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
Report Number:	R2XM190402063-10-M1
Test Date:	2018-01-30 to 2019-04-23
Report Date:	2019-05-13
Reviewed By:	Bill Xiong / EE Engineer
Revised Note:	The previous report R2XM190402063-10 is replaced by this report on 2019-05-13
Test Facility:	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax:+86-0769-86858588
Accreditation:	The IAS Accreditation Number TL-460.

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).
This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

TABLE OF CONTENTS

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 150mA
Nominal CCT:	2700K
Power:	0.48W
Average Current Density per LED die:	538mA/mm^2
Average Power Density per LED die:	1.72W/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)	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)	150	0.48	2700K	1	150	538	0.049	N/A
BXEN-(A)(B)-(C)(D)(E)-(F)(G)	150	0.48	≥2200K	1	150	538	0.049	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:

1. The applicant Bridgelux Inc. declare that their products with model BXEN-27E-11M-39A are the same to the products in report # R2XM180128061-10 and is authorized by original applicant to use their test data.

2. All the data in previous report (R2XM180128061-10) 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 ±3% of the specified value of the manufacturer during maintenance test, and was within ±0.5% during photometric and electrical measurement test.

1.5 Ambient Conditions for Maintenance Test

For lumen maintenance test, samples within one data set, were installed on cooling boards in thermal chambers with minimal ambient airflow. The case temperature and ambient temperature was monitored by thermocouples which one was soldered to the coldest DUTs' case (TMP_{LED}) location, while the other is mounted at a distance of 5 mm above the TMP location.

During life testing, TMP_{LED} of the coldest LEDs were maintained at a temperature that was greater than or equal to 2°C below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to 5°C below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

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

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

For photometry measurement, the ambient temperature during test was set to 25°C ± 2°C, RH <65%.

1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate u'v'. 2π measurement was used and sample was drived by DC power supply. The forward current was regulated to within ±0.5% of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to 25°C ± 2°C, RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

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

The uncertainty of the temperature is U=0.8671°C (K=2), at the 95% confidence level.

1.7 Statement of Traceability

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

1.8 Sample Set

Data Set 1: 55°C, 150mA

Part Number:	BXEN-27E-11M-39A
Number of Units:	25
Case Temperature:	>53°C
Ambient Temperature:	>50°C
Life Test Drive Current:	150mA
Measurement Current:	150mA

Data Set 2: 85°C, 150mA

Part Number:	BXEN-27E-11M-39A
Number of Units:	25
Case Temperature:	>83°C
Ambient Temperature:	>80°C
Life Test Drive Current:	150mA
Measurement Current:	150mA

Data Set 3: 105°C, 150mA

Part Number:	BXEN-27E-11M-39A
Number of Units:	25
Case Temperature:	>103°C
Ambient Temperature:	>100°C
Life Test Drive Current:	150mA
Measurement Current:	150mA

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	2.329E-06	1.006	>60000hours	48,000hours
2	25	0	1000hrs	10000hrs	2.932E-06	1.006	>60000hours	38,000 hours
3	25	0	1000hrs	10000hrs	3.433E-06	1.005	>60000hours	32,000 hours

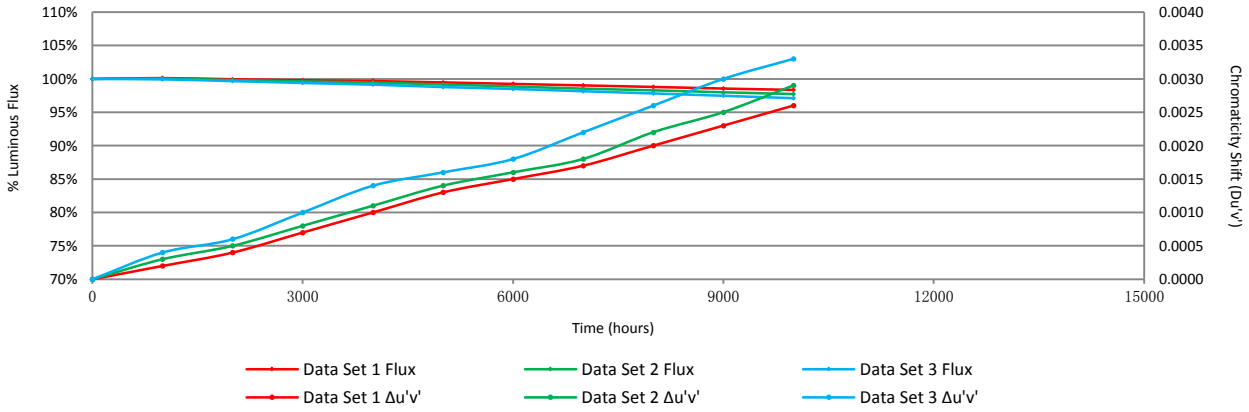
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	100.13%	99.95%	99.80%	99.67%	99.47%	99.24%	99.01%	98.78%	98.53%	98.33%
2	100.05%	99.82%	99.62%	99.44%	99.15%	98.85%	98.53%	98.27%	97.97%	97.71%
3	99.94%	99.68%	99.40%	99.15%	98.79%	98.51%	98.16%	97.83%	97.48%	97.12%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.0002	0.0004	0.0007	0.0010	0.0013	0.0015	0.0017	0.0020	0.0023	0.0026
2	0.0003	0.0005	0.0008	0.0011	0.0014	0.0016	0.0018	0.0022	0.0025	0.0029
3	0.0004	0.0006	0.0010	0.0014	0.0016	0.0018	0.0022	0.0026	0.0030	0.0033

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 55°C, 150mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	68.11	100.26	100.16	99.99	99.96	99.82	99.53	99.27	99.10	98.93	98.77
2	65.45	100.02	99.91	99.76	99.63	99.51	99.27	98.98	98.79	98.55	98.40
3	67.45	100.27	100.15	100.09	99.91	99.50	99.36	99.11	99.01	98.87	98.61
4	66.52	100.06	99.88	99.70	99.55	99.32	99.07	98.81	98.45	98.09	97.81
5	67.03	99.96	99.85	99.81	99.67	99.46	99.15	98.85	98.64	98.37	98.21
6	64.14	100.23	100.06	99.86	99.67	99.45	99.17	98.89	98.75	98.50	98.24
7	67.39	100.31	100.19	100.15	100.06	99.96	99.76	99.58	99.47	99.18	98.99
8	66.85	100.04	99.94	99.76	99.72	99.54	99.31	99.15	98.76	98.55	98.35
9	66.20	100.05	99.94	99.77	99.73	99.55	99.31	99.12	98.85	98.67	98.56
10	66.09	100.23	100.06	99.92	99.76	99.56	99.35	99.14	99.03	98.80	98.64
11	67.15	100.22	99.94	99.66	99.64	99.40	99.15	98.87	98.63	98.26	98.15
12	66.64	100.27	100.09	100.08	100.06	99.80	99.67	99.49	99.32	99.05	98.86
13	66.74	99.97	99.79	99.60	99.39	99.13	98.88	98.64	98.38	98.22	97.96
14	66.10	100.15	99.94	99.91	99.77	99.59	99.30	99.15	98.97	98.80	98.52
15	65.63	100.18	99.92	99.60	99.56	99.39	99.09	98.84	98.63	98.34	98.05
16	68.14	100.10	99.91	99.68	99.47	99.35	99.10	98.86	98.69	98.46	98.21
17	67.09	99.96	99.78	99.76	99.66	99.39	99.14	98.90	98.67	98.46	98.20
18	66.30	99.91	99.77	99.68	99.52	99.34	99.11	98.76	98.64	98.34	98.17
19	66.48	100.05	99.91	99.64	99.38	99.16	98.92	98.78	98.56	98.23	98.01
20	66.86	100.07	99.88	99.82	99.54	99.31	99.15	98.94	98.65	98.44	98.27
21	67.04	100.12	99.88	99.82	99.55	99.45	99.31	98.99	98.69	98.36	98.17
22	68.12	100.22	100.03	99.94	99.57	99.46	99.31	99.12	98.88	98.63	98.39
23	67.62	100.10	99.85	99.73	99.57	99.42	99.10	98.82	98.45	98.25	97.99
24	66.83	100.25	99.88	99.75	99.73	99.46	99.18	99.03	98.53	98.22	98.05
25	68.05	100.25	99.94	99.63	99.60	99.49	99.29	99.07	98.96	98.71	98.56
Avg.	66.80	100.13	99.95	99.80	99.67	99.47	99.24	99.01	98.78	98.53	98.33
Med.	66.85	100.12	99.92	99.76	99.64	99.46	99.18	98.98	98.69	98.46	98.24
st dev	0.93	0.12	0.12	0.15	0.18	0.18	0.20	0.22	0.27	0.29	0.30
Min.	64.14	99.91	99.77	99.60	99.38	99.13	98.88	98.64	98.38	98.09	97.81
Max.	68.14	100.31	100.19	100.15	100.06	99.96	99.76	99.58	99.47	99.18	98.99

3.2 Data Set 1, 55°C, 150mA (Forward Voltage)

No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	3.221	3.225	3.225	3.227	3.222	3.223	3.223	3.222	3.223	3.225	3.224
2	3.227	3.225	3.225	3.225	3.224	3.224	3.225	3.224	3.223	3.224	3.225
3	3.220	3.221	3.218	3.216	3.216	3.219	3.218	3.217	3.220	3.220	3.220
4	3.255	3.256	3.255	3.254	3.253	3.256	3.256	3.253	3.254	3.255	3.255
5	3.220	3.220	3.220	3.217	3.219	3.220	3.218	3.217	3.219	3.219	3.219
6	3.251	3.250	3.248	3.247	3.247	3.248	3.247	3.248	3.249	3.249	3.251
7	3.222	3.222	3.220	3.218	3.224	3.223	3.220	3.221	3.221	3.224	3.224
8	3.221	3.220	3.218	3.221	3.219	3.221	3.219	3.218	3.221	3.222	3.222
9	3.224	3.224	3.225	3.223	3.223	3.225	3.222	3.222	3.223	3.225	3.224
10	3.249	3.251	3.249	3.248	3.247	3.247	3.249	3.247	3.249	3.249	3.251
11	3.229	3.230	3.226	3.229	3.228	3.229	3.227	3.228	3.229	3.229	3.230
12	3.249	3.245	3.245	3.247	3.245	3.246	3.245	3.245	3.244	3.247	3.247
13	3.226	3.228	3.225	3.223	3.224	3.242	3.225	3.225	3.242	3.227	3.228
14	3.251	3.247	3.248	3.247	3.244	3.248	3.247	3.246	3.246	3.250	3.248
15	3.221	3.219	3.218	3.218	3.218	3.219	3.219	3.216	3.221	3.220	3.220
16	3.251	3.253	3.250	3.249	3.248	3.251	3.250	3.247	3.250	3.252	3.252
17	3.270	3.268	3.265	3.264	3.265	3.266	3.264	3.264	3.267	3.268	3.267
18	3.229	3.227	3.227	3.227	3.225	3.229	3.227	3.225	3.228	3.227	3.228
19	3.266	3.265	3.264	3.265	3.263	3.265	3.261	3.262	3.263	3.263	3.265
20	3.225	3.225	3.222	3.226	3.225	3.226	3.225	3.222	3.226	3.226	3.225
21	3.232	3.231	3.231	3.232	3.232	3.231	3.231	3.229	3.233	3.228	3.235
22	3.278	3.274	3.274	3.272	3.273	3.273	3.274	3.274	3.274	3.274	3.276
23	3.220	3.221	3.219	3.222	3.218	3.224	3.221	3.219	3.222	3.222	3.224
24	3.233	3.232	3.229	3.231	3.231	3.231	3.229	3.229	3.230	3.230	3.233
25	3.221	3.221	3.222	3.217	3.220	3.222	3.222	3.218	3.220	3.221	3.221
Avg.	3.236	3.236	3.235	3.235	3.234	3.236	3.235	3.234	3.236	3.236	3.237
Med.	3.229	3.228	3.226	3.227	3.225	3.229	3.227	3.225	3.229	3.227	3.228
st dev	0.018	0.017	0.017	0.017	0.017	0.016	0.017	0.017	0.017	0.017	0.017
Min.	3.220	3.219	3.218	3.216	3.216	3.219	3.218	3.216	3.219	3.219	3.219
Max.	3.278	3.274	3.274	3.272	3.273	3.273	3.274	3.274	3.274	3.274	3.276

3.3 Data Set 1, 55°C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.2620	0.5274	2711	0.0002	0.0004	0.0006	0.0009	0.0013	0.0016	0.0017	0.0021	0.0025	0.0029
2	0.2628	0.5252	2703	0.0001	0.0004	0.0007	0.0011	0.0010	0.0011	0.0014	0.0015	0.0017	0.0020
3	0.2624	0.5240	2716	0.0001	0.0004	0.0007	0.0009	0.0013	0.0014	0.0016	0.0019	0.0021	0.0022
4	0.2590	0.5234	2792	0.0002	0.0003	0.0009	0.0012	0.0017	0.0020	0.0023	0.0029	0.0031	0.0033
5	0.2601	0.5250	2761	0.0002	0.0005	0.0009	0.0011	0.0014	0.0015	0.0018	0.0022	0.0032	0.0035
6	0.2597	0.5246	2771	0.0002	0.0005	0.0008	0.0014	0.0017	0.0019	0.0021	0.0023	0.0026	0.0030
7	0.2611	0.5265	2733	0.0002	0.0004	0.0009	0.0014	0.0017	0.0018	0.0021	0.0022	0.0024	0.0029
8	0.2626	0.5254	2706	0.0001	0.0003	0.0006	0.0010	0.0016	0.0017	0.0018	0.0021	0.0022	0.0025
9	0.2617	0.5239	2730	0.0002	0.0003	0.0004	0.0005	0.0008	0.0011	0.0013	0.0014	0.0016	0.0020
10	0.2612	0.5236	2744	0.0001	0.0003	0.0007	0.0009	0.0011	0.0012	0.0014	0.0016	0.0017	0.0020
11	0.2605	0.5254	2750	0.0001	0.0003	0.0009	0.0012	0.0016	0.0017	0.0019	0.0022	0.0023	0.0024
12	0.2634	0.5256	2687	0.0001	0.0003	0.0006	0.0011	0.0016	0.0018	0.0019	0.0023	0.0024	0.0025
13	0.2614	0.5255	2731	0.0002	0.0003	0.0009	0.0015	0.0020	0.0022	0.0024	0.0029	0.0032	0.0033
14	0.2624	0.5269	2704	0.0001	0.0005	0.0008	0.0015	0.0019	0.0021	0.0024	0.0030	0.0032	0.0036
15	0.2637	0.5265	2678	0.0001	0.0002	0.0006	0.0011	0.0017	0.0019	0.0021	0.0026	0.0033	0.0038
16	0.2611	0.5238	2744	0.0002	0.0005	0.0007	0.0009	0.0014	0.0016	0.0019	0.0023	0.0027	0.0031
17	0.2630	0.5265	2693	0.0001	0.0004	0.0007	0.0008	0.0011	0.0013	0.0015	0.0018	0.0022	0.0024
18	0.2617	0.5274	2716	0.0001	0.0002	0.0002	0.0004	0.0005	0.0008	0.0011	0.0013	0.0016	0.0019
19	0.2627	0.5258	2702	0.0002	0.0004	0.0005	0.0007	0.0008	0.0009	0.0011	0.0013	0.0014	0.0019
20	0.2601	0.5240	2765	0.0002	0.0005	0.0007	0.0009	0.0012	0.0014	0.0015	0.0016	0.0018	0.0014
21	0.2626	0.5281	2695	0.0002	0.0004	0.0006	0.0009	0.0010	0.0011	0.0013	0.0018	0.0021	0.0023
22	0.2612	0.5267	2731	0.0002	0.0004	0.0007	0.0009	0.0012	0.0013	0.0014	0.0017	0.0024	0.0026
23	0.2599	0.5249	2766	0.0001	0.0004	0.0008	0.0009	0.0012	0.0013	0.0015	0.0016	0.0020	0.0026
24	0.2596	0.5248	2772	0.0002	0.0004	0.0006	0.0009	0.0010	0.0011	0.0013	0.0016	0.0018	0.0022
25	0.2591	0.5259	2778	0.0002	0.0006	0.0010	0.0013	0.0014	0.0016	0.0020	0.0022	0.0024	0.0026
Avg.	0.2614	0.5255	2731	0.0002	0.0004	0.0007	0.0010	0.0013	0.0015	0.0017	0.0020	0.0023	0.0026
Med.	0.2614	0.5254	2731	0.0002	0.0004	0.0007	0.0009	0.0013	0.0015	0.0017	0.0021	0.0023	0.0025
st dev	0.0014	0.0013	32	0.0001	0.0001	0.0002	0.0003	0.0004	0.0004	0.0004	0.0005	0.0006	0.0006
Min.	0.2590	0.5234	2678	0.0001	0.0002	0.0002	0.0004	0.0005	0.0008	0.0011	0.0013	0.0014	0.0014
Max.	0.2637	0.5281	2792	0.0002	0.0006	0.0010	0.0015	0.0020	0.0022	0.0024	0.0030	0.0033	0.0038

3.4 Data Set 2, 85°C, 150mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	66.47	100.09	99.89	99.73	99.53	99.23	98.84	98.59	98.33	97.97	97.70
27	65.89	100.02	99.79	99.68	99.32	98.88	98.71	98.50	98.21	97.91	97.65
28	65.18	99.97	99.75	99.32	99.11	98.73	98.51	98.17	97.85	97.41	97.28
29	68.88	100.22	99.93	99.84	99.74	99.54	99.32	98.95	98.77	98.52	98.34
30	68.56	99.87	99.68	99.37	99.11	98.94	98.63	98.32	97.89	97.54	97.24
31	65.77	100.09	99.80	99.65	99.51	99.10	98.81	98.56	98.22	97.99	97.69
32	66.46	99.98	99.86	99.55	99.47	99.19	98.95	98.65	98.50	98.16	97.95
33	65.85	99.92	99.80	99.57	99.45	99.24	99.00	98.77	98.62	98.38	98.13
34	66.52	100.03	99.79	99.71	99.43	99.16	98.90	98.63	98.27	98.00	97.78
35	68.29	100.09	99.79	99.40	99.28	99.05	98.84	98.61	98.30	97.99	97.67
36	65.00	100.20	99.91	99.65	99.43	99.18	98.89	98.66	98.42	98.09	97.69
37	69.07	100.16	99.91	99.75	99.49	99.29	99.03	98.64	98.54	98.44	98.22
38	65.25	100.08	99.88	99.60	99.37	99.19	98.87	98.57	98.41	98.13	97.84
39	66.33	99.89	99.77	99.64	99.61	99.29	99.02	98.57	98.24	97.95	97.75
40	66.87	99.90	99.78	99.60	99.45	99.06	98.77	98.40	97.97	97.68	97.55
41	64.15	100.20	100.02	99.84	99.49	99.22	98.99	98.72	98.33	97.96	97.66
42	65.05	100.02	99.82	99.43	99.42	99.09	98.77	98.57	98.32	97.86	97.59
43	65.41	99.85	99.72	99.62	99.48	99.08	98.76	98.44	98.13	97.81	97.68
44	64.83	100.06	99.85	99.61	99.35	99.14	98.86	98.47	98.15	97.86	97.66
45	67.07	100.15	99.79	99.54	99.40	99.05	98.78	98.40	98.15	97.85	97.69
46	67.23	99.99	99.67	99.64	99.52	99.21	98.74	98.41	98.22	97.98	97.55
47	66.72	100.15	99.90	99.75	99.46	99.16	98.77	98.53	98.41	98.22	97.90
48	66.22	100.11	99.83	99.64	99.62	99.35	98.84	98.49	98.19	97.83	97.42
49	66.73	100.01	99.72	99.64	99.34	98.97	98.53	98.11	97.90	97.69	97.14
50	66.05	100.15	99.83	99.77	99.71	99.49	99.03	98.61	98.41	98.08	97.87
Avg.	66.39	100.05	99.82	99.62	99.44	99.15	98.85	98.53	98.27	97.97	97.71
Med.	66.33	100.06	99.80	99.64	99.45	99.16	98.84	98.57	98.27	97.97	97.69
st dev	1.28	0.11	0.08	0.13	0.15	0.18	0.17	0.18	0.22	0.26	0.28
Min.	64.15	99.85	99.67	99.32	99.11	98.73	98.51	98.11	97.85	97.41	97.14
Max.	69.07	100.22	100.02	99.84	99.74	99.54	99.32	98.95	98.77	98.52	98.34

3.5 Data Set 2, 85°C, 150mA (Forward Voltage)

No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	3.246	3.247	3.244	3.243	3.242	3.245	3.244	3.242	3.243	3.245	3.246
27	3.221	3.219	3.219	3.221	3.218	3.218	3.221	3.217	3.219	3.221	3.221
28	3.230	3.228	3.227	3.228	3.229	3.230	3.230	3.227	3.229	3.231	3.234
29	3.252	3.253	3.252	3.251	3.251	3.252	3.253	3.252	3.253	3.253	3.253
30	3.234	3.234	3.233	3.232	3.233	3.233	3.232	3.233	3.233	3.237	3.238
31	3.247	3.248	3.244	3.245	3.244	3.246	3.246	3.246	3.246	3.247	3.246
32	3.225	3.225	3.225	3.223	3.225	3.225	3.224	3.225	3.224	3.224	3.226
33	3.224	3.225	3.224	3.223	3.224	3.223	3.222	3.223	3.222	3.223	3.224
34	3.229	3.224	3.224	3.223	3.224	3.228	3.223	3.223	3.226	3.225	3.227
35	3.225	3.224	3.223	3.224	3.224	3.224	3.222	3.223	3.226	3.224	3.226
36	3.222	3.221	3.218	3.221	3.224	3.223	3.225	3.225	3.224	3.227	3.229
37	3.219	3.220	3.216	3.219	3.218	3.220	3.217	3.216	3.219	3.218	3.221
38	3.223	3.226	3.222	3.224	3.223	3.220	3.222	3.222	3.223	3.224	3.224
39	3.219	3.222	3.221	3.219	3.221	3.218	3.219	3.220	3.219	3.220	3.221
40	3.227	3.228	3.224	3.224	3.224	3.225	3.223	3.224	3.224	3.227	3.227
41	3.240	3.239	3.237	3.239	3.241	3.238	3.239	3.237	3.239	3.241	3.239
42	3.241	3.238	3.237	3.237	3.234	3.237	3.235	3.235	3.238	3.237	3.241
43	3.237	3.241	3.238	3.237	3.240	3.240	3.237	3.237	3.243	3.240	3.239
44	3.257	3.258	3.255	3.256	3.257	3.255	3.255	3.255	3.256	3.255	3.258
45	3.248	3.251	3.247	3.244	3.248	3.246	3.246	3.247	3.248	3.248	3.252
46	3.224	3.224	3.222	3.222	3.222	3.224	3.223	3.221	3.225	3.225	3.225
47	3.242	3.241	3.241	3.240	3.242	3.241	3.242	3.240	3.243	3.242	3.244
48	3.221	3.223	3.223	3.223	3.224	3.224	3.223	3.224	3.223	3.223	3.226
49	3.240	3.242	3.241	3.240	3.241	3.239	3.240	3.238	3.241	3.241	3.242
50	3.266	3.265	3.265	3.264	3.263	3.264	3.262	3.262	3.264	3.265	3.264
Avg.	3.234	3.235	3.233	3.233	3.233	3.234	3.233	3.233	3.234	3.235	3.236
Med.	3.230	3.228	3.227	3.228	3.229	3.230	3.230	3.227	3.229	3.231	3.234
st dev	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
Min.	3.219	3.219	3.216	3.219	3.218	3.218	3.217	3.216	3.219	3.218	3.221
Max.	3.266	3.265	3.265	3.264	3.263	3.264	3.262	3.262	3.264	3.265	3.264

3.6 Data Set 2, 85°C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	0.2626	0.5270	2698	0.0002	0.0005	0.0011	0.0014	0.0017	0.0018	0.0021	0.0024	0.0028	0.0031
27	0.2604	0.5266	2748	0.0004	0.0006	0.0011	0.0015	0.0018	0.0021	0.0022	0.0025	0.0027	0.0033
28	0.2628	0.5254	2702	0.0002	0.0005	0.0009	0.0015	0.0018	0.0020	0.0022	0.0025	0.0030	0.0033
29	0.2612	0.5283	2724	0.0004	0.0006	0.0009	0.0013	0.0017	0.0018	0.0021	0.0025	0.0027	0.0030
30	0.2615	0.5272	2721	0.0004	0.0005	0.0010	0.0014	0.0018	0.0021	0.0023	0.0027	0.0028	0.0033
31	0.2624	0.5248	2712	0.0002	0.0005	0.0008	0.0013	0.0017	0.0020	0.0023	0.0026	0.0028	0.0033
32	0.2600	0.5249	2763	0.0003	0.0004	0.0008	0.0011	0.0018	0.0020	0.0022	0.0027	0.0028	0.0033
33	0.2622	0.5235	2722	0.0004	0.0006	0.0009	0.0012	0.0016	0.0017	0.0018	0.0026	0.0027	0.0031
34	0.2627	0.5271	2696	0.0003	0.0005	0.0010	0.0013	0.0018	0.0021	0.0022	0.0026	0.0030	0.0036
35	0.2613	0.5254	2733	0.0004	0.0006	0.0011	0.0014	0.0020	0.0022	0.0024	0.0027	0.0029	0.0034
36	0.2609	0.5261	2739	0.0003	0.0005	0.0009	0.0013	0.0017	0.0019	0.0021	0.0026	0.0030	0.0034
37	0.2620	0.5255	2717	0.0001	0.0004	0.0006	0.0009	0.0015	0.0017	0.0020	0.0024	0.0028	0.0034
38	0.2606	0.5250	2750	0.0001	0.0004	0.0005	0.0007	0.0011	0.0013	0.0015	0.0020	0.0025	0.0029
39	0.2604	0.5241	2758	0.0003	0.0005	0.0006	0.0008	0.0010	0.0013	0.0014	0.0019	0.0025	0.0029
40	0.2587	0.5251	2790	0.0002	0.0004	0.0008	0.0010	0.0012	0.0015	0.0017	0.0020	0.0024	0.0028
41	0.2629	0.5244	2703	0.0003	0.0005	0.0009	0.0011	0.0013	0.0014	0.0016	0.0019	0.0021	0.0024
42	0.2620	0.5245	2723	0.0002	0.0004	0.0009	0.0011	0.0013	0.0016	0.0017	0.0020	0.0022	0.0024
43	0.2597	0.5240	2773	0.0002	0.0004	0.0008	0.0011	0.0013	0.0015	0.0016	0.0019	0.0022	0.0024
44	0.2628	0.5265	2698	0.0004	0.0007	0.0010	0.0015	0.0016	0.0018	0.0020	0.0023	0.0027	0.0029
45	0.2625	0.5263	2705	0.0002	0.0004	0.0004	0.0009	0.0010	0.0012	0.0015	0.0017	0.0021	0.0024
46	0.2603	0.5238	2763	0.0003	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014	0.0015	0.0022	0.0025
47	0.2612	0.5258	2733	0.0002	0.0004	0.0007	0.0010	0.0012	0.0015	0.0018	0.0019	0.0020	0.0021
48	0.2617	0.5256	2723	0.0001	0.0003	0.0007	0.0008	0.0009	0.0010	0.0012	0.0015	0.0017	0.0021
49	0.2629	0.5255	2698	0.0003	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0012	0.0015	0.0019
50	0.2604	0.5246	2756	0.0003	0.0006	0.0008	0.0010	0.0011	0.0012	0.0014	0.0018	0.0019	0.0023
Avg.	0.2614	0.5255	2730	0.0003	0.0005	0.0008	0.0011	0.0014	0.0016	0.0018	0.0022	0.0025	0.0029
Med.	0.2615	0.5254	2723	0.0003	0.0005	0.0008	0.0011	0.0015	0.0017	0.0018	0.0023	0.0027	0.0029
st dev	0.0012	0.0012	27	0.0001	0.0001	0.0002	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005
Min.	0.2587	0.5235	2696	0.0001	0.0003	0.0004	0.0007	0.0008	0.0009	0.0010	0.0012	0.0015	0.0019
Max.	0.2629	0.5283	2790	0.0004	0.0007	0.0011	0.0015	0.0020	0.0022	0.0024	0.0027	0.0030	0.0036

3.7 Data Set 3, 105°C, 150mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
51	67.97	100.07	99.76	99.56	99.15	98.76	98.41	98.10	97.70	97.41	97.03
52	66.71	99.97	99.72	99.36	99.00	98.71	98.40	97.92	97.66	97.20	96.66
53	68.65	99.85	99.65	99.27	99.24	98.95	98.66	98.35	98.05	97.73	97.39
54	66.62	99.98	99.77	99.46	99.28	98.86	98.47	98.12	97.91	97.63	97.42
55	67.68	99.99	99.70	99.57	99.19	98.86	98.61	98.23	97.98	97.70	97.52
56	67.17	99.84	99.55	99.45	99.17	98.91	98.57	98.26	98.01	97.54	97.14
57	66.42	99.88	99.52	99.37	99.20	98.99	98.71	98.34	98.10	97.82	97.49
58	65.69	100.08	99.79	99.38	99.15	98.83	98.66	98.45	98.07	97.81	97.38
59	67.92	99.96	99.59	99.22	99.00	98.54	98.32	97.97	97.66	97.41	97.06
60	67.48	99.93	99.69	99.56	99.29	98.84	98.56	98.16	97.87	97.47	97.01
61	67.78	99.81	99.66	99.44	99.23	98.78	98.51	98.17	97.85	97.37	97.11
62	66.03	99.79	99.55	99.45	99.41	98.96	98.70	98.27	97.85	97.61	97.30
63	67.68	99.97	99.82	99.39	99.13	98.85	98.71	98.36	98.12	97.71	97.40
64	66.99	100.01	99.73	99.43	99.18	98.84	98.55	98.16	97.82	97.36	97.04
65	66.77	100.19	99.91	99.81	99.72	99.37	99.15	98.74	98.43	98.04	97.83
66	66.96	99.88	99.69	99.39	99.04	98.69	98.46	98.15	97.94	97.51	96.98
67	67.79	100.07	99.87	99.66	99.26	98.89	98.61	98.17	97.79	97.64	97.17
68	66.11	99.92	99.68	99.32	99.15	98.90	98.61	98.18	97.78	97.47	97.10
69	67.46	99.82	99.56	99.27	98.89	98.49	98.21	98.06	97.73	97.26	96.99
70	66.87	99.97	99.69	99.34	99.30	98.83	98.52	98.33	97.98	97.59	97.44
71	67.20	100.04	99.82	99.55	99.43	99.12	98.76	98.41	97.99	97.81	97.43
72	66.56	99.92	99.59	99.29	99.10	98.66	98.35	98.02	97.48	96.98	96.68
73	65.77	99.80	99.50	99.32	98.84	98.53	98.33	97.89	97.72	97.22	96.75
74	66.78	99.78	99.40	98.77	98.22	97.92	97.66	97.20	96.80	96.51	96.08
75	66.65	100.05	99.68	99.46	99.07	98.57	98.17	97.90	97.55	97.16	96.62
Avg.	67.03	99.94	99.68	99.40	99.15	98.79	98.51	98.16	97.83	97.48	97.12
Med.	66.96	99.96	99.69	99.39	99.17	98.84	98.55	98.17	97.85	97.51	97.11
st dev	0.74	0.11	0.12	0.19	0.26	0.26	0.27	0.28	0.30	0.32	0.37
Min.	65.69	99.78	99.40	98.77	98.22	97.92	97.66	97.20	96.80	96.51	96.08
Max.	68.65	100.19	99.91	99.81	99.72	99.37	99.15	98.74	98.43	98.04	97.83

3.8 Data Set 3, 105°C, 150mA (Forward Voltage)

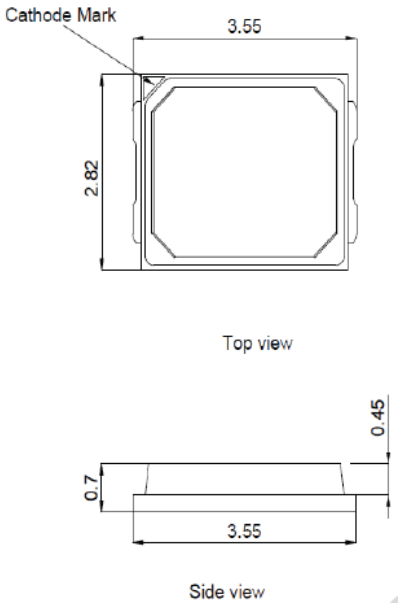
No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
51	3.266	3.270	3.280	3.266	3.296	3.268	3.267	3.267	3.284	3.268	3.269
52	3.232	3.231	3.228	3.229	3.231	3.229	3.231	3.227	3.230	3.231	3.232
53	3.240	3.236	3.235	3.236	3.237	3.238	3.238	3.235	3.237	3.240	3.241
54	3.219	3.216	3.213	3.216	3.217	3.217	3.216	3.214	3.217	3.218	3.217
55	3.239	3.239	3.237	3.237	3.239	3.236	3.239	3.235	3.237	3.240	3.239
56	3.227	3.224	3.223	3.224	3.224	3.222	3.224	3.221	3.223	3.223	3.224
57	3.229	3.230	3.227	3.227	3.228	3.229	3.227	3.228	3.229	3.232	3.230
58	3.224	3.221	3.220	3.220	3.224	3.221	3.221	3.219	3.219	3.221	3.223
59	3.231	3.226	3.225	3.228	3.228	3.229	3.229	3.225	3.227	3.229	3.231
60	3.248	3.243	3.239	3.239	3.242	3.240	3.239	3.240	3.240	3.241	3.243
61	3.218	3.220	3.220	3.219	3.222	3.219	3.219	3.221	3.221	3.219	3.223
62	3.225	3.227	3.225	3.224	3.226	3.226	3.224	3.226	3.226	3.225	3.227
63	3.225	3.223	3.223	3.223	3.224	3.222	3.223	3.223	3.224	3.221	3.225
64	3.217	3.217	3.213	3.217	3.218	3.217	3.212	3.216	3.216	3.217	3.221
65	3.257	3.258	3.255	3.257	3.260	3.257	3.256	3.257	3.257	3.260	3.260
66	3.218	3.217	3.217	3.217	3.218	3.218	3.213	3.216	3.218	3.219	3.219
67	3.219	3.218	3.215	3.217	3.218	3.217	3.215	3.215	3.217	3.217	3.217
68	3.265	3.264	3.260	3.264	3.264	3.264	3.264	3.263	3.263	3.264	3.269
69	3.241	3.241	3.240	3.241	3.240	3.240	3.239	3.241	3.241	3.241	3.244
70	3.228	3.225	3.226	3.227	3.227	3.226	3.227	3.230	3.227	3.228	3.230
71	3.229	3.230	3.229	3.226	3.279	3.239	3.229	3.317	3.251	3.228	3.225
72	3.223	3.223	3.220	3.224	3.223	3.223	3.221	3.228	3.229	3.227	3.222
73	3.220	3.221	3.219	3.220	3.220	3.219	3.219	3.220	3.218	3.221	3.220
74	3.222	3.222	3.220	3.222	3.220	3.219	3.220	3.219	3.223	3.220	3.222
75	3.269	3.269	3.266	3.268	3.268	3.269	3.268	3.265	3.268	3.270	3.269
Avg.	3.233	3.232	3.231	3.232	3.236	3.232	3.231	3.235	3.234	3.233	3.234
Med.	3.228	3.226	3.225	3.226	3.227	3.226	3.227	3.227	3.227	3.228	3.227
st dev	0.016	0.016	0.017	0.016	0.021	0.016	0.017	0.023	0.018	0.016	0.017
Min.	3.217	3.216	3.213	3.216	3.217	3.217	3.212	3.214	3.216	3.217	3.217
Max.	3.269	3.270	3.280	3.268	3.296	3.269	3.268	3.317	3.284	3.270	3.269

3.9 Data Set 3, 105°C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
51	0.2613	0.5223	2747	0.0003	0.0004	0.0009	0.0013	0.0016	0.0017	0.0019	0.0022	0.0023	0.0026
52	0.2611	0.5256	2737	0.0005	0.0007	0.0011	0.0015	0.0017	0.0020	0.0022	0.0025	0.0028	0.0029
53	0.2622	0.5266	2710	0.0005	0.0007	0.0010	0.0016	0.0018	0.0021	0.0025	0.0029	0.0031	0.0034
54	0.2625	0.5269	2702	0.0004	0.0007	0.0011	0.0013	0.0015	0.0017	0.0023	0.0030	0.0031	0.0034
55	0.2607	0.5245	2749	0.0003	0.0004	0.0011	0.0013	0.0015	0.0016	0.0021	0.0025	0.0031	0.0035
56	0.2597	0.5238	2775	0.0005	0.0006	0.0012	0.0016	0.0019	0.0021	0.0022	0.0026	0.0034	0.0038
57	0.2619	0.5267	2716	0.0004	0.0005	0.0013	0.0017	0.0019	0.0021	0.0027	0.0030	0.0035	0.0040
58	0.2624	0.5240	2716	0.0004	0.0006	0.0012	0.0016	0.0017	0.0019	0.0027	0.0031	0.0032	0.0037
59	0.2625	0.5261	2705	0.0003	0.0004	0.0008	0.0014	0.0016	0.0017	0.0025	0.0029	0.0032	0.0035
60	0.2611	0.5270	2731	0.0002	0.0004	0.0008	0.0013	0.0015	0.0017	0.0021	0.0027	0.0030	0.0034
61	0.2592	0.5253	2778	0.0001	0.0003	0.0007	0.0012	0.0013	0.0014	0.0015	0.0021	0.0027	0.0032
62	0.2614	0.5262	2729	0.0003	0.0006	0.0007	0.0011	0.0013	0.0015	0.0015	0.0018	0.0025	0.0032
63	0.2592	0.5244	2782	0.0004	0.0006	0.0012	0.0014	0.0015	0.0016	0.0018	0.0019	0.0022	0.0023
64	0.2610	0.5258	2739	0.0002	0.0004	0.0009	0.0016	0.0019	0.0022	0.0026	0.0031	0.0033	0.0036
65	0.2634	0.5244	2693	0.0003	0.0004	0.0010	0.0016	0.0018	0.0021	0.0024	0.0028	0.0034	0.0039
66	0.2613	0.5250	2734	0.0004	0.0006	0.0009	0.0016	0.0019	0.0021	0.0024	0.0030	0.0034	0.0041
67	0.2623	0.5257	2711	0.0004	0.0006	0.0009	0.0014	0.0017	0.0020	0.0026	0.0031	0.0035	0.0037
68	0.2605	0.5256	2750	0.0005	0.0007	0.0011	0.0014	0.0016	0.0018	0.0023	0.0028	0.0032	0.0038
69	0.2604	0.5246	2756	0.0004	0.0005	0.0010	0.0013	0.0014	0.0016	0.0020	0.0022	0.0024	0.0028
70	0.2624	0.5265	2705	0.0004	0.0006	0.0008	0.0013	0.0016	0.0018	0.0021	0.0021	0.0021	0.0024
71	0.2610	0.5250	2741	0.0002	0.0005	0.0008	0.0014	0.0016	0.0018	0.0024	0.0023	0.0025	0.0027
72	0.2614	0.5267	2725	0.0002	0.0005	0.0009	0.0013	0.0015	0.0017	0.0020	0.0022	0.0028	0.0030
73	0.2616	0.5242	2732	0.0003	0.0006	0.0009	0.0013	0.0015	0.0017	0.0023	0.0027	0.0030	0.0033
74	0.2608	0.5253	2744	0.0003	0.0007	0.0011	0.0014	0.0016	0.0019	0.0025	0.0028	0.0032	0.0035
75	0.2625	0.5266	2704	0.0006	0.0008	0.0010	0.0013	0.0016	0.0020	0.0024	0.0029	0.0035	0.0038
Avg.	0.2614	0.5254	2732	0.0004	0.0006	0.0010	0.0014	0.0016	0.0018	0.0022	0.0026	0.0030	0.0033
Med.	0.2613	0.5256	2732	0.0004	0.0006	0.0010	0.0014	0.0016	0.0018	0.0023	0.0027	0.0031	0.0034
st dev	0.0011	0.0012	24	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002	0.0003	0.0004	0.0004	0.0005
Min.	0.2592	0.5223	2693	0.0001	0.0003	0.0007	0.0011	0.0013	0.0014	0.0015	0.0018	0.0021	0.0023
Max.	0.2634	0.5270	2782	0.0006	0.0008	0.0013	0.0017	0.0019	0.0022	0.0027	0.0031	0.0035	0.0041

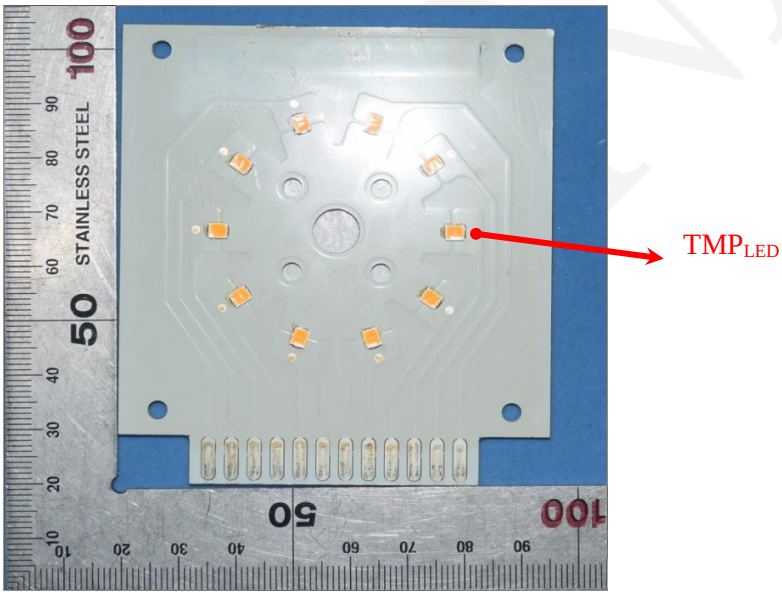
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



5 - Report Revision

Report Number	Report Date	Contents
R2XM190402063-10	2019-04-29	Original report.
R2XM190402063-10-M1	2019-05-13	Update the Family products covered

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

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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)