

TÜV Rheinland (Shanghai) Co., Ltd.
Solar/ Fuelcell Technology

Test Report

Photovoltaic Module Tests
according to Client's Requirements

TÜV Report No. CN22LXQI 004

Shanghai, February 2023

Test report No.: CN22LXQI 004		Page 2 / 10	
<i>Prüfbericht - Nr.:</i>			
Client (Customer No. +address): <i>Auftraggeber</i> <i>(Kunden-Nr. +Adresse):</i>		Trina Solar Co., Ltd. No. 2 TianHe Road, Trina PV Industrial Park, New District Changzhou City, 213031 Jiangsu P.R. China	
Test Item: <i>Gegenstand der Prüfung:</i>	Photovoltaic (PV) Module(s)	Date of receipt: <i>Eingangsdatum:</i>	N/A
Identification: <i>Bezeichnung:</i>	TSM-675NEG21C.20		
Order No.: <i>Auftragsnummer:</i>	244448906	Quotation No.: <i>Angebotsnummer:</i>	245783296
Testing location: <i>Prüfort:</i>	Tests were performed at the laboratory of Trina Solar Co., Ltd.		
Testing laboratory: <i>Prüfort:</i>	TÜV Rheinland (Shanghai) Co., Ltd. B1-13F No. 177, Lane 777, West Guangzhong Road, Zhabei District Shanghai 200072, P. R. China		
Test specification: <i>Prüfgrundlage:</i>	IEC 61215-2:2016		
Test Result: <i>Prüfergebnis:</i>	Refer to the verdict of the test report		
tested by / geprüft:		reviewed by / kontrolliert:	
 Project Engineer/ Daniel W.S.Wang		 Technical Reviewer/ Wen Yao Lu	
14.02.2023		14.02.2023	
Date <i>Datum</i>	Title/Name <i>Titel/Name</i>	Signature <i>Unterschrift</i>	Date <i>Datum</i>
Other Aspects / Sonstiges:			
N/A			
Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet		Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested	
<p>This test report relates to the listed test samples. Without permission of the test centre this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</p> <p>Dieser Prüfbericht bezieht sich nur auf die gelisteten Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</p>			



Table of Content

General information:	4
Sampling procedure.....	4
Module group assignment:	4
Tables	5
Visual inspection (accord. to IEC 61215-2:2016, MQT 01).....	5
Initial performance at STC (accord. to IEC 61215-2:2016, MQT 06.1).....	5
EL-images	5
Light Induced Degradation (LID)	5
Performance at STC after 60 kwh/m ² LID (accord. to IEC 61215-2:2016, MQT 06.1).....	6
EL-images after 60 kwh/m ² LID.....	6
Appendix 1: Measuring equipment and used software	7
Appendix 2: Statement of the estimated uncertainty of the test verdicts	7
Appendix 3: Photos of the modules.....	8
Appendix 4: EL-images of the modules	9

General information:

Pmpp	– Maximum power	Vmpp	– Maximum power voltage
Impp	– Maximum power current	Voc	– Open circuit voltage
Isc	– Short circuit current	FF	– Fill factor
STC	– Standard Test Conditions	EL	– Electroluminescence imaging
IV	– Current-voltage characteristics	LID	– Light Induced Degradation

Sampling procedure

<input type="checkbox"/>	Random sampling from production (e.g. during factory audit (FA) or inline inspection)
<input type="checkbox"/>	Random sampling from the warehouse, container or transportation boxes
<input checked="" type="checkbox"/>	Modules have been submitted by the manufacturer/ client without random sampling by TÜV Rheinland

Module group assignment:

Serial no.	Module type	Remarks / constructional characteristics	Type of extra connectors used*	Test item
A12221000100294	TSM-650NEG21C.20	Cut-cell mono c-Si module, 132 pcs	B	STC, EL, LID
A12221000100298				
Supplementary information: (*) A: Customer provided; B: TÜV Rheinland provided.				

Tables

Visual inspection (accord. to IEC 61215-2:2016, MQT 01)

Test Date [DD-MM-YYYY]	19-01-2023	—
Serial no.	Nature and position of initial findings	Verdict
A12221000100294	No visual defect	P
A12221000100298	No visual defect	P
Supplementary information: Refer to Appendix 3: Photos of the modules.		

Initial performance at STC (accord. to IEC 61215-2:2016, MQT 06.1)

Test Date [DD-MM-YYYY]		19-01-2023				—
Test method		<input checked="" type="checkbox"/> indoor		<input type="checkbox"/> outdoor		—
Irradiance [W/m²]		1000				—
Module temperature [°C].....		25				—
Serial no.	Pmpp [W]	Vmpp [V]	Impp [A]	Voc [V]	Isc [A]	FF [%]
A12221000100294_Front	675.3	39.42	17.132	47.15	18.039	79.4
A12221000100294_Rear	530.5	39.83	13.318	46.76	14.622	77.6
A12221000100298_Front	673.7	39.33	17.128	47.01	18.075	79.3
A12221000100298_Rear	524.2	39.82	13.166	46.66	14.102	79.7
Supplementary information: N/A						

EL-images

Test Date [DD-MM-YYYY]	19-01-2023	—
Current applied	Isc ± 5%	—
Serial no.	Remarks	—
A12221000100294	N/A	—
A12221000100298	N/A	—
Supplementary information: Refer to Appendix 4: EL-images.		

Light Induced Degradation (LID)

Test Date [DD-MM-YYYY] start – end	19-01-2023 ~ 13-02-2023	—
Total irradiation [kWh/m²]	60	—
Serial no.	—	—
A12221000100294	—	—
A12221000100298	—	—

Supplementary information: According to client's request, Light soaking was performed under steady state simulator with short circuit condition according to an irradiation level of 60 kWh/m².

Performance at STC after 60 kWh/m² LID (accord. to IEC 61215-2:2016, MQT 06.1)

Test Date [DD-MM-YYYY]			13-02-2023				—
Test method			<input checked="" type="checkbox"/> indoor		<input type="checkbox"/> outdoor		—
Irradiance [W/m²]			1000				—
Module temperature [°C].....			25				—
Serial no.	Pmpp [W]	Vmpp [V]	Ipp [A]	Voc [V]	Isc [A]	FF [%]	Change on Pmpp [%]
A12221000100294_Front	678.1	39.57	17.137	47.40	18.021	79.39	0.41%
A12221000100294_Rear	534.4	40.10	13.325	47.02	14.334	79.3	0.74%
A12221000100298_Front	669.9	39.57	16.927	47.31	17.776	79.7	-0.56%
A12221000100298_Rear	530.5	40.32	13.157	46.96	14.261	79.2	1.20%
Supplementary information: N/A							

EL-images after 60 kWh/m² LID

Test Date [DD-MM-YYYY]		13-02-2023	—
Current applied.....		Isc ± 5%	—
Serial no.	Remarks		—
A12221000100294	N/A		—
A12221000100298	N/A		—
Supplementary information: Refer to Appendix 4: EL-images.			

Appendix 1: Measuring equipment and used software

Main Measuring equipment

Device	Index no	Measured variable	Application
Insulation measuring instrument	ZK001890 TS-PVTC-R252, ZK001891 TS-PVTC-R253	Current, resistance	Insulation and leakage current test
Steady Solar simulator	SUN2500 XE091105-1/ TS-PVTC-R033	Current, voltage, irradiance	Solar simulator measurements

Appendix 2: Statement of the estimated uncertainty of the test verdicts

- The verdicts of performance rating are only related to the test samples that were subjected to the tests. They cannot be generalised to the modules from the series production.
- The STC measurement was performed with a steady solar simulator of Class ABA according to IEC60904-9:2007.

Appendix 3: Photos of the modules



Fig. 1: front view of module type
TSM-565NEG21C.20



Fig. 2: rear view of module type
TSM-565NEG21C.20



Fig. 3: rating label of module type TSM-565NEG21C.20



Fig. 4: junction box of module type TSM-565NEG21C.20

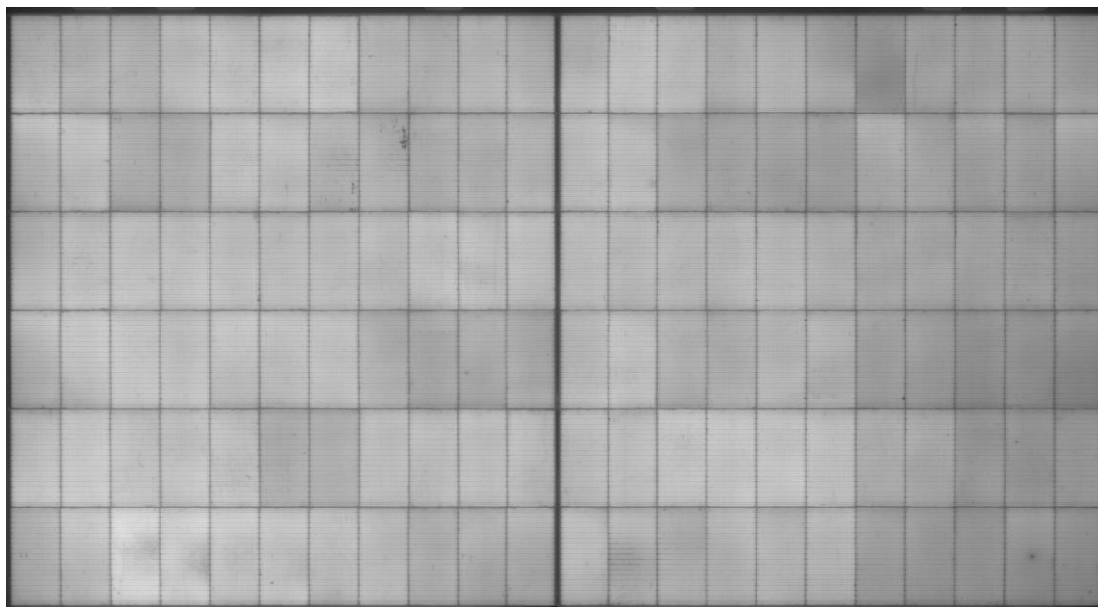
Appendix 4: EL-images of the modules

Fig. 5: EL-images initial (sample 1)

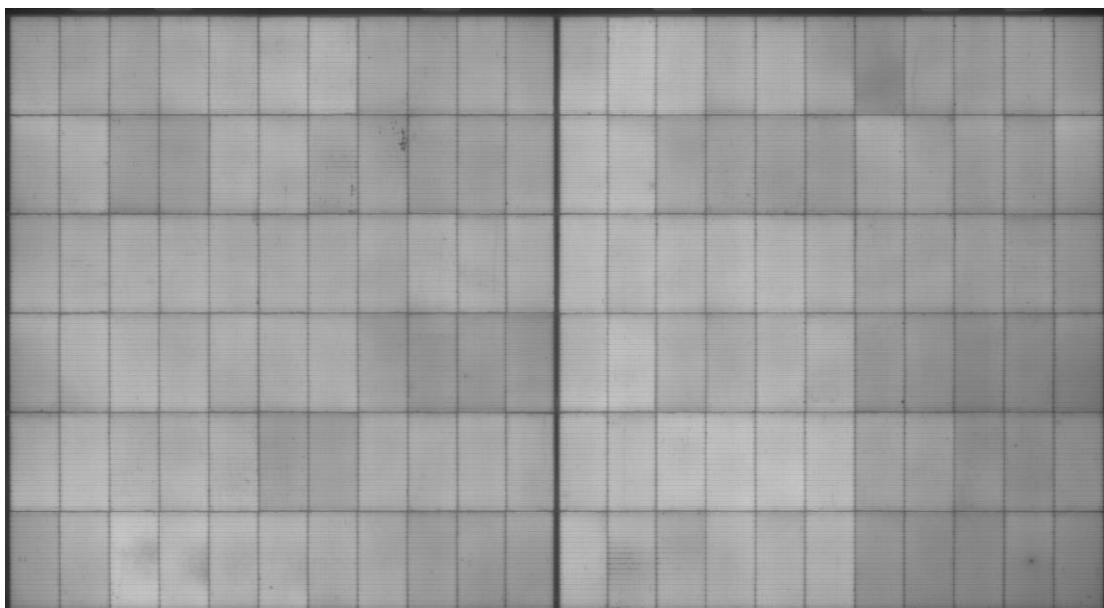


Fig. 6: EL-images after 60kwh/m² LID (sample 1)

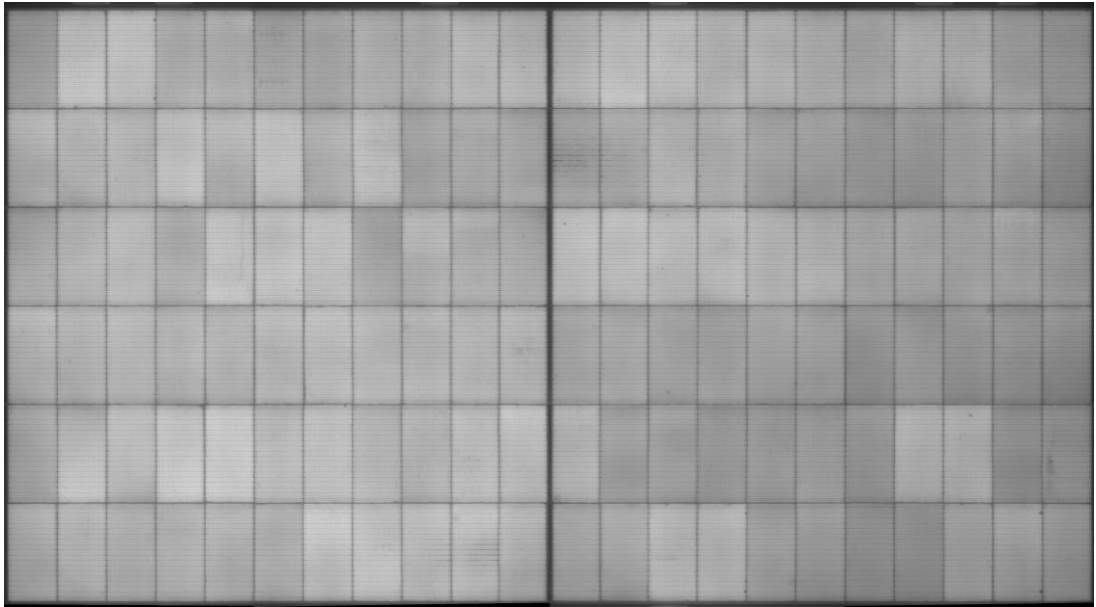


Fig. 7: EL-images initial (sample 2)

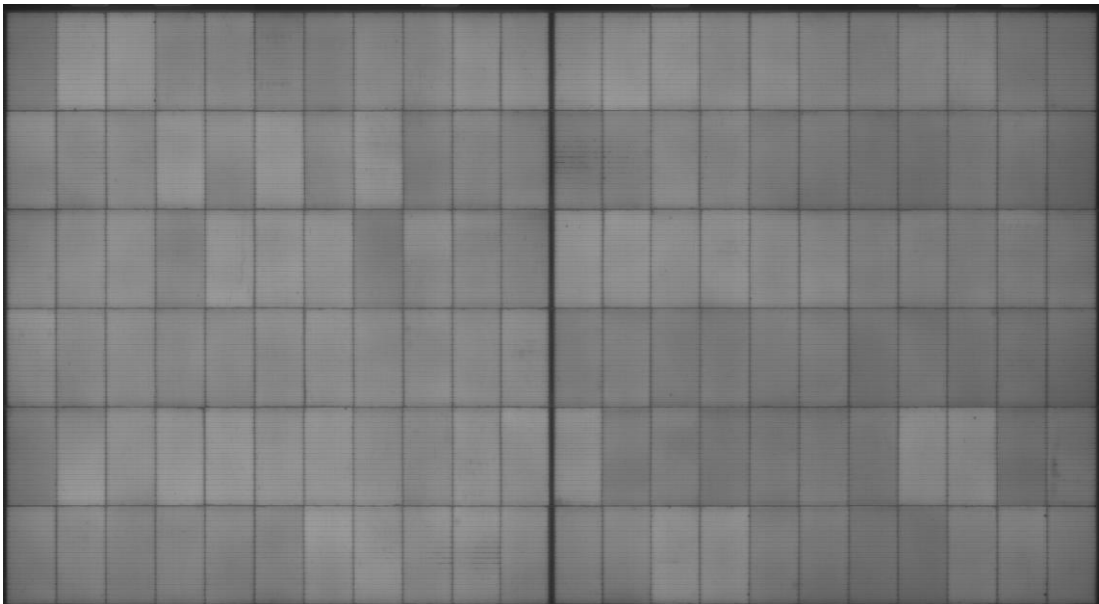


Fig. 8: EL-images after 60kWh/m² LID (sample 2)

End of Test Report