

Crystalline Silicon PV Module Installation Manual

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1. Introduction

1.1 Purpose

This document provides detailed instructions and valuable safety information regarding the installation, electrical connection, and maintenance of following Chint Solar Crystalline Photovoltaic modules:

CHSM 6612P(DG) CHSM 6612P(DG)/F CHSM 6612M(DG) CHSM6612M(DG)/F
CHSM60M(DG)-B CHSM60M(DGT)-B CHSM72M(DG)-B CHSM72M(DGT)-B
CHSM60M(DG)/F-B CHSM60M(DGT)/F-B CHSM72M(DG)/F-B CHSM72M(DGT)/F-B
CHSM60M(DG)-BH CHSM60M(DGT)-BH CHSM72M(DG)-BH CHSM72M(DGT)-BH
CHSM60M(DG)/F-BH CHSM60M(DGT)/F-BH CHSM72M(DG)/F-BH CHSM72M(DGT)/F-BH

All the instructions should be read and understood before installation. The installers should be trained and conform to all safety precautions in this guide when installing the module. Keep this guide in a safe place for further reference.

1.2 Limitation of Liability

Because the use of this manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) products are beyond Chint Solar's control, Chint Solar does not afford the responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance. Chint Solar reserves the right to change the manual without prior notice.

1.3 Precautions of Installation

1.3.1 Module's unpack and transfer

- a) When the whole pallet of modules are delivered to the site and unloaded, make sure the safety of the modules especially if they need to be lifted for roof projects. Put them into a protective device and then lift it to the roof in case of bumping against the wall during the lifting process.
- b) Firstly, tear the stretch film, then move away the top cover after cutting off each module packing strip while unpacking. Two operators work as a group, grasp the module frame tightly in the same direction and take out the module one by one. It is a must that the operators remove the adhesive tape of the fixed module one by one, rive one piece and then take out one piece of module. We don't allow to tear off all the adhesive tape at one time to prevent the whole package from toppling over or falling down. The whole process

must be taken very gently. Don't collide with any hard objects or let any parts of the frame touch and drag on the ground.

- c) After unpacking the modules should be installed that day as far as possible. It's recommended to take the right amount of modules according to the progress of the project every day. Heavy rain and other inclement weather may have the potential to soak the packaging which can affect product reliability, such as storms, typhoons, hurricanes or other events in which they may be blown away. If the users need to store modules before installation, do not open the package, the goods should be stored in a room temperature, dark, dry and ventilated place.

1.3.2 Module's Stack

- a) When a module is taken out of the box, cardboard bedding below should be applied in order to avoid contact with cement surface / ground, hard metal or tile. Modules should be placed neatly and should not be dropped, slammed or scratched.
- b) When stacking modules, it needs to be stacked neatly in the horizontal plane, under the condition of the glass facing down and the back way piled up, while the cardboard bedding need to be underside the modules. If the modules will be installed on the rooftop, the number of each stack is suggested no more than 20. In case of the poor load-bearing capacity, it's recommended that the designer and/or installer check with the structural engineer or architect to determine the amount of load allowable for specific location. During the whole process, the installation tools and other objects must be prevented from contacting the module surface.
- c) If the modules are requested to be classified by current, the handling personnel are required to carry out of the level of the current and make a mark separately according to the power on the list. (e.g. 275W-L, identifies the modules of the packaging according to the power on the list, indicating a low current position; 275W-H, compared to high current position). Usually, the same series of modules in the same current position are required in accordance with the system design requirements.
- d) If the modules are color-coded and marked the corresponding logo on the carton due to the customer requirements, when modules are taken out and stacked, they should be labeled to avoid confusion. Usually the same row or the same square have the same color according to the system design requirements.

- e) Due to the complexity and difference of the construction site, these precautions may not cover all items, please refer to the specific construction standards.

2. Safety

2.1 General Safety

- 2.1.1 Consult and follow local codes and other applicable laws concerning required permitting as well as installation & inspection requirements, rules, and regulations.
- 2.1.2 PV modules should be installed and maintained by qualified personnel.
- 2.1.3 Use the same performance modules within a given series.
- 2.1.4 Follow all safety precautions of all components used in the system.
- 2.1.5 Do not shade portions of the PV module surface from the sun for a long period of time. The shaded cell may become hot (hot spot phenomenon), which can result in solder joints peeling off.
- 2.1.6 Do not clean the glass surface with chemicals.
- 2.1.7 Do not drop the PV module or drop objects onto the PV module.
- 2.1.1 Do not concentrate sunlight on the modules or panels and do not expose the artificially concentrated sunlight to a module or panel.
- 2.1.2 Do not attempt to disassemble the modules, and do not remove any attached components from the modules.
- 2.1.3 Do not scratch or hit at the back sheet, the glass, the terminal box. Do not pull the cables or touch them with bare hands.
- 2.1.4 Do not drill holes in the frame or scratch the insulating coating of the frame.
- 2.1.5 Keep the PV module packed in the carton until installation.
- 2.1.6 Do not use modules near equipment or in places where flammable gases may be generated.
- 2.1.7 Do not use modules in an environment with aliphatic, aromatic, phenols, ketones, halogenated substance or mineral oil, which may corrode the junction box by chemical attack.
- 2.1.8 The modules are qualified for the application class A: Modules rated for use in this application class may be used in systems operating at greater than 50 VDC or 240W, where general contact access is anticipated. Modules qualified for safety through this part of IEC61730 and with this application class are considered to meet the requirements for safety Class II according to IEC 61140.

2.2 Installation Safety

- 2.2.1 Wear protective clothing such as head gear, insulating gloves, safety shoes as prescribed

by local safety codes. Use insulated tools when installing the modules.

- 2.2.2 Do not install the modules in heavy rain, snow, or otherwise wet or windy conditions.
- 2.2.3 Completely cover the PV module surface with an opaque material during PV module installation and wiring to prevent accidental charge buildup.
- 2.2.4 Plug in connectors tightly when working on wiring.
- 2.2.5 Due to the risk of electrical shock, do not perform any work if the terminals of PV module are wet.
- 2.2.6 Do not touch the terminal box and the end of output cables (connectors) with bare hands.
- 2.2.7 Do not unplug the connector under load.
- 2.2.8 Do not work alone.
- 2.2.9 Wear a safety harness if working far above the ground.
- 2.2.10 Do not wear metallic jewelry, which can cause electric shock, while installing or troubleshooting the PV system.
- 2.2.11 Follow the safety regulations for any and all other system components, including wires, connectors, charging regulators, batteries, inverters, etc.
- 2.2.12 Do not expose wires to direct sunlight. Use UV-resistant cable.
- 2.2.13 Do not damage the surrounding PV modules or mounting structure when replacing a PV module.
- 2.2.14 Do not change any PV module components (diode, junction box, connectors, etc.).
- 2.2.15 The maximum reverse current is 27A for bifacial module. Application of the blocking diode and fuse in the combiner box are recommended for reverse current protection when more than two strings are connected in parallel.
- 2.2.16 A certain gap is maintained between the PV module and the mounting surface to prevent the mounting surface touching the junction box.
- 2.2.17 Standing on the solar PV module is forbidden and also prohibit installation tools or other objects hitting surface of the solar PV module.
- 2.2.18 The solar modules are recommended to be installed over a fireproof and insulating roof covering when installed on a roof.
- 2.2.19 PV cable connection cannot be too tight, it is recommended that the connector and the backsheet have a certain gap.
- 2.2.20 In sandy regions, in order to avoid getting sand into the connector, we suggest to short circuit module connectors before installation. If grains of sand get into the connectors it, may cause internal live parts wear and tear and affect electrical safety.

3 Mechanical Installation

3.1 Installation Conditions

3.1.1 Extreme environment temperature: -40°C to +85°C

3.1.2 Operating temperature: -40°C to +85°C

3.1.3 Sea level elevation: Below 4000 m

3.1.4 Mechanical load on panels (e.g., snow/wind):

Design Load/Safety Factors-for panels with frame for normal module:

4666 Pa/ 1.5(Front), 2400 Pa/1.5(Rear) ;

Design Load/Safety Factors-for panels without frame for normal module:

3600 Pa/ 1.5(Front), 2400 Pa/1.5(Rear) ;

Design Load/Safety Factors-for panels without frame for Bifacial module:

1600 Pa/ 1.5(Front), 1600 Pa/1.5(Rear) .

Design Load/Safety Factors-for panels with frame for Bifacial module:

1600 Pa/ 1.5(Front), 1600 Pa/1.5(Rear) .

Please refer to the detailed mounting instructions as Chapter 3.2.

3.1.5 Tilt Angle selection: The installation should be facing north in the southern hemisphere and facing south in the northern hemisphere.

3.1.6 To maintain the modules' Class A fire rating, the fire class of the roof and building materials should be higher than Class A.

3.1.7 To maintain the modules' fire performance type 3(for US market), it could be possible to achieve the Class A system fire rating, with the Class A class racking system.

3.2 Installation Methods

3.2.1 Inspection roof structure:

It is important to inspect the structural integrity of the roof and the durability of the roof materials. The mounting structure and solar modules require a strong base for durable and reliable operation in local environments. Always wear a safety harness when working on the roof. Inspect the roof surface in the area of the installation for cracks, water leakage, and roofing material quality and uniformity. PV modules shall be mounted over fire resistant roofs covering rated for the application and on any slope less than 5in/ft (127mm/305mm) to maintain a fire Class rating. A deep depression in the roof may indicate a structural weakness in the support system that may require correction. The roof covering has the Class C against light fire test exposures.

3.2.2 Wiring the solar modules:

Never step or sit on the glass surface of the solar modules. The glass may break. When you install the solar modules on the mount, never allow an output cable to become caught between

the mount and a module frame. The solar modules generate electricity when exposed to sunlights, take care not to short circuit the output cables. The cables can become overheated and their cable sheaths can melt. Ensure the module connectors are fully inserted. There is a risk of malfunction if they are not pushed in all the way. Support output cables so that there is no slack. High winds can blow slack cable against the mount, damaging the cables. Modules are supplied with or without cables, according to the order placed. Should they be supplied without cables, it is recommended that cables with cross sections between 4 and 10 mm² be used. The use of cables formed by flexible Cu conductors, cross linked polyethylene insulated and with a polyvinyl chloride coat or similar, which allow easy handling while providing high performances against overloads and short-circuits is recommended. They must not be flame nor fire propagating and they must be low corrosive gas emitters and acid and alkali resistant.

Determine the wind loads for the installation site. Check with your local building and safety department for the specific requirements. Make certain that the roof structure can support the live and dead loads resulting from the installation of the PV array. Consult with a professional engineer if additional assistance is required. Get latest definitions from local building code. Determine total pressure by compiling basic wind speed, exposure and roof height. Check with technical support if your total pressure exceeds 45 PSF.

For wiring through walls, protect the cables with metal conduits, flexible metal conduits, or other protection. Failure to do so can result in shock and short circuits. Always use conduit to protect sections of array output cables that are exposed to sunlight. For wiring outdoors, protect cables with PVC conduits, metal conduits or flexible conduits. Prevent water from entering or building up in conduit by using water proof fittings or duct seal. To prevent shock, tape and label the cut ends of array output extension cables (the side opposite to the connector side) before connecting to solar module output cables. Further, tape them again after measuring the voltage of each array. To prevent shock when you connect the array output cables to the inverter, remove the tape of one cable at a time when you connect the cables. The installation of project must be facing north in the southern hemisphere, and facing south in the northern hemisphere, the electricity will be comparatively lower when the project facing west or east. The incorrect installation will lead to the loss of power. The modules, which are connected in series, must be in the same angle, otherwise, it will lose power because of the difference in sunlight intensity.

Solar modules generate the power to the maximum when they are pointed directly at the sun.

For installations where the solar modules are mounted to a permanent structure, the solar modules should be tilted for optimum winter performance. As a rule, if the system power output is adequate in the winter, it will be satisfactory during the rest of the year. The module tilt angle is measured between the solar modules and the ground.

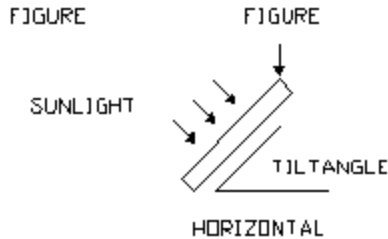


Figure a

3.3 Clamping on the Module surface

3.3.1 Frameless Double Glass Module

Modules can be laid either across the supporting bars (Figure-b)

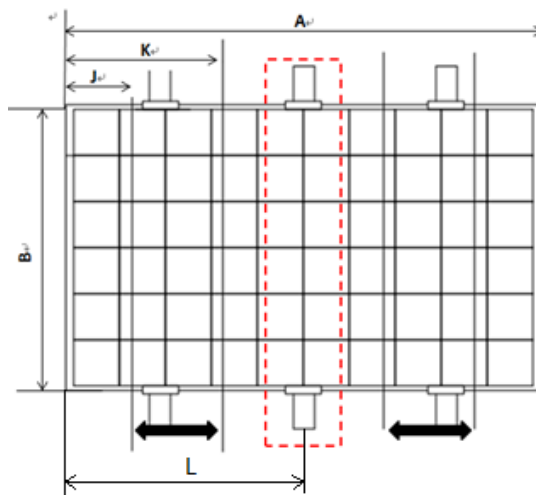


Figure b

Remark: Illustrations (Figure-b) of the method for clamping modules on the frame with aluminum clamps. “ \longleftrightarrow ” means the aluminum clamp’s permissible clamping range. The recommended installation position shows as below table:

Module Series	Dimension A*B	J	K	L	The length of the clamp	Design mechanical load
CHSM6612P/M (DG)	1968*992	280	320	984	120mm	Positive load $\leq 4666\text{Pa}$ Negative load $\leq 2400\text{Pa}$

To fasten the module:

1. Place the module on the two supporting bars (not provided). The bars should be made with

stainless material and treated with an anti-corrosion process (e.g., anodic oxidation treatment) or aluminum profile. Each solar PV module needs at least four clamps to fix. Do not make the clamp contact the glass directly or make the aluminum frame deformation in the installation process, and avoid the shadow of solar PV components.

2. The bar's top surface contacted with module should come with grooves compatible with an M8 bolt.
3. If the bars do not come with grooves, holes of a suitable diameter may need to be drilled to allow bolts to be attached to the bars at the same locations as mentioned above.
4. Secure each clamp by attaching plain washer, spring washer, and nut, in that order.
5. The clamp for double glass module is different from the general module such as Figure b. The double glass module must be fixed between two pieces of rubber named EPDM.

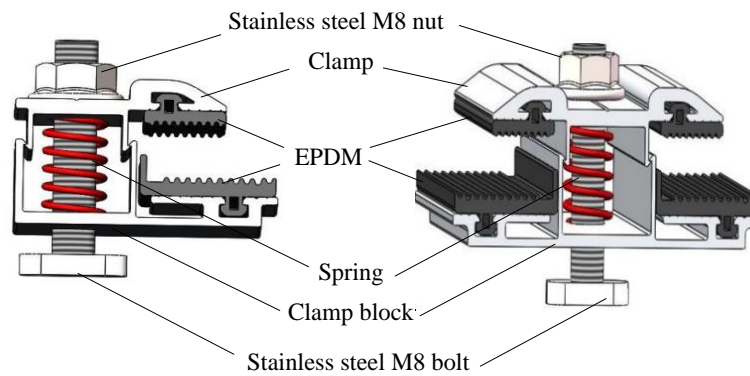


Figure c

3.3.2 Frame Double Glass Module

Modules can be laid either across the supporting bars (Figure d) or parallel to the

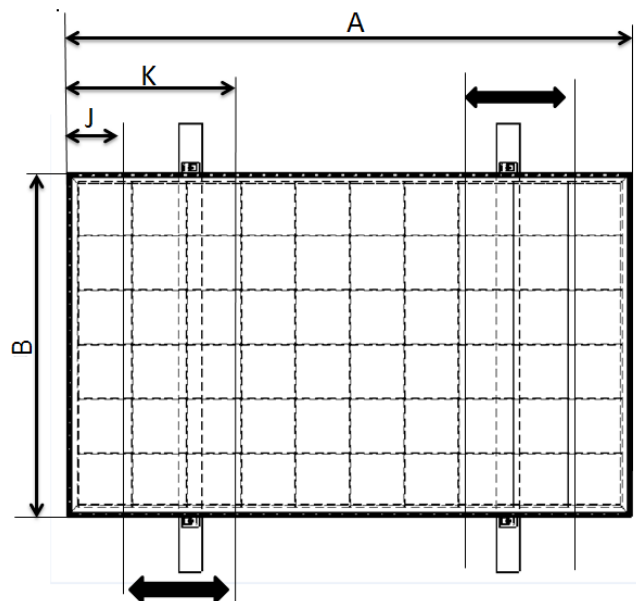


Figure d

Remark:


- The length of supporting bars must be longer than the length of module frame, otherwise please confirm with our product team to get approval.
- As for above figure d, the solid red rectangles indicate primary clamp installation positions and the center positions of long frames where clamps can be added for additional support.
- Illustrations (figure d) of the four different methods for clamping modules on the frame with aluminum clamps. “” means the aluminum clamp’s permissible clamping range. The recommended installation position shows as below table.

Table 2

Module Series	Dimension A*B*C	J	K	Design mechanical load
CHSM6612P/M (DG)/F	1974*998*3 5	42 0	46 0	Positive load $\leq 4666\text{Pa}$ Negative load $\leq 2400\text{Pa}$

To fasten the module:

- Place the module on the two supporting bars (not provided). The bars should be made with stainless material and treated with an anti-corrosion process (e.g., anodic oxidation treatment) or aluminum profile. Each solar PV module needs at least four clamps to fix. Do not make the clamp contact the glass directly or make the aluminum frame deformation in the installation process, and avoid the shadow of solar PV components.
- The bar’s top surface contacted with module frame should come with grooves compatible with an M8 bolt.
- If the bars do not come with grooves, holes of a suitable diameter may need to be drilled to allow bolts to be attached to the bars at the same locations as mentioned above.
- Secure each clamp by attaching plain washer, spring washer, and nut, in that order.
- Both of close-ups of Figure e, indicating the middle clamps and Figure f, indicating the side clamps for reference. Suggest the dimensions for middle clamps are: $a \geq 40\text{ mm}$, $b \geq 26\text{ mm}$, $c = 8\text{ mm}$, $d \geq 28\text{ mm}$, and $\varnothing = 9\text{ mm}$. The torque for tightening the nut and bolts are recommended 28Nm when the property class of bolts and screws is Class 8.8.

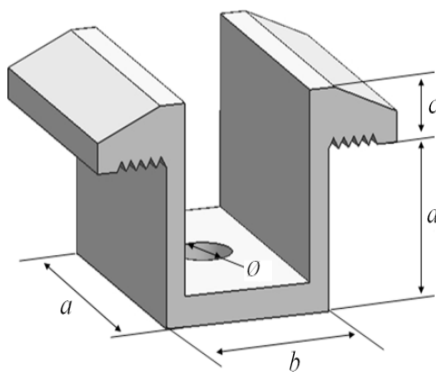


Figure e

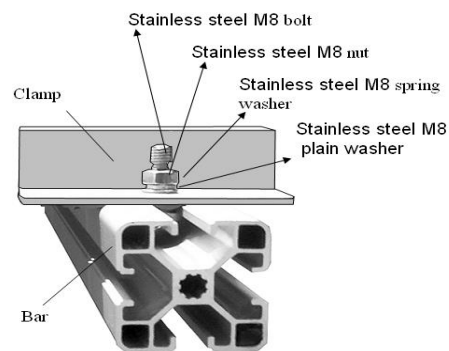


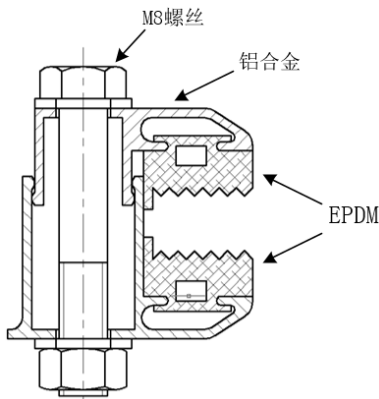
Figure f

3.3.3 Installation of frameless bifacial modules

1. Installation of frameless bifacial modules with clamps is illustrated as figure 1 ~ figure 3.

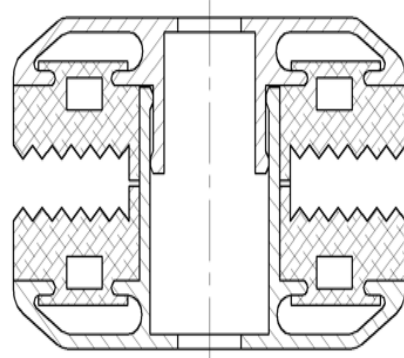
Frameless bifacial modules must be installed on the rack with specialized clamps, which is demonstrated as follows:

Bolt: M8. Material: aluminum alloy. Tape: EPDM. Length: 120mm/150mm (choose according to installation condition and load requirement). Torque: 17~23Nm



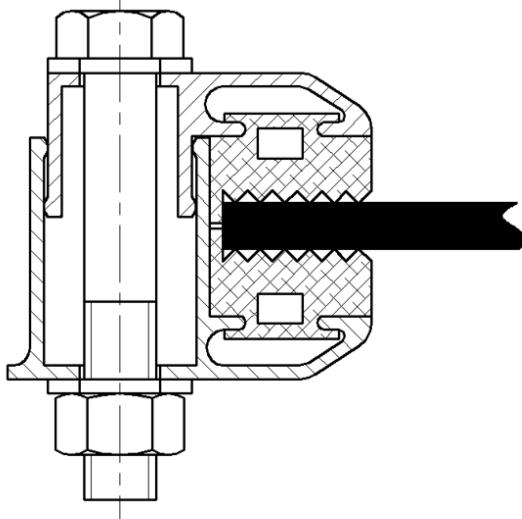
边缘夹具截面图

Figure 1



中间夹具截面图

Figure 2



组件安装截面图

Figure 3

2. Please make sure that the clamps used do not cast shadow on the glass, and be sure to use at least 4 clamps for each module, with no less than 2 on each side. The exact number of clamps is determined by installation conditions including wind/snow load. The contact between clamps and the module must be smooth and free of flaws to avoid module cracks. Under no circumstances should the clamps be installed in a distorted way, and the proper torque applied is 17~23Nm. Detailed installation locations of the clamps are shown in figure 4~ figure 7.

3. For normal and low requirement of load, it is suggested to apply “four-point installation”, which is designed for most applications with equivalent load of 2400pa for both the front (wind/snow

load) and rear (wind load) sides.

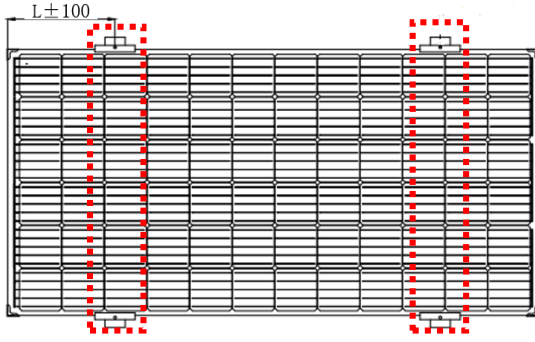


Figure 4

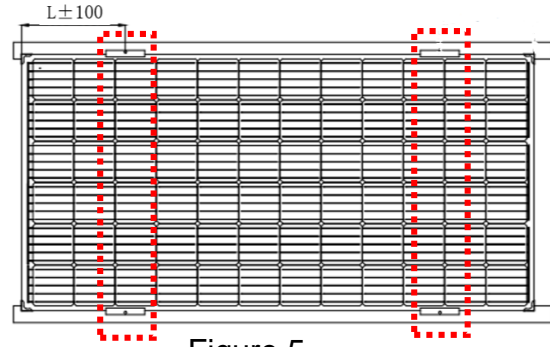


Figure 5

4. Under stressful environment that requires higher load bearing to withstand big wind and snow, it is suggested to apply “six-point installation”, with equivalent load of 2400pa for both the front and rear sides

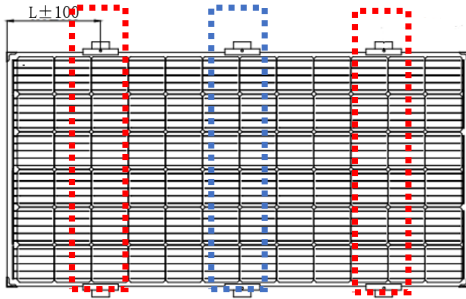


Figure 6

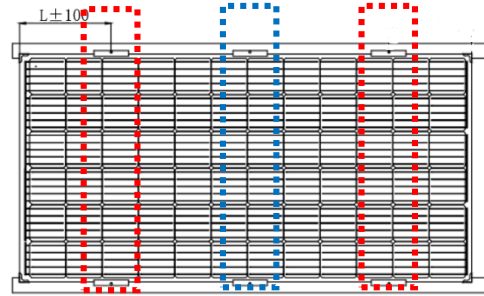


Figure 7

5. The module can be installed vertically or horizontally while the latter is recommended (as shown in figure 5 and 7).

Remark:

- 1) The length of supporting bars must be longer than the length of module frame, otherwise please confirm with our product team to get approval.
- 2) As for above figure 13, the solid red rectangles indicate primary clamp installation positions and the center positions of long frames where clamps can be added for additional support.
- 3) The above figures illustrate the proper installation method of frame surface clamp. “L±100” indicates its mounting location, as specified as follows:

Module type	Dimensions	L±100
	L*W*H	
CHSM60M(DG)-B	1658*992*6mm	300
CHSM60M(DGT)-B	1658*992*6mm	300
CHSM72M(DG)-B	1974*992*6mm	400
CHSM72M(DGT)-B	1974*992*6mm	400

3.3.4 Installation of frame bifacial modules

3.3.4.1 Bolting through the mounting holes

- ① All modules must be secured by at least 4 bolts (as shown in figure 1 and 2). For maximum safety precaution, it is recommended to make use of all installation holes available, as shown in figure 3.
- ② While installing, the module frame should be parallel to the mounting rack to avoid casting shadow on the rear side, as shown in figure 4.

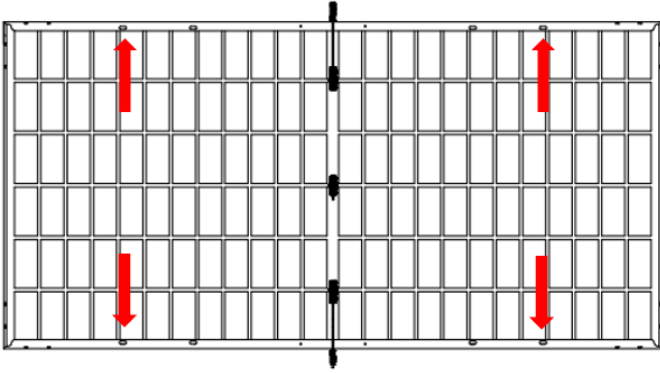


Figure 1

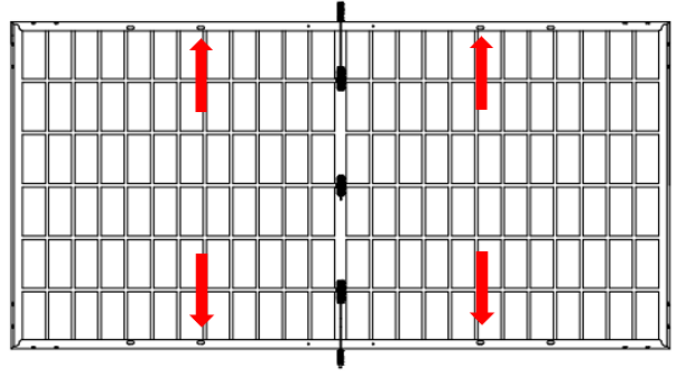


Figure 2

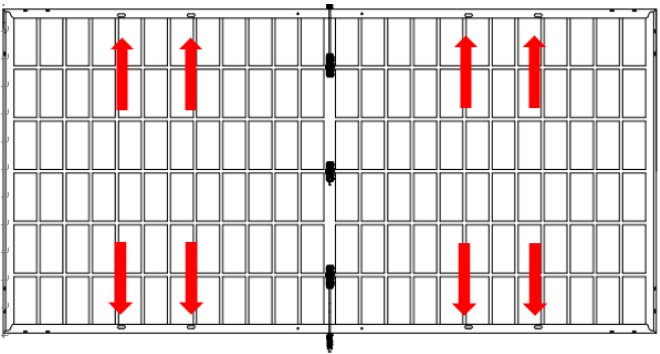


Figure 3

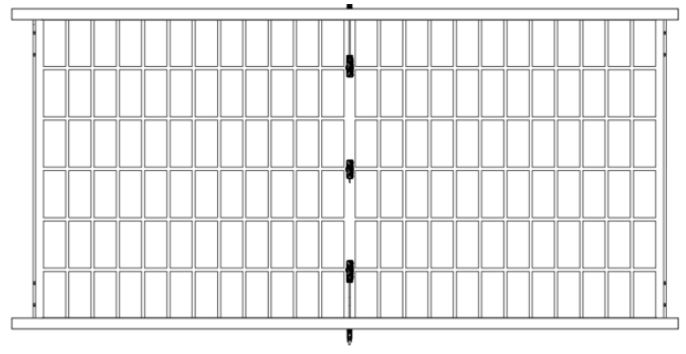


Figure 4

Note: the red arrows above is indicative of the bolts' location. The installation steps are as follows (figure 5):

1. Place the module underneath the mounting rack.
2. Insert 4 stainless bolts (M8) into the mounting holes in figure 1 or 2.
3. Make sure that each bolt is installed with two washers, one on each side of the rack. then screw them tight onto spring washer or toothed washer, and at last, lock them with stainless nuts.
4. The reference value of tightening torques should be within 17~23 Nm for M8 bolts. For the torque value, recommendations from specific clamping hardware suppliers should prevail.

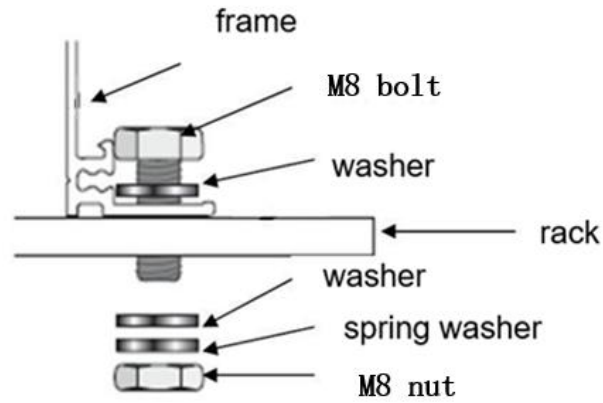


Figure 5

3.3.4.2 Clamping on the frame surface

Double glass module

During the installation of bifacial modules, the frame and mounting rack should maintain parallel, as shown in figure 6.

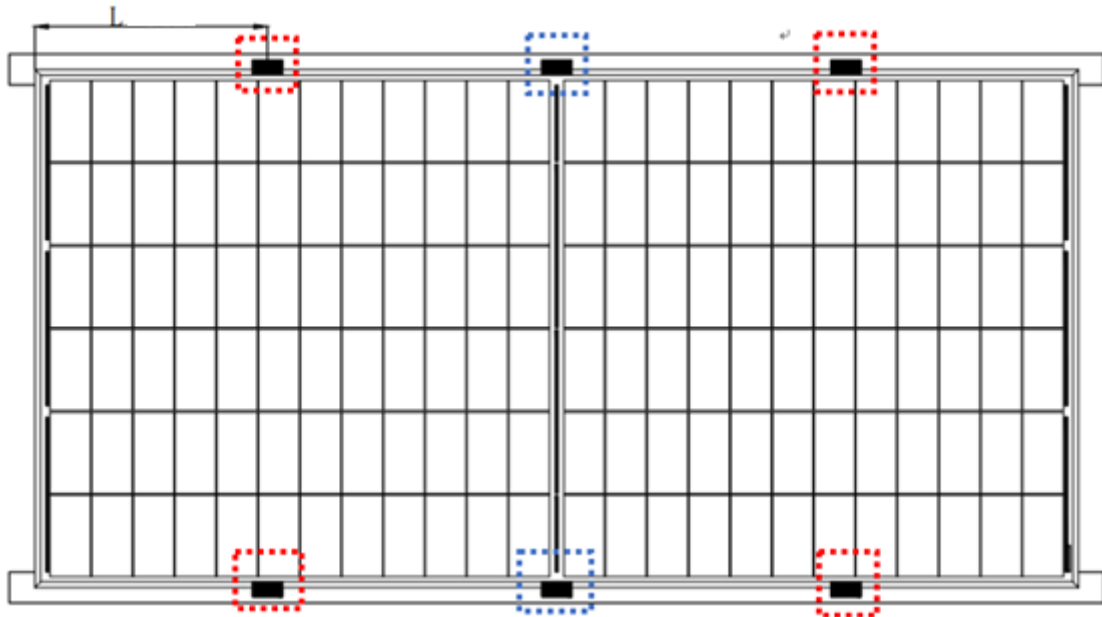


Figure 6

Remark:

- 1) The length of supporting bars must be longer than the length of module frame, otherwise please confirm with our product team to get approval.
- 2) As for above figure 6, the solid red rectangles indicate primary clamp installation positions and the center positions of long frames where clamps can be added for additional support.
- 3) The above figures illustrate the proper installation method of frame surface clamp. “ $L \pm 100$ ” indicates its mounting location, as specified as follows:

Module type	Dimensions	L
	L*W*H (mm)	
CHSM60M(DG)/F-B CHSM60M(DGT)/F-B	1664*998*30	350±100
CHSM72M(DG)/F-B CHSM72M(DGT)/F-B	1980*998*30	450±100
CHSM60M(DG)/F-BH CHSM60M(DGT)/F-BH	1696*998*30	350±100
	1714*1010*30	
	1791x1052x30mm	448±50
CHSM72M(DG)/F-BH CHSM72M(DGT)/F-BH	2018*998*30	450±100
	2038*1010*30	
	2131x1052x30mm	533±50

- 4) Each aluminum clamp is equipped with a M8 bolt, a plain washer, a spring washer and a M8 nut, to fasten the module:
- f) Place the module on the two supporting bars (not provided). The bars should be made with stainless material and treated with an anti-corrosion process (e.g., anodic oxidation treatment) or aluminum profile. Each solar PV module needs at least four clamps to fix. Do not make the clamp contact the glass directly or make the aluminum frame deformation in the installation process, and avoid the shadow of solar PV components.
 - g) The bar's top surface contacted with module frame should come with grooves compatible with an M8 bolt.
 - h) If the bars do not come with grooves, holes of a suitable diameter may need to be drilled to allow bolts to be attached to the bars at the same locations as mentioned above.
 - i) Secure each clamp by attaching plain washer, spring washer, and nut, in that order.
 - j) Both of close-ups of Figure 7, indicating the middle clamps and Figure 8, indicating the side clamps for reference. Suggest the dimensions for middle clamps are: $a \geq 40$ mm, $b \geq 26$ mm, $c = 8$ mm, $d \geq 28$ mm, and $\varnothing = 9$ mm. The torque for tightening the nut and bolts are recommended 17~23Nm when the property class of bolts and screws is Class 8.8.

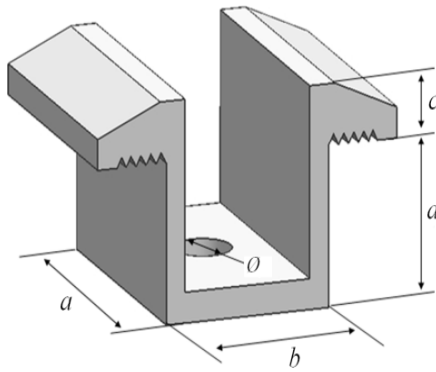


Figure 7

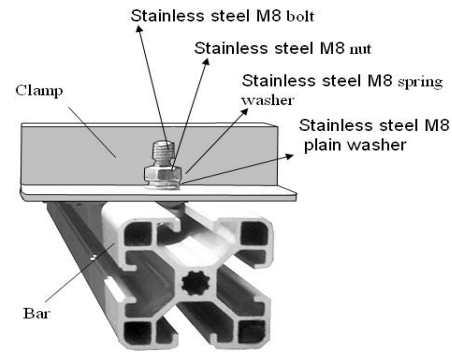


Figure 8

- k) For figure 6 mounting method, the modules must be supported along the length of the edge, and should overlap the array rail by 10mm – 14mm, as shown in figure 9.

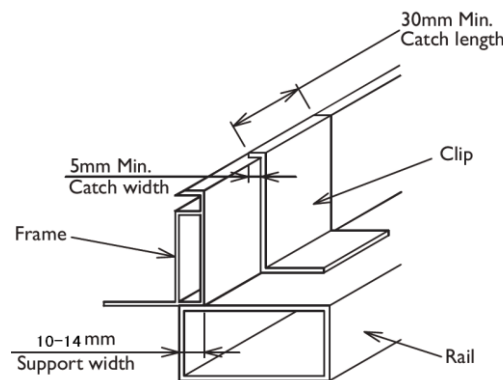


Figure 9

4 Electrical Installation and Grounding

4.1 Installation Condition

- 4.1.1 The electrical characteristics are within $\pm 10\%$ of the indicated values of I_{sc} , V_{oc} and P_{mpp} under the standard test conditions (irradiance of 1000 W/m^2 , AM1.5 spectrum, cell temperature of 25°C).
- 4.1.2 The IEC & UL standard maximum system voltage for the bifacial module series is 1500V.
- 4.1.3 Connect quantity of modules that match the voltage specifications of the inverters used in system. The maximum series/parallel PV module configurations must be calculated according to the requirements of the relevant regulations. The sum of open circuit voltage (V_{oc}) at the predictable lowest temperature shall not exceed the maximum system voltage and the values required by other DC components.
- 4.1.4 Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the value of I_{sc} marked on this module should be multiplied by a factor of

- 1.25 when determining component conductor ampacities, fuse sizes, and size of controls connected to the PV output.
- 4.1.5 Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125% (80% derating) which may be applicable.
- 4.1.6 Each module (or series-connected string of modules) shall be provided with the maximum series fuse, specified 20A for bifacial module.
- 4.1.7 Use a special solar cable and plugs for installing the PV system and make sure that all connections are safe and tight. The cable should be 4 mm² (12AWG), and able to withstand the maximum possible system open-circuit voltage.

Table 3

Connector Type	Manufacturer	Standard	Polarity of terminals
MH5	Ningbo Minghe New Energy Technology Co., Ltd	IEC 62852:2014	
PV-KST4-EVO 2/ xy-UR; PV-KBT4-EVO 2/ xy-UR	Staubli Electrical Connectors AG	IEC 62852:2014	
UTXCFabcde; UTXCMabcde (a=A or B, b=4)	Amphenol Technology (Shenzhen) Co., Ltd.	IEC 62852:2014	
PV-HCB40	Zhejiang Xinhui Photovoltaic Technology Co., Ltd	IEC 62852:2014	

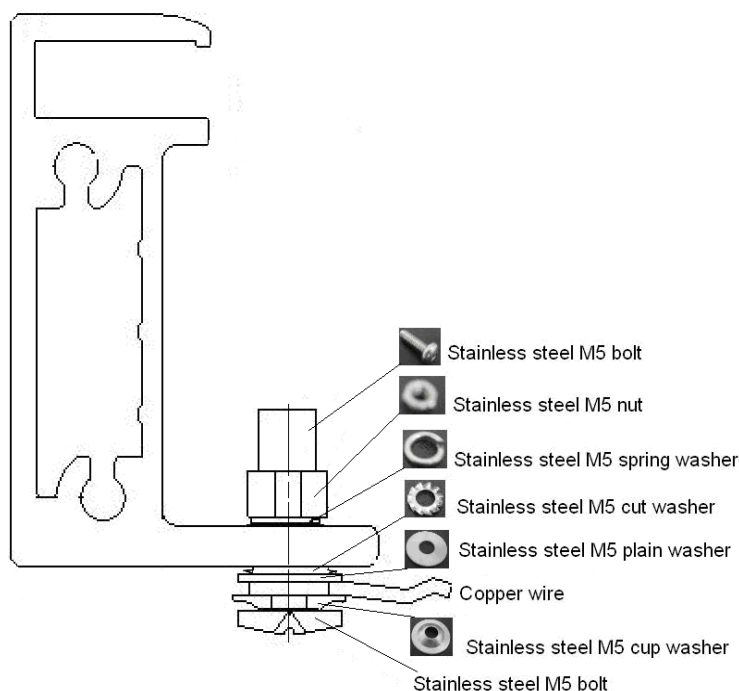
- 4.1.8 Bypass diodes are included in module junction boxes to avoid decreased module performance in the event of shade. Please check the relevant product datasheet for the specific diodes of J-box.

2 Table 4

Diode Type	If	Vds
GFS2045	20A	45V
20SQ045	20A	45V
25SQ045	25A	45V

- 4.1.1 Prohibit interconnection between different types of connectors.

4.2 Grounding



- 4.2.1 The grounding requirements must be checked in accordance with the applicable regulations and standards before work is started.
- 4.2.2 Use the marked 5.5 mm grounding holes to ground the anodized frame. Use one M5 nut, two M5 cut washers, one M5 plain washer, one M5 spring washer, and one M5 bolt and the copper wire. All nuts, bolts, and washers are type M5 and should be made of stainless steel (Fig. (n)).
- 4.2.3 Put the bolt through the cup washer and wrap the copper wire around the bolt. (Note that the copper wire cannot be attached directly to the aluminum.)
- 4.2.4 Put the bolt through the cut washer and then through the hole in the aluminum frame.
- 4.2.5 Add the spring washer and nut on the other side of the bolt and tighten to secure all parts. The tightening torque should be 210 ± 20 N•cm.
- 4.2.6 Approve the use of UL-467 certified bonding and grounding devices, including Burndy (formerly Wiley Electronics) Washer Electrical Equipment Bonding (WEEB) and similar devices, such as barbed washers, that meet the requirements of UL-467 as suitable for electrical bonding and grounding PV modules to PV mounting systems.
- 4.2.7 Other grounding methods may be allowable when tested with the racking system per UL 2703 requirements.

5 Maintenance

- 5.1 Regularly carry out a visual inspection for dirt, dust, bird dropping, leaves, and other detritus covering the modules.

-
- 5.2 If snow is present, a soft-bristled brush with soft bristles may be used to clean the surface of the modules.
- 5.3 Regular electrical and mechanical inspection by a licensed professional will keep the system safe and operating at maximum efficiency.

5.4 Cleaning

In order to obtain optimal output performance, we recommend cleaning the PV module periodically as stated below:

5.4.1 (a) In Normal Condition: Once a month

(b) Dusty Weather: Clean immediately

5.4.2 Maintenance personnel shall determine based on actual photos and daily weather conditions/records, to determine the cleaning period which also considers the condition of weather and pollution.

5.5 Condition of Cleaning

- 5.5.1 Use clean water or filtered water with soft type material (a sponge) to wipe the PV module. Never use chemicals on the surface of the module.
- 5.5.2 Cleaning after sunset or before sunrise is recommended for safety of O&M operator shock from heat stroke.
- 5.5.3 Do not use abrasive powder, abrasive cleaners, scrubber cleaners, polishers, sodium hydroxide, benzene, nitro-thinners, acid or alkali and other chemical substances.
- 5.5.4 Do not clean broken glass or modules with broken lines or exposed wires, as it may cause the electric shock.

Annex1: The electric data

Type Name or Model No.....:	CHSM6612M(DG)-xxx (6" mono 72cells)	CHSM6612P(DG)-xxx (6" poly 72cells)
	CHSM6612M(DG)/F-xxx (6" mono 72cells)	CHSM6612P(DG)/F-xxx (6" poly 72cells)
Maximum System Voltage [VDC]	1500	1500
Rated Maximum Power [W].....:	310, 315, 320, 325, 330, 335, 340, 345, 350, 355, 360	310, 315, 320, 325, 330, 335, 340
Rated Short Circuit Current [A].....:	9.11, 9.13, 9.17, 9.19, 9.26, 9.35, 9.40, 9.47, 9.54, 9.64, 9.73	8.92, 9.03, 9.21, 9.34, 9.51, 9.56, 9.62
Rated Open Circuit Voltage [V].....:	45.46, 45.56, 45.71, 45.81, 46.09, 46.29, 46.65, 46.96, 47.27, 47.41, 47.52	45.18, 45.33, 45.51, 45.72, 45.87, 46.02, 46.22
Tolerance of Rating Pmax / Isc / Voc [%].....:	3 / 5 / 3	3 / 5 / 3
Over-current protection rating[A]:	15/20	15/20
Classification (IEC 61730).....:	Class II	Class II
Fire rating.....:	Class A	Class A
Pollution degree.....:	I	I
Dimensions (l x w x h) [mm].....:	1974x998x35mm 1968x992x6mm	1974x998x35mm 1968x992x6mm
Module area [m²].....:	1.97 / 1.95	1.97 / 1.95
Min- creepage distance [mm].....:	11mm	11mm
Number of solar cells	72	72
Cells per bypass diode	24	24
Module family B: 6" Mono c-Si Bifi cell type		
Type Name or Model No.....:	CHSM72M(DG)-B-xxx (6" mono 72cells)	CHSM60M(DG)-B-xxx (6" mono 60cells)
	CHSM72M(DG)/F-B-xxx (6" mono 72cells)	CHSM60M(DG)/F-B-xxx (6" mono 60cells)
Maximum System Voltage [VDC]	1500	1500
Rated Maximum Power [W].....:	345, 350, 355, 360, 365, 370, 375, 380, 385, 390, 395	285, 290, 295, 300, 305, 310, 315, 320, 325
Rated Short Circuit Current [A].....:	9.53, 9.60, 9.67, 9.74, 9.81, 9.88, 9.95, 10.03, 10.11, 10.19, 10.27	9.35, 9.43, 9.51, 9.59, 9.67, 9.75, 9.83, 9.91, 9.99
Rated Open Circuit Voltage [V].....:	47.05, 47.25, 47.45, 47.65, 47.85, 48.05, 48.24, 48.43, 48.62, 48.81, 49.00	39.27, 39.47, 39.67, 39.87, 40.07, 40.27, 40.46, 40.65, 40.84
Tolerance of Rating Pmax / Isc / Voc [%].....:	3.5 / 5 / 3.5	3.5 / 5 / 3.5
Over-current protection rating[A]:	15/20	15/20
Classification (IEC 61730).....:	Class II	Class II
Fire rating.....:	Class A	Class A
Pollution degree.....:	I	I
Dimensions (l x w x h) [mm].....:	1968x992x6mm 1980*998*30mm	1658x992x6mm 1664*998*30mm
Module area [m²].....:	1.95/1.98	1.64/1.66
Min- creepage distance [mm].....:	11mm	11mm

Number of solar cells	72	60
Cells per bypass diode	24	20
Serial/parallel connection of cells	S	S
Type Name or Model No.:	CHSM72M(DGT)-B-xxx (6" mono 72cells)	CHSM60M(DGT)-B-xxx (6" mono 60cells)
	CHSM72M(DGT)/F-B-xxx (6" mono 72cells)	CHSM60M(DGT)/F-B-xxx (6" mono 60cells)
Maximum System Voltage [VDC]	1500	1500
Rated Maximum Power [W]	340, 345, 350, 355, 360, 365, 370	280, 285, 290, 295, 300, 305
Rated Short Circuit Current [A]	9.34, 9.41, 9.48, 9.55, 9.62, 9.69, 9.76	9.20, 9.28, 9.36, 9.44, 9.52, 9.60
Rated Open Circuit Voltage [V].....	47.36, 47.56, 47.76, 47.96, 48.16, 48.36, 48.56	39.28, 39.48, 39.68, 39.88, 40.08, 40.28
Tolerance of Rating Pmax / Isc / Voc [%].....	3.5 / 5 / 3.5	3.5 / 5 / 3.5
Over-current protection rating[A]:	20	20
Classification (IEC 61730)	Class II	Class II
Fire rating	Class A	Class A
Pollution degree	I	I
Dimensions (l x w x h) [mm].....	1968x992x6mm	1658x992x6mm
	1980*998*30mm	1664*998*30mm
Module area [m²].....	1.95/1.98	1.64/1.66
Min-creepage distance [mm]	11mm	11mm
Number of solar cells	72	60
Cells per bypass diode	24	20
Serial/parallel connection of cells	S	S
Type Name or Model No.:	CHSM72M(DG)-BH-xxx (6" mono 144 cells)	CHSM60M(DG)-BH-xxx (6" mono 120 cells)
	CHSM72M(DG)/F-BH-xxx (6" mono 144 cells)	CHSM60M(DG)/F-BH-xxx (6" mono 120 cells)
Maximum System Voltage [VDC]	1500	1500
Rated Maximum Power [W] :	365, 370, 375, 380, 385, 390, 395, 400, 405, 410, 415, 420, 125, 430, 435, 440, 445, 450, 455	305, 310, 315, 320, 325, 330, 335, 340, 345, 350, 355, 360, 365, 370, 375, 380
Rated Short Circuit Current [A] :	9.74, 9.82, 9.90, 9.98, 10.06, 10.14, 10.22, 10.30, 10.38, 10.46, 10.54, 10.90, 10.97, 11.06, 11.12, 11.20, 11.25, 11.30, 11.36	9.72, 9.79, 9.86, 9.93, 10.00, 10.07, 10.14, 10.21, 10.92, 10.99, 11.06, 11.12, 11.20, 11.25, 11.30, 1.36
Rated Open Circuit Voltage [V] :	46.98, 47.16, 47.34, 47.52, 47.70, 47.88, 48.06, 48.24, 48.42, 48.60, 48.78, 48.17, 48.43, 48.60, 48.90, 49.11, 49.44, 49.78, 50.07	39.66, 39.85, 40.04, 40.23, 40.42, 40.61, 40.80, 40.99, 39.49, 39.81, 40.12, 40.47, 40.74, 41.11, 41.48, 4.1.81
Tolerance of Rating Pmax / Isc / Voc [%] :	3.5 / 5 / 3.5	3.5 / 5 / 3.5
Over-current protection rating[A]:	20	20
Classification (IEC 61730) :	Class II	Class II
Fire rating :	Class A	Class A
Pollution degree :	I	I

Dimensions (l x w x h) [mm] :	2012x992x6mm/ 2032x1004x6mm/ 2018x998x30mm/ 2038x1010x30mm/ 2131x1052x30mm	1690x992x6mm/ 1708x1004x6mm/ 1696x998x30mm/ 1714x1010x30mm/ 1791x1052x30mm
Module area [m ²] :	2.00/ 2.33/ 2.01/ 2.06/ 2.24	1.68/ 1.71/ 1.69/ 1.73/ 1.88
Min- creepage distance [mm] :	17.5mm	17.5mm
Number of solar cells	144	120
Cells per bypass diode	48	40
Serial/parallel connection of cells	S	S
Type Name or Model No.:	CHSM72M(DGT)-BH-xxx (6" mono 72cells)	CHSM60M(DGT)-BH-xxx (6" mono 60cells)
	CHSM72M(DGT)/F-BH-xxx (6" mono 72cells)	CHSM60M(DGT)/F-BH-xxx (6" mono 60cells)
Maximum System Voltage [VDC]	1500	1500
Rated Maximum Power [W]	355, 360, 365, 370, 375, 380, 385, 390, 395, 400, 405	295, 300, 305, 310, 315, 320, 325, 330, 335
Rated Short Circuit Current [A] .:	9.57, 9.65, 9.73, 9.81, 9.89, 9.97, 10.05, 10.13, 10.21, 10.29, 10.37	9.51, 9.58, 9.65, 9.72, 9.79, 9.86, 9.93, 10.00, 10.07, 10.14
Rated Open Circuit Voltage [V] .:	46.72, 46.90, 47.08, 47.26, 47.44, 47.62, 47.80, 47.98, 48.16, 48.34, 48.52	39.49, 39.68, 39.87, 40.06, 40.25, 40.44, 40.63, 40.82, 41.01
Tolerance of Rating Pmax / Isc / Voc [%]	3.5 / 5 / 3.5	3.5 / 5 / 3.5
Over-current protection rating[A]:	20	20
Classification (IEC 61730).....:	Class II	Class II
Fire rating	Class A	Class A
Pollution degree	I	I
Dimensions (l x w x h) [mm].....:	2012x992x6mm/ 2032x1004x6mm 2018x998x30mm/ 2038x1010x30mm	1690x992x6mm/ 1708x1004x6mm 1696x998x30mm/ 1714x1010x30mm
Module area [m ²].....:	2.00 / 2.33 2.01 / 2.06	1.68 / 1.71 1.69 / 1.73
Min- creepage distance [mm] ...:	17.5mm	17.5mm
Number of solar cells	144	120
Cells per bypass diode	48	40
Serial/parallel connection of cells	S	S

$P_{mp} \sim I_{ma}$ are measured under STC (irradiance = 1000 mW/cm², AM = 1.5, and cell temperature = 25°C)