



IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Guangzhou Hongli Opto-Electronic Co., Ltd.

No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

Model:HL-LM003H384W-17B8C12(Ra2)

Report Type: 7000 Hours Test Report	Product Type: LED Array
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Report Number: RSZ130319515-10-M2	
Test Date: 2013-12-27 to 2014-10-15	
Report Date: 2016-10-31	
Revised Note:	The previous report RSZ130319515-10-M1 is replaced by this report on 2016-10-31
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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).

This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

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1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number: HL-LM003H384W-17B8C12(Ra2)
 Part Type: LED Array
 Nominal CCT: 3000K

Family products covered by this report:

According to ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products, the following products can be covered by this report base on the declaration letter of manufacturer (see attachment B for more information). The information of these models shows that the covered products meet all section 3 item 7 requirements of ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products (September 9, 2011)

Model type	Model name	CRI (typ.)	CCT (typ.)	Series	Parallel	Power intensity (W/mm ²)	Distance between of dies (mm)	Current (mA)
COB-LM003 series	HL-LM003H384W-17B8C12(Ra2)	80	3000K	12	8	0.061	0.33	640
COB-LM003 series	HL-LM003H384W-17B8C12(Ra2)	80	4000K	12	8	0.061	0.33	640
		80	5000K	12	8	0.061	0.33	640
		80	5700K	12	8	0.061	0.33	640
		80	6000K	12	8	0.061	0.33	640
		80	6500K	12	8	0.061	0.33	640
COB-LM003 series	HL-LM003H384W-15B7C12(Ra2)	80	3000K	12	7	0.060	0.33	600
		80	4000K	12	7	0.060	0.33	600
		80	5000K	12	7	0.060	0.33	600
		80	5700K	12	7	0.060	0.33	600
		80	6000K	12	7	0.060	0.33	600
		80	6500K	12	7	0.060	0.33	600
COB-LM003 series	HL-LM003H384W-13B6C12(Ra2)	80	3000K	12	6	0.060	0.33	600
		80	4000K	12	6	0.060	0.33	600
		80	5000K	12	6	0.060	0.33	600
		80	5700K	12	6	0.060	0.33	600

Model type	Model name	CRI (typ.)	CCT (typ.)	Series	Parallel	Power intensity (W/mm ²)	Distance between of dies (mm)	Current (mA)
		80	6000K	12	6	0.060	0.33	600
		80	6500K	12	6	0.060	0.33	600
COB-LM003 series	HL-LM003H384W-11B5C12(Ra2)	80	3000K	12	5	0.050	0.33	500
		80	4000K	12	5	0.050	0.33	500
		80	5000K	12	5	0.050	0.33	500
		80	5700K	12	5	0.050	0.33	500
		80	6000K	12	5	0.050	0.33	500
		80	6500K	12	5	0.050	0.33	500
COB-LM003 series	HL-LM003H384W-18B3C28(Ra2)	80	3000K	28	3	0.055	0.50	240
		80	4000K	28	3	0.055	0.50	240
		80	5000K	28	3	0.055	0.50	240
		80	5700K	28	3	0.055	0.50	240
		80	6000K	28	3	0.055	0.50	240
		80	6500K	28	3	0.055	0.50	240
COB-LM003 series	HL-LM003H384W-15B3C24(Ra2)	80	3000K	24	3	0.047	0.69	240
		80	4000K	24	3	0.047	0.69	240
		80	5000K	24	3	0.047	0.69	240
		80	5700K	24	3	0.047	0.69	240
		80	6000K	24	3	0.047	0.69	240
		80	6500K	24	3	0.047	0.69	240
COB-LM003 series	HL-LM003H384W-9B4C12(Ra2)	80	3000K	12	4	0.035	0.33	350
		80	4000K	12	4	0.035	0.33	350
		80	5000K	12	4	0.035	0.33	350
		80	5700K	12	4	0.035	0.33	350
		80	6000K	12	4	0.035	0.33	350
		80	6500K	12	4	0.035	0.33	350

Model type	Model name	CRI (typ.)	CCT (typ.)	Series	Parallel	Power intensity (W/mm ²)	Distance between of dies (mm)	Current (mA)
COB-LM003 series	HL-LM003H384W-24B3C32(Ra2)	80	3000K	32	3	0.061	0.36	240
		80	4000K	32	3	0.061	0.36	240
		80	5000K	32	3	0.061	0.36	240
		80	5700K	32	3	0.061	0.36	240
		80	6000K	32	3	0.061	0.36	240
		80	6500K	32	3	0.061	0.36	240
COB-LM003 series	HL-LM003H384W-18B2C18(RA2)	80	3000K	18	2	0.0499	1.07	300
		80	4000K	18	2	0.0499	1.07	300
		80	5000K	18	2	0.0499	1.07	300
		80	5700K	18	2	0.0499	1.07	300
		80	6000K	18	2	0.0499	1.07	300
		80	6500K	18	2	0.0499	1.07	300

Disclaimer:

The truthfulness and accuracy of all the technical information above for the covered LED products is ensured by manufacturer of LED light source. Bay Area Compliance Laboratories Corp. (Dongguan) isn't responsible or gives any guarantees for the truthfulness of the technical information.

1.2 Standards Used:

- IESNA LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products(This test method was not accredited by IAS)

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
2.0m integrating sphere	EVERFINE	R98	11010018	N/A	2013-12-26	2014-12-26

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
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
Multilayer aging machine	BACL	B2-270	20013	N/A	2014-08-11	2015-08-11
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 $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 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 $U=21\text{K}$ ($K=2$), 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 Ts 85°C and 100°C were received at 2013-12-24 and tested during 2013-12-27 to 2014-10-15. The samples were numbered from 1to 15, 16 to 30.

Data Set 1: 85°C,640mA

Part Number:	HL-LM003H384W-17B8C12(Ra2)
Number of Units:	15
Actual Case Temperature(T _S):	T _S =84.3°C
Actual Ambient Temperature(T _A):	T _A =83.1°C
Life Test Drive Current:	I _F =640mA
Measurement Current:	I _F = 640mA

Data Set 2: 100°C, 640mA

Part Number:	HL-LM003H384W-17B8C12(Ra2)
Number of Units:	15
Actual Case Temperature(T _S):	T _S =98.6°C
Actual Ambient Temperature(T _A):	T _A =97.5°C
Life Test Drive Current:	I _F = 640mA
Measurement Current:	I _F = 640mA

2 - SUMMARY OF TEST RESULT

Data Set:	Data Set 1, 85°C, 640Ma
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:	96.32%
Average Chromaticity Shift at 7000 hours($\Delta u'v'$):	0.0028
Reported TM-21 L ₇₀ Lifetime:	>39,000 hours

Data Set:	Data Set 2, 100°C, 640mA
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:	95.63%
Average Chromaticity Shift at 7000 hours($\Delta u'v'$):	0.0032
Reported TM-21 L ₇₀ Lifetime:	>39,000 hours

3 - Test Data

3.1 Data Set 1, 85°C, 640mA (Lumen Maintenance)

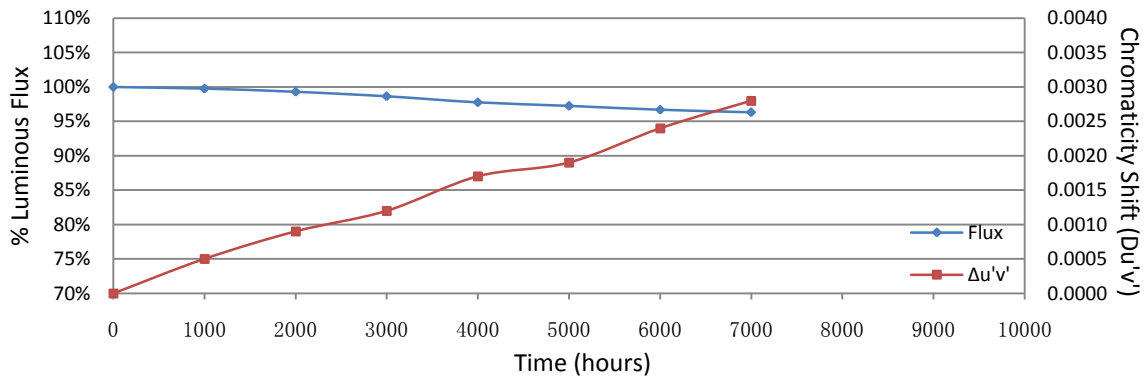
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	34.06	2223	99.60	99.06	97.93	97.00	96.54	95.95	95.55
2	34.09	2225	99.60	99.55	98.65	97.83	97.57	96.85	96.54
3	34.10	2183	99.91	99.77	98.40	97.56	97.30	96.89	96.47
4	34.64	2123	99.72	99.43	98.82	97.97	97.46	96.94	96.70
5	34.04	2204	99.77	99.50	98.77	97.96	97.41	96.78	96.51
6	34.09	2215	99.50	98.83	98.28	97.46	97.11	96.30	96.03
7	34.01	2206	99.82	99.73	99.59	98.79	97.96	97.37	96.92
8	33.98	2184	99.82	99.40	97.89	97.01	96.29	95.74	95.42
9	34.57	2119	99.81	99.24	98.49	97.59	96.98	96.41	96.04
10	34.09	2187	99.86	99.18	98.72	97.61	97.26	96.71	96.34
11	33.93	2193	99.73	99.09	98.72	97.81	97.31	96.85	96.53
12	33.90	2162	99.91	99.49	98.98	97.96	97.46	96.85	96.44
13	33.94	2156	99.49	99.07	98.42	97.63	97.08	96.47	96.10
14	33.95	2198	99.59	99.14	99.04	98.22	97.50	97.00	96.63
15	34.21	2165	99.77	98.98	98.94	98.04	97.41	96.81	96.54
Ave.	34.11	2183	99.73	99.30	98.64	97.76	97.24	96.66	96.32
Med.	34.06	2187	99.77	99.24	98.72	97.81	97.31	96.81	96.47
st dev	0.2186	32.6122	0.1391	0.2803	0.4355	0.4489	0.4109	0.4201	0.4170
Min.	33.90	2119	99.49	98.83	97.89	97.00	96.29	95.74	95.42
Max.	34.64	2225	99.91	99.77	99.59	98.79	97.96	97.37	96.92

TM-21 Projection:

Test Duration: 7000 hours
Failures Observed: 0
 α : 6.243E-06
 β : 1.004
Calculated L₇₀: 58,000hours
Reported L₇₀: >39,000hours

3.2 Data Set 1, 85°C, 640mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)						
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	0.2512	0.5254	2959	0.0004	0.0005	0.0012	0.0015	0.0018	0.0022	0.0025
2	0.2514	0.5257	2955	0.0005	0.0009	0.0015	0.0020	0.0021	0.0025	0.0028
3	0.2508	0.5254	2970	0.0005	0.0009	0.0016	0.0021	0.0023	0.0027	0.0031
4	0.2520	0.5258	2940	0.0005	0.0009	0.0012	0.0018	0.0019	0.0026	0.0028
5	0.2511	0.5251	2965	0.0006	0.0009	0.0012	0.0017	0.0021	0.0025	0.0029
6	0.2506	0.5246	2979	0.0004	0.0008	0.0008	0.0015	0.0018	0.0023	0.0027
7	0.2513	0.5257	2956	0.0005	0.0009	0.0011	0.0013	0.0016	0.0021	0.0026
8	0.2514	0.5253	2957	0.0006	0.0008	0.0008	0.0016	0.0017	0.0024	0.0028
9	0.2516	0.5254	2950	0.0005	0.0009	0.0011	0.0015	0.0017	0.0023	0.0026
10	0.2515	0.5253	2955	0.0006	0.0009	0.0011	0.0018	0.0022	0.0025	0.0028
11	0.2510	0.5248	2970	0.0006	0.0009	0.0012	0.0015	0.0017	0.0023	0.0027
12	0.2504	0.5252	2981	0.0008	0.0011	0.0015	0.0015	0.0018	0.0023	0.0027
13	0.2514	0.5260	2952	0.0007	0.0011	0.0016	0.0019	0.0022	0.0028	0.0032
14	0.2513	0.5255	2957	0.0005	0.0008	0.0012	0.0018	0.0021	0.0023	0.0026
15	0.2512	0.5248	2964	0.0005	0.0009	0.0012	0.0014	0.0018	0.0022	0.0025
Ave.	0.2512	0.5253	2961	0.0005	0.0009	0.0012	0.0017	0.0019	0.0024	0.0028
Med.	0.2513	0.5254	2957	0.0005	0.0009	0.0012	0.0016	0.0018	0.0023	0.0027
st dev	0.0004	0.0004	10.9718	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2504	0.5246	2940	0.0004	0.0005	0.0008	0.0013	0.0016	0.0021	0.0025
Max.	0.2520	0.5260	2981	0.0008	0.0011	0.0016	0.0021	0.0023	0.0028	0.0032



3.3 Data Set 2, 100°C, 640mA (Lumen Maintenance)

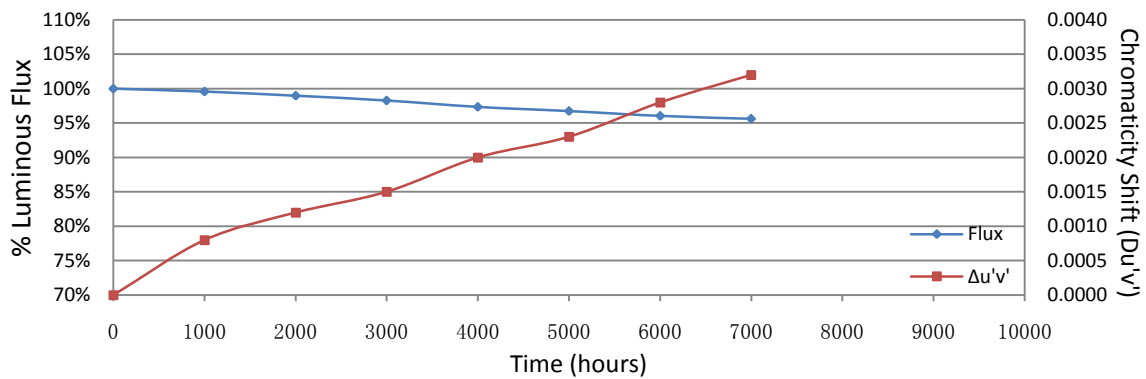
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
16	34.01	2208	99.23	98.51	97.78	96.77	96.20	95.70	95.43
17	33.86	2207	99.55	99.41	99.18	98.25	97.46	96.51	96.10
18	33.99	2208	99.59	99.14	98.46	97.48	96.78	95.88	95.52
19	34.10	2156	99.81	98.70	98.61	97.76	97.17	96.71	96.47
20	33.96	2191	99.54	98.63	98.17	97.21	96.81	95.85	95.53
21	34.49	2118	99.95	99.43	98.30	97.30	96.93	96.13	95.80
22	33.91	2201	99.36	99.18	97.91	97.03	96.37	95.64	95.18
23	33.96	2208	99.55	99.05	98.28	97.33	96.65	95.74	95.38
24	34.22	2165	99.68	98.52	98.01	97.14	96.67	96.12	95.75
25	33.95	2196	99.36	98.86	98.00	97.16	96.58	95.99	95.63
26	33.96	2196	99.41	98.82	97.54	96.68	96.04	95.40	94.99
27	33.85	2135	99.53	98.97	98.27	97.33	96.72	96.02	95.64
28	33.93	2183	99.73	99.31	98.31	97.53	96.75	95.97	95.56
29	33.95	2187	99.54	99.18	98.95	97.68	96.84	96.20	95.84
30	33.99	2149	99.40	98.88	98.42	97.49	97.07	96.28	95.67
Ave.	34.01	2181	99.55	98.97	98.28	97.34	96.74	96.01	95.63
Med.	33.96	2191	99.54	98.97	98.28	97.33	96.75	95.99	95.63
st dev	0.1609	29.0808	0.1885	0.3043	0.4243	0.3902	0.3621	0.3377	0.3552
Min.	33.85	2118	99.23	98.51	97.54	96.68	96.04	95.40	94.99
Max.	34.49	2208	99.95	99.43	99.18	98.25	97.46	96.71	96.47

TM-21 Projection:

Test Duration: 7000 hours
Failures Observed: 0
 α : 7.084E-06
 β : 1.003
Calculated L₇₀: 51,000hours
Reported L₇₀: >39,000hours

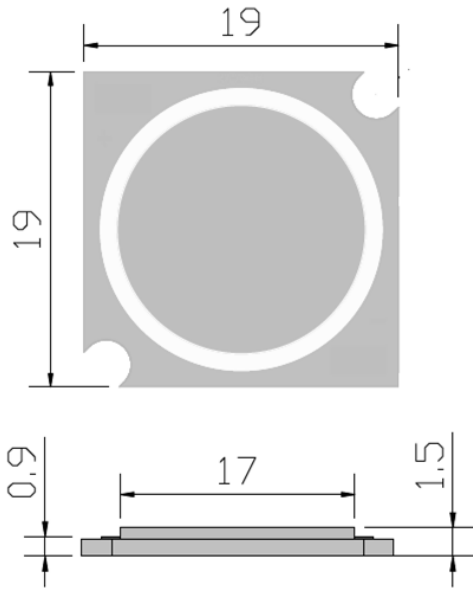
3.4 Data Set 2, 100°C, 640mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)						
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
16	0.2511	0.5250	2966	0.0006	0.0010	0.0013	0.0020	0.0024	0.0027	0.0030
17	0.2514	0.5253	2956	0.0006	0.0011	0.0013	0.0018	0.0022	0.0026	0.0028
18	0.2515	0.5259	2952	0.0008	0.0012	0.0013	0.0020	0.0022	0.0027	0.0031
19	0.2516	0.5251	2953	0.0007	0.0012	0.0011	0.0018	0.0021	0.0025	0.0028
20	0.2510	0.5245	2972	0.0008	0.0011	0.0014	0.0017	0.0021	0.0026	0.0028
21	0.2515	0.5252	2954	0.0007	0.0013	0.0013	0.0019	0.0021	0.0028	0.0031
22	0.2507	0.5259	2970	0.0009	0.0013	0.0015	0.0021	0.0022	0.0030	0.0035
23	0.2513	0.5257	2956	0.0007	0.0011	0.0014	0.0019	0.0022	0.0029	0.0034
24	0.2508	0.5243	2976	0.0006	0.0010	0.0018	0.0024	0.0027	0.0032	0.0037
25	0.2517	0.5257	2948	0.0007	0.0012	0.0015	0.0018	0.0021	0.0026	0.0028
26	0.2513	0.5252	2959	0.0008	0.0012	0.0017	0.0020	0.0023	0.0028	0.0032
27	0.2515	0.5263	2948	0.0009	0.0013	0.0017	0.0021	0.0025	0.0034	0.0039
28	0.2518	0.5258	2945	0.0007	0.0013	0.0016	0.0023	0.0023	0.0029	0.0034
29	0.2514	0.5255	2956	0.0011	0.0013	0.0016	0.0023	0.0026	0.0028	0.0030
30	0.2501	0.5241	2995	0.0007	0.0010	0.0015	0.0022	0.0027	0.0031	0.0036
Ave.	0.2512	0.5253	2960	0.0008	0.0012	0.0015	0.0020	0.0023	0.0028	0.0032
Med.	0.2514	0.5253	2956	0.0007	0.0012	0.0015	0.0020	0.0022	0.0028	0.0031
st dev	0.0004	0.0006	13.2816	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0004
Min.	0.2501	0.5241	2945	0.0006	0.0010	0.0011	0.0017	0.0021	0.0025	0.0028
Max.	0.2518	0.5263	2995	0.0011	0.0013	0.0018	0.0024	0.0027	0.0034	0.0039



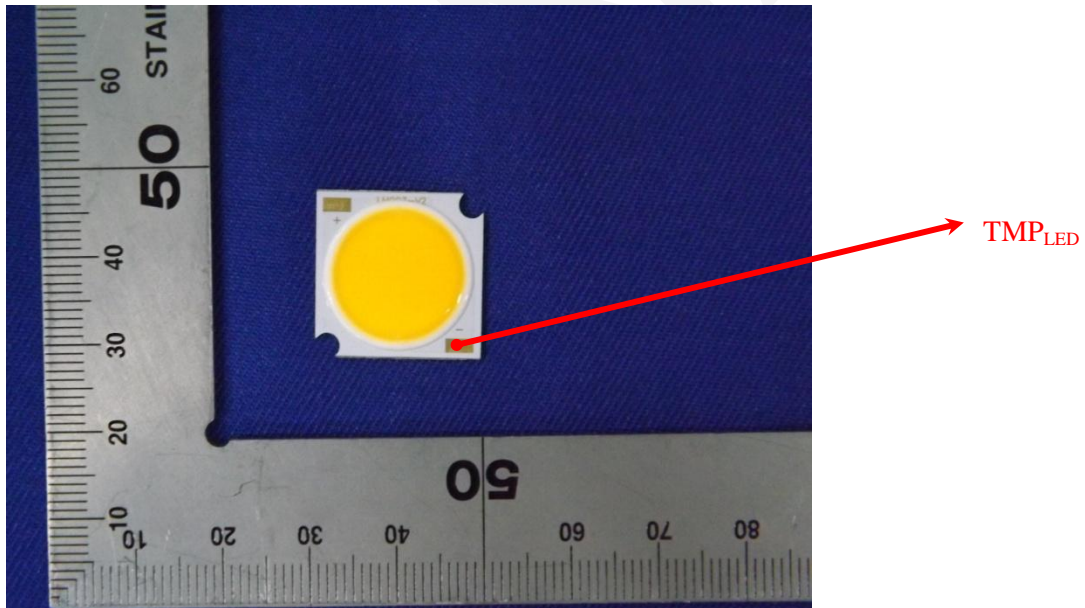
Appendix A – EUT PHOTO

A.1 Mechanical Dimensions (Ta = 25°C)



All dimensions are in millimeter

A.2 EUT Photo



Appendix B-Family Declaration Letter

FINNAL

Appendix C – REVISION HISTORY

Report Number	Report Date	Contents
RSZ130319515-10	2014-10-27	Original report.
RSZ130319515-10-M1	2015-04-27	Correct the typos of family models
RSZ130319515-10-M2	2016-10-31	Add the series model

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

FINAL