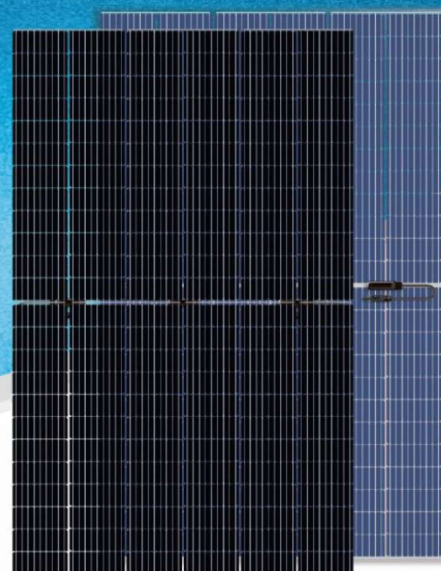


Spirit series

M10 (182mm)

445W/450W/455W/460W/465W/470W

120 CELLS MBB BIFACIAL MONO PV MODULE
BIFACIAL DOUBLE GLASS



445-470W

30 year warranty*

Tunghsu components with high efficiency and high reliability

- * Advanced production equipment, highly automated process control, world-class production technology
- * The company has a product research and development laboratory that meets the new ISO/IEC international standards
- * Excellent weak light performance, resistant to salt spray and ammonia corrosion.
- Passing the certification test of the PV standards.
- * Certified by international quality management and environmental management system
- * Application grade: A, Safe grade: II, Fireproofing grade: C

Comprehensive Products And System Certificates

IEC61215/IEC61730/UL1703/IEC61701/IEC62716

ISO 9001: Quality Management System

ISO 14001: Environmental Management System

ISO 45001: Occupation Health and Safety Management System

GB/T 23001-2017: Management system with Integration of Information Technology and Industrialization



High power output

Combined with MBB technology, Maximum power of 470w, efficiency 20.9%
Reduce BOS cost with higher power bin and 1500V system voltage



Higher power generation

Lower temperature coefficient (-0.35%) and lower working temperature bring more power generation
Half-cell technology brings stronger anti-shadow occlusion ability



High-efficiency PERC+ cell technology

Double-sided PERC cell, half-cut technology and transparent grid backsheet
Higher module power and efficiency, lower power attenuation



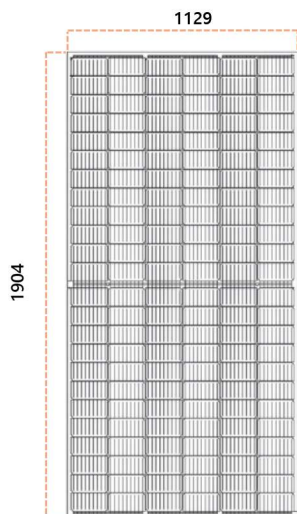
Certified to withstand the most challenging environmental conditions

2400 Pa wind load
5400 Pa snow load

Industry-leading linear warranty



DIMENSIONS OF PV MODULE (mm)



ELECTRICAL DATA (STC)

Peak Power Watts- P_{MAX} (Wp)	445	450	455	460	465	470
Power Output Tolerance- P_{MAX} (W)						
Maximum Power Voltage- V_{MPP} (V)	34.45	34.65	34.85	35.05	35.25	35.45
Maximum Power Current- I_{MPP} (A)	12.92	12.99	13.06	13.13	13.20	13.26
Open Circuit Voltage- V_{OC} (V)	41.40	41.60	41.80	42.00	42.20	42.40
Short Circuit Current- I_{SC} (A)	13.64	13.71	13.78	13.85	13.92	13.99
Module Efficiency η_m (%)	20.6	20.8	21.0	21.2	21.5	21.7

STC: Irradiance 1000W/m², Cell Temperature 25°C, Air Mass AM1.5.

ELECTRICAL PARAMETERS AND DIFFERENT POWER GAIN BACK (Take 10% irradiation ratio as an example)

Maximum Power- P_{MAX} (Wp)	476	481	486	491	496
Maximum Power Voltage- V_{MPP} (V)	34.77	35.02	35.27	35.51	35.77
Maximum Power Current- I_{MPP} (A)	13.69	13.74	13.78	13.83	13.87
Open Circuit Voltage- V_{OC} (V)	41.73	41.89	42.05	42.21	42.37
Short Circuit Current- I_{SC} (A)	14.33	14.38	14.43	14.48	14.53

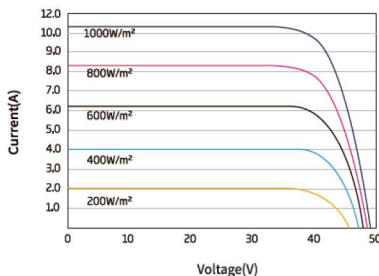
Back gain: Under standard test conditions, the additional gain from the back and the front power depends on the installation and ground albedo parameters.

ELECTRICAL DATA (NOCT)

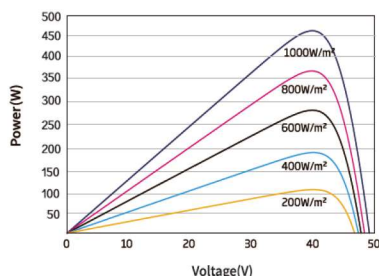
Maximum Power- P_{MAX} (Wp)	336	340	344	348	352
Maximum Power Voltage- V_{MPP} (V)	32.10	32.34	32.58	32.82	33.06
Maximum Power Current- I_{MPP} (A)	10.47	10.52	10.56	10.61	10.65
Open Circuit Voltage- V_{OC} (V)	38.79	38.96	39.13	39.30	39.47
Short Circuit Current- I_{SC} (A)	10.96	11.01	11.06	11.11	11.16

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

I-V CURVES OF PV MODULE (465W)



P-V CURVES OF PV MODULE (465W)



MECHANICAL DATA

Solar Cells	Monocrystalline
Cell Orientation	120 cell (6x20)
Module Dimensions	1904 x 1128 x 8 mm
Weight	37.0kg
Front Glass	3.2mm , High Transmission, Tempered Coated Glass
Encapsulant Material	POE
Rear glass	3.2mm semi-tempered glass
J-Box	IP 68 rated
Cables	4.0mm, 350mm photovoltaic special cable, or customized
Connector	MC4、QC4

TEMPERATURE RATING

NOCT (Nominal Operating Cell Temperature)	41°C (± 3°C)
Temperature Coefficient of P_{MAX}	- 0.35%/°C
Temperature Coefficient of V_{OC}	- 0.25%/°C
Temperature Coefficient of I_{SC}	0.04%/°C

LIMIT PARAMETERS

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

(DO NOT connect Fuse in Combiner Box with two or more strings in

WARRANTY

15 year Product Workmanship Warranty
30 year Linear Power Warranty

PACKAGING CONFIGURATION

Modules per box: 35 pieces
Modules per 40' container: 700 pieces