

3M™ Products for Solar Energy

Designed  
for efficiency.  
Built to last.



A large-scale solar farm is shown under a clear blue sky. The foreground is dominated by tall, golden-brown grass. In the middle ground, a large solar panel array is mounted on a dark metal structure. The panels are blue with white grid lines. In the background, several white wind turbines are visible against a hazy horizon. The overall scene is bright and sunny.

From factory to field,  
3M is with you.  
Every step of the way.

**Making solar power more efficient.  
More reliable. And more affordable.**

For more than 40 years, 3M has been a trusted supplier of advanced materials for the solar industry. From durable films that can replace glass to the adhesives that hold panels in place, 3M products are engineered to enhance performance, improve reliability, and drive down the cost per watt and the cost of each kilowatt hour produced. As one of the world's leading suppliers of advanced films, tapes, coatings and adhesives, we have the ability to supply products and provide technical support around the world.



## Applications for 3M™ Solar Energy Products

**Light optimization**

**Power optimization**

**Module assembly solutions**

- ▶ Crystalline silicon (c-Si)
- ▶ Rigid thin film
- ▶ Flexible thin film
- ▶ Concentrated photovoltaics (CPV)

# Light Optimization



## 3M™ Solar Light Redirecting Film

3M™ Solar Light Redirecting Film (LRF) is a microstructured reflective film that is applied over cell tabbing ribbons to recapture a significant portion of light that would otherwise be reflected out of the module. Use of LRF over tabbing ribbons results in 1.5–2.5% increased module power by increasing the amount of light on the cells. The product is designed to be easily integrated into automated module assembly processes.



Photo courtesy of SOLAR

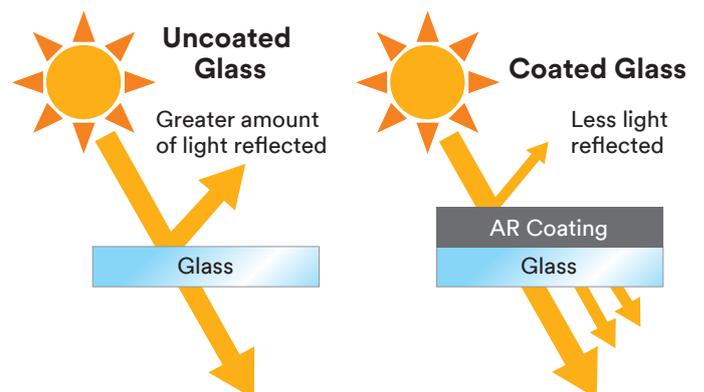
## 3M™ Cool Mirror Film

3M™ Cool Mirror Film is an all-polymeric wavelength-selective mirror film designed to reflect wavelengths of high conversion efficiency in PV modules, transmit longer infrared wavelengths, and absorb ultraviolet wavelengths. The film can be used in low-concentration PV (LCPV) configurations to help increase the amount of light on PV modules, thus significantly increasing energy production while limiting module heating. Increases in annual energy production of up to 15–34% have been demonstrated versus non-concentrated configurations when using Cool Mirror panels in LCPV configurations\*.

\* Energy production improvement varies depending on latitude of installation, time of year, PV module tilt, and mirror panel tilt.

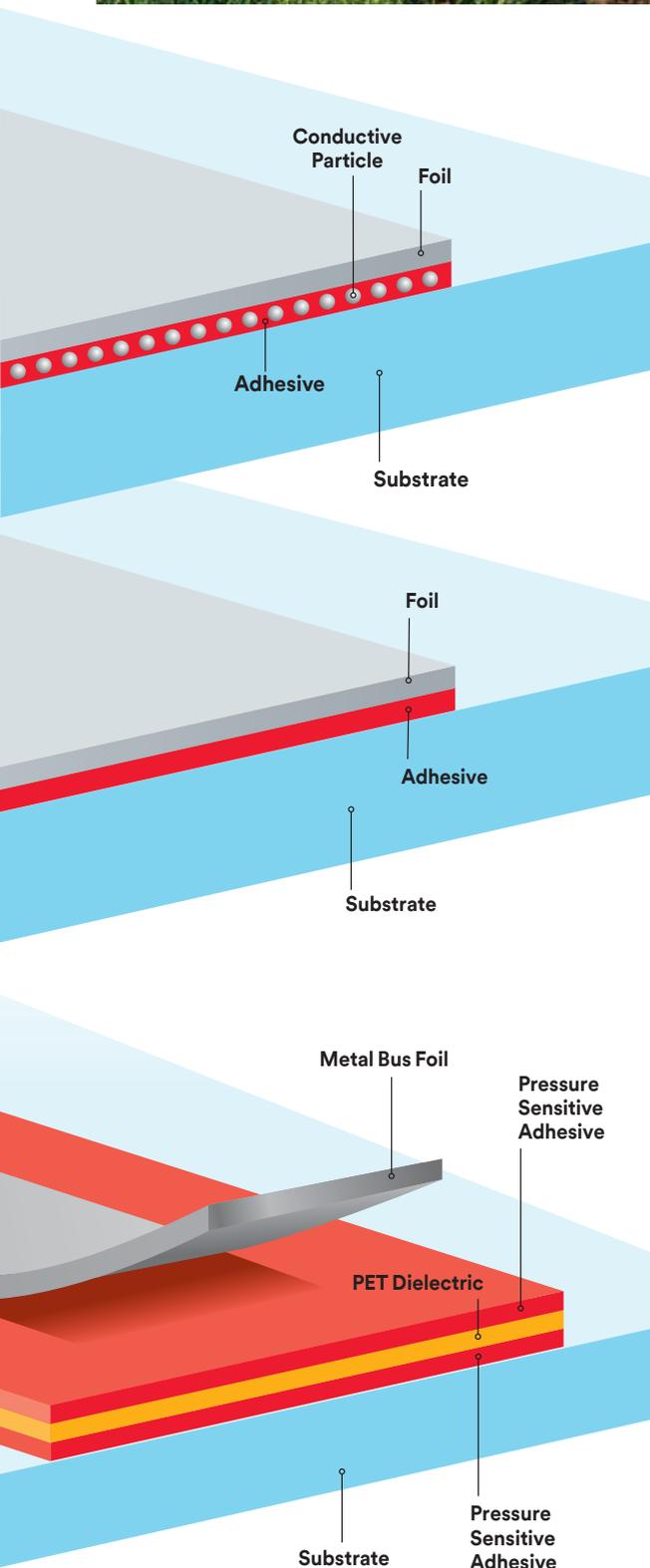
## 3M™ Anti-Reflection Coatings

The 3M™ Anti-Reflection (AR) Coating portfolio includes water-based and solvent-based products that help increase front glass transmission, thereby raising solar module efficiency. The water-based products provide a hydrophilic surface, which has been demonstrated to provide a degree of anti-soiling performance in the field. Designed specifically for OEM use, the products are applied to glass prior to tempering, which increases the coating's durability and resistance to UV, humidity, and abrasion. The products are formulated to apply uniformly, thus reducing the rate of coating defects.





# Power Optimization



## 3M™ Charge-Collection and Bus Tapes

3M™ Charge-Collection Solar Tapes consist of tin-plated copper foil with acrylic-based, pressure sensitive adhesives used in thin film solar applications requiring x, y, and z-axis conductivity. These tapes can be applied at high speeds using automation equipment. Because there is no curing required (as with liquid conductive adhesives) they allow for high productivity during panel manufacturing.

- ▶ Stable electrical performance
- ▶ Compatible with typical lamination processes
- ▶ Tin-plated foil allows for solderability
- ▶ Available in many formats to suit different manufacturing processes



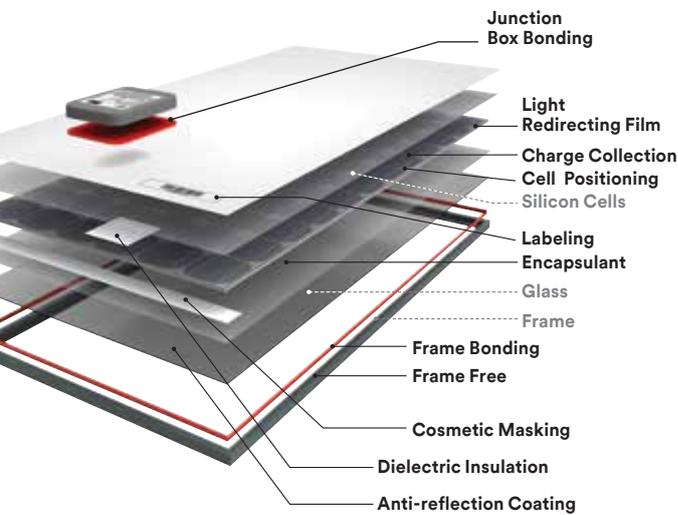
## 3M™ Dielectric Tapes

3M™ Dielectric Tapes perform as reliable insulators when used in conjunction with buses/foils in thin film solar panels. They consist of a polymeric film with acrylic adhesive on one or both sides. These tapes can be applied at high speeds using automation equipment, resulting in high productivity during panel manufacturing.

- ▶ Compatible with typical lamination processes
- ▶ Available in one- and two-sided adhesive versions
- ▶ Available in many formats to suit different manufacturing processes

# Module Assembly Solutions

## Crystalline Silicon (c-Si) Solutions



3M solar materials offer excellent protection from extreme weather conditions, including high temperatures and moisture that can damage modules and decrease system lifetime. At the same time, these advanced materials are designed to work together to help increase energy output – driving down the cost per watt, while helping to improve your potential profit.

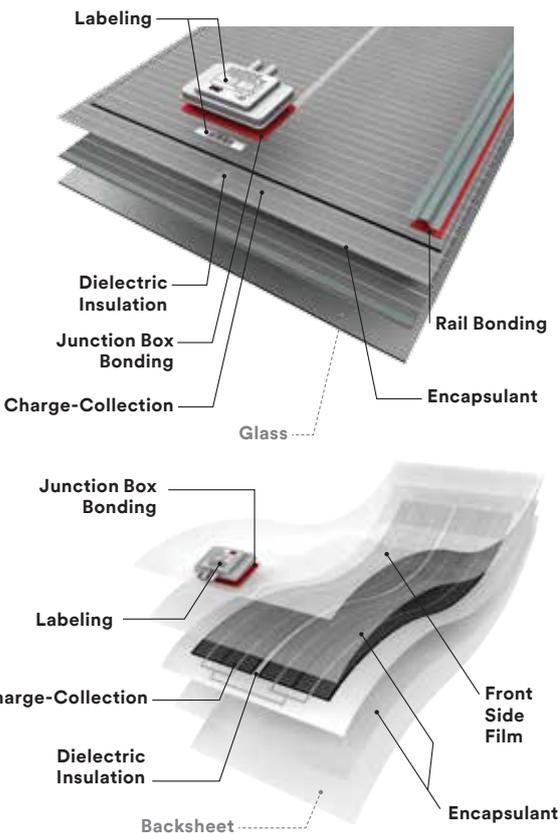
## 3M™ Solar Encapsulant Film

3M™ Solar Encapsulant Films are fast-cure encapsulants designed to work with PV modules.

They protect against UV damage and weathering, while allowing broad band light transmission to solar cells. Conformable and flexible film is easy to laminate and features a low shrinkage rate. The films offer excellent broadband light transparency, strong adhesion and elasticity properties required for solar cell encapsulation.



## Thin Film Solutions



## 3M™ Ultra Barrier Solar Films

Transparent 3M™ Ultra Barrier Solar Film can be used to replace glass – enabling high efficiency, lightweight, flexible photovoltaic (PV) modules. Designed to address the needs of flexible thin-film solar manufacturers, 3M Ultra Barrier Solar Film offers high light transmission, superb moisture barrier performance and excellent weatherability. 3M Ultra Barrier Solar Film is a UL certified component.



## 3M™ Solar Acrylic Foam Tapes

For over 30 years, industries worldwide have been using 3M™ Solar Acrylic Foam Tape technology to permanently bond and attach many substrates. The acrylic-based chemistry makes it ideal for critical applications that demand durability, including automotive, electronics, signage, glazing and construction markets.



### ▶ Frame Bonding

UL-Certified 3M Solar Acrylic Foam Tapes can provide durable attachment solutions for solar module frames. The immediate holding feature allows for high throughput during manufacturing. Compared to sealants, there is no need to clean off any excess material, resulting in less labor and a more professional look.

### ▶ Rail Bonding

3M Solar Acrylic Foam Tapes are proven and accepted adhesives for attaching rails to PV modules and other long-term outdoor applications. They offer benefits including immediate handling strength, consistent bond quality due to ease of application in the bonding process, tolerance to thermal mechanical stresses, protection of bond interfaces through stress relaxation, weather resistance and long-term durability.

### ▶ Junction Box Bonding

3M Solar Acrylic Foam Tape technology enables rapid attachment of junction boxes to solar modules. The easy, no-mess application allows for faster fabrication and can result in a cleaner look, compared to liquid adhesives and mastics. These tapes are all UL certified.

## 3M™ EPE Film



3M™ EPE Films are multi-layer film products consisting of ethylene vinyl acetate (EVA) layers bonded to both sides of a polyester film. They can be used with crystalline silicon and thin-film solar cells in rigid and flexible modules. Applications include providing electrical insulation between components and serving as a cosmetic mask to provide consistent appearance.

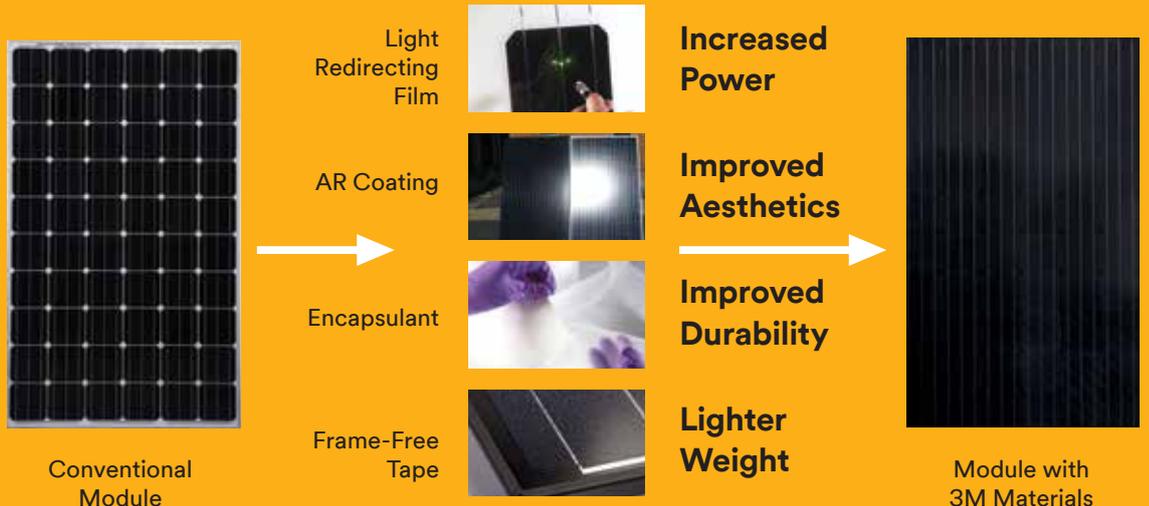
## 3M™ Specialty Tapes



3M provides a wide range of tapes designed specifically for use in PV modules. These durable tapes ensure reliable, long-term application for everything from cosmetic masking to cell positioning.

## Bringing it all together

Residential product solutions optimized for performance, aesthetics and reliability.



# Connecting you to a world of 3M resources.

## Your reliable supplier of technologies for solar modules

With over 100 years of experience in manufacturing roll goods, 70 years developing products for outdoor applications, and a proven history of producing renewable energy solutions for more than 40 years, 3M is ideally positioned to provide the solar power industry with innovative, reliable solutions.

From frame bonding to light redirecting film, our extensive portfolio is based on a platform of core technologies including light management, microreplication, films, adhesives and weathering. Because we produce both raw materials and finished goods, we are able to conduct extensive reliability testing – ensuring consistent high performance and optimal compatibility between module components.

Working with a single, dedicated supplier gives you one contact for many issues. And as a global company with operations in 70 countries, and laboratories in 36 countries, we have the ability to connect you with local 3M personnel to provide expert technical and business support almost anywhere in the world. Contact us today to see how our renewable energy expertise can help you increase the performance and reliability of your modules.

### 3M Global Footprint



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**For more information on our solar manufacturing product line, contact 3M Renewable Energy at 800 755 2654 or visit us at [3M.com/solar](http://3M.com/solar)**

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