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Koki no-clean **LEAD FREE** solder paste

Multi-feature Lead-free Solder Paste S3X58-HF1200



Product Information

Maximizes Voiding & Wetting Performances
with
“Dual 2-Step” Enhancement Technology

Disclaimer

This Product Information contains product performance assessed strictly according to our own test procedures and is not the guaranteed result at end-users. Please conduct thorough process optimization before mass production application.



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- Solder alloy composition : Sn3.0Ag0.5Cu
- Realizes low voiding with BTCs (e.g., Pw.Tr., QFN, LGA) and BGA
- Powerful wetting as good as Halogen containing solder paste
- Wide process window and enhanced flexibility of reflow profile design
- Exhibits excellent print quality response with >1hour stencil idle time
- Excellent stability of shape retention and contour of each printed paste deposit helps to reduce stencil cleaning frequency.
- Complies with Halogen Free standard (Cl+Br = 0ppm): BS EN14582
- No artificial addition of any halogen element
Flux type: ROL0 (Cl+Br+I+F = < 0.05% / IPC J-STD-004C)
- RoHS, REACH compliant product



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Feature – Flux Gas Discharge Effect

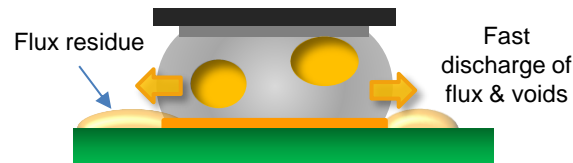
The 2-step Flux Gas Discharge Effect

The technology designed to reduce voids by rapidly discharging flux through the **Active Coagulation Effect** in the first step.

For the second step, the Extended Active Outflow Effect continues to discharge any remaining voids, realizing the lowest void performance ever achieved.

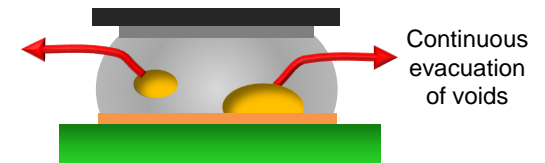
■ Step-1 Active Coagulation Effect

As solder powder melts, liquefied flux is designed to simultaneously enhance its coagulation and rapidly evacuate from the molten solder.

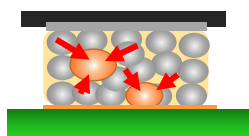


■ Step-2 Active Outflow Effect

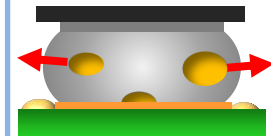
After the Step-1 process, an 'Outflow' effect actively continues to discharge the liquefied flux and flux gas while the solder is in a molten state.



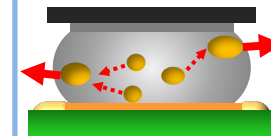
Starts to melt & coagulate



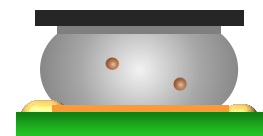
Step-1
Active Coagulation



Step-2
Active Outflow



Realization of
low voids!



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Feature – Activation Boost Effect

The 2-step Activation Boost Effect

This begins with **Activation Stabilizer technology**, which prevents premature chemical reactions during storage and transportation by stabilizing the activator system's reactivity.

Upon exposure to reflow heating, the stabilizer is released, unlocking maximum activation power.

For the second step, the newly formulated high-temperature-resistant activator, with superior activation in high-temperature zones, ensures robust and powerful solder meltability and wetting, despite being halogen-free.

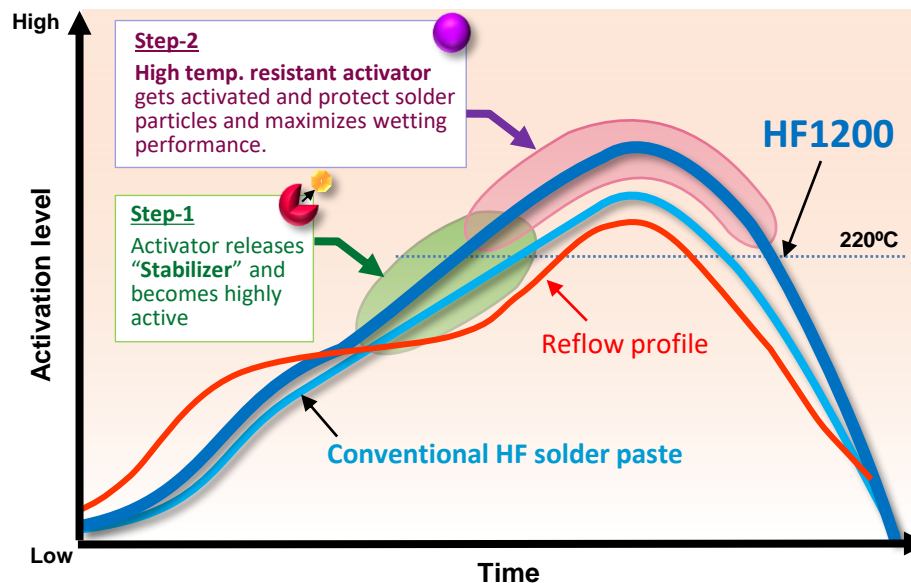
This breakthrough significantly enhances the flexibility of reflow profile design, providing a broad process window for a wide range of applications.

■ Step-1 Activation Stabilizer

The newly designed activator system inhibits the chemical reaction with solder during storage and even during the pre-heating stage and exerts maximum activation strength during the time above liquidus temperature.

■ Step-2 High Temperature Activator

High temp. resistant activator gets activated and protect solder particles and maximizes wetting performance.



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Purpose		Printing
Product Name		S3X58-HF1200
Alloy	Alloy Composition (%)	Sn3.0Ag0.5Cu
	Melting Point (°C)	217 - 219
	Powder Shape	Spherical
	Particle Size (μm)	20 - 38
Flux	Halide Content (%)	0
	Flux type*1	ROL0
Solder Paste	Flux Content (%)	11.9 ±1.0
	Viscosity *2 (Pa.s)	190 ±30
	Copper Plate Corrosion*3	Passed
	Tack Time	≥ 72 hours
	Shelf Life (below 10°C)	6 months (provisional)

*1. Flux Designation:

In accordance with IPC J-STD-004B and 004C

*2. Viscosity:

Measured by Malcom viscometer at 10 rpm at 25°C.

*3. Copper Plate Corrosion:

In accordance with IPC TM650-2.6.15



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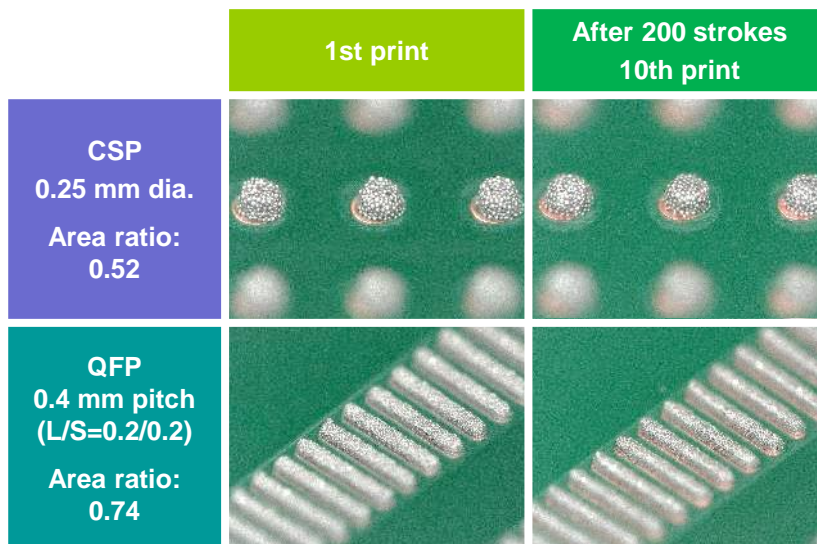
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Printability - Continuous printing

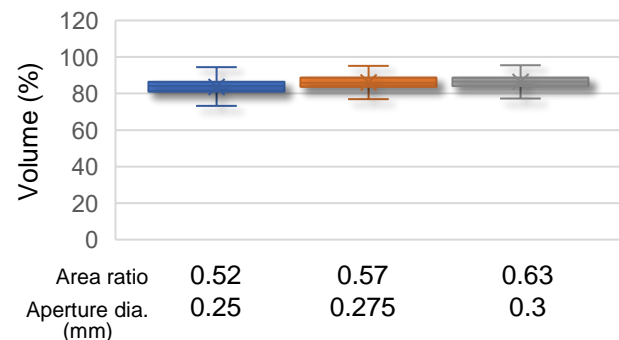
Test Condition

- Printer: Model YVP-Xg YAMAHA Motor
- Squeegee: Metal, 55° angle
- Stencil: 0.12 mm thick, laser
- Print speed: 40 mm/sec
- Atmosphere: 24~26°C (40~60%RH)
- Pattern: 0.25 mm dia. CSP, 0.4 mm pitch QFP

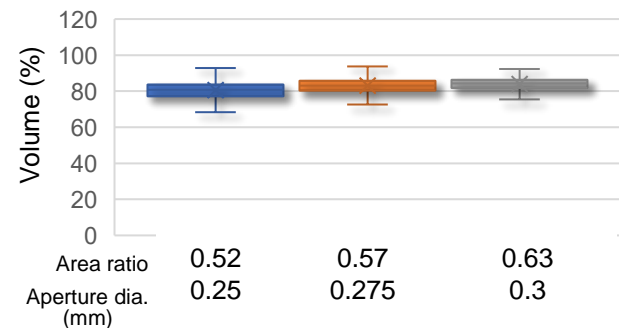


$$\text{Area ratio} = \frac{\text{Aperture area}}{\text{Aperture wall area}}$$

Average of initial 10 prints



Average of 10 prints after 200 strokes



➤ Consistent print quality with good printed paste shape even with area ratio ≥0.52.



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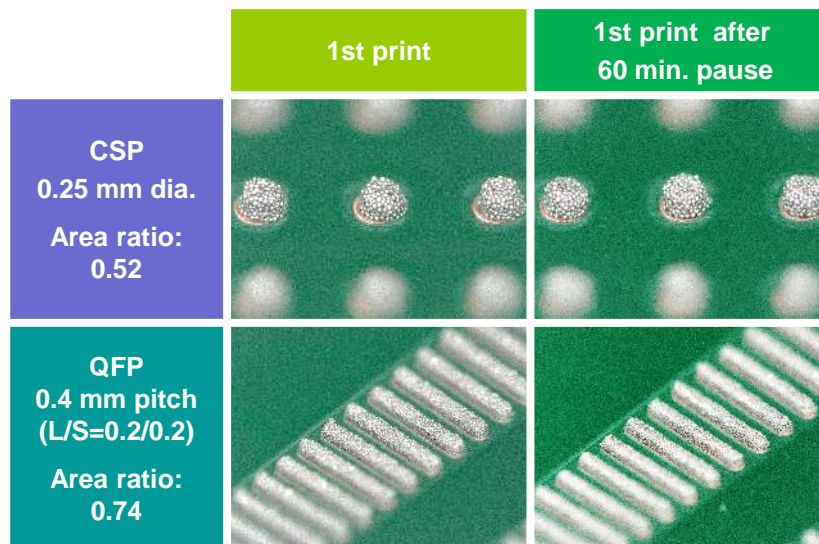
General properties

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Printability - Intermittent printing

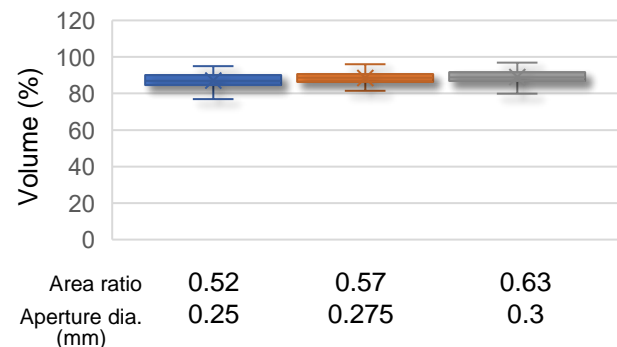
Test Condition

- Printer: Model YVP-Xg YAMAHA Motor
- Squeegee: Metal, 55° angle
- Stencil: 0.12 mm thick, laser
- Print speed: 40 mm/sec
- Atmosphere: 24~26°C (40~60%RH)
- Pattern: 0.25 mm dia. CSP, 0.4 mm pitch QFP

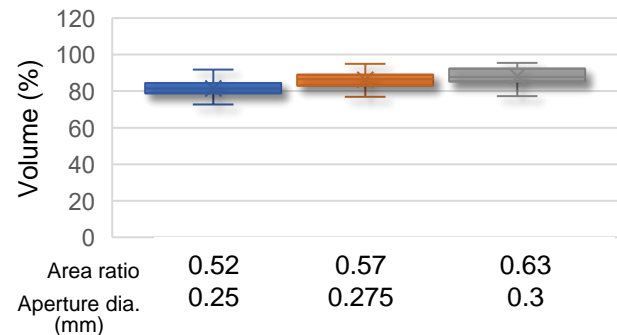


$$\text{Area ratio} = \frac{\text{Aperture area}}{\text{Aperture wall area}}$$

1st print



1st print after 60min. pause



- Consistent paste transfer volume from the initial paste print even after 60 min. pause even with area ratio ≥0.52.



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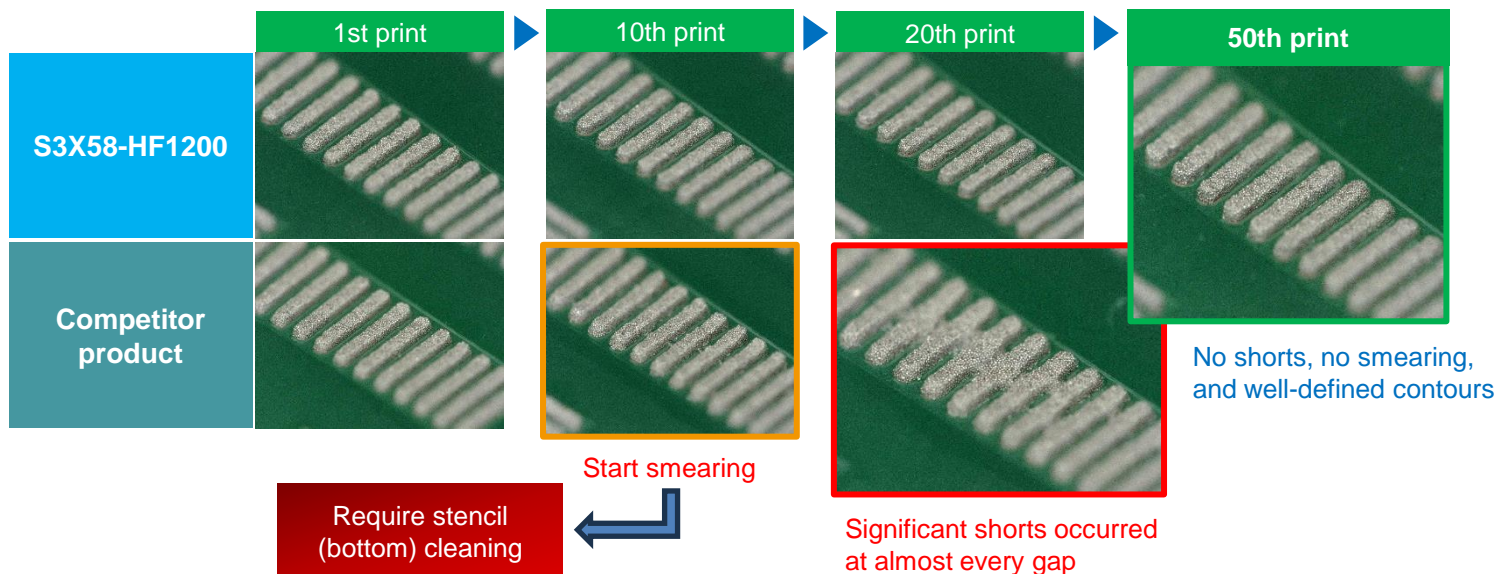
General properties

Handling guide

Printability – Stability in continuous printing

Test Condition

- Printer: Model YVP-Xg YAMAHA Motor
- Squeegee: Metal, 55° angle
- Stencil: 0.12 mm thick, laser
- Print speed: 40 mm/sec
- Atmosphere: 24~26°C (40~60%RH)
- Pattern: 0.4 mm pitch QFP (0.25mm width 0.15mm gap)



- The newly formulated flux is designed to extend shape and contour retention of the print deposit. This minimizes issues like slumping, smearing, and bleeding, reducing the frequency of stencil underside cleaning and contributing to shorter cycle times.

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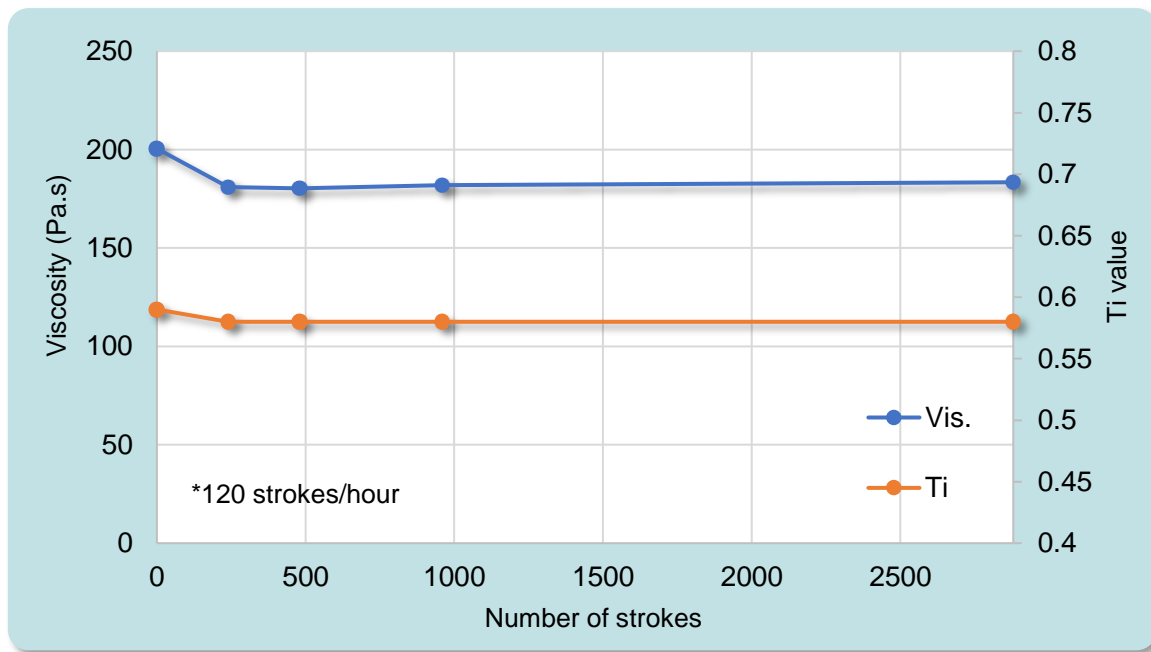
Handling guide

Viscosity stability - During continual paste printing

Test condition

Print (knead) solder paste on the sealed-up stencil continually for 24 hours to observe viscosity variation.

- Squeegee: Metal blades
- Squeegee angle: 55°
- Squeegee speed: 20 mm/sec.
- Print stroke: 300 mm
- Printing environment: 24~26 °C, 40~60%RH



➤ Activator stability technology ensures minimal variation of rheology (viscosity & thixotropy) in continual printing.



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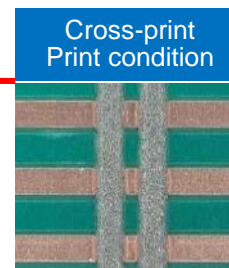
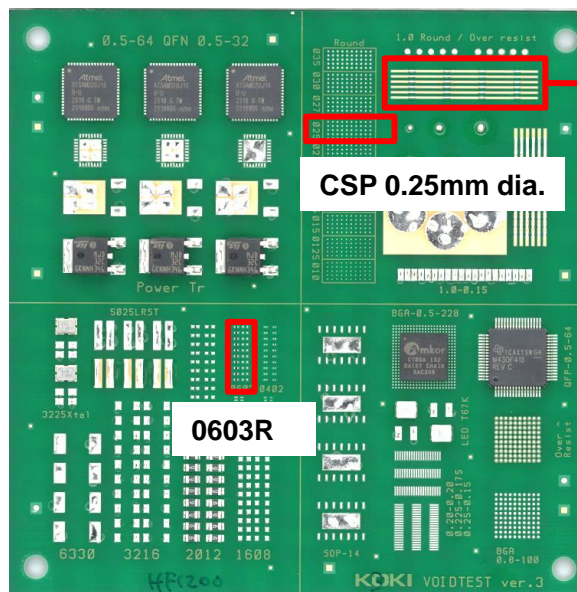
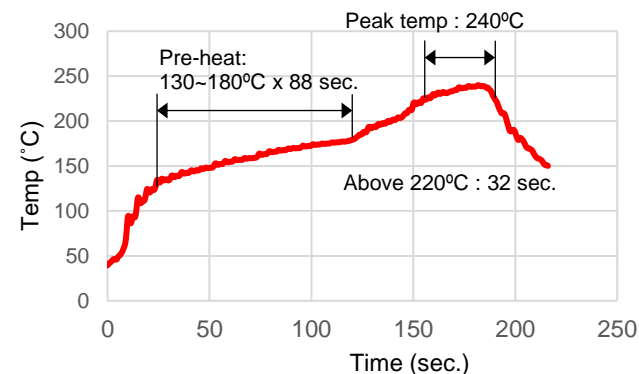
General properties

Handling guide

Meltability – Fine pattern

Test condition

- Material: Glass epoxy FR-4
- Surface finish: OSP, ImSn, ImAg, ENIG
- 0603chip: 100% Sn plated
- Stencil thickness: 0.12 mm (laser cut)
- Pad size: 0.25 mm dia., 0603 metric chip pattern
- Stencil aperture: 100% aperture opening to pad
- Heat source: Hot air convection
- Atmosphere: Air



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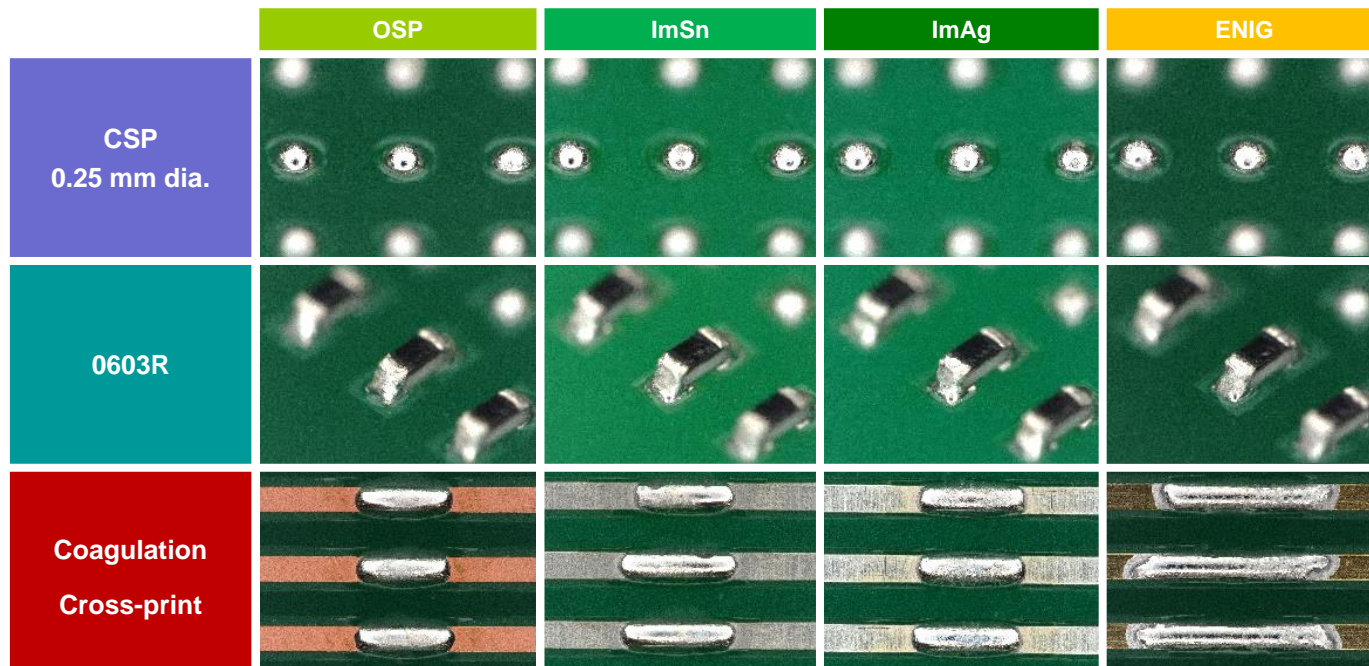
Handling guide

Meltability – Fine pattern

Test condition

- Material: Glass epoxy FR-4
- Surface finish: OSP, ImSn, ImAg, ENIG
- 0603chip: 100% Sn plated
- Stencil thickness: 0.12 mm (laser cut)

- Pad size: 0.25 mm dia., 0603 metric chip pattern
- Stencil aperture: 100% aperture opening to pad
- Heat source: Hot air convection
- Atmosphere: Air



- Regardless of the type of surface finish, the solder coalesced completely and caused no unmolten solder particles.



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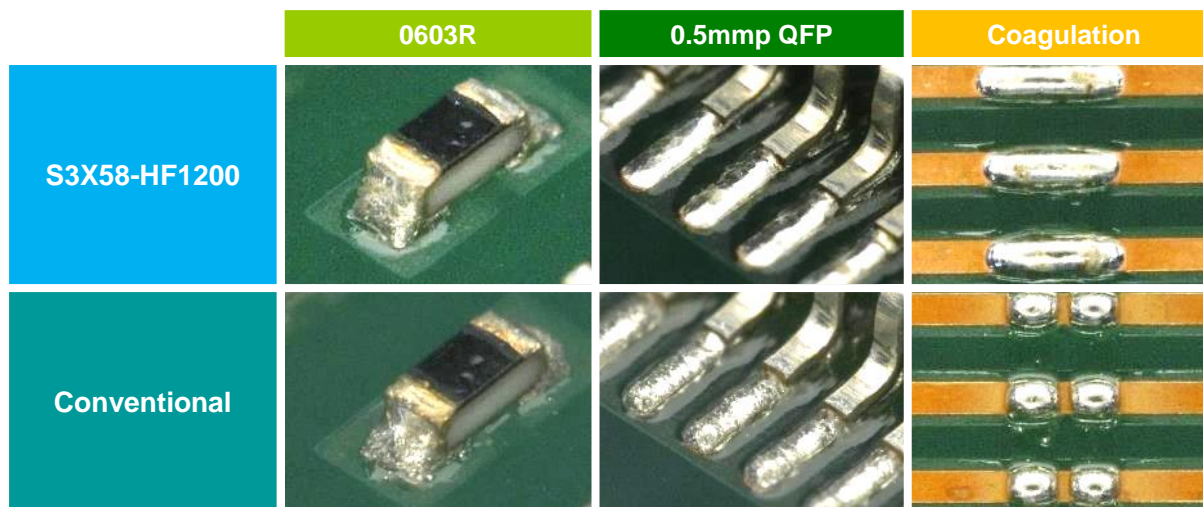
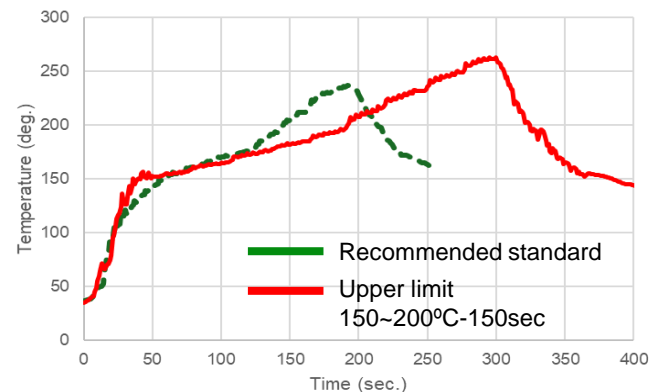
General properties

Handling guide

Meltability – High temp. reflow profile resistance

Test condition

- Material: Glass epoxy FR-4
- Surface finish: OSP
- Components: 0603R 100% Sn plated
0.5mm pitch QFP Ni-Pd plated
- Stencil thickness: 0.12 mm (laser cut)
- Stencil aperture: 100% aperture opening to pad
- Heat source: Hot air convection
- Atmosphere: Air



- Despite the high temperature profile, S3X58-HF1200 exhibited excellent wetting and caused no unmolten solder particles.



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Meltability – Solder dewetting test

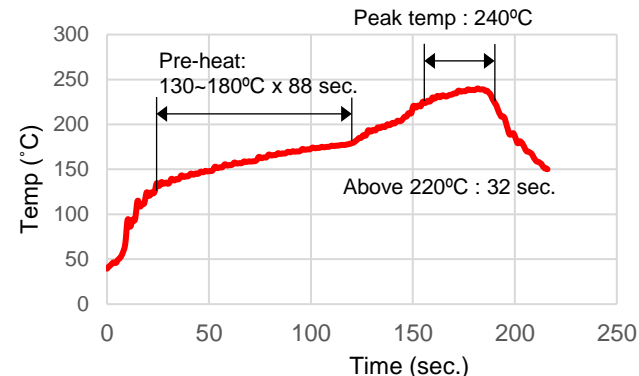
Test condition

- Material: Cu, Ni, Oxidized Cu*¹, C7521*², Ni/Al
- Stencil thickness: 0.2 mm (laser cut)
- Heat source: Hot air convection
- Atmosphere: Air

*¹ Oxidization condition-1: 150°C x 40 hrs

*¹ Oxidization condition-2: 85°C85RH% x 168 hrs

*³ C7521: Nickel Silver(64Cu-18Ni-18Zn)



- Newly developed powerful activator technology provided excellent solder spreading not only on standard substrates, but also difficult to solder oxidized Cu, C7521 & oxidized ImSn.

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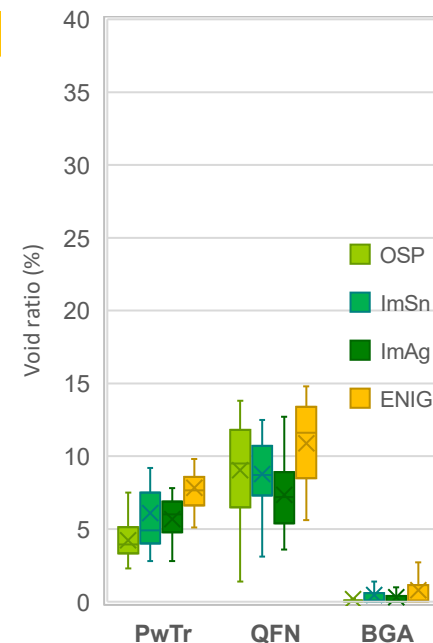
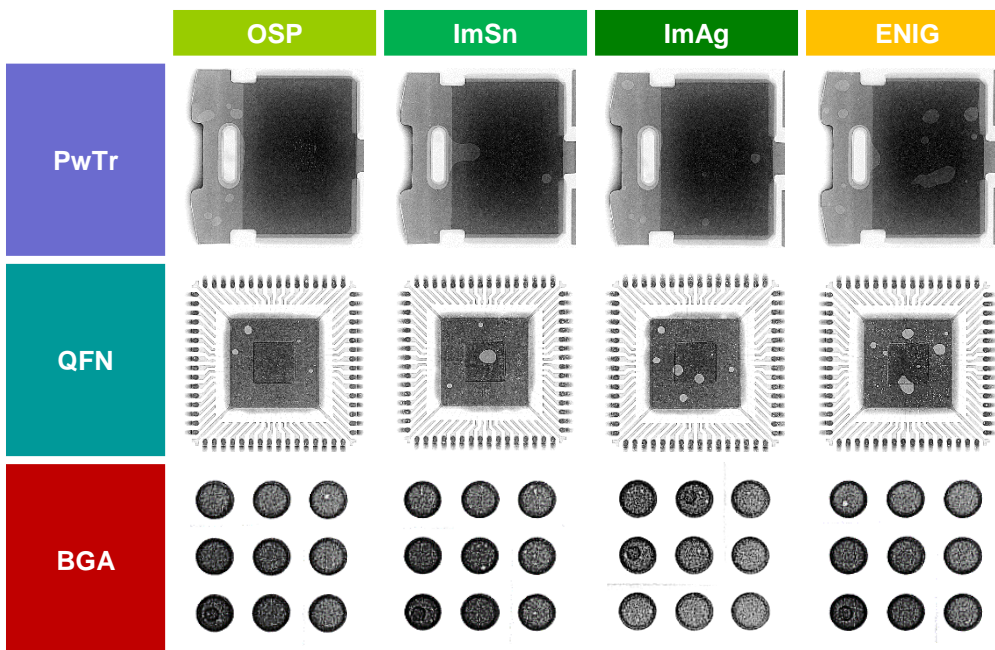
Handling guide

Voiding

Test condition

- Material: Glass epoxy FR-4
- Surface finish: OSP, ImSn, ImAg, ENIG
- Stencil thickness: 0.12 mm (laser cut)
- Stencil aperture: 100% aperture opening to pad

- Component: 100% Sn plated – PwTr, QFN x n15
SAC305 – BGA x n132
- Heat source: Hot air convection
- Atmosphere: Air
- Reflow profile: See “Meltability - Fine pattern”



➤ Consistently low voiding is achieved with each type of component and surface finish.



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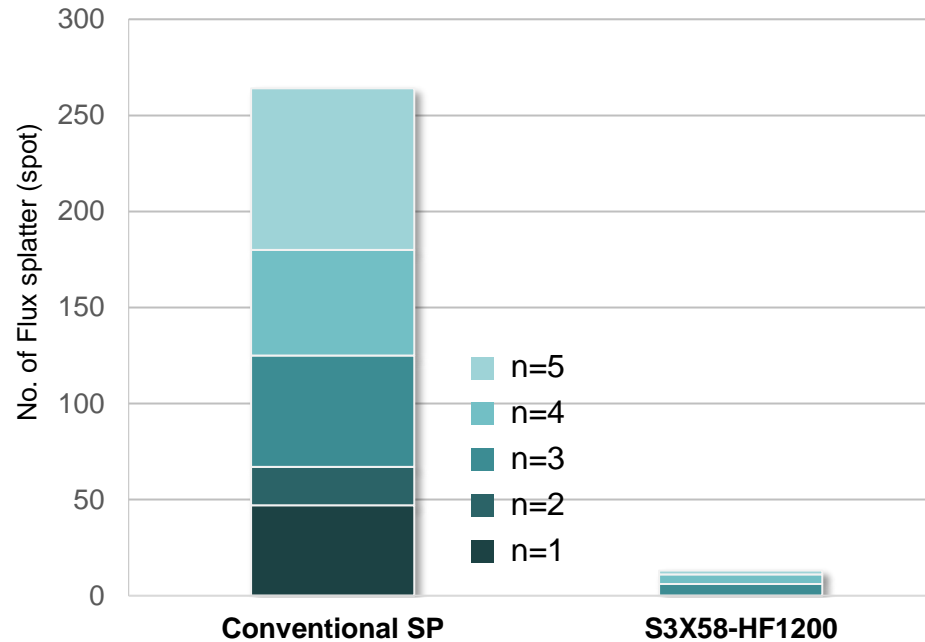
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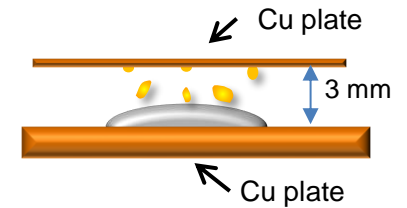
Flux splattering

Test condition

- Material: Phosphorous deoxidized copper (C1220)
- Stencil: 0.2 mm thickness, 6.5 mm diameter
- No. of specimens: n=5
- Reflow profile: See "Meltability - Fine pattern"

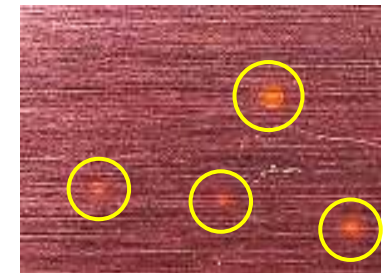


Splatter test



Place Cu plate above deposited solder paste and reflow to allow for attachment of flux splatter.

Count flux splatter number.



Flux splatter / example

- **S3X58-HF1200** resulted in very few flux splatter while conventional solder paste splattered in high amounts.



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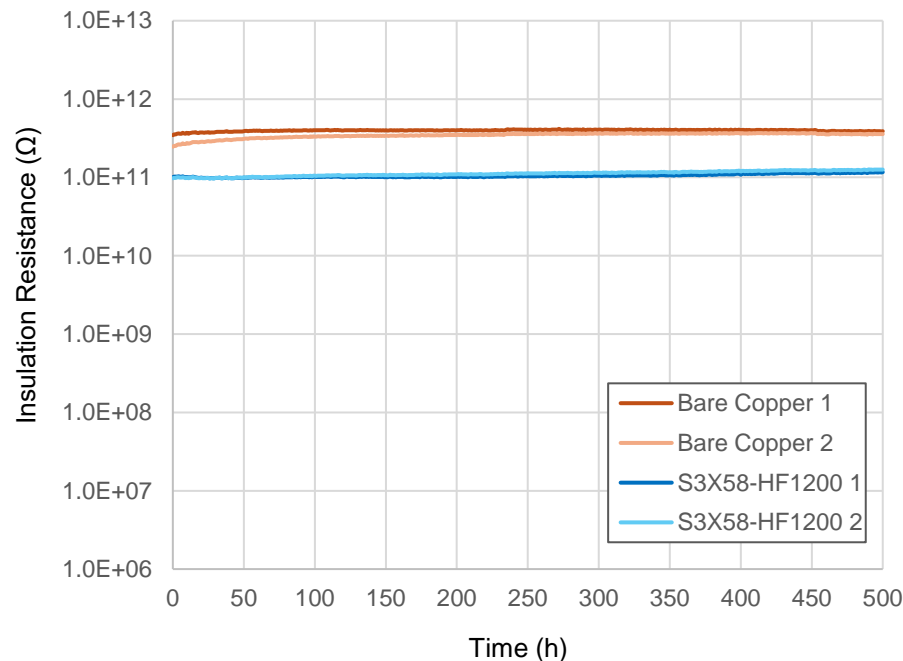
General properties

Handling guide

Electrical reliability - Electro-chemical migration (ECM)

Test condition

- Test standard: IPC TM-650 2.6.14.1
- Test coupon: IPC-B-25
- Surface finish: OSP
- Chamber condition: 65°C / 88.5%RH
- Voltage: Applied 10 V / measurement 100 V
- Reflow: Hot air convection in air atmosphere
- Reflow profile: See "Meltability - Fine pattern"



$$IR_{avg} = 10^{\left[\frac{1}{N} \sum_{i=1}^N \log IR_i \right]}$$

N = number of test points (10 minimum),

IR_i = individual insulation resistance measurements

Coupon	IR _{avg} (Ω)
Bare Copper (Control) 1	3.97E+11
Bare Copper (Control) 2	3.44E+11
S3X58-HF1200 1	1.05E+11
S3X58-HF1200 2	1.12E+11

➤ **S3X58-HF1200** resulted with high insulation resistance.



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Measurement Method

Ion Chromatography, Quartz combustion tube



Elements	Results
F	Not detected*
Cl	Not detected
Br	Not detected
I	Not detected

*Not detected: Detection limit <50ppm

- **S3X58-HF1200** has no addition of any of the halogens and is classified as ROL0 (Cl+Br+I+F = <500ppm according to IPC J-STD-004B and 004C).



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Item	Result	Test Method
Slump properties	0.3 mm pass	JIS Z 3284-3 150°C for 10 min.
Solder ball test	Category 3	JIS Z 3284-4
Tack time	≥ 72 hours	JIS Z 3284-3
Cu mirror test	Type L	IPC-TM-650 2.3.32
Cu plate corrosion test	No corrosion	IPC-TM-650 2.6.15
Insulation resistance test	≥ 1E+11 Ω	IPC-TM-650 2.6.3.7
Electrochemical migration test	No evidence of migration	IPC-TM-650 2.6.14.1



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Recommended print condition

1) Squeegee condition

- | | |
|-------------------|--------------------------|
| 1. Shape | Flat |
| 2. Material | Metal or Urethane blade |
| 3. Angle | 50-60° |
| 4. Print pressure | Relatively low (40-60 N) |
| 5. Squeegee speed | 20 - 80 mm/sec. |

2) Stencil

- | | |
|--------------------------|---|
| 1. Thickness | 0.15-0.10 mm for 0.65-0.4 mm pitch pads |
| 2. Fabrication method | Laser or chemical etch |
| 3. Stencil release speed | 7.0-10.0 mm/sec. |
| 4. Snap-off speed | 0 mm |

3) Ambient condition

- | | |
|---------------------|---|
| 1. Temperature | 23-26°C |
| 2. Humidity | 40-60%RH |
| 3. Air conditioning | Direct air blowing on the stencil will dry the solder paste faster. Adjust the direction of air blowing on the stencil using a shield, etc. |

4) Notes

- | | |
|----------------------|---|
| 1. Stencil thickness | The maximum recommended stencil thickness is 0.2 mm.
A thicker stencil than this may induce the occurrence of solder balling around the solder fillet. |
| 2. Pin-in-Paste | Flux residue may accumulate on the tip of connector pins. It is not recommended to strike the ICT probe at the tip of the connector pins. |

Caution: When handling solder paste, personal protective measures as advised by your Health and Safety department should always be adhered to.



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1. Pot life

- 1) Once paste has returned to ambient temperature it is fit for use.
- 2) Once the solder paste is opened, but not kneaded by a spatula nor a mixing machine
→ **Within the remaining shelf life of the product by storing it back in the refrigerator at 0-10°C.**
- 3) Once the solder paste is opened and kneaded by a spatula or a mixing machine
→ **Within 1 week to 1 month by storing it back in the refrigerator at 0-10°C**
- 4) Once the solder paste is opened, kneaded by a spatula and worked on the stencil with the squeegee blades.
→ **Within 24 hours**

*NOTE: What is described in this guide does not necessarily mean a guarantee of the performance/quality of the solder paste.

2. Shelf life (at 0 ~ 10°C)

Storage temperature	Package	Shelf life
0 ~ 10°C	Jar	6 months from manufacturing date
	Cartridges	6 months from manufacturing date

Attention: “Storage temperature” is applicable upon receipt by a customer – label information on product also relates to storage conditions of product upon receipt by a customer.

* How to interpret the lot number: e.g. Lot No. **4 10 25 1**

- # of production batch: 1st batch
- Date of production: 25th
- Month of production: October
- Year of production: 2024



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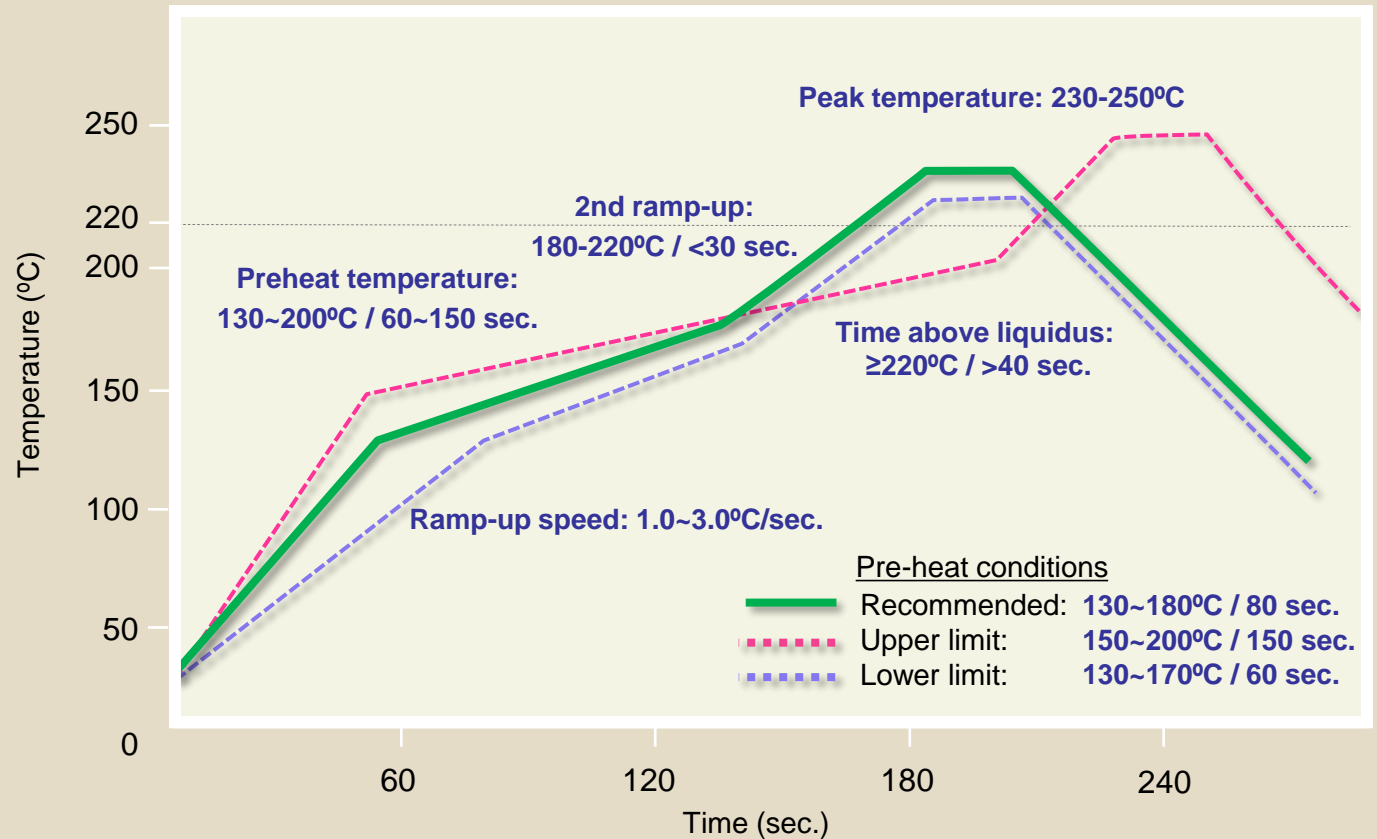
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