



# IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

## MEASUREMENT AND TEST REPORT

For

### Shenzhen Runlite Technology Co., Ltd

Building 15, Tantou Wset Industrial Zone, Songgang Street, Baoan District, Shenzhen City, China.

**Model: T2835**

<b>Report Type:</b> 9000 hours test report	<b>Product Type:</b> LED Package
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<b>Report Number:</b>	RSZ141117510-10-9000-M3
<b>Test Date:</b>	2014-11-21 to 2015-12-01
<b>Report Date:</b>	2017-03-08
<b>Revised Note:</b>	The previous report RSZ141117510-10-9000-M2 is replaced by this report on 2017-03-08
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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: T2835  
 Part Type: LED Package  
 Nominal CCT: 2700K

### 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	2015-03-25	2016-03-25
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2015-03-05	2016-03-05
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2015-03-25	2016-03-25
Standard Light Source	EVERFINE	D062	1011093	N/A	2015-08-05	2016-08-05
Precision digital stabilized DC power supply	EVERFINE	WY605	G115987C J7321114	300VA	2015-03-05	2016-03-05
Multilayer aging machine	BACL	B2-270	20005	25°C~110°C	2015-09-14	2016-09-13
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060002	(50V/15A)	2015-07-11	2016-07-11
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060010	(50V/15A)	2015-03-05	2016-03-05
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090007	(50V/15A)	2015-03-05	2016-03-05

## 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 2014-11-17 and tested during 2014-11-21 to 2015-12-01. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75

#### Data Set 1: 55 °C, 150mA

Part Number:	T2835
Number of Units:	25
Actual Case Temperature( $T_S$ ):	$T_S = 54.1$ °C
Actual Ambient Temperature( $T_A$ ):	$T_A = 51.2$ °C
Life Test Drive Current:	$I_F = 150$ mA
Measurement Current:	$I_F = 150$ mA

#### Data Set 2: 85 °C,150mA

Part Number:	T2835
Number of Units:	25
Actual Case Temperature( $T_S$ ):	$T_S = 84.2$ °C
Actual Ambient Temperature( $T_A$ ):	$T_A = 82.4$ °C
Life Test Drive Current:	$I_F = 150$ mA
Measurement Current:	$I_F = 150$ mA

#### Data Set 3: 105 °C, 150mA

Part Number:	T2835
Number of Units:	25
Actual Case Temperature( $T_S$ ):	$T_S = 104.4$ °C
Actual Ambient Temperature( $T_A$ ):	$T_A = 103.2$ °C
Life Test Drive Current:	$I_F = 150$ mA
Measurement Current:	$I_F = 150$ mA

## 2 - SUMMARY OF TEST RESULT

<b>Data Set:</b>	<b>Data Set 1, 55 °C, 150mA</b>
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	97.94%
Average. Lumen Maintenance at 9000 hours:	96.69%
Average Chromaticity Shift at 6000 hours ( $\Delta u'v'$ ):	0.0014
Average Chromaticity Shift at 9000 hours ( $\Delta u'v'$ ):	0.0025
Reported TM-21 L <sub>70</sub> Lifetime:	>54,000 hours
Reported TM-21 L <sub>90</sub> Lifetime:	26,000 hours

<b>Data Set:</b>	<b>Data Set 2, 85 °C, 150mA</b>
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	97.38%
Average. Lumen Maintenance at 9000 hours:	95.56%
Average Chromaticity Shift at 6000 hours( $\Delta u'v'$ ):	0.0018
Average Chromaticity Shift at 9000 hours ( $\Delta u'v'$ ):	0.0024
Reported TM-21 L <sub>70</sub> Lifetime:	>54,000 hours
Reported TM-21 L <sub>90</sub> Lifetime:	19,000 hours

<b>Data Set:</b>	<b>Data Set 3, 105 °C, 150mA</b>
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	96.86%
Average. Lumen Maintenance at 9000 hours:	94.59%
Average Chromaticity Shift at 6000 hours( $\Delta u'v'$ ):	0.0016
Average Chromaticity Shift at 9000 hours ( $\Delta u'v'$ ):	0.0028
Reported TM-21 L <sub>70</sub> Lifetime:	47,000 hours
Reported TM-21 L <sub>90</sub> Lifetime:	15,000 hours

### 3 - Test Data

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

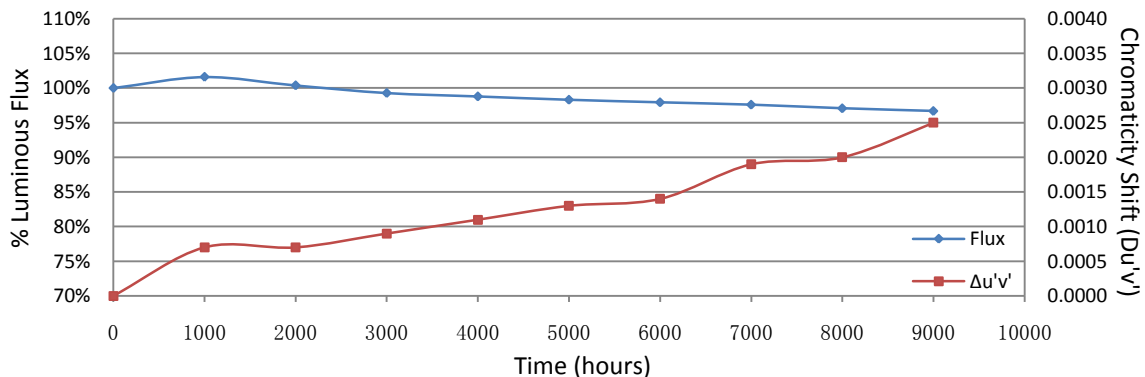
No.	V <sub>F</sub> (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	3.162	57.41	101.41	100.35	99.53	99.11	98.52	98.38	98.15	97.63	97.21
2	3.163	57.97	101.78	100.67	100.29	99.74	99.38	98.88	98.40	98.17	97.90
3	3.174	57.78	101.02	99.93	99.12	98.70	98.17	97.65	97.33	96.64	96.02
4	3.160	57.07	101.07	99.37	99.74	99.23	98.91	97.72	97.44	96.99	96.58
5	3.197	56.45	101.88	100.85	99.19	98.78	98.12	98.09	98.03	97.70	97.47
6	3.167	57.04	101.96	100.82	97.69	97.16	96.74	96.25	95.95	95.34	95.04
7	3.170	56.53	102.19	101.11	99.75	99.20	98.74	98.37	97.88	97.54	97.22
8	3.178	57.69	101.87	100.81	99.48	98.96	98.39	97.83	97.33	96.98	96.67
9	3.161	58.39	102.00	100.86	99.73	99.35	98.99	98.00	97.53	97.19	96.54
10	3.180	56.86	101.79	100.62	99.26	98.86	98.36	97.19	96.75	96.15	95.88
11	3.182	55.91	102.09	100.43	99.55	99.14	98.69	98.30	98.09	97.66	97.35
12	3.162	57.40	101.36	99.86	99.76	99.25	98.92	98.62	98.40	97.67	97.26
13	3.193	58.11	99.69	98.33	97.56	97.11	96.68	96.37	96.21	95.20	94.75
14	3.178	58.04	101.64	99.95	97.88	97.31	96.76	96.45	96.28	95.74	95.33
15	3.179	57.90	101.57	99.79	99.45	98.96	98.48	98.20	97.98	97.51	97.12
16	3.193	57.97	101.33	99.71	98.07	97.55	97.00	96.96	96.10	95.67	95.17
17	3.151	58.78	101.58	100.51	99.59	99.01	98.50	98.32	97.91	97.31	96.92
18	3.159	58.41	101.35	100.38	100.29	99.76	99.37	98.97	98.22	97.91	97.59
19	3.181	58.07	101.43	100.57	99.74	99.29	98.85	98.64	98.55	97.90	97.62
20	3.157	56.79	102.03	100.99	99.37	98.73	98.27	98.15	98.05	97.46	97.04
21	3.264	57.45	100.70	99.74	98.47	97.95	97.56	97.42	97.09	96.66	96.05
22	3.197	57.08	101.58	100.53	99.74	99.23	98.70	98.69	98.37	98.11	97.83
23	3.156	57.41	101.45	100.49	100.26	99.79	99.22	98.95	98.50	97.96	97.72
24	3.176	57.01	103.37	102.14	99.18	98.65	98.19	97.86	97.32	96.40	96.26
25	3.186	56.72	101.87	100.63	99.29	98.80	98.31	98.20	98.11	97.44	96.81
Ave.	3.177	57.45	101.60	100.38	99.28	98.79	98.31	97.94	97.60	97.08	96.69
Med.	3.176	57.41	101.58	100.51	99.48	98.96	98.48	98.15	97.91	97.44	96.92
st dev	0.0226	0.7022	0.6408	0.7136	0.7704	0.7765	0.7920	0.7863	0.7998	0.8793	0.9163
Min.	3.151	55.91	99.69	98.33	97.56	97.11	96.68	96.25	95.95	95.20	94.75
Max.	3.264	58.78	103.37	102.14	100.29	99.79	99.38	98.97	98.55	98.17	97.90

TM-21 Projection:

**Test Duration:** 9000 hours  
**Failures Observed:** 0  
 $\alpha$ : 4.248E-06  
 $\beta$ : 1.005  
**Calculated L<sub>70</sub>:** >54,000hours

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

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	0.2641	0.5326	2647	0.0006	0.0006	0.0008	0.0008	0.0010	0.0017	0.0021	0.0019	0.0022
2	0.2671	0.5348	2583	0.0005	0.0006	0.0013	0.0014	0.0016	0.0012	0.0017	0.0017	0.0018
3	0.2671	0.5355	2580	0.0004	0.0006	0.0009	0.0013	0.0016	0.0015	0.0018	0.0019	0.0020
4	0.2664	0.5340	2598	0.0005	0.0006	0.0022	0.0020	0.0020	0.0018	0.0021	0.0021	0.0022
5	0.2655	0.5327	2621	0.0007	0.0006	0.0010	0.0018	0.0014	0.0015	0.0023	0.0025	0.0022
6	0.2642	0.5316	2650	0.0005	0.0008	0.0014	0.0017	0.0016	0.0013	0.0021	0.0025	0.0022
7	0.2663	0.5333	2604	0.0007	0.0007	0.0007	0.0004	0.0006	0.0006	0.0013	0.0016	0.0021
8	0.2649	0.5320	2633	0.0007	0.0006	0.0008	0.0009	0.0013	0.0014	0.0015	0.0015	0.0022
9	0.2653	0.5327	2625	0.0006	0.0007	0.0009	0.0012	0.0016	0.0017	0.0019	0.0016	0.0021
10	0.2652	0.5328	2626	0.0006	0.0007	0.0008	0.0013	0.0016	0.0011	0.0021	0.0026	0.0028
11	0.2656	0.5337	2615	0.0006	0.0008	0.0009	0.0012	0.0015	0.0018	0.0020	0.0026	0.0034
12	0.2663	0.5332	2604	0.0012	0.0009	0.0007	0.0007	0.0008	0.0019	0.0022	0.0022	0.0030
13	0.2660	0.5337	2606	0.0007	0.0008	0.0009	0.0015	0.0017	0.0016	0.0024	0.0025	0.0033
14	0.2662	0.5356	2597	0.0005	0.0008	0.0011	0.0008	0.0011	0.0016	0.0024	0.0023	0.0032
15	0.2647	0.5316	2640	0.0007	0.0007	0.0007	0.0008	0.0010	0.0011	0.0018	0.0016	0.0026
16	0.2643	0.5320	2646	0.0005	0.0006	0.0007	0.0009	0.0012	0.0010	0.0017	0.0033	0.0043
17	0.2629	0.5314	2676	0.0006	0.0006	0.0007	0.0009	0.0011	0.0014	0.0018	0.0022	0.0032
18	0.2631	0.5310	2674	0.0006	0.0006	0.0006	0.0008	0.0009	0.0006	0.0011	0.0013	0.0027
19	0.2634	0.5295	2674	0.0006	0.0007	0.0008	0.0010	0.0014	0.0004	0.0011	0.0014	0.0016
20	0.2657	0.5331	2615	0.0006	0.0006	0.0007	0.0010	0.0013	0.0011	0.0013	0.0004	0.0013
21	0.2652	0.5324	2627	0.0007	0.0007	0.0007	0.0009	0.0010	0.0004	0.0010	0.0009	0.0017
22	0.2668	0.5333	2594	0.0005	0.0007	0.0009	0.0010	0.0012	0.0010	0.0015	0.0008	0.0016
23	0.2661	0.5324	2610	0.0006	0.0007	0.0008	0.0011	0.0014	0.0011	0.0014	0.0009	0.0018
24	0.2637	0.5317	2660	0.0011	0.0009	0.0004	0.0001	0.0005	0.0009	0.0011	0.0011	0.0012
25	0.2642	0.5313	2650	0.0008	0.0007	0.0008	0.0008	0.0010	0.0045	0.0051	0.0058	0.0067
Ave.	0.2652	0.5327	2626	0.0007	0.0007	0.0009	0.0011	0.0013	0.0014	0.0019	0.0020	0.0025
Med.	0.2653	0.5327	2625	0.0006	0.0007	0.0008	0.0010	0.0013	0.0013	0.0018	0.0019	0.0022
st dev	0.0012	0.0014	28.1425	0.0002	0.0001	0.0003	0.0004	0.0004	0.0008	0.0008	0.0011	0.0011
Min.	0.2629	0.5295	2580	0.0004	0.0006	0.0004	0.0001	0.0005	0.0004	0.0010	0.0004	0.0012
Max.	0.2671	0.5356	2676	0.0012	0.0009	0.0022	0.0020	0.0020	0.0045	0.0051	0.0058	0.0067





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

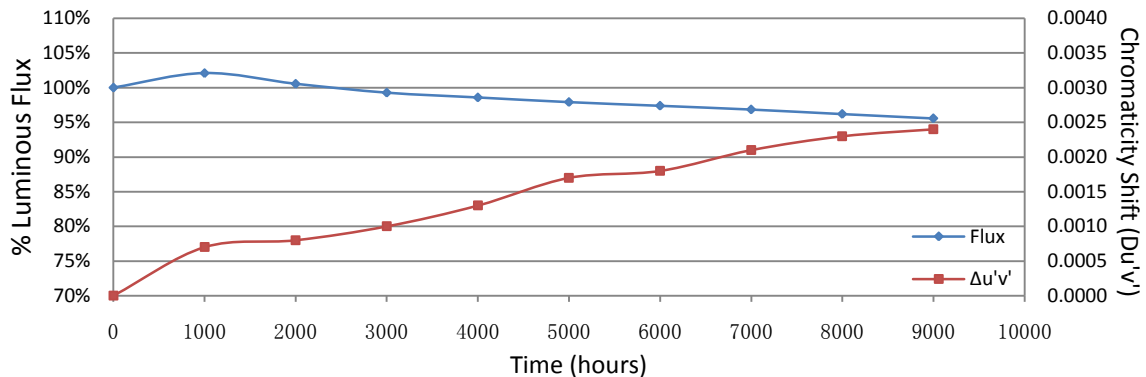
No.	V <sub>F</sub> (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	3.183	56.19	101.01	99.91	98.99	98.11	97.44	97.35	97.03	96.46	95.84
27	3.172	57.83	101.47	100.45	98.62	97.94	97.20	96.90	96.47	95.92	95.30
28	3.148	57.83	99.84	99.10	98.51	97.86	97.20	96.84	95.85	95.52	94.92
29	3.148	58.67	100.32	99.52	97.66	96.83	96.16	95.67	95.19	94.68	94.05
30	3.193	57.37	101.27	100.33	98.94	98.26	97.63	97.42	96.57	95.78	94.93
31	3.165	58.42	100.91	99.61	98.32	97.86	97.31	97.26	96.92	96.23	95.65
32	3.174	57.88	100.86	100.69	100.36	99.57	98.86	98.64	98.57	98.08	97.13
33	3.152	58.45	101.01	100.62	99.71	99.01	98.31	98.19	97.47	96.80	96.15
34	3.155	57.12	102.77	101.47	99.79	98.91	98.28	98.27	97.86	97.95	97.34
35	3.155	57.84	102.82	101.68	100.99	100.28	99.60	98.84	98.60	97.87	97.34
36	3.167	58.54	102.77	101.47	101.47	100.89	100.19	99.93	99.39	97.92	97.18
37	3.171	56.67	102.35	101.13	99.38	98.46	97.78	97.74	97.48	96.98	96.26
38	3.185	57.79	102.35	101.06	98.89	98.11	97.39	97.32	96.83	96.40	95.74
39	3.180	57.08	102.47	101.10	99.16	98.55	97.86	97.18	96.36	95.48	95.01
40	3.162	57.07	102.79	101.02	100.46	99.96	99.26	98.88	97.93	97.27	96.85
41	3.159	58.40	102.86	100.98	97.38	96.40	95.84	95.33	94.78	94.16	93.08
42	3.192	57.44	102.59	100.70	99.16	98.45	97.77	97.09	96.52	95.89	95.33
43	3.158	57.34	102.49	100.61	99.16	98.45	97.77	97.17	96.88	95.81	95.24
44	3.166	57.73	102.17	100.33	99.01	98.44	97.85	97.00	96.69	95.53	94.94
45	3.192	57.51	102.87	101.01	99.10	98.40	97.69	97.57	96.73	96.23	95.77
46	3.180	56.93	102.65	100.70	100.35	99.86	99.16	97.87	97.26	97.14	96.54
47	3.158	58.12	103.18	100.89	99.12	98.37	97.68	94.98	94.27	93.86	93.22
48	3.153	57.60	103.09	99.88	99.90	99.38	98.72	98.19	97.81	97.43	96.89
49	3.279	56.88	102.67	99.74	98.80	98.03	97.45	96.26	95.78	94.94	94.46
50	3.186	57.13	102.71	99.82	98.62	98.09	97.39	96.66	95.89	94.36	93.84
Ave.	3.173	57.59	102.09	100.55	99.27	98.58	97.91	97.38	96.84	96.19	95.56
Med.	3.167	57.60	102.49	100.69	99.12	98.44	97.77	97.32	96.83	96.23	95.65
st dev	0.0262	0.6326	0.9468	0.6727	0.9485	1.0029	0.9835	1.1280	1.1888	1.2214	1.2348
Min.	3.148	56.19	99.84	99.10	97.38	96.40	95.84	94.98	94.27	93.86	93.08
Max.	3.279	58.67	103.18	101.68	101.47	100.89	100.19	99.93	99.39	98.08	97.34

**TM-21 Projection:**

**Test Duration:** 9000 hours  
**Failures Observed:** 0  
**α:** 6.123E-06  
**β:** 1.010  
**Calculated L<sub>70</sub>:** >54,000hours

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

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	0.2669	0.5342	2589	0.0007	0.0009	0.0011	0.0014	0.0016	0.0017	0.0020	0.0021	0.0023
27	0.2663	0.5340	2601	0.0005	0.0006	0.0014	0.0013	0.0017	0.0013	0.0015	0.0016	0.0016
28	0.2667	0.5334	2596	0.0009	0.0012	0.0012	0.0017	0.0020	0.0019	0.0023	0.0025	0.0025
29	0.2642	0.5338	2641	0.0005	0.0007	0.0009	0.0013	0.0016	0.0016	0.0021	0.0027	0.0022
30	0.2658	0.5332	2613	0.0005	0.0007	0.0009	0.0012	0.0016	0.0012	0.0020	0.0025	0.0020
31	0.2671	0.5344	2585	0.0007	0.0006	0.0007	0.0012	0.0016	0.0012	0.0019	0.0023	0.0019
32	0.2652	0.5309	2632	0.0006	0.0008	0.0011	0.0013	0.0016	0.0013	0.0019	0.0023	0.0023
33	0.2666	0.5342	2593	0.0005	0.0006	0.0008	0.0011	0.0024	0.0018	0.0021	0.0022	0.0022
34	0.2672	0.5344	2582	0.0006	0.0006	0.0008	0.0012	0.0015	0.0017	0.0020	0.0023	0.0023
35	0.2667	0.5344	2593	0.0006	0.0006	0.0010	0.0011	0.0014	0.0016	0.0018	0.0022	0.0023
36	0.2646	0.5326	2639	0.0007	0.0008	0.0010	0.0012	0.0016	0.0019	0.0021	0.0023	0.0024
37	0.2623	0.5315	2687	0.0007	0.0007	0.0011	0.0018	0.0021	0.0024	0.0024	0.0026	0.0026
38	0.2665	0.5327	2601	0.0014	0.0015	0.0017	0.0020	0.0023	0.0026	0.0030	0.0031	0.0031
39	0.2650	0.5320	2632	0.0009	0.0008	0.0009	0.0013	0.0016	0.0020	0.0023	0.0025	0.0025
40	0.2655	0.5322	2622	0.0008	0.0008	0.0009	0.0013	0.0015	0.0018	0.0022	0.0023	0.0025
41	0.2669	0.5351	2586	0.0007	0.0005	0.0007	0.0010	0.0014	0.0015	0.0020	0.0021	0.0023
42	0.2646	0.5327	2638	0.0006	0.0006	0.0009	0.0012	0.0015	0.0019	0.0021	0.0023	0.0024
43	0.2659	0.5342	2608	0.0007	0.0008	0.0009	0.0011	0.0015	0.0017	0.0021	0.0022	0.0023
44	0.2637	0.5318	2659	0.0007	0.0006	0.0006	0.0011	0.0014	0.0019	0.0022	0.0023	0.0024
45	0.2622	0.5293	2699	0.0008	0.0009	0.0009	0.0012	0.0016	0.0016	0.0021	0.0022	0.0024
46	0.2642	0.5323	2647	0.0009	0.0009	0.0009	0.0011	0.0014	0.0015	0.0019	0.0020	0.0022
47	0.2653	0.5341	2619	0.0007	0.0006	0.0008	0.0010	0.0015	0.0016	0.0019	0.0021	0.0022
48	0.2656	0.5331	2617	0.0007	0.0007	0.0010	0.0011	0.0014	0.0017	0.0021	0.0022	0.0024
49	0.2649	0.5329	2631	0.0008	0.0011	0.0013	0.0021	0.0024	0.0029	0.0032	0.0033	0.0034
50	0.2665	0.5334	2598	0.0007	0.0007	0.0008	0.0012	0.0016	0.0017	0.0021	0.0022	0.0022
Ave.	0.2655	0.5331	2620	0.0007	0.0008	0.0010	0.0013	0.0017	0.0018	0.0021	0.0023	0.0024
Med.	0.2656	0.5332	2617	0.0007	0.0007	0.0009	0.0012	0.0016	0.0017	0.0021	0.0023	0.0023
st dev	0.0014	0.0013	30.7852	0.0002	0.0002	0.0002	0.0003	0.0003	0.0004	0.0003	0.0003	0.0003
Min.	0.2622	0.5293	2582	0.0005	0.0005	0.0006	0.0010	0.0014	0.0012	0.0015	0.0016	0.0016
Max.	0.2672	0.5351	2699	0.0014	0.0015	0.0017	0.0021	0.0024	0.0029	0.0032	0.0033	0.0034



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

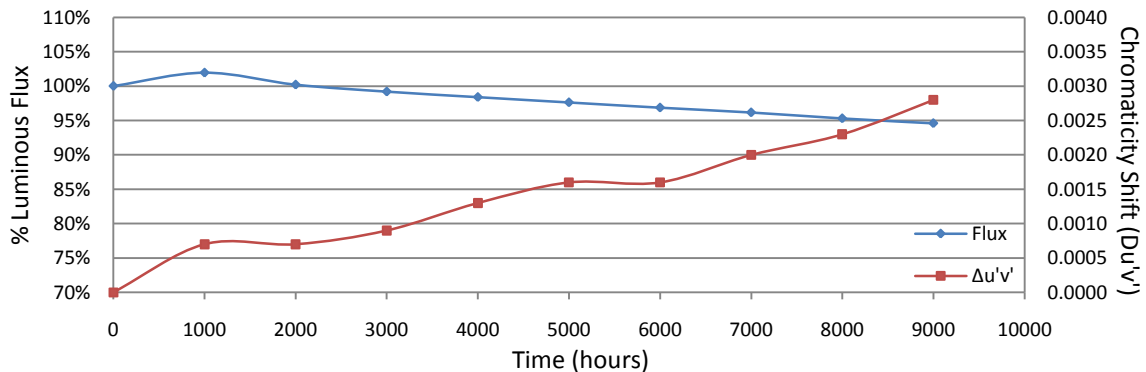
No.	V <sub>F</sub> (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	3.165	58.09	102.41	100.38	98.93	98.14	97.40	96.18	95.44	94.51	93.89
52	3.152	57.83	102.06	100.22	99.95	99.20	98.44	97.54	96.94	96.52	95.82
53	3.182	57.10	102.43	100.47	99.74	98.86	98.16	98.07	97.85	97.09	96.41
54	3.163	58.64	102.01	99.66	99.06	98.29	97.61	96.74	96.28	95.98	95.38
55	3.163	57.48	102.80	100.24	99.88	99.15	98.26	97.48	96.78	95.81	95.16
56	3.175	58.06	101.96	100.16	98.28	97.50	96.73	96.47	96.06	95.56	95.19
57	3.170	57.60	102.14	100.16	99.05	98.32	97.55	97.14	96.49	95.57	94.83
58	3.156	57.61	101.86	99.48	98.13	97.29	96.56	96.51	95.61	94.90	93.96
59	3.179	56.77	101.55	99.35	98.63	98.15	97.30	95.95	95.12	94.45	93.69
60	3.166	57.49	102.05	100.02	99.62	98.82	98.07	96.10	96.00	95.08	94.36
61	3.151	57.24	102.46	100.47	99.23	98.43	97.59	96.72	96.30	95.51	94.85
62	3.151	59.41	99.70	98.30	97.14	96.20	95.40	94.50	94.24	93.49	92.85
63	3.158	57.83	102.32	101.21	101.14	100.54	99.81	98.91	97.60	96.70	96.13
64	3.149	58.39	102.11	100.70	98.96	97.91	97.09	97.09	96.11	95.36	94.31
65	3.148	58.60	101.67	100.26	99.08	98.41	97.70	96.76	95.84	94.97	94.11
66	3.268	57.43	102.44	101.01	99.36	98.55	97.82	97.65	96.99	95.59	94.60
67	3.177	56.60	100.16	98.96	98.06	97.00	96.17	96.01	95.39	94.20	93.43
68	3.165	57.80	101.61	100.14	99.08	98.37	97.54	96.57	95.97	95.10	94.34
69	3.176	58.59	102.01	100.56	99.33	98.45	97.64	97.05	96.69	95.87	95.07
70	3.179	57.18	102.15	100.51	99.84	99.37	98.55	96.99	96.38	95.87	95.07
71	3.191	58.32	101.94	100.50	100.00	99.11	98.29	96.81	95.37	93.62	93.02
72	3.153	56.91	102.13	100.58	99.12	98.31	97.58	97.54	96.66	95.50	94.96
73	3.335	57.45	102.30	101.06	99.88	98.80	98.10	97.32	96.26	95.16	94.60
74	3.169	56.38	101.88	99.77	98.72	98.00	97.25	96.65	95.64	94.61	94.06
75	3.163	58.56	102.27	100.91	99.49	98.62	97.95	96.74	96.04	95.49	94.76
Ave.	3.176	57.73	101.94	100.20	99.19	98.39	97.62	96.86	96.16	95.30	94.59
Med.	3.165	57.61	102.06	100.26	99.12	98.41	97.61	96.76	96.11	95.49	94.60
st dev	0.0406	0.7313	0.6720	0.6687	0.7962	0.8478	0.8560	0.8330	0.7795	0.8636	0.8774
Min.	3.148	56.38	99.70	98.30	97.14	96.20	95.40	94.50	94.24	93.49	92.85
Max.	3.335	59.41	102.80	101.21	101.14	100.54	99.81	98.91	97.85	97.09	96.41

**TM-21 Projection:**

**Test Duration:** 9000 hours  
**Failures Observed:** 0  
**α:** 7.896E-06  
**β:** 1.016  
**Calculated L<sub>70</sub>:** 47,000 hours

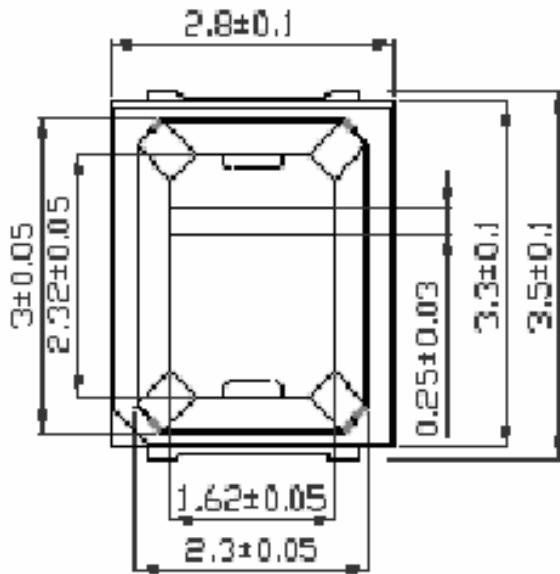
### 3.6 Data Set 3, 105 °C, 150 mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	0.2652	0.5335	2623	0.0007	0.0009	0.0010	0.0014	0.0017	0.0017	0.0018	0.0024	0.0024
52	0.2672	0.5333	2586	0.0006	0.0008	0.0009	0.0014	0.0018	0.0027	0.0030	0.0036	0.0025
53	0.2653	0.5320	2626	0.0008	0.0008	0.0009	0.0011	0.0016	0.0022	0.0029	0.0034	0.0025
54	0.2636	0.5320	2660	0.0007	0.0008	0.0009	0.0014	0.0018	0.0023	0.0028	0.0036	0.0026
55	0.2664	0.5347	2596	0.0008	0.0006	0.0007	0.0013	0.0017	0.0012	0.0021	0.0024	0.0028
56	0.2655	0.5322	2621	0.0007	0.0007	0.0008	0.0012	0.0017	0.0012	0.0018	0.0024	0.0026
57	0.2638	0.5328	2653	0.0007	0.0007	0.0009	0.0012	0.0015	0.0011	0.0017	0.0022	0.0026
58	0.2642	0.5319	2649	0.0007	0.0007	0.0009	0.0014	0.0017	0.0012	0.0018	0.0023	0.0026
59	0.2638	0.5314	2658	0.0009	0.0008	0.0007	0.0013	0.0016	0.0020	0.0029	0.0037	0.0055
60	0.2643	0.5324	2645	0.0007	0.0007	0.0009	0.0013	0.0018	0.0017	0.0019	0.0021	0.0029
61	0.2647	0.5334	2633	0.0006	0.0006	0.0005	0.0011	0.0015	0.0014	0.0016	0.0017	0.0027
62	0.2552	0.5206	2893	0.0008	0.0010	0.0013	0.0012	0.0015	0.0015	0.0019	0.0021	0.0029
63	0.2647	0.5318	2640	0.0007	0.0007	0.0011	0.0013	0.0016	0.0015	0.0018	0.0022	0.0029
64	0.2649	0.5326	2632	0.0006	0.0007	0.0009	0.0014	0.0017	0.0021	0.0023	0.0024	0.0031
65	0.2609	0.5289	2726	0.0007	0.0007	0.0007	0.0009	0.0013	0.0015	0.0017	0.0019	0.0026
66	0.2652	0.5328	2625	0.0009	0.0007	0.0009	0.0011	0.0014	0.0013	0.0015	0.0018	0.0024
67	0.2646	0.5311	2644	0.0009	0.0008	0.0007	0.0015	0.0019	0.0016	0.0022	0.0023	0.0030
68	0.2665	0.5353	2592	0.0005	0.0005	0.0006	0.0011	0.0014	0.0015	0.0016	0.0018	0.0024
69	0.2660	0.5329	2609	0.0007	0.0006	0.0007	0.0011	0.0013	0.0015	0.0017	0.0020	0.0027
70	0.2631	0.5290	2681	0.0009	0.0008	0.0009	0.0011	0.0015	0.0013	0.0015	0.0018	0.0024
71	0.2672	0.5346	2581	0.0007	0.0007	0.0009	0.0012	0.0015	0.0016	0.0018	0.0019	0.0026
72	0.2658	0.5343	2609	0.0006	0.0008	0.0009	0.0012	0.0015	0.0014	0.0017	0.0018	0.0025
73	0.2670	0.5352	2583	0.0006	0.0008	0.0010	0.0012	0.0016	0.0014	0.0019	0.0021	0.0027
74	0.2665	0.5343	2596	0.0007	0.0009	0.0014	0.0016	0.0019	0.0018	0.0020	0.0022	0.0027
75	0.2641	0.5342	2642	0.0006	0.0007	0.0006	0.0012	0.0016	0.0013	0.0017	0.0019	0.0026
Ave.	0.2646	0.5323	2640	0.0007	0.0007	0.0009	0.0013	0.0016	0.0016	0.0020	0.0023	0.0028
Med.	0.2649	0.5328	2632	0.0007	0.0007	0.0009	0.0012	0.0016	0.0015	0.0018	0.0022	0.0026
st dev	0.0024	0.0029	62.2604	0.0001	0.0001	0.0002	0.0002	0.0002	0.0004	0.0004	0.0006	0.0006
Min.	0.2552	0.5206	2581	0.0005	0.0005	0.0005	0.0009	0.0013	0.0011	0.0015	0.0017	0.0024
Max.	0.2672	0.5353	2893	0.0009	0.0010	0.0014	0.0016	0.0019	0.0027	0.0030	0.0037	0.0055



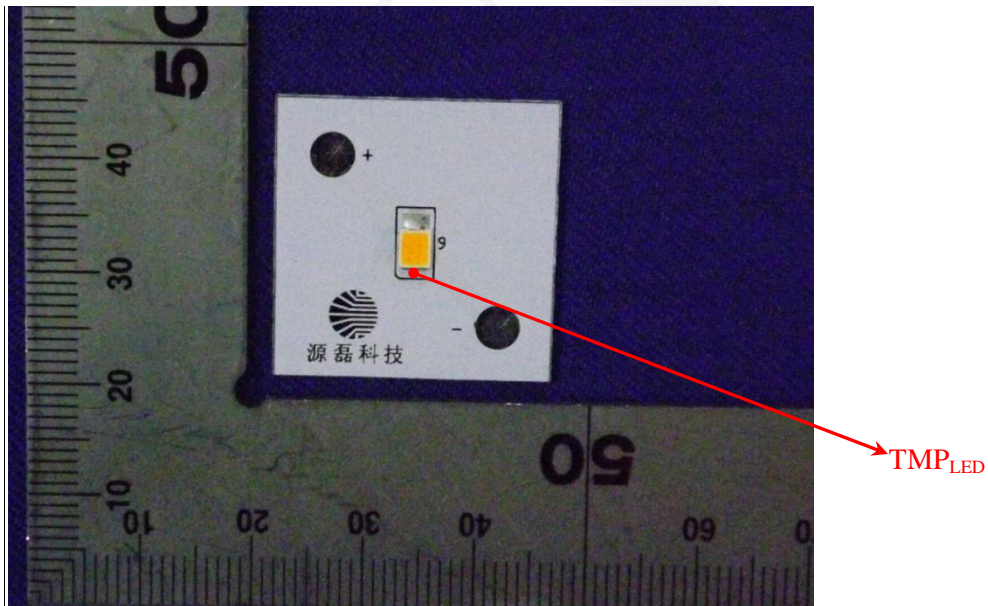
## Appendix A – EUT PHOTO

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



All dimensions are in millimeter

### A.2 EUT Photo



**Appendix B – Report Revision (LM-80)**

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Report Number	Report Date	Contents
RSZ141117510-10-9000	2015-12-16	Original report.
RSZ141117510-10-9000-M1	2016-07-26	Add L90 Lifetime.
RSZ141117510-10-9000-M2	2016-08-31	Update the Chromaticity Shift of 85 °C
RSZ141117510-10-9000-M3	2017-03-08	Add the 7000hrs, 8000hrs and 9000hrs data of 55 °C and 85 °C.

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

FINAL