THORNOVA

Tangra[™] M Black

N-Type High efficiency Bifacial Single Glass Module

TS-BBT72(580-600)



Bifacial technology allows for the harvesting of up to an additional 30% energy from the rear side of the module.



30 years lifespan brings 10-30% additional power generation comparing with conventional P-type module.



N-type solar cell has no LID naturally which can increase power generation.



Excellent low irradiance performance.



Enhanced light trapping and optimized current collection contribute to the improvement of both module power output and reliability.



Industry leading lowest thermal coefficient of power.



Design optimized for lower operating



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current, resulting in minimized hot spot loss and improved temperature coefficient. Certified to withstand: wind load (2400 Pa) and



snow load (5400 Pa). 100% triple EL test enables remarkable reduction of

module hidden crack rate.

RE INSURANCE

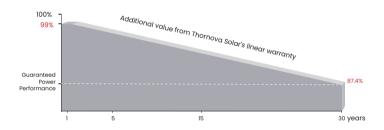
Warranty partner

Munich RE



* Optional performance warranty insurance. Please contact our local sales staff for more information

LINEAR PERFORMANCE WARRANTY



Product quality & process guarantee

vears Linear power guarantee

Annual degradation Over 30 years

COMPREHENSIVE CERTIFICATES



ISO 9001:	Quality Management System
ISO 14001:	Environmental Management System Standard
ISO 45001:	International Occupational Health and
	Safety Assessment System Standard

* Different markets have different certification requirements. Also, the products are under rapid innovation e confirm the certification status with regional sales rep

ELECTRICAL CHARACTERISTICS



Model of modules	TS-BBT72(580)		TS-BBT72(585)		TS-BBT72(590)		TS-BBT72(595)		TS-BBT72(600)	
	STC	NMOT								
Peak power - $P_{mp}(W)$	580	444	585	448	590	452	595	456	600	460
Open circuit voltage - $V_{oc}(V)$	51.97	49.76	52.16	49.94	52.35	50.12	52.54	50.30	52.73	50.48
Short circuit current - $I_{sc}(A)$	13.80	11.12	13.85	11.16	13.90	11.20	13.95	11.24	14.00	11.28
MPP voltage - $V_{mp}(V)$	44.04	42.17	44.22	42.34	44.40	42.51	44.58	42.68	44.76	42.85
MPP current - $I_{mp}(A)$	13.17	10.53	13.23	10.58	13.29	10.63	13.35	10.68	13.41	10.73
Module efficiency - η_m (%)	22	2.5	22.6		22.8		23.0		23.2	

STC (Standard Testing Conditions): Irradiance 1000W/m², Cell Temperature 25 °C , Spectra at AM1.5

NMOT (Nominal Module Operating Temperature): Irradiance 800W/m², Ambient Temperature 20°C, Spectra at AM1.5, Wind at 1m/s

ELECTRICAL CHARACTERISTICS WITH DIFFERENT POWER BIN (REFERENCE TO 13.5% IRRADIANCE RATIO)

Peak power - P _{mp} (W)	643	648	654	659	665
Open circuit voltage - $V_{oc}(V)$	51.97	52.16	52.35	52.54	52.73
Short circuit current - $I_{sc}(A)$	15.29	15.35	15.40	15.46	15.51
MPP voltage - $V_{mp}(V)$	44.04	44.22	44.40	44.58	44.76
MPP current - $I_{mp}(A)$	14.59	14.66	14.72	14.79	14.86
Irradiance ratio (rear/front)			13.5 %		

STRUCTURAL CHARACTERISTICS

Module dimension (L*W*H)	89.69 x 44.65 x 1.38 inch (2278 x 1134 x 35 mm)		
Weight	59.97 lbs (27.2 kg)		
Number of cells	144 cells		
Cell	N-type monocrystalline (M10)		
Glass	Tempered, 32 mm AR, High transmittance, Low iron		
Backsheet	Transparent black mesh backsheet		
Frame	Anodized aluminum alloy		
Junction box	IP68, 3 diodes		
Output wire	4.0 mm ²		
Wire length (Including Connector)	(+): 400 mm, (-): 200 mm or Customized Length		
Connector	MC4 Compatible		
Packing specification	31 pcs/Pallet; 620 pcs/40'HQ		

OPERATING PARAMETERS

Power tolerance (W)	(0,+5)
Maximum system voltage (V)	1500
Maximum rated fuse current (A)	30
Current operating temperature (°C)	-40~+185 °F (-40~+85 °C)
Bifaciality	80±10 %

MECHANICAL LOADING

Front side maximum static loading (Pa)	5400
Rear side maximum static loading (Pa)	2400
Hailstone test (mm)	35

TEMPERATURE RATINGS

600

500 400

> 300 PO

200

100

50

3

Temperature coefficient (P _{max})	-0.29 %/K
Temperature coefficient (V_{oc})	-0.28 %/K
Temperature coefficient (I_{sc})	+0.04 %/K
Nominal Module Operating Temperature	109.4±35.6 °F (43±2 °C)

180

80

60

20

-50 -25 0 25 50

Voc, 100

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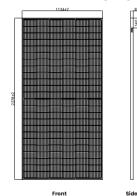
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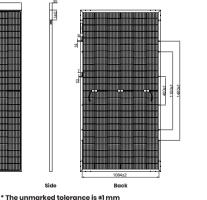
Temperature Dependence of

lsc,Voc,Pmax

Cell Temperature (°C)

MODULE DIMENSIONS (MM)





Length shown in mm

Web: www.thornovasolar.com

Scan the OR code to

aet more information

E-mail: info@thornovasolar.com

_600 **__**400 **__**200

* The parameters delineated within this datasheet, both technical and monetary, may exhibit variations contingent upon the region. Thornova Solar provides no warranty as to their absolute accuracy. Owing to our unceasing commitment to innovation, research, development, and product enhancement. Thornova Solar retains the discretion to amend any information encognauted in this datasheet without any proceeding notification. Clients are urged to procure the most recent iteration of this datasheet without actorporate it as an intrinsic component of the legally binding agreement ratified by both parties. The English renation shall take procedence. Should discrepancies arise between the English text and various rendered in other longuages, the stipulations of the English version shall take precedence.

Current-Voltage & Power-Voltage Curves

(590W)

10 15 20 25 30 35 40 45

Voltage (V)

- 800 -



14

1000 -

urrent (A)



Isc

100