

Test Report September 20, 2024

Validated PAN File LONGI Bifacial Module LR5-72HBD-545M



Issued by:

Renewable Energy Test Center (RETC) 46457 Landing Parkway Fremont, CA 94538

Issued to:

Dr. Hongbin FangHead of Production Solutions



RETC Validated PAN File for LONGI LR5-72HBD-545M

Parametric Testing per IEC 61853-1 Incident Angle Modifier per IEC 61853-2

Tested Product Configuration

Product	Description	Model Number	ВОМ	Qty	Remark
Module	144-Half Cell Bifacial PERC PV Module	LR5-72HBD-545M (V4)	5	4	Engineering

Applicable Models	LR5-72HBD-xxxM (V4)	LR5-72HBD-xxxM (V6)		
Module Dimensions (LxWxH):	2278 x 1134 x 30 mm	2256 x 1133 x 35 mm		
Single Cell Dimensions (LxW):	182 x 91.8 mm	182 x 91 mm		
Module Weight:	31.8 Kg	32.3 Kg		

PAN File Generation: (V4): LR5-72HBD-545M

PAN File Extrapolation: (V4): LR5-72HBD-540M, LR5-72HBD-550M, LR5-72HBD-555M, LR5-72HBD-560M, LR5-72HBD-565M

(V6): LR5-72HBD-535M, LR5-72HBD-540M, LR5-72HBD-545M, LR5-72HBD-550M

Client	Company	LONGi Green Energy Technology Co., Ltd. No. 388, Middle Hangtian Road Chang'an District, Xi'an, Shaanxi 710100, P.R. China
ij	Contact Person	Dr. Hongbin Fang Head of Product Solutions Email: hbfang@longi.com

Site	Associated Test Laboratory	Jiaxing, Zhejiang China
Test Si	Contact Person	Manpreet Kaur Project Manager O: 510-226-1635 – F: 510-952-4351 Email: manpreet@retc-ca.com

Reviewed by:	Angel	ico Siason	Sulvani			
Samples Received:			7/13/2023			
Test Date (Start/End):		10/23/2023 – 2/21/2024				
rest Date (Start/Ellu):	9/19/2024					
	V1.0	2/27/2024	Report Issuance			
Submission Date:	V2.0	V2.0 8/01/2024 Additional PAN File Extrapolations for Applicable Model V6				
Submission Date:	V3.0	8/29/2024	Additional PAN File Extrapolation for 535W Model V6			
	V4.0	9/21/2024	IAM Retest on coupon samples, PAN Files Updated			

This report shall not be reproduced except in full, without written approval of the laboratory. No modifications are allowed. The results were obtained by following standard laboratory procedures and per the international standards listed in the test plan. The results in this report are only representative of the samples provided by the manufacturer and as received by RETC.



Table of Contents

1	Test	Flow	. 4
2		ple Allocation	
3		ple Selection and Traceability	
4		Results	
2	1.1	Initial Visual Inspection	
	4.1.1	·	
2	1.2	Electroluminescence	. 8
	4.2.1	LRI-294-B	. 8
	4.2.2	2 LRI-294-C	. 8
	4.2.3	3 LRI-294-D	. :
4	1.3	Measurement of Temperature Coefficients	1(
4	1.4	Maximum Power Determination	12
	4.4.1	% Degradation	12
	4.4.2	Performance Graph	13
4	1.5	Performance at Multi-Irradiances, 25°C	14
2	1.6	Performance at Multi-Irradiances, 15°C	15
4	1.7	Performance at Multi-Irradiances, 50°C	16
4	1.8	Performance at Multi-Irradiances, 75°C	17
4	1.9	Performance at LTC, LIC, HTC	18
4	1.10	Bifaciality Factor	18
4	1.11	Incident Angle Modifier	19
	4.11.	.1 IAM Polynomial Regression Variables	20
	4.11.	.2 IAM Polynomial Regression Variables Definitions	20
4	1.12	PAN File Creation	2:
	4.12.	.1 LR5-72HBD-545M (V4) PAN File	2:
2	1.13	PAN File Extrapolation	22
	4.13.	.1 LR5-72HBD-540M (V4) PAN File	22
	4.13.	.2 LR5-72HBD-550M (V4) PAN File	23
	4.13.	.3 LR5-72HBD-555M (V4) PAN File	24
	4.13.	.4 LR5-72HBD-560M (V4) PAN File	25
	4.13.	.5 LR5-72HBD-565M (V4) PAN File	26
	4.13.	.6 LR5-72HBD-535M (V6) PAN File	27
	4.13.	.7 LR5-72HBD-540M (V6) PAN File	28
	4.13.	.8 LR5-72HBD-545M (V6) PAN File	29
	4.13.	.9 LR5-72HBD-550M (V6) PAN File	30
Anı	nex 1:	List of measurement equipment	3:
Anı	nex 2:	Statement of the estimated uncertainty of the test results	32
Αb	out RE	TC	33





Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

1 Test Flow

		LRI-294				LRI-361
Standard	Station	A	В	С	D	A
ENG	Electroluminescence		✓	✓	✓	
IEC 61215:2021	Visual Inspection		✓	✓	✓	
IEC 61215:2021	Maximum Power Determination (MNF)	✓	✓	✓	✓	
IEC 61215:2021	Maximum Power Determination (MNB)		✓	✓	✓	
IEC 61215:2021	LS1 40 kWh/m ² - Light Soak Stabilization		✓	✓	✓	
IEC 61215:2021	Maximum Power Determination (MNF)	✓	✓	✓	✓	
IEC 61215:2021	LS2 20 kWh/m ² - Light Soak Stabilization		✓	✓	✓	
IEC 61215:2021	Maximum Power Determination (MNF)	✓	✓	✓	✓	
IEC 61215:2021	Maximum Power Determination (MNB)		✓	✓	✓	
IEC 61853	Measurement of Temperature Coefficients		✓			
IEC 61853	Multi-Irradiances @15C		✓	✓	✓	
IEC 61853	Multi-Irradiances @25C		✓	✓	✓	
IEC 61853	Multi-Irradiances @50C		✓	✓	✓	
IEC 61853	Multi-Irradiances @75C		✓	✓	✓	
IEC 61853	AOI Measurement					✓
IEC 61853	IAM Computation					✓
IEC 61853	PAN File Creation		✓	✓	✓	✓

^{✓:} Denotes Test Completed

Notes:

- 1. **Mono-Front (MNF)** is a flash test where the rear side of the module is blocked with an opaque cover and the front side is exposed to the light source. This test is used to measure the font side mono-facial performance.
- 2. **Mono-Back (MNB)** is a flash test where the front side of the module is blocked with an opaque cover and the backside of the module is exposed to the light source. This is used to measure the mono-facial performance of the backside of the module with no contributions from the front.





Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

2 Sample Allocation

Sample ID	Module ID	Model Number	Test
LRI-294-A	LRRI04139230618700009		Control
LRI-294-B	LRRI04139230618700010	LR5-72HBD-545M	Multi-Irr, Multi-Temp, Tempco
LRI-294-C	LRRI04139230618700011	(V4) (BOM-5)	Multi-Irradiances at Multi-Temperatures
LRI-294-D	LRRI04139230618700013		Multi-Irradiances at Multi-Temperatures
LRI-361-A	LRRI00139240900300001	LR5-72HBD (V4) Coupon	AOI/IAM

3 Sample Selection and Traceability

	Sampling Oversight Details					
Scope of Work	PV Module Sampling					
Sampling Dates	June 26 to June 29, 2023					
Inspector	Tracy Feng PI Berlin (Shanghai) Co., Ltd.					
Module Sampling Location	No. 8369 Shangyuan Road, Caotan Eco-industrial Park, Xi'an Economic and Technological Development Zone, Xi'an, Shannxi, 710100 China					
Report #	RETC-LON-018					
Report BOM Reference	BOM-5 V4					

C-CS-2306-LRI-294

LONGi Green Energy Technology Co., Ltd.



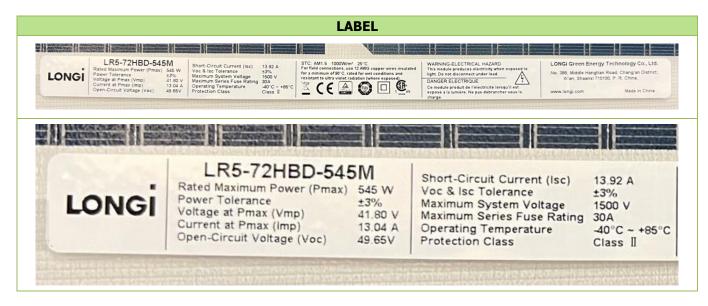
Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4 Test Results

4.1 Initial Visual Inspection

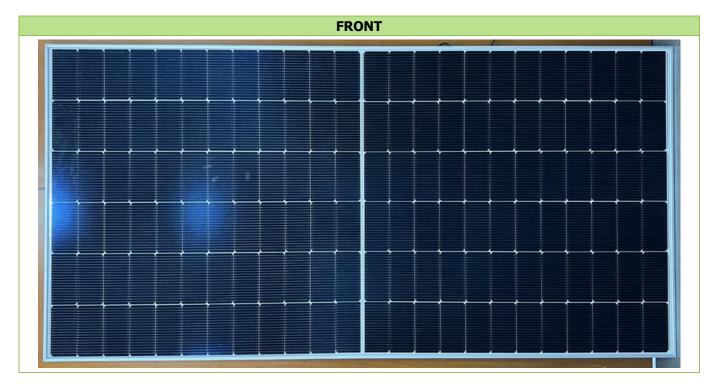
Note: Representative Photos

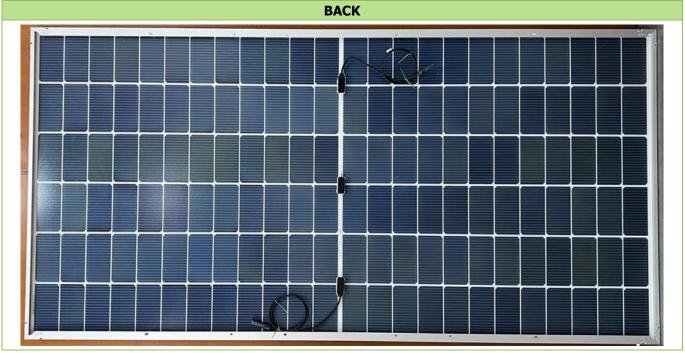
Initial [T0]: No major visual defects observed as per IEC 61215





4.1.1 Visual Inspection – continued

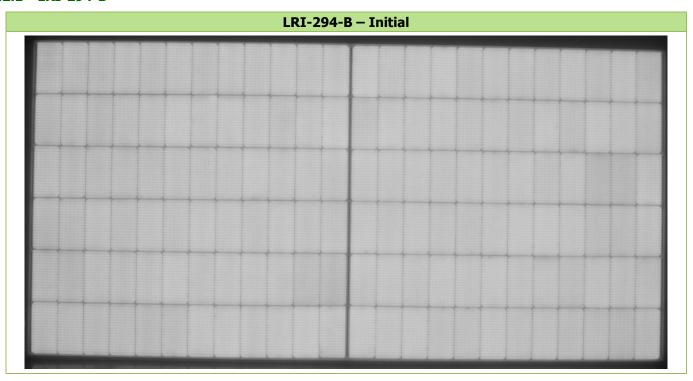




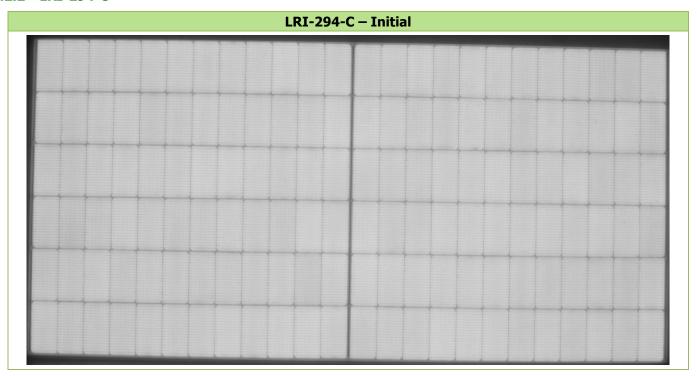


4.2 Electroluminescence

4.2.1 LRI-294-B

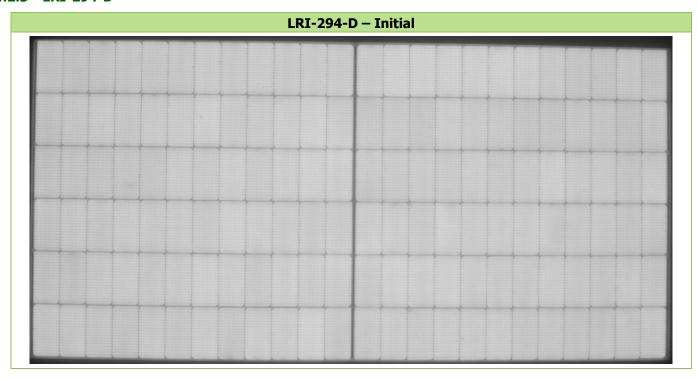


4.2.2 LRI-294-C





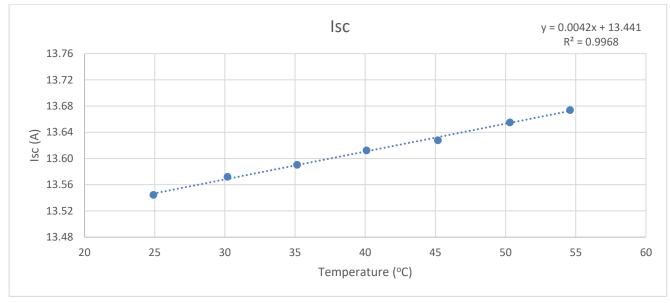
4.2.3 LRI-294-D

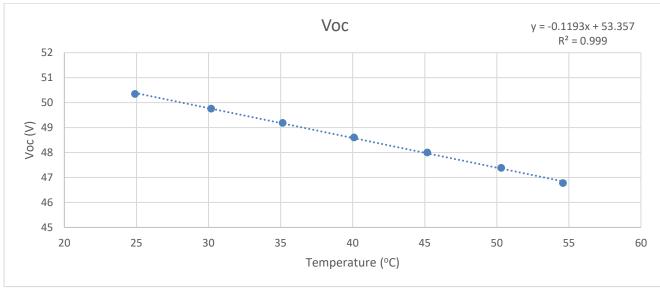




4.3 Measurement of Temperature Coefficients

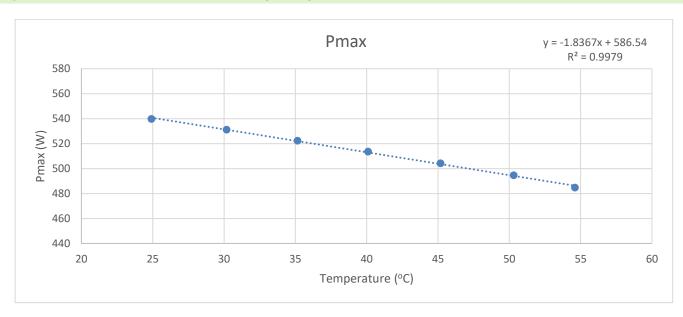
Radiant source		nulator, 🗌 Natural sunlight		
Irradiance at which the measure	ments were made (W/m²)	1000		
Range of module temperature (nigh/low) (°C):	54.60 / 24.91		
Parameter	Sample ID	Calculated Value		
Current: a (%/°C)		0.031		
Voltage: B (%/°C)	LRI-294-B	-0.237		
Peak power: δ (%/C)		-0.340		







Project: PAN File Creation: LR5-72HBD-545M (BOM-5)





4.4 Maximum Power Determination

Note: Values are normalized to a Stable Control Sample (LRI-294-A)

Total accumulated Light Soak irradiance: 60 kWh/m²

Sample ID	Sequence (Post)	Method	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmax (W)	FF (%)
	Tnitial	MNF	50.391	42.438	13.652	12.900	547.474	79.582
	Initial	MNB	49.850	42.348	10.309	9.588	406.026	79.010
LRI-294-B	LS1	MNF	50.475	42.510	13.751	12.868	547.008	78.811
	LS2	MNF	50.481	42.576	13.654	12.852	547.171	79.383
	L52	MNB	49.930	<i>43.006</i>	10.270	<i>9.435</i>	405.779	79.133
	Initial	MNF	50.403	42.438	13.738	12.936	548.987	79.282
	Illitial	MNB	49.899	42.880	<i>10.348</i>	9.497	407.236	78.864
LRI-294-C	LS1	MNF	50.484	42.528	13.794	12.896	548.436	78.756
	1.63	MNF	50.460	42.567	13.695	12.875	548.059	79.310
	LS2	MNB	49.910	<i>42.511</i>	10.308	<i>9.544</i>	405.712	78.862
	Toitial	MNF	50.369	42.417	13.697	12.890	546.731	79.248
	Initial	MNB	49.839	42.827	10.281	9.470	405.565	79.153
LRI-294-D	LS1	MNF	50.461	42.501	13.758	12.862	546.665	78.742
	LS2	MNF	50.460	42.564	13.668	12.843	546.662	79.265
	LSZ	MNB	49.915	43.494	10.251	9.305	404.719	79.098

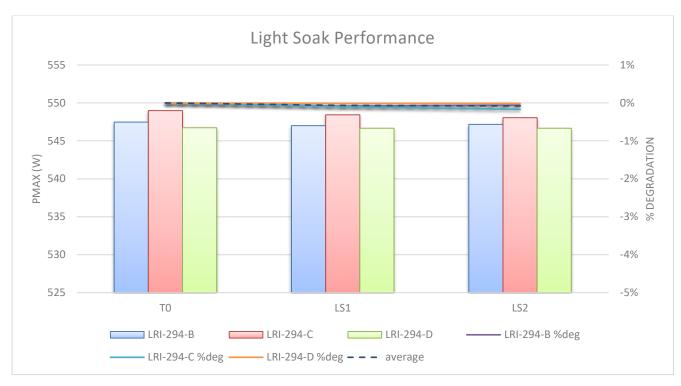
4.4.1 % Degradation

Sample ID	Sequence (Post)	Method	Voc	Vmp	Isc	Imp	Pmax	FF
	LS1	MNF	0.17%	0.17%	0.72%	-0.25%	-0.09%	-0.97%
LRI-294-B	LCO	MNF	0.18%	0.32%	0.02%	-0.38%	-0.06%	-0.25%
	LS2	MNB	0.16%	1.55%	-0.38%	-1.59%	-0.06%	0.16%
	LS1	MNF	0.16%	0.21%	0.41%	-0.31%	-0.10%	-0.66%
LRI-294-C	1.63	MNF	0.11%	0.31%	-0.32%	-0.47%	-0.17%	0.04%
	LS2	MNB	0.02%	-0.86%	-0.39%	0.49%	-0.37%	0.00%
	LS1	MNF	0.18%	0.20%	0.45%	-0.21%	-0.01%	-0.64%
LRI-294-D	LCO	MNF	0.18%	0.35%	-0.22%	-0.36%	-0.01%	0.02%
	LS2	MNB	0.15%	1.56%	-0.29%	-1.74%	-0.21%	-0.07%

Average % degradation: post-LS1 = -0.07% (MNF); post-LS2 = -0.08% (MNF), -0.21% (MNB)



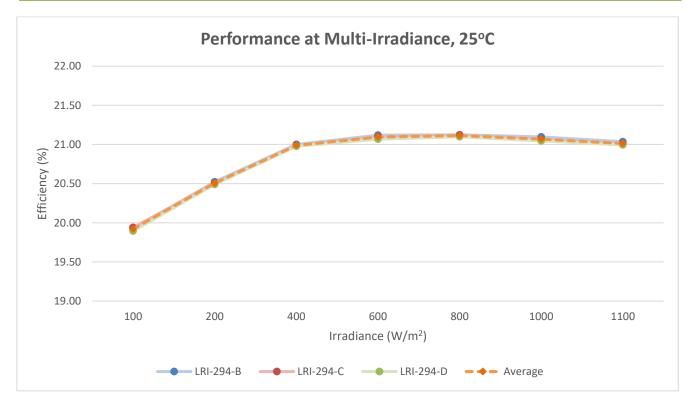
4.4.2 Performance Graph





4.5 Performance at Multi-Irradiances, 25°C

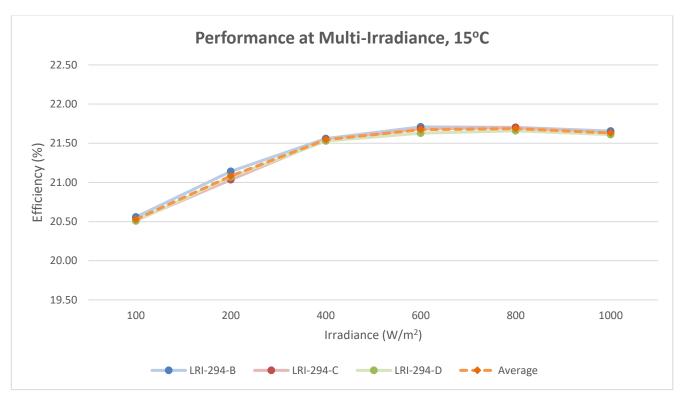
Sample ID	IRR (W/m²)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmax (W)	FF (%)	Eff (%)
	100	46.081	39.833	1.362	1.292	51.472	81.983	19.925
	200	47.475	40.577	2.721	2.613	106.027	82.068	20.522
	400	48.815	41.741	5.460	5.199	216.993	81.415	21.000
LRI-294-B	600	49.586	41.892	8.174	7.814	327.337	80.763	21.119
	800	50.125	41.869	10.892	10.426	436.534	79.957	21.123
	100 46.081 39.833 1.362 1.292 51.472 81.983 200 47.475 40.577 2.721 2.613 106.027 82.068 400 48.815 41.741 5.460 5.199 216.993 81.415 800 50.125 41.869 10.892 10.426 436.534 79.957 1000 50.543 42.204 13.622 12.913 544.962 79.152 1100 50.720 42.350 14.977 14.114 597.728 78.689 1000 47.491 40.588 2.720 2.610 105.937 82.023 400 48.838 41.746 5.452 5.195 216.862 81.451 800 50.148 41.874 10.881 10.423 436.471 79.989 1000 50.559 42.221 13.595 12.888 544.141 79.167 1100 50.736 42.364 14.952 14.092 596.997 78.699 1000 50.5736 42.364 14.952 14.092 596.997 78.699 1000 46.067 39.831 1.363 1.290 51.394 81.877 200 47.463 40.568 2.716 2.609 105.860 82.109 400 48.794 41.705 5.448 5.198 216.764 81.540 400 48.794 41.705 5.448 5.198 216.764 81.540 400 49.558 41.870 8.157 7.799 326.551 80.779 800 50.102 42.333 10.875 10.300 436.008 80.019 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 1000 50.519 42.206 13.589 12.881 543.654 79.190 10000 50.519 42.206 13.589 12.881 543.654 79.190 10000 50.519 42.206 13.	79.152	21.096					
		50.720	42.350	14.977	14.114	597.728	78.689	21.035
	100	46.102	39.863	1.364	1.292	51.509	81.911	19.940
LRI-294-C	200	47.491	40.588	2.720	2.610	105.937	82.023	20.505
	400	48.838	41.746	5.452	5.195	216.862	81.451	20.987
LRI-294-C	600	49.601	41.906	8.158	7.803	327.011	80.818	21.098
	800	50.148	41.874	10.881	10.423	436.471	79.989	21.120
	1000	50.559	(v) (A) (W) (%) 81 39.833 1.362 1.292 51.472 81.983 75 40.577 2.721 2.613 106.027 82.068 15 41.741 5.460 5.199 216.993 81.415 86 41.892 8.174 7.814 327.337 80.763 25 41.869 10.892 10.426 436.534 79.957 43 42.204 13.622 12.913 544.962 79.152 20 42.350 14.977 14.114 597.728 78.689 02 39.863 1.364 1.292 51.509 81.911 91 40.588 2.720 2.610 105.937 82.023 38 41.746 5.452 5.195 216.862 81.451 01 41.906 8.158 7.803 327.011 80.818 48 41.874 10.881 10.423 436.471 79.989 59 <t< td=""><td>79.167</td><td>21.064</td></t<>	79.167	21.064			
	1100	50.736	42.364	14.952	14.092	596.997	6.993 81.415 7.337 80.763 6.534 79.957 4.962 79.152 7.728 78.689 509 81.911 5.937 82.023 6.862 81.451 7.011 80.818 6.471 79.989 4.141 79.167 6.997 78.699 394 81.877 5.860 82.109 6.764 81.540 6.551 80.779 6.008 80.019 3.654 79.190	21.009
	100	46.067	39.831	1.363	1.290	51.394	81.877	19.895
	200	47.463	40.568	2.716	2.609	105.860	82.109	20.490
	400	48.794	41.705	5.448	5.198	216.764	81.540	20.978
LRI-294-D	600	49.558	41.870	8.157	7.799	216.993 81.415 327.337 80.763 436.534 79.957 544.962 79.152 597.728 78.689 51.509 81.911 105.937 82.023 216.862 81.451 327.011 80.818 436.471 79.989 544.141 79.167 596.997 78.699 51.394 81.877 105.860 82.109 216.764 81.540 326.551 80.779 436.008 80.019 543.654 79.190	21.068	
	100 46.102 39.863 1.364 1.292 51.509 81.911 200 47.491 40.588 2.720 2.610 105.937 82.023 400 48.838 41.746 5.452 5.195 216.862 81.451 600 49.601 41.906 8.158 7.803 327.011 80.818 800 50.148 41.874 10.881 10.423 436.471 79.989 1000 50.559 42.221 13.595 12.888 544.141 79.167 1100 50.736 42.364 14.952 14.092 596.997 78.699 100 46.067 39.831 1.363 1.290 51.394 81.877 200 47.463 40.568 2.716 2.609 105.860 82.109 400 48.794 41.705 5.448 5.198 216.764 81.540 600 49.558 41.870 8.157 7.799 326.551 80.779 800 50.102 42.333 10.875 10.300 436.008 80.019 <td>21.098</td>	21.098						
	1000	50.519	42.206	.577 2.721 2.613 106.027 82.068 .741 5.460 5.199 216.993 81.415 .892 8.174 7.814 327.337 80.763 .869 10.892 10.426 436.534 79.957 .204 13.622 12.913 544.962 79.152 .350 14.977 14.114 597.728 78.689 .863 1.364 1.292 51.509 81.911 .588 2.720 2.610 105.937 82.023 .746 5.452 5.195 216.862 81.451 .906 8.158 7.803 327.011 80.818 .874 10.881 10.423 436.471 79.989 .221 13.595 12.888 544.141 79.167 .364 14.952 14.092 596.997 78.699 .831 1.363 1.290 51.394 81.877 .568 2.716 2.609 105.860 82.109	79.190	21.045		
	1100	50.696	42.333	14.942	14.092	596.568	78.755	20.994





4.6 Performance at Multi-Irradiances, 15°C

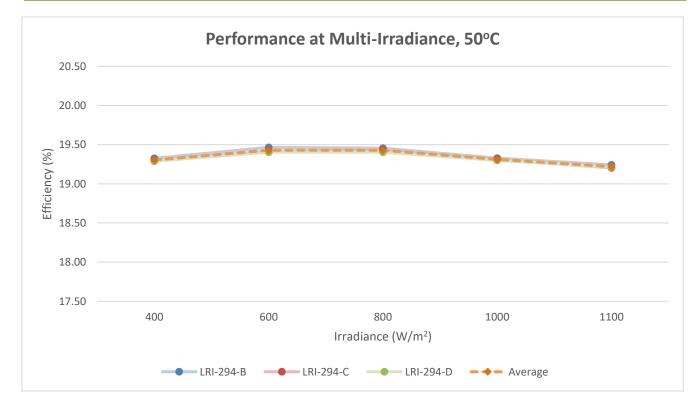
Sample ID	IRR (W/m²)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmax (W)	FF (%)	Eff (%)
	100	47.357	40.942	1.355	1.297	53.108	82.750	20.558
100	2.596	109.219	83.005	21.140				
LDT 204 P	Columbia	82.096	21.560					
LR1-294-D	600	50.731	43.364	8.134	7.760	336.485	81.546	21.709
LRI-294-B 100 47.357 40.942 1.355 1.297 53.108 8 200 48.638 42.073 2.705 2.596 109.219 8 400 49.957 42.696 5.432 5.218 222.783 8 800 51.213 43.364 8.134 7.760 336.485 8 800 51.213 43.274 10.845 10.364 448.498 8 1000 51.611 43.091 13.554 12.983 559.435 7 100 47.349 40.942 1.356 1.295 53.002 8 200 48.613 42.038 2.701 2.585 108.670 8 400 50.005 43.226 5.419 5.150 222.610 8 400 50.772 43.399 8.113 7.743 336.058 8 8 8 1000 51.632 43.113 13.526 12.958 558.655 7 100 47.270 40.909 1.355 1.295 52.977 8 200 48.671 42.103 2.698 2.585 108.856 8 400 49.898 42.649 5.420 5.216 222.461 8 400 49.898 42.649 5.420 5.216 222.461 8 400 49.898 42.649 5.420 5.216 222.461 8 400 49.898 42.649 5.420 5.216 222.461 8 400 49.898 43.290 8.115 7.744 335.225 8	80.755	21.702						
	1000	51.611	43.091	13.554	12.983	559.435	79.974	21.656
	100	47.349	40.942	1.356	1.295	53.002	82.558	20.517
	200	48.613	42.038	2.701	2.585	108.670	82.747	21.034
LDI 204 C	400	50.005	43.226	5.419	5.150	222.610	82.156	21.544
LR1-294-C	600	50.772	43.399	8.113	7.743	336.058	81.582	21.682
	800	47.35740.9421.3551.29753.10882.75048.63842.0732.7052.596109.21983.00549.95742.6965.4325.218222.78382.09650.73143.3648.1347.760336.48581.54651.21343.27410.84510.364448.49880.75551.61143.09113.55412.983559.43579.97447.34940.9421.3561.29553.00282.55848.61342.0382.7012.585108.67082.74750.00543.2265.4195.150222.61082.15650.77243.3998.1137.743336.05881.58251.25543.30210.82210.356448.44680.84951.63243.11313.52612.958558.65579.99647.27040.9091.3551.29552.97782.71248.67142.1032.6982.585108.85682.89449.89842.6495.4205.216222.46182.25450.64843.2908.1157.744335.22581.561	21.700					
	1000	51.632	43.113	13.526	12.958	558.655	09.219 83.005 22.783 82.096 36.485 81.546 48.498 80.755 59.435 79.974 3.002 82.558 08.670 82.747 22.610 82.156 36.058 81.582 48.446 80.849 58.655 79.996 2.977 82.712 08.856 82.894 22.461 82.254 35.225 81.561 47.602 80.802	21.626
	100	47.270	40.909	1.355	1.295	52.977	82.712	20.508
	200	48.671	42.103	2.698	2.585	108.856	82.894	21.070
LDI 204 D	400	49.898	42.649	5.420	5.216	222.461	82.254	21.529
LK1-294-D	800 51.255 43.302 10.822 10.356 448.446 80.84 1000 51.632 43.113 13.526 12.958 558.655 79.99 100 47.270 40.909 1.355 1.295 52.977 82.73 200 48.671 42.103 2.698 2.585 108.856 82.89 400 49.898 42.649 5.420 5.216 222.461 82.29 600 50.648 43.290 8.115 7.744 335.225 81.56 800 51.174 43.232 10.825 10.354 447.602 80.80	81.561	21.628					
		80.802	21.659					
	1000	51.607	43.090	13.523	12.955	558.245	79.992	21.610





4.7 Performance at Multi-Irradiances, 50°C

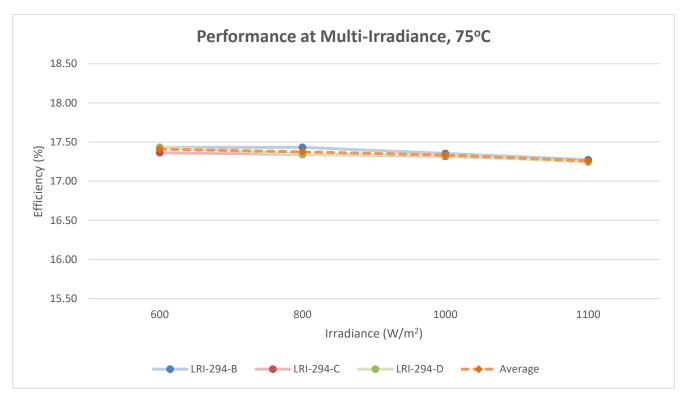
Sample ID	IRR (W/m²)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmax (W)	FF (%)	Eff (%)
	400	45.748	38.661	5.497	5.165	199.694	79.405	19.326
	600	46.573	38.902	8.237	7.755	301.704	78.651	19.465
LRI-294-B	800	47.158	39.387	10.976	10.208	402.049	77.675	19.455
	1000	47.608	39.754	13.712	12.559	499.281	76.482	19.328
	1100	V/m²) (V) (V) (A) (M) 400 45.748 38.661 5.497 5.165 199.694 600 46.573 38.902 8.237 7.755 301.704 800 47.158 39.387 10.976 10.208 402.049 .000 47.608 39.754 13.712 12.559 499.281 .100 47.803 39.920 15.077 13.697 546.786 400 45.739 38.644 5.494 5.159 199.378 600 46.567 38.892 8.221 7.738 300.964 800 47.152 39.380 10.964 10.195 401.490 .000 47.604 39.745 13.698 12.549 498.756 .100 47.798 39.910 15.057 13.673 545.682 400 45.721 38.184 5.485 5.220 199.328 600 46.541 38.864 8.212 7.739 300.755	546.786	75.868	19.242			
	400	45.739	38.644	5.494	5.159	199.378	79.342	19.295
	600	46.567	38.892	8.221	7.738	300.964	78.615	19.418
LRI-294-C	800	47.152	39.380	10.964	10.195	401.490	77.665	19.428
	1000	47.604	39.745	13.698	12.549	498.756	(%) 79.405 78.651 77.675 76.482 75.868 79.342 78.615	19.307
	1100	47.798	39.910	15.057	13.673	545.682		19.203
	400	45.721	38.184	5.485	5.220	199.328	79.479	19.290
	600	46.541	38.864	8.212	7.739	300.755	78.688	19.404
LRI-294-D	800	47.130	39.358	10.946	10.189	401.002	77.734	19.404
	1000	47.578	39.733	13.676	12.548	498.583	76.624	19.301
	(W/m²) (V) 400 45.748 38.4 600 46.573 38.4 4-B 800 47.158 39.3 1000 47.608 39.3 1100 47.803 39.4 400 45.739 38.4 600 46.567 38.3 4-C 800 47.152 39.3 1100 47.798 39.3 400 45.721 38.3 600 46.541 38.3 4-D 800 47.130 39.3 1000 47.578 39.3	39.887	15.034	13.687	545.918	76.017	19.212	





4.8 Performance at Multi-Irradiances, 75°C

Sample ID	IRR (W/m²)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmax (W)	FF (%)	Eff (%)
	600	43.212	36.073	8.233	7.490	270.188	75.942	17.432
LDI 204 D	800	43.907	36.648	11.007	9.830	360.260	74.541	17.432
LR1-294-D	1000	44.503	37.163	13.807	12.063	448.317	72.963	17.355
	(W/m²) (V) (V) (A) (A) 800 43.212 36.073 8.233 7.4 800 43.907 36.648 11.007 9.8 1000 44.503 37.163 13.807 12.0 1100 44.753 37.382 15.211 13.1 800 43.163 36.029 8.216 7.4 800 43.865 36.595 10.963 9.7 1000 44.502 37.171 13.791 12.0 1100 44.787 37.419 15.187 13.1 800 43.248 36.105 8.219 7.4 800 43.850 36.588 10.960 9.7 1000 44.482 37.147 13.767 12.0	13.131	490.869	72.108	17.275			
LRI-294-B 600 43.212 36.073 8.233 7.490 270.188 800 43.907 36.648 11.007 9.830 360.260 1000 44.503 37.163 13.807 12.063 448.317 1100 44.753 37.382 15.211 13.131 490.869 600 43.163 36.029 8.216 7.470 269.130 800 43.865 36.595 10.963 9.793 358.389 1000 44.502 37.171 13.791 12.036 447.375 1100 44.787 37.419 15.187 13.106 490.414 600 43.248 36.105 8.219 7.484 270.197 800 43.850 36.588 10.960 9.798 358.492 1000 44.482 37.147 13.767 12.050 447.611	600	43.163	36.029	8.216	7.470	269.130	75.890	17.364
	74.527	17.342						
LR1-294-C	1000	44.502	37.171	13.791	12.036	447.375	72.896	17.318
	1100	44.787	37.419	15.187	13.106	490.414	(%) 75.942 74.541 72.963 72.108 75.890 74.527	17.259
	600	43.248	36.105	8.219	7.484	270.197	76.014	17.433
LDI 204 D	800	43.850	36.588	10.960	9.798	358.492	74.593	17.347
LK1-294-D	1000	44.482	37.147	13.767	12.050	447.611	72.108 75.890 74.527 72.896 72.102 76.014 274.593 173.094	17.327
	1100	(W/m²) (V) (V) (A) (W) (%) 600 43.212 36.073 8.233 7.490 270.188 75.942 800 43.907 36.648 11.007 9.830 360.260 74.541 1000 44.503 37.163 13.807 12.063 448.317 72.963 1100 44.753 37.382 15.211 13.131 490.869 72.108 600 43.163 36.029 8.216 7.470 269.130 75.890 800 43.865 36.595 10.963 9.793 358.389 74.527 1000 44.502 37.171 13.791 12.036 447.375 72.896 1100 44.787 37.419 15.187 13.106 490.414 72.102 600 43.248 36.105 8.219 7.484 270.197 76.014 800 43.850 36.588 10.960 9.798 358.492 74.593 1000 44.482 </td <td>72.163</td> <td>17.245</td>	72.163	17.245				





Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.9 Performance at LTC, LIC, HTC

Sample ID	Condition	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmax (W)	FF (%)	Eff (%)
	LTC	50.328	43.001	6.777	6.490	279.092	81.832	21.608
LRI-294-B	LIC	47.475	40.577	2.721	2.613	106.027	82.068	20.522
	HTC	44.503	37.163	13.807	12.063	448.317	72.963	17.355
	LTC	50.363	43.043	6.763	6.477	278.776	81.852	21.583
LRI-294-C	LIC	47.491	40.588	2.720	2.610	105.937	82.023	20.505
	HTC	44.502	37.171	13.791	12.036	447.375	72.896	17.318
	LTC	50.403	43.084	6.750	6.474	278.910	81.976	21.594
LRI-294-D	LIC	47.463	40.568	2.716	2.609	105.860	82.109	20.490
	LTC 50.328 43.003 LIC 47.475 40.577 HTC 44.503 37.163 LTC 50.363 43.043 LIC 47.491 40.588 HTC 44.502 37.173 LTC 50.403 43.084 LIC 47.463 40.568	37.147	13.767	12.050	447.611	73.094	17.327	

4.10 Bifaciality Factor

The Bifaciality Factor is determined by the ratio of the average mono-facial backside power to the average mono-facial frontside power of the test samples after light soak (LS) stabilization.

Bifaciality Factor: 0.741

Note: This value is used in generating PVsyst PAN files.

Condition	Sample ID	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmax (W)	FF (%)
Mono-Back	LRI-294-B	49.930	43.006	10.270	9.435	405.779	79.133
(post LS2)	LRI-294-C	49.910	42.511	10.308	9.544	405.712	78.862
(post L32)	LRI-294-D	49.915	43.494	10.251	9.305	404.719	79.098
	LRI-294-B	50.481	42.576	13.654	12.852	547.171	79.383
Mono-Front (post LS2)	LRI-294-C	50.460	42.567	13.695	12.875	548.059	79.310
(post L32)	LRI-294-D	50.460	42.564	13.668	12.843	546.662	79.265

Condition	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmax (W)	FF (%)
Average (Mono-Back)	49.919	43.003	10.276	<i>9.428</i>	405.403	<i>79.031</i>
Average (Mono-Front)	<i>50.467</i>	42.569	13.672	12.857	547.297	79.319
Bifaciality Factor	0.989	1.010	0.752	0.733	0.741	0.996



4.11 Incident Angle Modifier

The angular response testing is performed per IEC61853-2, Indoor method. The module is mounted on a rotating fixture in front of a fixed direct light source. A special setup is designed to reduce off-angle light reflection within the tester. The module is then rotated relative to the light source and measured at each target angle. Each measurement is performed on a single tabbed cell, isolated from the rest of the module circuit. The module Isc is measured at different angles relative to the light source in order to extract the IAM coefficients. The relative transmission into the module is defined by the standard as:

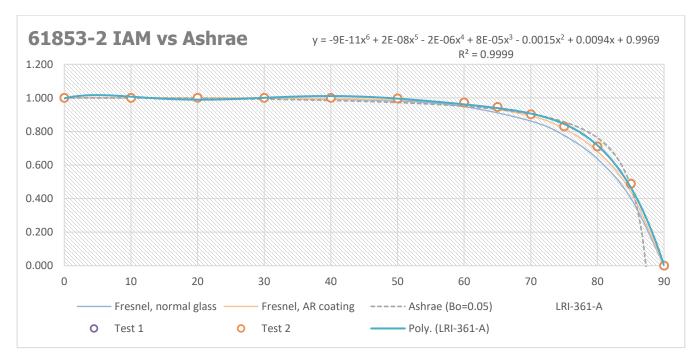
$$T(\theta) = Isc(\theta)/(cos(\theta))Isc(0)$$

Where θ corresponds to the angle of incidence with respect to the module normal.

Measured IAM Coefficients

Angle	LRI-361-A	Values used in PAN Files
0	1.000	←
10	1.000	
20	1.000	
30	1.000	(
40	1.000	
50	0.997	(
60	0.972	(
65	0.946	
70	0.902	(
75	0.830	(
80	0.710	(
85	0.488	(
90	0.000	+

Highlighted values were used on the PVsyst PAN files.





4.11.1 IAM Polynomial Regression Variables

	Coefficients	Standard Error	RSQ	F Stat	Regression of Sum Squared
a	-9.06354E-11	2.27831E-12	0.999868193	618244.9106	18.29061643
b	2.12316E-08	6.34229E-10	0.002220538	489	0.002411157
С	-1.89591E-06	6.70091E-08			
d	7.83655E-05	3.32801E-06			
е	-0.00145525	7.74635E-05			
f	0.009438277	0.000723726			
Constant	0.996935305	0.002211771			

4.11.2 IAM Polynomial Regression Variables Definitions

a	n	Sen	r ₂	F	SSreg
b	m _{n-1}	Se _{n-1}	se _y	d _f	SS _{resid}
С					
d					
е					
f	m ₁	se ₁			
Constant	b	Seb			

Variable	Description
m _i	The array of constant multipliers for the straight-line equation
b	The constant value of y when x=0
sei	The standard error values for the coefficients, m _i
seb	The standard error value for the constant b
r ₂	The coefficient of determination
se _y	The standard error for the y estimate
F	The F statistic, or the F-observed value
d _f	The number of degrees of freedom
SS _{reg}	The regression sum of squares
SSresid	The residual sum of squares



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.12 PAN File Creation 4.12.1 LR5-72HBD-545M (V4) PAN File



RETC Project Report: C-CS-2306-LRI-294



PVSySt V1.4.0			

Manufacturer		LONGi	Commercial data	
Model		LR5-72HBD-545M	Data source : RETCCT-LRI29	4-240920
Pnom STC power (ma	anufacturer)	545 Wp	Technology	Si-mono
Module size (W x L)	1.134	x 2.278 m ²	Rough module area (Amodule)	2.58 m ²
Number of cells		2 x 72	Sensitive area (cells) (Acells)	2.41 m²
Specifications for	the model (manuf	acturer or measureme	ent data)	
Reference temperatur	re (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m ²
Open circuit voltage (\	Voc)	49.7 V	Short-circuit current (Isc)	13.92 A
Max. power point volta	age (Vmpp)	41.8 V	Max. power point current (Impp)	13.04 A
=> maximum power (F	Pmpp)	545.1 W	Isc temperature coefficient (mulsc)	4.3 mA/°C
One-diode model	parameters			
Shunt resistance (Rsh	*	550 Ω	Diode saturation current (loRef)	0.017 nA
Serie resistance (Rsei	rie)	0.21 Ω	Voc temp. coefficient (MuVoc)	-134 mV/°C
Specified Pmax temper	er. coeff. (muPMaxR)	-0.34 %/°C	Diode quality factor (Gamma)	0.98
			Diode factor temper. coeff. (muGamma)	0.000 1/°C
			s under partial shadings or mismatch	
Reverse characteristic		3.20 mA/V ²	(quadratic factor (per cell))	
Number of by-pass die	odes per module	3	Direct voltage of by-pass diodes	-0.7 V
Model results for s	standard condition	s (STC: T=25 °C, G=	:1000 W/m², AM=1.5)	
Max. power point volta		41.2 V	Max. power point current (Impp)	13.25 A
Maximum power (Pmp	pp)	546.0 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
Efficiency(/ Module are	ea) (Eff_mod)	21.1 %	Fill factor (FF)	0.790
Efficiency(/ Cells area) (Eff_cells)	22.6 %		
16		PV module: I ON	GLL R5-72HRD-545M	-
	Cells temp. = 25 °C	PV module: LON	Gi, LR5-72HBD-545M	
			Gi, LR5-72HBD-545M	-
			-,	
	Inc	dent Irrad. = 1000 W/m²	-,	
14	Inc		546.0 W	
14	Inc	dent Irrad. = 1000 W/m²	-,	
14	Inc	dent Irrad. = 1000 W/m²	546.0 W	
14	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m²	546.0 W	
12 -	Inci	dent Irrad. = 1000 W/m²	546.0 W	
12 -	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m²	546.0 W	
14 - 12 - 10 - 10 -	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m²	546.0 W	
12 -	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m²	546.0 W	
12 -	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m²	546.0 W	
14	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m² dent Irrad. = 600 W/m²	546.0 W 437.8 W 328.0 W	
14	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m² dent Irrad. = 600 W/m²	546.0 W 437.8 W 328.0 W	
14	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m² dent Irrad. = 600 W/m²	546.0 W 437.8 W 328.0 W	
14	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m² dent Irrad. = 600 W/m²	546.0 W 437.8 W 328.0 W	
14 - 12 - 10 - 10 - 10 - 10 - 10 - 10 - 10	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m² dent Irrad. = 600 W/m² dent Irrad. = 400 W/m²	437.8 W	
14	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m² dent Irrad. = 600 W/m² dent Irrad. = 400 W/m²	437.8 W	
14 - 12 - 10 - 10 - 10 - 10 - 10 - 10 - 10	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m² dent Irrad. = 600 W/m² dent Irrad. = 400 W/m²	437.8 W	
14 - 12 - 10 - 10 - 10 - 10 - 10 - 10 - 10	Inci	dent Irrad. = 1000 W/m² dent Irrad. = 800 W/m² dent Irrad. = 600 W/m² dent Irrad. = 400 W/m²	437.8 W	

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13 PAN File Extrapolation 4.13.1 LR5-72HBD-540M (V4) PAN File



RETC Project Report: C-CS-2306-LRI-294



PVsyst V7.4.

	PV module - I	_R5-72HBD-540M	
Manufacturer Model	LONGi LR5-72HBD-540M	Commercial data Data source : RETCCT-LRI29	4e-240920
nom STC power (manufacturer)	540 Wp	Technology	Si-mono
Module size (W x L) 1.	134 x 2.278 m ²	Rough module area (Amodule)	2.58 m ²
lumber of cells	2 x 72	Sensitive area (cells) (Acells)	2.41 m²
Specifications for the model (mar			
Reference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m ²
Open circuit voltage (Voc)	49.5 V	Short-circuit current (Isc)	13.85 A
Max. power point voltage (Vmpp)	41.7 V	Max. power point current (Impp)	12.97 A
> maximum power (Pmpp)	540.2 W	lsc temperature coefficient (mulsc)	4.3 mA/°C
One-diode model parameters			
Shunt resistance (Rshunt)	450 Ω	Diode saturation current (loRef)	0.015 nA
Serie resistance (Rserie)	0.21 Ω	Voc temp. coefficient (MuVoc)	-134 mV/°C
Specified Pmax temper. coeff. (muPMax	kR) -0.34 %/°C	Diode quality factor (Gamma)	0.97
		Diode factor temper. coeff. (muGamma)	0.000 1/°C
Reverse Bias Parameters, for use	in behaviour of PV array	s under partial shadings or mismatch	
Reverse characteristics (dark) (BRev)	3.20 mA/V ²	(quadratic factor (per cell))	
lumber of by-pass diodes per module	3	Direct voltage of by-pass diodes	-0.7 V
Model results for standard condit	tions (STC: T=2E°C G-	1000 M/m² AM=1 5\	
Max. power point voltage (Vmpp)	41.1 V	Max. power point current (Impp)	13.18 A
Maximum power (Pmpp)	541.1 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
Efficiency(/ Module area) (Eff_mod)	20.9 %	Fill factor (FF)	0.789
	22.4 %	Fill factor (FF)	0.769
:mciencv(/ Cells area) (Ell. cells)			
Efficiency(/ Cells area) (Eff_cells)	22.4 //		
16		Gi, LR5-72HBD-540M	
		Gi, LR5-72HBD-540M	
16		,	•
Cells temp. = 25 °C	PV module: LON	Gi, LR5-72HBD-540M	,
Cells temp. = 25 °C	PV module: LON	,	-
Cells temp. = 25 °C	PV module: LON	,	
16 Cells temp. = 25 °C	PV module: LON	541.1 W	-
16 Cells temp. = 25 °C	' PV module: L'ON	,	-
16 Cells temp. = 25 °C	' PV module: L'ON	541.1 W	-
16 Cells temp. = 25 °C	' PV module: L'ON	541.1 W	-
16 Cells temp. = 25 °C	' PV module: L'ON	541.1 W	-
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	541.1 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	541.1 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	541.1 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	541.1 W 433.8 W 325.0 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	541.1 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	541.1 W 433.8 W 325.0 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
16 Cells temp. = 25 °C	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	541.1 W 433.8 W 325.0 W	
16 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 13 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 13 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	541.1 W 433.8 W 325.0 W	
16 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 13 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 13 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	541.1 W 433.8 W 325.0 W	
16 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 13 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25 °C 18 Cells temp. = 25 °C 19 Cells temp. = 25 °C 10 Cells temp. = 25 °C 11 Cells temp. = 25 °C 12 Cells temp. = 25 °C 13 Cells temp. = 25 °C 14 Cells temp. = 25 °C 15 Cells temp. = 25 °C 16 Cells temp. = 25 °C 17 Cells temp. = 25 °C 18 Cells temp. = 25	PV mbdule: LON Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	541.1 W 433.8 W 325.0 W	60

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13.2 LR5-72HBD-550M (V4) PAN File



RETC Project Report: C-CS-2306-LRI-294



Vsyst V7.4.8
,

	PV module - L	LR5-72HBD-550M	
Manufacturer Model	LONGi LR5-72HBD-550M	Commercial data Data source : RETCCT-LRI29	94e-240920
Pnom STC power (manufacturer)	550 Wp	Technology	Si-mono
Module size (W x L) 1.134	1 x 2.278 m²	Rough module area (Amodule)	2.58 m ²
Number of cells	2 x 72	Sensitive area (cells) (Acells)	2.41 m²
Specifications for the model (manuf			
Reference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m ²
Open circuit voltage (Voc)	49.8 V	Short-circuit current (Isc)	13.99 A
Max. power point voltage (Vmpp)	42.0 V	Max. power point current (Impp)	13.12 A
=> maximum power (Pmpp)	550.4 W	Isc temperature coefficient (mulsc)	4.3 mA/°C
One-diode model parameters			
Shunt resistance (Rshunt)	600 Ω	Diode saturation current (IoRef)	0.016 nA
Serie resistance (Rserie)	0.20 Ω	Voc temp. coefficient (MuVoc)	-135 mV/°C
Specified Pmax temper. coeff. (muPMaxR)	-0.34 %/°C	Diode quality factor (Gamma)	0.98
		Diode factor temper. coeff. (muGamma)	0.000 1/°C
Reverse Bias Parameters, for use in	behaviour of PV array	ys under partial shadings or mismatch	
Reverse characteristics (dark) (BRev)	3.20 mA/V ²	(quadratic factor (per cell))	
Number of by-pass diodes per module	3	Direct voltage of by-pass diodes	-0.7 V
Model results for standard condition	ns (STC: T=25 °C, G=	=1000 W/m², AM=1.5)	
Max. power point voltage (Vmpp)	41.4 V	Max. power point current (Impp)	13.33 A
Maximum power (Pmpp)	551.3 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
Efficiency(/ Module area) (Eff_mod)	21.3 %	Fill factor (FF)	0.791
Efficiency(/ Module area) (Eff_mod) Efficiency(/ Cells area) (Eff_cells)	21.3 % 22.9 %	Fill factor (FF)	0.791
Efficiency(/ Cells area) (Eff_cells)	22.9 %	Fill factor (FF) Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells)	22.9 % PV module: LON	. ,	0.791
Efficiency(/ Cells area) (Eff_cells)	22.9 %	. ,	0.791
Efficiency(/ Cells area) (Eff_cells)	22.9 % PV module: LON	Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. = 25 °C Inc	22.9 % PV module: LON	Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. # 25 °C 14	22.9 % PV module: LONe	Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. # 25 °C 14	22.9 % PV module: LON	Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. # 25 °C 14 12 Inc	22.9 % PV module: LONe	Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. # 25 °C 14	22.9 % PV module: LONe	Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. = 25 °C 14 12 Inc	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m²	Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. = 25 °C 14 12 Inc	22.9 % PV module: LONe	Gi, LR5-72HBD-550M	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. = 25 °C 14 12 Inc	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m²	Gi, LR5-72HBD-550M 551.3 W	0.791
Efficiency(/ Cells area) (Eff_cells) 16 Cells temp. = 25 *C Inc. 12 Inc.	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m²	Gi, LR5-72HBD-550M 551.3 W	0.791
16	22.9 % PV module: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W	0.791
16	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m²	Gi, LR5-72HBD-550M 551.3 W	0.791
16	22.9 % PV module: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W 442.0 V	0.791
16	22.9 % PV module: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W 442.0 V	0.791
16	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W 442.0 W 219.3 W	0.791
16	22.9 % PV module: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W 442.0 V	0.791
16	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W 442.0 W 219.3 W	0.791
16	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W 442.0 W 219.3 W	0.791
16	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W 442.0 W 219.3 W	0.791
16	22.9 % PV mbdule: LONe ident Irrad. = 1000 W/m² ident Irrad. = 800 W/m² ident Irrad. = 600 W/m²	Gi, LR5-72HBD-550M 551.3 W 442.0 W 219.3 W	0.791

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13.3 LR5-72HBD-555M (V4) PAN File



RETC Project Report: C-CS-2306-LRI-294



,			

Manufacturer	LONGi	Commercial data	
Model	LR5-72HBD-555M	Data source : RETCCT-LRI294	e-240920
Pnom STC power (manufacturer)	555 Wp	Technology	Si-mono
Module size (W x L)	1.134 x 2.278 m ²	Rough module area (Amodule)	2.58 m²
Number of cells	2 x 72	Sensitive area (cells) (Acells)	2.41 m²
Specifications for the model (manufacturer or measureme	ent data)	
Reference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m²
Open circuit voltage (Voc)	50.0 V	Short-circuit current (Isc)	14.05 A
Max. power point voltage (Vmpp)	42.1 V	Max. power point current (Impp)	13.19 A
=> maximum power (Pmpp)	555.3 W	Isc temperature coefficient (mulsc)	4.4 mA/°C
One-diode model parameters			
Shunt resistance (Rshunt)	700 Ω	Diode saturation current (loRef)	0.016 nA
Serie resistance (Rserie)	0.20 Ω	Voc temp. coefficient (MuVoc)	-136 mV/°C
Specified Pmax temper. coeff. (muP	MaxR) -0.34 %/°C	Diode quality factor (Gamma)	0.98
	,	Diode factor temper. coeff. (muGamma)	0.000 1/°C
Reverse Bias Parameters for	use in hehaviour of PV array	ys under partial shadings or mismatch	
Reverse characteristics (dark) (BRe		(quadratic factor (per cell))	
Number of by-pass diodes per modu	ile 3	Direct voltage of by-pass diodes	-0.7 V
Model results for standard cor	nditions (STC: T=25 °C, G=	=1000 W/m², AM=1.5)	
Max. power point voltage (Vmpp)	41.5 V	Max. power point current (Impp)	13.40 A
Maximum power (Pmpp)	556.2 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
Efficiency(/ Module area) (Eff_mod)	21.5 %	Fill factor (FF)	0.793
Efficiency(/ Cells area) (Eff_cells)	23.1 %		
16			
Cells temp. = 25 °	PV mbdule: LON	Gi, LR5-72HBD-555M	'
1			1
I	Incident Irrad. = 1000 W/m ²		
14	Incident Irrad. = 1000 W/m²	556.2 W	-
14	Incident Irrad. = 1000 W/m²	556.2 W	-
	Incident Irrad. = 1000 W/m ²	556.2 W	-
14	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²		
		556.2 W	-
12 -			
-			-
12 -		446.0 VV	-
12 -	Incident Irrad. = 800 W/m²		-
12 -	Incident Irrad. = 800 W/m²	446.0 VV	- - - - - -
12 — 10 —	Incident Irrad. = 800 W/m²	446.0 VV	-
12 -	Incident Irrad. = 800 W/m²	446.0 VV	-
To — 10 — 8 — 8	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	446.0 VV	-
To — 10 — 8 — 8	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	446.0 VV	-
To — 10 — 8 — 8	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	446.0 VV	
To — 10 — 8 — 8	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	334.1 W 221.3 W	- - - - - - - - -
To — 10 — 8 — 8	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	446.0 VV	- - - - - - - -
To — 10 — 8 — 8	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	334.1 W 221.3 W	
TO T	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	334.1 W 221.3 W	
TO T	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	334.1 W 221.3 W	
Crument (A) 12 — 10 — 10 — 8 — 8 — 4 — 2 — 4 — 2 —	Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	334.1 W 221.3 W	

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13.4 LR5-72HBD-560M (V4) PAN File



RETC Project Report: C-CS-2306-LRI-294



PVsyst V7.4.8

	- PV module - i	LR5-72HBD-560M	
lanufacturer	LONGi	Commercial data	
lodel	LR5-72HBD-560M	Data source : RETCCT-LRI29	4e-240920
nom STC power (manufacturer)	560 Wp	Technology	Si-mono
lodule size (W x L) 1.13	34 x 2.278 m²	Rough module area (Amodule)	2.58 m²
umber of cells	2 x 72	Sensitive area (cells) (Acells)	2.41 m ²
pecifications for the model (manu	facturer or measureme	ent data)	
eference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m ²
pen circuit voltage (Voc)	50.1 V	Short-circuit current (Isc)	14.10 A
ax. power point voltage (Vmpp)	42.3 V	Max. power point current (Impp)	13.26 A
maximum power (Pmpp)	560.2 W	Isc temperature coefficient (mulsc)	4.4 mA/°C
ne-diode model parameters			
hunt resistance (Rshunt)	850 Ω	Diode saturation current (loRef)	0.015 nA
erie resistance (Rserie)	0.20 Ω	Voc temp. coefficient (MuVoc)	-136 mV/°C
pecified Pmax temper. coeff. (muPMaxR	c) -0.34 %/°C	Diode quality factor (Gamma)	0.98
		Diode factor temper. coeff. (muGamma)	0.000 1/°C
		ys under partial shadings or mismatch	
everse characteristics (dark) (BRev)	3.20 mA/V ²	(quadratic factor (per cell))	
umber of by-pass diodes per module	3	Direct voltage of by-pass diodes	-0.7 V
lodel results for standard condition	ons (STC: T=25 °C, G=	=1000 W/m², AM=1.5)	
ax. power point voltage (Vmpp)	41.7 V	Max. power point current (Impp)	13.46 A
aximum power (Pmpp)	561.1 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
fficiency(/ Module area) (Eff_mod)	21.7 %	Fill factor (FF)	0.794
fficiency(/ Cells area) (Eff_cells)	23.3 %		
10			
16 , Cells temp. = 25 °C	PV module: LON	Gi, LR5-72HBD-560M	
Cells temp. = 25 °C in		Gi, LR5-72HBD-560M 561.1 W	
Cells temp. = 25 °C In	ocident Irrad. = 1000 W/m² ocident Irrad. = 800 W/m²	561.1 W	
Cells temp. = 25 °C In	ncident Irrad. = 1000 W/m²	561.1 W	,
Cells temp. = 25 °C In	ocident Irrad. = 1000 W/m² ocident Irrad. = 800 W/m²	561.1 W	-
Cells temp. = 25 °C In	ocident Irrad. = 1000 W/m² ocident Irrad. = 800 W/m²	561.1 W	
Cells temp. = 25 °C 14	ocident Irrad. = 1000 W/m² ocident Irrad. = 800 W/m² ocident Irrad. = 600 W/m²	561.1 W	
Cells temp. = 25 °C 14	ocident Irrad. = 1000 W/m² ocident Irrad. = 800 W/m²	561.1 W	-
Cells temp. = 25 °C 14	ocident Irrad. = 1000 W/m² ocident Irrad. = 800 W/m² ocident Irrad. = 600 W/m²	561.1 W	
Cells temp. = 25 °C 14	ocident Irrad. = 1000 W/m² ocident Irrad. = 800 W/m² ocident Irrad. = 600 W/m²	561.1 W	
Cells temp. = 25 °C 14	acident Irrad. = 1000 W/m² acident Irrad. = 800 W/m² acident Irrad. = 600 W/m² acident Irrad. = 400 W/m²	337.0 W	
Cells temp. = 25 °C 14 = 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10	ocident Irrad. = 1000 W/m² ocident Irrad. = 800 W/m² ocident Irrad. = 600 W/m²	561.1 W	
Cells temp. = 25 °C In In In In In In In In In I	acident Irrad. = 1000 W/m² acident Irrad. = 800 W/m² acident Irrad. = 600 W/m² acident Irrad. = 400 W/m²	337.0 W	
Cells temp. = 25 °C	acident Irrad. = 1000 W/m² acident Irrad. = 800 W/m² acident Irrad. = 600 W/m² acident Irrad. = 400 W/m²	337.0 W	
Cells temp. = 25 °C In In In In In In In In In I	acident Irrad. = 1000 W/m² acident Irrad. = 800 W/m² acident Irrad. = 600 W/m² acident Irrad. = 400 W/m²	337.0 W	
Cells temp. = 25 °C In In In In In In In In In I	acident Irrad. = 1000 W/m² acident Irrad. = 800 W/m² acident Irrad. = 600 W/m² acident Irrad. = 400 W/m²	337.0 W	

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13.5 LR5-72HBD-565M (V4) PAN File



RETC Project Report: C-CS-2306-LRI-294



PVsyst V7.4.8

	PV module - I	LR5-72HBD-565M —————	
Manufacturer	LONGi	Commercial data	
Model	LR5-72HBD-565M	Data source : RETCCT-LRI29	94e-240920
nom STC power (manufacturer)	565 Wp	Technology	Si-mono
Module size (W x L) 1.13	34 x 2.278 m ²	Rough module area (Amodule)	2.58 m ²
lumber of cells	2 x 72	Sensitive area (cells) (Acells)	2.41 m ²
specifications for the model (man	ufacturer or measureme	ent data)	
deference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m ²
pen circuit voltage (Voc)	50.3 V	Short-circuit current (Isc)	14.16 A
fax. power point voltage (Vmpp)	42.4 V	Max. power point current (Impp)	13.33 A
> maximum power (Pmpp)	565.2 W	Isc temperature coefficient (mulsc)	4.4 mA/°C
One-diode model parameters			
hunt resistance (Rshunt)	1100 Ω	Diode saturation current (loRef)	0.015 nA
erie resistance (Rserie)	0.19 Ω	Voc temp. coefficient (MuVoc)	-136 mV/°C
pecified Pmax temper. coeff. (muPMaxF	R) -0.34 %/°C	Diode quality factor (Gamma)	0.99
		Diode factor temper. coeff. (muGamma)	0.000 1/°C
		ys under partial shadings or mismatch	
everse characteristics (dark) (BRev)	3.20 mA/V ²	(quadratic factor (per cell))	
lumber of by-pass diodes per module	3	Direct voltage of by-pass diodes	-0.7 V
lodel results for standard condition	ons (STC: T=25 °C, G=	=1000 W/m², AM=1.5)	
lax. power point voltage (Vmpp)	41.9 V	Max. power point current (Impp)	13.53 A
faximum power (Pmpp)	566.0 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
fficiency(/ Module area) (Eff_mod)	21.9 %	Fill factor (FF)	0.795
fficiency(/ Cells area) (Eff cells)	23.5 %		
inciency(/ Cells area) (Ell_cells)	20.0 /0		
7 7.	20.0 %		
16		Gi, LR5-72HBD-565M	·
16 Cells temp. = 25 °C		GI, LR5-72HBD-565M	,
16 Cells temp. = 25 °C	PV module: LON	GI, LR5-72HBD-565M	
Cells temp. = 25 °C	PV module: LON		
Cells temp. = 25 °C	PV module: LON		,
16 Cells temp. = 25 °C	PV module: LON	566.0 W	-
16 Cells temp. = 25 °C	' PV module: LON ncident Irrad. = 1000 W/m²		-
16 Cells temp. = 25 °C	' PV module: LON ncident Irrad. = 1000 W/m²	566.0 W	-
16 Cells temp. = 25 °C	' PV module: LON ncident Irrad. = 1000 W/m²	566.0 W	-
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m²	566.0 W 453.8 W	-
16 Cells temp. = 25 °C	' PV module: LON ncident Irrad. = 1000 W/m²	566.0 W	-
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m²	566.0 W 453.8 W	-
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m²	566.0 W 453.8 W	-
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W	-
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m²	566.0 W 453.8 W	
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W	
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W	-
16 Cells temp. = 25 °C 14 To	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W 340.0 W	
16 Cells temp. = 25 °C 14 To	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W	
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W 340.0 W	
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W 340.0 W	
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W 340.0 W	
16 Cells temp. = 25 °C	PV module: LON ncident Irrad. = 1000 W/m² ncident Irrad. = 800 W/m² ncident Irrad. = 600 W/m²	566.0 W 453.8 W 340.0 W	

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13.6 LR5-72HBD-535M (V6) PAN File



RETC Project Report: C-CS-2306-LRI-294



PVsyst '	V7.4.8
----------	--------

Manufacturer Model	LONGi LR5-72HBD-535M	Commercial data Data source : RETCCT-LRI360	e-240920
Pnom STC power (manufacturer)	535 Wp	Technology	Si-mono
Module size (W x L)	1.133 x 2.256 m ²	Rough module area (Amodule)	2.56 m ²
Number of cells	2 x 72	Sensitive area (cells) (Acells)	2.38 m²
Specifications for the model (n	nanufacturer or measureme	ent data)	
Reference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m ²
Open circuit voltage (Voc)	49.4 V	Short-circuit current (Isc)	13.78 A
Max. power point voltage (Vmpp)	41.5 V	Max. power point current (Impp)	12.90 A
=> maximum power (Pmpp)	535.4 W	Isc temperature coefficient (mulsc)	4.3 mA/°C
One-diode model parameters			
Shunt resistance (Rshunt)	430 Ω	Diode saturation current (loRef)	0.015 nA
Serie resistance (Rserie)	0.21 Ω	Voc temp. coefficient (MuVoc)	-134 mV/°C
Specified Pmax temper. coeff. (muPf	MaxR) -0.34 %/°C	Diode quality factor (Gamma)	0.97
		Diode factor temper. coeff. (muGamma)	0.000 1/°C
Reverse Bias Parameters, for u	se in behaviour of PV array	ys under partial shadings or mismatch	
Reverse characteristics (dark) (BRev) 3.20 mA/V ²	(quadratic factor (per cell))	
Number of by-pass diodes per modul	le 3	Direct voltage of by-pass diodes	-0.7 V
Model results for standard con	ditions (STC: T=25 °C, G=	=1000 W/m², AM=1.5)	
Max. power point voltage (Vmpp)	40.9 V	Max. power point current (Impp)	13.10 A
Maximum power (Pmpp)	536.2 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
Efficiency(/ Module area) (Eff_mod)	21.0 %	Fill factor (FF)	0.789
Efficiency(/ Cells area) (Eff_cells)	22.5 %		
16			
16 Cells temp. = 25 °C	PV module: LON	Gi, LR5-72HBD-535M	
	PV module: LON	-,	
Cells temp. = 25 °C		Gi, LR5-72HBD-535M ¹	-
Cells temp. = 25 °C		-,	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m²	-,	
Cells temp. = 25 °C		536.2 W	, - -
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m²	-,	-
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m²	536.2 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	536.2 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m²	536.2 W	-
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	536.2 W	-
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	536.2 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	536.2 W	-
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	536.2 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	536.2 W 429.9 W 322.0 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	536.2 W 429.9 W 322.0 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	536.2 W 429.9 W 322.0 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	536.2 W 429.9 W 322.0 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	536.2 W 429.9 W 322.0 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	536.2 W 429.9 W 322.0 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	536.2 W 429.9 W 322.0 W	
Cells temp. = 25 °C	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m² Incident Irrad. = 400 W/m²	536.2 W 429.9 W 322.0 W	

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13.7 LR5-72HBD-540M (V6) PAN File



RETC Project Report: C-CS-2306-LRI-294



PVsyst V7.4.8

	- PV module - i	LR5-72HBD-540M ————	
Manufacturer	LONGi	Commercial data	
Model	LR5-72HBD-540M	Data source : RETCCT-LRI36	0e-240920
Pnom STC power (manufacturer)	540 Wp	Technology	Si-mono
Module size (W x L) 1.13	3 x 2.256 m ²	Rough module area (Amodule)	2.56 m²
lumber of cells	2 x 72	Sensitive area (cells) (Acells)	2.38 m²
Specifications for the model (manu	facturer or measureme	ent data)	
Reference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m ²
Open circuit voltage (Voc)	49.5 V	Short-circuit current (Isc)	13.85 A
fax. power point voltage (Vmpp)	41.7 V	Max. power point current (Impp)	12.97 A
> maximum power (Pmpp)	540.2 W	Isc temperature coefficient (mulsc)	4.3 mA/°C
One-diode model parameters			
Shunt resistance (Rshunt)	450 Ω	Diode saturation current (loRef)	0.015 nA
Serie resistance (Rserie)	0.21 Ω	Voc temp. coefficient (MuVoc)	-134 mV/°C
specified Pmax temper. coeff. (muPMaxR) -0.34 %/°C	Diode quality factor (Gamma)	0.97
		Diode factor temper. coeff. (muGamma)	0.000 1/°C
Reverse Bias Parameters, for use in	n behaviour of PV array	ys under partial shadings or mismatch	
Reverse characteristics (dark) (BRev)	3.20 mA/V ²	(quadratic factor (per cell))	
lumber of by-pass diodes per module	3	Direct voltage of by-pass diodes	-0.7 V
Model results for standard conditio	ns (STC: T=25 °C, G=	=1000 W/m², AM=1.5)	
fax. power point voltage (Vmpp)	41.1 V	Max. power point current (Impp)	13.18 A
Maximum power (Pmpp)	541.1 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
fficiency(/ Module area) (Eff_mod)	21.2 %	Fill factor (FF)	0.789
fficiency(/ Cells area) (Eff_cells)	22.7 %		
Calla tama = 25 °C	PV module: LON	Gi, LR5-72HBD-540M	'
Cells temp. = 25 °C		Gi, LR5-72HBD-540M	· .
Cells temp. = 25 °C	PV module: L'ON		,
Cells temp. = 25 °C		Gi, LR5-72HBD-540M	
Cells temp. = 25 °C			
Cells temp. = 25 °C	cident Irrad. = 1000 W/m²		
Cells temp. = 25 °C		541.1 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m²		
Cells temp. = 25 °C	cident Irrad. = 1000 W/m²	541.1 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m²	541.1 W	
Cells temp. = 25 °C 14 — In 12 — In	cident Irrad. = 1000 W/m²	541.1 W	
Cells temp. = 25 °C 14 — In 12 — In	cident Irrad. = 1000 W/m²	541.1 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m²	541.1 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m²	541.1 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	541.1 W 433.8 W 325.0 W	

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13.8 LR5-72HBD-545M (V6) PAN File



RETC Project Report: C-CS-2306-LRI-294



PVsyst V7.4.

	- Pv module - i	LR5-72HBD-545M —————	
Manufacturer	LONGi	Commercial data	
Model	LR5-72HBD-545M	Data source : RETCCT-LRI36	00e-240920
nom STC power (manufacturer)	545 Wp	Technology	Si-mono
Module size (W x L) 1.13	3 x 2.256 m ²	Rough module area (Amodule)	2.56 m²
lumber of cells	2 x 72	Sensitive area (cells) (Acells)	2.38 m²
Specifications for the model (manu			
Reference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m ²
pen circuit voltage (Voc)	49.7 V	Short-circuit current (Isc)	13.92 A
fax. power point voltage (Vmpp)	41.8 V	Max. power point current (Impp)	13.04 A
> maximum power (Pmpp)	545.1 W	Isc temperature coefficient (mulsc)	4.3 mA/°C
One-diode model parameters			
Shunt resistance (Rshunt)	550 Ω	Diode saturation current (loRef)	0.017 nA
Serie resistance (Rserie)	0.21 Ω	Voc temp. coefficient (MuVoc)	-134 mV/°C
specified Pmax temper. coeff. (muPMaxR) -0.34 %/°C	Diode quality factor (Gamma)	0.98
		Diode factor temper. coeff. (muGamma)	0.000 1/°C
		ys under partial shadings or mismatch	
Reverse characteristics (dark) (BRev)	3.20 mA/V ²	(quadratic factor (per cell))	
lumber of by-pass diodes per module	3	Direct voltage of by-pass diodes	-0.7 V
Model results for standard conditio	ns (STC: T=25 °C, G=	=1000 W/m², AM=1.5)	
Max. power point voltage (Vmpp)	41.2 V	Max. power point current (Impp)	13.25 A
Maximum power (Pmpp)	546.0 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C
fficiency(/ Module area) (Eff_mod)	21.4 %	Fill factor (FF)	0.790
fficiency(/ Cells area) (Eff_cells)	22.9 %		
Cells temp = 25 °C	PV module: LON	Gi, LR5-72HBD-545M	
Cells temp. = 25 °C		Gi, LR5-72HBD-545M	,
Cells temp. = 25 °C	PV module: LON	Gi, LR5-72HBD-545M	
Cells temp. = 25 °C			
Cells temp. = 25 °C			
Cells temp. = 25 °C	cident Irrad. = 1000 W/m²		-
Cells temp. = 25 °C			
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m²	546.0 W	
Cells temp. = 25 °C	cident Irrad. = 1000 W/m²	546.0 W	-
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m²	546.0 W	-
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m²	546.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m²	546.0 W	-
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m²	546.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	546.0 W 437.8 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m²	546.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	546.0 W 437.8 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	546.0 W 437.8 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	328.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	546.0 W 437.8 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	328.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	328.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	328.0 W	
Cells temp. = 25 °C 14	cident Irrad. = 1000 W/m² cident Irrad. = 800 W/m² cident Irrad. = 600 W/m²	328.0 W	

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

4.13.9 LR5-72HBD-550M (V6) PAN File



RETC Project Report: C-CS-2306-LRI-294



vsyst v7.4.8		

		LR5-72HBD-550M		
Manufacturer Model	LONGi LR5-72HBD-550M	Commercial data Data source : RETCCT-LRI36	0e-240920	
Pnom STC power (manufacturer)	nufacturer) 550 Wp Technology		Si-mono	
Module size (W x L)	1.133 x 2.256 m ²	Rough module area (Amodule)	2.56 m²	
Number of cells	2 x 72 Sensitive area (cells) (2.38 m²	
Considerations for the model	/	ant data)		
Reference temperature (TRef)	(manufacturer or measurement 25 °C	Reference irradiance (GRef)	1000 W/m²	
Open circuit voltage (Voc) 49.8 V		Short-circuit current (Isc)	13.99 A	
fax. power point voltage (Vmpp) 42.0 V		Max. power point current (Impp)	13.12 A	
:> maximum power (Pmpp)	550.4 W	Isc temperature coefficient (mulsc)	4.3 mA/°C	
		,		
One-diode model parameters		District and the second (In De C	0.040 - 4	
Shunt resistance (Rshunt)	600 Ω	Diode saturation current (loRef)	0.016 nA	
Serie resistance (Rserie)	0.20 Ω	Voc temp. coefficient (MuVoc)	-135 mV/°C	
Specified Pmax temper. coeff. (mul	PMaxR) -0.34 %/°C	Diode quality factor (Gamma)	0.98	
		Diode factor temper. coeff. (muGamma)	0.000 1/°C	
Reverse Bias Parameters, for	r use in behaviour of PV array	ys under partial shadings or mismatch		
Reverse characteristics (dark) (BRev) 3.20 mA/V ² (quadratic factor (per		(quadratic factor (per cell))		
Number of by-pass diodes per mod	dule 3	Direct voltage of by-pass diodes	-0.7 V	
Model results for standard or	onditions (STC: T=25 °C, G=	=1000 W/m² AM=1 5)		
Max. power point voltage (Vmpp)	41.4 V	Max. power point current (Impp)	13.33 A	
Maximum power (Pmpp)	551.3 Wp	Power temper. coefficient (muPmpp)	-0.34 %/°C	
Efficiency(/ Module area) (Eff_mod		Fill factor (FF)	0.791	
Efficiency(/ Cells area) (Eff. cells)	23.1 %	12525 (1.1)	0.701	
16	PV module: LON	Gi, LR5-72HBD-550M		
Cells temp. = 25	PV module: LON			
	5 °C	Gi, LR5-72HBD-550M		
Cells temp. = 25	s °C Incident Irrad. = 1000 W/m²	551.3 W		
Cells temp. = 25	"C Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m²	551.3 W		
Cells temp. = 25	Incident Irrad. = 1000 W/m² Incident Irrad. = 800 W/m² Incident Irrad. = 600 W/m²	551.3 W 442.0 W		

09/21/24

PVsyst Licensed to Renewable Energy Test Center (United states)



Annex 1: List of measurement equipment

Description	Identification #	Calibration Due Date
Luminometer	JXYQ-024	2025/04/19
Steel tape	JXYQ-034	2025/04/19
Vernier calliper	JXYQ-033	2025/04/19
Pulsed Solar Simulator	JXYQ-043	2025/05/05
Infrared thermometer	JXYQ-021	2025/04/27
Steady state solar simulator	JXYQ-030	2025/05/05
Pyranometer	JXYQ-003	2025/07/16
Pulsed Solar Simulator	JXYQ-111	2024/12/25



Project: PAN File Creation: LR5-72HBD-545M (BOM-5)

Annex 2: Statement of the estimated uncertainty of the test results

Under the condition of fixed temperature and irradiance, using Zhongsen transient solar simulator to measure the relative uncertainty of short-circuit current expansion of crystalline silicon photovoltaic modules Urel = 2.4%, open-circuit voltage expansion relative uncertainty Urel = 2.6%. And for performance measurement tests other than 1000 W/m^2 , the relative uncertainty of short-circuit current expansion of crystalline silicon photovoltaic modules Urel = 3.0%, open-circuit voltage expansion relative uncertainty Urel = 3.1%.

The reported AOI measurements are subject to relative uncertainty of short circuit current, Urel =2.4% for 0 to 40 degrees, Urel =2.6% for 50 to 65 degrees, Urel =2.7% for 70 degrees, Urel =2.9% for 75 degrees, Urel =3.3% for 80 degrees, Urel =4.2% for 85 degrees.

Stated quantities represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Unless otherwise specified (such as inherent clauses in the standard), all compliance and pass/fail statements are binary simple acceptance based on the tolerance interval.



About RETC



RETC, LLC (Renewable Energy Test Center, LLC) is an engineering services, and certification testing provider for photovoltaic and renewable energy products. Headquartered in sunny California, USA, with global partners UL, VDE, TUV SUD, TUV Rheinland, and Intertek, complementing its strategy to deliver a One-Stop-Shop capabilities for the growth of PV testing and certification services. RETC is an ILAC affiliated laboratory, ISO 17025 accredited by A2LA, and holds a CBTL status, a distinguished accreditation for global market access in the IEC CB scheme.

RETC provides testing services for PV panels, components (cells, connectors, backsheets), BOS devices (racking, trackers/tracking systems controls and monitoring, inverters, micro-inverters), Energy Storage Systems and other renewable energy product components to support the

growing need for a 3rd party performance validation and monitoring.

RETC offers Outdoor Endurance and Long-Term Performance testing capabilities at its Nevada test site for desert / southwest weather conditions, Chile for high irradiance and at its Philippines test site for tropical high temperature and high humidity weather conditions.

RETC launched the Solar Industry's first Bifacial Module Ranking in collaboration with Black and Veatch and released its inaugural PV Module Index in 2019, the industry's first comprehensive solar module ranking initiative that focuses on Reliability, Performance and a manufacturer's commitment to Quality.