

## MiaSolé Flexible Solar Benefits

MiaSolé unique solar cells and modules are the key to the world's most powerful lightweight flexible thin-film CIGS solar modules. These modules are ideal for a wide variety of applications not suitable for fragile, heavy, rigid silicon modules.



- **Lightweight:** Less than  $2.4 \text{ kg/m}^2$  ( $<0.5 \text{ lb/ft}^2$ ). Because FLEX-02 modules are so much lighter than heavy rigid silicon panels mounted with racks, they are the best solution for building structures with low dead load and environmental load limitations (such as snow). The modules are also ideal for other structures, such as autos, trucks, and RVs, that are not constructed to support the weight of traditional solar panels.
- **Powerful:** MiaSolé FLEX modules are the highest efficiency flexible thin-film CIGS modules in production today, providing the highest power density per kilogram in a commercially available solar module. Our aperture efficiencies are as high as 17%, providing over four times the power generation per kilogram of silicon. In the future, efficiencies of up to 20% are expected.
- **Easy to Install:** MiaSolé FLEX modules use peel-and-stick application. This eliminates penetrations into the structure, reducing the chance of leaks. Peel-and-stick application also allows for installation on surfaces such as autos, trucks, and RVs where racks would not be feasible, and lowers the balance-of-systems (BOS) costs and complexity when mounting FLEX modules on rooftops.
- **Flexible:** MiaSolé FLEX modules conform to curved surfaces, enabling solar power generation on surfaces not suited to traditional rigid silicon panels.
- **Shatterproof:** FLEX modules are shatterproof, and won't break if struck by debris.
- **Resistant to Natural Disasters:** MiaSolé modules are thin (2.5mm) and adhere directly to surfaces, providing excellent wind and seismic resistance.
- **Reliable:** MiaSolé modules' unique redundant interconnect design enables industry-leading reliability.

# SolarRide™ Transportation Solution

*Let the sun work for you!*

The SolarRide™ transportation solution is comprised of ideally sized solar modules and a proprietary smart charge controller that ensures you receive the maximum benefit from your solar investment.

## SolarRide auxiliary power allows you to:

- **Reduce Fuel Consumption.** Use solar energy instead of gas to power auxiliary systems
- **Reduce Maintenance Costs.** Running the truck engine less results in decreased intervals for scheduled maintenance.
- **Minimize battery jump start service call cost.** Solar energy keeps the battery charged, reducing the need for jump starts.
- **Reduce Emissions.** Using clean solar power instead of fuel reduces emissions to help truckers comply with environmental regulations
- **Provide Stand-by Power.** Use solar energy for standby power without running the engine.
- **Provide Power to Truck De-icing Systems.** De-ice the truck with solar energy instead of fuel
- **Offload Alternator Loads.** Use solar power to provide offoad electrical power

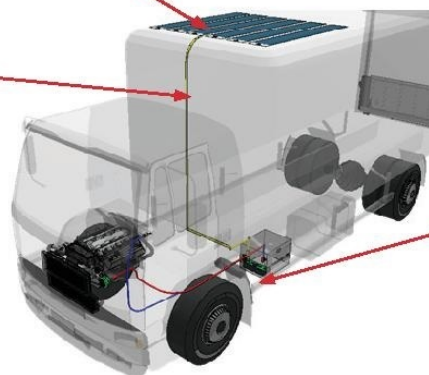


## FLEX solar modules

## Cables

## Components:

- FLEX solar modules - sized for transportation applications
- Charge controller
- Cables





## Off-Grid Solutions

Many solar applications are considered "off-grid" when the power they generate is self-contained. Following are examples of off-grid applications where MiaSolé FLEX modules provide unique benefits:

### GPS Tracking

- Lightweight panels integrate into the surface, reducing the incidence of theft
- Lightweight panels keep overall weight low
- Shatterproof modules are durable
- Superior performance under low light conditions
- Most powerful flexible panel on the market today



Mobike shared bicycle program

### Off-grid Lighting

- Flexible modules curve around light and charging pole structures for an unobtrusive look
- Modules can withstand 150+ mph winds and are shatterproof, creating a low risk of theft and vandalism
- Generates four times the wattage per kilogram compared to silicon panels
- Powerful enough to charge the battery to power the light for multiple days



*photos courtesy of ClearWorld*



# FLEX Modules for Carports

The MiaSolé FLEX-W Series—the world’s most powerful lightweight and flexible thin-film solar module—is a perfect fit for new and existing carports.

## Solar Carport Benefits:

- Provide highly desirable shade for parked cars, delivering increased owner comfort and a lower carbon footprint when the car is started and cooled
- Sun, rain, snow and hail protection
- Reduced parking lot temperatures and a lower heat-island effect
- Large power-generation area when compared to traditional roofs
- Fewer engineering and inspection challenges than traditional rooftop solar installations
- Fewer shading issues than traditional roofs

## MiaSolé FLEX for Carport Benefits:

- Lightweight: less than 2.2 kg/m<sup>2</sup> (<0.5 lb/ft<sup>2</sup>)—Ideal for today’s cost-optimized carport structures
- Easy to install—simply peel-and-stick
- Bonds directly to standard 7.2 trapezoid rib corrugated panels and standing-seam metal roofing
- Ideal for retrofitting solar onto existing carports
- Resistant to wind and seismic events; won’t detach or shatter if struck by debris
- Blends into the carport—minimal protrusion above the carport structure
- Theft and vandalism resistant
- Conforms to curved carport surfaces
- Low weight—four times the wattage per kilogram than silicon
- No rails or custom purlins
- No module grounding
- Non-penetrating
- Building-integrated PV module
- Designed for high wind and seismic zones





# Solar Engineered for Today's Membrane Roof Systems

MiaSolé FLEX-W Series - the world's most powerful flexible thin-film solar modules.

## High Performance Solar Roofing in a Lightweight Format

The FLEX-W Series modules are designed for low-slope commercial roofs. The FLEX modules bond directly onto the membrane roof system, eliminating the need for solar racking, concrete ballasts, and roof penetrations. Integration of the low-profile, thin-film modules onto the membrane roof surface protects against seismic movement and high winds. MiaSolé FLEX modules simplify project logistics and reduce labor costs and installation times. The final installed solar solution is lightweight, making it ideal for low weight bearing building structures.

## Features and Benefits

- Factory-applied self-adhesive—simple peel-and-stick application
- Aperture efficiency rating of up to 18.3%
- Lightweight—2.2 kg/m<sup>2</sup> (0.5 lb/ft<sup>2</sup>)
- High wind zone performance
- Low labor and balance-of-system (BOS) Costs
- Direct bonding on TPO with some roof manufactures
- Optional: Secondary membrane panel option for older TPO roofs
- Provides four times the wattage per kilogram than silicon panels
- No ballast or racking/No rails or custom purlins
- No module grounding
- Non-penetrating
- Building-integrated PV module
- Designed for high wind & seismic zones



Layout Modules



Clean & Prep TPO



Peel & Stick Modules to TPO

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*The 3M FLEX module installation in Columbia, Missouri did not require expensive retrofitting—due to the lightweight FLEX modules the building could continue to support the annual snow load in addition to the solar system. The directly adhered modules provide excellent wind resistance and caused no increased risk of roof leakage and damage to valuable equipment in the building. According to Bill Moore, 3M Columbia plant manager, “MiaSolé has been a great partner in helping us establish a solar energy footprint. Their expertise helped us determine how to install a solar array on an older roof section and identify a qualified installer. The installation performs well and creates electricity each day that is essentially maintenance free.” Since the system was installed in December 2013, there have been no reports of problems due to wind damage or roof leakage, and performance is better than expected.*

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# Metal Roofing Systems with High Efficiency Thin Film Solar

MiaSolé FLEX-N series modules are ideal for metal roofs, integrating seamlessly between the standing seams for an unobtrusive look.

*BlueScope, the leading manufacturer of steel roofing products for the Australian market, installed the first prototype of its Building Integrated PV Thermal (BIPV-T) hybrid roofing system in 2014. This new technology integrates new COLORBOND® Steel roofing with MiaSolé FLEX modules and draws air through the two skins of the roof through a plenum to provide warm or cool fresh air for the home. In BlueScope's BIPV-T design, a patented profile of the metal roof forms both the air plenum and a flat surface for the installation of photovoltaic (PV) modules. The solar modules generate electricity, while the air inside the channels is warmed by the sun, then drawn into the building for heating in the winter months. During clear summer evenings, the steel roof cools below ambient temperature and the air is then drawn into the building for night-time cooling. This roof is billed by ARENA chief executive Ivor Frischknecht as "an exciting new renewable energy solution that combines steel roofing with cutting-edge thin-film solar modules."*

## High Performance of Thin-film Solar in a Lightweight and Flexible Form Factor

The FLEX Series product is the ideal solar solution for metal roofs. These panels are lightweight and can be directly bonded to the roof—eliminating racking, reducing weight load, and significantly lowering labor and project costs. FLEX modules can be installed over a wide range of standard architectural and specific exposed fastener metal roof panels. For example, the FLEX Series modules can be directly applied to industry-standard 7.2 trapezoid rib corrugated panels to create solar parking and RV canopies.

### Features and Benefits

- Factory-applied self-adhesive—simple peel-and-stick application
- Operating efficiency rating of up to 18.3%
- Lightweight—2.2 kg/m<sup>2</sup> (0.5 lb/ft<sup>2</sup>)
- High wind zone performance
- Lowest solar rooftop installation cost
- Integrated profile for aesthetic appeal
- Low installation cost
- Provides four times the wattage per kilogram than silicon panels
- Superior resistance to wind



Steep-slope Standing Seam



Low-slope Corrugated



Solar Parking Canopies



# Geomembrane Covers for Water Reservoirs and Landfills

Placing solar modules on water reservoir and landfill covers is an ideal way to boost power generation capability.

## Water Reservoir and Landfill Cover Benefits:

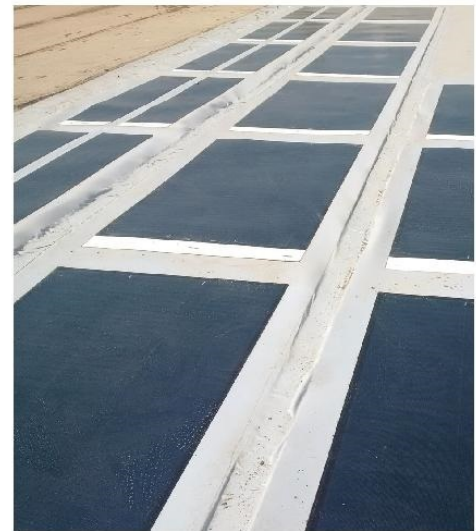
- Both are located on large, open areas with no commercial or agriculture use or value—perfect for solar installations.
- Large power-generation area and fewer shading issues when compared to rooftop solar.
- Excellent complement to landfill gas technology and hydro-based power generation to increase overall energy output.

### For Reservoirs:

- Reduced evaporation due to the solar covering—a three-acre storage pond covered with solar panels could save over four million gallons of water each year.
- Less water contamination and algae growth, minimizing water treatment and associated labor costs.
- Modules are naturally cooled by the water for better performance.

### For landfills:

- Closing and sealing landfills with a synthetic TPO membrane cover reduces costs compared to conventional standard subtitle D methods. Flexible modules can be bonded directly to the membrane cover.
- Membrane covers and flexible modules are a perfect combination for sloped landfill sites where conventional solar arrays cannot be installed due to slope and live-load limitations.



## MiaSolé FLEX offers these benefits when used on geomembrane covers:

- Easy to install—simply peel-and-stick module onto the membrane used to cover the reservoir or landfill
- Non-penetration installation means no increased risk of leakage, protecting the environment
- Flexible—conforms to the contours of the landfill and accommodates differential settlement
- Lightweight: less than 2.2 kg/m<sup>2</sup> (<0.5 lb/ft<sup>2</sup>)—Ideal for floating structures
- Provides four times the wattage per kilogram than silicon
- Resistant to theft and vandalism
- Wind- and seismic-resistant
- Shatter-proof—won't break if struck by debris



*photos of Dynactiv Power developed by Benecke-Kaliko*

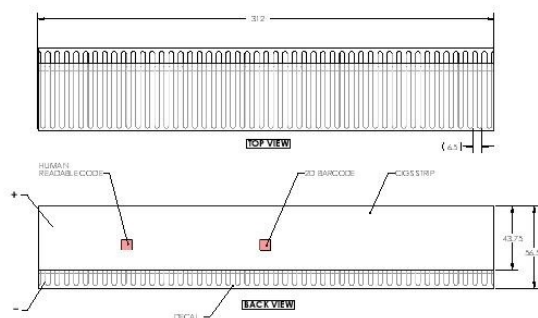
# CIGS Solar Cell

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

## KEY FEATURES

- Cell efficiency level of up to 17% 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 shatterproof

## CELL DIAGRAM



## ELECTRICAL PERFORMANCE BY .5% EFFICIENCY BINS

Cell Efficiency			15.5%	16.0%	16.5%	17.0%
Nominal Power	$P_{MPP}$	[W]	2.12	2.18	2.25	2.32
Power Output Tolerance		[W]	+0.1/-0	+0.1/-0	+0.1/-0	+0.1/-0
Maximum Power Voltage	$V_{MPP}$	[V]	0.526	0.531	0.538	0.545
Maximum Power Current		[A]	4.04	4.11	4.17	4.26
Open Circuit Voltage	$V_{OC}$	[V]	0.661	0.664	0.670	0.673
Short Circuit Current		[A]	4.70	4.70	4.70	4.70

## PHYSICAL AND MECHANICAL SPECIFICATIONS

Length	312 mm +3.5/-4 mm
Width	43.75 mm ± .25 mm
Thickness	0.33 mm ± 0.1 mm
Weight	7.5 gm ± 0.1 gm
Cell Type	Thin Film CIGS
Packaging Info	150 cells per package, 10 packages per box





# FLEX-03N & M Series Modules

## KEY FEATURES

- Record efficiency levels in a flexible form factor
- Low installed weight at less than 2.4 kg/m<sup>2</sup> (<0.5lb/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

## RELIABILITY AND SAFETY

- IEC 61646, IEC 61730, IEC 62716, IEC 61701 (Salt Spray)
- UL 1703, cUL 1703
- For Roofing Systems as the external fire exposure per UL file E483778 for Class A, B or C

## WARRANTY

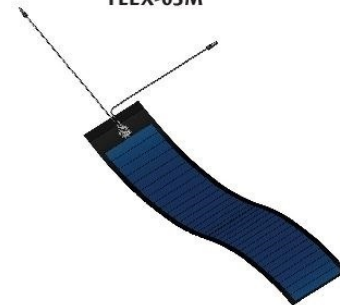
- 5-year workmanship
- 10/25 year warranty against power loss

## FLEX-03M Specifications

	FLEX-03M 2.6m
Power (Watts)	340W – 420W
Maximum Power Voltage V <sub>MPP</sub>	29.0 – 33.9
Length	2583 mm (101.7 in, 8ft 5.7in)
Width	973 mm (38.3 in, 3ft 2.3in)
Module Thickness	17 mm (0.7 in), 2.5 mm (0.1 in)
Weight	4.3 kg (9.5 lb) without adhesive 5.3 kg (11.7 lb) with adhesive
Weight/Area	1.7 kg/m <sup>2</sup> (0.3 lb/ft <sup>2</sup> ) w/out adhesive, 2.1 kg/m <sup>2</sup> (0.4 lb/ft <sup>2</sup> ) with adhesive
Junction Box Type	IP68
Cable Connections	Helios H4 (S&F)
Cell Type	Copper Indium Gallium Selenide (CIGS)
Warranty*	5 year workmanship; 10/25 year power output
Certifications	UL 1703, IEC 61646, IEC 61730, For Roofing Systems as the external fire exposure per UL file E483778 for Class A, B or C, cUL 1703, IEC 62716, IEC 61701 (Salt Spray)



FLEX-03M



FLEX-03N

## FLEX-03N 1.7m, FLEX-03N 2.6m and FLEX-03NL 5.9m Specifications

	FLEX-03N 1.7m	FLEX-03N 2.6m	FLEX-03NL 5.9m
Power (Watts)	70W – 90W	110W – 140W	260W – 330W
Maximum Power Voltage V <sub>MPP</sub>	18.1 – 21.8	28.4 – 33.9	67.2 – 80.8
Length	1709 mm (67.3 in, 5ft 7.3in)	(101.7 in, 8ft 5.7in)	5905 mm (232.5 in, 19ft 4.7in)
Width	348 mm (13.7 in, 1ft 1.7in)	348 mm (13.7 in, 1ft 1.7in)	348 mm (13.7 in, 1ft 1.7in)
Module Thickness	2.5 mm (0.1 in)	2.5 mm (0.1 in)	2.5 mm (0.1 in)
Weight	1.2 kg (2.6 lb) without adhesive 1.6 kg (3.5 lb) with adhesive	1.7 kg (3.7 lb) without adhesive 2.3 kg (5.0 lb) with adhesive	3.4 kg (7.5 lb) without adhesive 4.9 kg (10.8 lb) with adhesive
Weight/Area	2.0 kg/m <sup>2</sup> (0.4 lb/ft <sup>2</sup> ) without adhesive, 2.7 kg/m <sup>2</sup> (0.6 lb/ft <sup>2</sup> ) with adhesive		
Junction Box Type	IP68		
Cable Connections	Helios H4 (S&F)		
Cell Type	Copper Indium Gallium Diselenide (CIGS)		
Warranty*	5 year workmanship, 10/25 year power output		
Certifications	UL 1703, IEC 61646, IEC 61730, cUL 1703, IEC 62716		

\*Please see full warranty for details.

# FLEX-03W Series Modules

## KEY FEATURES

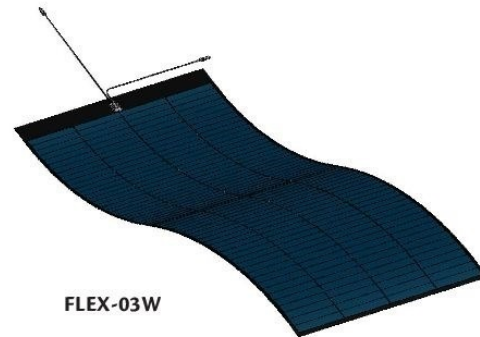
- Record efficiency levels in a flexible form factor
- Low installed weight at less than 2.4 kg/m<sup>2</sup> (<0.5lb/ft<sup>2</sup>)
- No penetrations, ballast or racking required
- Applicable for high wind load and high seismic hazard areas
- Bypass diodes reduce PV system shading losses
- Directly bonds to many approved surfaces

## RELIABILITY AND SAFETY

- IEC 61646, IEC 61730, IEC 62716, IEC 61701 (Salt Spray)
- UL 1703, cUL 1703
- For Roofing Systems as the external fire exposure per UL file E483778 for Class A, B or C

## WARRANTY

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



FLEX-03W



*FLEX-03W ships rolled for easy handling and lower shipping costs*

## FLEX-03W 1.0m and FLEX-03W 2.6m Specifications

	FLEX-03W 1.0m	FLEX-03W 2.6m
Power (Watts)	160W – 200W	490W – 540W
Maximum Power Voltage V <sub>MPP</sub>	20.6 – 24.2	61.4 – 66.0
Length	1010 mm (39.8 in, 3ft 3.8in)	2583 mm (101.8 in, 8'ft 5.8in)
Width	1293 mm (50.9 in, 4ft 4.9in)	1293 mm (50.9 in, 4ft 4.9in)
Module Thickness	17 mm (0.7 in), 2.5 mm (0.1 in)	17 mm (0.7 in), 2.5 mm (0.1 in)
Weight	2.2 kg (4.9 lb) without adhesive 2.6 kg (5.7 lb) with adhesive	5.5 kg (12.2 lb) without adhesive 6.6 kg (14.6 lb) with adhesive
Weight/Area	1.7 kg/m <sup>2</sup> (0.3 lb/ft <sup>2</sup> ) w/out adhesive, 2.0 kg/m <sup>2</sup> (0.4 lb/ft <sup>2</sup> ) with adhesive	
Junction Box Type	IP68	
Cable Connections	Helios H4 (S&F)	
Cell Type	Copper Indium Gallium Selenide (CIGS)	
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## CUSTOM MODULES

Custom modules sizes are available. Minimum order quantities apply.

[www.miasole.com](http://www.miasole.com)