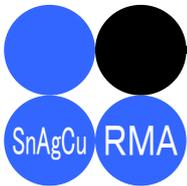


Lead-free Solder paste

EVASOL J3-8843-KG



Technical date

A. Feature 『Good wettability and antioxidation effect of flux』

We have considered active temperature and persistence of flux, and selected activator newly. As results of this, J3-8843-KG has good wettability and solves solder balls issue in high density products and micro pattern, and unmelted issue with minuteness of solder balls.

ΔT is large in products where a lot of big and micro parts are mounted. The ΔT cause locally over-heat and lack of heat, which occurs issue. And in case of minute solder powder and micro pattern, superficial area per volume of printed solder paste increase. That promotes oxidation of solder in pre-heat, which makes solder powder unmelted.

J3-8843-KG solves these issues, because this product contains activator which has heat resistance and wide active temperature region.

1. High temperature pre-heat test**B. Characteristic**

- 1. Solder powder shape and surface condition test**
- 2. Solder powder grain size distribution measurement test**
- 3. Halogen content test**
- 4. Silver-chromate test**
- 5. Copper mirror test**
- 6. Water solution resistance**
- 7. Solder ball test**
- 8. Copper plate corrosion test**
- 9. Printability of solder paste**
- 10. Slump-in-printing and heating test**
- 11. Tackiness test**
- 12. Spreading ratio**
- 13. Characteristics at the printing**
- 14. Insulation resistance test**
- 15. Voltage-applied moisture resistance test (Migration test)**
- 16. Wetting ability test**
- 17. Void test**
- 18. Storage stability**

Characteristics data

Test terms		Characteristic	Test method (based on JIS)	Test method
Alloy composition (%)		Sn:Balance, Ag:3.0, Cu:0.5	Allowable impurity level is based on JIS Z 3282 class-A	
Solidus temperature (°C)		217	DSC (Differential Scanning Calorimetry)	
Liquidus temperature (°C)		220		
Powder particle size (μm)		38~25	Reference by JIS Z 3284 Annex 1	
Flux contents (%)		12.0	Reference by JIS Z 3197 8.1.2	
Halide content (%)		0.010	Reference by JIS Z 3197 8.1.4.2.1	Reference by 2.3.35
Copper mirror test		No corrosion	Reference by JIS Z 3197 8.4.2	Reference by 2.3.32
Copper plate corrosion test		No corrosion	Reference by JIS Z 3197 8.4.1	Reference by 2.6.15
Insulation resistance test (Ω)		2.6x10 ⁹	Reference by JIS Z 3197 8.5.3 JIS type, 85°C-90RH%, 168hr DC100V in the chamber	Reference by 2.6.3.3
Voltage-applied moisture resistance test	Insulation resistance (Ω)	3.3x10 ¹⁰	Reference by JIS Z 3197 8.5.4 JIS type, 85°C-90RH%, 1000h, Applied DC48V DC100V in the chamber	
	Migration	No migration		
Dryness test		Passed	Reference by JIS Z 3197 8.5.1	
Spreading ratio (%)		82	Reference by JIS Z 3197 8.3.1.1	
Viscosity (Pa·s)		200	Reference by JIS Z 3284 Annex 6	
Thixotropy index		0.52		
Tackiness test	Initial (N)	1.5	Reference by JIS Z 3284 Annex 9	Reference by 2.4.44
	After 24 hour (N)	1.5		
Slump-in-printing	Pattern I	0.2	Reference by JIS Z 3284 Annex 7	Reference by 2.4.35
	Pattern II	0.2		
Slump-in-heating	Pattern I	0.4	Reference by JIS Z 3284 Annex 8	
	Pattern II	0.3		

* Above values are typical values.

* This solder paste includes non-ionic halide activator.

A. Feature

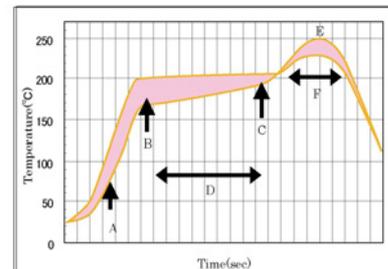
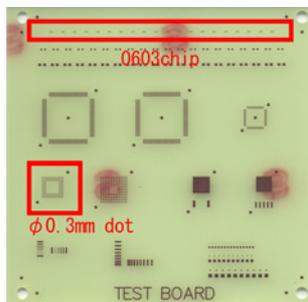
1. High temperature pre-heat test

Test method:

Print the solder paste on the evaluation board shown, and mount the 0603 chip(0.6 x 0.3mm, Sn plating) on it. Then reflow the test board in air atmosphere with temperature profiles, and observe the wetting.

• Temperature profile condition:

Elevation rate: A→B	2.0~4.0°C/sec
Preheat start temp: B	170~190°C
Preheat end temp: C	190~210°C
Preheat preserve time: D	90~140sec
Peak temp: E	230~250°C
More than 220°C: F	30~60sec
Elevation rate: C→E	2.0~3.0°C/sec



• Evaluation board:

Material of board: glass-epoxy board (FR-4)
Size of board: 100 x 100 x 1.6mm

• Printing condition

Printer: TPM200 (HITACHI)
Material of squeegee: urethane
Thickness of stencil: 0.15mm
Velocity: 30mm/s Pressure: 45N
Releasing rate of stencil: 0.5mm/s
Temperature: 25°C

Test result:

	J3-8843-KG	Product of other company
φ0.3 dot pattern	 Good	 Unmelted
0603 chip	 Good	 Unmelted

B. Characteristic

1. Solder powder shape and surface condition test

Test method:

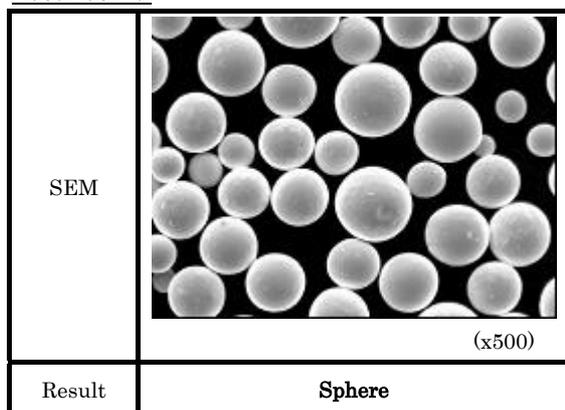
It is observed by scanning electron microscope. (SEM)

Model: SEDX (SSX-550 : by SHIMADZU)

Standard:

Reference by JIS Z 3284 annex 1.

Test result:



2. Solder powder grain size distribution measurement test

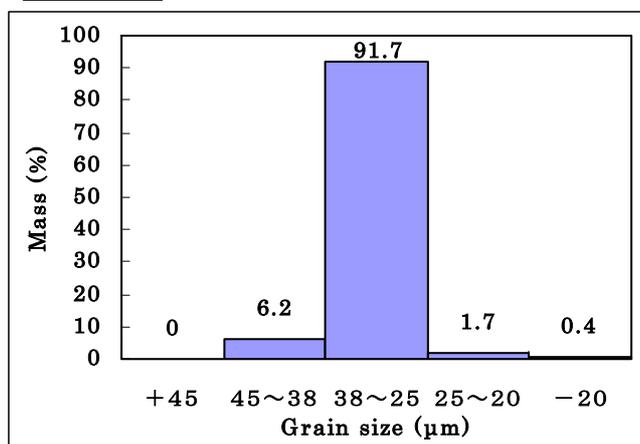
Test method:

This test method is reference by JIS Z 3284 annex 1. Measure the solder powder by using a sonic shifter for 30min. Obtain the respective weights of the powder groups whose grain size is over, within and under the acceptable range of nominal grain size distribution, and indicate the measured values as the mass% for the sample.

Standard:

It consists of more than 45 μ m (0%), 45~38 μ m (under 15%), 25~20 μ m (under 7%), less than 20 μ m (under 1%).

Test result:



3. Halogen content test

Test method:

This test is defined by JIS Z 3197 8.1.4.2.1. Weigh 0.5±0.1g of flux at the accuracy of 0.001g and put it into a 300ml beaker. Add 200ml of 2-propanol and stir it at normal temperature to make test solution. Putting an electrode into the beaker, place the beaker on a magnetic stirrer. Stir strongly, and titrate with silver nitrate standard solution.

Standard:

Halide content shall be less than 0.02 (%).

Test result:

Halide content (%)	0.010
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4. Silver-chromate test

Test method:

This test method is reference by JIS Z 3197 8.1.4.2.3. On a silver chromate test paper, place one drop of the specimen and at once drop of chlorine reference solution.

At this time, the distance between the two drops shall be 20mm or more. Leave the paper for 15 sec. and remove the flux on it with 2-propanol and dry it.

Discoloring to white or off-white means the existence of halide in the flux.

Standard:

It's not white color in comparison with standard paper.

Test Result:

	J3-8843-KG	Standard (reference)
Sample		
Result	Passed	

5. Copper mirror test

Test method:

This test method is reference by JIS Z 3197 8.4.2. Place the copper mirror test piece facing the mirror upward on a horizontal plane. Drop 0.05ml of specimen on the face. Drop 0.05ml of reference rosin at the spot of 35mm away. Put the test piece in the thermoregulator kept at $25 \pm 2^\circ\text{C}$, relative humidity $50 \pm 5\%$, within 5 min after dropping, and leave them for 24hr After 24hr, take out the test piece and remove the flux with 2-propanol, and dry it.

Standard:

No corrosion

Test result:

	J3-8843-KG	WWRosin (Reference)
Sample		
Result	No corrosion	

6. Water solution resistance test

Test method:

This test method is reference by JIS Z 3197 8.1.1. Measure the resistivity of purified water with an electric conductivity meter. Put the specimen to $0.05 \pm 0.005\text{g}$ into a beaker with 50ml of purified water. Cover the beaker with a watch glass. The beaker capped with a watch glass shall be heated on a hot plate and be boiled 60sec. Then, it shall be cooled in running water and be placed in a test tank kept at $20 \pm 2^\circ\text{C}$. After heat is balanced, the resistivity of it shall be measured with an electric conductivity meter.

Test result:

	Resistivity (Ωm)	Average (Ωm)
Sample 1	1080	1073
Sample 2	1100	
Sample 3	1040	

7. Solder ball test

Test method:

This test method is reference by JIS Z 3284 annex 11. Place the stencil (6.5mm in diameter and 0.2mm in thickness) on the ceramic substrate (50 x 50 x 0.3 mm) and print the solder paste. Heat and dissolve one of two test pieces under the condition.

Condition a Within 1hr. after printing.

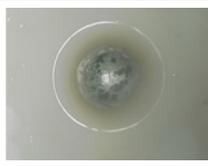
Condition b After being left for 24hr.

Humidity: $60 \pm 20\%$

Temperature: $25 \pm 2^\circ\text{C}$

The solder paste melted for 5 sec. and leave it to be cooled until the test specimen is solidified. The solidified solder shall be observed by magnifier.

Test result:

	Condition a	Condition b
Sample		
Result	Degree 1	Degree 1

8. Copper plate corrosion test

Test method:

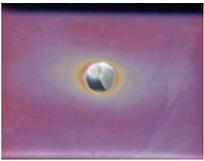
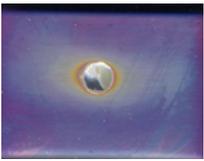
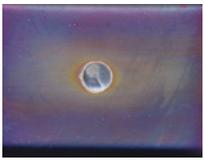
This test method is reference by JIS Z 3197 8.4.1. 2 pieces of copper plate with the size of 50 x 50 x 0.5mm shall be bent at right angles at 5mm from the both edges and other 2 pieces at 6mm from the both edges, and called plates A and B respectively. Solder paste shall be printed on the copper plate B by using the stencil, and circular solder paste of 6.5mm in diameter and of 0.2mm in thickness shall be made. Put the copper plate A as a cap to be a test piece. Put plate A as a cap on plate B on which solder paste is not applied. (It shall be taken as a blank test piece.) Reflow the pieces and cool it down.

Leave the test piece and the blank piece in the thermoregulator adjusted at the temperature $40 \pm 2^\circ\text{C}$ and the relative humidity 90~95% for 96hr. After 96hr, take out them from the thermoregulator and inspect the corrosion. Compare with the reference (blank) piece.

Standard:

No corrosion.

Test result:

	Copper A	Copper B
Initial		
96hr (Before cleaning)		
96hr (After cleaning)		
Result	No corrosion	No corrosion

9. Printability of solder pasteTest method:

Measure the viscosity by PCU-203 (Malcom), after the continuous printing test

• Test condition:

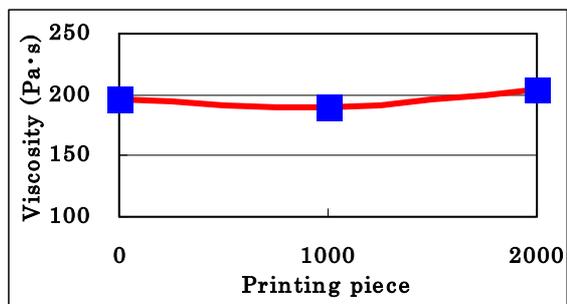
Printing machine: Technos TQ-1100
(Qualtec)

Printing speed: 35 mm/s

Temperature: 25°C

Test result:

	Initial	1000	2000
Viscosity (Pa·s)	195.8	189.3	205.0
Thixotropy index	0.52	0.53	0.52
Non recoverability (%)	4.26	3.38	3.37

10. Slump-in-printing and heating testTest method:

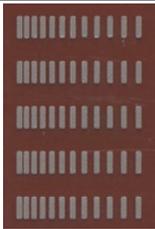
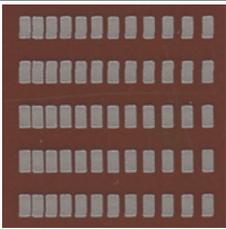
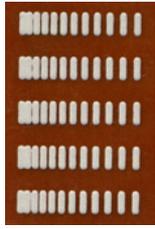
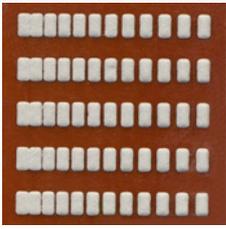
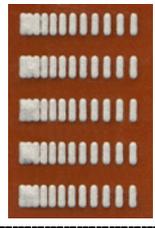
This test method is reference by JIS Z 3284 annex 7 and 8. The stencil for slump evaluating test has two pattern holes. ((I)3.0x0.7mm and (II)3.0x1.5mm) It has the interval of holes from 0.2mm to 1.2mm by each 0.1mm. The test condition is as follows:

Condition a: Keep the printed test plate at the room temperature for 1hr.

Condition b: Heat the printed test plate for 1min at 150 and 180°C.

Measure and record the minimum interval where no printed solder pastes are integrated out of 5 rows of patterns of two kinds.

Test result:

		Pattern I	Pattern II
Condition a			
Result		0.2	0.2
Condition b	150°C		
	Result	0.4	0.3
	180°C		
	Result	0.4	0.4

(Unit:mm)

11. Tackiness test

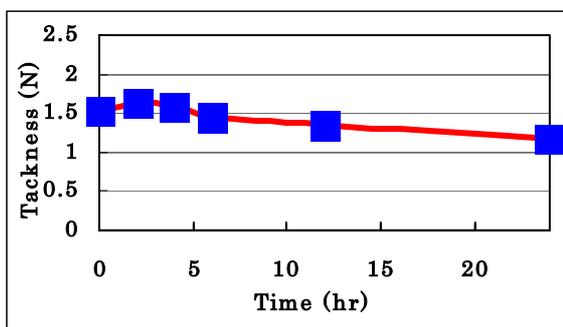
Test method:

This test method is reference by JIS Z 3284 annex 9. The solder paste is printed on the ceramic plate by using the stencil, and four circular solder pastes of 6.5mm in diameter and of 0.2mm in thickness shall be made. The test specimen shall be placed under the probe. The probe shall be lowered into the printed paste at the speed of 2.0mm/s, and pressurized at the specified pressure of 50±5g. After pressurization, the probe is pulled upward out of the solder paste at the speed of 10mm/s within 0.2s, and the maximum load required for the separation is recorded. The measured values shall be averaged, and the tackiness strength shall be calculated from these load values.

Test result:

Time (hr)	0	2	4	6	12	24
Tackiness(N)	1.49	1.61	1.64	1.68	1.73	1.54

(n = 5)

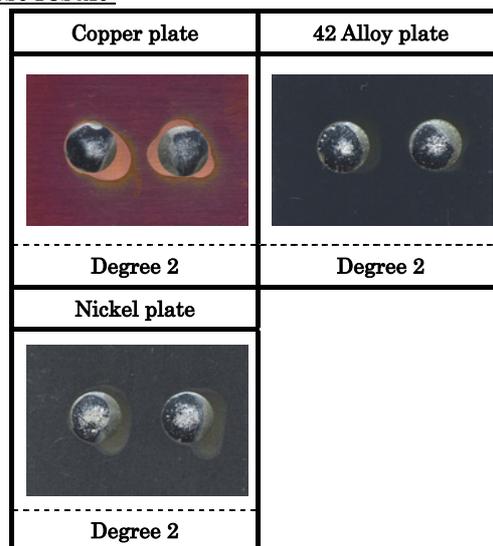


12. Wetting effect and de-wetting test

Test method:

This test method is reference by JIS Z 3284 annex 10. Dip one side of the copper, nickel and the 42 alloy plate with the size of 30 x 30 x 0.3mm in 2-propanol and polish with polishing paper. Reflow substrate after printing. The degree of spread shall be classified.

Test result:

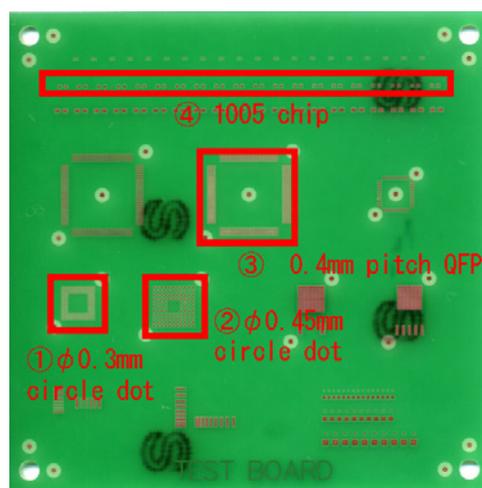


13. Characteristics at the printing

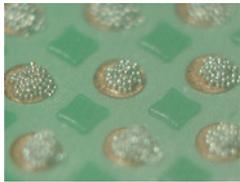
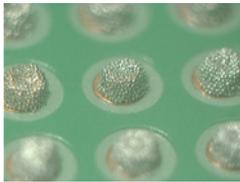
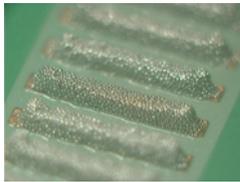
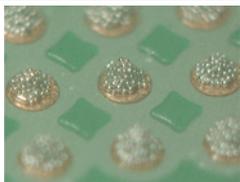
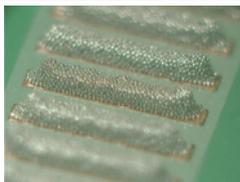
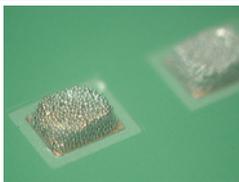
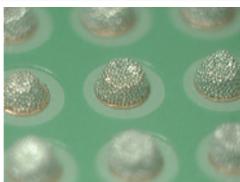
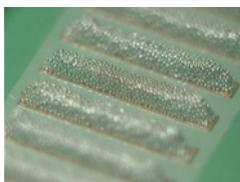
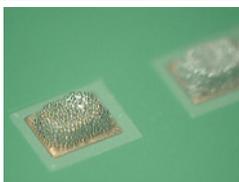
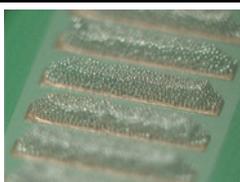
Test method:

Print solder paste on the evaluation board shown with the stencil at initial, 500, 1000 and 2000.

- Evaluation board:
 - Material of board: glass-epoxy board (FR-4)
 - Size of board: 100 x 130 x 1.6mm
- Printing condition:
 - Printer: TPM200 (HITACHI)
 - Material of squeegee: urethane
 - Thickness of stencil: 0.15mm
 - Velocity: 30mm/s, Pressure: 45N
 - Releasing rate of stencil: 0.5mm/s
 - Temperature: 25°C



Test result:

Number of pieces	1 (φ 0.30 circle dot)	2 (φ 0.45 circle dot)	3 (0.4mm Pitch QFP)	4 (1005 Chip)
Initial				
500				
After one hour interval				
1000				
2000				

14. Insulation resistance test

Test method:

This test method is reference by JIS Z 3197 8.5.3. 3 test pieces shall be prepared. The insulation resistance between the terminals shall be measured at the test voltage of DC 100V by using an insulation resistance tester before test piece is placed in a thermo-hygrostat. The test piece shall be placed in a thermo-hygrostat kept at the temperature 85°C and the relative humidity 90%. The insulation resistance shall be measured at DC 100V in the thermo-hygrostat at the time of 24hr, 96hr, 168hr, 408hr, 648hr, 840hr and 1008hr after the test piece is placed in it. The test shall be carried out for 3 test pieces, and the geometric mean of the respective measurements shall be calculated.

Test result:

	Initial	24hr	96hr	168hr
Sample 1	1.6×10^{13}	5.5×10^8	7.3×10^8	7.5×10^8
Sample 2	3.7×10^{13}	2.0×10^9	1.5×10^9	1.3×10^9
Sample 3	3.2×10^{13}	2.2×10^9	1.4×10^9	1.8×10^9
Average	2.7×10^{13}	1.3×10^9	1.2×10^9	1.2×10^9
	408hr	648hr	840hr	1008hr
Sample 1	1.4×10^9	3.3×10^9	1.4×10^{10}	4.1×10^{10}
Sample 2	4.0×10^9	1.4×10^{10}	1.6×10^{10}	3.1×10^{10}
Sample 3	3.1×10^9	5.1×10^9	2.8×10^{10}	3.2×10^{10}
Average	2.6×10^9	6.2×10^9	1.8×10^{10}	3.4×10^{10}

(Unit : Ω)

15. Voltage-applied moisture resistance test (Migration test)

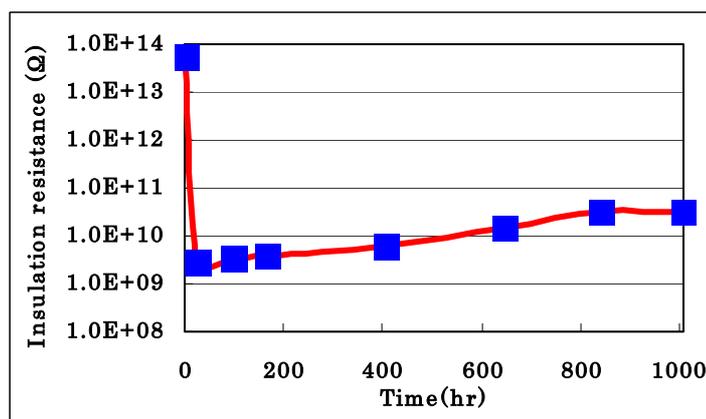
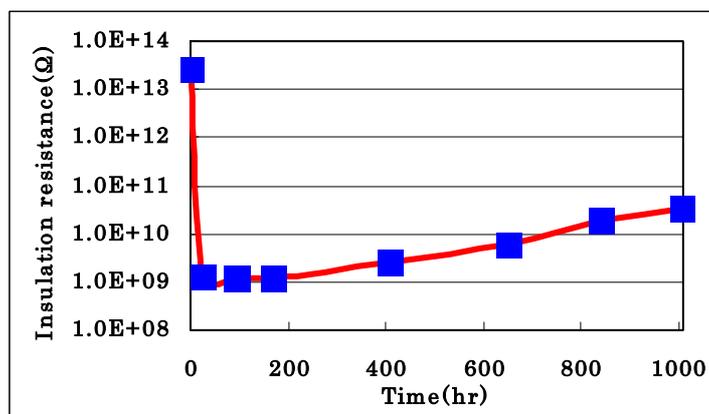
Test method:

This test method is reference by JIS Z 3197 8.5.4. The test piece shall be placed in a thermo-hygrostat kept at the temperature 85°C and the relative humidity 90%, and apply the voltage DC 48V between the electrodes. The insulation resistance shall be measured at DC 100V in the thermo-hygrostat at the time of 24hr, 96hr, 168hr, 408hr, 648hr, 840hr and 1008hr after the test piece is placed in it. Take the test piece out of the thermo-hygrostat 1008hr after the test piece is placed in it, and check for the migration by using a magnifier. The test shall be carried out for 3 test pieces.

Test result:

No migration

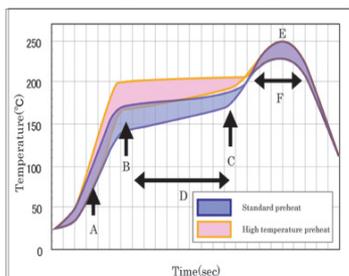
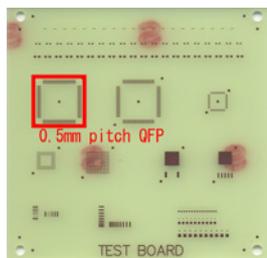
	Initial	24hr	96hr	168hr
Sample 1	4.1×10^{13}	2.5×10^9	3.1×10^9	3.5×10^9
Sample 2	3.5×10^{13}	3.0×10^9	4.0×10^9	3.2×10^9
Sample 3	1.1×10^{14}	2.8×10^9	3.7×10^9	5.6×10^9
Average	5.4×10^{13}	2.8×10^9	3.6×10^9	4.0×10^9
	408hr	648hr	840hr	1008hr
Sample 1	6.0×10^9	1.5×10^{10}	3.4×10^{10}	2.1×10^{10}
Sample 2	8.1×10^9	1.0×10^{10}	3.0×10^{10}	4.1×10^{10}
Sample 3	5.0×10^9	2.1×10^{10}	2.8×10^{10}	3.7×10^{10}
Average	6.2×10^9	1.5×10^{10}	3.1×10^{10}	3.2×10^{10}

(Unit : Ω)

16. Wetting ability test

Test method:

Print the solder paste on the evaluation board shown, and mount the QFP (Pitch: 0.5mm, Sn plating) on it. Then reflow the test board in air atmosphere with two temperature profiles (preheat 160°C, 200°C), and observe the wetting.



• Temperature profile condition:

	<160°C pre>	<200°C pre>
Elevation rate: A→B	2.0~4.0°C/sec	2.0~4.0°C/sec
Preheat start temp: B	150~170°C	170~190°C
Preheat end temp: C	170~190°C	190~210°C
Preheat preserve time: D	90~140sec	90~140sec
Peak temp: E	230~250°C	230~250°C
More than 220°C: F	30~60sec	30~60sec
Elevation rate: C→E	2.0~3.0°C/sec	2.0~3.0°C/sec

• Evaluation board:

Material of board: glass-epoxy board (FR-4)
Size of board: 100 x 100 x 1.6mm

• Printing condition

Printer: TPM200 (HITACHI)
Material of squeegee: urethane
Thickness of stencil: 0.15mm
Velocity: 30mm/s Pressure: 45N
Releasing rate of stencil: 0.5mm/s
Temperature: 25°C

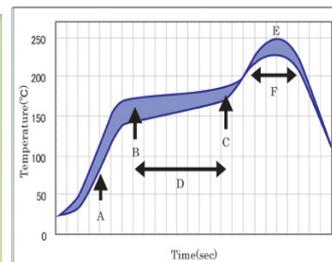
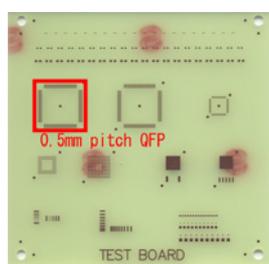
Test result:

	QFP front	QFP back
Preheat 160°C	 Good	 Good
Preheat 200°C	 Good	 Good

17. Void test

Test method:

Print solder paste on the evaluation board shown, and after reflow, inspect the void by X-ray inspector.



• Temperature profile condition

Elevation rate: A→B	2.0~4.0°C/sec
Preheat start temp: B	150~170°C
Preheat end temp: C	170~190°C
Preheat preserve time: D	90~140sec
Peak temp: E	230~250°C
More than 220°C: F	30~60sec
Elevation rate: C→E	2.0~3.0°C/sec

• Evaluation board:

Material of board: glass-epoxy board (FR-4)
Size of board: 100 x 100 x 1.6mm

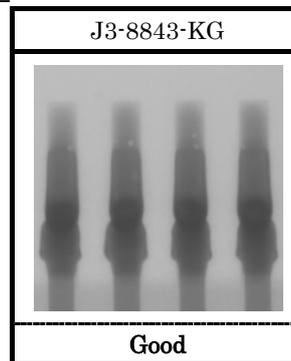
• Printing condition

Printer: TPM200 (HITACHI)
Material of squeegee: urethane
Thickness of stencil: 0.15mm
Velocity: 30mm/s Pressure: 45N
Releasing rate of stencil: 0.5mm/s
Temperature: 25°C

Standard:

No bigger voids comparison with conventional product.

Test result:



18. Storage stability

Test method:

Measure the viscosity of the solder paste, which stored at 4°C, by PCU-203 (Malcom).

Test result:

	Viscosity (Pa·s) / Thixotropy index
Initial	196 / 0.52
1 months	199 / 0.53
2 months	198 / 0.53
3 months	205 / 0.53

