

Anti-Pillow Defect Lead Free Solder Paste

S3X48-M406-5

PREVENTS the occurrence of **HIDDEN PILLOW DEFECT** (Head in Pillow) and ensures the highest quality of solder joints.

Ensures **OUTSTANDING** continual **PRINTABILITY** with super fine pitch and CSP applications and has exceptionally long stencil idle time.

New heat **RESISTANT** flux formulation achieves complete solder melting and wetting on micro-components and footprints in all finishes.

Background of development

Using mobile telephones as a typical example, whilst downsizing of the electronic devices continues, more and more space saving components, such as BGAs and CSPs, are being widely used. It has become a critical issue when complete solder merging between the bumps and solder does not occur, and is referred to as "hidden pillow defect" or "head in pillow" under certain conditions.

The solder paste **S3X48-M406-5** has been specifically developed to solve this difficult technical problem, not only for bumped components such as BGAs, but also exhibits excellent wetting with all other types of components.



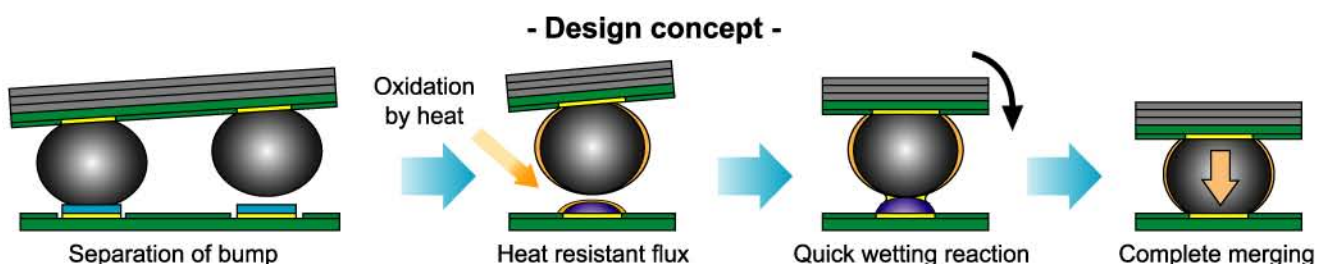
Pillow defect

Mechanism of occurrence of Pillow Defect

For various reasons, such as package warpage and co-planarity, inconsistent bump size, insufficient solder deposit, distortion of package during reflow etc., will induce the solder bump to be separated from the solder paste before the solder melts and wets to it. In such cases where the solder bump separates from the solder paste, during heating in the reflow oven, an adverse effect occurs in two areas. Firstly, the area of the bump surface where it is in contact with the molten solder gets badly oxidized, and secondly, the flux activation of the solder paste will be too quickly consumed as the solder melts, thus forming a layer of oxidized flux and solder on the surface.

When the bump descends onto the molten solder due to the weight of the package and wetting forces from the other joints, the oxide film formed on the surface of the molten solder paste and the molten solder bump with almost no flux activation, prohibits them from fully merging together.

It seems difficult to completely prevent the separation of the bumps from the solder paste, so it is critical to develop the solder paste featuring **high heat resistance** characteristics to protect the solder powder and bump from oxidation and sustain the activation strength of the flux for a long time at high temperatures. Furthermore it is necessary to facilitate **quick wetting reaction speeds** to reduce the exposure time of the solder bump and secure sufficient time for the bump to collapse and merge with the molten solder paste.



Anti-Pillow defect

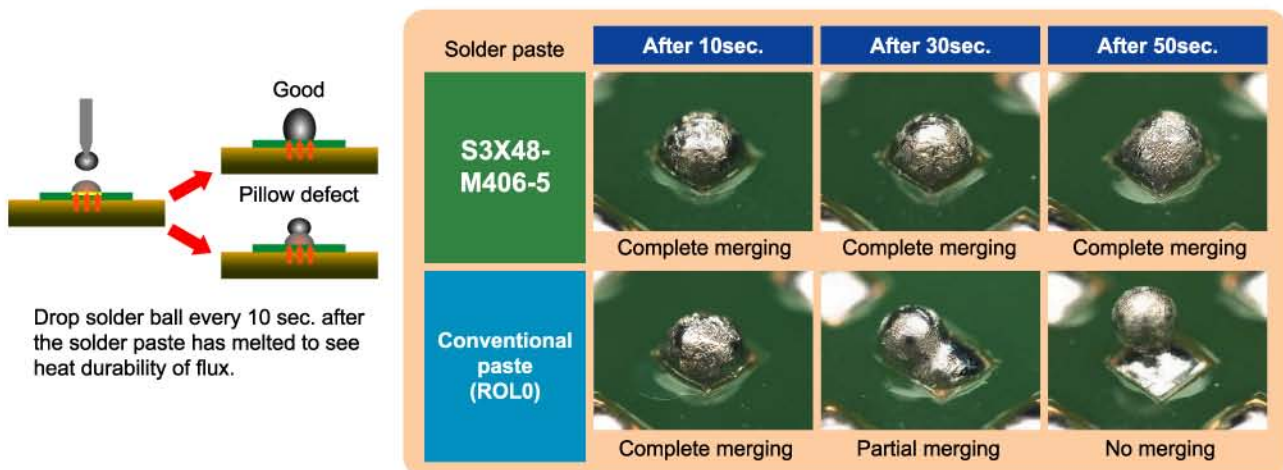
Significant enhancements in the heat resistance of the flux and wetting reaction speed have succeeded in reducing the occurrence of hidden pillow defect.

S3X48-M406-5 assures robust wetting action to BGA bumps even with intentional extra oxidation.

► Retention of flux activation

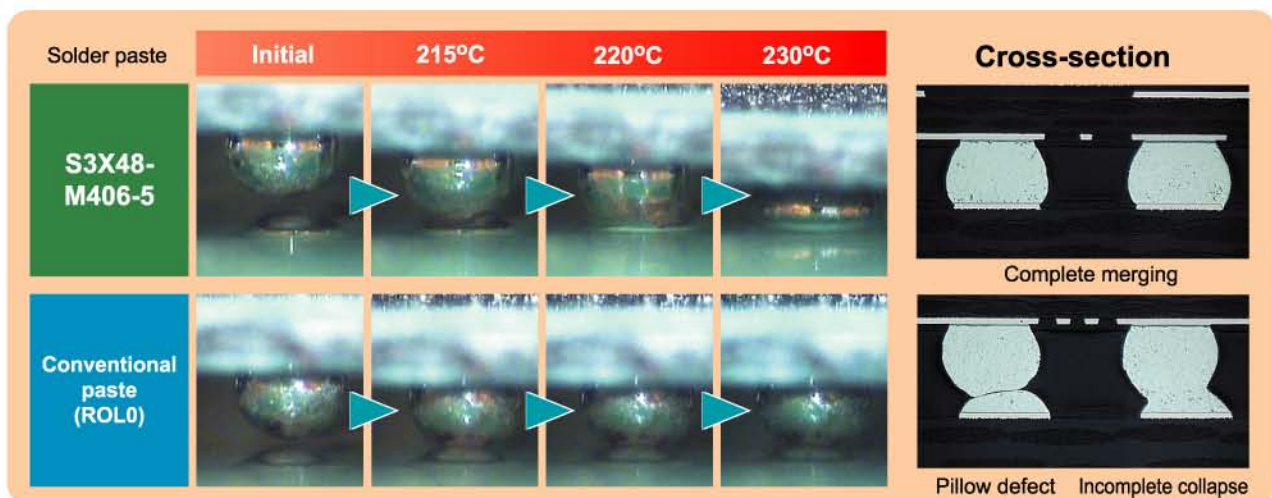
The influence of progressive oxidation of flux/molten solder over retention of flux activation.

- Stencil : 0.12mm thickness, 100% aperture to pad size
- Pad : 0.8 x 0.8mm chip pad
- Solder ball : Sn3Ag0.5Cu, 0.76mm diameter
- Test procedure : Melt solder paste on hot plate and drop solder ball at every 10sec.



► Pillow defect test

- Material : Glass epoxy FR-4
- Stencil thickness : 0.12mm
- Pad size : 0.5mm
- Component (BGA): SnAgCu, 1.0mm pitch, 196 bumps x 5, pre-conditioned at 180°C X 100sec.
- Procedure:
 1. Reflow solder paste without BGA.
 2. Place BGA on pre-reflowed solder.
 3. Reflow it.
- Surface treatment : OSP
- Stencil aperture : 100% aperture opening to pad
- Atmosphere : Air



New formula **S3X48-M406-5** wets much faster than the conventional product and immediately breaks the oxide film formed on the surface of both the solder bump and the molten solder and enables quicker wetting and complete collapse of the bump to ensure joint quality.

S3X48-M406-5 succeeded in securing a drastic reduction of pillow defects.

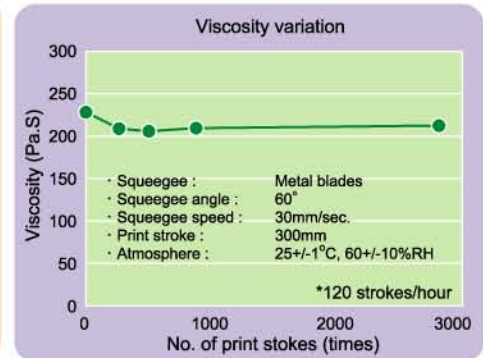
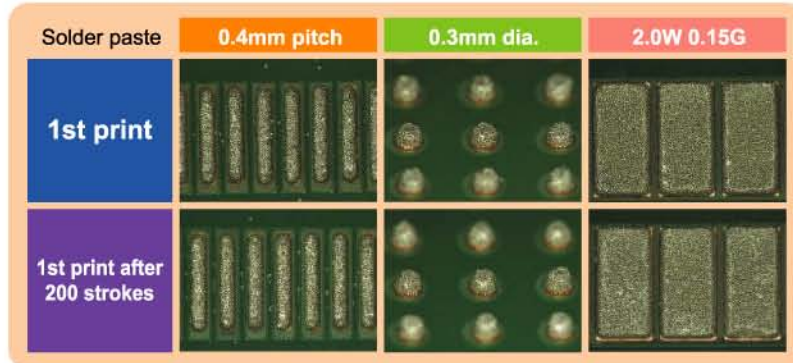
Print quality

► Print quality and Viscosity variation in continual print

A newly developed flux formula has succeeded in realizing consistent long term printability by preventing excess viscosity drop due to shear thinning and excess increase due to chemical reaction between solder powder and flux during rolling.

S3X48-M406-5 is specially designed to be resistant to smearing and effectively prevent the occurrence of bridging due to shear stresses.

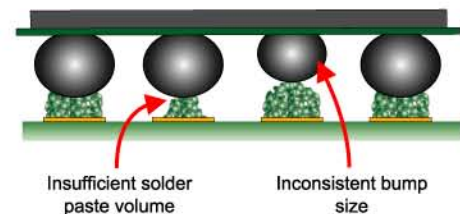
- Stencil: 0.12mm thickness, laser cut
- Print speed: 40 mm/sec
- Snap-off speed: 10mm/sec



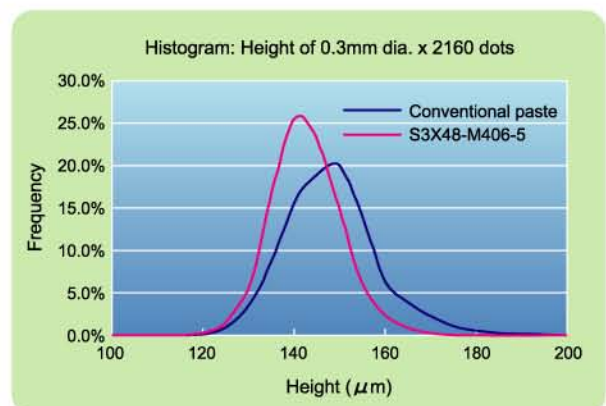
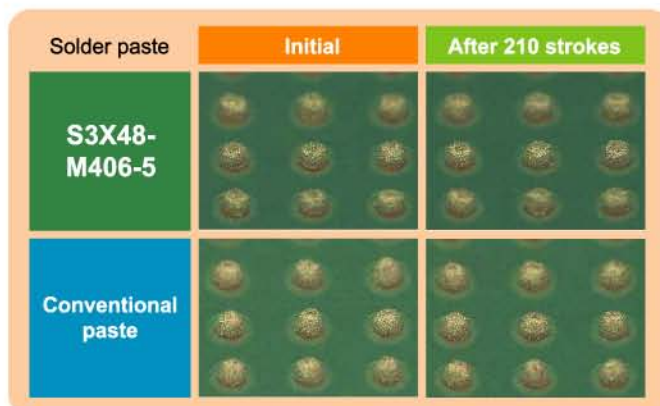
► Print stability

Printing of a consistent volume of the solder paste on the BGA pad is one of the most important factors in order to prevent various soldering defects, especially for pillow defects.

When the volume of the solder paste is insufficient due to poor printing, it can cause poor contact with solder bumps and also the resultant lack of flux in the smaller solder paste deposit. As a result, it will increase the chances of causing pillow problems.



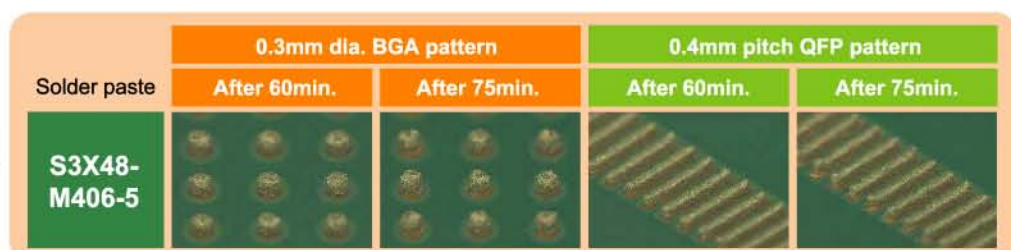
- Stencil: 0.12mm thickness, laser cut
- Stencil aperture: 0.3mm diameter
- Print speed: 40 mm/sec
- Snap-off speed: 10mm/sec



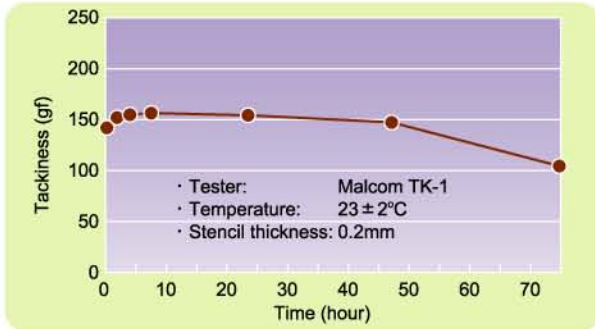
► Stencil idle time

Printing of consistent volume of the solder paste for

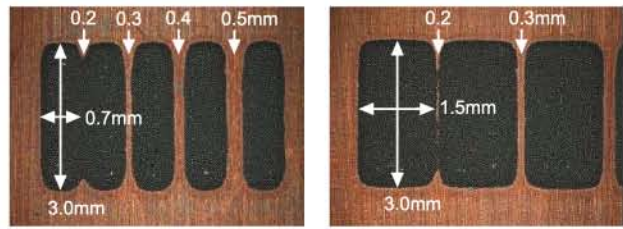
- Stencil: 0.12mm, laser cut
- Print speed: 40 mm/sec
- Snap-off speed: 10mm/sec



Tack time

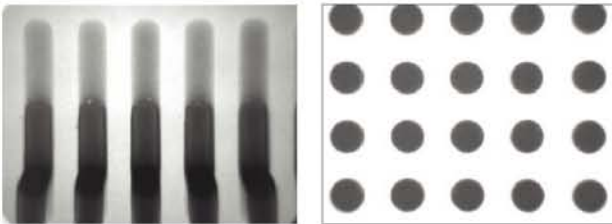


Heat slump



- Heat profile : 180°C × 5 min
- Test method : JIS Z 3284

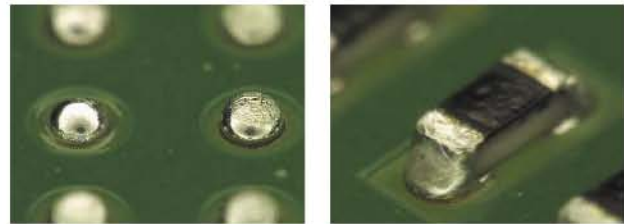
Voiding



QFP leads (100Sn)

BGA (SAC305)

Solder wetting



0.3mm dia. CSP pattern

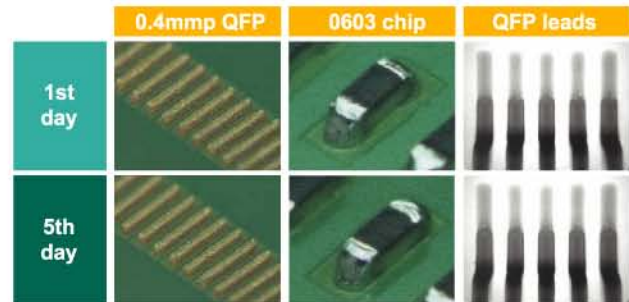
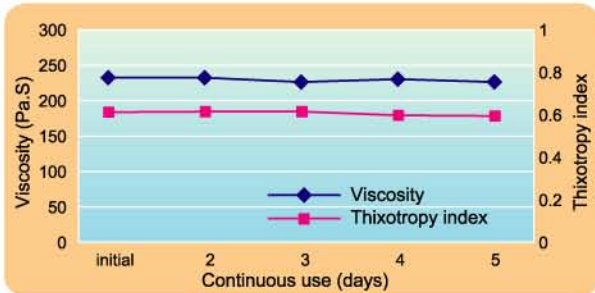
0603 chip (100Sn)

OSP board

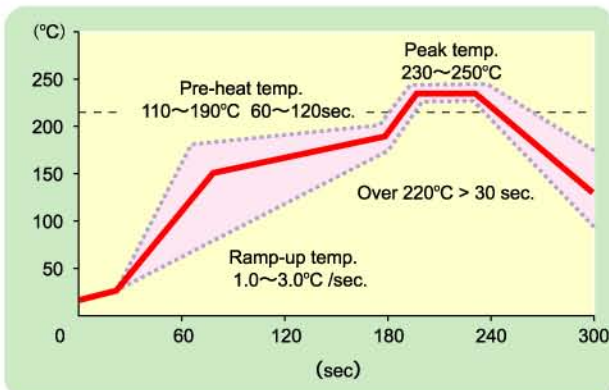
Durability (repeated use)

Test design enables a solder paste to be monitored under repeated use. **S3X48-M406-5** indicated consistent quality and performance over the period of 5 days of repeated use without any quality degradation.

- Rolling condition: 30mm/sec. x 300mm stroke, squeegee length 250mm
- Procedure: Viscosity/Ti check → Put 500g of fresh paste on stencil → Continuous rolling for 8hours/Check printability, wetting & voiding → Keep it in refrigerator over night → Dispose of 250g and add 250g of fresh paste → Viscosity/Ti check → Continue rolling for 8hours/check rest of features → Repeat this for 4 days.



Recommended reflow profile



Specifications

| Application | | Printing - Stencil |
|-------------|-------------------------|-------------------------|
| Products | | S3X48-M406-5 |
| Alloy | Composition (%) | Sn96.5, Ag3.0, Cu0.5 |
| | Melting point (°C) | 217 - 219 |
| Flux | Particle size (μm) | 20 - 45 |
| | Halide content (%) | 0.0 |
| | Flux type | ROL0 (ANSI / J-STD-004) |
| Product | Flux content (%) | 11.5 |
| | Viscosity (Pa.S) | 230 |
| | Copper plate corrosion | Passed |
| | Tack time | > 72 hours |
| | Shelf life (below 10°C) | 6 months |

*Specifications are subject to change.

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