3M™ Thermal Bonding Film 668

Product Description

3M™ Thermal Bonding Film 668 is a flexible, light colored, thermoplastic adhesive bonding film which exhibits good adhesion to a variety of substrates. The bonding film is supplied on a release coated paper liner.

Key Features

- Slight surface tack for temporary holding
- Excellent heat resistance
- Excellent adhesion to many substrates
- 100% solids
- Can be die-cut
- Quick fixturing/holding strength

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.

Product	3M™ Thermal Bonding Film 668
Base Resin	Polyamide Thermoplastic (non-curing)
Adhesive Thickness	2.5 mil (0.06 mm) 4.0 mil (0.10 mm)
Liner Thickness	3.0 mil (0.08 mm) [nominal]
Color	Translucent / Tan
Specific Gravity	1.00
Solids	100%
Ball and Ring Softening Range	149 to 160°C (300 to 320°F)
Tensile Strength @ Break	~2400 psi
Elongation @ Break	~1000%
Two Lb. Dead Load Heat Resistance	127°C (260°F)

Note 1: The data reported in this data sheet was determined using 4.0 mil film thickness 3M™ Thermal Bonding Film 668.

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

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 equipment used to bond 3M™ Thermal Bonding Film (TBF) 668 will depend on the application 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 TBF 668, the adhesive can be first tacked (lightly bonded) to one of the substrates using low heat, and placing the second substrate to the exposed adhesive surface, making the 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.

Since 3M TBF 668 inherently has some surface tack, in some cases it may be tacked to a substrate with pressure only (no heat).

Suggested TACKING Conditions

60°C to 80°C bondline temperature

1-2 seconds dwell time

5-10 psi (35-70 kPa) pressure

For optimum bonding, heat, pressure and dwell time for using 3M TBF 668 will depend upon the type and thicknesses of the substrates being bonded together.

A suggested starting point, however, is to use bonding conditions described below.

Suggested BEGINNING Bonding Conditions

150°C to 170°C bondline temperature

2-5 seconds dwell time

10-20 psi (70-140 kPa) pressure

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 121, 135, 149, 163 and 177°C (250, 275, 300, 325 and even 350°F). 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 93°C (200°F) 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 Adhesion vs Bonding Temperature
Aluminum / Aluminum Overlap Shear

Bondline Temperature	3M™ Thermal Bonding Film 668 (4.0 mil)
132°C (270°F)	750 psi
143°C (290°F)	800 psi
154°C (310°F)	900 psi
166°C (330°F)	1000 psi
177°C (350°F)	1000 psi

- Bond strength determined using MTS Tensile Tester at 2.0 in/minute.
- Oven/Weight method, 15 minutes, clamp pressure.

Peel Strength of Bonds Made at Various Temperatures using 4.0 mil 3M™ Thermal Bonding Film 668

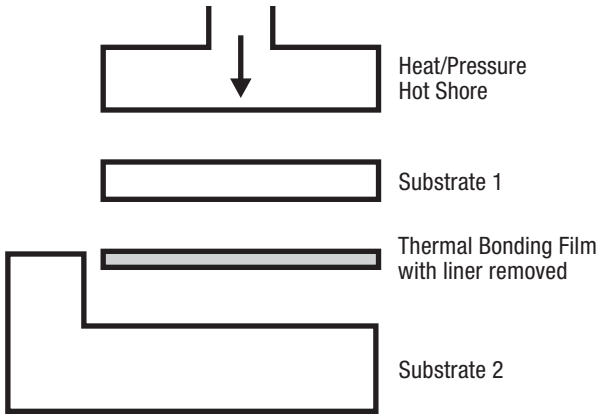
Bondline Temperature	CRS AL	FR-4 AL	PC AL
57°C (135°F)	2.0 piw	2.1 piw	0.6 piw
66°C (150°F)	2.2 piw	2.5 piw	0.9 piw
74°C (165°F)	2.3 piw	4.0 piw	1.6 piw
82°C (180°F)	4.4 piw	5.1 piw	2.0 piw
91°C (195°F)	3.8 piw	12.3 piw	3.8 piw
99°C (210°F)	5.4 piw	16.5 piw	3.5 piw
107°C (225°F)	6.0 piw	19.5 piw	6.0 piw
116°C (240°F)	4.5 piw	15.7 piw	8.7 piw
124°C (255°F)	8.5 piw	18.8 piw	10.7 piw
132°C (270°F)	15.2 piw	18.1 piw	13.5 piw
141°C (285°F)	15.3 piw	18.2 piw	12.1 piw
149°C (300°F)	18.5 piw	19.9 piw	14.6 piw
157°C (315°F)	20.4 piw	17.8 piw	14.6 piw
166°C (330°F)	17.9 piw	16.5 piw	14.2 piw
174°C (345°F)	14.7 piw	14.3 piw	14.1 piw
182°C (360°F)	13.5 piw	13.2 piw	13.7 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.

Typical Methods For Bonding 3M™ Thermal Bonding Film Adhesives

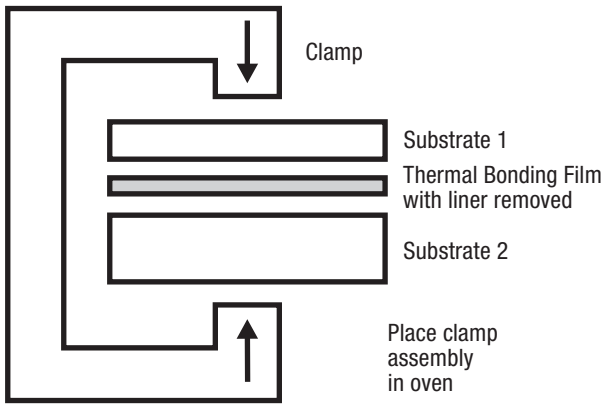
The following illustrations show several of the many methods that can be used to make bonds using 3M™ Thermal Bonding Film (TBF) adhesives. Equipment is generally available commercially or can be built or modified by the user to fit a particular application.

Hot Shoe or Thermode Bonding



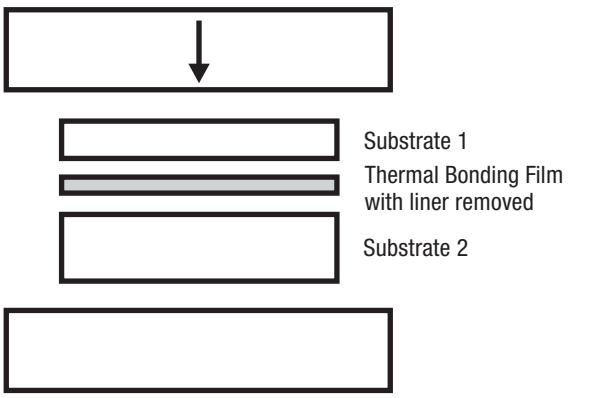
Generally used for small area bonding.

Oven (Static or Conveyorized) Bonding



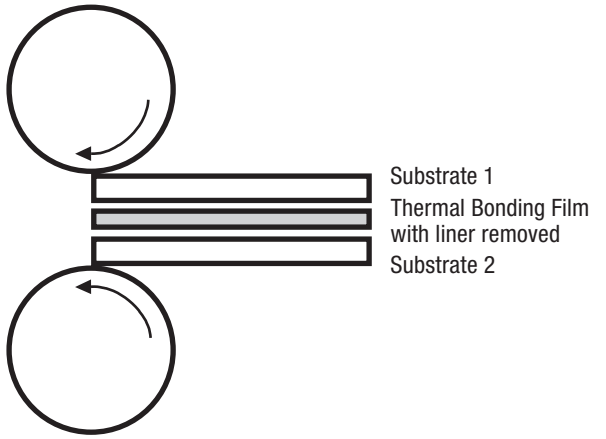
Good for small volume or startup bonding.

Hydraulic or Mechanical Press Bonding



Useful in larger area applications.

Lamination Bonding of Thin Substrates



Suitable for thin, large area parts.

Debonding – Since 3M™ Thermal Bonding Film (TBF) 668 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 135-149°C / 275-300°F) to soften the adhesive and then pry or peel the substrates apart.

Solvents, such as acetone, methyl ethyl ketone (MEK), toluene and 3M™ Citrus Base Cleaner will soften 3M TBF 668 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.

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™ Thermal Bonding Film 668 (4.0 mil)	90° Peel 3M™ Thermal Bonding Film 668 (4.0 mil)
Cold Rolled Steel	820 psi	14.0 piw
Stainless Steel	620 psi	13.4 piw
Aluminum	1000 psi	14.1 piw
Polycarbonate	600 psi	10.3 piw
Acrylic	620 psi	18.0 piw
FR-4 PCB	710 psi	17.0 piw

- Overlap shear made bonding 63 mil aluminum to test substrates using 177°C (350°F) bondline temperature, 5 seconds dwell, 5 lbs gauge pressure.
- Peel bonds made bonding 4.5 mil aluminum foil to test substrates using 177°C (350°F) bondline temperature, 5 seconds dwell, 5 lbs gauge pressure.
- Adhesion tests done using MTS Tensile Tester @ 2.0 in/minute for peel, 2.0 in/minute for OLS.

Bond Strength Retention After Humidity Aging

Copper to Polycarbonate Bonds	3M™ Thermal Bonding Film 668 (4.0 mil)
Initial (Before Aging)	12.5 piw
6 days @ 95% RH / 66°C (150°F) 21 days @ 95% RH / 66°C (150°F)	10.3 piw 6.3 piw
6 days @ 95% RH / 85°C (185°F) 21 days @ 95% RH / 85°C (185°F)	1.9 piw 0.7 piw

- Bonds made bonding 1.5 mil copper foil bonded to 0.125 in polycarbonate @ 149°C (300°F), 5 second dwell, 20 lbs gauge pressure.
- Bonds tested by Instron peel @ 2 in/minute @ 90° peel angle.

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™ Thermal Bonding Film 668 (4.0 mil) Overlap Shear Strength Aluminum / Aluminum
24°C (75°F)	1000 psi
45°C (113°F)	510 psi
66°C (150°F)	340 psi
85°C (185°F)	160 psi
95°C (203°F)	100 psi

- OLS bonds made @ 166°C (330°F), 10 minutes oven, 20 lbs pressure.
- Adhesion determined using MTS Tensile Tester @ 2.0 in/minute for OLS.

Electrical Data

Test	3M™ Thermal Bonding Film 668 Method	Value
Dielectric Constant	ASTM D-150	3.3 @ 1 kilohertz
Dissipation Factor	ASTM D-150	.035 @ 10 kilohertz .030 @ 500 kilohertz .030 @ 1000 kilohertz
Dielectric Breakdown Strength	ASTM D-149	1750 volts/mil
Volume Resistivity	ASTM D-257	1.4 x 10^{14} ohm-cm

Thermal Data

Test	3M™ Thermal Bonding Film 668 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 @ 239°C 5% wt loss @ 301°C 10% wt loss @ 338°C
Coefficient of Thermal Expansion By TMA (Thermal mechanical analysis)	Perkin-Elmer Series 7 -40°C to 150°C @ 10°C/min	350 x 10^{-6} unit/unit/°C (-50°C to 40°C)

Storage and Shelf Life

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

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

Safety Data Sheet

Please consult Safety Data Sheet prior to use.

Important Note

Please consult Federal, State, and Local Regulations. State Volatile Organic Compound (VOC) regulations may prohibit the use of certain alcohol solutions or solvents. You should check with your state environmental authorities to determine whether use of a solution or solvent is restricted or prohibited.

Regulatory

For regulatory information about this product, contact your 3M representative.

Technical Information

The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

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