Eco+PLUS® series

Lead free SOLUTIONS you can TRUST

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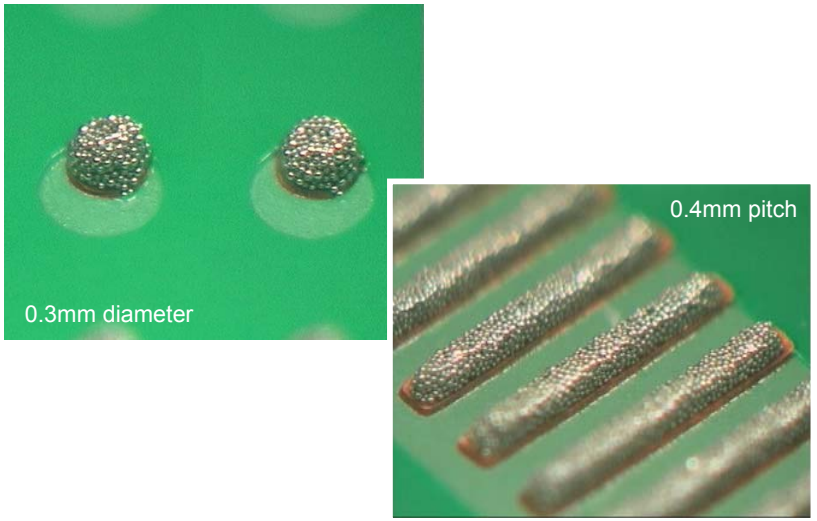
Contents

Koki no-clean LEAD FREE solder paste

Hi-performance S3X58-M406 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 series

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 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.
- **POWERFUL WETTING** with various metals, such as Alloy42 and Nickel.

No clean ROL0	Powder Type 4	Fine pattern 0.4mm pitch CSP<0.3mm	Idle time > 60 min. CSP 0.3mm	Tack time >72 hrs.	High heat slump resist	Powerful wetting	Low beading	Low voiding	High reliability

Contents

Specifications

Application		Printing - Stencil		
Product		**S3X58-M406L**	**S3X58-M406**	**S3X58-M406H**
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	11.5 ± 0.5	11.5± 0.5
	Viscosity*1 (Pa.S)	170 ± 10%	210 ± 10%	230 ± 10%
	Copper plate corrosion*2	Passed		
	Solder spread factor (%)	> 85		
	Tack time	> 72 hours		
	Shelf life (below 10°C)	6 months		
	Other alloy options	**SX58- / S38X- / TS58- / SXA58-**		

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

Contents

Specifications – Alloy selections

S3X 58 – M 406

- S3X 58 – M 406 → Alloy composition
- S3X 58 – M 406 → Particle size
- S3X 58 – M 406 → Flux type
- S3X 58 – M 406 → Flux number

Alloy composition (%)	**S3X** : SnAg3.0Cu0.5 **SX** : SnAg3.5Cu0.7 **S38X** : SnAg3.8Cu0.7 **TS** : SnAg3.5 **SXA** : SnAg3.5Cu0.5Sb0.2
Particle size (μm)	**58** : 20 ~ 38
Flux type	**M** : Low halide, halide free **N** : Nitrogen use
Flux number	Solids and solvent used

Contents

Continual printability

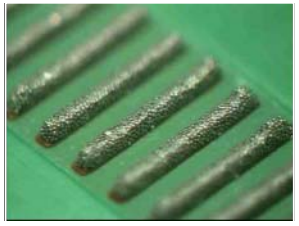
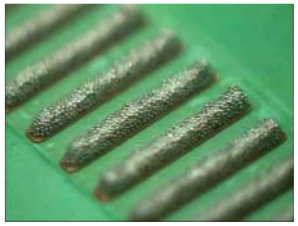
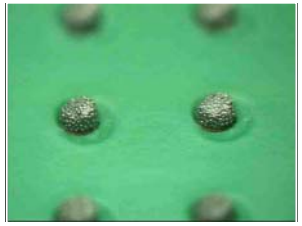
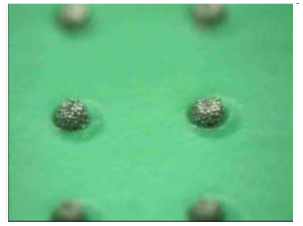
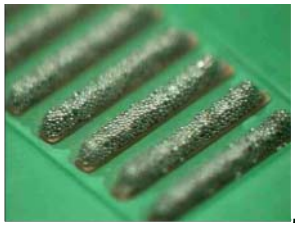
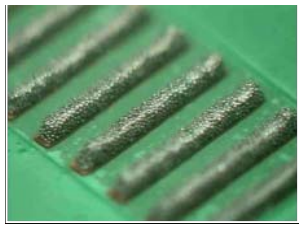
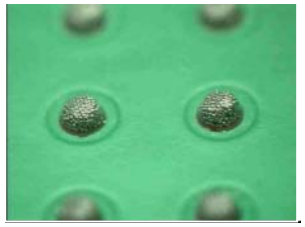
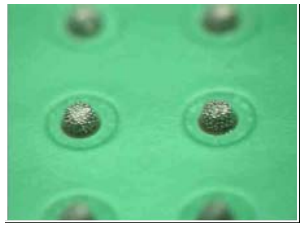
Print parameters

- Stencil : 0.12mm thickness, laser cut stencil
- Printer : Model MK-880SV Minami Kogaku
- Squeegee : Metal blade, Angle - 60°
- Print speed : 50 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

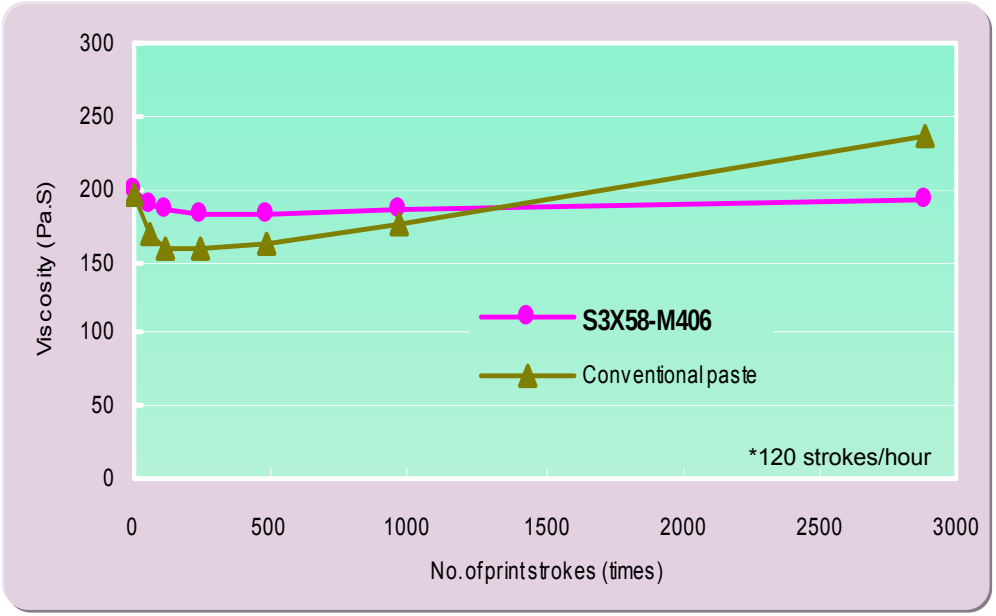
	Vertical to squeegee	Parallel to squeegee	0.3mm diameter	0.25mm diameter
1st print				
1st print after 200 strokes				

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.

Contents

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 : 50mm/sec.
- Print stroke : 300mm
- Printing environment : 25+/-1°C, 60+/-10%RH

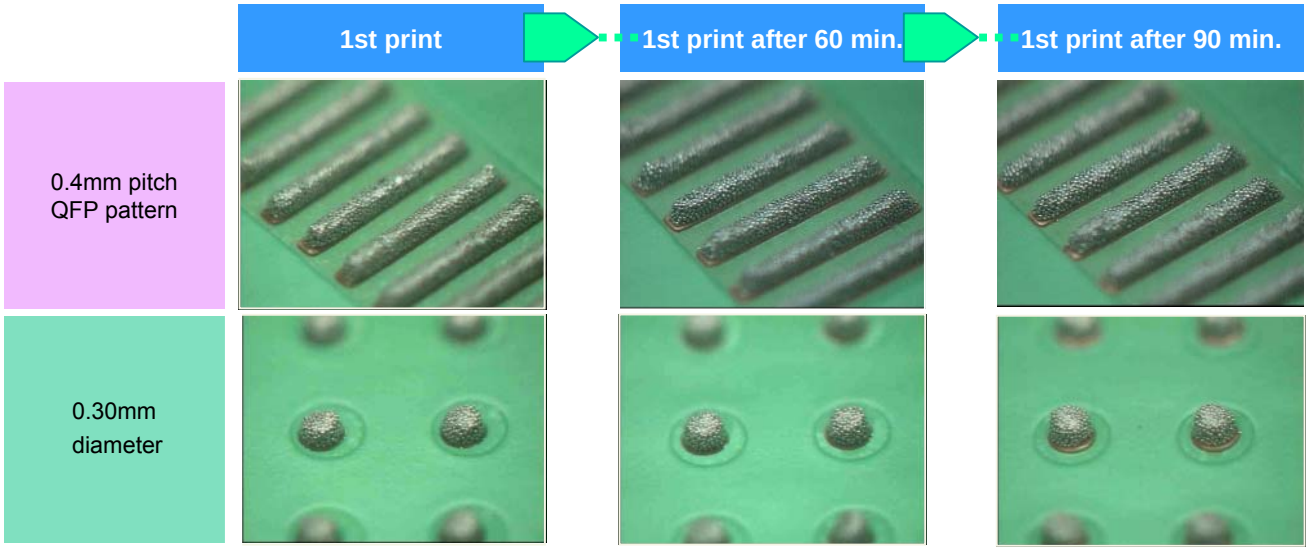


A newly developed flux formula has succeeded to realize consistent long term printability by preventing excess viscosity drop due to shear thinning and excess increase due to chemical reaction between solder powder and flux during print rolling

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 : 50mm/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



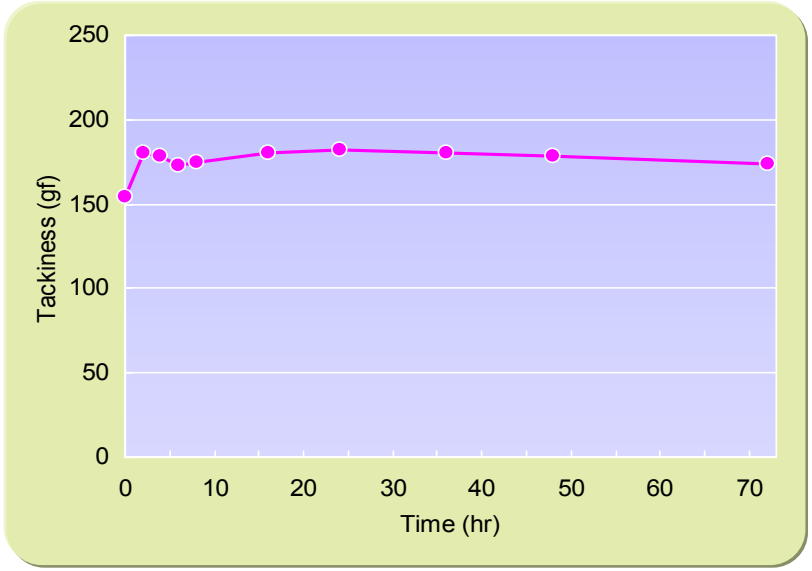
Unique formulation solvent system assures extremely long stencil idle time, eliminating printing faults and improving process window and production yields.

Contents

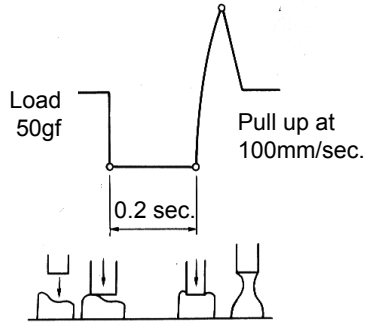
Tack time

- Stencil : 0.2mm thick, 0.6mm dia. aperture
- Measurement instrument : Malcom tackimeter FG-1
- Probe pressure : 50gs
- Pressurizing time : 0.2mm
- Pull speed : 10mm/sec.
- Test method : In accordance with JIS Z 3284

*Solder paste tested : S3X58-M406



Tensile strength = Tack force

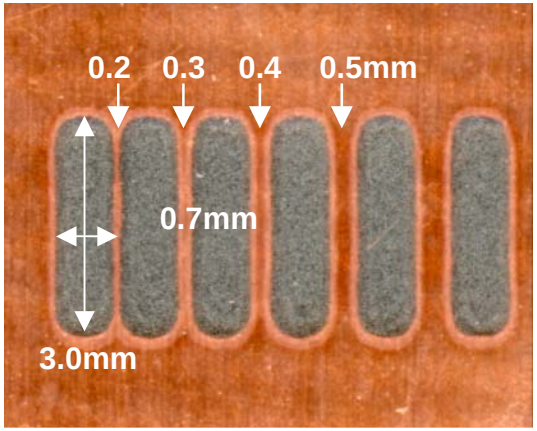


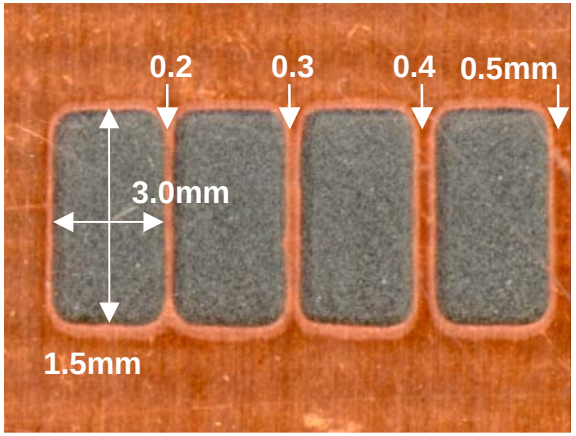
Unique solvent system has succeeded to extend tack time dramatically (>72 hours) helps widen process window significantly.

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 × 5 min.
- Test method : In accordance with JIS Z 3284

*Solder paste tested : S3X58-M406





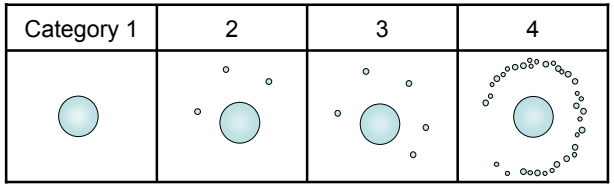
Improved heat slump property assures reduced soldering defects, such as solder beading and bridging.

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

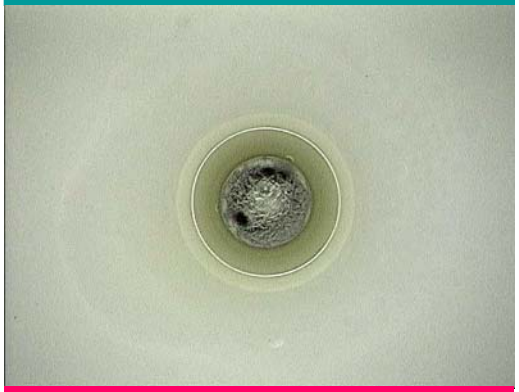
  Knead the paste for 8 hours on sealed-up stencil and print it on alumina plate.

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



*Solder paste tested : S3X58-M406

8-hour kneading + 1 hour after printing



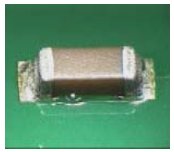
Category 2

8-hour kneading + 24-hour after printing

Category 2

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

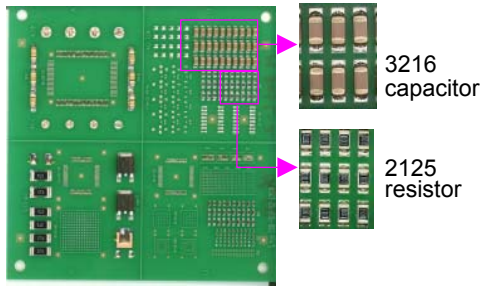
Solder beading

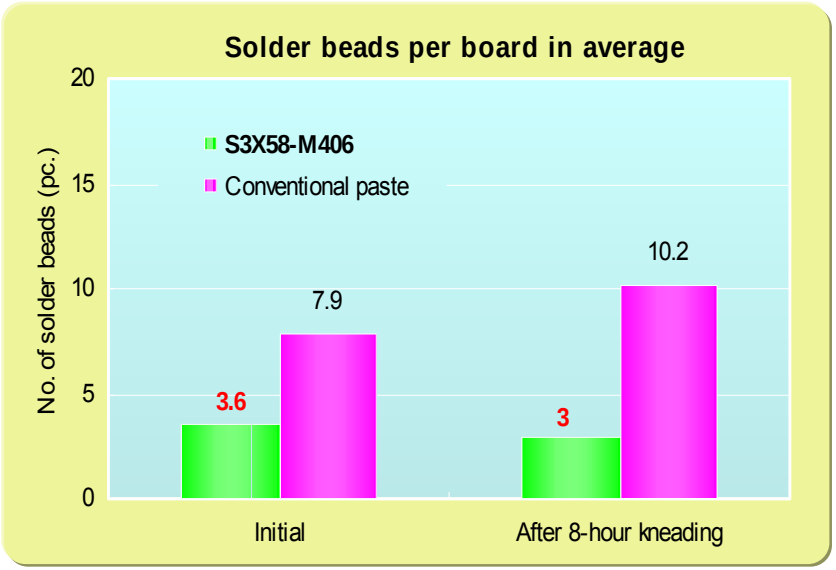


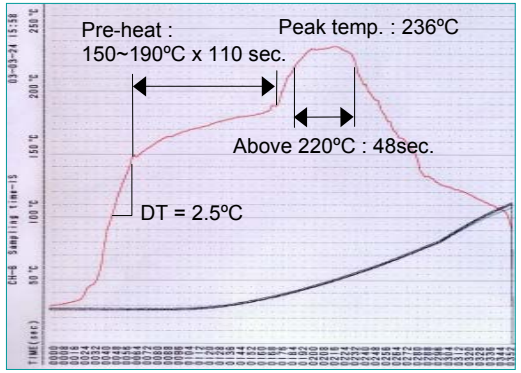
- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Stencil aperture : 100% aperture opening to pad
- Components
  - 3216 capacitor : 30 pcs./board
  - 2125 resistor : 10 pcs./board
  - Total : 40 chips/board × 5 boards = 200 components
- Heat source : Hot air convection
- Zone structure : 5 pre-heat zones +2 reflow zones
- Atmosphere : Air

*Solder paste tested : S3X58-M406

Fault finding design





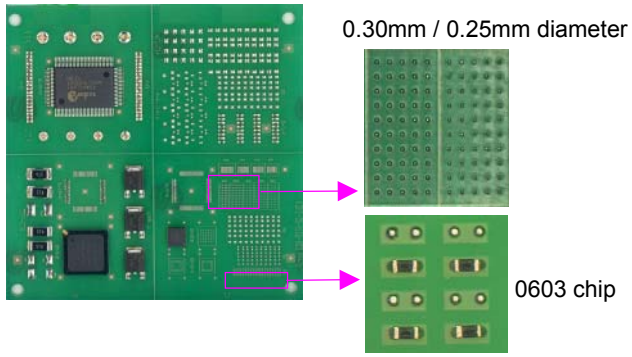


Reflow profile

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

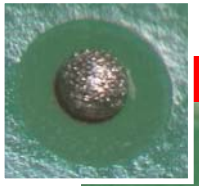
Super fine pattern wetting

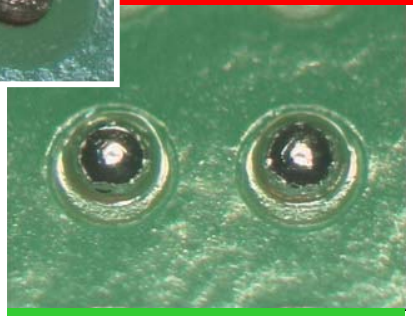
- Material : Glass epoxy FR-4
- Surface treatment : OSP
- Stencil thickness : 0.12mm (laser cut)
- Pad size : 0.30, 0.25mm diameter, 0603 chip pattern
- Stencil aperture : 100% aperture opening to pad
- Heat source : Hot air convection
- Zone structure : 5 pre-heat zones +2 reflow zones
- Atmosphere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



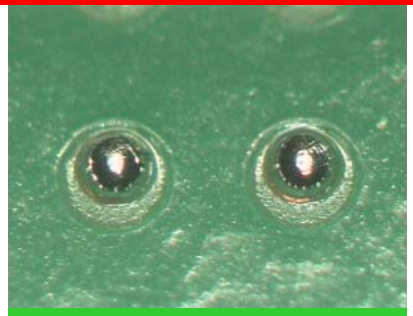
*Solder paste tested : S3X58-M406

After 8-hour printing on sealed-up stencil

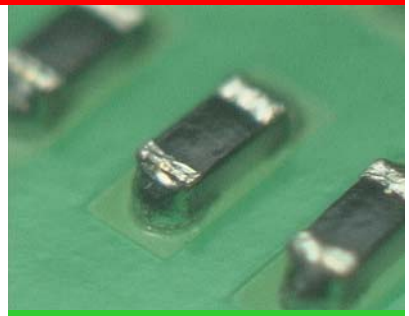




0.3mm diameter



0.25mm diameter



0603 chip pattern

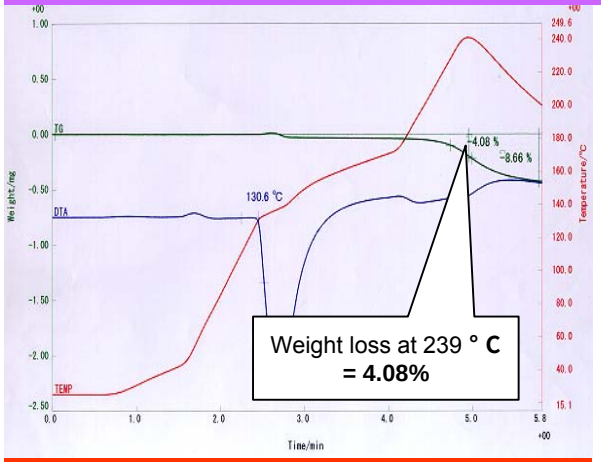
Larger relative surface areas of solder paste exposed due to miniaturization of components (CSP, 0603 chips), often cause incomplete melting due to excess oxidation during the reflow.

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

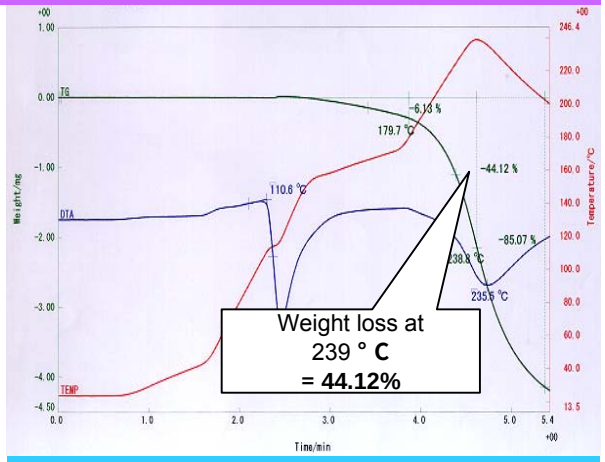
Super fine pattern wetting

S3X58-M406 series have been formulated with high-heat-resistant chemistry to provide a wide soldering process window. As TGA curve indicates below, as an example, one of the activator formula for **S3X58-M406 series** shows very limited weight loss and thus ensures it maintains sufficient activation until soldering is completed.

Heat resistant activation formula



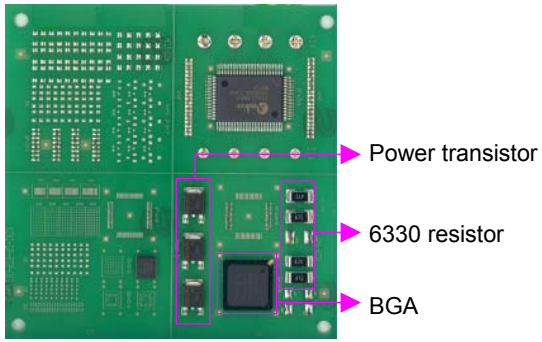
S3X58-M406 series



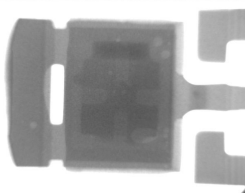
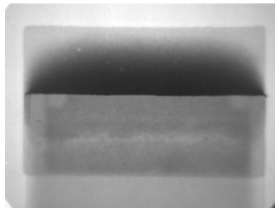
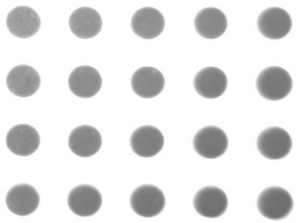
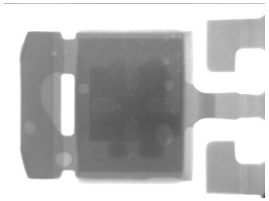
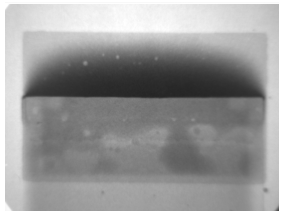
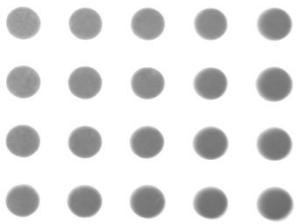
Conventional solder paste

Voiding

- Model : SPRTP-003 ver. 2
- 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 : SnPb plated
  - BGA : SnAgCu bumps 1.0mm pitch
- Heat source : Hot air convection
- Zone structure : 5 pre-heat zones +2 reflow zones
- Atmosphere : Air
- Reflow profile : Same as *"Solder beading"*



*Solder paste tested : S3X58-M406

	Power transistor (SnPb)	6330 chip resistor (100Sn)	BGA (Sn3Ag0.5Cu)
Initial			
After 8-hour kneading on sealed-up stencil			

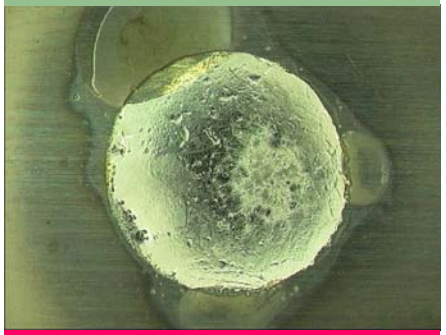
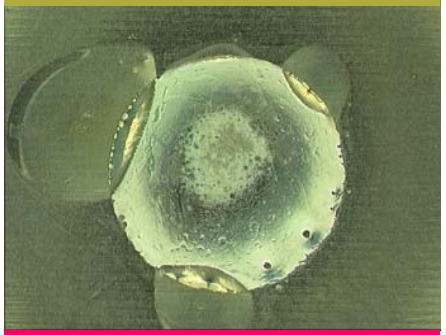
Voiding with various components has been drastically reduced and offers consistent level of voiding even after continual print for more than 4 hours.

Contents

Solder spreading

- Material pieces : Copper, Alloy 42, Nickel (*Pre-conditioning - IPA cleaning only)
- Stencil thickness : 0.2mm (laser cut)
- Stencil aperture : 6.5mm diameter
- Heat source & temp.: Hot plate-150ºC for 60sec. + Solder bath 240+/-2ºC for 5sec.

*Solder paste tested : S3X58-M406

Copper plate	Alloy 42	Nickel
		
Category 1	Category 2	Category 2

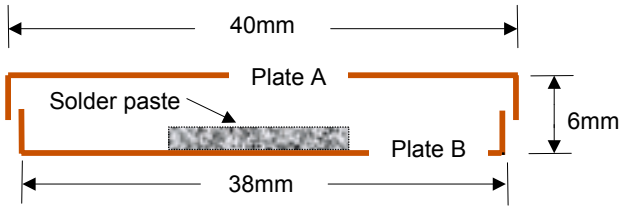
* Definition

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 partially spread.
Category 4 : Solder spread is less than the area where solder paste was printed.

Excellent spreading regardless of the kinds of the metal plate.

Copper corrosion

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



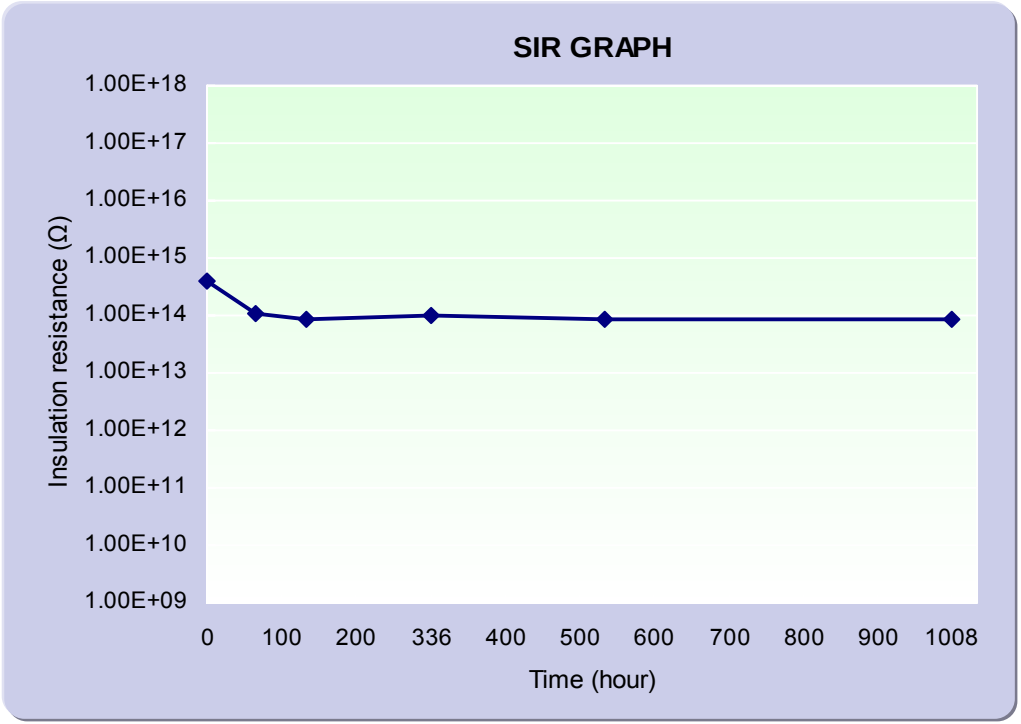
	Copper Plate A	Copper Plate B
× 30		
× 100		

No evidence of corrosion can be observed.

Contents

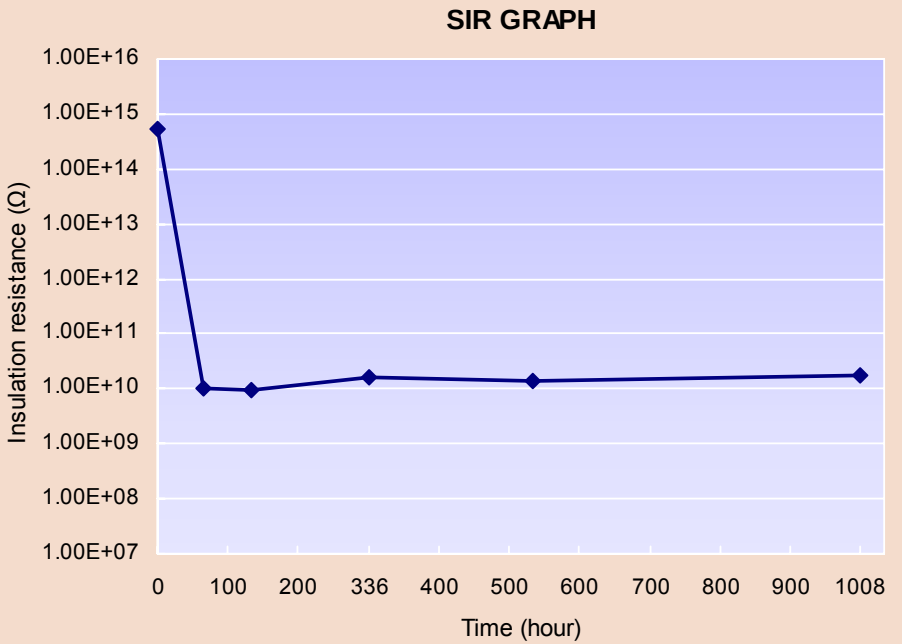
Surface insulation resistance

- 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

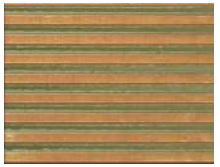


Voltage applied surface insulation resistance

- Test conditions : 85±2°C × 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



× 50 magnification



× 140 magnification

No evidence of electromigration can be observed.

Contents

Handling guide

1. Printing
   1) Recommended printing parameters
      (1) Squeegee
      1. Kind : Flat
      2. Material : Rubber or metal blade
      3. Angle : 60~70 ° (rubber) or metal blade
      4. Pressure : Lowest
      5. Squeegee speed : 10~80mm/sec.

      (2) Stencil
      1. Thickness : 200~120μm for 0.65~0.4mm pitch pattern
      2. Type : : Laser or electroform
      3. Separation speed : 0.5~3.0mm/sec.
      4. Snap-off distance : 0~0.5mm

      (3) Ambiance
      1. Temperature : 25 ± 5 ° C
      2. Humidity : 40~60%RH
      3. Air draft : Air draft in the printer badly affects stencil life and tack performance of solder pastes.

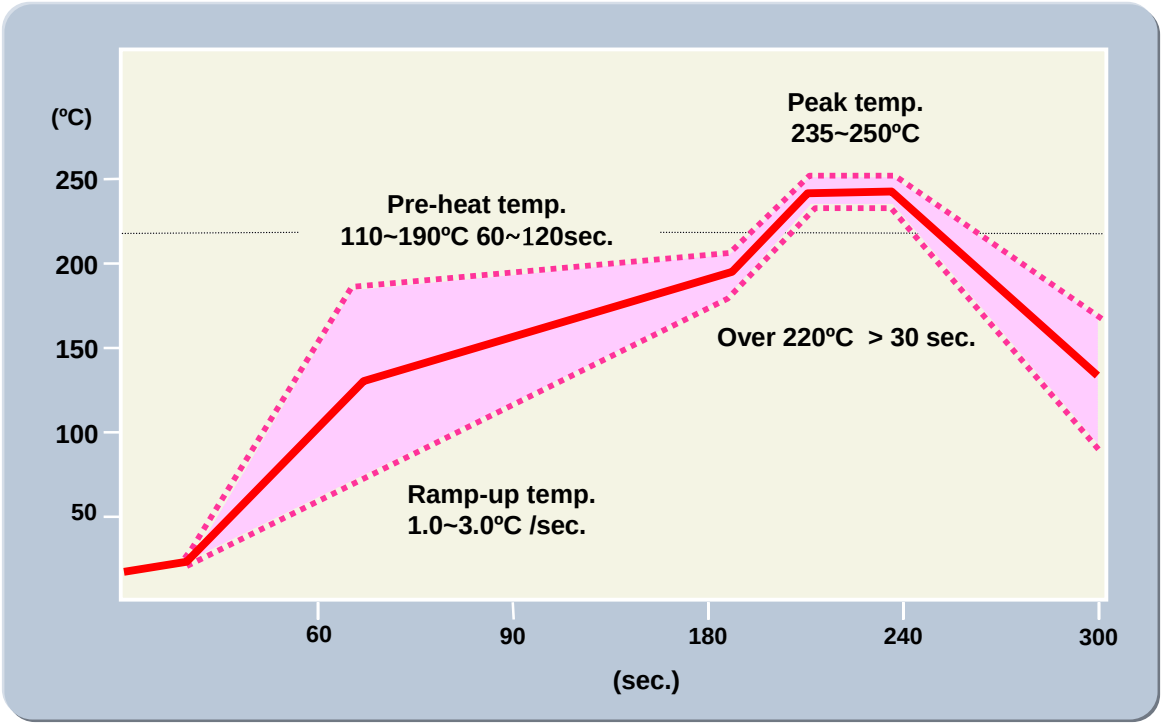
2. Shelf life
   1) 0 ~ 10 ° C : 6 months from manufacturing date
   2) At 20~30 ° C : 1 month from manufacturing date

   * Manufacturing date can be obtained from the lot number

   ex. **Lot No. 4 07 21 2**
   No. of lot : 2nd
   Date : 21st
   Month : July
   Year : 2004

Contents

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 .