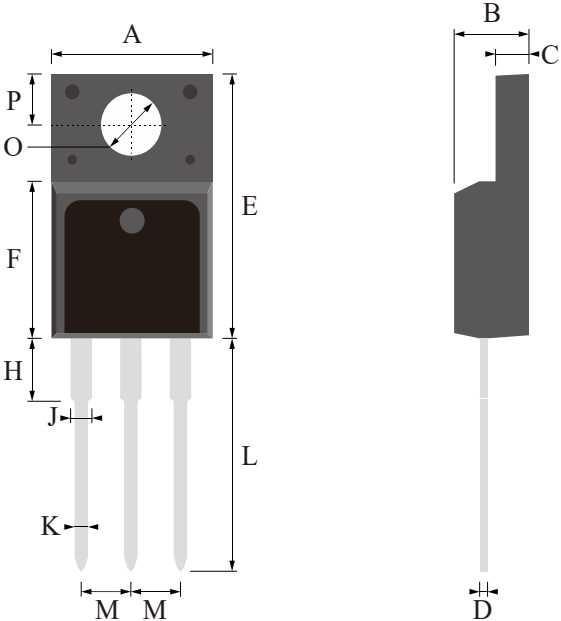
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OUTLINE DRAWINGS

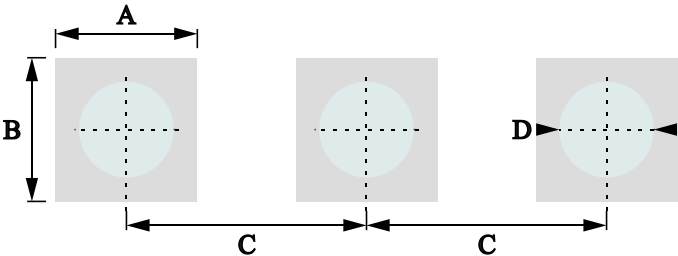
TO-220F



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	9.25	-	10.75	0.3642	-	0.4232
B	2.30	-	2.90	0.0906	-	0.1142
C	4.20	-	5.20	0.1654	-	0.2047
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	-

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MARKING INFORMATION



MARKING INSTRUCTIONS

NH=Niuhan Trademark

FF=Product Line Code,According To Actual Changes

YWW=Date Code,According To Actual Changes

LLWWF=Inernal Code,According To Actual Changes

NPB4N65F=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

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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(T _S min) -Temperature Max(T _S max) -Time(t _s min to t _s max)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: -Temperature (T _L) - Time (t _L)	183°C 60-150 seconds	217°C 60-150 seconds
Peak Temperature(T _P)	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.

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