



# 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-AS-2835D3W-2-S1-08L-  
PCT-HR3**

<b>Report Type:</b> 6000 Hours Test Report	<b>Product Type:</b> LED Package
<b>Reviewed By:</b> Pote Wang	<i>Pote Wang</i>
<b>Report Number:</b>	RSZ191101550-10-6000
<b>Test Date:</b>	2019-11-02 to 2020-07-11
<b>Report Date:</b>	2020-12-31
<b>Approved by:</b>	Bill Xiong / EE Engineer
<b>Test Facility:</b>	Test facility was located at No.12, Pulong East 1 <sup>st</sup> Road, Tangxia Town, Dongguan, Guangdong, China.
<b>Prepared By:</b>	Bay Area Compliance Laboratories Corp. (Dongguan). No.12, Pulong East 1 <sup>st</sup> Road, Tangxia Town, Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax:+86-0769-86858588
<b>Accreditation:</b>	The IAS Accreditation Number TL-460.

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## 1 - General Information

### 1.1 Description of LED Light Sources

#### Sample Size:

60 PCS test samples were in good condition and received on 2019-11-01. The samples were numbered from 1 to 30 and 31 to 60.

#Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
#Part Number:	HL-AS-2835D3W-2-S1-08L-PCT-HR3
#Part Type:	LED Package
#Drive Level:	DC 150mA
#Wavelength:	608nm
#Power:	0.945W
#Average Current Density per LED die:	431.69 mA/mm <sup>2</sup>
#Average Power Density per LED die:	1.36W/mm <sup>2</sup>
#CRI:	80
#Die Spacing:	0.15mm

#### 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	CCT	Series	Parallel	Power density (W/mm <sup>2</sup> )	Current density per LED die (mA/mm <sup>2</sup> )	Current per die (mA)	Distance between of dies	Current (mA)
Master model	HL-AS-2835D3W-2-S1-08L-PCT-HR3	80	2700K	1	2	0.0527	431.69	75	0.15	150
multiple model	HL-AS-2835D***W-2-S1-08L-PCT-HR3	80	3000K	1	2	0.0527	431.69	75	0.15	150
		80	4000K	1	2	0.0527	431.69	75	0.15	150
		80	5000K	1	2	0.0527	431.69	75	0.15	150
		80	5700K	1	2	0.0527	431.69	75	0.15	150
		80	6500K	1	2	0.0527	431.69	75	0.15	150
		80	≥2200K	1	2	0.0527	431.69	75	0.15	150
Multiple model	HL-AS-2835D***W-2-S1-08L-PCT-HR3 (R9)	80	2700K	1	2	0.0527	431.69	75	0.15	150
		80	3000K	1	2	0.0527	431.69	75	0.15	150
		80	4000K	1	2	0.0527	431.69	75	0.15	150
		80	5000K	1	2	0.0527	431.69	75	0.15	150
		80	5700K	1	2	0.0527	431.69	75	0.15	150
		80	6500K	1	2	0.0527	431.69	75	0.15	150
		80	≥2200K	1	2	0.0527	431.69	75	0.15	150

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Multiple model	HL-AS-2835D***W-2-S1-08-PCT-HR3	80	2700K	1	2	0.0527	431.69	75	0.15	150
		80	3000K	1	2	0.0527	431.69	75	0.15	150
		80	4000K	1	2	0.0527	431.69	75	0.15	150
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		80	5700K	1	2	0.0527	431.69	75	0.15	150
		80	6500K	1	2	0.0527	431.69	75	0.15	150
		80	≥2200K	1	2	0.0527	431.69	75	0.15	150
multiple model	HL-AS-2835D***W-2-S1-08L-PCT-HR3	80	2700K	1	2	0.02176	187.07	32.5	0.15	65
		80	3000K	1	2	0.02176	187.07	32.5	0.15	65
		80	4000K	1	2	0.02176	187.07	32.5	0.15	65
		80	5000K	1	2	0.02176	187.07	32.5	0.15	65
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Multiple model	HL-AS-2835H***W-2-S1-08L-PCT-HR3	80	2700K	1	2	0.02176	375.12	32.5	0.15	65
		80	3000K	1	2	0.02176	375.12	32.5	0.15	65
		80	4000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5700K	1	2	0.02176	375.12	32.5	0.15	65
		80	6500K	1	2	0.02176	375.12	32.5	0.15	65
		80	≥2200K	1	2	0.02176	375.12	32.5	0.15	65
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		80	4000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5700K	1	2	0.02176	375.12	32.5	0.15	65
		80	6500K	1	2	0.02176	375.12	32.5	0.15	65
		80	≥2200K	1	2	0.02176	375.12	32.5	0.15	65
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		80	5000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5700K	1	2	0.02176	375.12	32.5	0.15	65
		80	6500K	1	2	0.02176	375.12	32.5	0.15	65
		80	≥2200K	1	2	0.02176	375.12	32.5	0.15	65
Multiple model	HL-AS-2835D***W-S1-08L-PCT-HR3	80	2700K	1	1	0.02176	374.13	65	/	65
		80	3000K	1	1	0.02176	374.13	65	/	65
		80	4000K	1	1	0.02176	374.13	65	/	65
		80	5000K	1	1	0.02176	374.13	65	/	65
		80	5700K	1	1	0.02176	374.13	65	/	65
		80	6500K	1	1	0.02176	374.13	65	/	65
		80	≥2200K	1	1	0.02176	374.13	65	/	65
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		80	3000K	1	1	0.02176	374.13	65	/	65
		80	4000K	1	1	0.02176	374.13	65	/	65
		80	5000K	1	1	0.02176	374.13	65	/	65
		80	5700K	1	1	0.02176	374.13	65	/	65
		80	6500K	1	1	0.02176	374.13	65	/	65
		80	≥2200K	1	1	0.02176	374.13	65	/	65

Model type	Model name	CRI	CCT	Series	Parallel	Power density (W/mm <sup>2</sup> )	Current density per LED die (mA/mm <sup>2</sup> )	Current per die (mA)	Distance between of dies	Current (mA)
Multiple Model	HL-AS-2835D***W-S1-08-PCT-HR3	80	2700K	1	1	0.02176	374.13	65	/	65
		80	3000K	1	1	0.02176	374.13	65	/	65
		80	4000K	1	1	0.02176	374.13	65	/	65
		80	5000K	1	1	0.02176	374.13	65	/	65
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		80	5000K	1	1	0.02176	374.13	65	/	65
		80	5700K	1	1	0.02176	374.13	65	/	65
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		80	4000K	1	2	0.02176	187.07	32.5	0.15	65
		80	5000K	1	2	0.02176	187.07	32.5	0.15	65
		80	5700K	1	2	0.02176	187.07	32.5	0.15	65
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		80	6500K	1	2	0.02176	187.07	32.5	0.15	65
		80	≥2200K	1	2	0.02176	187.07	32.5	0.15	65
Multiple model	HL-A-2835H***W-2-S1-08L-PCT-HR3	80	2700K	1	2	0.02176	375.12	32.5	0.15	65
		80	3000K	1	2	0.02176	375.12	32.5	0.15	65
		80	4000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5700K	1	2	0.02176	375.12	32.5	0.15	65
		80	6500K	1	2	0.02176	375.12	32.5	0.15	65
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		80	5700K	1	2	0.02176	375.12	32.5	0.15	65
		80	6500K	1	2	0.02176	375.12	32.5	0.15	65
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		80	5000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5700K	1	2	0.02176	375.12	32.5	0.15	65
		80	6500K	1	2	0.02176	375.12	32.5	0.15	65
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Multiple model	HL-A-2835H***W-2-S1-08-PCT-HR3(R9)	80	2700K	1	2	0.02176	375.12	32.5	0.15	65
		80	3000K	1	2	0.02176	375.12	32.5	0.15	65
		80	4000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5000K	1	2	0.02176	375.12	32.5	0.15	65
		80	5700K	1	2	0.02176	375.12	32.5	0.15	65
		80	6500K	1	2	0.02176	375.12	32.5	0.15	65
		80	≥2200K	1	2	0.02176	375.12	32.5	0.15	65
Multiple model	HL-A-2835D***W-S1-08L-PCT-HR3	80	2700K	1	1	0.02176	374.13	65	/	65
		80	3000K	1	1	0.02176	374.13	65	/	65
		80	4000K	1	1	0.02176	374.13	65	/	65
		80	5000K	1	1	0.02176	374.13	65	/	65
		80	5700K	1	1	0.02176	374.13	65	/	65
		80	6500K	1	1	0.02176	374.13	65	/	65
		80	≥2200K	1	1	0.02176	374.13	65	/	65
Multiple model	HL-A-2835D***W-S1-08L-PCT-HR3(R9)	80	2700K	1	1	0.02176	374.13	65	/	65
		80	3000K	1	1	0.02176	374.13	65	/	65
		80	4000K	1	1	0.02176	374.13	65	/	65
		80	5000K	1	1	0.02176	374.13	65	/	65
		80	5700K	1	1	0.02176	374.13	65	/	65
		80	6500K	1	1	0.02176	374.13	65	/	65
		80	≥2200K	1	1	0.02176	374.13	65	/	65
Multiple Model	HL-A-2835D***W-S1-08-PCT-HR3	80	2700K	1	1	0.02176	374.13	65	/	65
		80	3000K	1	1	0.02176	374.13	65	/	65
		80	4000K	1	1	0.02176	374.13	65	/	65
		80	5000K	1	1	0.02176	374.13	65	/	65
		80	5700K	1	1	0.02176	374.13	65	/	65
		80	6500K	1	1	0.02176	374.13	65	/	65
		80	≥2200K	1	1	0.02176	374.13	65	/	65
Multiple model	HL-A-2835D***W-S1-08-PCT-HR3(R9)	80	2700K	1	1	0.02176	374.13	65	/	65
		80	3000K	1	1	0.02176	374.13	65	/	65
		80	4000K	1	1	0.02176	374.13	65	/	65
		80	5000K	1	1	0.02176	374.13	65	/	65
		80	5700K	1	1	0.02176	374.13	65	/	65
		80	6500K	1	1	0.02176	374.13	65	/	65
		80	≥2200K	1	1	0.02176	374.13	65	/	65

**Note:**

“\*\*\*” is a number from 1 to 999 which stand for the brightness level.



## 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
- ANSI/ASABE S640 JUL2017 Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms) (This standard was not accredited by IAS)
- ANSI/ASABE S642 SEP2018: Recommended Methods for Measurement and Testing of LED Products for Plant Growth and Development (This standard was not accredited by IAS)

## 1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
High Accuracy Array Spectroradiometer	EVERFINE	HAAS 2000	P600674CM5391140	2019-10-22	2020-10-21
0.5M Integrating Sphere	EVERFINE	0.5m	NA	2019-10-22	2020-10-21
LED Test Source	EVERFINE	LTS-300	P185616CJ1391143	2019-11-05	2020-11-04
Standard Light Source	EVERFINE	D204	G100283CA8351158	2019-11-19	2020-11-18
High Accuracy Array Spectroradiometer	EVERFINE	HAAS 2000	P600674CM5391140	2019-10-22	2020-10-21
Multilayer aging machine	BACL	B2-270	20023	2020-03-11	2021-03-10
DC Power Supply	BACL	B12001-12	90023	2020-03-16	2021-03-15

## 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  $\pm 3\%$  of the specified value of the manufacturer during maintenance test, and was within  $\pm 0.5\%$  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  $2^{\circ}C$  below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to  $5^{\circ}C$  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  $\pm 3\%$  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  $25^{\circ}C \pm 2^{\circ}C$ , RH <65%.

## 1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure spectral power distribution and photon flux.  $2\pi$  measurement was used and sample was driven by DC power supply. The forward current was regulated to within  $\pm 0.5\%$  of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to  $25^{\circ}C \pm 2^{\circ}C$ , RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

## 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, 150mA

Part Number: HL-AS-2835D3W-2-S1-08L-PCT-HR3  
Number of Units: 30  
Case Temperature: >53°C  
Ambient Temperature: >50°C  
Life Test Drive Current: 150mA  
Measurement Current: 150mA

### Data Set 2: 105°C, 150mA

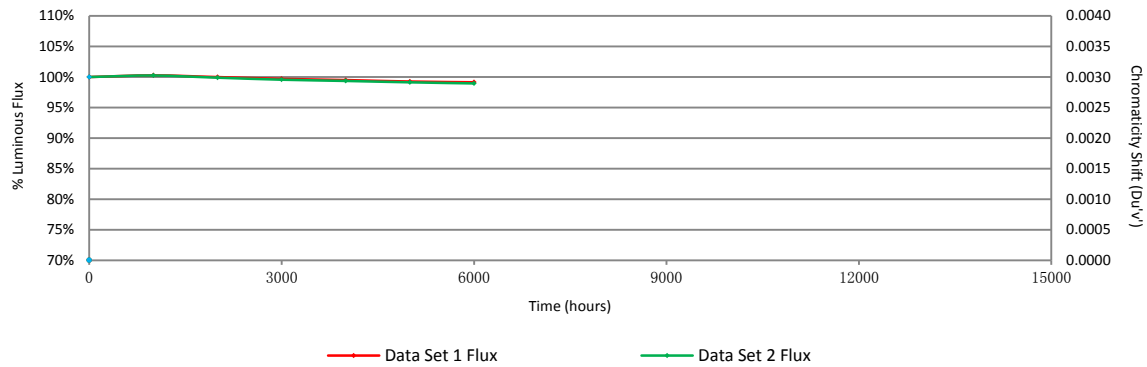
Part Number: HL-AS-2835D3W-2-S1-08L-PCT-HR3  
Number of Units: 30  
Case Temperature: >103°C  
Ambient Temperature: >100°C  
Life Test Drive Current: 150mA  
Measurement Current: 150mA

## 2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	$\alpha$	$\beta$	Reported TM-21 Q <sub>70</sub> Lifetime	Reported TM-21 Q <sub>90</sub> Lifetime
1	30	0	1000hrs	6000hrs	2.305E-06	1.004	>36000 hours	>36000 hours
2	30	0	1000hrs	6000hrs	2.577E-06	1.004	>36000 hours	>36000 hours

Average Photon Flux Maintenance, Photosynthetic 400-700nm (PFM<sub>P</sub>) (Percentage of Initial)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	100.27%	99.99%	99.70%	99.50%	99.26%	99.14%
2	100.25%	99.89%	99.56%	99.36%	99.13%	98.95%



### 3 - Test Data

#### 3.1 Data Set 1, 55°C, 150mA (400-700nm Photon Flux Maintenance)

No.	$\Phi_p$ ( $\mu\text{mol} \times \text{s}^{-1}$ )	400-700nm Photon Flux Maintenance (%)					
		0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs
1	0.9701	100.49	100.25	99.91	99.53	99.43	99.31
2	0.9734	100.59	100.01	99.87	99.52	99.35	99.17
3	0.9781	100.31	99.97	99.86	99.49	99.34	99.14
4	0.9678	100.31	100.01	99.82	99.61	99.34	99.19
5	0.9736	100.34	100.07	99.86	99.70	99.38	99.24
6	0.9720	100.37	100.11	99.92	99.68	99.41	99.26
7	0.9724	100.26	99.98	99.74	99.48	99.27	99.15
8	0.9680	100.24	99.90	99.75	99.49	99.28	99.13
9	0.9665	100.21	99.76	99.69	99.40	99.18	99.05
10	0.9550	100.17	99.94	99.69	99.49	99.25	99.11
11	0.9763	100.29	100.07	99.81	99.52	99.28	99.15
12	0.9711	100.18	99.94	99.65	99.46	99.25	99.02
13	0.9653	100.21	99.93	99.69	99.37	99.20	99.09
14	0.9669	100.14	99.91	99.14	99.48	99.20	99.10
15	0.9768	100.21	100.01	99.64	99.53	99.28	99.12
16	0.9712	100.40	100.11	99.81	99.58	99.29	99.23
17	0.9664	100.20	99.94	99.62	99.41	99.21	98.97
18	0.9767	100.39	100.12	99.88	99.62	99.42	99.22
19	0.9867	100.26	100.07	99.74	99.56	99.00	99.11
20	0.9694	100.19	99.90	99.55	99.39	99.12	99.04
21	0.9704	100.26	100.05	99.72	99.55	99.28	99.21
22	0.9718	100.15	99.98	99.66	99.45	99.12	99.10
23	0.9670	100.09	99.97	99.64	99.45	99.23	99.11
24	0.9771	100.29	99.99	99.67	99.57	99.32	99.21
25	0.9857	100.27	99.99	99.66	99.51	99.27	99.08
26	0.9627	100.25	100.01	99.65	99.51	99.27	99.16
27	0.9873	100.29	100.01	99.66	99.47	99.23	99.11
28	0.9769	100.31	99.98	99.58	99.42	99.14	99.07
29	0.9842	100.34	100.05	99.66	99.55	99.31	99.22
30	0.9660	100.18	99.82	99.58	99.33	99.13	99.04
Avg.	0.9724	100.27	99.99	99.70	99.50	99.26	99.14
Med.	0.9715	100.26	99.99	99.69	99.50	99.27	99.13
st dev	0.0073	0.11	0.09	0.15	0.09	0.10	0.08
Min.	0.9550	100.09	99.76	99.14	99.33	99.00	98.97
Max.	0.9873	100.59	100.25	99.92	99.70	99.43	99.31

**3.2 Data Set 1, 55°C, 150mA (Forward Voltage)**

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	2.907	2.912	2.913	2.912	2.914	2.911	2.912
2	2.905	2.909	2.911	2.910	2.910	2.910	2.910
3	2.911	2.916	2.916	2.915	2.916	2.915	2.915
4	2.910	2.915	2.914	2.915	2.916	2.914	2.915
5	2.918	2.923	2.923	2.923	2.922	2.923	2.923
6	2.914	2.921	2.921	2.921	2.921	2.920	2.922
7	2.911	2.916	2.917	2.916	2.914	2.914	2.915
8	2.911	2.916	2.916	2.917	2.915	2.916	2.917
9	2.899	2.904	2.904	2.904	2.904	2.903	2.905
10	2.907	2.913	2.913	2.914	2.912	2.912	2.913
11	2.902	2.905	2.907	2.905	2.903	2.904	2.905
12	2.902	2.906	2.906	2.907	2.905	2.904	2.907
13	2.918	2.923	2.925	2.923	2.922	2.923	2.924
14	2.907	2.912	2.912	2.911	2.912	2.912	2.912
15	2.908	2.911	2.911	2.912	2.910	2.911	2.912
16	2.896	2.899	2.901	2.901	2.900	2.901	2.900
17	2.908	2.913	2.914	2.916	2.912	2.914	2.914
18	2.893	2.899	2.898	2.900	2.898	2.899	2.898
19	2.914	2.920	2.921	2.921	2.919	2.921	2.921
20	2.902	2.906	2.906	2.909	2.906	2.907	2.908
21	2.904	2.908	2.909	2.909	2.908	2.909	2.910
22	2.905	2.910	2.910	2.911	2.909	2.910	2.911
23	2.904	2.911	2.910	2.910	2.909	2.911	2.911
24	2.913	2.919	2.920	2.921	2.917	2.920	2.920
25	2.911	2.915	2.917	2.919	2.916	2.917	2.919
26	2.920	2.923	2.923	2.924	2.923	2.924	2.925
27	2.911	2.916	2.917	2.919	2.914	2.916	2.917
28	2.902	2.906	2.909	2.909	2.906	2.907	2.909
29	2.900	2.904	2.906	2.906	2.905	2.906	2.907
30	2.912	2.916	2.917	2.919	2.916	2.916	2.917
Avg.	2.908	2.912	2.913	2.913	2.912	2.912	2.913
Med.	2.908	2.913	2.913	2.913	2.912	2.912	2.913
st dev	0.006	0.007	0.007	0.007	0.007	0.007	0.007
Min.	2.893	2.899	2.898	2.900	2.898	2.899	2.898
Max.	2.920	2.923	2.925	2.924	2.923	2.924	2.925

**3.3 Data Set 1, 55°C, 150mA (Wavelength)**

No.	Wavelength (nm)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	609.0	608.7	608.6	609.1	605.2	609.0	609.0
2	607.4	609.0	608.7	609.1	608.7	609.1	608.8
3	609.1	609.0	608.7	609.0	609.1	608.1	608.3
4	608.3	608.3	608.3	608.8	605.0	607.7	609.0
5	609.0	605.2	608.1	608.0	609.0	608.3	607.6
6	608.7	606.4	608.5	604.8	608.0	609.0	609.0
7	605.0	609.1	604.7	609.0	605.2	608.3	608.3
8	604.8	608.8	608.7	609.0	607.6	604.5	608.7
9	609.0	605.2	608.3	608.1	609.0	609.0	609.0
10	608.3	605.1	609.1	608.1	608.7	609.0	608.8
11	609.0	607.7	604.4	608.7	609.2	608.8	609.0
12	609.0	608.7	609.0	608.7	608.8	609.0	607.5
13	605.0	607.8	609.1	605.2	609.0	605.2	605.1
14	608.3	609.0	608.3	608.0	608.7	607.8	609.0
15	609.0	608.3	609.4	609.0	606.9	609.2	605.1
16	609.0	609.0	607.9	607.9	609.1	608.8	609.1
17	605.0	608.8	609.1	604.7	605.0	608.7	608.8
18	609.0	609.0	607.1	609.5	608.0	608.3	609.0
19	609.0	608.7	608.7	608.4	609.0	609.2	608.7
20	609.0	608.4	608.1	608.9	608.3	607.7	609.0
21	608.8	609.0	608.3	609.0	608.6	608.1	609.0
22	609.0	605.1	604.8	608.0	608.6	605.2	609.0
23	608.8	609.0	608.8	605.2	609.0	608.3	609.0
24	608.7	604.8	609.1	608.0	604.4	608.7	607.6
25	609.0	609.0	608.3	609.0	608.6	608.3	609.0
26	609.1	604.8	609.0	608.1	604.6	605.0	609.0
27	608.8	604.7	604.8	608.4	609.0	608.7	608.8
28	608.1	608.7	608.7	609.0	609.0	609.0	608.3
29	605.2	609.0	607.6	608.7	609.0	608.3	609.0
30	609.0	609.0	608.8	605.0	604.9	609.0	609.0
Avg.	608.1	607.8	608.0	608.0	607.8	608.1	608.5
Med.	608.9	608.7	608.6	608.6	608.7	608.5	609.0
st dev	1.5	1.7	1.4	1.4	1.7	1.3	1.0
Min.	604.8	604.7	604.4	604.7	604.4	604.5	605.1
Max.	609.1	609.1	609.4	609.5	609.2	609.2	609.1

**3.4 Data Set 2, 105°C, 150mA (400-700nm Photon Flux Maintenance)**

No.	$\Phi_p$ ( $\mu\text{mol} \times \text{s}^{-1}$ )	400-700nm Photon Flux Maintenance (%)					
		0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs
31	0.9762	100.13	99.78	99.45	99.21	99.00	98.91
32	0.9890	100.12	99.81	99.48	99.29	99.00	98.95
33	0.9764	100.12	99.85	99.50	99.37	99.08	98.82
34	0.9816	99.97	99.71	99.39	99.25	98.95	98.79
35	0.9658	100.08	99.74	99.43	99.14	99.03	98.79
36	0.9687	100.19	99.85	99.50	99.37	99.17	98.92
37	0.9725	100.13	99.75	99.53	99.28	99.05	98.91
38	0.9605	100.11	99.70	99.29	99.13	98.88	98.72
39	0.9693	100.20	99.76	99.41	99.23	99.00	98.80
40	0.9689	100.17	99.79	99.51	99.26	99.06	98.88
41	0.9698	100.31	99.94	99.42	99.40	99.15	98.94
42	0.9842	100.25	99.85	99.54	99.39	99.15	98.98
43	0.9800	100.21	99.84	99.59	99.38	99.15	98.93
44	0.9911	100.26	99.87	99.49	99.29	99.11	98.88
45	0.9773	100.28	99.96	99.62	99.37	99.15	98.94
46	0.9719	100.24	99.87	99.59	99.20	99.02	98.85
47	0.9724	100.13	99.80	99.44	99.30	99.07	98.87
48	0.9795	100.38	99.99	99.68	99.51	99.24	99.09
49	0.9682	100.38	99.87	99.70	99.46	99.16	99.06
50	0.9594	100.32	99.91	99.61	99.40	99.19	98.99
51	0.9724	100.36	100.04	99.60	99.42	99.19	99.02
52	0.9847	100.21	99.89	99.62	99.34	99.07	98.90
53	0.9912	100.44	100.10	99.77	99.56	99.29	99.08
54	0.9974	100.36	100.06	99.72	99.57	99.33	99.12
55	0.9772	100.21	99.92	99.52	99.35	99.12	99.02
56	0.9786	100.31	99.93	99.66	99.44	99.23	99.01
57	0.9831	100.34	99.97	99.65	99.48	99.23	99.02
58	0.9626	100.50	100.11	99.71	99.52	99.35	99.11
59	0.9892	100.42	100.06	99.79	99.61	99.34	99.21
60	0.9494	100.38	99.88	99.59	99.39	99.19	98.99
Avg.	0.9756	100.25	99.89	99.56	99.36	99.13	98.95
Med.	0.9763	100.25	99.87	99.57	99.37	99.15	98.94
st dev	0.0107	0.12	0.11	0.12	0.12	0.12	0.11
Min.	0.9494	99.97	99.70	99.29	99.13	98.88	98.72
Max.	0.9974	100.50	100.11	99.79	99.61	99.35	99.21

**3.5 Data Set 2, 105°C, 150mA (Forward Voltage)**

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
31	2.909	2.912	2.914	2.914	2.913	2.914	2.914
32	2.894	2.898	2.899	2.898	2.899	2.899	2.900
33	2.900	2.904	2.906	2.905	2.904	2.905	2.906
34	2.902	2.908	2.909	2.908	2.906	2.907	2.909
35	2.910	2.916	2.916	2.917	2.915	2.916	2.916
36	2.905	2.910	2.911	2.911	2.909	2.909	2.912
37	2.896	2.900	2.901	2.900	2.900	2.900	2.901
38	2.917	2.923	2.923	2.924	2.923	2.923	2.924
39	2.901	2.906	2.908	2.908	2.906	2.906	2.907
40	2.903	2.907	2.908	2.909	2.908	2.908	2.910
41	2.915	2.920	2.920	2.921	2.920	2.920	2.921
42	2.913	2.917	2.920	2.921	2.921	2.920	2.920
43	2.916	2.923	2.924	2.924	2.922	2.923	2.924
44	2.909	2.914	2.914	2.915	2.913	2.915	2.915
45	2.913	2.921	2.920	2.920	2.920	2.921	2.921
46	2.907	2.913	2.914	2.914	2.913	2.913	2.914
47	2.914	2.921	2.921	2.922	2.922	2.922	2.923
48	2.896	2.902	2.902	2.903	2.903	2.902	2.902
49	2.896	2.901	2.902	2.903	2.901	2.902	2.902
50	2.912	2.922	2.922	2.921	2.920	2.922	2.923
51	2.895	2.903	2.903	2.902	2.902	2.902	2.903
52	2.903	2.911	2.912	2.912	2.910	2.912	2.912
53	2.908	2.915	2.916	2.917	2.915	2.917	2.916
54	2.897	2.903	2.904	2.904	2.904	2.905	2.905
55	2.908	2.915	2.916	2.916	2.916	2.917	2.917
56	2.895	2.901	2.902	2.901	2.901	2.903	2.902
57	2.901	2.907	2.909	2.909	2.908	2.909	2.909
58	2.897	2.904	2.905	2.905	2.904	2.904	2.905
59	2.892	2.901	2.900	2.901	2.899	2.899	2.901
60	2.909	2.917	2.919	2.919	2.916	2.919	2.919
Avg.	2.904	2.911	2.911	2.911	2.910	2.911	2.912
Med.	2.904	2.911	2.912	2.912	2.910	2.911	2.912
st dev	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Min.	2.892	2.898	2.899	2.898	2.899	2.899	2.900
Max.	2.917	2.923	2.924	2.924	2.923	2.923	2.924

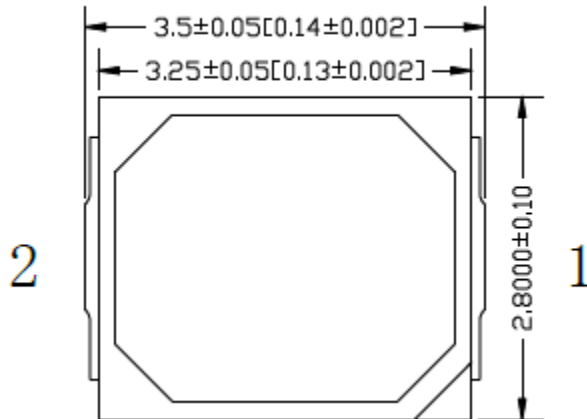


**3.6 Data Set 2, 105°C, 150mA (Wavelength)**

No.	Wavelength (nm)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
31	609.0	609.0	608.7	608.7	608.3	609.0	607.6
32	608.3	608.7	609.0	607.8	608.4	608.3	608.7
33	609.0	608.3	609.0	609.0	609.0	608.7	608.7
34	604.9	608.7	609.1	604.4	605.2	608.8	608.7
35	609.0	609.3	609.0	609.0	609.0	609.0	605.2
36	609.1	608.0	609.0	605.1	608.7	605.1	607.2
37	609.0	608.8	609.0	609.1	607.6	609.0	609.0
38	604.8	609.0	605.1	608.7	609.0	608.3	605.0
39	609.0	609.0	607.6	609.4	608.7	609.0	608.8
40	609.0	608.1	609.0	609.0	608.1	609.0	609.0
41	605.0	609.0	609.0	609.0	609.0	609.0	608.3
42	608.3	608.8	608.3	609.0	608.4	609.0	608.0
43	609.0	608.8	609.0	608.6	609.0	607.9	609.0
44	609.1	609.0	609.0	609.0	609.0	609.1	608.7
45	609.0	608.3	608.3	607.8	608.0	609.0	609.1
46	604.5	609.0	608.7	607.9	609.1	609.1	609.0
47	609.1	609.0	608.7	608.7	608.0	605.0	604.8
48	608.0	607.5	609.0	608.4	608.0	604.8	608.3
49	607.8	609.0	608.3	609.1	609.0	609.0	609.0
50	609.0	609.0	609.0	608.1	608.3	608.3	609.0
51	609.0	609.0	609.0	608.0	609.1	609.1	609.0
52	609.0	608.3	604.8	607.7	609.0	608.7	609.0
53	609.1	605.2	609.0	609.1	607.1	605.2	609.0
54	609.0	608.8	609.0	609.1	607.9	609.1	609.1
55	608.4	608.3	605.0	609.0	608.0	605.0	607.9
56	609.0	609.0	608.3	609.1	609.0	609.1	609.0
57	609.0	608.7	609.1	608.7	609.1	609.0	609.0
58	609.0	608.8	609.1	609.0	609.0	608.3	608.8
59	609.1	608.7	608.8	608.8	609.0	609.2	608.6
60	608.7	608.0	605.0	609.0	609.0	609.0	604.7
Avg.	608.3	608.6	608.3	608.4	608.5	608.2	608.2
Med.	609.0	608.8	609.0	608.9	608.9	609.0	608.8
st dev	1.4	0.8	1.4	1.1	0.8	1.5	1.4
Min.	604.5	605.2	604.8	604.4	605.2	604.8	604.7
Max.	609.1	609.3	609.1	609.4	609.1	609.2	609.1

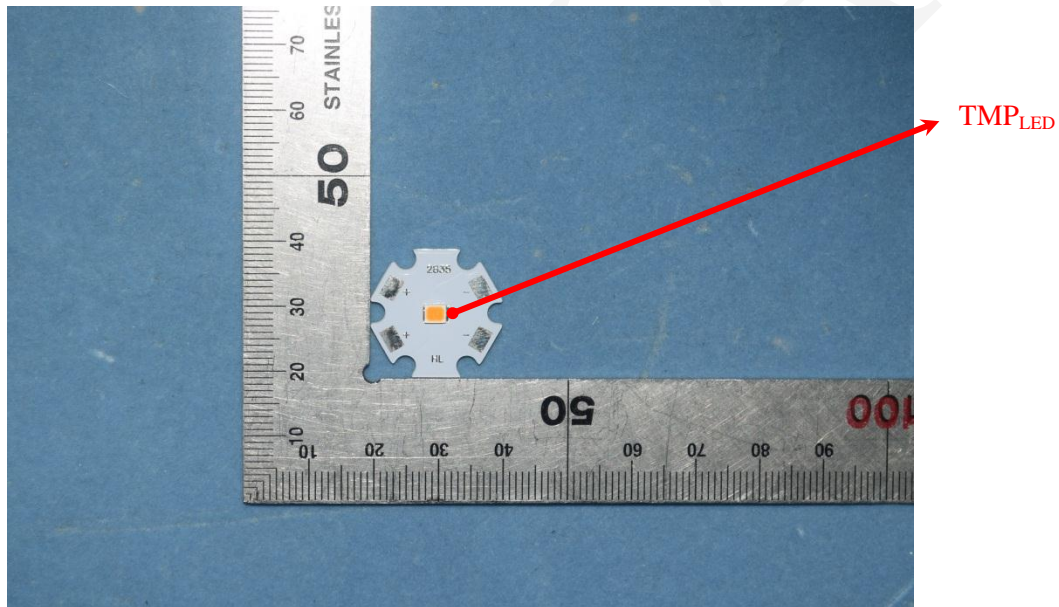
#### 4 - DUT Photo

##### 4.1 #Mechanical Dimensions



All dimensions are in millimeter

##### 4.2 DUT Photo



## Directions

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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 with the 95 confidence interval.
5. This report cannot be reproduced except in full, without prior written approval of the Company.
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\*\*\*\*\*END OF REPORT\*\*\*\*\*