

MSX-60 and MSX-64 Photovoltaic Modules

25
ANNIVERSARY
1973-1998



The MSX-64 and -60 are among the most powerful of Solarex's Megamodule™ series, a product line which is the culmination of nearly three decades of extensive research in polycrystalline silicon photovoltaics. With over 3 amperes of current at peak power, these modules offer the most cost-effective package in the industry, and charge batteries efficiently in virtually any climate.

These modules may be used in single-module arrays or deployed in multiple-module arrays, wired in series/parallel combinations as required to meet current and voltage requirements. They are engineered under Solarex's IntegraSystem™ system integration concept, which ensures full compatibility with other Solarex subsystems and components (support hardware, regulators, etc.) and easy system assembly. As single-module arrays, they may be mounted on a variety of surfaces using optional kits or by means of user-fabricated support hardware. Solarex also offers hardware for supporting multiple-module arrays.

These modules are well-suited for virtually all applications where photovoltaics are a feasible energy source, including telecommunications systems, pumping and irrigation, cathodic protection, remote villages and clinics, and aids to navigation.

Individually Tested, Labeled and Warranted

As part of the final inspection procedure, every MSX module is tested in a solar simulator and labeled with its actual output—voltage, current, and power at maximum power point (P_{max})—at Standard Test Conditions and Standard Operating Conditions. Furthermore, the MSX-64 and -60 are covered by our industry-leading limited warranty, which guarantees:

- that no module will generate less than its guaranteed minimum P_{max} when purchased;
- at least 80% of the guaranteed minimum P_{max} for twenty years.

Contact Solarex's Marketing Department for full terms and limitations of this unparalleled warranty.

Reliable and Versatile

The Megamodule series has proved its reliability at thousands of installations in every climate on Earth. Among the features that contribute to its versatility:

Dual Voltage Capability

These modules consist of 36 polycrystalline silicon solar cells electrically configured as two series strings of 18 cells each. The strings terminate in the junction box on the module back. Shipped in 12V configuration, modules may easily be switched to 6V configuration in the field by moving leads in the junction box. This design also allows instal-

lation of bypass diodes on 18-cell strings, which can improve reliability and performance in systems with nominal voltage 24V and above.

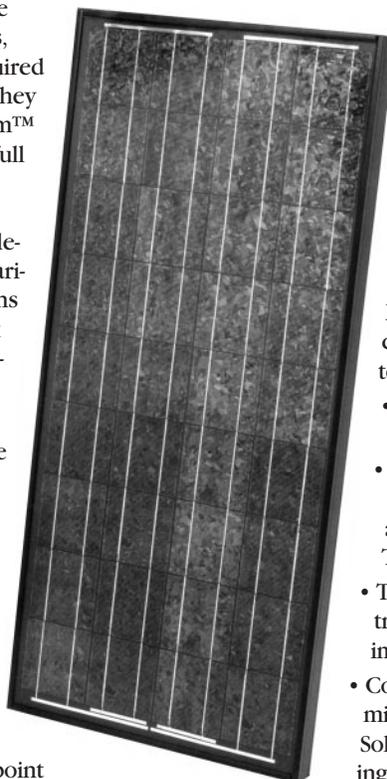
High-Capacity Multifunction Junction Box

The size of the junction box (25 cubic inches, 411cc) and its six-terminal connection block allow most system array connections to be made right in the J-box. The box also can accommodate bypass or blocking diodes or a small regulator, which can save the expense and labor of additional boxes. The box is raintight (IP54 rated) and accepts 1/2" nominal or PG13.5 conduit or cable fittings. The standard terminals accept wire as large as AWG #10 (6mm²); an optional terminal block accepts wire up to AWG #4 (25mm²).

Proven Materials and Construction

Megamodule materials reflect Solarex's quarter-century of experience with solar modules and systems installed in virtually every climate on Earth.

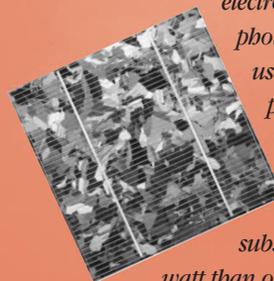
- Polycrystalline silicon solar cells: efficient, attractive, stable.
- Modules are rugged and weatherproof: cell strings are laminated between sheets of ethylene vinyl acetate (EVA) and tempered glass with a durable Tedlar backsheet.
- Tempered glass superstrate is highly light-transmissive (low iron content), stable, and impact-resistant.
- Corrosion-resistant, bronze-anodized extruded aluminum frame is strong, attractive, compatible with Solarex mounting hardware and most other mounting structures.



Options

- Blocking and bypass diodes
- Solarstate™ charge regulator
- Protective aluminum backplate

More than 20 years ago, Solarex made the first polycrystalline silicon solar cell, advancing photovoltaics beyond the first-generation monocrystalline technology developed for electronics. Developed specifically for photovoltaics, polycrystalline silicon is used in Solarex's Mega™ series to provide a wide range of attractive, efficient modules. They require substantially less energy to manufacture and generate substantially more energy per rated watt than other crystalline silicon modules.



Safety Approved

MSX-60 and -64 modules are listed by Underwriter's Laboratories for electrical and fire safety (Class C fire rating), certified by TÜV Rheinland as Class II equipment, and approved by Factory Mutual Research for application in NEC Class 1, Division 2, Group C & D hazardous locations.



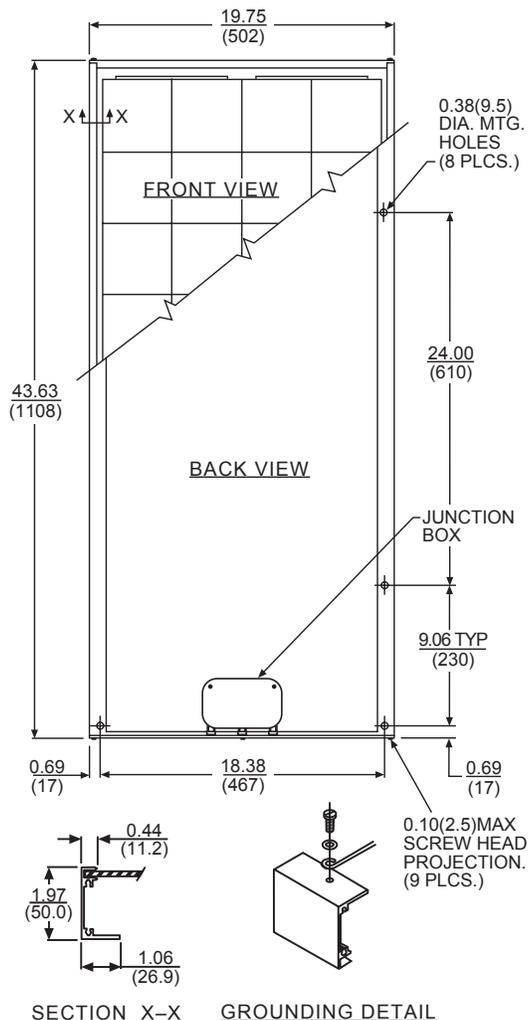
Quality Certified

These modules are manufactured in our ISO 9001-certified factories to demanding specifications, and comply with IEC 1215, IEEE 1262 and CEC 503 test requirements, including:

- repetitive cycling between -40°C and 85°C at 85% relative humidity;
- simulated impact of one-inch (25mm) hail at terminal velocity;
- 2700 VDC frame/cell string isolation test;
- a "damp heat" test, consisting of 1000 hours of exposure to 85°C and 85% relative humidity;
- a "hot-spot" test, which determines a module's ability to tolerate localized shadowing (which can cause reverse-biased operation and localized heating);
- simulated wind loading of 125 mph (200 kph).

Mechanical Characteristics

Weight: 15.9 pounds (7.2 kg)
Dimensions: Dimensions in brackets are in millimeters
 Unbracketed dimensions are in inches
 Overall tolerances ±1/8" (3mm)



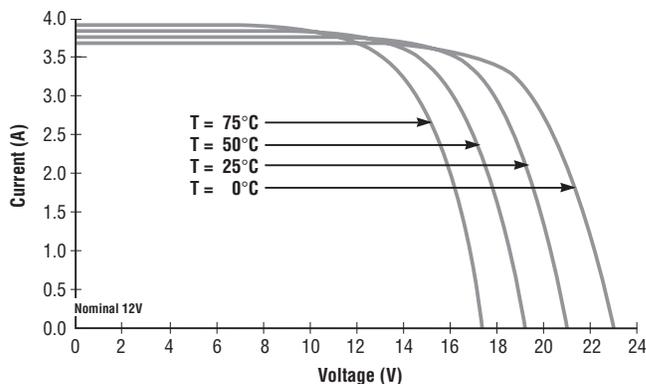
Typical Electrical Characteristics¹

	MSX-64	MSX-60
Maximum power (P _{max})	64W	60W
Voltage @ P _{max} (V _{mp})	17.5V	17.1V
Current @ P _{max} (I _{mp})	3.66A	3.5A
Guaranteed minimum P _{max}	62W	58W
Short-circuit current (I _{sc})	4.0A	3.8A
Open-circuit voltage (V _{oc})	21.3V	21.1V
Temperature coefficient of open-circuit voltage -(80±10)mV/°C	
Temperature coefficient of short-circuit current (0.065±0.015)%/°C ..	
Temperature coefficient of power -(0.5±0.05)%/°C ...	
NOCT ² 47±2°C	

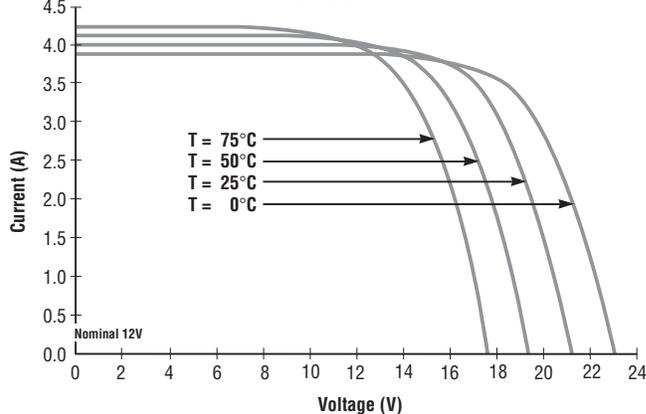
NOTES:

- (1) These modules are tested, labeled and shipped in 12V configuration. These data represent the performance of typical 12V modules as measured at their output terminals, and do not include the effect of such additional equipment as diodes and cabling. The data are based on measurements made in a solar simulator at Standard Test Conditions (STC), which are:
 - illumination of 1 kW/m² (1 sun) at spectral distribution of AM 1.5;
 - cell temperature of 25°C or as otherwise specified (on curves).
 Operating characteristics in sunlight may differ slightly. To determine the characteristics of modules in 6V configuration, divide the 12V voltage characteristics by 2 and multiply current characteristics by 2. Power values are unchanged.
- (2) Under most climatic conditions, the cells in a module operate hotter than the ambient temperature. NOCT (Nominal Operating Cell Temperature) is an indicator of this temperature differential, and is the cell temperature under Standard Operating Conditions: ambient temperature of 20°C, solar irradiation of 0.8 kW/m², and wind speed of 1 m/s.

MSX-60 I-V Characteristics



MSX-64 I-V Characteristics



For more information, contact:

VARIABLES AFFECTING PERFORMANCE

The performance of typical MEGA SX-64 and -60 modules is described by the I-V curves and electrical characteristics table on the next page. Each module's actual, tested output characteristics are printed on its label.

The current and power output of photovoltaic modules are approximately proportional to illumination intensity. At a given intensity, a module's output current and operating voltage are determined by the characteristics of the load. If that load is a battery, the battery's internal impedance will dictate the module's operating voltage. An I-V curve is simply all of a module's possible operating points (voltage/current combinations) at a given cell temperature and light intensity. Increases in cell temperature increase current but decrease voltage.

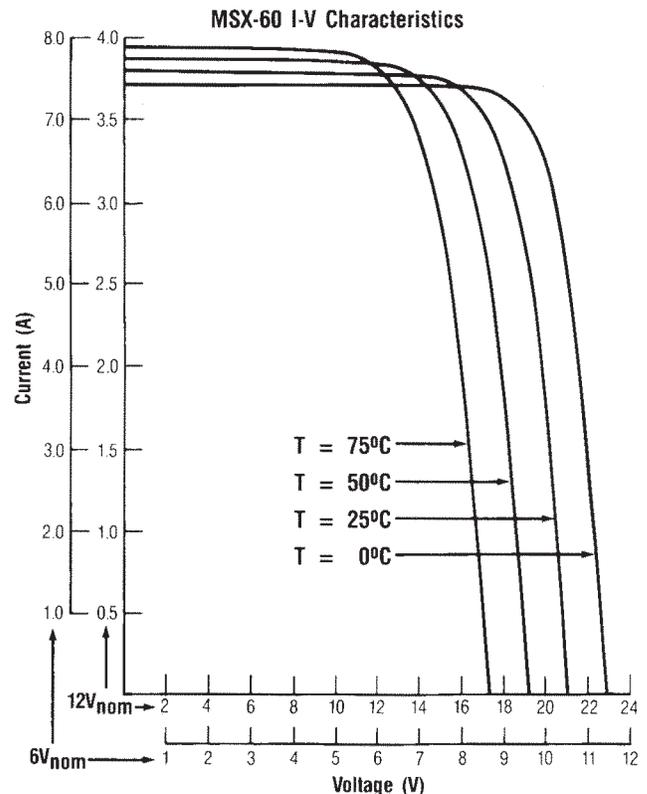
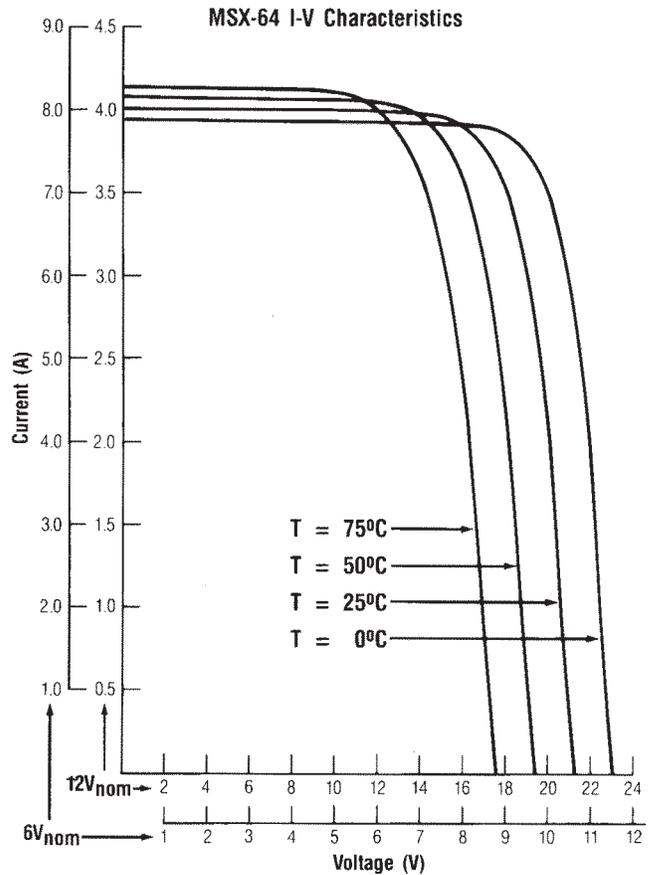
TYPICAL ELECTRICAL CHARACTERISTICS⁽¹⁾

	12 VOLT CONFIGURATION ⁽²⁾	
	MSX-64	MSX-60
Typical peak power (P _p)	64W	60W
Voltage @ peak power (V _{pp})	17.5V	17.1V
Current @ peak power (I _{pp})	3.66A	3.5A
Guaranteed minimum peak power	62W	58W
Short-circuit current (I _{sc})	4.0A	3.8A
Open-circuit voltage (V _{oc})	21.3V	21.1V
Temperature coefficient of open-circuit voltage-(80±10)mV/°C.....	
Temperature coefficient of short-circuit current(0.065±0.015)%/°C....	
Approximate effect of temperature on power-(0.5±0.05)%/°C.....	
NOCT ⁽³⁾ 49°C.....	

Notes:

- (1) These data represent the performance of typical modules as measured at their output terminals, and do not include the effect of such additional equipment as diodes and cabling. The data are based on measurements made at Standard Test Conditions (STC), which are:
 - Illumination of 1 kW/m² (1 sun) at spectral distribution of AM 1.5
 - Cell temperature of 25°C or as otherwise specified (on curves).
- (2) Electrical characteristics of modules wired in the nominal 6V configuration may be found by using the 6V scales on the I-V curves. For more exact values, divide the 12V voltage characteristics in the table by 2 and multiply the 12V current characteristics by 2. Power values are unchanged.
- (3) Under nearly all climatic conditions, the solar cells in an operating module are hotter than the ambient temperature, a fact which must be considered when reading module data. NOCT (Nominal Operating Cell Temperature) is an indication of this temperature rise, and is the cell temperature under Standard Operating Conditions: ambient temperature of 20°C, solar irradiation of 0.8 kW/m², and average wind speed of 1 m/s.

I-V CHARACTERISTICS



MECHANICAL CHARACTERISTICS

MEGA SX-64 and -60 are mechanically identical, differing only in electrical output.

Weight: 15.9 pounds (7.2 kg)

Dimensions: Dimensions in brackets are in millimeters
Unbracketed dimensions are in inches

