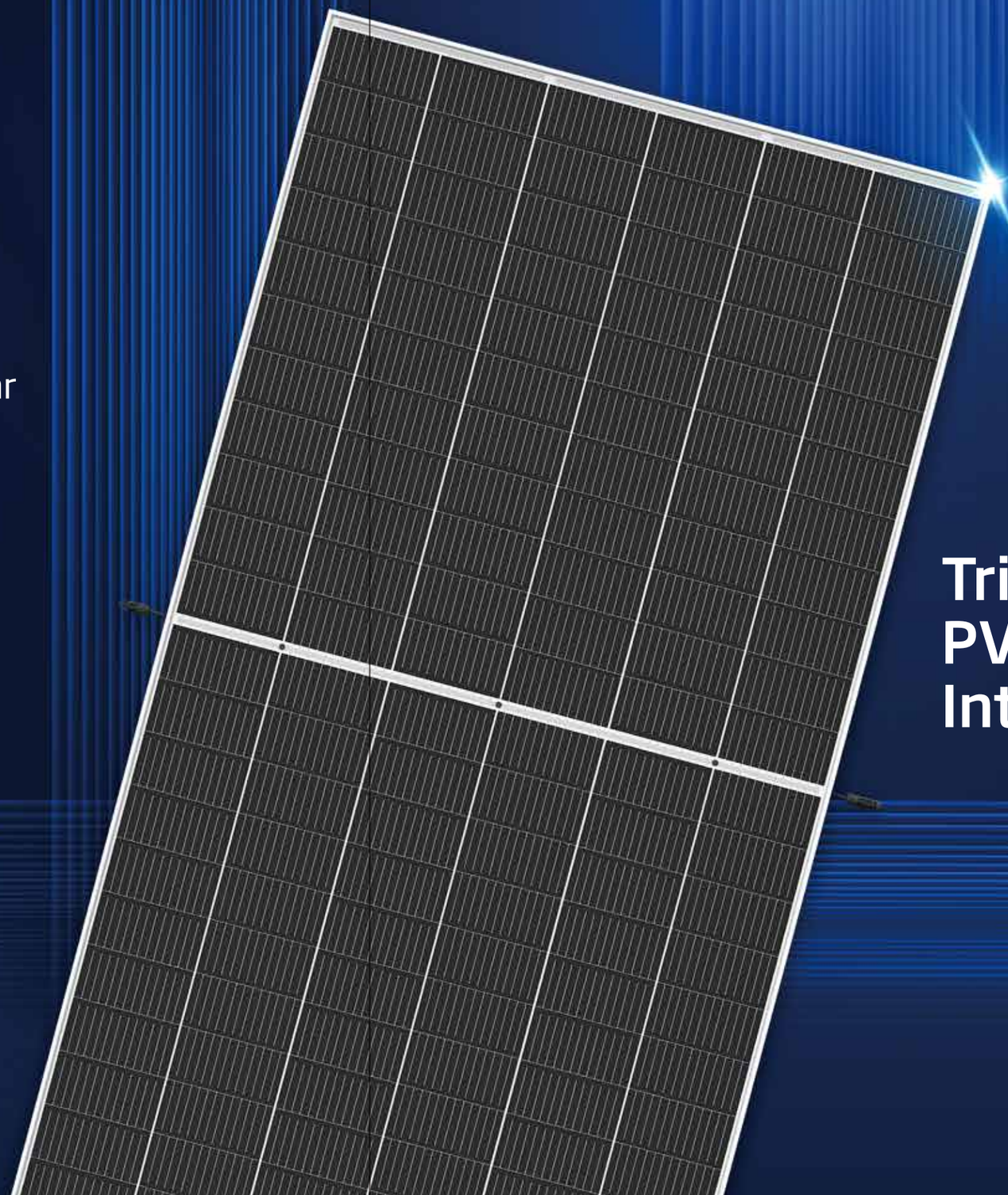
Trinasolar

Power Beyond Solar

The World Leading PV
and Smart Energy
IoT Total Solution Provider

www.trinasolar.com



Trinasolar

Trina Solar PV Module Introduction

OUTLINE

WORLD'S LEADING SOLAR COMPANY

Trina Solar (688599. SH), founded in 1997, is a manufacturer of photovoltaic module, and provider of smart energy solution, integrating R&D, production, sales, power station and system, EPC, O&M, smart micro-grid and multi-energy complementary systems development as well as energy cloud-platform operation, together into an energetic entirety. The company process upstream business across more than 100 countries and regions worldwide and has overseas employees from over 30 countries and regions.

On June 10, 2020, Trina Solar issued the first A-shares on the Shanghai Sci-Tech Innovation Board, becoming the first company whose main business is photovoltaic products, photovoltaic systems and smart energy to be listed on the Shanghai Stock Exchange Science and Technology Innovation Board.

USD 4.26bn
2020 Operating income

USD 8.23nb
Total Assests

77GW+
Cumulative total module shipments

50GW+
Module supply capacity Planning

MOST BANKABLE BRAND

Trina Solar's modules helps the power station projects to obtain bank financing more easily. As a result of company's product innovation, reliability and stability, people in the market global financial market and photovoltaic industry have strong desire for long-term cooperation with Trina.

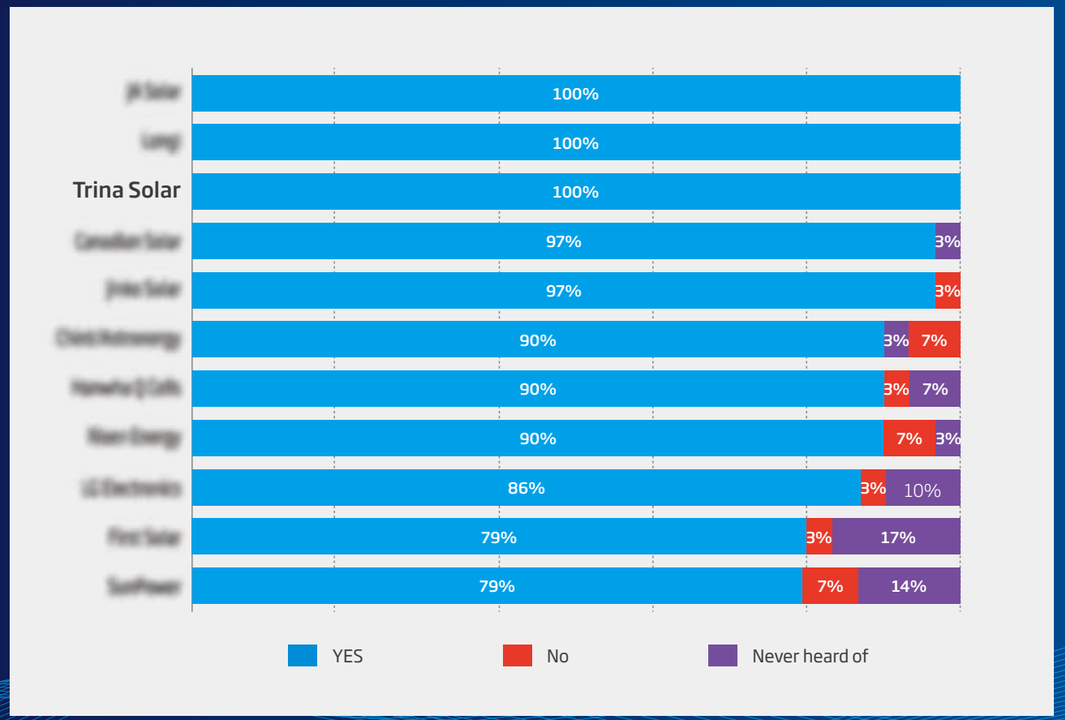
In 2020, Trina Solar was rated the World's Top "Bankable" PV Module Manufacturer by Bloomberg New Energy Finance for the sixth time.

The only one in the world recognized by the participating experts unanimously for 6 consecutive years

NO.1
MOST BANKABLE BRAND

Bankability 100%

BloombergNEF's 2021 PV module bankability survey results, top 10



Source: BloombergNEF

GROUND-BREAKING INNOVATIONS

For the past two decades, Trina Solar has been at the forefront in solar Innovation. Trina solar owns three national-level innovation platforms, the State Key Laboratory of PV Science and Technology(SKL), the National Enterprise Technology Center and the New Energy IoT Industrial Innovation Center, where has international top scientists from over ten countries. Trina Solar has set 22 world records in PV cell efficiency as well as module output which makes it hold the largest number of patents in the PV industry.

2000+
Patents Applied

96
Standards Issued

USD 1.86bn
R&D Investment

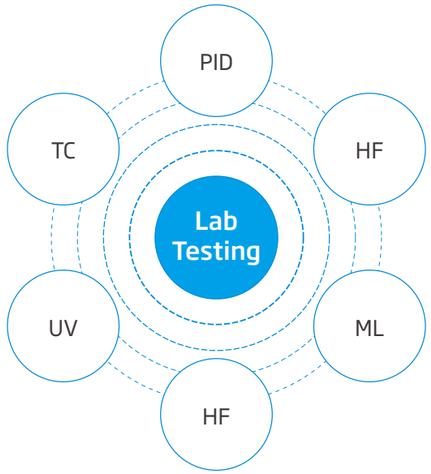
A Total of 22 World Records in PV Cell Efficiency & Module Output

01 Multi-Si Module — 274.3W — Sept, 2012
02 Multi-Si Module — 284.7W — May, 2012
03 2cm IBC cell — 24.4% — Feb, 2014
04 Mono-Si Module — 326.3W — Apr, 2014
05 156mm IBC cell — 22.94% — Apr, 2014
06 Mono-Si Module — 335.2W — Oct, 2014
07 156mm Multi-Si PERC cell — 20.76% — Nov, 2014
08 Mono-Si PERC cell — 21.4% — Nov, 2014
09 Multi-Si Module — 324.5W — Dec, 2014
10 Multi-Si Module Ap.Eff. — 19.14% — Apr, 2015
11 156mm Multi-Si cell — 21.25% — Nov, 2015
12 156mm Mono-Si cell — 22.13% — Dec, 2015
13 156mm IBC cell — 23.5% — Apr, 2016
14 Multi-Si Module Ap.Eff. — 19.86% — Oct, 2016
15 156mm Mono cell — 22.61% — Dec, 2016
16 156mm IBC cell — 24.13% — Apr, 2017
17 IBC Module — 410.5W — Dec, 2014
18 156mm IBC cell — 25.04% — Feb, 2018
19 N-mono -TOPCon cell — 24.58% — May, 2019
20 N-cast-mono-TOPCon cell — 23.22% — Nov, 2019
21 210mm Vertex — 23.03% — Jun, 2021
22 10mm Mass Production PERC — 23.56% — Aug, 2021

RELIABLE PRODUCT

Trina Solar's products have always maintained high reliability and solid performance based on its commitment to quality first policy.

The company has been ranked as **"Top performance" in the PVEL scorecard for 7 consecutive years.** Winners of the award are selected on the basis of the annual PV Module Reliability Scorecard report released by PVEL.



2014-2021

Reliability endorsed by third parties

1. 2010.6 Obtained CNAS's LABORATORY ACCREDITATION CERTIFICATE
2. 2011.10 Obtained the first TUV Rheinland TMP certification in PV industry
3. 2012.5 Obtained CGC WMT certification
4. 2016.8 Obtained CSA WMT certification
5. 2016.10 Obtained TUV Rheinland CTF test laboratory certification
6. 2019.8 Obtained TUV NORD CTF certification
7. 2019.8 Obtained World's first UL 61730-2 WMT certification
8. 2019.12 Obtained TVU SUD CTF certification

TÜVRheinland® UL CSA GROUP DEKRA

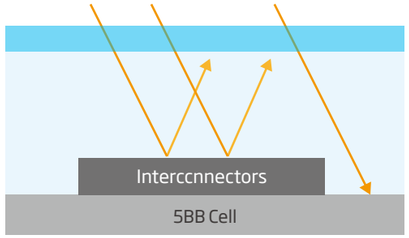
MULTI-BUSBAR TECHNOLOGY

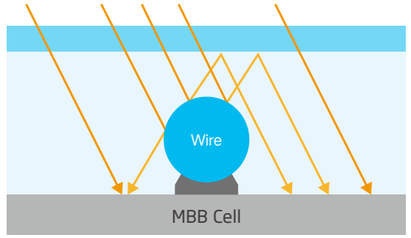
The world's first company for mass production of MBB multi-busbar module

Compared to the conventional design of five busbar, the multi-busbar(MBB) technology can increase output power of PV modules by 2% with thinner busbars. As the pioneer of MBB technology, Trina Solar takes the lead in R&D and mass production of MBB in the industry all the time.

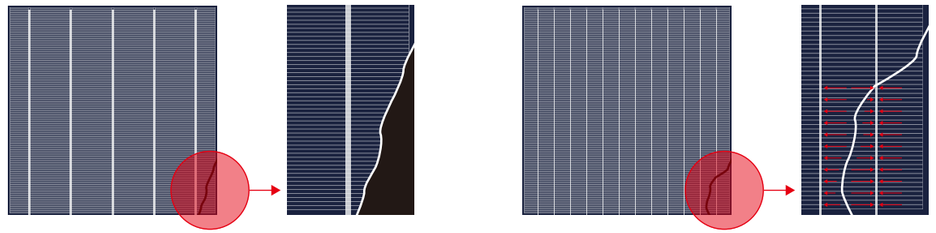
When matching with large wafers, MBB technology could remarkably decrease the power loss of current transmission. Meanwhile, it also enables modules with higher optical utilization and better anti-cracking performance.

Increased light absorption

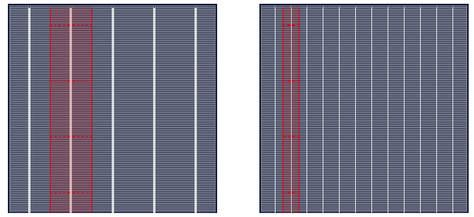




Rare chance of power loss due to micro-cracking



Reduced resistance losses with over 50% shortened current conduction distance



5BB MBB

Shortened current conduction distance

Up to 15% reduced series resistance

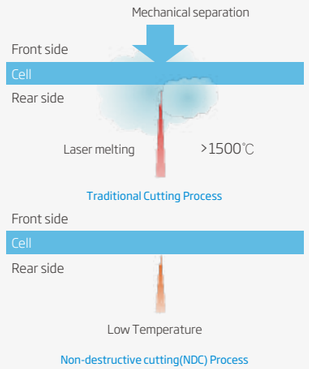
NON-DESTRUCTIVE CUTTING TECHNOLOGY

Non-destructive cutting uses low-temperature laser technology, combined with the principle of thermal expansion and contraction, so that the silicon wafers are naturally separated by thermal stress without micro-cracks.

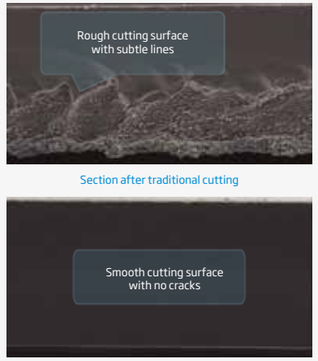
Trina Solar has adopted a non-destructive low-temperature cutting technology based on the principle of thermal expansion and contraction. Under the heat stress the wafer separates by itself. The cutting surface is very smooth without any micro-cracks. A NDC cell has a similar strength and mechanical robustness as a full cell and greatly surpasses that of the traditionally cut ones

Traditional Cutting vs. NDC

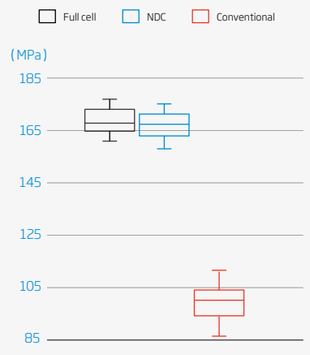
Cutting process



Cross section microscope picture of cutting edge

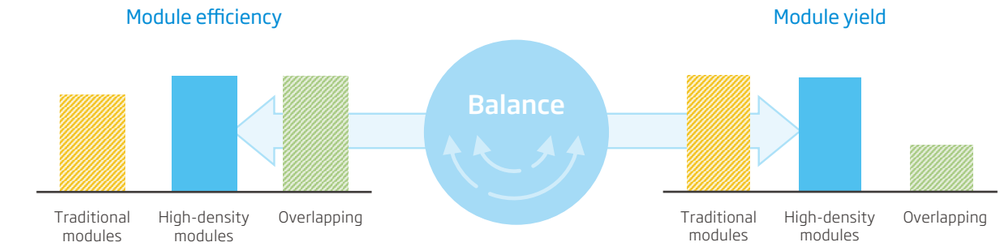


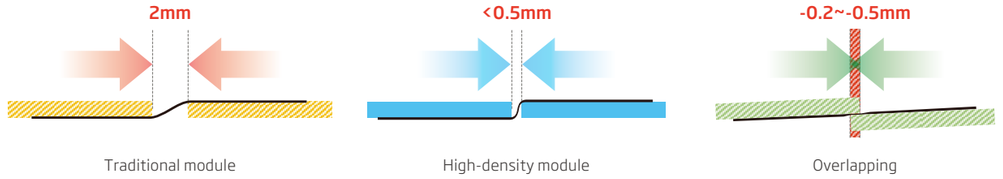
Comparison of mechanical properties

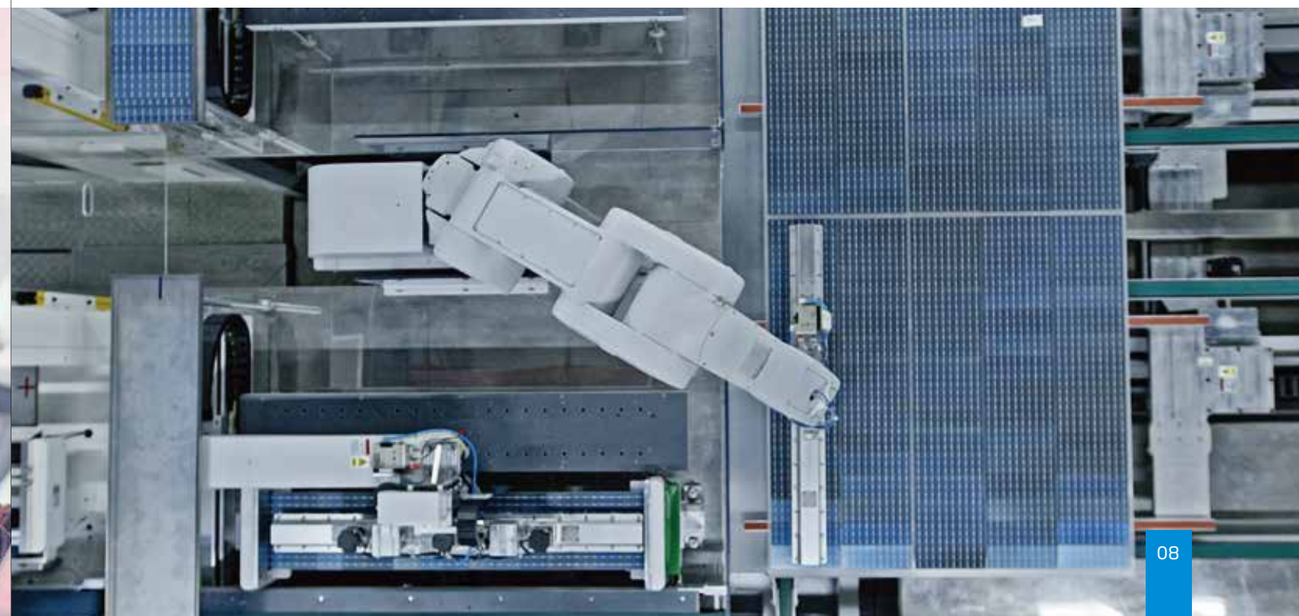


HIGH-DENSITY INTERCONNECTION TECHNOLOGY

The cell spacing of the traditional module is generally 2mm with the restriction of manufacturing process, ribbon strength, yield,etc. With the breakthrough of ribbon technology and process, Trina Solar adopts a mature and low-risk method as the high-density connecting process for 210 Vertex module. This process reduces the cell spacing to around 0.5mm by the flattening part of the ribbon in between cells, which further reduces the size of the module and improves the overall efficiency of the module. At the same time, the smaller cell spacing can effectively reduce yield losses, micro-cracks and other damage.

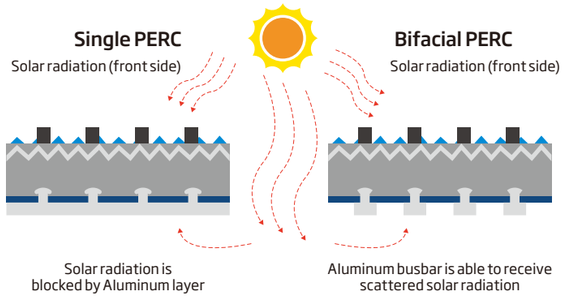


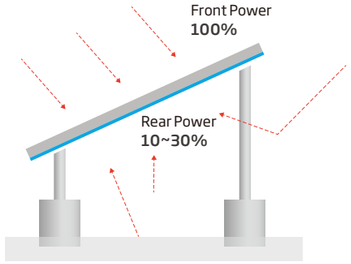




BIFACIAL PERC & DUAL-GLASS TECHNOLOGY

A typical PERC structure employs aluminum back surface field (Al-BSF), which blocks the absorption of light on the back; while Bifacial PERC is upgraded and optimized by adopting Al grid to receive scattered solar radiation and thus achieve a bifaciality rate of over 70%.Trina Solar has the most mature R&D and industrialization capabilities in the field of bifacial PERC cell technology.



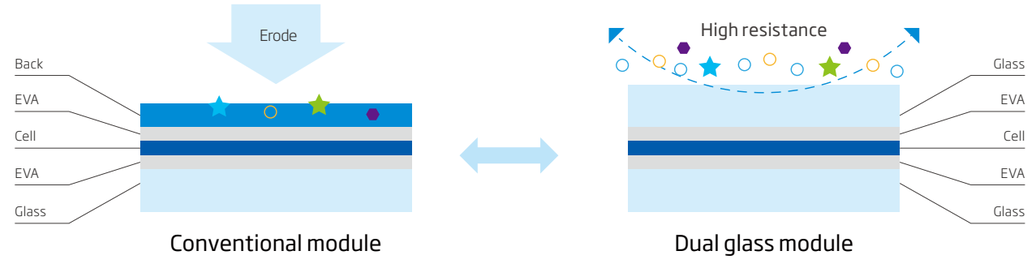


The conventional mono-glass structure is replaced by a heat strengthened dual-glass structure. Trina Solar is one of the pioneers in manufacturing efficient dual-glass modules and bringing them to market. Until now, Trina Solar has manufactured dual-glass modules with a rough proportion of 50% of the total volume.

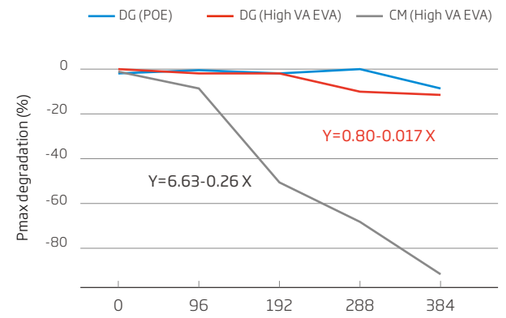
Trina Vertex modules incorporate with bifacial cell and dual glass reaching a higher reliability and lower power degradation, which further reduces LCOE.

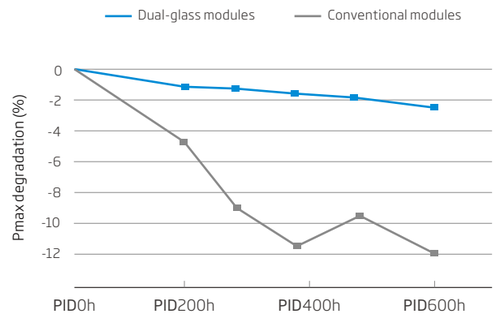
High power generation | High reliability | Low LCOE | Wide application

Highly reliable



Lower degradation





Product Portfolio

VERTEX FAMILY COVER ALL APPLICATION SCENARIOS

Trina solar Vertex series
Cover all application scenarios and have 30-90 power advantage over industrial level
Including Residential, C&I and Utility, etc.

Vertex

Vertex S

410W+ | 510W+ | 560W+ | 605W+ | 670W+

RESIDENTIAL, COMMERCIAL & INDUSTRIAL

GROUND-MOUNTED PLANT

370W+ | 450W+ | 540W+ | 580W+ | Industrial average

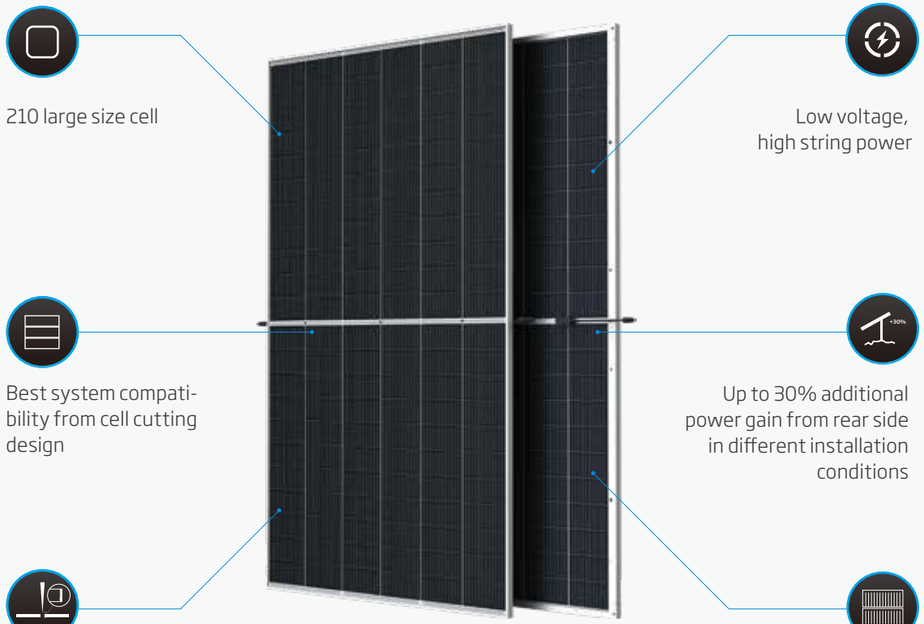
Vertex SERIES

Designed for utility and C&I projects

In 2020, Trina Solar launched high power series - Vertex series modules. The module power ranges from 500W to 670W, and the highest module efficiency can reach 21.6%. The Vertex series modules come in two versions - the bifacial dual-glass modules and back sheet modules. They can be easily matched with existing mainstream photovoltaic system and can be applied to both utility and C&I projects.

Trina Vertex series with ultra-high power is advantageous in the manufacturing supply chain, the compatibility of inverters, brackets, etc. in the system, and the value of customers such as LCOE and BOS. The combination of non-destructive cutting, high-density interconnection and MBB(multi-busbar) can make Vertex modules reach high efficiency and high reliability; while low voltage can lead to high string power.. Customers can get greater value from excellent performance on product value and BOS cost of Vertex series. 600W+ ultra-high-power modules are mature in manufacturing technology, and they are recognized by the photovoltaic industry.

The product capacity of 210 mm Vertex modules is expected to exceed 40 GW in 2021.



	Module Model	Maximum Power	# of cells	Size	Weight
Vertex (Bificial)	DEG18MC.20(II)	480~505W	150	2187 x 1102mm	30.1kg
	DEG19C.20	530~550W	110	2384 x 1096mm	32.6kg
	DEG20C.20	580~600W	120	2172 x 1303mm	35.3kg
	DEG21C.20	635~670W	132	2384 x 1303mm	38.7kg
Vertex (Backsheet)	DE18M(II)	485~510W	150	2187 x 1102mm	26.5kg
	DE18M.08(II)	485~510W	150	2187 x 1102mm	26.5kg
	DE19	535~560W	110	2384 x 1096mm	28.6kg
	DE20	585~605W	120	2172 x 1303mm	35kg
	DE21	640~670W	132	2384 x 1303mm	33.9kg

Customer value of 670W Vertex modules

Case study

Project location: Inner Mongolia
Project capacity: 100MW
Inverter: String Inverter
Capacity ratio: 1.2, Fixed Tilt 2P

-15% Racking
-17% Foundation
-11% Cable
-71% Inatallation

	Module Type	Reference Module 540W	Vertex 670W
BOS (¥/W)	Racking	BL	-0.023
	Foundation	BL	-0.010
	Cable	BL	-0.018
	Installation	BL	-0.034
	Sum	BL	-0.085
LCOE			~ -1.2%
Return on investment			+0.18%

*Source: Authority expert

Vertex S SERIES

Designed for Residential and C&I Scenarios

Vertex S series is Trina Solar's fully new-generation high-efficiency PV module for residential or industrial and commercial rooftop applications. Equipped with 210 mm cell, combined with multi-busbar, non-destructive cutting and high-density interconnection technologies, it has output power of over 405 W, which is widely known as "small in size, big in power".

With three panel models to choose from, the product satisfies diverse customer requirements for residential as well as industrial and commercial rooftops. Vertex S is compatible with the mainstream tracker systems, optimizers and inverters currently used in -distribution application, which is safer and more reliable for customers..

1c EUR/W
saving in BOS
Lower initail installation cost

16% higher
benefit for installer
Provide more benefit for installer

10% high revenue
from user generation
Shorter payback time

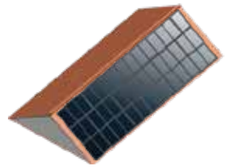
30% lower
in transportation cost
Lower transportation and storage costs

DE09.05 DE09 DE09.08

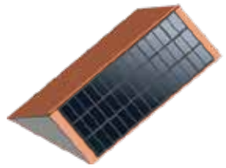
	Module Model	Maximum Power	# of cells	Size	Weight
Vertex S	DE09	390~405W	120	1754 x 1096mm	21kg
	DE09.08	390~410W	120	1754 x 1096mm	21kg
	DE09.05	380~400W	120	1754 x 1096mm	21kg

More Installation, Less Cost, and High Revenue

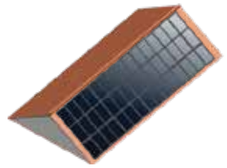
166(66) 410W
2 rows / 15 columns
12.30kW installed capacity



158(60) 340W
3 rows / 16 columns
16.32kW installed capacity

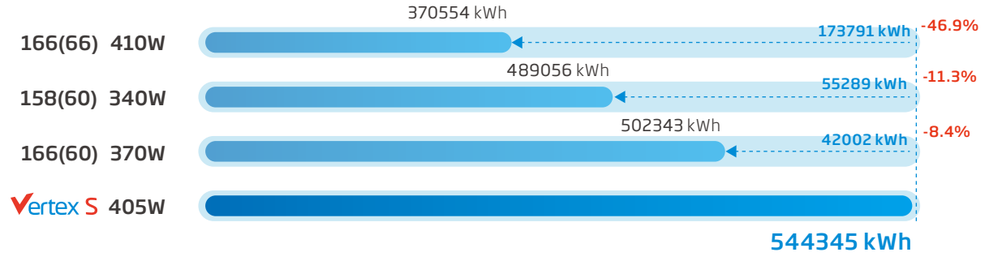


166(60) 370W
3 rows / 15 columns
16.65kW installed capacity



Vertex S 405W
3 rows / 15 columns
18.23kW installed capacity

For 25-year power generation on a south-faced sloping rooftop with size of 16.8m x 5.5m

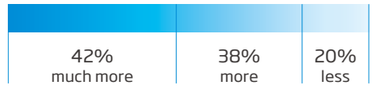


8.4%~46.9% higher power generation on the same rooftop

Items	166 410W	158 340W	166 370W	210 405W
Installed capacity (kWp)	12.30	16.32	16.65	18.23
Inverter price (cEUR/W)	+0.02	+0.005	Baseline	-0.02
Solar tracker (cEUR/W)	-0.01	+0.01	Baseline	-0.02
Cables(DC+AC) (cEUR/W)	+0.02	+0.01	Baseline	-0.02
Grid box (cEUR/W)	+0.01	+0.005	Baseline	0
Other costs(incl. laber cost) (cEUR/W)	+0.02	+0.01	Baseline	-0.02
Difference in BOS (cEUR/W)	**+0.06**	**+0.04**	Baseline	**-0.08**

The installation costs and revenues are calculated based on the Trina Solar model.

Under the same circumstances, Vertex S module can save **1.4 cEUR/W** in BOS cost, comparing with the 166 370W module.



According to big data analysis and layout design, more than **80%** of the rooftops are more suitable for Vertex S installation with higher power generation.

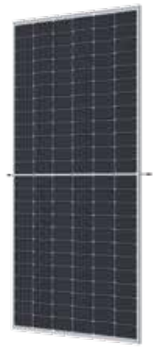
THE 166 SERIES Basic Product

Trina Solar 166 series could cover all kinds of application scenarios including residential, C&I and utility-scale projects. 166 series comes in two versions of the bifacial modules and backsheet modules, both featuring high reliability in extreme conditions, and extended 25-30 year warranty and more power generation with the integration of half-cut, dual glass (bifacial model) and multi-busbar technologies.

Trina solar's 166 series are recognized by industry professionals for their proven performance in the field and also has the leading shipments all over the world.

DEG17MC.20(II)

DE08M(II)



DE17M(II)

	Module Model	Maximum Power	# of cells	Size	Weight
166 Series	DEG17MC.20(II)	430~450W	144	2111 x 1046mm	28.6kg
	DE17M(II)	435~465W	144	2102 x 1040mm	24kg
	DE08M(II)	360~385W	120	1763 x 1040mm	20kg

Half-cut and
9 busbar design

1500V

Fully certified for
1500V system

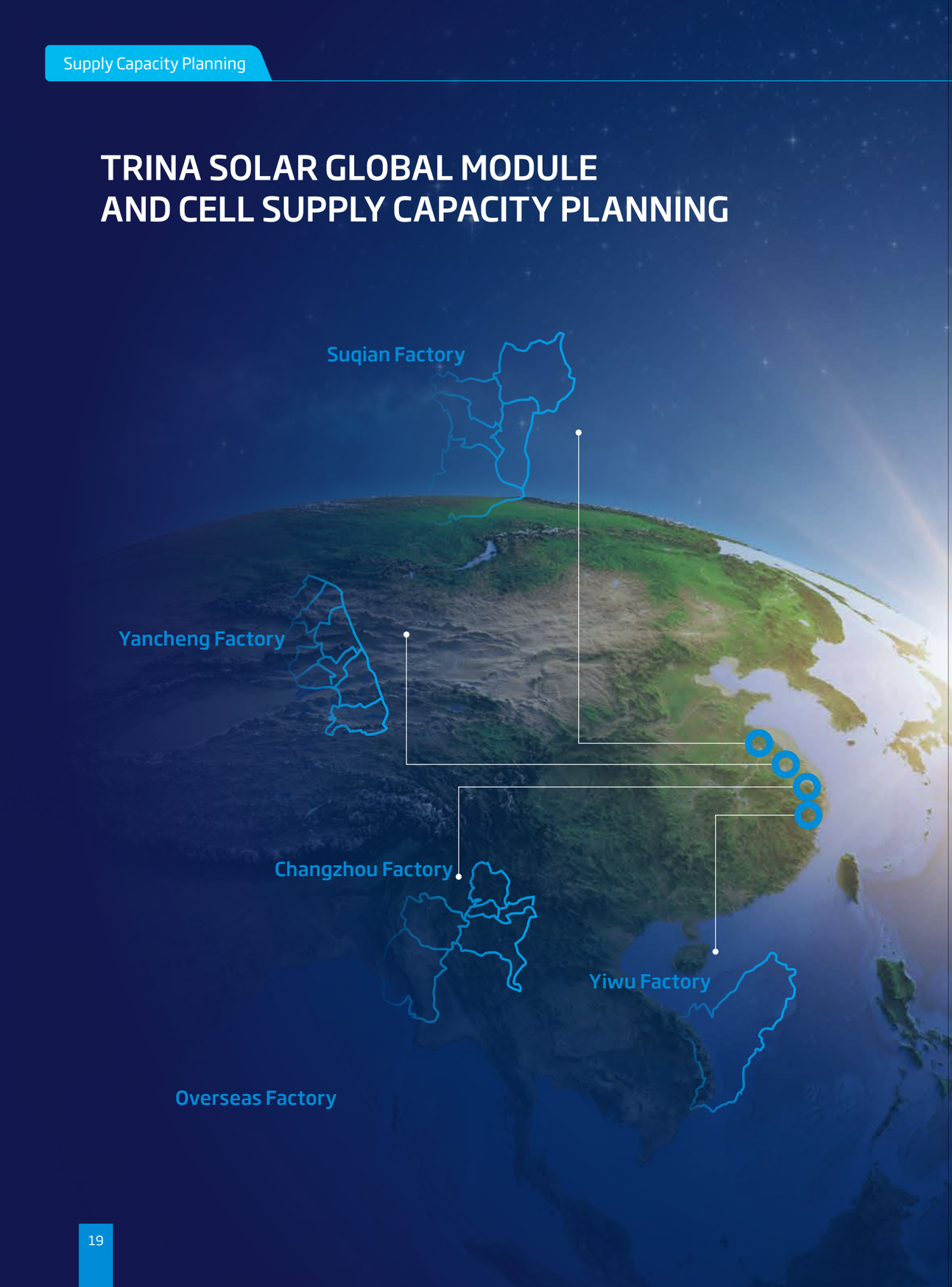
Widely used in
over 100 countries

Applicable to all
scenarios

High reliability with
best manufacturing techniques

Different BOM for different climates to
ensure power generation for its entire lifetime

TRINA SOLAR GLOBAL MODULE AND CELL SUPPLY CAPACITY PLANNING



MODULE CAPACITY IN 2021

50 GW+

CELL CAPACITY IN 2021

35 GW+

As of December 31 2020

Supply Capacity Planning

VERTEX CASE STUDY

C&I rooftop project in Zhe Jiang Province,China

400KW / 500W backsheet module /2021

Distributed Project in Vietnam

40MW / 510W Backsheet module / 2020

C&I rooftop project in Belgium, Europe

208KW / 410W Backsheet module / 2021

Ground-mounted power station project in Shan Xi Province, China

100MW / 500W baficial module / 2020

Tracker power station in Hebei Province

400MW / 555W Baficial module / 2021

Ground-mounted power station project in Qinghai Province

112MW / 670W Baficial module / 2021

SOLAR ENERGY FOR ALL

For two consecutive years
Ranked #1 in SVTC Solar Scorecard

103950 million kWh

103.65 million tons
CO_2 emissions reduced by

3.12 million tons
SO_2 emissions reduced by

28.27 million tons
Smoke emissions reduced by

5700 million trees
Equivalent to planting

Green power generation

Trina Solar officially joincd the golbal science Based Targets initlative(SBTI) »» Spport the global 1.5°C target limit

BUSINESS AMBITION FOR 1.5°C

SCIENCE BASED TARGETS