



SEOUL SEMICONDUCTOR



IES LM-80-08 TEST REPORT

Measuring Lumen Maintenance of LED Light Sources

Manufacturer : Seoul Semiconductor Co., Ltd.

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

Classification : LED Package



**Test Sample : MJT5050
(SAWxLH0A-xx)**

Test Date : Sep. 16, 2015 ~ Jun. 20, 2016

Report Date : Jul. 15, 2016

Report Number : I-150831-50-K-01

Revision Number : 01

Tested by In Hoi Sim Engineer	 (signature)	Reviewed by Young Joon Won Technical Manager	 (signature)
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The above test certificate is the accredited test results by
Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA

SEOUL SEMICONDUCTOR CO., LTD

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1. Summary

1.1 Test Results

Items	Condition 1	Condition 2	Condition 3
Required Temperature	55 °C	85 °C	105 °C
Number of LED light sources tested (ea)	20	20	20
Test Duration (h)	6 000	6 000	6 000
Drive Current (mA)	20	20	20
Actual Case Temperature (°C)	54.0	83.5	103.3
Actual Ambient Temperature (°C)	51.1	82.7	102.6
Air flow velocity (m/s)	0.87	0.54	0.18
Average Initial Luminous Flux (lm)	130.124	131.396	132.469
Average Initial CCT (K)	2 692	2 704	2 710
Average Initial Volatge (V)	63.39	63.35	63.32
Average Lumen maintenance (%)	110.7	106.3	103.1
Average Chromaticity Shift	0.001 7	0.000 6	0.000 6

※ The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full.

1.2 Lumen Maintenance Projection (IES TM-21-11)

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)		MJT5050 SAWxLH0A-xx, 20mA, 6000h			
Test Condition 1 - 55°C Case Temp		Test Condition 2 - 85°C Case Temp		Test Condition 3 - 105°C Case Temp	
Sample size	20	Sample size	20	Sample size	20
Number of failures	0	Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	20	DUT drive current used in the test (mA)	20	DUT drive current used in the test (mA)	20
Test duration (hours)	6,000	Test duration (hours)	6,000	Test duration (hours)	6,000
Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000
Tested case temperature (°C)	55	Tested case temperature (°C)	85	Tested case temperature (°C)	105
α	-7.803E-07	α	3.718E-06	α	8.652E-06
B	1.100	B	1.091	B	1.089
Reported L70(6k) (hours)	(580,000)	Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	>36000

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2. General Information : IES LM-80-08 Test Report Requirement

2.1 Number of LED Light Sources tested

- 20 Packages tested at actual case temperature $\geq 54.0\text{ }^{\circ}\text{C}$
- 20 Packages tested at actual case temperature $\geq 83.5\text{ }^{\circ}\text{C}$
- 20 Packages tested at actual case temperature $\geq 103.3\text{ }^{\circ}\text{C}$

2.2 Description of LED light Sources

- LED Package Part Number : SAWxLH0A-xx
- LED Forward Current [IF] : 20 mA
- Calculated LED Power : 1.27 W
- LED Package Dimension : 5.0 mm X 5.0 mm

2.3 Description of Auxiliary equipment

- Temperature controlling chamber for LED package/array/module consists of the water cooling heat-sink plates to control the case temperature of each device and of the power supply required by LM-80 test conditions.
- Photometric measurement tester for LED package/array/module consists of the integrating sphere with temperature controlling system(TEC) and of programmable current source meter.

2.4 Operating Cycle

- Drive Current : 20 mA
 - Typical Voltage : 63.35 V
- All tested LED packages are driven with a constant direct current.

2.5 Ambient conditions including airflow, temperature and relative humidity

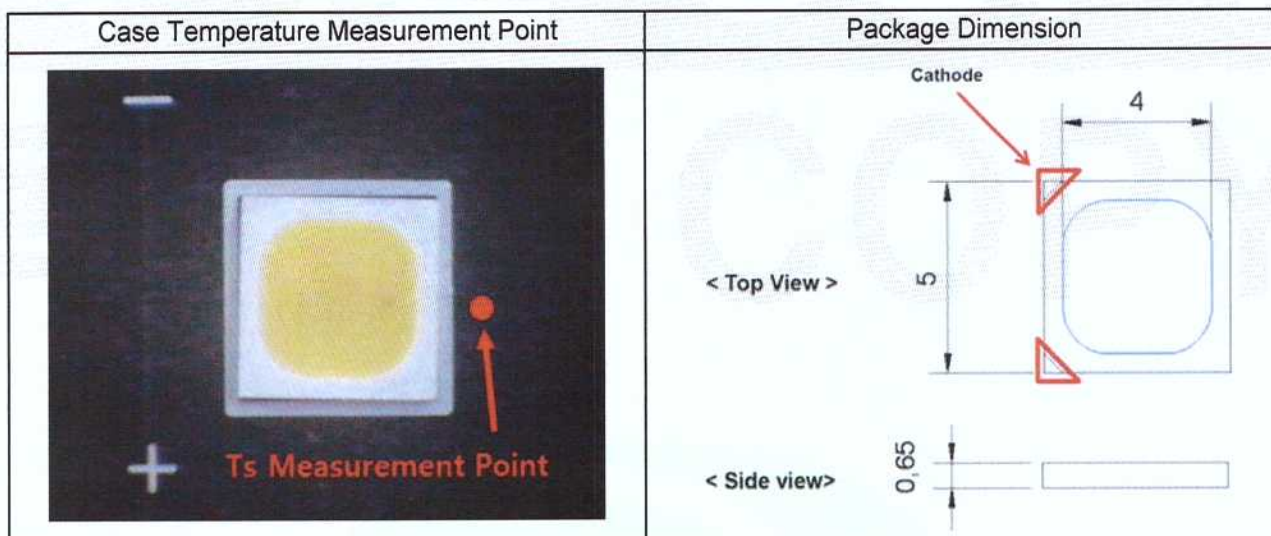
- Controlled ambient conditions

Ambient temperature	- 5 $^{\circ}\text{C}$
Air flow velocity	< 1 m/s
Relative humidity	< 65 RH

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2.6 Case Temperature (Test Point temperature)

- LED temperature measurement point is shown in the picture below.



2.7 Drive Current of the LED light source during lifetime test

- See the Test Data No. 1, 2 and 3

2.8 Lumen maintenance data for each individual LED light source

- See the Test Data No. 1, 2 and 3

2.9 Observation of LED light source failures

- No failures

2.10 LED Light source monitoring interval

- All tested package measurement at each case temperature conditions have 1 000 h interval.
0, 1 000, 2 000, 3 000, 4 000, 5 000 and 6 000 h

2.11 Photometric measurement uncertainty

- Seoul Semiconductor maintain a tolerance of $\pm 3.04 \%$ on flux measurements for LM-80 testing

2.12 Chromaticity shift over the measurement time

- See the Test Data No. 1, 2 and 3

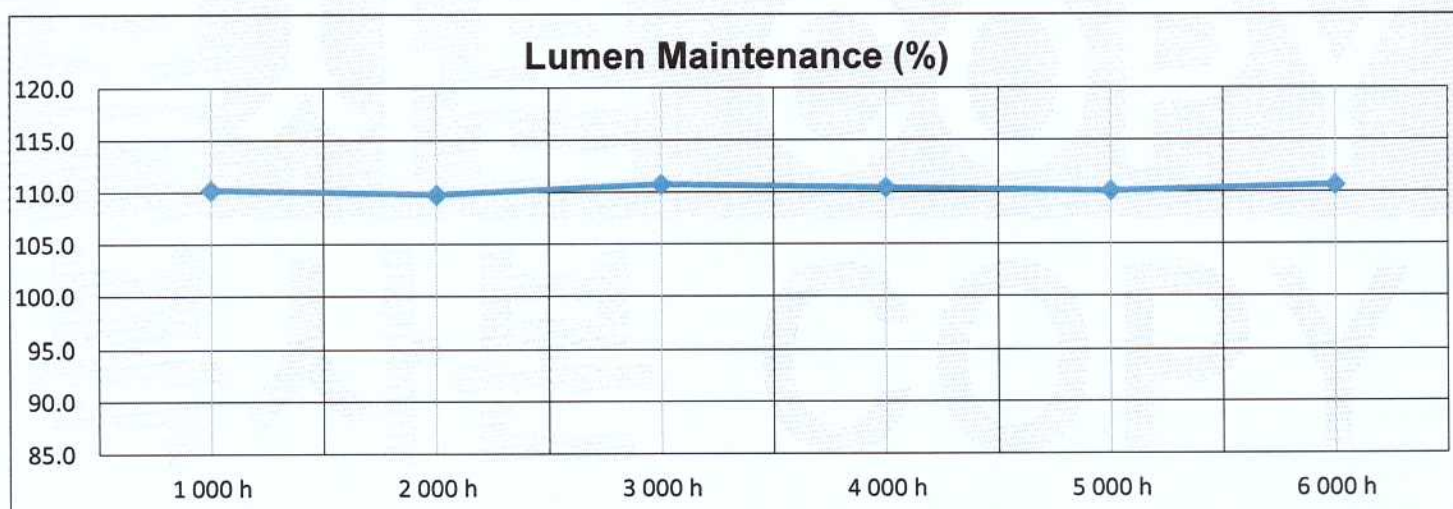
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3. Test Data

3.1 Condition 1 : [Ts = 55 °C]

[LUMEN MAINTENANCE]

No.	Vf(V)	Flux(lm)	CCT(K)	Lumen Maintenance (%)					
	0 h			1 000 h	2 000 h	3 000 h	4 000 h	5 000 h	6 000 h
1	64.34	126.302	2 696	109.5	108.9	109.6	109.7	109.4	109.8
2	63.03	135.499	2 713	109.8	109.5	110.2	109.9	109.6	110.0
3	63.23	134.644	2 723	109.5	109.3	110.1	109.7	109.4	110.1
4	63.52	135.297	2 666	108.8	108.3	109.4	109.0	108.8	109.2
5	63.43	128.798	2 672	111.2	110.8	112.2	111.7	111.5	111.9
6	63.54	127.541	2 712	110.6	110.0	110.3	110.5	110.7	110.8
7	63.88	133.539	2 711	110.3	110.3	111.2	111.3	109.0	111.2
8	63.34	133.154	2 656	109.0	108.6	109.9	109.5	108.9	109.6
9	63.26	128.403	2 677	109.8	109.2	110.4	110.0	108.4	110.3
10	63.34	125.538	2 677	110.6	110.1	111.2	110.7	111.0	111.1
11	63.28	132.213	2 736	109.8	109.6	110.6	110.2	109.9	110.5
12	63.83	132.714	2 650	110.3	109.8	110.5	110.2	110.1	110.7
13	63.21	126.169	2 708	111.3	111.1	111.9	111.6	111.3	111.9
14	62.81	123.381	2 728	111.3	110.8	111.8	111.3	111.2	111.7
15	63.00	124.159	2 667	111.1	110.3	111.7	111.2	111.0	111.6
16	63.77	129.861	2 667	110.6	110.1	111.6	111.1	110.8	111.3
17	63.27	133.711	2 699	110.5	110.3	111.1	110.8	110.9	111.0
18	62.81	128.671	2 697	111.7	111.1	112.2	111.9	111.7	112.0
19	63.65	136.188	2 669	109.2	108.3	109.3	108.9	108.6	108.6
20	63.24	126.698	2 706	109.7	109.3	110.1	109.7	109.8	110.1
Max.	64.34	136.188	2 736	111.7	111.1	112.2	111.9	111.7	112.0
Ave.	63.39	130.124	2 692	110.2	109.8	110.8	110.5	110.1	110.7
Min.	62.81	123.381	2 650	108.8	108.3	109.3	108.9	108.4	108.6
Med.	63.31	129.329	2 696	110.3	109.9	110.5	110.4	110.0	110.8
Std.	0.38	4.073	26	0.8	0.9	0.9	0.9	1.0	1.0

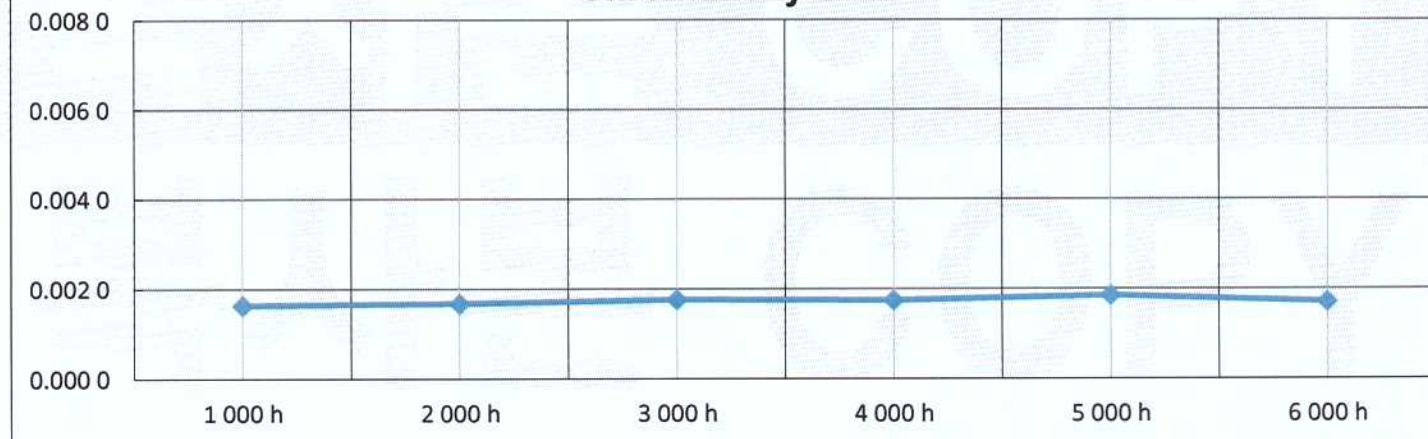


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[CHROMATICITY SHIFT]

No.	u'	v'	Chromaticity Shift					
	0 h		1 000 h	2 000 h	3 000 h	4 000 h	5 000 h	6 000 h
1	0.263 7	0.522 0	0.001 6	0.001 6	0.001 7	0.001 6	0.001 7	0.001 7
2	0.263 2	0.520 5	0.000 9	0.001 1	0.001 1	0.001 0	0.001 0	0.001 0
3	0.262 6	0.521 4	0.001 3	0.001 4	0.001 4	0.001 3	0.001 3	0.001 3
4	0.265 0	0.523 0	0.001 0	0.001 0	0.001 1	0.001 1	0.001 1	0.001 0
5	0.264 4	0.524 7	0.001 8	0.002 0	0.002 1	0.002 0	0.002 0	0.002 0
6	0.262 8	0.522 6	0.001 8	0.001 8	0.002 1	0.002 1	0.001 9	0.001 9
7	0.262 8	0.523 0	0.001 6	0.001 7	0.001 7	0.001 9	0.004 1	0.001 8
8	0.265 2	0.524 4	0.001 3	0.001 3	0.001 5	0.001 5	0.001 9	0.001 4
9	0.264 2	0.524 5	0.001 2	0.001 2	0.001 3	0.001 3	0.001 8	0.001 4
10	0.264 2	0.524 4	0.001 6	0.001 7	0.001 9	0.001 8	0.001 8	0.001 8
11	0.261 9	0.521 7	0.001 6	0.001 7	0.001 8	0.001 8	0.001 7	0.001 7
12	0.265 4	0.525 0	0.001 5	0.001 4	0.001 6	0.001 6	0.001 4	0.001 5
13	0.262 7	0.524 1	0.001 9	0.002 0	0.001 9	0.001 9	0.001 8	0.001 9
14	0.262 4	0.521 3	0.002 5	0.002 6	0.002 6	0.002 6	0.002 6	0.002 6
15	0.264 6	0.524 8	0.002 2	0.002 1	0.002 3	0.002 2	0.002 1	0.002 2
16	0.264 6	0.524 5	0.002 3	0.002 2	0.002 5	0.002 4	0.002 3	0.002 4
17	0.263 3	0.523 5	0.002 1	0.002 2	0.002 3	0.002 3	0.002 3	0.002 2
18	0.263 3	0.524 1	0.001 9	0.001 8	0.001 9	0.002 0	0.001 9	0.001 9
19	0.264 4	0.525 3	0.001 2	0.001 0	0.001 0	0.001 0	0.000 9	0.000 7
20	0.263 3	0.522 0	0.001 3	0.001 4	0.001 4	0.001 4	0.001 4	0.001 4
Max.	0.265 4	0.525 3	0.002 5	0.002 6	0.002 6	0.002 6	0.004 1	0.002 6
Ave.	0.263 7	0.523 3	0.001 6	0.001 7	0.001 8	0.001 7	0.001 8	0.001 7
Min.	0.261 9	0.520 5	0.000 9	0.001 0	0.001 0	0.001 0	0.000 9	0.000 7
Med.	0.263 5	0.523 8	0.001 6	0.001 7	0.001 8	0.001 8	0.001 8	0.001 8
Std.	0.001 0	0.001 4	0.000 4	0.000 4	0.000 5	0.000 5	0.000 7	0.000 5

Chromaticity Shift

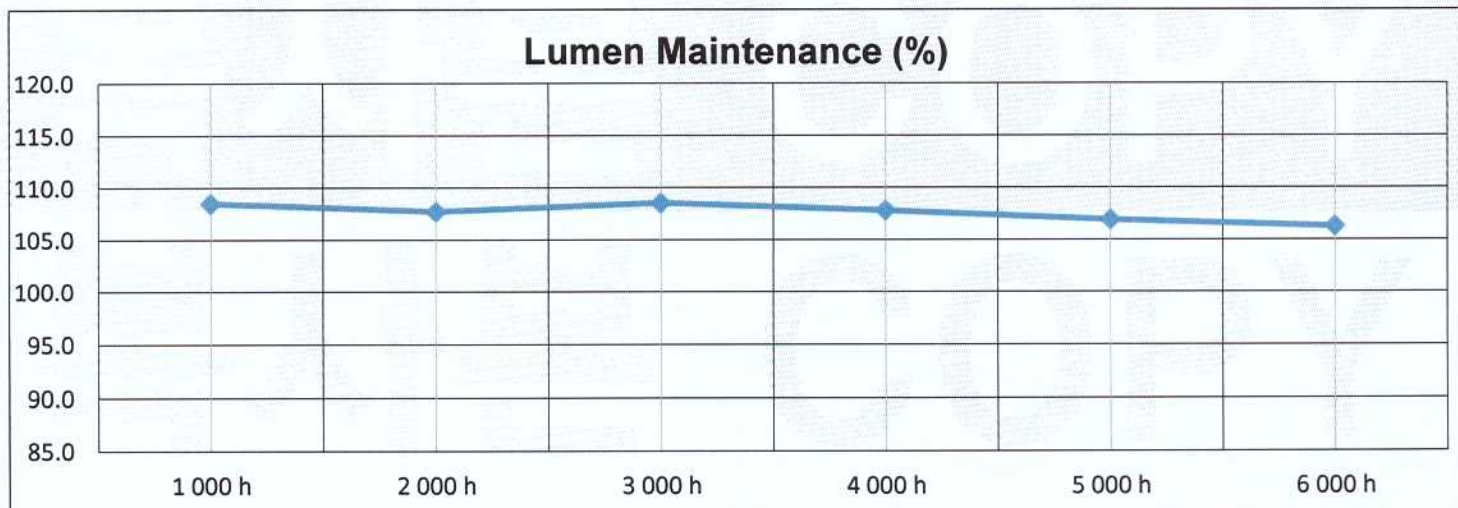


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3.2 Condition 2 : [Ts = 85 °C]

[LUMEN MAINTENANCE]

No.	Vf(V)	Flux(lm)	CCT(K)	Lumen Maintenance (%)					
	0 h			1 000 h	2 000 h	3 000 h	4 000 h	5 000 h	6 000 h
1	63.08	123.560	2 726	109.8	108.3	108.9	108.7	107.9	107.0
2	63.28	134.909	2 704	108.4	107.6	108.3	107.7	106.6	106.0
3	63.15	133.590	2 729	109.1	108.3	109.5	108.5	107.9	106.9
4	63.29	132.595	2 712	108.4	108.0	108.7	108.4	107.2	106.5
5	63.70	131.538	2 680	109.4	108.7	109.5	109.0	107.8	107.3
6	63.94	125.025	2 757	107.9	106.9	108.2	107.6	106.6	105.8
7	63.55	131.080	2 671	107.6	106.8	107.5	106.9	105.9	105.5
8	63.06	139.623	2 664	107.5	106.6	107.5	107.0	106.2	105.8
9	62.90	137.306	2 725	108.8	108.0	108.7	108.1	107.3	106.4
10	63.12	134.975	2 718	108.3	107.7	108.5	107.7	107.0	106.4
11	63.48	127.131	2 683	108.3	107.4	108.5	108.0	107.1	106.3
12	63.56	126.932	2 708	108.7	107.8	108.3	107.5	106.8	106.4
13	64.36	131.838	2 698	107.9	107.3	108.0	107.1	106.2	105.7
14	63.06	136.894	2 689	108.3	107.5	108.3	107.4	106.6	105.9
15	62.87	136.179	2 713	107.7	107.4	107.9	107.0	106.2	105.5
16	63.01	121.322	2 715	110.6	109.7	110.7	109.9	109.1	108.2
17	63.06	130.056	2 703	107.6	107.1	107.5	106.8	105.9	105.7
18	63.50	135.126	2 702	107.6	106.9	108.1	106.9	106.0	105.5
19	63.90	133.148	2 703	108.2	107.9	108.6	107.4	106.6	106.2
20	63.21	125.100	2 692	109.9	109.2	110.2	109.4	108.3	107.3
Max.	64.36	139.623	2 757	110.6	109.7	110.7	109.9	109.1	108.2
Ave.	63.35	131.396	2 704	108.5	107.7	108.6	107.9	107.0	106.3
Min.	62.87	121.322	2 664	107.5	106.6	107.5	106.8	105.9	105.5
Med.	63.24	132.217	2 703	108.3	107.7	108.4	107.6	106.7	106.3
Std.	0.39	5.065	22	0.9	0.8	0.9	0.9	0.9	0.7

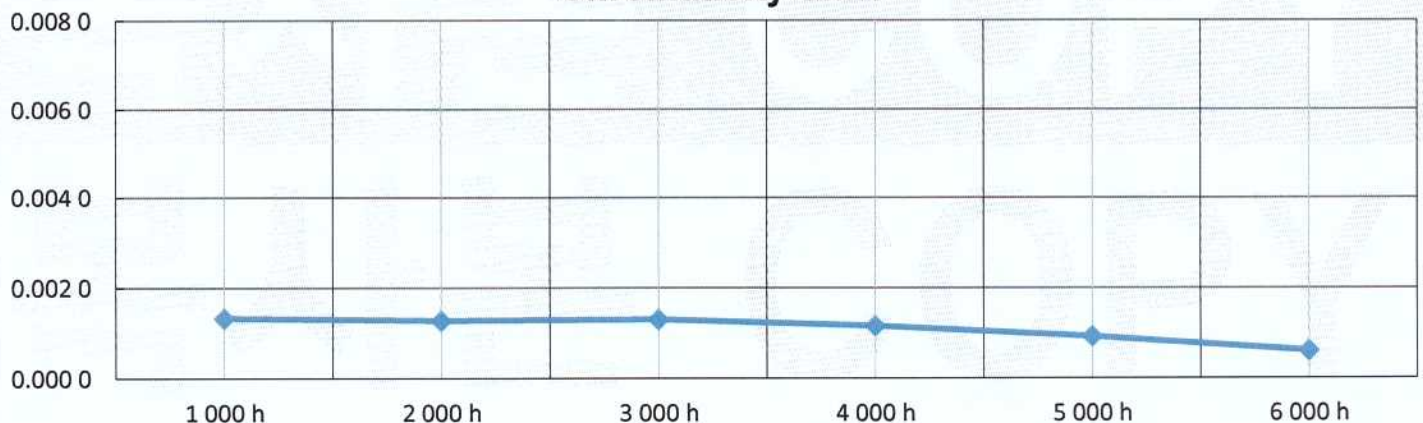


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[CHROMATICITY SHIFT]

No.	u'	v'	Chromaticity Shift					
	0 h		1 000 h	2 000 h	3 000 h	4 000 h	5 000 h	6 000 h
1	0.262 4	0.521 8	0.000 5	0.000 4	0.000 4	0.000 2	0.000 3	0.000 7
2	0.263 2	0.522 7	0.001 4	0.001 4	0.001 4	0.001 3	0.000 9	0.000 5
3	0.262 1	0.522 3	0.000 9	0.000 7	0.000 9	0.000 7	0.000 4	0.000 3
4	0.262 7	0.523 3	0.001 0	0.001 0	0.000 9	0.000 9	0.000 6	0.000 1
5	0.264 2	0.523 7	0.001 3	0.001 3	0.001 3	0.001 2	0.000 9	0.000 6
6	0.261 3	0.519 9	0.001 1	0.001 1	0.001 2	0.001 1	0.000 9	0.000 4
7	0.264 5	0.524 4	0.001 4	0.001 3	0.001 4	0.001 2	0.001 0	0.000 7
8	0.265 0	0.523 4	0.001 8	0.001 7	0.001 7	0.001 5	0.001 4	0.001 1
9	0.262 4	0.521 7	0.001 7	0.001 6	0.001 7	0.001 5	0.001 3	0.000 8
10	0.262 7	0.522 3	0.001 3	0.001 3	0.001 3	0.001 2	0.001 0	0.000 6
11	0.263 7	0.525 3	0.001 8	0.001 7	0.001 7	0.001 6	0.001 3	0.001 0
12	0.263 2	0.521 8	0.001 2	0.001 2	0.001 2	0.001 0	0.000 8	0.000 4
13	0.263 6	0.522 1	0.001 0	0.001 0	0.001 0	0.000 8	0.000 7	0.000 3
14	0.263 8	0.523 3	0.000 8	0.000 7	0.000 7	0.000 6	0.000 5	0.000 3
15	0.263 1	0.521 0	0.001 3	0.001 4	0.001 3	0.001 2	0.000 9	0.000 5
16	0.262 4	0.524 2	0.001 8	0.001 7	0.001 7	0.001 6	0.001 3	0.001 0
17	0.263 3	0.522 5	0.001 6	0.001 6	0.001 4	0.001 4	0.001 1	0.000 8
18	0.263 8	0.520 3	0.001 8	0.001 7	0.001 9	0.001 7	0.001 4	0.001 0
19	0.263 4	0.522 1	0.001 7	0.001 8	0.001 8	0.001 5	0.001 3	0.001 0
20	0.263 6	0.523 5	0.001 0	0.001 0	0.001 1	0.001 0	0.000 6	0.000 2
Max.	0.265 0	0.525 3	0.001 8	0.001 8	0.001 9	0.001 7	0.001 4	0.001 1
Ave.	0.263 2	0.522 6	0.001 3	0.001 3	0.001 3	0.001 2	0.000 9	0.000 6
Min.	0.261 3	0.519 9	0.000 5	0.000 4	0.000 4	0.000 2	0.000 3	0.000 1
Med.	0.263 3	0.522 4	0.001 3	0.001 3	0.001 3	0.001 2	0.000 9	0.000 6
Std.	0.000 9	0.001 3	0.000 4	0.000 4	0.000 4	0.000 4	0.000 3	0.000 3

Chromaticity Shift

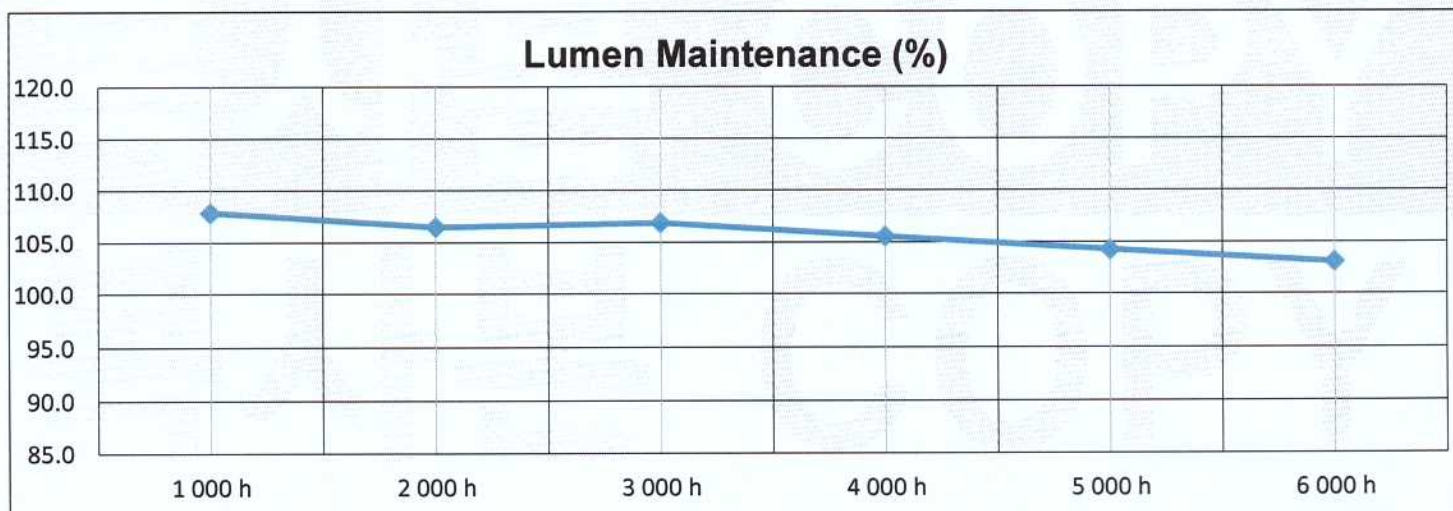


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3.3 Condition 3 : [Ts = 105 °C]

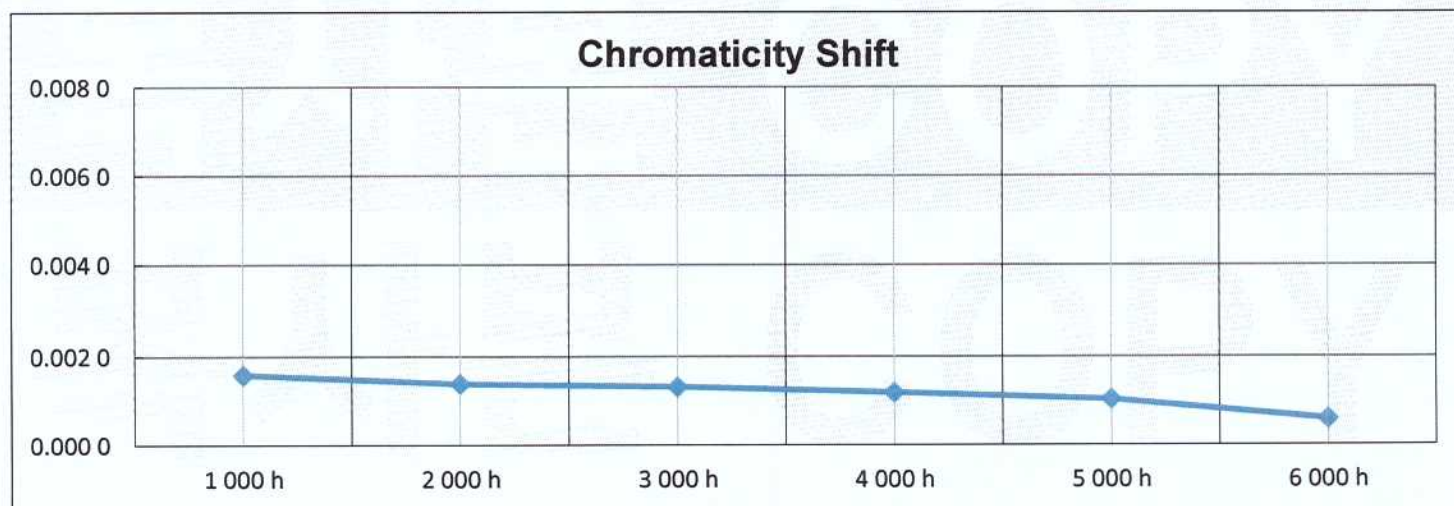
[LUMEN MAINTENANCE]

No.	Vf(V)	Flux(lm)	CCT(K)	Lumen Maintenance (%)					
	0 h			1 000 h	2 000 h	3 000 h	4 000 h	5 000 h	6 000 h
1	62.97	126.608	2 709	107.5	105.9	105.9	104.7	103.5	102.7
2	63.55	133.274	2 712	107.8	106.9	106.9	105.9	104.7	103.4
3	63.30	134.771	2 722	108.2	106.8	107.1	105.7	104.7	103.8
4	63.40	132.385	2 720	106.9	105.8	106.2	104.8	103.5	102.3
5	63.77	136.739	2 693	105.9	104.8	105.4	104.3	103.1	102.4
6	63.15	125.247	2 710	108.8	107.1	107.4	106.3	104.9	103.9
7	63.16	135.227	2 675	107.5	106.3	107.0	105.2	104.0	102.6
8	62.87	136.515	2 703	107.8	106.6	106.6	105.2	103.9	102.6
9	63.75	134.903	2 711	108.4	107.0	107.4	106.4	104.9	103.8
10	63.88	130.602	2 724	108.3	106.8	107.2	105.8	104.6	103.3
11	62.87	129.357	2 698	107.7	105.7	106.4	105.5	104.0	103.1
12	64.39	133.583	2 696	107.2	105.8	106.4	105.2	103.7	102.5
13	63.40	136.964	2 713	106.9	105.4	106.0	104.6	103.4	102.2
14	63.01	132.357	2 698	108.7	107.6	107.8	106.4	105.0	103.8
15	63.51	134.795	2 733	108.0	106.8	107.2	105.6	104.6	102.9
16	63.01	127.935	2 708	108.3	106.8	107.2	105.7	104.6	103.1
17	63.20	133.745	2 715	108.3	106.9	107.1	106.0	104.3	103.5
18	62.97	134.094	2 708	108.3	106.8	107.6	105.7	104.6	103.4
19	63.07	134.220	2 725	108.3	107.0	107.4	106.0	104.8	103.3
20	63.09	126.061	2 737	108.5	106.7	107.3	106.0	104.4	103.0
Max.	64.39	136.964	2 737	108.8	107.6	107.8	106.4	105.0	103.9
Ave.	63.32	132.469	2 710	107.9	106.5	106.9	105.6	104.2	103.1
Min.	62.87	125.247	2 675	105.9	104.8	105.4	104.3	103.1	102.2
Med.	63.18	133.664	2 710	108.1	106.8	107.1	105.7	104.5	103.1
Std.	0.40	3.624	15	0.7	0.7	0.6	0.6	0.6	0.5



[CHROMATICITY SHIFT]

No.	u'	v'	Chromaticity Shift					
	0 h		1 000 h	2 000 h	3 000 h	4 000 h	5 000 h	6 000 h
1	0.263 0	0.522 3	0.000 4	0.000 2	0.000 2	0.000 5	0.001 0	0.001 4
2	0.263 2	0.520 9	0.001 2	0.001 1	0.000 9	0.001 0	0.000 9	0.000 5
3	0.262 7	0.521 2	0.001 6	0.001 3	0.001 1	0.001 0	0.000 9	0.000 5
4	0.262 9	0.520 6	0.001 5	0.001 2	0.001 2	0.001 1	0.001 0	0.000 6
5	0.264 0	0.521 5	0.000 9	0.000 8	0.000 9	0.000 9	0.000 8	0.000 5
6	0.263 0	0.522 3	0.001 9	0.001 7	0.001 7	0.001 4	0.001 1	0.000 6
7	0.264 4	0.523 6	0.001 5	0.001 3	0.001 3	0.001 0	0.000 9	0.000 5
8	0.263 4	0.522 2	0.001 7	0.001 6	0.001 5	0.001 1	0.001 0	0.000 6
9	0.263 0	0.522 0	0.001 7	0.001 4	0.001 3	0.001 4	0.001 1	0.000 6
10	0.262 8	0.520 1	0.001 7	0.001 5	0.001 4	0.001 2	0.001 0	0.000 5
11	0.263 4	0.523 0	0.001 6	0.001 3	0.001 3	0.001 3	0.001 0	0.000 5
12	0.263 6	0.522 9	0.001 6	0.001 3	0.001 3	0.001 2	0.001 0	0.000 5
13	0.263 1	0.521 0	0.001 4	0.001 2	0.001 1	0.001 0	0.000 9	0.000 5
14	0.263 5	0.522 8	0.001 9	0.001 8	0.001 5	0.001 4	0.001 1	0.000 6
15	0.262 1	0.521 5	0.001 9	0.001 8	0.001 7	0.001 4	0.001 3	0.000 5
16	0.263 1	0.522 2	0.001 7	0.001 6	0.001 5	0.001 3	0.001 1	0.000 5
17	0.262 7	0.522 9	0.002 0	0.001 8	0.001 6	0.001 5	0.001 1	0.000 7
18	0.263 0	0.522 5	0.001 8	0.001 7	0.001 7	0.001 3	0.001 2	0.000 6
19	0.262 4	0.521 7	0.001 7	0.001 6	0.001 5	0.001 3	0.001 1	0.000 6
20	0.261 9	0.521 6	0.001 8	0.001 6	0.001 5	0.001 4	0.001 1	0.000 5
Max.	0.264 4	0.523 6	0.002 0	0.001 8	0.001 7	0.001 5	0.001 3	0.001 4
Ave.	0.263 1	0.521 9	0.001 6	0.001 4	0.001 3	0.001 2	0.001 0	0.000 6
Min.	0.261 9	0.520 1	0.000 4	0.000 2	0.000 2	0.000 5	0.000 8	0.000 5
Med.	0.263 0	0.522 1	0.001 7	0.001 4	0.001 4	0.001 2	0.001 0	0.000 5
Std.	0.000 6	0.000 9	0.000 4	0.000 4	0.000 3	0.000 2	0.000 1	0.000 2



SEOUL SEMICONDUCTOR

4. Revision History

Revision No.	Revision Date	Contents
01	Jul. 15, 2016	First Issued at test duration 6 000 h