

3M™ Tapes for Solar Panel Fabrication

A hand is shown applying a clear adhesive tape to the edge of a solar panel. The background shows a factory setting with a large roll of tape and a bright sun in a blue sky.

Reliable
Tapes
for the
Solar Industry

3M

Engineered to improve product reliability

More than 80 years ago, 3M invented the world's first practical pressure-sensitive tapes. Today, we are a leading manufacturer of adhesive tapes for industry, consumer and office use — offering a broad range of high-performance and specialty tapes for bonding, protecting, masking, appearance, cushioning, mounting, enhancement and more.

...and reduce your costs

These technologies are proving their utility in the manufacture of solar panels and other components, where they are increasingly being used to help control costs, speed assembly and potentially improve product reliability.

This brochure includes a number of other examples of how 3M tape technologies can benefit you. If you have an application that is not addressed in these pages, we invite you to challenge us with your specific requirements. Learn how 3M offers you the most productive and profitable solutions under the sun.



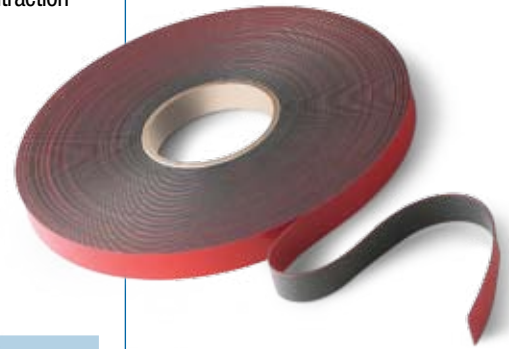
Solar panel photo courtesy of Hennepin County Public Affairs

3M™ Solar Acrylic Foam Tapes

Reliable and immediate bonding

The technology behind 3M™ Solar Acrylic Foam Tapes has been used around the world since 1980 to replace liquid adhesives and mechanical fasteners in permanent bonding and sealing applications. These applications range from assembly of electronic hand-held devices and commercial signage to architectural cladding and glazing on skyscrapers.

- Acrylic adhesive chemistry offers long-term outdoor durability against heat and UV
- Closed-cell foam construction seals against dust, dirt, and rain
- Viscoelastic response of foam accommodates for differential thermal expansion/contraction between bonded surfaces
- Uniform thickness provides consistent separation between bonded surfaces when optical path-length is critical, as in Concentrated Photovoltaic (CPV) applications
- Saves time and money – pressure sensitive adhesive tape holds immediately and neatly without the mess, clamping and curing time of liquid adhesives and sealants



3M™ Solar Acrylic Foam Tapes - 4000 Series

Product	Thickness		Density (lb/ft³)	UL*	Color	Key Features/Applications
	mil	mm				
4063	25	0.63	37	-	Black	Conformable acrylic foam tapes that adhere to a broad range of substrates – glass, metal, and several plastics. Typically used for junction box attachment, frame bonding and CPV applications
4080	32	0.8	37	746C		
4110	45	1.1	37	746C		
4155	62	1.55	37	746C		

*UL 746C category Q0QW2 file number MH17478

3M™ Solar Acrylic Foam Tapes - 3000 Series

Product	Thickness		Density (lb/ft³)	UL*	Color	Key Features/Applications
	mil	mm				
3230	90	2.3	43	746C	Grey	Thick acrylic foam tape for bonding rails to photovoltaic panels

*UL 746C category Q0QW2 file number MH17478

3M™ Solar Acrylic Foam Tapes - 2000 Series

Product	Thickness		Density (lb/ft³)	UL*	Color	Key Features/Applications
	mil	mm				
2063	25	0.63	52	-	Dark Grey	High temperature, firm acrylic foam tapes ideal for metal and glass substrates. Typically used for frame and CPV applications
2110	45	1.1	52	-		
2155	62	1.55	52	-		
2080	31	0.80	44	746C		

*UL 746C category Q0QW2 file number MH17478



3M™ Solar Acrylic Foam Tape attaches panels to the frame



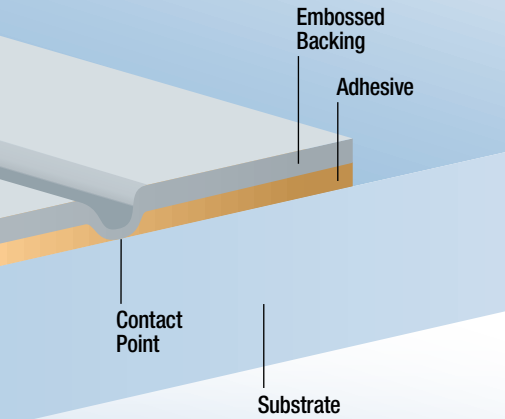
3M™ Solar Acrylic Foam Tape bonds and seals junction boxes to panel backs




3M™ Solar Acrylic Foam Tape bonds plastic to metal in CPV applications

3M™ Charge-Collection and Bus Tapes

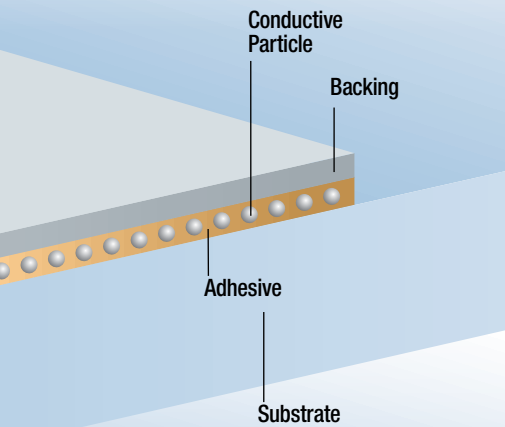
- Low resistance solutions for thin film photovoltaic applications
- Typical automation options offer faster installation than soldering
- Suitable for standard thin film laminating temperatures
- Consist of low outgassing pressure sensitive adhesives on metal foil backing




Charge-Collection and Bus

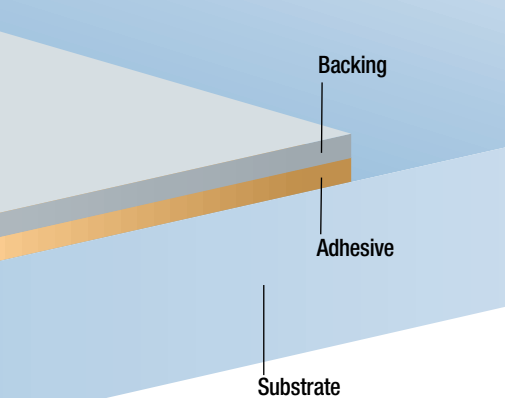
Product	Thickness		Adhesive		UL*	Highlights	
	mil	mm					
	6013	5	0.13	Non-Conducting	High Temperature	510	<ul style="list-style-type: none"> • Embossed foil tape for direct substrate contact • Non-corrosive acrylic adhesive • 1-ounce tin-plated deadsoft copper foil • Excellent for charge-collection over installed footprint
	6013V	4	0.11	Non-Conducting	General Purpose	510	


*UL 510 Flame Retardancy 1446 for UL1703 Category OANZ2 file number E17385



Product	Thickness		Adhesive		UL*	Highlights	
	mil	mm					
	1007	2.6	0.07	Conducting	High Temp	510	<ul style="list-style-type: none"> • Electrically conductive, particle filled non-corrosive acrylic adhesive (silver coated glass bubbles) • 1-ounce tin-plated deadsoft copper foil • Excellent for charge-collection over installed footprint
	1007V	2.6	0.07	Conducting	General Purpose	510	

*UL 510 Flame Retardancy 1446 for UL1703 Category OANZ2 file number E17385



Product	Thickness		Adhesive		UL*	Highlights	
	mil	mm					
	1007N	2.6	0.07	Non-Conducting	High Temp	510	<ul style="list-style-type: none"> • Non-conductive adhesive • Non-corrosive acrylic adhesive • 1-ounce tin-plated deadsoft copper foil • Excellent for bus applications

*UL 510 Flame Retardancy 1446 for UL1703 Category OANZ2 file number E17385

3M™ Dielectric Tapes

- Excellent high temperature tapes for crystalline silicon (c-Si) and thin film applications
- Reliable electrical insulation
- Automation potential allows for rapid application – high productivity
- Low outgassing adhesive
- Available in custom widths

Product	Carrier Type	Carrier Thickness		Total Thickness		UL*	Dielectric Breakdown Strength	Outgassing** (micrograms/in ²)	Typical Applications
		mil	mm	mil	mm				
Double Coated Dielectric Carrier with Non-conductive High-temp Acrylic Adhesive									
3514	PET	1.0	0.025	5.6	0.14	510	6.7kV	57	Insulating bus from substrate in thin film applications
3504	PET	0.5	0.013	1.5	0.04	510	4.9kV	14	
1508	PET	1.0	0.025	3	0.076	-	6.3kV	10	

* UL 510 Insulating Category OANZ2 file number E230409

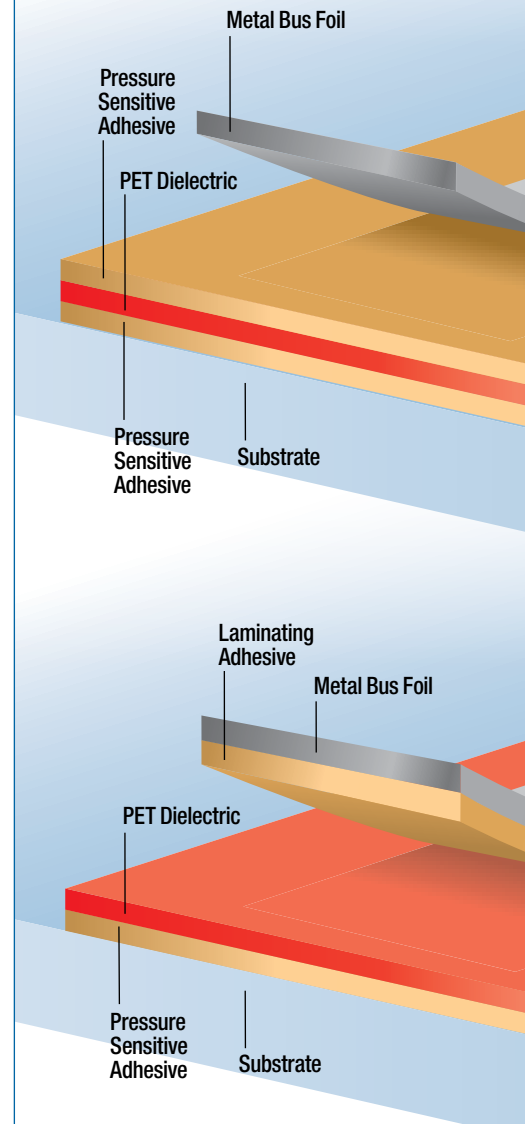
** Outgassing 160°C 30 minutes static headspace

Product	Backing Type	Backing Thickness		Total Thickness		UL	Dielectric Breakdown Strength	Outgassing** (micrograms/in ²)	Typical Applications
		mil	mm	mil	mm				
Single Coated Dielectric Backing with Non-conductive High-temp Acrylic Adhesive									
8006C	PET	0.9	0.02	1.9	0.05	-	5.9kV	2	Insulating bus from substrate in thin film applications
1506	PET	1.0	0.025	2.5	0.063	-	5.5kV	10	
51018	PET	1.0	0.025	2	0.051	-	5.6kV	10	

** Outgassing 160°C 30 minutes static headspace

Product	Liner Type	Adhesive Thickness		UL	Dielectric Breakdown Strength	Outgassing** (micrograms/in ²)	Typical Applications
		mil	mm				
Laminating Adhesive							
501W	NA	1	0.025	-	1.2kV	11	Adhesive for bus/ribbon metal foils

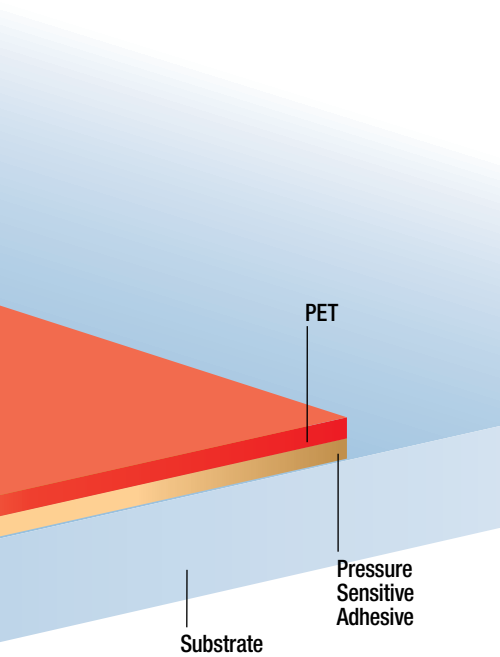
** Outgassing 160°C 30 minutes static headspace



3M™ Specialty Tapes

For PV laminates

- Compatible with typical lamination processes
- Durable materials for long term applications
 - Cosmetic masking - Acrylic adhesive
 - Cell positioning - Polyester backing



Product	Total Thickness		Backing Type	Adhesive Type	Color	Key Features/Applications
	mil	mm				
8006C 8006R 8006B 8006W	1.9	0.048	Polyester	Acrylic	Clear Red Black White	<ul style="list-style-type: none"> • Low outgassing • Can be used to hide visual components such as electrical traces • Can also be used as a dielectric tape
8306	2.2	0.056	Polyester	Acrylic	Clear	<ul style="list-style-type: none"> • Solvent resistant • Low outgassing
1306	2.5	0.064	Polyester	Acrylic	Black	<ul style="list-style-type: none"> • Excellent flagging resistance • Printable

For Electrical Wire Bundling Applications

- Excellent electrical properties
- Conformable

Product	Total Thickness		Backing Type	Adhesive Type	Color	Key Features/Applications
	mil	mm				
4414	5.5	0.139	Polyester	Rubber	Caramel Translucent	<ul style="list-style-type: none"> • Puncture resistant • Excellent electrical properties • UL recognized • Class B (130°C) • Conformable/Dielectric Breakdown = 5.6kV • Excellent high-temp shear properties



3M™ Performance Label Materials

Durable solutions for variable data

3M supplies a complete range of materials that will ensure the correct identification and labeling of solar modules.

Materials	Print Method	Facestock (mils) Adhesive Type (mils) Liner (mils)	Aluminium	Glass	Backsheet	Durability	
						UV	Temp.
7816 ¹	Flexo, TT	White Polyester Gloss TC (2.0) 310 (0.8) 55# Densified Kraft (3.2)	●	●		Good	Good
7868	Flexo, TT	White Polyester Gloss TC (2.0) 350 (1.1) 55# Densified Kraft (3.2)	●			Good	Good
FM055702 ^{1,2}	Flexo, TT	White Polyester MC (2.0) P1280 (1.2) 50# SC (3.2)	●	●	●	Good	Good
7871	Flexo, TT	White Polyester Gloss TC (2.0) 350 (1.8) 55# Densified Kraft (3.2)	●			Good	Good
7875	Flexo, TT	Platinum Polyester Gloss TC (2.0) 310 (0.8) 55# Densified Kraft (3.2)	●	●		Good	Good
7872	Flexo, TT	Platinum Polyester Gloss TC (2.0) 350 (1.8) 55# Densified Kraft (3.2)	●			Good	Good
7847	Laser Etch	Matte Black/White Acrylate (2.4) 350 (1.2) 55# Densified Kraft (3.2)	●			Excellent	Excellent
7848	Laser Etch	Matte Silver/Black Acrylate (2.4) 350 (1.2) 55# Densified Kraft (3.2)	●			Excellent	Excellent

Overlaminates	Facestock Clarity	Facestock (mils) Adhesive Type (mils) Liner (mils)	Description	Durability				
				UV	Abrasion	Moisture Resistance	Temp.	Chem.
7730FL	Polyester Clear	Clear Polyester NTC (1.0) 400 (0.8) Polyester Film (1.5)	Suitable for indoor and outdoor use	Good	Good	Excellent	Good	Excellent
7733FL	Polyester Clear	UV Resistant Polyester NTC (1.0) 400 (0.8) Polyester Film (1.5)	Resists UV exposure to protect images	Excellent	Good	Excellent	Good	Excellent
7735FL	Acrylate Clear	Clear UV Resistant Acrylar™ (3.0) 400 (0.8) Polyester Film (1.5)	Provides extended outdoor durability to protect images	Superior	Good	Excellent	Fair	Excellent

¹ Passes UL969 water immersion test on solar panel glass surfaces, as well as other standard surfaces. Reference UL file number MH16411.

² Offers most durable bond available for solar panel backside barrier surfaces.

TC= Top Coat
MC= Micro Cavitated
TT= Thermal Transfer
NTC= Non-Top Coated



Note: For specifics on 3M product listing regarding UL standards, go to www.ul.com. This technical information and data should be considered representative or typical only and should not be used for specification purposes.

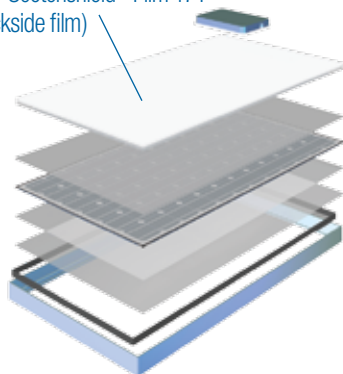
Other Products from 3M

3M™ Scotchshield™ Film 17T

UL Recognized Component



3M™ Scotchshield™ Film 17T
(backside film)



3M™ Scotchshield™ Film 17T is a backside barrier film for photovoltaic solar modules. The outer surface is treated to facilitate the use of a broad range of adhesives, tapes and labels. Similar to other commercially available backside films, it utilizes a fluoropolymer layer as a key component. Fluoropolymers are well known to have excellent resistance to degradation from sources such as UV, heat and moisture. Their weatherability exceeds that of non-fluorinated materials. 3M™ Scotchshield™ Film 17T is designed for easy use by module manufacturers. It can be used as received with most existing production equipment and cycles, with no pre-treating required. During lamination, strong, stable, bonds are formed to standard peroxide curable EVA encapsulants. Features include:

- Conformable and flexible, for ease of lamination
- Robust processing window for wrinkle-free lamination
- Excellent retention of interlayer adhesion after environmental aging
- Excellent UV stability
- Very low moisture vapor transmission rate
- Solvent-free process, no residual solvents
- Resilient, low flammability fluoropolymer
- No special packaging or storage required
- 1100 VDC rating (IEC 60664-1)

3M Weathering Resource Center

Established over 60 years ago as a testing laboratory for reflective traffic control materials, 3M's state-of-the-art weathering facility is used to test various environmental factors, such as long-term exposure to heat and UV radiation, that could affect the performance of various tape substrates and bonding systems, including films for solar panels. Using both accelerated lab studies and data collected at multiple outdoor sites located in strategic climatic areas worldwide, we can continually improve our ability to produce durable, reliable tapes and other materials that will stand up to the elements.



For more information on our solar manufacturing product line, contact 3M Renewable Energy at 800-755-2654 or visit us at www.3M.com/solar.

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