

MANUFACTURER



SOLAR INNOVA GREEN TECHNOLOGY, S.L.

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Paseo de los Molinos, 12

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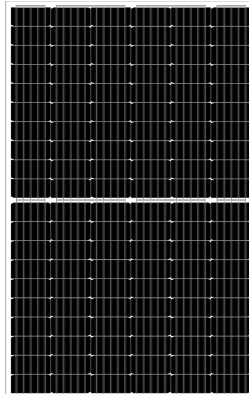
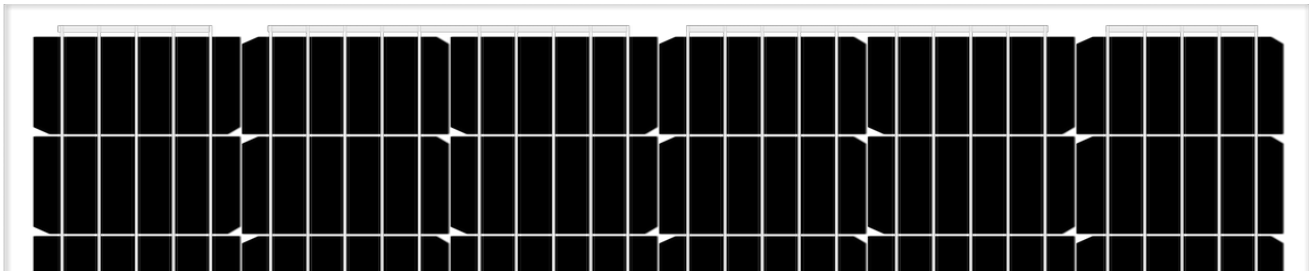
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PHOTOVOLTAIC MODULES

Series GLASS/GLASS Reference SI-ESF-M-BIPV-GG-M156-120-PERC 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).
- POE (Polyolefin).
- PVB (Polivinil Butiral).

**BACK**

The rear of the module contains a tempered glass which provides complete protection and seals against environmental agents and electrical insulation.

**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.

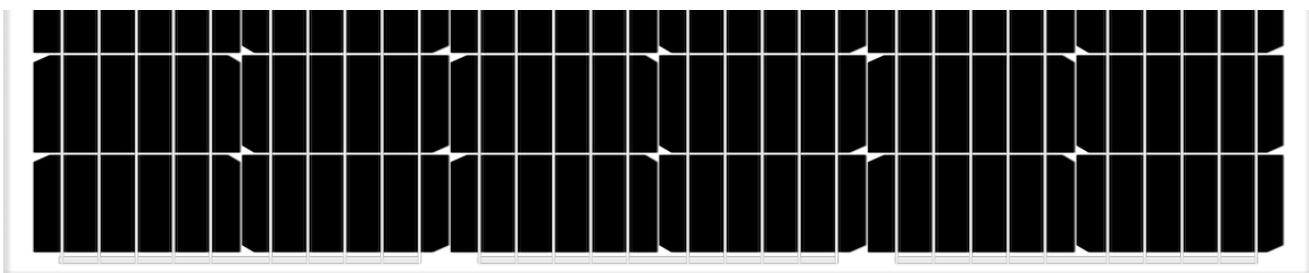
**WARRANTIES**

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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PHOTOVOLTAIC MODULES

|        |             |           |                                |      |                 |
|--------|-------------|-----------|--------------------------------|------|-----------------|
| Series | GLASS/GLASS | Reference | SI-ESF-M-BIPV-GG-M156-120-PERC | Type | MONOCRYSTALLINE |
|--------|-------------|-----------|--------------------------------|------|-----------------|

PV CELLS

ELECTRICAL CHARACTERISTICS

| Type                              | Monofacial | sc-Si                                | TEMPERATURE COEFFICIENTS        |     |       |
|-----------------------------------|------------|--------------------------------------|---------------------------------|-----|-------|
| <b>MECHANICAL CHARACTERISTICS</b> |            |                                      | <b>TEMPERATURE COEFFICIENTS</b> |     |       |
| 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

| Parameter                  | [Pmpp]  | Wp | 310   | 315         | 320   | 325   | ±3% (*)     |
|----------------------------|---------|----|-------|-------------|-------|-------|-------------|
| Maximum power              | [Pmpp]  | Wp | 310   | 315         | 320   | 325   | ±3% (*)     |
| Power selection            | [Pmpp]  | Wp |       | 0/+5        |       |       |             |
| Voltage at maximum power   | [Vmpp]  | V  | 33,60 | 33,90       | 34,02 | 34,14 | IEC 60904-1 |
| Current at maximum power   | [Impp]  | A  | 9,22  | 9,30        | 9,42  | 9,51  | IEC 60904-3 |
| Open circuit voltage       | [Voc]   | V  | 40,86 | 41,20       | 41,27 | 41,29 | ±3% (*)     |
| Short circuit current      | [Isc]   | A  | 9,66  | 9,81        | 9,96  | 10,06 | ±4% (*)     |
| Maximum system voltage     | [Vsyst] | V  |       | 1500 / 1000 |       |       | IEC / UL    |
| Maximum series fuse rating | [Icf]   | A  |       | 15          |       |       |             |
| Efficiency                 | [ηm]    | %  | 18,64 | 18,97       | 19,29 | 19,54 |             |
| Form Factor                | [FF]    | %  | 78,48 | 78,00       | 77,94 | 78,15 |             |

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

\* (Considering LID, the power range of the certification authority)

NMOT CONDITIONS

| Parameter                | [Pmpp] | Wp | 228   | 232   | 236   | 239   | IEC 61215 |
|--------------------------|--------|----|-------|-------|-------|-------|-----------|
| Maximum power            | [Pmpp] | Wp | 228   | 232   | 236   | 239   | IEC 61215 |
| Voltage at maximum power | [Vmpp] | V  | 30,59 | 30,87 | 30,98 | 31,08 |           |
| Current at maximum power | [Impp] | A  | 7,49  | 7,55  | 7,65  | 7,72  |           |
| Open circuit voltage     | [Voc]  | V  | 37,35 | 37,65 | 37,73 | 37,74 |           |
| Short circuit current    | [Isc]  | A  | 7,84  | 7,96  | 8,08  | 8,16  |           |

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 | 1675     | mm | 1,66 m2   |
| <b>CELLS</b> |           |   |          |    |           |
| Size         | 156,75    | x | 78,38    | mm | 0,01 m2   |
| Quantity     | 6         | x | 20       | =  | 120 units |
|              |           |   |          |    | 1,47 m2   |

COMPONENTS

| MATERIAL          | QUANTITY  | THICKNESS (Z)  | DESCRIPTION | DENSITY            | TOTAL WEIGHT    |
|-------------------|-----------|----------------|-------------|--------------------|-----------------|
| Glass-1           | 1 units   | 3,2 mm         | Tempered    | 8,10 kg/m2         | 13,46 kg        |
| Sheet Encapsulant | 1 units   | 0,38 mm        | EVA         | 0,40 kg/m2         | 0,67 kg         |
| Busbars           | 5 units   | 0,2 mm         | CuSn6       | 0,10 kg/m2         | 0,15 kg         |
| PV Cells          | 120 units | 0,21 mm        | sc-Si       | 0,20 kg/m2         | 0,29 kg         |
| Sheet Encapsulant | 1 units   | 0,38 mm        | EVA         | 0,40 kg/m2         | 0,67 kg         |
| Glass-2           | 1 units   | 3,2 mm         | Tempered    | 8,10 kg/m2         | 13,46 kg        |
| Junction Box      | 1 units   | 10 mm          | Monopolar   | 0,10 kg/m2         | 0,10 kg         |
| Diodes (By-pass)  | 10 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         |
| <b>TOTAL</b>      |           | <b>7,37 mm</b> |             | <b>19,75 kg/m2</b> | <b>29,12 kg</b> |

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 35       | 97 m/s IEC 61215 |
| Conductivity at ground       | ≤ 0.1 Ω        | Resistance                      | ≥ 100 Ω    |                  |

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           | A Class  | ANSI/UL 790 IEC 61730 | Safety    | Factors | 1.5 | IEC 61730 |

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DRAWING

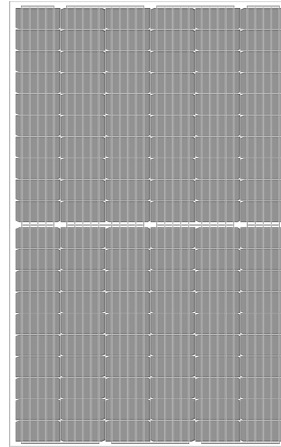
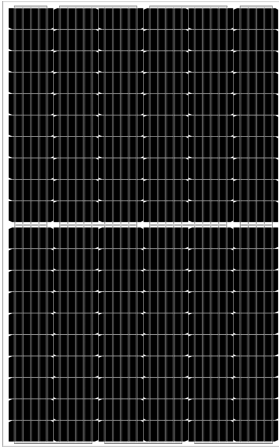
JUNCTION BOX

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

PANEL

FRONT

REAR



WIDTH (X) 992 mm

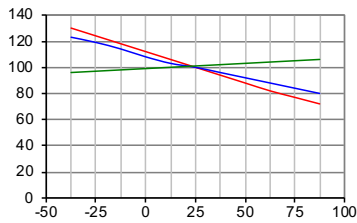
HIGH (Y) 1675 mm

PERFORMANCE

CELLS

TEMPERATURE

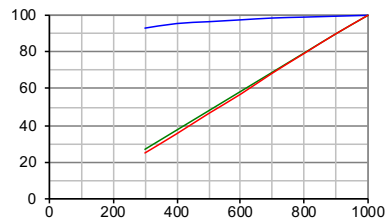
Temperature depending on Isc, Voc and Pmax



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

IRRADIANCE

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

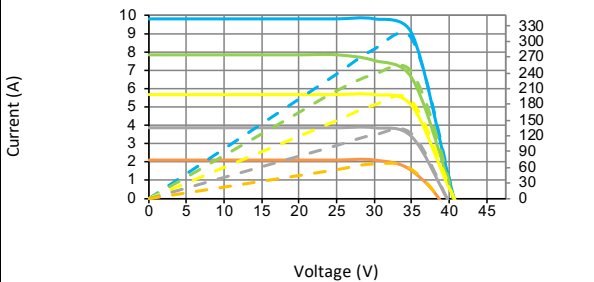


Irradiance (W/m²)  
--- Voc --- Isc --- Pmax

PANELS

TEMPERATURE

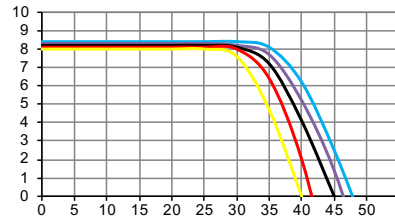
Electrical performance (cell temperature: 25° C)



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 %

ELECTRICAL MEASURES

| STC CONDITIONS   |           | NMOT CONDITIONS     |          |
|------------------|-----------|---------------------|----------|
| Irradiance       | 1000 W/m² | Irradiance          | 800 W/m² |
| Cell temperature | 25 °C     | Ambient temperature | 20 °C    |
| Air Mass         | 1,5       | Air Mass            | 1,5      |
|                  | ASTM G173 | Wind speed          | 1 m/s    |
|                  | ASTM 1036 |                     |          |

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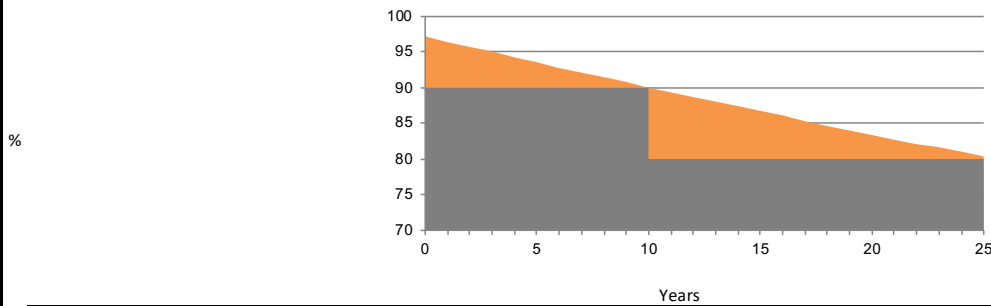


**PHOTOVOLTAIC MODULES**

**Series** GLASS/GLASS      **Reference** SI-ESF-M-BIPV-GG-M156-120-PERC      **Type** MONOCRYSTALLINE

**STANDARD GUARANTEES**

**LINEAR PERFORMANCE WARRANTY**



|                              |  |
|------------------------------|--|
| <b>Manufacturing defects</b> | 12 years.  |
| <b>Performance</b>           | 90 % of rated power after 12 years of operation,<br>80 % of rated power after 25 years of operation. |
| <b>Lifespan</b>              | > 30 years.  |

**ENVIRONMENTAL INFORMATION**

|                         |               | kWh              |            |          |              |
|-------------------------|---------------|------------------|------------|----------|--------------|
|                         |               | Coal             | Petrol/Gas | Combined |              |
| <b>Solar Hours Peak</b> | 6 day         |                  |            |          |              |
| <b>Irradiation rate</b> | 1000 W/ m2    | 1                | 0,961      | 0,828    | 0,372 kg/CO2 |
| <b>Energy generated</b> | 1,86 kWh/ day | <b>Avoided</b>   | 1,79       | 1,54     | 0,69 kg/CO2  |
|                         | 56 kWh/ month | <b>CO2</b>       | 53,59      | 46,17    | 20,74 kg/CO2 |
|                         | 678 kWh/ year | <b>emissions</b> | year       | 651,99   | 561,75       |

**CERTIFICATES**

|                           |   |
|---------------------------|---|
| <b>ISO 9001</b>           | Quality Management Systems.   |
| <b>ISO 14001</b>          | Environmental Management Systems.   |
| <b>OHSAS 18001</b>        | Occupational Health and Safety Management Systems.  |
| <b>CE</b>                 | 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. |
| <b>IEC/EN 61215</b>       | Crystalline silicon terrestrial photovoltaic (PV) modules. Design qualification and type approval.  |
| <b>IEC/EN 61730-1</b>     | Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction.  |
| <b>IEC/EN 61730-2</b>     | Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing.   |
| <b>IEC/EN 61701</b>       | Salt mist corrosion testing of photovoltaic (PV) modules.   |
| <b>IEC/EN 62716</b>       | Photovoltaic (PV) modules - Ammonia corrosion testing.  |
| <b>UNE-EN IEC 62804-1</b> | Photovoltaic (PV) Modules - Test Methods for the detection of potential-induced degradation. Part 1: Crystalline silicone.  |
| <b>IEC/EN 62790</b>       | Junction boxes for photovoltaic modules - Safety requirements and tests.  |
| <b>IEC/EN 62852</b>       | Connectors for DC-application in photovoltaic systems - Safety requirements and test.   |
| <b>UL 1703</b>            | Standard for Flat-Plate Photovoltaic Modules and Panels.  |



**PACKING**

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

**EXPORT INFORMATION**

|                |          |                   |            |
|----------------|----------|-------------------|------------|
| <b>HS Code</b> | 85414020 | <b>TARIC code</b> | 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.