#46019E (provisional)
Revised on JUN 15, 2009

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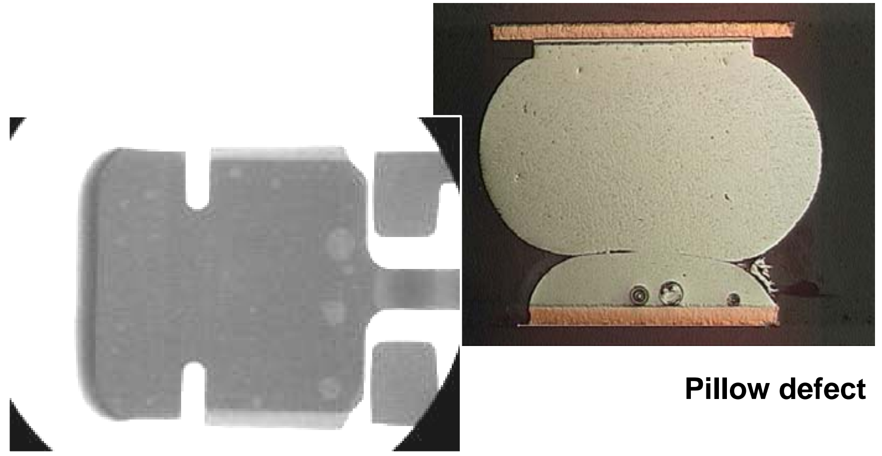
- Halide content
- Handling guide

Koki no-clean LEAD FREE solder paste

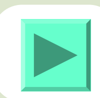
Super Low-Void & Anti-pillow S3X48-M500

Product information



Pillow defect

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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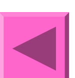

Product Features

- Ensures **OUTSTANDING** continual **PRINTABILITY** with super fine pitch (0.4mm/16mil) and CSP (>0.3mm dia.) applications for normal to fast printing (10 ~ 70mm/sec.) and long stencil idle time.
- Highly heat **RESISTANT and PERFECT MELTING** and wetting at super fine pitch (<0.4mm pitch) and micro components (<0.3mm dia CSP, 0603 chip).
- **Conforms to Halogen-free** standard（Cl + Br：below1500ppm) EN-14582
- Specially formulated flux chemistry ensures **EXTREMELY LOW VOIDING** with CSPs and broad contact area components, e.g. QFN.
- Designed to prevent occurrence of **HIDDEN PILLOW DEFECTS**.
- Enables **REUSE** of leftover from previous day. Economical.

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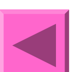
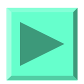

Specifications

	Application	Printing – Stencil
	Product	**S3X48-M500**
Alloy	Composition (%)	Sn96.5Ag3.0Cu0.5
	Melting point (°C)	217 – 219
	Shape	Spherical
	Particle size (μm)	20 – 45
Flux	Halide content (%)	0
	Flux type*2	ROL0
Product	Flux content (%)	11.5 ± 0.5
	Viscosity*1 (Pa.S)	220 ± 30
	Copper plate corrosion*3	Passed
	Tack time	> 48 hours
	Shelf life (below 10°C)	6 months
	Optional powder (μm)	20 – 38; Product code S3X58-M500

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

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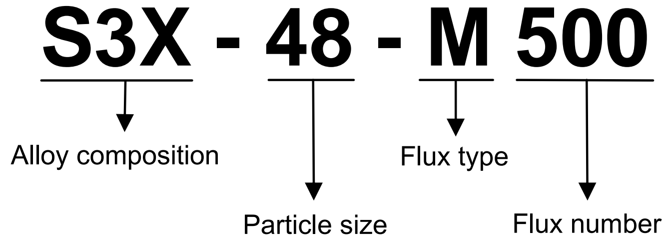
Specifications – Alloy selections



Alloy composition (%)	**S3X** : Sn96.5 Ag3.0 Cu0.5
Particle size (µm)	**48** : 20 ~ 45
Flux type	**M** : Low halide, halide free
Flux number	Solids and solvent used

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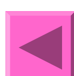


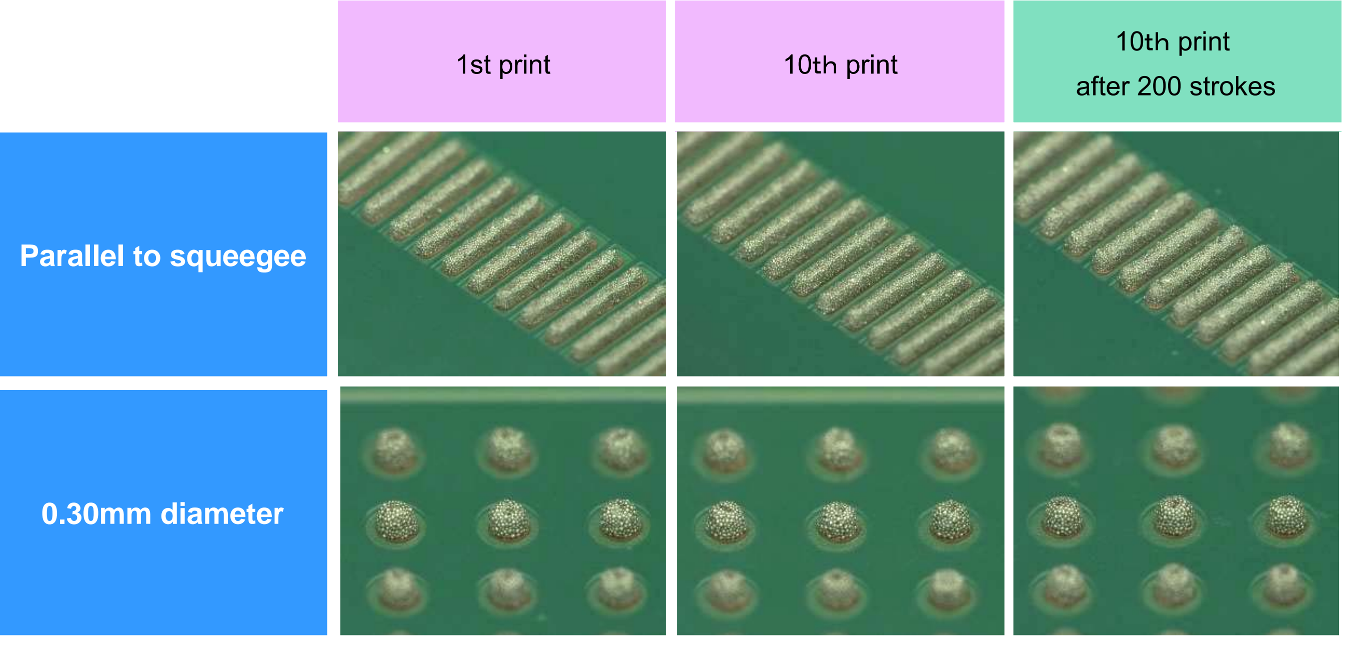
Continual printability

Print parameters

- Stencil : 0.12mm thickness, laser cut stencil
- Printer : Model Yamaha YVP-Xg
- Squeegee : Metal blade, Angle - 60°
- Print speed : 40 mm/sec
- Stencil separation speed : 10.0 mm/sec
- Atmosphere : 25±1°C (50±10%RH)

Test patterns

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



Newly developed additives provide a lubricating effect that greatly improve the paste release properties and assures excellent print quality with microBGA at high speed priting.

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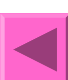
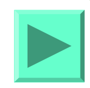
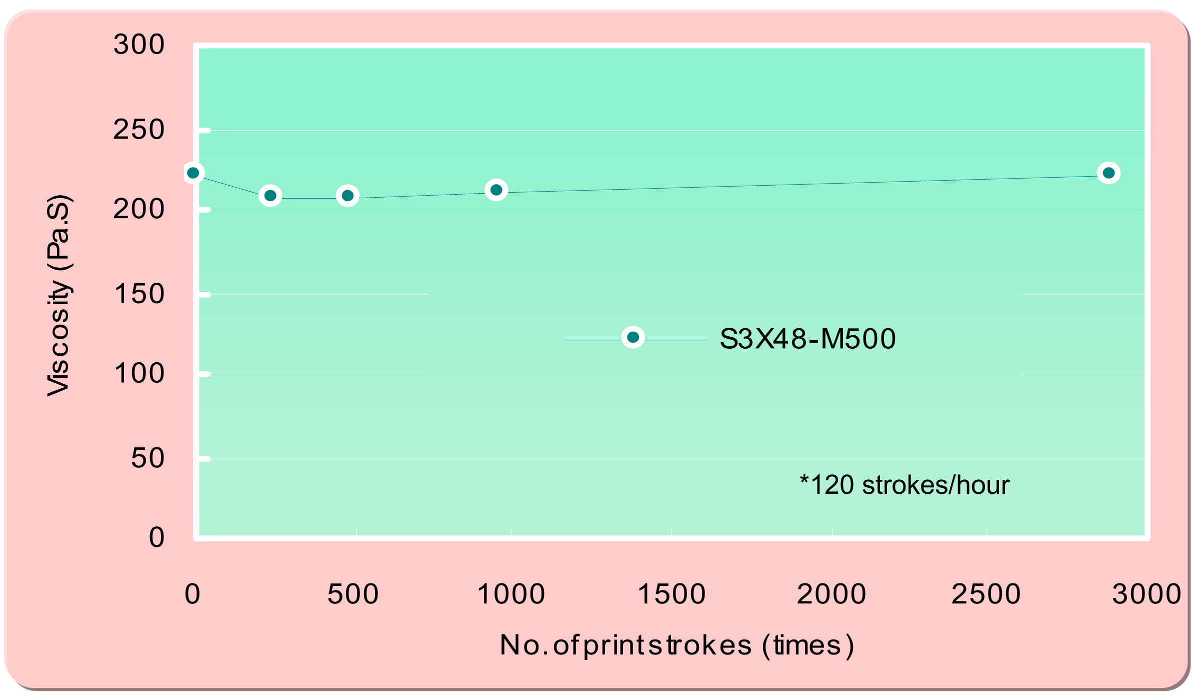



Viscosity variation in continual printing

- Print (knead) solder paste on the sealed-up stencil continually up 2880 strokes and observe viscosity variation.
- Squeegee : Metal blades
- Squeegee angle : 60°
- Squeegee speed : 30mm/sec.
- Print stroke : 300mm
- Printing environment : 23.0~25.0°C, 50~60%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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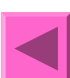
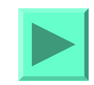

Intermittent printability (Stencil idle time)

- 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, 50+/-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

	Parallel to squeegee	0.30mm diameter
1st print		
1st print after 60 min		

Newly developed additives provide a lubricating effect that greatly improve the paste release properties and assures excellent print quality with microBGA at high speed printing.

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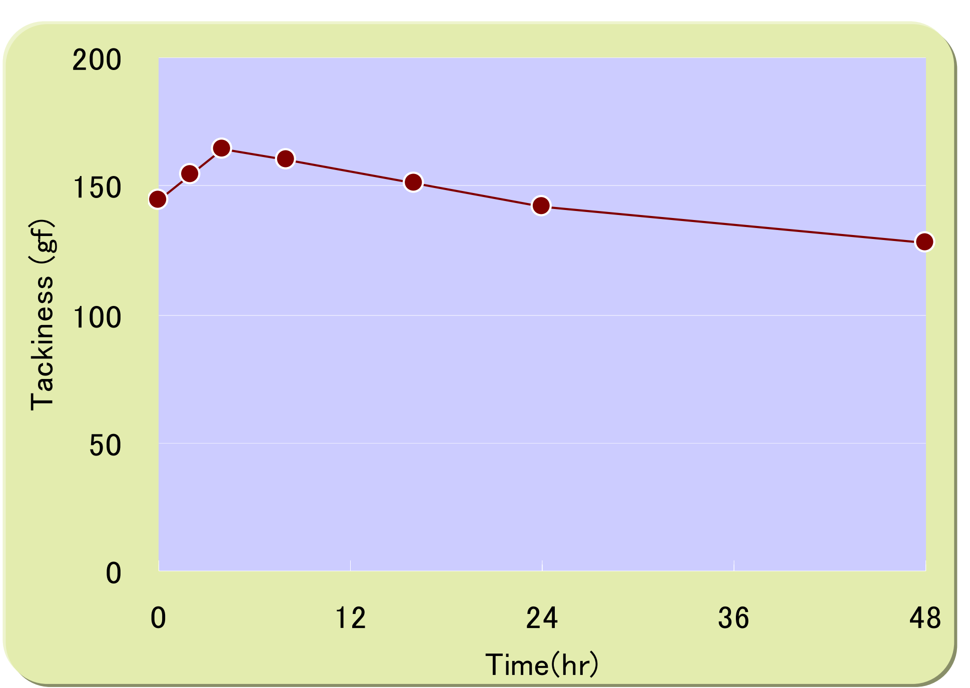
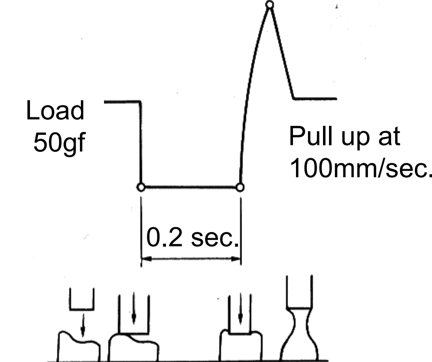
Tack time

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





Unique solvent system successfully assures sufficient tack time.

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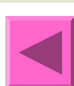


Heat slump

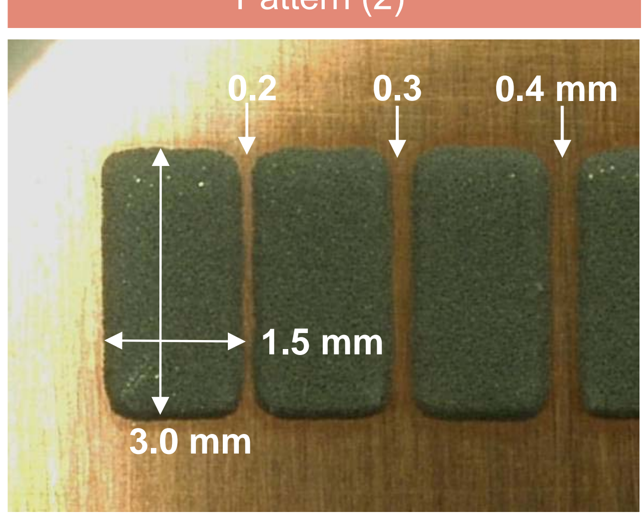
- Stencil thickness : 0.2mm
- Stencil aperture : Pattern (1) 3.0mm × 0.7mmm
  Pattern (2) 3.0mm × 1.5mm
- Spacing between apertures: 0.2mm to 1.2mm
- Heat profile : 180ºC × 5min.

Pattern (1)

0.2 0.3 0.4 0.5 mm
0.7 mm
3.0 mm

No merge at 0.3mm

Pattern (2)



No merge at 0.2mm

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

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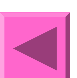

Solder balling (Residue cosmetics)

- 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	24 hour after printing
Category 2～3	Category 2～3

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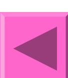
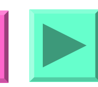
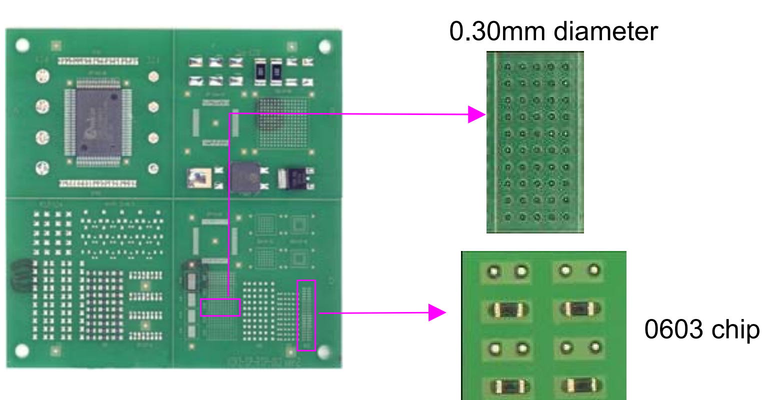
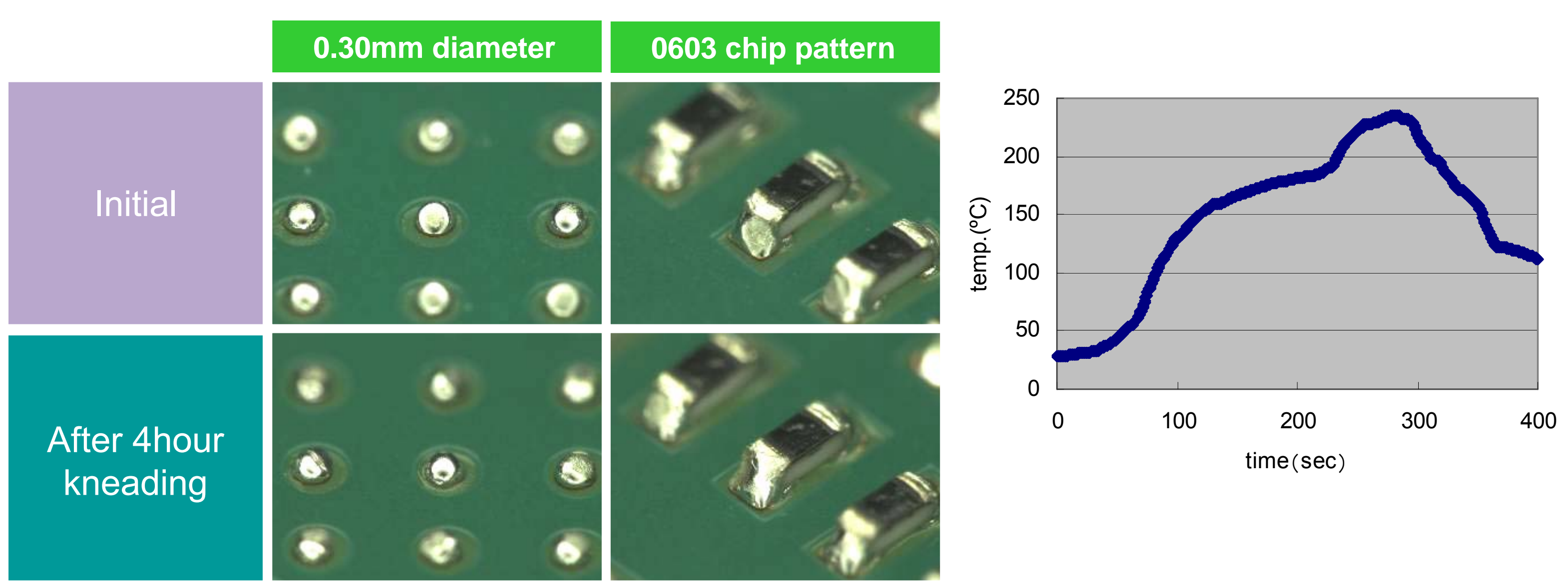



Super fine pattern wetting

- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Pad size : 0.30mm diameter
- Component: 0603 chip,
- 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 : See below





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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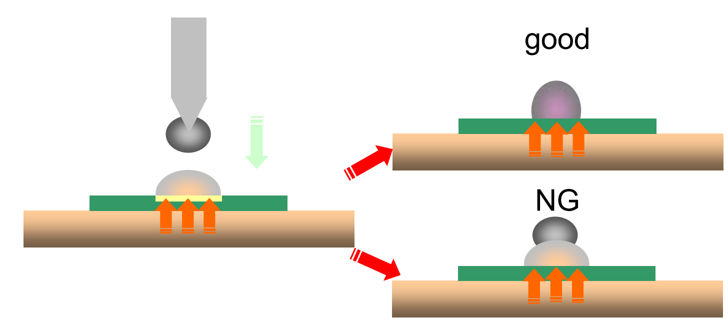
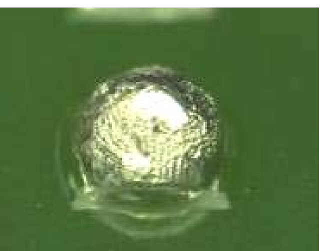
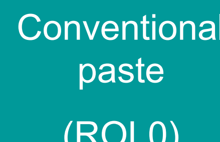
Anti-Pillow test

- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Pad size : 0.8×0.8mm diameter
- Component: 0.76mm ball SAC305
- Stencil aperture : 100% aperture opening to pad
- Heat source : Solder pod 275℃
- mount interval 10sec



Drop solder ball every 10 sec. after the solder paste has melted to see heat durability of flux.

	20sec	40secsec	60sec	80sec
S3X48-M500				
Conventional paste (ROL0) 				

S3X48-M500 indicated much longer heat durability nearly up to 80sec., while the conventional solder paste lost activation less than 40 sec. since the solder paste started melting.

S3X48-M500

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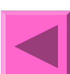
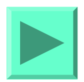
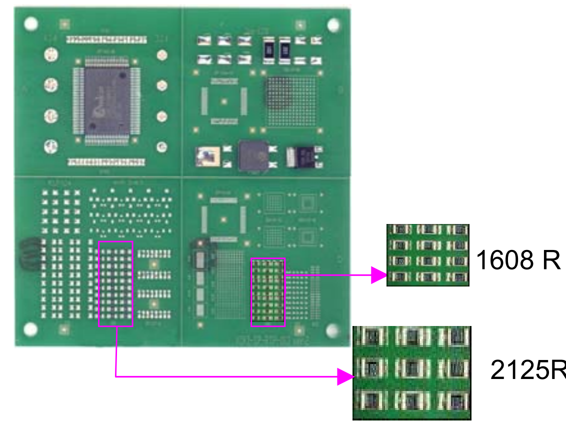
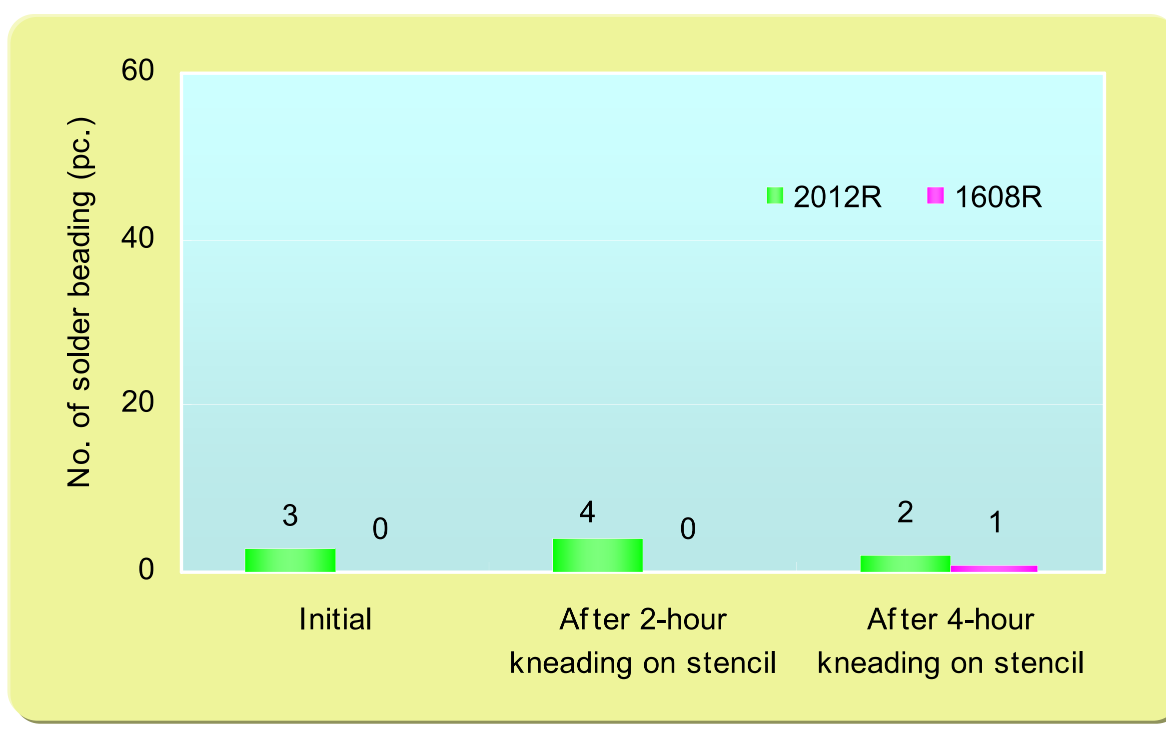



Solder beading

- 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
  - 1608 resistor: 30 pcs./board
  - Total : 60 chips/board
- Heat source : Hot air convection
- Zone structure : 5 pre-heat zones +2 peak zones
- Atmosphere : Air

Fault finding design





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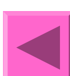
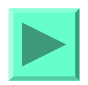
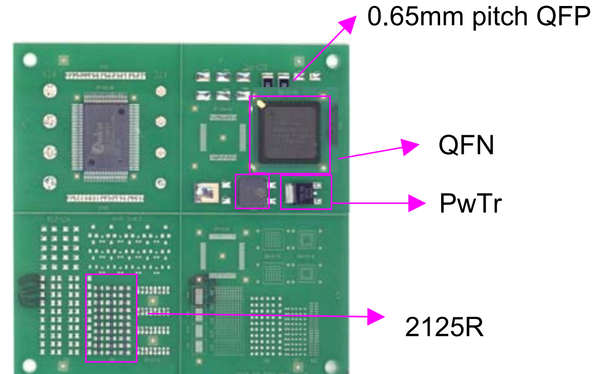



Voiding

- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Stencil aperture : 100% aperture opening to pad
- Components
  PwTr, QFN, 2125R, 100% Sn plated
  1.0mm pitch BGA: SAC305
- Heat source : Hot air convection
- Zone structure : 5 pre-heat zones +2 peak zones
- Atmosphere : Air
- Reflow profile : Same as *"Super fine pattern wetting"*



	PwTr	QFN	2125)	BGA
Initial				
After 4-hour kneading on stencil				
Conventional product				

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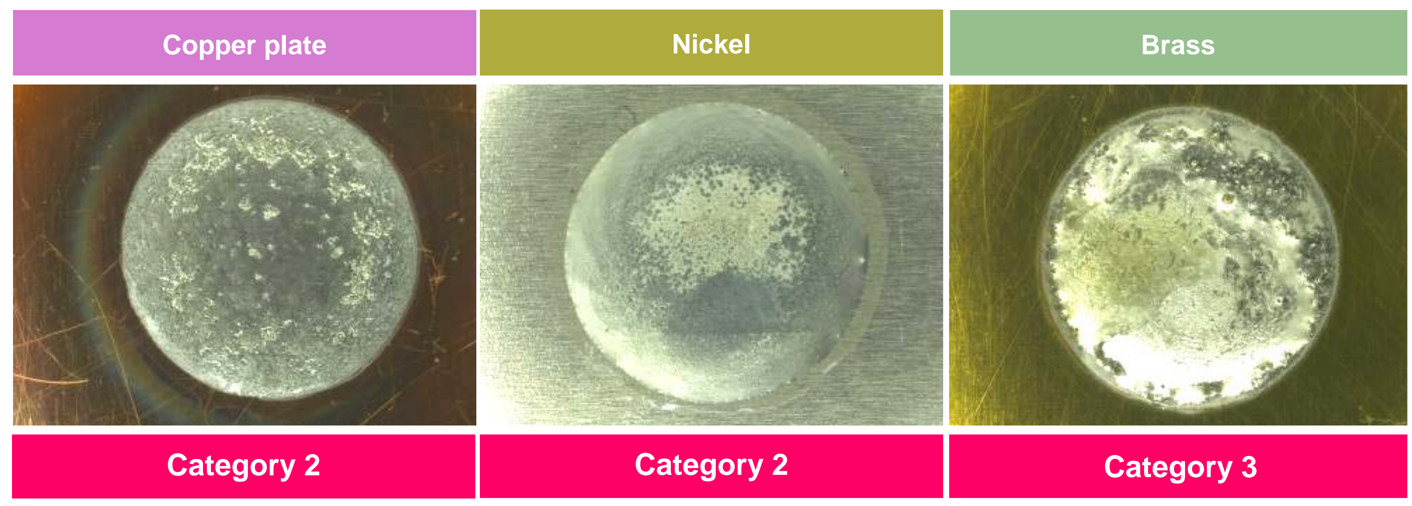
Solder spreading

Material pieces : Copper, Brass, Nickel (*Pre-conditioning – acetone cleaning + soft etched by 15% sulfuric acid solution)

- Stencil thickness : 0.2mm (laser cut)
- Stencil aperture : 6.5mm diameter
- Heat source & temp.: Reflow simulator *Same profile as *“Super fine pattern wetting”.*



* Definition

Category 1 : Solder has spread more than the area where solder paste was printed.
Category 2 : Solder has spread whole area where solder pasted was printed.
Category 3 : Solder has not partially spread.
Category 4 : Solder spread is less than the area where solder paste was printed.

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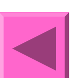
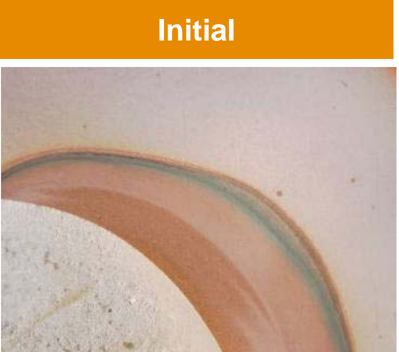


Copper corrosion

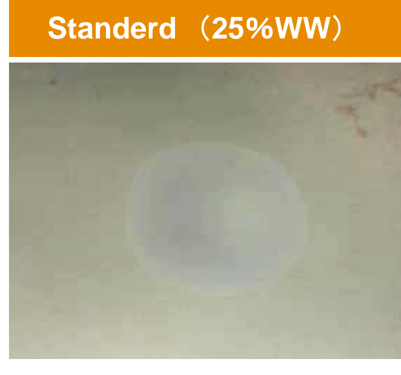
- Test conditions : 40±3°C 93±5%RH for 240hours
- Test method : IPC-TM-650 2.6.15 Rev.C

Initial	After 240Hr
	

No evidence of corrosion can be observed.

Copper mirror

- Test conditions : 23±3°C 50±5%RH for 24hours
- Test method : IPC-TM-650 2.3.32 Rev.D

Standerd （25%WW）	S3X48-M500
	

No breakthrough occurred.

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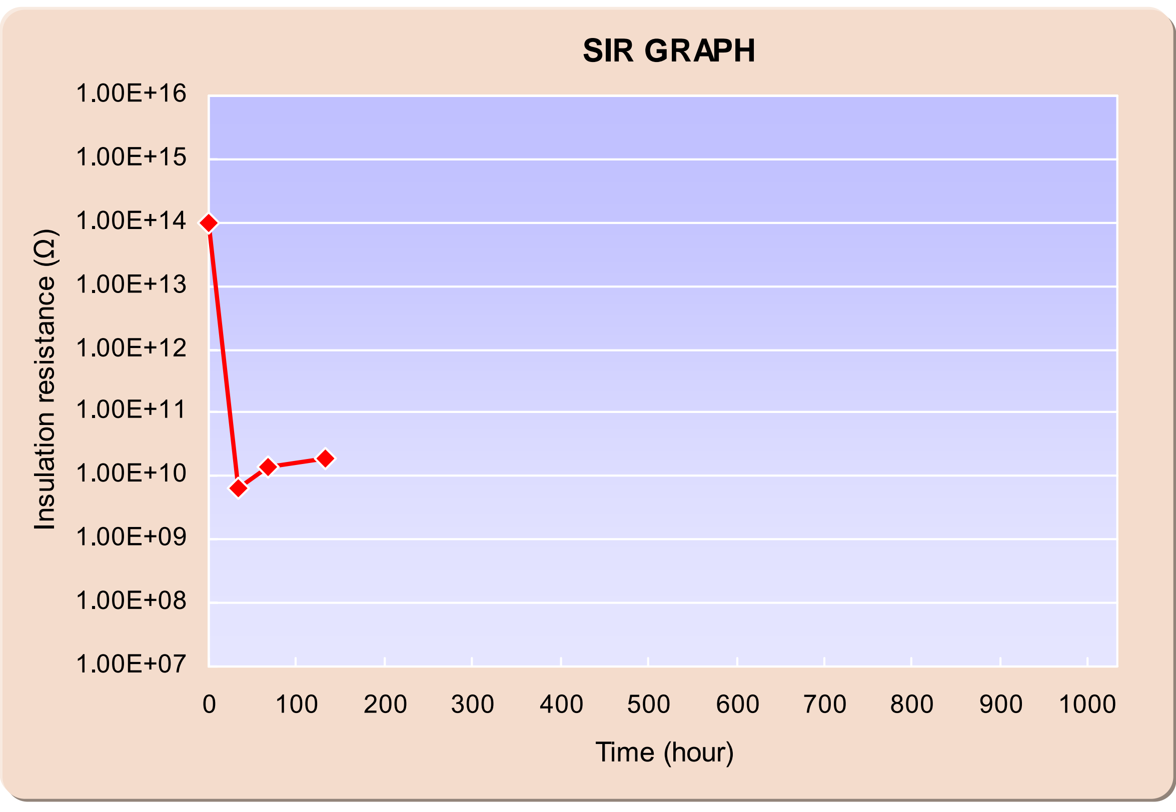
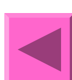
- Anti-Pillow defect
- Solder beading
- Voiding
- Solder spreading
- Copper corrosion
- Voltage applied SIR
- Halide content
- Handling guide

Voltage applied surface insulation resistance

- Test conditions : 85±2ºC × 85%RH for 1000 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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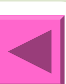

Halide content

・Test method : A: IPC-TM650 2.3.28.1
B: BS EN14582

・Measurement instrument: ICS-1500 (DIONEX)
AQF-100（MITSUBISHI CHEMICAL ANALYTECH）

Halide content (wt%)

Method	A	B
Fluoride	ND	ND
Chloride	ND	ND
Bromide	0.02	0.03

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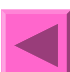
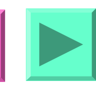



Handling guide

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	: 20~70mm/sec.

      (2) Stencil

1. Thickness	: 150~100µm for 0.65~0.4mm pitch pattern
2. Type :	: Laser or electroform
3. Separation speed	: 7.0~10.0mm/sec.
4. Snap-off distance	: 0mm

      (3) Ambiance

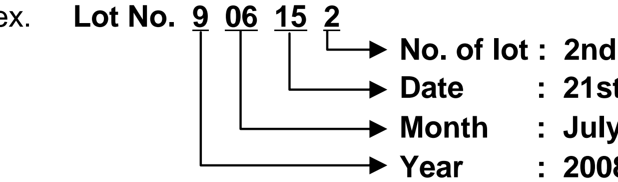
1. Temperature	: 22~25ºC
2. Humidity	: 40~60%RH
3. Air draft	: Air draft in the printer badly affects stencil life and tack performance of solder pastes.

2. Shelf life

0~10ºC	: 6 months from manufacturing date

* Manufacturing date can be obtained from the lot number

ex. **Lot No. 9 06 15 2**



S3X48-M500

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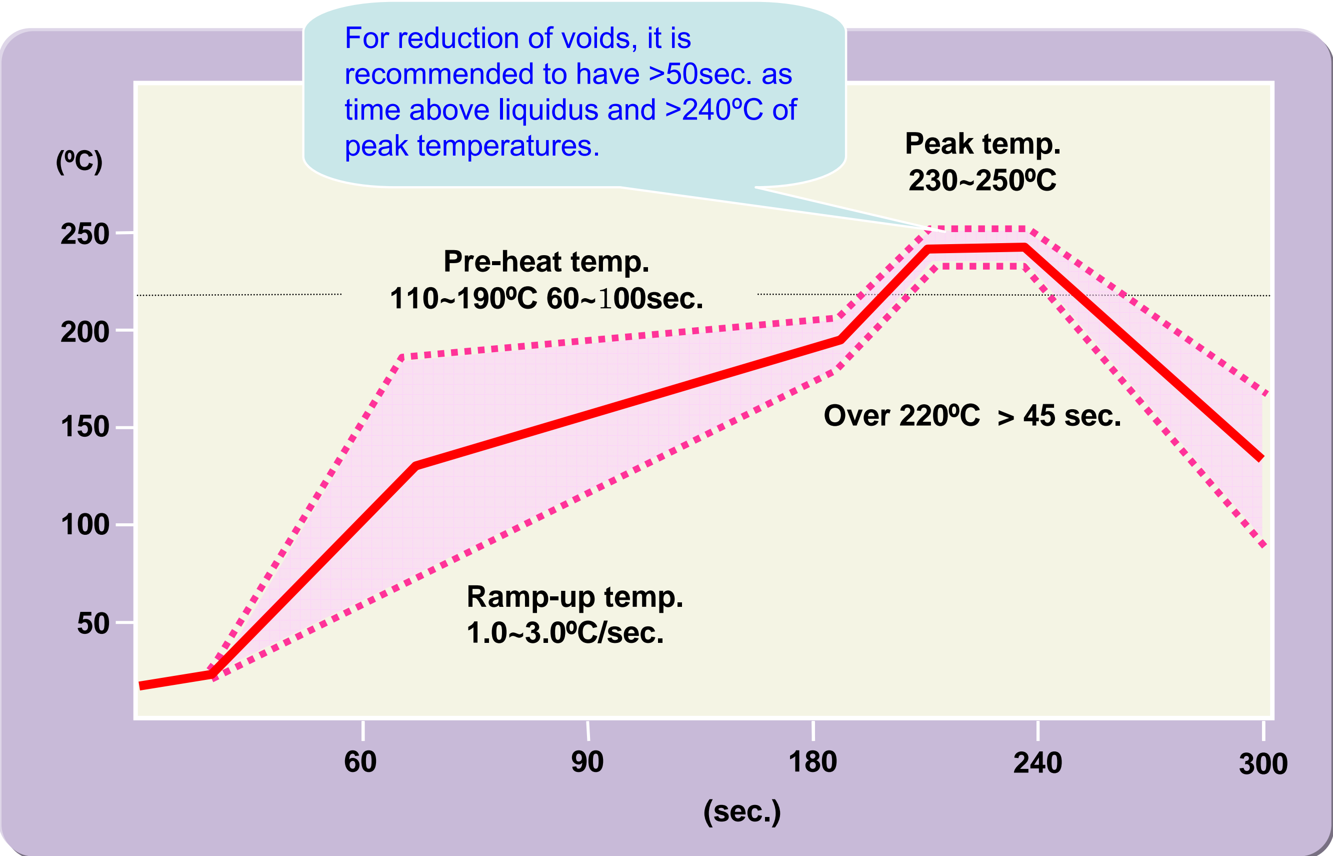
Handling guide - Recommended reflow profile



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 .