

NPB4N65F

650V N-Channel Enhancement Mode Power MOSFET



VOLTAGE:	650	Volts	CURRENT:	4.0	AmpeES	TO-220F	Marking and Polarity
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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
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)

PRODUCT SUMMARY

VDS@T _J MAX.	650	V
ID	4.0	A
RDS(ON) ,Typ. @10V	2.3	Ω

Remark:

- ①. NH=niuhang trademark;
- ②. FF=Product line code,According to actual changes
YWW=Data code,According to actual changes
LLWWF=Inernal code,According to actual changes
- ③. NPB4N65F=Modle.

Absolute Maximum Ratings (Ratings at 25°C ambient temperature 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	4.0	A
	Ta= 100 °C			
Drain Current-Pulsed	(Note 1)	I _{DM}	16	A
Maximum Power Dissipation	Ta= 25 °C	P _D	33	W
Power Dissipation Derating Factor above 25°C	Ta= 100 °C		13	
Derating Factor		D _F	0.26	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}	5	A
Single Pulse Avalanche Energy	L=10mH,IAS=5A, VDD=15V, RG=25Ω, Starting T _J =25°C	E _{AS}	125	mJ

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

Parameter	Symbol	Max	Unit
Thermal Resistance Junction to Ambient	R _{θJA}	62.5	°C/W
Thermal Resistance Junction-Case	R _{θJC}	3.79	°C/W

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
- 2 The value of R_{θJA} is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with TA =25° C.
The value in any given application depends on the user's specific board design.This transistor is sensitive to electrostatic discharge and

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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	-	-	10	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	3	4	V
Drain-Source On Resistance	$R_{DS(ON)}$	VGS=10V, ID=2A	-	2.30	2.70	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	VDS=25V, VGS=0V, f=1.0MHz	-	600	-	pF
Output Capacitance	C_{oss}		-	50	-	pF
Reverse Transfer Capacitance	C_{rss}		-	3	-	pF
Switching Parameters						
Turn-On Delay Time	$t_{d(on)}$	VDS=325V, ID=4A, VGS=10V, RG=25Ω	-	12	-	ns
Turn-On Rise Time	t_r		-	18	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	30	-	ns
Turn-Off Rise Time	t_f		-	10	-	ns
Total Gate Charge	Q_g	VDS=520V, ID=4A, VGS=10V	-	14	-	nC
Gate-Source Charge	Q_{gs}		-	5.5	-	nC
Gate-Drain Charge	Q_{gd}		-	3.8	-	nc
Drain-Source Diode Characteristics and Maximum Ratings						
Max. Diode Forward Current	I_S		-	-	4	A
Max. Pulsed Forward Current	I_{SM}		-	-	16	A
Diode Forward Voltage	V_{SD}	VGS=0V, IS=4A	-	0.79	1.4	V
Reverse Recovery Time	t_{rr}	VR=400V, IF=4A, di/dt=100A/us	-	250	380	ns
Reverse Recovery Charge	Q_{rr}		-	2	-	μC

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Typical Characteristics Curves

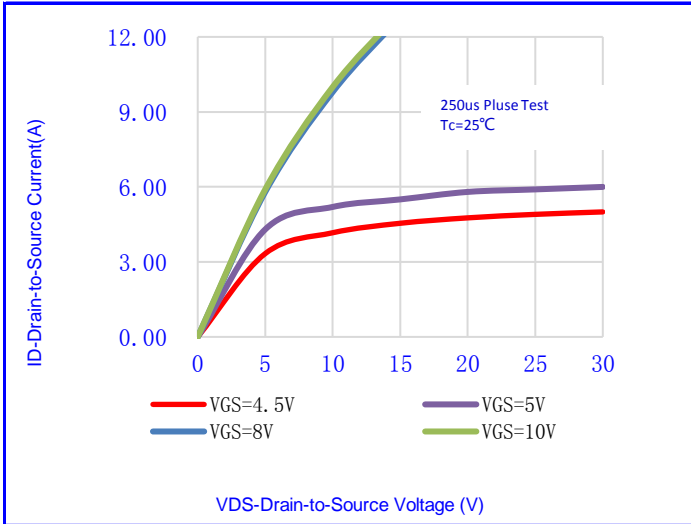


Fig.1-Output Characteristics

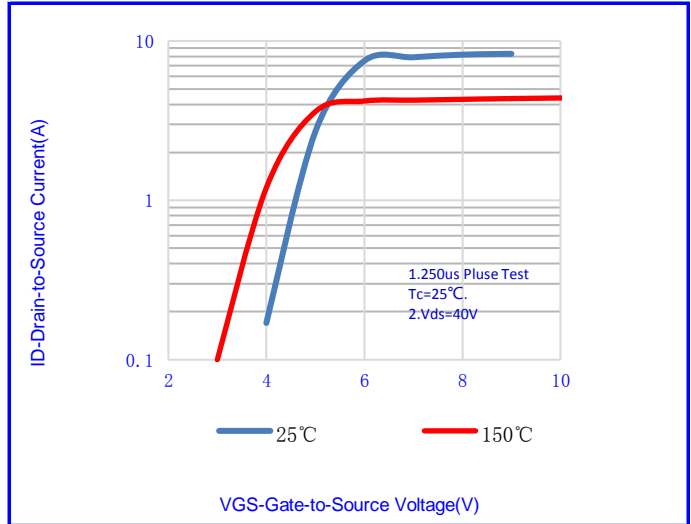


Fig.2- Transfer Characteristics

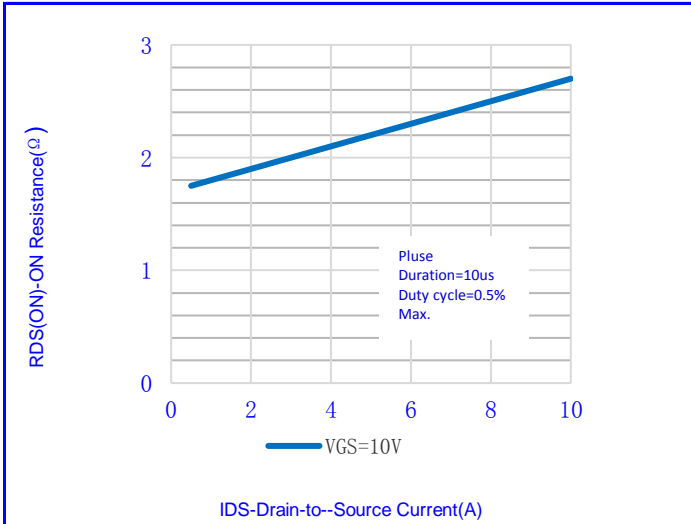


Fig.3- On Resistance vs. Drain Current

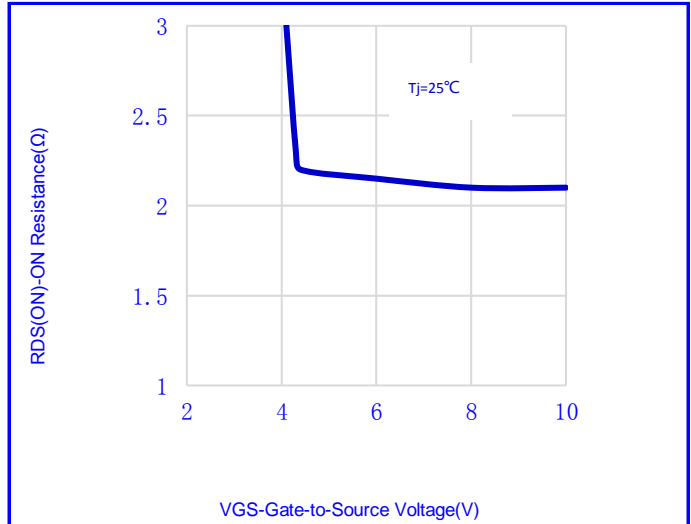


Fig.4- On Resistance vs. Gate Source Voltage

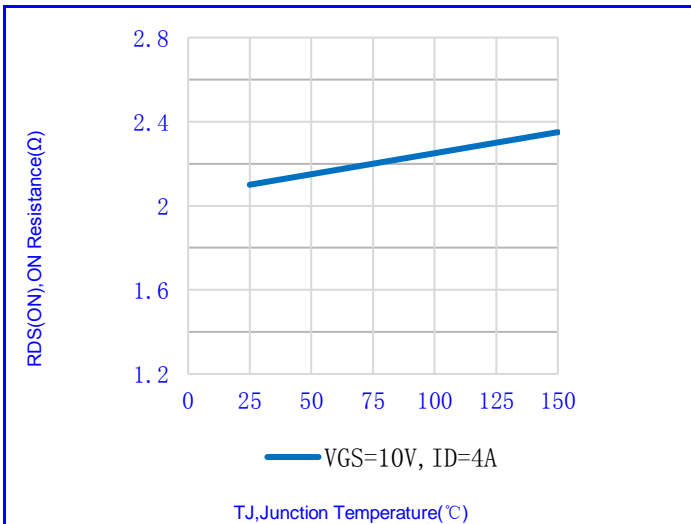


Fig.5- On Resistance vs. Junction Temperature

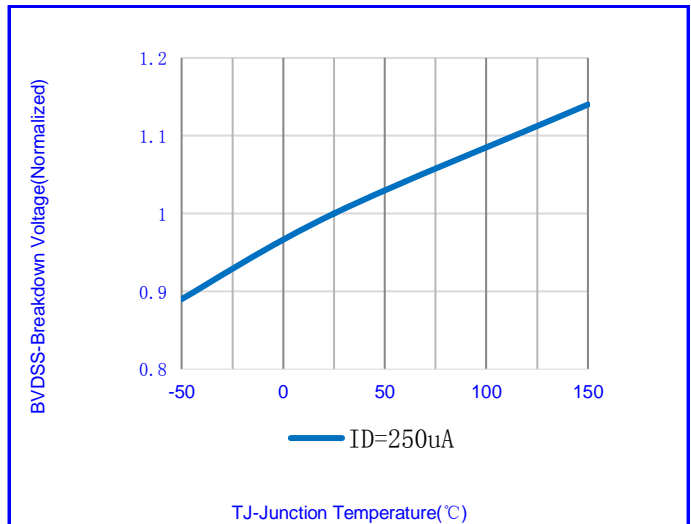


Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

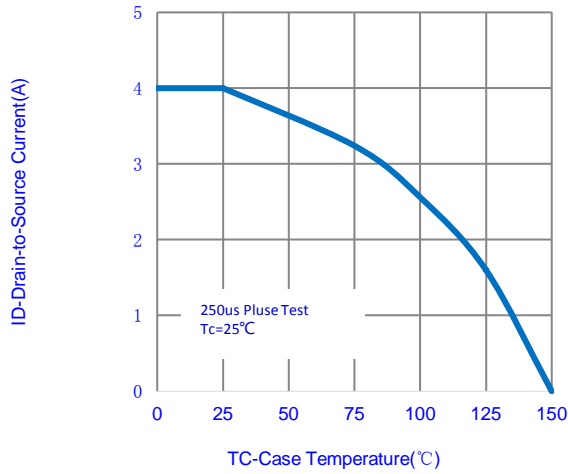


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

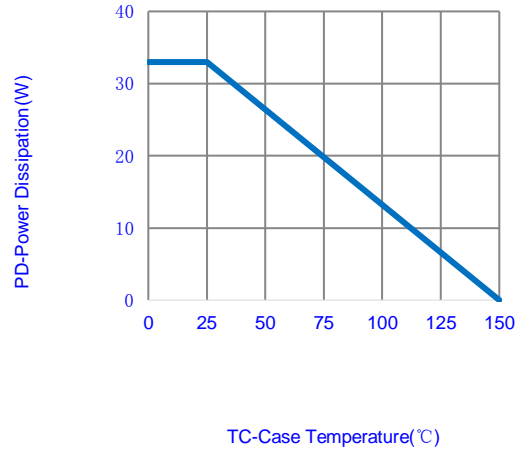


Fig.8-Maximum Power Dissipation vs. Case Temperature

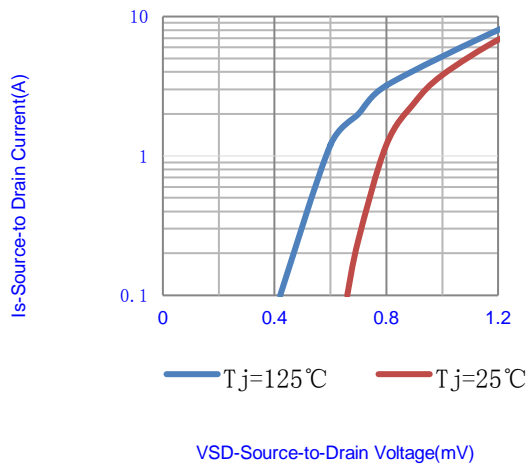


Fig.9- Source-Drain Diode Forward Voltage

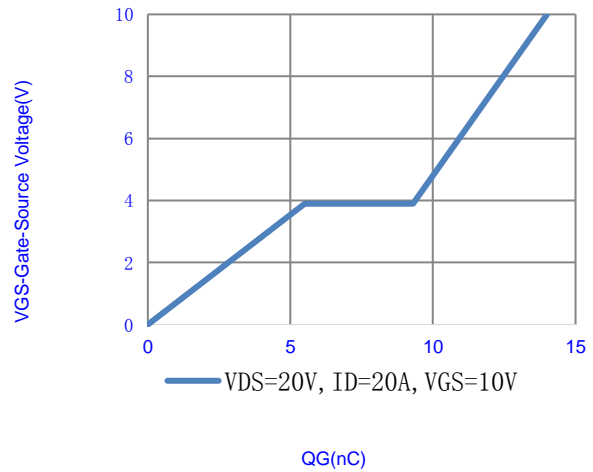


Fig.10-Gate Charge Waveform

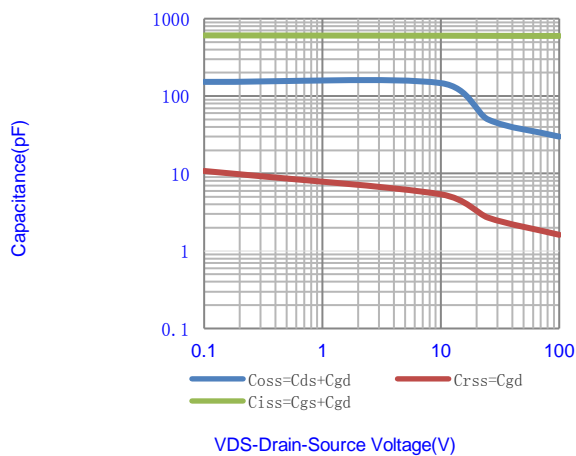


Fig.11- Gate-Source Voltage-VGS(V)

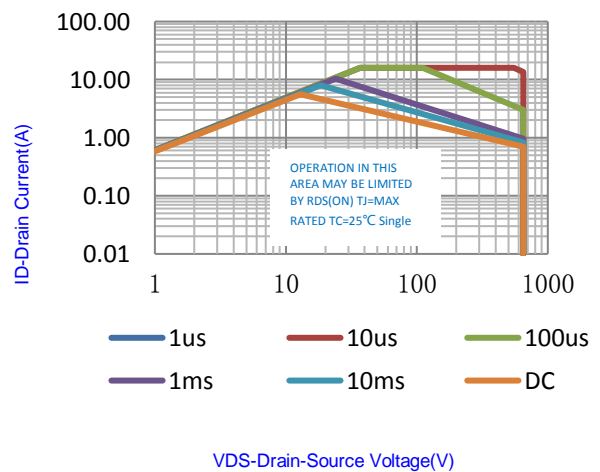


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

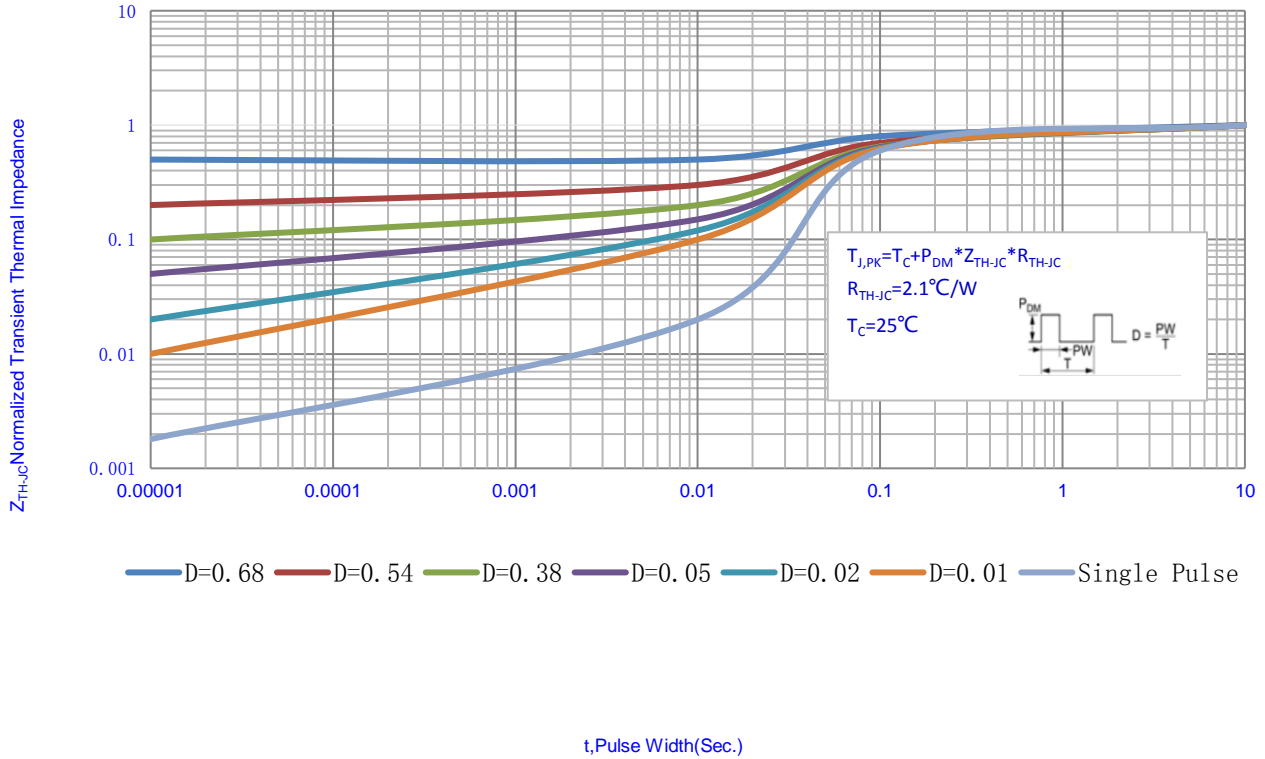


Fig.13- Normalized Transient Thermal Impedance vs. Pulse Width

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Test Circuit & Waveform

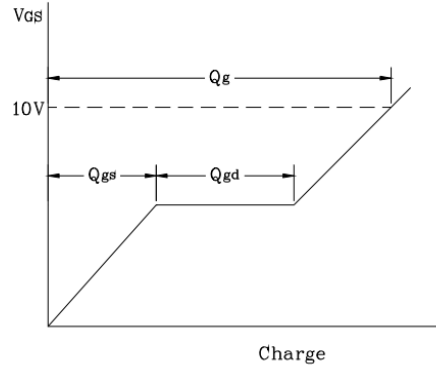
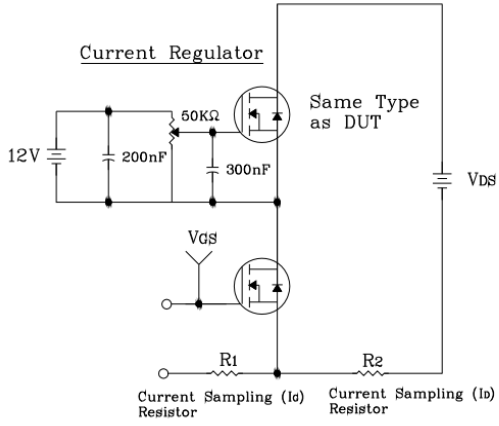


Fig.12-Gate Charge Test Circuit & Waveform

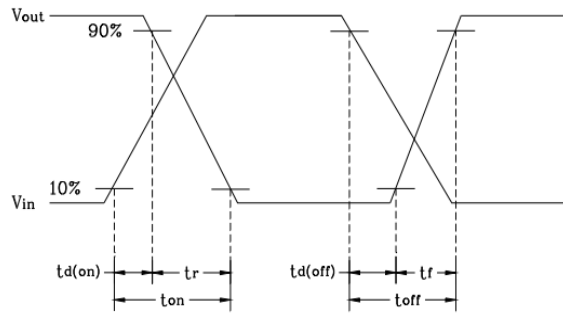
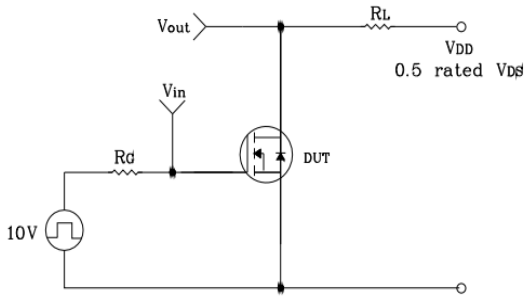


Fig.13- Resistive Switching Test Circuit & Waveform

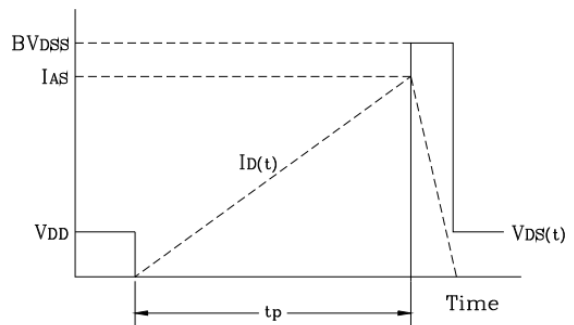
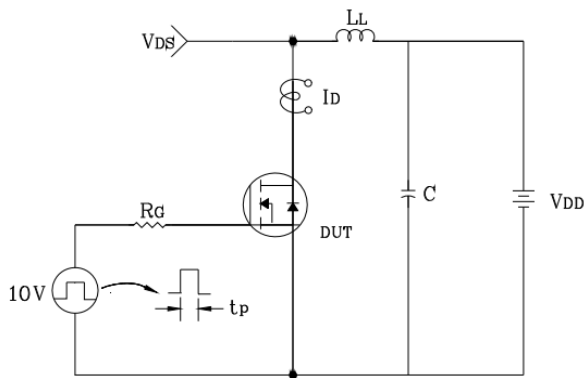


Fig.14- EAS Test Circuit & Waveform

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OUTLINE DRAWINGS		TO-220F				
		OUTLINE DIMENSIONS				
		Millimeters			Inches	
Dim.	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 LxWxH(mm)	Quantity (pcs/box)	Carton Size LxWxH(mm)	Quantity (box/carton)
Box Package	570x153x47	1000	580x250x180	5000

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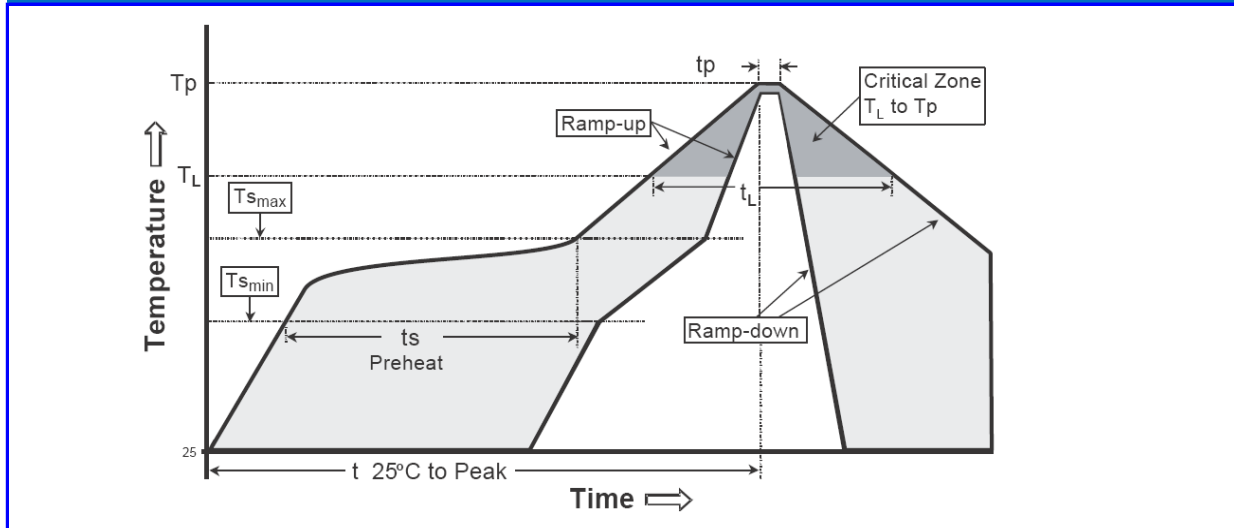
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Recommended wave soldering condition

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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