

Vertex S⁺ Shield

DUAL GLASS N type i-TOPCon Ultra MODULE

PRODUCT: TSM-NED9R.28

POWER RANGE: 445-470 W

470 W

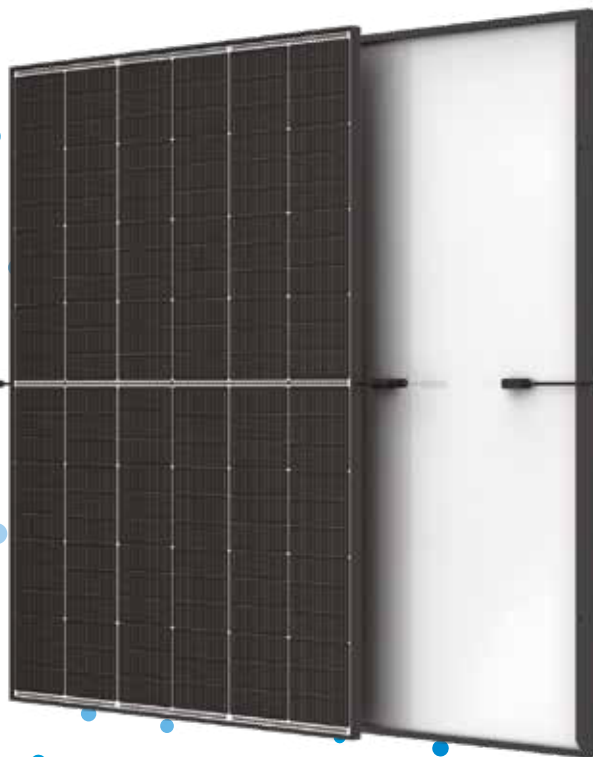
MAXIMUM POWER OUTPUT

0/+5 W

POSITIVE POWER TOLERANCE

23.5 %

MAXIMUM EFFICIENCY



Small in size, bigger on power

- High module power: Up to 470 W, 23.5 % module efficiency with n type i-TOPCon technology
- Reduces installation cost with higher power bin and efficiency



Dual-glass Design, High Reliability

- Excellent fire rating and resistance to harsh environmental conditions



Key Features

- VKF HW4 Hail Test
- Standard load capacity: +7000/-5000 Pa,
- Fire rating (IEC 61730-2): Class A+A



Maximize Energy Harvest

- Up to 25 years product warranty and 30 years power warranty
- 1 % first-year degradation and 0.4 % annual degradation enabled by N-type technology



Universal solution for residential and C&I rooftops

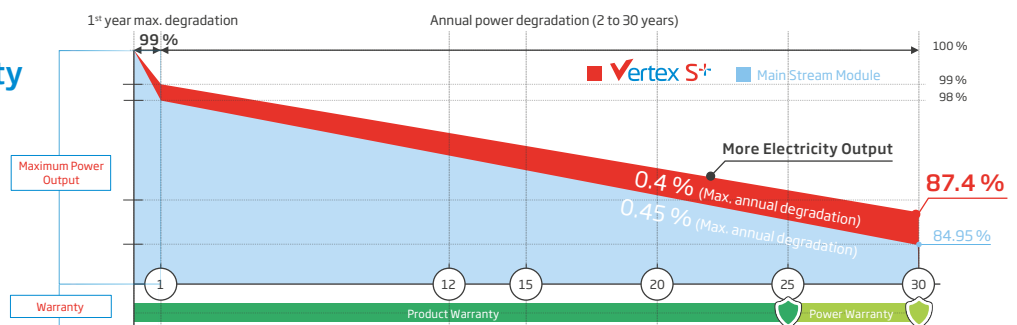
- Designed for compatibility with existing mainstream inverters, optimizers and mounting systems
- Flexible installation solutions for system deployment

Extended Vertex S⁺ Warranty

1 %
1st year max. degradation

0.4 %
Max. annual degradation from year 2 to 30

25 Years
Product Workmanship Warranty



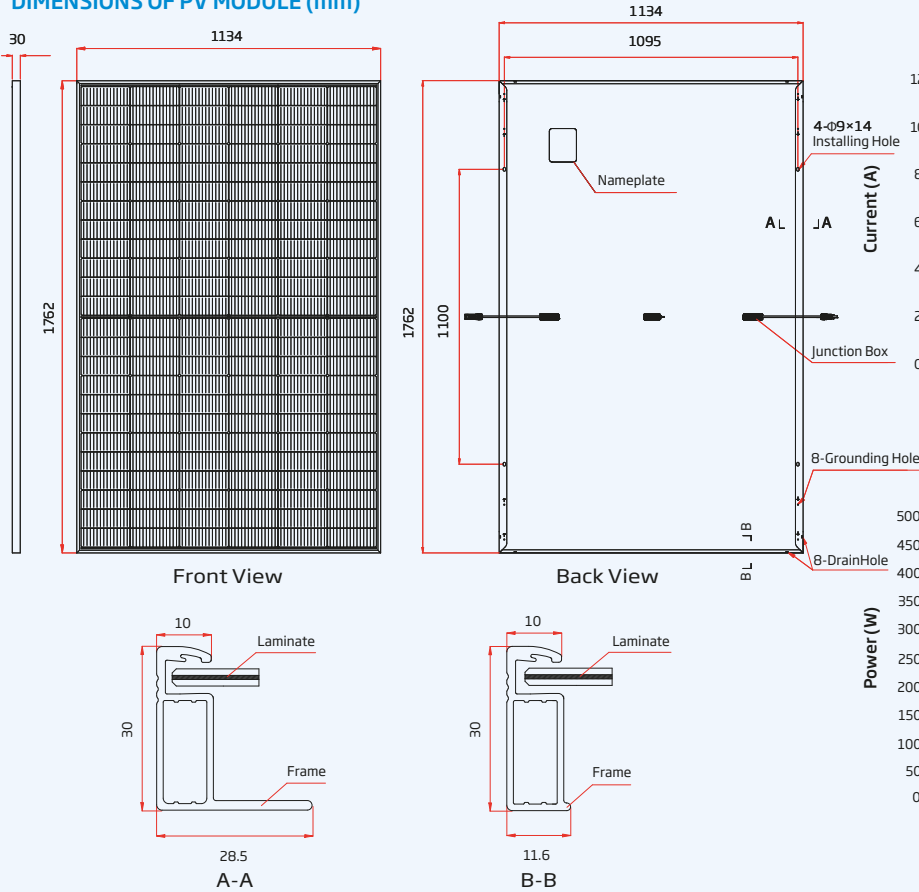
Comprehensive Products and System Certificates



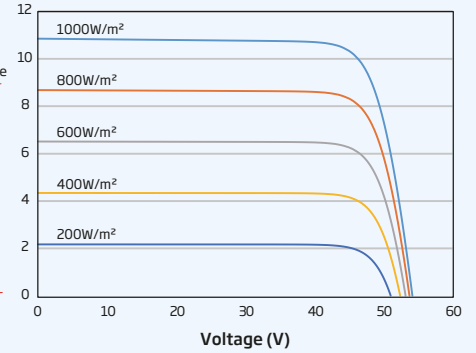
IEC61215/IEC61730/IEC61701/IEC62716
 ISO 9001: Quality Management System
 ISO 14001: Environmental Management System
 ISO14064: Greenhouse Gases Emissions Verification
 ISO45001: Occupational Health and Safety Management System



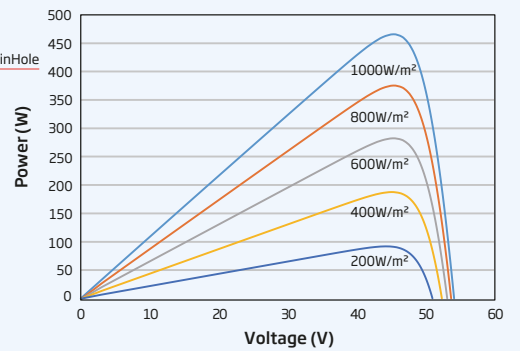
DIMENSIONS OF PV MODULE (mm)



I-V CURVES OF PV MODULE (465 W)



P-V CURVES OF PV MODULE (465 W)



ELECTRICAL DATA (STC)

	TSM-445 NED9R.28	TSM-450 NED9R.28	TSM-455 NED9R.28	TSM-460 NED9R.28	TSM-465 NED9R.28	TSM-470 NED9R.28
Peak Power Watts- P_{MAX} (Wp)*	445	450	455	460	465	470
Power Selection (W)**			0/+5			
Maximum Power Voltage- V_{MPP} (V)	44.3	44.6	45.0	45.4	45.7	46.1
Maximum Power Current- I_{MPP} (A)	10.05	10.09	10.11	10.14	10.16	10.19
Open Circuit Voltage- V_{OC} (V)	52.6	52.9	53.4	53.8	54.2	54.6
Short Circuit Current- I_{SC} (A)	10.71	10.74	10.77	10.81	10.85	10.89
Module Efficiency η_m (%)	22.3	22.5	22.8	23.0	23.3	23.5

STC: Irradiance 1000 W/m², Cell Temperature 25 °C, Air Mass AM 1.5. *Measuring tolerance: $\pm 3\%$. **Power Selection up to: +3%

ELECTRICAL DATA (NOCT)

	TSM-445 NED9R.28	TSM-450 NED9R.28	TSM-455 NED9R.28	TSM-460 NED9R.28	TSM-465 NED9R.28	TSM-460 NED9R.28
Maximum Power- P_{MAX} (Wp)	341	344	348	352	355	359
Maximum Power Voltage- V_{MPP} (V)	41.7	42.0	42.3	42.7	42.8	43.2
Maximum Power Current- I_{MPP} (A)	8.17	8.19	8.22	8.25	8.28	8.31
Open Circuit Voltage- V_{OC} (V)	49.9	50.2	50.6	51.0	51.4	51.7
Short Circuit Current- I_{SC} (A)	8.63	8.66	8.68	8.71	8.74	8.78

NOCT: Irradiance at 800 W/m², Ambient Temperature 20 °C, Wind Speed 1 m/s.

MECHANICAL DATA

Solar Cells	N-type i-TOPCon Monocrystalline
No. of cells	144 cells
Module Dimensions	1762x1134x30 mm
Weight	27 kg
Front Glass	2.5 mm AR Coating Heat Strengthened Glass
Back Glass	2.0 mm Heat Strengthened Glass
Frame	30 mm Anodized Aluminium Alloy, Black
J-Box	IP 68 rated, 3 bypass diodes
Cables	Photovoltaic Technology Cable 4.0 mm ² Landscape: 1100/1100 mm Portrait: 200/320 mm*
Connector	TS4 Plus / TS4 / MC4 EVO2*

*Special order only

TEMPERATURE RATINGS

NOCT (Nominal Operating Cell Temperature)	43 °C (± 2 °C)
Temperature Coefficient of P_{MAX}	-0.29 %/°C
Temperature Coefficient of V_{OC}	-0.24 %/°C
Temperature Coefficient of I_{SC}	0.04 %/°C

MAXIMUM RATINGS

Operational Temperature	-40 to +70 °C
Maximum System Voltage	1500 V DC (IEC)
Max Series Fuse Rating	25 A

WARRANTY

25 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: 900 pieces

CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

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