



# 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-3528HW-3C-S1-08-PCT-HR3**

<b>Report Type:</b> 9000 Hours Test Report		<b>Product Type:</b> LED Package	
<b>Test Engineer:</b>	Pote Wang	<i>Pote Wang</i>	
<b>Report Number:</b>	RSZ180816532-10		
<b>Test Date:</b>	2018-08-18 to 2019-08-30		
<b>Report Date:</b>	2019-09-06		
<b>Reviewed By:</b>	Bill Xiong / EE Engineer	<i>Bill Xiong</i>	
<b>Test Facility:</b>	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.		
<b>Prepared By:</b>	Bay Area Compliance Laboratories Corp. (Dongguan). No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax:+86-0769-86858588		
<b>Accreditation:</b>	The IAS Accreditation Number TL-460.		

**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).

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.

## TABLE OF CONTENTS

<b>1 - General Information</b> .....	<b>3</b>
1.1 Description of LED Light Sources .....	3
1.2 Standards and Reference Documentations .....	5
1.3 Testing Equipment .....	5
1.4 Drive Level .....	6
1.5 Ambient Conditions for Maintenance Test .....	6
1.6 Photometric Measurement Method and Uncertainty.....	6
1.7 Statement of Traceability .....	6
1.8 Sample Set.....	7
<b>2 - Summary of Test Result</b> .....	<b>8</b>
<b>3 - Test Data</b> .....	<b>9</b>
3.1 Data Set 1, 85°C, 100mA (Lumen Maintenance) .....	9
3.2 Data Set 1, 85°C, 100mA (Forward Voltage).....	10
3.3 Data Set 1, 85°C, 100mA (Chromaticity Shift) .....	11
3.4 Data Set 2, 105°C, 100mA (Lumen Maintenance) .....	12
3.5 Data Set 2, 105°C, 100mA (Forward Voltage).....	13
3.6 Data Set 2, 105°C, 100mA (Chromaticity Shift) .....	14
<b>4 - DUT Photo</b> .....	<b>15</b>
4.1 Mechanical Dimensions .....	15
4.2 DUT Photo.....	15

## 1 - General Information

### 1.1 Description of LED Light Sources

#### Sample Size:

60 PCS samples were received on 2018-08-16. The samples were numbered from 1 to 30 and 31 to 60.

Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Part Number:	HL-AS-3528HW-3C-S1-08-PCT-HR3
Part Type:	LED Package
Drive Level:	DC 100mA
Nominal CCT:	2700K
Power:	1.04W
Average Current Density per LED die:	772.78mA/mm <sup>2</sup>
Average Power Density per LED die:	5.757W/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 Name	Total Input Current (mA)	CRI	CCT (K)	Series	Parallel	Driver current per die (mA)	Current Density per Die (mA/mm <sup>2</sup> )	Power Density per PCB (W/mm <sup>2</sup> )	Die Spacing (mm)
HL-AS-3528HW-3C-S1-08-PCT-HR3 (Test model)	100	80	2700	3	1	100	772.78	0.1021	0.15
HL-AS-3528HW-3C-S1-08-PCT-HR3(R9)	100	80	>2200	3	1	100	772.78	0.1021	0.15
HL-AS-3528DW-3C-S1-08-PCT-HR3	100	80	>2200	3	1	100	516.67	0.1021	0.15
HL-AS-3528DW-3C-S1-08-PCT-HR3(R9)	100	80	>2200	3	1	100	516.67	0.1021	0.15
HL-AS-3528HW-3C-S1-08L-PCT-HR3	100	80	>2200	3	1	100	772.78	0.1021	0.15
HL-AS-3528HW-3C-S1-08L-PCT-HR3(R9)	100	80	>2200	3	1	100	772.78	0.1021	0.15
HL-AS-3528DW-3C-S1-08L-PCT-HR3	100	80	>2200	3	1	100	516.67	0.1021	0.15
HL-AS-3528DW-3C-S1-08L-PCT-HR3(R9)	100	80	>2200	3	1	100	516.67	0.1021	0.15
HL-AS-3528HW-2C-S1-08-PCT-HR3	150	80	>2200	2	1	150	753.77	0.1021	0.15
HL-AS-3528HW-2C-S1-08-PCT-HR3(R9)	150	80	>2200	2	1	150	753.77	0.1021	0.15

Model Name	Total Input Current (mA)	CRI	CCT (K)	Series	Parallel	Driver current per die (mA)	Current Density per Die (mA/mm <sup>2</sup> )	Power Density per PCB (W/mm <sup>2</sup> )	Die Spacing (mm)
HL-AS-3528HW-2C-S1-08L-PCT-HR3	150	80	>2200	2	1	150	753.77	0.1021	0.15
HL-AS-3528HW-2C-S1-08L-PCT-HR3(R9)	150	80	>2200	2	1	150	753.77	0.1021	0.15
HL-AS-3528DW-2C-S1-08-PCT-HR3	150	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528DW-2C-S1-08-PCT-HR3(R9)	150	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528DW-2C-S1-08L-PCT-HR3	150	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528DW-2C-S1-08L-PCT-HR3(R9)	150	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528HW-2-S1-08-PCT-HR3	300	80	>2200	2	1	150	753.77	0.1021	0.15
HL-AS-3528HW-2-S1-08-PCT-HR3(R9)	300	80	>2200	2	1	150	753.77	0.1021	0.15
HL-AS-3528DW-2-S1-08-PCT-HR3	300	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528DW-2-S1-08-PCT-HR3(R9)	300	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528HW-2-S1-08L-PCT-HR3	300	80	>2200	2	1	150	753.77	0.1021	0.15
HL-AS-3528HW-2-S1-08L-PCT-HR3(R9)	300	80	>2200	2	1	150	753.77	0.1021	0.15
HL-AS-3528DW-2-S1-08L-PCT-HR3	300	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528DW-2-S1-08L-PCT-HR3(R9)	300	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528DW-2-S1-08L-PCT-HR3-LY	300	80	>2200	2	1	150	624.91	0.1021	0.15
HL-AS-3528HW-S1-08-PCT-HR3	60	80	>2200	1	1	60	371.98	0.0204	/
HL-AS-3528HW-S1-08-PCT-HR3(R9)	60	80	>2200	1	1	60	371.98	0.0204	/
HL-AS-3528DW-S1-08-PCT-HR3	150	80	>2200	1	1	150	753.47	0.0511	/
HL-AS-3528DW-S1-08-PCT-HR3(R9)	150	80	>2200	1	1	150	753.47	0.0511	/
HL-AS-3528HW-S1-08L-PCT-HR3	60	80	>2200	1	1	60	371.98	0.0204	/
HL-AS-3528HW-S1-08L-PCT-HR3(R9)	60	80	>2200	1	1	60	371.98	0.0204	/
HL-AS-3528DW-S1-08L-PCT-HR3	150	80	>2200	1	1	150	753.47	0.0511	/
HL-AS-3528DW-S1-08L-PCT-HR3(R9)	150	80	>2200	1	1	150	753.47	0.0511	/
SL-*B2835YTA-31KA*	100	80	>2200	3	1	100	772.78	0.102041	0.15

Model Name	Total Input Current (mA)	CRI	CCT (K)	Series	Parallel	Driver current per die (mA)	Current Density per Die (mA/mm <sup>2</sup> )	Power Density per PCB (W/mm <sup>2</sup> )	Die Spacing (mm)
SL-*B2835YTA-31KA*H	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-31KA*-*	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-31KA*-*	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-31KA*-*	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-31KA*H-*	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-31KA*H-*	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-31KAH*H-***	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-31KA*/*	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-31KA*H/*	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-**B2835YTA-31KA****-APH***	100	80	>2200	3	1	100	772.78	0.102041	0.15
SL-*B2835YTA-11KC*	100	80	>2200	1	1	100	469.7	0.102041	/
SL-*B2835YTA-11KC*H	100	80	>2200	1	1	100	469.7	0.102041	/

**Note:**

- The first \* is the letter I/N/W which stand for color temperature. I means 2200-3700K, N means 3700-4700K, W means above 4700K. The second \* is a different product solution (Color coordinate and applications and special solution etc...). The third \*\* mainly distinguishes specific color temperature codes, for example, 27 stands for 2700K color temperature.
- The first and second \* of SL-\*\*B2835FTA-21CC\*\*\*\*-APH\*\*\*/ SL-\*\*B2835FTA-12CC\*\*\*\* -APH\*\*\*/ SL-\*\*B2835FTA-11CC\*\*\*\* -APH\*\*\* is a numbers 27, 30,40,50,65, which stand for CCT. Number From three to six \* is a different product solution (Color coordinate and applications and special solution etc...), from seven to nine \* is different version numbers.

**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
0.5m integrating sphere	EVERFINE	AIS-2	G185304TA1381172	2019-06-28	2020-06-27
LED Test Source	EVERFINE	LTS-300	P185616CD1371113	2019-07-23	2020-07-22
High Accuracy Array Spectroradiometer	EVERFINE	HAAS-2000	P600674CM1381123	2019-06-28	2020-06-27
Standard Light Source	EVERFINE	D062	G100278CJ7351206	2018-12-24	2019-12-24

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
Multilayer aging machine	BACL	B2-270	20024	2019-03-10	2020-03-09
DC Power Supply	BACL	B12001-12	90023	2019-01-07	2020-01-07

#### 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 luminous flux and chromaticity coordinate  $u'v'$ .  $2\pi$  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.

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  $U=0.8671^{\circ}C$  ( $K=2$ ), 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, 100mA

Part Number: HL-AS-3528HW-3C-S1-08-PCT-HR3  
Number of Units: 30  
Case Temperature: >83°C  
Ambient Temperature: >80°C  
Life Test Drive Current: 100mA  
Measurement Current: 100mA

### Data Set 2: 105°C, 100mA

Part Number: HL-AS-3528HW-3C-S1-08-PCT-HR3  
Number of Units: 30  
Case Temperature: >103°C  
Ambient Temperature: >100°C  
Life Test Drive Current: 100mA  
Measurement Current: 100mA

## 2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	$\alpha$	$\beta$	Reported TM-21 L <sub>70</sub> Lifetime	Reported TM-21 L <sub>90</sub> Lifetime
1	30	0	1000hrs	9000hrs	2.497E-06	1.004	>54000hrs	44,000hrs
2	30	0	1000hrs	9000hrs	3.401E-06	1.005	>54000hrs	32,000hrs

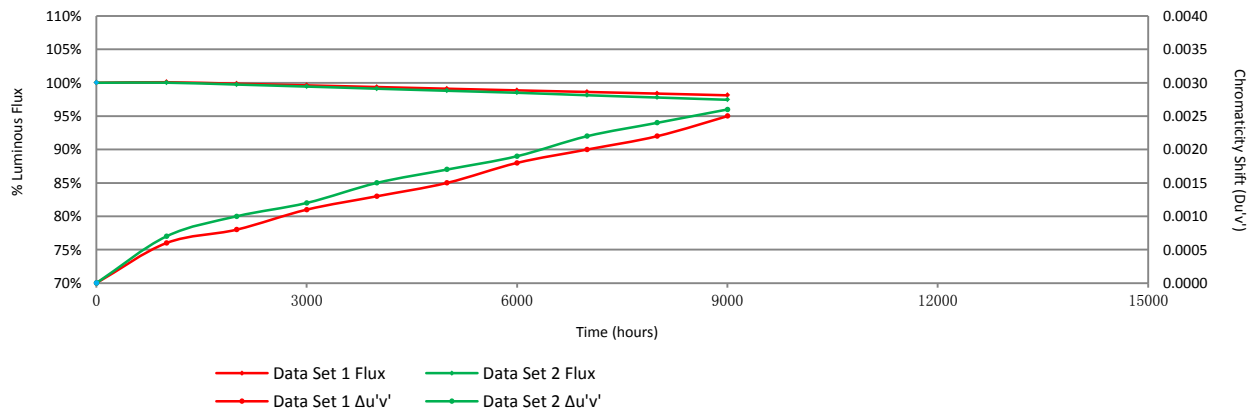
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	100.08%	99.85%	99.61%	99.36%	99.11%	98.86%	98.62%	98.38%	98.12%
2	100.01%	99.73%	99.43%	99.11%	98.80%	98.50%	98.13%	97.79%	97.45%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.0006	0.0008	0.0011	0.0013	0.0015	0.0018	0.0020	0.0022	0.0025
2	0.0007	0.0010	0.0012	0.0015	0.0017	0.0019	0.0022	0.0024	0.0026

Average Lumen Maintenance and Chromaticity Shift VS. Time





### 3 - Test Data

#### 3.1 Data Set 1, 85°C, 100mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	129.8	100.08	99.92	99.77	99.46	99.23	99.00	98.77	98.69	98.38
2	130.1	100.15	99.92	99.54	99.23	98.92	98.85	98.62	98.39	98.23
3	130.7	100.31	100.08	99.77	99.54	99.31	99.01	98.62	98.39	98.16
4	125.6	100.24	100.08	99.84	99.68	99.28	98.89	98.73	98.33	98.09
5	128.6	99.84	99.69	99.46	99.30	99.07	98.83	98.52	98.37	98.13
6	131.2	99.92	99.70	99.39	99.16	98.93	98.70	98.48	98.25	98.09
7	128.4	100.16	99.77	99.53	99.22	98.83	98.75	98.44	98.29	98.05
8	124.8	100.16	100.00	99.84	99.52	99.28	98.72	98.48	98.24	98.00
9	127.3	100.24	99.92	99.69	99.45	99.21	99.14	98.82	98.51	98.19
10	124.6	100.16	99.84	99.44	99.12	98.80	98.64	98.31	97.99	97.83
11	125.3	99.84	99.68	99.44	99.12	98.80	98.40	98.08	97.92	97.69
12	131.5	100.08	99.85	99.70	99.39	99.24	99.09	98.94	98.63	98.33
13	123.3	99.76	99.43	99.27	99.11	98.86	98.78	98.62	98.38	98.13
14	130.4	100.15	99.85	99.62	99.31	99.16	98.85	98.47	98.31	98.01
15	124.7	99.84	99.52	99.36	99.04	98.88	98.72	98.40	98.24	97.91
16	125.1	99.84	99.60	99.36	99.12	98.88	98.72	98.56	98.24	98.00
17	123.2	99.92	99.76	99.59	99.35	99.03	98.70	98.46	98.21	98.05
18	119.7	100.08	99.92	99.83	99.58	99.33	99.00	98.75	98.41	98.08
19	125.0	100.24	100.08	99.84	99.68	99.52	99.36	99.12	98.88	98.64
20	126.3	100.24	100.16	99.92	99.68	99.52	99.29	99.13	99.05	98.65
21	123.7	100.08	99.84	99.68	99.27	98.87	98.71	98.22	97.98	97.74
22	128.0	100.23	100.00	99.69	99.45	99.22	99.06	98.75	98.44	98.13
23	131.5	99.85	99.54	99.39	99.16	99.09	98.78	98.56	98.25	97.95
24	129.1	99.92	99.77	99.38	99.15	98.92	98.61	98.53	98.30	98.14
25	125.4	100.24	99.92	99.68	99.36	99.12	98.64	98.41	98.17	97.85
26	124.3	100.32	100.16	99.84	99.60	99.44	99.03	98.71	98.55	98.23
27	129.5	100.23	100.08	99.85	99.54	99.31	99.00	98.92	98.53	98.15
28	125.3	99.92	99.76	99.60	99.36	98.96	98.72	98.56	98.32	98.08
29	122.9	100.16	99.84	99.59	99.43	99.27	99.10	98.94	98.62	98.21
30	133.3	100.08	99.85	99.55	99.32	99.10	98.72	98.65	98.57	98.42
Avg.	127.0	100.08	99.85	99.61	99.36	99.11	98.86	98.62	98.38	98.12
Med.	126.0	100.12	99.85	99.61	99.36	99.11	98.81	98.59	98.35	98.11
st dev	3.3	0.17	0.19	0.18	0.19	0.22	0.21	0.24	0.24	0.22
Min.	119.7	99.76	99.43	99.27	99.04	98.80	98.40	98.08	97.92	97.69
Max.	133.3	100.32	100.16	99.92	99.68	99.52	99.36	99.13	99.05	98.65

**3.2 Data Set 1, 85°C, 100mA (Forward Voltage)**

No.	Forward Voltage (V)									
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	9.053	9.099	9.050	9.043	9.040	9.041	9.046	9.043	9.044	9.038
2	9.075	9.129	9.065	9.062	9.057	9.062	9.066	9.063	9.061	9.063
3	9.073	9.123	9.066	9.067	9.058	9.055	9.064	9.060	9.059	9.057
4	9.266	9.260	9.268	9.264	9.250	9.254	9.256	9.261	9.257	9.256
5	9.163	9.159	9.118	9.111	9.103	9.108	9.112	9.108	9.105	9.104
6	9.116	9.123	9.079	9.067	9.064	9.072	9.074	9.067	9.070	9.062
7	9.114	9.118	9.075	9.063	9.057	9.058	9.062	9.063	9.063	9.058
8	9.222	9.232	9.229	9.202	9.197	9.196	9.206	9.204	9.199	9.192
9	9.142	9.246	9.126	9.114	9.109	9.122	9.118	9.123	9.124	9.110
10	9.111	9.208	9.109	9.091	9.090	9.091	9.096	9.104	9.093	9.090
11	9.226	9.216	9.243	9.226	9.224	9.221	9.228	9.229	9.221	9.216
12	9.106	9.149	9.104	9.083	9.088	9.084	9.083	9.089	9.087	9.082
13	9.227	9.222	9.228	9.215	9.216	9.221	9.219	9.229	9.216	9.204
14	9.142	9.198	9.124	9.119	9.120	9.121	9.123	9.124	9.119	9.113
15	9.279	9.283	9.272	9.256	9.263	9.256	9.259	9.275	9.255	9.250
16	9.219	9.267	9.221	9.213	9.225	9.217	9.216	9.228	9.212	9.200
17	9.218	9.284	9.209	9.204	9.214	9.209	9.208	9.224	9.206	9.200
18	9.285	9.285	9.288	9.279	9.286	9.278	9.282	9.296	9.282	9.268
19	9.225	9.254	9.202	9.196	9.209	9.193	9.201	9.212	9.196	9.187
20	9.167	9.228	9.154	9.149	9.152	9.152	9.159	9.168	9.153	9.147
21	9.218	9.293	9.229	9.214	9.223	9.210	9.217	9.230	9.216	9.206
22	9.080	9.117	9.078	9.076	9.075	9.074	9.074	9.084	9.065	9.062
23	9.103	9.162	9.097	9.087	9.090	9.081	9.088	9.106	9.084	9.079
24	9.126	9.207	9.135	9.115	9.125	9.119	9.120	9.132	9.128	9.111
25	9.263	9.232	9.240	9.231	9.229	9.233	9.237	9.251	9.236	9.228
26	9.238	9.234	9.213	9.206	9.208	9.208	9.205	9.216	9.202	9.199
27	9.069	9.062	9.049	9.041	9.050	9.044	9.046	9.053	9.045	9.040
28	9.261	9.284	9.256	9.236	9.242	9.234	9.231	9.239	9.236	9.231
29	9.224	9.294	9.220	9.214	9.221	9.212	9.216	9.219	9.215	9.212
30	9.095	9.131	9.096	9.077	9.079	9.076	9.077	9.078	9.074	9.066
Avg.	9.170	9.203	9.161	9.151	9.152	9.150	9.153	9.159	9.151	9.144
Med.	9.165	9.219	9.145	9.134	9.139	9.137	9.141	9.150	9.141	9.130
st dev	0.073	0.068	0.077	0.076	0.078	0.076	0.076	0.079	0.076	0.075
Min.	9.053	9.062	9.049	9.041	9.040	9.041	9.046	9.043	9.044	9.038
Max.	9.285	9.294	9.288	9.279	9.286	9.278	9.282	9.296	9.282	9.268

**3.3 Data Set 1, 85°C, 100mA (Chromaticity Shift)**

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2641	0.5262	2671	0.0004	0.0005	0.0011	0.0014	0.0016	0.0021	0.0023	0.0025	0.0028
2	0.2643	0.5252	2671	0.0007	0.0008	0.0010	0.0012	0.0015	0.0018	0.0021	0.0024	0.0027
3	0.2614	0.5242	2736	0.0007	0.0008	0.0011	0.0013	0.0016	0.0019	0.0021	0.0023	0.0026
4	0.2612	0.5236	2743	0.0005	0.0008	0.0009	0.0012	0.0014	0.0018	0.0021	0.0023	0.0025
5	0.2652	0.5275	2644	0.0008	0.0009	0.0011	0.0013	0.0015	0.0018	0.0021	0.0023	0.0025
6	0.2633	0.5270	2686	0.0007	0.0010	0.0013	0.0014	0.0017	0.0017	0.0020	0.0023	0.0025
7	0.2655	0.5268	2642	0.0008	0.0011	0.0013	0.0015	0.0017	0.0019	0.0020	0.0023	0.0026
8	0.2649	0.5295	2644	0.0005	0.0009	0.0011	0.0015	0.0017	0.0019	0.0020	0.0023	0.0026
9	0.2623	0.5263	2708	0.0004	0.0006	0.0008	0.0011	0.0014	0.0017	0.0019	0.0021	0.0023
10	0.2647	0.5251	2663	0.0006	0.0007	0.0009	0.0012	0.0014	0.0017	0.0018	0.0023	0.0024
11	0.2622	0.5239	2720	0.0006	0.0007	0.0011	0.0012	0.0013	0.0016	0.0019	0.0024	0.0026
12	0.2648	0.5245	2665	0.0006	0.0008	0.0011	0.0013	0.0013	0.0017	0.0020	0.0024	0.0026
13	0.2634	0.5237	2695	0.0005	0.0008	0.0012	0.0014	0.0016	0.0017	0.0018	0.0021	0.0024
14	0.2647	0.5265	2658	0.0006	0.0008	0.0011	0.0014	0.0017	0.0019	0.0021	0.0021	0.0022
15	0.2622	0.5260	2713	0.0006	0.0008	0.0011	0.0014	0.0017	0.0020	0.0021	0.0022	0.0023
16	0.2640	0.5244	2681	0.0006	0.0008	0.0011	0.0013	0.0016	0.0019	0.0022	0.0024	0.0025
17	0.2622	0.5224	2727	0.0006	0.0007	0.0010	0.0013	0.0016	0.0019	0.0022	0.0024	0.0026
18	0.2626	0.5236	2713	0.0006	0.0007	0.0009	0.0011	0.0013	0.0016	0.0019	0.0023	0.0025
19	0.2605	0.5232	2760	0.0006	0.0007	0.0010	0.0011	0.0013	0.0014	0.0017	0.0021	0.0023
20	0.2641	0.5266	2670	0.0006	0.0007	0.0009	0.0012	0.0014	0.0015	0.0016	0.0019	0.0021
21	0.2645	0.5265	2663	0.0005	0.0007	0.0010	0.0012	0.0014	0.0016	0.0017	0.0020	0.0022
22	0.2652	0.5259	2649	0.0007	0.0009	0.0011	0.0014	0.0016	0.0019	0.0020	0.0021	0.0021
23	0.2646	0.5244	2668	0.0008	0.0012	0.0013	0.0014	0.0015	0.0018	0.0020	0.0021	0.0023
24	0.2644	0.5256	2668	0.0007	0.0010	0.0016	0.0018	0.0019	0.0021	0.0022	0.0024	0.0026
25	0.2648	0.5274	2652	0.0007	0.0010	0.0014	0.0016	0.0018	0.0019	0.0020	0.0022	0.0024
26	0.2646	0.5276	2656	0.0006	0.0008	0.0011	0.0015	0.0017	0.0020	0.0023	0.0024	0.0026
27	0.2635	0.5252	2687	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018	0.0021	0.0025	0.0026
28	0.2626	0.5257	2705	0.0006	0.0009	0.0011	0.0013	0.0015	0.0017	0.0018	0.0021	0.0024
29	0.2644	0.5273	2660	0.0006	0.0009	0.0013	0.0014	0.0015	0.0017	0.0019	0.0021	0.0022
30	0.2613	0.5246	2737	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0021	0.0023	0.0024
Avg.	0.2636	0.5255	2685	0.0006	0.0008	0.0011	0.0013	0.0015	0.0018	0.0020	0.0022	0.0025
Med.	0.2641	0.5257	2671	0.0006	0.0008	0.0011	0.0014	0.0016	0.0018	0.0020	0.0023	0.0025
st dev	0.0014	0.0016	33	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2605	0.5224	2642	0.0004	0.0005	0.0008	0.0011	0.0013	0.0014	0.0016	0.0019	0.0021
Max.	0.2655	0.5295	2760	0.0008	0.0012	0.0016	0.0018	0.0019	0.0021	0.0023	0.0025	0.0028

**3.4 Data Set 2, 105°C, 100mA (Lumen Maintenance)**

No.	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	122.8	100.08	99.76	99.43	99.19	99.02	98.62	98.21	97.96	97.80
32	123.1	99.92	99.59	99.35	98.94	98.62	98.46	98.05	97.73	97.40
33	124.1	100.24	99.84	99.52	99.27	98.95	98.63	98.31	97.90	97.58
34	129.7	100.15	99.92	99.61	99.31	99.15	98.84	98.46	98.15	97.84
35	132.8	99.85	99.47	99.17	98.87	98.64	98.42	98.04	97.67	97.29
36	123.3	99.92	99.59	99.35	98.95	98.54	98.30	97.81	97.40	97.16
37	131.5	100.23	100.08	99.85	99.54	99.09	98.78	98.40	98.10	97.64
38	130.5	99.92	99.62	99.23	99.00	98.62	98.31	98.01	97.70	97.39
39	126.1	100.24	100.00	99.76	99.44	99.21	98.97	98.41	97.94	97.46
40	123.4	99.92	99.59	99.27	99.03	98.78	98.46	98.22	97.89	97.49
41	125.3	99.92	99.76	99.52	99.12	98.72	98.40	98.00	97.69	97.29
42	122.8	99.76	99.35	99.10	98.78	98.45	98.13	97.56	97.23	96.74
43	128.8	100.16	99.92	99.61	99.30	98.91	98.52	98.21	97.90	97.36
44	130.4	99.85	99.62	99.39	99.16	98.85	98.54	98.24	97.78	97.39
45	132.1	100.15	99.85	99.47	99.17	99.02	98.71	98.41	98.11	97.80
46	132.1	100.15	100.00	99.77	99.39	99.02	98.79	98.41	98.18	97.96
47	130.1	99.92	99.54	99.31	99.08	99.00	98.69	98.23	97.85	97.46
48	122.4	100.16	99.92	99.67	99.26	98.77	98.45	98.20	97.88	97.55
49	128.2	99.84	99.69	99.30	98.99	98.75	98.44	98.21	97.97	97.66
50	127.3	99.84	99.53	99.06	98.59	98.35	97.96	97.49	97.17	96.86
51	127.7	99.92	99.61	99.22	98.90	98.59	98.28	98.04	97.65	97.18
52	123.3	100.08	99.84	99.59	99.35	99.11	98.70	98.22	97.81	97.40
53	127.8	100.16	99.84	99.61	99.30	99.06	98.75	98.44	98.20	97.81
54	131.0	100.15	99.92	99.62	99.31	99.01	98.78	98.40	98.09	97.79
55	124.5	99.92	99.52	99.28	98.96	98.55	98.15	97.83	97.51	97.35
56	132.5	100.08	99.85	99.40	99.09	98.79	98.57	98.04	97.81	97.51
57	131.1	99.85	99.54	99.31	99.08	98.63	98.32	98.17	97.71	97.48
58	129.9	99.92	99.62	99.23	98.77	98.38	98.08	97.61	97.31	97.00
59	119.5	99.92	99.58	99.25	99.00	98.66	98.49	98.24	97.82	97.57
60	121.7	100.08	99.92	99.51	99.18	98.85	98.44	97.95	97.70	97.29
Avg.	127.2	100.01	99.73	99.43	99.11	98.80	98.50	98.13	97.79	97.45
Med.	127.8	99.92	99.72	99.39	99.11	98.79	98.48	98.21	97.82	97.46
st dev	3.9	0.14	0.19	0.21	0.22	0.24	0.24	0.26	0.27	0.28
Min.	119.5	99.76	99.35	99.06	98.59	98.35	97.96	97.49	97.17	96.74
Max.	132.8	100.24	100.08	99.85	99.54	99.21	98.97	98.46	98.20	97.96

**3.5 Data Set 2, 105°C, 100mA (Forward Voltage)**

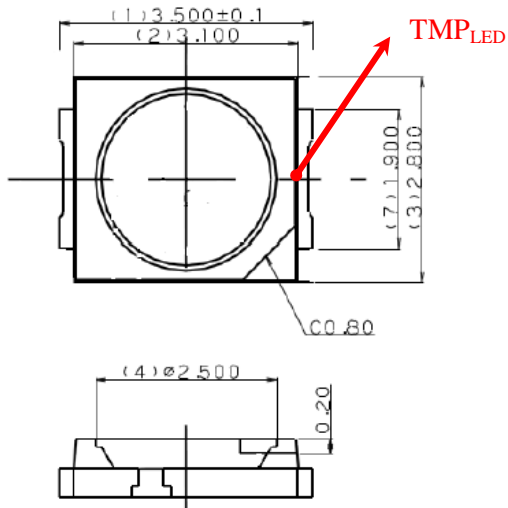
No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	9.209	9.268	9.222	9.191	9.187	9.183	9.191	9.189	9.189	9.183
32	9.236	9.292	9.208	9.198	9.193	9.194	9.190	9.199	9.194	9.182
33	9.237	9.234	9.222	9.210	9.208	9.212	9.204	9.219	9.207	9.200
34	9.095	9.100	9.051	9.023	9.028	9.026	9.023	9.035	9.027	9.018
35	9.121	9.236	9.115	9.093	9.097	9.091	9.095	9.095	9.089	9.079
36	9.222	9.215	9.205	9.192	9.196	9.195	9.197	9.197	9.189	9.183
37	9.136	9.170	9.102	9.081	9.085	9.083	9.084	9.086	9.081	9.074
38	9.102	9.224	9.082	9.061	9.067	9.065	9.066	9.062	9.062	9.056
39	9.236	9.199	9.250	9.201	9.203	9.204	9.203	9.208	9.201	9.193
40	9.222	9.296	9.249	9.194	9.195	9.187	9.199	9.190	9.191	9.181
41	9.100	9.169	9.131	9.077	9.078	9.078	9.077	9.080	9.076	9.062
42	9.237	9.234	9.233	9.206	9.208	9.210	9.215	9.212	9.207	9.194
43	9.087	9.130	9.092	9.060	9.061	9.065	9.064	9.064	9.056	9.051
44	9.157	9.262	9.136	9.106	9.112	9.112	9.107	9.108	9.105	9.100
45	9.098	9.198	9.132	9.065	9.064	9.069	9.067	9.066	9.063	9.059
46	9.079	9.193	9.119	9.057	9.062	9.060	9.053	9.054	9.055	9.048
47	9.080	9.167	9.105	9.066	9.069	9.064	9.065	9.059	9.061	9.052
48	9.279	9.269	9.257	9.240	9.247	9.239	9.243	9.236	9.238	9.230
49	9.085	9.126	9.100	9.075	9.076	9.077	9.079	9.075	9.079	9.064
50	9.314	9.308	9.327	9.288	9.289	9.285	9.286	9.280	9.284	9.274
51	9.230	9.231	9.267	9.232	9.232	9.226	9.232	9.227	9.230	9.220
52	9.288	9.310	9.309	9.259	9.260	9.252	9.262	9.249	9.257	9.251
53	9.083	9.145	9.092	9.078	9.078	9.069	9.079	9.076	9.076	9.063
54	9.062	9.130	9.075	9.058	9.064	9.057	9.069	9.062	9.057	9.052
55	9.221	9.287	9.239	9.216	9.222	9.216	9.227	9.217	9.222	9.215
56	9.106	9.176	9.120	9.098	9.102	9.102	9.109	9.095	9.100	9.093
57	9.054	9.117	9.061	9.055	9.054	9.058	9.061	9.051	9.058	9.050
58	9.054	9.074	9.062	9.049	9.054	9.054	9.058	9.050	9.056	9.046
59	9.339	9.334	9.347	9.335	9.338	9.332	9.347	9.333	9.340	9.326
60	9.192	9.244	9.209	9.193	9.185	9.182	9.191	9.185	9.190	9.176
Avg.	9.165	9.211	9.171	9.142	9.144	9.142	9.145	9.142	9.141	9.133
Med.	9.147	9.220	9.134	9.102	9.107	9.107	9.108	9.102	9.103	9.097
st dev	0.085	0.069	0.086	0.086	0.085	0.084	0.086	0.084	0.085	0.085
Min.	9.054	9.074	9.051	9.023	9.028	9.026	9.023	9.035	9.027	9.018
Max.	9.339	9.334	9.347	9.335	9.338	9.332	9.347	9.333	9.340	9.326

**3.6 Data Set 2, 105°C, 100mA (Chromaticity Shift)**

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	0.2627	0.5243	2709	0.0004	0.0006	0.0009	0.0013	0.0014	0.0016	0.0019	0.0021	0.0022
32	0.2635	0.5253	2688	0.0004	0.0008	0.0009	0.0011	0.0015	0.0016	0.0019	0.0022	0.0024
33	0.2617	0.5226	2737	0.0006	0.0009	0.0011	0.0013	0.0018	0.0021	0.0024	0.0027	0.0029
34	0.2665	0.5262	2623	0.0005	0.0008	0.0011	0.0013	0.0013	0.0016	0.0019	0.0021	0.0024
35	0.2650	0.5255	2656	0.0006	0.0008	0.0011	0.0014	0.0015	0.0016	0.0019	0.0023	0.0025
36	0.2640	0.5257	2676	0.0008	0.0011	0.0014	0.0017	0.0019	0.0021	0.0023	0.0024	0.0026
37	0.2648	0.5262	2658	0.0005	0.0008	0.0009	0.0012	0.0014	0.0016	0.0019	0.0023	0.0025
38	0.2631	0.5254	2696	0.0008	0.0009	0.0011	0.0012	0.0015	0.0017	0.0021	0.0022	0.0025
39	0.2645	0.5279	2658	0.0006	0.0008	0.0009	0.0011	0.0014	0.0017	0.0018	0.0021	0.0024
40	0.2636	0.5241	2691	0.0009	0.0011	0.0013	0.0014	0.0015	0.0016	0.0019	0.0022	0.0024
41	0.2625	0.5274	2701	0.0007	0.0010	0.0011	0.0013	0.0016	0.0018	0.0019	0.0021	0.0024
42	0.2640	0.5246	2680	0.0009	0.0011	0.0014	0.0016	0.0017	0.0020	0.0022	0.0024	0.0026
43	0.2647	0.5258	2662	0.0008	0.0011	0.0013	0.0015	0.0017	0.0020	0.0021	0.0023	0.0025
44	0.2662	0.5282	2622	0.0007	0.0011	0.0013	0.0014	0.0016	0.0018	0.0021	0.0022	0.0023
45	0.2645	0.5274	2659	0.0009	0.0012	0.0013	0.0016	0.0017	0.0020	0.0023	0.0024	0.0025
46	0.2640	0.5253	2676	0.0008	0.0011	0.0013	0.0016	0.0018	0.0021	0.0024	0.0026	0.0027
47	0.2641	0.5244	2678	0.0007	0.0010	0.0012	0.0015	0.0016	0.0020	0.0024	0.0027	0.0028
48	0.2639	0.5262	2676	0.0007	0.0010	0.0012	0.0015	0.0018	0.0019	0.0021	0.0025	0.0027
49	0.2643	0.5296	2654	0.0006	0.0009	0.0011	0.0013	0.0015	0.0018	0.0019	0.0023	0.0026
50	0.2634	0.5289	2676	0.0007	0.0011	0.0013	0.0015	0.0018	0.0019	0.0023	0.0028	0.0029
51	0.2619	0.5261	2718	0.0008	0.0011	0.0012	0.0013	0.0016	0.0017	0.0018	0.0020	0.0022
52	0.2648	0.5252	2661	0.0008	0.0010	0.0012	0.0015	0.0019	0.0023	0.0025	0.0027	0.0030
53	0.2650	0.5271	2650	0.0008	0.0011	0.0012	0.0013	0.0015	0.0016	0.0019	0.0023	0.0026
54	0.2624	0.5253	2710	0.0008	0.0010	0.0013	0.0016	0.0017	0.0018	0.0020	0.0023	0.0025
55	0.2636	0.5255	2685	0.0008	0.0011	0.0013	0.0016	0.0019	0.0022	0.0023	0.0026	0.0027
56	0.2640	0.5247	2680	0.0008	0.0010	0.0012	0.0014	0.0017	0.0020	0.0022	0.0024	0.0026
57	0.2633	0.5263	2688	0.0007	0.0011	0.0013	0.0015	0.0018	0.0021	0.0022	0.0025	0.0027
58	0.2652	0.5261	2650	0.0007	0.0010	0.0013	0.0016	0.0018	0.0020	0.0023	0.0025	0.0028
59	0.2631	0.5227	2707	0.0011	0.0015	0.0018	0.0023	0.0025	0.0028	0.0030	0.0032	0.0034
60	0.2630	0.5254	2698	0.0011	0.0013	0.0015	0.0018	0.0021	0.0023	0.0026	0.0028	0.0029
Avg.	0.2639	0.5258	2677	0.0007	0.0010	0.0012	0.0015	0.0017	0.0019	0.0022	0.0024	0.0026
Med.	0.2640	0.5256	2677	0.0007	0.0010	0.0012	0.0015	0.0017	0.0019	0.0021	0.0024	0.0026
st dev	0.0011	0.0016	26	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
Min.	0.2617	0.5226	2622	0.0004	0.0006	0.0009	0.0011	0.0013	0.0016	0.0018	0.0020	0.0022
Max.	0.2665	0.5296	2737	0.0011	0.0015	0.0018	0.0023	0.0025	0.0028	0.0030	0.0032	0.0034

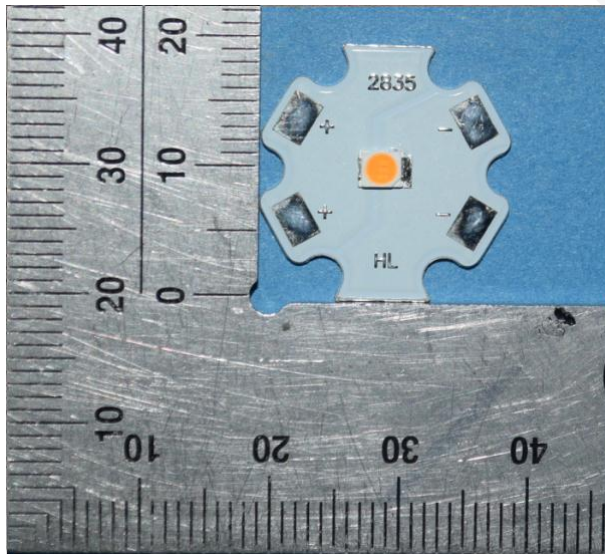
#### 4 - DUT Photo

##### 4.1 Mechanical Dimensions



All dimensions are in millimeter

##### 4.2 DUT Photo



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