Change the World with Solar

TOYO SOLAR

www.toyo-solar.com

Solar Energy Group Structure

FUJI SOLAR Co., Ltd.

- Founded 2006 in Tokyo, Japan
- Expanded operations to North America, Southeast Asia, and EMEA regions
- Subsidiary of publicly traded Abalance Corporation (3856.T)

Vietnam Sunergy Joint Stock Company (VSUN)

- PV module company of Fuji Solar
- Globally renowned Japanese brand in solar PV module
- Production capacityof 4GW
- Known for high-quality standards and advanced automated production lines

TOYO SOLAR

- Solar cell company of VSUN
- Established in Phu Tho Province, Vietnam, 2022
  - ➢ 4GW cell capacity for Phase 1 production
  - ➢ 4GW cell capacity for Phase 2 production, coming in Q3 2024

VSUN WAFER

- 4GW VSUN wafer factory in Vietnam, coming in April 2024

Historical Milestone

2015
VSUN Establish

2017
- Capital Infusion FUJI Solar, Japan
- Rated as a high-tech enterprise
- Established European branch

2018
- Established US branch
- Established VNREE Company

2019
- Bloomberg Named Excellent Solar Module Company
- Vietnam Base Expansion for 166mm Solar Module

2020
- Products are used by 100+ multiple power stations
- Vietnam Base Expansion for 182mm Solar Module

2021
- PVEL Named Best Performance Award
- Ecovadies Named Third Place in Social Responsibility Awards

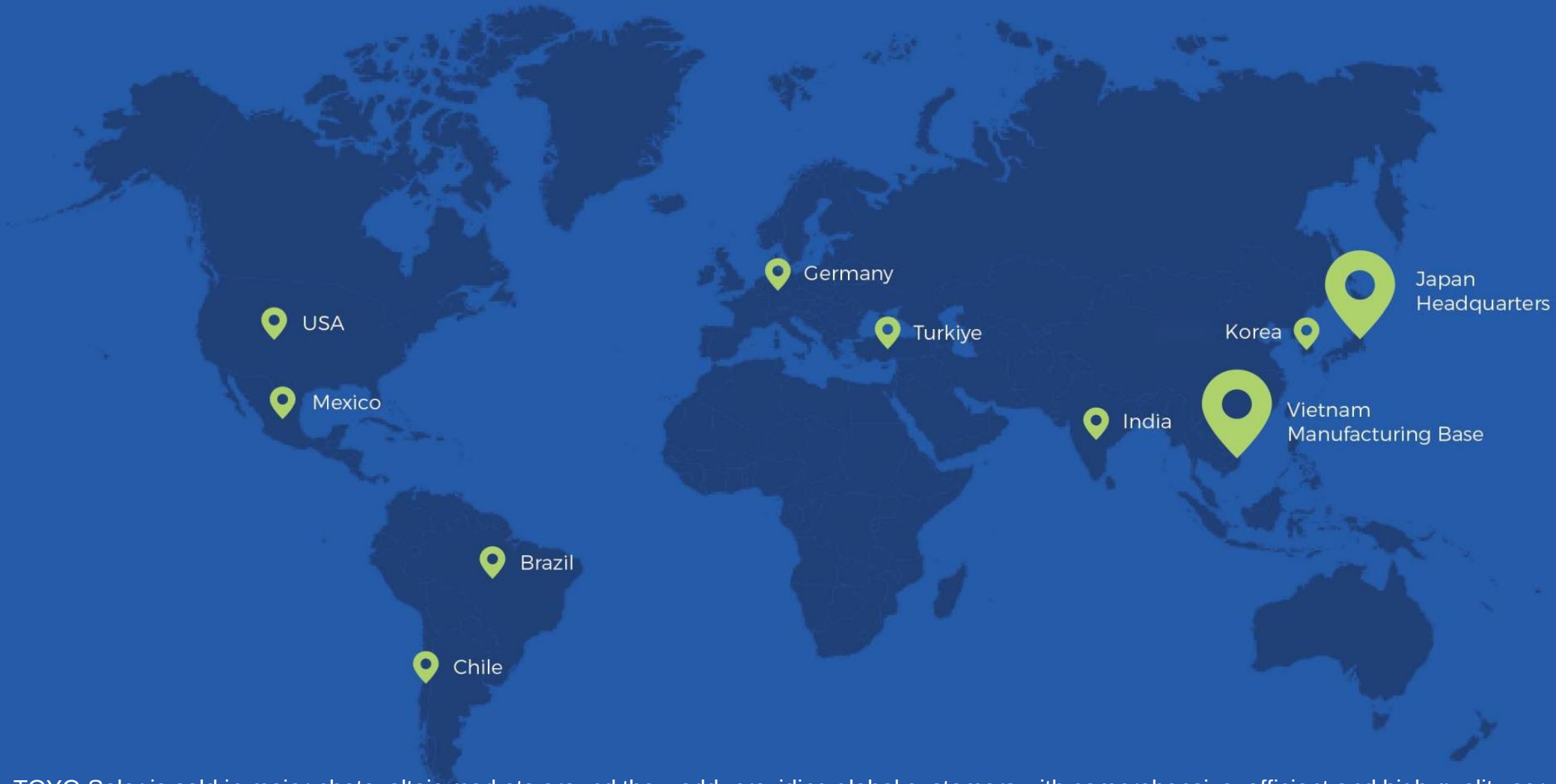
2022
TOYO Solar 8GW High Performance N-type TOPCon Cell Project Established

2023
Phase1 4GW N-type TOPCon Cell Start Mass Production

2024
4GW Wafer Factory Start Mass Production in April

2024
Phase2 4GW N-type TOPCon Cell Start Mass Production in Q3

Global Market Layout, Made in Vietnam



TOYO Solar is sold in major photovoltaic markets around the world, providing global customers with comprehensive, efficient and high-quality services; market demand-oriented balanced market layout, steady development.

Japanese Brand, Made in Vietnam

Advantages of N-type Solar Cells

LETID/LID Free Impurities

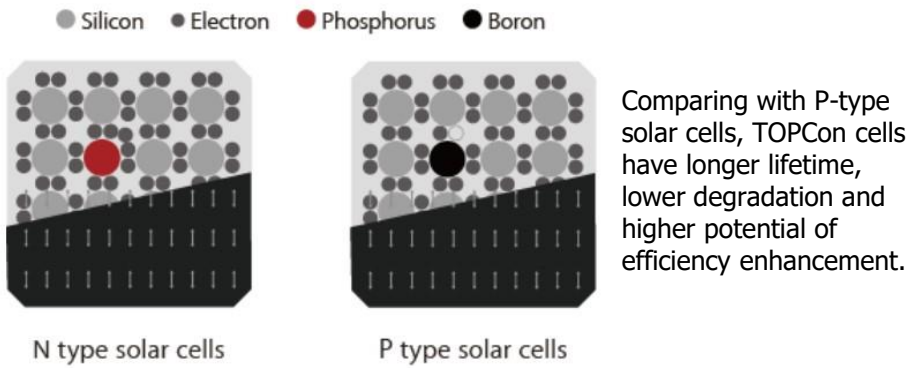
Lower Temperature Coefficient

Better Anti-PID performance

Higher Bifacial Rate

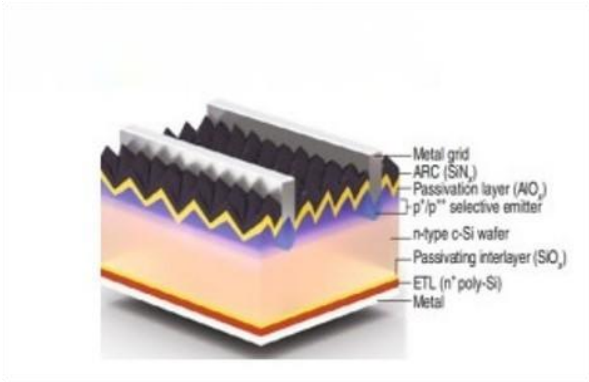
Longer Lifetime

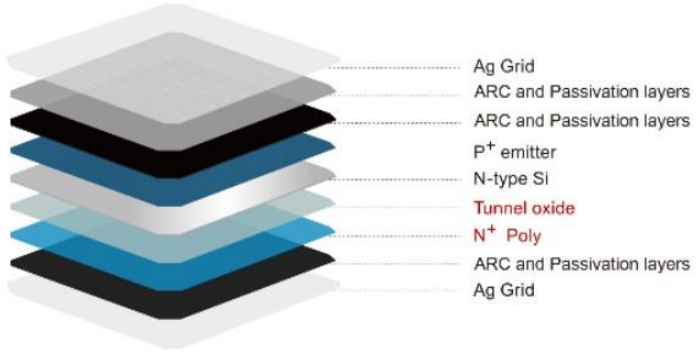
No B-O Defect



Comparing with P-type solar cells, TOPCon cells have longer lifetime, lower degradation and higher potential of efficiency enhancement.

Advantages of N-Type TOPCon Cells





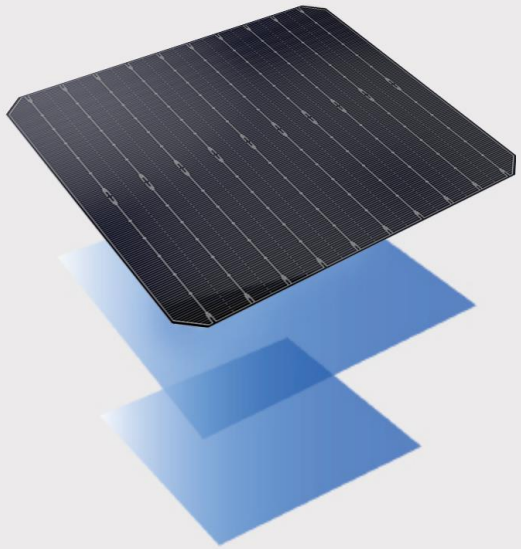
Higher efficiency
High bifaciality

Lower Temperature coefficient
Lower degradation

Average Efficiency **24.8%** Bifaciality ≥ **80%**

Product Description, VTS-N-P-M10B10

Dimension： 182mmx182mm±0.5mm， 182mmx183.75mm±0.5mm， 182mmx210mm±0.5mm	**TkVoltage：** -0.30%/K
Cell Thickness： 130μm±15μm	**TkCurrent：** 0.04%/K
Front side： 1.2mm wide bus bars, Passivated Emitter(AlOx & Silicon nitride anti-reflection coating)	**TkPower：** -0.32%/K
Back side： 1.2mm wide bus bars, Tunnel Oxide, Silicon nitride anti-reflection coating	**Rsh≥**50Ω， **Irev2≤**1.0A



No Light-Induced Degradation
Light-Induced Degradation: "0"

Anti-PID (Potential-Induced Degradation)
Excellent anti-PID performance

Low Encapsulation Loss
Lower encapsulation loss, making it more suitable for high-efficiency modules

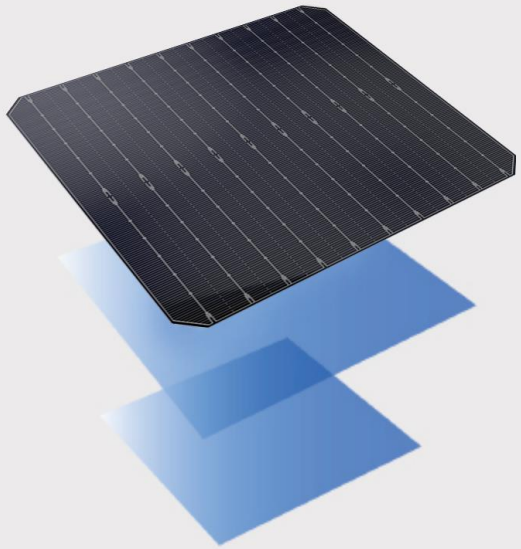
Low Temperature Coefficient
Power Temperature Coefficient as low as -0.30%/K

Strong Low-Light Performance
Relative conversion efficiency of ≥97% under 200W/m² low-light conditions

High Conversion Efficiency
Front Efficiency ≥ 24.8%, Bifacial Efficiency ≥ 80%

Product Description, VTS-N-P-M10B16

Dimension： 182mmx182mm±0.5mm， 182mmx183.75mm±0.5mm， 182mmx210mm±0.5mm	**TkVoltage：** -0.30%/K
Cell Thickness： 130μm±15μm	**TkCurrent：** 0.04%/K
Front side： 1.2mm wide bus bars, Passivated Emitter(AlOx & Silicon nitride anti-reflection coating)	**TkPower：** -0.32%/K
Back side： 1.2mm wide bus bars, Tunnel Oxide, Silicon nitride anti-reflection coating	**Rsh≥**50Ω， **Irev2≤**1.0A



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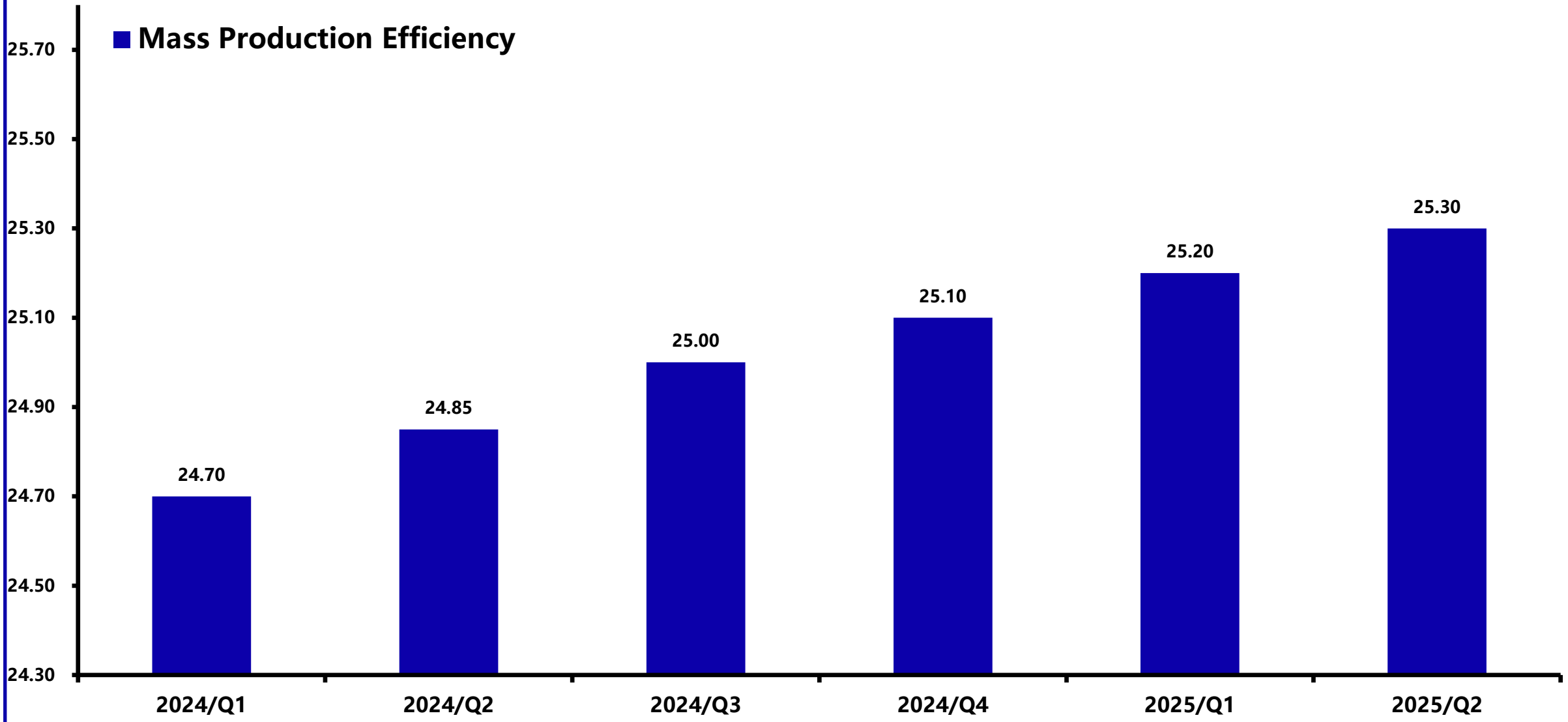
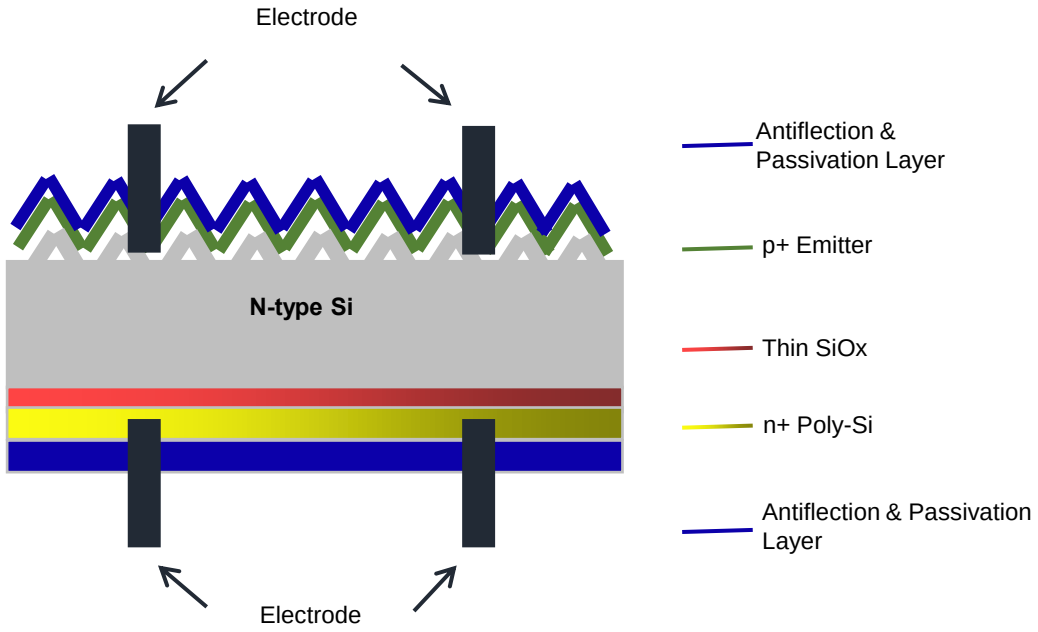
N-TOPCon Cell

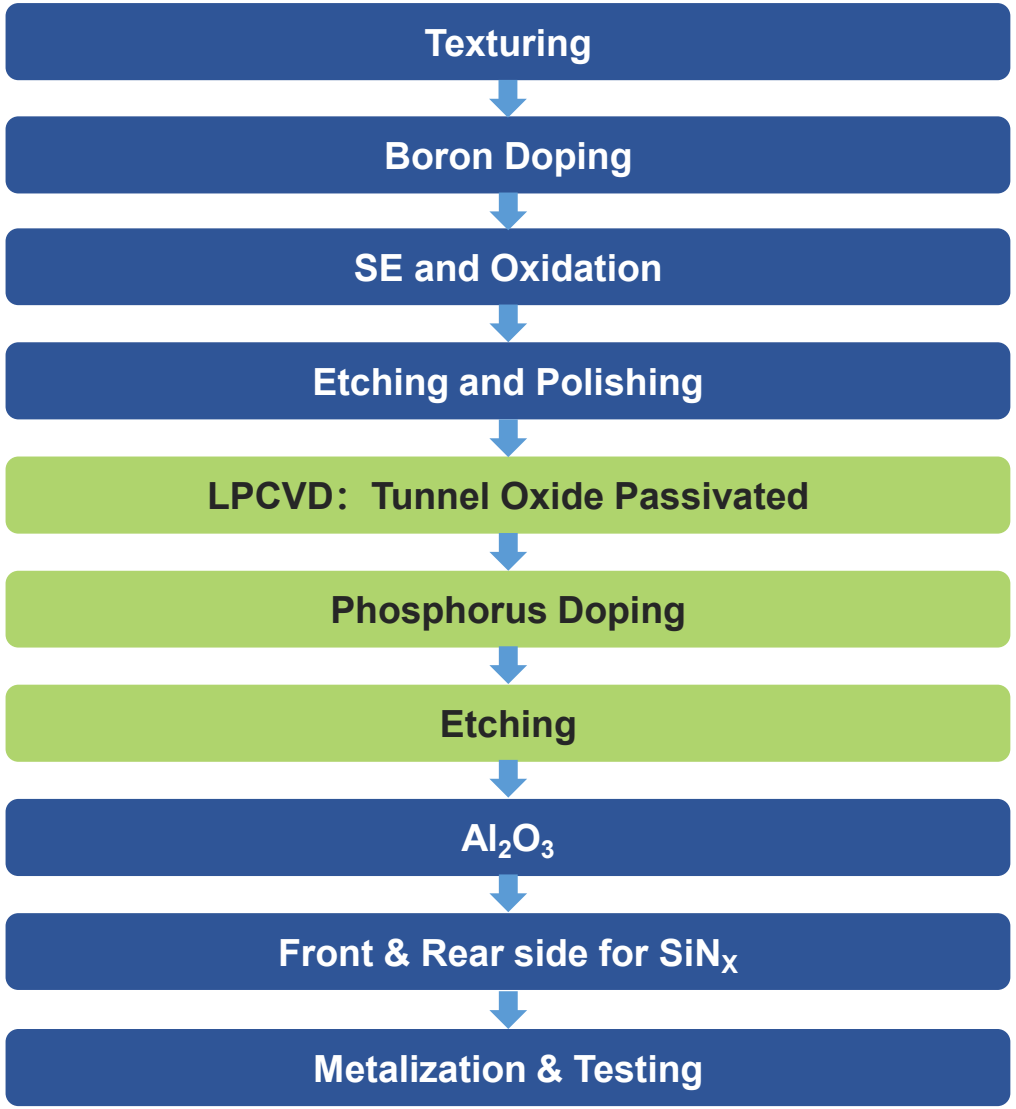


Technology Roadmap

Phase 1.
N-TOPCon Cells from LPCVP Path

- Higher efficiency
- High yield of A grade products
- Rapid mass production





Research and Development

R&D Team

Dr. Jianhua Zhao - Technical Consultant

Dr. Aihua Wang - Chief Technical Officer

Dr. Zhao and Dr. Wang

Leading the R&D team consisting of 1 principal technical doctor, 2 technical managers, 6 senior engineers, along with several engineers and technical trainers.

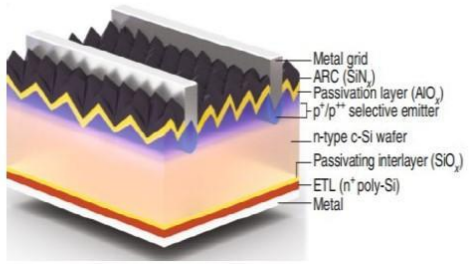
The technical team dedicated to the research and development of higher efficiency and higher quality TOPCon solar cells at TOYO SOLAR

Winner of the Queen Elizabeth Award for Engineering

Research and Development

Experimental Analysis Laboratory

- Rapid response to mass production technical issues
- Quick response volume customer complaint handling
- Innovative product development and promotion



Advantages of N-Type TOPCon Cells


TLM


WCT120

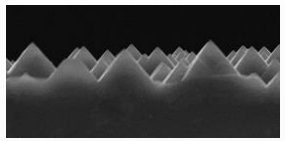
ECV

SEM

QE


PL

TOPCON Solar Cell Process



Pyramid size: 1-2 μ m
Reflectivity ≤ 10.5%

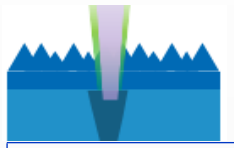
$NaOH/HCL/HF/H_2O_2/O_3/DIW/ADD$

Texturing

Form pn Junction
R-Sheet: 110-120 Ω/□

$BCl_3/N_2/O_2$

Boron diffusion



Laser doping to form selective emitter

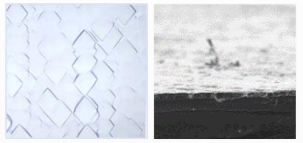
Power, Graphics

SE Laser

Annealing & Boron-rich layer oxidation

N_2/O_2

Oxidation



Backside polishing reflectivity ≥ 39%

$NaOH/HCL/HF/H_2O_2/O_3/DIW/ADD$

Alkali polishing on the back

Tunneling Oxide growth and a-poly deposition

$SiH_4/N_2/O_2$

LPCVD

N + layer diffusion
R-Sheet: 30-50Ω/□

$POCl_3/N_2/O_2$

Phosphorus diffusion

Alkali etching on the front

$NaOH/HCL/HF/H_2O_2/O_3/DIW/ADD$

Remove polysilicon layer, boron/phosphorus silicon glass

ALD

$TMA/N_2/H_2O$
270℃

Surface Passivation

PECVD

$SiH_4/NH_3/N_2/O_2$
Front 460℃;Back 530℃

Anti-reflection film deposition

Screen printing

Ag Paste
Ag/Al Paste

Prepare positive and back electrodes

Sintering

850 ℃, Belt speed

Metallize electrode to form good ohmic contact

Light injection

Time, Power

Activate hydrogen atoms and reduce recombination centers

IV test

Appearance,
Efficiency, EL

Cell testing & sorting

Certificates

DCI

QUALITY MANAGEMENT SYSTEM CERTIFICATE

This is to Certify that the QUALITY MANAGEMENT SYSTEM of

VIETNAM SUNERGY CELL COMPANY LIMITED

Registered Address: Cam Khe Industrial Park,Cam Khe Town,Cam Khe District, Phu Tho Province, Vietnam

Audit Address: Plot CN02, Cam Khe Industrial Park,Cam Khe Town,Cam Khe District, Phu Tho Province, Vietnam

has been assessed by DCI Certification Service and found to comply with

GB/T 19001-2016 idt ISO9001:2015

for the

Solar cell production and sales

Certificate Number: 204162

Unified Social Credit Code: 2601084657

Initial Certification Date: 27 Oct. 2023

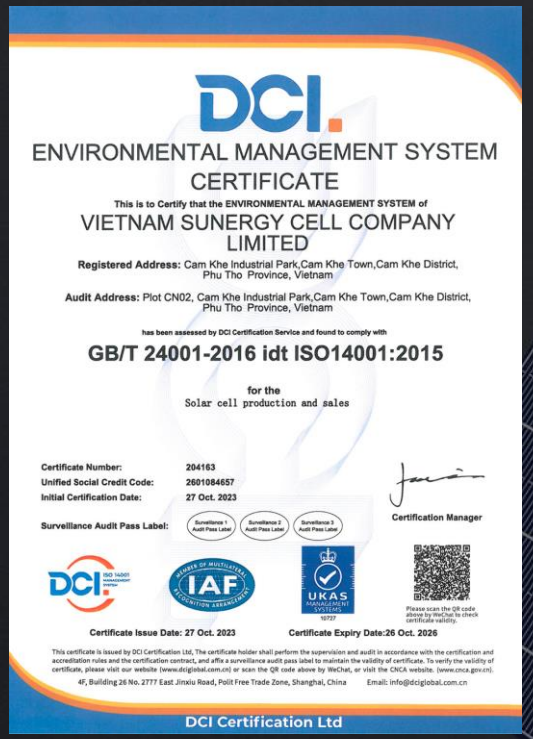
Surveillance Audit Pass Label:

Certification Manager

Certificate Issue Date: 27 Oct. 2023 Certificate Expiry Date:26 Oct. 2026

DCI Certification Ltd

ISO9001 Quality Management System Certification



DCI

ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATE

This is to Certify that the ENVIRONMENTAL MANAGEMENT SYSTEM of

VIETNAM SUNERGY CELL COMPANY LIMITED

Registered Address: Cam Khe Industrial Park,Cam Khe Town,Cam Khe District, Phu Tho Province, Vietnam

Audit Address: Plot CN02, Cam Khe Industrial Park,Cam Khe Town,Cam Khe District, Phu Tho Province, Vietnam

has been assessed by DCI Certification Service and found to comply with

GB/T 24001-2016 idt ISO14001:2015

for the

Solar cell production and sales

Certificate Number: 204163

Unified Social Credit Code: 2601084657

Initial Certification Date: 27 Oct. 2023

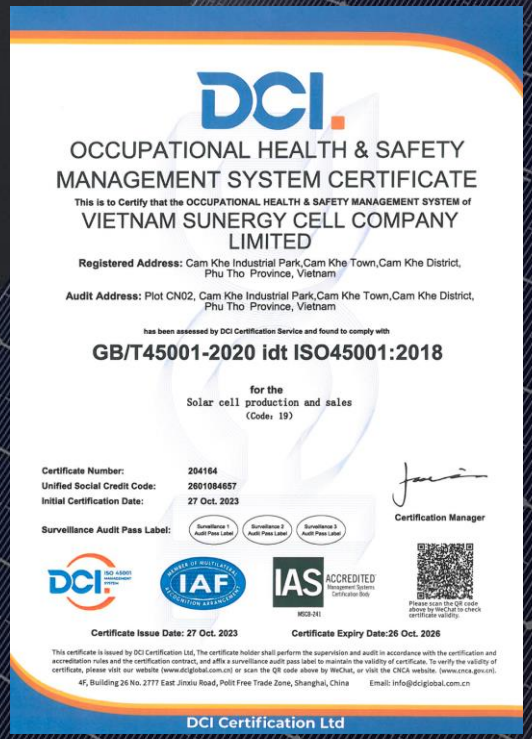
Surveillance Audit Pass Label:

Certification Manager

Certificate Issue Date: 27 Oct. 2023 Certificate Expiry Date:26 Oct. 2026

DCI Certification Ltd

ISO14001 Environment Management System Certification



DCI

OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEM CERTIFICATE

This is to Certify that the OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEM of

VIETNAM SUNERGY CELL COMPANY LIMITED

Registered Address: Cam Khe Industrial Park,Cam Khe Town,Cam Khe District, Phu Tho Province, Vietnam

Audit Address: Plot CN02, Cam Khe Industrial Park,Cam Khe Town,Cam Khe District, Phu Tho Province, Vietnam

has been assessed by DCI Certification Service and found to comply with

GB/T45001-2020 idt ISO45001:2018

for the

Solar cell production and sales

(Code：19)

Certificate Number: 204164

Unified Social Credit Code: 2601084657

Initial Certification Date: 27 Oct. 2023

Surveillance Audit Pass Label:

Certification Manager

Certificate Issue Date: 27 Oct. 2023 Certificate Expiry Date:26 Oct. 2026

DCI Certification Ltd

ISO45001 Occupational Health and Safety Management System Certification

ZRLK

CERTIFICATE OF CONFORMITY

RoHS Directive 2011/65/EU and (EU) 2015/863

Certificate No.: ZKS23005912

The following product has been tested by Dongguan ZRLK Testing Technology Co., Ltd. as specified complied with the requirements of RoHS Directive 2011/65/EU (RoHS 2.0) & Commission Delegated Directive (EU) 2015/863. It is possible to use CE marking to demonstrate the conformity with the RoHS Directive.

Applicant	:	Vietnam Sunergy Cell Company Limited Cam Khe Industrial Park, Cam Khe Town, Cam Khe District, Phu Tho Province, Vietnam
Manufacturer	:	Vietnam Sunergy Cell Company Limited Cam Khe Industrial Park, Cam Khe Town, Cam Khe District, Phu Tho Province, Vietnam
Sample Name	:	Solar cell
Sample Model	:	182M
Trade Name	:	TOYO SOLAR
Test Methods	:	IEC 62321-3-1:2013, IEC 62321-4:2013/AMD 1:2017, IEC 62321-5:2013, IEC 62321-6:2015, IEC 62321-7-1:2015, IEC 62321-7-2:2017, IEC 62321-8:2017.
Report No.	:	DSP23090261-1

The Declaration is issued after testing of the named product(s) and audit of the technical documentation and confirms that the tested product complies with the essential protection requirements of the mentioned directives on a voluntary basis. The statement is based on a single evaluation of one sample of above-mentioned products.

CE

Certification Body

Frank Feng / General Manager

Date: Sep 14, 2023

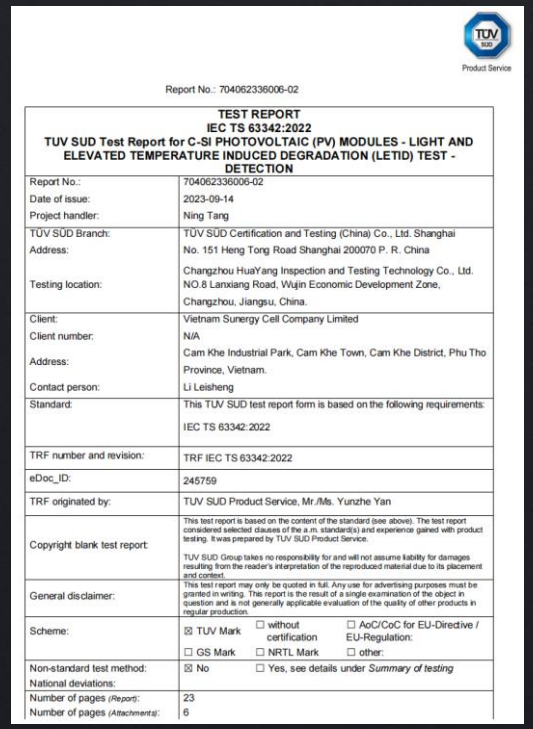
Dongguan ZRLK Testing Technology Co., Ltd

Building 2, No. 1, Technology 10th Road, Songshan Lake Park, Dongguan City, Guangdong Province.

Tel.: +86-0769-26621775 Fax.: +86-0769-26621775 Website: www.zrlklab.com

Environmental protection Certification

TEST REPORT

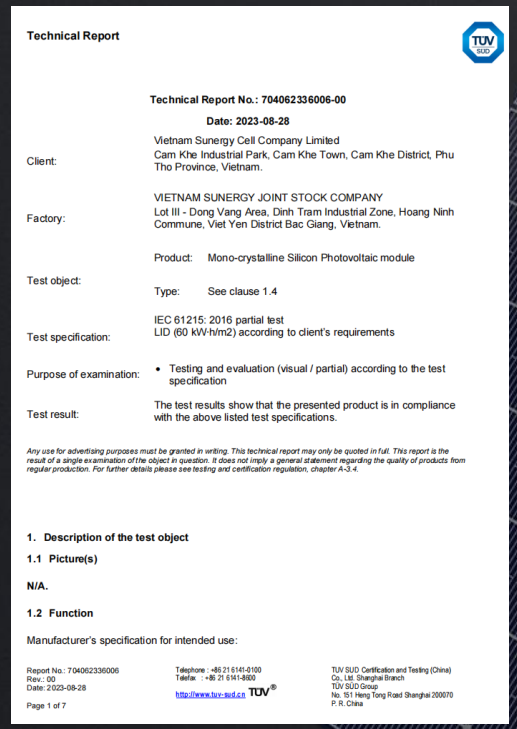


Report No.: 704062336006-02

TEST REPORT
IEC TS 63342:2022
TUV SUD Test Report for C-SI PHOTOVOLTAIC (PV) MODULES - LIGHT AND ELEVATED TEMPERATURE INDUCED DEGRADATION (LETID) TEST - DETECTION

Report No.:	704062336006-02
Date of issue:	2023-09-14
Project handler:	Ning Tang
TÜV SÜD Branch:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai
Address:	No. 151 Heng Tong Road Shanghai 200070 P. R. China
Testing location:	Changzhou HuaYang Inspection and Testing Technology Co., Ltd. NO.8 Lanxiang Road, Wujin Economic Development Zone, Changzhou, Jiangsu, China.
Client:	Vietnam Sunergy Cell Company Limited
Client number:	N/A
Address:	Cam Khe Industrial Park, Cam Khe Town, Cam Khe District, Phu Tho Province, Vietnam.
Contact person:	Li Leisheng
Standard:	This TUV SUD test report form is based on the following requirements: IEC TS 63342:2022
TRF number and revision:	TRF IEC TS 63342:2022
eDoc_ID:	245759
TRF originated by:	TUV SUD Product Service, Mr./Ms. Yunzhe Yan
Copyright blank test report:	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TUV SUD Product Service. TUV SUD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
General disclaimer:	This test report may only be quoted in full. Any use for advertising purposes must be granted in writing. This report is the result of a single examination of the object in question and is not generally applicable evaluation of the quality of other products in regular production.
Scheme:	☒ TUV Mark ☐ without certification ☐ AoC/CoC for EU-Directive / EU-Regulation: ☐ GS Mark ☐ NRTL Mark ☐ other:
Non-standard test method:	☒ No ☐ Yes, see details under *Summary of testing*
National deviations:	
Number of pages *(Report)*:	23
Number of pages *(Attachments)*:	6

LeTID report-TUV



Technical Report

Technical Report No.: 704062336006-00

Date: 2023-08-28

Client:	Vietnam Sunergy Cell Company Limited Cam Khe Industrial Park, Cam Khe Town, Cam Khe District, Phu Tho Province, Vietnam.
Factory:	VIETNAM SUNERGY JOINT STOCK COMPANY Lot III - Dong Vang Area, Dinh Tram Industrial Zone, Hoang Ninh Commune, Viet Yen District Bac Giang, Vietnam.
Test object:	Product: Mono-crystalline Silicon Photovoltaic module Type: See clause 1.4
Test specification:	IEC 61215: 2016 partial test LID (60 kW-h/m2) according to client's requirements
Purpose of examination:	• Testing and evaluation (visual / partial) according to the test specification
Test result:	The test results show that the presented product is in compliance with the above listed test specifications.

Any use for advertising purposes must be granted in writing. This technical report may only be quoted in full. This report is the result of a single examination of the object in question. It does not imply a general statement regarding the quality of products from regular production. For further details please see testing and certification regulation, chapter A-3.4.

1. Description of the test object

1.1 Picture(s)

N/A.

1.2 Function

Manufacturer's specification for intended use:

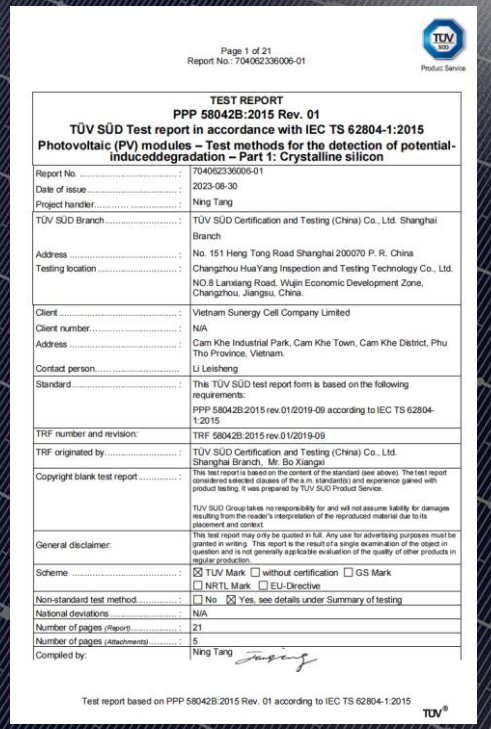
Report No.: 704062336006
Rev.: 00
Date: 2023-08-28

Page 1 of 7

Telephone : +86 21 6141-0100
Telefax : +86 21 6141-8600
http://www.tuv-sud.cn

TUV SUD Certification and Testing (China) Co., Ltd. Shanghai Branch
TÜV SÜD Group
No. 151 Heng Tong Road Shanghai 200070
P. R. China

LID_60kwh-IEC61215-TUV



Page 1 of 21
Report No.: 704062336006-01

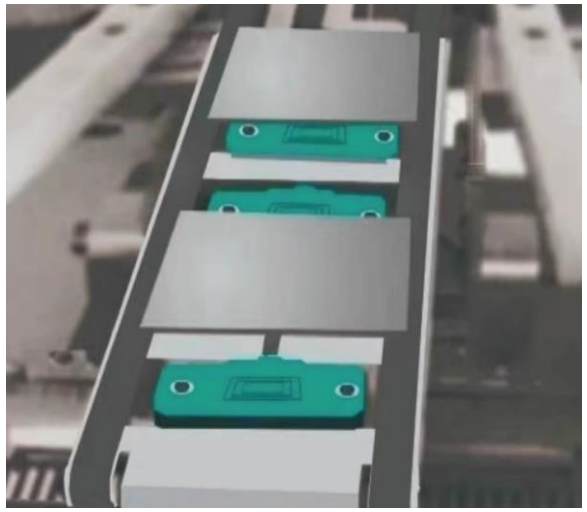
TEST REPORT
PPP 58042B:2015 Rev. 01
TÜV SÜD Test report in accordance with IEC TS 62804-1:2015
Photovoltaic (PV) modules – Test methods for the detection of potential-induceddegradation – Part 1: Crystalline silicon

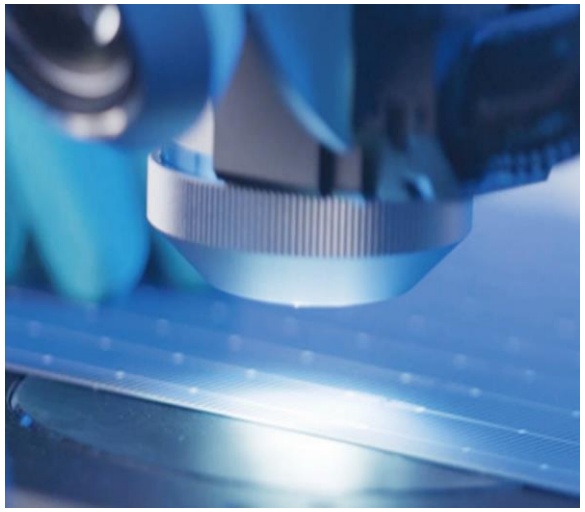
Report No.	704062336006-01
Date of issue	2023-08-30
Project handler	Ning Tang
TÜV SÜD Branch	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
Address	No. 151 Heng Tong Road Shanghai 200070 P. R. China
Testing location	Changzhou HuaYang Inspection and Testing Technology Co., Ltd. NO.8 Lanxiang Road, Wujin Economic Development Zone, Changzhou, Jiangsu, China.
Client	Vietnam Sunergy Cell Company Limited
Client number	N/A
Address	Cam Khe Industrial Park, Cam Khe Town, Cam Khe District, Phu Tho Province, Vietnam.
Contact person	Li Leisheng
Standard	This TÜV SÜD test report form is based on the following requirements: PPP 58042B:2015 rev.01/2019-09 according to IEC TS 62804-1:2015
TRF number and revision:	TRF 58042B:2015 rev.01/2019-09
TRF originated by	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch, Mr. Bo Xiangxi
Copyright blank test report	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TUV SUD Product Service. TUV SUD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
General disclaimer:	This test report may only be quoted in full. Any use for advertising purposes must be granted in writing. This report is the result of a single examination of the object in question and is not generally applicable evaluation of the quality of other products in regular production.
Scheme	☒ TUV Mark ☐ without certification ☐ GS Mark ☐ NRTL Mark ☐ EU-Directive
Non-standard test method	☐ No ☒ Yes, see details under Summary of testing
National deviations	N/A
Number of pages *(Report)*	21
Number of pages *(Attachments)*	5
Compiled by:	Ning Tang

Test report based on PPP 58042B:2015 Rev. 01 according to IEC TS 62804-1:2015

PID_192h-TUV

Comprehensive Quality System





Straight Raw Material Traceability and Supplier Governance

High standards and stringent requirements for managing qualified suppliers who provide materials.
High-precision testing equipment to monitor the quality of incoming materials, implement a comprehensive incoming inspection system.

Advanced Process Quality Management

Strict first piece control and key process inspection to monitor key process characteristics and product features through SPC. Advanced MES System for material traceability control.

Comprehensive Customer Service System

Established a comprehensive customer service system that comprises dedicated teams for pre-sales, during-sales, and after-sales support to ensure a seamless and efficient flow of information and a prompt response to customer needs throughout the entire process, from order review to delivery.

Comprehensive Quality System

Product Reliability Assurance

Ensure product reliability through real-time monitoring and testing of various reliability parameters, including Light-Induced Degradation (LID), Light and elevated Temperature Induced Degradation (LeTID), electrode adhesion, acetic acid, and boiling water tests.

Well-established System Processes

Obtained certifications for ISO 9001, ISO 14001, and ISO 45001.

Strict Control of Outgoing Product Quality

Implemented stringent controls to ensure the quality of our outgoing products. Every outgoing product undergoes a 100% inspection conducted by our Final Quality Control (FQC) team, guaranteeing the quality of the products before shipment.

Automative Production

01

High Automation

Electrification and IT-driven automation lead to highly automated production lines, reducing the need for manual labor

02

Advanced Equipment

Integration of upstream technologies and advanced equipment and facilities

03

Professional Staff

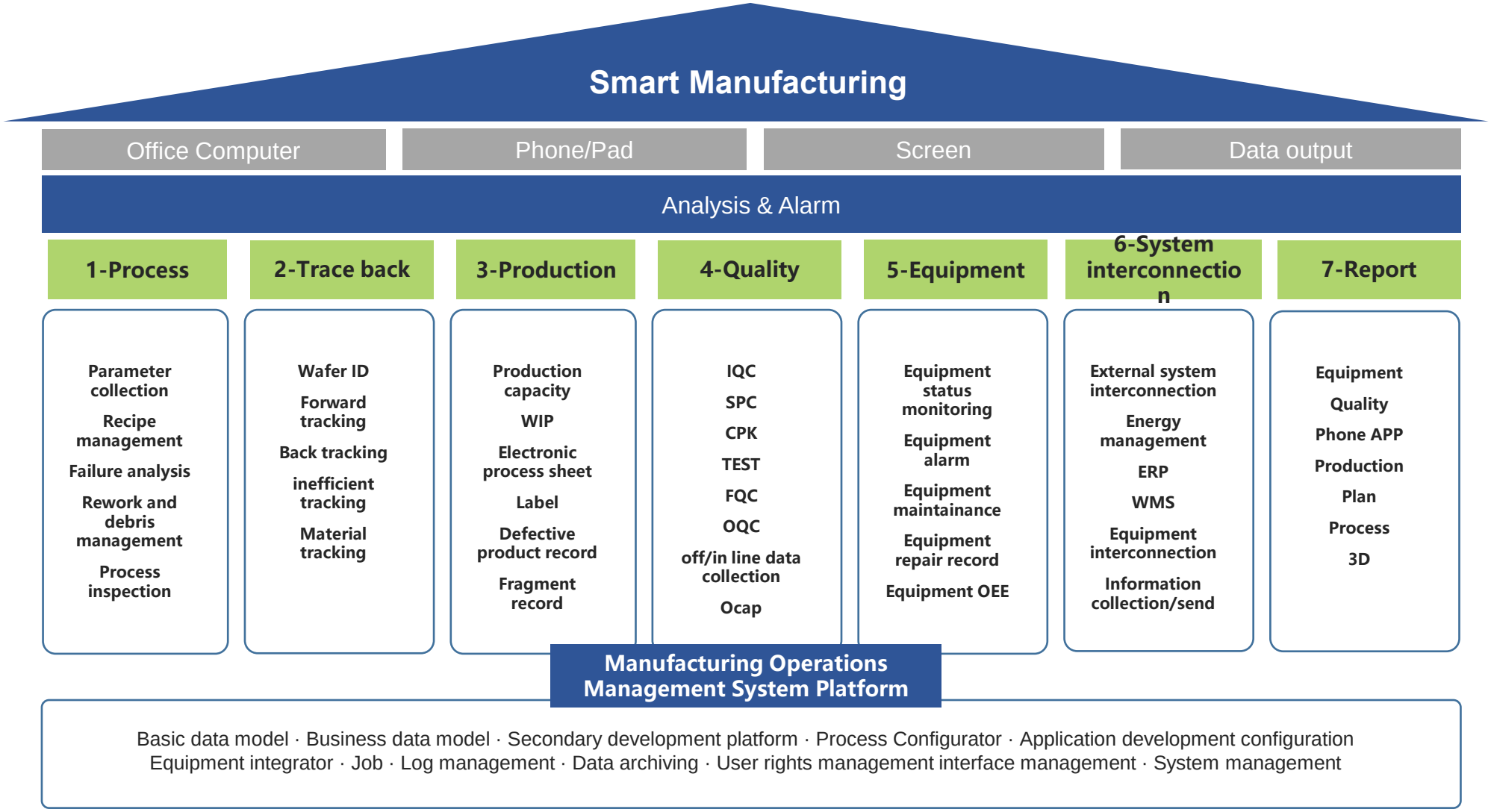
Professional and well-trained staff to address challenges

04

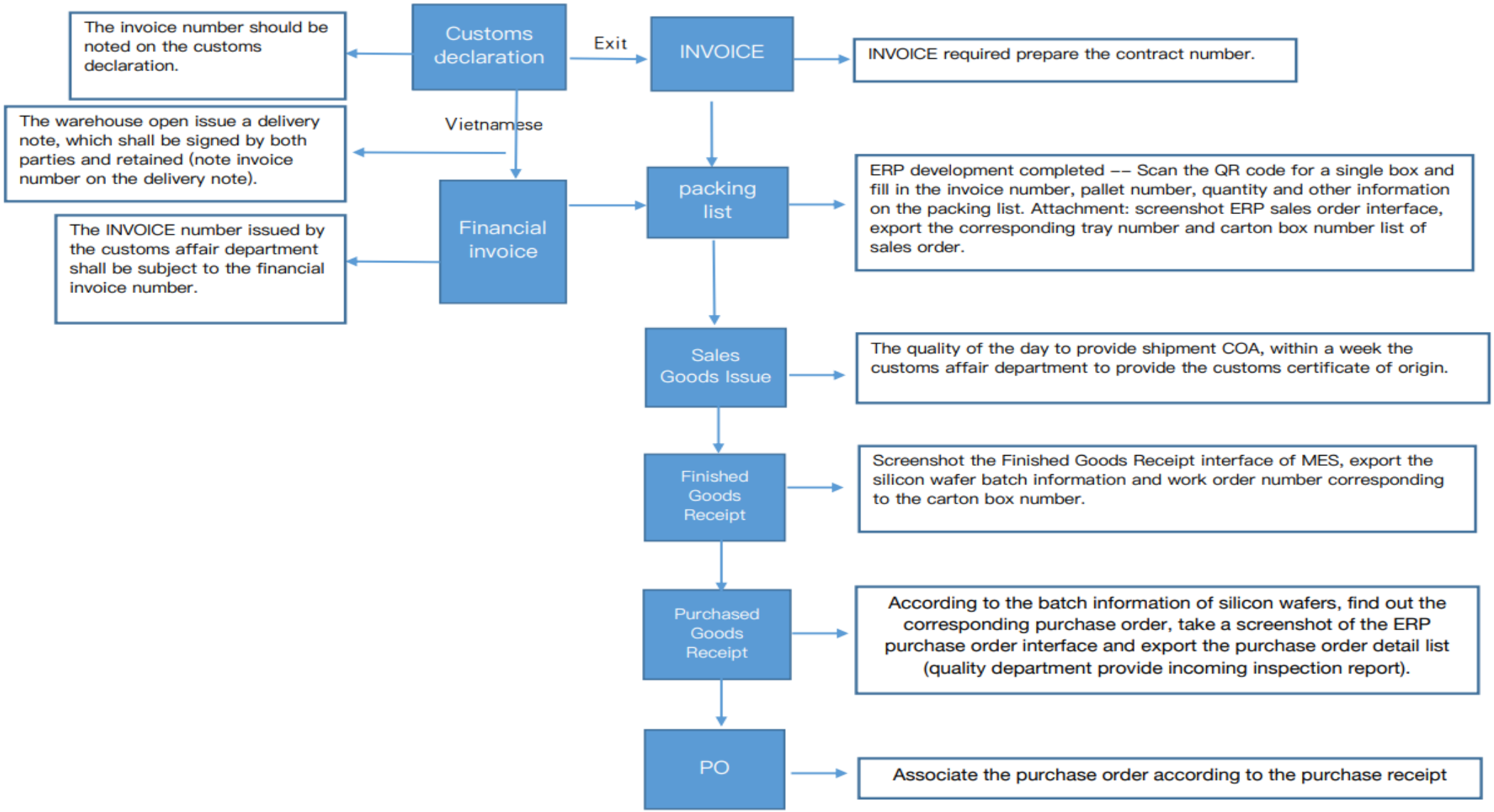
Smart Manufacturing

Intelligent systematic processing of big data to identify and optimize issue resolution

Complete Traceability Information for Client



Complete Traceability Information for Client



Company Engagement Activities and Staff Care

New Year Celebration

Care for Employees in need

Union Floral Event

International Women's Day Event

Christmas Celebration

Lunar New Year Celebration

Social Responsibility Management

RESPONSIBILITY COMMUNICATION

TOYO SOLAR places great emphasis on communicating with stakeholders, meeting the requirements and expecta-tions of stakeholders, and turning relevant requests into actionable social responsibility initiatives, strengthening its own capacity, and building multi-level and multi-directional communication channels. For example, TOYO SOLAR distributes its social responsibility reports via the Company’s corporate website and its WeChat public account and third-party media agencies, to communicate the concept of responsibility and related performance of the Company.

RESPONSIBILITY CONCEPT

TOYO SOLAR development is the result of support for renewable energy development from all over the world,customers’ favor for our products,and people’s awareness of green environment.TOYO SOLAR regards' Change the World with Solar 'as its mission,to continuously improve product quality and actively build a mutually beneficial ecological value system together with upstream and downstream customers,employees,government and society,etc.

Make the world better

TOYO SOLAR focuses on the development of the clean energy industry, adheres to the global supply chain strategy and customized services, and contributes to the sustainable development of human beings with more professional, efficient and cleaner products.

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