

Test Report

Report No.: EED35I000136-1

Page 1 of 12

APPLICATION FOR LUMEN MAINTENANCE TESTING ACCORDING TO THE IES LM-80-08 TEST STANDARD

Prepared for: ShenZhen Jingrui photoelectric Co., Ltd.

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Description of the submitted sample(s):

Sample Name : SMD LED
Sample Model : XX-2835XX-XXDX
Sample No. : 35I0136-01~48
Ratings : 100 mA
Target CCT : 2700 K
Manufacturer : ShenZhen Jingrui photoelectric Co., Ltd.
State of Sample(s) : Normal
Sample Quantity : 48 pcs
Reference Standard : IES LM-80-08 Measuring Lumen Maintenance of LED Light Sources

Sample Received Date : Mar. 30, 2016

Sample Tested Date : Apr. 07, 2016 to Dec. 15, 2016

The laboratory that conducted the testing items in this report has been accredited by the National Voluntary Laboratory Accreditation Program (NVLAP LAB CODE: 200889-0), for LM-80 testing of SSL products. And the report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Compiled by

Huangxiubo

Reviewed by

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Approved by

Vivian Wang

Date:

Dec. 21, 2016

Supervisor /Vivian Wang

Check No.: 1996216288

CENTRE TESTING INTERNATIONAL CORPORATION

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Test Report

Report No.: EED35I000136-1

Page 2 of 12

1 SUMMARY

	LM-80 Required Temperature		Specified Temperature of the manufacturer
	55 °C	85 °C	105 °C
Number of LED tested	---	24	24
Drive Current [I_F]	---	100 mA	100 mA
Measurement Current [I_F]	---	100 mA	100 mA
Actual Case Temp. [T_s]	---	≥ 83 °C	≥ 103 °C
Actual Ambient Temp. [T_A]	---	≥ 80 °C	≥ 100 °C
Relative Humidity		$\leq 65\%$	$\leq 65\%$
Average Lumen Maintenance at 6000 hours (%)	---	97.23	96.87
Average Chromaticity Shift ($\Delta u'v'$) at 6000 hours	---	0.0027	0.0028
Calculated L70(6k) (hours)	---	71000	67000
Reported L70(6k) (hours)	---	>36000	>36000
Failures observed	---	None	None

Case Temperature	0 Hour	1,000 Hours	2,000 Hours	3,000 Hours	4,000 Hours	5,000 Hours	6,000 Hours
55°C	---	---	---	---	---	---	---
85°C	100.00	99.63	99.12	98.59	98.03	97.55	97.23
105°C	100.00	99.45	99.01	98.36	97.79	97.36	96.87

Case Temperature	0 Hour	1,000 Hours	2,000 Hours	3,000 Hours	4,000 Hours	5,000 Hours	6,000 Hours
55°C	---	---	---	---	---	---	---
85°C	0.0000	0.0007	0.0013	0.0014	0.0017	0.0023	0.0027
105°C	0.0000	0.0009	0.0017	0.0021	0.0024	0.0026	0.0028

Test Report

Report No.: EED35I000136-1

Page 3 of 12

2 EQUIPMENT LIST

Test Equipment	Model	Calibration Date	Calibration Due Date
Spectroradiometer	CDS 600	Mar. 05, 2016	Mar. 04, 2017
Integrating Sphere	Φ 1.0m	---	---
Standard Lamp	FFS-100-1000	Sept. 03, 2013	Sept. 02, 2016
Standard Lamp	FFS-100-1000	Sept. 02, 2016	Sept. 01, 2019
DC Power Supply	WY12010	Jun. 23, 2015	Jun. 22, 2016
DC Power Supply	WY12010	Jun. 17, 2016	Jun. 16, 2017
Digital Recorder	34970A	Jun. 23, 2015	Jun. 22, 2016
Digital Recorder	34970A	Jun. 17, 2016	Jun. 16, 2017
Multimeter	FLUKE189	Jun. 23, 2015	Jun. 22, 2016
Multimeter	FLUKE17B+	Jun. 17, 2016	Jun. 16, 2017
Oven	LM-80-Q400	Jun. 23, 2015	Jun. 24, 2016
Oven	LM-80-Q400	Jun. 17, 2016	Jun. 16, 2017
DC power Supply	LM-80-Q400	Jun. 23, 2015	Jun. 22, 2016
DC power Supply	LM-80-Q400	Jun. 17, 2016	Jun. 16, 2017
Temperature Tester	LM-80-Q400	Jun. 23, 2015	Jun. 22, 2016
Temperature Tester	LM-80-Q400	Jun. 17, 2016	Jun. 16, 2017

Remark: LM-80-Q400 is an integrated LM-80 Aging Test System

3 Photometry Measurement Uncertainty

 The uncertainty of the light output measurements is $U=1.5\%$ ($K=2$), at the 95% confidence level.

Test Report

Report No.: EED35I000136-1

Page 4 of 12

4 TEST METHODS

4.1 Requirements of Environmental Conditions

Operation of the LED light sources between photometric measurements shall be at a minimum of three case temperatures, T_s , using the same drive current. The three case temperatures, T_s , shall be 55°C and 85°C with a third temperature selected by the manufacturer. Case temperatures shall be controlled to -2°C during life testing. The temperature of the surrounding air should be maintained to within -5°C of the case temperature during testing. The surrounding air temperature should be monitored within the test chamber. Humidity shall be maintained to less than 65%RH throughout the life test. The case temperature T_s is the cathode lead temperature of the LED mounted on a reliability test board. The surrounding air temperature (T_A) should be monitored within the test chamber. The ambient temperature during lumen and chromaticity measurements shall be set to 25°C ± 2°C. The LED light source shall be required to cool to room temperature prior to measurement. Air flow shall be minimized for proper light source starting and operation. The operating orientation of the LED light sources under test should be as specified by the manufacturer.

4.2 Lumen Maintenance Testing Method

Samples under test shall be driven for at least 6,000 hours with data collection at a minimum of every 1000 hours. 10,000 hours are preferred for the purposes of improved predictive modeling. LED light sources are driven at constant current. Checking for LED light source failures either by visual observation or automatic monitoring shall be done at a minimum of every measurement interval. Catastrophic LED light source failure shall be reported and included in the test report. The chromaticity shift shall be measured and reported over the course of the lumen maintenance test time by measuring chromaticity at each photometric test interval.

4.3 Photometric and Electrical Measurements

A CCD Spectroradiometer and Integrating Sphere was used to measure total luminous flux, correlated color temperature, color rendering index, and chromaticity coordinates for each sample. Ambient temperature was measured at a position inside the integrating sphere. Electrical measurements including voltage, current, and power were measured.

Test Report

Report No.: EED35I000136-1

Page 5 of 12

5 TEST DATA

5.1 85°C, 100 mA

No.	Φv [lm]	VF [V]	CCT [K]	Lumen Maintenance [%]					
	0 h (Initial)			1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	136.35	9.17	2752	99.35	99.19	98.41	97.65	97.16	97.04
2	136.38	9.13	2788	99.82	99.43	98.73	98.15	97.77	97.48
3	138.54	9.13	2771	99.48	98.98	98.19	97.46	97.34	96.71
4	136.82	9.17	2796	99.72	99.30	98.67	98.20	97.59	97.31
5	138.90	9.14	2762	99.73	99.22	98.79	98.22	97.69	97.42
6	140.37	9.12	2779	99.77	99.31	98.07	97.47	97.20	96.12
7	136.74	9.12	2777	99.64	99.19	98.40	98.18	97.52	97.36
8	135.68	9.13	2773	99.12	98.90	98.65	98.30	97.62	97.30
9	136.46	9.12	2795	99.53	98.98	98.44	97.96	97.35	97.26
10	139.02	9.13	2767	99.62	98.84	98.51	97.77	97.25	97.09
11	136.95	9.13	2781	99.84	99.42	99.41	98.77	98.29	98.17
12	136.59	9.14	2788	99.85	99.35	98.12	97.63	97.02	96.75
13	137.61	9.10	2765	99.87	99.13	98.93	98.21	97.66	97.36
14	135.59	9.10	2776	99.63	99.47	99.01	98.34	97.86	97.54
15	136.59	9.14	2788	99.39	99.13	98.55	97.80	97.63	97.48
16	135.77	9.15	2767	99.50	98.99	98.56	98.02	97.51	97.37
17	139.85	9.11	2778	99.63	98.84	98.55	98.06	97.72	97.10
18	135.01	9.11	2754	99.60	99.18	98.18	97.62	97.32	96.34
19	139.23	9.15	2773	99.31	98.75	98.70	98.26	97.77	97.29
20	138.12	9.14	2768	99.86	99.01	98.78	98.44	97.81	97.65
21	137.81	9.11	2758	99.84	99.30	98.73	98.25	97.64	97.44
22	137.60	9.14	2755	99.79	98.90	98.53	98.01	97.45	97.26
23	139.16	9.14	2753	99.43	99.11	98.93	98.15	97.61	97.35
24	134.69	9.15	2750	99.78	99.08	98.20	97.83	97.49	97.28
n	24	24	24	24	24	24	24	24	24
Mean	137.33	9.13	2771.4	99.63	99.12	98.59	98.03	97.55	97.23
Median	136.89	9.13	2772.0	99.63	99.13	98.56	98.10	97.60	97.31
St. dev.	1.55	0.02	13.7	0.20	0.20	0.32	0.32	0.27	0.42
Min.	134.69	9.10	2750	99.12	98.75	98.07	97.46	97.02	96.12
Max.	140.37	9.17	2796	99.87	99.47	99.41	98.77	98.29	98.17

Test Report

Report No.: EED35I000136-1

Page 6 of 12

No.	u'	v'	Chromaticity Shift $\Delta u'v'$					
	0 h (Initial)		1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.2595	0.5297	0.0009	0.0016	0.0016	0.0021	0.0026	0.0031
2	0.2579	0.5290	0.0006	0.0013	0.0014	0.0020	0.0024	0.0029
3	0.2586	0.5295	0.0007	0.0014	0.0013	0.0019	0.0024	0.0030
4	0.2575	0.5292	0.0010	0.0016	0.0017	0.0020	0.0028	0.0030
5	0.2590	0.5296	0.0007	0.0014	0.0015	0.0019	0.0026	0.0028
6	0.2581	0.5302	0.0007	0.0015	0.0018	0.0021	0.0028	0.0032
7	0.2582	0.5301	0.0007	0.0014	0.0015	0.0018	0.0024	0.0028
8	0.2586	0.5290	0.0002	0.0013	0.0013	0.0016	0.0022	0.0026
9	0.2574	0.5301	0.0008	0.0013	0.0013	0.0014	0.0020	0.0023
10	0.2587	0.5298	0.0007	0.0014	0.0014	0.0019	0.0025	0.0029
11	0.2581	0.5296	0.0003	0.0009	0.0010	0.0015	0.0020	0.0025
12	0.2578	0.5293	0.0006	0.0013	0.0013	0.0018	0.0025	0.0029
13	0.2589	0.5296	0.0006	0.0012	0.0014	0.0018	0.0024	0.0028
14	0.2583	0.5299	0.0002	0.0008	0.0010	0.0014	0.0019	0.0023
15	0.2578	0.5293	0.0011	0.0008	0.0009	0.0006	0.0009	0.0013
16	0.2588	0.5294	0.0006	0.0013	0.0015	0.0018	0.0024	0.0028
17	0.2581	0.5303	0.0009	0.0015	0.0014	0.0018	0.0023	0.0027
18	0.2593	0.5300	0.0007	0.0014	0.0016	0.0019	0.0024	0.0028
19	0.2584	0.5299	0.0008	0.0014	0.0016	0.0020	0.0026	0.0029
20	0.2587	0.5298	0.0005	0.0012	0.0012	0.0015	0.0019	0.0023
21	0.2592	0.5294	0.0008	0.0013	0.0014	0.0019	0.0024	0.0027
22	0.2593	0.5296	0.0008	0.0013	0.0015	0.0018	0.0024	0.0026
23	0.2594	0.5297	0.0007	0.0014	0.0014	0.0018	0.0023	0.0028
24	0.2596	0.5293	0.0002	0.0008	0.0007	0.0012	0.0018	0.0023
n	24	24	24	24	24	24	24	24
Mean	0.2586	0.5296	0.0007	0.0013	0.0014	0.0017	0.0023	0.0027
Median	0.2586	0.5296	0.0007	0.0013	0.0014	0.0018	0.0024	0.0028
St. dev.	0.0006	0.0004	0.0002	0.0002	0.0003	0.0003	0.0004	0.0004
Min.	0.2574	0.5290	0.0002	0.0008	0.0007	0.0006	0.0009	0.0013
Max.	0.2596	0.5303	0.0011	0.0016	0.0018	0.0021	0.0028	0.0032

Test Report

Report No.: EED35I000136-1

Page 7 of 12

5.2 105°C, 100 mA

No.	Φ_v [lm]	VF [V]	CCT [K]	Lumen Maintenance [%]					
	0 h (Initial)			1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	138.9	9.14	2756	99.32	98.83	98.30	97.66	97.30	96.70
2	135.7	9.12	2778	99.56	99.25	98.93	98.34	98.11	97.48
3	136.4	9.13	2764	99.51	99.25	98.80	98.26	98.04	97.32
4	137.8	9.12	2746	99.48	98.91	98.48	97.83	97.63	96.94
5	138.5	9.11	2771	99.64	99.19	98.77	98.14	97.89	97.16
6	138.3	9.11	2759	99.31	98.76	98.40	98.29	98.08	97.40
7	140.2	9.13	2765	99.50	99.15	98.59	98.04	97.76	96.97
8	134.5	9.12	2760	99.68	99.48	98.61	98.13	97.43	96.90
9	138.4	9.12	2767	99.53	99.21	98.28	97.72	96.99	96.76
10	138.6	9.18	2767	99.45	99.03	98.14	97.58	96.87	96.54
11	137.1	9.12	2770	99.32	98.76	98.31	97.80	97.41	97.12
12	139.2	9.13	2773	99.25	98.83	97.91	97.30	96.64	96.39
13	137.7	9.12	2756	99.07	98.53	97.72	97.18	96.88	96.54
14	137.4	9.10	2759	99.59	99.15	98.31	97.70	97.02	96.67
15	138.4	9.12	2767	98.97	98.28	97.82	97.05	96.42	96.03
16	136.3	9.14	2769	99.67	99.42	98.47	98.02	97.31	96.65
17	137.03	9.13	2751	99.36	98.87	97.98	97.50	97.46	96.79
18	136.04	9.11	2758	99.69	99.22	98.41	97.90	97.25	96.61
19	135.40	9.13	2759	99.46	99.07	98.00	97.64	96.97	96.70
20	140.13	9.15	2762	99.64	99.24	98.58	97.58	97.35	97.04
21	137.32	9.13	2763	99.47	99.14	98.25	97.65	97.34	97.10
22	139.48	9.13	2794	99.35	98.51	98.49	98.00	97.64	97.38
23	140.03	9.14	2782	99.25	98.88	98.31	97.38	97.03	96.72
24	136.86	9.16	2773	99.71	99.29	98.72	98.15	97.78	97.04
n	24	24	24	24	24	24	24	24	24
Mean	137.7	9.13	2765.4	99.45	99.01	98.36	97.79	97.36	96.87
Median	137.7	9.13	2764.5	99.48	99.10	98.36	97.76	97.34	96.84
St. dev.	1.5	0.02	10.3	0.19	0.30	0.32	0.35	0.45	0.35
Min.	134.5	9.10	2746	98.97	98.28	97.72	97.05	96.42	96.03
Max.	140.2	9.18	2794	99.71	99.48	98.93	98.34	98.11	97.48

Test Report

Report No.: EED35I000136-1

Page 8 of 12

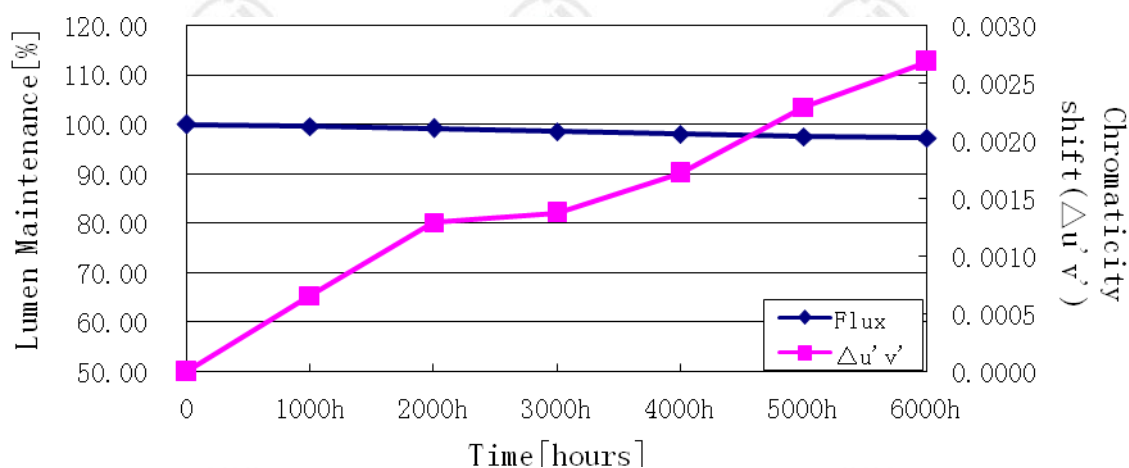
No.	u'	v'	Chromaticity Shift $\Delta u'v'$					
	0 h (Initial)		1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.2593	0.5295	0.0010	0.0018	0.0023	0.0028	0.0030	0.0031
2	0.2583	0.5294	0.0009	0.0017	0.0021	0.0024	0.0026	0.0027
3	0.2588	0.5299	0.0009	0.0016	0.0020	0.0023	0.0025	0.0025
4	0.2597	0.5296	0.0010	0.0019	0.0023	0.0026	0.0029	0.0030
5	0.2585	0.5297	0.0008	0.0017	0.0022	0.0025	0.0027	0.0028
6	0.2592	0.5296	0.0007	0.0016	0.0021	0.0024	0.0026	0.0027
7	0.2588	0.5301	0.0008	0.0016	0.0021	0.0024	0.0025	0.0026
8	0.2591	0.5294	0.0009	0.0018	0.0021	0.0024	0.0026	0.0027
9	0.2587	0.5298	0.0010	0.0019	0.0023	0.0026	0.0028	0.0028
10	0.2586	0.5303	0.0008	0.0017	0.0021	0.0025	0.0027	0.0028
11	0.2586	0.5295	0.0009	0.0018	0.0022	0.0025	0.0028	0.0029
12	0.2584	0.5301	0.0012	0.0020	0.0023	0.0026	0.0029	0.0030
13	0.2593	0.5296	0.0009	0.0017	0.0021	0.0025	0.0027	0.0028
14	0.2592	0.5293	0.0007	0.0015	0.0019	0.0023	0.0026	0.0026
15	0.2587	0.5298	0.0010	0.0015	0.0021	0.0022	0.0025	0.0035
16	0.2585	0.5303	0.0007	0.0016	0.0020	0.0023	0.0026	0.0026
17	0.2595	0.5295	0.0011	0.0018	0.0023	0.0026	0.0026	0.0027
18	0.2592	0.5296	0.0009	0.0016	0.0021	0.0025	0.0027	0.0028
19	0.2591	0.5300	0.0006	0.0014	0.0020	0.0020	0.0022	0.0023
20	0.2589	0.5300	0.0009	0.0017	0.0021	0.0025	0.0028	0.0029
21	0.2590	0.5292	0.0005	0.0013	0.0018	0.0019	0.0021	0.0021
22	0.2574	0.5300	0.0008	0.0017	0.0020	0.0024	0.0025	0.0028
23	0.2580	0.5301	0.0010	0.0019	0.0023	0.0027	0.0029	0.0030
24	0.2585	0.5297	0.0007	0.0017	0.0021	0.0024	0.0028	0.0028
n	24	24	24	24	24	24	24	24
Mean	0.2588	0.5297	0.0009	0.0017	0.0021	0.0024	0.0026	0.0028
Median	0.2588	0.5297	0.0009	0.0017	0.0021	0.0024	0.0027	0.0028
St. dev.	0.0005	0.0003	0.0002	0.0002	0.0001	0.0002	0.0002	0.0003
Min.	0.2574	0.5292	0.0005	0.0013	0.0018	0.0019	0.0021	0.0021
Max.	0.2597	0.5303	0.0012	0.0020	0.0023	0.0028	0.0030	0.0035

Test Report

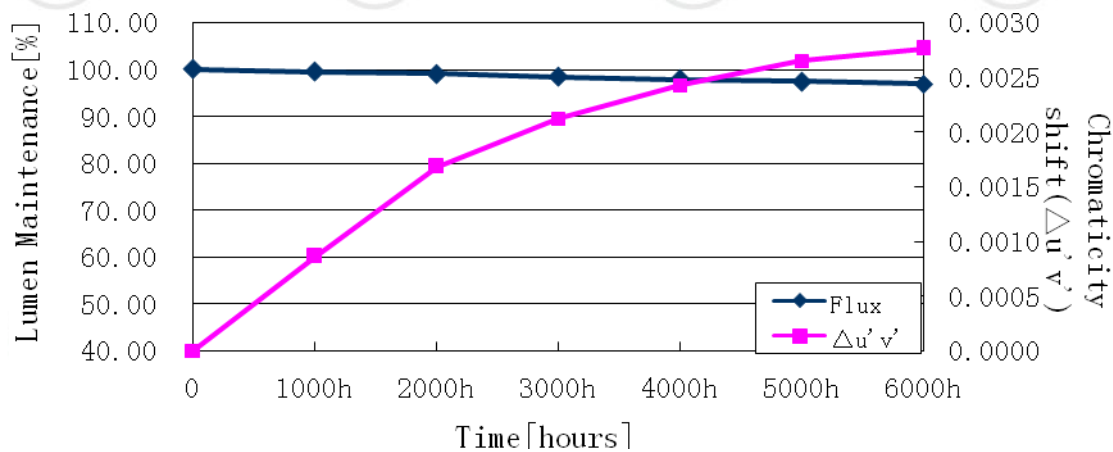
Report No.: EED35I000136-1

Page 9 of 12

6 Graph of Lumen Maintenance and Chromaticity Shift



Graph 2 – 85 °C, 100 mA



Graph 3 – 105 °C, 100 mA

Test Report

Report No.: EED35I000136-1

Page 10 of 12

7 TM-21-11 Report: Projecting Long Term Lumen Maintenance of LED Light Source

Table 1: Report at each LM-80 Test Condition			
	55°C case Temperature	85°C case Temperature	Specified case Temperature
Sample size	---	24	24
Number of failures	---	0	0
DUT drive current used in the test (mA)	---	100	100
Test duration (hours)	---	6,000	6,000
Test duration used for projection (hour to hour)	---	1,000 - 6,000	1,000 - 6,000
Tested case temperature (°C)	---	85	105
α	---	5.206E-06	5.362E-06
B	---	1.001	1.000
Calculated L70(6k) (hours)	---	71000	67000
Reported L70(6k) (hours)	---	>36000	>36000

Test Report

Report No.: EED35I000136-1

Page 11 of 12

Photos of the sample

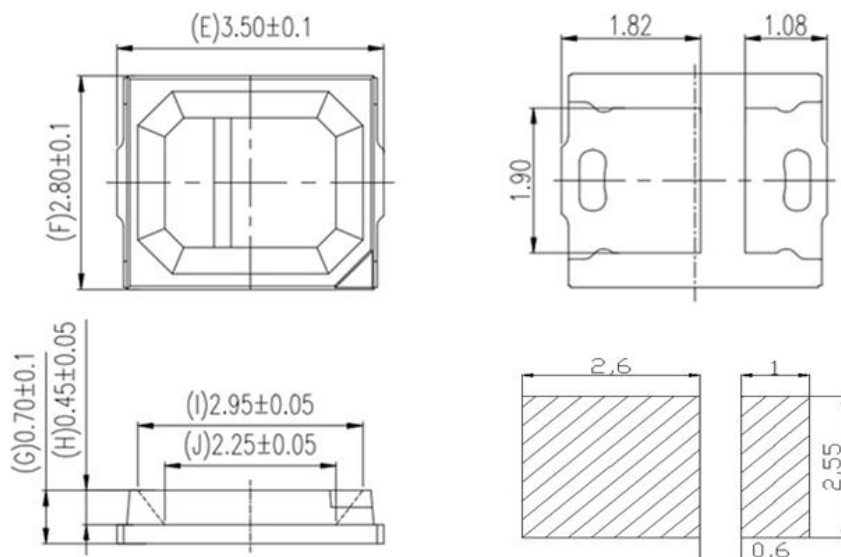


Fig.1- Mechanical Dimension

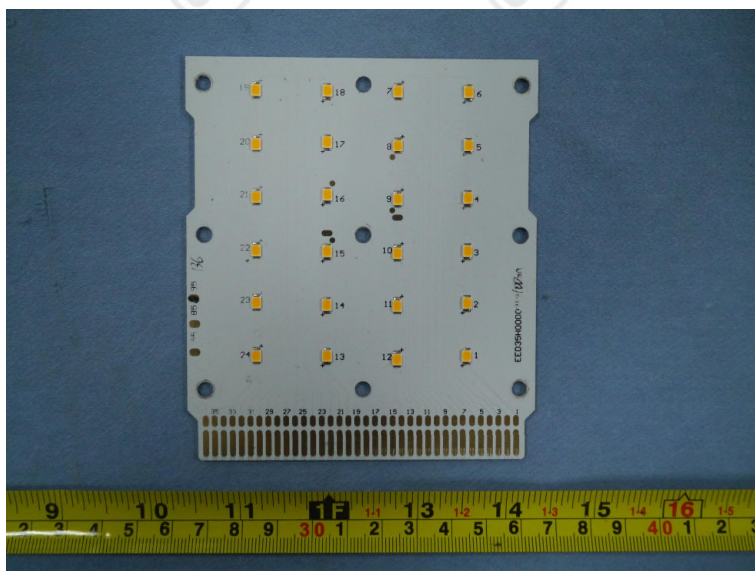


Fig.2- Overall view

Test Report

Report No.: EED35I000136-1

Page 12 of 12

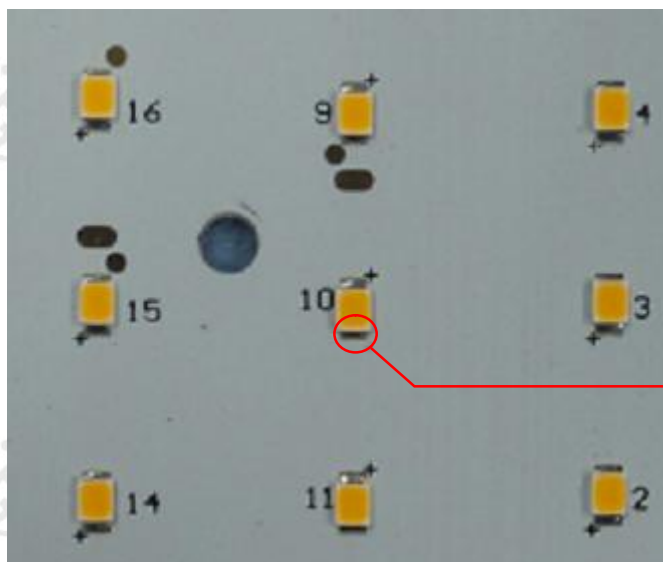


Fig.3- Temperature Measurement Point

*** End of Report ***

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