



TEST REPORT

According to ANSI/IES LM-80-15
For

Bridgelux Inc.

46430 Fremont Boulevard , Fremont ,CA 94538 USA

Model: BXEN-27E-11M-39A

Report Type: 10000 Hours Test Report		Product Type: LED Package	
Test Engineer:	Pote Wang	<i>Pote Wang</i>	
Report Number:	R2XM190402062-10		
Test Date:	2018-01-30 to 2019-04-17		
Report Date:	2019-04-29		
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 2018-01-28. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Manufacturer:	Bridgelux Inc.
Part Number:	BXEN-27E-11M-39A
Part Type:	LED Package
Drive Level:	DC 120mA
Nominal CCT:	2700K
Power:	0.37W
Average Current Density per LED die:	430mA/mm ²
Average Power Density per LED die:	1.326W/mm ²
CRI:	80
Die Spacing:	N/A

Sampling Method:

LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.

These manufacturing lots are picked to represent a wide parametric distribution.

Family products covered by this report:

According to *ENERGY STAR® Requirements for the Use of LM-80 Data*, the following products can be covered by this report base on the information and declaration provided by manufacturer. The information of these models shows that the covered products meet all section 4 requirements of *ENERGY STAR® Requirements for the Use of LM-80 Data* (September 28, 2017)

This report covers the following models:

Model Name	Total Input Current (mA)	Power (W)	CCT (K)	CRI	Number of dies	Driver current per die (mA)	Current Density per Die (mA/mm ²)	Power Density per PCB (W/mm ²)	Die Spacing (mm)
BXEN-27E-11M-39A(Tested)	120	0.37	2700	80	1	120	430	0.0378	N/A
BXEN-(A)(B)-(C)(D)(E)-(F)(G)	120	0.37	≥2200	80	1	120	430	0.0378	N/A

Identifiers Information (if any):

BXEN-(A)(B)-(C)(D)(E)-(F)(G)

BXEN: Designates product family

(A) CCT Variation, can be 22-65 for 2200K~6500K;

(B) CRI

(C) Parallel connected variation, can be 1~9(total chip number is less than 9)

(D) Series connected variation, can be 1~9(total chip number is less than 9)

(E) Power

(F) Voltage

(G) Customer code, can be 0~ZZ

Note:

- The applicant Bridgelux Inc. declare that their products with model BXEN-27E-11M-39A are the same to the products in report # R2XM180128060-10 and is authorized by original applicant to use their test data.
- All the data in previous report (R2XM180128060-10) 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
0.5m integrating sphere	EVERFINE	AIS-2	G185304TA1381172	2018-06-28	2019-06-28
LED Test Source	EVERFINE	LTS-300	P185616CD1371113	2018-06-28	2019-06-28
High Accuracy Array Spectroradiometer	EVERFINE	HAAS-2000	P600674CM1381123	2018-06-28	2019-06-28
Standard Light Source	EVERFINE	D062	G100278CJ7351206	2018-12-24	2019-12-24
Multilayer aging machine	BACL	B2-270	20022	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 $2^{\circ}C$ below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to $5^{\circ}C$ below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within $\pm 3\%$ of the specified value of the manufacturer.

The relative humidity within chamber was kept less than 65% during test.

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

1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate $u'v'$. 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 $25^{\circ}C \pm 2^{\circ}C$, RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

The uncertainty of the light output measurements is $U=1.59\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is $U=21K$ ($K=2$), at the 95% confidence level.

The uncertainty of the temperature is $U=0.8671^{\circ}C$ ($K=2$), at the 95% confidence level.

1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.8 Sample Set

Data Set 1: 55°C, 120mA

Part Number: BXEN-27E-11M-39A
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: BXEN-27E-11M-39A
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: BXEN-27E-11M-39A
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	Reported TM-21 L ₉₀ Lifetime
1	25	0	1000hrs	10000hrs	1.845E-06	1.005	>60000hours	>60000hours
2	25	0	1000hrs	10000hrs	2.379E-06	1.004	>60000hours	46,000hours
3	25	0	1000hrs	10000hrs	2.882E-06	1.004	>60000hours	38,000hours

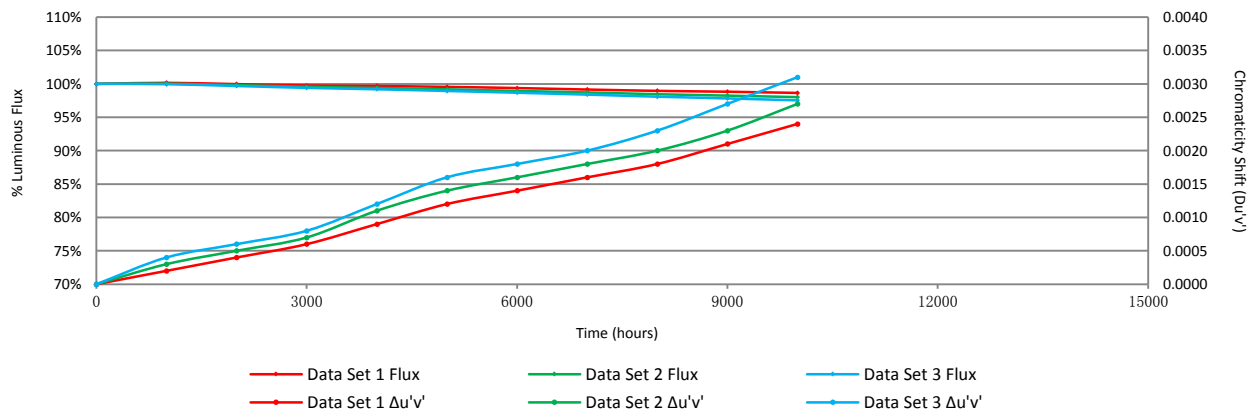
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	100.15%	99.96%	99.76%	99.68%	99.55%	99.37%	99.15%	98.95%	98.82%	98.64%
2	100.03%	99.81%	99.56%	99.39%	99.18%	98.94%	98.71%	98.45%	98.24%	98.01%
3	99.95%	99.68%	99.40%	99.19%	98.94%	98.67%	98.39%	98.08%	97.82%	97.53%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.0002	0.0004	0.0006	0.0009	0.0012	0.0014	0.0016	0.0018	0.0021	0.0024
2	0.0003	0.0005	0.0007	0.0011	0.0014	0.0016	0.0018	0.0020	0.0023	0.0027
3	0.0004	0.0006	0.0008	0.0012	0.0016	0.0018	0.0020	0.0023	0.0027	0.0031

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	56.70	100.14	99.95	99.79	99.61	99.47	99.21	98.99	98.85	98.77	98.55
2	55.26	100.33	100.14	99.93	99.80	99.66	99.49	99.26	99.11	99.02	98.81
3	54.75	100.26	100.18	99.96	99.85	99.73	99.49	99.29	99.14	99.07	98.89
4	54.60	100.22	99.96	99.78	99.74	99.65	99.52	99.18	98.94	98.77	98.63
5	56.29	100.14	99.86	99.70	99.61	99.56	99.43	99.15	98.95	98.79	98.56
6	55.86	100.13	100.02	99.82	99.79	99.64	99.43	99.21	98.93	98.85	98.73
7	55.22	100.09	99.87	99.60	99.53	99.46	99.20	99.06	98.91	98.80	98.50
8	54.89	100.15	100.02	99.85	99.78	99.73	99.58	99.40	99.20	99.03	98.85
9	55.23	100.22	100.05	99.87	99.80	99.60	99.37	99.09	98.90	98.77	98.59
10	57.17	100.21	100.05	99.90	99.77	99.62	99.39	99.23	99.09	98.99	98.85
11	54.27	100.20	99.98	99.69	99.61	99.47	99.37	99.12	98.91	98.80	98.71
12	55.42	99.93	99.73	99.53	99.46	99.31	99.10	98.95	98.72	98.66	98.52
13	56.85	99.95	99.81	99.56	99.51	99.35	99.24	99.01	98.72	98.61	98.35
14	54.84	100.18	99.93	99.82	99.71	99.53	99.36	99.16	98.98	98.91	98.69
15	54.25	100.20	100.04	99.87	99.85	99.76	99.61	99.50	99.26	99.13	98.91
16	55.84	100.16	99.95	99.70	99.62	99.46	99.25	98.94	98.73	98.57	98.37
17	54.57	100.24	100.07	99.74	99.65	99.56	99.43	99.25	99.07	98.83	98.61
18	55.54	100.11	99.96	99.78	99.60	99.51	99.37	99.24	99.10	99.05	98.78
19	55.40	100.14	99.98	99.82	99.77	99.53	99.37	99.15	98.95	98.81	98.68
20	56.06	99.93	99.73	99.39	99.38	99.20	98.95	98.68	98.39	98.22	98.02
21	54.90	100.24	100.13	99.98	99.91	99.73	99.54	99.40	99.27	99.07	98.91
22	55.35	100.27	100.16	99.93	99.82	99.71	99.58	99.24	99.10	98.97	98.88
23	55.87	100.07	99.95	99.82	99.80	99.61	99.48	99.32	99.05	98.78	98.64
24	53.78	100.17	99.87	99.72	99.61	99.55	99.31	99.13	98.85	98.79	98.61
25	55.08	99.96	99.67	99.47	99.44	99.33	99.16	98.89	98.62	98.42	98.28
Avg.	55.36	100.15	99.96	99.76	99.68	99.55	99.37	99.15	98.95	98.82	98.64
Med.	55.26	100.16	99.96	99.79	99.71	99.56	99.37	99.16	98.95	98.80	98.64
st dev	0.84	0.11	0.13	0.15	0.14	0.15	0.16	0.18	0.21	0.21	0.22
Min.	53.78	99.93	99.67	99.39	99.38	99.20	98.95	98.68	98.39	98.22	98.02
Max.	57.17	100.33	100.18	99.98	99.91	99.76	99.61	99.50	99.27	99.13	98.91

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

No.	Forward Voltage (V)										
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	3.124	3.122	3.127	3.121	3.122	3.122	3.123	3.124	3.120	3.122	3.120
2	3.119	3.120	3.119	3.117	3.116	3.117	3.119	3.120	3.116	3.119	3.117
3	3.127	3.126	3.127	3.124	3.127	3.123	3.129	3.134	3.125	3.126	3.126
4	3.135	3.135	3.136	3.132	3.131	3.131	3.135	3.133	3.130	3.135	3.131
5	3.137	3.141	3.137	3.138	3.135	3.136	3.140	3.141	3.134	3.138	3.136
6	3.125	3.128	3.124	3.124	3.121	3.124	3.129	3.129	3.120	3.124	3.123
7	3.130	3.131	3.129	3.130	3.128	3.126	3.132	3.141	3.126	3.131	3.128
8	3.126	3.126	3.124	3.124	3.127	3.125	3.165	3.133	3.124	3.126	3.123
9	3.124	3.126	3.127	3.126	3.124	3.125	3.130	3.143	3.123	3.126	3.125
10	3.113	3.116	3.119	3.113	3.116	3.116	3.117	3.150	3.113	3.118	3.113
11	3.155	3.153	3.154	3.156	3.155	3.157	3.155	3.155	3.158	3.156	3.154
12	3.158	3.160	3.162	3.159	3.158	3.160	3.161	3.158	3.156	3.159	3.159
13	3.107	3.113	3.112	3.112	3.113	3.111	3.110	3.113	3.109	3.110	3.109
14	3.121	3.120	3.121	3.119	3.118	3.119	3.122	3.122	3.122	3.119	3.119
15	3.112	3.110	3.110	3.112	3.111	3.110	3.111	3.110	3.109	3.108	3.111
16	3.138	3.137	3.136	3.134	3.134	3.135	3.135	3.136	3.135	3.135	3.135
17	3.109	3.110	3.108	3.108	3.106	3.108	3.107	3.105	3.106	3.106	3.109
18	3.118	3.119	3.117	3.116	3.117	3.117	3.118	3.119	3.116	3.115	3.117
19	3.144	3.142	3.141	3.145	3.142	3.145	3.146	3.145	3.142	3.143	3.141
20	3.126	3.125	3.124	3.124	3.122	3.124	3.124	3.126	3.124	3.124	3.122
21	3.154	3.139	3.137	3.139	3.135	3.139	3.137	3.138	3.138	3.135	3.143
22	3.150	3.152	3.152	3.150	3.151	3.151	3.152	3.150	3.150	3.150	3.148
23	3.111	3.113	3.110	3.108	3.106	3.111	3.112	3.112	3.109	3.106	3.108
24	3.144	3.146	3.146	3.145	3.145	3.145	3.145	3.145	3.143	3.144	3.143
25	3.120	3.119	3.119	3.118	3.117	3.118	3.123	3.119	3.119	3.117	3.119
Avg.	3.129	3.129	3.129	3.128	3.127	3.128	3.131	3.132	3.127	3.128	3.127
Med.	3.126	3.126	3.127	3.124	3.124	3.124	3.129	3.133	3.124	3.126	3.123
st dev	0.015	0.014	0.014	0.015	0.014	0.015	0.016	0.015	0.015	0.015	0.014
Min.	3.107	3.110	3.108	3.108	3.106	3.108	3.107	3.105	3.106	3.106	3.108
Max.	3.158	3.160	3.162	3.159	3.158	3.160	3.165	3.158	3.158	3.159	3.159

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
1	0.2610	0.5254	2740	0.0001	0.0004	0.0006	0.0008	0.0010	0.0013	0.0014	0.0016	0.0019	0.0023
2	0.2619	0.5261	2718	0.0001	0.0003	0.0006	0.0010	0.0011	0.0013	0.0014	0.0017	0.0019	0.0023
3	0.2629	0.5244	2704	0.0002	0.0004	0.0007	0.0010	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023
4	0.2602	0.5257	2757	0.0003	0.0006	0.0009	0.0011	0.0014	0.0015	0.0017	0.0019	0.0023	0.0025
5	0.2620	0.5245	2721	0.0003	0.0006	0.0007	0.0010	0.0015	0.0017	0.0020	0.0022	0.0026	0.0027
6	0.2618	0.5247	2725	0.0002	0.0004	0.0007	0.0010	0.0013	0.0014	0.0016	0.0019	0.0023	0.0026
7	0.2605	0.5232	2760	0.0002	0.0003	0.0006	0.0007	0.0012	0.0013	0.0014	0.0016	0.0020	0.0023
8	0.2615	0.5266	2724	0.0001	0.0002	0.0004	0.0006	0.0009	0.0011	0.0013	0.0014	0.0017	0.0022
9	0.2612	0.5265	2730	0.0001	0.0002	0.0004	0.0004	0.0008	0.0009	0.0010	0.0013	0.0015	0.0020
10	0.2605	0.5249	2753	0.0001	0.0003	0.0006	0.0009	0.0010	0.0013	0.0014	0.0016	0.0017	0.0019
11	0.2607	0.5223	2759	0.0001	0.0003	0.0004	0.0007	0.0010	0.0013	0.0015	0.0018	0.0020	0.0021
12	0.2618	0.5263	2718	0.0003	0.0004	0.0005	0.0006	0.0008	0.0011	0.0013	0.0014	0.0020	0.0025
13	0.2605	0.5256	2750	0.0003	0.0005	0.0006	0.0007	0.0009	0.0010	0.0012	0.0014	0.0016	0.0021
14	0.2623	0.5235	2719	0.0003	0.0005	0.0008	0.0012	0.0012	0.0015	0.0017	0.0019	0.0020	0.0021
15	0.2619	0.5242	2727	0.0001	0.0003	0.0006	0.0011	0.0016	0.0019	0.0021	0.0024	0.0028	0.0029
16	0.2619	0.5248	2723	0.0003	0.0006	0.0008	0.0012	0.0017	0.0019	0.0021	0.0023	0.0028	0.0029
17	0.2632	0.5252	2695	0.0001	0.0002	0.0004	0.0005	0.0013	0.0016	0.0018	0.0021	0.0027	0.0031
18	0.2626	0.5274	2697	0.0003	0.0005	0.0007	0.0008	0.0009	0.0011	0.0012	0.0014	0.0019	0.0026
19	0.2624	0.5247	2714	0.0002	0.0003	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014	0.0016	0.0023
20	0.2609	0.5236	2750	0.0002	0.0004	0.0006	0.0006	0.0007	0.0009	0.0012	0.0014	0.0018	0.0025
21	0.2629	0.5274	2690	0.0001	0.0004	0.0005	0.0006	0.0008	0.0010	0.0013	0.0014	0.0016	0.0018
22	0.2602	0.5256	2756	0.0002	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0018	0.0019	0.0020
23	0.2603	0.5243	2761	0.0003	0.0006	0.0008	0.0014	0.0018	0.0020	0.0021	0.0024	0.0026	0.0028
24	0.2596	0.5235	2779	0.0003	0.0006	0.0008	0.0012	0.0018	0.0021	0.0023	0.0025	0.0028	0.0030
25	0.2617	0.5245	2728	0.0001	0.0003	0.0007	0.0011	0.0015	0.0017	0.0021	0.0023	0.0025	0.0027
Avg.	0.2615	0.5250	2732	0.0002	0.0004	0.0006	0.0009	0.0012	0.0014	0.0016	0.0018	0.0021	0.0024
Med.	0.2617	0.5248	2727	0.0002	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0018	0.0020	0.0023
st dev	0.0010	0.0013	24	0.0001	0.0001	0.0001	0.0002	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004
Min.	0.2596	0.5223	2690	0.0001	0.0002	0.0004	0.0004	0.0007	0.0009	0.0010	0.0013	0.0015	0.0018
Max.	0.2632	0.5274	2779	0.0003	0.0006	0.0009	0.0014	0.0018	0.0021	0.0023	0.0025	0.0028	0.0031

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	54.06	99.91	99.74	99.46	99.33	99.15	98.89	98.65	98.39	98.21	98.00
27	55.09	99.95	99.69	99.40	99.29	99.00	98.69	98.40	98.20	98.00	97.62
28	55.17	100.16	99.85	99.69	99.46	99.20	99.04	98.82	98.60	98.37	98.08
29	55.04	100.20	99.96	99.75	99.73	99.56	99.31	99.11	98.80	98.60	98.35
30	55.85	100.07	99.79	99.66	99.57	99.28	98.98	98.73	98.44	98.19	97.83
31	53.82	100.20	99.96	99.72	99.59	99.35	99.03	98.87	98.63	98.42	98.05
32	56.20	99.93	99.84	99.70	99.45	99.29	99.11	98.88	98.67	98.51	98.42
33	54.83	100.02	99.74	99.47	99.27	99.16	99.02	98.69	98.40	98.10	97.96
34	53.42	100.09	99.79	99.55	99.49	99.34	99.18	99.03	98.84	98.58	98.39
35	55.08	99.95	99.73	99.51	99.44	99.27	99.09	98.93	98.71	98.62	98.31
36	54.98	99.93	99.73	99.38	99.29	99.02	98.74	98.54	98.31	98.07	97.80
37	55.43	99.87	99.75	99.37	99.12	99.03	98.79	98.56	98.20	98.14	97.94
38	55.44	99.95	99.80	99.59	99.26	98.99	98.72	98.45	98.11	97.75	97.35
39	55.63	100.18	100.07	99.87	99.68	99.51	99.23	98.96	98.60	98.35	98.02
40	54.99	100.18	99.95	99.65	99.62	99.36	99.15	98.93	98.71	98.64	98.38
41	54.90	100.13	99.96	99.71	99.65	99.47	99.23	99.11	98.83	98.69	98.60
42	55.08	100.11	99.93	99.69	99.60	99.42	99.18	99.00	98.82	98.58	98.49
43	55.35	99.89	99.69	99.53	99.33	99.11	98.93	98.61	98.30	98.08	97.81
44	55.28	100.05	99.76	99.48	99.19	98.82	98.63	98.32	98.08	97.74	97.56
45	54.26	99.93	99.74	99.41	99.23	98.88	98.69	98.36	98.06	97.81	97.53
46	54.92	99.98	99.69	99.29	98.96	98.58	98.36	98.16	97.89	97.61	97.36
47	56.02	99.96	99.79	99.59	99.32	99.13	98.82	98.59	98.45	98.23	98.18
48	55.08	100.22	99.96	99.73	99.62	99.42	99.15	98.78	98.58	98.22	98.08
49	53.21	99.92	99.64	99.30	99.08	98.99	98.83	98.61	98.31	98.23	98.14
50	54.15	100.02	99.69	99.43	99.26	99.13	98.80	98.67	98.21	98.15	98.10
Avg.	54.93	100.03	99.81	99.56	99.39	99.18	98.94	98.71	98.45	98.24	98.01
Med.	55.08	100.02	99.79	99.55	99.33	99.16	98.98	98.69	98.44	98.22	98.05
st dev	0.75	0.11	0.12	0.16	0.21	0.24	0.23	0.26	0.27	0.30	0.35
Min.	53.21	99.87	99.64	99.29	98.96	98.58	98.36	98.16	97.89	97.61	97.35
Max.	56.20	100.22	100.07	99.87	99.73	99.56	99.31	99.11	98.84	98.69	98.60

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

No.	Forward Voltage (V)										
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	3.116	3.116	3.117	3.117	3.114	3.114	3.114	3.116	3.115	3.114	3.117
27	3.119	3.118	3.116	3.116	3.114	3.118	3.118	3.115	3.115	3.116	3.115
28	3.120	3.120	3.119	3.118	3.120	3.120	3.119	3.118	3.119	3.118	3.118
29	3.133	3.132	3.134	3.130	3.131	3.130	3.133	3.134	3.133	3.131	3.131
30	3.124	3.124	3.123	3.120	3.125	3.123	3.122	3.122	3.120	3.124	3.120
31	3.135	3.133	3.130	3.133	3.130	3.130	3.131	3.130	3.129	3.131	3.133
32	3.125	3.124	3.123	3.125	3.124	3.126	3.126	3.123	3.122	3.130	3.127
33	3.114	3.114	3.111	3.113	3.111	3.113	3.113	3.111	3.110	3.111	3.113
34	3.123	3.124	3.121	3.123	3.124	3.122	3.123	3.120	3.119	3.125	3.124
35	3.129	3.128	3.127	3.124	3.127	3.124	3.125	3.125	3.124	3.128	3.124
36	3.152	3.152	3.154	3.151	3.155	3.151	3.154	3.151	3.150	3.152	3.152
37	3.113	3.116	3.113	3.114	3.119	3.113	3.115	3.114	3.111	3.115	3.113
38	3.178	3.176	3.176	3.175	3.182	3.173	3.174	3.173	3.173	3.176	3.176
39	3.142	3.143	3.141	3.139	3.144	3.140	3.142	3.137	3.137	3.141	3.140
40	3.123	3.124	3.121	3.122	3.127	3.122	3.123	3.118	3.120	3.121	3.122
41	3.113	3.112	3.113	3.112	3.111	3.113	3.122	3.113	3.108	3.110	3.114
42	3.135	3.136	3.137	3.136	3.132	3.135	3.134	3.134	3.133	3.137	3.136
43	3.159	3.159	3.161	3.158	3.158	3.158	3.157	3.158	3.156	3.158	3.157
44	3.136	3.135	3.137	3.134	3.133	3.134	3.133	3.134	3.131	3.133	3.132
45	3.124	3.126	3.128	3.124	3.123	3.123	3.122	3.122	3.121	3.123	3.123
46	3.116	3.115	3.125	3.112	3.115	3.116	3.114	3.115	3.115	3.114	3.115
47	3.153	3.155	3.157	3.151	3.150	3.153	3.151	3.151	3.151	3.151	3.151
48	3.129	3.130	3.132	3.127	3.127	3.131	3.127	3.127	3.125	3.130	3.127
49	3.140	3.141	3.143	3.139	3.140	3.140	3.138	3.136	3.138	3.136	3.138
50	3.128	3.130	3.131	3.127	3.126	3.128	3.127	3.129	3.126	3.127	3.129
Avg.	3.131	3.131	3.132	3.130	3.130	3.130	3.130	3.129	3.128	3.130	3.130
Med.	3.128	3.128	3.128	3.125	3.127	3.126	3.126	3.125	3.124	3.128	3.127
st dev	0.016	0.016	0.016	0.016	0.017	0.015	0.015	0.016	0.016	0.016	0.016
Min.	3.113	3.112	3.111	3.112	3.111	3.113	3.113	3.111	3.108	3.110	3.113
Max.	3.178	3.176	3.176	3.175	3.182	3.173	3.174	3.173	3.173	3.176	3.176

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
26	0.2603	0.5236	2763	0.0001	0.0004	0.0006	0.0011	0.0016	0.0019	0.0021	0.0024	0.0028	0.0032
27	0.2617	0.5268	2720	0.0001	0.0004	0.0006	0.0009	0.0015	0.0017	0.0019	0.0022	0.0028	0.0032
28	0.2580	0.5252	2805	0.0002	0.0004	0.0006	0.0009	0.0013	0.0014	0.0016	0.0017	0.0026	0.0034
29	0.2608	0.5251	2746	0.0003	0.0005	0.0007	0.0010	0.0013	0.0015	0.0017	0.0020	0.0024	0.0032
30	0.2614	0.5241	2736	0.0002	0.0003	0.0005	0.0007	0.0011	0.0013	0.0016	0.0018	0.0021	0.0023
31	0.2625	0.5261	2704	0.0004	0.0006	0.0007	0.0009	0.0011	0.0014	0.0016	0.0017	0.0019	0.0023
32	0.2613	0.5269	2726	0.0004	0.0006	0.0009	0.0012	0.0012	0.0014	0.0017	0.0018	0.0022	0.0026
33	0.2618	0.5264	2719	0.0004	0.0005	0.0007	0.0011	0.0014	0.0016	0.0017	0.0019	0.0021	0.0025
34	0.2632	0.5257	2693	0.0005	0.0006	0.0008	0.0012	0.0013	0.0014	0.0015	0.0018	0.0021	0.0022
35	0.2607	0.5224	2760	0.0003	0.0005	0.0007	0.0008	0.0010	0.0012	0.0014	0.0016	0.0017	0.0020
36	0.2592	0.5236	2788	0.0004	0.0006	0.0008	0.0009	0.0011	0.0014	0.0017	0.0019	0.0021	0.0022
37	0.2620	0.5255	2719	0.0004	0.0006	0.0008	0.0011	0.0012	0.0014	0.0017	0.0019	0.0021	0.0022
38	0.2618	0.5251	2723	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017	0.0019	0.0021	0.0025	0.0027
39	0.2617	0.5239	2731	0.0004	0.0006	0.0009	0.0013	0.0014	0.0016	0.0017	0.0019	0.0022	0.0024
40	0.2600	0.5249	2763	0.0003	0.0004	0.0006	0.0010	0.0013	0.0016	0.0018	0.0019	0.0021	0.0025
41	0.2600	0.5243	2765	0.0004	0.0006	0.0008	0.0013	0.0017	0.0019	0.0021	0.0024	0.0026	0.0026
42	0.2590	0.5230	2793	0.0003	0.0004	0.0006	0.0011	0.0017	0.0019	0.0021	0.0024	0.0027	0.0029
43	0.2612	0.5247	2738	0.0002	0.0003	0.0004	0.0010	0.0017	0.0019	0.0021	0.0023	0.0029	0.0034
44	0.2619	0.5269	2714	0.0003	0.0004	0.0006	0.0008	0.0014	0.0016	0.0019	0.0021	0.0027	0.0033
45	0.2615	0.5254	2730	0.0003	0.0004	0.0007	0.0009	0.0009	0.0012	0.0014	0.0015	0.0021	0.0026
46	0.2602	0.5242	2762	0.0004	0.0007	0.0008	0.0011	0.0010	0.0011	0.0013	0.0015	0.0018	0.0027
47	0.2624	0.5253	2710	0.0005	0.0008	0.0010	0.0016	0.0018	0.0020	0.0021	0.0023	0.0024	0.0025
48	0.2612	0.5247	2739	0.0004	0.0005	0.0008	0.0015	0.0017	0.0018	0.0020	0.0021	0.0024	0.0025
49	0.2618	0.5238	2729	0.0002	0.0003	0.0005	0.0011	0.0014	0.0017	0.0019	0.0021	0.0023	0.0025
50	0.2611	0.5237	2745	0.0002	0.0004	0.0005	0.0012	0.0017	0.0018	0.0021	0.0025	0.0028	0.0030
Avg.	0.2611	0.5249	2741	0.0003	0.0005	0.0007	0.0011	0.0014	0.0016	0.0018	0.0020	0.0023	0.0027
Med.	0.2613	0.5249	2736	0.0003	0.0005	0.0007	0.0011	0.0014	0.0016	0.0017	0.0019	0.0023	0.0026
st dev	0.0012	0.0012	28	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0004
Min.	0.2580	0.5224	2693	0.0001	0.0003	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0017	0.0020
Max.	0.2632	0.5269	2805	0.0005	0.0008	0.0010	0.0016	0.0018	0.0020	0.0021	0.0025	0.0029	0.0034

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	55.81	100.02	99.80	99.61	99.53	99.39	99.21	99.05	98.82	98.44	98.35
52	56.67	99.96	99.61	99.22	98.99	98.87	98.62	98.48	98.15	97.92	97.71
53	54.88	99.89	99.73	99.42	99.22	98.92	98.72	98.52	98.18	97.92	97.59
54	55.32	99.91	99.62	99.39	99.24	98.90	98.57	98.28	98.05	97.85	97.60
55	54.50	99.80	99.50	99.10	98.83	98.62	98.31	97.94	97.65	97.39	97.06
56	54.27	99.96	99.67	99.41	99.10	98.88	98.60	98.36	97.95	97.60	97.33
57	54.38	100.11	99.91	99.76	99.65	99.32	99.01	98.75	98.44	98.16	97.85
58	56.37	99.96	99.77	99.54	99.33	99.06	98.76	98.56	98.12	97.75	97.61
59	55.37	100.11	99.93	99.58	99.40	99.22	98.86	98.72	98.34	98.03	97.71
60	56.46	99.96	99.61	99.49	99.22	99.13	98.90	98.55	98.28	98.02	97.70
61	53.69	100.09	99.78	99.40	99.24	99.07	98.79	98.49	98.32	98.06	97.76
62	55.85	99.80	99.44	99.23	99.09	98.73	98.46	98.16	97.99	97.73	97.37
63	53.45	99.91	99.55	99.21	99.12	98.78	98.52	98.15	97.81	97.70	97.36
64	55.99	99.93	99.61	99.25	98.86	98.50	98.16	97.80	97.39	96.93	96.64
65	55.34	99.80	99.55	99.11	98.88	98.70	98.43	98.23	97.90	97.60	97.16
66	55.35	100.14	99.91	99.55	99.24	98.93	98.64	98.34	98.07	97.87	97.54
67	53.97	99.93	99.67	99.37	99.07	98.94	98.74	98.46	98.15	98.02	97.80
68	54.52	99.89	99.60	99.34	99.12	98.83	98.44	98.24	97.91	97.60	97.40
69	56.28	99.88	99.72	99.59	99.34	99.06	98.90	98.60	98.15	97.87	97.64
70	55.42	99.87	99.55	99.22	99.10	99.04	98.77	98.39	98.00	97.92	97.82
71	54.61	99.82	99.58	99.32	98.92	98.57	98.39	98.15	97.82	97.58	97.25
72	53.97	99.83	99.69	99.41	99.35	99.15	98.94	98.54	98.24	97.98	97.68
73	55.11	100.05	99.75	99.47	99.33	99.09	98.71	98.31	98.15	97.95	97.57
74	53.65	99.96	99.76	99.40	99.16	98.71	98.49	98.19	98.01	97.63	97.15
75	54.54	100.06	99.82	99.54	99.32	99.08	98.84	98.51	98.13	97.91	97.62
Avg.	55.03	99.95	99.68	99.40	99.19	98.94	98.67	98.39	98.08	97.82	97.53
Med.	55.11	99.93	99.67	99.40	99.22	98.93	98.71	98.39	98.12	97.87	97.60
st dev	0.94	0.10	0.13	0.16	0.20	0.23	0.24	0.26	0.27	0.29	0.33
Min.	53.45	99.80	99.44	99.10	98.83	98.50	98.16	97.80	97.39	96.93	96.64
Max.	56.67	100.14	99.93	99.76	99.65	99.39	99.21	99.05	98.82	98.44	98.35

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

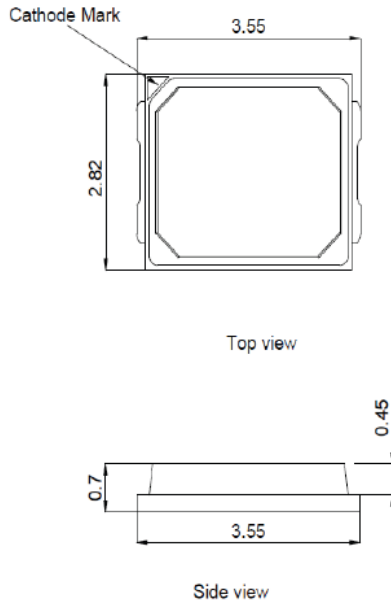
No.	Forward Voltage (V)										
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
51	3.161	3.161	3.161	3.156	3.159	3.160	3.160	3.160	3.159	3.156	3.157
52	3.154	3.152	3.152	3.150	3.150	3.152	3.154	3.156	3.152	3.154	3.154
53	3.125	3.124	3.124	3.123	3.123	3.124	3.123	3.121	3.123	3.120	3.123
54	3.111	3.113	3.111	3.110	3.113	3.111	3.112	3.111	3.110	3.111	3.113
55	3.142	3.142	3.142	3.138	3.139	3.140	3.140	3.140	3.140	3.138	3.140
56	3.115	3.115	3.114	3.113	3.113	3.113	3.115	3.114	3.113	3.115	3.113
57	3.123	3.124	3.122	3.123	3.121	3.123	3.123	3.120	3.120	3.123	3.122
58	3.117	3.118	3.116	3.117	3.118	3.117	3.119	3.117	3.118	3.118	3.116
59	3.117	3.118	3.117	3.115	3.118	3.118	3.116	3.117	3.117	3.116	3.117
60	3.119	3.120	3.123	3.118	3.120	3.121	3.123	3.121	3.122	3.119	3.118
61	3.131	3.134	3.160	3.134	3.133	3.132	3.138	3.136	3.131	3.129	3.133
62	3.122	3.124	3.141	3.115	3.120	3.129	3.120	3.121	3.116	3.121	3.120
63	3.134	3.136	3.151	3.130	3.134	3.132	3.133	3.133	3.133	3.135	3.132
64	3.113	3.120	3.135	3.114	3.113	3.113	3.115	3.117	3.112	3.114	3.111
65	3.133	3.156	3.157	3.153	3.133	3.133	3.131	3.136	3.129	3.130	3.130
66	3.123	3.126	3.149	3.125	3.123	3.122	3.123	3.126	3.124	3.123	3.122
67	3.114	3.122	3.138	3.117	3.113	3.113	3.112	3.117	3.112	3.110	3.115
68	3.110	3.110	3.128	3.108	3.110	3.108	3.109	3.108	3.107	3.106	3.105
69	3.118	3.122	3.136	3.118	3.122	3.118	3.117	3.119	3.117	3.119	3.116
70	3.150	3.148	3.171	3.165	3.148	3.147	3.148	3.151	3.146	3.147	3.148
71	3.200	3.195	3.205	3.205	3.208	3.205	3.195	3.208	3.199	3.209	3.205
72	3.123	3.122	3.129	3.122	3.121	3.121	3.120	3.131	3.124	3.123	3.157
73	3.149	3.134	3.153	3.162	3.164	3.200	3.166	3.152	3.145	3.147	3.153
74	3.136	3.126	3.157	3.134	3.145	3.154	3.132	3.134	3.160	3.159	3.153
75	3.130	3.155	3.146	3.157	3.143	3.158	3.158	3.142	3.135	3.144	3.157
Avg.	3.131	3.133	3.142	3.133	3.132	3.135	3.132	3.132	3.131	3.131	3.133
Med.	3.123	3.124	3.141	3.123	3.123	3.124	3.123	3.126	3.124	3.123	3.123
st dev	0.020	0.019	0.021	0.023	0.022	0.026	0.021	0.021	0.021	0.022	0.023
Min.	3.110	3.110	3.111	3.108	3.110	3.108	3.109	3.108	3.107	3.106	3.105
Max.	3.200	3.195	3.205	3.205	3.208	3.205	3.195	3.208	3.199	3.209	3.205

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
51	0.2618	0.5260	2721	0.0002	0.0003	0.0006	0.0012	0.0018	0.0020	0.0023	0.0025	0.0030	0.0033
52	0.2619	0.5245	2724	0.0004	0.0007	0.0010	0.0012	0.0017	0.0019	0.0022	0.0025	0.0031	0.0034
53	0.2612	0.5249	2738	0.0005	0.0007	0.0008	0.0009	0.0013	0.0014	0.0016	0.0018	0.0023	0.0030
54	0.2619	0.5237	2728	0.0002	0.0003	0.0005	0.0009	0.0012	0.0015	0.0018	0.0021	0.0024	0.0029
55	0.2615	0.5238	2736	0.0004	0.0006	0.0008	0.0013	0.0017	0.0019	0.0021	0.0024	0.0028	0.0033
56	0.2618	0.5250	2723	0.0003	0.0004	0.0006	0.0009	0.0014	0.0017	0.0019	0.0022	0.0023	0.0029
57	0.2607	0.5254	2745	0.0004	0.0006	0.0008	0.0009	0.0014	0.0016	0.0019	0.0023	0.0024	0.0030
58	0.2606	0.5247	2750	0.0005	0.0007	0.0009	0.0012	0.0015	0.0017	0.0018	0.0022	0.0025	0.0030
59	0.2617	0.5271	2718	0.0006	0.0008	0.0011	0.0016	0.0018	0.0020	0.0021	0.0025	0.0028	0.0034
60	0.2625	0.5268	2703	0.0006	0.0008	0.0010	0.0015	0.0020	0.0023	0.0024	0.0028	0.0030	0.0034
61	0.2631	0.5254	2695	0.0003	0.0005	0.0008	0.0013	0.0016	0.0017	0.0019	0.0022	0.0026	0.0031
62	0.2612	0.5252	2736	0.0003	0.0005	0.0008	0.0012	0.0016	0.0017	0.0018	0.0021	0.0025	0.0030
63	0.2628	0.5236	2708	0.0004	0.0006	0.0007	0.0008	0.0013	0.0015	0.0017	0.0020	0.0022	0.0024
64	0.2617	0.5262	2721	0.0004	0.0007	0.0010	0.0012	0.0014	0.0016	0.0018	0.0022	0.0026	0.0029
65	0.2611	0.5237	2744	0.0003	0.0005	0.0008	0.0014	0.0019	0.0020	0.0021	0.0025	0.0029	0.0032
66	0.2623	0.5248	2715	0.0004	0.0006	0.0009	0.0016	0.0020	0.0022	0.0023	0.0026	0.0031	0.0033
67	0.2624	0.5261	2707	0.0002	0.0005	0.0006	0.0010	0.0014	0.0017	0.0020	0.0022	0.0026	0.0029
68	0.2617	0.5261	2722	0.0004	0.0005	0.0007	0.0009	0.0014	0.0016	0.0018	0.0022	0.0026	0.0027
69	0.2591	0.5242	2787	0.0003	0.0006	0.0008	0.0011	0.0017	0.0019	0.0021	0.0023	0.0027	0.0030
70	0.2620	0.5250	2721	0.0006	0.0009	0.0012	0.0014	0.0022	0.0023	0.0025	0.0027	0.0029	0.0035
71	0.2613	0.5268	2728	0.0004	0.0007	0.0009	0.0012	0.0017	0.0018	0.0021	0.0025	0.0029	0.0031
72	0.2608	0.5231	2755	0.0003	0.0005	0.0006	0.0012	0.0014	0.0017	0.0019	0.0023	0.0025	0.0028
73	0.2624	0.5244	2714	0.0005	0.0007	0.0008	0.0011	0.0013	0.0016	0.0019	0.0021	0.0025	0.0029
74	0.2621	0.5257	2715	0.0003	0.0004	0.0005	0.0013	0.0016	0.0017	0.0019	0.0025	0.0028	0.0031
75	0.2629	0.5254	2699	0.0002	0.0005	0.0006	0.0010	0.0014	0.0016	0.0019	0.0023	0.0025	0.0029
Avg.	0.2617	0.5251	2726	0.0004	0.0006	0.0008	0.0012	0.0016	0.0018	0.0020	0.0023	0.0027	0.0031
Med.	0.2618	0.5250	2722	0.0004	0.0006	0.0008	0.0012	0.0016	0.0017	0.0019	0.0023	0.0026	0.0030
st dev	0.0009	0.0011	20	0.0001	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0003	0.0003
Min.	0.2591	0.5231	2695	0.0002	0.0003	0.0005	0.0008	0.0012	0.0014	0.0016	0.0018	0.0022	0.0024
Max.	0.2631	0.5271	2787	0.0006	0.0009	0.0012	0.0016	0.0022	0.0023	0.0025	0.0028	0.0031	0.0035

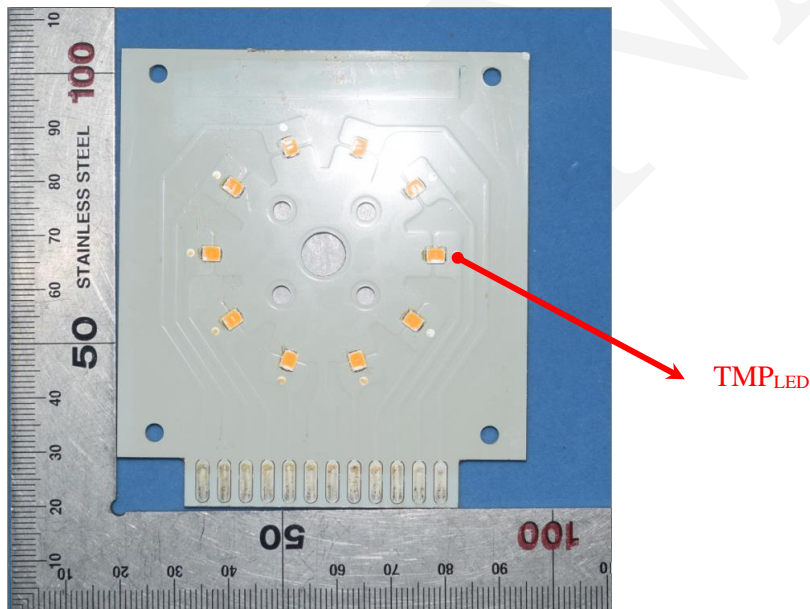
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



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



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C.P. Ramani, P.E., C.B.O
President



SCOPE OF ACCREDITATION

FIELDS OF TESTING	ACCREDITED TEST METHODS
ENERGY STAR Program Requirements for Lighting (except Electromagnetic and Radio Frequency Interference, Air Tight for Restricted Air Flow, and Mercury Content) (continued)	IES LM-78-17 IESNA approved method for total luminous flux measurement of lamps using an integrating sphere photometer IES LM-79-2008: Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products, Sections 9, 10 and 12 IES LM-80-2008: Approved Method for Measuring Lumen Maintenance of LED Light Sources (LED Packages/Modules/Arrays) IES LM-80-2015: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules IES LM-82-2012: Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature IES LM-84-2014: Approved Method for Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires IES LM-85-14 Electrical and Photometric Measurements of High-Power IES LM-86-2015 Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components IES TM-16-2005: Technical Memorandum on Light Emitting Diode (LED) Sources and Systems IES TM-21-11 Projecting Long Term Lumen Maintenance of LED Light Sources IES TM-26-2015: Method for Projecting Catastrophic Failure Rate of LED Packages IES TM-28-2014: Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires NEMA SSL 7A-2013 Phase Cut Dimming for Solid-State Lighting – Basic Compatibility NEMA SSL 7A-2015 Phase cut dimming for solid-state lighting – basic compatibility NEMA 77-2017 Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria SASO 2870: 2015: Energy Efficiency, Functionality and Labeling Requirements for Lighting Products, Part 1 SASO 2870: 2018: Energy Efficiency, Functionality and Labeling Requirements for Lighting Products, Part 1 SASO 2902: 2018: Energy Efficiency, Functionality and Labeling Requirements for Lighting Products, Part 2 US EPA: ENERGY STAR Program Requirements V1.5 for decorative light strings Appendix A US EPA ENERGY STAR Program Requirements V1.1 for Lamps (Light Bulbs), (except Sections 4, 12, and 13)