



## PHOTOVOLTAIC SOLAR ENERGY POLYCRYSTALLINE MODULES - SI-ESF-M-SF-P-12W



Solar Innova uses the latest materials to manufacture photovoltaic modules.

Our modules are ideal for any application that uses the photoelectric effect as a clean energy source because of its minimal chemical pollution and no noise pollution. By design, they can be integrated easily into any installation.

These semi-flexible PV modules use squared, high-efficiency, polycrystalline silicon cells (the cells are made of several crystals of high purity silicon) to transform the energy of sunlight into electric energy. Each cell is electrically rated to optimize the behavior of the module.

The front of the module contains an unbreakable plastic surface with high transmissivity and low reflectivity.

The cell circuit is laminated using EVA (Ethylene-Vinyl Acetate) as an encapsulant.

The intermediate part includes a semi-flexible sheet aluminum makes these modules ideal for installation on flat or gently curved surfaces.

The back sheet consists of a plastic polymer (Tedlar) on the back, which provides complete protection and seals against environmental agents and electrical insulation.

Each module has 4 holes for quick mounting outdoors.

Our modules comply with all safety requirements not only flexibility but also double insulation and high resistance to UV rays, all of which are ideal for use in outdoor applications.

### WARRANTIES

Our manufacturing plants have been prepared in accordance with the ISO 9001:2008, ISO 14001:2004 and OHSAS 18001:2007.

We have quality control divided into three elements:

- ✓ Regular inspections allow us to guarantee the quality of the raw material.
- ✓ Quality control in the process of our manufacturing procedures.
- ✓ Quality control of finished products, we conduct through inspections and tests of reliability and performance.

Our PV modules are certified by internationally recognized laboratories and are proof of our strict adherence to international safety standards, long term performance and overall quality of products.





## PHOTOVOLTAIC SOLAR ENERGY POLYCRYSTALLINE MODULES - SI-ESF-M-SF-P-12W

ELECTRICAL CHARACTERISTICS		
Maximum power (P <sub>mpp</sub> )	Wp	12
Tolerance	Wp	0 ~ + 0.3
Voltage at maximum power (V <sub>mpp</sub> )	Volts	15.30
Current at maximum power (I <sub>mpp</sub> )	Amperes	0.78
Open circuit voltage (V <sub>oc</sub> )	Volts	19.30
Short circuit current (I <sub>sc</sub> )	Amperes	0.86
Maximum system voltage (V <sub>syst</sub> )	Volts	715 (IEC)
Diodes (By-pass)	Quantity	1
Maximum series fuse	Amperes	10
Efficiency (η <sub>m</sub> )	%	11.16
Form Factor	%	≥ 73

MECHANICAL CHARACTERISTICS			
Size	Height	400 mm	31.50 inches
	Width	358 mm	22 inches
	Thickness	15 mm	0.60 inches
Weight	Net	1.06 kg	2.30 lbs
Front	Material	High transmissivity toughened TPT	
	Thickness	0.30 mm	0.012 inches
Cells	Type	Polycrystalline	
	Quantity	4 x 8 units	
	Size	156 x 52 mm	6 x 2 inches
Serial connection	Quantity	32 units	
Parallel connection	Quantity	1 unit	
Encapsulation	Material	EVA	
	Thickness	0.50 ± 0.03 mm	0.020 ± 0.0012 inches
	Material	TPT	
Intermediate Sheet	Thickness	0.32 ± 0.03 mm	0.013 ± 0.0012 inches
	Material	Anodized Aluminum	
Backsheet	Thickness	1.50 ± 0.03 mm	0.060 ± 0.0012 inches
	Material	TPT	
Junction box	Thickness	0.50 ± 0.03 mm	0.020 ± 0.0012 inches
	Material	PVC	
Cables	Protection	IP-65	
	Isolation	Versus humidity and inclement weather	
	Type	Polarized and symmetric in length	
	Length	3000 mm	118.11 inches
Connectors	Section	1 mm <sup>2</sup>	0.0004 inches <sup>2</sup>
	Features	Low contact resistance Minimal losses for voltage drop	
	Material	PVC	
Connectors	Type	MC4	
	Protection	IP-67	

THERMAL CHARACTERISTICS		
Temperature coefficient of short circuit current α (I <sub>cc</sub> )	%/° C	+ 0.055
Temperature coefficient of open circuit voltage β (V <sub>oc</sub> )	%/° C	- 0.347
Temperature coefficient of power γ (P <sub>mpp</sub> )	%/° C	- 0.48
Maximum power temperature coefficient (I <sub>mpp</sub> )	%/° C	+ 0.10
Voltage temperature coefficient of maximum power (V <sub>mpp</sub> )	%/° C	- 0.38
NOCT (Nominal Operating Cell Temperature)	° C	+ 47 ± 2

TOLERANCES			
Working temperature	° C/° F	- 40 ~ + 85	- 40 ~ + 185
Dielectric Isolation Voltage	Volts	3,000	
Relative humidity	%	0 ~ 100	
Wind resistance	m/s	60	
	kg/m <sup>2</sup>	2,400	
	lbs/feet <sup>2</sup>	491.56	
Mechanical load-bearing capacity	kg/m <sup>2</sup>	551 (5400 Pa) IEC	
	lbs/feet <sup>2</sup>	75.2 (3600 Pa) UL	
Fire resistance	Class	C	
Maximum curvature	mm	50	



## PHOTOVOLTAIC SOLAR ENERGY POLYCRYSTALLINE MODULES - SI-ESF-M-SF-P-12W

<b>MEASUREMENTS PERFORMED IN ACCORDANCE WITH ASTM STANDARD TEST METHODS E1036, CORRECTED TO STANDARD TEST CONDITIONS (STC)</b>		
<b>Air quality/Spectral distribution</b>	AM	1.5 ASTM G173-03e1 (2008)
<b>Luminous intensity/Radiation</b>	W/m <sup>2</sup>	1,000
<b>Cell temperature</b>	° C	25

<b>MEASUREMENTS PERFORMED IN SOLAR SIMULATOR</b>	
<b>Class</b>	AAA (according to IEC 60904-4)
<b>Power measurement uncertainty is within</b>	± 3 %

<b>STRUCTURAL CHARACTERISTICS</b>	
<b>Cells</b>	High efficiency cells with anti-reflective layer of Silicon Nitride.
<b>Electric conductors</b>	Flat Copper (Cu) bath in a Tin (Sn) and Silver (Ag) alloy, which improves weldability.
<b>Welds</b>	Cell and drivers in installments for stress relief.
<b>Laminate</b>	Composed of TPT transparent on the front, EVA encapsulant thermostable embedding cells and electrical insulation on the back formed by a compound of tedlar and polyester.
<b>Junction box</b>	Hoses and quick connectors with anti-error. Include bypass diodes, interchangeable thanks to the wiring system has no welds, all electrical contacts are made by pressure, thus avoiding the possibility of cold welding.

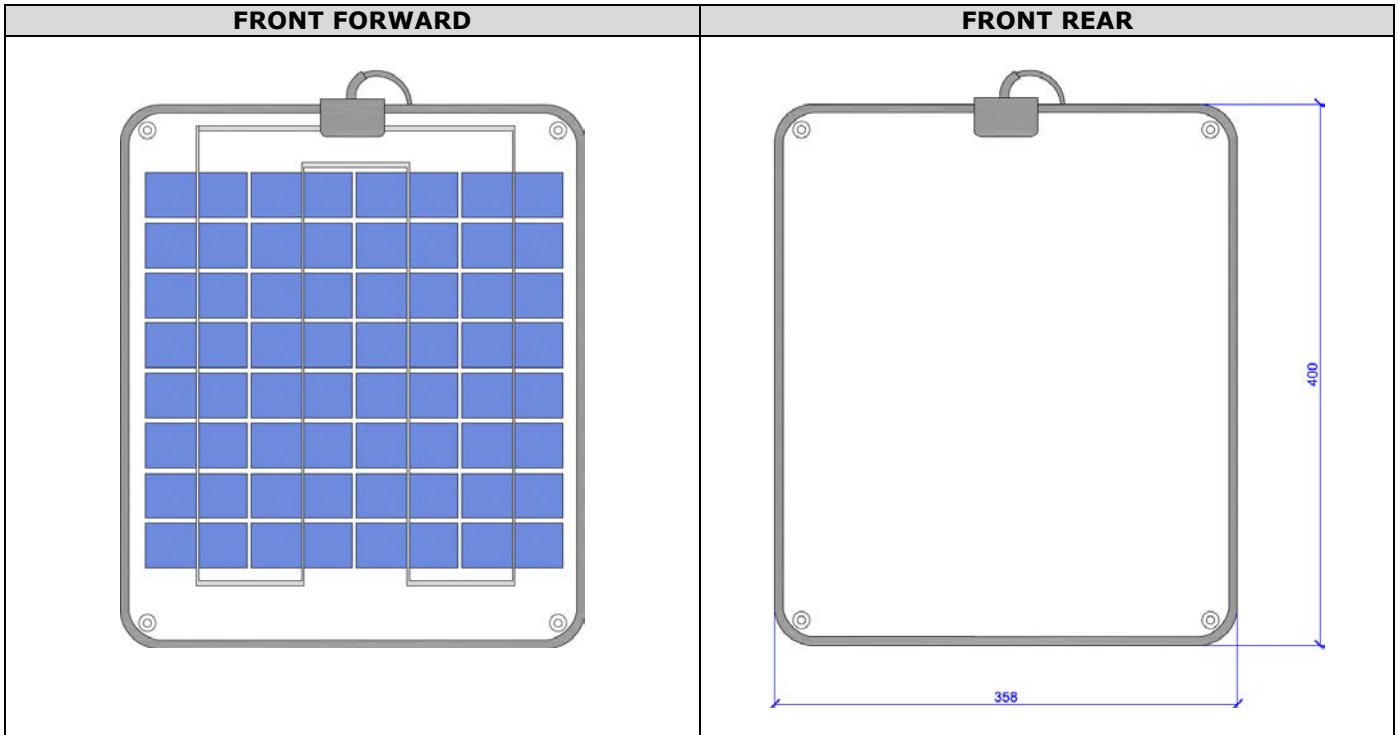
<b>CHARACTERISTICS OF WORK</b>	
- The power of solar cells varies in the output of the production process. The different power specifications of these modules reflect this dispersion.	
- Cells during the early months of light exposure, may experience a degradation photonics could decrease the value of the maximum power the module up to 3 %.	
- The cells, in normal operating conditions, reach a temperature above the standard measurement conditions of the laboratory. The NOCT is a quantitative measure of the increase. NOCT measurement is performed under the following conditions: radiation of 0.8 kW/m <sup>2</sup> , temperature 20° C and wind speed of 1 m/s.	
- The electrical data reflect typical values of the modules and laminates as measured at the output terminals at the end of the manufacturing process.	

<b>WARRANTIES</b>		
<b>Manufacturing defects</b>	Years	2
<b>Performance</b>	Minimal Rated Power %/Years	90 % at 5 years, 80 % at 10 years.

<b>CERTIFICATES</b>			
			



**PHOTOVOLTAIC SOLAR ENERGY**  
**POLYCRYSTALLINE MODULES - SI-ESF-M-SF-P-12W**



**CONSTRUCTION DETAILS**

**OUTER SURFACE**

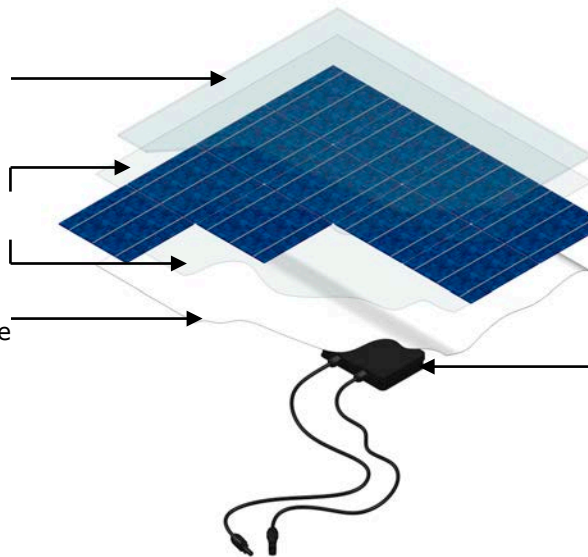
TPT transparent for high optical transmittance

**EVA (Ethyl Vinyl Acetate)**

Rapid solidification

**BASE TPT**

Tedlar rear layer for module protection



**SILICON CELLS**

Polycrystalline

**JUNCTION BOX**

With quick connectors and double insulated flexible cable with bypass diodes