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Ver.
Prepared on Feb. 25, 2013

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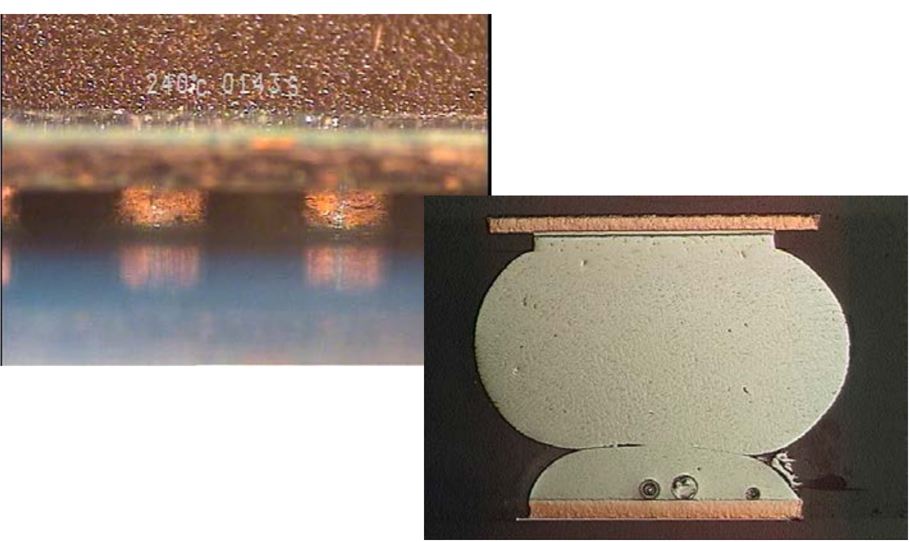
Koki no-clean LEAD FREE solder paste

Anti-Pillow Defect S3X48-M406ECO 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.

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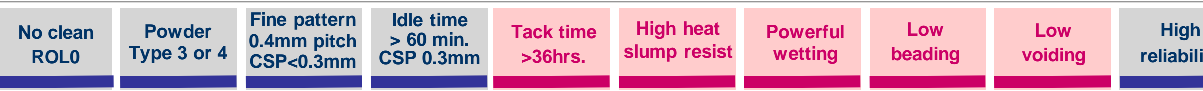
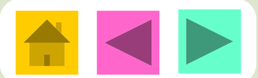
Product Features

- Solder alloy composition is **Sn3Ag0.5Cu**.
- Ensures **OUTSTANDING** continual **PRINTABILITY** with super fine pitch (0.4mm/16mil) and CSP (>0.3mm 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 (<0.3mm 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**.





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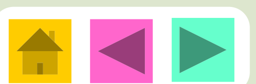

Specifications

Application		Printing - Stencil
Product		S3X48-M406ECO
Alloy	Composition (%)	Sn96.5, Ag3.0, Cu0.5
	Melting point (°C)	217 - 218
	Shape	Spherical
	Particle size (μm)	20 – 45
Flux	Halide content (%)	0.0
	Flux type	ROL0*[3]
Product	Flux content (%)	11.5 ± 0.5
	Viscosity*[1] (Pa.S)	210 ± 10%
	Copper plate corrosion*[2]	Passed
	Tack time	> 72 hours
	Shelf life (0 - 30°C)	6 months

1. Viscosity : Malcom spiral type viscometer,PCU-205 at 25ºC 10rpm
2. Copper plate corrosion : In accordance with JIS
3. Flux type : According to IPC J-STD-004

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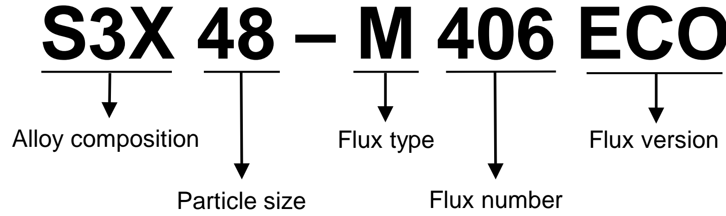
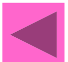
Specifications – Alloy selections



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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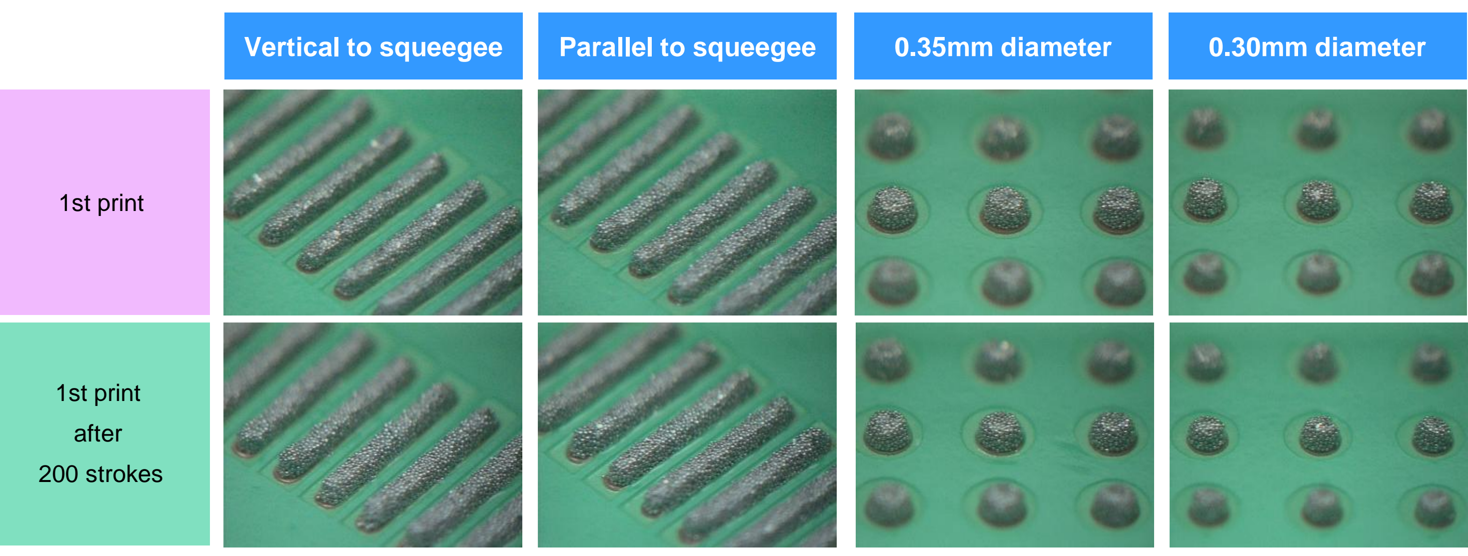
Continual printability

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 0.35 mm, 2) Diameter 0.30 mm



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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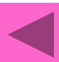
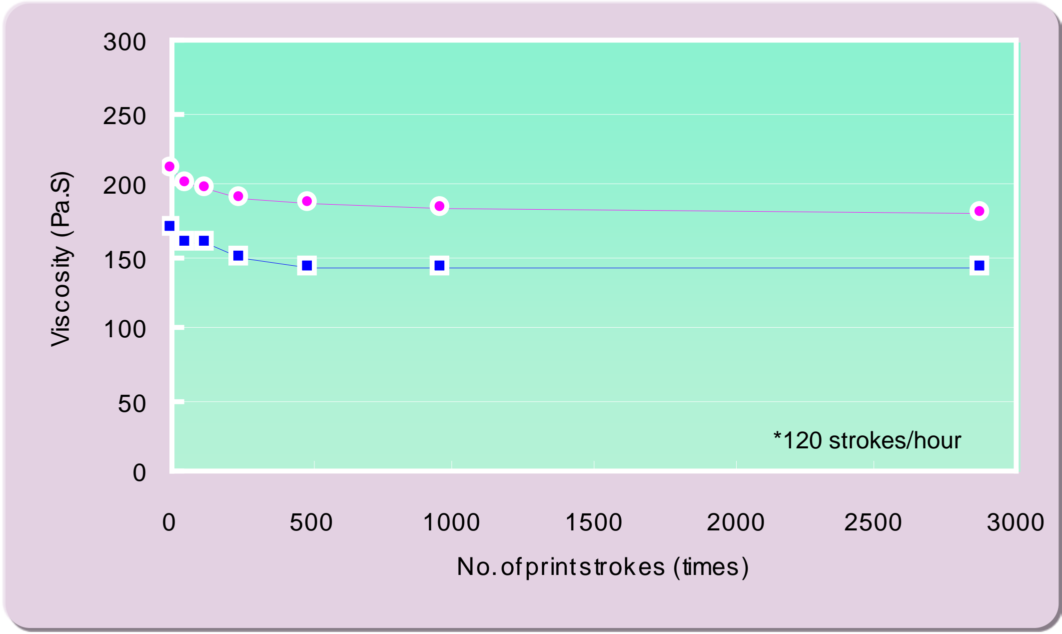


Viscosity variation in continual printing

- 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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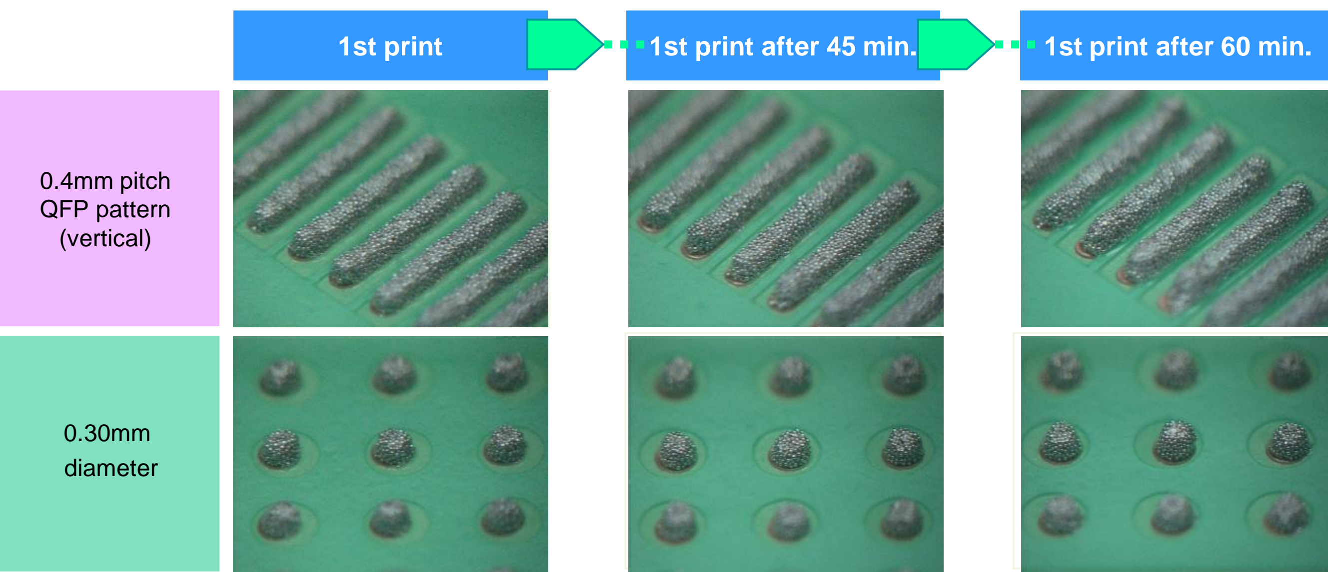
Intermittent printability (Stencil idle time)

- 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



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

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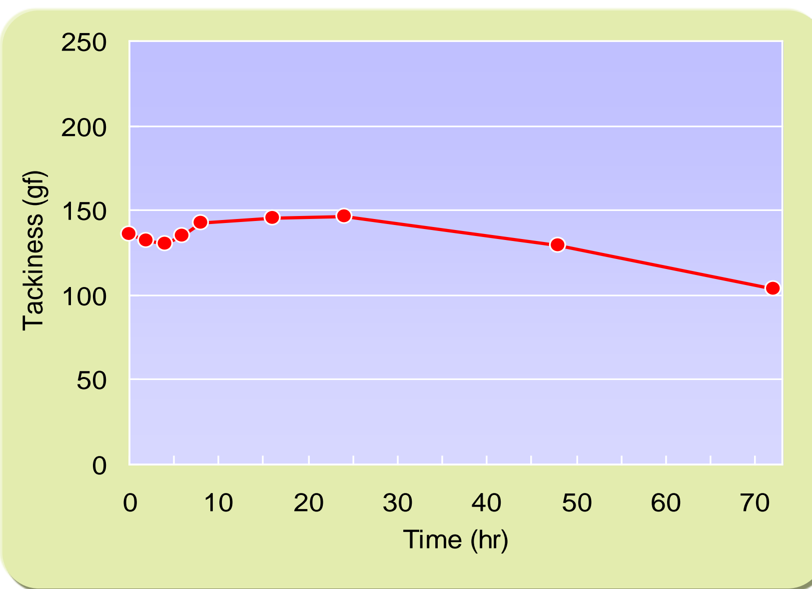
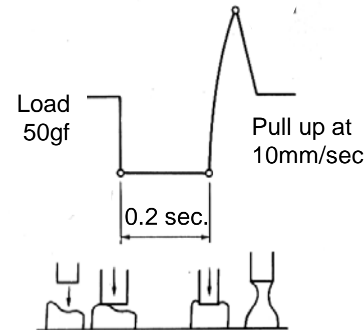
Tack time

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





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

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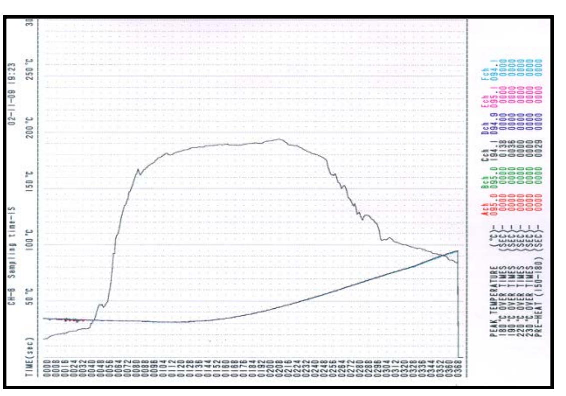
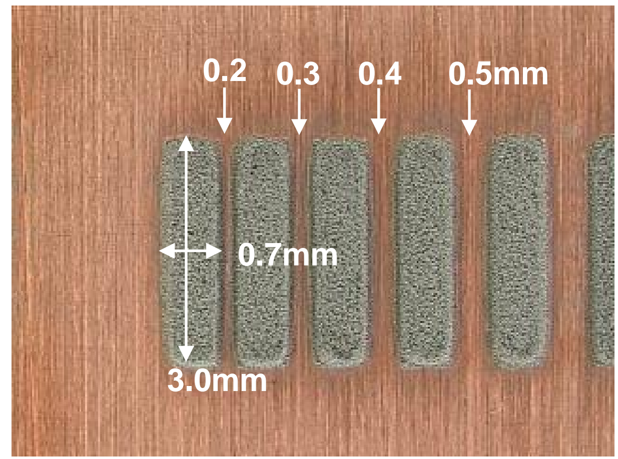
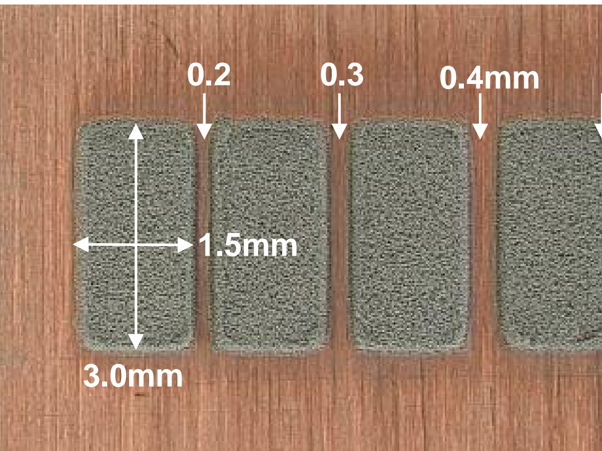
Heat slump

- 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







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

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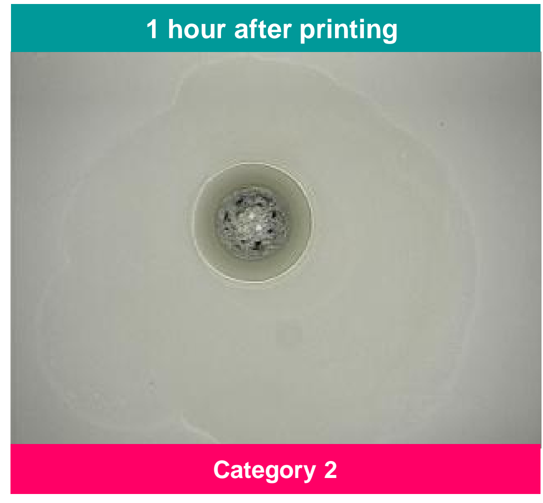
Solder balling (Residue cosmetics)

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

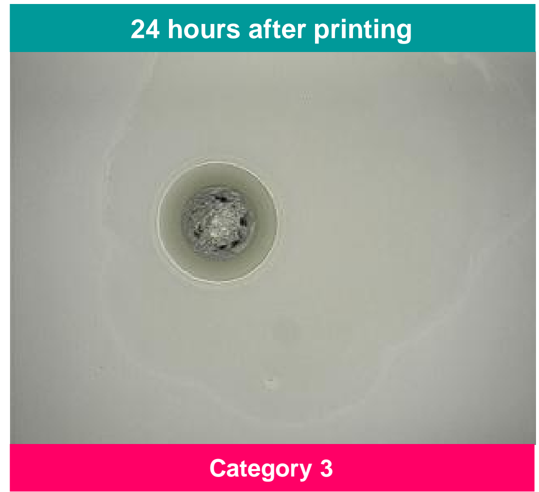
Category 1	2	3	4

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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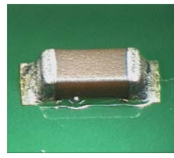
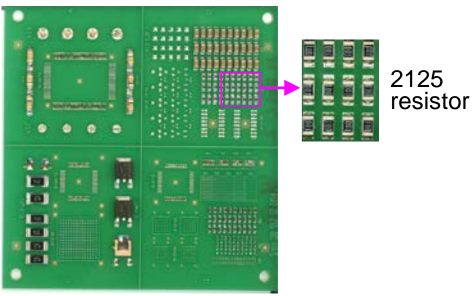
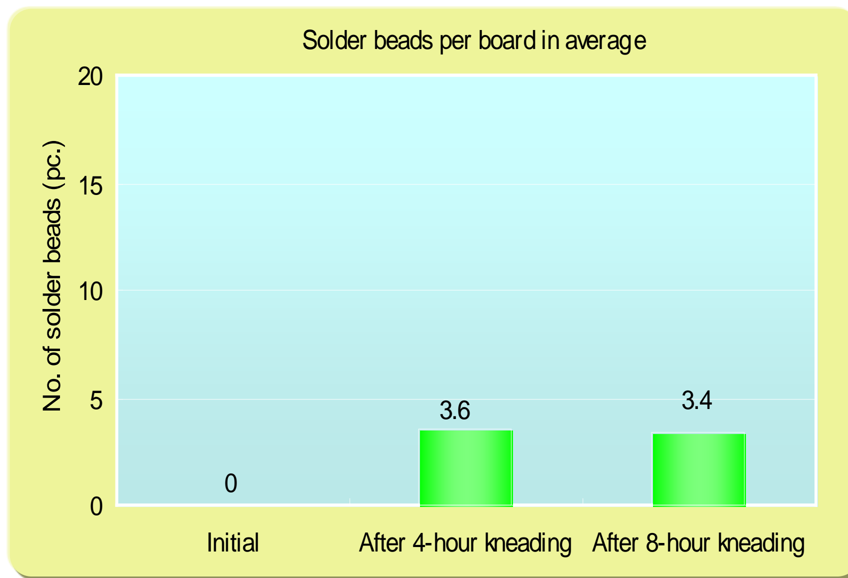
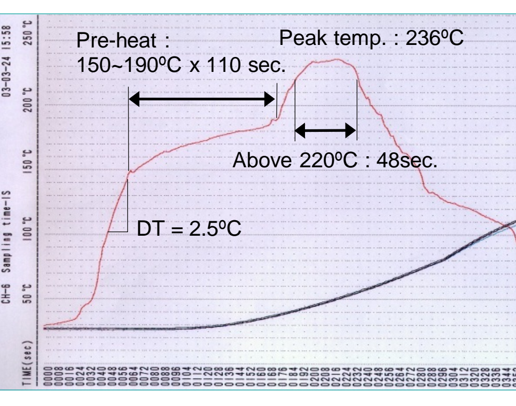
Solder beading

- 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









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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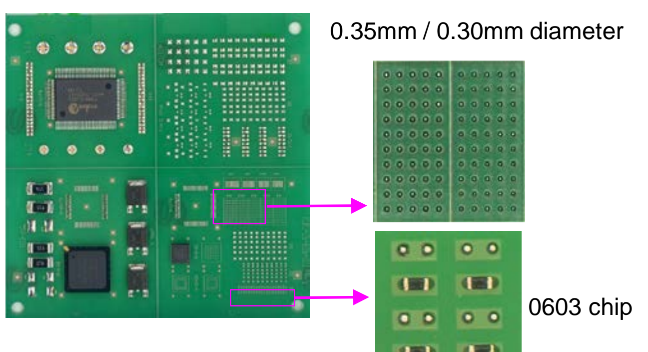
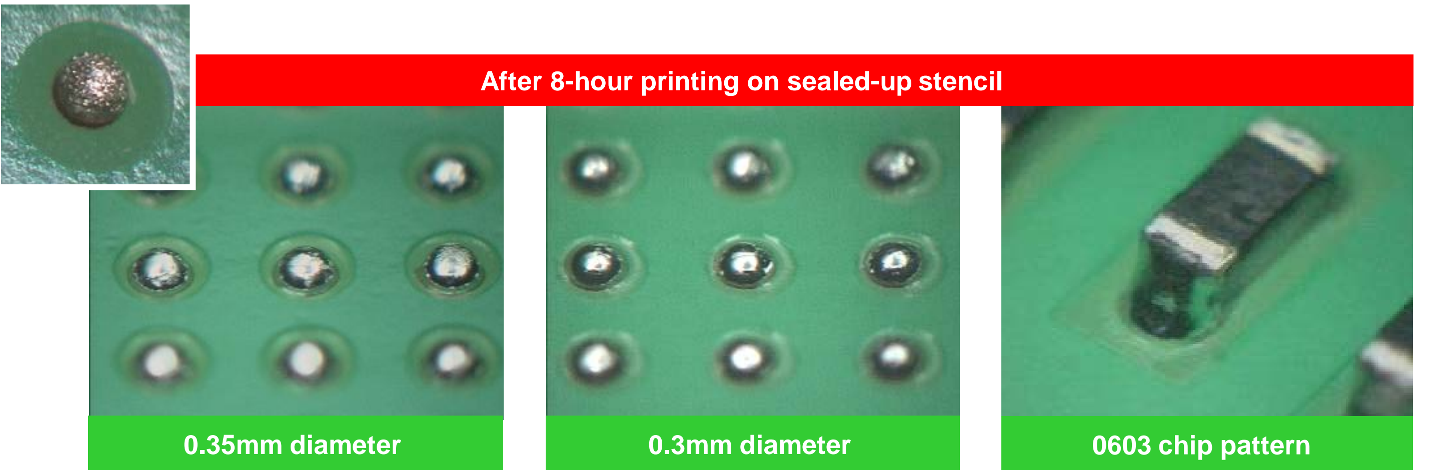
Super fine pattern wetting

- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Pad size : 0.35, 0.30mm 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"*





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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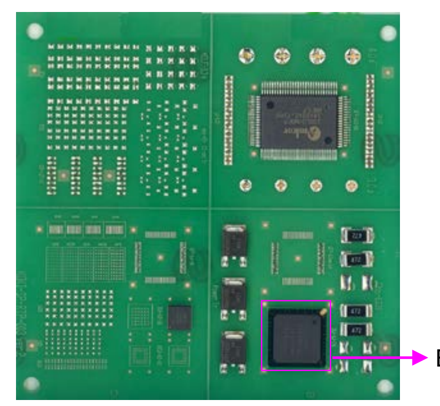
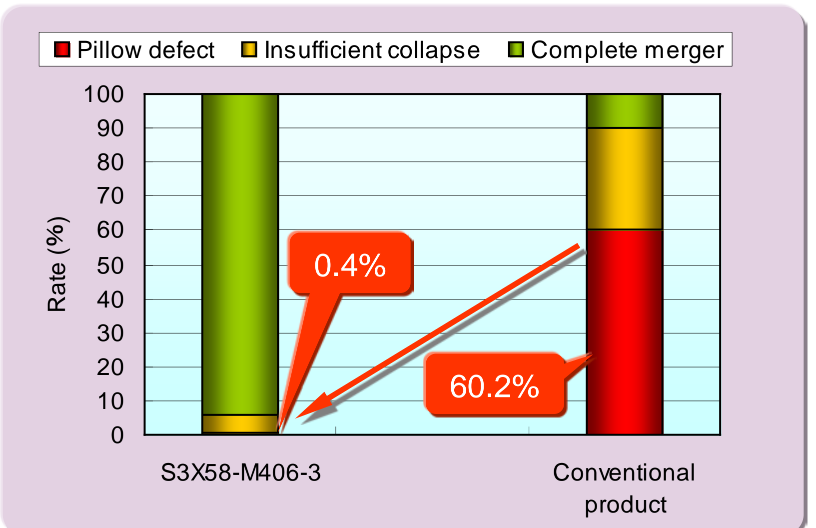
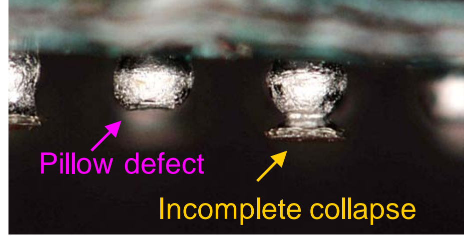
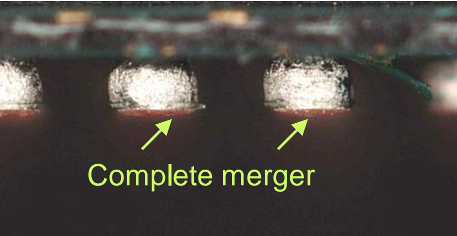
Hidden pillow defect test

- 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.

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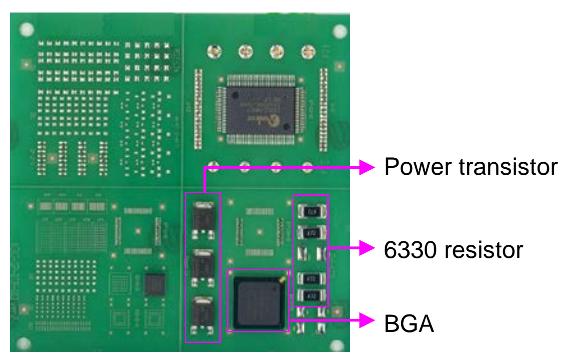
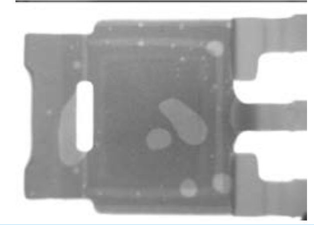
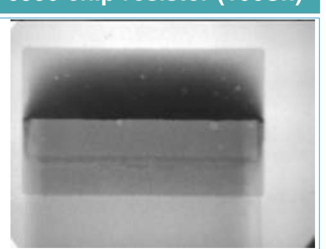
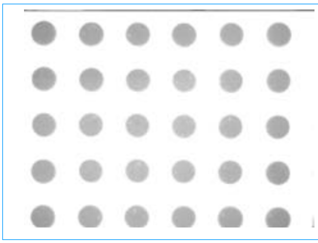
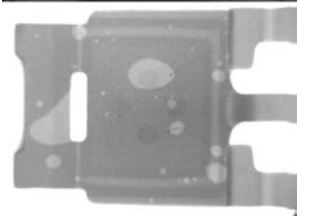
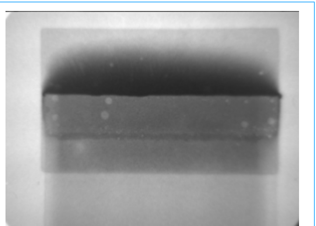
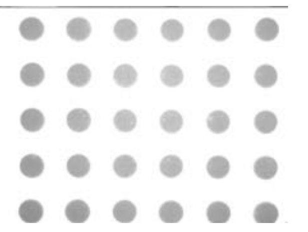
Voiding

- 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"*



	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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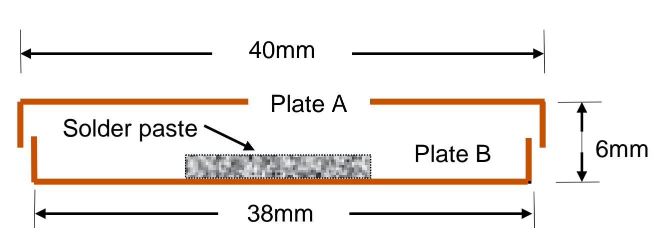
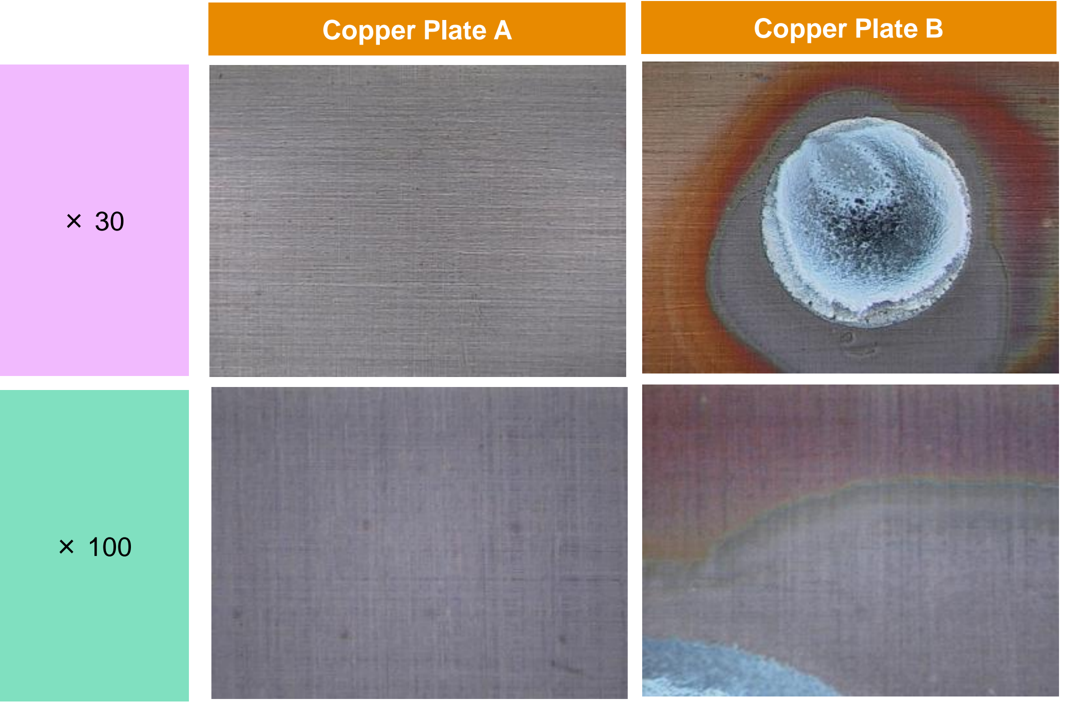
Copper corrosion

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





No evidence of corrosion can be observed.

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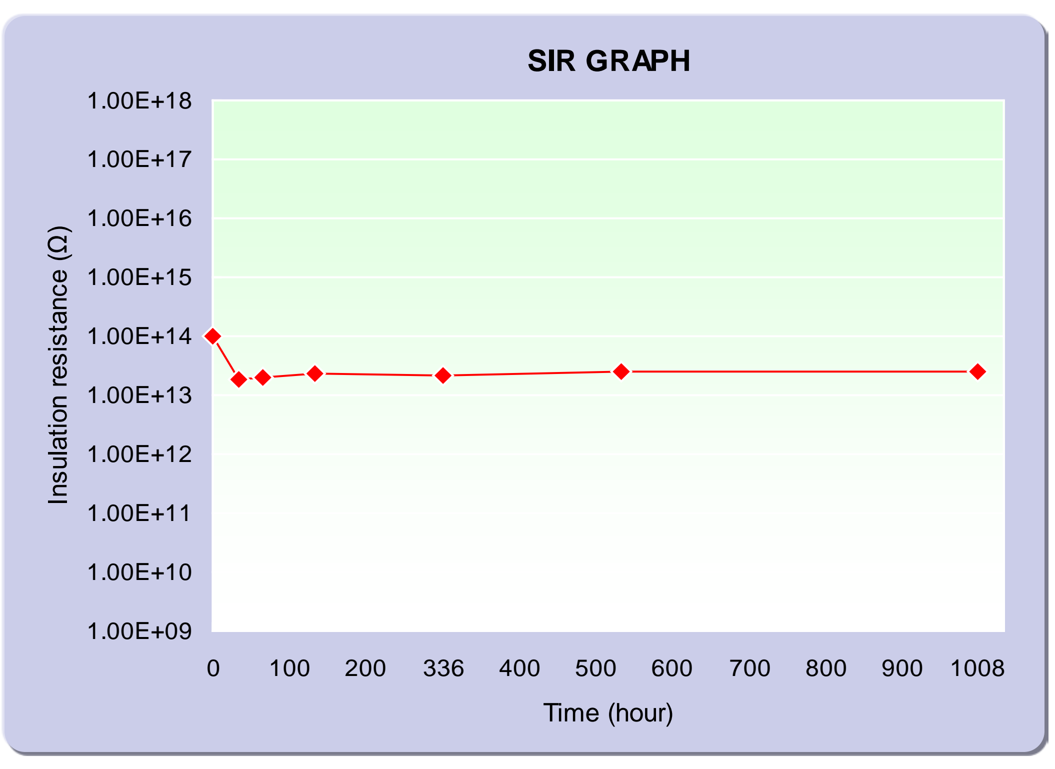
Surface insulation resistance

- 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



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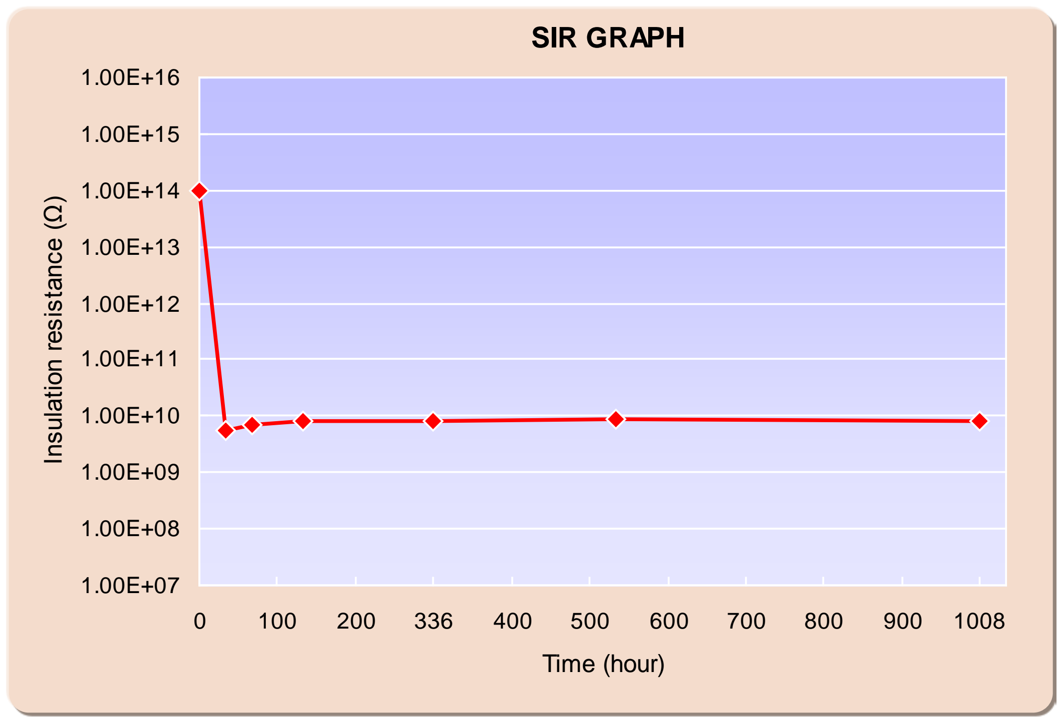
Voltage applied surface insulation resistance

- 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



No evidence of electromigration can be observed.

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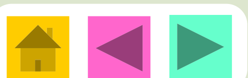
- Heat slump
- Solder balling
- Solder beading
- Super fine pattern wetting
- Anti-Pillow defect
- Voiding
- Copper corrosion
- Surface insulation resistance
- Voltage applied SIR
- Handling guide



Handling guide

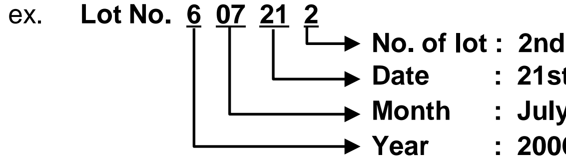
1. Printing
   1) Recommended printing parameters
      (1) Squeegee
         1. Kind : Flat
         2. Material : Rubber or metal blade
         3. Angle : 60~70º (rubber) or metal blade
         4. Pressure : Lowest
         5. Squeegee speed
            - S3X48-M406ECO : 10~50mm/sec.
            - S3X48-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 : 0mm

      (3) Ambiance
         1. Temperature : 22~27ºC
         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) 0~30ºC : 6 months from manufacturing date

* Manufacturing date can be obtained from the lot number



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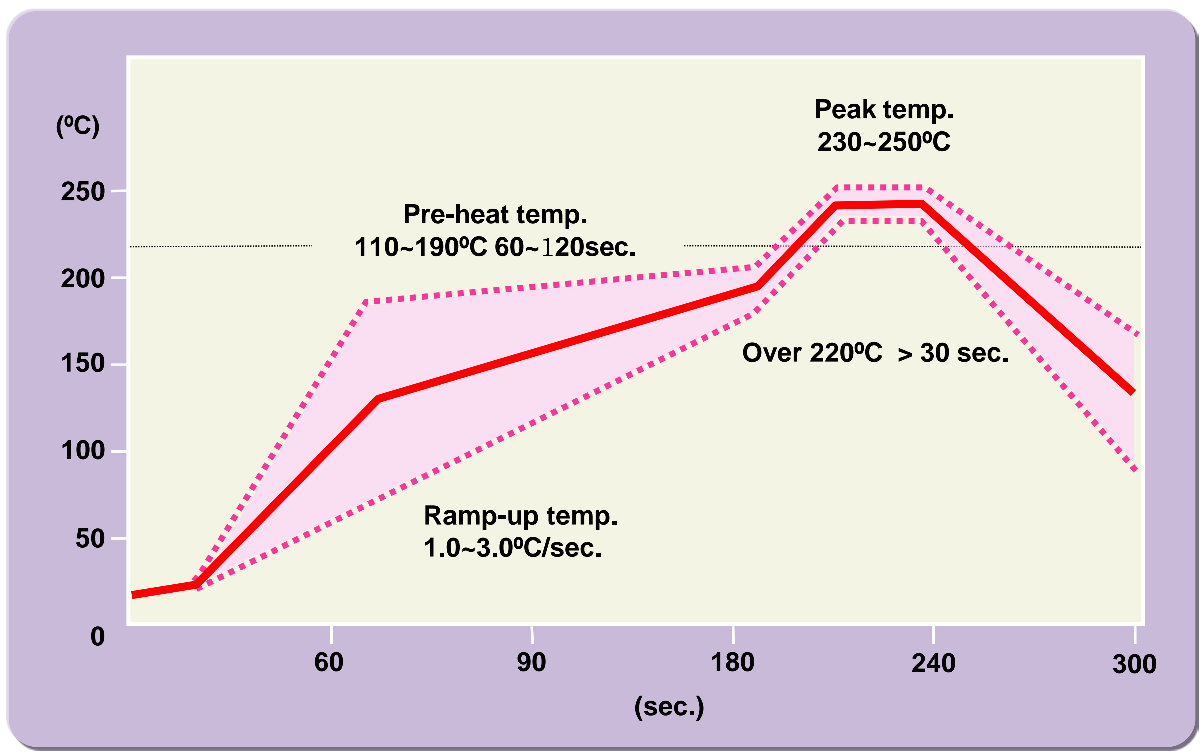
Handling guide - Recommended reflow profile



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 .