TECHNICAL INFORMATION

Hi-Performance
NO-CLEAN SOLDER PASTE

SE48 – M955
SS48 – M955

[Content]

1. FEATURES

1) Employment of rigidly classified 20~45 micron solder powder ensures outstanding continual printing with fine pitch (0.5mm/20mil) and even super fine pitch (0.4mm/16mil) application and long stencil idle time.

2) Carefully selected rosins and activators ensure powerful solder wetting.

3) Extremely long stencil idle time and tack time offers a wide process window.

4) Low colour flux residue offers superior cosmetic appearance.

5) Conforms to Bellcore tests (Copper Mirror, Halides, Surface Insulation Resistance, Electromigration) GR-78-CORE, Issue 1.

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2. SPECIFICATIONS

1) Alloy

Item	Unit	**SE48-M955**	**SS48-M955**	Remarks
Composition	%	Sn63, Pb37	Sn62, Pb36, Ag2	JIS E grade
Shape	--	Spherical		Microscope×50
Particle size	μm	20 ~ 45		--
Melting point	°C	183	179~190	--

2) Flux

Halogen content		%	0.0	Potentiometer
SIR*[1]	Initial value	Ω	$> 1 \times 10^{12}$	JIS comb type electrode type Ⅱ
	After humidification		$> 1 \times 10^{11}$	
Aqueous solution resistivity*[2]		Ωcm	$> 5 \times 10^{4}$	Conductivity
Flux type		–	ROL0	ANSI/J-STD-004

3) Solder paste

Flux content	%	10	By weight
Viscosity*[3]	Pa.s	200 ± 10%	Malcom PCU-2
Copper plate corrosion*[4]	--	Passed	--
Solder spread factor	%	90	Copper plate
Tack time	hour	36	Malcom FG-1
Shelf life	month	6	Below 10°C

1. SIR ..... 40°C×90%RH×96Hr
2. Aqueous solution resistivity..... In accordance with MIL specifications.
3. Viscosity ..... Malcom spiral type viscometer, PCU-2 at 25°C 10rpm
4. Copper plate corrosion ..... In accordance with JIS

3. TEMPERATURE - VISCOSITY CURVE

• Test method

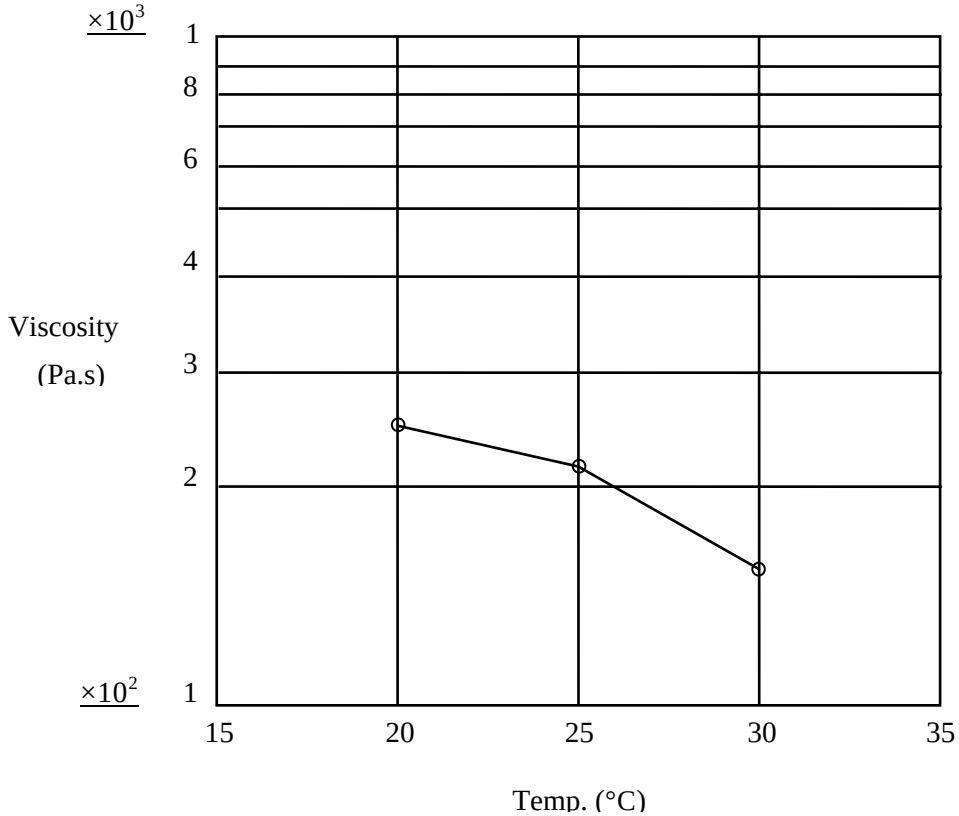
Equipment : Malcom viscometer PCU-205

Rotation of spindle : 10 r.p.m.

Measuring time : 5 min,

• Test result

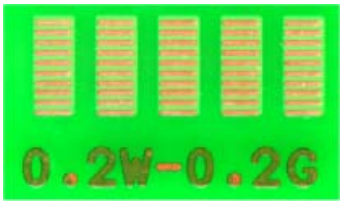
Measuring temp. (°C)	Viscosity (Pa.s)
20	263
25	215
30	169

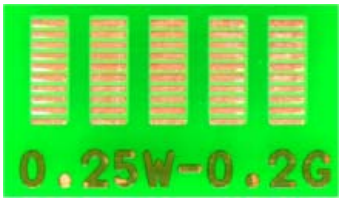


4. PRINTABILITY

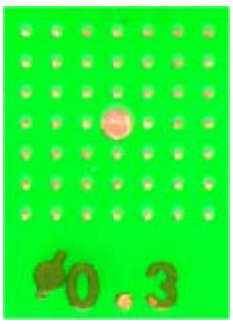
- Print parameters

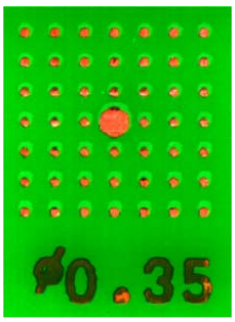
Stencil : 0.15mm thickness, laser cut stencil
Printer : Model MK-880SV Minami Kogaku
Squeegee : Metal blade
Angle - 60°
Speed - 30 mm/sec
Stencil separation speed : 0.5mm/sec
Atmosphere : 23.5~25.0°C（50~60%RH）
Test patterns
1. QFP pad pattern : 1) Width 0.25 mm Length 1.5 mm Distance 0.2 mm
2) Width 0.2 mm Length 1.5 mm Distance 0.2 mm





2. MBGA pad pattern : 1) Diameter 0.35 mm
2) Diameter 0.3 mm

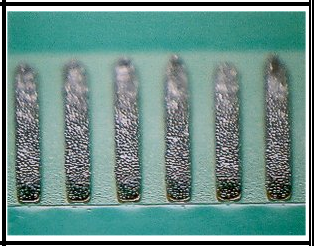
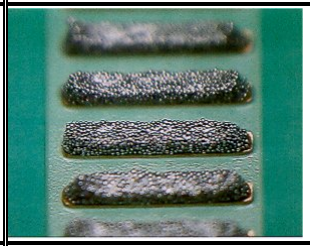
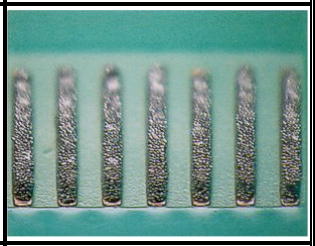
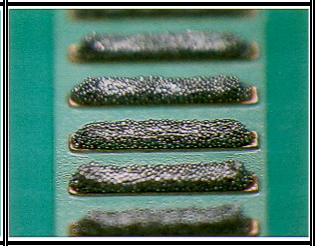
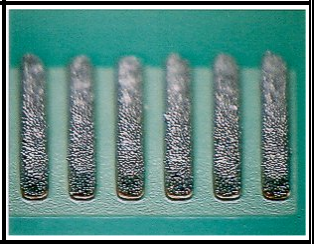
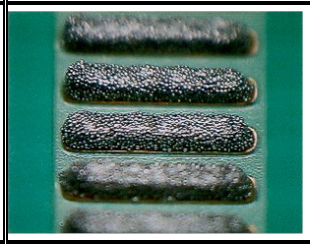
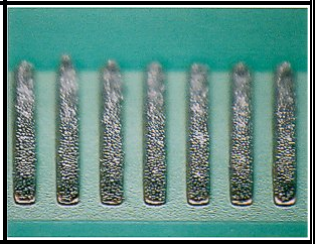
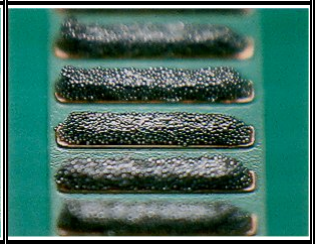
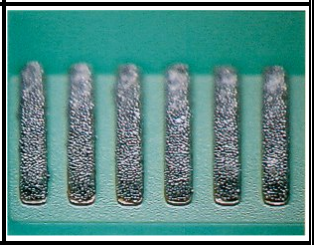
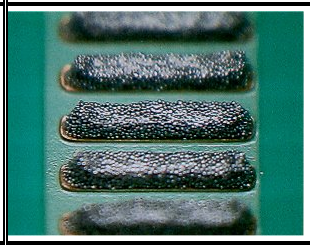
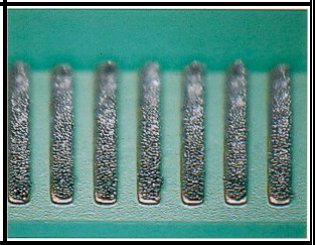
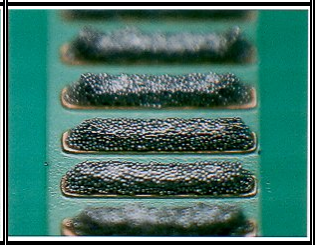
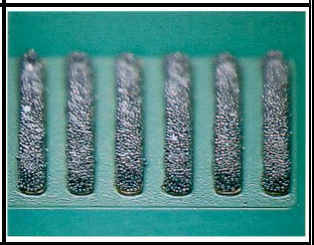
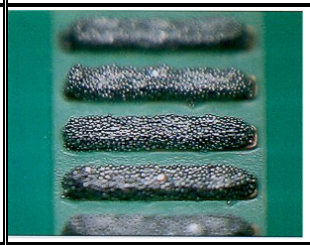
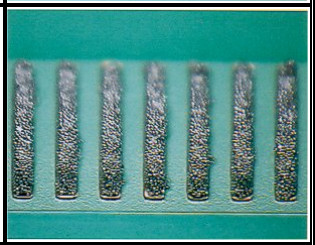
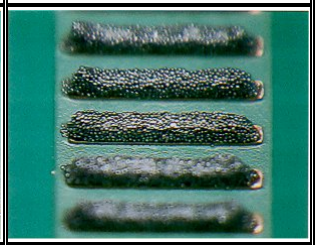
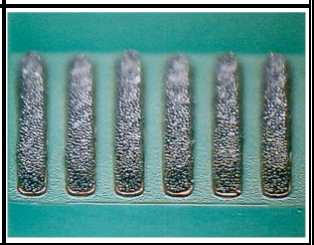
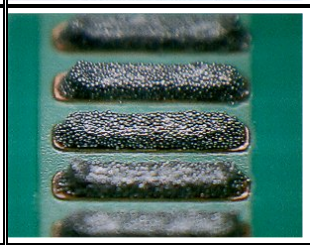
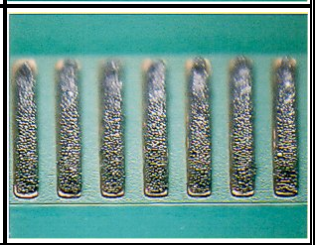
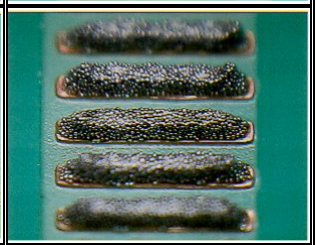
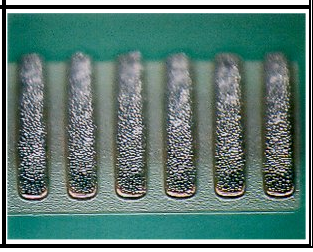
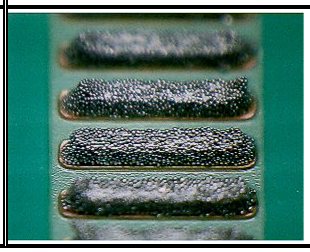
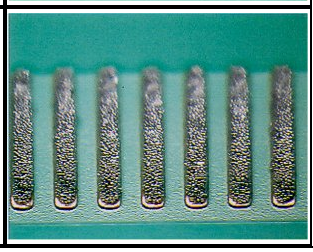
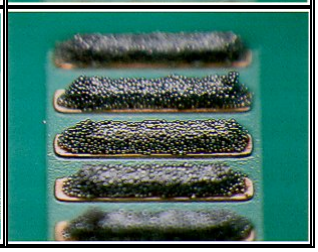




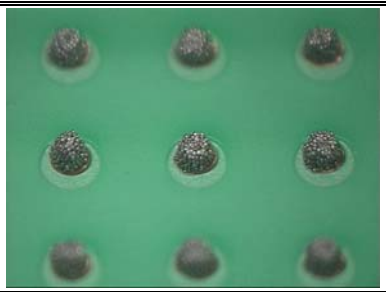
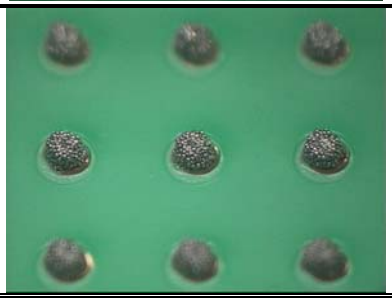
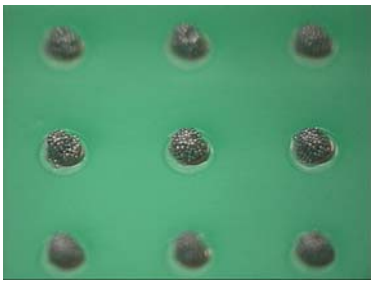
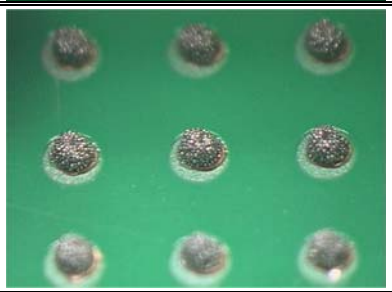
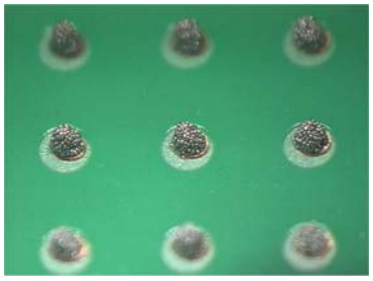
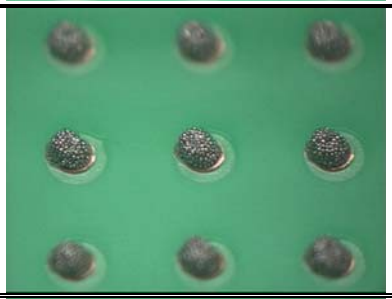
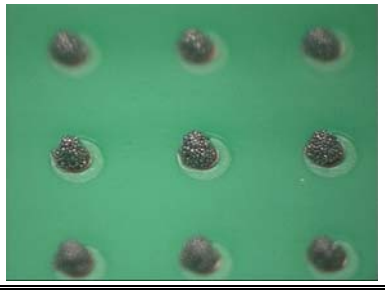
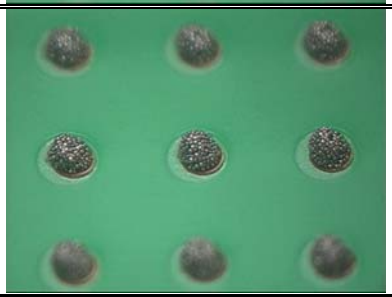
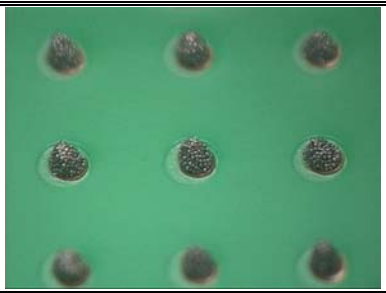
- Print results

No. of print	0.25 with - 0.2mm distance		0.25 with - 0.2mm distance		MBGA	
	Vertical	Parallel	Vertical	Parallel	0.35mm dia.	0.30mm dia.
1st	Good	Good	Good	Good	Good	Good
5th	Good	Good	Good	Good	Good	Good
10th	Good	Good	Good	Good	Good	Good
15th	Good	Good	Good	Good	Good	Good
20th	Good	Good	Good	Good	Good	Good
30th	Good	Good	Good	Good	Good	Good

Continual printability test results – QFP Pattern

No. of print	0.25mm width – 2.0mm distance		0.20mm width – 2.0mm distance	
	Vertical to squeegee traveling direction	Parallel to squeegee traveling direction	Vertical to squeegee traveling direction	Parallel to squeegee traveling direction
1st				
5th				
10th				
15th				
20th				
30th				

Continual printability test results – MBGA Pattern

No. of print	0.35mm diameter	0.30mm diameter
1st		
5th		
10th		
15th		
20th		
30th		

5. Viscosity Variation in Continual Print

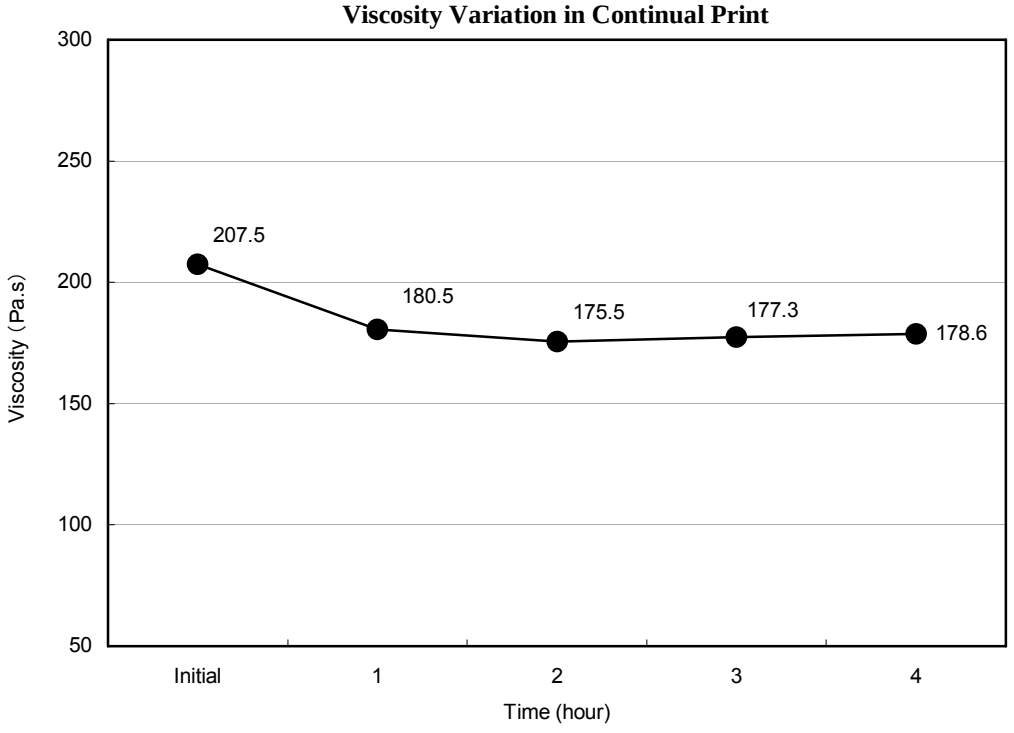
- Test method

Print (knead) solder paste on the sealed-up stencil continuously for 4 hours to observe the viscosity variation.

Stencil	:	0.15mm thickness, laser cut stencil
Printer	:	Model MK-880SV Minami Kogaku
Squeegee	:	Metal blade Angle - 60˚ Speed - 30 mm/sec
Print stroke	:	300mm
Atmosphere	:	23.5~25.0°C（50~60%RH）
Measurement of viscosity	:	Before printing, at 1, 2, 3 and 4 hours by Malcom viscometer PCU-205

- Result

Time (hour)	Initial	1	2	3	4
Viscosity (Pa.s)	207.5	180.5	175.5	177.3	178.6



6. Intermittent Printability (Stencil idle time)

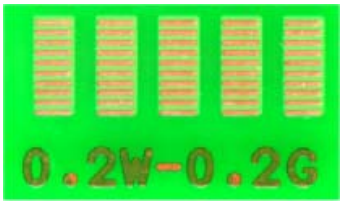
- Test method

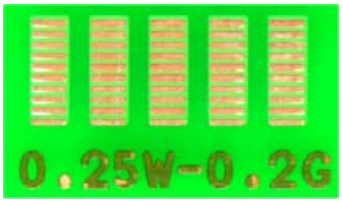
Print solder paste for 30min. continuously and stop to idle the paste for 30, 60, 90min. intervals, and resume the printing and observe the 1st print result to verify intermittent printability.

Stencil	:	0.15mm thickness, laser cut stencil
Printer	:	Model MK-880SV Minami Kogaku
Squeegee	:	Metal blade Angle - 60˚ Speed - 30 mm/sec
Print stroke	:	300mm
Atmosphere	:	23.5~25.0°C（50~60%RH）

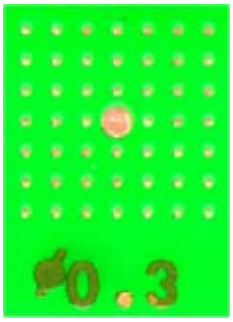
Test patterns

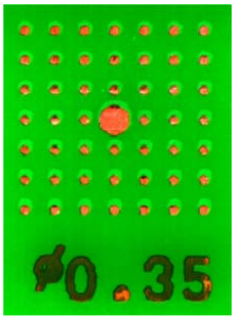
1. QFP pad pattern : 1) Width 0.25 mm Length 1.5 mm Distance 0.2 mm
   2) Width 0.2 mm Length 1.5 mm Distance 0.2 mm





2. MBGA pad pattern : 1) Diameter 0.35 mm
   2) Diameter 0.3 mm

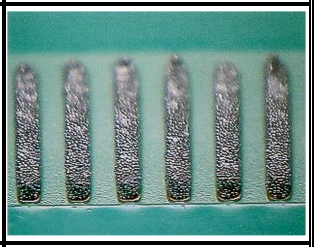
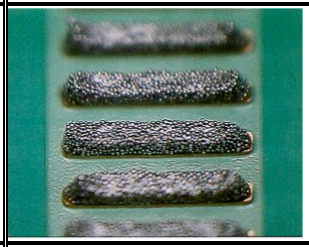
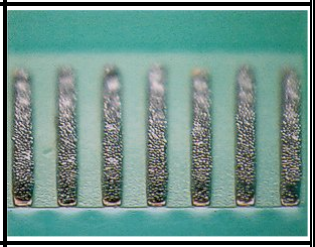
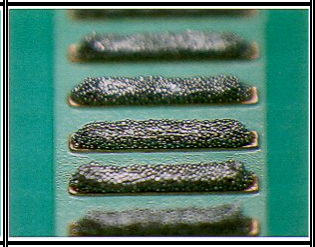
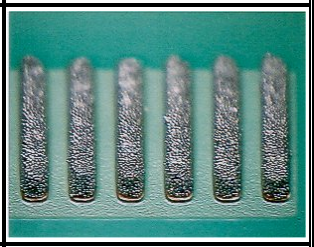
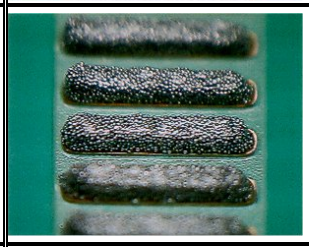
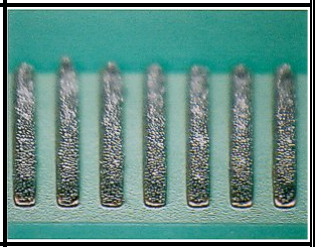
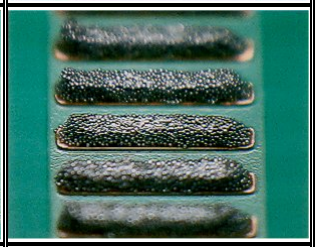
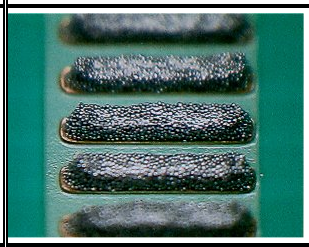
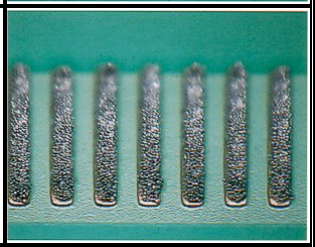
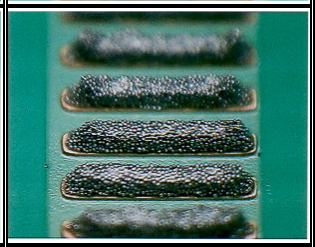
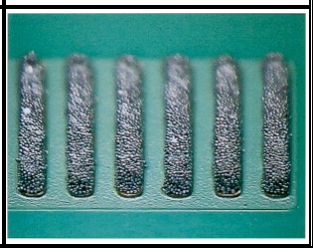
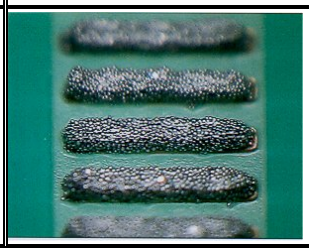
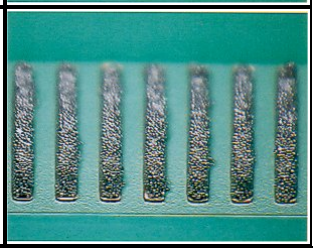
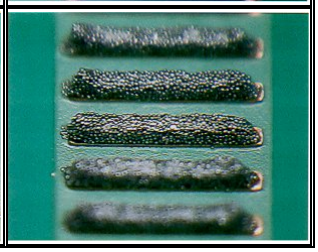




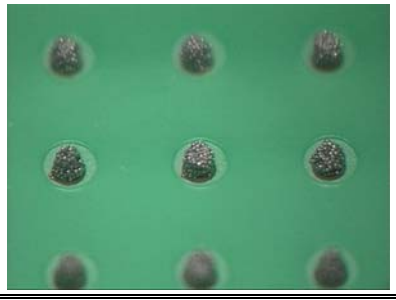
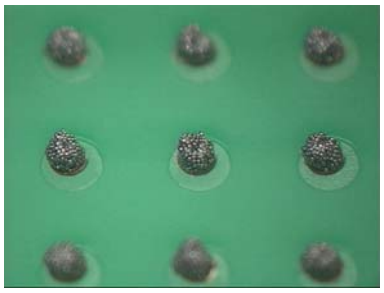
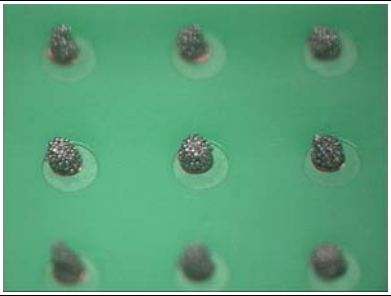
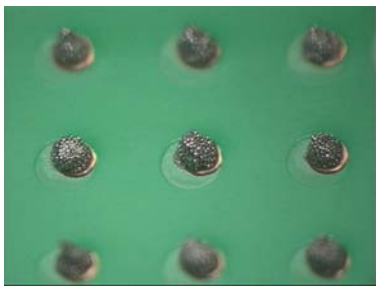
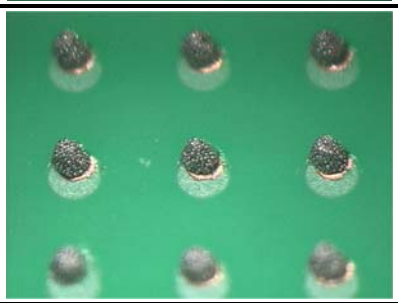
- Print results

Idle time	0.25 with - 0.2mm distance		0.25 with - 0.2mm distance		MBGA	
	Vertical	Parallel	Vertical	Parallel	0.35mm dia.	0.30mm dia
Initial	Good	Good	Good	Good	Good	Good
30 min.	As good as initial result	As good as initial result	As good as initial result	As good as initial result	As good as initial result	As good as initial result
60 min.	As good as initial result	As good as initial result	As good as initial result	As good as initial result	As good as initial result	As good as initial result
90 min.	As good as initial result	As good as initial result	As good as initial result	As good as initial result	As good as initial result	Slightly less than initial

Continual printability test results – QFP Pattern

No. of print	0.25mm width – 2.0mm distance		0.20mm width – 2.0mm distance	
	Vertical to squeegee traveling direction	Parallel to squeegee traveling direction	Vertical to squeegee traveling direction	Parallel to squeegee traveling direction
Intial				
30 min.				
60 min.				
90 min.				

Continual printability test results – MBGA Pattern

No. of print	0.35mm diameter	0.30mm diameter
Initial		
30 min.		
60 min.		
90 min.		

7. TACKINESS

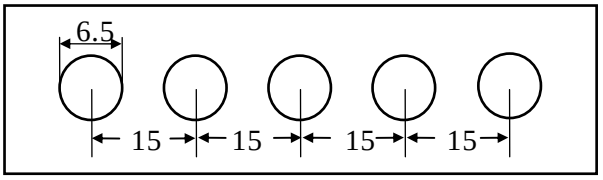
- Test method

Print the solder paste on an alumina plate with a 0.2mm thick stencil that has five 6.5mm dia. holes, to obtain the test piece.

Press the flat tip cylindrical probe of a Malcom Solder Checker FG-1 onto the printed solder paste with a pressure of 50gs for 0.2mm sec. and pull it back up at a speed of 10mm/sec., in order to measure the maximum tensile strength needed to separate the probe from the paste.

Evaluate the tackiness of the solder paste from the obtained tack force and time after printing.

*Ambient condition : 25°C 50±10%RH



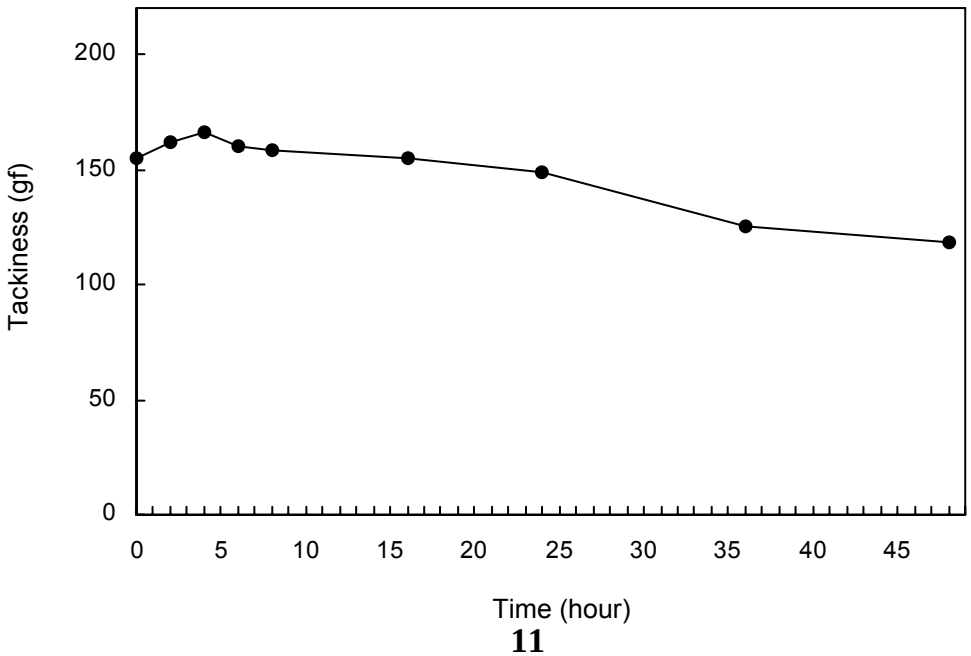
*Unit : mm

Stencil used

	Time (hour)								
Product	0	2	4	6	8	16	24	36	48
Tackiness (gf)	155	162	166	160	158	155	149	125	118

*Unit : (gf) Average of n = 5

Tackiness Data



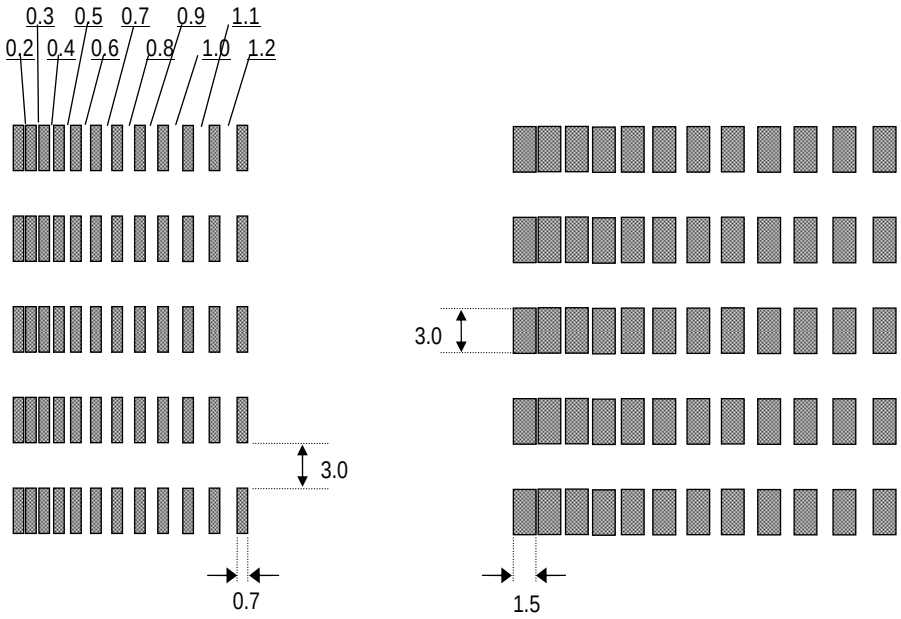
8. SLUMP

• Test method

Using 0.2mm thick stainless steel stencil with two patterns of apertures, (1)3.0mm×0.7mm, (2)3.0mm×1.5mm arranged as grids with the spacing between the apertures varying from 0.2mm to 1.2mm in steps of 0.1mm, print the solder paste on 1.6mm thick copper clad laminate plate to obtain test pieces.

(1) Observe the slump behavior after leaving the test pieces at room temperature for 1 hour.

(2) Observe the minimum spacing across which the paste has not merged after storing the test pieces at room temperature for 1 hour, and heating it for 5 minutes at 150°C in the thermostatic oven.



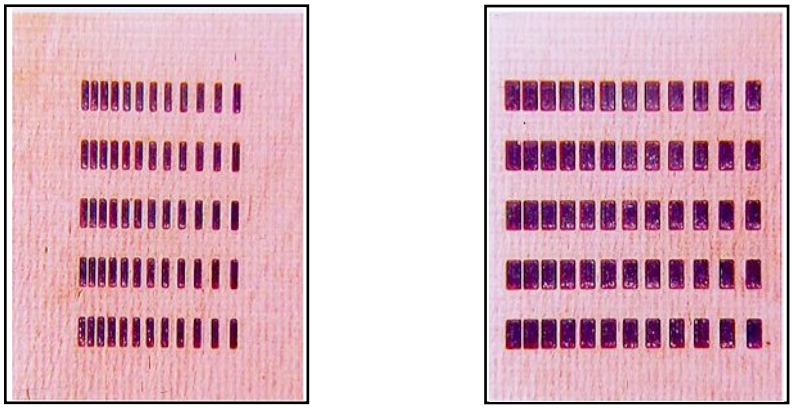
Test pattern (1) Test pattern (2)

• Test result

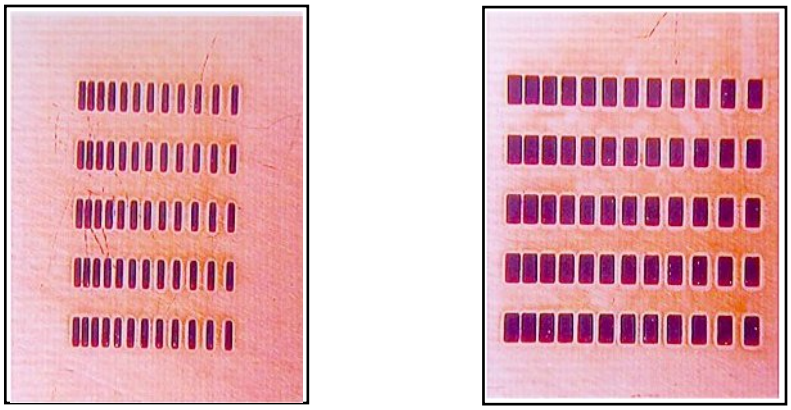
n	Stored at room temperature for 1 hour		
	Room temp.	100°C×20min.	150°C×5min.
(1)	0.2	0.2	0.3
(2)	0.2	0.2	0.3

*Store at room temperature for 1 hour.

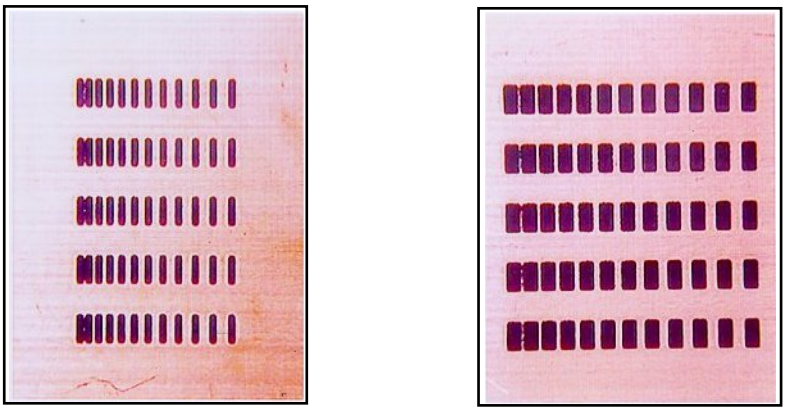
[Room temperature (no heating)]



[100°C × 20min.]



[150°C ×5min.]



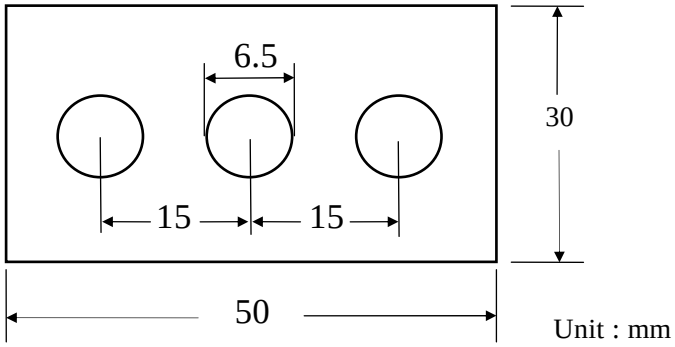
9. SOLDER BALL

• Test method

Prepare two test pieces by printing the paste on each alumina plate (50×50×0.8tmm) with a 0.2mm thick stencil provided with three 6.5mm diameter apertures with a distance between centers of 15mm.

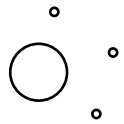
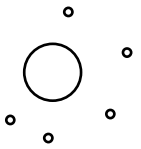
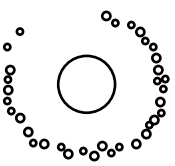
Reflow one of them in 1 hour after printing and the other after storing it at 25±2°C 60±20%RH for 24 hours, on a hot plate at 250°C. Remove the test pieces from the hot plate after 5 seconds since the solder paste melted completely and cool them down to room temperature.

Inspect the degree of reflowing referring to 'Solder balling evaluation standard' using the ×10 magnifying glass.



Stencil used.

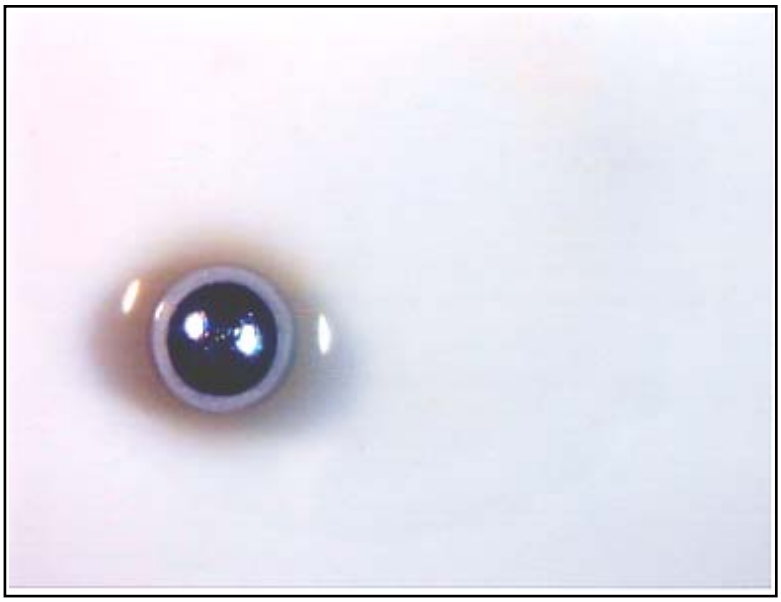
• Solder balling evaluation standard

Category	Status of coalescence of solder	Illustration (ex.)
1	The molten solder from the paste has melted in to one solder ball.	
2	The molten solder from the paste has melted into one large solder ball with no more than three isolated small solder balls with diameter less than 75μm.	
3	The molten solder from the paste has melted into one large solder ball surrounded by more than three solder balls with diameters less than 75μm which do not form a semi-continuous halo.	
4	The molten solder from the paste has melted into one ball accompanied by a large number of smaller solder balls which may form a semi-continuous halo, or has melted to form a number of similarly sized balls.	

• Test result :

Test piece	1 hour after print	24 hours after print
a	Category 2	Category 3
b	2	2
c	3	3

[1 hour after printing]



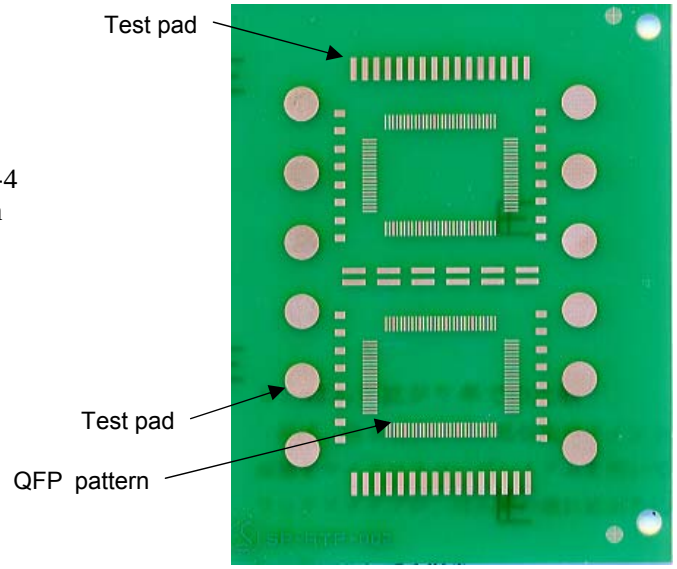
[24 hour after printing]

10. SOLDER SPREAD FACTOR & WETTING

• Test method

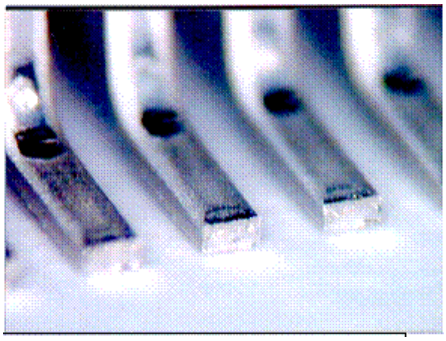
1. Test board

Model :	SP-RTP-002
Material :	Glass epoxy FR-4
Dimension :	80×100×1.6tmm
Surface treatment :	Bare copper
Pad size (round pad) :	6.0mm



2. QFP tested

PC board :	Glass epoxy FR-4
Component :	QFP 0.65mm pitch 100 pins
Lead wire :	Ni/Fe with Sn/Pb plating



3. Print condition

Stencil thickness :	0.150mm (laser cut)
Printer :	Model MK-880SV (Minami Kogaku)

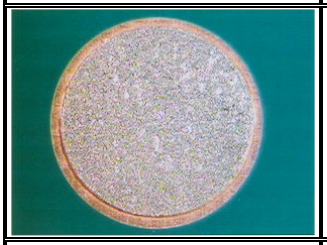
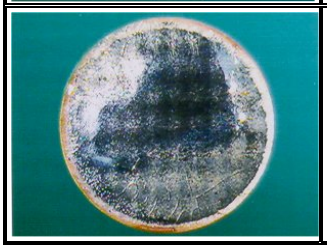
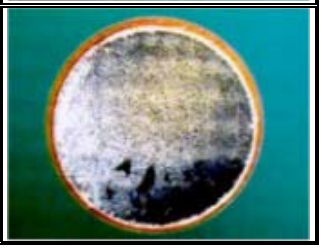
4. Reflow condition

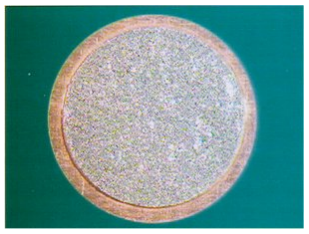
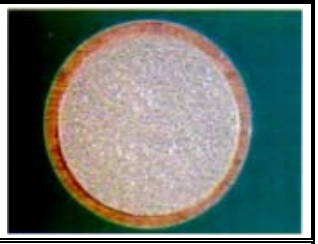
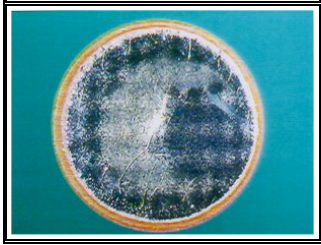
Heat source :	Far infrared + Hot air convection
Zone structure :	3 pre-heat zones + 1 reflow zone
Atmosphere :	Air
Temperature profile :	

Profile	Pre-heat zones	Peak temp.	Time over 220°C
Profile	150 - 160°C × 90 sec.	220°C	40sec.

- Result

Solder spread factor results

Pad diameter 6.0mm stencil aperture 5.4mm	
SE48-M955	Conventional Paste
	
	

Pad diameter 6.0mm stencil aperture 5.2mm	
SE48-M955	Conventional Paste
	
	

Pad diameter 6.0mm stencil aperture 5.0mm	
SE48-M955	Conventional Paste
	
	

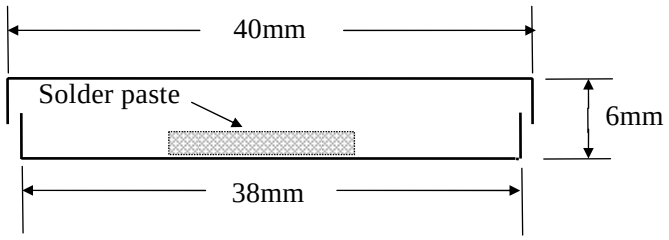
Solder wetting results

SE48-M955	Conventional paste
	

11. COPPER PLATE CORROSION

• Test method

Prepare 6 pcs. of phosphorus deoxidized copper plate of 50×50×0.5tmm in size (JIS-H-3100). Bend 3 of them at right angle at 5mm (copper plate A), and the rest at 6mm (copper plate B) from the both edges to form three open ended boxes.



After removing any grease from both copper plate A and B with acetone, soak them in 5% sulfuric acid for 1 minute and in ammonium persulfate solution (solution which contains 25% of ammonium persulfate in 0.5% of sulfuric acid) in 1 minute to etch the surface uniformly. After washing them with running water, soak in 5% sulfuric acid for 1 minute and rinse thoroughly with running tap water and demineralised water. Then finally, rinse them with acetone and dry.

Obtain test pieces by printing solder paste on the copper plate B with a 0.2mm thick stencil provided with 6.5mm diameter aperture.

Place all three copper plates A over the copper plates B and lower each box in a horizontal position on to the surface of the solder bath at the temperature of 235±2°C and maintain the test pieces in this position for 5 seconds.

Remove each test piece from the solder bath and allow it to cool in a horizontal position down to room temperature. Place all three boxes in the thermohygrostat under the condition of 40±2°C, 90~95%RH for 72 hours.

Remove the boxes from the thermohygrostat and inspect the inside surfaces of the boxes (including the lid) for possible corrosion.

• Test result

n	Copper plate A	Copper plate B
1	No corrosion	No corrosion
2	No corrosion	No corrosion
3	No corrosion	No corrosion

12. SURFACE INSULATION RESISTANCE

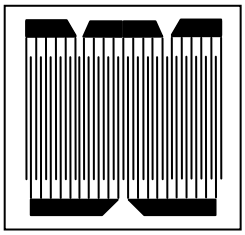
• Print the solder paste with a 0.2mm thick stencil on a comb type electrode type-II specified in JIS-Z-3197 6.8. and reflow to obtain the test piece.

Put the test piece in a thermohygrostat under the conditions of 85±2°C and 85±2%RH.

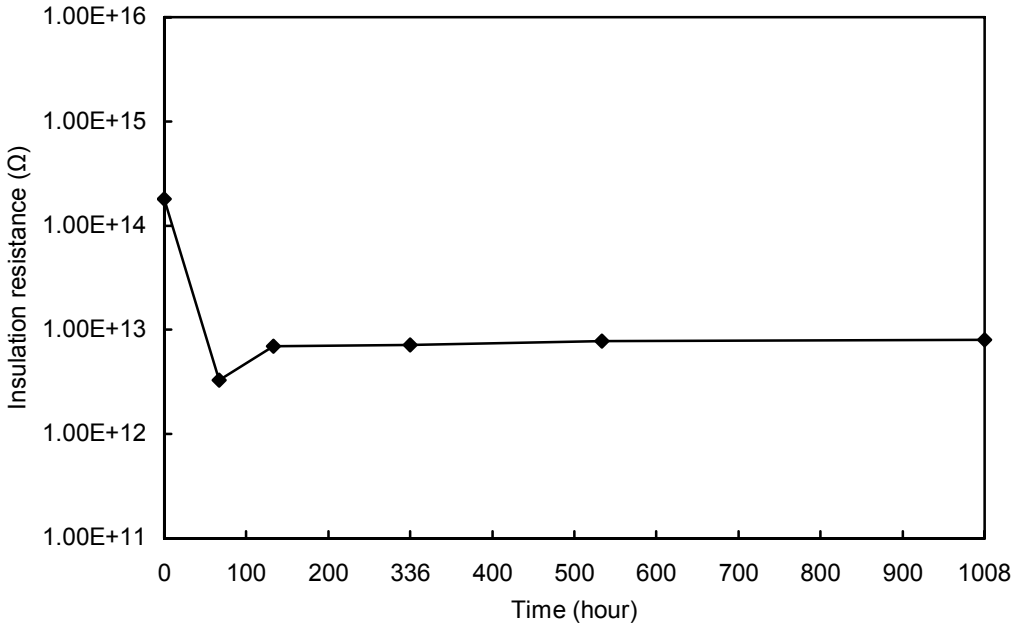
Measure the insulation resistance at every specific time taking the test pieces out of the thermohygrostat. DC100V for the measurement.

• Test result

Time (hour)	S.I.R. Value (Ω)
Initial value	1.8×10^{14}
96	3.3×10^{12}
168	7.0×10^{12}
336	7.2×10^{12}
504	7.8×10^{12}
1008	8.0×10^{12}

Comb type electrode Type-II	
	
Width of conductor	0.318 mm
Conductor spacing	0.318 mm
Overlap length	15.75 mm

SIR GRAPH



13. VOLTAGE APPLIED SIR

(Electromigration Test)

• Test method

Print the solder paste with a 0.2mm thick stencil on a comb type electrode Type-II specified in JIS-Z-3196 6.8. and reflow to obtain test pieces.

Put the test pieces in a thermogygrostat under the conditions of 85±2°C and 85±2%RH.

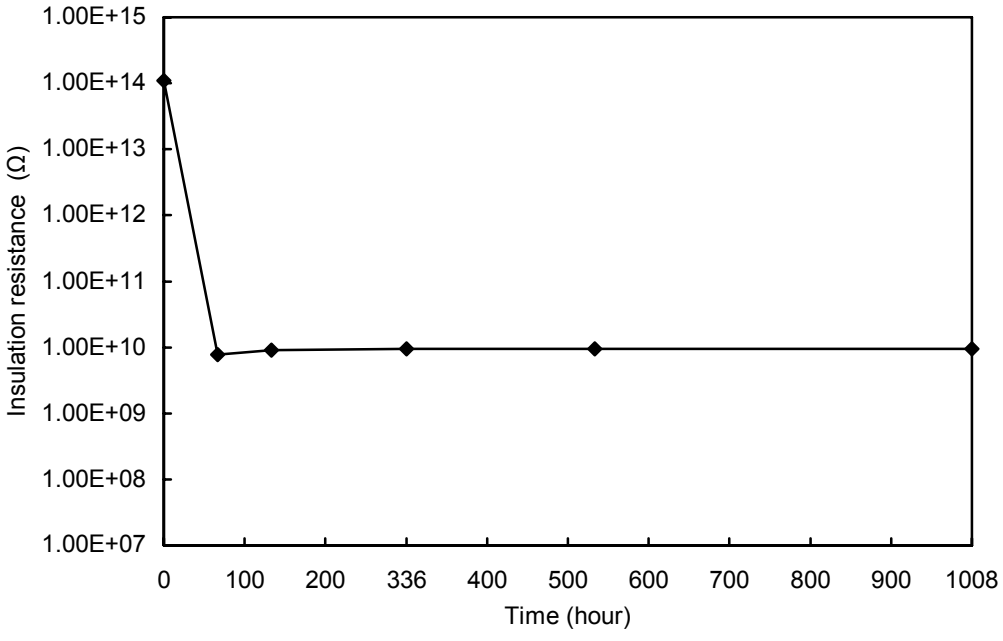
Measure the insulation resistance at every specific time keeping the test pieces in the thermohygrostat and apply DC50V. Apply 100V for the measurement.

• Test result

Time (hour)	Place measured	Average (Ω)
Initial value	Out thermohygrostat	1.1×10^{14}
96	In thermohygrostat	7.7×10^{9}
168	In thermohygrostat	9.1×10^{9}
336	In thermohygrostat	9.4×10^{9}
504	In thermohygrostat	9.5×10^{9}
1008	In thermohygrostat	9.5×10^{9}

✧ There was no evidence of electromigration.

SIR GRAPH



14. USE OF KOKI SOLDER PASTE

In order to make the paste use of KOKI SOLDER PASTE, please refer to the following guideline carefully before use.

1. Preparation for printing

1) Temperature

After taking the solder paste from the refrigerator, in which the temperature is controlled to between 5 - 10°C, allow the paste temperature to return to ambient.

*Caution : Do not open the jar while it is cold, as it causes condensation moisture on the paste, and could be the cause of poor performance, such as an increase in viscosity, solder balling etc.

Do not under any circumstances heat the paste prior to use.

2) Stirring

By using a stainless steel or chemically resistive plastic spatula, fold the paste before use.

It is recommended to fold it for at least 1~2 min. to obtain a uniform and stable viscosity.

*Caution : When automatic stirring equipment is used, do not stir the paste for longer than 4 min.

2. 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 : 10~100mm/sec.

(2) Stencil

1. Thickness : 200~120μm for 0.65~0.4mm pitch pattern
2. Snap-off distance : 0~0.5mm

*Although on-contact (0mm snap-off) is normally recommended for fine pitch printing, if the printing equipment is not provided with a stencil separation speed control system, proper snap-off distance is necessary to ensure smooth and gradual separation of the stencil from the substrate to ensure good solder paste deposits.

3. Fixing method of substrate : It is recommended to have a fixture or vacuum system to hold the substrate in position during printing to prevent movement of the PC board and to have a good separation from the stencil.
4. It is strongly recommended to set the stencil separation speed as slow as possible.

(3) Ambient

1. Temperature : 25 ± 5°C
2. Humidity : 40~60%RH
3. Climate control : Air flow seriously affects stencil life and tack performance of solder pastes.

*Caution : When local air conditioner is equipped, make sure it is not enhancing the drying out of the solder paste.

(4) Printing

1. Initial quantity of solder paste to put on the stencil shall be decided according to the size of the stencil, blade or squeegee and the PC board.

Ex. Size of PC board. B5 - 300gs
A4 - 400gs

*In order to ensure good rolling of the paste across the stencil and easy separation from squeegees, a certain amount of solder paste is required throughout the printing process.

2. Add paste to replenish only the consumed amount.

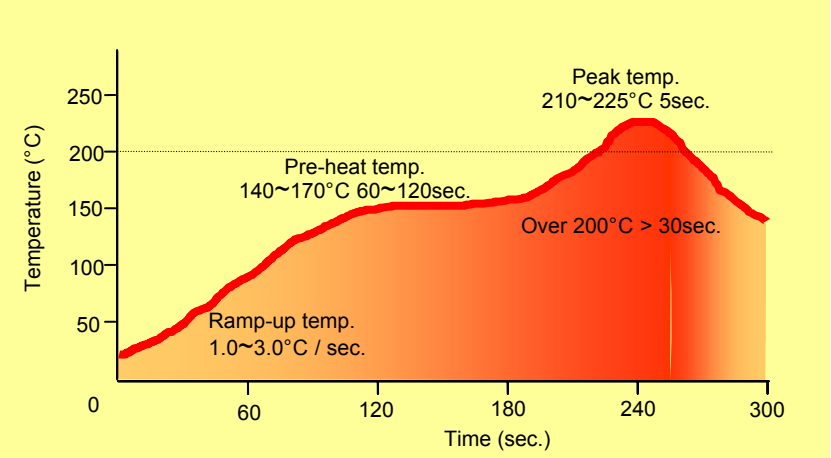
*Minimize the amount of paste left on the stencil as degradation is accelerated once it is processed on the stencil.

3. After a certain number of continuous prints, thoroughly clean the bottom side or both the top and bottom side of the stencil – the number of prints will vary depending on individual set-ups.

4. Clean both the top and bottom side of the stencil before every break.

5. Do not return the used paste into the original jar in order to prevent mixture and contamination of the fresh paste, but put it in a separate container for re-use, if necessary.

3. Reflowing



4. Transport

Room temp. ~ 40°C : 5 days

5. Storage

Storage upon receipt by customer – label information on product also relates to storage conditions of product upon receipt by customer.
Store in a refrigerator at 0 - 10°C.
DO NOT FREEZE!
*** Data available upon request regarding stability of product during transportation ***

6. Shelf life

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

* 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