



# BIFACIAL SERIES – GLASS-TO-GLASS PHOTOVOLTAIC MODULE

WITH OPTICAL TRACKING TECHNOLOGY

## ENGINEERING

The bifacial dual sided glass module (G2G) generates more electricity by converting direct, radiant and scattered solar energy on both the front and the back side of the module. The thinner tempered glass means less light trapping inside the glass increasing overall module efficiency. Proprietary IR resistant encapsulate increases the life expectancy and energy production over the life time of the module while maximizing the time per day the modules can generate electricity from the sun. The unique hydroscopic properties of the encapsulate material provide a distinct advantage over traditional processes for both framed and frameless module manufacturing. ASP bifacial G2G modules also have a low temperature coefficient, which allows them to produce more electricity than conventional crystalline silicon solar modules at the same temperature. Together these features can result in energy output as much as 30% higher than conventional technology.



Dual tempered glass laminates create bullet proof structure providing the maximum strength to withstand the most harsh operating conditions.

## ECONOMICS

Bifacial G2G technology is a turning point in photovoltaic (PV) system technology. It replaces costly single-axis and double-axis mechanical tracking systems with less costly bifacial panels while achieving the same increases in efficiency. In an average system cost of \$4/Watt for a conventional fixed ground-mount system, a double-axis tracking system would add about \$1/Watt to the installed cost of the system (plus operations and maintenance costs) and increase energy generation by approximately 30%. ASP's bifacial G2G panels will also increase energy generation by about 30% but only add approximately \$0.50/Watt to the overall cost of the system. Net result - a 12.5% increase in cost will add 30% in energy revenue for system owners, virtually eliminating the need for tracking systems.

## DESIGN

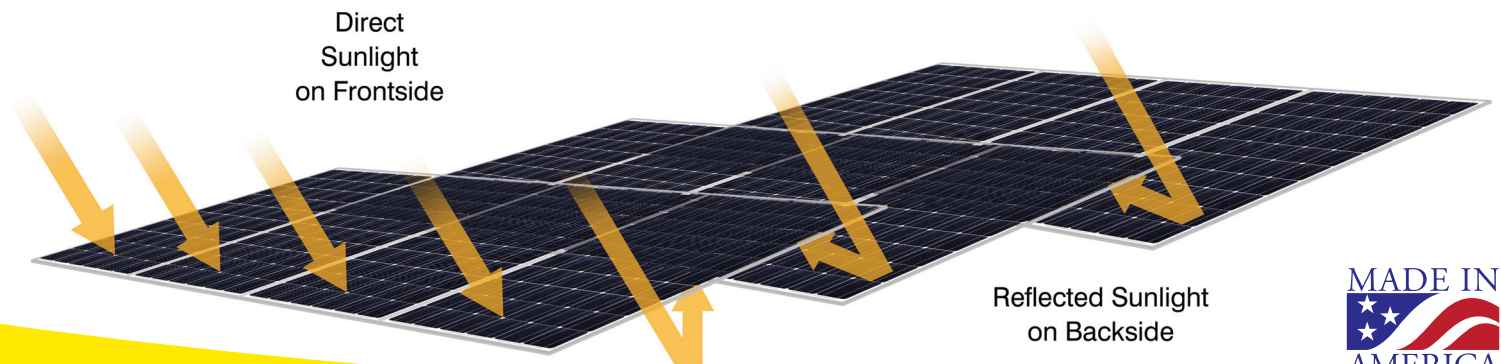
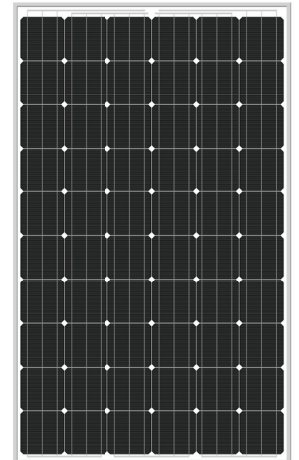
This lamination method, with no multi-layer back sheet, results in reduced fire hazard and less probability of mechanical damage over the lifetime of the module. The G2G architecture provides dual sided protection of silicon materials from extreme weather conditions. Thinner glass ensures less heat, thermal stability, resistance to impact and elimination of micro fractures. A frameless construction requires less connections, materials and labor resulting in compact packaging and facilitated transportation. The bifacial G2G modules have a life expectancy of 50 years without danger of mechanical damage or temperature/ humidity-related delamination of the back sheet, resulting in a loss of energy production performance or outright failure.



Eliminating of any flammable materials from the base structure of a module greatly reduces the fire hazard and fume generation at high temperature.

## APPLICATIONS

This breakthrough PV product is made up of 60 bifacial mono-crystalline silicon cells with up to 20.5% module efficiency on each side. The total rated power output of the panel will range from 283 Watts to 333 Watts. Bifacial modules are ideally suited for applications with limited ground space such as military bases, municipalities, and schools. In addition, modern rooftop designs using reflective "cool roof" materials would maximize the harvesting from that enhanced reflectivity.





## BIFACIAL SERIES – GLASS-TO-GLASS MODULE (Preliminary)

### RATED POWER

PARAMETER	VALUE	
	Total Output	Module Efficiency*
Front Side 100% + Back Side 10%	283 W	17.4 %
Front Side 100% + Back Side 20%	308 W	19.0 %
Front Side 100% + Back Side 30%	333 W	20.5 %

\* Equivalent module efficiency, including power from back side

### ELECTRICAL SPECIFICATIONS

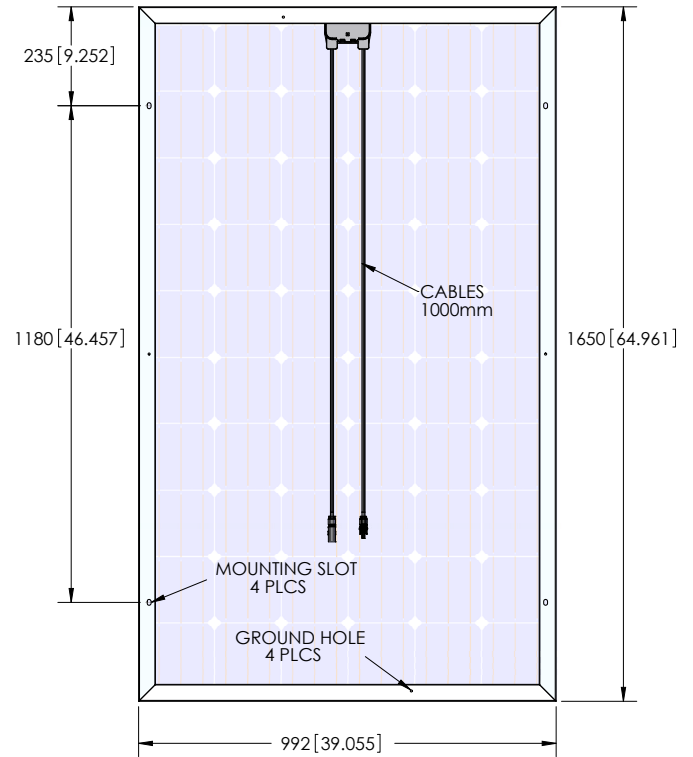
PARAMETER	VALUE		
	10% / 283 W	20% / 308 W	30% / 333 W
Maximum Power Voltage (Vmp)	30.51 V	30.54 V	30.60 V
Maximum Power Current (Imp)	9.27 A	10.08 A	10.87 A
Open Circuit Voltage (Voc)	38.61 V	38.64 V	38.70 V
Short Circuit Current (Isc)	9.85 A	10.72 A	11.59 A
NOCT	47±2° C	47±2° C	47±2° C
Watts per Ft. <sup>2</sup>	16.07 W	17.48 W	18.90 W
Maximum System Voltage UL/IEC (VDC)	600/1000	600/1000	600/1000
Series Fuse Rating	15 A	15 A	15 A
Output Tolerance	±5%	±5%	±5%

Measured at Standard Test Conditions (STC): Irradiance of 1000W/m<sup>2</sup>, air mass of 1.5 cell temperature of 25° C

### MECHANICAL SPECIFICATIONS

PARAMETER	VALUE
Solar Cell	60 Cells, 6x10 Bifacial Monocrystalline
Junction Box Internal Bypass Diodes	3 Bypass Diodes, IP65
Module Area	17.62 ft <sup>2</sup> (1.64 m <sup>2</sup> )
Frame Type	Anodized Aluminum Alloy with Twin-Wall Profile
Dimensions (LxWxH)	64.96" x 39.05" x 1.57" (1650 mm x 992 mm x 40 mm)
Cable Length (+Male/-Female)	39.37" (1000 mm)
Cable Size/ Connector Type	No. 12 AWG/MC4 Compatible
Cell Encapsulation	Proprietary
Glass - 2 Layers	2 x 0.089" (2.26 mm)
Weight	48.5 lbs. (22 kg)

### MODULE DIAGRAM



### OPERATION CONDITIONS & SAFETY RATINGS

PARAMETER	VALUE
Ambient Operating Temperature	-40° F to 185° F (-40° C to 85° C)
Fire Safety Classification	Class A Fire Rating
Max. Surface Resistance (Front & Back)	50PSF (2400Pa)
Hail Impact Rating	1"Ø (25mm) at 52 mph (23 m/s)

### TEMPERATURE COEFFICIENT

PARAMETER	VALUE
Power: Pmax (%/°C)	-0.37
Voltage: Voc (mV/°C)	-1.91
Current: Isc (mA/°C)	+4.12

### WARRANTY & CERTIFICATIONS

PARAMETER	VALUE
Warranty	Linear warranty not exceeding 20% degradation over 25 years 5 year limited product warranty
Warranted Tolerance	±5%
Certifications	UL1703, IEC 61215, IEC 61730, CE, CEC, FSEC and Class A Fire Rating (Pending)