



TEST REPORT

According to ANSI/IES LM-80-15
For

Samsung Electronics Co., LTD.

1,Samsung-Ro,Giheung-Gu,Yongin-City,Gyeonggi-do 17113, Korea

Model: SPMWH1228FD7WAW0SC

Report Type: 10000 Hours Test Report		Product Type: LED Package	
Test Engineer:	Pote Wang <i>Pote Wang</i>		
Report Number:	RSZ190808502-10		
Test Date:	2018-05-20 to 2019-07-16		
Report Date:	2019-09-12		
Reviewed By:	Bill Xiong / EE Engineer <i>Bill Xiong</i>		
Test Facility:	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.		
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Accreditation:	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).

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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

75 PCS samples were received on 2018-05-19. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Part Number:	SPMWH1228FD7WAW0SC
Part Type:	LED Package
Drive Level:	DC 120mA
Nominal CCT:	2700K
Power:	0.36W
Average Current Density per LED die:	372mA/mm ²
Average Power Density per LED die:	1.1W/mm ²
CRI:	90
Die Spacing:	0.4mm

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:

Test Models	Multiple Models	Differences Items
SPMWH1228FD7WAW0SC	SPMWH122xxx7xxxxxx	x1= Product Version x2= Sorting Current (mA) x3=ANSI Standard x4,x5= PKG Q'TY x6,x7= CCT X8,x9= PKG rank

Note:

- The applicant Samsung Electronics Co., LTD. declare that their products with model SPMWH1228FD7WAW0SC are the same to the products in report # RSZ180519504-10 and is authorized by original applicant to use their test data.
- All the data in previous report (RSZ180519504-10) is shared in this report.

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	2019-03-18	2020-03-17

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	2019-03-26	2020-03-25
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	2019-03-18	2020-03-17
Standard Light Source	EVERFINE	D062	G100278CJ7351206	2018-12-24	2019-12-24
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987CJ7321114	2019-03-26	2020-03-25
Multilayer aging machine	BACL	B2-270	20015	2019-03-13	2020-03-12
DC Power Supply	BACL	B12001-12	90023	2018-12-17	2019-12-17

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 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 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 $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 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 $U=21\text{K}$ ($K=2$), 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: 55°C, 120mA

Part Number: SPMWH1228FD7WAW0SC
Number of Units: 25
Case Temperature: >53°C
Ambient Temperature: >50°C
Life Test Drive Current: 120mA
Measurement Current: 120mA

Data Set 2: 85°C, 120mA

Part Number: SPMWH1228FD7WAW0SC
Number of Units: 25
Case Temperature: >83°C
Ambient Temperature: >80°C
Life Test Drive Current: 120mA
Measurement Current: 120mA

Data Set 3: 105°C, 120mA

Part Number: SPMWH1228FD7WAW0SC
Number of Units: 25
Case Temperature: >103°C
Ambient Temperature: >100°C
Life Test Drive Current: 120mA
Measurement Current: 120mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM-21 L ₇₀ Lifetime
1	25	0	1000hrs	10000hrs	2.568E-06	1.005	>60000hrs
2	25	0	1000hrs	10000hrs	3.032E-06	1.005	>60000hrs
3	25	0	1000hrs	10000hrs	3.469E-06	1.003	>60000hrs

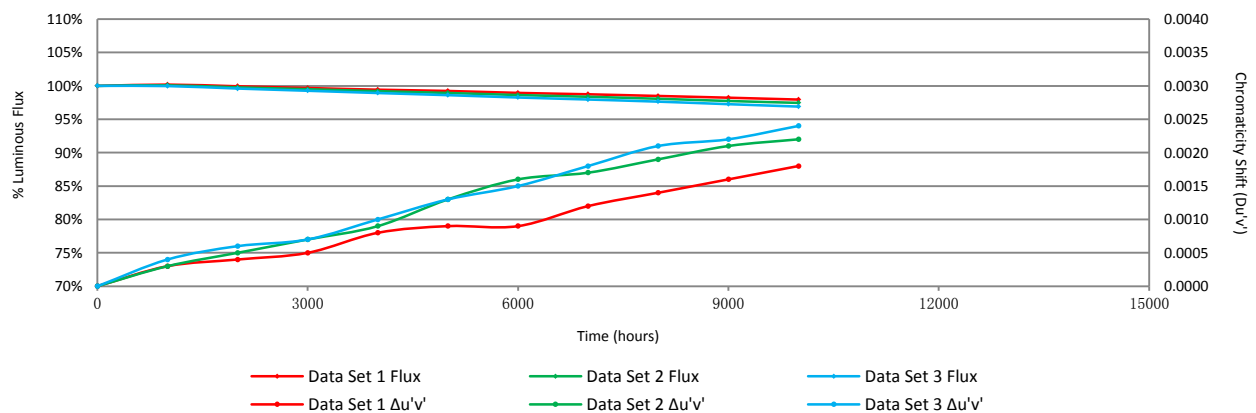
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	100.19%	99.94%	99.68%	99.43%	99.24%	98.95%	98.74%	98.49%	98.23%	97.95%
2	100.08%	99.78%	99.50%	99.21%	98.94%	98.63%	98.37%	98.07%	97.74%	97.45%
3	99.97%	99.60%	99.27%	98.93%	98.61%	98.26%	97.96%	97.64%	97.26%	96.90%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.0003	0.0004	0.0005	0.0008	0.0009	0.0009	0.0012	0.0014	0.0016	0.0018
2	0.0003	0.0005	0.0007	0.0009	0.0013	0.0016	0.0017	0.0019	0.0021	0.0022
3	0.0004	0.0006	0.0007	0.0010	0.0013	0.0015	0.0018	0.0021	0.0022	0.0024

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 55°C, 120mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	52.79	99.66	99.64	99.19	98.79	98.54	98.50	98.26	98.01	97.69	97.25
2	53.35	100.02	99.79	99.33	99.06	98.97	98.76	98.39	98.29	98.03	97.94
3	52.90	100.13	99.89	99.51	99.15	98.75	98.56	98.41	98.24	97.92	97.75
4	53.14	100.17	99.85	99.60	99.45	99.23	98.63	98.16	97.82	97.78	97.74
5	53.56	100.21	99.93	99.51	99.44	99.25	99.05	98.86	98.45	98.04	97.68
6	53.35	100.21	99.76	99.63	99.34	99.10	99.06	98.91	98.50	98.29	98.07
7	53.48	100.36	100.11	99.81	99.53	99.40	99.16	99.10	98.65	98.32	98.17
8	52.92	100.13	99.98	99.74	99.41	99.15	99.02	98.81	98.47	98.32	97.90
9	53.61	100.15	99.96	99.66	99.37	99.07	98.77	98.73	98.49	98.13	97.74
10	53.21	100.09	99.92	99.68	99.55	99.27	99.02	98.91	98.68	98.48	98.33
11	53.38	100.22	100.13	99.93	99.87	99.64	98.97	98.91	98.74	98.54	98.43
12	53.09	100.17	100.08	99.83	99.60	99.42	99.08	98.98	98.79	98.42	98.34
13	53.36	100.13	99.87	99.85	99.55	99.44	99.01	98.95	98.78	98.50	98.09
14	52.55	100.23	99.94	99.92	99.54	99.51	99.18	99.12	98.84	98.61	98.15
15	52.99	100.25	100.11	99.94	99.72	99.58	99.25	99.19	98.94	98.57	98.21
16	52.69	100.28	99.77	99.54	99.51	99.41	99.15	98.86	98.60	98.18	97.87
17	52.97	100.34	99.98	99.66	99.38	99.23	99.06	98.75	98.70	98.58	98.30
18	53.16	100.28	100.08	99.66	99.29	99.17	98.98	98.57	98.53	98.19	98.06
19	53.56	100.22	100.02	99.57	99.22	99.16	98.81	98.56	98.28	98.11	97.78
20	52.59	100.32	99.87	99.62	99.22	99.07	98.84	98.40	98.08	97.91	97.51
21	52.82	100.19	99.92	99.81	99.64	99.39	98.79	98.50	98.14	97.97	97.61
22	52.59	100.27	100.11	99.73	99.58	99.39	98.82	98.59	98.25	97.95	97.59
23	53.43	100.22	99.94	99.72	99.38	99.21	98.91	98.47	98.17	97.92	97.51
24	52.97	100.30	99.89	99.68	99.60	99.43	99.40	99.09	98.94	98.64	98.38
25	52.51	100.15	99.98	99.79	99.56	99.31	99.10	98.99	98.78	98.57	98.27
Avg.	53.08	100.19	99.94	99.68	99.43	99.24	98.95	98.74	98.49	98.23	97.95
Med.	53.09	100.21	99.94	99.68	99.45	99.25	99.01	98.81	98.50	98.19	97.94
st dev	0.34	0.14	0.12	0.18	0.23	0.25	0.21	0.29	0.31	0.29	0.32
Min.	52.51	99.66	99.64	99.19	98.79	98.54	98.50	98.16	97.82	97.69	97.25
Max.	53.61	100.36	100.13	99.94	99.87	99.64	99.40	99.19	98.94	98.64	98.43

3.2 Data Set 1, 55°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	2.905	2.925	3.003	2.962	2.983	2.956	3.004	3.002	2.939	3.002	3.008
2	2.915	3.009	3.001	3.005	2.979	2.972	3.008	3.001	2.941	3.013	3.006
3	2.924	2.995	3.000	3.001	2.999	2.947	3.001	2.975	2.979	3.007	3.002
4	2.902	2.927	3.007	3.002	2.945	3.003	2.953	3.005	2.938	3.001	3.007
5	2.903	2.964	3.006	3.003	2.937	2.993	2.984	3.004	2.950	3.012	3.007
6	2.904	2.991	3.009	3.007	2.956	2.971	2.998	2.967	2.943	3.002	2.933
7	2.912	2.924	3.000	3.001	2.942	3.003	2.956	2.962	2.945	3.013	2.962
8	2.899	2.921	3.005	2.977	2.970	3.001	3.004	2.945	2.942	3.001	2.942
9	2.905	2.921	2.909	3.001	2.975	2.951	3.002	2.963	2.955	2.968	2.941
10	2.917	2.922	3.005	2.976	2.991	3.001	3.003	2.968	2.962	2.994	2.950
11	2.925	2.940	3.007	2.975	3.001	2.968	3.005	2.953	2.956	2.962	2.938
12	2.905	2.947	3.006	2.953	2.963	2.954	2.957	2.962	2.942	2.950	2.957
13	2.916	2.925	3.018	2.956	2.981	3.003	2.993	2.970	2.949	2.949	2.997
14	2.904	2.904	3.013	2.992	2.967	3.004	2.983	2.943	2.952	2.998	3.007
15	2.907	2.906	2.989	2.957	2.956	3.006	2.997	2.946	2.968	2.950	3.004
16	2.906	3.003	3.003	2.942	2.962	3.016	2.963	2.950	2.946	2.990	3.005
17	2.904	2.925	2.936	2.961	2.982	3.003	2.938	2.960	2.953	2.944	3.006
18	2.910	2.933	2.937	2.961	3.001	3.003	2.976	2.945	2.946	2.956	3.008
19	2.904	2.912	2.914	2.953	2.978	3.007	3.001	2.958	2.962	2.939	3.005
20	2.909	2.937	3.005	2.965	2.972	3.005	3.012	2.978	2.966	2.941	3.017
21	2.904	2.947	3.006	2.966	2.970	3.001	3.005	2.932	3.005	2.993	3.009
22	2.912	3.002	3.005	3.003	2.979	3.008	3.001	2.949	2.965	2.962	3.005
23	2.908	2.988	2.989	3.010	2.999	2.989	2.991	2.947	2.998	2.982	3.009
24	2.901	2.941	3.007	3.017	2.967	3.006	3.003	2.952	3.005	2.945	3.007
25	2.911	2.956	2.983	3.007	2.971	3.016	3.016	2.960	2.964	2.966	3.009
Avg.	2.908	2.947	2.991	2.982	2.973	2.991	2.990	2.964	2.959	2.978	2.990
Med.	2.906	2.937	3.005	2.977	2.972	3.003	3.001	2.960	2.953	2.982	3.005
st dev	0.007	0.033	0.031	0.023	0.018	0.021	0.021	0.020	0.020	0.026	0.028
Min.	2.899	2.904	2.909	2.942	2.937	2.947	2.938	2.932	2.938	2.939	2.933
Max.	2.925	3.009	3.018	3.017	3.001	3.016	3.016	3.005	3.005	3.013	3.017

3.3 Data Set 1, 55°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.2599	0.5215	2780	0.0003	0.0005	0.0005	0.0008	0.0012	0.0012	0.0016	0.0017	0.0021	0.0024
2	0.2596	0.5255	2769	0.0004	0.0004	0.0004	0.0006	0.0006	0.0008	0.0009	0.0013	0.0016	0.0019
3	0.2593	0.5242	2783	0.0001	0.0002	0.0005	0.0006	0.0006	0.0008	0.0010	0.0013	0.0016	0.0019
4	0.2594	0.5238	2781	0.0003	0.0004	0.0005	0.0008	0.0006	0.0007	0.0010	0.0012	0.0015	0.0019
5	0.2588	0.5258	2784	0.0004	0.0004	0.0004	0.0006	0.0006	0.0009	0.0011	0.0013	0.0015	0.0021
6	0.2597	0.5241	2773	0.0001	0.0002	0.0005	0.0005	0.0007	0.0008	0.0010	0.0013	0.0015	0.0019
7	0.2586	0.5262	2788	0.0001	0.0003	0.0005	0.0007	0.0006	0.0006	0.0010	0.0012	0.0016	0.0019
8	0.2605	0.5241	2756	0.0002	0.0002	0.0005	0.0007	0.0009	0.0007	0.0010	0.0013	0.0015	0.0019
9	0.2572	0.5226	2836	0.0003	0.0005	0.0005	0.0009	0.0009	0.0010	0.0012	0.0015	0.0017	0.0022
10	0.2610	0.5255	2739	0.0002	0.0004	0.0004	0.0004	0.0007	0.0009	0.0010	0.0013	0.0016	0.0018
11	0.2586	0.5260	2788	0.0003	0.0004	0.0004	0.0006	0.0007	0.0006	0.0009	0.0011	0.0014	0.0015
12	0.2587	0.5253	2789	0.0001	0.0002	0.0002	0.0006	0.0007	0.0008	0.0011	0.0013	0.0016	0.0018
13	0.2590	0.5254	2784	0.0001	0.0002	0.0004	0.0008	0.0008	0.0008	0.0011	0.0013	0.0016	0.0018
14	0.2617	0.5256	2723	0.0004	0.0004	0.0005	0.0008	0.0007	0.0008	0.0009	0.0011	0.0013	0.0015
15	0.2594	0.5237	2783	0.0003	0.0004	0.0004	0.0008	0.0009	0.0010	0.0012	0.0013	0.0017	0.0019
16	0.2591	0.5224	2794	0.0000	0.0004	0.0004	0.0005	0.0009	0.0011	0.0012	0.0014	0.0019	0.0019
17	0.2618	0.5236	2730	0.0002	0.0003	0.0005	0.0007	0.0008	0.0009	0.0011	0.0013	0.0016	0.0018
18	0.2601	0.5246	2761	0.0002	0.0004	0.0004	0.0006	0.0010	0.0010	0.0010	0.0011	0.0015	0.0017
19	0.2574	0.5240	2824	0.0004	0.0005	0.0007	0.0008	0.0008	0.0009	0.0010	0.0011	0.0014	0.0015
20	0.2624	0.5251	2711	0.0002	0.0006	0.0007	0.0011	0.0009	0.0012	0.0013	0.0013	0.0017	0.0018
21	0.2601	0.5233	2768	0.0002	0.0003	0.0007	0.0010	0.0013	0.0012	0.0013	0.0015	0.0017	0.0018
22	0.2611	0.5239	2745	0.0001	0.0002	0.0006	0.0010	0.0012	0.0012	0.0015	0.0017	0.0017	0.0018
23	0.2598	0.5267	2759	0.0004	0.0005	0.0006	0.0009	0.0010	0.0013	0.0015	0.0016	0.0016	0.0019
24	0.2615	0.5245	2733	0.0003	0.0005	0.0005	0.0010	0.0010	0.0012	0.0014	0.0016	0.0016	0.0017
25	0.2605	0.5222	2765	0.0004	0.0005	0.0007	0.0011	0.0013	0.0013	0.0015	0.0017	0.0017	0.0019
Avg.	0.2598	0.5244	2770	0.0003	0.0004	0.0005	0.0008	0.0009	0.0009	0.0012	0.0014	0.0016	0.0018
Med.	0.2597	0.5242	2773	0.0002	0.0004	0.0005	0.0008	0.0008	0.0009	0.0011	0.0013	0.0016	0.0019
st dev	0.0013	0.0013	29	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2572	0.5215	2711	0.0000	0.0002	0.0002	0.0004	0.0006	0.0006	0.0009	0.0011	0.0013	0.0015
Max.	0.2624	0.5267	2836	0.0004	0.0006	0.0007	0.0011	0.0013	0.0013	0.0016	0.0017	0.0021	0.0024

3.4 Data Set 2, 85°C, 120mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	53.28	100.04	99.76	99.40	99.06	98.93	98.69	98.50	98.24	98.22	97.99
27	52.73	100.08	99.77	99.45	99.01	98.77	98.56	98.52	98.20	97.97	97.89
28	52.73	99.96	99.66	99.30	98.94	98.65	98.43	98.37	98.12	97.84	97.71
29	53.29	100.23	99.68	99.40	99.16	98.63	98.50	98.25	97.95	97.62	97.35
30	52.71	99.94	99.66	99.34	98.98	98.82	98.41	98.08	97.84	97.53	97.27
31	53.19	100.15	99.83	99.42	99.14	98.85	98.51	98.20	97.91	97.57	97.35
32	52.84	99.98	99.56	99.24	98.86	98.60	98.03	97.79	97.52	97.27	96.82
33	52.77	99.96	99.72	99.36	99.01	98.83	98.26	97.90	97.56	97.50	96.95
34	52.91	99.94	99.81	99.32	99.07	98.77	98.56	97.92	97.62	97.47	96.88
35	52.68	99.79	99.73	99.35	98.96	98.79	98.46	98.20	97.59	97.34	96.70
36	52.88	99.98	99.72	99.28	98.88	98.79	98.51	98.09	97.54	97.30	96.90
37	52.16	99.79	99.77	99.21	98.89	98.58	98.49	98.18	97.93	97.39	96.97
38	52.66	99.96	99.68	99.62	99.26	98.65	98.48	98.25	98.01	97.40	96.98
39	52.88	100.04	99.57	99.51	99.13	98.60	98.34	98.03	97.83	97.18	96.80
40	53.38	100.02	99.79	99.68	99.51	99.48	99.12	99.01	98.65	98.30	97.90
41	52.33	100.10	99.56	99.50	99.27	98.99	98.76	98.66	98.57	98.15	97.61
42	52.38	100.04	99.62	99.47	99.20	99.03	98.76	98.59	98.51	98.47	98.30
43	52.90	100.19	100.06	99.85	99.68	99.36	98.83	98.64	98.34	98.09	98.05
44	52.96	100.15	99.94	99.92	99.57	99.40	98.90	98.73	98.32	98.17	98.02
45	53.00	100.25	100.08	99.94	99.70	99.19	98.70	98.34	98.04	97.66	97.57
46	53.04	100.25	99.87	99.79	99.57	99.42	98.93	98.66	98.34	97.93	97.70
47	52.89	100.21	99.77	99.64	99.41	99.24	98.83	98.58	98.28	97.69	97.52
48	52.83	100.28	99.91	99.41	99.30	99.00	98.86	98.60	98.26	97.77	97.61
49	52.78	100.38	99.98	99.62	99.43	99.17	98.94	98.56	98.24	97.76	97.61
50	52.85	100.26	99.94	99.53	99.30	99.00	98.90	98.69	98.37	97.86	97.67
Avg.	52.84	100.08	99.78	99.50	99.21	98.94	98.63	98.37	98.07	97.74	97.45
Med.	52.85	100.04	99.77	99.45	99.16	98.85	98.56	98.37	98.12	97.69	97.57
st dev	0.28	0.15	0.15	0.21	0.26	0.28	0.25	0.31	0.33	0.35	0.46
Min.	52.16	99.79	99.56	99.21	98.86	98.58	98.03	97.79	97.52	97.18	96.70
Max.	53.38	100.38	100.08	99.94	99.70	99.48	99.12	99.01	98.65	98.47	98.30

3.5 Data Set 2, 85°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	2.901	2.962	3.002	2.978	2.985	2.980	3.004	2.936	2.982	2.962	2.987
27	2.903	3.001	3.003	2.989	3.016	2.961	2.975	2.959	2.944	2.943	3.008
28	2.916	2.908	3.009	3.009	3.003	2.990	3.000	2.955	2.958	3.006	3.007
29	2.909	3.001	2.990	3.005	2.992	2.949	2.957	2.955	2.941	2.962	3.014
30	2.911	2.992	3.003	2.976	2.977	2.987	3.001	2.946	2.949	2.944	3.006
31	2.906	2.935	3.002	3.004	2.991	3.012	2.962	2.973	2.945	3.007	3.008
32	2.918	2.963	3.004	2.950	2.948	3.005	2.986	2.959	2.945	2.942	3.005
33	2.914	2.914	3.003	2.975	2.975	2.981	2.969	2.946	2.946	2.938	3.003
34	2.910	2.920	3.003	2.960	2.985	3.001	2.999	2.942	2.937	2.937	2.983
35	2.921	2.933	3.002	2.977	3.005	2.967	2.950	2.939	2.944	2.924	3.011
36	2.915	2.950	3.003	2.962	2.973	2.986	3.003	2.965	2.939	2.942	3.002
37	2.913	2.948	3.016	2.947	2.969	2.966	2.985	2.965	2.937	2.946	2.953
38	2.914	3.001	3.004	3.004	2.963	2.949	3.016	2.957	2.950	2.952	2.948
39	2.907	2.961	2.993	2.974	2.965	3.003	2.980	2.936	2.949	2.943	2.944
40	2.908	2.929	3.004	3.004	3.011	2.993	2.947	3.003	2.971	2.937	3.012
41	2.912	2.919	3.005	2.967	2.995	2.956	2.946	2.960	2.944	2.934	3.004
42	2.902	2.917	2.972	2.981	2.990	2.958	2.988	2.950	2.934	2.924	3.001
43	2.909	2.914	2.992	2.967	2.982	2.954	2.962	2.953	2.948	2.924	3.003
44	2.934	2.904	2.996	2.993	2.973	2.941	3.002	2.961	2.939	2.927	3.006
45	2.916	3.001	3.024	2.987	2.950	2.932	2.948	2.961	2.939	2.950	3.002
46	2.905	2.939	3.007	3.006	2.956	2.969	2.951	2.971	2.937	2.934	2.967
47	2.907	2.964	3.003	3.006	2.973	2.956	2.967	3.003	2.944	2.931	3.015
48	2.911	2.901	3.005	2.974	2.963	2.940	3.000	3.005	2.937	2.938	3.005
49	2.916	2.930	3.023	3.007	2.977	2.931	2.998	2.949	2.953	2.944	3.003
50	2.907	2.934	3.008	3.002	2.970	2.955	2.961	2.958	2.944	2.968	3.001
Avg.	2.911	2.946	3.003	2.984	2.979	2.969	2.978	2.960	2.946	2.946	2.996
Med.	2.911	2.935	3.003	2.981	2.977	2.966	2.980	2.958	2.944	2.942	3.003
st dev	0.007	0.033	0.010	0.019	0.018	0.024	0.022	0.019	0.011	0.021	0.021
Min.	2.901	2.901	2.972	2.947	2.948	2.931	2.946	2.936	2.934	2.924	2.944
Max.	2.934	3.001	3.024	3.009	3.016	3.012	3.016	3.005	2.982	3.007	3.015

3.6 Data Set 2, 85°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	0.2601	0.5268	2753	0.0001	0.0003	0.0006	0.0008	0.0013	0.0013	0.0015	0.0017	0.0018	0.0021
27	0.2595	0.5243	2777	0.0002	0.0004	0.0006	0.0008	0.0014	0.0013	0.0016	0.0019	0.0019	0.0018
28	0.2606	0.5238	2754	0.0001	0.0002	0.0005	0.0007	0.0013	0.0015	0.0015	0.0018	0.0018	0.0020
29	0.2597	0.5262	2763	0.0003	0.0004	0.0004	0.0006	0.0014	0.0013	0.0015	0.0017	0.0019	0.0020
30	0.2612	0.5243	2739	0.0002	0.0004	0.0005	0.0006	0.0014	0.0013	0.0016	0.0017	0.0021	0.0021
31	0.2595	0.5236	2779	0.0001	0.0003	0.0004	0.0006	0.0012	0.0014	0.0016	0.0018	0.0019	0.0019
32	0.2598	0.5243	2770	0.0002	0.0003	0.0005	0.0008	0.0012	0.0015	0.0016	0.0016	0.0017	0.0018
33	0.2602	0.5245	2760	0.0001	0.0004	0.0004	0.0007	0.0012	0.0015	0.0017	0.0017	0.0018	0.0019
34	0.2605	0.5246	2754	0.0005	0.0005	0.0005	0.0007	0.0013	0.0016	0.0018	0.0018	0.0019	0.0021
35	0.2614	0.5241	2736	0.0003	0.0005	0.0005	0.0008	0.0012	0.0016	0.0018	0.0020	0.0020	0.0023
36	0.2584	0.5225	2809	0.0004	0.0006	0.0007	0.0009	0.0014	0.0016	0.0018	0.0021	0.0020	0.0023
37	0.2601	0.5255	2759	0.0003	0.0005	0.0007	0.0007	0.0014	0.0017	0.0018	0.0021	0.0021	0.0022
38	0.2598	0.5241	2772	0.0004	0.0004	0.0007	0.0008	0.0014	0.0016	0.0018	0.0020	0.0021	0.0022
39	0.2610	0.5267	2735	0.0003	0.0006	0.0010	0.0011	0.0013	0.0017	0.0018	0.0021	0.0022	0.0024
40	0.2588	0.5245	2790	0.0001	0.0006	0.0009	0.0010	0.0013	0.0016	0.0017	0.0020	0.0019	0.0021
41	0.2604	0.5228	2763	0.0004	0.0006	0.0008	0.0011	0.0013	0.0016	0.0018	0.0021	0.0023	0.0023
42	0.2616	0.5233	2736	0.0003	0.0007	0.0008	0.0010	0.0014	0.0017	0.0018	0.0021	0.0020	0.0022
43	0.2601	0.5240	2766	0.0002	0.0006	0.0008	0.0011	0.0014	0.0017	0.0018	0.0021	0.0025	0.0026
44	0.2606	0.5256	2748	0.0002	0.0004	0.0008	0.0009	0.0012	0.0016	0.0017	0.0019	0.0021	0.0023
45	0.2595	0.5240	2779	0.0005	0.0005	0.0008	0.0010	0.0014	0.0018	0.0019	0.0021	0.0024	0.0025
46	0.2604	0.5248	2755	0.0002	0.0006	0.0007	0.0012	0.0014	0.0017	0.0018	0.0021	0.0022	0.0024
47	0.2621	0.5255	2717	0.0002	0.0005	0.0009	0.0010	0.0014	0.0017	0.0018	0.0020	0.0024	0.0025
48	0.2599	0.5226	2775	0.0001	0.0004	0.0008	0.0011	0.0013	0.0017	0.0019	0.0022	0.0024	0.0025
49	0.2603	0.5235	2764	0.0001	0.0002	0.0006	0.0013	0.0013	0.0017	0.0019	0.0021	0.0024	0.0024
50	0.2602	0.5256	2756	0.0002	0.0003	0.0006	0.0009	0.0012	0.0016	0.0018	0.0021	0.0023	0.0024
Avg.	0.2602	0.5245	2760	0.0003	0.0005	0.0007	0.0009	0.0013	0.0016	0.0017	0.0019	0.0021	0.0022
Med.	0.2602	0.5243	2760	0.0002	0.0004	0.0007	0.0009	0.0013	0.0016	0.0018	0.0020	0.0021	0.0022
st dev	0.0008	0.0012	20	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002
Min.	0.2584	0.5225	2717	0.0001	0.0002	0.0004	0.0006	0.0012	0.0013	0.0015	0.0016	0.0017	0.0018
Max.	0.2621	0.5268	2809	0.0005	0.0007	0.0010	0.0013	0.0014	0.0018	0.0019	0.0022	0.0025	0.0026

3.7 Data Set 3, 105°C, 120mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
51	52.72	99.96	99.73	99.62	99.32	99.03	98.84	98.60	98.29	97.91	97.88
52	52.52	99.94	99.62	99.45	99.16	98.93	98.74	98.53	98.21	98.12	97.83
53	53.37	99.96	99.53	99.38	99.08	98.84	98.74	98.44	98.07	98.03	97.53
54	53.21	100.13	99.94	99.72	99.15	98.85	98.46	98.44	98.06	97.71	97.65
55	53.26	100.11	99.64	99.38	99.16	99.00	98.55	98.50	97.99	97.22	96.98
56	53.12	100.15	99.68	99.32	99.12	98.96	98.76	98.34	97.95	97.52	96.99
57	52.66	99.73	99.32	98.84	98.46	97.99	97.85	97.53	97.44	97.15	96.71
58	52.50	99.85	99.35	99.10	98.97	98.74	98.42	98.23	98.10	97.85	97.28
59	52.98	99.85	99.49	99.41	98.83	98.58	98.21	98.00	97.89	97.55	97.11
60	52.70	100.13	99.81	99.32	98.80	98.60	98.31	97.99	97.57	97.53	96.77
61	52.92	100.04	99.66	99.41	99.07	98.45	98.09	97.71	97.47	97.17	96.94
62	53.69	100.11	99.76	99.50	99.14	98.55	98.29	97.93	97.60	97.06	96.91
63	52.93	100.08	99.89	99.66	99.41	99.06	98.66	98.13	97.75	97.17	97.05
64	53.37	99.89	99.79	99.55	99.25	98.91	98.52	97.88	97.56	97.32	97.02
65	53.42	99.63	99.40	99.18	98.93	98.52	98.39	98.07	97.64	97.29	97.02
66	52.94	99.77	99.36	98.98	98.73	98.47	97.96	97.85	97.56	97.19	97.02
67	52.80	99.73	99.49	99.17	98.75	98.54	98.30	97.86	97.46	97.29	96.86
68	53.28	99.94	99.42	99.06	98.72	98.44	98.16	97.92	97.60	97.47	96.90
69	52.89	99.62	99.32	98.94	98.68	98.43	97.88	97.64	97.60	97.05	96.99
70	52.96	100.09	99.55	99.09	98.73	98.40	98.06	97.68	97.36	97.04	96.62
71	53.47	100.13	99.48	98.92	98.65	98.35	98.11	97.55	97.21	96.69	96.22
72	53.52	99.93	99.50	98.82	98.51	98.19	97.57	97.22	96.84	96.09	95.76
73	52.78	100.27	99.72	99.13	98.92	98.43	97.82	97.61	97.25	96.67	96.02
74	53.19	100.04	99.74	99.53	99.02	98.38	97.89	97.78	97.39	96.67	96.24
75	53.10	100.15	99.91	99.23	98.78	98.49	97.91	97.61	97.12	96.76	96.20
Avg.	53.05	99.97	99.60	99.27	98.93	98.61	98.26	97.96	97.64	97.26	96.90
Med.	52.98	99.96	99.62	99.32	98.93	98.54	98.29	97.92	97.60	97.22	96.98
st dev	0.32	0.18	0.19	0.26	0.25	0.28	0.35	0.37	0.36	0.47	0.53
Min.	52.50	99.62	99.32	98.82	98.46	97.99	97.57	97.22	96.84	96.09	95.76
Max.	53.69	100.27	99.94	99.72	99.41	99.06	98.84	98.60	98.29	98.12	97.88

3.8 Data Set 3, 105°C, 120mA (Forward Voltage)

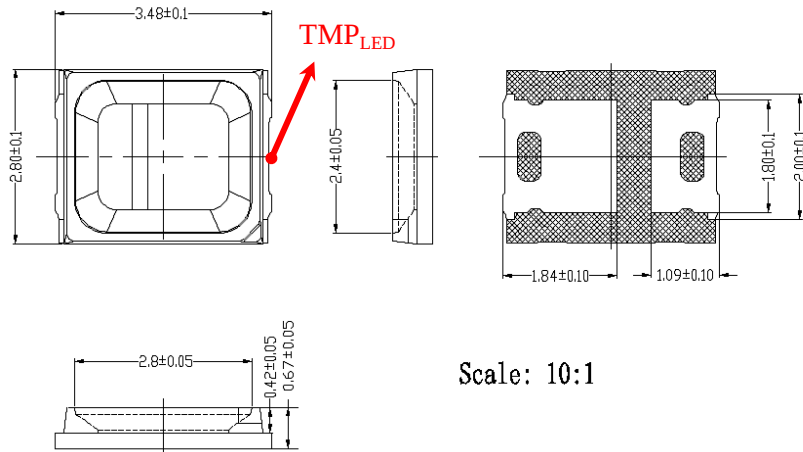
No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
51	2.998	2.905	2.985	3.028	2.962	2.997	3.004	2.961	2.952	2.999	2.984
52	2.904	2.912	3.001	2.980	2.981	2.961	3.011	2.975	2.961	2.975	3.003
53	2.926	2.929	3.015	3.018	2.971	2.971	2.976	2.945	2.968	2.984	2.993
54	2.911	2.901	3.004	2.962	2.952	2.934	2.951	2.956	2.975	3.002	3.001
55	2.923	2.915	2.991	2.994	2.970	2.989	2.962	2.961	2.964	2.940	2.987
56	2.907	2.925	3.028	2.961	2.960	2.962	2.990	2.950	2.949	2.966	2.965
57	2.895	2.905	2.980	2.945	2.941	2.934	2.991	2.944	2.940	2.933	2.937
58	2.899	2.916	2.950	3.010	2.953	2.963	2.987	2.959	2.946	2.986	2.987
59	2.897	2.906	3.007	2.972	2.951	2.975	2.968	2.947	2.954	2.980	2.993
60	2.960	2.979	2.961	2.987	2.967	2.956	2.994	2.975	2.942	2.984	2.935
61	2.915	2.919	2.949	2.995	2.950	3.015	2.935	2.983	2.951	3.002	2.951
62	2.903	3.000	2.960	3.012	2.948	2.952	3.005	2.961	2.957	2.978	2.954
63	2.906	2.934	2.962	2.943	2.956	2.946	2.964	2.945	2.949	3.003	2.952
64	2.917	2.919	2.957	2.950	2.962	2.946	2.984	2.935	2.948	3.000	3.000
65	2.895	2.906	2.993	2.942	2.937	2.940	2.946	2.938	2.931	3.024	3.004
66	2.899	2.900	2.955	2.944	2.938	3.004	2.934	2.939	2.935	3.001	2.934
67	2.900	2.909	2.992	3.006	2.948	3.000	2.935	2.940	2.939	3.004	3.001
68	2.902	2.934	3.006	2.962	2.985	2.987	2.955	2.947	2.948	3.001	3.003
69	2.899	2.916	2.956	2.972	3.002	3.001	2.942	2.938	2.938	3.003	2.932
70	2.904	2.920	2.945	2.962	2.964	3.028	2.979	2.940	2.948	3.001	3.015
71	2.896	2.902	3.000	2.962	2.967	2.966	2.945	2.932	2.947	3.005	2.926
72	2.902	2.919	3.002	2.963	2.970	2.998	2.993	2.936	2.957	3.001	2.937
73	2.893	2.898	3.005	2.950	2.969	2.983	2.954	2.937	2.949	3.003	3.005
74	2.896	2.903	2.946	2.972	3.005	2.944	2.944	2.933	2.937	3.003	3.006
75	2.911	2.909	2.966	2.968	2.951	2.942	2.956	2.928	2.931	3.006	3.002
Avg.	2.910	2.919	2.981	2.974	2.962	2.972	2.968	2.948	2.949	2.991	2.976
Med.	2.903	2.915	2.985	2.968	2.962	2.966	2.964	2.945	2.948	3.001	2.987
st dev	0.023	0.024	0.025	0.025	0.017	0.027	0.024	0.015	0.011	0.021	0.030
Min.	2.893	2.898	2.945	2.942	2.937	2.934	2.934	2.928	2.931	2.933	2.926
Max.	2.998	3.000	3.028	3.028	3.005	3.028	3.011	2.983	2.975	3.024	3.015

3.9 Data Set 3, 105°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
51	0.2623	0.5260	2709	0.0001	0.0002	0.0005	0.0008	0.0014	0.0018	0.0018	0.0021	0.0023	0.0025
52	0.2615	0.5232	2739	0.0004	0.0004	0.0004	0.0006	0.0013	0.0017	0.0018	0.0021	0.0021	0.0023
53	0.2589	0.5251	2787	0.0004	0.0004	0.0006	0.0009	0.0014	0.0018	0.0018	0.0021	0.0023	0.0024
54	0.2580	0.5213	2825	0.0001	0.0004	0.0007	0.0009	0.0014	0.0017	0.0018	0.0021	0.0021	0.0023
55	0.2600	0.5244	2765	0.0004	0.0004	0.0005	0.0009	0.0016	0.0016	0.0018	0.0021	0.0023	0.0025
56	0.2604	0.5245	2756	0.0004	0.0004	0.0008	0.0008	0.0016	0.0018	0.0019	0.0022	0.0023	0.0024
57	0.2609	0.5247	2745	0.0008	0.0010	0.0011	0.0011	0.0014	0.0018	0.0018	0.0021	0.0024	0.0027
58	0.2616	0.5250	2729	0.0004	0.0004	0.0005	0.0012	0.0015	0.0018	0.0019	0.0021	0.0024	0.0024
59	0.2594	0.5218	2791	0.0005	0.0005	0.0003	0.0008	0.0012	0.0017	0.0018	0.0021	0.0021	0.0023
60	0.2612	0.5259	2733	0.0003	0.0004	0.0004	0.0007	0.0012	0.0016	0.0018	0.0020	0.0022	0.0025
61	0.2597	0.5241	2773	0.0004	0.0005	0.0006	0.0008	0.0013	0.0018	0.0020	0.0022	0.0022	0.0024
62	0.2569	0.5234	2840	0.0003	0.0005	0.0007	0.0010	0.0012	0.0018	0.0019	0.0022	0.0024	0.0025
63	0.2616	0.5257	2727	0.0003	0.0005	0.0007	0.0006	0.0009	0.0014	0.0019	0.0021	0.0022	0.0024
64	0.2581	0.5241	2810	0.0003	0.0004	0.0005	0.0006	0.0009	0.0016	0.0020	0.0023	0.0024	0.0026
65	0.2603	0.5259	2752	0.0005	0.0006	0.0006	0.0007	0.0006	0.0012	0.0017	0.0019	0.0021	0.0022
66	0.2607	0.5258	2744	0.0004	0.0006	0.0009	0.0011	0.0008	0.0011	0.0018	0.0021	0.0021	0.0024
67	0.2609	0.5236	2750	0.0005	0.0005	0.0009	0.0012	0.0009	0.0013	0.0019	0.0022	0.0023	0.0026
68	0.2602	0.5254	2756	0.0003	0.0006	0.0009	0.0013	0.0013	0.0010	0.0017	0.0020	0.0021	0.0023
69	0.2609	0.5240	2749	0.0004	0.0004	0.0008	0.0012	0.0015	0.0013	0.0018	0.0021	0.0022	0.0025
70	0.2618	0.5239	2729	0.0006	0.0007	0.0007	0.0012	0.0014	0.0014	0.0018	0.0019	0.0021	0.0023
71	0.2578	0.5239	2816	0.0008	0.0010	0.0010	0.0012	0.0014	0.0014	0.0018	0.0021	0.0022	0.0024
72	0.2600	0.5246	2763	0.0006	0.0009	0.0009	0.0012	0.0012	0.0013	0.0018	0.0021	0.0021	0.0022
73	0.2604	0.5240	2759	0.0008	0.0010	0.0010	0.0011	0.0013	0.0013	0.0018	0.0021	0.0024	0.0025
74	0.2603	0.5231	2764	0.0007	0.0010	0.0012	0.0013	0.0014	0.0013	0.0018	0.0020	0.0021	0.0023
75	0.2585	0.5237	2802	0.0001	0.0004	0.0011	0.0013	0.0013	0.0014	0.0019	0.0021	0.0023	0.0024
Avg.	0.2601	0.5243	2765	0.0004	0.0006	0.0007	0.0010	0.0013	0.0015	0.0018	0.0021	0.0022	0.0024
Med.	0.2603	0.5241	2756	0.0004	0.0005	0.0007	0.0010	0.0013	0.0016	0.0018	0.0021	0.0022	0.0024
st dev	0.0014	0.0012	34	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001
Min.	0.2569	0.5213	2709	0.0001	0.0002	0.0003	0.0006	0.0006	0.0010	0.0017	0.0019	0.0021	0.0022
Max.	0.2623	0.5260	2840	0.0008	0.0010	0.0012	0.0013	0.0016	0.0018	0.0020	0.0023	0.0024	0.0027

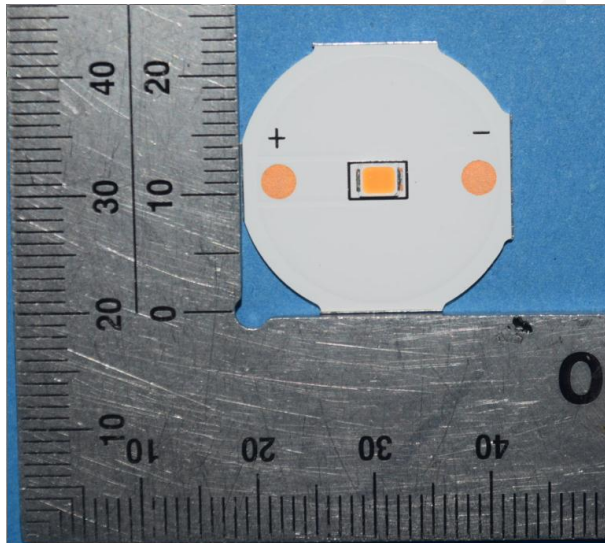
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



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