

TEST REPORT

According to ANSI/IES LM-80-15
For

#FOSHAN NATIONSTAR OPTOELECTRONICS CO.,LTD.
#NO.18 SOUTH HUABAO ROAD, CHAN CHENG DISTRICT, FOSHAN, GUANGDONG, CHINA

#Model: FM-TP3528WRS-460QH-R809-AX-3

Report Type: 17000 Hours Test Report		Product Type: LED Package	
Reviewed By:	Pote Wang 		
Report Number:	RSZ200103508-10-17000		
Test Date:	2020-03-04 to 2022-04-20		
Report Date:	2022-07-11		
Approved by:	Bill Xiong / EE Engineer		
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Test Facility:	Test facility was located at No.12, Pulong East 1 st Road, Tangxia Town, Dongguan, Guangdong, China.		

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.(Shenzhen). This report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, or any agency of the U.S. Government.

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Note:

**: The items tested by Bay Area Compliance Laboratories Corp. (Dongguan) and covered by IAS accreditation, the reference report No. is RSZ200103508-10-15000 (test Date: 2020-03-04 to 2021-12-14).
Bay Area Compliance Laboratories Corp. (Dongguan) is EPA-Recognized Laboratories and the ORG ID: 1109266.

1 - General Information

1.1 Description of LED Light Sources[#]

Sample Size:

75 PCS test samples were in good condition and received on 2020-01-03. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Manufacturer:	FOSHAN NATIONSTAR OPTOELECTRONICS CO.,LTD.
Part Number:	FM-TP3528WRS-460QH-R809-AX-3
Part Type:	LED Package
Drive Level:	DC 120mA
Nominal CCT:	2700K
Power:	1.152W
Average Current Density per LED die:	861mA/mm ²
Average Power Density per LED die:	2.76W/mm ²
CRI:	80
Die Spacing:	0.07mm

Sampling Method:

LED samples for IESNA LM-80 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.

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:

OEM MODEL NUMBER(S)	Power (W)	CCT (K)	Ra	Input Current (mA)	The Number of Dies	Minimum Die Spacing (mm)	Power Density of PCB (mW/mm ²)	Current Density (mA/mm ²)
FM-TP3528WRS-460QH-R809-AX-3	1.152W	2700K	80	120	3	0.07	118	861
FM-TP3528WHS-460xxx-R80x-xxx-x	≤1.152W	2200K	80	120	3	0.07	≤118	≤861
FM-TP3528WRS-460xxx-R80x-xxx-x	≤1.152W	2700K	80	120	3	0.07	≤118	≤861
FM-TP3528WLS-460xxx-R80x-xxx-x	≤1.152W	3000K	80	120	3	0.07	≤118	≤861
FM-TP3528WES-460xxx-R80x-xxx-x	≤1.152W	3500K	80	120	3	0.07	≤118	≤861
FM-TP3528WDS-460xxx-R80x-xxx-x	≤1.152W	4000K	80	120	3	0.07	≤118	≤861
FM-TP3528WCS-460xxx-R80x-xxx-x	≤1.152W	5000K	80	120	3	0.07	≤118	≤861
FM-TP3528WFS-460xxx-R80x-xxx-x	≤1.152W	5700K	80	120	3	0.07	≤118	≤861
FM-TP3528WGS-460xxx-R80x-xxx-x	≤1.152W	6000K	80	120	3	0.07	≤118	≤861
FM-TP3528WNS-460xxx-R80x-xxx-x	≤1.152W	6500K	80	120	3	0.07	≤118	≤861
FM-TP3528WJS-460xxx-R80x-xxx-x	≤1.152W	7000K	80	120	3	0.07	≤118	≤861

Note:

FM-TP3528W₁X₂S-460₂xxx-R80₃X₄-xxx-X₅

Identifiers Information (if any):

1. The first X represent CCT range, it can be alphanumeric
2. The second X represent brightness rank range, it can be blank or alphanumeric.
3. The third X represent internal reference code, it can be alphanumeric;
4. The fourth X represent internal management code and customer code, it can be blank or alphanumeric;
5. The fifth X represent color center version, it can be blank or alphanumeric;

1.2 Standards and Reference Documentations

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- *CIE 127:2007: Measurement of LEDs(This standard was not accredited by NVLAP)
- *ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by NVLAP)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
0.3m integrating sphere	EVERFINE	Diameter 0.3m	1011119	2022-01-05	2023-01-04
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	2022-01-05	2023-01-04
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	2022-01-05	2023-01-04
Standard Light Source	EVERFINE	D062	1011093	2021-10-15	2022-10-14
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987CJ7321114	2022-01-06	2023-01-05
Multilayer aging machine	BACL	B2-270	20023	2022-01-04	2023-01-03
DC Power Supply	BACL	B12001-12	90023	2022-01-04	2023-01-03

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°C $\pm$ 2°C, RH <65%.

1.6 Photometric Measurement Method and Uncertainty

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 measurements is $U=1.59\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is $U=21\text{K}$ ($K=2$), at the 95% confidence level.

The uncertainty of the temperature is $U=0.8671^{\circ}\text{C}$ ($K=2$), at the 95% confidence level.

1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Shenzhen) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.8 Sample Set

Data Set 1: 85°C, 120mA

Part Number: FM-TP3528WRS-460QH-R809-AX-3
Number of Units: 25
Case Temperature: >83°C
Ambient Temperature: >80°C
Life Test Drive Current: 120mA
Measurement Current: 120mA

Data Set 2: 105°C, 120mA

Part Number: FM-TP3528WRS-460QH-R809-AX-3
Number of Units: 25
Case Temperature: >103°C
Ambient Temperature: >100°C
Life Test Drive Current: 120mA
Measurement Current: 120mA

Data Set 3: 115°C, 120mA

Part Number: FM-TP3528WRS-460QH-R809-AX-3
Number of Units: 25
Case Temperature: >113°C
Ambient Temperature: >110°C
Life Test Drive Current: 120mA
Measurement Current: 120mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM-21 L ₇₀ Lifetime	Reported TM-21 L ₉₀ Lifetime
1	25	0	1000hrs	17000hrs	2.490E-06	1.003	>102000 hours	43,000 hours
2	25	0	1000hrs	17000hrs	2.926E-06	1.001	>102000 hours	36,000 hours
3	25	0	1000hrs	17000hrs	3.353E-06	1.000	>102000 hours	32,000 hours

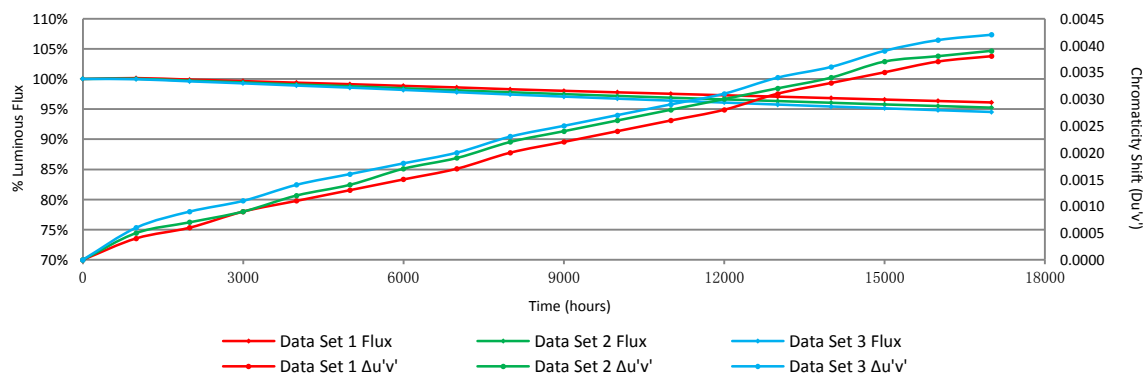
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
1	100.14%	99.89%	99.64%	99.38%	99.13%	98.85%	98.59%	98.29%	98.03%
2	100.03%	99.71%	99.42%	99.08%	98.79%	98.45%	98.12%	97.79%	97.48%
3	99.95%	99.60%	99.27%	98.90%	98.56%	98.18%	97.80%	97.42%	97.07%
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs	
	97.78%	97.54%	97.29%	97.06%	96.82%	96.58%	96.34%	96.10%	
	97.18%	96.89%	96.61%	96.33%	96.05%	95.77%	95.51%	95.24%	
	96.73%	96.40%	96.08%	95.75%	95.43%	95.13%	94.82%	94.52%	

Average Chromaticity Shift

Data Set:	**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
1	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0017	0.002	0.0022
2	0.0005	0.0007	0.0009	0.0012	0.0014	0.0017	0.0019	0.0022	0.0024
3	0.0006	0.0009	0.0011	0.0014	0.0016	0.0018	0.002	0.0023	0.0025
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs	
	0.0024	0.0026	0.0028	0.0031	0.0033	0.0035	0.0037	0.0038	
	0.0026	0.0028	0.003	0.0032	0.0034	0.0037	0.0038	0.0039	
	0.0027	0.0029	0.0031	0.0034	0.0036	0.0039	0.0041	0.0042	

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 85°C, 120mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	**0hr(Initial)	**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
1	159.30	99.94	99.69	99.50	99.31	99.06	98.87	98.68	98.49	98.31
2	159.10	100.19	99.87	99.69	99.37	99.06	98.74	98.49	98.18	97.86
3	160.00	100.06	99.75	99.38	99.25	98.94	98.63	98.38	98.00	97.75
4	159.90	100.19	100.06	99.75	99.44	99.19	98.87	98.69	98.50	98.31
5	160.10	100.06	99.75	99.56	99.31	98.94	98.56	98.31	98.00	97.63
6	158.20	99.94	99.68	99.56	99.24	98.93	98.67	98.42	98.23	97.91
7	159.50	100.25	100.06	99.81	99.44	99.06	98.75	98.43	98.12	97.87
8	159.20	100.31	99.94	99.62	99.50	99.25	98.93	98.68	98.49	98.12
9	159.70	100.19	99.94	99.69	99.37	99.12	98.94	98.62	98.43	98.12
10	159.30	100.25	100.06	99.81	99.62	99.37	99.18	98.93	98.56	98.31
11	159.70	100.06	99.94	99.69	99.31	99.12	98.94	98.62	98.37	98.25
12	159.00	100.13	99.81	99.50	99.31	99.06	98.74	98.49	98.11	97.86
13	159.00	100.25	99.94	99.75	99.62	99.37	99.06	98.74	98.43	98.18
14	158.20	100.06	99.75	99.56	99.30	99.05	98.74	98.36	98.10	97.91
15	158.90	100.25	99.94	99.69	99.31	98.93	98.68	98.49	98.17	97.80
16	159.50	100.06	99.81	99.50	99.25	99.06	98.75	98.50	98.12	97.87
17	158.20	100.13	99.94	99.56	99.30	99.12	98.86	98.55	98.29	98.10
18	160.40	99.94	99.81	99.56	99.25	99.19	98.94	98.69	98.32	98.00
19	159.20	100.13	99.87	99.62	99.37	99.12	98.81	98.49	98.18	97.86
20	160.80	100.12	99.88	99.63	99.25	98.94	98.76	98.57	98.26	98.01
21	160.60	100.19	99.94	99.75	99.50	99.38	99.07	98.88	98.63	98.38
22	159.40	100.13	99.94	99.75	99.44	99.31	99.06	98.68	98.24	97.99
23	158.00	100.32	100.19	99.87	99.56	99.30	99.05	98.86	98.61	98.35
24	160.80	100.19	99.94	99.69	99.50	99.38	99.07	98.82	98.45	98.13
25	159.10	100.13	99.75	99.50	99.25	98.93	98.62	98.30	98.05	97.80
Avg.	159.40	100.14	99.89	99.64	99.38	99.13	98.85	98.59	98.29	98.03
Med.	159.30	100.13	99.94	99.63	99.31	99.12	98.86	98.57	98.26	98.00
st dev	0.79	0.11	0.13	0.12	0.12	0.16	0.17	0.18	0.19	0.21
Min.	158.00	99.94	99.68	99.38	99.24	98.93	98.56	98.30	98.00	97.63
Max.	160.80	100.32	100.19	99.87	99.62	99.38	99.18	98.93	98.63	98.38

No.	Lumen Maintenance (%)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
1	97.99	97.80	97.55	97.30	97.11	96.92	96.61	96.48
2	97.55	97.30	97.05	96.86	96.48	96.17	95.98	95.79
3	97.44	97.25	96.88	96.69	96.50	96.31	96.13	96.00
4	98.12	97.87	97.69	97.44	97.12	96.87	96.50	96.06
5	97.44	97.19	97.00	96.81	96.63	96.44	96.31	96.00
6	97.60	97.35	97.09	96.90	96.59	96.46	96.14	95.95
7	97.68	97.43	97.12	96.93	96.68	96.43	96.24	95.80
8	97.99	97.74	97.55	97.36	97.11	96.92	96.61	96.29
9	97.93	97.62	97.37	97.06	96.93	96.62	96.56	96.18
10	97.99	97.68	97.36	97.11	96.86	96.61	96.48	96.23
11	98.00	97.75	97.50	97.24	97.06	96.81	96.56	96.31
12	97.61	97.30	97.17	96.92	96.67	96.42	96.10	95.97
13	97.92	97.61	97.23	97.04	96.73	96.42	96.10	95.91
14	97.60	97.47	97.28	97.09	96.90	96.78	96.52	96.14
15	97.48	97.17	96.85	96.54	96.22	96.04	95.78	95.72
16	97.62	97.43	97.24	96.93	96.68	96.49	96.18	96.05
17	97.85	97.60	97.28	97.09	96.84	96.65	96.40	95.95
18	97.88	97.69	97.38	97.13	97.01	96.82	96.45	96.13
19	97.61	97.36	97.17	96.98	96.86	96.55	96.29	95.98
20	97.76	97.45	97.33	96.95	96.70	96.39	96.14	96.02
21	98.13	97.95	97.70	97.45	97.14	96.89	96.58	96.45
22	97.80	97.55	97.30	97.05	96.80	96.49	96.36	96.11
23	98.16	97.91	97.78	97.59	97.47	97.15	97.03	96.71
24	97.95	97.76	97.45	97.20	96.95	96.70	96.64	96.46
25	97.42	97.17	97.05	96.79	96.54	96.23	95.85	95.79
Avg.	97.78	97.54	97.29	97.06	96.82	96.58	96.34	96.10
Med.	97.80	97.55	97.28	97.05	96.84	96.55	96.36	96.05
st dev	0.23	0.24	0.25	0.25	0.27	0.27	0.28	0.25
Min.	97.42	97.17	96.85	96.54	96.22	96.04	95.78	95.72
Max.	98.16	97.95	97.78	97.59	97.47	97.15	97.03	96.71

3.2 Data Set 1, 85°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)									
	**0hr(Initial)	**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
1	9.077	9.141	9.079	9.087	9.125	9.104	9.076	9.083	9.080	9.080
2	9.034	9.037	9.031	9.046	9.056	9.063	9.029	9.037	9.033	9.034
3	9.097	9.094	9.092	9.103	9.109	9.102	9.095	9.103	9.099	9.093
4	9.047	9.050	9.041	9.050	9.072	9.073	9.044	9.054	9.051	9.044
5	9.081	9.081	9.072	9.083	9.095	9.085	9.080	9.084	9.082	9.077
6	9.095	9.090	9.090	9.100	9.099	9.105	9.089	9.101	9.093	9.090
7	9.072	9.069	9.065	9.077	9.073	9.083	9.064	9.079	9.071	9.066
8	9.075	9.073	9.069	9.072	9.081	9.087	9.068	9.081	9.077	9.069
9	9.058	9.059	9.051	9.056	9.068	9.064	9.056	9.062	9.059	9.053
10	9.083	9.087	9.078	9.079	9.104	9.106	9.081	9.087	9.085	9.082
11	9.090	9.099	9.085	9.085	9.105	9.109	9.086	9.095	9.091	9.086
12	9.107	9.124	9.102	9.105	9.102	9.106	9.104	9.113	9.110	9.105
13	9.073	9.070	9.068	9.075	9.088	9.083	9.068	9.080	9.070	9.072
14	9.078	9.088	9.073	9.077	9.101	9.104	9.075	9.081	9.077	9.077
15	9.068	9.075	9.063	9.068	9.087	9.086	9.066	9.071	9.068	9.066
16	9.077	9.086	9.071	9.081	9.087	9.085	9.076	9.086	9.078	9.077
17	9.053	9.062	9.047	9.056	9.058	9.068	9.053	9.060	9.056	9.055
18	9.089	9.103	9.086	9.088	9.102	9.106	9.088	9.095	9.090	9.083
19	9.094	9.094	9.090	9.096	9.102	9.102	9.092	9.107	9.093	9.089
20	9.085	9.085	9.081	9.085	9.100	9.106	9.082	9.099	9.085	9.080
21	9.051	9.047	9.047	9.053	9.057	9.067	9.047	9.063	9.054	9.047
22	9.079	9.078	9.071	9.084	9.088	9.078	9.075	9.089	9.083	9.075
23	9.078	9.081	9.075	9.085	9.103	9.105	9.075	9.088	9.082	9.078
24	9.081	9.090	9.076	9.085	9.088	9.088	9.076	9.094	9.084	9.080
25	9.094	9.097	9.085	9.100	9.106	9.105	9.089	9.104	9.094	9.090
Avg.	9.077	9.082	9.072	9.079	9.090	9.091	9.073	9.084	9.078	9.074
Med.	9.078	9.085	9.073	9.083	9.095	9.088	9.076	9.086	9.082	9.077
st dev	0.017	0.023	0.017	0.017	0.018	0.015	0.017	0.018	0.017	0.017
Min.	9.034	9.037	9.031	9.046	9.056	9.063	9.029	9.037	9.033	9.034
Max.	9.107	9.141	9.102	9.105	9.125	9.109	9.104	9.113	9.110	9.105

No.	Forward Voltage (V)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
1	9.090	9.136	9.088	9.082	9.090	9.096	9.092	9.081
2	9.048	9.053	9.039	9.042	9.040	9.047	9.045	9.052
3	9.103	9.124	9.105	9.134	9.108	9.117	9.108	9.099
4	9.051	9.068	9.055	9.069	9.053	9.091	9.062	9.078
5	9.082	9.090	9.088	9.087	9.086	9.125	9.090	9.080
6	9.096	9.109	9.102	9.110	9.100	9.124	9.104	9.098
7	9.076	9.084	9.087	9.086	9.075	9.107	9.080	9.071
8	9.079	9.093	9.084	9.081	9.082	9.097	9.083	9.075
9	9.059	9.078	9.073	9.066	9.066	9.084	9.072	9.059
10	9.087	9.104	9.096	9.092	9.090	9.102	9.093	9.083
11	9.091	9.104	9.099	9.091	9.095	9.107	9.101	9.088
12	9.117	9.129	9.126	9.133	9.115	9.127	9.121	9.119
13	9.083	9.090	9.089	9.081	9.079	9.091	9.084	9.070
14	9.086	9.092	9.088	9.089	9.081	9.092	9.085	9.077
15	9.081	9.083	9.078	9.079	9.072	9.082	9.078	9.069
16	9.091	9.089	9.148	9.095	9.084	9.090	9.085	9.079
17	9.062	9.070	9.077	9.059	9.060	9.065	9.068	9.073
18	9.101	9.104	9.116	9.096	9.095	9.103	9.106	9.093
19	9.110	9.108	9.109	9.111	9.100	9.104	9.103	9.095
20	9.092	9.117	9.104	9.097	9.090	9.096	9.098	9.092
21	9.056	9.081	9.068	9.077	9.059	9.064	9.055	9.050
22	9.083	9.104	9.090	9.081	9.083	9.092	9.085	9.076
23	9.086	9.097	9.086	9.082	9.084	9.092	9.089	9.077
24	9.084	9.100	9.084	9.141	9.086	9.093	9.084	9.083
25	9.100	9.110	9.096	9.095	9.099	9.107	9.100	9.094
Avg.	9.084	9.097	9.091	9.090	9.083	9.096	9.087	9.080
Med.	9.086	9.097	9.088	9.087	9.084	9.096	9.085	9.079
st dev	0.018	0.019	0.022	0.023	0.017	0.019	0.017	0.015
Min.	9.048	9.053	9.039	9.042	9.040	9.047	9.045	9.050
Max.	9.117	9.136	9.148	9.141	9.115	9.127	9.121	9.119

3.3 Data Set 1, 85°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	**0hr(Initial)			**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
1	0.2612	0.5286	2722	0.0004	0.0007	0.0009	0.0011	0.0012	0.0014	0.0017	0.0020	0.0023
2	0.2619	0.5319	2694	0.0004	0.0006	0.0009	0.0012	0.0014	0.0017	0.0018	0.0020	0.0023
3	0.2614	0.5286	2718	0.0004	0.0006	0.0008	0.0011	0.0014	0.0016	0.0019	0.0020	0.0023
4	0.2603	0.5296	2737	0.0005	0.0008	0.0010	0.0011	0.0015	0.0017	0.0018	0.0020	0.0022
5	0.2611	0.5293	2721	0.0004	0.0006	0.0009	0.0010	0.0012	0.0013	0.0016	0.0019	0.0022
6	0.2639	0.5287	2666	0.0006	0.0008	0.0011	0.0013	0.0014	0.0016	0.0018	0.0020	0.0022
7	0.2624	0.5292	2695	0.0004	0.0006	0.0009	0.0012	0.0013	0.0014	0.0016	0.0017	0.0020
8	0.2623	0.5304	2691	0.0003	0.0005	0.0007	0.0010	0.0013	0.0016	0.0018	0.0019	0.0021
9	0.2631	0.5311	2674	0.0005	0.0006	0.0008	0.0011	0.0014	0.0017	0.0020	0.0022	0.0023
10	0.2635	0.5292	2671	0.0002	0.0005	0.0008	0.0010	0.0013	0.0014	0.0016	0.0019	0.0021
11	0.2618	0.5276	2713	0.0004	0.0006	0.0009	0.0012	0.0015	0.0018	0.0020	0.0022	0.0024
12	0.2637	0.5314	2660	0.0003	0.0006	0.0008	0.0011	0.0012	0.0015	0.0018	0.0020	0.0022
13	0.2623	0.5281	2701	0.0004	0.0006	0.0009	0.0011	0.0015	0.0017	0.0019	0.0022	0.0023
14	0.2640	0.5297	2661	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0018	0.0022	0.0023
15	0.2638	0.5304	2661	0.0004	0.0006	0.0009	0.0011	0.0013	0.0014	0.0017	0.0019	0.0021
16	0.2632	0.5304	2674	0.0003	0.0006	0.0008	0.0011	0.0012	0.0014	0.0016	0.0018	0.0021
17	0.2639	0.5287	2667	0.0003	0.0006	0.0009	0.0011	0.0013	0.0016	0.0018	0.0018	0.0020
18	0.2607	0.5291	2730	0.0004	0.0007	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022	0.0023
19	0.2616	0.5296	2709	0.0004	0.0006	0.0007	0.0009	0.0011	0.0014	0.0017	0.0020	0.0023
20	0.2613	0.5300	2714	0.0004	0.0006	0.0008	0.0010	0.0014	0.0016	0.0019	0.0021	0.0023
21	0.2606	0.5304	2727	0.0001	0.0005	0.0007	0.0009	0.0011	0.0013	0.0016	0.0019	0.0022
22	0.2608	0.5275	2734	0.0003	0.0005	0.0006	0.0008	0.0011	0.0014	0.0015	0.0017	0.0020
23	0.2643	0.5302	2653	0.0004	0.0007	0.0009	0.0012	0.0013	0.0016	0.0017	0.0016	0.0019
24	0.2603	0.5294	2738	0.0002	0.0006	0.0009	0.0011	0.0012	0.0014	0.0016	0.0017	0.0020
25	0.2620	0.5279	2709	0.0003	0.0006	0.0009	0.0011	0.0011	0.0013	0.0016	0.0018	0.0021
Avg.	0.2622	0.5295	2698	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0017	0.0020	0.0022
Med.	0.2620	0.5294	2701	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0018	0.0020	0.0022
st dev	0.0013	0.0011	28	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001
Min.	0.2603	0.5275	2653	0.0001	0.0005	0.0006	0.0008	0.0011	0.0013	0.0015	0.0016	0.0019
Max.	0.2643	0.5319	2738	0.0006	0.0008	0.0011	0.0013	0.0015	0.0018	0.0020	0.0022	0.0024

No.	Chromaticity Shift ($\Delta u'v'$)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
1	0.0025	0.0028	0.0030	0.0032	0.0033	0.0034	0.0035	0.0037
2	0.0025	0.0028	0.0031	0.0034	0.0036	0.0038	0.0036	0.0036
3	0.0025	0.0028	0.0030	0.0033	0.0035	0.0038	0.0036	0.0037
4	0.0024	0.0027	0.0030	0.0033	0.0035	0.0038	0.0036	0.0038
5	0.0024	0.0027	0.0029	0.0031	0.0034	0.0037	0.0035	0.0037
6	0.0023	0.0025	0.0028	0.0030	0.0033	0.0035	0.0037	0.0038
7	0.0022	0.0023	0.0025	0.0027	0.0029	0.0032	0.0036	0.0038
8	0.0021	0.0023	0.0024	0.0026	0.0029	0.0032	0.0037	0.0038
9	0.0024	0.0025	0.0027	0.0028	0.0030	0.0032	0.0037	0.0040
10	0.0022	0.0023	0.0025	0.0026	0.0027	0.0028	0.0032	0.0039
11	0.0027	0.0028	0.0031	0.0032	0.0033	0.0035	0.0037	0.0041
12	0.0025	0.0027	0.0029	0.0031	0.0033	0.0034	0.0034	0.0037
13	0.0026	0.0028	0.0030	0.0033	0.0035	0.0038	0.0039	0.0040
14	0.0025	0.0026	0.0029	0.0031	0.0034	0.0036	0.0038	0.0036
15	0.0024	0.0025	0.0028	0.0030	0.0033	0.0035	0.0038	0.0037
16	0.0024	0.0026	0.0029	0.0031	0.0034	0.0036	0.0039	0.0036
17	0.0022	0.0025	0.0027	0.0030	0.0031	0.0035	0.0039	0.0040
18	0.0025	0.0026	0.0029	0.0031	0.0032	0.0033	0.0036	0.0038
19	0.0025	0.0026	0.0028	0.0030	0.0031	0.0035	0.0036	0.0038
20	0.0024	0.0027	0.0029	0.0031	0.0033	0.0035	0.0039	0.0041
21	0.0024	0.0026	0.0028	0.0031	0.0033	0.0034	0.0038	0.0040
22	0.0023	0.0026	0.0029	0.0031	0.0033	0.0036	0.0039	0.0041
23	0.0022	0.0025	0.0027	0.0030	0.0032	0.0035	0.0036	0.0038
24	0.0023	0.0025	0.0028	0.0031	0.0033	0.0036	0.0037	0.0038
25	0.0023	0.0026	0.0029	0.0031	0.0033	0.0037	0.0036	0.0038
Avg.	0.0024	0.0026	0.0028	0.0031	0.0033	0.0035	0.0037	0.0038
Med.	0.0024	0.0026	0.0029	0.0031	0.0033	0.0035	0.0037	0.0038
st dev	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.0021	0.0023	0.0024	0.0026	0.0027	0.0028	0.0032	0.0036
Max.	0.0027	0.0028	0.0031	0.0034	0.0036	0.0038	0.0039	0.0041

3.4 Data Set 2, 105°C, 120mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	**0hr(Initial)	**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
26	158.30	100.13	99.87	99.43	99.24	98.93	98.55	98.17	97.92	97.66
27	157.70	99.94	99.56	99.24	98.99	98.60	98.35	98.10	97.84	97.46
28	157.60	99.87	99.62	99.18	98.79	98.54	98.16	97.72	97.46	97.21
29	158.50	99.94	99.68	99.37	98.93	98.74	98.49	98.23	97.79	97.41
30	157.00	100.06	99.75	99.49	99.11	98.73	98.34	97.90	97.58	97.32
31	159.00	100.06	99.75	99.50	99.18	98.99	98.62	98.36	97.99	97.61
32	158.70	99.87	99.56	99.24	98.87	98.61	98.36	98.05	97.61	97.35
33	158.10	99.94	99.49	99.18	98.80	98.36	98.04	97.79	97.41	97.15
34	159.30	100.06	99.75	99.44	99.06	98.74	98.37	98.05	97.74	97.30
35	159.50	100.06	99.75	99.56	99.25	98.81	98.50	98.31	97.99	97.62
36	159.00	99.94	99.50	99.31	98.93	98.81	98.49	98.18	97.92	97.61
37	157.80	99.94	99.68	99.30	99.11	98.80	98.35	97.97	97.53	97.40
38	157.80	100.13	99.75	99.56	99.30	99.05	98.80	98.42	98.16	97.78
39	158.10	100.25	99.87	99.49	99.24	99.05	98.61	98.36	97.98	97.79
40	158.00	100.13	99.75	99.49	99.18	99.11	98.86	98.48	98.04	97.78
41	160.90	99.88	99.50	99.25	98.88	98.57	98.20	97.95	97.64	97.33
42	158.20	99.94	99.62	99.49	99.12	98.61	98.23	97.91	97.60	97.16
43	158.80	100.06	99.81	99.50	99.12	98.87	98.61	98.30	97.92	97.61
44	158.00	99.94	99.56	99.37	98.99	98.73	98.35	97.91	97.66	97.34
45	159.70	100.13	99.87	99.50	99.12	98.81	98.37	98.00	97.62	97.37
46	157.60	100.06	99.81	99.49	99.05	98.86	98.60	98.35	98.10	97.65
47	158.30	99.81	99.49	99.18	98.93	98.67	98.23	97.85	97.47	97.16
48	158.60	100.19	99.87	99.50	99.18	98.80	98.42	98.11	97.73	97.48
49	157.90	100.19	99.87	99.62	99.24	98.99	98.67	98.35	98.10	97.78
50	159.60	100.13	99.94	99.75	99.31	98.93	98.62	98.31	97.87	97.56
Avg.	158.48	100.03	99.71	99.42	99.08	98.79	98.45	98.12	97.79	97.48
Med.	158.30	100.06	99.75	99.49	99.11	98.80	98.42	98.11	97.79	97.46
st dev	0.85	0.12	0.14	0.15	0.16	0.18	0.20	0.22	0.22	0.21
Min.	157.00	99.81	99.49	99.18	98.79	98.36	98.04	97.72	97.41	97.15
Max.	160.90	100.25	99.94	99.75	99.31	99.11	98.86	98.48	98.16	97.79

No.	Lumen Maintenance (%)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
26	97.47	97.22	96.97	96.72	96.40	96.08	95.89	95.70
27	97.15	96.89	96.64	96.39	96.13	95.94	95.75	95.31
28	96.95	96.57	96.19	95.81	95.49	95.24	95.11	94.86
29	97.10	96.78	96.53	96.15	96.03	95.71	95.46	95.21
30	97.01	96.75	96.50	96.18	95.92	95.61	95.41	95.22
31	97.30	96.98	96.54	96.29	95.97	95.60	95.41	95.28
32	96.91	96.60	96.22	95.97	95.65	95.27	94.83	94.58
33	96.90	96.58	96.27	95.95	95.64	95.32	95.19	95.07
34	96.99	96.74	96.42	96.11	95.98	95.67	95.42	95.23
35	97.43	97.18	96.93	96.61	96.30	96.05	95.61	95.24
36	97.30	96.92	96.67	96.35	96.04	95.72	95.41	95.28
37	97.15	96.89	96.51	96.32	96.01	95.69	95.44	95.18
38	97.40	97.08	96.70	96.39	96.07	95.88	95.69	95.50
39	97.53	97.28	97.03	96.84	96.52	96.20	96.02	95.83
40	97.53	97.22	96.90	96.65	96.33	96.20	95.76	95.57
41	97.02	96.83	96.58	96.27	96.02	95.77	95.21	94.78
42	96.84	96.52	96.33	96.14	95.76	95.58	95.45	95.39
43	97.29	97.10	96.85	96.66	96.41	96.22	95.97	95.40
44	96.96	96.58	96.39	96.08	95.89	95.70	95.44	94.94
45	96.99	96.74	96.49	96.18	95.99	95.74	95.37	95.12
46	97.40	96.95	96.76	96.45	96.13	95.75	95.69	95.62
47	96.90	96.65	96.40	96.08	95.89	95.64	95.20	94.76
48	97.23	96.97	96.78	96.53	96.15	95.78	95.59	95.46
49	97.47	97.15	96.96	96.71	96.39	96.14	95.88	95.31
50	97.24	96.93	96.68	96.37	96.24	95.86	95.49	95.18
Avg.	97.18	96.89	96.61	96.33	96.05	95.77	95.51	95.24
Med.	97.15	96.89	96.58	96.32	96.03	95.74	95.45	95.24
st dev	0.22	0.23	0.24	0.27	0.26	0.27	0.28	0.30
Min.	96.84	96.52	96.19	95.81	95.49	95.24	94.83	94.58
Max.	97.53	97.28	97.03	96.84	96.52	96.22	96.02	95.83

3.5 Data Set 2, 105°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)									
	**0hr(Initial)	**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
26	9.022	9.037	9.019	9.021	9.063	9.059	9.023	9.031	9.023	9.020
27	9.054	9.057	9.047	9.054	9.076	9.073	9.052	9.061	9.059	9.054
28	9.039	9.066	9.036	9.046	9.069	9.074	9.038	9.046	9.041	9.040
29	9.063	9.062	9.064	9.063	9.111	9.106	9.062	9.070	9.066	9.065
30	9.062	9.070	9.060	9.062	9.072	9.082	9.059	9.068	9.063	9.060
31	9.106	9.104	9.105	9.110	9.114	9.112	9.104	9.114	9.108	9.105
32	9.112	9.110	9.108	9.109	9.105	9.106	9.113	9.123	9.116	9.112
33	9.064	9.071	9.062	9.061	9.110	9.115	9.066	9.078	9.066	9.062
34	9.070	9.072	9.069	9.072	9.109	9.096	9.072	9.083	9.075	9.070
35	9.039	9.042	9.035	9.040	9.046	9.058	9.039	9.048	9.040	9.037
36	9.107	9.109	9.108	9.108	9.111	9.108	9.108	9.114	9.111	9.105
37	9.033	9.040	9.037	9.034	9.038	9.046	9.034	9.040	9.035	9.031
38	9.076	9.078	9.071	9.076	9.081	9.085	9.077	9.083	9.077	9.070
39	9.071	9.075	9.068	9.075	9.078	9.086	9.069	9.079	9.077	9.072
40	9.071	9.073	9.073	9.075	9.081	9.086	9.071	9.079	9.077	9.071
41	9.105	9.105	9.100	9.105	9.114	9.105	9.103	9.111	9.106	9.105
42	9.110	9.107	9.104	9.110	9.119	9.109	9.109	9.116	9.111	9.106
43	9.083	9.085	9.080	9.083	9.109	9.113	9.087	9.088	9.083	9.084
44	9.101	9.100	9.095	9.095	9.108	9.101	9.105	9.108	9.102	9.103
45	9.106	9.113	9.103	9.106	9.104	9.101	9.110	9.116	9.108	9.109
46	9.062	9.070	9.064	9.065	9.077	9.075	9.064	9.072	9.067	9.061
47	9.037	9.048	9.040	9.040	9.052	9.067	9.041	9.047	9.041	9.036
48	9.095	9.113	9.093	9.094	9.107	9.108	9.094	9.104	9.103	9.094
49	9.033	9.036	9.032	9.033	9.043	9.053	9.035	9.037	9.037	9.035
50	9.112	9.116	9.116	9.110	9.118	9.113	9.113	9.119	9.114	9.117
Avg.	9.073	9.078	9.072	9.074	9.089	9.089	9.074	9.081	9.076	9.073
Med.	9.071	9.073	9.069	9.075	9.104	9.096	9.071	9.079	9.077	9.070
st dev	0.029	0.026	0.029	0.028	0.026	0.021	0.029	0.029	0.029	0.030
Min.	9.022	9.036	9.019	9.021	9.038	9.046	9.023	9.031	9.023	9.020
Max.	9.112	9.116	9.116	9.110	9.119	9.115	9.113	9.123	9.116	9.117

No.	Forward Voltage (V)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
26	9.032	9.037	9.035	9.032	9.030	9.045	9.034	9.049
27	9.072	9.068	9.069	9.063	9.060	9.080	9.066	9.055
28	9.053	9.051	9.047	9.048	9.045	9.066	9.048	9.037
29	9.086	9.078	9.075	9.074	9.068	9.089	9.070	9.066
30	9.091	9.071	9.078	9.089	9.090	9.083	9.066	9.060
31	9.112	9.113	9.112	9.123	9.117	9.121	9.117	9.107
32	9.121	9.120	9.128	9.118	9.121	9.132	9.124	9.115
33	9.076	9.073	9.082	9.069	9.072	9.088	9.074	9.063
34	9.088	9.081	9.086	9.086	9.077	9.093	9.081	9.073
35	9.057	9.046	9.054	9.050	9.044	9.054	9.047	9.042
36	9.121	9.118	9.115	9.137	9.111	9.132	9.116	9.111
37	9.085	9.046	9.088	9.049	9.037	9.057	9.038	9.035
38	9.087	9.091	9.106	9.098	9.081	9.099	9.087	9.074
39	9.113	9.081	9.107	9.077	9.078	9.086	9.078	9.072
40	9.096	9.088	9.076	9.080	9.082	9.088	9.082	9.074
41	9.120	9.113	9.115	9.111	9.111	9.118	9.110	9.102
42	9.125	9.123	9.132	9.115	9.114	9.129	9.116	9.112
43	9.095	9.097	9.102	9.089	9.087	9.102	9.096	9.083
44	9.116	9.114	9.108	9.106	9.106	9.117	9.111	9.099
45	9.134	9.125	9.116	9.117	9.111	9.127	9.117	9.118
46	9.087	9.083	9.086	9.073	9.069	9.087	9.074	9.064
47	9.050	9.052	9.071	9.040	9.043	9.062	9.045	9.057
48	9.113	9.110	9.114	9.099	9.103	9.117	9.108	9.100
49	9.058	9.044	9.061	9.036	9.038	9.051	9.047	9.034
50	9.132	9.128	9.131	9.123	9.114	9.128	9.123	9.113
Avg.	9.093	9.086	9.092	9.084	9.080	9.094	9.083	9.077
Med.	9.091	9.083	9.088	9.086	9.081	9.089	9.081	9.073
st dev	0.028	0.029	0.027	0.030	0.029	0.028	0.029	0.028
Min.	9.032	9.037	9.035	9.032	9.030	9.045	9.034	9.034
Max.	9.134	9.128	9.132	9.137	9.121	9.132	9.124	9.118

3.6 Data Set 2, 105°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	**0hr(Initial)			**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
26	0.2622	0.5294	2699	0.0004	0.0005	0.0008	0.0011	0.0012	0.0015	0.0018	0.0021	0.0024
27	0.2629	0.5288	2686	0.0004	0.0006	0.0009	0.0011	0.0011	0.0014	0.0016	0.0019	0.0022
28	0.2642	0.5303	2654	0.0003	0.0005	0.0007	0.0011	0.0011	0.0014	0.0017	0.0019	0.0022
29	0.2616	0.5296	2709	0.0004	0.0005	0.0008	0.0011	0.0013	0.0015	0.0018	0.0021	0.0023
30	0.2645	0.5300	2649	0.0004	0.0005	0.0006	0.0010	0.0013	0.0016	0.0018	0.0022	0.0024
31	0.2632	0.5302	2674	0.0004	0.0005	0.0007	0.0010	0.0012	0.0013	0.0016	0.0019	0.0022
32	0.2645	0.5299	2649	0.0006	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0019	0.0020
33	0.2631	0.5291	2680	0.0004	0.0006	0.0008	0.0011	0.0013	0.0015	0.0016	0.0019	0.0020
34	0.2628	0.5312	2679	0.0006	0.0009	0.0012	0.0014	0.0017	0.0019	0.0021	0.0022	0.0020
35	0.2613	0.5303	2714	0.0005	0.0009	0.0011	0.0014	0.0016	0.0018	0.0021	0.0023	0.0023
36	0.2638	0.5298	2663	0.0004	0.0007	0.0009	0.0013	0.0016	0.0019	0.0022	0.0025	0.0027
37	0.2638	0.5304	2661	0.0005	0.0008	0.0010	0.0013	0.0016	0.0019	0.0021	0.0024	0.0026
38	0.2642	0.5319	2649	0.0005	0.0007	0.0010	0.0012	0.0013	0.0016	0.0019	0.0022	0.0024
39	0.2641	0.5313	2653	0.0004	0.0007	0.0008	0.0012	0.0014	0.0017	0.0018	0.0022	0.0024
40	0.2625	0.5282	2697	0.0004	0.0007	0.0010	0.0013	0.0016	0.0017	0.0018	0.0021	0.0023
41	0.2609	0.5312	2718	0.0006	0.0009	0.0012	0.0013	0.0016	0.0019	0.0021	0.0024	0.0026
42	0.2639	0.5285	2667	0.0005	0.0009	0.0011	0.0015	0.0017	0.0019	0.0022	0.0024	0.0026
43	0.2618	0.5281	2712	0.0004	0.0007	0.0010	0.0014	0.0018	0.0019	0.0022	0.0025	0.0027
44	0.2641	0.5291	2660	0.0006	0.0007	0.0010	0.0011	0.0013	0.0016	0.0018	0.0021	0.0025
45	0.2624	0.5287	2697	0.0007	0.0009	0.0012	0.0015	0.0015	0.0016	0.0019	0.0022	0.0026
46	0.2617	0.5276	2716	0.0004	0.0006	0.0008	0.0011	0.0014	0.0016	0.0018	0.0019	0.0022
47	0.2646	0.5308	2645	0.0004	0.0008	0.0009	0.0012	0.0014	0.0016	0.0017	0.0019	0.0022
48	0.2644	0.5302	2651	0.0005	0.0008	0.0009	0.0013	0.0014	0.0016	0.0019	0.0022	0.0024
49	0.2638	0.5312	2660	0.0005	0.0006	0.0009	0.0012	0.0013	0.0016	0.0019	0.0021	0.0023
50	0.2621	0.5291	2701	0.0004	0.0005	0.0008	0.0011	0.0014	0.0016	0.0018	0.0021	0.0022
Avg.	0.2631	0.5298	2678	0.0005	0.0007	0.0009	0.0012	0.0014	0.0017	0.0019	0.0022	0.0024
Med.	0.2632	0.5299	2674	0.0004	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0021	0.0023
st dev	0.0011	0.0011	25	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2609	0.5276	2645	0.0003	0.0005	0.0006	0.0010	0.0011	0.0013	0.0016	0.0019	0.0020
Max.	0.2646	0.5319	2718	0.0007	0.0009	0.0012	0.0015	0.0018	0.0019	0.0022	0.0025	0.0027

No.	Chromaticity Shift ($\Delta u'v'$)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
26	0.0025	0.0027	0.0029	0.0032	0.0034	0.0036	0.0038	0.0042
27	0.0025	0.0027	0.0028	0.0030	0.0033	0.0035	0.0035	0.0038
28	0.0025	0.0028	0.0029	0.0031	0.0033	0.0036	0.0038	0.0038
29	0.0023	0.0026	0.0028	0.0030	0.0033	0.0034	0.0035	0.0037
30	0.0026	0.0027	0.0029	0.0031	0.0033	0.0036	0.0035	0.0036
31	0.0025	0.0028	0.0031	0.0034	0.0037	0.0038	0.0036	0.0038
32	0.0021	0.0024	0.0026	0.0029	0.0032	0.0035	0.0035	0.0035
33	0.0021	0.0023	0.0026	0.0029	0.0030	0.0034	0.0035	0.0035
34	0.0021	0.0022	0.0024	0.0027	0.0029	0.0033	0.0037	0.0036
35	0.0024	0.0025	0.0028	0.0029	0.0030	0.0034	0.0038	0.0038
36	0.0030	0.0032	0.0034	0.0035	0.0036	0.0037	0.0036	0.0039
37	0.0028	0.0028	0.0031	0.0034	0.0036	0.0038	0.0035	0.0036
38	0.0027	0.0030	0.0031	0.0033	0.0034	0.0036	0.0034	0.0036
39	0.0027	0.0030	0.0031	0.0033	0.0035	0.0039	0.0036	0.0037
40	0.0026	0.0028	0.0031	0.0033	0.0035	0.0038	0.0035	0.0037
41	0.0029	0.0031	0.0032	0.0035	0.0036	0.0039	0.0038	0.0041
42	0.0028	0.0031	0.0034	0.0036	0.0038	0.0042	0.0044	0.0044
43	0.0028	0.0030	0.0032	0.0034	0.0037	0.0040	0.0041	0.0041
44	0.0027	0.0030	0.0032	0.0034	0.0037	0.0041	0.0046	0.0049
45	0.0028	0.0030	0.0032	0.0034	0.0036	0.0038	0.0038	0.0042
46	0.0025	0.0026	0.0028	0.0029	0.0032	0.0034	0.0035	0.0037
47	0.0025	0.0026	0.0028	0.0031	0.0032	0.0036	0.0037	0.0038
48	0.0027	0.0029	0.0031	0.0033	0.0035	0.0039	0.0039	0.0041
49	0.0026	0.0029	0.0031	0.0034	0.0036	0.0039	0.0042	0.0039
50	0.0024	0.0026	0.0028	0.0030	0.0033	0.0038	0.0041	0.0039
Avg.	0.0026	0.0028	0.0030	0.0032	0.0034	0.0037	0.0038	0.0039
Med.	0.0026	0.0028	0.0031	0.0033	0.0034	0.0037	0.0037	0.0038
st dev	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003
Min.	0.0021	0.0022	0.0024	0.0027	0.0029	0.0033	0.0034	0.0035
Max.	0.0030	0.0032	0.0034	0.0036	0.0038	0.0042	0.0046	0.0049

3.7 Data Set 3, 115°C, 120mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	**0hr(Initial)	**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
51	160.00	100.06	99.81	99.50	99.13	98.69	98.25	97.94	97.63	97.31
52	161.30	100.06	99.63	99.26	98.82	98.51	98.08	97.83	97.52	97.27
53	158.50	100.13	99.87	99.56	99.18	98.93	98.61	98.23	97.85	97.54
54	158.50	99.94	99.62	99.18	98.74	98.42	98.11	97.73	97.29	96.85
55	159.60	99.87	99.62	99.31	98.93	98.81	98.43	98.18	97.87	97.49
56	160.50	99.81	99.38	99.13	98.75	98.63	98.13	97.76	97.38	97.01
57	159.60	99.87	99.50	99.12	98.68	98.37	98.06	97.68	97.31	96.93
58	159.30	99.94	99.50	99.06	98.81	98.43	97.93	97.61	97.18	96.92
59	159.80	99.87	99.56	99.25	98.94	98.44	98.00	97.62	97.12	96.81
60	159.30	100.06	99.75	99.31	98.93	98.74	98.43	98.05	97.68	97.30
61	158.80	100.06	99.75	99.37	98.99	98.74	98.36	97.98	97.61	97.29
62	160.30	99.94	99.63	99.31	99.06	98.63	98.19	97.75	97.32	96.94
63	158.60	99.81	99.56	99.12	98.74	98.36	98.05	97.54	97.10	96.72
64	157.40	99.87	99.36	99.11	98.79	98.48	98.09	97.71	97.27	96.95
65	157.90	99.81	99.43	98.99	98.61	98.10	97.72	97.34	96.96	96.58
66	159.70	99.75	99.37	98.94	98.50	98.12	97.81	97.43	97.06	96.68
67	159.30	99.94	99.50	99.12	98.68	98.56	98.12	97.68	97.18	96.74
68	158.50	100.13	99.75	99.43	99.12	98.74	98.42	97.98	97.54	97.16
69	158.60	100.13	99.81	99.62	99.24	98.99	98.55	98.17	97.86	97.60
70	158.90	100.06	99.75	99.43	99.12	98.93	98.62	98.17	97.92	97.61
71	160.40	100.12	99.88	99.69	99.25	98.82	98.38	98.07	97.63	97.26
72	157.80	99.75	99.30	99.11	98.73	98.23	97.91	97.66	97.40	96.96
73	159.10	99.81	99.37	98.99	98.62	98.11	97.74	97.23	96.86	96.54
74	159.70	99.87	99.50	99.12	98.81	98.31	98.00	97.56	97.24	96.93
75	158.10	100.19	99.87	99.68	99.30	98.86	98.42	98.10	97.85	97.47
Avg.	159.18	99.95	99.60	99.27	98.90	98.56	98.18	97.80	97.42	97.07
Med.	159.30	99.94	99.62	99.25	98.82	98.56	98.12	97.75	97.38	96.96
st dev	0.94	0.13	0.18	0.22	0.23	0.27	0.26	0.28	0.31	0.32
Min.	157.40	99.75	99.30	98.94	98.50	98.10	97.72	97.23	96.86	96.54
Max.	161.30	100.19	99.88	99.69	99.30	98.99	98.62	98.23	97.92	97.61

No.	Lumen Maintenance (%)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
51	97.00	96.81	96.38	96.19	96.00	95.63	95.13	94.94
52	97.02	96.78	96.40	96.03	95.72	95.41	95.04	94.30
53	97.10	96.72	96.47	96.03	95.65	95.33	95.08	94.89
54	96.40	96.03	95.71	95.39	95.08	94.89	94.51	94.13
55	97.12	96.68	96.24	95.86	95.49	95.11	94.74	94.55
56	96.70	96.39	96.01	95.83	95.45	95.33	95.08	94.58
57	96.62	96.30	95.93	95.55	95.11	94.74	94.49	94.17
58	96.55	96.11	95.79	95.48	95.17	94.85	94.54	94.10
59	96.50	96.06	95.81	95.49	95.12	94.93	94.37	94.18
60	96.99	96.55	96.30	95.86	95.67	95.42	95.23	95.10
61	96.98	96.60	96.22	95.91	95.53	95.15	94.58	94.46
62	96.69	96.44	96.26	96.07	95.76	95.32	95.26	95.13
63	96.41	96.09	95.84	95.52	95.40	95.08	94.58	94.33
64	96.63	96.25	96.06	95.62	95.24	94.85	94.54	94.35
65	96.14	95.95	95.63	95.25	95.00	94.62	94.43	94.24
66	96.37	96.06	95.80	95.49	95.05	94.74	94.36	93.80
67	96.36	96.05	95.61	95.29	94.92	94.79	94.66	94.41
68	96.78	96.34	95.96	95.71	95.33	94.95	94.76	94.51
69	97.23	96.97	96.78	96.47	96.15	95.90	95.40	94.83
70	97.36	96.92	96.60	96.29	95.97	95.85	95.53	95.28
71	96.82	96.51	96.13	95.82	95.51	95.14	95.01	94.76
72	96.58	96.26	95.94	95.63	95.50	95.12	94.87	94.68
73	96.23	95.98	95.66	95.29	94.91	94.59	94.53	93.97
74	96.56	96.31	95.99	95.62	95.37	94.99	94.74	94.55
75	97.09	96.77	96.52	96.14	95.76	95.45	95.00	94.75
Avg.	96.73	96.40	96.08	95.75	95.43	95.13	94.82	94.52
Med.	96.69	96.34	96.01	95.71	95.45	95.11	94.74	94.51
st dev	0.33	0.32	0.32	0.33	0.35	0.35	0.34	0.38
Min.	96.14	95.95	95.61	95.25	94.91	94.59	94.36	93.80
Max.	97.36	96.97	96.78	96.47	96.15	95.90	95.53	95.28

3.8 Data Set 3, 115°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)									
	**0hr(Initial)	**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
51	9.087	9.088	9.125	9.085	9.107	9.109	9.093	9.093	9.094	9.084
52	9.087	9.087	9.108	9.086	9.103	9.102	9.087	9.093	9.092	9.088
53	9.073	9.077	9.072	9.078	9.102	9.104	9.078	9.082	9.082	9.077
54	9.041	9.050	9.043	9.041	9.079	9.069	9.044	9.050	9.047	9.042
55	9.063	9.065	9.071	9.066	9.066	9.062	9.070	9.073	9.071	9.064
56	9.106	9.114	9.110	9.105	9.107	9.107	9.109	9.117	9.115	9.108
57	9.100	9.106	9.102	9.100	9.104	9.105	9.106	9.108	9.114	9.101
58	9.044	9.048	9.047	9.044	9.089	9.074	9.051	9.055	9.057	9.043
59	9.104	9.115	9.101	9.103	9.110	9.109	9.108	9.108	9.115	9.100
60	9.037	9.041	9.037	9.036	9.047	9.055	9.041	9.041	9.045	9.036
61	9.095	9.099	9.114	9.097	9.116	9.116	9.103	9.102	9.103	9.092
62	9.089	9.091	9.089	9.090	9.121	9.124	9.092	9.094	9.097	9.086
63	9.065	9.070	9.066	9.068	9.096	9.084	9.065	9.069	9.076	9.060
64	9.069	9.071	9.073	9.073	9.096	9.107	9.072	9.079	9.081	9.066
65	9.053	9.064	9.060	9.059	9.061	9.064	9.060	9.060	9.067	9.057
66	9.040	9.040	9.043	9.039	9.042	9.049	9.042	9.045	9.050	9.039
67	9.066	9.065	9.068	9.068	9.068	9.072	9.070	9.073	9.078	9.066
68	9.080	9.078	9.077	9.080	9.080	9.079	9.079	9.084	9.088	9.078
69	9.103	9.103	9.104	9.109	9.109	9.108	9.107	9.110	9.117	9.107
70	9.060	9.060	9.061	9.064	9.095	9.079	9.064	9.061	9.068	9.060
71	9.074	9.080	9.092	9.084	9.093	9.087	9.082	9.084	9.089	9.081
72	9.063	9.061	9.068	9.069	9.070	9.072	9.073	9.072	9.077	9.067
73	9.062	9.062	9.067	9.064	9.068	9.071	9.072	9.075	9.071	9.063
74	9.091	9.099	9.097	9.092	9.099	9.107	9.100	9.103	9.103	9.090
75	9.094	9.093	9.096	9.095	9.113	9.101	9.097	9.106	9.105	9.094
Avg.	9.074	9.077	9.080	9.076	9.090	9.089	9.079	9.081	9.084	9.074
Med.	9.073	9.077	9.073	9.078	9.096	9.087	9.078	9.082	9.082	9.077
st dev	0.021	0.022	0.025	0.021	0.022	0.021	0.021	0.022	0.022	0.021
Min.	9.037	9.040	9.037	9.036	9.042	9.049	9.041	9.041	9.045	9.036
Max.	9.106	9.115	9.125	9.109	9.121	9.124	9.109	9.117	9.117	9.108

No.	Forward Voltage (V)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
51	9.106	9.099	9.102	9.094	9.089	9.102	9.101	9.095
52	9.103	9.096	9.106	9.093	9.088	9.102	9.115	9.093
53	9.089	9.088	9.079	9.079	9.078	9.087	9.089	9.086
54	9.062	9.054	9.067	9.068	9.043	9.050	9.055	9.047
55	9.086	9.078	9.085	9.072	9.070	9.075	9.081	9.072
56	9.126	9.117	9.119	9.111	9.112	9.117	9.119	9.111
57	9.118	9.107	9.116	9.108	9.105	9.110	9.109	9.112
58	9.060	9.057	9.070	9.051	9.054	9.055	9.057	9.057
59	9.119	9.113	9.102	9.109	9.106	9.111	9.111	9.110
60	9.046	9.051	9.055	9.051	9.041	9.046	9.042	9.045
61	9.107	9.109	9.104	9.099	9.103	9.104	9.108	9.102
62	9.096	9.103	9.102	9.096	9.092	9.100	9.094	9.096
63	9.077	9.076	9.072	9.074	9.067	9.089	9.073	9.071
64	9.078	9.085	9.083	9.076	9.072	9.079	9.079	9.072
65	9.061	9.064	9.066	9.057	9.060	9.065	9.063	9.060
66	9.043	9.045	9.061	9.041	9.040	9.045	9.041	9.043
67	9.071	9.078	9.072	9.071	9.068	9.078	9.079	9.072
68	9.081	9.093	9.087	9.084	9.081	9.089	9.086	9.084
69	9.108	9.118	9.114	9.111	9.106	9.121	9.113	9.111
70	9.063	9.070	9.072	9.064	9.062	9.063	9.062	9.065
71	9.082	9.089	9.087	9.086	9.084	9.079	9.086	9.082
72	9.065	9.077	9.071	9.080	9.070	9.066	9.073	9.066
73	9.068	9.073	9.071	9.077	9.069	9.075	9.069	9.064
74	9.096	9.101	9.101	9.104	9.099	9.107	9.099	9.096
75	9.100	9.103	9.097	9.116	9.101	9.106	9.101	9.100
Avg.	9.084	9.086	9.086	9.083	9.078	9.085	9.084	9.080
Med.	9.082	9.088	9.085	9.080	9.078	9.087	9.086	9.082
st dev	0.023	0.021	0.019	0.021	0.022	0.023	0.023	0.022
Min.	9.043	9.045	9.055	9.041	9.040	9.045	9.041	9.043
Max.	9.126	9.118	9.119	9.116	9.112	9.121	9.119	9.112

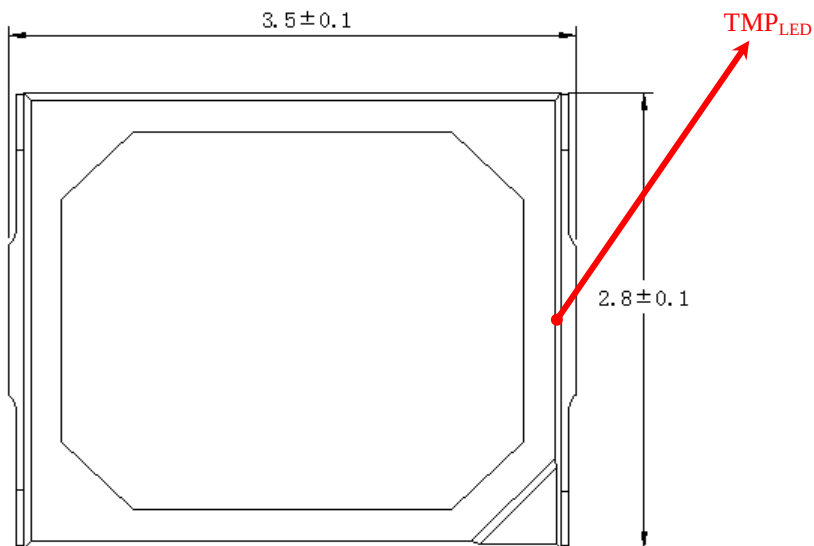
3.9 Data Set 3, 115°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	**0hr(Initial)			**1000hrs	**2000hrs	**3000hrs	**4000hrs	**5000hrs	**6000hrs	**7000hrs	**8000hrs	**9000hrs
51	0.2627	0.5308	2682	0.0004	0.0007	0.0011	0.0013	0.0013	0.0014	0.0016	0.0019	0.0021
52	0.2606	0.5310	2725	0.0004	0.0007	0.0010	0.0013	0.0014	0.0015	0.0016	0.0018	0.0021
53	0.2641	0.5300	2657	0.0003	0.0006	0.0009	0.0013	0.0016	0.0018	0.0020	0.0021	0.0022
54	0.2641	0.5312	2654	0.0004	0.0006	0.0009	0.0011	0.0015	0.0018	0.0020	0.0023	0.0023
55	0.2625	0.5295	2691	0.0006	0.0008	0.0011	0.0013	0.0014	0.0016	0.0018	0.0021	0.0023
56	0.2608	0.5286	2730	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018	0.0021	0.0023	0.0025
57	0.2612	0.5276	2727	0.0005	0.0008	0.0011	0.0014	0.0015	0.0018	0.0021	0.0023	0.0025
58	0.2612	0.5300	2717	0.0006	0.0008	0.0011	0.0013	0.0015	0.0018	0.0021	0.0023	0.0024
59	0.2633	0.5315	2667	0.0007	0.0010	0.0013	0.0016	0.0016	0.0019	0.0021	0.0023	0.0024
60	0.2632	0.5308	2673	0.0008	0.0010	0.0013	0.0016	0.0018	0.0020	0.0023	0.0025	0.0027
61	0.2634	0.5295	2672	0.0006	0.0009	0.0011	0.0013	0.0016	0.0017	0.0021	0.0023	0.0025
62	0.2607	0.5294	2729	0.0007	0.0010	0.0013	0.0016	0.0019	0.0020	0.0023	0.0025	0.0028
63	0.2626	0.5290	2692	0.0007	0.0009	0.0013	0.0015	0.0018	0.0020	0.0023	0.0026	0.0028
64	0.2627	0.5286	2691	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022	0.0025	0.0028	0.0028
65	0.2634	0.5292	2675	0.0006	0.0009	0.0012	0.0013	0.0017	0.0019	0.0022	0.0025	0.0028
66	0.2618	0.5305	2703	0.0006	0.0009	0.0012	0.0014	0.0017	0.0019	0.0022	0.0024	0.0026
67	0.2630	0.5298	2681	0.0007	0.0008	0.0010	0.0012	0.0015	0.0018	0.0020	0.0022	0.0026
68	0.2634	0.5297	2673	0.0007	0.0010	0.0013	0.0014	0.0016	0.0018	0.0021	0.0024	0.0025
69	0.2641	0.5288	2662	0.0006	0.0009	0.0011	0.0012	0.0014	0.0017	0.0018	0.0022	0.0023
70	0.2618	0.5294	2706	0.0006	0.0007	0.0011	0.0013	0.0016	0.0017	0.0019	0.0022	0.0023
71	0.2587	0.5286	2775	0.0007	0.0009	0.0012	0.0015	0.0017	0.0019	0.0020	0.0022	0.0024
72	0.2625	0.5281	2696	0.0007	0.0010	0.0013	0.0015	0.0018	0.0020	0.0021	0.0021	0.0023
73	0.2624	0.5304	2690	0.0008	0.0009	0.0012	0.0015	0.0017	0.0018	0.0019	0.0021	0.0024
74	0.2611	0.5289	2722	0.0006	0.0008	0.0010	0.0012	0.0016	0.0018	0.0022	0.0023	0.0023
75	0.2631	0.5296	2679	0.0005	0.0008	0.0011	0.0013	0.0014	0.0017	0.0019	0.0021	0.0023
Avg.	0.2623	0.5296	2695	0.0006	0.0009	0.0011	0.0014	0.0016	0.0018	0.0020	0.0023	0.0025
Med.	0.2626	0.5295	2691	0.0006	0.0009	0.0011	0.0013	0.0016	0.0018	0.0021	0.0023	0.0024
st dev	0.0013	0.0010	29	0.0002	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2587	0.5276	2654	0.0003	0.0006	0.0009	0.0011	0.0013	0.0014	0.0016	0.0018	0.0021
Max.	0.2641	0.5315	2775	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022	0.0025	0.0028	0.0028

No.	Chromaticity Shift ($\Delta u'v'$)							
	**10000hrs	**11000hrs	**12000hrs	**13000hrs	**14000hrs	**15000hrs	16000hrs	17000hrs
51	0.0023	0.0025	0.0028	0.0031	0.0033	0.0036	0.0039	0.0040
52	0.0024	0.0026	0.0028	0.0031	0.0034	0.0036	0.0037	0.0038
53	0.0023	0.0026	0.0029	0.0032	0.0035	0.0039	0.0042	0.0044
54	0.0026	0.0026	0.0029	0.0032	0.0034	0.0037	0.0038	0.0038
55	0.0025	0.0026	0.0028	0.0030	0.0033	0.0036	0.0039	0.0039
56	0.0026	0.0027	0.0029	0.0030	0.0031	0.0033	0.0039	0.0041
57	0.0028	0.0030	0.0033	0.0034	0.0035	0.0037	0.0040	0.0043
58	0.0027	0.0029	0.0032	0.0033	0.0035	0.0037	0.0037	0.0039
59	0.0025	0.0028	0.0031	0.0033	0.0035	0.0037	0.0036	0.0038
60	0.0029	0.0031	0.0033	0.0036	0.0038	0.0039	0.0036	0.0039
61	0.0028	0.0030	0.0032	0.0035	0.0037	0.0040	0.0038	0.0036
62	0.0030	0.0033	0.0036	0.0038	0.0040	0.0044	0.0042	0.0040
63	0.0031	0.0034	0.0036	0.0038	0.0041	0.0045	0.0042	0.0042
64	0.0031	0.0033	0.0035	0.0037	0.0040	0.0044	0.0043	0.0043
65	0.0032	0.0034	0.0035	0.0036	0.0038	0.0043	0.0043	0.0045
66	0.0029	0.0031	0.0034	0.0036	0.0039	0.0043	0.0045	0.0047
67	0.0025	0.0028	0.0031	0.0034	0.0037	0.0041	0.0042	0.0044
68	0.0028	0.0030	0.0032	0.0033	0.0036	0.0041	0.0042	0.0045
69	0.0027	0.0029	0.0032	0.0033	0.0035	0.0038	0.0042	0.0043
70	0.0026	0.0028	0.0031	0.0034	0.0036	0.0040	0.0040	0.0043
71	0.0026	0.0029	0.0032	0.0033	0.0036	0.0040	0.0042	0.0044
72	0.0025	0.0028	0.0031	0.0034	0.0036	0.0039	0.0043	0.0045
73	0.0026	0.0028	0.0031	0.0034	0.0036	0.0039	0.0043	0.0045
74	0.0026	0.0029	0.0030	0.0031	0.0033	0.0035	0.0044	0.0047
75	0.0025	0.0028	0.0030	0.0031	0.0033	0.0036	0.0040	0.0042
Avg.	0.0027	0.0029	0.0031	0.0034	0.0036	0.0039	0.0041	0.0042
Med.	0.0026	0.0029	0.0031	0.0033	0.0036	0.0039	0.0042	0.0043
st dev	0.0002	0.0003	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
Min.	0.0023	0.0025	0.0028	0.0030	0.0031	0.0033	0.0036	0.0036
Max.	0.0032	0.0034	0.0036	0.0038	0.0041	0.0045	0.0045	0.0047

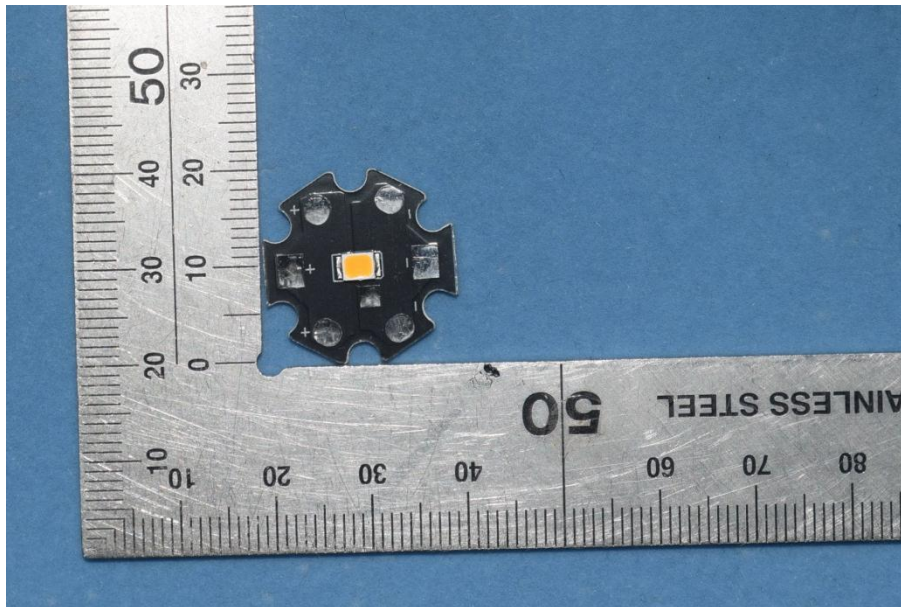
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



Directions

1. The information marked “superscript #” is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. This report includes some test methods are not in NVLAP accreditation scope marked *.
3. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
4. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
5. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor $K=2$ with the 95% confidence interval.
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*****END OF REPORT*****