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:

CHSM60M(DG)/F-B	CHSM60M(DGT)/F-B	CHSM72M(DG)/F-B	CHSM72M(DGT)/F-B
CHSM60M(DG)/F-BH	CHSM60M(DGT)/F-BH	CHSM72M(DG)/F-BH	CHSM72M(DGT)/F-BH
CHSM60P(DG)/F-B	CHSM72P(DG)/F-B		
CHSM60P(DG)/F-BH	CHSM72P(DG)/F-BH		
CHSM66M(DGT)/F-BH	CHSM66M(DG)/F-BH		
CHSM54M(DG)-BH	**CHSM54M(DG)/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.

2. Codes and Regulations

The mechanical and electrical installation of PV systems should be performed in accordance with all applicable codes, including electrical codes, building codes and electric utility interconnection requirements. Such requirements may vary for mounting location, such as building rooftop or motor vehicle applications. Requirements may also vary with system voltage, and for DC or AC application. Contact local authorities for governing regulations.

3. Safety

Chint solar modules are designed to meet the requirements of IEC 61215 and IEC 61730, application class A. Modules rated for use in this application class may be used in system operating

at greater than 50V DC or 240W, where general contact access is anticipated. Modules qualified for safety through IEC 61730-1 and IEC 61730-2 and within this application class are considered to meet the requirements for safety class Ⅱ equipment.

3.1 General Safety

3.1.1 Consult and follow local codes and other applicable laws concerning required permitting as well as installation & inspection requirements, rules, and regulations.

3.1.2 PV modules should be installed and maintained by qualified personnel.

3.1.3 Use the same performance modules within a given series.

3.1.4 Follow all safety precautions of all components used in the system.

3.1.5 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.

3.1.6 Do not clean the glass surface with chemicals.

3.1.7 Do not drop the PV module or drop objects onto the PV module.

3.1.8 Do not concentrate sunlight on the modules or panels.

3.1.9 Do not attempt to disassemble the modules, and do not remove any attached components from the modules.

3.1.10 Do not scratch or hit at the front and back glass, the terminal box. Do not pull the cables or touch them with bare hands.

3.1.11 Do not drill holes in the frame or scratch the anodized film of the frame.

3.1.12 Keep the PV module packed in the carton until installation.

3.1.13 Do not use modules near equipment or in places where flammable gases may be generated.

3.1.14 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.

3.2 Installation Precautions

3.2.1 Module's unpack and transfer

a) When the whole pallet of modules is 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.

c) Two operators work as a group, if the modules are fixed with anti-inverted tapes, 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. If the modules are fixed with packing belt, firstly cut the two packing belt, use non-sharp and dependable items such as anti-falling sticks to hold one side of the long side carton, and then cut the other side of the carton, two operators take out the module one by one. We don't allow to tear off all the adhesive tape at one time in 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.

d) 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.

3.2.2 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.

3.3 Installation Safety

3.3.1 Wear protective clothing such as head gear, insulating gloves, safety shoes as prescribed by local safety codes. Use insulated tools when installing the modules.

3.3.2 Do not install the modules in heavy rain, snow, or otherwise wet or windy conditions.

3.3.3 Completely cover the PV module surface with an opaque material during PV module installation and wiring to prevent accidental charge buildup.

3.3.4 Plug in connectors tightly when working on wiring.

3.3.5 Due to the risk of electrical shock, do not perform any work if the terminals of PV module are wet.

3.3.6 Do not touch the terminal box and the end of output cables (connectors) with bare hands.

3.3.7 Do not unplug the connector under load.

3.3.8 Do not work alone.

3.3.9 Wear a safety harness if working far above the ground.

3.3.10 Do not wear metallic jewelry, which can cause electric shock, while installing or

troubleshooting the PV system.

3.3.11 Follow the safety regulations for any and all other system components, including wires, connectors, charging regulators, batteries, inverters, etc.

3.3.12 Do not expose wires to direct sunlight. Use UV-resistant cable.

3.3.13 Do not damage the surrounding PV modules or mounting structure when replacing a PV module.

3.3.14 Do not change any PV module components (diode, junction box, connectors, etc.).

3.3.15 The maximum reverse current is 20.25A for module with Isc≤9.61A and 27A for module with Isc＞9.61A. 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.

3.3.16 A certain gap is maintained between the PV module and the mounting surface to prevent the mounting surface touching the junction box.

3.3.17 Standing on the solar PV module is forbidden and also prohibit installation tools or other objects hitting surface of the solar PV module.

3.3.18 The solar modules are recommended to be installed over a fireproof and insulating roof covering when installed on a roof.

3.3.19 PV cable connection cannot be too tight, it is recommended that the connector and the backsheet have a certain gap.

3.3.20 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.

4　Mechanical Installation

4.1 Installation Conditions

4.3.1　Extreme environment temperature：-40℃ to +40℃

4.3.2　Operating temperature：-40℃ to +85℃

4.3.3　Mechanical load on panels (e.g., snow/wind): The max tested snow/wind load is 5400Pa/2400Pa, and the design load is 3600Pa/1600Pa with a safety factor 1.5 under standard mounting system. For specific installation methods and mechanical load test

values, please refer to 4.3 detailed component installation instructions.

4.3.4 The modules mounting structure must be made of durable, corrosion-resistant and UV-resistant material. Modules must be securely attached to the mounting structure.

4.3.5 In regions with heavy snowfall in winter, select the height of the mounting system, so that the lowest edge of the modules is not covered by snow for any length of time. In addition, ensure that the lowest portion of the modules is placed high enough so that it is not shaded by tress or other plants.

4.3.6 When the modules are supported parallel to the surface of a building roof, a minimum clearance of 10cm between the module frame and the surface of the roof is required to allow air to circulate behind the modules and to prevent wiring damage.

4.3.7 Chint solar modules are designed to meet the requirements of IEC61730 and UL 61730, application the fire performance Class A (IEC61730) and type 29 (UL61730 for US) or Class C (UL61730 for Canada).

4.3.8 Observe the linear thermal expansion of the modules frames, must ensure that the minimum distance between neighboring frames is 10mm.

4.3.9 The PV-modules are suitable for areas below 2000 meters above sea level.

4.2 Tilt Angle Selection

The tilt angle of the modules is measured between the surface of modules and a horizontal grounding face, as shown in figure a. The modules generate maximum power output when it faces the sun directly.
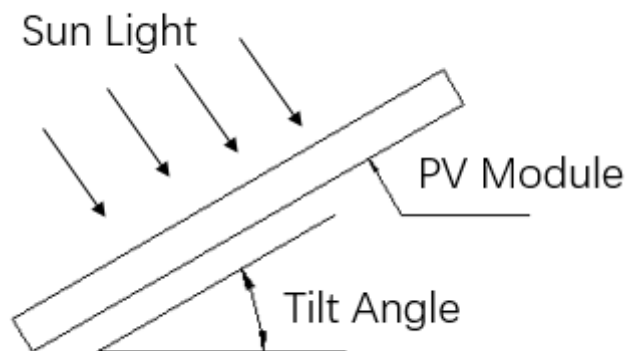

Figure a   Schematic diagram of tilt angle

In the northern hemisphere, modules should typically face south, and in the southern
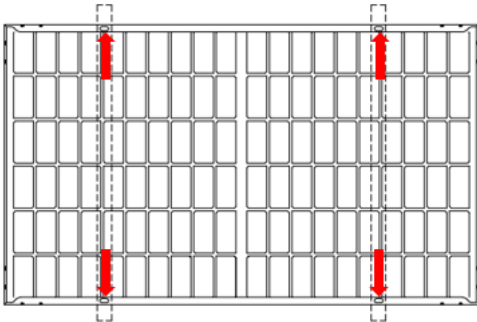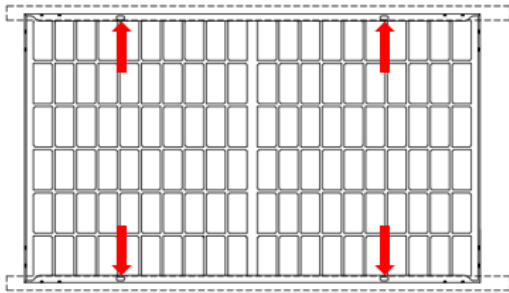
hemisphere, modules should typically face north. Dust building up on the surface of the modules can impair module performance, Chint Solar recommends installing the modules with a tilt angle of at least 10 degrees, making it easier for dust to be washed off by rain. At the same time, it is conducive to the flow of accumulated water on the surface of the module, and avoids long-term large amounts of accumulated water leaving marks on the glass surface, thereby affecting the appearance and performance of the module.
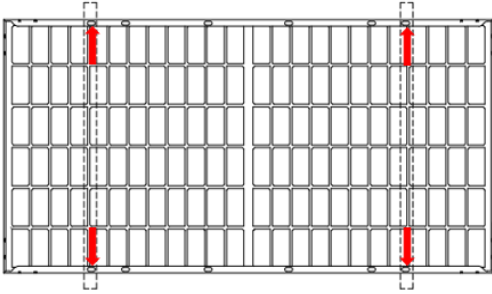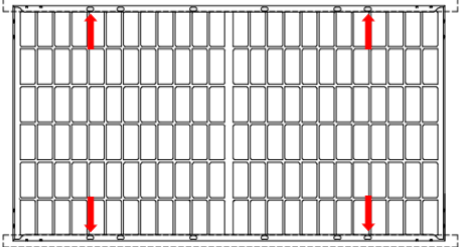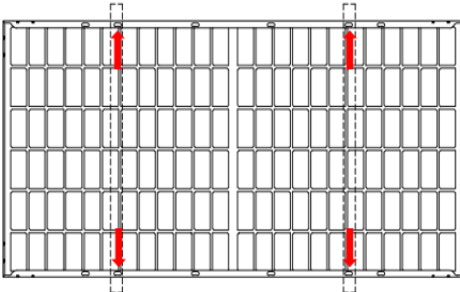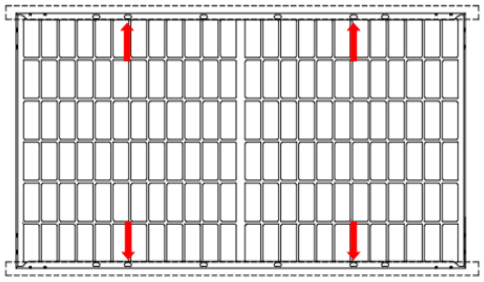
PV modules connected in series should be installed in the same orientation and angle. If the orientation and angle are different, the solar radiation received by each module may be different, resulting in power loss.
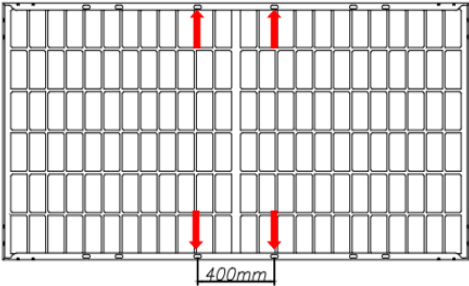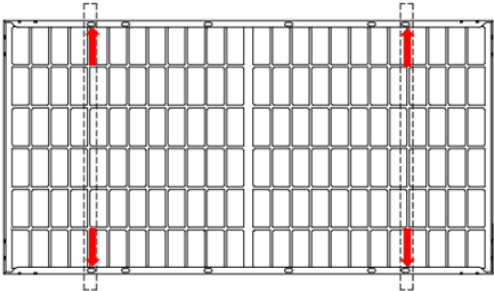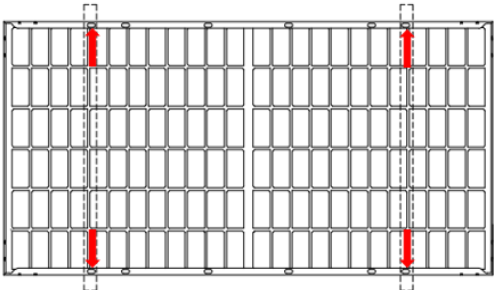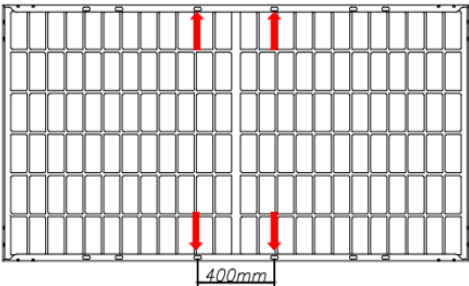
4.3 Installation Methods
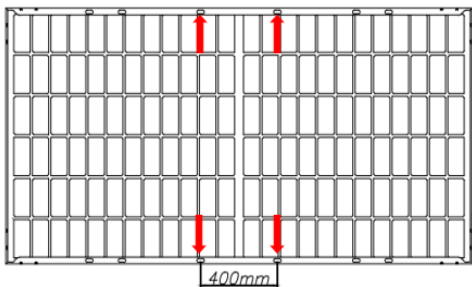
4.3.1 Bolting through the mounting holes

All modules must be secured by at least 4 bolts. See the table below for specific installation methods and corresponding load values.

Module type	Dimensions L*W*H (mm)	Mounting Direction	Mechanical Load Pressure
CHSM60M(DG)/F-B CHSM60M(DGT)/F-B CHSM60M(DG)/F-BH CHSM60M(DGT)/F-BH CHSM60P(DG)/F-B CHSM60P(DG)/F-BH CHSM66M(DG)/F-B CHSM66M(DGT)/F-B **CHSM54M(DG)/F-BH**	1664*998*30 1696*998*30 1714*1010*30 1791*1052*30 1755*1038*30 **1708 *1133*30**	 Bolting on long frame side using four mounting holes. Mounting rails run perpendicularly to the long frame side.	+5400Pa -2400Pa
		 Bolting on long frame side using four mounting	+5400Pa -2400Pa (Need confirm with Chint) +3600Pa -2400Pa

		holes. Mounting rails run parallel to the long frame side.	(Standard)
CHSM72M(DG)/F-B CHSM72M(DGT)/F-B CHSM72M(DG)/F-BH CHSM72M(DGT)/F-BH CHSM72P(DG)/F-B CHSM72P(DG)/F-BH	1980*998*30 2018*998*30 2038*1010*30 2131*1052*30 2094*1038*30 2256*1133*35 2285*1134*35	 Bolting on long frame side using four outer mounting holes. Mounting rails run perpendicularly to the long frame side.	+5400Pa -2400Pa
		  Bolting on long frame side using four outer mounting holes. Mounting rails run parallel to the long frame side.	+5400Pa -2400Pa (Need confirm with Chint) +3600Pa -2400Pa (Standard)
		  Bolting on long frame side using four middle mounting holes. Mounting rails run perpendicularly to the long frame side.	+2400Pa -2400Pa
		  Bolting on long frame side using four middle	+2400Pa -2400Pa

|---|---|---|---|
		mounting holes. Mounting rails run parallel to the long frame side.	
CHSM72M(DG)/F-B CHSM72M(DGT)/F-B CHSM72M(DG)/F-BH CHSM72M(DGT)/F-BH CHSM72P(DG)/F-B CHSM72P(DG)/F-BH	1980*998*30 2018*998*30 2038*1010*30 2131*1052*30 2094*1038*30 2256*1133*35 2285*1134*35	 Mounting with Single-axis Tracking System with 4-φ7*10mm mounting holes	+2400Pa -2400Pa
CHSM60M(DG)/F-BH CHSM60M(DGT)/F-BH	**2172*1303*35**	 **Bolting on long frame side using four mounting holes. Mounting rails run perpendicularly to the long frame side.**	**+5400Pa -2400Pa**
CHSM66M(DG)/F-BH CHSM66M(DGT)/F-BH	**2384*1303*35**	 **Bolting on long frame side using four outer mounting holes. Mounting rails run perpendicularly to the long frame side.**	**+5400Pa -2400Pa**
CHSM60M(DG)/F-BH CHSM60M(DGT)/F-BH	**2172*1303*35**	 **Mounting with Single-axis Tracking**	**+1800Pa -1800Pa**

		System with 4-φ7*10mm mounting holes	
CHSM66M(DG)/F-BH CHSM66M(DGT)/F-BH	2384*1303*35	400mm **Mounting with Single-axis Tracking** **System with 4-φ7*10mm mounting holes**	+1800Pa -1800Pa

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

1. Place the module underneath the mounting rack.

2. Insert 4 stainless bolts (M8) into the mounting holes. The φ7*10mm mounting holes need 4 M6 bolts.

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, and 9~12N for M6 bolts. For the torque value, recommendations from specific clamping hardware suppliers should prevail.
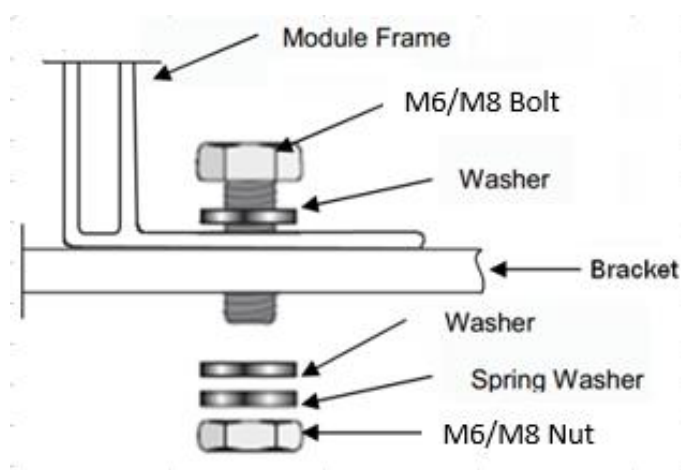
Figure b

4.3.2 Clamping on the frame surface

Each module must be securely fastened at a minimum of four points on two opposite sides, the clamps should be positioned symmetrically, which is shown in fig c and fig d.
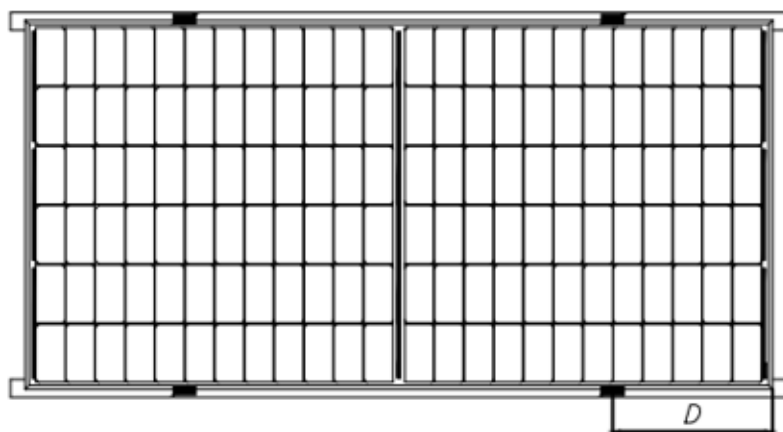
Figure c Mounting rails run parallel to the long frame side
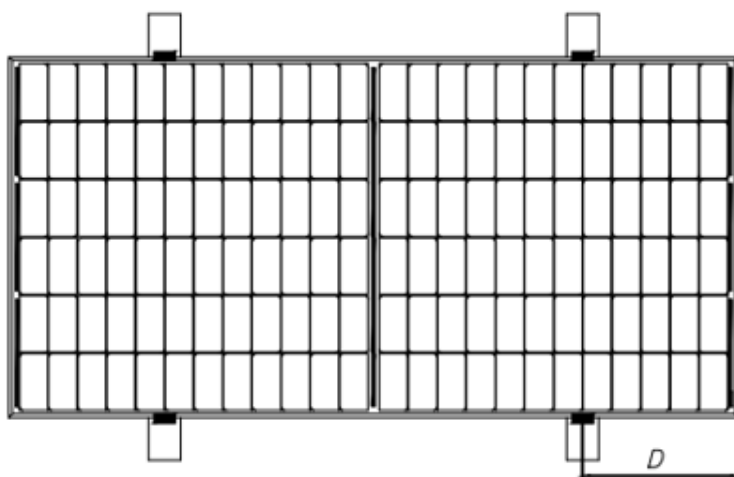
Figure d Mounting rails run perpendicularly to the long frame side

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) The above figures illustrate the proper installation method of frame surface clamp. "D" indicates its mounting location, the installation location and mechanical load pressure are shown in follow table:

Module type	Dimensions	D	Fig c	Fig d
	L*W*H (mm)			
CHSM60M(DG)/F-B CHSM60M(DGT)/F-B CHSM60P(DG)/F-B	1664*998*30	350±100	+5400Pa/-2400Pa (Need confirm with Chint) +3600Pa/-2400Pa (Standard)	+5400Pa -2400Pa
CHSM60M(DG)/F-BH CHSM60M(DGT)/F-BH CHSM60P(DG)/F-BH	1696*998*30 1714*998*30 1704*1008*30			

CHSM60M(DG)/F-BH CHSM60M(DGT)/F-BH CHSM60P(DG)/F-BH	1791*1052*30 1755*1038*30 2172*1303*35	1/4L±50	+5400Pa/-2400Pa (Need confirm with Chint) +3600Pa/-2400Pa (Standard)	+5400Pa -2400Pa
CHSM66M(DG)/F-BH CHSM66M(DGT)/F-BH	2073*1133*35 2100*1134*35 2384*1303*35	350~450mm	+3600Pa/-2400Pa	+5400Pa -2400Pa
CHSM72M(DG)/F-B CHSM72M(DGT)/F-B CHSM72P(DG)/F-B	1980*998*30	450±100 450±100	+5400Pa/-2400Pa (Need confirm with Chint) +3600Pa/-2400Pa (Standard)	+5400Pa -2400Pa
CHSM72M(DG)/F-BH CHSM72M(DGT)/F-BH CHSM72P(DG)/F-BH	2018*998*30 2038*1010*30 2031*1008*30			
CHSM72M(DG)/F-BH CHSM72M(DGT)/F-BH CHSM72P(DG)/F-BH	2131*1052*30 2094*1038*30	1/4L±50	+5400Pa/-2400Pa (Need confirm with Chint) +3600Pa/-2400Pa (Standard)	+5400Pa -2400Pa
CHSM72M(DG)/F-BH CHSM72M(DGT)/F-BH	2256*1133*35 2285*1134*35	400~450mm	+3600Pa/-2400Pa	+5400Pa -2400Pa
CHSM54M(DG)/F-BH	1708*1133*30	350~450mm	+3600Pa/-2400Pa	+5400Pa -2400Pa
CHSM60M(DG)/F-BH CHSM60M(DGT)/F-BH	2172*1303*35	375~425	---	+5400Pa -2400Pa
CHSM66M(DG)/F-BH CHSM66M(DGT)/F-BH	2384*1303*35	475~525	---	+5400Pa -2400Pa

3) Each aluminum clamp is equipped with a M8 bolt, a plain washer, a spring washer and a M8 nut, to fasten the module:

a) 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., hot dipped galvanizing) or aluminum profile (with anodic oxidation treatment). 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, otherwise may break the modules.

b) Be sure to avoid shadowing effects from the module clamps. Weep holes on the module frame must not be closed or obscured by the clamps. The clamp must overlap the module frame by at least 8mm but no more than 11mm (The clamp section can be changed under the premise of ensuring the reliable installation of the components).

c) The bar's top surface contacted with module frame should come with grooves compatible with an M8 bolt.

d) 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.

e) Secure each clamp by attaching plain washer, spring washer, and nut, in that order.

f) Both of close-ups of Figure 8, indicating the middle clamps and Figure 9, 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.
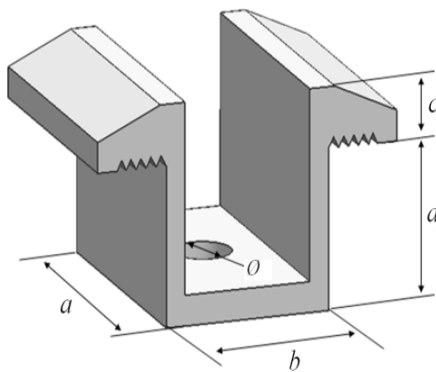
Figure e
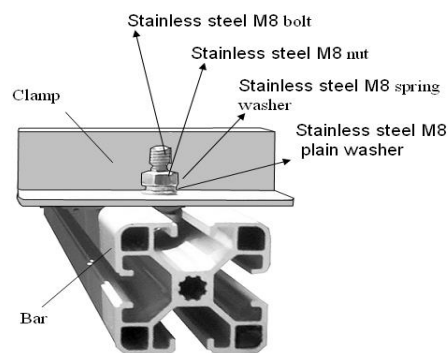
Figure f

g) For the installation method shown in Figure d, the modules need to be fixed with professional solar pressure blocks (as shown in Figure g), and the overlap between the C surface of the module and the guide rail should be ≥15mm. If improper fixtures or incorrect installation methods are used, the Chint Solar limited warranty will be invalid.
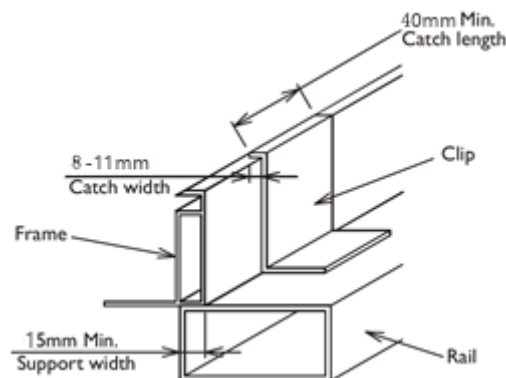
Figure g

5 Electrical Installation

5.1 Installation Condition

5.1.1 Rated electrical characteristics such as Isc is within ±5% and Voc within ±3% and Pmpp within ±3% of tolerance values at Standard Test Conditions. Standard Test Conditions: 1000W/m^2 Irradiance, 25℃ Cell Temperature and 1.5 Air Mass.

5.1.2 The IEC & UL standard maximum system voltage for the bifacial module series is 1500V. The maximum voltage of the system must be less than the maximum certified voltage and the maximum input voltage of the inverter and of the other electrical devices installed in the system. To ensure that this is the case, the open circuit voltage of the array string needs to be calculated at the lowest expected ambient temperature for the location. This can be done using the following formula.

$$\text{Max System voltage} \geqslant N * V_{oc} * [1 + TCvoc \times (T_{min}-25)]$$

N	No modules in series
V_{oc}	Open circuit voltage of each module (refer to product label or data sheet)
Tcvoc	Thermal coefficient of open circuit voltage for the module (refer to data sheet)
T_{min}	The lowest ambient temperature

In the case of high current system, several photovoltaic modules can be connected in parallel. The total current equals the sum of the current of each module, and the maximum number of modules N= I_{max}(maximum fuse current)/I_{sc}, as illustrated in Figure h.
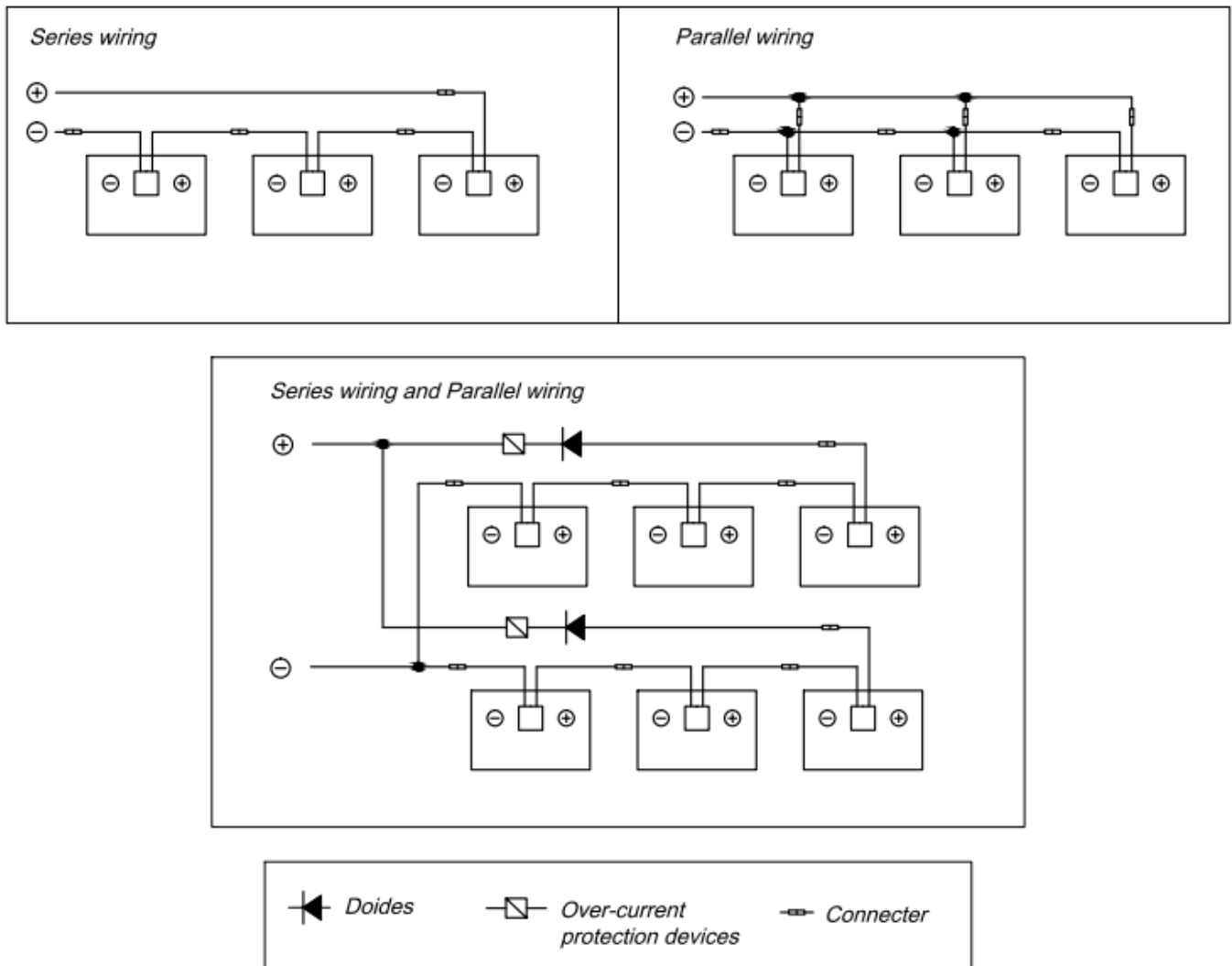
Figure h Electrical diagrams of series and parallel wiring

5.1.3 Connect quantity of modules that match the voltage specifications of the inverters used in system. Modules must not be connected together to create a voltage higher than the permitted maximum system voltage under the lowest local temperature conditions.

5.1.4 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.

5.1.5 Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125%（80% derating） which may be applicable. That means, when determining the voltage rating, conductor capacity, fuse rating, and photovoltaic output control size, the parameters need to be multiplied by the square of 1.25.

5.1.6 Each module (or series-connected string of modules) shall be provided with the maximum series fuse, specified 20A for bifacial module.

5.1.7 Modules with different electrical characteristics must not be connected directly in series.

5.1.8 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 mm^2 (12AWG), and able to withstand the maximum possible system open-circuit voltage.

5.1.9 Cables should be fixed to the mounting structure in such a way that mechanical damage of the cable and/or the modules is avoided. Don't apply stress to the cables. For fixing, use appropriate means, such as sunlight resistant cable ties and/or wire management clips specifically designed to attach to the module frame. While the cables are sunlight resistant and waterproof, where possible, avoid direct sunlight exposure and water immersion of the cables.

5.1.10 The junction boxes used with Chint Solar modules contain bypass diodes wired in parallel with the PV cell string. The bypass diode in the junction box can avoid the degradation of component performance caused by shading or covering (such as aging of packaging materials, sealing-off, etc.), please refer to the junction box diode specifications provided in the relevant product specifications.

5.1.11 In the case of partial shading, the diodes bypass the current generated by the non-shaded cells, thereby limiting modules heating and performance losses. In the event of a known or suspected diode failure, installers or maintenance providers should contact Chint Solar. Never attempt to open the junction box by yourself.

5.1.12 Prohibit interconnection between different types of connectors.

5.1.13 Keep connectors dry and clean, and ensure that connector caps are hand tight before connecting the modules. Don't attempt making an electrical connection with wet, soiled, or otherwise faulty connectors. Avoid sunlight exposure and water immersion of the connectors. Avoid connectors resting on the ground or roof surface.

5.1.14 Don't disconnect under load. When it is necessary to open the connector, make sure that the component is in a non-working state, and must use a professional unlocking tool, and it is forbidden to pull it hard.

5.2 Grounding

5.2.1 Chint Solar modules use an anodic oxidized aluminum frame to resist corrosion. So the frame of modules should be connected to the equipment grounding conductor to prevent thunder and electrical shock. The grounding device should fully contact with the inside of the aluminum alloy, and penetrate the surface of the frame oxidation film.

5.2.2 Chint Solar recommends using the following methods to ground modules properly:
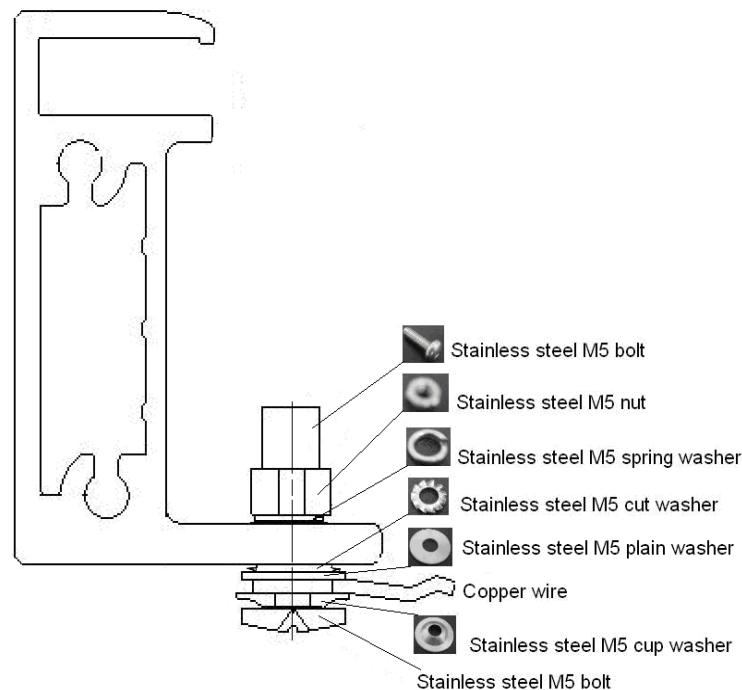
Figure i Grounding the aluminum frame with copper wire

a) The grounding requirements must be checked in accordance with the applicable regulations and standards before work is started.

b) 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. (i)).

c) 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.)

d) Put the bolt through the cut washer and then through the hole in the aluminum frame.

e) Add the spring washer and nut on the other side of the bolt and tighten to secure all parts. The tightening torque should be 4~5.5N•m.

5.2.3 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.

5.2.4 Other grounding methods may be allowable when tested with the racking system per UL 2703 requirements.

5.2.5 Please don't drill any additional grounding hole on the frame of the modules.

5.2.6 The frame rails have pre-drilled holes marked with a grounding sign. These holes should be used for grounding purposes and should not be used for mounting the modules.

6 Maintenance

It is required to perform regular inspection and maintenance of the modules, especially within warranty scope. It is the user's responsibility to the report to the supplier regarding the damages found in time.

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

6.2 If snow is present, a soft-bristled brush with soft bristles may be used to clean the surface of the modules.

6.3 Regular electrical and mechanical inspection by a licensed professional will keep the system safe and operating at maximum efficiency.

6.4 Recommended PV module Clean-up period

To get high output performance, PV module needs to be cleaned-up periodically as below:

① Normal: Minimum one time per every month; Dust weather: Right away after the dust wind;

② The period of the PV module cleaning shall be determined by the condition of the weather & pollution. O&M operator shall keep a record of weather condition everyday with data.

6.5 If there is a lot of dirt on the surface of the modules, use clean water and a soft cleaning tool (such as a sponge) to clean the modules array during a cooler time of the day. Do not scratch the dust on the surface of the modules in a dry condition, otherwise it will cause scratches.

6.6 Condition of Cleaning

6.6.1 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.

6.6.2 Cleaning after sunset or before sunrise is recommended for safety of O&M operator shock from heat stroke.

6.6.3 Do not use abrasive powder, abrasive cleaners, scrubber cleaners, polishers, sodium hydroxide, benzene, nitro-thinners, acid or alkali and other chemical substances.

6.6.4 Do not clean broken glass or modules with broken lines or exposed wires, as it may cause the electric shock.

Meaning of crossed –out wheeled dustbin:

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.

Contact your local government for information regarding the collection systems available.

If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being.

When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals at least free of charge.

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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]..............	10.4mm	10.4mm
Number of solar cells	72	72
Cells per bypass diode	24	24
Module family B: 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, 400	285, 290, 295, 300, 305, 310, 315, 320, 325, 330
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, 10.27,10.35	9.35, 9.43, 9.51, 9.59, 9.67, 9.75, 9.83, 9.91, 9.99,10.07
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, 49.19	39.27, 39.47, 39.67, 39.87, 40.07, 40.27, 40.46, 40.65, 40.84, 41.03
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]..............	10.4 mm	10.4 mm
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) CHSM72M(DGT)/F-B-xxx (6" mono 72cells)		CHSM60M(DGT)-B-xxx (6" mono 60cells) 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 1980*998*30mm		1658x992x6mm 1664*998*30mm	
Module area [m²]................................	1.95/1.98		1.64/1.66	
Min- creepage distance [mm]..............	10.4 mm		10.4 mm	
Number of solar cells	72		60	
Cells per bypass diode	24		20	
Serial/parallel connection of cells	SP		SP	
Module family C: Mono c-Si Bifi Half-cell type				
Type Name or Model No. :	CHSM72M(DG)-BH-xxx (6" mono 144cells) CHSM72M(DG)/F-BH-xxx (6" mono 144cells)		CHSM60M(DG)-BH-xxx (6" mono 120cells) CHSM60M(DG)/F-BH-xxx (6" mono 120cells)	
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	*515, 520, 525, 530, 535, 540, 545	305, 310, 315, 320, 325, 330,335,340,345, 350,355,360,365,370,375	580,585,590,595, 600,605,610
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	13.28, 13.32, 13.40, 13.48, 13.57, 13.66, 13.75	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	18.21,18.26, 18.31,18.36, 18.41,18.46, 18.51
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	48.90, 49.10, 49.30, 49.50, 49.70, 49.90, 50.10	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	40.90,41.10, 41.30,41.50, 41.70,41.90, 42.10
Tolerance of Rating Pmax / Isc / Voc [%] :	3.5 / 5 / 3.5		3.5 / 5 / 3.5	
Over-current protection	20	25	20	35

rating[A]:				
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/ 2094x1038x30mm/ 2036x1002x30mm/ 2031x1008x30mm	2256x1133x35mm 2285x1134x35mm	1690x992x6mm/ 1708x1004x6mm 1696x998x30mm/ 1714x1010x30mm/ 1791x1052x30mm/ 1755x1038x30mm/ 1704x1008x30mm	**2172 x 1303 x 35**
Module area [m²] :	2.00/ 2.04/ 2.01/ 2.06/ 2.24/ 2.17/ 2.05	2.56 / 2.59	1.68/ 1.71/ 1.69/ 1.73/ 1.88/ 1.82/ 1.72	**2.83**
Min- creepage distance [mm]:	10.4 mm		10.4 mm	
Number of solar cells	144		120	
Cells per bypass diode	48		40	
Serial/parallel connection of cells	SP		SP	

*Remark: Power range of model type CHSM72M(DG)-BH-xxx & CHSM72M(DG)/F-BH-xxx from 515W to 545W is with cell dimension 182mmx91mm.

*Remark: Power range of model type CHSM60M(DG)-BH-xxx & CHSM60M(DG)/F-BH-xxx from 580W to 610W is with cell dimension 210mmx105mm.

Type Name or Model No.....................	CHSM72M(DGT)-BH-xxx (6" mono 144 cells) CHSM72M(DGT)/F-BH-xxx (6" mono 144 cells)		CHSM60M(DGT)-BH-xxx (6" mono 120 cells) CHSM60M(DGT)/F-BH-xxx (6" mono 120 cells)
Maximum System Voltage [VDC]	1500		1500
Rated Maximum Power [W]................	355, 360, 365, 370, 375, 380, 385, 390, 395, 400, 405, 410, 415,420,425, 430,435,440,445	*505,510,515,520, 525,530,535,540,5 45	295, 300, 305, 310, 315, 320, 325, 330, 335,340,345,350,355,360,365,370
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, 10.37,10.72, 10.79,10.86,10.92,10.98, 11.07,11.16,11.22	13.28,13.29,13.30, 13.31,13.32,13.41, 13.50,13.59,13.68	9.51, 9.58, 9.65, 9.72, 9.79, 9.86, 9.93, 10.00, 10.07, 10.14,10.91,10.98,11.05, 11.12,11.18,11.27,11.34
Rated Open Circuit Voltage [V]...........	46.72, 46.90, 47.08, 47.26, 47.44, 47.62, 47.80, 47.98, 48.16, 48.34,48.52,48.23, 48.50,48.77,49.08,49.38, 49.55,49.72,50.01	48.90,49.10,49.30, 49.50,49.70,49.90, 50.10,50.30,50.50	39.49, 39.68, 39.87, 40.06, 40.25, 40.44, 40.63, 40.82, 41.01,39.30,39.62,39.94, 40.26,40.61,40.84,41.14
Tolerance of Rating Pmax / Isc / Voc [%]	3.5 / 5 / 3.5		3.5 / 5 / 3.5
Over-current protection rating[A]:	20	25	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/	2256x1133x35mm / 2285x1134x35mm	1690x992x6mm/ 1708x1004x6mm 1696x998x30mm/ 1714x1010x30mm/

			1791x1052x30mm/ 1755x1038x30mm/ 1704x1008x30mm
	2038x1010x30mm/ 2131x1052x30mm/ 2094x1038x30mm/ 2036x1002x30mm/ 2031x1008x30mm		
Module area [m²].................................	2.00/ 2.04/ 2.01/ 2.06/ 2.24/ 2.17/ 2.05	2.56 / 2.59	1.68/ 1.71/ 1.69/ 1.73/ 1.88/ 1.82/ 1.72
Min- creepage distance [mm].............	10.4 mm		10.4 mm
Number of solar cells	144		120
Cells per bypass diode	48		40
Serial/parallel connection of cells	SP		SP
*Remark: Power range of model type CHSM72M(DGT)-BH-xxx & CHSM72M(DGT)/F-BH-xxx from 505W to 545W is with cell dimension 182mmx91mmx200µm (±20µm).			

Module family E: Poly c-Si Bifi cell type

Type Name or Model No......................	CHSM72P(DG)-B-xxx (mono 72 cells) CHSM72P(DG)/F-B-xxx (mono 72 cells)	CHSM60P(DG)-B-xxx (mono 60 cells) CHSM60P(DG)/F-B-xxx (mono 60 cells)
Maximum System Voltage [VDC]	1500	1500
Rated Maximum Power [W].................	370, 375, 380, 385, 390, 395	310,315,320,325
Rated Short Circuit Current [A]	10.05,10.12,10.19,10.25,10.32,10.38	10.19,10.25,10.32,10.38
Rated Open Circuit Voltage [V]............	48.01,48.22,48.42,48.63,48.83,49.03	40.26,40.46,40.64,40.81
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].................	1968x992x6mm 1980x998x30mm 2004x1010x30mm	1658x992x6mm 1664 x 998 x 30mm 1684 x1010 x30mm
Module area [m²].................................	1.95 1.98 2.02	1.64 1.66 1.70
Min- creepage distance [mm].............	10.4	10.4
Number of solar cells	72	60
Cells per bypass diode	24	20
Serial/parallel connection of cells	S	S

Module family F: Poly c-Si Bifi Half-cell type

Type Name or Model No......................	CHSM72P(DG)-BH-xxx (mono 144 cells) CHSM72P(DG)/F-BH-xxx (mono 144 cells)	CHSM60P(DG)-BH-xxx (mono 120 cells) CHSM60P(DG)/F-BH-xxx (mono 120 cells)
Maximum System Voltage [VDC]	1500	1500
Rated Maximum Power [W].................	385,390,395,400,405,410,415,420,425,430,435,44	320,325,330,335,340,345,350,360,365

	0	
Rated Short Circuit Current [A]	10.12,10.19,10.25,10.31,10.38,10.45,10.52,10.58, 11.19,11.25,11.31,11.38	10.35,10.39,10.51,10.55,10.63,10.74,10.80, 11.26,11.32,11.38
Rated Open Circuit Voltage [V]............	47.98,48.17,48.37,48.57,48.78,48.99,49.18, 49.39,47.96,48.26,48.56,48.85	40.01,40.23,40.42,40.61,40.79,41.21,39.78,40.08 ,40.38
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/ 2094x1038x30mm/ 2036 x1002 x30mm/ 2031x1008x30mm	1690x992x6mm/ 1708x1004x6mm 1696x998x30mm/ 1714x1010x30mm/ 1791x1052x30mm/ 1755x1038x30mm/ 1704x1008x30mm
Module area [m²].................................	2.00/ 2.04/ 2.01/ 2.06/ 2.24/ 2.17/ 2.05	1.68/ 1.71/ 1.69/ 1.73/ 1.88/ 1.82/ 1.72
Min- creepage distance [mm].............	10.4	10.4
Number of solar cells	144	120
Cells per bypass diode	48	40
Serial/parallel connection of cells	SP	SP
Module family G: Mono c-Si Bifi Half-cell type		

Type Name or Model No....................	CHSM66M(DGT)-BH-xxx (mono 132 cells) CHSM66M(DGT)/F-BH-xxx (mono 132 cells)	CHSM66M(DG)-BH-xxx (mono 132 cells) CHSM66M(DG)/F-BH-xxx (mono 132 cells)	
Maximum System Voltage [VDC]	1500	1500	
Rated Maximum Power [W]	465,470,475,480,485,490,495	475, 480, 485, 490, 495	**635,640,645,650, 655,660,665,670, 675**
Rated Short Circuit Current [A]	12.99,13.09,13.18,13.28,13.38,13.47,13.57	13.27, 13.37, 13.46, 13.56, 13.65	**18.17,18.22,18.27, 18.32,18.37,18.42, 18.47,18.52,18.57**
Rated Open Circuit Voltage [V]	44.98,45.18,45.38,45.58,45.78,45.98,46.18	44.98, 45.18, 45.38, 45.58, 45.78	**44.89,45.09,45.29, 45.49,45.69,45.89, 46.09,46.29,46.49**
Tolerance of Rating Pmax / Isc / Voc [%]	3.5 / 5 / 3.5	3.5 / 5 / 3.5	
Over-current protection rating[A]:	25	30 (with junction box: CHS2x)	**35 (with junction box: CHS2x)**
Classification (IEC 61730)	Class II	Class II	**Class II**
Fire rating	Class A	Class A	**Class A**
Pollution degree.................................	I	I	**I**
Dimensions (l x w x h) [mm]...............	2073 x1133 x35mm /2100 x1134 x35mm	2073x1133x35mm/ 2100x1134x35mm	**2384 x 1303 x 35**
Module area [m²]	2.35 / 2.38	2.35 / 2.38	**3.11**

Min- creepage distance [mm]	10.4	10.4	10.4
Number of solar cells	132	132	132
Cells per bypass diode	44	44	44
Serial/parallel connection of cells	SP	SP	SP

*Remark: Power range of model type CHSM66M(DG)-BH-xxx & CHSM66M(DG)/F-BH-xxx from 635W to 675W is with cell dimension 210mmx105mm.

Type Name or Model No.	CHSM54M(DG)-BH-xxx (mono 108 cells)	-
	CHSM54M(DG)/F-BH-xxx (mono 108 cells)	-
Maximum System Voltage [VDC]	1500	-
Rated Maximum Power [W].............	390,395,400,405	-
Rated Short Circuit Current [A]	13.33,13.43,13.54,13.66	-
Rated Open Circuit Voltage [V].......	36.80,37.00,37.20,37.40	-
Tolerance of Rating Pmax / Isc / Voc [%]	3.5 / 5 / 3.5	-
Over-current protection rating[A]:	30 (with junction box: CHS2x)	-
Classification (IEC 61730)	Class II	-
Fire rating.......................................	Class A	-
Pollution degree	I	-
Dimensions (l x w x h) [mm]............	1708 x 1133 x 30mm	-
Module area [m²].............................	19.4	-
Min- creepage distance [mm]..........	10.4	-
Number of solar cells	108	-
Cells per bypass diode...................	36	-
Serial/parallel connection of cells	SP	-

*Remark: Power range of model type CHSM54M(DG)-BH-xxx & CHSM54M(DG)/F-BH-xxx from 390W to 405W is with cell dimension 182mmx91mm.

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