IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Hongli Zhihui Group Co.,Ltd. Guangzhou Branch

Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

Model:HL-LT005F33W-100B10C10(Ra2)

Report Type: 7000 Hours Test Report	**Product Type:** LED Array
Test Engineer:	Daniel Duan
Report Number:	RSZ131101510-10-M3
Test Date:	2013-11-05 to 2014-09-15
Report Date:	2019-01-12
Revised Note:	The previous report RSZ131101510-10-M2 is replaced by this report on 2019-01-12
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1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number:	HL-LT005F33W-100B10C10(Ra2)
Part Type:	LED Array
Nominal CCT:	3000K
Power:	108.94W
Average Current Density per LED die:	267.90mA/mm^2
Average Power Density per LED die:	0.8274 W/mm^2
CRI:	80
Die Spacing:	0.88mm

Family products covered by this report:

According to ENERGY STAR® Requirements for the Use of LM-80 Data, the following products can be covered by this report base on the information and declaration provided by manufacturer. The information of these models shows that the covered products meet all section 4 requirements of ENERGY STAR® Requirements for the Use of LM-80 Data (September 28, 2017)

This report covers the following models:

Model name	CCT(typ.)	CRI (typ.)	Series	Parallel	Power intensity(W/mm^2)	Dies Spacing (mm)	Current(A)
HL-LT005F33W-100B10C10(Ra2)	3000K	80	10	10	0.0571	0.88	3.5
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F33W-100B10C10(Ra1)	3000K	70	10	10	0.0571	0.88	3.5
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F22W-100B10C10(Ra1)	3000K	70	10	10	0.0571	0.88	3.5
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F22W-	3000K	80	10	10	0.0571	0.88	3.5

Model name	CCT(typ.)	CRI (typ.)	Series	Parallel	Power intensity(W/mm^2)	Dies Spacing (mm)	Current(A)
100B10C10(Ra2)	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F38W-100B10C10(Ra1)	3000K	70	10	10	0.0571	0.88	3.5
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F38W-100B10C10(Ra2)	3000K	80	10	10	0.0571	0.88	3.5
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F45W-100B10C10(Ra1)	3000K	70	10	10	0.0571	1.185	3.5
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F45W-100B10C10(Ra2)	3000K	80	10	10	0.0571	1.185	3.5
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F33W-70B7C10(Ra1)	3000K	70	10	7	0.0408	0.88	2.45
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F33W-70B7C10(Ra2)	3000K	80	10	7	0.0408	1.185	2.45
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F22W-70B7C10(Ra1)	3000K	70	10	7	0.0408	1.185	2.45
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F22W-	3000K	80	10	7	0.0408	1.185	2.45

Model name	CCT(typ.)	CRI (typ.)	Series	Parallel	Power intensity(W/mm^2)	Dies Spacing (mm)	Current(A)
70B7C10(Ra2)	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F38W-70B7C10(Ra1)	3000K	70	10	7	0.0408	1.185	2.45
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F38W-70B7C10(Ra2)	3000K	80	10	7	0.0408	1.185	2.45
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F45W-70B7C10(Ra1)	3000K	70	10	7	0.0408	1.185	2.45
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F45W-70B7C10(Ra2)	3000K	80	10	7	0.0408	1.185	2.45
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F33W-50B5C10(Ra1)	3000K	70	10	5	0.0293	1.185	1.75
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F33W-50B5C10(Ra2)	3000K	80	10	5	0.0293	1.185	1.75
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F22W-50B5C10(Ra1)	3000K	70	10	5	0.0293	1.185	1.75
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F22W-	3000K	80	10	5	0.0293	1.185	1.75

Model name	CCT(typ.)	CRI (typ.)	Series	Parallel	Power intensity(W/mm^2)	Dies Spacing (mm)	Current(A)
50B5C10(Ra2)	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F38W-50B5C10(Ra1)	3000K	70	10	5	0.0293	1.185	1.75
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F38W-50B5C10(Ra2)	3000K	80	10	5	0.0293	1.185	1.75
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F45W-50B5C10(Ra1)	3000K	70	10	5	0.0293	1.185	1.75
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F45W-50B5C10(Ra2)	3000K	80	10	5	0.0293	1.185	1.75
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F33W-40B4C10(Ra1)	3000K	70	10	4	0.0234	1.185	1.4
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F33W-40B4C10(Ra2)	3000K	80	10	4	0.0234	1.185	1.4
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F22W-40B4C10(Ra1)	3000K	70	10	4	0.0234	1.185	1.4
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F22W-	3000K	80	10	4	0.0234	1.185	1.4

Model name	CCT(typ.)	CRI (typ.)	Series	Parallel	Power intensity(W/mm^2)	Dies Spacing (mm)	Current(A)
40B4C10(Ra2)	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F38W-40B4C10(Ra1)	3000K	70	10	4	0.0234	1.185	1.4
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F38W-40B4C10(Ra2)	3000K	80	10	4	0.0234	1.185	1.4
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F45W-40B4C10(Ra1)	3000K	70	10	4	0.0234	1.185	1.4
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F45W-40B4C10(Ra2)	3000K	80	10	4	0.0234	1.185	1.4
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F33W-30B3C10(Ra1)	3000K	70	10	3	0.0174	0.88	1.05
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F33W-30B3C10(Ra2)	3000K	80	10	3	0.0174	1.185	1.05
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F22W-30B3C10(Ra1)	3000K	70	10	3	0.0174	0.88	1.05
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F22W-	3000K	80	10	3	0.0174	1.185	1.05

Model name	CCT(typ.)	CRI (typ.)	Series	Parallel	Power intensity(W/mm^2)	Dies Spacing (mm)	Current(A)
30B3C10(Ra2)	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F38W-30B3C10(Ra1)	3000K	70	10	3	0.0174	0.88	1.05
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F38W-30B3C10(Ra2)	3000K	80	10	3	0.0174	1.185	1.05
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F45W-30B3C10(Ra1)	3000K	70	10	3	0.0174	1.185	1.05
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F45W-30B3C10(Ra2)	3000K	80	10	3	0.0174	1.185	1.05
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F33W-20B2C10(Ra1)	3000K	70	10	2	0.0114	1.185	0.7
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F33W-20B2C10(Ra2)	3000K	80	10	2	0.0114	1.185	0.7
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F22W-20B2C10(Ra1)	3000K	70	10	2	0.0114	1.185	0.7
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F22W-	3000K	80	10	2	0.0114	1.185	0.7

Model name	CCT(typ.)	CRI (typ.)	Series	Parallel	Power intensity(W/mm^2)	Dies Spacing (mm)	Current(A)
20B2C10(Ra2)	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F38W-20B2C10(Ra1)	3000K	70	10	2	0.0114	1.185	0.7
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F38W-20B2C10(Ra2)	3000K	80	10	2	0.0114	1.185	0.7
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					
HL-LT005F45W-20B2C10(Ra1)	3000K	70	10	2	0.0114	1.185	0.7
	4000 K	70					
	5000 K	70					
	5700 K	70					
	6000 K	70					
	6500 K	70					
HL-LT005F45W-20B2C10(Ra2)	3000K	80	10	2	0.0114	1.185	0.7
	4000 K	80					
	5000 K	80					
	5700K	80					
	6000 K	80					
	6500 K	80					

The family models HL-LT005FXXW-XBXCX(RaX） and tested model HL-LT005F33W-100B10C10(Ra2) could meet all the requirements listed as below:

a. the tested model has been conducted on the largest LED array and have the largest per chip current;
b. the family models have the equal or fewer LED dies than the tested model;
c. die spacing greater than or equal to the tested model;
d. power density (i.e. W/mm^2 of PCB or substrate total area, or equivalent calculation) less than or equal to the tested model;
e. identical materials used (note: this does not constrain quantity and/or dimensional adjustments);
f. identical construction processes used;

1.2 Standards Used:

- IESNA LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by IAS)

1.3 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan). is located at No.69, Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

1.4 Description of Auxiliary Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	N/A	2013-03-08	2014-03-08
Standard Light Source	EVERFINE	D204	01331191	N/A	2013-12-04	2014-12-04
Precision digital stabilized DC power supply	EVERFINE	WY605	G115987C J7321114	300VA	2014-03-12	2015-03-12
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2013-12-26	2014-12-26
LM-80 High power full-automatic aging equipment	BACL	B3-900	20030	25℃~110℃	2014-3-13	2015-3-13
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090005	(50/15A)	2014-03-12	2015-03-12
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090009	(50/15A)	2014-03-12	2015-03-12
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090005	(50/15A)	2014-03-12	2015-03-12
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090003	(50/15A)	2014-03-12	2015-03-12
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090006	(50/15A)	2014-03-12	2015-03-12
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090007	(50/15A)	2014-03-12	2015-03-12

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

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.
Each Sample is soldered to all of the reliability stress boards for a given set of IESNA LM-80 tests.

Sample Size:
Total 30Pcs;
Each Ts test condition 15Pcs
The samples tested at T_S 85℃ and TS 100℃ were received at 2013-11-01 and tested during 2013-11-05 to 2014-09-15. The samples were numbered from 1to 15 and 16 to 30.

Data Set 1: 85°C,3500mA	
Part Number:	HL-LT005F33W-100B10C10(Ra2)
Number of Units:	15
Actual Case Temperature(T_S):	T_S =84.0℃
Actual Ambient Temperature(T_A):	T_A =82.6℃
Life Test Drive Current:	I_F =3500mA
Measurement Current:	I_F = 3500mA

Data Set 2: 100°C, 3500mA	
Part Number:	HL-LT005F33W-100B10C10(Ra2)
Number of Units:	15
Actual Case Temperature(T_S):	T_S =99.2℃
Actual Ambient Temperature(T_A):	T_A =98.1℃
Life Test Drive Current:	I_F = 3500mA
Measurement Current:	I_F = 3500mA

2 - SUMMARY OF TEST RESULT

Data Set:	**Data Set 1, 85°C, 3500mA**
Number of Units:	15
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h
Average. Lumen Maintenance at7000 hours:	96.63%
Average Chromaticity Shift at 7000 hours(Δu'v'):	0.0027
Reported TM-21 L_{70} Lifetime:	>39,000 hours

Data Set:	**Data Set 2, 100°C, 3500mA**
Number of Units:	15
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h
Average. Lumen Maintenance at 7000 hours:	95.76%
Average Chromaticity Shift at 7000 hours(Δu'v'):	0.0032
Reported TM-21 L_{70} Lifetime:	>39,000 hours

3 - Test Data

3.1 Data Set 1, 85°C, 3500mA (Lumen Maintenance)

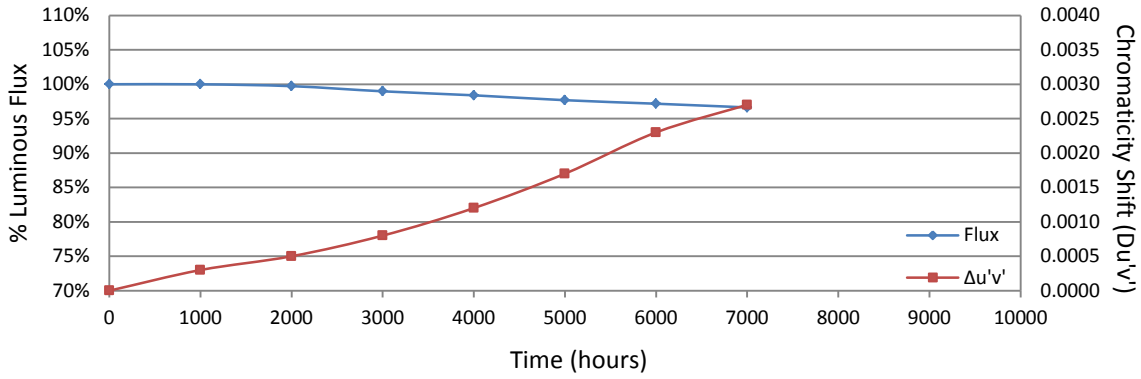
No.	V_F(V)	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	30.810	9891.40	100.08	99.79	99.04	98.40	97.60	97.00	96.51
2	30.820	9872.09	99.62	99.41	98.69	98.20	97.57	96.99	96.46
3	30.790	9881.74	99.69	99.46	98.70	98.13	97.46	96.98	96.35
4	30.920	9789.98	100.66	100.26	99.48	98.85	98.10	97.52	96.98
5	31.010	9727.19	99.98	99.75	99.02	98.58	97.89	97.44	97.05
6	30.820	9901.06	99.72	99.48	98.73	98.23	97.64	97.22	96.74
7	31.140	9683.72	99.52	99.31	98.55	97.99	97.24	96.71	96.11
8	30.880	9838.28	99.57	99.35	98.62	98.07	97.36	96.81	96.28
9	31.070	9698.21	99.67	99.41	98.64	98.00	97.26	96.74	96.17
10	31.030	9862.43	100.54	100.13	99.39	98.71	97.93	97.37	96.85
11	30.860	9954.19	100.16	99.96	99.19	98.55	97.89	97.35	96.87
12	30.760	9765.83	100.32	99.92	99.14	98.34	97.52	96.93	96.33
13	30.790	9780.32	100.39	100.17	99.43	98.96	98.38	97.98	97.48
14	30.750	9736.85	99.75	99.50	98.76	98.13	97.39	96.89	96.25
15	30.810	9789.98	100.11	99.86	99.11	98.72	97.94	97.56	97.08
Ave.	30.884	9811.55	99.99	99.72	98.97	98.39	97.68	97.17	96.63
Med.	30.820	9789.98	99.98	99.75	99.02	98.34	97.60	97.00	96.51
st dev	0.1223	81.2881	0.3711	0.3219	0.3170	0.3192	0.3319	0.3619	0.4051
Min.	30.750	9683.72	99.52	99.31	98.55	97.99	97.24	96.71	96.11
Max.	31.140	9954.19	100.66	100.26	99.48	98.96	98.38	97.98	97.48

TM-21 Projection:

Test Duration: 7000 hours
Failures Observed: 0
α: 6.277E-06
β: 1.009
Calculated L_{70}: 58,000hours
Reported L_{70}: >39,000hours

3.2 Data Set 1, 85°C, 3500mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')						
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	0.2505	0.5243	2984	0.0005	0.0009	0.0011	0.0017	0.0023	0.0026	0.0031
2	0.2495	0.5236	3012	0.0001	0.0003	0.0005	0.0009	0.0014	0.0020	0.0024
3	0.2489	0.5238	3026	0.0002	0.0006	0.0008	0.0013	0.0019	0.0025	0.0030
4	0.2499	0.5239	3000	0.0003	0.0004	0.0008	0.0012	0.0017	0.0023	0.0027
5	0.2493	0.5229	3022	0.0003	0.0002	0.0006	0.0011	0.0016	0.0021	0.0025
6	0.2489	0.5241	3024	0.0004	0.0004	0.0005	0.0010	0.0016	0.0019	0.0024
7	0.2502	0.5248	2988	0.0005	0.0007	0.0005	0.0004	0.0008	0.0011	0.0015
8	0.2483	0.5237	3042	0.0003	0.0004	0.0007	0.0012	0.0017	0.0022	0.0027
9	0.2497	0.5245	3000	0.0002	0.0003	0.0004	0.0007	0.0013	0.0019	0.0023
10	0.2505	0.5237	2986	0.0003	0.0006	0.0009	0.0015	0.0021	0.0028	0.0032
11	0.2493	0.5243	3012	0.0004	0.0009	0.0011	0.0017	0.0022	0.0028	0.0033
12	0.2487	0.5235	3032	0.0005	0.0009	0.0012	0.0016	0.0022	0.0026	0.0031
13	0.2487	0.5225	3038	0.0001	0.0003	0.0008	0.0013	0.0019	0.0026	0.0030
14	0.2499	0.5244	2996	0.0003	0.0004	0.0008	0.0013	0.0018	0.0022	0.0027
15	0.2510	0.5239	2974	0.0002	0.0004	0.0006	0.0012	0.0017	0.0022	0.0027
Ave.	0.2496	0.5239	3009	0.0003	0.0005	0.0008	0.0012	0.0017	0.0023	0.0027
Med.	0.2495	0.5239	3012	0.0003	0.0004	0.0008	0.0012	0.0017	0.0022	0.0027
st dev	0.0008	0.0006	21.2316	0.0001	0.0002	0.0002	0.0004	0.0004	0.0005	0.0005
Min.	0.2483	0.5225	2974	0.0001	0.0002	0.0004	0.0004	0.0008	0.0011	0.0015
Max.	0.2510	0.5248	3042	0.0005	0.0009	0.0012	0.0017	0.0023	0.0028	0.0033



3.3 Data Set 2, 100°C, 3500mA (Lumen Maintenance)

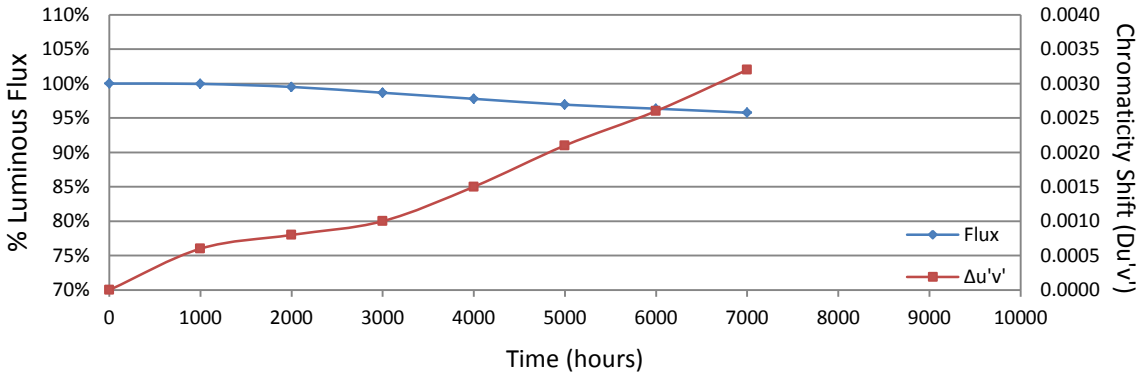
No.	V_F(V)	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
16	30.780	9780.32	99.31	98.88	98.02	97.34	96.42	95.79	95.15
17	31.020	9688.55	100.05	99.63	98.79	98.16	97.32	96.85	96.37
18	30.860	9751.34	99.98	99.57	98.73	97.99	97.16	96.62	96.10
19	30.900	9785.15	99.95	99.51	98.65	97.66	96.71	96.16	95.56
20	30.930	9775.49	99.76	99.32	98.48	97.59	96.71	96.09	95.46
21	30.810	9809.30	100.92	100.51	99.65	98.81	97.94	97.27	96.66
22	31.020	9674.06	99.75	99.33	98.44	97.79	97.02	96.56	95.99
23	31.090	9693.38	99.53	99.10	98.26	97.67	96.95	96.49	95.91
24	30.680	9905.89	99.32	98.91	98.05	97.36	96.62	96.04	95.35
25	30.950	9712.70	100.08	99.66	98.76	97.73	96.80	96.13	95.53
26	30.920	9765.83	100.11	99.68	98.82	97.83	96.88	96.20	95.57
27	30.840	9789.98	99.88	99.38	98.53	97.44	96.48	95.84	95.21
28	30.840	9852.77	100.34	99.91	99.05	97.96	97.23	96.76	96.23
29	31.150	9659.57	100.37	99.96	99.09	97.99	97.14	96.53	95.95
30	30.800	9876.91	99.84	99.35	98.51	97.43	96.51	95.89	95.30
Ave.	31.080	9712.70	99.95	99.51	98.66	97.78	96.93	96.35	95.76
Med.	30.820	9804.47	99.95	99.51	98.65	97.73	96.88	96.20	95.57
st dev	30.840	9756.17	0.4137	0.4196	0.4163	0.3785	0.3985	0.4219	0.4550
Min.	30.810	9761.00	99.31	98.88	98.02	97.34	96.42	95.79	95.15
Max.	31.010	9664.40	100.92	100.51	99.65	98.81	97.94	97.27	96.66

TM-21 Projection:

Test Duration: 7000 hours
Failures Observed: 0
α: 7.768E-06
β: 1.010
Calculated L_{70}: 47,000hours
Reported L_{70}: >39,000hours

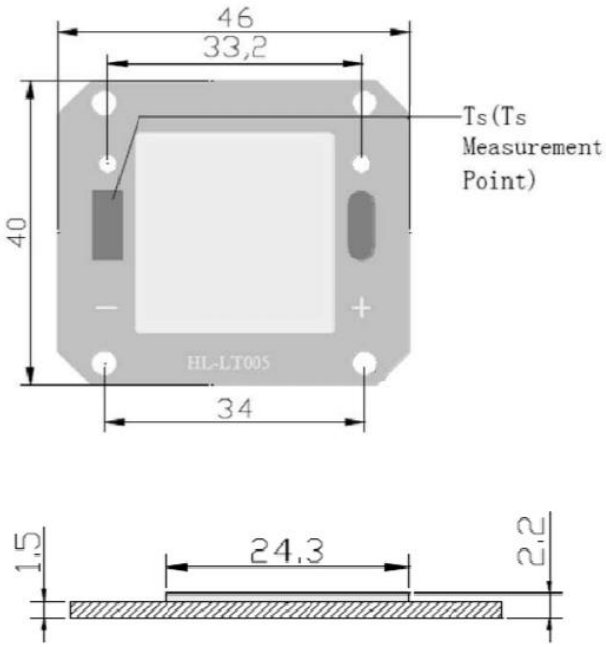
3.4 Data Set 2, 100°C, 3500mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')						
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
16	0.2504	0.5236	2992	0.0006	0.0001	0.0004	0.0009	0.0016	0.0021	0.0027
17	0.2493	0.5239	3016	0.0008	0.0009	0.0009	0.0009	0.0016	0.0021	0.0026
18	0.2500	0.5231	3004	0.0004	0.0008	0.0011	0.0016	0.0023	0.0029	0.0034
19	0.2508	0.5248	2974	0.0004	0.0008	0.0013	0.0018	0.0027	0.0033	0.0038
20	0.2486	0.5246	3028	0.0004	0.0004	0.0006	0.0012	0.0017	0.0024	0.0030
21	0.2499	0.5242	3000	0.0006	0.0005	0.0007	0.0013	0.0016	0.0023	0.0028
22	0.2498	0.5233	3006	0.0004	0.0003	0.0006	0.0011	0.0017	0.0023	0.0028
23	0.2483	0.5236	3042	0.0006	0.0012	0.0015	0.0019	0.0025	0.0031	0.0037
24	0.2493	0.5249	3010	0.0008	0.0009	0.0011	0.0016	0.0021	0.0025	0.0031
25	0.2500	0.5232	3004	0.0004	0.0011	0.0013	0.0018	0.0024	0.0031	0.0036
26	0.2496	0.5239	3008	0.0007	0.0004	0.0006	0.0012	0.0018	0.0023	0.0029
27	0.2494	0.5240	3012	0.0005	0.0014	0.0016	0.0021	0.0028	0.0033	0.0038
28	0.2499	0.5237	3004	0.0005	0.0009	0.0012	0.0017	0.0023	0.0029	0.0035
29	0.2495	0.5235	3012	0.0008	0.0006	0.0004	0.0009	0.0014	0.0020	0.0025
30	0.2495	0.5236	3012	0.0004	0.0013	0.0017	0.0022	0.0026	0.0033	0.0038
Ave.	0.2502	0.5239	2994	0.0006	0.0008	0.0010	0.0015	0.0021	0.0026	0.0032
Med.	0.2503	0.5240	2990	0.0005	0.0008	0.0011	0.0016	0.0021	0.0025	0.0031
st dev	0.2489	0.5235	3028	0.0002	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005
Min.	0.2493	0.5236	3018	0.0004	0.0001	0.0004	0.0009	0.0014	0.0020	0.0025
Max.	0.2497	0.5231	3010	0.0008	0.0014	0.0017	0.0022	0.0028	0.0033	0.0038



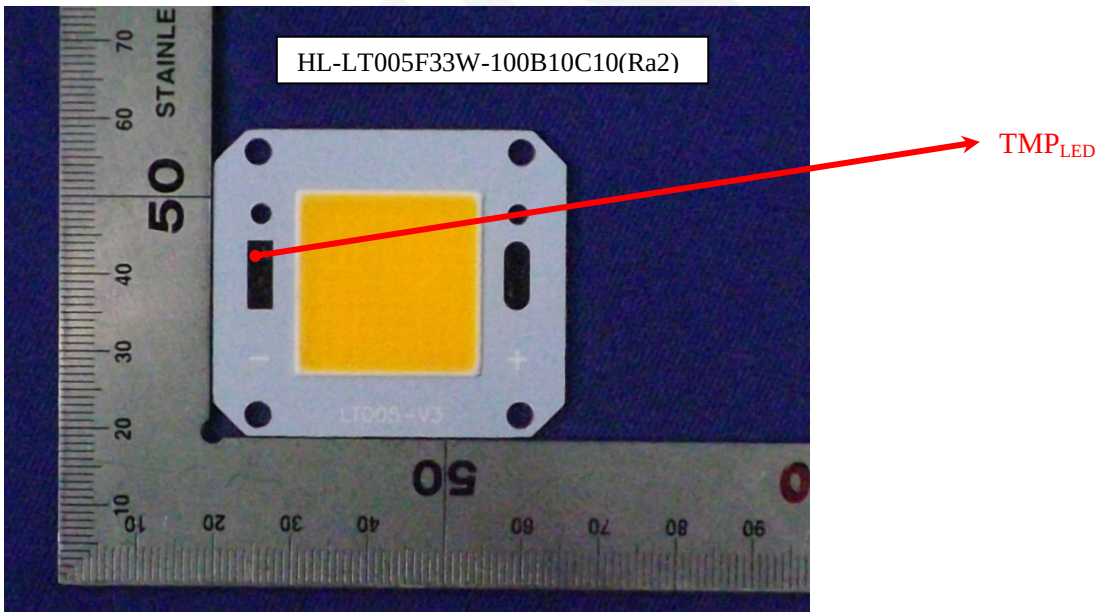
Appendix A – EUT PHOTO

A.1 Mechanical Dimensions (Ta = 25°C)



All dimensions are in millimeter

A.2 EUT Photo



Appendix B– REVISION HISTORY

Report Number	Report Date	Contents
RSZ131101510-10	2014/09/28	Original report.
RSZ131101510-10-M1	2015/03/02	Correct the typos of some titles.
RSZ131101510-10-M2	2015/06/09	Correct the typos of models.
RSZ131101510-10-M3	2019/01/12	Update the Logo and address of lab on the Page1&10 Update Company name and address on page 1. Add DUT Characteristics on page 3 according to ENERGY STAR requirements

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