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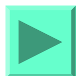
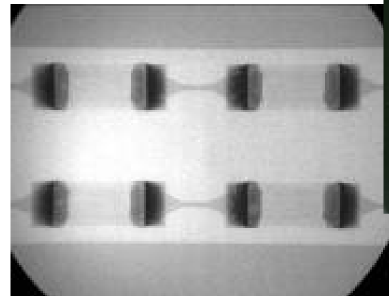


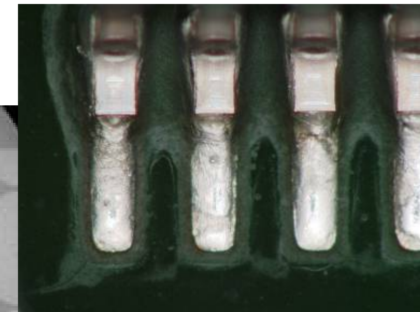
LEAD FREE solder paste

TOYOTA's recommended solder paste for automotive electronics

GSP

Product information





Crack-Free Residue

This Product Information contains product performance assessed strictly according to our own test procedures and may not be compatible with results at end-users.

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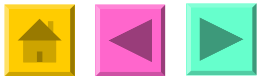

Product Features

- **Alloy composition: Sn96.5Ag3.0Cu0.5**
- **Highly reliable flux residue**
- **Crack-free in flux residue after 1000 thermal cycles of -40ºC / +125ºC**
- **Prevent the occurrence of capillary balling through 4-hour continual printing**
- **Excelling wetting to lead frames of QFP and SOP**
- **Residue adhesion is extremely low**
- **Specially designed for automotive electronics e.g. ECU, EV, EHV, to be used in N_2 environment**

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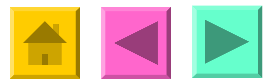

Specifications

Application		Printing - Stencil
Product		G S P
Alloy	Composition (%)	Sn96.5 Ag3.0 Cu0.5
	Melting point (℃)	217 － 219
	Shape	Spherical
	Particle size (μm)	20 – 38
Product	Halide content (%)	0.06
	Flux content (%)	10.9 ± 0.5
	Viscosity* (Pa.S)	160 ± 30
	Copper plate corrosion**	Passed
	Tack time	24 hours
	Shelf life (below 10℃)	6 months

* Viscosity — Malcom spiral type viscometer, PCU-205 at 25℃ 10rpm (Processing before measurement: Malcom sofner SPS-1 at 12min)

**Copper plate corrosion — In accordance with JIS Z 3197

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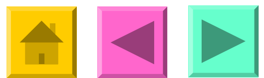

Product identification

G S P

This product has been designed and co-developed by Toyota Motor Corporation with the objective of improving the quality, cost performance, and lead time of automotive electronics to be used in N_2 environment.

Toyota group GSP co-development participated by:

Toyota Motor Corporation / Denso Corporation / Fujitsu Ten Limited

Product name 'GSP' stands for ***Global Solder Paste.***
Note that the conventional product identification system of Koki does not apply.

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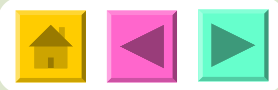
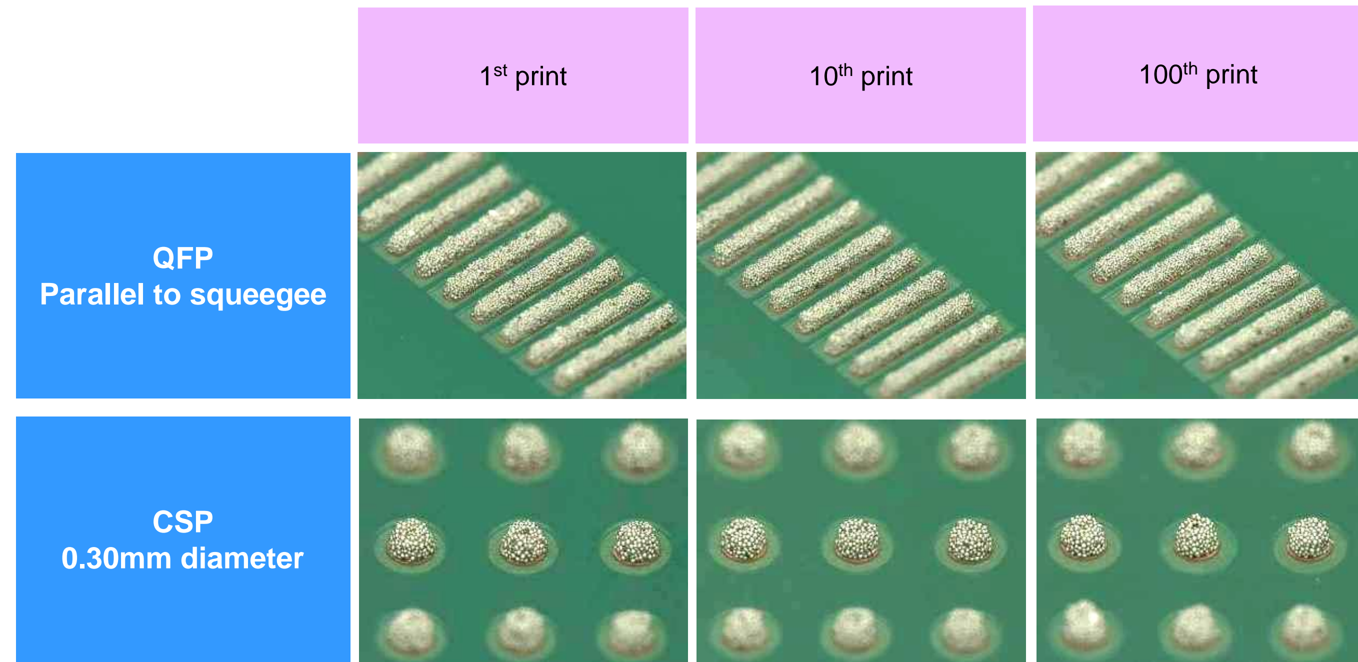


Continual printability

- Squeegee — Metal blade, angle - 60º
- Print speed — 40mm/sec.
- Stencil — 0.15mm thickness, laser cut
- Stencil separation speed — 10mm/sec
- Atmosphere — 25±1°C, 50±10%RH
- Test patterns — QFP pad pattern – 0.4mm pitch, Length 1.5mm, Width 0.2mm
  CSP pad pattern – Diameter 0.30mm



Excellent and consistent printability through 100 prints.

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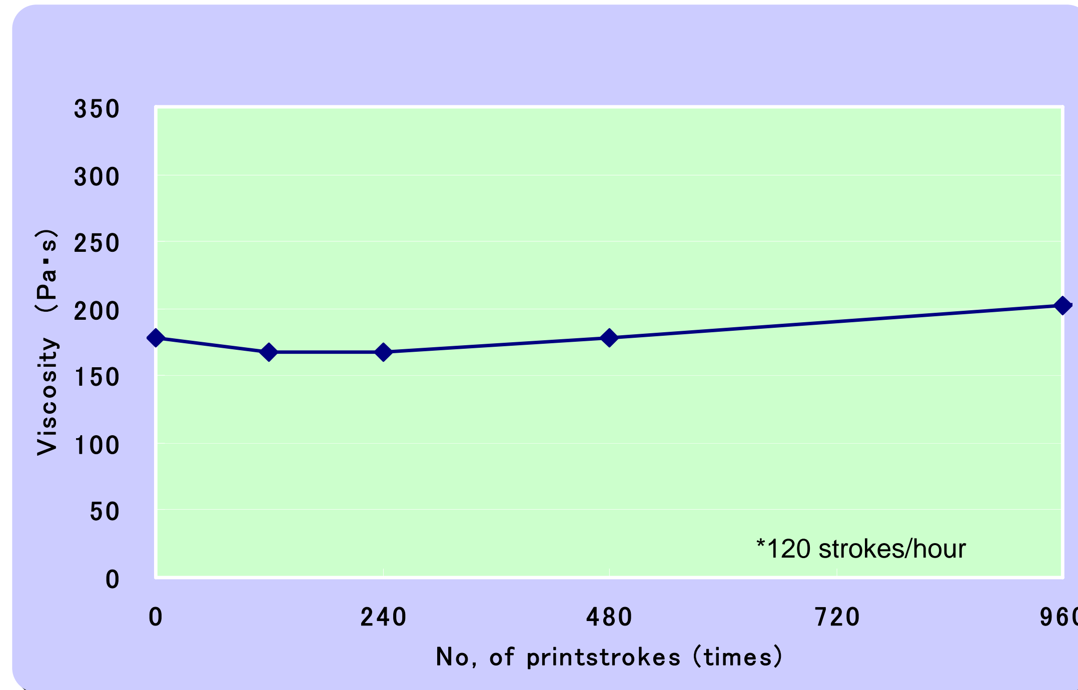
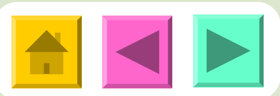
Viscosity variation in continual printing

- Print (knead) solder paste on the sealed-up stencil continually and observe viscosity variation.
- Squeegee Metal blade, Angle - 60º
- Squeegee speed 30mm/sec.
- Print stroke 300mm
- Printing environment 25±1ºC, 50±10%RH



Specially formulated flux chemistry has succeeded in minimizing chemical reaction between solder powder and flux during print rolling, thus exhibiting consistent long term printability.



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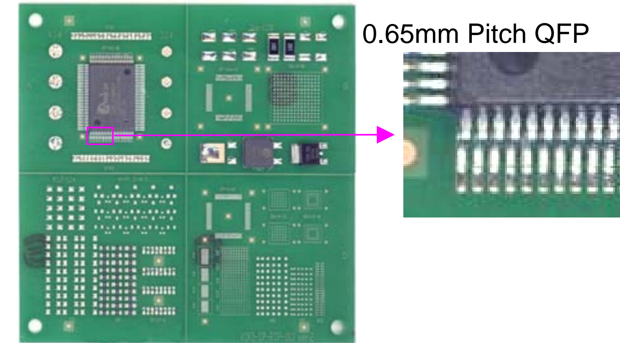
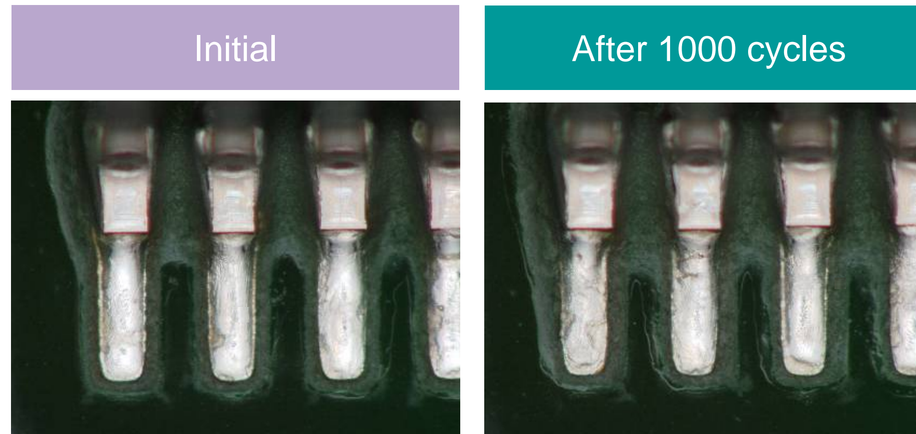
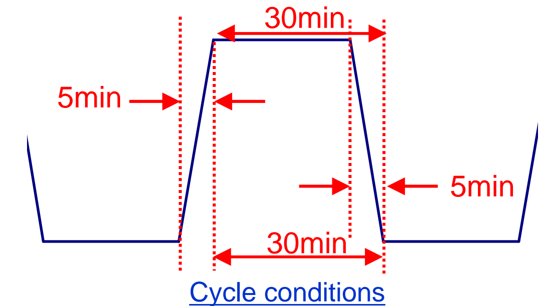
Thermal cycling

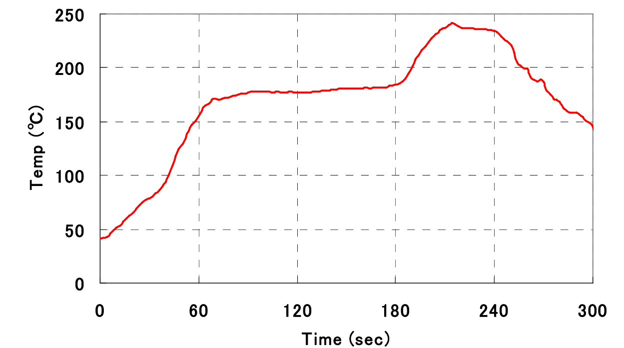
- Cycle condition — +40/+125ºC x 1000 cycles
- Material — Glass epoxy FR-4
- Surface treatment — OSP
- Stencil thickness — 0.18mm (laser cut)
- Component — 0.65mm pitch QFP
- Stencil aperture — 100% aperture opening to pad
- Reflow machine — Koki Tech APSR-257
- Atmosphere — N_2 (O_2 concentration < 1500ppm)
- Reflow profile — See below



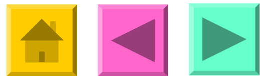




Cycle conditions



No notable cracking in the residue through 1000 cycles.



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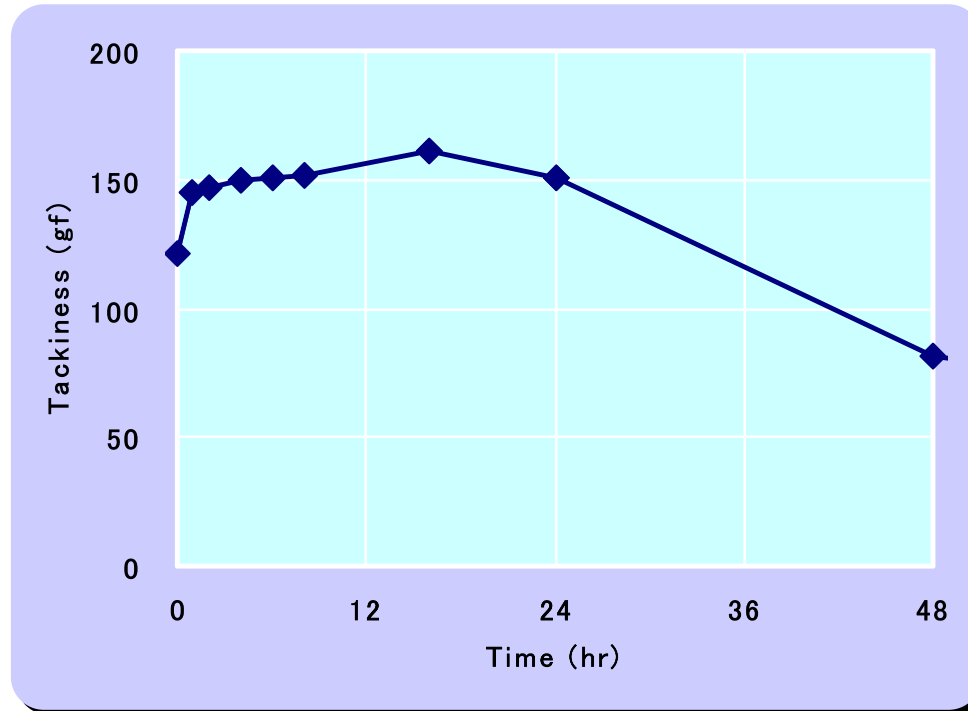
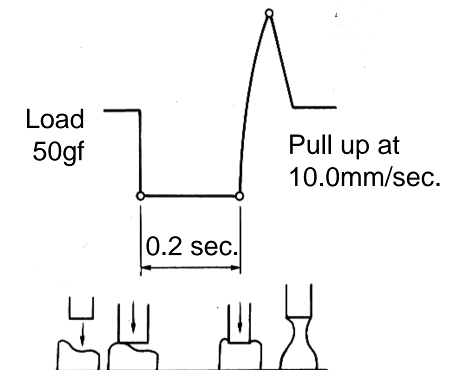
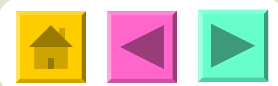
Tack time

- Stencil — 0.2mm thick, 6.5mm dia. aperture
- Measurement instrument — Malcom tackimeter TK-1
- Probe pressure — 50gf
- Pressurizing time — 0.2sec
- Pull speed — 10mm/sec.
- Test method — JIS Z 3284
- Test environment — 25±1°C, 50±10%RH





Unique solvent system successfully assures sufficient tack time.



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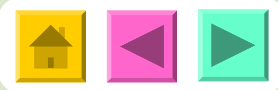
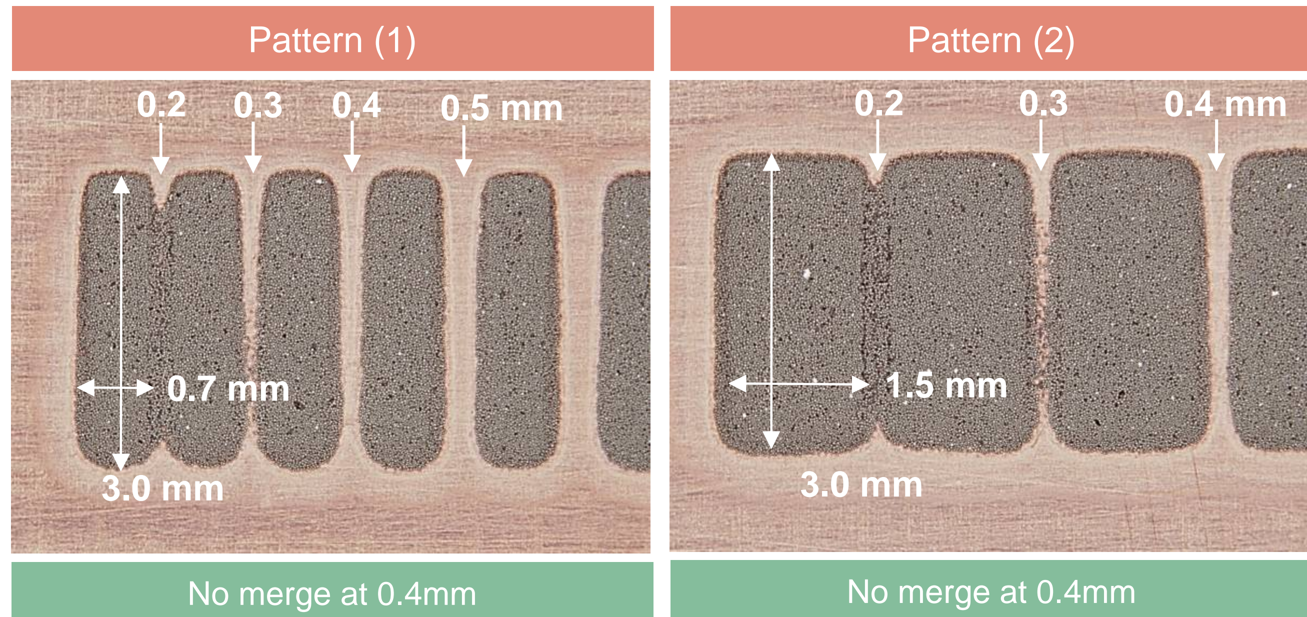


Heat slump

- Stencil thickness 0.2mm
- Stencil aperture Pattern (1) 3.0mm x 0.7mmm
  Pattern (2) 3.0mm x 1.5mm
- Spacing between apertures 0.2mm to 1.2mm
- Heat profile 180ºC X 5min.



Improved heat slump property assures reduced soldering defects, such as solder beading and bridging.

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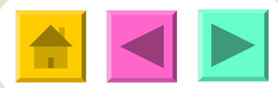
Solder balling (in air)

- Stencil 0.2mm
- Stencil aperture 6.5mm diameter
- Solder pot temperature 250ºC
- Test method JIS Z 3284

Category 1	2	3	4

1 hour after printing	24 hours after printing
Category 3	Category 3



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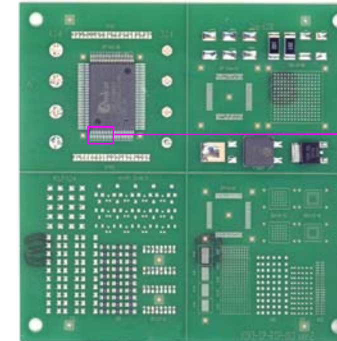
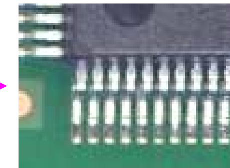
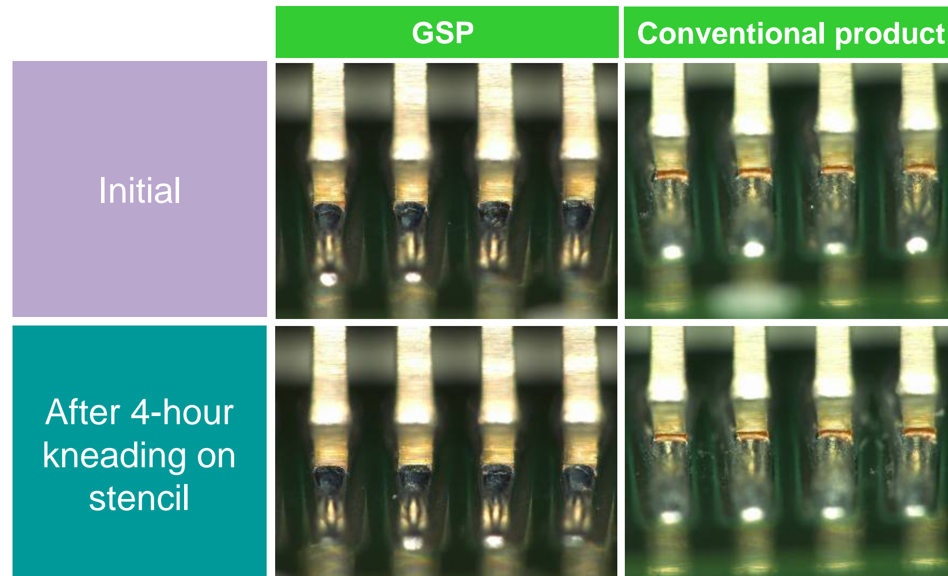
Wetting test

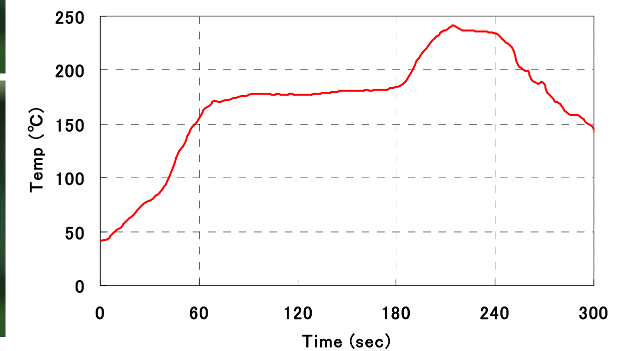
• Material	Glass epoxy FR-4
• Surface treatment	OSP
• Stencil thickness	0.18mm (laser cut)
• Component	0.65mm pitch QFP
• Stencil aperture	100% aperture opening to pad
• Reflow machine	Koki Tech APSR-257
• Atmosphere	N_2 (O_2 concentration - 1500ppm)
• Reflow profile	See below



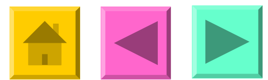
0.65mm Pich QFP







Complete coalescence by minimum deterioration of barrier performances through 4-hour kneading.



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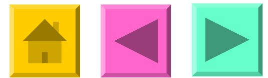
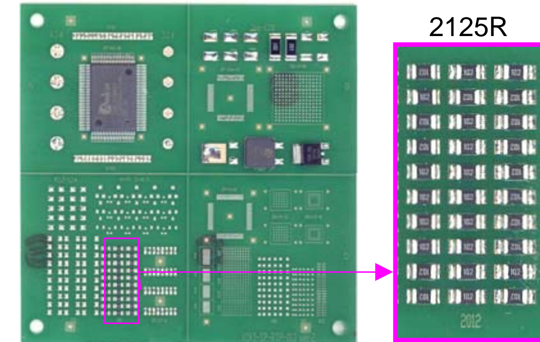


Capillary balling

- Material — Glass epoxy FR-4
- Surface treatment — OSP
- Stencil thickness — 0.15mm (laser cut)
- Stencil aperture — 100% aperture opening to pad
- Component — 2125R 30 pieces / board
- Reflow profile — Same as “*Wetting test*”



	GSP	Conventional product
Initial	0 pc.	3 pcs.
After 4-hour Kneading On stencil	0 pc.	13 pcs.

The occurrence of capillary balls is contained through 4-hour kneading.

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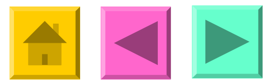
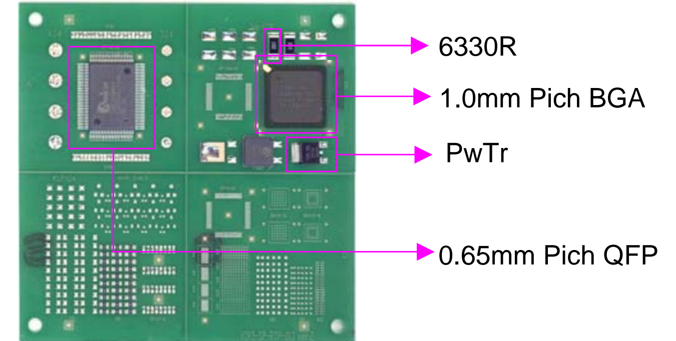


Voiding

• Material	Glass epoxy FR-4
• Surface treatment	OSP
• Stencil thickness	0.15mm (Laser cut)
• Stencil aperture	100% aperture opening to pad
• Components	
PwTr	100% Sn plated
2125R	100% Sn plated
1.0mm pitch BGA	Sn96.5Ag3.0Cu0.5
• Reflow profile	Same as "*Wetting test*"



	PwTr	6330R	BGA	QFP
Initial				
After 4-hour kneading on stencil				

Prolonged kneading time does not affect the occurrence of voids.

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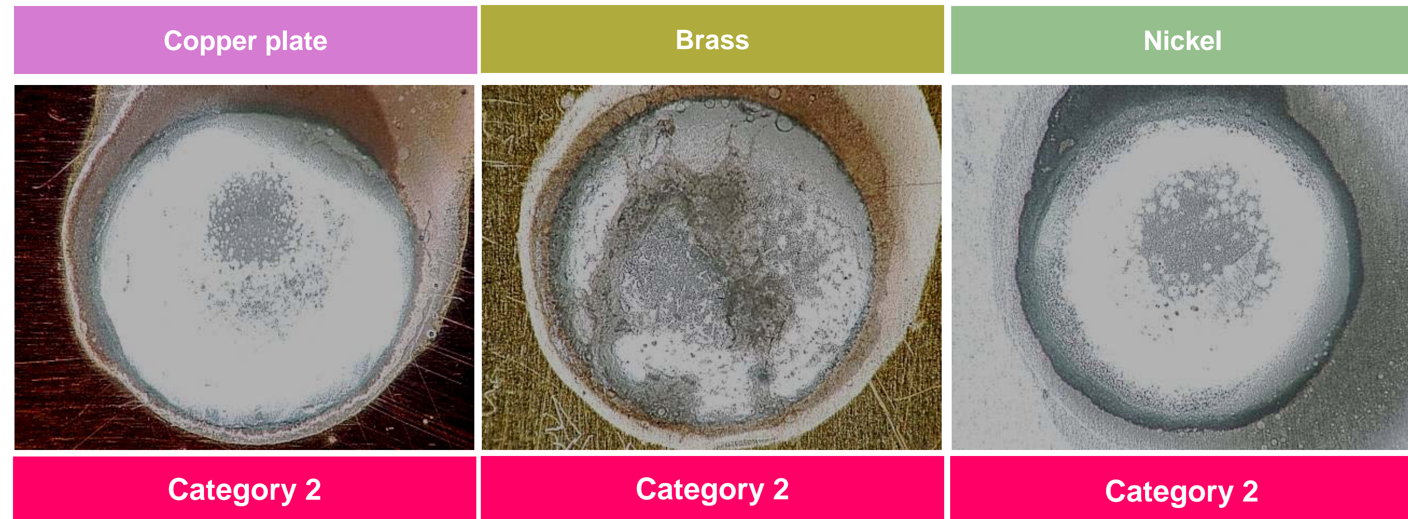
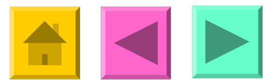
Solder spreading

- Material piece — Copper, Brass, Nickel
- Stencil thickness — 0.2mm (laser cut)
- Stencil aperture — 6.5mm diameter
- Heat source & temp. — Same as "*Wetting test*"



Category 1 : Solder has spread more than the area where solder paste was printed.
Category 2 : Solder has spread whole area where solder paste was printed.
Category 3 : Solder has not partially spread.
Category 4 : Solder spread is less than the area where solder paste was printed (non-wetting)

Solder spreads well to all of the materials.



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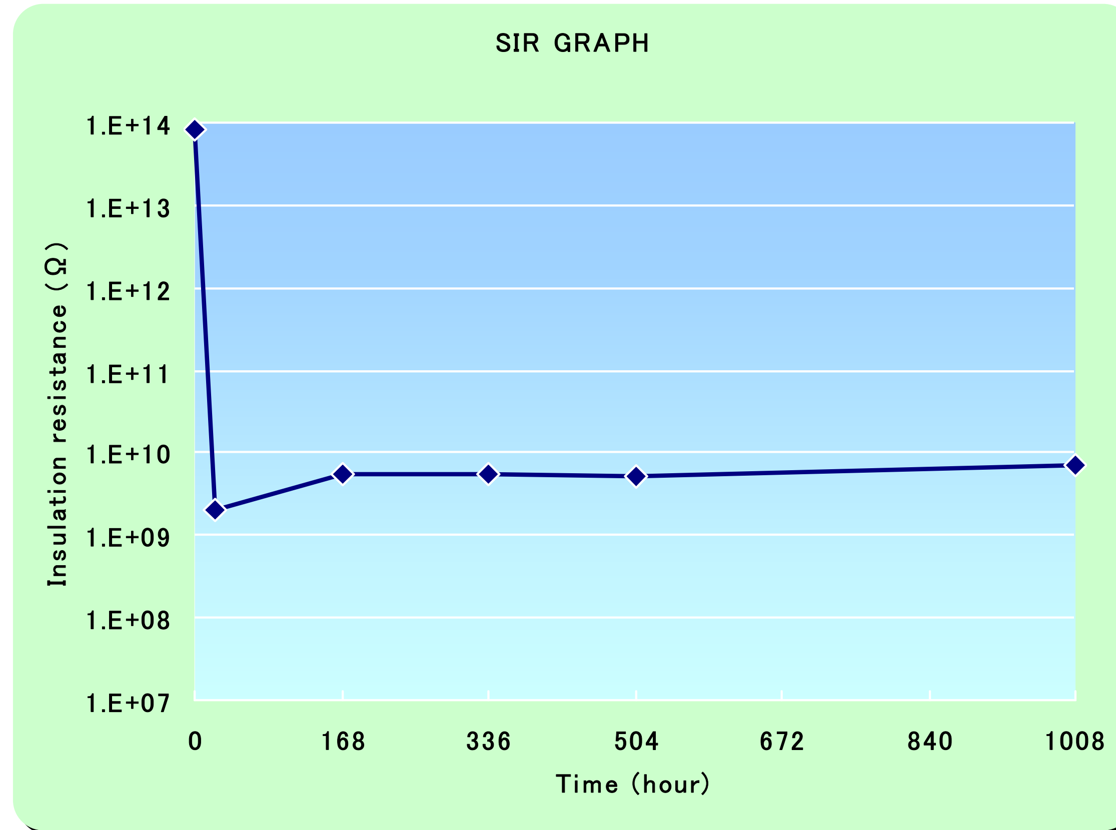
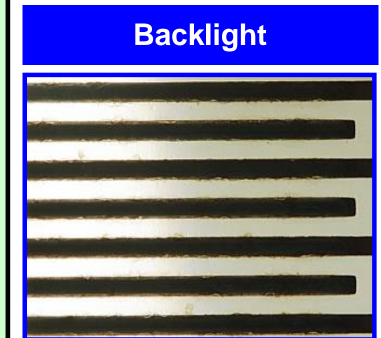
Voltage applied surface insulation resistance

- Test conditions: 85±2ºC x 85%±5RH 1000 hr.
- Stencil thickness: 150 μm
- Comb type electrode: JIS type-II
- Measurement voltage: DC100V
- Voltage applied: DC20V

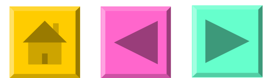


Backlight



Direct light

No evidence of electro-migration.



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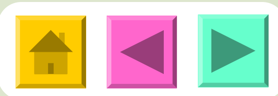

Halide content

- Test method JIS Z 3197（Potentiometric titration method）
- Measurement instrument AT-400 (Kyoto Electronics Manufacturing)

(%)

n1	n2	n3	AVE
0.06108	0.06113	0.05943	0.0606

＊Figures are converted into Chlorine.

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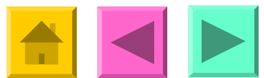
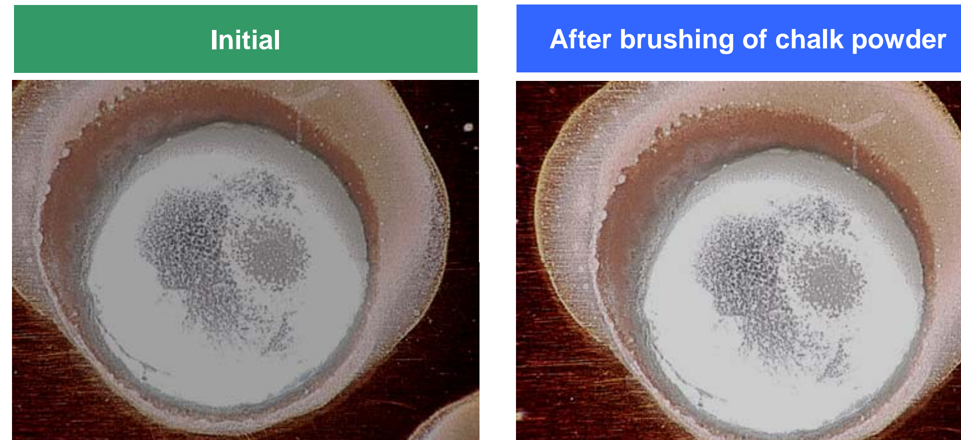


Dryness

- Material piece — Copper plate
- Stencil thickness — 0.2mm（laser cut）
- Stencil aperture — 6.5mm diameter
- Heat source & temp. — Same as “*Wetting test*”
- Judge — chalk powder on flux residue are softly brushed.



Chalk powder can be easily removed by a soft brush.

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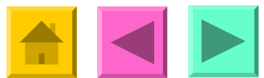


Handling guide

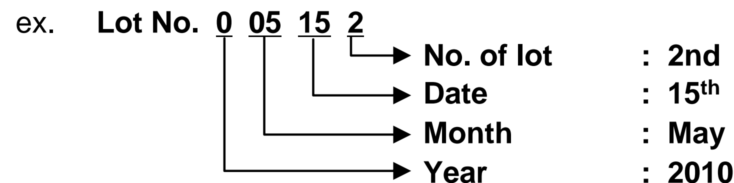
1. Printing
   1) Recommended printing parameters
      (1) Squeegee
         1. Kind : Flat
         2. Material : Rubber or metal blade
         3. Angle : 60°
         4. Pressure : 40N
         5. Squeegee speed : 20～40mm/sec.

      (2) Stencil
         1. Thickness : 180～150μm for 0.65mm pitch pattern
            120～100μm for 0.5～0.4mm pitch pattern
         2. Type: : Laser or electroform
         3. Separation speed : 7.0～10.0mm/sec.
         4. Snap-off distance : 0mm

      (3) Ambiance
         1. Temperature : 22～25ºC
         2. Humidity : 40～60%RH
         3. Air draft : Air draft in the printer badly affects stencil life and tack performance of solder pastes.

2. Shelf life
   0～10℃ : 6 months from manufacturing date

   * Manufacturing date can be obtained from the lot number



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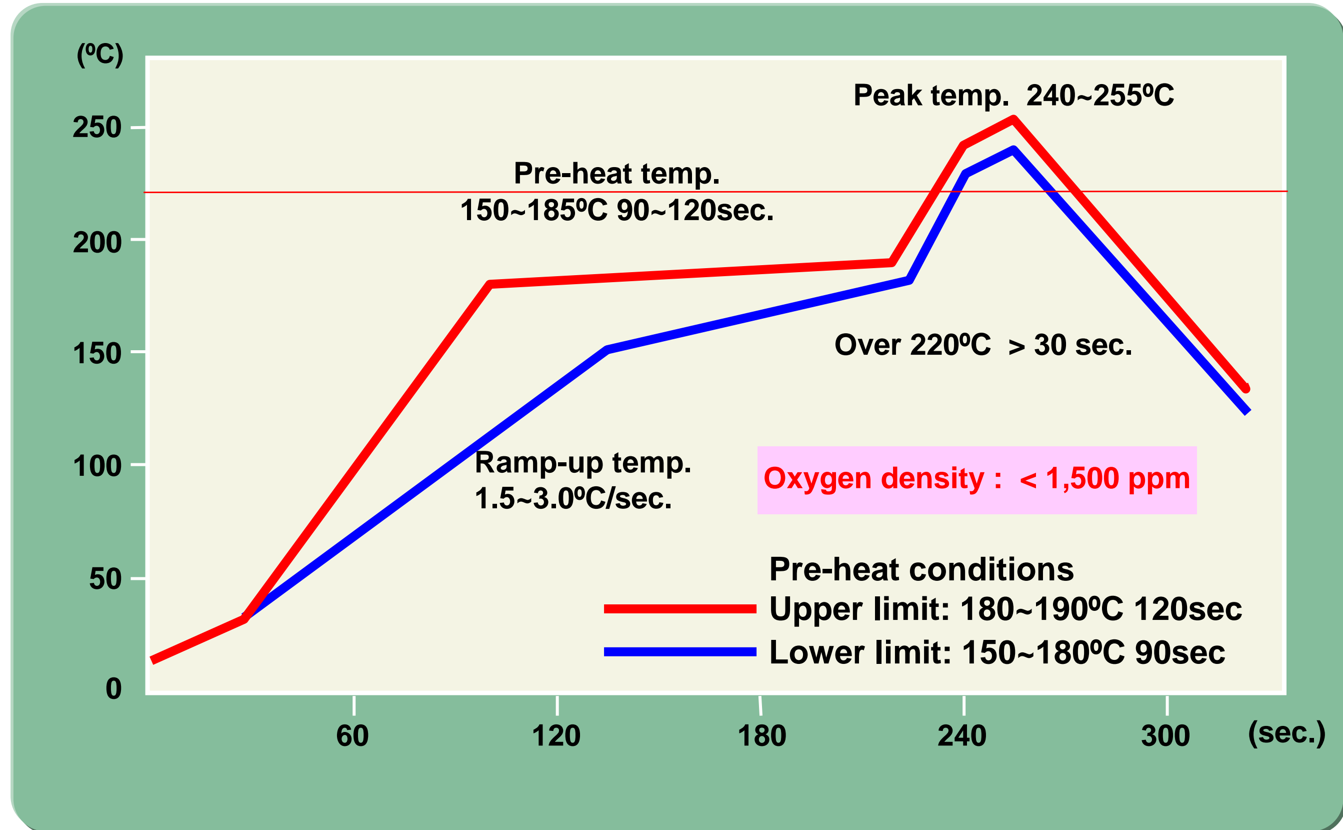
Thermal cycling
Tack time
Heat slump
Solder balling
Wetting
Capillary balling
Voiding
Solder spreading
Voltage applied SIR
Halide content
Dryness
Handling guide

Handling guide – Recommended reflow profile



Exclusively designed for N_2 environment (Atmospheric environment not recommended).

Recommended O_2 concentration is below 1500ppm. However, it may require ample studies before use as the optimum parameters may vary depending on the machine and environment.