

# TEST REPORT

According to ANSI/IES LM-80-15  
For

**Bridgelux Inc.**

46430 Fremont Boulevard , Fremont ,CA 94538 USA

**#Model: BXEN-27E-11L-3Y**

<b>Report Type:</b> 9000 Hours Test Report		<b>Product Type:</b> LED Package	
<b>Test Engineer:</b>	Pote Wang <i>Pote Wang</i>		
<b>Report Number:</b>	R2XM190704060-10		
<b>Test Date:</b>	2018-06-23 to 2019-07-04		
<b>Report Date:</b>	2019-10-12		
<b>Reviewed By:</b>	Bill Xiong / EE Engineer <i>Bill Xiong</i>		
<b>Test Facility:</b>	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.		
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<b>Accreditation:</b>	The IAS Accreditation Number TL-460.		

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## 1 - General Information

### 1.1 Description of LED Light Sources

#### Sample Size:

50 PCS samples were received on 2018-06-23. The samples were numbered from 1 to 25 and 26 to 50.

#Manufacturer:	Bridgelux Inc.
#Part Number:	BXEN-27E-11L-3Y
#Part Type:	LED Package
#Drive Level:	DC 80mA
#Nominal CCT:	2700K
#Power:	0.26W
#Average Current Density per LED die:	1181mA/mm <sup>2</sup>
#Average Power Density per LED die:	3.78W/mm <sup>2</sup>
#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 <sup>2</sup> )	Power Density per PCB (W/mm <sup>2</sup> )	Die Spacing (mm)
BXEN-27E-11L-3Y (Tested)	80	0.26	2700	1	80	1181	0.0265	NA
BXEN -(A)(B)-(C)(D)(E)-(F)(G)	80	0.26	≥2200	1	80	1181	0.0265	NA

Here is part number designation for LED package products:

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

BXEN: Designates product family name

(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-11L-3Y are the same to the products in report #R2XM180623060-10 and is authorized by original applicant to use their test data.

2. All the data in previous report (R2XM180623060-10) 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	2019-06-28	2020-06-27
LED Test Source	EVERFINE	LTS-300	P185616CD1371113	2019-06-28	2020-06-27
High Accuracy Array Spectroradiometer	EVERFINE	HAAS-2000	P600674CM1381123	2019-06-28	2020-06-27
Standard Light Source	EVERFINE	D062	G100278CJ7351206	2018-12-24	2019-12-24
Multilayer aging machine	BACL	B2-270	20023	2019-03-10	2020-03-09
DC Power Supply	BACL	B12001-12	90023	2019-01-07	2020-01-07

## 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  $2^{\circ}\text{C}$  below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to  $5^{\circ}\text{C}$  below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

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

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

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

## 1.6 Photometric Measurement Method and Uncertainty

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

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

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

## 1.7 Statement of Traceability

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

## 1.8 Sample Set

### Data Set 1: 55°C, 80mA

Part Number: BXEN-27E-11L-3Y

Number of Units: 25

Case Temperature: >53°C

Ambient Temperature: >50°C

Life Test Drive Current: 80mA

Measurement Current: 80mA

### Data Set 2: 85°C, 80mA

Part Number: BXEN-27E-11L-3Y

Number of Units: 25

Case Temperature: >83°C

Ambient Temperature: >80°C

Life Test Drive Current: 80mA

Measurement Current: 80mA

## 2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	$\alpha$	$\beta$	Reported TM-21 L <sub>70</sub> Lifetime
1	25	0	1000hrs	9000hrs	4.551E-06	1.006	>54000hrs
2	25	0	1000hrs	9000hrs	5.132E-06	1.005	>54000hrs

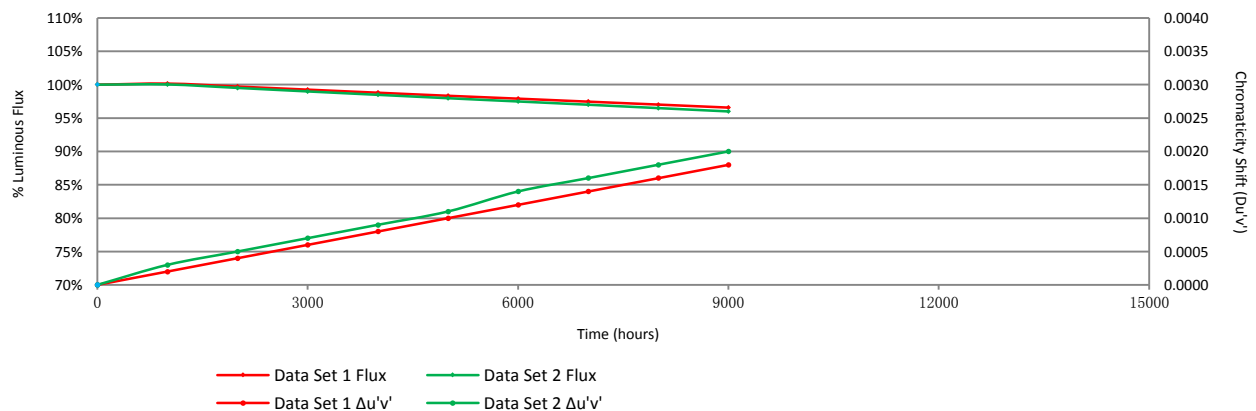
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	100.17%	99.72%	99.26%	98.80%	98.34%	97.91%	97.46%	97.02%	96.57%
2	100.03%	99.51%	98.98%	98.47%	97.96%	97.47%	96.98%	96.47%	95.97%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018
2	0.0003	0.0005	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018	0.0020

Average Lumen Maintenance and Chromaticity Shift VS. Time



### 3 - Test Data

#### 3.1 Data Set 1, 55°C, 80mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	32.15	100.12	99.72	99.35	98.79	98.23	97.82	97.33	96.83	96.39
2	30.89	100.23	99.74	99.29	98.87	98.35	97.80	97.38	97.02	96.67
3	32.30	100.15	99.75	99.26	98.70	98.17	97.80	97.21	96.78	96.25
4	32.77	100.15	99.63	99.18	98.60	98.08	97.53	97.10	96.67	96.16
5	32.54	100.09	99.72	99.17	98.74	98.31	97.91	97.42	96.93	96.50
6	32.15	100.09	99.56	99.13	98.69	98.29	97.92	97.48	96.92	96.45
7	33.27	100.15	99.79	99.31	98.89	98.44	98.05	97.54	96.96	96.45
8	33.15	100.15	99.70	99.22	98.67	98.28	97.77	97.25	96.83	96.32
9	32.09	100.16	99.72	99.19	98.72	98.25	97.82	97.38	96.91	96.42
10	32.99	100.12	99.76	99.33	98.82	98.33	98.00	97.67	97.12	96.64
11	31.75	100.09	99.75	99.34	98.93	98.39	98.05	97.67	97.35	96.85
12	32.08	100.16	99.69	99.19	98.78	98.35	97.94	97.51	97.01	96.60
13	32.56	100.12	99.60	99.11	98.68	98.19	97.76	97.30	96.87	96.44
14	33.02	100.15	99.67	99.15	98.70	98.18	97.64	97.30	97.00	96.49
15	32.54	100.09	99.66	99.14	98.77	98.34	97.76	97.26	96.90	96.53
16	32.29	100.34	99.78	99.35	98.92	98.48	97.99	97.49	97.12	96.69
17	32.23	100.25	99.84	99.38	99.07	98.63	98.23	97.77	97.36	97.02
18	31.75	100.16	99.65	99.28	98.83	98.49	98.02	97.48	97.13	96.72
19	32.57	100.25	99.79	99.32	98.89	98.50	98.04	97.45	96.99	96.50
20	32.08	100.09	99.66	99.13	98.66	98.32	98.00	97.63	97.07	96.66
21	32.05	100.06	99.66	99.28	98.94	98.44	98.00	97.66	97.32	97.00
22	32.33	100.19	99.72	99.16	98.67	98.24	97.87	97.43	96.88	96.38
23	32.83	100.30	99.88	99.45	98.93	98.51	97.99	97.62	97.08	96.53
24	33.00	100.30	99.79	99.27	98.85	98.39	98.00	97.52	97.21	96.88
25	31.41	100.22	99.81	99.43	98.95	98.44	98.09	97.68	97.23	96.66
Avg.	32.35	100.17	99.72	99.26	98.80	98.34	97.91	97.46	97.02	96.57
Med.	32.30	100.15	99.72	99.27	98.79	98.34	97.94	97.48	97.00	96.53
st dev	0.56	0.07	0.08	0.10	0.12	0.13	0.15	0.17	0.18	0.22
Min.	30.89	100.06	99.56	99.11	98.60	98.08	97.53	97.10	96.67	96.16
Max.	33.27	100.34	99.88	99.45	99.07	98.63	98.23	97.77	97.36	97.02

### 3.2 Data Set 1, 55°C, 80mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	3.120	3.128	3.121	3.118	3.120	3.119	3.123	3.229	3.123	3.129
2	3.077	3.075	3.077	3.076	3.079	3.075	3.076	3.076	3.075	3.074
3	3.069	3.071	3.071	3.071	3.080	3.072	3.069	3.066	3.067	3.065
4	3.109	3.107	3.110	3.110	3.108	3.107	3.111	3.107	3.105	3.105
5	3.119	3.116	3.117	3.118	3.116	3.113	3.115	3.113	3.117	3.118
6	3.095	3.099	3.095	3.096	3.095	3.093	3.095	3.095	3.096	3.093
7	3.129	3.131	3.128	3.126	3.129	3.127	3.128	3.128	3.130	3.131
8	3.115	3.115	3.114	3.113	3.114	3.112	3.113	3.113	3.112	3.115
9	3.071	3.070	3.071	3.071	3.070	3.070	3.070	3.068	3.071	3.067
10	3.098	3.103	3.101	3.100	3.099	3.097	3.099	3.099	3.099	3.101
11	3.114	3.113	3.111	3.113	3.112	3.116	3.114	3.111	3.112	3.112
12	3.081	3.083	3.083	3.082	3.082	3.082	3.084	3.079	3.079	3.081
13	3.067	3.075	3.069	3.071	3.068	3.068	3.068	3.065	3.066	3.068
14	3.098	3.096	3.094	3.098	3.095	3.093	3.095	3.091	3.096	3.096
15	3.110	3.112	3.107	3.112	3.107	3.111	3.108	3.111	3.107	3.103
16	3.072	3.074	3.072	3.076	3.071	3.076	3.072	3.073	3.072	3.072
17	3.044	3.046	3.042	3.042	3.045	3.044	3.043	3.046	3.046	3.045
18	3.057	3.056	3.055	3.053	3.053	3.056	3.056	3.052	3.054	3.055
19	3.089	3.088	3.088	3.084	3.086	3.087	3.089	3.087	3.088	3.086
20	3.063	3.064	3.063	3.065	3.060	3.064	3.063	3.063	3.060	3.063
21	3.096	3.092	3.092	3.098	3.098	3.099	3.100	3.093	3.092	3.095
22	3.090	3.083	3.086	3.085	3.082	3.086	3.084	3.086	3.082	3.087
23	3.108	3.108	3.108	3.111	3.106	3.111	3.108	3.105	3.115	3.114
24	3.135	3.137	3.136	3.136	3.136	3.138	3.136	3.134	3.134	3.138
25	3.047	3.044	3.047	3.048	3.047	3.046	3.045	3.045	3.044	3.045
Avg.	3.091	3.091	3.090	3.091	3.090	3.090	3.091	3.093	3.090	3.090
Med.	3.095	3.092	3.092	3.096	3.095	3.093	3.095	3.091	3.092	3.093
st dev	0.025	0.026	0.025	0.025	0.025	0.025	0.026	0.037	0.026	0.027
Min.	3.044	3.044	3.042	3.042	3.045	3.044	3.043	3.045	3.044	3.045
Max.	3.135	3.137	3.136	3.136	3.136	3.138	3.136	3.229	3.134	3.138



### 3.3 Data Set 1, 55°C, 80mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2595	0.5291	2755	0.0001	0.0003	0.0005	0.0006	0.0009	0.0012	0.0016	0.0018	0.0020
2	0.2628	0.5281	2690	0.0001	0.0004	0.0005	0.0008	0.0011	0.0013	0.0016	0.0018	0.0021
3	0.2604	0.5293	2735	0.0003	0.0005	0.0008	0.0009	0.0012	0.0014	0.0016	0.0019	0.0021
4	0.2615	0.5268	2722	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0017	0.0019
5	0.2644	0.5300	2652	0.0002	0.0005	0.0008	0.0011	0.0013	0.0014	0.0016	0.0018	0.0021
6	0.2641	0.5307	2654	0.0001	0.0004	0.0006	0.0008	0.0011	0.0012	0.0014	0.0017	0.0018
7	0.2618	0.5297	2705	0.0001	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0017	0.0020
8	0.2622	0.5291	2699	0.0001	0.0004	0.0007	0.0010	0.0012	0.0016	0.0018	0.0021	0.0023
9	0.2633	0.5277	2682	0.0001	0.0005	0.0006	0.0008	0.0011	0.0014	0.0016	0.0017	0.0019
10	0.2617	0.5320	2699	0.0003	0.0005	0.0006	0.0008	0.0011	0.0014	0.0016	0.0018	0.0019
11	0.2631	0.5296	2679	0.0001	0.0004	0.0006	0.0007	0.0008	0.0009	0.0011	0.0013	0.0016
12	0.2626	0.5292	2690	0.0001	0.0004	0.0006	0.0007	0.0009	0.0012	0.0013	0.0015	0.0018
13	0.2606	0.5278	2737	0.0002	0.0005	0.0008	0.0011	0.0014	0.0015	0.0016	0.0018	0.0020
14	0.2597	0.5268	2762	0.0001	0.0004	0.0007	0.0008	0.0011	0.0013	0.0017	0.0018	0.0019
15	0.2579	0.5295	2788	0.0002	0.0003	0.0006	0.0008	0.0010	0.0012	0.0016	0.0018	0.0020
16	0.2630	0.5300	2681	0.0003	0.0006	0.0007	0.0008	0.0009	0.0011	0.0012	0.0015	0.0016
17	0.2588	0.5299	2767	0.0002	0.0003	0.0006	0.0008	0.0010	0.0011	0.0013	0.0014	0.0016
18	0.2640	0.5313	2654	0.0002	0.0004	0.0005	0.0006	0.0008	0.0011	0.0014	0.0017	0.0018
19	0.2625	0.5309	2687	0.0001	0.0004	0.0005	0.0006	0.0008	0.0010	0.0011	0.0013	0.0016
20	0.2593	0.5299	2756	0.0002	0.0004	0.0005	0.0007	0.0008	0.0009	0.0011	0.0013	0.0016
21	0.2572	0.5287	2808	0.0003	0.0004	0.0005	0.0006	0.0007	0.0010	0.0014	0.0016	0.0018
22	0.2628	0.5299	2684	0.0001	0.0004	0.0005	0.0006	0.0007	0.0008	0.0012	0.0014	0.0015
23	0.2610	0.5283	2728	0.0002	0.0005	0.0007	0.0008	0.0010	0.0011	0.0012	0.0016	0.0017
24	0.2604	0.5293	2735	0.0001	0.0003	0.0006	0.0008	0.0009	0.0012	0.0013	0.0016	0.0018
25	0.2607	0.5266	2740	0.0001	0.0004	0.0005	0.0008	0.0009	0.0011	0.0013	0.0017	0.0018
Avg.	0.2614	0.5292	2716	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018
Med.	0.2617	0.5293	2705	0.0001	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0017	0.0018
st dev	0.0019	0.0014	42	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2572	0.5266	2652	0.0001	0.0003	0.0005	0.0006	0.0007	0.0008	0.0011	0.0013	0.0015
Max.	0.2644	0.5320	2808	0.0003	0.0006	0.0008	0.0011	0.0014	0.0016	0.0018	0.0021	0.0023

### 3.4 Data Set 2, 85°C, 80mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	32.43	100.06	99.69	99.29	98.89	98.49	98.00	97.53	97.10	96.70
27	31.17	99.94	99.49	98.94	98.36	97.75	97.14	96.60	96.18	95.67
28	32.21	99.97	99.38	98.76	98.23	97.70	97.39	96.83	96.31	95.75
29	32.71	99.91	99.36	98.84	98.44	97.92	97.40	96.85	96.33	95.78
30	32.49	100.03	99.60	99.11	98.55	98.03	97.54	97.14	96.65	96.09
31	31.62	100.19	99.78	99.37	98.96	98.29	97.79	97.19	96.65	96.24
32	32.03	100.06	99.50	99.03	98.53	98.06	97.53	97.03	96.53	96.10
33	31.17	100.06	99.49	98.91	98.33	97.75	97.34	96.92	96.44	95.89
34	32.15	99.94	99.50	99.00	98.44	97.92	97.42	96.92	96.45	95.93
35	32.53	99.97	99.42	98.95	98.46	97.94	97.39	96.80	96.28	95.85
36	32.79	100.03	99.54	98.99	98.51	98.08	97.53	97.13	96.61	95.94
37	32.50	99.94	99.51	98.89	98.40	97.82	97.42	96.86	96.37	95.78
38	32.68	99.97	99.51	98.93	98.38	97.80	97.37	97.00	96.54	95.93
39	32.71	99.94	99.30	98.78	98.23	97.77	97.19	96.67	96.06	95.66
40	32.92	100.09	99.64	99.06	98.57	98.03	97.54	97.02	96.45	95.93
41	32.29	99.94	99.38	98.98	98.42	97.86	97.46	97.00	96.59	96.16
42	32.74	100.09	99.54	98.99	98.50	97.98	97.53	97.10	96.67	96.15
43	32.30	100.09	99.47	98.95	98.36	97.96	97.46	96.97	96.41	95.98
44	31.50	100.03	99.43	98.89	98.41	97.94	97.43	96.79	96.22	95.71
45	30.32	100.10	99.51	98.94	98.42	97.99	97.53	97.03	96.54	96.01
46	31.48	100.10	99.65	99.08	98.67	98.06	97.62	97.11	96.54	96.03
47	32.58	99.91	99.51	98.90	98.43	98.00	97.42	96.96	96.41	95.86
48	32.94	100.09	99.54	99.09	98.57	98.06	97.57	97.09	96.54	96.14
49	32.31	100.12	99.54	99.01	98.42	97.93	97.52	96.97	96.56	96.07
50	33.12	100.09	99.58	98.94	98.37	97.86	97.19	96.98	96.44	95.92
Avg.	32.23	100.03	99.51	98.98	98.47	97.96	97.47	96.98	96.47	95.97
Med.	32.43	100.03	99.51	98.95	98.43	97.94	97.46	96.98	96.45	95.93
st dev	0.67	0.08	0.11	0.14	0.17	0.17	0.18	0.18	0.20	0.22
Min.	30.32	99.91	99.30	98.76	98.23	97.70	97.14	96.60	96.06	95.66
Max.	33.12	100.19	99.78	99.37	98.96	98.49	98.00	97.53	97.10	96.70

### 3.5 Data Set 2, 85°C, 80mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	3.128	3.129	3.130	3.127	3.129	3.128	3.126	3.125	3.125	3.129
27	3.054	3.058	3.060	3.057	3.057	3.058	3.060	3.059	3.058	3.057
28	3.080	3.078	3.079	3.078	3.077	3.079	3.076	3.077	3.079	3.077
29	3.086	3.083	3.082	3.084	3.085	3.087	3.087	3.089	3.087	3.083
30	3.072	3.073	3.075	3.071	3.072	3.074	3.072	3.070	3.071	3.073
31	3.093	3.094	3.090	3.093	3.093	3.098	3.096	3.095	3.093	3.094
32	3.118	3.116	3.117	3.117	3.114	3.114	3.117	3.114	3.115	3.118
33	3.065	3.068	3.064	3.066	3.065	3.061	3.066	3.068	3.068	3.066
34	3.118	3.116	3.116	3.117	3.115	3.116	3.118	3.117	3.116	3.116
35	3.098	3.099	3.100	3.100	3.094	3.095	3.096	3.101	3.101	3.103
36	3.081	3.081	3.080	3.082	3.079	3.081	3.081	3.081	3.081	3.082
37	3.105	3.103	3.105	3.104	3.104	3.103	3.106	3.106	3.103	3.105
38	3.086	3.084	3.086	3.086	3.082	3.085	3.084	3.082	3.082	3.084
39	3.071	3.071	3.070	3.072	3.070	3.072	3.073	3.070	3.072	3.071
40	3.122	3.122	3.119	3.120	3.118	3.119	3.120	3.118	3.119	3.122
41	3.036	3.037	3.037	3.037	3.033	3.040	3.039	3.037	3.038	3.040
42	3.101	3.100	3.103	3.102	3.096	3.104	3.103	3.104	3.101	3.103
43	3.118	3.115	3.108	3.110	3.111	3.110	3.111	3.110	3.113	3.113
44	3.058	3.056	3.057	3.058	3.056	3.058	3.059	3.054	3.058	3.059
45	3.079	3.080	3.081	3.077	3.076	3.080	3.080	3.081	3.092	3.090
46	3.078	3.075	3.076	3.075	3.075	3.075	3.075	3.074	3.078	3.078
47	3.072	3.071	3.072	3.070	3.075	3.076	3.073	3.073	3.078	3.074
48	3.095	3.094	3.091	3.093	3.090	3.094	3.091	3.090	3.092	3.092
49	3.110	3.109	3.111	3.108	3.109	3.108	3.107	3.109	3.110	3.108
50	3.117	3.118	3.115	3.117	3.116	3.118	3.115	3.118	3.118	3.117
Avg.	3.090	3.089	3.089	3.089	3.088	3.089	3.089	3.089	3.090	3.090
Med.	3.086	3.084	3.086	3.086	3.085	3.087	3.087	3.089	3.092	3.090
st dev	0.024	0.023	0.023	0.023	0.023	0.023	0.022	0.023	0.022	0.023
Min.	3.036	3.037	3.037	3.037	3.033	3.040	3.039	3.037	3.038	3.040
Max.	3.128	3.129	3.130	3.127	3.129	3.128	3.126	3.125	3.125	3.129

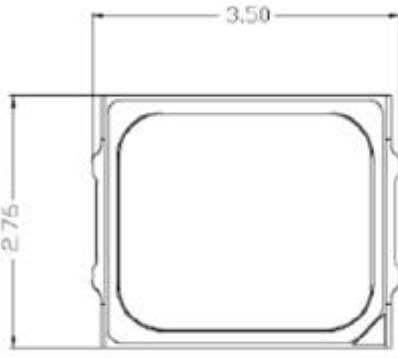
### 3.6 Data Set 2, 85°C, 80mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	0.2618	0.5290	2708	0.0001	0.0004	0.0005	0.0009	0.0011	0.0013	0.0015	0.0016	0.0018
27	0.2591	0.5289	2764	0.0004	0.0006	0.0008	0.0010	0.0013	0.0015	0.0019	0.0021	0.0023
28	0.2632	0.5286	2681	0.0004	0.0007	0.0010	0.0012	0.0013	0.0017	0.0020	0.0023	0.0025
29	0.2603	0.5276	2744	0.0002	0.0006	0.0008	0.0010	0.0013	0.0015	0.0018	0.0021	0.0022
30	0.2625	0.5296	2692	0.0003	0.0004	0.0006	0.0007	0.0009	0.0010	0.0014	0.0018	0.0020
31	0.2617	0.5288	2711	0.0002	0.0004	0.0006	0.0008	0.0010	0.0011	0.0014	0.0017	0.0019
32	0.2606	0.5299	2728	0.0004	0.0006	0.0008	0.0010	0.0013	0.0014	0.0016	0.0017	0.0018
33	0.2629	0.5275	2691	0.0003	0.0005	0.0008	0.0011	0.0014	0.0018	0.0020	0.0022	0.0023
34	0.2640	0.5296	2661	0.0003	0.0004	0.0007	0.0010	0.0011	0.0015	0.0016	0.0019	0.0022
35	0.2600	0.5279	2751	0.0003	0.0005	0.0007	0.0010	0.0012	0.0014	0.0016	0.0019	0.0022
36	0.2605	0.5277	2741	0.0001	0.0003	0.0006	0.0009	0.0011	0.0013	0.0017	0.0020	0.0023
37	0.2617	0.5282	2713	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009	0.0010	0.0013	0.0017
38	0.2610	0.5278	2730	0.0004	0.0005	0.0006	0.0008	0.0010	0.0013	0.0014	0.0016	0.0018
39	0.2577	0.5276	2801	0.0003	0.0004	0.0005	0.0007	0.0008	0.0010	0.0011	0.0013	0.0016
40	0.2592	0.5285	2765	0.0003	0.0005	0.0006	0.0007	0.0008	0.0011	0.0013	0.0014	0.0016
41	0.2595	0.5290	2756	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0012	0.0014	0.0016
42	0.2591	0.5284	2768	0.0002	0.0006	0.0008	0.0009	0.0010	0.0011	0.0013	0.0016	0.0019
43	0.2616	0.5288	2713	0.0003	0.0004	0.0006	0.0009	0.0012	0.0014	0.0016	0.0018	0.0019
44	0.2581	0.5310	2777	0.0001	0.0003	0.0004	0.0006	0.0008	0.0012	0.0014	0.0017	0.0019
45	0.2602	0.5280	2746	0.0005	0.0006	0.0007	0.0009	0.0010	0.0013	0.0015	0.0016	0.0019
46	0.2620	0.5295	2703	0.0004	0.0006	0.0008	0.0011	0.0013	0.0015	0.0017	0.0018	0.0021
47	0.2590	0.5286	2768	0.0004	0.0006	0.0009	0.0012	0.0013	0.0016	0.0018	0.0019	0.0022
48	0.2597	0.5281	2757	0.0004	0.0007	0.0010	0.0012	0.0015	0.0017	0.0021	0.0022	0.0023
49	0.2597	0.5270	2759	0.0002	0.0005	0.0009	0.0010	0.0013	0.0016	0.0018	0.0021	0.0021
50	0.2626	0.5294	2690	0.0003	0.0004	0.0007	0.0008	0.0013	0.0017	0.0018	0.0021	0.0023
Avg.	0.2607	0.5286	2733	0.0003	0.0005	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018	0.0020
Med.	0.2605	0.5286	2741	0.0003	0.0005	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018	0.0020
st dev	0.0016	0.0009	35	0.0001	0.0001	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
Min.	0.2577	0.5270	2661	0.0001	0.0003	0.0004	0.0006	0.0007	0.0009	0.0010	0.0013	0.0016
Max.	0.2640	0.5310	2801	0.0005	0.0007	0.0010	0.0012	0.0015	0.0018	0.0021	0.0023	0.0025

#### 4 - DUT Photo

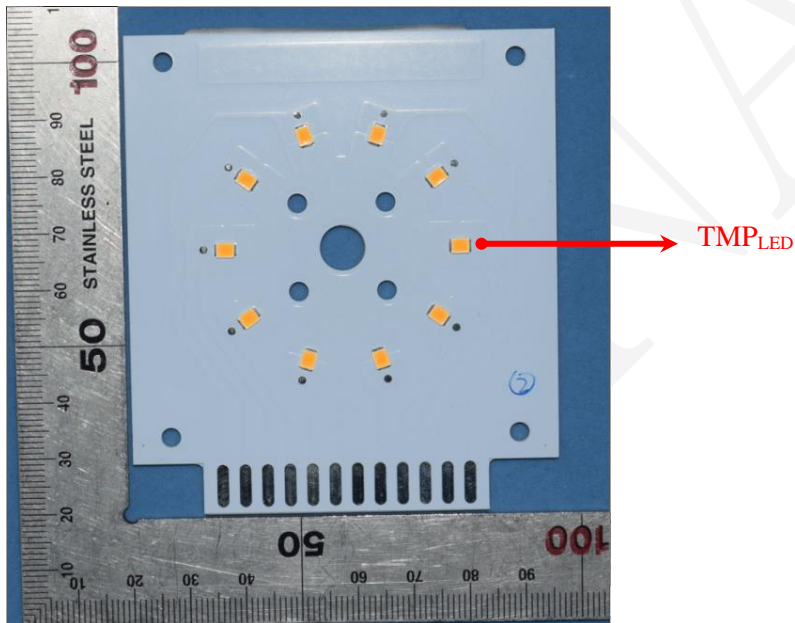
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##### 4.1 #Mechanical Dimensions



All dimensions are in millimeter

##### 4.2 DUT Photo



## Directions

1. The information marked # is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
3. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
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\*\*\*\*\*END OF REPORT\*\*\*\*\*



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*C.P. Ramani*

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



## SCOPE OF ACCREDITATION

FIELDS OF TESTING	ACCREDITED TEST METHODS
<b>ENERGY STAR Program</b> 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)