MANUFACTURER

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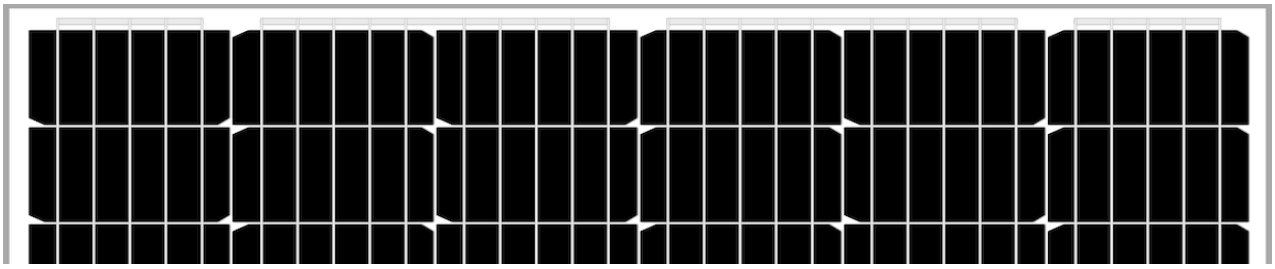
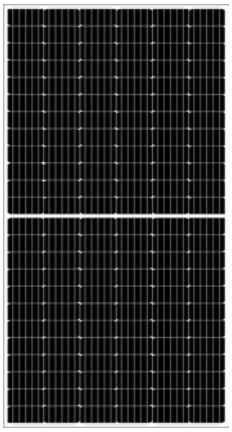
PHOTOVOLTAIC MODULES

Series	STANDARD	**Reference**	SI-ESF-M-M156-144	**Type**	MONOCRYSTALLINE

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).

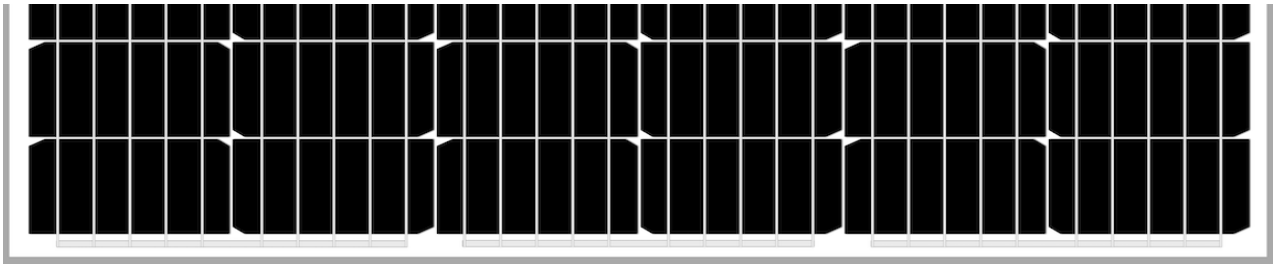
These modules are supplied with symmetric lengths of cable, with a diameter of copper section of 4 mm and an extremely low contact resistance, all designed to achieve the minimum voltage drop losses.

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

Type	Monofacial	sc-Si

MECHANICAL CHARACTERISTICS			TEMPERATURE COEFFICIENTS		
Size	mm	156,75 x 78,375 ±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	340	345	350	355	IEC 60904-1
Tolerance	[Pmpp]	Wp		0/+5			IEC 60904-3
Voltage at maximum power	[Vmpp]	V	38,79	38,96	39,36	39,66	ASTM G173
Current at maximum power	[Impp]	A	8,76	8,84	8,89	8,95	ASTM 1036
Open circuit voltage	[Voc]	V	47,03	47,31	47,45	48,68	
Short circuit current	[Isc]	A	9,27	9,31	9,40	9,49	
Maximum system voltage	[Vsyst]	V		1500 / 1000			IEC / UL
Maximum series fuse rating		A		15			
Efficiency	[ηm]	%	17,18	17,43	17,69	17,94	
Form Factor	[FF]	%	77,99	78,33	78,47	78,47	

STC (Standard Test Conditions): Irradiance: 1000 W/m2 + Cell Temperature: 25º C + Air Mass: 1.5

NMOT CONDITIONS

Maximum power	[Pmpp]	Wp	251	254	258	262	IEC 61215
Voltage at maximum power	[Vmpp]	V	35,32	35,47	35,84	36,11	
Current at maximum power	[Impp]	A	7,11	7,18	7,22	7,27	
Open circuit voltage	[Voc]	V	42,99	43,24	43,37	44,49	
Short circuit current	[Isc]	A	7,52	7,55	7,62	7,70	

NMOT (Nominal Module Operating Temperature): Irradiance: 800 W/m2 + Ambient Temperature: 20º C + Air Mass: 1.5 + Wind Speed: 1 m/s

MECHANICAL CHARACTERISTICS

PANEL	WIDTH (X)		HIGH (Y)			AREA
Size	992	x	1995	mm		1,98 m2
CELLS						
Size	156,75	x	78,38	mm	210 mm	0,01 m2
Quantity	6	x	24	=	144 units	1,77 m2

COMPONENTS

MATERIAL	QUANTITY		THICKNESS (Z)		DESCRIPTION	DENSITY	TOTAL WEIGHT
Frame	1	units	40	mm	Al 6065-T5	1,40 kg/m2	2,77 kg
Glass-1	1	units	3,2	mm	Tempered	8,10 kg/m2	16,03 kg
Sheet Encapsulant	1	units	0,38	mm	EVA	0,40 kg/m2	0,80 kg
Busbars	5	units	0,2	mm	CuSn6	kg/m2	kg
PV Cells	1	units	0,21	mm	sc-Si	0,11 kg/m2	0,21 kg
Sheet Encapsulant	1	units	0,38	mm	EVA	0,40 kg/m2	0,80 kg
Backsheet	1	units	0,5	mm	TPT	0,47 kg/m2	0,93 kg
Junction Box	1	units	10	mm	Monopolar	0,10 kg/m2	0,10 kg
Diodes (By-pass)	12	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			**40**	**mm**		**12,41 kg/m2**	**21,95 kg**

THERMAL CHARACTERISTICS

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

TOLERANCES

Working temperature	- 40 / + 85	ºC	Glass dimension	< ± 2,5	mm
Dielectric isolation voltage	3000	V	Glass symmetrytolerance	< ± 3	mm
Relative humidity	0 / 100	%	Cell single string distolerance	< ± 1	mm
Wind resistance	2400 Pa	244 kg/mm2			
Snow resistance	5400 Pa	550 kg/mm2	Maximum hail resistance	⌀ 28	23 m/s

CLASSIFICATIONS

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

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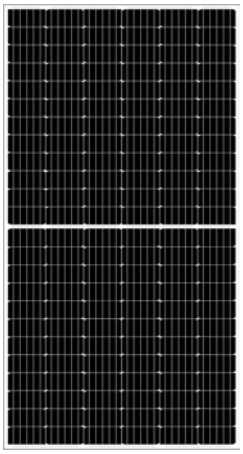
DRAWING

JUNCTION BOX

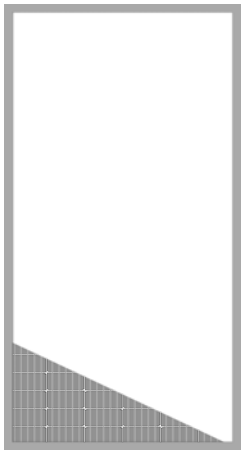
Position	Rear ■	Border -	Axis (X) ■	Axis (Y) -

PANEL

FRONT



REAR



HIGH (Y) 1995 mm

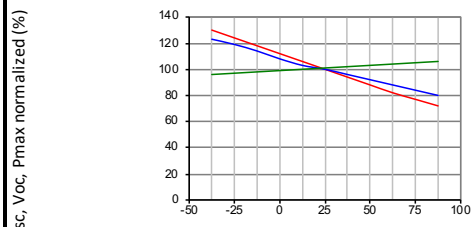
WIDTH (X) 992 mm

PERFORMANCE

CELLS

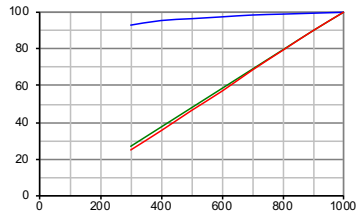
TEMPERATURE

Temperature depending on Isc, Voc and Pmax



IRRADIANCE

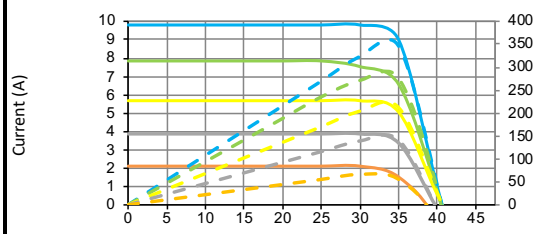
Irradiance depending on Isc, Voc and Pmax
(cell temperature: 25º C)



PANELS

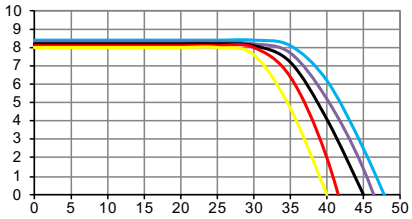
TEMPERATURE

Electrical performance
(cell temperature: 25º C)



--- 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



I-V (-25ºC) I-V (0ºC) I-V (+25ºC) I-V (+50ºC) I-V (+75ºC)

SOLAR SIMULATOR

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

ELECTRICAL MEASURES

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

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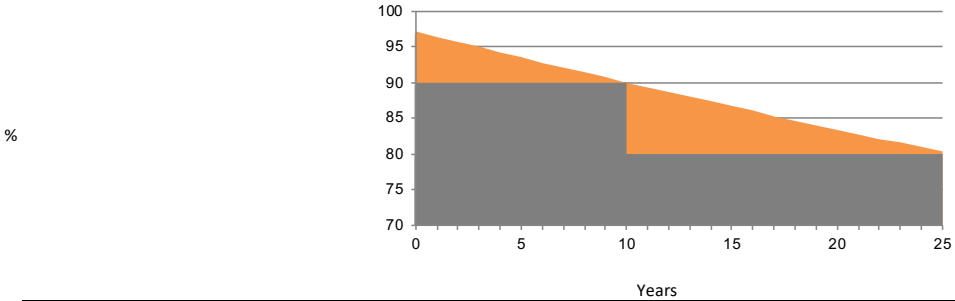
STANDARD GUARANTEES

LINEAR PERFORMANCE WARRANTY



Manufacturing defects	12 years.
Performance	90% of rated power after 10 years of operation,
	80% of rated power after 25 years of operation.

ENVIRONMENTAL INFORMATION

Solar Hours Peak	6 day			**kWh**	**Coal**	**Petrol/Gas**	**Combined**
Irradiation rate	1000 W/ m2			1	0,961	0,828	0,372 kg/CO2
Energy generated	2040 kWh day	**Avoid**		**day**	1960	1689	759 kg/CO2
	61200 kWh month	**CO2**		**month**	58813	50674	22766 kg/CO2
	744600 kWh year	**emissions**		**year**	715561	616529	276991 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

CONTAINER 20'			CONTAINER 40'HQ		
PANELS X PALLET	**PALLETS**	**TOTAL**	**PANELS X PALLET**	**PALLETS**	**TOTAL**
-	-	-	26	22	572

IEC 62759-1	Photovoltaic (PV) modules - Transportation testing - Part 1: Transportation and shipping of module package units.

EXPORT INFORMATION

HS Code	85414020	**TARiC code**	8541409021

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.