



PHOTOVOLTAIC MODULES

Changes for the Better

Solid Products, Solid Company.



for a greener tomorrow



Mitsubishi Electric Corporation

Over 90 years of Excellence

From pushing the limits of precision in microelectronics to producing entire space satellites, Mitsubishi Electric has built up a reputation for innovating key technologies and achieving technological feats in a wide range of fields for nearly a century.

Especially for a long-term investment like photovoltaics, it is crucial to have a reliable and stable manufacturer to honor its warranties and provide lasting support. Mitsubishi Electric is the brand name that you can trust to be there for you in the long run... for centuries to come.

Just a few of our achievements

Power Semiconductors



DIP-IPMs are compact power semiconductors that realize dramatically enhanced efficiency. Used in home appliances and other diverse applications, they contribute to significant energy savings.

Transforming Equipment Development Technologies

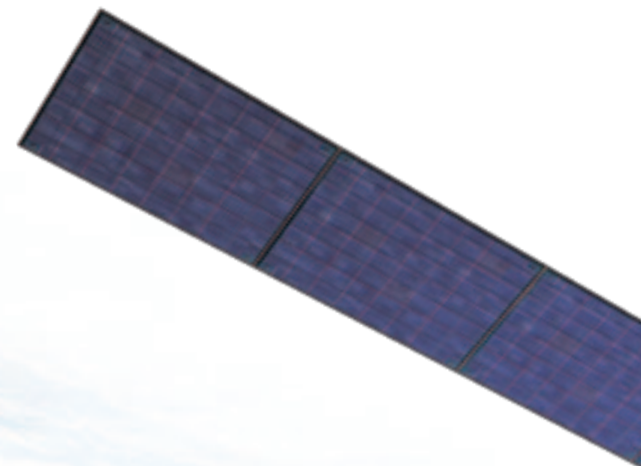


We verify the reliability of our transforming equipment through simulating severe natural environments including extreme cold/heat, lightning strikes and earthquakes at the world's largest testing facilities.

Hole-piercing Laser-processing Technologies for Printed Circuit Boards



High-speed, precision laser processing enabling printed circuit boards to be pierced with 4,500 holes per second; an FA technology supporting the evolution of smartphones.



1921

Mitsubishi Electric is branched off from Mitsubishi Corporation as a separate identity

1928

E52, the first large-scale electric locomotive produced in Japan



1935

Commencement of elevator & escalator production



1953

First commercial television release



1964

Completion of radar equipment for the weather station atop Mt. Fuji



1980

Debut of Diamond Vision display at Dodger Stadium in the United States



Our photovoltaic history

- 1974** ● Began research and development of photovoltaic technology.
- 1981** ● Commenced joint research on industrial-use photovoltaic inverters with New Energy and Industrial Technology Development Organization (NEDO) and on electric power utilities.
- 1987** ● Commenced research on residential-use photovoltaic inverters.
- 1998** ● 1998 Established a PV plant at Iida, Japan and began production of cells and modules.
- 2001** ● Awarded the 6th New Energy Award for residential hip-roof systems.
- 2003** ● Began the production of "lead-free solder" modules.
- 2008** ● Achieved the world record for polycrystalline cell efficiency of 18.6%.
- 2010** ● Completed a second, larger cell factory in Iida and began the production of high-efficiency monocrystalline cells and modules.



1990

Commercial release of the world's first car navigation system incorporating GPS



2000

Adoption of MISTY® technology as encryption standard for 3rd-generation mobile phones



2007

Completion of 173-meter-tall elevator testing tower (world's tallest at the time)



2008

Launch of SUPERBIRD-C2, Japan's first domestically produced commercial satellite



2011

"Hayabusa" Series E5, holder of the Japanese speed record for a train



Mitsubishi Electric's Monocrystalline

The technology and design of our products incorporates our comprehensive experience and extensive know-how in creating photovoltaic modules. The Mitsubishi Electric difference lies in all of the small details that add up for outstanding performance, reliability, and safety.

Technology

Mitsubishi Electric is constantly pursuing the latest in technological innovations and adapting the newest breakthroughs into our photovoltaic products.

Quality

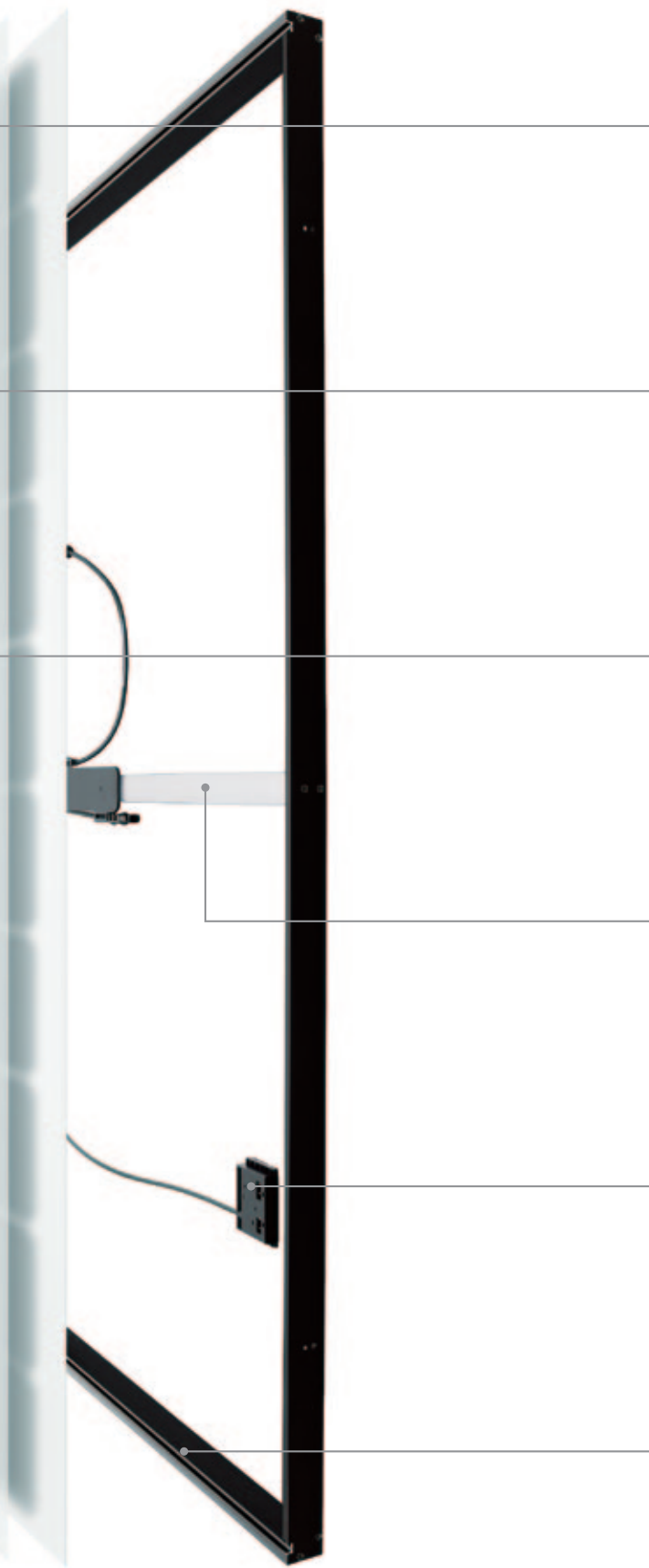
Total quality from design to manufacturing ensures optimal performance and safety of our products in the real world.

Reliability

Building upon almost a century of manufacturing experience since our founding in 1921, we know how to make our products last. Rest assured that we will be there for our customers in the long term.

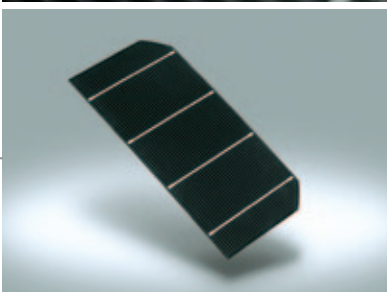


Premium Module Line



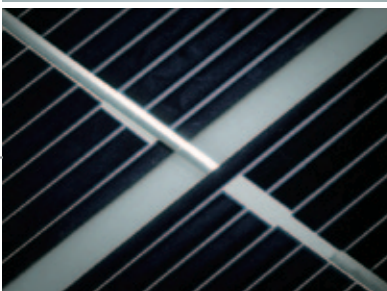
Mitsubishi Electric Logo and Traceable Barcode

Each module is tagged with a unique barcode which is used for greater product quality control and product traceability



High-efficiency 4 Busbar Monocrystalline Cells

New selective emitter and half-cut technologies boost cell efficiency



Flexible Cell Tab Wiring

Flexible tab material has been developed to reduce physical stress on the cells caused by thermal fluctuations



Improved Frame Design with New Protection Bar

A re-designed module frame with protection bar has improved overall module strength



New Junction Box Design with 4-layer Protection

New thermally efficient design reduces the amount of emitted heat by approximately 66% compared to earlier models.

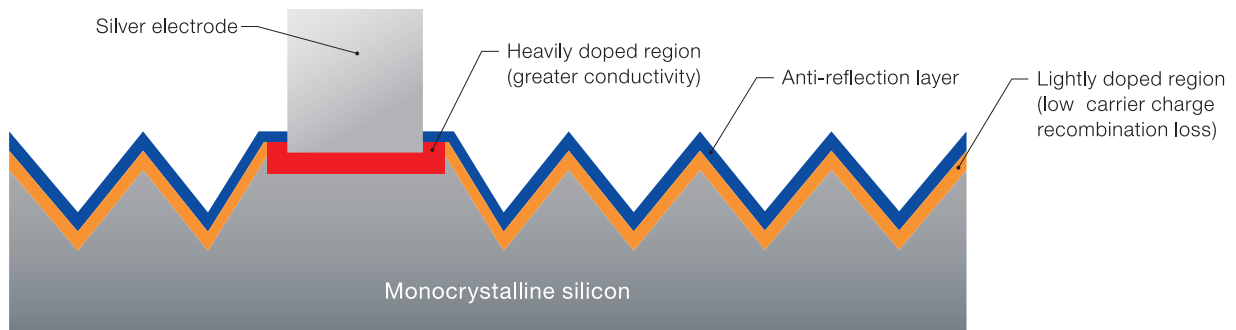


Excellent Durability and Protection

Our modules have an uncompromising design and are built to last. Installable even in areas with high salt concentrations in the air

Technology

Selective Emitter



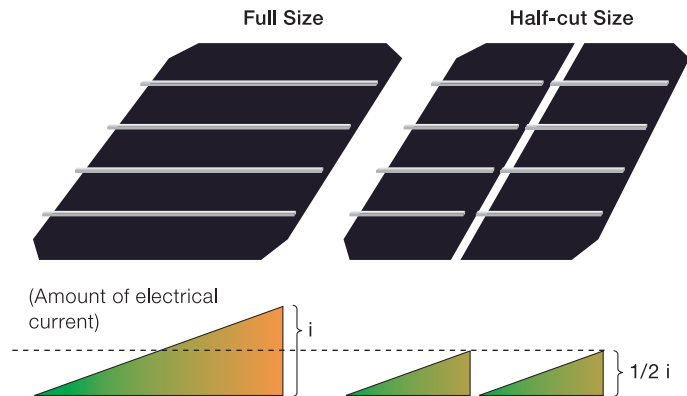
In a standard doping process, silicon wafers are doped with phosphorus to create a P/N junction. The level of doping concentration was a trade-off between conductivity with the cell electrodes and carrier charge recombination. Higher concentration levels leads to higher conductivity, but more carrier charge losses, and vice versa.

As a solution, Mitsubishi Electric has introduced a new selective emitter process in which only the area in contact with the electrodes is doped with high concentrations to maintain both high conductivity and low carrier charge losses. This improvement has resulted in an increase in cell output of approximately 5%.

Half-cut Cell

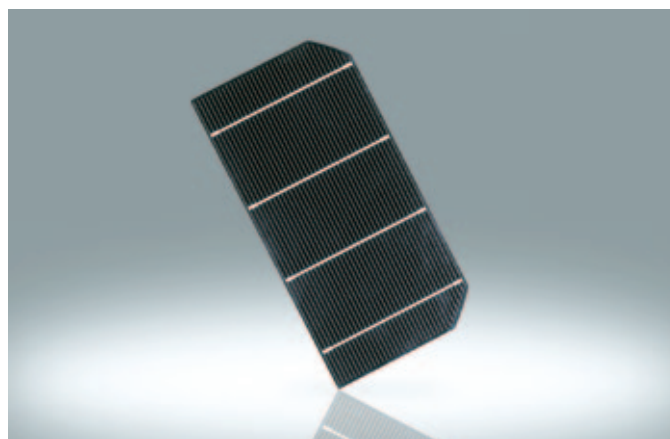
By reducing the area of each cell and connecting them in a parallel formation, the amount of electrical current carried by each busbar is reduced by half. This results in decreased electrical resistance within the busbars and an increase in overall efficiency of about 2.5%.

Cells are cut with a special process using a high-precision laser to maintain the integrity of the cell.

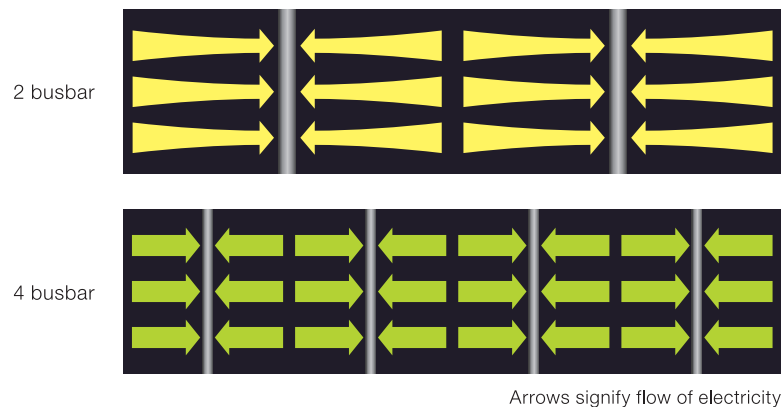


$$\text{electrical losses} = \text{current}^2 \times \text{resistance}$$

By using half-cut cells, the electrical current (i) flowing in each busbar is halved. Therefore, the amount of internal losses in a half-cut module is 1/4 of a full sized cell module.



4 Busbar Cell

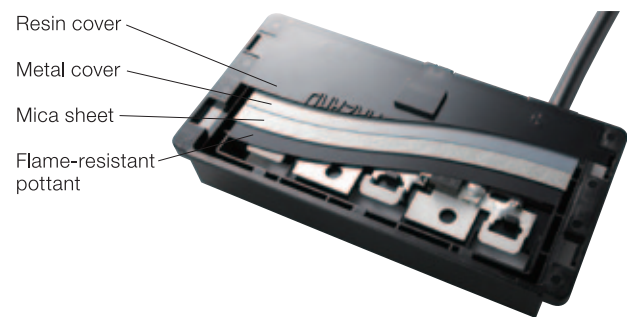


Through an industry-leading innovation of integrating 4 busbars into each cell, internal electrical resistance is reduced, boosting cell output by 3%*. This is possible because the distances between the busbars are shorter and less current flows through each smaller electrode where resistance is the highest.

*Approximate improvement compared to a standard 2 busbar cell.

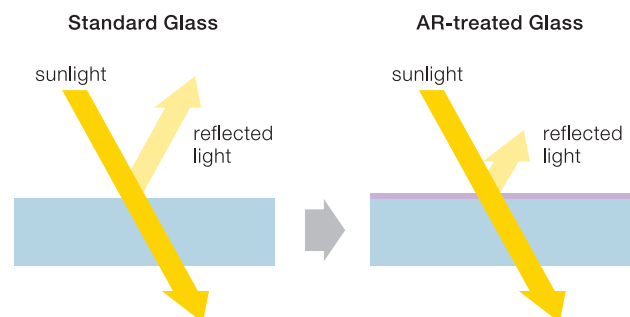
Newly Re-designed Junction Box

The junction box has been completely re-designed from the ground up. The thermal characteristics have been vastly improved since our last series, reducing the amount of emitted heat by approximately 66%. Top safety and fire protection has been maintained with our unique four-layer encapsulating design. In the highly unlikely event that a fire should occur, the junction box is designed to enclose the flames, and not let them spread to other areas. Certified as IP67, the highest defined standard for water and dust sealing.



Anti-reflective Glass

An anti-reflective coating has been added to the glass of our modules. It improves the light transmittance of the glass by reducing the amount of reflection on the surface. This improvement has led to a module output increase of 2%. Furthermore, Mitsubishi Electric modules use a non-porous type of anti-reflective coating, which is more resistant to the adhesion of dust than porous types.



Lead-free Solder

Mitsubishi Electric was the first Japanese manufacturer to introduce (and still use) 100% lead-free solder in the inter-cell connections as another initiative contributing to environmental protection.

Quality

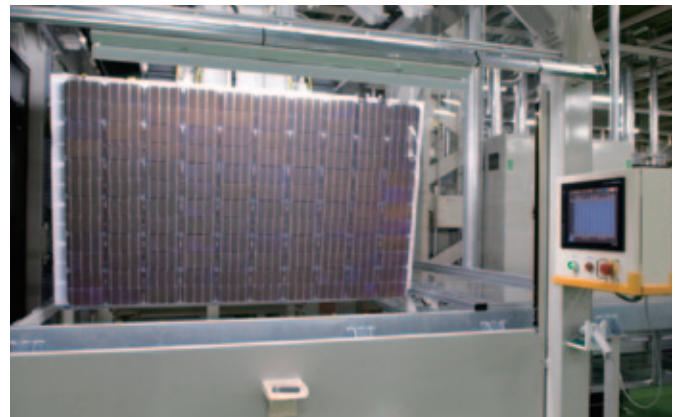
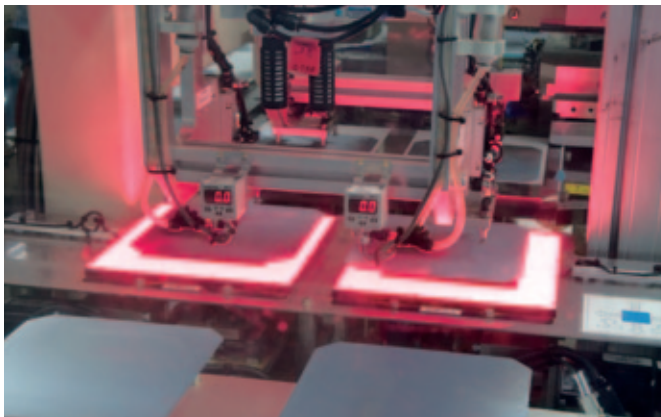
Positive Tolerance

Modules are measured and sorted so that output wattages are always above the nominal label rating.

Taguchi Method

By integrating the quality control methods of Genichi Taguchi, a renowned engineer and statistician, we have been able to optimize our quality management processes and further expand the range of production quality controls. As a result, our products boast not only very high, but also a very stable level of production quality.

Production from the Cell to Module



Mitsubishi Electric has been manufacturing cells and modules in its own state-of-the-art factories for over 15 years. 100% of our modules are assembled and produced in our own facilities in Japan.

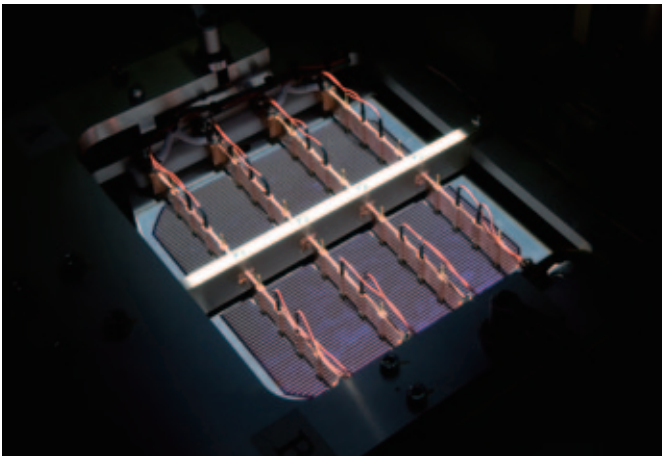
Highly Automated Production Line



From assembly to inspections, our module lines are highly automated with our own factory automation equipment developed in-house. For example, using ccd camera imaging to align busbars for soldering or to detect mispositioned cells in an array, the high precision machines ensure an unsurpassed level of production uniformity and the ability to conduct greater quality inspections than traditional manual methods.

Cell Uniformity

Every cell we produce is measured for electrical characteristics and undergoes a very strict selection process before being assembled into a module. This ensures that all cells in the module have uniform characteristics for optimal performance.



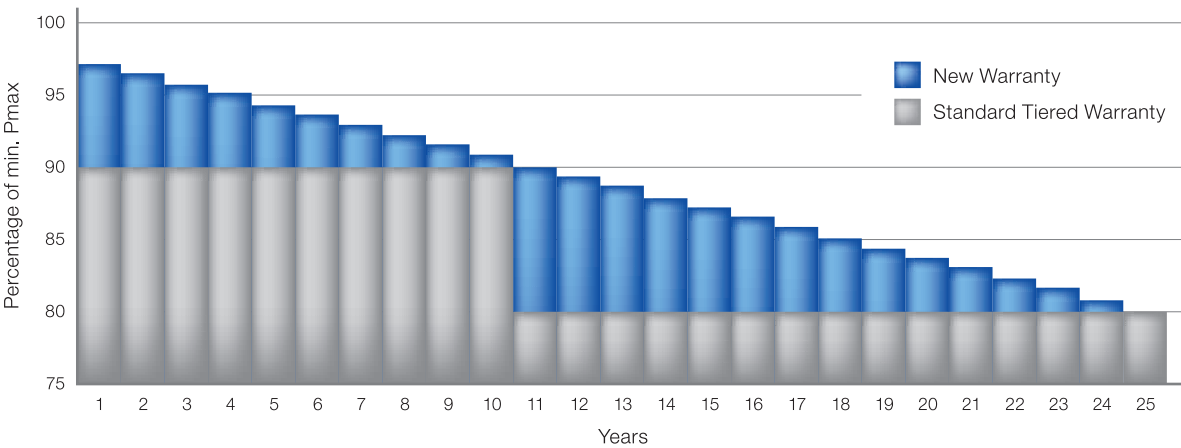
Module Barcode

Every individual module is marked with a unique identifiable barcode, which is used for tracking the module through all production steps as part of our quality control.



Linear Output Warranty

The new module series now feature a 25-year linear output warranty, which guarantees 5.5% more output performance than a standard tiered warranty. The improved warranty is based on our unwavering confidence in the quality of our products, and meticulous confirmation of the real-world performance data. Backed up by one of the most stable companies in the world, our customers can rest assured that we will stand behind our promises now and in the long-term.



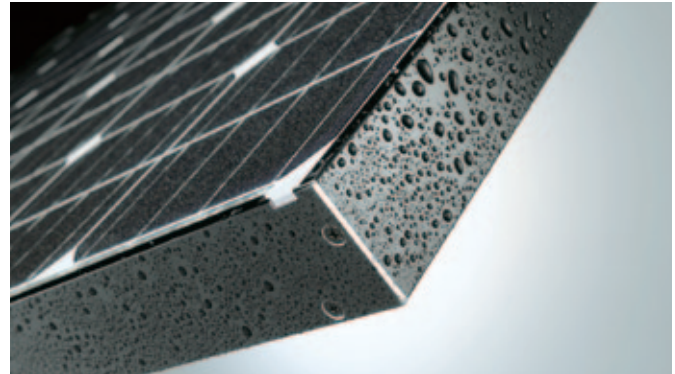
Reliability

Improved Frame

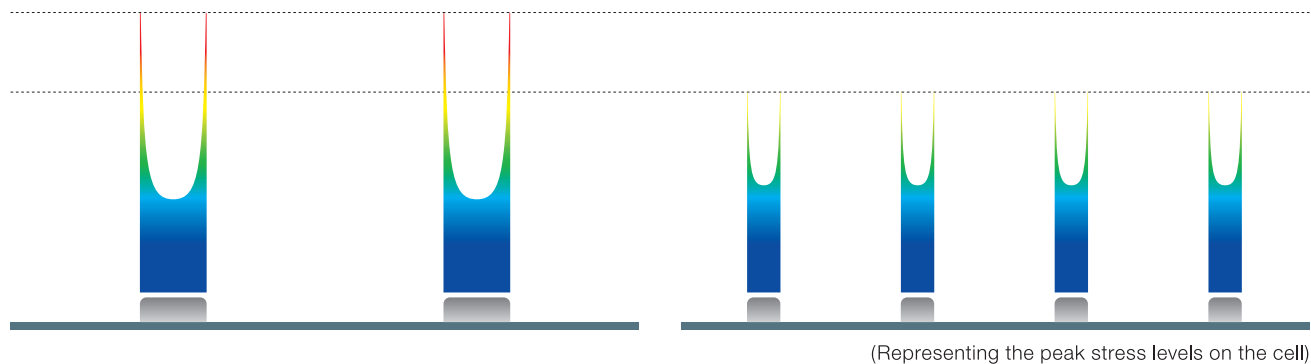
Our classic L-frame design has been improved with a smarter protection bar insert and redesigned end frames. As a result, the strength of the new frame has increased by approximately double that of the original L-frame. In addition, modules can now be installed by clipping the shorter sides, simplifying system design and installation.

Double Corrosion-resistant Frame Coating

The highly durable aluminum frame is treated with two separate corrosion-resistant coatings for excellent durability and a beautiful finish. Even the individual screws have double anti-corrosive coatings for lasting protection.



4 Busbar Cell Strength



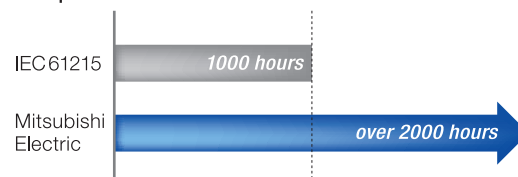
The 4 busbar cell has a more uniform tab stress dispersion than cells with fewer busbars. Because the stress peaks of the cell are lower, it is less prone to cracking.

Internal Testing Standards

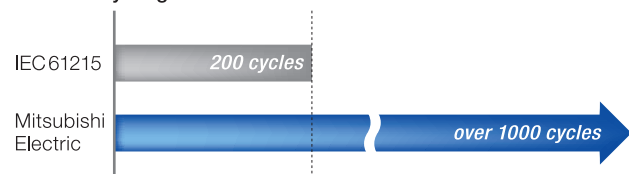
At Mitsubishi Electric, our philosophy is to make products that will last. Our PV modules undergo very rigorous internal testing, using strict parameters that are well above those required by international standards. Only after we have confirmed the reliability of the module's design do we introduce it into mass production.

Some examples of Mitsubishi Electric's reliability standards

Damp Heat Test



Thermal Cycling Test



High Snow Load

Our modules have been designed to withstand harsh environmental conditions, such as in areas with high snowfall. The high structural strength of the modules has passed the IEC 61215 static loading test at 5400Pa.



Installable in Areas with High Salt Concentration

Normally, high salt content in the air (such as in areas next to the ocean) can do serious damage to the structural integrity of a PV module, and can also pose an electrical safety hazard by causing corrosion. However, due to the intelligent design and high quality of the materials used, our modules can be safely installed in areas with high salt concentration in the air*.

*Excluding areas in which the module comes into direct contact with salt water.



The frame and laminate are designed so that a strong physical and electrical barrier is maintained even in harsh environments.

Real-World Field Test

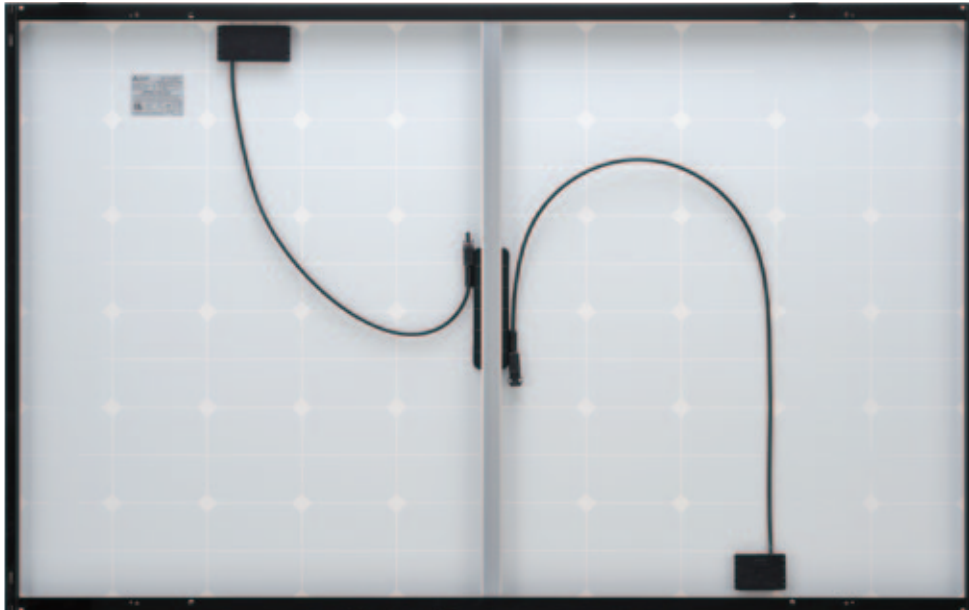
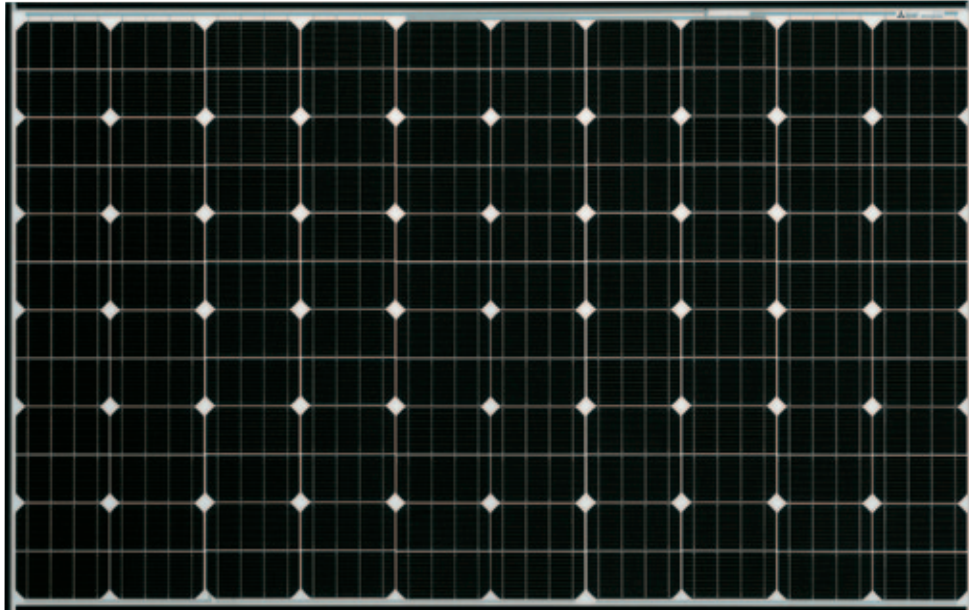
In addition to our accelerated testing in the laboratory, we have also been monitoring the performance of our products in real-world field testing. For example, we have installed our modules near the seaside in Okinawa where the high salt content in the air poses a high threat of chemical corrosion to metal. Our modules have been working perfectly and safely as a testament to the true quality of the product.



Product Line-up

PV-MLE Series

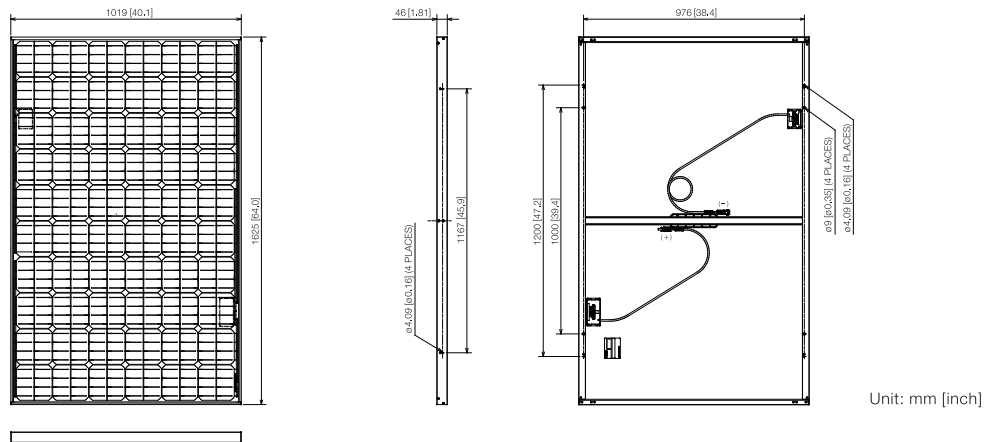
High-efficiency modules featuring half-cut monocrystalline cells



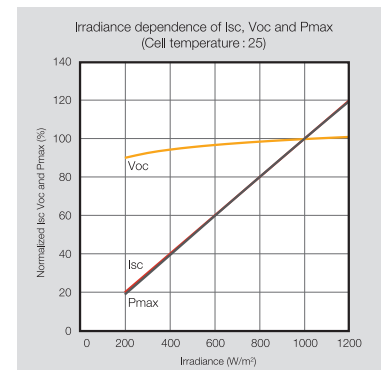
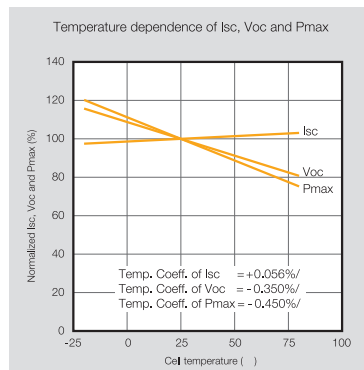
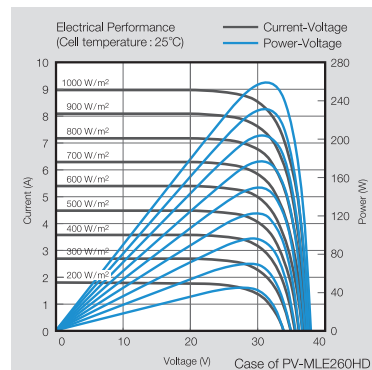
Specifications

Model name	PV-MLE255HD	PV-MLE260HD	PV-MLE265HD
Cell type	Monocrystalline silicon, 78mm × 156mm		
Number of cells	120 cells		
Performance at STC			
Maximum power rating (Pmax)	255W	260W	265W
Warranted minimum Pmax	255.0W	260.0W	265.0W
Tolerance of Pmax	-0 / +5%		
Open circuit voltage (Voc)	37.8V	38.0V	38.2V
Short circuit current (Isc)	8.89A	8.98A	9.08A
Maximum power voltage (Vmp)	31.2V	31.4V	31.7V
Maximum power current (Imp)	8.18A	8.29A	8.38A
Performance at NOCT*			
Maximum power rating [Pmax]	185W	189W	192W
Open circuit voltage [Voc]	34.5V	34.7V	34.9V
Short circuit current [Isc]	7.19A	7.27A	7.35A
Maximum power voltage [Vmp]	28.0V	28.2V	28.4V
Maximum power current [Imp]	6.60A	6.69A	6.76A
Normal operating cell temperature (NOCT)	45.7°C		
Maximum system voltage	600V (UL), 1000V (IEC)		
Fuse rating	15A		
Dimensions	1625×1019×46mm (64.0×40.1×1.81 inches)		
Weight	20kg (44lbs.)		
Output terminal	(+) 800mm/(-) 1250mm with SMK (PV-03) connector		
Module efficiency	15.4%	15.7%	16.0%
Packing condition	2 modules per carton		
Certificates	IEC 61215 2nd ed., IEC 61730, UL 1703		
Temperature Coefficient	*Measured at 800W/m2, ambient temp. 20°C, wind speed 1m/s		
α (Isc) 0.056%/°C			
β (Voc) -0.350%/°C			
γ (Pmax) -0.450%/°C			

Drawing and Dimensions



Electrical Characteristics



Our Factory

Made in Japan



Iida Factory
Cell production



Kyoto Factory
Module production



Nakatsugawa Works
Product development headquarters,
Inverter Production

ISO 14001 Certified Factory

Our factories are managed using comprehensive water conservation and recycling measures in order to minimize the impact on the environment.



Waste paper and other materials are collected and separated for recycling.



Dozens of apple trees line the factory grounds, providing delicious apples in the fall.



A message from Mitsubishi Electric engineering:

Since our founding in 1921, Mitsubishi Electric has always put great emphasis on the long-term future. Our purpose is simple: to create quality products that will continue to satisfy our customers for a long period of time. Up until now, this philosophy has been one of the fundamental factors of our success in becoming one of the most firmly established electronics companies in the world, and will further continue to propel our prosperity in the future. Such emphasis on the long-term matches very well with the requirements of the photovoltaic generation business; after all, investing in a PV system is a major long-term investment. Choosing the right products in the beginning is critical in order to avoid major problems down the road.

Our professional engineering team utilizes our expansive technical experience and production know-how in order to develop a superb product. Not only are our customers satisfied by the outstanding performance of our products, but are also able to rest easy knowing that the reliability and safety standards of our modules are top-class.

When making a long-term investment, it is always a good idea to go with the best product. I have unwavering confidence in the quality of our photovoltaic modules, and I hope that you too, can experience what we call "Mitsubishi Electric Quality."



Dr. Satoshi Arimoto
Senior manager,
Photovoltaic
Power Systems Dept. A

Example Installations

USA

USA (10kW system)



Residential

USA (1.9MW system)



Agricultural farm

USA (1.3MW system)



Brewery

USA (680kW system)



Retail

Southeast Asia

Singapore (163kW system)



Academic Building

Malaysia (700kW system)



Ground-mounted Plant

Mitsubishi Electric US, Inc.

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