

NPB7N65F

650V N-channel Enhancement MOSFET



VOLTAGE 650 Volts

CURRENT 7 Amperes

TO-220F

Marking and Polarity

FEATURES

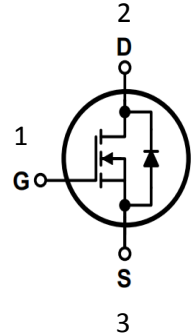
- Low RDS(ON)
- Ultra Low Gate Charge
- RoHS Compliant
- 100% UIS and RG Tested

TYPICAL APPLICATIONS

- Adapter, PC, PD, Charger
- Switched mode power supplies (SMPS)
- Uninterruptible Power Supply (UPS)

PRODUCT SUMMARY

B_{VDS} , Min. at Max. T_J	650	V
I_D	7	A
$R_{DS(ON)}$, Max. at $V_{GS}=10V$	1.20	Ω
Q_g , Typ.	28.0	nC



1 2 3

Remark:

- NH=niu hang trademark;
- FF=Product line code, According to actual changes
YWW=Data code, According to actual changes
LLWWF=Internal code, According to actual changes
- NPS7N65F=Module.

Absolute Maximum Ratings (Ratings at 25°C ambient temperature unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current (Note 1)	I_D	7	A
Drain Current-Pulsed (Note 1)	I_{DM}	28	A
Total Dissipation	P_D	48	W
Junction Temperature	T_J	-55 to +150	°C
Storage temperature range	T_{STD}	-55 to +150	°C
Single Pulse Avalanche Energy (Note 2)	E_{AS}	350	mJ

Thermal Characteristics (Ratings at 25°C ambient temperature unless otherwise specified)

Parameter	Symbol	Max	Unit
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	80.0	°C/W
Thermal Resistance Junction-Case (Note 3)	$R_{\theta JC}$	3.5	°C/W

Notes:

- Repetitive Rating : Pulse width limited by maximum junction temperature
- $L=10mH$, $I_{AS}=10A$, $V_{DD}=50V$, $R_G=25\Omega$, Starting $T_J=25^\circ C$
- The value of $R_{\theta JA}$ is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ C$.
The value in any given application depends on the user's specific board design. This transistor is sensitive to electrostatic discharge and should be handled with care.

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Electrical Characteristics (Ratings at 25°C ambient temperature unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	VGS=0V,ID=250uA	650	-	-	V
Drain-Source Leakage Current	I_{DSS}	VDS=650V,VGS=0V	-	-	1	uA
Gate-Body Leakage Current	I_{GSS}	VGS=±30V,VDS=0V	-	-	±100	nA
Static on Characteristics						
Gate Threshold Voltage	$V_{GS(TH)}$	VGS=VDS,ID=250uA	2.0	3.0	4.0	V
Drain-Source On Resistance	$R_{DS(ON)}$	VGS=10V,ID=3.5A	-	1.20	1.38	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	VDS=25V,VGS=0V, f=1.0MHz	-	1150	-	pF
Output Capacitance	C_{oss}		-	90	-	pF
Reverse Transfer Capacitance	C_{rss}		-	6.0	-	pF
Switching Paramters						
Turn-On Delay Time	$t_{d(on)}$	VDS=325V,ID=7A, VGS=10V,RG=25Ω	-	18	-	ns
Turn-On Rise Time	t_r		-	25	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	42	-	ns
Turn-Off Rise Time	t_f		-	20	-	ns
Gate Resistance	R_g	VDS=0V,VGS=0V,f=1.0MHz	-	2.5	-	Ω
Total Gate Charge	Q_g	VDS=520V,ID=7A,VGS=10V	-	28	-	nC
Gate-Source Charge	Q_{gs}		-	5	-	nC
Gate-Drain Charge	Q_{gd}		-	12	-	nc
Drain-Source Diode Characteristics and Maximum Ratings						
Max. Diode Forward Cuurent	I_S		-	-	7	A
Max. Pulsed Forward Cuurent	I_{SM}		-	-	28	A
Diode Forward Voltage	V_{SD}	VGS=0V,IS=7A	-	0.85	1.5	V
Reverse Recovery Time	t_{rr}	VR=400V,IF=7A,di/dt=100A/us	-	385	-	ns
Reverse Recovery Charge	Q_{rr}		-	3	-	μC

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Typical Characteristics Curves

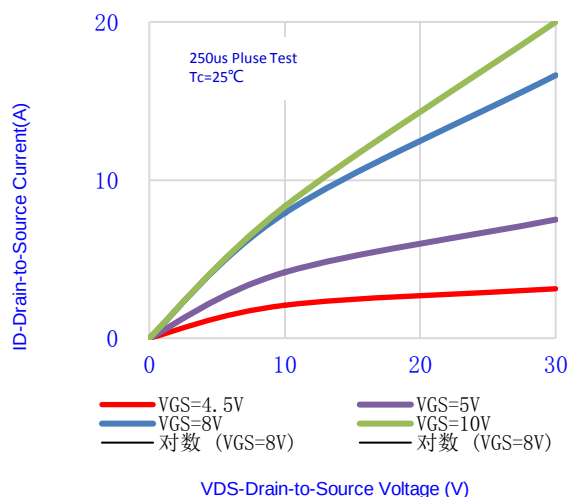


Fig.1-Output Characteristics

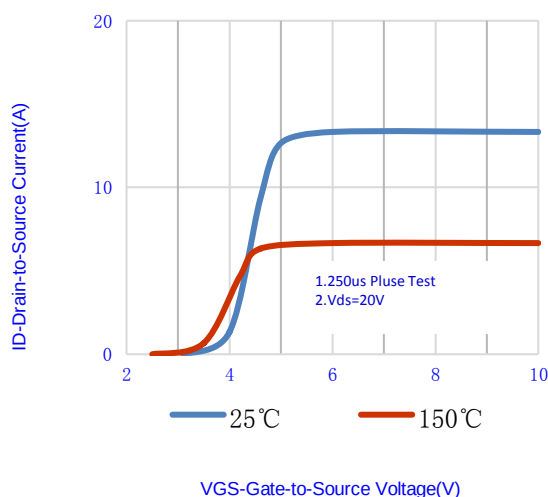


Fig.2- Transfer Characteristics

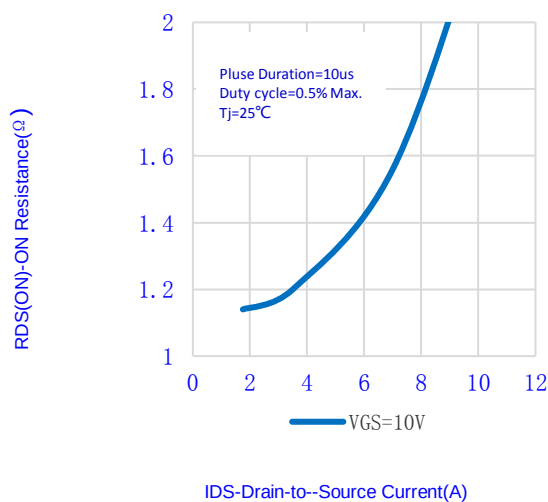


Fig.3- On Resistance vs. Drain Current

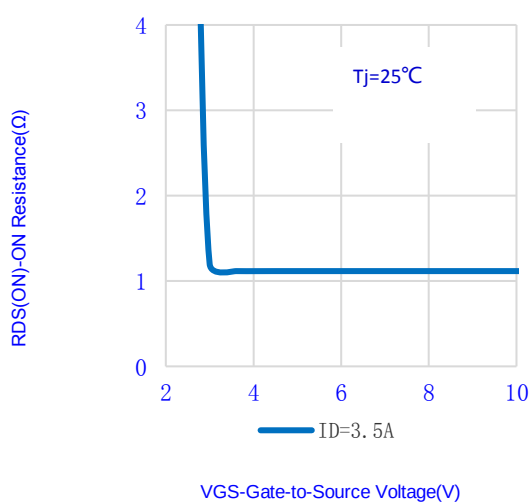


Fig.4- On Resistance vs. Gate Source Voltage

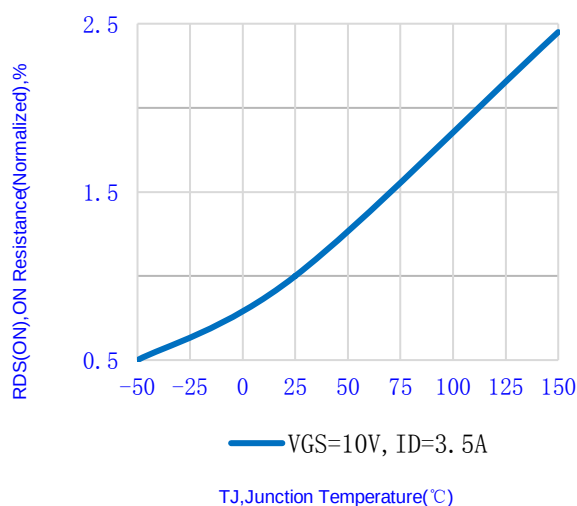


Fig.5- On Resistance vs. Junction Temperature

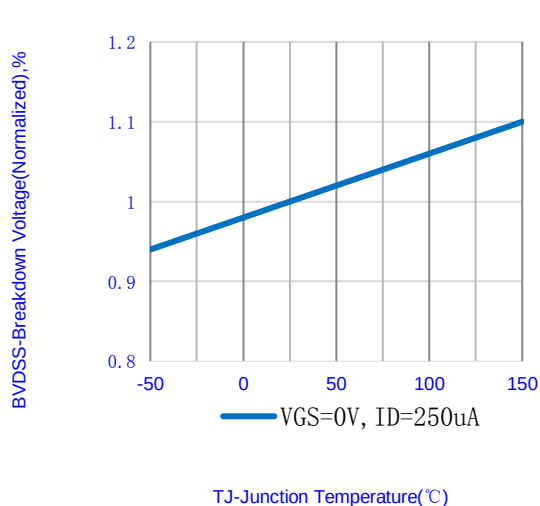


Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

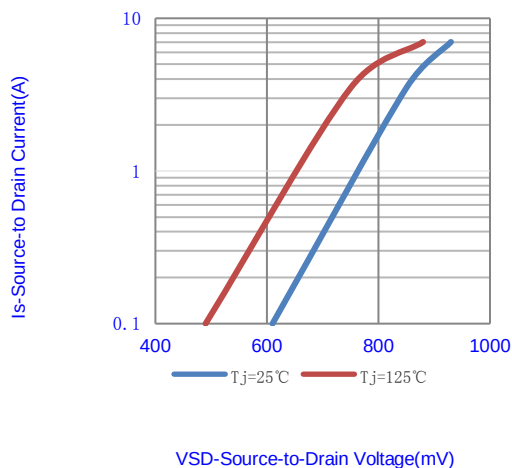


Fig.7- Source-Drain Diode Forward Voltage

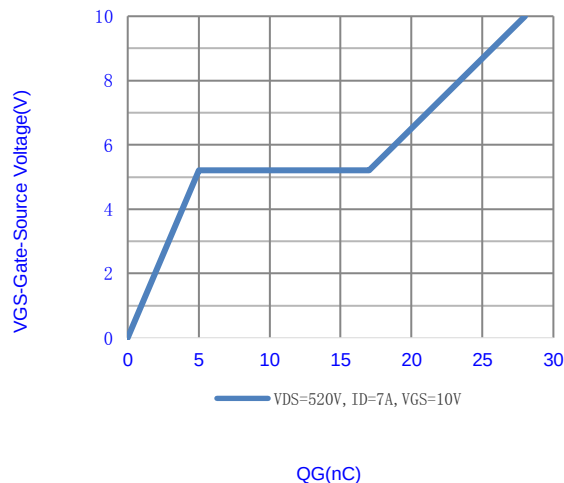


Fig.8- Gate Charge Waveform

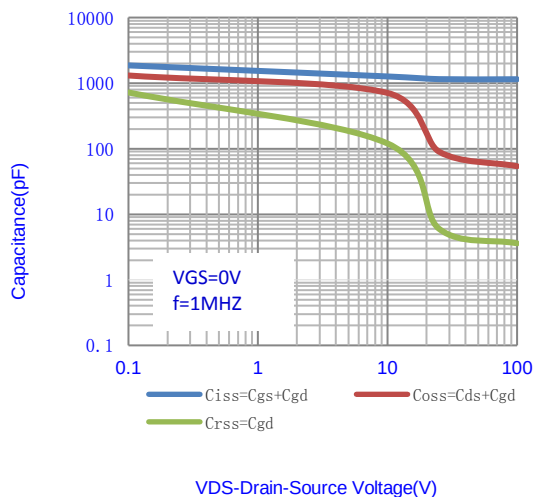


Fig.9- Gate-Source Voltage-VGS(V)

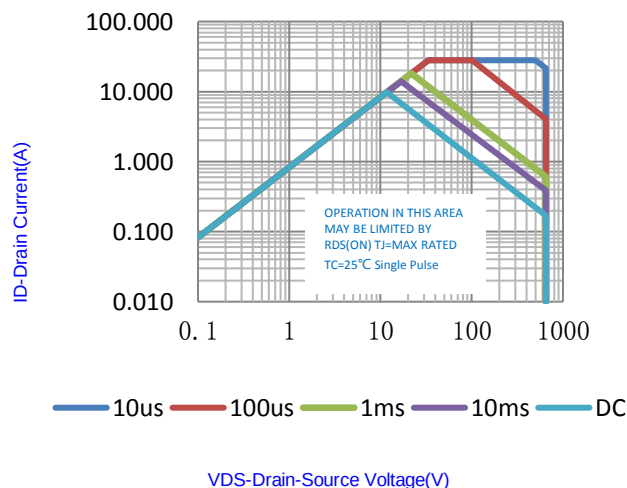


Fig.10- Maximum Safe Operating Area(SOA)

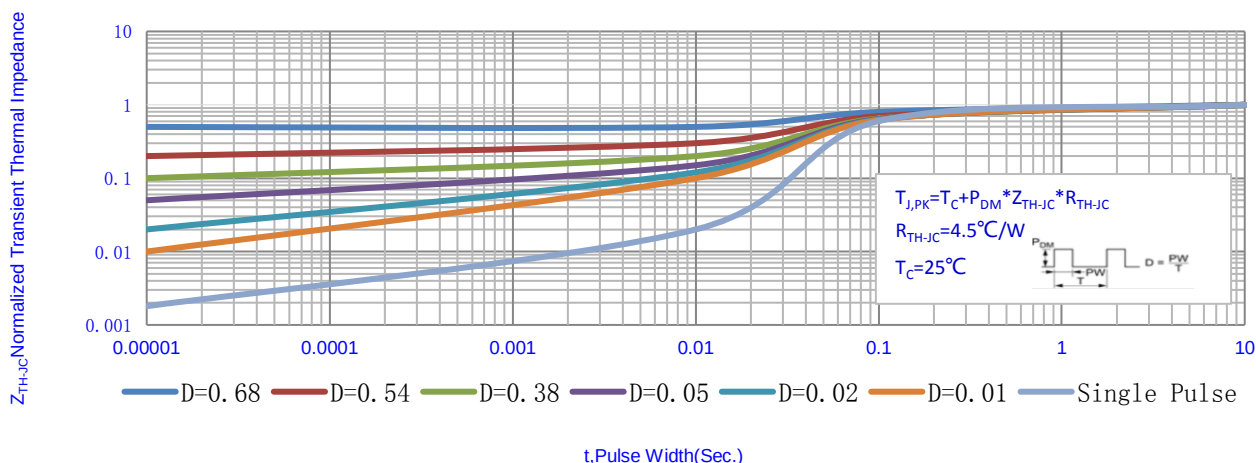


Fig.11- Normalized Transient Thermal Impedance vs. Pulse Width

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Test Circuit & Waveform

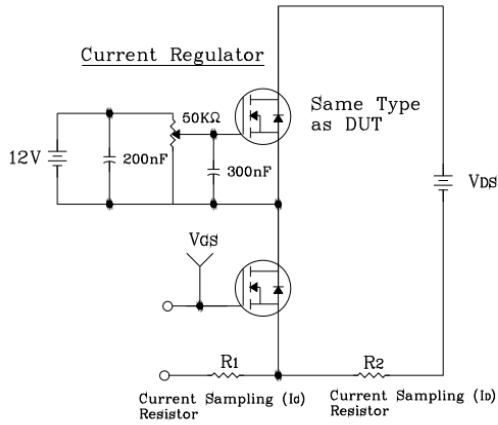


Fig.12- Gate Charge Test Circuit & Waveform

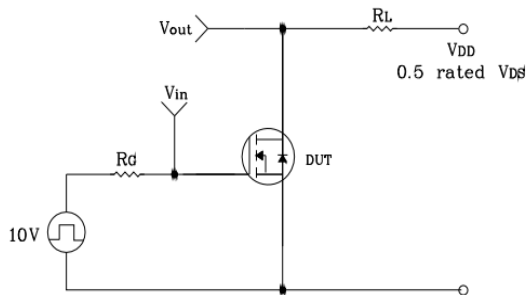


Fig.13- Resistive Switching Test Circuit & Waveform

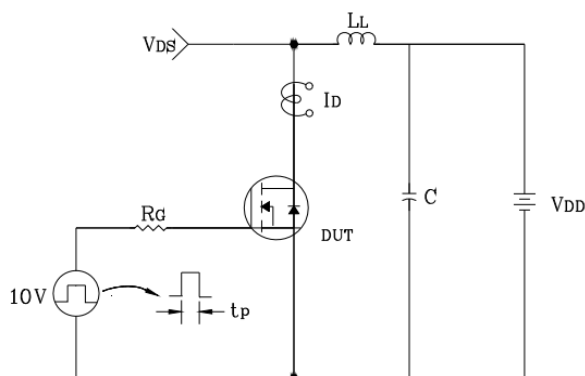


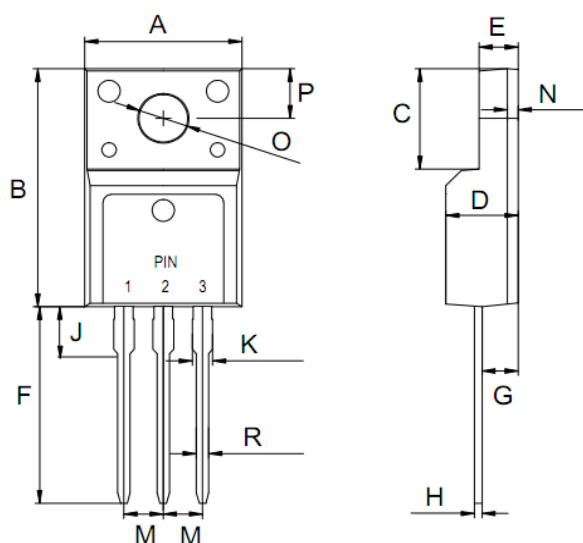
Fig.14- EAS Test Circuit & Waveform

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OUTLINE DRAWINGS



TO-220F

OUTLINE DIMENSIONS

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	10.00	-	10.50	0.39	-	0.41
B	15.40	-	16.20	0.61	-	0.64
C	6.48	-	6.88	0.26	-	0.27
D	4.50	-	4.90	0.18	-	0.19
E	2.35	-	2.75	0.09	-	0.11
F	12.50	-	-	0.49	-	-
G	2.40	-	3.00	0.09	-	0.12
H	0.40	-	0.60	0.02	-	0.02
J	2.20	-	4.20	0.09	-	0.17
M	2.40	-	2.70	0.09	-	0.11
N	0.80	-	1.10	0.03	-	0.04
K	1.20	-	1.50	0.05	-	0.06
R	0.60	-	1.00	0.02	-	0.04
O	3.10	-	3.70	0.12	-	0.15
P	3.00	-	4.00	0.12	-	0.16

PACKING INFORMATION

TO-220F

Package Method	Inner Box Size L×W×H(mm)	Quantity (pcs/box)	Carton Size L×W×H(mm)	Quantity (box/carton)
Box Package	570×153×47	1000	580×250×180	5000

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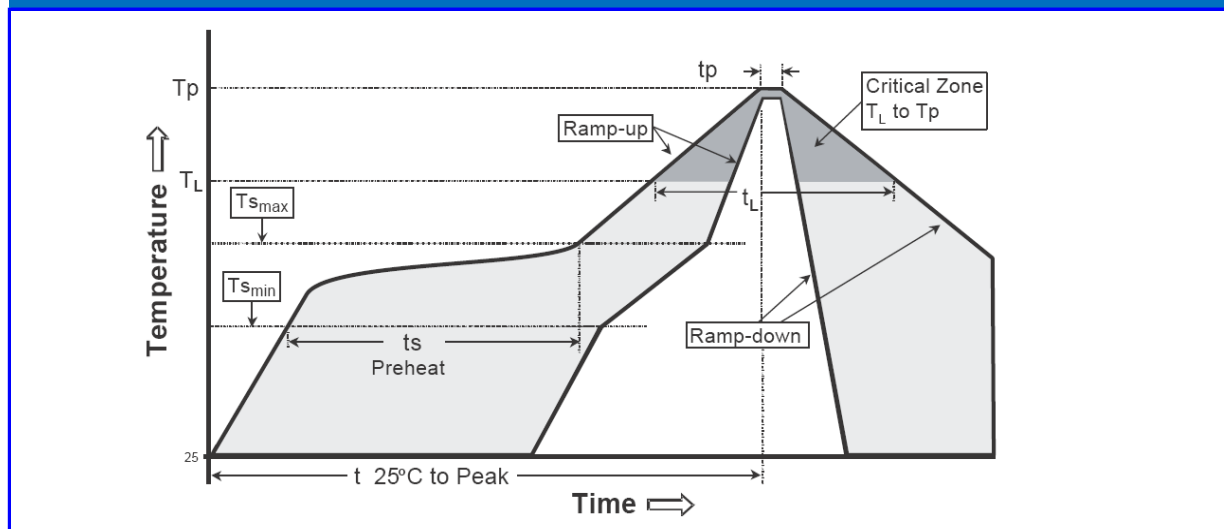
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Recommended wave soldering condition

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 (Tsmax to Tp)	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.

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