

NPS20N65F

N-Channel Enhancement Mode Power MOSFET



VOLTAGE: 650 Volts

CURRENT: 20 Amperes

Package: TO-220F

Marking And Polarity

FEATURES

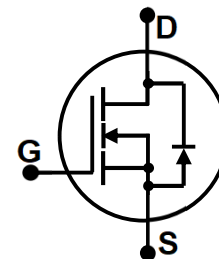
- Low $R_{DS(ON)}$ For High Efficiency
- Low Gate Charge For High Speed Switching
- High EAS For High Reliability
- 100% UIS And RG Tested

TYPICAL APPLICATIONS

- AC/DC converter
- Adaptor and Charger
- LED Drives
- High-Frequency Circuits and Switching Power Supply
- **Weight: App. 2.048 Grams (0.07224 Ounce)**

PRODUCT SUMMARY

VDS Min.@Tj	650	V
I _D Min.@Ta	20	A
RDS(ON) Type@10V	400.00	mΩ



Remark:

- ①. NH=Niuhan Trademark
- ②. FF=Product Line Code,According To Actual Changes
YWW=Date Code,According To Actual Changes
LLWWF=Inernal Code,According To Actual Changes
- ③. NPS20N65F=Model

Absolute Maximum Ratings (Ta=25°C 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 °C	I_D	20	A
	Ta= 100 °C		13	
Drain Current-Pulsed (Note 1)	Tj< 150 °C	I_{DM}	80	A
Maximum Power Dissipation Power	Ta= 25 °C	P_D	45	W
Dissipation Derating Factor Above 25°C	Ta= 100 °C		18	
Derating Factor		D_F	0.36	W/°C
Junction Temperature		T_J	-55 to 150	°C
Storage Temperature Range		T_{STD}	-55 to 150	°C
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I_{AS}	57.6	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 0.5 mH,VDD= 50 V IAS= 57.63 A,RG= 10 Ω Starting Tj=25 °C,VG = 10 V	E_{AS}	830	mJ

Thermal Characteristics (Ta=25°C Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Thermal Resistance Junction To Ambient	Still Air Environment With Ta =25°C	$R_{θJA}$	62.5	°C/W
Thermal Resistance Junction-Case	Device Mounted On 1 in ² FR-4 Board With 2oz	$R_{θJC}$	2.75	

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

NPS20N65F

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}	650	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.772	--	V/℃
Drain-Source Leakage Current	VDS= 650 V,VGS=0V	I_{DSS}	--	--	1.0	uA
Gate-Body Leakage Current	VGS= ±30 V,VDS=0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	ID= 10 A,VDS= 15 V	g_{fs}	--	17	--	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= 10 A,VGS= 10 V	$R_{DS(ON)}$	--	400.00	500.00	mΩ
	ID= 10 A,VGS= 4.5 V		--	460.00	670.00	
Dynamic Characteristics						
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	2.20	--	Ω
Input Capacitance	VDS= 25 V	C_{iss}	--	2990.0	--	pF
Output Capacitance	VGS= 0 V	C_{oss}	--	2000.0	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	--	6.5	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 325 V	$t_{d(on)}$	--	30.0	--	ns
Turn-On Rise Time	VGS= 10 V	t_r	--	60.0	--	ns
Turn-Off Delay Time	RL= 1.2 Ω	$t_{d(off)}$	--	60.0	--	ns
Turn-Off Rise Time	RG= 10 Ω	t_f	--	53.0	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 325 V	Q_g	--	52.0	--	nC
Gate-Source Charge	VGS= 10 V	Q_{gs}	--	14.3	--	nC
Gate-Drain Charge	ID= 10 A	Q_{gd}	--	16.0	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I_S	--	--	20	A
Max. Pulsed Forward Cuurent		I_{SM}	--	--	70	A
Diode Forward Voltage	ID= 10 A,VGS=0V	V_{SD}	--	1.08	1.5	V
Reverse Recovery Time	ID= 10 A,di/dt= 100 A/us	t_{rr}	--	925	--	ns
Reverse Recovery Charge	VGS= 10 V,VDS= 325 V	Q_{rr}	--	11.6	--	uC

NPS20N65F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

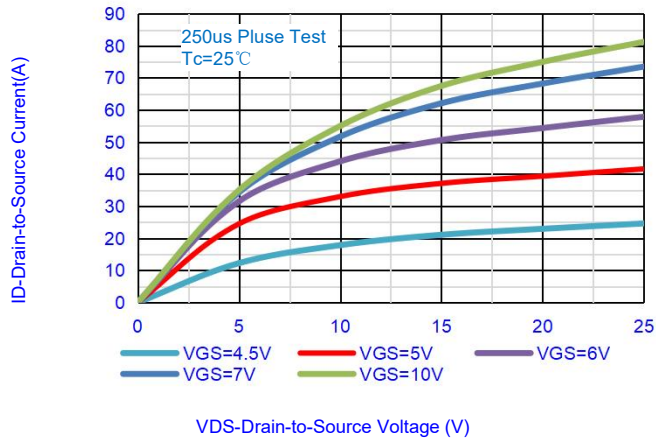


Fig.1-Output Characteristics

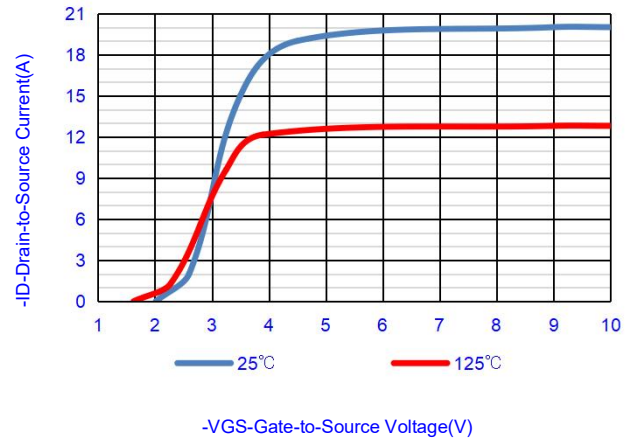


Fig.2- Transfer Characteristics

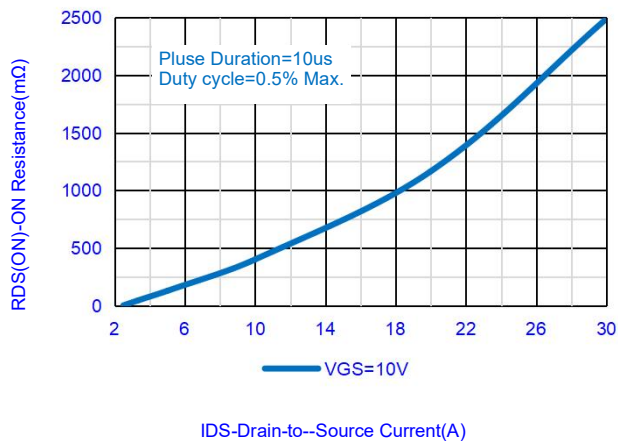


Fig.3- On Resistance vs. Drain Current

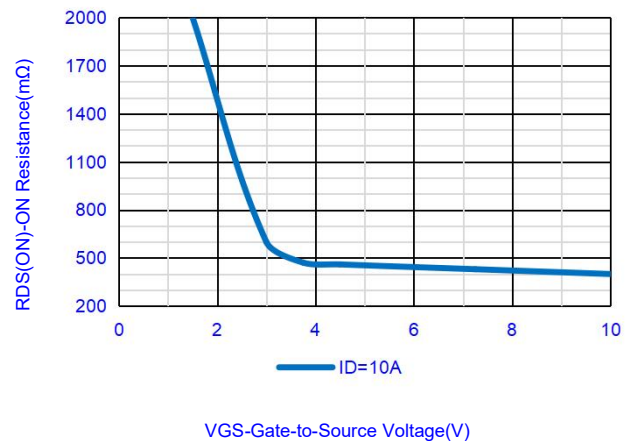


Fig.4- On Resistance vs. Gate Source Voltage

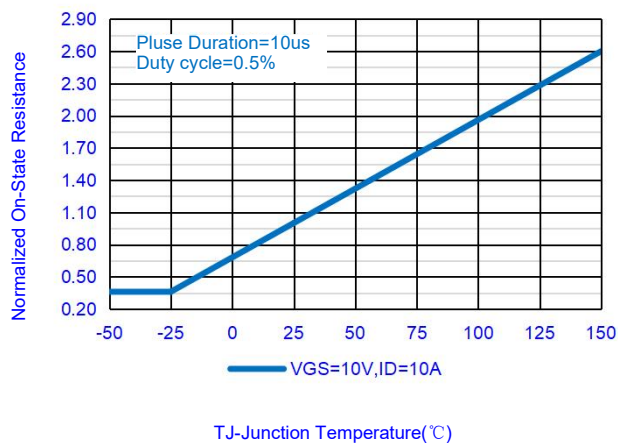


Fig.5- On Resistance vs. Junction Temperature

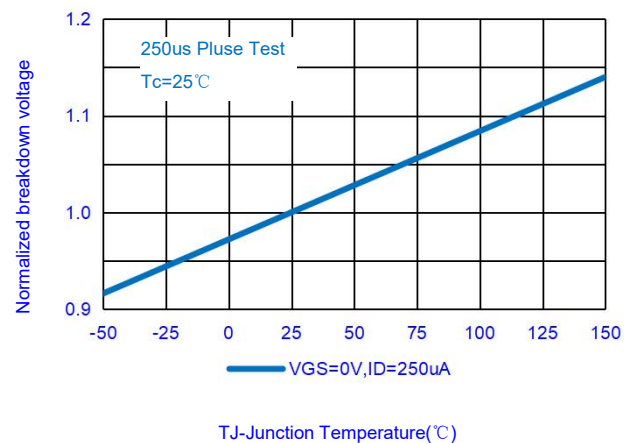


Fig.6- Breakdown Voltage vs. Junction Temperature

NPS20N65F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

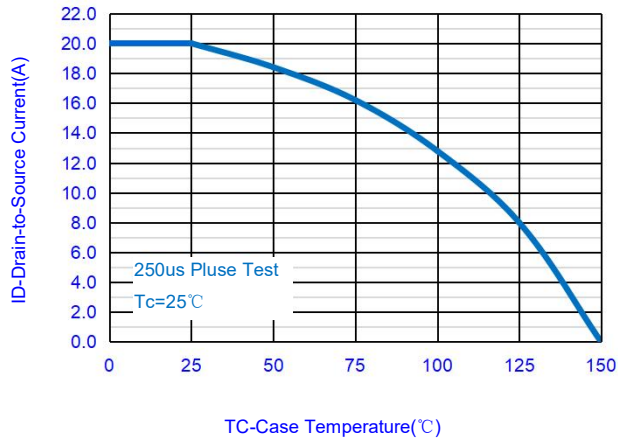


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

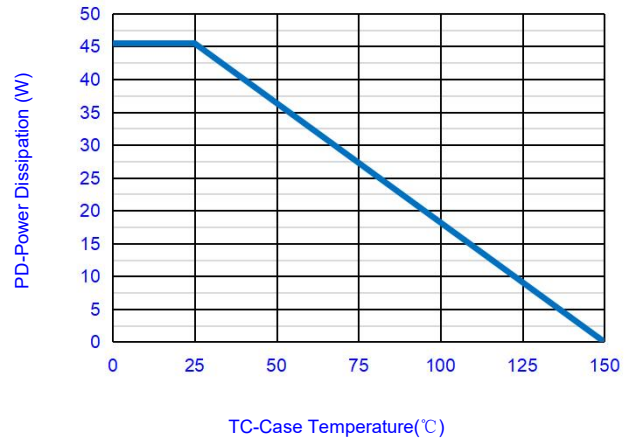


Fig.8-Maximum Power Dissipation vs. Case Temperature

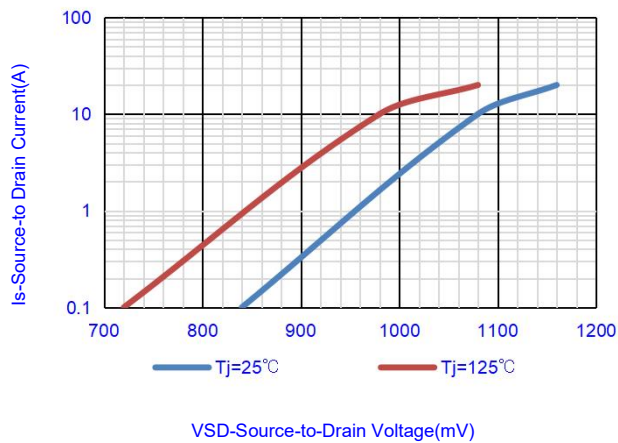


Fig.9- Source-Drain Diode Forward Voltage

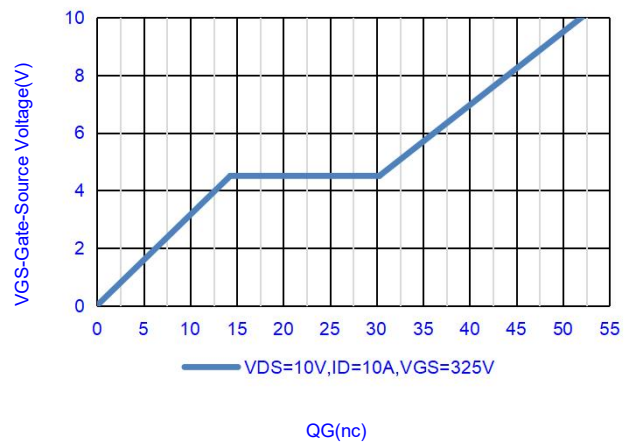


Fig.10-Gate Charge Waveform

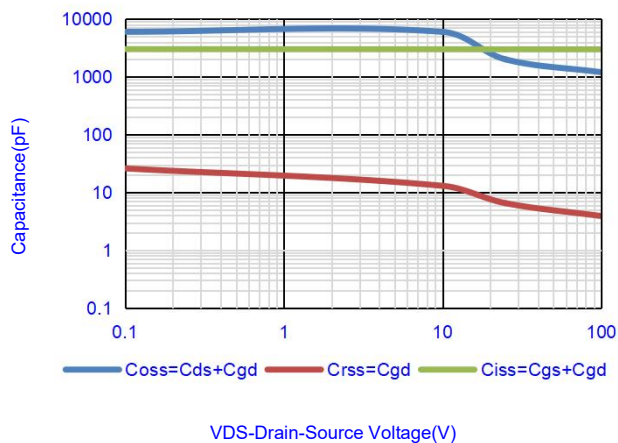


Fig.11- Gate-Source Voltage-VGS(V)

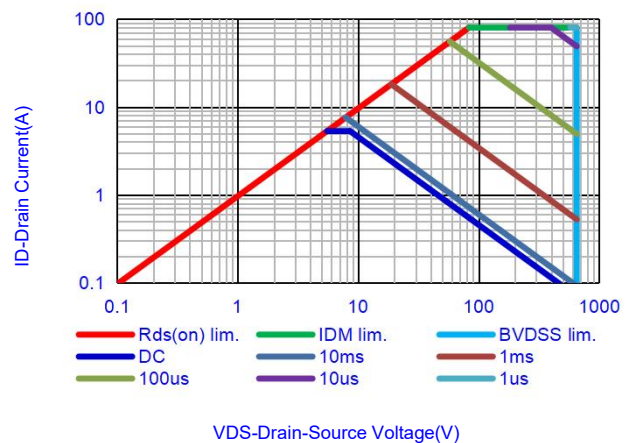


Fig.12-Maximum Safe Operating Area(SOA)

NPS20N65F

N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

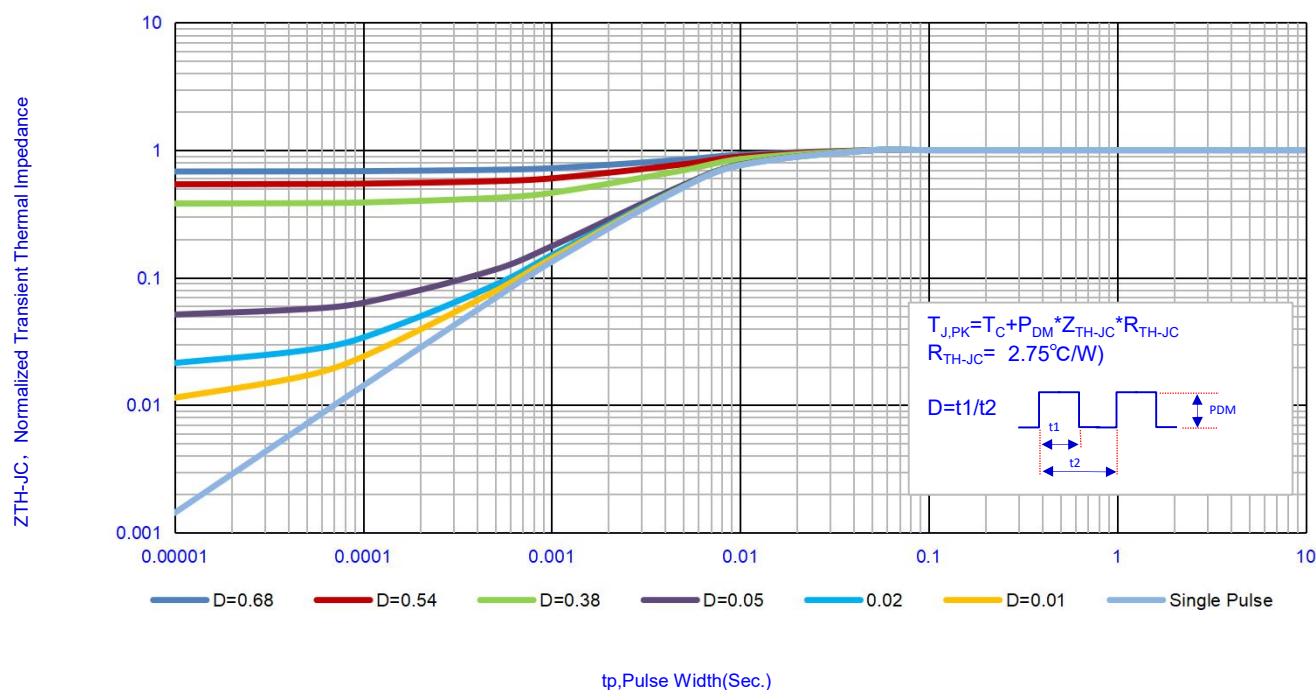


Fig.13- Normalized Maximum Transient Thermal Impedance vs. Pulse Width

Test Circuit & Waveform

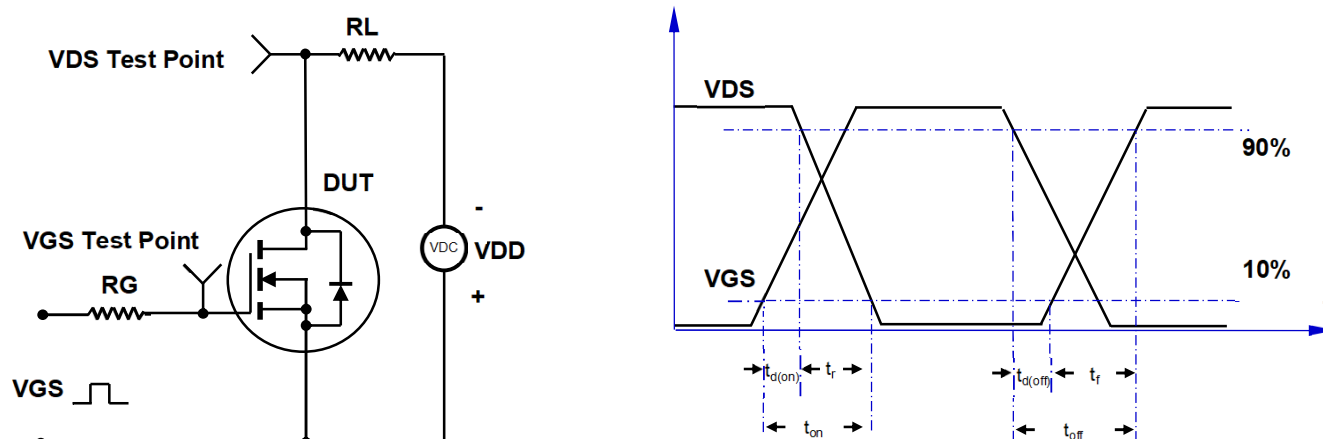


Fig.14- Resistive Switching Test Circuit & Waveform

NPS20N65F

N-Channel Enhancement Mode Power MOSFET



Test Circuit & Waveform

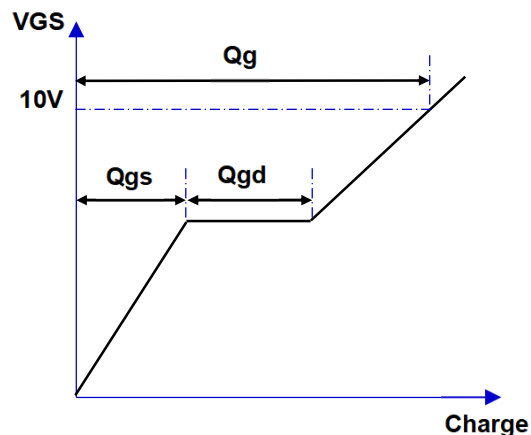
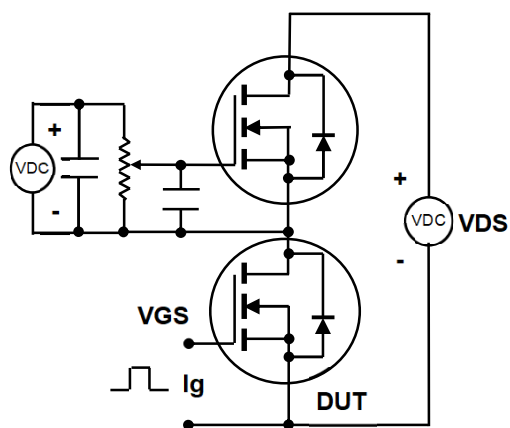


Fig.15-Gate Charge Test Circuit & Waveform

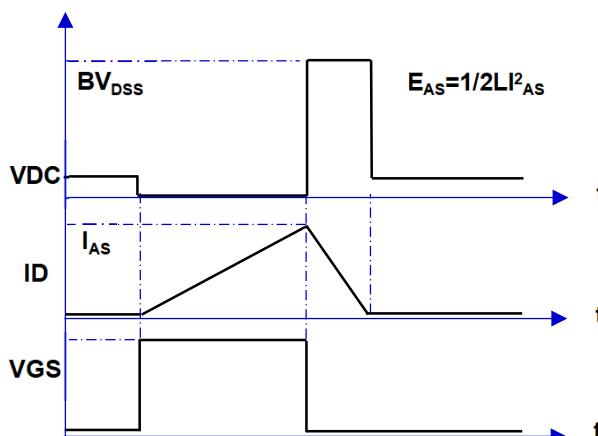
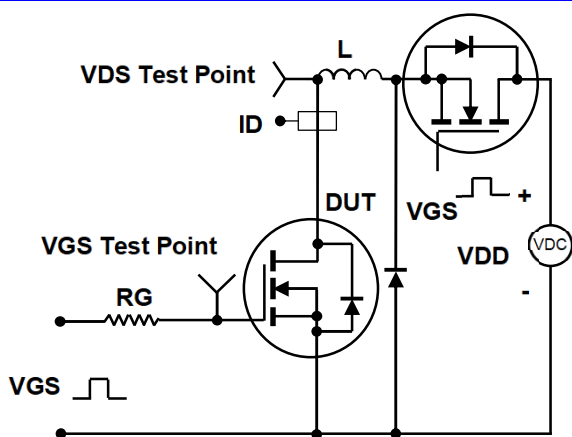


Fig.16- EAS Test Circuit & Waveform

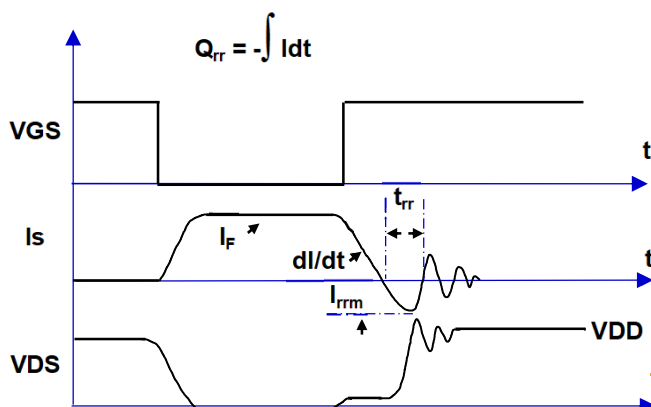
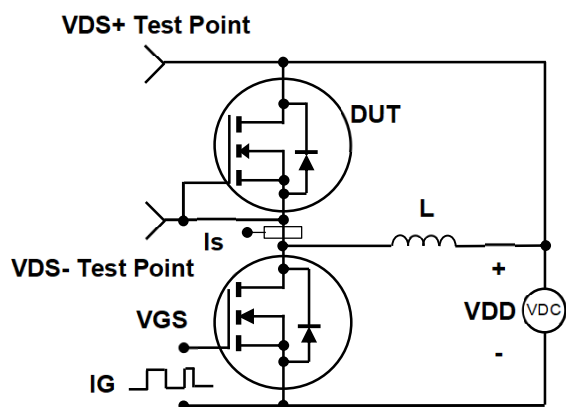


Fig.17- Diode Recovery Test Circuit & Waveform

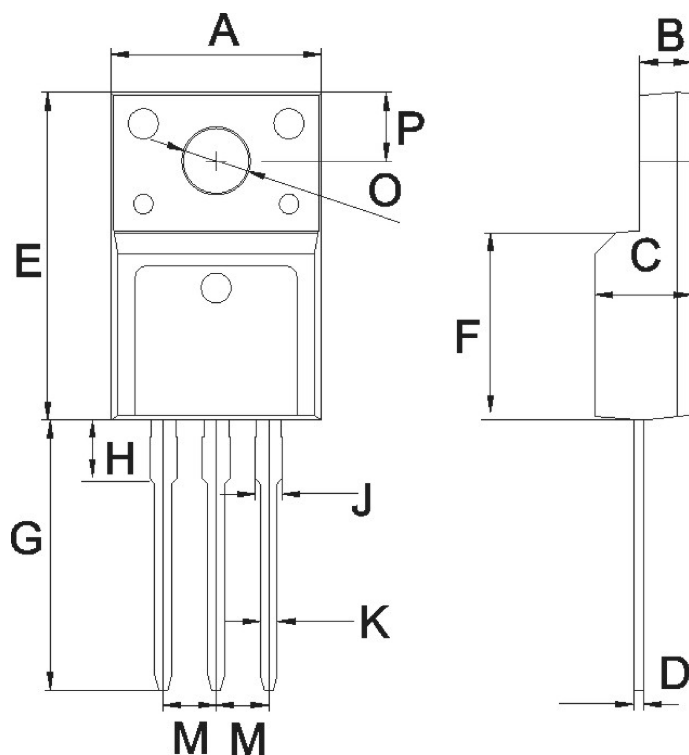
NPS20N65F

N-Channel Enhancement Mode Power MOSFET



OUTLINE DRAWINGS

TO-220F



OUTLINE DIMENSIONS

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	9.25	-	10.75	0.36	-	0.42
B	2.30	-	2.90	0.09	-	0.11
C	4.20	-	5.20	0.17	-	0.20
D	0.35	-	0.75	0.01	-	0.03
E	14.80	-	16.80	0.58	-	0.66
F	8.25	-	9.75	0.32	-	0.38
G	12.15	-	14.15	0.48	-	0.56
H	2.40	-	3.00	0.09	-	0.12
J	1.10	-	1.50	0.04	-	0.06
K	0.60	-	1.00	0.02	-	0.04
M	2.20	-	3.00	0.09	-	0.12
O	2.70	-	3.50	0.11	-	0.14
P	2.25	-	2.85	0.09	-	0.11

PACKING INFORMATION

Package Code	Package Method	Inner Box Size L×W×H(mm)	Quantity (Pcs/Inner Box)	Outer Carton Size L×W×H(mm)	Quantity (Pcs/Carton)
TO-220F	Tube Packaging	560x155x55	1000	570×284×185	5000

NPS20N65F

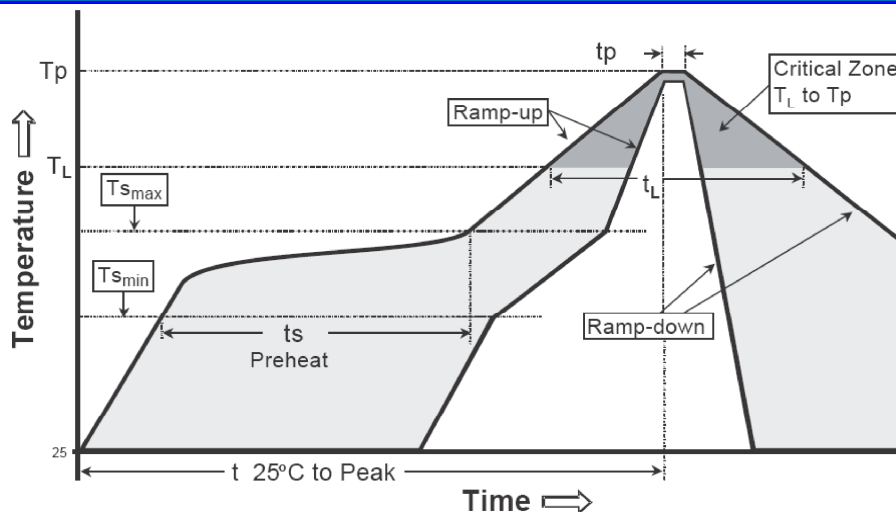
N-Channel Enhancement Mode Power MOSFET



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 (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.

NPS20N65F

N-Channel Enhancement Mode Power MOSFET



Disclaimer

- Reproducing and modifying information of the document is prohibited without permission from niuhang Electronics co., LTD
- Niuhan Electronics co., LTD. reserves the rights to make changes of the content herein the document anytime without notification.
- Niuhan Electronics 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 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 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 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