TEST REPORT

ANSI/IES LM-80-15

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES
For

Shenzhen HoneBright Technology Co.,Ltd

Floor, 5 Building, Hongyu Guangming Valley, 11 Youmagang Road, Gongming Town, Guangming District, Shenzhen, China

Report No.:	BL210714009-9
Product Description:	SMD LED
Model No.:	AW-21/DAB1D27Y41HJ
Test Initiation Date:	2021-07-15
Test Completion Date:	2021-07-15 to 2023-08-07
Report Issue Date:	2023-08-14
Test Standard:	ANSI/IES LM-80-15
Test Laboratory:	Shenzhen Belling Efficiency Testing Lab Co.,Ltd

Tested by

Sam Chen

Reviewed by

Jason zhou

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1-GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

Manufacturer:	Shenzhen HoneBright Technology Co.,Ltd
Brand name:	HoneBright
Part Number:	AW-21/DAB1D27Y41HJ
Part Type:	SMD LED
Product Description:	VF 6V, IF 150mA
CCT:	2700K
Die Spacing(mm):	N/A
Average Power Density per LED die(W/mm2):	1.182
Average Current Density per LED die(mA/mm2):	394.167
Repersnetative CRI (Ra) of the tested sample set (Indicate whether the reported calue s the mean or median value of the sample set, or per unit):	90
LED light source monitoring interval:	The LED array are inspected at regular interval (24 hours) throughout the 17000 hours test.
Photometric measurement uncertainty:	1.8% on flux measurements for LM-80 testing.

1.2 Family products covered by this report:

According to ENERGY STAR® Requirements for the Use of LM-80 Data, the following products can be covered by this report base on the information and declaration provided by manufacturer. The information of these models shows that the covered products meet all section 4 requirements of ENERGY STAR® Requirements for the Use of IES/NA LM-80 Data (September 28, 2017)

This report covers the following models:

Test Model Name	Family Model Name	Difference
AW-21/DAB1D27Y41HJ	AW-21/AAB1DXXXXXXJ	First XXX: CCT code; Sencond XX: Flux code; Last X: CRI code.
	AW-21/BAB1DXXXXXXJ	
	AW-21/CAB1DXXXXXXJ	
	AW-21/DAB1DXXXXXXJ	

1.3 Drive Level

Samples are driven with a constant direct current (DC) during maintenance test, photometric and electrical measurement. The current value was regulated to within ±3% of the specified value of the manufacturer during maintenance test, and was within ±0.5% during photometric and electrical measurement test.

1.4 Ambient Conditions for Maintenance Test

For lumen maintenance test, samples within one data set, were installed on cooling boards in thermal chambers with minimal ambient airflow. The case temperature and ambient temperature was monitored by thermocouples which one was soldered to the coldest DUTs' case (TMP_{LED}) location, while the other is mounted at a distance of 5 mm above the TMP location. During life testing, TMP_{LED} of the coldest LEDs were maintained at a temperature that was greater than or equal to 2℃ below the corresponding nominal case temperature.

Surrounding air was maintained at a temperature that was greater than or equal to 5℃ below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with Type K.

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within ±3% of the specified value of the manufacturer.

Surrounding Air temperature for life test : controlled to within -5℃of the case temperature (Ts)

Humidity : < 65% RH

Ambient temperature for Photometry measurement : maintained at 25℃±2℃

1.5 Photometric measurement uncertainty

The uncertainty of the light output measurements is U=1.8% (K=2)

Long term measurement uncertainty is based on reproducibility tests done over a period of one year, calculated to K=2 coverage (i.e. 95% coverage).

1.6 Standards Used:

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- CIE 127:2007: Measurement of LEDs(This test method was not accredited by NVLAP)

1.7 Test Facility Description

The test facility used by Shenzhen Belling Efficiency Testing Lab Co., Ltd is located at 1Floor, No.1 Building, Meibaohe Industrial Park, Dalang Street, Longhua District, Shenzhen, Guangdong Prov.518101 China.

1.8 Statement of Traceability

Shenzhen Belling Efficiency Testing Lab Co., Ltd attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.9 Test Equipment List

Device	Manufacture	Model No.	Serial No.	Calibration due date
Digital Power Meter	YOKOGAWA	WT310	N.A	2024-03-27
Integral Sphere(0.5M)	SENSING	Ball0516	N.A	2024-03-27
Spectral radiometer	SENSING	SPR-3000	S1101108	2024-03-27
Stop watch	KISLO	K610	N/A	2024-04-19
LED aging equipment	Guangzhou CK	Box0516	N.A	2024-04-11
DC Power Supply	AIKESAI	APS300-5	N.A	2024-03-27
Thermocouple K	OMEGA	Type K	23736-1	2024-04-17

1.10 Sample Set

Sampling Method:

LED samples for ANSI/IES LM-80-15 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 ANSI/IES LM-80-15 tests.

Sample Size:

Total 75Pcs; Each Ts test condition 25Pcs, The samples tested at T_S 55°C, T_S 85°C and T_S 105°C were received at 2021-07-14 and tested during 2021-07-15 to 2023-08-07. The samples were numbered from L1 to L25, L26 to L50 and L51 to L75.

2-Summary of Test Result

Data Set	1	2	3
Nominal case temperatures	55°C	85°C	105°C
Drive Current	150mA	150mA	150mA
Condition	Ts=54.3°C Ta=53.4°C	Ts=84.5°C Ta=83.5°C	Ts=104.6°C Ta=103.4°C
Sample size	25	25	25
Duration (in Hours)	17000	17000	17000
Intervals (in Hours)	1000	1000	1000
Failure	0	0	0
α	2.080E-06	2.195E-06	2.255E-06
β	1.007	1.005	1.002
Reported L70 (17k) (17000h)	>102000	>102000	>102000
Reported L90 (17k) (17000h)	54,000	50,000	48,000

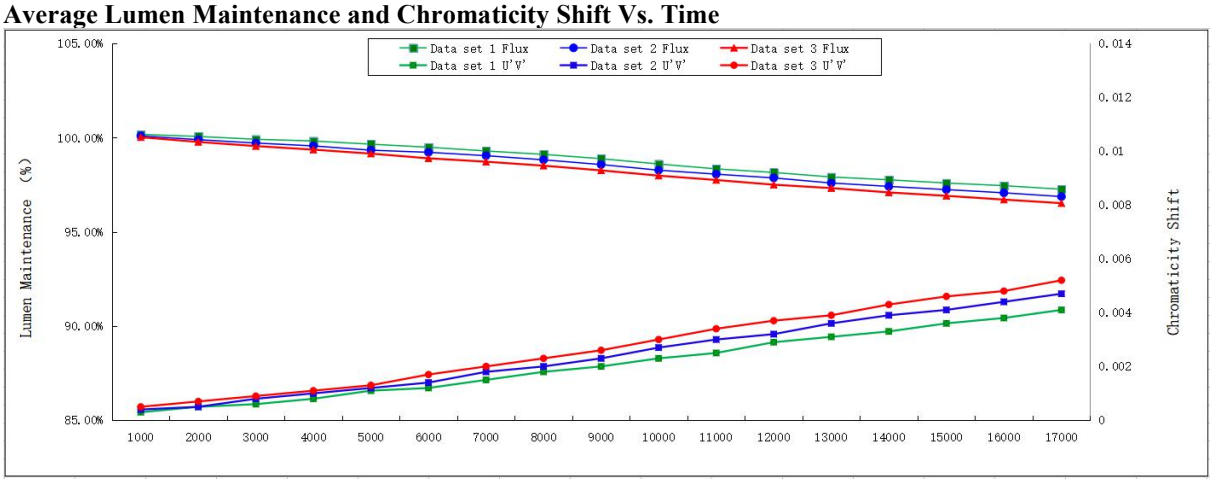
Average Lumen Maintenance (%)

Data Set	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
1	100.17	100.06	99.91	99.82	99.65	99.49	99.29	99.11	98.88
2	100.09	99.89	99.71	99.56	99.33	99.22	99.04	98.82	98.57
3	100.02	99.77	99.55	99.36	99.15	98.90	98.72	98.51	98.26
Data Set	**10000h**	**11000h**	**12000h**	**13000h**	**14000h**	**15000h**	**16000h**	**17000h**	-
1	98.60	98.34	98.15	97.91	97.76	97.59	97.45	97.26	-
2	98.27	98.06	97.86	97.59	97.41	97.24	97.07	96.87	-
3	97.98	97.75	97.50	97.32	97.09	96.91	96.71	96.52	-

Average Chromaticity Shift

Data Set	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
1	0.0003	0.0005	0.0006	0.0008	0.0011	0.0012	0.0015	0.0018	0.0020
2	0.0004	0.0005	0.0008	0.0010	0.0012	0.0014	0.0018	0.0020	0.0023
3	0.0005	0.0007	0.0009	0.0011	0.0013	0.0017	0.0020	0.0023	0.0026
Data Set	**10000h**	**11000h**	**12000h**	**13000h**	**14000h**	**15000h**	**16000h**	**17000h**	-
1	0.0023	0.0025	0.0029	0.0031	0.0033	0.0036	0.0038	0.0041	-
2	0.0027	0.0030	0.0032	0.0036	0.0039	0.0041	0.0044	0.0047	-
3	0.0030	0.0034	0.0037	0.0039	0.0043	0.0046	0.0048	0.0052	-

Average Lumen Maintenance and Chromaticity Shift Vs. Time



TM-21 Report for Lumen Maintenance

TM-21 Report

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)	Shenzhen HoneBright Technology Co.,Ltd AW-21/DAB1D27Y41HJ				
Test Condition 1 - 55ºC Case Temp		Test Condition 2 - 85ºC Case Temp		Test Condition 3 - 105ºC Case Temp	
Sample size	25	Sample size	25	Sample size	25
Number of failures	0	Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150
Test duration (hours)	17,000	Test duration (hours)	17,000	Test duration (hours)	17,000
Test duration used for projection (hour to hour)	8,000 - 17,000	Test duration used for projection (hour to hour)	8,000 - 17,000	Test duration used for projection (hour to hour)	8,000 - 17,000
Tested case temperature (ºC)	55	Tested case temperature (ºC)	85	Tested case temperature (ºC)	105
α	2.080E-06	α	2.195E-06	α	2.255E-06
B	1.007	B	1.005	B	1.002
Reported L70(17k) (hours)	>102000	Reported L70(17k) (hours)	>102000	Reported L70(17k) (hours)	>102000

Table 2: Interpolation Report (projection based on *in-situ* temperature entered)	
$T_{s,1}$ (ºC)	105.00
$T_{s,1}$ (K)	378.15
α_1	2.255E-06
B_1	1.002
$T_{s,2}$ (ºC)	-
$T_{s,2}$ (K)	-
α_2	-
B_2	-
E_a/k_b	-
A	-
B_0	1.002
$T_{s,i}$ (ºC)	105.00
$T_{s,i}$ (K)	378.15
α_i	2.255E-06
Reported L70(17k) at 105ºC (hours)	>102000

TM-21 Report

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)	Shenzhen HoneBright Technology Co.,Ltd AW-21/DAB1D27Y41HJ				
Test Condition 1 - 55ºC Case Temp		Test Condition 2 - 85ºC Case Temp		Test Condition 3 - 105ºC Case Temp	
Sample size	25	Sample size	25	Sample size	25
Number of failures	0	Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150
Test duration (hours)	17,000	Test duration (hours)	17,000	Test duration (hours)	17,000
Test duration used for projection (hour to hour)	8,000 - 17,000	Test duration used for projection (hour to hour)	8,000 - 17,000	Test duration used for projection (hour to hour)	8,000 - 17,000
Tested case temperature (ºC)	55	Tested case temperature (ºC)	85	Tested case temperature (ºC)	105
α	2.080E-06	α	2.195E-06	α	2.255E-06
B	1.007	B	1.005	B	1.002
Reported L90(17k) (hours)	54,000	Reported L90(17k) (hours)	50,000	Reported L90(17k) (hours)	48,000

Table 2: Interpolation Report (projection based on *in-situ* temperature entered)	
$T_{s,1}$ (ºC)	105.00
$T_{s,1}$ (K)	378.15
α_1	2.255E-06
B_1	1.002
$T_{s,2}$ (ºC)	-
$T_{s,2}$ (K)	-
α_2	-
B_2	-
E_a/k_b	-
A	-
B_0	1.002
$T_{s,i}$ (ºC)	105.00
$T_{s,i}$ (K)	378.15
α_i	2.255E-06
Reported L90(17k) at 105ºC (hours)	48,000

3 Test Data

3.1 Data Set 1, 55℃, 150mA (Lumen Maintenance)

Sample No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L1	145.3	100.22	100.10	99.97	99.91	99.72	99.56	99.33	99.11	98.93
L2	145.7	100.10	100.00	99.89	99.79	99.61	99.45	99.27	99.11	98.82
L3	145.2	100.15	100.05	99.84	99.74	99.61	99.45	99.23	99.07	98.87
L4	146.0	100.18	100.07	99.88	99.79	99.59	99.43	99.26	99.09	98.87
L5	144.3	100.23	100.07	99.90	99.82	99.61	99.42	99.25	99.05	98.87
L6	144.8	100.05	99.96	99.75	99.68	99.54	99.36	99.19	99.05	98.78
L7	144.6	100.22	100.06	99.93	99.86	99.72	99.60	99.38	99.19	98.91
L8	144.2	100.25	100.17	100.04	99.98	99.77	99.63	99.40	99.26	98.98
L9	145.4	100.19	100.11	100.01	99.92	99.72	99.60	99.39	99.23	98.96
L10	145.4	100.12	100.03	99.84	99.73	99.51	99.35	99.16	99.01	98.77
L11	146.2	100.18	100.07	99.93	99.87	99.74	99.62	99.39	99.22	99.02
L12	146.2	100.06	99.91	99.80	99.70	99.56	99.44	99.25	99.07	98.85
L13	146.3	100.20	100.10	99.98	99.89	99.77	99.55	99.31	99.16	98.90
L14	146.1	100.28	100.15	100.04	99.97	99.77	99.62	99.40	99.23	98.98
L15	145.8	100.12	100.01	99.90	99.83	99.67	99.50	99.29	99.14	98.90
L16	146.0	100.11	99.94	99.83	99.76	99.55	99.39	99.16	98.99	98.76
L17	146.2	100.23	100.12	100.00	99.89	99.68	99.49	99.27	99.11	98.89
L18	146.0	100.14	100.05	99.87	99.80	99.60	99.42	99.18	98.99	98.78
L19	145.1	100.04	99.91	99.72	99.63	99.44	99.30	99.11	98.90	98.69
L20	144.6	100.23	100.13	99.93	99.83	99.65	99.49	99.28	99.05	98.84
L21	145.9	100.21	100.07	99.92	99.82	99.71	99.56	99.36	99.15	98.88
L22	146.2	100.29	100.18	100.02	99.93	99.73	99.52	99.30	99.12	98.86
L23	144.7	100.21	100.09	99.94	99.86	99.71	99.55	99.38	99.22	99.02
L24	145.1	100.05	99.94	99.79	99.72	99.54	99.42	99.23	99.07	98.80
L25	146.6	100.27	100.10	99.98	99.87	99.69	99.55	99.36	99.21	98.96
Ave.	145.5	100.17	100.06	99.91	99.82	99.65	99.49	99.29	99.11	98.88
Med.	145.7	100.19	100.07	99.92	99.83	99.67	99.49	99.28	99.11	98.87
st dev	0.6938	0.0752	0.0770	0.0883	0.0905	0.0911	0.0926	0.0847	0.0903	0.0846
Min.	144.2	100.04	99.91	99.72	99.63	99.44	99.30	99.11	98.90	98.69
Max.	146.6	100.29	100.18	100.04	99.98	99.77	99.63	99.40	99.26	99.02

Sample No.	Lumen Maintenance (%)								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L1	98.68	98.39	98.21	98.01	97.82	97.66	97.54	97.31	-
L2	98.57	98.28	98.08	97.83	97.66	97.46	97.37	97.15	-
L3	98.55	98.29	98.11	97.85	97.69	97.51	97.38	97.19	-
L4	98.60	98.32	98.12	97.89	97.70	97.53	97.37	97.13	-
L5	98.60	98.33	98.11	97.85	97.63	97.42	97.29	97.07	-
L6	98.52	98.29	98.05	97.86	97.65	97.46	97.37	97.14	-
L7	98.62	98.33	98.15	97.93	97.73	97.57	97.44	97.21	-
L8	98.74	98.53	98.33	98.07	97.93	97.78	97.61	97.47	-
L9	98.69	98.44	98.24	97.99	97.79	97.65	97.49	97.31	-
L10	98.47	98.18	97.95	97.71	97.54	97.35	97.22	97.09	-
L11	98.73	98.52	98.32	98.09	97.98	97.81	97.68	97.54	-
L12	98.60	98.37	98.22	98.01	97.84	97.65	97.55	97.40	-
L13	98.60	98.32	98.12	97.85	97.73	97.58	97.49	97.28	-
L14	98.73	98.43	98.23	98.03	97.89	97.75	97.63	97.47	-
L15	98.64	98.38	98.14	97.93	97.82	97.67	97.50	97.36	-
L16	98.45	98.21	98.07	97.80	97.68	97.49	97.32	97.20	-
L17	98.63	98.41	98.19	97.95	97.83	97.66	97.51	97.26	-
L18	98.45	98.17	97.99	97.77	97.57	97.37	97.20	96.97	-
L19	98.44	98.14	97.99	97.71	97.57	97.40	97.27	97.10	-
L20	98.60	98.37	98.16	97.91	97.77	97.62	97.48	97.29	-
L21	98.64	98.37	98.20	97.99	97.85	97.68	97.51	97.29	-
L22	98.62	98.33	98.17	97.91	97.74	97.60	97.50	97.35	-
L23	98.76	98.46	98.32	98.06	97.90	97.71	97.58	97.39	-
L24	98.54	98.25	98.11	97.90	97.76	97.61	97.44	97.29	-
L25	98.63	98.35	98.17	97.97	97.85	97.64	97.54	97.31	-
Ave.	98.60	98.34	98.15	97.91	97.76	97.59	97.45	97.26	-
Med.	98.60	98.33	98.15	97.91	97.76	97.61	97.49	97.29	-
st dev	0.0912	0.1004	0.0995	0.1051	0.1165	0.1266	0.1266	0.1385	-
Min.	98.44	98.14	97.95	97.71	97.54	97.35	97.20	96.97	-
Max.	98.76	98.53	98.33	98.09	97.98	97.81	97.68	97.54	-

3.2 Data Set 1, 55℃, 150mA (Forward Voltage)

Sample No.	Forward Voltage (V)									
	0hr(Initial)	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L1	5.978	5.997	6.021	6.048	6.127	6.067	6.066	6.016	6.019	6.011
L2	6.005	6.082	6.084	6.071	6.064	6.108	6.071	6.064	6.099	5.991
L3	5.993	6.050	6.013	6.032	6.113	6.092	6.046	6.049	5.968	6.077
L4	5.975	6.029	6.070	6.040	6.122	6.001	6.032	6.005	6.059	6.092
L5	5.980	5.993	6.112	6.008	6.110	6.106	6.052	6.106	6.006	6.040
L6	5.969	6.066	6.061	6.077	6.006	6.054	6.070	6.124	5.982	6.085
L7	5.987	6.066	6.103	6.045	6.100	6.018	6.069	5.992	6.092	6.086
L8	5.991	5.966	6.038	6.001	5.989	6.032	6.006	6.114	5.982	6.035
L9	6.008	6.023	6.093	6.037	6.042	6.029	6.029	6.004	5.980	6.034
L10	6.000	6.061	6.096	6.023	6.079	5.980	5.967	6.096	6.029	6.109
L11	6.008	5.984	6.031	6.031	6.108	6.018	6.076	6.095	6.059	6.051
L12	6.004	6.094	6.001	6.044	6.084	6.101	6.067	6.015	6.081	6.028
L13	6.050	6.064	6.061	5.998	6.036	6.039	6.042	6.088	5.990	5.999
L14	6.000	5.988	6.019	6.013	6.101	6.068	5.992	6.035	6.027	6.037
L15	6.005	6.099	6.098	6.015	6.129	6.069	6.094	6.106	6.100	5.991
L16	6.100	5.975	6.055	5.976	6.095	6.053	6.096	6.085	6.033	6.089
L17	5.975	6.051	6.064	5.965	6.077	6.077	5.991	6.092	5.969	6.050
L18	5.979	6.028	6.042	6.010	6.014	6.069	5.993	6.003	6.025	6.084
L19	5.994	6.002	6.122	6.005	6.089	6.063	6.015	6.060	6.036	6.119
L20	5.997	6.063	6.072	6.056	6.013	6.096	6.005	5.981	6.097	6.076
L21	5.997	6.087	6.037	6.084	6.013	6.071	6.082	6.098	6.055	6.121
L22	6.021	5.997	6.015	6.048	6.120	6.029	6.071	6.115	6.027	6.058
L23	5.991	6.011	6.089	5.964	6.092	6.062	5.978	5.982	6.043	6.042
L24	6.007	6.001	6.104	5.974	6.048	6.043	6.085	6.017	6.095	6.045
L25	6.007	5.984	6.093	6.003	6.078	6.086	6.100	6.094	5.965	6.117
Ave.	6.001	6.030	6.064	6.023	6.074	6.057	6.044	6.057	6.033	6.059
Med.	5.997	6.028	6.064	6.023	6.084	6.063	6.052	6.064	6.029	6.051
st dev	0.0268	0.0409	0.0352	0.0333	0.0423	0.0333	0.0403	0.0477	0.0449	0.0391
Min.	5.969	5.966	6.001	5.964	5.989	5.980	5.967	5.981	5.965	5.991
Max.	6.100	6.099	6.122	6.084	6.129	6.108	6.100	6.124	6.100	6.121

Sample No.	Forward Voltage (V)								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L1	6.128	6.032	6.064	6.021	6.083	6.000	5.969	6.062	-
L2	6.090	6.033	5.970	6.117	6.024	6.109	6.016	6.093	-
L3	6.117	6.084	6.081	6.063	6.052	5.981	6.058	6.069	-
L4	6.059	6.063	5.987	6.112	5.992	6.106	6.008	5.991	-
L5	6.105	6.008	5.995	6.107	6.078	6.047	6.039	6.055	-
L6	5.988	6.067	6.034	6.056	6.052	6.085	5.978	6.026	-
L7	5.994	6.058	6.074	6.060	5.966	6.094	6.046	5.989	-
L8	6.044	5.965	5.961	6.027	5.990	5.999	5.992	6.040	-
L9	6.057	5.979	5.972	6.015	5.971	6.013	6.011	6.001	-
L10	6.054	6.077	5.971	6.026	6.081	6.022	5.982	6.002	-
L11	6.112	6.081	5.984	6.015	6.051	6.105	6.053	5.983	-
L12	6.018	6.021	5.974	6.075	6.064	6.102	6.026	6.016	-
L13	6.013	6.059	5.961	6.003	6.085	6.006	5.972	6.026	-
L14	5.992	6.007	5.977	5.981	5.978	6.103	5.988	6.076	-
L15	6.011	5.999	6.072	6.102	5.983	6.091	5.961	6.105	-
L16	6.096	6.055	5.994	5.999	6.023	6.097	5.983	6.122	-
L17	6.073	5.993	6.100	6.041	6.067	6.111	5.961	6.092	-
L18	6.103	6.010	5.984	6.013	6.092	6.009	6.039	6.112	-
L19	6.018	5.968	6.007	6.008	5.990	6.117	6.077	6.023	-
L20	6.013	6.048	6.079	6.098	6.085	6.077	6.044	6.083	-
L21	6.116	6.022	5.971	6.068	6.079	6.115	6.022	6.061	-
L22	6.085	6.091	5.968	6.029	6.058	6.098	6.094	6.073	-
L23	6.127	6.064	6.048	6.019	5.966	6.091	6.057	6.066	-
L24	6.114	6.039	5.977	6.031	6.042	5.991	5.966	6.095	-
L25	5.992	6.075	6.031	6.093	6.011	6.090	6.006	6.021	-
Ave.	6.061	6.036	6.009	6.047	6.035	6.066	6.014	6.051	-
Med.	6.059	6.039	5.987	6.031	6.051	6.091	6.011	6.061	-
st dev	0.0489	0.0373	0.0455	0.0400	0.0438	0.0472	0.0384	0.0414	-
Min.	5.988	5.965	5.961	5.981	5.966	5.981	5.961	5.983	-
Max.	6.128	6.091	6.100	6.117	6.092	6.117	6.094	6.122	-

3.3 Data Set 1, 55℃, 150mA (Chromaticity Shift)

Sample No.	u'	v'	CCT(K)	Chromaticity Shift Δu'v'								
	0hr(Initial)			1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L1	0.2580	0.5313	2778	0.0002	0.0004	0.0005	0.0007	0.0010	0.0011	0.0014	0.0017	0.0019
L2	0.2608	0.5312	2719	0.0003	0.0005	0.0006	0.0008	0.0010	0.0011	0.0015	0.0018	0.0019
L3	0.2627	0.5316	2678	0.0002	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0015	0.0017
L4	0.2597	0.5275	2758	0.0003	0.0005	0.0006	0.0010	0.0011	0.0012	0.0014	0.0019	0.0021
L5	0.2609	0.5319	2716	0.0002	0.0005	0.0006	0.0008	0.0011	0.0013	0.0016	0.0020	0.0021
L6	0.2634	0.5309	2668	0.0003	0.0006	0.0008	0.0012	0.0016	0.0017	0.0020	0.0023	0.0024
L7	0.2619	0.5316	2695	0.0003	0.0006	0.0007	0.0010	0.0012	0.0015	0.0017	0.0021	0.0023
L8	0.2634	0.5308	2669	0.0004	0.0007	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022	0.0026
L9	0.2628	0.5304	2682	0.0001	0.0002	0.0003	0.0004	0.0007	0.0008	0.0011	0.0014	0.0016
L10	0.2628	0.5310	2679	0.0002	0.0004	0.0005	0.0006	0.0009	0.0011	0.0014	0.0017	0.0019
L11	0.2609	0.5296	2724	0.0004	0.0006	0.0007	0.0009	0.0010	0.0011	0.0013	0.0016	0.0018
L12	0.2606	0.5318	2720	0.0001	0.0003	0.0005	0.0006	0.0009	0.0010	0.0012	0.0016	0.0017
L13	0.2627	0.5309	2682	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0015	0.0017	0.0020
L14	0.2610	0.5319	2713	0.0001	0.0003	0.0004	0.0007	0.0010	0.0011	0.0014	0.0018	0.0021
L15	0.2587	0.5320	2759	0.0004	0.0006	0.0008	0.0012	0.0014	0.0017	0.0019	0.0022	0.0024
L16	0.2607	0.5308	2724	0.0001	0.0003	0.0004	0.0007	0.0009	0.0011	0.0015	0.0019	0.0020
L17	0.2604	0.5302	2733	0.0003	0.0004	0.0005	0.0007	0.0010	0.0011	0.0013	0.0015	0.0017
L18	0.2621	0.5313	2692	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0017	0.0019	0.0021
L19	0.2626	0.5316	2681	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0015	0.0018	0.0019
L20	0.2604	0.5319	2725	0.0001	0.0003	0.0005	0.0007	0.0010	0.0012	0.0015	0.0020	0.0021
L21	0.2598	0.5300	2745	0.0003	0.0005	0.0006	0.0010	0.0013	0.0015	0.0018	0.0021	0.0022
L22	0.2621	0.5314	2692	0.0003	0.0005	0.0007	0.0009	0.0012	0.0014	0.0016	0.0019	0.0022
L23	0.2626	0.5311	2683	0.0002	0.0003	0.0004	0.0007	0.0010	0.0012	0.0016	0.0019	0.0021
L24	0.2612	0.5314	2711	0.0003	0.0006	0.0008	0.0009	0.0010	0.0011	0.0014	0.0018	0.0022
L25	0.2616	0.5313	2703	0.0004	0.0007	0.0009	0.0011	0.0012	0.0014	0.0016	0.0019	0.0021
Ave.	0.2614	0.5310	2709	0.0003	0.0005	0.0006	0.0008	0.0011	0.0012	0.0015	0.0018	0.0020
Med.	0.2612	0.5313	2711	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0015	0.0019	0.0021
st dev	0.0014	0.0010	29.86	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2580	0.5275	2668	0.0001	0.0002	0.0003	0.0004	0.0007	0.0008	0.0011	0.0014	0.0016
Max.	0.2634	0.5320	2778	0.0004	0.0007	0.0009	0.0012	0.0016	0.0017	0.0020	0.0023	0.0026

Sample No.	Chromaticity Shift Δu'v'								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L1	0.0021	0.0022	0.0024	0.0027	0.0030	0.0033	0.0035	0.0037	-
L2	0.0024	0.0026	0.0028	0.0031	0.0032	0.0034	0.0035	0.0038	-
L3	0.0022	0.0024	0.0026	0.0028	0.0031	0.0033	0.0035	0.0037	-
L4	0.0024	0.0027	0.0033	0.0035	0.0039	0.0043	0.0045	0.0047	-
L5	0.0025	0.0026	0.0029	0.0032	0.0034	0.0037	0.0040	0.0045	-
L6	0.0026	0.0028	0.0033	0.0036	0.0040	0.0044	0.0046	0.0050	-
L7	0.0024	0.0026	0.0029	0.0030	0.0034	0.0036	0.0039	0.0040	-
L8	0.0029	0.0031	0.0037	0.0039	0.0040	0.0041	0.0044	0.0047	-
L9	0.0018	0.0019	0.0020	0.0021	0.0022	0.0024	0.0025	0.0029	-
L10	0.0024	0.0025	0.0027	0.0028	0.0030	0.0033	0.0035	0.0036	-
L11	0.0021	0.0022	0.0028	0.0031	0.0032	0.0035	0.0038	0.0041	-
L12	0.0021	0.0023	0.0028	0.0029	0.0033	0.0036	0.0038	0.0039	-
L13	0.0025	0.0027	0.0029	0.0031	0.0034	0.0037	0.0038	0.0039	-
L14	0.0023	0.0026	0.0030	0.0033	0.0036	0.0038	0.0039	0.0042	-
L15	0.0026	0.0027	0.0032	0.0034	0.0037	0.0041	0.0043	0.0046	-
L16	0.0023	0.0025	0.0031	0.0032	0.0035	0.0036	0.0037	0.0040	-
L17	0.0019	0.0020	0.0021	0.0024	0.0026	0.0028	0.0030	0.0033	-
L18	0.0024	0.0027	0.0029	0.0032	0.0036	0.0040	0.0042	0.0044	-
L19	0.0023	0.0024	0.0027	0.0029	0.0032	0.0037	0.0039	0.0043	-
L20	0.0023	0.0026	0.0029	0.0030	0.0033	0.0037	0.0040	0.0043	-
L21	0.0025	0.0027	0.0031	0.0033	0.0034	0.0036	0.0037	0.0041	-
L22	0.0024	0.0027	0.0032	0.0034	0.0036	0.0039	0.0042	0.0043	-
L23	0.0024	0.0026	0.0028	0.0030	0.0033	0.0036	0.0037	0.0042	-
L24	0.0025	0.0028	0.0030	0.0031	0.0034	0.0036	0.0038	0.0042	-
L25	0.0023	0.0026	0.0027	0.0029	0.0032	0.0034	0.0036	0.0040	-
Ave.	0.0023	0.0025	0.0029	0.0031	0.0033	0.0036	0.0038	0.0041	-
Med.	0.0024	0.0026	0.0029	0.0031	0.0034	0.0036	0.0038	0.0041	-
st dev	0.0002	0.0003	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	-
Min.	0.0018	0.0019	0.0020	0.0021	0.0022	0.0024	0.0025	0.0029	-
Max.	0.0029	0.0031	0.0037	0.0039	0.0040	0.0044	0.0046	0.0050	-

3.4 Data Set 2, 85℃, 150mA (Lumen Maintenance)

Sample No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L26	145.2	100.16	100.00	99.80	99.71	99.48	99.40	99.16	98.94	98.73
L27	145.7	100.06	99.88	99.74	99.62	99.37	99.30	99.11	98.92	98.73
L28	144.6	100.12	99.92	99.70	99.56	99.30	99.15	98.92	98.74	98.48
L29	147.7	100.02	99.85	99.67	99.54	99.36	99.25	99.03	98.79	98.59
L30	146.3	100.10	99.93	99.73	99.58	99.33	99.23	99.04	98.81	98.53
L31	145.6	99.98	99.72	99.56	99.44	99.17	99.08	98.93	98.68	98.48
L32	146.0	100.18	99.94	99.82	99.73	99.48	99.37	99.15	98.87	98.64
L33	145.5	100.12	99.96	99.75	99.57	99.37	99.29	99.12	98.95	98.68
L34	144.2	99.99	99.79	99.67	99.47	99.22	99.13	98.96	98.75	98.45
L35	145.4	99.99	99.77	99.57	99.44	99.27	99.18	99.01	98.79	98.53
L36	145.3	99.99	99.84	99.63	99.53	99.32	99.21	99.04	98.77	98.54
L37	145.1	100.08	99.83	99.63	99.43	99.15	99.08	98.91	98.72	98.43
L38	145.2	100.05	99.90	99.78	99.60	99.37	99.23	99.06	98.78	98.55
L39	144.7	100.21	99.98	99.85	99.70	99.44	99.37	99.21	99.00	98.73
L40	146.6	100.06	99.87	99.73	99.56	99.32	99.18	98.97	98.73	98.52
L41	144.9	100.17	99.94	99.73	99.62	99.44	99.34	99.15	98.92	98.66
L42	146.3	100.19	99.94	99.74	99.58	99.39	99.27	99.13	98.96	98.68
L43	145.3	100.01	99.85	99.63	99.48	99.24	99.15	99.00	98.77	98.54
L44	145.4	100.16	99.95	99.75	99.55	99.35	99.19	99.02	98.84	98.54
L45	145.3	100.18	100.01	99.79	99.69	99.44	99.36	99.13	98.91	98.68
L46	144.6	100.08	99.86	99.73	99.55	99.38	99.28	99.04	98.83	98.56
L47	145.7	100.00	99.78	99.54	99.35	99.09	98.93	98.70	98.47	98.21
L48	144.9	100.00	99.85	99.63	99.45	99.23	99.09	98.86	98.69	98.48
L49	144.9	100.19	99.92	99.75	99.65	99.47	99.31	99.14	98.93	98.68
L50	146.3	100.12	99.89	99.72	99.53	99.36	99.25	99.12	98.86	98.66
Ave.	145.5	100.09	99.89	99.71	99.56	99.33	99.22	99.04	98.82	98.57
Med.	145.3	100.08	99.89	99.73	99.56	99.36	99.23	99.04	98.81	98.55
st dev	0.7581	0.0771	0.0740	0.0813	0.0967	0.1049	0.1119	0.1150	0.1163	0.1196
Min.	144.2	99.98	99.72	99.54	99.35	99.09	98.93	98.70	98.47	98.21
Max.	147.7	100.21	100.01	99.85	99.73	99.48	99.40	99.21	99.00	98.73

Sample No.	Lumen Maintenance (%)								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L26	98.40	98.14	97.90	97.61	97.45	97.29	97.15	96.96	-
L27	98.44	98.22	97.99	97.66	97.48	97.33	97.19	97.01	-
L28	98.25	98.07	97.88	97.62	97.45	97.29	97.09	96.92	-
L29	98.25	98.08	97.86	97.58	97.40	97.26	97.11	96.91	-
L30	98.18	97.97	97.77	97.46	97.26	97.07	96.86	96.62	-
L31	98.19	97.94	97.70	97.37	97.22	97.03	96.88	96.73	-
L32	98.29	98.06	97.90	97.63	97.48	97.28	97.06	96.83	-
L33	98.43	98.23	98.05	97.74	97.58	97.40	97.24	97.05	-
L34	98.10	97.90	97.71	97.47	97.26	97.12	96.94	96.79	-
L35	98.25	97.98	97.81	97.50	97.36	97.19	97.04	96.82	-
L36	98.30	98.11	97.95	97.69	97.56	97.40	97.19	97.03	-
L37	98.16	98.00	97.78	97.53	97.33	97.15	97.01	96.77	-
L38	98.30	98.07	97.91	97.65	97.48	97.30	97.13	96.93	-
L39	98.40	98.21	98.03	97.72	97.50	97.31	97.16	96.91	-
L40	98.19	97.97	97.75	97.45	97.26	97.08	96.95	96.70	-
L41	98.30	98.13	97.94	97.68	97.54	97.36	97.16	96.99	-
L42	98.42	98.21	97.98	97.74	97.57	97.43	97.25	97.03	-
L43	98.28	98.04	97.86	97.57	97.36	97.20	97.00	96.83	-
L44	98.23	97.98	97.76	97.52	97.30	97.15	96.97	96.78	-
L45	98.40	98.14	97.98	97.73	97.52	97.34	97.15	96.96	-
L46	98.22	97.97	97.79	97.49	97.33	97.15	97.02	96.87	-
L47	97.87	97.64	97.43	97.19	96.96	96.81	96.66	96.43	-
L48	98.18	97.98	97.78	97.53	97.38	97.17	97.01	96.76	-
L49	98.44	98.26	98.10	97.85	97.69	97.51	97.35	97.18	-
L50	98.31	98.14	97.96	97.67	97.51	97.30	97.12	96.89	-
Ave.	98.27	98.06	97.86	97.59	97.41	97.24	97.07	96.87	-
Med.	98.28	98.07	97.88	97.61	97.45	97.28	97.09	96.89	-
st dev	0.1286	0.1339	0.1417	0.1406	0.1524	0.1504	0.1459	0.1563	-
Min.	97.87	97.64	97.43	97.19	96.96	96.81	96.66	96.43	-
Max.	98.44	98.26	98.10	97.85	97.69	97.51	97.35	97.18	-

3.5 Data Set 2, 85℃, 150mA (Forward Voltage)

Sample No.	Forward Voltage (V)									
	0hr(Initial)	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L26	5.993	6.031	6.113	6.091	6.035	6.036	6.033	6.029	6.073	6.129
L27	5.969	6.006	6.038	6.049	6.055	6.076	6.115	5.978	6.079	6.081
L28	6.001	6.058	6.033	6.062	6.034	5.988	5.984	6.109	6.060	6.108
L29	6.103	5.998	6.063	5.966	5.985	6.017	6.079	6.019	6.049	5.990
L30	6.003	6.029	6.083	6.016	6.111	5.996	6.083	5.974	6.015	6.010
L31	5.993	6.074	6.090	6.013	6.127	5.976	6.077	6.025	6.096	6.074
L32	5.990	6.027	6.031	5.989	6.125	5.966	6.109	6.058	5.995	6.061
L33	6.076	6.009	6.026	6.044	6.103	6.100	6.049	6.052	6.104	6.120
L34	6.002	6.118	6.105	6.069	6.108	6.049	6.024	6.068	6.052	6.083
L35	5.971	6.044	6.064	6.002	6.040	6.020	6.084	6.061	6.071	5.993
L36	6.039	6.068	6.028	6.023	6.015	6.110	6.130	5.987	6.006	6.101
L37	5.990	6.027	6.012	6.003	6.062	5.988	5.981	6.061	6.070	6.114
L38	6.024	6.108	6.058	6.028	5.990	6.038	6.035	6.068	6.116	6.001
L39	6.002	6.095	6.027	6.063	6.104	6.002	6.101	6.005	6.086	6.106
L40	5.993	6.020	6.064	6.104	6.060	6.100	6.028	6.035	6.016	6.122
L41	5.982	6.031	6.050	6.034	6.016	5.990	5.998	6.040	6.105	5.981
L42	5.999	6.088	6.097	6.034	6.090	6.058	6.090	5.984	6.085	6.110
L43	5.983	6.123	6.103	6.017	5.990	5.993	6.028	6.101	6.094	6.114
L44	5.981	5.992	6.097	6.107	6.111	6.035	5.990	6.064	6.030	5.985
L45	6.006	6.054	6.013	6.005	6.109	6.080	6.064	6.049	6.085	5.983
L46	5.988	5.985	6.115	6.028	6.065	6.065	6.087	6.054	6.080	6.112
L47	6.056	6.004	6.032	6.083	6.127	5.979	6.081	6.102	6.080	6.119
L48	5.993	6.039	6.050	5.993	6.035	6.029	6.038	6.005	6.016	6.007
L49	5.993	6.087	6.008	6.097	6.069	6.062	6.008	5.993	6.055	6.081
L50	6.036	6.014	6.075	5.965	6.070	5.981	6.048	6.078	6.007	6.063
Ave.	6.007	6.045	6.059	6.035	6.065	6.029	6.054	6.040	6.061	6.066
Med.	5.993	6.031	6.058	6.028	6.065	6.029	6.049	6.049	6.071	6.081
st dev	0.0324	0.0404	0.0339	0.0409	0.0452	0.0433	0.0427	0.0393	0.0353	0.0538
Min.	5.969	5.985	6.008	5.965	5.985	5.966	5.981	5.974	5.995	5.981
Max.	6.103	6.123	6.115	6.107	6.127	6.110	6.130	6.109	6.116	6.129

Sample No.	Forward Voltage (V)								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L26	5.979	6.017	6.055	5.995	6.030	6.039	6.057	6.102	-
L27	6.002	6.026	6.062	6.074	6.027	6.121	6.049	6.067	-
L28	5.968	6.119	6.000	6.017	6.044	6.031	6.068	6.021	-
L29	6.082	6.129	6.109	6.088	6.080	6.036	6.092	5.998	-
L30	6.026	6.039	6.035	5.985	6.076	6.121	5.982	6.097	-
L31	5.977	5.995	6.094	6.019	6.064	6.029	6.086	6.102	-
L32	5.971	6.129	5.993	5.983	6.002	6.045	6.070	5.968	-
L33	6.057	6.107	5.971	6.096	5.975	6.036	6.093	6.021	-
L34	6.056	6.091	6.060	6.056	6.093	6.071	6.029	6.089	-
L35	6.005	5.987	6.044	5.999	6.005	6.020	6.058	5.976	-
L36	6.032	6.051	5.992	6.014	6.017	6.003	6.000	6.046	-
L37	6.029	6.018	6.092	6.108	6.037	6.054	6.049	6.019	-
L38	6.073	6.107	6.109	6.055	6.092	6.057	6.003	6.012	-
L39	6.067	6.124	6.007	6.013	5.991	6.088	6.067	5.984	-
L40	6.001	6.021	6.014	5.991	6.047	6.071	6.017	6.010	-
L41	6.021	6.126	6.070	6.067	5.973	6.095	6.064	6.063	-
L42	6.008	6.003	6.035	6.084	6.069	5.994	6.098	6.041	-
L43	6.032	6.112	6.022	6.007	6.085	5.992	6.066	6.071	-
L44	6.083	6.114	6.081	6.037	6.005	6.089	6.075	5.995	-
L45	6.022	6.019	6.041	5.983	6.107	6.024	5.980	6.086	-
L46	6.078	6.047	6.018	6.028	6.064	6.024	6.001	6.034	-
L47	6.075	6.061	6.020	6.064	6.044	6.045	6.067	6.009	-
L48	6.064	6.088	5.981	6.011	6.106	6.048	5.989	6.049	-
L49	6.096	6.041	6.091	6.018	6.045	6.119	6.030	6.093	-
L50	6.008	6.091	6.067	6.103	6.099	6.075	6.026	6.077	-
Ave.	6.032	6.066	6.043	6.036	6.047	6.053	6.045	6.041	-
Med.	6.029	6.061	6.041	6.019	6.045	6.045	6.057	6.041	-
st dev	0.0387	0.0479	0.0405	0.0403	0.0405	0.0374	0.0364	0.0418	-
Min.	5.968	5.987	5.971	5.983	5.973	5.992	5.980	5.968	-
Max.	6.096	6.129	6.109	6.108	6.107	6.121	6.098	6.102	-

3.6 Data Set 2, 85℃, 150mA (Chromaticity Shift)

Sample No.	u'	v'	CCT(K)	Chromaticity Shift Δu'v'								
	0hr(Initial)			1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L26	0.2629	0.5311	2678	0.0002	0.0003	0.0006	0.0008	0.0009	0.0011	0.0016	0.0020	0.0025
L27	0.2593	0.5275	2767	0.0006	0.0008	0.0012	0.0014	0.0017	0.0018	0.0023	0.0024	0.0027
L28	0.2598	0.5302	2744	0.0005	0.0007	0.0009	0.0011	0.0015	0.0017	0.0021	0.0022	0.0025
L29	0.2608	0.5312	2719	0.0005	0.0006	0.0007	0.0008	0.0010	0.0011	0.0013	0.0014	0.0017
L30	0.2602	0.5313	2732	0.0006	0.0008	0.0012	0.0014	0.0016	0.0019	0.0023	0.0025	0.0029
L31	0.2583	0.5310	2773	0.0005	0.0006	0.0010	0.0012	0.0013	0.0015	0.0017	0.0021	0.0024
L32	0.2596	0.5318	2742	0.0005	0.0007	0.0009	0.0012	0.0013	0.0015	0.0019	0.0020	0.0022
L33	0.2613	0.5318	2708	0.0004	0.0005	0.0007	0.0008	0.0011	0.0014	0.0015	0.0018	0.0021
L34	0.2622	0.5300	2695	0.0004	0.0006	0.0008	0.0010	0.0012	0.0013	0.0017	0.0020	0.0023
L35	0.2605	0.5314	2726	0.0004	0.0005	0.0009	0.0011	0.0014	0.0018	0.0020	0.0023	0.0026
L36	0.2608	0.5307	2722	0.0003	0.0005	0.0007	0.0009	0.0010	0.0013	0.0017	0.0020	0.0024
L37	0.2604	0.5319	2726	0.0005	0.0006	0.0008	0.0010	0.0012	0.0013	0.0017	0.0020	0.0023
L38	0.2625	0.5313	2685	0.0003	0.0005	0.0008	0.0010	0.0014	0.0015	0.0017	0.0019	0.0023
L39	0.2613	0.5311	2710	0.0003	0.0004	0.0007	0.0008	0.0009	0.0012	0.0013	0.0015	0.0018
L40	0.2593	0.5305	2754	0.0004	0.0005	0.0007	0.0009	0.0011	0.0014	0.0018	0.0019	0.0024
L41	0.2603	0.5320	2728	0.0002	0.0004	0.0007	0.0010	0.0012	0.0015	0.0016	0.0017	0.0021
L42	0.2592	0.5318	2751	0.0004	0.0006	0.0009	0.0010	0.0012	0.0015	0.0019	0.0023	0.0027
L43	0.2613	0.5318	2707	0.0002	0.0003	0.0007	0.0009	0.0010	0.0013	0.0018	0.0022	0.0024
L44	0.2615	0.5303	2709	0.0002	0.0003	0.0006	0.0009	0.0011	0.0014	0.0018	0.0022	0.0024
L45	0.2623	0.5316	2688	0.0002	0.0003	0.0004	0.0005	0.0007	0.0010	0.0012	0.0015	0.0018
L46	0.2611	0.5317	2711	0.0003	0.0005	0.0008	0.0009	0.0012	0.0015	0.0019	0.0022	0.0025
L47	0.2622	0.5298	2696	0.0006	0.0008	0.0010	0.0011	0.0013	0.0014	0.0018	0.0020	0.0022
L48	0.2617	0.5312	2701	0.0005	0.0007	0.0010	0.0011	0.0014	0.0015	0.0018	0.0019	0.0021
L49	0.2608	0.5319	2716	0.0001	0.0002	0.0005	0.0006	0.0010	0.0011	0.0016	0.0018	0.0021
L50	0.2605	0.5306	2729	0.0005	0.0006	0.0010	0.0012	0.0013	0.0016	0.0019	0.0021	0.0023
Ave.	0.2608	0.5310	2721	0.0004	0.0005	0.0008	0.0010	0.0012	0.0014	0.0018	0.0020	0.0023
Med.	0.2608	0.5312	2719	0.0004	0.0005	0.0008	0.0010	0.0012	0.0014	0.0018	0.0020	0.0023
st dev	0.0012	0.0010	24.80	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003
Min.	0.2583	0.5275	2678	0.0001	0.0002	0.0004	0.0005	0.0007	0.0010	0.0012	0.0014	0.0017
Max.	0.2629	0.5320	2773	0.0006	0.0008	0.0012	0.0014	0.0017	0.0019	0.0023	0.0025	0.0029

Sample No.	Chromaticity Shift Δu'v'								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L26	0.0028	0.0032	0.0033	0.0036	0.0039	0.0041	0.0044	0.0049	-
L27	0.0031	0.0033	0.0035	0.0040	0.0044	0.0047	0.0048	0.0050	-
L28	0.0028	0.0031	0.0033	0.0038	0.0042	0.0044	0.0045	0.0047	-
L29	0.0022	0.0025	0.0027	0.0029	0.0032	0.0035	0.0038	0.0040	-
L30	0.0033	0.0035	0.0039	0.0041	0.0043	0.0046	0.0050	0.0054	-
L31	0.0028	0.0030	0.0034	0.0038	0.0040	0.0043	0.0045	0.0050	-
L32	0.0025	0.0029	0.0030	0.0033	0.0037	0.0039	0.0042	0.0047	-
L33	0.0026	0.0029	0.0033	0.0036	0.0039	0.0042	0.0044	0.0047	-
L34	0.0027	0.0031	0.0033	0.0037	0.0040	0.0044	0.0048	0.0050	-
L35	0.0030	0.0032	0.0034	0.0037	0.0040	0.0041	0.0042	0.0045	-
L36	0.0028	0.0032	0.0034	0.0037	0.0040	0.0042	0.0046	0.0050	-
L37	0.0026	0.0030	0.0032	0.0037	0.0041	0.0044	0.0049	0.0051	-
L38	0.0025	0.0028	0.0031	0.0035	0.0037	0.0039	0.0043	0.0045	-
L39	0.0023	0.0026	0.0029	0.0033	0.0036	0.0037	0.0039	0.0041	-
L40	0.0027	0.0030	0.0032	0.0037	0.0041	0.0045	0.0047	0.0051	-
L41	0.0024	0.0028	0.0032	0.0034	0.0037	0.0040	0.0044	0.0046	-
L42	0.0032	0.0034	0.0035	0.0039	0.0042	0.0043	0.0048	0.0049	-
L43	0.0028	0.0031	0.0034	0.0038	0.0042	0.0044	0.0046	0.0052	-
L44	0.0027	0.0030	0.0032	0.0035	0.0039	0.0041	0.0043	0.0048	-
L45	0.0023	0.0027	0.0030	0.0033	0.0036	0.0039	0.0044	0.0047	-
L46	0.0028	0.0030	0.0034	0.0037	0.0040	0.0042	0.0044	0.0045	-
L47	0.0027	0.0030	0.0033	0.0036	0.0040	0.0042	0.0045	0.0047	-
L48	0.0025	0.0027	0.0028	0.0031	0.0035	0.0037	0.0038	0.0039	-
L49	0.0024	0.0027	0.0031	0.0034	0.0037	0.0041	0.0043	0.0048	-
L50	0.0027	0.0030	0.0032	0.0035	0.0038	0.0039	0.0043	0.0047	-
Ave.	0.0027	0.0030	0.0032	0.0036	0.0039	0.0041	0.0044	0.0047	-
Med.	0.0027	0.0030	0.0033	0.0036	0.0040	0.0042	0.0044	0.0047	-
st dev	0.0003	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0004	-
Min.	0.0022	0.0025	0.0027	0.0029	0.0032	0.0035	0.0038	0.0039	-
Max.	0.0033	0.0035	0.0039	0.0041	0.0044	0.0047	0.0050	0.0054	-

3.7 Data Set 3, 105℃, 150mA (Lumen Maintenance)

Sample No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L51	144.8	99.98	99.68	99.46	99.31	99.11	98.82	98.58	98.33	98.06
L52	144.2	100.06	99.79	99.61	99.38	99.13	98.86	98.70	98.50	98.26
L53	145.3	99.97	99.77	99.52	99.30	99.13	98.94	98.69	98.45	98.17
L54	144.1	99.97	99.72	99.50	99.30	99.14	98.85	98.68	98.42	98.14
L55	145.7	100.09	99.80	99.57	99.38	99.18	98.89	98.73	98.53	98.30
L56	144.8	99.97	99.75	99.51	99.32	99.12	98.84	98.69	98.49	98.20
L57	145.2	100.00	99.76	99.54	99.34	99.12	98.86	98.65	98.45	98.16
L58	145.1	100.05	99.78	99.53	99.38	99.15	98.93	98.75	98.50	98.26
L59	144.8	100.01	99.78	99.52	99.33	99.15	98.85	98.65	98.50	98.30
L60	146.1	100.07	99.85	99.61	99.48	99.23	98.95	98.71	98.46	98.24
L61	144.3	100.05	99.78	99.54	99.34	99.09	98.82	98.65	98.42	98.15
L62	147.4	99.93	99.68	99.50	99.24	99.04	98.77	98.59	98.37	98.13
L63	144.7	99.98	99.79	99.53	99.38	99.16	98.89	98.67	98.44	98.22
L64	146.3	100.06	99.86	99.67	99.43	99.24	98.98	98.78	98.55	98.28
L65	144.7	99.97	99.77	99.61	99.46	99.27	99.02	98.85	98.63	98.40
L66	144.4	100.03	99.74	99.53	99.35	99.09	98.90	98.71	98.50	98.27
L67	145.5	100.00	99.72	99.48	99.24	99.08	98.85	98.67	98.47	98.17
L68	145.0	99.97	99.72	99.53	99.34	99.17	98.88	98.75	98.59	98.39
L69	145.0	100.12	99.82	99.59	99.35	99.17	98.98	98.84	98.69	98.38
L70	145.2	100.06	99.79	99.57	99.34	99.11	98.84	98.67	98.50	98.28
L71	144.5	100.14	99.86	99.60	99.44	99.18	98.97	98.80	98.62	98.43
L72	145.3	100.15	99.91	99.75	99.62	99.40	99.19	99.00	98.80	98.53
L73	146.2	100.05	99.80	99.57	99.33	99.13	98.88	98.70	98.45	98.17
L74	145.2	99.93	99.67	99.50	99.33	99.11	98.92	98.75	98.57	98.32
L75	146.6	99.97	99.67	99.49	99.27	99.11	98.88	98.67	98.45	98.23
Ave.	145.2	100.02	99.77	99.55	99.36	99.15	98.90	98.72	98.51	98.26
Med.	145.1	100.01	99.78	99.53	99.34	99.13	98.88	98.70	98.50	98.26
st dev	0.8009	0.0617	0.0623	0.0644	0.0810	0.0729	0.0843	0.0885	0.1015	0.1089
Min.	144.1	99.93	99.67	99.46	99.24	99.04	98.77	98.58	98.33	98.06
Max.	147.4	100.15	99.91	99.75	99.62	99.40	99.19	99.00	98.80	98.53

Sample No.	Lumen Maintenance (%)								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L51	97.80	97.57	97.30	97.09	96.85	96.71	96.55	96.34	-
L52	97.93	97.70	97.44	97.31	97.11	96.96	96.79	96.63	-
L53	97.93	97.74	97.51	97.37	97.15	97.01	96.80	96.63	-
L54	97.88	97.68	97.37	97.20	96.99	96.77	96.57	96.41	-
L55	98.07	97.85	97.59	97.35	97.08	96.92	96.73	96.55	-
L56	97.96	97.72	97.47	97.29	97.08	96.90	96.69	96.50	-
L57	97.92	97.67	97.45	97.26	96.99	96.81	96.60	96.44	-
L58	98.00	97.74	97.44	97.31	97.04	96.80	96.63	96.49	-
L59	98.05	97.78	97.56	97.36	97.09	96.93	96.74	96.51	-
L60	97.99	97.78	97.56	97.36	97.10	96.87	96.68	96.48	-
L61	97.88	97.63	97.38	97.21	96.97	96.78	96.55	96.38	-
L62	97.82	97.60	97.39	97.24	97.01	96.84	96.60	96.40	-
L63	97.93	97.68	97.44	97.27	97.04	96.89	96.73	96.54	-
L64	98.02	97.78	97.56	97.39	97.21	96.97	96.80	96.63	-
L65	98.13	97.88	97.64	97.45	97.28	97.03	96.77	96.61	-
L66	97.99	97.79	97.56	97.34	97.09	96.96	96.76	96.54	-
L67	97.92	97.72	97.51	97.29	97.11	96.90	96.66	96.44	-
L68	98.07	97.82	97.59	97.39	97.14	97.00	96.79	96.64	-
L69	98.10	97.85	97.63	97.43	97.21	97.08	96.92	96.73	-
L70	98.03	97.78	97.50	97.26	96.99	96.79	96.57	96.38	-
L71	98.17	97.90	97.63	97.45	97.19	96.96	96.77	96.55	-
L72	98.21	97.94	97.63	97.48	97.31	97.15	96.90	96.73	-
L73	97.83	97.63	97.39	97.21	97.02	96.80	96.61	96.45	-
L74	97.99	97.75	97.46	97.32	97.06	96.86	96.69	96.48	-
L75	97.92	97.73	97.51	97.34	97.14	96.98	96.75	96.55	-
Ave.	97.98	97.75	97.50	97.32	97.09	96.91	96.71	96.52	-
Med.	97.99	97.74	97.51	97.32	97.09	96.90	96.73	96.51	-
st dev	0.1062	0.0936	0.0941	0.0909	0.1025	0.1061	0.1035	0.1062	-
Min.	97.80	97.57	97.30	97.09	96.85	96.71	96.55	96.34	-
Max.	98.21	97.94	97.64	97.48	97.31	97.15	96.92	96.73	-

3.8 Data Set 3, 105℃, 150mA (Forward Voltage)

Sample No.	Forward Voltage (V)									
	0hr(Initial)	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L51	5.965	6.004	5.991	5.965	6.088	6.030	6.014	6.094	5.987	6.045
L52	5.983	6.093	6.007	6.092	6.057	6.116	6.067	6.062	6.031	6.012
L53	5.997	6.096	6.033	6.059	6.055	5.960	6.024	6.112	6.114	6.025
L54	5.989	6.064	6.109	6.036	6.067	6.014	6.029	6.110	5.986	6.040
L55	5.995	5.987	6.098	6.035	5.979	5.961	6.059	6.072	6.094	6.118
L56	5.993	6.001	6.011	6.107	5.988	6.115	6.084	5.991	6.003	6.021
L57	6.002	5.999	6.042	6.059	6.079	6.086	6.025	6.100	6.027	6.140
L58	6.016	5.997	6.074	6.005	6.071	6.081	6.091	6.061	5.955	5.970
L59	5.999	6.007	6.031	6.040	5.993	6.075	6.033	6.071	6.039	6.002
L60	5.981	6.008	6.075	6.056	6.082	6.120	5.989	6.139	6.061	6.004
L61	5.989	6.065	6.101	6.092	5.967	5.981	6.070	6.082	6.038	6.118
L62	6.005	6.005	6.023	6.018	6.101	5.960	6.102	6.017	6.088	6.101
L63	6.017	5.990	6.087	6.077	5.998	5.985	6.028	6.103	5.991	6.090
L64	5.994	6.006	6.115	6.003	6.029	6.002	5.975	6.063	6.107	6.114
L65	5.982	6.047	5.961	5.980	6.063	6.007	5.993	5.999	6.008	6.126
L66	5.989	6.005	5.971	6.002	6.039	6.051	6.049	5.994	6.117	6.100
L67	5.980	6.092	6.055	6.092	6.066	5.957	6.077	6.124	6.049	5.973
L68	6.004	6.000	5.998	6.073	5.981	6.105	6.028	6.077	6.006	6.084
L69	5.980	6.077	6.091	6.041	6.012	5.971	5.980	5.976	6.016	6.084
L70	5.989	6.079	6.035	6.042	6.076	5.987	6.035	6.123	6.015	5.981
L71	6.003	6.100	6.103	6.099	6.015	5.969	6.086	6.066	6.032	6.012
L72	6.002	6.053	5.985	6.077	6.063	6.052	6.066	6.106	5.973	6.117
L73	6.020	6.008	5.968	6.090	6.009	6.106	6.056	6.033	5.984	6.124
L74	6.006	5.994	6.092	5.990	5.988	6.056	6.034	6.059	6.076	5.978
L75	6.012	6.071	5.978	6.080	5.971	5.957	5.978	6.083	5.993	6.029
Ave.	5.996	6.034	6.041	6.048	6.033	6.028	6.039	6.069	6.032	6.056
Med.	5.995	6.008	6.035	6.056	6.039	6.014	6.034	6.072	6.027	6.045
st dev	0.0134	0.0402	0.0505	0.0406	0.0422	0.0590	0.0371	0.0449	0.0463	0.0566
Min.	5.965	5.987	5.961	5.965	5.967	5.957	5.975	5.976	5.955	5.970
Max.	6.020	6.100	6.115	6.107	6.101	6.120	6.102	6.139	6.117	6.140

Sample No.	Forward Voltage (V)								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L51	6.103	6.042	6.080	6.118	6.031	6.112	5.986	5.988	-
L52	5.976	6.055	5.996	5.987	6.066	5.956	5.967	6.011	-
L53	5.999	5.989	6.112	6.082	5.970	6.000	6.006	6.097	-
L54	6.042	6.100	6.096	6.111	6.035	6.063	6.096	6.021	-
L55	6.039	6.081	6.099	6.010	6.005	5.991	6.038	5.998	-
L56	5.967	6.035	5.982	6.110	6.071	6.026	6.118	6.055	-
L57	6.004	6.037	6.106	6.071	6.026	6.011	6.064	6.080	-
L58	6.000	5.991	5.954	6.012	6.108	6.019	6.078	6.001	-
L59	5.989	6.019	6.090	6.064	5.978	6.063	6.015	6.127	-
L60	5.991	6.019	5.994	6.070	5.972	5.964	5.961	5.973	-
L61	5.979	5.980	5.980	5.970	6.073	6.023	6.071	6.016	-
L62	6.011	6.007	6.100	6.041	6.007	5.966	6.056	6.037	-
L63	5.963	6.005	5.989	6.027	6.013	5.955	5.962	6.121	-
L64	6.026	6.042	5.959	5.971	6.060	6.040	6.119	6.041	-
L65	6.060	6.014	6.099	5.998	6.012	6.064	5.978	5.988	-
L66	6.011	5.966	6.094	6.014	5.974	5.976	5.950	6.005	-
L67	6.051	5.970	6.003	5.983	6.057	6.073	6.112	6.041	-
L68	6.105	5.998	6.072	6.106	5.985	5.992	6.037	5.988	-
L69	6.052	6.089	6.049	6.083	6.050	6.005	6.043	6.025	-
L70	6.092	5.971	5.951	6.046	6.070	6.019	6.001	6.068	-
L71	5.956	6.034	5.996	6.054	6.033	5.953	6.023	6.012	-
L72	5.960	6.052	6.087	5.995	6.110	6.074	5.968	6.068	-
L73	6.040	6.036	6.119	6.123	6.031	6.089	6.025	6.093	-
L74	6.016	6.042	6.110	6.109	6.023	6.001	6.048	6.010	-
L75	6.072	6.058	5.977	6.117	6.049	5.973	6.011	6.091	-
Ave.	6.020	6.025	6.044	6.051	6.032	6.016	6.029	6.038	-
Med.	6.011	6.034	6.072	6.054	6.031	6.011	6.025	6.025	-
st dev	0.0444	0.0368	0.0603	0.0514	0.0397	0.0458	0.0514	0.0442	-
Min.	5.956	5.966	5.951	5.970	5.970	5.953	5.950	5.973	-
Max.	6.105	6.100	6.119	6.123	6.110	6.112	6.119	6.127	-

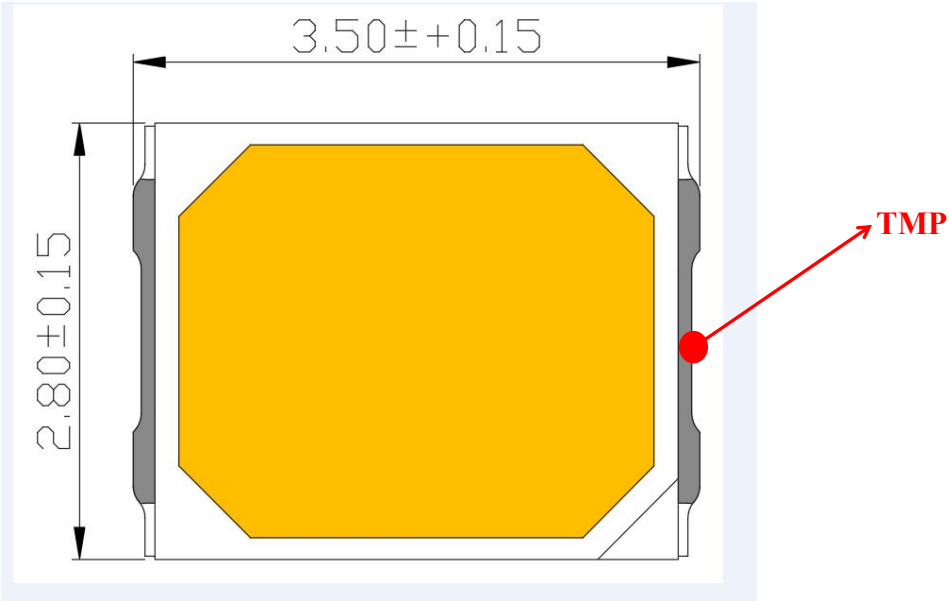
3.9 Data Set 3, 105℃, 150mA (Chromaticity Shift)

Sample No.	u'	v'	CCT(K)	Chromaticity Shift Δu'v'								
	0hr(Initial)			1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h
L51	0.2601	0.5308	2736	0.0004	0.0006	0.0007	0.0009	0.0012	0.0017	0.0020	0.0022	0.0024
L52	0.2627	0.5312	2681	0.0005	0.0007	0.0010	0.0011	0.0012	0.0015	0.0016	0.0017	0.0020
L53	0.2626	0.5311	2684	0.0006	0.0008	0.0011	0.0013	0.0015	0.0017	0.0021	0.0025	0.0030
L54	0.2621	0.5318	2691	0.0006	0.0007	0.0010	0.0011	0.0015	0.0020	0.0024	0.0025	0.0029
L55	0.2606	0.5313	2723	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014	0.0016	0.0017	0.0021
L56	0.2641	0.5308	2654	0.0006	0.0008	0.0011	0.0014	0.0017	0.0019	0.0022	0.0026	0.0030
L57	0.2609	0.5290	2726	0.0004	0.0005	0.0006	0.0008	0.0010	0.0014	0.0018	0.0020	0.0024
L58	0.2625	0.5315	2684	0.0005	0.0008	0.0010	0.0011	0.0012	0.0016	0.0018	0.0021	0.0023
L59	0.2609	0.5296	2724	0.0007	0.0009	0.0012	0.0013	0.0016	0.0019	0.0021	0.0024	0.0027
L60	0.2604	0.5301	2733	0.0005	0.0006	0.0008	0.0010	0.0014	0.0017	0.0019	0.0022	0.0025
L61	0.2634	0.5308	2668	0.0007	0.0008	0.0010	0.0012	0.0013	0.0017	0.0018	0.0020	0.0025
L62	0.2591	0.5311	2756	0.0003	0.0005	0.0007	0.0008	0.0012	0.0015	0.0019	0.0022	0.0026
L63	0.2619	0.5312	2698	0.0004	0.0006	0.0009	0.0012	0.0016	0.0018	0.0021	0.0025	0.0028
L64	0.2601	0.5316	2732	0.0006	0.0008	0.0010	0.0011	0.0014	0.0019	0.0023	0.0025	0.0030
L65	0.2613	0.5319	2706	0.0006	0.0009	0.0012	0.0015	0.0017	0.0020	0.0021	0.0025	0.0029
L66	0.2617	0.5319	2700	0.0005	0.0006	0.0008	0.0011	0.0014	0.0019	0.0022	0.0024	0.0027
L67	0.2601	0.5298	2740	0.0007	0.0008	0.0010	0.0011	0.0014	0.0019	0.0022	0.0024	0.0027
L68	0.2634	0.5309	2667	0.0005	0.0006	0.0008	0.0010	0.0013	0.0017	0.0020	0.0023	0.0028
L69	0.2617	0.5298	2706	0.0006	0.0007	0.0008	0.0010	0.0012	0.0015	0.0020	0.0024	0.0027
L70	0.2623	0.5318	2686	0.0004	0.0005	0.0008	0.0010	0.0012	0.0014	0.0018	0.0021	0.0025
L71	0.2619	0.5312	2696	0.0003	0.0005	0.0006	0.0008	0.0011	0.0016	0.0021	0.0023	0.0025
L72	0.2606	0.5319	2721	0.0006	0.0008	0.0011	0.0014	0.0017	0.0022	0.0025	0.0026	0.0030
L73	0.2609	0.5302	2722	0.0003	0.0005	0.0007	0.0010	0.0012	0.0016	0.0019	0.0023	0.0027
L74	0.2613	0.5318	2706	0.0006	0.0007	0.0009	0.0011	0.0012	0.0016	0.0019	0.0022	0.0026
L75	0.2583	0.5308	2773	0.0004	0.0006	0.0008	0.0010	0.0011	0.0015	0.0016	0.0018	0.0021
Ave.	0.2614	0.5310	2709	0.0005	0.0007	0.0009	0.0011	0.0013	0.0017	0.0020	0.0023	0.0026
Med.	0.2613	0.5311	2706	0.0005	0.0007	0.0009	0.0011	0.0013	0.0017	0.0020	0.0023	0.0027
st dev	0.0014	0.0008	28.78	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003
Min.	0.2583	0.5290	2654	0.0003	0.0005	0.0006	0.0008	0.0010	0.0014	0.0016	0.0017	0.0020
Max.	0.2641	0.5319	2773	0.0007	0.0009	0.0012	0.0015	0.0017	0.0022	0.0025	0.0026	0.0030

Sample No.	Chromaticity Shift Δu'v'								
	10000h	11000h	12000h	13000h	14000h	15000h	16000h	17000h	-
L51	0.0028	0.0031	0.0035	0.0038	0.0043	0.0045	0.0047	0.0050	-
L52	0.0022	0.0024	0.0028	0.0032	0.0037	0.0041	0.0043	0.0047	-
L53	0.0034	0.0036	0.0040	0.0043	0.0045	0.0049	0.0052	0.0055	-
L54	0.0032	0.0035	0.0039	0.0040	0.0044	0.0046	0.0049	0.0050	-
L55	0.0023	0.0027	0.0029	0.0032	0.0034	0.0038	0.0042	0.0045	-
L56	0.0036	0.0042	0.0047	0.0049	0.0054	0.0057	0.0059	0.0062	-
L57	0.0026	0.0031	0.0033	0.0036	0.0039	0.0043	0.0046	0.0050	-
L58	0.0029	0.0033	0.0035	0.0038	0.0042	0.0044	0.0047	0.0049	-
L59	0.0032	0.0038	0.0040	0.0041	0.0045	0.0047	0.0050	0.0056	-
L60	0.0029	0.0033	0.0034	0.0036	0.0040	0.0043	0.0045	0.0046	-
L61	0.0028	0.0031	0.0034	0.0036	0.0039	0.0043	0.0045	0.0050	-
L62	0.0031	0.0033	0.0038	0.0040	0.0043	0.0046	0.0048	0.0051	-
L63	0.0033	0.0039	0.0042	0.0044	0.0048	0.0051	0.0054	0.0059	-
L64	0.0033	0.0037	0.0040	0.0042	0.0046	0.0049	0.0051	0.0056	-
L65	0.0033	0.0035	0.0036	0.0040	0.0043	0.0047	0.0048	0.0050	-
L66	0.0031	0.0033	0.0037	0.0039	0.0041	0.0045	0.0046	0.0047	-
L67	0.0029	0.0034	0.0038	0.0041	0.0044	0.0047	0.0048	0.0053	-
L68	0.0033	0.0035	0.0040	0.0042	0.0046	0.0048	0.0049	0.0053	-
L69	0.0030	0.0036	0.0040	0.0041	0.0044	0.0047	0.0050	0.0052	-
L70	0.0030	0.0034	0.0039	0.0041	0.0043	0.0047	0.0048	0.0052	-
L71	0.0031	0.0037	0.0039	0.0040	0.0043	0.0047	0.0050	0.0056	-
L72	0.0034	0.0037	0.0039	0.0041	0.0046	0.0049	0.0053	0.0059	-
L73	0.0030	0.0033	0.0036	0.0039	0.0043	0.0047	0.0048	0.0054	-
L74	0.0031	0.0034	0.0036	0.0038	0.0041	0.0045	0.0048	0.0054	-
L75	0.0025	0.0029	0.0033	0.0035	0.0039	0.0042	0.0044	0.0051	-
Ave.	0.0030	0.0034	0.0037	0.0039	0.0043	0.0046	0.0048	0.0052	-
Med.	0.0031	0.0034	0.0038	0.0040	0.0043	0.0047	0.0048	0.0052	-
st dev	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	-
Min.	0.0022	0.0024	0.0028	0.0032	0.0034	0.0038	0.0042	0.0045	-
Max.	0.0036	0.0042	0.0047	0.0049	0.0054	0.0057	0.0059	0.0062	-

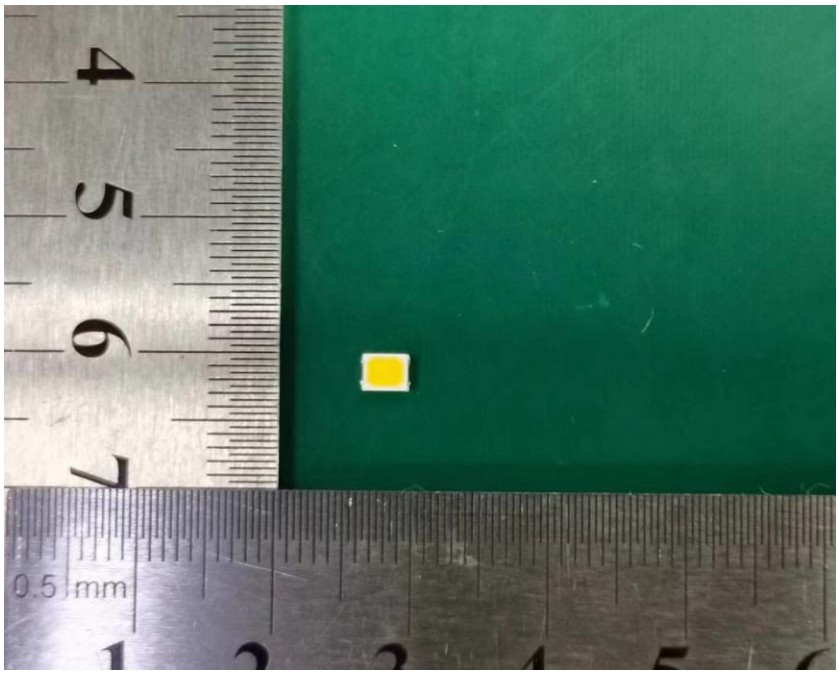
4-EUT Photos

4.1 Mechanical Dimensions



Note: All dimensions are in millimeters(mm).

4.2 EUT Photo



----End of report----