



TEST REPORT

ACCORDING TO IES LM-80-15
For

Seoul Semiconductor Co., LTD

97-11, Sandan-ro 163, Danwon-gu, Ansan-si, Gyeonggi-do, Korea 15429

Model: F5115A-251W27SL2L4FR3R8-D000-LSR

Report Type: 6000 Hours Test Report		Product Type: LED Array	
Test Engineer:	Pote Wang	<i>Pote Wang</i>	
Report Number:	RSZ190815501-10-M1		
Test Date:	2016-09-08 to 2017-05-16		
Report Date:	2019-09-05		
Reviewed By:	Blake Zhang / EE Engineer	<i>Blake Zhang</i>	
Revised Note:	The previous report RSZ190815501-10 is replaced by this report on 2019-09-05		
Test Facility:	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.		
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Note: 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 used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).
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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

36 PCS samples were received on 2016-09-06. The samples were numbered from 1 to 12, 13 to 24 and 25 to 36.

Manufacturer:	Seoul Semiconductor Co., LTD
Part Number:	F5115A-251W27SL2L4FR3R8-D000-LSR
Series Number:	50mm
Part Type:	LED Array
Drive Level:	DC 23mA
Nominal CCT:	2700K
Power:	1.5W
Average Current Density per LED die:	247.57mA/mm ²
Average Power Density per LED die:	0.693W/mm ²
CRI:	80
Die Spacing:	1.73mm

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:

Model Name	Power (W)	CCT (K)	Total Input Current (mA)	The Number of Dies	Die Spacing (mm)	Power Density per PCB (W/mm ²)	Current Density per Die(mA/mm ²)
F5115A-251W27SL2L4FR3R8-D000-LSR	1.5	2700	23	25	1.73	0.0239	247.570
F5115A-XXXXXXXXXXXXXXXXXX-XXXX-XXX	1.5	2200K~6500K	23	25	1.73	0.0239	247.570

Note:

1. The applicant Seoul Semiconductor Co., LTD declare that their products with model F5115A-251W27SL2L4FR3R8-D000-LSR are the same to the products in report# RSZ160906522-10-M2 and is authorized by original applicant to use their test data.
2. All the data in previous report (RSZ160906522-10-M2) is shared in this report.

1.2 Standards Used:

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

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
1.0m integrating sphere	SENSING	SCD-20008	N/A	2016-07-11	2017-07-10
spectroradiometer	SENSING	SCD-20008	N/A	2016-07-11	2017-07-10
DC Power Supply	Hanshenpuyuan	HSPY-100-05	2013010210003	2016-05-18	2017-05-17
Standard Light Source	EVERFINE	D062	1011093	2016-09-13	2017-09-12
Multilayer aging machine	BACL	B2-270	20022	2016-12-08	2017-12-07
DC Power Supply	GUTE	LLA1200112-U	2012082001	2016-12-21	2017-12-20
Adjustable constant-current DC switching power supply	GUTE	DK-60V20A	120 5036	2016-08-29	2017-08-29
DC Power Supply	BACL	B12001-12	90023	2016-12-21	2017-12-20

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 $2^{\circ}C$ below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to $5^{\circ}C$ 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 $25^{\circ}C \pm 2^{\circ}C$, RH <65%.

1.6 Measurement Uncertainty

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 $U=21K$ ($K=2$), at the 95% confidence level.

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

1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Dongguan) 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, 23mA

Part Number: F5115A-251W27SL2L4FR3R8-D000-LSR
Number of Units: 12
Case Temperature: >83°C
Ambient Temperature: >80°C
Life Test Drive Current: 23mA
Measurement Current: 23mA

Data Set 2: 105°C, 23mA

Part Number: F5115A-251W27SL2L4FR3R8-D000-LSR
Number of Units: 12
Case Temperature: >103°C
Ambient Temperature: >100°C
Life Test Drive Current: 23mA
Measurement Current: 23mA

Data Set 3: 125°C, 23mA

Part Number: F5115A-251W27SL2L4FR3R8-D000-LSR
Number of Units: 12
Case Temperature: >123°C
Ambient Temperature: >120°C
Life Test Drive Current: 23mA
Measurement Current: 23mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	Reported TM-21 L ₇₀ Lifetime
1	12	0	1000	6000	>33000 hours
2	12	0	1000	6000	>33000 hours
3	12	0	1000	6000	32000 hours

Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000	2000	3000	4000	5000	6000
1	99.61%	99.03%	98.23%	97.45%	96.68%	95.91%
2	99.31%	98.46%	97.53%	96.61%	95.71%	94.79%
3	99.16%	98.05%	96.96%	95.88%	94.79%	93.71%

Average Color Maintenance

Data Set:	1000	2000	3000	4000	5000	6000
1	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014
2	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014
3	0.0003	0.0004	0.0006	0.0007	0.0010	0.0011

3 - Test Data

3.1 Data Set 1, 85°C, 23mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	279.04	99.69	99.16	98.38	97.60	96.87	96.15
2	280.21	99.64	99.06	98.25	97.48	96.70	95.93
3	287.78	99.59	98.97	98.26	97.56	96.93	96.38
4	285.95	99.63	99.01	98.12	97.27	96.42	95.59
5	288.17	99.59	99.00	98.17	97.38	96.55	95.63
6	288.30	99.58	99.04	98.27	97.58	96.83	96.04
7	286.73	99.54	98.96	98.16	97.35	96.52	95.68
8	288.69	99.61	99.11	98.33	97.52	96.76	96.04
9	283.86	99.60	98.96	98.16	97.41	96.65	95.94
10	287.78	99.63	99.05	98.26	97.44	96.67	95.93
11	286.99	99.69	99.14	98.30	97.52	96.80	96.02
12	283.47	99.52	98.88	98.11	97.29	96.43	95.56
Ave.	285.58	99.61	99.03	98.23	97.45	96.68	95.91
Med.	286.86	99.60	99.02	98.26	97.46	96.68	95.94
st dev	3.25	0.0522	0.0820	0.0860	0.1131	0.1694	0.2483
Min.	279.04	99.52	98.88	98.11	97.27	96.42	95.56
Max.	288.69	99.69	99.16	98.38	97.60	96.93	96.38

TM-21 Projection:

Test Duration: 6000 hours

Failures Observed: 0

α: 7.694E-06

β: 1.005

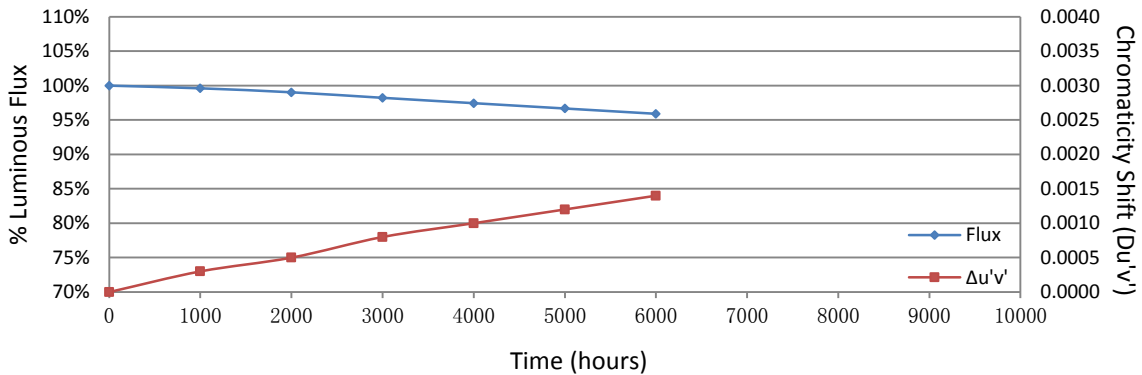
Reported L₇₀: >33000 hours

3.2 Data Set 1, 85°C, 23mA (Forward Voltage)

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	69.16	69.64	69.64	69.73	70.93	70.99	70.94
2	69.47	69.58	69.58	69.69	70.85	70.96	70.79
3	69.51	69.53	69.55	69.71	70.84	70.92	70.72
4	69.45	69.54	69.59	69.72	70.85	70.94	70.69
5	69.51	69.51	69.55	69.68	70.77	70.92	70.69
6	69.51	69.53	69.51	69.66	70.76	70.90	70.67
7	69.54	69.50	69.57	69.67	70.76	70.94	70.64
8	69.74	69.50	69.56	69.64	70.77	70.97	70.85
9	69.52	69.51	69.51	69.75	70.78	70.90	70.75
10	69.59	69.52	69.49	69.71	70.79	70.93	70.70
11	69.52	69.51	69.51	69.69	70.81	70.92	70.75
12	69.66	69.53	69.57	69.69	70.77	70.94	70.72
Ave.	69.52	69.53	69.55	69.70	70.81	70.94	70.74
Med.	69.52	69.53	69.56	69.69	70.79	70.94	70.72
st dev	0.14	0.04	0.04	0.03	0.05	0.03	0.08
Min.	69.16	69.50	69.49	69.64	70.76	70.90	70.64
Max.	69.74	69.64	69.64	69.75	70.93	70.99	70.94

3.3 Data Set 1, 85°C, 23mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs
1	0.2616	0.5274	2720	0.0005	0.0008	0.0011	0.0014	0.0016	0.0017
2	0.2626	0.5276	2698	0.0003	0.0006	0.0007	0.0009	0.0010	0.0012
3	0.2609	0.5276	2734	0.0004	0.0007	0.0006	0.0006	0.0009	0.0013
4	0.2618	0.5270	2716	0.0002	0.0004	0.0006	0.0007	0.0008	0.0009
5	0.2618	0.5276	2714	0.0004	0.0007	0.0012	0.0016	0.0017	0.0016
6	0.2616	0.5278	2716	0.0003	0.0004	0.0006	0.0010	0.0012	0.0014
7	0.2617	0.5274	2716	0.0002	0.0004	0.0009	0.0012	0.0014	0.0016
8	0.2619	0.5274	2712	0.0002	0.0004	0.0005	0.0006	0.0008	0.0011
9	0.2620	0.5269	2712	0.0003	0.0005	0.0008	0.0009	0.0009	0.0012
10	0.2621	0.5277	2706	0.0004	0.0006	0.0010	0.0011	0.0013	0.0015
11	0.2615	0.5279	2720	0.0004	0.0006	0.0011	0.0012	0.0016	0.0018
12	0.2617	0.5279	2714	0.0001	0.0001	0.0004	0.0006	0.0008	0.0010
Ave.	0.2618	0.5275	2715	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014
Med.	0.2618	0.5276	2715	0.0003	0.0005	0.0008	0.0009	0.0011	0.0013
st dev	0.0004	0.0003	9	0.0001	0.0002	0.0003	0.0003	0.0003	0.0003
Min.	0.2609	0.5269	2698	0.0001	0.0001	0.0004	0.0006	0.0008	0.0009
Max.	0.2626	0.5279	2734	0.0005	0.0008	0.0012	0.0016	0.0017	0.0018



3.4 Data Set 2, 105°C, 23mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
13	281.91	99.33	98.46	97.50	96.56	95.69	94.84
14	286.21	99.27	98.39	97.47	96.61	95.74	94.93
15	281.51	99.25	98.42	97.56	96.73	95.85	95.03
16	286.86	99.31	98.45	97.57	96.74	95.98	95.19
17	287.78	99.32	98.53	97.60	96.72	95.88	94.98
18	287.51	99.34	98.52	97.44	96.40	95.41	94.40
19	288.17	99.33	98.46	97.48	96.59	95.62	94.60
20	287.91	99.33	98.45	97.51	96.61	95.69	94.71
21	285.17	99.35	98.49	97.60	96.68	95.78	94.92
22	284.12	99.37	98.49	97.64	96.75	95.88	94.94
23	286.47	99.29	98.40	97.31	96.11	94.91	93.68
24	289.21	99.25	98.47	97.65	96.85	96.09	95.31
Ave.	286.07	99.31	98.46	97.53	96.61	95.71	94.79
Med.	286.67	99.32	98.46	97.54	96.65	95.76	94.92
st dev	2.45	0.0382	0.0438	0.0980	0.1951	0.3081	0.4273
Min.	281.51	99.25	98.39	97.31	96.11	94.91	93.68
Max.	289.21	99.37	98.53	97.65	96.85	96.09	95.31

TM-21 Projection:

Test Duration: 6000 hours

Failures Observed: 0

α: 9.353E-06

β: 1.003

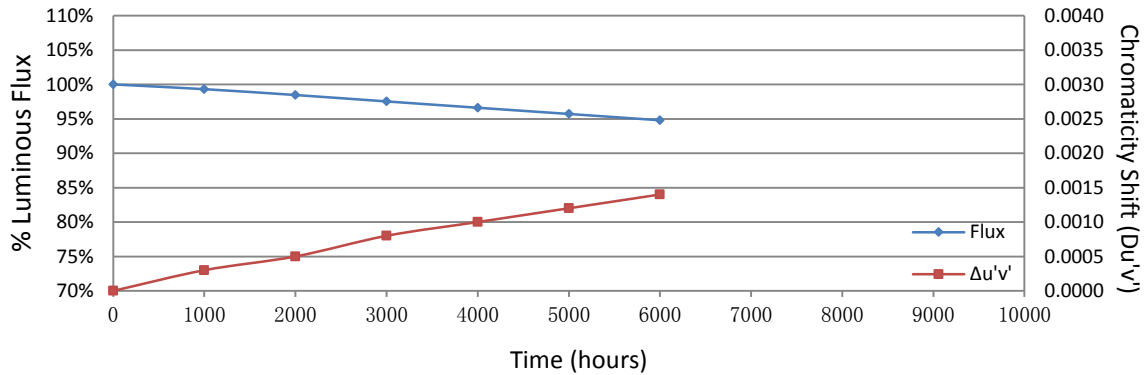
Reported L₇₀: >33000 hours

3.5 Data Set 2, 105°C, 23mA (Forward Voltage)

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
13	69.51	69.56	69.64	69.74	70.91	71.05	70.83
14	69.75	69.52	69.54	69.68	70.82	70.99	70.77
15	69.57	69.56	69.51	69.72	70.77	70.98	70.70
16	69.53	69.52	69.49	69.71	70.74	70.92	70.65
17	69.52	69.51	69.49	69.69	70.74	70.94	70.64
18	69.67	69.49	69.50	69.75	70.79	71.05	70.68
19	69.51	69.50	69.49	69.67	70.76	70.97	70.68
20	69.52	69.51	69.48	69.68	70.75	70.88	70.65
21	69.49	69.47	69.49	69.76	70.77	70.83	70.66
22	69.52	69.58	69.50	69.75	70.74	70.88	70.66
23	69.62	69.53	69.51	69.66	70.79	70.87	70.61
24	69.55	69.53	69.49	69.65	70.73	70.92	70.61
Ave.	69.56	69.52	69.51	69.71	70.78	70.94	70.68
Med.	69.53	69.52	69.50	69.70	70.77	70.93	70.66
st dev	0.08	0.03	0.04	0.04	0.05	0.07	0.06
Min.	69.49	69.47	69.48	69.65	70.73	70.83	70.61
Max.	69.75	69.58	69.64	69.76	70.91	71.05	70.83

3.6 Data Set 2, 105°C, 23mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs
13	0.2620	0.5276	2710	0.0004	0.0006	0.0008	0.0013	0.0016	0.0018
14	0.2617	0.5276	2716	0.0002	0.0004	0.0009	0.0011	0.0013	0.0016
15	0.2621	0.5272	2710	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015
16	0.2617	0.5282	2714	0.0003	0.0006	0.0004	0.0006	0.0007	0.0008
17	0.2616	0.5279	2716	0.0004	0.0004	0.0006	0.0009	0.0011	0.0013
18	0.2621	0.5273	2710	0.0002	0.0004	0.0008	0.0010	0.0012	0.0015
19	0.2615	0.5280	2718	0.0002	0.0005	0.0007	0.0010	0.0015	0.0018
20	0.2614	0.5277	2722	0.0004	0.0006	0.0010	0.0012	0.0013	0.0014
21	0.2615	0.5272	2720	0.0004	0.0005	0.0005	0.0007	0.0008	0.0008
22	0.2622	0.5284	2702	0.0002	0.0004	0.0005	0.0008	0.0011	0.0011
23	0.2612	0.5273	2728	0.0004	0.0007	0.0008	0.0009	0.0011	0.0012
24	0.2612	0.5281	2724	0.0002	0.0007	0.0011	0.0012	0.0015	0.0017
Ave.	0.2617	0.5277	2716	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014
Med.	0.2617	0.5277	2716	0.0003	0.0005	0.0008	0.0010	0.0013	0.0015
st dev	0.0003	0.0004	7	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003
Min.	0.2612	0.5272	2702	0.0002	0.0004	0.0004	0.0006	0.0007	0.0008
Max.	0.2622	0.5284	2728	0.0004	0.0007	0.0011	0.0013	0.0016	0.0018



3.7 Data Set 3, 125°C, 23mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
25	287.47	99.19	98.02	96.90	95.77	94.69	93.61
26	284.70	99.25	98.16	97.00	95.82	94.66	93.52
27	281.27	99.24	98.13	97.13	96.21	95.39	94.63
28	281.87	99.13	98.07	96.92	95.77	94.55	93.31
29	287.28	99.04	97.98	96.93	95.95	94.90	93.78
30	286.85	99.30	98.07	96.97	95.72	94.42	93.08
31	285.97	99.12	97.93	96.87	95.76	94.66	93.58
32	288.11	99.15	97.93	96.99	96.08	95.12	94.19
33	285.05	98.99	97.92	96.89	95.95	95.00	94.10
34	286.41	99.20	98.14	97.01	95.83	94.62	93.43
35	286.09	99.29	98.30	97.01	95.74	94.50	93.30
36	288.00	99.00	97.94	96.92	95.95	95.00	94.01
Ave.	285.76	99.16	98.05	96.96	95.88	94.79	93.71
Med.	286.25	99.17	98.05	96.95	95.83	94.68	93.59
st dev	2.23	0.1071	0.1181	0.0738	0.1520	0.2894	0.4475
Min.	281.27	98.99	97.92	96.87	95.72	94.42	93.08
Max.	288.11	99.30	98.30	97.13	96.21	95.39	94.63

TM-21 Projection:

Test Duration: 6000 hours

Failures Observed: 0

α: 1.129E-05

β: 1.003

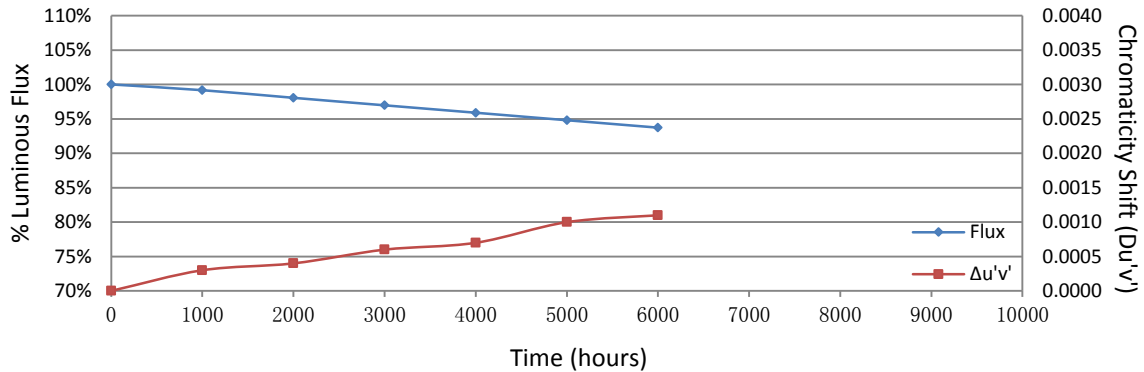
Reported L₇₀: 32000 hours

3.8 Data Set 3, 125°C, 23mA (Forward Voltage)

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
25	70.99	70.97	70.97	70.85	70.88	71.01	70.78
26	71.08	70.85	70.90	70.83	70.88	70.98	70.75
27	71.52	70.85	70.90	70.74	70.81	70.96	70.66
28	71.25	70.82	70.81	71.06	70.79	70.92	70.70
29	70.88	70.77	70.80	70.88	70.74	70.99	70.72
30	70.97	70.74	70.82	70.83	70.73	70.92	70.65
31	70.94	70.73	70.79	70.79	70.75	70.90	70.67
32	71.02	70.70	70.81	70.83	70.77	70.86	70.63
33	70.98	70.74	70.98	70.89	70.87	70.90	70.63
34	71.02	70.74	70.88	70.83	70.74	70.93	70.64
35	70.85	70.69	70.78	70.78	70.74	70.96	70.66
36	70.85	70.69	71.05	70.69	70.90	70.89	70.64
Ave.	71.03	70.77	70.87	70.83	70.80	70.94	70.68
Med.	70.99	70.74	70.85	70.83	70.78	70.93	70.66
st dev	0.19	0.08	0.09	0.09	0.07	0.05	0.05
Min.	70.85	70.69	70.78	70.69	70.73	70.86	70.63
Max.	71.52	70.97	71.05	71.06	70.90	71.01	70.78

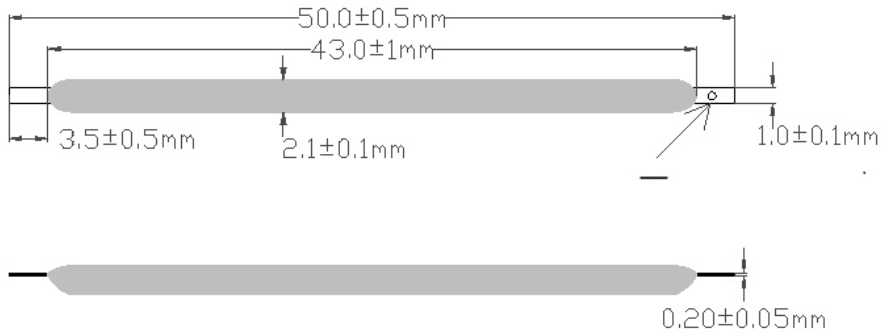
3.9 Data Set 3, 125°C, 23mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs
25	0.2602	0.5249	2758	0.0006	0.0011	0.0012	0.0009	0.0018	0.0020
26	0.2604	0.5267	2748	0.0003	0.0003	0.0006	0.0009	0.0011	0.0014
27	0.2615	0.5275	2722	0.0006	0.0009	0.0011	0.0013	0.0012	0.0014
28	0.2601	0.5253	2758	0.0004	0.0005	0.0005	0.0007	0.0009	0.0012
29	0.2599	0.5268	2756	0.0001	0.0004	0.0006	0.0010	0.0012	0.0015
30	0.2614	0.5262	2728	0.0002	0.0004	0.0006	0.0007	0.0011	0.0012
31	0.2614	0.5276	2722	0.0004	0.0005	0.0005	0.0007	0.0009	0.0010
32	0.2612	0.5269	2730	0.0001	0.0002	0.0004	0.0006	0.0008	0.0011
33	0.2612	0.5264	2730	0.0001	0.0002	0.0002	0.0004	0.0004	0.0007
34	0.2619	0.5285	2708	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001
35	0.2606	0.5283	2736	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011
36	0.2606	0.5283	2736	0.0002	0.0002	0.0004	0.0006	0.0009	0.0010
Ave.	0.2609	0.5270	2736	0.0003	0.0004	0.0006	0.0007	0.0010	0.0011
Med.	0.2609	0.5269	2733	0.0002	0.0003	0.0005	0.0007	0.0009	0.0012
st dev	0.0006	0.0012	16	0.0002	0.0003	0.0003	0.0003	0.0004	0.0005
Min.	0.2599	0.5249	2708	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001
Max.	0.2619	0.5285	2758	0.0006	0.0011	0.0012	0.0013	0.0018	0.0020



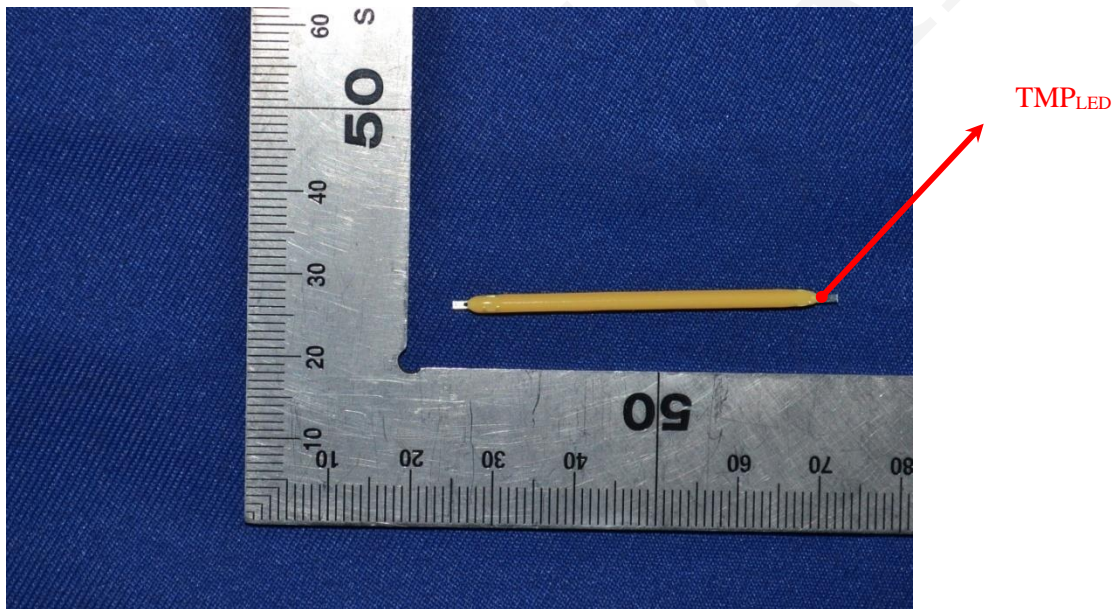
4 - EUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 EUT Photo



5 - Report Revision

Report Number	Report Date	Contents
RSZ190815501-10	2019-08-16	Original report.
RSZ190815501-10-M1	2019-09-05	Replaced the quoted report.

*****END OF REPORT*****

FINAL