

**NPB7N65F**

650V N-channel Enhancement MOSFET



<b>VOLTAGE</b>	650 Volts	<b>CURRENT</b>	7 Amperes	<b>TO-220F</b>	<b>Marking and Polarity</b>										
<b>FEATURES</b>															
<ul style="list-style-type: none"> <li>Low RDS(ON)</li> <li>Ultra Low Gate Charge</li> <li>RoHS Compliant</li> <li>100% UIS and RG Tested</li> </ul>															
<b>TYPICAL APPLICATIONS</b>															
<ul style="list-style-type: none"> <li>Adapter,PC,PD,Charger</li> <li>Switched mode power supplies(SMPS)</li> <li>Uninterruptible Power Supply (UPS)</li> </ul>				<p><b>Remark:</b></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. NPS7N65F=Modle.</p>											
<b>PRODUCT SUMMARY</b>															
<table border="1"> <tr> <td><math>V_{DSS,Min.}</math> at Max. Tj</td> <td>650</td> <td>V</td> </tr> <tr> <td><math>I_D</math></td> <td>7</td> <td>A</td> </tr> <tr> <td><math>R_{DS(ON)}</math> ,Max. at Vgs=10V</td> <td>1.20</td> <td><math>\Omega</math></td> </tr> <tr> <td>Qg,Typ.</td> <td>28.0</td> <td>nC</td> </tr> </table>						$V_{DSS,Min.}$ at Max. Tj	650	V	$I_D$	7	A	$R_{DS(ON)}$ ,Max. at Vgs=10V	1.20	$\Omega$	Qg,Typ.
$V_{DSS,Min.}$ at Max. Tj	650	V													
$I_D$	7	A													
$R_{DS(ON)}$ ,Max. at Vgs=10V	1.20	$\Omega$													
Qg,Typ.	28.0	nC													
<b>Absolute Maximum Ratings (Ratings at 25°C ambient temperature unless otherwise specified )</b>															
<b>Parameter</b>		<b>Symbol</b>		<b>Ratings</b>	<b>Unit</b>										
Drain-Source Voltage		$V_{DS}$		650	V										
Gate-Source Voltage		$V_{GS}$		±30	V										
Continuous Drain Current (Note 1)	Ta=25°C	$I_D$		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										
<b>Thermal Characteristics (Ratings at 25°C ambient temperature unless otherwise specified )</b>															
<b>Parameter</b>		<b>Symbol</b>		<b>Max</b>	<b>Unit</b>										
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										
<p>Notes:</p> <p>1. Repetitive Rating : Pulse width limited by maximum junction temperature</p> <p>2. L=10mH,IAS=10A, VDD=50V, RG=25<math>\Omega</math>, Starting TJ =25°C</p> <p>3. The value of <math>R_{\theta JA}</math> 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 should be handled with care.</p>															

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

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static off Characteristics</b>						
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
<b>Static on Characteristics</b>						
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
<b>Dynamic Characteristics</b>						
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
<b>Switching Paramters</b>						
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
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
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

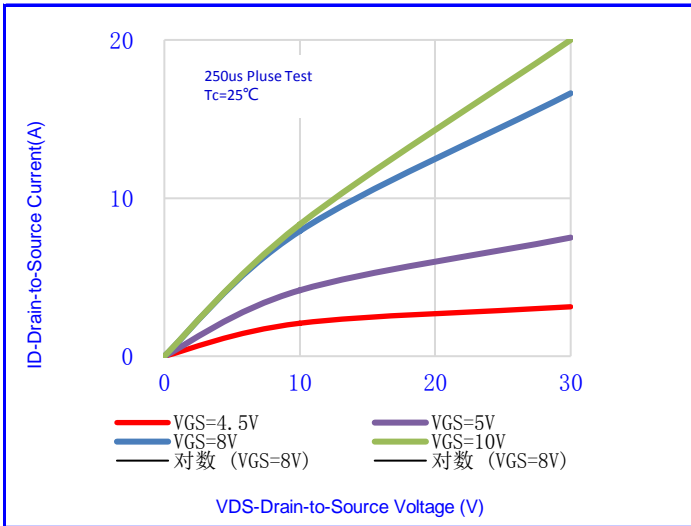


Fig.1-Output Characteristics

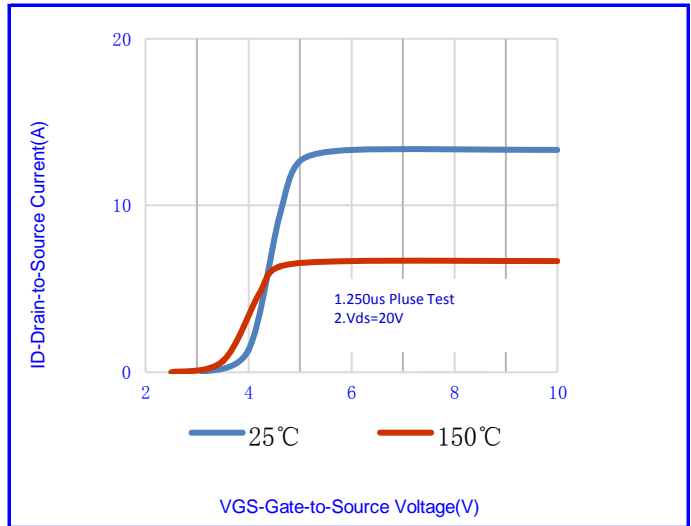


Fig.2- Transfer Characteristics

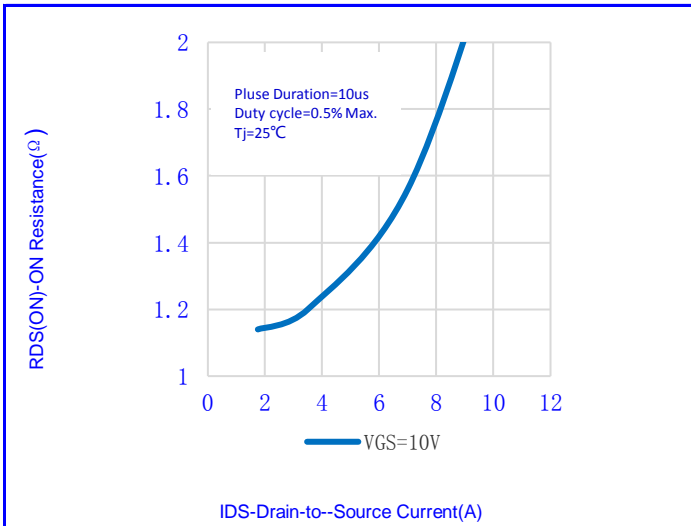


Fig.3- On Resistance vs. Drain Current

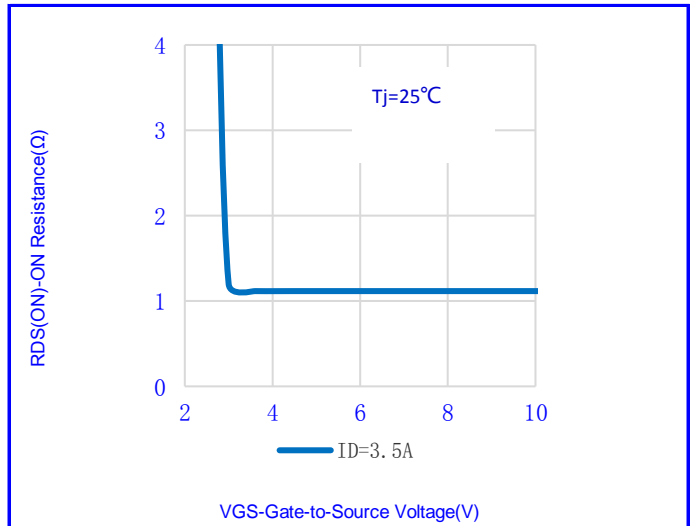


Fig.4- On Resistance vs. Gate Source Voltage

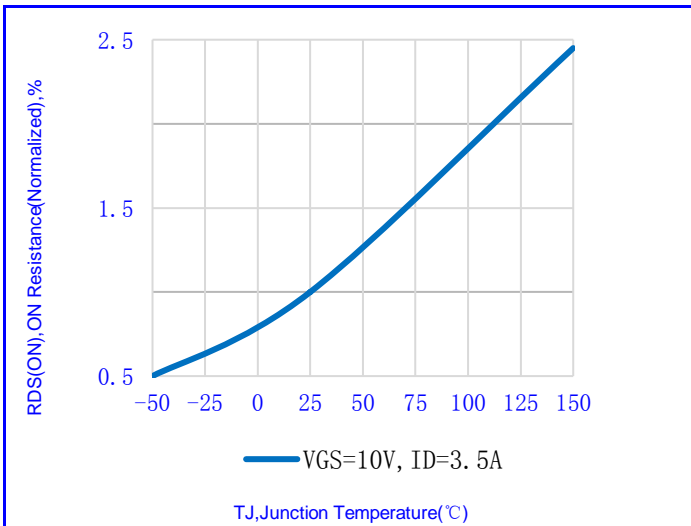


Fig.5- On Resistance vs. Junction Temperature

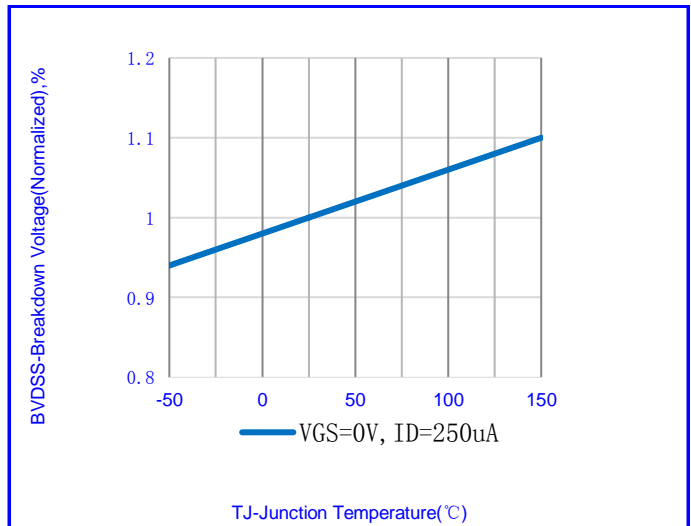


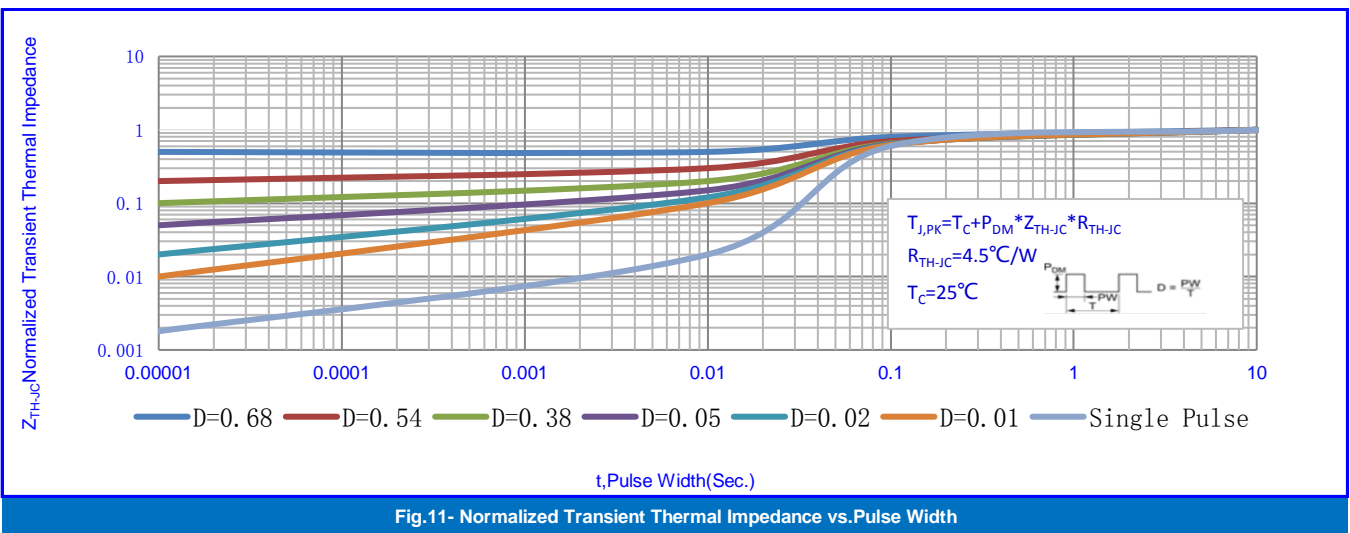
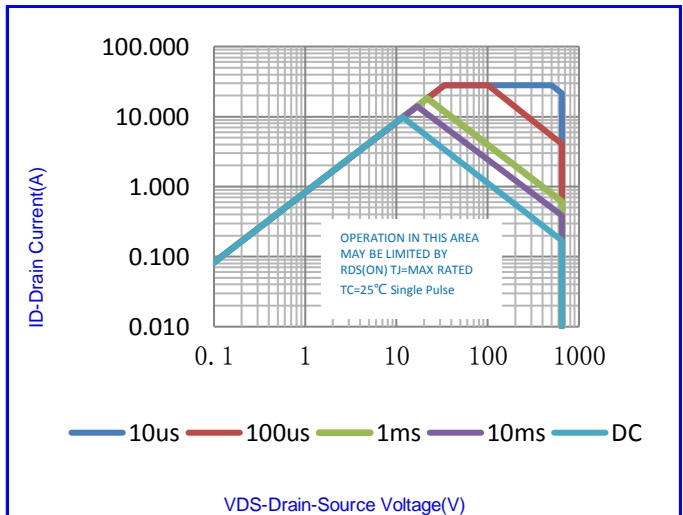
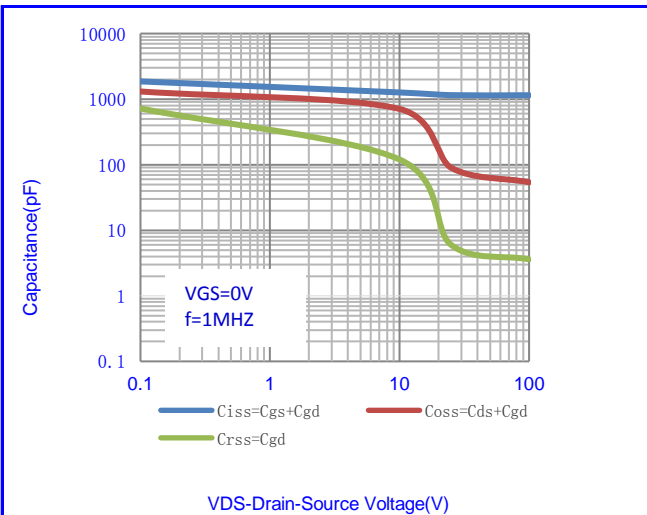
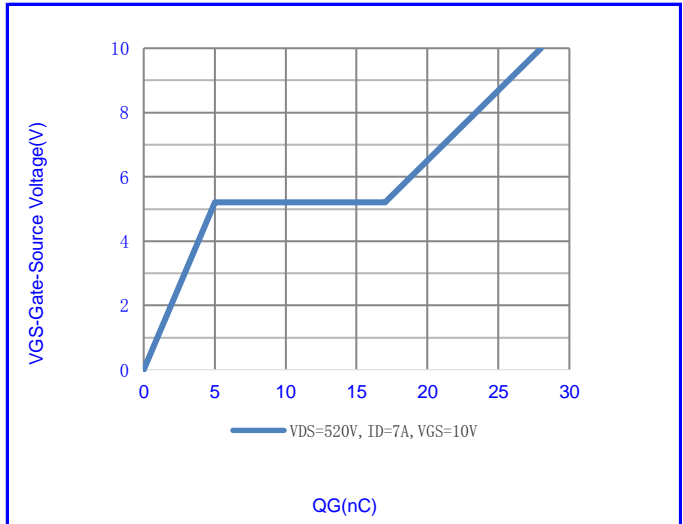
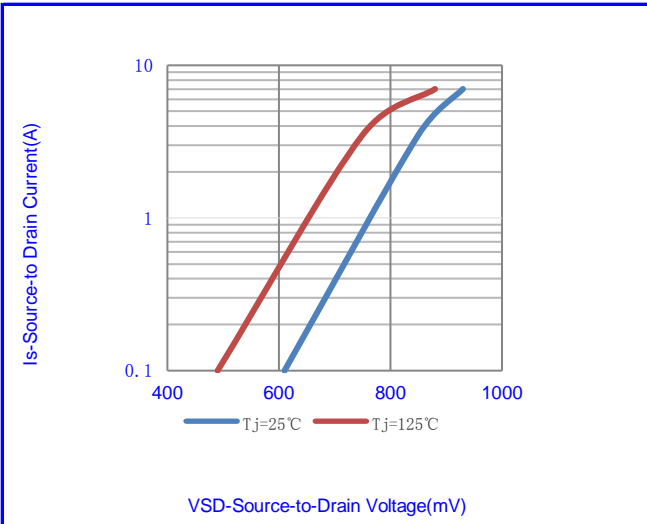
Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves



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Test Circuit & Waveform

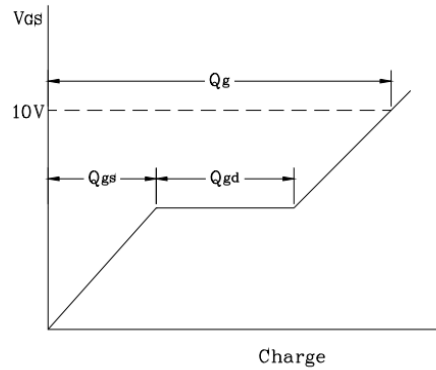
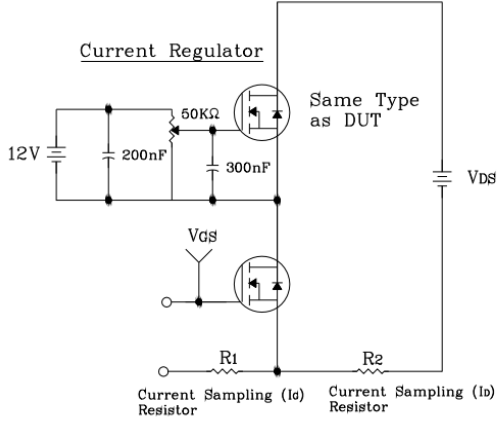


Fig.12-Gate Charge Test Circuit & Waveform

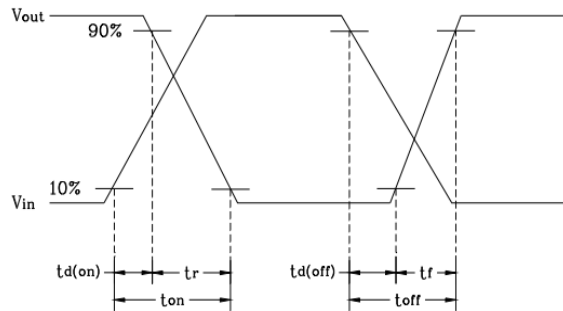
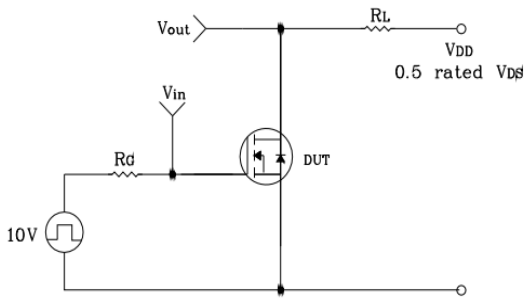


Fig.13- Resistive Switching Test Circuit & Waveform

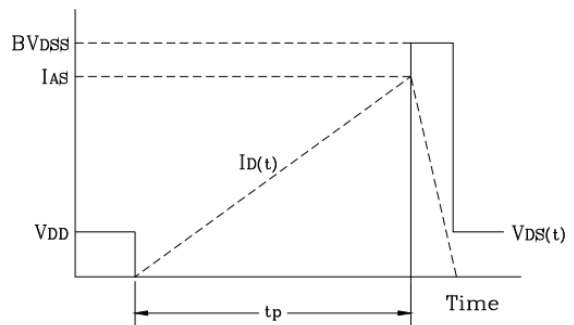
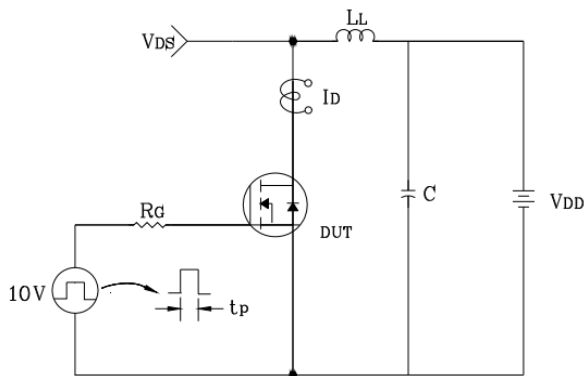


Fig.14- EAS Test Circuit & Waveform

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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 LxWxH(mm)	Quantity (pcs/box)	Carton Size LxWxH(mm)	Quantity (box/carton)
Box Package	570x153x47	1000	580x250x180	5000

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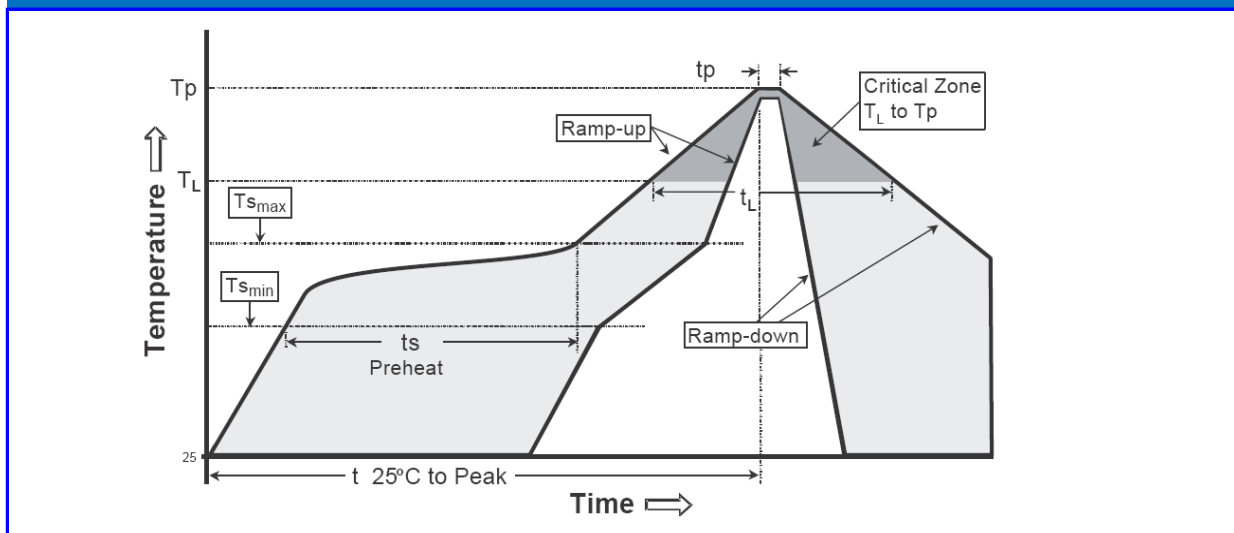
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**Recommended wave soldering condition**

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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