



TEST REPORT

ACCORDING TO IES LM-80-2015
For

Hongli Zhihui Group Co.,Ltd.

No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

Model: HL-LM002H384W-9B4C12(Ra5)

Report Type: 7000 Hours Test Report		Product Type: LED Array	
Test Engineer:	Pote Wang <i>Pote Wang</i>		
Report Number:	RSZ160329509-10-7000		
Test Date:	2016-04-05 to 2017-01-22		
Report Date:	2017-02-09		
Reviewed By:	Daniel Duan / EE Manager <i>Daniel Duan</i>		
Test Facility:	Test facility was located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.		
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Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

40 PCS samples were received on 2016-03-29. The samples were numbered from 1 to 20 and 21 to 40.

Manufacturer: Hongli Zhihui Group Co.,Ltd.
Part Number: HL-LM002H384W-9B4C12(Ra5)
Part Type: LED Array
Drive Level: DC 600mA
Nominal CCT: 2700K

Family products covered by this report:

According to ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products, the following products can be covered by this report base on the declaration letter of manufacturer. The information of these models shows that the covered products meet all section 3 item 7 requirements of ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products (September 9, 2011)

Model name	CCT	Series	Parallel	Number of Dies	Power density (W/mm ²)	Distance between of dies (mm)	Current per die (mA)
HL-LM002H384W-9B4C12(Ra5)	2700K	12	4	48	0.1251	0.26	150
	3000K	12	4	48	0.1251	0.26	150
	3500K	12	4	48	0.1251	0.26	150
	4000K	12	4	48	0.1251	0.26	150
	5000K	12	4	48	0.1251	0.26	150
	5700K	12	4	48	0.1251	0.26	150
	6000K	12	4	48	0.1251	0.26	150
HL-LM002H384W-7B3C12(Ra5)	2700K	12	3	36	0.0939	0.43	150
	3000K	12	3	36	0.0939	0.43	150
	3500K	12	3	36	0.0939	0.43	150
	4000K	12	3	36	0.0939	0.43	150
	5000K	12	3	36	0.0939	0.43	150
	5700K	12	3	36	0.0939	0.43	150
	6000K	12	3	36	0.0939	0.43	150
HL-LM002H384W-5B2C12(Ra5)	2700K	12	2	24	0.0626	0.60	150
	3000K	12	2	24	0.0626	0.60	150
	3500K	12	2	24	0.0626	0.60	150
	4000K	12	2	24	0.0626	0.60	150
	5000K	12	2	24	0.0626	0.60	150
	5700K	12	2	24	0.0626	0.60	150
	6000K	12	2	24	0.0626	0.60	150
HL-LM002H384W-5B5C3(Ra5)	2700K	3	5	15	0.0389	0.86	150
	3000K	3	5	15	0.0389	0.86	150
	3500K	3	5	15	0.0389	0.86	150
	4000K	3	5	15	0.0389	0.86	150
	5000K	3	5	15	0.0389	0.86	150
	5700K	3	5	15	0.0389	0.86	150
	6000K	3	5	15	0.0389	0.86	150
HL-LM002H384W-5B1C10(Ra5)	2700K	10	1	10	0.0260	1.48	150
	3000K	10	1	10	0.0260	1.48	150
	3500K	10	1	10	0.0260	1.48	150
	4000K	10	1	10	0.0260	1.48	150
	5000K	10	1	10	0.0260	1.48	150

Model name	CCT	Series	Parallel	Number of Dies	Power density (W/mm2)	Distance between of dies (mm)	Current per die (mA)
	5700K	10	1	10	0.0260	1.48	150
	6000K	10	1	10	0.0260	1.48	150
	6500K	10	1	10	0.0260	1.48	150
HL-LM002H384W-6B4C3(Ra5)	2700K	3	4	12	0.0312	1.28	150
	3000K	3	4	12	0.0312	1.28	150
	3500K	3	4	12	0.0312	1.28	150
	4000K	3	4	12	0.0312	1.28	150
	5000K	3	4	12	0.0312	1.28	150
	5700K	3	4	12	0.0312	1.28	150
	6000K	3	4	12	0.0312	1.28	150
	6500K	3	4	12	0.0312	1.28	150
HL-LM002H384W-7B2C7(Ra5)	2700K	7	2	14	0.0545	0.89	150
	3000K	7	2	14	0.0545	0.89	150
	3500K	7	2	14	0.0545	0.89	150
	4000K	7	2	14	0.0545	0.89	150
	5000K	7	2	14	0.0545	0.89	150
	5700K	7	2	14	0.0545	0.89	150
	6000K	7	2	14	0.0545	0.89	150
	6500K	7	2	14	0.0545	0.89	150
HL-LM002H384W-7B1C14(Ra5)	2700K	14	1	14	0.0545	1.22	150
	3000K	14	1	14	0.0545	1.22	150
	3500K	14	1	14	0.0545	1.22	150
	4000K	14	1	14	0.0545	1.22	150
	5000K	14	1	14	0.0545	1.22	150
	5700K	14	1	14	0.0545	1.22	150
	6000K	14	1	14	0.0545	1.22	150
	6500K	14	1	14	0.0545	1.22	150
HL-LM002H384W-7B1C24(Ra5)	2700K	24	1	24	0.0623	0.79	150
	3000K	24	1	24	0.0623	0.79	150
	3500K	24	1	24	0.0623	0.79	150
	4000K	24	1	24	0.0623	0.79	150
	5000K	24	1	24	0.0623	0.79	150
	5700K	24	1	24	0.0623	0.79	150
	6000K	24	1	24	0.0623	0.79	150
	6500K	24	1	24	0.0623	0.79	150
HL-LM002H384W-9B2C9(Ra5)	2700K	9	2	18	0.0467	0.58	150
	3000K	9	2	18	0.0467	0.58	150
	3500K	9	2	18	0.0467	0.58	150
	4000K	9	2	18	0.0467	0.58	150
	5000K	9	2	18	0.0467	0.58	150
	5700K	9	2	18	0.0467	0.58	150
	6000K	9	2	18	0.0467	0.58	150
	6500K	9	2	18	0.0467	0.58	150
HL-LM002H384W-9B1C18(Ra5)	2700K	18	1	18	0.0467	0.58	150
	3000K	18	1	18	0.0467	0.58	150
	3500K	18	1	18	0.0467	0.58	150
	4000K	18	1	18	0.0467	0.58	150
	5000K	18	1	18	0.0467	0.58	150
	5700K	18	1	18	0.0467	0.58	150
	6000K	18	1	18	0.0467	0.58	150
	6500K	18	1	18	0.0467	0.58	150
HL-LM002H384W-10B2C10(Ra5)	2700K	10	2	20	0.0519	0.52	150
	3000K	10	2	20	0.0519	0.52	150
	3500K	10	2	20	0.0519	0.52	150
	4000K	10	2	20	0.0519	0.52	150
	5000K	10	2	20	0.0519	0.52	150
	5700K	10	2	20	0.0519	0.52	150
	6000K	10	2	20	0.0519	0.52	150
	6500K	10	2	20	0.0519	0.52	150
HL-LM002H384W-10B1C20(Ra5)	2700K	20	1	20	0.0519	0.80	150
	3000K	20	1	20	0.0519	0.80	150

Model name	CCT	Series	Parallel	Number of Dies	Power density (W/mm ²)	Distance between of dies (mm)	Current per die (mA)
	3500K	20	1	20	0.0519	0.80	150
	4000K	20	1	20	0.0519	0.80	150
	5000K	20	1	20	0.0519	0.80	150
	5700K	20	1	20	0.0519	0.80	150
	6000K	20	1	20	0.0519	0.80	150
	6500K	20	1	20	0.0519	0.80	150
HL-LM002H384W-10B2C24(Ra5)	2700K	24	2	48	0.1251	0.28	150
	3000K	24	2	48	0.1251	0.28	150
	3500K	24	2	48	0.1251	0.28	150
	4000K	24	2	48	0.1251	0.28	150
	5000K	24	2	48	0.1251	0.28	150
	5700K	24	2	48	0.1251	0.28	150
	6000K	24	2	48	0.1251	0.28	150
HL-LM002H384W-15B2C15(Ra5)	2700K	15	2	30	0.0778	0.79	150
	3000K	15	2	30	0.0778	0.79	150
	3500K	15	2	30	0.0778	0.79	150
	4000K	15	2	30	0.0778	0.79	150
	5000K	15	2	30	0.0778	0.79	150
	5700K	15	2	30	0.0778	0.79	150
	6000K	15	2	30	0.0778	0.79	150
	6500K	15	2	30	0.0778	0.79	150
HL-LM002H384W-15B1C30(Ra5)	2700K	30	1	30	0.0778	0.58	150
	3000K	30	1	30	0.0778	0.58	150
	3500K	30	1	30	0.0778	0.58	150
	4000K	30	1	30	0.0778	0.58	150
	5000K	30	1	30	0.0778	0.58	150
	5700K	30	1	30	0.0778	0.58	150
	6000K	30	1	30	0.0778	0.58	150
	6500K	30	1	30	0.0778	0.58	150
HL-LM002H384W-18B2C18(Ra5)	2700K	18	2	36	0.0934	0.59	150
	3000K	18	2	36	0.0934	0.59	150
	3500K	18	2	36	0.0934	0.59	150
	4000K	18	2	36	0.0934	0.59	150
	5000K	18	2	36	0.0934	0.59	150
	5700K	18	2	36	0.0934	0.59	150
	6000K	18	2	36	0.0934	0.59	150
	6500K	18	2	36	0.0934	0.59	150
HL-LM002H384W-18B1C36(Ra5)	2700K	36	1	36	0.0934	0.67	150
	3000K	36	1	36	0.0934	0.67	150
	3500K	36	1	36	0.0934	0.67	150
	4000K	36	1	36	0.0934	0.67	150
	5000K	36	1	36	0.0934	0.67	150
	5700K	36	1	36	0.0934	0.67	150
	6000K	36	1	36	0.0934	0.67	150
	6500K	36	1	36	0.0934	0.67	150
HL-LM002H384W-20B2C20(Ra5)	2700K	20	2	40	0.1037	0.55	150
	3000K	20	2	40	0.1037	0.55	150
	3500K	20	2	40	0.1037	0.55	150
	4000K	20	2	40	0.1037	0.55	150
	5000K	20	2	40	0.1037	0.55	150
	5700K	20	2	40	0.1037	0.55	150
	6000K	20	2	40	0.1037	0.55	150
HL-LM002H384W-20B1C40(Ra5)	2700K	40	1	40	0.1037	0.55	150
	3000K	40	1	40	0.1037	0.55	150
	3500K	40	1	40	0.1037	0.55	150
	4000K	40	1	40	0.1037	0.55	150
	5000K	40	1	40	0.1037	0.55	150
	5700K	40	1	40	0.1037	0.55	150
6000K	40	1	40	0.1037	0.55	150	

Model name	CCT	Series	Parallel	Number of Dies	Power density (W/mm ²)	Distance between of dies (mm)	Current per die (mA)
	6500K	40	1	40	0.1037	0.55	150
HL-LM002H9VW-6B1C29(Ra5)	2700K	29	1	29	0.0502	0.93	35
	3000K	29	1	29	0.0502	0.93	35
	3500K	29	1	29	0.0502	0.93	35
	4000K	29	1	29	0.0502	0.93	35
	5000K	29	1	29	0.0502	0.93	35
	5700K	29	1	29	0.0502	0.93	35
	6000K	29	1	29	0.0502	0.93	35
	6500K	29	1	29	0.0502	0.93	35
HL-LM002H431W-4B1C12(Ra5)	2700K	12	1	12	0.0249	1.28	120
	3000K	12	1	12	0.0249	1.28	120
	3500K	12	1	12	0.0249	1.28	120
	4000K	12	1	12	0.0249	1.28	120
	5000K	12	1	12	0.0249	1.28	120
	5700K	12	1	12	0.0249	1.28	120
	6000K	12	1	12	0.0249	1.28	120
	6500K	12	1	12	0.0249	1.28	120
HL-LM065D94W-6B1C12(Ra5)	2700K	12	1	12	0.0300	0.50	150
	3000K	12	1	12	0.0300	0.50	150
	3500K	12	1	12	0.0300	0.50	150
	4000K	12	1	12	0.0300	0.50	150
	5000K	12	1	12	0.0300	0.50	150
	5700K	12	1	12	0.0300	0.50	150
	6000K	12	1	12	0.0300	0.50	150
	6500K	12	1	12	0.0300	0.50	150
HL-LM065D94W-8B2C8(Ra5)	2700K	8	2	16	0.0400	0.37	150
	3000K	8	2	16	0.0400	0.37	150
	3500K	8	2	16	0.0400	0.37	150
	4000K	8	2	16	0.0400	0.37	150
	5000K	8	2	16	0.0400	0.37	150
	5700K	8	2	16	0.0400	0.37	150
	6000K	8	2	16	0.0400	0.37	150
	6500K	8	2	16	0.0400	0.37	150
HL-LM065D94W-10B3C8(Ra5)	2700K	8	3	24	0.0600	0.28	150
	3000K	8	3	24	0.0600	0.28	150
	3500K	8	3	24	0.0600	0.28	150
	4000K	8	3	24	0.0600	0.28	150
	5000K	8	3	24	0.0600	0.28	150
	5700K	8	3	24	0.0600	0.28	150
	6000K	8	3	24	0.0600	0.28	150
	6500K	8	3	24	0.0600	0.28	150
HL-LM065D94W-10B2C12(Ra5)	2700K	12	2	24	0.0600	0.28	150
	3000K	12	2	24	0.0600	0.28	150
	3500K	12	2	24	0.0600	0.28	150
	4000K	12	2	24	0.0600	0.28	150
	5000K	12	2	24	0.0600	0.28	150
	5700K	12	2	24	0.0600	0.28	150
	6000K	12	2	24	0.0600	0.28	150
	6500K	12	2	24	0.0600	0.28	150
HL-LM065D42W-6B1C12(Ra5)	2700K	12	1	12	0.0300	0.51	150
	3000K	12	1	12	0.0300	0.51	150
	3500K	12	1	12	0.0300	0.51	150
	4000K	12	1	12	0.0300	0.51	150
	5000K	12	1	12	0.0300	0.51	150
	5700K	12	1	12	0.0300	0.51	150
	6000K	12	1	12	0.0300	0.51	150
	6500K	12	1	12	0.0300	0.51	150
HL-LM065D42W-8B2C8(Ra5)	2700K	8	2	16	0.0400	0.38	150
	3000K	8	2	16	0.0400	0.38	150
	3500K	8	2	16	0.0400	0.38	150
	4000K	8	2	16	0.0400	0.38	150

Model name	CCT	Series	Parallel	Number of Dies	Power density (W/mm ²)	Distance between of dies (mm)	Current per die (mA)
	5000K	8	2	16	0.0400	0.38	150
	5700K	8	2	16	0.0400	0.38	150
	6000K	8	2	16	0.0400	0.38	150
	6500K	8	2	16	0.0400	0.38	150
HL-LM065D42W-10B3C8(Ra5)	2700K	8	3	24	0.0600	0.29	150
	3000K	8	3	24	0.0600	0.29	150
	3500K	8	3	24	0.0600	0.29	150
	4000K	8	3	24	0.0600	0.29	150
	5000K	8	3	24	0.0600	0.29	150
	5700K	8	3	24	0.0600	0.29	150
	6000K	8	3	24	0.0600	0.29	150
	6500K	8	3	24	0.0600	0.29	150
HL-LM065D42W-10B2C12(Ra5)	2700K	12	2	24	0.0600	0.29	150
	3000K	12	2	24	0.0600	0.29	150
	3500K	12	2	24	0.0600	0.29	150
	4000K	12	2	24	0.0600	0.29	150
	5000K	12	2	24	0.0600	0.29	150
	5700K	12	2	24	0.0600	0.29	150
	6000K	12	2	24	0.0600	0.29	150
	6500K	12	2	24	0.0600	0.29	150

Disclaimer:

The truthfulness and accuracy of all the technical information above for the covered LED products is ensured by manufacturer of LED light source. Bay Area Compliance Laboratories Corp. (Dongguan) isn't responsible or gives any guarantees for the truthfulness of the technical information.

1.2 Standards Used:

- IESNA LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products(This test method was not accredited by IAS)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
1.0m integrating sphere	SENSING	SCD-20008	N/A	N/A	2016-07-11	2017-07-10
spectroradiometer	SENSING	SCD-20008	N/A	N/A	2016-07-11	2017-07-10
DC Power Supply	Hanshenpuyuan	HSPY-100-05	2013010210003	N/A	2016-05-18	2017-05-17
Standard Light Source	EVERFINE	D062	1011093	3000K	2016-09-13	2017-09-12
Multilayer aging machine	BACL	B2-270	20005	25°C~110°C	2016-09-01	2017-09-01
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090006	(50/15A)	2016-03-04	2017-03-03

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090009	(50/15A)	2016-12-15	2017-12-14

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°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 $\pm 3\%$ 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 $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, RH <65%.

1.6 Measurement Uncertainty

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 $U=21\text{K}$ ($K=2$), at the 95% confidence level.

The uncertainty of the temperature is $U=0.8671^{\circ}\text{C}$ ($K=2$), 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: 85°C,600mA

Part Number: HL-LM002H384W-9B4C12(Ra5)

Number of Units: 20

Case Temperature: >83°C

Ambient Temperature: >80°C

Life Test Drive Current: 600mA

Measurement Current: 600mA

Data Set 2: 105°C,600mA

Part Number: HL-LM002H384W-9B4C12(Ra5)

Number of Units: 20

Case Temperature: >105°C

Ambient Temperature: >102°C

Life Test Drive Current: 600mA

Measurement Current: 600mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	Reported TM-21 L ₇₀ Lifetime
1	20	0	1000	7000	>42,000hours
2	20	0	1000	7000	>42,000hours

Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000	2000	3000	4000	5000	6000	7000
1	99.58%	99.13%	98.72%	98.30%	97.94%	97.48%	96.97%
2	99.24%	98.65%	98.15%	97.62%	97.20%	96.65%	95.93%

Average Color Maintenance

Data Set:	1000	2000	3000	4000	5000	6000	7000
1	0.0011	0.0014	0.0016	0.0019	0.0021	0.0025	0.0029
2	0.0010	0.0015	0.0019	0.0023	0.0021	0.0025	0.0028

3 - Test Data

3.1 Data Set 1, 85°C, 600mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	1859.05	99.84	99.46	99.21	98.98	98.66	98.09	97.43
2	1853.74	99.83	99.64	98.99	98.73	98.20	98.05	97.61
3	1859.05	99.74	99.34	99.01	98.63	98.23	98.12	97.65
4	1859.05	99.65	99.43	99.21	98.71	98.57	98.44	97.78
5	1864.37	99.66	99.15	98.57	98.39	98.07	97.52	96.99
6	1853.74	99.44	98.82	98.60	98.18	98.02	97.29	96.63
7	1853.74	99.54	99.11	98.57	98.21	97.85	97.23	96.54
8	1859.05	99.24	98.52	98.29	97.74	97.26	96.86	96.35
9	1864.37	99.76	99.41	98.99	98.71	98.24	97.59	97.10
10	1853.74	99.43	99.08	98.66	98.04	97.57	96.88	96.63
11	1874.99	99.49	99.00	98.36	97.92	97.58	97.07	96.60
12	1864.37	99.76	99.27	98.91	98.48	97.95	97.36	96.68
13	1853.74	99.73	99.14	98.67	98.03	97.58	97.13	96.49
14	1864.37	99.46	98.96	98.41	97.87	97.64	97.10	96.60
15	1853.74	99.24	98.64	98.20	97.75	97.18	96.69	96.26
16	1843.12	99.81	99.35	98.86	98.52	98.36	97.72	97.30
17	1864.37	99.27	98.84	98.63	98.07	97.67	97.52	97.28
18	1859.05	99.65	99.12	98.90	98.56	98.45	98.02	97.59
19	1853.74	99.13	98.80	98.28	97.89	97.49	97.45	96.99
20	1859.05	99.84	99.51	99.01	98.51	98.14	97.45	96.97
Ave.	1858.52	99.58	99.13	98.72	98.30	97.94	97.48	96.97
Med.	1859.05	99.65	99.13	98.66	98.30	97.98	97.45	96.98
st dev	6.65	0.2263	0.3033	0.3106	0.3717	0.4275	0.4768	0.4723
Min.	1843.12	99.13	98.52	98.20	97.74	97.18	96.69	96.26
Max.	1874.99	99.84	99.64	99.21	98.98	98.66	98.44	97.78

TM-21 Projection:

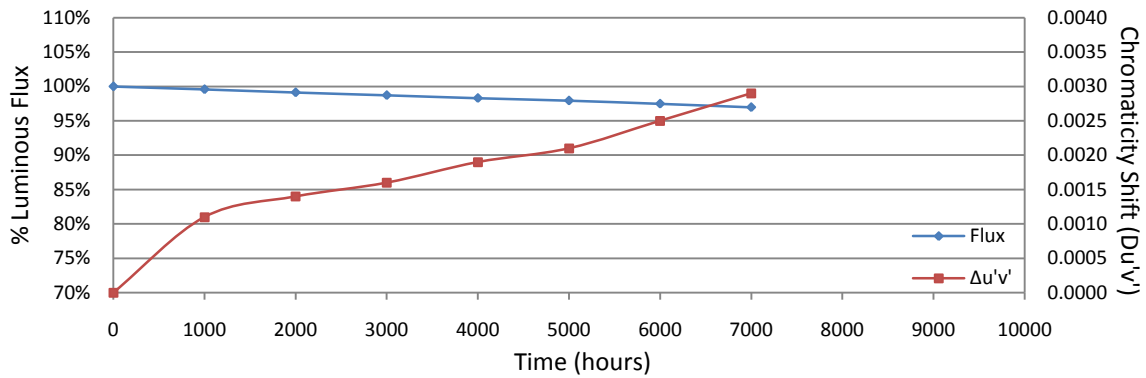
Test Duration: 7,000 hours
Failures Observed: 0
 α : 4.335E-06
 β : 1.000
Reported L₇₀: >42,000 hours

3.2 Data Set 1, 85°C, 600mA (Forward Voltage)

No.	Forward Voltage (V)							
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	38.10	38.16	38.22	38.17	38.18	37.69	38.25	38.72
2	38.04	38.10	38.16	38.17	38.24	37.83	38.20	38.72
3	38.00	38.10	38.08	38.14	38.18	37.33	38.08	38.57
4	38.06	38.09	38.08	38.13	38.17	38.04	38.11	38.53
5	37.99	38.14	38.08	38.10	38.06	37.67	38.04	38.48
6	38.00	38.09	38.06	38.15	38.21	37.49	37.80	38.65
7	38.03	38.07	38.06	38.19	38.31	37.88	38.02	38.49
8	38.04	38.05	38.05	38.21	38.37	37.74	38.15	38.44
9	38.07	38.12	38.11	38.19	38.26	37.80	38.23	38.39
10	38.02	38.06	38.05	38.18	38.30	37.91	38.11	38.39
11	38.06	38.15	38.06	37.84	37.53	37.95	38.08	38.41
12	38.10	38.19	38.02	37.99	37.79	38.21	37.80	38.37
13	38.04	38.09	37.96	37.95	37.81	38.07	37.95	38.35
14	37.99	38.20	37.97	37.97	37.74	37.97	38.23	38.35
15	38.04	38.09	37.89	38.02	37.95	37.95	38.00	38.39
16	37.85	38.08	37.82	38.01	37.94	37.93	38.04	38.43
17	38.06	38.15	37.82	38.02	37.89	38.04	38.01	38.44
18	38.09	38.19	37.83	37.97	37.75	37.96	38.00	38.41
19	37.97	38.08	37.77	37.97	37.86	37.96	37.96	38.38
20	37.95	38.14	37.84	38.00	37.86	38.06	37.72	38.35
Ave.	38.03	38.12	38.00	38.07	38.02	37.87	38.04	38.46
Med.	38.04	38.10	38.05	38.06	38.01	37.94	38.04	38.42
st dev	0.06	0.05	0.13	0.11	0.24	0.21	0.15	0.12
Min.	37.85	38.05	37.77	37.84	37.53	37.33	37.72	38.35
Max.	38.10	38.20	38.22	38.21	38.37	38.21	38.25	38.72

3.3 Data Set 1, 85°C, 600mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)						
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2600	0.5289	2746	0.0010	0.0014	0.0017	0.0021	0.0027	0.0028	0.0028
2	0.2596	0.5286	2756	0.0008	0.0011	0.0017	0.0022	0.0020	0.0023	0.0025
3	0.2600	0.5286	2748	0.0011	0.0012	0.0014	0.0016	0.0022	0.0024	0.0023
4	0.2598	0.5288	2752	0.0014	0.0016	0.0018	0.0021	0.0028	0.0033	0.0035
5	0.2606	0.5288	2734	0.0012	0.0013	0.0015	0.0018	0.0021	0.0025	0.0031
6	0.2602	0.5285	2742	0.0007	0.0011	0.0015	0.0018	0.0020	0.0023	0.0024
7	0.2607	0.5289	2732	0.0017	0.0017	0.0022	0.0026	0.0021	0.0025	0.0030
8	0.2604	0.5285	2740	0.0014	0.0018	0.0019	0.0021	0.0018	0.0024	0.0024
9	0.2594	0.5288	2760	0.0009	0.0009	0.0011	0.0013	0.0018	0.0021	0.0025
10	0.2597	0.5285	2752	0.0008	0.0010	0.0011	0.0013	0.0021	0.0025	0.0031
11	0.2592	0.5284	2764	0.0013	0.0016	0.0020	0.0024	0.0021	0.0026	0.0028
12	0.2601	0.5288	2744	0.0011	0.0013	0.0014	0.0016	0.0021	0.0022	0.0027
13	0.2612	0.5292	2718	0.0009	0.0013	0.0017	0.0021	0.0022	0.0028	0.0036
14	0.2600	0.5283	2748	0.0008	0.0013	0.0017	0.0021	0.0021	0.0023	0.0031
15	0.2599	0.5287	2748	0.0010	0.0011	0.0014	0.0016	0.0020	0.0021	0.0024
16	0.2609	0.5289	2726	0.0010	0.0014	0.0019	0.0025	0.0023	0.0027	0.0035
17	0.2598	0.5285	2752	0.0017	0.0021	0.0023	0.0025	0.0018	0.0023	0.0025
18	0.2604	0.5285	2738	0.0017	0.0019	0.0020	0.0022	0.0023	0.0031	0.0038
19	0.2606	0.5287	2734	0.0007	0.0009	0.0010	0.0012	0.0019	0.0026	0.0036
20	0.2592	0.5281	2766	0.0009	0.0011	0.0012	0.0014	0.0020	0.0022	0.0024
Ave.	0.2601	0.5287	2745	0.0011	0.0014	0.0016	0.0019	0.0021	0.0025	0.0029
Med.	0.2600	0.5287	2747	0.0010	0.0013	0.0017	0.0021	0.0021	0.0025	0.0028
st dev	0.0005	0.0003	12	0.0003	0.0003	0.0004	0.0004	0.0003	0.0003	0.0005
Min.	0.2592	0.5281	2718	0.0007	0.0009	0.0010	0.0012	0.0018	0.0021	0.0023
Max.	0.2612	0.5292	2766	0.0017	0.0021	0.0023	0.0026	0.0028	0.0033	0.0038



3.4 Data Set 2, 105°C, 600mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
21	1853.74	98.93	98.27	97.90	97.56	97.46	97.04	96.31
22	1853.74	99.06	98.46	97.78	97.20	96.66	96.12	95.45
23	1853.74	98.76	98.17	97.48	97.11	96.52	95.70	95.06
24	1864.37	98.95	98.29	97.83	97.11	96.25	95.79	95.01
25	1859.05	98.77	98.27	97.71	97.04	96.88	96.51	95.74
26	1848.43	99.24	98.74	98.16	97.61	97.25	96.80	96.12
27	1859.05	99.26	98.64	98.09	97.51	96.88	96.50	95.78
28	1853.74	99.35	98.62	98.29	97.89	97.46	96.72	95.91
29	1864.37	99.18	98.76	98.22	97.70	97.21	96.89	96.10
30	1874.99	99.39	98.68	98.05	97.28	96.97	96.43	95.87
31	1848.43	99.73	99.04	98.37	97.78	97.13	96.75	95.94
32	1853.74	98.95	98.46	98.07	97.54	97.46	96.88	96.16
33	1853.74	99.55	98.84	98.36	97.91	97.77	97.22	96.63
34	1874.99	99.00	98.49	98.04	97.45	97.41	96.72	96.03
35	1816.56	99.29	98.69	98.37	98.00	97.37	96.79	96.15
36	1890.92	99.33	98.56	98.12	97.68	96.89	96.43	95.75
37	1853.74	99.74	99.34	98.89	98.33	97.59	96.72	95.94
38	1869.68	99.62	98.99	98.62	98.21	97.99	97.59	96.84
39	1869.68	99.38	98.89	98.30	97.63	97.38	96.85	96.06
40	1853.74	99.33	98.75	98.36	97.91	97.49	96.50	95.67
Ave.	1858.52	99.24	98.65	98.15	97.62	97.20	96.65	95.93
Med.	1853.74	99.28	98.66	98.14	97.62	97.31	96.72	95.94
st dev	14.61	0.2907	0.2930	0.3222	0.3611	0.4308	0.4389	0.4381
Min.	1816.56	98.76	98.17	97.48	97.04	96.25	95.70	95.01
Max.	1890.92	99.74	99.34	98.89	98.33	97.99	97.59	96.84

TM-21 Projection:

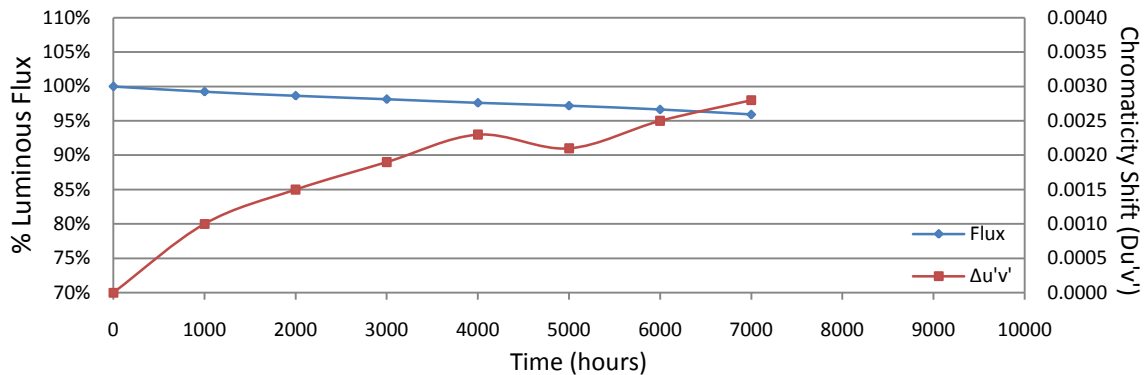
Test Duration: 7,000 hours
Failures Observed: 0
α: 5.437E-06
β: 0.998
Reported L₇₀: >42,000 hours

3.5 Data Set 2, 105°C, 600mA (Forward Voltage)

No.	Forward Voltage (V)							
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
21	38.08	38.05	38.48	38.13	38.21	38.04	38.11	38.05
22	37.97	38.19	38.45	38.00	37.81	38.00	37.91	38.19
23	37.86	38.21	38.38	37.98	37.75	37.66	37.83	38.21
24	37.91	38.02	38.39	38.04	38.06	37.97	37.86	38.02
25	38.13	38.16	38.36	38.00	37.84	37.95	37.80	38.16
26	38.00	38.09	38.24	37.98	37.87	37.94	37.57	38.09
27	37.93	38.17	38.19	37.98	37.79	37.93	37.49	38.17
28	37.93	38.13	38.16	38.04	37.95	37.77	37.66	38.13
29	38.01	38.13	38.22	38.02	37.91	38.22	37.75	38.13
30	38.02	38.16	38.22	38.00	37.84	38.00	37.78	38.16
31	37.95	38.09	37.93	37.86	37.63	37.97	37.77	37.93
32	37.95	38.07	37.93	37.82	37.57	38.04	37.85	37.93
33	37.80	38.10	37.93	37.81	37.52	37.84	37.77	37.93
34	38.09	38.10	37.91	37.82	37.54	38.21	37.57	37.91
35	38.17	38.06	37.88	37.91	37.76	37.82	37.78	37.88
36	38.06	38.16	38.11	37.88	37.60	37.99	37.57	38.11
37	37.97	38.08	38.11	37.86	37.64	38.09	37.66	38.11
38	38.12	38.10	38.12	37.84	37.58	38.23	37.69	38.12
39	37.98	38.06	38.10	37.80	37.54	37.93	37.51	38.10
40	37.80	37.99	38.10	37.80	37.61	37.77	37.67	38.10
Ave.	37.99	38.11	38.16	37.93	37.75	37.97	37.73	38.07
Med.	37.98	38.10	38.14	37.95	37.76	37.97	37.76	38.11
st dev	0.10	0.06	0.19	0.10	0.19	0.15	0.15	0.10
Min.	37.80	37.99	37.88	37.80	37.52	37.66	37.49	37.88
Max.	38.17	38.21	38.48	38.13	38.21	38.23	38.11	38.21

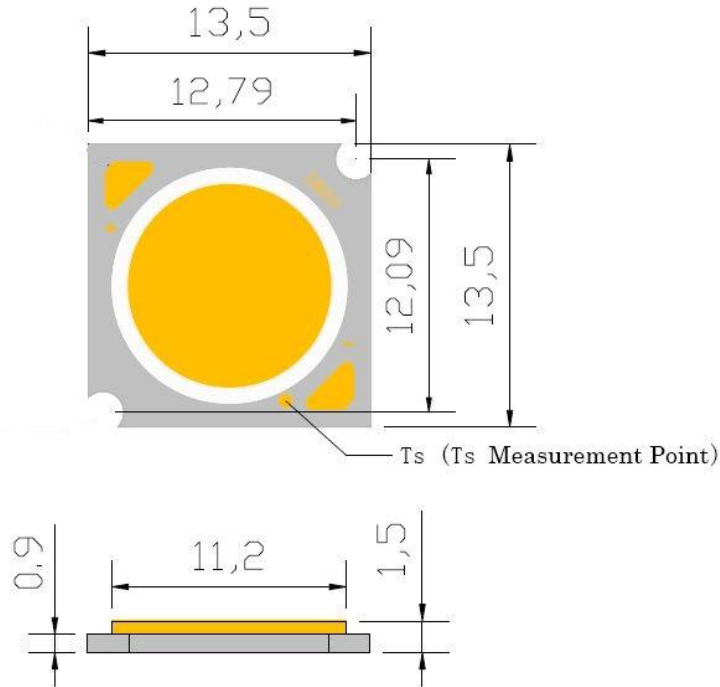
3.6 Data Set 2, 105°C, 600mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)						
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
21	0.2610	0.5287	2726	0.0006	0.0009	0.0012	0.0015	0.0021	0.0025	0.0027
22	0.2601	0.5285	2746	0.0008	0.0013	0.0014	0.0016	0.0020	0.0022	0.0026
23	0.2609	0.5292	2726	0.0011	0.0016	0.0020	0.0024	0.0022	0.0025	0.0028
24	0.2591	0.5284	2766	0.0009	0.0009	0.0012	0.0017	0.0022	0.0027	0.0032
25	0.2595	0.5291	2756	0.0012	0.0019	0.0024	0.0029	0.0021	0.0025	0.0027
26	0.2607	0.5285	2734	0.0010	0.0014	0.0017	0.0020	0.0021	0.0024	0.0027
27	0.2605	0.5290	2734	0.0014	0.0019	0.0023	0.0027	0.0020	0.0023	0.0026
28	0.2608	0.5286	2730	0.0014	0.0018	0.0025	0.0032	0.0020	0.0026	0.0029
29	0.2595	0.5287	2756	0.0010	0.0015	0.0016	0.0017	0.0025	0.0031	0.0035
30	0.2587	0.5314	2762	0.0007	0.0013	0.0016	0.0019	0.0019	0.0025	0.0026
31	0.2612	0.5290	2720	0.0012	0.0018	0.0021	0.0025	0.0022	0.0025	0.0031
32	0.2607	0.5290	2730	0.0013	0.0021	0.0027	0.0033	0.0022	0.0029	0.0030
33	0.2603	0.5282	2744	0.0012	0.0017	0.0021	0.0025	0.0022	0.0025	0.0031
34	0.2596	0.5285	2756	0.0015	0.0019	0.0024	0.0029	0.0023	0.0025	0.0025
35	0.2599	0.5287	2750	0.0008	0.0013	0.0017	0.0022	0.0020	0.0024	0.0024
36	0.2580	0.5311	2778	0.0007	0.0011	0.0016	0.0020	0.0018	0.0020	0.0024
37	0.2607	0.5287	2732	0.0009	0.0013	0.0016	0.0019	0.0018	0.0023	0.0024
38	0.2599	0.5287	2748	0.0011	0.0012	0.0016	0.0020	0.0028	0.0034	0.0034
39	0.2600	0.5285	2746	0.0010	0.0016	0.0020	0.0024	0.0021	0.0022	0.0028
40	0.2595	0.5287	2756	0.0008	0.0011	0.0014	0.0017	0.0019	0.0026	0.0027
Ave.	0.2600	0.5290	2745	0.0010	0.0015	0.0019	0.0023	0.0021	0.0025	0.0028
Med.	0.2601	0.5287	2746	0.0010	0.0015	0.0017	0.0021	0.0021	0.0025	0.0027
st dev	0.0008	0.0008	15	0.0003	0.0004	0.0004	0.0005	0.0002	0.0003	0.0003
Min.	0.2580	0.5282	2720	0.0006	0.0009	0.0012	0.0015	0.0018	0.0020	0.0024
Max.	0.2612	0.5314	2778	0.0015	0.0021	0.0027	0.0033	0.0028	0.0034	0.0035



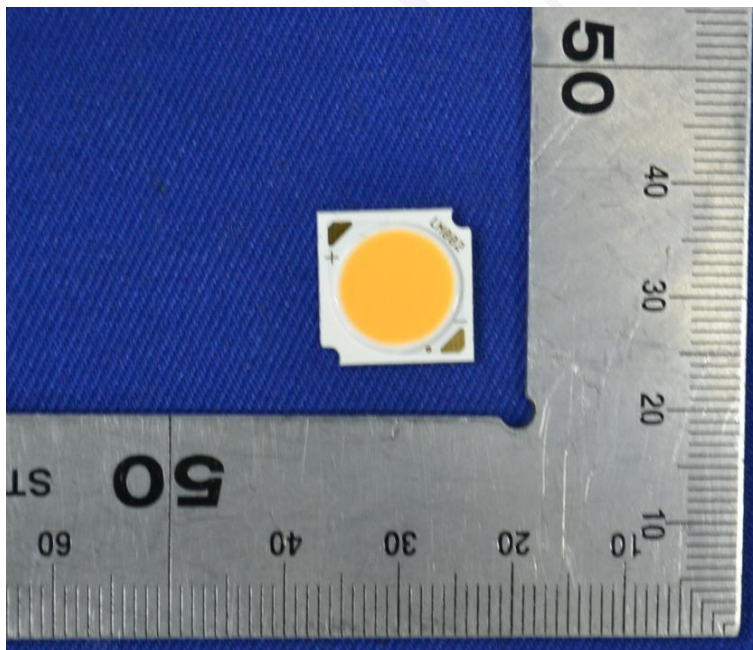
4 - EUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 EUT Photo



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