IESNA LM-80: 2008

6000 Hours Measurement and Test Report

for

Shenzhen Lepower Opto Electronics Corp., Ltd.

Building B, Chuangfu Science Technology Park, Beihuan Rd., Shiyan Town, Bao'an District, Shenzhen, China

Product Name:	Power LED
Model No:	H20
Tested By:	David Zhang 
Report No.:	BTR66.181.15.0010.39
Test Initiation Date:	Jan 20, 2015
Revision Date:	Oct 13, 2015
Test Completion Date:	Oct 09, 2015
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NVLAP LAB CODE 200770-0

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TABLE OF CONTENTS

1 - GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

Applicant	:	Shenzhen Lepower Opto Electronics Corp., Ltd.
Model Name	:	Power LED
Model Number	:	H20
Number of LED Light Source tested	:	See tables.
Description of auxiliary Equipment	:	Labsphere 50cm 2∏ Integrating Sphere Labsphere CDS2100 Spectrometer Keithley 242O Sourcemeter ESPEC PH301 Temperature Chamber
Operating Cycle	:	Constant current.
Ambient Conditions	:	LED light source are operated in environmental control chambers. The temperature of the ambient air around the LED light source is actively controlled by air flowing through the chamber. T_A : See tables; RH : < 45%; Air flow : 300 CFM
Case temperature (test point temperature)	:	See Section 11.
Drive current of the LED light source during lifetime test	:	See tables.
Initial luminous flux and forward voltage at photometric measurement current	:	See tables.
Lumen maintenance data for each individual LED light source along with median value, standard deviation, minimum and maximum lumen maintenance value for all of the LED Light sources	:	See tables.
Observation of LED light source failures including the failure conditions and time of failure.	:	See tables.
LED light source monitoring interval	:	The LED light sources are inspected at regular intervals (24 hours) throughout the 6000 hours test.
Photometric measurement uncertainty	:	+/- 1.5% on flux measurements for LM- 80 testing.
Chromaticity shift reported over the Measurement time	:	See tables.
Stabilization Time	:	0.75 hours
LED Light Source Test interval	:	At regular intervals (1000 hours) throughout the 6000 hours test.
Date of Receiving Sample	:	Jan 20, 2015
Test Duration	:	Jan 20, 2015 to Oct 09, 2015

1.2 Objective

The following test report is prepared on behalf of Shenzhen Lepower Opto Electronics Corp., Ltd. in accordance with IESNA LM-80-08, used the following American National Standards or illumination Engineering Society of North America test guides:

Measurement of LEDs (2nd ed.), CIE 127:2007; IESNA Testing Procedures Committee. IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of LED Light Sources, New York: Illuminating Engineering Society of North America, 2008.
ASSIST Recommends: LED Life Testing. Vol. 1-6, 2005. Lighting Research Center, Rensselaer Polytechnic Institute, Troy, NY, 2005.
ANSI/IESNA Testing Procedures Committee, IESNA RP-16-07, Nomenclature and Definitions for Illuminating Engineering. See also Addendum A on solid-state lighting (Document is now continuously updated)

IESNA Testing Procedures Committee, IESNA LM-40-01, Approved Method for Life Performance Testing of Fluorescent Lamps, New York: Illuminating Engineering Society of North America, 2001.

1.3 Test Facility Description

The Energy Efficiency Lab used by BEST to collect energy efficiency measurement data is located in 1st Floor, 1st Building, Weitai Industrial Park, Yingrenshi, Shiyan, Baoan, Shenzhen, China. BEST Test Service Shenzhen Co., Ltd is a EPA recognized lab for lighting products, BEST is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200770-0). BEST Test Service Shenzhen Co., Ltd is also an ELI accredited lab for lighting products (ELI Certificate No. ELI-L04-2010) and UL accredited lab for lighting products

1.4 Test Equipment List

Apparatus List	Device	Cal. Date	Cal Due Date
1	Integral Sphere+ Spectroradiometer	Calibrated before Test	
2	Standard Light Source	Mar 10, 2015	Mar 09, 2016
3	Source Meter	Oct 18, 2014	Oct 17, 2015
4	Temperature Chamber	Sep 17, 2015	Sep 16, 2016
5	Multi Channel LED Aging Source	Sep 17, 2015	Sep 16, 2016
6	$6^{1/2}$ Digital Multimeter	Mar 28, 2015	Mar 27, 2016
7	Temperature Controller	Oct 18, 2014	Oct 17, 2015
8	Second Meter	Oct 18, 2014	Oct 17, 2015

Statement of Traceability: BEST Test Service Shenzhen Co., Ltd. certifies that all calibration has been performed using suitable standards traceable to the NIM China.

2 – Summary of Test Result

Data Set	Case Temperature(Ts) ℃	Ambient Temperature(Ta) ℃	Drive Current(mA)	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours
1	55	55±2	250.0	95.4%	0.0028
2	85	85±2	250.0	94.2%	0.0030
3	105	105±2	250.0	93.5%	0.0035

3 - Test Method

3.1 Photometric and Electrical Measurement

Total light output (luminous flux) for the 25℃ ±1℃ ambient temperature conditions is measured using a Labsphere 50cm 2∏ geometry integrating sphere. Temperature is controlled and measured at manufacture defined TMP inside the sphere. Spectral radiant flux measurements are made using Labsphere CDS 2100 to the detector port of the integrating sphere. Each LED package is operated at rated drive current (CC Mode). Each package should be stable before measurements are made. The determining method of stable is as follows:

Step 1 Take 3 measurements of the lamp light output at 15 minute interval (total time=30mintues.)This time period is in addition to the recommended pre-burning time.

Step 2 Calculate the percent difference between the maximum measured value and the minimum measured value for the three consecutive measurements.

Step 3 if the value calculated in Step 2 does not exceed 0.5 percent, the lamp is considered stable.

Luminous flux, chromaticity coordinates, correlated color temperature and color rendering index for each lamp are calculated from the spectral radiant flux measurements taken at 2 nm intervals over the range 350 to 1050 nm. The calibration of the sphere photometer-spectrometer system is traceable to the NIST USA. The EUT fed under CC mode at rated input by KEITHLEY 2420 power source.

The total uncertainty of the light output measurements is estimated, at the 95% confidence level, not to exceed ±1.6% over the wavelength range 350-1050 nm.

3.2 Season the LED light source from 0 hour to 6000 hours

Three ESPEC Temperature Chambers are using for Season, and the temperature is set to 55℃, 85℃, 105℃, the airflow is minimum to keep the uniformity of temperature.LED light source are operated steady state (no cycling) for a period of 6000 hours, checked the lumen flux and Chromaticity Shift every 1000 hours. The samples are inspected at regular intervals (12 hours) throughout the 6000hours. The time and date of failure of each lamp is recorded. The actual elapsed time for each light source is in hour.

4 – Data Set 1: 55℃; 250mA

Description of Light Sources tested	:	H20
Case Temperature	:	55°C
Ambient Temperature	:	55°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

INITIAL DATA								
Sample No.	Ref.Voltage (V)	Forward Current (mA)	Luminous Flux (Lumens)	CCT (K)	x (CIE 1931)	y (CIE 1931)	u' (CIE 1976)	v' (CIE 1976)
L1	36.62	250.0	917.23	2902	0.4339	0.4032	0.2490	0.5206
L2	36.60	250.0	912.23	2916	0.4406	0.4063	0.2520	0.5228
L3	36.52	250.0	900.35	2995	0.4408	0.4060	0.2522	0.5227
L4	36.61	250.0	913.74	2968	0.4344	0.3982	0.2515	0.5187
L5	36.57	250.0	894.58	2911	0.4423	0.4077	0.2525	0.5236
L6	36.59	250.0	906.53	2935	0.4410	0.4014	0.2544	0.5209
L7	36.44	250.0	896.67	2921	0.4405	0.4079	0.2512	0.5234
L8	36.44	250.0	902.06	2955	0.4404	0.4016	0.2539	0.5209
L9	36.67	250.0	909.60	2916	0.4378	0.4003	0.2528	0.5200
L10	36.27	250.0	866.95	2899	0.4412	0.4042	0.2533	0.5221
AV	36.53	250.0	901.99	2932	0.4424	0.4022	0.2549	0.5215
MIN	36.27	250.0	866.95	2899	0.4339	0.3982	0.2490	0.5187
MAX	36.67	250.0	917.23	2995	0.4423	0.4079	0.2544	0.5236
STDEV	0.12	0.0	14.40	31	0.0029	0.0033	0.0015	0.0016
N	10	10	10	10	10	10	10	10

Description of Light Sources tested	:	H20
Case Temperature	:	55°C
Ambient Temperature	:	55°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

LUMEN MAINTEIANCE							
Sample No.	0H	1000H	2000H	3000H	4000H	5000H	6000H
L1	100.0%	99.1%	98.7%	98.0%	97.4%	96.6%	95.5%
L2	100.0%	99.3%	98.7%	98.2%	97.2%	96.5%	95.3%
L3	100.0%	99.1%	98.7%	98.0%	97.3%	96.4%	95.7%
L4	100.0%	99.2%	98.7%	98.0%	97.1%	96.5%	95.2%
L5	100.0%	99.1%	98.5%	98.0%	97.3%	96.4%	95.6%
L6	100.0%	99.2%	98.8%	98.1%	97.5%	96.8%	94.8%
L7	100.0%	99.1%	98.6%	98.0%	97.0%	96.1%	95.4%
L8	100.0%	99.3%	98.7%	98.1%	97.4%	96.6%	95.7%
L9	100.0%	99.3%	98.8%	98.2%	97.5%	96.8%	94.6%
L10	100.0%	99.1%	98.5%	98.0%	97.3%	96.4%	95.7%
AV	100.0%	99.2%	98.7%	98.1%	97.3%	96.5%	95.4%
MIN	100.0%	99.1%	98.5%	98.0%	97.0%	96.1%	94.6%
MAX	100.0%	99.3%	98.8%	98.2%	97.5%	96.8%	95.7%
STDEV	0.0%	0.1%	0.1%	0.1%	0.2%	0.2%	0.4%
N	10	10	10	10	10	10	10

Test Condition 1 - 55 C Case Temp	
Sample size	10
Number of failures	0
DUT drive current used in the test (mA)	250
Test duration (hours)	6,000
Test duration used for projection (hour to hour)	1,000 - 6,000
Tested case temperature (C)	55
α	7.746E-06
B	1.002
Reported L70(6k)	>33000

Description of Light Sources tested	:	H20
Case Temperature	:	55°C
Ambient Temperature	:	55°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

Δu'v'							
Sample No.	0H	1000H	2000H	3000H	4000H	5000H	6000H
L1	0.0003	0.0011	0.0014	0.0016	0.0020	0.0022	0.0026
L2	0.0003	0.0010	0.0013	0.0015	0.0019	0.0021	0.0025
L3	0.0020	0.0015	0.0017	0.0020	0.0023	0.0026	0.0029
L4	0.0000	0.0011	0.0014	0.0017	0.0020	0.0023	0.0026
L5	0.0016	0.0015	0.0017	0.0020	0.0023	0.0026	0.0029
L6	0.0001	0.0013	0.0015	0.0018	0.0021	0.0024	0.0027
L7	0.0015	0.0015	0.0017	0.0020	0.0023	0.0026	0.0029
L8	0.0016	0.0012	0.0014	0.0017	0.0020	0.0023	0.0027
L9	0.0009	0.0015	0.0017	0.0020	0.0023	0.0026	0.0029
L10	0.0014	0.0015	0.0017	0.0020	0.0023	0.0026	0.0029
AV	0.0010	0.0013	0.0016	0.0018	0.0022	0.0024	0.0028
MIN	0.0000	0.0010	0.0013	0.0015	0.0019	0.0021	0.0025
MAX	0.0020	0.0015	0.0017	0.0020	0.0023	0.0026	0.0029
STDEV	0.0007	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
N	10	10	10	10	10	10	10

5 – Data Set 2: 85℃; 250 mA

Description of Light Sources tested	:	H20
Case Temperature	:	85°C
Ambient Temperature	:	85°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

INITIAL DATA								
Sample No.	Ref.Voltage (V)	Forward Current (mA)	Luminous Flux (Lumens)	CCT (K)	x (CIE 1931)	y (CIE 1931)	u' (CIE 1976)	v' (CIE 1976)
L11	36.72	250.0	906.52	2953	0.4397	0.4039	0.2524	0.5217
L12	36.67	250.0	892.85	2968	0.4389	0.4078	0.2502	0.5231
L13	36.54	250.0	905.63	2947	0.4387	0.4013	0.2529	0.5206
L14	36.61	250.0	901.59	2968	0.4405	0.4028	0.2534	0.5214
L15	36.51	250.0	878.27	2956	0.4406	0.4073	0.2515	0.5232
L16	36.63	250.0	893.03	2935	0.4415	0.4019	0.2545	0.5212
L17	36.65	250.0	910.18	2968	0.4403	0.4081	0.2510	0.5235
L18	36.54	250.0	892.34	2996	0.4344	0.4026	0.2496	0.5204
L19	36.53	250.0	894.98	2989	0.4401	0.4057	0.2519	0.5225
L20	36.72	250.0	915.82	2968	0.4399	0.4065	0.2514	0.5228
AV	36.61	250.0	899.12	2965	0.4395	0.4048	0.2519	0.5220
MIN	36.51	250.0	878.27	2935	0.4344	0.4013	0.2496	0.5204
MAX	36.72	250.0	915.82	2996	0.4415	0.4081	0.2545	0.5235
STDEV	0.08	0.0	10.95	18	0.0020	0.0026	0.0015	0.0011
N	10	10	10	10	10	10	10	10

Description of Light Sources tested	:	H20
Case Temperature	:	85°C
Ambient Temperature	:	85°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

LUMEN MAINTEIANCE							
Sample No.	0H	1000H	2000H	3000H	4000H	5000H	6000H
L11	100.0%	99.3%	98.6%	97.7%	96.8%	95.7%	94.0%
L12	100.0%	99.4%	98.7%	98.0%	97.1%	96.0%	94.9%
L13	100.0%	99.3%	98.6%	97.3%	96.4%	95.3%	94.2%
L14	100.0%	99.3%	98.6%	97.7%	96.8%	95.7%	93.8%
L15	100.0%	99.5%	98.7%	97.8%	96.8%	95.7%	94.6%
L16	100.0%	99.6%	98.8%	97.5%	96.6%	95.5%	93.6%
L17	100.0%	99.5%	98.7%	98.2%	97.3%	96.2%	95.1%
L18	100.0%	99.3%	98.5%	97.6%	96.8%	95.6%	93.6%
L19	100.0%	99.6%	98.8%	97.9%	97.0%	95.9%	94.8%
L20	100.0%	99.3%	98.6%	97.7%	96.8%	95.7%	93.9%
AV	100.0%	99.4%	98.7%	97.7%	96.9%	95.7%	94.2%
MIN	100.0%	99.3%	98.5%	97.3%	96.4%	95.3%	93.6%
MAX	100.0%	99.6%	98.8%	98.2%	97.3%	96.2%	95.1%
STDEV	0.0%	0.1%	0.1%	0.2%	0.2%	0.2%	0.6%
N	10	10	10	10	10	10	10

Test Condition 2 - 85 C Case Temp	
Sample size	10
Number of failures	0
DUT drive current used in the test (mA)	250
Test duration (hours)	6,000
Test duration used for projection (hour to hour)	1,000 - 6,000
Tested case temperature (C)	85
α	1.056E-05
B	1.007
Reported L70(6k)	>33000

Description of Light Sources tested	:	H20
Case Temperature	:	85°C
Ambient Temperature	:	85°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

Δu'v'							
Sample No.	0H	1000H	2000H	3000H	4000H	5000H	6000H
L11	0.0010	0.0012	0.0016	0.0019	0.0023	0.0025	0.0029
L12	0.0001	0.0013	0.0016	0.0020	0.0027	0.0026	0.0027
L13	0.0014	0.0013	0.0017	0.0019	0.0023	0.0025	0.0029
L14	0.0011	0.0017	0.0020	0.0022	0.0026	0.0028	0.0032
L15	0.0000	0.0013	0.0016	0.0019	0.0023	0.0025	0.0029
L16	0.0015	0.0014	0.0018	0.0021	0.0025	0.0027	0.0031
L17	0.0001	0.0012	0.0015	0.0018	0.0021	0.0024	0.0028
L18	0.0020	0.0017	0.0020	0.0022	0.0026	0.0028	0.0032
L19	0.0004	0.0014	0.0017	0.0020	0.0023	0.0026	0.0030
L20	0.0002	0.0017	0.0020	0.0022	0.0026	0.0028	0.0032
AV	0.0008	0.0014	0.0017	0.0020	0.0024	0.0026	0.0030
MIN	0.0000	0.0012	0.0015	0.0018	0.0021	0.0024	0.0027
MAX	0.0020	0.0017	0.0020	0.0022	0.0027	0.0028	0.0032
STDEV	0.0007	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
N	10	10	10	10	10	10	10

6 – Data Set 3: 105℃; 250 mA

Description of Light Sources tested	:	H20
Case Temperature	:	105°C
Ambient Temperature	:	105°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

INITIAL DATA								
Sample No.	Ref.Voltage (V)	Forward Current (mA)	Luminous Flux (Lumens)	CCT (K)	x (CIE 1931)	y (CIE 1931)	u' (CIE 1976)	v' (CIE 1976)
L21	36.72	250.0	915.60	2986	0.4406	0.4065	0.2519	0.5229
L22	36.61	250.0	900.18	2953	0.4398	0.4064	0.2514	0.5227
L23	36.52	250.0	880.07	2978	0.4361	0.3996	0.2520	0.5195
L24	36.68	250.0	911.33	2936	0.4402	0.4089	0.2506	0.5238
L25	36.69	250.0	894.14	2953	0.4416	0.4020	0.2545	0.5213
L26	36.67	250.0	885.03	2951	0.4399	0.4085	0.2506	0.5236
L27	36.57	250.0	898.99	2923	0.4411	0.4031	0.2537	0.5216
L28	36.56	250.0	885.69	2966	0.4405	0.4060	0.2520	0.5227
L29	36.73	250.0	887.68	2958	0.4398	0.4089	0.2503	0.5237
L30	36.73	250.0	902.51	2958	0.4376	0.4050	0.2506	0.5218
AV	36.65	250.0	896.12	2956	0.4397	0.4055	0.2518	0.5224
MIN	36.52	250.0	880.07	2923	0.4361	0.3996	0.2503	0.5195
MAX	36.73	250.0	915.60	2986	0.4416	0.4089	0.2545	0.5238
STDEV	0.08	0.0	11.74	18	0.0017	0.0031	0.0014	0.0013
N	10	10	10	10	10	10	10	10

Description of Light Sources tested	:	H20
Case Temperature	:	105°C
Ambient Temperature	:	105°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

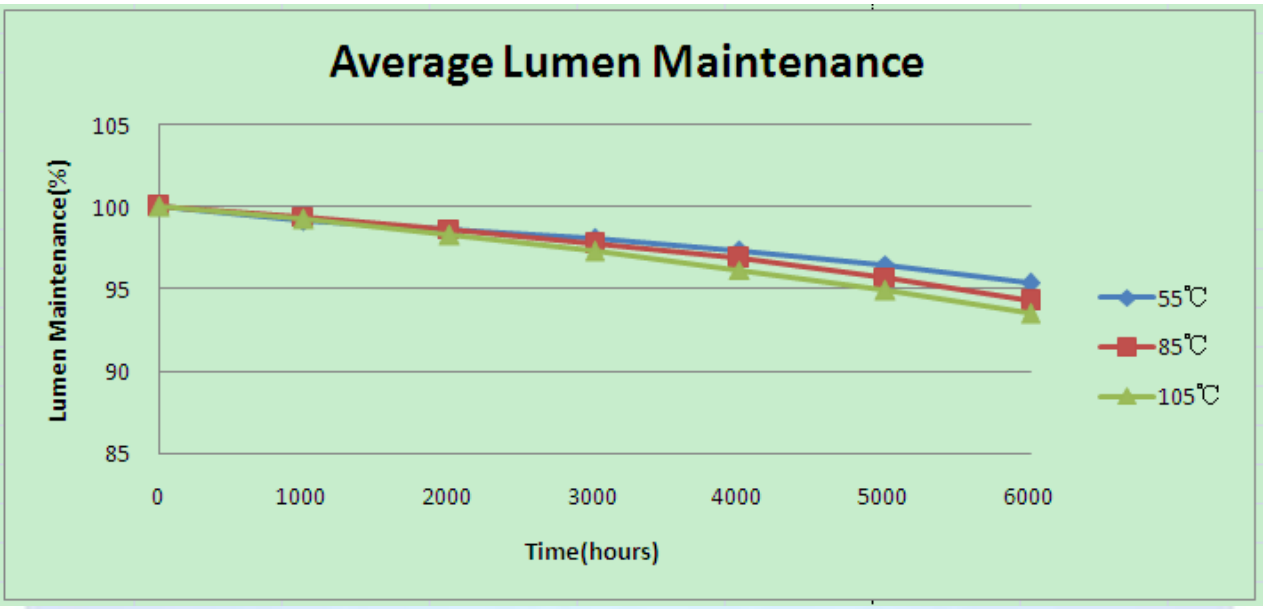
LUMEN MAINTEIANCE							
Sample No.	0H	1000H	2000H	3000H	4000H	5000H	6000H
L21	100.0%	99.2%	98.3%	97.3%	96.2%	95.0%	93.5%
L22	100.0%	99.5%	98.5%	97.0%	95.8%	94.6%	93.1%
L23	100.0%	99.3%	98.2%	97.6%	96.4%	95.2%	93.8%
L24	100.0%	99.3%	98.3%	97.7%	96.6%	95.4%	94.1%
L25	100.0%	99.3%	98.3%	97.1%	95.9%	94.6%	93.1%
L26	100.0%	99.4%	98.3%	97.3%	96.2%	94.9%	93.6%
L27	100.0%	99.4%	98.4%	97.4%	96.2%	95.0%	93.7%
L28	100.0%	99.2%	98.2%	97.5%	96.2%	95.0%	93.4%
L29	100.0%	99.2%	98.1%	97.1%	95.9%	94.7%	93.0%
L30	100.0%	99.2%	98.2%	97.4%	96.2%	95.0%	93.7%
AV	100.0%	99.3%	98.3%	97.3%	96.2%	94.9%	93.5%
MIN	100.0%	99.2%	98.1%	97.0%	95.8%	94.6%	93.0%
MAX	100.0%	99.5%	98.5%	97.7%	96.6%	95.4%	94.1%
STDEV	0.0%	0.1%	0.1%	0.2%	0.3%	0.3%	0.3%
N	10	10	10	10	10	10	10

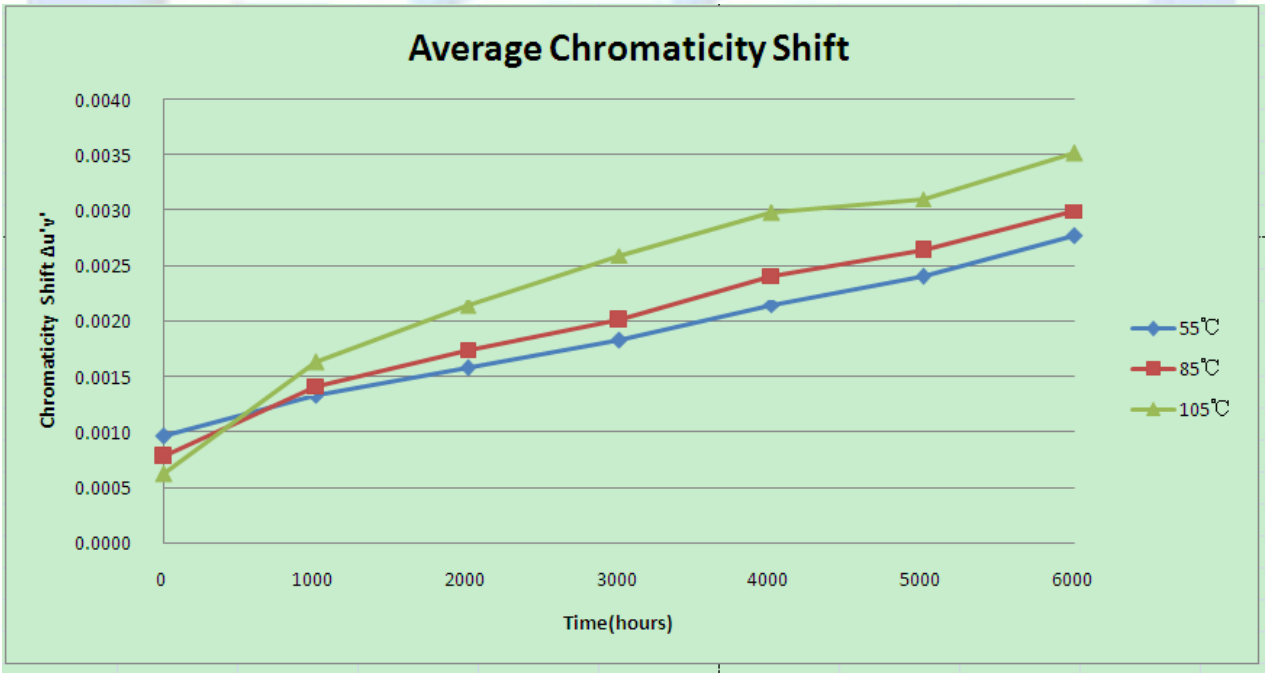
Test Condition 3 - 105 C Case Temp	
Sample size	10
Number of failures	0
DUT drive current used in the test (mA)	250
Test duration (hours)	6,000
Test duration used for projection (hour to hour)	1,000 - 6,000
Tested case temperature (C)	105
α	1.194E-05
B	1.007
Reported L70(6k)	30,000

Description of Light Sources tested	:	H20
Case Temperature	:	105°C
Ambient Temperature	:	105°C
Drive Current	:	250 mA
Measure Current	:	250 mA
Failures Observed	:	None

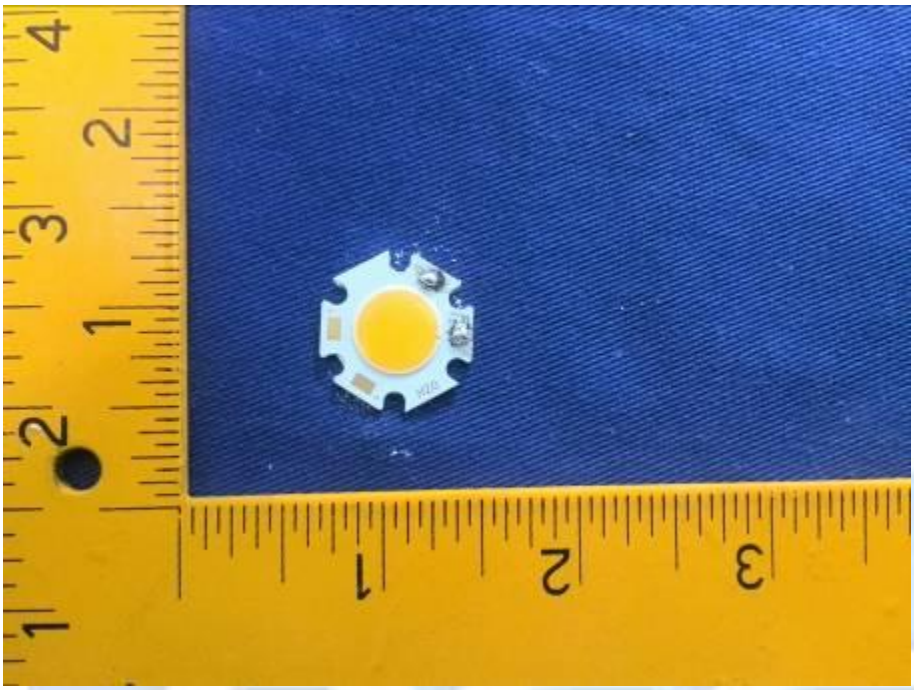
Δu'v'							
Sample No.	0H	1000H	2000H	3000H	4000H	5000H	6000H
L21	0.0002	0.0019	0.0022	0.0026	0.0027	0.0031	0.0032
L22	0.0002	0.0012	0.0029	0.0027	0.0025	0.0027	0.0025
L23	0.0017	0.0017	0.0021	0.0024	0.0028	0.0030	0.0037
L24	0.0003	0.0017	0.0021	0.0023	0.0035	0.0037	0.0041
L25	0.0014	0.0012	0.0016	0.0025	0.0029	0.0029	0.0033
L26	0.0003	0.0018	0.0022	0.0029	0.0033	0.0031	0.0035
L27	0.0009	0.0019	0.0023	0.0026	0.0030	0.0033	0.0042
L28	0.0004	0.0016	0.0020	0.0023	0.0027	0.0029	0.0033
L29	0.0002	0.0014	0.0017	0.0031	0.0034	0.0031	0.0035
L30	0.0007	0.0019	0.0023	0.0026	0.0030	0.0033	0.0037
AV	0.0006	0.0016	0.0021	0.0026	0.0030	0.0031	0.0035
MIN	0.0002	0.0012	0.0016	0.0023	0.0025	0.0027	0.0025
MAX	0.0017	0.0019	0.0029	0.0031	0.0035	0.0037	0.0042
STDEV	0.0005	0.0003	0.0004	0.0003	0.0003	0.0003	0.0005
N	10	10	10	10	10	10	10

7 – Summary

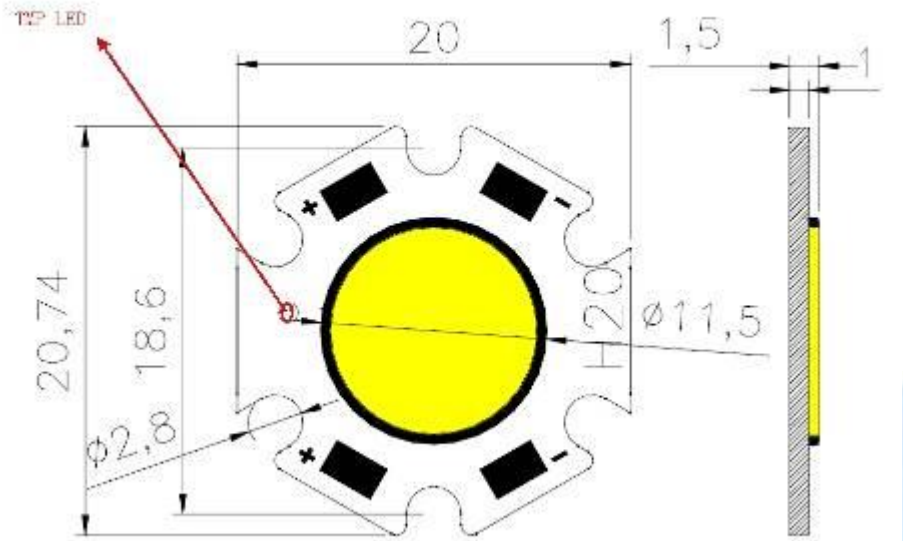

Average Lumen Maintenance
Lumen Maintenance(%)
105
100
95
90
85
0
1000
2000
3000
4000
5000
6000
Time(hours)
55℃
85℃
105℃


Average Chromaticity Shift
Chromaticity Shift Δu'v'
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
0
1000
2000
3000
4000
5000
6000
Time(hours)
55℃
85℃
105℃

8 – EUT Photos



9 –TMP



10 –Appendix (Applicable product series)

Light sources Tested:

Product	Size	Die count in series	Die count in parallel	CCT	CRI
H20	20*20*1.0mm	12	2	3000K	80

Die Count	Drive Current	Nominal Voltage	Nominal Power	Nominal Light output
24	250mA	36V	9W	900lm

Drive Current per die	Current Density	Power Density
0.12A	0.0025A/mm²	0.095W/mm²

Applicable Product:

The test date is also applied to the 5W; 7W H20 series.