



# 2021 NEW

**FLEXIBLE. POWERFUL. LIGHTWEIGHT**  
**Flexible Solar PV Panels**  
**CIGS Technology**

## **SINOLTECH COOPERATION WITH HANERGY:**

SINOLTECH becomes authorized cooperator of Hanergy in year 2015. Representing brand “Global Solar”, “Miasole” and “Solibro” CIGS Modules in overseas market. Now our ODM factory is located in Zibo, Shandong province, ranging in capacity from an annual output of 30MW of up to annual output of 300 MW in 2020.

SINOLTECH is professional in designing custom-made projects with Flex PV BIPV solution. Our experienced engineering and training team is available from pre-design, installation, after sale maintenance, providing whole process tracking services. We are also available to help with upgrades and troubleshooting should any problems occur.

Our professional product knowledge, quick customer response, responsible after sale service will make your whole purchase process worry-free!

# Technology

CIGS (Copper Indium Gallium Selenide) thin-film solar cells and modules. The front end workcell is where the MiaSolé high-efficiency solar cells are manufactured using equipment such as roll coater and sheet-to-cell feeder and cell laminator. MiaSolé front end workcell is the most efficient continuous "Roll to Cell" process. The back end workcell is where the solar cells are assembled into standard and customized solar modules using equipment such as cell layup robot machines, bus bar stations and module laminators. MiaSolé also provides test equipment to ensure the quality of the modules.

MiaSolé adopts the world's only CIGS one-stop automatic coiling magnetron sputtering coating system. It can complete the deposition of films for CIGS cells in vacuum conditions. A stainless steel substrate of eight kilometers long and one-meter-wide can be used once to produce 1.2MW of films.

Unique in-situ selenide technique and CdS sputtering coating technique shatters the yield rate and high cost ceilings of CIGS production.

Exclusive three-sided rotating comminuting and sputtering techniques; and rapid technique development.

Takt time less than 60 minutes; shortest R&D and manufacture cycle among the industry, 5% or less of normal takt time.

Environmentally friendly technique with no waste water or gas, featuring low energy consumption and meeting national environmental requirements.

The technology has received national attention with specified requirements of prioritizing development.





# Key Features

## High Power Density in a Flexible Form Factor

- Record efficiency levels in a CIGS flexible form factor
- Low installed weight at less than 2.2 kg/m<sup>2</sup> (<0.5 lb/ft<sup>2</sup>)
- No penetrations, ballast or racking required
- Applicable for high wind load and high seismic hazard areas
- Bypass diodes reduce PV system shading losses
- Directly bonds to many approved surfaces

Thin-film CIGS solar cells on stainless steel substrate have high efficiency levels and provide significant advantages over conventional, rigid solar cells.

### Cell Features:

- Efficiency level of up to 16.5% in a flexible form factor.
- Thin - 0.33mm
- Lightweight - 7.5 gm
- Ideal for many specialized uses. Versatile cell architecture means the size can be modified to suit various applications.
- Bendable and shatter-proof

## RELIABILITY AND SAFETY

- IEC 61646 & IEC 61730
- UL 1703
- Salt Spray Test Certificate
- Fireproof Testing Report

## WARRANTY

- 5 years workmanship
- 5/10/25 years warranty against power loss

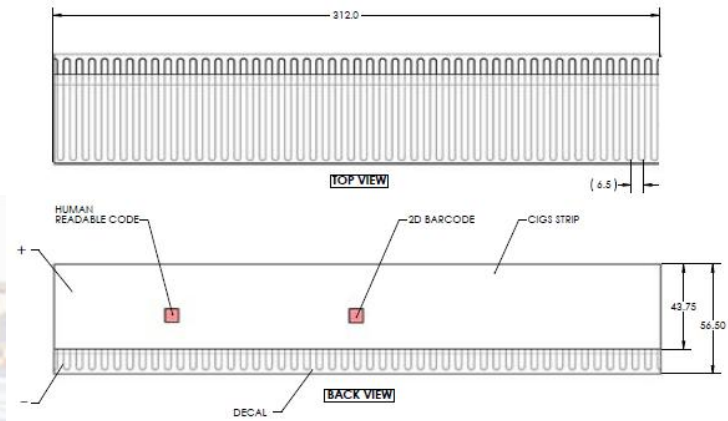
## Low-Light Performance

Intensity	Relative Efficiency
1000 W/m <sup>2</sup>	100%
500 W/m <sup>2</sup>	99%
200 W/m <sup>2</sup>	91%

Note: Relative to Standard Test Conditions(STC): Cell Temperature at 25°C; AM1.5 solar reference spectrum(ASTM E892)

## Operating Conditions

Temperature range	-40 to + 85 °C
Maximum System Voltage	1000 VDC IEC, 600VDC UL
Maximum Series Fuse Rating	10A



## Thermal Characteristics

NOCT	[°C]	48
Temperature Coefficient of V <sub>max</sub>	V <sub>max</sub>	-0.38 %/°C
Temperature Coefficient of V <sub>oc</sub>	V <sub>oc</sub>	-0.28 %/°C
Temperature Coefficient of I <sub>sc</sub>	I <sub>sc</sub>	0.008 %/°C
NOCT	[°C]	48

Note: Relative to Standard Test Conditions(STC): Solar irradiance intensity of 100W/m<sup>2</sup>; AM1.5 Solar reference spectrum (ASTM E892)

## FLEX-03NX 40W.45W

40W | 45W

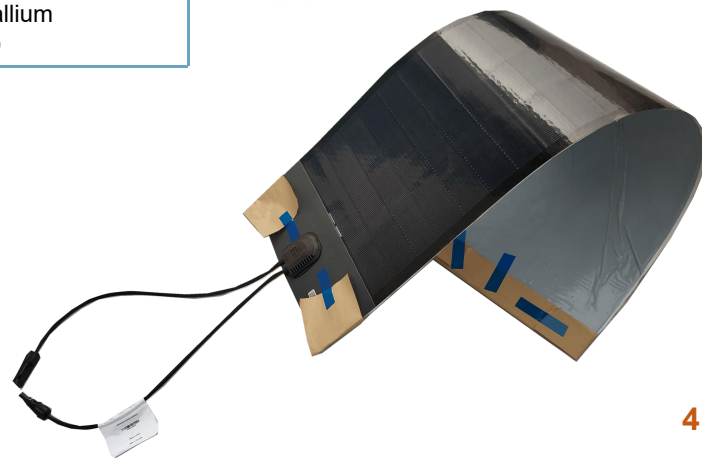
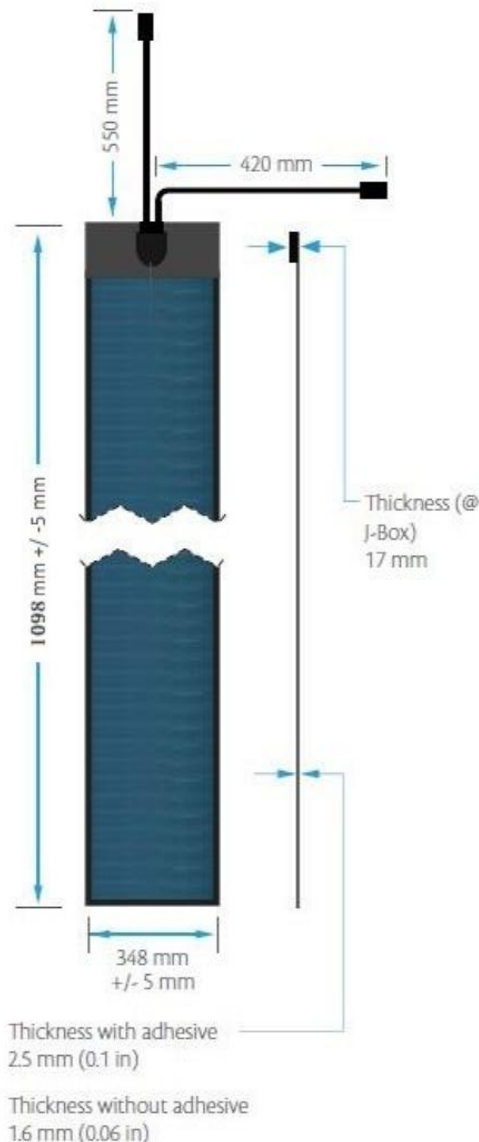
348mm \*1098mm | Rolling to 250MM Dia. | CIGS Cell

### Electrical Specifications

Model Selection		03NX-40	03NX-45
Capacity rating	Pmax	40W	45W
Tolerance of Pmax	%	+5/-2%	+5/-2%
Module aperture area efficiency	%	13.3%	15.0%
Maximum Power Voltage	Vmpp	10.92V	11.50V
Maximum Power Current	Impp	3.71A	3.94A
Open circuit voltage	Voc	14.07V	14.37V
Short circuit current	Isc	4.65A	4.68A
Maximum Series Fuse Rating	A	10A	10A
Maximum System Voltage	(IEC/UL)	1000/1000	
Dimension of Module	MM	1098*348*2.5(15)	

### Mechanical Specification

Model Selection	FLEX-03NX SERIES
Length	1100mm (+5/-2)
Width	348 mm (+2/-2)
Thickness, Maximum at J-Box*	2.5 mm (15 mm)
Weight(Module without adhesive)	0.77 kg
Weight(Module with adhesive)	1.0 kg
Weight/Area(Module without adhesive)	2.0 kg/m <sup>2</sup>
Weight/Area(Module with adhesive)	2.7 kg/m <sup>2</sup>
Junction Box Type	IP68
Cable connections	MC4 Compatible
Cell type	Copper Indium Gallium Diselenide (CIGS)



## FLEX-03NC 70W

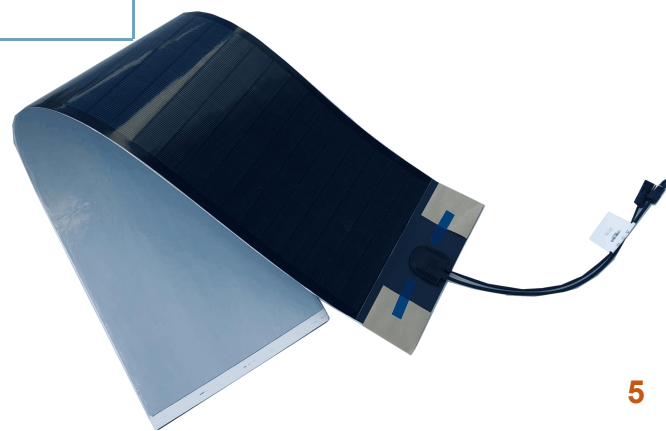
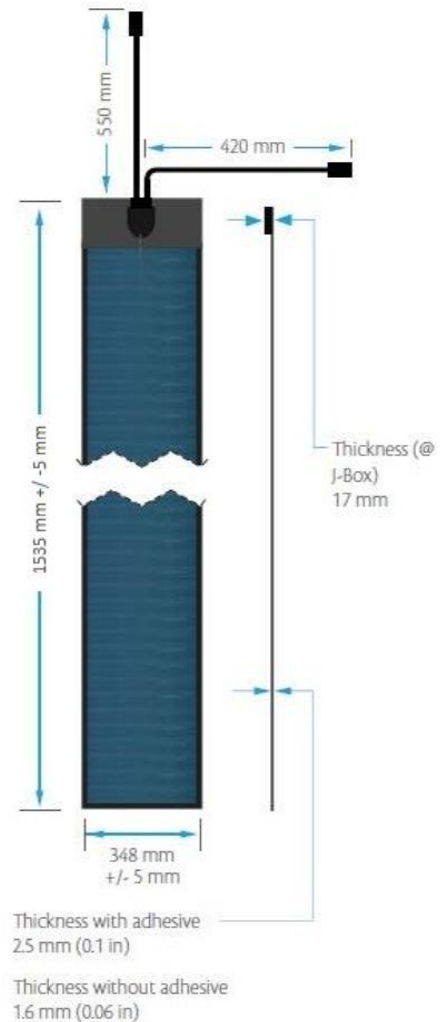
70W | 348mm \*1535mm | Rolling to 250MM Dia. | CIGS Cell

### Electrical Specifications

Model Selection		03NC-70
Capacity rating	Pmax	70W
Tolerance of Pmax	%	+5/-0%
Module aperture area efficiency	%	13.39%
Maximum Power Voltage	Vmpp	17.7V
Maximum Power Current	Impp	4.01A
Open circuit voltage	Voc	21.9V
Short circuit current	Isc	4.54A
Maximum Series Fuse Rating	A	10A
Maximum System Voltage	(IEC/UL)	1000/1000
Dimension of Module	MM	1535*348*2.5/17

### Mechanical Specification

Model Selection		FLEX-03NX SERIES
Length		1535mm (+5/-2)
Width		348 mm (+2/-2)
Thickness, Maximum at J-Box*		2.5 mm (17 mm)
Weight(Module without adhesive)		0.95 kg
Weight(Module with adhesive)		1.17 kg
Weight/Area(Module without adhesive)		1.8 kg/m2
Weight/Area(Module with adhesive)		2.2 kg/m2
Junction Box Type		IP68
Cable connections		Amphenol H4
Cell type		Copper Indium Gallium Diselenide (CIGS)



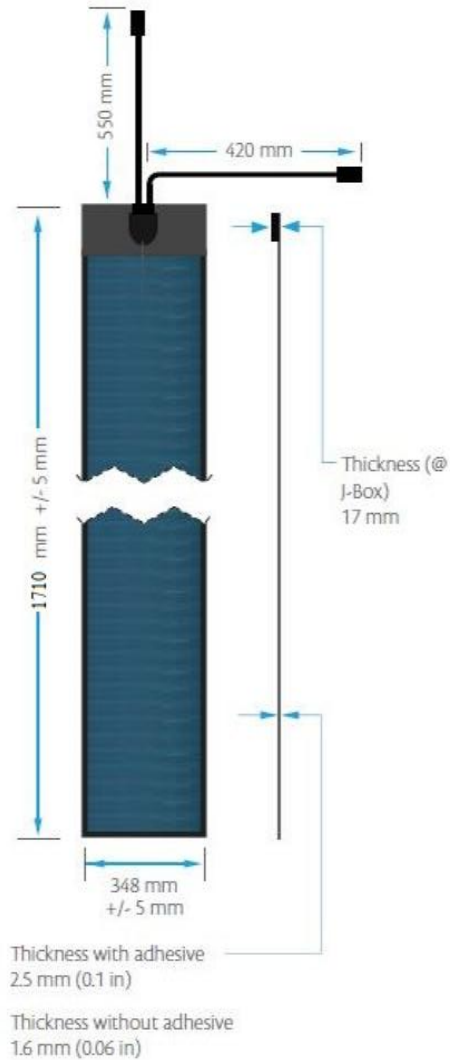
## FLEX-03NS 75W.80W

75W | 80W

348mm \*1710mm | Rolling to 250MM Dia. | CIGS Cell

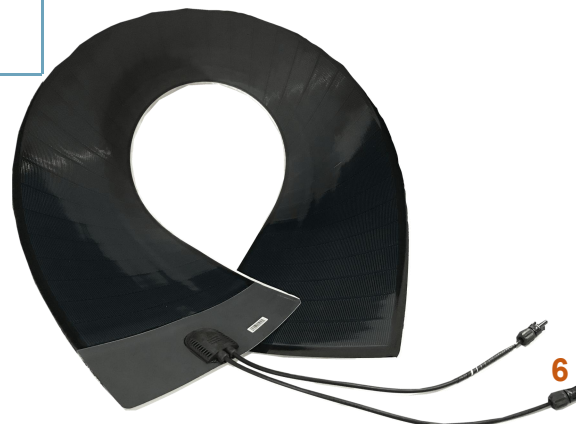
### Electrical Specifications

Model Selection		03NS-75	03NS-80
Capacity rating	Pmax	75W	80W
Tolerance of Pmax	%	+5/-0%	+5/-0%
Module aperture area efficiency	%	15.3%	16.3%
Maximum Power Voltage	Vmpp	18.8V	19.3V
Maximum Power Current	Impp	4.00A	4.15A
Open circuit voltage	Voc	23.7V	24.0V
Short circuit current	Isc	4.70A	4.70A
Maximum Series Fuse Rating	A	10A	10A
Maximum System Voltage	(IEC/UL)	1000/1000	
Dimension of Module	MM	1710*348*2.5/17	



### Mechanical Specification

Model Selection	FLEX-03NS SERIES
Length	1710mm (+5/-2)
Width	348 mm (+2/-2)
Thickness, Maximum at J-Box*	2.5 mm (17 mm)
Weight(Module without adhesive)	1.1 kg
Weight(Module with adhesive)	1.3 kg
Weight/Area(Module without adhesive)	1.8 kg/m <sup>2</sup>
Weight/Area(Module with adhesive)	2.2 kg/m <sup>2</sup>
Junction Box Type	IP68
Cable connections	Amphenol H4
Cell type	Copper Indium Gallium Diselenide (CIGS)



## FLEX-03N 110W.115W.120W.125W

110W | 115W | 120W | 125W

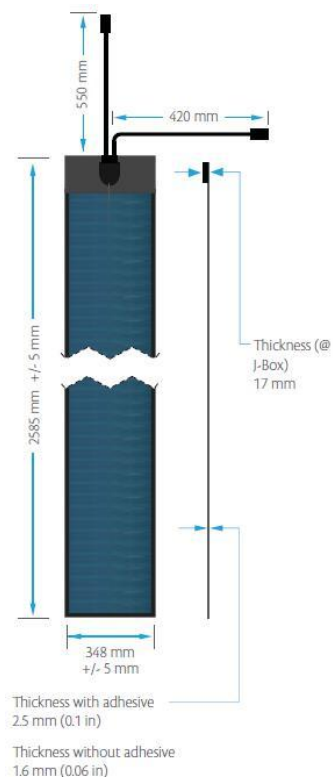
348mm \*2585mm | Rolling to 250MM Dia. | CIGS Cell

### Electrical Specifications

Model Selection		03N-110	03N-115	03N-120	03N-125	03N-130
Capacity rating	Pmax	110W	115W	120W	125W	130W
Tolerance of Pmax	%	+5/-0%	+5/-0%	+5/-0%	+5/-0%	+5/-0%
Module aperture area efficiency	%	14.4%	15.0%	15.7%	16.4%	17.0%
Maximum Power Voltage	Vmpp	28.5V	29.0V	29.5V	30.0V	30.5V
Maximum Power Current	Imp	3.87A	3.97A	4.07A	4.16A	4.26A
Open circuit voltage	Voc	36.5V	36.8V	37.1V	37.4V	37.7V
Short circuit current	Isc	4.70A	4.70A	4.70A	4.70A	4.70A
Maximum Series Fuse Rating	A	10A	10A	10A	10A	10A
Maximum System Voltage	(IEC/UL)	1000/1000				
Dimension of Module	MM	2585*348*2.5/17				

### Mechanical Specification

Model Selection	FLEX-03N SERIES
Length	2585mm (+5/-2)
Width	348 mm (+2/-2)
Thickness, Maximum at J-Box*	2.5 mm (17 mm)
Weight(Module without adhesive)	1.6 kg
Weight(Module with adhesive)	1.9 kg
Weight/Area(Module without adhesive)	1.8 kg/m <sup>2</sup>
Weight/Area(Module with adhesive)	2.2 kg/m <sup>2</sup>
Junction Box Type	IP68
Cable connections	Amphenol H4
Cell type	Copper Indium Gallium Diselenide (CIGS)





## FLEX-03NL 260W 270W.280W.290W

260W | 270W | 280W | 290W

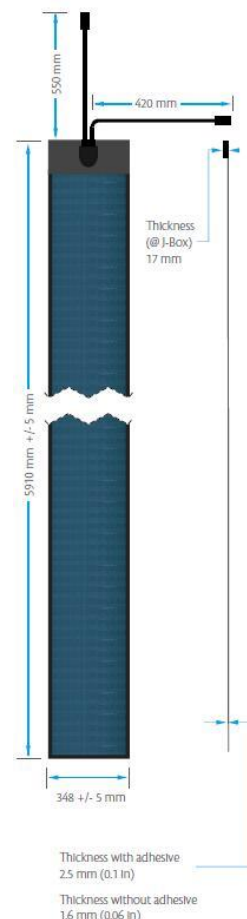
348mm \*5910mm | Rolling to 250MM Dia. | CIGS Cell

### Electrical Specifications

Model Selection		03NL-260	03NL-270	03NL-280	03NL-290
Capacity rating	Pmax	260W	270W	280W	290W
Tolerance of Pmax	%	+10/-0%	+10/-0%	+10/-0%	+10/-0%
Module aperture area efficiency	%	14.4%	15.0%	15.5%	16.1%
Maximum Power Voltage	Vmpp	67.3V	68.3V	69.3V	70.3V
Maximum Power Current	Imp	3.88A	3.96A	4.04A	4.13A
Open circuit voltage	Voc	86.2V	86.8V	87.3V	87.9V
Short circuit current	Isc	4.70A	4.70A	4.70A	4.70A
Maximum Series Fuse Rating	A	10A	10A	10A	10A
Maximum System Voltage	(IEC/UL)	1000/1000		1000/1000	
Dimension of Module	MM	5910*348*2.5/17			

### Mechanical Specification

Model Selection	FLEX-03NL SERIES
Length	5910mm (+5/-2)
Width	348 mm (+2/-2)
Thickness, Maximum at J-Box*	2.5 mm (17 mm)
Weight(Module without adhesive)	3.6 kg
Weight(Module with adhesive)	4.3 kg
Weight/Area(Module without adhesive)	1.7 kg/m <sup>2</sup>
Weight/Area(Module with adhesive)	2.1 kg/m <sup>2</sup>
Junction Box Type	IP68
Cable connections	Amphenol H4
Cell type	Copper Indium Gallium Diselenide (CIGS)





## FLEX-03M-1.7M 210W.220W.230W.240W

210W | 220W | 230W | 240W

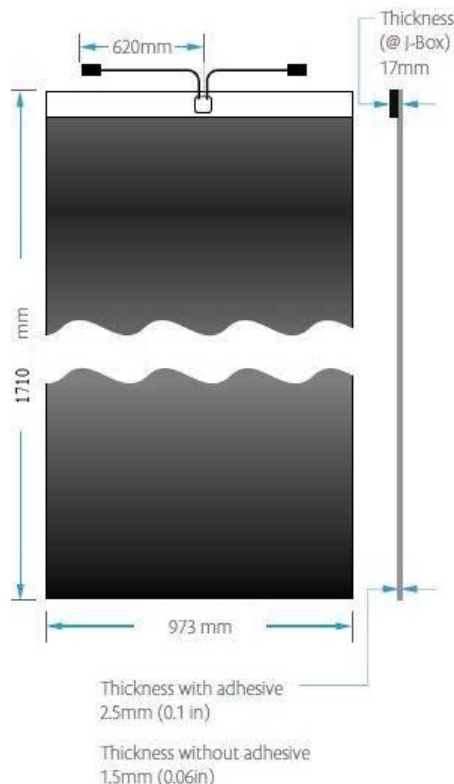
973mm \*1710mm | Rolling to 250MM Dia. | CIGS Cell

### Electrical Specifications

Model Selection		03M-1.7M-210	03M-1.7M-220	03M-1.7M-230	03M-1.7M-240
Capacity rating	Pmax	210W	220W	230W	240W
Tolerance of Pmax	%	+10/-0%	+10/-0%	+10/-0%	+10/-0%
Module aperture area efficiency	%	14.2%	14.9%	15.6%	16.3%
Maximum Power Voltage	Vmpp	18.1V	18.8V	19.4V	20.0V
Maximum Power Current	Impp	11.6A	11.8A	11.9A	12.0A
Open circuit voltage	Voc	23.2V	23.7V	24.2V	24.7V
Short circuit current	Isc	14.0A	13.9A	13.7A	13.6A
Maximum Series Fuse Rating	A	10A	10A	10A	10A
Maximum System Voltage	(IEC/UL)	1000/1000			
Dimension of Module	MM	1710*973*2.5/17			

### Mechanical Specification

Model Selection	FLEX-03M-1.7M SERIES
Length	1710mm
Width	973mm
Thickness, Maximum at J-Box*	17mm
Weight(Module without adhesive)	3.4 kg
Weight(Module with adhesive)	4.0 kg
Weight/Area(Module without adhesive)	2.04 kg/m <sup>2</sup>
Weight/Area(Module with adhesive)	2.40 kg/m <sup>2</sup>
Junction Box Type	IP68
Cable connections	Amphenol H4
Cell type	Copper Indium Gallium Diselenide (CIGS)



## FLEX-03M-2.6M 340W.350W.360W.370W

**340W | 350W | 360W | 370W**

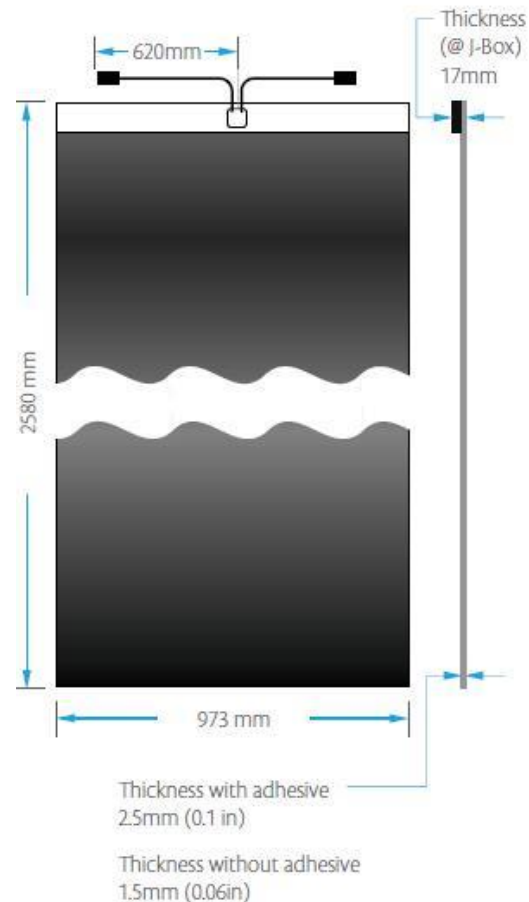
**973mm \*2580mm | Rolling to 250MM Dia. | CIGS Cell**

### Electrical Specifications

Model Selection		03M-2.6M-340	03M-2.6M-350	03M-2.6M-360	03M-2.6M-370
Capacity rating	Pmax	340W	350W	360W	370W
Tolerance of Pmax	%	+10/-0%	+10/-0%	+10/-0%	+10/-0%
Module aperture area efficiency	%	14.2%	14.9%	15.6%	16.3%
Maximum Power Voltage	Vmpp	29V	29.7V	30.3V	30.9V
Maximum Power Current	Imp	11.8A	11.8A	11.9A	12.0A
Open circuit voltage	Voc	36.8V	37.3V	37.8V	38.3V
Short circuit current	Isc	13.9A	13.8A	13.7A	13.6A
Maximum Series Fuse Rating	A	10A	10A	10A	10A
Maximum System Voltage	(IEC/UL)	1000/1000		1000/1000	
Dimension of Module	MM	2580*973*2.5/17		2580*973*2.5/17	

### Mechanical Specification

Model Numbers	FLEX-03M-2.6M SERIES
Length	2580mm
Width	973mm
Thickness, Maximum at J-Box*	17mm
Weight(Module without adhesive)	5.0 kg
Weight(Module with adhesive)	6.0 kg
Weight/Area(Module without adhesive)	1.99 kg/m <sup>2</sup>
Weight/Area(Module with adhesive)	2.39 kg/m <sup>2</sup>
Junction Box Type	IP68
Cable connections	Amphenol H4
Cell type	Copper Indium Gallium Diselenide (CIGS)



## FLEX-03WS 170W

### 170W

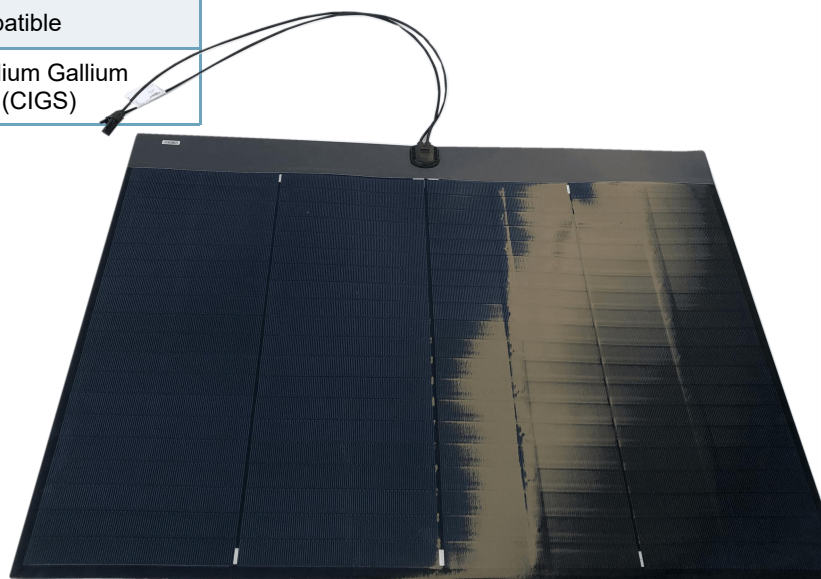
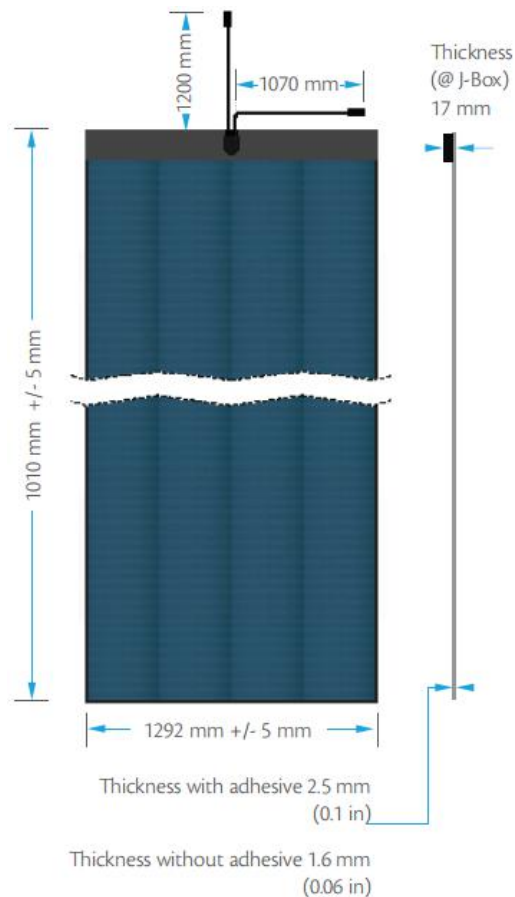
1010mm \*1292mm | Rolling to 250MM Dia. | CIGS Cell

### Electrical Specifications

Model Selection	03WS-1M	
Capacity rating	Pmax	170W
Tolerance of Pmax	%	+10 / -0%
Module aperture area efficiency	%	16.5%
Maximum Power Voltage	Vmpp	21.5V
Maximum Power Current	Impp	7.93A
Open circuit voltage	Voc	26.9V
Short circuit current	Isc	9.17A
Maximum Series Fuse Rating	A	10A
Maximum System Voltage	(IEC/UL)	1000/1000
Dimension of Module	MM	1535*348*2.5/17

### Mechanical Specification

Model Numbers	FLEX-03WS-1M SERIES
Length	1010mm
Width	1292mm
Thickness, Maximum at J-Box*	17mm
Weight(Module without adhesive)	2.1 kg
Weight(Module with adhesive)	2.5 kg
Weight/Area(Module without adhesive)	1.6 kg/m <sup>2</sup>
Weight/Area(Module with adhesive)	1.9 kg/m <sup>2</sup>
Junction Box Type	IP68
Cable connections	MC4 Compatible
Cell type	Copper Indium Gallium Diselenide (CIGS)



## FLEX-03W-2.6M 500W

500W | 510W | 520W

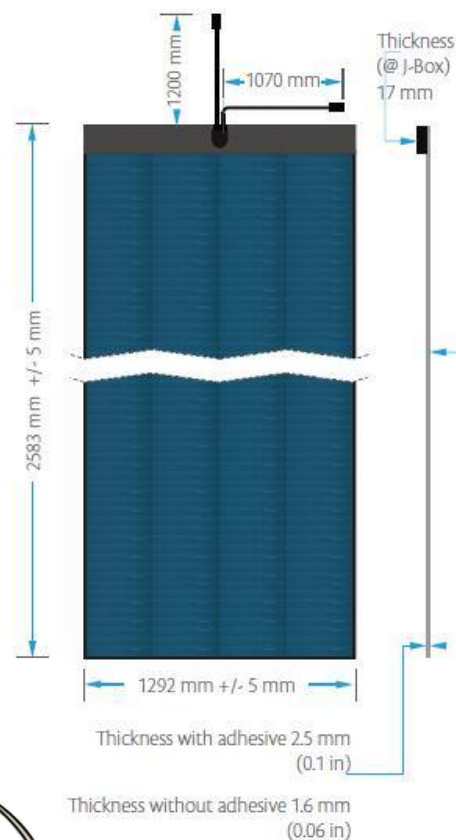
1292mm \*2583mm | Rolling to 500MM Dia. | CIGS Cell

### Electrical Specifications

Model Selection		03W-2.6M-500	03W-2.6M-510	03W-2.6M-520
Capacity rating	Pmax	500W	510W	520W
Tolerance of Pmax	%	+10/-0%	+10/-0%	+10/-0%
Module aperture area efficiency	%	16.4%	16.7%	17.0%
Maximum Power Voltage	Vmpp	62.4V	63.3V	64.2V
Maximum Power Current	I <sub>mp</sub>	8.03A	8.07A	8.11A
Open circuit voltage	V <sub>oc</sub>	77.2V	77.9V	78.7V
Short circuit current	I <sub>sc</sub>	9.07A	9.02A	8.98A
Maximum Series Fuse Rating	A	10A	10A	10A
Maximum System Voltage	(IEC/UL)	1000/1000	1000/1000	1000/1000
Dimension of Module	MM	2583*1292*2.5/17		

### Mechanical Specification

Model Numbers	FLEX-03W-2.6M SERIES
Length	2583mm
Width	1292mm
Thickness, Maximum at J-Box*	17mm
Weight(Module without adhesive)	5.5 kg
Weight(Module with adhesive)	6.6 kg
Weight/Area(Module without adhesive)	1.7 kg/m <sup>2</sup>
Weight/Area(Module with adhesive)	2.0 kg/m <sup>2</sup>
Junction Box Type	IP68
Cable connections	MC4 Compatible
Cell type	Copper Indium Gallium Diselenide (CIGS)





# Advantages of CIGS Flex PV Solar

## Flexible Modules vs. Polysilicon

Flexible Modules	Polysilicon
<b>Flexible</b> <ul style="list-style-type: none"> <li>Can fit around curved structures</li> <li>Can be integrated into materials</li> </ul>	<b>Rigid</b> <ul style="list-style-type: none"> <li>Not bendable</li> <li>Requires racking to install</li> </ul>
<b>Lightweight</b> <ul style="list-style-type: none"> <li>No retrofitting required</li> <li>Can be used in applications such as consumer goods where weight is a concern</li> </ul>	<b>Heavy</b> <ul style="list-style-type: none"> <li>Roofs require reinforcement to support weight</li> </ul>
<b>Durable</b> <ul style="list-style-type: none"> <li>Won't break/Resistant to vandalism</li> <li>No risk of microcracks to cells</li> </ul>	<b>Breakable</b> <ul style="list-style-type: none"> <li>Can shatter</li> <li>Cells can develop microracks</li> </ul>
<b>Bonded Directly to Surface</b> <ul style="list-style-type: none"> <li>Lower installation costs</li> <li>Resistant to theft</li> </ul>	<b>Requires Mounting Hardware</b> <ul style="list-style-type: none"> <li>Drives up installation costs</li> <li>Subject to theft</li> </ul>
<b>Thin-2mm-3mm</b> <ul style="list-style-type: none"> <li>Unobtrusive</li> <li>Superior wind resistance</li> </ul>	<b>Thick-40mm-50mm</b> <ul style="list-style-type: none"> <li>Visible</li> <li>Subject to wind uplift</li> </ul>
<b>Aesthetically Pleasing</b> <ul style="list-style-type: none"> <li>Uniform "black-tie" appearance</li> <li>Dark interconnect wires</li> </ul>	<b>Clunky-looking</b> <ul style="list-style-type: none"> <li>Checkerboard appearance</li> <li>Bulky paneling does not conform to the roof</li> </ul>
<b>Powerful</b> <ul style="list-style-type: none"> <li>288W form factor for large TPO installations</li> <li>More watts per KG</li> </ul>	<b>Not as powerful</b> <ul style="list-style-type: none"> <li>Traditional 60-cell house module 260-290 watts</li> <li>Utility sized 72-cell field module is only 290-310W</li> </ul>
<b>Safer</b> <ul style="list-style-type: none"> <li>FLEX modules are lightweight-won't injure people or property in high wind or earthquake</li> <li>No cell degradation at high voltage</li> <li>No grounding wires to corrode</li> </ul>	<b>Dangerous in environmental emergencies</b> <ul style="list-style-type: none"> <li>Metal racks+box modules can damage people and property in an earthquake</li> <li>Metal racks+box modules hazardous in the event of wind pull-off</li> </ul>

## Flexible Product Comparison

	Miasole FLEX Module	Poly Si
Efficiency	17.5% *	16%
BOS costs (\$/watt)	81%†	100%
Weight (kg/m <sup>2</sup> )	2.5	11.36
Thickness (mm)	2.5	35
Flexible ?	Yes	No
Unbreable	Yes	No

\*Aperture efficiency

# FAQ

## 1. What is efficiency?

Module efficiency characterizes a PV module's ability to convert available sunlight into useable power within a given area. The formula to calculate efficiency is:

$$\text{Efficiency (\%)} = \frac{\text{Module Power Rating (W}_p\text{)}}{1000 \text{ W/m}^2 * \text{Total PV module area (m}^2\text{)}}$$

The module area is the total area of the product that includes both the active and inactive area.

Aperture efficiency is when only the active area of a PV module is considered. This does not include the inactive area.

## 2. What is the maximum rated power of PV module?

Maximum rated power of a PV module is the nominal power rating that is based on STC.

## 3. What does STC mean?

STC stands for Standard Test Conditions. STC has three conditions:

- 1) Cell Temperature 25 deg C
- 2) Irradiance 1000 W/m<sup>2</sup>
- 3) Air Mass 1.5

## 4. What is rating tolerance?

The tolerance is specified on the datasheet by a "+/-" label by a nominal rating. This is the nominal deviation from a specification.

## 5. What is temperature coefficient? How does temperature and sunlight impact PV system performance?

On the datasheet, you'll notice 3 different temperature coefficients:

- 1) Temperature Coefficient of P<sub>mp</sub>
- 2) Temperature Coefficient of V<sub>oc</sub>
- 3) Temperature Coefficient of I<sub>sc</sub>

The performance of a PV cell behaves differently depending upon applied sunlight and temperature. The sunlight (aka irradiance) significantly impacts the current of the PV cell. The temperature has a significant impact on the voltage of PV cell.

At higher irradiance levels, the current goes higher, which means the temperature coefficient is positive.

At higher temperatures, the voltage goes lower, which is why the temperature coefficient is negative.

The P<sub>mp</sub> temperature coefficient is the factor that impacts the maximum rated power per deg C.

For example, if the temperature coefficient is - 0.35 %/deg C, this means that for every degree above 25 deg C cell temperature (based on STC), you'll see a - 0.35% impact on the nominal voltage rating.

## 6. What factors contribute to the overall system performance of a PV system?

"System performance" is a term we use to describe how closely the energy output of the PV system matches up with expectations. When determining whether a PV system is outperforming, meeting expectations or underperforming, it is very important to establish expectations based on technically sound assumptions.

There are a number of factors that can contribute overall to the absolute system performance of a PV system which may include:

- 1). Type of PV modules: product, technology, electrical specifications etc.
- 2). Installation location (determines environmental factors)
- 3). Ambient Temperature
- 4). Irradiance at the PV module
- 5). Shading
- 6). The azimuth (Direction of PV plane in relation to due north) and tilt angle of the PV modules
- 7). The cell temperature during operation: is there air flow on the back of the modules?
- 8). The type of inverters being used
- 9). System Application: Directly Adhered vs. Ballasted system
- 10). Length of DC wiring: i.e. Homerun Wiring (cables between PV Array and Inverter)
- 11). Module level power electronics, for example DC optimizers.
- 12). Soiling : dirt on the PV modules, debris, leaves

# FAQ

## 7. What makes the Thin Film FLEX modules different from conventional C- Si solar modules?

- 1) Flexible – conforms to curved surfaces
- 2) Lightweight – structures don't have to be reinforced to support the weight of racks and panels
- 3) Powerful – the efficiencies are superior to other thin- film modules, rivaling rigid silicon modules
- 4) Wind resistant – low profile modules offer little resistance to wind
- 5) Theft resistant – once attached, FLEX modules are difficult for a thief to remove (but can be removed by the owner if necessary)
- 6) Easy to install – peel- and- stick application requires very little training. In addition, the modules offer superior resistance to damage in seismic events and are difficult to steal once installed.
- 7) Shatterproof – FLEX modules will not shatter when struck by debris
- 8) Improved shade performance – FLEX modules use bypass diodes for every two cells that ensure that every cell receiving lights contributes to the module output
- 9) Improved aesthetics – the thin modules are unobtrusive and blend into surfaces
- 10) Doesn't require ballasting – many municipalities are restricting the use of ballast to secure solar modules. FLEX modules adhere directly to surfaces using peel- and- stick adhesive.
- 11) No roof penetrations – no increased risk of leaks or damage to surfaces

## 8. What BOS components are required to install a FLEX module?

Since FLEX modules are flexible, lightweight and frameless, the modules can be directly adhered to the surface. This avoids the necessity of a mechanical racking system and ballasting. This also provides the benefit of having no roof penetrations.

For the electrical installation, all other BOS components like combiner boxes, wire management, and inverters would still be required.

## 9. Which inverters are FLEX modules compatible with?

On non- metal surfaces, any type of inverter is compatible with modules. For metal surfaces, Please consult with a technical engineer.

## 10. Micro- inverters vs. string inverters vs. central inverters: What is the difference?

Central inverters start at around 100kW to as large as 10MW inverters. These inverters can be very large and heavy. The central inverter design is optimized for utilizing the least number of inverters at the site and is usually ideal for large ground mount projects.

This is typically the most cost- effective solution from an installed cost standpoint. However, if a 1MW project utilizes a 1MW central inverter, the production at the site has a single failure point at the inverter. This adds O&M cost for any loss of energy production and the need for more skilled labor for any maintenance and repair in the case of an event. This is the reason why more EPCs are starting to use the string inverter configuration for large projects. There is a higher potential for cost savings from an O&M perspective.

String inverters are usually 10kW- 80kW sized inverters that are ideal for commercial rooftop applications. Although you may need more string inverters for a project when comparing to a central inverter configuration, you can take advantage of multiple failure points, more max power tracking throughout the system, string level monitoring and lower skilled labor that is required for maintenance and repair.

Micro- inverters are designed to attach to a single or a couple of PV modules at a time. Although this configuration is more expensive than the other inverter configurations, it offers more maximum power tracking throughout the system, module- level monitoring and better energy output in shaded conditions. Micro- inverters are ideal for the residential market where the projects are smaller and more likely subject to shading conditions that are difficult to avoid. Also, since they are attached at the module- level, they can provide more control over the system with the ability to shut off the power and energize the DC homerun cables between the PV system and the inverter.

## 11. What type of surfaces are FLEX modules compatible with?

- TPO membranes
- Modified Bitumen
- Coated Steels, PVDF, SMP, Polyseter, Acrylic, Galvalume Plus, Galvaneal
- EPDM membranes
- Polycarbonate
- Other Materials, including Multiple RV Backsheets, PVDF film(kynar), Tefzel, Glass, Stainless steel, Noryl, Lexan, Xyron, Fiberglass reinforced plastics, Aluminum

# Warranty Statement

## Limited Warranty:

SINOLTECH warrants to Buyer that, for a period of 5 years after shipment of a particular Product to the original Buyer, the Product will be free from defects in materials and workmanship that negatively affect the Product's functionality under proper installation, operation, and maintenance conditions in accordance with procedures described in the Installation Guide supplied by SINOLTECH. SINOLTECH warrants to Buyer that under Standard Test Conditions (STC), the Product will, for a period of 5 years after shipment, produce at least 95% of the power output specified on the Product's faceplate or in its published specifications (+/- the specified or published tolerance levels); for the next 5-year period (years 6 through 10 after shipment), produce at least 90% of the power output specified on the Product's faceplate or in its published specifications (+/- the specified or published tolerance levels); and for the next 15-year period (years 11 through 25 after shipment), produce at least 80% of the power output specified on the Product's faceplate or in its published specifications (+/- the specified or published tolerance levels).

To make a warranty claim, Buyer must immediately notify SINOLTECH (Tech@sinoltech.com) of the nonconformance during the applicable warranty period. Warranty claims must be submitted to SINOLTECH with a description of the claimed defect and any supporting evidence, the Product serial number, and evidence of purchase date. SINOLTECH will then investigate the nonconformance and determine whether the warranty claim is valid. SINOLTECH's exclusive obligation with respect to any defective or nonconforming Product is, at SINOLTECH's option, to repair or replace that Product, to provide additional units or components to bring the aggregate power output to at least the warranted percentages of the specified minimum power output, or to otherwise provide monetary compensation to Buyer, as determined by SINOLTECH in its sole and absolute discretion, taking into consideration the warranted power output, the actual power output, and the amount of time the Product has been installed. SINOLTECH will pay shipping costs for Products that are repaired or replaced under the terms of this limited warranty and returned to Buyer. This limited warranty applies to Buyer and to any permitted assignees, provided the Product remains installed in its original location. SINOLTECH reserves the right to charge Buyer on a time-and-materials basis for returned Products in the event such Products are determined not to be defective. If any Product returned to SINOLTECH is determined not to be defective, or if the warranty has expired, Buyer shall be responsible for all packaging and shipping costs. THE FOREGOING IS BUYER'S SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY BY SINOLTECH WITH RESPECT TO THE PRODUCTS.

**Limitations on Warranty and Warranty Exclusions.** The limited warranty set forth above does not apply to any damage, malfunctions, or failures of any Product that, in the judgment of SINOLTECH, has been subject to, caused by, or is in connection with:

- Modification, repair, or alteration by anyone other than SINOLTECH, unless SINOLTECH approved such modification, repair, or alteration in advance;
- Improper installation, application, integration, use, operation, cleaning or maintenance not in accordance with any handling or operating instructions as specified in the SINOLTECH Module Installation Guide;
- Application to substrates or materials that have not been approved by SINOLTECH;
- Improper or negligent storage, transportation or handling;
- Physical or electrical stress, improper handling, misuse, abuse, negligence, vandalism, excessive wear and tear, intentional misconduct or accidents;
- Damage or corrosion caused by substrates, roofing materials, or their properties, such as corrosion resistance, thermal expansion and contraction, and water sealing properties;
- Lack of compliance with applicable codes;
- Altered, removed, or illegible Product serial number(s);
- Damage due to water pooling on the Product surface or any evidence thereof;
- Damage or corrosion due to environmental pollution, such as soot, chemical vapors, acid rain or salt water; or
- Events of force majeure or other events or causes beyond SINOLTECH's reasonable control and not arising under normal operating conditions, including, but not limited to, power surges, lightning, fire, falling objects, flood, and damage caused by wind, hail, storms, pest, animals, or people;

In addition, the above limited warranty does not cover any deterioration in the appearance of the Products, whether resulting from normal wear and tear or other cosmetic variations that do not negatively affect the functionality of the Products.

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