

MANUFACTURER



SOLAR INNOVA GREEN TECHNOLOGY, S.L.

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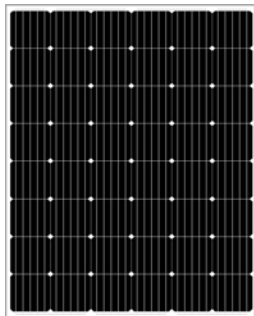
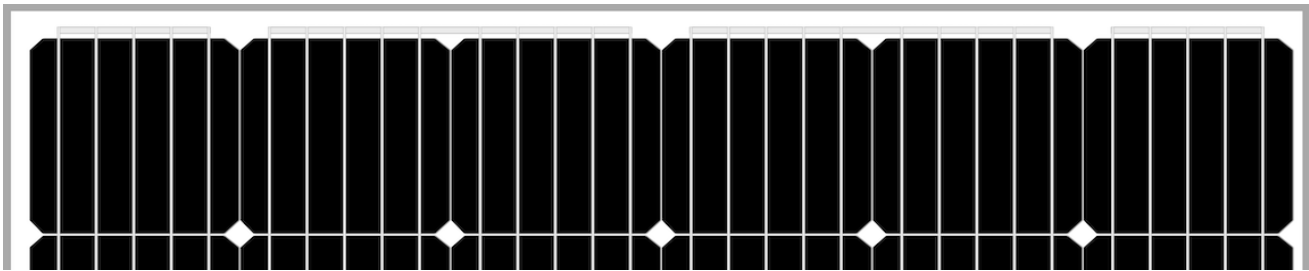
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PHOTOVOLTAIC MODULES

Series	STANDARD	Reference	SI-ESF-M-M156-48	Type	MONOCRYSTALLINE
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INTRODUCTION



MATERIALS

Solar Innova uses the latest materials to manufacture photovoltaic modules.

USE

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.

FRONT

The front of the module contains a tempered solar glass with:

- High transmissivity.
- Low reflectivity.
- Low iron content.

PV CELLS

These PV modules use 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.

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).

ENCAPSULANT

The cell circuit is laminated using as encapsulant:

- EVA (Ethylene-Vinyl Acetate).

BACK

The rear of the module contains a plastic polymer (Tedlar) which provides complete protection and seals against environmental agents and electrical insulation.

FRAME

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.

JUNCTION BOX

The junction boxes with IP67, 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.

PERFORMANCE

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. 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.

QUALITY CONTROL

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.

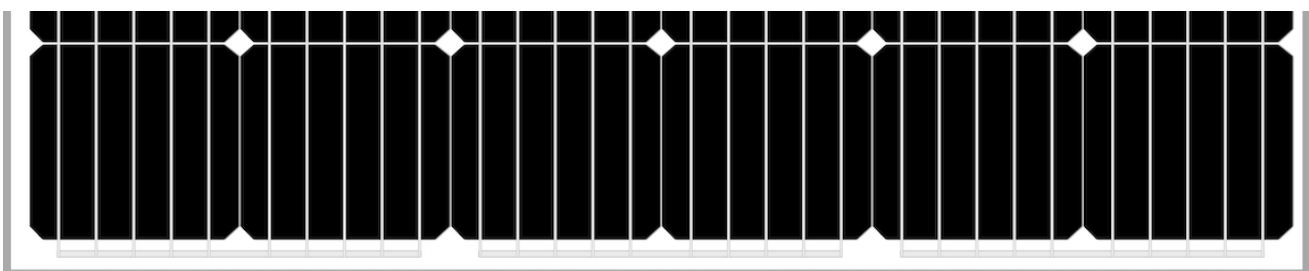
WARRANTIES

Our manufacturing plants have been prepared in accordance with:

- ISO 9001, in terms of Quality Systems and Business.
- ISO 14001, in terms of Environmental Management Systems.
- OHSAS 18001, in terms of Management Systems Health and Safety.

CERTIFICATES

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.



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PV CELLS

ELECTRICAL CHARACTERISTICS

Type	Monofacial	sc-Si	TEMPERATURE COEFFICIENTS		
MECHANICAL CHARACTERISTICS			TEMPERATURE COEFFICIENTS		
Size	mm	156,75 x 156,75 ±0,5	Tk Voltage	%/K	-0,36
Thickness	µm	210 ±20	Tk Current	%/K	0,07
Front	-	Si3N4 anti-reflection coating	Tk Power	%/K	-0,38
Back	+	Aluminum back surface field (Al-BSF)			

PV MODULES

ELECTRICAL CHARACTERISTICS

STC CONDITIONS

Maximum power	[Pmpp]	Wp	225	230	235	240	±3%	
Tolerance	[Pmpp]	Wp	0/+5					
Voltage at maximum power	[Vmpp]	V	26,16	26,26	26,45	26,83	IEC 60904-1	
Current at maximum power	[Impp]	A	8,62	8,75	8,87	8,93	IEC 60904-3	
Open circuit voltage	[Voc]	V	31,92	32,13	32,33	32,72	±2%	
Short circuit current	[Isc]	A	9,34	9,41	9,48	9,55	±4%	
Maximum system voltage	[Vsyst]	V	1500 / 1000					IEC / UL
Maximum series fuse rating	[Icf]	A	15					
Efficiency	[ηm]	%	17,19	17,52	17,89	18,27		
Form Factor	[FF]	%	75,63	75,98	76,54	76,68		
STC (Standard Test Conditions): Irradiance: 1000 W/m2 + Cell Temperature: 25° C + Air Mass: 1.5								

NMOT CONDITIONS

Maximum power	[Pmpp]	Wp	166	169	173	177	IEC 61215
Voltage at maximum power	[Vmpp]	V	23,82	23,91	24,08	24,43	
Current at maximum power	[Impp]	A	7,00	7,11	7,20	7,25	
Open circuit voltage	[Voc]	V	29,18	29,37	29,55	29,91	
Short circuit current	[Isc]	A	7,57	7,63	7,69	7,75	
NMOT (Nominal Module Operating Temperature): Irradiance: 800 W/m2 + Ambient Temperature: 20° C + Air Mass: 1.5 + Wind Speed: 1 m/s							

MECHANICAL CHARACTERISTICS

PANEL	WIDTH (X)		HIGH (Y)		AREA
Size	992	x	1322	mm	1,31 m2
CELLS					
Size	156,75	x	156,75	mm	0,02 m2
Quantity	6	x	8	=	48 units
					1,18 m2

COMPONENTS

MATERIAL	QUANTITY	THICKNESS (Z)	DESCRIPTION	DENSITY	TOTAL WEIGHT
Frame	1 units	35 mm	Al 6065-T5	1,23 kg/m2	1,61 kg
Glass	1 units	3,2 mm	Tempered	8,10 kg/m2	10,62 kg
Sheet Encapsulant	1 units	0,38 mm	EVA	0,40 kg/m2	0,53 kg
Busbars	5 units	0,2 mm	CuSn6	0,10 kg/m2	0,12 kg
PV Cells	48 units	0,21 mm	sc-Si	0,20 kg/m2	0,24 kg
Sheet Encapsulant	1 units	0,38 mm	EVA	0,40 kg/m2	0,53 kg
Backsheet	1 units	0,5 mm	TPT	0,47 kg/m2	0,61 kg
Junction Box	1 units	10 mm	Monopolar	0,10 kg/m2	0,10 kg
Diodes (By-pass)	4 units			0,01 kg/m2	0,02 kg
Cables (+/-)	2 units	4 mm2	900 mm	0,10 kg/m2	0,20 kg
Connectors	2 units	MC4-T4 type	PVC-IP67	0,05 kg/m2	0,10 kg
TOTAL		35 mm		11,16 kg/m2	14,68 kg

THERMAL CHARACTERISTICS

TEMPERATURE COEFFICIENTS			MONOCRYSTALLINE		
Temperature coefficient of short circuit current	α	[Isc]		0,0814	%/° C
Temperature coefficient of open circuit voltage	β	[Voc]		-0,3910	%/° C
Temperature coefficient of maximum power	γ	[Pmpp]		-0,5141	%/° C
Temperature coefficient of current at maximum power		[Impp]		0,1000	%/° C
Temperature coefficient of voltage at maximum power		[Vmpp]		-0,3800	%/° C
Nominal Module Operating Temperature		[NMOT]		+ 47 ± 2	° C

TOLERANCES

Working temperature	- 40 / + 85 °C	Glass dimension	< ± 2,5 mm	EN 12543-5
Dielectric isolation voltage	3000 V	Glass symmetry tolerance	< ± 3 mm	EN 12543-5
Relative humidity	0 / 100 %	Cell single string distolerance	< ± 1 mm	EN 12543-6
Wind resistance	2400 Pa			IEC 61215
Snow resistance	5400 Pa	Maximum hail resistance	Ø 28	23 m/s
Conductivity at ground	≤ 0.1 Ω	Resistance	≥ 100 Ω	IEC 61215

CLASSIFICATIONS

Application class	A Class	IEC 61730	Pollution	Degree	1	IEC 61730
Electrical protection class	II Class	IEC 61140	Material	Group	I	IEC 61730
Fire safety class	C Class	ANSI/UL 790	Safety	Factors	1.5	IEC 61730

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PHOTOVOLTAIC MODULES

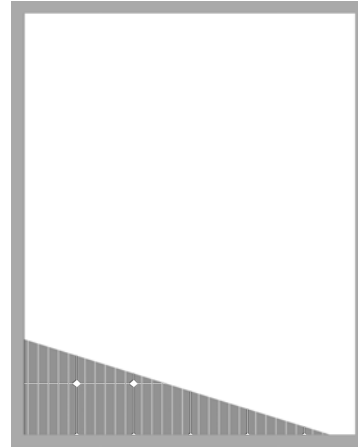
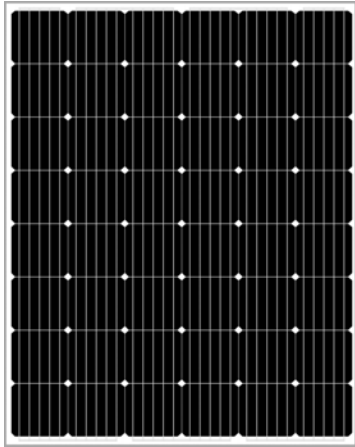
Series	STANDARD	Reference	SI-ESF-M-M156-48	Type	MONOCRYSTALLINE
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DRAWING

JUNCTION BOX

Position	Front	-	Rear	Border	-	Axis (X)	Axis (Y)
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FRONT				REAR			
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WIDTH (X) 992 mm

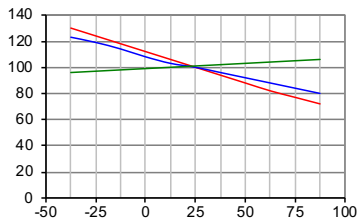
HIGH (Y) 1322 mm

PERFORMANCE

CELLS

TEMPERATURE

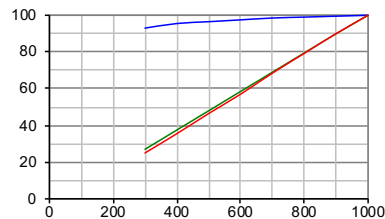
Temperature depending on Isc, Voc and Pmax



Cell temperature (°C)
 --- Pmax --- Voc --- Isc

IRRADIANCE

Irradiance depending on Isc, Voc and Pmax (cell temperature: 25° C)

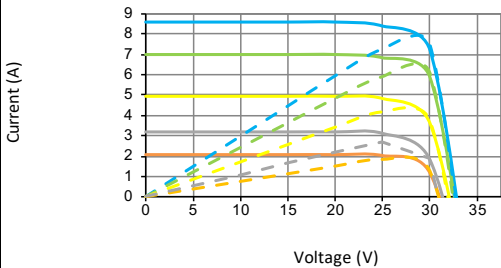


Irradiance (W/m²)
 --- Voc --- Isc --- Pmax

PANELS

TEMPERATURE

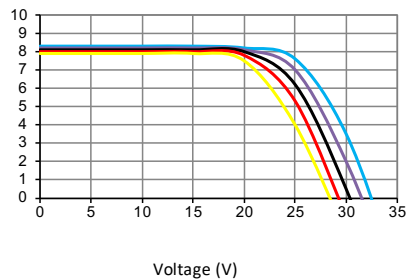
Electrical performance (cell temperature: 25° C)



Voltage (V)

--- I-V 1000 W/m2	--- P-I 1000 W/m2
--- I-V 800 W/m2	--- P-I 800 W/m2
--- I-V 600 W/m2	--- P-I 600 W/m2
--- I-V 400 W/m2	--- P-I 400 W/m2
--- I-V 200 W/m2	--- P-I 200 W/m2

IV-IRRADIANCE



Voltage (V)

I-V (-25°C) I-V (0°C) I-V (+25°C) I-V (+50°C) I-V (+75°C)

SOLAR SIMULATOR

Class	AAA	IEC 60904-9	Power measurement uncertainty is	± 3 %
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ELECTRICAL MEASURES

STC CONDITIONS		ELECTRICAL MEASURES		NMOT CONDITIONS	
Irradiance	1000 W/m2	IEC 60904-1	Irradiance	800 W/m2	IEC 61215
Cell temperature	25 °C	IEC 60904-3	Ambient temperature	20 °C	
Air Mass	1,5	ASTM G173	Air Mass	1,5	ASTM G173-03
		ASTM 1036	Wind speed	1 m/s	

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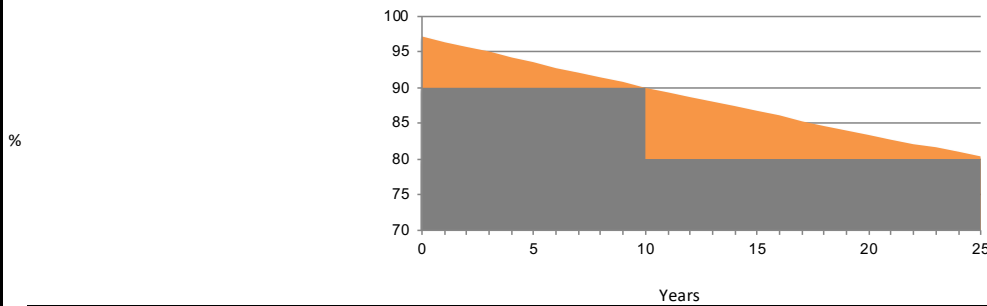


PHOTOVOLTAIC MODULES

Series STANDARD **Reference** SI-ESF-M-M156-48 **Type** MONOCRYSTALLINE

STANDARD GUARANTEES

LINEAR PERFORMANCE WARRANTY



Manufacturing defects	12 years.
Performance	90 % of rated power after 12 years of operation, 80 % of rated power after 25 years of operation.
Lifespan	> 30 years.

ENVIRONMENTAL INFORMATION

		kWh	Coal	Petrol/Gas	Combined
Solar Hours Peak	6 day				
Irradiation rate	1000 W/ m2		1	0,961	0,828
Energy generated	1,35 kWh/ day	Avoid		1,30	1,12
	41 kWh/ month	CO2		39,01	33,61
	494 kWh/ year	emissions		474,58	408,90
				183,71	15,10
					kg/CO2

CERTIFICATES

ISO 9001	Quality Management Systems.
ISO 14001	Environmental Management Systems.
OHSAS 18001	Occupational Health and Safety Management Systems.
CE	Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.
IEC/EN 61215	Crystalline silicon terrestrial photovoltaic (PV) modules. Design qualification and type approval.
IEC/EN 61730-1	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction.
IEC/EN 61730-2	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing.
IEC/EN 61701	Salt mist corrosion testing of photovoltaic (PV) modules.
IEC/EN 62716	Photovoltaic (PV) modules - Ammonia corrosion testing.
UNE-EN IEC 62804-1	Photovoltaic (PV) Modules - Test Methods for the detection of potential-induced degradation. Part 1: Crystalline silicone.
IEC/EN 62790	Junction boxes for photovoltaic modules - Safety requirements and tests.
IEC/EN 62852	Connectors for DC-application in photovoltaic systems - Safety requirements and test.
UL 1703	Standard for Flat-Plate Photovoltaic Modules and Panels.



PACKING

PANELS X PALLET	CONTAINER 20'		CONTAINER 40'HQ		TOTAL
	PALLETS	TOTAL	PALLETS	TOTAL	
IEC 62759-1	26	572	22	572	572

EXPORT INFORMATION

HS Code	85414020	TARIC code	8541409021
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COMMENTS

NOTICE

The specifications and technical data may be subject to possible modifications without notice.
This data sheet are conform to the requirements of the Standard EN 50380:2018.