

SMIC



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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



Various forms of solder material for the *Future of Connection* through our Total Solutions

In 2000, we commercialized the standard lead-free solder material M705, making outstanding contribution for elimination of lead from components and products. We are 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. All this enables us to offer total solutions for soldering, including cost reduction, reliability improvement, density enhancement, energy conservation and environmental sustainability enhancement.

ECO SOLDER ALLOY

Harmonizing with environment

Solder Alloy ... P3

POST FLUX

Promising effective solder wettability

Post Flux ... P7

ECO SOLDER CORED

Challenging and evolving

Flux Cored Solder ... P9

ECO SOLDER PASTE

Realizing next-generation soldering

Solder Paste.. P11

ECO SOLDER PREFORM

Changing the future of soldering

Solder Preform ... P15

ECO SOLDER BALL

Evolving semiconductor soldering one step ahead

Solder Ball ... P17

FLUX for SEMICONDUCTORS

Taking advantage of organic synthesis technologies

Flux for Semiconductors ... P19

Environmental Conservation

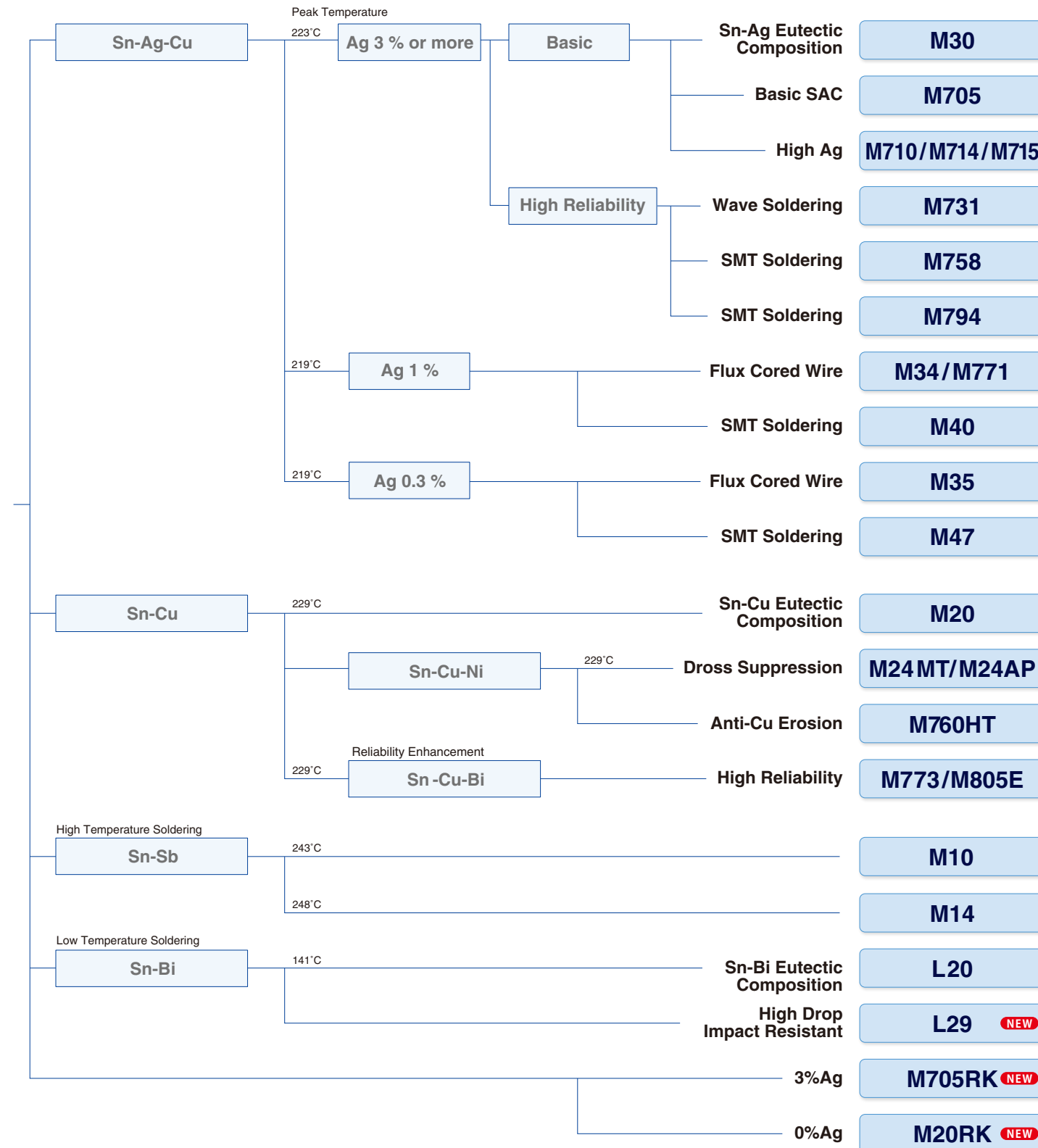
Conflict-Free Minerals Declaration

Conflict-Free Minerals Declaration

Environmentally-conscious Products ... P21

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

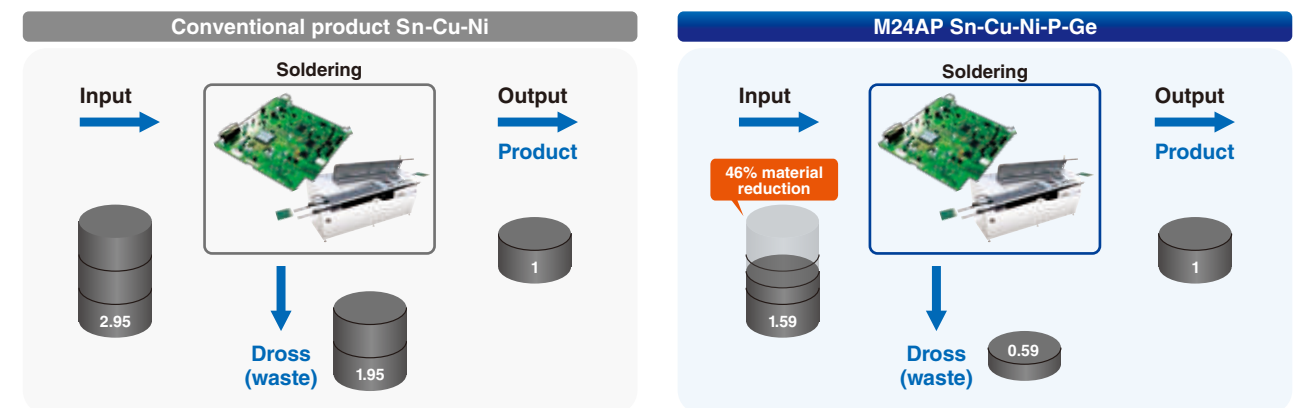
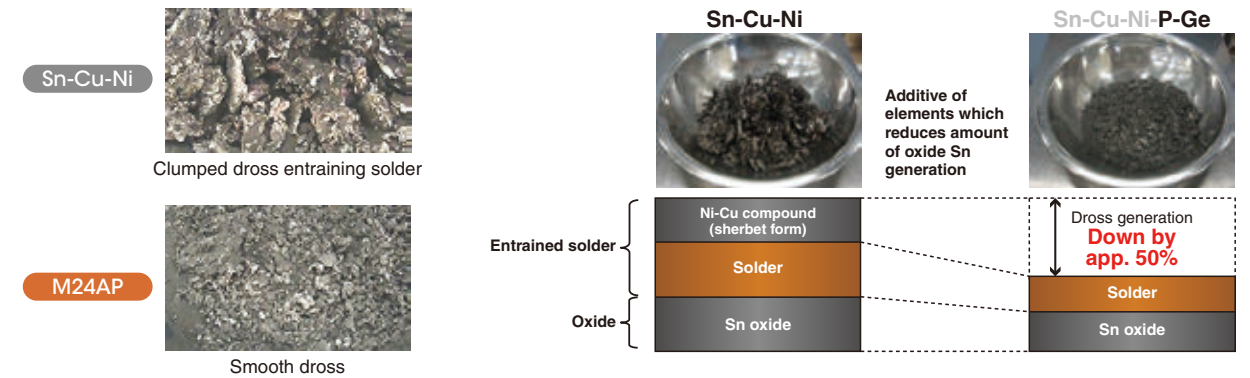
Wealth of lineups to meet customers' requirements



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.

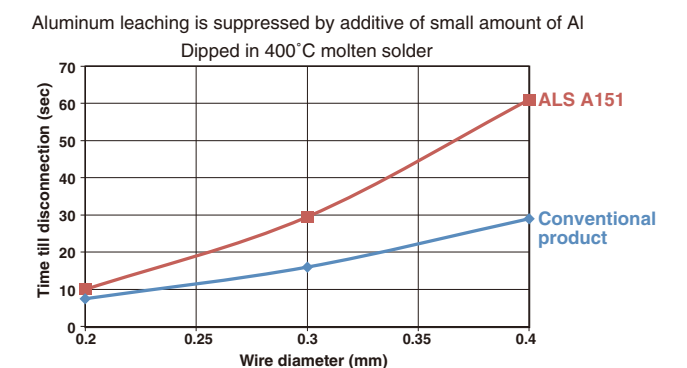
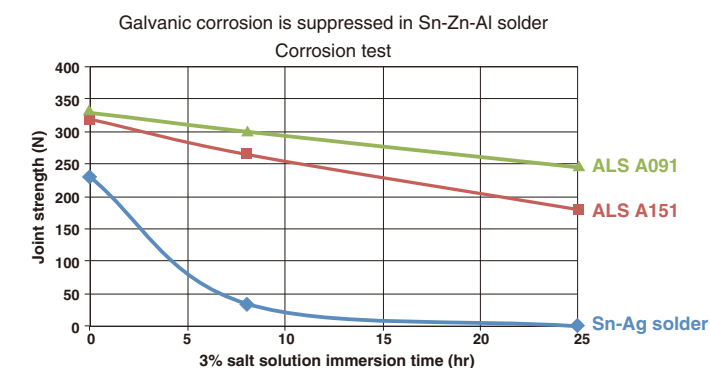
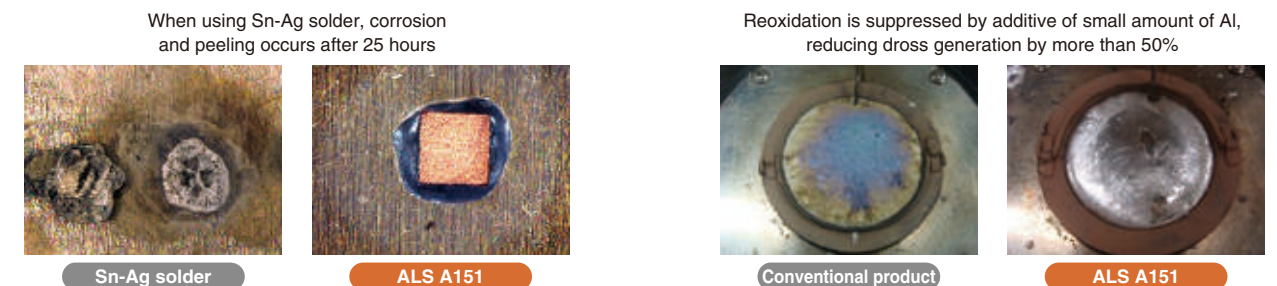


By suppressing dross, 46% of the solder usage is reduced and cost reduction is promoted.

Sn-Zn-Al Solder for Aluminum Soldering

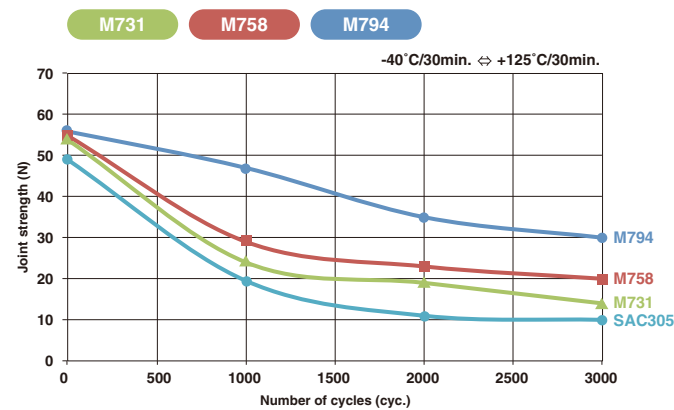
■ ALS A151 and A091 are solder materials for aluminum soldering that suppress galvanic corrosion

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



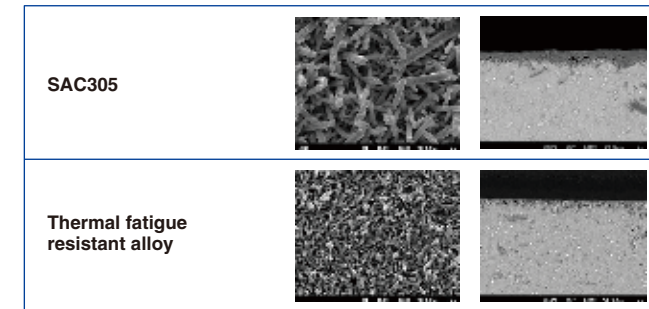
Latest Thermal Fatigue Resistant Solder Alloy

■ M794 was developed with three advanced technologies



Joint interface reaction control technology

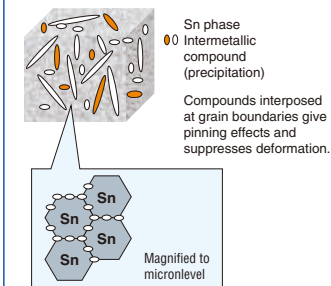
Additives of Ni improve fragile diffusion layer of joint interface and secure joint interface strength



Precipitation hardening and solid solution hardening combination technology

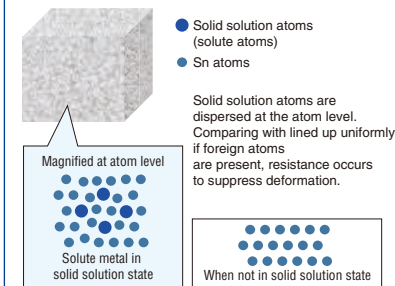
Precipitation hardening

Intermetallic compound (such as Cu6Sn5 and Ag3Sn) improves strength



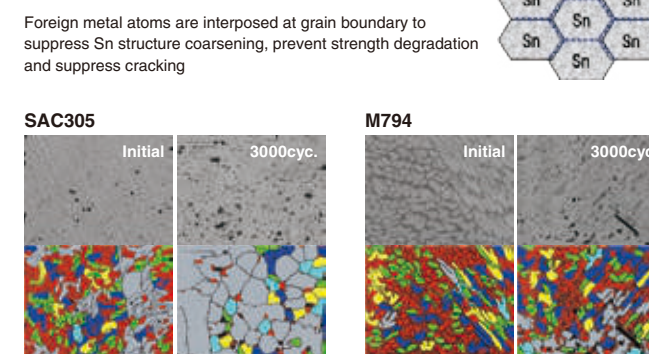
Solid solution hardening

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



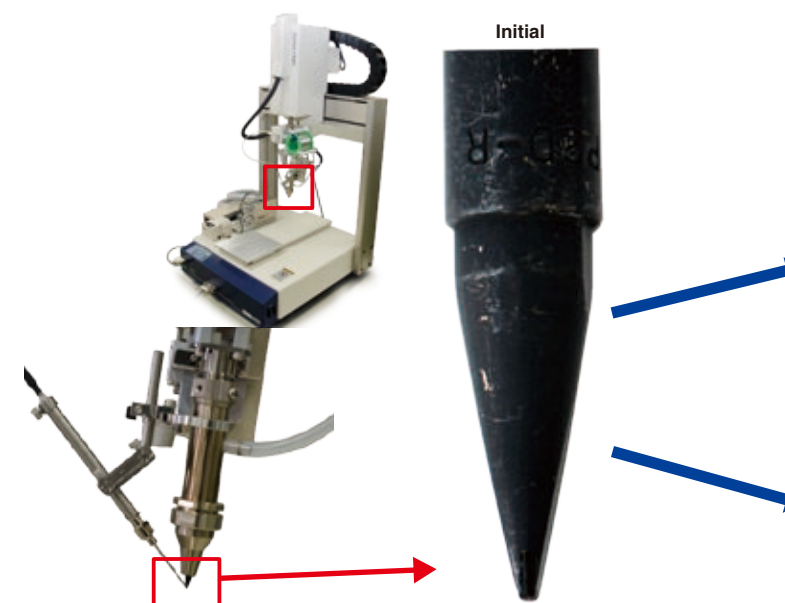
Sn crystal grain coarsening suppression technology

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



NEW Enhanced Cost Reduction Solution Following Material Cost

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

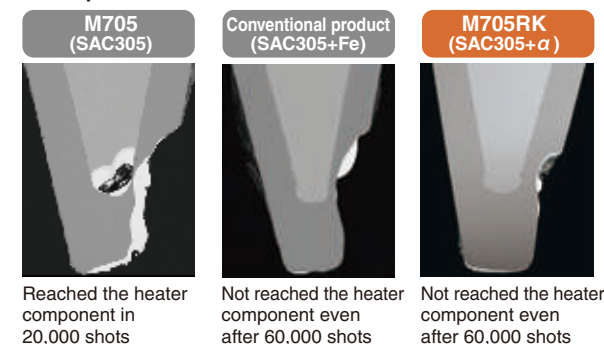


Test conditions

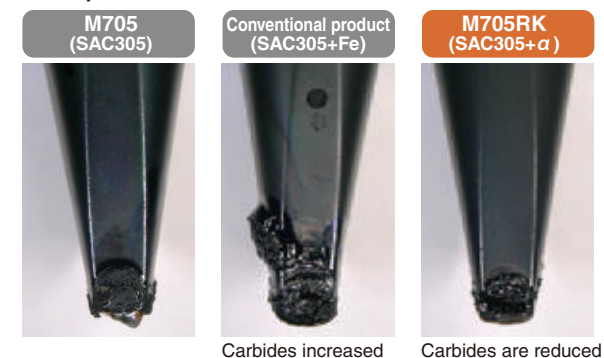
Solder wire diameter: $\phi 0.8\text{mm}$
Iron tip temperature: 420°C
Solder feed length: 10mm
Solder feed rate: 20mm/sec

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

Iron tip erosion

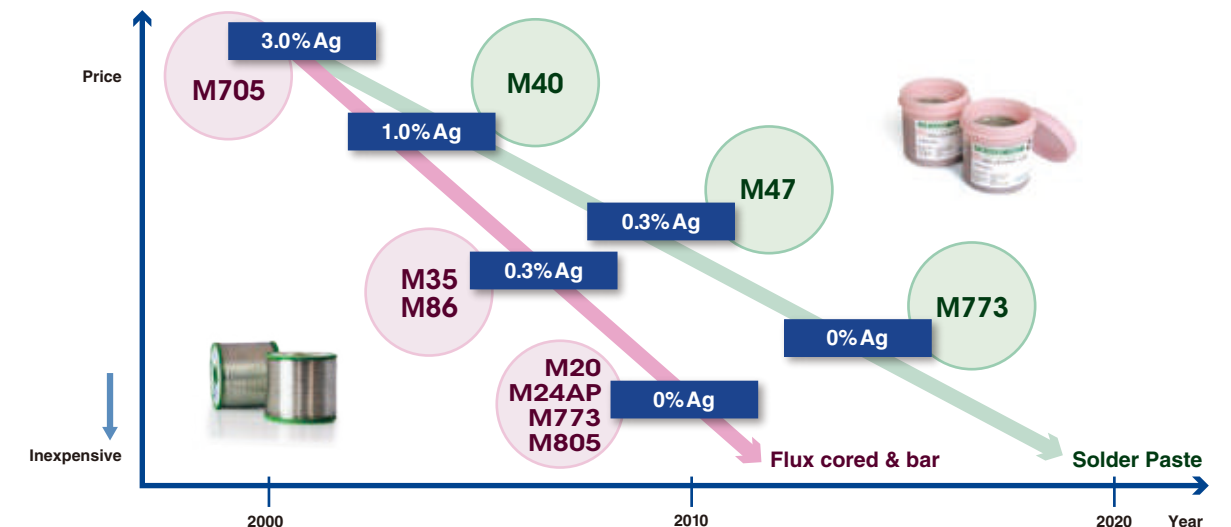


Iron tip contamination after 5000 shots

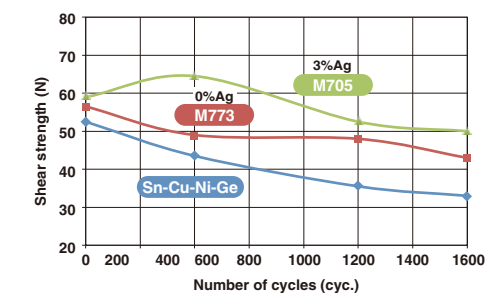
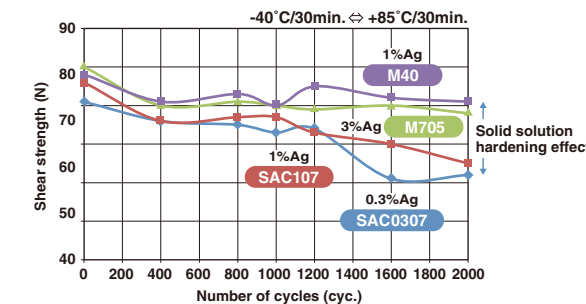


Price Reduction Achieved by Low-Ag/Ag-Free Solder Alloy

■ 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

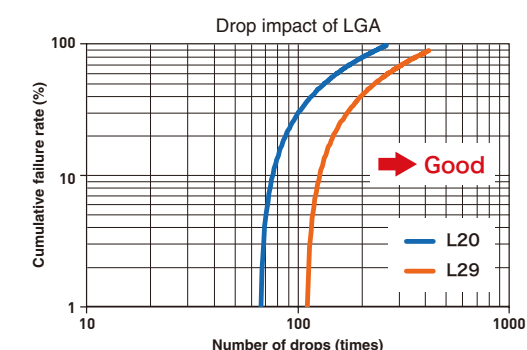
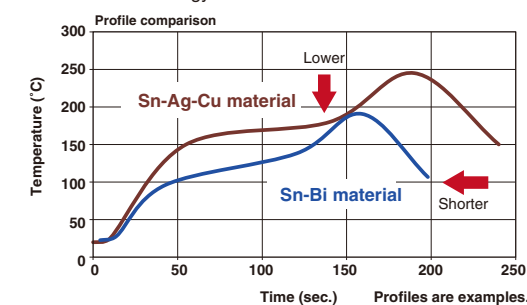


Low temperature Packaging Technology

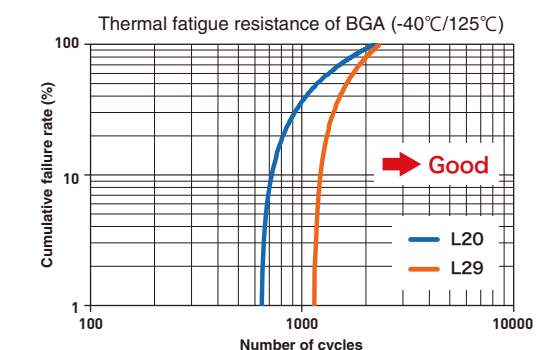
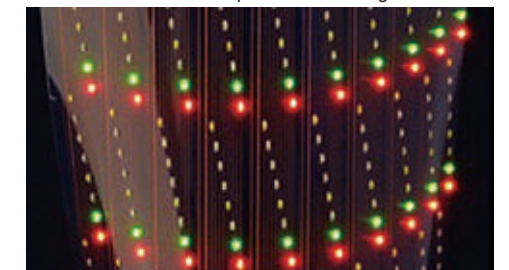
■ Consistently evolving Sn-Bi low temperature solder

- Soldering which is gentle to components and the environment with lead-free low temperature solder.
- New lineup of L29 in 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

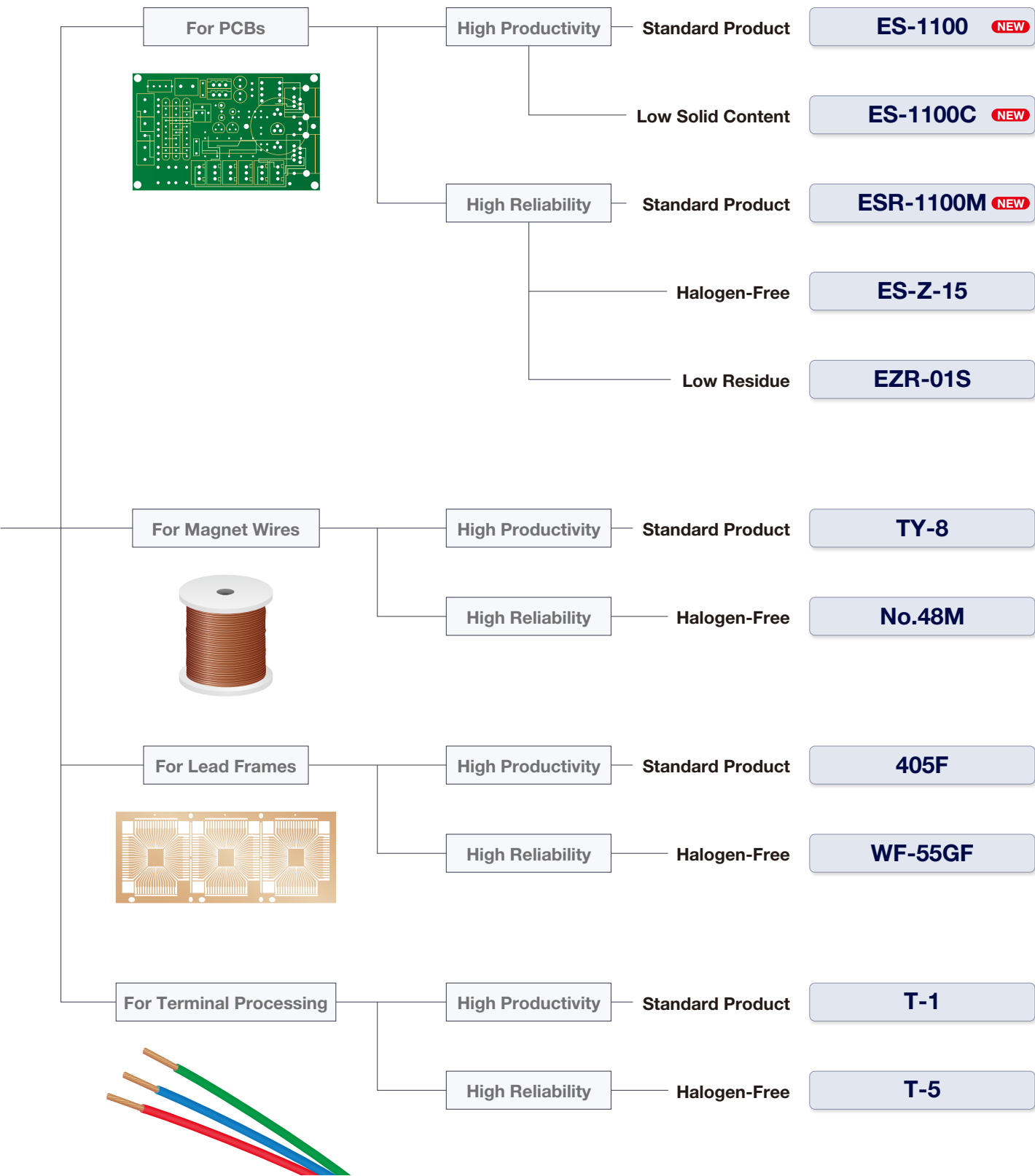


POST FLUX

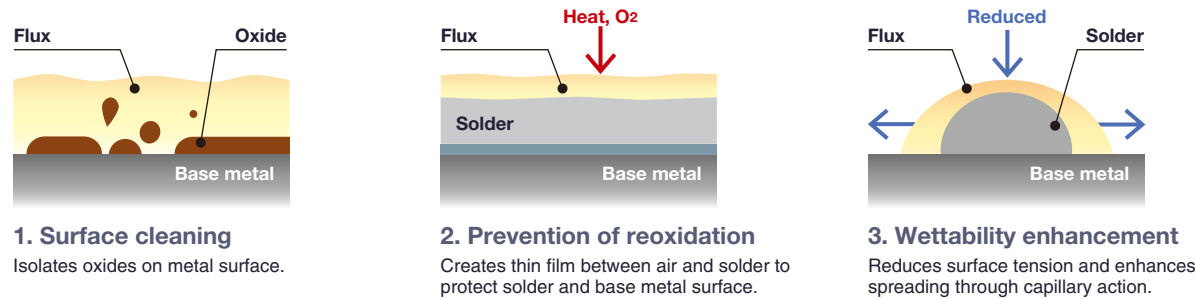
Consisting of activators, solvents and resins such as rosin



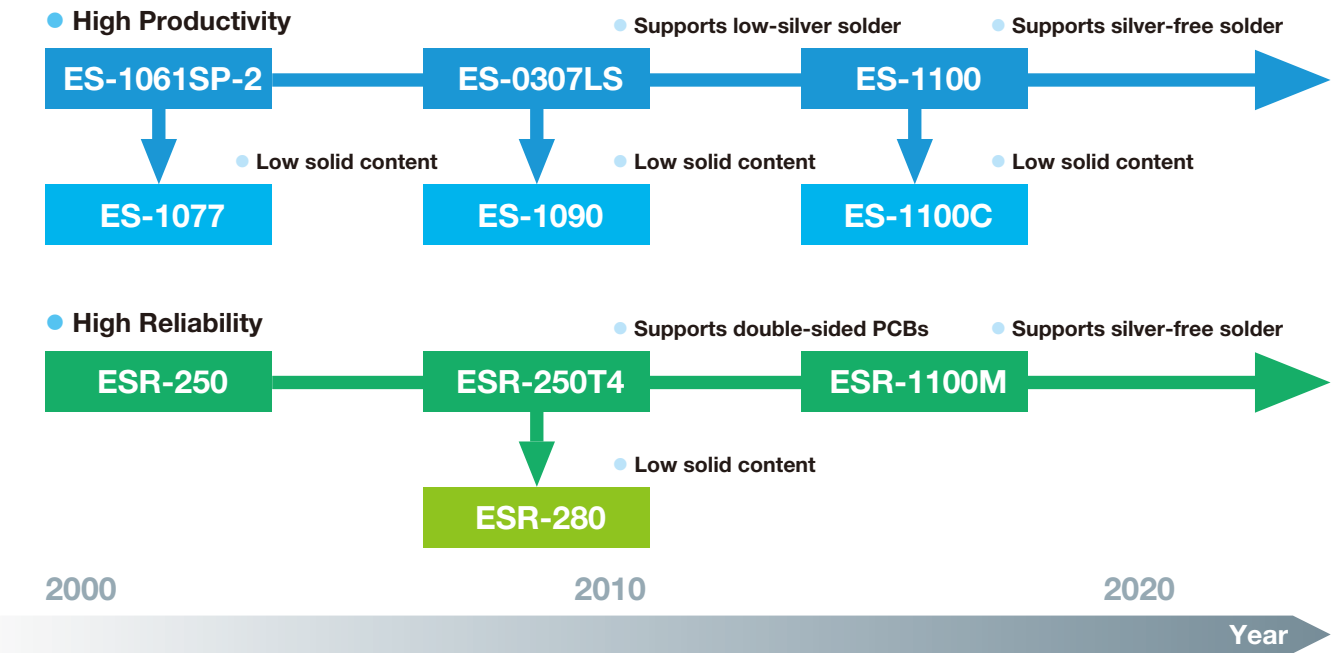
Choose the effective soldering products by purpose or application



Functions of flux



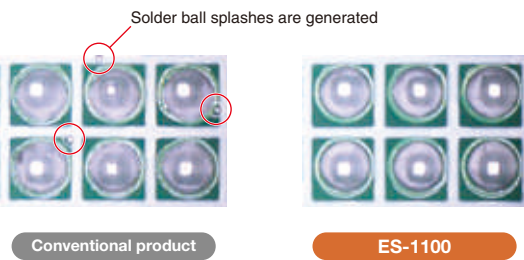
Roadmap of post-flux for PCB



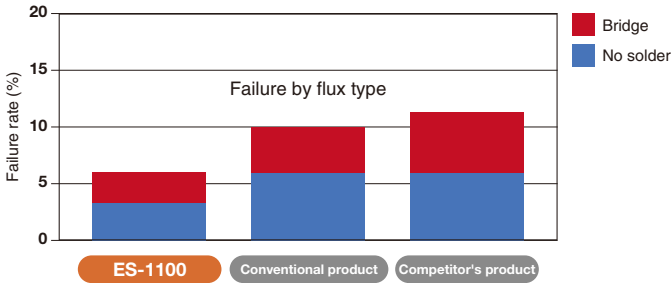
Improved Basic Performance and Fine Finish

ES-1100 leaves a fine-finish and reduces errors at image and pin contact inspection

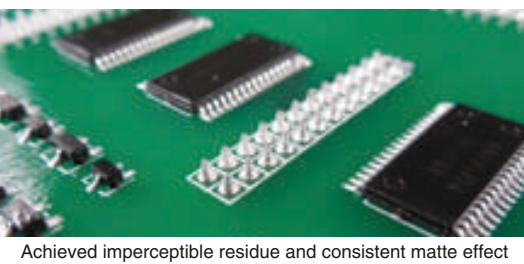
Reduction of solder ball splash



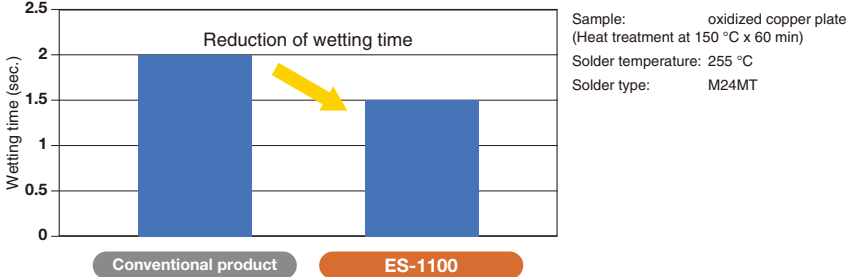
Jointing failure rate



Comparison of color tone



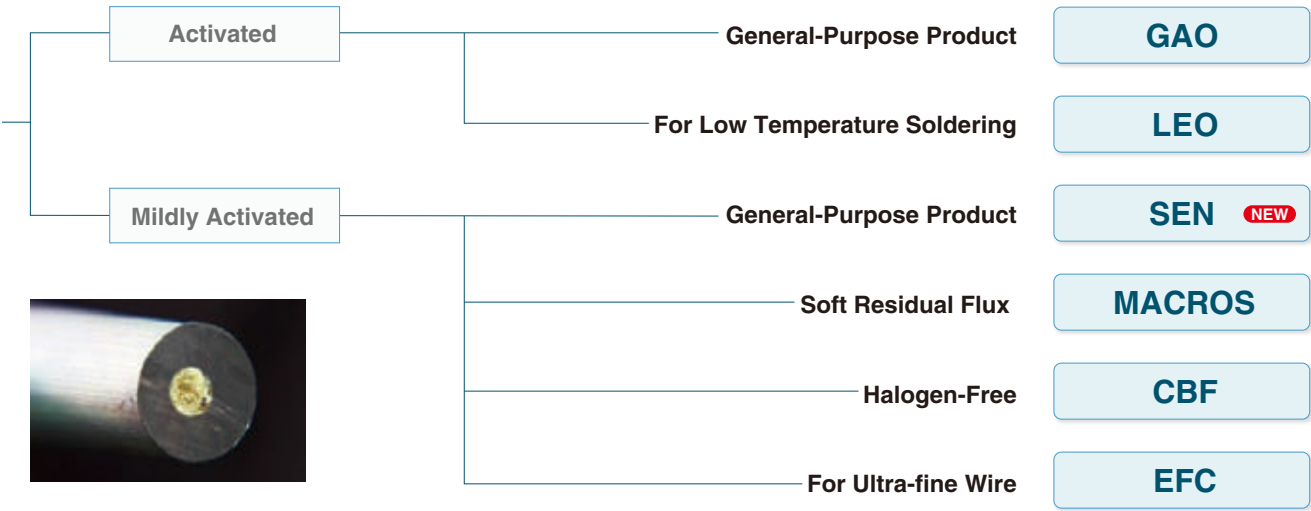
Comparison of wettability



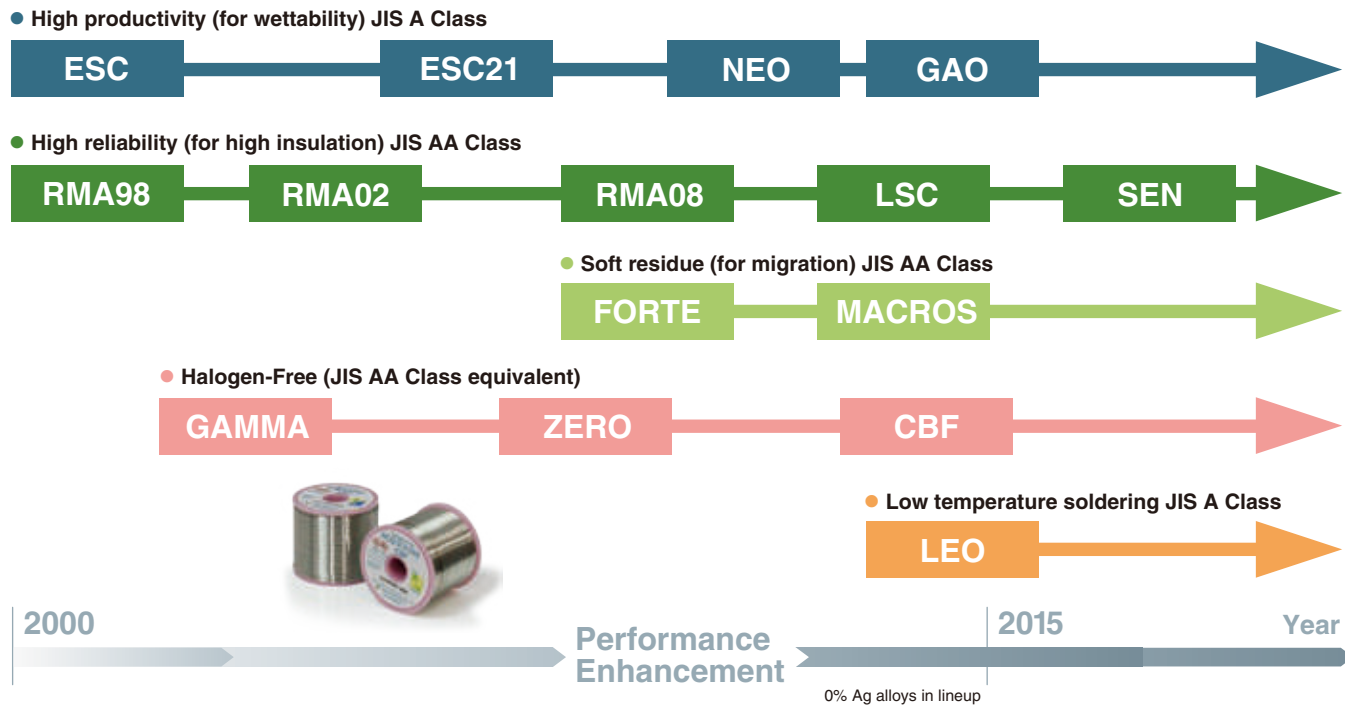
Lead-free flux cored solder which continues to challenge and evolve

Please choose the products by your purpose or application

- **SEN** Suppresses of flux and 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



Roadmap of lead-free flux cored solder



SEN Non-splash of flux and solder by exclusive control



JIS AA class with high insulation reliability suppresses splash even for wider ranges of operational temperatures 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

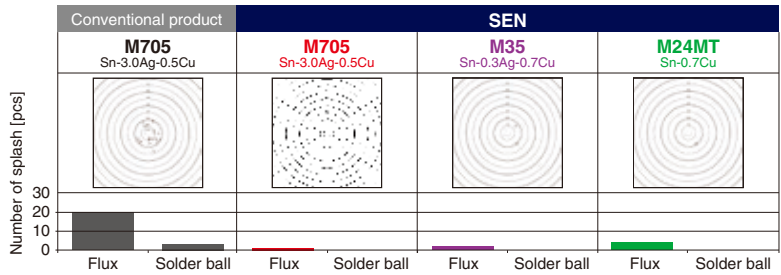


SEN

- 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



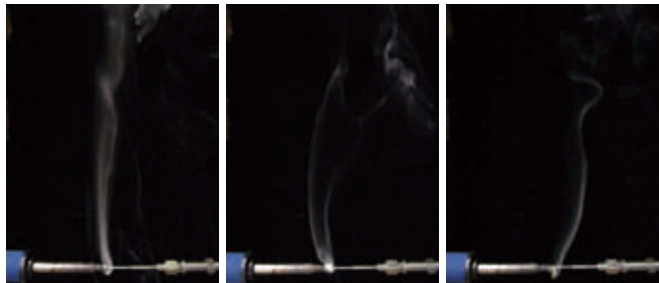
GAO Realizing good working environments and beautiful surface after soldering



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

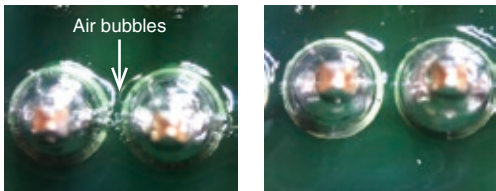


Conventional product

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, realizes cost reduction by using low heat-resistant substrates or components.

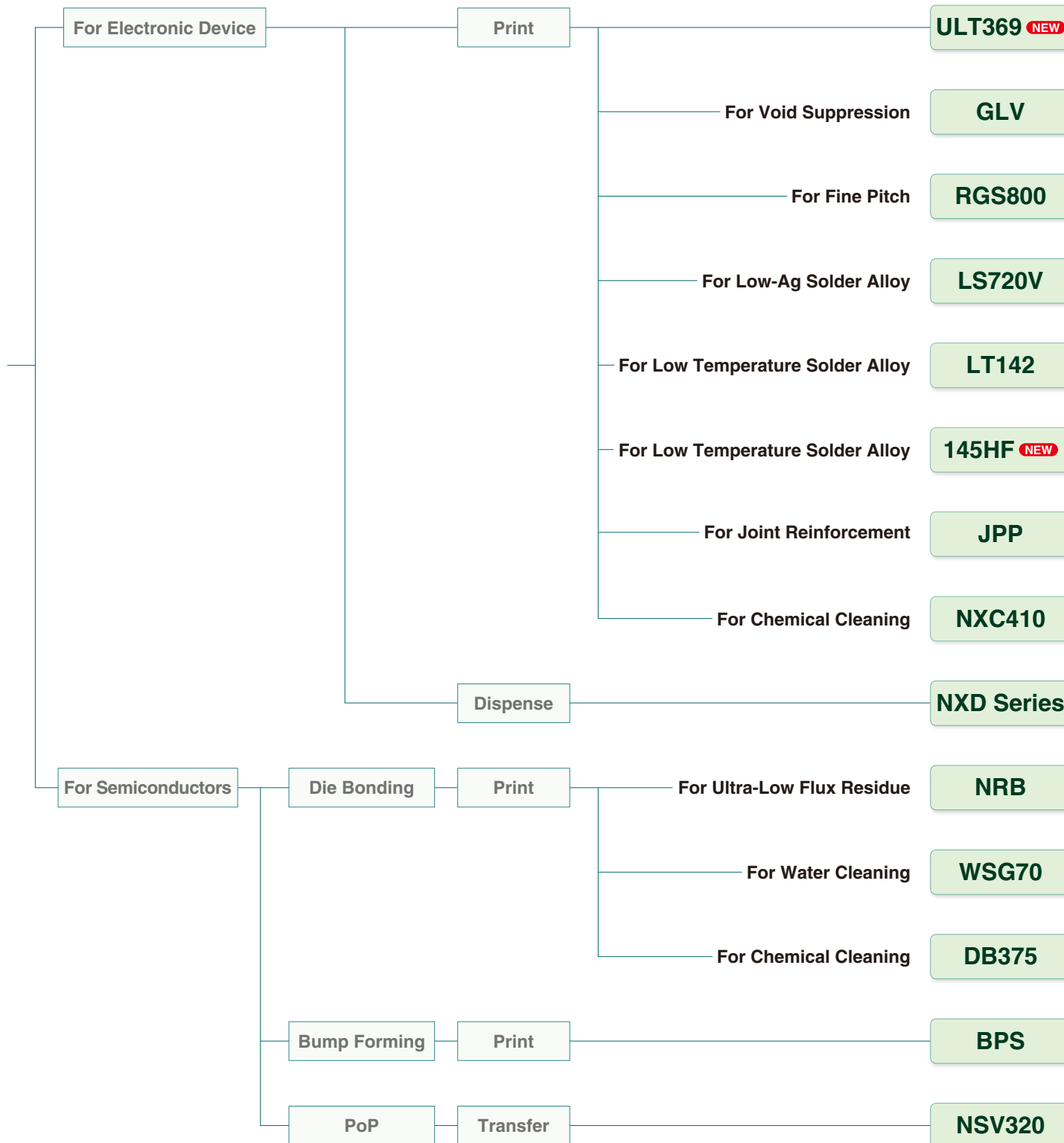
We have succeeded in commercializing flux cored solder at low ductility and fragile Sn-Bi alloy by full advantage of unique processing and wire drawing technologies.



Recommended alloy: L20



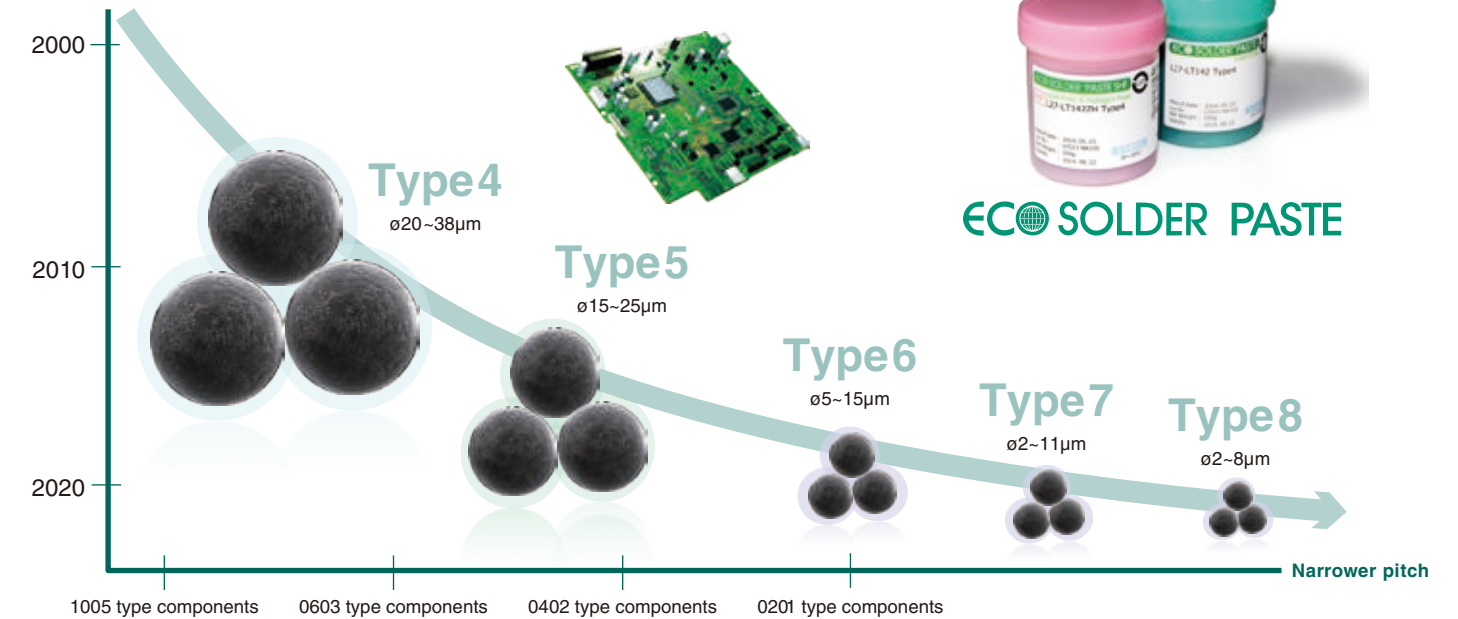
Please choose optimal solder pastes by purpose or application for the development of next-generation products



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.

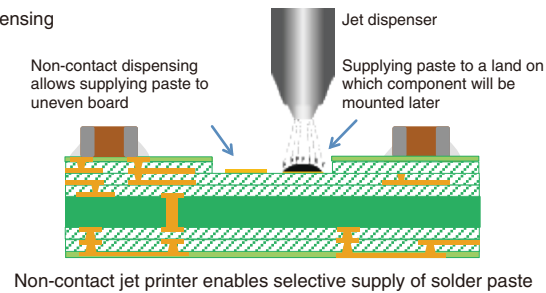


Solder Pastes Applicable for New Process Development

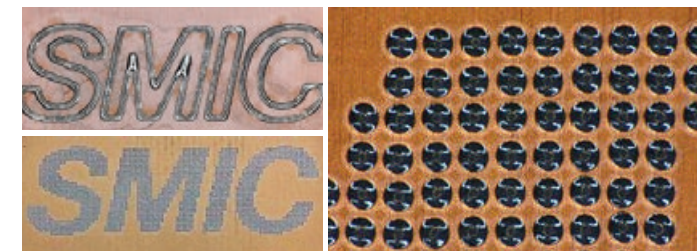
Jet Dispensing

Product lineup applicable for halogen-free

Jet dispensing



High accurate dotted and linear dispensing

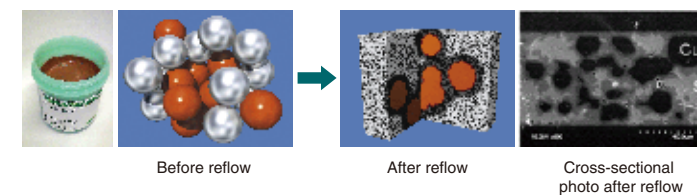


RAM

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.

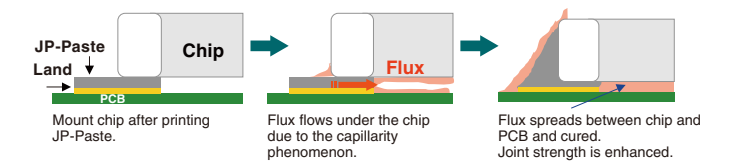
Alternative Paste to High-Temperature Solder



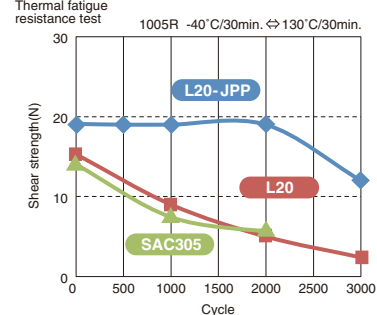
JPP

Achieved joint strength enhancement and drop impact reduction

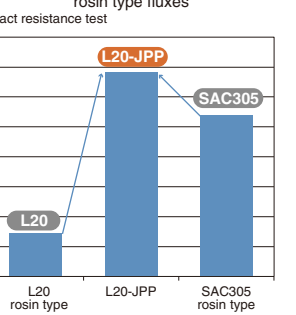
JPP Series flux is optimal for joint reinforcement with chip components and improve drop impact resistance of low melting point Sn-Bi solder



L20-JPP achieves better thermal fatigue resistance than SAC305



L20-JPP achieves app. 5 times as much drop impact resistance than rosin type fluxes



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 us for other weight categories from above list.

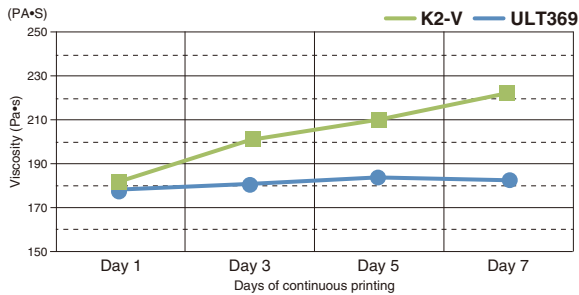
Solder Pastes for SMT

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

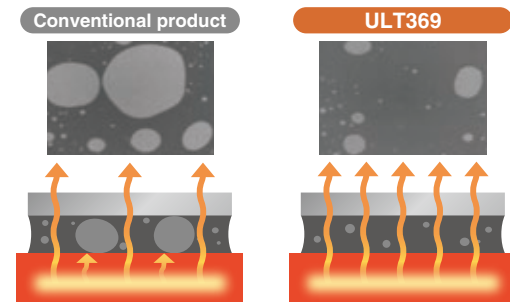
Revised latest SMT process and improved basic performance of wettability as well as printability for miniaturized components and compatibility with Non-Wet-Open (NWO) at slim BGA are the best for downsizing trend of electronic devices.

Recommended alloy: M705

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



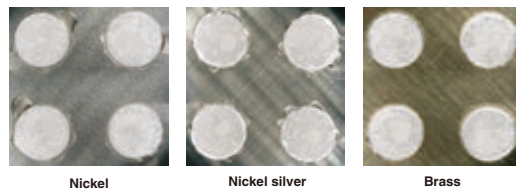
- Enhancement of heat dissipation
Void as gas layer with low thermal conductivity will be discharged through heat-sealed QFN or QFP.



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

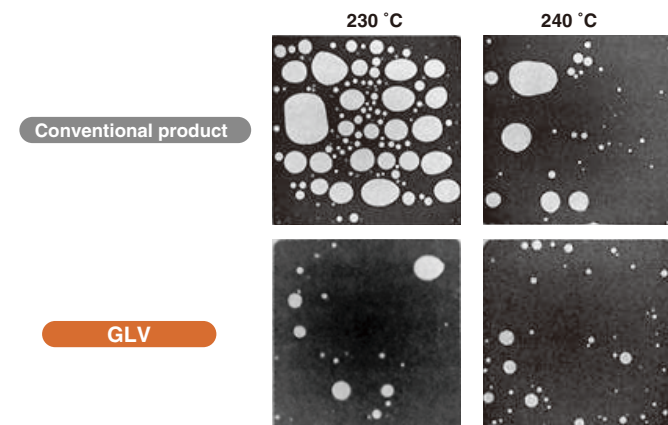


LS720V

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.



Recommended alloy: M705/M794/M758

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

M705-RGS800 Type6

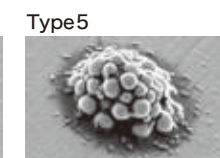


Ensures a sufficient amount of solder even for micro patterns by adopting RGS800 and Type 6 micro powder.

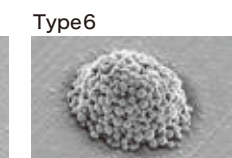
Enabling jointing of 0201 components.



Insufficient print quantity



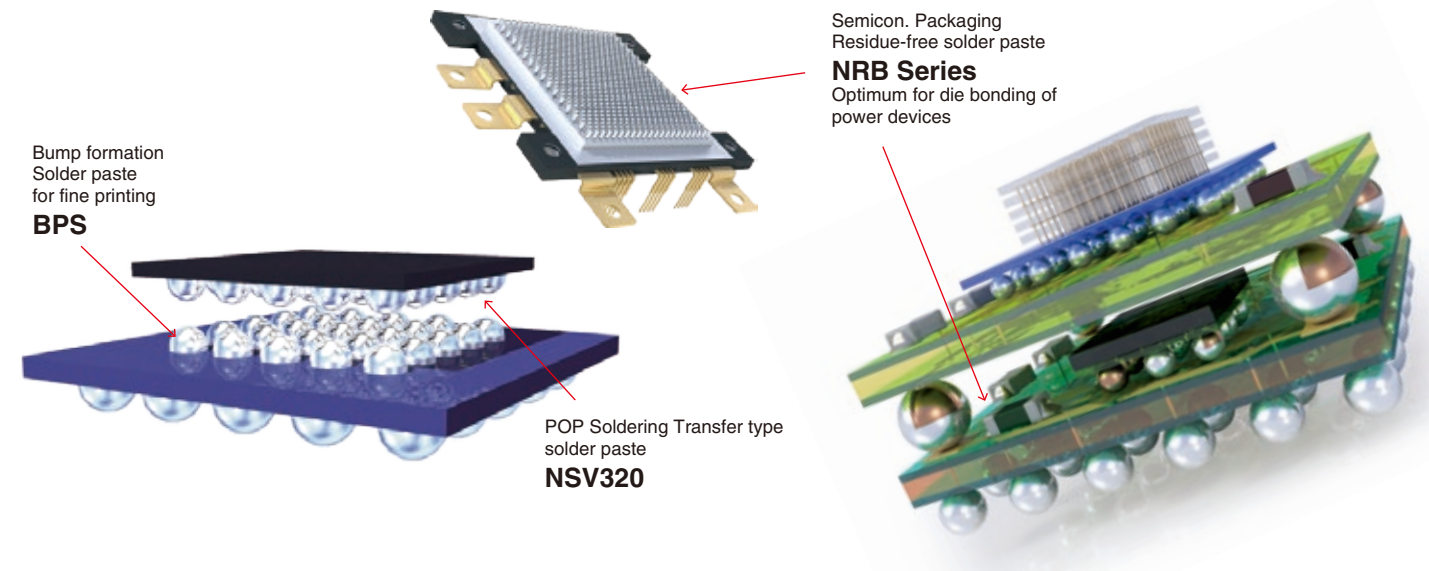
Insufficient print quantity



Sufficient print quantity

Recommended alloy: M705

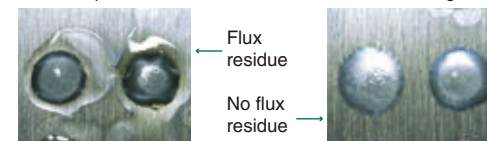
Solder Pastes for Semiconductor Packaging



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

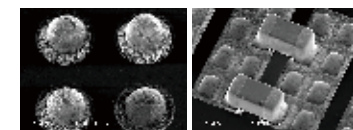
Recommended alloy: M705

Comparison of flux residue after reflow soldering

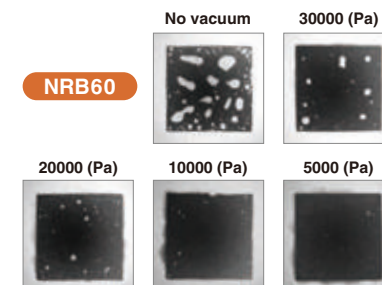


Paste for general printing

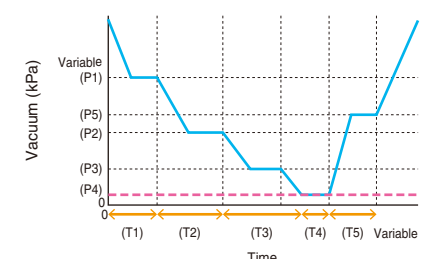
NRB70



NRB70 realizes extremely low flux residue even during N₂ reflow soldering.

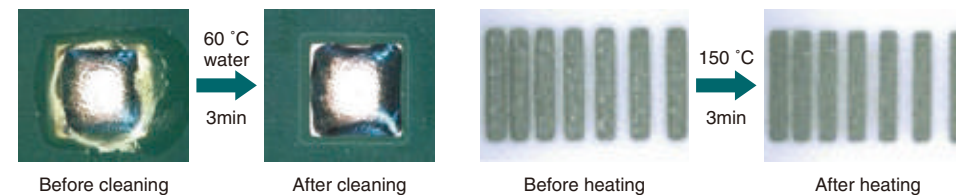


Realizes low splashing residue and void-free soldering with vacuum reflow oven SVR-625GT capable of variable vacuum control.



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

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



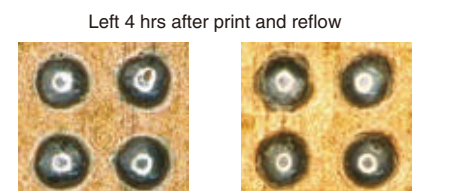
Before cleaning

After cleaning

Before heating

After heating

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



WSG70 (Type6)

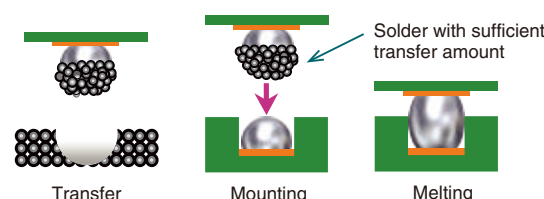
Conventional product (Type6)

Stable reflow property for substrates with many components

Recommended alloy: M705

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

Recommended alloy: M705



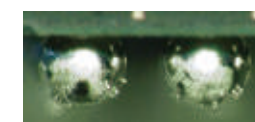
Transfer

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

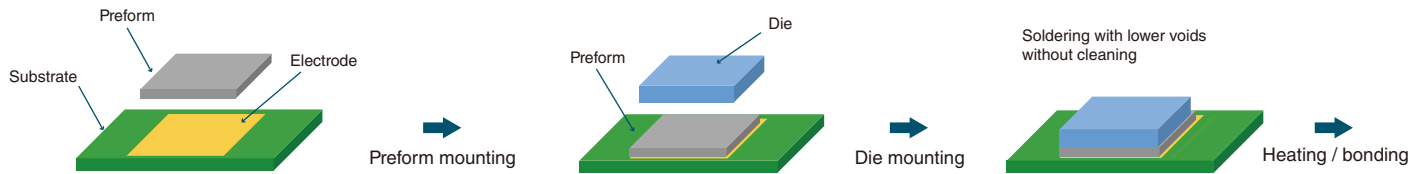
Structure	Shape						Packaging		
	Ribbon	Square	Disc	Washer	Chip	Wire	Reel	Container	Tape & Reel
Single Layered									
Ni Balls Contained									
Flux Cored									
Flux Coated									
Solder Coated Metal									
Double Layered									

Typical forms

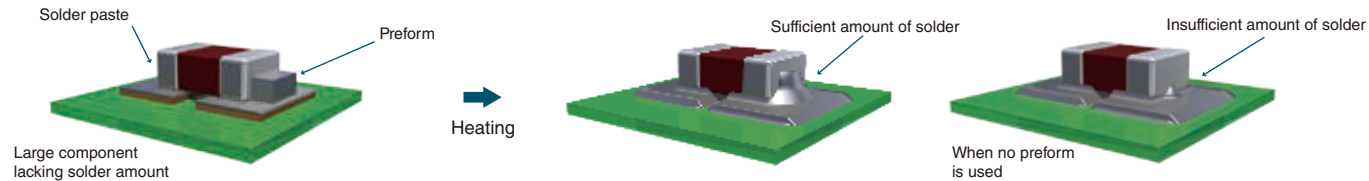


Application Examples

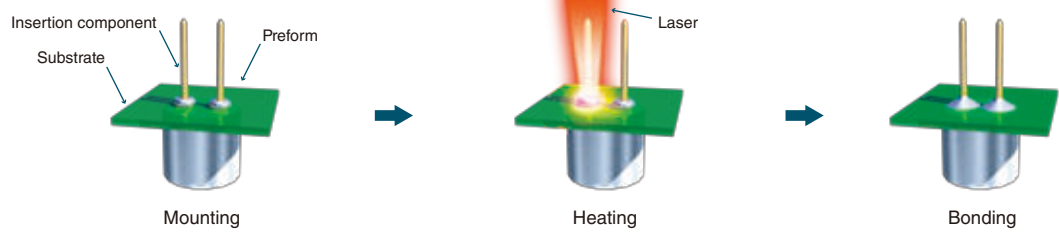
Case 1 Die bonding using single layer or nickel balls contained preform suppresses void and realizes soldering with high heat dissipation effect, even without cleaning flux.



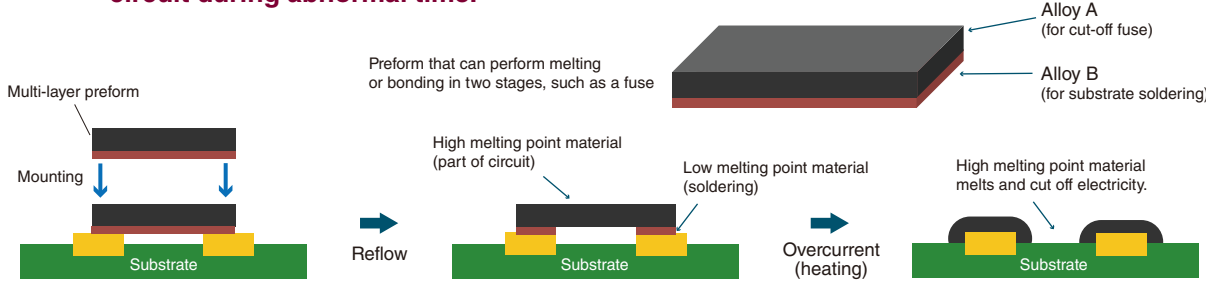
Case 2 Single layer or flux coated material is processed into chip form by tape package and automatically mounted on pad to prevent lacking solder amount, in order to supply solder and enhance strength. Our unique chip surface processing technology improves the mounting accuracy



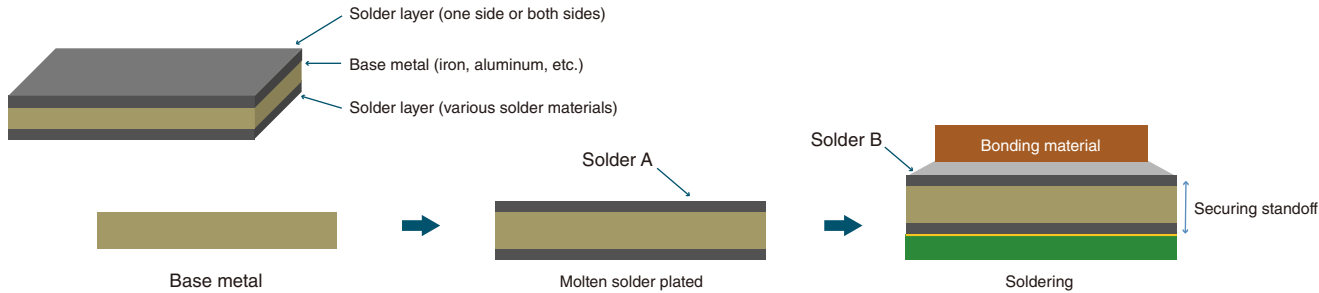
Case 3 Preform inserted into terminals of component on through-holes of substrate and selective heat by laser or other methods achieved soldering without causing thermal damage to the substrate or component.



Case 4 Alloys with different melting temperatures are laminated in bimetal structure and bonded into substrate with low melting point solder. By using a 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.



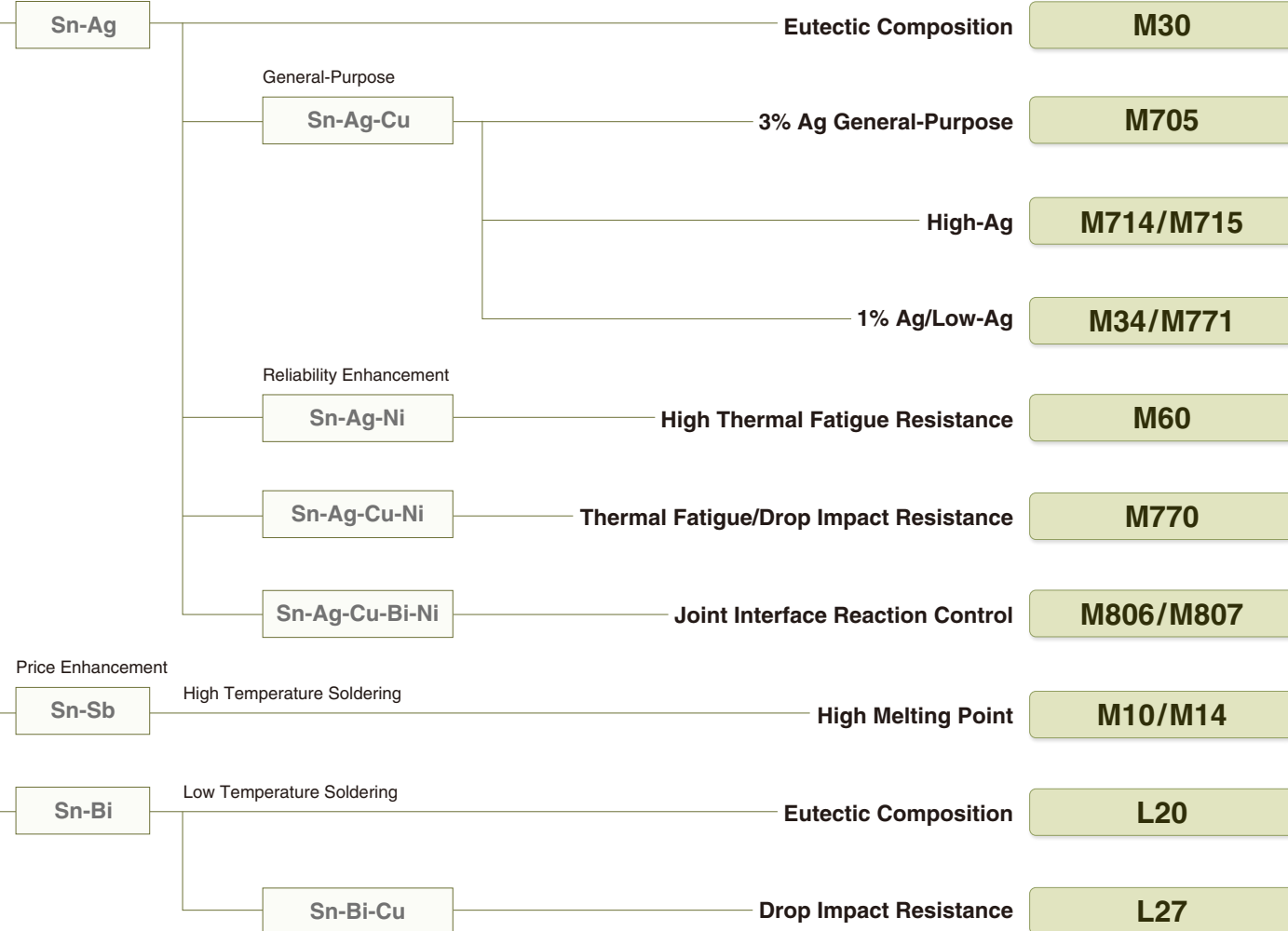
Case 5 Solder coated metal for surface of the base material that cannot easily be soldered or does not melt at soldering temperature. Optimal for bonding to aluminum, applications with standoff or for hermetic sealed case.





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

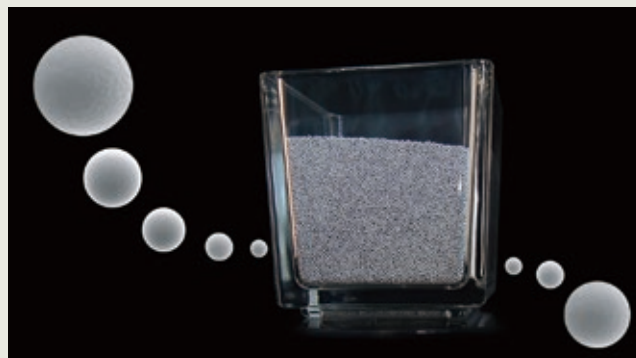
Reliability Enhancement



LAS Solder Ball protects Products from "Soft Errors"

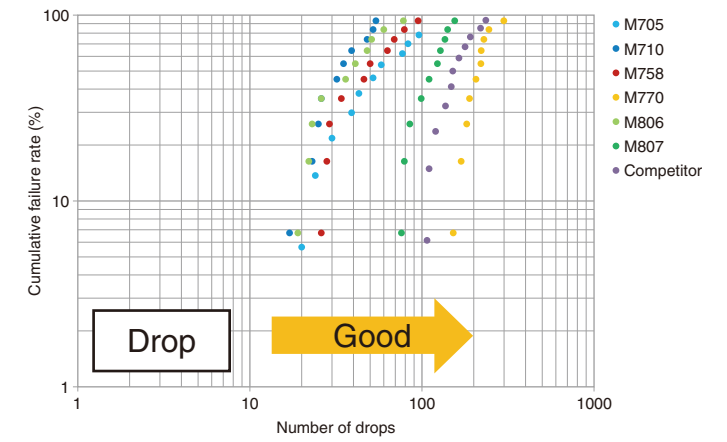
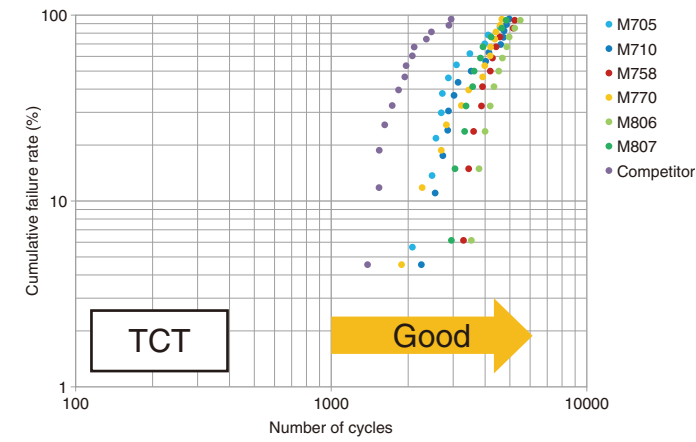
Trace amount of alpha rays or cosmic rays discharged from solder materials or semiconductor materials may rewrite memory data, which is called "soft error." In particular, flip chip package is highly sensitive to soft errors, and reduction of alpha rays is required for solder materials or other electronic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



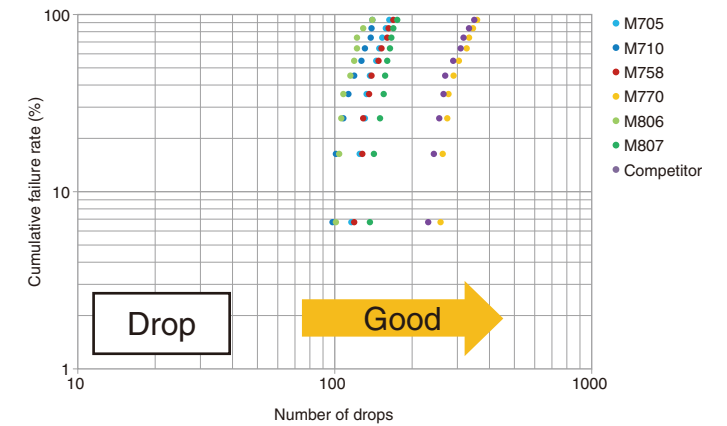
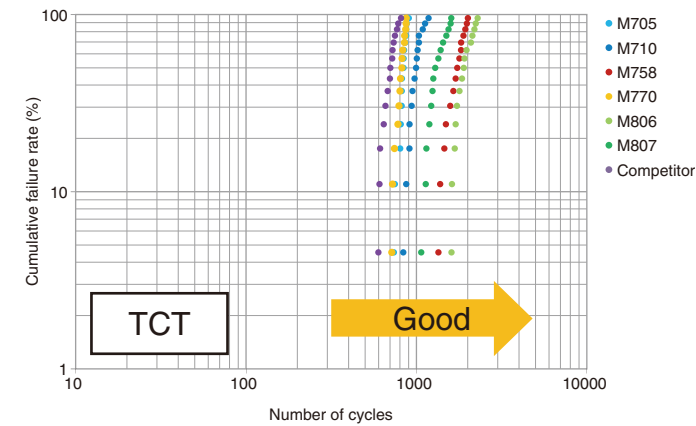
TCT and drop test with CSP

CSP	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

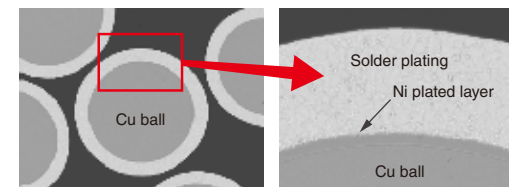
WLP	TEST Condition
Size: 7 x 7 mm	[TCT]
SRO: 0.24 mm	Temperature Cycle : -40°C/+125°C each 10min
Pitch: 0.5 mm	
Ball: 0.3 mm	[Drop]
S/F: Cu	Impact acceleration : 1500G/Half-sine pulse 0.5msec.



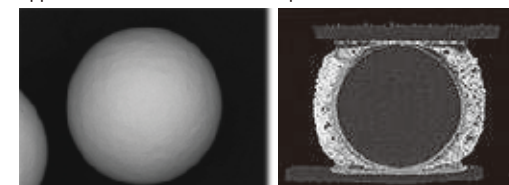
Cu Cored Ball

Advanced plating technology easily secures space in 3D soldering

Cross-sectional photos

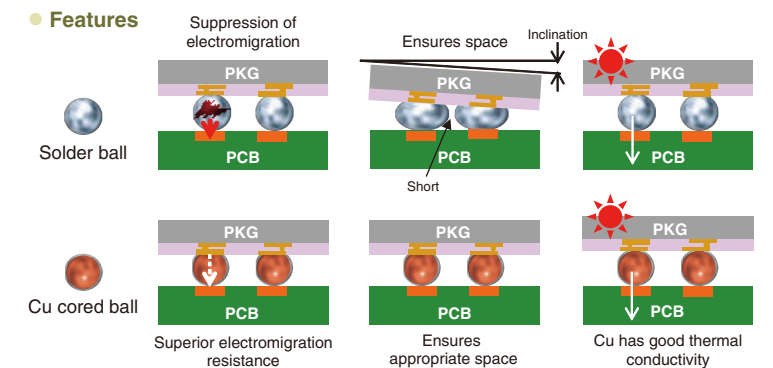


Appearance and cross-sectional photos of M90

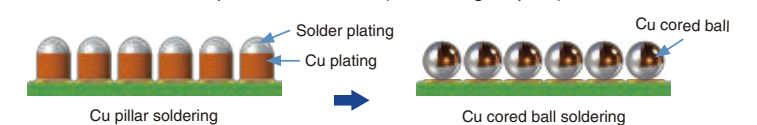


M90 improves drop impact resistance through reforming of the joint interface by Ni in the Ni plating.

Features



Example of Cu cored ball (substituting Cu pillar)



FLUX for SEMICONDUCTORS

Consisting of activators, solvents and resins such as rosin



Please choose effective products for soldering by your purpose or application

Flux for Packaging

Application	Type	Heating	Process	
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)
	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

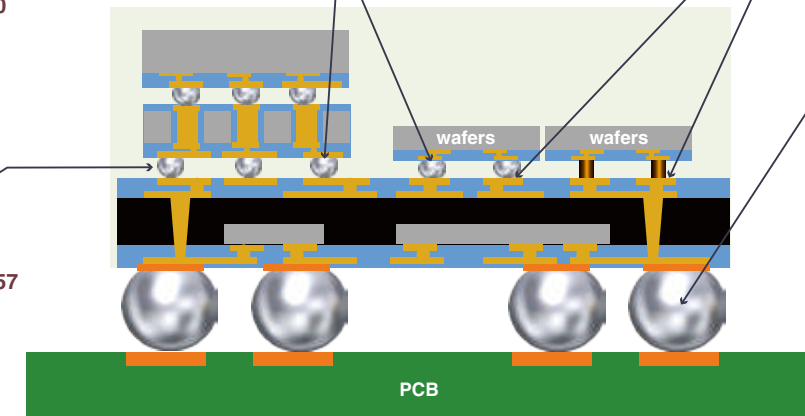
Application	Type	Heating	Process	
Micro Ball Attach	Water Soluble	Reflow	Print	WF-6457
	Rosin Type	Reflow	Print	MB-T100
Fusing	Water Soluble	Reflow	Spray/Spincoat	SPK-3420
	Rosin Type	Reflow	Spray/Spincoat	7200A

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

for Flushing
Water-soluble: WF-6457

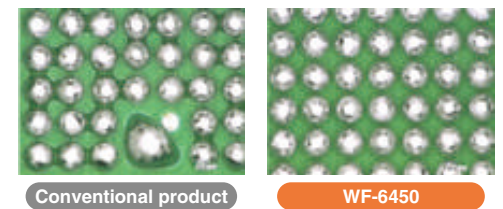
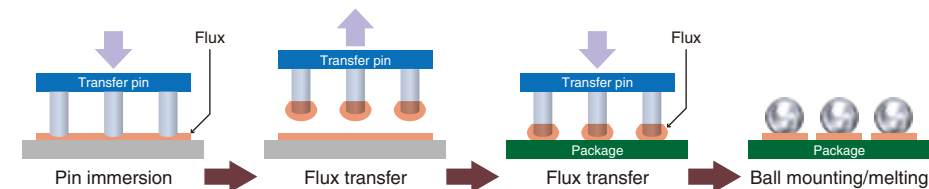
for Chip Attach (Flip Chip)
Water-clean: WF-6317, WF-6450
Rosin-based: GTN-68
Ultra-low residue: 901K5

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



WF-6450

Suppresses bridge even at ball attachment to narrow-pitched package

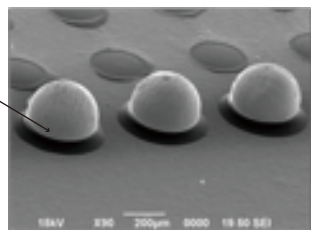


JOINT PROTECT FLUX EF-100

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



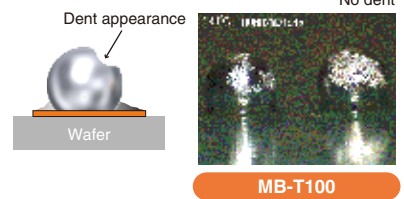
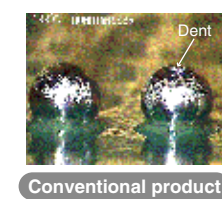
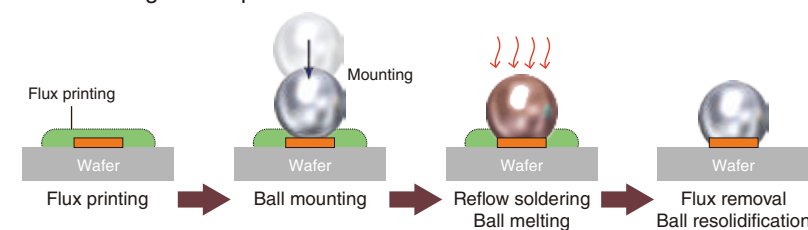
Reinforces solder joint with flux residue (thermosetting resin)



MB-T100

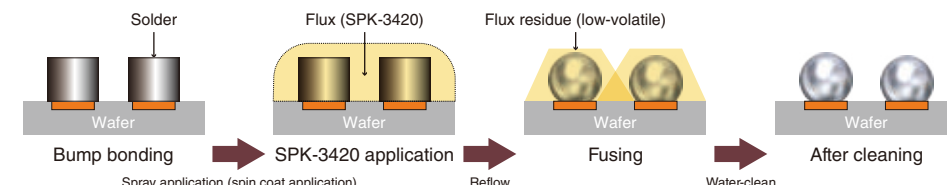
Highly-activated MB-T100 reproduces dent-free spheres when balls are resolidified

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

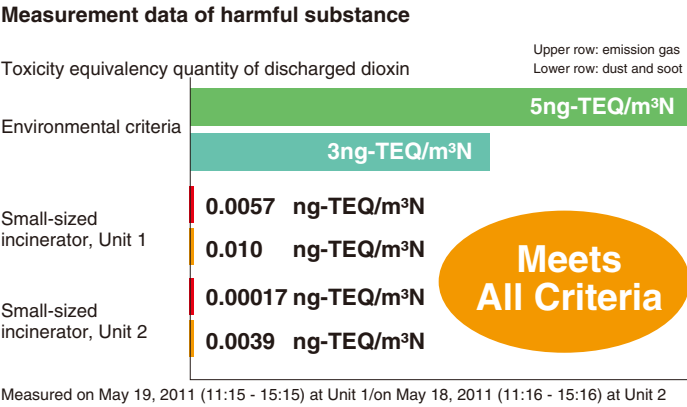
Developing environmentally-conscious projects and products



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



Package of 10 kg Solder Bar

Gender-friendly and lightweight package

- Features
- Lightweight package realizes 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

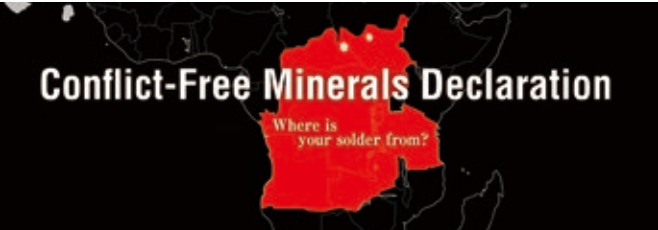
Package	Weight
10 kg package	455 mm x 116 mm x 38 mm
20 kg package	455 mm x 139 mm x 65 mm



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)

List of Lead-free Solder Alloys

ECCO SOLDER	Alloy composition (wt%)	Melting temperature (°C)			Form				
		Solidus line	Peak	Liquidus line	BAR	CORE	BALL	PASTE	PREFORM
M-series: Melting 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		●	●	●	●
M832	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: Melting 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