Thermally-Conductive Adhesive Transfer Tapes

9882 • 9885 • 9890

Technical Data **April, 1998**

(Supersedes August, 1995)

Product Description

9882 0.002 in. (0.05 mm) adhesive transfer tape.

9885 0.005 in. (0.13 mm) adhesive transfer tape.

9890 0.010 in. (0.25 mm) adhesive transfer tape.

9882, 9885 and 9890 tapes are 2, 5 and 10 mil versions, respectively, of thermally-conductive adhesive transfer tape. They feature a ceramic-filled acrylic pressure-sensitive adhesive film supported on a protective release liner. The tape yields an excellent combination of thermal conductivity, electrical insulation, adhesion (with reworkability) and ease of use in applications that do not require a heat cured adhesive.

Example applications ideas for the thermally conductive adhesive transfer tapes include bonding of ICs, packages, components and flex circuits to heat sinks.

Construction

Products	9882	9885	9890
Adhesive Resin Type:	Filled Acrylic	Filled Acrylic	Filled Acrylic
Adhesive Filler Type:	Ceramic	Ceramic	Ceramic
Release Liner:	Silicone Treated Polyester	Silicone Treated Polyester	Silicone Treated Polyester
Adhesive Thickness:	0.002 in. (0.05 mm)	0.005 in. (0.13 mm)	0.010 in. (0.25 mm)
Adhesive Thickness Tolerance:	0.005 in. (0.13 mm)	0.005 in. (0.13 mm)	0.005 in. (0.13 mm)
Liner Thickness:	0.002 in. (0.05 mm)	0.002 in. (0.05 mm)	0.002 in. (0.05 mm)

General Information

- Thermally-conductive adhesive transfer tape allows easy joining of many substrates with light pressure in just seconds at room temperature. Bonds are permanent with reworkability.
- Clamps and screws no longer needed in many applications, helping save processing time.
- Electrical insulation with high dielectric strength allows separate insulating films, washers, etc. to be eliminated in many applications.
- Transfer tape format means that there is no carrier layer – instead a homogeneous film of adhesive is supported on the protective release liner. Absence of a carrier film allows better gap-filling between rigid parts. This improved contact results in higher bond strength and lower thermal resistance in the actual application.

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General Information ***(continued)***

- Extended cure times, high temperatures, fixturing, etc. required for use of liquid adhesives or bonding films (thermoset or thermoplastic) are eliminated with the tape.
- Bond strength builds over time (as the adhesive wetting of the substrate surfaces advances) to values often double the initial values.
- Tape can be die cut or fashioned to meet specific applications.

Application Ideas

Bond together heat-generating and heat-sinking (or sensing) electronic and general-industrial components.

Products	9882	9885	9890
Mounting flexible heating foils	✔		
Mounting temperature-indicating films	✔		
Mounting thermoelectric cooling modules	✔	✔	✔
Bonding flex circuit to heat sink	✔	✔	
Bonding heat sink to microprocessor		✔	✔
Bonding TAB-mounted IC to PCB		✔	✔
Bonding power transistor to PCB			✔
Bonding power transistor to heat sink*			✔

*May require additional mechanical fixturing.

Typical Physical Properties and Performance Characteristics

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

Underwriters Laboratories™ Recognition:	File MH17478, Section QOQW2 Component - Polymeric Adhesive Systems, Electrical Equipment		
Thermal Conductivity: (ASTM C-177)	0.43 W/m-K (0.25 BTU/Ft. Hr. ° F)		
Thermal Impedance:* (ASTM C-177)	9882 tape 0.2 C-in.^{2}/W	9885 tape 0.5 C-in.^{2}/W	9890 tape 0.9 C-in.^{2}/W
	*Calculated based on thermal conductivity measurement above. Assumes 100% adhesive contact in the bond area - see notes in Thermal Resistance below.		
Thermal Resistance:	Thermal resistance (° C/W) values depend on the adhesive contact area in a given application. While estimates can be made by dividing the adhesive thermal impedance by the bond area, this exercise can produce an inaccurate or even misleading result – in some cases an assembly with a thicker adhesive film will perform with lower thermal resistance than with the thinner one! The reason is that thermal impedance or thermal conductivity test measurements are usually taken on flat parts under ideal assembly conditions in order to produce 100% adhesive contact in the bond area. In a given application the percentage of adhesive contact will depend on the flexibility of the parts bonded, and their non-planarity or runout with respect to the thickness and softness of the adhesive. Assembly conditions (e.g., temperature, force, method, dwell time) can also have a pronounced effect.		

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Typical Physical Properties and 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.

Shear Adhesion Strength:*

	Dynamic (ASTM D-1002)	Static (ASTM D-3654)
72° F (22° C)	70 lbs./in.^{2} (500 kPa)	1000 grams/(0.5 in.^{2})
158° F (70° C)	40 lbs./in.^{2} (300 kPa)	1000 grams/(0.5 in.^{2}) (weight held for > 7 days)

*Shear strength test measurements are usually taken on flat parts under ideal assembly conditions. Performance in a given application will depend on the flexibility and non-planarity of the parts in relation to the thickness and softness of adhesive chosen (gap-filling effect), and the assembly conditions (e.g., force, temperature, methods, dwell time) as this will affect the percentage of the bond area in which the adhesive is wetted to the substrates.

Peel Adhesion Strength: (ASTM D-3330)

90 degree angle peel test to substrates listed, using 5 mil (0.13) thick anodized aluminum foil backing. Dwell times given are storage conditions following assembly of the samples.

Values in oz./in. width (multiply by 11 to convert to N/m).

	9882 tape	9885 tape	9890 tape
72°F (23°C) dwell (5 min./72 hr.)			
Ceramic	25 / 40	40 / 75	45 / 80
Anodized Aluminum	70 / 85	90 / 110	110/150
150°F (70°C) dwell (5 min./72 hr.)			
Ceramic	25 / 65	45 / 120	50 / 120
Anodized Aluminum	70 / 85	90 / 115	110 / 150

Dielectric Strength: (ASTM D149) — 750 Volts (AC) / mil thickness (30 kV/mm)

Dielectric Properties: (ASTM D150)

	Dielectric Constant:	Dissipation Factor:
1 kHz	6	0.003
1 MHz	5	0.003

Volume Resistivity (ASTM D-257) — 2×10^{14} Ohm-cm

Outgassing: (NASA SP-R-0022 or ASTM E-595)

257° F (125° C), 24 hrs. in 2×10^{-6} Torr vacuum

Total Mass Loss (TML)	0.7%
Collected Volatile Condensable Materials (CVCM)	0.01%

Elastic Modulus: (ASTM D4065) — Dynamic/mechanical analysis, 6 rad/sec oscillation.

	-67°F (-55°C)	72°F (23°C)	220°F (100°C)	300°F (150°C)	572°F (300°C)
Pascals (Pa)	10^9	10^6	10^5	10^5	10^5

Coefficient of Thermal Expansion (CTE): (ASTM D3386)

-67°F (-55°C)	250 ppm/° C
72°F to 302°F (23°C to 150°C)	400 ppm/° C

Specific Gravity: 2 g/cm^3

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Typical Physical Properties and 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.

Operating Temperature Range:	Assumes well-bonded parts assembled at 72° F (23° C)
Short Term (seconds-minutes)	-67° F†/500° F (-55° C†/260° C)
Long Term*	-31° F†/194° F (-35° C†/90° C)
	*Based on UL746C testing of the retention of dynamic shear strength. Actual limits may be design dependent. For more details, request 3M publication 70-0704-8798-1, “Notes on System Design and Performance”.
	†Cold temperatures may cause temporary increase in elastic and storage modulus, making the adhesive stiffer, less able to compensate stress due to substrates having mismatched CTE’s and less resistant to mechanical shock.
Solvent Resistance:	Well-bonded parts are usually able to withstand typical cleaning operations (aqueous or solvent) with little detrimental effect. Be sure to evaluate solvent resistance for your particular application.
Shelf Life:	24 months from date of manufacture when stored in original cartons at 70° F (21° C) and 50% relative humidity.

Available Sizes

Products	9882	9885	9890
Available Lengths:			
Standard	36 yds. (32.9 m)	36 yds. (32.9 m)	36 yds. (32.9 m)
Maximum			
3/8 in. to 1 in. wide 9.5 mm to 25.4 mm	144 yds. (131.6 m)	144 yds. (131.6 m)	144 yds. (131.6 m)
>1 in. to 9 in. wide >25.4 mm to 229 mm	360 yds. (329 m)	216 yds. (197.4 m)	144 yds. (131.6 m)
>9 in. to 14 in. wide >229 mm to 356 mm	288 yds. (263.2 m)	180 yds. (164.5 m)	72 yds. (65.8 m)
Available Widths:			
Minimum	3/8 in. (9.5 mm)	3/8 in. (9.5 mm)	3/8 in. (9.5 mm)
Maximum	14 in. (356 mm)	14 in. (356 mm)	14 in. (356 mm)
Normal Slitting Tolerance:		± 1/32 in ± 0.031 in. (± 0.8 mm)	

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Application Techniques/ Optimization

(For additional technical information, request 3M publication 70-0704-8798-1, "Notes on System Design and Performance".)

1. Thermally-conductive adhesive transfer tape is a homogeneous film of adhesive supported on a protective release liner. Do not remove this release liner prior to application of the tape to one of the substrate surfaces, as the transfer adhesive tape is not intended to be handled as a free-standing film.
2. Metals prone to forming loosely bound oxides or rusting, such as copper, may require treatment to passivate them (metal plating or plastic films, lacquers, etc.) prior to application of the tape.
3. Substrate surfaces should be clean and dry prior to application. Isopropyl alcohol (isopropanol) taken from a clean, previously-unused container and applied with a lint-free wiper or swab should be adequate for removal of most finger print oils, dust, etc. Do not use "denatured alcohol" or glass cleaners which often contain oily mineral spirits. A couple of minutes drying time for the alcohol should be allowed.

   More aggressive solvents (such as acetone) may be required to remove heavier contamination (grease, machining oils, solder flux – including "no-clean" solder flux) and should be followed with final isopropanol wipe.

   Note: Be sure to follow the manufacturer's precautions and directions for use when using solvents.

   Some plastic-molded electronic components can be heavily contaminated with silicone mold-release agents and may need abrasive cleaning (e.g., 3M™ Scotch-Brite™ pad) and/or priming to make them amenable to the tape.

   Do not touch fingers to the exposed adhesive, as this may deposit oils or create wrinkles.
4. With the release liner in place, apply tape to one of the surfaces to be bonded in a manner that will avoid air entrapment. A roller (or careful use of fingers) is often used. The temperature of the tape and substrates should not be less than 60°F (16°C) as this will stiffen the adhesive and be detrimental to proper contact between adhesive and substrate.
5. Trim excess tape if necessary (or use die-cut or fabricated parts).
6. Remove release liner to expose second face of adhesive.
7. Align second substrate over exposed adhesive and press the two parts together (or use a roller if one of the substrates is flexible) for a few seconds. Optimal thermal and mechanical results will be obtained when the adhesive wets 100% of the surfaces of both substrates. The pressure and time necessary to achieve this will depend on the roughness, non-planarity and stiffness of the substrates in relation to the thickness of the adhesive chosen. Methods of force application such as sequentially pressing for a short time in several places, or heating the parts and adhesives to 158°F-212°F (70°C-100°C) can help reduce the force or assembly time required to achieve the same degree of contact. Experiment with assembly methods by bonding parts to a flat glass plate and inspecting through the reverse side of the glass for air entrapment under the adhesive.
8. Reworking the bond: mechanically separate the parts, using torque for rigid parts and peel for flexible ones. Remove the adhesive by rubbing it off with a pad such as a 3M™ Scotch-Brite™ pad, clean up the site and apply new adhesive. The force needed to separate the parts and/or remove the adhesive can be reduced by softening the adhesive by heating 158°F-212°F (70°C-100°C) or using solvents such as acetone.

   Note: Be sure to follow the manufacturer's precautions and directions for use when using solvents.

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For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550. Address correspondence to: 3M Bonding Systems Division, 3M Center, Building 220-7E-01, St. Paul, MN 55144-1000. Our fax number is 612-733-9175. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-809-750-3000. In Mexico, phone: 5-728-2180.

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ISO 9002

This Bonding Systems Division product was manufactured under a 3M quality system registered to ISO 9002 standards.

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