

This application note is designed to provide step-by-step processing recommendations. It covers the popular SMD soldering processes currently in use and provides recommendations and cautions for each step. Since many variations of temperature, time, processes, cleaning agents and board types are found in the electronics industry, you'll want to test and verify your own system.

The process steps, recommendations and cautions are based on Bourns' Trimpot® surveys of SMD users, equipment manufacturers and materials suppliers. Also, comments reflect results of Bourns' testing. Our findings suggest the following soldering and cleaning processes:

1. SOLDERING - Forced Hot Air, Convection, IR, Wave (Single and Dual)
2. CLEANING - Solvent, Aqueous, Semi-Aqueous, No-Clean

## 1



### Solder Paste Printing

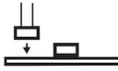
#### Reflow

**GENERAL**  
Use the optimum solder paste for the pattern, printing process, solder paste density and solder joint quality.

**RECOMMENDED**  
Use Sn 63 % Pb 37 % solder paste. Use 8 to 10 mil thickness for solder paste print.

**CAUTION**  
Since solder paste usually contains a high percentage of activators, you must ensure adequate cleaning to remove all residues, unless no-clean (low solids) paste is used.

## 2



### SMD Placement

**GENERAL**  
Use pick-and-place equipment with vacuum nozzle ID size that allows adequate suction to pick the SMD out of the embossed cavity.

**RECOMMENDED**  
The nozzle inside diameter (ID) should not exceed .100 in. (2.54mm) to ensure adequate suction and part alignment.

**CAUTION**  
Assure parts are placed so that all terminals are equidistant (<4 mils) from the solder pads.

Align terminals with solder belt direction of travel to avoid body shadowing effects during flow soldering.

## 3



### Flux Application

#### Flow (Wave)

**GENERAL**  
Use the correct flux to remove surface oxides, prevent reoxidation and promote wetting.

**RECOMMENDED**  
• RMA  
• No-clean SRB (Synthetic resin based)  
• OA (Organic Acid) (See caution)

**CAUTION**  
Avoid highly activated fluxes. Consult factory before using OA.



### SMD Trimmers

#### Solder

##### Reflow; Hot Air, and IR

**GENERAL**  
Preheat sufficiently using both time and temperature to vaporize all solder paste solvents and moisture, leaving only solder and flux as component enters solder reflow phase.

**RECOMMENDED**  
Solder zone profile of 230 °C for 20 seconds.

**CAUTION**  
Do not exceed time and temperature reflow profile of 235 °C for 45 ±5 seconds for hot air/IR reflow. Use 215 °C as minimum reflow temperature.

Minimize thermal shock by limiting temperature rise rate to 3 °C/sec and by stabilizing board and components temperature during preheating.

## 4



### Through-hole Trimmers

#### Solder

##### Flow (Wave)

**GENERAL**  
For maximum component reliability and performance, minimize the time of temperature exposure above 200 °C.

**RECOMMENDED**  
Use Sn 63 % Pb 37 % solder or lead free solder paste, depending upon application. Solder zone profile of 245 °C for 5 seconds max.

**Please see Page 2 for additional Wave Soldering recommendations.**

**CAUTION**  
Do not exceed 260 °C peak temperature for dual wave solder process with a flow zone totaling 5 seconds.

Minimize thermal shock by limiting temperature rise rate to 3 °C/sec and by stabilizing board and components temperature during preheating.

## 5



### Wash\*

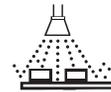
#### Solvent

**GENERAL**  
Use solvent cleaning primarily for nonpolar contaminants such as rosin based flux residues.

**RECOMMENDED**  
Use any suitable washing solvents that meet ODC requirements.

**CAUTION**  
Limit excessive direct spray pressure to 60 psi or below for optimum reliability.

## 6



### Wash\*

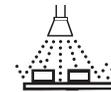
#### Semi-Aqueous

**GENERAL**  
Use semi-aqueous for nonpolar contaminants such as rosin based flux residues.

**RECOMMENDED**  
Use terpene or hydrocarbon based for pre-wash. Use water for final wash.

**CAUTION**  
Limit excessive direct spray pressure to 60 psi or below for optimum reliability.

## 7



### Wash\*

#### Aqueous

**GENERAL**  
Use aqueous cleaning primarily for polar contaminants such as organic flux residues.

**RECOMMENDED**  
Use any of these aqueous wash materials:  
• Deionized water

**CAUTION**  
Limit excessive direct spray pressure to 60 psi or below for optimum reliability. Ultrasonics may cause component damage or failure.

## 8

### No-Wash

**GENERAL**  
No-wash is an option when no-clean (low solids) flux is used for solder operations.

\*Process descriptions 5 through 7 do not apply to open frame trimmers.

### Board Rework Technique



**GENERAL**  
Limit solder iron temperature to 350 °C for 3 seconds.

Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

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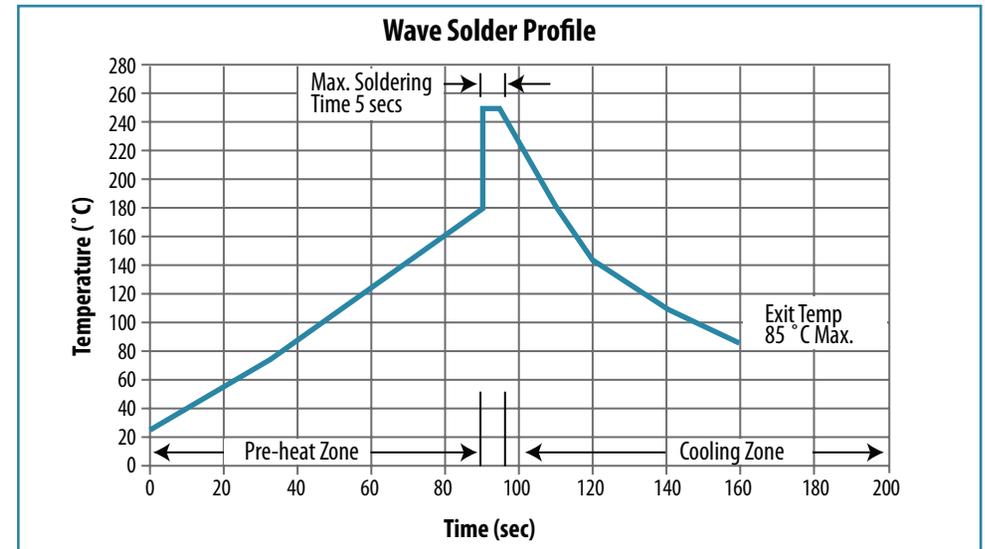
## Solder

Flow (Wave)

### RECOMMENDED -Continued from Page 1-

- The belt speed should be adjusted per the solder equipment manufacturer's recommendations in order to insure a dwell time in the solder wave of 2 to 3 seconds.
- The solder pot temperature should be adjusted to a range of 240 °C to 250 °C.
- The flux station (foam or wave) preheat temperature should be adjusted to a range of 80 °C to 105 °C.
- The preheat temperature must not exceed 100 °C under the solder wave temperature and the preheat rate of 1.5 to 2.5 °C/sec.
- The underside PC board temperature at the last preheat zone should be approximately 150 °C.
- Verify that the difference between the solder temperature and the board is 100 °C or less at the point in time when the PC board leaves the last preheat zone.
- The PC board should be permitted to air-cool at room ambient conditions following exposure to the soldering environment. Forced air-cooling is not recommended.

Use of the following recommended RoHS solder profile should optimize terminal solder wetting:



Following are the common methods, materials and maximum temperature/time parameters for soldering and cleaning processes.

## SOLDERING/CLEANING METHODS

Process Step	REFLOW (SMD Processing)				FLOW (Through-hole Processing)			
	Hot Air; Infrared (Solvent)	Hot Air; Infrared (Semi-Aq)	Hot Air; Infrared (Aqueous)	Hot Air; Infrared (No-Clean)	Wave (Solvent)	Wave (Semi-Aq)	Wave (Aqueous)	Wave (No-Clean)
1. Solder Paste Printing	X	X	X	X				
2. Component Placement	X	X	X	X	X	X	X	X
3. Flux Application					X			
3. Flux Application						X		
3. Flux Application							X	
3. Flux Application								X
4. Solder (Reflow)	X	X		X				
4. Solder (Flow)					X	X	X	X
5. Wash (Solvent)	X				X			
6. Wash (Semi-Aqueous)		X				X		
7. Wash (Aqueous)			X				X	
High Pressure Fluids			X				X	
Max. Temp. (°C)/Time (Secs)	235/40	235/40	235/40	235/40	260/5	260/5	260/5	
Min. Temp. (°C)	215	215	215	215	215	215	215	

Vapor Phase Reflow: Limit to 215 °C for 3 minutes max.