



IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

DONGGUAN SINOWIN OPTO-ELECTRONIC CO.,LTD

No. 3, Xin Cheng Road, Song Shan Lake, Dongguan City, Guangdong Province

Model: ZT2835WOM1

Report Type: 12000 Hours Test Report		Product Type: LED Package
Test Engineer:	Pote Wang <i>Pote Wang</i>	
Report Number:	R2DG160328052-10-12000	
Test Date:	2016-04-05 to 2017-12-05	
Report Date:	2018-01-03	
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Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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TABLE OF CONTENTS

1 - General Information	3
1.1 Description of LED Light Sources	3
1.2 Standards Used:.....	3
1.3 Test Facility.....	3
1.4 Description of Auxiliary Equipment	3
1.5 Operating Cycle.....	4
1.6 Ambient Conditions	4
1.7 Photometry Measurement Uncertainty	4
1.8 Sample Set.....	5
2 - Summary OF Test Result	6
3 - Test Data	7
3.1 Data Set 1, 55 °C, 60mA (Lumen Maintenance).....	7
3.2 Data Set 1, 55 °C, 60mA (Chromaticity Shift).....	8
3.3 Data Set 2, 85 °C, 60mA (Lumen Maintenance).....	9
3.4 Data Set 2, 85 °C, 60mA (Chromaticity Shift).....	10
3.5 Data Set 3, 105 °C, 60mA (Lumen Maintenance).....	11
3.5 Data Set 3, 105 °C, 60mA (Lumen Maintenance).....	11
3.6 Data Set 3, 105 °C, 60mA (Chromaticity Shift).....	12
Attachment A – EUT Photo	13
A.1 Mechanical Dimensions (Ta = 25 °C)	13
A.2 EUT Photo.....	13

1 - General Information

1.1 Description of LED Light Sources

Devices tested

Part Number:	ZT2835WOM1
Part Type:	LED Package
Nominal CCT:	3000K
Power:	0.2W
Current Density per LED die:	221.18mA/mm ²
Power Density per LED die:	0.7373W/mm ²
CRI:	83
Die Spacing:	N/A

1.2 Standards Used:

- IESNA LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- CIE 127:2007: Measurement of LEDs (This standard was not accredited by IAS)
- ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by IAS)

1.3 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan). is located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.

1.4 Description of Auxiliary Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
0.3m integrating sphere	EVERFINE	Diameter 0.3m	1011119	2017-03-09	2018-03-09
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	2017-03-03	2018-03-03
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	2017-03-09	2018-03-09
Standard Light Source	EVERFINE	D062	1011093	2017-09-13	2018-09-13
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987CJ7321114	2017-03-03	2018-03-03
Multilayer aging machine	BACL	B2-270	20022	2017-12-08	2018-12-07
DC Power Supply	Taishan Xingguang	T0150E8.5-80	ST06606	2017-10-27	2018-10-26

DC Power Supply	Taishan Xingguang	T0150E8.5-80	ST06607	2017-10-27	2018-10-26
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1.5 Operating Cycle

Samples are driven with a constant direct current (DC)

1.6 Ambient Conditions

For lumen maintenance test, samples were operated in thermal chambers with minimal ambient airflow. For long term reliability test, the case temperature was controlled by mounting several thermocouples on a sample reliability stress board at the designated thermal measurement point, as shown in APPENDIX. The ambient temperature T_A was measured by several thermocouples at a distance of 5 mm above the reliability test board. The relative humidity within chamber was less than 65%.

For photometry measurement, temperature was set to $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, RH <65%.

1.7 Photometry Measurement Uncertainty

The uncertainty of the light output measurements is $U=1.59\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is $U=21\text{K}$ ($K=2$), at the 95% confidence level. This calibration results traceable to the NATIONAL INSTITUTE OF METROLOGY (NIM).

1.8 Sample Set

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.

Sample Size:

Total 60Pcs;

Each Ts test condition 20Pcs

The 60pcs samples tested at Ts 55 °C, 85 °C and Ts 105 °C were received at 2016-03-28 and tested during 2016-04-05 to 2017-12-05. The samples were numbered from 1 to 20, 21 to 40 and 41 to 60

Data Set 1: 55 °C, 60mA

Part Number:	ZT2835WOM1
Number of Units:	20
Actual Case Temperature(T _S):	T _S =54.6 °C
Actual Ambient Temperature(T _A):	T _A =51.7 °C
Life Test Drive Current:	I _F = 60mA
Measurement Current:	I _F = 60mA

Data Set 2: 85 °C,60mA

Part Number:	ZT2835WOM1
Number of Units:	20
Actual Case Temperature(T _S):	T _S =83.9 °C
Actual Ambient Temperature(T _A):	T _A =82.5 °C
Life Test Drive Current:	I _F =60mA
Measurement Current:	I _F = 60mA

Data Set 3: 105 °C, 60mA

Part Number:	ZT2835WOM1
Number of Units:	20
Actual Case Temperature(T _S):	T _S =103.8 °C
Actual Ambient Temperature(T _A):	T _A =101.6 °C
Life Test Drive Current:	I _F = 60mA
Measurement Current:	I _F = 60mA

2 - Summary OF Test Result

Data Set:	Data Set 1, 55 °C, 60mA
Number of Units:	20
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,8000h,9000h,10000h,11000h,12000h
Average. Lumen Maintenance at 12000 hours:	97.37%
Average Chromaticity Shift at 12000 hours ($\Delta u'v'$):	0.0029
Reported TM-21 L ₇₀ Lifetime:	>72,000 hours

Data Set:	Data Set 2, 85 °C, 60mA
Number of Units:	20
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,8000h,9000h,10000h,11000h,12000h
Average. Lumen Maintenance at 12000 hours:	95.94%
Average Chromaticity Shift at 12000 hours($\Delta u'v'$):	0.0031
Reported TM-21 L ₇₀ Lifetime	>72,000 hours

Data Set:	Data Set 3, 105 °C, 60mA
Number of Units:	20
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,8000h,9000h,10000h,11000h,12000h
Average. Lumen Maintenance at 12000 hours:	94.75%
Average Chromaticity Shift at 12000 hours($\Delta u'v'$):	0.0033
Reported TM-21 L ₇₀ Lifetime	70,000 hours

3 - Test Data

3.1 Data Set 1, 55 °C, 60mA (Lumen Maintenance)

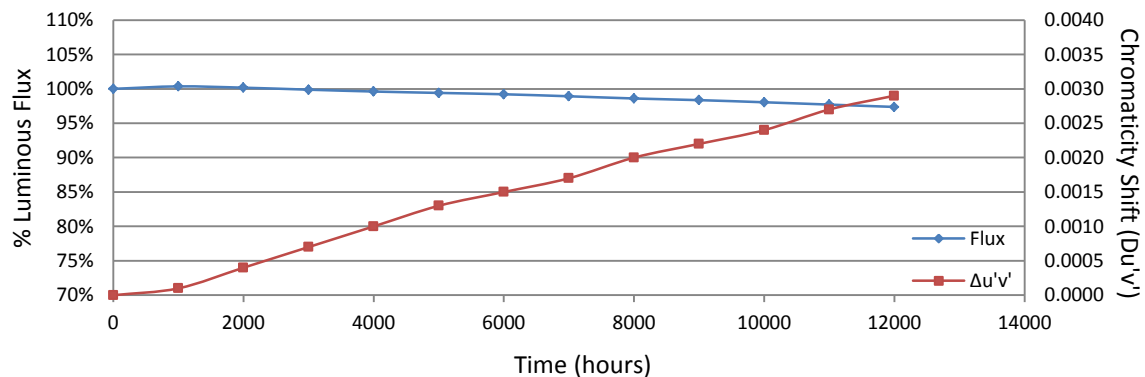
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)											
	Ohr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
1	2.900	26.95	100.33	100.19	99.81	99.70	99.48	99.37	99.00	98.66	98.48	98.40	97.92	97.66
2	2.900	27.37	100.29	100.11	99.93	99.63	99.38	99.16	98.87	98.47	98.28	97.77	97.37	96.75
3	2.900	27.01	100.30	99.93	99.63	99.19	99.07	98.82	98.74	98.59	98.33	98.07	97.74	97.56
4	2.900	27.01	100.15	99.85	99.52	99.22	99.04	98.85	98.74	98.48	98.15	97.89	97.56	97.00
5	2.900	27.28	100.37	100.22	99.96	99.52	99.38	99.23	98.83	98.68	98.42	98.06	97.69	97.43
6	2.898	26.34	100.42	100.23	100.04	99.96	99.89	99.73	99.66	99.13	98.63	98.29	97.95	97.65
7	2.903	26.54	100.26	99.96	99.74	99.59	99.47	99.32	98.94	98.79	98.46	98.19	97.93	97.70
8	2.900	26.03	100.46	100.31	99.92	99.85	99.69	99.23	98.92	98.73	98.42	98.23	97.73	97.50
9	2.900	27.01	100.33	100.19	99.85	99.48	99.41	99.11	98.56	98.45	98.33	98.15	97.85	97.52
10	2.901	26.84	100.15	99.85	99.74	99.40	99.03	98.96	98.77	98.62	98.47	98.10	97.80	97.35
11	2.903	26.58	100.23	100.08	99.96	99.62	99.36	99.29	99.06	98.57	98.42	98.08	97.67	97.37
12	2.906	26.97	100.41	100.26	99.96	99.89	99.52	99.26	99.00	98.48	98.26	98.11	97.66	97.40
13	2.898	26.54	100.49	100.34	99.96	99.85	99.70	99.43	99.06	98.53	98.38	98.12	97.78	97.40
14	2.902	27.49	100.40	100.25	99.89	99.60	99.56	99.31	98.98	98.47	98.29	97.96	97.85	97.45
15	2.897	27.13	100.44	100.22	100.04	99.78	99.56	99.34	98.86	98.71	98.49	97.97	97.49	97.09
16	2.900	26.78	100.34	100.26	99.89	99.55	99.33	99.22	98.99	98.47	98.32	98.10	97.68	97.46
17	2.901	26.04	100.50	100.35	99.96	99.62	99.23	99.19	99.00	98.46	98.39	97.73	97.39	97.04
18	2.906	27.01	100.41	100.11	99.85	99.48	99.07	98.89	98.70	98.56	98.30	97.85	97.56	97.22
19	2.901	26.94	100.52	100.37	100.04	99.67	99.63	99.26	98.96	98.44	97.96	97.74	97.70	97.48
20	2.896	26.67	100.41	100.26	99.93	99.59	99.33	99.18	98.80	98.65	98.35	98.20	97.86	97.38
Ave.	2.901	26.83	100.36	100.17	99.88	99.61	99.41	99.21	98.92	98.60	98.36	98.05	97.71	97.37
Med.	2.900	26.95	100.38	100.22	99.92	99.61	99.39	99.23	98.93	98.56	98.37	98.09	97.72	97.42
st dev	0.003	0.39	0.1072	0.1592	0.1365	0.2018	0.2363	0.2133	0.2187	0.1644	0.1403	0.1833	0.1697	0.2417
Min.	2.896	26.03	100.15	99.85	99.52	99.19	99.03	98.82	98.56	98.44	97.96	97.73	97.37	96.75
Max.	2.906	27.49	100.52	100.37	100.04	99.96	99.89	99.73	99.66	99.13	98.63	98.40	97.95	97.70

TM-21 Projection:

Test Duration: 12000 hours
Failures Observed: 0
 α : 3.085E-06
 β : 1.011
Reported L₇₀: >72,000 hours

3.2 Data Set 1, 55 ℃, 60mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)											
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
1	0.2526	0.5292	2908	0.0000	0.0002	0.0008	0.0010	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027
2	0.2515	0.5269	2945	0.0001	0.0005	0.0008	0.0010	0.0014	0.0017	0.0020	0.0023	0.0026	0.0029	0.0032	0.0035
3	0.2525	0.5306	2901	0.0001	0.0003	0.0007	0.0009	0.0012	0.0015	0.0018	0.0021	0.0024	0.0027	0.0030	0.0033
4	0.2519	0.5301	2917	0.0001	0.0001	0.0006	0.0008	0.0011	0.0014	0.0017	0.0021	0.0024	0.0027	0.0030	0.0033
5	0.2513	0.5283	2940	0.0001	0.0002	0.0007	0.0009	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027
6	0.2507	0.5275	2960	0.0000	0.0002	0.0007	0.0010	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027
7	0.2537	0.5296	2879	0.0001	0.0004	0.0009	0.0010	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027
8	0.2520	0.5318	2907	0.0001	0.0003	0.0009	0.0010	0.0013	0.0016	0.0019	0.0023	0.0026	0.0029	0.0032	0.0035
9	0.2514	0.5283	2939	0.0001	0.0003	0.0007	0.0010	0.0012	0.0015	0.0018	0.0021	0.0024	0.0027	0.0030	0.0033
10	0.2540	0.5296	2872	0.0000	0.0002	0.0007	0.0010	0.0013	0.0015	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026
11	0.2536	0.5312	2873	0.0002	0.0001	0.0007	0.0009	0.0014	0.0014	0.0014	0.0014	0.0014	0.0015	0.0016	0.0017
12	0.2509	0.5305	2938	0.0003	0.0006	0.0007	0.0008	0.0012	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026
13	0.2542	0.5274	2881	0.0002	0.0005	0.0008	0.0010	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027
14	0.2519	0.5293	2923	0.0002	0.0005	0.0008	0.0010	0.0013	0.0016	0.0019	0.0024	0.0029	0.0032	0.0034	0.0037
15	0.2519	0.5309	2912	0.0001	0.0004	0.0008	0.0010	0.0012	0.0015	0.0018	0.0021	0.0024	0.0027	0.0030	0.0033
16	0.2534	0.5302	2884	0.0002	0.0005	0.0006	0.0009	0.0012	0.0015	0.0018	0.0021	0.0024	0.0027	0.0030	0.0033
17	0.2543	0.5268	2881	0.0001	0.0005	0.0007	0.0010	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028
18	0.2507	0.5268	2963	0.0002	0.0003	0.0006	0.0009	0.0013	0.0014	0.0015	0.0016	0.0017	0.0018	0.0019	0.0020
19	0.2522	0.5294	2916	0.0002	0.0005	0.0008	0.0012	0.0015	0.0015	0.0016	0.0017	0.0018	0.0020	0.0022	0.0023
20	0.2520	0.5263	2936	0.0002	0.0005	0.0006	0.0010	0.0012	0.0016	0.0019	0.0023	0.0026	0.0027	0.0028	0.0029
Ave.	0.2523	0.5290	2914	0.0001	0.0004	0.0007	0.0010	0.0013	0.0015	0.0017	0.0020	0.0022	0.0024	0.0027	0.0029
Med.	0.2520	0.5294	2914	0.0001	0.0004	0.0007	0.0010	0.0013	0.0015	0.0017	0.0020	0.0022	0.0024	0.0026	0.0028
st dev	0.0012	0.0017	29	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0005
Min.	0.2507	0.5263	2872	0.0000	0.0001	0.0006	0.0008	0.0011	0.0014	0.0014	0.0014	0.0014	0.0015	0.0016	0.0017
Max.	0.2543	0.5318	2963	0.0003	0.0006	0.0009	0.0012	0.0015	0.0017	0.0020	0.0024	0.0029	0.0032	0.0034	0.0037



3.3 Data Set 2, 85 °C, 60mA (Lumen Maintenance)

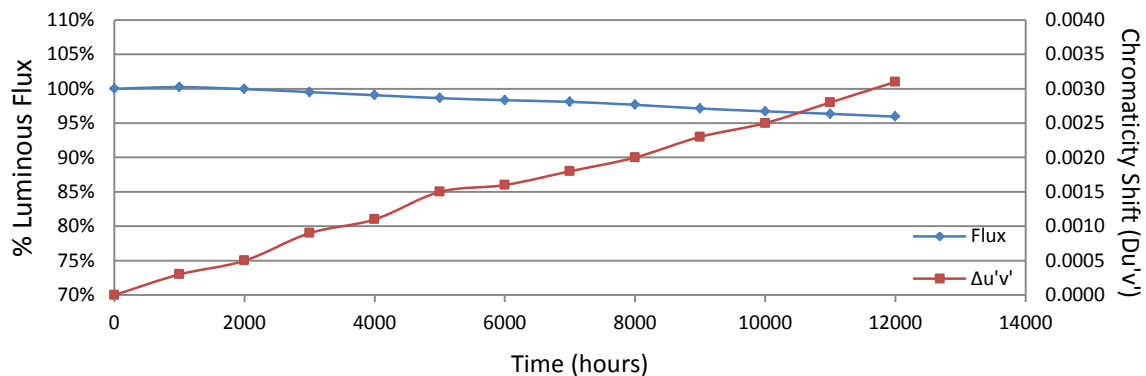
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)											
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
21	2.903	26.70	100.19	99.93	99.48	99.21	98.84	98.58	98.16	97.72	97.23	96.78	96.18	95.77
22	2.929	26.53	100.08	99.77	99.36	98.94	98.64	98.15	98.00	97.89	97.29	96.98	96.91	96.42
23	2.905	26.99	100.33	100.04	99.56	99.26	98.70	98.44	98.22	97.96	97.30	96.63	96.33	95.70
24	2.901	26.72	100.22	99.89	99.44	99.06	98.69	98.32	97.98	97.94	97.27	96.97	96.89	96.67
25	2.900	27.22	100.26	99.96	99.45	99.04	98.57	98.24	97.87	97.83	97.32	96.95	96.44	96.11
26	2.897	27.28	100.44	100.15	99.78	99.52	98.90	98.64	98.42	97.80	97.14	96.85	96.63	96.19
27	2.900	27.38	100.29	99.93	99.78	99.31	98.94	98.76	98.61	97.92	97.52	96.82	96.79	96.35
28	2.900	27.09	100.33	100.07	99.63	99.19	98.63	98.49	98.38	97.75	97.08	96.64	96.57	96.46
29	2.901	26.52	100.30	99.92	99.47	98.98	98.49	98.23	98.00	97.74	97.06	96.72	96.30	95.97
30	2.905	27.45	100.22	99.85	99.34	98.83	98.54	98.47	98.29	97.81	97.19	96.72	96.10	95.81
31	2.905	27.65	100.25	100.04	99.42	98.88	98.59	98.26	98.12	97.87	97.22	96.60	96.20	95.70
32	2.900	27.14	100.22	99.93	99.56	99.04	98.64	98.19	97.90	97.53	96.98	96.57	96.50	96.02
33	2.902	27.61	100.29	99.96	99.53	99.09	98.52	98.26	97.83	97.43	96.92	96.67	96.16	95.87
34	2.909	27.31	100.26	99.96	99.49	99.23	98.61	98.35	98.10	97.51	97.00	96.74	96.34	95.94
35	2.905	27.29	100.48	100.18	99.74	99.19	98.79	98.35	98.17	97.51	96.89	96.23	96.08	95.79
36	2.900	26.50	100.08	99.89	99.43	98.79	98.49	98.23	97.89	97.36	96.94	96.57	95.92	95.58
37	2.905	27.16	100.04	99.74	99.34	98.93	98.56	98.20	97.94	97.46	97.02	96.80	96.13	95.69
38	2.906	26.93	100.26	99.96	99.52	98.96	98.70	98.25	98.11	97.59	97.18	96.81	96.14	95.47
39	2.900	27.23	100.22	99.93	99.49	99.01	98.46	98.05	97.83	97.36	96.92	96.66	96.11	95.56
40	2.917	26.62	100.04	99.81	99.32	98.69	98.38	98.12	97.90	97.26	96.96	96.73	96.36	95.76
Ave.	2.905	27.07	100.24	99.95	99.51	99.06	98.63	98.33	98.09	97.66	97.12	96.72	96.35	95.94
Med.	2.903	27.15	100.25	99.93	99.48	99.04	98.62	98.26	98.05	97.73	97.11	96.73	96.32	95.84
st dev	0.007	0.36	0.1178	0.1117	0.1378	0.1984	0.1474	0.1825	0.2157	0.2211	0.1704	0.1708	0.2817	0.3301
Min.	2.897	26.50	100.04	99.74	99.32	98.69	98.38	98.05	97.83	97.26	96.89	96.23	95.92	95.47
Max.	2.929	27.65	100.48	100.18	99.78	99.52	98.94	98.76	98.61	97.96	97.52	96.98	96.91	96.67

TM-21 Projection:

Test Duration: 12000 hours
Failures Observed: 0
 α : 4.260E-06
 β : 1.010
Reported L₇₀: >72,000 hours

3.4 Data Set 2, 85 ℃, 60mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)											
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
21	0.2533	0.5306	2884	0.0003	0.0005	0.0007	0.0010	0.0013	0.0016	0.0019	0.0022	0.0025	0.0028	0.0031	0.0034
22	0.2536	0.5294	2883	0.0003	0.0006	0.0008	0.0011	0.0013	0.0016	0.0019	0.0022	0.0025	0.0028	0.0031	0.0034
23	0.2515	0.5286	2935	0.0004	0.0005	0.0008	0.0010	0.0016	0.0017	0.0019	0.0021	0.0023	0.0025	0.0028	0.0030
24	0.2527	0.5297	2902	0.0003	0.0006	0.0008	0.0011	0.0015	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028
25	0.2525	0.5285	2913	0.0003	0.0005	0.0008	0.0011	0.0014	0.0015	0.0017	0.0019	0.0021	0.0024	0.0026	0.0029
26	0.2517	0.5307	2918	0.0002	0.0004	0.0007	0.0011	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028
27	0.2522	0.5297	2914	0.0002	0.0005	0.0009	0.0012	0.0016	0.0016	0.0017	0.0018	0.0020	0.0022	0.0024	0.0026
28	0.2533	0.5280	2896	0.0002	0.0005	0.0009	0.0011	0.0016	0.0016	0.0017	0.0018	0.0021	0.0024	0.0027	0.0030
29	0.2533	0.5296	2890	0.0003	0.0006	0.0011	0.0013	0.0016	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027	0.0029
30	0.2522	0.5306	2909	0.0004	0.0005	0.0008	0.0012	0.0015	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028
31	0.2511	0.5302	2935	0.0004	0.0006	0.0009	0.0013	0.0016	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027	0.0029
32	0.2511	0.5295	2939	0.0002	0.0005	0.0008	0.0010	0.0014	0.0015	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027
33	0.2526	0.5295	2905	0.0002	0.0004	0.0006	0.0010	0.0014	0.0015	0.0017	0.0019	0.0026	0.0028	0.0030	0.0032
34	0.2505	0.5279	2962	0.0002	0.0004	0.0007	0.0011	0.0015	0.0015	0.0016	0.0017	0.0023	0.0029	0.0035	0.0041
35	0.2526	0.5297	2905	0.0002	0.0005	0.0008	0.0011	0.0014	0.0014	0.0015	0.0016	0.0022	0.0028	0.0034	0.0040
36	0.2515	0.5266	2946	0.0002	0.0004	0.0010	0.0011	0.0014	0.0015	0.0016	0.0017	0.0021	0.0026	0.0031	0.0037
37	0.2524	0.5287	2915	0.0004	0.0005	0.0010	0.0012	0.0014	0.0016	0.0019	0.0022	0.0025	0.0028	0.0031	0.0034
38	0.2538	0.5282	2885	0.0003	0.0006	0.0010	0.0013	0.0016	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027	0.0029
39	0.2542	0.5281	2876	0.0003	0.0004	0.0009	0.0012	0.0016	0.0016	0.0017	0.0018	0.0019	0.0021	0.0022	0.0024
40	0.2530	0.5292	2897	0.0005	0.0005	0.0010	0.0012	0.0015	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028
Ave.	0.2525	0.5292	2910	0.0003	0.0005	0.0009	0.0011	0.0015	0.0016	0.0018	0.0020	0.0023	0.0025	0.0028	0.0031
Med.	0.2526	0.5295	2907	0.0003	0.0005	0.0008	0.0011	0.0015	0.0016	0.0018	0.0020	0.0022	0.0025	0.0027	0.0029
st dev	0.0010	0.0011	23	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0003	0.0005
Min.	0.2505	0.5266	2876	0.0002	0.0004	0.0006	0.0010	0.0013	0.0014	0.0015	0.0016	0.0019	0.0021	0.0022	0.0024
Max.	0.2542	0.5307	2962	0.0005	0.0006	0.0011	0.0013	0.0016	0.0017	0.0019	0.0022	0.0026	0.0029	0.0035	0.0041



3.5 Data Set 3, 105 °C, 60mA (Lumen Maintenance)

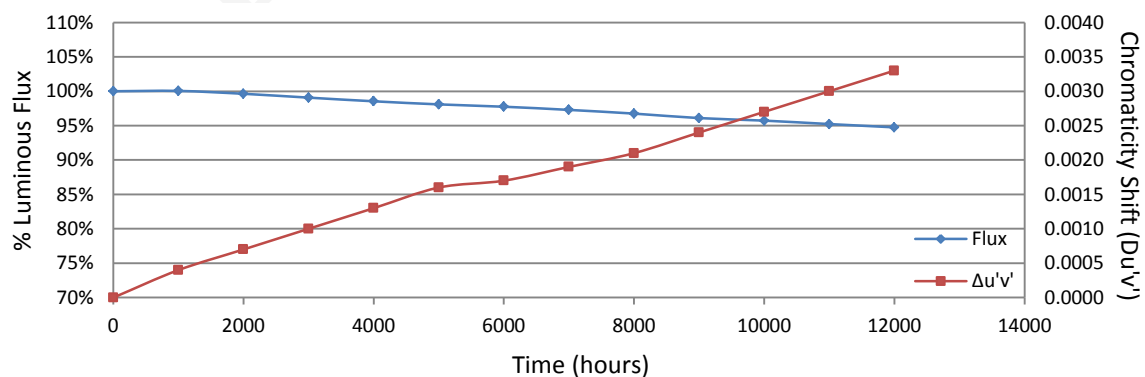
No.	V _f (V)	Φ(lm)	Lumen Maintenance (%)											
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
41	2.901	26.93	100.04	99.63	99.11	98.59	98.22	97.99	97.55	96.92	96.32	95.92	95.58	95.14
42	2.901	27.00	100.30	99.85	99.26	98.78	98.11	97.74	97.33	96.93	96.26	96.11	95.81	95.11
43	2.899	27.14	100.07	99.67	99.12	98.71	98.42	98.01	97.49	96.87	96.13	95.84	95.36	94.80
44	2.905	27.02	100.11	99.70	99.15	98.59	98.30	97.78	97.52	96.89	96.15	95.63	95.11	94.45
45	2.902	26.74	100.04	99.55	99.07	98.54	98.09	97.68	97.34	96.71	96.04	95.74	95.21	94.80
46	2.902	27.22	100.11	99.71	99.16	98.64	98.24	97.87	97.28	96.66	96.11	95.89	95.22	94.60
47	2.934	26.35	99.96	99.54	98.98	98.44	98.29	97.91	97.42	97.15	96.55	96.24	95.98	95.29
48	2.901	27.02	99.85	99.44	98.89	98.41	98.00	97.71	97.34	96.71	96.04	95.67	95.08	94.63
49	2.901	27.44	100.07	99.67	99.13	98.62	98.18	97.81	97.16	96.61	95.92	95.77	95.30	94.75
50	2.900	26.18	100.08	99.66	99.08	98.55	97.82	97.40	96.94	96.79	96.07	95.65	95.34	94.77
51	2.911	26.55	100.11	99.62	99.17	98.49	98.04	97.66	97.06	96.80	96.20	95.86	95.22	94.61
52	2.896	26.61	100.04	99.59	99.02	98.50	98.05	97.71	97.37	96.73	96.05	95.68	95.04	94.40
53	2.899	27.71	99.93	99.53	99.03	98.56	97.91	97.65	97.40	96.79	96.21	95.78	94.98	94.73
54	2.906	27.26	100.07	99.67	99.05	98.46	97.91	97.73	97.14	96.77	96.15	95.74	95.23	94.68
55	2.901	26.60	100.11	99.62	99.06	98.50	98.08	97.63	97.26	96.77	96.13	95.56	95.23	94.92
56	2.900	27.28	100.07	99.71	99.01	98.53	97.91	97.69	97.21	96.59	95.93	95.42	95.16	94.87
57	2.901	27.34	100.04	99.63	99.09	98.46	98.28	97.77	97.22	96.60	95.98	95.46	94.92	94.62
58	2.901	27.65	99.96	99.57	99.02	98.41	98.01	97.94	97.43	96.64	96.06	95.62	94.97	94.50
59	2.902	27.14	99.93	99.52	98.97	98.45	98.01	97.64	97.05	96.43	95.69	95.39	95.03	94.77
60	2.901	27.68	100.04	99.64	99.02	98.52	97.90	97.69	97.29	96.68	96.03	95.56	94.76	94.47
Ave.	2.903	27.04	100.05	99.63	99.07	98.54	98.09	97.75	97.29	96.75	96.10	95.73	95.23	94.75
Med.	2.901	27.08	100.06	99.63	99.06	98.53	98.06	97.72	97.31	96.75	96.09	95.71	95.21	94.74
st dev	0.008	0.43	0.0929	0.0880	0.0830	0.0965	0.1625	0.1430	0.1630	0.1566	0.1727	0.2141	0.2921	0.2354
Min.	2.896	26.18	99.85	99.44	98.89	98.41	97.82	97.40	96.94	96.43	95.69	95.39	94.76	94.40
Max.	2.934	27.71	100.30	99.85	99.26	98.78	98.42	98.01	97.55	97.15	96.55	96.24	95.98	95.29

TM-21 Projection:

Test Duration: 12000 hours
Failures Observed: 0
 α : 5.247E-06
 β : 1.009
Reported L₇₀: 70,000 hours

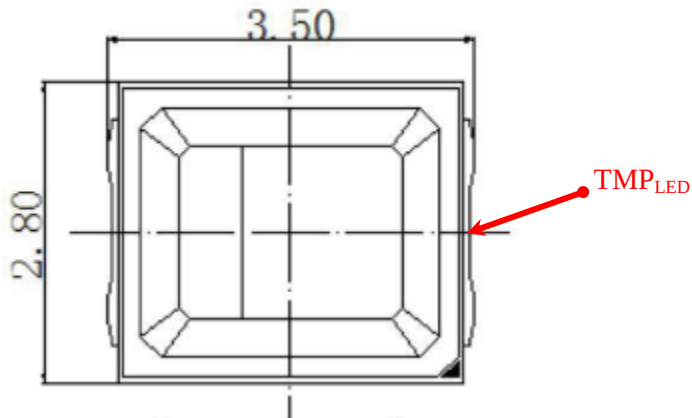
3.6 Data Set 3, 105 ℃, 60mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)											
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
41	0.2524	0.5310	2903	0.0004	0.0006	0.0010	0.0014	0.0016	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027	0.0029
42	0.2523	0.5279	2921	0.0004	0.0008	0.0010	0.0013	0.0015	0.0015	0.0016	0.0017	0.0022	0.0027	0.0032	0.0037
43	0.2527	0.5299	2901	0.0002	0.0006	0.0009	0.0012	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028
44	0.2522	0.5283	2921	0.0002	0.0006	0.0010	0.0012	0.0016	0.0018	0.0021	0.0024	0.0027	0.0030	0.0033	0.0036
45	0.2533	0.5288	2893	0.0002	0.0004	0.0008	0.0012	0.0014	0.0015	0.0016	0.0017	0.0022	0.0027	0.0031	0.0036
46	0.2533	0.5304	2885	0.0006	0.0006	0.0010	0.0013	0.0016	0.0017	0.0018	0.0019	0.0021	0.0024	0.0027	0.0030
47	0.2531	0.5277	2904	0.0006	0.0009	0.0013	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028	0.0030	0.0032
48	0.2539	0.5305	2871	0.0005	0.0008	0.0012	0.0014	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027	0.0029	0.0031
49	0.2509	0.5278	2955	0.0005	0.0008	0.0011	0.0013	0.0016	0.0017	0.0018	0.0019	0.0023	0.0028	0.0032	0.0037
50	0.2520	0.5275	2929	0.0003	0.0007	0.0010	0.0014	0.0015	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027	0.0029
51	0.2514	0.5268	2947	0.0003	0.0006	0.0009	0.0013	0.0016	0.0017	0.0018	0.0019	0.0022	0.0025	0.0028	0.0033
52	0.2529	0.5283	2904	0.0005	0.0009	0.0012	0.0014	0.0016	0.0019	0.0021	0.0023	0.0025	0.0028	0.0030	0.0032
53	0.2518	0.5313	2913	0.0003	0.0006	0.0009	0.0012	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028
54	0.2508	0.5280	2955	0.0004	0.0007	0.0010	0.0014	0.0015	0.0017	0.0020	0.0022	0.0024	0.0026	0.0028	0.0031
55	0.2533	0.5302	2886	0.0003	0.0007	0.0010	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027	0.0029
56	0.2526	0.5290	2907	0.0004	0.0007	0.0010	0.0012	0.0015	0.0017	0.0019	0.0021	0.0025	0.0029	0.0034	0.0038
57	0.2536	0.5294	2884	0.0003	0.0008	0.0011	0.0014	0.0016	0.0017	0.0018	0.0019	0.0025	0.0031	0.0034	0.0036
58	0.2511	0.5285	2945	0.0004	0.0007	0.0011	0.0012	0.0016	0.0017	0.0018	0.0019	0.0021	0.0023	0.0026	0.0029
59	0.2538	0.5297	2877	0.0005	0.0007	0.0010	0.0014	0.0016	0.0017	0.0019	0.0021	0.0027	0.0030	0.0032	0.0034
60	0.2528	0.5287	2904	0.0004	0.0007	0.0009	0.0012	0.0016	0.0016	0.0017	0.0018	0.0024	0.0030	0.0036	0.0042
Ave.	0.2525	0.5290	2910	0.0004	0.0007	0.0010	0.0013	0.0016	0.0017	0.0019	0.0021	0.0024	0.0027	0.0030	0.0033
Med.	0.2527	0.5288	2904	0.0004	0.0007	0.0010	0.0013	0.0016	0.0017	0.0019	0.0021	0.0023	0.0027	0.0030	0.0032
st dev	0.0009	0.0013	25	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0004
Min.	0.2508	0.5268	2871	0.0002	0.0004	0.0008	0.0012	0.0014	0.0015	0.0016	0.0017	0.0021	0.0023	0.0026	0.0028
Max.	0.2539	0.5313	2955	0.0006	0.0009	0.0013	0.0016	0.0018	0.0020	0.0022	0.0024	0.0027	0.0031	0.0036	0.0042



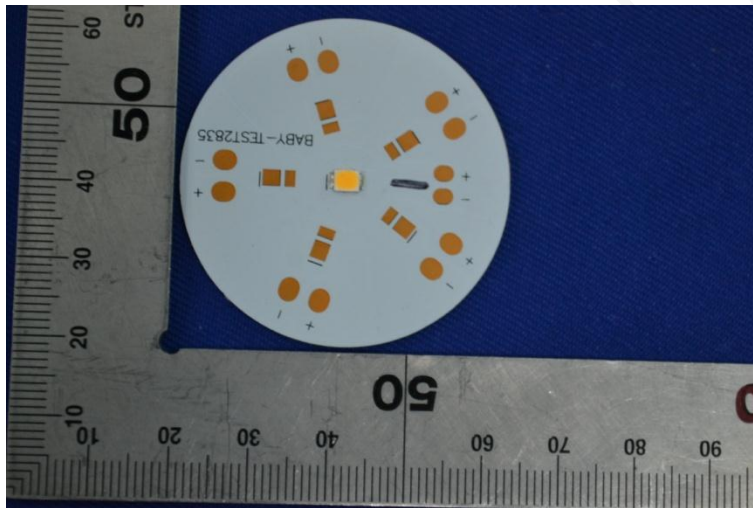
Attachment A – EUT Photo

A.1 Mechanical Dimensions (Ta = 25 °C)



All dimensions are in millimeter

A.2 EUT Photo



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