TECHNICAL INFORMATION

NO-CLEAN SOLDER PASTE

SE(S)58-M405L-2

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KOKI COMPANY LIMITED

1. FEATURES

1) Employment of rigidly classified 20-38micron solder powder ensures outstanding continual printing with super fine pitch (0.4mm/16mil) and micro-component (0603, MBGA) application and long stencil idle time.

2) Designed for slow to fast speed printing (20 ~ 150mm/sec.) application

3) Specially developed 'heat resistant' flux system ensures both extremely high slump resistance and low solder beading.

4) Carefully selected flux chemistry ensures low voids formation.

2. SPECIFICATIONS

1) Alloy

Item	Unit	**SE58-M405L-2**	**SS58-M405L-2**	Remarks
Composition	%	Sn63, Pb37	Sn62, Pb36, Ag2	JIS E grade
Shape	--	Spherical		Microscope×50
Particle size	μm	20 – 38		Laser microsizer

2) Flux

Item		Unit	Value	Remarks
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

Item	Unit	Value	Remarks
Flux content	%	10.0	By weight
Viscosity*3	Pa.S	160 ± 10%	Malcom PCU-205
Copper plate corrosion*4	--	Passed	--
Solder spreadability	%	90	Copper plate
Tack time	hour	24	Malcom FG-1
Shelf life	month	6	Below 10°C
Anti-tombstone option (Sn62.6, Pb36.8, Ag2, Sb0.2)	--	***SSA58-M405L-2***	--

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 .... In accordance with JIS

3. TEMPERATURE - VISCOSITY CURVE

• Test method

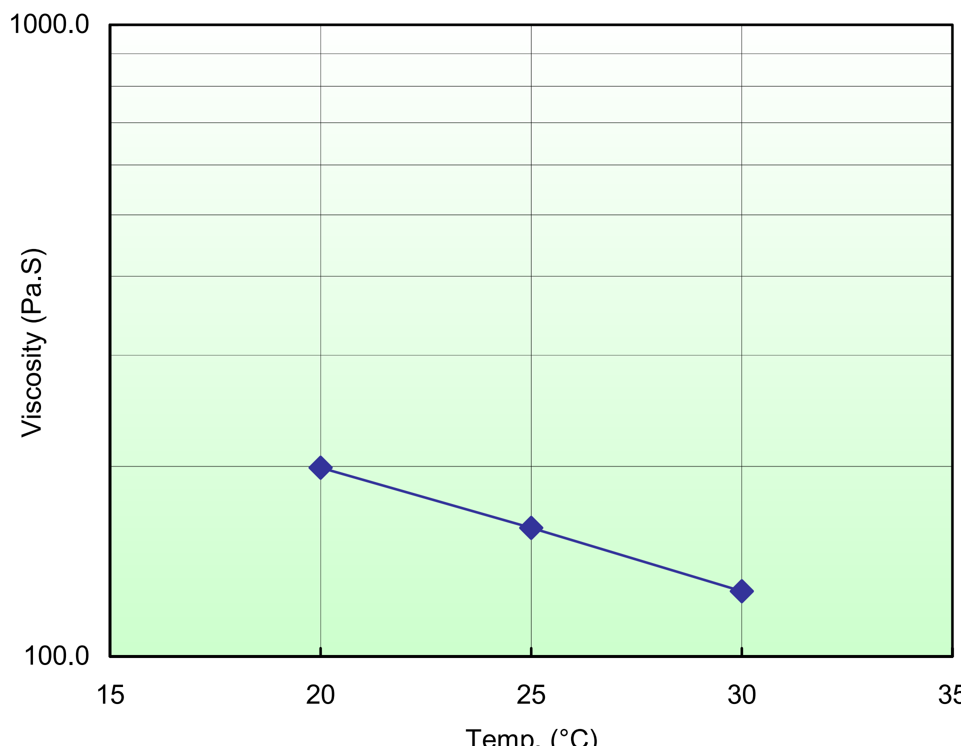
Equipment : Malcom viscometer PCU-205

Rotation of spindle : 10 rpm.

Measuring time : JIS mode

• Test result

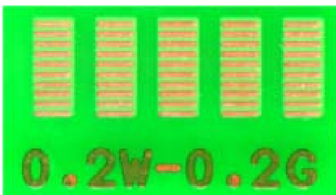
Measuring temp. (°C)	Viscosity (Pa.S)
20	199
25	160
30	127



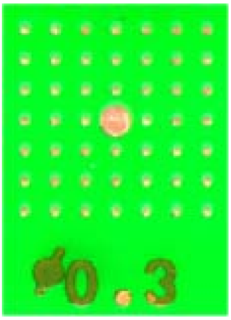
4. PRINTING

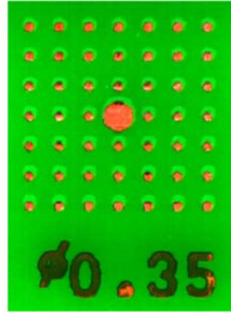
- Print parameters

Stencil : 0.12mm thickness, laser cut stencil
Printer : Model MK-880SV Minami Kogaku
Squeegee : Metal blade
Angle - 60°
Print speed : 30 mm/sec
Stencil separation speed : 0.5mm/sec
Atmosphere : 25~28.0°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 0.35 mm





- Print results

No. of print	0.20 width - 0.2mm distance		MBGA	
	Vertical	Parallel	0.30mm dia.	0.35mm dia.
1st	Good	Good	Good	Good
5th	Good	Good	Good	Good
10th	Good	Good	Good	Good
101st	Good	Good	Good	Good
105th	Good	Good	Good	Good
110th	Good	Good	Good	Good

*Wiping of the bottom side of stencil after 100 strokes.

- Test result

No.of Print	QFP 0.20mm width – 0.20mm distance		BGA	
	Parallel	Vertical	Diameter 0.25 mm	Diameter 0.30 mm
1st				
5th				
10th				
101st				
105th				
110th				

5. TACKINESS

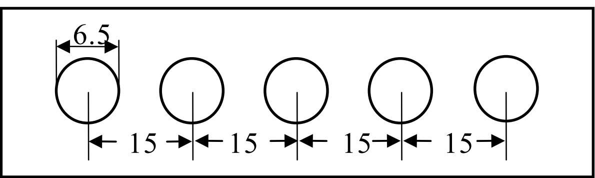
• Test method

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

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

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

*Ambient condition : 25°C 50 ± 10%RH



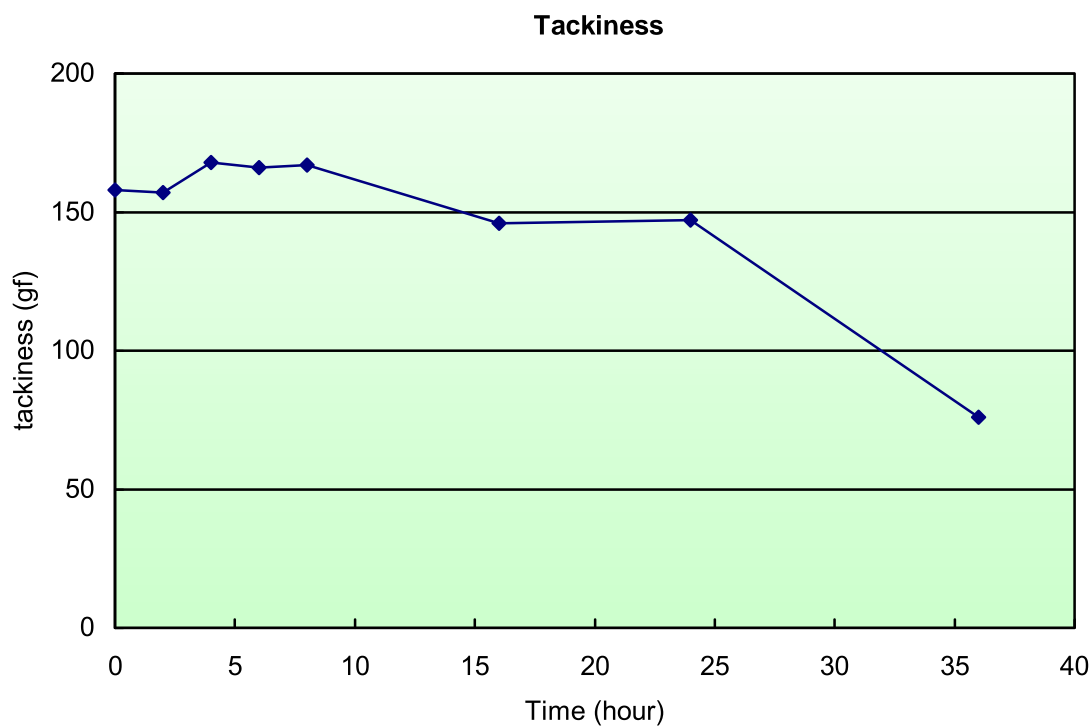
*Unit : mm

Stencil used

• Test Result

Time (hour)	0	2	4	6	8	16	24	36
Tack force (gf)	158	157	168	166	167	146	147	76

*Unit : (gf) Average of n = 5



6. SLUMP

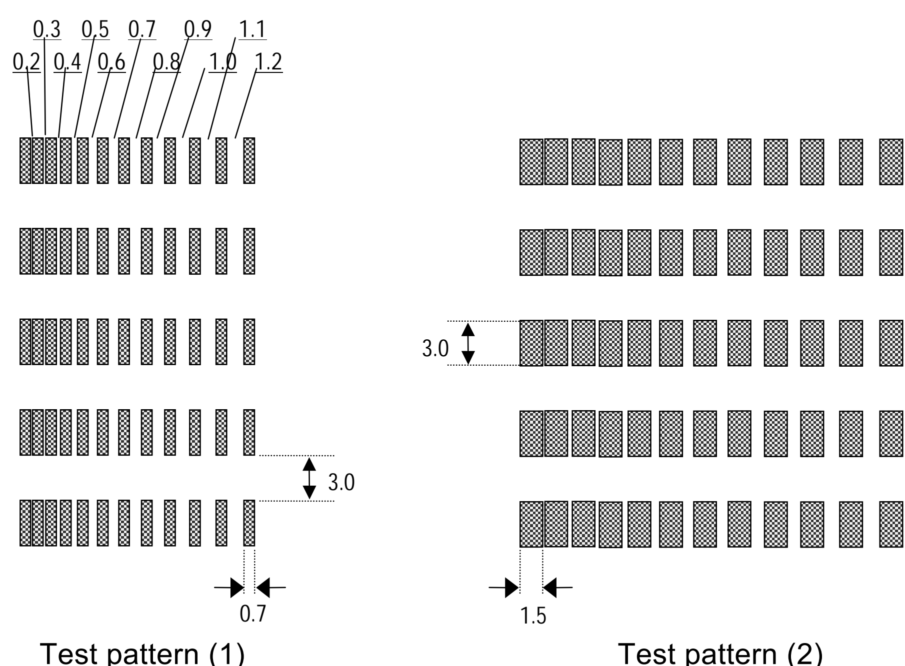
• Test method

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 no merged after storing the test pieces at room temperature for 1 hour, and heating it for 20 minutes at 100°C in the thermostatic oven.

(3) 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.

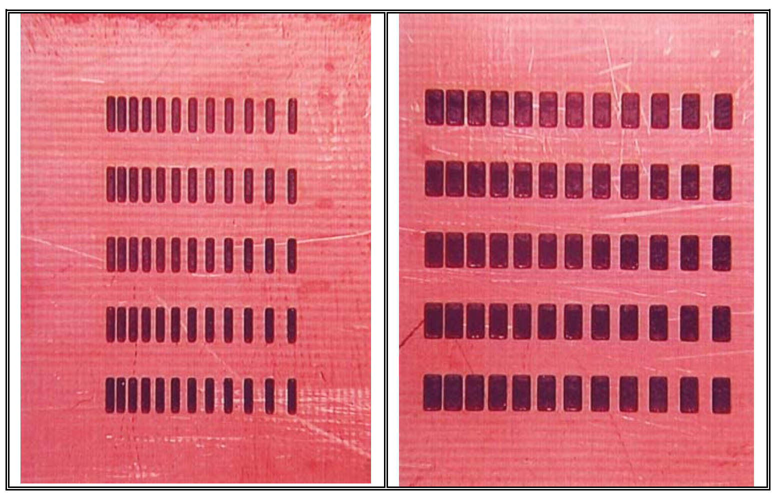


Test pattern (1)   Test pattern (2)

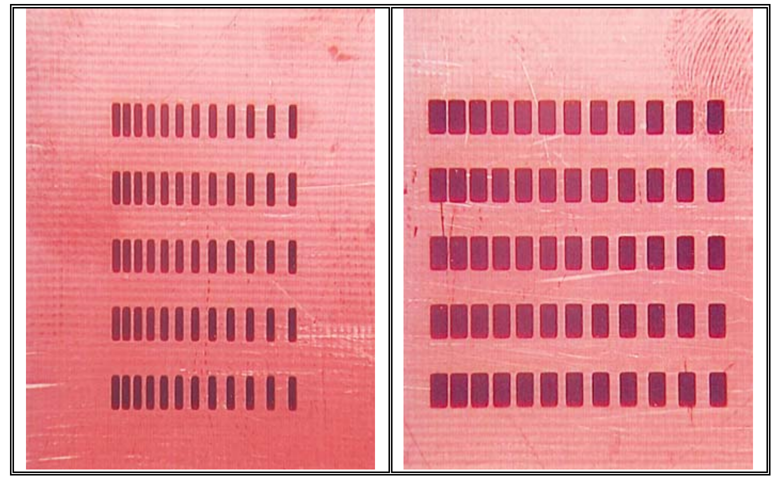
• Test result

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

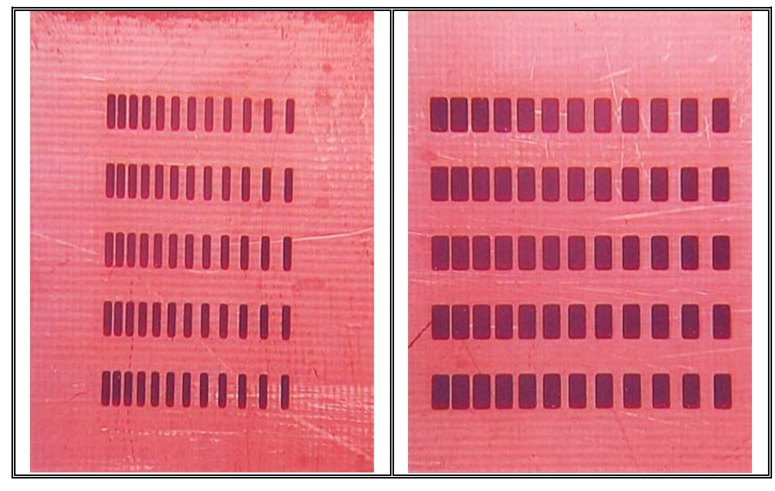
[Room temperature (no heating)]



[100°C × 20min.]



[150°C × 5min.]



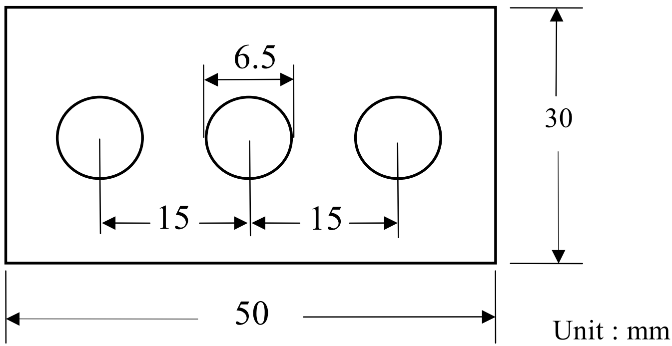
7. SOLDER BALL

• 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 3	Category 3
b	3	3
c	3	3

[1 hour after printing]

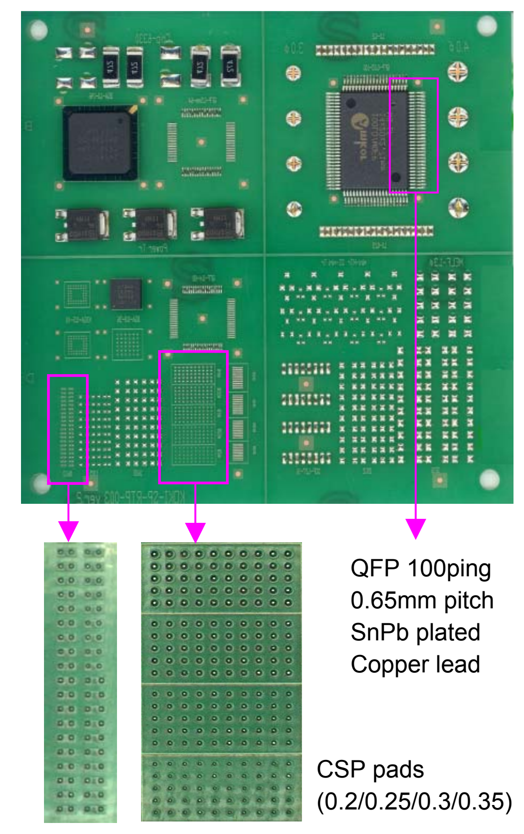
[24 hour after printing]

8. FINE PATTERN SOLDERABILITY

• Test method

1. Test board

Model	:	SPR-PTP-003 ver.2
Material	:	Glass epoxy FR-4
Dimension	:	80×100×1.6tmm
Surface treatment	:	OSP

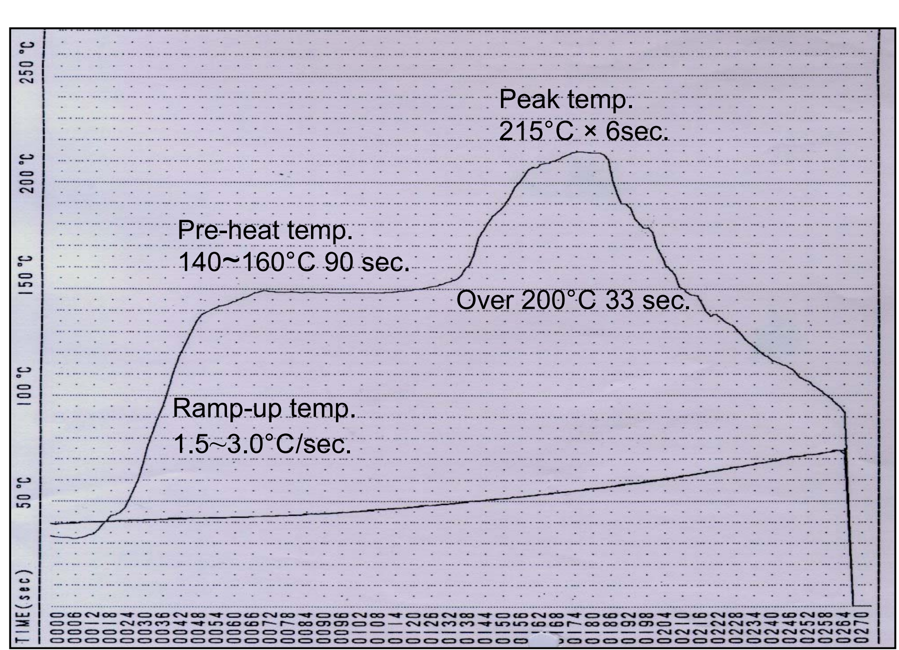


2. Print condition

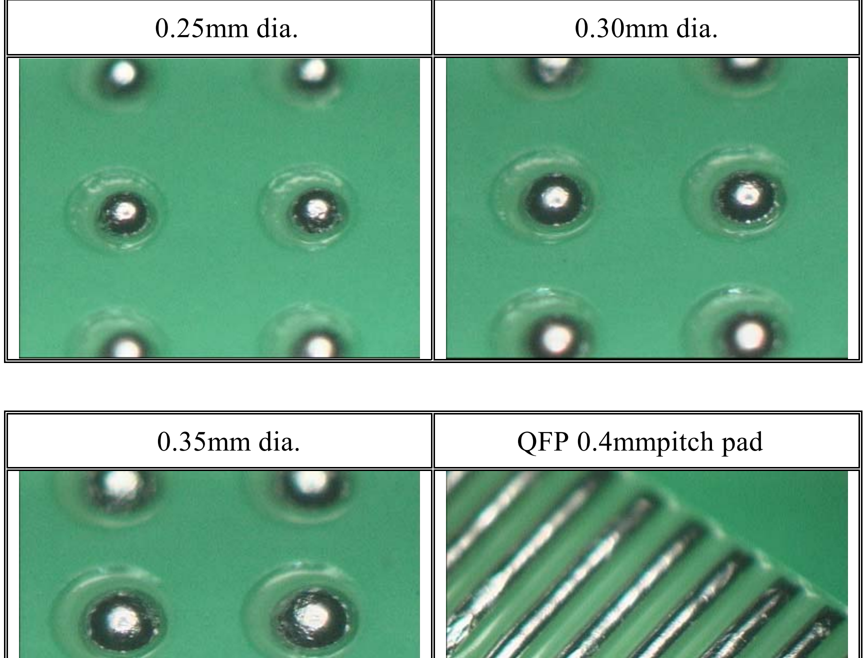
Stencil thickness	:	0.12 mm (laser cut)
Printer	:	Model MK-880SV (Minami Kogaku)
Stencil aperture	:	100% aperture opening to pad

3. Reflow condition

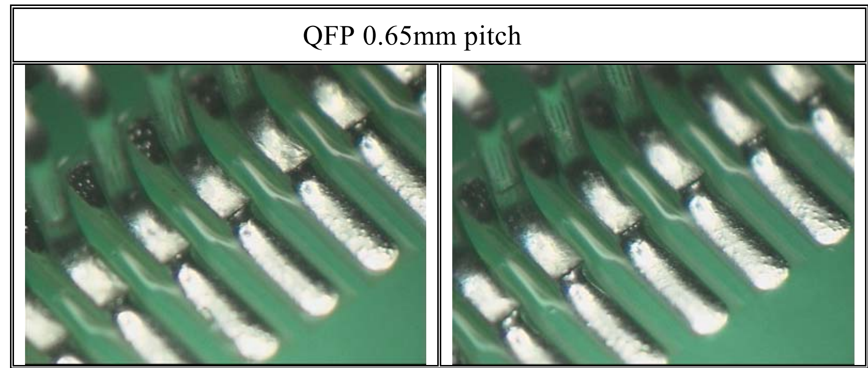
Reflow oven	:	Koki Model : APSR-257
Heat source	:	Hot air convection
Zone structure	:	3 pre-heat zones + 2 reflow zones
Atmosphere	:	Air
Temperature profile	:	



- Fine pattern result



- Wetting result

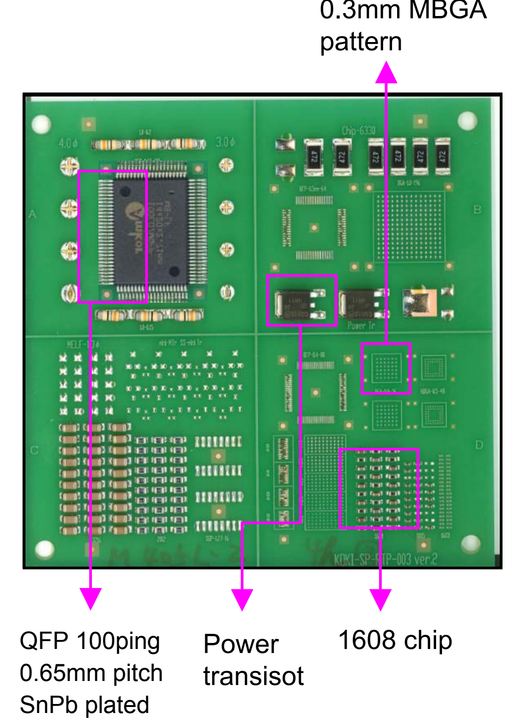


9. VOIDING

• Test method

1. Test board

Model	:	SPR-PTP-003 ver.2
Material	:	Glass epoxy FR-4
Dimension	:	80×100×1.6tmm
Surface treatment	:	OSP



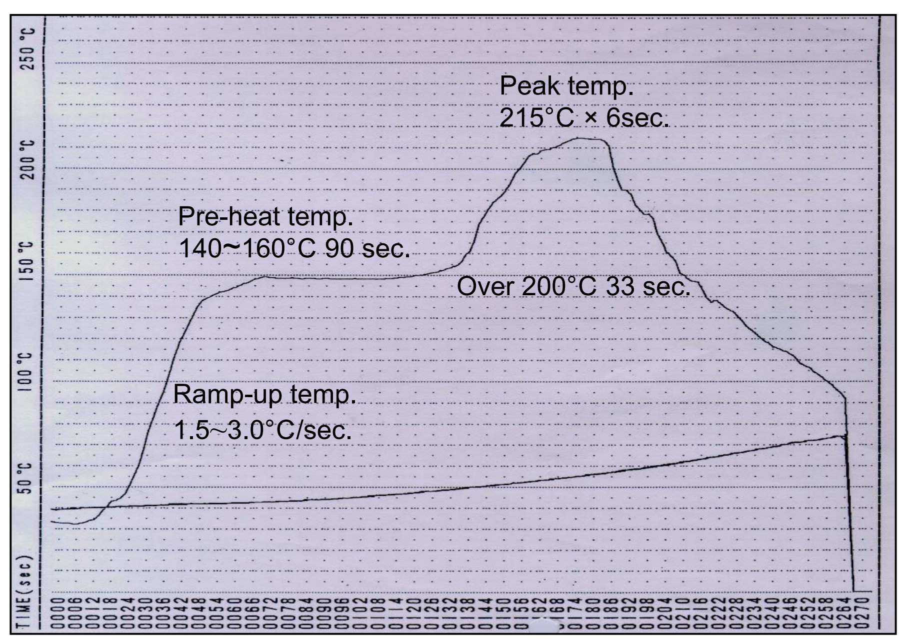
2. Print condition

Stencil thickness	:	0.12 mm (laser cut)
Printer	:	Model MK-880SV (Minami Kogaku)
Stencil aperture	:	100% aperture opening to pad

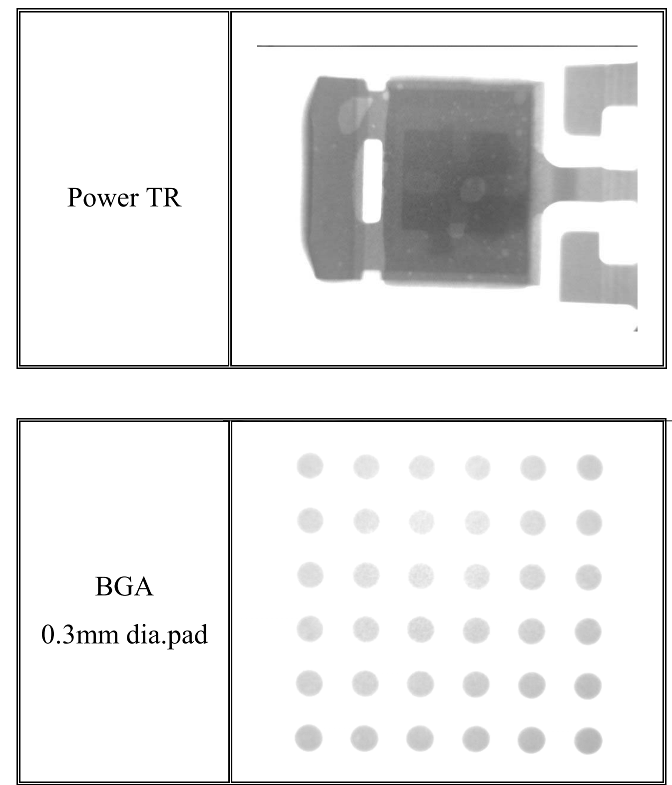
3. Reflow condition

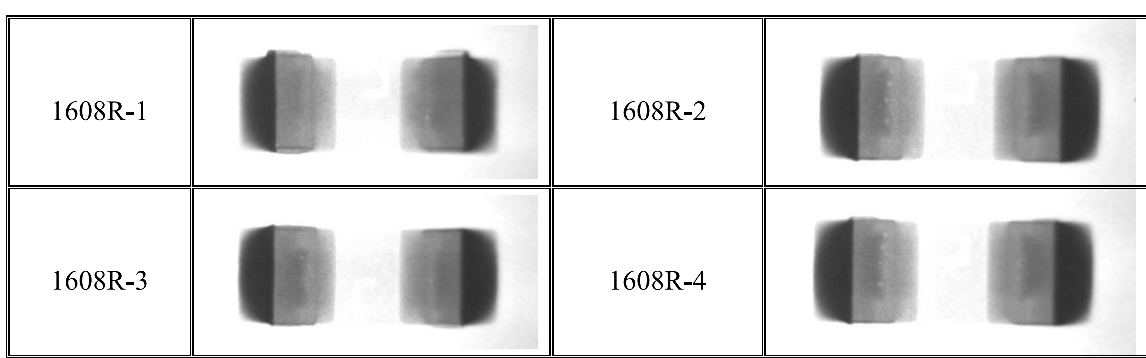
Reflow oven	:	Koki Model : APSR-257
Heat source	:	Hot air convection
Zone structure	:	3 pre-heat zones + 2 reflow zones
Atmosphere	:	Air
Temperature profile	:	

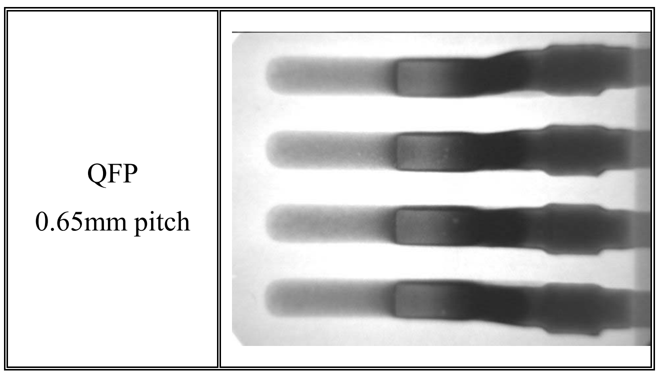
0603 chip pads



• Test result







10. DEWETTING

• Test method

Use as test plate of copper, 0.3×30×30mm in size cleaned with alcohol, and another copper plate subject it to an oxidizing treatment in an electric furnace maintained at about 150°C for 4 hour.

Also uses as test plate, a nickel plate, 0.3×30×30mm in size washed with alcohol.

Print the solder paste with a 0.15mm thick stencil provided with three 6.5mm diameter apertures.

After pre-heating on the hot plate at 150°C for 60 sec., melt the solder paste on the solder pot at 235±2°C for 30seconds after the solder has melted completely.

Assess the degree of dewetting with the following criteria.

Category	Dewetting condition
1	Solder has spread more than the area where solder paste was printed.
2	Solder has spread whole area where solder paste was printed..
3	Solder has partially spread.
4	Solder spread is less than the area where solder paste was printed

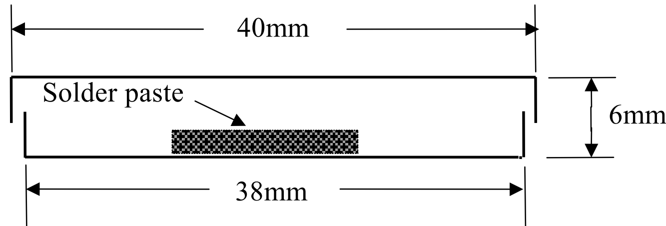
• Test result

Copper plate		Nickel plate
Cleaned	Oxidized	Cleaned
Category 1	Category 1	Category 3

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 grease from the 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 then rinse thoroughly with running tap water and demineralized water. Then finally, 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 a 6.5mm diameter aperture.

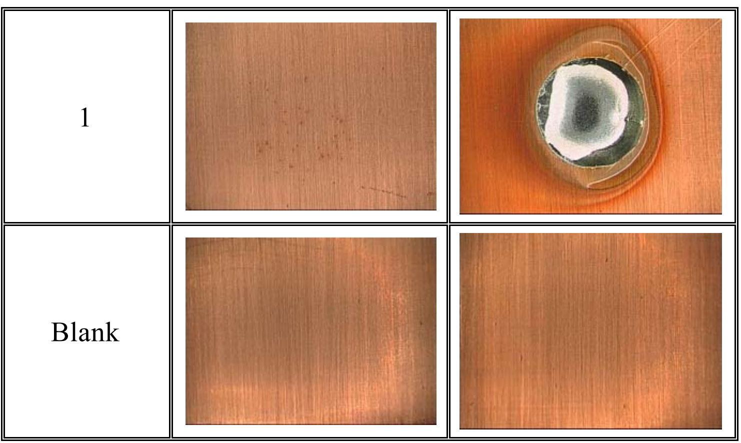
Place all three copper plate A over the copper plate B and lower each box in a horizontal position on to the surface of the solder bath at the temperature of 235±2°C and maintain the test pieces in this position for 5 seconds.

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 96 hours.

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

• Test results

n	Copper plate A	Copper plate B
1	No corrosion	No corrosion
2	No corrosion	No corrosion
Blank test	No corrosion	No corrosion



12. SURFACE INSULATION RESISTANCE

• Test method

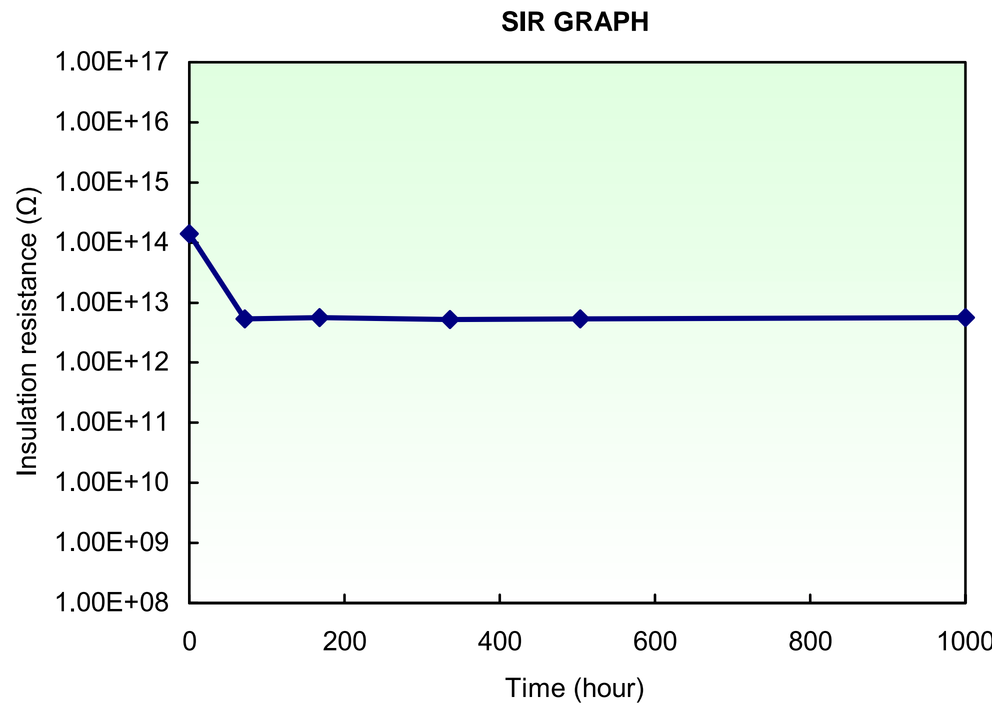
Print the solder paste on to comb type electrode JIS type-II (stencil thickness: 0.15mm) and the flux on to comb type electrode IPC type-A (stencil thickness: 0.1mm) each and reflow them to obtain test piece

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

Condition	Time (hour)	S.I.R. Value (Ω)
Out of thermohygrostat	Initial value	1.8×10^{14}
	72	5.3×10^{12}
	168	5.6×10^{12}
	336	5.2×10^{12}
	504	5.4×10^{12}
	1000	5.6×10^{12}



13. VOLTAGE APPLIED SIR
(Electromigration Test)

• Test method

Print the solder paste with a 0.1mm thick stencil on comb type electrode Type-II specified in JIS-Z-3196 6.8. and reflow them to obtain test pieces.

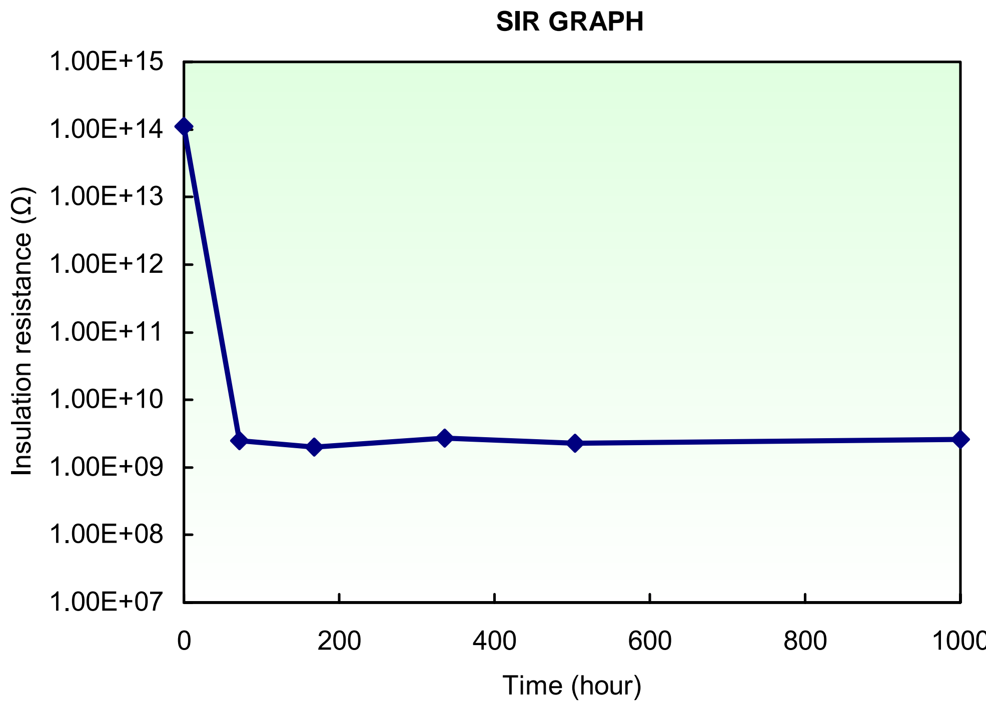
Put the test pieces in a thermogygrostat under the conditions of 85±2°C and 85±2%RH.

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	9.9×10^{13}
72	In thermohygrostat	2.5×10^{9}
168	In thermohygrostat	2.0×10^{9}
336	In thermohygrostat	2.7×10^{9}
504	In thermohygrostat	2.3×10^{9}
1000	In thermohygrostat	2.6×10^{9}

* There was no evidence of electromigration.



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 a solder paste out of the refrigerator, in which the temperature is controlled to be below 10°C, wait the paste temperature come back to a room temperature

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

Do not heat the paste.

2) Stirring

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

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

*Caution : When an automatic stirring equipment is used, do not stir the paste 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°
4. Pressure : Lowest.
5. Squeegee speed : 10~50mm/sec.

(2) Stencil

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

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

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

(3) Ambiance

1. Temperature : 25 ± 5°C
2. Humidity : 40~60%RH
3. Wind : Wind badly affects stencil life and tack performance of solder pastes.

*Caution : When local air conditioner is equipped, make sure it is not enhancing drying out of 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 (PC board).

   Ex. Size of PC board A5 - approx. 200gs
   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 must be required through out the printing process.

2. Add the paste to replenish only the consumed amount.

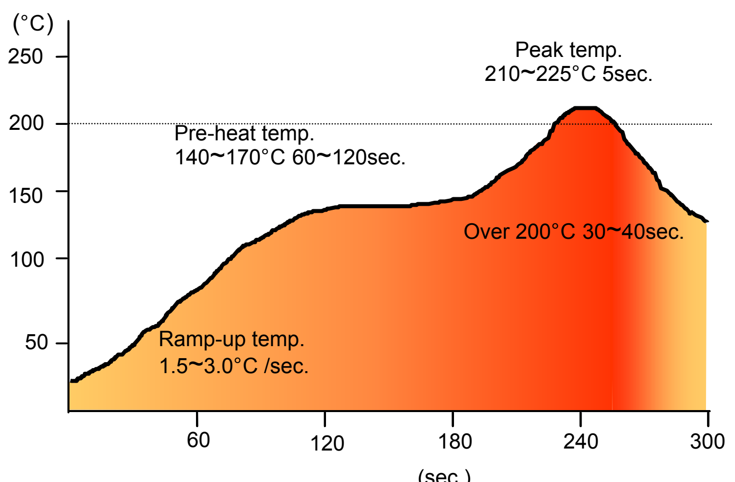
   *Minimize the amount of paste left on the stencil as the degradation gets accelerated once it is processed on the stencil.

3. Every after certain times of continuous printing, thoroughly clean the bottom side or both the top and bottom side of the stencil.

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 to prevent mixture and contamination of the fresh paste, but put it in a separate container for reuse, if necessary.

3. Reflowing



4. Storage

Store in a refrigerator at 10°C.

DO NOT FREEZE!

5. Shelf life

1) 0 ~ 10°C : 6 months from manufacturing date
2) At 20°C : 1 month from manufacturing date
3) At 30°C : 1 month from manufacturing date
* Manufacturing date can be obtained from the lot number