True Halogen Free – High Performance LF SP

S3X58 - HF1000

Realizes powerful wetting, low voiding and other critical properties at high performances with wide open process window.

Main features:

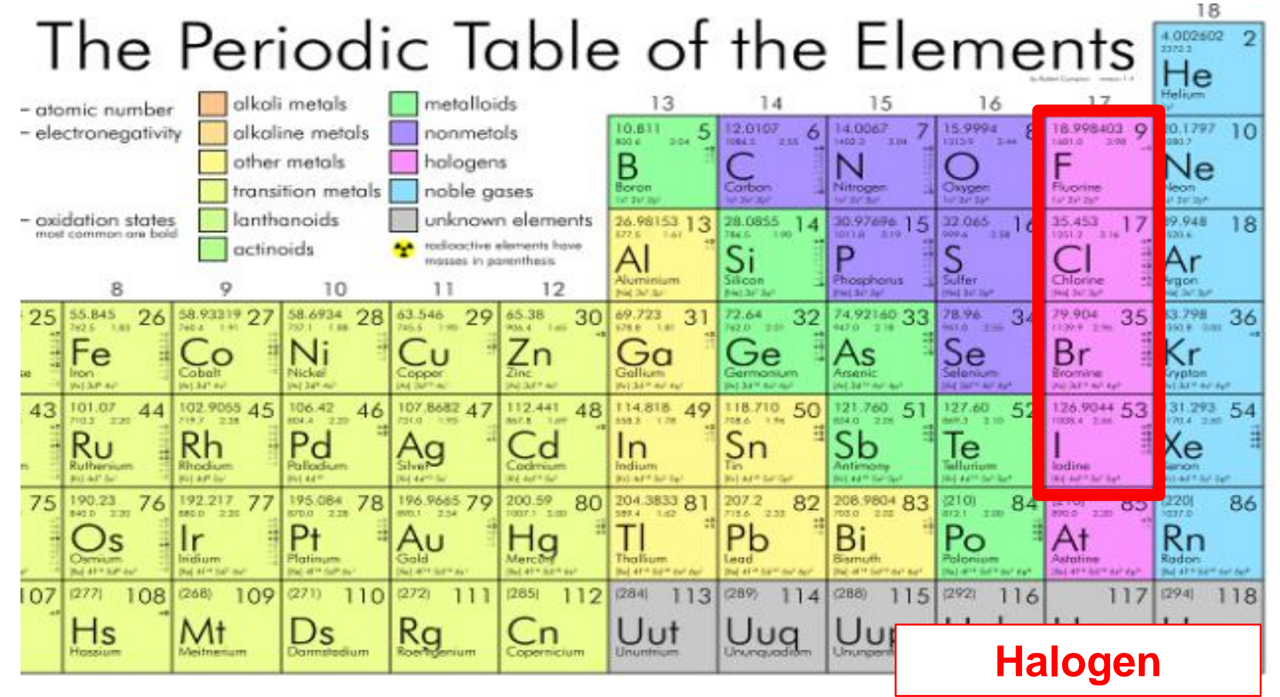
- ROL0 IPC J-STD-004B designated
- Good printing
- Powerful wetting and low voiding

Target Features

1. Halogen Free (ROL0) by IPC J-STD-004B
2. Long stencil idle time (Print-to-Pause) >1 hour
4. Poweful solderability with various metal finishes
5. High heat resistant flux formulation
6. Low voiding
7. Pin-in-Paste applicable
8. ICT testable (OSP)

Increasing Demand for Total Halogen Free

IPC	Halide (Ionized halogen)	Limit （ROL0)
J-STD-004A	**Cl, Br,**	**Cl & Br: <900ppm each, <1500ppm combined**
J-STD-004B	**Cl, Br, I, F**	**<500ppm all halogens combined**



Contradiction for Elimination of Halogen

Halogen
Containing flux

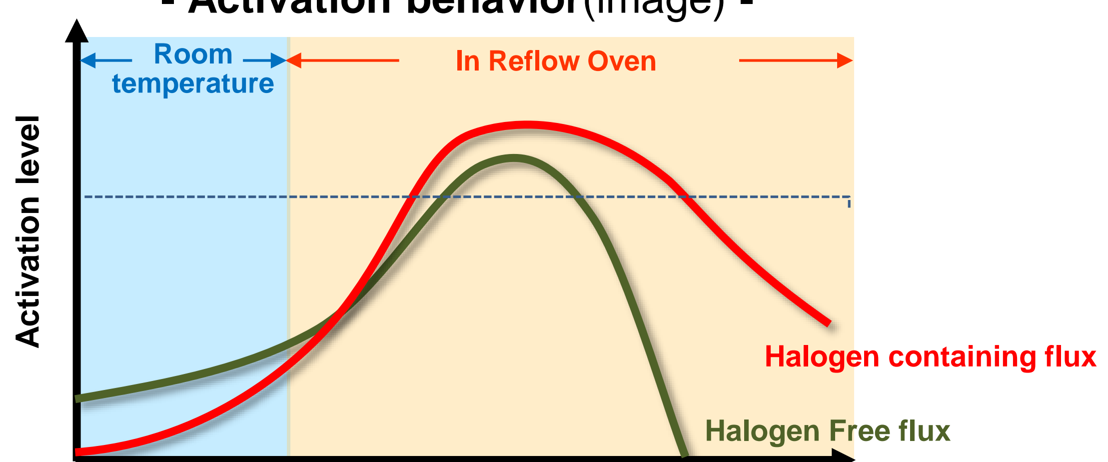
- Powerful activation (oxide reduction) strength
- Long duration of activation
- Resistant to high temperature

- Robust wetting
- Low voiding
- Etc.

Halogen Free
Containing flux
(Organic acids)

- Weaker activation strength
- Prone to decompose at high temperature

- Less powerful wetting
- More voiding
- Less heat resistant

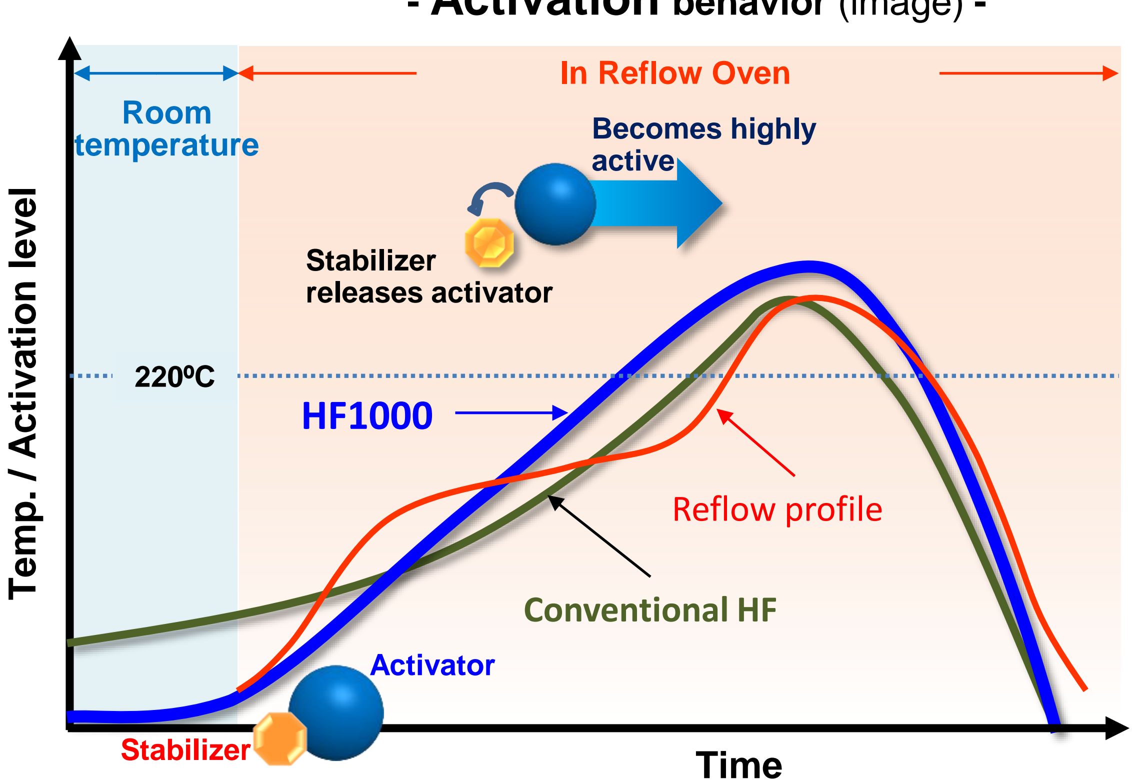


Halogen containing flux
- Quick activation
- Heat resistant
- Longer activation time

Halogen Free flux
- Slower activation
- Less heat resistant
- Shorter activation time

Activator Technique – Stabilizer!

Newly developed activator technique is designed to inhibit reaction with solder powder as low as possible during storage and even during pre-heating stage, but exerts maximum activation strength during the time above liquidus temperature.



HF1000 flux formulation

A Stabilizer inhibits reaction between activator and powder.

- **Viscosity stability**
- **Powerful wetting.**
- **Low voiding**
- **High insulation resistance**

Conventional Product HF

A certain activation strength is consumed during storage/before use. Insufficient wetting power at reflow temperatures.

Activator Technique – Stabilizer!

Activator combined by Stabilizer

Activator without Stabilizer

TG (%)

0.00

-50.00

-100.00

-150.00

-12.9%

-29.9%

-45.0%

-92.5%

220°C

200°C

50.0 100.0 150.0 200.0 250.0 300.0

TEMP (℃)

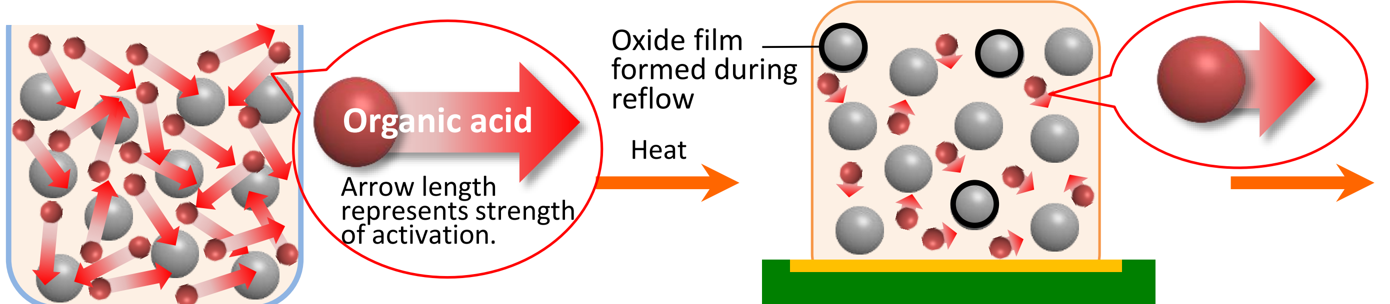
TG analysis data	
Activator	Weight loss at 220°C
W/out Stabilizer	**- 92.5%**
With Stabilizer	**- 29.9%**

Heat resistant!

Activator Technique – Stabilizer!

Conventional halogen free formulation

Relatively large volume of organic acids are formulated for good wetting.



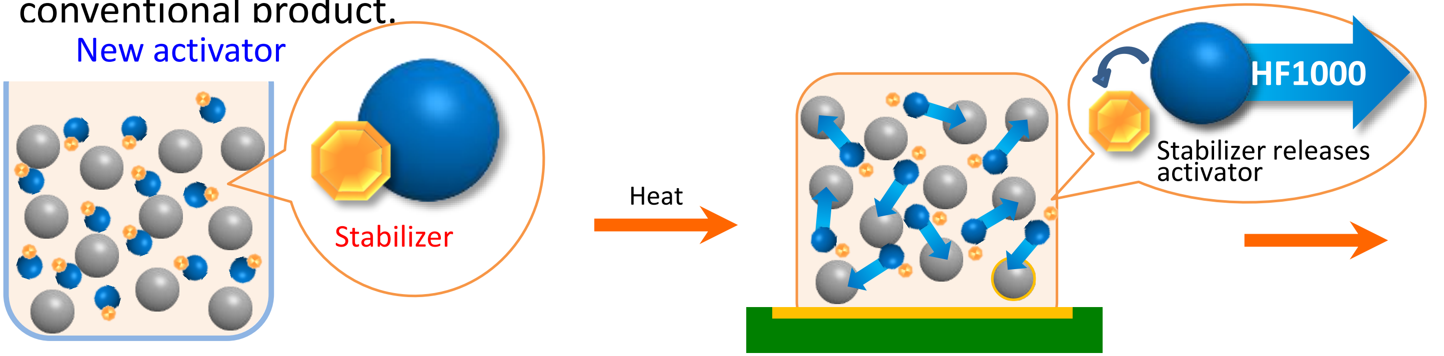
During storage, reaction between activator and oxide metal from solder powder continues to takes place.

Consumed activation strength during storage disables prevention/reduction of oxide film formed by re-oxidation.

Leaves unmolten solder particles, poor wetting.

S3X58-HF1000 Halogen free formulation

Adopted activator system almost non-reactive during storage and also its volume is much less than conventional product.



Almost no chemical reaction betwen flux and solder particles.

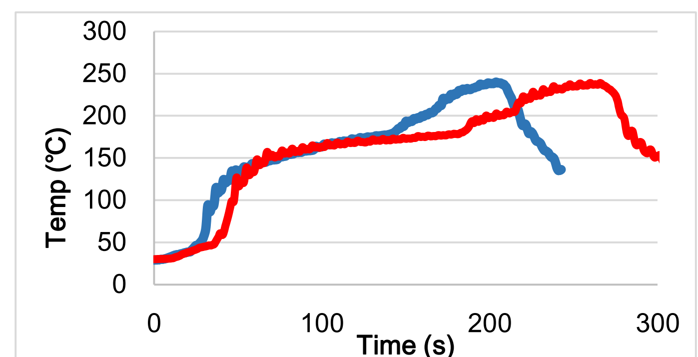
Flux becomes vigorously reactive as being heated

Complete removal of oxide substance, complete melting of solder

Meltability

<u>Test Method</u>

- PCB : KOKI test board
- Surface treatment: OSP
- Stencil Thickness: 0.12 mm (Laser)
- Evaluation Pad Number: 0603R, 0.5mmP QFN,
- Reflow profile: Refer to the right.



	150~190°C
Profile A	90sec
Profile B	130sec

SP	Profile A 0603 R	Profile A 0.5mmPQFN	Profile B 0603 R	Profile B 0.5mmPQFN
S3X58-HF1000				
Conventional				

S3X58-HF1000は、従来品と比較して、予熱時間が長くても、微細部の未溶融発生が少ない。

Meltability

<u>Test condition</u>

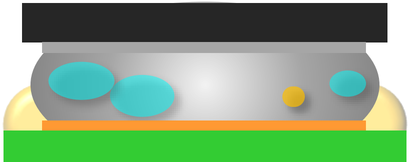
- Material pieces : Nickel, Copper, ImSn, C7701 (CuNiZn)
- Pretreatment: Reflowed twice in advance
- Stencil thickness : 0.20mm (laser cut)
- Stencil aperture : 6.5mm diameter
- Heat source: Profile A

	Cu	Brass	Ni	CuNiZn (C7701)
Without Reflow pretreatment				
With Reflow pretreatment				

HF1000: New void reduction technique

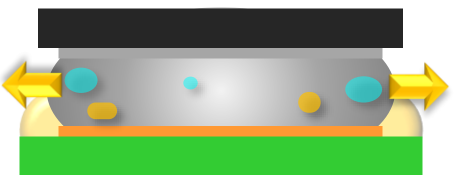
Technique-1: Enhanced flux discharge

W/out technique

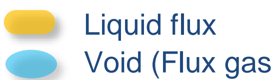


- Flux gas (voids) stays and coagulate.
- Some of flux also stays in molten solder.
- These result in large voids.

With technique

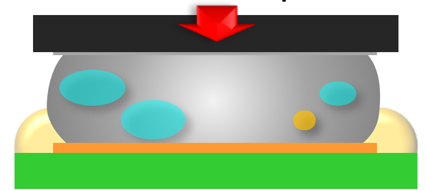


- Fast discharge of flux gas / liquid flux.



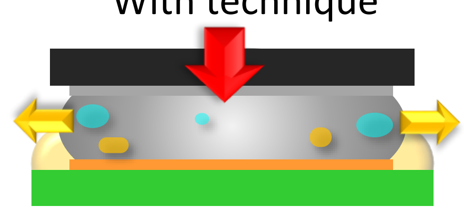
Technique-2: Powerful wetting / Pumping effect

W/out technique

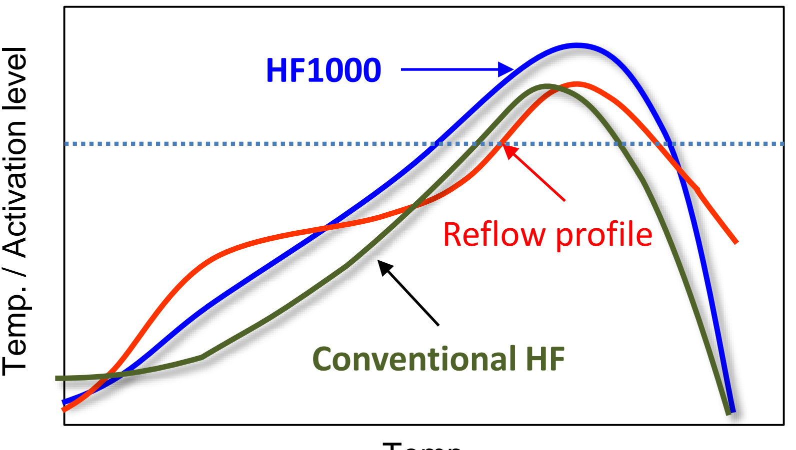


- Weak wetting strength = weak pull force = weak flux gas discharge → Voids remain.

With technique



- Powerful wetting pulls component quickly and strongly (pumping effect)= swift flux gas discharge → Low voids.



S3X58-HF1000

Newly developed activation technique realizes;

1) an enhanced flux (liquid flux / flux gas) discharge out of the joint once the solder melts with a robust activation strength and highly heat resistant formulation (=extended activation time)

2) powerful and quick wetting to the termination of the component. Consequently, the component is pulled down and it helps to push flux gas out of the joint.

Voiding

Test Method

- PCB No.: KOKI test board
- Surface treatment: OSP, ENIG, Ag
- Stencil Thickness: 0.12 mm (Laser)
- Evaluation Component: Pwtr, 6330R QFN (Sn100%) BGA(SAC305)
- Reflow Atmosphere: Air
- Reflow Profile: Profile A .

	Pwtr.	QFN	BGA	6330R
OSP				
ENIG				
Ag				

Print-to-Pause Property

Test Method

Print 4 PCB's in a row, then clean back of the stencil. Let it stand for 60 minutes. After 60 minutes pause, print another 2 PCB's in a row.

- Printer: Model YVP-Xg YAMAHA Motor
- Stencil Thickness: 0.12 mm (Laser)
- Squeegee: Metal squeegee
- Print Speed: 40 mm/ sec.
- Print Pressure: 60 N
- Test Pad Size: 0.25, 0.30 mmφ CSP
- Print Ambient: 25±1ºC, 50±10%RH

0.25mm dia. CSP

Volume (%)
140
120
100
80
60
40
20
0
60 min
Conventional
S3X58-HF1000
1st
2nd
3rd
4th
1st
2nd
Initial
After 60 min

0.30 mm dia. CSP

Volume (%)
140
120
100
80
60
40
20
0
60 min
Conventional
S3X58-HF1000
1st
2nd
3rd
4th
1st
2nd
Initial
After 60 min

Print-to-Pause Property

	Initial – Continual print		After 60 minutes idle time – 1st print	
SP	0.25mmφ CSP	0.30mmφ CSP	0.25mmφ CSP	0.30mmφ CSP
S3X58-HF1000				
Conventional paste				

Specifications

Application		Printing	
Product name		**S3X58-HF1000**	Remarks
Alloy	Alloy composition (%)	**Sn 3Ag 0.5Cu**	
	Melting point (ºC)	217 - 219	
	Shape	Spherical	IPC-TM-650 2.2.14.2 JISZ3284-2
	Particle size (μm)	20-38μm:	IPC TM-650 2.2.14.2 JIS Z 3284-2
Flux	Halide content (%)	0	IPC-JSTD-004B
	Flux type	ROL0	IPC-JSTD-004B
Solder paste	Flux content (%)	12 ±1.0	IPC TM-650 2.2.20 JIS Z 3197 8.1.2
	Viscosity (Pa.s 25ºC)	220± 30	IPC TM-650 2.4.43
	Copper plate	Passed	IPC-TM-650-2.3.32
	Copper mirror	Category L	IPC-TM-650-2.6.15
	Heat slump	0.3pass	JISZ3284-3
	SIR	>1E+9	IPC-TM-650-2.6.15(60ºC-88.5%)
	Electromigration	No evidence of ECM	IPC-TM-650 2.6.14.1
	Shelf life	6 months	0-10ºC

S3X58-HF1000 vs. Conventional Product

Conventional paste
S3X58-HF1000

Rm temp. stability
Continual print viscosity stability
Bridging
Print to pause
Heat slump
Meltability
Solder beading
Dewetting
Head-in-Pillow
Void-large
Void-BGA
SIR
ICT testability
Residue state

10
8
6
4
2
0