



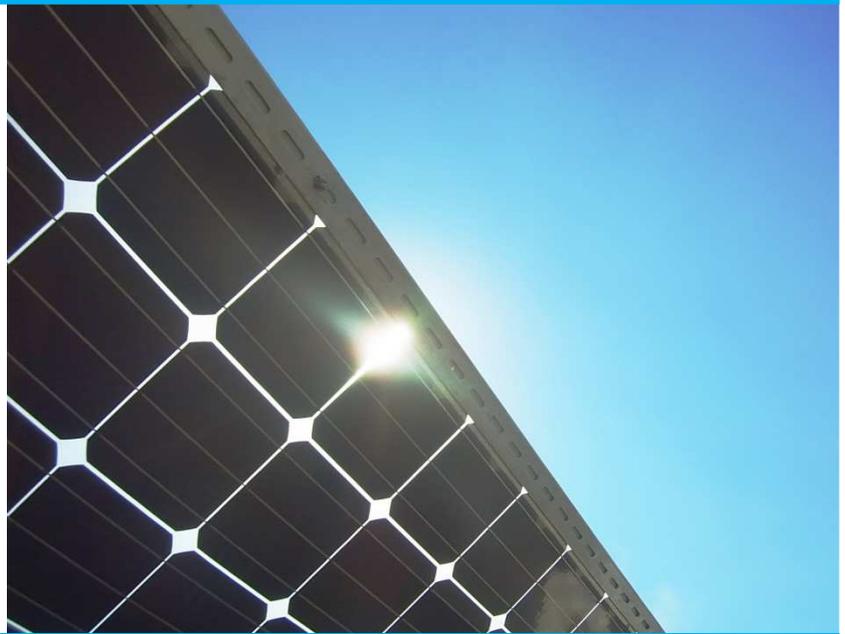
Tokyo Solar Bldg. Materials Corp.

TSBM Bifacial Solar Module

280/336H

TB60M- 285/342H

290/348H



“High-Power” Bifacial Solar Module

The Bifacial Advantage

Bifacial modules collect sunlight by both front and rear surfaces, generating additional electricity from light reflected from the ground, rooftops, clouds or the atmosphere as well as from light entering the module’s rear-side directly. By utilizing both sides of the panel, TSBM’s TB60M series modules generate significantly more power per installed area or kWp, resulting in:

- 10%-20% higher energy (kWh) in standard applications
- Up to 50% higher energy (kWh) in vertical installations
- Total module power of 302-342 W (60 cell module, [1])
- Ideal for white-roof installations, with significant US federal and state tax credits.

[1] Values are installation dependent and are defined for 10%-20% gain conditions

The TB60M module series is based on p-type, mono C-Si cells, which have an industry-leading cell equivalent efficiency of 21%-24% and conform to high quality standards. TSBM modules and cells are manufactured in Germany and are now available also in Japan, US.

Optimal Installation of Bifacial Modules

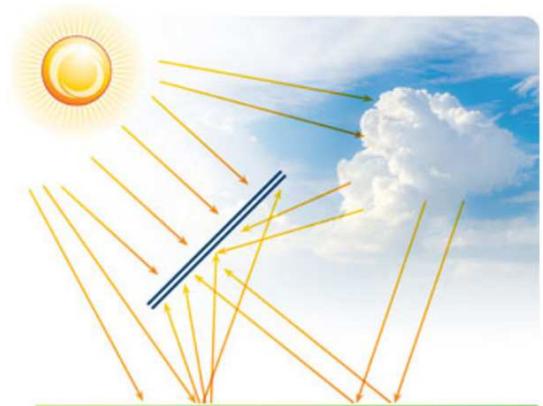
The efficiency of bifacial panels can be optimized in the following installation conditions:

- Ground treatment under the installation with white or bright colored materials such as white roof coat (membrane, paint) or light colored gravel for a high ground albedo.
- Higher installation above ground for optimized penetration of reflected and diffused light.
- Open-rear mounting to prevent the mount from shading the module’s rear side.



Bifacial Operation Features @10-20% Gain

- Equivalent module efficiency : 18.39~20.79%
- Equivalent module power : 302~342W
Example: 275 Wp front x 1.20 = 330W
peak equivalent power @ 20% bifacial gain



Applications

- Flat rooftop installations (tilted, horizontal, vertical)
- Utility ground installations including tracking system
- Highway / railway sound barriers and fences (vertical, tilted)
- Carports, parking lots, train and bus shelters, greenhouses

Module Electrical Data				
Front (STC) *1		280/336H	285/342H	290/348H
Rated Power [W]	Pmpp	280	285	290
Efficiency [%]	H	17.02%	17.32%	17.63%
Voltage [V]	Vmpp	30.7	31.1	31.5
Current (Front side) [A]	Imp	9.14	9.20	9.26
Open circuit voltage [V]	Voc	38.70	38.90	39.10
Short-circuit current (Front side) [A]	Isc	9.48	9.54	9.60
Front + Back (Equivalent Performance per Annual Gain Level)				
+10% gain / Typical installations (STC × 110%) [W]		308	313	319
+20% gain / Optimal installations (STC× 120%) [W] *2		336	342	348
+35% / Instantaneous gain (STC×35%) [W] *3		378	385	391
Equivalent Module Efficiency (at +20% gain) [%]	η	20.42%	20.79%	21.15%

*1 = Given for front side only and when backside is covered and not lit.

*2 = Given for a white rooftop typical installation with an annual bifacial gain of 20%

*3 = Given for specially high irradiation test conditions, e.g. a single module installed high above ground, over 90% reflective ground, sunny day, noontime

MODULE'S PERFORMANCE IN VARIOUS INSTALLATION CONDITIONS

Nominal Equivalent Power -EP [Wp] / Equivalent Efficiency - EE, [%]	280/336H		285/342H		290/348H	
	[W]	[%]	[W]	[%]	[W]	[%]
Nominal front power, Pmax-front, STC	280	17.02%	285	17.32%	290	17.63%
Front + 10% Back side gain (Alb=25%, H=50cm, Tilt=30° or, Alb=40%, H=30cm, Tilt=30°)	308	18.72%	313	19.03%	319	19.39%
Front + 15% Back side gain (Alb=50%, H=50cm, Tilt=30° or, Alb=50%, H=70cm, Tilt=20°)	322	19.57%	327	19.88%	333	20.27%
Front + 20% Back side gain (Alb=70%, H=30cm, Tilt=15° or, Alb=90%, H=20cm, Tilt=20°)	336	20.42%	342	20.79%	348	21.15%
Front + Instantaneous back side gain around noontime= +35% (Alb=>90%, H=>70cm, Stand alone module)	378		385		391	

※Alb=Albedo (Ground reflection) 、H=Module height (ground~lower side of the module) 、Tilt=Module inclination

※the installation conditions above are only examples and vary per specific installation parameters, geographical location and weather conditions, etc.

TEMPERATURE COEFFICIENTS

Nominal Operating Cell Temperature		45±2℃
Temperature coefficient of Pmax [%/K]	Pmpp	-0.39
Temperature coefficient of Voc [%/K]	Voc	-0.28
Temperature coefficient of Isc [%/K]	Isc	+0.045

These values are valid for the following standard test conditions, STC: 1000W/m², 25°C, AM 1.5 (IEC 60904-3 ED.2), accuracy in the range of 25°C to 75°C: ±2.5%

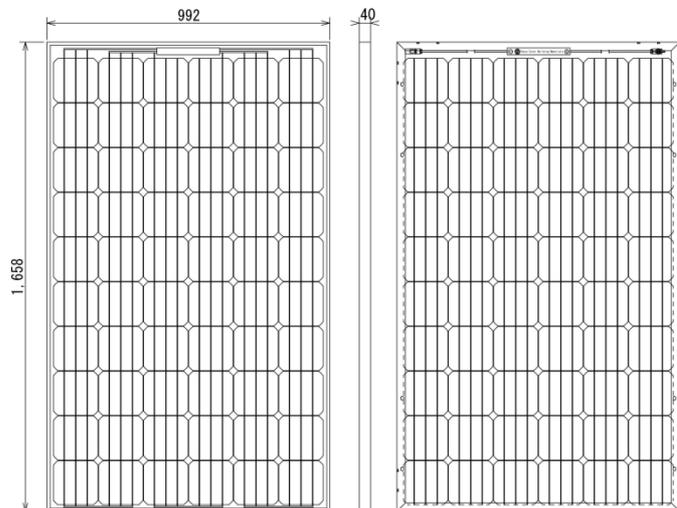
MECHANICAL SPECIFICATION

Solar Cell	156 x 156 mm Bifacial mono-crystalline silicon cell
Number of cells	60 cells (6x10)
Dimension	1658 x 992 x 40mm
Weight	23kg
Front & Back glass	2mm Tempered low-iron glass with anti-reflex coating+2mm Tempered low-iron glass
Frame	Aluminum anodized, 40x30mm
Junction box	IP67
Cables	2 x approx. 1m solar cable, Ø 4 mm ²

PERMISSIBLE OPERATING CONDITIONS

Operating Module Temperature	-45℃~+85℃
Max. system voltage, [V]	1,000V (IEC) / 600V (US)
Snow load, [Pa]	5,400Pa *
Reverse current loading capability, [A]	15A

* In compliance with the installation and operating manual.



[Front]



25

[Rear]

25years performance warranty**

Warranty / Certificate

Warranty**	Guaranteed output of 90% for 10 years and 80% for 25 years (In Accordance to Front side STC)
Certification	Approved for IEC61215 ED.2, IEC61730, Conformity to TUV Rheinland.

※Information in this document is subject to change without notice. For additional information, please contact;



TOKYO SOLAR BUILDING MATERIALS CORP.
 〒110-0005 2F Verco Kuromon Bldg. 3-14-5
 Ueno Taito-Ku Tokyo Japan
 TEL:03-5812-8050 FAX:03-5812-8051
www.tsbm.co.jp
info@tsbm.co.jp