

Millennia MST-56, -50 & -43 Photovoltaic Modules



MST-56, -50, and -43 modules are part of Solarex's Millennia™ line of photovoltaics, which uses advanced tandem-junction thin-film technology to transform light energy into electricity. Solarex is a pioneer in thin-film manufacturing, which creates solar cells by depositing semiconductor alloys in thin layers on glass, using less material than traditional sawn-wafer methods. A major development in both efficiency and stability, the tandem-junction cell stacks two cells vertically, with each cell tuned for optimum conversion of different spectral segments.

The MST-56, -50, and -43 are designed specifically for applications which require moderate to high DC voltage arrays, and can result in cost savings up to 25% in such arrays. These applications include residential, commercial, and industrial utility-interactive arrays; building facades; and direct-coupled (batteryless) water pumping systems. EPRI has identified the Millennia technology as among the most promising in the field for large-scale utility photovoltaic systems and R & D programs.

With their uniform color and precise laser scribing, Millennia modules are especially suited to architectural applications. They are available in three configurations:

- framed with architectural-grade bronze-anodized extruded aluminum framing and a high-volume junction box;
- double-glass frameless laminate with 15-inch output leads (mounting system optional);
- as a single-glass "plate"; this configuration includes no frame and no electrical output leads.

Stabilized, guaranteed power

All Solarex Millennia photovoltaics are fully derated for the attenuation which occurs during the first week or two of a thin film product's solar exposure. They are rated at their stabilized, rather than initial power values, and are guaranteed to deliver at least 80% of their rated minimum power ten years after purchase. Contact Solarex Marketing for full terms of this limited warranty.

When first deployed, a typical Millennia module generates as much as 20% above its rated power. In some applications, this initial power bonus must be considered when sizing power system components such as wiring, inverters and switchgear.

Millennia array savings

Because these modules are designed specifically for medium- and high-voltage arrays, they can provide savings beyond their competitive price tags. A 200-volt array, for example, needs only three modules in series instead of the twelve needed with traditional modules, which can reduce inter-connection time and materials.

Additional savings may be realized because a Millennia module doesn't require the protection of bypass diodes in a high-voltage array. Its microstructural uniformity and large-area electrical connections give it the ability to better withstand reverse voltages due to cell shading. Also, Millennia modules operate on a broad power curve, reducing the curve mismatch losses that can affect arrays of other types of modules.

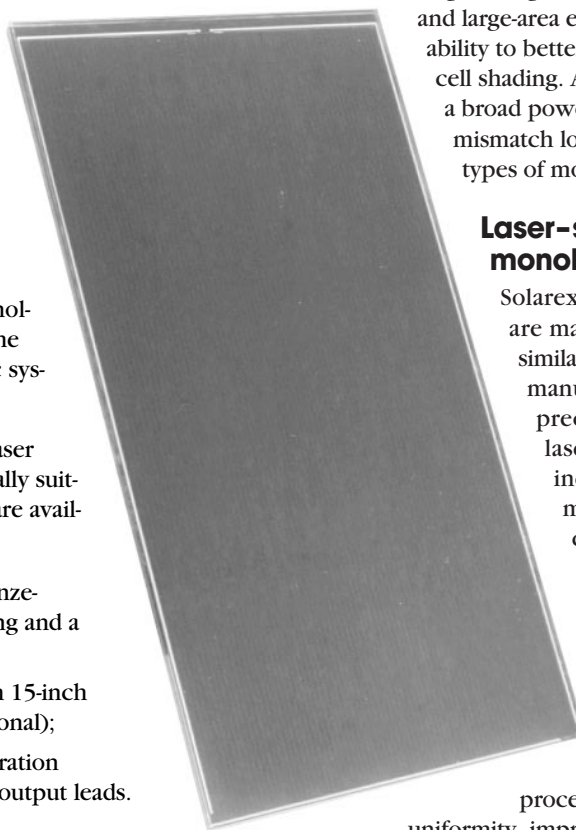
Laser-scribed, monolithic structure

Solarex amorphous silicon modules are made by automated processes similar to the ones used in semiconductor manufacturing, producing a monolithic precision-coated module. A patented laser-scribing procedure forms individual solar cells within the module, with all intercell electrical connections *internal to the module*. Since the module has no intercell solder joints, it is innately reliable and unique among large power-producing photovoltaics.

The conductive oxide layer is applied by a proprietary process which results in excellent film uniformity, improved optical coupling and enhanced module efficiency. The combination of laser processing and our ultra-uniform textured tin oxide film produce a module which is both attractive and efficient. The laser's precision means cell divisions can be very thin, allowing more glass surface to be devoted to power production.

Enhanced on-site performance

Photovoltaic modules are rated under a set of standard conditions which include a solar spectrum approximating the spectrum at sea level at the Equator—often called the AM (for Air Mass) 1.5 spectrum. Recent U.S. government testing indicates that a Millennia module's efficiency actually increases at sites which are clearer than an AM 1.5 site, such as high-elevation sites.



Attractive and uniform

These modules are extremely attractive, with a smooth, uniformly black surface ideal for many architectural applications. They provide an excellent match or contrast to many standard building materials.

Proven reliability and materials

The MST-56, -50, and -43 are designed to qualify under IEC 1646 (CEC 701), which includes tests measuring the effects of extended solar exposure, application of reverse voltage, robustness of terminations, hail impact, annealing, and:

- 200 cycles between -40°C and 90°C;
- 10 cycles between -40°C and 90°C at 85% relative humidity;
- wet high-voltage leakage (before and after above tests).

The materials in these modules reflect Solarex's 25 years of experience with modules and systems installed in virtually every climate on Earth. The modules are a lamination of two 3mm sheets of impact-resistant solar-grade glass with EVA (ethylene vinyl acetate) encapsulation providing a weatherproof seal. The framed versions are framed with corrosion-resistant, bronze-anodized extruded aluminum; strong, attractive framing compatible with Solarex mounting hardware and a broad range of other mounting structures.

Safety approved

MST-56, -50, and -43 modules are listed by Underwriters Laboratory for electrical and fire safety.



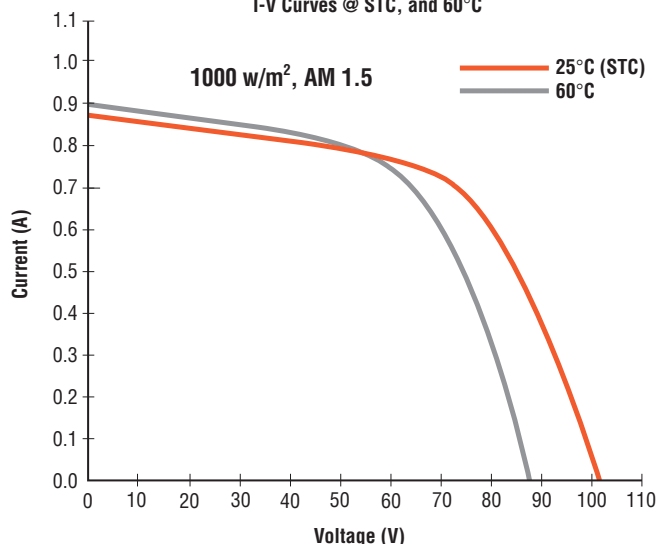
MST-56 Power Output (W) at Various Irradiance Levels and Cell Temperatures*

Cell Temperature	Irradiance (W/m ²)					
°C	100	300	600	800	1000	1200
0	5.53	17.95	36.29	48.31	60.09	71.38
25	5.12	16.78	33.89	45.18	56.00	66.82
50	4.69	15.48	31.48	41.82	51.67	61.53
75	4.21	14.08	28.60	37.97	47.11	56.00

* **Note:** The relationships between an MST module's power output and its temperature and irradiance are not linear. This table is useful in estimating exact output of an MST-56 at irradiance levels and cell temperatures other than STC. To estimate MST-50 and -43 output, apply the ratio of the modules' nominal powers to the table figures. That is, for MST-50 figures, multiply the table figures by 50/56, or 0.893; for the MST-43, multiply by 0.768.

For more information, contact:

MST-56 MV
I-V Curves @ STC, and 60°C



Electrical Characteristics at STC¹

	MST-56	MST-50	MST-43
Maximum power (P _{max})	56.0W	50.0W	43.0W
Voltage at P _{max}	73V	72V	71V
Current at P _{max}	0.761A	0.688A	0.616A
Open-circuit voltage (V _{oc})	102V	101V	101V
Short-circuit current (I _{sc})	0.871A	0.829A	0.787A
Guaranteed minimum P _{max}	53.0W	47.0W	38.7W
Nominal voltage (battery charging)	48V
Maximum system voltage	600V

(1) **Important Note:** When these MST modules are first deployed, their output characteristics are higher than the above figures. Power may be as much as 18% higher; voltage, 12% higher; and current, 6% higher. This initial power bonus must be considered when designing the power system.

The above data represent the performance of typical modules, after attenuation, as measured at their output terminals, and are based on measurements made at Standard Test Conditions (STC), which are:

- Illumination of 1 kW/m² (1 sun) with a spectral distribution of AM 1.5;
- Cell temperature of 25°C.

Mechanical Characteristics

Weight: (unframed) 33±1 pounds (15 kg)

Thickness of laminate: . . . 6.5±1mm

Framed module: 26-1/4" X 48-3/8" X 2"

Frameless configurations: . 25-7/8" X 48" X 0.26" ± .025"