SMIC

SMIC Lead-Free Solder Preforms Catalog

# ECO SOLDER PREFORM

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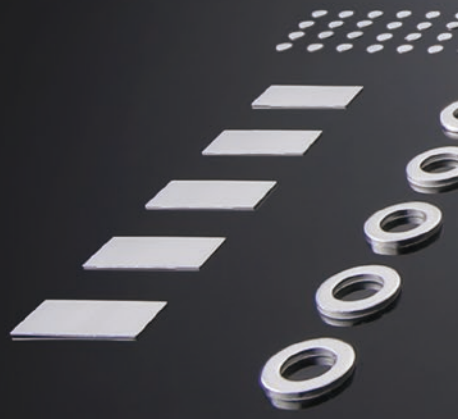
**Solder Preform is pre-forms of solid solder alloys with potential to change the future. Combination of machining technologies such as rolling and pressing are used to process the solder alloy into various shapes, allowing the solder to be used effectively. With the evolution of the mounting process, SMIC has developed *ECO SOLDER PREFORM* that has various structures to help customer's innovation.**



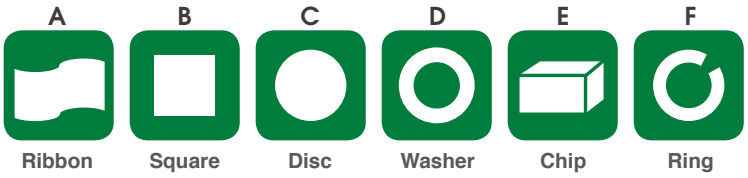
## Contents



## Line up

**Promote various synergies by selecting from 6 shapes as well as from solder alloy composition and dimensions.**

### Shape




**Variety of standard shapes including square, washer, and disc.**
**Custom shapes and dimensions are available for customer requirements.**

### Surface Treatment

**S**
Surface treatment for general-purpose products.
Suitable for soldering in flux coating or reducing atmosphere. Adaptable to all ECO SOLDER PREFORM.

**HQ**
Specially-processed surface treatment.
With thin oxide film and no flux, suitable for mounting in reducing and inert atmospheres.

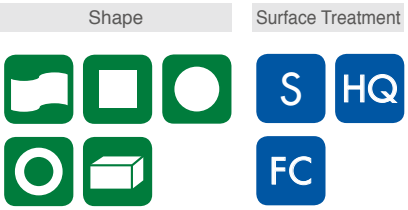
**FC**
**FC : Flux Coated**
Flux is dry-coated onto the exterior of general-purpose preforms.
Suitable for soldering where it is difficult to apply flux or perform solder paste printing. Improves the efficiency of manufacturing processes.

| Type | Shape | | | | | | Surface Treatment | | Packaging | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | S | HQ | Container | Reel | Tape & Reel |
| **Single Layer** | ● | ● | ● | ● | ● | | ● | ● | | ● | ● |
| **Nickel Balls Contained Preform** | ● | ● | ● | ● | | | ● | ● | ● | ● | ● |
| **Single Layer Flux Cored** | ● | ● | ● | ● | | ● | ● | | ● | ● | |
| **Solder Coated Metal** | ● | ● | ● | ● | | | ● | | ● | ● | |
| **Multi Layers Laminated Solder** | ● | ● | ● | ● | | | ● | | ● | ● | ● |

# Single Layer

## Solder Alloy Composition and Shapes for Customer's Requirements

- Consistent solder joint quality in mass production with fixed shape and constant feed
- *HQ* allows for flux-free soldering in inert atmospheres
- Solder alloys with difficult process properties such as Bi and Sb contained are available

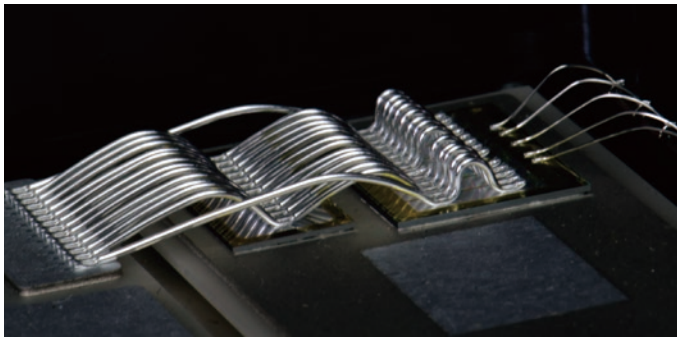



## Structure

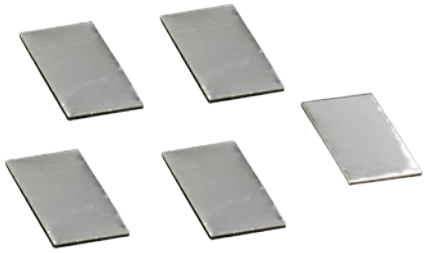
The standard ECO SOLDER Preform is the *Single Layer* type. Selecting proper solder alloy composition according to expected physical properties and processed into target shapes for use in various mounting methods. In addition, the product is processed with high dimensional accuracy, which contributes to mass production stability.

## Applications

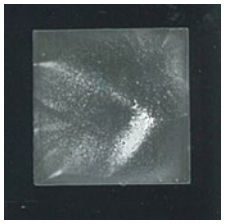
### Ideal for die bonding

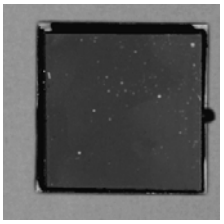


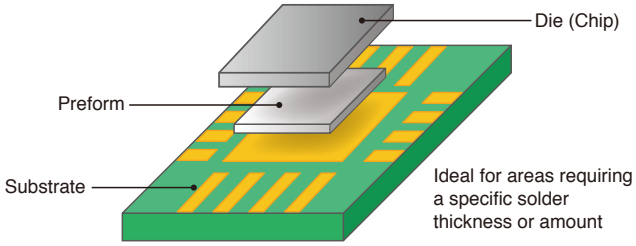
Ideal for die bonding where it is difficult to feed the solder and expecting to eliminate voids



HQ requires no cleaning and achieves good wettability and few voids without flux



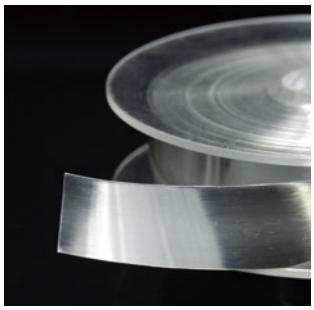


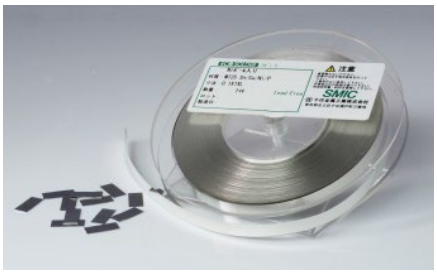


## Mounting method for each shape

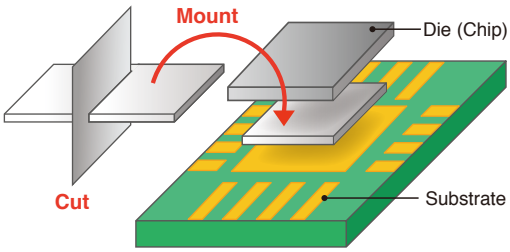
### Ribbon

Preforms be winding in tape reels can be cut into required length just prior to mounting



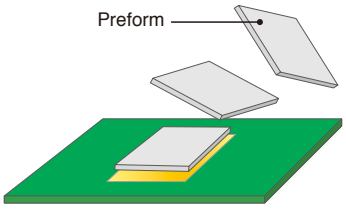


Reel winding for easy automated cutting

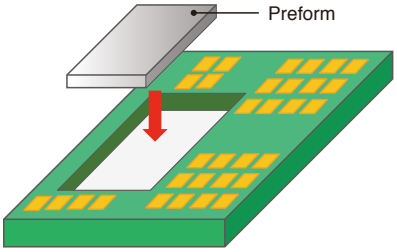



### Square

Fixed amount of solder is supplied to components within a predetermined tolerance range



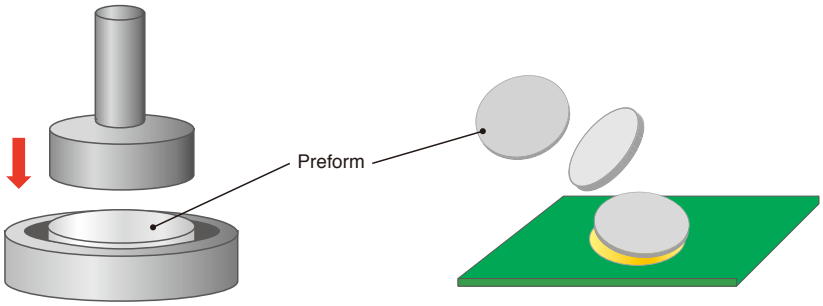

Enables identification by matching the pad shapes of substrates and components.




Feed to areas where it is difficult to supply solder paste and flux cored solder.

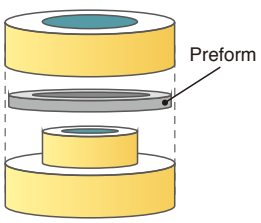
### Disc

Feed preform material fit to the soldering pads

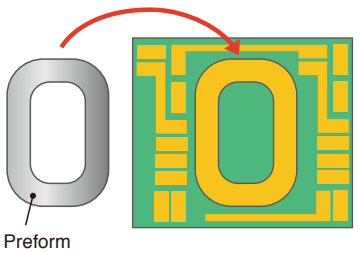


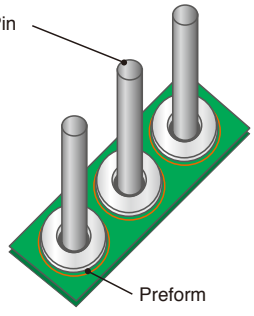

### Washer

Reliable heat sealing for areas where paste printing is difficult, preventing uneven heating




Reliable heat sealing.

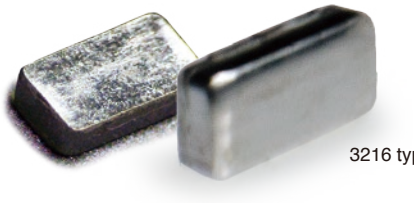


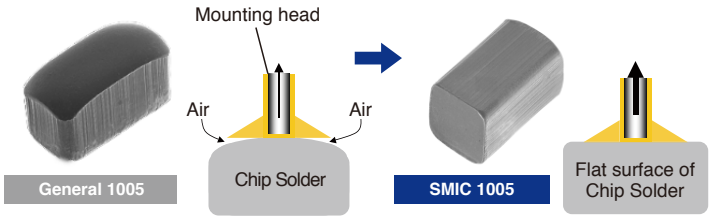

**Note) Various shapes and sizes can be made according to customer requirements.**

## Chip

The chip-shaped solder preform reinforces the area where the amount of solder is insufficient and increases the bonding reliability



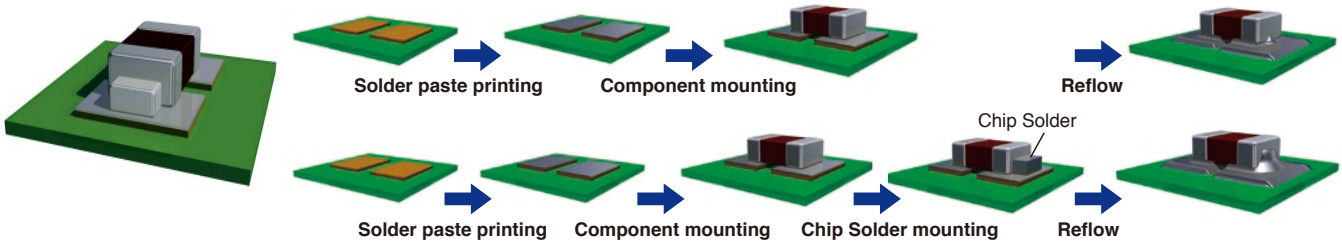
3216 type Chip Solder




**Tape and reel type can automatically be mounted at the same time as components**

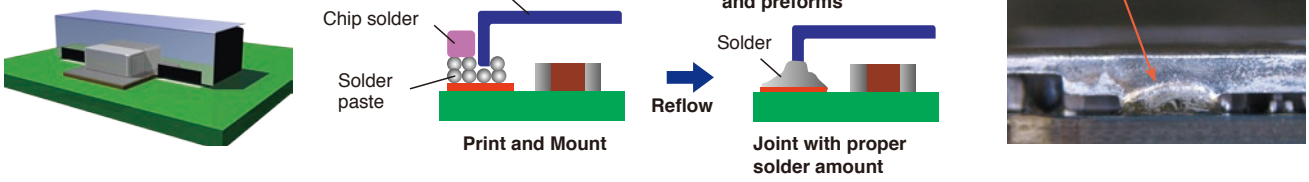
**Flat surface improves mounting accuracy**

### Automatic Chip Solder mounting and then soldering simultaneously with solder paste in reflow process

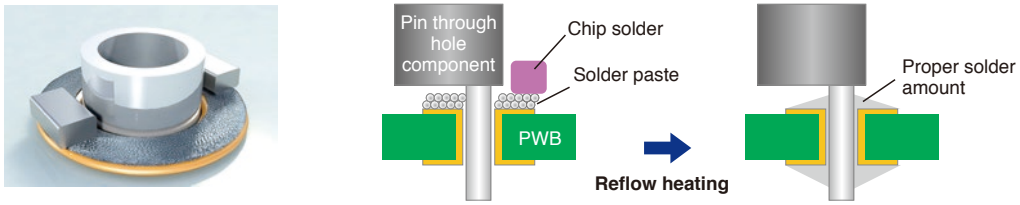


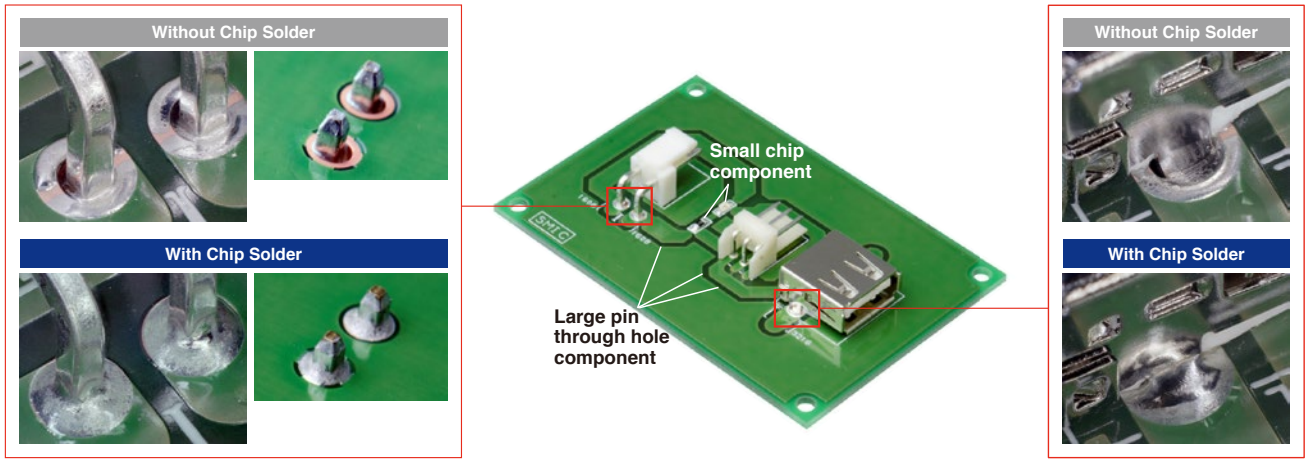

## Applications

### Joint reinforcement of shield case




### Joint reinforcement of pin through hole components using reflow where small SMDs are mixed



# Nickel Balls Contained Preform

## Ni Ball Spacing Function Improves Joint Reliability

- Ensures standoff to prevent cracking due to concentrated thermal stress
- Flat layered structure improves wire bonding accuracy
- Unique Ni ball technology eliminates causes of voids and helps maintain heat dissipation performance

Shape

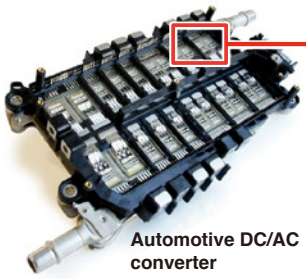
Surface Treatment


## Structure

Nickel balls contained preform has nickel balls with a small particle size inside the preform. When soldering, it forms a standoff with the particle size of the Ni balls as the minimum to ensure the evenness of the soldering components.

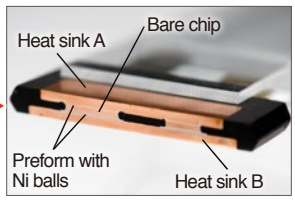
## Applications

### High-quality power modules



Automotive DC/AC converter

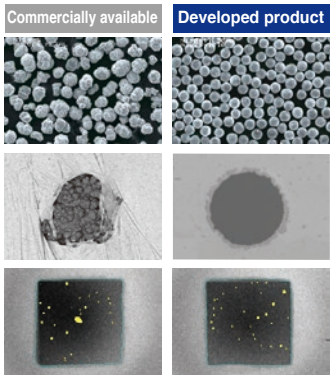
Power semiconductor mounting using preform with Ni balls




Power module

## Performance / Lineup

### Integrated manufacturing from Ni ball pelletization to preforming

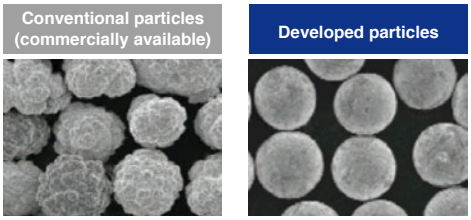



**Spherical balls manufactured with narrow tolerance using advanced pelletization technology**

**Unique Ni ball technology shows good reaction to solder**

**Powder and Preform technologies achieve horizontal mounting with few voids**

### Select the Ni ball size for various design




Product lineup includes diameters of 50, 65 and 80 µm. Ni balls are closer to true spherical in shape than conventional ones and guarantee the rating due to its high classified accuracy.

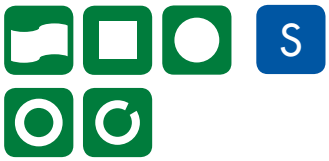
**Please contact us about other sizes.**

# Flux Cored

## Synergistic Effect of Resin Flux Cored Solder and Preform

- Fixed shapes and constant feed while ensuring the latest flux cored solder performance
- Ideal for through-hole mounting of connectors, discrete and metal components
- Reduces production costs by switching from local flow soldering

Shape | Surface Treatment

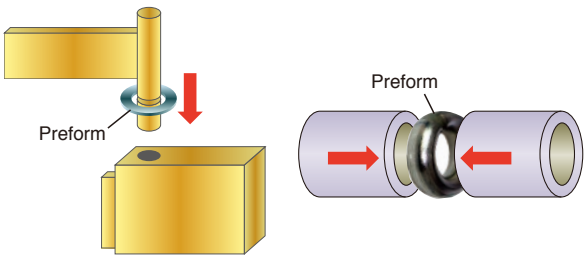



## Structure

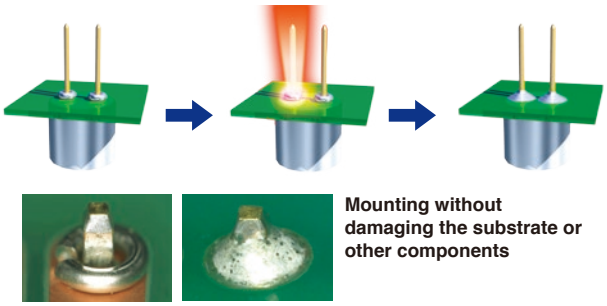
*Single Layer Flux Cored* products have flux built into the preform. In addition to eliminating the flux application process, storage and handling are also easier due to the solid stability. Except for special applications, customer has a choice to select the alloy and flux function according to the requirements from the lineup of flux cored solders.

## Applications

### Assembling metal components

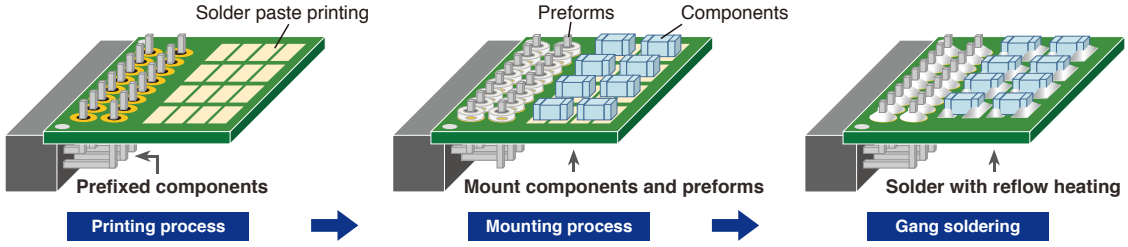



### Local heat mounting of heat-sensitive components



**Mounting without damaging the substrate or other components**

### Through-hole reflow mounting of inserted components




## Performance / Lineup

Please refer to our ECO SOLDER CORED product catalog.

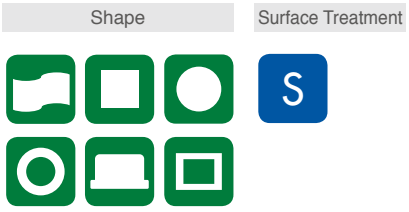
**Contact us for more information about other products.**

**Cross-section of flux cored solder preform**

# Solder Coated Metal

## Applying the Shapes, Dimensions, and Properties of Base Metal to Soldering

- Thick solder coating protects the base metal surface and ensures the solder feed
- Base metal ensures the soldering standoff and improves its reliability
- Molding technology enables supplying a variety of shapes



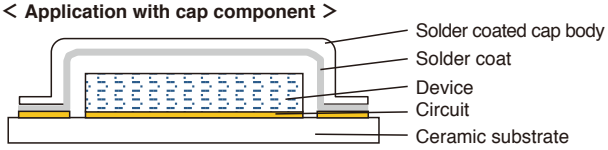

## Structure

*Solder Coated Metal* can be used as *composite solder joining components* by forming a solder alloy layer on the surface of ferrous and non-ferrous base metals through a melt coating process and shaping it according to the purpose.

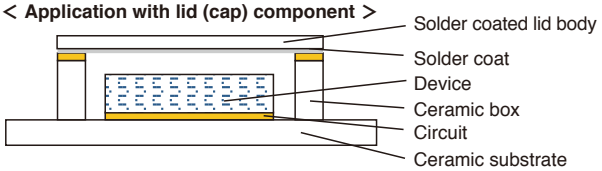
## Applications

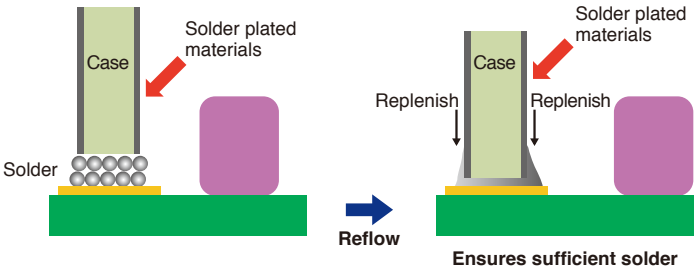
### Component for hermetically sealed devices

< Application with cap component >




< Application with lid (cap) component >

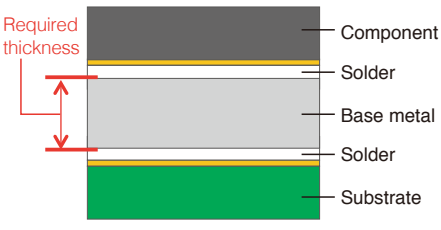



**Ensures sufficient solder**

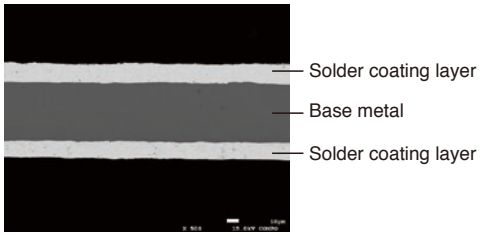
## Performance

### Ensures standoff and adds joint characteristics



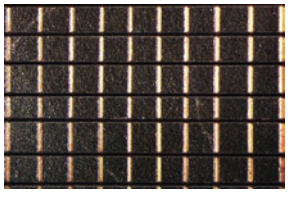

**Base metal can be used as a spacer**

### Uniformity of the solder coating layer




**Forms 10 to 25 µm solder coating thickness**

### Maintains peel resistance



**Molten solder coating layer does not peel (JIS K5600: Crosscut method)**

# Multi Layers Laminated Solder

## Integrating Materials with Different Properties to Develop New Joint Processing

- Solder alloys with different properties are laminated
- Two-step soldering utilizing different melting temperatures
- Optimal joint for electrodes with different surface materials

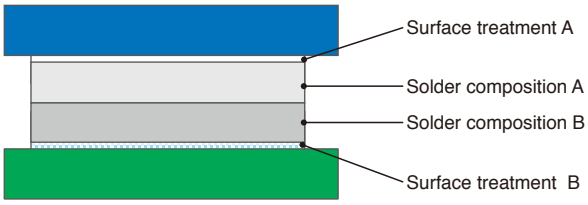
Shape | Surface Treatment


## Structure

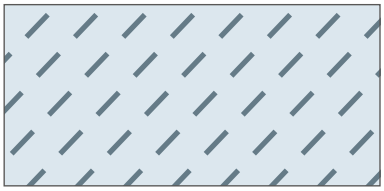
*Multi Layers Laminated Solder* is a multifunctional product where two or more solder alloys with different properties are roll cladded.
Enables two-step joints by temperature and optimum composition solder joints with different materials and treatments by utilizing the difference in temperatures and mechanical properties.

## Applications

### Joining with optimum solder composition for bonding surface conditions



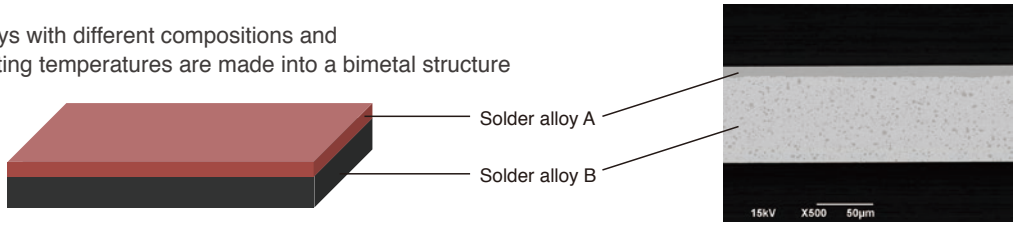

### Surface treatment for identifying the composition of the surface

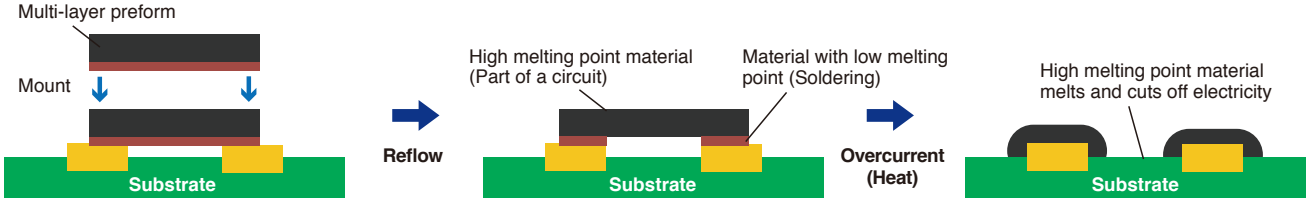


Designated surface can be engraved

### Cutoff fuses for temperature sensors

Alloys with different compositions and melting temperatures are made into a bimetal structure

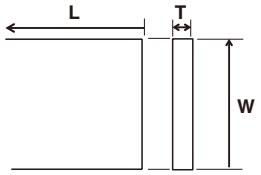



**Note) All products are tailor made. Please contact us when considering these products.**

# Shape

## Ribbon

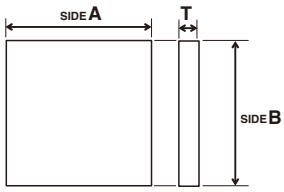



**W Width**
Min = 0.5mm (0.0197in)
Max = 70mm (2.7560in)

**T Thickness**
Min = 0.05mm (0.0020in)
Max = 0.35mm (0.0138in)

**L Length**
Please ask about this specification.

## Square

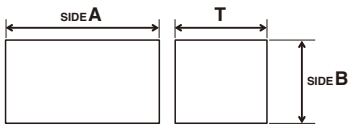



**SIDE A**
Min = 0.5mm (0.0200in)
Max = 100mm (3.9370in)

**SIDE B**
Min = 0.5mm (0.0200in)
Max = 70mm (2.7559in)

**T Thickness**
Min = 0.05mm (0.0020in)
Max = 2.5mm (0.0984in)

## Chip

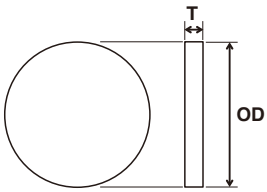



**SIDE A**
Min = 0.6mm (0.024in)
Max = 3.2mm (0.12in)

**SIDE B**
Min = 0.3mm (0.012in)
Max = 1.6mm(0.06in)

**T Thickness**
Min = 0.3mm (0.012in)
Max = 1.6mm(0.06in)

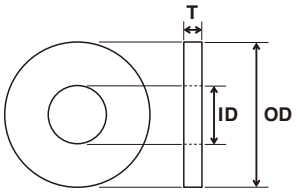
## Disc




**OD Outer Diameter**
Min = 0.3mm (0.0118in)
Max = 62mm (2.4410in)

**T Thickness**
Min = 0.05mm (0.0020in)
Max = 2.5mm (0.0984in)

## Washer



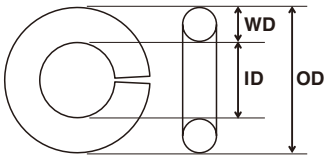

**OD Outer Diameter**
Min = 1.2mm (0.0472in)
Max = 40mm (1.5748in)

**ID Inner Diameter**
Min = 0.6mm (0.0236in)
Max = 35mm (1.3780in)

**W Width**
Min = 0.05mm (0.0020in)
Max = 2.5mm (0.0984in)

•Processing condition: (OD–ID)÷2 ≧ T

## Ring



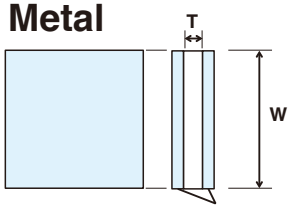

**OD Outer Diameter**
Min = 1.0mm (0.0394in)
Max = 19mm (0.7480in)

**ID Inner Diameter**
Min = 0.4mm (0.0158in)
Max = 15mm (0.5906in)

**WD Wire Diameter**
Min = 0.3mm (0.0118in)
Max = 2.0mm (0.0787in)

•Processing condition: ID ≧ WD
•WD (mm): 0.3,0.4,0.5,0.6,0.65, 0.8,1.0,1.2,1.6,2.0

## Solder Coated Metal




Thickness of solder coating Tc

**W Width**
Min = 1.0mm (0.0394in)
Max = 70mm (2.7559in)

**T Thickness of base material**
Min = 0.05mm (0.0020in)
Max = 0.3mm (0.0118in)

**Tc Thickness of solder coating (each side)**
Min = 0.01mm (0.0004in)
Max = 0.025mm(0.0010in)

Please contact us about single-sided solder coatings and processing dimensions for different base materials.

## Other Shapes

To make other shape by customers, design drawings and specifications will be required.
Please contact us for more details.

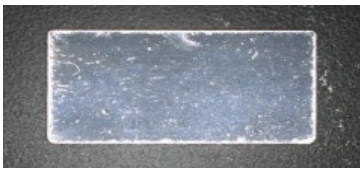
**Minimum and maximum values may vary depending on the alloy composition.**

# Surface Treatment

**S** For general-purpose products soldering with flux.

**HQ** Special treatment features good wettability and needs no flux.
Ideal for products that cannot receive the cleaning process.

**FC** Flux is dry-coated evenly onto the exterior of general-purpose preforms.
No flux coating process is needed.



## Select coating flux according to the purpose

| Flux | Type | IPC classification | Applicable base material |
|---|---|---|---|
| SFC1 | R | ROL0 | Ni/Au plating, Ag, Cu, etc. |
| SFC2 | Halogen free | ROL0 | Ni/Au plating, Ag, Cu, etc. |
| SFC3 | RMA | ROL1 | Ni/Au plating, Ag, Cu, etc. |
| SFC4 | RA | ROL1 | Ni, brass, Cu, Sn, etc. |
| SFC5 | RA | ROM1 | Ni, brass, Cu, Sn, etc. |

Colored types are also available.
Please contact us about available flux types.
Flux residue can be removed with a commercially available flux cleaner.

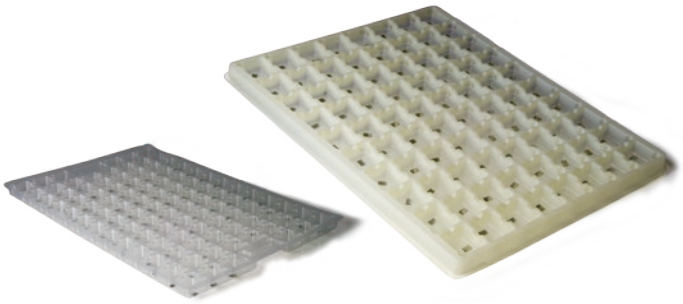
# Packaging

## Supplying by parts-feeders

### Capped container

For preforms that are difficult to deform such as small and thick items. Cap can be detached and convenient for storage. Choose a container size according to the quantity.

## Packaging deformable products

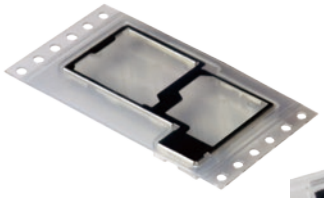


### Tray

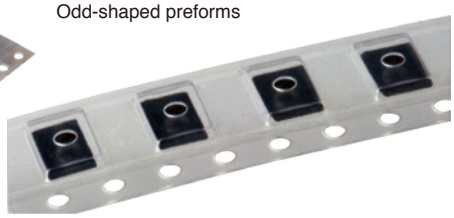
For transporting deformable preforms such as items that are large, thin, and those with protrusions or holes. Contact us for more information about shapes, sizes, and materials.

## Ideal for handling with SMT pick and place machines

Chip Solder



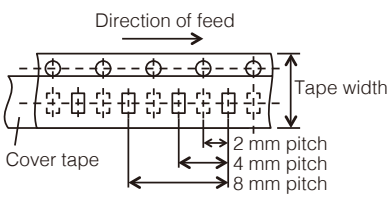
Odd-shaped preforms



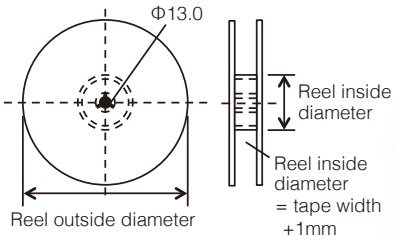
| Preform dimension (mm) | Tape width | Pocket pitch | Reel outside diameter (Reel inside diameter) |
|---|---|---|---|
| 05025 - 1608 size | 8mm | 2mm | Φ180mm (Φ60mm) |
| 3216 size | 8mm | 4mm | Φ180mm (Φ60mm) |
| 5×5 mm | 12mm | 8mm | Φ330mm (Φ80mm) |
| Larger than above size | Contact us about tape and reel dimensions. | | |

Large preform

**Carrier tape**




**Reel**




### Tape & Reel

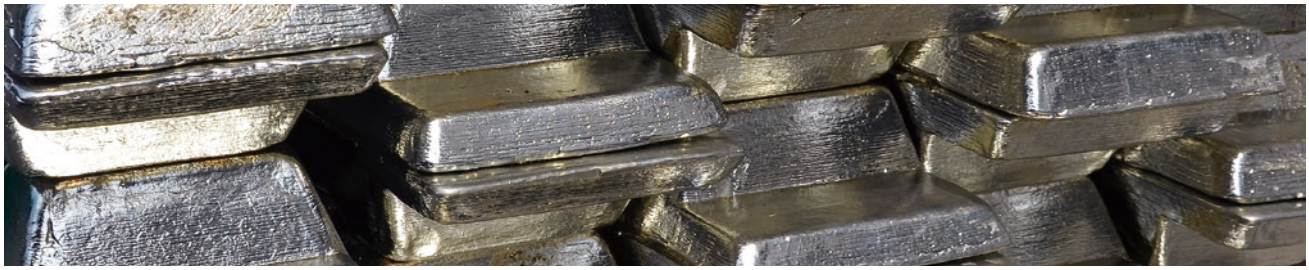
Taping is possible for everything from small chip solder to large preforms for die bonding. It can be used with automatic mounting for high accuracy and productivity. Taping for *Odd- shaped preforms* is also possible.

# Solder Alloy Lineup

| Alloy name | Alloy composition(wt%) | Melting temperature range | Structure of products | | | | |
|---|---|---|---|---|---|---|---|
| | | °C | | | | | |
| M705 | Sn-3.0Ag-0.5Cu | 217 – 220 | ● | ● | ● | ● | ● |
| M30 | Sn-3.5Ag | 221 – 226 | ● | ● | ● | ● | ● |
| M31 | Sn-3.5Ag-0.75Cu | 217 – 219 | ● | ● | ● | ● | ● |
| M34 | Sn-1.0Ag-0.5Cu | 196 – 214 | ● | ● | ● | ● | ● |
| M20 | Sn-0.75Cu | 227 – 229 | ● | ● | ● | ● | ● |
| M40 | Sn-1.0Ag-0.7Cu-Bi-In | 211 – 222 | ● | ● | | ● | ● |
| M10 | Sn-5.0Sb | 240 – 243 | ● | | ● | ● | ● |
| M14 | Sn-10Sb | 245 – 266 | ● | | ● | ● | ● |
| M794 | Sn-3.4Ag-0.7Cu-Bi-Sb-Ni-x | 210 – 221 | ● | | | ● | ● |
| M725 | Sn-0.7Cu-Ni-P | 228 – 230 | ● | ● | | ● | ● |
| M731 | Sn-3.9Ag-0.6Cu-3.0Sb | 221 – 226 | ● | ● | ● | ● | ● |
| M716 | Sn-3.5Ag-0.5Bi-8.0In | 196 – 214 | ● | ● | ● | ● | ● |
| L20 | Sn-58Bi | 139 – 141 | ● | | | ● | |

**Please contact us for more information about other alloy composition.**

- **M705** 3% Ag general-purpose alloy with more than 15 years of experience
- **M794** Heat & fatigue-resistant alloy for automotive applications
- **M731** Heat & fatigue-resistant general-purpose alloy for automotive applications
- **M20** Ag-free, Cu based general-purpose alloy
- **M10** Sb based general-purpose alloy with a high melting point
- **L20** Bi based general-purpose alloy with a low melting point



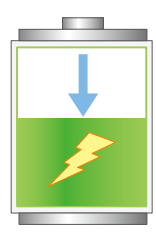
## Realization of *fixed shape & constant supply* by low-temperature, Bi-based solder preform

Typical composition

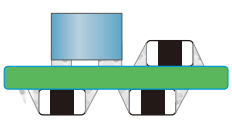
# L20
## (Sn-58Bi)

**139~141°C**

Improving mass production stability for low-temperature mountings and effective for solder feeding methods to which solder pastes are difficult to apply.

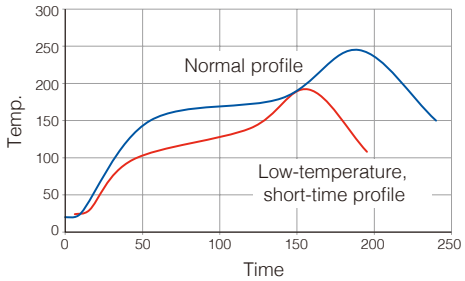


**Saving energy**



**Applicable to heat-sensitive components**

**Reducing high heat-resistant components**

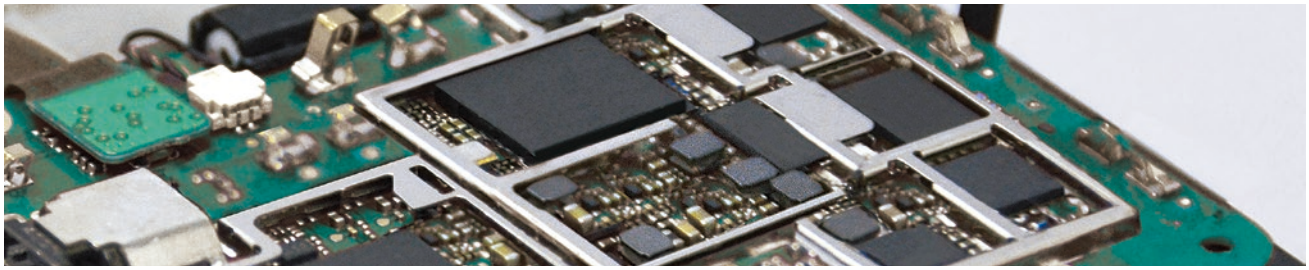



**Enhance productivity**

# Base Material Physical Properties for Solder Coated Metal

| Metal base material | Metal No. | | Melting temperature (°C) [(°F)] | Composition | Tensile strength (N/mm²) | Elongation (%) | Vickers hardness (Hv) | Young's module (GPa) | Coefficient of thermal expansion ($10^{-6}$/K) | Specific gravity (g/cm³) | Electrical conductivity (%IACS) | Thermal conductivity (20°C) (W/m/K) | Specific heat (J/g/K) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | JIS | Classification | | | | | | | | | | | |
| Kovar | KV-6 | O | 1450 [2642] | Fe-29Ni-17Co | 490-618 | 20-40 | 145-175 | 159 | 4.8(30-300°C) 6.0(30-400°C) | 8.35 | 4 | 16.8 | 0.46 |
| | KV-6 | H | 1450 [2642] | Fe-29Ni-17Co | 490-618 | 20-40 | 230-270 | 159 | 4.8(30-300°C) 6.0(30-400°C) | 8.35 | 4 | 16.8 | 0.46 |
| Nickel silver | C7521 | O | 1110 [2030] | Zn-63Cu-18Ni | ≧375 | ≧20 | - | 125 | 16.2 (30-300°C) | 8.73 | 6 | 33 | 0.377 |
| | | ½H | 1110 [2030] | Zn-63Cu-18Ni | 440-570 | ≧5 | 120-180 | 125 | 16.2 (30-300°C) | 8.73 | 6 | 33 | 0.377 |
| | | H | 1110 [2030] | Zn-63Cu-18Ni | ≧540 | ≧3 | ≧150 | 125 | 16.2 (30-300°C) | 8.73 | 6 | 33 | 0.377 |
| | C7701 | H | 1055 [1931] | Zn-56Cu-18Ni | 630-735 | ≧4 | 180-240 | 125 | 16.7 (30-300°C) | 8.70 | 5.5 | 29 | 0.377 |
| Stainless steel | SUS304 | H | 1450 [2642] | Fe-(8-10.5) Ni-(18-20)Cr | ≧1130 | - | ≦370 | 193 | 17.6 (30-200°C) | 7.93 | 2.4 | 16.7 | 0.59 |
| Copper | C1020 | H | 1083 [1981] | ≧Cu99.96% | ≧275 | 2-15 | ≧80 | 110-128 | 17.0 (20-100°C) 17.7 (20-200°C) | 8.94 | 101 | 349 | 0.38 |
| | C1100 | H | 1083 [1981] | ≧Cu99.90% | ≧275 | 2-15 | ≧80 | 110-128 | 17.0 (20-100°C) 17.7 (20-200°C) | 8.89-8.94 | 101 | 349 | 0.38 |
| Phosphor bronze | C5210 | H | 1020 [1868] | Cu-8Sn-0.2P | 590-705 | ≧12 | 185-235 | 110 | 16.2 (20-100°C) 17.6 (20-200°C) | 8.8 | 13 | 63 | 0.377 |
| Aluminum | A1050 | O | 650 [1202] | ≧Al99.5% | 70 | 43 | 19 | 69 | 23.8 (20-300°C) | 2.7 | 62 | 225 | 0.88 |

**The above values are for reference only. Please contact us about materials not listed above.**



## High-strength, Sb-based solder composition preforms allow for secure mounting of electronic power devices

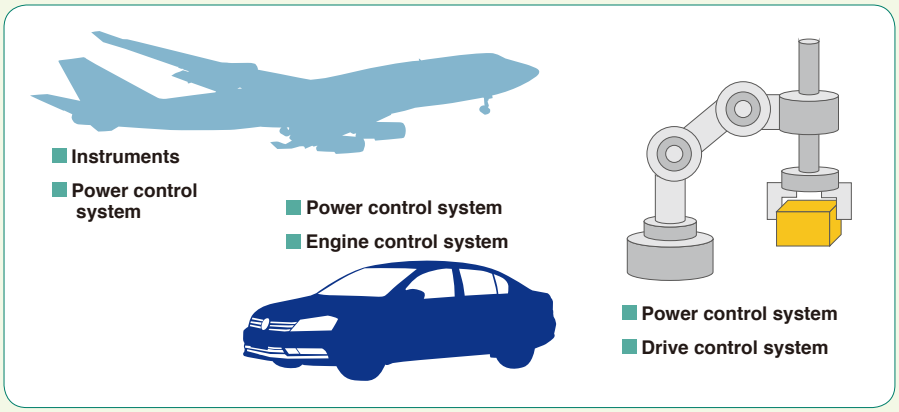
Typical composition

# M14

## (Sn-10Sb)

**245~266°C**

Constant feeding of high-strength solder ensures reliable mounting that can withstand severe environments such as those in automotive, industrial, and aerospace equipment.



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Beware of counterfeit products.
Counterfeit flux cored and other inauthentic Senju solder products have been circulating abroad.
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