

CLEAN ENERGY



**Solar Panels**

450W Photovoltaic Solar Panel	<b>CE: 2-4</b>
550W Photovoltaic Solar Panel	<b>CE: 5-7</b>
600w Photovoltaic Solar Panel	<b>CE: 8-10</b>

**Power Inverters**

Off Grid Inverter	<b>CE: 11-12</b>
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**Energy Storage**

Solar Tubular Batteries	<b>CE: 13-15</b>
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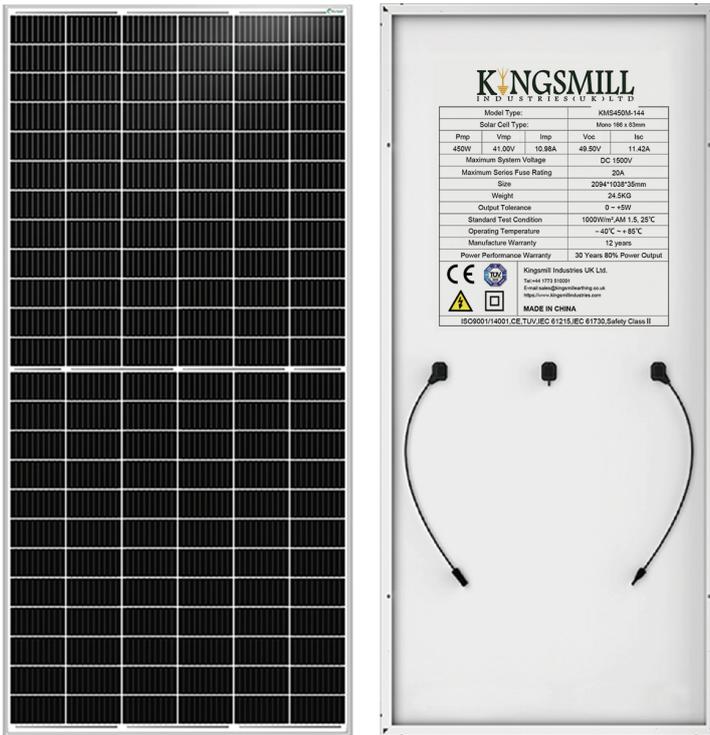
**Clean Energy Accessories**

MC4 Connector	<b>CE: 16</b>
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## Introduction

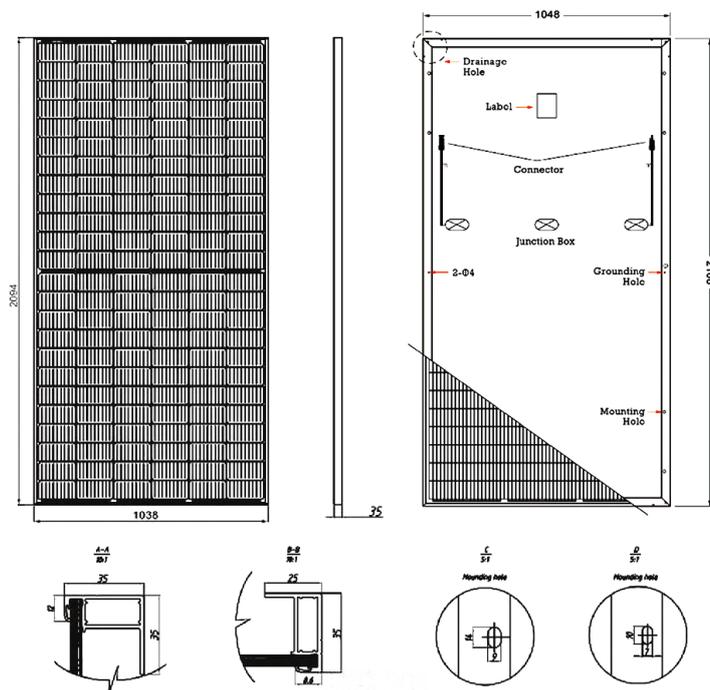
450W Photovoltaic Solar Panels are certified for the most challenging environmental conditions. This 450W Photovoltaic high-power monocrystalline solar panel operates at 20.7% efficiency to maximize the light absorption area.

## Product Options



### Mono Solar Panel Features

-  Widely using of the most popular and mature type of modules for solar system
-  High power output and highest conversion efficiency of 20.7%
-  Anti-reflective and anti-soiling surface reduces power loss from dirt and dust
-  Outstanding Performance in low-light irradiance environments
-  Excellent mechanical load resistance: Certified to withstand high wind loads (2400Pa) and Snow loads (5400Pa)
-  Positive power tolerance: 0~+5W

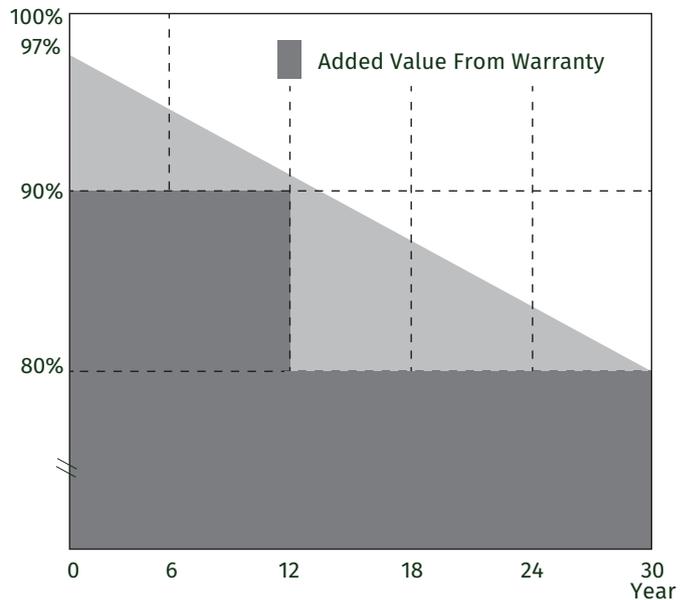


Electrical Characteristics(STC)	
Module Type	KMS450M-144
Maximum Power (Pmax)	450W
Maximum Power Voltage (Vmp)	41.00V
Maximum Power Current (Imp)	10.98A
Open-circuit Voltage (Voc)	49.50V
Short-circuit Current (Isc)	11.42A
Module Efficiency (%)	20.7%
Power Tolerance	0~+5W
Temperature Coefficient of Isc	+0.05%/°C
Temperature Coefficient of Voc	-0.29%/°C
Temperature Coefficient of Pmax	-0.37%/°C

Product Features

Warranty	
12 years for product defects in materials & workmanship	
12 years for 90% of warranted minimum power output	
30 years for 80% of warranted minimum power output	
30 years liner warranty	

Reliable Quality	
Positive power tolerance: 0~+5W	
100% EL Double-inspection ensures modules are defects free	
Modules Binned by Current to improve system performance	
Potential induced Degradation (PID) Resistant	

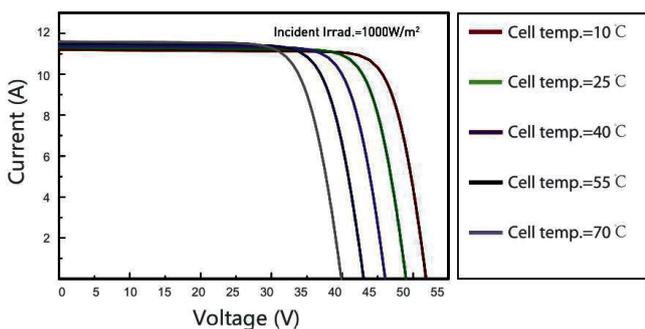


Mechanical Parameters	
Cell(mm)	9BB Mono 166*83
Weight(kg)	24.5kg
Glass Thickness	3.2mm,Low Iron Tempered Glass
Dimensions (L*W*H)(mm)	2094*1038*35mm
Cable Cross Section Size (mm <sup>2</sup> )	4
Cable Cross Section Length (mm)	300
No.of Cells and Connections	144(6*24)
Junction Box	IP67/68,3 Diodes
Connector	MC4 Compatiple

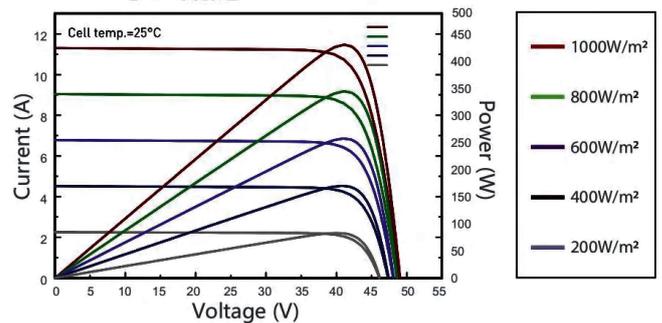
Working Conditions	
Maximum System Voltage	DC 1500V
Operating Temperature	-40°C~ +85°C
Maximum Series Fuse	20A
Maximum Static Load,Front (e.g.,snow and wind)	5400Pa (112 lb/ft <sup>2</sup> )
Maximum Static Load,Back (e.g.,wind)	2400Pa (50 lb/ft <sup>2</sup> )
NOCT	44±2°C
Positive power tolerance	0~ +5W
Application Class	Class A

I-V Curve

Current-Voltage curves



I-V CURVE



### Product Features

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#### GLASS

- Antireflective glass
- Translucency of normal luminance is increased by 2%
- Module efficiency is increased by 2%
- Self-cleaning option
- Service life as long as 25 years (30 years optional)



#### SOLAR CELL

- High efficiency PV cells
- Appearance consistency
- Color sorting ensure consistent appearance on each module
- Anti-PID



#### FRAME

- Conventional frame
- Boost bearing capability and prolong service life
- Serrated-clip design tensile strength
- Seal-lip design glue injection



#### JUNCTION BOX

- Conventional standalone edition and engineering custom edition
- Quality diode ensures module running safety
- IP67 protection level
- Heat dissipation
- Long service life



### More Information

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All with A Grade for on-grid & off-grid use for residential and public rooftop and ground mounting  
Solar panels are a clean source of energy that use the sun's rays to convert them into electricity or heat.

Our clean energy solutions provide electrical power as a way to decarbonize  
and transition to clean energy in our mission to combat climate change.

## Introduction

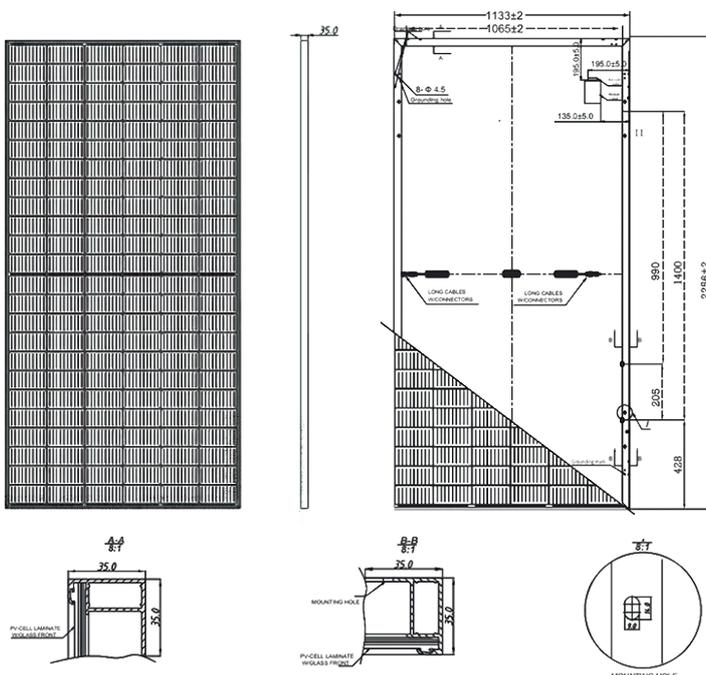
550W Photovoltaic Solar Panels are certified for the most challenging environmental conditions. This 550W Photovoltaic high-power monocrystalline solar panel operates at 21.30% efficiency to maximize the light absorption area.

## Product Options



### Mono Solar Panel Features

-  Widely using of the most popular and mature type of modules for solar system
-  High power output and highest conversion efficiency of 21.30%
-  Anti-reflective and anti-soiling surface reduces power loss from dirt and dust
-  Outstanding Performance in low-light irradiance environments
-  Excellent mechanical load resistance: Certified to withstand high wind loads (2400Pa) and Snow loads (5400Pa)
-  Positive power tolerance: 0~+5W



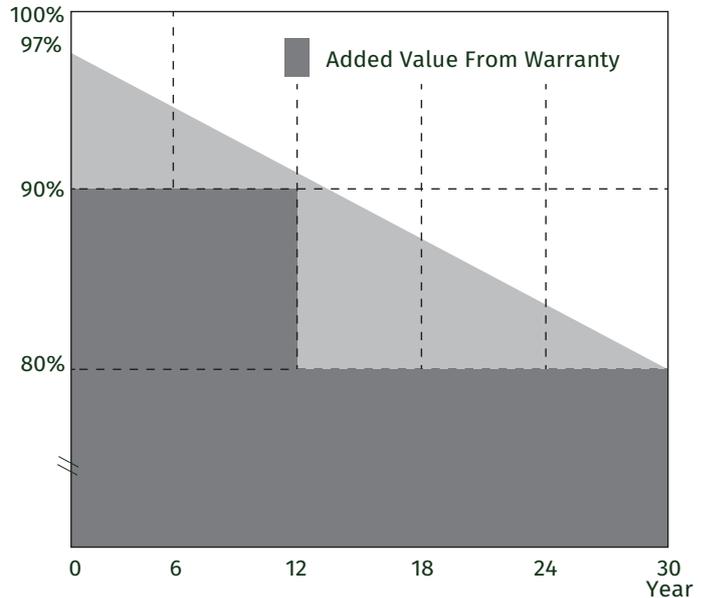
### Electrical Characteristics(STC)

Module Type	KMS550M-144
Maximum Power (Pmax)	550W
Maximum Power Voltage (Vmp)	42.10V
Maximum Power Current (Imp)	13.07A
Open-circuit Voltage (Voc)	49.90V
Short-circuit Current (Isc)	13.80A
Module Efficiency (%)	21.30%
Power Tolerance	0~+5W
Temperature Coefficient of Isc	+0.043%/°C
Temperature Coefficient of Voc	-0.26%/°C
Temperature Coefficient of Pmax	-0.36%/°C

Product Features

Warranty
12 years for product defects in materials & workmanship
12 years for 90% of warranted minimum power output
30 years for 80% of warranted minimum power output
30 years liner warranty

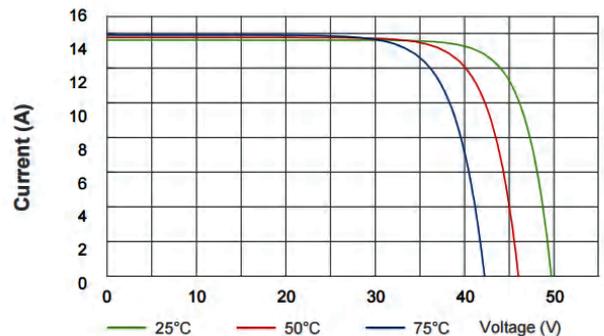
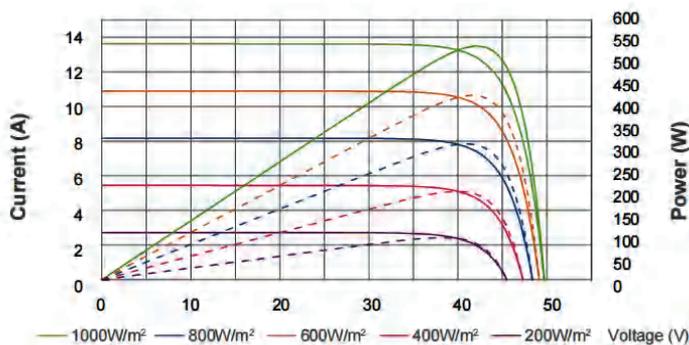
Reliable Quality
Positive power tolerance: 0~+5W
100% EL Double-inspection ensures modules are defects free
Modules Binned by Current to improve system performance
Potential induced Degradation (PID) Resistant



Mechanical Parameters	
Cell(mm)	Mono 182*182mm
Weight(kg)	29kg
Glass Thickness	3.2mm,AR Coating Tempered Glass
Dimensions (L*W*H)(mm)	2279*1134*35mm
Cable Cross Section Size (mm <sup>2</sup> )	4
Cable Cross Section Length (mm)	300
No.of Cells and Connections	144(6*24)
Junction Box	IP67
Connector	MC4 Compatiple

Working Conditions	
Maximum System Voltage	DC 1000V/1500V(IEC)
Operating Temperature	-40°C~ +85°C
Maximum Series Fuse	25A
Maximum Static Load,Front (e.g.,snow and wind)	5400Pa (112 lb/ft <sup>2</sup> )
Maximum Static Load,Back (e.g.,wind)	2400Pa (50 lb/ft <sup>2</sup> )
NOCT	45±2°C
Positive power tolerance	0~ +5W
Application Class	Class A

I-V Curve

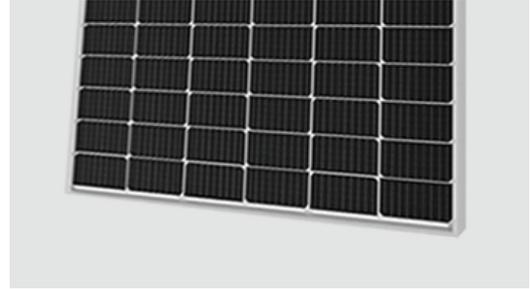


### Product Features

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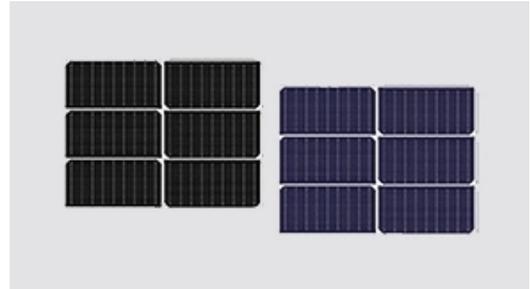
#### GLASS

- Antireflective glass
- Self-cleaning function
- Module efficiency is increased by 2%
- Service life as long as 25 years (30 years optional)
- Translucency of normal luminance is increased by 2%



#### SOLAR CELL

- Uniform color
- High PID resistant
- Low breakage rate
- High stunt-resistance
- High model efficiency up to 20%



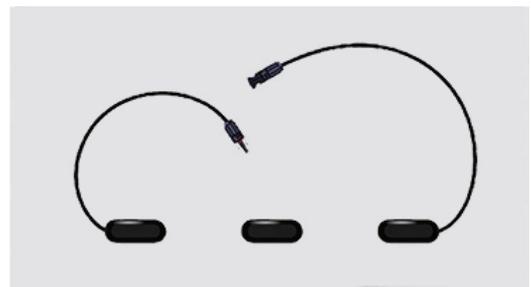
#### FRAME

- Conventinal frame
- Seal-lip design glue injection
- Serrated-clip design tensile strength
- Boost bearing capability and prolong service life



#### JUNCTION BOX

- Heat dissipation
- Long service life
- >IP67 protection level
- Innovative Full-Glue-Filled
- Waterproofness Junction Box



### More Information

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Solar panels are a clean source of energy that use the sun's rays to convert them into electricity or heat.

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and transition to clean energy in our mission to combat climate change.

## Introduction

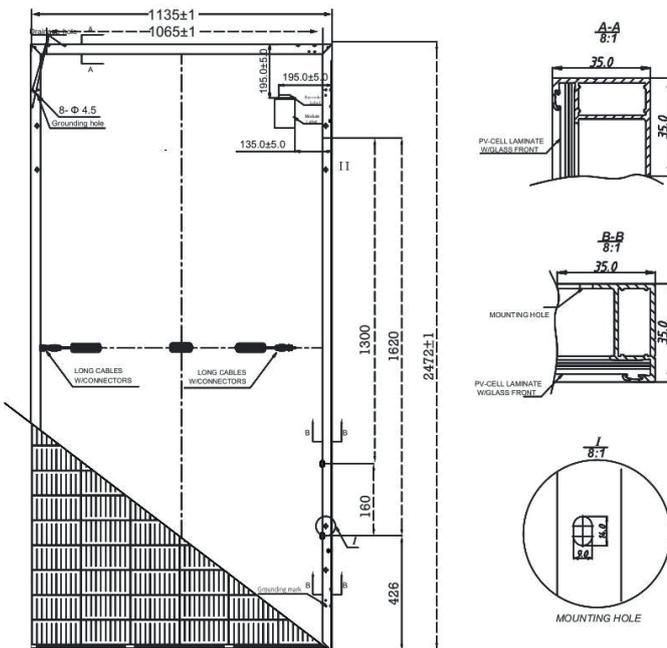
600W Photovoltaic Solar Panels are certified for the most challenging environmental conditions. This 600W Photovoltaic high-power monocrystalline solar panel operates at 21.20% efficiency to maximize the light absorption area.

## Product Options



### Mono Solar Panel Features

-  Widely using of the most popular and mature type of modules for solar system
-  High power output and highest conversion efficiency of 21.20%
-  Anti-reflective and anti-soiling surface reduces power loss from dirt and dust
-  Outstanding Performance in low-light irradiance environments
-  Excellent mechanical load resistance: Certified to withstand high wind loads (2400Pa) and Snow loads (5400Pa)
-  Positive power tolerance: 0~+5W

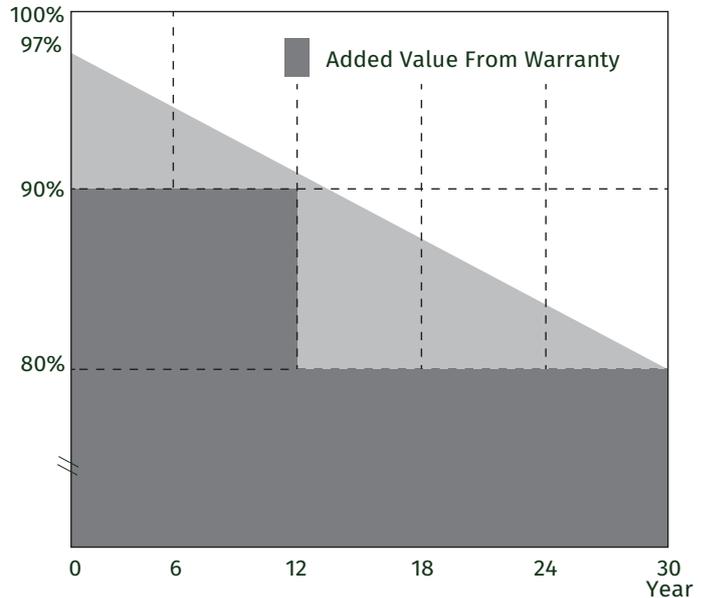


Electrical Characteristics(STC)	
Module Type	KMS600M-156
Maximum Power (Pmax)	600W
Maximum Power Voltage (Vmp)	45.00V
Maximum Power Current (Imp)	13.26A
Open-circuit Voltage (Voc)	53.90V
Short-circuit Current (Isc)	14.01A
Module Efficiency (%)	21.20%
Power Tolerance	0~+5W
Temperature Coefficient of Isc	+0.05%/°C
Temperature Coefficient of Voc	-0.29%/°C
Temperature Coefficient of Pmax	-0.37%/°C

Product Features

Warranty
12 years for product defects in materials & workmanship
12 years for 90% of warranted minimum power output
25 years for 80% of warranted minimum power output
25 years liner warranty

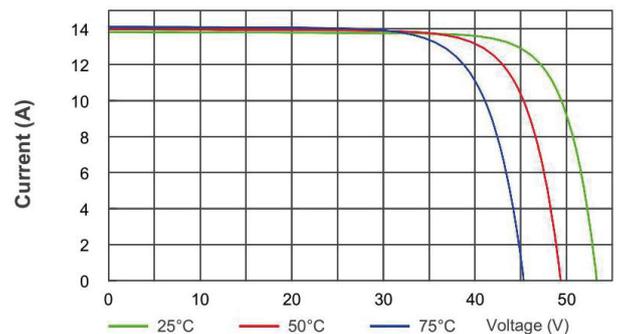
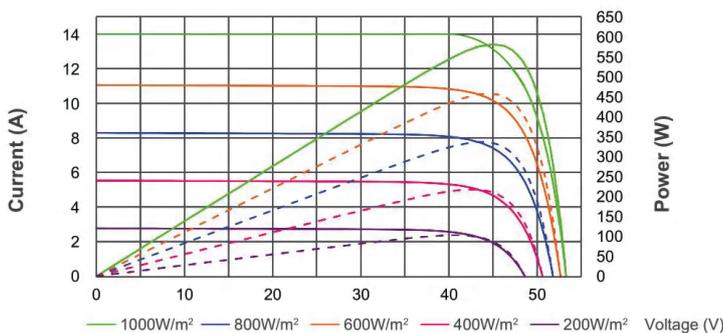
Reliable Quality
Positive power tolerance: 0~+5W
100% EL Double-inspection ensures modules are defects free
Modules Binned by Current to improve system performance
Potential induced Degradation (PID) Resistant



Mechanical Parameters	
Cell(mm)	10BB Mono 182*91
Weight(kg)	31.5kg
Glass Thickness	3.2mm (0.13inches), Tempered AR Glass
Dimensions (L*W*H)(mm)	2472*1135*35mm
Cable Cross Section Size (mm <sup>2</sup> )	4
Cable Cross Section Length (mm)	300
No.of Cells and Connections	156(6*26)
Junction Box	IP68,with Bypass Diodes
Connector	MC4 Compatiple

Working Conditions	
Maximum System Voltage	DC 1000V/1500V
Operating Temperature	-40°C~ +85°C
Maximum Series Fuse	25A
Maximum Static Load,Front (e.g.,snow and wind)	5400Pa (112 lb/ft <sup>2</sup> )
Maximum Static Load,Back (e.g.,wind)	2400Pa (50 lb/ft <sup>2</sup> )
NOCT	44±2°C
Positive power tolerance	0~ +5W
Application Class	Class A

I-V Curve

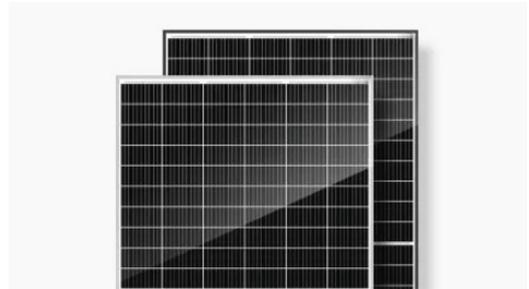


### Product Features

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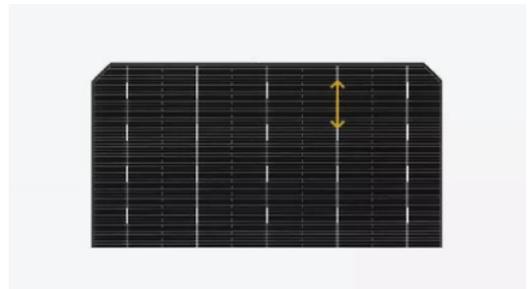
#### MULTI BUSBAR TECHNOLOGY

- Improves efficiency of modules
- Offers better appearance



#### HALF CUT TECHNOLOGY

- Under the same shadow condition
- Lower power loss than full cell



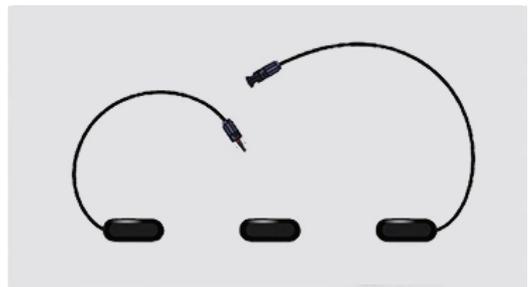
#### FRAME

- Conventional frame
- Boost bearing capability
- Prolong service life
- Serrated-clip design tensile strength



#### SPLIT JUNCTION BOX

- Reduced internal power loss
- Ensures model running safety



### More Information

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Solar panels are a clean source of energy that use the sun's rays to convert them into electricity or heat.

Our clean energy solutions provide electrical power as a way to decarbonize  
and transition to clean energy in our mission to combat climate change.

## Introduction

Growatt SPF 3500-5000 ES is a 230VAC output voltage off-grid inverter for back up power and self-consumption application, with a maximum PV input voltage up to 450VDC. It can also work without battery to saving system investment cost.

## Product Options



Datasheet	KMSPF 3500 ES	KMSPF 5000 ES
Battery Voltage	48VDC	
Battery Type	Lithium/Lead-acid	

INVERTER OUTPUT	KMSPF 3500 ES	KMSPF 5000 ES
Rated Power	3500VA/ 3500W	5000VA/ 5000W
Parallel Capability	Yes, 6 units maximum	
AC Voltage Regulation (Battery Mode)	23DVAC $\pm$ 5% @50/6DHz	
Surge Power	7000VA	10000VA
Efficiency (Peak)	93%	
Waveform	Pure sine wave	
Transfer Time	10ms typical 20ms Max	

SOLAR CHARGER	KMSPF 3500 ES	KMSPF 5000 ES
Maximum PV Array Power	4500W	6000W
MPPT Range @ Operating Voltage	120VDC - 430VDC	
Number of Independent MPP Trackers / Strings Per MPP Tracker	1/1	
Maximum PV Array Open Circuit Voltage	450VDC	
Maximum Solar Charge Current	80A	100A

AC CHARGER	KMSPF 3500 ES	KMSPF 5000 ES
Charge Current	60A	80A
AC Input Voltage	230 VAC	
Selectable Voltage Range	170-280 VAC (For Personal Computers) : 90-280 VAC (For Home Appliances)	
Frequency Range	50Hz/60Hz (Auto Sensing)	

PHYSICAL	KMSPF 3500 ES	KMSPF 5000 ES
Protection Degree	IP20	
Dimension(W/H/D)	330/485/135mm	330/485/135mm
Net Weight	11.5kgs	12kgs

OPERATING ENVIRONMENT	KMSPF 3500 ES	KMSPF 5000 ES
Humidity	5% to 95% Relative Humidity (Non-condensing)	
Attitude	<2000m	
Operating Temperature	0°C - 55°C	
Storage Temperature	-15°C - 60°C	

## Product Features

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- Integrated MPPT charge controller.
- Equalization charging function.
- Work with battery or without battery.
- Maximum PV input voltage up to 450VDC.
- Configurable grid or solar input priority.
- Optional WIFI/ GPRS remote monitoring.
- Support parallel operation for capacity expansion up to 30kW.
- PV and Grid power the load jointly if PV energy insufficient.
- Flexibly schedule the Inverter charging and discharging time.

## More Information

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Our clean energy solutions provide electrical power as a way to decarbonize and transition to clean energy in our mission to combat climate change.

## Introduction

These lead tubular batteries use premium technology and high grade materials to deliver maximum power for extended durations and have an appreciably longer life span. These batteries are specifically suitable for powering up UPS and inverters. These flooded lead acid batteries are environment-friendly, highly reliable in performance and are low in cost. Hear again our extensive research and development wing has helped us create batteries customized to suit Indian operating conditions. These flooded batteries are perfect for use in battery powered vehicles and to power inverters as well as for telecom use.

## Product Options



Model	Capacity at 27 deg C when discharged at (C20 upto 1.75 Vpc 1.280)	Dimension (±3mm)			Weight (KG±5%)	
		Length	Width	Height	Dry	Filled
KMASTB16500	150 AH	505	190	410	29	56
KMASTB22000	200 AH	505	190	410	29	61
KMASTB26000	240 AH	505	190	410	34	68

\*The height mentioned is upto terminal top

Model	Initial Charge Minimum AH Input (AH)	Initial Charge At Constant Current (A)		Constant Potential Limiting Current (Amps)	Triple Charge Current in (mA)	
		Start (Upto 2.3Vpc)	Finish (Upto 2.75Vpc)		Min.	Max.
KMASTB16500	15	7.5	525	25	130	520
KMASTB22000	20	9	630	30	155	625
KMASTB26000	24	11	770	36.6	190	765

## Initial charging instruction for dry charge battery

- 1: Filling in specific 1.220± 0.005 at 27 deg C
- 2: Rest Period 12 hrs
- 3: In order to reduce the charging time, the following route may be adopted
  - For ASTB 22000 The initial 2.36Vpc charging current may be 20A upto followed by 9A upto 2.75Vpc
  - For ASTB 26000 The initial 2.36Vpc charging current may be 24A upto followed by 11A upto 2.75Vpc

## Condition of Fully Charged

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- 3 Consecutive hourly reading of specific gravity and voltage become constant
- Top of charge voltage will be around 16.2V - 16.5V
- All Cells should be gas freely
- Minimum Ah has been given
- Specific Gravity at fully Charged condition  $1.240 \pm 0.005$  at 27 Deg C

## Product Features

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Long Shelf Life when left unattended for extended periods



Acid Resistant Polyester Gauntlets



Pasted Negative Plates



High Porosity Envelope Separators



Tubular Positive Plates



Micro Porous Ceamic Vent Plug

## Product Benefits

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Long Design Life



Rugged Performance



Very Low Maintenance



Longer Life Without Charging



Can Handle Extreme Weather Conditions

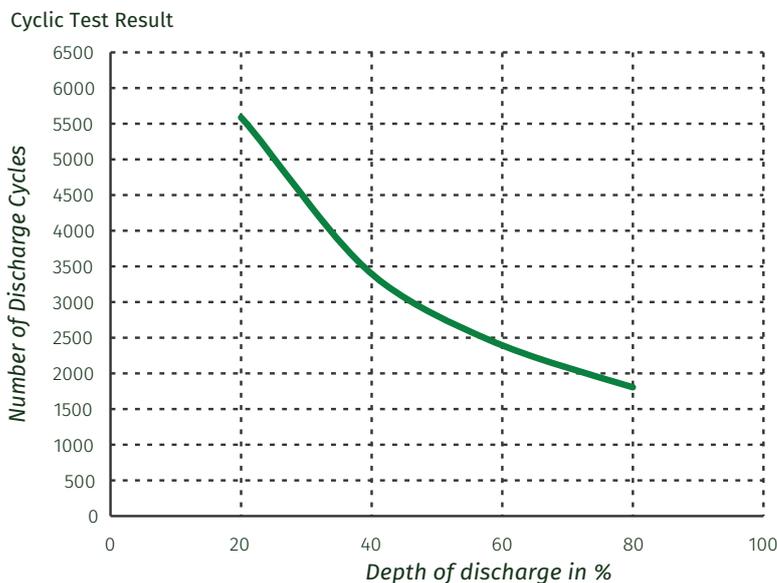


More Efficient and Save Money

## Battery Cyclic Performance

Calculation & Estimation  
IDEAL CYCLIC PERFORMANCE

**Graph 1, Cycle life vs. DOD of KINGSMILL SOLAR TUBULAR BATTERY with Ideal Charge Table 1, data of cycle number**



## Discharge & Charge Scenario (80%DOD)

### CYCLE METHOD

Discharge with  $2I_{10}$  for 4 hours (80% DOD), charge with  $2I_{10}$  for 3.5 hour +  $I_{10}$  for 0.5 hour +  $0.25I$  for 3.5 hour. This is one cycle

### RESIDUE CAPACITY DETERMINATION

The batteries are discharged at 10 hour rate after every 50 cycles to test battery capacity. When residue capacity of 10-hour rate capacity is lower than 80%, test is ended. After discharge at 10-hour rate after every 50 cycles, the charge method is: charge 80% of discharged capacity with current of  $2I_{10}$ + charge 20% with 10 current of  $I_{10}$ + charge 20% with current of  $0.4I_{10}$  (i.e. charge 120% of discharged capacity)

### TEMPERATURE - 27 C

Advantage of Upper Constant Current Charge Model Battery; can be completely recharged within 8 hours. The end charge voltage will be higher than 2.6Vpc, which is good for active material exchange.

Disadvantage of Upper Constant Current Charge Model

It has risk of battery malfunction without voltage limited. It is not easy to manage charging in practice.

*\* Technical Parameters are Subject to Change due to Continuous improvements and R&D*

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## Introduction

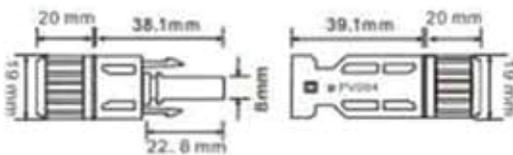
MC4 connectors are commonly used for connecting solar panels. It is a standard connector that enables the easy construction of strings of panels and is a staple in the renewable energy sector.

## Product Options



DESCRIPTION	PART NO.
Module Type	KMSW450M-144
Type	PV004
Rated Voltage	1000V DC
Rated Current	30A
Standard	ICE 62852
Protection Degree	IP67
Contact Resistance	≤ 0.5 mΩ
Pollution degree	2
Ambient Temperature	40°C-+85°C
Cable Cross Section Area	2.5mm <sup>2</sup> .4mm <sup>2</sup> .6mm <sup>2</sup>
Insulation Material	PC EXL9330
Flame Class	UL94 V.0

## Product Features

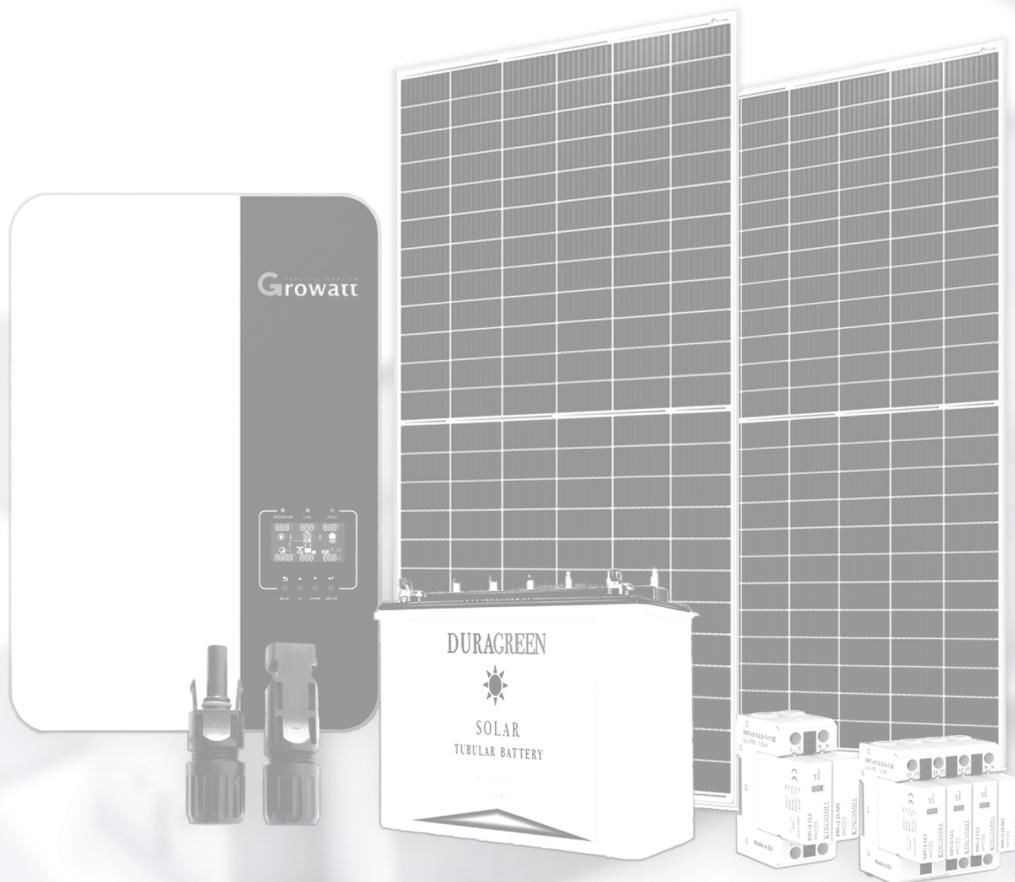


The MC4 system consists of a plug and socket design, a male and female connector.

## More Information

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