

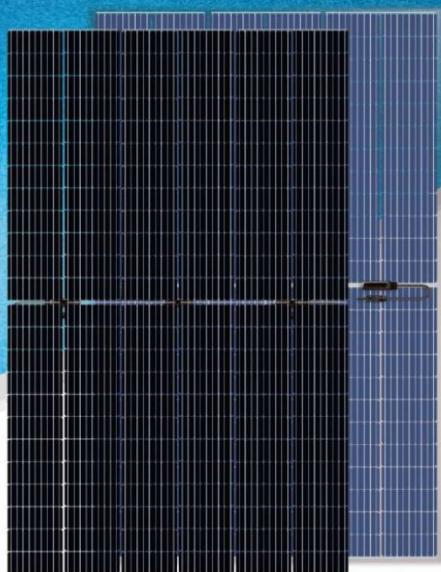


## Spirit series

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: Occupational 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

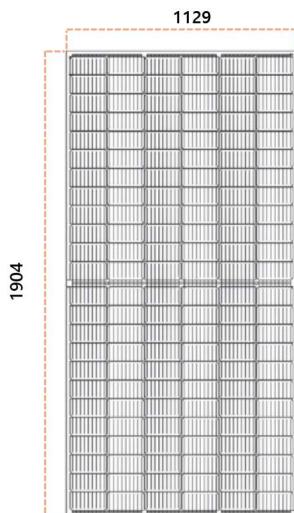


2400 Pa wind load  
5400 Pa snow load

### Industry-leading linear warranty

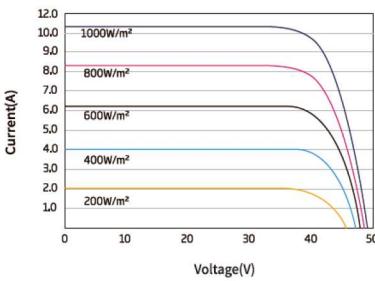


## DIMENSIONS OF PV MODULE (mm)

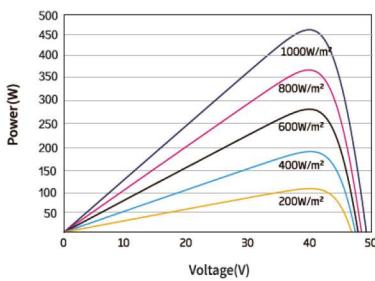


Front View

## I-V CURVES OF PV MODULE(465W)



## P-V CURVES OF PV MODULE(465W)



## ELECTRICAL DATA (STC)

Peak Power Watts-P <sub>MAX</sub> (W <sub>p</sub> )	445	450	455	460	465	470
Power Output Tolerance-P <sub>MAX</sub> (W)						
Maximum Power Voltage-V <sub>MPP</sub> (V)	34.45	34.65	34.85	35.05	35.25	35.45
Maximum Power Current-I <sub>MPP</sub> (A)	12.92	12.99	13.06	13.13	13.20	13.26
Open Circuit Voltage-V <sub>OC</sub> (V)	41.40	41.60	41.80	42.00	42.20	42.40
Short Circuit Current-I <sub>SC</sub> (A)	13.64	13.71	13.78	13.85	13.92	13.99
Module Efficiency η <sub>m</sub> (%)	20.6	20.8	21.0	21.2	21.5	21.7

STC: Irradiance 1000W/m<sup>2</sup>, 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 <sub>MAX</sub> (W <sub>p</sub> )	476	481	486	491	496
Maximum Power Voltage-V <sub>MPP</sub> (V)	34.77	35.02	35.27	35.51	35.77
Maximum Power Current-I <sub>MPP</sub> (A)	13.69	13.74	13.78	13.83	13.87
Open Circuit Voltage-V <sub>OC</sub> (V)	41.73	41.89	42.05	42.21	42.37
Short Circuit Current-I <sub>SC</sub> (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 aboco parameters.

## ELECTRICAL DATA (NOCT)

Maximum Power-P <sub>MAX</sub> (W <sub>p</sub> )	336	340	344	348	352
Maximum Power Voltage-V <sub>MPP</sub> (V)	32.10	32.34	32.58	32.82	33.06
Maximum Power Current-I <sub>MPP</sub> (A)	10.47	10.52	10.56	10.61	10.65
Open Circuit Voltage-V <sub>OC</sub> (V)	38.79	38.96	39.13	39.30	39.47
Short Circuit Current-I <sub>SC</sub> (A)	10.96	11.01	11.06	11.11	11.16

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

## 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 <sub>MAX</sub>	- 0.35%/°C
Temperature Coefficient of V <sub>OC</sub>	- 0.25%/°C
Temperature Coefficient of I <sub>SC</sub>	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