

TEST REPORT OF ANSI/IES LM-80-15

Approved Method for Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

Client..... : Shenzhen Mingtu Photoelectric Technology Co., LTD.
Address..... : 3 / F, Building E, Guanlan Zhongnan Port Industrial Zone, Longhua District,
Shenzhen
Test Model..... : PCT3030
Brand Name..... : Mingtu Photoelectric
Testing Laboratory..... : Guangdong Meide Testing Technology Co., Ltd.
Address..... : 1st floor, B Area, Jinbaisheng Industrial Park, Headquarters 2 Road,
SongshanLake Hi-tech Industrial Development Zone, Dongguan City,
Guangdong Pr., China.
Testing Location..... : As above
Report No..... : N02A22090571L00101
Date of receipt..... : 2021-05-17
Date of test : 2021-05-17 to 2022-06-25
Date of report..... : 2022-09-27

Tested by:

Jarvis Zhang

Jarvis Zhang/ Test Engineer

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Sandy Chen/ Project Engineer

Approved by:

Jessie Li

Jessie Li/ Technical Manager



Note 1: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or use in part without prior written consent from Guangdong Meide Testing Technology Co., Ltd. This report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
Note 2: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

ENERGY STAR® LM-80 Cover Sheet**Administrative Information**

Tested subcomponent series: N/A

Tested subcomponent model number: PCT3030

DUT Identification

DUT manufacture's name: Shenzhen Mingtu Photoelectric Technology Co., LTD

DUT identification, e.g., model number: PCT3030

Description of DUT, including if the DUT is an LED package or module: LED Package

DUT Characteristics

Total input power(W): 1 W

Average current density per LED die(mA/mm²): 302 mA/mm²Average power density per LED die(W/mm²): 0.825 W/mm²Representative CRI(Ra) of the tested sample set: 80-85
(Indicate whether the reported value is the mean or
Median value of the sample set, or per unit)

Minimum die edge to die edge spacing: 0.15mm

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1. General Information

1.1 Description of LED Light Sources

Sample Size:

75Pcs samples were received on 2021-05-17, The samples were numbered from S1 to S25, S26 to S50 and S51 to S75.

Manufacture: Shenzhen Mingtu Photoelectric Technology Co., LTD

Part Number: PCT3030

Part Type: LED Package

Drive Level: DC150mA

Tested CCT: 3000K

Nominal CCT: 2800K-3200K

Power: 1W

CRI: 80-85

Sampling Method:

LED samples for IESNA LM-80 testing consist of units built from 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.

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 LM-80 Data (September 28, 2017)

This report covers the following models:

Model name	CCT (K)	Number of dies	Current density per die (mA/mm ²)	Current (mA)	Power density (W/mm ²)	Power (W)	Die Spacing (mm)	Current of die (mA)
Test Model PCT3030	3000	2	302	150	0.11	1	0.15	150
PCT2835	2800-3200	2	302	150	0.11	1	0.2	150

Disclaimer:

The truthfulness and accuracy of all the technical information above for the covered LED products is ensured by manufacturer of LED light source. Guangdong Meide Testing Technology Co., Ltd. isn't responsible or gives any guarantees for the truthfulness of the technical information.

1.2 Standards Used

- ANSI/IES LM-80-15 IES Approved Method for Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
- ENERGY STAR® Requirements for the use of LM-80 Data (This standard was not accredited by NVLAP)

1.3 Test equipment list

Test Equipment	Serial No	Model No	Calibration due date
Integrating Sphere System	MD-E033	0.5m	2023/05/17
Standard Light Source	MD-E034	D062	2023/05/17
High Accuracy Array Spectroradiometer	MD-E011	HAAS-3000	2023/09/17
Digital Power Meter	MD-E008	PF310	2023/09/17
Precision digital stabilized DC power supply	MD-E009	WY305	2023/09/17
Temperature Tester	MD-E038	UFS-D8036	2023/08/28

Statement of Traceability: Guangdong Meide Testing Technology Co., Ltd. attested that all calibration has been performed using suitable standards traceable to national primary standards and International System of Unit(SI).

1.4 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 $\pm 3\%$ of the specified value of the manufacturer during maintenance test, and was within $\pm 0.5\%$ during photometric and electrical measurement test.

1.5 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°C below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to 5°C below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

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

The relative humidity within chamber was kept less than 65% during test.

For photometry measurement, the ambient temperature during test was set to $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, $RH < 65\%$.

1.6 Photometric Measurement Method

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate $u'v'$. 2π measurement was used and sample was driven by DC power supply. The forward current was regulated to within $\pm 0.5\%$ of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, $RH < 65\%$. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

The uncertainty of the light output (luminous flux) measurements is $U=2.1\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is $U=18\text{K}$ ($K=2$), at the 95% confidence level. The uncertainty of the temperature is $U=0.5^{\circ}\text{C}$ ($K=2$), at the 95% confidence level.

1.7 Sample Set

Data Set 1:85°C,150mA	
Part number:	PCT3030
Number of Units:	25
Case Temperature(T_S):	>83°C
Ambient Temperature(T_A):	>80°C
Life Test Drive Current:	150mA
Measurement Current:	150mA

Data Set 2:95°C,150mA	
Part number:	PCT3030
Number of Units:	25
Case Temperature(T_S):	>93°C
Ambient Temperature(T_A):	>90°C
Life Test Drive Current:	150mA
Measurement Current:	150mA

Data Set 3:105°C,150mA	
Part number:	PCT3030
Number of Units:	25
Case Temperature(T_S):	>103°C
Ambient Temperature(T_A):	>100°C
Life Test Drive Current:	150mA
Measurement Current:	150mA

2. SUMMARY OF TEST RESULT

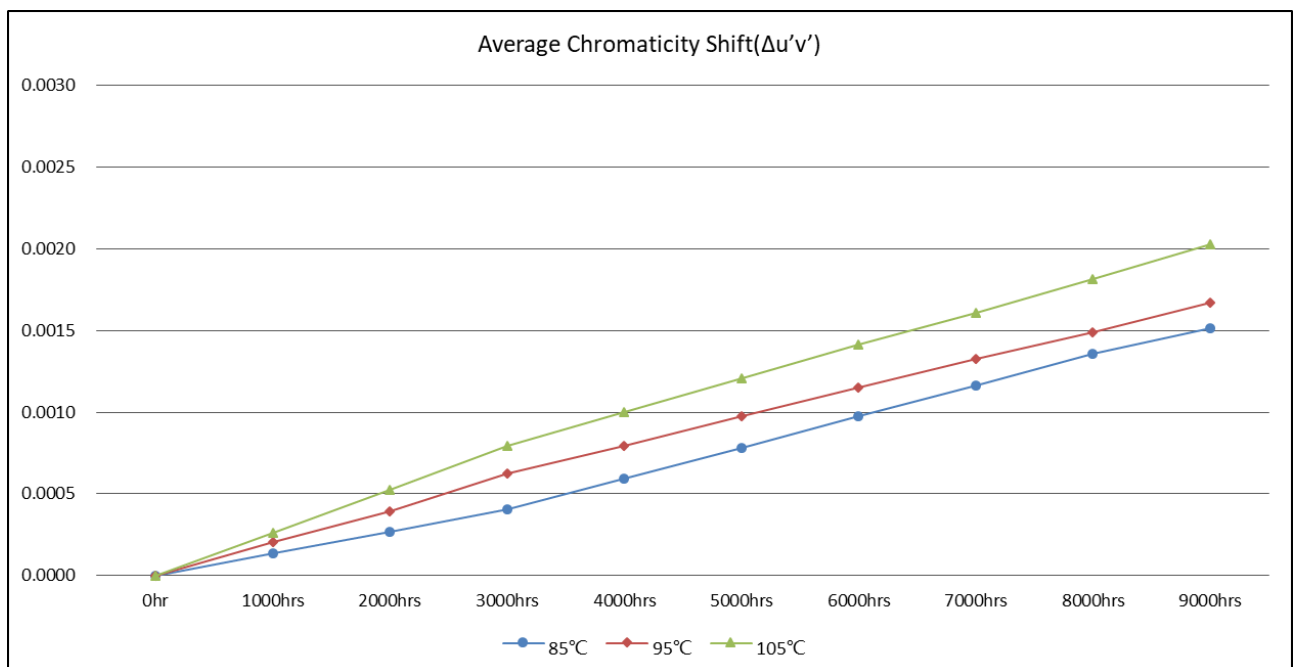
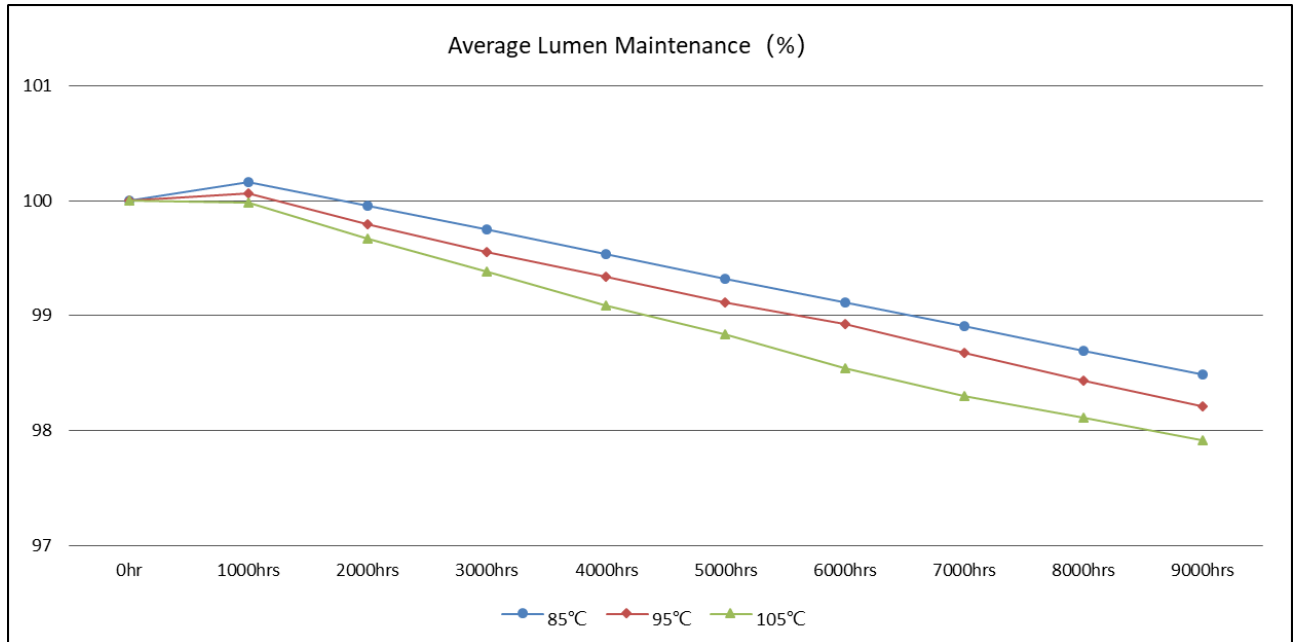
Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	B	Reported TM-21 L ₇₀ Lifetime	Reported TM-21 L ₉₀ Lifetime
1	25	0	1000hrs	9000hrs	2.110E-06	1.004	>54000hours	52000hours
2	25	0	1000hrs	9000hrs	2.283E-06	1.003	>54000hours	47000hours
3	25	0	1000hrs	9000hrs	2.394E-06	1.000	>54000hours	44000hours

Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	100.16%	99.96%	99.75%	99.54%	99.33%	99.11%	98.91%	98.70%	98.49%
2	100.07%	99.80%	99.56%	99.34%	99.11%	98.92%	98.68%	98.43%	98.21%
3	99.98%	99.67%	99.38%	99.09%	98.83%	98.54%	98.30%	98.12%	97.91%

Average Chromaticity Shift ($\Delta u'v'$)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.0001	0.0003	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0015
2	0.0002	0.0004	0.0006	0.0008	0.0010	0.0011	0.0013	0.0015	0.0017
3	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020



3. Test Data

3.1 Data Set 1, 85°C, 150mA (Lumen Maintenance)

Sample Number	$\Phi(\text{lm})$	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S1	138.74	100.17	99.95	99.73	99.52	99.31	99.10	98.87	98.65	98.45
S2	138.93	100.15	99.93	99.74	99.52	99.31	99.10	98.89	98.67	98.47
S3	138.76	100.13	99.92	99.70	99.48	99.27	99.07	98.86	98.66	98.45
S4	138.12	100.14	99.95	99.73	99.52	99.30	99.08	98.88	98.68	98.49
S5	138.20	100.18	99.96	99.76	99.56	99.36	99.15	98.96	98.75	98.52
S6	139.61	100.20	100.00	99.79	99.58	99.37	99.16	98.97	98.76	98.57
S7	138.70	100.13	99.91	99.70	99.49	99.28	99.06	98.83	98.61	98.40
S8	139.32	100.18	99.98	99.79	99.58	99.36	99.16	98.97	98.76	98.54
S9	139.90	100.14	99.95	99.75	99.53	99.33	99.11	98.92	98.69	98.50
S10	138.97	100.13	99.93	99.74	99.52	99.30	99.08	98.86	98.65	98.46
S11	138.95	100.14	99.92	99.71	99.50	99.29	99.08	98.87	98.65	98.42
S12	138.93	100.16	99.96	99.75	99.53	99.32	99.10	98.91	98.70	98.49
S13	139.16	100.23	100.01	99.79	99.58	99.37	99.16	98.97	98.78	98.57
S14	138.26	100.11	99.92	99.70	99.48	99.27	99.06	98.86	98.65	98.44
S15	138.43	100.23	100.02	99.80	99.60	99.38	99.17	98.98	98.78	98.58
S16	140.92	100.16	99.94	99.73	99.51	99.30	99.09	98.88	98.66	98.45
S17	138.78	100.11	99.92	99.70	99.50	99.28	99.06	98.85	98.63	98.42
S18	140.06	100.17	99.95	99.74	99.54	99.33	99.12	98.93	98.72	98.52
S19	139.96	100.16	99.97	99.77	99.57	99.37	99.16	98.96	98.75	98.56
S20	138.73	100.19	100.00	99.80	99.58	99.36	99.14	98.94	98.71	98.49
S21	138.74	100.23	100.02	99.82	99.60	99.38	99.17	98.94	98.73	98.51
S22	138.56	100.15	99.95	99.74	99.53	99.33	99.11	98.91	98.71	98.51
S23	137.86	100.11	99.92	99.70	99.48	99.27	99.07	98.86	98.64	98.43
S24	137.91	100.18	99.96	99.77	99.55	99.35	99.15	98.94	98.73	98.52
S25	139.36	100.17	99.97	99.77	99.56	99.35	99.14	98.93	98.74	98.51
Ave.	138.95	100.16	99.96	99.75	99.54	99.33	99.11	98.91	98.70	98.49
Med.	138.78	100.16	99.95	99.74	99.53	99.33	99.11	98.91	98.70	98.49
St dev	0.7218	0.0349	0.0328	0.0366	0.0379	0.0376	0.0385	0.0446	0.0514	0.0504
Min.	137.86	100.11	99.91	99.70	99.48	99.27	99.06	98.83	98.61	98.40
Max.	140.92	100.23	100.02	99.82	99.60	99.38	99.17	98.98	98.78	98.58

3.2 Data Set 1, 85°C,150mA (Forward Voltage)

Sample Number	Forward Voltage(V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S1	5.958	5.956	5.956	5.955	5.956	5.955	5.954	5.953	5.951	5.954
S2	5.959	5.957	5.957	5.957	5.956	5.955	5.955	5.955	5.953	5.954
S3	5.959	5.958	5.957	5.956	5.956	5.955	5.955	5.955	5.955	5.954
S4	5.958	5.957	5.956	5.956	5.956	5.954	5.954	5.954	5.952	5.953
S5	5.958	5.957	5.956	5.956	5.954	5.956	5.953	5.954	5.954	5.952
S6	5.958	5.956	5.957	5.957	5.955	5.955	5.954	5.954	5.954	5.954
S7	5.958	5.957	5.957	5.957	5.955	5.955	5.954	5.953	5.952	5.954
S8	5.959	5.958	5.957	5.958	5.957	5.956	5.955	5.954	5.953	5.955
S9	5.959	5.957	5.958	5.956	5.955	5.956	5.955	5.954	5.955	5.954
S10	5.958	5.955	5.956	5.955	5.955	5.955	5.954	5.954	5.952	5.953
S11	5.958	5.956	5.957	5.956	5.956	5.955	5.954	5.954	5.953	5.954
S12	5.958	5.956	5.956	5.956	5.956	5.956	5.954	5.954	5.952	5.952
S13	5.958	5.956	5.957	5.956	5.955	5.955	5.954	5.953	5.953	5.953
S14	5.959	5.957	5.957	5.957	5.956	5.956	5.956	5.955	5.955	5.954
S15	5.959	5.957	5.958	5.958	5.955	5.957	5.954	5.955	5.954	5.953
S16	5.958	5.955	5.956	5.956	5.956	5.956	5.954	5.954	5.954	5.954
S17	5.958	5.955	5.956	5.957	5.956	5.955	5.954	5.953	5.953	5.954
S18	5.958	5.956	5.955	5.956	5.956	5.956	5.954	5.953	5.953	5.953
S19	5.960	5.958	5.958	5.959	5.957	5.958	5.956	5.956	5.956	5.956
S20	5.958	5.956	5.957	5.956	5.956	5.955	5.955	5.953	5.953	5.953
S21	5.959	5.958	5.958	5.957	5.957	5.957	5.955	5.955	5.955	5.954
S22	5.959	5.956	5.956	5.958	5.957	5.955	5.955	5.954	5.953	5.955
S23	5.958	5.957	5.957	5.955	5.954	5.956	5.953	5.954	5.954	5.954
S24	5.958	5.956	5.956	5.956	5.955	5.954	5.954	5.954	5.952	5.953
S25	5.958	5.956	5.956	5.956	5.956	5.954	5.954	5.954	5.953	5.954
Ave.	5.958	5.956	5.957	5.956	5.956	5.955	5.954	5.954	5.953	5.954
Med.	5.958	5.956	5.957	5.956	5.956	5.955	5.954	5.954	5.953	5.954
St dev	0.0006	0.0008	0.0007	0.0008	0.0007	0.0008	0.0007	0.0008	0.0012	0.0009
Min.	5.958	5.955	5.955	5.955	5.954	5.954	5.953	5.953	5.951	5.952
Max.	5.960	5.958	5.958	5.959	5.957	5.958	5.956	5.956	5.956	5.956

3.3 Data Set 1, 85°C,150mA (Chromaticity Shift)

Sample Number	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S1	0.2480	0.5066	3175	0.0001	0.0002	0.0003	0.0005	0.0007	0.0009	0.0012	0.0014	0.0015
S2	0.2480	0.5066	3174	0.0001	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0013	0.0015
S3	0.2480	0.5065	3177	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011	0.0013	0.0016	0.0017
S4	0.2478	0.5063	3184	0.0001	0.0003	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0017
S5	0.2479	0.5064	3180	0.0002	0.0003	0.0004	0.0006	0.0008	0.0010	0.0011	0.0013	0.0016
S6	0.2476	0.5065	3187	0.0001	0.0003	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0016
S7	0.2481	0.5067	3171	0.0001	0.0002	0.0003	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014
S8	0.2483	0.5068	3165	0.0001	0.0003	0.0005	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018
S9	0.2480	0.5064	3177	0.0001	0.0003	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0016
S10	0.2486	0.5070	3155	0.0002	0.0004	0.0005	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018
S11	0.2475	0.5066	3188	0.0001	0.0002	0.0003	0.0005	0.0007	0.0008	0.0010	0.0012	0.0013
S12	0.2479	0.5065	3178	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009	0.0010	0.0012	0.0013
S13	0.2480	0.5066	3176	0.0001	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0013	0.0014
S14	0.2478	0.5063	3184	0.0002	0.0003	0.0004	0.0006	0.0008	0.0011	0.0012	0.0014	0.0016
S15	0.2480	0.5064	3179	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009	0.0011	0.0012	0.0015
S16	0.2476	0.5066	3188	0.0001	0.0003	0.0004	0.0006	0.0008	0.0010	0.0011	0.0012	0.0014
S17	0.2482	0.5067	3170	0.0001	0.0002	0.0004	0.0006	0.0009	0.0011	0.0012	0.0014	0.0016
S18	0.2483	0.5069	3166	0.0001	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011	0.0014	0.0016
S19	0.2480	0.5065	3176	0.0001	0.0002	0.0003	0.0005	0.0006	0.0008	0.0009	0.0011	0.0013
S20	0.2486	0.5069	3154	0.0001	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011	0.0012	0.0014
S21	0.2475	0.5066	3189	0.0002	0.0003	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016
S22	0.2480	0.5066	3176	0.0001	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011	0.0013	0.0014
S23	0.2478	0.5063	3185	0.0001	0.0003	0.0004	0.0006	0.0008	0.0010	0.0012	0.0015	0.0017
S24	0.2480	0.5064	3178	0.0001	0.0002	0.0003	0.0005	0.0006	0.0008	0.0010	0.0013	0.0014
S25	0.2476	0.5066	3187	0.0001	0.0002	0.0003	0.0005	0.0007	0.0008	0.0011	0.0012	0.0013
Ave.	0.2480	0.5066	3177	0.0001	0.0003	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0015
Med.	0.2480	0.5066	3177	0.0001	0.0003	0.0004	0.0006	0.0008	0.0010	0.0012	0.0013	0.0015
St dev	0.0003	0.0002	9.4440	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002
Min.	0.2475	0.5063	3154	0.0001	0.0002	0.0003	0.0005	0.0006	0.0008	0.0009	0.0011	0.0013
Max.	0.2486	0.5070	3189	0.0002	0.0004	0.0005	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018

3.4 Data Set 2, 95°C,150mA (Lumen Maintenance)

Sample Number	$\Phi(\text{lm})$	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S26	137.18	100.06	99.80	99.56	99.35	99.13	98.94	98.70	98.44	98.23
S27	137.19	100.03	99.75	99.50	99.29	99.06	98.88	98.64	98.40	98.17
S28	136.95	100.09	99.81	99.56	99.33	99.10	98.91	98.66	98.41	98.19
S29	138.17	100.10	99.82	99.58	99.36	99.14	98.94	98.69	98.45	98.23
S30	138.93	100.10	99.84	99.59	99.37	99.15	98.96	98.71	98.45	98.23
S31	137.52	100.08	99.82	99.58	99.37	99.15	98.97	98.73	98.50	98.26
S32	138.71	100.07	99.81	99.56	99.33	99.12	98.93	98.68	98.44	98.22
S33	139.22	100.07	99.80	99.57	99.35	99.14	98.95	98.70	98.46	98.24
S34	138.36	100.03	99.76	99.53	99.31	99.09	98.91	98.67	98.42	98.18
S35	138.27	100.04	99.76	99.53	99.31	99.08	98.89	98.65	98.39	98.18
S36	138.10	100.03	99.76	99.53	99.32	99.10	98.90	98.65	98.39	98.17
S37	138.34	100.13	99.86	99.61	99.40	99.17	98.98	98.73	98.47	98.26
S38	137.51	100.04	99.76	99.53	99.30	99.09	98.90	98.65	98.39	98.18
S39	137.60	100.13	99.87	99.63	99.41	99.19	99.00	98.77	98.51	98.29
S40	137.55	100.05	99.78	99.55	99.33	99.11	98.92	98.67	98.43	98.20
S41	137.17	100.09	99.82	99.57	99.36	99.13	98.94	98.70	98.47	98.25
S42	137.68	100.13	99.86	99.61	99.39	99.16	98.97	98.73	98.50	98.28
S43	137.80	100.03	99.77	99.52	99.30	99.08	98.90	98.64	98.40	98.19
S44	139.06	100.10	99.84	99.61	99.38	99.16	98.98	98.74	98.51	98.29
S45	139.74	100.02	99.74	99.49	99.27	99.05	98.85	98.61	98.37	98.16
S46	138.32	100.04	99.78	99.54	99.33	99.11	98.92	98.67	98.43	98.22
S47	139.52	100.09	99.81	99.57	99.35	99.13	98.93	98.68	98.42	98.21
S48	140.03	100.06	99.78	99.53	99.31	99.08	98.88	98.63	98.39	98.17
S49	139.04	100.02	99.74	99.51	99.28	99.05	98.87	98.63	98.40	98.18
S50	139.08	100.04	99.77	99.53	99.32	99.09	98.89	98.66	98.42	98.20
Ave.	138.28	100.07	99.80	99.56	99.34	99.11	98.92	98.68	98.43	98.21
Med.	138.27	100.06	99.80	99.56	99.33	99.11	98.92	98.67	98.43	98.21
St dev	0.8723	0.0345	0.0377	0.0371	0.0370	0.0376	0.0392	0.0399	0.0397	0.0401
Min.	136.95	100.02	99.74	99.49	99.27	99.05	98.85	98.61	98.37	98.16
Max.	140.03	100.13	99.87	99.63	99.41	99.19	99.00	98.77	98.51	98.29

3.5 Data Set 2, 95°C,150mA (Forward Voltage)

Sample Number	Forward Voltage(V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S26	5.965	5.983	5.950	5.946	5.964	5.942	5.973	5.973	5.947	5.938
S27	5.963	5.976	5.962	5.948	5.976	5.941	5.941	5.948	5.961	5.934
S28	5.949	5.928	5.929	5.948	5.967	5.949	5.934	5.949	5.931	5.949
S29	5.949	5.928	5.951	5.959	5.944	5.956	5.961	5.961	5.947	5.966
S30	5.949	5.967	5.956	5.928	5.939	5.926	5.940	5.932	5.926	5.938
S31	5.949	5.959	5.929	5.944	5.929	5.948	5.956	5.927	5.956	5.957
S32	5.949	5.950	5.934	5.951	5.944	5.948	5.949	5.927	5.927	5.941
S33	5.948	5.949	5.919	5.947	5.947	5.939	5.939	5.939	5.933	5.948
S34	5.948	5.966	5.929	5.947	5.938	5.949	5.930	5.933	5.933	5.937
S35	5.948	5.919	5.927	5.938	5.943	5.933	5.955	5.933	5.933	5.948
S36	5.948	5.927	5.947	5.947	5.955	5.933	5.955	5.949	5.939	5.948
S37	5.948	5.958	5.961	5.938	5.919	5.948	5.948	5.948	5.933	5.921
S38	5.948	5.950	5.966	5.947	5.933	5.933	5.956	5.933	5.947	5.968
S39	5.948	5.938	5.966	5.947	5.929	5.933	5.955	5.930	5.930	5.965
S40	5.948	5.955	5.950	5.933	5.927	5.947	5.955	5.931	5.931	5.922
S41	5.936	5.946	5.943	5.949	5.907	5.921	5.918	5.913	5.927	5.910
S42	5.936	5.916	5.931	5.916	5.916	5.919	5.927	5.921	5.934	5.928
S43	5.936	5.916	5.935	5.935	5.917	5.935	5.937	5.935	5.914	5.955
S44	5.936	5.935	5.935	5.921	5.949	5.918	5.935	5.919	5.927	5.909
S45	5.936	5.935	5.916	5.915	5.917	5.919	5.936	5.921	5.944	5.925
S46	5.936	5.954	5.946	5.907	5.931	5.936	5.944	5.936	5.943	5.955
S47	5.936	5.917	5.949	5.937	5.931	5.943	5.913	5.927	5.921	5.953
S48	5.936	5.916	5.935	5.935	5.907	5.937	5.948	5.919	5.919	5.928
S49	5.936	5.949	5.916	5.921	5.935	5.944	5.913	5.944	5.936	5.956
S50	5.936	5.915	5.943	5.915	5.938	5.927	5.936	5.936	5.918	5.928
Ave.	5.945	5.942	5.941	5.937	5.936	5.937	5.942	5.935	5.934	5.941
Med.	5.948	5.946	5.943	5.938	5.935	5.937	5.941	5.933	5.933	5.941
St dev	0.0084	0.0201	0.0148	0.0138	0.0176	0.0109	0.0150	0.0138	0.0116	0.0169
Min.	5.936	5.915	5.916	5.907	5.907	5.918	5.913	5.913	5.914	5.909
Max.	5.965	5.983	5.966	5.959	5.976	5.956	5.973	5.973	5.961	5.968

3.6 Data Set 2, 95°C,150mA (Chromaticity Shift)

Sample Number	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S26	0.2491	0.5080	3134	0.0002	0.0004	0.0005	0.0007	0.0009	0.0012	0.0013	0.0015	0.0017
S27	0.2490	0.5081	3134	0.0001	0.0003	0.0006	0.0007	0.0009	0.0012	0.0014	0.0015	0.0016
S28	0.2493	0.5080	3127	0.0003	0.0004	0.0007	0.0009	0.0010	0.0012	0.0015	0.0016	0.0017
S29	0.2493	0.5080	3128	0.0001	0.0004	0.0007	0.0009	0.0011	0.0012	0.0014	0.0017	0.0019
S30	0.2489	0.5080	3139	0.0003	0.0004	0.0006	0.0007	0.0009	0.0010	0.0011	0.0012	0.0014
S31	0.2495	0.5081	3121	0.0001	0.0004	0.0005	0.0008	0.0009	0.0011	0.0012	0.0014	0.0015
S32	0.2496	0.5083	3118	0.0001	0.0003	0.0004	0.0007	0.0009	0.0011	0.0012	0.0013	0.0014
S33	0.2492	0.5079	3130	0.0002	0.0005	0.0007	0.0009	0.0010	0.0012	0.0015	0.0016	0.0019
S34	0.2498	0.5084	3110	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008	0.0011	0.0012	0.0014
S35	0.2487	0.5080	3144	0.0003	0.0004	0.0006	0.0007	0.0010	0.0011	0.0014	0.0016	0.0018
S36	0.2493	0.5079	3129	0.0001	0.0004	0.0007	0.0008	0.0010	0.0011	0.0012	0.0014	0.0015
S37	0.2492	0.5081	3128	0.0001	0.0003	0.0006	0.0008	0.0011	0.0012	0.0014	0.0016	0.0018
S38	0.2491	0.5078	3135	0.0001	0.0003	0.0006	0.0007	0.0010	0.0012	0.0014	0.0017	0.0019
S39	0.2492	0.5078	3132	0.0002	0.0005	0.0008	0.0011	0.0012	0.0015	0.0016	0.0018	0.0020
S40	0.2494	0.5081	3124	0.0002	0.0005	0.0007	0.0009	0.0010	0.0012	0.0013	0.0015	0.0017
S41	0.2487	0.5072	3151	0.0001	0.0004	0.0005	0.0008	0.0009	0.0010	0.0011	0.0014	0.0015
S42	0.2485	0.5069	3158	0.0001	0.0003	0.0005	0.0006	0.0009	0.0010	0.0011	0.0014	0.0016
S43	0.2487	0.5070	3152	0.0002	0.0004	0.0005	0.0008	0.0009	0.0010	0.0013	0.0014	0.0016
S44	0.2487	0.5072	3151	0.0001	0.0004	0.0006	0.0008	0.0009	0.0010	0.0012	0.0013	0.0015
S45	0.2483	0.5072	3162	0.0001	0.0003	0.0006	0.0008	0.0009	0.0011	0.0013	0.0014	0.0016
S46	0.2489	0.5072	3145	0.0003	0.0004	0.0007	0.0008	0.0011	0.0012	0.0014	0.0015	0.0017
S47	0.2490	0.5074	3140	0.0002	0.0004	0.0007	0.0008	0.0010	0.0012	0.0014	0.0016	0.0019
S48	0.2488	0.5070	3150	0.0003	0.0005	0.0007	0.0009	0.0012	0.0013	0.0015	0.0016	0.0018
S49	0.2493	0.5074	3133	0.0003	0.0005	0.0008	0.0010	0.0012	0.0013	0.0016	0.0017	0.0018
S50	0.2482	0.5072	3164	0.0001	0.0004	0.0007	0.0008	0.0010	0.0011	0.0013	0.0014	0.0015
Ave.	0.2490	0.5077	3138	0.0002	0.0004	0.0006	0.0008	0.0010	0.0011	0.0013	0.0015	0.0017
Med.	0.2491	0.5079	3134	0.0001	0.0004	0.0006	0.0008	0.0010	0.0012	0.0013	0.0015	0.0017
St dev	0.0004	0.0005	13.9226	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
Min.	0.2482	0.5069	3110	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008	0.0011	0.0012	0.0014
Max.	0.2498	0.5084	3164	0.0003	0.0005	0.0008	0.0011	0.0012	0.0015	0.0016	0.0018	0.0020

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

Sample Number	$\Phi(\text{lm})$	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S51	139.13	100.01	99.71	99.40	99.12	98.86	98.57	98.32	98.12	97.92
S52	139.06	99.95	99.65	99.40	99.11	98.85	98.55	98.31	98.11	97.91
S53	138.36	99.93	99.63	99.32	99.04	98.78	98.49	98.25	98.05	97.85
S54	138.53	100.01	99.72	99.46	99.16	98.91	98.62	98.38	98.18	97.98
S55	139.94	99.93	99.64	99.38	99.10	98.86	98.56	98.31	98.14	97.97
S56	138.52	99.95	99.60	99.29	99.01	98.76	98.46	98.22	98.02	97.82
S57	139.65	100.02	99.67	99.42	99.12	98.86	98.58	98.33	98.14	97.93
S58	140.22	99.95	99.66	99.35	99.05	98.79	98.49	98.27	98.07	97.86
S59	139.32	99.93	99.64	99.33	99.03	98.78	98.50	98.25	98.09	97.91
S60	139.19	100.01	99.72	99.46	99.16	98.90	98.60	98.36	98.19	97.98
S61	139.18	99.99	99.69	99.38	99.08	98.84	98.54	98.29	98.12	97.92
S62	139.10	99.98	99.69	99.38	99.09	98.84	98.55	98.31	98.11	97.91
S63	138.40	100.04	99.69	99.38	99.08	98.84	98.55	98.33	98.16	97.96
S64	138.54	100.01	99.66	99.36	99.05	98.79	98.51	98.29	98.09	97.89
S65	139.91	100.02	99.73	99.42	99.12	98.86	98.57	98.35	98.15	97.95
S66	139.71	99.93	99.63	99.32	99.04	98.79	98.50	98.28	98.08	97.88
S67	140.15	99.94	99.64	99.39	99.09	98.83	98.53	98.28	98.12	97.91
S68	139.26	99.99	99.64	99.38	99.08	98.84	98.55	98.34	98.14	97.93
S69	139.28	99.99	99.64	99.39	99.11	98.86	98.57	98.35	98.15	97.97
S70	139.31	99.93	99.64	99.38	99.08	98.84	98.54	98.30	98.10	97.89
S71	138.72	100.02	99.72	99.41	99.12	98.85	98.57	98.33	98.13	97.95
S72	138.07	99.99	99.70	99.44	99.14	98.90	98.59	98.38	98.18	97.97
S73	138.97	99.99	99.69	99.38	99.09	98.83	98.53	98.29	98.09	97.89
S74	140.32	100.01	99.66	99.35	99.05	98.79	98.51	98.29	98.10	97.89
S75	138.95	100.00	99.65	99.34	99.04	98.78	98.48	98.23	98.04	97.83
Ave.	139.19	99.98	99.67	99.38	99.09	98.83	98.54	98.30	98.12	97.91
Med.	139.18	99.99	99.66	99.38	99.09	98.84	98.55	98.31	98.12	97.91
St dev	0.6156	0.0359	0.0349	0.0426	0.0414	0.0405	0.0407	0.0420	0.0438	0.0463
Min.	138.07	99.93	99.60	99.29	99.01	98.76	98.46	98.22	98.02	97.82
Max.	140.32	100.04	99.73	99.46	99.16	98.91	98.62	98.38	98.19	97.98

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

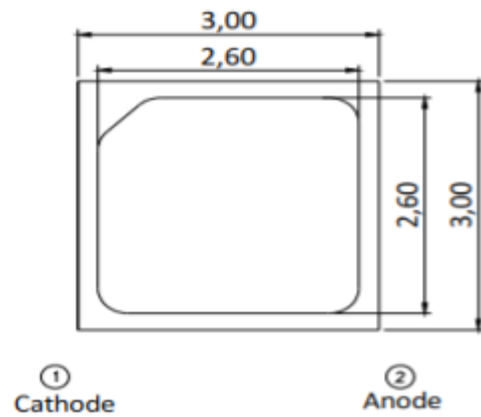
Sample Number	Forward Voltage(V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S51	6.006	5.984	6.021	6.004	5.990	5.978	5.977	5.978	5.989	6.023
S52	6.004	6.004	5.988	6.004	5.976	5.985	5.999	6.023	5.989	6.012
S53	6.004	5.990	6.014	6.014	5.976	6.020	5.976	5.985	5.987	6.005
S54	6.004	5.980	6.004	5.980	6.002	5.983	5.999	5.976	6.020	6.020
S55	6.004	5.988	6.019	5.980	5.980	5.975	6.020	6.004	6.023	5.989
S56	6.004	5.992	5.982	5.980	6.019	5.985	6.023	6.019	5.975	5.987
S57	6.004	6.014	6.014	5.988	5.992	5.975	5.975	6.015	6.004	5.992
S58	6.004	6.015	5.976	5.986	5.990	6.000	5.976	6.015	5.976	6.020
S59	6.003	6.014	5.989	5.975	5.989	6.022	6.003	5.998	5.984	5.994
S60	6.003	5.979	5.979	5.975	5.979	5.986	6.022	5.975	6.013	6.020
S61	6.003	5.991	5.987	5.989	6.013	5.975	6.013	6.014	5.974	6.020
S62	6.003	5.975	5.979	5.989	5.991	5.974	5.999	5.974	5.998	5.991
S63	6.003	5.975	6.013	5.975	6.001	5.982	6.003	6.018	6.014	6.020
S64	6.003	5.989	6.013	5.989	6.018	5.982	5.998	5.998	5.986	6.004
S65	6.003	5.985	6.003	5.985	5.989	5.998	5.986	6.018	5.986	5.976
S66	6.003	6.014	5.989	5.979	6.003	6.018	5.988	5.999	5.988	5.976
S67	6.003	6.013	6.013	5.989	5.991	5.984	5.998	5.984	5.999	5.988
S68	6.003	6.018	5.991	5.989	5.991	6.019	5.975	5.984	6.003	5.987
S69	6.003	5.985	6.018	5.989	5.991	5.986	6.018	5.975	5.999	6.015
S70	6.002	5.988	5.988	6.012	6.002	5.998	6.018	6.017	5.994	6.017
S71	6.002	5.978	6.000	5.988	5.978	5.974	6.012	5.997	6.021	6.018
S72	6.002	6.002	6.012	6.017	5.986	6.017	5.974	5.974	6.012	5.987
S73	6.001	5.973	5.987	5.985	5.987	6.016	5.996	6.001	5.982	5.992
S74	6.001	6.016	5.985	5.973	5.989	6.011	6.001	6.012	5.982	6.001
S75	6.001	6.016	5.999	5.989	6.011	6.016	5.993	5.997	6.017	5.985
Ave.	6.003	5.995	5.998	5.989	5.993	5.994	5.998	5.998	5.996	6.002
Med.	6.003	5.990	5.999	5.988	5.991	5.986	5.999	5.998	5.994	6.001
St dev	0.0011	0.0159	0.0147	0.0124	0.0125	0.0176	0.0162	0.0170	0.0155	0.0156
Min.	6.001	5.973	5.976	5.973	5.976	5.974	5.974	5.974	5.974	5.976
Max.	6.006	6.018	6.021	6.017	6.019	6.022	6.023	6.023	6.023	6.023

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

Sample Number	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
S51	0.2485	0.5082	3148	0.0003	0.0005	0.0008	0.0010	0.0012	0.0013	0.0015	0.0017	0.0019
S52	0.2484	0.5081	3150	0.0002	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0019
S53	0.2483	0.5079	3156	0.0003	0.0005	0.0008	0.0010	0.0012	0.0015	0.0017	0.0019	0.0021
S54	0.2484	0.5081	3151	0.0003	0.0006	0.0008	0.0010	0.0013	0.0015	0.0017	0.0019	0.0022
S55	0.2481	0.5082	3160	0.0003	0.0005	0.0008	0.0010	0.0011	0.0013	0.0015	0.0018	0.0020
S56	0.2486	0.5083	3145	0.0002	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020
S57	0.2488	0.5085	3138	0.0003	0.0006	0.0008	0.0011	0.0013	0.0015	0.0016	0.0019	0.0021
S58	0.2485	0.5081	3150	0.0002	0.0005	0.0008	0.0010	0.0013	0.0015	0.0017	0.0020	0.0022
S59	0.2490	0.5086	3132	0.0002	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0017	0.0019
S60	0.2479	0.5081	3165	0.0003	0.0005	0.0007	0.0010	0.0011	0.0013	0.0015	0.0017	0.0019
S61	0.2484	0.5082	3150	0.0003	0.0006	0.0008	0.0011	0.0012	0.0014	0.0016	0.0018	0.0020
S62	0.2485	0.5082	3150	0.0003	0.0005	0.0008	0.0010	0.0012	0.0015	0.0016	0.0018	0.0020
S63	0.2483	0.5079	3157	0.0003	0.0006	0.0009	0.0010	0.0012	0.0014	0.0016	0.0019	0.0021
S64	0.2484	0.5080	3154	0.0002	0.0005	0.0008	0.0010	0.0012	0.0013	0.0015	0.0017	0.0019
S65	0.2481	0.5082	3160	0.0003	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0021
S66	0.2487	0.5085	3140	0.0003	0.0006	0.0008	0.0009	0.0012	0.0014	0.0016	0.0018	0.0021
S67	0.2485	0.5081	3150	0.0002	0.0005	0.0008	0.0010	0.0012	0.0013	0.0016	0.0018	0.0020
S68	0.2490	0.5086	3131	0.0003	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020
S69	0.2479	0.5082	3164	0.0002	0.0005	0.0008	0.0010	0.0012	0.0015	0.0017	0.0019	0.0022
S70	0.2485	0.5083	3148	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020
S71	0.2488	0.5082	3141	0.0002	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020
S72	0.2486	0.5080	3147	0.0003	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0017	0.0020
S73	0.2487	0.5081	3144	0.0002	0.0005	0.0007	0.0010	0.0012	0.0013	0.0015	0.0018	0.0020
S74	0.2484	0.5083	3150	0.0002	0.0005	0.0008	0.0011	0.0013	0.0015	0.0017	0.0019	0.0021
S75	0.2489	0.5083	3135	0.0003	0.0006	0.0008	0.0011	0.0013	0.0016	0.0018	0.0020	0.0022
Ave.	0.2485	0.5082	3149	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020
Med.	0.2485	0.5082	3150	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020
St dev	0.0003	0.0002	9.1053	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2479	0.5079	3131	0.0002	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0017	0.0019
Max.	0.2490	0.5086	3165	0.0003	0.0006	0.0009	0.0011	0.0013	0.0016	0.0018	0.0020	0.0022

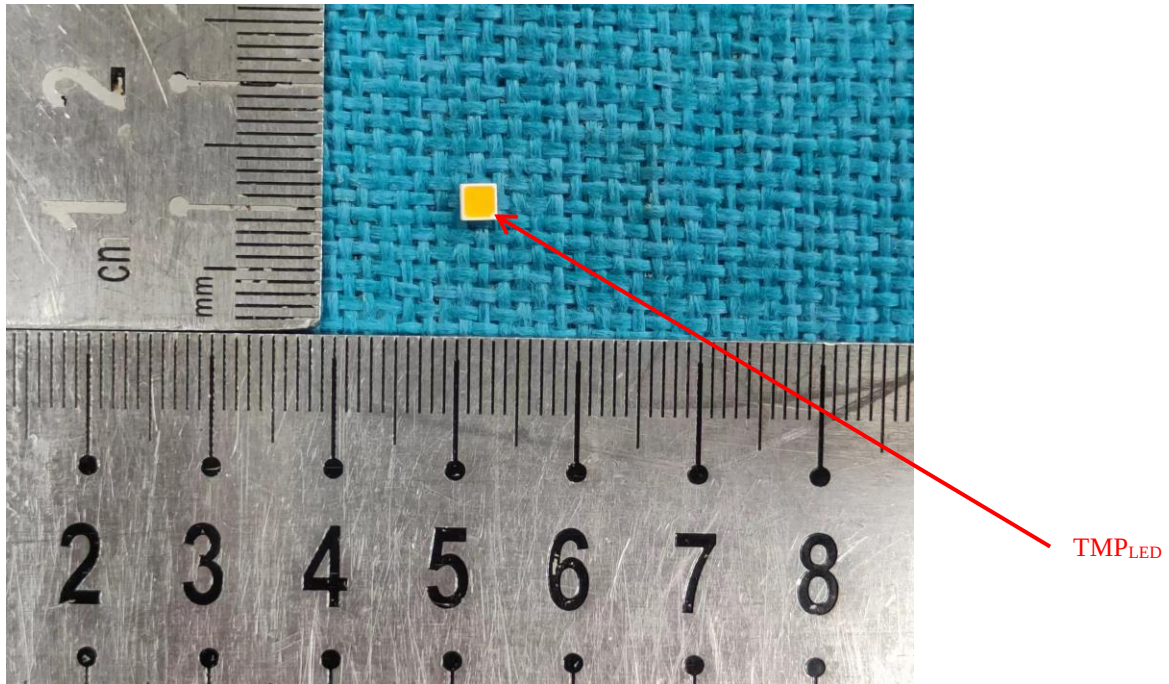
4 . EUT PHOTO

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 EUT Photo



***** END OF THE TEST REPORT*****