



## PHOTOVOLTAIC SOLAR ENERGY POLYCRYSTALLINE MODULES - SI-ESF-M-P156-60



These 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 cell circuit is laminated using EVA (Ethylene-Vinyl Acetate) as an encapsulant in combination with a tempered glass on its front and a plastic polymer (Tedlar) on the back which provides complete protection and seals against environmental agents and electrical insulation.

The junction boxes with IP-65, are made from high temperature resistant plastics and containing terminals, connection terminals and protection diodes (by-pass).

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 compact, anodized aluminum frame provides an optimal relationship-weight moment of inertia, to obtain greater rigidity and resistance to twisting and bending. It has several holes to attach the module to the support structure and ground if necessary.

The design of these modules makes their integration in both industrial and residential buildings (one of the most emerging sectors in the photovoltaic market), and other infrastructure, simple and aesthetic.

### 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-P156-60

ELECTRICAL CHARACTERISTICS						
Maximum power (Pmpp)	Wp	240	245	250	255	260
Tolerance	Wp	0 ~ + 5				
Voltage at maximum power (Vmpp)	Volts	29.84	29.99	30.23	30.42	30.62
Current at maximum power (Impp)	Amperes	8.04	8.17	8.27	8.38	8.49
Open circuit voltage (Voc)	Volts	36.84	37.02	37.32	37.56	37.80
Short circuit current (Isc)	Amperes	8.56	8.63	8.77	8.83	8.97
Maximum system voltage (Vsyst)	Volts	600 (UL) / 1000 (IEC)				
Diodes (By-pass)	Quantity	6				
Maximum series fuse	Amperes	15				
Efficiency (ηm)	%	14.62	14.92	15.23	15.53	15.84
Form Factor	%	≥ 73				

MECHANICAL CHARACTERISTICS			
Size	Height	1655 mm	65.2 inches
	Width	992 mm	39.1 inches
	Thickness	40 mm	1.57 inches
Weight	Net	20 kg	44.1 lbs
Frame	Material	Anodized aluminum AL6063-T5, minim 15 μm	
Front	Material	High transmissivity toughened glass	
	Thickness	3.2 ± 0.2 mm	0.13 inches
Cells	Type	Polycrystalline	
	Quantity	6 x 10	
	Size	156 x 156 mm	6 inches
Serial connection	Quantity	60	
Parallel connection	Quantity	1	
Encapsulation	Material	EVA	
	Thickness	0.50 ± 0.03 mm	0.020 ± 0.0012 inches
Back-Sheet	Material	TPT	
	Thickness	0.32 ± 0.03 mm	0.013 ± 0.0012 inches
Junction box	Material	PVC	
	Protection	IP-65	
	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	IP-67	

THERMAL CHARACTERISTICS		
Temperature coefficient of short circuit current α (Icc)	%/°C	+ 0.055
Temperature coefficient of open circuit voltage β (Voc)	%/°C	- 0.347
Temperature coefficient of power γ (Pmpp)	%/°C	- 0.48
Maximum power temperature coefficient (Impp)	%/°C	+ 0.10
Voltage temperature coefficient of maximum power (Vmpp)	%/°C	- 0.38
NOCT (Nominal Operating Cell Temperature)	°C	+ 47 ± 2

TOLERANCES		
Working temperature	°C	- 40 ~ + 85
Dielectric Isolation Voltage	V	3000
Relative humidity	%	0 ~ 100
Wind resistance	m/s	60
	kg/m <sup>2</sup>	2400
	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



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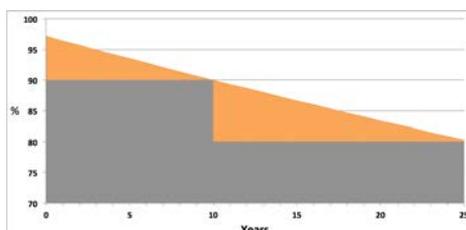
MEASUREMENTS PERFORMED IN ACCORDANCE WITH ASTM STANDARD TEST METHODS E1036, CORRECTED TO STANDARD TEST CONDITIONS (STC)		
Air quality/Spectral distribution	AM	1.5 ASTM G173-03e1 (2008)
Luminous intensity/Radiation	W/m <sup>2</sup>	1000
Cell temperature	° C	25

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

STRUCTURAL CHARACTERISTICS	
Cells	High efficiency cells with anti-reflective layer of Silicon Nitride.
Electric conductors	Flat Copper (Cu) bath in a Tin (Sn) and Silver (Ag) alloy, which improves weldability.
Welding	Of cells and drivers in sections for stress relief.
Laminate	Composed of ultra-clear tempered glass on the front, thermostable, EVA encapsulant embedding cells and electrical insulation on the rear formed by a tedlar and polyester compound.
Junction box	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 vary 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 of 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 reflects typical values of the modules and laminates as measured at the output terminals at the end of the manufacturing process.

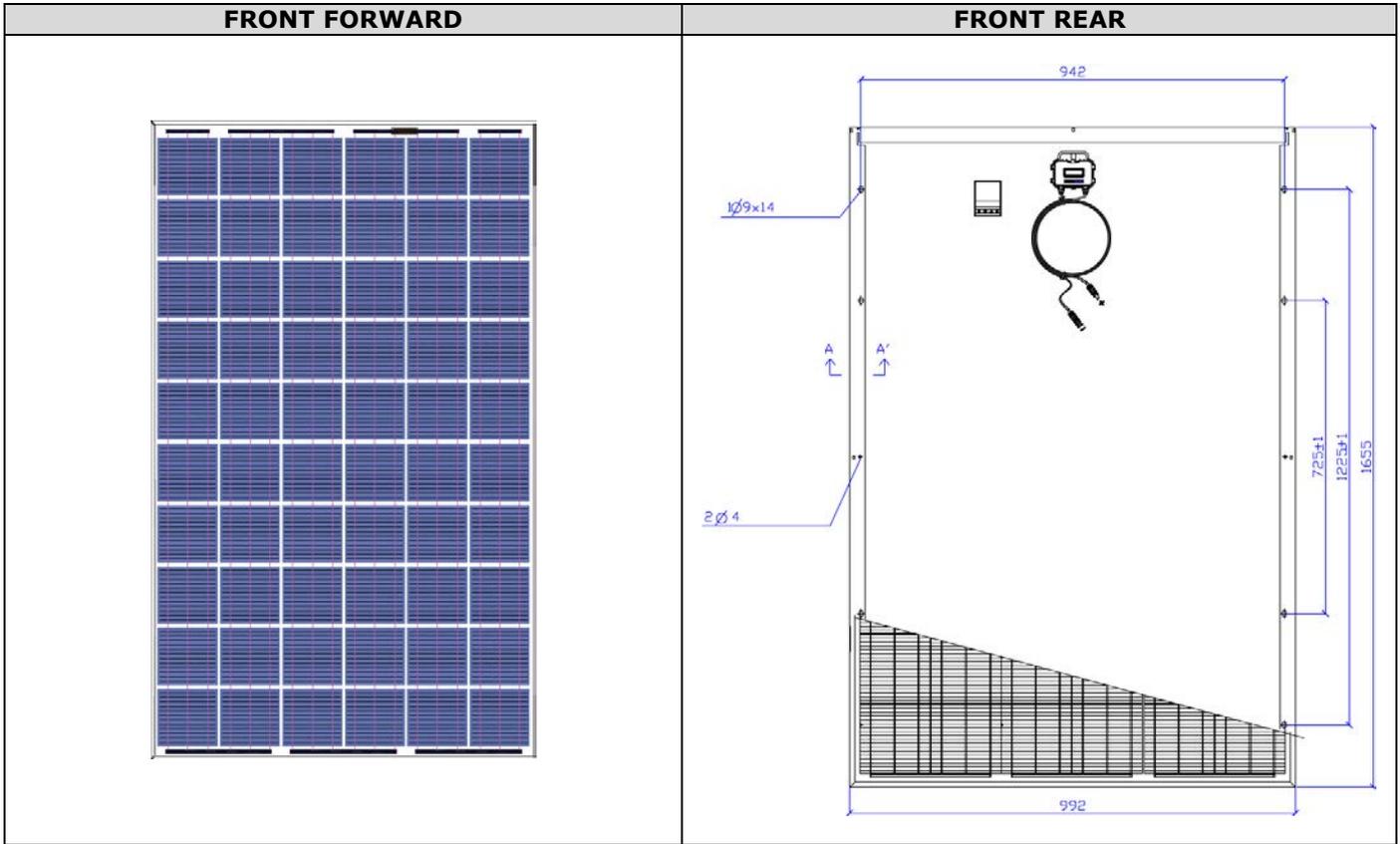
WARRANTIES		
Manufacturing defects	Years	12
Performance	Minimal Rated Power %/Years	90 % at 12 years, 80 % at 25 years.



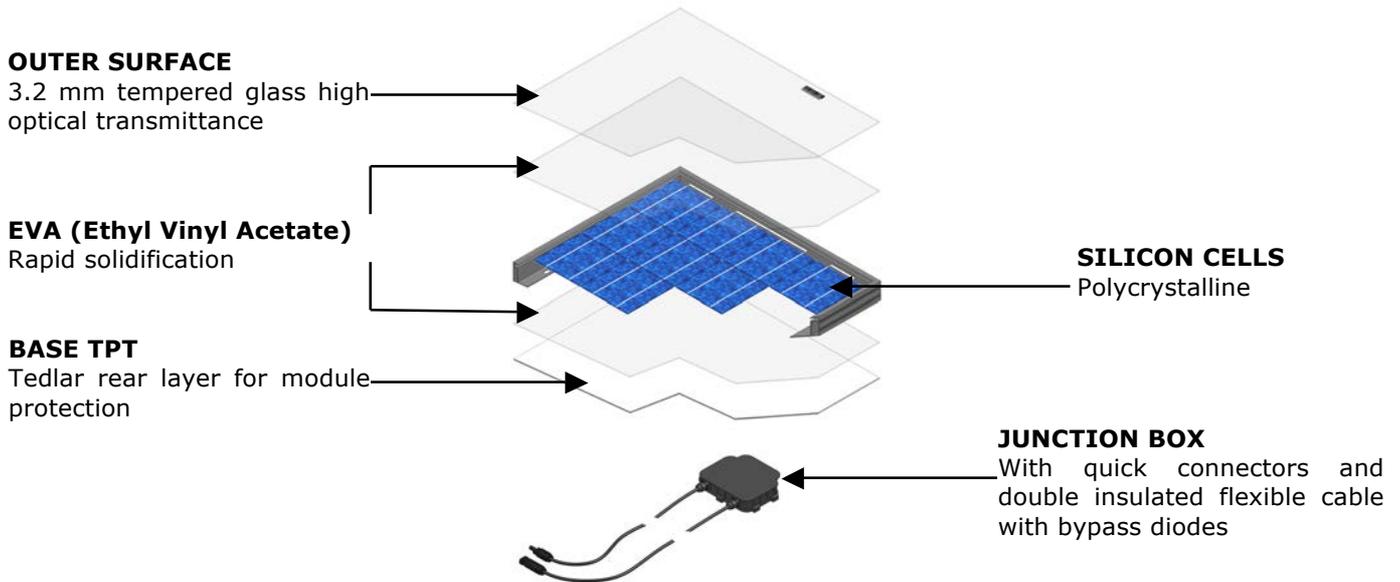
CERTIFICATES			
			
			



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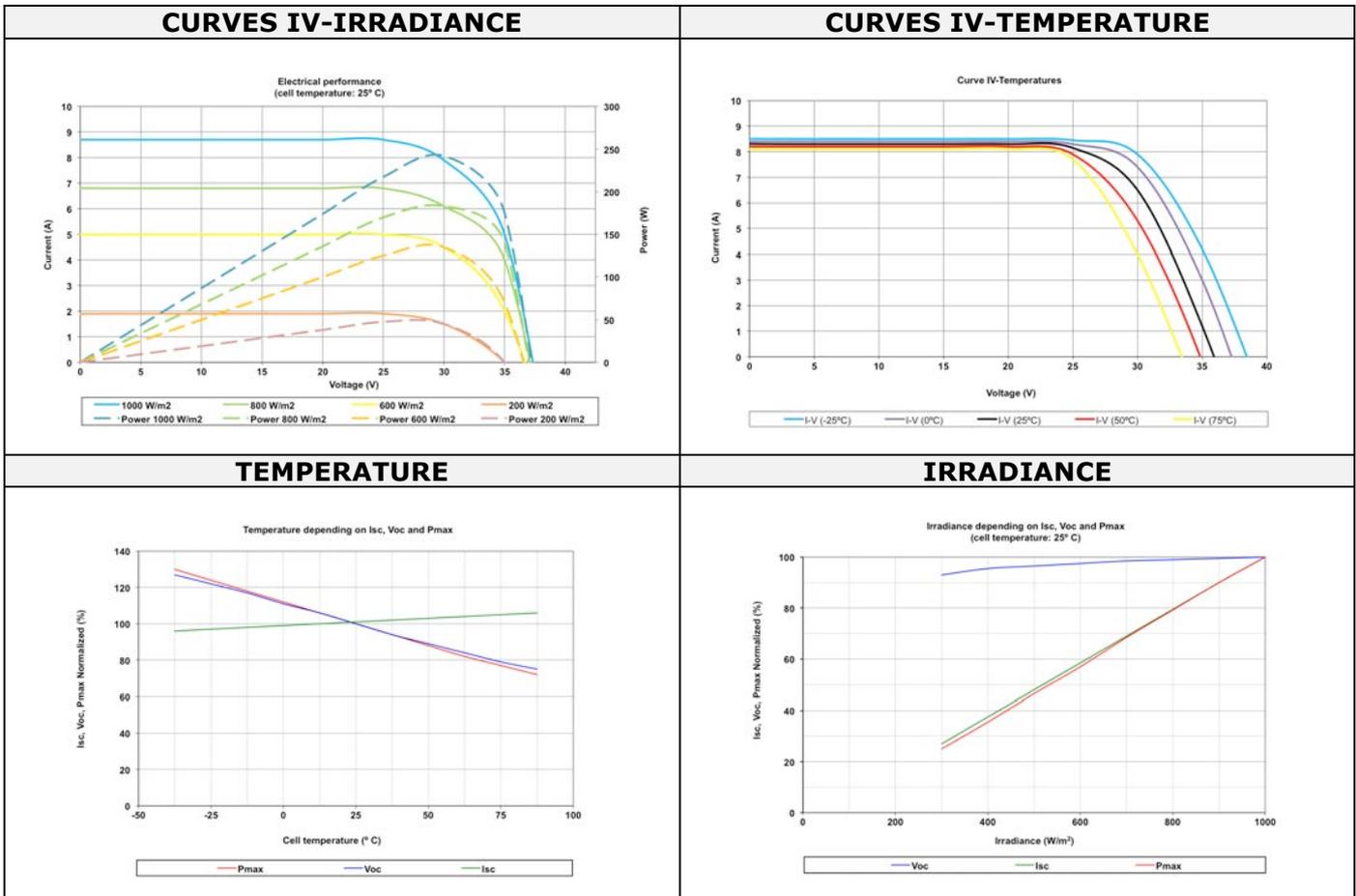
**CONSTRUCTION DETAILS**





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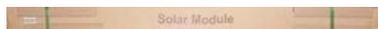
### PERFORMANCE





**PHOTOVOLTAIC SOLAR ENERGY**  
**POLYCRYSTALLINE MODULES - SI-ESF-M-P156-60**

**PACKAGING AND TRANSPORT**



<b>Box 2 Panels</b>	Size	1655 x 992 x 45 mm
	Weight	20 kg



<b>Box</b> (each big pallet add 18 pieces solar modules by 9 boxes)	Size	1700 x 1150 x 2140 mm (20' GP)
		1700 x 1150 x 2510 mm (40' GP)
	Panels	40 pcs/pallet (20' GP)
		48 pcs/pallet (40' GP)
	Weight (Empty)	165 kg (20' GP)
250 kg (40' GP)		



<b>Container 20' GP</b>	Size	5.898 x 2.352 x 2.393 m	20' x 8' x 8'6"
	Panels	240 pcs	
	Pallets	6 pcs	
	Weight (Net)	20 kg x 40 pcs + 165 kg = 965 kg	
	Weight (Gross)	965 kg x 6 pallets = 5790 kg	



<b>Container 40' GP</b> (each big pallet add 4 pieces solar modules by 2 boxes)	Size	12.025 x 2.352 x 2.393 m	40' x 8' x 8'6"
	Panels	624 pcs	
	Pallets	13 pcs	
	Weight (Net)	20 kg x 48 pcs + 250 kg = 1210 kg	
	Weight (Gross)	1210 kg x 13 pallets = 15730 kg	