IES LM-80-08 Report

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Product	:	**CLU046-1818C1-273H1D2**
Issue Date	:	**2015/9/4**
Initial Test Date	:	**2014/5/1**
Complete Test Date	:	**-**
Test Duration	:	**6,000 H**
Report Number	:	**LM1400201**

CONTENTS

CITIZEN ELECTRONICS CO., LTD. LABORATORY

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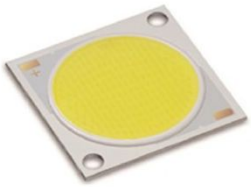
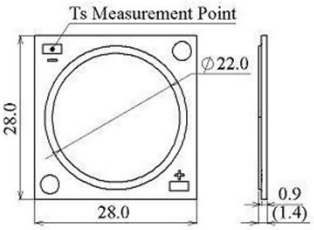
1. Description of LED light sources Tested

Table 1

Product	Nominal CCT	Die Count	Die Spacing	Drive Current	Power Density	Product Picture	Mechanical Drawing
CLU046-1818C1-273H1D2	2,700K	324pcs	0.20mm	4,140mA	0.336W/mm2		

2. Applicable Product Series

Applicable product series of this IES LM-80-08 report shows in Appendix report.

Identical construction process is used for the applicable product series.

Approved Signatory

Laboratory Director : Hidenori Toyama

Test engineer : Masayuki Hada

Test report reviewer (Technical manager) : Mitsunori Ishizaka

Quality manager : Kazuhiro Arai

3. IES LM-80-08 Reports Requirements

1. Number of LED light sources tested

20 samples are selected for each test condition.

(Nominal Ts = 55C, 85C)

2. Description of LED sources

Classification : LED Array

Product : CLU046-1818C1-273H1D2

(Nominal CCT : 2,700K)

3. Description of auxiliary equipment

~ Life test equipment ~

Thermal controlled life test system

LED arrays are tested in a thermal chamber which controls the case temperature (Ts) and ambient temperature (Ta) by water cooling system.

~ Measuring equipment ~

Table 2

Measurement Item	Equipment Name	Part Number	Manufacturer	Measurement Range	Calibration Date	Next Calibration Date
Temperature	Thermo regulator	LSCC-20A	KYUSHU NISSHO	0C~120C	2015/4/8	2016/4/30
	Data logger	LR8400	HIOKI	0C~120C	2015/4/8	2016/4/30
Temperature and humidity	Data logger	TR-72S	T&D Corporation	0C~ 50C, 10~95% RH	2015/8/1	2016/8/31
Drive current	Digital multimeter	34401A	Agilent Technologies	10mA~3A	2014/10/17	2015/10/30
Input power	DC power supply	PAS320-3	Kikusui Electronics	10mA~3A	-	-
Voltage	Oscilloscope	DPO2012-D1	Tektronix	10mV~100V	2014/12/24	2015/12/31
Luminous flux	Integrating sphere	MCPD7000	Otsuka Electronics	3lm~30,000lm	2014/11/12	2015/11/30

4. Operating cycle

LED arrays are driven with constant direct current (DC).

5. Ambient conditions including airflow temperature and relative humidity

LED arrays are operated in environmental control chambers. The data of the ambient conditions is shown in the tables of individual conditions. The ambient condition complies with the requirements of IES LM-80-08.

Surrounding Air temperature for life test : controlled to within -5C of the case temperature (Ts)

Humidity : < 65% RH

Minimal air flow

Ambient temperature for Photometry measurement : maintained at 25C±2C

6. Case temperature (Ts)

See data tables for individual test conditions.

The case temperature measurement point and detailed mechanical drawing are shown in table 1 of 1.Description of LED Light Sources Tested.

7. Drive current (If)

See data tables for individual test conditions.

8. Initial luminous flux, forward voltage and CCT

See data tables for individual test conditions.

9. Lumen maintenance data

See data tables for individual test conditions.

Ambient temperature during lumen measurements is maintained at 25C±2C.

10. Observation of LED light source failures

No failures observed during test.

11. LED light source monitoring interval

Measurements have been taken at each 1,000 hours.

12. Photometric measurement uncertainty

Uncertainty for relative luminous flux measurement is ±1.9% .

Long term measurement uncertainty is based on reproducibility tests done over a period of one year, calculated to k=2 coverage (i.e. 95% coverage).

13. Chromaticity shift reported over the measurement time

See data tables for individual test conditions.

Ambient temperature during chromaticity testing set to 25C±2C.

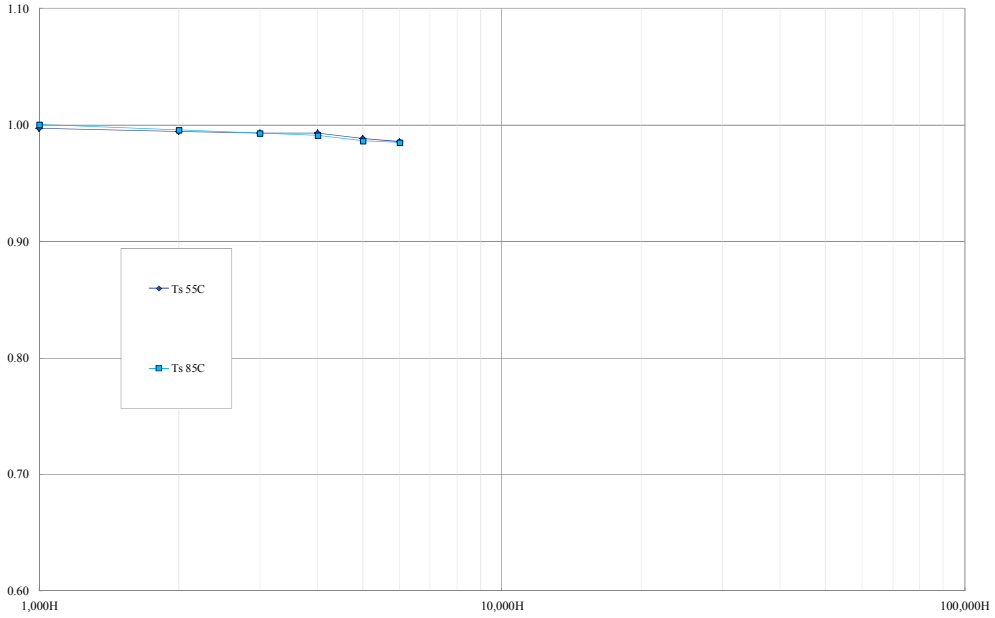
4. IES TM-21-11 Prediction

Test condition	55C	85C
Sample size	20pcs	20pcs
Number of failures	0pcs	0pcs
DUT drive current used in the test	4,140mA	4,140mA
Test duration	6,000H	6,000H
Test duration used for projection	1,000H - 6,000H	1,000H - 6,000H
Tested case temperatureTc	55C	85C
α	2.19599E-06	3.02807E-06
B	1.000	1.003
Reported L70 (6k) (hour)	>36000	>36000
Reported L80 (6k) (hour)	>36000	>36000
Reported L90 (6k) (hour)	>36000	>36000

5. IES LM-80-08 Test Summary

Product	:	**CLU046-1818C1-273H1D2**
Issue Date	:	**2015/9/1**
Initial Test Date	:	**2014/5/1**
Complete Test Date	:	**-**
Test Duration	:	**6,000 H**
Report Number	:	**LM1400201**
Drive current	:	**4140mA**

Case temperature	Lumen Maintenance (normalized value)																				
	-	0H	1,000H	2,000H	3,000H	4,000H	5,000H	6,000H	7,000H	8,000H	8,336H	9,000H	10,000H	11,000H	12,000H	13,000H	14,000H	15,000H	16,000H	17,000H	18,000H
55C	Max.	1.000	1.001	0.999	0.996	0.996	0.991	0.989													
	Ave.	1.000	0.997	0.995	0.993	0.993	0.989	0.986													
	Min.	1.000	0.995	0.992	0.991	0.991	0.987	0.983													
	Std.dev.	0.000	0.002	0.002	0.001	0.002	0.001	0.002													
	Median	1.000	0.997	0.995	0.993	0.993	0.989	0.985													
85C	Max.	1.000	1.004	1.002	0.998	0.997	0.996	0.991													
	Ave.	1.000	1.000	0.996	0.993	0.991	0.987	0.985													
	Min.	1.000	0.999	0.993	0.990	0.986	0.984	0.983													
	Std.dev.	0.000	0.001	0.002	0.002	0.002	0.003	0.002													
	Median	1.000	1.000	0.995	0.993	0.991	0.985	0.985													



6. IES LM80-08 Test Result

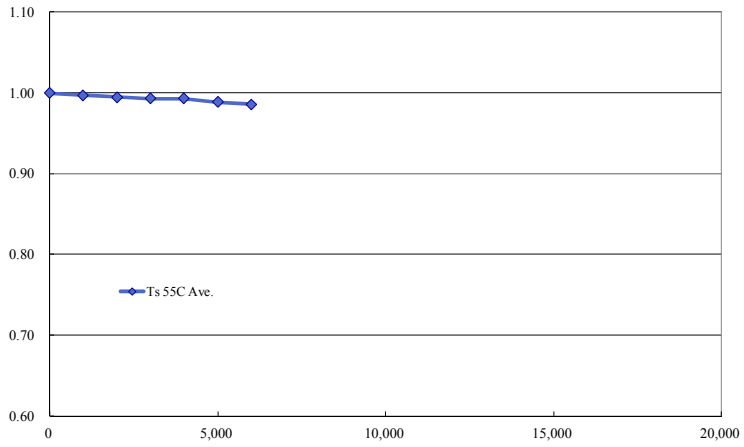
6-1. Test condition 1 : 55C

6-1-1. Lumen Maintenance

Actual case temperature (Ts)	54.1C
Actual ambient temperature (Ta)	54.2C
Drive current (If)	4,140mA

Sample No.	Luminous Flux (lm)	Lumen Maintenance (normalized value)																		
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	21,627	1.000	0.996	0.994	0.993	0.993	0.988	0.987													
2	21,635	1.000	0.995	0.992	0.991	0.992	0.987	0.984													
3	21,609	1.000	0.998	0.993	0.992	0.993	0.991	0.988													
4	21,601	1.000	0.999	0.995	0.996	0.994	0.990	0.987													
5	21,583	1.000	1.001	0.997	0.995	0.996	0.989	0.987													
6	21,598	1.000	0.997	0.994	0.991	0.994	0.990	0.989													
7	21,601	1.000	0.997	0.995	0.993	0.992	0.988	0.987													
8	21,612	1.000	0.997	0.995	0.991	0.993	0.989	0.988													
9	21,588	1.000	0.998	0.995	0.993	0.996	0.989	0.985													
10	21,607	1.000	0.996	0.994	0.992	0.991	0.991	0.985													
11	21,621	1.000	0.997	0.995	0.993	0.991	0.988	0.984													
12	21,566	1.000	1.001	0.997	0.994	0.994	0.990	0.985													
13	21,593	1.000	0.998	0.997	0.995	0.995	0.989	0.984													
14	21,589	1.000	0.996	0.999	0.994	0.993	0.988	0.986													
15	21,619	1.000	0.998	0.995	0.994	0.993	0.988	0.984													
16	21,646	1.000	0.995	0.992	0.993	0.991	0.988	0.984													
17	21,614	1.000	0.997	0.993	0.992	0.994	0.988	0.985													
18	21,618	1.000	0.999	0.993	0.992	0.992	0.989	0.985													
19	21,619	1.000	0.995	0.994	0.993	0.992	0.988	0.983													
20	21,579	1.000	0.997	0.995	0.995	0.993	0.989	0.985													
Max.		1.000	1.001	0.999	0.996	0.996	0.991	0.989													
Ave.		1.000	0.997	0.995	0.993	0.993	0.989	0.986													
Min.		1.000	0.995	0.992	0.991	0.991	0.987	0.983													
Std. dev.		0.000	0.002	0.002	0.001	0.002	0.001	0.002													
Median		1.000	0.997	0.995	0.993	0.993	0.989	0.985													

Lumen Maintenance (normalized value)

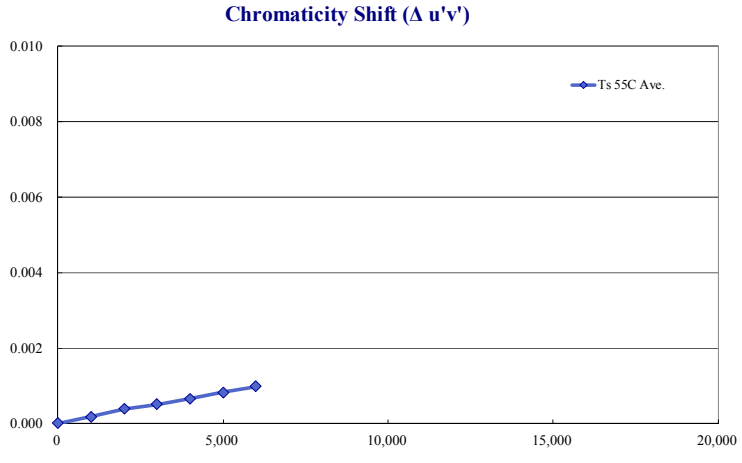


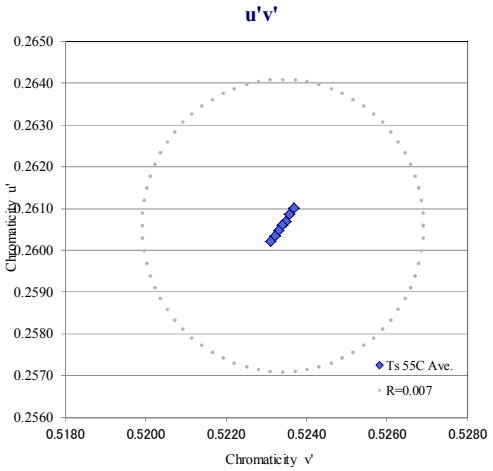
6-1. Test condition 1 : 55C

6-1-2. Chromaticity Shift (Δu'v')

Actual case temperature (Ts)	54.1C
Actual ambient temperature (Ta)	54.2C
Drive current (If)	4,140mA

Sample No.	x	y	Chromaticity Shift (Δ u'v')																			
	0H	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	0.4307	0.4081	-	0.0001	0.0003	0.0004	0.0004	0.0006	0.0008													
2	0.4288	0.4017	-	0.0002	0.0004	0.0004	0.0007	0.0009	0.0011													
3	0.4327	0.4093	-	0.0002	0.0006	0.0008	0.0009	0.0013	0.0015													
4	0.4324	0.4027	-	0.0001	0.0003	0.0004	0.0006	0.0008	0.0010													
5	0.4284	0.3988	-	0.0002	0.0004	0.0007	0.0009	0.0011	0.0012													
6	0.4282	0.3980	-	0.0002	0.0003	0.0005	0.0007	0.0009	0.0012													
7	0.4294	0.4029	-	0.0002	0.0004	0.0005	0.0007	0.0009	0.0012													
8	0.4325	0.4078	-	0.0002	0.0004	0.0007	0.0007	0.0009	0.0012													
9	0.4299	0.4087	-	0.0001	0.0002	0.0003	0.0004	0.0006	0.0008													
10	0.4279	0.4012	-	0.0002	0.0004	0.0005	0.0007	0.0009	0.0012													
11	0.4299	0.4038	-	0.0001	0.0003	0.0004	0.0007	0.0009	0.0011													
12	0.4291	0.3990	-	0.0002	0.0004	0.0007	0.0009	0.0011	0.0012													
13	0.4313	0.4035	-	0.0002	0.0004	0.0007	0.0009	0.0009	0.0011													
14	0.4300	0.4127	-	0.0002	0.0003	0.0005	0.0006	0.0006	0.0007													
15	0.4301	0.4029	-	0.0002	0.0004	0.0005	0.0006	0.0006	0.0008													
16	0.4302	0.4050	-	0.0002	0.0004	0.0007	0.0007	0.0008	0.0008													
17	0.4283	0.3999	-	0.0001	0.0003	0.0003	0.0003	0.0004	0.0004													
18	0.4303	0.4082	-	0.0002	0.0004	0.0005	0.0006	0.0006	0.0007													
19	0.4275	0.3987	-	0.0002	0.0004	0.0005	0.0007	0.0008	0.0008													
20	0.4281	0.4041	-	0.0001	0.0002	0.0004	0.0006	0.0006	0.0008													
Max.			-	0.0002	0.0006	0.0008	0.0009	0.0013	0.0015													
Ave.			-	0.0002	0.0004	0.0005	0.0007	0.0008	0.0010													
Min.			-	0.0001	0.0002	0.0003	0.0003	0.0004	0.0004													
Std. dev.			-	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002													
Median			-	0.0002	0.0004	0.0005	0.0007	0.0008	0.0011													



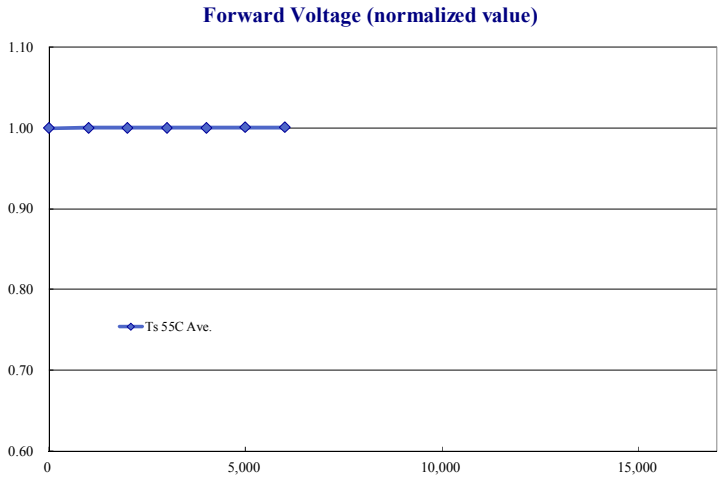


6-1. Test condition 1 : 55C

6-1-3. Forward Voltage

Actual case temperature (Ts)	54.1C
Actual ambient temperature (Ta)	54.2C
Drive current (If)	4,140mA

Sample No.	Forward Voltage (V)	Forward Voltage (normalized value)																		
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	57.69	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
2	57.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
3	57.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
4	58.32	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
5	57.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
6	58.23	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
7	57.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
8	58.13	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
9	58.14	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
10	57.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
11	58.24	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
12	57.81	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
13	58.22	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
14	58.18	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
15	58.15	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
16	57.87	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
17	57.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
18	57.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
19	58.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
20	58.14	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
Max.		1.00	1.00	1.00	1.00	1.00	1.00	1.00													
Ave.		1.00	1.00	1.00	1.00	1.00	1.00	1.00													
Min.		1.00	1.00	1.00	1.00	1.00	1.00	1.00													
Std. dev.		0.00	0.00	0.00	0.00	0.00	0.00	0.00													
Median		1.00	1.00	1.00	1.00	1.00	1.00	1.00													



6-1. Test condition 1 : 55C

6-1-4. Calculated CCT

Actual case temperature (Ts)	54.1C
Actual ambient temperature (Ta)	54.2C
Drive current (If)	4,140mA

Sample No.	ANSI Target CCT (K)	Calculated CCT (K)																		
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	2,700	2,738	2,739	2,743	2,744	2,744	2,749	2,754													
2	2,700	2,754	2,759	2,764	2,764	2,769	2,774	2,779													
3	2,700	2,686	2,691	2,700	2,702	2,705	2,714	2,719													
4	2,700	2,652	2,652	2,657	2,657	2,662	2,667	2,671													
5	2,700	2,746	2,751	2,756	2,761	2,766	2,771	2,771													
6	2,700	2,746	2,751	2,751	2,756	2,761	2,766	2,771													
7	2,700	2,742	2,747	2,752	2,752	2,757	2,762	2,767													
8	2,700	2,685	2,689	2,694	2,699	2,699	2,704	2,708													
9	2,700	2,767	2,767	2,768	2,768	2,773	2,778	2,783													
10	2,700	2,779	2,784	2,789	2,789	2,794	2,799	2,805													
11	2,700	2,735	2,736	2,741	2,745	2,750	2,755	2,760													
12	2,700	2,725	2,729	2,734	2,739	2,744	2,749	2,750													
13	2,700	2,691	2,695	2,700	2,705	2,709	2,709	2,714													
14	2,700	2,791	2,795	2,796	2,801	2,801	2,802	2,802													
15	2,700	2,721	2,726	2,731	2,731	2,732	2,732	2,737													
16	2,700	2,733	2,738	2,743	2,747	2,748	2,748	2,749													
17	2,700	2,758	2,758	2,763	2,763	2,763	2,764	2,764													
18	2,700	2,749	2,754	2,759	2,760	2,760	2,760	2,761													
19	2,700	2,772	2,777	2,782	2,783	2,788	2,789	2,789													
20	2,700	2,791	2,791	2,792	2,797	2,802	2,802	2,807													
Max.		2,791	2,795	2,796	2,801	2,802	2,802	2,807													
Ave.		2,738	2,742	2,746	2,748	2,751	2,755	2,758													
Min.		2,652	2,652	2,657	2,657	2,662	2,667	2,671													
Std. dev.		36	36	35	35	35	34	34													
Median		2,744	2,749	2,751	2,754	2,759	2,761	2,763													

6-1. Test condition 1 : 55C

6-1-5. Ra

Actual case temperature (Ts)	54.1C
Actual ambient temperature (Ta)	54.2C
Drive current (If)	4,140mA

Sample No.	Ra	Ra																		
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	93	93	93	93	93	93	93	93													
2	93	93	93	93	93	93	93	93													
3	93	93	93	93	93	93	93	93													
4	93	93	93	93	93	93	93	93													
5	93	93	93	93	93	93	93	93													
6	93	93	93	93	93	93	93	93													
7	93	93	93	93	93	93	93	93													
8	93	93	93	93	93	93	93	93													
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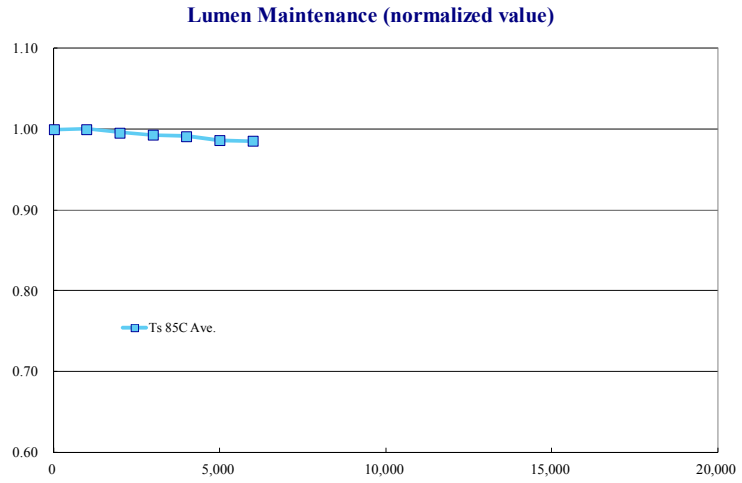
19	93	93	93	93	93	93	93	93													
20	93	93	93	93	93	93	93	93													
Max.		93	93	93	93	93	93	93													
Ave.		93	93	93	93	93	93	93													
Min.		93	93	93	93	93	93	93													
Std. dev.		0	0	0	0	0	0	0													
Median		93	93	93	93	93	93	93													

6-2. Test condition 2 : 85C

6-2-1. Lumen Maintenance

Actual case temperature (Ts)	84.7C
Actual ambient temperature (Ta)	83.7C
Drive current (If)	4,140mA

Sample No.	Luminous Flux (lm)	Lumen Maintenance (normalized value)																		
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	21,562	1.000	1.004	1.002	0.994	0.992	0.992	0.991													
2	21,595	1.000	1.003	0.997	0.993	0.988	0.986	0.986													
3	21,608	1.000	1.000	0.995	0.994	0.989	0.985	0.984													
4	21,613	1.000	1.000	0.994	0.993	0.993	0.985	0.984													
5	21,602	1.000	1.001	1.000	0.994	0.994	0.985	0.984													
6	21,596	1.000	1.002	0.996	0.994	0.994	0.986	0.986													
7	21,605	1.000	0.999	0.995	0.995	0.993	0.986	0.984													
8	21,590	1.000	1.001	0.998	0.994	0.994	0.987	0.986													
9	21,607	1.000	1.000	0.998	0.992	0.992	0.987	0.984													
10	21,619	1.000	0.999	0.996	0.990	0.989	0.986	0.985													
11	21,589	1.000	1.001	0.996	0.993	0.992	0.987	0.986													
12	21,627	1.000	1.000	0.995	0.992	0.991	0.984	0.983													
13	21,591	1.000	1.000	0.994	0.993	0.994	0.985	0.987													
14	21,619	1.000	0.999	0.993	0.991	0.991	0.985	0.984													
15	21,588	1.000	1.001	0.998	0.998	0.997	0.996	0.985													
16	21,624	1.000	0.999	0.993	0.991	0.989	0.985	0.984													
17	21,625	1.000	0.999	0.993	0.991	0.990	0.985	0.986													
18	21,588	1.000	1.000	0.994	0.993	0.991	0.991	0.989													
19	21,600	1.000	1.000	0.995	0.992	0.989	0.985	0.983													
20	21,606	1.000	1.000	0.995	0.991	0.986	0.984	0.985													
Max.		1.000	1.004	1.002	0.998	0.997	0.996	0.991													
Ave.		1.000	1.000	0.996	0.993	0.991	0.987	0.985													
Min.		1.000	0.999	0.993	0.990	0.986	0.984	0.983													
Std. dev.		0.000	0.001	0.002	0.002	0.002	0.003	0.002													
Median		1.000	1.000	0.995	0.993	0.991	0.985	0.985													

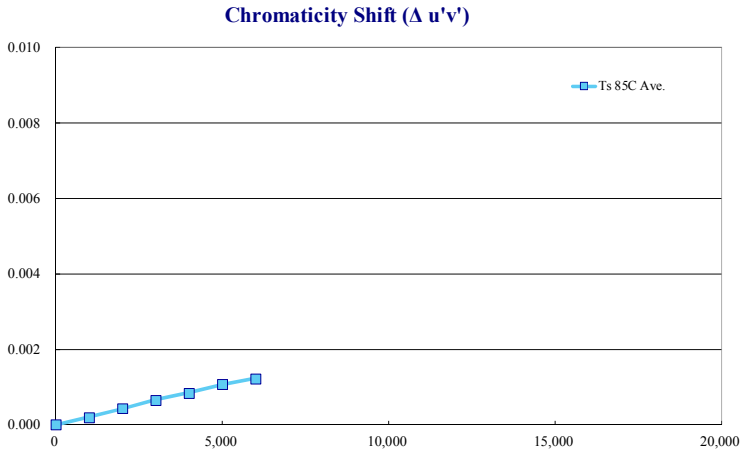


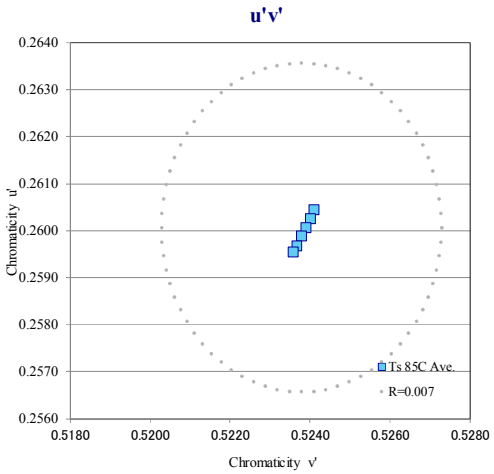
6-2. Test condition 2 : 85C

6-2-2. Chromaticity Shift (Δu'v')

Actual case temperature (Ts)	84.7C
Actual ambient temperature (Ta)	83.7C
Drive current (If)	4,140mA

Sample No.	x	y	Chromaticity Shift (Δ u'v')																		
	0H	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	0.4509	0.4077	-	0.0002	0.0004	0.0007	0.0007	0.0008	0.0008													
2	0.4566	0.4009	-	0.0004	0.0007	0.0009	0.0012	0.0014	0.0016													
3	0.4513	0.4073	-	0.0002	0.0005	0.0007	0.0009	0.0012	0.0014													
4	0.4551	0.4040	-	0.0001	0.0003	0.0005	0.0007	0.0009	0.0012													
5	0.4550	0.4059	-	0.0001	0.0003	0.0006	0.0008	0.0010	0.0013													
6	0.4545	0.4056	-	0.0002	0.0005	0.0008	0.0010	0.0012	0.0014													
7	0.4536	0.4046	-	0.0002	0.0004	0.0007	0.0007	0.0009	0.0010													
8	0.4506	0.4019	-	0.0002	0.0003	0.0004	0.0008	0.0011	0.0013													
9	0.4529	0.4039	-	0.0001	0.0003	0.0005	0.0007	0.0009	0.0010													
10	0.4495	0.4034	-	0.0002	0.0004	0.0007	0.0009	0.0014	0.0017													
11	0.4470	0.4061	-	0.0002	0.0004	0.0007	0.0009	0.0011	0.0013													
12	0.4535	0.4039	-	0.0002	0.0004	0.0006	0.0009	0.0011	0.0013													
13	0.4572	0.4076	-	0.0002	0.0004	0.0007	0.0007	0.0009	0.0010													
14	0.4547	0.4052	-	0.0002	0.0002	0.0004	0.0005	0.0005	0.0005													
15	0.4553	0.4065	-	0.0002	0.0006	0.0008	0.0011	0.0013	0.0015													
16	0.4544	0.4041	-	0.0002	0.0005	0.0008	0.0010	0.0012	0.0014													
17	0.4530	0.4061	-	0.0001	0.0003	0.0005	0.0006	0.0008	0.0010													
18	0.4540	0.4032	-	0.0002	0.0004	0.0007	0.0009	0.0014	0.0014													
19	0.4527	0.4029	-	0.0002	0.0005	0.0007	0.0009	0.0012	0.0014													
20	0.4475	0.4059	-	0.0002	0.0004	0.0007	0.0012	0.0012	0.0013													
Max.			-	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017													
Ave.			-	0.0002	0.0004	0.0007	0.0009	0.0011	0.0012													
Min.			-	0.0001	0.0002	0.0004	0.0005	0.0005	0.0005													
Std. dev.			-	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003													
Median			-	0.0002	0.0004	0.0007	0.0009	0.0011	0.0013													



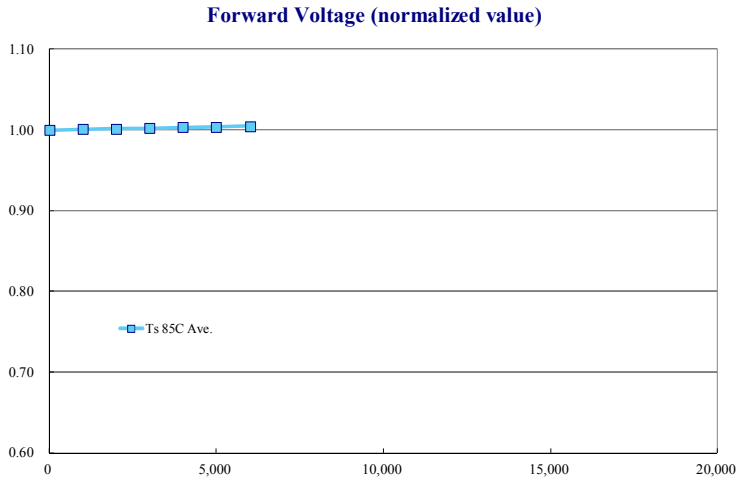


6-2. Test condition 2 : 85C

6-2-3. Forward Voltage

Actual case temperature (Ts)	84.7C
Actual ambient temperature (Ta)	83.7C
Drive current (If)	4,140mA

Sample No.	Forward Voltage (V)	Forward Voltage (normalized value)																		
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	58.12	1.00	1.00	1.00	1.00	1.00	1.00	1.01													
2	58.03	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
3	58.36	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
4	58.43	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
5	58.53	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
6	58.41	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
7	58.15	1.00	1.00	1.00	1.01	1.01	1.01	1.01													
8	57.90	1.00	1.00	1.00	1.01	1.01	1.01	1.01													
9	58.26	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
10	58.11	1.00	1.00	1.00	1.01	1.01	1.01	1.01													
11	58.39	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
12	58.24	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
13	57.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
14	57.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
15	57.76	1.00	1.00	1.00	1.01	1.01	1.01	1.01													
16	58.13	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
17	58.44	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
18	58.22	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
19	58.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
20	58.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00													
Max.		1.00	1.00	1.00	1.01	1.01	1.01	1.01													
Ave.		1.00	1.00	1.00	1.00	1.00	1.00	1.00													
Min.		1.00	1.00	1.00	1.00	1.00	1.00	1.00													
Std. dev.		0.00	0.00	0.00	0.00	0.00	0.00	0.00													
Median		1.00	1.00	1.00	1.00	1.00	1.00	1.00													



6-2. Test condition 2 : 85C

6-2-4. Calculated CCT

Actual case temperature (Ts)	84.7C
Actual ambient temperature (Ta)	83.7C
Drive current (If)	4,140mA

Sample No.	ANSI Target CCT (K)	Calculated CCT (K)																		
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	2,700	2,799	2,804	2,809	2,814	2,815	2,815	2,816													
2	2,700	2,657	2,666	2,673	2,678	2,682	2,687	2,692													
3	2,700	2,791	2,796	2,801	2,806	2,811	2,816	2,821													
4	2,700	2,705	2,706	2,710	2,715	2,720	2,725	2,730													
5	2,700	2,722	2,723	2,727	2,734	2,739	2,744	2,749													
6	2,700	2,727	2,732	2,739	2,744	2,749	2,754	2,759													
7	2,700	2,734	2,739	2,743	2,748	2,749	2,751	2,754													
8	2,700	2,756	2,761	2,761	2,762	2,768	2,777	2,782													
9	2,700	2,738	2,738	2,743	2,748	2,753	2,758	2,758													
10	2,700	2,786	2,791	2,796	2,801	2,806	2,818	2,823													
11	2,700	2,846	2,851	2,857	2,862	2,867	2,872	2,878													
12	2,700	2,728	2,733	2,738	2,742	2,747	2,752	2,757													
13	2,700	2,705	2,710	2,715	2,719	2,720	2,724	2,725													
14	2,700	2,721	2,726	2,726	2,731	2,731	2,731	2,731													
15	2,700	2,723	2,728	2,734	2,739	2,744	2,748	2,753													
16	2,700	2,717	2,721	2,728	2,733	2,738	2,743	2,748													
17	2,700	2,754	2,754	2,759	2,764	2,764	2,769	2,774													
18	2,700	2,716	2,721	2,726	2,730	2,735	2,747	2,747													
19	2,700	2,733	2,738	2,743	2,748	2,753	2,758	2,762													
20	2,700	2,837	2,842	2,847	2,853	2,865	2,865	2,866													
Max.		2,846	2,851	2,857	2,862	2,867	2,872	2,878													
Ave.		2,745	2,749	2,754	2,759	2,763	2,768	2,771													
Min.		2,657	2,666	2,673	2,678	2,682	2,687	2,692													
Std. dev.		45	45	45	45	46	46	46													
Median		2,731	2,735	2,741	2,746	2,749	2,753	2,758													

6-2. Test condition 2 : 85C

6-2-5. Ra

Actual case temperature (Ts)	84.7C
Actual ambient temperature (Ta)	83.7C
Drive current (If)	4,140mA

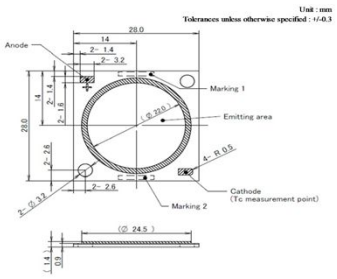
Sample No.	Ra	Ra																		
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,336 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	93	93	93	93	93	93	93	93													
2	93	93	93	94	94	94	94	94													
3	93	93	93	93	93	93	94	94													
4	93	93	93	93	93	93	93	93													
5	93	93	93	93	93	93	93	93													
6	93	93	93	93	94	94	94	94													
7	93	93	93	93	93	94	94	94													
8	93	93	93	93	93	93	93	94													
9	93	93	93	93	93	93	93	93													
10	93	93	93	93	93	94	94	94													
11	93	93	93	93	93	93	94	94													
12	93	93	93	93	93	93	93	93													
13	93	93	93	93	94	94	94	94													
14	93	93	93	93	94	94	94	94													
15	93	93	93	93	93	93	93	93													
16	93	93	93	93	93	93	93	93													
17	93	93	93	93	93	93	94	94													
18	93	93	93	93	93	93	93	93													
19	93	93	93	93	93	93	94	94													
20	93	93	93	93	93	93	93	93													
Max.		93	93	94	94	94	94	94													
Ave.		93	93	93	93	93	94	94													
Min.		93	93	93	93	93	93	93													
Std. dev.		0	0	0	0	0	0	0													
Median		93	93	93	93	93	93	94													

~CLU046 LM-80report Appendix~ Applicable product series

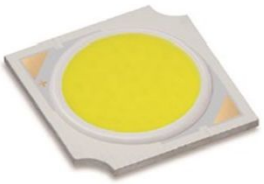
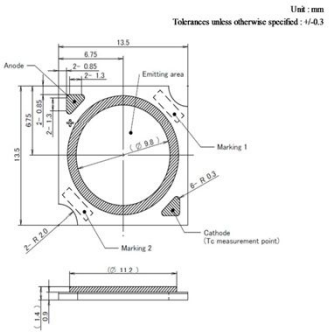
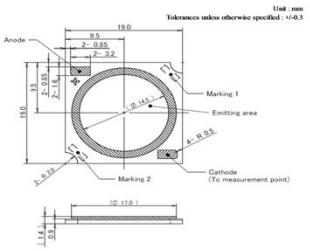
The per-chip current density of the maximum forward current in Table

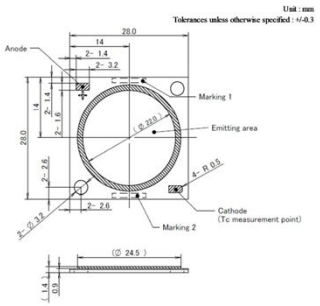
Identical construction process is used for the products in Table below.

~ LED light sources Tested ~

Product	Nominal CCT	Die Count	Die Spacing	Drive Current	Power Density	Product Picture	Mechanical Drawing
CLU046-1818	2,700K	324pcs	0.20mm	4,140mA (230mA/die)	0.336W/mm2		

~ Applicable Product Series ~

Product		Die Count	Die Spacing	Maximum Forward Current	Maximum Power Density	Product Picture	Mechanical Drawing
CLU026	1201series	12 pcs	1.25mm	230 mA	0.051 W/mm2		
CLU026	1202series	24 pcs	0.35mm	460 mA	0.103 W/mm2		
CLU026	1203series	36 pcs	0.36mm	690 mA	0.154 W/mm2		
CLU026	1204series	48 pcs	0.35mm	920 mA	0.206 W/mm2		
CLU036	1205series	60 pcs	0.57mm	1,150 mA	0.136 W/mm2		
CLU036	1206series	72 pcs	0.65mm	1,380 mA	0.163 W/mm2		
CLU036	1208series	96 pcs	0.37mm	1,840 mA	0.217 W/mm2		

Product		Die Count	Die Spacing	Maximum Forward Current	Maximum Power Density	Product Picture	Mechanical Drawing
CLU046	1212series	144 pcs	0.60mm	2,760 mA	0.150 W/mm2		
CLU046	1812series	216 pcs	0.34mm	2,760 mA	0.224 W/mm2		
CLU046	1818series	324 pcs	0.28mm	4,140 mA	0.336 W/mm2		
CLU046	1312series	156 pcs	0.50mm	2,760 mA	0.162 W/mm2		
CLU046	1512series	180 pcs	0.30mm	2,760 mA	0.187 W/mm2		
CLU027	0303series	9 pcs	0.60mm	690 mA	0.029 W/mm2