

# 450 W

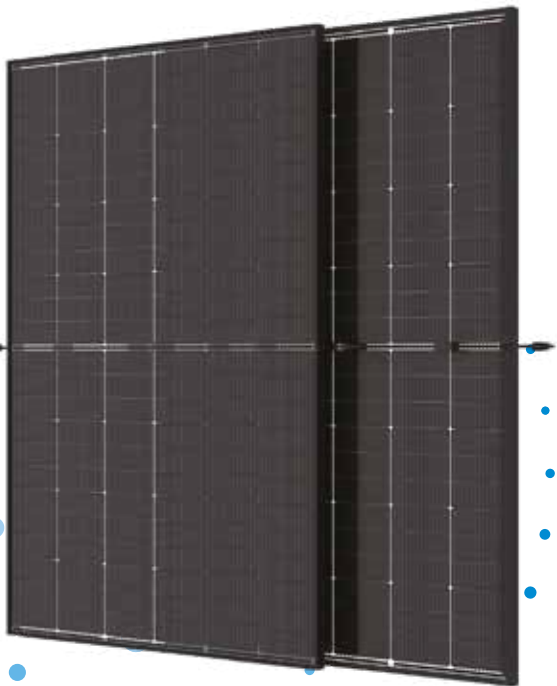
MAXIMUM POWER OUTPUT

# 0/+5 W

POSITIVE POWER TOLERANCE

# 22.5 %

MAXIMUM EFFICIENCY



### Small in size, bigger on power

- Generates up to 450 W, 22.5 % module efficiency with high density interconnect technology
- Boost performance at high temperature environments with better thermal behavior



### Transparent Dual-glass Design

- Designed with aesthetics in mind
- Excellent fire rating and resistance to harsh environmental conditions
- 5,400 Pa snow load and 4,000 Pa wind load (test loads)



### Maximize Energy Harvest

- Higher bifaciality up to 85 %
- 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

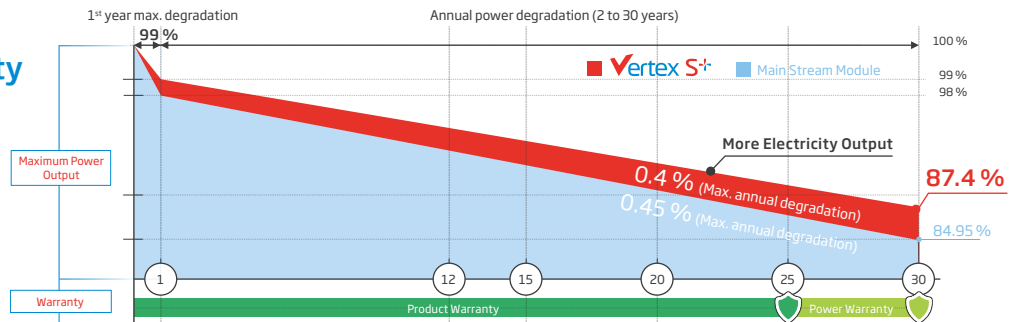
- Designed for compatibility with existing mainstream inverters, optimizers and mounting systems
- Perfect size and low weight for easy handling

## Extended Vertex S+ Warranty

**1 %**  
1<sup>st</sup> year max. degradation

**0.4 %**  
Max. annual degradation from year 2 to 30

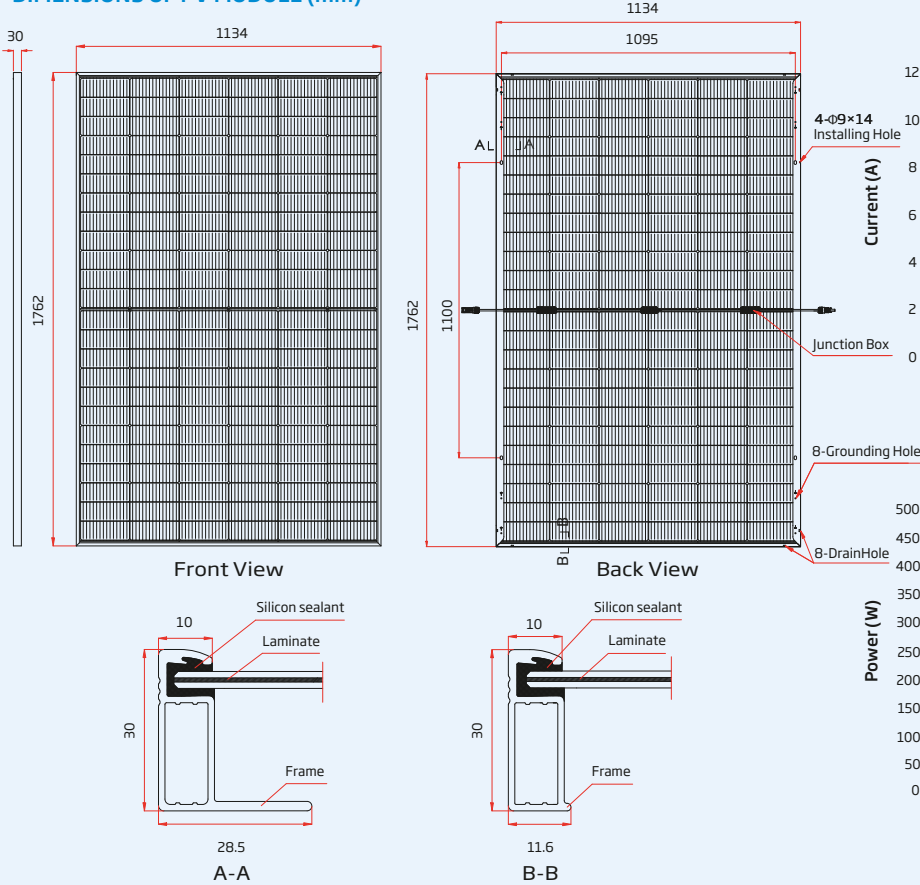
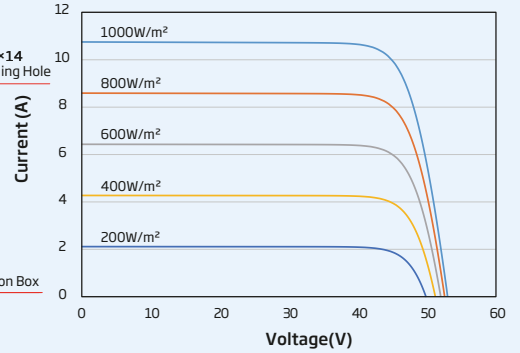
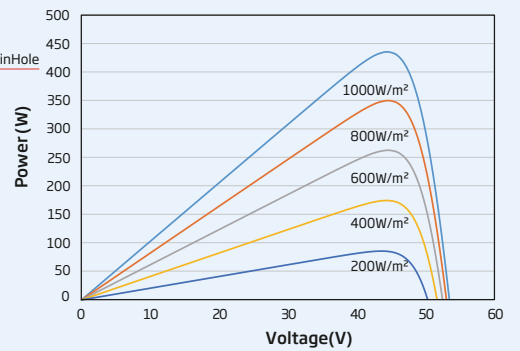
**25 Years**  
Product Workmanship Warranty



## Comprehensive Products and System Certificates



IEC61215/IEC61730/IEC61701/IEC62716/UL61730  
 ISO 9001: Quality Management System  
 ISO 14001: Environmental Management System  
 ISO14064: Greenhouse Gases Emissions Verification  
 ISO45001: Occupational Health and Safety Management System  
 ISO14067: Product Carbon Footprint Limited Assurance  
 ISO14025: Environmental Product Declaration

**DIMENSIONS OF PV MODULE (mm)**

**I-V CURVES OF PV MODULE (440 W)**

**P-V CURVES OF PV MODULE (440 W)**

**MECHANICAL DATA**

Solar Cells	N-type i-TOPCon Monocrystalline	Frame	30 mm Anodized Aluminium Alloy, Black
No. of cells	144 cells	J-Box	IP 68 rated
Module Dimensions	1762×1134×30 mm	Cables	Photovoltaic Technology Cable 4.0 mm <sup>2</sup> Landscape: 1100/1100 mm Portrait: 280/350 mm*
Weight	21.0 kg	Connector	TS4 Plus / TS4 / MC4 EVO2*
Front Glass	1.6 mm, AR Coated Heat Strengthened Glass		
Back Glass	1.6 mm, Heat Strengthened Glass		

\*Special order only

**ELECTRICAL DATA (STC & NOCT & BNPI)**

Testing Condition	TSM-425 NEG9RC.27			TSM-430 NEG9RC.27			TSM-435 NEG9RC.27			TSM-440 NEG9RC.27			TSM-445 NEG9RC.27			TSM-450 NEG9RC.27		
	STC	NOCT	BNPI	STC	NOCT	BNPI	STC	NOCT	BNPI	STC	NOCT	BNPI	STC	NOCT	BNPI	STC	NOCT	BNPI
Peak Power Watts-P <sub>MAX</sub> (Wp)*	425	325	471	430	329	476	435	333	482	440	337	488	445	341	493	450	344	499
Power Tolerance-P <sub>MAX</sub> (W)	0 ~ +5																	
Maximum Power Voltage-V <sub>MPP</sub> (V)	42.9	40.4	42.9	43.2	40.7	43.2	43.6	41.0	43.6	44.0	41.4	44.0	44.3	41.7	44.3	44.6	42.0	44.6
Maximum Power Current-I <sub>MPP</sub> (A)	9.92	8.06	10.98	9.96	8.08	11.03	9.99	8.12	11.05	10.01	8.14	11.08	10.05	8.17	11.13	10.09	8.19	11.18
Open Circuit Voltage-V <sub>OC</sub> (V)	50.9	48.3	50.9	51.4	48.7	51.4	51.8	49.1	51.8	52.2	49.5	52.2	52.6	49.9	52.6	52.9	50.2	52.9
Short Circuit Current-I <sub>SC</sub> (A)	10.56	8.51	11.70	10.59	8.54	11.73	10.64	8.58	11.79	10.67	8.60	11.82	10.71	8.63	11.87	10.74	8.66	11.90
Module Efficiency-η <sub>m</sub> (%)	21.3			21.5			21.8			22.0			22.3			22.5		

 STC: Irradiance 1000 W/m<sup>2</sup>, Cell Temperature 25 °C, Air Mass AM1.5. NOCT: Irradiance at 800 W/m<sup>2</sup>, Ambient Temperature 20 °C, Wind Speed 1 m/s. \*Measuring tolerance: ±3%.

**ELECTRICAL CHARACTERISTICS WITH DIFFERENT POWER BIN (reference to 5% & 10% backside power gain)**

Backside Power Gain	5%		10%		5%		10%		5%		10%		5%		10%		5%		10%	
	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%
Total Equivalent power -P <sub>MAX</sub> (Wp)	446	468	452	473	457	479	462	484	467	490	473	495								
Maximum Power Voltage-V <sub>MPP</sub> (V)	42.9	42.9	43.2	43.2	43.6	43.6	44.0	44.0	44.3	44.3	44.6	44.6								
Maximum Power Current-I <sub>MPP</sub> (A)	10.42	10.91	10.46	10.96	10.49	10.99	10.51	11.01	10.55	11.06	10.59	11.10								
Open Circuit Voltage-V <sub>OC</sub> (V)	50.9	50.9	51.4	51.4	51.8	51.8	52.2	52.2	52.6	52.6	52.9	52.9								
Short Circuit Current-I <sub>SC</sub> (A)	11.09	11.62	11.12	11.65	11.17	11.70	11.20	11.74	11.25	11.78	11.28	11.81								

Power Bifaciality: 80 ±5%.

**TEMPERATURE RATINGS**

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

**MAXIMUM RATINGS**

Operational Temperature	-40~+85 °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: 936 pieces