Technical Information Book

MICROBOND FC712 SAC Series

Technical Information Book

- **General Information**
  - Product Information
  - Metal Powder
  - Flux Classification
  - Storage& Conditioning
  - Qc test
- **Print Performance**
  - Viscosity Stability
  - Hot slump
  - Line Resolution
- **Soldering Performance**
  - Wetting
  - Solder Balling
  - Voiding
  - Reflow profile

Product - Key properties

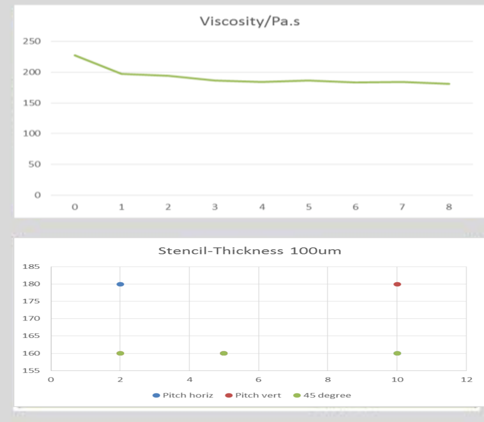
The FC712 Solder Pastes Series is a state of the art no clean lead free solder paste that promotes outstanding wetting and minimizes soldering defects. The flux system is specifically optimized for lead free alloys such as the SAC series. This Formula provides superior performance on a variety of surfaces and leaves a clear residue after reflow. The paste is developed a halogen free paste.

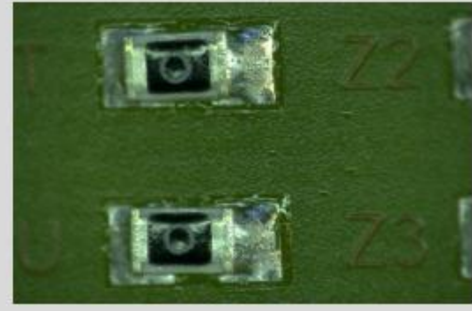
Other key features of the paste are:

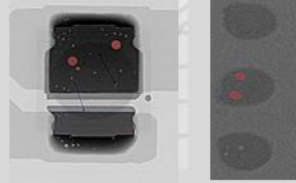
- Excellent wetting and solder performance.
- Good high-volume print capability
- Halogen Free

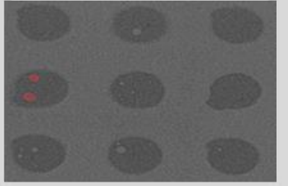
Product - Key properties

- ➢ **Excellent Viscosity Stability**
- ➢ **Very Good Print Behavior**
- ➢ **Transparent Flux Residue**
- ➢ **Excellent Wetting In Air**
- ➢ **Low Voiding**









Product Information Note

- This product is in the scale-up phase and the information shown here has been determined for reference only and its formulation and manufacturing method may change after the finalization of the scale-up phase.
- The description and engineering data shown here have been compiled by Heraeus using commonly-accepted procedures, in conjunction with modern testing equipment, and have been compiled as according to the latest factual knowledge in our possession. The information was up-to date on the date this document was printed (latest versions can always be supplied upon request).
- Although the data are considered accurate, we cannot, without prior written express agreement, provide a guarantee as to the accuracy of such data, the achievement of any intended results from the use of the solder paste or the non-infringement of any patent by the use of the solder paste.
- The data is supplied on the condition that the user shall conduct tests to determine materials suitability for a particular application.

Certification test	IPC-TM-650 Method	Result Pass-Fail-N/A
Paste level	J-STD-004	ROL0
Metal Content	IPC-TM-650	88.0%
Tin ball test	IPC-TM-650	Class 1
Slump	IPC-TM-650	0.2mm
Halide content	Cl,Br<900ppm, Cl+Br<1500ppm	Br =0 Cl <500ppm
Chromic acid silver test	J-STD-004	pass
Copper Mirror	J-STD-004	Pass
Copper corrosion test	J-STD-004	Pass
SIR	IPC-TM-650	85C/85%/168H: 8.2E+09 ohm
Electronic migration test	IPC-TM-650	pass

Metal powder

- Alloy Composition:
  - SAC305

1) Chemical composition : (Spectromax - Spark Analysis)

Element	Specification (%)
Ag	3 ± 0.2
Al	< 0,0050
As	< 0,0300
Au	< 0,0500
Bi	< 0,0300
Cd	< 0,0020
Cu	0.5 ± 0.1
Fe	< 0,0200
In	< 0,1000
Ni	< 0,0100
Pb	< 0,0500
Sb	< 0,0500
Sn	96.5 ± 0.5
Zn	< 0,0030

CUSTOMER : HMT

Elements	Required Percentages		Percentages in Sample	Pass / Fail
	As an Alloy Element	As an Impurity Element		
Ag	2.80-3.20		2.95	PASS
Al		0.001 Max	< 0.001	PASS
As		0.01 Max	< 0.01	PASS
Au		0.005 Max	< 0.001	PASS
Bi		0.03 Max	< 0.007	PASS
Cd		0.002 Max	< 0.001	PASS
Cu	0.3-0.7		0.49	PASS
Fe		0.02 Max	< 0.007	PASS
In		0.05 Max	< 0.007	PASS
Ni		0.005 Max	< 0.005	PASS
P		0.0015 Max	< 0.0015	PASS
Pb		0.05 Max	< 0.04	PASS
S		0.0015 Max	< 0.0015	PASS
Sb		0.05 Max	< 0.015	PASS
Sn	96.0-97.0		96.46	PASS
Zn		0.001 Max	< 0.001	PASS

Metal powder

Powder Content:

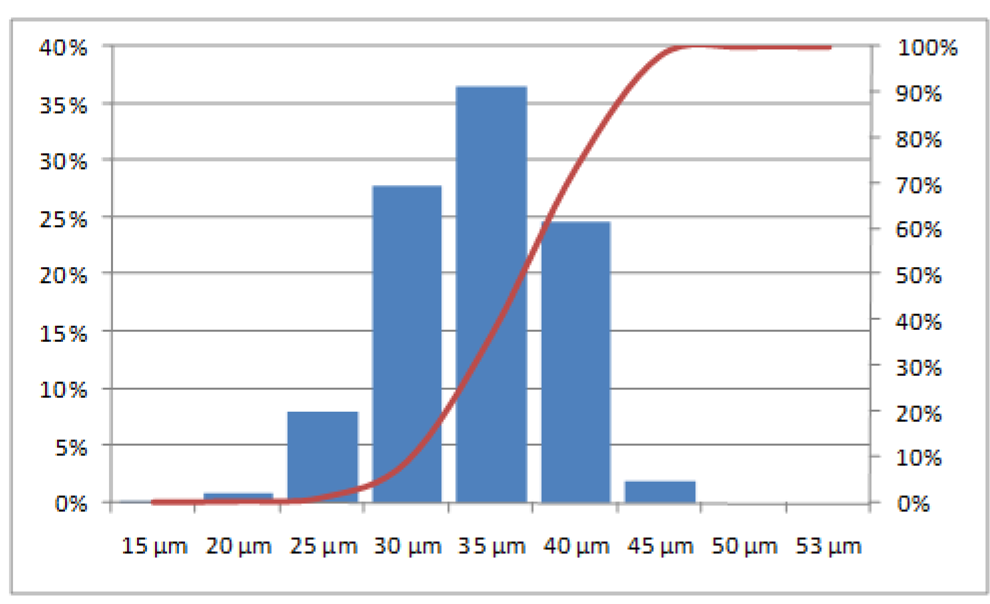
- 88 weight-% +/- 1 weight-%

Powder Size Distribution:

- Type 4 (20 – 38 µm)

IN PRODUCT	
Ave. Diameter	32 ± 1.5 µm
Std. Deviation	5 µm
D10	25 ± 1 µm
D50	32 ± 1 µm
D90	37 ± 1 µm

Specification		IN PRODUCT
> 45 µm	0%	0 %
> 38 µm	/	13% ± 5%
20 - 38 µm	> 80 %	86% ± 5%
< 20 µm	< 5%	≤ 1 %



Flux classification

- Classification of FC712 solder paste according to J-STD-004B

Flux Composition – Classification: ROL0

- RO:
  - *Resin based flux formulation used in FC712*
- L0:
  - *L = Low Activation*
  - *0 = Halide < 0.05%*

Corrosion – Classification: No Corrosion

- No Corrosion according to J-STD-004B Section 3.4.1.2 which refers to IPC-TM-650-#2.6.15
  - *Result: No Corrosion*

Flux classification

Flux activity type – Classification: L0 – all made tests are passed

- Classification according to J-STD-004B table 3-2, which includes the following tests:
- Corrosion Test according to IPC-TM-650, 2.6.15
  - *Result: No Corrosion*
  - *Copper Mirror Test according to IPC-TM-650, 2.3.32*
  - *Result: No Breakthrough*
- Halide Test according to IPC-TM-650, 2.3.28.1
  - *Result: All measurements of total bromine, chlorine & fluorine <1 ppm; iodine <20 ppm.*
- SIR Test according to CN 200010-000:2012-10-31
  - *262 h intermediate results: 5 soldered boards with resistance >100 MOhm*
- Summary:
  - *Classification L0*

Storage and Conditioning

Refrigerated storage of the paste @ 2 – 10°C is recommended

- Shelf life: Please refer to the expiry date on the label of the packing unit
- Store the product in the tightly sealed packing unit and avoid exposure to high humidity and sunlight
- The paste should be removed from refrigeration at least two hours before use to reach ambient working temperature.
- Do not open the packing unit while the paste is still cold to prevent condensation of moisture.
- Do not heat up the paste
- Solder paste in cartridges or syringes should be stored tip down

Solder paste check of the solder paste prior to the usage

- Do not use the paste if packing unit is broken
- Do not use the paste if packing unit is not closed properly
- After opening the packing unit homogenize the paste for approx. 30 to 60 sec in order to mix possible separated flux in the paste. After mixing the paste should have a creamy appearance.
- For a uniform and stable viscosity stir the paste about 1 – 2 minutes, using a stainless steel or chemically resistive plastic spatula.

QC test

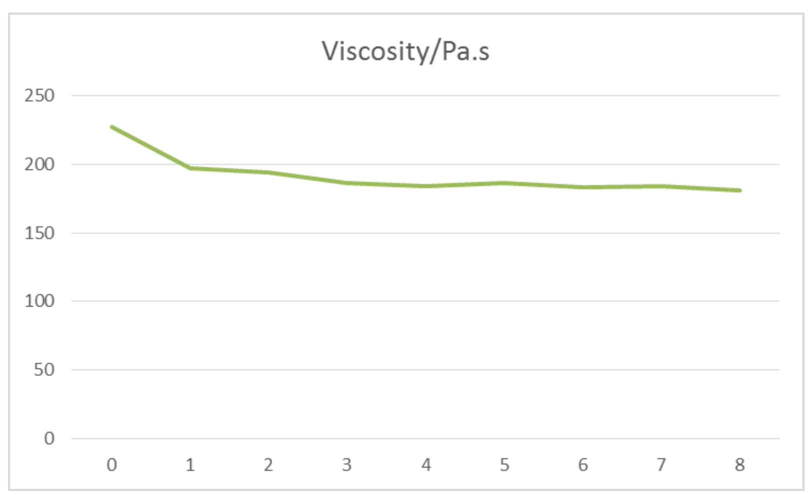
Test project	Result
Viscosity@10s-1 (Pa.S)	216
Solder ball	Class 1
Wetting	Class 1
Hot slump	0.2mm

Viscosity Stability

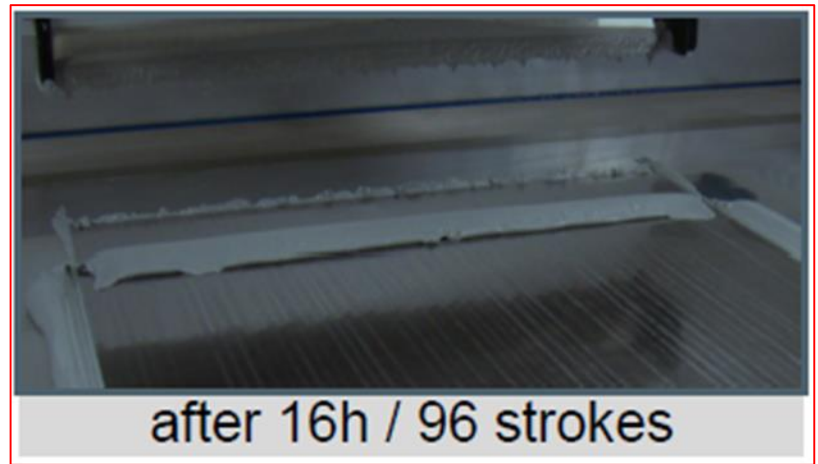
Test method:
Continuous Printing:360 PCS/hour

Test condition:
Surround temperature: 18~22℃
Surround humidity: 30~45%

Requirements after 8 h - pass:
- Rolling of paste
- Viscosity stability



Print parameters	
Squeegee angle	60°
Print speed	110 mm/s
Print pressure	50 N
Squeegee length	250mm
Gap	0
Separation speed	1 mm/s
Separation distance	2 mm

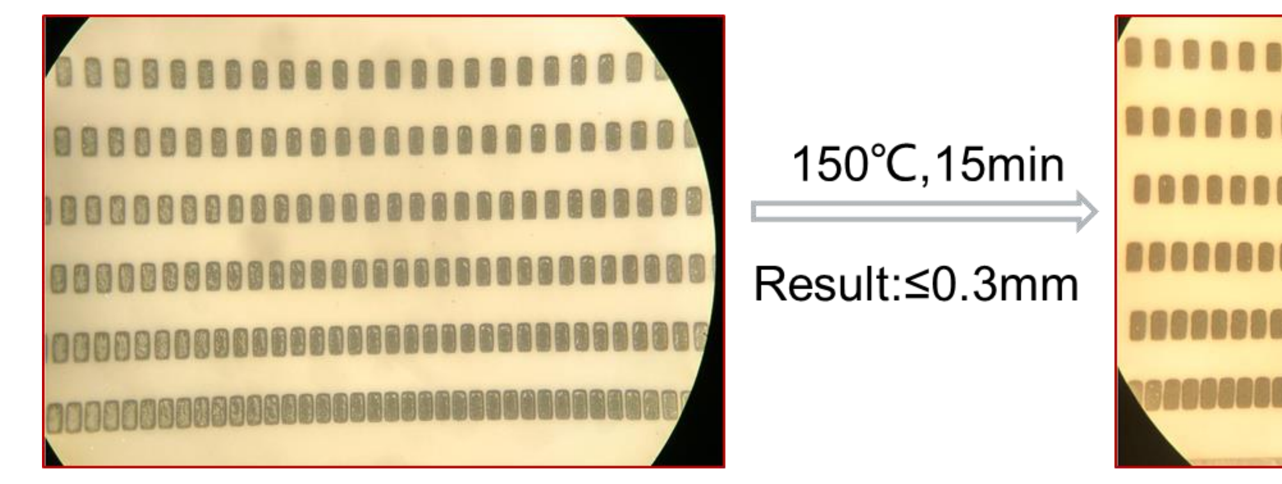


Excellent Viscosity Stability

Hot slump (according to IPC-TM-650_2.4.35)

Test **condition:** 150℃,15min

<u>Test method</u>:
Print paste on PCB and make sure there are no bridge at 0.2 mm.
Then storage the PCB at 150℃ temperature oven, and storage 15min.
Check if there are any bridges after high temperature storage and record.



Before

After

Hot slump (according to IPC-TM-650_2.4.35)

No paste sample shall slump together for spacings of 0.40 mm or greater.

Requested

Spacing

33mm .41 .48 .56 .63 .71 .79 .71 .63 .56 .48 .41 .33mm

Spacing

Spacing

0.06 mm
0.10 mm
0.15 mm
0.20 mm
0.25 mm
0.30 mm
0.35 mm
0.40 mm
0.45 mm
0.40 mm
0.35 mm
0.30 mm
0.25 mm
0.20 mm
0.15 mm
0.10 mm
0.06 mm

Spacing

Vertical Rows

Pad Size:
0.63 x 2.03 mm
—14 identical pads per row
—Same spacings each row

Pad Size:
0.33 x 2.03 mm
—18 identical pads per row
—Same spacings each row

J-003060

Figure 1 Slump test stencil, IPC-A-21

Hot slump (according to IPC-TM-650_2.4.35)

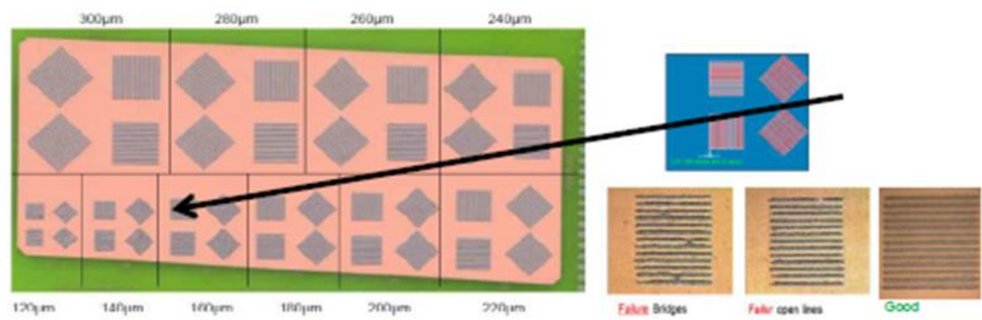
<u>Test method</u>:
Print paste on PCB and make sure there are no bridge at 0.2 mm.
Then storage the PCB at 150℃ temperature oven, and storage 15min.
Check if there are any bridges after high temperature storage and record.

		Sample
PCB	Initial	
	After heating	
		0.06 → 0.06

Line Resolution

➢ **Test method:**

10 groups of fine pitch apertures with same width ranging from 120µm to 300µm in 20µm steps, vertical, horizontal and 45° angle was printed.
The analysis criteria was showed at the right side.



Print- Results of 10 prints with stencil thickness of 100µm

Stencil-Thickness 100um

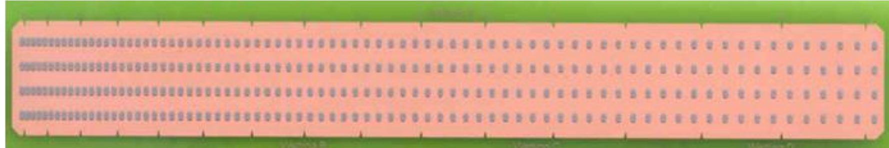
Y-axis: 155, 160, 165, 170, 175, 180, 185
X-axis: 0, 2, 4, 6, 8, 10, 12

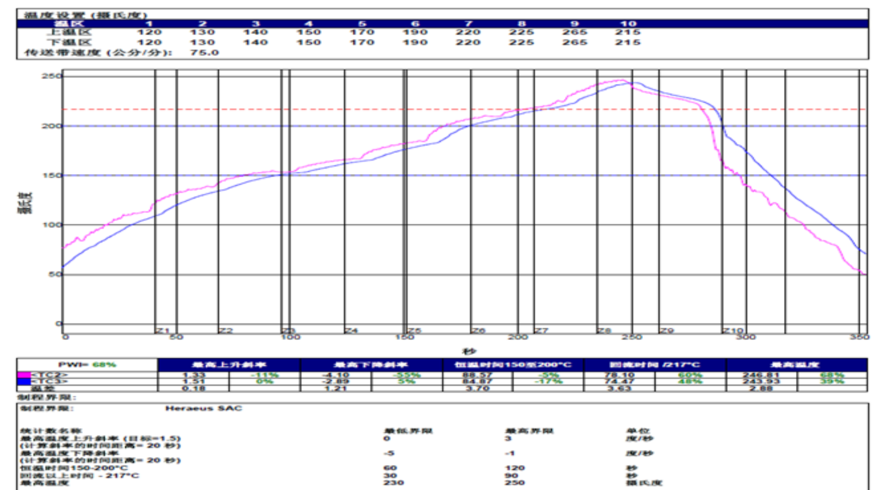
Legend: Pitch horiz, Pitch vert, 45 degree

Wetting

Test method:
Print at least 2 boards each combination
(board surface, air atmosphere, profile);
reflow & inspect wetting areas* “A”, “B”, “C” and “D”

area “A”:



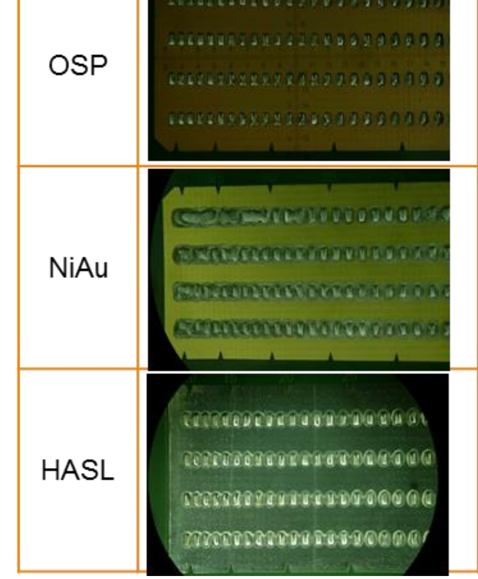


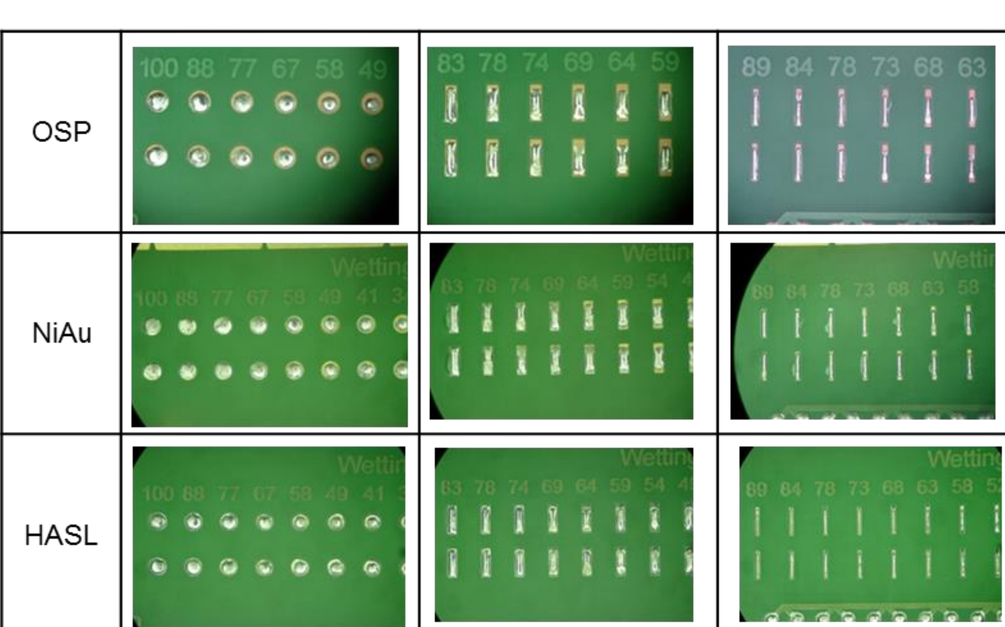
*the pictures show printed paste

area “B”:

area “C”:

area “D”:





Head on pillow test

<u>Test condition</u>

Solder sphere: SAC305, dia. 0.8mm
Pretreatment: 150degC, 3hrsr oxidation treatment
Paste printing: 1mm×1mm, t=0.2mm
Pre-heating: 178degC, 120sec
Main-heating: 230degC
25sec (immersion start 20sec)
45sec (immersion start 40sec)

230degC, 25sec/45sec

178degC, 120sec

Wetting Force [mN]

Temperature [°C]

Time [sec]

Test condition for wettability

25sec (immersion start 20sec)
45sec (immersion start 40sec)

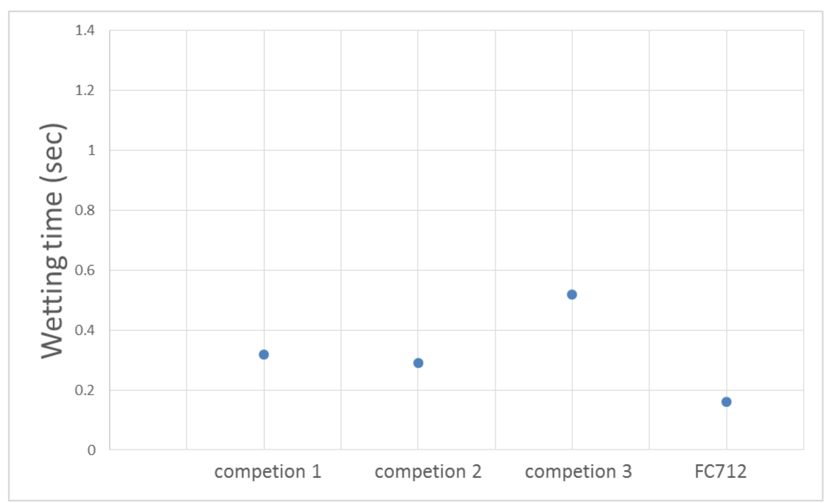
Wetting Force [mN]
Temperature [°C]
Time [sec]

Under stringent conditions
-Oxidation treatment of solder sphere
-High pre-heating temperature
-Lower main-heating temperature
-Longer pull away time

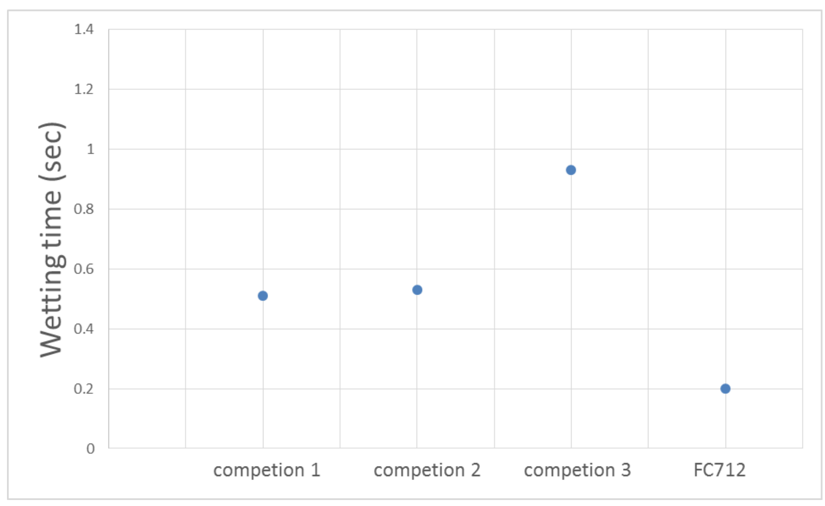
Value for good solder paste for head and pillow

0.01mm
Wetting force
Heating start
Pull away 50degC
Immersion 230degC
0.05mm

Test results of wetting speed



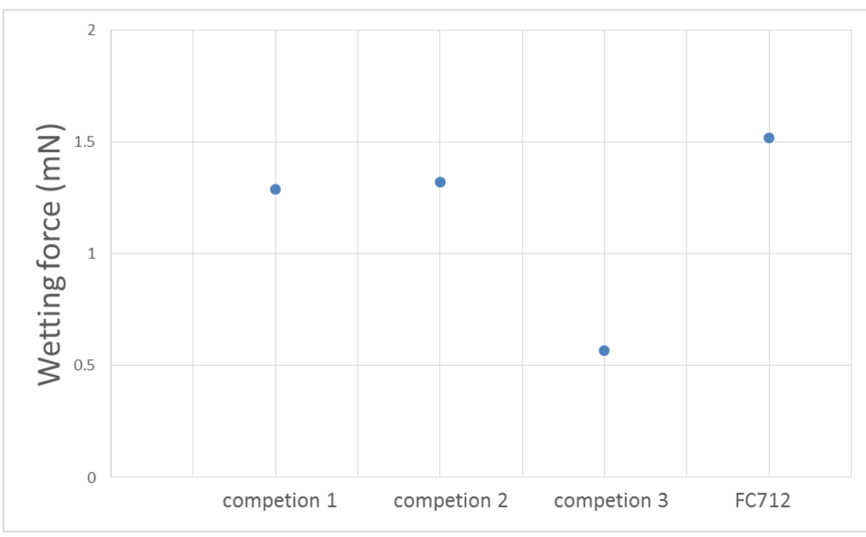
wetting time
25sec (immersion start 20sec)



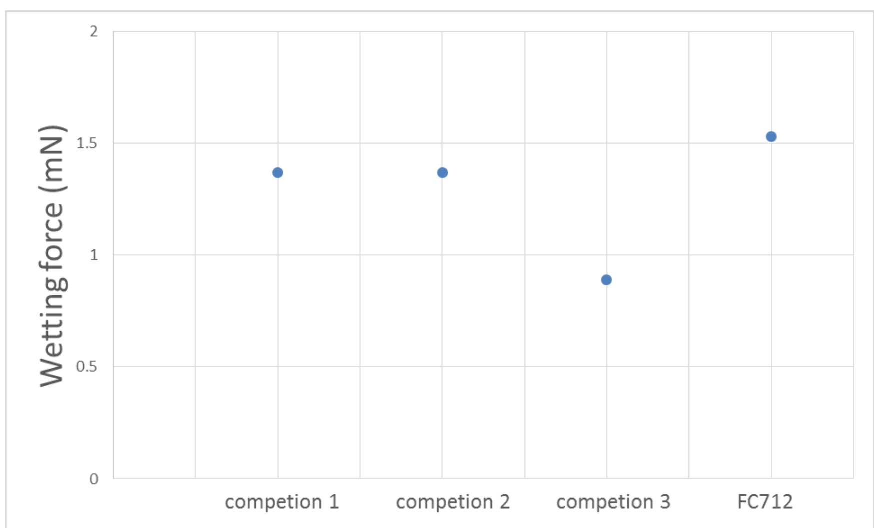
wetting time
45sec (immersion start 40sec)

FC712 is fast wetting compared with competitors.
FC712 is no wetting speed changes under the long time heating.
Therefore a heat resistance and head and pillow effect are excellent.

Test results of wetting force



wetting force
25sec (immersion start 20sec)



wetting force
45sec (immersion start 40sec)

FC712 is high wetting force compared with competitors.
FC712 is no wetting force changes under the long time heating.
Therefore a heat resistance and head and pillow effect are excellent.

State under the reflow (immersion start 20sec → 5sec)

Competitor 1	Competitor 2	Competitor 3	FC712

A solder sphere doesn't often melt in competitor 1, competitor 2 and competitor 3.
A solder sphere melts in competitor 2 and FC712 perfectly.

State under the reflow (immersion start 40sec → 5sec)

Competitor 1	Competitor 2	Competitor 3	FC712

A solder sphere doesn't often melt in competitor 1, competitor 2 and competitor 3.
A solder sphere melts in FC712 perfectly.

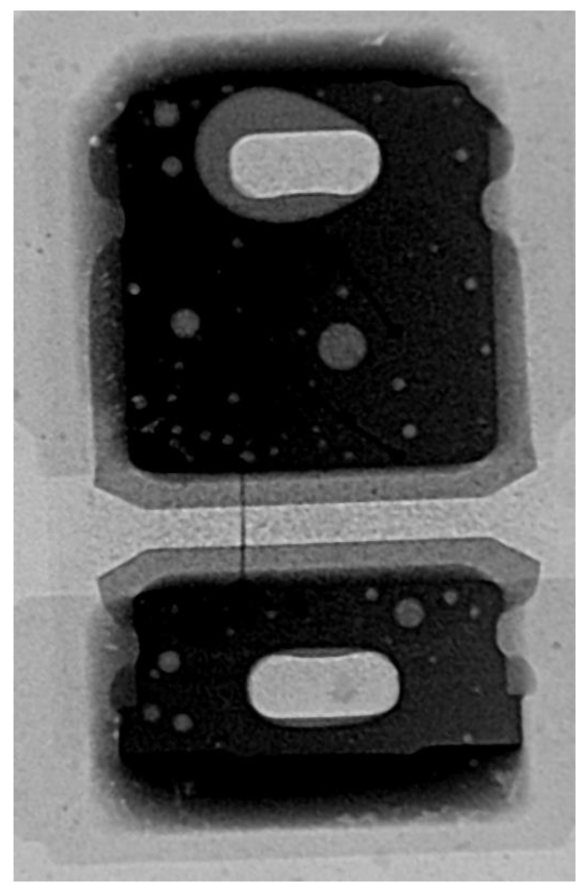
Solder balls

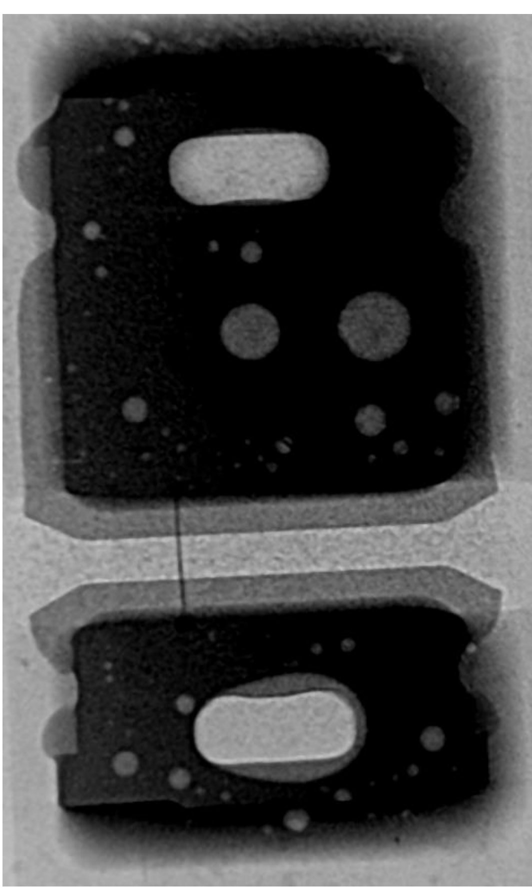
Test method:

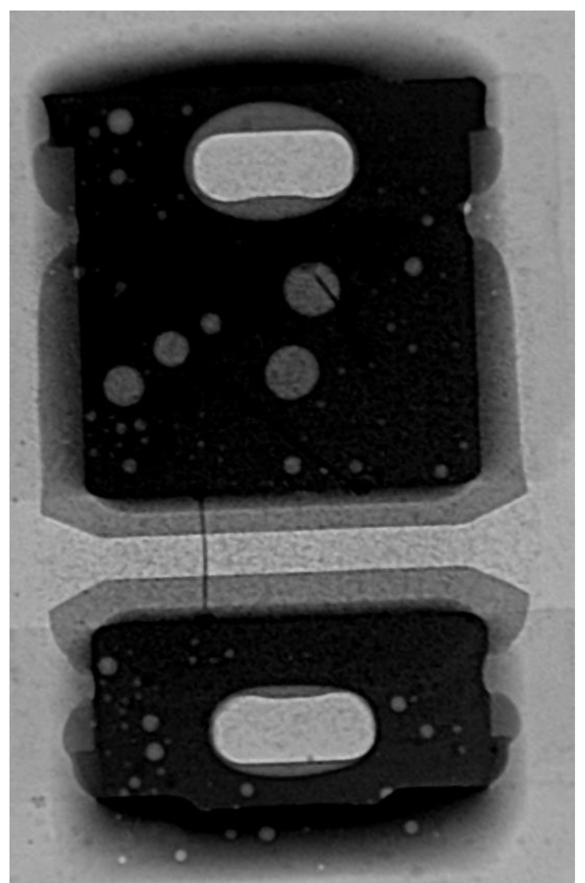
PCB-Type: Benchmarker II
PCB-Surface : OSP, NiAu, HASL
Stencil Thickness: 100µm
Reflow Profile: HLFP
Atmosphere: Air

	OSP	NiAu	HASL
1206			
0805			
0603			
0402			
0201			

X-ray Void







Recommended profile for FC712 SAC Series

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (200 to 250℃)	3℃/second max.
Ramp-Down Rate	6℃/second max.
Preheat	
Temperature Min	150℃
Temperature Max	200℃
Time range(150 to 200℃)	60-120 second
Time maintained above:	
Temperature(217℃)	217℃
Time above(217℃)	30-90 second
Peak Temperature	230-250℃
Time 25℃ to Peak Temperature	8 minutes max.

Setpoints (摄氏)

温区	1	2	3	4	5	6	7	8	9	10
上温区	115	130	150	165	180	190	210	235	260	235
下温区	115	130	150	165	180	190	210	235	260	235

Conveyor Speed (公分/分): 90.00

PWI= 76%	最高上升斜率		最高下降斜率		预热 40至150C		回流时间 /217C		最高温度		预热150至200C-(2)	
2	1.37	-63%	-1.50	75%	96.14	-60%	68.47	14%	238.34	-55%	87.88	-7%
3	1.39	-61%	-1.74	63%	95.13	-62%	60.73	-17%	239.06	-46%	87.60	-8%
4	1.37	-63%	-1.81	60%	95.41	-61%	64.39	-2%	241.06	-19%	88.27	-6%
5	1.38	-62%	-1.48	76%	96.75	-58%	67.79	11%	237.59	-65%	86.98	-10%
6	1.41	-59%	-1.73	63%	96.59	-59%	60.96	-16%	237.71	-64%	86.68	-11%
温差	0.04		0.33		1.62		7.74		3.47		1.59	

Heraeus