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-2835VDW-2C-S1-08-PCT-HR3(R9)

Report Type: 9000 Hours Test Report	**Product Type:** LED Package
Test Engineer:	Pote Wang
Report Number:	RSZ171124501-10
Test Date:	2017-11-28 to 2018-12-09
Report Date:	2018-12-19
Reviewed By:	Daniel Duan / EE Engineer
Test Facility:	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax:+86-0769-86858588
Accreditation:	The IAS Accreditation Number TL-460.

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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

90 PCS samples were received on 2017-11-24. The samples were numbered from 1 to 30, 31 to 60 and 61 to 90.

Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Part Number:	HL-AS-2835VDW-2C-S1-08-PCT-HR3(R9)
Part Type:	LED Package
Drive Level:	DC 30mA
Nominal CCT:	2700K
Power:	1W
Average Current Density per LED die:	134.782mA/mm^2
Average Power Density per LED die:	2.246W/mm^2
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:

Testing Model	Multiple Models	Differences Details
HL-AS-2835VDW-2C-S1-08-PCT-HR3(R9)	HL-AS-2835VDW-2C-S1-08-PCT-HR3	Only different Model name for different market
	HL-AS-2835VDW-2C-S1-08L-PCT-HR3(R9)	
	HL-AS-2835VDW-2C-S1-08L-PCT-HR3	
	HL-AS-2835DVW-2C-S1-08-PCT-HR3(R9)	
	HL-AS-2835DVW-2C-S1-08-PCT-HR3	
	HL-AS-2835DVW-2C-S1-08L-PCT-HR3(R9)	
	HL-AS-2835DVW-2C-S1-08L-PCT-HR3	
	SL-*B2835FTA-21BD*	
	SL-*B2835FTA-21BD*H	

Note:

1. The first symbol "*" is the letter I /N /W which stand for color temperature. I means 2200-3700K, N means 3700-4700K, W means above 4700K.
2. The second symbol "*" is a different product solution.

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
0.3m integrating sphere	EVERFINE	Diameter 0.3m	1011119	2018-03-18	2019-03-18
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	2018-03-26	2019-03-26
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	2018-03-18	2019-03-18
Standard Light Source	EVERFINE	D062	1011064	2018-01-15	2019-01-15
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987CJ7321114	2018-03-26	2019-03-26
Multilayer aging machine	BACL	B2-270	20024	2018-03-13	2019-03-13
Multilayer aging machine	BACL	B2-270	20023	2018-03-13	2019-03-13
Multilayer aging machine	BACL	B2-270	20015	2018-03-13	2019-03-13
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090008	2018-06-15	2019-06-15
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060002	2018-06-15	2019-06-15
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090007	2018-03-26	2019-03-26

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, 30mA

Part Number:	HL-AS-2835VDW-2C-S1-08-PCT-HR3(R9)
Number of Units:	30
Case Temperature:	>53°C
Ambient Temperature:	>50°C
Life Test Drive Current:	30mA
Measurement Current:	30mA

Data Set 2: 85°C, 30mA

Part Number:	HL-AS-2835VDW-2C-S1-08-PCT-HR3(R9)
Number of Units:	30
Case Temperature:	>83°C
Ambient Temperature:	>80°C
Life Test Drive Current:	30mA
Measurement Current:	30mA

Data Set 3: 105°C, 30mA

Part Number:	HL-AS-2835VDW-2C-S1-08-PCT-HR3(R9)
Number of Units:	30
Case Temperature:	>103°C
Ambient Temperature:	>100°C
Life Test Drive Current:	30mA
Measurement Current:	30mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM-21 L_{70} Lifetime
1	30	0	1000hrs	9000hrs	3.116E-06	1.003	>54000Hours
2	30	0	1000hrs	9000hrs	3.767E-06	1.001	>54000Hours
3	30	0	1000hrs	9000hrs	4.316E-06	1.000	>54000Hours

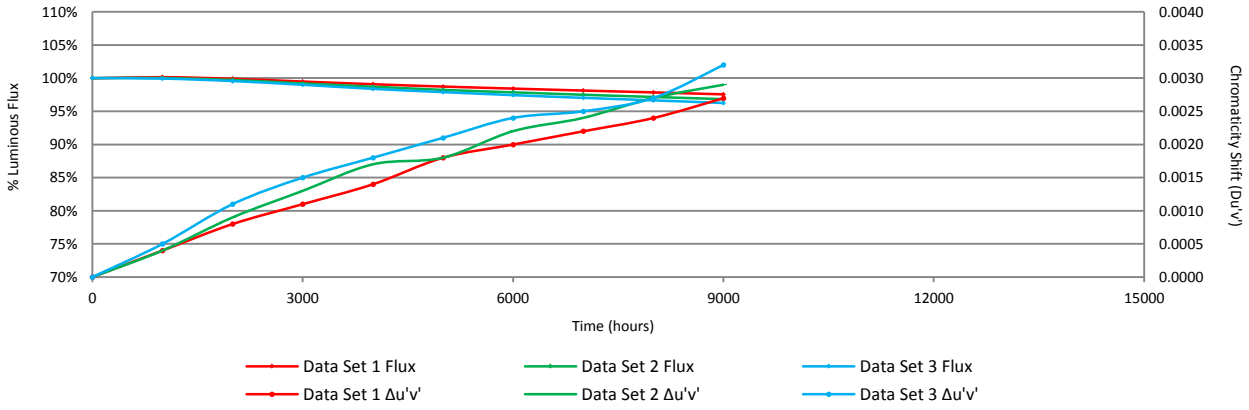
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	100.17%	99.92%	99.50%	99.09%	98.73%	98.42%	98.12%	97.84%	97.54%
2	100.02%	99.72%	99.21%	98.72%	98.24%	97.87%	97.51%	97.18%	96.85%
3	99.92%	99.55%	98.99%	98.38%	97.89%	97.44%	97.03%	96.66%	96.26%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.0004	0.0008	0.0011	0.0014	0.0018	0.0020	0.0022	0.0024	0.0027
2	0.0004	0.0009	0.0013	0.0017	0.0018	0.0022	0.0024	0.0027	0.0029
3	0.0005	0.0011	0.0015	0.0018	0.0021	0.0024	0.0025	0.0027	0.0032

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 55°C, 30mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	146.60	99.86	99.73	99.11	98.84	98.64	98.36	98.02	97.48	97.14
2	148.30	100.07	99.73	99.12	98.72	98.25	97.98	97.57	97.37	97.10
3	145.20	100.14	99.79	99.38	99.04	98.76	98.35	98.07	97.80	97.59
4	149.2	100.34	100.07	99.53	98.99	98.79	98.39	98.26	98.19	97.86
5	148.8	100.13	99.87	99.26	98.86	98.25	98.12	97.92	97.51	97.31
6	147.1	100.07	99.86	99.59	99.18	98.78	98.37	97.89	97.69	97.55
7	149.4	100.13	99.93	99.40	99.06	98.93	98.59	98.33	97.79	97.46
8	145.9	100.14	99.86	99.45	98.97	98.70	98.42	98.22	97.94	97.60
9	149.1	100.13	99.87	99.40	98.99	98.59	98.39	97.99	97.85	97.59
10	149.1	100.13	99.93	99.33	99.06	98.59	98.26	97.99	97.79	97.45
11	147.1	100.07	99.80	99.18	98.64	98.23	97.96	97.62	97.48	97.08
12	148.8	100.20	99.93	99.53	99.06	98.66	98.25	97.98	97.78	97.51
13	147.5	100.27	100.07	99.53	99.12	98.71	98.24	97.97	97.76	97.29
14	147.7	100.27	100.14	99.66	99.26	98.78	98.44	98.10	97.77	97.36
15	149.2	100.07	99.80	99.26	98.99	98.46	98.12	97.99	97.86	97.52
16	146.3	100.27	100.14	99.73	99.25	98.63	98.43	98.02	97.61	97.20
17	146.3	100.27	100.07	99.86	99.32	99.04	98.70	98.36	98.15	97.95
18	150.1	100.07	99.93	99.53	99.20	98.73	98.53	98.13	97.67	97.47
19	147.7	100.20	100.07	99.66	99.19	98.85	98.51	98.31	98.04	97.63
20	146.0	100.27	99.93	99.73	99.25	98.86	98.63	98.49	98.29	98.01
21	145.6	100.34	100.07	99.52	99.11	98.97	98.83	98.49	98.35	97.94
22	147.3	100.07	99.93	99.66	99.32	98.71	98.44	98.03	97.76	97.49
23	147.3	100.07	99.80	99.25	98.98	98.44	98.17	98.03	97.49	97.35
24	147.3	100.20	99.93	99.59	99.05	98.85	98.44	98.10	98.03	97.83
25	148.1	100.27	100.14	99.93	99.66	99.32	99.12	98.72	98.51	98.38
26	146.6	100.20	99.93	99.66	99.18	99.05	98.70	98.50	98.16	97.82
27	147.6	100.14	99.80	99.66	99.19	98.98	98.71	98.37	97.97	97.56
28	149.1	100.20	99.87	99.60	99.26	98.79	98.52	98.12	97.65	97.38
29	144.2	100.28	99.93	99.45	99.03	98.54	98.20	97.85	97.78	97.64
30	148.9	100.13	99.80	99.40	98.99	98.86	98.52	98.19	97.58	97.25
Avg.	147.6	100.17	99.92	99.50	99.09	98.73	98.42	98.12	97.84	97.54
Med.	147.6	100.14	99.93	99.53	99.06	98.75	98.43	98.09	97.78	97.52
st dev	1.4	0.10	0.12	0.21	0.20	0.25	0.25	0.25	0.28	0.30
Min.	144.2	99.86	99.73	99.11	98.64	98.23	97.96	97.57	97.37	97.08
Max.	150.1	100.34	100.14	99.93	99.66	99.32	99.12	98.72	98.51	98.38

3.2 Data Set 1, 55°C, 30mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	36.54	36.64	36.57	37.61	37.63	37.44	37.68	37.66	37.64	37.62
2	37.23	37.33	37.28	37.16	37.16	36.98	37.16	37.13	37.14	37.33
3	37.12	37.20	37.18	37.04	37.06	36.85	37.04	37.15	37.01	37.20
4	37.18	37.26	37.24	37.10	37.10	36.95	37.08	37.23	37.08	37.27
5	37.31	37.40	37.38	37.23	37.25	37.04	37.24	37.28	37.21	37.42
6	37.30	37.38	37.36	37.23	37.23	37.07	37.21	37.23	37.19	37.41
7	36.99	37.07	37.08	36.91	36.94	36.79	36.93	36.94	36.93	37.14
8	36.66	36.70	36.71	36.56	36.59	37.36	36.59	36.60	36.59	36.75
9	37.17	37.21	37.22	37.06	37.09	36.92	37.07	37.32	37.08	37.25
10	36.87	36.93	36.94	36.79	36.82	36.65	36.79	36.83	36.83	36.99
11	37.40	37.42	37.44	37.28	37.31	37.16	37.28	37.34	37.31	37.48
12	36.79	36.83	36.84	36.66	36.70	36.56	36.67	36.72	36.70	36.90
13	36.60	36.64	36.66	36.51	36.54	36.34	36.51	36.55	36.53	36.71
14	37.43	37.49	37.50	37.33	37.36	37.22	37.33	37.36	37.36	37.54
15	36.82	36.89	36.89	36.72	36.77	36.99	36.73	36.78	36.77	36.95
16	36.85	36.93	36.93	36.76	36.81	36.63	36.78	36.81	36.77	36.97
17	37.23	37.31	37.30	37.12	37.18	37.05	37.13	37.16	37.15	37.33
18	37.22	37.28	37.28	37.10	37.18	37.02	37.14	37.14	37.13	37.31
19	37.38	37.47	37.44	37.27	37.34	37.17	37.32	37.33	37.32	37.51
20	37.27	37.36	37.34	37.18	37.24	37.07	37.21	37.24	37.21	37.41
21	36.72	36.80	36.80	36.64	36.70	37.18	36.67	36.69	36.65	36.84
22	37.20	37.28	37.27	37.09	37.21	37.03	37.15	37.14	37.12	37.33
23	37.29	37.36	37.35	37.18	37.29	37.10	37.24	37.22	37.21	37.40
24	37.20	37.28	37.27	37.10	37.19	37.01	37.17	37.13	37.12	37.30
25	37.36	37.44	37.43	37.25	37.39	37.20	37.34	37.31	37.30	37.49
26	37.18	37.23	37.22	37.06	37.16	36.97	37.12	37.09	37.10	37.29
27	36.67	36.71	36.74	36.56	36.64	36.46	36.63	36.59	36.58	36.77
28	36.79	36.84	36.86	36.68	36.75	36.58	36.75	36.71	36.70	36.91
29	36.81	36.86	36.87	36.72	36.78	37.28	36.77	36.73	36.74	36.91
30	37.34	37.37	37.39	37.23	37.29	37.10	37.29	37.22	37.24	37.42
Avg.	37.06	37.13	37.13	37.00	37.06	36.97	37.03	37.05	37.02	37.21
Med.	37.18	37.25	37.23	37.10	37.16	37.03	37.13	37.14	37.11	37.30
st dev	0.27	0.28	0.27	0.28	0.28	0.26	0.28	0.28	0.28	0.27
Min.	36.54	36.64	36.57	36.51	36.54	36.34	36.51	36.55	36.53	36.71
Max.	37.43	37.49	37.50	37.61	37.63	37.44	37.68	37.66	37.64	37.62

3.3 Data Set 1, 55°C, 30mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2610	0.5360	2698	0.0004	0.0007	0.0013	0.0015	0.0016	0.0018	0.0020	0.0021	0.0025
2	0.2583	0.5351	2755	0.0006	0.0010	0.0013	0.0016	0.0018	0.0020	0.0022	0.0023	0.0027
3	0.2575	0.5335	2779	0.0004	0.0011	0.0015	0.0016	0.0017	0.0020	0.0023	0.0026	0.0028
4	0.2573	0.5340	2780	0.0006	0.0009	0.0011	0.0018	0.0018	0.0021	0.0022	0.0025	0.0029
5	0.2577	0.5346	2769	0.0006	0.0009	0.0013	0.0017	0.0018	0.0021	0.0022	0.0024	0.0026
6	0.2591	0.5345	2741	0.0006	0.0009	0.0012	0.0017	0.0020	0.0021	0.0023	0.0026	0.0029
7	0.2588	0.5323	2757	0.0006	0.0007	0.0011	0.0015	0.0020	0.0020	0.0022	0.0023	0.0025
8	0.2599	0.5342	2725	0.0005	0.0006	0.0010	0.0014	0.0017	0.0021	0.0023	0.0026	0.0028
9	0.2579	0.5350	2765	0.0006	0.0008	0.0011	0.0015	0.0018	0.0020	0.0021	0.0024	0.0028
10	0.2583	0.5341	2759	0.0006	0.0008	0.0012	0.0014	0.0017	0.0019	0.0021	0.0023	0.0026
11	0.2598	0.5354	2722	0.0006	0.0007	0.0010	0.0013	0.0015	0.0019	0.0021	0.0024	0.0026
12	0.2588	0.5316	2760	0.0005	0.0009	0.0013	0.0016	0.0019	0.0023	0.0024	0.0026	0.0029
13	0.2586	0.5339	2754	0.0004	0.0008	0.0012	0.0014	0.0018	0.0019	0.0021	0.0026	0.0027
14	0.2594	0.5350	2734	0.0003	0.0007	0.0011	0.0014	0.0017	0.0020	0.0022	0.0025	0.0028
15	0.2590	0.5347	2743	0.0003	0.0008	0.0011	0.0015	0.0018	0.0019	0.0021	0.0025	0.0027
16	0.2590	0.5333	2749	0.0003	0.0007	0.0011	0.0014	0.0018	0.0019	0.0020	0.0023	0.0025
17	0.2581	0.5323	2772	0.0004	0.0008	0.0011	0.0014	0.0017	0.0021	0.0021	0.0022	0.0028
18	0.2580	0.5339	2766	0.0003	0.0007	0.0011	0.0014	0.0017	0.0020	0.0022	0.0024	0.0028
19	0.2587	0.5341	2751	0.0004	0.0010	0.0012	0.0014	0.0017	0.0021	0.0022	0.0025	0.0028
20	0.2597	0.5335	2732	0.0002	0.0007	0.0011	0.0014	0.0017	0.0019	0.0021	0.0023	0.0027
21	0.2567	0.5315	2804	0.0004	0.0008	0.0012	0.0013	0.0018	0.0021	0.0022	0.0026	0.0028
22	0.2594	0.5364	2727	0.0001	0.0005	0.0009	0.0012	0.0017	0.0018	0.0020	0.0023	0.0025
23	0.2585	0.5341	2755	0.0002	0.0005	0.0010	0.0013	0.0016	0.0019	0.0020	0.0021	0.0026
24	0.2575	0.5327	2783	0.0002	0.0008	0.0012	0.0013	0.0017	0.0021	0.0023	0.0023	0.0026
25	0.2582	0.5344	2760	0.0002	0.0005	0.0010	0.0012	0.0016	0.0019	0.0020	0.0023	0.0024
26	0.2567	0.5331	2797	0.0002	0.0006	0.0011	0.0013	0.0017	0.0020	0.0022	0.0025	0.0028
27	0.2587	0.5319	2760	0.0002	0.0007	0.0011	0.0014	0.0017	0.0020	0.0023	0.0022	0.0027
28	0.2577	0.5340	2772	0.0003	0.0008	0.0011	0.0016	0.0020	0.0021	0.0023	0.0024	0.0029
29	0.2591	0.5343	2741	0.0001	0.0006	0.0010	0.0012	0.0018	0.0020	0.0022	0.0027	0.0029
30	0.2572	0.5342	2782	0.0002	0.0006	0.0011	0.0014	0.0017	0.0021	0.0023	0.0025	0.0027
Avg.	0.2585	0.5339	2756	0.0004	0.0008	0.0011	0.0014	0.0018	0.0020	0.0022	0.0024	0.0027
Med.	0.2586	0.5341	2758	0.0004	0.0008	0.0011	0.0014	0.0017	0.0020	0.0022	0.0024	0.0027
st dev	0.0010	0.0012	23	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2567	0.5315	2698	0.0001	0.0005	0.0009	0.0012	0.0015	0.0018	0.0020	0.0021	0.0024
Max.	0.2610	0.5364	2804	0.0006	0.0011	0.0015	0.0018	0.0020	0.0023	0.0024	0.0027	0.0029

3.4 Data Set 2, 85°C, 30mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	147.70	100.07	99.86	99.19	98.78	98.24	97.97	97.77	97.63	97.29
32	146.80	100.20	99.93	99.46	98.98	98.84	98.37	97.96	97.89	97.68
33	144.40	100.07	99.79	99.58	99.03	98.48	98.20	97.92	97.58	97.37
34	147.1	100.07	99.66	99.39	98.91	98.37	98.03	97.82	97.62	97.14
35	143.6	99.86	99.58	98.89	98.61	98.05	97.70	97.42	97.21	96.87
36	146.3	99.93	99.52	98.97	98.43	97.95	97.74	97.33	96.92	96.51
37	146.3	99.93	99.66	98.97	98.36	97.81	97.40	96.99	96.79	96.51
38	148.3	100.13	99.80	99.12	98.65	97.84	97.37	97.03	96.90	96.56
39	147.0	100.07	99.86	99.32	98.84	98.30	97.82	97.41	97.14	96.80
40	150.8	100.13	99.93	99.47	99.07	98.61	98.21	97.88	97.28	96.95
41	147.6	100.07	99.73	99.32	98.78	98.58	98.04	97.70	97.43	97.22
42	145.3	100.14	99.93	99.59	99.11	98.83	98.42	98.07	97.59	97.25
43	146.3	100.14	99.79	99.18	98.70	98.15	97.88	97.54	97.40	97.06
44	146.5	99.93	99.59	98.98	98.43	98.09	97.68	97.13	96.72	96.45
45	146.7	100.34	99.93	99.45	98.84	98.23	97.68	97.27	97.00	96.73
46	146.5	100.07	99.73	99.25	98.70	98.36	98.02	97.75	97.27	96.86
47	145.5	100.07	99.79	99.52	99.11	98.42	97.94	97.39	96.84	96.70
48	147.9	99.93	99.66	99.39	98.85	98.11	97.97	97.57	97.23	96.82
49	145.9	99.73	99.38	99.04	98.63	98.36	98.08	97.74	97.33	96.98
50	145.7	100.07	99.73	99.18	98.83	98.56	98.01	97.67	97.32	96.84
51	148.7	99.87	99.46	98.66	98.25	97.65	97.24	96.84	96.37	96.17
52	145.1	100.07	99.66	99.10	98.55	97.79	97.38	97.11	96.97	96.55
53	145.8	100.14	99.79	99.11	98.70	98.22	97.87	97.46	97.19	96.98
54	149.1	100.07	99.87	99.40	98.73	98.12	97.85	97.45	97.05	96.71
55	148.0	100.14	99.93	99.26	98.92	98.51	98.18	97.84	97.43	96.96
56	147.3	99.80	99.66	99.25	98.64	98.44	98.03	97.56	97.01	96.54
57	145.8	100.14	99.93	99.52	98.90	98.42	98.15	97.81	97.46	97.19
58	143.7	99.79	99.37	98.82	98.33	97.84	97.43	97.15	96.52	96.10
59	148.2	99.73	99.39	98.72	98.31	97.84	97.50	97.17	96.90	96.56
60	145.1	99.93	99.52	99.24	98.55	98.28	98.00	97.52	97.38	97.04
Avg.	146.6	100.02	99.72	99.21	98.72	98.24	97.87	97.51	97.18	96.85
Med.	146.5	100.07	99.73	99.25	98.71	98.26	97.95	97.53	97.22	96.85
st dev	1.6	0.15	0.18	0.25	0.24	0.31	0.30	0.32	0.35	0.35
Min.	143.6	99.73	99.37	98.66	98.25	97.65	97.24	96.84	96.37	96.10
Max.	150.8	100.34	99.93	99.59	99.11	98.84	98.42	98.07	97.89	97.68

3.5 Data Set 2, 85°C, 30mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	37.38	37.41	37.44	37.26	37.34	37.65	37.33	37.29	37.26	37.47
32	36.94	36.97	36.98	36.83	36.90	37.18	36.89	36.85	36.85	37.01
33	36.93	36.98	36.97	36.82	36.90	37.17	36.90	36.84	36.85	37.01
34	37.02	37.08	37.07	36.91	36.99	37.33	37.00	36.93	36.95	37.15
35	36.83	36.86	36.84	36.71	36.78	37.07	36.79	36.72	36.74	36.91
36	37.36	37.44	37.34	37.24	37.28	37.61	37.30	37.24	37.23	37.45
37	36.52	36.58	36.52	36.44	36.47	36.78	36.48	36.42	36.43	36.59
38	37.46	37.53	37.48	37.35	37.40	37.74	37.41	37.36	37.43	37.56
39	36.55	36.61	36.57	36.46	36.50	36.81	36.50	36.47	36.53	36.63
40	36.99	37.07	37.02	36.88	36.94	37.31	36.92	36.94	36.96	37.12
41	36.88	36.93	36.89	36.78	36.82	37.16	36.82	36.81	36.83	36.99
42	36.78	36.83	36.81	36.66	36.72	37.05	36.71	36.69	36.75	36.87
43	36.61	36.66	36.64	36.52	36.57	36.88	36.58	36.54	36.59	36.71
44	36.69	36.73	36.70	36.58	36.63	36.94	36.64	36.60	36.64	36.79
45	37.28	37.36	37.30	37.16	37.22	37.57	37.22	37.19	37.24	37.39
46	36.78	36.86	36.81	36.69	36.73	37.05	36.73	36.74	36.75	36.87
47	36.78	36.84	36.83	36.68	36.73	37.04	36.72	36.71	36.76	36.88
48	37.21	37.27	37.25	37.10	37.18	37.53	37.16	37.13	37.18	37.33
49	37.28	37.38	37.33	37.19	37.24	37.58	37.26	37.21	37.28	37.42
50	36.73	36.80	36.77	36.64	36.69	37.00	36.70	36.66	36.75	36.84
51	37.18	37.25	37.21	37.05	37.15	37.48	37.11	37.09	37.16	37.30
52	36.78	36.84	36.80	36.68	36.76	37.04	36.71	36.74	36.76	36.88
53	37.26	37.31	37.28	37.16	37.22	37.53	37.19	37.21	37.21	37.35
54	36.96	37.04	37.02	36.85	36.96	37.29	36.90	36.92	36.96	37.11
55	36.72	36.80	36.78	36.62	36.72	37.04	36.68	36.70	36.71	36.85
56	37.22	37.29	37.27	37.14	37.20	37.53	37.18	37.18	37.18	37.35
57	37.00	37.07	37.05	36.92	36.98	37.31	36.97	37.02	36.99	37.10
58	36.80	36.86	36.84	36.72	36.78	37.08	36.76	36.75	36.77	36.92
59	37.32	37.39	37.36	37.21	37.28	37.64	37.29	37.24	37.31	37.46
60	37.19	37.23	37.22	37.09	37.14	37.47	37.19	37.11	37.17	37.28
Avg.	36.98	37.04	37.01	36.88	36.94	37.26	36.93	36.91	36.94	37.09
Med.	36.95	37.01	37.00	36.84	36.92	37.24	36.90	36.89	36.90	37.06
st dev	0.27	0.27	0.27	0.26	0.27	0.28	0.27	0.26	0.26	0.28
Min.	36.52	36.58	36.52	36.44	36.47	36.78	36.48	36.42	36.43	36.59
Max.	37.46	37.53	37.48	37.35	37.40	37.74	37.41	37.36	37.43	37.56

3.6 Data Set 2, 85°C, 30mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	0.2584	0.5353	2753	0.0003	0.0009	0.0012	0.0016	0.0018	0.0021	0.0023	0.0025	0.0029
32	0.2561	0.5330	2811	0.0002	0.0009	0.0013	0.0017	0.0019	0.0023	0.0024	0.0025	0.0030
33	0.2597	0.5354	2725	0.0001	0.0008	0.0011	0.0014	0.0017	0.0020	0.0022	0.0022	0.0028
34	0.2583	0.5301	2777	0.0003	0.0010	0.0014	0.0018	0.0019	0.0022	0.0025	0.0024	0.0031
35	0.2589	0.5342	2747	0.0001	0.0009	0.0012	0.0016	0.0017	0.0022	0.0023	0.0027	0.0028
36	0.2595	0.5342	2734	0.0003	0.0010	0.0013	0.0017	0.0017	0.0021	0.0023	0.0027	0.0029
37	0.2598	0.5356	2722	0.0005	0.0011	0.0013	0.0016	0.0020	0.0021	0.0023	0.0026	0.0031
38	0.2585	0.5342	2755	0.0004	0.0008	0.0010	0.0015	0.0015	0.0020	0.0022	0.0023	0.0029
39	0.2589	0.5334	2749	0.0004	0.0009	0.0013	0.0016	0.0017	0.0021	0.0023	0.0026	0.0029
40	0.2558	0.5317	2823	0.0006	0.0010	0.0012	0.0017	0.0017	0.0022	0.0023	0.0027	0.0030
41	0.2598	0.5348	2725	0.0004	0.0010	0.0013	0.0016	0.0019	0.0023	0.0024	0.0026	0.0030
42	0.2591	0.5320	2753	0.0004	0.0011	0.0017	0.0018	0.0019	0.0024	0.0027	0.0030	0.0031
43	0.2572	0.5322	2791	0.0003	0.0009	0.0013	0.0016	0.0017	0.0021	0.0022	0.0027	0.0029
44	0.2580	0.5316	2777	0.0004	0.0010	0.0014	0.0017	0.0018	0.0023	0.0024	0.0029	0.0035
45	0.2582	0.5346	2758	0.0006	0.0010	0.0015	0.0018	0.0020	0.0025	0.0026	0.0028	0.0026
46	0.2582	0.5341	2762	0.0006	0.0010	0.0013	0.0016	0.0021	0.0023	0.0024	0.0029	0.0029
47	0.2586	0.5325	2760	0.0001	0.0009	0.0013	0.0017	0.0018	0.0023	0.0024	0.0027	0.0032
48	0.2586	0.5329	2759	0.0004	0.0009	0.0013	0.0016	0.0017	0.0022	0.0024	0.0028	0.0033
49	0.2595	0.5345	2732	0.0003	0.0005	0.0013	0.0016	0.0017	0.0021	0.0024	0.0025	0.0029
50	0.2584	0.5317	2767	0.0004	0.0005	0.0013	0.0016	0.0017	0.0021	0.0023	0.0026	0.0031
51	0.2593	0.5342	2738	0.0005	0.0010	0.0012	0.0018	0.0022	0.0025	0.0027	0.0033	0.0038
52	0.2595	0.5347	2732	0.0001	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0027	0.0033
53	0.2559	0.5334	2813	0.0003	0.0010	0.0013	0.0017	0.0018	0.0021	0.0023	0.0025	0.0030
54	0.2591	0.5334	2746	0.0002	0.0010	0.0014	0.0016	0.0017	0.0020	0.0023	0.0024	0.0027
55	0.2581	0.5309	2776	0.0001	0.0009	0.0011	0.0016	0.0019	0.0021	0.0024	0.0027	0.0025
56	0.2576	0.5348	2771	0.0006	0.0010	0.0013	0.0016	0.0017	0.0021	0.0023	0.0026	0.0026
57	0.2588	0.5340	2749	0.0002	0.0008	0.0011	0.0014	0.0016	0.0019	0.0021	0.0023	0.0025
58	0.2579	0.5321	2777	0.0004	0.0010	0.0014	0.0018	0.0019	0.0023	0.0025	0.0030	0.0028
59	0.2570	0.5314	2800	0.0004	0.0010	0.0016	0.0017	0.0019	0.0021	0.0023	0.0027	0.0026
60	0.2571	0.5324	2791	0.0005	0.0010	0.0014	0.0017	0.0018	0.0021	0.0024	0.0028	0.0027
Avg.	0.2583	0.5333	2762	0.0004	0.0009	0.0013	0.0017	0.0018	0.0022	0.0024	0.0027	0.0029
Med.	0.2585	0.5334	2759	0.0004	0.0010	0.0013	0.0016	0.0018	0.0021	0.0023	0.0027	0.0029
st dev	0.0011	0.0015	27	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0003
Min.	0.2558	0.5301	2722	0.0001	0.0005	0.0010	0.0014	0.0015	0.0019	0.0021	0.0022	0.0025
Max.	0.2598	0.5356	2823	0.0006	0.0011	0.0017	0.0018	0.0022	0.0025	0.0027	0.0033	0.0038

3.7 Data Set 3, 105°C, 30mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
61	143.40	99.93	99.58	98.95	98.33	98.05	97.70	97.35	97.21	96.93
62	146.20	99.73	99.38	98.91	98.15	97.81	97.33	96.99	96.44	95.96
63	146.40	99.93	99.45	98.91	98.22	97.75	97.47	97.27	96.86	96.38
64	146.8	99.86	99.59	98.98	98.23	97.89	97.55	97.00	96.87	96.32
65	144.9	99.86	99.59	98.96	98.27	97.79	97.52	96.96	96.83	96.27
66	146.7	99.80	99.32	99.05	98.50	97.82	97.48	96.93	96.52	96.11
67	145.4	99.79	99.31	98.76	98.42	98.07	97.52	96.97	96.42	96.01
68	144.9	99.93	99.59	98.96	98.55	97.93	97.38	96.89	96.55	96.27
69	148.6	99.87	99.46	98.79	98.32	97.78	97.44	97.04	96.43	95.96
70	143.6	100.07	99.65	99.03	98.40	97.77	97.49	97.14	96.73	96.31
71	147.9	99.66	99.39	98.85	98.24	97.50	97.16	96.96	96.48	96.28
72	148.2	99.73	99.26	98.92	98.52	98.25	97.71	97.30	96.96	96.56
73	145.4	99.79	99.45	98.83	98.14	98.01	97.66	97.11	96.84	96.56
74	147.5	99.93	99.46	98.92	98.17	97.69	97.29	96.88	96.54	96.00
75	145.9	99.86	99.45	98.90	98.42	97.94	97.33	96.85	96.50	96.23
76	148.2	100.20	99.87	99.19	98.52	98.11	97.64	97.23	96.76	96.29
77	147.5	99.93	99.73	99.12	98.44	97.83	97.29	97.02	96.47	95.93
78	145.6	99.79	99.59	98.90	98.35	97.66	97.12	96.77	96.43	96.15
79	147.1	99.86	99.46	98.84	98.30	98.03	97.48	97.08	96.80	96.26
80	148.4	100.13	99.60	99.19	98.52	98.05	97.71	97.30	96.83	96.36
81	150.0	100.20	99.73	99.33	98.67	98.00	97.53	97.27	96.87	96.60
82	148.5	99.80	99.53	98.92	98.38	97.71	97.24	96.70	96.57	96.16
83	148.0	99.86	99.46	98.85	98.31	97.84	97.50	97.16	96.55	96.15
84	147.5	100.14	99.73	99.12	98.37	98.03	97.63	97.29	97.15	96.95
85	147.9	99.93	99.66	99.05	98.51	98.11	97.50	96.96	96.55	96.15
86	146.8	99.93	99.46	98.98	98.50	98.09	97.68	97.41	97.00	96.80
87	147.3	99.93	99.39	98.91	98.23	97.62	97.15	96.81	96.33	95.86
88	146.5	99.93	99.45	99.04	98.29	97.54	97.00	96.79	96.52	96.11
89	149.1	100.07	99.93	99.20	98.52	98.12	97.52	96.98	96.51	96.11
90	147.5	100.07	99.86	99.19	98.58	97.76	97.15	96.61	96.20	95.86
Avg.	146.9	99.92	99.55	98.99	98.38	97.89	97.44	97.03	96.66	96.26
Med.	147.2	99.93	99.50	98.96	98.38	97.86	97.49	97.00	96.55	96.25
st dev	1.5	0.14	0.17	0.14	0.14	0.19	0.20	0.21	0.24	0.29
Min.	143.4	99.66	99.26	98.76	98.14	97.50	97.00	96.61	96.20	95.86
Max.	150.0	100.20	99.93	99.33	98.67	98.25	97.71	97.41	97.21	96.95

3.8 Data Set 3, 105°C, 30mA (Forward Voltage)

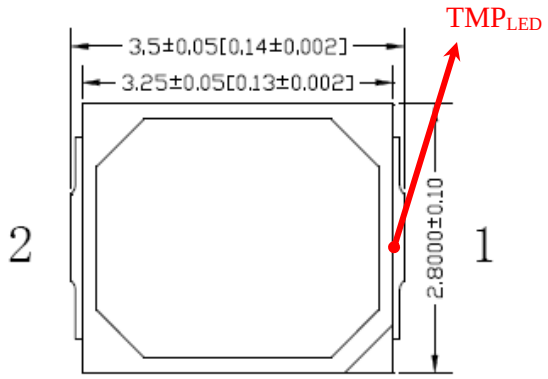
No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
61	36.87	36.92	36.93	36.78	36.85	37.13	36.86	36.84	36.84	36.97
62	37.40	37.46	37.46	37.31	37.38	37.69	37.37	37.36	37.41	37.53
63	37.19	37.25	37.25	37.09	37.15	37.47	37.19	37.14	37.21	37.31
64	37.38	37.44	37.45	37.29	37.35	37.65	37.39	37.32	37.38	37.50
65	37.23	37.27	37.29	37.13	37.19	37.49	37.22	37.17	37.22	37.33
66	37.30	37.36	37.36	37.20	37.26	37.59	37.29	37.27	37.31	37.42
67	36.82	36.88	36.86	36.73	36.78	37.08	36.79	36.77	36.80	36.92
68	36.56	36.63	36.62	36.49	36.54	36.81	36.54	36.53	36.55	36.67
69	36.88	36.95	36.92	36.80	36.84	37.15	36.84	36.83	36.88	37.01
70	36.74	36.83	36.77	36.65	36.69	36.98	36.69	36.70	36.73	36.85
71	37.20	37.29	37.25	37.10	37.15	37.48	37.16	37.18	37.18	37.32
72	37.35	37.43	37.40	37.26	37.30	37.63	37.34	37.32	37.35	37.48
73	37.01	37.07	37.09	36.92	36.96	37.26	36.99	36.98	37.00	37.13
74	36.58	36.60	36.59	36.47	36.51	36.80	36.53	36.53	36.52	36.67
75	37.27	37.27	37.27	37.15	37.21	37.51	37.20	37.20	37.21	37.34
76	37.35	37.38	37.37	37.24	37.29	37.59	37.29	37.29	37.30	37.46
77	37.23	37.26	37.25	37.12	37.18	37.47	37.17	37.20	37.21	37.34
78	36.79	36.82	36.81	36.68	36.74	37.01	36.72	36.76	36.78	36.88
79	37.32	37.32	37.30	37.17	37.22	37.59	37.20	37.24	37.27	37.39
80	36.80	36.82	36.80	36.67	36.73	37.05	36.70	36.73	36.77	36.91
81	37.26	37.28	37.26	37.13	37.18	37.49	37.15	37.22	37.23	37.37
82	36.74	36.75	36.75	36.62	36.68	36.96	36.65	36.69	36.72	36.84
83	37.16	37.18	37.17	37.03	37.10	37.40	37.07	37.11	37.13	37.27
84	37.33	37.35	37.32	37.19	37.27	37.58	37.25	37.28	37.36	37.45
85	37.32	37.35	37.34	37.18	37.25	37.57	37.22	37.27	37.36	37.42
86	36.58	36.60	36.58	36.47	36.52	36.78	36.51	36.54	36.59	36.67
87	37.32	37.36	37.33	37.20	37.25	37.57	37.24	37.29	37.35	37.43
88	36.50	36.54	36.51	36.41	36.45	36.73	36.44	36.47	36.50	36.61
89	37.26	37.31	37.30	37.15	37.20	37.53	37.19	37.22	37.29	37.38
90	36.56	36.60	36.59	36.47	36.50	36.78	36.50	36.53	36.57	36.67
Avg.	37.04	37.09	37.07	36.94	36.99	37.29	36.99	37.00	37.03	37.15
Med.	37.20	37.26	37.25	37.10	37.15	37.47	37.16	37.16	37.20	37.32
st dev	0.30	0.31	0.31	0.30	0.30	0.32	0.31	0.30	0.31	0.31
Min.	36.50	36.54	36.51	36.41	36.45	36.73	36.44	36.47	36.50	36.61
Max.	37.40	37.46	37.46	37.31	37.38	37.69	37.39	37.36	37.41	37.53

3.9 Data Set 3, 105°C, 30mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
61	0.2582	0.5322	2768	0.0002	0.0011	0.0014	0.0018	0.0019	0.0022	0.0024	0.0026	0.0031
62	0.2611	0.5340	2703	0.0006	0.0012	0.0015	0.0019	0.0020	0.0024	0.0025	0.0026	0.0033
63	0.2612	0.5353	2695	0.0004	0.0011	0.0013	0.0016	0.0019	0.0021	0.0023	0.0024	0.0030
64	0.2594	0.5333	2741	0.0005	0.0012	0.0014	0.0019	0.0021	0.0024	0.0025	0.0027	0.0033
65	0.2581	0.5338	2765	0.0004	0.0011	0.0013	0.0018	0.0020	0.0023	0.0025	0.0028	0.0032
66	0.2595	0.5324	2742	0.0006	0.0012	0.0014	0.0018	0.0021	0.0023	0.0025	0.0025	0.0031
67	0.2572	0.5322	2790	0.0007	0.0012	0.0016	0.0019	0.0022	0.0024	0.0025	0.0026	0.0033
68	0.2595	0.5333	2737	0.0006	0.0011	0.0014	0.0017	0.0019	0.0021	0.0023	0.0024	0.0031
69	0.2564	0.5329	2805	0.0004	0.0011	0.0014	0.0018	0.0019	0.0022	0.0024	0.0027	0.0031
70	0.2595	0.5321	2742	0.0004	0.0011	0.0013	0.0019	0.0020	0.0022	0.0024	0.0025	0.0030
71	0.2597	0.5366	2720	0.0006	0.0010	0.0013	0.0018	0.0022	0.0023	0.0025	0.0028	0.0032
72	0.2582	0.5336	2763	0.0006	0.0010	0.0015	0.0019	0.0025	0.0024	0.0025	0.0027	0.0030
73	0.2608	0.5350	2706	0.0005	0.0010	0.0015	0.0018	0.0023	0.0024	0.0026	0.0026	0.0031
74	0.2578	0.5331	2775	0.0006	0.0010	0.0016	0.0019	0.0025	0.0024	0.0026	0.0026	0.0033
75	0.2572	0.5337	2784	0.0006	0.0010	0.0015	0.0019	0.0021	0.0024	0.0025	0.0027	0.0032
76	0.2578	0.5331	2774	0.0006	0.0010	0.0014	0.0018	0.0021	0.0025	0.0026	0.0026	0.0032
77	0.2577	0.5323	2779	0.0004	0.0012	0.0016	0.0018	0.0020	0.0025	0.0026	0.0029	0.0033
78	0.2584	0.5333	2760	0.0007	0.0011	0.0016	0.0019	0.0022	0.0024	0.0026	0.0027	0.0032
79	0.2578	0.5321	2779	0.0004	0.0010	0.0014	0.0019	0.0019	0.0025	0.0026	0.0028	0.0034
80	0.2598	0.5334	2732	0.0006	0.0010	0.0014	0.0018	0.0021	0.0025	0.0026	0.0026	0.0030
81	0.2574	0.5342	2777	0.0004	0.0009	0.0013	0.0017	0.0020	0.0024	0.0025	0.0027	0.0031
82	0.2570	0.5351	2783	0.0006	0.0011	0.0015	0.0019	0.0020	0.0025	0.0026	0.0027	0.0032
83	0.2579	0.5323	2775	0.0006	0.0011	0.0015	0.0019	0.0019	0.0024	0.0026	0.0026	0.0031
84	0.2572	0.5340	2782	0.0006	0.0012	0.0016	0.0019	0.0022	0.0025	0.0026	0.0027	0.0033
85	0.2589	0.5340	2748	0.0009	0.0011	0.0015	0.0019	0.0021	0.0025	0.0027	0.0026	0.0034
86	0.2593	0.5326	2746	0.0006	0.0011	0.0016	0.0019	0.0021	0.0025	0.0026	0.0029	0.0034
87	0.2588	0.5350	2746	0.0007	0.0012	0.0014	0.0018	0.0022	0.0024	0.0026	0.0027	0.0032
88	0.2571	0.5310	2798	0.0006	0.0010	0.0016	0.0020	0.0021	0.0026	0.0027	0.0026	0.0034
89	0.2569	0.5342	2789	0.0006	0.0011	0.0015	0.0017	0.0021	0.0025	0.0026	0.0025	0.0031
90	0.2582	0.5319	2770	0.0004	0.0010	0.0015	0.0019	0.0024	0.0026	0.0028	0.0030	0.0033
Avg.	0.2585	0.5334	2759	0.0005	0.0011	0.0015	0.0018	0.0021	0.0024	0.0025	0.0027	0.0032
Med.	0.2582	0.5333	2767	0.0006	0.0011	0.0015	0.0019	0.0021	0.0024	0.0026	0.0027	0.0032
st dev	0.0013	0.0012	28	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
Min.	0.2564	0.5310	2695	0.0002	0.0009	0.0013	0.0016	0.0019	0.0021	0.0023	0.0024	0.0030
Max.	0.2612	0.5366	2805	0.0009	0.0012	0.0016	0.0020	0.0025	0.0026	0.0028	0.0030	0.0034

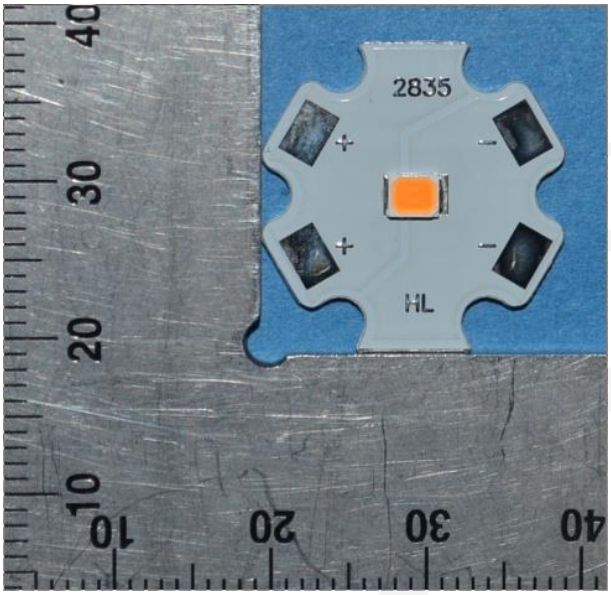
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



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