

# Vertex S<sup>+</sup>

**N-type i-TOPCon DUAL GLASS**  
Monocrystalline module

PRODUCT: TSM-NEG9R.28

PRODUCT RANGE: 430-455W

**445W**

MAXIMUM POWER OUTPUT

**0~+5W**

POSITIVE POWER TOLERANCE

**22.3 %**

MAXIMUM EFFICIENCY



### Small in size, bigger on power

- Up to 455W, 22.8% module efficiency with high density interconnect technology
- Multi-busbar technology for better light trapping, lower series resistance, improved current collection and enhanced reliability
- Reduce installation cost with higher power bin and efficiency
- Boost performance in warm weather with low temperature coefficient and operating temperature



### Dual-glass Design, more secure and sustainable

- Upgraded dual glass of Vertex S, less prone to micro-cracks and scratches on the back during installation
- Excellent fire rating, weather resistance, salt spray, sand dust, ammonia performance which is fully applicable in coastal, high temperature, humidity area and harsh environment



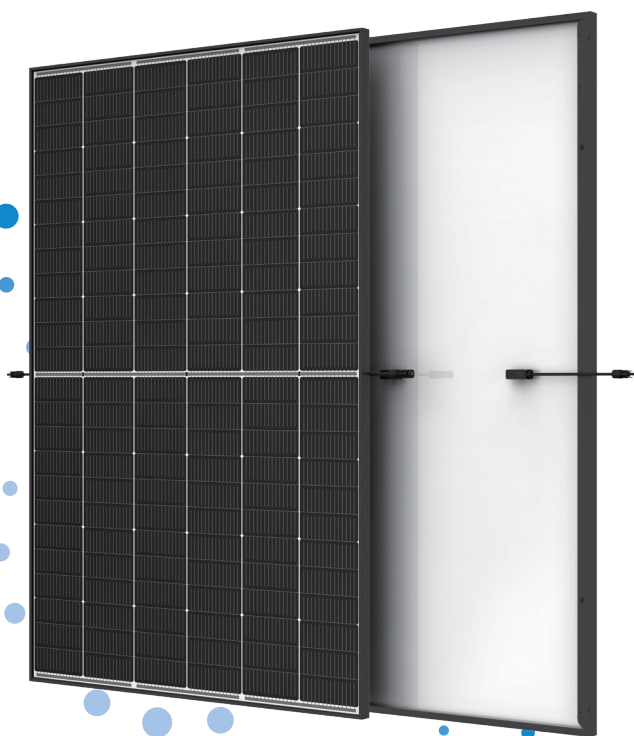
### Ultra-low Degradation, longer warranty, higher output

- First-year degradation 1% and annual degradation at 0.4%
- Up to 15 years product warranty and 30 years power warranty

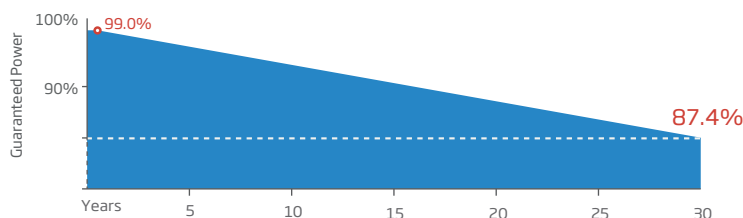


### Universal solution for residential and C&I rooftops

- Easy for integration, designed for compatibility with existing mainstream inverters and diverse mounting systems
- Perfect size and low weight for handling and installation
- Most valuable solution on low load capacity rooftops (weight similar to backsheet version)
- Mechanical performance up to 5400 Pa positive load and 4000 Pa negative load



### Trina Solar's Dual Glass Performance Warranty



### Comprehensive Products and System Certificates



IEC61215/IEC61730/IEC61701/IEC62716

ISO 9001: Quality Management System

ISO 14001: Environmental Management System

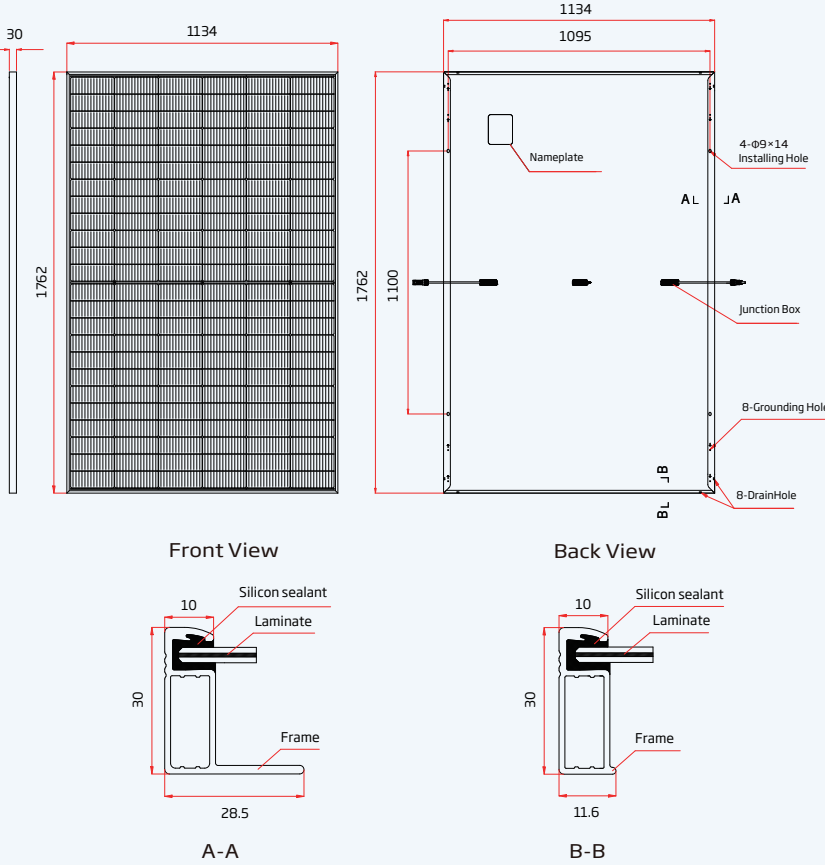


ISO14064: Greenhouse Gases Emissions Verification

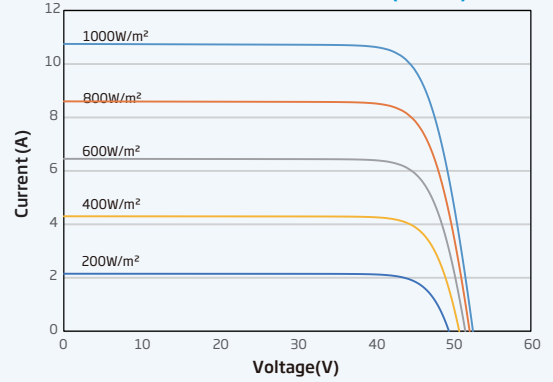
ISO45001: Occupational Health and Safety Management System



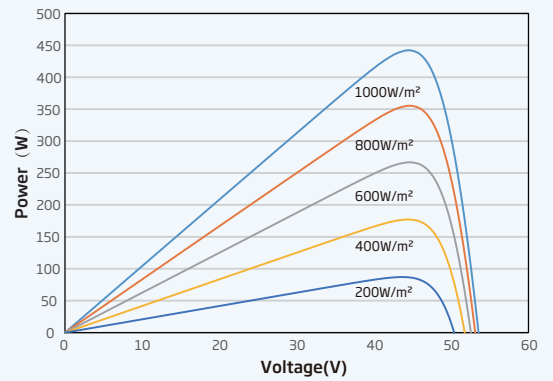
**DIMENSIONS OF PV MODULE(mm)**



**I-V CURVES OF PV MODULE(445W)**



**P-V CURVES OF PV MODULE(445W)**



**ELECTRICAL DATA (STC)**

Peak Power Watts-P <sub>MAX</sub> (Wp)*	430	435	440	445	450	455
Power Tolerance-P <sub>MAX</sub> (W)	0 ~ +5					
Maximum Power Voltage-V <sub>MPP</sub> (V)	43.2	43.6	44.0	44.3	44.6	45.0
Maximum Power Current-I <sub>MPP</sub> (A)	9.96	9.99	10.01	10.05	10.09	10.11
Open Circuit Voltage-V <sub>OC</sub> (V)	51.4	51.8	52.2	52.6	52.9	53.4
Short Circuit Current-I <sub>SC</sub> (A)	10.59	10.64	10.67	10.71	10.74	10.77
Module Efficiency η <sub>m</sub> (%)	21.5	21.8	22.0	22.3	22.5	22.8

STC: Irradiance 1000W/m<sup>2</sup>, Cell Temperature 25°C, Air Mass AM1.5. \*Measuring tolerance: ±3%.

**ELECTRICAL DATA (NOCT)**

Maximum Power-P <sub>MAX</sub> (Wp)	329	333	337	341	344	348
Maximum Power Voltage-V <sub>MPP</sub> (V)	40.7	41.0	41.4	41.7	42.0	42.3
Maximum Power Current-I <sub>MPP</sub> (A)	8.08	8.12	8.14	8.17	8.19	8.22
Open Circuit Voltage-V <sub>OC</sub> (V)	48.7	49.1	49.5	49.9	50.2	50.6
Short Circuit Current-I <sub>SC</sub> (A)	8.54	8.58	8.60	8.63	8.66	8.68

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

**MECHANICAL DATA**

Solar Cells	N-type i-TOPCon Monocrystalline
No. of cells	144 cells
Module Dimensions	1762×1134×30 mm (69.37×44.65×1.18 inches)
Weight	21.8kg (48.06 lb)
Front Glass	1.6 mm (0.06 inches), High Transmission, AR Coated Heat Strengthened Glass
Encapsulant material	POE/EVA
Back Glass	1.6mm(0.06 inches), Heat Strengthened Glass
Frame	30mm (1.18 inches) Anodized Aluminium Alloy, Black
J-Box	IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm <sup>2</sup> (0.006 inches <sup>2</sup> ), Portrait: 350/280 mm(13.78/11.02 inches) Length can be customized
Connector	MC4 EV02 / EVO2A / TS4 Plus / TS4*

\*Please refer to regional datasheet for specified connector.

**TEMPERATURE RATINGS**

NOCT (Nominal Operating Cell Temperature)	43°C (±2°C)
Temperature Coefficient of P <sub>MAX</sub>	-0.29%/°C
Temperature Coefficient of Voc	-0.24%/°C
Temperature Coefficient of Isc	0.04%/°C

**MAXIMUM RATINGS**

Operational Temperature	-40~+85°C
Maximum System Voltage	1500V DC (IEC)
Max Series Fuse Rating	25A

**WARRANTY**

15 year Product Workmanship Warranty  
30 year Power Warranty  
1% first year degradation  
0.4% Annual Power Attenuation

(Please refer to product warranty for details)

**PACKAGING CONFIGURATION**

Modules per box: 36 pieces  
Modules per 40' container: 936 pieces