

SMIC

SENJU METAL INDUSTRY CO.,LTD.



Contact

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HEADQUARTERS

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

SMIC LEAD FREE SOLDER CATALOG





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

Changes the future of soldering
Solder Preform ... P15



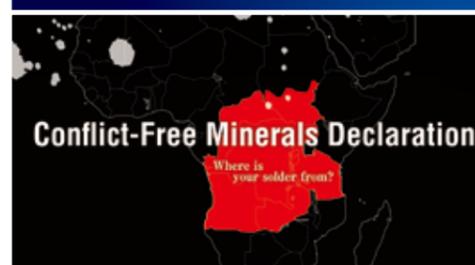
ECO SOLDER BALL

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



FLUX for SEMICONDUCTORS

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



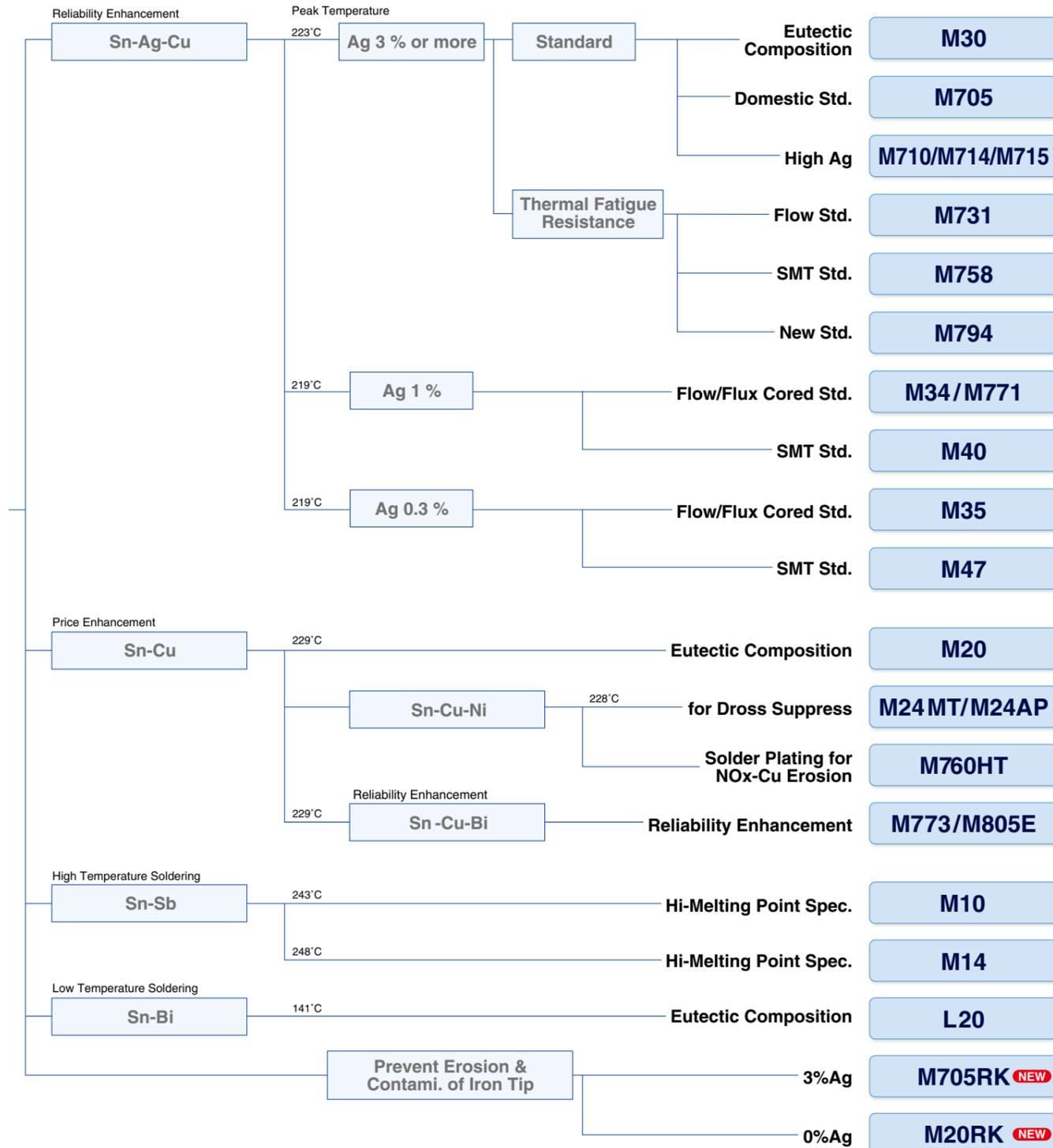
Conflict-Free Minerals Declaration

Environmental Conservation

Conflict-Free Minerals Declaration
Environmentally-conscious Products ... P22

All products are harmonizing with environment and can choose by purpose or application

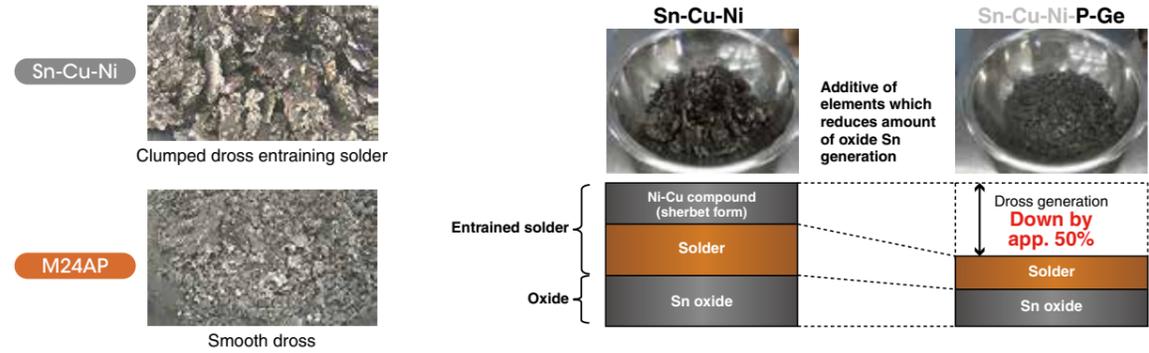
Wealth of lineups to meet the customers' requirements



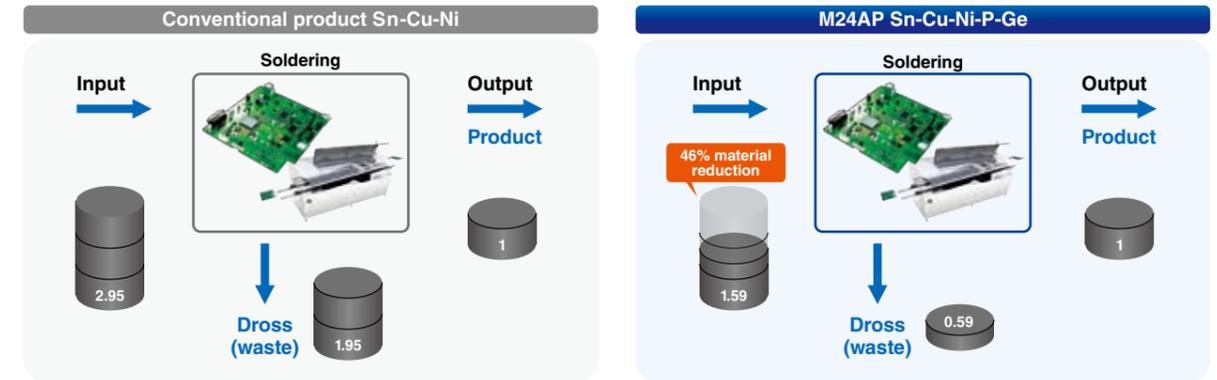
Material for Suppress Dross

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.

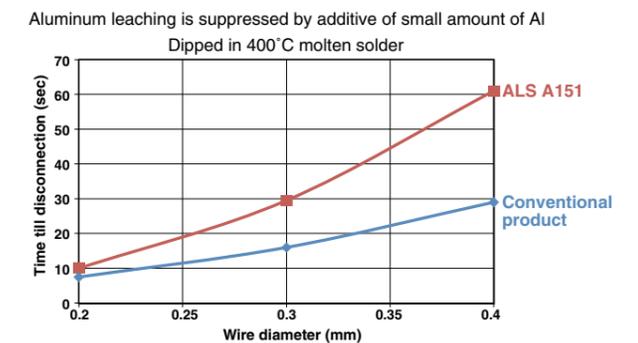
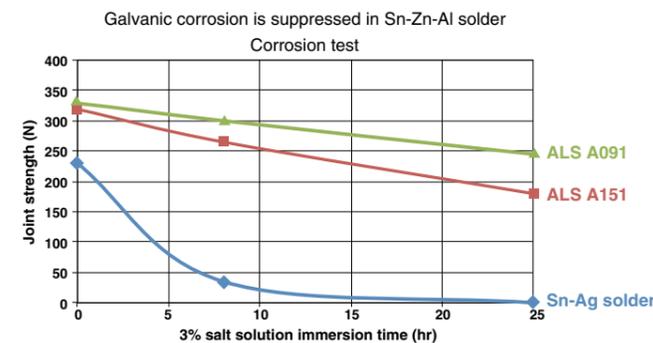
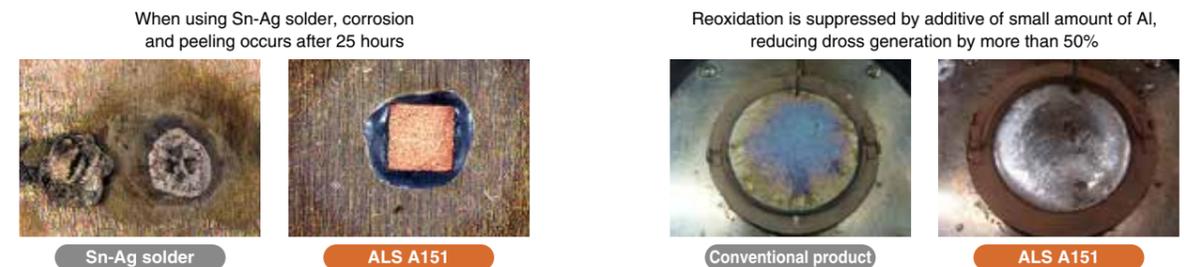


By suppressing dross, 46% of the solder usage is reduced and cost reduction is promoted.

Sn-Zn-Al Solder for Aluminum Soldering

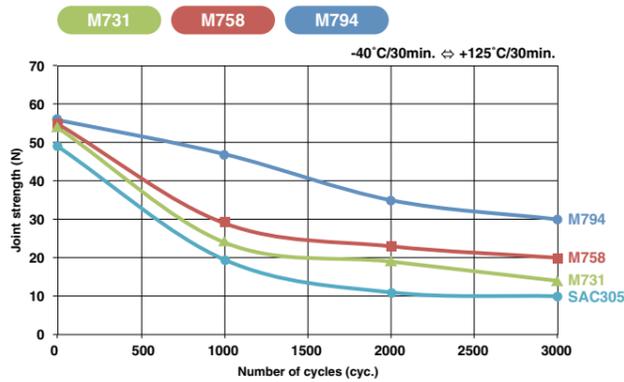
ALS A151 and A091 are solder materials for aluminum soldering that suppress galvanic corrosion

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.



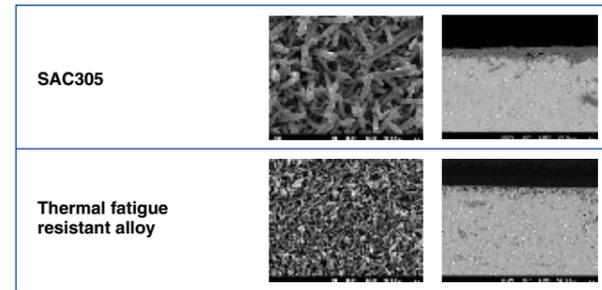
Thermal Fatigue Resistant by Latest Solder Alloy

■ M794 was developed with three advanced technologies



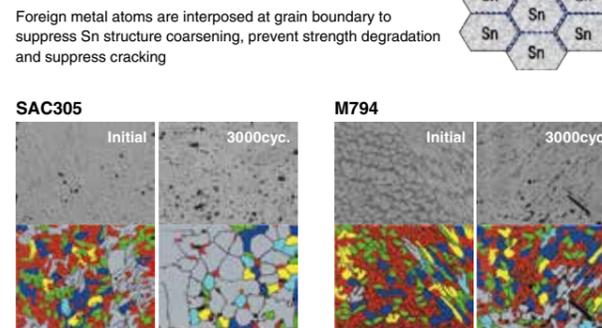
Joint interface reaction control technology

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



Sn crystal grain coarsening suppression technology

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



Precipitation hardening and solid solution hardening combination technology

Precipitation hardening

Intermetallic compound (such as Cu6Sn5 and Ag3Sn) improves strength

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

Solid solution hardening

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

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

NEW Enhanced Cost Reduction Solution Following Material Cost

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

Initial

Iron tip erosion

	M705 (SAC305)	Conventional product (SAC305+Fe)	M705RK (SAC305+α)
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

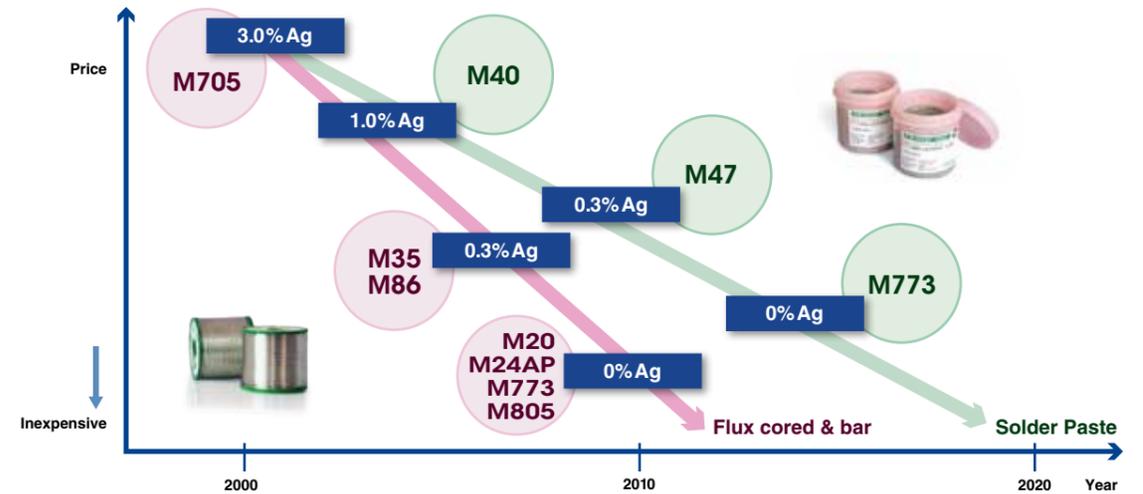
	M705 (SAC305)	Conventional product (SAC305+Fe)	M705RK (SAC305+α)
Carbides increased	○	○	○
Carbides are reduced	○	○	○

Test conditions

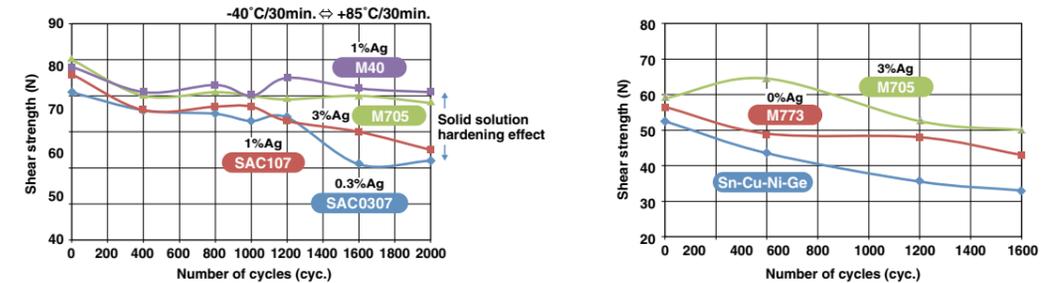
	M705	Conventional product	M705RK
Erosion	×	○	○
Carbonization	○	△	○
Equip't Maintenance	○	△	○

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

■ Resolved the issue of material strength in low or no-Ag materials by combination of solid solution and precipitation hardening technologies, and commercialized



Low-Ag/No-Ag material evaluation using chip resistor



Low-temperature Packaging Technology

■ Low-temperature soldering enables the use of inexpensive low heat-resistant components or materials

Cost reduction is achieved by eco-friendly products that contribute to energy conservation in which soldering temperatures becoming higher in lead-free solders are made lower than those of conventional Sn-Pb solder. In addition, JPP Series for joint reinforcement can increase joint strength and drop impact resistance.

Short-time low-temperature soldering using Sn-Bi solder realizes energy conservation more than 50%

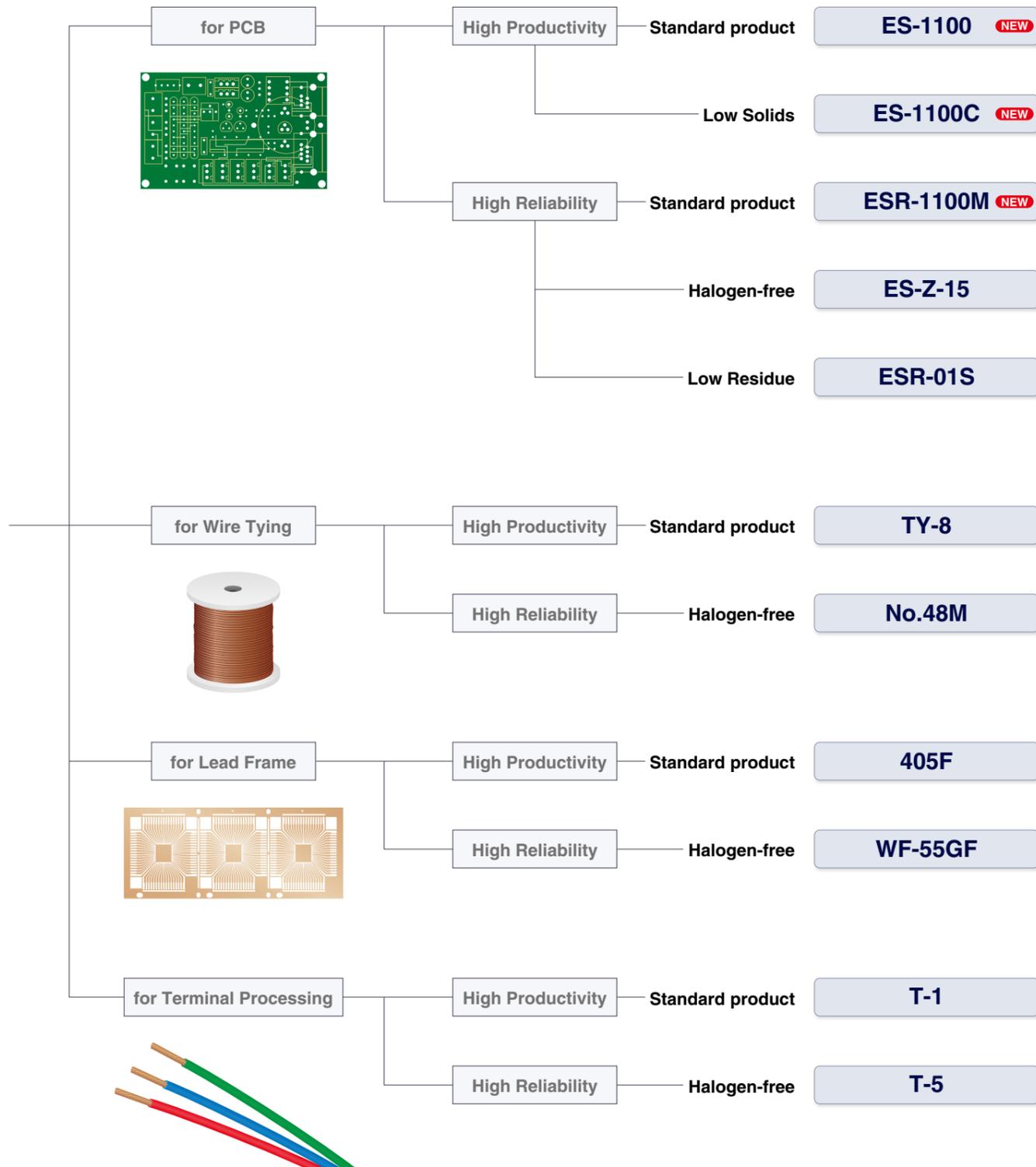
Sn-Bi low-temperature lead-free solder with high thermal fatigue resistance

L27 with high drop impact resistance

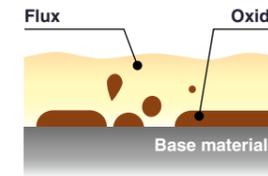
Cross section of L20 show excellent joint



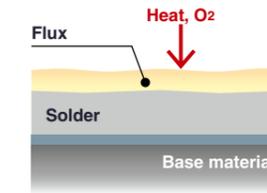
Please choose the effective soldering products by purpose or application



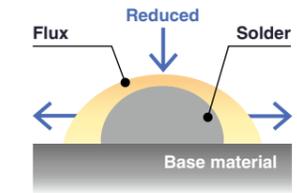
Function of flux



1. Surface cleaning
Isolate oxides on metal surface.

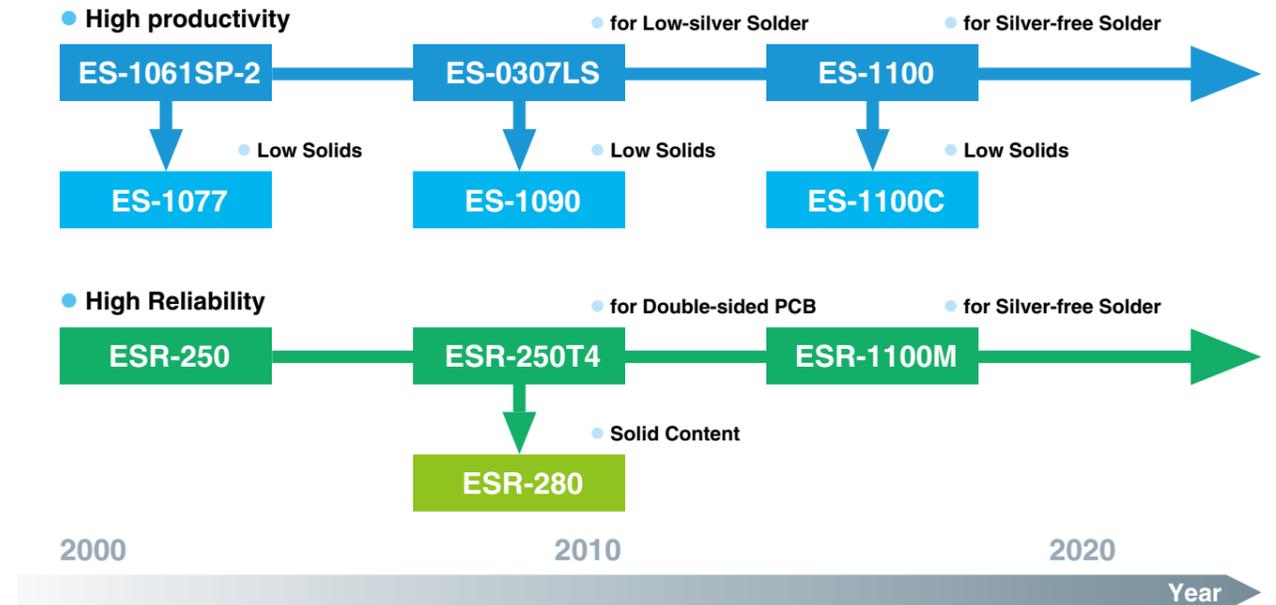


2. Prevention of reoxidation
Create thin film between air and solder to protect solder and base material surface.



3. Wettability enhancement
Reduce surface tension and enhance spreading through capillary action.

Post-flux roadmap for PCB



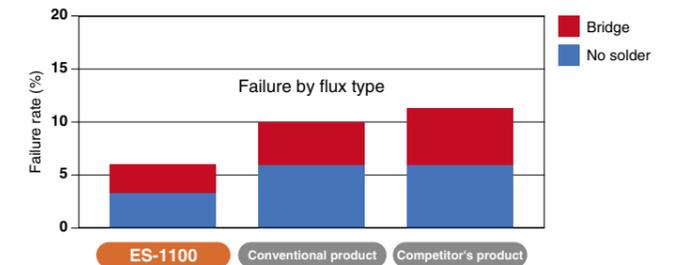
Improved Basic Performance and Fine Finish

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

Reduction of solder ball splash



Jointing failure rate

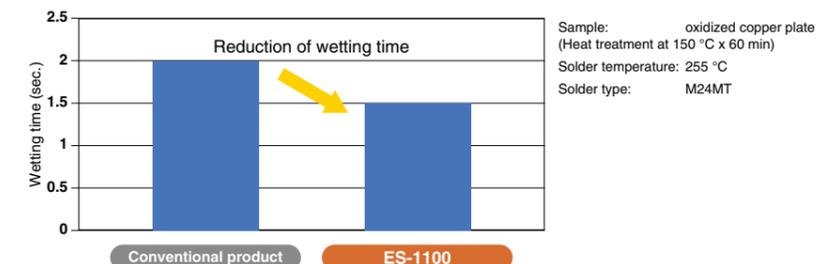


Comparison of color tone



Achieved imperceptible residue and consistent matte effect

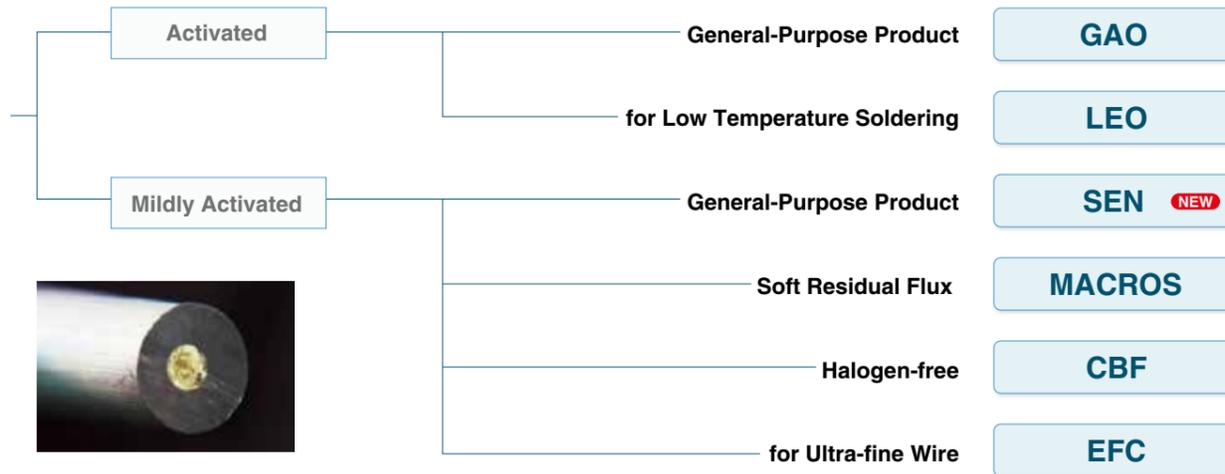
Comparison of wettability



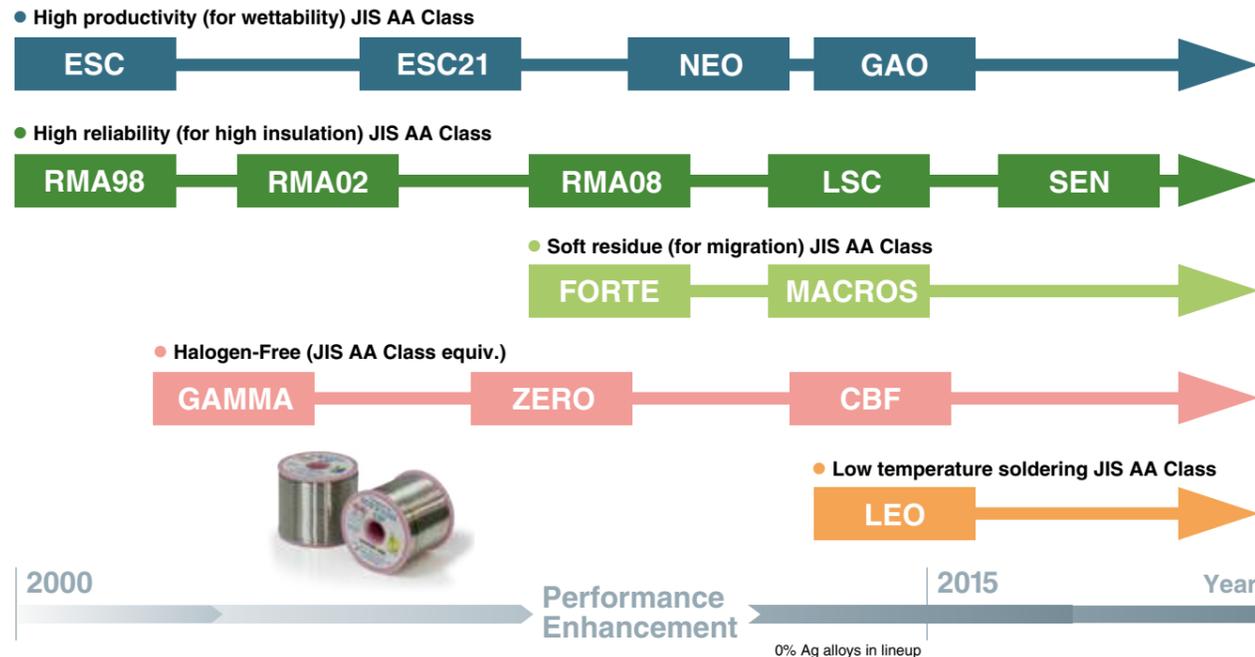
Lead-Free flux cored solder continuing new challenges and evolving

Please choose the products by your purpose or application

- **SEN** Suppress of flux & solder for high IR reliability
- **LEO** Sn-Bi solder at low melting point realizing low temperature soldering
- **GAO** Guarantee excellent wettability and working environment
- **MACRO** Optimal for severe environments including automotive applications
- **CBF** Ensure good wettability despite being halogen-free
- **EFC** Realize narrow pitch soldering with ultra-fine wire



Lead-Free Flux Cored Solder Roadmap



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 video equipment.

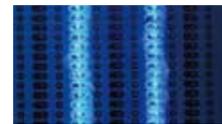
Recommended alloys; M705/M705RK/M20RK

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

Evaluation by spraying chemical agent



Conventional product



SEN



Conventional product

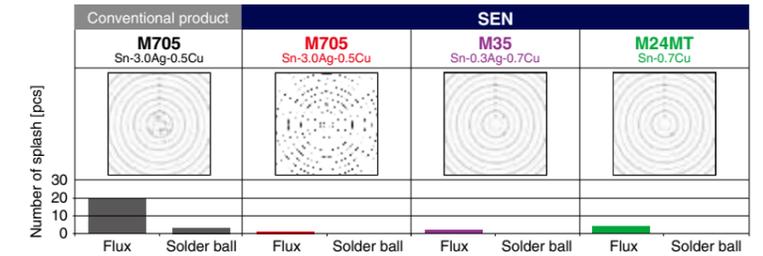


SEN

- 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.

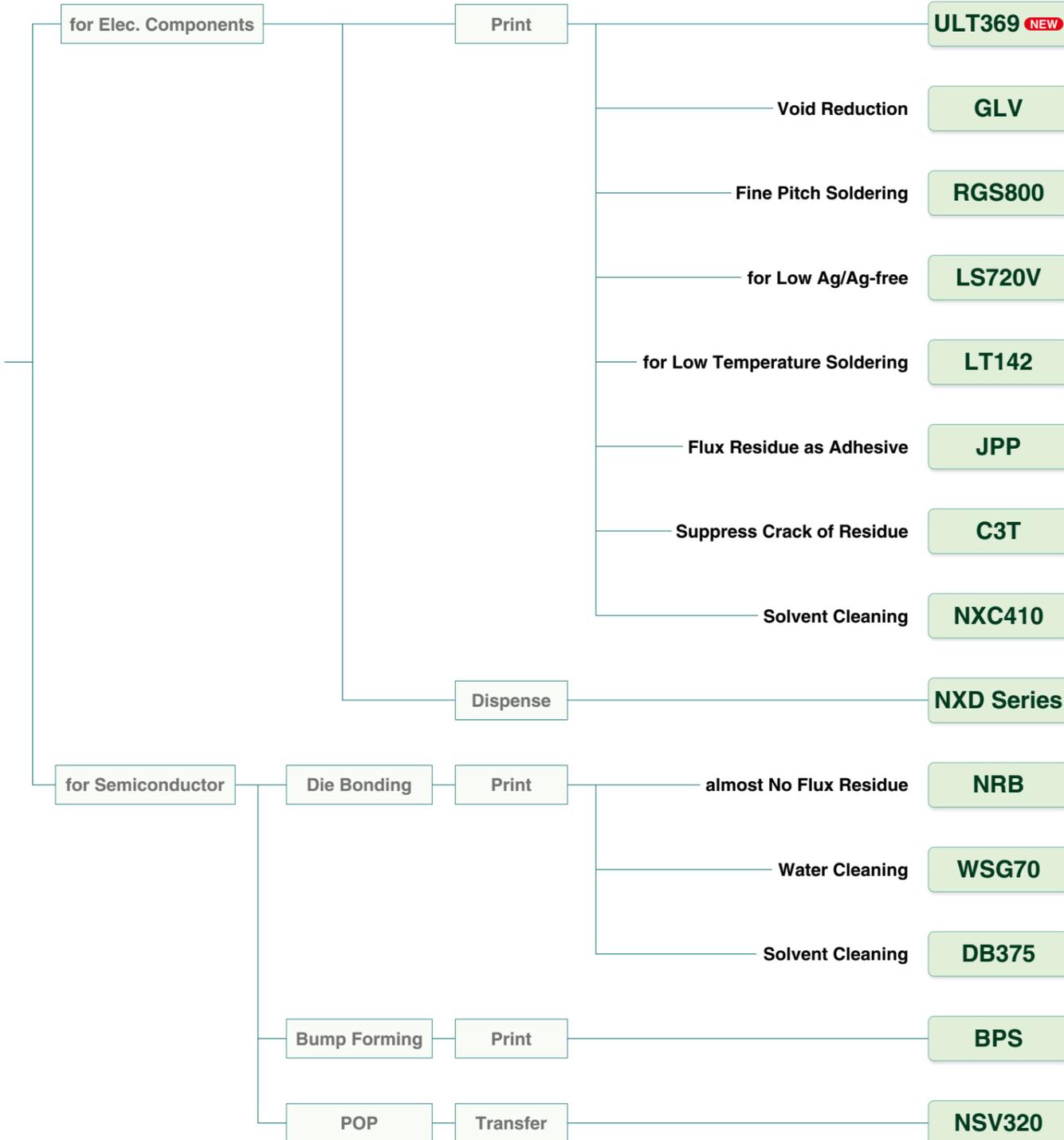


Leo succeed manufacturing process

Recommended alloy; L20

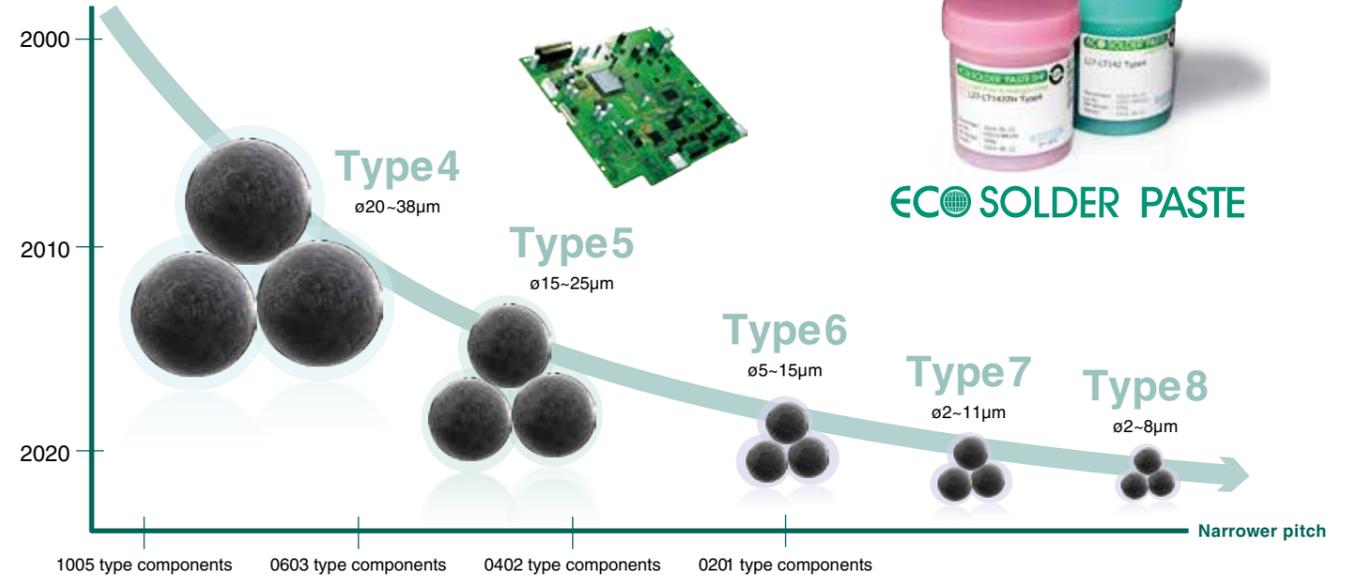


Choosing optimal solder pastes by purpose or application for the development of next-generation products



Flux developed for powder grain miniaturization

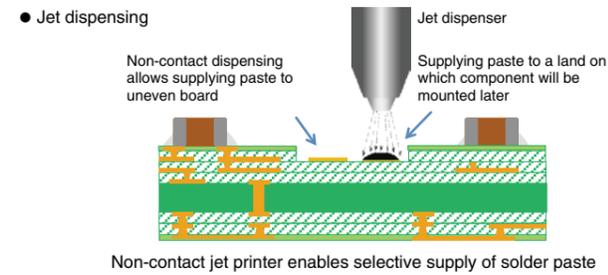
As powder grain becomes finer, the surface area and amount of oxidation increase. Therefore, highly-activated flux that suppresses reoxidation during reflow soldering is required.



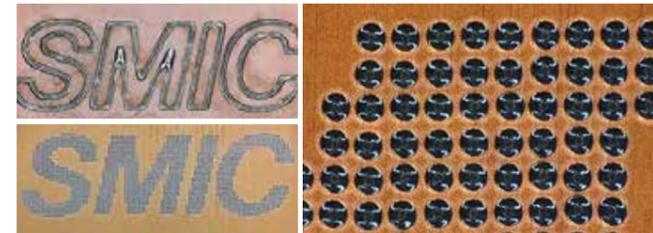
Solder Paste Applicable for New Process Development

Jet Dispensing

Product lineup applicable for halogen-free



High accurate dotted and linear dispensing

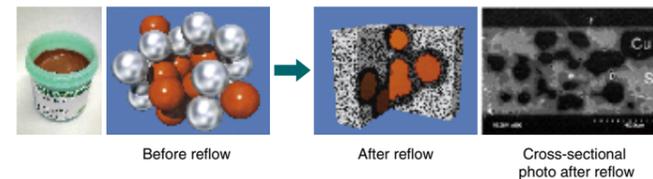


RAM

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.

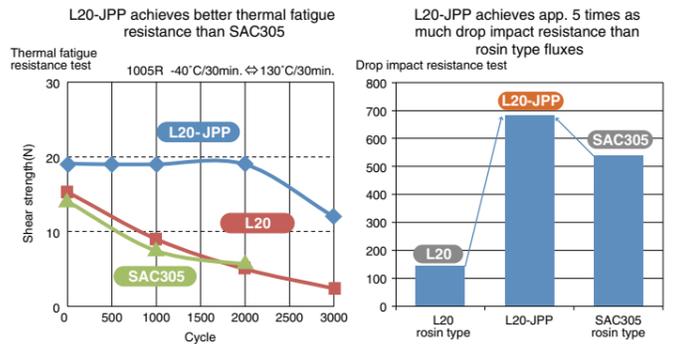
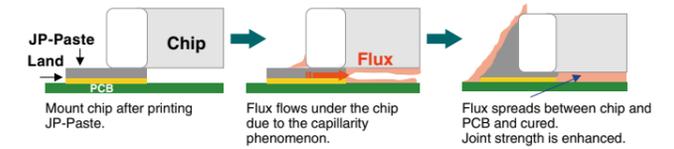
Alternative Paste to High-Temperature Solder



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.

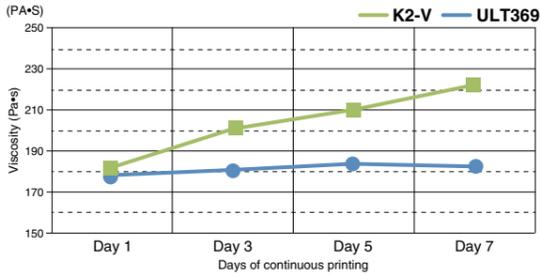
Solder Paste for SMT

ULT369 NEW Achieved both usability and void suppression

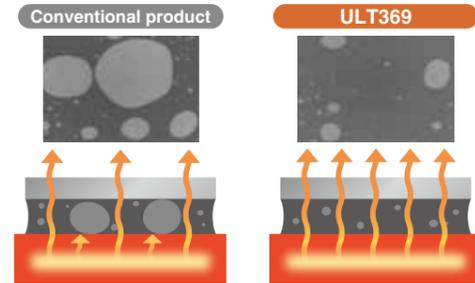
Revised latest SMT process and improved basic performance of wettability as well as printability for miniaturized components and compatibility with Non-Wet-Open (NOW) at slim BGA are best for downsizing trend of electronic devices.

Recommended alloy; M705

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

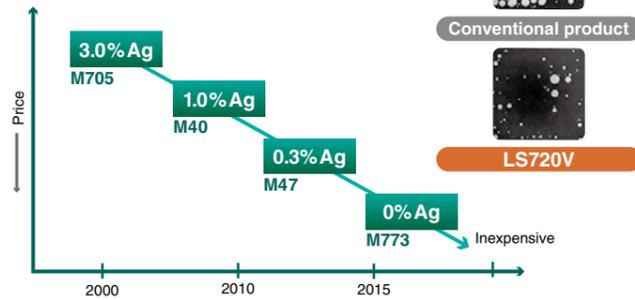


- Enhancement of heat dissipation
Void as gas layer with low thermal conductivity will be discharged through heat-sealed QFN or QFP



LS720V Prevents void formation by Low-Ag/Ag-free flux

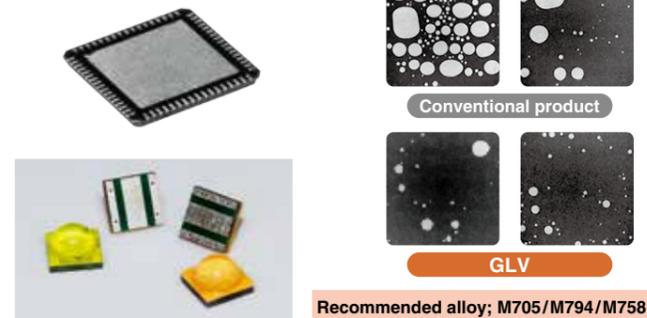
LS720 prevent void formation by enhanced wettability and improved flux fluidity during melting.



Recommended alloys; M40/M47/M773

GLV Significant reduction of void by improved flux

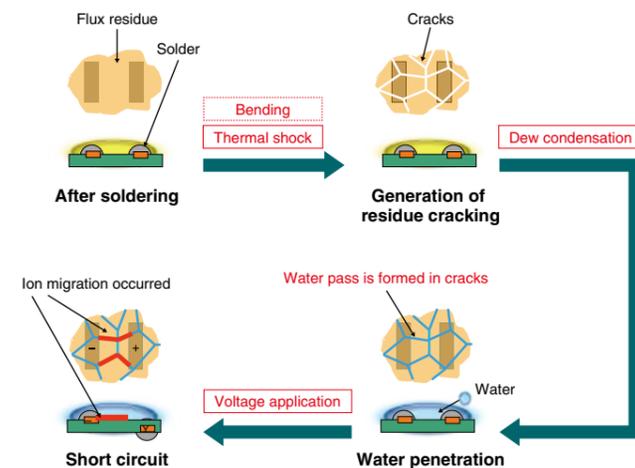
GLV prevent void on large bottom terminal components, in which temperature does not rise easily, and significantly reduce unmelted solder defect in BGA.



Recommended alloy; M705/M794/M758

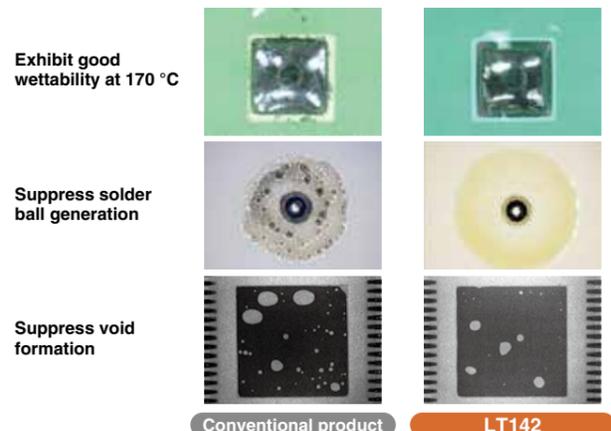
C3T C3T shows no flux residue cracking even in thermal fatigue resistance test

Crack-free flux residue enhances ion migration resistance



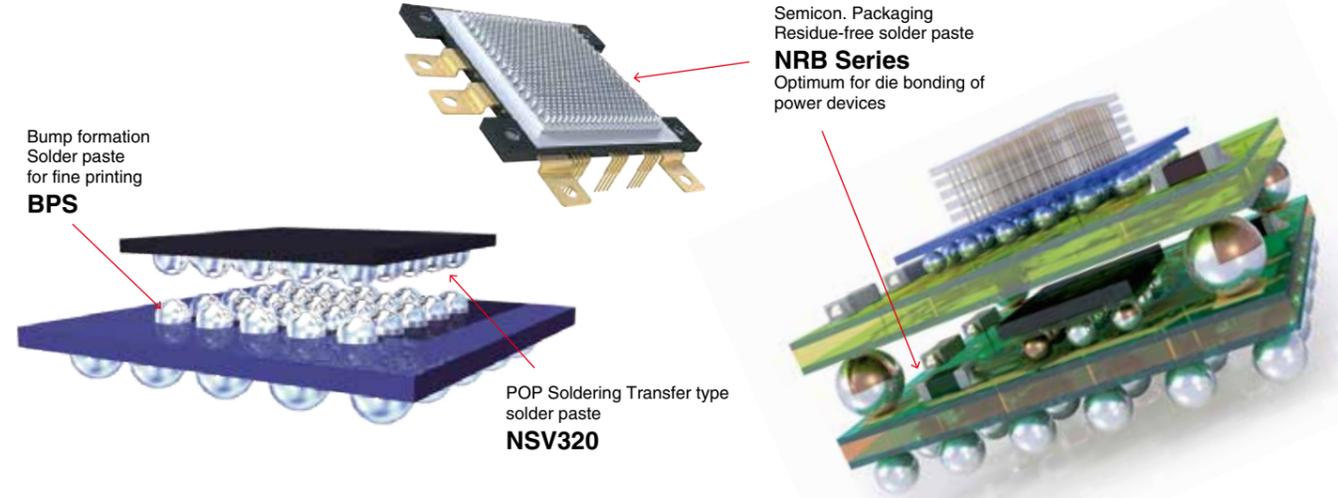
LT142 Realizes cost reduction through energy conservation by flux for alloys at low melting points

Improved active component of flux enhance reflow result of Bi alloy easily oxidized and suppress void formation.



Recommended alloy; L20/L27

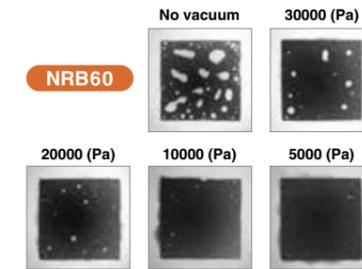
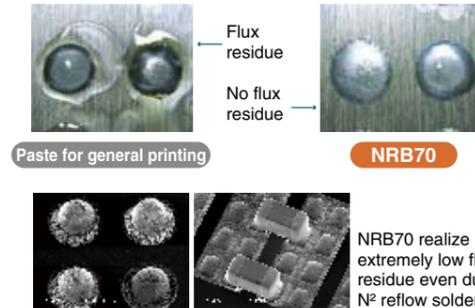
Solder Paste for Semiconductor Packaging



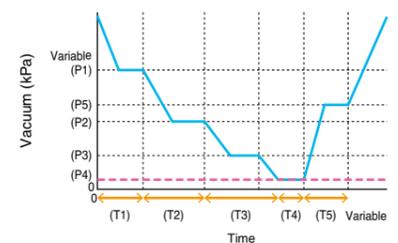
NRB Realize residue & cleaning free soldering with non-rosin-type flux

Recommended alloy; M705

Comparison of flux residue after reflow soldering



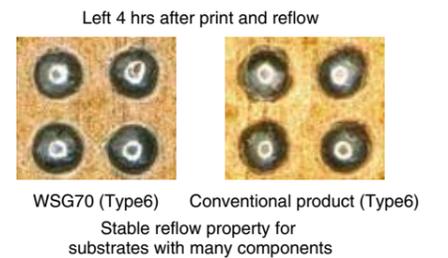
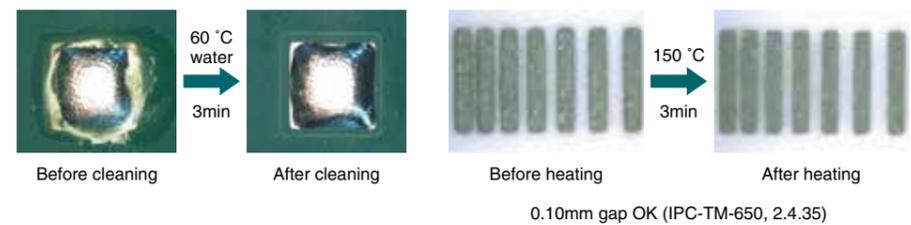
Realize low splashing residue & void-free soldering with vacuum reflow oven SVR-625GT capable of variable vacuum control.



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

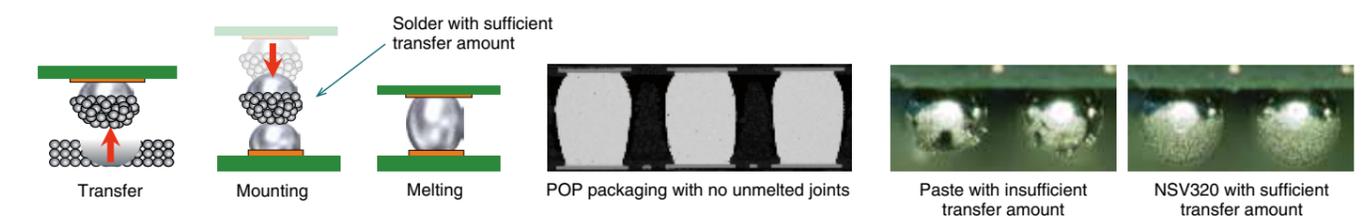
Recommended alloy; M705

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



NSV320 Transferring sufficient solder amount, realize POP soldering with high joint reliability

Recommended alloy; M705





Expected form for soldering with various alloys and structural materials

Single Layer



Basic type with high dimensional precision for stable soldering.

Ni Ball Contained



Ni 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 Layer



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.

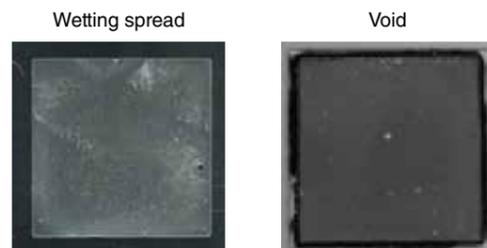
Typical forms



Surface Treatment Specification

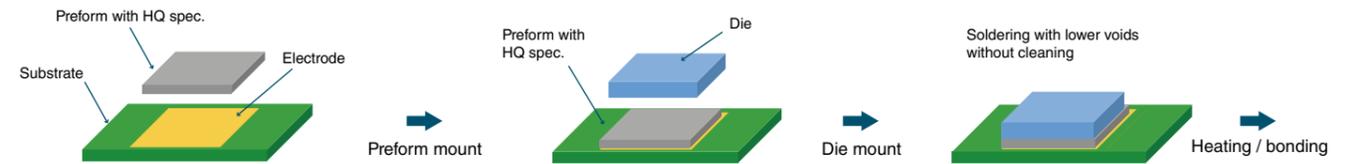
Provide excellent wettability with special processing and realize flux-free soldering in reducing atmosphere. Effective for reducing void formation and cleaning process.

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

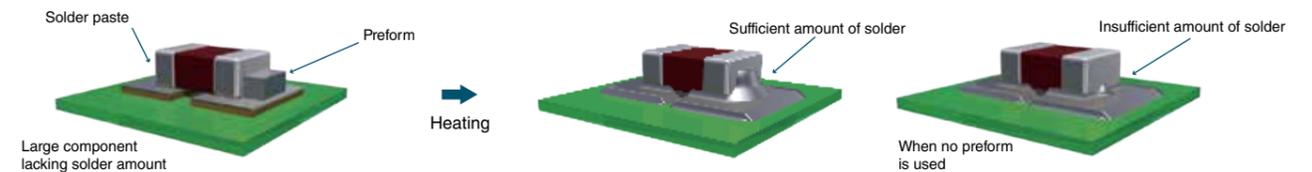


Application Examples

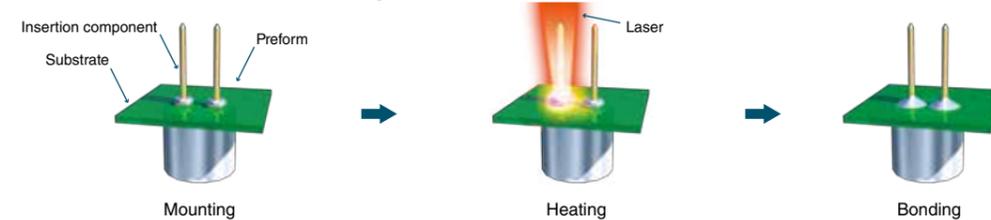
Case 1 Die bonding using single layer or Ni ball contained preform suppress void and realizes soldering with high heat dissipation effect. Flux is eliminated by using HQ spec. preform, enabling clear soldering even without cleaning.



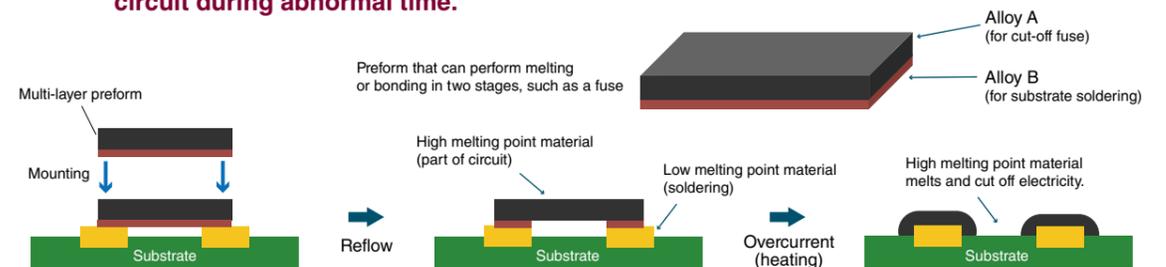
Case 2 Single layer or flux coated material is processed into chip form and automatic mounting on pad to prevent lacking solder amount by tape package, in order to supply solder and enhance strength. SMIC's unique chip surface processing technology improves the mounting rate.



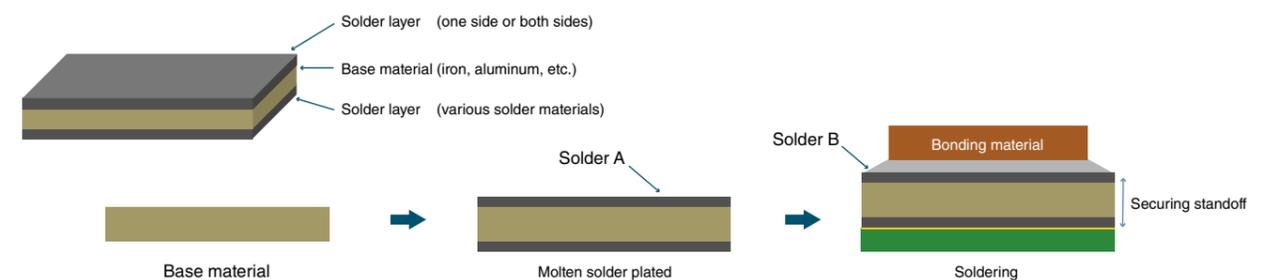
Case 3 Ring preform inserted into terminals of component on through-holes of substrate and selective heat by laser or other methods achieved soldering without causing thermal damage to the substrate or component.



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.

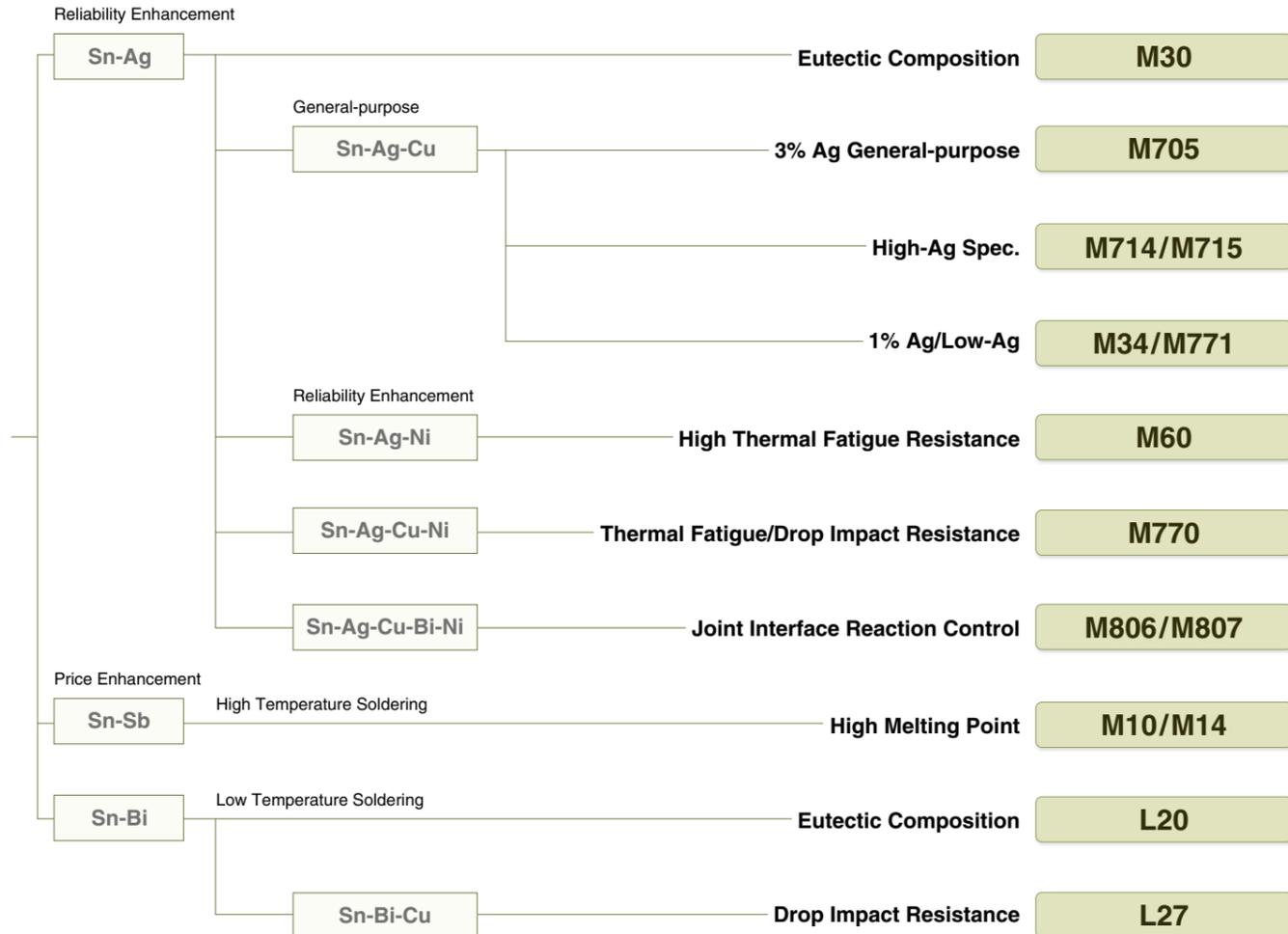


Case 5 Solder coated material for surface of the base material that cannot easily be soldered or does not melt at soldering temperature. Optimal for bonding to aluminum, applications with standoff or for hermetic sealed case.





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.

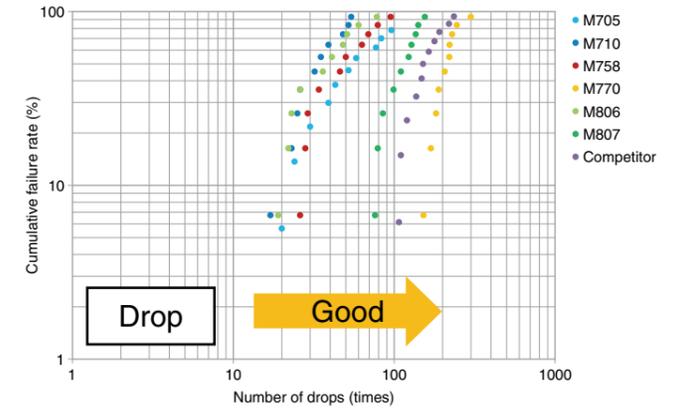
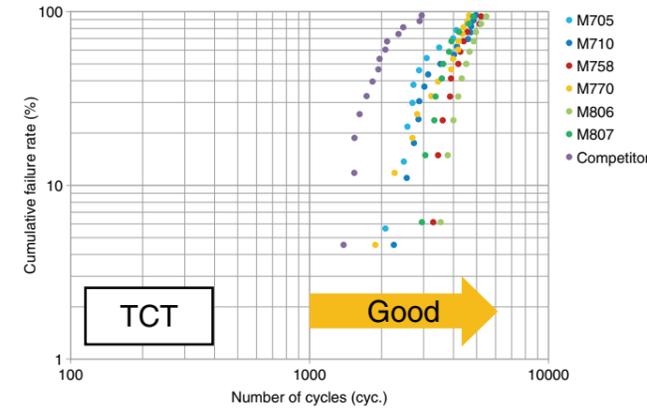


- Standard specification product
- Diameter ; 50 to 110 μm
- Alpha count ; 0.002 cph/cm² or less
- Composition ; M705 M200

TCT and drop test with CSP

CSP Size: 12 x 12 mm SRO: 0.24 mm Pitch: 0.5 mm Ball: 0.3 mm S/F: Cu

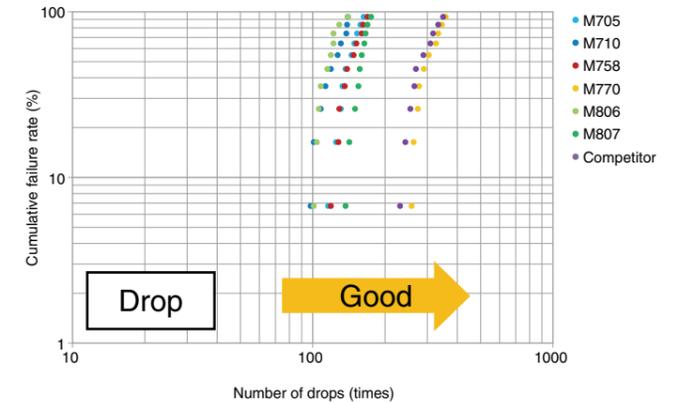
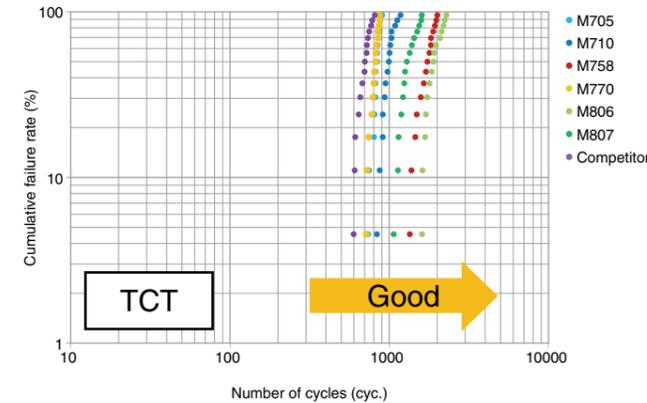
TEST Condition [TCT] Temperature Cycle : -40°C/+125°C each 10min [Drop] Impact acceleration : 1500G/Half-sine pulse 0.5msec.



TCT and drop test with WLP

WLP Size: 7 x 7 mm SRO: 0.24 mm Pitch: 0.5 mm Ball: 0.3 mm S/F: Cu

TEST Condition [TCT] Temperature Cycle : -40°C/+125°C each 10min [Drop] Impact acceleration : 1500G/Half-sine pulse 0.5msec.



M806/M807 Improving joint interface for wafer bump formation

Sn-3.5Ag-0.8Cu-Bi-Ni

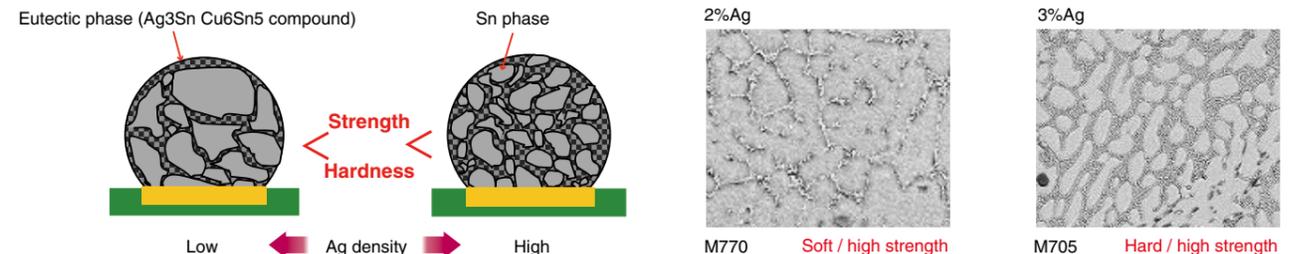
Optimum for wafer bump formation which stressed by gap of coefficient of thermal expansion. Developed with solid solution hardening of Sn-Ag-Cu, control of boundary surface reaction by Bi and suppressing coarsening of crystal grains by Ni additive.

M770

Sn-2Ag-Cu-Ni

Achieving both thermal fatigue resistance and drop impact resistance

Ag content increasing, induced precipitation amount of compound (Ag₃Sn) in solder increased, making solder harder and giving improved mechanical strength. The opposite occurs when the Ag content is reduced. Utilizing this property, SMC has developed M770, which achieves both thermal fatigue resistance and drop impact resistance by studying optimal Ag amount and slight amount of additive.



FLUX for SEMICONDUCTORS

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



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

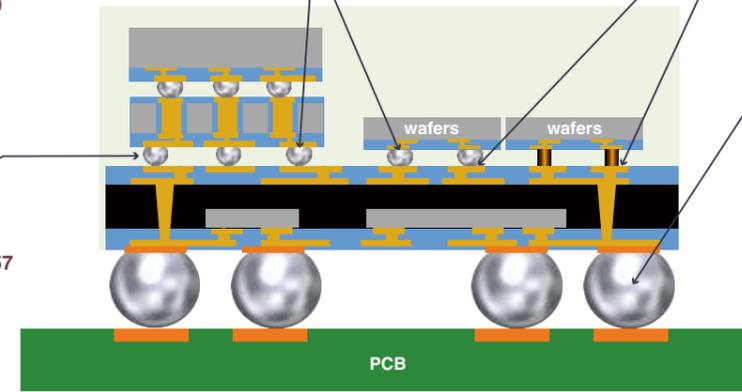
Application	Type	Heating	Process	Product
Micro Ball Attach	Water Soluble	Reflow	Print	WF-6457
	Rosin Type	Reflow	Print	MB-T100
Fusing	Water Soluble	Reflow	Spray/Spincoat	SPK-3420
	Rosin Type	Reflow	Spray/Spincoat	7200A

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

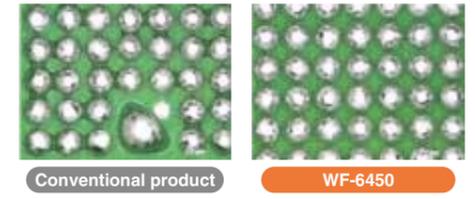
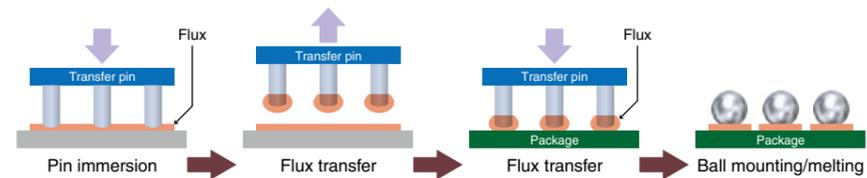
for BGA Attach (BGA)
Water-soluble: WF-6317, WF-6450
Rosin-based: GTN-68
Epoxy type: EF-100

for Flushing
Water-soluble: WF-6457



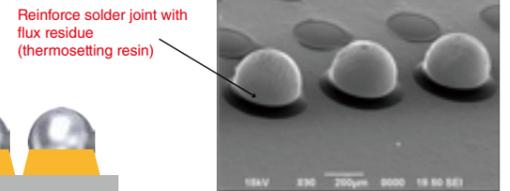
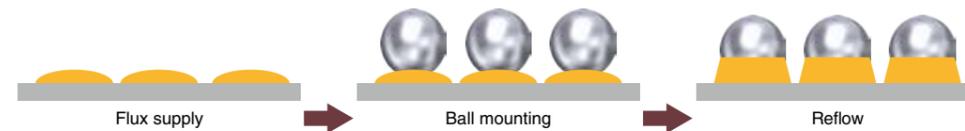
WF-6450

Suppress bridge even at ball attachment to narrow-pitched package



JOINT PROTECT FLUX EF-100

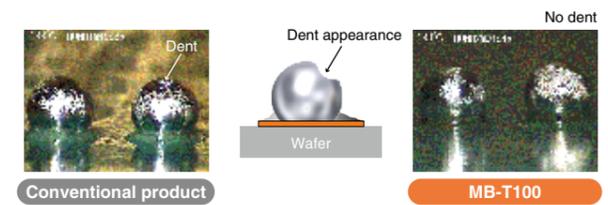
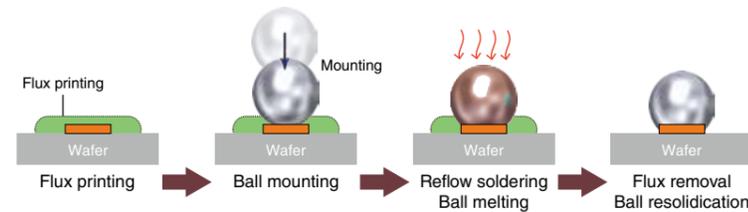
Reduce cleaning/drying process and reinforce solder joint
Please consider when joint strength of WLP etc. is insecure.



MB-T100

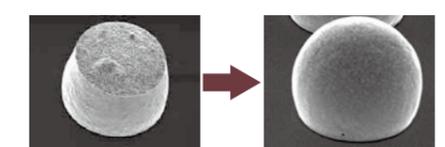
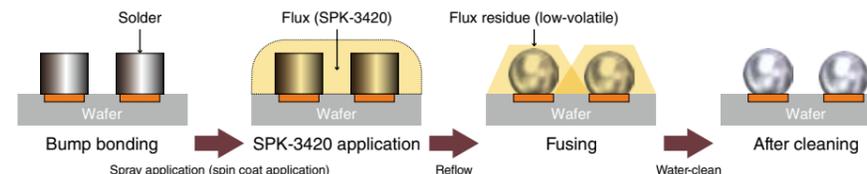
Highly-activated MB-T100 reproduce dent-free spheres when balls are resolidified

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.



Technologies by SMIC

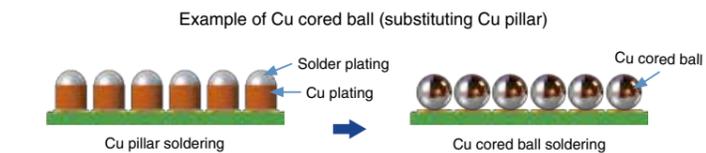
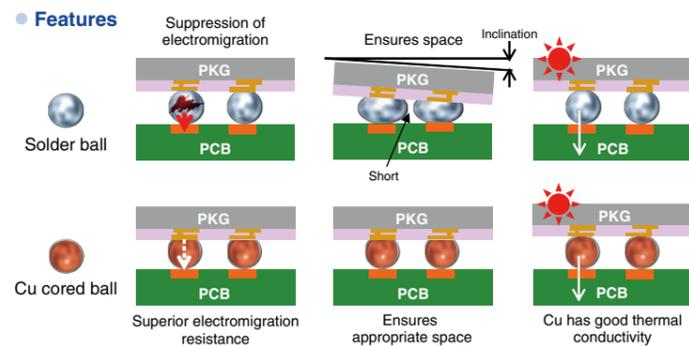
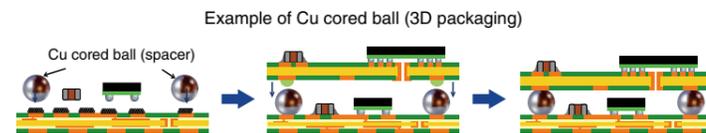
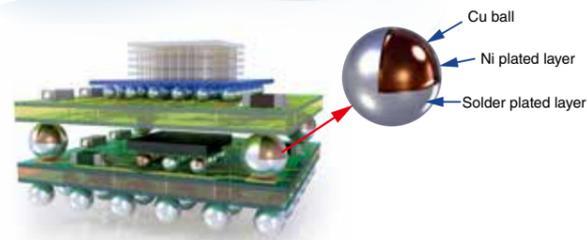
SMIC offers distinctive products responding requests from customers

Environmental Conservation

SMIC develops environmentally-conscious projects and products

Cu Cored Ball

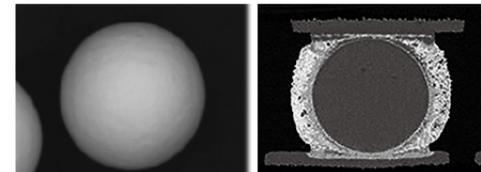
Advanced plating technology has easily securing of space in 3D soldering



Cross-sectional photos



Appearance and cross-sectional photos of M90

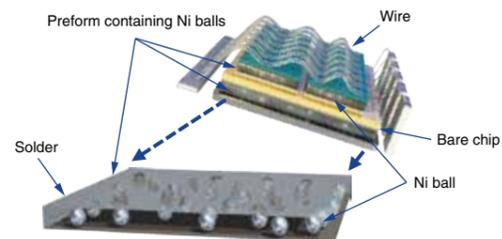


M90 improves drop impact resistance through reforming of the joint interface by Ni in the Ni plating.

Solder Containing Ni Balls

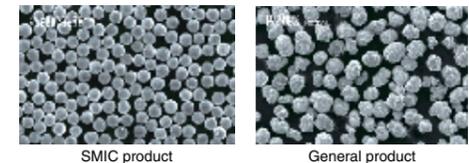
Realized by outstanding Ni granulation, unique Ni inclusion, and special surface processing technologies

Good grain size distribution of Ni balls contained in preform or solder paste ensures level and even thickness, maximizing the heat dissipation effect.



Level die bond mounting realizes highly reliable wire bonding.

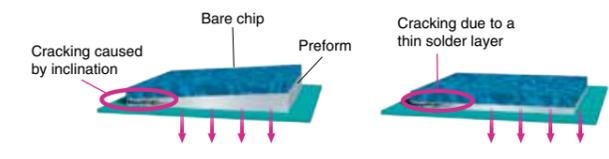
Spherical and uniform Ni ball produced by SMIC's unique production technology achieve void suppression and level soldering



Formation of the reaction layer with Ni suppress void generation, and all positions is almost uniform thickness.

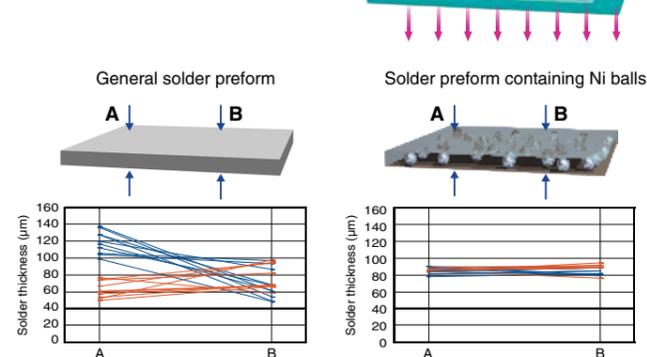
High heat dissipation

Air layers in cracks disturb thermal conductivity and reduce heat dissipation effect.



Good heat dissipation

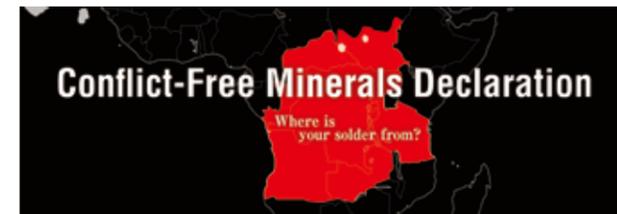
Thickness is almost same at all positions.



Conflict Mineral Free

Declared our intention not to be complicit in environmental destruction, terrorist activities or human rights violations

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



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



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

All supplier smelters have been checked by audits to deliver "conflict mineral free" products to our customers.



Recycling of Solder Pastes

Promote environmentally and customer friendly recycling initiatives

Features

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

Recover and recycle whole solder paste including container



Suppress generation of harmful substance to the utmost limit

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

Meets All Criteria

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

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 × 116 mm × 38 mm
20 kg package	455 mm × 139 mm × 65 mm



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