



IES LM-80 Test Report

Report Issue Date : September 02, 2016 **Report Number :** I-151104-89-K-01
Testing Start Date : November 11, 2015 **Testing Completion Date :** August 13, 2016
Revision Number : 01 **Test Duration :** 6 000 h

Manufacturer Information :

Applicant : Seoul Semiconductor Co., LTD
Address : 97-11, Sandan-ro 163, Danwon-gu, Ansan, Gyeonggi-do, Korea 15429

Description of Test Samples :

Classification : LED Package
PKG Name : 3528
Part Number : STWxA2SD-xx
Drive Current : 150 mA

Test Procedure :

IES LM-80-08 Approved Method for Measuring Lumen Maintenance of LED Light Sources

Tested by

InHoi SIM, Research Engineer

Approved by

YoungJoon WON, Laboratory Manager



The above testing certificate is the accredited test result by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

Seoul Semiconductor Testing Laboratory

97-11, Sandan-ro 163, Danwon-gu, Ansan, Gyeonggi-do, Korea 15429

Accredited by KOLAS, Republic of KOREA

Applicable Series Model Numbers

This LM-80 report is applicable to the following

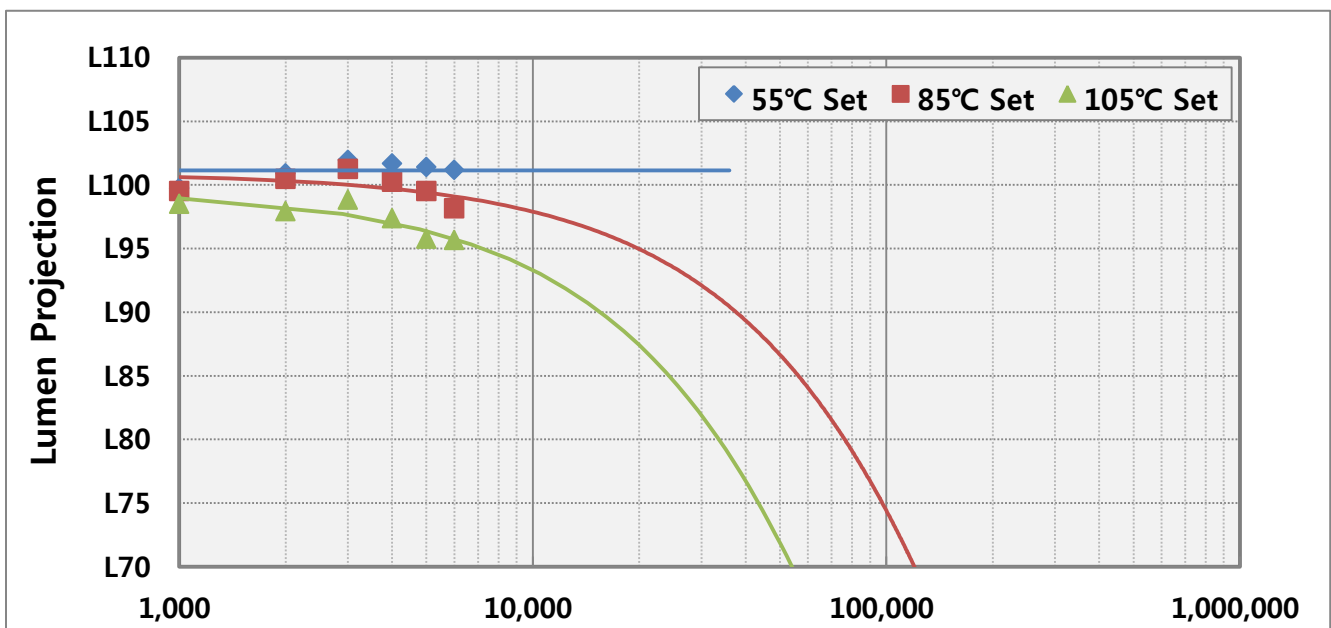
Series	Model Number	Case Temperature	Forward Current	Typical VF	Power	CCT
3528	STWxA2SD-xx	55 °C	150 mA	6.0 V	0.9 W	≥2200 K
3528	STWxA2SD-xx	85 °C	150 mA	6.0 V	0.9 W	≥2200 K
3528	STWxA2SD-xx	105 °C	150 mA	6.0 V	0.9 W	≥2200 K
3528	STWxA2PD-xx	55 °C	300 mA	3.0 V	0.9 W	≥2200 K
3528	STWxA2PD-xx	85 °C	300 mA	3.0 V	0.9 W	≥2200 K
3528	STWxA2PD-xx	105 °C	300 mA	3.0 V	0.9 W	≥2200 K


SEOUL SEMICONDUCTOR

1. Test Summary

Items	Nominal Case Temperature		
	55 °C	85 °C	105 °C
Number of LED tested	20	20	20
Drive Current	150 mA	150 mA	150 mA
Measurement Current	150 mA	150 mA	150 mA
Test Duration	6 000 h	6 000 h	6 000 h
Actual Case Temperature	≥55.7 °C	≥83.3 °C	≥104.3 °C
Actual Ambient Temperature	≥54.2 °C	≥82.9 °C	≥101.2 °C
Air Flow Velocity	≤0.85 m/s	≤0.57 m/s	≤0.18 m/s
Averaged Initial Luminous Flux	110.5 lm	110.5 lm	110.8 lm
Averaged Initial CCT	2694 K	2703 K	2698 K
Averaged Forward Voltage	6.23 V	6.24 V	6.22 V
Averaged Lumen Maintenance	101.2 %	98.2 %	95.7 %
Averaged Chromacity Shift	0.000 4	0.000 8	0.001 1
α	2.165E-21	3.049E-06	6.522E-06
B	1.011	1.009	0.996
TM-21 Projection L ₇₀	>36000	>36000	>36000
TM-21 Projection L ₈₀	>36000	>36000	34000
TM-21 Projection L ₉₀	>36000	>36000	16000

※ The results shown in this certificate refer only to the sample(s) tested unless otherwise stated.
This test report cannot be reproduced, except in full.



2. IES LM-80-08 Test Report Requirement :

Number of LED Light Sources Tested

See the Test Summary

Description of LED Light Sources

See the Description of Test samples at the cover of certificate

Description of auxiliary equipment

Active cooling Test System

Temperature controlling chamber for LED package/array/module consists of the water cooling heat-sink plates to control the case temperature of each device and of the power supply required by LM-80 test conditions.

Measurement System

Photometric measurement tester for LED package/array/module consists of the integrating sphere with temperature controlling system(TEC) and of programmable current source meter.

Operating Cycle

Constant Direct Current (DC)

Ambient Conditions Including Airflow, Temperature and Relative Humidity

Airflow : < 1 m/s

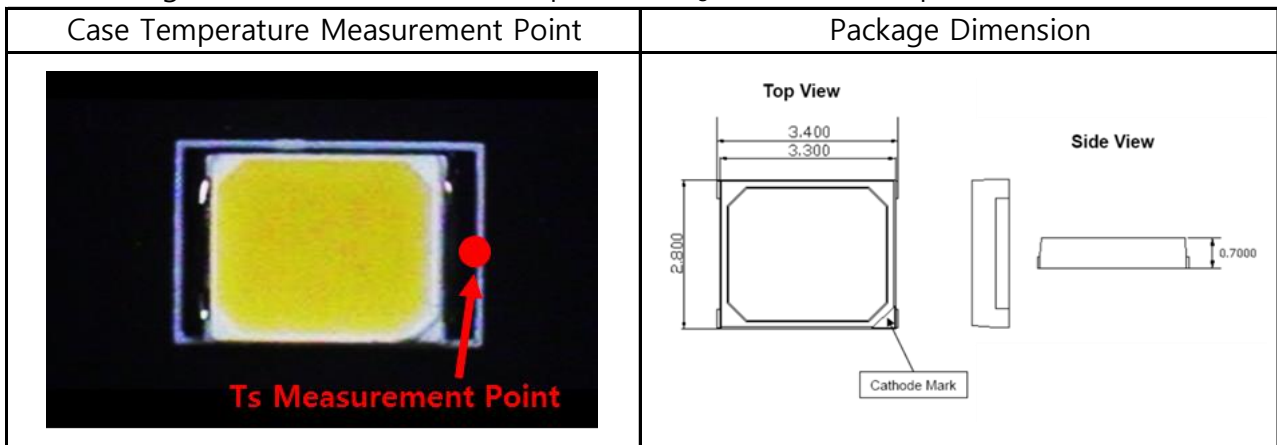
Ambient temperature : ≥ -5 °C of Nominal T_A

(See the Test Summary for actual T_A)

Relative Humidity : $\leq 65\%$ RH

Case Temperature (Test Point Temperature)

See the figure below, for the case temperature (T_C) measurement point and dimension



Drive Current of the LED Light Source During Lifetime Test

See the Test Summary

Initial Luminous Flux and Forward Voltage at Photometric Measurement Current

See the Test Summary

Lumen Maintenance Data for Each Individual LED Light Source Along with Median Value, Standard Deviation, Minimum and Maximum Lumen Maintenance Value for All of the LED Light Sources

See the table of each data set

Observation of LED light Sources Failures

No failure observed

LED Light Source Monitoring Interval

See the table of each data set

Photometric Measurement Uncertainty

Seoul Semiconduc maintain a tolerance of ± 3.04 % at 95% confidence level ($k = 2$)

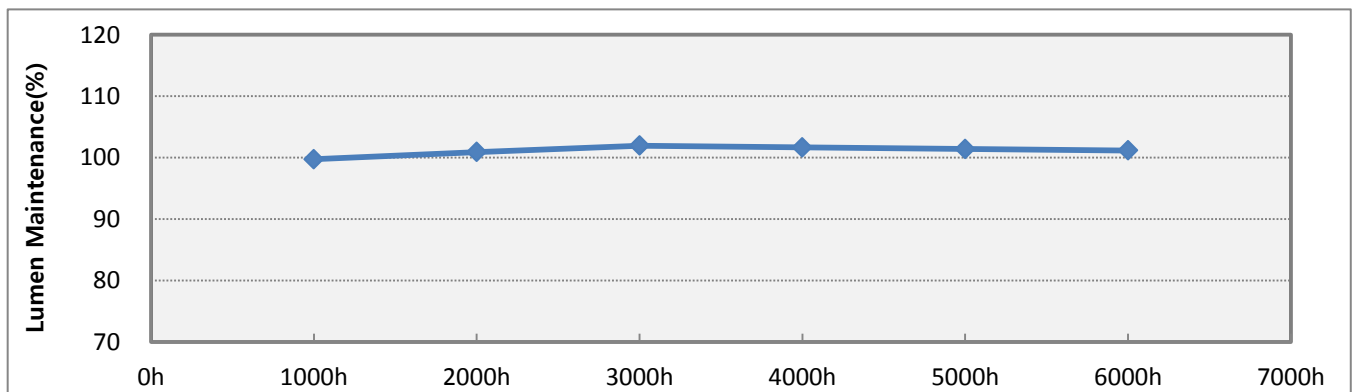
Chromaticity Shift Over the Measurement Time

See the table of each data set

A large, semi-transparent watermark of the Seoul Semiconductor logo and name is overlaid on the page. The logo is a green oval with "SEOUL" in white, and the name "SEOUL SEMICONDUCTOR" is written in large, grey, capital letters below it.

3. 55°C Data Set

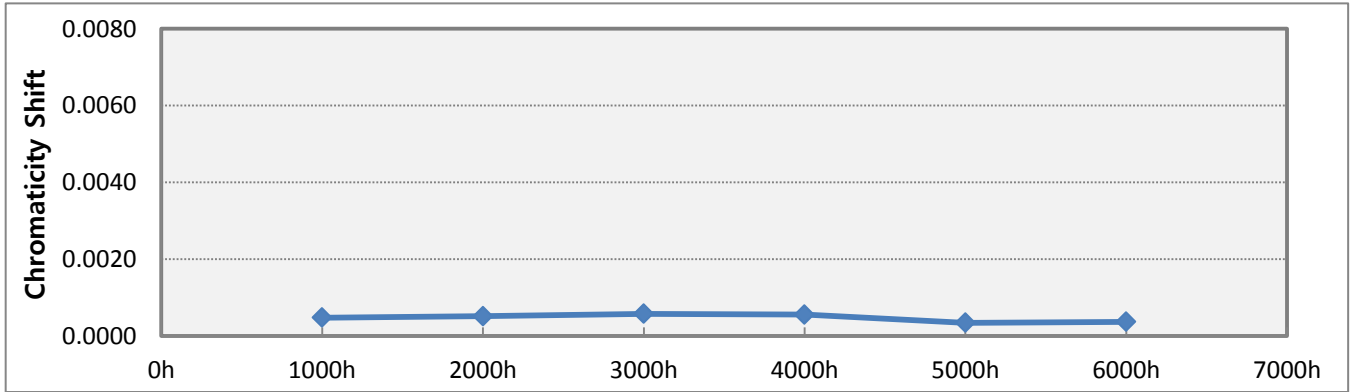
No.	Initial Characteristics			Lumen Maintenance								
	V _f (V)	Flux (lm)	CCT (K)	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h			
01	6.29	110.20	2702	99.6	101.0	102.4	101.9	102.2	101.3			
02	6.19	112.39	2689	99.3	100.4	102.2	101.4	101.1	100.8			
03	6.20	112.09	2713	100.0	101.1	102.1	102.0	101.7	101.8			
04	6.23	110.02	2684	100.1	102.1	103.0	102.4	101.6	101.7			
05	6.21	112.04	2727	99.0	100.8	101.1	101.2	101.2	101.2			
06	6.23	107.87	2688	99.9	100.5	101.6	101.7	101.6	101.1			
07	6.28	109.13	2670	99.1	100.5	101.2	100.6	100.3	100.3			
08	6.21	111.00	2707	100.2	100.8	102.6	101.6	100.9	101.3			
09	6.20	112.46	2676	99.0	100.2	101.6	100.6	100.6	100.3			
10	6.26	111.10	2714	99.8	101.0	102.1	101.6	101.1	101.2			
11	6.29	110.92	2715	99.9	100.8	102.1	102.1	101.4	101.8			
12	6.18	111.19	2671	100.1	100.7	101.8	101.8	101.7	101.2			
13	6.19	108.97	2688	100.2	101.9	102.4	101.7	102.2	101.4			
14	6.21	107.01	2715	99.1	100.7	101.4	101.7	100.8	101.2			
15	6.25	110.29	2682	100.1	101.3	101.6	102.3	101.0	100.9			
16	6.23	112.71	2674	99.3	100.0	101.0	100.6	101.0	100.2			
17	6.19	112.05	2721	99.8	100.7	101.7	101.9	101.3	101.9			
18	6.27	110.60	2708	100.0	101.2	102.3	102.2	101.9	101.5			
19	6.18	110.42	2668	100.2	100.9	102.0	101.7	101.5	101.1			
20	6.22	107.89	2675	100.3	101.3	103.0	102.6	103.1	101.5			
Ave.	6.23	110.52	2694	99.7	100.9	102.0	101.7	101.4	101.2			
Med.	6.22	110.76	2688	99.9	100.8	102.0	101.7	101.3	101.2			
Min.	6.18	107.01	2668	99.0	100.0	101.0	100.6	100.3	100.2			
Max.	6.29	112.71	2727	100.3	102.1	103.0	102.6	103.1	101.9			
σ	0.04	1.64	19	0.4	0.5	0.6	0.6	0.6	0.5			





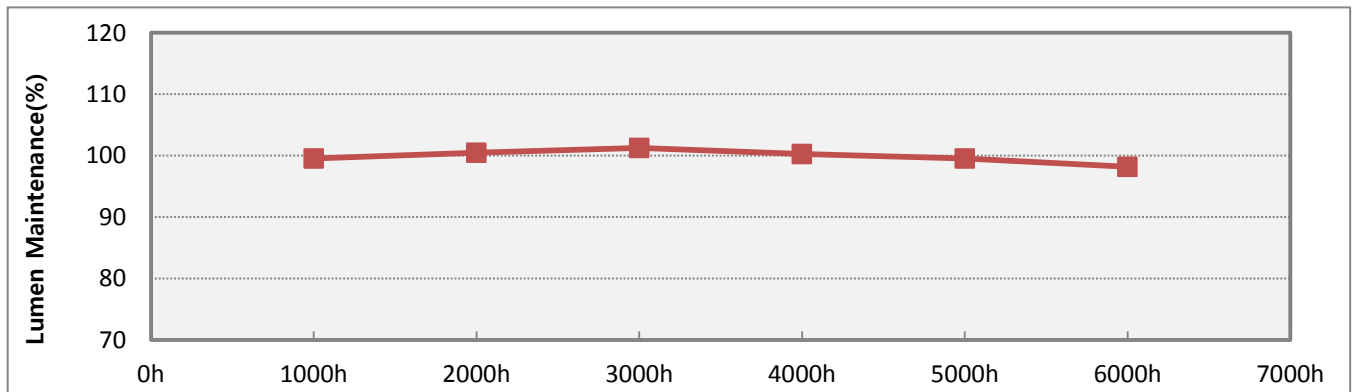
3. 55°C Data Set

No.	Initial Characteristics		Chromaticity Shift $du'v'$								
	CIE1976 u'	CIE1976 v'	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h			
01	0.2629	0.5247	0.0004	0.0005	0.0006	0.0006	0.0003	0.0003			
02	0.2633	0.5260	0.0004	0.0004	0.0005	0.0004	0.0003	0.0004			
03	0.2623	0.5251	0.0004	0.0005	0.0005	0.0005	0.0002	0.0002			
04	0.2637	0.5248	0.0005	0.0007	0.0008	0.0007	0.0004	0.0005			
05	0.2619	0.5238	0.0004	0.0003	0.0003	0.0003	0.0002	0.0002			
06	0.2633	0.5261	0.0006	0.0007	0.0008	0.0008	0.0005	0.0005			
07	0.2643	0.5254	0.0006	0.0006	0.0007	0.0007	0.0006	0.0008			
08	0.2627	0.5247	0.0005	0.0005	0.0006	0.0005	0.0004	0.0004			
09	0.2639	0.5263	0.0006	0.0005	0.0006	0.0006	0.0005	0.0005			
10	0.2625	0.5236	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003			
11	0.2623	0.5247	0.0005	0.0004	0.0005	0.0005	0.0003	0.0003			
12	0.2643	0.5253	0.0005	0.0004	0.0005	0.0005	0.0002	0.0003			
13	0.2634	0.5258	0.0005	0.0007	0.0006	0.0005	0.0002	0.0002			
14	0.2624	0.5242	0.0003	0.0005	0.0004	0.0005	0.0002	0.0002			
15	0.2639	0.5247	0.0004	0.0005	0.0004	0.0005	0.0003	0.0004			
16	0.2639	0.5268	0.0006	0.0006	0.0007	0.0007	0.0006	0.0007			
17	0.2622	0.5237	0.0005	0.0004	0.0005	0.0005	0.0002	0.0002			
18	0.2627	0.5242	0.0003	0.0004	0.0005	0.0005	0.0001	0.0001			
19	0.2643	0.5262	0.0007	0.0007	0.0008	0.0009	0.0006	0.0007			
20	0.2638	0.5270	0.0005	0.0005	0.0007	0.0007	0.0004	0.0001			
Ave.	0.2632	0.5252	0.0005	0.0005	0.0006	0.0006	0.0003	0.0004			
Med.	0.2633	0.5249	0.0005	0.0005	0.0006	0.0005	0.0003	0.0003			
Min.	0.2619	0.5236	0.0003	0.0003	0.0003	0.0003	0.0001	0.0001			
Max.	0.2643	0.5270	0.0007	0.0007	0.0008	0.0009	0.0006	0.0008			
σ	0.0008	0.0010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002			



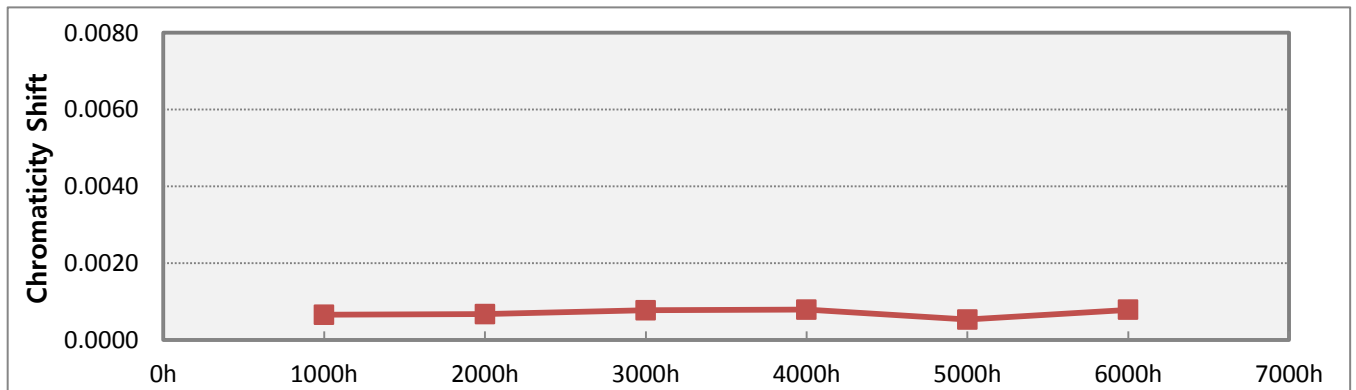
3. 85°C Data Set

No.	Initial Characteristics			Lumen Maintenance								
	V _f (V)	Flux (lm)	CCT (K)	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h			
01	6.22	108.56	2710	98.8	99.2	100.1	99.2	98.6	97.4			
02	6.18	111.41	2720	99.5	100.4	101.6	100.6	99.9	98.9			
03	6.26	111.19	2684	99.5	100.9	101.1	100.1	99.5	98.3			
04	6.22	111.96	2685	98.2	99.1	100.2	98.6	98.9	96.7			
05	6.26	110.97	2673	99.6	100.7	101.2	100.8	100.3	97.9			
06	6.19	110.16	2740	100.3	101.4	101.7	100.9	100.5	99.1			
07	6.22	108.08	2681	98.8	99.8	100.8	99.2	99.0	97.4			
08	6.28	110.92	2701	99.7	100.9	101.4	100.8	99.7	99.2			
09	6.27	111.43	2691	99.1	100.3	101.3	99.7	98.8	97.2			
10	6.27	112.65	2754	99.7	100.7	102.1	100.5	99.7	98.8			
11	6.28	111.27	2730	99.9	101.3	101.5	100.9	99.7	98.9			
12	6.20	110.79	2719	101.1	101.5	102.0	101.1	100.3	99.1			
13	6.19	110.04	2724	99.9	100.7	102.1	100.2	99.3	97.6			
14	6.26	106.05	2684	99.6	101.0	101.8	100.2	99.6	98.7			
15	6.28	110.18	2693	99.8	100.2	101.5	99.8	99.6	97.5			
16	6.21	112.11	2685	98.5	99.8	100.3	100.2	99.0	97.2			
17	6.19	112.37	2729	99.9	100.8	101.7	101.3	99.4	98.4			
18	6.21	111.58	2697	100.4	100.8	101.9	100.8	100.3	99.6			
19	6.29	110.57	2684	98.2	99.4	99.8	99.0	98.4	96.5			
20	6.27	106.82	2683	99.9	100.5	100.9	101.1	99.8	98.8			
Ave.	6.24	110.46	2703	99.5	100.5	101.2	100.3	99.5	98.2			
Med.	6.24	110.95	2695	99.6	100.7	101.4	100.4	99.6	98.4			
Min.	6.18	106.05	2673	98.2	99.1	99.8	98.6	98.4	96.5			
Max.	6.29	112.65	2754	101.1	101.5	102.1	101.3	100.5	99.6			
σ	0.04	1.78	23	0.7	0.7	0.7	0.8	0.6	0.9			



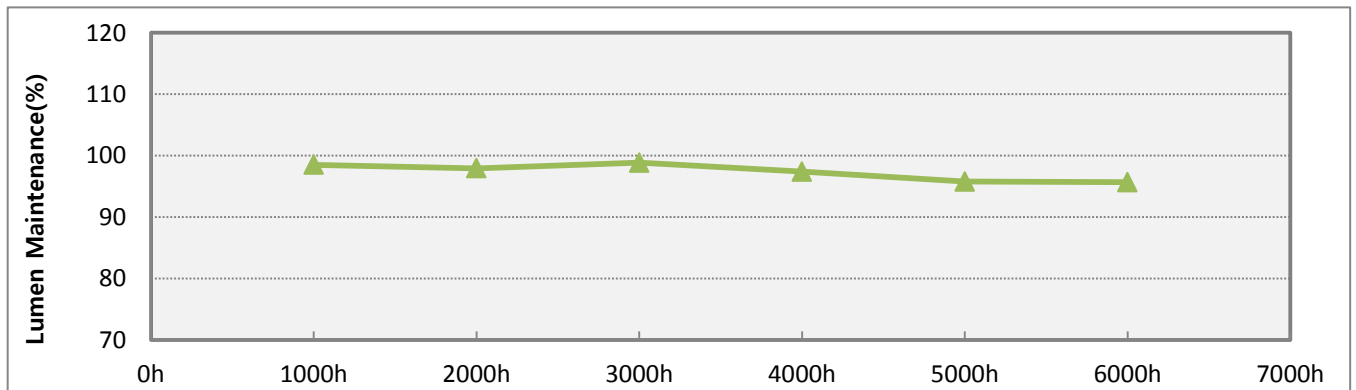
3. 85°C Data Set

No.	Initial Characteristics		Chromaticity Shift du'v'								
	CIE1976 u'	CIE1976 v'	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h			
01	0.2625	0.5248	0.0008	0.0008	0.0009	0.0009	0.0008	0.0010			
02	0.2618	0.5259	0.0007	0.0007	0.0009	0.0010	0.0006	0.0008			
03	0.2635	0.5262	0.0005	0.0006	0.0006	0.0006	0.0003	0.0006			
04	0.2634	0.5265	0.0011	0.0010	0.0012	0.0011	0.0010	0.0014			
05	0.2639	0.5266	0.0005	0.0005	0.0006	0.0007	0.0005	0.0008			
06	0.2611	0.5250	0.0005	0.0007	0.0007	0.0008	0.0004	0.0004			
07	0.2637	0.5257	0.0009	0.0007	0.0008	0.0008	0.0007	0.0010			
08	0.2629	0.5251	0.0005	0.0006	0.0006	0.0007	0.0003	0.0006			
09	0.2634	0.5252	0.0007	0.0006	0.0007	0.0006	0.0006	0.0010			
10	0.2603	0.5253	0.0006	0.0006	0.0008	0.0006	0.0004	0.0007			
11	0.2617	0.5243	0.0005	0.0007	0.0007	0.0009	0.0003	0.0005			
12	0.2621	0.5246	0.0006	0.0006	0.0006	0.0006	0.0002	0.0004			
13	0.2617	0.5256	0.0005	0.0006	0.0010	0.0008	0.0005	0.0009			
14	0.2638	0.5243	0.0006	0.0008	0.0009	0.0007	0.0005	0.0007			
15	0.2634	0.5244	0.0007	0.0007	0.0009	0.0007	0.0006	0.0010			
16	0.2636	0.5251	0.0009	0.0008	0.0009	0.0010	0.0007	0.0011			
17	0.2618	0.5238	0.0005	0.0005	0.0007	0.0009	0.0004	0.0006			
18	0.2631	0.5248	0.0005	0.0005	0.0007	0.0007	0.0004	0.0005			
19	0.2636	0.5254	0.0009	0.0007	0.0007	0.0007	0.0007	0.0012			
20	0.2636	0.5260	0.0005	0.0005	0.0006	0.0010	0.0003	0.0004			
Ave.	0.2627	0.5252	0.0007	0.0007	0.0008	0.0008	0.0005	0.0008			
Med.	0.2632	0.5251	0.0006	0.0007	0.0007	0.0008	0.0005	0.0008			
Min.	0.2603	0.5238	0.0005	0.0005	0.0006	0.0006	0.0002	0.0004			
Max.	0.2639	0.5266	0.0011	0.0010	0.0012	0.0011	0.0010	0.0014			
σ	0.0010	0.0008	0.0002	0.0001	0.0002	0.0001	0.0002	0.0003			



3. 105°C Data Set

No.	Initial Characteristics			Lumen Maintenance								
	V _f (V)	Flux (lm)	CCT (K)	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h			
01	6.18	110.79	2697	98.0	97.5	98.7	97.8	95.3	93.5			
02	6.26	110.99	2673	98.3	98.1	98.2	95.9	94.2	93.6			
03	6.27	111.91	2683	98.7	98.5	98.6	96.9	95.7	95.1			
04	6.21	111.82	2686	98.7	98.4	98.9	97.7	96.5	97.2			
05	6.21	110.68	2722	97.9	97.6	98.8	96.3	94.4	92.8			
06	6.23	112.31	2682	97.4	97.1	97.5	96.3	94.9	94.7			
07	6.26	112.22	2758	98.9	98.6	99.2	96.7	94.9	95.6			
08	6.18	112.59	2696	99.4	99.1	99.1	98.2	97.3	97.3			
09	6.25	111.73	2724	98.2	99.3	99.2	97.6	96.1	98.6			
10	6.19	111.59	2711	98.5	98.3	99.4	97.7	95.9	96.9			
11	6.18	110.73	2681	98.3	98.0	98.5	97.8	95.9	95.6			
12	6.24	108.33	2686	98.7	97.4	99.6	98.2	96.6	94.9			
13	6.18	106.80	2672	97.7	95.4	97.8	96.4	94.7	93.1			
14	6.20	111.79	2696	98.0	96.5	97.9	96.3	94.0	93.0			
15	6.20	111.92	2683	98.6	98.5	99.2	98.1	96.6	97.7			
16	6.18	111.23	2691	98.8	98.4	98.9	97.5	96.2	96.8			
17	6.25	110.35	2688	99.4	99.4	99.7	98.5	97.4	98.9			
18	6.19	110.40	2687	98.9	99.1	99.3	98.0	95.6	96.5			
19	6.23	110.98	2724	99.2	97.9	99.7	98.1	96.9	96.6			
20	6.23	107.18	2717	98.6	95.5	98.9	97.6	96.3	95.0			
Ave.	6.22	110.82	2698	98.5	97.9	98.9	97.4	95.8	95.7			
Med.	6.21	111.11	2689	98.6	98.2	98.9	97.6	95.9	95.6			
Min.	6.18	106.80	2672	97.4	95.4	97.5	95.9	94.0	92.8			
Max.	6.27	112.59	2758	99.4	99.4	99.7	98.5	97.4	98.9			
σ	0.03	1.61	22	0.5	1.1	0.6	0.8	1.0	1.9			



3. 105°C Data Set

No.	Initial Characteristics		Chromaticity Shift du'v'								
	CIE1976 u'	CIE1976 v'	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h			
01	0.2633	0.5242	0.0007	0.0009	0.0011	0.0014	0.0012	0.0012			
02	0.2640	0.5261	0.0008	0.0010	0.0012	0.0013	0.0017	0.0018			
03	0.2637	0.5255	0.0010	0.0011	0.0012	0.0013	0.0016	0.0017			
04	0.2636	0.5253	0.0006	0.0008	0.0009	0.0011	0.0011	0.0010			
05	0.2622	0.5235	0.0007	0.0008	0.0011	0.0009	0.0012	0.0012			
06	0.2636	0.5262	0.0008	0.0009	0.0010	0.0012	0.0012	0.0012			
07	0.2607	0.5226	0.0007	0.0009	0.0011	0.0010	0.0012	0.0012			
08	0.2630	0.5257	0.0007	0.0010	0.0010	0.0012	0.0009	0.0007			
09	0.2620	0.5242	0.0006	0.0009	0.0008	0.0008	0.0007	0.0008			
10	0.2627	0.5233	0.0006	0.0008	0.0012	0.0012	0.0010	0.0010			
11	0.2637	0.5259	0.0009	0.0011	0.0011	0.0014	0.0011	0.0012			
12	0.2637	0.5249	0.0007	0.0008	0.0011	0.0011	0.0009	0.0009			
13	0.2644	0.5244	0.0008	0.0010	0.0011	0.0012	0.0013	0.0014			
14	0.2632	0.5245	0.0008	0.0009	0.0011	0.0013	0.0015	0.0016			
15	0.2635	0.5261	0.0008	0.0010	0.0010	0.0011	0.0008	0.0009			
16	0.2635	0.5243	0.0007	0.0008	0.0009	0.0010	0.0010	0.0010			
17	0.2634	0.5256	0.0006	0.0008	0.0008	0.0008	0.0007	0.0008			
18	0.2638	0.5238	0.0007	0.0012	0.0012	0.0013	0.0010	0.0010			
19	0.2619	0.5246	0.0006	0.0008	0.0010	0.0010	0.0008	0.0008			
20	0.2623	0.5240	0.0007	0.0009	0.0009	0.0010	0.0008	0.0007			
Ave.	0.2631	0.5247	0.0007	0.0009	0.0010	0.0011	0.0011	0.0011			
Med.	0.2635	0.5245	0.0007	0.0009	0.0011	0.0011	0.0010	0.0010			
Min.	0.2607	0.5226	0.0006	0.0008	0.0008	0.0008	0.0007	0.0007			
Max.	0.2644	0.5262	0.0010	0.0012	0.0012	0.0014	0.0017	0.0018			
σ	0.0009	0.0010	0.0001	0.0001	0.0001	0.0002	0.0003	0.0003			

