

Belmont Middle & High School Project

Panel Manufacturer Comparison, 4/28/22

Compare three PV Panel manufacturers and advantages one vs the others

Items	Q Cell / Hanwha Group High Quality Panel	Mission Solar / OCI Co. Ltd. Higher Quality Panel	Maxeon (formerly SunPower) Highest Quality Panel (of the 3)
Panel	Q.Peak Duo XL-G10.2, 495	MSExxxSX6W	X21-470-COM
Locations			
Engineering	Germany (Original Home of QCell)	All Operations in San Antonio TX	
Headquarters	South Korea (Hanwha Group)	Parent OCI in South Korea	Singapore
Manufactured in	South Korea, Malaysia, China, Dalton Georgia	San Antonio, TX	Malaysia, Mexico, France, Philippines
Power	495 Watts	425 Watts	470 Watts
Delivery Times	Varies	Varies	Varies
Efficiency	21.4%	19.3%	21.7%
Approximate Cost	\$.68/W	\$.75/W	\$.85/W
Size of Panel	87" x 41" x 1.4"	82" x 42" x 1.6"	81" x 41" x 1.8"
Frame Material	Anodized Aluminum	Anodized Aluminum	Anodized Aluminum
Weight of Panel	58 lbs.	52 lbs.	56 lbs.
Warranty	12 year on Product, 25 Year Linear Performance	25 Year Limited Warranty (Read the fine print)	25 Year Power and Product Warranty (See Limitations)

powered by

Q.ANTUM DUO Z

Q.PEAK DUO XL-G10.2

470-495

ENDURING HIGH
PERFORMANCE



BREAKING THE 21% EFFICIENCY BARRIER

Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 21.6%.



LOW ELECTRICITY GENERATION COSTS

Higher yield per surface area, lower BOS costs and up to 80 watts more module power than standard 144 half-cell modules.



ENDURING HIGH PERFORMANCE

Long-term yield security with Anti LID Technology, Anti PID Technology¹, Hot-Spot Protect and Traceable Quality Tra.Q™.



EXTREME WEATHER RATING

High-tech aluminum alloy frame, certified for high snow (5400 Pa) and wind loads (3000 Pa).



A RELIABLE INVESTMENT

Inclusive 12-year product warranty and 25-year linear performance warranty².



STATE OF THE ART MODULE TECHNOLOGY

Q.ANTUM DUO combines cutting edge cell separation and innovative 12-busbar design with Q.ANTUM Technology.



6 BUSBAR
CELL TECHNOLOGY



12 BUSBAR
CELL TECHNOLOGY

THE IDEAL SOLUTION FOR:



Ground-mounted
solar power plants

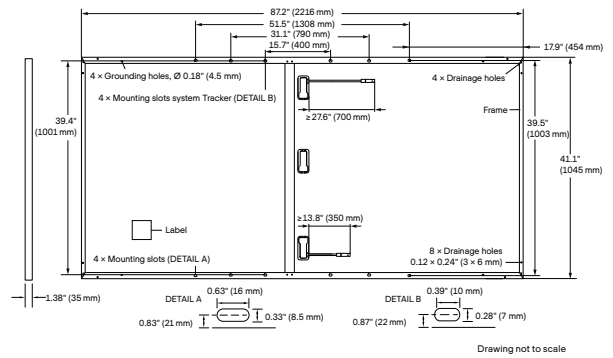
¹ APT test conditions according to IEC / TS 62804-1:2015, method A (-1500V, 96h)

² See data sheet on rear for further information.

MECHANICAL SPECIFICATION

Format	87.2 in × 41.1 in × 1.38 in (including frame) (2216 mm × 1045 mm × 35 mm)
Weight	58.4 lbs (26.5 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Anodized aluminum
Cell	6 × 26 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm ² Solar cable; (+) ≥27.6 in (700 mm), (-) ≥13.8 in (350 mm)*
Connector	Stäubli MC4, Stäubli MC4-Evo2, Hanwha Q CELLS HQC4; IP68

*Long cables (+) ≥57.1 in (1450 mm), (-) ≥57.1 in (1450 mm) for landscape installation are available upon request.

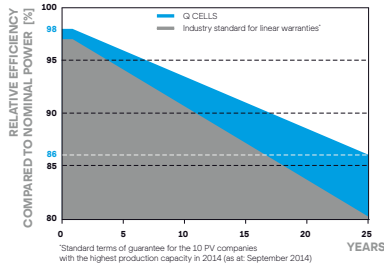


ELECTRICAL CHARACTERISTICS

POWER CLASS			470	475	480	485	490	495	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC ¹ (POWER TOLERANCE +5W / -0W)									
Minimum	Power at MPP ¹	P _{MPP}	[W]	470	475	480	485	490	495
	Short Circuit Current ¹	I _{SC}	[A]	11.21	11.24	11.26	11.29	11.31	11.34
	Open Circuit Voltage ¹	V _{OC}	[V]	53.54	53.58	53.61	53.64	53.68	53.71
	Current at MPP	I _{MPP}	[A]	10.62	10.66	10.71	10.76	10.81	10.86
	Voltage at MPP	V _{MPP}	[V]	44.27	44.54	44.81	45.07	45.33	45.59
	Efficiency ¹	η	[%]	≥20.3	≥20.5	≥20.7	≥20.9	≥21.2	≥21.4
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT ²									
Minimum	Power at MPP	P _{MPP}	[W]	352.6	356.4	360.1	363.9	367.6	371.4
	Short Circuit Current	I _{SC}	[A]	9.03	9.05	9.07	9.09	9.12	9.14
	Open Circuit Voltage	V _{OC}	[V]	50.49	50.53	50.56	50.59	50.62	50.65
	Current at MPP	I _{MPP}	[A]	8.34	8.39	8.43	8.47	8.52	8.56
	Voltage at MPP	V _{MPP}	[V]	42.26	42.49	42.72	42.94	43.17	43.39

¹Measurement tolerances P_{MPP} ±3%; I_{SC}, V_{OC} ±5% at STC: 1000 W/m², 25 ± 2 °C, AM 1.5 according to IEC 60904-3 • ²800 W/m², NMOT, spectrum AM 1.5

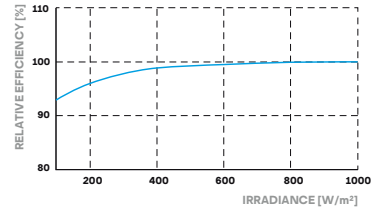
Q CELLS PERFORMANCE WARRANTY



At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²)

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I _{SC}	α [%/K]	+0.04	Temperature Coefficient of V _{OC}	β [%/K]	-0.27
Temperature Coefficient of P _{MPP}	γ [%/K]	-0.34	Nominal Module Operating Temperature	NMOT [°F]	109 ± 5.4 (43 ± 3 °C)

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V _{sys}	[V]	1500 (IEC)/1500 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 1
Max. Design Load, Push / Pull ³	[lbs/ft ²]	75 (3600 Pa) / 42 (2000 Pa)	Permitted Module Temperature on Continuous Duty	-40 °F up to +185 °F (-40 °C up to +85 °C)
Max. Test Load, Push / Pull ³	[lbs/ft ²]	113 (5400 Pa) / 63 (3000 Pa)		

³ See Installation Manual

QUALIFICATIONS AND CERTIFICATES

UL 61730, CE-compliant,
IEC 61215:2016,
IEC 61730:2016,
U.S. Patent No. 9,893,215
(solar cells);



PACKAGING INFORMATION

Horizontal packaging	89.4 in 2270 mm	43.3 in 1100 mm	47.6 in 1210 mm	1809 lbs 821 kg	22 pallets	20 pallets	29 modules

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.

400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | **TEL** +1 949 748 59 96 | **EMAIL** inquiry@us.q-cells.com | **WEB** www.q-cells.us

MSE PERC 72

MISSION SOLAR
ENERGY

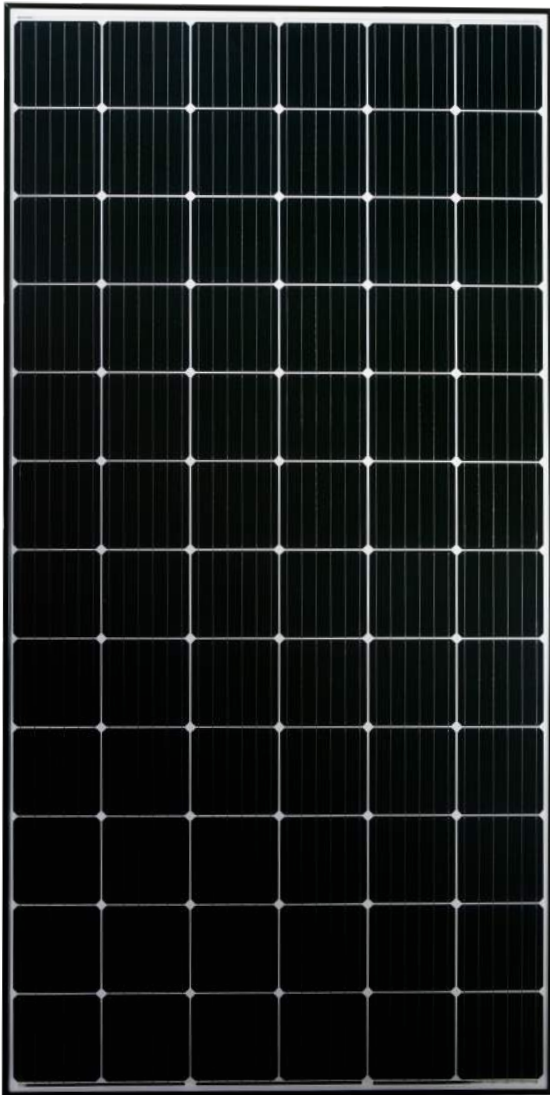


420W

Class leading power output

Positive
Power
Tolerance

-0 to +3%



True American Quality True American Brand

Mission Solar Energy is headquartered in San Antonio, Texas where we manufacture our modules. We produce American, high-quality solar modules ensuring the highest-in-class power output and best-in-class reliability. Our product line is tailored for residential, commercial and utility applications. Every Mission Solar Energy solar module is certified and surpasses industry standard regulations, proving excellent performance over the long term.

Demand the best. Demand Mission Solar Energy.



Certified Reliability

- Tested to UL 61730 & IEC Standards
- PID resistant
- Resistance to salt mist corrosion



Advanced Technology

- 6 Busbar
- Passivated Emitter Rear Contact
- Ideal for all applications



Extreme Weather Resilience

- Up to 5,400 Pa front load & 3,600 Pa back load
- Tested load to UL 61730
- 40 mm frame



BAA Compliant for Government Projects

- Buy American Act
- American Recovery & Reinvestment Act

FRAME-TO-FRAME WARRANTY

Degradation guaranteed not to exceed 2% in year one and 0.58% annually from years two to 30 with 84.08% capacity guaranteed in year 25.

For more information, visit www.missionsolar.com/warranty

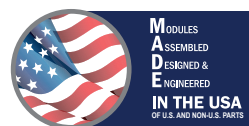
CERTIFICATIONS

CEC



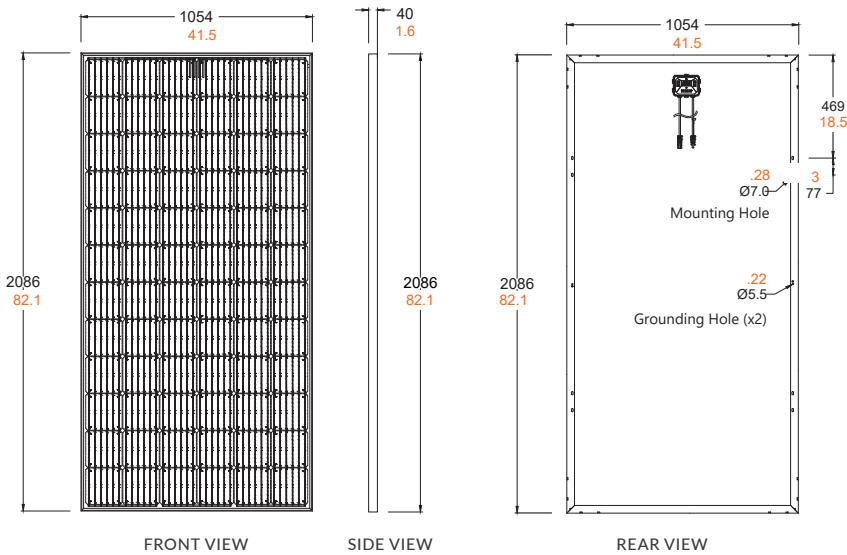
UL 61730 / IEC 61215 / IEC 61730 / IEC 61701

If you have questions or concerns about certification of our products in your area, please contact Mission Solar Energy.



BASIC DIMENSIONS

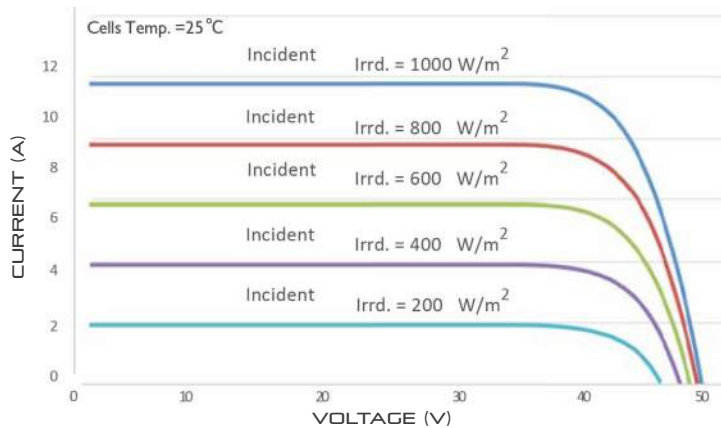
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CURRENT-VOLTAGE CURVE

MSE415SX6W: 415WP, 72 CELL SOLAR MODULE

Current-voltage characteristics with dependence on irradiance and module temperature



CERTIFICATIONS AND TESTS

IEC	61215, 61730, 61701
UL	61730



CEC



Mission Solar Energy

8303 S. New Braunfels Ave., San Antonio, Texas 78235

www.missionsolar.com | info@missionsolar.com

ELECTRICAL SPECIFICATION

PRODUCT TYPE	MSExxxSX6W (xxx = P _{max})				
Power Output	P _{max}	W _p	415	420	425
Module Efficiency		%	18.9	19.1	19.3
Tolerance		%	0/+3	0/+3	0/+3
Short Circuit Current	I _{sc}	A	10.99	11.05	11.09
Open Circuit Voltage	V _{oc}	V	48.92	49.14	49.28
Rated Current	I _{mp}	A	10.39	10.46	10.55
Rated Voltage	V _{mp}	V	39.93	40.14	40.27
Fuse Rating		A	20	20	20
System Voltage		V	1,500	1,500	1,500

TEMPERATURE COEFFICIENTS

Normal Operating Cell Temperature (NOCT)	44.69°C (±3.7%)
Temperature Coefficient of P _{max}	-0.359%/°C
Temperature Coefficient of V _{oc}	-0.261%/°C
Temperature Coefficient of I _{sc}	0.044%/°C

OPERATING CONDITIONS

Maximum System Voltage	1,500Vdc
Operating Temperature Range	-40°C (-40°F) to +85°C (185°F)
Maximum Series Fuse Rating	20A
Fire Safety Classification	Type 1*
Front & Back Load (UL Standard)	Up to 5400 Pa front and 3600 Pa back load, Tested to UL 61730
Hail Safety Impact Velocity	25mm at 23 m/s

*Mission Solar Energy uses quality sourced materials that result in a Type 1 fire rating. Please note, the 'Fire Class' Rating is designated for the fully-installed PV system, which includes, but is not limited to, the module, the type of mounting used, pitch and roof composition.

MECHANICAL DATA

Solar Cells	P-type mono-crystalline silicon
Cell Orientation	72 cells (6x12)
Module Dimension	2,086mm x 1,054mm x 40mm
Weight	23.4 kg (51.6 lbs.)
Front Glass	3.2mm, tempered, low-iron, anti-reflective
Frame	Anodized
Encapsulant	Ethylene vinyl acetate (EVA)
Junction Box	Protection class IP67 with 3 bypass-diodes
Cable	1.2m, Wire 4mm ² (12AWG)
Connector	Staubli PV-KBT4/6II-UR and PV-KST4/6II-UR, MC4, Renhe 05-8

SHIPPING INFORMATION

Container Feet	Ship To	Pallet	Panels	415 W Bin
53'	Most States	28	728	305.76 kW
Double Stack	CA	25	650	273 kW

PALLET [26 PANELS]

Weight	Height	Width	Length
1,450 lbs. (657 kg)	47.5 in (120.65 cm)	46 in (116.84 cm)	83.75 in (212.72 cm)



maxeon



Maxeon X-Series: X21-470-COM

Maxeon Commercial DC Panel

Maxeon X-Series panels combine the top efficiency, durability and warranty available in the market today, resulting in more long-term energy and savings.^{1,2}



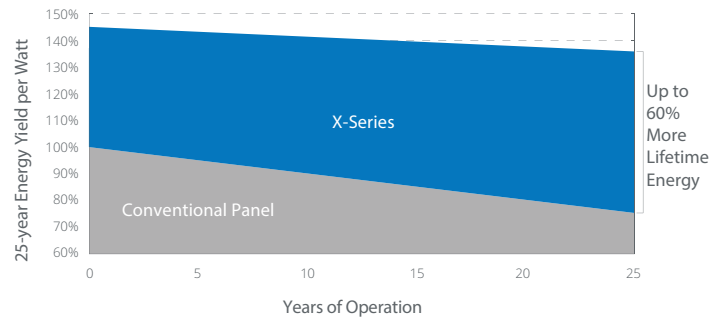
Maximum Power. Minimalist Design.

Generates more power and savings per available space, making it easier to meet your organization's goals.



Highest Lifetime Energy and Savings

Designed to deliver 60% more energy in the same space over 25 years in real-world conditions like partial shade and high temperatures.¹

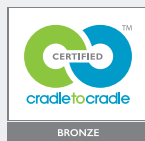


Fundamentally Different. And Better.



The Maxeon Solar Cell

- Enables highest efficiency panels available²
- Delivers leading reliability³
- Patented solid metal foundation prevents breakage and corrosion



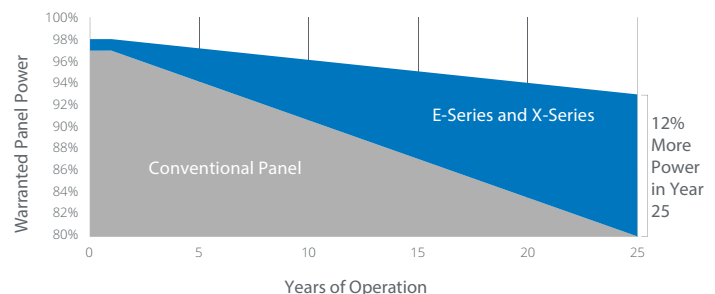
As Sustainable As Its Energy

- First solar panels to achieve Cradle to Cradle Certified™ Bronze recognition⁴
- Contributes to more LEED categories than conventional panels⁵



Best Reliability, Best Warranty

With more than 35 million panels deployed around the world, Maxeon technology is proven to last. That's why we stand behind our panel with an industry-leading 25-year Combined Power and Product Warranty.

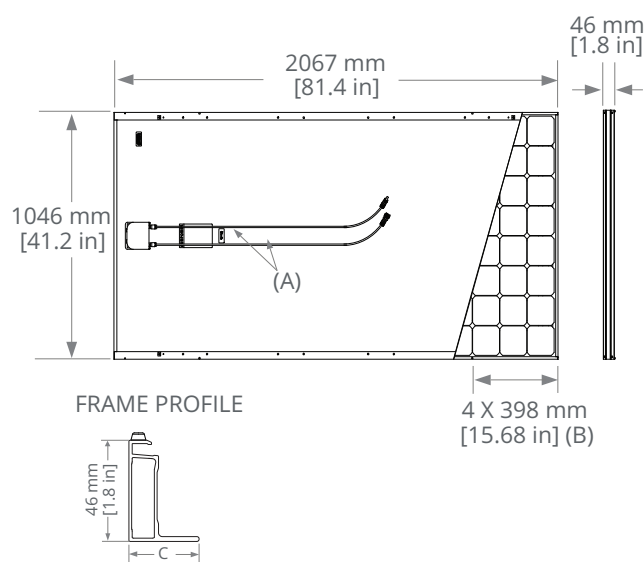


Maxeon X-Series: X21-470-COM Commercial DC Panel

Electrical Data		
	SPR-X21-470-COM	SPR-X21-460-COM
Nominal Power (P _{nom}) ⁶	470 W	460 W
Power Tolerance	+5/0%	+5/0%
Panel Efficiency	21.7%	21.3%
Rated Voltage (V _{mpp})	77.6 V	77.3 V
Rated Current (I _{mpp})	6.06 A	5.95 A
Open-Circuit Voltage (V _{oc})	91.5 V	90.5 V
Short-Circuit Current (I _{sc})	6.45 A	6.39 A
Max. System Voltage	1500 V UL & 1500 V IEC	
Maximum Series Fuse	15 A	
Power Temp Coef.	-0.29% / °C	
Voltage Temp Coef.	-223.2 mV / °C	
Current Temp Coef.	2.9 mA / °C	

Tests And Certifications	
Standard Tests ⁷	UL1703 (Type 2 Fire Rating), IEC 61215, IEC 61730
Quality Management Certs	ISO 9001:2015, ISO 14001:2015
EHS Compliance	RoHS, OHSAS 18001:2007, lead free, Recycle Scheme, REACH SVHC-163
Sustainability	Cradle to Cradle Certified™ Bronze. "Declare." listed.
Ammonia Test	IEC 62716
Desert Test	MIL-STD-810G
Salt Spray Test	IEC 61701 (maximum severity)
PID Test	1500 V: IEC 62804, PVEL 600 hr duration
Available Listings	UL, TUV, MCS, CEC

Operating Condition And Mechanical Data	
Temperature	-40° F to +185° F (-40° C to +85° C)
Impact Resistance	1 inch (25 mm) diameter hail at 52 mph (23 m/s)
Appearance	Class A
Solar Cells	128 Monocrystalline Maxeon Gen III
Tempered Glass	High-transmission tempered anti-reflective
Junction Box	IP-65, 1230 mm cables / PV4S
Weight	56 lbs (25.4 kg)
Max. Test Load ⁸	Wind: 50 psf, 2400 Pa, 244 kg/m² back Snow: 112 psf, 5400 Pa, 550 kg/m² front
Design Load	Wind: 50 psf, 2400 Pa, 244 kg/m² back Snow: 112 psf, 5400 Pa, 550 kg/m² front
Frame	Class 2 silver anodized; stacking pins



(A) Cable Length: 1230 mm +/- 10 mm

(B) Stacking Pins

(C) Long Side: 32 mm [1.3 in]

Short Side: 22 mm [0.9 in]

1 Maxeon 360 W compared to a Conventional Panel on same-sized arrays (260 W, 16% efficient, approx. 1.6 m²), 4% more energy per watt (based on PVsyst pan files), 0.75%/yr slower degradation (Campeau, Z. et al. Module Degradation Rate white paper, 2013).

2 Based on search of datasheet values from websites of top 10 manufacturers per IHS, as of May 2019.

3 Jordan, et. al. Robust PV Degradation Methodology and Application. PVSC 2018.

4 Cradle to Cradle Certified is a multi-attribute certification program that assesses products and materials for safety to human and environmental health, design for future use cycles, and sustainable manufacturing.

5 X-Series panels additionally contribute to LEED Materials and Resources credit categories.

6 Standard Test Conditions (1000 W/m² irradiance, AM 1.5, 25° C). NREL calibration Standard: SOMS current, LACCS FF and Voltage.

7 Type 2 fire rating per UL1703:2013, Class C fire rating per UL1703:2002.

8 Please read the safety and installation guide for more information regarding load ratings and mounting configurations.

Specifications included in this datasheet are subject to change without notice.

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