

3M™ Bonding Film 615/615S

Product Description

3M™ Bonding Film 615/615S is a flexible, light colored, thermoplastic adhesive bonding film which exhibits good adhesion to a variety of substrates. The bonding film is removable from the release coated paper liner. Bonding Film 615S contains a non-woven scrim reinforcing web that improves handling of the film, and reduces flow of the adhesive during bonding.

Key Features

- Can be die-cut
- Consistent, uniform adhesive thickness
- Quick fixturing/holding strength
- 100% solids
- Excellent adhesion to many substrates

Typical Physical Properties

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Base Resin		Polyester Thermoplastic (non-curing)
Adhesive Thickness	3M™ Bonding Film 615 3M™ Bonding Film 615S 3M™ Bonding Film 615S	4 mil (.004 in. [.10 mm]) 6 mil (.006 in. [.15 mm]) (nominal) 9 mil (.009 in. [.22 mm])
Liner Thickness		3 mil (.003 in. [.08 mm]) (nominal)
Color		Translucent/Tan
Specific Gravity		1.00
Solids		100%
Ball and Ring Softening Range		240 to 250°F (116 to 123°C)
Tensile Strength @ Break	3M™ Bonding Film 615 3M™ Bonding Film 615S	450 psi 900 psi
Elongation @ Break		~300%
Two Lb. Dead Load Heat Resistance		215°F (102°C)

Note 1: The data reported in this data sheet was determined using 4.0 mil film thickness 3M™ Bonding Film 615.

Note 2: Other thicknesses may be available upon request. Contact your local 3M sales representative for details.



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Application Equipment Suggestions

Note: Appropriate application equipment can enhance bonding film performance. We suggest the following equipment for the user's evaluation in light of the user's particular purpose and method of application.

The type of application equipment used to bond 3M™ Bonding Film 615/615S will depend on the application involved and on the type of equipment available for the user. Thin films and flexible substrates can be bonded using a heated roll laminator where heat and pressure can be varied to suit the application. Larger, thicker substrates can be bonded using a heated static press or, in some cases, an autoclave. For applications where a shaped adhesive is to be transferred to a flat or three-dimensional part, a hot shoe or thermode method may be appropriate.

It is recommended that whatever method of bonding the user chooses, the user should determine the optimum bonding conditions using the specific substrates involved.

Directions For Use

To make a bond using 3M™ Bonding Film 615/615S, the adhesive, with the liner in place, can be first tacked (lightly bonded) to one of the substrates using low heat. The liner can then be removed, and placing the second substrate to the exposed adhesive surface, make the final bond using heat and pressure.

Alternatively, remove the liner and place the adhesive film between the two substrates and make the bond through heat and pressure using a heated press, a hot roll laminator, a hot shoe thermode method or similar equipment.

Suggested TACKING Conditions

100°F to 120°F (38°C to 49°C) bondline temperature

1-2 seconds dwell time

5-10 psi pressure

For optimum bonding, heat, pressure and dwell time will depend upon the type and thicknesses of the substrates being bonded together.

A suggested starting point is to use a method which will result in an adhesive bondline temperature of 275°F (135°C) for 2-5 seconds using 10-20 psi pressure.

Suggested BEGINNING Bonding Conditions

270°F to 280°F (132°C to 138°C) bondline temperature

2-5 seconds dwell time

10-20 psi pressure

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Directions For Use (continued)

One approach to establishing the correct/optimum bonding conditions for a user's application is to evaluate a series of bonding temperatures, for example 250, 275, 300, 325 and even 350°F (121, 135, 149, 163 and 177°C). Time and pressure will be dictated by the thickness of the substrate and the type of substrate being bonded. Thicker substrates and more difficult to bond surfaces will require longer times, higher pressures and higher temperatures.

Once the bond is made, the bondline should be allowed to cool somewhat before stress is applied to the bond. Generally, cooling the bondline below 200°F (93°C) is adequate to allow the bonded parts to be unfixtured/unclamped and handled.

For reference, the following tables show typical bond strengths for bonds made at various temperatures. **Such tables can be used to evaluate optimum bondline temperatures.** It is very important to note that this table is valid only for the specific substrates shown. Varying temperature, pressure, or substrates can affect bond strengths. **User should develop a similar table using the specific substrates involved.**

Note: Temperatures shown are bondline temperatures and not heat block or roll settings!

Overlap Shear Adhesive vs Bonding Temperature CRS/CRS Overlap Shear	
Bondline Temperature	3M™ Bonding Film 615 (4.0 mil)
230°F (110°C)	460 psi
250°F (121°C)	820 psi
270°F (132°C)	910 psi
290°F (143°C)	1070 psi
310°F (154°C)	1100 psi
330°F (166°C)	1090 psi

- Bond strength determined using Instron tester at 0.2 in/minute.
- Oven bonding method 10 minutes, 4.4 psi pressure.
- CRS is Cold Rolled Steel.

T-Peel Adhesion of PET/PET and PI/PI Bonded at Various Temperatures		
Bondline Temperature	3M™ Bonding Film 615 (4.0 mil) PET/PET	3M™ Bonding Film 615 (4.0 mil) PI/PI
180°F (82°C)	0.3 piw	1.2 piw
196°F (91°C)	0.6 piw	2.9 piw
216°F (102°C)	1.3 piw	3.8 piw
235°F (113°C)	1.8 piw	6.1 piw
256°F (124°C)	3.6 piw	6.7 piw
277°F (136°C)	5.2 piw	9.7 piw
298°F (148°C)	6.4 piw	10.7 piw
315°F (157°C)	8.0 piw	11.2 piw

- PET is 2 mil polyester film.
- PI is 3 mil polyimide film.
- Bonds made using 5 second dwell, 5 lb gauge pressure.
- T-Peel adhesion is 90° peel pulled @ room temperature using Instron tester @ 2 in/minute.

3M™ Bonding Film 615 Peel Strengths of Bonds Made at Various Temperatures			
Bondline Temperature	CRS AL	FR-4 AL	PC AL
135°F (57°C)	0.4 piw	0.4 piw	0.2 piw
150°F (66°C)	0.4 piw	0.7 piw	0.2 piw
165°F (74°C)	0.9 piw	3.0 piw	0.5 piw
180°F (82°C)	1.7 piw	3.7 piw	1.0 piw
195°F (91°C)	3.3 piw	7.0 piw	2.9 piw
210°F (99°C)	2.1 piw	8.2 piw	4.0 piw
225°F (107°C)	8.4 piw	8.8 piw	3.6 piw
240°F (116°C)	9.2 piw	9.0 piw	8.8 piw
255°F (124°C)	8.6 piw	8.3 piw	9.3 piw
270°F (132°C)	8.7 piw	9.4 piw	8.6 piw
285°F (141°C)	7.9 piw	10.0 piw	9.4 piw
300°F (149°C)	7.8 piw	9.9 piw	9.6 piw
315°F (157°C)	8.5 piw	9.7 piw	9.9 piw
330°F (166°C)	9.7 piw	10.8 piw	9.9 piw
345°F (174°C)	10.6 piw	9.9 piw	10.7 piw
360°F (182°C)	10.5 piw	9.8 piw	9.3 piw

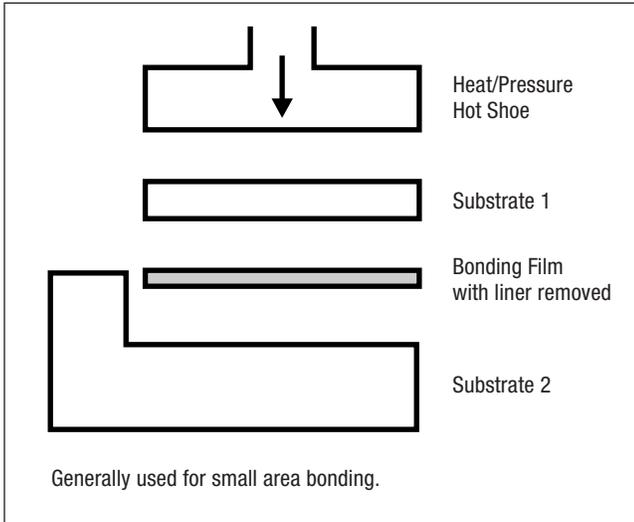
- Substrates used: Cold Rolled Steel (CRS), FR-4 PCB (FR-4), Polycarbonate (PC), Aluminum (AL).
- Bonds made using 2 second dwell, 10 psi.
- Peels tested at 90° angle, 2 in./min.

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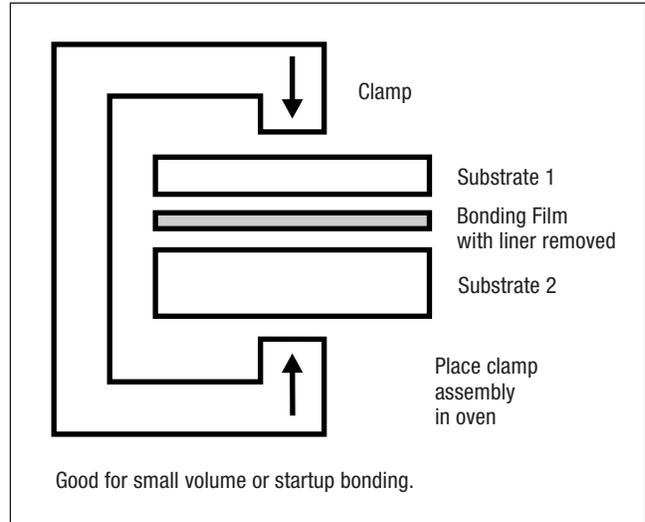
Typical Methods For Bonding 3M™ Bonding Film Adhesives

The following illustrations show several of the many methods that can be used to make bonds using 3M™ Bonding Film Adhesives. Equipment is generally available commercially or can be built or modified by the user to fit a particular application.

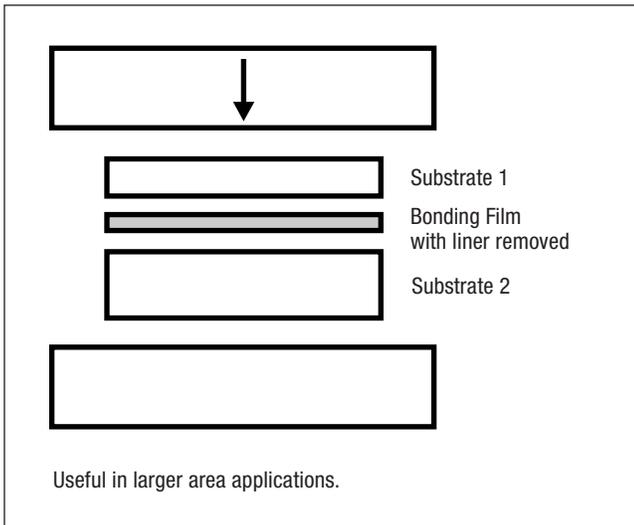
Hot Shoe or Thermode Bonding



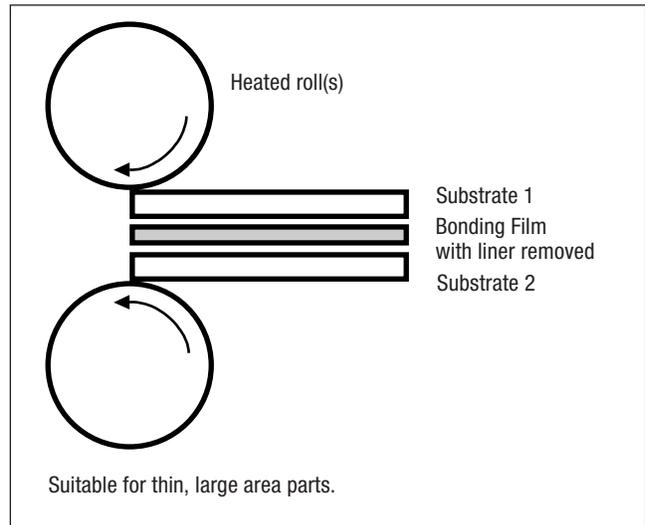
Oven (Static or Conveyorized) Bonding



Hydraulic or Mechanical Press Bonding



Lamination Bonding of Thin Substrates



Debonding – Since 3M™ Bonding Film 615/615S is a thermoplastic material, no curing during heating or aging occurs. To debond or open bonded parts, simply heat the bonded part to an adequate temperature (typically 275-300°F / 135-149°C) to soften the adhesive and then pry or peel the substrates apart.

Solvents, such as acetone, MEK, toluene and 3M™ Citrus Based Cleaner will soften this bonding film adhesive and can be used to remove excess adhesive in unwanted areas.* Soaking bonds in these solvents can also aid in debonding operations where appropriate.

***Note:** When using solvents, extinguish all ignition sources and follow the manufacturer's precautions and directions for use.

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Typical Performance Characteristics

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Adhesion to Various Substrates

Test Substrate	Overlap Shear 3M™ Bonding Film 615 (4.0 mil)	90° Peel 3M™ Bonding Film 615 (4.0 mil)
Cold Rolled Steel	840 psi	13.5 piw
Stainless Steel	825 psi	16.0 piw
Aluminum	810 psi	15.5 piw
Polycarbonate	890 psi	11.5 piw
Acrylic	905 psi	13.0 piw
FR-4 PCB	930 psi	10.5 piw
ABS	805 psi	10.5 piw
HDPE	210 psi	3.5 piw
Polypropylene	410 psi	0.7 piw
PVC	915 psi	12.0 piw
Fir Wood	360 psi	NT
LCP (Vectra A-130)	NT	14.0 piw
LCP (Vectra B-130)	NT	11.0 piw
LCP (Zenite 6130L)	NT	13.0 piw
Nylon 6,6	NT	9.5 piw
PPS (Polyphenylene Sulfide)	NT	7.5 piw

- Overlap shear made bonding 20 mil aluminum to test substrates using 280°F (138°C) bondline temperature, 5 seconds dwell, 5 lbs gauge pressure.
- Peel bonds made bonding 4.5 mil aluminum foil to test substrates using 280°F (138°C) bondline temperature, 5 seconds dwell, 5 lbs gauge pressure.
- Adhesion tests done using Instron @ 2 in/minute for peel, .2 in/minute for OLS.
- NT – Not Tested.

Bond Strength Retention After Humidity Aging

Copper to Polycarbonate Bonds	3M™ Bonding Film 615 (4.0 mil)
Initial (Before Aging)	11.0 piw
6 days @ 95% RH / 150°F (66°C) 21 days @ 95% RH / 150°F (66°C)	10.2 piw 5.4 piw
6 days @ 95% RH / 185°F (85°C) 21 days @ 95% RH / 185°F (85°C)	10.2 piw 4.2 piw

- Bonds made bonding 1.5 mil copper foil bonded to 0.125 in polycarbonate @ 260°F (127°C), 5 second dwell, 5 lbs gauge pressure.
- Bonds tested by Instron peel @ 2 in/minute @ 90° peel angle.

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Typical Performance Characteristics (continued)

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Adhesion Strength TESTED at Various Temperatures

Test Temperature	3M™ Bonding Film 615 (4.0 mil) Peel Strength Cu to PC	3M™ Bonding Film 615 (4.0 mil) Overlap Shear Strength CRS to CRS
75°F (24°C)	11.0 piw	1130 psi
113°F (45°C)	8.5 piw	220 psi
150°F (66°C)	1.8 piw	35 psi
185°F (85°C)	0.4 piw	20 psi
203°F (95°C)	0.2 piw	7 psi

- Cu is 1.5 mil copper foil, PC is 0.125 in polycarbonate, CRS is Cold Rolled Steel.
- Peel bonds made @ 260°F (127°C), 5 seconds dwell, 5 lbs pressure.
- OLS bonds made @ 280°F (138°C), 10 minutes oven, 5 lbs pressure.
- Adhesion determined using Instron tester @ 2 in/minute for peels, .2 in/minute for OLS.

Electrical Data

3M™ Bonding Film 615 (4.0 mil)		
Test	Method	Value
Dielectric Constant	ASTM D-150	4.4 @ 1 kilohertz 4.4 @ 3 kilohertz
Dissipation Factor	ASTM D-150	0.018 @ 10 kilohertz 0.018 @ 100 kilohertz 0.017 @ 1000 kilohertz
Dielectric Breakdown Strength	ASTM D-149	520 volts/mil
Surface Resistivity	ASTM D-257	2 x 10 ¹³ ohms/sq.
Volume Resistivity	ASTM D-257	6 x 10 ¹⁴ ohm-cm

Thermal Data

3M™ Bonding Film 615 (4.0 mil)		
Test	Method	Value
Weight Loss By TGA (Thermal gravametric analysis)	Perkin-Elmer Series 7 RT to 800°C, 5°C/min, in air	1% wt loss @ 202°C 5% wt loss @ 268°C 10% wt loss @ 307°C
Coefficient of Thermal Expansion By TMA (Thermal mechanical analysis)	Perkin-Elmer Series 7 -60°C to 125°C @ 10°C/min	102 x 10 ⁻⁶ unit/unit/°C (-60°C to 20°C)

Storage and Shelf Life

Storage: Store in a dry (preferably <50% RH) location at 35°F (2°C) to 80°F (27°C).

Shelf Life: Shelf life is 2 years from the date of shipment under storage conditions mentioned above.

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Certification/Recognition

MSDS: 3M has not prepared a MSDS for this product which is not subject to the MSDS requirements of the Occupational Safety and Health Administration's Hazard Communication Standard, 29 C.F.R. 1910.1200(b)(6)(v). When used under reasonable conditions or in accordance with the 3M directions for use, the product should not present a health and safety hazard. However, use or processing of the product in a manner not in accordance with the directions for use may affect its performance and present potential health and safety hazards.

TSCA: This product is defined as an article under the Toxic Substances Control Act and therefore, it is exempt from inventory listing requirements.

RoHS: This product complies with the requirements of EU Directive 2002/95/EC and 2005/618/EC.

For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-251-8634. Address correspondence to: 3M Electronics Markets Materials Division, Building 21-1W-10, 900 Bush Avenue, St. Paul, MN 55144-1000. Our fax number is 651-778-4244 or 1-877-369-2923. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-787-750-3000. In Mexico, phone: 52-70-04-00.

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Electronics Markets Materials Division

3M Electronics

3M Center, Building 21-1W-10, 900 Bush Avenue
St. Paul, MN 55144-1000
1-800-251-8634 phone
651-778-4244 fax
www.3M.com/electronics

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