IES LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Shenzhen Refond Optoelectronic Co.,Ltd.

6th wing, 2nd block of Baiwangxin Industry Park , Songbai Road , Nanshan District, Shenzhen, China

Model: RF-WMMI30

Report Type: 6000 Hours Test Report	**Product Type:** LED Package
Test Engineer:	Daniel Duan
Report Number:	R2DG120619050-10
Test Date:	2012-6-26 to 2013-03-03
Report Date:	2013-03-29
Reviewed By:	Jeanne Han /Safety Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China. Tel: +86-0769-86858888 Fax:+86-0769-86858588

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1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number: RF-WMMI30
Part Name: /
Part Type: LED Package
Nominal CCT: 6500K

1.2 Standards Used:

- IESNA LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

1.3 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan). is located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.

1.4 Description of Auxiliary Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Integral Sphere	EVERFINE	Diameter 0.3M	1011119	380-780nm, length:0.3M ,0-1999LUMEN	2012-03-08	2013-03-08
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2012-03-02	2013-03-02
Standard Light Source	EVERFINE	D062	1011064	N/A	2012-03-15	2013-03-15
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2012-03-08	2013-03-08

1.5 Operating Cycle

Samples are driven with a constant direct current (DC)

1.6 Ambient Conditions

For lumen maintenance test, samples were operated in thermal chambers with minimal ambient airflow. For long term reliability test, the case temperature was controlled by mounting several thermocouples on a sample reliability stress board at the designated thermal measurement point, as shown in APPENDIX. The ambient temperature T_A was measured by several thermocouples at a distance of 5 mm above the reliability test board. The relative humidity within chamber was less than 65%.

For photometry measurement, temperature was set to 25℃ ±2℃, RH <65%.

1.7 Photometry 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. This calibration results traceable to the NATIONAL INSTITUTE OF METROLOGY (NIM).

1.8 Sample Set

Data Set 1: 45℃, 30mA	
Part Number:	RF-WMMI30
Number of Units:	25
Actual Case Temperature(T_S):	T_S =44.6℃
Actual Ambient Temperature(T_A):	T_A =41.2℃
Life Test Drive Current:	I_F = 30mA
Measurement Current:	I_F = 30mA

Data Set 2: 55℃, 30mA	
Part Number:	RF-WMMI30
Number of Units:	25
Actual Case Temperature(T_S):	T_S =54.3℃
Actual Ambient Temperature(T_A):	T_A =51.5℃
Life Test Drive Current:	I_F = 30mA
Measurement Current:	I_F =30mA

Data Set 3: 85℃, 30mA	
Part Number:	RF-WMMI30
Number of Units:	25
Actual Case Temperature(T_S):	T_S =84.5℃
Actual Ambient Temperature(T_A):	T_A =81.3℃
Life Test Drive Current:	I_F = 30mA
Measurement Current:	I_F =30mA

2 - SUMMARY OF TEST RESULT

Data Set:	**Data Set 1, 45℃, 30mA**
Number of Units:	25
Failures Observed:	0
Average. Lumen Maintenance at 6000 hours:	96.18%
Average Chromaticity Shift at 6000 hours (Δu'v'):	0.0012
Reported TM-21 L_{70} Lifetime:	>36,000 hours

Data Set:	**Data Set 2, 55℃, 30mA**
Number of Units:	25
Failures Observed:	0
Average. Lumen Maintenance at 6000 hours:	95.75%
Average Chromaticity Shift at 6000 hours(Δu'v'):	0.0013
Reported TM-21 L_{70} Lifetime	>36,000 hours

Data Set:	**Data Set 2, 85℃, 30mA**
Number of Units:	25
Failures Observed:	0
Average. Lumen Maintenance at 6000 hours:	94.89%
Average Chromaticity Shift at 6000 hours(Δu'v'):	0.0013
Reported TM-21 L_{70} Lifetime	35,000 hours

3 - Test Data

3.1 Data Set 1, 45℃, 30mA (Lumen Maintenance)

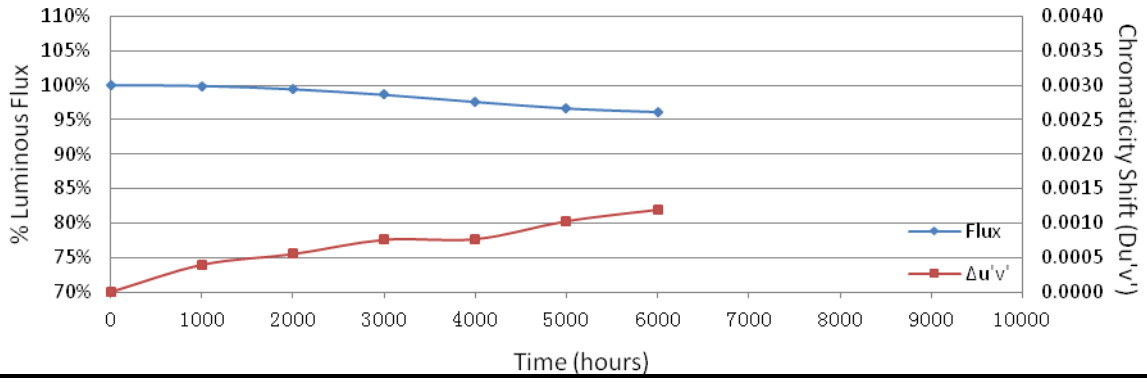
No.	V_F(V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	2.853	12.000	99.92	99.50	98.83	97.75	96.67	96.08
2	2.856	11.990	99.83	99.33	98.67	97.66	96.75	96.16
3	2.849	12.130	100.00	99.59	98.76	97.53	96.78	96.21
4	2.838	11.850	99.92	99.49	98.57	97.55	96.79	96.12
5	2.844	12.060	99.83	99.34	98.59	97.51	96.60	96.02
6	2.852	12.070	99.83	99.25	98.43	97.68	96.85	96.52
7	2.843	12.140	99.84	99.34	98.43	97.45	96.62	95.96
8	2.849	12.070	100.00	99.50	98.51	97.43	96.52	96.11
9	2.856	12.130	99.84	99.42	98.68	97.61	96.70	96.13
10	2.848	12.180	99.92	99.59	98.60	97.78	96.63	96.31
11	2.845	12.200	99.92	99.43	98.44	97.54	96.56	95.90
12	2.838	12.150	100.08	99.51	98.68	97.70	96.79	96.30
13	2.850	12.000	99.83	99.25	98.42	97.50	96.67	96.17
14	2.849	12.170	99.92	99.34	98.69	97.45	96.47	96.06
15	2.838	11.950	99.83	99.25	98.66	97.41	96.57	96.40
16	2.848	12.030	99.83	99.09	98.42	97.42	96.67	96.18
17	2.841	12.370	99.84	99.43	98.71	97.66	96.85	96.36
18	2.861	11.780	99.92	99.58	98.73	97.79	96.94	96.43
19	2.854	12.110	99.83	99.42	98.60	97.77	96.53	96.04
20	2.851	11.990	99.92	99.58	98.83	97.83	96.83	96.41
21	2.847	12.070	99.92	99.34	98.76	97.93	96.77	96.27
22	2.842	11.910	99.83	99.24	98.49	97.57	96.81	96.14
23	2.849	12.170	100.08	99.59	98.85	97.62	96.63	96.14
24	2.850	12.130	99.84	99.42	98.60	97.86	96.78	96.13
25	2.859	11.730	99.91	99.49	98.72	97.61	96.59	96.08
Ave.	2.848	12.055	99.90	99.41	98.63	97.62	96.70	96.18
Med.	2.849	12.070	99.91	99.42	98.66	97.61	96.67	96.14
st dev	0.0063	0.1399	0.0765	0.1336	0.1363	0.1487	0.1231	0.1555
Min.	2.838	11.730	99.83	99.09	98.42	97.41	96.47	95.90
Max.	2.861	12.370	100.08	99.59	98.85	97.93	96.94	96.52

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
α: 8.084E-06
β: 1.009
Calculated L_{70}: 45,000 hours
Reported L_{70}: >36,000 hours

3.2 Data Set 1, 45 ℃, 30mA (Chromaticity Shift)

No.	u'	v'	Chromaticity Shift (Δu'v')					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2040	0.4612	0.0006	0.0007	0.0009	0.0010	0.0010	0.0008
2	0.2034	0.4618	0.0008	0.0004	0.0006	0.0009	0.0013	0.0009
3	0.2040	0.4614	0.0003	0.0004	0.0010	0.0007	0.0009	0.0009
4	0.2038	0.4627	0.0004	0.0008	0.0005	0.0006	0.0007	0.0010
5	0.2036	0.4645	0.0005	0.0003	0.0008	0.0008	0.0011	0.0016
6	0.2038	0.4616	0.0002	0.0009	0.0004	0.0008	0.0010	0.0008
7	0.2034	0.4631	0.0007	0.0010	0.0009	0.0007	0.0010	0.0012
8	0.2037	0.4639	0.0006	0.0002	0.0006	0.0007	0.0008	0.0014
9	0.2035	0.4658	0.0007	0.0002	0.0006	0.0006	0.0009	0.0011
10	0.2031	0.4642	0.0005	0.0002	0.0009	0.0009	0.0009	0.0006
11	0.2036	0.4626	0.0004	0.0010	0.0005	0.0002	0.0009	0.0012
12	0.2030	0.4650	0.0003	0.0003	0.0009	0.0010	0.0012	0.0017
13	0.2041	0.4588	0.0006	0.0003	0.0010	0.0011	0.0012	0.0007
14	0.2038	0.4657	0.0004	0.0007	0.0008	0.0004	0.0008	0.0015
15	0.2035	0.4606	0.0002	0.0004	0.0007	0.0012	0.0013	0.0008
16	0.2037	0.4634	0.0002	0.0005	0.0009	0.0009	0.0011	0.0018
17	0.2031	0.4657	0.0004	0.0006	0.0010	0.0004	0.0011	0.0016
18	0.2038	0.4612	0.0003	0.0006	0.0004	0.0004	0.0006	0.0011
19	0.2039	0.4622	0.0001	0.0008	0.0008	0.0009	0.0014	0.0016
20	0.2041	0.4568	0.0002	0.0008	0.0004	0.0011	0.0014	0.0020
21	0.2032	0.4645	0.0006	0.0003	0.0006	0.0010	0.0010	0.0013
22	0.2033	0.4641	0.0003	0.0006	0.0008	0.0009	0.0010	0.0009
23	0.2038	0.4629	0.0001	0.0007	0.0010	0.0006	0.0011	0.0014
24	0.2033	0.4641	0.0004	0.0006	0.0009	0.0009	0.0014	0.0013
25	0.2036	0.4604	0.0000	0.0004	0.0010	0.0005	0.0007	0.0008
Ave.	0.2036	0.4627	0.0004	0.0006	0.0008	0.0008	0.0010	0.0012
Med.	0.2036	0.4629	0.0004	0.0006	0.0008	0.0008	0.0010	0.0012
st dev	0.0003	0.0022	0.0002	0.0003	0.0002	0.0003	0.0002	0.0004
Min.	0.2030	0.4568	0.0000	0.0002	0.0004	0.0002	0.0006	0.0006
Max.	0.2041	0.4658	0.0008	0.0010	0.0010	0.0012	0.0014	0.0020



3.3 Data Set 2, 55℃, 30mA (Lumen Maintenance)

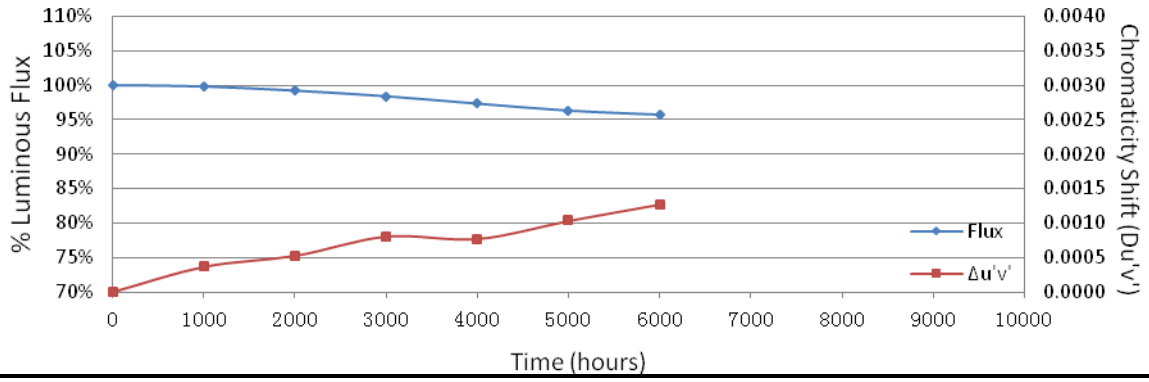
No.	V_F(V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	2.857	11.940	99.92	99.25	98.32	97.57	96.40	96.06
2	2.854	12.110	99.92	99.26	98.10	97.03	96.20	95.71
3	2.844	12.310	99.84	99.03	98.13	97.40	96.51	95.94
4	2.856	11.920	99.83	99.08	98.15	97.23	96.31	95.64
5	2.840	11.620	99.66	99.05	98.19	97.16	96.13	95.52
6	2.855	11.690	99.74	99.23	98.46	97.52	96.66	95.89
7	2.856	11.890	99.66	99.16	98.57	97.39	96.30	95.46
8	2.852	12.250	99.92	99.35	98.53	97.39	96.33	95.67
9	2.857	11.740	99.83	99.32	98.38	97.10	96.17	95.66
10	2.841	12.060	99.75	99.09	98.51	97.43	96.43	95.77
11	2.844	12.140	99.84	99.26	98.52	97.53	96.46	95.55
12	2.847	12.210	99.75	99.18	98.53	97.54	96.56	95.99
13	2.856	11.840	99.92	99.24	98.48	97.13	96.20	95.52
14	2.858	12.190	99.75	99.10	98.44	97.13	96.23	95.73
15	2.839	11.760	99.74	99.23	98.55	97.19	96.17	95.66
16	2.850	11.810	99.92	99.32	98.56	97.46	96.53	95.85
17	2.852	11.980	99.83	99.25	98.41	97.33	96.08	95.74
18	2.851	11.930	99.83	99.16	98.49	97.49	96.23	95.64
19	2.857	11.910	99.92	99.33	98.57	97.48	96.56	95.89
20	2.844	12.100	99.75	99.01	98.18	97.27	96.12	95.70
21	2.849	12.080	99.83	99.34	98.43	97.52	96.44	96.03
22	2.861	11.730	99.91	99.23	98.38	97.44	96.68	96.08
23	2.858	12.010	99.92	99.33	98.42	97.34	96.42	95.84
24	2.841	12.020	99.75	99.25	98.50	97.17	96.17	95.59
25	2.845	12.260	99.92	99.35	98.45	97.55	96.49	95.68
Ave.	2.851	11.980	99.83	99.22	98.41	97.35	96.35	95.75
Med.	2.852	11.980	99.83	99.24	98.45	97.39	96.33	95.71
st dev	0.0067	0.1920	0.0842	0.1058	0.1467	0.1658	0.1776	0.1755
Min.	2.839	11.620	99.66	99.01	98.10	97.03	96.08	95.46
Max.	2.861	12.310	99.92	99.35	98.57	97.57	96.68	96.08

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
α: 8.786E-06
β: 1.009
Calculated L_{70}: 42,000 hours
Reported L_{70}: >36,000 hours

3.4 Data Set 2, 55℃, 30mA (Chromaticity Shift)

No.	u'	v'	Chromaticity Shift (Δu'v')					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2044	0.4603	0.0004	0.0002	0.0010	0.0007	0.0011	0.0012
2	0.2036	0.4613	0.0001	0.0006	0.0003	0.0006	0.0011	0.0011
3	0.2031	0.4646	0.0002	0.0003	0.0012	0.0011	0.0013	0.0018
4	0.2040	0.4619	0.0003	0.0005	0.0011	0.0004	0.0006	0.0010
5	0.2037	0.4613	0.0008	0.0008	0.0009	0.0008	0.0011	0.0012
6	0.2046	0.4563	0.0003	0.0003	0.0011	0.0006	0.0007	0.0009
7	0.2038	0.4610	0.0006	0.0006	0.0007	0.0009	0.0010	0.0013
8	0.2036	0.4644	0.0001	0.0006	0.0008	0.0008	0.0012	0.0017
9	0.2045	0.4589	0.0004	0.0008	0.0011	0.0004	0.0010	0.0013
10	0.2038	0.4635	0.0006	0.0003	0.0010	0.0006	0.0012	0.0017
11	0.2032	0.4630	0.0003	0.0007	0.0004	0.0008	0.0013	0.0015
12	0.2037	0.4619	0.0002	0.0007	0.0006	0.0010	0.0012	0.0014
13	0.2046	0.4589	0.0004	0.0007	0.0008	0.0007	0.0009	0.0011
14	0.2040	0.4629	0.0004	0.0006	0.0006	0.0007	0.0008	0.0009
15	0.2039	0.4617	0.0002	0.0002	0.0008	0.0004	0.0006	0.0009
16	0.2043	0.4621	0.0001	0.0001	0.0004	0.0011	0.0012	0.0013
17	0.2040	0.4598	0.0003	0.0001	0.0006	0.0010	0.0010	0.0014
18	0.2038	0.4634	0.0004	0.0006	0.0009	0.0013	0.0015	0.0018
19	0.2043	0.4600	0.0003	0.0004	0.0010	0.0005	0.0009	0.0010
20	0.2035	0.4610	0.0002	0.0009	0.0013	0.0008	0.0011	0.0011
21	0.2038	0.4597	0.0004	0.0006	0.0011	0.0017	0.0019	0.0021
22	0.2035	0.4616	0.0004	0.0002	0.0006	0.0006	0.0007	0.0010
23	0.2035	0.4615	0.0006	0.0011	0.0005	0.0005	0.0006	0.0009
24	0.2035	0.4612	0.0006	0.0006	0.0004	0.0005	0.0009	0.0011
25	0.2034	0.4644	0.0003	0.0004	0.0009	0.0007	0.0009	0.0011
Ave.	0.2038	0.4615	0.0004	0.0005	0.0008	0.0008	0.0010	0.0013
Med.	0.2038	0.4615	0.0003	0.0006	0.0008	0.0007	0.0010	0.0012
st dev	0.0004	0.0019	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003
Min.	0.2031	0.4563	0.0001	0.0001	0.0003	0.0004	0.0006	0.0009
Max.	0.2046	0.4646	0.0008	0.0011	0.0013	0.0017	0.0019	0.0021



3.5 Data Set 3, 85℃, 30mA (Lumen Maintenance)

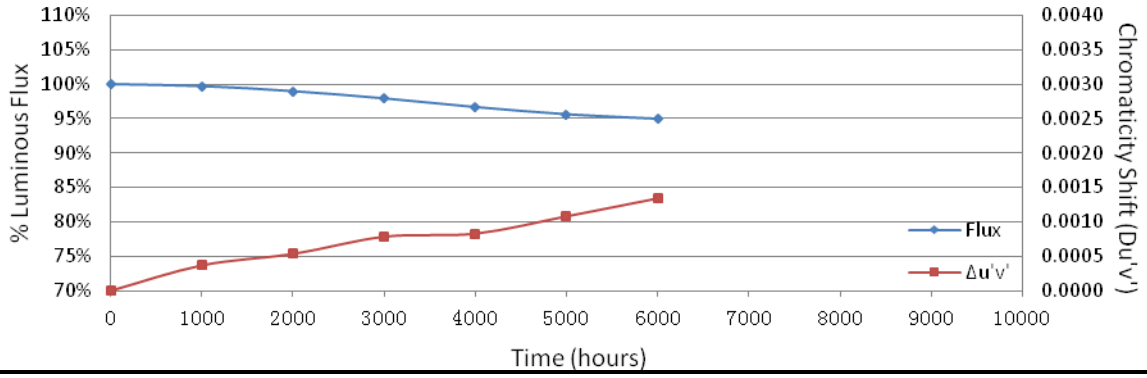
No.	V_F(V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	2.857	11.730	99.66	98.89	98.04	96.76	95.74	94.97
2	2.844	12.320	99.76	98.94	97.81	96.75	95.54	95.05
3	2.845	12.200	99.59	98.93	98.03	96.89	95.74	95.25
4	2.844	11.880	99.49	98.82	97.73	96.55	95.45	94.61
5	2.857	12.070	99.83	99.17	98.09	96.52	95.53	94.70
6	2.853	11.740	99.74	98.98	98.13	96.59	95.66	95.06
7	2.857	11.960	99.58	99.00	98.08	96.82	95.82	94.73
8	2.847	12.070	99.42	98.84	97.68	96.44	95.44	94.78
9	2.850	11.780	99.49	98.81	97.79	96.60	95.33	94.99
10	2.842	11.840	99.83	99.16	98.06	96.71	95.69	95.02
11	2.850	12.150	99.67	98.93	98.02	96.71	95.56	94.90
12	2.850	12.000	99.75	99.08	98.00	96.58	95.75	94.75
13	2.841	12.230	99.84	99.18	98.04	96.81	95.67	94.85
14	2.855	12.180	99.75	98.93	97.87	96.72	95.65	94.99
15	2.855	11.880	99.75	98.91	97.73	96.46	95.62	94.87
16	2.839	12.380	99.76	99.03	97.74	96.53	95.40	94.83
17	2.858	11.930	99.92	99.08	97.99	96.48	95.31	94.80
18	2.846	11.710	99.74	98.80	97.69	96.67	95.30	95.05
19	2.850	11.740	99.74	98.89	97.79	96.51	95.32	94.72
20	2.852	11.980	99.67	99.00	97.83	96.58	95.58	94.82
21	2.857	11.910	99.83	98.91	97.98	96.56	95.55	94.96
22	2.849	12.170	99.84	99.01	97.86	96.55	95.23	94.74
23	2.850	12.170	99.75	98.85	97.95	96.71	95.56	94.82
24	2.850	11.970	99.75	99.08	97.83	96.49	95.66	94.82
25	2.849	11.740	99.66	98.98	97.70	96.68	95.74	95.14
Ave.	2.850	11.989	99.71	98.97	97.90	96.63	95.55	94.89
Med.	2.850	11.970	99.75	98.94	97.87	96.59	95.56	94.85
st dev	0.0054	0.1977	0.1213	0.1109	0.1451	0.1236	0.1658	0.1537
Min.	2.839	11.710	99.42	98.80	97.68	96.44	95.23	94.61
Max.	2.858	12.380	99.92	99.18	98.13	96.89	95.82	95.25

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
α: 1.047E-05
β: 1.009
Calculated L_{70}: 35,000 hours
Reported L_{70}: 35,000 hours

3.6 Data Set 3, 85℃, 30mA (Chromaticity Shift)

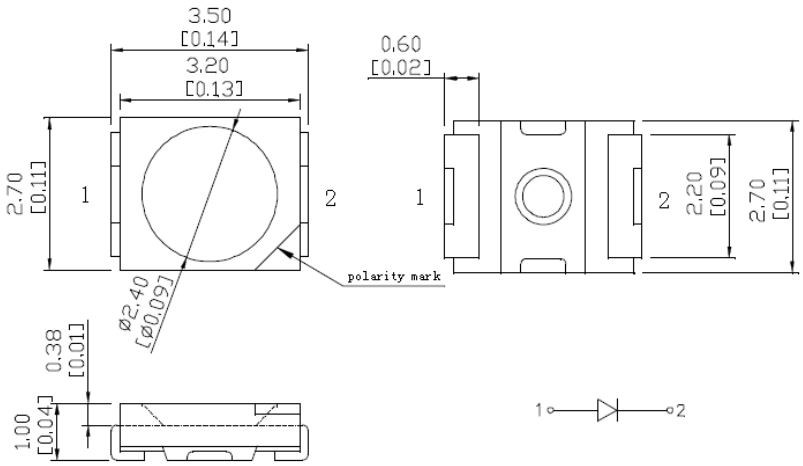
No.	u'	v'	Chromaticity Shift (Δu'v')					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2035	0.4633	0.0004	0.0004	0.0010	0.0006	0.0009	0.0010
2	0.2033	0.4625	0.0004	0.0006	0.0004	0.0006	0.0009	0.0010
3	0.2035	0.4625	0.0001	0.0009	0.0007	0.0007	0.0010	0.0011
4	0.2038	0.4614	0.0001	0.0002	0.0008	0.0008	0.0009	0.0012
5	0.2044	0.4619	0.0005	0.0006	0.0004	0.0006	0.0012	0.0012
6	0.2035	0.4603	0.0004	0.0002	0.0007	0.0009	0.0012	0.0013
7	0.2043	0.4609	0.0003	0.0008	0.0007	0.0004	0.0006	0.0010
8	0.2039	0.4621	0.0004	0.0005	0.0011	0.0008	0.0013	0.0014
9	0.2047	0.4578	0.0003	0.0003	0.0010	0.0009	0.0011	0.0014
10	0.2036	0.4623	0.0004	0.0006	0.0013	0.0012	0.0014	0.0015
11	0.2037	0.4630	0.0007	0.0003	0.0005	0.0009	0.0011	0.0015
12	0.2039	0.4593	0.0002	0.0009	0.0009	0.0013	0.0013	0.0013
13	0.2035	0.4646	0.0004	0.0007	0.0004	0.0009	0.0011	0.0014
14	0.2035	0.4623	0.0004	0.0004	0.0013	0.0004	0.0012	0.0016
15	0.2043	0.4580	0.0003	0.0002	0.0008	0.0013	0.0013	0.0013
16	0.2030	0.4657	0.0006	0.0007	0.0009	0.0009	0.0010	0.0017
17	0.2043	0.4621	0.0003	0.0001	0.0008	0.0009	0.0009	0.0013
18	0.2049	0.4576	0.0001	0.0008	0.0006	0.0010	0.0015	0.0018
19	0.2042	0.4596	0.0003	0.0008	0.0006	0.0009	0.0010	0.0013
20	0.2038	0.4601	0.0005	0.0002	0.0011	0.0010	0.0011	0.0015
21	0.2039	0.4617	0.0003	0.0003	0.0004	0.0006	0.0007	0.0012
22	0.2035	0.4617	0.0007	0.0007	0.0006	0.0007	0.0009	0.0010
23	0.2034	0.4649	0.0003	0.0007	0.0004	0.0008	0.0011	0.0015
24	0.2040	0.4609	0.0000	0.0006	0.0012	0.0006	0.0012	0.0013
25	0.2046	0.4574	0.0005	0.0006	0.0010	0.0007	0.0010	0.0014
Ave.	0.2039	0.4614	0.0004	0.0005	0.0008	0.0008	0.0011	0.0013
Med.	0.2038	0.4617	0.0004	0.0006	0.0008	0.0008	0.0011	0.0013
st dev	0.0005	0.0022	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002
Min.	0.2030	0.4574	0.0000	0.0001	0.0004	0.0004	0.0006	0.0010
Max.	0.2049	0.4657	0.0007	0.0009	0.0013	0.0013	0.0015	0.0018



Appendix A – EUT PHOTO

A.1 Mechanical Dimensions (Ta = 25℃)

Unit: mm



A.2 EUT Photo

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