

# SMIC



## Contact

### SENJU METAL INDUSTRY CO.,LTD.

**HEADQUARTERS**  
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URL [www.senju.com/en](http://www.senju.com/en)

Attention to counterfeit products.  
Counterfeit flux cored and other inauthentic SMIC solder products have been distributed abroad.  
Please purchase genuine SMIC products from SMIC subsidiaries or authorized distributors.

## SMIC LEAD FREE SOLDER CATALOGUE





## Offering Various Forms of Solder Material for the Future of Connection through “Total Solutions”

Senju Metal Industry Co., Ltd. (SMIC) commercialized the standard lead-free solder material M705 in 2000, making outstanding contribution for elimination of lead from components and products. SMIC is continuously developing and commercializing various forms of solder material based on our solder alloy development capabilities, such as high-level metal processing, organic synthesis, viscoelasticity control, compounding, soldering, unique casting/forging and granulation. SMIC is offering total solutions for soldering, including cost reduction, reliability improvement, density enhancement, energy conservation and environmental sustainability enhancement.



**ECO SOLDER ALLOY**

Various alloys harmonizing with environment  
**Solder Alloy ... P3**



**POST FLUX**

Promise effective solder wettability  
**Post Flux ... P7**



**ECO SOLDER CORED**

Continue new challenges and evolving  
**Flux Cored Solder ... P9**



**ECO SOLDER PASTE**

Realize next-generation soldering  
**Solder Paste.. P11**



**ECO SOLDER PREFORM**

Change the future of soldering  
**Solder Preform ... P15**



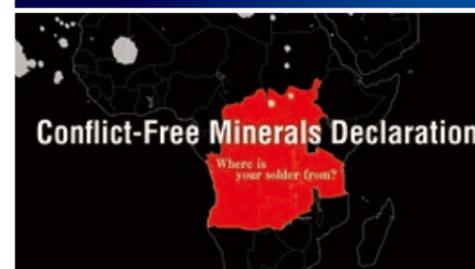
**ECO SOLDER BALL**

Realize semiconductor soldering one step ahead  
**Solder Ball ... P17**



**FLUX for SEMICONDUCTORS**

Take advantage of organic synthesis technologies  
**Flux for Semiconductors ... P19**



**Conflict-Free Minerals Declaration**

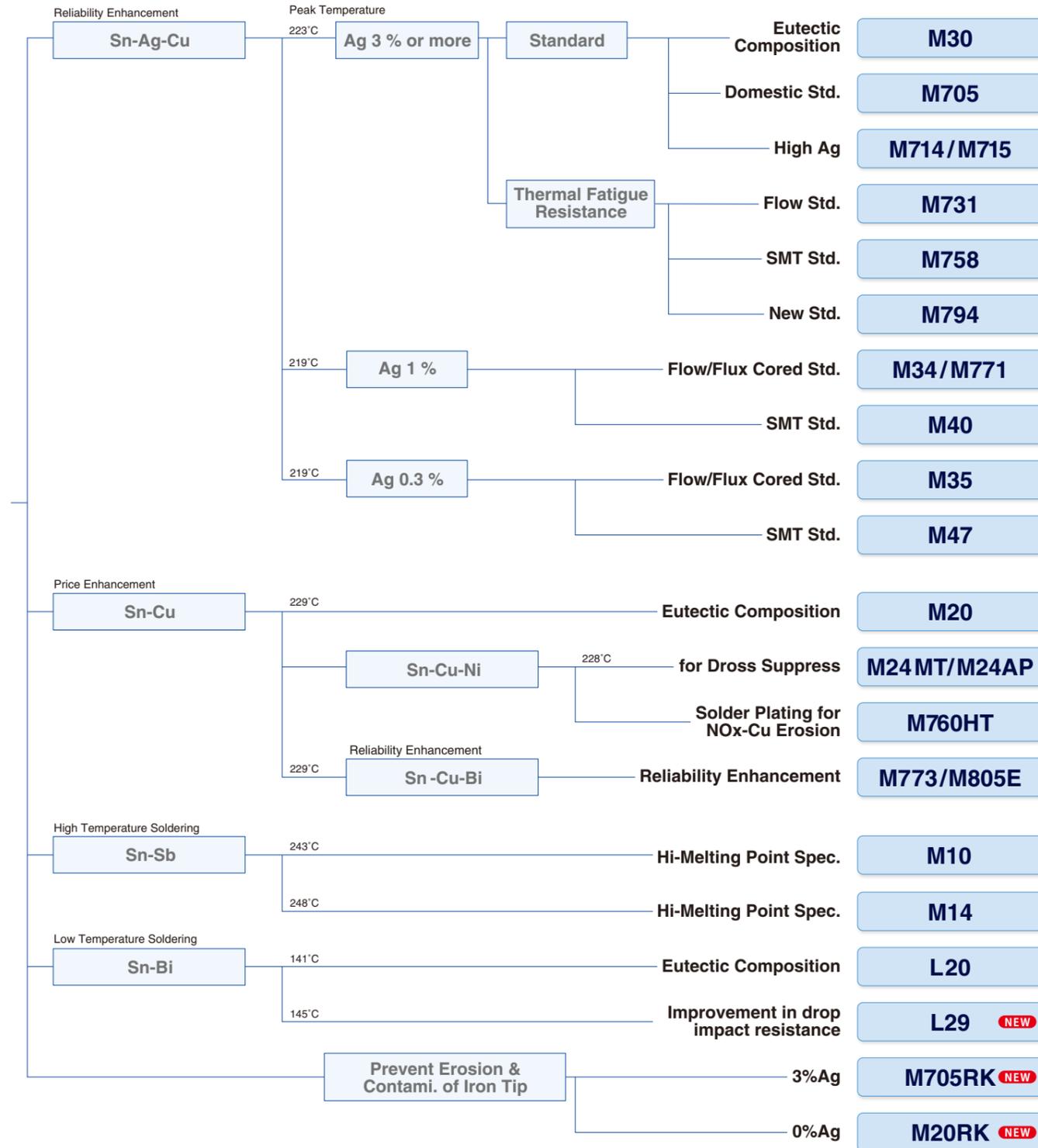
Where is your solder from?

**Environmental Conservation**

**Conflict-Free Minerals Declaration**  
**Environmentally-conscious Products ... P21**

All products are harmonizing with the environment and can be chosen by purpose or application

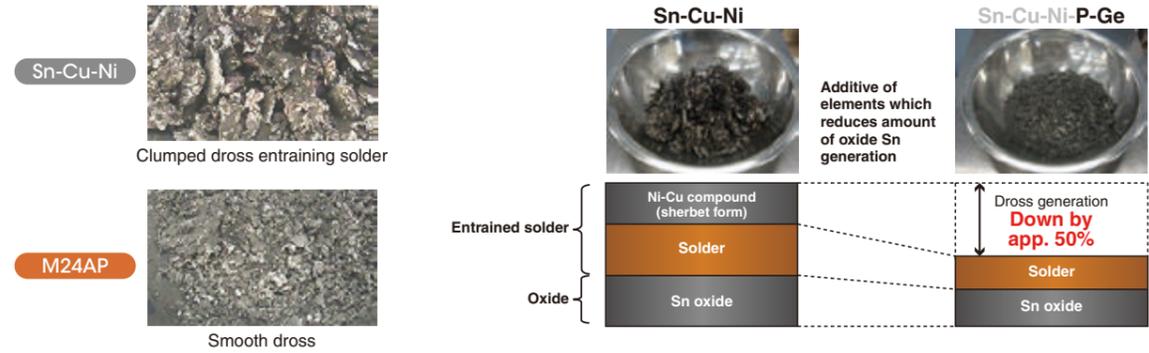
Wealth of lineups to meet customers' requirements



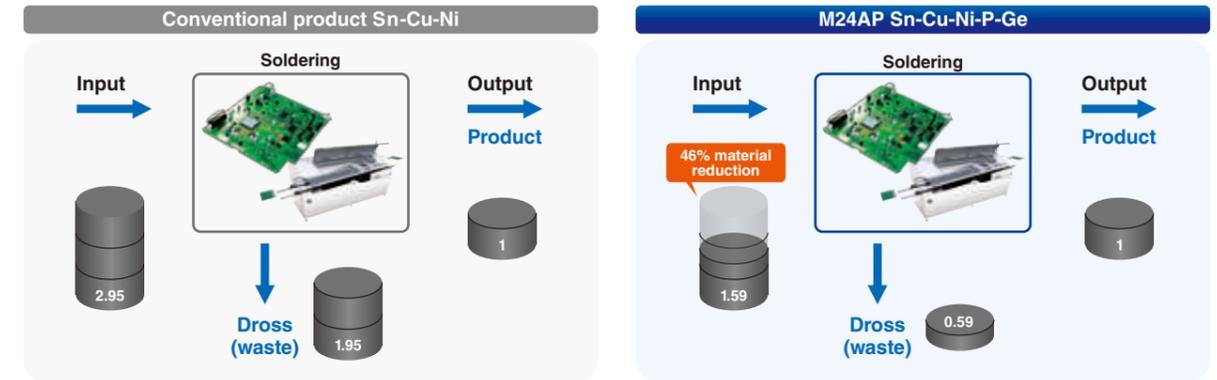
## Materials for Suppressing Dross

MT and AP series containing phosphorus and germanium completely suppress dross generation

Significant reduction of oxide as well as entrained solder will be achieved.



To produce "1" product, the required amount of conventional material is "2.95," whereas only "1.59" is required when using MT/AP series.

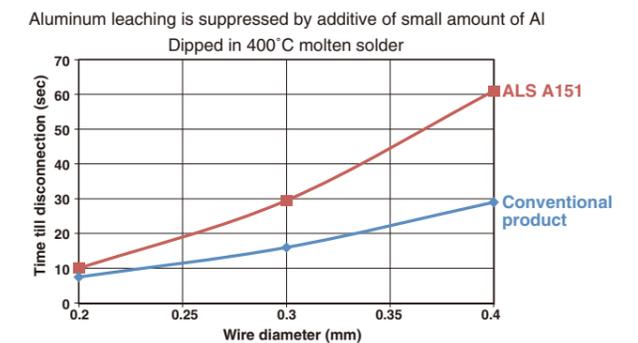
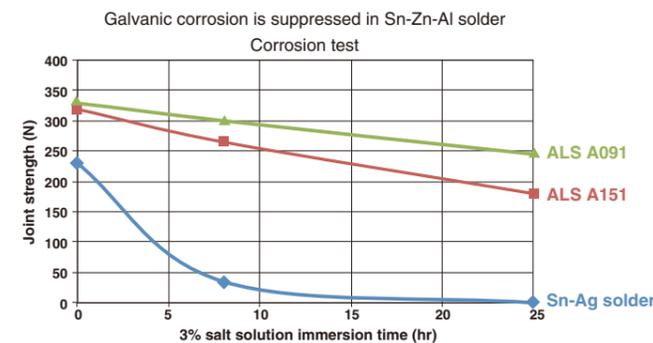
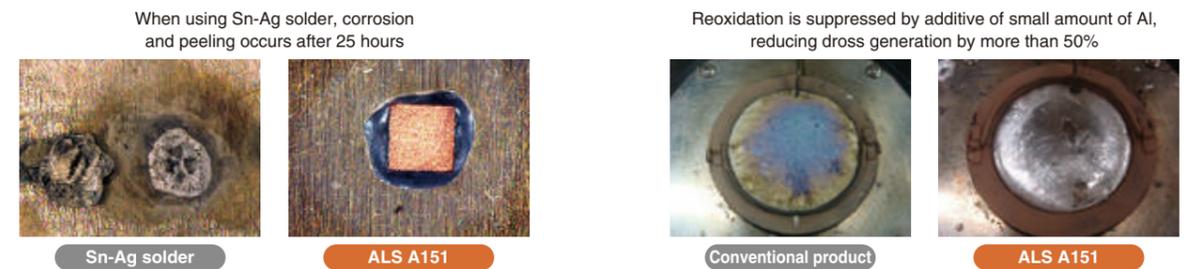


By suppressing dross, 46% of the solder usage is reduced and cost reduction is promoted.

## Sn-Zn-Al Solder for Aluminum Soldering

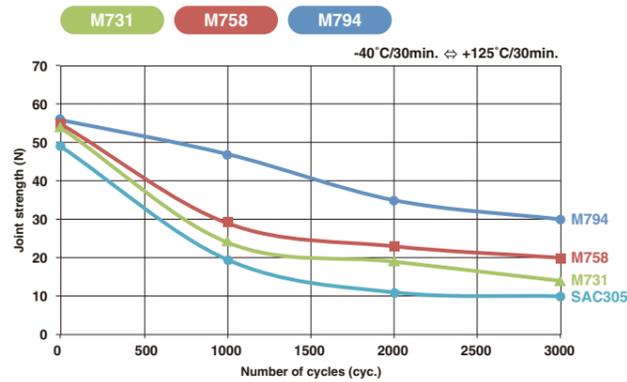
ALS A151 and A091 are solder materials for aluminum soldering that suppress galvanic corrosion

On light-weight and inexpensive aluminum, galvanic corrosion easily occurs due to the large potential difference from tin, causing soldering defects. In ALS A151 and A091, galvanic corrosion is suppressed by using of zinc, which has small electric potential difference from tin.



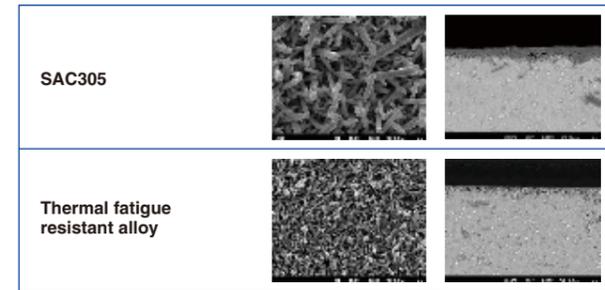
## Latest Thermal Fatigue Resistant Solder Alloy

■ M794 was developed with three advanced technologies



### Joint interface reaction control technology

Additives of Ni improve fragile diffusion layer of joint interface and secure joint interface strength



### Precipitation hardening and solid solution hardening combination technology

#### Precipitation hardening

Intermetallic compound (such as Cu<sub>6</sub>Sn<sub>5</sub> and Ag<sub>3</sub>Sn) improves strength

Compounds interposed at grain boundaries give pinning effects and suppresses deformation.

Magnified to micron level

#### Solid solution hardening

Solid solution (Sb/Bi/In/etc.) into Sn improves strength

● Solid solution atoms (solute atoms)  
● Sn atoms

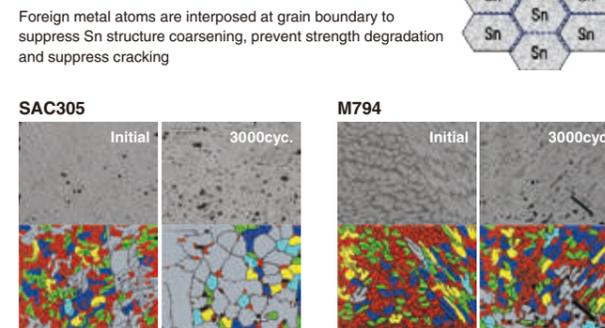
Solid solution atoms are dispersed at the atom level. Comparing with lined up uniformly, if foreign atoms are present, resistance occurs to suppress deformation.

Magnified at atom level

● Solute metal in solid solution state  
● When not in solid solution state

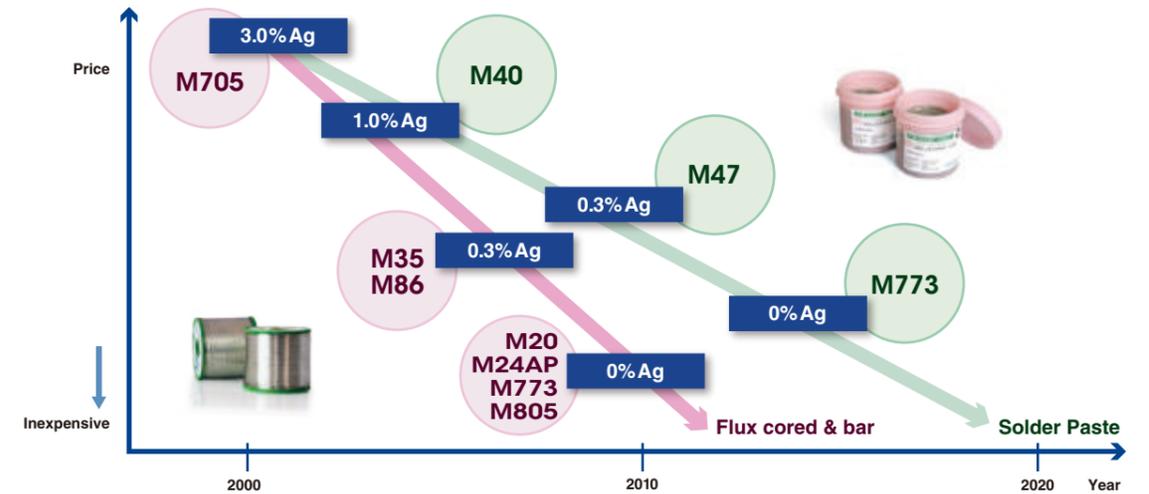
### Sn crystal grain coarsening suppression technology

By additives of Ni/x, coarsening of crystal grains of Sn is suppressed at initial and after TCT

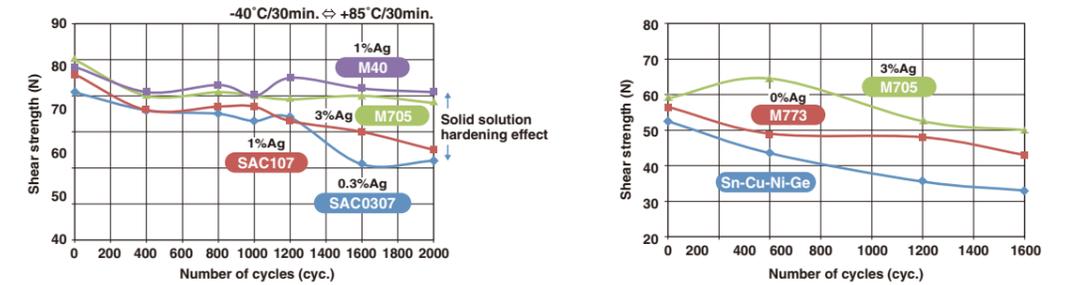


## Price Reduction Achieved by Low-Ag/Ag-Free Solder Alloy

■ Resolved the issue of material strength in low-Ag or Ag-free materials by combination of solid solution and precipitation hardening technologies, and commercialized



### Low-Ag/Ag-free material evaluation using chip resistor



## NEW Enhanced Cost Reduction Solution Following Material Cost

■ RK series alloys reduce erosion and contamination at solder iron chip

#### Iron tip erosion

Material	Initial	After 20,000 shots	After 60,000 shots
M705 (SAC305)	Sharp tip	Blunted tip	Severely eroded tip
Conventional product (SAC305+Fe)	Sharp tip	Blunted tip	Severely eroded tip
M705RK (SAC305+α)	Sharp tip	Sharp tip	Sharp tip

Reached the heater component in 20,000 shots | No reach to heater component even after 60,000 shots | No reach to heater component even after 60,000 shots

#### Iron tip contamination after 5000 shots

Material	Initial	After 5000 shots
M705 (SAC305)	Clean tip	Tip covered in carbides
Conventional product (SAC305+Fe)	Clean tip	Tip covered in carbides
M705RK (SAC305+α)	Clean tip	Tip with reduced carbides

Carbides increased | Carbides are reduced

#### Test conditions

Solder wire diameter: ø0.8mm  
Iron tip temperature: 420°C  
Solder feed length: 10mm  
Solder feed rate: 20mm/sec

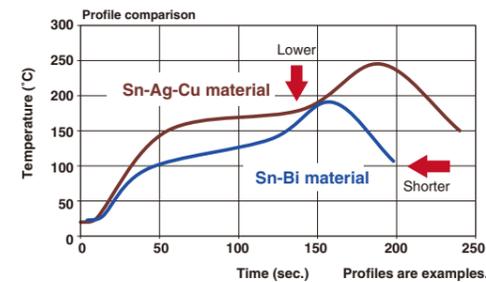
	M705	Conventional product	M705RK
Erosion	×	○	○
Carbonization	○	△	○
Equipment Maintenance	○	△	○

## Low temperature Packaging Technology

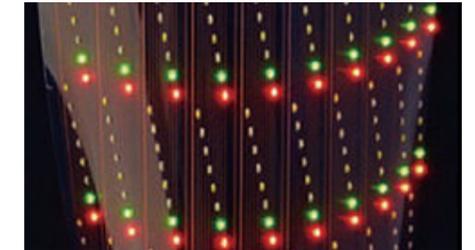
■ Consistently evolving Sn-Bi low temperature solder

- Soldering which is gentle to components and the environment with lead-free low temperature solder.
- New lineup of L29 which high drop impact and thermal fatigue resistance coexist.

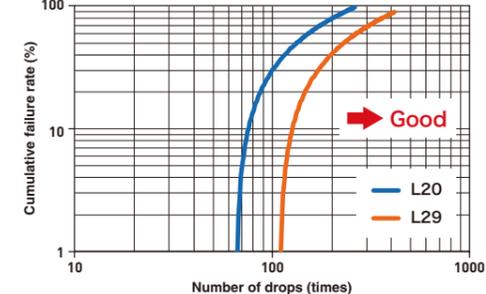
Low temperature soldering using Sn-Bi solder realizes energy conservation more than 20%



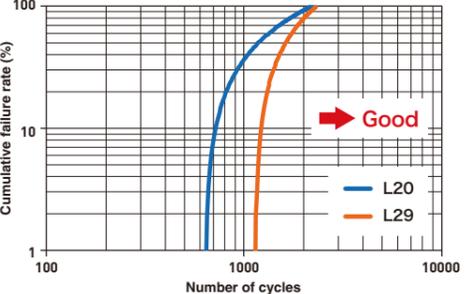
LED lights mounted on a PEN film FPC with low temperature soldering



Drop impact of LGA

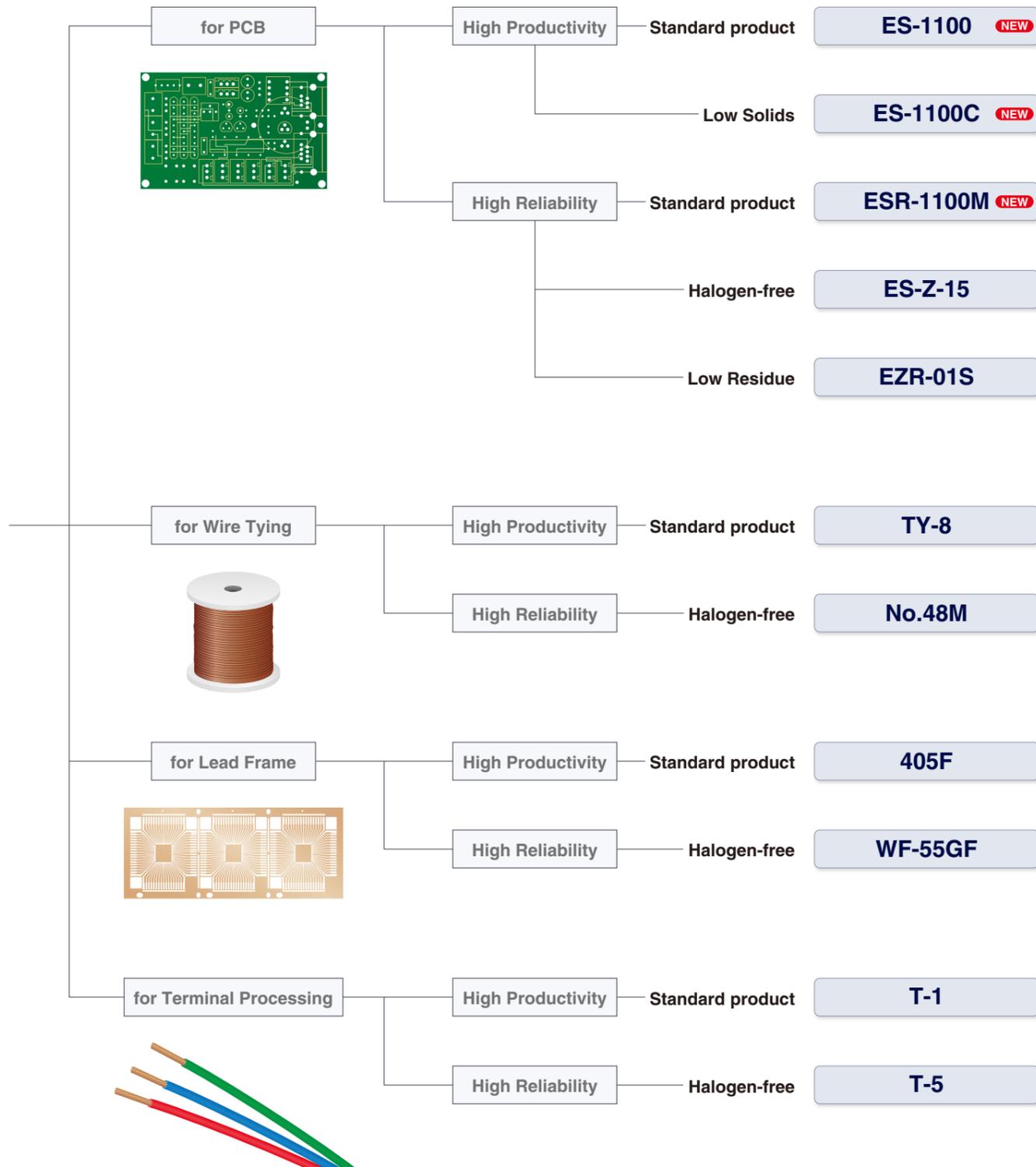


Thermal fatigue resistance of BGA (-40°C/125°C)

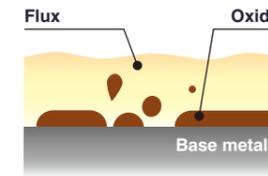




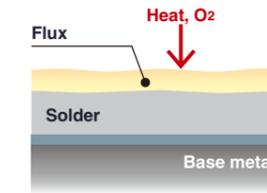
## Please choose the effective soldering products by purpose or application



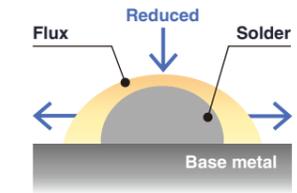
### Functions of flux



**1. Surface cleaning**  
Isolates oxides on metal surface.

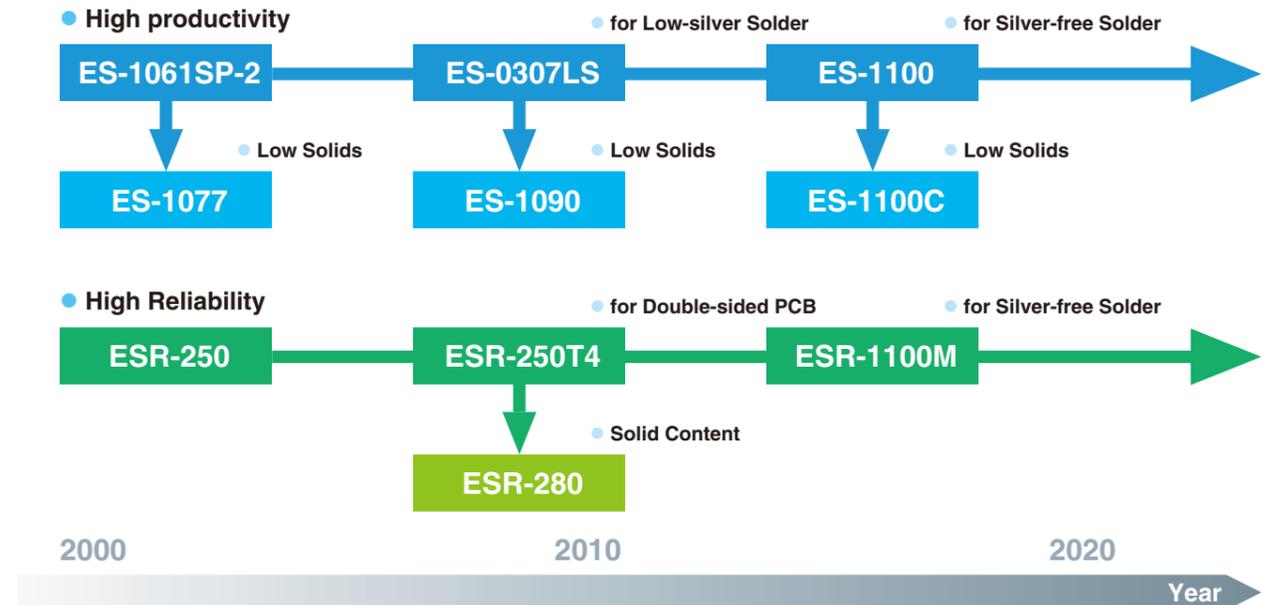


**2. Prevention of reoxidation**  
Creates thin film between air and solder to protect solder and base metal surface.



**3. Wettability enhancement**  
Reduces surface tension and enhances spreading through capillary action.

### Post-flux roadmap for PCB



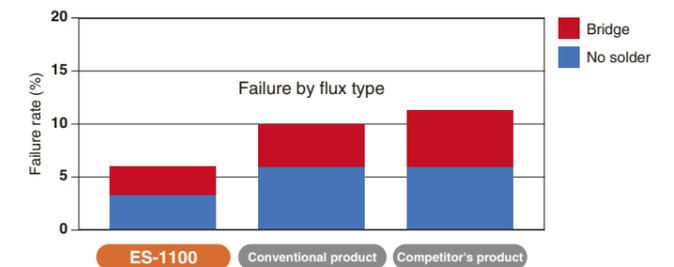
## Improved Basic Performance and Fine Finish

### ES-1100 is fine-finished and reduces errors at image and pin contact inspection

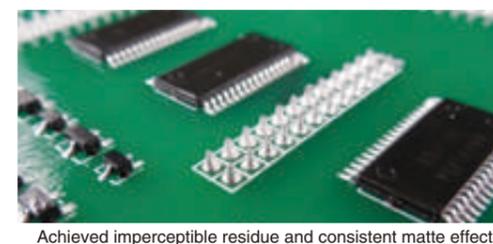
#### Reduction of solder ball splash



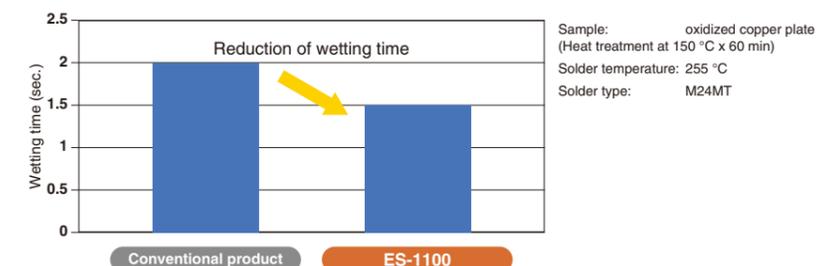
#### Jointing failure rate



#### Comparison of color tone



#### Comparison of wettability



# ECO SOLDER CORED

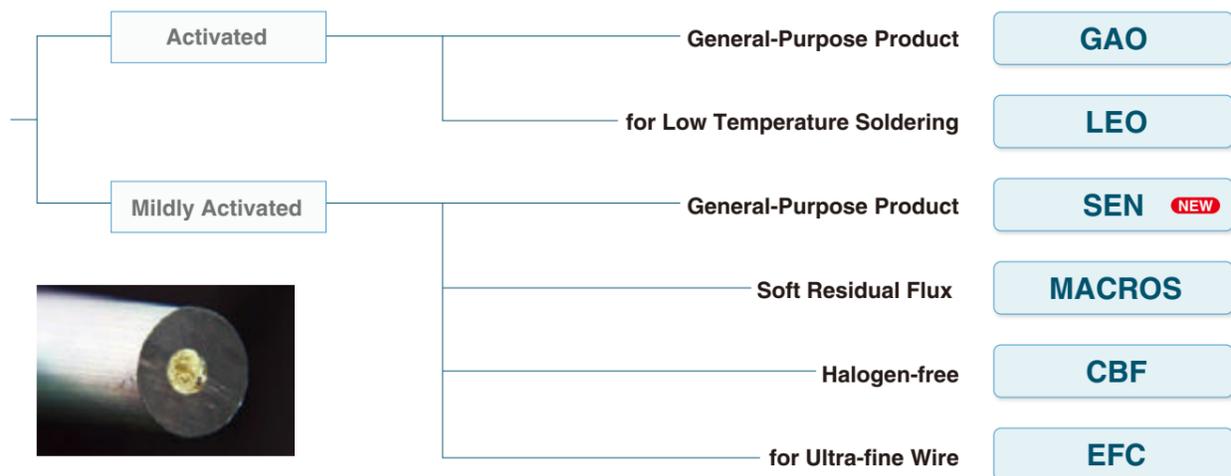
Flux cored solder has flux at the center of wire form solder alloy



## Lead-Free flux cored solder continuing to challenge and evolve

### Please choose the products by your purpose or application

- **SEN** Suppresses of flux & solder for high IR reliability
- **LEO** Sn-Bi solder at low melting point realizes low temperature soldering
- **GAO** Guarantees excellent wettability and working environment
- **MACROS** Optimal for severe environments including automotive applications
- **CBF** Ensures good wettability despite being halogen-free
- **EFC** Realizes narrow pitch soldering with ultra-fine wire



### Lead-Free Flux Cored Solder Roadmap

• High productivity (for wettability) JIS A Class



• High reliability (for high insulation) JIS AA Class



• Soft residue (for migration) JIS AA Class



• Halogen-Free (JIS AA Class equiv.)



• Low temperature soldering JIS A Class



## SEN NEW Non-splash of flux & solder by exclusive control

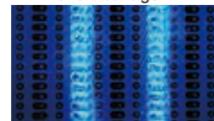


JIS AA class with high insulation reliability suppress splash even for wider range of operation temperature and achieve splash-free property for rapid heating by laser soldering, which is perfect for automotives or OA applications.

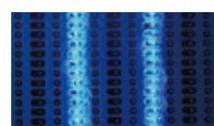
Recommended alloys: M705/M705RK/M20RK

- Splashes during soldering with a soldering robot
- Splashes through laser heating

Evaluation by spraying chemical agent



Conventional product



SEN



Conventional product

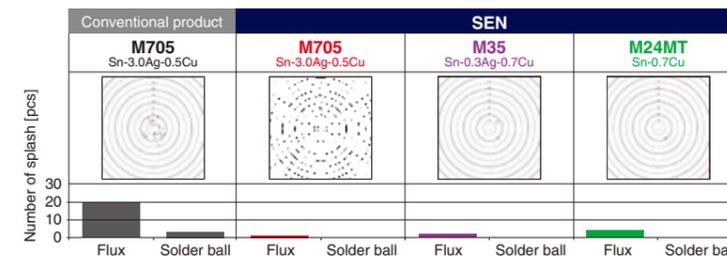


SEN

• Splash by various alloys

Product	Composition	Solidus line-Liquidus line
M705	Sn-3Ag-0.5Cu	217-220
M35	Sn-0.3Ag-0.7Cu	217-227
M24MT	Sn-Cu-Ni-P-Ge	228-230

- When gap between solidus and liquidus is large, splash is increased
- When alloy is at high melting point, splash is increased



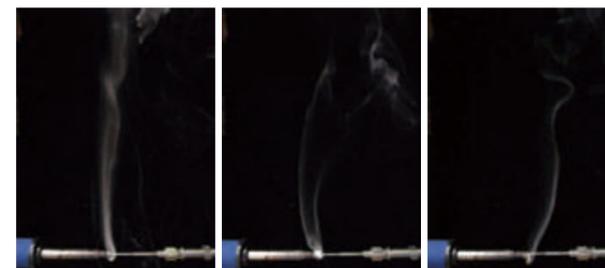
## GAO Realizing good working environment and beautiful surface after soldering



Products are available in two types: GAO-ST that completely suppress burning and air bubbles and GAO-LF that suppress fumes and irritating odors.

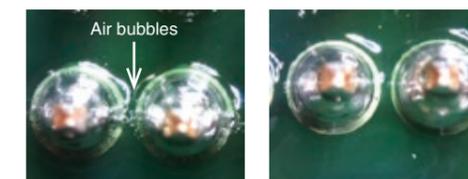
Recommended alloys: M24MT/M24AP/M20RK

Evaluation of fuming after 3 seconds of soldering at 450 °C



Conventional product GAO-ST GAO-LF

Evaluation of residual air bubbles



Conventional product GAO-ST

Evaluation of burning after 8 seconds of soldering at 380 °C



Conventional product GAO-ST GAO-LF

## MACROS Soft residue flux is optimal for automotive applications always standing with condensation risk

MACROS features flux residue that does not crack even under mechanical bending or thermal stress, and prevents electro-ionic migration caused by condensation.

In addition, water repellency and excellent adhesion to substrate prevent migration or corrosion under high temperature / high humidity stress tests.



Bending test



Thermal stress test

Recommended alloy: M705

## LEO The first product in the industry for soldering at 200 °C

LEO for soldering at 200 °C, realizing cost reduction by using low heat-resistant substrates or components.

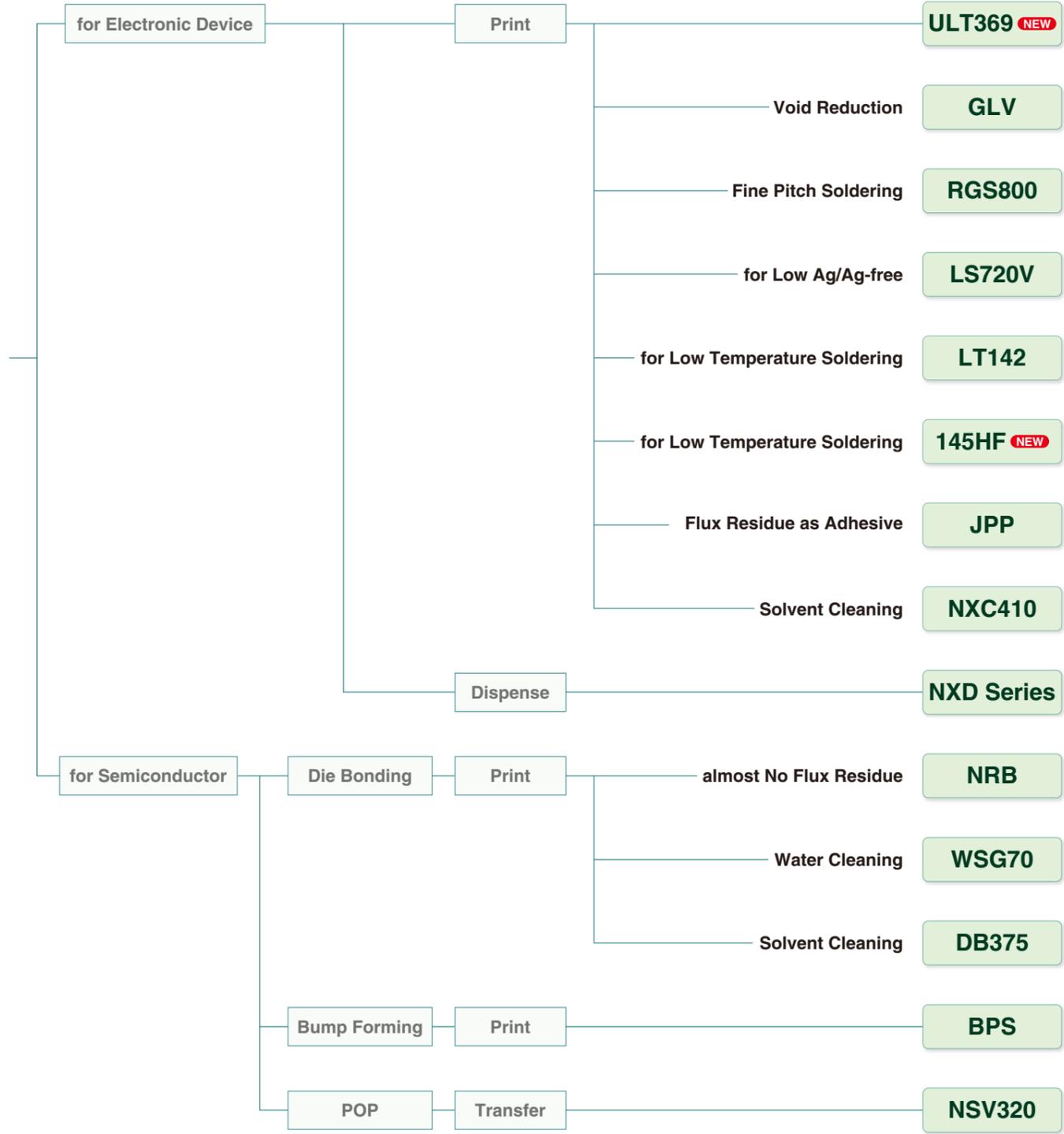
SMIC has succeeded in commercializing flux cored solder at low ductility and fragile Sn-Bi alloy by full advantage of unique processing and wire drawing technologies.



Recommended alloy: L20

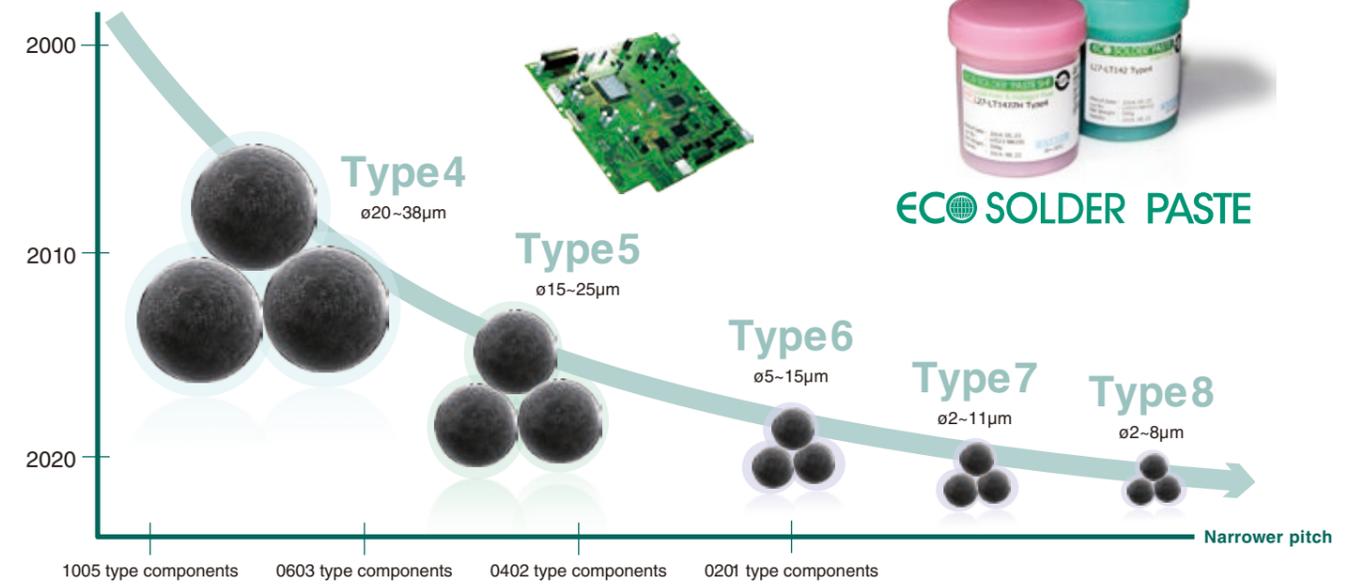


**Please choose optimal solder pastes by purpose or application for the development of next-generation products**



**Flux developed for powder grain miniaturization**

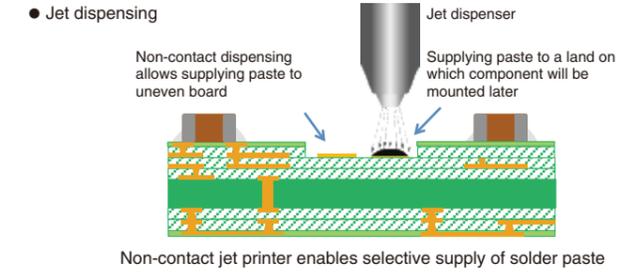
As powder grain becomes finer, the surface area and amount of oxidation increase. Therefore, highly-activated flux that suppresses reoxidation during reflow soldering is required.



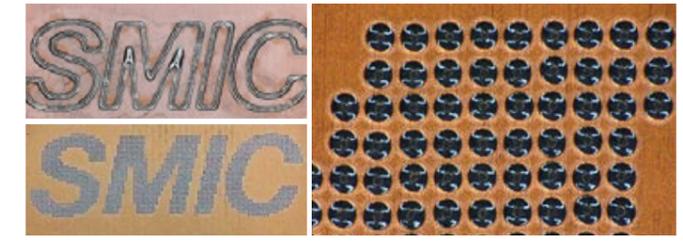
**Solder Pastes Applicable for New Process Development**

**Jet Dispensing**

Product lineup applicable for halogen-free



**High accurate dotted and linear dispensing**

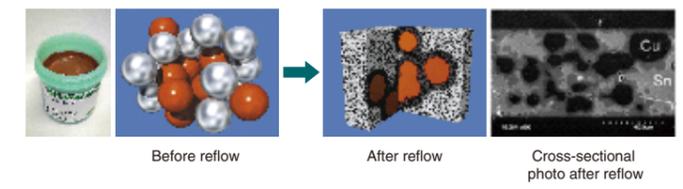


**RAM**

Prevents parts drop out even at re-heating over 270 °C

The same mounting profiles as those for normal SnAgCu solder can be applied. Although the solder part melts again after re-heating at 270°C or higher, the compound layer at the high temperature joint retains its shape and prevents dropping of the component.

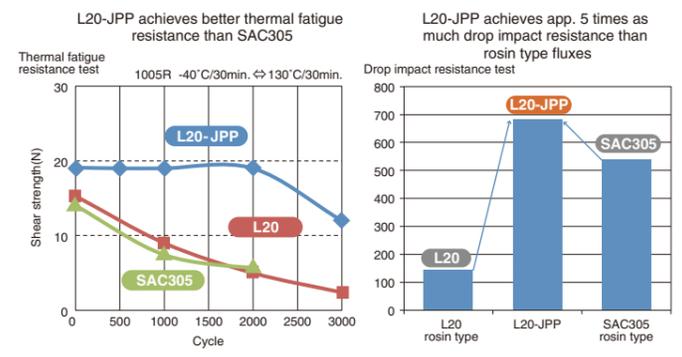
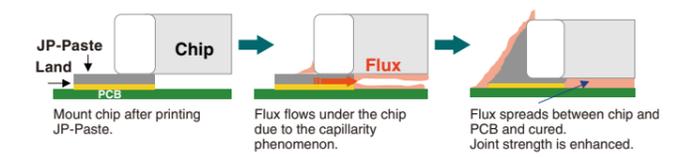
**Alternative Paste to High-Temperature Solder**



**JPP**

Achieved joint strength enhancement and drop impact reduction

JPP Series flux is optimal for joint reinforcement with chip components and improve drop impact resistance of low melting point Sn-Bi solder



**Syringe Supply**

Tailored barrels for customers



Barrels	Weight
5 cc	20 g
10 cc	40 g
20 cc	80 g
30 cc	120 g

Please feel free to contact for other weight categories from above list.

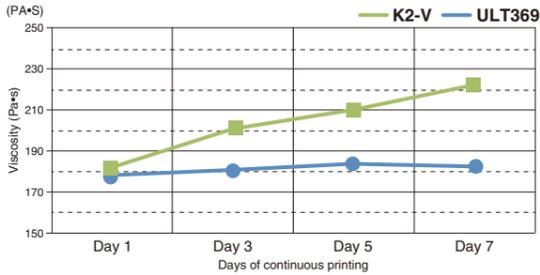
## Solder Pastes for SMT

### ULT369 **NEW** Achieved both usability and enhancement of heat dissipation

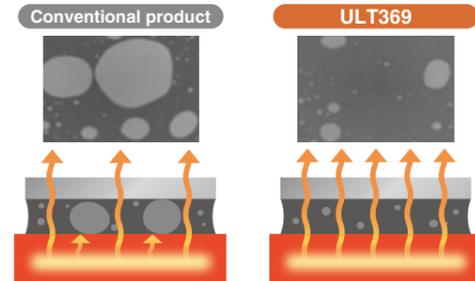
Revised latest SMT process and improved basic performance of wettability as well as printability for miniaturized components and compatibility with Non-Wet-Open (NOW) at slim BGA are the best for downsizing trend of electronic devices.

Recommended alloy: M705

- Reduction of waste  
Prevent reaction of solder powder and flux during printing. Improve stencil life to reduce solder paste waste.



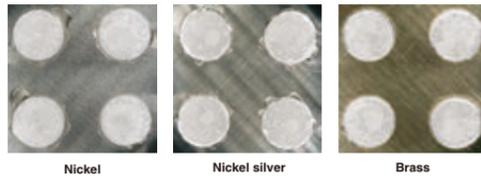
- Enhancement of heat dissipation  
Void as gas layer with low thermal conductivity will be discharged through heat-sealed QFN or QFP



### 145HF **NEW** Improved wettability and stability

Coexists of improved wettability and stability which is difficult with conventional low temperature solder pastes and realizes the same usability as Sn-Ag-Cu products.

Good wettability on various base metals



	Stencil life	Refrigerated storage
145HF	◎	◎
Conventional product	○	◎

Recommended alloys: L20/L29

### LS720V Prevents void formation by Low-Ag or Ag-free Flux

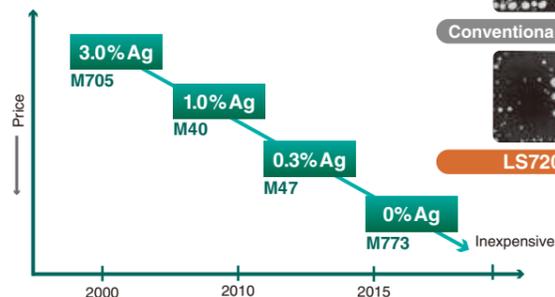
LS720 prevents void formation by enhanced wettability and improved flux fluidity during melting.



Conventional product



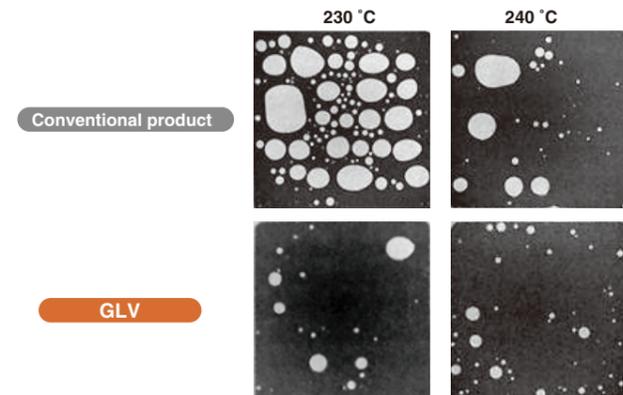
LS720V



Recommended alloys: M40/M47/M773

### GLV Significant reduction of void by improved flux

GLV prevents void on large bottom terminal components, in which temperature does not rise easily, and significantly reduces unmelted solder defect in BGA.



GLV

Recommended alloy: M705/M794/M758

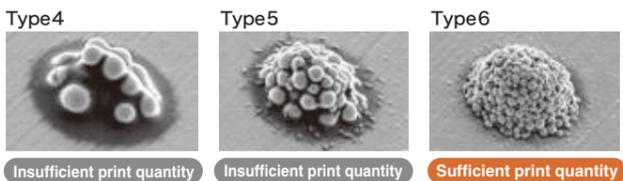
### RGS800 Exhibits good wettability even with fine powder, enabling mounting of 0201 components

M705-RGS800 Type6



Ensures a sufficient amount of solder even for micro patterns by adopting RGS800 and Type 6 micro powder.

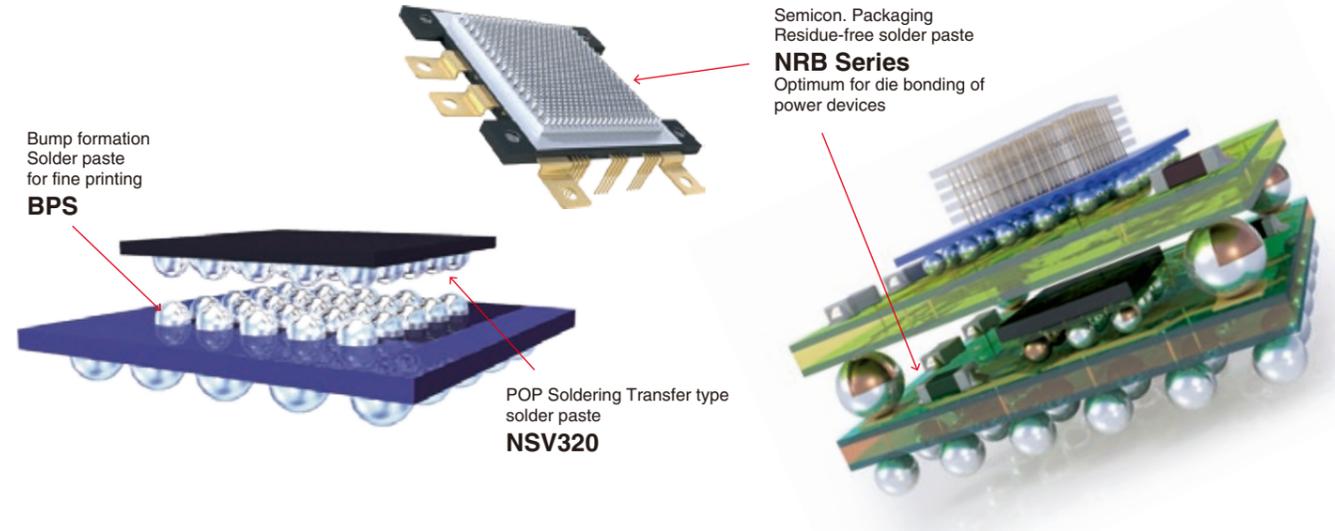
Enabling jointing of 0201 components.



Insufficient print quantity, Insufficient print quantity, Sufficient print quantity

Recommended alloy: M705

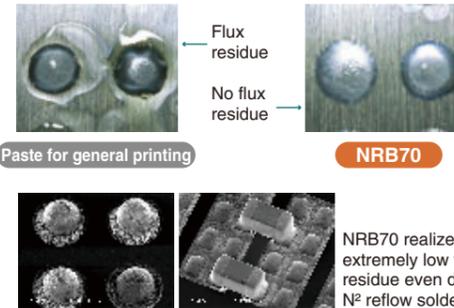
## Solder Pastes for Semiconductor Packaging



### NRB Realizes residue & cleaning free soldering with non-rosin-type flux

Recommended alloy: M705

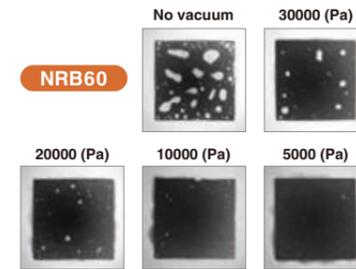
Comparison of flux residue after reflow soldering



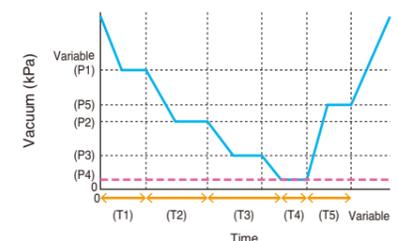
Paste for general printing

NRB70

NRB70 realize extremely low flux residue even during N<sup>2</sup> reflow soldering.



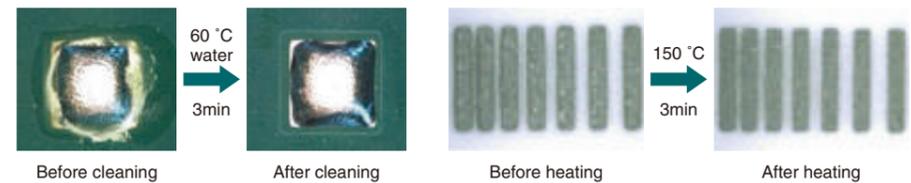
Realize low splashing residue & void-free soldering with vacuum reflow oven SVR-625GT capable of variable vacuum control.



### WSG70 Flux residue is cleaned with 60 °C warm water, with no special cleaning solution

Recommended alloy: M705

Applicable to fine pitch printing in spite of halogen-free property. Solderability will be maintained even if time passed after printing.



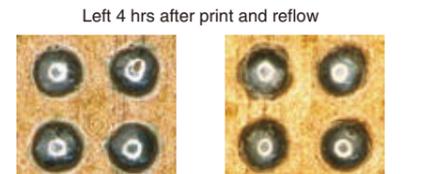
Before cleaning

After cleaning

Before heating

After heating

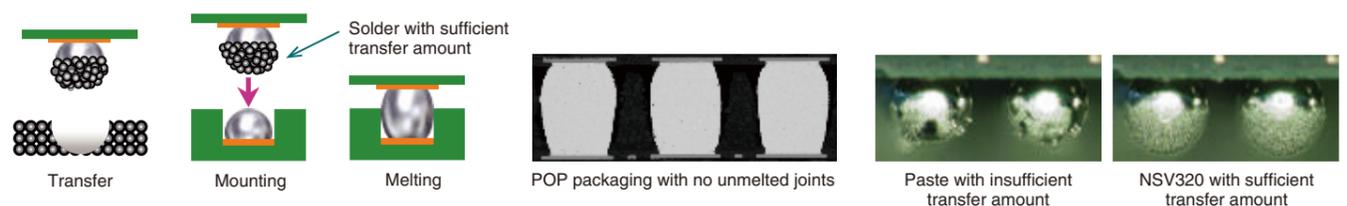
0.10mm gap OK (IPC-TM-650, 2.4.35)



WSG70 (Type6) Conventional product (Type6)  
Stable reflow property for substrates with many components

### NSV320 Transfers sufficient solder amount, realizes POP soldering with high joint reliability

Recommended alloy: M705



Transfer

Mounting

Melting

POP packaging with no unmelted joints

Paste with insufficient transfer amount

NSV320 with sufficient transfer amount



## Expected form for soldering with various alloys and structural materials

### Single Layer



Basic type with high dimensional precision for stable soldering.

### Nickel Balls Contained



Nickel balls as standoff suppress inclination of solder.

### Flux Cored



Flux inside eliminate flux application process and improve wettability.

### Flux Coated



Flux applied on preform surface eliminate fixing process by adhesive force and achieve high-efficiency production.

### Solder Coated Metal



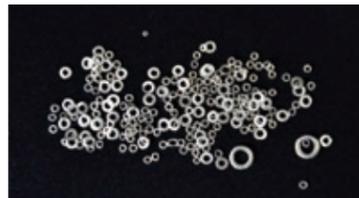
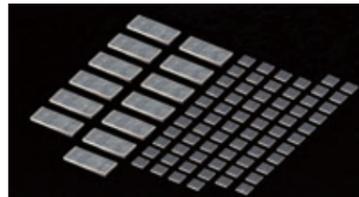
Solder layer is formed on surface, good adhesive strength and structures without voids provide highly reliable results.

### Multi Layers



Solder alloys at different physical properties are clad-rolled. If the melting points of solder are different, two-stage soldering by temperature can be performed.

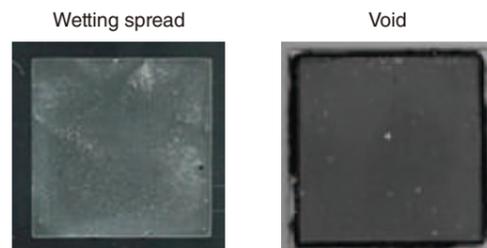
### Typical forms



## Surface Treatment Specification

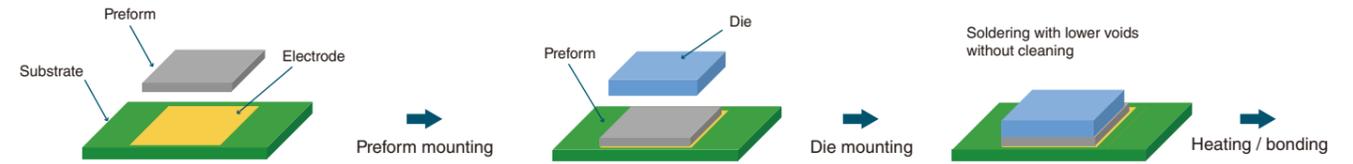
Provides excellent wettability with special processing and realizes flux-free soldering in reducing atmosphere. Effective for reducing void formation and cleaning process.

(The right pictures) show wetting spread and condition of voids when performing flux-free reflow soldering in a hydrogen reducing atmosphere

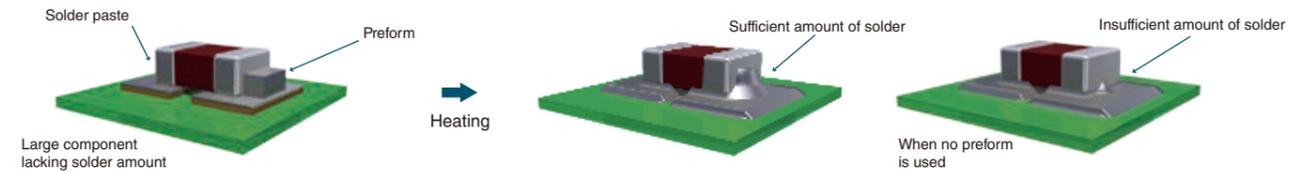


## Application Examples

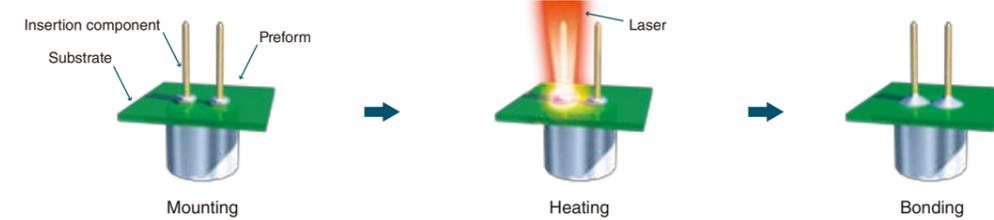
**Case 1** Die bonding using single layer or nickel balls contained preform suppresses void and realizes soldering with high heat dissipation effect. Clear soldering even without cleaning flux is also enabled



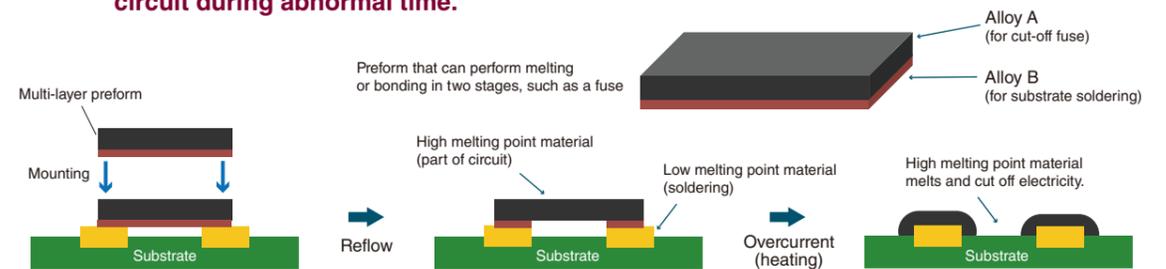
**Case 2** Single layer or flux coated material is processed into chip form and automatic mounting on pad to prevent lacking solder amount by tape package, in order to supply solder and enhance strength. SMIC's unique chip surface processing technology improves the mounting rate.



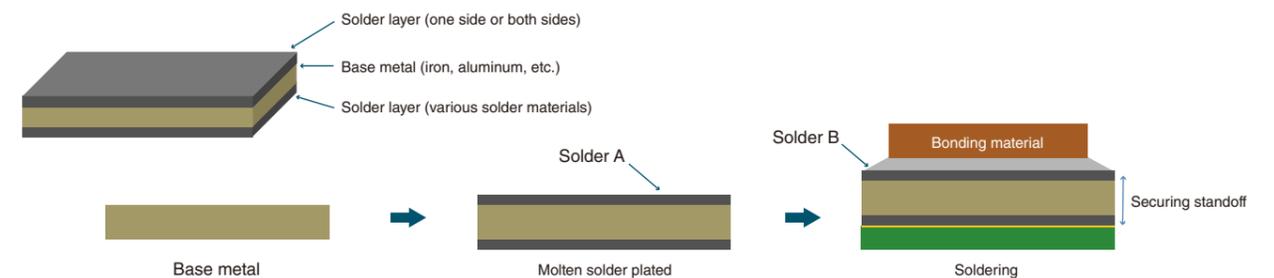
**Case 3** Ring preform inserted into terminals of component on through-holes of substrate and selective heat by laser or other methods achieved soldering without causing thermal damage to the substrate or component.



**Case 4** Alloys with different melting temperatures are laminated in bimetal structure and bonded into substrate with low melting point solder. By making solder that does not melt at soldering temperature in a part of the overcurrent detection circuit, solder will melt and cut off the circuit during abnormal time.

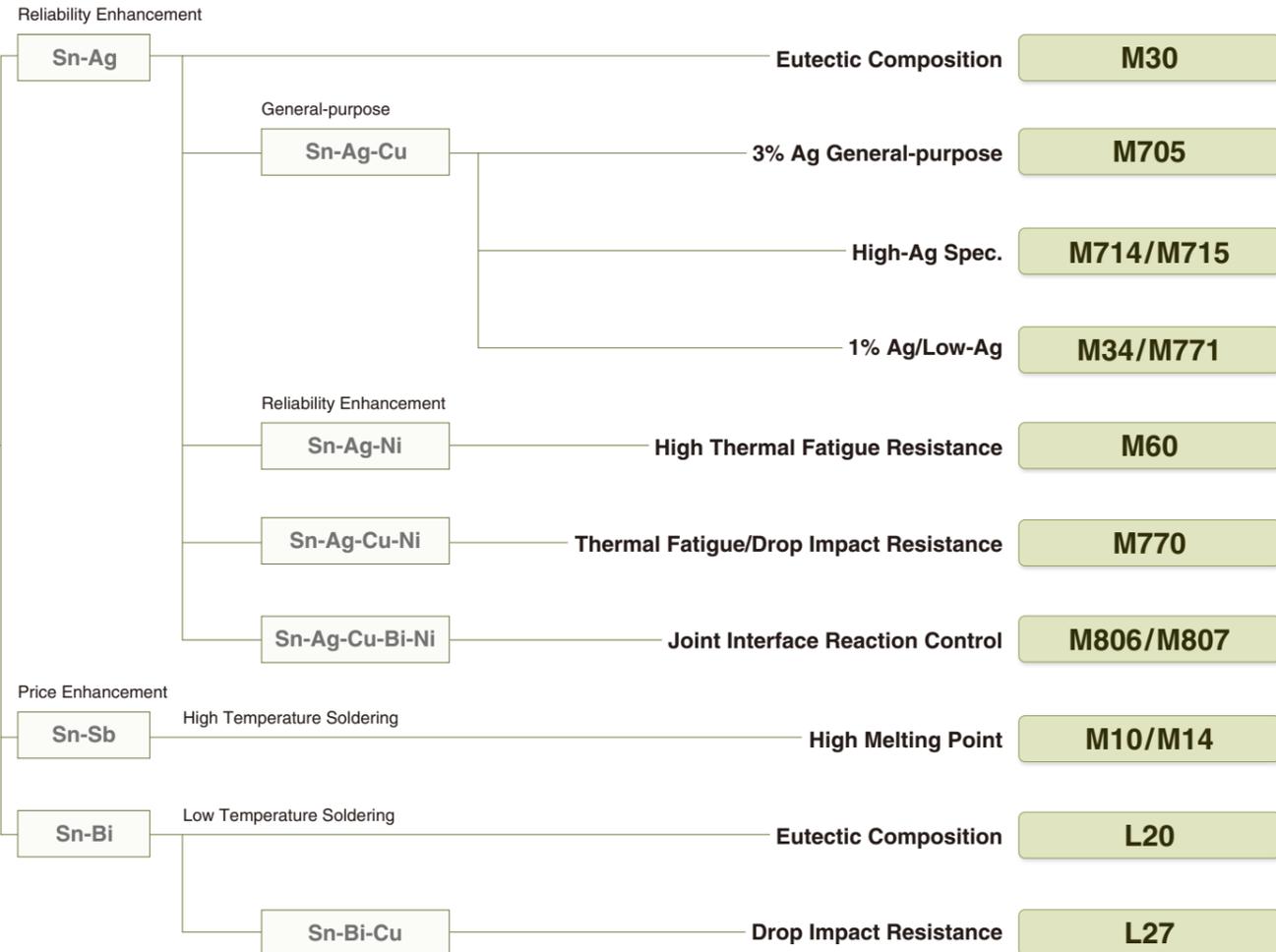


**Case 5** Solder coated material for surface of the base material that cannot easily be soldered or does not melt at soldering temperature. Optimal for bonding to aluminum, applications with standoff or for hermetic sealed case.



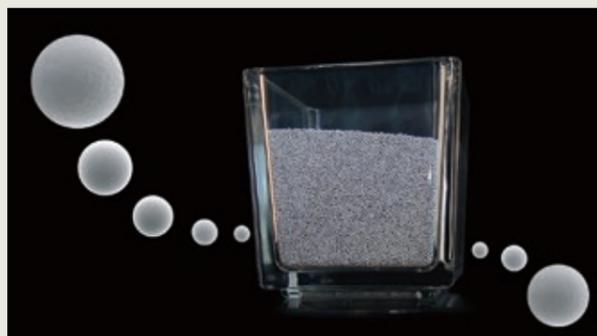


## Various ball diameters and compositions are available to support cutting-edge semiconductor packaging



## LAS Solder Ball protects Products from "Soft Errors"

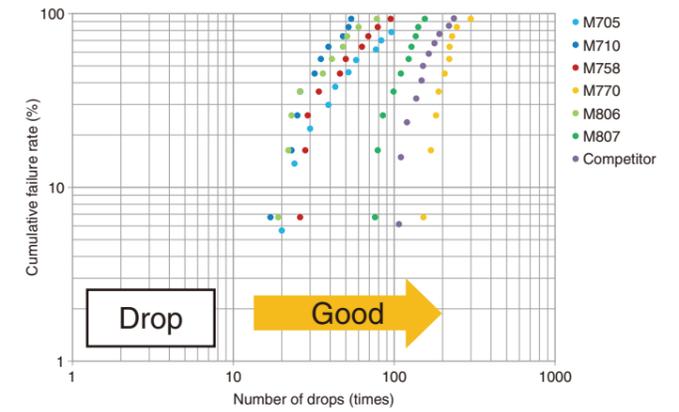
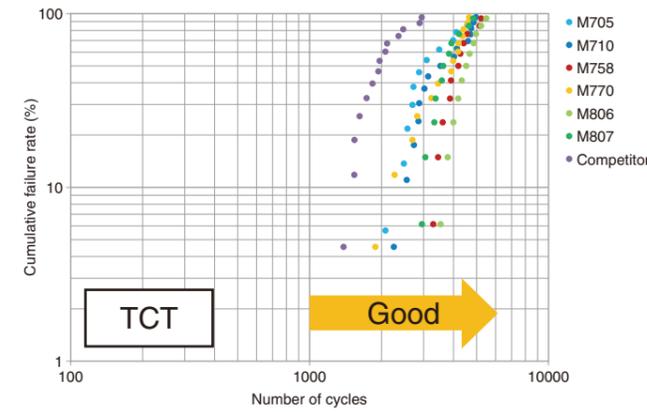
Trace amount of alpha rays or cosmic rays discharged from solder materials or semiconductor materials may rewrite memory data, which is called "soft error." In particular, flip chip package is highly sensitive to soft errors, and reduction of alpha rays is required for solder materials or other electronic packaging materials. LAS solder ball is material meets this requirement.



- Standard specification product
- Diameter ; 50 to 110 μm
- Alpha count ; 0.002 cph/cm<sup>2</sup> or less
- Composition ; M705 M200

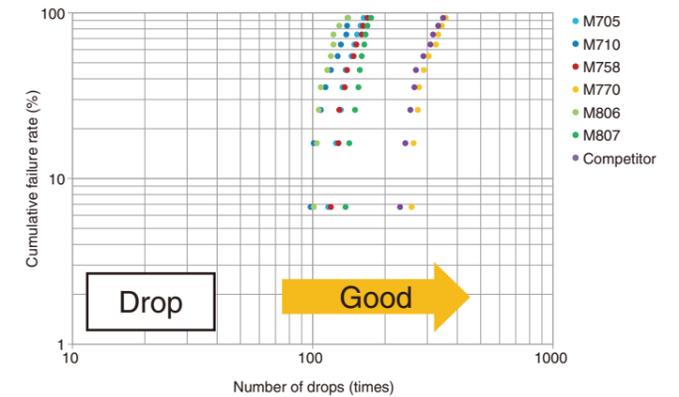
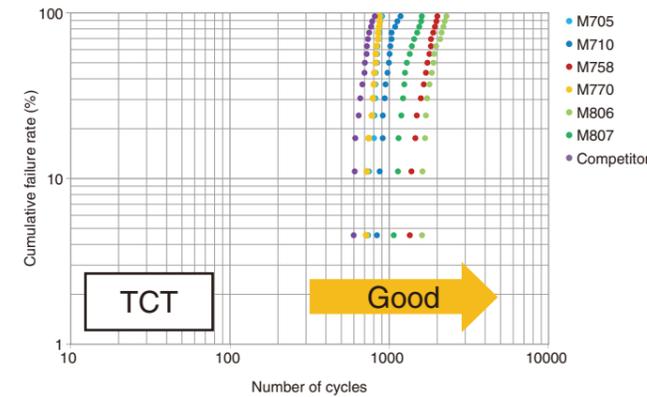
### TCT and drop test with CSP

CSP TEST Condition  
 Size: 12 x 12 mm [TCT]  
 SRO: 0.24 mm Temperature Cycle : -40°C/+125°C each 10min  
 Pitch: 0.5 mm  
 Ball: 0.3 mm [Drop]  
 S/F: Cu Impact acceleration : 1500G/Half-sine pulse 0.5msec.



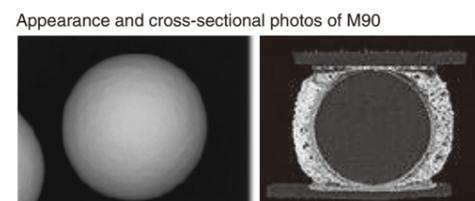
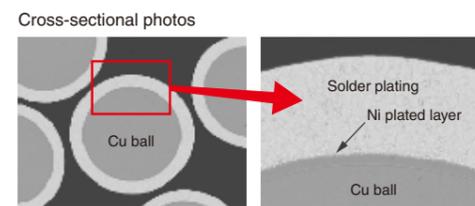
### TCT and drop test with WLP

WLP TEST Condition  
 Size: 7 x 7 mm [TCT]  
 SRO: 0.24 mm Temperature Cycle : -40°C/+125°C each 10min  
 Pitch: 0.5 mm  
 Ball: 0.3 mm [Drop]  
 S/F: Cu Impact acceleration : 1500G/Half-sine pulse 0.5msec.

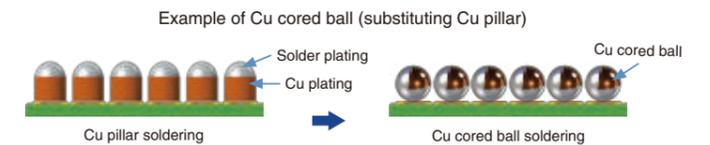
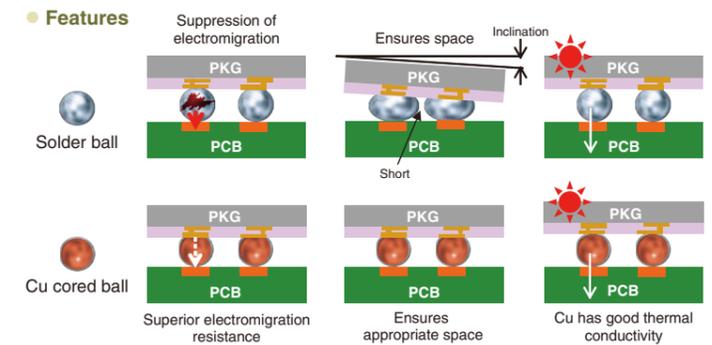


## Cu Cored Ball

Advanced plating technology has easily securing of space in 3D soldering



M90 improves drop impact resistance through reforming of the joint interface by Ni in the Ni plating.



# FLUX for SEMICONDUCTORS

Flux for semiconductors is liquid consisting of resins, activators and solvents



Please choose effective products for soldering by your purpose or application

## Flux for Packaging

Application	Type	Heating	Process	Product
Chip Attach	Water Soluble	Reflow/TCB	Transfer	WF-6317/WF-6450
			Print	WF-6317P/WF-6457
			Spray	SPK-340
	Rosin Type	Reflow	Transfer	GTN-68/GTN-68 (HF)
			Print	GTN-68P/GTN-68P (HF)
			Spray	901T1SP
	Low Residue	Reflow	Transfer	901K5
			Spray	901T1SP
		TCB	Transfer/Spray	NRF-SP1
Ball Attach	Water Soluble	Reflow	Transfer	WF-6317/WF-6450
			Print	WF-6317P/WF-6457
	Rosin Type	Reflow	Transfer	GTN-68/GTN-68 (HF)
			Print	GTN-68P/GTN-68P (HF)
	Epoxy Type	Reflow	Transfer	JPK9S/EF-100*1
			Print	EF-100P

## Flux for micro Bump Formation

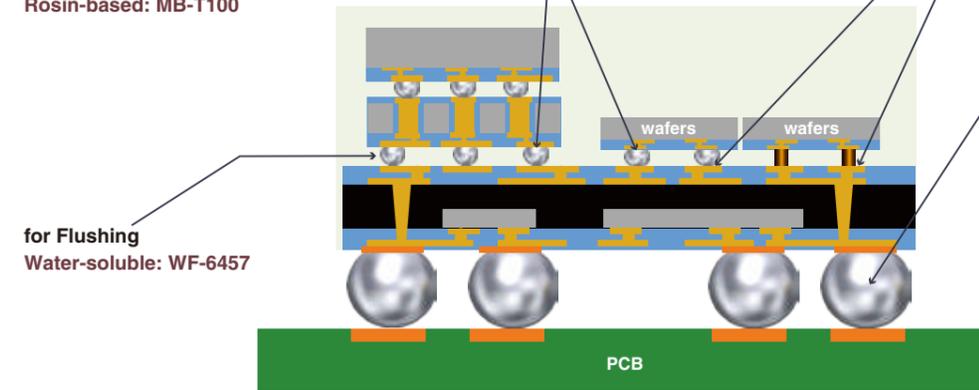
Application	Type	Heating	Process	Product
Micro Ball Attach	Water Soluble	Reflow	Print	WF-6457
	Rosin Type	Reflow	Print	MB-T100
Fusing	Water Soluble	Reflow	Spray/Spincoat	SPK-3420
	Rosin Type	Reflow	Spray/Spincoat	7200A

for Micro Bump  
Water-soluble: WF-6457  
Rosin-based: MB-T100

for Chip Attach (Flip Chip)  
Water-clean: WF-6317, WF-6450  
Rosin-based: GTN-68  
Ultra-low residue: 901K5

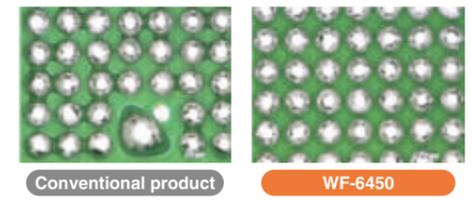
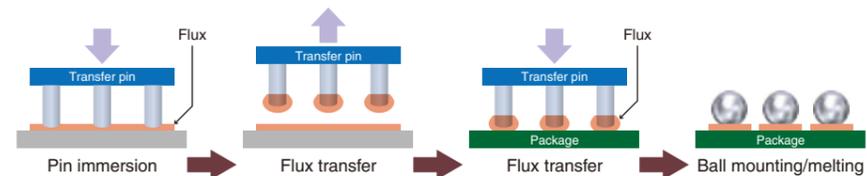
for BGA Attach (BGA)  
Water-soluble: WF-6317, WF-6450  
Rosin-based: GTN-68  
Epoxy type: EF-100

for Flushing  
Water-soluble: WF-6457



### WF-6450

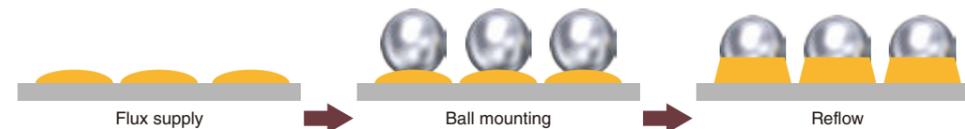
Suppresses bridge even at ball attachment to narrow-pitched package



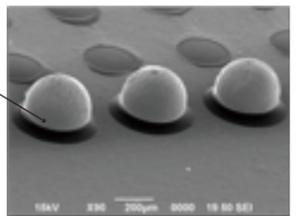
### JOINT PROTECT FLUX EF-100

Reduces cleaning/drying process and reinforces solder joint

Please consider when joint strength of WLP etc. is insecure.



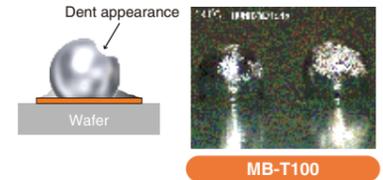
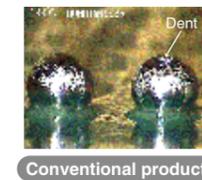
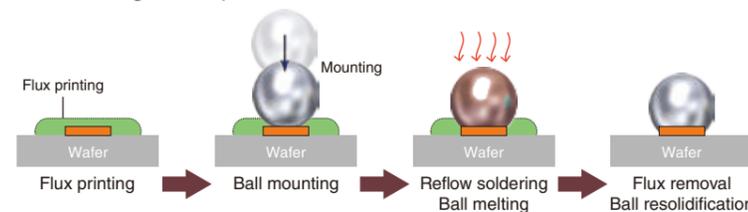
Reinforces solder joint with flux residue (thermosetting resin)



### MB-T100

Highly-activated MB-T100 reproduces dent-free spheres when balls are resolidified

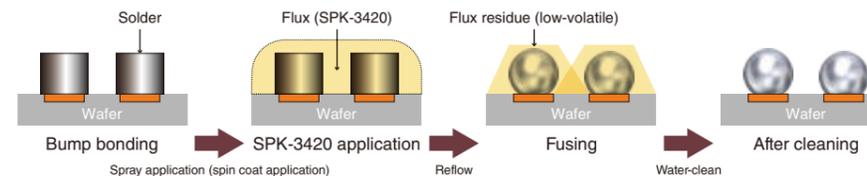
Highly-activated and exhibits high heat resistance, and can be cleaned with semi-aqueous cleaning solution. A halogen-free product is also available.



### SPK-3420

SPK-3420 forms even spherical bumps, and flux residue can be removed by water-cleaning

Halogen-free flux that can be easily removed by water-cleaning even after high-temperature reflow soldering.



# Environmental Conservation

SMIC develops environmentally-conscious projects and products



# List of Lead-free Solder Alloys

## Recycling of Solder Pastes

Promotes environmentally and customer friendly recycling initiatives

### Features

- Recover and recycle whole solder paste including container
- Suppresses generation of harmful substance to the utmost limit



### Measurement data of harmful substance

Measurement data of harmful substance	Upper row: emission gas Lower row: dust and soot
Toxicity equivalency quantity of discharged dioxin	5ng-TEQ/m <sup>3</sup> N
Environmental criteria	3ng-TEQ/m <sup>3</sup> N
Small-sized incinerator, Unit 1	0.0057 ng-TEQ/m <sup>3</sup> N
	0.010 ng-TEQ/m <sup>3</sup> N
Small-sized incinerator, Unit 2	0.00017 ng-TEQ/m <sup>3</sup> N
	0.0039 ng-TEQ/m <sup>3</sup> N

Measured on May 19, 2011 (11:15 - 15:15) at Unit 1/on May 18, 2011 (11:16 - 15:16) at Unit 2

**Meets All Criteria**

## Package of 10 kg Solder Bar

Gender-friendly and lightweight package

### Features

- Lightweight package realize easy transportation even for women
- Small-size package helps reduce inventory management
- Same unit price per weight at both 20 kg and 10 kg package

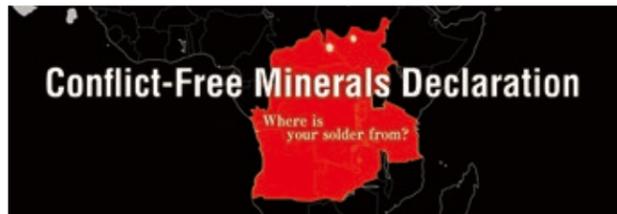
Package	Weight
10 kg package	455 mm x 116 mm x 38 mm
20 kg package	455 mm x 139 mm x 65 mm



10 kg package (left) and 20 kg package (right). Even women can easily hold 10 kg package.

## Conflict Mineral Free

SMIC is the only company in the industry to participate in the RBA and declared "Conflict Free Sourcing" as a RMI member



As a RMI member, we request all our smelters to participate in the Conflict-Free Smelter Program.



\*RBA (Responsible Business Alliance)  
\*RMI (Responsible Minerals Initiative)

## IATF 16949 Certification

SMIC has adapted the quality management system of the company and its subsidiary to comply with the new standard "IATF 16949: 2016" and our soldering materials and bearings businesses have approved the renewal of registration from the old standard.



ECO SOLDER	Alloy composition (wt%)	Melting temperature (°C)			Form					
		Solidus line	Peak	Liquidus line	BAR	CORE	BALL	PASTE	PREFORM	
M-series: Solidus temperature 200 to 250°C										
M705	Sn-3.0Ag-0.5Cu	217	219	220	●	●	●	●	●	
M30	Sn-3.5Ag	221	223	223	●	●	●	●	●	
M31	Sn-3.5Ag-0.75Cu	217	219	219	●	●	●	●	●	
M714	Sn-3.8Ag-0.7Cu	217	219	220	●	●	●	●	●	
M715	Sn-3.9Ag-0.6Cu	217	219	226	●	●	●	●	●	
M710	Sn-4.0Ag-0.5Cu	217	219	229	●	●	●	●	●	
M34	Sn-1.0Ag-0.5Cu	217	219	227	●	●	●	●	●	
M771	Sn-1.0Ag-0.7Cu	217	219	224	●	●	●	●	●	
M35	Sn-0.3Ag-0.7Cu	217	219	227	●	●	●	●	●	
M20	Sn-0.75Cu	227	229	229	●	●	●	●	●	
M24MT	Sn-0.7Cu-Ni-P-Ge	228	230	230	●	●	●	●	●	
M24AP	Sn-0.6Cu-Ni-P-Ge	227	228	228	●	●	●	●	●	
M805E	Sn-0.3Bi-0.7Cu-P	225	229	229	●	●	●	●	●	
M40	Sn-1.0Ag-0.7Cu-Bi-In	211	222	222	●	●	●	●	●	
M47	Sn-0.3Ag-0.7Cu-0.5Bi-Ni	216	228	228	●	●	●	●	●	
M773	Sn-0.7Cu-0.5Bi-Ni	225	229	229	●	●	●	●	●	
M794	Sn-3.4Ag-0.7Cu-Bi-Sb-Ni-x	210	221	221	●	●	●	●	●	
M731	Sn-3.9Ag-0.6Cu-3.0Sb	221	224	226	●	●	●	●	●	
M716	Sn-3.5Ag-0.5Bi-8.0In	196	208	214	●	●	●	●	●	
M10	Sn-5.0Sb	240	243	243	●	●	●	●	●	
M14	Sn-10Sb	245	248	266	●	●	●	●	●	
M709	Sn-0.5Ag-6.0Cu	217	226	378	●	●	●	●	●	
M760HT	Sn-5.0Cu-0.15Ni-x	228	229	365	●	●	●	●	●	
M711	Sn-0.5Ag-4.0Cu	217	226	344	●	●	●	●	●	
M770	Sn-2.0Ag-Cu-Ni	218	220	224	●	●	●	●	●	
M758	Sn-3.0Ag-0.8Cu-Bi-Ni	205	215	215	●	●	●	●	●	
M806	Sn-3.5Ag-0.8Cu-Bi-Ni	203	214	214	●	●	●	●	●	
M807	Sn-3.5Ag-0.8Cu-Bi-Ni	214	219	219	●	●	●	●	●	
M725	Sn-0.7Cu-Ni-P	228	230	230	●	●	●	●	●	
M823	Sn-0.75Cu-1.5Bi-Ni-x	224	229	229	●	●	●	●	●	
M705RK	Sn-3.0Ag-0.5Cu-x	219	221	221	●	●	●	●	●	
M20RK	Sn-0.75Cu-x	227	229	229	●	●	●	●	●	
M35RK	Sn-0.3Ag-0.7Cu-x	217	219	227	●	●	●	●	●	
L-series: Solidus temperature : 200 °C or lower										
L20	Sn-58Bi	139	141	141	●	●	●	●	●	
L29	Sn-58Bi-Sb-Ni	140	145	145	●	●	●	●	●	

Peak temp. : Max. endothermic reaction point on DSC curve  
For inquiries regarding alloy compositions not listed above, please contact our sales representatives or contact us by e-mail (web@senju.com).

### Lead-free product impurity standard (unit: percentage by mass)

Sb	Cu	Bi	Zn	Fe	Al	As	Cd	Ag	In	Ni	Au	Pb
0.07 or less	0.05 or less	0.05 or less	0.001 or less	0.02 or less	0.001 or less	0.03 or less	Less than 0.002	0.03 or less	0.02 or less	0.01 or less	0.005 or less	Less than 0.05