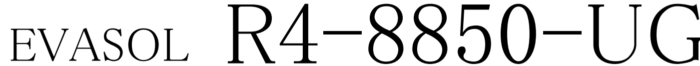
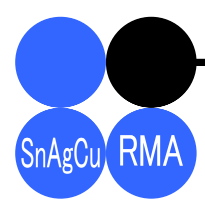
Lead-free Solder paste

EVASOL R4-8850-UG





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Characteristics data

Test terms		Standard	Characteristic	Test method
Alloy composition (%)		Sn:Balance, Ag:0.3, Cu:0.7	Sn:Balance, Ag:0.3, Cu:0.7	Allowable impurity level is based on JIS Z 3282 class-A
Solidus temperature (℃)		217	217	DSC (Differential Scanning Calorimetry)
Liquidus temperature (℃)		226	226	
Powder particle size (μm)		38～20	38～20	Reference by JIS Z 3284 Annex 1
Flux contents (%)		11.5±1.0	11.5	Reference by JIS Z 3197 8.1.2
Halide content (%)		< 0.01	0.002	Reference by JIS Z 3197 8.1.4.2.1
Copper mirror test		No corrosion	No corrosion	Reference by JIS Z 3197 8.4.2
Copper plate corrosion test		No corrosion	No corrosion	Reference by JIS Z 3197 8.4.1
Insulation resistance test (Ω)		≧5.0x10^{8}	1.7x10^{9}	Reference by JIS Z 3197 8.5.3 JIS-2 type, 85℃-90RH%, 168hr DC100V in the chamber
Voltage-applied moisture resistance test	Insulation resistance (Ω)	≧5.0x10^{8}	2.1x10^{10}	Reference by JIS Z 3197 8.5.4 JIS-2 type, 85℃-90RH%, 1000h, Applied DC48V DC100V in the chamber
	Migration	No migration	No migration	
Dryness test		Passed	Passed	Reference by JIS Z 3197 8.5.1
Spreading ratio (%)		≧75	82	Reference by JIS Z 3197 8.3.1.1
Viscosity (Pa・s)		200±30	200	Reference by JIS Z 3284 Annex 6
Thixotropy index		0.53±0.1	0.52	
Tackiness test	Initial (N)	≧1.2	1.5	Reference by JIS Z 3284 Annex 9
	After 24 hour (N)	≧1.0	1.3	
Slump-in-printing	Pattern I	≦0.2	0.2	Reference by JIS Z 3284 Annex 7
	Pattern II	≦0.2	0.2	
Slump-in-heating	Pattern I	≦0.4	0.2	Reference by JIS Z 3284 Annex 8
	Pattern II	≦0.4	0.2	

＊Above values are typical values.

＊This solder paste includes non-ionic halide activator.

1. Solder powder shape and surface condition test

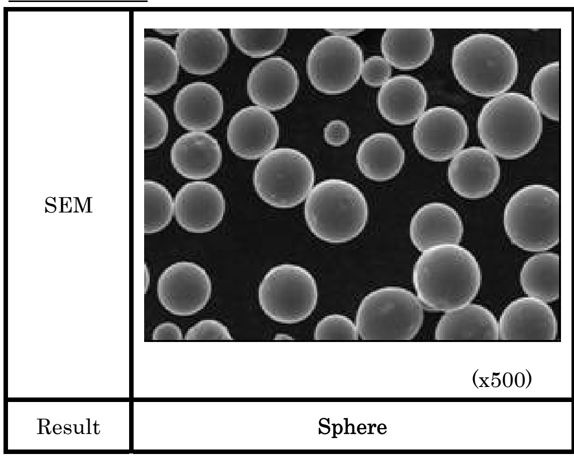
Test method:

It is observed by scanning electron microscope. (SEM)
Model: SEDX (SSX-550 : by SHIMADZU)

Standard:

Reference by JIS Z 3284 annex 1.

Test result:



SEM	(x500)
Result	Sphere

2. Solder powder grain size distribution measurement test

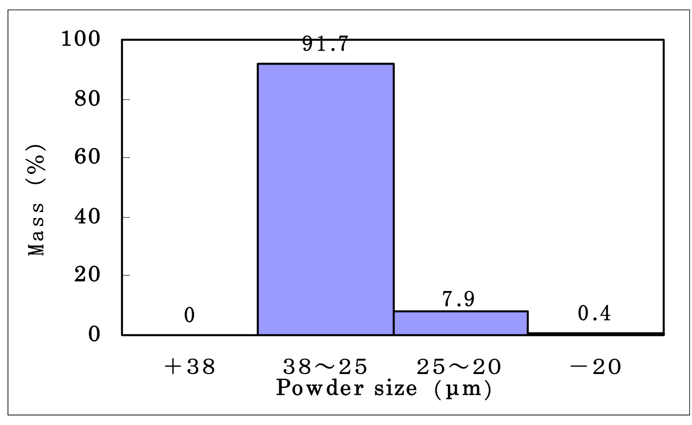
Test method:

This test method is reference by JIS Z 3284 annex 1. Measure the solder powder by using a sonic shifter for (TSUTSUI SCIENTIFIC INSTRUMENTS CO., LTD). 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 38 μ m (under 1%),38 ～20 μ m(90% minimum between), less than 20 μ m (under 10%).

Test result:



3. Halogen content test

Test method:

This test is defined by JIS Z 3197 8.1.4.2.1.
Weigh 5.0±0.1g of flux and put it into a 100ml beaker.
Add 100ml 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 0.01 (%).

Test result:

Halide content (%)	0.002

4. Silver-chromate test

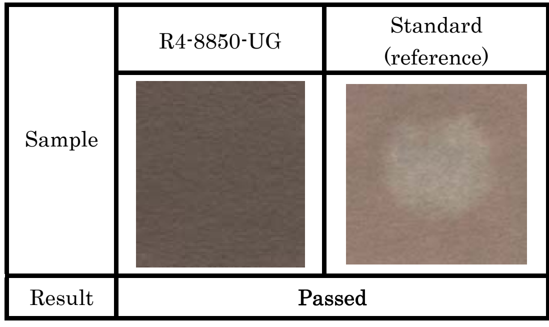
Test method:

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 (2-propanol solution of flux 25 mass%) and at once drop of chlorine reference solution.
At this time, the distance between the two drops shall be 20mm or more. 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:



	R4-8850-UG	Standard (reference)
Sample		
Result	Passed	

5. Copper mirror test

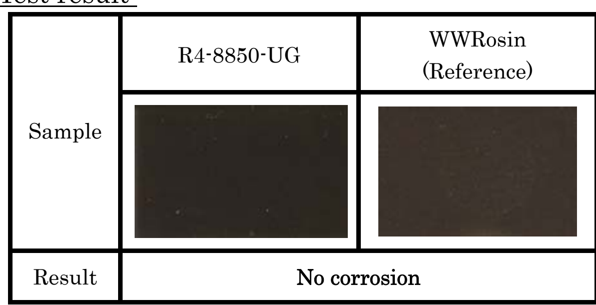
Test method:

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 (2-propanol solution of flux 25 mass%) 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±2℃, relative humidity 50 ± 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:



Sample	R4-8850-UG	WWRosin (Reference)
Result	No corrosion	

6. 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 (28 x 50 x 0.6 ㎜) 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±20%
Temperature: 25±2℃

After cleaning surface of melting solder put substrate printed on solder bath holizontally. 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**

7. Copper plate corrosion test

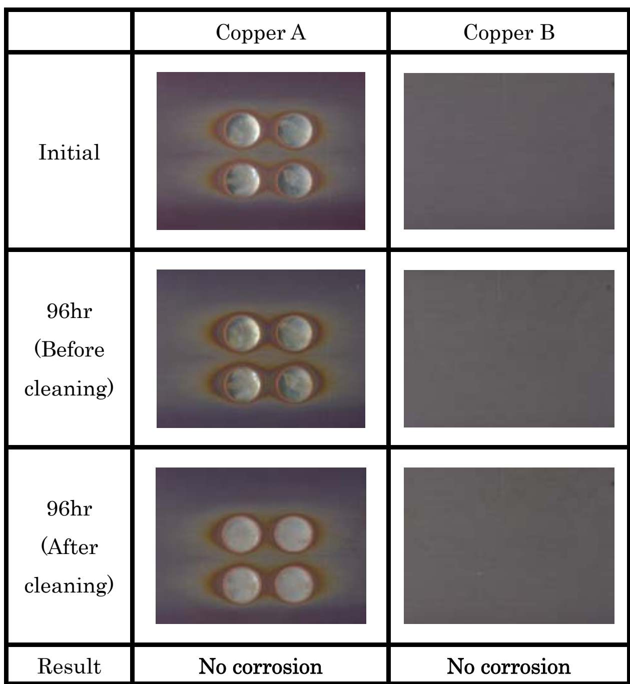
Test method:

This test method is reference by JIS Z 3197 8.4.1. 6 pieces dephosphate copper plate(JIS H 3100) with the size of 50 x 50 x 0.5mm shall be prepared. 3 pieces of these shall be bent at right angles at 5mm from the both edges and other 3 pieces shall be bent at right angles at 6mm from the both edges, (plate A and B respectively). Degrease these plate with acetone and dip in sulfuric acid (around 65℃,5%), ammonium persalfate (25mass%) for 1min, then rinse in running water for 5 sec. And dip in sulfuric acid (5%) and rinse in running water for 5sec. There rinse again in purified water enough and immediately rinse with acetone. 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. And 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 pieces and the blank piece in the thermoregulator adjusted at the temperature 40°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

8. Printability of solder paste

Test method:

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

・Test condition:

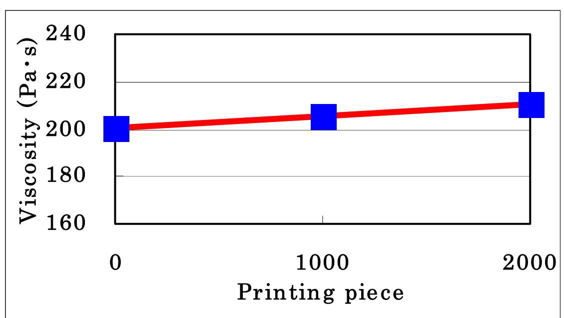
Printing machine: Technos TQ-1100 (Qualtec)

Printing speed: 35 ㎜/s

Temperature: 25℃

Test result:

	Initial	1000	2000
Viscosity (Pa･s)	200	204.5	210.7
Thixotropy index	0.52	0.52	0.53
Non recoverability (%)	1.51	1.34	2.12



9. Slump-in-printing and heating test

Test 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℃.

Measure and record the minimum interval where printed solder pastes aren't 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℃		
	Result	0.2	0.2
	180℃		
	Result	0.2	0.2

(Unit:㎜)

10. Tackiness test

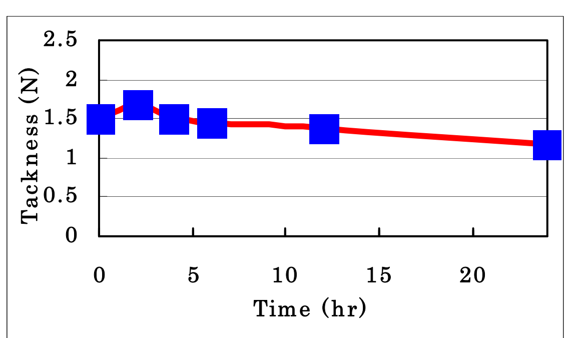
Test method:

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 five circular solder pastes of 6.5mm in diameter and of 0.2mm in thickness shall be made. The test specimen prepared in the above procedures shall be kept under the condition of the temperature of 25 ± 2 ℃ and the relative humidity of 50 ± 10% until the test is carried out. 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)	1.45	1.51	1.43	1.32	1.39	1.34

(n = 5)

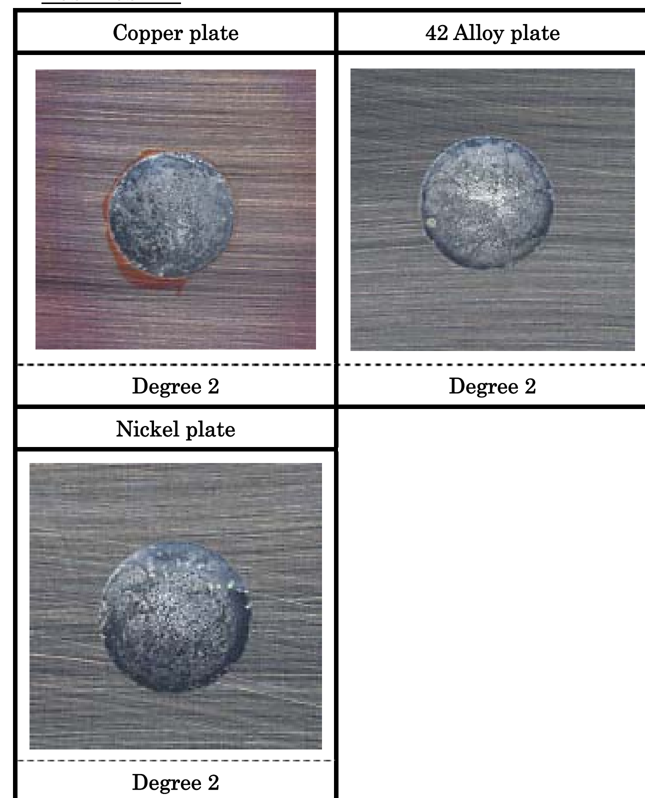


11. Wetting effect and de-wetting test

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. Print solder paste on each plate by using stencil and circular solder paste of 6.5mm in diameter and of 0.2mm in thickness shall be made. Reflow substrate after printing. The degree of spread shall be classified.

Test result:

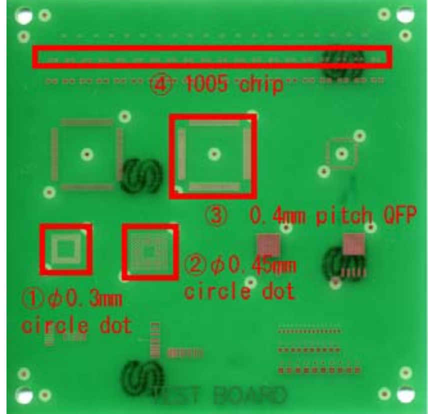


12. Characteristics at the printing

Test method:

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

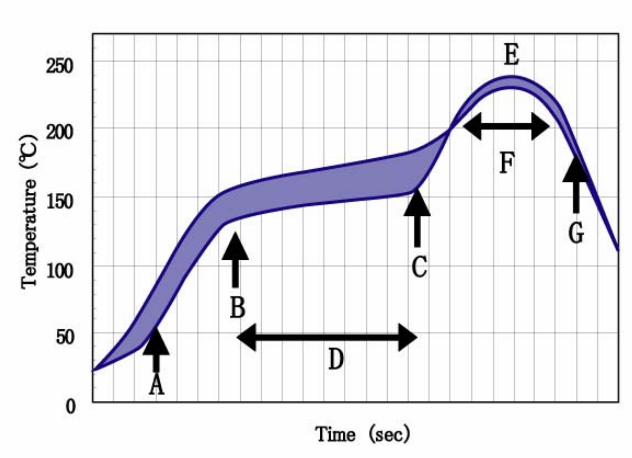
- Evaluation board:
  - Material of board: glass-epoxy board (FR-4)
  - Size of board: 100 x 100 x 1.6mm
- Printing condition:
  - Printer: TPM200 (HITACHI)
  - Material of squeegee: urethane
  - Thickness of stencil: 0.15mm
  - Velocity: 30mm/s
  - Releasing rate of stencil: 0.5mm/s
  - Temperature: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



Test result:

Number of pieces	1 (φ0.3 circle dot)	2 (φ0.45 circle dot)	3 (0.4mm Pitch QFP)	4 (1005 Chip)
Initial				
500				
After one hour interval				
1000				
2000				

Temperature profile



Elevation rate: A→B	1.0～3.0℃/sec
Preheat start temp: B	150～170℃
Preheat end temp: C	170～190℃
Preheat preserve time: D	60～140sec
Peak temp: E	230～255℃
More than 220℃: F	30～100sec
Cooling rate: E→G (235～180℃)	≧1.0℃/sec

13. Insulation resistance test

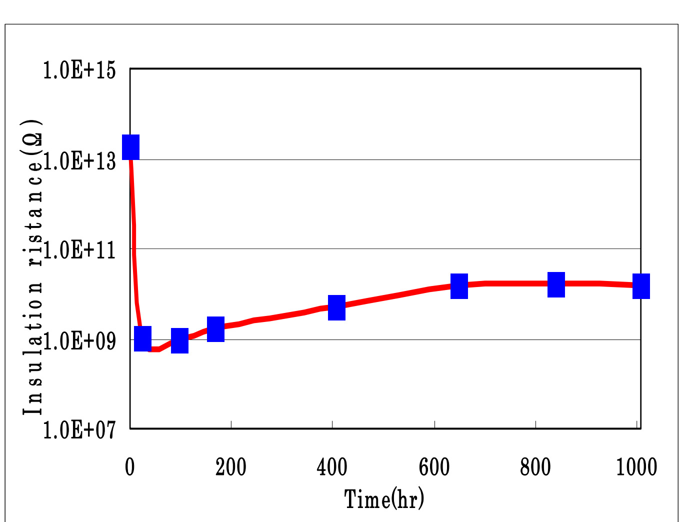
Test method:

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-hygro stat. The test pieces shall be placed in a thermohygrostat kept at the temperature 85°C and the relative humidity 90%. The insulation resistance shall be measured at DC 100V in the thermohygrostat 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 test pieces, and the geometric mean of the respective measurements shall be calculated.

Test result:

	Initial	24hr	96hr	168hr
Sample 1	1.8×10^{13}	9.1×10^{8}	7.4×10^{8}	9.0×10^{8}
Sample 2	2.1×10^{13}	1.3×10^{9}	9.4×10^{8}	1.6×10^{9}
Sample 3	1.7×10^{13}	8.9×10^{8}	1.4×10^{9}	3.2×10^{9}
Average	**1.8×10^{13}**	**1.0×10^{9}**	**9.8×10^{8}**	**1.7×10^{9}**
	408hr	648hr	840hr	1008hr
Sample 1	3.5×10^{9}	1.4×10^{10}	2.4×10^{10}	1.3×10^{10}
Sample 2	4.7×10^{9}	1.5×10^{10}	1.1×10^{10}	1.3×10^{10}
Sample 3	9.3×10^{9}	1.9×10^{10}	1.9×10^{10}	1.9×10^{10}
Average	**5.4×10^{9}**	**1.6×10^{10}**	**1.7×10^{10}**	**1.5×10^{10}**

(Unit： Ω)



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

Test method:

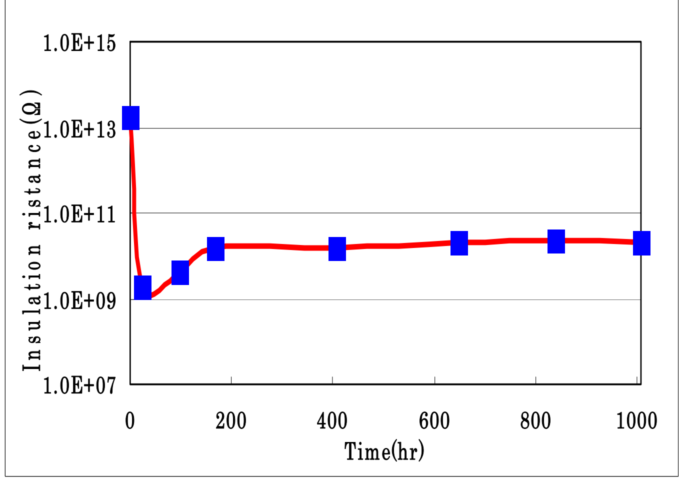
This test method is reference by JIS Z 3197 8.5.4. 3 test pieces shall be placed in a thermohygrostat kept at the temperature 85°C and the relative humidity 90%, and apply the voltage DC 48V between the electrodes. The insulation resistance shall be measured at DC 100V in the thermo-hygrostat at the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

Test result:

No migration

	Initial	24hr	96hr	168hr
Sample 1	1.9×10^{13}	2.0×10^{9}	4.3×10^{9}	2.1×10^{10}
Sample 2	1.5×10^{13}	1.7×10^{9}	4.6×10^{9}	1.4×10^{10}
Sample 3	1.6×10^{13}	1.8×10^{9}	4.1×10^{9}	1.1×10^{10}
Average	**1.7×10^{13}**	**1.8×10^{9}**	**4.3×10^{9}**	**1.5×10^{10}**
	408hr	648hr	840hr	1008hr
Sample 1	1.2×10^{10}	2.2×10^{10}	2.4×10^{10}	1.9×10^{10}
Sample 2	1.7×10^{10}	3.2×10^{10}	1.7×10^{10}	2.5×10^{10}
Sample 3	1.5×10^{10}	1.5×10^{10}	2.5×10^{10}	1.8×10^{10}
Average	**1.5×10^{10}**	**2.1×10^{10}**	**2.2×10^{10}**	**2.1×10^{10}**

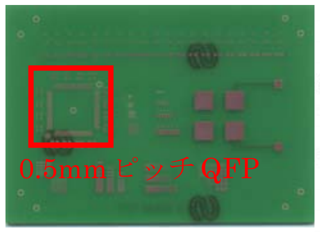
(Unit： Ω)

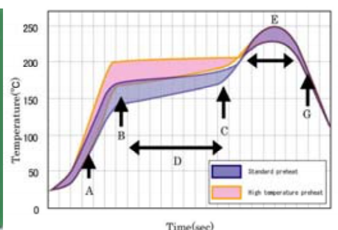


15. Wetting ability test

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 airatmosphere with two temperature profiles (preheat 160℃, 200℃), and observe the wetting.





・Temperature profile condition:

	<160℃ pre>	<200℃ pre>
Elevation rate: A→B	1.0～3.0℃/sec	1.0～3.0℃/sec
Preheat start temp: B	150～170℃	170～190℃
Preheat end temp: C	170～190℃	190～210℃
Preheat preserve time: D	60～140sec	60～140sec
Peak temp: E	230～250℃	230～255℃
More than 220℃: F	30～100sec	30～100sec
Cooling rate:E→G(235~180℃)	≧1.0℃/sec	≧1.0℃/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

Releasing rate of stencil: 0.5mm/s

Temperature: 25℃

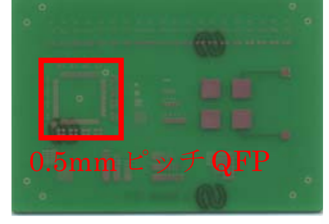
Test result:

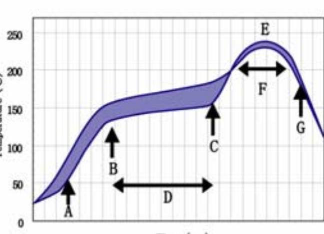
	QFP front	QFP back
Preheat 160℃	Good	Good
Preheat 200℃	Good	Good

16. 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 1.0～3.0℃/sec

Preheat start temp: B 150～170℃

Preheat end temp: C 170～190℃

Preheat preserve time: D 60～140sec

Peak temp: E 230～255℃

More than 220℃: F 30～100sec

Cooling rate:E→G(235~180℃) ≧1.0℃/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

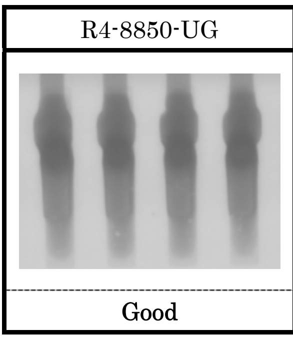
Thickness of stencil: 0.15mm

Velocity: 30mm/s

Releasing rate of stencil: 0.5mm/s

Temperature: 25℃

Test result:

R4-8850-UG

Good