

**NPS13N50F**

500V N-Channel Enhancement Mode Power MOSFET



<b>VOLTAGE:</b>	500 Volts	<b>CURRENT:</b>	13 Amperes	<b>TO-220F</b>	<b>Marking and Polarity</b>
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**FEATURES**

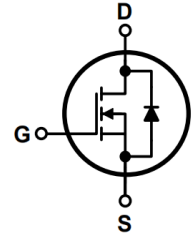
- Low RDS(ON)
- Ultra Low Gate Charge
- RoHS Compliant
- 100% UIS and RG Tested

**TYPICAL APPLICATIONS**

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

**PRODUCT SUMMARY**

VDS@T <sub>J</sub> MAX.	500	V
ID	13	A
RDS(ON) ,Typ.@10V	0.385	Ω



**Remark:**

- NH=niuhang trademark;
- FF=Product line code,According to actual changes  
YWW=Data code,According to actual changes  
LLWWF=Internal code,According to actual changes
- NPS13N50F=Model.

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

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		$V_{DS}$	500	V
Gate-Source Voltage		$V_{GS}$	±30	V
Continuous Drain Current (Note 1)	T <sub>a</sub> = 25 °C	$I_D$	13	A
	T <sub>a</sub> = 100 °C		8.3	
Drain Current-Pulsed (Note 1)	T <sub>J</sub> < 150 °C	$I_{DM}$	52	A
Maximum Power Dissipation	T <sub>a</sub> = 25 °C	$P_D$	42	W
Power Dissipation Derating Factor above 25°C	T <sub>a</sub> = 100 °C		17	
Derating Factor		$D_F$	0.33	W/°C
Junction Temperature		$T_J$	-55 to 150	°C
Storage temperature range		$T_{STD}$	-55 to 150	°C
Avalanche Current,Single pulse	L= 10 mH	$I_{AS}$	13	A
Single Pulse Avalanche Energy	L= 10 mH,VDD=15V IAS= 13 A, RG=25Ω Starting T <sub>J</sub> =25°C	$E_{AS}$	845	mJ

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

Parameter	Test Conditions	Symbol	Typ.	Unit
Thermal Resistance Junction to Ambient(Note 2)	1.still air environment with T <sub>A</sub> =25° C.	$R_{θJA}$	62.5	°C/W
Thermal Resistance Junction-Case(Note 2)	2.device mounted on 1 in <sup>2</sup> FR-4 board with 2oz	$R_{θJC}$	3	

Notes:

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

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit		
<b>Static off Characteristics</b>								
Drain-Source Breakdown Voltage	VGS=0V, ID=250uA	$BV_{DSS}$	500	-	-	V		
Bvdss Temperature Coefficient	ID=250uA, Reference 25°C	$\Delta BV_{DSS}/\Delta T_J$	-	0.6	-	V/°C		
Drain-Source Leakage Current	VDS= 500 V, VGS=0V, Ta = 25°C	$I_{DSS}$	-	-	1	uA		
	VDS= 400 V, VGS=0V, Ta = 125°C		-	-	100			
Gate-Body Leakage Current	VGS= ±30 V, VDS=0V	$I_{GSS}$	-	-	±100	nA		
<b>Static on Characteristics</b>								
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	2.0	3.0	4.0	V		
Drain-Source On Resistance	ID= 6.5 A, VGS=10V	$R_{DS(ON)}$	-	0.385	0.5	Ω		
<b>Dynamic Characteristics</b>								
Input Capacitance	VDS= 25 V	$C_{iss}$	-	1960	-	pF		
Output Capacitance	VGS= 0 V		$C_{oss}$	-	190		-	pF
Reverse Transfer Capacitance	F= 1 MHZ		$C_{rss}$	-	10		-	pF
<b>Switching Parameters</b>								
Turn-On Delay Time	VDS= 250 V ID= 13 A RG= 10 Ω	$t_{d(on)}$	-	30	-	ns		
Turn-On Rise Time		$t_r$	-	20	-	ns		
Turn-Off Delay Time		$t_{d(off)}$	-	60	-	ns		
Turn-Off Rise Time		$t_f$	-	30	-	ns		
Total Gate Charge	VDS= 400 V	$Q_g$	-	40	-	nC		
Gate-Source Charge	ID= 13 A	$Q_{gs}$	-	9	-	nC		
Gate-Drain Charge	VGS= 10 V	$Q_{gd}$	-	13	-	nC		
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>								
Max. Diode Forward Current		$I_S$	-	-	13	A		
Max. Pulsed Forward Current		$I_{SM}$	-	-	52	A		
Diode Forward Voltage	ID= 13 A, VGS=0V	$V_{SD}$	-	0.9	1.5	V		
Reverse Recovery Time	ID= 13 A, VGS=0V	$t_{rr}$	-	550	-	ns		
Reverse Recovery Charge	di/dt= 100 A/us	$Q_{rr}$	-	5	-	μC		

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Typical Characteristics Curves

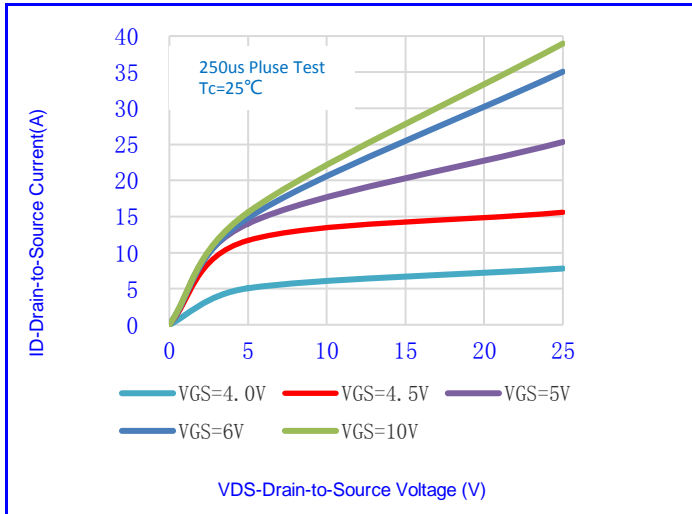


Fig.1-Output Characteristics

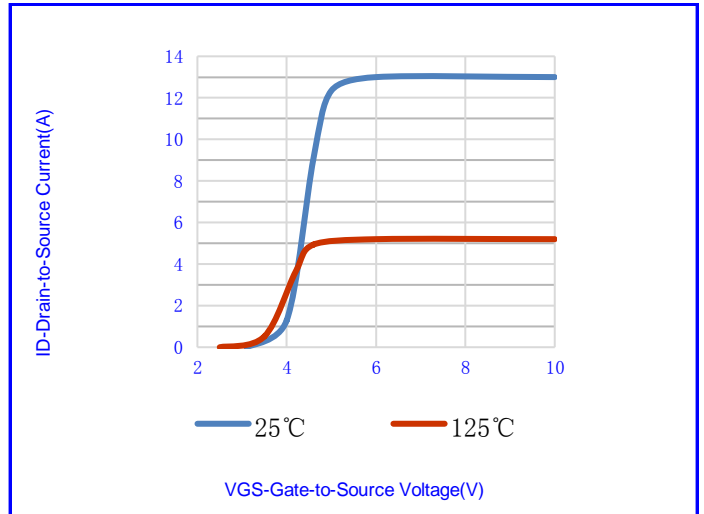


Fig.2- Transfer Characteristics

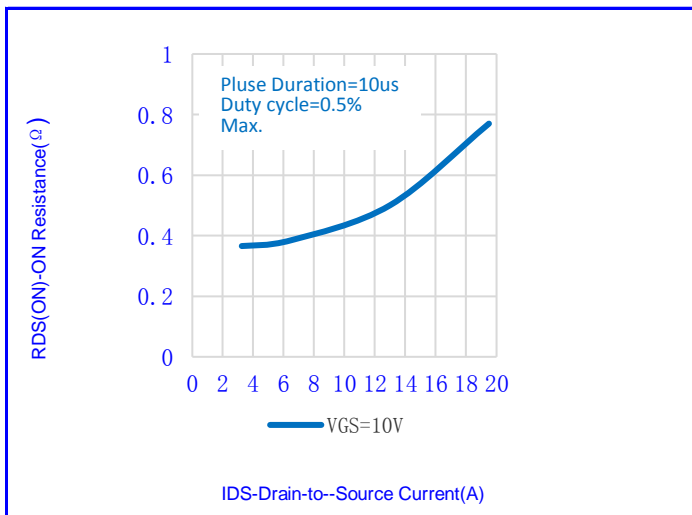


Fig.3- On Resistance vs. Drain Current

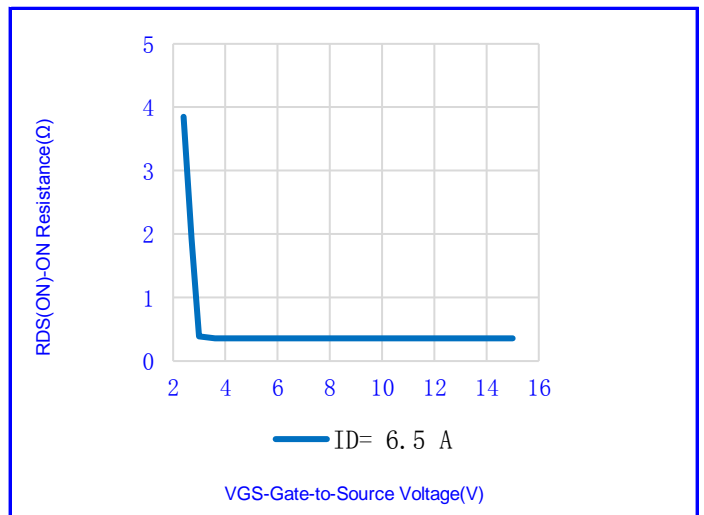


Fig.4- On Resistance vs. Gate Source Voltage

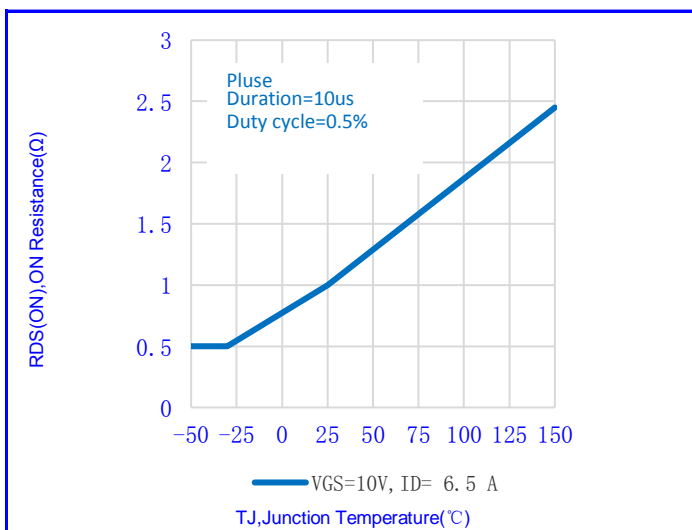


Fig.5- On Resistance vs. Junction Temperature

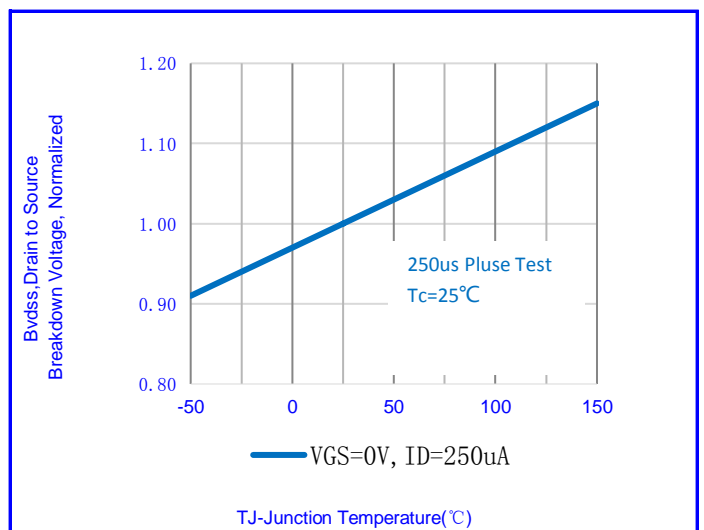


Fig.6- Breakdown Voltage vs. Junction Temperature

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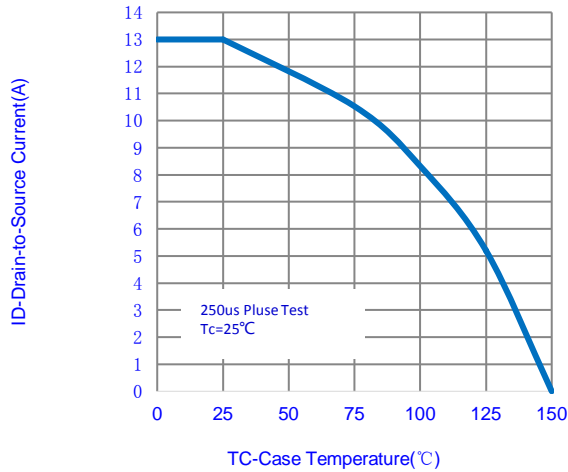


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

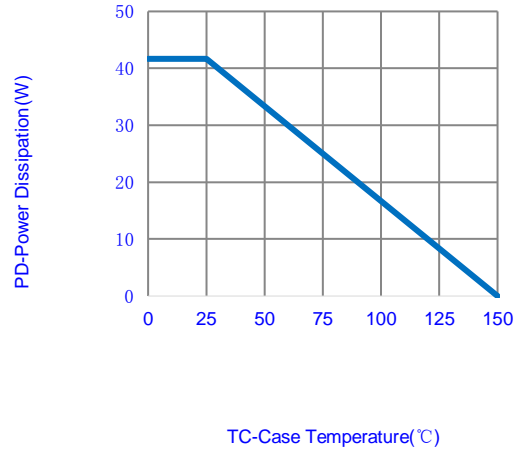


Fig.8-Maximum Power Dissipation vs. Case Temperature

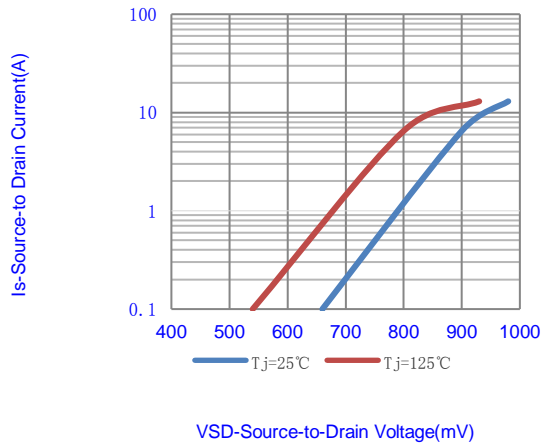


Fig.9- Source-Drain Diode Forward Voltage

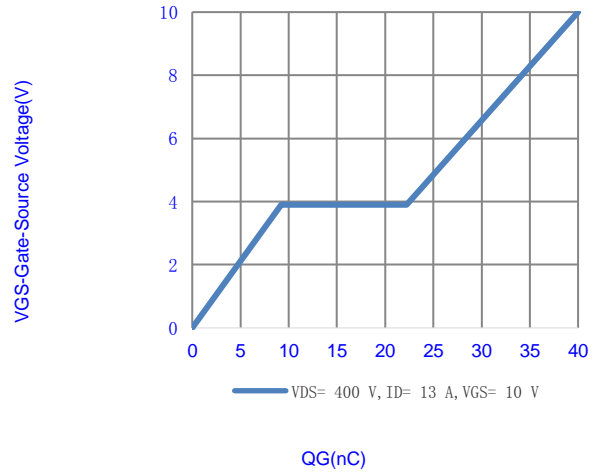


Fig.10-Gate Charge Waveform

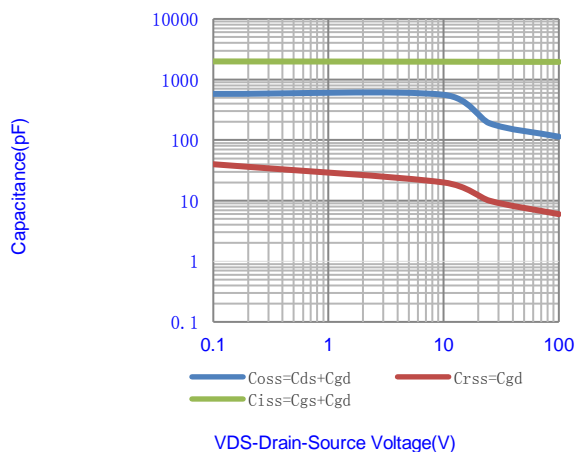


Fig.11- Gate-Source Voltage-VGS(V)

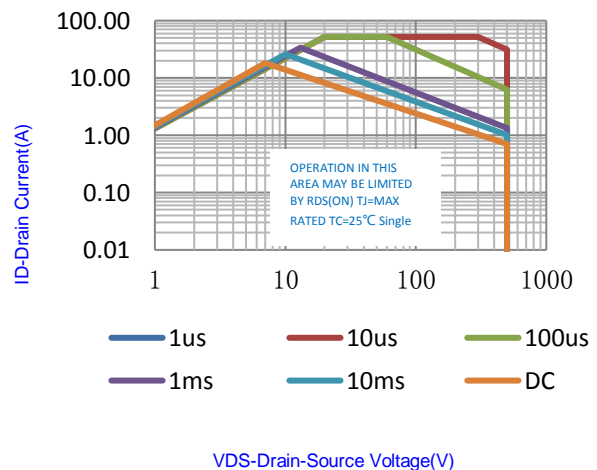


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

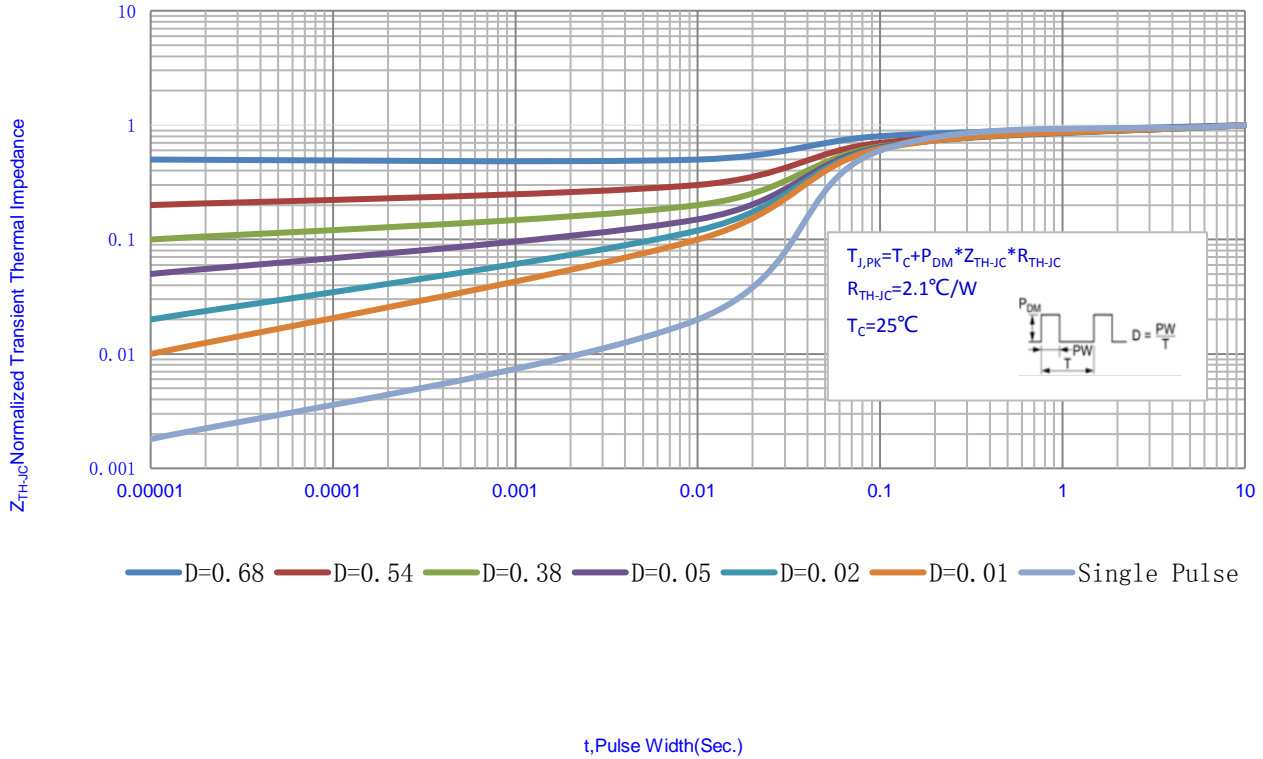


Fig.13- Normalized Transient Thermal Impedance vs. Pulse Width

Test Circuit & Waveform

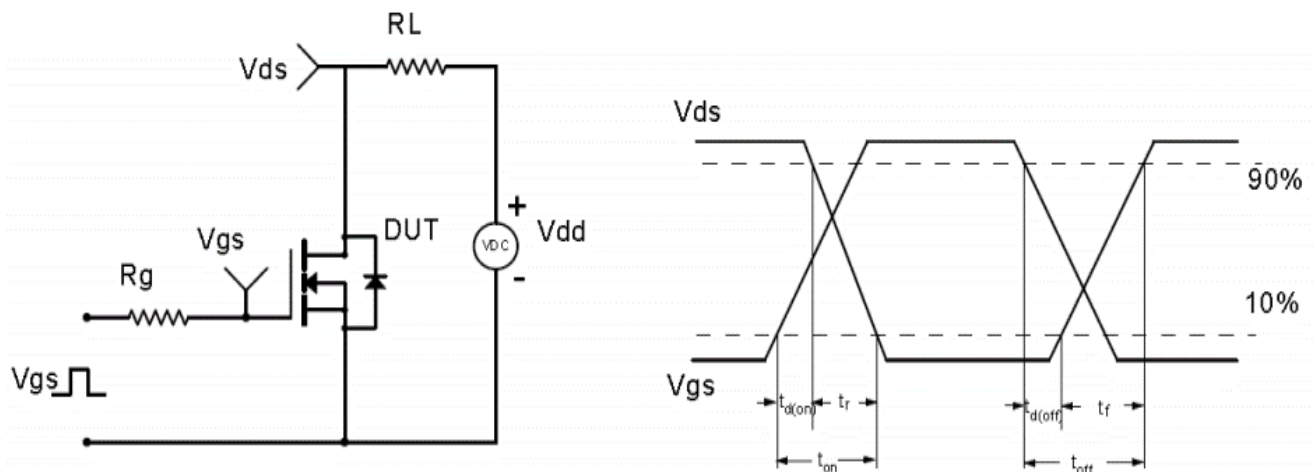


Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

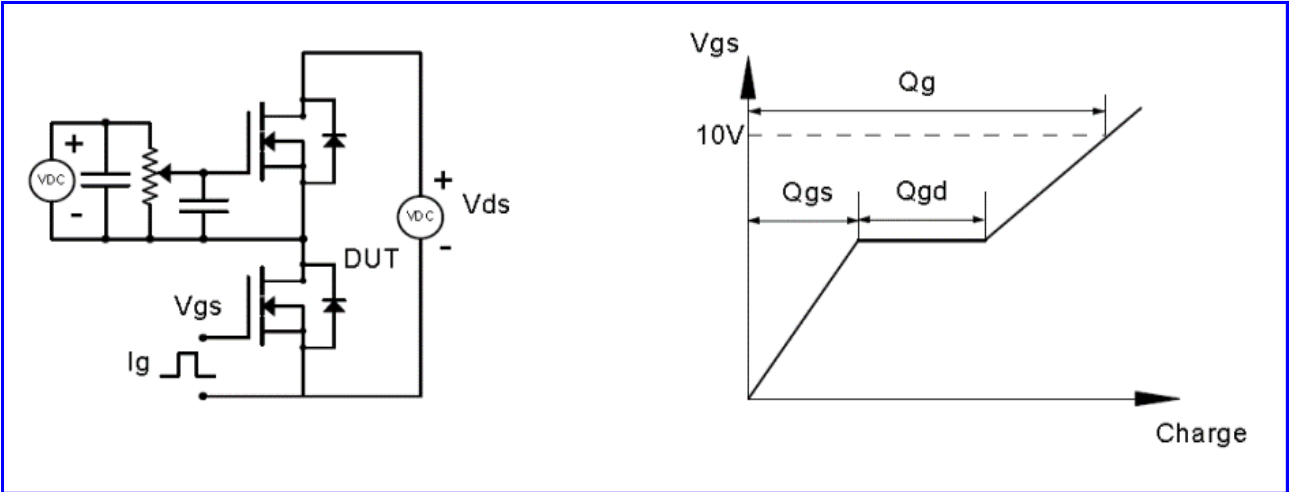


Fig.15- Gate Charge Test Circuit & Waveform

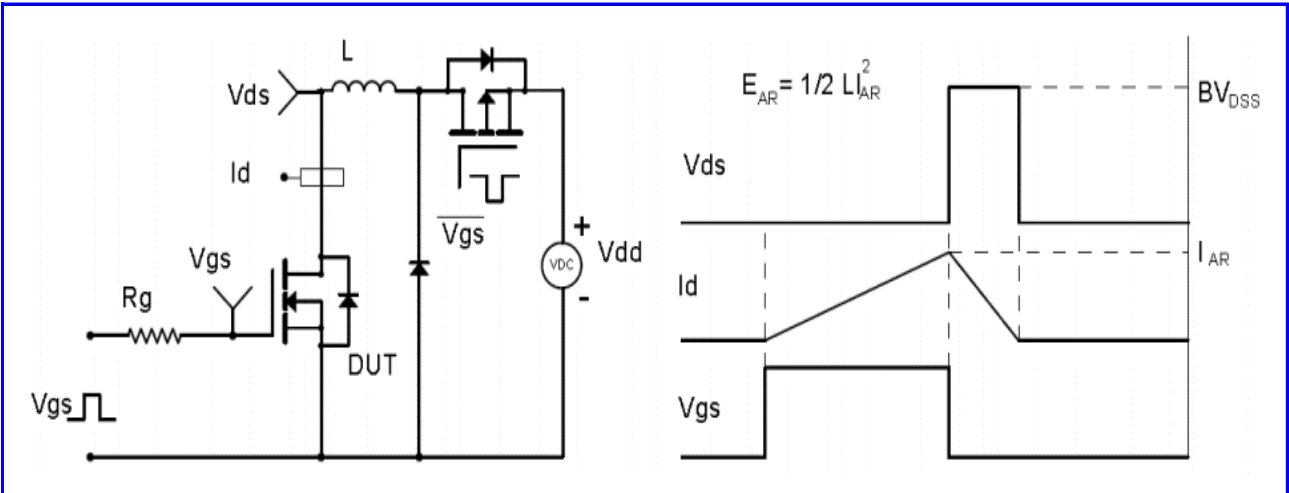


Fig.16- EAS Test Circuit & Waveform

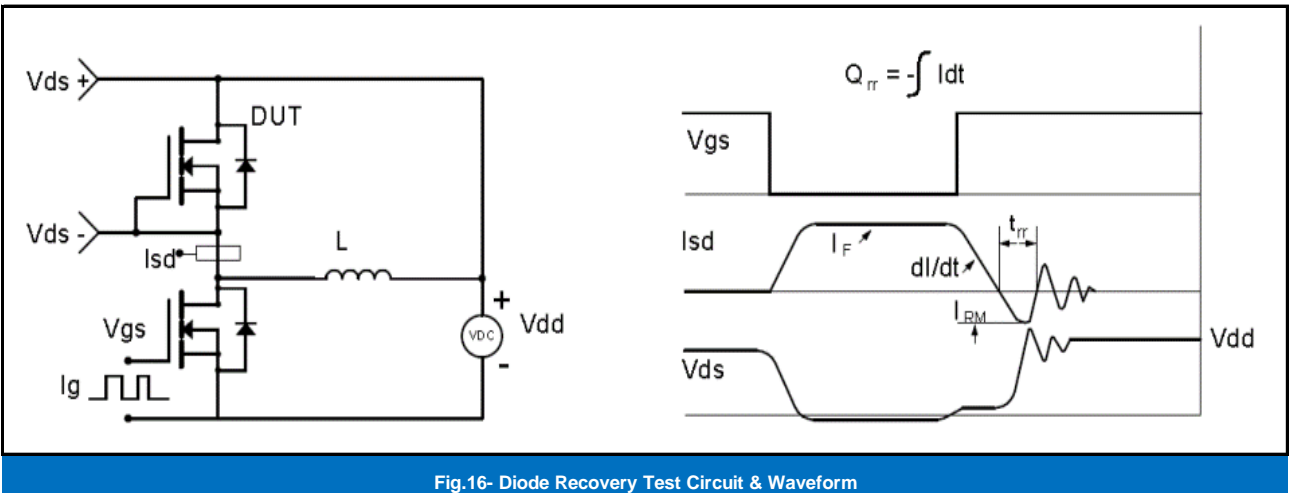


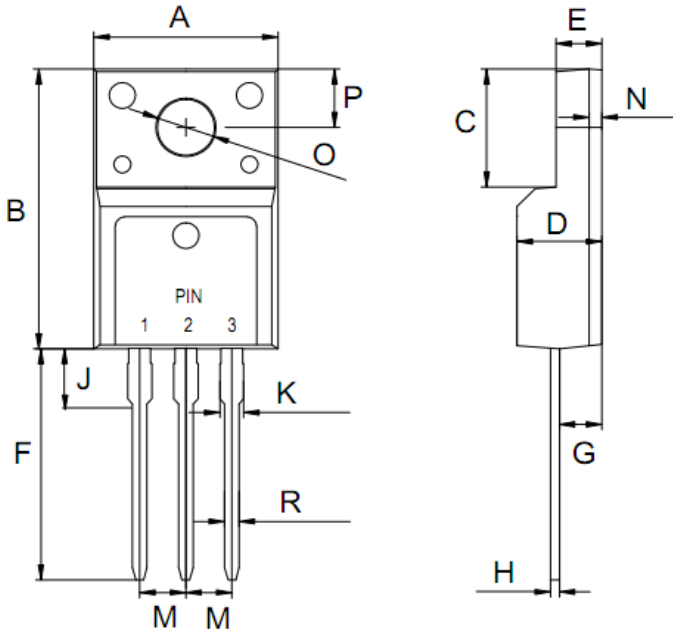
Fig.16- Diode Recovery Test Circuit & Waveform

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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**

Package Code	Package Method	Tube Size LxWxH(mm)	Quantity (pcs/Tube)	Inner Box Size LxWxH(mm)	Quantity (pcs/Inner Box)	Outer Carton Size LxWxH(mm)	Quantity (pcs/carton)
TO-220F	Tube	530x35x8	50	560x155x55	1000	570x284x185	5000

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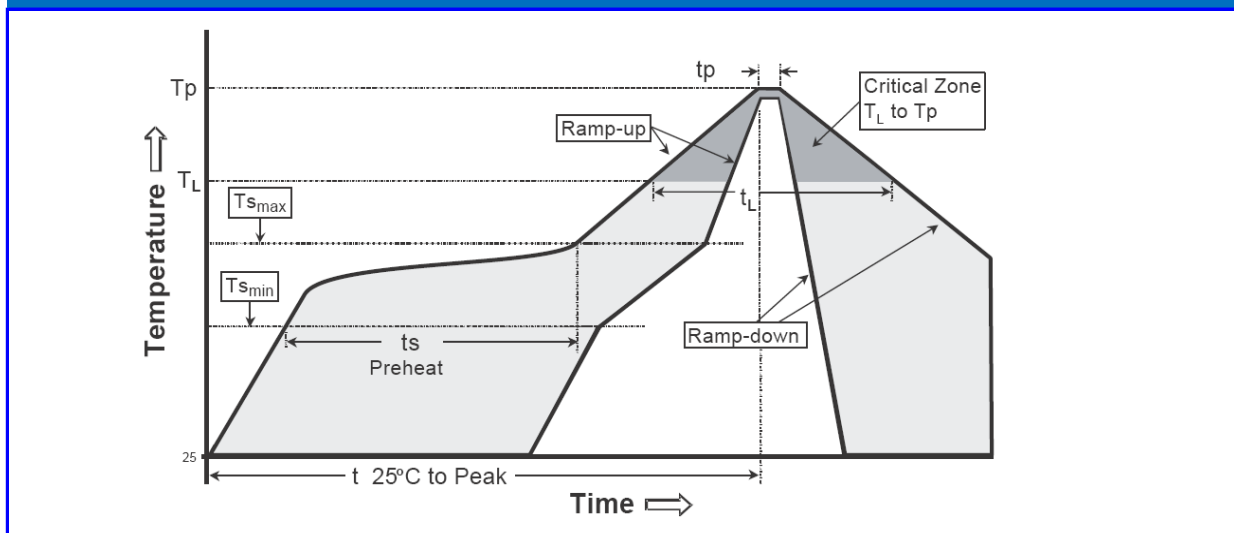
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**Recommended wave soldering condition**

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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