TEST REPORT

According to ANSI/IES LM-80-15
For

Hongli Zhihui Group Co.,Ltd.Guangzhou Branch

Room 316, Building 2, No.1,Xianke Yi Road, Huadong Town, Huadu District, Guangzhou,China

Model: HL-LH1611F95W-18B4C12(Ra4)-FC-DS

Report Type: 7000 Hours Test Report	**Product Type:** LED Module
Reviewed By:	Pote Wang
Report Number:	SZ2230522-28391E-EE-7000
Test Date:	2023-05-30 to 2024-04-02
Report Date:	2024-04-29
Approved by:	Blake Zhang / EE Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax:+86-0769-86858588

TABLE OF CONTENTS

1 - General Information

1.1 Description of LED Light Sources#

Sample Size:

30 PCS test samples were in good condition and received on 2023-05-22. The samples were numbered from 1 to 15 and 16 to 30.

Manufacturer:	Hongli Zhihui Group Co.,Ltd.Guangzhou Branch
Part Number:	HL-LH1611F95W-18B4C12(Ra4)-FC-DS
Part Type:	LED Module
Drive Level:	DC 750mA
Nominal CCT:	2700K
Power:	27W
Average Current Density per LED die:	567.628mA/mm^2
Average Power Density per LED die:	1.703W/mm^2
CRI:	90
Die Spacing:	0.2mm

Sampling Method:

LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.
These manufacturing lots are picked to represent a wide parametric distribution.

Family products covered by this report:

According to *ENERGY STAR® Requirements for the Use of LM-80 Data*, the following products can be covered by this report base on the information and declaration provided by manufacturer. The information of these models shows that the covered products meet all section 4 requirements of *ENERGY STAR® Requirements for the Use of LM-80 Data* (September 28, 2017)

This report covers the following models:

Model type	Model name	CRI(typ.)	CCT(typ.)	Series&Parallel	Power density (W/mm^2)	Current density per LED die (mA/mm^2)	Current per die(mA)	Distance between of dies	Current (mA)
Tested model	HL-LH1611F95W-18B4C12(Ra4)-FC-DS	90	2700K	B2C12+B2C12	0.1755	567.628	375	0.2	750
Multiple models	HL-LH1308F95W-9B2C12(Ra*)-FC-DS	80~90	2700K~6500K	B1C12+B1C12	0.0700	529.786	350	0.335	350
Multiple models	HL-LH1308F95W-9B4C6(Ra*)-FC-DS	80~90	2700K~6500K	B2C6+B2C6	0.0700	529.786	350	0.25	700
Multiple models	HL-LH002F95W-12B2C12(Ra*)-DS	80~90	2700K~6500K	B1C12+B1C12	0.0692	529.786	350	0.484	350
Multiple models	HL-LH012F82W-12B2C12(Ra*)-DS	80~90	2700K~6500K	B1C12+B1C12	0.0692	442.858	350	0.383	350
Multiple models	HL-LH015F95W-12B2C12(Ra*)-DS	80~90	2700K~6500K	B1C12+B1C12	0.0692	529.786	350	0.484	350
Multiple models	HL-LH003F95W-24B4C12(Ra*)-DS	80~90	2700K~6500K	B2C12+B2C12	0.0748	567.628	375	0.326	750
Tested model	HL-LH1611F95W-18B4C12(Ra*)-FC-DS	80~90	2700K~6500K	B2C12+B2C12	0.1755	567.628	375	0.2	750

Note:

The model name begins with "HL", such as " HL-LH1308F95W-9B2C12(Ra*)-FC-DS " is described in detail as follows :
1. The "*"is the number 2 or 4 which stands for the different CRI style.

1.2 Standards and Reference Documentations

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- CIE 127:2007: Measurement of LEDs
- ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by IAS)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
1.0m integrating sphere	SENSING	SCD-20008	N/A	2023-09-02	2024-09-01
spectroradiometer	SENSING	SSP 3112-D	N/A	2023-09-02	2024-09-01
DC Power Supply	Hanshenpuyuan	HSPY-100-05	2013010210003	2023-09-02	2024-09-01
Standard Light Source	EVERFINE	D204	N/A	2023-05-12	2025-05-11
Programmable Test Power for LEDs	EVERFINE	LED300E	N/A	2023-10-16	2024-10-15
DC Power Supply	BACL	B25001	90020	2023-10-16	2024-10-15
Multilayer aging machine	BACL	B3-900	20030	2023-10-16	2024-10-15
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090003	2023-09-02	2024-09-01

1.4 Drive Level

Samples are driven with a constant direct current (DC) during maintenance test, photometric and electrical measurement. The current value was regulated to within ±3% of the specified value of the manufacturer during maintenance test, and was within ±0.5% during photometric and electrical measurement test.

1.5 Ambient Conditions for Maintenance Test

For lumen maintenance test, samples within one data set, were installed on cooling boards in thermal chambers with minimal ambient airflow. The case temperature and ambient temperature was monitored by thermocouples which one was soldered to the coldest DUTs' case (TMP_{LED}) location, while the other is mounted at a distance of 5 mm above the TMP location.

During life testing, TMP_{LED} of the coldest LEDs were maintained at a temperature that was greater than or equal to 2°C below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to 5°C below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within ±3% of the specified value of the manufacturer.

The relative humidity within chamber was kept less than 65% during test.

For photometry measurement, the ambient temperature during test was set to 25°C ± 2°C, RH <65%.

1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate u'v'. 2π measurement was used and sample was drived by DC power supply. The forward current was regulated to within ±0.5% of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to 25°C ± 2°C, RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

The uncertainty of the light output measurements is U=1.59% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=21K (K=2), at the 95% confidence level.

The uncertainty of the temperature is U=0.8671°C (K=2), at the 95% confidence level.

1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.8 Sample Set

Data Set 1: 55°C, 750mA

Part Number:	HL-LH1611F95W-18B4C12(Ra4)-FC-DS
Number of Units:	15
Case Temperature:	>53°C
Ambient Temperature:	>50°C
Life Test Drive Current:	750mA
Measurement Current:	750mA

Data Set 2:105°C, 750mA

Part Number:	HL-LH1611F95W-18B4C12(Ra4)-FC-DS
Number of Units:	15
Case Temperature:	>103°C
Ambient Temperature:	>100°C
Life Test Drive Current:	750mA
Measurement Current:	750mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM-21 L_{70} Lifetime	Reported TM-21 L_{90} Lifetime
1	15	0	1000hrs	7000hrs	2.442E-06	1.002	>39000 hours	>39000 hours
2	15	0	1000hrs	7000hrs	2.892E-06	1.002	>39000 hours	37,000 hours

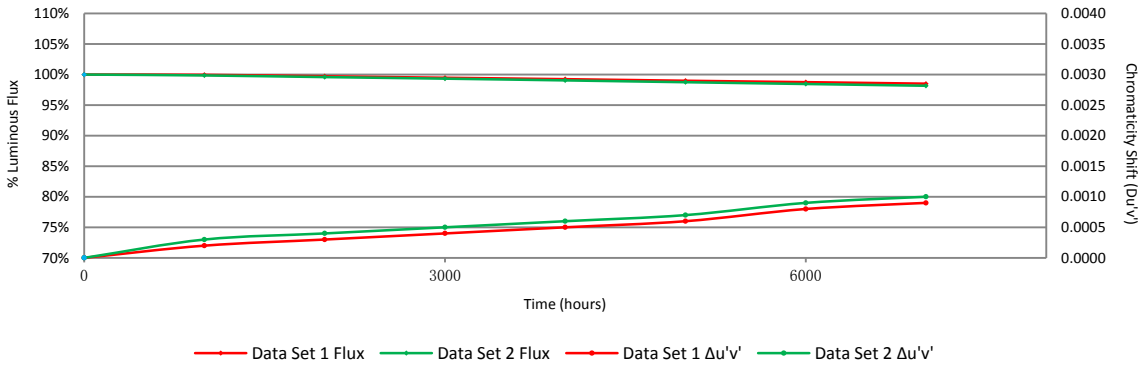
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	99.96%	99.72%	99.48%	99.25%	98.99%	98.76%	98.51%
2	99.86%	99.59%	99.33%	99.05%	98.75%	98.46%	98.17%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009
2	0.0003	0.0004	0.0005	0.0006	0.0007	0.0009	0.0010

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 55°C, 750mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	2311.99	99.70	99.41	99.33	98.99	98.73	98.57	98.19
2	2410.79	100.05	99.69	99.50	99.25	98.94	98.50	98.36
3	2384.44	99.72	99.38	99.28	99.07	98.91	98.74	98.58
4	2417.38	99.91	99.67	99.38	99.29	98.96	98.71	98.50
5	2456.90	99.81	99.71	99.41	99.02	98.78	98.50	98.23
6	2443.72	100.18	100.06	99.65	99.49	99.11	98.94	98.31
7	2410.79	99.77	99.61	99.23	99.04	98.90	98.74	98.42
8	2443.72	99.95	99.81	99.62	99.50	99.02	98.75	98.63
9	2423.96	100.09	99.93	99.82	99.48	99.03	98.84	98.58
10	2456.90	100.28	100.22	100.02	99.81	99.62	99.41	99.26
11	2437.14	100.21	100.05	99.80	99.65	99.41	99.10	98.89
12	2423.96	100.05	99.82	99.48	99.37	99.11	98.67	98.38
13	2397.62	99.92	99.53	99.31	99.00	98.79	98.76	98.49
14	2437.14	99.86	99.56	99.14	98.95	98.82	98.55	98.41
15	2404.20	99.83	99.39	99.30	98.85	98.67	98.58	98.46
Avg.	2417.38	99.96	99.72	99.48	99.25	98.99	98.76	98.51
Med.	2423.96	99.92	99.69	99.41	99.25	98.94	98.74	98.46
st dev	36.08	0.18	0.26	0.25	0.29	0.26	0.24	0.27
Min.	2311.99	99.70	99.38	99.14	98.85	98.67	98.50	98.19
Max.	2456.90	100.28	100.22	100.02	99.81	99.62	99.41	99.26

3.2 Data Set 1, 55°C, 750mA (Forward Voltage)

No.	Forward Voltage (V)							
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	35.43	35.48	35.49	35.24	35.26	35.46	35.38	35.34
2	35.61	35.88	35.68	35.67	35.62	35.82	35.77	35.72
3	35.53	35.51	35.43	35.45	35.44	35.64	35.82	35.78
4	35.68	35.68	35.72	35.74	35.67	35.62	35.45	35.52
5	35.82	35.83	35.63	35.69	35.62	35.83	35.67	35.62
6	36.05	35.97	35.39	35.23	35.27	35.34	35.42	35.45
7	35.68	35.64	35.76	35.74	35.64	35.62	35.64	35.68
8	35.35	35.42	35.37	35.34	35.32	35.53	35.56	35.52
9	35.83	35.78	35.69	35.64	35.67	35.58	35.52	35.54
10	35.64	35.41	35.75	35.72	35.69	35.62	35.68	35.64
11	35.65	35.71	35.36	35.64	35.58	35.79	35.72	35.76
12	35.67	35.69	35.29	35.27	35.34	35.54	35.62	35.62
13	35.56	35.66	35.37	35.33	35.36	35.56	35.52	35.58
14	35.66	35.69	35.34	35.41	35.44	35.42	35.44	35.42
15	35.57	35.62	35.36	35.32	35.42	35.63	35.68	35.62
Avg.	35.65	35.66	35.51	35.50	35.49	35.60	35.59	35.59
Med.	35.65	35.68	35.43	35.45	35.44	35.62	35.62	35.62
st dev	0.17	0.16	0.17	0.20	0.16	0.14	0.13	0.12
Min.	35.35	35.41	35.29	35.23	35.26	35.34	35.38	35.34
Max.	36.05	35.97	35.76	35.74	35.69	35.83	35.82	35.78

3.3 Data Set 1, 55°C, 750mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')						
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	0.2599	0.5285	2750	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.0009
2	0.2598	0.5294	2748	0.0002	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009
3	0.2653	0.5271	2644	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009
4	0.2599	0.5295	2746	0.0004	0.0005	0.0006	0.0007	0.0009	0.0010	0.0011
5	0.2606	0.5297	2730	0.0001	0.0001	0.0002	0.0004	0.0005	0.0006	0.0008
6	0.2603	0.5289	2740	0.0003	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008
7	0.2619	0.5298	2704	0.0004	0.0005	0.0006	0.0007	0.0009	0.0010	0.0011
8	0.2601	0.5297	2740	0.0003	0.0002	0.0001	0.0002	0.0003	0.0004	0.0006
9	0.2606	0.5293	2732	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009
10	0.2601	0.5294	2742	0.0003	0.0002	0.0001	0.0002	0.0003	0.0004	0.0006
11	0.2600	0.5292	2744	0.0001	0.0001	0.0002	0.0004	0.0005	0.0006	0.0008
12	0.2593	0.5291	2760	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009
13	0.2635	0.5301	2670	0.0002	0.0004	0.0005	0.0006	0.0008	0.0009	0.0011
14	0.2598	0.5293	2750	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008	0.0009
15	0.2602	0.5292	2740	0.0003	0.0004	0.0006	0.0007	0.0008	0.0010	0.0011
Avg.	0.2608	0.5292	2729	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009
Med.	0.2601	0.5293	2740	0.0002	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009
st dev	0.0016	0.0007	32	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2593	0.5271	2644	0.0001	0.0001	0.0001	0.0002	0.0003	0.0004	0.0006
Max.	0.2653	0.5301	2760	0.0004	0.0005	0.0006	0.0007	0.0009	0.0010	0.0011

3.4 Data Set 2,105°C, 750mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
16	2404.20	99.82	99.55	99.15	98.95	98.54	98.06	97.77
17	2423.96	99.79	99.49	99.14	99.06	98.63	98.38	98.13
18	2443.72	99.86	99.66	99.53	99.12	98.86	98.65	98.31
19	2404.20	99.93	99.56	99.14	98.95	98.68	98.34	98.06
20	2423.96	99.84	99.56	99.37	99.06	98.68	98.38	98.19
21	2437.14	99.95	99.75	99.69	99.24	99.09	98.85	98.56
22	2437.14	99.78	99.53	99.42	99.03	98.73	98.42	98.30
23	2423.96	99.91	99.56	99.40	99.21	98.84	98.63	98.36
24	2430.55	100.05	99.80	99.47	99.10	98.89	98.69	98.23
25	2450.31	99.67	99.40	99.16	98.86	98.65	98.46	98.05
26	2423.96	99.88	99.56	99.33	99.06	98.83	98.53	98.23
27	2437.14	99.93	99.76	99.25	98.93	98.69	98.42	98.17
28	2456.90	99.94	99.46	99.14	98.96	98.73	98.19	97.77
29	2423.91	99.88	99.78	99.52	99.11	98.68	98.43	98.21
30	2423.96	99.65	99.44	99.24	99.07	98.73	98.53	98.20
Avg.	2429.67	99.86	99.59	99.33	99.05	98.75	98.46	98.17
Med.	2423.96	99.88	99.56	99.33	99.06	98.73	98.43	98.20
st dev	14.70	0.10	0.13	0.18	0.11	0.13	0.20	0.20
Min.	2404.20	99.65	99.40	99.14	98.86	98.54	98.06	97.77
Max.	2456.90	100.05	99.80	99.69	99.24	99.09	98.85	98.56

3.5 Data Set 2,105°C, 750mA (Forward Voltage)

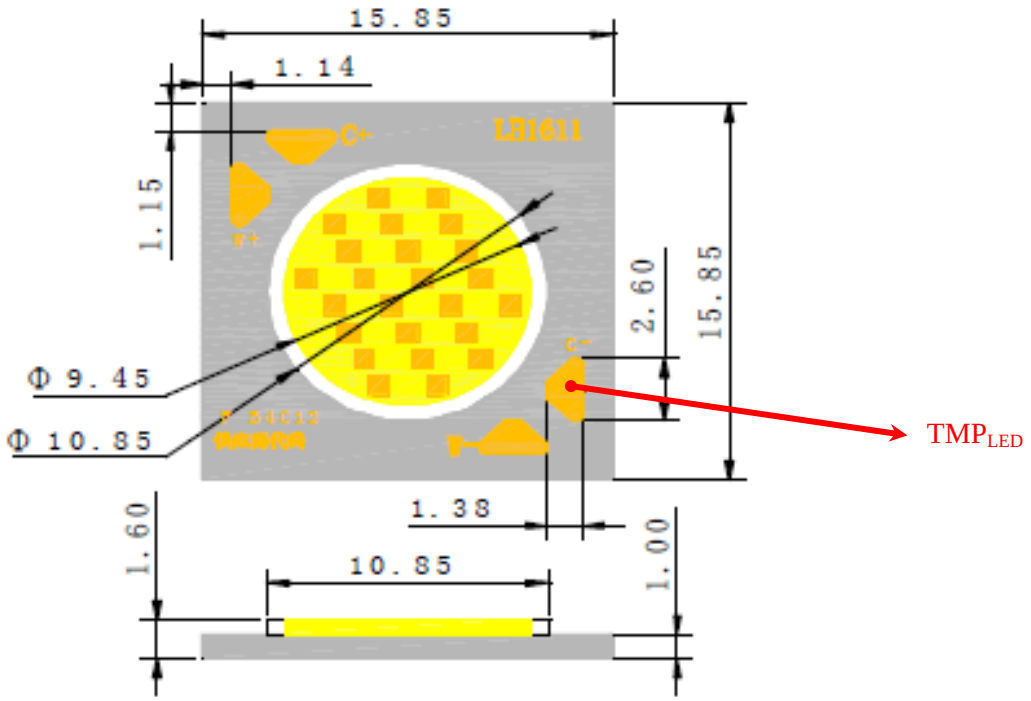
No.	Forward Voltage (V)							
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
16	35.61	35.71	35.67	35.64	35.62	35.57	35.58	35.62
17	35.71	35.66	35.43	35.24	35.28	35.34	35.42	35.45
18	35.57	35.58	35.62	35.68	35.62	35.58	35.64	35.65
19	35.57	35.64	35.19	35.26	35.34	35.54	35.42	35.44
20	35.59	35.49	35.29	35.36	35.34	35.54	35.47	35.42
21	35.39	35.44	35.22	35.36	35.33	35.54	35.52	35.58
22	35.66	35.76	35.42	35.46	35.42	35.42	35.38	35.32
23	35.66	35.68	35.72	35.64	35.62	35.58	35.52	35.45
24	35.50	35.49	35.47	35.56	35.52	35.57	35.64	35.68
25	35.41	35.49	35.62	35.67	35.69	35.89	35.64	35.67
26	35.51	35.47	35.37	35.28	35.31	35.51	35.57	35.52
27	35.65	35.52	35.53	35.57	35.52	35.72	35.62	35.67
28	35.53	35.56	35.57	35.51	35.57	35.78	35.77	35.75
29	35.50	35.49	35.59	35.64	35.64	35.68	35.64	35.62
30	35.55	35.60	35.73	35.75	35.72	35.67	35.62	35.68
Avg.	35.56	35.57	35.50	35.51	35.50	35.60	35.56	35.57
Med.	35.57	35.56	35.53	35.56	35.52	35.57	35.58	35.62
st dev	0.09	0.10	0.17	0.17	0.15	0.14	0.11	0.13
Min.	35.39	35.44	35.19	35.24	35.28	35.34	35.38	35.32
Max.	35.71	35.76	35.73	35.75	35.72	35.89	35.77	35.75

3.6 Data Set 2,105°C, 750mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')						
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
16	0.2601	0.5291	2742	0.0002	0.0001	0.0002	0.0004	0.0005	0.0007	0.0008
17	0.2623	0.5299	2694	0.0003	0.0001	0.0004	0.0005	0.0007	0.0009	0.0010
18	0.2595	0.5293	2754	0.0002	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008
19	0.2623	0.5297	2694	0.0002	0.0001	0.0002	0.0005	0.0006	0.0010	0.0012
20	0.2589	0.5287	2770	0.0004	0.0003	0.0002	0.0004	0.0005	0.0006	0.0008
21	0.2616	0.5300	2708	0.0004	0.0006	0.0007	0.0010	0.0011	0.0015	0.0016
22	0.2614	0.5299	2712	0.0002	0.0004	0.0005	0.0007	0.0009	0.0010	0.0012
23	0.2596	0.5293	2752	0.0004	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012
24	0.2609	0.5296	2724	0.0004	0.0003	0.0004	0.0001	0.0003	0.0003	0.0004
25	0.2602	0.5295	2740	0.0001	0.0004	0.0006	0.0006	0.0008	0.0008	0.0009
26	0.2597	0.5293	2750	0.0003	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010
27	0.2598	0.5292	2748	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008	0.0009
28	0.2601	0.5298	2740	0.0003	0.0004	0.0006	0.0006	0.0008	0.0008	0.0009
29	0.2605	0.5293	2734	0.0002	0.0004	0.0005	0.0005	0.0007	0.0007	0.0009
30	0.2601	0.5292	2742	0.0002	0.0003	0.0004	0.0006	0.0008	0.0010	0.0011
Avg.	0.2605	0.5295	2734	0.0003	0.0004	0.0005	0.0006	0.0007	0.0009	0.0010
Med.	0.2601	0.5293	2740	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.0009
st dev	0.0010	0.0004	23	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003
Min.	0.2589	0.5287	2694	0.0001	0.0001	0.0002	0.0001	0.0003	0.0003	0.0004
Max.	0.2623	0.5300	2770	0.0004	0.0007	0.0008	0.0010	0.0011	0.0015	0.0016

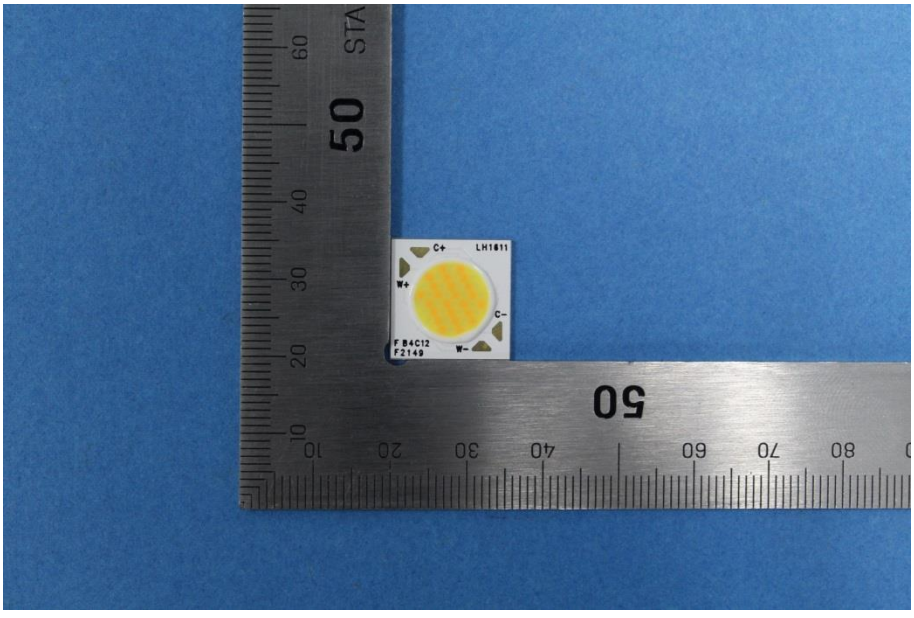
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



Directions

1. The information marked “superscript #” is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
3. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
4. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K=2 with the 95% confidence interval.
5. This report cannot be reproduced except in full, without prior written approval of the Company.
6. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

**********END OF REPORT**********