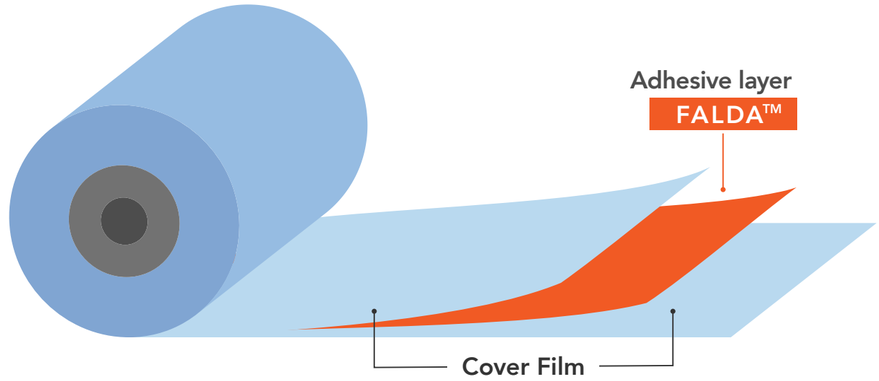
FALDA

'TORAY'

Innovation by Chemistry

Adhesive Film FALDA™

Since it was established in 1926, Toray has cultivated not only material design technologies in polymer chemistry and organic synthetic chemistry but also material processing technologies. Based on these, FALDA™ adhesive film products were developed for semiconductors and electronic components. These products offer excellent reliability and photodefinition, and have helped make devices smaller and more functional. FALDA™ allows the thickness to be controlled easily, which is difficult with liquid adhesives. Our product lineup is as follows.



FALDA™ has a cover film.
Peel the film from one or both surfaces just before application.

FALDA™

- **Epoxy**
  - Non-photodefinable
    - **Epoxy Thermal Cure Adhesive Film**
      - Good adhesive
      - High conformability
      - Stress relaxation
- **Polyimide**
  - Photodefinable
    - **Polyimide Photodefinable Adhesive Film**
      - Good photosensitivity
      - Thick film
      - High planarity
  - Non-photodefinable
    - **Polyimide Thermal Cure Adhesive Film**
      - Good adhesive
      - High reliability
      - Connection reliability
    - **Polyimide High Heat Resistance Temporary Adhesive Film**
      - High heat resistance
      - No residue
      - Warpage control
    - **Polyimide High Thermal-Conductivity Adhesive Film**
      - High thermal conductivity
      - Good handling property

Mass production

Development product

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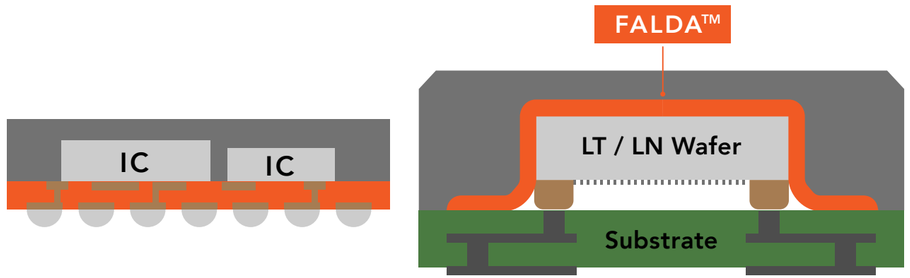
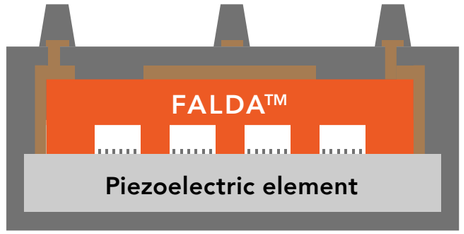
FALDA™ Application Examples

FALDA™ helps to miniaturize and improve the performance of various electronic components by leveraging the high performance of each material in our product lineup.

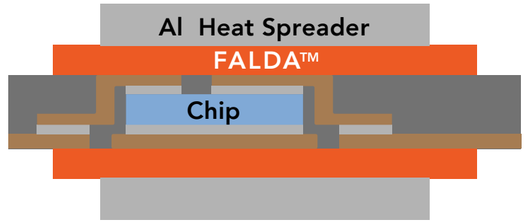
Insulation layer

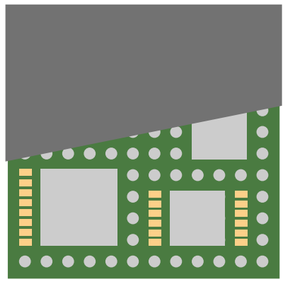


Cavity structure formation

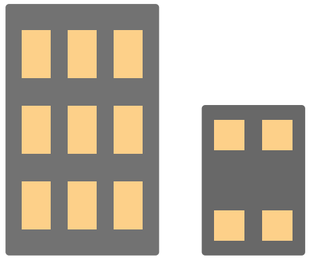


Thermally-conductive adhesive film

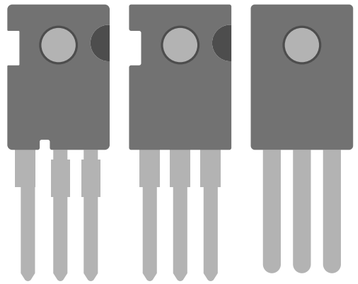




System-in-packages



RF Devices



Power Semiconductors

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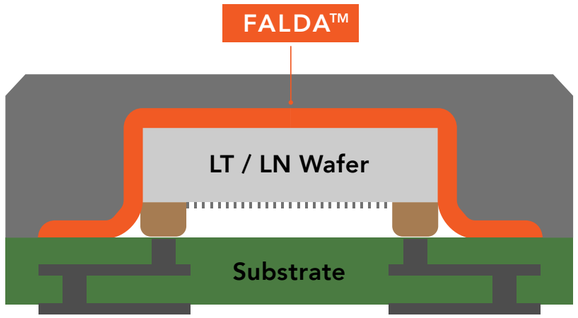
Epoxy Thermal Cure Adhesive Film

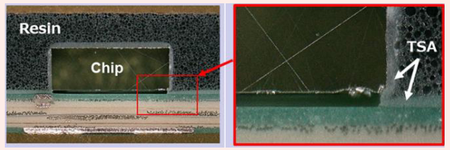
FALDA™ epoxy thermal cure type adhesive film has excellent properties such as high heat resistance, high elongation, and stress relaxation. With its good elongation and effective filling and planarization, it is ideal for fabricating and mounting electronic components. Meanwhile, its stress relaxation property makes it ideal for adhering materials with differing CTE.
We offer a wide range of products to suit customers' diverse needs.

Good conformability

Has excellent followability and can fill even the corners of irregularities according to the shape of the device.

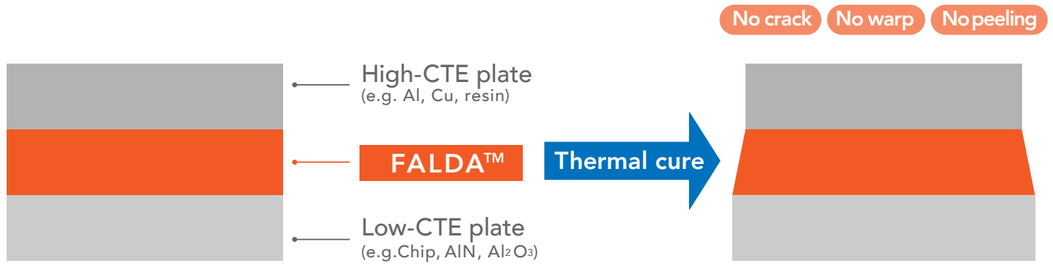


Cross section of molded substrate after post cure



Good stress relaxation

Has excellent stress relaxation, making it ideal for adhering materials with differing CTE.



Epoxy Thermal Cure Adhesive Film

Basic specifications

Item		TSA-16	TSA-19	Notes
Features		High Adhesion	Stress Mitigation	
		High adhesion with a thin film of 20 μm	Suitable for bonding of materials with large linear expansion differences, and large materials	
Adhesion after curing		18 N/cm	20 N/cm	Sample:PI film 75 μm/FALDA™/Ni-Cu plate 5 mm width, 90° peel
Reflow resistance		260°C	260°C	JEDEC LEVEL3
Glass transition temperature		30°C, 130°C	-4°C	DMA Method
Post-cure storage modulus		6,000 MPa	2,600 MPa	
		5 MPa	1 MPa	
Water absorption ratio		1.2 %	1.2 %	Weight increase after 85°C/85 %RH/48 hr
High Temperature Storage (HTS) conditions		150°C/500 hr	150°C/1,000 hr	—
State after heat resistance test		No delamination	No delamination	Sample:Ceramic/Adhesive/IC
Thermal cycling test after heat-resistance test	-40°C⇔125°C	≥1,000 cycles	≥1,000 cycles	
	-40°C⇔150°C	≥500 cycles	≥1,000 cycles	
Recommended curing conditions		100°C/1 hr + 170°C/2 hr		—

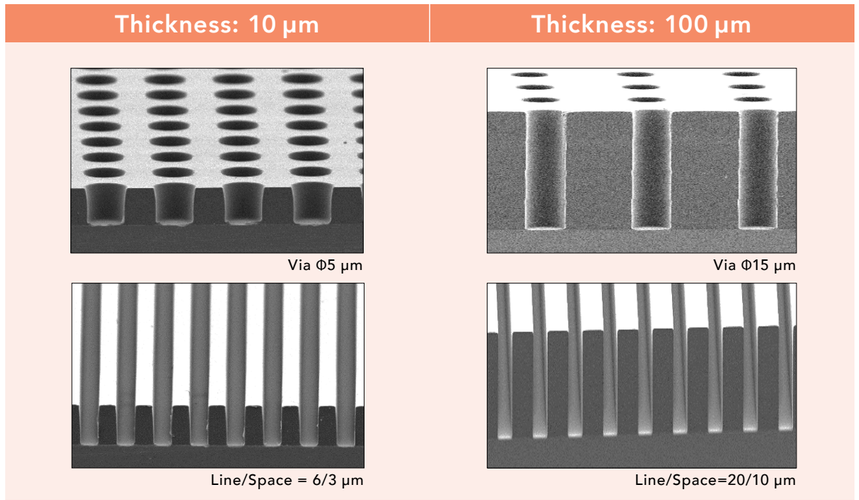
Polyimide Photodefinable Adhesive Film

FALDA™ polyimide photodefinable adhesive film is a negative-type photoresist material which can be used for permanent film applications. With excellent heat resistance, insulation properties, and processability, it is ideal for use as an interlayer insulation film and in cavity structure formation applications. We are also developing models for applications requiring high modulus of elasticity and low linear coefficient of thermal expansion (low CTE).

- Good wiring and via embedding
- High surface planarity
- Good molding stress resistance
- High resolution with thickness versatility

FALDA™
Maintains cavity shape

Conventional Film
Risk of roof collapse during molding

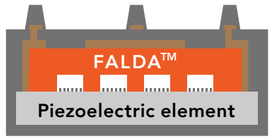


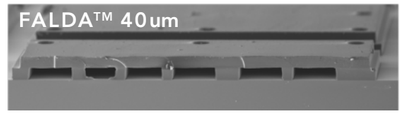
Polyimide Photodefinable Adhesive Film

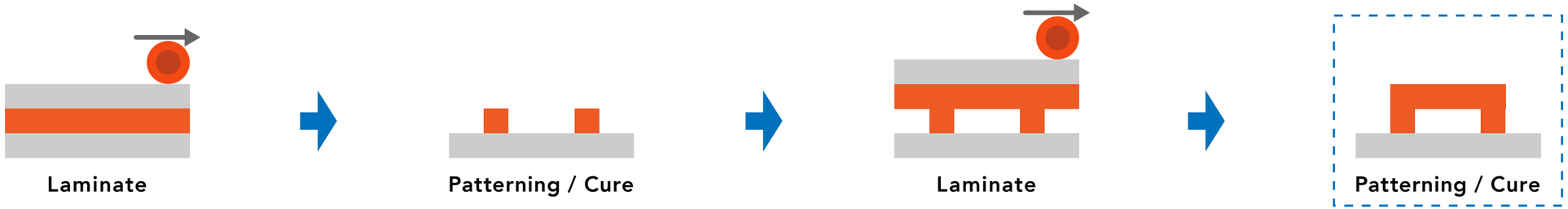
Cavity-Structure

FALDA™ has good molding stress resistance and fine pattern processing, so it is ideal for fine cavity structure formation.
FALDA™ enables miniaturization of electronic components.

e.g. SAW Filter

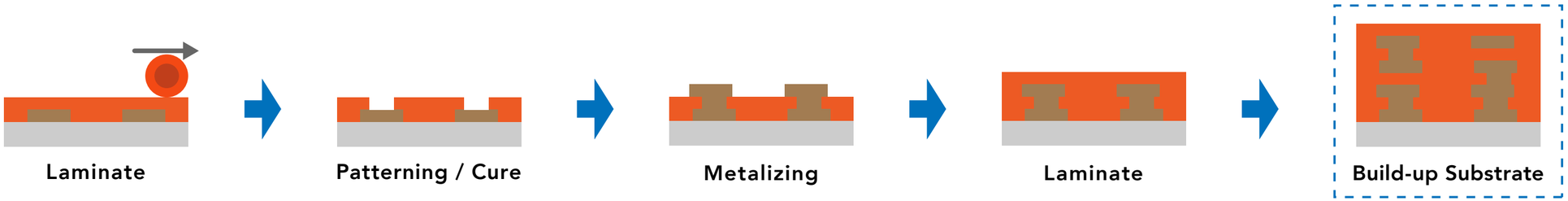






Dielectric layer for build-up substrate

FALDA™ has low residual stress in multi-layer and fine pattern processing, so it is ideal for RDL (Re-distribution Layer).



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Polyimide Photodefinable Adhesive Film

Basic specifications

Type	Negative-type
Young's modulus	3 GPa
Tensile strength	100 MPa
Elongation	10 %
Film stress	30 MPa
Glass transition temperature	250°C
5% Weight loss temperature	370°C
Coefficient of linear thermal expansion	55 ppm/°C

Polyimide Photodefinable Adhesive Film

This Toray product is a listed regulated substance according to Japanese export control laws. Accordingly, when exporting this product, your company must comply with the Foreign Exchange and Foreign Trade Act, and obtain an export license from the Minister of Economy, Trade and Industry. We will contact you regarding this process. In addition, if your company wishes to provide Toray products to a Japanese domestic client, please notify the client of this document and ensure they comply with the law.

1. Product name: FALDA™ Polyimide Photodefinable Adhesive Film
2. Applicable law: Item 1-5 (17) of the Export Trade Control Order/Ministerial Ordinance, Article 4, Paragraph 14

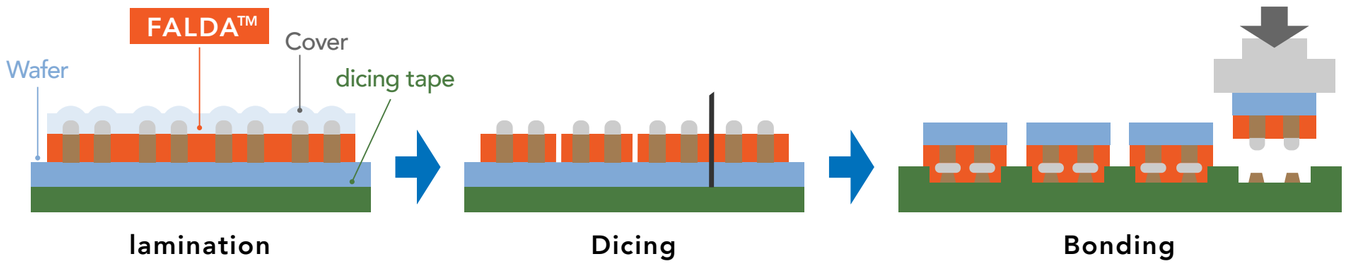
Polyimide Thermal Cure Adhesive Film

FALDA™ Polyimide thermal cure adhesive film is a "non-conductive film (NCF)". Product width and thickness can be customized according to customer requirements.

Lineup to meet customer process

Item	LNA -31	LNA -34	LNA -55
Transparency	×	×	✓
Flux function	×	✓	✓
Wafer lamination	✓	✓	✓
Substrate lamination	✓	✓	✓
Dicing	✓	✓	✓
Melt viscosity (B-stage)	Low	Low	High

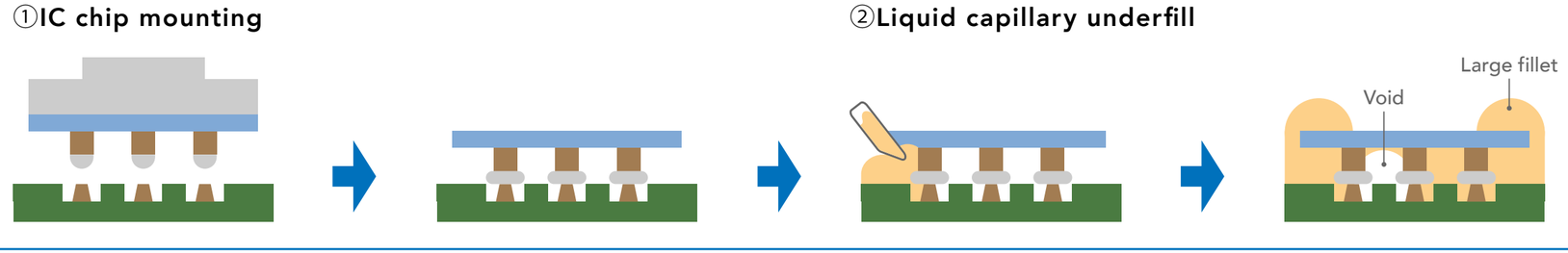
Process image (Wafer laminate / Flip chip bonding)



Polyimide Thermal Cure Adhesive Film

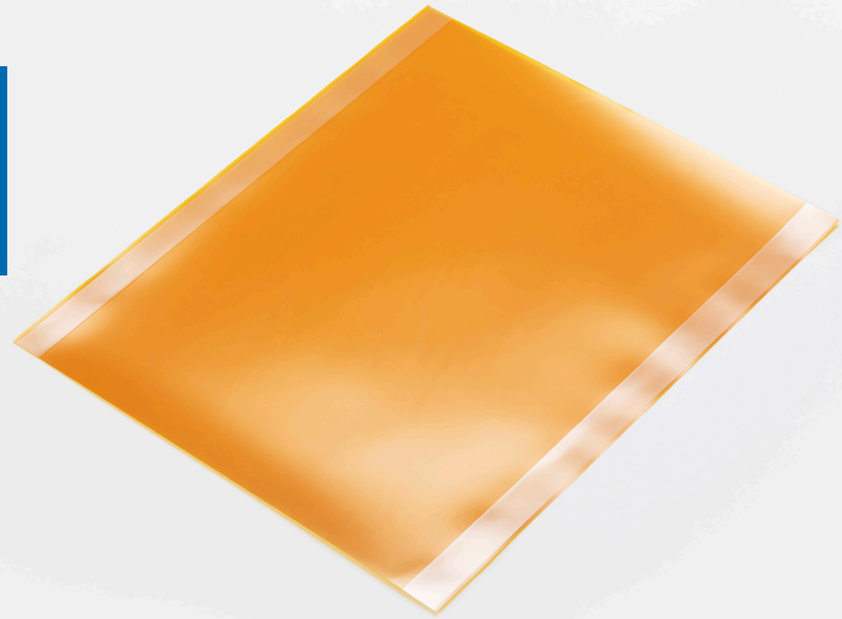
Compared to liquid underfill, FALDA™ is more effective in reducing voids and minimizing and controlling fillet size.

Conventional technology (Capillary Underfill, CUF)



FALDA™

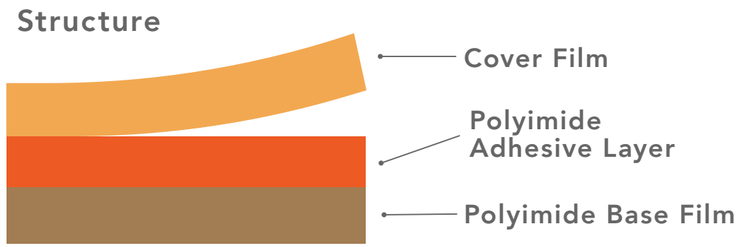
Polyimide High Heat Resistance Temporary Adhesive Film (Development Product)



FALDA™ temporary adhesive film uses polyimide-base materials for both the substrate and the adhesive layer.
Bonding and debonding can be performed at room temperature, and there is less adhesive residue after debonding. Its excellent heat resistance enables use in high-temperature processes.

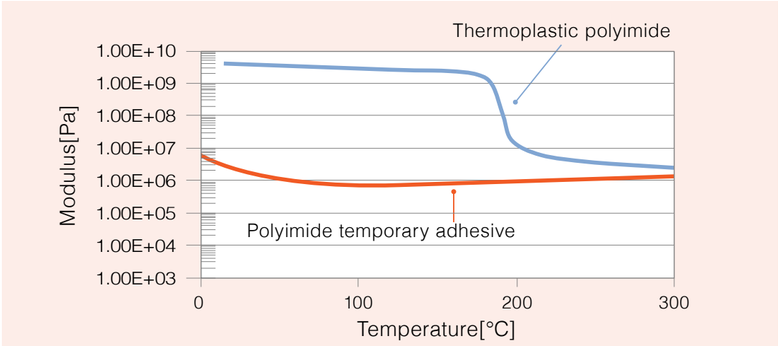
Excellent heat resistance using polyimide adhesive agent

Excellent adhesion properties are developed by the design of polyimide polymer structures. By using polyimide with a higher heat resistance than that of acryl and silicone, FALDA™ has a heat resistance of 300°C or higher.



Room temperature laminating

There is a smaller modulus change from low temperature to high temperature compared to that of a thermoplastic polyimide, enabling room temperature lamination.



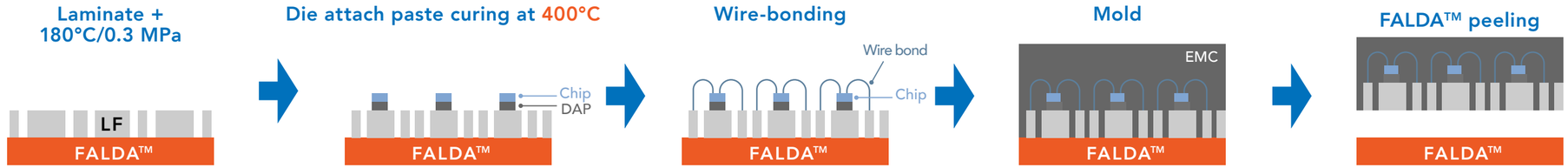
Polyimide High Heat Resistance Temporary Adhesive Film (Development Product)

Application Examples

FALDA™ can be used in Advanced Package manufacturing to improve customers' productivity.

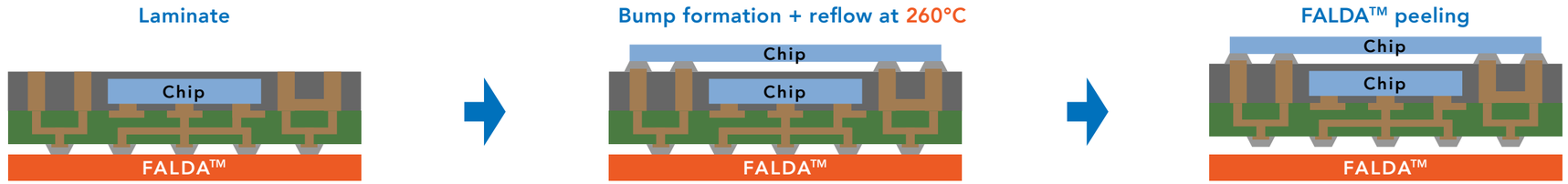
QFN packages

- 400°C heat resistance
- Room temp. bonding/debonding
- Suppresses warping of base material



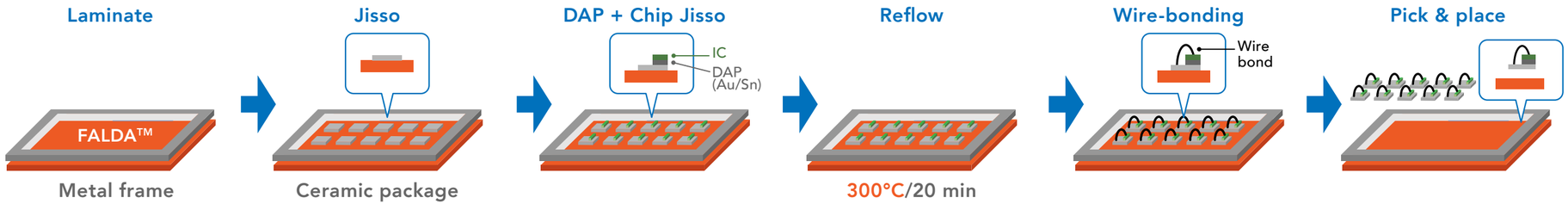
FOWLP

- Solder reflow resistance
- Solder shape maintenance



Carrier tape

- 300°C heat resistance
- Tackiness at high temp.
- No residue after debonding



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Polyimide High Thermal-Conductivity Adhesive Film (Development Product)

FALDA™ polyimide high-thermal conductivity adhesive film has high heat resistance and high insulation resistance. There is a thermal cure adhesive type and a pressure sensitive adhesive (PSA) type. Both have excellent flexibility and good adhesion.

Low thermal stress

It has low thermal stress and good adhesion, so does not delaminate even after a thermal cycle test.

SAT photo

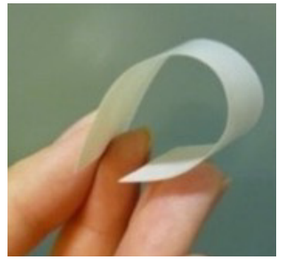
Initial

After 3,000 cycles –55°C/150°C

Flexible with high thermal conductivity

FALDA™ has a high thermal conductivity of 11 W/mK and excellent flexibility. It also has a good insulation resistance of 9.0 kV @ 175 µm thickness.

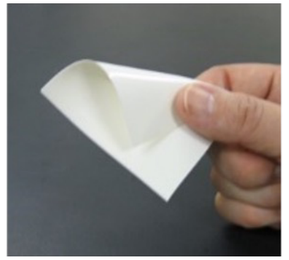
Heat-curing Adhesive Type



Before cure

After cure

PSA Type



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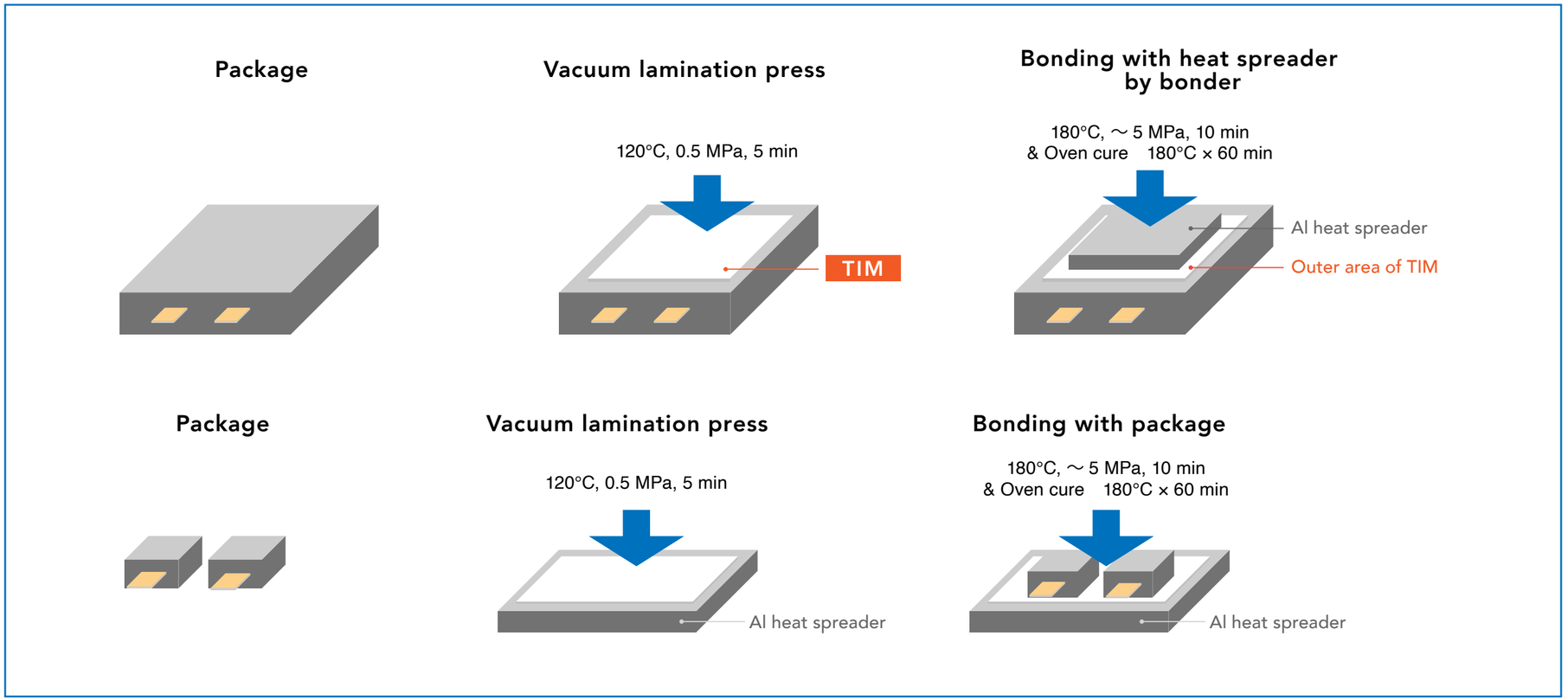
Polyimide High Thermal-Conductivity Adhesive Film (Development Product)

Application Examples

FALDA™ can be used as a thermal interface material (TIM) in the following processes.



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