

NPS13N50F

500V N-Channel Enhancement Mode Power MOSFET



VOLTAGE: 500 Volts	CURRENT: 13 Amperes	TO-220F	Marking and Polarity
FEATURES			
<ul style="list-style-type: none"> ■ Low RDS(ON) ■ Ultra Low Gate Charge ■ RoHS Compliant ■ 100% UIS and RG Tested 			
TYPICAL APPLICATIONS		<p>Remark:</p> <p>①. NH=niuhang trademark;</p> <p>②. FF=Product line code,According to actual changes YWW=Data code,According to actual changes LLWWF=Internal code,According to actual changes</p> <p>③. NPS13N50F=Module.</p>	
<ul style="list-style-type: none"> ■ Adapter,PC,PD,Charger,LED Driver ■ Switched mode power supplies(SMPS) ■ Uninterruptible Power Supply (UPS) 			
PRODUCT SUMMARY			
VDS@T _J MAX.	500	V	
ID	13	A	
RDS(ON) ,Typ.@10V	0.385	Ω	

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 _a = 25 °C	I_D	13	A
	T _a = 100 °C		8.3	
Drain Current-Pulsed (Note 1)	T _J < 150 °C	I_{DM}	52	A
Maximum Power Dissipation	T _a = 25 °C	P_D	42	W
Power Dissipation Derating Factor above 25°C	T _a = 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 _J =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 _A =25° C.	$R_{\theta JA}$	62.5	°C/W
Thermal Resistance Junction-Case(Note 2)	2. device mounted on 1 in ² FR-4 board with 2oz	$R_{\theta JC}$	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
Static off Characteristics						
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
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= 6.5 A, VGS=10V	$R_{DS(ON)}$	-	0.385	0.5	Ω
Dynamic Characteristics						
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
Switching Parameters						
Turn-On Delay Time	VDS= 250 V	$t_{d(on)}$	-	30	-	ns
Turn-On Rise Time	ID= 13 A	t_r	-	20	-	ns
Turn-Off Delay Time	RG= 10 Ω	$t_{d(off)}$	-	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
Drain-Source Diode Characteristics and Maximum Ratings						
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

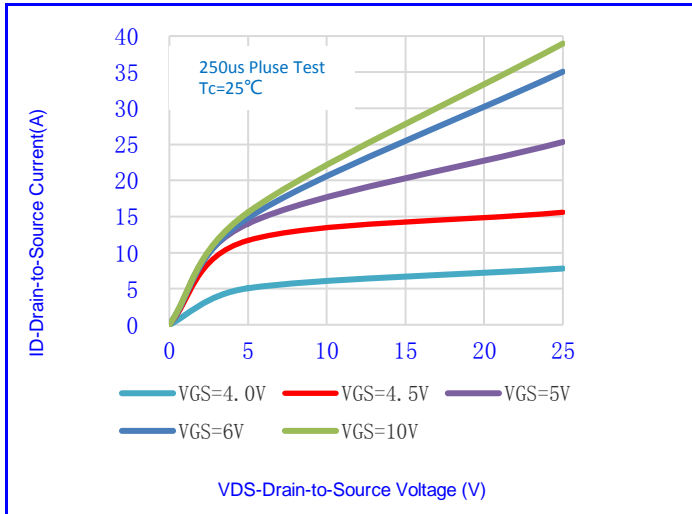


Fig.1-Output Characteristics

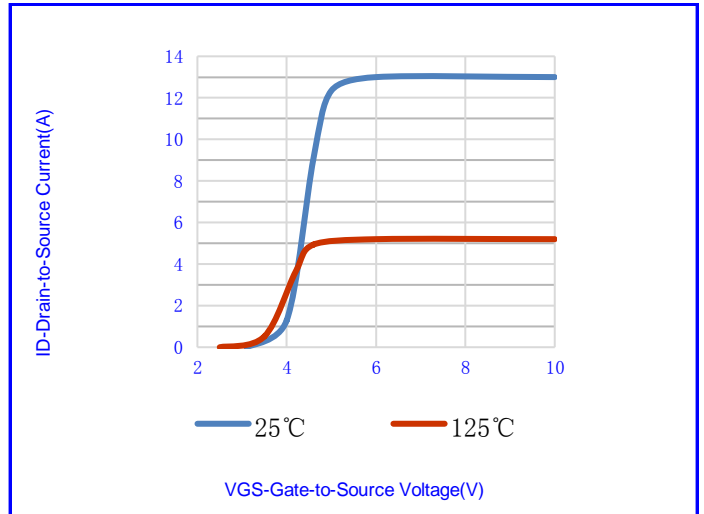


Fig.2- Transfer Characteristics

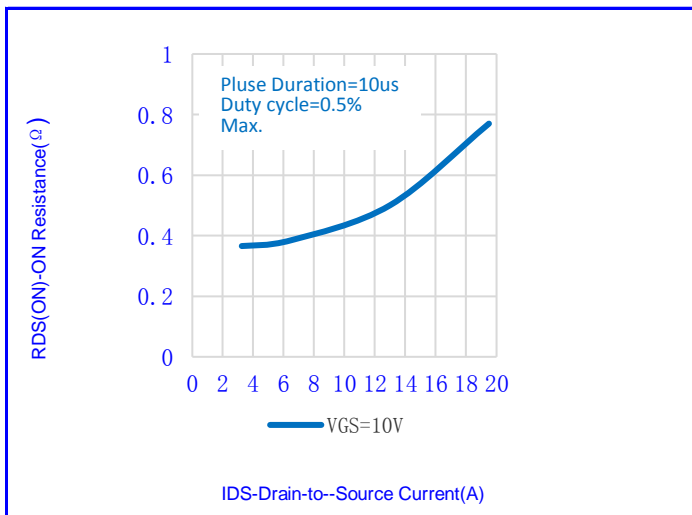


Fig.3- On Resistance vs. Drain Current

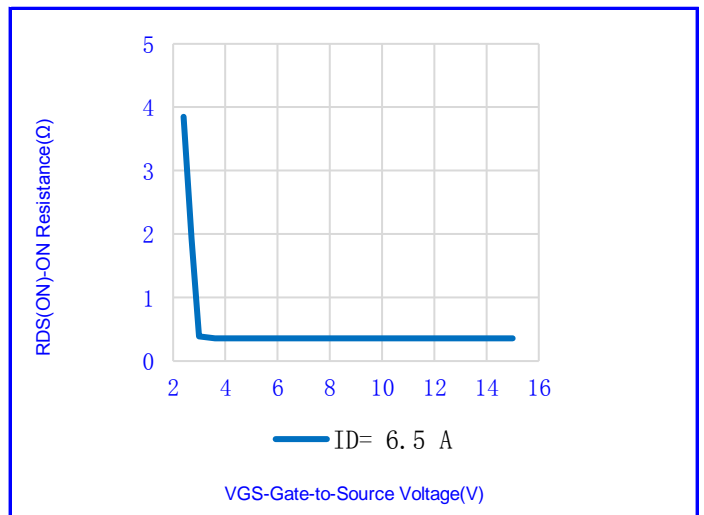


Fig.4- On Resistance vs. Gate Source Voltage

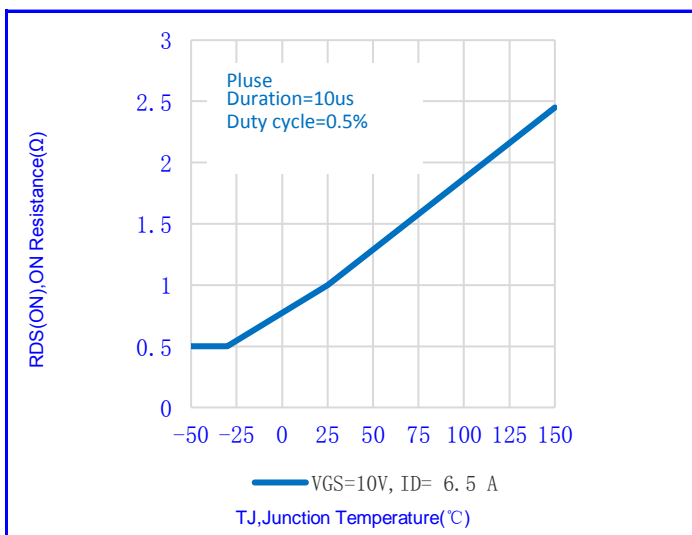


Fig.5- On Resistance vs. Junction Temperature

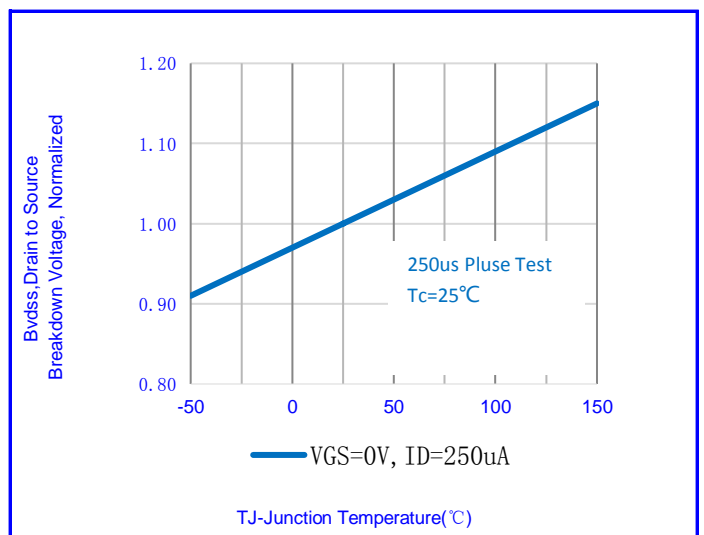


Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

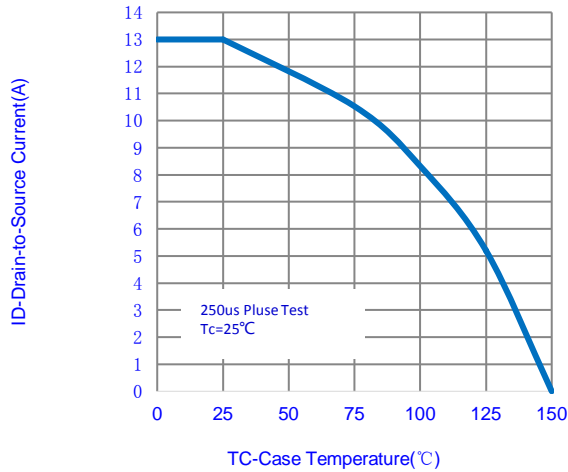


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

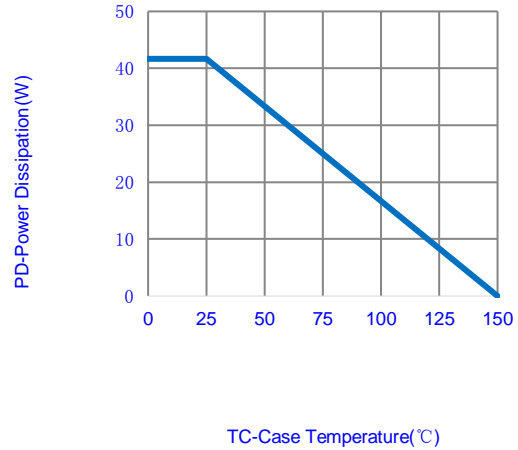


Fig.8-Maximum Power Dissipation vs. Case Temperature

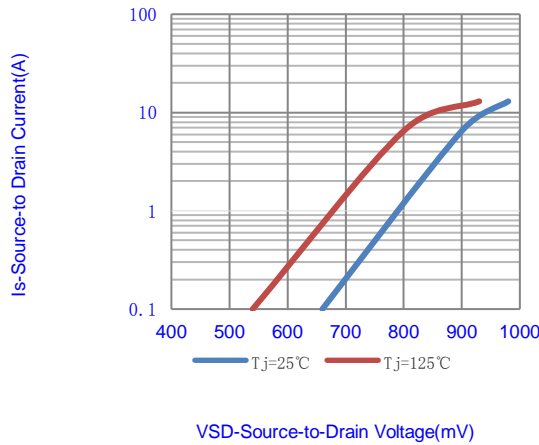


Fig.9- Source-Drain Diode Forward Voltage

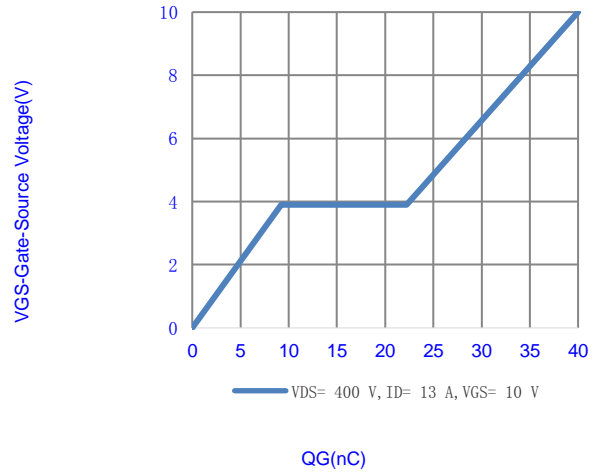


Fig.10-Gate Charge Waveform

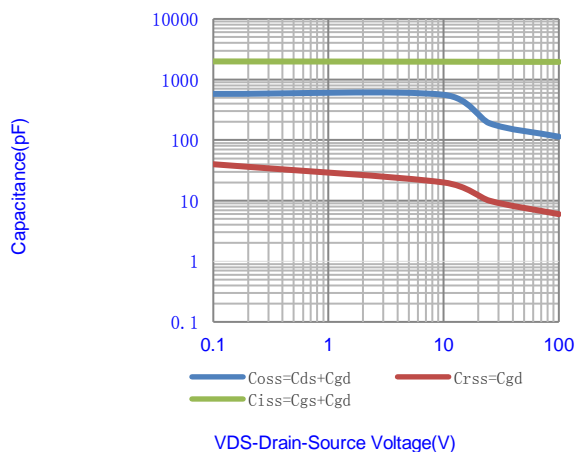


Fig.11- Gate-Source Voltage-VGS(V)

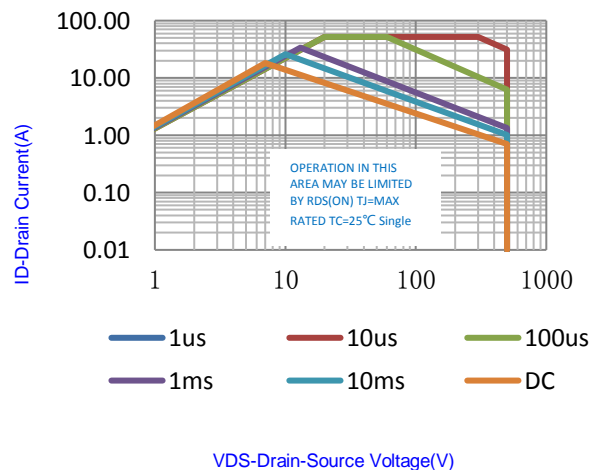


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

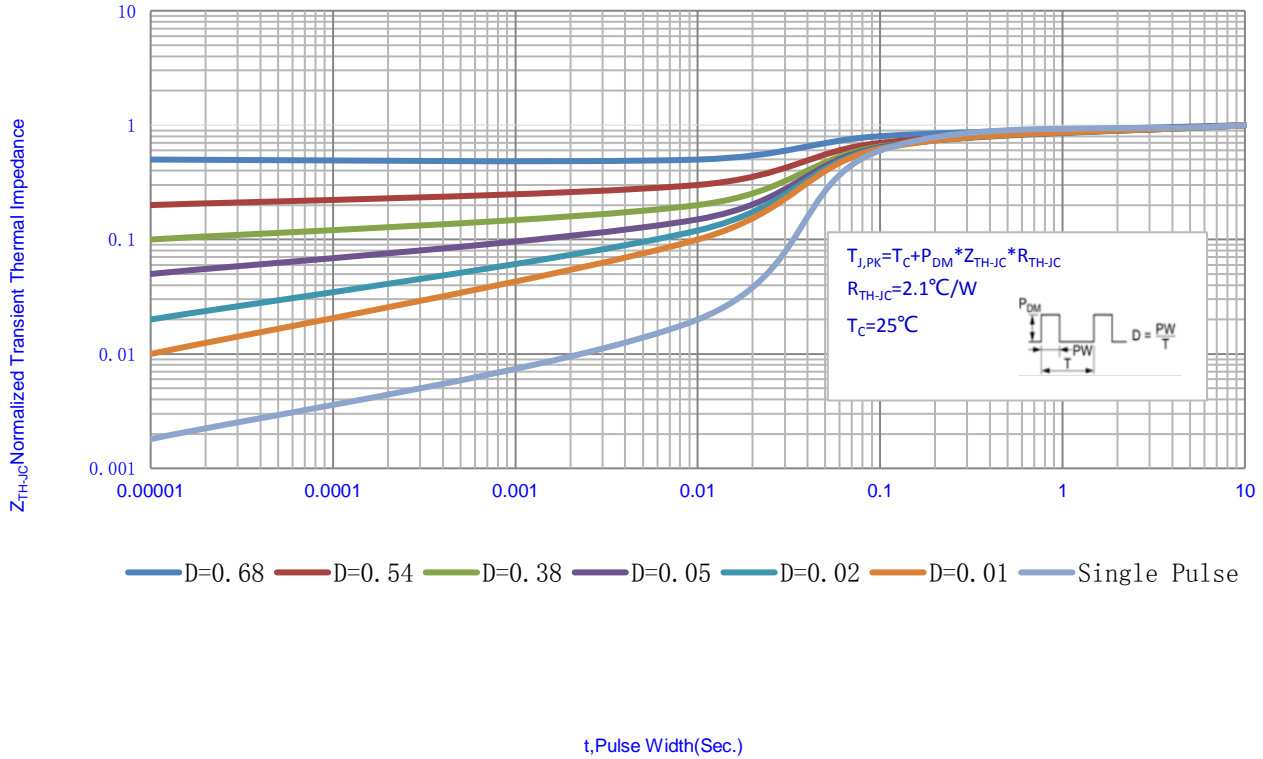


Fig.13- Normalized Transient Thermal Impedance vs. Pulse Width

Test Circuit & Waveform

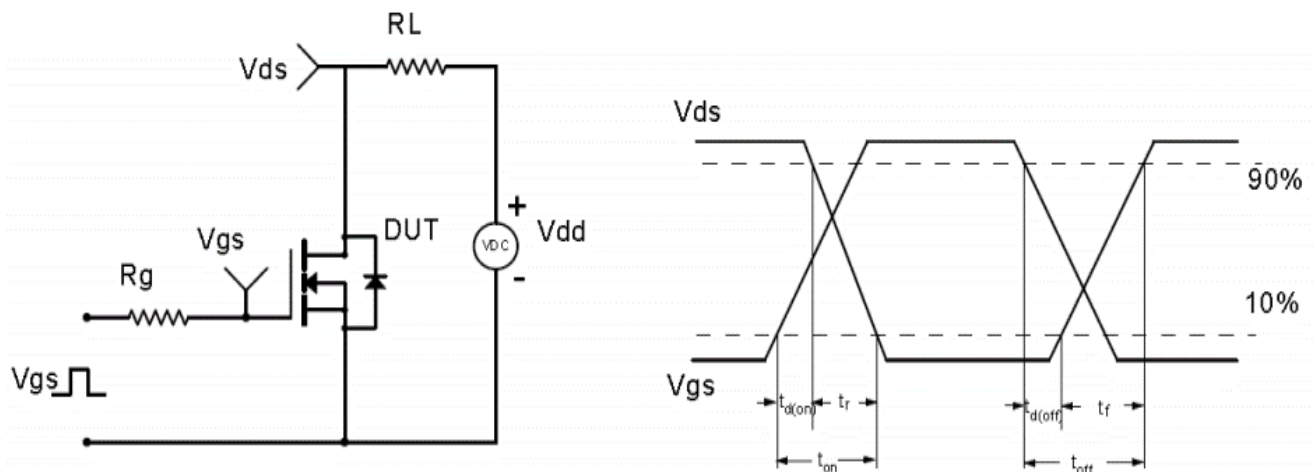


Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

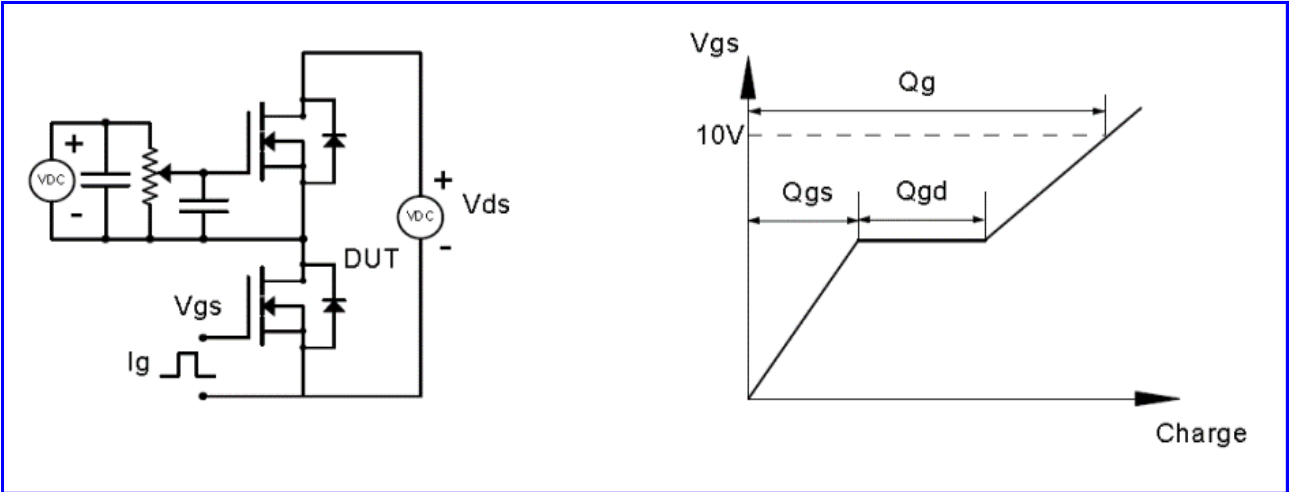


Fig.15- Gate Charge Test Circuit & Waveform

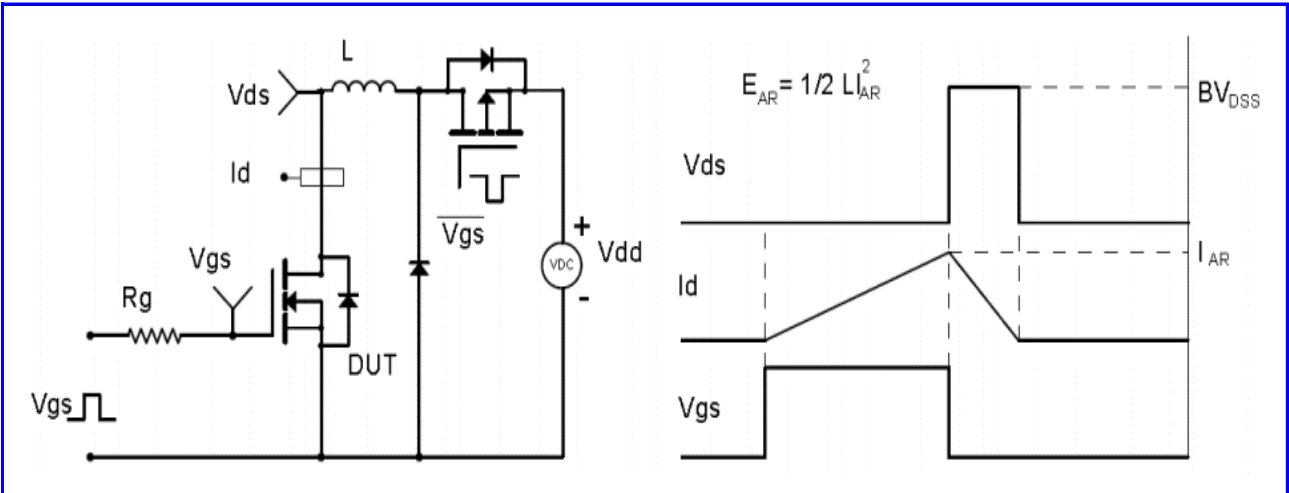


Fig.16- EAS Test Circuit & Waveform

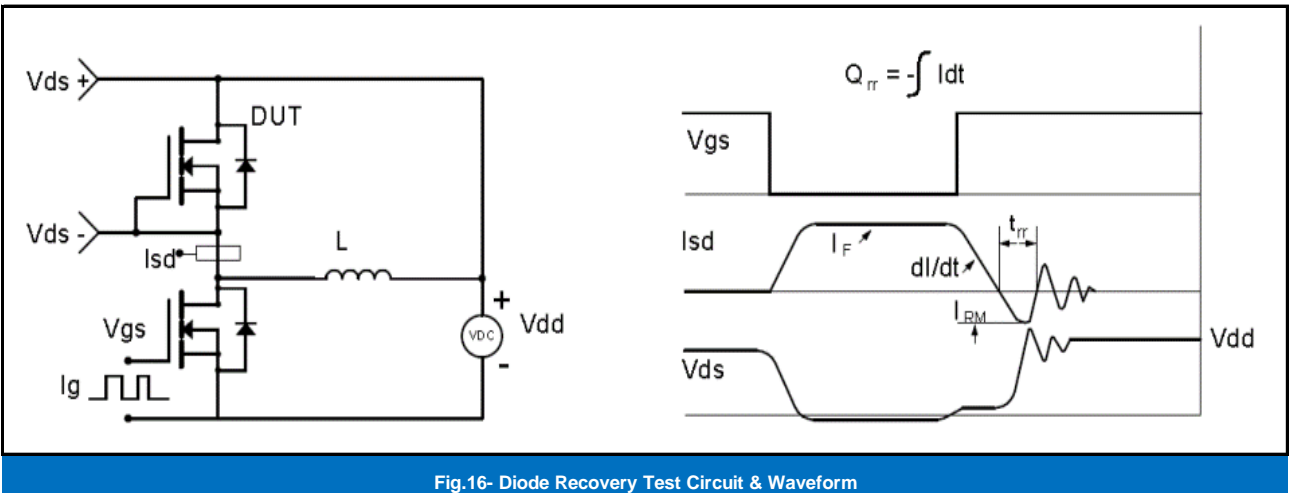


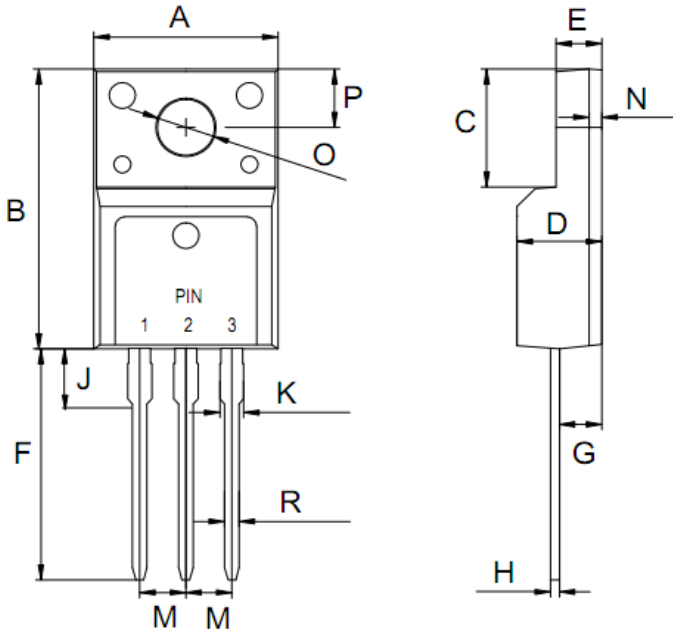
Fig.16- Diode Recovery Test Circuit & Waveform

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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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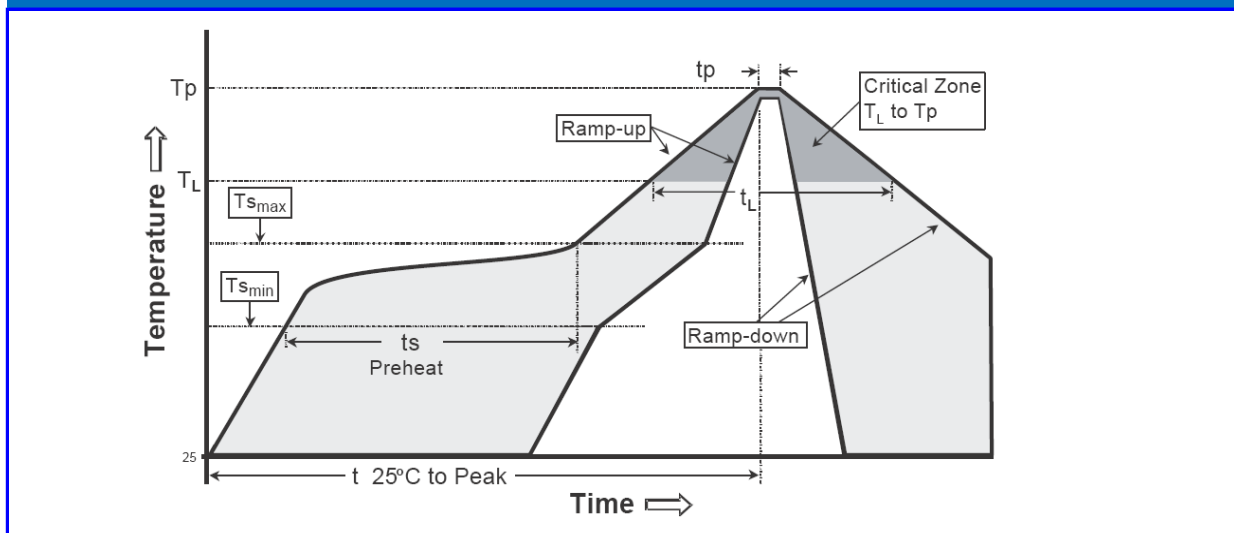
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Recommended wave soldering condition

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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