



## **PHOTOVOLTAIC SOLAR ENERGY**

### **MONOCRYSTALLINE MODULES - SI-ESF-M-M90-105W**



These PV modules use pseudo-squared, high-efficiency, monocrystalline silicon cells (the cells are made of a single crystal 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 a 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.

The photovoltaic modules from Solar Innova have passed several international certification requirements and continue to even improve on an already superior quality and performance of products of proven technologies. Quality is one of our core principles and the pursuit of quality is the engine of the company's future, in our desire to continually offer better products.

Our PV modules are certified by internationally recognized laboratories (ZDHY, SGS, BRE Global, TÜV Rheinland Germany, TÜV Rheinland North America), and are proof of our strict adherence to international safety standards, long term performance and overall quality of products (ISO, CE, IEC, EN, MCS, UL).



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ELECTRICAL CHARACTERISTICS					
Maximum power (P <sub>mpp</sub> )	Watts	90	95	100	105
Tolerance	%	0 ~ + 3			
Voltage at maximum power (V <sub>mpp</sub> )	Volts	18.05	18.17	18.40	18.55
Current at maximum power (I <sub>mpp</sub> )	Amperes	4.99	5.23	5.43	5.66
Open circuit voltage (V <sub>oc</sub> )	Volts	22.28	22.43	22.72	22.90
Short circuit current (I <sub>sc</sub> )	Amperes	5.23	5.57	5.64	5.72
Maximum system Voltage (V <sub>syst</sub> )	Volts	600 (UL) / 1000 (IEC)			
Diodes (By-pass)	Quantity	2			
Maximum series fuse	Amperes	10			
Efficiency (η <sub>m</sub> )	%	13.92	14.69	15.47	16.24
Form Factor	%	≥ 73			
Protection	Grade	IP-65			

MECHANICAL CHARACTERISTICS		
Height	mm.	1195
Width	mm.	541
Thickness	mm.	35
Structure	Material	Anodized aluminum AL6063-T5, minim 15 μm
Weight	kg.	8
Front	Material	High transmission tempered glass
Front-Thickness	mm.	3.2 ± 0.2
Cells	Type	Monocrystalline
Cells	Quantity	4 x 9 = 36
Cells	Size	5" (125 x 125 mm.)
Cells-Serial connection	Quantity	36
Cells-Parallel connection	Quantity	1
Encapsulation	Materials	Glass/EVA/Cells/EVA/TPT
Junction box	Type	IP-65 - TÜV-IEC/EN 61215
Junction box	Isolation	Against humidity and inclement weather
Cables	Type	Polarized and symmetric in length
Cables-Length	mm.	900
Cables-Section of copper	mm <sup>2</sup>	4
Cables	Features	Low contact resistance Minimal losses for voltage drop
Connectors	Type	Compatible Type III and Type IV

THERMAL CHARACTERISTICS		
Temperature coefficient of short circuit current α (I <sub>cc</sub> )	%/° C	+ 0.028
Temperature coefficient of open circuit voltage β (V <sub>oc</sub> )	%/° C	- 0.347
Temperature coefficient of power γ (P <sub>mpp</sub> )	%/° C	- 0.471
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	- 40 ~ + 85
Dielectric Isolation Voltage	V	3000
Relative humidity	%	0 ~ 100
Wind resistance	m/s	60
	kg./m <sup>2</sup>	2400
	lbs./pies <sup>2</sup>	491.56
	kg./m <sup>2</sup>	551 (5400 Pa) IEC
Mechanical load-bearing capacity	lbs./pies <sup>2</sup>	75,2 (3600 Pa) UL



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

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

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, interchangeables 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.

### CONSTRUCTION DETAILS

#### OUTER SURFACE

3.2 mm. tempered glass high optical transmittance

#### EVA (Ethyl Vinyl Acetate)

Rapid solidification

#### JUNCTION BOX

With quick connectors and double insulated flexible cable with bypass diodes

#### BASE TPT

Tedlar rear layer for module protection

#### FRAME-CELL DISTANCE

Specially designed to prevent cross shadows withdraw the active part of the number of cells

35 mm.

#### TOUGHNESS

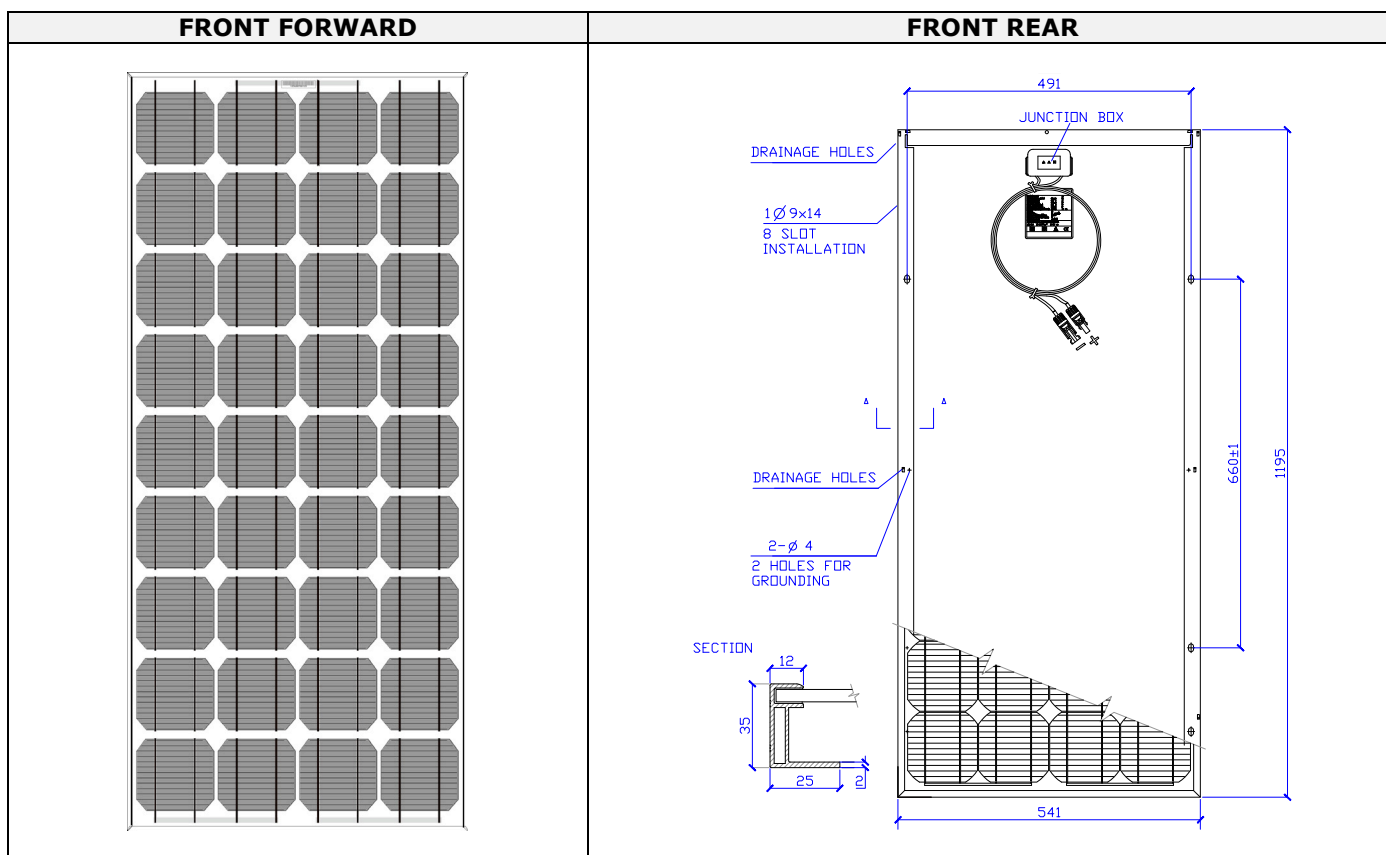
With its aluminum frame










#### SILICON CELLS

Monocrystalline



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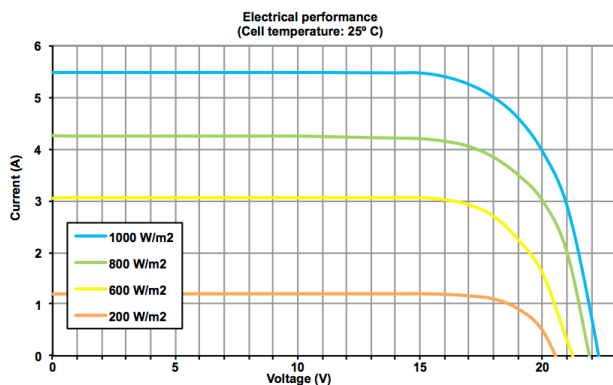
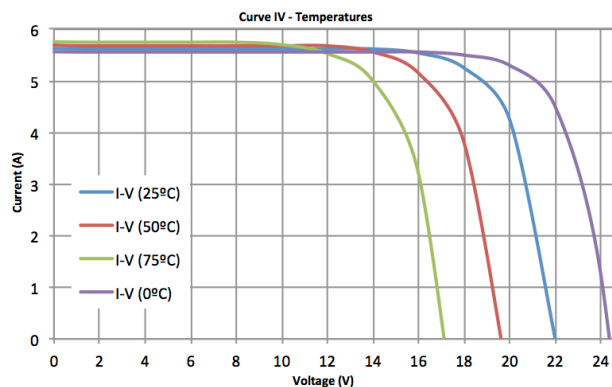
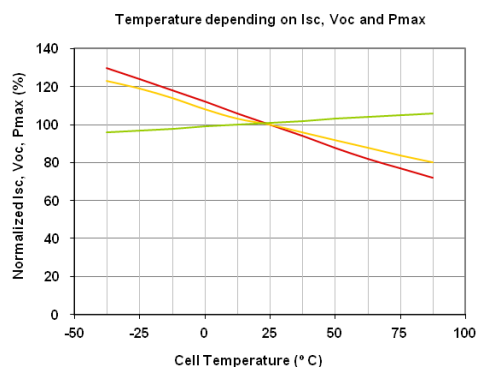
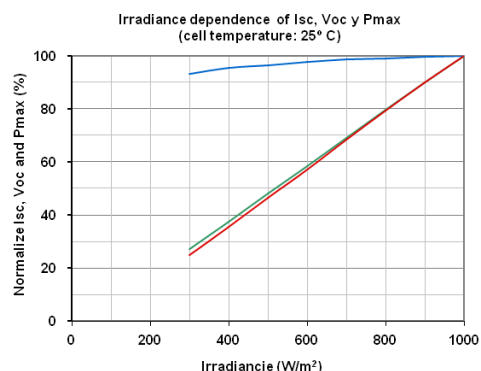


CERTIFICATES				
 <p>TÜVRheinland® <b>CERT</b> ISO 9001 ISO 14001 BS OHSAS 18001</p>	 <p>MADE IN EUROPE</p>	 <p>CE</p>		 <p>PV CYCLE</p>
	 <p>www.tuv.com TÜVRheinland® ID: 0000027455</p> <ul style="list-style-type: none"> <li>• Qualified, IEC 61215</li> <li>• Periodic Inspection</li> </ul>	 <p>www.tuv.com TÜVRheinland® ID: 0000027455</p> <ul style="list-style-type: none"> <li>• Qualified, IEC 61215</li> <li>• Safety tested, IEC 61730</li> <li>• Periodic Inspection</li> </ul>	 <p>MCS</p>	 <p>TÜVRheinland US</p>



## PHOTOVOLTAIC SOLAR ENERGY MONOCRYSTALLINE MODULES - SI-ESF-M-M90-105W

### PERFORMANCE

**CURVES IV-IRRADIANCE**

**CURVE IV-TEMPERATURE**

**TEMPERATURE**

**IRRADIANCE**




## PHOTOVOLTAIC SOLAR ENERGY MONOCRYSTALLINE MODULES - SI-ESF-M-M90-105W

PACKAGING AND TRANSPORT		
<b>Panel</b>	Size	1195 x 541 x 35 mm.
	Weight	8 kg.
<b>Pallet</b>	Size	1250 x 1140 x 700 mm.
	Panels	84 u./pallet (20' GP) 84 u./pallet (40' HC)
	Weight pallet (Empty)	270 kg.
<b>Container 20' FT</b>	Size	6.89 x 2.35 x 2.39 m.
	Panels	672 u.
	Pallets	8 u.
	Weight (Net)	8 kg. x 84 u. + 270 kg. = 942 kg.
	Weight (Gross)	942 kg. x 8 pallets = 7536 kg.
<b>Container 40' HC</b>	Size	12.04 x 2.35 x 2.68 m.
	Panels	1512 u.
	Pallets	18 u.
	Weight (Net)	8 kg. x 84 u. + 270 kg. = 314 kg.
	Weight (Gross)	942 kg. x 18 pallets = 16956 kg.

