



H04N65 Series

N-Channel Power Field Effect Transistor (650V, 4A)

Description

This advanced high voltage MOSFET is designed to withstand high energy in the avalanche mode and switch efficiently. This new high energy device also offers a drain-to-source diode with fast recovery time. Designed for high voltage, high speed switching applications such as power supplies, converters, power motor controls and bridge circuits.

Features

- Higher Current Rating
- Lower $R_{DS(on)} < 3.0\Omega$ (@ $V_{GS}=10V$, $I_D=2A$)
- Lower Capacitances
- Lower Total Gate Charge
- Tighter VSD Specifications
- Avalanche Energy Specified

Thermal Characteristics

Symbol	Parameter	Value		Units
$R_{\theta JC}$	Thermal Resistance Junction to Case Max.	TO-220AB	1.3	°C/W
		TO-220FP	5	
$R_{\theta JA}$	Thermal Resistance Junction to Ambient (Maximum)	62.5		°C/W

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
V_{DS}	Drain-Source Voltage	650	V
I_D	Drain to Current (Continuous)	4	A
I_{DM}	Drain to Current (Pulsed)	16	A
V_{GS}	Gate-to-Source Voltage (Continue)	±30	V
P_D	Total Power Dissipation ($T_C=25^\circ C$)		
	H04N65E (TO-220AB) H04N65F (TO-220FP)	70 30	W
P_D	Derate above 25°C		
	H04N65E (TO-220AB) H04N65F (TO-220FP)	0.56 0.2	W/°C
T_j, T_{stg}	Operating and Storage Temperature Range	-55 to 150	°C
E_{AS}	Single Pulse Drain-to-Source Avalanche Enrgy- $T_j=25^\circ C$ ($V_{DD}=100V$, $V_{GS}=10V$, $I_L=2A$, $L=10mH$, $R_G=25\Omega$)	250	mJ
T_L	Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	260	°C

H04N65 Series Pin Assignment

3-Lead Plastic **TO-220AB**
 Package Code: E
 Pin 1: Gate
 Pin 2 & Tab: Drain
 Pin 3: Source

3-Lead Plastic **TO-220FP**
 Package Code: F
 Pin 1: Gate
 Pin 2: Drain
 Pin 3: Source

H04N65 Series
 Symbol:



Electrical Characteristics (T_j=25°C, unless otherwise specified)

Symbol	Characteristic	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-Source Breakdown Voltage (V _{GS} =0V, I _D =250uA)	650	-	-	V
I _{DSS}	Drain-Source Leakage Current (V _{DS} =650V, V _{GS} =0V)	-	-	10	uA
	Drain-Source Leakage Current (V _{DS} =480V, V _{GS} =0V, T _j =125°C)	-	-	50	uA
I _{GSSF}	Gate-Source Leakage Current-Forward (V _{gsf} =30V, V _{DS} =0V)	-	-	100	nA
I _{GSSR}	Gate-Source Leakage Current-Reverse (V _{gsr} =-30V, V _{DS} =0V)	-	-	-100	nA
V _{GS(th)}	Gate Threshold Voltage (V _{DS} =V _{GS} , I _D =250uA)	2	-	4	V
R _{DS(on)}	Static Drain-Source On-Resistance (V _{GS} =10V, I _D =2A)*	-	2.3-	3.0	Ω
g _{FS}	Forward Transconductance (V _{DS} =15V, I _D =2A)*	2	-	-	Mhos
C _{iss}	Input Capacitance	-	560	-	pF
C _{oss}	Output Capacitance	-	50	-	
C _{rss}	Reverse Transfer Capacitance	-	3	-	
t _{d(on)}	Turn-on Delay Time	-	20	-	Ns
t _r	Rise Time	-	19	-	
t _{d(off)}	Turn-off Delay Time	-	128	-	
t _f	Fall Time	-	20	-	
Q _g	Total Gate Charge	-	16	-	nC
Q _{gs}	Gate-Source Charge	-	3.5	-	
Q _{gd}	Gate-Drain Charge	-	5.7	-	

*: Pulse Test: Pulse Width ≤300us, Duty Cycle≤2%

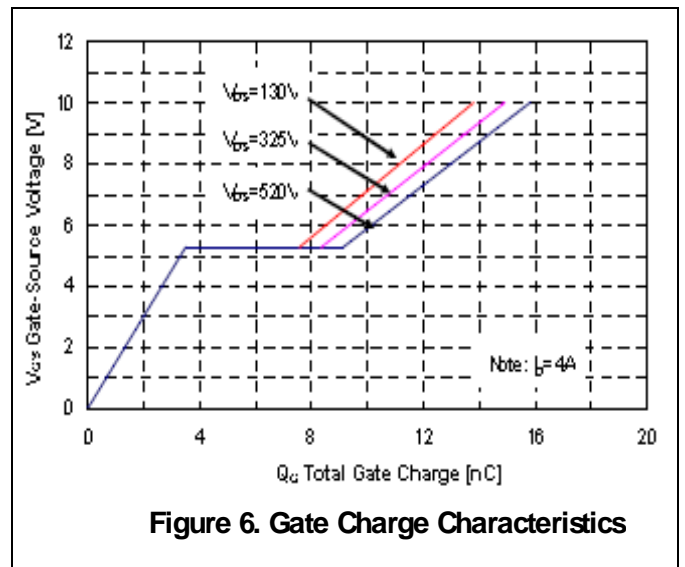
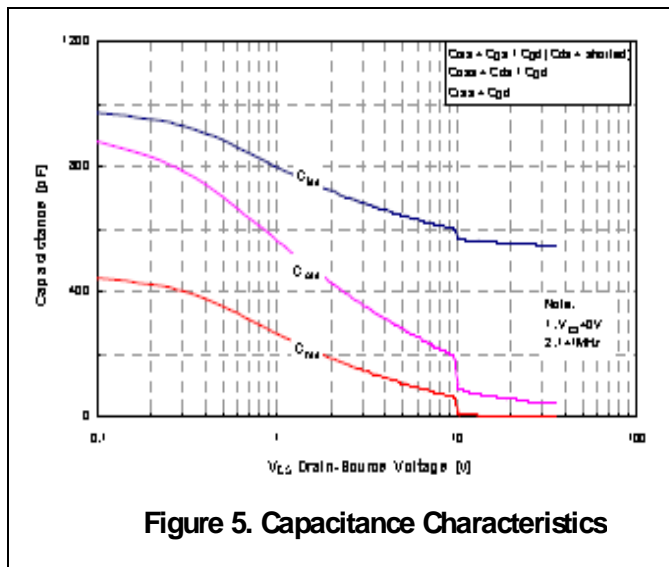
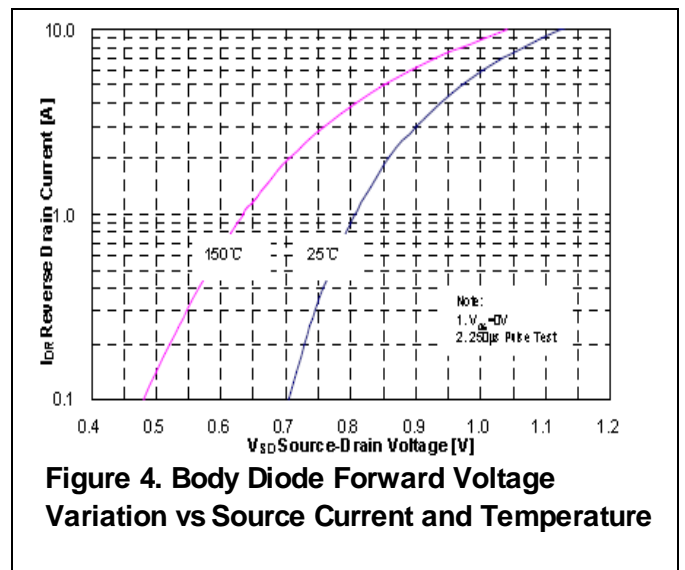
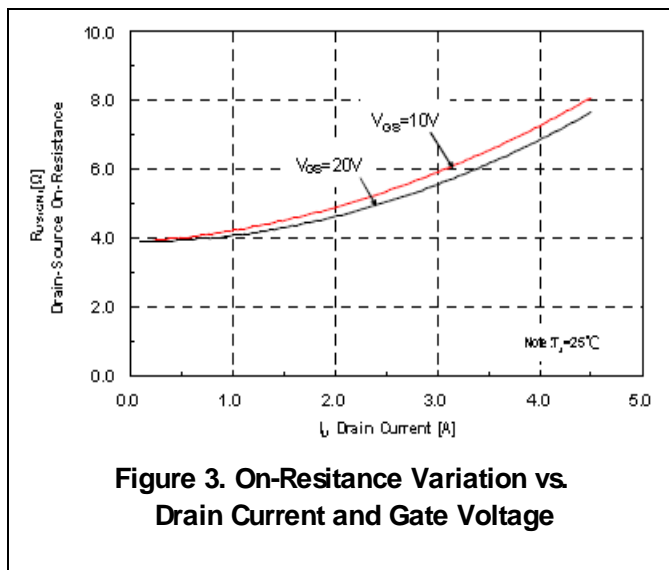
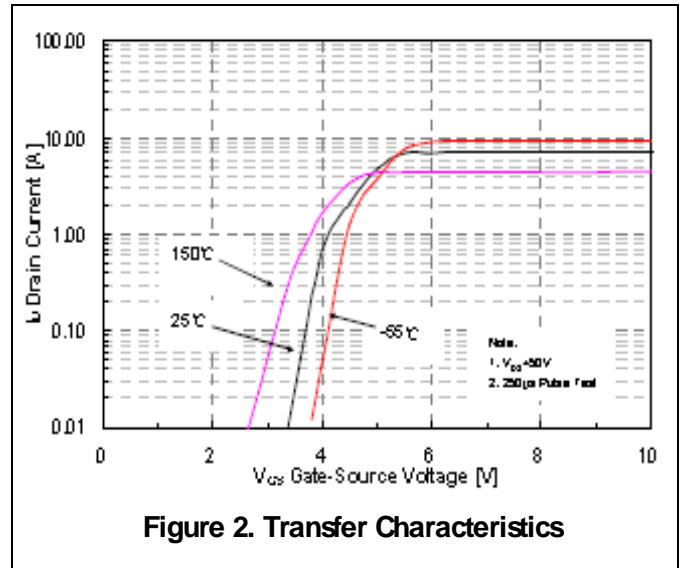
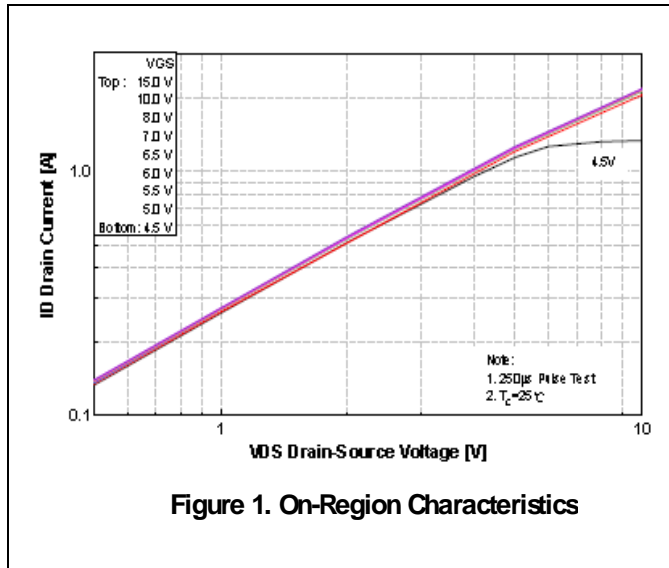
Source-Drain Diode

Symbol	Characteristic	Min.	Typ.	Max.	Units
V _{SD}	Forward On Voltage(1)	-	-	1.4	V
t _{rr}	Reverse Recovery Time	-	300	-	ns
Q _{rr}	Reverse Recovery Charge	-	2.2	-	uC

** : Negligible, Dominated by circuit inductance

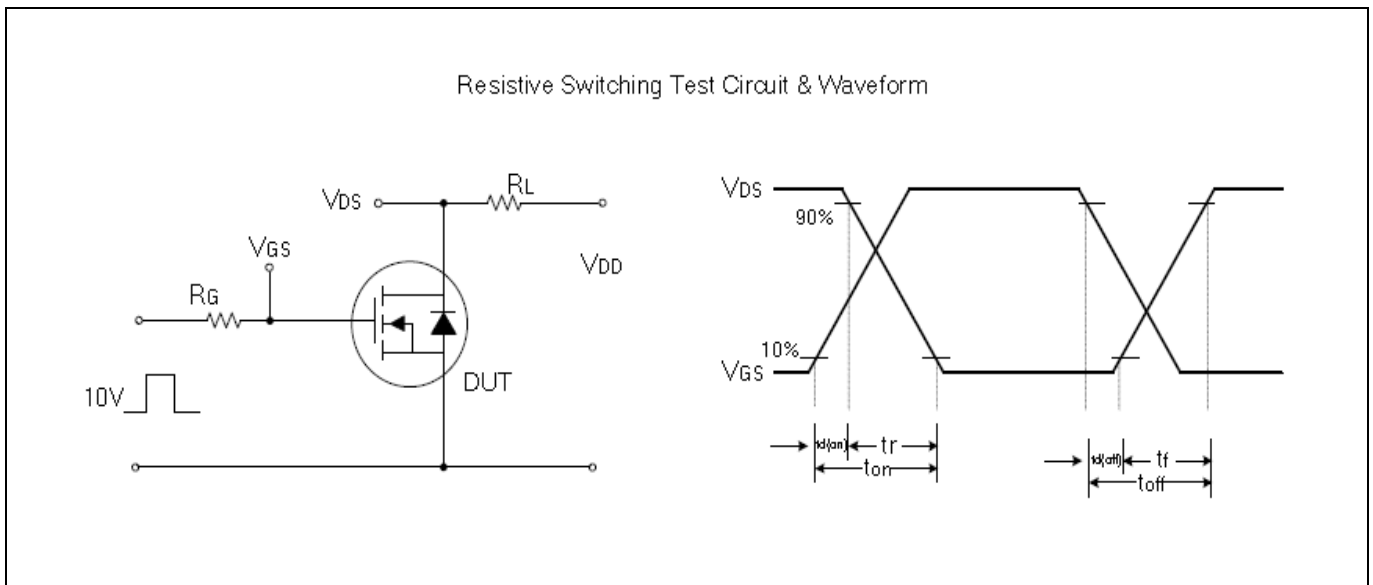
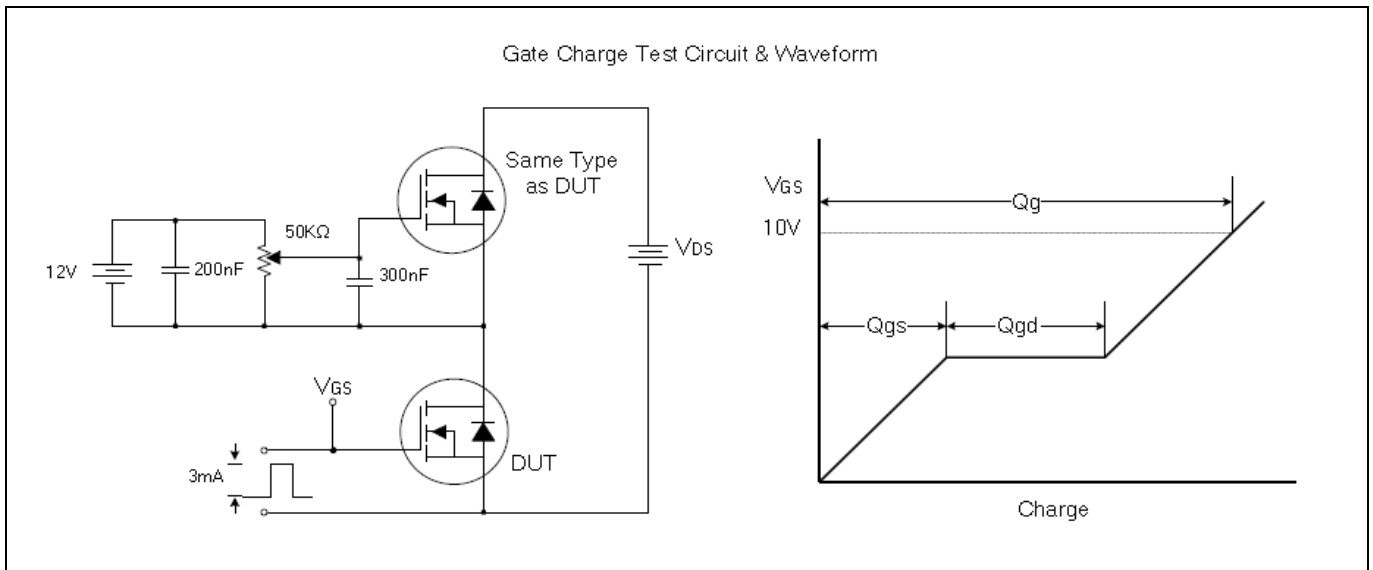
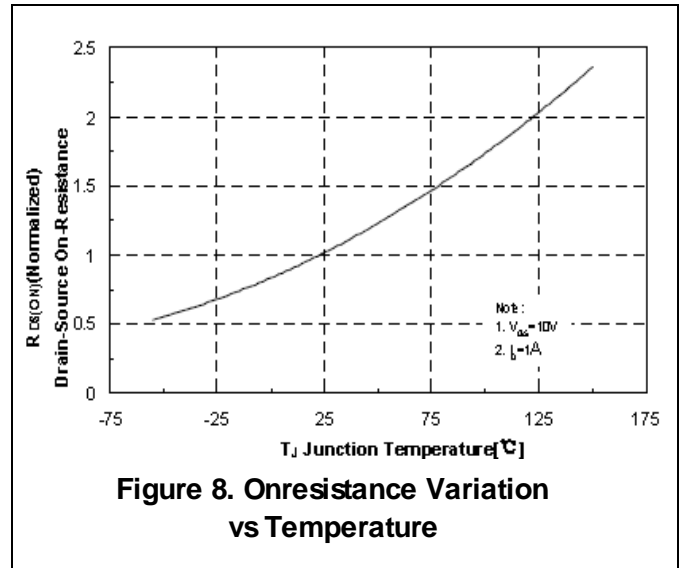
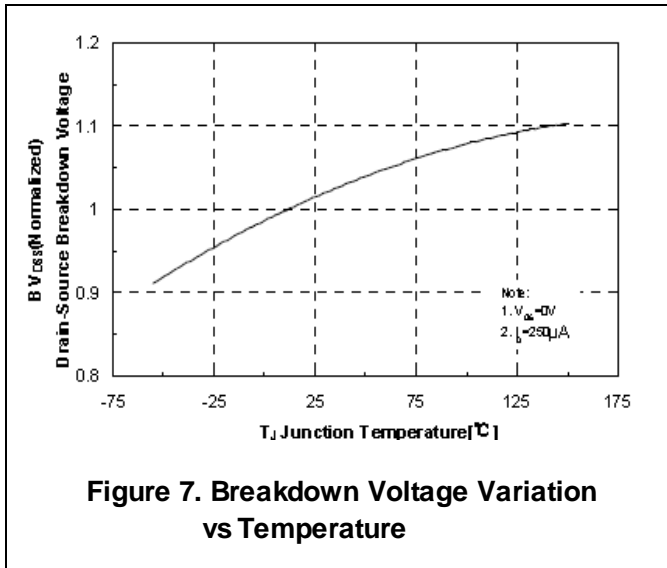


Characteristics Curve





Characteristics Curve





TO-220AB Dimension

3-Lead TO-220AB
Plastic Package
HSMC Package Code: E

Marking:

Pb Free Mark
 Pb-Free: "●" (Note)
 Normal: None

Date Code Control Code

Note: Green label is used for pb-free packing

Pin Style: 1.Gate 2 & Tab.Drain 3.Source

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	5.58	7.49
B	8.38	8.90
C	4.40	4.70
D	1.15	1.39
E	0.35	0.60
F	2.03	2.92
G	9.66	10.28
H	-	*16.25
I	-	*3.83
J	3.00	4.00
K	0.75	0.95
L	2.54	3.42
M	1.14	1.40
N	-	*2.54
O	12.70	14.27
P	14.48	15.87

*: Typical, Unit: mm

TO-220FP Dimension

3-Lead TO-220FP
Plastic Package
HSMC Package Code: F

Marking:

Pb Free Mark
 Pb-Free: "●" (Note)
 Normal: None

Date Code Control Code

Note: Green label is used for pb-free packing

Pin Style: 1.Gate 2.Drain 3.Source

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	6.48	7.40
C	4.40	4.90
D	2.34	3.00
E	0.45	0.80
F	9.80	10.36
G	3.10	3.60
I	2.70	3.43
J	0.60	1.00
K	2.34	2.74
L	12.48	13.60
M	15.67	16.20
N	0.90	1.47
O	2.00	2.96
$\alpha 1/2/4/5$	-	*5°
$\alpha 3$	-	*27°

*: Typical, Unit: mm

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Head Office And Factory:

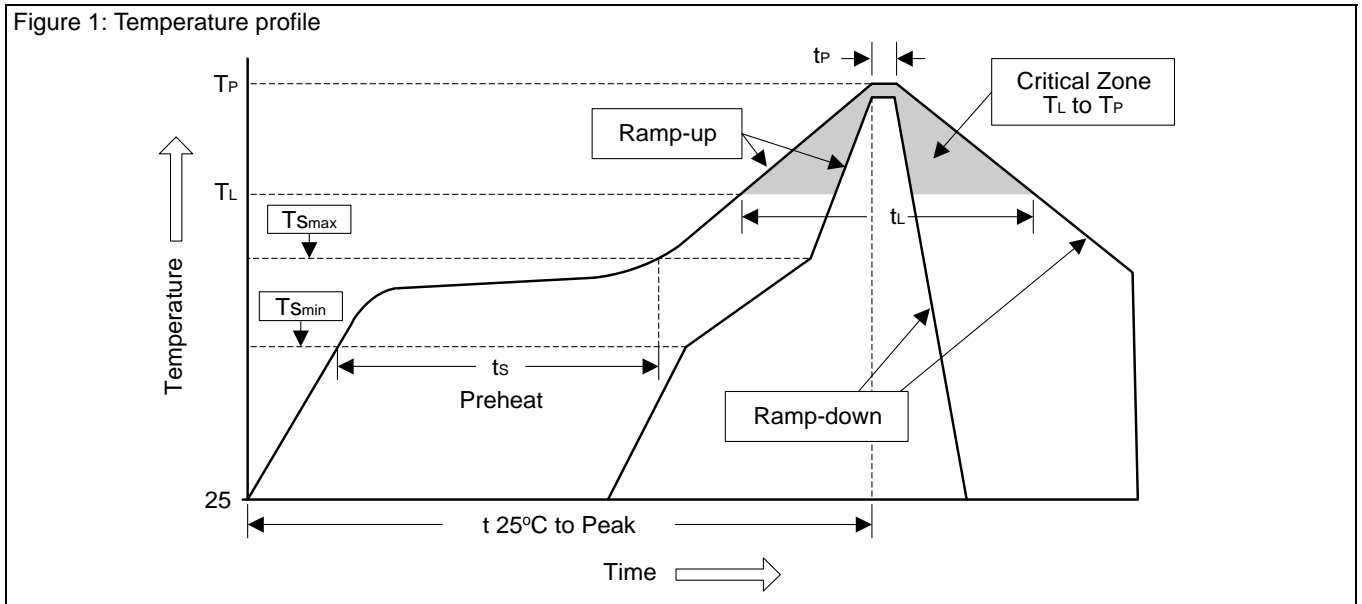
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Soldering Methods for HSMC's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min (T_{Smin})	100°C	150°C
- Temperature Max (T_{Smax})	150°C	200°C
- Time (min to max) (t_s)	60~120 sec	60~180 sec
T_{Smax} to T_L		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (T_L)	183°C	217°C
- Time (t_L)	60~150 sec	60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	10sec ±1sec
Pb-Free devices.	260°C ±5°C	10sec ±1sec