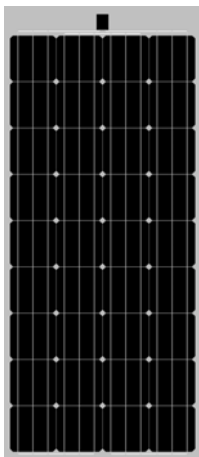
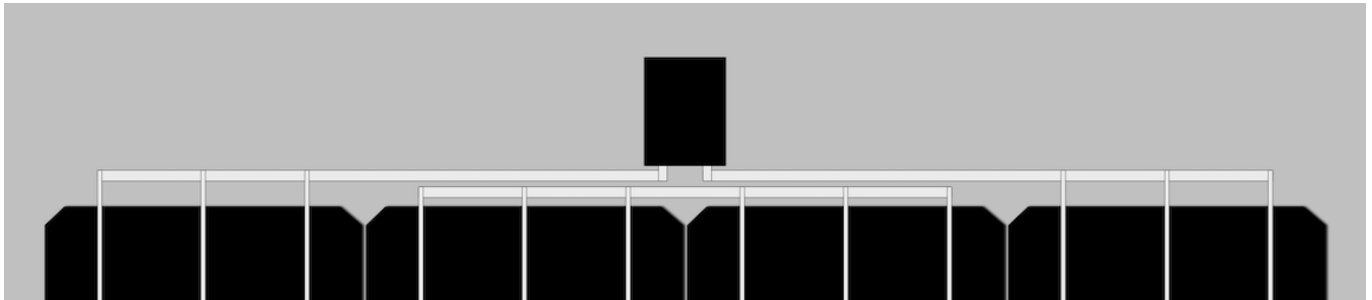




## PHOTOVOLTAIC SOLAR ENERGY

### MONOCRYSTALLINE MODULES - SI-ESF-M-SF-M-150W



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.

The front part of the module contains a high strength ETFE plastic polymer with a high level of transmissivity and low reflectivity.

These PV modules use high-efficiency monocrystalline silicon cells to transform the energy of sunlight into electric energy. Each cell is electrically rated to optimize the behavior of the module.

The cell circuit is laminated using EVA (Ethylene-Vinyl Acetate) as an encapsulant that provides complete protection and sealing against environmental agents and electrical insulation.

Its performance is excellent over the entire range of light spectrum, with particularly high yields in low light situations or cloudiness to direct sunlight (diffuse radiation).

The rear part is manufactured with an anodized aluminum sheet to obtain the highest stiffness and resistance to torsion and flexion.

The junction boxes with IP65, are made from high temperature resistant plastics and containing terminals, connection terminals and protection diodes (by-pass). These modules are supplied with symmetric lengths of cable, with a diameter of copper section of 4 mm and an extremely low contact resistance, all designed to achieve the minimum voltage drop losses.

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

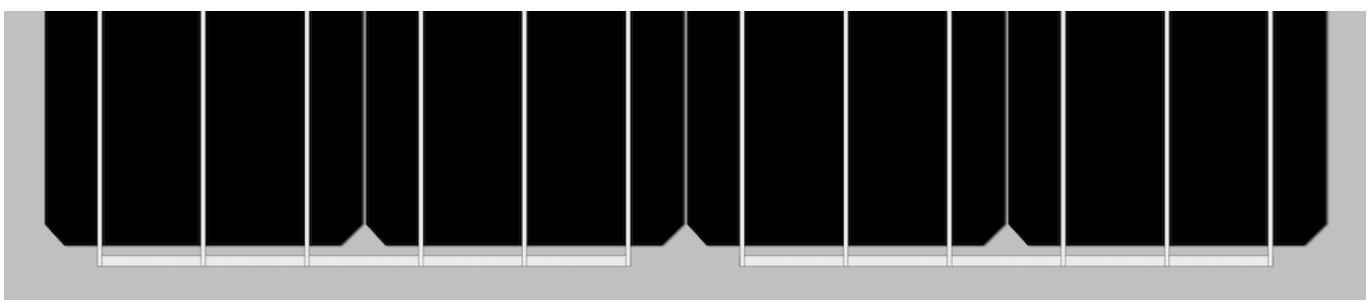
#### WARRANTIES

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

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 MONOCRYSTALLINE MODULES - SI-ESF-M-SF-M-150W

ELECTRICAL CHARACTERISTICS (STC)		
Maximum power (P <sub>mpp</sub> )	Wp	150
Tolerance	Wp	0 ~ + 5
Voltage at maximum power (V <sub>mpp</sub> )	Volts	18.34
Current at maximum power (I <sub>mpp</sub> )	Amperes	8.18
Open circuit voltage (V <sub>oc</sub> )	Volts	22.64
Short circuit current (I <sub>sc</sub> )	Amperes	8.71
Maximum system voltage (V <sub>syst</sub> )	Volts	715 (IEC)
Diodes (By-pass)	Quantity	4
Maximum series fuse	Amperes	15
Efficiency (η <sub>m</sub> )	%	14.97
Form Factor	%	≥ 73

STC:	 Irradiance: 1.000 W/m <sup>2</sup>	 Cell temperature: 25° C	 Air mass: 1,5
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ELECTRICAL CHARACTERISTICS (NMOT)		
Maximum power (P <sub>mpp</sub> )	Wp	111
Voltage at maximum power (V <sub>mpp</sub> )	Volts	16.70
Current at maximum power (I <sub>mpp</sub> )	Amperes	6.64
Open circuit voltage (V <sub>oc</sub> )	Volts	20.69
Short circuit current (I <sub>sc</sub> )	Amperes	7.06

NMOT:	 Irradiance: 800 W/m <sup>2</sup>	 Ambient temperature: 20° C	 Air mass: 1,5	 Wind speed: 1 m/s
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MECHANICAL CHARACTERISTICS			
Size	Height	1,372 mm	54.02 inches
	Width	660 mm	25.98 inches
	Thickness	3 mm	0.12 inches
Weight	Net	2.5 kg	5.51 lbs
Front	Material	High transmissivity ETFE	
	Thickness	0.3 mm	0.012 inches
Cells	Type	Monocrystalline	
	Quantity	4 x 9	
	Size	156 x 156 mm	6 inches
Serial connection	Quantity	36	
Parallel connection	Quantity	1	
Encapsulation	Material	EVA	
	Thickness	0.50 ± 0.03 mm	0.020 ± 0.0012 inches
Backsheet	Material	Aluminum	
	Thickness	1.50 ± 0.03 mm	0.06 ± 0.0012 inches
Junction box	Material	PVC	
	Protection	IP65	
	Isolation	Versus humidity and inclement weather	
Cables	Type	Polarized and symmetric in length	
	Length	900 mm	35.4 inches
	Section	4 mm <sup>2</sup>	0.006 inches <sup>2</sup>
	Features	Low contact resistance Minimal losses for voltage drop	
Connectors	Material	PVC	
	Type	MC4	
	Protection	IP67	

THERMAL CHARACTERISTICS		
Temperature coefficient of short circuit current α (I <sub>sc</sub> )	%/° C	+ 0.0814
Temperature coefficient of open circuit voltage β (V <sub>oc</sub> )	%/° C	- 0.3910
Temperature coefficient of power γ (P <sub>mpp</sub> )	%/° C	- 0.5141
Maximum power temperature coefficient (I <sub>mpp</sub> )	%/° C	+ 0.10
Voltage temperature coefficient of maximum power (V <sub>mpp</sub> )	%/° C	- 0.38
NMOT (Nominal Module Operating Temperature)	° C	+ 47 ± 2



## PHOTOVOLTAIC SOLAR ENERGY MONOCRYSTALLINE MODULES - SI-ESF-M-SF-M-150W

TOLERANCES			
<b>Working temperature</b>	° C	° F	- 40 ~ + 85 - 40 ~ + 185
<b>Dielectric Isolation Voltage</b>	Volts		3,000
<b>Relative humidity</b>	%		0 ~ 100
<b>Wind resistance</b>	m/s		60
	kg/m <sup>2</sup>		2,400
	lbs/feet <sup>2</sup>		491.56
<b>Mechanical load-bearing capacity</b>	kg/m <sup>2</sup>		551 (5,400 Pa) IEC
	lbs/feet <sup>2</sup>		75.2 (3,600 Pa) UL
<b>Maximum curvature</b>	mm		50

CLASIFICACION		
<b>Application</b>	Class	A
<b>Electrical protection</b>	Class	II
<b>Fire safety</b>	Class	C
<b>Pollution</b>	Grade	1
<b>Material</b>	Group	I
<b>Safety</b>	Factors	1,5

MEASUREMENTS PERFORMED IN ACCORDANCE WITH ASTM STANDARD TEST METHODS E1036, CORRECTED TO STANDARD TEST CONDITIONS (STC)		
<b>Air quality/Spectral distribution</b>	AM	1.5 ASTM G173-03
<b>Luminous intensity/Radiation</b>	W/m <sup>2</sup>	1000
<b>Cell temperature</b>	° C	25

MEASUREMENTS PERFORMED IN SOLAR SIMULATOR	
<b>Class</b>	AAA (according to IEC 60904-9)
<b>Power measurement uncertainty is within</b>	± 3 %

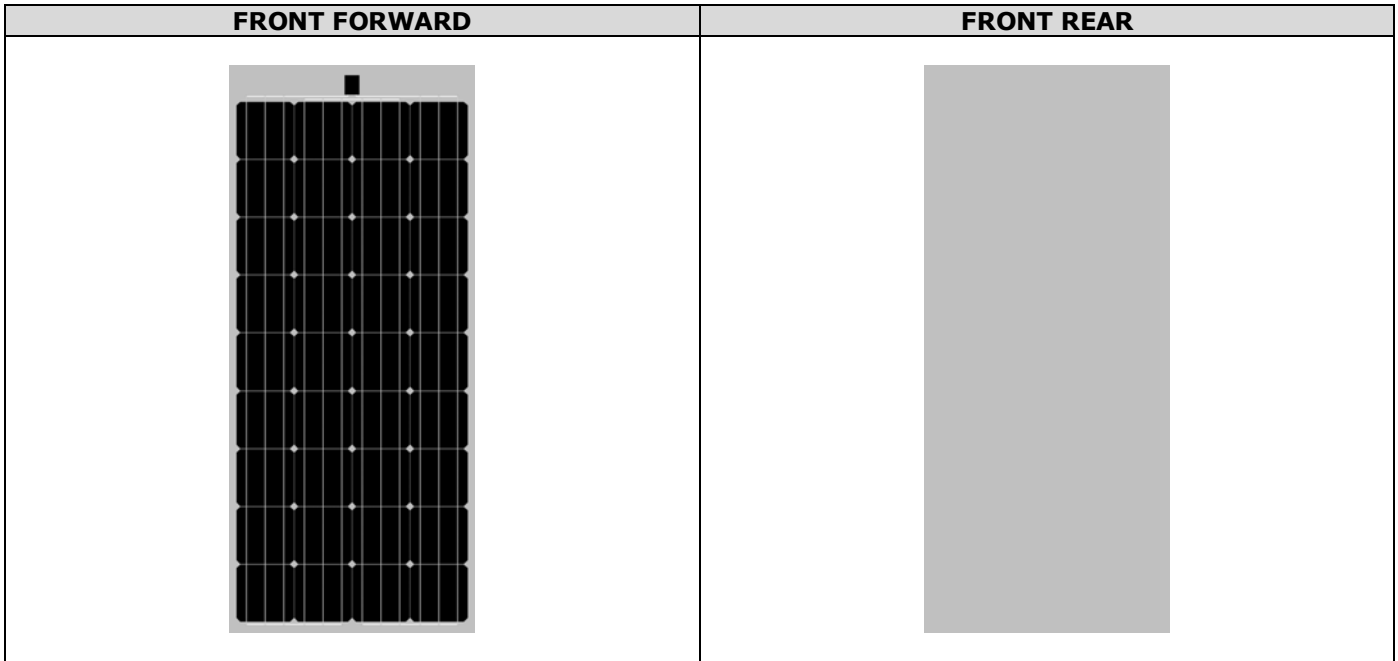
STRUCTURAL CHARACTERISTICS	
<b>Cells</b>	High efficiency cells with anti-reflective layer of Silicon Nitride.
<b>Electric conductors</b>	Flat Copper (Cu) bath in a Tin (Sn) and Silver (Ag) alloy, which improves weldability.
<b>Welds</b>	Cell and drivers in installments for stress relief.
<b>Laminate</b>	Composed of ultra-clear tempered glass on the front and rear, 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.

CHARACTERISTICS OF WORK	
- 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.	

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



**PHOTOVOLTAIC SOLAR ENERGY**  
**MONOCRYSTALLINE MODULES - SI-ESF-M-SF-M-150W**



**CONSTRUCTION DETAILS**

**OUTER SURFACE**

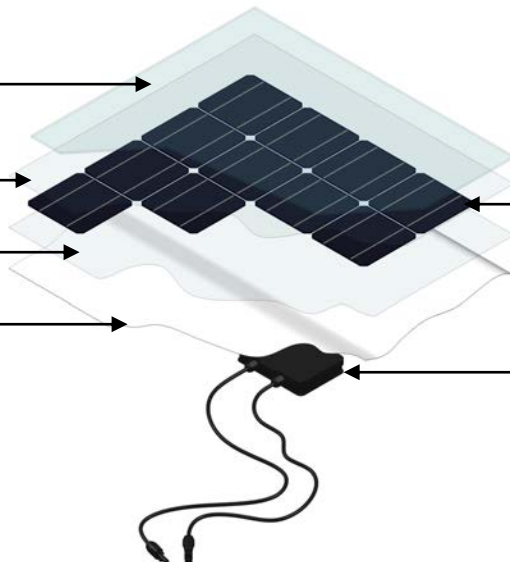
ETFE-high strength plastic polymer with high optical transmittance

**EVA (Ethyl Vinyl Acetate)**

Rapid solidification

**ALUMINUM BASE**

Back layer of anodized aluminum foil for module protection



**SILICON CELLS**

Monocrystalline

**JUNCTION BOX**

With quick connectors and double insulated flexible cable with bypass diodes

**CERTIFICATES**




# PHOTOVOLTAIC SOLAR ENERGY

## MONOCRYSTALLINE MODULES - SI-ESF-M-SF-M-150W

### PERFORMANCE

