IES LM-80-08 Report

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Product	:	**CLU056-3626C1-273H1D7**
Issue Date	:	**2015/9/30**
Initial Test Date	:	**2014/4/2**
Complete Test Date	:	-
Test Duration	:	**10,000 H**
Report Number	:	**LM1400104**

CONTENTS

CITIZEN ELECTRONICS CO., LTD. LABORATORY

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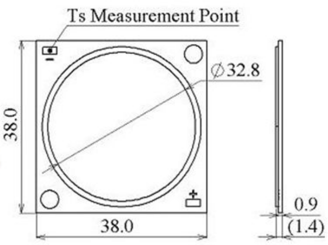
1. Description of LED light sources Tested

Table 1

Product	Nominal CCT	Die Count	Die Spacing	Drive Current	Power Density	Product Picture	Mechanical Drawing
CLU056-3626C1-273H1D7	2,700K	936pcs	0.20mm	4680mA (180mA/die)	0.402W/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.

69510

Approved Signatory

Laboratory Director : Hidenori Toyama — H. Toyama

Test engineer : Masayuki Hada — M. Hada

Test report reviewer (Technical manager) : Mitsunori Ishizaka — M. Ishizaka

Quality manager : Kazuhiro Arai — K. 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, 105C)

2. Description of LED sources

Classification : LED Array

Product : CLU056-3626C1-273H1D7

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	2015/6/24	2016/6/30
	Data logger	LR8400	HIOKI	0C~120C	2015/6/24	2016/6/30
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 ±2% .

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.

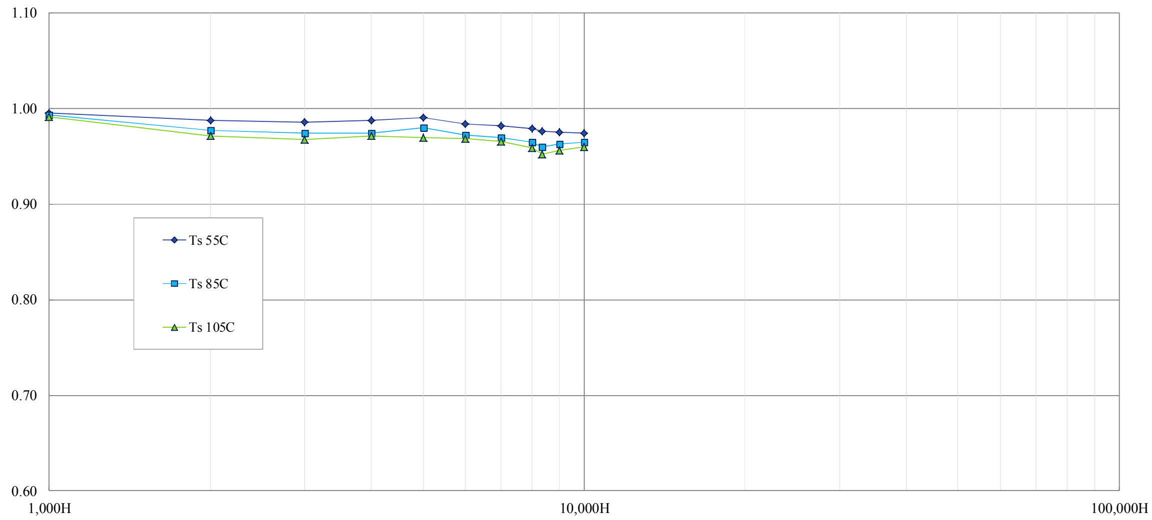
4. IES TM-21-11 Prediction

Test condition	55C	85C	105C
Sample size	20pcs	20pcs	20pcs
Number of failures	0pcs	0pcs	0pcs
DUT drive current used in the test	4680mA	4680mA	4680mA
Test duration	10,000H	10,000H	10,000H
Test duration used for projection	4,000H - 10,000H	4,000H - 10,000H	4,000H - 10,000H
Tested case temperatureTc	55C	85C	105C
α	3.29852E-06	3.51396E-06	3.23091E-06
B	1.005	0.994	0.985
Reported L70 (10k) (hour)	**>60000**	**>60000**	**>60000**
Reported L80 (10k) (hour)	**>60000**	**>60000**	**>60000**
Reported L90 (10k) (hour)	**34,000**	**28,000**	**28,000**

5. IES LM-80-08 Test Summary

Product	:	**CLU056-3626C1-273H1D7**
Issue Date	:	**2015/9/30**
Initial Test Date	:	**2014/4/2**
Complete Test Date	:	**-**
Test Duration	:	**10,000 H**
Report Number	:	**LM1400104**

Case temperature	Lumen Maintenance (normalized value)																				
	-	0H	1,000H	2,000H	3,000H	4,000H	5,000H	6,000H	7,000H	8,000H	8,335H	9,000H	10,000H	11,000H	12,000H	13,000H	14,000H	15,000H	16,000H	17,000H	18,000H
55C	Max.	1.000	1.013	1.010	1.006	1.017	1.022	1.024	1.021	1.018	1.016	1.015	1.014								
	Ave.	1.000	0.995	0.988	0.986	0.987	0.991	0.984	0.982	0.979	0.976	0.975	0.974								
	Min.	1.000	0.978	0.975	0.969	0.964	0.958	0.951	0.950	0.946	0.944	0.943	0.942								
	Std.dev.	0.000	0.007	0.008	0.008	0.013	0.016	0.018	0.018	0.018	0.018	0.018	0.018								
	Median	1.000	0.995	0.986	0.985	0.989	0.992	0.986	0.984	0.981	0.979	0.978	0.977								
85C	Max.	1.000	1.001	0.992	0.984	0.984	0.993	0.983	0.980	0.975	0.970	0.973	0.976								
	Ave.	1.000	0.994	0.977	0.974	0.974	0.980	0.973	0.970	0.965	0.960	0.963	0.965								
	Min.	1.000	0.983	0.959	0.964	0.964	0.960	0.960	0.958	0.953	0.948	0.947	0.950								
	Std.dev.	0.000	0.005	0.008	0.006	0.006	0.008	0.008	0.008	0.008	0.008	0.008	0.008								
	Median	1.000	0.995	0.977	0.975	0.975	0.982	0.976	0.973	0.968	0.963	0.965	0.968								
105C	Max.	1.000	1.017	0.999	0.993	1.004	0.997	0.997	0.994	0.987	0.980	0.984	0.988								
	Ave.	1.000	0.991	0.971	0.968	0.971	0.970	0.968	0.966	0.959	0.952	0.956	0.959								
	Min.	1.000	0.963	0.924	0.922	0.950	0.946	0.946	0.943	0.936	0.928	0.932	0.935								
	Std.dev.	0.000	0.010	0.014	0.015	0.012	0.014	0.015	0.015	0.015	0.015	0.015	0.015								
	Median	1.000	0.991	0.972	0.966	0.968	0.971	0.970	0.967	0.960	0.953	0.956	0.959								



6. IES LM80-08 Test Result

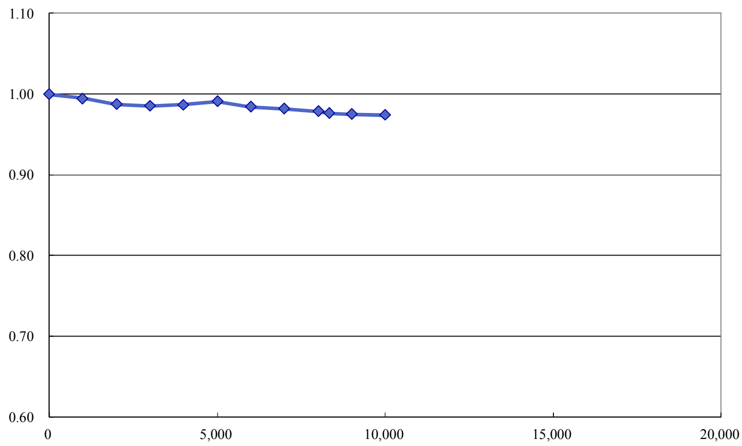
6-1. Test condition 1 : 55C

6-1-1. Lumen Maintenance

Actual case temperature (Ts)	55.2C
Actual ambient temperature (Ta)	54.6C
Drive current (If)	4,680mA

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	8,335 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	40,778	1.000	0.978	0.975	0.969	0.991	0.997	0.989	0.987	0.984	0.981	0.980	0.979								
2	41,211	1.000	0.994	0.988	0.981	0.973	0.976	0.973	0.971	0.967	0.964	0.963	0.962								
3	40,707	1.000	0.993	0.985	0.985	0.988	0.991	0.987	0.985	0.982	0.979	0.978	0.977								
4	40,891	1.000	0.995	0.985	0.984	0.989	0.992	0.988	0.985	0.982	0.979	0.978	0.977								
5	41,878	1.000	0.996	0.989	0.990	0.977	0.986	0.976	0.974	0.970	0.968	0.967	0.966								
6	41,478	1.000	0.997	0.989	0.986	0.977	0.990	0.981	0.979	0.976	0.973	0.972	0.971								
7	41,001	1.000	0.996	0.988	0.989	0.972	0.984	0.972	0.969	0.967	0.965	0.964	0.963								
8	40,345	1.000	0.998	0.991	0.988	0.988	0.997	0.983	0.980	0.978	0.975	0.974	0.973								
9	40,587	1.000	0.997	0.986	0.982	0.992	0.988	0.986	0.984	0.981	0.979	0.978	0.977								
10	41,888	1.000	0.996	0.986	0.985	0.978	0.962	0.952	0.950	0.946	0.944	0.944	0.943								
11	39,583	1.000	0.992	0.985	0.985	0.998	1.007	0.998	0.996	0.993	0.991	0.990	0.989								
12	40,227	1.000	0.992	0.985	0.982	0.998	1.004	1.000	0.998	0.995	0.992	0.991	0.990								
13	41,070	1.000	0.993	0.977	0.978	0.973	0.982	0.972	0.970	0.967	0.965	0.964	0.963								
14	40,654	1.000	0.989	0.982	0.983	0.989	1.005	0.993	0.991	0.988	0.986	0.985	0.984								
15	41,100	1.000	0.992	0.983	0.978	0.994	0.997	0.990	0.988	0.985	0.982	0.981	0.980								
16	41,253	1.000	0.991	0.990	0.990	0.978	0.958	0.951	0.950	0.947	0.944	0.943	0.942								
17	39,752	1.000	0.996	0.990	0.989	1.004	1.008	1.024	1.021	1.018	1.016	1.015	1.014								
18	41,811	1.000	0.995	0.984	0.979	0.964	0.969	0.956	0.954	0.952	0.950	0.949	0.948								
19	40,136	1.000	1.013	1.010	1.004	1.017	1.022	1.010	1.008	1.005	1.003	1.002	1.001								
20	40,599	1.000	1.009	1.004	1.006	1.003	1.001	1.000	0.998	0.995	0.993	0.992	0.991								
Max.		1.000	1.013	1.010	1.006	1.017	1.022	1.024	1.021	1.018	1.016	1.015	1.014								
Ave.		1.000	0.995	0.988	0.986	0.987	0.991	0.984	0.982	0.979	0.976	0.975	0.974								
Min.		1.000	0.978	0.975	0.969	0.964	0.958	0.951	0.950	0.946	0.944	0.943	0.942								
Std. dev.		0.000	0.007	0.008	0.008	0.013	0.016	0.018	0.018	0.018	0.018	0.018	0.018								
Median		1.000	0.995	0.986	0.985	0.989	0.992	0.986	0.984	0.981	0.979	0.978	0.977								

Lumen Maintenance (normalized value)

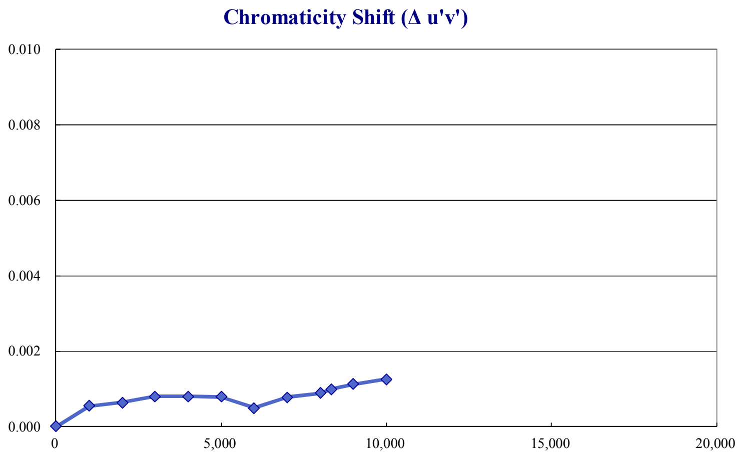


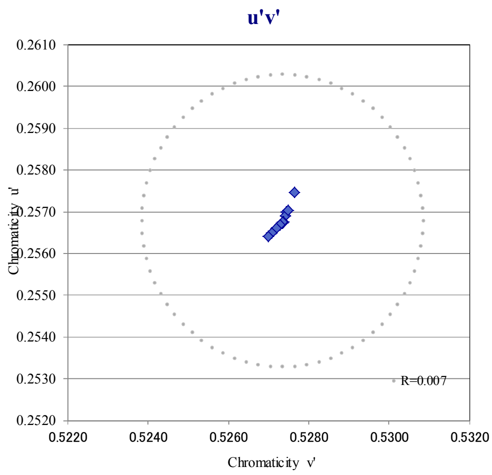
6-1. Test condition 1 : 55C

6-1-2. Chromaticity Shift (Δu'v')

Actual case temperature (Ts)	55.2C
Actual ambient temperature (Ta)	54.6C
Drive current (If)	4,680mA

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	8,335 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	0.4304	0.4138	-	0.0020	0.0021	0.0023	0.0023	0.0023	0.0023	0.0023	0.0018	0.0016	0.0017	0.0018								
2	0.4303	0.4145	-	0.0005	0.0008	0.0007	0.0007	0.0006	0.0004	0.0010	0.0011	0.0012	0.0014	0.0015								
3	0.4293	0.4135	-	0.0002	0.0004	0.0005	0.0005	0.0005	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008								
4	0.4295	0.4125	-	0.0004	0.0004	0.0005	0.0005	0.0005	0.0002	0.0004	0.0005	0.0006	0.0008	0.0009								
5	0.4300	0.4130	-	0.0004	0.0005	0.0005	0.0005	0.0005	0.0004	0.0006	0.0007	0.0009	0.0010	0.0012								
6	0.4296	0.4142	-	0.0004	0.0006	0.0006	0.0006	0.0006	0.0003	0.0006	0.0007	0.0009	0.0010	0.0011								
7	0.4301	0.4134	-	0.0004	0.0001	0.0006	0.0006	0.0005	0.0003	0.0006	0.0007	0.0009	0.0010	0.0011								
8	0.4304	0.4144	-	0.0005	0.0005	0.0007	0.0007	0.0008	0.0003	0.0006	0.0007	0.0009	0.0010	0.0011								
9	0.4294	0.4131	-	0.0004	0.0004	0.0006	0.0006	0.0006	0.0002	0.0005	0.0007	0.0008	0.0009	0.0010								
10	0.4299	0.4128	-	0.0006	0.0005	0.0008	0.0008	0.0009	0.0004	0.0008	0.0009	0.0010	0.0012	0.0013								
11	0.4303	0.4140	-	0.0004	0.0005	0.0007	0.0007	0.0006	0.0003	0.0007	0.0008	0.0009	0.0011	0.0012								
12	0.4304	0.4129	-	0.0003	0.0005	0.0006	0.0006	0.0006	0.0004	0.0006	0.0008	0.0009	0.0010	0.0012								
13	0.4279	0.4134	-	0.0005	0.0005	0.0008	0.0008	0.0007	0.0006	0.0009	0.0011	0.0012	0.0013	0.0015								
14	0.4294	0.4140	-	0.0002	0.0003	0.0005	0.0005	0.0004	0.0002	0.0005	0.0006	0.0008	0.0009	0.0010								
15	0.4300	0.4131	-	0.0004	0.0003	0.0006	0.0006	0.0009	0.0003	0.0006	0.0007	0.0008	0.0010	0.0011								
16	0.4306	0.4142	-	0.0004	0.0006	0.0007	0.0007	0.0007	0.0004	0.0007	0.0008	0.0010	0.0011	0.0012								
17	0.4304	0.4127	-	0.0004	0.0004	0.0007	0.0007	0.0005	0.0002	0.0005	0.0006	0.0008	0.0009	0.0010								
18	0.4292	0.4152	-	0.0004	0.0005	0.0007	0.0007	0.0007	0.0003	0.0006	0.0007	0.0008	0.0010	0.0011								
19	0.4305	0.4141	-	0.0016	0.0020	0.0018	0.0018	0.0019	0.0015	0.0018	0.0019	0.0020	0.0022	0.0023								
20	0.4303	0.4137	-	0.0008	0.0011	0.0013	0.0013	0.0011	0.0007	0.0010	0.0012	0.0013	0.0014	0.0016								
Max.			-	0.0020	0.0021	0.0023	0.0023	0.0023	0.0023	0.0023	0.0019	0.0020	0.0022	0.0023								
Ave.			-	0.0006	0.0006	0.0008	0.0008	0.0008	0.0005	0.0008	0.0009	0.0010	0.0011	0.0013								
Min.			-	0.0002	0.0001	0.0005	0.0005	0.0004	0.0002	0.0004	0.0005	0.0006	0.0007	0.0008								
Std. dev.			-	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0004	0.0004	0.0003	0.0003	0.0003								
Median			-	0.0004	0.0005	0.0007	0.0007	0.0006	0.0003	0.0006	0.0007	0.0009	0.0010	0.0011								





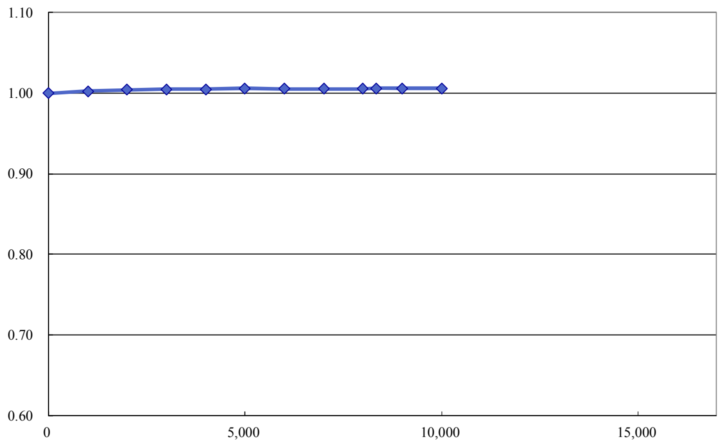
6-1. Test condition 1 : 55C

6-1-3. Forward Voltage

Actual case temperature (Ts)	55.2C
Actual ambient temperature (Ta)	54.6C
Drive current (If)	4,680mA

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	8,335 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	114.04	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
2	115.12	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
3	114.53	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
4	115.05	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
5	113.59	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
6	113.25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
7	113.47	1.00	1.00	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
8	114.82	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
9	113.86	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
10	113.83	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
11	112.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
12	113.48	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
13	113.94	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
14	113.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
15	113.76	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
16	113.60	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01								
17	112.99	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
18	114.84	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
19	114.36	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
20	113.44	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
Max.		1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
Ave.		1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
Min.		1.00	1.00	1.00	1.00	1.00	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	0.00	0.00	0.00	0.00	0.00								
Median		1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.01	1.01	1.01								

Forward Voltage (normalized value)



6-1. Test condition 1 : 55C

6-1-4. Calculated CCT

Actual case temperature (Ts)	55.2C
Actual ambient temperature (Ta)	54.6C
Drive current (If)	4,680mA

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	8,335 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	2,791	2,849	2,859	2,859	2,860	2,860	2,860	2,860	2,854	2,857	2,813	2,815								
2	2,700	2,798	2,809	2,816	2,813	2,813	2,813	2,808	2,820	2,815	2,818	2,821	2,823								
3	2,700	2,825	2,828	2,833	2,835	2,835	2,835	2,826	2,834	2,828	2,831	2,834	2,837								
4	2,700	2,811	2,819	2,819	2,823	2,823	2,823	2,815	2,819	2,814	2,817	2,820	2,823								
5	2,700	2,800	2,810	2,811	2,812	2,812	2,811	2,809	2,814	2,810	2,812	2,815	2,818								
6	2,700	2,818	2,827	2,832	2,830	2,830	2,831	2,822	2,832	2,827	2,830	2,833	2,836								
7	2,700	2,797	2,806	2,800	2,810	2,810	2,809	2,803	2,810	2,805	2,808	2,811	2,813								
8	2,700	2,796	2,807	2,806	2,811	2,811	2,813	2,803	2,809	2,804	2,807	2,810	2,813								
9	2,700	2,817	2,826	2,825	2,831	2,831	2,830	2,822	2,829	2,825	2,828	2,830	2,833								
10	2,700	2,802	2,814	2,813	2,819	2,819	2,821	2,810	2,819	2,815	2,817	2,820	2,823								
11	2,700	2,797	2,805	2,807	2,811	2,811	2,811	2,802	2,812	2,808	2,810	2,813	2,816								
12	2,700	2,786	2,794	2,797	2,801	2,801	2,800	2,795	2,800	2,795	2,798	2,801	2,804								
13	2,700	2,866	2,876	2,877	2,885	2,885	2,882	2,879	2,887	2,884	2,887	2,890	2,892								
14	2,700	2,822	2,825	2,828	2,833	2,833	2,831	2,825	2,833	2,829	2,832	2,835	2,837								
15	2,700	2,799	2,807	2,806	2,812	2,812	2,818	2,805	2,812	2,807	2,810	2,812	2,815								
16	2,700	2,788	2,797	2,800	2,804	2,804	2,804	2,796	2,803	2,799	2,801	2,804	2,807								
17	2,700	2,786	2,794	2,794	2,801	2,801	2,797	2,791	2,798	2,793	2,795	2,798	2,801								
18	2,700	2,837	2,846	2,848	2,852	2,852	2,852	2,843	2,850	2,846	2,849	2,852	2,855								
19	2,700	2,790	2,825	2,833	2,829	2,829	2,831	2,822	2,828	2,824	2,826	2,829	2,832								
20	2,700	2,793	2,809	2,815	2,820	2,820	2,816	2,807	2,816	2,811	2,814	2,816	2,819								
Max.		2,866	2,876	2,877	2,885	2,885	2,882	2,879	2,887	2,884	2,887	2,890	2,892								
Ave.		2,806	2,819	2,821	2,825	2,825	2,824	2,817	2,824	2,820	2,822	2,823	2,826								
Min.		2,786	2,794	2,794	2,801	2,801	2,797	2,791	2,798	2,793	2,795	2,798	2,801								
Std. dev.		20	20	21	20	21	20	21	21	21	21	20	20								
Median		2,798	2,812	2,816	2,820	2,820	2,819	2,809	2,819	2,814	2,817	2,818	2,821								

6-1. Test condition 1 : 55C

6-1-5. Ra

Actual case temperature (Ts)	55.2C
Actual ambient temperature (Ta)	54.6C
Drive current (If)	4,680mA

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	8,335 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	92	92	94	94	94	94	94	94	94	94	94	94	94								
2	92	92	92	92	92	92	92	92	92	92	92	92	92								
3	92	92	92	92	92	92	92	92	92	92	92	92	92								
4	92	92	92	92	92	92	92	92	92	92	92	92	92								
5	92	92	92	92	92	92	92	92	92	92	92	92	92								
6	92	92	92	92	92	92	92	92	92	92	92	92	92								
7	92	92	92	92	92	92	92	92	92	92	92	92	92								
8	92	92	92	92	92	92	92	92	92	92	92	92	92								
9	92	92	92	92	92	92	92	92	92	92	92	92	92								
10	92	92	92	92	92	92	92	92	92	92	92	92	92								
11	92	92	92	92	92	92	92	92	92	92	92	92	92								
12	92	92	92	92	92	92	92	92	92	92	92	92	92								
13	92	92	92	92	92	92	92	92	92	92	92	92	92								
14	92	92	92	92	92	92	92	92	92	92	92	92	92								
15	92	92	92	92	92	92	92	92	92	92	92	92	92								
16	92	92	92	92	92	92	92	92	92	92	92	92	92								
17	92	92	92	92	92	92	92	92	92	92	92	92	92								
18	92	92	92	92	92	92	92	92	92	92	92	92	92								
19	92	92	92	92	92	92	92	92	92	92	92	92	92								
20	92	92	92	92	92	92	92	92	92	92	92	92	92								
Max.		92	94	94	94	94	94	94	94	94	94	94	94								
Ave.		92	92	92	92	92	92	92	92	92	92	92	92								
Min.		92	92	92	92	92	92	92	92	92	92	92	92								
Std. dev.		0	0	1	0	0	0	0	0	0	0	0	0								
Median		92	92	92	92	92	92	92	92	92	92	92	92								

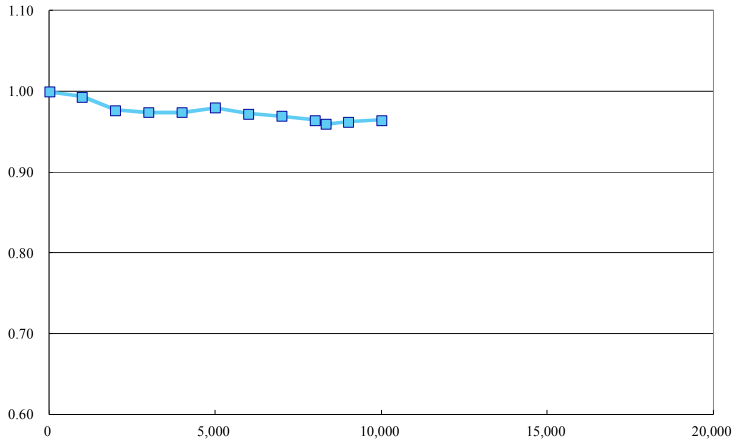
6-2. Test condition 2 : 85C

6-2-1. Lumen Maintenance

Actual case temperature (Ts)	82.3C
Actual ambient temperature (Ta)	81.8C
Drive current (If)	4,680mA

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	8,335 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	40,488	1.000	0.987	0.974	0.970	0.970	0.984	0.969	0.966	0.961	0.956	0.959	0.963								
2	40,258	1.000	0.995	0.984	0.976	0.976	0.988	0.981	0.978	0.973	0.968	0.970	0.973								
3	37,913	1.000	0.993	0.967	0.970	0.970	0.976	0.968	0.965	0.960	0.955	0.956	0.959								
4	40,916	1.000	0.991	0.977	0.976	0.976	0.982	0.980	0.977	0.972	0.968	0.971	0.975								
5	40,299	1.000	0.983	0.972	0.968	0.968	0.979	0.970	0.967	0.962	0.957	0.960	0.961								
6	40,193	1.000	0.990	0.976	0.975	0.975	0.982	0.977	0.974	0.969	0.964	0.967	0.969								
7	40,304	1.000	0.996	0.974	0.977	0.977	0.986	0.980	0.977	0.973	0.968	0.971	0.970								
8	39,016	1.000	0.995	0.979	0.974	0.974	0.986	0.979	0.976	0.971	0.966	0.971	0.971								
9	39,624	1.000	1.001	0.981	0.978	0.978	0.984	0.979	0.977	0.972	0.967	0.970	0.973								
10	40,092	1.000	0.998	0.982	0.982	0.982	0.982	0.978	0.976	0.971	0.966	0.969	0.969								
11	40,354	1.000	0.997	0.984	0.984	0.984	0.987	0.983	0.980	0.975	0.970	0.973	0.976								
12	40,642	1.000	1.001	0.981	0.980	0.980	0.978	0.977	0.974	0.969	0.964	0.964	0.968								
13	39,328	1.000	0.994	0.970	0.970	0.970	0.960	0.960	0.958	0.953	0.948	0.947	0.950								
14	40,548	1.000	0.999	0.992	0.983	0.983	0.981	0.980	0.977	0.972	0.967	0.969	0.972								
15	41,340	1.000	0.994	0.978	0.965	0.965	0.977	0.961	0.958	0.953	0.948	0.950	0.951								
16	39,607	1.000	0.997	0.981	0.976	0.976	0.982	0.968	0.965	0.960	0.955	0.959	0.962								
17	38,582	1.000	0.993	0.972	0.971	0.971	0.978	0.964	0.962	0.957	0.952	0.954	0.957								
18	39,906	1.000	0.996	0.990	0.981	0.981	0.993	0.975	0.972	0.967	0.962	0.965	0.968								
19	39,073	1.000	0.989	0.968	0.969	0.969	0.967	0.962	0.959	0.954	0.949	0.954	0.955								
20	40,197	1.000	0.985	0.959	0.964	0.964	0.968	0.961	0.958	0.953	0.949	0.952	0.955								
Max.		1.000	1.001	0.992	0.984	0.984	0.993	0.983	0.980	0.975	0.970	0.973	0.976								
Ave.		1.000	0.994	0.977	0.974	0.974	0.980	0.973	0.970	0.965	0.960	0.963	0.965								
Min.		1.000	0.983	0.959	0.964	0.964	0.960	0.960	0.958	0.953	0.948	0.947	0.950								
Std. dev.		0.000	0.005	0.008	0.006	0.006	0.008	0.008	0.008	0.008	0.008	0.008	0.008								
Median		1.000	0.995	0.977	0.975	0.975	0.982	0.976	0.973	0.968	0.963	0.965	0.968								

Lumen Maintenance (normalized value)

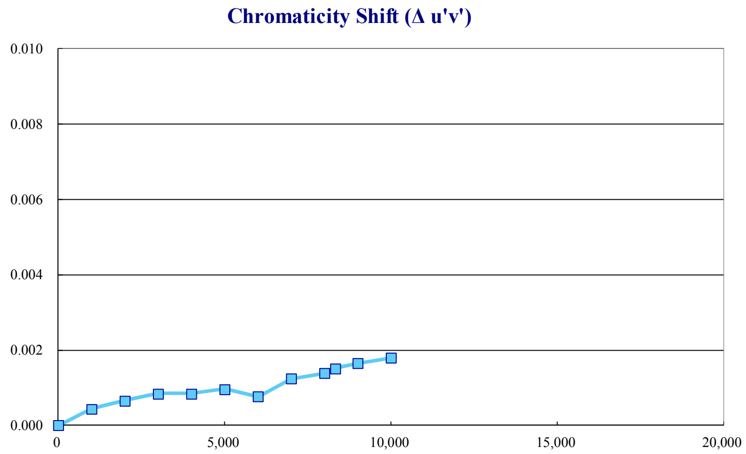


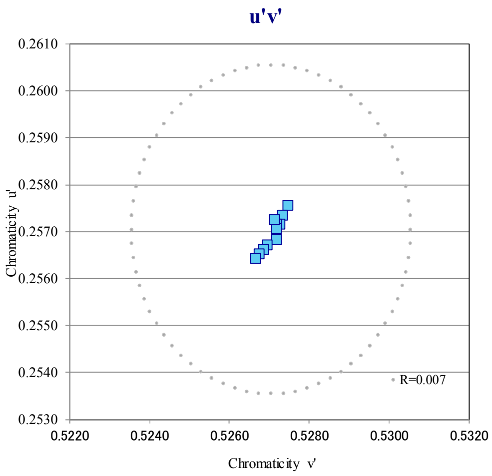
6-2. Test condition 2 : 85C

6-2-2. Chromaticity Shift (Δu'v')

Actual case temperature (Ts)	82.3C
Actual ambient temperature (Ta)	81.8C
Drive current (If)	4,680mA

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	8,335 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	0.4548	0.4121	-	0.0003	0.0008	0.0009	0.0009	0.0012	0.0009	0.0012	0.0014	0.0015	0.0017	0.0018								
2	0.4540	0.4134	-	0.0004	0.0009	0.0008	0.0008	0.0010	0.0007	0.0013	0.0014	0.0015	0.0017	0.0018								
3	0.4533	0.4101	-	0.0003	0.0006	0.0008	0.0008	0.0008	0.0005	0.0010	0.0011	0.0013	0.0014	0.0016								
4	0.4546	0.4141	-	0.0004	0.0005	0.0008	0.0008	0.0009	0.0008	0.0010	0.0012	0.0013	0.0014	0.0016								
5	0.4540	0.4133	-	0.0003	0.0006	0.0005	0.0005	0.0006	0.0005	0.0009	0.0011	0.0012	0.0013	0.0015								
6	0.4552	0.4139	-	0.0005	0.0005	0.0008	0.0008	0.0008	0.0007	0.0011	0.0012	0.0013	0.0015	0.0016								
7	0.4554	0.4133	-	0.0005	0.0006	0.0009	0.0009	0.0011	0.0009	0.0014	0.0015	0.0017	0.0018	0.0019								
8	0.4545	0.4135	-	0.0004	0.0008	0.0008	0.0008	0.0009	0.0006	0.0010	0.0011	0.0013	0.0014	0.0015								
9	0.4544	0.4131	-	0.0004	0.0002	0.0004	0.0004	0.0005	0.0002	0.0006	0.0008	0.0009	0.0010	0.0012								
10	0.4542	0.4140	-	0.0004	0.0005	0.0008	0.0008	0.0009	0.0007	0.0012	0.0013	0.0014	0.0015	0.0017								
11	0.4561	0.4131	-	0.0005	0.0006	0.0009	0.0009	0.0009	0.0007	0.0012	0.0013	0.0015	0.0016	0.0017								
12	0.4535	0.4122	-	0.0007	0.0006	0.0009	0.0009	0.0010	0.0007	0.0013	0.0014	0.0016	0.0017	0.0019								
13	0.4542	0.4134	-	0.0006	0.0007	0.0011	0.0011	0.0010	0.0011	0.0018	0.0019	0.0021	0.0022	0.0024								
14	0.4542	0.4133	-	0.0006	0.0010	0.0010	0.0010	0.0011	0.0009	0.0014	0.0015	0.0017	0.0018	0.0019								
15	0.4538	0.4126	-	0.0004	0.0009	0.0009	0.0009	0.0011	0.0009	0.0016	0.0017	0.0018	0.0020	0.0021								
16	0.4554	0.4128	-	0.0004	0.0008	0.0009	0.0009	0.0012	0.0009	0.0015	0.0016	0.0017	0.0019	0.0020								
17	0.4544	0.4130	-	0.0005	0.0007	0.0011	0.0011	0.0012	0.0011	0.0017	0.0018	0.0020	0.0021	0.0022								
18	0.4546	0.4129	-	0.0005	0.0011	0.0009	0.0009	0.0010	0.0007	0.0009	0.0010	0.0012	0.0013	0.0014								
19	0.4546	0.4127	-	0.0005	0.0007	0.0011	0.0011	0.0011	0.0011	0.0015	0.0016	0.0018	0.0019	0.0020								
20	0.4546	0.4133	-	0.0002	0.0002	0.0008	0.0008	0.0010	0.0008	0.0014	0.0015	0.0017	0.0018	0.0019								
Max.			-	0.0007	0.0011	0.0011	0.0011	0.0012	0.0011	0.0018	0.0019	0.0021	0.0022	0.0024								
Ave.			-	0.0004	0.0007	0.0009	0.0009	0.0010	0.0008	0.0012	0.0014	0.0015	0.0017	0.0018								
Min.			-	0.0002	0.0002	0.0004	0.0004	0.0005	0.0002	0.0006	0.0008	0.0009	0.0010	0.0012								
Std. dev.			-	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003								
Median			-	0.0004	0.0007	0.0009	0.0009	0.0010	0.0008	0.0012	0.0014	0.0015	0.0017	0.0018								





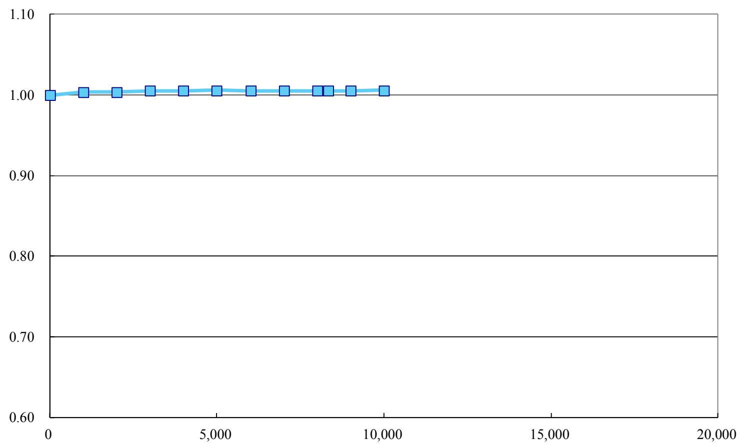
6-2. Test condition 2 : 85C

6-2-3. Forward Voltage

Actual case temperature (Ts)	82.3C
Actual ambient temperature (Ta)	81.8C
Drive current (If)	4,680mA

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	8,335 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	114.20	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
2	113.91	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
3	114.91	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
4	114.15	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
5	113.78	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
6	113.24	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
7	113.02	1.00	1.01	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
8	113.50	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
9	112.83	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
10	113.28	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
11	113.27	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01								
12	113.43	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
13	113.32	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
14	113.42	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
15	113.87	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
16	113.02	1.00	1.00	1.00	1.01	1.01	1.00	1.01	1.01	1.01	1.01	1.01	1.01								
17	112.79	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.01	1.01	1.01	1.01								
18	113.33	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
19	115.06	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
20	113.49	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
Max.		1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
Ave.		1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
Min.		1.00	1.00	1.00	1.00	1.00	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	0.00	0.00	0.00	0.00	0.00								
Median		1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.01								

Forward Voltage (normalized value)



6-2. Test condition 2 : 85C

6-2-4. Calculated CCT

Actual case temperature (Ts)	82.3C
Actual ambient temperature (Ta)	81.8C
Drive current (If)	4,680mA

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	8,335 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	2,784	2,790	2,800	2,803	2,803	2,809	2,803	2,810	2,805	2,808	2,811	2,813								
2	2,700	2,806	2,816	2,826	2,824	2,824	2,828	2,822	2,834	2,830	2,833	2,836	2,838								
3	2,700	2,791	2,797	2,804	2,807	2,807	2,808	2,801	2,812	2,807	2,810	2,812	2,815								
4	2,700	2,803	2,812	2,815	2,820	2,820	2,822	2,820	2,825	2,820	2,823	2,826	2,828								
5	2,700	2,805	2,800	2,820	2,817	2,817	2,819	2,816	2,826	2,822	2,825	2,828	2,830								
6	2,700	2,793	2,803	2,804	2,810	2,810	2,811	2,807	2,816	2,812	2,815	2,817	2,820								
7	2,700	2,784	2,794	2,798	2,804	2,804	2,808	2,804	2,815	2,810	2,813	2,815	2,818								
8	2,700	2,800	2,810	2,817	2,818	2,818	2,821	2,814	2,823	2,818	2,821	2,824	2,827								
9	2,700	2,798	2,806	2,800	2,806	2,806	2,808	2,802	2,812	2,807	2,810	2,812	2,815								
10	2,700	2,808	2,818	2,820	2,827	2,827	2,828	2,823	2,834	2,829	2,832	2,835	2,838								
11	2,700	2,773	2,784	2,785	2,792	2,792	2,793	2,789	2,799	2,794	2,797	2,799	2,802								
12	2,700	2,804	2,819	2,818	2,825	2,825	2,826	2,821	2,832	2,828	2,831	2,833	2,836								
13	2,700	2,803	2,815	2,818	2,826	2,826	2,826	2,827	2,842	2,838	2,841	2,844	2,846								
14	2,700	2,803	2,815	2,824	2,824	2,824	2,827	2,823	2,833	2,829	2,832	2,835	2,837								
15	2,700	2,803	2,812	2,822	2,823	2,823	2,828	2,823	2,837	2,833	2,836	2,838	2,841								
16	2,700	2,781	2,790	2,797	2,801	2,801	2,806	2,800	2,813	2,808	2,811	2,813	2,816								
17	2,700	2,798	2,810	2,814	2,822	2,822	2,825	2,822	2,835	2,831	2,834	2,836	2,839								
18	2,700	2,793	2,805	2,816	2,813	2,813	2,815	2,809	2,812	2,808	2,810	2,813	2,816								
19	2,700	2,792	2,803	2,806	2,816	2,816	2,816	2,814	2,824	2,819	2,822	2,825	2,827								
20	2,700	2,797	2,801	2,802	2,814	2,814	2,820	2,815	2,829	2,824	2,827	2,830	2,832								
Max.		2,808	2,819	2,826	2,827	2,827	2,828	2,827	2,842	2,838	2,841	2,844	2,846								
Ave.		2,796	2,805	2,810	2,815	2,815	2,817	2,813	2,823	2,819	2,821	2,824	2,827								
Min.		2,773	2,784	2,785	2,792	2,792	2,793	2,789	2,799	2,794	2,797	2,799	2,802								
Std. dev.		9	10	11	10	10	9	10	11	11	11	12	12								
Median		2,798	2,805	2,814	2,816	2,816	2,820	2,815	2,824	2,820	2,822	2,825	2,828								

6-2. Test condition 2 : 85C

6-2-5. Ra

Actual case temperature (Ts)	82.3C
Actual ambient temperature (Ta)	81.8C
Drive current (If)	4,680mA

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	8,335 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	92	92	92	92	92	92	92	92	92	92	92	92	92								
2	92	92	92	92	92	92	92	92	92	92	92	92	92								
3	92	92	92	92	92	92	92	92	92	92	92	92	92								
4	92	92	92	92	92	92	92	92	92	92	92	92	92								
5	92	92	92	92	92	92	92	92	92	92	92	92	92								
6	92	92	92	92	92	92	92	92	92	92	92	92	92								
7	92	92	92	92	92	92	92	92	92	92	92	92	92								
8	92	92	92	92	92	92	92	92	92	92	92	92	92								
9	92	92	92	92	92	92	92	92	92	92	92	92	92								
10	92	92	92	92	92	92	92	92	92	92	92	92	92								
11	92	92	92	92	92	92	92	92	92	92	92	92	92								
12	92	92	92	92	92	92	92	92	92	92	92	92	92								
13	92	92	92	92	92	92	92	92	92	92	92	92	92								
14	92	92	92	92	92	92	92	92	92	92	92	92	92								
15	92	92	92	92	92	92	92	92	92	92	92	92	92								
16	92	92	92	92	92	92	92	92	92	92	92	92	92								
17	92	92	92	92	92	92	92	92	92	92	92	92	92								
18	92	92	92	92	92	92	92	92	92	92	92	92	92								
19	92	92	92	92	92	92	92	92	92	92	92	92	92								
20	92	92	92	92	92	92	92	92	92	92	92	92	92								
Max.		92	92	92	92	92	92	92	92	92	92	92	92								
Ave.		92	92	92	92	92	92	92	92	92	92	92	92								
Min.		92	92	92	92	92	92	92	92	92	92	92	92								
Std. dev.		0	0	0	0	0	0	0	0	0	0	0	0								
Median		92	92	92	92	92	92	92	92	92	92	92	92								

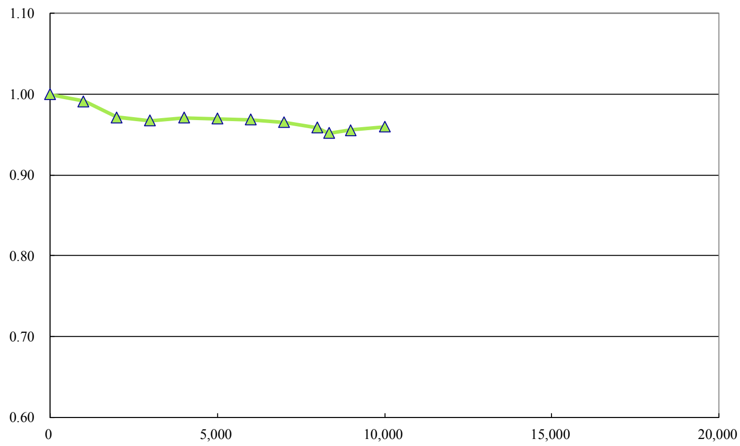
6-3. Test condition 3 : 105C

6-3-1. Lumen Maintenance

Actual case temperature (Ts)	104.4C
Actual ambient temperature (Ta)	102.4C
Drive current (If)	4,680mA

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	8,335 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	39,869	1.000	0.988	0.974	0.973	0.984	0.974	0.970	0.967	0.960	0.954	0.958	0.961								
2	40,868	1.000	0.983	0.968	0.966	0.966	0.971	0.971	0.968	0.961	0.955	0.960	0.965								
3	40,223	1.000	0.998	0.979	0.975	0.975	0.975	0.975	0.972	0.965	0.958	0.963	0.968								
4	40,375	1.000	0.991	0.973	0.963	0.963	0.960	0.959	0.956	0.949	0.942	0.946	0.950								
5	39,680	1.000	0.981	0.967	0.963	0.963	0.964	0.970	0.967	0.960	0.954	0.957	0.961								
6	40,353	1.000	0.990	0.968	0.959	0.959	0.951	0.947	0.944	0.937	0.931	0.934	0.938								
7	39,813	1.000	0.963	0.924	0.922	0.950	0.946	0.946	0.943	0.936	0.928	0.932	0.935								
8	39,621	1.000	0.991	0.970	0.963	0.963	0.961	0.959	0.956	0.949	0.943	0.947	0.950								
9	40,183	1.000	0.992	0.971	0.964	0.964	0.954	0.951	0.948	0.942	0.935	0.939	0.943								
10	40,226	1.000	0.997	0.985	0.990	0.990	0.993	0.997	0.994	0.987	0.980	0.984	0.988								
11	40,273	1.000	0.994	0.970	0.966	0.977	0.968	0.966	0.963	0.955	0.948	0.951	0.955								
12	39,883	1.000	0.994	0.976	0.973	0.973	0.974	0.968	0.965	0.959	0.952	0.955	0.958								
13	39,268	1.000	0.984	0.954	0.956	0.966	0.951	0.952	0.949	0.942	0.936	0.940	0.943								
14	39,869	1.000	0.994	0.975	0.975	0.975	0.981	0.985	0.982	0.975	0.968	0.972	0.976								
15	39,298	1.000	0.989	0.977	0.972	0.972	0.973	0.976	0.973	0.967	0.960	0.964	0.968								
16	40,071	1.000	0.990	0.968	0.962	0.962	0.957	0.951	0.948	0.942	0.935	0.939	0.943								
17	39,148	1.000	0.997	0.979	0.970	0.970	0.972	0.971	0.968	0.960	0.953	0.954	0.956								
18	38,848	1.000	1.017	0.999	0.993	1.004	0.997	0.994	0.991	0.984	0.977	0.981	0.985								
19	39,198	1.000	0.986	0.967	0.959	0.959	0.975	0.970	0.967	0.960	0.954	0.957	0.961								
20	38,434	1.000	1.007	0.986	0.987	0.987	0.997	0.991	0.988	0.981	0.974	0.979	0.984								
Max.		1.000	1.017	0.999	0.993	1.004	0.997	0.997	0.994	0.987	0.980	0.984	0.988								
Ave.		1.000	0.991	0.971	0.968	0.971	0.970	0.968	0.966	0.959	0.952	0.956	0.959								
Min.		1.000	0.963	0.924	0.922	0.950	0.946	0.946	0.943	0.936	0.928	0.932	0.935								
Std. dev.		0.000	0.010	0.014	0.015	0.012	0.014	0.015	0.015	0.015	0.015	0.015	0.015								
Median		1.000	0.991	0.972	0.966	0.968	0.971	0.970	0.967	0.960	0.953	0.956	0.959								

Lumen Maintenance (normalized value)



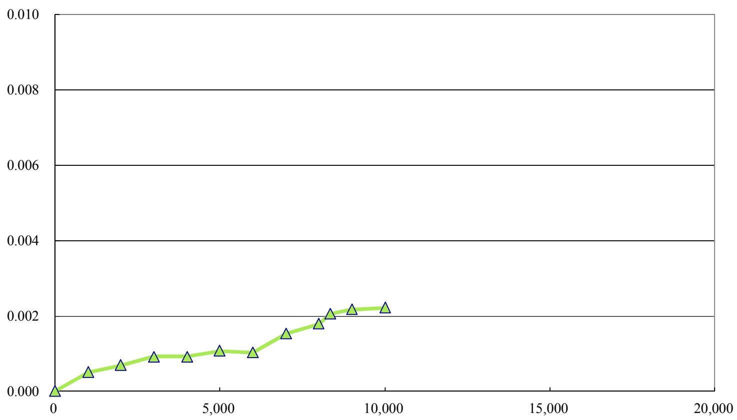
6-3. Test condition 3 : 105C

6-3-2. Chromaticity Shift (Δu'v')

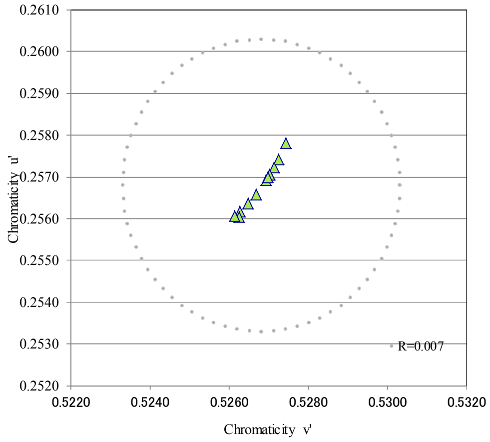
Actual case temperature (Ts)	104.4C
Actual ambient temperature (Ta)	102.4C
Drive current (If)	4,680mA

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	8,335 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	0.4549	0.4132	-	0.0004	0.0007	0.0009	0.0009	0.0011	0.0010	0.0016	0.0019	0.0022	0.0025	0.0024								
2	0.4541	0.4131	-	0.0003	0.0004	0.0006	0.0006	0.0007	0.0007	0.0012	0.0015	0.0018	0.0018	0.0018								
3	0.4551	0.4138	-	0.0007	0.0004	0.0007	0.0007	0.0009	0.0009	0.0012	0.0015	0.0018	0.0021	0.0023								
4	0.4541	0.4122	-	0.0006	0.0005	0.0009	0.0009	0.0011	0.0012	0.0020	0.0023	0.0025	0.0028	0.0027								
5	0.4532	0.4126	-	0.0003	0.0005	0.0007	0.0007	0.0010	0.0012	0.0006	0.0009	0.0011	0.0014	0.0017								
6	0.4544	0.4125	-	0.0002	0.0005	0.0009	0.0009	0.0014	0.0014	0.0021	0.0024	0.0027	0.0024	0.0021								
7	0.4519	0.4117	-	0.0003	0.0006	0.0007	0.0007	0.0007	0.0007	0.0007	0.0008	0.0009	0.0011	0.0013								
8	0.4542	0.4138	-	0.0002	0.0003	0.0008	0.0008	0.0009	0.0009	0.0015	0.0017	0.0020	0.0023	0.0026								
9	0.4542	0.4129	-	0.0005	0.0007	0.0010	0.0010	0.0012	0.0012	0.0023	0.0026	0.0029	0.0028	0.0027								
10	0.4547	0.4133	-	0.0005	0.0007	0.0010	0.0010	0.0007	0.0005	0.0009	0.0012	0.0014	0.0017	0.0014								
11	0.4543	0.4132	-	0.0005	0.0008	0.0010	0.0010	0.0016	0.0015	0.0020	0.0023	0.0025	0.0025	0.0025								
12	0.4544	0.4131	-	0.0003	0.0006	0.0007	0.0007	0.0012	0.0011	0.0018	0.0021	0.0024	0.0024	0.0022								
13	0.4533	0.4126	-	0.0003	0.0003	0.0008	0.0008	0.0012	0.0011	0.0018	0.0021	0.0024	0.0025	0.0025								
14	0.4541	0.4126	-	0.0004	0.0005	0.0007	0.0007	0.0007	0.0007	0.0010	0.0013	0.0015	0.0017	0.0019								
15	0.4537	0.4131	-	0.0002	0.0008	0.0008	0.0008	0.0008	0.0009	0.0012	0.0014	0.0017	0.0018	0.0021								
16	0.4538	0.4136	-	0.0003	0.0006	0.0008	0.0008	0.0008	0.0008	0.0020	0.0023	0.0026	0.0026	0.0026								
17	0.4539	0.4127	-	0.0006	0.0010	0.0009	0.0009	0.0011	0.0011	0.0018	0.0021	0.0024	0.0027	0.0026								
18	0.4547	0.4124	-	0.0011	0.0013	0.0014	0.0014	0.0014	0.0010	0.0016	0.0018	0.0020	0.0022	0.0025								
19	0.4565	0.4147	-	0.0018	0.0021	0.0022	0.0022	0.0019	0.0019	0.0017	0.0020	0.0022	0.0025	0.0026								
20	0.4556	0.4139	-	0.0006	0.0008	0.0010	0.0010	0.0012	0.0009	0.0016	0.0018	0.0021	0.0018	0.0021								
Max.			-	0.0018	0.0021	0.0022	0.0022	0.0019	0.0019	0.0023	0.0026	0.0029	0.0028	0.0027								
Ave.			-	0.0005	0.0007	0.0009	0.0009	0.0011	0.0010	0.0015	0.0018	0.0021	0.0022	0.0022								
Min.			-	0.0002	0.0003	0.0006	0.0006	0.0007	0.0005	0.0006	0.0008	0.0009	0.0011	0.0013								
Std. dev.			-	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0005	0.0005	0.0005	0.0005	0.0004								
Median			-	0.0004	0.0006	0.0009	0.0009	0.0011	0.0010	0.0016	0.0019	0.0021	0.0023	0.0024								

Chromaticity Shift (Δ u'v')



u'v'



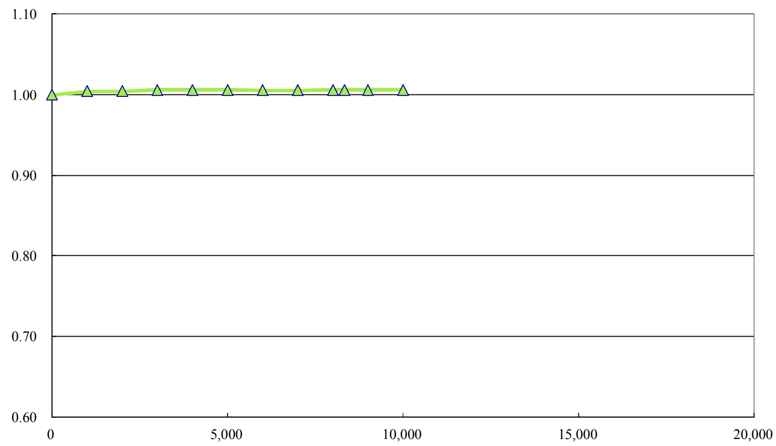
6-3. Test condition 3 : 105C

6-3-3. Forward Voltage

Actual case temperature (Ts)	104.4C
Actual ambient temperature (Ta)	102.4C
Drive current (If)	4,680mA

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	8,335 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	113.04	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
2	113.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
3	113.42	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
4	113.59	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
5	113.58	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
6	113.53	1.00	1.00	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
7	114.12	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
8	113.07	1.00	1.01	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
9	114.18	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00								
10	113.66	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
11	113.77	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.01	1.01	1.01	1.01								
12	113.56	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
13	113.60	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
14	113.55	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.01	1.01								
15	113.40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
16	113.51	1.00	1.01	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
17	114.46	1.00	1.01	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
18	113.74	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
19	113.85	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
20	112.71	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
Max.		1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
Ave.		1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								
Min.		1.00	1.00	1.00	1.00	1.00	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	0.00	0.00	0.00	0.00	0.00								
Median		1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01								

Forward Voltage (normalized value)



6-3. Test condition 3 : 105C

6-3-4. Calculated CCT

Actual case temperature (Ts)	104.4C
Actual ambient temperature (Ta)	102.4C
Drive current (If)	4,680mA

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	8,335 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	2,791	2,799	2,806	2,810	2,810	2,814	2,813	2,826	2,846	2,874	2,835	2,831								
2	2,700	2,802	2,809	2,810	2,816	2,816	2,818	2,818	2,828	2,849	2,877	2,829	2,825								
3	2,700	2,793	2,808	2,802	2,808	2,808	2,812	2,812	2,820	2,838	2,867	2,827	2,833								
4	2,700	2,795	2,808	2,806	2,815	2,815	2,818	2,821	2,836	2,857	2,885	2,846	2,843								
5	2,700	2,811	2,817	2,821	2,827	2,827	2,832	2,837	2,823	2,844	2,872	2,833	2,838								
6	2,700	2,792	2,796	2,803	2,812	2,812	2,821	2,822	2,837	2,858	2,886	2,835	2,829								
7	2,700	2,824	2,818	2,826	2,820	2,820	2,819	2,812	2,814	2,834	2,862	2,823	2,829								
8	2,700	2,807	2,811	2,814	2,823	2,823	2,826	2,826	2,837	2,858	2,887	2,847	2,853								
9	2,700	2,800	2,811	2,814	2,820	2,820	2,824	2,825	2,848	2,869	2,898	2,851	2,850								
10	2,700	2,795	2,807	2,810	2,817	2,817	2,811	2,807	2,815	2,835	2,863	2,824	2,818								
11	2,700	2,800	2,812	2,817	2,823	2,823	2,835	2,833	2,843	2,864	2,893	2,848	2,844								
12	2,700	2,798	2,804	2,811	2,814	2,814	2,823	2,821	2,837	2,858	2,886	2,845	2,839								
13	2,700	2,810	2,816	2,817	2,827	2,827	2,836	2,835	2,850	2,871	2,900	2,858	2,859								
14	2,700	2,798	2,807	2,809	2,814	2,814	2,814	2,813	2,821	2,841	2,869	2,828	2,833								
15	2,700	2,808	2,813	2,825	2,825	2,825	2,825	2,826	2,834	2,855	2,883	2,841	2,847								
16	2,700	2,810	2,817	2,823	2,828	2,828	2,828	2,828	2,853	2,874	2,903	2,861	2,857								
17	2,700	2,802	2,814	2,824	2,822	2,822	2,825	2,825	2,840	2,861	2,890	2,850	2,846								
18	2,700	2,788	2,806	2,809	2,813	2,813	2,815	2,801	2,822	2,842	2,870	2,831	2,836								
19	2,700	2,780	2,807	2,815	2,818	2,818	2,808	2,812	2,802	2,822	2,849	2,811	2,807								
20	2,700	2,787	2,799	2,804	2,808	2,808	2,813	2,805	2,819	2,839	2,867	2,817	2,823								
Max.		2,824	2,818	2,826	2,828	2,828	2,836	2,837	2,853	2,874	2,903	2,861	2,859								
Ave.		2,800	2,809	2,813	2,818	2,818	2,821	2,820	2,830	2,851	2,879	2,837	2,837								
Min.		2,780	2,796	2,802	2,808	2,808	2,808	2,801	2,802	2,822	2,849	2,811	2,807								
Std. dev.		10	6	7	6	6	8	10	13	14	14	13	13								
Median		2,799	2,809	2,813	2,818	2,818	2,820	2,821	2,831	2,852	2,880	2,835	2,837								

6-3. Test condition 3 : 105C

6-3-5. Ra

Actual case temperature (Ts)	104.4C
Actual ambient temperature (Ta)	102.4C
Drive current (If)	4,680mA

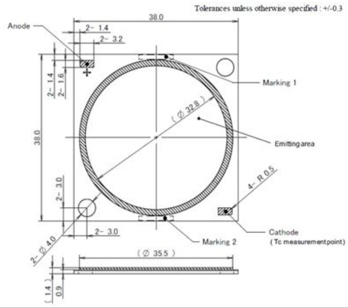
Sample No.	Ra	Ra																			
	0H	0H	1,000 H	2,000 H	3,000 H	4,000 H	5,000 H	6,000 H	7,000 H	8,000 H	8,335 H	9,000 H	10,000 H	11,000 H	12,000 H	13,000 H	14,000 H	15,000 H	16,000 H	17,000 H	18,000 H
1	92	92	92	92	92	92	92	92	92	92	92	92	92								
2	92	92	92	92	92	92	92	92	92	92	92	92	92								
3	92	92	92	92	92	92	92	92	92	92	92	92	92								
4	92	92	92	92	92	92	92	92	92	92	92	92	92								
5	92	92	92	92	92	92	92	92	92	92	92	92	92								
6	92	92	92	92	92	92	92	92	92	92	92	92	92								
7	92	92	92	92	92	92	92	92	92	92	92	92	92								
8	92	92	92	92	92	92	92	92	92	92	92	92	92								
9	92	92	92	92	92	92	92	92	92	92	92	92	92								
10	92	92	92	92	92	92	92	92	92	92	92	92	92								
11	92	92	92	92	92	92	92	92	92	92	92	92	92								
12	92	92	92	92	92	92	92	92	92	92	92	92	92								
13	92	92	92	92	92	92	92	92	92	92	92	92	92								
14	92	92	92	92	92	92	92	92	92	92	92	92	92								
15	92	92	92	92	92	92	92	92	92	92	92	92	92								
16	92	92	92	92	92	92	92	92	92	92	92	92	92								
17	92	92	92	92	92	92	92	92	92	92	92	92	92								
18	92	92	92	92	92	92	92	92	92	92	92	92	92								
19	91	91	92	92	92	92	92	92	92	92	92	92	92								
20	92	92	92	92	92	92	92	92	92	92	92	92	92								
Max.		92	92	92	92	92	92	92	92	92	92	92	92								
Ave.		92	92	92	92	92	92	92	92	92	92	92	92								
Min.		91	92	92	92	92	92	92	92	92	92	92	92								
Std. dev.		0	0	0	0	0	0	0	0	0	0	0	0								
Median		92	92	92	92	92	92	92	92	92	92	92	92								

~CLU056 LM-80report Appendix~ Applicable product series

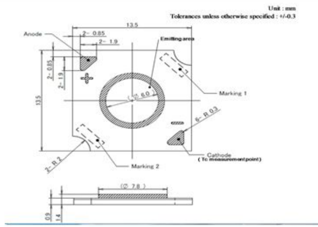
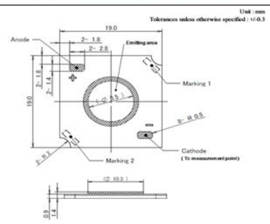
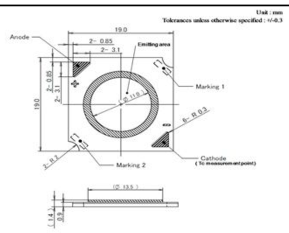
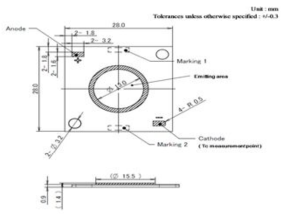
The per-chip current density of the maximum forward current in Table

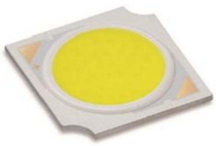
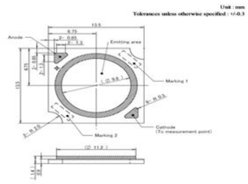
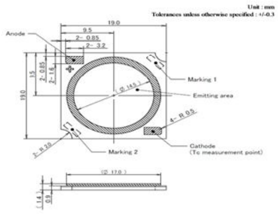
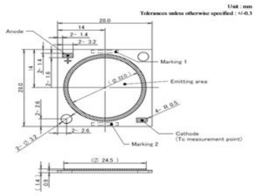
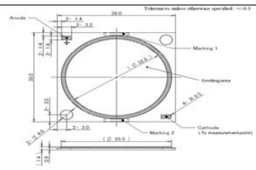
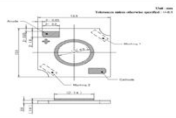
Identical construction process is used for the products in Table below.

~ LED light sources Tested ~

Product	Nominal CCT	Die Count	Die Spacing	Drive Current	Power Density	Product Picture	Mechanical Drawing
CLU056-3626	2,700K	936pcs	0.20mm	4,680mA (180mA/die)	0.402W/mm2		

~ Applicable Product Series ~

Product		Die Count	Die Spacing	Maximum Forward Current	Maximum Power Density	Product Picture	Mechanical Drawing
CLU700	-1002 series	20 pcs	0.25mm	360 mA	0.068 W/mm2		
CLU701	-1002 series	20 pcs	0.25mm	360 mA	0.068 W/mm2		
CLU710	1204series	48 pcs	0.25mm	720 mA	0.083 W/mm2		
CLU711	1204series	48 pcs	0.25mm	720 mA	0.083 W/mm2		
CLU720	1206series	72 pcs	0.34mm	1,080 mA	0.139 W/mm2		
CLU721	1206series	72 pcs	0.34mm	1,080 mA	0.139 W/mm2		
CLU730	1210series	120 pcs	0.26mm	1,800 mA	0.095 W/mm2		
CLU731	1210series	120 pcs	0.26mm	1,800 mA	0.095 W/mm2		

Product		Die Count	Die Spacing	Maximum Forward Current	Maximum Power Density	Product Picture	Mechanical Drawing
CLU026	1201series	12 pcs	1.25mm	180 mA	0.039 W/mm2		
CLU026	1202series	24 pcs	0.35mm	360 mA	0.079 W/mm2		
CLU026	1203series	36 pcs	0.36mm	540 mA	0.118 W/mm2		
CLU026	1204series	48 pcs	0.35mm	720 mA	0.157 W/mm2		
CLU028	1201series	12 pcs	1.25mm	180 mA	0.039 W/mm2		
CLU028	1202series	24 pcs	0.35mm	360 mA	0.079 W/mm2		
CLU028	1203series	36 pcs	0.36mm	540 mA	0.118 W/mm2		
CLU028	1204series	48 pcs	0.35mm	720 mA	0.157 W/mm2		
CLU036	1205series	60 pcs	0.57mm	900 mA	0.103 W/mm2		
CLU036	1206series	72 pcs	0.65mm	1,080 mA	0.124 W/mm2		
CLU036	1208series	96 pcs	0.37mm	1,440 mA	0.165 W/mm2		
CLU038	1205series	60 pcs	0.57mm	900 mA	0.103 W/mm2		
CLU038	1206series	72 pcs	0.65mm	1,080 mA	0.124 W/mm2		
CLU038	1208series	96 pcs	0.37mm	1,440 mA	0.165 W/mm2		
CLU038	1210series	120 pcs	0.30mm	1,800 mA	0.211 W/mm2		
CLU046	1212series	144 pcs	0.60mm	2,160 mA	0.114 W/mm2		
CLU046	1812series	216 pcs	0.34mm	2,160 mA	0.171 W/mm2		
CLU046	1818series	324 pcs	0.28mm	3,240 mA	0.257 W/mm2		
CLU048	1212series	144 pcs	0.60mm	2,160 mA	0.114 W/mm2		
CLU048	1812series	216 pcs	0.34mm	2,160 mA	0.171 W/mm2		
CLU048	1818series	324 pcs	0.28mm	3,240 mA	0.257 W/mm2		
CLU056	1825series	450 pcs	0.40mm	4,500 mA	0.193 W/mm2		
CLU056	3618series	648 pcs	0.39mm	3,240 mA	0.278 W/mm2		
CLU058	1825series	450 pcs	0.40mm	4,500 mA	0.193 W/mm2		
CLU058	3618series	648 pcs	0.39mm	3,240 mA	0.278 W/mm2		
CLU027	0303series	9 pcs	0.60mm	540 mA	0.029 W/mm2		
CLU550	3626series	936 pcs	0.20mm	4,680 mA	0.402 W/mm2