

Test Report

Report No.: EED35K000014-1

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APPLICATION FOR LUMEN MAINTENANCE TESTING ACCORDING TO THE IES LM-80-15 TEST STANDARD

Prepared for: Shenzhen HSG Electronics Co., Ltd

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Shenzhen City

Description of the submitted sample(s):

Sample Name : 2835 1W
Sample Model : HSX-2835XXXX-XXXX
Sample No. : 35J0221-01~48
Ratings : 300 mA
Nominal CCT : 2700 K
Manufacturer : Shenzhen HSG Electronics Co., Ltd
State of Sample(s) : Normal
Sample Quantity : 48 pcs
Reference Standard : IES LM-80-15 Measuring Lumen Flux and Color Maintenance of LED Packages, Arrays and Modules

Sample Received Date : Apr. 01, 2017
Sample Tested Date : May 05, 2017 to May 30, 2018

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.

The test data of 0-6000h is derived from the report of No. EED35J000221-1.

Reviewed by _____

Uo-wng

Approved by _____

Uo-wng

Supervisor/Vivian Wang

Date _____

Jun. 11, 2018

Check No.: 2457557628

CENTRE TESTING INTERNATIONAL CORPORATION



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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]	---	300 mA	300 mA
Measurement Current [I_F]	---	300 mA	300 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 9000 hours (%)	---	95.60	95.31
Average Chromaticity Shift ($\Delta u'v'$) at 9000 hours	---	0.0032	0.0037
Reported L70(9k) (hours)	---	>54000	>54000
Failures observed	---	None	None

Test Time Points/Average Lumen Maintenance (%)										
T_s	0 Hour	1,000 Hours	2,000 Hours	3,000 Hours	4,000 Hours	5,000 Hours	6,000 Hours	7,000 Hours	8,000 Hours	9,000 Hours
85 °C	100.00	99.51	99.01	98.49	97.97	97.46	96.97	96.49	96.03	95.60
105 °C	100.00	99.48	98.92	98.40	97.88	97.34	96.81	96.30	95.77	95.31

Test Time Points/Average Color Shift ($\Delta u'v'$)										
T_s	0 Hour	1,000 Hours	2,000 Hours	3,000 Hours	4,000 Hours	5,000 Hours	6,000 Hours	7,000 Hours	8,000 Hours	9,000 Hours
85 °C	0.0000	0.0004	0.0007	0.0009	0.0010	0.0013	0.0020	0.0024	0.0029	0.0032
105 °C	0.0000	0.0007	0.0010	0.0011	0.0013	0.0016	0.0022	0.0030	0.0034	0.0037

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2 EQUIPMENT LIST

Test Equipment	Model	Calibration Date	Calibration Due Date
Spectroradiometer	CDS 600	Sept. 04, 2017	Sept. 03, 2018
Spectroradiometer	CDS 600	Sept. 05, 2016	Sept. 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. 17, 2016	Jun. 16, 2017
DC Power Supply	WY12010	Jun. 15, 2017	Jun. 14, 2018
Digital Recorder	34970A	Jun. 17, 2016	Jun. 16, 2017
Digital Recorder	34970A	Jun. 15, 2017	Jun. 14, 2018
Multimeter	FLUKE17B+	Jun. 17, 2016	Jun. 16, 2017
Multimeter	FLUKE17B+	Jun. 15, 2017	Jun. 14, 2018
Oven	LM-80-Q400	Jun. 17, 2016	Jun. 16, 2017
Oven	LM-80-Q400	Jun. 15, 2017	Jun. 14, 2018
DC power Supply	LM-80-Q400	Jun. 17, 2016	Jun. 16, 2017
DC power Supply	LM-80-Q400	Jun. 15, 2017	Jun. 14, 2018
Temperature Tester	LM-80-Q400	Jun. 17, 2016	Jun. 16, 2017
Temperature Tester	LM-80-Q400	Jun. 15, 2017	Jun. 14, 2018

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.

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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 location temperature specified by customer 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.

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5 TEST DATA

5.1 Initial Data

Initial Data-85°C							
No.	Φ_v [lm]	VF[V]	CCT	x	y	u'	v'
1	126.6	3.11	2672	0.4663	0.4186	0.2630	0.5313
2	125.3	3.11	2630	0.4707	0.4207	0.2649	0.5328
3	125.0	3.10	2655	0.4678	0.4191	0.2638	0.5317
4	126.2	3.10	2652	0.4653	0.4142	0.2644	0.5295
5	126.5	3.10	2670	0.4683	0.4220	0.2628	0.5329
6	123.9	3.10	2647	0.4660	0.4149	0.2645	0.5299
7	125.8	3.12	2682	0.4646	0.4170	0.2627	0.5305
8	126.4	3.11	2682	0.4665	0.4204	0.2624	0.5320
9	125.7	3.10	2665	0.4685	0.4215	0.2631	0.5327
10	125.7	3.12	2703	0.4647	0.4199	0.2614	0.5316
11	125.9	3.11	2667	0.4683	0.4216	0.2630	0.5327
12	125.9	3.12	2674	0.4654	0.4173	0.2631	0.5307
13	124.7	3.12	2668	0.4646	0.4152	0.2635	0.5298
14	125.3	3.12	2656	0.4664	0.4167	0.2640	0.5306
15	125.6	3.12	2690	0.4639	0.4167	0.2624	0.5303
16	126.9	3.10	2676	0.4669	0.4202	0.2627	0.5320
17	125.0	3.13	2685	0.4640	0.4163	0.2626	0.5301
18	125.6	3.12	2672	0.4656	0.4173	0.2632	0.5307
19	124.9	3.14	2669	0.4679	0.4211	0.2629	0.5325
20	125.6	3.11	2690	0.4639	0.4167	0.2624	0.5303
21	125.4	3.13	2633	0.4705	0.4207	0.2648	0.5327
22	125.8	3.11	2664	0.4673	0.4195	0.2633	0.5318
23	123.3	3.13	2674	0.4654	0.4174	0.2630	0.5308
24	125.2	3.12	2670	0.4660	0.4179	0.2632	0.5310
n	24	24	24	24	24	24	24
Mean	125.5	3.11	2669	0.4665	0.4185	0.2632	0.5313
Median	125.6	3.11	2670	0.4662	0.4183	0.2630	0.5312
St. dev.	0.8	0.01	17.1	0.0019	0.0023	0.0008	0.0011
Min.	123.3	3.10	2630	0.4639	0.4142	0.2614	0.5295
Max.	126.9	3.14	2703	0.4707	0.4220	0.2649	0.5329

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Initial Data-105°C							
No.	Φ_v [lm]	VF [V]	CCT	x	y	u'	v'
1	125.0	3.11	2709	0.4653	0.4219	0.2610	0.5324
2	124.9	3.12	2664	0.4661	0.4172	0.2635	0.5308
3	126.2	3.11	2674	0.4675	0.4211	0.2627	0.5324
4	126.2	3.11	2690	0.4661	0.4206	0.2620	0.5320
5	127.6	3.12	2724	0.4639	0.4214	0.2603	0.5320
6	124.8	3.12	2670	0.4648	0.4157	0.2634	0.5300
7	124.1	3.11	2659	0.4659	0.4163	0.2639	0.5304
8	125.7	3.12	2641	0.4671	0.4160	0.2647	0.5305
9	124.7	3.10	2655	0.4666	0.4169	0.2640	0.5307
10	126.0	3.11	2665	0.4661	0.4174	0.2634	0.5308
11	125.1	3.12	2655	0.4673	0.4181	0.2639	0.5313
12	125.7	3.11	2669	0.4670	0.4194	0.2631	0.5317
13	125.6	3.13	2650	0.4691	0.4208	0.2639	0.5325
14	126.0	3.10	2691	0.4665	0.4214	0.2619	0.5324
15	126.8	3.10	2681	0.4657	0.4187	0.2626	0.5313
16	125.0	3.11	2681	0.4647	0.4170	0.2627	0.5305
17	127.4	3.11	2687	0.4655	0.4193	0.2622	0.5314
18	124.9	3.11	2656	0.4662	0.4164	0.2640	0.5305
19	125.5	3.11	2701	0.4628	0.4163	0.2618	0.5299
20	126.8	3.10	2681	0.4657	0.4187	0.2626	0.5313
21	126.2	3.12	2659	0.4668	0.4179	0.2637	0.5312
22	126.3	3.10	2699	0.4647	0.4195	0.2617	0.5314
23	125.0	3.10	2677	0.4647	0.4166	0.2629	0.5303
24	126.2	3.11	2683	0.4655	0.4188	0.2625	0.5313
n	24	24	24	24	24	24	24
Mean	125.7	3.11	2676	0.4659	0.4185	0.2629	0.5312
Median	125.7	3.11	2676	0.4660	0.4184	0.2628	0.5313
St. dev.	0.9	0.01	20.1	0.0013	0.0020	0.0011	0.0008
Min.	124.1	3.10	2641	0.4628	0.4157	0.2603	0.5299
Max.	127.6	3.13	2724	0.4691	0.4219	0.2647	0.5325

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5.2 Lumen Maintenance

Lumen Maintenance calculator-85 °C										
No.	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h
1	100.00	99.74	99.34	98.87	98.49	98.05	97.69	97.19	96.60	96.20
2	100.00	99.63	98.91	98.39	97.81	97.60	97.03	96.57	96.26	95.84
3	100.00	99.68	99.21	98.55	97.94	97.91	97.32	96.70	96.08	95.65
4	100.00	99.60	99.04	98.61	98.04	97.80	97.43	97.03	96.63	96.18
5	100.00	99.41	98.87	98.46	97.78	96.96	96.22	95.33	94.80	94.40
6	100.00	99.72	99.19	98.51	98.10	97.63	97.48	97.04	96.53	96.04
7	100.00	99.66	99.21	98.75	98.36	98.02	97.20	96.74	96.32	95.86
8	100.00	99.22	98.68	98.24	97.67	96.85	96.39	95.75	95.65	95.22
9	100.00	99.29	98.67	98.15	97.87	96.93	96.21	95.54	94.91	94.48
10	100.00	99.36	98.66	98.08	97.77	97.14	96.53	95.98	95.32	94.93
11	100.00	99.41	99.07	98.68	98.30	97.68	96.88	95.96	95.34	94.88
12	100.00	99.50	99.16	98.76	98.28	97.87	97.71	97.11	96.35	95.93
13	100.00	99.50	98.99	98.25	97.86	97.41	96.95	96.78	96.52	96.08
14	100.00	99.47	98.88	98.48	98.13	97.57	97.06	96.45	95.76	95.36
15	100.00	99.37	98.68	98.19	97.60	97.33	96.87	96.53	96.42	96.01
16	100.00	99.26	98.88	98.50	97.66	97.11	96.19	95.56	95.05	94.65
17	100.00	99.52	98.86	98.43	97.89	97.34	96.91	96.69	96.28	95.86
18	100.00	99.46	98.95	98.50	97.60	97.54	97.26	96.77	96.36	95.94
19	100.00	99.52	99.05	98.52	98.14	97.44	97.02	96.72	96.40	95.99
20	100.00	99.58	99.18	98.52	98.01	97.25	97.06	96.63	96.31	95.87
21	100.00	99.63	99.04	98.32	97.87	97.20	96.73	96.44	95.85	95.38
22	100.00	99.49	99.04	98.46	97.72	96.82	96.64	96.17	96.13	95.70
23	100.00	99.64	99.21	98.88	98.13	97.50	97.23	97.04	96.26	95.85
24	100.00	99.66	99.38	98.62	98.27	97.99	97.30	96.97	96.57	96.14
n	24	24	24	24	24	24	24	24	24	24
Mean	100.00	99.51	99.01	98.49	97.97	97.46	96.97	96.49	96.03	95.60
Median	100.00	99.51	99.04	98.50	97.92	97.47	97.03	96.66	96.27	95.86
St. dev.	0.00	0.15	0.21	0.21	0.25	0.37	0.44	0.54	0.56	0.56
Min.	100.00	99.22	98.66	98.08	97.60	96.82	96.19	95.33	94.80	94.40
Max.	100.00	99.74	99.38	98.88	98.49	98.05	97.71	97.19	96.63	96.20

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Lumen Maintenance calculator-105 °C										
No.	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h
1	100.00	99.10	98.60	98.09	97.51	96.92	96.69	96.44	96.07	95.61
2	100.00	99.44	98.95	98.63	98.32	97.76	97.09	96.64	96.01	95.60
3	100.00	99.74	98.89	98.45	97.55	97.49	97.27	96.38	96.16	95.69
4	100.00	99.21	98.77	98.27	97.73	97.31	96.48	96.17	95.90	95.44
5	100.00	99.68	98.85	98.10	97.20	96.99	96.39	95.93	95.62	95.21
6	100.00	99.15	98.65	98.11	97.56	96.76	95.95	95.10	94.48	93.97
7	100.00	99.25	98.78	98.38	98.10	97.97	97.12	96.21	95.37	94.89
8	100.00	99.69	99.30	98.94	98.59	98.05	97.81	97.41	96.61	96.17
9	100.00	99.87	99.25	98.57	98.19	97.56	96.78	96.51	96.12	95.71
10	100.00	99.38	99.36	98.70	98.33	97.60	96.72	96.43	95.68	95.25
11	100.00	99.63	99.12	98.35	97.80	97.13	96.53	96.06	95.80	95.33
12	100.00	99.17	99.07	98.65	98.18	97.54	97.04	96.11	95.20	94.79
13	100.00	99.39	98.96	98.21	97.97	97.24	96.61	96.42	95.69	95.24
14	100.00	99.47	98.72	98.40	98.00	97.12	96.77	96.00	95.51	95.06
15	100.00	99.56	98.72	98.05	97.34	96.97	96.73	95.96	95.73	95.28
16	100.00	99.31	98.88	98.53	97.76	97.25	97.05	96.70	95.82	95.34
17	100.00	99.56	99.07	98.33	97.75	97.29	97.10	96.29	95.72	95.24
18	100.00	99.40	98.86	98.40	97.92	97.16	96.31	96.08	95.28	94.82
19	100.00	99.18	98.47	98.13	97.61	96.91	96.02	95.91	95.05	94.62
20	100.00	99.72	99.27	98.81	98.54	97.93	97.78	97.02	96.68	96.23
21	100.00	99.81	98.94	98.29	97.41	97.28	96.51	96.33	95.71	95.21
22	100.00	99.37	98.63	98.19	97.58	97.04	96.68	95.83	95.56	95.10
23	100.00	99.75	98.99	98.57	98.14	97.30	96.87	96.62	96.28	95.81
24	100.00	99.69	98.88	98.34	97.94	97.68	97.17	96.53	96.31	95.83
n	24	24	24	24	24	24	24	24	24	24
Mean	100.00	99.48	98.92	98.40	97.88	97.34	96.81	96.30	95.77	95.31
Median	100.00	99.45	98.88	98.37	97.86	97.28	96.75	96.31	95.73	95.27
St. dev.	0.00	0.23	0.23	0.24	0.37	0.36	0.46	0.45	0.49	0.50
Min.	100.00	99.10	98.47	98.05	97.20	96.76	95.95	95.10	94.48	93.97
Max.	100.00	99.87	99.36	98.94	98.59	98.05	97.81	97.41	96.68	96.23

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5.3 Chromaticity shift($\Delta u'v'$)

Chromaticity shift($\Delta u'v'$)-85 °C										
No.	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h
1	0.0000	0.0003	0.0004	0.0005	0.0007	0.0011	0.0016	0.0021	0.0025	0.0028
2	0.0000	0.0003	0.0006	0.0007	0.0009	0.0013	0.0017	0.0023	0.0028	0.0030
3	0.0000	0.0004	0.0007	0.0007	0.0006	0.0012	0.0019	0.0023	0.0026	0.0029
4	0.0000	0.0003	0.0009	0.0008	0.0011	0.0015	0.0021	0.0024	0.0024	0.0028
5	0.0000	0.0007	0.0013	0.0018	0.0019	0.0022	0.0027	0.0032	0.0036	0.0040
6	0.0000	0.0003	0.0008	0.0008	0.0011	0.0013	0.0017	0.0022	0.0026	0.0029
7	0.0000	0.0003	0.0004	0.0004	0.0006	0.0013	0.0016	0.0021	0.0027	0.0030
8	0.0000	0.0006	0.0010	0.0010	0.0013	0.0015	0.0029	0.0034	0.0038	0.0042
9	0.0000	0.0007	0.0010	0.0015	0.0018	0.0017	0.0023	0.0026	0.0029	0.0032
10	0.0000	0.0006	0.0009	0.0012	0.0014	0.0016	0.0023	0.0030	0.0030	0.0032
11	0.0000	0.0002	0.0006	0.0009	0.0010	0.0015	0.0028	0.0031	0.0035	0.0038
12	0.0000	0.0003	0.0003	0.0005	0.0006	0.0014	0.0027	0.0031	0.0038	0.0042
13	0.0000	0.0002	0.0005	0.0008	0.0011	0.0010	0.0017	0.0022	0.0022	0.0025
14	0.0000	0.0004	0.0007	0.0010	0.0012	0.0014	0.0020	0.0025	0.0033	0.0036
15	0.0000	0.0002	0.0014	0.0012	0.0011	0.0015	0.0029	0.0030	0.0035	0.0039
16	0.0000	0.0002	0.0005	0.0008	0.0010	0.0011	0.0016	0.0020	0.0024	0.0029
17	0.0000	0.0003	0.0005	0.0009	0.0012	0.0012	0.0019	0.0028	0.0032	0.0034
18	0.0000	0.0003	0.0004	0.0007	0.0007	0.0010	0.0014	0.0018	0.0023	0.0027
19	0.0000	0.0006	0.0008	0.0010	0.0012	0.0015	0.0024	0.0024	0.0028	0.0032
20	0.0000	0.0003	0.0005	0.0006	0.0006	0.0012	0.0016	0.0019	0.0023	0.0025
21	0.0000	0.0005	0.0005	0.0007	0.0010	0.0011	0.0021	0.0022	0.0026	0.0029
22	0.0000	0.0003	0.0005	0.0008	0.0010	0.0009	0.0015	0.0022	0.0029	0.0032
23	0.0000	0.0002	0.0004	0.0007	0.0010	0.0011	0.0014	0.0020	0.0027	0.0029
24	0.0000	0.0002	0.0004	0.0007	0.0009	0.0010	0.0012	0.0020	0.0024	0.0028
n	24	24	24	24	24	24	24	24	24	24
Mean	0.0000	0.0004	0.0007	0.0009	0.0010	0.0013	0.0020	0.0024	0.0029	0.0032
Median	0.0000	0.0003	0.0006	0.0008	0.0010	0.0013	0.0019	0.0023	0.0027	0.0030
St. dev.	0.0000	0.0002	0.0003	0.0003	0.0003	0.0003	0.0005	0.0005	0.0005	0.0005
Min.	0.0000	0.0002	0.0003	0.0004	0.0006	0.0009	0.0012	0.0018	0.0022	0.0025
Max.	0.0000	0.0007	0.0014	0.0018	0.0019	0.0022	0.0029	0.0034	0.0038	0.0042

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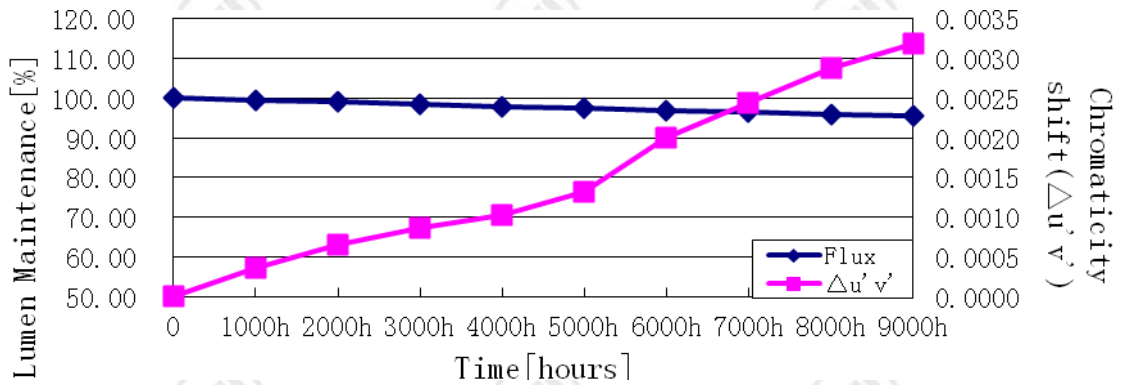
Chromaticity shift($\Delta u'v'$)-105 °C										
No.	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h
1	0.0000	0.0007	0.0020	0.0020	0.0021	0.0024	0.0026	0.0035	0.0037	0.0040
2	0.0000	0.0009	0.0011	0.0012	0.0016	0.0016	0.0020	0.0025	0.0038	0.0041
3	0.0000	0.0007	0.0008	0.0008	0.0011	0.0016	0.0018	0.0026	0.0027	0.0028
4	0.0000	0.0006	0.0006	0.0008	0.0010	0.0014	0.0022	0.0030	0.0033	0.0035
5	0.0000	0.0005	0.0013	0.0014	0.0014	0.0014	0.0020	0.0023	0.0024	0.0026
6	0.0000	0.0010	0.0013	0.0013	0.0014	0.0019	0.0020	0.0027	0.0034	0.0036
7	0.0000	0.0005	0.0011	0.0013	0.0014	0.0016	0.0018	0.0025	0.0032	0.0036
8	0.0000	0.0009	0.0012	0.0012	0.0012	0.0017	0.0022	0.0025	0.0027	0.0030
9	0.0000	0.0007	0.0010	0.0009	0.0013	0.0015	0.0020	0.0024	0.0029	0.0032
10	0.0000	0.0005	0.0006	0.0008	0.0012	0.0013	0.0017	0.0030	0.0033	0.0036
11	0.0000	0.0007	0.0007	0.0010	0.0012	0.0016	0.0019	0.0034	0.0037	0.0041
12	0.0000	0.0006	0.0006	0.0007	0.0011	0.0013	0.0018	0.0025	0.0028	0.0032
13	0.0000	0.0006	0.0009	0.0011	0.0013	0.0015	0.0025	0.0034	0.0038	0.0041
14	0.0000	0.0008	0.0009	0.0010	0.0013	0.0014	0.0019	0.0034	0.0038	0.0040
15	0.0000	0.0008	0.0008	0.0011	0.0012	0.0015	0.0037	0.0042	0.0049	0.0051
16	0.0000	0.0010	0.0011	0.0012	0.0014	0.0018	0.0021	0.0029	0.0031	0.0037
17	0.0000	0.0008	0.0009	0.0010	0.0013	0.0015	0.0023	0.0026	0.0031	0.0034
18	0.0000	0.0009	0.0011	0.0010	0.0012	0.0016	0.0022	0.0040	0.0046	0.0053
19	0.0000	0.0008	0.0013	0.0012	0.0015	0.0019	0.0026	0.0037	0.0042	0.0045
20	0.0000	0.0009	0.0010	0.0011	0.0014	0.0018	0.0025	0.0035	0.0037	0.0043
21	0.0000	0.0007	0.0009	0.0010	0.0012	0.0017	0.0021	0.0033	0.0037	0.0038
22	0.0000	0.0008	0.0009	0.0012	0.0014	0.0015	0.0018	0.0025	0.0026	0.0028
23	0.0000	0.0006	0.0008	0.0009	0.0011	0.0015	0.0023	0.0024	0.0026	0.0031
24	0.0000	0.0006	0.0007	0.0011	0.0012	0.0015	0.0023	0.0034	0.0037	0.0040
n	24	24	24	24	24	24	24	24	24	24
Mean	0.0000	0.0007	0.0010	0.0011	0.0013	0.0016	0.0022	0.0030	0.0034	0.0037
Median	0.0000	0.0007	0.0009	0.0011	0.0013	0.0016	0.0021	0.0029	0.0033	0.0037
St. dev.	0.0000	0.0002	0.0003	0.0003	0.0002	0.0002	0.0004	0.0006	0.0006	0.0007
Min.	0.0000	0.0005	0.0006	0.0007	0.0010	0.0013	0.0017	0.0023	0.0024	0.0026
Max.	0.0000	0.0010	0.0020	0.0020	0.0021	0.0024	0.0037	0.0042	0.0049	0.0053

Test Report

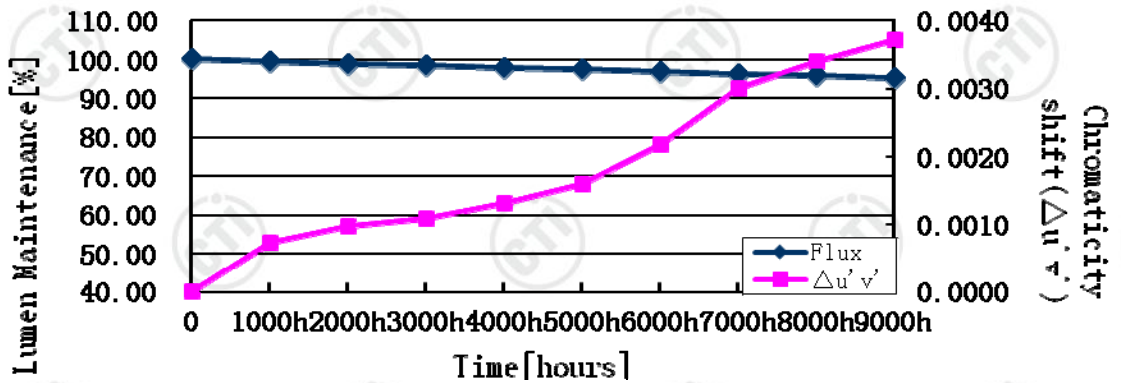
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6 Graph of Lumen Maintenance and Chromaticity Shift



Graph 1 – 85 °C, 300 mA



Graph 2 – 105 °C, 300 mA

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

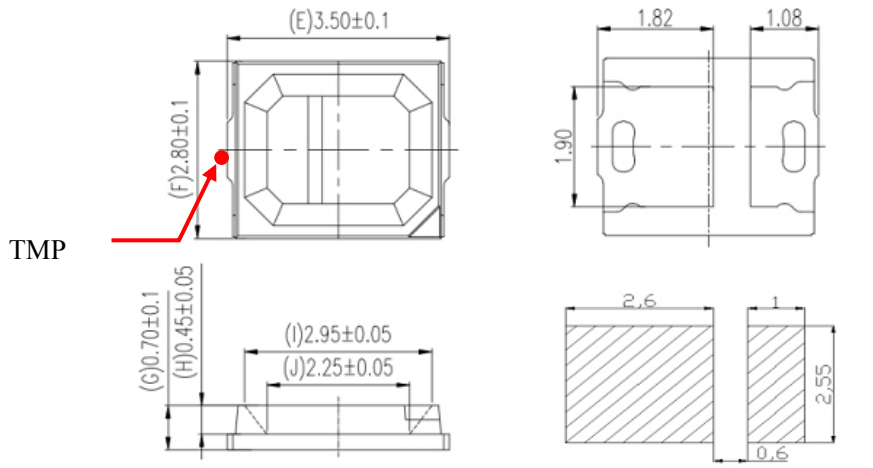
Table 1: Report at each LM-80 Test Condition			
	55°C case Temperature	85°C case Temperature	Specified case Temperature
Sample size	---	24	24
Number of failures	---	0	0
DUT drive current used in the test (mA)	---	300	300
Test duration (hours)	---	9,000	9,000
Test duration used for projection (hour to hour)	---	4,000 - 9,000	4,000 - 9,000
Tested case temperature (°C)	---	85	105
α	---	4.907E-06	5.346E-06
B	---	0.999	1.000
Reported L70(9k) (hours)	---	>54000	>54000

Test Report

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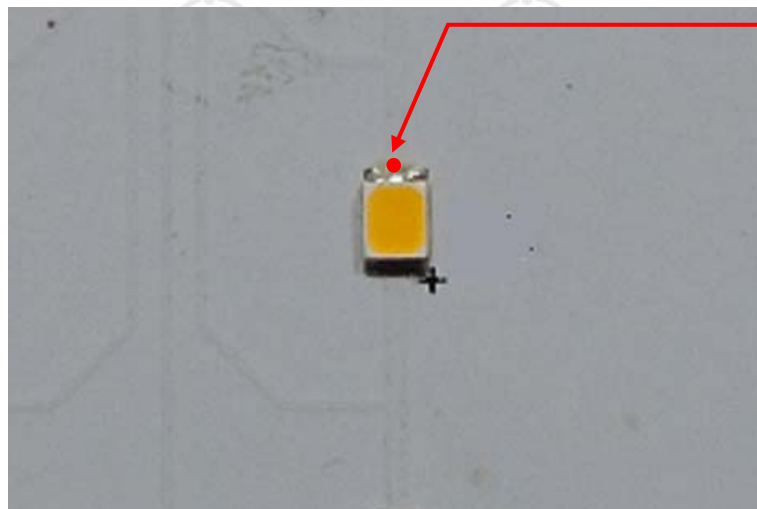
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Photos of the sample



All dimensions in mm

Fig.1- Mechanical Dimension



TMP

Fig.2- Temperature Measurement Point

*** End of Report ***

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