Eco+PLUS® series

Lead free SOLUTIONS you can TRUST

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Contents

- Features
- Specifications
- Continual printability
- Viscosity variation
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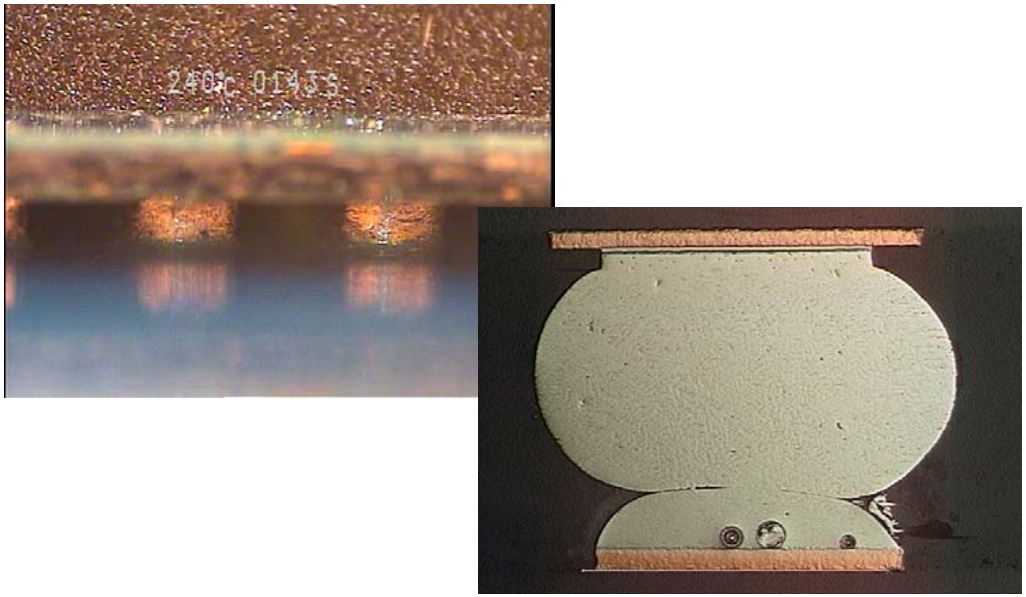
- Tack time
- Heat slump
- Solder balling
- Solder beading
- Super fine pattern wetting
- Anti-Pillow defect
- Voiding
- Copper corrosion
- Surface insulation resistance
- Voltage applied SIR
- Handling guide

Koki no-clean LEAD FREE solder paste

Anti-Pillow Defect S3X58-M406-3 series

Product information



This Product Information contains product performance assessed strictly according to our own test procedures and may not be compatible with results at end-users.

KOKI
CHALLENGING NEW TECHNOLOGIES

S3X58-M406-3

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Product Features

- Solder alloy composition is **Sn3Ag0.5Cu**.
- Ensures **OUTSTANDING** continual **PRINTABILITY** with super fine pitch (0.4mm/16mil) and CSP (>0.25mm dia.) applications for normal to fast printing (10 ~ 100mm/sec.) and long stencil idle time.
- **PERFECT MELTING** and wetting at super fine pitch (<0.4mm pitch) and micro components (<0.25mm dia CSP, 0603 chip).
- Specially formulated flux chemistry ensures extremely **LOW VOIDING** with CSPs and broad contact area components.
- Designed to prevent occurrence of **HIDDEN PILLOW DEFECTS**.

No clean ROL0	Powder Type 3 or 4	Fine pattern 0.4mm pitch CSP<0.3mm	Idle time > 60 min. CSP 0.3mm	Tack time >36hrs.	High heat slump resist	Powerful wetting	Low beading	Low voiding	High reliability

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Specifications

Application		Printing - Stencil	
Product		S3X58-M406-3	S3X58-M406L-3
Alloy	Composition (%)	Sn96.5, Ag3.0, Cu0.5	
	Melting point (°C)	217 - 218	
	Shape	Spherical	
	Particle size (μm)	20 – 38	
Flux	Halide content (%)	0.0	
	Flux type	ROL0	
Product	Flux content (%)	11.5 ± 0.5	11.8 ± 0.5
	Viscosity*1 (Pa.S)	210 ± 10%	170 ± 10%
	Copper plate corrosion*2	Passed	
	Tack time	> 72 hours	
	Shelf life (below 10°C)	6 months	

1. Viscosity : Malcom spiral type viscometer,PCU-205 at 25ºC 10rpm
2. Copper plate corrosion : In accordance with JIS.

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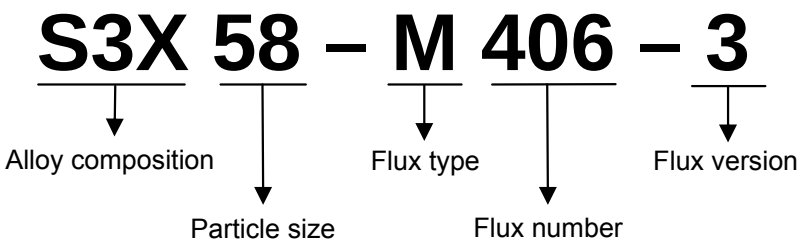
Specifications – Alloy selections



Alloy composition (%)	**S3X** : SnAg3.0Cu0.5
Particle size (μm)	**58** : 20 ~ 38 **48** : 20 ~ 45
Flux type	**M** : Low halide, halide free **N** : Nitrogen use
Flux number	Solids and solvent used

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Continual printability

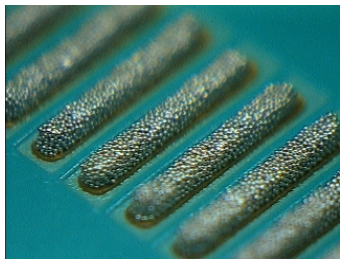
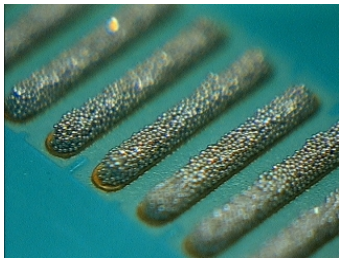
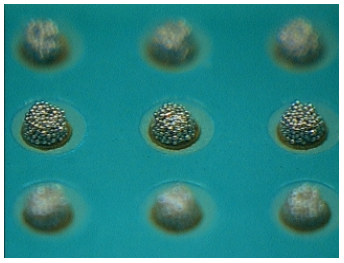
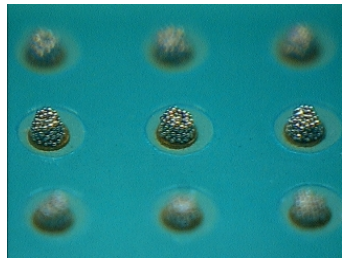
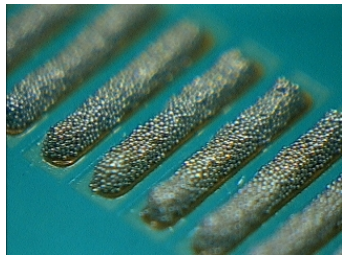
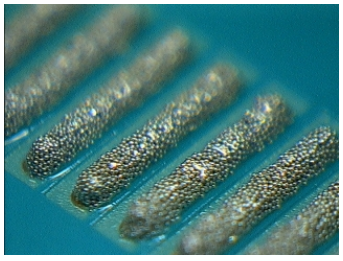
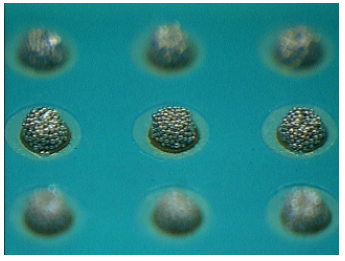
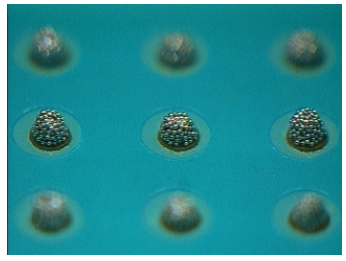
Print parameters

- Stencil : 0.12mm thickness, laser cut stencil
- Printer : Model MK-880SV Minami Kogaku
- Squeegee : Metal blade, Angle - 60°
- Print speed : 40 mm/sec
- Stencil separation speed : 10.0 mm/sec
- Atmosphere : 24.5~27.0°C (50~60%RH)

Test patterns

1. QFP pad pattern : Width 0.20 mm
   Length 1.5 mm Distance 0.2 mm
2. MBGA pad pattern : 1) Diameter 0.30 mm
   2) Diameter 0.25 mm

*Solder paste tested: S3X58-M406-3

	Vertical to squeegee	Parallel to squeegee	0.3mm diameter	0.25mm diameter
1st print				
1st print after 200 strokes				

Newly developed additives provide a lubricating effect that greatly improve the paste release properties and assures excellent print quality even with microBGA, 0603 and super fine pitch components.

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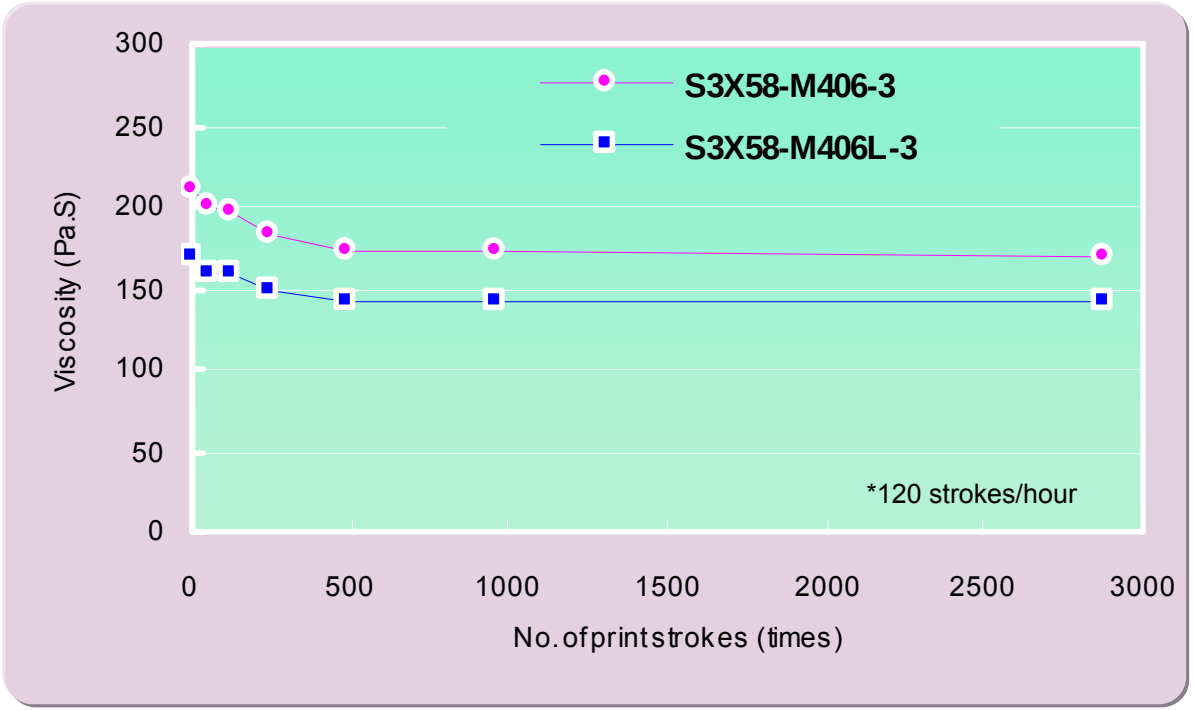
Viscosity variation in continual printing

- Print (knead) solder paste on the sealed-up stencil continually up for 24 hours to observe viscosity variation.
- Squeegee : Metal blades
- Squeegee angle : 60°
- Squeegee speed : 30mm/sec.
- Print stroke : 300mm
- Printing environment : 26+/-1°C, 60+/-10%RH



A newly developed flux formula has succeeded to realize consistent long term printability by preventing excess viscosity drop due to shear thinning and excess increase due to chemical reaction between solder powder and flux during print rolling

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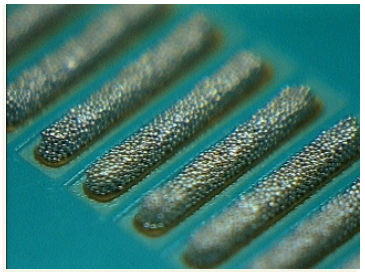
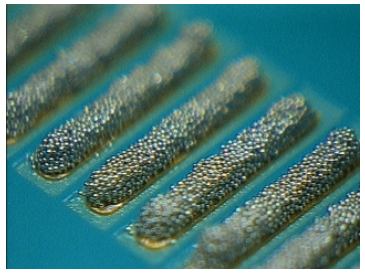
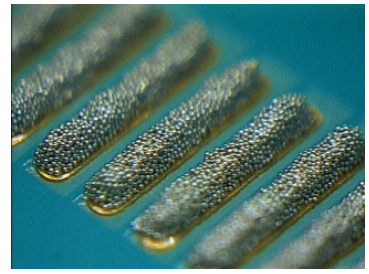
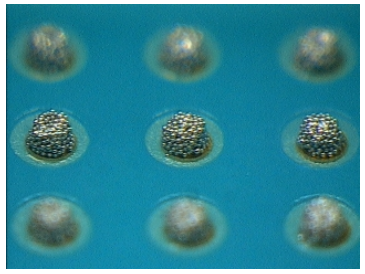
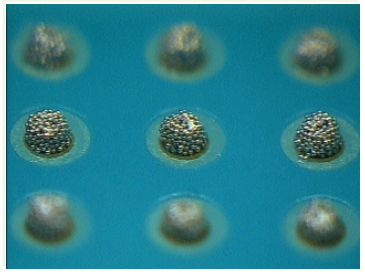
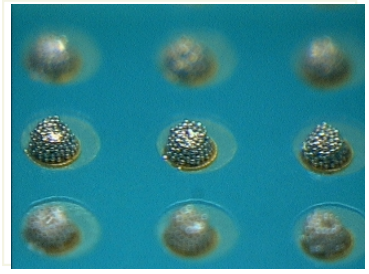
Intermittent printability (Stencil idle time)

- Print solder paste continuously and stop to idle the paste for 60, 90 min. intervals, and resume the printing and observe the 1st print result to verify intermittent printability.
- Squeegee : Metal blades
- Squeegee angle : 60°
- Squeegee speed : 40mm/sec.
- Print stroke : 300mm
- Printing environment : 25+/-1°C, 60+/-10%RH
- Test pattern : QFP pad pattern - Width 0.20 mm Length 1.5 mm Distance 0.2 mm
  MBGA pad pattern - Diameter 0.30 mm

*Solder paste tested: S3X58-M406-3

	1st print	1st print after 45 min.	1st print after 60 min.
0.4mm pitch QFP pattern (vertical)			
0.30mm diameter			

Unique formulation solvent system assures extremely long stencil idle time, eliminating printing faults and improving process window and production yields.

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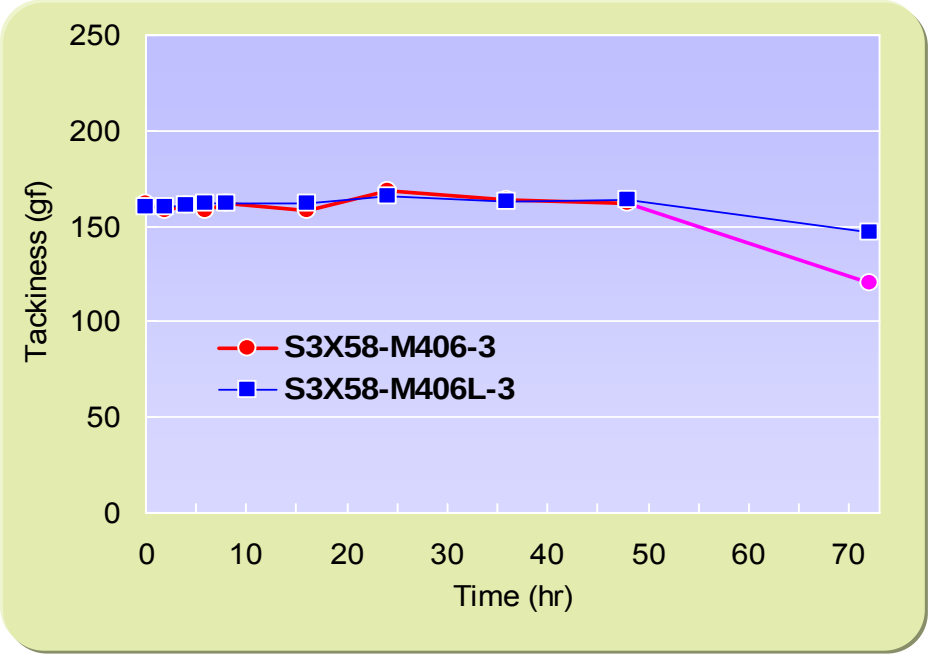
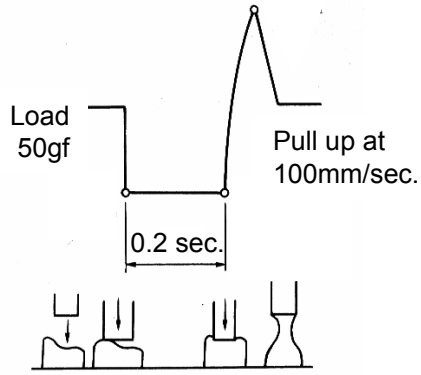
Tack time

- Stencil : 0.2mm thick, 0.6mm dia. aperture
- Measurement instrument : Malcom tackimeter TK-1
- Probe pressure : 50gs
- Pressurizing time : 0.2mm
- Pull speed : 10mm/sec.
- Test method : In accordance with JIS Z 3284
- Test environment : 25+/-1°C, 60+/-10%RH



Tensile strength = Tack force



Unique solvent system has succeeded to extend tack time dramatically (>72 hours) helps widen process window significantly.

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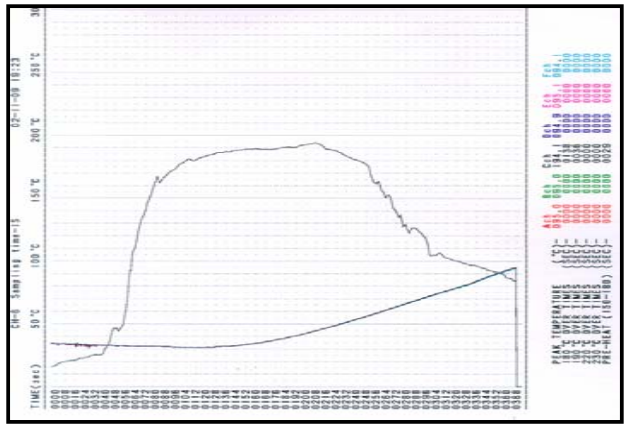
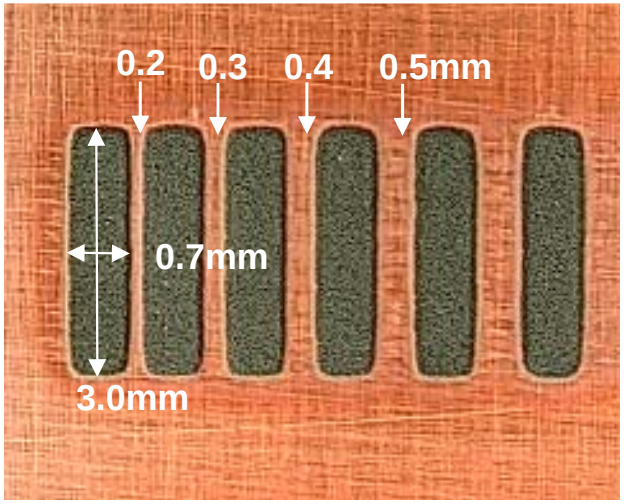
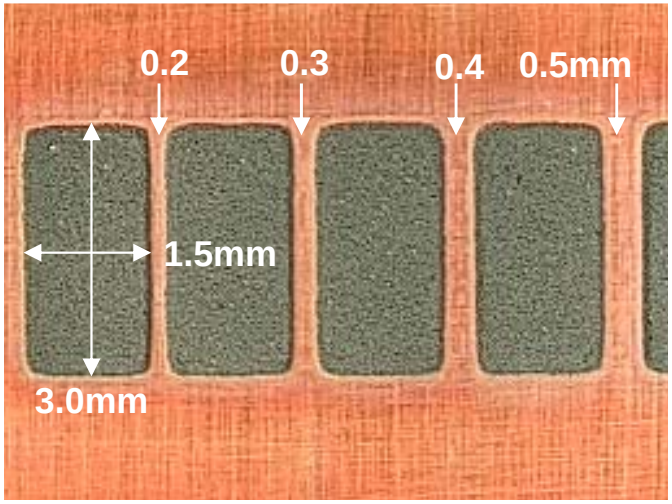
Heat slump

- Stencil thickness : 0.2mm
- Stencil aperture : Pattern (1) 3.0mm × 0.7mmm
  Pattern (2) 3.0mm × 1.5mm
- Spacing between apertures: 0.2mm to 1.2mm
- Heat profile : 180~190ºC × 120 sec.
- Test method : In accordance with JIS Z 3284







*Solder paste tested: S3X58-M406-3

Improved heat slump property assures reduced soldering defects, such as solder beading and bridging.

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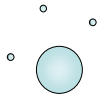
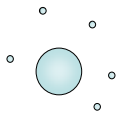
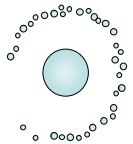
Solder balling (Residue cosmetics)

- Stencil : 0.2mm thick
- Stencil aperture : 6.5mm diameter
- Solder pot temperature : 250ºC
- Test method : In accordance with JIS Z 3284

  Knead the paste for 8 hours on sealed-up stencil and print it on alumina plate.

  Melt it on hot plate after leaving it for a certain period of time at room temperature.

Category 1	2	3	4
			

*Solder paste tested: S3X58-M406-3

1 hour after printing

Category 2

24-hours after printing

Category 3

Almost no solder balling and resistant to ambient temperature and humidity.

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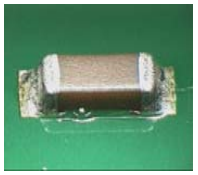
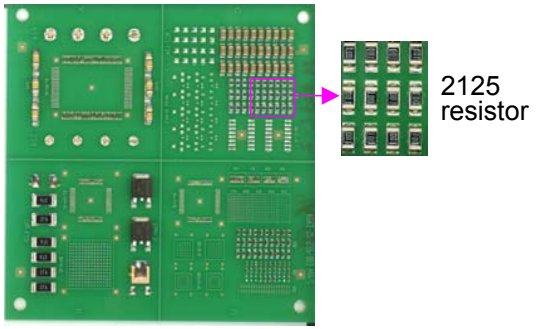
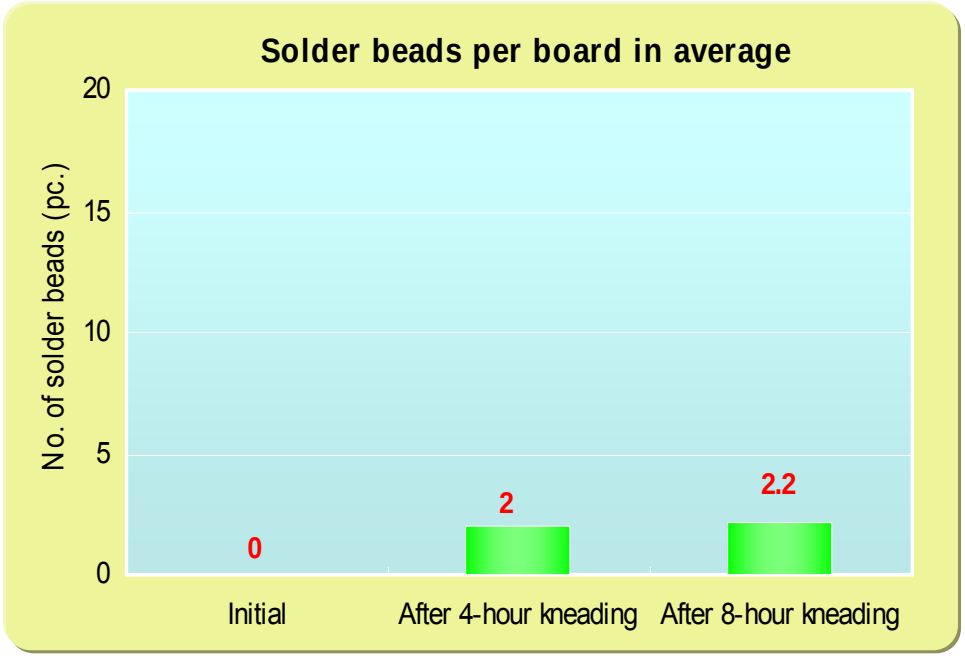
Solder beading

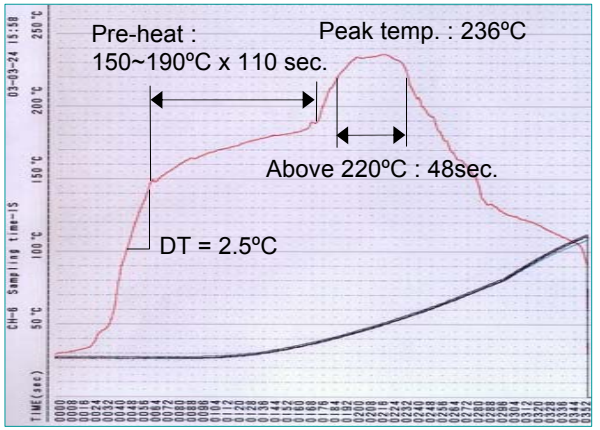
- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Stencil aperture : 100% aperture opening to pad
- Components
  2125 resistor : 30 pcs./board
  Total : 30 chips/board × 5 boards = Total 150 components
- Heat source : Hot air convection
- Zone structure : 5 pre-heat zones +2 peak zones
- Atmosphere : Air



*Fault finding design







Reflow profile

*Solder paste tested: S3X58-M406-3

Largely reduces the generation of solder beads by the addition of resin fluidity suppressing effect at high temperature.

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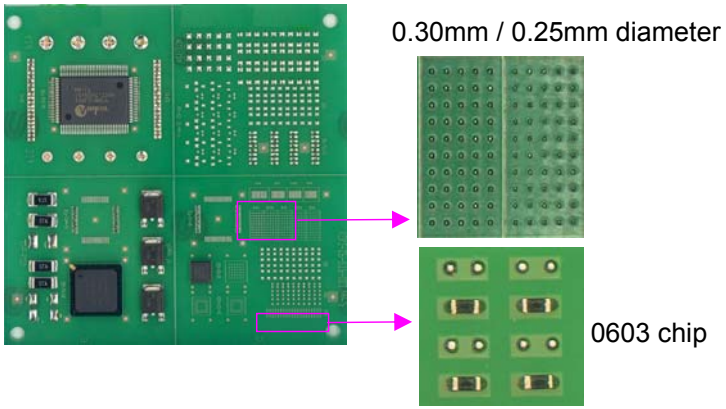
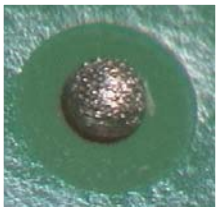
Super fine pattern wetting

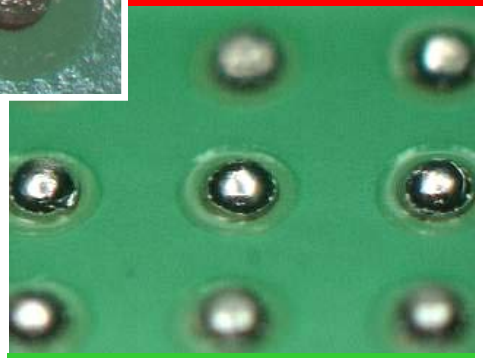
- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Pad size : 0.30, 0.25mm diameter, 0603 chip pattern
- Stencil aperture : 100% aperture opening to pad
- Heat source : Hot air convection
- Zone structure : 5 pre-heat zones +2 peak zones
- Atmosphere : Air
- Reflow profile : Same as *"Solder beading"*



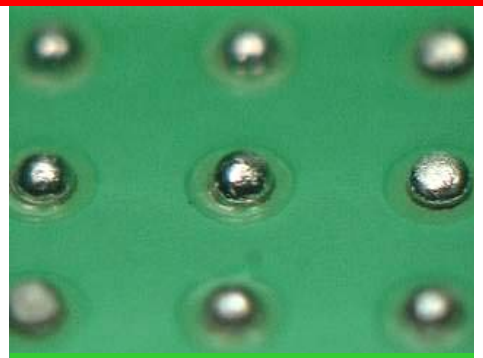
*Solder paste tested: S3X58-M406-3



After 8-hour printing on sealed-up stencil



0.3mm diameter



0.25mm diameter

0603 chip pattern

Larger relative surface areas of solder paste exposed due to miniaturization of components (CSP, 0603 chips), often cause incomplete melting due to excess oxidation during the reflow.

An improved flux formula ensures complete coalescence by minimum deterioration of barrier performances .

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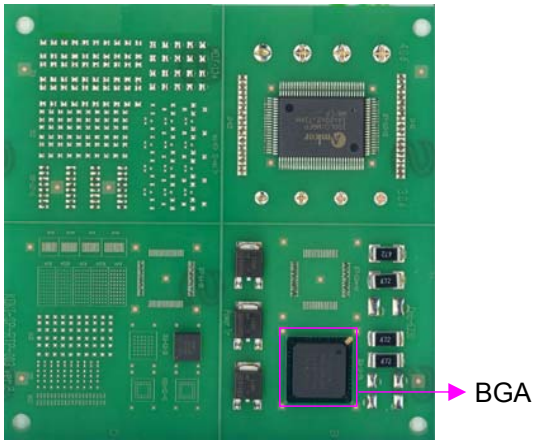
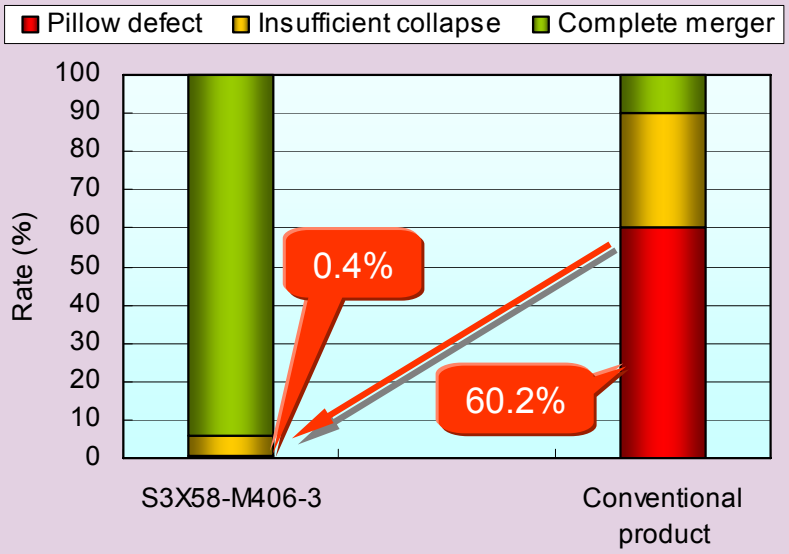
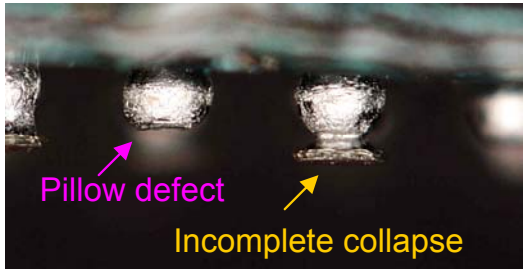
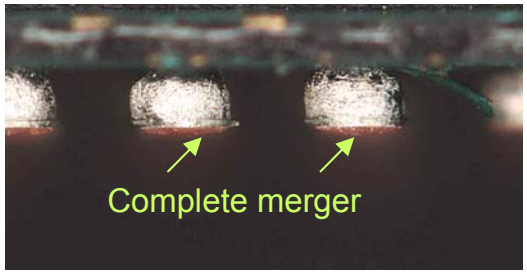
Hidden pillow defect test

- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Pad size : 0.5mm diameter
- Stencil aperture : 100% aperture opening to pad
- Component (BGA): SnAgCu, 1.0mm pitch, pre-conditioned at 180ºC × 100sec.
- Heat source : Hot air convection
- Atmosphere : Air
- Reflow profile : Same as *"Solder beading"*
- Procedure:
  1. Reflow solder paste without BGA
  2. Place BGA on pre-reflowed solder.
  3. Reflow it.









After peel-off

Newly developed flux formulation with higher heat resistance and quicker wetting reaction, drastically reduces pillow defect.

S3X58-M406-3

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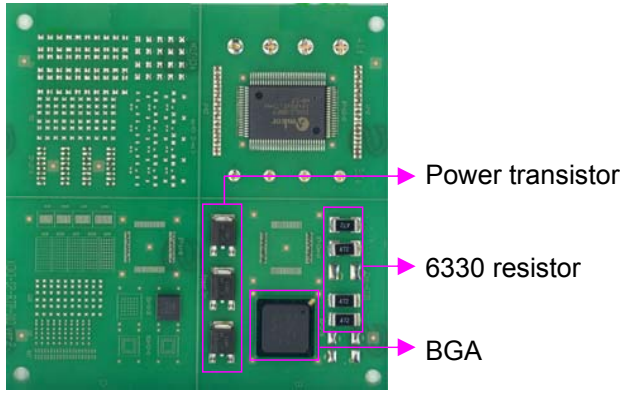
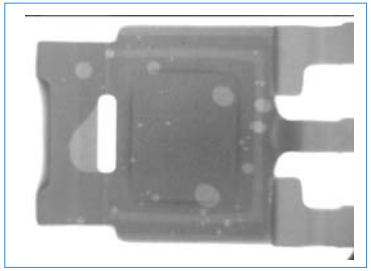
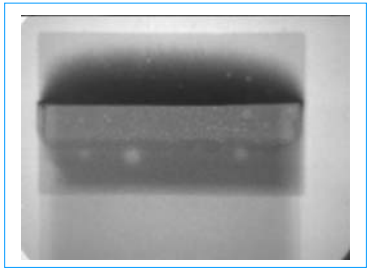
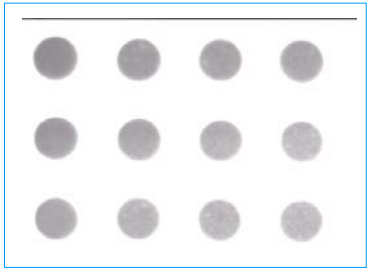
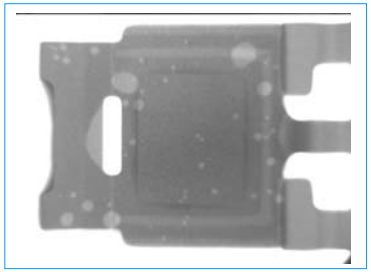
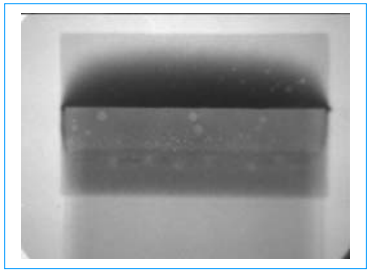
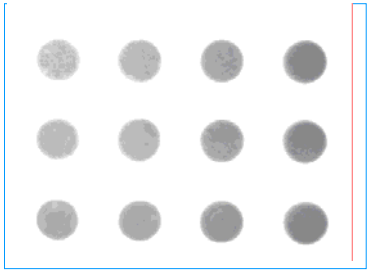
Voiding

- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Stencil aperture : 100% aperture opening to pad
- Components
  6330 resistor : 100% Sn plated
  Power transistor : 100% Sn plated
  BGA : SnAgCu bumps 1.0mm pitch
- Heat source : Hot air convection
- Zone structure : 5 pre-heat zones +2 peak zones
- Atmosphere : Air
- Reflow profile : Same as *"Solder beading"*



*Solder paste tested: S3X58-M406-3

	Power transistor (100Sn)	6330 chip resistor (100Sn)	BGA (Sn3Ag0.5Cu)
Initial			
After 4-hour kneading on sealed-up stencil			

Voiding with various components has been drastically reduced and offers consistent level of voiding even after continual print for more than 8 hours.

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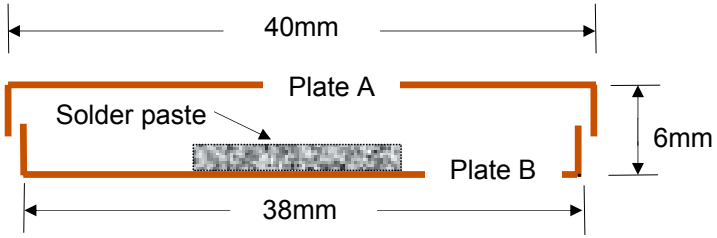
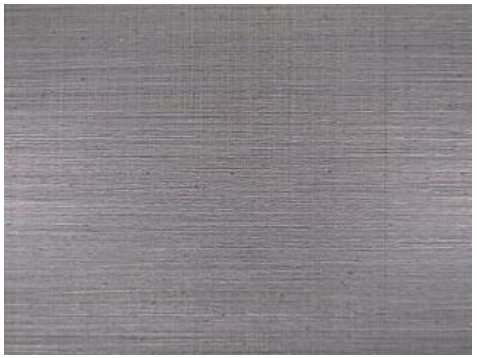
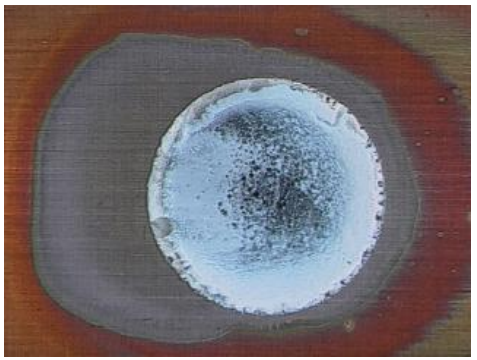
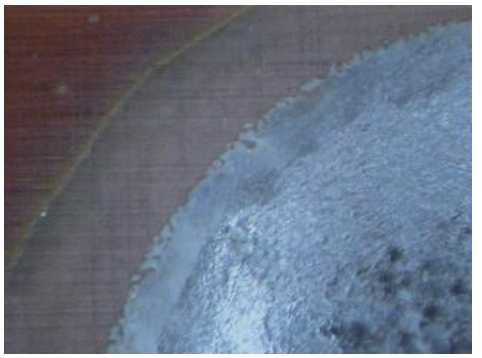
Copper corrosion

- Test conditions : 40±2ºC 90~95%RH for 72 hours
- Test method : JIS Z 3197



	Copper Plate A	Copper Plate B
× 30		
× 100		

*Solder paste tested: S3X58-M406-3

No evidence of corrosion can be observed.

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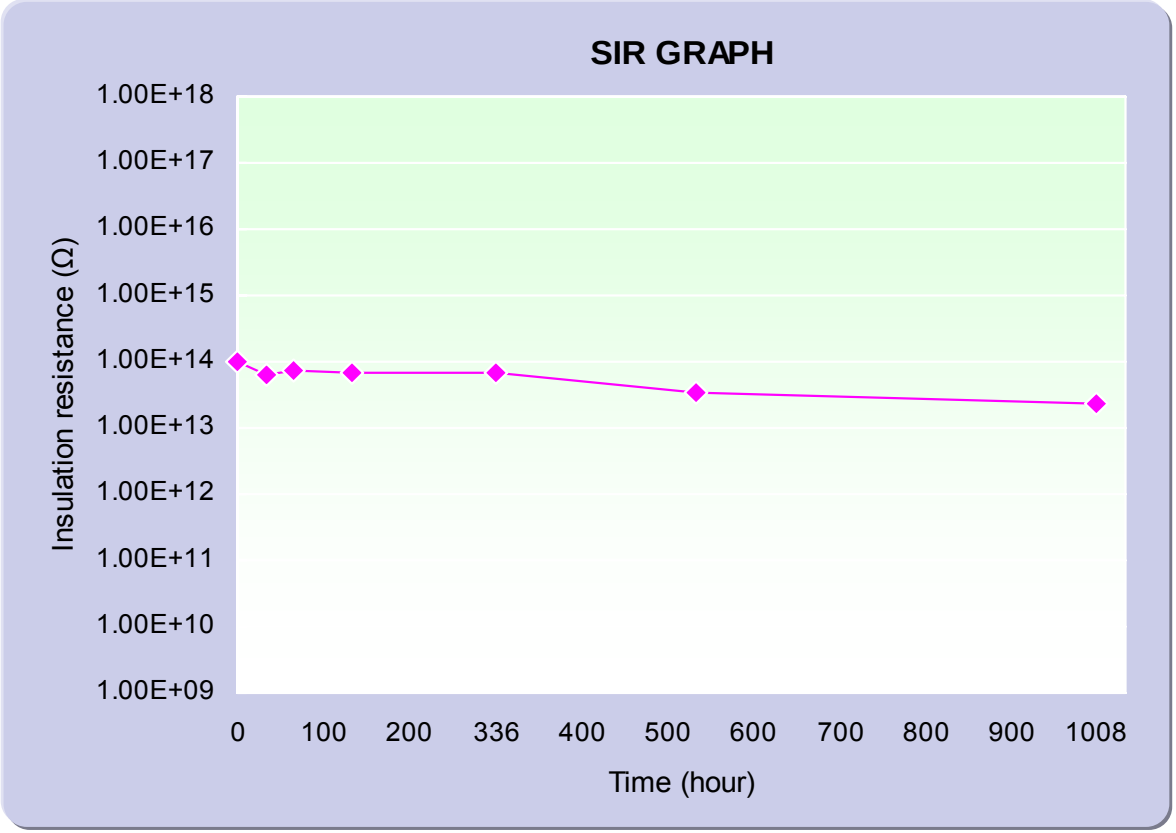
Surface insulation resistance

- Test conditions : 85±2ºC × 85%RH for 1008 hours
- Stencil thickness : 100 micron
- Comb type electrode : JIS type-II
- Measurement voltage : DC100V
- Test method : JIS Z 3197

*Solder paste tested: S3X58-M406-3



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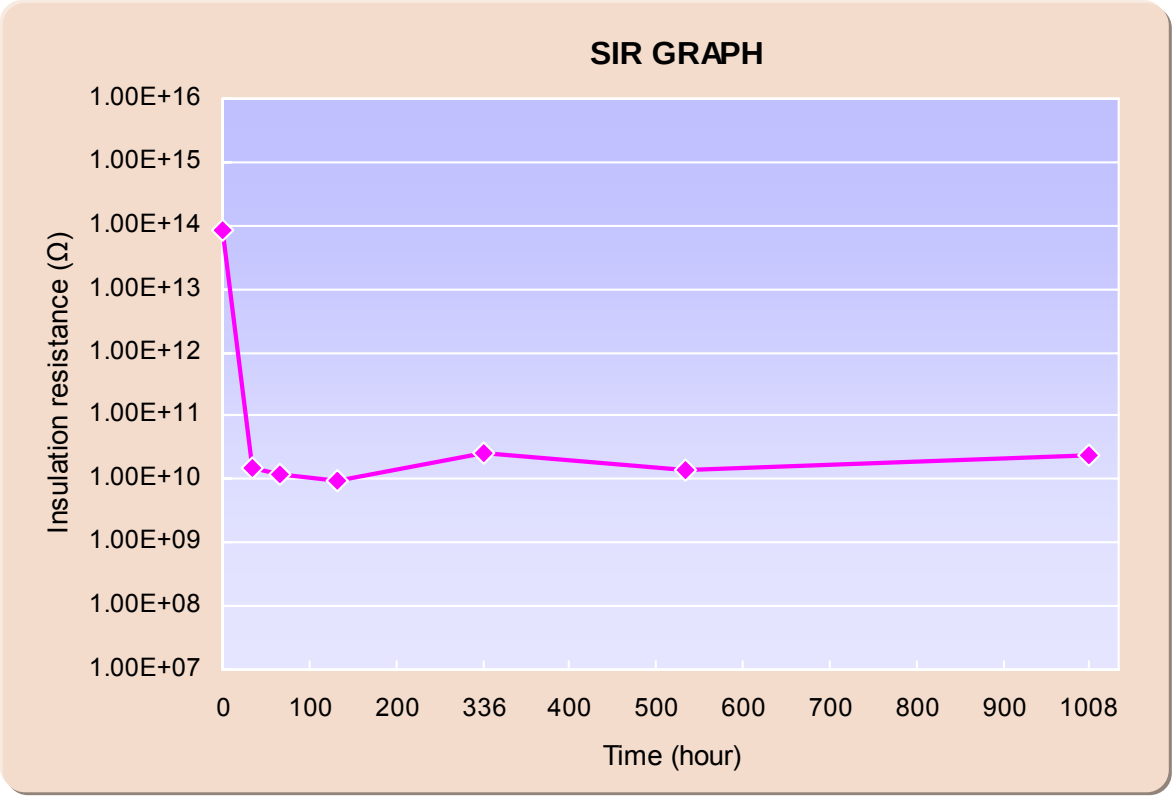
Voltage applied surface insulation resistance

- Test conditions : 85±2ºC × 85%RH for 1008 hours
- Stencil thickness : 100 micron
- Comb type electrode : JIS type-II
- Measurement voltage : DC100V
- Voltage applied : DC50V
- Test method : JIS Z 3197

*Solder paste tested: S3X58-M406-3



No evidence of electromigration can be observed.

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Handling guide

1. Printing
   1) Recommended printing parameters
      (1) Squeegee
         1. Kind : Flat
         2. Material : Rubber or metal blade
         3. Angle : 60~70º (rubber) or metal blade
         4. Pressure : Lowest
         5. Squeegee speed
            - S3X58-M406-3 : 10~50mm/sec.
            - S3X58-M406L-3 : 20~100mm/sec.

      (2) Stencil
         1. Thickness : 200~110μm for 0.65~0.4mm pitch pattern
         2. Type : : Laser or electroform
         3. Separation speed : 0.5~10.0mm/sec.
         4. Snap-off distance : 0~0.5mm

      (3) Ambiance
         1. Temperature : 22~25ºC
         2. Humidity : 40~60%RH
         3. Air draft : Air draft in the printer badly affects stencil life and tack performance of solder pastes.

2. Shelf life
   1) 0~10ºC : 6 months from manufacturing date
   2) At 20~30ºC : 1 month from manufacturing date

   * Manufacturing date can be obtained from the lot number

ex. **Lot No. 6 07 21 2**

- **No. of lot : 2nd**
- **Date : 21st**
- **Month : July**
- **Year : 2006**

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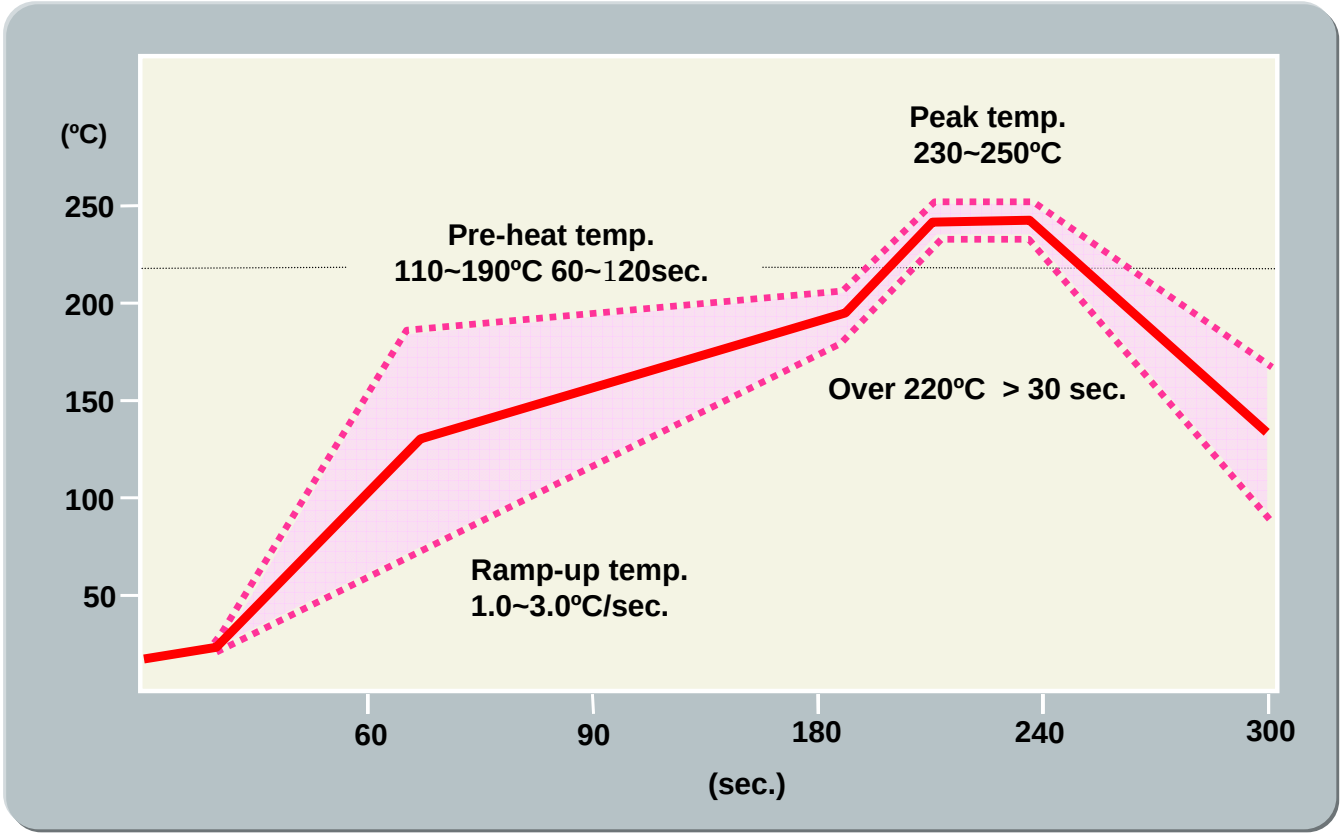
Handling guide - Recommended reflow profile



Excess pre-heating (time & temperature) may cause too much oxidation.

Relatively short and low pre-heat may be recommendable, especially for fine pitch/micro pattern components .