



IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

LIGHTNING OPTOELECTRONIC TECHNOLOGY (SZ) Co., LTD.

Building B. Wen Tao Technological Park. Yingrenshi Community. Shiyuan Street. Baoan District. Shenzhen.
518108 China

Model: T20 Series

Report Type: 6000 Hours Interim Test Report		Product Type: LED Package	
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Test Date:	2014-08-13 to 2015-04-20		
Report Date:	2015-04-23		
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Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number: T2030821A
 Part Name: 2016
 Part Type: LED Package
 Nominal CCT: 3000K
 LED Driver Current : 60mA

Family products covered by this report:

According to ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products, the following products can be covered by this report base on the declaration letter of manufacturer (see attachment B for more information). The information of these models shows that the covered products meet all section 3 item 7 requirements of ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products (September 9, 2011)

Model Name	CCT (K)	CRI	Number of Dies	Current (mA)	Volt (V)	Series	Parallel	Current Per Die (mA)	Current Density (mA/m ²)	Power Density (W/mm ²)
T2030821A (test model)	3000	80	2	60	6	2	1	60	465	2790
T2030921A	3000	90	2	60	6	2	1	60	465	2790
T2027821Q-01AA	2700	80	2	60	6	2	1	60	310	1860
T2030821Q-01AA	3000	80	2	60	6	2	1	60	310	1860
T2035821Q-01AA	3500	80	2	60	6	2	1	60	310	1860
T2040821Q-01AA	4000	80	2	60	6	2	1	60	310	1860
T2050821Q-01AA	5000	80	2	60	6	2	1	60	310	1860
T2057821Q-01AA	5700	80	2	60	6	2	1	60	310	1860
T2065821Q-01AA	6500	80	2	60	6	2	1	60	310	1860
T2027821Q-02AA	2700	80	2	60	6	2	1	60	344	2067
T2030821Q-02AA	3000	80	2	60	6	2	1	60	344	2067
T2035821Q-02AA	3500	80	2	60	6	2	1	60	344	2067

Model Name	CCT (K)	CRI	Number of Dies	Current (mA)	Volt (V)	Series	Parallel	Current Per Die (mA)	Current Density (mA/m ²)	Power Density (W/mm ²)
T2040821Q-02AA	4000	80	2	60	6	2	1	60	344	2067
T2050821Q-02AA	5000	80	2	60	6	2	1	60	344	2067
T2057821Q-02AA	5700	80	2	60	6	2	1	60	344	2067
T2065821Q-02AA	6500	80	2	60	6	2	1	60	344	2067

Disclaimer:

The truthfulness and accuracy of all the technical information above for the covered LED products is ensured by manufacturer of LED light source. Bay Area Compliance Laboratories Corp. (Dongguan) isn't responsible or gives any guarantees for the truthfulness of the technical information.

1.2 Standards Used:

- IESNA LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products(This test method was not accredited by IAS)

1.3 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan). is located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.

1.4 Description of Auxiliary Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Integral Sphere	EVERFINE	Diameter 0.3m	1011119	380-780nm, Diameter:0.3m,0-1999Lumen	2015-03-04	2016-03-04
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2015-03-12	2016-03-12
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2014-12-26	2015-12-26
Standard Light Source	EVERFINE	D062	1011093	N/A	2014-05-06	2015-05-06
Precision digital stabilized DC power supply	EVERFINE	WY605	G115987C J7321114	300VA	2015-03-12	2016-03-12
Multilayen aging machine	BACL	B2-270	20013	N/A	2014-08-11	2015-08-11

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090009	(50/15A)	2014-07-11	2015-07-11
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060002	(50/15A)	2014-07-11	2015-07-11
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060010	(50/15A)	2015-03-12	2016-03-12

1.5 Operating Cycle

Samples are driven with a constant direct current (DC)

1.6 Ambient Conditions

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

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

1.7 Photometry Measurement Uncertainty

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

1.8 Sample Set

Sampling Method:

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

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

Each Sample is soldered to all of the reliability stress boards for a given set of IESNA LM-80 tests.

Sample Size:

Total 75Pcs;

Each Ts test condition 25Pcs

The samples tested at Ts 55 °C, Ts 85 °C and Ts 105 °C were received at 2014-08-11 and tested during 2014-08-13 to 2015-04-20. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75

Data Set 1: 55 °C, 60mA

Part Number:	T2030821A
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 53.2$ °C
Actual Ambient Temperature(T_A):	$T_A = 52.5$ °C
Life Test Drive Current:	$I_F = 60$ mA
Measurement Current:	$I_F = 60$ mA

Data Set 2: 85 °C, 60mA

Part Number:	T2030821A
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 83.1$ °C
Actual Ambient Temperature(T_A):	$T_A = 82.4$ °C
Life Test Drive Current:	$I_F = 60$ mA
Measurement Current:	$I_F = 60$ mA

Data Set 3: 105 °C, 60mA

Part Number:	T2030821A
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 104.3$ °C
Actual Ambient Temperature(T_A):	$T_A = 103.2$ °C
Life Test Drive Current:	$I_F = 60$ mA
Measurement Current:	$I_F = 60$ mA

2 - SUMMARY OF TEST RESULT

Data Set:	Data Set 1, 55 °C, 60mA
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h
Average. Lumen Maintenance at 6000 hours:	97.81%
Average Chromaticity Shift at 6000 hours ($\Delta u'v'$):	0.0021
Reported TM-21 L ₇₀ Lifetime:	>36,000hours

Data Set:	Data Set 2, 85 °C, 60mA
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h
Average. Lumen Maintenance at 6000 hours:	97.35%
Average Chromaticity Shift at 6000 hours($\Delta u'v'$):	0.0026
Reported TM-21 L ₇₀ Lifetime:	>36,000hours

Data Set:	Data Set 3, 105 °C, 60mA
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h
Average. Lumen Maintenance at 6000 hours:	96.22%
Average Chromaticity Shift at 6000 hours($\Delta u'v'$):	0.0029
Reported TM-21 L ₇₀ Lifetime:	>36,000hours

3 - Test Data

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

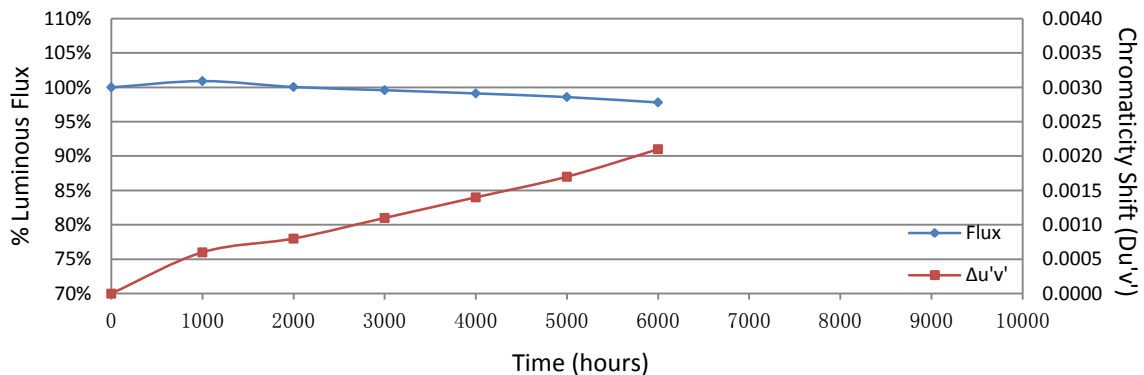
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	6.273	41.81	100.62	100.36	99.93	99.50	98.97	98.04
2	6.294	42.23	100.81	100.40	100.12	99.93	99.50	98.20
3	6.270	41.69	100.46	99.62	98.99	98.46	97.89	97.03
4	6.276	42.21	100.47	99.43	99.08	98.55	98.06	97.84
5	6.281	41.72	100.46	99.86	99.28	98.66	97.91	96.48
6	6.261	42.36	100.50	99.95	99.81	99.62	99.10	98.23
7	6.268	41.96	101.38	100.50	100.19	99.93	99.36	98.07
8	6.261	41.88	101.29	100.50	100.07	99.50	99.04	98.73
9	6.186	42.10	100.64	99.52	99.12	98.72	98.19	97.43
10	6.275	42.70	100.96	99.91	99.25	98.69	98.15	97.92
11	6.266	40.65	101.65	100.96	100.15	99.36	98.77	98.06
12	6.270	42.15	100.55	99.26	98.77	98.15	97.60	96.54
13	6.253	41.16	101.12	100.61	99.88	99.27	98.79	97.76
14	6.271	42.09	101.38	99.93	99.38	98.65	98.08	97.53
15	6.252	41.44	101.16	99.90	99.35	98.67	98.12	97.64
16	6.186	42.06	101.00	99.90	99.41	98.79	98.26	97.86
17	6.261	42.23	100.26	99.83	99.31	98.91	98.53	98.01
18	6.257	41.58	100.34	99.57	99.13	98.82	98.44	97.76
19	6.268	41.86	100.98	99.90	99.59	99.14	98.78	98.09
20	6.182	41.45	100.70	99.95	99.78	99.57	98.94	97.90
21	6.248	41.10	101.61	100.68	100.15	99.78	99.42	98.78
22	6.266	42.33	101.13	100.21	99.91	99.72	99.27	98.35
23	6.207	42.40	100.87	99.62	99.41	99.27	98.63	97.85
24	6.310	41.22	100.97	100.22	99.56	98.91	98.11	97.48
25	6.272	42.11	101.38	100.64	100.05	99.38	98.77	97.65
Ave.	6.257	41.86	100.91	100.05	99.59	99.12	98.59	97.81
Med.	6.266	41.96	100.96	99.93	99.56	99.14	98.63	97.86
st dev	0.032	0.48	0.40	0.44	0.42	0.4990	0.5341	0.5458
Min.	6.182	40.65	100.26	99.26	98.77	98.15	97.60	96.48
Max.	6.310	42.70	101.65	100.96	100.19	99.93	99.50	98.78

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
 α : 5.853E-06
 β : 1.014
Calculated L₇₀: 63,000hrs
Reported L₇₀: >36,000hrs

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

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2485	0.5137	3106	0.0004	0.0007	0.0009	0.0011	0.0015	0.0018
2	0.2466	0.5119	3170	0.0007	0.0011	0.0014	0.0017	0.0014	0.0018
3	0.2472	0.5155	3128	0.0011	0.0013	0.0016	0.0018	0.0023	0.0026
4	0.2467	0.5142	3152	0.0004	0.0007	0.0008	0.0012	0.0014	0.0019
5	0.2465	0.5134	3161	0.0006	0.0007	0.0007	0.0009	0.0014	0.0020
6	0.2459	0.5210	3121	0.0005	0.0005	0.0006	0.0009	0.0014	0.0019
7	0.2468	0.5161	3134	0.0006	0.0007	0.0007	0.0010	0.0015	0.0020
8	0.2465	0.5143	3155	0.0010	0.0014	0.0017	0.0021	0.0025	0.0029
9	0.2474	0.5152	3123	0.0008	0.0010	0.0009	0.0011	0.0016	0.0020
10	0.2467	0.5201	3107	0.0006	0.0007	0.0009	0.0012	0.0014	0.0018
11	0.2477	0.5133	3131	0.0007	0.0009	0.0011	0.0012	0.0014	0.0017
12	0.2465	0.5131	3164	0.0004	0.0006	0.0008	0.0013	0.0014	0.0018
13	0.2469	0.5156	3136	0.0011	0.0012	0.0014	0.0017	0.0020	0.0025
14	0.2463	0.5130	3171	0.0006	0.0009	0.0010	0.0012	0.0015	0.0019
15	0.2445	0.5155	3200	0.0004	0.0004	0.0006	0.0010	0.0013	0.0017
16	0.2473	0.5163	3118	0.0004	0.0007	0.0011	0.0015	0.0021	0.0026
17	0.2496	0.5198	3033	0.0004	0.0006	0.0009	0.0014	0.0017	0.0021
18	0.2448	0.5141	3203	0.0005	0.0007	0.0009	0.0011	0.0014	0.0020
19	0.2505	0.5201	3010	0.0003	0.0005	0.0010	0.0013	0.0017	0.0021
20	0.2484	0.5156	3095	0.0005	0.0005	0.0012	0.0017	0.0020	0.0025
21	0.2447	0.5117	3227	0.0010	0.0015	0.0016	0.0018	0.0021	0.0025
22	0.2464	0.5154	3149	0.0006	0.0008	0.0011	0.0016	0.0019	0.0025
23	0.2466	0.5160	3140	0.0004	0.0004	0.0006	0.0010	0.0013	0.0016
24	0.2486	0.5144	3099	0.0004	0.0004	0.0008	0.0011	0.0017	0.0020
25	0.2459	0.5140	3174	0.0007	0.0014	0.0017	0.0021	0.0024	0.0030
Ave.	0.2469	0.5153	3136	0.0006	0.0008	0.0011	0.0014	0.0017	0.0021
Med.	0.2467	0.5152	3136	0.0006	0.0007	0.0009	0.0012	0.0015	0.0020
st dev	0.0014	0.0025	47.8657	0.0002	0.0003	0.0004	0.0004	0.0004	0.0004
Min.	0.2445	0.5117	3010	0.0003	0.0004	0.0006	0.0009	0.0013	0.0016
Max.	0.2505	0.5210	3227	0.0011	0.0015	0.0017	0.0021	0.0025	0.0030



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

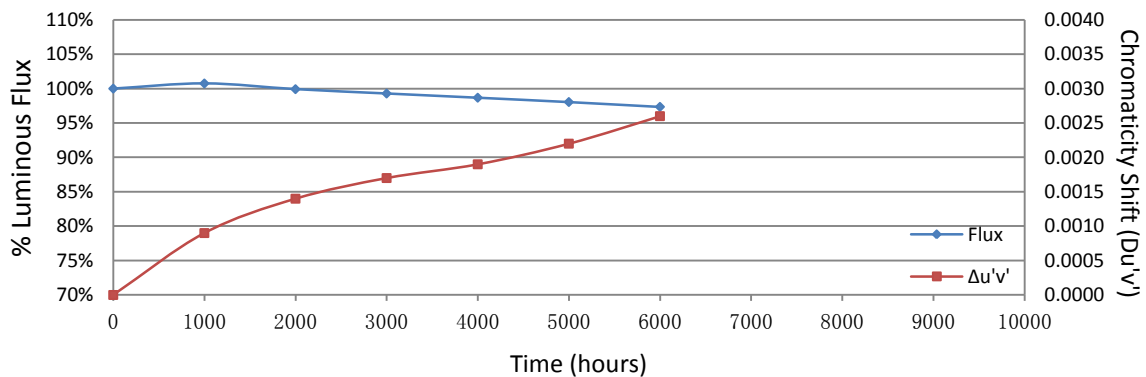
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)					
	Ohr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	6.26	42.08	100.26	99.31	98.74	98.05	97.43	96.60
27	6.28	41.47	100.55	99.76	99.06	98.46	97.71	96.77
28	6.16	40.86	100.20	99.39	98.85	97.72	97.01	96.60
29	6.27	41.90	100.31	99.52	98.83	98.19	97.54	96.52
30	6.28	42.14	100.14	99.34	98.67	98.10	97.48	96.39
31	6.28	42.23	100.36	99.55	98.65	97.73	97.21	96.64
32	6.29	40.58	102.37	101.68	100.91	100.20	99.43	98.79
33	6.28	41.70	100.60	99.76	99.04	98.32	97.65	96.69
34	6.28	41.15	101.99	101.34	100.63	99.90	99.30	98.52
35	6.29	42.27	100.50	99.69	98.96	98.23	97.47	96.78
36	6.28	41.88	100.57	99.79	98.85	97.95	97.18	96.28
37	6.28	41.29	101.45	100.82	100.12	99.56	98.74	97.82
38	6.20	42.12	100.62	99.72	99.00	98.41	97.77	96.94
39	6.21	42.72	100.51	99.67	98.97	98.41	97.85	97.07
40	6.29	40.17	101.42	100.47	100.05	99.83	99.30	98.33
41	6.30	41.44	100.70	99.64	99.13	98.43	97.85	97.32
42	6.29	41.90	100.67	99.76	99.21	98.76	98.09	97.37
43	6.28	42.28	100.38	99.50	98.98	98.51	98.04	97.26
44	6.22	42.74	100.66	99.77	99.13	98.53	97.99	97.54
45	6.31	41.93	100.48	99.55	99.09	98.55	98.07	97.57
46	6.27	40.69	101.55	100.79	100.22	99.68	99.04	98.72
47	6.26	42.14	100.57	99.76	99.29	98.67	98.05	97.77
48	6.28	41.96	100.19	99.38	98.81	98.28	97.71	97.28
49	6.31	41.75	100.81	99.95	99.52	99.14	98.51	98.11
50	6.28	41.98	101.00	100.00	99.62	99.48	98.71	98.00
Ave.	6.27	41.73	100.75	99.92	99.29	98.68	98.05	97.35
Med.	6.28	41.90	100.57	99.76	99.06	98.46	97.85	97.28
st dev	0.04	0.64	0.57	0.62	0.62	0.7041	0.6934	0.7507
Min.	6.16	40.17	100.14	99.31	98.65	97.72	97.01	96.28
Max.	6.31	42.74	102.37	101.68	100.91	100.20	99.43	98.79

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
 α : 6.700E-06
 β : 1.013
Calculated L₇₀: 55,000hrs
Reported L₇₀: >36,000hrs

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

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	0.2485	0.5190	3068	0.0010	0.0015	0.0018	0.0020	0.0023	0.0028
27	0.2478	0.5135	3126	0.0009	0.0015	0.0017	0.0020	0.0024	0.0029
28	0.2472	0.5141	3137	0.0009	0.0014	0.0017	0.0019	0.0021	0.0025
29	0.2482	0.5156	3100	0.0009	0.0014	0.0018	0.0020	0.0024	0.0027
30	0.2465	0.5141	3157	0.0009	0.0014	0.0018	0.0021	0.0024	0.0029
31	0.2460	0.5144	3169	0.0009	0.0014	0.0019	0.0021	0.0024	0.0028
32	0.2455	0.5144	3183	0.0009	0.0013	0.0015	0.0015	0.0018	0.0021
33	0.2469	0.5146	3142	0.0009	0.0014	0.0017	0.0020	0.0023	0.0028
34	0.2456	0.5151	3173	0.0009	0.0012	0.0014	0.0015	0.0017	0.0020
35	0.2480	0.5161	3102	0.0009	0.0014	0.0017	0.0020	0.0023	0.0027
36	0.2492	0.5146	3082	0.0009	0.0015	0.0017	0.0021	0.0024	0.0027
37	0.2456	0.5148	3176	0.0007	0.0012	0.0015	0.0016	0.0019	0.0023
38	0.2470	0.5158	3131	0.0009	0.0013	0.0017	0.0020	0.0022	0.0026
39	0.2490	0.5203	3047	0.0009	0.0014	0.0016	0.0017	0.0021	0.0025
40	0.2474	0.5125	3145	0.0009	0.0011	0.0014	0.0015	0.0017	0.0021
41	0.2531	0.5250	2918	0.0012	0.0016	0.0021	0.0024	0.0027	0.0032
42	0.2478	0.5161	3108	0.0010	0.0016	0.0018	0.0021	0.0026	0.0030
43	0.2455	0.5139	3186	0.0009	0.0015	0.0018	0.0021	0.0025	0.0028
44	0.2463	0.5193	3123	0.0009	0.0015	0.0017	0.0018	0.0023	0.0026
45	0.2447	0.5141	3208	0.0009	0.0016	0.0018	0.0020	0.0023	0.0026
46	0.2481	0.5147	3109	0.0008	0.0014	0.0015	0.0017	0.0020	0.0024
47	0.2472	0.5140	3139	0.0009	0.0016	0.0017	0.0021	0.0023	0.0027
48	0.2471	0.5138	3142	0.0008	0.0015	0.0016	0.0020	0.0023	0.0027
49	0.2459	0.5153	3165	0.0010	0.0016	0.0017	0.0019	0.0022	0.0026
50	0.2470	0.5146	3141	0.0009	0.0013	0.0016	0.0020	0.0023	0.0027
Ave.	0.2472	0.5156	3127	0.0009	0.0014	0.0017	0.0019	0.0022	0.0026
Med.	0.2471	0.5146	3139	0.0009	0.0014	0.0017	0.0020	0.0023	0.0027
st dev	0.0017	0.0027	57.9784	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003
Min.	0.2447	0.5125	2918	0.0007	0.0011	0.0014	0.0015	0.0017	0.0020
Max.	0.2531	0.5250	3208	0.0012	0.0016	0.0021	0.0024	0.0027	0.0032



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

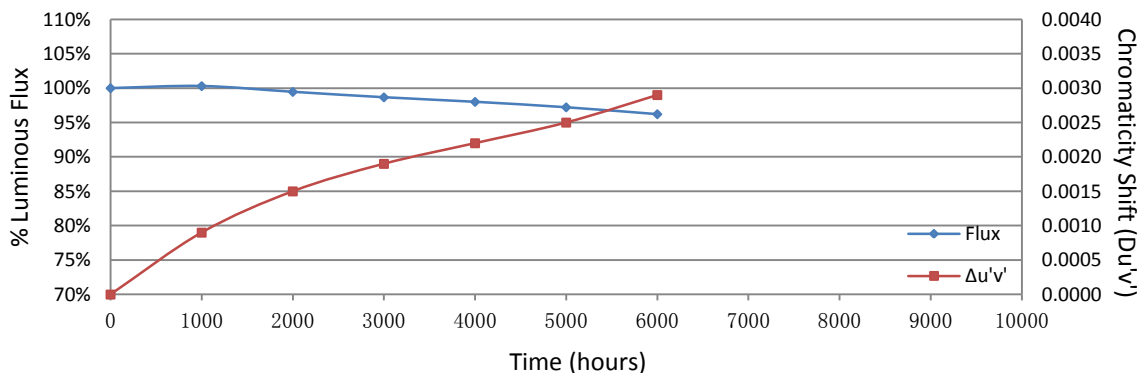
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
51	6.29	42.42	100.26	99.29	98.44	97.60	96.91	96.09
52	6.26	41.66	100.67	99.71	98.97	98.42	97.72	96.88
53	6.27	40.89	101.49	100.51	99.85	99.17	97.48	96.72
54	6.31	41.80	100.07	99.04	98.35	97.58	96.75	95.29
55	6.19	41.98	100.19	99.19	98.40	97.71	97.00	96.31
56	6.26	41.79	100.12	99.09	98.40	97.80	97.06	96.10
57	6.29	41.73	100.41	99.52	98.85	98.32	97.56	96.65
58	6.28	42.03	99.88	98.98	98.22	97.45	96.53	95.65
59	6.28	42.24	100.07	98.82	98.01	97.30	96.57	95.67
60	6.28	41.97	100.24	99.12	98.38	97.83	97.12	96.76
61	6.27	41.85	99.74	98.88	98.09	97.47	96.82	96.15
62	6.28	41.21	100.46	99.66	98.84	98.25	97.62	96.53
63	6.19	41.99	101.00	100.07	99.19	98.55	97.83	97.05
64	6.26	41.87	100.41	99.67	98.52	97.71	96.94	96.23
65	6.26	41.02	100.80	99.88	99.02	98.10	97.25	96.64
66	6.29	42.12	100.21	99.34	98.41	97.84	97.03	95.80
67	6.17	41.53	100.63	100.02	99.30	98.53	97.69	96.32
68	6.27	41.25	100.51	99.85	99.15	98.52	97.67	96.65
69	6.26	41.69	99.93	99.28	98.54	98.18	97.31	95.97
70	6.25	42.47	100.07	99.39	98.54	98.12	97.34	95.64
71	6.26	41.99	99.38	98.71	97.98	97.40	96.74	95.38
72	6.28	41.24	101.36	100.53	99.95	99.25	98.47	97.33
73	6.28	42.33	99.83	99.34	98.46	97.61	96.83	95.54
74	6.27	42.17	100.19	99.55	98.86	98.17	97.34	96.06
75	6.28	41.73	99.64	98.95	98.06	97.46	96.81	96.09
Ave.	6.26	41.80	100.30	99.46	98.67	98.01	97.22	96.22
Med.	6.27	41.85	100.21	99.34	98.52	97.84	97.12	96.15
st dev	0.03	0.42	0.50	0.49	0.53	0.5269	0.4623	0.5356
Min.	6.17	40.89	99.38	98.71	97.98	97.30	96.53	95.29
Max.	6.31	42.47	101.49	100.53	99.95	99.25	98.47	97.33

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
α: 8.077E-06
β: 1.011
Calculated L₇₀: 46,000hrs
Reported L₇₀: >36,000hrs

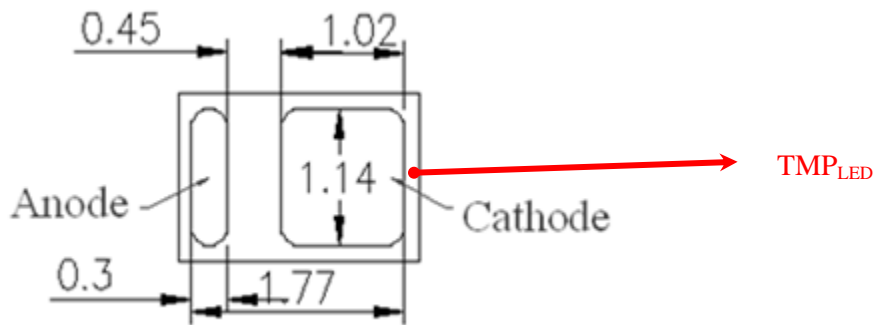
3.6 Data Set 3, 105 °C, 60 mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
51	0.2515	0.5197	2988	0.0009	0.0016	0.0019	0.0023	0.0026	0.0029
52	0.2456	0.5143	3181	0.0010	0.0015	0.0019	0.0022	0.0024	0.0027
53	0.2474	0.5146	3130	0.0009	0.0013	0.0017	0.0017	0.0017	0.0020
54	0.2463	0.5120	3178	0.0009	0.0016	0.0019	0.0024	0.0026	0.0031
55	0.2468	0.5164	3131	0.0008	0.0015	0.0017	0.0023	0.0026	0.0030
56	0.2470	0.5142	3144	0.0009	0.0016	0.0020	0.0025	0.0029	0.0033
57	0.2476	0.5144	3124	0.0008	0.0015	0.0019	0.0023	0.0026	0.0029
58	0.2463	0.5138	3166	0.0008	0.0015	0.0018	0.0021	0.0023	0.0027
59	0.2497	0.5205	3028	0.0008	0.0016	0.0020	0.0022	0.0024	0.0027
60	0.2457	0.5139	3180	0.0008	0.0016	0.0019	0.0023	0.0026	0.0029
61	0.2466	0.5147	3148	0.0009	0.0016	0.0019	0.0022	0.0026	0.0030
62	0.2462	0.5126	3176	0.0009	0.0016	0.0018	0.0020	0.0024	0.0027
63	0.2495	0.5205	3033	0.0008	0.0016	0.0018	0.0020	0.0024	0.0027
64	0.2464	0.5140	3162	0.0008	0.0016	0.0019	0.0022	0.0025	0.0029
65	0.2473	0.5149	3130	0.0008	0.0015	0.0018	0.0021	0.0024	0.0027
66	0.2494	0.5208	3033	0.0007	0.0013	0.0018	0.0020	0.0024	0.0028
67	0.2465	0.5152	3149	0.0008	0.0014	0.0018	0.0020	0.0024	0.0027
68	0.2493	0.5150	3074	0.0008	0.0012	0.0018	0.0021	0.0024	0.0027
69	0.2472	0.5140	3140	0.0011	0.0016	0.0020	0.0024	0.0026	0.0030
70	0.2504	0.5232	2994	0.0009	0.0014	0.0020	0.0024	0.0026	0.0030
71	0.2479	0.5150	3112	0.0009	0.0016	0.0019	0.0023	0.0026	0.0030
72	0.2455	0.5144	3184	0.0009	0.0014	0.0016	0.0020	0.0021	0.0024
73	0.2462	0.5139	3166	0.0009	0.0017	0.0020	0.0024	0.0027	0.0032
74	0.2468	0.5144	3147	0.0010	0.0016	0.0019	0.0023	0.0026	0.0029
75	0.2473	0.5139	3138	0.0009	0.0017	0.0021	0.0024	0.0028	0.0031
Ave.	0.2475	0.5156	3121	0.0009	0.0015	0.0019	0.0022	0.0025	0.0029
Med.	0.2470	0.5144	3140	0.0009	0.0016	0.0019	0.0022	0.0026	0.0029
st dev	0.0016	0.0029	60.1852	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003
Min.	0.2455	0.5120	2988	0.0007	0.0012	0.0016	0.0017	0.0017	0.0020
Max.	0.2515	0.5232	3184	0.0011	0.0017	0.0021	0.0025	0.0029	0.0033



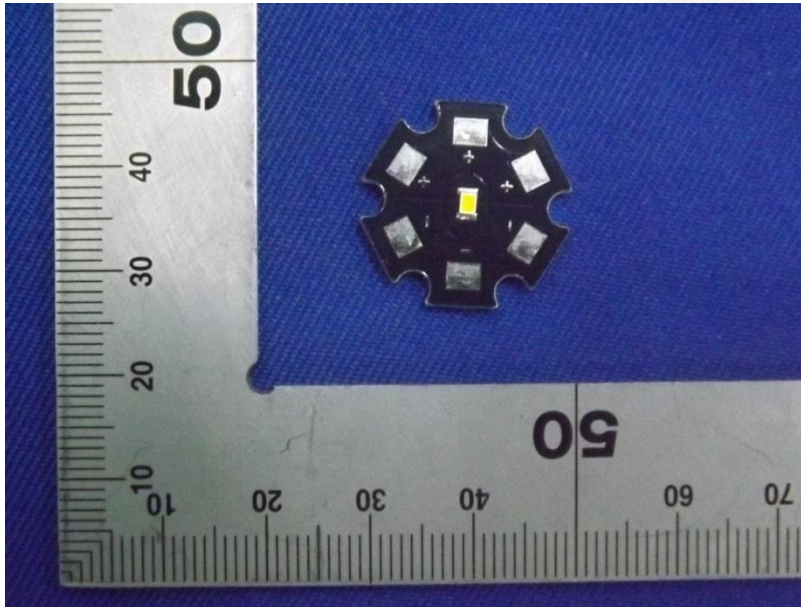
Appendix A – EUT PHOTO

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



All dimensions are in millimeter

A.2 EUT Photo



Attachment B – Family declaration letter

LIGHTNING OPTOELECTRONIC TECHNOLOGY (SZ) Co., LTD

Building B ,Wen Tao Technological Park,Yingrenshi Community,Shiyan Street,Baoan District,Shenzhen,China

ATTESTATION OF SIMILARITY

To Whom It May Concern:

LIGHTNING OPTOELECTRONIC TECHNOLOGY(SZ) Co.,LTD. hereby attest LED 2016 series are designed with identical material and construction processes. And the tested model T2030821A is tested by BACL, the results of which are featured in BACL project is RSZ140811501-10.

The tested model and the other LED package which attest similarity are designed with identical material and identical construction processes. The differences between the tested model and the other LED package which attest similarity are only CCT, CRI, current density and power density. The tested model is the largest LED package, with the greatest current density and power density, and their difference listed in the following table:

Model Name	CCT (K)	CRI	Number of Dies	Current (mA)	Volt (V)	Chip Layout		Current Per Die (mA)	Current Density (mA/mm ²)	Power Density (W/mm ²)
						Series	Parallel			
T2030821A	3000	80	2	60	6	2	1	60	465	2790
T2030921A	3000	90	2	60	6	2	1	60	465	2790
T2027821Q-01AA	2700	80	2	60	6	2	1	60	310	1860
T2030821Q-01AA	3000	80	2	60	6	2	1	60	310	1860
T2035821Q-01AA	3500	80	2	60	6	2	1	60	310	1860
T2040821Q-01AA	4000	80	2	60	6	2	1	60	310	1860
T2050821Q-01AA	5000	80	2	60	6	2	1	60	310	1860
T2057821Q-01AA	5700	80	2	60	6	2	1	60	310	1860
T2065821Q-01AA	6500	80	2	60	6	2	1	60	310	1860
T2027821Q-02AA	2700	80	2	60	6	2	1	60	344	2067
T2030821Q-02AA	3000	80	2	60	6	2	1	60	344	2067
T2035821Q-02AA	3500	80	2	60	6	2	1	60	344	2067
T2040821Q-02AA	4000	80	2	60	6	2	1	60	344	2067
T2050821Q-02AA	5000	80	2	60	6	2	1	60	344	2067
T2057821Q-02AA	5700	80	2	60	6	2	1	60	344	2067
T2065821Q-02AA	6500	80	2	60	6	2	1	60	344	2067

Signature:

Print name: Ray yuan

Title: Manager

LIGHTNING OPTOELECTRONIC TECHNOLOGY(SZ) Co.,LTD.

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