

## HISTORIC AND DESIGN REVIEW COMMISSION

February 01, 2017

Agenda Item No: 06

**HDRC CASE NO:** 2017-036  
**ADDRESS:** 1830 E PYRON AVE  
**LEGAL DESCRIPTION:** NCB 7650 LOT NW IRR 24 FT OF M & NE IRR 137.68 FT OF M  
**ZONING:** R-6, H, RIO-5  
**CITY COUNCIL DIST.:** 3  
**DISTRICT:** Mission Historic District  
**APPLICANT:** Jessica Silva/Advanced Solar & Electric, LLC  
**OWNER:** Rudolf Harst  
**TYPE OF WORK:** Solar panel installation  
**REQUEST:**

The applicant is requesting a Certificate of Appropriateness for approval to install an additional 15 solar panels to a pre-existing system including 22 panels.

### APPLICABLE CITATIONS:

*Historic Design Guidelines, Chapter 3, Guidelines for Additions*

#### 6. Designing for Energy Efficiency

##### C. SOLAR COLLECTORS

*i. Location*—Locate solar collectors on side or rear roof pitch of the primary historic structure to the maximum extent feasible to minimize visibility from the public right-of-way while maximizing solar access. Alternatively, locate solar collectors on a garage or outbuilding or consider a ground-mount system where solar access to the primary structure is limited.

*ii. Mounting* (sloped roof surfaces)—Mount solar collectors flush with the surface of a sloped roof. Select collectors that are similar in color to the roof surface to reduce visibility.

### FINDINGS:

- a. The home is a 2 story home with a side gable roof. It is a contributing structure in the Mission Historic District, which was designated in 1977. The existing solar panels were approved in 2012.
- b. The structure has a side gable, a left rear addition with a shed roof, and a right rear addition with a rear gable roof form. The structure has composition shingles. There are existing 22 solar panels installed flush on the rear shed roof, the rear slope of the side gable, and the left slope of the rear gable. The proposed new solar panels will be installed flush on the left slope of the rear gable, and the right slope of the rear gable. According to the Guidelines for Additions 6.C., installations should be in locations that minimize visibility from the public right-of-way.
- c. Staff visited the site on January 24, 2017. The home is on East Pyron, which is a dead end street with many curves. The rear of the lot faces the San Antonio River. Staff found that the existing and proposed panels cannot be seen from the street. The house nor the solar panels can be seen from the San Antonio River, thus will not negatively impact the river. Staff finds the proposed panels consistent with the Guidelines
- d. The proposed panels will be mounted flush with the pitched roofs. According to the Guidelines for Additions 6.C.ii, solar collectors should be flush with the roof surface. Staff finds the proposal consistent with the guidelines.

### RECOMMENDATION:

Staff recommends approval as submitted based on findings a through d.

### CASE MANAGER:

Lauren Sage



## Flex Viewer

Powered by ArcGIS Server

Printed: Jan 24, 2017

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San Antonio River

E Pyron Ave

E Pyron Ave



1830 East Pyron Avenue



CITY OF SAN ANTONIO  
NOTICE OF HEARING  
HISTORIC & DESIGN  
REVIEW COMMISSION

ADDRESS: 1000 N. LOOP W.

REQUEST: HOME IMPROVEMENT

HEARING DATE: 10/10/2019 TIME: 10:00 A.M.

FOR MORE INFORMATION CONTACT  
312-222-2222

ALL HOURS HEARING TAKE PLACE AT 0101 S. MARO





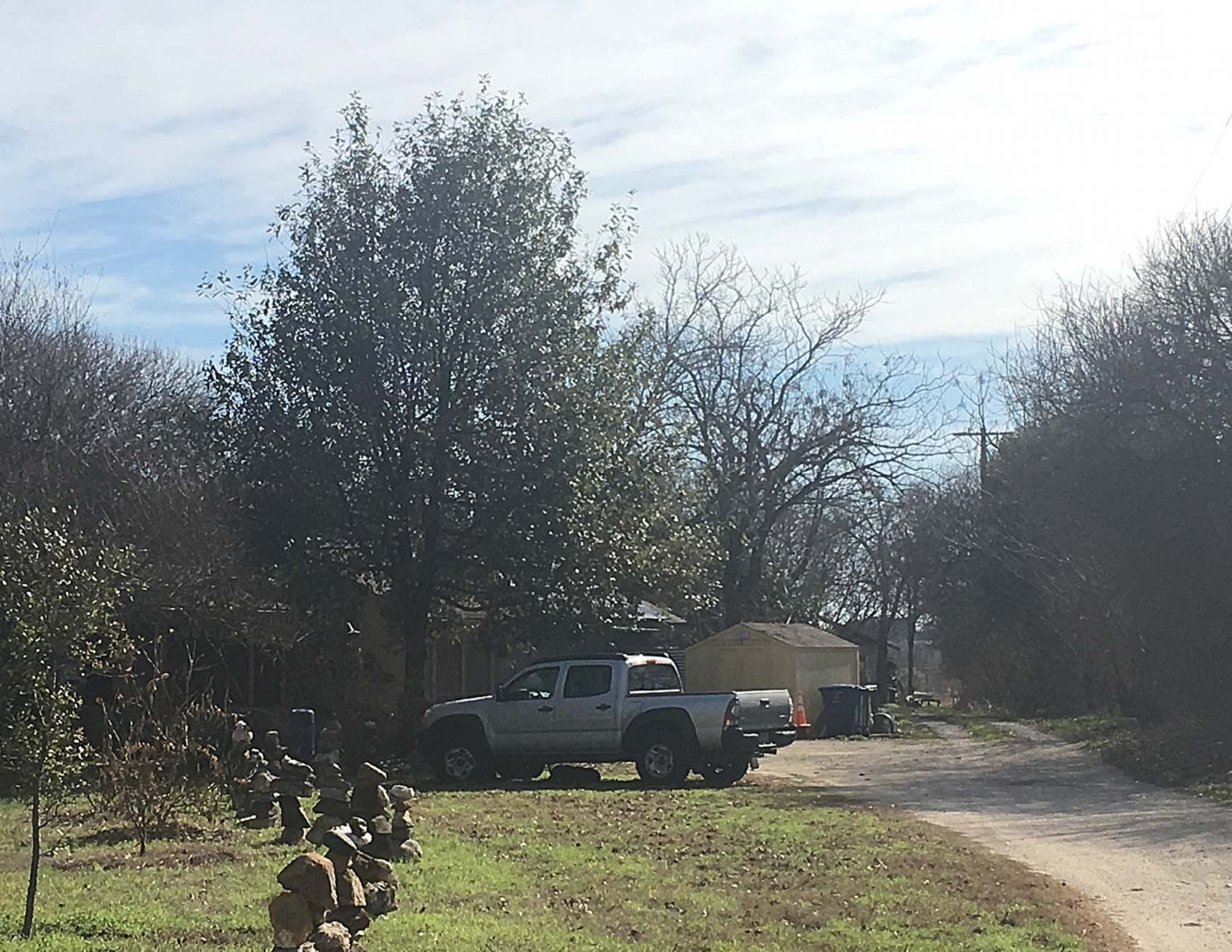






















We at Advanced Solar & Electric, LLC, in conjunction with the property owner, Rudolf Harst, propose to install an additional 15 solar electric (photovoltaic) panels onto the rooftop of his residence located at 1830 East Pyron Ave., San Antonio, Texas 78223. The roof top material is composite shingle, and our primary mounting materials will be Sol Attch feet, along with End and mid-clamps manufactured by Unirac. See attached diagrams for further information on the proposed mounting methods along with certification documentation of the materials to be used. The solar (photovoltaic) panels we propose to install are manufactured by Trina and the model number is TSM-255PD05.082. We would be installing a total of 15 of these panels, all onto the rooftop, which have the capacity to produce 3.825 kilowatts of D/C power (which will convert to 3.344 kilowatts of A/C power through the inverters). This system would also include the installation of one inverters, manufactured by ABB. The model number for this inverter is PVI-3.0-OUTD-S-US. Full spec sheets further describing the panel and inverter types, written by the manufacturers, are attached in this packet. See included documents for any further information on the proposed plans.































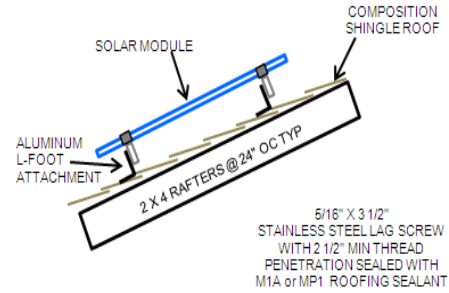


1830 East Pyron Avenue





PV SITE LAYOUT



MOUNTING METHOD

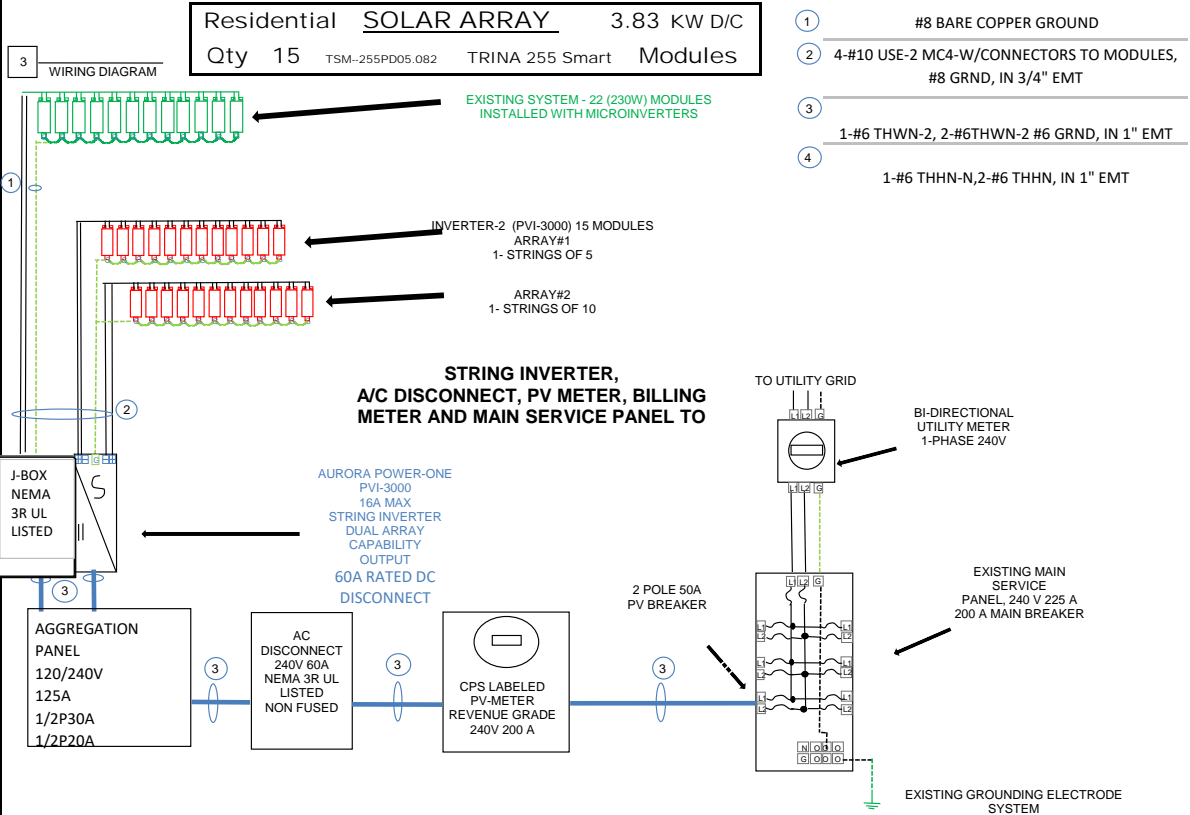
### CONSTRUCTION NOTES:

1. ALL EQUIPMENT TO BE LISTED OR LABELED FOR ITS APPLICATION.
2. INSTALLATION TO BE COMPLIANT WITH THE NEC.
3. MODULE GROUNDING METHOD SHALL BE WEEB UGC AND WEEB LUGS.
4. ALL CONDUCTORS ARE COPPER, UNLESS OTHERWISE SPECIFIED.
5. 3.0 PSF MAX DEAD LOAD CONTRIBUTED FROM SOLAR ARRAY

### LEGEND

---	= EQUIPMENT GROUNDING CONDUCTORS	—	= CIRCUIT CONDUCTORS
L1	= LINE 1 TERMINAL (PHASED BLACK)	L2	= LINE 2 TERMINAL (PHASED RED)
N	= NEUTRAL TERMINAL (PHASED WHITE)	G	= GROUND TERMINAL (PHASED GREEN)
+	= POSITIVE TERMINAL (PHASED BLACK)	-	= NEGATIVE TERMINAL (PHASED WHITE)
~	= FUSE	~	= CIRCUIT BREAKER

DESCRIPTION	DATE	REV
ORIGINAL	10/20/2016	A
REVISED		B
REVISED		C
Mstr Elect#	96107	
DESIGN & DRAFTING BY: Advanced Solar and Electric LLC Master Electrician: James D. Flores, Sr		



Rudolf Harst  
1803 E. Pyron  
San Antonio TX 78223  
Residential Application  
TECL #27328

SHEET TITLE:  
PHOTOVOLTAIC  
INSTALLATION  
PAGE NUMBER:  
PV-1

These drawings are the instruments of service and are the property of **ADVANCED SOLAR AND ELECTRIC LLC**. All designs and other information contained on these drawings are for use on the specified project and shall not be used on other projects, or for additions to this project, or for the completion of this project, by others without the expressed written consent of **ADVANCED SOLAR AND ELECTRIC LLC**. nor are they to be assigned to any third party without said written permission and consent.

### SIGNAGES PER NEC 690.17 & 705.10-705.12:

PV AC DISCONNECT (2014 NEC ARTICLES: 690.17, 690.53)  
PV SYSTEM DC DISCONNECT  
RATED MAX. POWER-POINT CURRENT: XXX ADC  
RATED MAX. POWER-POINT VOLTAGE: XXX VDC  
MAXIMUM SYSTEM VOLTAGE: XXX VDC  
SHORT-CIRCUIT CURRENT: XXX ADC

PV AC DISCONNECT (2014 NEC ARTICLES: 690.54)  
PV SYSTEM AC DISCONNECT  
RATED AC OUTPUT CURRENT: XXX AMPS  
NOMINAL OPERATING AC VOLTAGE: XXX VOLTS  
PV METER SOCKET: PV METER

WARNING: ELECTRIC SHOCK HAZARD  
TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

### INVERTER OUTPUT CONNECTION: (2014 NEC ARTICLE 705.12 D-2 B)

WARNING: INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE  
CUSTOMER SERVICE PANEL (2014 NEC ARTICLE 705.10)  
WARNING: THIS PREMISE IS SUPPLIED BY MORE THAN ONE SOURCE OF ELECTRIC POWER (UTILITY, PV, XXX)

CPS ENERGY REVENUE METER SOCKET  
REVENUE METER

PV AGGREGATION PANEL:  
DO NOT REMOVE, ADD OR RELOCATE ANY CIRCUITS FROM THIS PANEL  
TRANSFORMERLESS OR NON-ISOLATED INVERTERS ONLY:

WARNING  
ELECTRIC SHOCK HAZARD  
THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDING AND MAY BE

### NOTES:

- 1- CUSTOMERS SHALL BE RESPONSIBLE FOR COMPLYING WITH THE NEC AND OTHER APPLICABLE CODES ON ALL LABELING THAT IS REQUIRED FOR OTHER COMPONENTS OF THE PV SYSTEM INSTALLATION.
- 2- LABELING SHALL MEET THE FOLLOWING REQUIREMENTS:  
A) REFLECTIVE, WEATHER RESISTANT AND SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.  
B) RED BACKGROUND WITH WHITE LETTERING.  
C) MINIMUM 3/8" TALL CHARACTERS (SIZE MAY BE REDUCED ONLY WHEN NECESSARY TO FIT ON EQUIPMENT)
- 3- ADHESIVE FOR ALL LABELING SHALL BE WEATHER RESISTANT AND OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.
- 4- PERMANENT PLACARDS IDENTIFYING LOCATIONS SHALL BE PLACED AT BOTH THE PV METER AND REVENUE METER WHERE A VARIANCE HAS BEEN APPROVED FOR THE METERS TO BE PLACED REMOTE.
- 4- LABELING WARNING THAT THERE ARE DUAL SOURCES SUPPLYING SHALL ALSO BE PLACED ON THE JUNCTION BOX USED ON LINE-SIDE INTERCONNECTIONS.



# Advanced Solar and Electric L.L.C.

105 W. Loop 539, Cibola, Texas 78108 (210) 556-1399 www.advancedsolar.com sales@advancedsolar.com

TECL# 27328

## Site Survey Worksheet

**CUSTOMER:** Rudolf Harst  
**JOB SITE:** 1803 E. Pyron  
**CITY / ST / ZIP** San Antonio 78223 TX  
**EMAIL**

**DATE:** October 10, 2016  
**w Phone:** 210 534-3737  
**c Phone:** 210 534-3737  
**1 or 2 Story:** One Story

Proposed System	3.825 (D/C KW capacity)	AHJ: COSA
Panel Configuration	QTY 15 255 TSM--255PD05.082 TRINA 255 Smart	
Inverter Configuration	QTY 1 ABB PVI-3.0-OUTD-S-US	
Inverter Configuration	QTY 0 ABB 0	
Roof Type	Composite Shingle	Drawn By: Rep: Joel Alderman

**All Arrays**  
**Tilt:**  
**Azimuth:**

Array #1	Array #2	Array #3	Array #4
25.0	25.0		
125	305		
5	10		
1.28	2.55	0.00	0.00
1849	3698		0
1772	3078	0	0
95.86%	83.24%		

QTY	15
KW d/c	0.00
(CPSE only) KW a/c	0.00
NREL Default kWh	5546
NREL Actual kWh:	4850
% Default	87.45%





# **Advanced Solar and Electric L.L.C.**

105 W. Loop 539, Cibola, Texas 78108 (210) 556-1399 [www.advancedsolar.com](http://www.advancedsolar.com) [sales@advancedsolar.com](mailto:sales@advancedsolar.com)

## **Site Survey Worksheet**

**CUSTOMER:** Rudolf Harst  
**JOB SITE:** 1803 E. Pyron  
**CITY / ST / ZIP** San Antonio  
**EMAIL** 0

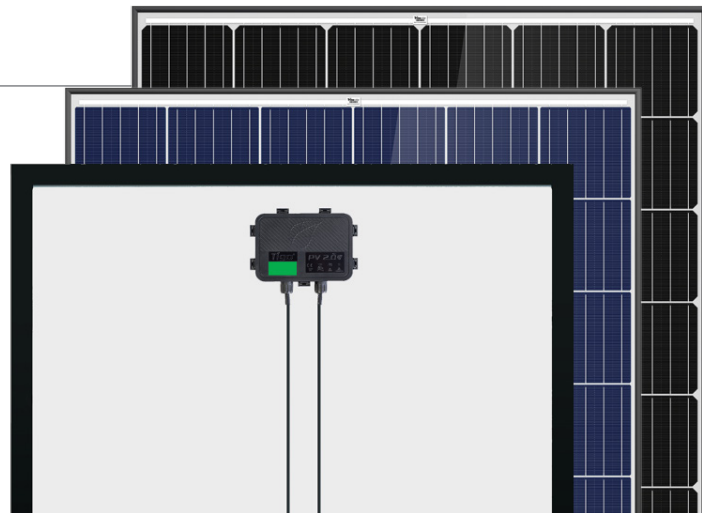
**DATE: #VALUE!**  
**PHONE #1:** 210 534-3737  
**TX PHONE #2:** 210 534-3737  
**TYPE:** Residential





# Trina smart

## THE OPTIMIZED SOLUTION



### COMPATIBLE WITH MOST TRINA MODULES

**255-295W**  
POWER OUTPUT RANGE

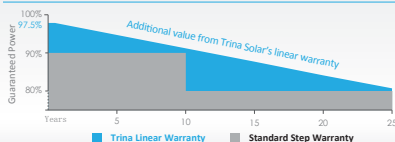
### FULLY INTEGRATED SMART SOLUTION

As a leading global manufacturer of next generation photovoltaic products, we believe close cooperation with our partners is critical to success. With local presence around the globe, Trina is able to provide exceptional service to each customer in each market and supplement our innovative, reliable products with the backing of Trina as a strong, bankable partner. We are committed to building strategic, mutually beneficial collaboration with installers, developers, distributors and other partners as the backbone of our shared success in driving Smart Energy Together.

Trina Solar Limited  
www.trinasolar.com

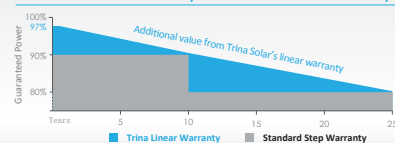
#### LINEAR PERFORMANCE WARRANTY

10 Year Product Warranty - 25 Year Linear Power Warranty



#### LINEAR PERFORMANCE WARRANTY

10 Year Product Warranty - 25 Year Linear Power Warranty



**Trina solar**  
Smart Energy Together



#### Safer Solar

- Module-level disconnect to remotely deactivate modules
- Fire, over-heating, over-voltage and other safety hazard mitigation
- 2014 NEC 690.12 Compliant



#### More Efficient O&M

- Module-level monitoring to pinpoint problems
- Detailed real-time alerts and analytics



#### Highest Power Density

- Install more modules on any roof
- Uneven string lengths enables design flexibility



#### Maximized Energy Harvest

- Predictive IV and Impedance Matching technology eliminate mismatch losses
- More power from each module bin



#### Lower BOS Costs from Smart Curve Technology

- Lower max open circuit voltage allows for longer strings
- Fewer combiners, fuses and copper wiring required



#### Fully Integrated

- Compatible with a variety of inverters
- No additional boxes to mount on module

### Comprehensive products and system certificates

- IEC 61215/ IEC 61730/ UL 1703/ IEC 61701/IEC 62716
- ISO 9001: Quality Management System
- ISO 14001: Environmental Management System
- ISO 14064: Greenhouse Gases Emissions Verification
- OHSAS 18001: Occupation Health and Safety Management System



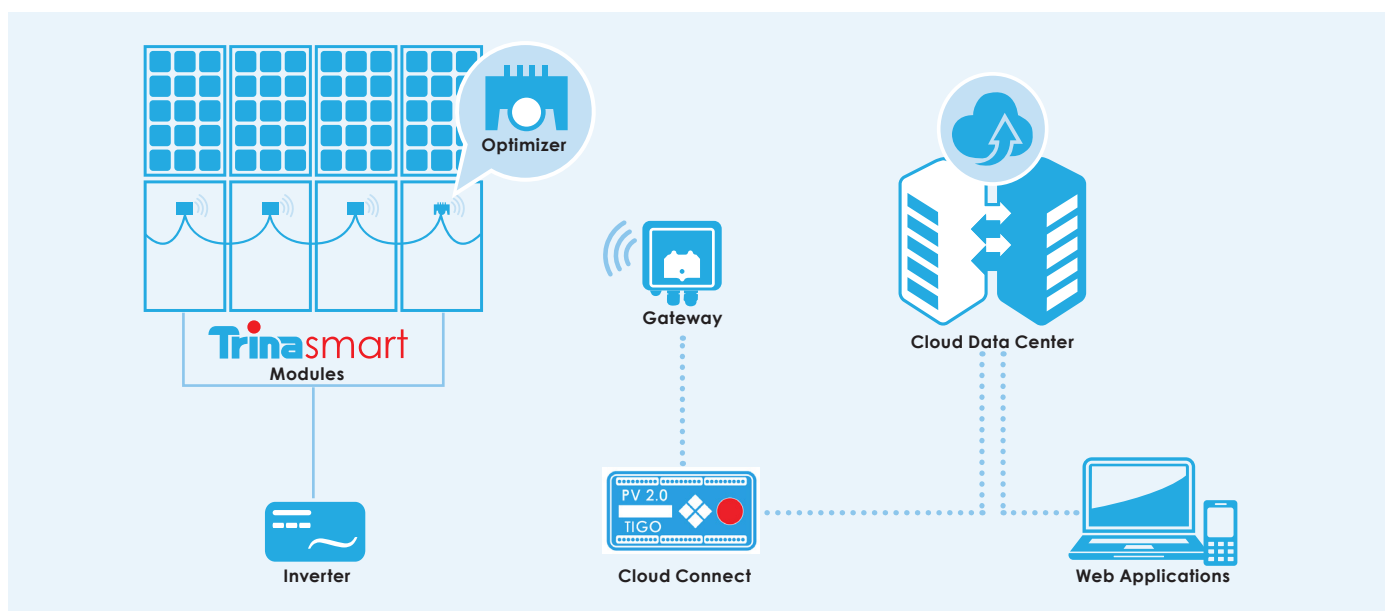


Trinasmart modules incorporate innovative power electronics from Tigo Energy to achieve module-level diagnostics, maximum energy harvest through module level DC power optimization, and reduction of arc, fire and safety hazards.

Integration of the module optimizer into the junction-box enables patented Smart Curve technology, which allows for longer strings and significant balance-of-system (BOS) savings.

## SYSTEM ARCHITECTURE

Trinasmart system components work together with any inverter to maximize energy harvest. Trinasmart modules communicate wirelessly through the gateway, allowing users to monitor system performance in real time.

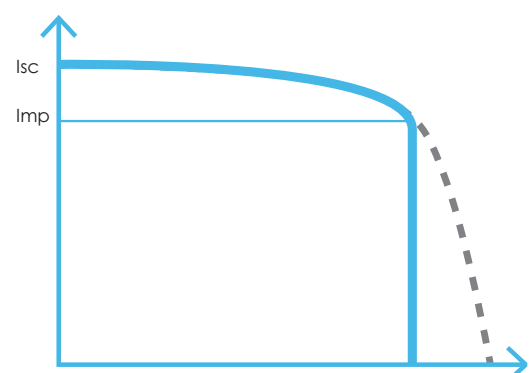


## SMART CURVE TECHNOLOGY

Module-integrated Trinasmart technology reduces the open circuit voltage range for each module and allows longer strings to be designed. The maximum voltage is programmed by Trina Solar in the factory.

- Hardware voltage clamp prevents over-voltage
- Design up to 30% longer strings
- Fewer combiner boxes, fuses and wiring

■ With Smart-Curve      ■ Without Smart-Curve



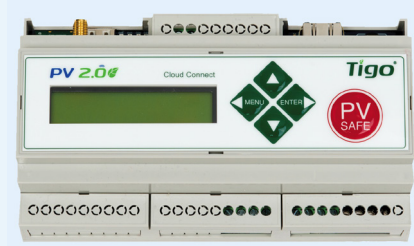


# THE OPTIMIZED SOLUTION

## CLOUD CONNECT

The Cloud Connect controls processes in real time and sends data to a remote sever for monitoring.

SPECIFICATIONS	ONE CC SUPPORTS UP TO 7 GATEWAYS, 360 TRINASMART MODULES	
Internet Connectivity Options	Ethernet Interface	10/100M
	Wireless Interface	Wi-Fi
Electrical	Supply Voltage	24VDC +/-1V
	Power Consumption	Max 10W
	Power Supply	100-240VAC
	Din Rail	Terminal Block
	Socket	EU/UK/US/AU Interchangeable, 2-Pin Plug
Capacity (single CC)	Supports to Gateway	7 PCS
	Supports to Smart modules	360 PCS
Mechanical Specifications	Mounting Type	DIN Rail/Wall Mount
	Dimensions (L x W x H)	159.5 x 90.2 x 57.5 mm (6.28" x 3.55" x 2.26")
	Weight	0.5 kg (1.1 lb)
	Enclosure	Indoor NEMA 1
	Operating Temperature	-20° to +60° C (-4 to 140F)



**Cloud Connect**  
An internet connection is required for full monitoring functionality.

## GATEWAY

Radio transceiver that communicates with TrinaSmart modules and relays data to the Cloud Connect.

SPECIFICATIONS	ONE GATEWAY SUPPORTS UP TO 120 TRINASMART MODULES	
Communication with modules	Wireless (802.15)	
Communication with CC	RS-485 cable connection; in series with other Gateways	
Mounting Location	Center of array	
Mounting Method	Mounted to module frame or rack Clips included for frame mounting	
Wireless Range	15m/50ft line-of-sight	
Capacity (single GW)	120 Smart modules	
Mechanical Specifications	Dimensions	141.3 x 48.5 x 33.3 mm 5.56 x 1.91 x 1.31 inches (with bracket)
	Weight	0.9kg/1.98lbs
	Operating temperature range	-30°C +70°C
	Enclosure environmental rating	IP 65



**Gateway**  
The wireless communications system is FCC and CE Class 2 certified. Fixing hole comes with a M3.5X6 SST pan head screw.

## MONITORING SERVICE

Trinasmart monitoring provides total insight into the performance of any system. You can choose to upgrade online once your system is installed.



Explore the  
monitoring portal at  
[www.trinasmart.com](http://www.trinasmart.com)

FEATURES	FREE	PREMIUM
Reports	Monthly	Daily
1-min data granularity	current&previous month	Full History
Full history	•	•
Safety alerts	•	•
Dashboard showing enviromental impact	•	•
Trending data charts	•	•
Device Integration	•	•
Ability to download		•
Performance Analytics		•
Performance alerts		•
API access		•



## PRODUCTS

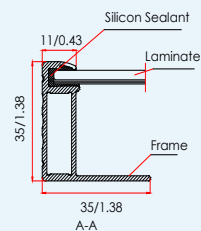
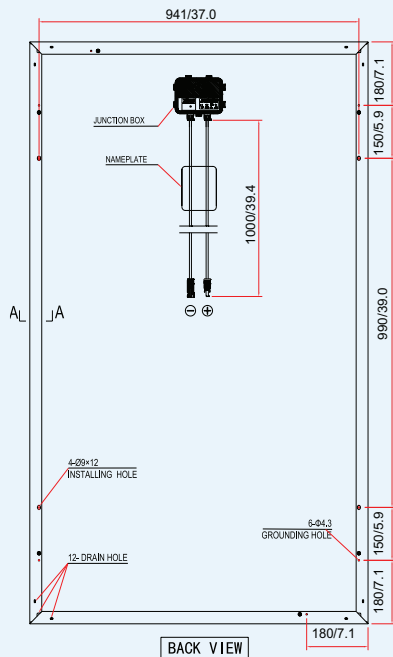
TSM-PD05.082

## POWER RANGE

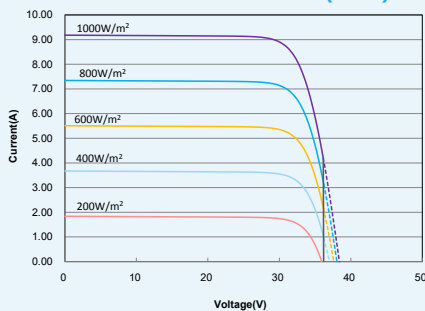
255-270W

### DIMENSIONS OF PV MODULE

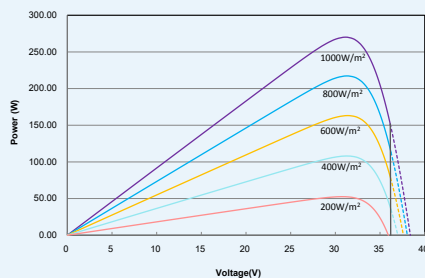
Unit:mm/inches



### I-V CURVES OF PV MODULE (270W)



### P-V CURVES OF PV MODULE (270W)



### ELECTRICAL DATA (STC)

Peak Power Watts- $P_{MAX}$ (Wp)*	255	260	265	270
Power Output Tolerance- $P_{MAX}$ (W)	0 ~ +5			
Maximum Power Voltage- $V_{MPP}$ (V)	30.5	30.6	30.8	30.9
Maximum Power Current- $I_{MPP}$ (A)	8.37	8.50	8.61	8.73
Smart Voltage Output - $V_{oc}$ (V)	36.2			
Maximum PV string current (DC)- $I_M$ (A)	12.5			
Module Efficiency $\eta_m$ (%)	15.6	15.9	16.2	16.5

STC: Irradiance 1000W/m<sup>2</sup>, Cell Temperature 25°C, Air Mass AM1.5.

\*Test tolerance: ±3%.

### ELECTRICAL DATA (NOCT)

Maximum Power- $P_{MAX}$ (Wp)	189	193	197	200
Maximum Power Voltage- $V_{MPP}$ (V)	28.2	28.4	28.6	28.7
Maximum Power Current- $I_{MPP}$ (A)	6.71	6.81	6.89	6.97
Smart Voltage Output - $V_{oc}$ (V)	36.2			
Maximum PV string current (DC)- $I_M$ (A)	12.5			

NOCT: Irradiance at 800 W/m<sup>2</sup>, Ambient Temperature 20°C, Wind Speed 1 m/s.

### MECHANICAL DATA

Solar Cells	Multicrystalline 156 × 156 mm (6 inches)
Cell Orientation	60 cells (6 × 10)
Module Dimensions	1650 × 992 × 35 mm (65.0 × 39.1 × 1.4 inches)
Weight	19.0 kg (41.9 lb)
Glass	3.2 mm (0.13 inches), High Transmission, AR Coated Tempered Glass
Backsheet	White
Frame	Black Anodized Aluminium Alloy
J-Box	IP 65 or IP 67 rated
Cables	Photovoltaic Technology Cable 4.0 mm <sup>2</sup> (0.006 inches <sup>2</sup> ), 1000 mm (39.4 inches)
Connector	MC4 Compatible
Fire Type	Type 1 or Type 2

### TEMPERATURE RATINGS

Nominal Operating Cell Temperature (NOCT)	44°C(±2°C)
Temperature Coefficient of $P_{MAX}$	-0.41%/°C
Temperature Coefficient of $V_{oc}$	0%/°C
Temperature Coefficient of $I_{sc}$	0.05%/°C

### MAXIMUM RATINGS

Operational Temperature	-40~+85°C
Maximum System Voltage	1000V DC (IEC) 1000V DC (UL)
Max Series Fuse Rating	15A

### WARRANTY

10 year workmanship warranty

25 year linear performance warranty

(Please refer to product warranty for details)

### PACKAGING CONFIGURATION

Modules per box: 30 pieces

Modules per 40' container: 840 pieces



## ABB string inverters

### PVI-3.0/3.6/3.8/4.2-TL-OUTD

3.0kW to 4.2kW



This family of single-phase string inverters complements the typical number of rooftop solar panels enabling homeowners to get the most efficient energy harvesting for the size of the property.

**This inverter offers a dual input section that processes two strings with independent Multiple Power Point Tracking (MPPT).**

This is especially useful for rooftop installations with two different orientations from two sub-arrays oriented in different directions, or unbalanced strings (for example: East and West).

The dual-input sections with independent MPPT enable a more optimal energy harvesting condition.

**The high-speed MPPT offers real-time power tracking and improved energy harvesting.**

The flat efficiency curve ensures high-efficiency at all output levels allowing a consistent and stable performance across the entire input voltage and output power range.

The transformerless operation gives the highest efficiency of up to 97.0 percent.

The wide input voltage range makes the inverter suitable to low-power installations with reduced string size.

This rugged, outdoor inverter has been designed to be a completely sealed unit, to withstand the harshest environmental conditions.

#### Highlights

- Single-phase and three-phase output grid connection
- Wide input-voltage range for increased stringing flexibility and energy harvesting
- The high-speed and precise MPPT algorithm offers real-time power tracking and improved energy harvesting
- Outdoor NEMA 4X rated enclosure for unrestricted use under any environmental conditions
- Integrated DC disconnect switch in compliance with international Standards (-S Version)



### Additional highlights

- RS-485 communication interface (for connection to laptop or data logger)
- Available with the optional VSN300 Wifi Logger Card for easy and affordable wireless monitoring
- Compliant with NEC 690.12 when used with ABB's Rapid Shutdown device
- Comes standard with DC Arc Fault Circuit Interruptor (AFCI) to comply with NEC 690.11



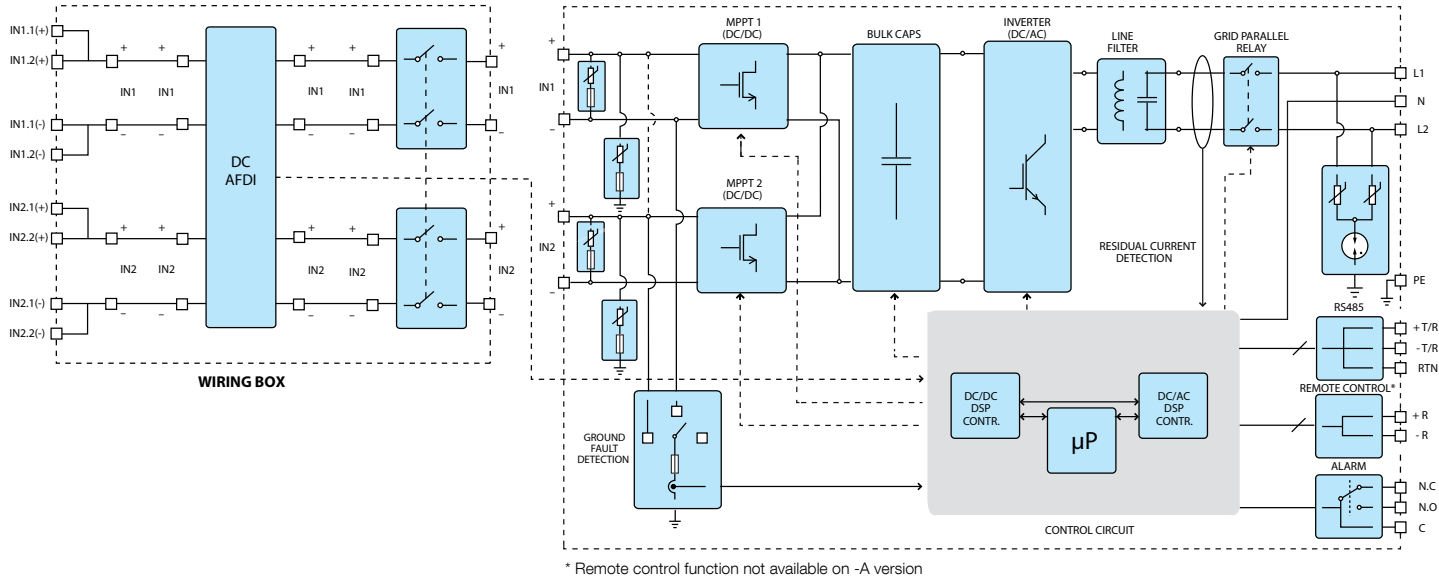
### Technical data and types

Type code	PVI-3.0-OUTD-US			PVI-3.6-OUTD-US			PVI-3.8-OUTD-US			PVI-4.2-OUTD-US		
General specifications												
Nominal output power	3000W			3600W			3300 W	3800W		4200W		
Maximum output power wattage	3000 W	3300 <sup>1</sup> W	3300 <sup>1</sup> W	3600 W	4000 <sup>1</sup> W	4000 <sup>1</sup> W	3300 W	4200 <sup>1</sup> W	4200 <sup>1</sup> W	4200 W	4600 <sup>1</sup> W	4600 <sup>1</sup> W
Rated grid AC voltage	208V	240V	277V	208V	240V	277V	208V	240V	277V	208V	240V	277V
Input side (DC)												
Number of independent MPPT channels	2			2			2			2		
Maximum usable power for each channel	2000W			3000W			3000W			3000W		
Absolute maximum voltage (Vmax)	600V											
Start-up voltage (Vstart)	200V (adj. 120-350V)											
Full power MPPT voltage range	160-530V			120-530V			140-530V			140-530V		
Operating MPPT voltage range	0.7 x Vstart - 580V (≥90V)											
Maximum current (Idcmax) for both MPPT in parallel	20A			32A			32A			32A		
Maximum usable current per channel	10A			16A			16A			16A		
Maximum short circuit current limit per channel	12.5A			20.0A			20.0A			20.0A		
Number of wire landing terminals per channel	2 pairs											
Array wiring termination	Terminal block, pressure clamp, AWG20-AWG6											
Output side (AC)												
Grid connection type	1Ø/ 2W	Split- Ø/3W	1Ø/ 2W	1Ø/ 2W	Split- Ø/3W	1Ø/ 2W	1Ø/ 2W	Split- Ø/3W	1Ø/ 2W	1Ø/ 2W	Split- Ø/3W	1Ø/ 2W
Adjustable voltage range (Vmin-Vmax) (V)	183- 228V	211- 264V	244- 304V	183- 228V	211- 264V	244- 304V	183- 228V	211- 264V	244- 304V	183- 228V	211- 264V	244- 304V
Grid frequency	60Hz											
Adjustable grid frequency range	57-60.5Hz											
Maximum current (Iac,max)	14.5A	14.5A	12.0A	17.2A	16.0A	16.0A	16.0A	16.0A	16.0A	20.0A	20.0A	20.0A
Power factor	> 0.995 (adjustable to ±0.8)											
Total harmonic distortion at rated power	< 2%											
Grid wiring termination type	Terminal block, Pressure clamp, AWG20-AWG6											
Input protection devices												
Reverse polarity protection	Yes											
Over-voltage protection type	Varistor, 2 for each channel											
PV array ground fault detection	Pre start-up Riso and dynamic GFDI (requires floating arrays)											
Output protection devices												
Anti-islanding protection	Meets UL1741 / IEEE1547 requirements											
Over-voltage protection type	Varistor, 2 (L1 - L2 / L1 - G)											
Maximum AC OCPD rating	20A	20A	15A	25A	20A	20A	20A	20A	20A	25A	25A	25A
Efficiency												
Maximum efficiency	96.9%			97%			97%			97%		
CEC efficiency	96%											
Operating performance												
Nighttime consumption	< 0.6W <sub>RMS</sub>											
Stand-by consumption	< 8W <sub>RMS</sub>											
Communication												
User-interface	16 characters x 2 lines LCD display											
Remote monitoring (1xRS485 incl.)	VSN700 Data Logger (opt.), VSN300 Wifi Logger Card (opt.)											
Environmental												
Ambient air operating temperature range	-13°F to +140°F (-25°C to 60°C) with derating above 122°F (50°C)											
Ambient air storage temperature range	-40°F to +176°F (-40°C to +80°C)											
Relative humidity	0-100% RH condensing											
Acoustic noise emission level	< 50 db (A) @1m											
Maximum operating altitude without derating	6560ft (2000m)											

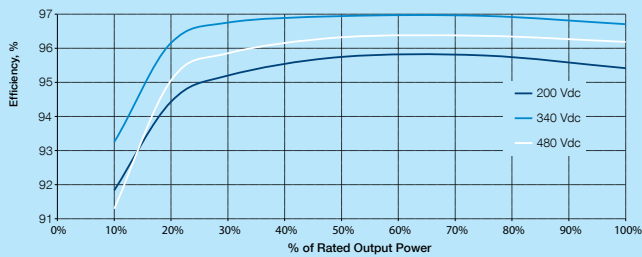
1. Capability enabled at nominal AC voltage and with sufficient DC power available.



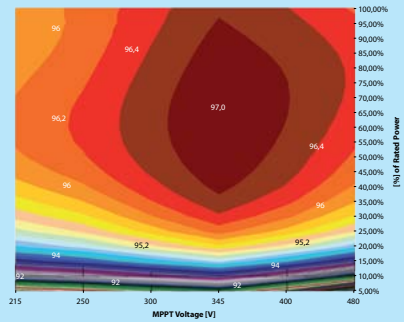
## Block diagram of PVI-3.0/3.6/3.8/4.2-TL-OUTD



PVI-4.2-OUTD-US



PVI-4.2-OUTD-US



## Technical data and types

Type code	PVI-3.0-OUTD-US	PVI-3.6-OUTD-US	PVI-3.8-OUTD-US	PVI-4.2-OUTD-US
Mechanical specifications				
Enclosure rating	NEMA 4X			
Cooling	Natural convection			
Dimensions H x W x D	33.8 x 12.8 x 8.7in (859 x 325 x 222mm) <sup>2</sup>			
Weight	<47.3lb (21.3kg) <sup>2</sup>			
Shipping weight	< 60lb (27.0kg) <sup>2</sup>			
Mounting system	Wall bracket			
Conduit connections <sup>2</sup>	Bottom: (2) pre-drilled opening for ¾ inch conduits and concentric markings for 1 inch (both sides) and 1½ inch conduit (DC side only) Sides: (2) pre-drilled opening for ¾ inch conduits with concentric markings for 1 inch (both sides) and 1½ inch conduit (DC side only) Back: (2) concentric markings for ¾ inch and 1 inch conduits			
DC switch rating (per contact) (A/V)	25/600			
Safety and Compliance				
Isolation level	Transformerless (floating array)			
Safety and EMC standard	UL1741, UL1741SA (draft), IEEE1547, IEEE1547.1, CSA-C22.2 N. 107.1-01, UL1998 UL 1699B, FCC Part 15 Class B			
Safety approval	cCSA <sub>US</sub> or cTUV <sub>US</sub>			
Regional Compliance	Rule 21, HECO, NEC 2014 690.11, NEC 2014 690.12 with ABB Rapid Shutdown device			
Available models				
With DC switch, wiring box, arc fault detector and interrupter	PVI-3.0-OUTD-S-US-A	PVI-3.6-OUTD-S-US-A	PVI-3.8-OUTD-S-US-A	PVI-4.2-OUTD-S-US-A

<sup>2</sup> When equipped with optional DC switch and wiring box.  
All data is subject to change without notice



### Support and service

ABB supports its customers with a dedicated, global service organization in more than 60 countries, with strong regional and national technical partner networks providing a complete range of life cycle services.

For more information please contact your local ABB representative or visit:

**[www.abb.com/solarinverters](http://www.abb.com/solarinverters)**

**[www.abb.com](http://www.abb.com)**

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This inverter is marked with one of the two certification marks shown here (TuV or CSA).



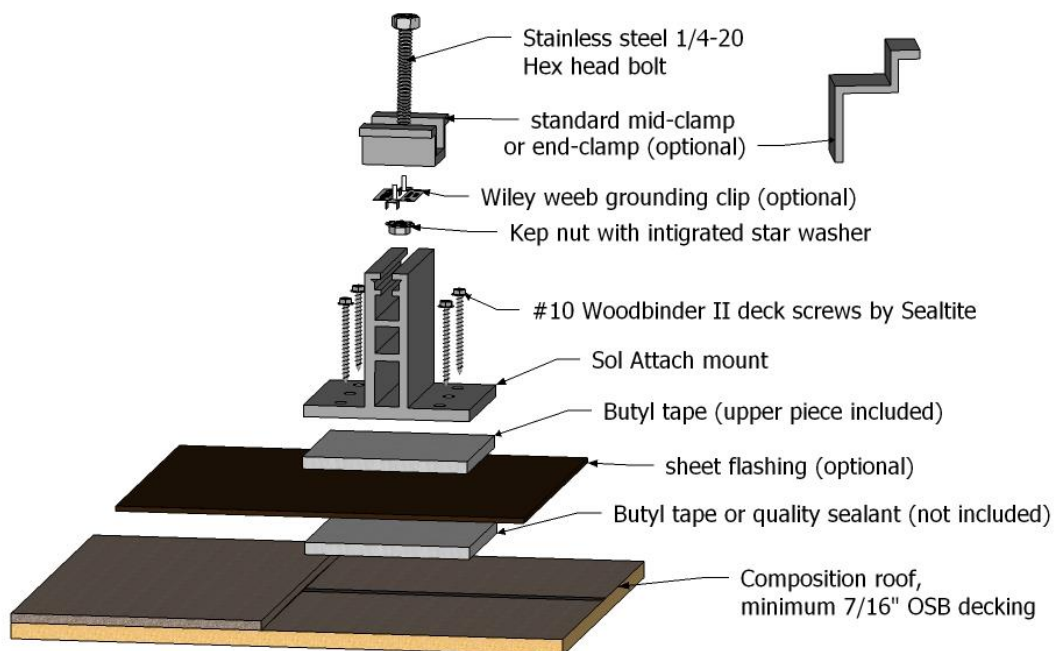
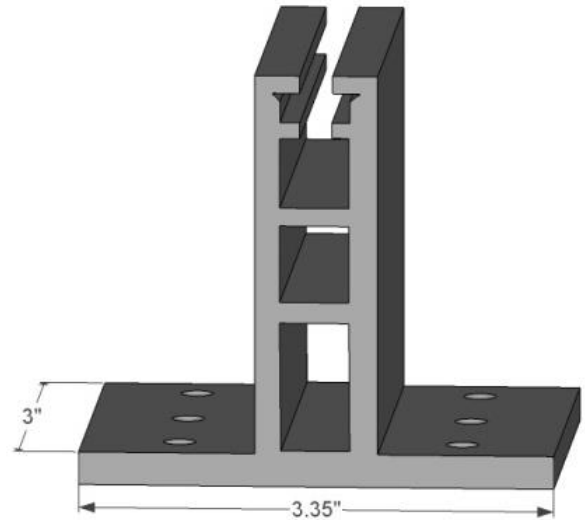
# SOL ATTACH

Sol Attach, LLC

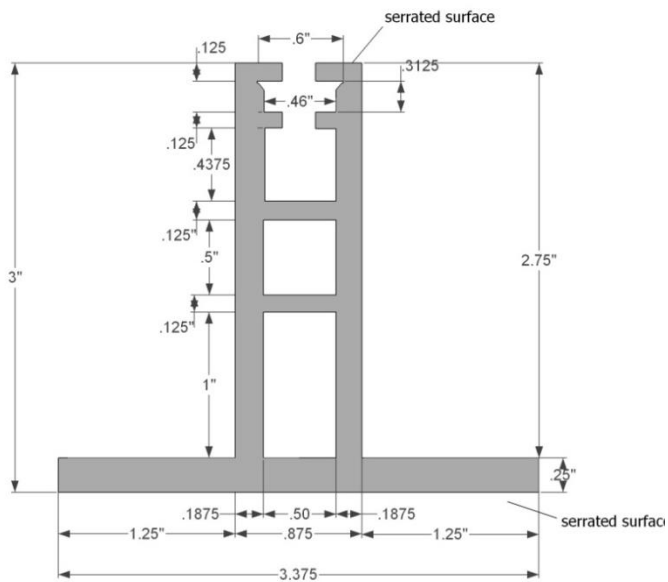
## **Composition roof mounting foot**

Extrusions made of 6061-T6 alloy

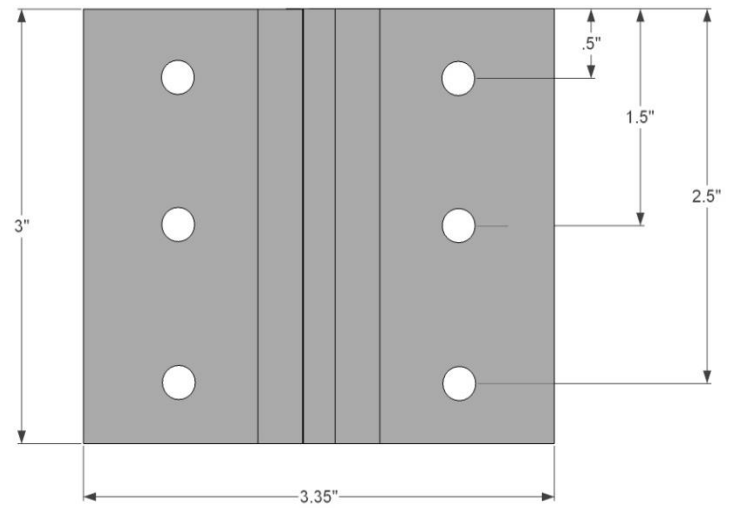
Patent Pending







### Front View

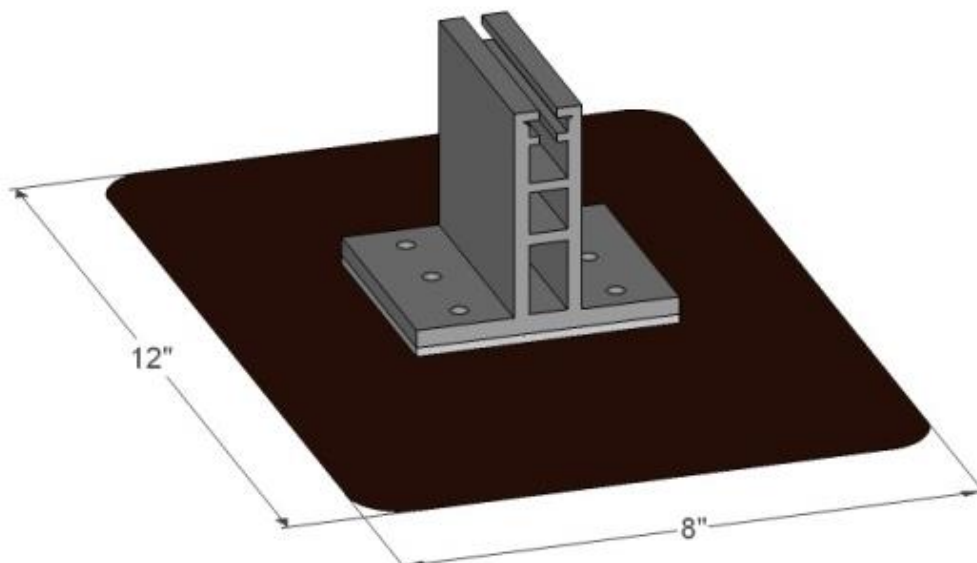


### Top View

### Weights:

Each single mount	6.6 oz
One mount with 4 deck screws and butyl tape	8.6 oz
One mount with screws, butyl, and mid-clamp	10.1 oz
One mount with screws, butyl, mid-clamp, and flashing	12.6 oz

## Flat flashing



May 22, 2014

Sol Attach, LLC  
Attn: Kevin Stapleton  
16238 Bear Run  
San Antonio, TX 78247



Texas Registered Engineering Firm #1979

Re: Solar Mounting System for Pitched Rooftops with Sol Attach Roof Mounting System in **Texas**

To Whom It May Concern:

Anchor Engineering, Inc. has reviewed the Sol Attach Roof Mounting System for the design assumptions outlined below and we have concluded that the Sol Attach Roof Mounting System is in compliance with the following codes/standards.

1. ASCE 7-05 – Minimum Design Loads for Buildings and Other Structures, by ASCE/SEI, 2005.
2. ASCE 7-10 – Minimum Design Loads for Buildings and Other Structures, by ASCE/SEI, 2010.
3. 2006 IBC/ 2009 IBC/ 2012 IBC, by International Code Council, 2006/2009/2012.
4. 2006 IRC/ 2009 IRC/ 2012 IRC, by International Code Council, 2006/2009/2012.

#### Design Assumptions:

- Maximum mean roof height of no more than 30'-0" as defined by ASCE 7-05/ASCE 7-10.
- Importance Factor of no more than 1.0 as defined by ASCE 7-05/ASCE 7-10.
- Dry service conditions.
- Array may be located within roof zones 1, 2, or 3.
- Analysis of the mount is based upon the maximum effects of either the largest gravity loads or wind uplift loads. The point loads (either positive or negative) can act in either direction depending upon the type of loading (i.e. wind, snow...etc.).
- Fasteners installed per manufacturer specifications.
- When using the Sol Attach, four PV mounts per PV module such that adjacent modules share two PV mounts.
- Use two Sol Attach per side unless noted otherwise (See charts below).
- At end clamp locations the Sol Attach Mount is only activated by one half of the panel.
- Snow load = 5 psf.

#### Product Specifications:

- Aluminum alloy is 6061-T6.
- Kwikseal II Woodbinder Screws. The screws must penetrate the sheathing fully and have a minimum of three threads exposed.
- (3) screws per Sol Attach Mount at end clamp locations.

#### Module Specifications:

- Modules may be installed in landscape or portrait orientation.
- Modules may have a maximum short side dimension of 39.1".
- Modules may have a maximum long side dimension of 77.1".
- Modules may be a maximum of 59.5lb.



Roof Pitch: 7-27°			
Wind Speed, ( $V_{ult}$ )	Wind Speed, ( $V_{asd}$ )	Exposure	Fastener Req'd per Sol Attach w/ 7/16" OSB
155 mph $\geq x$	120 mph $\geq x$	C	(6) Screws
155 mph $\geq x > 148$ mph	120 mph $\geq x > 115$ mph	B	(6) Screws
148 mph $\geq x$	115 mph $\geq x$	B	(4) Screws

Roof Pitch: 27-45°			
Wind Speed, ( $V_{ult}$ )	Wind Speed, ( $V_{asd}$ )	Exposure	Fastener Req'd per Sol Attach w/ 7/16" OSB
155 mph $\geq x >$	120 mph $\geq x$	B, C	(4) Screws

Module Specifications:

- Modules may be installed in landscape or portrait orientation.
- Modules may have a maximum short side dimension of 39.1".
- Modules may have a maximum long side dimension of 77.1".
- Modules may be a maximum of 59.5lb.

Please see attached data sheets for the Sol Attach Roof Mounting System specification sheet.

The Sol Attach Roof Mounting System was evaluated for pull-out resistance of the fasteners and punching shear in the OSB. Review of any building structural element is outside the scope of this letter.

Should questions arise, or if further information is required, please contact our office.

Sincerely,  
Anchor Engineering, Inc.

Reviewed by:



Dustin C. Stallings, E.I.  
Design Engineer I



David A. Poe, P.E., S.E.  
Principal Engineer

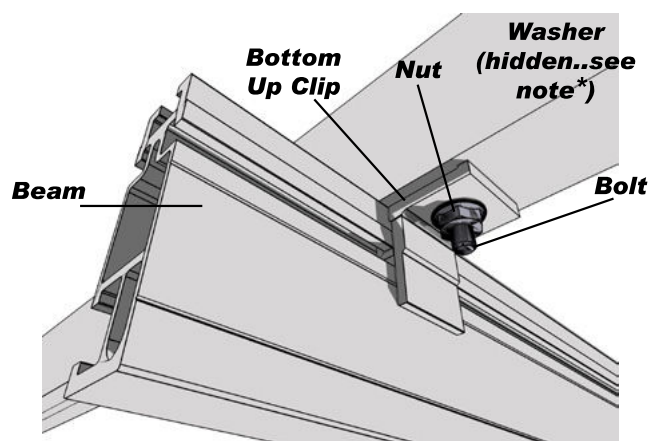
## SOLARMOUNT Technical Datasheet

Pub 130817

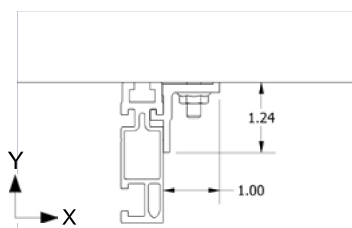
<b>SOLARMOUNT Module Connection Hardware</b> .....	<b>1</b>
Bottom Up Module Clip.....	1
Mid Clamp .....	2
End Clamp.....	2
<b>SOLARMOUNT Beam Connection Hardware</b> .....	<b>3</b>
L-Foot .....	3
<b>SOLARMOUNT Beams</b> .....	<b>4</b>

### SOLARMOUNT Module Connection Hardware

#### SOLARMOUNT Bottom Up Module Clip Part No. 302000C



- **Bottom Up Clip material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear Anodized
- **Bottom Up Clip weight:** ~0.031 lbs (14g)
- Allowable and design loads are valid when components are assembled with SOLARMOUNT series beams according to authorized UNIRAC documents
- Assemble with one ¼"-20 ASTM F593 bolt, one ¼"-20 ASTM F594 serrated flange nut, and one ¼" flat washer
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
- Module edge must be fully supported by the beam
- \* **NOTE ON WASHER:** Install washer on bolt head side of assembly. **DO NOT** install washer under serrated flange nut



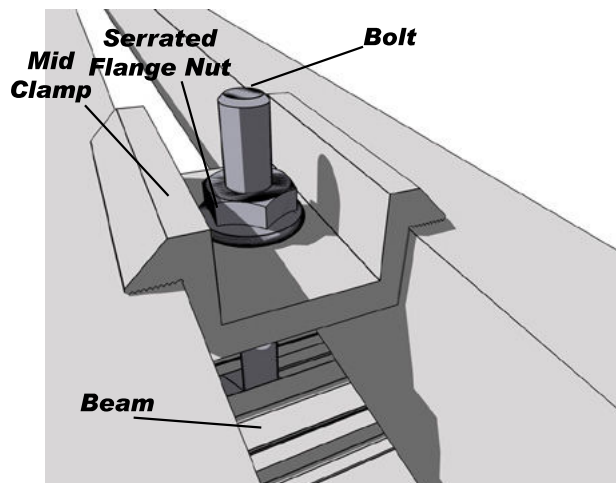
Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, $\Phi$
Tension, Y+	1566 (6967)	686 (3052)	2.28	1038 (4615)	0.662
Transverse, X±	1128 (5019)	329 (1463)	3.43	497 (2213)	0.441
Sliding, Z±	66 (292)	27 (119)	2.44	41 (181)	0.619

Dimensions specified in inches unless noted

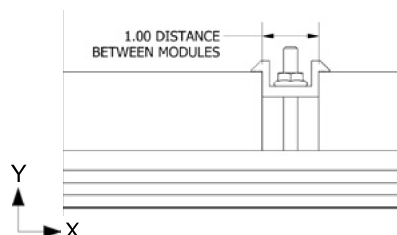


## SOLARMOUNT Mid Clamp

Part No. 302101C, 302101D, 302103C, 302104D,  
302105D, 302106D



- **Mid clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **Mid clamp weight:** 0.050 lbs (23g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single mid clamp assembly when used with a SOLARMOUNT series beam to retain a module in the direction indicated
- Assemble mid clamp with one Unirac 1/4"-20 T-bolt and one 1/4"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory

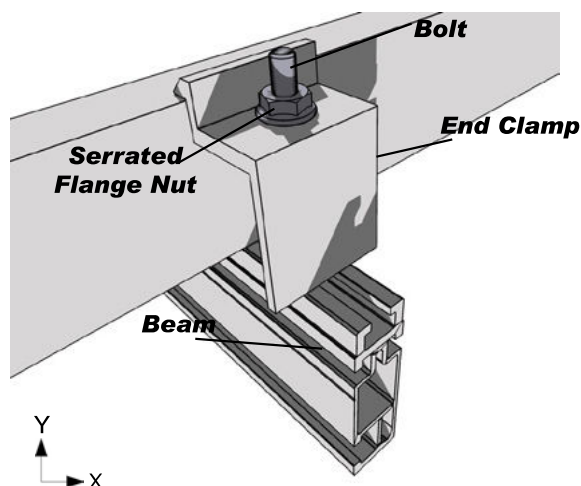


Dimensions specified in inches unless noted

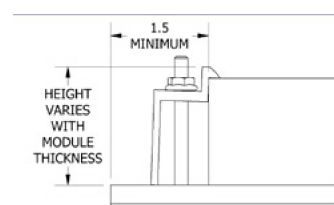
Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, $\Phi$
Tension, Y+	2020 (8987)	891 (3963)	2.27	1348 (5994)	0.667
Transverse, Z±	520 (2313)	229 (1017)	2.27	346 (1539)	0.665
Sliding, X±	1194 (5312)	490 (2179)	2.44	741 (3295)	0.620

## SOLARMOUNT End Clamp

Part No. 302001C, 302002C, 302002D, 302003C,  
302003D, 302004C, 302004D, 302005C, 302005D,  
302006C, 302006D, 302007D, 302008C, 302008D,  
302009C, 302009D, 302010C, 302011C, 302012C



- **End clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **End clamp weight:** varies based on height: ~0.058 lbs (26g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single end clamp assembly when used with a SOLARMOUNT series beam to retain a module in the direction indicated
- Assemble with one Unirac 1/4"-20 T-bolt and one 1/4"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
- Modules must be installed at least 1.5 in from either end of a beam

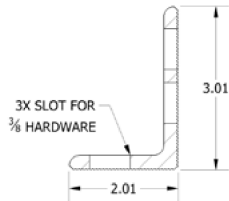
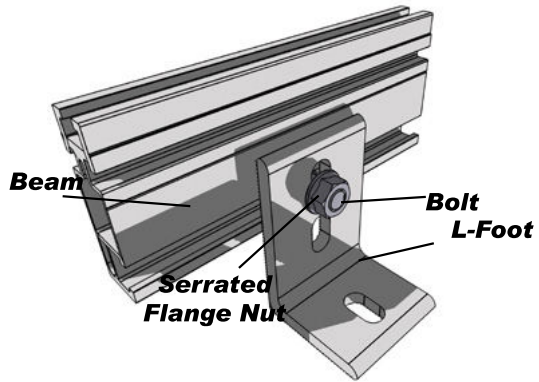


Dimensions specified in inches unless noted

Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Loads lbs (N)	Resistance Factor, $\Phi$
Tension, Y+	1321 (5876)	529 (2352)	2.50	800 (3557)	0.605
Transverse, Z±	63 (279)	14 (61)	4.58	21 (92)	0.330
Sliding, X±	142 (630)	52 (231)	2.72	79 (349)	0.555

## SOLARMOUNT Beam Connection Hardware

### SOLARMOUNT L-Foot Part No. 304000C, 304000D



Dimensions specified in inches unless noted

- **L-Foot material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **L-Foot weight:** 0.215 lbs (98g)
- Allowable and design loads are valid when components are assembled with SOLARMOUNT series beams according to authorized UNIRAC documents
- **For the beam to L-Foot connection:**
  - Assemble with one ASTM F593 3/8"-16 hex head screw and one ASTM F594 3/8" serrated flange nut
  - Use anti-seize and tighten to 30 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory

**NOTE:** Loads are given for the L-Foot to beam connection only; be sure to check load limits for standoff, lag screw, or other attachment method

Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, $\Phi$
Sliding, Z $\pm$	1766 (7856)	755 (3356)	2.34	1141 (5077)	0.646
Tension, Y+	1859 (8269)	707 (3144)	2.63	1069 (4755)	0.575
Compression, Y-	3258 (14492)	1325 (5893)	2.46	2004 (8913)	0.615
Traverse, X $\pm$	486 (2162)	213 (949)	2.28	323 (1436)	0.664

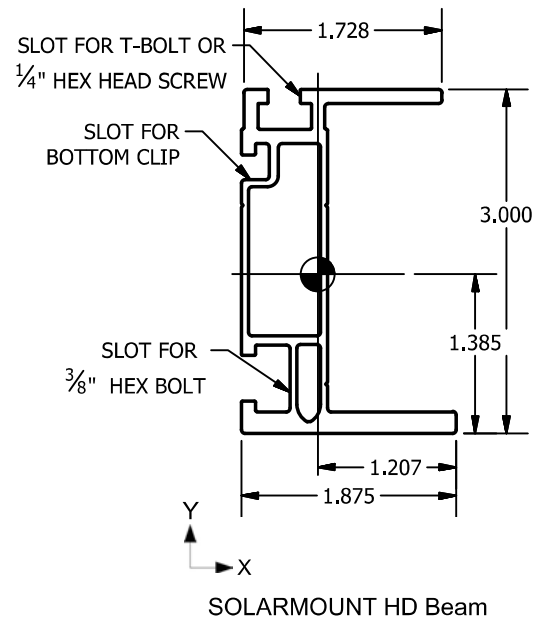
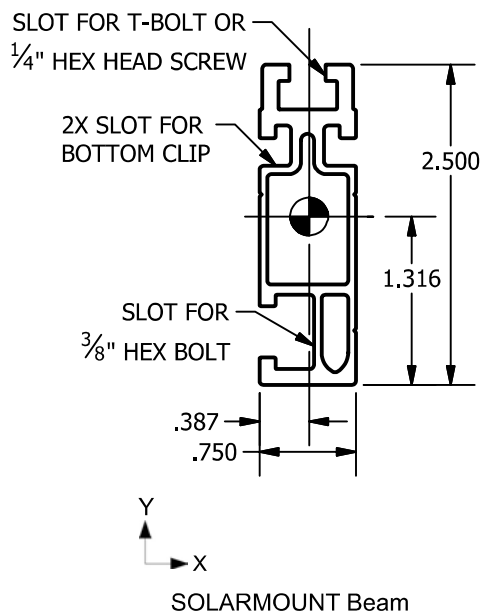


## SOLARMOUNT Beams

Part No. 310132C, 310132C-B, 310168C, 310168C-B, 310168D  
310208C, 310208C-B, 310240C, 310240C-B, 310240D,  
410144M, 410168M, 410204M, 410240M

Properties	Units	SOLARMOUNT	SOLARMOUNT HD
Beam Height	in	2.5	3.0
Approximate Weight (per linear ft)	plf	0.811	1.271
Total Cross Sectional Area	in <sup>2</sup>	0.676	1.059
Section Modulus (X-Axis)	in <sup>3</sup>	0.353	0.898
Section Modulus (Y-Axis)	in <sup>3</sup>	0.113	0.221
Moment of Inertia (X-Axis)	in <sup>4</sup>	0.464	1.450
Moment of Inertia (Y-Axis)	in <sup>4</sup>	0.044	0.267
Radius of Gyration (X-Axis)	in	0.289	1.170
Radius of Gyration (Y-Axis)	in	0.254	0.502

\* Rails are extruded using these aluminum alloys: 6005-T5, 6105-T5, 6061-T6



Dimensions specified in inches unless noted