



Report No. : SQETMOJ75B01

LM-80 Test Report

This LM-80 testing is performed in accordance with IES LM-80-08.

Part No. NVSL219C

Issue Date:	October 20, 2020	Revision Date:	-
Test Initiation Date:	September 26, 2014	Test Completion Date:	January 26, 2016
Test Duration:	10,000 hours	Report No.:	SQETMOJ75B01

Customer Information:

Company Name: Nichia Corporation
 Address: 491-100, Oka, Kaminaka-cho, Anan-shi, Tokushima, 774-8601, JAPAN

Description of Test Samples:

Manufacturer's Name: Nichia Corporation
 Classification: LED Package
 Part Name: Warm White LED
 Part No.: NVSL219C
 Nominal CCT: 2700 K

Test Summary:

Data Set	Case Temperature [°C]	Ambient Temperature [°C]	Drive Current [mA]	Luminous Flux Maintenance at 10K hours [%]	Chromaticity Shift ($\Delta u'v'$) at 10K hours	TM-21 Projection $L_{70}(10K)$ [hours]	TM-21 Projection $L_{80}(10K)$ [hours]	TM-21 Projection $L_{90}(10K)$ [hours]
1	55	> 50	700	99.7	0.0016	> 60000	> 60000	> 60000
2	55	> 50	1500	99.1	0.0019	> 60000	> 60000	> 60000
3	85	> 80	700	99.4	0.0019	> 60000	> 60000	> 60000
4	85	> 80	1200	97.0	0.0018	> 60000	> 60000	37900
5	85	> 80	1500	99.4	0.0021	> 60000	> 60000	> 60000
6	105	> 100	700	94.4	0.0014	> 60000	47100	20400
7	105	> 100	1200	91.8	0.0017	53900	32200	12900
8	105	> 100	1500	90.1	0.0022	47400	27500	9930
9	120	> 115	700	94.4	0.0018	> 60000	> 60000	25300
10	120	> 115	1200	94.5	0.0029	> 60000	58600	24200
11	120	> 115	1500	89.0	0.0037	49000	27300	8330 *

* The L_p value is reached experimentally in the course of LM-80 testing.

Approved Signatory:

Takara WAKAKI, Lab Manager

Nichia Corporation LED Testing Laboratory

1-1, Tatsumi-Cho, Anan-Shi, TOKUSHIMA 774-0001, JAPAN

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**Applicable Part Nos.:****This LM-80 test report applies to the following parts:**

Series	Part No.	Case Temperature [°C]	Forward Current [mA]	Nominal CCT * [K]	Data Set No.
219	NVSL219C NVSL219CT	55	700	≥ 2200	1
		55	1500	≥ 2200	2
		85	700	≥ 2200	3
		85	1200	≥ 2200	4
		85	1500	≥ 2200	5
		105	700	≥ 2200	6
		105	1200	≥ 2200	7
		105	1500	≥ 2200	8
		120	700	≥ 2200	9
		120	1200	≥ 2200	10
		120	1500	≥ 2200	11
219	NVSW219C NVSW219CT	55	700	≥ 5000	1
		55	1500	≥ 5000	2
		85	700	≥ 5000	3
		85	1200	≥ 5000	4
		85	1500	≥ 5000	5
		105	700	≥ 5000	6
		105	1200	≥ 5000	7
		105	1500	≥ 5000	8
		120	700	≥ 5000	9
		120	1200	≥ 5000	10
		120	1500	≥ 5000	11

* The Nominal CCT category in this document refers ENERGY STAR® Requirements for the Use of LM-80 Data.

**Applicable Part Nos.:****This LM-80 test report applies to the following parts:**

Series	Part No.	Case Temperature [°C]	Forward Current [mA]	Nominal CCT * [K]	Data Set No.
219	NVSW219D NVSW219DT	55	700	≥ 2200	1
		55	1500	≥ 2200	2
		85	700	≥ 2200	3
		85	1200	≥ 2200	4
		85	1500	≥ 2200	5
		105	700	≥ 2200	6
		105	1200	≥ 2200	7
		105	1500	≥ 2200	8
		120	700	≥ 2200	9
		120	1200	≥ 2200	10
		120	1500	≥ 2200	11

* The Nominal CCT category in this document refers ENERGY STAR® Requirements for the Use of LM-80 Data.

IES LM-80 Test Report Requirement :

1. Number of LED light sources tested	See tables
2. Description of LED light sources	See Description of Test Samples
3. Description of auxiliary equipment	
Active cooling life test system	Consisting of small boxes, in which each box contains a reliability test board, and a water-cooled heat sink or a heater to control device temperature
LED Tester	Consisting of an integrating sphere, a programmable current-source meter, and a spectroradiometer
4. Operating cycle	Constant direct current (DC)
5. Ambient conditions	
Ambient Temperature (T_A)	See tables
Air flow	Ambient temperature is the temperature of the air at a distance of 1.5 mm above the reliability test board < 0.1 m/s
Relative Humidity	< 65 %
6. Case temperature (Test point temperature)	See tables

For the case temperature (T_s) measurement point, see the figure 1

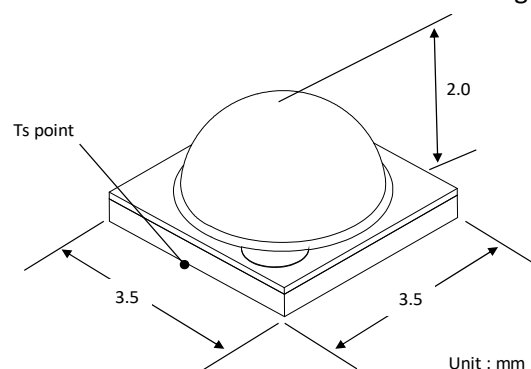


Figure 1: The case temperature (T_s) measurement point

7. Drive current of the LED light sources during lifetime test	See tables
8. Initial luminous flux, forward voltage and chromaticity coordinates	See tables
9. Luminous flux maintenance data for each individual LED light source along with average value, median value, standard deviation, minimum and maximum luminous flux maintenance value for all of the LED light sources	See tables
10. Observation of LED light sources failures including the failure conditions and time of failure	No failure observed
11. LED light source monitoring interval	See tables
12. Photometric measurement uncertainty	
Flux measurement	4.8 % ($k=2$)
Luminous flux maintenance	1.8 % ($k=2$)
13. Chromaticity shift reported over the measurement time	See tables
14. Photometric and electrical measurements	
Measurement point temperature	25°C ± 2°C
Temperature measurement point location	Sphere ambient air temperature monitor
Measurement method	See LM-85-14 section 5.3



ENERGY STAR® LM-80 Cover Sheet

Administrative Information

Tested subcomponent series :	Warm White LED
Tested subcomponent Part No. :	NVSL219C
Report issue date :	October 20, 2020
Report revision date :	-
Testing start date :	September 26, 2014
Testing completion date :	January 26, 2016
LED sampling method :	Comply with LM-80
LED sample size :	24 Packages

LED Identification

LED manufacturer's name :	Nichia Corporation
LED Part No. :	NVSL219C
Description of LED :	LED Package

LED Characteristics

Total input power (W) :

Average current density per LED die (mA/mm²):

Average power density per LED die (W/mm²):

Case Temperature [°C]	Drive Current [mA]	Total Input Power [W]	Average Current density per LED die [mA/mm ²]	Average Power density per LED die [W/mm ²]
55	700	2.08	357	1.06
55	1500	4.85	765	2.48
85	700	2.08	357	1.06
85	1200	3.78	612	1.93
85	1500	4.89	765	2.50
105	700	2.08	357	1.06
105	1200	3.75	612	1.91
105	1500	4.81	765	2.45
120	700	2.09	357	1.07
120	1200	3.73	612	1.90
120	1500	4.83	765	2.46

Representative CRI (Ra) of the tested sample set : Ra = 82.3

Minimum die edge to die edge spacing : N/A

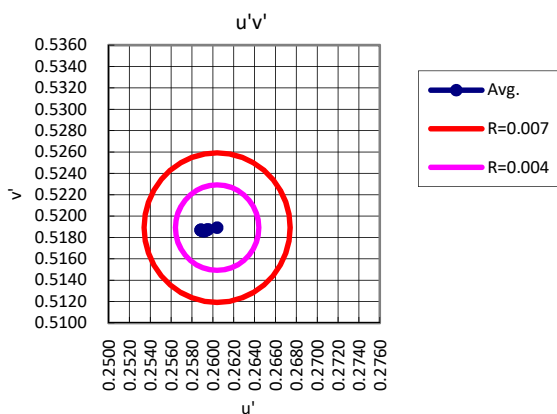
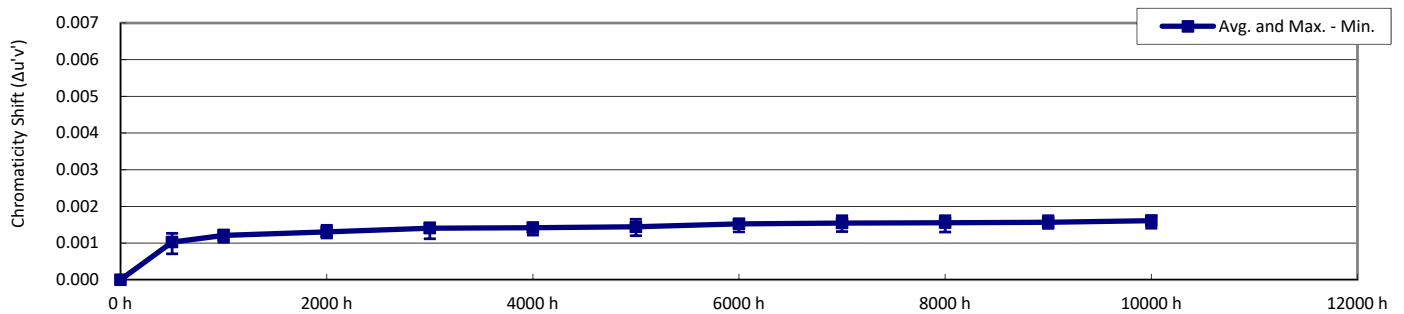
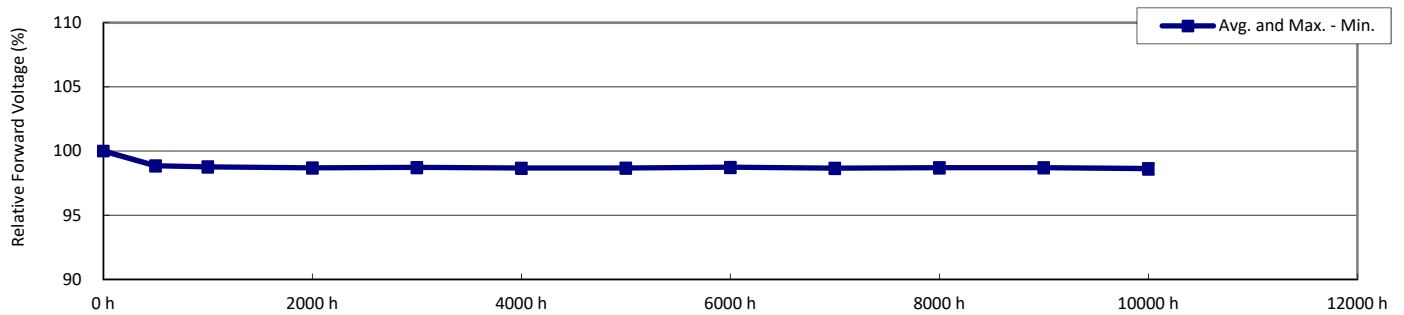
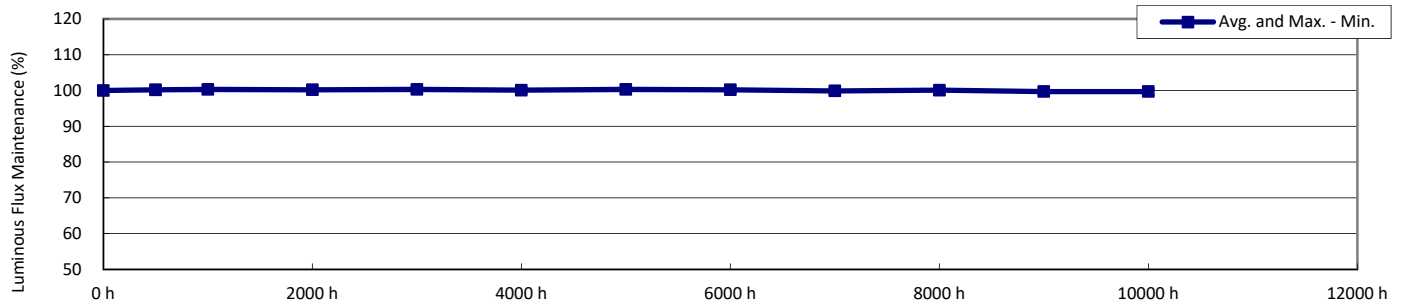
Data Set 1 : 55 °C, 700 mA

Actual Case Temperature [T_S]	56.8 °C
Actual Ambient Temperature [T_A]	55.6 °C
Drive Current [I_F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 1 : 55 °C, 700 mA

Actual Case Temperature [T _S]	56.8 °C
Actual Ambient Temperature [T _A]	55.6 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 1-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _v [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	246	2.96	2714	2.07	0.454	0.401	0.263	0.523						
2	249	2.95	2784	2.06	0.445	0.395	0.260	0.519						
3	250	2.95	2810	2.07	0.443	0.392	0.259	0.518						
4	247	2.95	2793	2.07	0.444	0.393	0.260	0.518						
5	247	2.96	2743	2.07	0.450	0.398	0.262	0.521						
6	250	2.95	2802	2.07	0.443	0.392	0.260	0.517						
7	250	2.95	2819	2.07	0.442	0.393	0.259	0.518						
8	247	2.95	2748	2.07	0.449	0.396	0.262	0.520						
9	246	2.95	2761	2.06	0.448	0.396	0.261	0.520						
10	249	2.95	2748	2.06	0.449	0.397	0.262	0.520						
11	249	2.95	2789	2.07	0.445	0.395	0.260	0.519						
12	248	2.95	2783	2.07	0.445	0.394	0.260	0.519						
13	246	2.95	2743	2.07	0.451	0.399	0.262	0.522						
14	249	2.99	2807	2.09	0.443	0.393	0.260	0.518						
15	248	2.99	2807	2.09	0.444	0.394	0.259	0.519						
16	251	3.00	2820	2.10	0.441	0.391	0.259	0.517						
17	248	2.99	2774	2.09	0.446	0.394	0.261	0.519						
18	248	2.99	2791	2.09	0.446	0.396	0.260	0.519						
19	249	2.99	2831	2.09	0.441	0.392	0.259	0.517						
20	247	2.99	2781	2.09	0.445	0.393	0.261	0.518						
21	245	2.99	2760	2.09	0.446	0.394	0.262	0.519						
22	250	2.99	2801	2.09	0.445	0.395	0.260	0.519						
23	249	2.99	2810	2.09	0.443	0.393	0.259	0.518						
24	246	2.99	2749	2.09	0.448	0.395	0.262	0.519						
n	24	24	24	24	24	24	24	24						
Avg.	248	2.97	2782	2.08	0.446	0.395	0.260	0.519						
Med.	248	2.96	2786	2.07	0.445	0.394	0.260	0.519						
σ	1.5	0.020	30.4	0.014	0.0031	0.0024	0.0011	0.0014						
Min.	245	2.95	2714	2.06	0.441	0.391	0.259	0.517						
Max.	251	3.00	2831	2.10	0.454	0.401	0.263	0.523						



Data Set 1 : 55 °C, 700 mA

Actual Case Temperature [T _S]	56.8 °C
Actual Ambient Temperature [T _A]	55.6 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 1-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	99.6	100.2	99.9	100.1	100.0	100.1	99.6	99.8	100.1	99.7	99.8						
2	100.0	99.8	99.7	99.5	99.6	99.7	99.6	99.8	99.3	99.5	99.3	99.3						
3	100.0	98.8	99.6	99.5	99.7	99.5	99.9	99.7	99.4	99.6	99.2	99.3						
4	100.0	100.9	101.0	100.8	100.8	100.8	101.0	101.0	100.6	100.8	99.5	100.5						
5	100.0	100.0	100.6	100.4	100.8	100.4	100.7	100.7	100.3	100.6	100.5	100.3						
6	100.0	100.2	99.8	99.6	99.8	99.6	100.0	99.7	99.3	99.7	99.4	99.3						
7	100.0	100.8	100.9	100.6	100.8	100.6	100.8	100.6	100.4	100.6	100.3	100.4						
8	100.0	99.2	100.3	100.5	100.7	100.4	100.5	100.7	100.2	100.5	100.5	100.2						
9	100.0	99.7	100.8	100.9	101.0	100.8	101.3	101.0	100.7	100.9	100.8	100.6						
10	100.0	99.5	99.9	99.9	100.1	99.9	100.2	100.0	99.9	99.9	99.2	99.3						
11	100.0	100.0	99.7	99.7	99.8	99.6	100.0	100.1	99.6	99.9	99.7	99.6						
12	100.0	99.3	100.3	100.6	100.9	100.7	101.2	100.8	100.5	100.8	100.5	100.4						
13	100.0	100.6	100.6	100.3	100.5	100.2	100.6	100.5	100.2	100.5	100.4	100.2						
14	100.0	101.2	100.7	100.6	100.6	100.5	100.5	100.3	100.1	100.3	100.0	100.0						
15	100.0	101.3	101.0	100.8	100.8	100.6	100.7	100.6	100.2	100.6	100.2	100.2						
16	100.0	100.0	100.0	99.6	99.7	99.6	99.8	99.8	99.2	99.3	99.1	99.0						
17	100.0	100.4	100.3	100.1	100.2	99.8	100.2	100.1	99.8	100.1	99.6	99.6						
18	100.0	100.6	100.5	100.3	100.4	100.1	100.4	100.2	99.9	100.0	99.1	99.6						
19	100.0	100.9	100.7	100.4	100.4	100.1	100.2	100.0	99.8	99.9	99.7	99.5						
20	100.0	100.3	100.5	100.2	100.2	100.1	100.3	100.3	99.9	100.0	99.7	99.7						
21	100.0	100.2	100.2	99.9	100.0	99.8	100.2	100.1	99.7	99.8	99.6	99.5						
22	100.0	100.0	99.9	99.5	99.4	99.3	99.1	99.3	98.8	98.9	98.9	98.7						
23	100.0	100.5	100.3	100.0	100.0	99.8	99.7	99.9	99.7	99.8	99.4	99.5						
24	100.0	100.3	100.1	100.0	100.0	99.8	99.5	99.8	99.5	99.8	99.4	99.3						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	100.2	100.3	100.2	100.3	100.1	100.3	100.2	99.9	100.1	99.7	99.7						
Med.	100.0	100.2	100.3	100.2	100.2	100.1	100.2	100.1	99.9	100.0	99.7	99.6						
σ	0.00	0.63	0.42	0.45	0.47	0.44	0.54	0.46	0.48	0.51	0.54	0.51						
Min.	100.0	98.8	99.6	99.5	99.4	99.3	99.1	99.3	98.8	98.9	98.9	98.7						
Max.	100.0	101.3	101.0	100.9	101.0	100.8	101.3	101.0	100.7	100.9	100.8	100.6						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	1.009		
α	1.229E-06		
R ²	0.8044		
Calculated L ₇₀ (10K)	298000	hours	
Reported L ₇₀ (10K)	> 60000	hours	
Calculated L ₈₀ (10K)	189000	hours	
Reported L ₈₀ (10K)	> 60000	hours	
Calculated L ₉₀ (10K)	93000	hours	
Reported L ₉₀ (10K)	> 60000	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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Data Set 1 : 55 °C, 700 mA

Actual Case Temperature [T _s]	56.8 °C
Actual Ambient Temperature [T _A]	55.6 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 1-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.9	98.8	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7						
2	100.0	98.9	98.8	98.7	98.8	98.7	98.7	98.8	98.7	98.7	98.7	98.7						
3	100.0	98.8	98.7	98.6	98.6	98.6	98.6	98.7	98.6	98.6	98.6	98.6						
4	100.0	99.0	98.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8						
5	100.0	99.0	98.9	98.9	98.9	98.8	98.8	98.9	98.8	98.8	98.8	98.8						
6	100.0	99.0	98.9	98.9	98.9	98.8	98.9	98.9	98.8	98.8	98.8	98.8						
7	100.0	99.1	99.1	99.0	99.0	99.0	99.0	99.0	98.9	99.0	99.0	98.9						
8	100.0	99.1	99.0	98.9	99.0	98.9	98.9	98.9	98.9	98.9	98.9	98.8						
9	100.0	99.0	99.0	98.9	98.9	98.9	98.9	98.9	98.8	98.9	98.9	98.8						
10	100.0	99.2	99.1	99.0	99.0	99.0	99.0	99.1	99.0	99.0	99.0	98.9						
11	100.0	99.1	99.0	98.9	98.9	98.9	98.9	98.9	98.8	98.9	98.9	98.8						
12	100.0	99.2	99.1	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	98.9						
13	100.0	99.2	99.2	99.1	99.1	99.0	99.1	99.1	99.1	99.1	99.1	99.0						
14	100.0	98.7	98.6	98.5	98.6	98.5	98.6	98.6	98.5	98.6	98.6	98.5						
15	100.0	98.7	98.6	98.5	98.6	98.5	98.5	98.6	98.5	98.6	98.6	98.5						
16	100.0	98.4	98.3	98.3	98.3	98.2	98.3	98.3	98.2	98.3	98.3	98.2						
17	100.0	98.6	98.6	98.5	98.5	98.5	98.5	98.6	98.5	98.5	98.5	98.5						
18	100.0	98.6	98.6	98.5	98.5	98.5	98.5	98.6	98.5	98.6	98.6	98.5						
19	100.0	98.6	98.5	98.4	98.5	98.4	98.5	98.5	98.4	98.5	98.5	98.4						
20	100.0	98.6	98.5	98.4	98.5	98.4	98.4	98.5	98.4	98.5	98.5	98.4						
21	100.0	98.7	98.6	98.5	98.6	98.5	98.6	98.6	98.5	98.6	98.6	98.5						
22	100.0	98.7	98.6	98.5	98.6	98.5	98.5	98.6	98.5	98.6	98.5	98.5						
23	100.0	98.6	98.5	98.5	98.5	98.5	98.4	98.5	98.5	98.5	98.5	98.4						
24	100.0	98.6	98.6	98.5	98.5	98.5	98.4	98.6	98.5	98.5	98.5	98.5						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.9	98.8	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.6						
Med.	100.0	98.9	98.8	98.7	98.7	98.7	98.7	98.7	98.6	98.7	98.6	98.6						
σ	0.00	0.24	0.23	0.23	0.23	0.22	0.23	0.21	0.22	0.21	0.21	0.22						
Min.	100.0	98.4	98.3	98.3	98.3	98.2	98.3	98.3	98.2	98.3	98.3	98.2						
Max.	100.0	99.2	99.2	99.1	99.1	99.0	99.1	99.1	99.1	99.1	99.1	99.0						

Data Set 1 : 55 °C, 700 mA

Actual Case Temperature [T _S]	56.8 °C
Actual Ambient Temperature [T _A]	55.6 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 1-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.0000	0.0009	0.0012	0.0012	0.0013	0.0014	0.0014	0.0015	0.0015	0.0016	0.0015	0.0016						
2	0.0000	0.0008	0.0010	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013	0.0014	0.0014						
3	0.0000	0.0008	0.0011	0.0012	0.0013	0.0013	0.0013	0.0014	0.0014	0.0014	0.0014	0.0015						
4	0.0000	0.0011	0.0014	0.0015	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0015	0.0017						
5	0.0000	0.0009	0.0012	0.0013	0.0015	0.0015	0.0016	0.0016	0.0017	0.0017	0.0017	0.0017						
6	0.0000	0.0009	0.0011	0.0012	0.0012	0.0013	0.0012	0.0014	0.0014	0.0013	0.0014	0.0015						
7	0.0000	0.0011	0.0013	0.0014	0.0015	0.0014	0.0015	0.0016	0.0016	0.0016	0.0016	0.0017						
8	0.0000	0.0007	0.0012	0.0014	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0017	0.0017						
9	0.0000	0.0008	0.0013	0.0014	0.0016	0.0016	0.0015	0.0016	0.0016	0.0017	0.0017	0.0017						
10	0.0000	0.0008	0.0011	0.0012	0.0013	0.0013	0.0014	0.0015	0.0015	0.0015	0.0014	0.0015						
11	0.0000	0.0010	0.0012	0.0012	0.0014	0.0013	0.0014	0.0015	0.0015	0.0015	0.0016	0.0015						
12	0.0000	0.0010	0.0013	0.0015	0.0016	0.0016	0.0015	0.0016	0.0017	0.0016	0.0017	0.0017						
13	0.0000	0.0011	0.0012	0.0013	0.0014	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0017						
14	0.0000	0.0012	0.0012	0.0013	0.0015	0.0014	0.0015	0.0015	0.0016	0.0016	0.0016	0.0016						
15	0.0000	0.0012	0.0012	0.0014	0.0015	0.0014	0.0014	0.0016	0.0016	0.0015	0.0016	0.0017						
16	0.0000	0.0011	0.0012	0.0013	0.0014	0.0014	0.0015	0.0015	0.0015	0.0016	0.0015	0.0016						
17	0.0000	0.0010	0.0011	0.0012	0.0013	0.0013	0.0014	0.0014	0.0014	0.0015	0.0015	0.0015						
18	0.0000	0.0013	0.0013	0.0014	0.0015	0.0015	0.0014	0.0015	0.0015	0.0016	0.0014	0.0016						
19	0.0000	0.0012	0.0012	0.0013	0.0015	0.0015	0.0015	0.0014	0.0015	0.0015	0.0016	0.0015						
20	0.0000	0.0010	0.0013	0.0014	0.0015	0.0015	0.0016	0.0016	0.0016	0.0017	0.0016	0.0016						
21	0.0000	0.0011	0.0013	0.0013	0.0013	0.0014	0.0014	0.0015	0.0015	0.0015	0.0016	0.0015						
22	0.0000	0.0010	0.0011	0.0012	0.0014	0.0013	0.0013	0.0014	0.0014	0.0015	0.0015	0.0015						
23	0.0000	0.0011	0.0012	0.0013	0.0014	0.0014	0.0014	0.0015	0.0015	0.0015	0.0015	0.0016						
24	0.0000	0.0011	0.0012	0.0014	0.0014	0.0014	0.0012	0.0015	0.0015	0.0014	0.0016	0.0016						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.0000	0.0010	0.0012	0.0013	0.0014	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0016						
Med.	0.0000	0.0010	0.0012	0.0013	0.0014	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0016						
σ	0.0000	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001						
Min.	0.0000	0.0007	0.0010	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013	0.0014	0.0014						
Max.	0.0000	0.0013	0.0014	0.0015	0.0016	0.0016	0.0016	0.0016	0.0017	0.0017	0.0017	0.0017						



Data Set 1 : 55 °C, 700 mA

Actual Case Temperature [T _s]	56.8 °C
Actual Ambient Temperature [T _A]	55.6 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 1-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2614	0.2605	0.2602	0.2602	0.2601	0.2600	0.2600	0.2599	0.2599	0.2598	0.2599	0.2598						
2	0.2591	0.2583	0.2581	0.2580	0.2580	0.2579	0.2579	0.2578	0.2578	0.2578	0.2577	0.2577						
3	0.2586	0.2578	0.2575	0.2574	0.2573	0.2573	0.2573	0.2572	0.2572	0.2572	0.2572	0.2571						
4	0.2589	0.2578	0.2576	0.2575	0.2574	0.2574	0.2573	0.2573	0.2573	0.2573	0.2574	0.2572						
5	0.2606	0.2597	0.2594	0.2593	0.2591	0.2591	0.2590	0.2590	0.2589	0.2589	0.2589	0.2589						
6	0.2591	0.2582	0.2580	0.2579	0.2579	0.2578	0.2579	0.2577	0.2577	0.2578	0.2577	0.2576						
7	0.2580	0.2569	0.2568	0.2567	0.2566	0.2566	0.2565	0.2564	0.2564	0.2564	0.2564	0.2563						
8	0.2605	0.2598	0.2593	0.2592	0.2590	0.2591	0.2590	0.2589	0.2589	0.2589	0.2588	0.2588						
9	0.2603	0.2595	0.2591	0.2590	0.2588	0.2588	0.2588	0.2587	0.2587	0.2586	0.2586	0.2586						
10	0.2604	0.2596	0.2593	0.2592	0.2591	0.2591	0.2590	0.2589	0.2589	0.2589	0.2590	0.2589						
11	0.2589	0.2579	0.2578	0.2577	0.2575	0.2576	0.2575	0.2574	0.2574	0.2574	0.2573	0.2574						
12	0.2596	0.2586	0.2584	0.2582	0.2581	0.2581	0.2581	0.2580	0.2579	0.2580	0.2579	0.2579						
13	0.2603	0.2592	0.2591	0.2590	0.2589	0.2588	0.2588	0.2588	0.2587	0.2587	0.2587	0.2586						
14	0.2585	0.2573	0.2573	0.2572	0.2571	0.2571	0.2570	0.2570	0.2569	0.2569	0.2569	0.2569						
15	0.2583	0.2571	0.2571	0.2570	0.2569	0.2569	0.2569	0.2567	0.2567	0.2568	0.2567	0.2566						
16	0.2580	0.2569	0.2568	0.2567	0.2566	0.2566	0.2565	0.2565	0.2565	0.2564	0.2565	0.2564						
17	0.2594	0.2584	0.2583	0.2582	0.2581	0.2581	0.2580	0.2580	0.2580	0.2579	0.2579	0.2579						
18	0.2589	0.2577	0.2577	0.2576	0.2575	0.2575	0.2575	0.2574	0.2574	0.2573	0.2575	0.2573						
19	0.2574	0.2563	0.2563	0.2562	0.2560	0.2560	0.2560	0.2560	0.2559	0.2559	0.2558	0.2559						
20	0.2594	0.2584	0.2582	0.2581	0.2580	0.2580	0.2579	0.2578	0.2578	0.2577	0.2578	0.2578						
21	0.2607	0.2596	0.2595	0.2595	0.2594	0.2593	0.2593	0.2592	0.2592	0.2592	0.2591	0.2592						
22	0.2584	0.2574	0.2573	0.2572	0.2571	0.2571	0.2571	0.2570	0.2570	0.2569	0.2569	0.2569						
23	0.2581	0.2570	0.2569	0.2569	0.2568	0.2567	0.2567	0.2566	0.2566	0.2566	0.2566	0.2565						
24	0.2605	0.2594	0.2593	0.2592	0.2592	0.2591	0.2593	0.2590	0.2590	0.2591	0.2589	0.2589						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2593	0.2583	0.2581	0.2580	0.2579	0.2579	0.2579	0.2578	0.2578	0.2578	0.2578	0.2577						
Med.	0.2591	0.2583	0.2581	0.2580	0.2580	0.2579	0.2579	0.2578	0.2578	0.2578	0.2577	0.2577						
σ	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0010	0.0011	0.0011	0.0010	0.0011						
Min.	0.2574	0.2563	0.2563	0.2562	0.2560	0.2560	0.2560	0.2560	0.2559	0.2559	0.2558	0.2559						
Max.	0.2614	0.2605	0.2602	0.2602	0.2601	0.2600	0.2600	0.2599	0.2599	0.2598	0.2599	0.2598						



Data Set 1 : 55 °C, 700 mA

Actual Case Temperature [T _s]	56.8 °C
Actual Ambient Temperature [T _A]	55.6 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 1-6
Chromaticity

LED No.	Chromaticity v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.5216	0.5215	0.5214	0.5214	0.5214	0.5214	0.5214	0.5215	0.5214	0.5215	0.5215	0.5215					
2	0.5177	0.5176	0.5175	0.5174	0.5175	0.5175	0.5175	0.5176	0.5175	0.5176	0.5176	0.5176					
3	0.5167	0.5166	0.5164	0.5164	0.5165	0.5165	0.5165	0.5166	0.5165	0.5166	0.5166	0.5166					
4	0.5169	0.5166	0.5165	0.5165	0.5165	0.5165	0.5165	0.5166	0.5166	0.5166	0.5169	0.5166					
5	0.5196	0.5196	0.5194	0.5193	0.5193	0.5193	0.5193	0.5194	0.5193	0.5194	0.5194	0.5194					
6	0.5162	0.5161	0.5160	0.5161	0.5160	0.5161	0.5162	0.5162	0.5161	0.5162	0.5162	0.5162					
7	0.5167	0.5164	0.5163	0.5163	0.5163	0.5164	0.5164	0.5165	0.5164	0.5164	0.5165	0.5165					
8	0.5188	0.5189	0.5185	0.5184	0.5185	0.5184	0.5185	0.5185	0.5185	0.5185	0.5185	0.5185					
9	0.5188	0.5188	0.5184	0.5184	0.5184	0.5184	0.5185	0.5185	0.5185	0.5185	0.5186	0.5185					
10	0.5190	0.5190	0.5189	0.5189	0.5189	0.5189	0.5189	0.5189	0.5189	0.5189	0.5191	0.5190					
11	0.5179	0.5176	0.5175	0.5176	0.5176	0.5176	0.5176	0.5177	0.5177	0.5177	0.5177	0.5177					
12	0.5177	0.5175	0.5173	0.5172	0.5173	0.5173	0.5174	0.5173	0.5173	0.5174	0.5173	0.5173					
13	0.5204	0.5202	0.5201	0.5201	0.5201	0.5201	0.5202	0.5202	0.5202	0.5202	0.5202	0.5203					
14	0.5166	0.5163	0.5163	0.5163	0.5162	0.5163	0.5163	0.5163	0.5164	0.5164	0.5163	0.5163					
15	0.5173	0.5170	0.5170	0.5169	0.5169	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170					
16	0.5154	0.5152	0.5152	0.5152	0.5152	0.5152	0.5152	0.5153	0.5153	0.5153	0.5153	0.5153					
17	0.5174	0.5172	0.5171	0.5171	0.5171	0.5172	0.5171	0.5172	0.5172	0.5172	0.5172	0.5172					
18	0.5181	0.5177	0.5177	0.5177	0.5177	0.5177	0.5178	0.5178	0.5178	0.5178	0.5179	0.5178					
19	0.5158	0.5154	0.5154	0.5154	0.5154	0.5154	0.5154	0.5155	0.5155	0.5155	0.5155	0.5155					
20	0.5167	0.5164	0.5163	0.5163	0.5163	0.5163	0.5163	0.5163	0.5163	0.5163	0.5163	0.5163					
21	0.5186	0.5183	0.5182	0.5182	0.5183	0.5183	0.5183	0.5183	0.5183	0.5183	0.5183	0.5183					
22	0.5175	0.5172	0.5172	0.5172	0.5171	0.5172	0.5172	0.5172	0.5172	0.5173	0.5173	0.5173					
23	0.5164	0.5161	0.5161	0.5160	0.5160	0.5161	0.5161	0.5161	0.5161	0.5161	0.5161	0.5161					
24	0.5181	0.5178	0.5178	0.5177	0.5177	0.5178	0.5179	0.5178	0.5178	0.5179	0.5179	0.5178					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.5177	0.5175	0.5174	0.5174	0.5174	0.5175	0.5175	0.5175	0.5175	0.5175	0.5176	0.5175					
Med.	0.5176	0.5174	0.5173	0.5172	0.5172	0.5173	0.5173	0.5173	0.5173	0.5174	0.5173	0.5173					
σ	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015					
Min.	0.5154	0.5152	0.5152	0.5152	0.5152	0.5152	0.5152	0.5153	0.5153	0.5153	0.5153	0.5153					
Max.	0.5216	0.5215	0.5214	0.5214	0.5214	0.5214	0.5214	0.5215	0.5214	0.5215	0.5215	0.5215					

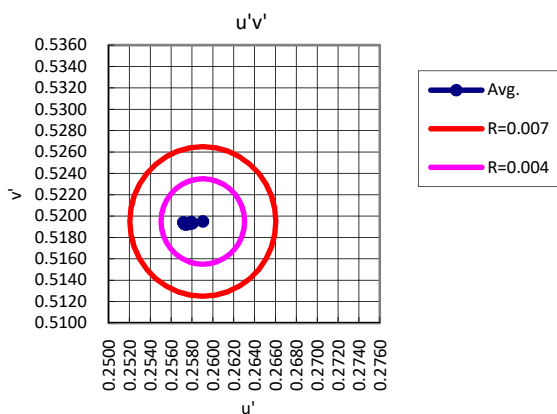
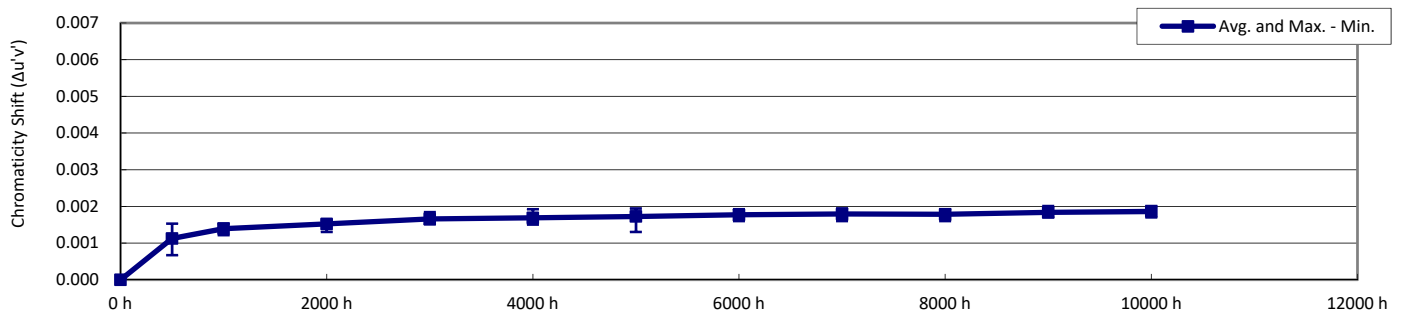
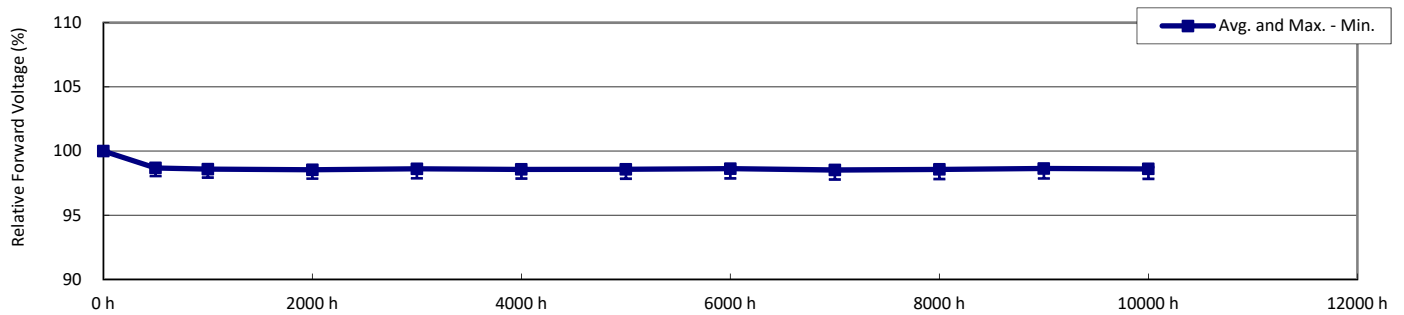
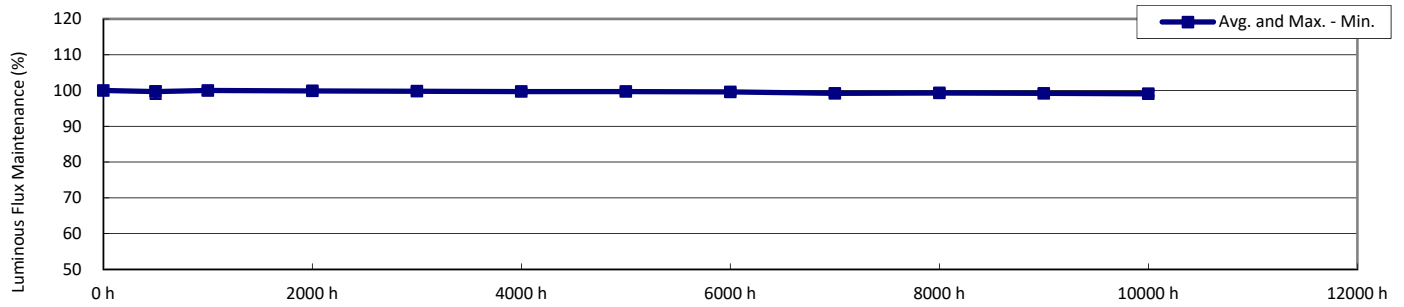
Data Set 2 : 55 °C, 1500 mA

Actual Case Temperature [T_S]	59.8 °C
Actual Ambient Temperature [T_A]	58.1 °C
Drive Current [I_F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 2 : 55 °C, 1500 mA

Actual Case Temperature [T _s]	59.8 °C
Actual Ambient Temperature [T _A]	58.1 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 2-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _v [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	476	3.24	2827	4.87	0.444	0.397	0.258	0.520						
2	478	3.25	2815	4.87	0.444	0.396	0.259	0.519						
3	480	3.25	2806	4.87	0.445	0.397	0.259	0.520						
4	479	3.24	2813	4.86	0.445	0.397	0.259	0.520						
5	481	3.24	2866	4.86	0.440	0.394	0.257	0.518						
6	481	3.24	2829	4.86	0.445	0.400	0.258	0.521						
7	484	3.24	2845	4.86	0.445	0.401	0.257	0.521						
8	477	3.24	2815	4.86	0.444	0.395	0.259	0.519						
9	476	3.24	2774	4.86	0.448	0.399	0.260	0.521						
10	480	3.24	2814	4.85	0.445	0.398	0.259	0.520						
11	478	3.24	2788	4.85	0.448	0.400	0.260	0.521						
12	479	3.24	2797	4.86	0.448	0.400	0.259	0.522						
13	477	3.24	2767	4.86	0.451	0.404	0.260	0.523						
14	480	3.25	2841	4.88	0.442	0.395	0.258	0.519						
15	473	3.24	2826	4.86	0.442	0.393	0.259	0.518						
16	473	3.24	2808	4.86	0.444	0.396	0.259	0.519						
17	471	3.24	2783	4.86	0.448	0.398	0.260	0.521						
18	478	3.25	2831	4.88	0.442	0.394	0.258	0.518						
19	477	3.25	2839	4.88	0.440	0.392	0.258	0.517						
20	475	3.25	2856	4.88	0.439	0.391	0.258	0.517						
21	468	3.25	2726	4.88	0.452	0.399	0.262	0.522						
22	480	3.18	2802	4.77	0.444	0.393	0.260	0.518						
23	478	3.18	2794	4.77	0.443	0.392	0.260	0.518						
24	469	3.19	2789	4.78	0.444	0.392	0.260	0.518						
n	24	24	24	24	24	24	24	24						
Avg.	477	3.24	2810	4.85	0.445	0.396	0.259	0.520						
Med.	478	3.24	2813	4.86	0.444	0.396	0.259	0.519						
σ	3.9	0.021	31.1	0.032	0.0032	0.0033	0.0012	0.0017						
Min.	468	3.18	2726	4.77	0.439	0.391	0.257	0.517						
Max.	484	3.25	2866	4.88	0.452	0.404	0.262	0.523						



Data Set 2 : 55 °C, 1500 mA

Actual Case Temperature [T _s]	59.8 °C
Actual Ambient Temperature [T _A]	58.1 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 2-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.7	99.6	99.5	99.4	99.2	99.4	99.1	98.8	98.9	98.8	98.7						
2	100.0	99.1	99.5	99.6	99.4	99.2	99.2	99.3	98.9	98.9	98.8	98.8						
3	100.0	99.3	99.8	100.0	99.7	99.7	99.8	99.4	99.0	99.2	99.0	99.0						
4	100.0	99.1	99.8	99.7	99.5	99.2	99.5	99.3	99.0	98.9	98.9	98.8						
5	100.0	99.1	99.3	99.3	99.3	99.1	99.0	98.9	98.5	98.9	98.6	98.5						
6	100.0	98.3	99.5	99.6	99.4	99.3	99.5	99.3	98.9	99.1	98.9	98.9						
7	100.0	100.2	100.1	99.7	99.6	99.6	99.8	99.4	99.1	99.2	99.2	98.9						
8	100.0	97.7	98.8	99.3	99.3	99.1	99.1	99.2	98.7	98.8	98.7	98.8						
9	100.0	100.3	100.1	99.9	99.9	99.9	99.5	99.3	98.9	99.0	98.9	98.8						
10	100.0	99.4	100.1	99.7	99.6	99.4	99.7	99.4	99.1	99.2	99.0	99.2						
11	100.0	98.3	99.5	99.3	99.2	99.3	99.3	99.2	98.7	98.8	98.9	98.6						
12	100.0	100.0	100.2	100.0	100.0	100.2	99.0	99.4	99.3	99.7	99.4	99.3						
13	100.0	101.0	100.8	100.5	100.5	100.2	100.2	100.2	99.7	99.6	99.7	99.4						
14	100.0	99.8	99.8	99.9	99.7	99.6	99.5	99.4	99.1	99.4	99.1	99.2						
15	100.0	100.3	100.4	100.3	100.4	100.2	100.4	100.1	99.8	100.0	99.8	99.7						
16	100.0	100.7	100.9	100.7	100.7	100.3	100.3	100.4	100.1	100.1	100.1	99.9						
17	100.0	100.4	100.2	100.0	100.0	99.9	100.1	99.7	99.3	99.6	99.4	99.5						
18	100.0	98.7	99.5	99.8	99.9	99.7	99.9	99.6	99.2	99.5	99.3	99.2						
19	100.0	100.5	100.6	100.3	100.3	100.2	100.2	100.2	99.6	99.9	99.9	99.8						
20	100.0	99.5	99.8	99.9	99.9	99.6	99.8	99.6	99.4	99.4	99.3	99.2						
21	100.0	100.7	100.8	100.6	100.6	100.4	100.5	100.4	100.1	100.3	100.1	100.0						
22	100.0	100.5	100.2	99.8	99.8	99.6	99.5	99.3	99.0	98.9	99.0	98.9						
23	100.0	100.2	99.9	99.8	99.6	99.4	99.4	99.4	98.7	99.1	98.9	98.6						
24	100.0	101.1	100.9	100.6	100.5	100.3	100.1	100.1	99.7	99.9	99.8	99.7						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	99.7	100.0	99.9	99.8	99.7	99.7	99.6	99.2	99.3	99.2	99.1						
Med.	100.0	99.9	100.0	99.9	99.8	99.6	99.6	99.4	99.1	99.2	99.1	99.1						
σ	0.00	0.93	0.54	0.41	0.45	0.43	0.44	0.43	0.44	0.45	0.45	0.44						
Min.	100.0	97.7	98.8	99.3	99.2	99.1	99.0	98.9	98.5	98.8	98.6	98.5						
Max.	100.0	101.1	100.9	100.7	100.7	100.4	100.5	100.4	100.1	100.3	100.1	100.0						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	1.002		
α	1.178E-06		
R ²	0.8142		
Calculated L ₇₀ (10K)	304000	hours	
Reported L ₇₀ (10K)	> 60000	hours	
Calculated L ₈₀ (10K)	191000	hours	
Reported L ₈₀ (10K)	> 60000	hours	
Calculated L ₉₀ (10K)	91100	hours	
Reported L ₉₀ (10K)	> 60000	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

*The certificate shall not be reproduced, except in full, without written approval of the laboratory.
The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.*



Data Set 2 : 55 °C, 1500 mA

Actual Case Temperature [T _S]	59.8 °C
Actual Ambient Temperature [T _A]	58.1 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 2-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.8	98.7	98.7	98.7	98.7	98.7	98.7	98.6	98.7	98.7	98.7						
2	100.0	98.7	98.6	98.6	98.6	98.6	98.6	98.7	98.6	98.6	98.7	98.6						
3	100.0	98.7	98.6	98.6	98.6	98.6	98.6	98.6	98.5	98.6	98.7	98.6						
4	100.0	98.8	98.7	98.6	98.7	98.7	98.7	98.7	98.6	98.7	98.7	98.7						
5	100.0	98.8	98.7	98.6	98.7	98.7	98.7	98.7	98.6	98.7	98.8	98.7						
6	100.0	98.7	98.7	98.6	98.7	98.6	98.7	98.7	98.6	98.7	98.7	98.7						
7	100.0	98.8	98.7	98.6	98.7	98.7	98.7	98.7	98.6	98.7	98.8	98.7						
8	100.0	98.8	98.7	98.6	98.7	98.7	98.7	98.7	98.6	98.7	98.8	98.7						
9	100.0	98.7	98.7	98.6	98.7	98.6	98.7	98.7	98.6	98.7	98.7	98.7						
10	100.0	98.8	98.7	98.7	98.7	98.7	98.7	98.8	98.7	98.7	98.8	98.7						
11	100.0	98.8	98.7	98.6	98.7	98.7	98.7	98.8	98.6	98.7	98.8	98.7						
12	100.0	98.8	98.7	98.7	98.7	98.7	98.7	98.8	98.7	98.7	98.8	98.7						
13	100.0	98.8	98.6	98.6	98.7	98.7	98.6	98.7	98.6	98.7	98.7	98.7						
14	100.0	98.6	98.5	98.5	98.6	98.5	98.5	98.6	98.5	98.5	98.6	98.5						
15	100.0	98.8	98.7	98.6	98.7	98.7	98.6	98.7	98.6	98.7	98.7	98.7						
16	100.0	98.8	98.7	98.6	98.7	98.7	98.6	98.7	98.6	98.6	98.7	98.7						
17	100.0	98.7	98.6	98.6	98.7	98.7	98.7	98.7	98.6	98.6	98.7	98.7						
18	100.0	98.6	98.5	98.4	98.5	98.5	98.5	98.5	98.4	98.4	98.5	98.5						
19	100.0	98.6	98.5	98.4	98.5	98.5	98.5	98.5	98.4	98.5	98.5	98.5						
20	100.0	98.6	98.5	98.5	98.6	98.5	98.5	98.6	98.5	98.5	98.6	98.6						
21	100.0	98.6	98.5	98.4	98.5	98.5	98.5	98.5	98.4	98.5	98.5	98.5						
22	100.0	98.7	98.6	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5						
23	100.0	98.7	98.5	98.5	98.5	98.5	98.5	98.5	98.4	98.4	98.5	98.5						
24	100.0	98.1	97.9	97.8	97.9	97.9	97.8	97.9	97.8	97.8	97.9	97.8						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.7	98.6	98.5	98.6	98.6	98.6	98.6	98.5	98.6	98.6	98.6						
Med.	100.0	98.7	98.7	98.6	98.7	98.6	98.6	98.7	98.6	98.6	98.7	98.7						
σ	0.00	0.15	0.16	0.17	0.18	0.17	0.18	0.19	0.18	0.18	0.19	0.19						
Min.	100.0	98.1	97.9	97.8	97.9	97.9	97.8	97.9	97.8	97.8	97.9	97.8						
Max.	100.0	98.8	98.7	98.7	98.7	98.7	98.7	98.8	98.7	98.7	98.8	98.7						

Data Set 2 : 55 °C, 1500 mA

Actual Case Temperature [T _S]	59.8 °C
Actual Ambient Temperature [T _A]	58.1 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 2-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.0000	0.0008	0.0012	0.0014	0.0015	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018					
2	0.0000	0.0009	0.0013	0.0014	0.0015	0.0015	0.0016	0.0016	0.0016	0.0017	0.0017	0.0017					
3	0.0000	0.0010	0.0013	0.0013	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0017	0.0017					
4	0.0000	0.0010	0.0014	0.0015	0.0016	0.0016	0.0017	0.0017	0.0017	0.0017	0.0018	0.0018					
5	0.0000	0.0011	0.0013	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0018	0.0019	0.0019					
6	0.0000	0.0010	0.0014	0.0016	0.0017	0.0017	0.0017	0.0019	0.0019	0.0018	0.0019	0.0019					
7	0.0000	0.0013	0.0014	0.0015	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018	0.0019					
8	0.0000	0.0007	0.0012	0.0014	0.0016	0.0017	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018					
9	0.0000	0.0012	0.0014	0.0015	0.0016	0.0015	0.0016	0.0017	0.0018	0.0017	0.0018	0.0018					
10	0.0000	0.0011	0.0015	0.0015	0.0017	0.0018	0.0019	0.0019	0.0019	0.0019	0.0020	0.0020					
11	0.0000	0.0008	0.0013	0.0014	0.0016	0.0016	0.0016	0.0016	0.0016	0.0017	0.0017	0.0017					
12	0.0000	0.0011	0.0013	0.0014	0.0016	0.0015	0.0013	0.0016	0.0017	0.0017	0.0018	0.0018					
13	0.0000	0.0013	0.0014	0.0016	0.0016	0.0017	0.0018	0.0017	0.0018	0.0018	0.0018	0.0019					
14	0.0000	0.0010	0.0013	0.0015	0.0016	0.0016	0.0017	0.0017	0.0017	0.0017	0.0018	0.0018					
15	0.0000	0.0012	0.0015	0.0016	0.0017	0.0018	0.0018	0.0019	0.0019	0.0018	0.0019	0.0020					
16	0.0000	0.0013	0.0015	0.0016	0.0018	0.0018	0.0019	0.0019	0.0019	0.0019	0.0020	0.0020					
17	0.0000	0.0012	0.0014	0.0015	0.0017	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018	0.0019					
18	0.0000	0.0010	0.0013	0.0015	0.0016	0.0017	0.0017	0.0018	0.0018	0.0017	0.0018	0.0019					
19	0.0000	0.0013	0.0014	0.0016	0.0016	0.0018	0.0018	0.0018	0.0019	0.0019	0.0019	0.0019					
20	0.0000	0.0012	0.0013	0.0016	0.0017	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018	0.0019					
21	0.0000	0.0013	0.0015	0.0016	0.0018	0.0018	0.0018	0.0019	0.0019	0.0018	0.0020	0.0020					
22	0.0000	0.0013	0.0014	0.0015	0.0016	0.0017	0.0017	0.0017	0.0018	0.0017	0.0018	0.0018					
23	0.0000	0.0012	0.0014	0.0015	0.0016	0.0017	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018					
24	0.0000	0.0015	0.0015	0.0016	0.0018	0.0019	0.0018	0.0019	0.0019	0.0019	0.0019	0.0019					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.0000	0.0011	0.0014	0.0015	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018	0.0018	0.0019					
Med.	0.0000	0.0012	0.0014	0.0015	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018	0.0019					
σ	0.0000	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001					
Min.	0.0000	0.0007	0.0012	0.0013	0.0015	0.0015	0.0013	0.0016	0.0016	0.0016	0.0017	0.0017					
Max.	0.0000	0.0015	0.0015	0.0016	0.0018	0.0019	0.0019	0.0019	0.0019	0.0019	0.0020	0.0020					



Data Set 2 : 55 °C, 1500 mA

Actual Case Temperature [T _S]	59.8 °C
Actual Ambient Temperature [T _A]	58.1 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 2-5
Chromaticity

LED No.	Chromaticity u'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.2572	0.2564	0.2560	0.2558	0.2557	0.2556	0.2555	0.2555	0.2555	0.2554	0.2554	0.2554					
2	0.2579	0.2570	0.2566	0.2565	0.2564	0.2564	0.2563	0.2563	0.2563	0.2562	0.2562	0.2562					
3	0.2585	0.2575	0.2572	0.2572	0.2570	0.2570	0.2570	0.2569	0.2569	0.2569	0.2568	0.2568					
4	0.2580	0.2570	0.2566	0.2565	0.2564	0.2564	0.2563	0.2563	0.2563	0.2563	0.2562	0.2562					
5	0.2560	0.2549	0.2547	0.2545	0.2544	0.2544	0.2543	0.2542	0.2542	0.2542	0.2541	0.2541					
6	0.2574	0.2564	0.2560	0.2558	0.2557	0.2557	0.2557	0.2555	0.2555	0.2555	0.2555	0.2555					
7	0.2562	0.2549	0.2548	0.2547	0.2546	0.2545	0.2545	0.2545	0.2544	0.2544	0.2544	0.2543					
8	0.2580	0.2574	0.2568	0.2566	0.2565	0.2563	0.2563	0.2563	0.2563	0.2562	0.2562	0.2562					
9	0.2597	0.2585	0.2583	0.2582	0.2581	0.2582	0.2581	0.2580	0.2579	0.2580	0.2579	0.2579					
10	0.2578	0.2567	0.2563	0.2563	0.2561	0.2560	0.2559	0.2559	0.2559	0.2559	0.2558	0.2558					
11	0.2585	0.2577	0.2572	0.2571	0.2569	0.2569	0.2569	0.2569	0.2569	0.2568	0.2568	0.2568					
12	0.2583	0.2572	0.2570	0.2569	0.2567	0.2568	0.2570	0.2567	0.2566	0.2566	0.2565	0.2565					
13	0.2592	0.2579	0.2578	0.2576	0.2576	0.2575	0.2574	0.2575	0.2574	0.2574	0.2574	0.2573					
14	0.2568	0.2558	0.2555	0.2553	0.2552	0.2552	0.2551	0.2551	0.2551	0.2551	0.2550	0.2550					
15	0.2579	0.2567	0.2564	0.2563	0.2562	0.2561	0.2561	0.2560	0.2560	0.2561	0.2560	0.2559					
16	0.2581	0.2568	0.2566	0.2565	0.2563	0.2563	0.2562	0.2562	0.2562	0.2562	0.2561	0.2561					
17	0.2587	0.2575	0.2573	0.2572	0.2570	0.2570	0.2569	0.2569	0.2569	0.2569	0.2569	0.2568					
18	0.2577	0.2567	0.2564	0.2562	0.2561	0.2560	0.2560	0.2559	0.2559	0.2560	0.2559	0.2558					
19	0.2573	0.2560	0.2559	0.2557	0.2557	0.2555	0.2555	0.2555	0.2554	0.2554	0.2554	0.2554					
20	0.2565	0.2553	0.2552	0.2549	0.2548	0.2548	0.2547	0.2547	0.2547	0.2547	0.2547	0.2546					
21	0.2614	0.2601	0.2599	0.2598	0.2596	0.2596	0.2596	0.2595	0.2595	0.2596	0.2594	0.2594					
22	0.2588	0.2575	0.2574	0.2573	0.2572	0.2571	0.2571	0.2571	0.2570	0.2571	0.2570	0.2570					
23	0.2592	0.2580	0.2578	0.2577	0.2576	0.2575	0.2575	0.2575	0.2575	0.2574	0.2574	0.2574					
24	0.2596	0.2581	0.2581	0.2580	0.2578	0.2577	0.2578	0.2577	0.2577	0.2577	0.2577	0.2577					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.2581	0.2570	0.2567	0.2566	0.2565	0.2564	0.2564	0.2564	0.2563	0.2563	0.2563	0.2563					
Med.	0.2580	0.2570	0.2566	0.2565	0.2564	0.2564	0.2563	0.2563	0.2563	0.2562	0.2562	0.2562					
σ	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012					
Min.	0.2560	0.2549	0.2547	0.2545	0.2544	0.2544	0.2543	0.2542	0.2542	0.2542	0.2541	0.2541					
Max.	0.2614	0.2601	0.2599	0.2598	0.2596	0.2596	0.2595	0.2595	0.2595	0.2596	0.2594	0.2594					

Data Set 2 : 55 °C, 1500 mA

Actual Case Temperature [T _S]	59.8 °C
Actual Ambient Temperature [T _A]	58.1 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 2-6
Chromaticity

LED No.	Chromaticity v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.5186	0.5187	0.5184	0.5184	0.5183	0.5184	0.5183	0.5183	0.5183	0.5184	0.5185	0.5185					
2	0.5178	0.5180	0.5176	0.5177	0.5176	0.5177	0.5177	0.5177	0.5177	0.5177	0.5178	0.5178					
3	0.5188	0.5188	0.5186	0.5187	0.5186	0.5187	0.5187	0.5187	0.5187	0.5187	0.5187	0.5187					
4	0.5185	0.5185	0.5183	0.5183	0.5183	0.5184	0.5183	0.5184	0.5184	0.5184	0.5185	0.5185					
5	0.5169	0.5168	0.5166	0.5166	0.5165	0.5166	0.5166	0.5165	0.5166	0.5166	0.5167	0.5167					
6	0.5202	0.5202	0.5199	0.5199	0.5198	0.5199	0.5199	0.5199	0.5199	0.5200	0.5200	0.5201					
7	0.5202	0.5201	0.5200	0.5200	0.5200	0.5200	0.5200	0.5200	0.5200	0.5201	0.5201	0.5201					
8	0.5178	0.5181	0.5176	0.5175	0.5174	0.5175	0.5174	0.5175	0.5175	0.5175	0.5176	0.5176					
9	0.5204	0.5202	0.5202	0.5203	0.5202	0.5203	0.5202	0.5202	0.5203	0.5203	0.5203	0.5204					
10	0.5192	0.5191	0.5189	0.5189	0.5189	0.5189	0.5189	0.5189	0.5189	0.5189	0.5190	0.5190					
11	0.5200	0.5202	0.5198	0.5198	0.5198	0.5199	0.5198	0.5198	0.5199	0.5199	0.5200	0.5199					
12	0.5207	0.5206	0.5204	0.5205	0.5204	0.5206	0.5208	0.5206	0.5205	0.5206	0.5206	0.5206					
13	0.5224	0.5224	0.5223	0.5224	0.5223	0.5224	0.5223	0.5224	0.5224	0.5224	0.5225	0.5225					
14	0.5173	0.5173	0.5171	0.5171	0.5170	0.5171	0.5171	0.5171	0.5171	0.5171	0.5172	0.5172					
15	0.5170	0.5168	0.5167	0.5167	0.5167	0.5167	0.5167	0.5168	0.5168	0.5168	0.5169	0.5169					
16	0.5179	0.5177	0.5176	0.5176	0.5175	0.5176	0.5175	0.5176	0.5176	0.5176	0.5177	0.5177					
17	0.5195	0.5194	0.5192	0.5193	0.5192	0.5193	0.5193	0.5193	0.5193	0.5193	0.5194	0.5194					
18	0.5172	0.5173	0.5171	0.5170	0.5169	0.5170	0.5171	0.5170	0.5170	0.5172	0.5172	0.5172					
19	0.5158	0.5156	0.5155	0.5155	0.5154	0.5155	0.5155	0.5155	0.5154	0.5155	0.5156	0.5156					
20	0.5152	0.5151	0.5149	0.5149	0.5148	0.5150	0.5149	0.5149	0.5149	0.5150	0.5151	0.5151					
21	0.5208	0.5207	0.5206	0.5207	0.5206	0.5206	0.5207	0.5206	0.5207	0.5207	0.5207	0.5208					
22	0.5171	0.5168	0.5168	0.5168	0.5168	0.5169	0.5168	0.5168	0.5169	0.5169	0.5169	0.5170					
23	0.5165	0.5163	0.5162	0.5162	0.5161	0.5162	0.5162	0.5162	0.5162	0.5163	0.5163	0.5163					
24	0.5170	0.5167	0.5167	0.5167	0.5167	0.5167	0.5168	0.5167	0.5168	0.5168	0.5168	0.5169					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.5185	0.5184	0.5182	0.5182	0.5182	0.5182	0.5182	0.5182	0.5182	0.5183	0.5183	0.5184					
Med.	0.5182	0.5183	0.5180	0.5180	0.5180	0.5181	0.5180	0.5180	0.5180	0.5181	0.5182	0.5182					
σ	0.0018	0.0018	0.0018	0.0019	0.0019	0.0018	0.0019	0.0019	0.0019	0.0018	0.0018	0.0018					
Min.	0.5152	0.5151	0.5149	0.5149	0.5148	0.5150	0.5149	0.5149	0.5149	0.5150	0.5151	0.5151					
Max.	0.5224	0.5224	0.5223	0.5224	0.5223	0.5224	0.5223	0.5224	0.5224	0.5224	0.5225	0.5225					

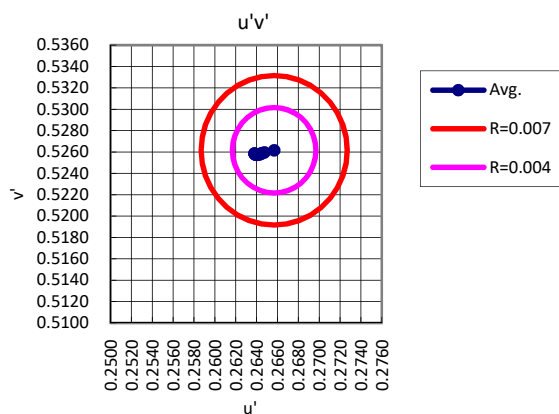
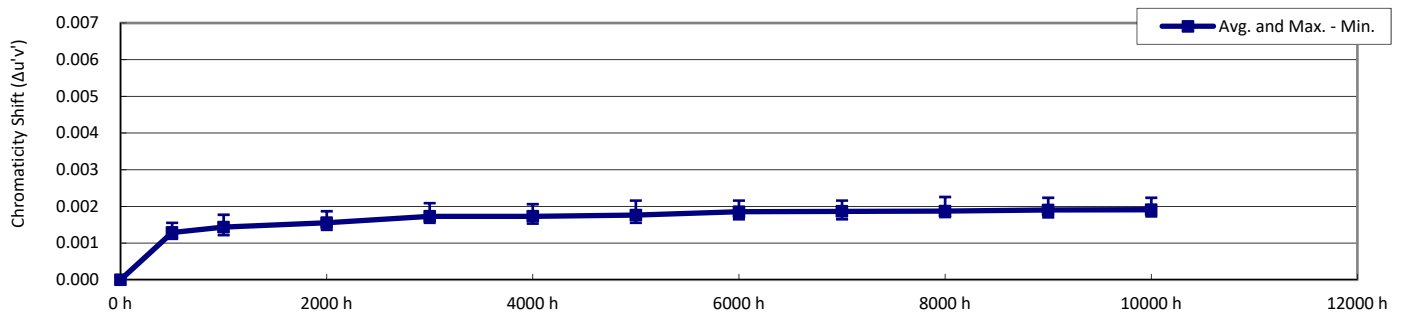
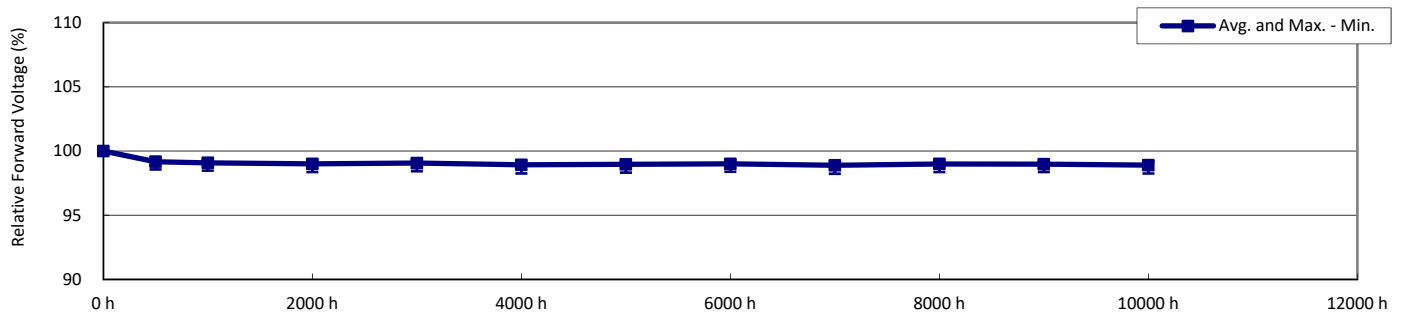
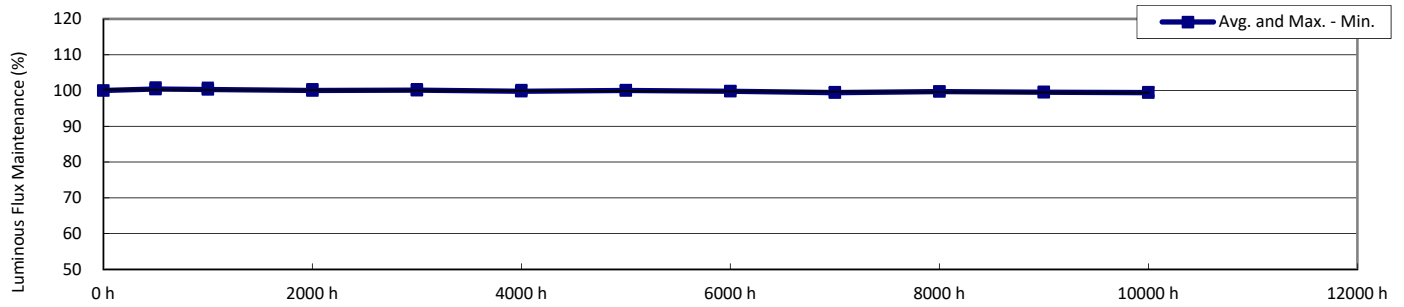
Data Set 3 : 85 °C, 700 mA

Actual Case Temperature [T_S]	87.6 °C
Actual Ambient Temperature [T_A]	84.9 °C
Drive Current [I_F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 3 : 85 °C, 700 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.9 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 3-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _V [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	243	3.04	2639	2.13	0.461	0.405	0.266	0.526						
2	246	3.05	2679	2.13	0.459	0.406	0.264	0.526						
3	244	3.04	2649	2.13	0.461	0.406	0.265	0.526						
4	245	3.03	2640	2.12	0.462	0.407	0.266	0.526						
5	244	3.04	2629	2.13	0.464	0.409	0.266	0.527						
6	241	3.05	2578	2.13	0.470	0.413	0.268	0.530						
7	237	2.95	2589	2.06	0.467	0.408	0.268	0.528						
8	240	2.95	2609	2.06	0.464	0.406	0.267	0.526						
9	243	2.95	2685	2.06	0.458	0.406	0.264	0.525						
10	243	2.95	2670	2.06	0.458	0.404	0.264	0.525						
11	243	2.95	2662	2.06	0.459	0.405	0.265	0.525						
12	243	2.95	2638	2.07	0.462	0.406	0.266	0.526						
13	244	2.95	2659	2.06	0.461	0.407	0.265	0.526						
14	246	2.95	2671	2.07	0.459	0.405	0.264	0.525						
15	243	2.95	2634	2.06	0.462	0.406	0.266	0.526						
16	242	2.95	2624	2.06	0.464	0.409	0.266	0.527						
17	240	2.95	2590	2.06	0.469	0.412	0.268	0.529						
18	243	2.97	2639	2.08	0.461	0.405	0.266	0.526						
19	244	2.96	2629	2.07	0.462	0.405	0.266	0.526						
20	243	2.95	2633	2.06	0.462	0.406	0.266	0.526						
21	245	2.95	2667	2.07	0.460	0.406	0.264	0.526						
22	243	2.95	2634	2.06	0.461	0.405	0.266	0.525						
23	246	2.95	2657	2.06	0.461	0.407	0.265	0.526						
24	247	2.97	2646	2.08	0.462	0.407	0.265	0.526						
n	24	24	24	24	24	24	24	24						
Avg.	243	2.97	2640	2.08	0.462	0.407	0.266	0.526						
Med.	243	2.95	2639	2.07	0.461	0.406	0.266	0.526						
σ	2.2	0.040	27.9	0.028	0.0031	0.0021	0.0012	0.0012						
Min.	237	2.95	2578	2.06	0.458	0.404	0.264	0.525						
Max.	247	3.05	2685	2.13	0.470	0.413	0.268	0.530						



Data Set 3 : 85 °C, 700 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.9 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 3-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	100.5	100.4	100.3	100.3	100.0	100.3	100.1	99.7	99.9	99.7	99.7						
2	100.0	100.5	100.0	100.1	100.2	99.9	99.9	100.1	99.8	100.0	99.7	99.6						
3	100.0	100.0	99.9	99.8	100.0	99.6	100.0	99.9	99.7	99.8	99.6	99.6						
4	100.0	100.4	100.3	100.1	100.1	100.0	100.1	100.1	99.7	99.8	99.8	99.8						
5	100.0	100.2	100.3	100.1	100.3	100.0	100.2	100.0	99.7	100.1	99.8	99.8						
6	100.0	101.2	101.2	101.0	101.1	100.8	101.2	100.9	100.6	100.8	100.5	100.5						
7	100.0	102.2	102.1	101.7	101.7	101.5	101.5	101.2	100.9	101.0	101.0	100.9						
8	100.0	100.1	100.1	99.9	100.0	99.5	99.6	99.7	99.1	99.5	99.1	99.1						
9	100.0	100.7	100.5	100.2	100.4	100.0	100.5	100.0	99.6	100.0	99.6	99.5						
10	100.0	100.6	100.5	100.1	100.1	99.8	99.8	99.7	99.3	99.6	99.2	99.3						
11	100.0	100.2	99.8	99.5	99.6	99.3	99.2	99.2	98.9	99.0	99.0	98.8						
12	100.0	100.5	100.3	100.1	100.3	99.9	100.4	100.0	99.5	99.8	99.6	99.5						
13	100.0	99.6	99.6	99.2	99.3	98.9	99.3	99.1	98.8	99.0	98.7	98.9						
14	100.0	99.9	99.5	99.3	99.4	99.3	99.2	99.1	98.6	98.8	98.8	98.5						
15	100.0	100.2	100.0	99.7	99.8	99.5	99.7	99.5	99.1	99.5	99.1	99.1						
16	100.0	99.8	99.8	99.7	99.6	99.5	99.5	99.5	99.1	99.3	99.2	99.1						
17	100.0	100.6	100.6	100.1	100.4	99.9	100.0	99.7	99.3	99.7	99.3	99.3						
18	100.0	101.3	101.2	100.8	100.9	100.6	100.8	100.6	100.1	100.4	100.3	100.2						
19	100.0	101.1	101.0	100.5	100.5	100.2	100.2	99.9	99.5	99.7	99.7	99.6						
20	100.0	99.6	99.8	99.6	99.5	99.2	99.6	99.6	98.8	99.3	98.9	98.8						
21	100.0	100.6	100.5	100.2	100.3	100.0	100.2	99.9	99.5	99.8	99.6	99.5						
22	100.0	100.4	100.3	99.8	100.0	99.7	99.5	99.6	99.3	99.4	99.2	99.2						
23	100.0	99.6	99.4	99.3	99.1	99.0	99.1	99.1	98.7	98.9	98.7	98.5						
24	100.0	100.0	99.8	99.6	99.7	99.4	99.6	99.3	99.0	99.2	99.0	98.9						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	100.4	100.3	100.0	100.1	99.8	100.0	99.8	99.4	99.7	99.5	99.4						
Med.	100.0	100.4	100.3	100.1	100.1	99.9	100.0	99.8	99.4	99.7	99.5	99.4						
σ	0.00	0.61	0.62	0.57	0.59	0.58	0.61	0.54	0.56	0.55	0.57	0.58						
Min.	100.0	99.6	99.4	99.2	99.1	98.9	99.1	99.1	98.6	98.8	98.7	98.5						
Max.	100.0	102.2	102.1	101.7	101.7	101.5	101.5	101.2	100.9	101.0	101.0	100.9						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	1.004		
α	1.032E-06		
R ²	0.6309		
Calculated L ₇₀ (10K)	349000	hours	
Reported L ₇₀ (10K)	> 60000	hours	
Calculated L ₈₀ (10K)	220000	hours	
Reported L ₈₀ (10K)	> 60000	hours	
Calculated L ₉₀ (10K)	106000	hours	
Reported L ₉₀ (10K)	> 60000	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.*



Data Set 3 : 85 °C, 700 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.9 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 3-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.7	98.6	98.5	98.6	98.3	98.4	98.5	98.4	98.5	98.4	98.4						
2	100.0	98.7	98.6	98.5	98.5	98.3	98.4	98.5	98.4	98.5	98.4	98.3						
3	100.0	98.7	98.7	98.6	98.6	98.4	98.5	98.6	98.5	98.6	98.5	98.5						
4	100.0	98.8	98.7	98.6	98.7	98.6	98.6	98.7	98.5	98.7	98.6	98.5						
5	100.0	98.8	98.7	98.6	98.6	98.5	98.5	98.6	98.4	98.6	98.5	98.4						
6	100.0	98.6	98.5	98.4	98.4	98.3	98.3	98.4	98.2	98.4	98.4	98.2						
7	100.0	99.3	99.3	99.2	99.2	99.1	99.1	99.2	99.1	99.1	99.1	99.1						
8	100.0	99.3	99.2	99.1	99.2	99.1	99.1	99.1	99.0	99.1	99.1	99.0						
9	100.0	99.2	99.1	99.1	99.1	99.0	99.0	99.1	98.9	99.0	99.1	99.0						
10	100.0	99.3	99.2	99.1	99.2	99.0	99.1	99.1	99.0	99.1	99.1	99.0						
11	100.0	99.3	99.2	99.1	99.2	99.1	99.1	99.1	99.0	99.1	99.1	99.0						
12	100.0	99.4	99.3	99.2	99.3	99.2	99.2	99.3	99.1	99.3	99.3	99.1						
13	100.0	99.3	99.3	99.2	99.2	99.1	99.2	99.2	99.1	99.2	99.2	99.1						
14	100.0	99.4	99.3	99.3	99.3	99.2	99.2	99.3	99.2	99.3	99.3	99.2						
15	100.0	99.3	99.2	99.1	99.2	99.0	99.1	99.1	99.0	99.1	99.1	99.0						
16	100.0	99.3	99.2	99.1	99.1	99.0	99.1	99.1	99.0	99.1	99.1	99.0						
17	100.0	99.3	99.3	99.2	99.2	99.1	99.1	99.2	99.0	99.2	99.1	99.1						
18	100.0	99.3	99.2	99.1	99.2	99.1	99.1	99.1	99.1	99.2	99.1	99.1						
19	100.0	99.3	99.3	99.2	99.3	99.2	99.2	99.2	99.1	99.3	99.2	99.2						
20	100.0	99.4	99.3	99.2	99.3	99.2	99.2	99.2	99.1	99.2	99.2	99.1						
21	100.0	99.4	99.4	99.3	99.3	99.2	99.2	99.3	99.2	99.3	99.3	99.2						
22	100.0	99.4	99.3	99.3	99.3	99.2	99.2	99.3	99.2	99.2	99.2	99.2						
23	100.0	99.3	99.3	99.2	99.2	99.1	99.2	99.2	99.1	99.2	99.1	99.1						
24	100.0	99.1	99.0	98.9	99.0	98.9	98.9	98.9	98.8	98.9	98.9	98.8						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	99.2	99.1	99.0	99.1	98.9	99.0	99.0	98.9	99.0	99.0	98.9						
Med.	100.0	99.3	99.2	99.1	99.2	99.1	99.1	99.1	99.0	99.1	99.1	99.0						
σ	0.00	0.28	0.29	0.30	0.29	0.34	0.31	0.29	0.30	0.30	0.31	0.31						
Min.	100.0	98.6	98.5	98.4	98.4	98.3	98.3	98.4	98.2	98.4	98.4	98.2						
Max.	100.0	99.4	99.4	99.3	99.3	99.2	99.2	99.3	99.2	99.3	99.3	99.2						



Data Set 3 : 85 °C, 700 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.9 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 3-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.0000	0.0012	0.0015	0.0016	0.0017	0.0017	0.0017	0.0019	0.0019	0.0019	0.0019	0.0019						
2	0.0000	0.0012	0.0012	0.0014	0.0016	0.0015	0.0016	0.0017	0.0017	0.0017	0.0017	0.0017						
3	0.0000	0.0012	0.0014	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018						
4	0.0000	0.0014	0.0015	0.0017	0.0018	0.0018	0.0019	0.0019	0.0019	0.0019	0.0020	0.0020						
5	0.0000	0.0012	0.0015	0.0016	0.0018	0.0018	0.0019	0.0020	0.0020	0.0020	0.0020	0.0020						
6	0.0000	0.0016	0.0016	0.0017	0.0019	0.0019	0.0019	0.0021	0.0021	0.0021	0.0022	0.0021						
7	0.0000	0.0016	0.0018	0.0019	0.0021	0.0021	0.0022	0.0022	0.0022	0.0023	0.0022	0.0022						
8	0.0000	0.0012	0.0015	0.0016	0.0018	0.0017	0.0018	0.0018	0.0019	0.0019	0.0019	0.0019						
9	0.0000	0.0014	0.0014	0.0016	0.0016	0.0017	0.0016	0.0017	0.0018	0.0017	0.0018	0.0018						
10	0.0000	0.0014	0.0015	0.0016	0.0017	0.0018	0.0018	0.0019	0.0018	0.0018	0.0019	0.0019						
11	0.0000	0.0012	0.0014	0.0015	0.0016	0.0016	0.0016	0.0017	0.0017	0.0018	0.0018	0.0018						
12	0.0000	0.0012	0.0014	0.0015	0.0016	0.0016	0.0016	0.0017	0.0017	0.0018	0.0018	0.0018						
13	0.0000	0.0011	0.0013	0.0014	0.0016	0.0015	0.0017	0.0018	0.0017	0.0017	0.0017	0.0018						
14	0.0000	0.0011	0.0013	0.0014	0.0016	0.0016	0.0016	0.0017	0.0016	0.0017	0.0017	0.0017						
15	0.0000	0.0013	0.0015	0.0015	0.0016	0.0017	0.0016	0.0017	0.0018	0.0017	0.0018	0.0018						
16	0.0000	0.0011	0.0013	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0018	0.0018	0.0019						
17	0.0000	0.0012	0.0014	0.0015	0.0017	0.0017	0.0017	0.0018	0.0018	0.0019	0.0019	0.0019						
18	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0018	0.0018	0.0020	0.0020	0.0019	0.0019						
19	0.0000	0.0013	0.0015	0.0016	0.0017	0.0018	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018						
20	0.0000	0.0013	0.0015	0.0016	0.0018	0.0018	0.0018	0.0019	0.0019	0.0019	0.0020	0.0020						
21	0.0000	0.0014	0.0015	0.0016	0.0018	0.0018	0.0018	0.0018	0.0019	0.0018	0.0019	0.0018						
22	0.0000	0.0013	0.0015	0.0016	0.0017	0.0018	0.0017	0.0018	0.0018	0.0018	0.0018	0.0019						
23	0.0000	0.0012	0.0015	0.0016	0.0016	0.0016	0.0017	0.0018	0.0018	0.0018	0.0019	0.0019						
24	0.0000	0.0012	0.0014	0.0015	0.0017	0.0016	0.0016	0.0016	0.0017	0.0017	0.0017	0.0017						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.0000	0.0013	0.0014	0.0016	0.0017	0.0017	0.0018	0.0019	0.0019	0.0019	0.0019	0.0019						
Med.	0.0000	0.0012	0.0015	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018	0.0019	0.0019						
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001						
Min.	0.0000	0.0011	0.0012	0.0014	0.0016	0.0015	0.0016	0.0016	0.0016	0.0017	0.0017	0.0017						
Max.	0.0000	0.0016	0.0018	0.0019	0.0021	0.0021	0.0022	0.0022	0.0022	0.0023	0.0022	0.0022						

Data Set 3 : 85 °C, 700 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.9 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 3-5

Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2645	0.2633	0.2631	0.2630	0.2628	0.2628	0.2628	0.2626	0.2626	0.2626	0.2626	0.2626						
2	0.2623	0.2611	0.2611	0.2609	0.2607	0.2608	0.2607	0.2606	0.2606	0.2606	0.2606	0.2605						
3	0.2642	0.2630	0.2628	0.2627	0.2625	0.2625	0.2625	0.2624	0.2624	0.2624	0.2624	0.2623						
4	0.2643	0.2630	0.2629	0.2627	0.2626	0.2626	0.2624	0.2624	0.2624	0.2624	0.2624	0.2623	0.2623					
5	0.2646	0.2634	0.2632	0.2630	0.2628	0.2628	0.2627	0.2626	0.2626	0.2626	0.2626	0.2626	0.2626					
6	0.2668	0.2653	0.2652	0.2651	0.2649	0.2649	0.2649	0.2647	0.2647	0.2647	0.2647	0.2646	0.2647					
7	0.2663	0.2648	0.2646	0.2645	0.2643	0.2643	0.2642	0.2642	0.2642	0.2641	0.2641	0.2641	0.2641					
8	0.2657	0.2645	0.2643	0.2642	0.2640	0.2640	0.2639	0.2639	0.2638	0.2638	0.2638	0.2638	0.2638					
9	0.2624	0.2611	0.2611	0.2609	0.2608	0.2607	0.2608	0.2607	0.2606	0.2607	0.2606	0.2606	0.2606					
10	0.2631	0.2618	0.2617	0.2616	0.2615	0.2614	0.2614	0.2612	0.2613	0.2613	0.2612	0.2612	0.2612					
11	0.2634	0.2622	0.2621	0.2620	0.2618	0.2618	0.2618	0.2617	0.2617	0.2616	0.2616	0.2616	0.2616					
12	0.2648	0.2636	0.2635	0.2634	0.2632	0.2632	0.2632	0.2631	0.2631	0.2630	0.2630	0.2630	0.2630					
13	0.2634	0.2623	0.2621	0.2620	0.2618	0.2619	0.2617	0.2616	0.2617	0.2617	0.2617	0.2617	0.2616					
14	0.2629	0.2618	0.2617	0.2616	0.2614	0.2614	0.2613	0.2612	0.2613	0.2612	0.2612	0.2612	0.2612					
15	0.2649	0.2637	0.2635	0.2635	0.2633	0.2632	0.2633	0.2632	0.2631	0.2632	0.2631	0.2631	0.2631					
16	0.2648	0.2637	0.2635	0.2633	0.2632	0.2632	0.2631	0.2630	0.2630	0.2630	0.2629	0.2629	0.2629					
17	0.2659	0.2647	0.2645	0.2644	0.2642	0.2642	0.2642	0.2641	0.2641	0.2640	0.2640	0.2640	0.2640					
18	0.2645	0.2631	0.2630	0.2629	0.2628	0.2628	0.2628	0.2627	0.2626	0.2626	0.2626	0.2626	0.2626					
19	0.2650	0.2637	0.2636	0.2635	0.2633	0.2633	0.2633	0.2632	0.2632	0.2632	0.2632	0.2632	0.2632					
20	0.2646	0.2633	0.2632	0.2630	0.2629	0.2629	0.2628	0.2627	0.2627	0.2627	0.2626	0.2626	0.2626					
21	0.2634	0.2621	0.2620	0.2619	0.2617	0.2617	0.2617	0.2616	0.2616	0.2616	0.2615	0.2616	0.2616					
22	0.2648	0.2635	0.2634	0.2633	0.2631	0.2630	0.2631	0.2630	0.2630	0.2630	0.2630	0.2629	0.2629					
23	0.2637	0.2625	0.2623	0.2622	0.2621	0.2621	0.2620	0.2619	0.2619	0.2619	0.2618	0.2618	0.2618					
24	0.2643	0.2631	0.2630	0.2629	0.2627	0.2628	0.2628	0.2627	0.2626	0.2626	0.2626	0.2626	0.2626					
n	24	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.2644	0.2631	0.2630	0.2629	0.2627	0.2627	0.2626	0.2625	0.2625	0.2625	0.2625	0.2625	0.2625					
Med.	0.2645	0.2632	0.2631	0.2630	0.2628	0.2628	0.2628	0.2627	0.2626	0.2626	0.2626	0.2626	0.2626					
σ	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011					
Min.	0.2623	0.2611	0.2611	0.2609	0.2607	0.2607	0.2607	0.2606	0.2606	0.2606	0.2606	0.2605	0.2605					
Max.	0.2668	0.2653	0.2652	0.2651	0.2649	0.2649	0.2649	0.2647	0.2647	0.2647	0.2646	0.2647	0.2647					

Data Set 3 : 85 °C, 700 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.9 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 3-6

Chromaticity

LED No.	Chromaticity v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.5242	0.5239	0.5238	0.5238	0.5238	0.5238	0.5238	0.5238	0.5239	0.5239	0.5239	0.5240					
2	0.5241	0.5239	0.5239	0.5239	0.5238	0.5238	0.5238	0.5239	0.5239	0.5239	0.5240	0.5239					
3	0.5243	0.5240	0.5240	0.5239	0.5239	0.5239	0.5240	0.5240	0.5240	0.5240	0.5241	0.5241					
4	0.5248	0.5244	0.5244	0.5243	0.5243	0.5243	0.5244	0.5244	0.5244	0.5244	0.5245	0.5245					
5	0.5260	0.5258	0.5256	0.5256	0.5256	0.5256	0.5256	0.5256	0.5256	0.5256	0.5257	0.5257					
6	0.5285	0.5281	0.5281	0.5281	0.5281	0.5281	0.5281	0.5281	0.5281	0.5281	0.5282	0.5282					
7	0.5262	0.5258	0.5257	0.5257	0.5256	0.5257	0.5257	0.5257	0.5257	0.5257	0.5258	0.5258					
8	0.5247	0.5244	0.5243	0.5243	0.5242	0.5243	0.5243	0.5243	0.5243	0.5243	0.5244	0.5244					
9	0.5242	0.5238	0.5238	0.5238	0.5238	0.5238	0.5238	0.5238	0.5238	0.5239	0.5239	0.5239					
10	0.5235	0.5231	0.5230	0.5230	0.5230	0.5230	0.5230	0.5231	0.5231	0.5231	0.5231	0.5231					
11	0.5239	0.5236	0.5235	0.5235	0.5235	0.5235	0.5235	0.5235	0.5235	0.5236	0.5236	0.5236					
12	0.5248	0.5245	0.5244	0.5244	0.5244	0.5244	0.5245	0.5245	0.5245	0.5245	0.5245	0.5245					
13	0.5246	0.5244	0.5243	0.5243	0.5243	0.5243	0.5243	0.5243	0.5243	0.5243	0.5243	0.5244					
14	0.5234	0.5231	0.5230	0.5230	0.5230	0.5230	0.5230	0.5230	0.5230	0.5230	0.5231	0.5231					
15	0.5250	0.5246	0.5246	0.5246	0.5246	0.5246	0.5246	0.5246	0.5247	0.5247	0.5247	0.5247					
16	0.5261	0.5259	0.5258	0.5258	0.5257	0.5258	0.5258	0.5258	0.5258	0.5258	0.5258	0.5258					
17	0.5280	0.5278	0.5277	0.5277	0.5276	0.5277	0.5277	0.5277	0.5277	0.5277	0.5278	0.5278					
18	0.5244	0.5240	0.5240	0.5239	0.5239	0.5239	0.5239	0.5240	0.5239	0.5239	0.5240	0.5240					
19	0.5243	0.5240	0.5239	0.5239	0.5239	0.5238	0.5239	0.5239	0.5239	0.5239	0.5239	0.5239					
20	0.5247	0.5244	0.5243	0.5243	0.5242	0.5242	0.5243	0.5243	0.5243	0.5243	0.5243	0.5243					
21	0.5248	0.5244	0.5244	0.5244	0.5243	0.5243	0.5243	0.5244	0.5243	0.5244	0.5244	0.5244					
22	0.5239	0.5236	0.5235	0.5235	0.5235	0.5235	0.5235	0.5235	0.5235	0.5236	0.5236	0.5236					
23	0.5248	0.5245	0.5244	0.5244	0.5244	0.5244	0.5244	0.5245	0.5244	0.5245	0.5245	0.5245					
24	0.5252	0.5249	0.5248	0.5248	0.5247	0.5248	0.5248	0.5248	0.5248	0.5248	0.5249	0.5248					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.5249	0.5246	0.5246	0.5245	0.5245	0.5245	0.5245	0.5246	0.5246	0.5246	0.5246	0.5246					
Med.	0.5247	0.5244	0.5243	0.5243	0.5243	0.5243	0.5243	0.5243	0.5243	0.5243	0.5244	0.5244					
σ	0.0013	0.0013	0.0013	0.0013	0.0012	0.0013	0.0013	0.0013	0.0013	0.0012	0.0013	0.0013					
Min.	0.5234	0.5231	0.5230	0.5230	0.5230	0.5230	0.5230	0.5230	0.5230	0.5230	0.5231	0.5231					
Max.	0.5285	0.5281	0.5281	0.5281	0.5281	0.5281	0.5281	0.5281	0.5281	0.5281	0.5282	0.5282					

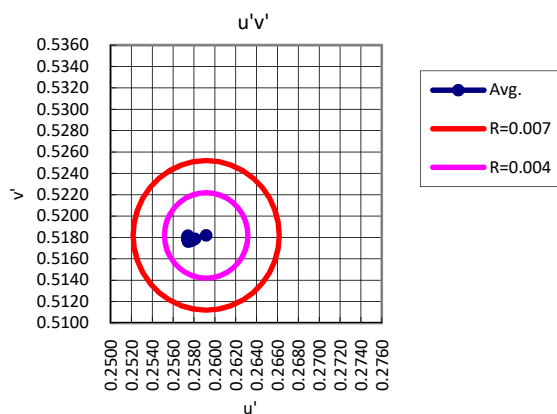
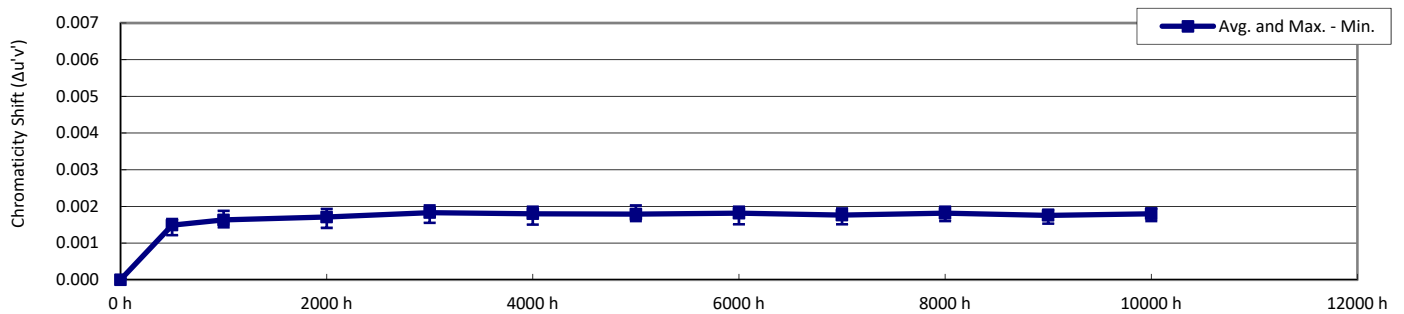
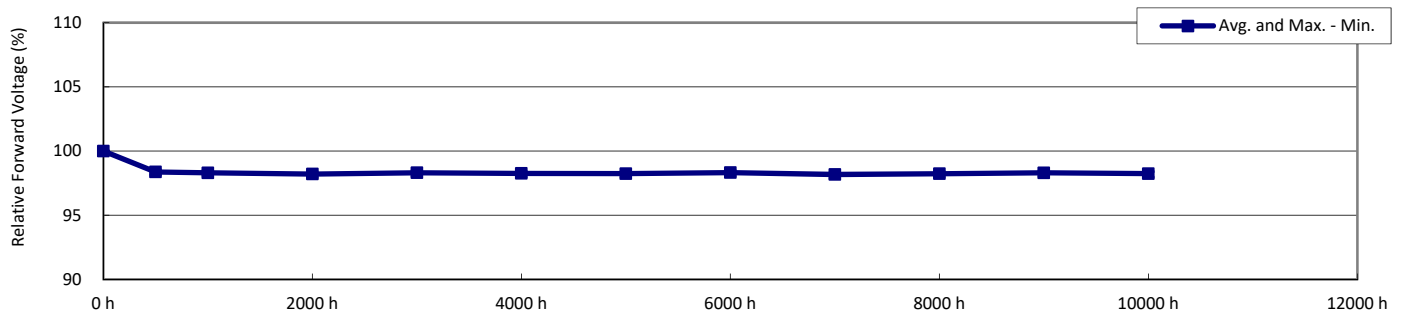
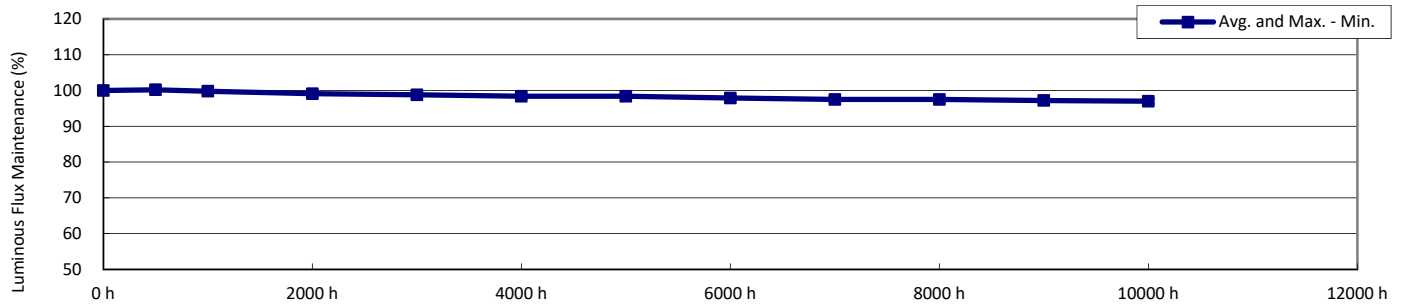
Data Set 4 : 85 °C, 1200 mA

Actual Case Temperature [T_S]	87.6 °C
Actual Ambient Temperature [T_A]	84.7 °C
Drive Current [I_F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 4 : 85 °C, 1200 mA

Actual Case Temperature [T _s]	87.6 °C
Actual Ambient Temperature [T _A]	84.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 4-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _v [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	389	3.15	2725	3.77	0.453	0.401	0.262	0.523						
2	398	3.14	2813	3.77	0.444	0.396	0.259	0.519						
3	399	3.15	2828	3.77	0.441	0.391	0.259	0.517						
4	397	3.15	2846	3.77	0.439	0.390	0.258	0.516						
5	390	3.15	2818	3.77	0.442	0.393	0.259	0.518						
6	389	3.14	2775	3.77	0.448	0.399	0.260	0.521						
7	390	3.16	2795	3.79	0.445	0.396	0.260	0.519						
8	395	3.15	2837	3.78	0.441	0.392	0.258	0.517						
9	389	3.14	2757	3.77	0.450	0.400	0.261	0.522						
10	390	3.15	2805	3.77	0.444	0.394	0.259	0.519						
11	396	3.15	2854	3.78	0.438	0.390	0.258	0.516						
12	392	3.15	2834	3.78	0.440	0.391	0.259	0.517						
13	386	3.15	2787	3.78	0.445	0.395	0.260	0.519						
14	386	3.16	2767	3.79	0.448	0.398	0.261	0.521						
15	392	3.15	2812	3.77	0.444	0.395	0.259	0.519						
16	391	3.15	2836	3.78	0.440	0.391	0.259	0.517						
17	388	3.15	2801	3.78	0.444	0.395	0.260	0.519						
18	391	3.14	2774	3.77	0.449	0.399	0.260	0.521						
19	393	3.15	2848	3.78	0.441	0.395	0.258	0.518						
20	393	3.15	2852	3.78	0.439	0.390	0.258	0.516						
21	396	3.14	2840	3.76	0.439	0.390	0.259	0.516						
22	393	3.14	2843	3.77	0.440	0.390	0.258	0.516						
23	394	3.15	2852	3.78	0.439	0.391	0.258	0.516						
24	388	3.15	2831	3.78	0.440	0.391	0.259	0.516						
n	24	24	24	24	24	24	24	24						
Avg.	392	3.15	2814	3.78	0.443	0.394	0.259	0.518						
Med.	391	3.15	2823	3.78	0.442	0.393	0.259	0.518						
σ	3.6	0.004	34.8	0.005	0.0041	0.0036	0.0011	0.0021						
Min.	386	3.14	2725	3.76	0.438	0.390	0.258	0.516						
Max.	399	3.16	2854	3.79	0.453	0.401	0.262	0.523						



Data Set 4 : 85 °C, 1200 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 4-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	99.8	99.5	98.7	98.4	97.8	97.8	97.2	96.9	96.9	96.5	96.3						
2	100.0	100.0	99.4	98.6	98.3	98.1	97.7	97.4	97.0	96.8	96.7	96.6						
3	100.0	99.7	99.1	98.5	98.2	97.8	97.9	97.2	96.9	97.0	96.5	96.3						
4	100.0	99.9	99.4	98.6	98.5	98.2	98.0	97.7	97.2	97.2	97.1	96.8						
5	100.0	100.5	100.0	99.4	98.9	98.6	98.4	97.8	97.7	97.6	97.2	97.1						
6	100.0	100.6	100.1	99.2	98.8	98.6	98.6	98.1	97.7	97.7	97.4	97.2						
7	100.0	99.7	99.5	99.0	98.7	98.3	98.4	98.0	97.6	97.5	97.2	97.1						
8	100.0	99.9	99.2	98.5	98.2	97.9	97.7	97.3	97.0	96.9	96.8	96.4						
9	100.0	100.9	100.4	99.5	99.4	98.9	99.0	98.4	98.0	98.1	97.7	97.5						
10	100.0	100.4	99.9	99.1	98.9	98.6	98.5	98.2	97.8	97.7	97.4	97.3						
11	100.0	99.7	99.2	98.6	98.1	97.8	98.0	97.5	97.2	97.1	96.8	96.7						
12	100.0	100.7	100.2	99.5	99.3	98.9	99.0	98.4	97.9	98.1	97.5	97.3						
13	100.0	100.6	100.2	99.4	99.3	98.8	98.8	98.4	98.2	98.1	97.7	97.7						
14	100.0	99.5	99.2	98.7	98.3	97.9	98.1	97.8	97.3	97.3	96.9	96.8						
15	100.0	101.0	100.5	99.9	99.5	99.1	99.2	98.6	98.2	98.2	97.9	97.7						
16	100.0	100.4	100.1	99.7	99.3	98.9	98.5	98.4	98.0	97.8	97.7	97.5						
17	100.0	101.0	100.4	99.6	99.3	98.8	99.1	98.5	98.1	98.2	97.7	97.5						
18	100.0	100.5	100.2	99.5	99.2	98.8	99.1	98.4	98.0	98.1	97.7	97.5						
19	100.0	100.8	100.3	99.4	99.0	98.8	98.6	98.3	97.9	97.7	97.5	97.3						
20	100.0	99.9	99.4	98.9	98.6	98.1	98.0	97.5	97.0	97.1	96.7	96.6						
21	100.0	100.2	99.7	99.1	98.9	98.5	98.7	98.0	97.6	97.6	97.3	97.1						
22	100.0	99.6	99.2	98.7	98.5	98.2	98.3	97.9	97.6	97.2	97.3	97.0						
23	100.0	100.0	99.5	98.8	98.3	97.9	97.8	97.4	97.0	97.1	96.7	96.5						
24	100.0	100.0	99.6	98.9	98.5	98.5	98.2	97.7	97.3	97.2	97.0	96.8						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	100.2	99.8	99.1	98.8	98.4	98.4	97.9	97.5	97.5	97.2	97.0						
Med.	100.0	100.1	99.7	99.1	98.8	98.5	98.4	98.0	97.6	97.6	97.3	97.1						
σ	0.00	0.47	0.46	0.42	0.44	0.42	0.48	0.45	0.44	0.46	0.43	0.44						
Min.	100.0	99.5	99.1	98.5	98.1	97.8	97.7	97.2	96.9	96.8	96.5	96.3						
Max.	100.0	101.0	100.5	99.9	99.5	99.1	99.2	98.6	98.2	98.2	97.9	97.7						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	0.9955		
α	2.662E-06		
R ²	0.9336		
Calculated L ₇₀ (10K)	132000	hours	
Reported L ₇₀ (10K)	> 60000	hours	
Calculated L ₈₀ (10K)	82100	hours	
Reported L ₈₀ (10K)	> 60000	hours	
Calculated L ₉₀ (10K)	37900	hours	
Reported L ₉₀ (10K)	37900	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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Data Set 4 : 85 °C, 1200 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 4-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.5	98.4	98.3	98.4	98.3	98.3	98.4	98.3	98.3	98.4	98.4						
2	100.0	98.4	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3						
3	100.0	98.4	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3						
4	100.0	98.4	98.4	98.3	98.4	98.3	98.3	98.4	98.2	98.3	98.4	98.3						
5	100.0	98.4	98.3	98.2	98.3	98.3	98.3	98.3	98.2	98.2	98.3	98.3						
6	100.0	98.4	98.3	98.2	98.3	98.3	98.3	98.3	98.2	98.3	98.3	98.3						
7	100.0	98.1	98.1	97.9	98.0	98.0	98.0	98.0	97.9	98.0	98.0	98.0						
8	100.0	98.3	98.3	98.2	98.3	98.2	98.2	98.3	98.1	98.2	98.3	98.2						
9	100.0	98.4	98.3	98.3	98.4	98.3	98.3	98.4	98.2	98.3	98.4	98.3						
10	100.0	98.4	98.3	98.2	98.3	98.3	98.2	98.3	98.2	98.2	98.3	98.3						
11	100.0	98.4	98.3	98.2	98.3	98.2	98.2	98.3	98.1	98.2	98.3	98.2						
12	100.0	98.3	98.3	98.1	98.3	98.2	98.2	98.3	98.1	98.2	98.3	98.2						
13	100.0	98.4	98.3	98.2	98.3	98.3	98.3	98.3	98.2	98.2	98.3	98.3						
14	100.0	98.2	98.1	98.0	98.1	98.1	98.0	98.1	97.9	98.0	98.1	98.0						
15	100.0	98.4	98.3	98.2	98.3	98.3	98.3	98.3	98.2	98.2	98.3	98.3						
16	100.0	98.3	98.3	98.2	98.3	98.3	98.2	98.3	98.2	98.2	98.3	98.2						
17	100.0	98.3	98.3	98.2	98.3	98.2	98.2	98.3	98.1	98.2	98.3	98.2						
18	100.0	98.4	98.4	98.3	98.4	98.3	98.3	98.4	98.2	98.3	98.4	98.3						
19	100.0	98.4	98.3	98.2	98.3	98.3	98.3	98.4	98.2	98.3	98.3	98.3						
20	100.0	98.4	98.3	98.2	98.3	98.3	98.2	98.3	98.2	98.2	98.3	98.2						
21	100.0	98.5	98.5	98.4	98.5	98.4	98.4	98.5	98.3	98.4	98.5	98.4						
22	100.0	98.5	98.4	98.3	98.4	98.3	98.3	98.4	98.3	98.3	98.4	98.3						
23	100.0	98.4	98.3	98.2	98.3	98.3	98.3	98.3	98.2	98.2	98.3	98.3						
24	100.0	98.3	98.3	98.2	98.3	98.2	98.2	98.3	98.1	98.2	98.3	98.2						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.4	98.3	98.2	98.3	98.3	98.2	98.3	98.2	98.2	98.3	98.2						
Med.	100.0	98.4	98.3	98.2	98.3	98.3	98.3	98.3	98.2	98.2	98.3	98.3						
σ	0.00	0.08	0.08	0.09	0.08	0.09	0.09	0.09	0.10	0.09	0.09	0.09						
Min.	100.0	98.1	98.1	97.9	98.0	98.0	98.0	98.0	97.9	98.0	98.0	98.0						
Max.	100.0	98.5	98.5	98.4	98.5	98.4	98.4	98.5	98.3	98.4	98.5	98.4						



Data Set 4 : 85 °C, 1200 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 4-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.0000	0.0014	0.0015	0.0017	0.0018	0.0018	0.0017	0.0018	0.0017	0.0018	0.0018	0.0018					
2	0.0000	0.0012	0.0014	0.0014	0.0016	0.0015	0.0016	0.0015	0.0015	0.0016	0.0015	0.0016					
3	0.0000	0.0015	0.0015	0.0016	0.0018	0.0017	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016					
4	0.0000	0.0016	0.0017	0.0018	0.0019	0.0019	0.0019	0.0019	0.0018	0.0019	0.0018	0.0019					
5	0.0000	0.0017	0.0019	0.0019	0.0020	0.0020	0.0020	0.0020	0.0019	0.0020	0.0019	0.0019					
6	0.0000	0.0015	0.0016	0.0017	0.0019	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018					
7	0.0000	0.0015	0.0017	0.0018	0.0019	0.0018	0.0018	0.0018	0.0018	0.0019	0.0018	0.0018					
8	0.0000	0.0015	0.0016	0.0017	0.0018	0.0017	0.0017	0.0017	0.0017	0.0018	0.0017	0.0018					
9	0.0000	0.0016	0.0018	0.0017	0.0019	0.0019	0.0018	0.0019	0.0018	0.0019	0.0019	0.0019					
10	0.0000	0.0015	0.0016	0.0017	0.0018	0.0017	0.0018	0.0018	0.0018	0.0018	0.0017	0.0018					
11	0.0000	0.0014	0.0015	0.0016	0.0017	0.0016	0.0017	0.0018	0.0016	0.0017	0.0017	0.0017					
12	0.0000	0.0015	0.0017	0.0017	0.0018	0.0018	0.0016	0.0018	0.0017	0.0016	0.0017	0.0017					
13	0.0000	0.0014	0.0016	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018					
14	0.0000	0.0014	0.0016	0.0017	0.0019	0.0017	0.0018	0.0018	0.0017	0.0018	0.0017	0.0018					
15	0.0000	0.0016	0.0017	0.0018	0.0019	0.0019	0.0017	0.0019	0.0018	0.0018	0.0018	0.0019					
16	0.0000	0.0015	0.0016	0.0017	0.0018	0.0019	0.0019	0.0019	0.0018	0.0019	0.0018	0.0018					
17	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0019	0.0019	0.0018	0.0019	0.0018	0.0018					
18	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018					
19	0.0000	0.0016	0.0018	0.0019	0.0020	0.0020	0.0020	0.0020	0.0018	0.0019	0.0018	0.0019					
20	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0018	0.0017	0.0017	0.0017	0.0017	0.0017					
21	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0016	0.0017	0.0017	0.0017	0.0017	0.0017					
22	0.0000	0.0015	0.0016	0.0017	0.0018	0.0019	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018					
23	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0018	0.0018	0.0017	0.0018	0.0017	0.0018					
24	0.0000	0.0015	0.0017	0.0017	0.0018	0.0016	0.0017	0.0017	0.0017	0.0018	0.0017	0.0018					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018					
Med.	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018					
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001					
Min.	0.0000	0.0012	0.0014	0.0014	0.0016	0.0015	0.0016	0.0015	0.0015	0.0016	0.0015	0.0016					
Max.	0.0000	0.0017	0.0019	0.0019	0.0020	0.0020	0.0020	0.0020	0.0019	0.0020	0.0019	0.0019					

Data Set 4 : 85 °C, 1200 mA

Actual Case Temperature [T _s]	87.6 °C
Actual Ambient Temperature [T _A]	84.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 4-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2610	0.2596	0.2595	0.2593	0.2592	0.2592	0.2593	0.2592	0.2593	0.2592	0.2592	0.2592						
2	0.2579	0.2567	0.2565	0.2565	0.2564	0.2564	0.2563	0.2564	0.2564	0.2563	0.2564	0.2563						
3	0.2582	0.2568	0.2568	0.2567	0.2565	0.2565	0.2566	0.2566	0.2566	0.2566	0.2566	0.2566						
4	0.2573	0.2558	0.2557	0.2556	0.2555	0.2555	0.2555	0.2555	0.2555	0.2555	0.2555	0.2554						
5	0.2578	0.2563	0.2561	0.2560	0.2560	0.2559	0.2559	0.2559	0.2559	0.2559	0.2559	0.2559						
6	0.2590	0.2576	0.2574	0.2573	0.2572	0.2572	0.2572	0.2572	0.2572	0.2572	0.2572	0.2572						
7	0.2585	0.2571	0.2569	0.2568	0.2567	0.2567	0.2567	0.2567	0.2567	0.2566	0.2567	0.2567						
8	0.2572	0.2558	0.2557	0.2556	0.2555	0.2555	0.2555	0.2555	0.2555	0.2554	0.2555	0.2554						
9	0.2600	0.2584	0.2583	0.2583	0.2582	0.2581	0.2582	0.2581	0.2582	0.2581	0.2581	0.2581						
10	0.2582	0.2568	0.2567	0.2566	0.2565	0.2565	0.2564	0.2564	0.2564	0.2564	0.2565	0.2564						
11	0.2567	0.2554	0.2553	0.2552	0.2551	0.2551	0.2550	0.2550	0.2551	0.2550	0.2550	0.2550						
12	0.2576	0.2562	0.2561	0.2560	0.2559	0.2559	0.2560	0.2559	0.2559	0.2560	0.2559	0.2559						
13	0.2587	0.2573	0.2572	0.2570	0.2570	0.2569	0.2569	0.2569	0.2569	0.2569	0.2569	0.2569						
14	0.2592	0.2579	0.2577	0.2576	0.2574	0.2575	0.2574	0.2574	0.2575	0.2574	0.2575	0.2574						
15	0.2579	0.2564	0.2563	0.2562	0.2561	0.2561	0.2562	0.2561	0.2561	0.2561	0.2561	0.2560						
16	0.2572	0.2558	0.2557	0.2556	0.2555	0.2554	0.2554	0.2554	0.2554	0.2554	0.2554	0.2554						
17	0.2582	0.2568	0.2567	0.2566	0.2565	0.2565	0.2564	0.2564	0.2564	0.2564	0.2564	0.2564						
18	0.2593	0.2579	0.2577	0.2576	0.2575	0.2575	0.2576	0.2575	0.2575	0.2575	0.2575	0.2575						
19	0.2562	0.2547	0.2545	0.2544	0.2543	0.2543	0.2543	0.2543	0.2544	0.2543	0.2544	0.2543						
20	0.2568	0.2554	0.2553	0.2552	0.2551	0.2551	0.2551	0.2551	0.2551	0.2551	0.2551	0.2551						
21	0.2577	0.2563	0.2562	0.2561	0.2560	0.2560	0.2561	0.2560	0.2560	0.2560	0.2560	0.2560						
22	0.2571	0.2557	0.2556	0.2555	0.2554	0.2553	0.2553	0.2553	0.2553	0.2553	0.2553	0.2553						
23	0.2566	0.2552	0.2551	0.2550	0.2549	0.2549	0.2549	0.2549	0.2549	0.2548	0.2549	0.2548						
24	0.2576	0.2562	0.2560	0.2560	0.2559	0.2560	0.2559	0.2559	0.2559	0.2558	0.2559	0.2558						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2580	0.2566	0.2565	0.2564	0.2563	0.2563	0.2563	0.2562	0.2563	0.2562	0.2562	0.2562						
Med.	0.2579	0.2564	0.2563	0.2562	0.2561	0.2561	0.2562	0.2561	0.2561	0.2561	0.2561	0.2560						
σ	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011						
Min.	0.2562	0.2547	0.2545	0.2544	0.2543	0.2543	0.2543	0.2543	0.2544	0.2543	0.2544	0.2543						
Max.	0.2610	0.2596	0.2595	0.2593	0.2592	0.2592	0.2593	0.2592	0.2593	0.2592	0.2592	0.2592						



Data Set 4 : 85 °C, 1200 mA

Actual Case Temperature [T _S]	87.6 °C
Actual Ambient Temperature [T _A]	84.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 4-6
Chromaticity

LED No.	Chromaticity v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.5212	0.5210	0.5209	0.5210	0.5208	0.5211	0.5210	0.5210	0.5214	0.5211	0.5215	0.5213						
2	0.5176	0.5174	0.5173	0.5174	0.5172	0.5175	0.5175	0.5174	0.5178	0.5175	0.5179	0.5178						
3	0.5154	0.5149	0.5148	0.5150	0.5149	0.5150	0.5151	0.5150	0.5153	0.5152	0.5154	0.5153						
4	0.5146	0.5140	0.5140	0.5140	0.5140	0.5141	0.5141	0.5141	0.5143	0.5141	0.5144	0.5143						
5	0.5162	0.5155	0.5154	0.5155	0.5154	0.5156	0.5155	0.5156	0.5158	0.5156	0.5160	0.5158						
6	0.5199	0.5195	0.5195	0.5196	0.5194	0.5196	0.5196	0.5196	0.5199	0.5197	0.5200	0.5199						
7	0.5179	0.5174	0.5174	0.5174	0.5173	0.5175	0.5175	0.5175	0.5177	0.5176	0.5179	0.5177						
8	0.5159	0.5154	0.5154	0.5154	0.5153	0.5155	0.5155	0.5155	0.5157	0.5156	0.5159	0.5157						
9	0.5206	0.5202	0.5201	0.5202	0.5200	0.5202	0.5203	0.5202	0.5205	0.5203	0.5207	0.5205						
10	0.5171	0.5166	0.5166	0.5166	0.5166	0.5167	0.5167	0.5167	0.5169	0.5168	0.5171	0.5170						
11	0.5144	0.5139	0.5139	0.5139	0.5139	0.5140	0.5140	0.5139	0.5141	0.5140	0.5143	0.5142						
12	0.5157	0.5151	0.5150	0.5151	0.5150	0.5151	0.5153	0.5151	0.5153	0.5153	0.5155	0.5154						
13	0.5176	0.5173	0.5172	0.5172	0.5171	0.5173	0.5173	0.5173	0.5174	0.5174	0.5177	0.5176						
14	0.5193	0.5188	0.5187	0.5188	0.5187	0.5189	0.5189	0.5189	0.5191	0.5189	0.5193	0.5191						
15	0.5177	0.5171	0.5171	0.5171	0.5170	0.5172	0.5173	0.5172	0.5174	0.5173	0.5176	0.5175						
16	0.5152	0.5147	0.5146	0.5146	0.5145	0.5146	0.5146	0.5146	0.5148	0.5147	0.5150	0.5149						
17	0.5174	0.5168	0.5168	0.5168	0.5167	0.5169	0.5168	0.5169	0.5170	0.5169	0.5173	0.5171						
18	0.5202	0.5198	0.5198	0.5198	0.5198	0.5199	0.5200	0.5199	0.5202	0.5200	0.5203	0.5202						
19	0.5167	0.5161	0.5161	0.5161	0.5160	0.5162	0.5162	0.5162	0.5164	0.5163	0.5166	0.5165						
20	0.5144	0.5140	0.5138	0.5139	0.5138	0.5139	0.5139	0.5140	0.5141	0.5140	0.5143	0.5142						
21	0.5148	0.5143	0.5142	0.5142	0.5142	0.5143	0.5145	0.5144	0.5145	0.5144	0.5147	0.5146						
22	0.5148	0.5143	0.5143	0.5143	0.5142	0.5143	0.5144	0.5144	0.5145	0.5144	0.5147	0.5146						
23	0.5147	0.5142	0.5141	0.5141	0.5141	0.5142	0.5142	0.5142	0.5144	0.5143	0.5145	0.5145						
24	0.5150	0.5146	0.5145	0.5145	0.5145	0.5147	0.5146	0.5147	0.5147	0.5147	0.5150	0.5149						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.5168	0.5164	0.5163	0.5164	0.5163	0.5164	0.5165	0.5164	0.5166	0.5165	0.5168	0.5167						
Med.	0.5165	0.5158	0.5158	0.5158	0.5157	0.5159	0.5159	0.5159	0.5161	0.5160	0.5163	0.5162						
σ	0.0021	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022						
Min.	0.5144	0.5139	0.5138	0.5139	0.5138	0.5139	0.5139	0.5139	0.5141	0.5140	0.5143	0.5142						
Max.	0.5212	0.5210	0.5209	0.5210	0.5208	0.5211	0.5210	0.5210	0.5214	0.5211	0.5215	0.5213						

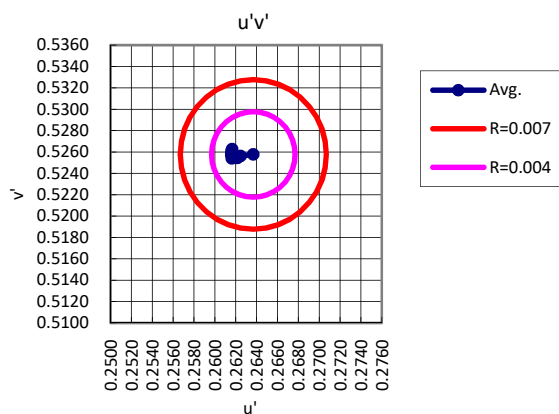
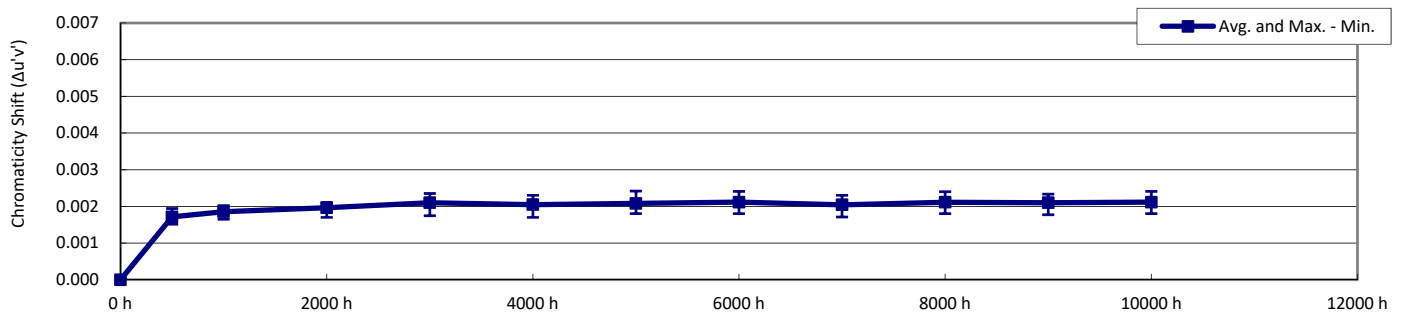
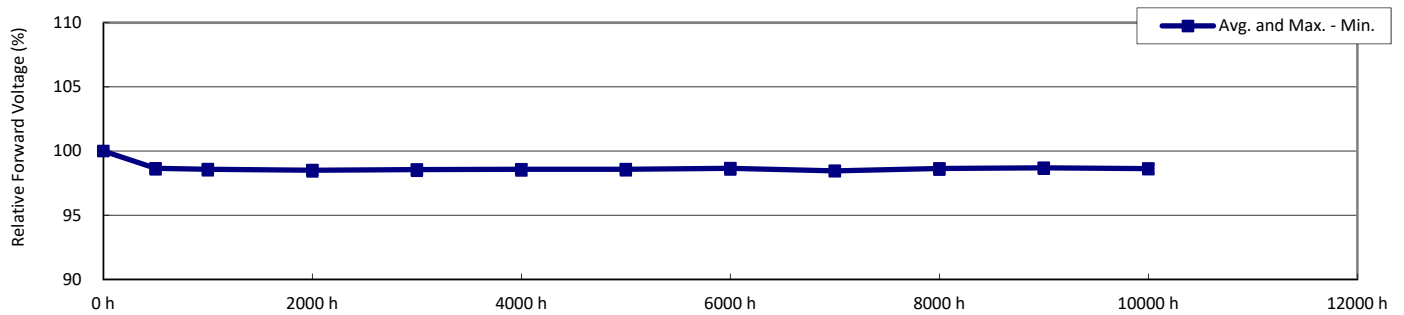
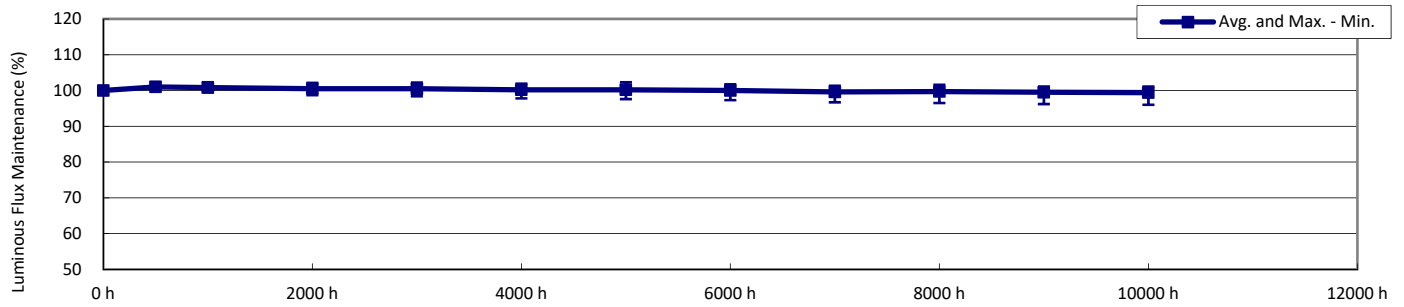
Data Set 5 : 85 °C, 1500 mA

Actual Case Temperature [T_S]	88.2 °C
Actual Ambient Temperature [T_A]	86.3 °C
Drive Current [I_F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 5 : 85 °C, 1500 mA

Actual Case Temperature [T _S]	88.2 °C
Actual Ambient Temperature [T _A]	86.3 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 5-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _V [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	461	3.23	2794	4.84	0.444	0.394	0.260	0.518						
2	462	3.23	2739	4.84	0.451	0.400	0.262	0.522						
3	456	3.25	2606	4.87	0.468	0.413	0.267	0.530						
4	460	3.25	2653	4.87	0.464	0.411	0.265	0.528						
5	463	3.25	2716	4.87	0.456	0.406	0.262	0.525						
6	461	3.25	2777	4.87	0.449	0.401	0.260	0.522						
7	460	3.25	2680	4.87	0.460	0.409	0.264	0.527						
8	462	3.24	2720	4.87	0.458	0.409	0.262	0.526						
9	460	3.24	2687	4.87	0.461	0.411	0.263	0.528						
10	455	3.24	2623	4.87	0.466	0.412	0.266	0.529						
11	458	3.24	2619	4.86	0.468	0.414	0.266	0.530						
12	455	3.28	2643	4.92	0.463	0.409	0.265	0.527						
13	455	3.28	2693	4.92	0.458	0.406	0.263	0.525						
14	461	3.28	2761	4.93	0.451	0.403	0.261	0.523						
15	459	3.29	2717	4.94	0.454	0.403	0.262	0.524						
16	461	3.27	2666	4.90	0.460	0.407	0.264	0.526						
17	464	3.26	2658	4.89	0.462	0.409	0.265	0.527						
18	464	3.26	2663	4.89	0.462	0.410	0.264	0.527						
19	453	3.26	2610	4.89	0.467	0.412	0.267	0.529						
20	451	3.27	2630	4.91	0.464	0.409	0.266	0.527						
21	454	3.28	2666	4.92	0.460	0.406	0.265	0.526						
22	455	3.28	2677	4.92	0.458	0.404	0.264	0.524						
23	459	3.28	2701	4.93	0.456	0.403	0.263	0.524						
24	460	3.30	2693	4.95	0.457	0.404	0.263	0.524						
n	24	24	24	24	24	24	24	24						
Avg.	459	3.26	2683	4.89	0.459	0.407	0.264	0.526						
Med.	460	3.26	2679	4.89	0.460	0.408	0.264	0.526						
σ	3.6	0.020	51.3	0.031	0.0061	0.0048	0.0020	0.0028						
Min.	451	3.23	2606	4.84	0.444	0.394	0.260	0.518						
Max.	464	3.30	2794	4.95	0.468	0.414	0.267	0.530						



Data Set 5 : 85 °C, 1500 mA

Actual Case Temperature [T _S]	88.2 °C
Actual Ambient Temperature [T _A]	86.3 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 5-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	100.3	99.7	98.7	98.4	97.8	97.6	97.3	96.7	96.5	96.2	96.0						
2	100.0	100.9	99.9	99.1	98.7	98.2	97.7	97.3	96.8	96.8	96.2	96.0						
3	100.0	101.7	101.4	101.2	101.3	101.0	101.1	100.9	100.4	100.7	100.4	100.6						
4	100.0	100.6	100.2	100.0	100.0	99.6	99.8	99.6	99.2	99.2	99.1	99.1						
5	100.0	100.5	100.3	100.1	100.1	99.8	99.8	99.7	99.2	99.6	99.2	99.1						
6	100.0	101.6	101.2	101.0	100.9	100.7	101.0	100.6	100.2	100.6	100.2	100.2						
7	100.0	100.9	100.8	100.3	100.3	100.2	100.1	99.8	99.5	99.6	99.4	99.4						
8	100.0	100.3	99.9	99.7	99.7	99.2	99.4	99.3	98.6	98.9	98.6	98.5						
9	100.0	101.5	101.4	101.1	101.2	100.8	101.0	100.7	100.2	100.5	100.3	100.2						
10	100.0	100.7	100.4	100.1	100.2	99.8	99.8	99.7	99.2	99.3	99.1	99.1						
11	100.0	100.1	99.8	99.5	99.5	99.3	99.2	99.0	98.5	98.6	98.4	98.4						
12	100.0	101.7	101.7	101.5	101.5	101.1	101.2	101.1	100.6	100.9	100.5	100.5						
13	100.0	101.1	101.0	100.7	100.8	100.6	100.5	100.4	100.0	100.1	100.0	100.0						
14	100.0	101.3	101.0	101.0	100.9	100.7	100.8	100.7	100.3	100.4	100.1	100.0						
15	100.0	101.7	101.7	101.5	101.6	101.4	101.5	101.3	100.8	101.1	100.8	100.7						
16	100.0	100.4	100.6	100.3	100.3	100.1	100.0	99.9	99.3	99.4	99.3	99.3						
17	100.0	100.1	99.9	99.7	99.6	99.3	99.2	99.1	98.8	98.9	98.5	98.4						
18	100.0	100.7	100.4	100.2	100.2	99.9	100.2	99.8	99.3	99.6	99.1	99.1						
19	100.0	101.4	101.2	100.8	100.9	100.6	100.2	100.3	99.8	100.0	99.6	99.6						
20	100.0	101.7	101.6	101.5	101.4	101.1	101.1	100.9	100.4	100.6	100.5	100.4						
21	100.0	102.3	102.3	102.1	102.2	101.9	102.3	101.7	101.3	101.6	101.1	101.1						
22	100.0	101.0	101.1	100.8	101.0	100.8	100.5	100.5	100.0	100.2	100.0	100.0						
23	100.0	101.3	101.0	101.0	100.9	100.6	100.6	100.4	100.2	100.2	99.9	99.5						
24	100.0	101.2	101.1	100.9	100.9	100.7	100.9	100.7	100.2	100.6	100.3	100.2						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	101.0	100.8	100.5	100.5	100.2	100.2	100.0	99.6	99.7	99.5	99.4						
Med.	100.0	101.1	101.0	100.8	100.9	100.6	100.4	100.4	99.9	100.1	99.8	99.6						
σ	0.00	0.60	0.71	0.83	0.91	0.97	1.09	1.09	1.12	1.21	1.24	1.28						
Min.	100.0	100.1	99.7	98.7	98.4	97.8	97.6	97.3	96.7	96.5	96.2	96.0						
Max.	100.0	102.3	102.3	102.1	102.2	101.9	102.3	101.7	101.3	101.6	101.1	101.1						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	1.009		
α	1.546E-06		
R ²	0.8804		
Calculated L ₇₀ (10K)	237000	hours	
Reported L ₇₀ (10K)	> 60000	hours	
Calculated L ₈₀ (10K)	150000	hours	
Reported L ₈₀ (10K)	> 60000	hours	
Calculated L ₉₀ (10K)	73900	hours	
Reported L ₉₀ (10K)	> 60000	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.*



Data Set 5 : 85 °C, 1500 mA

Actual Case Temperature [T _S]	88.2 °C
Actual Ambient Temperature [T _A]	86.3 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 5-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.3	98.2	98.2	98.2	98.2	98.2	98.3	98.1	98.3	98.3	98.2						
2	100.0	98.3	98.2	98.1	98.2	98.2	98.2	98.2	98.1	98.3	98.3	98.2						
3	100.0	98.9	98.8	98.7	98.8	98.8	98.8	98.9	98.7	98.9	98.9	98.8						
4	100.0	98.8	98.8	98.7	98.7	98.7	98.8	98.8	98.6	98.8	98.9	98.8						
5	100.0	98.8	98.8	98.7	98.7	98.8	98.8	98.8	98.6	98.8	98.9	98.8						
6	100.0	98.9	98.8	98.7	98.8	98.8	98.8	98.9	98.7	98.9	98.9	98.9						
7	100.0	99.0	98.9	98.9	98.9	98.9	98.9	99.0	98.8	99.0	99.0	99.0						
8	100.0	99.0	98.9	98.9	98.9	98.9	98.9	99.0	98.8	99.0	99.0	99.0						
9	100.0	99.0	98.9	98.8	98.9	98.9	98.9	99.0	98.7	99.0	99.0	98.9						
10	100.0	99.0	98.9	98.9	98.9	98.9	98.9	99.0	98.8	99.0	99.0	99.0						
11	100.0	98.9	98.9	98.8	98.9	98.9	98.9	99.0	98.7	98.9	99.0	98.9						
12	100.0	98.5	98.4	98.3	98.4	98.4	98.5	98.5	98.3	98.5	98.6	98.5						
13	100.0	98.5	98.4	98.3	98.4	98.4	98.4	98.5	98.3	98.4	98.5	98.5						
14	100.0	98.4	98.3	98.3	98.3	98.4	98.4	98.4	98.2	98.4	98.5	98.4						
15	100.0	98.3	98.2	98.1	98.1	98.2	98.2	98.3	98.0	98.3	98.3	98.3						
16	100.0	98.7	98.6	98.6	98.6	98.6	98.6	98.7	98.5	98.7	98.8	98.7						
17	100.0	98.7	98.7	98.6	98.6	98.6	98.7	98.7	98.5	98.7	98.8	98.7						
18	100.0	98.8	98.8	98.7	98.7	98.7	98.7	98.8	98.6	98.8	98.9	98.8						
19	100.0	98.8	98.7	98.6	98.6	98.6	98.6	98.7	98.5	98.7	98.8	98.7						
20	100.0	98.6	98.5	98.5	98.5	98.5	98.5	98.6	98.4	98.6	98.7	98.6						
21	100.0	98.4	98.3	98.2	98.3	98.3	98.3	98.4	98.2	98.3	98.4	98.4						
22	100.0	98.5	98.4	98.4	98.4	98.4	98.4	98.5	98.3	98.5	98.5	98.5						
23	100.0	98.4	98.3	98.3	98.3	98.3	98.3	98.4	98.2	98.4	98.5	98.4						
24	100.0	98.2	98.1	98.0	98.1	98.1	98.1	98.2	98.0	98.2	98.2	98.2						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.7	98.6	98.5	98.6	98.6	98.6	98.7	98.5	98.6	98.7	98.6						
Med.	100.0	98.7	98.6	98.6	98.6	98.6	98.6	98.7	98.5	98.7	98.8	98.7						
σ	0.00	0.26	0.27	0.27	0.28	0.27	0.27	0.28	0.26	0.28	0.28	0.27						
Min.	100.0	98.2	98.1	98.0	98.1	98.1	98.1	98.2	98.0	98.2	98.2	98.2						
Max.	100.0	99.0	98.9	98.9	98.9	98.9	98.9	99.0	98.8	99.0	99.0	99.0						

Data Set 5 : 85 °C, 1500 mA

Actual Case Temperature [T _S]	88.2 °C
Actual Ambient Temperature [T _A]	86.3 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 5-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.0000	0.0016	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0017	0.0018	0.0018	0.0018					
2	0.0000	0.0015	0.0017	0.0017	0.0018	0.0018	0.0018	0.0018	0.0017	0.0018	0.0018	0.0018					
3	0.0000	0.0017	0.0019	0.0020	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0022	0.0022					
4	0.0000	0.0017	0.0018	0.0019	0.0020	0.0020	0.0021	0.0021	0.0020	0.0021	0.0020	0.0021					
5	0.0000	0.0016	0.0018	0.0019	0.0021	0.0020	0.0020	0.0020	0.0019	0.0020	0.0020	0.0020					
6	0.0000	0.0019	0.0020	0.0020	0.0022	0.0022	0.0022	0.0022	0.0021	0.0022	0.0021	0.0022					
7	0.0000	0.0017	0.0019	0.0019	0.0020	0.0020	0.0021	0.0021	0.0020	0.0021	0.0021	0.0021					
8	0.0000	0.0015	0.0017	0.0018	0.0019	0.0019	0.0019	0.0019	0.0019	0.0020	0.0020	0.0019					
9	0.0000	0.0017	0.0019	0.0020	0.0021	0.0021	0.0020	0.0021	0.0020	0.0021	0.0022	0.0021					
10	0.0000	0.0017	0.0018	0.0020	0.0021	0.0020	0.0020	0.0021	0.0021	0.0022	0.0021	0.0021					
11	0.0000	0.0016	0.0017	0.0018	0.0020	0.0019	0.0020	0.0020	0.0019	0.0020	0.0021	0.0021					
12	0.0000	0.0018	0.0019	0.0021	0.0022	0.0022	0.0021	0.0022	0.0021	0.0023	0.0023	0.0022					
13	0.0000	0.0017	0.0018	0.0020	0.0020	0.0020	0.0020	0.0021	0.0020	0.0021	0.0021	0.0021					
14	0.0000	0.0018	0.0020	0.0021	0.0024	0.0022	0.0023	0.0023	0.0022	0.0023	0.0023	0.0023					
15	0.0000	0.0018	0.0020	0.0021	0.0023	0.0022	0.0022	0.0023	0.0022	0.0022	0.0023	0.0022					
16	0.0000	0.0016	0.0018	0.0020	0.0022	0.0020	0.0021	0.0022	0.0021	0.0022	0.0021	0.0021					
17	0.0000	0.0015	0.0017	0.0018	0.0019	0.0019	0.0020	0.0020	0.0019	0.0019	0.0019	0.0019					
18	0.0000	0.0016	0.0017	0.0018	0.0019	0.0019	0.0019	0.0020	0.0019	0.0019	0.0019	0.0019					
19	0.0000	0.0018	0.0019	0.0021	0.0022	0.0022	0.0023	0.0022	0.0021	0.0023	0.0023	0.0023					
20	0.0000	0.0018	0.0020	0.0021	0.0024	0.0023	0.0024	0.0024	0.0023	0.0024	0.0023	0.0024					
21	0.0000	0.0019	0.0020	0.0021	0.0023	0.0022	0.0021	0.0023	0.0022	0.0022	0.0022	0.0023					
22	0.0000	0.0017	0.0019	0.0021	0.0021	0.0021	0.0022	0.0022	0.0021	0.0022	0.0022	0.0022					
23	0.0000	0.0017	0.0019	0.0020	0.0021	0.0020	0.0021	0.0021	0.0021	0.0021	0.0021	0.0020					
24	0.0000	0.0017	0.0019	0.0020	0.0021	0.0021	0.0021	0.0022	0.0021	0.0021	0.0022	0.0021					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.0000	0.0017	0.0019	0.0020	0.0021	0.0020	0.0021	0.0021	0.0020	0.0021	0.0021	0.0021					
Med.	0.0000	0.0017	0.0019	0.0020	0.0021	0.0020	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021					
σ	0.0000	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002					
Min.	0.0000	0.0015	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0017	0.0018	0.0018	0.0018					
Max.	0.0000	0.0019	0.0020	0.0021	0.0024	0.0023	0.0024	0.0024	0.0023	0.0024	0.0023	0.0024					



Data Set 5 : 85 °C, 1500 mA

Actual Case Temperature [T _S]	88.2 °C
Actual Ambient Temperature [T _A]	86.3 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 5-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2588	0.2573	0.2572	0.2571	0.2571	0.2571	0.2570	0.2570	0.2571	0.2570	0.2571	0.2570						
2	0.2607	0.2592	0.2590	0.2590	0.2589	0.2589	0.2589	0.2589	0.2590	0.2589	0.2590	0.2590						
3	0.2658	0.2641	0.2639	0.2638	0.2637	0.2637	0.2637	0.2637	0.2637	0.2637	0.2637	0.2637						
4	0.2632	0.2615	0.2614	0.2613	0.2612	0.2612	0.2611	0.2611	0.2612	0.2611	0.2613	0.2612						
5	0.2606	0.2590	0.2588	0.2587	0.2586	0.2586	0.2586	0.2586	0.2587	0.2586	0.2587	0.2586						
6	0.2588	0.2570	0.2569	0.2568	0.2567	0.2566	0.2566	0.2566	0.2567	0.2566	0.2567	0.2566						
7	0.2621	0.2604	0.2602	0.2602	0.2601	0.2601	0.2600	0.2600	0.2601	0.2600	0.2601	0.2600						
8	0.2599	0.2584	0.2582	0.2581	0.2580	0.2580	0.2580	0.2580	0.2580	0.2579	0.2580	0.2580						
9	0.2616	0.2599	0.2597	0.2596	0.2595	0.2595	0.2596	0.2595	0.2596	0.2595	0.2595	0.2595						
10	0.2642	0.2625	0.2624	0.2622	0.2621	0.2622	0.2622	0.2621	0.2621	0.2620	0.2622	0.2621						
11	0.2642	0.2626	0.2625	0.2624	0.2622	0.2623	0.2622	0.2622	0.2623	0.2622	0.2622	0.2622						
12	0.2641	0.2623	0.2622	0.2620	0.2619	0.2619	0.2620	0.2619	0.2620	0.2618	0.2619	0.2619						
13	0.2616	0.2599	0.2598	0.2596	0.2596	0.2596	0.2596	0.2595	0.2596	0.2595	0.2596	0.2595						
14	0.2590	0.2572	0.2570	0.2569	0.2567	0.2568	0.2567	0.2567	0.2568	0.2567	0.2567	0.2567						
15	0.2613	0.2595	0.2593	0.2592	0.2590	0.2591	0.2591	0.2590	0.2591	0.2591	0.2591	0.2591						
16	0.2631	0.2615	0.2613	0.2611	0.2610	0.2611	0.2610	0.2609	0.2610	0.2609	0.2610	0.2610						
17	0.2633	0.2618	0.2616	0.2615	0.2614	0.2614	0.2613	0.2613	0.2614	0.2614	0.2615	0.2614						
18	0.2633	0.2617	0.2616	0.2615	0.2614	0.2614	0.2614	0.2613	0.2614	0.2614	0.2615	0.2614						
19	0.2653	0.2635	0.2634	0.2632	0.2631	0.2631	0.2630	0.2631	0.2632	0.2630	0.2631	0.2630						
20	0.2643	0.2625	0.2623	0.2622	0.2620	0.2620	0.2619	0.2619	0.2620	0.2619	0.2620	0.2619						
21	0.2632	0.2613	0.2612	0.2611	0.2609	0.2610	0.2611	0.2609	0.2610	0.2610	0.2610	0.2609						
22	0.2628	0.2611	0.2609	0.2607	0.2607	0.2607	0.2606	0.2606	0.2607	0.2606	0.2607	0.2606						
23	0.2618	0.2601	0.2599	0.2598	0.2597	0.2598	0.2597	0.2597	0.2597	0.2597	0.2597	0.2598						
24	0.2624	0.2607	0.2605	0.2604	0.2603	0.2603	0.2603	0.2602	0.2603	0.2603	0.2603	0.2603						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2623	0.2606	0.2605	0.2604	0.2602	0.2603	0.2602	0.2602	0.2603	0.2602	0.2603	0.2602						
Med.	0.2626	0.2609	0.2607	0.2606	0.2605	0.2605	0.2605	0.2604	0.2605	0.2605	0.2605	0.2605						
σ	0.0020	0.0019	0.0020	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019						
Min.	0.2588	0.2570	0.2569	0.2568	0.2567	0.2566	0.2566	0.2566	0.2567	0.2566	0.2567	0.2566						
Max.	0.2658	0.2641	0.2639	0.2638	0.2637	0.2637	0.2637	0.2637	0.2637	0.2637	0.2637	0.2637						



Data Set 5 : 85 °C, 1500 mA

Actual Case Temperature [T _S]	88.2 °C
Actual Ambient Temperature [T _A]	86.3 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 5-6
Chromaticity

LED No.	Chromaticity v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.5170	0.5166	0.5166	0.5168	0.5166	0.5170	0.5169	0.5169	0.5172	0.5171	0.5175	0.5173					
2	0.5208	0.5205	0.5206	0.5208	0.5205	0.5210	0.5209	0.5209	0.5212	0.5211	0.5215	0.5214					
3	0.5289	0.5288	0.5289	0.5290	0.5287	0.5292	0.5291	0.5291	0.5293	0.5292	0.5295	0.5295					
4	0.5271	0.5269	0.5271	0.5272	0.5269	0.5273	0.5272	0.5272	0.5275	0.5273	0.5277	0.5276					
5	0.5241	0.5237	0.5238	0.5240	0.5236	0.5241	0.5240	0.5240	0.5242	0.5241	0.5246	0.5243					
6	0.5206	0.5200	0.5201	0.5202	0.5200	0.5204	0.5203	0.5203	0.5205	0.5205	0.5208	0.5206					
7	0.5256	0.5252	0.5254	0.5255	0.5252	0.5257	0.5255	0.5255	0.5258	0.5257	0.5261	0.5259					
8	0.5249	0.5246	0.5247	0.5248	0.5245	0.5249	0.5248	0.5248	0.5251	0.5250	0.5254	0.5252					
9	0.5266	0.5263	0.5264	0.5265	0.5262	0.5267	0.5265	0.5266	0.5268	0.5267	0.5271	0.5269					
10	0.5274	0.5272	0.5273	0.5275	0.5271	0.5276	0.5274	0.5274	0.5276	0.5274	0.5280	0.5278					
11	0.5286	0.5286	0.5287	0.5288	0.5284	0.5289	0.5288	0.5288	0.5290	0.5287	0.5293	0.5291					
12	0.5265	0.5262	0.5263	0.5265	0.5261	0.5266	0.5265	0.5265	0.5267	0.5265	0.5270	0.5268					
13	0.5241	0.5238	0.5239	0.5241	0.5238	0.5242	0.5241	0.5241	0.5243	0.5242	0.5246	0.5245					
14	0.5218	0.5214	0.5215	0.5217	0.5213	0.5218	0.5216	0.5216	0.5219	0.5218	0.5222	0.5220					
15	0.5224	0.5221	0.5223	0.5224	0.5221	0.5226	0.5224	0.5224	0.5227	0.5226	0.5230	0.5228					
16	0.5248	0.5245	0.5245	0.5246	0.5243	0.5247	0.5246	0.5246	0.5248	0.5247	0.5251	0.5250					
17	0.5257	0.5255	0.5256	0.5257	0.5254	0.5259	0.5258	0.5258	0.5261	0.5259	0.5263	0.5261					
18	0.5264	0.5261	0.5263	0.5264	0.5261	0.5266	0.5266	0.5264	0.5267	0.5266	0.5270	0.5268					
19	0.5277	0.5275	0.5276	0.5277	0.5274	0.5278	0.5276	0.5277	0.5279	0.5278	0.5283	0.5281					
20	0.5263	0.5259	0.5260	0.5261	0.5258	0.5262	0.5260	0.5261	0.5264	0.5263	0.5266	0.5265					
21	0.5247	0.5243	0.5244	0.5245	0.5243	0.5246	0.5245	0.5246	0.5248	0.5248	0.5251	0.5250					
22	0.5230	0.5226	0.5228	0.5229	0.5226	0.5231	0.5229	0.5229	0.5232	0.5231	0.5235	0.5233					
23	0.5227	0.5224	0.5225	0.5226	0.5223	0.5227	0.5226	0.5226	0.5229	0.5228	0.5231	0.5231					
24	0.5234	0.5231	0.5232	0.5233	0.5231	0.5235	0.5234	0.5233	0.5236	0.5235	0.5239	0.5238					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.5246	0.5243	0.5244	0.5246	0.5243	0.5247	0.5246	0.5246	0.5248	0.5247	0.5251	0.5250					
Med.	0.5249	0.5246	0.5246	0.5247	0.5244	0.5248	0.5247	0.5247	0.5250	0.5249	0.5253	0.5251					
σ	0.0028	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0028	0.0029	0.0029					
Min.	0.5170	0.5166	0.5166	0.5168	0.5166	0.5170	0.5169	0.5169	0.5172	0.5171	0.5175	0.5173					
Max.	0.5289	0.5288	0.5289	0.5290	0.5287	0.5292	0.5291	0.5291	0.5293	0.5292	0.5295	0.5295					

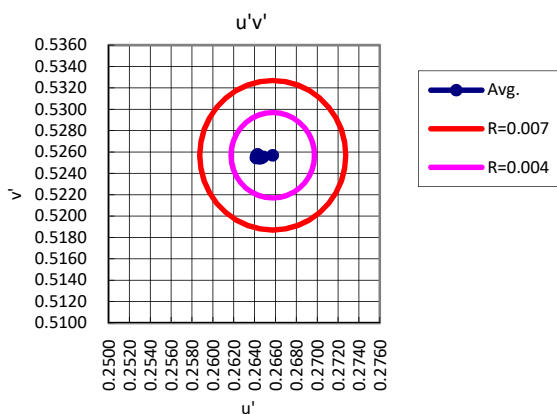
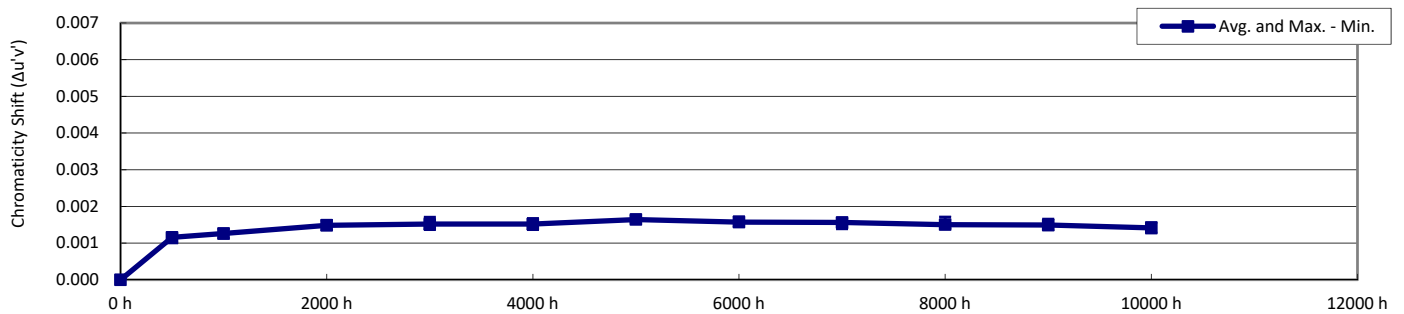
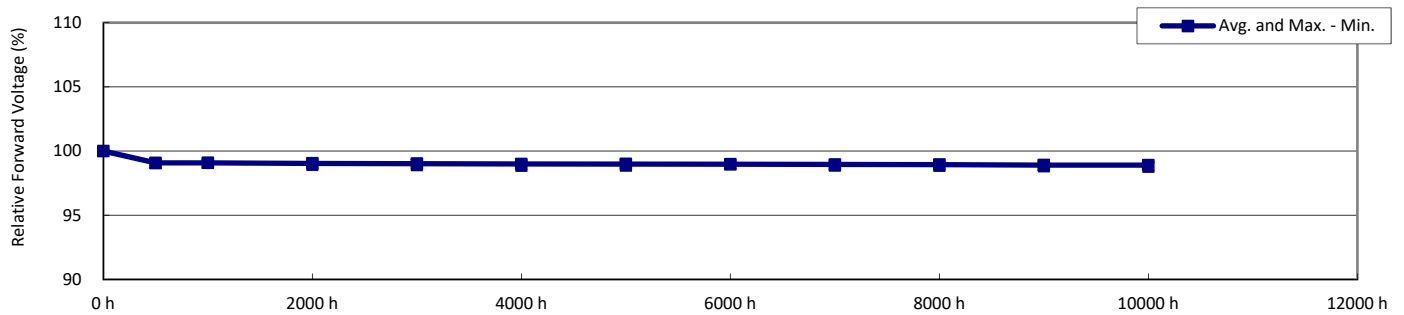
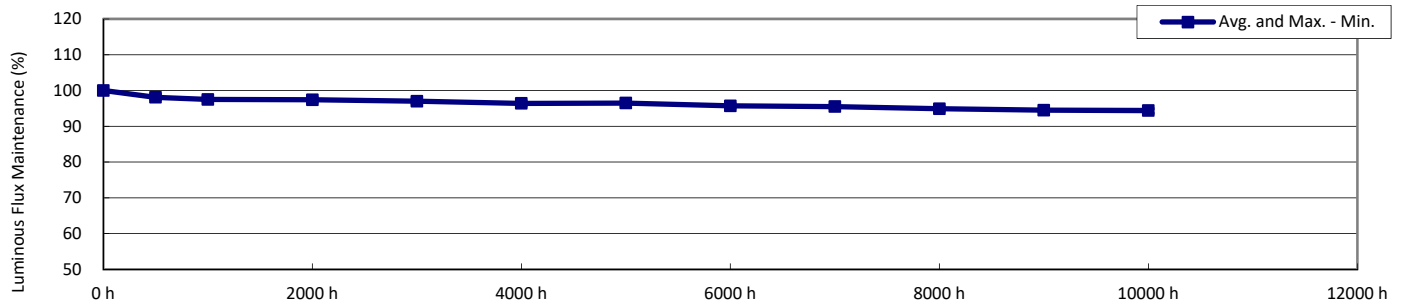
Data Set 6 : 105 °C, 700 mA

Actual Case Temperature [T_S]	105.7 °C
Actual Ambient Temperature [T_A]	102.3 °C
Drive Current [I_F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 6 : 105 °C, 700 mA

Actual Case Temperature [T _s]	105.7 °C
Actual Ambient Temperature [T _A]	102.3 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 6-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _v [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	246	2.98	2589	2.09	0.469	0.412	0.268	0.529						
2	249	2.97	2698	2.08	0.455	0.401	0.263	0.523						
3	247	2.97	2674	2.08	0.457	0.403	0.264	0.524						
4	246	2.98	2671	2.08	0.459	0.405	0.264	0.525						
5	246	2.98	2646	2.08	0.461	0.405	0.266	0.525						
6	246	2.97	2627	2.08	0.461	0.403	0.267	0.524						
7	248	2.97	2652	2.08	0.460	0.405	0.265	0.525						
8	248	2.97	2654	2.08	0.460	0.404	0.265	0.525						
9	248	2.97	2631	2.08	0.462	0.405	0.266	0.525						
10	247	2.97	2591	2.08	0.467	0.408	0.268	0.527						
11	250	2.97	2659	2.08	0.460	0.405	0.265	0.525						
12	251	2.97	2688	2.08	0.457	0.404	0.264	0.524						
13	250	2.97	2661	2.08	0.459	0.404	0.265	0.525						
14	250	2.97	2662	2.08	0.460	0.405	0.265	0.525						
15	249	2.97	2661	2.08	0.460	0.406	0.265	0.525						
16	246	2.97	2621	2.08	0.463	0.407	0.267	0.526						
17	249	2.98	2628	2.08	0.463	0.408	0.266	0.527						
18	249	2.97	2621	2.08	0.465	0.409	0.266	0.528						
19	248	2.97	2603	2.08	0.465	0.408	0.267	0.527						
20	246	2.97	2601	2.08	0.464	0.406	0.268	0.526						
21	246	2.98	2625	2.08	0.462	0.405	0.266	0.526						
22	245	2.98	2605	2.09	0.465	0.408	0.267	0.527						
23	246	2.98	2631	2.09	0.463	0.407	0.266	0.526						
24	250	2.98	2675	2.08	0.458	0.404	0.264	0.525						
n	24	24	24	24	24	24	24	24						
Avg.	248	2.97	2641	2.08	0.461	0.406	0.266	0.526						
Med.	248	2.97	2638	2.08	0.461	0.405	0.266	0.525						
σ	1.6	0.003	30.6	0.002	0.0034	0.0024	0.0013	0.0014						
Min.	245	2.97	2589	2.08	0.455	0.401	0.263	0.523						
Max.	251	2.98	2698	2.09	0.469	0.412	0.268	0.529						



Data Set 6 : 105 °C, 700 mA

Actual Case Temperature [T _S]	105.7 °C
Actual Ambient Temperature [T _A]	102.3 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 6-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.1	97.6	97.5	96.9	96.6	96.5	95.9	95.7	95.1	94.8	94.6						
2	100.0	97.8	97.3	97.1	96.8	96.3	96.2	95.6	95.5	94.9	94.6	94.4						
3	100.0	98.4	97.8	98.0	97.3	96.8	96.7	96.0	95.7	95.1	94.7	94.3						
4	100.0	97.4	96.9	96.6	96.2	95.6	95.6	95.0	94.8	94.2	93.9	93.6						
5	100.0	97.6	97.1	96.9	96.5	95.9	95.9	95.3	95.1	94.5	94.2	93.9						
6	100.0	98.3	98.0	97.6	97.3	96.9	96.7	95.9	95.8	95.0	94.7	94.3						
7	100.0	97.8	97.3	97.0	96.6	96.1	96.1	95.4	95.4	94.8	94.5	94.3						
8	100.0	97.8	97.2	97.2	96.8	96.2	96.3	95.7	95.6	94.9	94.6	94.5						
9	100.0	98.8	98.3	97.9	97.4	96.7	97.0	96.2	96.0	95.4	94.8	94.6						
10	100.0	98.0	97.4	97.2	96.7	96.2	96.2	95.5	95.3	94.8	94.5	94.5						
11	100.0	98.1	97.5	97.4	97.0	96.5	96.5	95.9	95.7	95.1	94.9	94.8						
12	100.0	99.0	98.3	98.1	97.9	97.1	97.2	96.4	96.2	95.6	95.1	94.9						
13	100.0	98.2	97.6	97.4	97.2	96.5	96.6	95.9	95.7	95.2	94.9	94.7						
14	100.0	98.3	97.7	97.6	97.2	96.5	96.7	95.9	95.8	95.2	94.9	94.8						
15	100.0	98.5	97.8	97.7	97.7	96.9	96.8	95.9	95.8	95.0	94.6	94.4						
16	100.0	97.6	97.1	96.9	96.6	96.0	96.0	95.2	95.2	94.6	94.2	94.1						
17	100.0	98.2	97.6	97.4	97.1	96.6	96.6	95.8	95.8	95.2	94.9	94.7						
18	100.0	98.5	97.9	97.6	97.4	96.8	96.8	95.9	95.7	95.2	94.6	94.5						
19	100.0	97.9	97.4	97.4	96.8	96.2	96.5	95.6	95.4	94.9	94.5	94.5						
20	100.0	97.8	97.2	97.3	96.7	96.1	96.3	95.5	95.3	94.8	94.4	94.3						
21	100.0	98.1	97.7	97.5	97.1	96.3	96.7	95.5	95.4	94.8	94.1	94.0						
22	100.0	97.6	97.0	97.0	96.5	95.8	96.0	95.0	95.0	94.3	94.0	93.8						
23	100.0	97.5	97.0	96.9	96.4	95.8	96.0	95.1	95.1	94.5	94.1	93.9						
24	100.0	98.4	97.8	97.8	97.5	96.6	96.9	95.8	95.8	95.0	94.4	94.4						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.1	97.5	97.4	97.0	96.4	96.5	95.7	95.5	94.9	94.5	94.4						
Med.	100.0	98.1	97.6	97.4	97.0	96.4	96.5	95.8	95.7	95.0	94.6	94.4						
σ	0.00	0.41	0.39	0.38	0.43	0.40	0.39	0.37	0.34	0.33	0.32	0.34						
Min.	100.0	97.4	96.9	96.6	96.2	95.6	95.6	95.0	94.8	94.2	93.9	93.6						
Max.	100.0	99.0	98.3	98.1	97.9	97.1	97.2	96.4	96.2	95.6	95.1	94.9						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	0.9845		
α	4.405E-06		
R ²	0.9552		
Calculated L ₇₀ (10K)	77400	hours	
Reported L ₇₀ (10K)	> 60000	hours	
Calculated L ₈₀ (10K)	47100	hours	
Reported L ₈₀ (10K)	47100	hours	
Calculated L ₉₀ (10K)	20400	hours	
Reported L ₉₀ (10K)	20400	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.



Data Set 6 : 105 °C, 700 mA

Actual Case Temperature [T _S]	105.7 °C
Actual Ambient Temperature [T _A]	102.3 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 6-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	99.0	99.1	99.0	99.1	99.1	99.1	99.0	98.9	99.0	98.9	99.0						
2	100.0	99.2	99.0	99.1	99.0	99.0	99.0	99.0	98.9	99.0	98.9	98.9						
3	100.0	98.8	98.9	98.8	98.9	98.7	98.8	98.7	98.8	98.7	98.8	98.7						
4	100.0	98.7	98.7	98.6	98.5	98.5	98.5	98.6	98.5	98.5	98.4	98.4						
5	100.0	99.0	98.9	98.9	98.9	98.7	98.7	99.0	98.7	98.7	98.7	98.6						
6	100.0	99.0	99.1	99.0	99.0	99.0	99.0	98.8	98.8	98.9	98.8	98.8						
7	100.0	99.1	99.0	99.0	99.0	98.9	98.9	99.0	99.0	98.9	98.8	98.8						
8	100.0	99.1	99.1	99.1	98.9	99.0	99.0	99.0	98.8	99.0	98.9	98.9						
9	100.0	99.2	99.2	99.3	99.3	99.2	99.2	99.1	99.3	99.1	99.1	99.1						
10	100.0	99.3	99.3	99.2	99.3	99.2	99.2	99.2	99.2	99.2	99.1	99.1						
11	100.0	99.4	99.2	99.3	99.2	99.1	99.2	99.1	99.2	99.1	99.2	99.1						
12	100.0	99.1	99.2	99.1	99.1	99.2	99.1	99.1	98.9	99.0	99.0	99.0						
13	100.0	99.0	99.2	99.2	99.1	99.1	99.1	99.1	98.9	99.1	99.1	99.1						
14	100.0	98.9	99.1	99.2	99.0	99.0	99.0	99.0	99.0	99.0	99.0	98.9						
15	100.0	99.1	99.1	99.1	99.0	99.0	99.0	99.0	98.9	98.9	99.0	98.9						
16	100.0	99.2	99.2	99.1	99.0	99.0	99.0	99.1	99.0	99.0	99.0	99.0						
17	100.0	99.3	99.1	99.0	99.2	99.1	99.0	98.9	99.2	99.1	99.0	99.0						
18	100.0	99.1	99.2	99.2	99.1	99.1	99.2	99.1	99.1	99.1	99.0	99.1						
19	100.0	99.3	99.2	99.1	99.1	99.3	99.2	99.2	99.2	99.2	99.1	99.1						
20	100.0	99.2	99.1	99.2	99.2	99.0	99.2	99.1	99.1	99.0	98.9	99.0						
21	100.0	98.9	99.0	98.9	98.8	98.8	98.8	98.7	98.8	98.8	98.7	98.7						
22	100.0	98.9	98.8	98.7	98.8	98.5	98.8	98.7	98.7	98.6	98.6	98.6						
23	100.0	98.9	99.0	98.9	98.9	98.9	98.9	98.9	98.9	98.8	98.7	98.7						
24	100.0	99.2	99.1	99.1	99.1	99.0	99.0	99.0	98.9	98.9	98.9	98.9						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	99.1	99.1	99.0	99.0	99.0	99.0	99.0	99.0	98.9	98.9	98.9						
Med.	100.0	99.1	99.1	99.1	99.0	99.0	99.0	99.0	98.9	99.0	98.9	98.9						
σ	0.00	0.17	0.14	0.18	0.18	0.21	0.18	0.16	0.18	0.19	0.18	0.19						
Min.	100.0	98.7	98.7	98.6	98.5	98.5	98.5	98.6	98.5	98.5	98.4	98.4						
Max.	100.0	99.4	99.3	99.3	99.3	99.3	99.2	99.2	99.3	99.2	99.2	99.1						



Data Set 6 : 105 °C, 700 mA

Actual Case Temperature [T _S]	105.7 °C
Actual Ambient Temperature [T _A]	102.3 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 6-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.0000	0.0012	0.0013	0.0015	0.0015	0.0016	0.0016	0.0016	0.0015	0.0015	0.0014	0.0013						
2	0.0000	0.0011	0.0011	0.0015	0.0014	0.0014	0.0016	0.0015	0.0016	0.0015	0.0016	0.0013						
3	0.0000	0.0011	0.0012	0.0014	0.0015	0.0014	0.0016	0.0015	0.0015	0.0015	0.0016	0.0014						
4	0.0000	0.0011	0.0013	0.0015	0.0016	0.0015	0.0017	0.0016	0.0016	0.0016	0.0015	0.0014						
5	0.0000	0.0012	0.0013	0.0015	0.0017	0.0017	0.0016	0.0017	0.0017	0.0017	0.0017	0.0015						
6	0.0000	0.0011	0.0012	0.0014	0.0015	0.0015	0.0016	0.0016	0.0016	0.0015	0.0015	0.0014						
7	0.0000	0.0011	0.0012	0.0014	0.0015	0.0014	0.0016	0.0016	0.0016	0.0015	0.0015	0.0014						
8	0.0000	0.0012	0.0014	0.0016	0.0016	0.0016	0.0017	0.0017	0.0017	0.0016	0.0016	0.0015						
9	0.0000	0.0012	0.0014	0.0016	0.0016	0.0015	0.0017	0.0017	0.0017	0.0016	0.0016	0.0015						
10	0.0000	0.0012	0.0013	0.0015	0.0015	0.0016	0.0016	0.0016	0.0016	0.0014	0.0015	0.0014						
11	0.0000	0.0012	0.0012	0.0016	0.0016	0.0015	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014						
12	0.0000	0.0012	0.0012	0.0014	0.0015	0.0015	0.0017	0.0014	0.0015	0.0014	0.0014	0.0013						
13	0.0000	0.0010	0.0012	0.0014	0.0014	0.0014	0.0016	0.0014	0.0014	0.0014	0.0014	0.0013						
14	0.0000	0.0012	0.0014	0.0015	0.0016	0.0016	0.0017	0.0016	0.0016	0.0015	0.0016	0.0014						
15	0.0000	0.0011	0.0012	0.0014	0.0014	0.0014	0.0016	0.0014	0.0015	0.0014	0.0014	0.0013						
16	0.0000	0.0011	0.0012	0.0015	0.0015	0.0016	0.0017	0.0016	0.0016	0.0014	0.0015	0.0014						
17	0.0000	0.0011	0.0013	0.0016	0.0015	0.0016	0.0017	0.0015	0.0016	0.0015	0.0015	0.0015						
18	0.0000	0.0012	0.0013	0.0014	0.0015	0.0016	0.0016	0.0016	0.0015	0.0015	0.0014	0.0015						
19	0.0000	0.0012	0.0013	0.0016	0.0016	0.0015	0.0016	0.0015	0.0016	0.0015	0.0015	0.0013						
20	0.0000	0.0013	0.0014	0.0015	0.0015	0.0016	0.0016	0.0016	0.0015	0.0015	0.0015	0.0015						
21	0.0000	0.0012	0.0012	0.0014	0.0016	0.0014	0.0016	0.0016	0.0016	0.0015	0.0015	0.0015						
22	0.0000	0.0011	0.0012	0.0014	0.0014	0.0014	0.0017	0.0015	0.0015	0.0014	0.0015	0.0014						
23	0.0000	0.0012	0.0012	0.0015	0.0014	0.0015	0.0017	0.0015	0.0016	0.0014	0.0015	0.0015						
24	0.0000	0.0012	0.0013	0.0016	0.0016	0.0016	0.0016	0.0017	0.0016	0.0017	0.0016	0.0016						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.0000	0.0012	0.0013	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0015	0.0015	0.0014						
Med.	0.0000	0.0012	0.0013	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0015	0.0015	0.0014						
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001						
Min.	0.0000	0.0010	0.0011	0.0014	0.0014	0.0014	0.0016	0.0014	0.0014	0.0014	0.0014	0.0013						
Max.	0.0000	0.0013	0.0014	0.0016	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0016						

Data Set 6 : 105 °C, 700 mA

Actual Case Temperature [T _S]	105.7 °C
Actual Ambient Temperature [T _A]	102.3 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 6-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2681	0.2669	0.2668	0.2666	0.2666	0.2665	0.2665	0.2665	0.2666	0.2666	0.2667	0.2669						
2	0.2639	0.2628	0.2628	0.2624	0.2625	0.2625	0.2623	0.2623	0.2623	0.2624	0.2623	0.2625						
3	0.2646	0.2636	0.2635	0.2633	0.2632	0.2633	0.2630	0.2631	0.2632	0.2632	0.2631	0.2633						
4	0.2647	0.2636	0.2634	0.2632	0.2631	0.2632	0.2630	0.2631	0.2631	0.2631	0.2632	0.2632						
5	0.2658	0.2647	0.2646	0.2643	0.2642	0.2642	0.2642	0.2641	0.2642	0.2642	0.2642	0.2643						
6	0.2668	0.2657	0.2656	0.2654	0.2653	0.2653	0.2652	0.2652	0.2652	0.2653	0.2653	0.2654						
7	0.2655	0.2645	0.2643	0.2641	0.2640	0.2641	0.2640	0.2639	0.2640	0.2640	0.2640	0.2642						
8	0.2655	0.2644	0.2642	0.2640	0.2640	0.2639	0.2638	0.2639	0.2639	0.2639	0.2639	0.2641						
9	0.2665	0.2654	0.2652	0.2650	0.2650	0.2650	0.2648	0.2648	0.2649	0.2650	0.2650	0.2650						
10	0.2682	0.2670	0.2670	0.2668	0.2668	0.2667	0.2666	0.2666	0.2667	0.2668	0.2668	0.2668						
11	0.2652	0.2640	0.2640	0.2637	0.2637	0.2637	0.2636	0.2637	0.2636	0.2638	0.2638	0.2639						
12	0.2638	0.2626	0.2626	0.2624	0.2623	0.2623	0.2621	0.2624	0.2623	0.2624	0.2624	0.2625						
13	0.2651	0.2641	0.2639	0.2637	0.2637	0.2637	0.2635	0.2636	0.2637	0.2636	0.2637	0.2638						
14	0.2651	0.2639	0.2638	0.2636	0.2635	0.2635	0.2634	0.2634	0.2635	0.2636	0.2635	0.2637						
15	0.2650	0.2640	0.2638	0.2637	0.2636	0.2636	0.2635	0.2636	0.2636	0.2636	0.2636	0.2637						
16	0.2669	0.2658	0.2658	0.2654	0.2654	0.2653	0.2652	0.2653	0.2654	0.2654	0.2654	0.2654						
17	0.2665	0.2654	0.2652	0.2649	0.2649	0.2649	0.2648	0.2649	0.2649	0.2650	0.2650	0.2649						
18	0.2666	0.2654	0.2654	0.2652	0.2651	0.2650	0.2650	0.2650	0.2651	0.2650	0.2652	0.2651						
19	0.2676	0.2665	0.2664	0.2661	0.2661	0.2661	0.2660	0.2661	0.2661	0.2662	0.2662	0.2663						
20	0.2679	0.2667	0.2666	0.2664	0.2664	0.2663	0.2663	0.2663	0.2664	0.2664	0.2664	0.2664						
21	0.2667	0.2655	0.2655	0.2653	0.2651	0.2652	0.2651	0.2650	0.2651	0.2651	0.2652	0.2651						
22	0.2676	0.2665	0.2664	0.2661	0.2662	0.2661	0.2659	0.2661	0.2661	0.2662	0.2661	0.2662						
23	0.2663	0.2652	0.2651	0.2649	0.2650	0.2648	0.2647	0.2649	0.2648	0.2649	0.2648	0.2649						
24	0.2645	0.2633	0.2632	0.2629	0.2629	0.2629	0.2629	0.2628	0.2629	0.2628	0.2629	0.2629						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2660	0.2649	0.2648	0.2645	0.2645	0.2645	0.2644	0.2644	0.2645	0.2645	0.2645	0.2646						
Med.	0.2661	0.2650	0.2649	0.2646	0.2646	0.2645	0.2644	0.2645	0.2645	0.2645	0.2645	0.2646						
σ	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013						
Min.	0.2638	0.2626	0.2626	0.2624	0.2623	0.2623	0.2621	0.2623	0.2623	0.2624	0.2623	0.2625						
Max.	0.2682	0.2670	0.2670	0.2668	0.2668	0.2667	0.2666	0.2666	0.2667	0.2668	0.2668	0.2669						



Data Set 6 : 105 °C, 700 mA

Actual Case Temperature [T _S]	105.7 °C
Actual Ambient Temperature [T _A]	102.3 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 6-6
Chromaticity

LED No.	Chromaticity v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.5290	0.5289	0.5289	0.5290	0.5291	0.5291	0.5291	0.5293	0.5290	0.5293	0.5293	0.5294					
2	0.5225	0.5223	0.5222	0.5223	0.5223	0.5223	0.5223	0.5224	0.5222	0.5225	0.5225	0.5226					
3	0.5232	0.5229	0.5230	0.5231	0.5230	0.5230	0.5230	0.5232	0.5230	0.5232	0.5234	0.5233					
4	0.5248	0.5245	0.5245	0.5245	0.5245	0.5246	0.5246	0.5247	0.5245	0.5249	0.5248	0.5248					
5	0.5251	0.5247	0.5247	0.5247	0.5248	0.5248	0.5248	0.5249	0.5248	0.5250	0.5250	0.5250					
6	0.5238	0.5235	0.5236	0.5236	0.5235	0.5235	0.5235	0.5237	0.5235	0.5237	0.5238	0.5238					
7	0.5249	0.5246	0.5246	0.5246	0.5246	0.5246	0.5246	0.5248	0.5246	0.5248	0.5249	0.5249					
8	0.5246	0.5244	0.5243	0.5244	0.5243	0.5244	0.5243	0.5245	0.5243	0.5246	0.5245	0.5246					
9	0.5248	0.5246	0.5245	0.5246	0.5246	0.5246	0.5245	0.5247	0.5245	0.5247	0.5248	0.5247					
10	0.5272	0.5270	0.5269	0.5269	0.5269	0.5270	0.5270	0.5272	0.5269	0.5273	0.5274	0.5273					
11	0.5250	0.5248	0.5247	0.5248	0.5248	0.5249	0.5248	0.5250	0.5248	0.5252	0.5252	0.5252					
12	0.5237	0.5236	0.5235	0.5234	0.5235	0.5235	0.5234	0.5236	0.5234	0.5237	0.5237	0.5238					
13	0.5243	0.5241	0.5241	0.5241	0.5242	0.5241	0.5241	0.5243	0.5240	0.5243	0.5243	0.5244					
14	0.5250	0.5246	0.5246	0.5247	0.5247	0.5247	0.5247	0.5249	0.5246	0.5249	0.5250	0.5249					
15	0.5247	0.5245	0.5245	0.5245	0.5245	0.5245	0.5245	0.5247	0.5244	0.5248	0.5248	0.5248					
16	0.5260	0.5257	0.5256	0.5258	0.5257	0.5258	0.5257	0.5258	0.5256	0.5259	0.5260	0.5261					
17	0.5264	0.5261	0.5261	0.5261	0.5262	0.5262	0.5262	0.5264	0.5262	0.5265	0.5265	0.5264					
18	0.5270	0.5268	0.5267	0.5268	0.5268	0.5269	0.5268	0.5270	0.5268	0.5271	0.5270	0.5271					
19	0.5268	0.5265	0.5265	0.5266	0.5265	0.5266	0.5266	0.5267	0.5265	0.5269	0.5268	0.5269					
20	0.5258	0.5255	0.5255	0.5256	0.5255	0.5256	0.5256	0.5258	0.5255	0.5259	0.5258	0.5259					
21	0.5251	0.5249	0.5247	0.5249	0.5248	0.5249	0.5249	0.5251	0.5248	0.5251	0.5251	0.5252					
22	0.5268	0.5265	0.5266	0.5266	0.5267	0.5267	0.5267	0.5269	0.5267	0.5270	0.5270	0.5270					
23	0.5259	0.5256	0.5255	0.5256	0.5256	0.5256	0.5258	0.5258	0.5256	0.5260	0.5260	0.5260					
24	0.5239	0.5237	0.5236	0.5237	0.5236	0.5237	0.5237	0.5238	0.5236	0.5239	0.5239	0.5240					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.5253	0.5250	0.5250	0.5250	0.5250	0.5251	0.5250	0.5252	0.5250	0.5253	0.5253	0.5253					
Med.	0.5250	0.5247	0.5247	0.5247	0.5247	0.5248	0.5247	0.5249	0.5247	0.5250	0.5250	0.5250					
σ	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015					
Min.	0.5225	0.5223	0.5222	0.5223	0.5223	0.5223	0.5223	0.5224	0.5222	0.5225	0.5225	0.5226					
Max.	0.5290	0.5289	0.5289	0.5290	0.5291	0.5291	0.5291	0.5293	0.5290	0.5293	0.5293	0.5294					

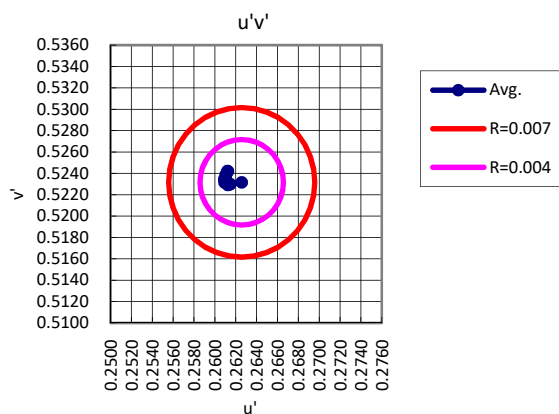
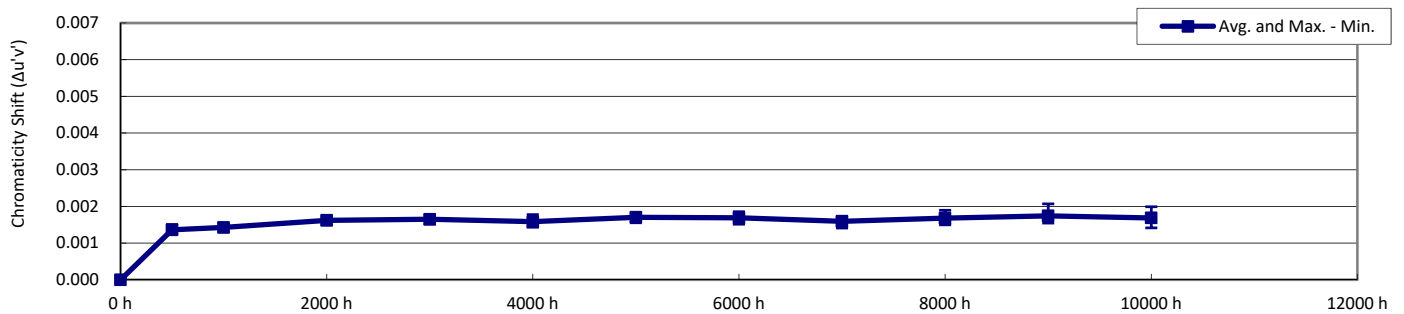
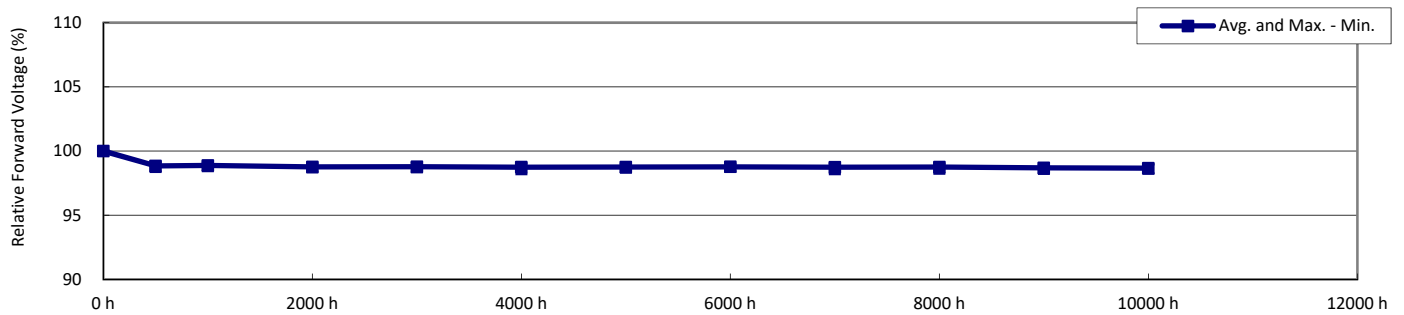
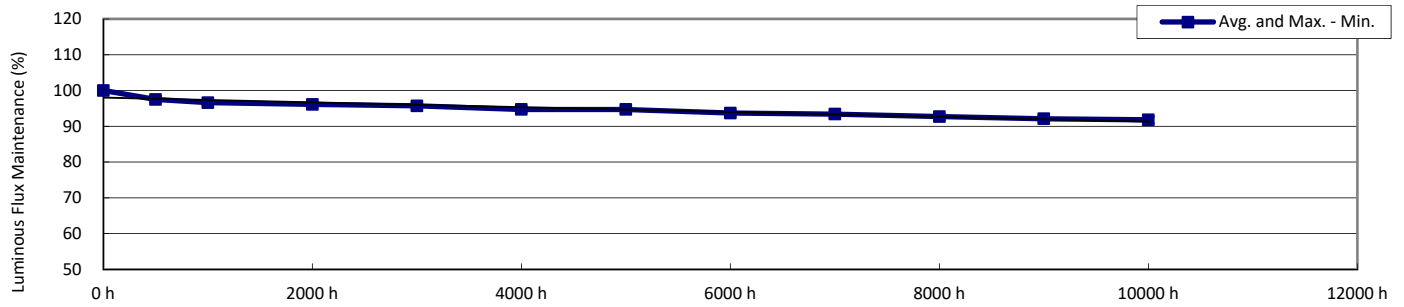
Data Set 7 : 105 °C, 1200 mA

Actual Case Temperature [T_S]	105.8 °C
Actual Ambient Temperature [T_A]	103.1 °C
Drive Current [I_F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 7 : 105 °C, 1200 mA

Actual Case Temperature [T _s]	105.8 °C
Actual Ambient Temperature [T _A]	103.1 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 7-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _v [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	394	3.13	2634	3.76	0.463	0.407	0.266	0.526						
2	395	3.13	2664	3.75	0.458	0.402	0.265	0.524						
3	395	3.13	2642	3.75	0.460	0.404	0.266	0.525						
4	402	3.12	2754	3.75	0.451	0.401	0.261	0.522						
5	399	3.12	2735	3.75	0.451	0.399	0.262	0.522						
6	402	3.12	2760	3.74	0.451	0.401	0.261	0.522						
7	400	3.12	2745	3.75	0.452	0.402	0.261	0.523						
8	397	3.12	2731	3.74	0.452	0.401	0.262	0.523						
9	396	3.13	2737	3.75	0.453	0.402	0.262	0.523						
10	390	3.14	2678	3.76	0.458	0.404	0.264	0.524						
11	390	3.13	2639	3.75	0.462	0.406	0.266	0.526						
12	392	3.12	2665	3.75	0.460	0.407	0.264	0.526						
13	392	3.13	2695	3.76	0.457	0.405	0.263	0.525						
14	402	3.13	2752	3.76	0.450	0.400	0.261	0.522						
15	404	3.13	2783	3.75	0.448	0.399	0.260	0.521						
16	401	3.13	2745	3.75	0.451	0.399	0.262	0.522						
17	401	3.12	2748	3.75	0.450	0.399	0.261	0.521						
18	401	3.12	2735	3.75	0.452	0.400	0.262	0.522						
19	401	3.12	2746	3.75	0.452	0.401	0.261	0.522						
20	399	3.12	2709	3.74	0.455	0.402	0.263	0.523						
21	396	3.12	2696	3.75	0.457	0.406	0.263	0.525						
22	395	3.13	2718	3.75	0.454	0.403	0.262	0.524						
23	392	3.13	2719	3.76	0.452	0.399	0.263	0.522						
24	397	3.13	2761	3.76	0.449	0.399	0.261	0.521						
n	24	24	24	24	24	24	24	24						
Avg.	397	3.13	2716	3.75	0.454	0.402	0.263	0.523						
Med.	397	3.13	2733	3.75	0.452	0.402	0.262	0.523						
σ	4.2	0.005	42.7	0.006	0.0042	0.0026	0.0017	0.0016						
Min.	390	3.12	2634	3.74	0.448	0.399	0.260	0.521						
Max.	404	3.14	2783	3.76	0.463	0.407	0.266	0.526						



Data Set 7 : 105 °C, 1200 mA

Actual Case Temperature [T _s]	105.8 °C
Actual Ambient Temperature [T _A]	103.1 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 7-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	97.5	96.8	96.2	96.0	95.0	95.0	94.1	93.9	93.3	92.6	92.5						
2	100.0	97.5	96.7	96.3	95.7	94.8	94.9	94.0	93.8	93.1	92.6	92.4						
3	100.0	98.1	97.2	96.9	96.4	95.2	95.2	94.3	94.0	93.3	92.4	92.5						
4	100.0	97.4	96.6	96.1	95.6	94.6	94.5	93.7	93.5	92.8	92.2	91.9						
5	100.0	97.3	96.5	95.9	95.4	94.4	94.3	93.5	93.3	92.6	92.0	91.8						
6	100.0	98.4	97.3	96.6	96.2	95.1	95.1	94.0	94.0	92.9	92.3	92.1						
7	100.0	97.1	96.4	95.8	95.4	94.4	94.3	93.4	93.1	92.4	92.0	91.6						
8	100.0	97.0	96.4	95.8	95.2	94.5	94.4	93.6	93.1	92.5	92.1	91.6						
9	100.0	97.9	96.9	96.2	95.9	94.7	94.6	93.7	93.3	92.6	91.7	91.4						
10	100.0	96.7	96.0	95.4	94.8	93.9	93.8	92.8	92.4	91.7	91.1	90.7						
11	100.0	96.8	96.0	95.5	95.0	94.1	94.0	93.1	92.7	91.9	91.5	91.2						
12	100.0	97.8	96.7	96.1	95.7	94.6	94.6	93.4	93.0	92.2	91.4	91.0						
13	100.0	96.9	96.2	95.6	95.2	94.3	94.3	93.3	92.9	92.2	91.7	91.4						
14	100.0	97.5	96.5	96.3	95.9	95.0	95.2	94.3	93.9	93.3	92.9	92.7						
15	100.0	98.3	97.1	96.6	96.5	95.5	95.5	94.4	94.0	93.2	92.5	92.3						
16	100.0	97.3	96.7	96.2	95.6	94.9	94.8	94.0	93.7	92.9	92.4	92.2						
17	100.0	97.3	96.6	96.1	95.5	94.7	94.6	93.8	93.5	92.7	92.3	91.9						
18	100.0	97.8	97.1	96.3	96.0	95.1	94.9	93.9	93.6	92.7	92.0	91.9						
19	100.0	97.3	96.5	96.0	95.5	94.6	94.4	93.7	93.4	92.5	92.1	91.7						
20	100.0	97.1	96.2	95.8	95.2	94.4	94.2	93.5	93.1	92.3	91.9	91.6						
21	100.0	98.1	96.9	96.5	96.1	95.0	95.0	94.0	93.6	92.8	92.2	91.8						
22	100.0	97.0	96.4	95.9	95.4	94.6	94.5	93.6	93.2	92.4	92.0	91.7						
23	100.0	97.0	96.3	96.0	95.3	94.5	94.5	93.5	93.1	92.3	91.9	91.7						
24	100.0	97.7	97.1	96.7	96.5	95.3	95.3	94.2	93.9	93.0	92.3	92.1						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	97.5	96.6	96.1	95.7	94.7	94.7	93.7	93.4	92.7	92.1	91.8						
Med.	100.0	97.4	96.6	96.1	95.6	94.7	94.6	93.7	93.5	92.7	92.1	91.8						
σ	0.00	0.48	0.37	0.38	0.47	0.39	0.43	0.40	0.44	0.44	0.41	0.49						
Min.	100.0	96.7	96.0	95.4	94.8	93.9	93.8	92.8	92.4	91.7	91.1	90.7						
Max.	100.0	98.4	97.3	96.9	96.5	95.5	95.5	94.4	94.0	93.3	92.9	92.7						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	0.9744		
α	6.134E-06		
R ²	0.9773		
Calculated L ₇₀ (10K)	53900	hours	
Reported L ₇₀ (10K)	53900	hours	
Calculated L ₈₀ (10K)	32200	hours	
Reported L ₈₀ (10K)	32200	hours	
Calculated L ₉₀ (10K)	12900	hours	
Reported L ₉₀ (10K)	12900	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.*



Data Set 7 : 105 °C, 1200 mA

Actual Case Temperature [T _s]	105.8 °C
Actual Ambient Temperature [T _A]	103.1 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 7-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	99.1	99.1	99.0	98.9	98.8	99.0	99.0	99.0	98.9	98.9	98.8						
2	100.0	98.9	99.0	98.9	99.0	98.9	98.9	98.9	98.9	98.9	98.9	98.8						
3	100.0	98.9	99.0	98.9	99.0	98.9	98.9	98.9	98.9	98.9	98.9	98.9						
4	100.0	99.1	99.1	99.0	99.0	99.0	98.9	99.0	98.9	99.0	98.9	98.9						
5	100.0	99.1	99.1	99.1	99.1	99.0	98.9	99.0	99.0	99.0	99.0	99.0						
6	100.0	99.1	99.1	99.0	99.0	98.9	99.0	99.0	99.0	98.9	98.9	98.9						
7	100.0	98.9	99.0	98.9	99.0	98.9	98.9	98.9	98.8	98.9	98.8	98.9						
8	100.0	98.8	99.0	98.8	98.8	98.7	98.8	98.8	98.8	98.7	98.7	98.7						
9	100.0	98.7	98.7	98.6	98.7	98.7	98.5	98.5	98.6	98.6	98.5	98.5						
10	100.0	98.5	98.5	98.4	98.4	98.4	98.3	98.4	98.3	98.4	98.4	98.3						
11	100.0	98.7	98.7	98.5	98.5	98.5	98.6	98.5	98.6	98.5	98.4	98.3						
12	100.0	98.8	98.8	98.6	98.6	98.7	98.7	98.6	98.6	98.7	98.6	98.5						
13	100.0	98.7	98.8	98.6	98.5	98.5	98.5	98.5	98.5	98.6	98.5	98.4						
14	100.0	98.8	98.8	98.8	98.7	98.8	98.9	98.7	98.7	98.7	98.7	98.7						
15	100.0	98.8	98.9	98.8	98.9	98.8	98.8	98.8	98.8	98.9	98.7	98.6						
16	100.0	99.1	99.1	99.0	99.1	98.9	99.0	99.0	98.9	98.9	98.9	98.9						
17	100.0	98.9	99.0	99.0	98.9	98.9	98.9	98.9	99.0	98.9	98.9	98.9						
18	100.0	98.9	98.9	98.8	98.9	99.0	98.9	98.9	98.8	98.9	98.7	98.8						
19	100.0	99.0	99.0	98.9	98.9	98.9	98.9	98.9	99.0	98.9	98.8	98.8						
20	100.0	98.9	99.0	98.9	99.0	98.9	98.9	98.9	98.9	99.0	98.8	98.8						
21	100.0	98.8	98.8	98.7	98.6	98.7	98.7	98.8	98.7	98.7	98.6	98.6						
22	100.0	98.7	98.6	98.4	98.6	98.5	98.5	98.6	98.5	98.5	98.4	98.4						
23	100.0	98.6	98.6	98.4	98.4	98.4	98.4	98.4	98.3	98.4	98.5	98.4						
24	100.0	98.4	98.5	98.4	98.4	98.2	98.4	98.4	98.2	98.3	98.2	98.2						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.8	98.9	98.8	98.8	98.7	98.8	98.8	98.7	98.8	98.7	98.7						
Med.	100.0	98.9	98.9	98.8	98.9	98.8	98.9	98.8	98.8	98.9	98.7	98.7						
σ	0.00	0.19	0.21	0.22	0.23	0.23	0.21	0.20	0.23	0.22	0.21	0.22						
Min.	100.0	98.4	98.5	98.4	98.4	98.2	98.3	98.4	98.2	98.3	98.2	98.2						
Max.	100.0	99.1	99.1	99.1	99.1	99.0	99.0	99.0	99.0	99.0	99.0	99.0						



Data Set 7 : 105 °C, 1200 mA

Actual Case Temperature [T _S]	105.8 °C
Actual Ambient Temperature [T _A]	103.1 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 7-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.0000	0.0014	0.0014	0.0017	0.0015	0.0015	0.0017	0.0017	0.0016	0.0017	0.0018	0.0016						
2	0.0000	0.0014	0.0014	0.0017	0.0017	0.0016	0.0017	0.0017	0.0016	0.0016	0.0018	0.0017						
3	0.0000	0.0014	0.0015	0.0017	0.0017	0.0016	0.0018	0.0017	0.0017	0.0018	0.0018	0.0018						
4	0.0000	0.0015	0.0015	0.0016	0.0017	0.0016	0.0018	0.0018	0.0016	0.0017	0.0018	0.0018						
5	0.0000	0.0013	0.0014	0.0015	0.0016	0.0015	0.0017	0.0016	0.0015	0.0016	0.0016	0.0016						
6	0.0000	0.0014	0.0013	0.0016	0.0017	0.0015	0.0016	0.0017	0.0015	0.0017	0.0018	0.0018						
7	0.0000	0.0013	0.0013	0.0016	0.0015	0.0014	0.0016	0.0015	0.0014	0.0016	0.0018	0.0017						
8	0.0000	0.0014	0.0015	0.0016	0.0015	0.0015	0.0017	0.0017	0.0016	0.0017	0.0019	0.0018						
9	0.0000	0.0014	0.0014	0.0016	0.0018	0.0016	0.0018	0.0018	0.0016	0.0019	0.0020	0.0019						
10	0.0000	0.0014	0.0015	0.0016	0.0018	0.0016	0.0017	0.0018	0.0017	0.0018	0.0018	0.0017						
11	0.0000	0.0014	0.0015	0.0017	0.0017	0.0017	0.0017	0.0017	0.0016	0.0016	0.0018	0.0018						
12	0.0000	0.0014	0.0015	0.0017	0.0017	0.0018	0.0018	0.0019	0.0017	0.0019	0.0021	0.0020						
13	0.0000	0.0014	0.0015	0.0017	0.0017	0.0017	0.0017	0.0018	0.0016	0.0018	0.0018	0.0018						
14	0.0000	0.0013	0.0013	0.0015	0.0016	0.0015	0.0016	0.0015	0.0015	0.0015	0.0015	0.0014						
15	0.0000	0.0015	0.0015	0.0016	0.0017	0.0016	0.0018	0.0017	0.0017	0.0017	0.0016	0.0016						
16	0.0000	0.0014	0.0015	0.0015	0.0017	0.0016	0.0017	0.0016	0.0015	0.0016	0.0016	0.0016						
17	0.0000	0.0013	0.0014	0.0016	0.0016	0.0016	0.0017	0.0016	0.0016	0.0016	0.0016	0.0015						
18	0.0000	0.0014	0.0015	0.0016	0.0016	0.0016	0.0017	0.0016	0.0015	0.0017	0.0018	0.0017						
19	0.0000	0.0013	0.0014	0.0016	0.0015	0.0016	0.0016	0.0017	0.0015	0.0015	0.0017	0.0016						
20	0.0000	0.0013	0.0014	0.0015	0.0016	0.0015	0.0017	0.0016	0.0015	0.0015	0.0016	0.0015						
21	0.0000	0.0013	0.0014	0.0016	0.0017	0.0016	0.0018	0.0018	0.0017	0.0018	0.0018	0.0017						
22	0.0000	0.0013	0.0014	0.0017	0.0017	0.0017	0.0017	0.0017	0.0016	0.0017	0.0017	0.0016						
23	0.0000	0.0013	0.0015	0.0017	0.0017	0.0017	0.0018	0.0018	0.0017	0.0018	0.0017	0.0017						
24	0.0000	0.0013	0.0014	0.0016	0.0017	0.0016	0.0017	0.0017	0.0016	0.0017	0.0017	0.0016						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.0000	0.0014	0.0014	0.0016	0.0017	0.0016	0.0017	0.0017	0.0016	0.0017	0.0017	0.0017						
Med.	0.0000	0.0014	0.0014	0.0016	0.0017	0.0016	0.0017	0.0017	0.0016	0.0017	0.0018	0.0017						
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001						
Min.	0.0000	0.0013	0.0013	0.0015	0.0015	0.0014	0.0016	0.0015	0.0014	0.0015	0.0015	0.0014						
Max.	0.0000	0.0015	0.0015	0.0017	0.0018	0.0018	0.0018	0.0019	0.0017	0.0019	0.0021	0.0020						



Data Set 7 : 105 °C, 1200 mA

Actual Case Temperature [T _S]	105.8 °C
Actual Ambient Temperature [T _A]	103.1 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 7-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2664	0.2650	0.2650	0.2648	0.2648	0.2649	0.2648	0.2649	0.2648	0.2650	0.2651	0.2652						
2	0.2655	0.2641	0.2640	0.2638	0.2638	0.2639	0.2638	0.2639	0.2639	0.2641	0.2641	0.2641						
3	0.2662	0.2648	0.2647	0.2645	0.2645	0.2646	0.2645	0.2647	0.2645	0.2646	0.2648	0.2648						
4	0.2615	0.2600	0.2600	0.2598	0.2598	0.2599	0.2597	0.2598	0.2598	0.2600	0.2601	0.2600						
5	0.2624	0.2611	0.2611	0.2609	0.2608	0.2610	0.2607	0.2609	0.2610	0.2610	0.2612	0.2611						
6	0.2610	0.2596	0.2597	0.2593	0.2593	0.2595	0.2594	0.2595	0.2595	0.2597	0.2597	0.2597						
7	0.2616	0.2603	0.2603	0.2600	0.2600	0.2602	0.2600	0.2602	0.2602	0.2602	0.2604	0.2604						
8	0.2623	0.2610	0.2609	0.2607	0.2608	0.2608	0.2607	0.2608	0.2608	0.2608	0.2609	0.2610						
9	0.2619	0.2605	0.2606	0.2603	0.2602	0.2604	0.2602	0.2604	0.2604	0.2604	0.2605	0.2606						
10	0.2645	0.2631	0.2630	0.2629	0.2628	0.2629	0.2628	0.2629	0.2629	0.2630	0.2631	0.2633						
11	0.2662	0.2648	0.2647	0.2646	0.2645	0.2646	0.2646	0.2647	0.2647	0.2649	0.2649	0.2649						
12	0.2648	0.2634	0.2634	0.2631	0.2631	0.2632	0.2631	0.2633	0.2632	0.2634	0.2635	0.2635						
13	0.2636	0.2622	0.2621	0.2619	0.2618	0.2619	0.2619	0.2619	0.2620	0.2620	0.2622	0.2622						
14	0.2614	0.2602	0.2602	0.2599	0.2599	0.2600	0.2599	0.2600	0.2599	0.2600	0.2601	0.2603						
15	0.2603	0.2589	0.2588	0.2587	0.2586	0.2587	0.2585	0.2586	0.2586	0.2587	0.2589	0.2589						
16	0.2619	0.2606	0.2605	0.2603	0.2602	0.2603	0.2602	0.2603	0.2603	0.2604	0.2605	0.2605						
17	0.2618	0.2605	0.2604	0.2602	0.2602	0.2602	0.2601	0.2602	0.2602	0.2603	0.2604	0.2605						
18	0.2622	0.2608	0.2607	0.2606	0.2606	0.2606	0.2605	0.2607	0.2607	0.2607	0.2608	0.2608						
19	0.2617	0.2604	0.2603	0.2600	0.2601	0.2601	0.2601	0.2601	0.2601	0.2603	0.2603	0.2604						
20	0.2631	0.2619	0.2617	0.2616	0.2615	0.2616	0.2614	0.2617	0.2616	0.2618	0.2618	0.2618						
21	0.2634	0.2621	0.2619	0.2618	0.2617	0.2618	0.2617	0.2618	0.2618	0.2619	0.2620	0.2621						
22	0.2627	0.2614	0.2613	0.2610	0.2610	0.2610	0.2610	0.2611	0.2611	0.2612	0.2612	0.2613						
23	0.2629	0.2617	0.2615	0.2612	0.2613	0.2613	0.2612	0.2613	0.2613	0.2613	0.2615	0.2614						
24	0.2610	0.2597	0.2596	0.2594	0.2593	0.2594	0.2593	0.2593	0.2594	0.2594	0.2595	0.2596						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2629	0.2616	0.2615	0.2613	0.2613	0.2614	0.2613	0.2614	0.2614	0.2615	0.2616	0.2616						
Med.	0.2624	0.2611	0.2610	0.2608	0.2608	0.2609	0.2607	0.2609	0.2609	0.2609	0.2610	0.2611						
σ	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018						
Min.	0.2603	0.2589	0.2588	0.2587	0.2586	0.2587	0.2585	0.2586	0.2586	0.2587	0.2589	0.2589						
Max.	0.2664	0.2650	0.2650	0.2648	0.2648	0.2649	0.2648	0.2649	0.2648	0.2650	0.2651	0.2652						



Data Set 7 : 105 °C, 1200 mA

Actual Case Temperature [T _S]	105.8 °C
Actual Ambient Temperature [T _A]	103.1 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 7-6

Chromaticity

LED No.	Chromaticity v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.5262	0.5260	0.5262	0.5265	0.5263	0.5265	0.5266	0.5270	0.5265	0.5271	0.5274	0.5272					
2	0.5234	0.5232	0.5234	0.5237	0.5235	0.5237	0.5238	0.5242	0.5237	0.5243	0.5246	0.5245					
3	0.5242	0.5241	0.5243	0.5245	0.5242	0.5245	0.5246	0.5249	0.5245	0.5251	0.5253	0.5253					
4	0.5221	0.5219	0.5220	0.5222	0.5221	0.5224	0.5224	0.5229	0.5225	0.5230	0.5233	0.5232					
5	0.5213	0.5210	0.5211	0.5213	0.5212	0.5214	0.5215	0.5218	0.5215	0.5220	0.5223	0.5223					
6	0.5217	0.5215	0.5216	0.5218	0.5217	0.5220	0.5220	0.5225	0.5221	0.5227	0.5230	0.5230					
7	0.5225	0.5222	0.5225	0.5226	0.5226	0.5228	0.5229	0.5233	0.5229	0.5235	0.5238	0.5238					
8	0.5222	0.5219	0.5222	0.5223	0.5223	0.5225	0.5226	0.5230	0.5225	0.5231	0.5235	0.5234					
9	0.5223	0.5221	0.5223	0.5225	0.5224	0.5228	0.5228	0.5232	0.5228	0.5234	0.5237	0.5236					
10	0.5242	0.5239	0.5241	0.5243	0.5242	0.5245	0.5246	0.5249	0.5245	0.5250	0.5254	0.5253					
11	0.5255	0.5253	0.5256	0.5258	0.5257	0.5260	0.5259	0.5263	0.5260	0.5264	0.5267	0.5267					
12	0.5254	0.5253	0.5256	0.5258	0.5257	0.5260	0.5260	0.5264	0.5261	0.5266	0.5269	0.5269					
13	0.5246	0.5243	0.5245	0.5248	0.5246	0.5248	0.5249	0.5253	0.5249	0.5254	0.5256	0.5257					
14	0.5214	0.5210	0.5212	0.5214	0.5212	0.5214	0.5215	0.5218	0.5215	0.5220	0.5222	0.5222					
15	0.5201	0.5198	0.5197	0.5199	0.5198	0.5201	0.5201	0.5204	0.5201	0.5207	0.5209	0.5209					
16	0.5212	0.5209	0.5209	0.5211	0.5210	0.5213	0.5212	0.5216	0.5212	0.5217	0.5220	0.5220					
17	0.5210	0.5208	0.5208	0.5211	0.5209	0.5211	0.5211	0.5215	0.5211	0.5216	0.5219	0.5219					
18	0.5215	0.5212	0.5214	0.5216	0.5214	0.5217	0.5217	0.5221	0.5217	0.5222	0.5225	0.5225					
19	0.5221	0.5219	0.5220	0.5222	0.5221	0.5224	0.5224	0.5228	0.5224	0.5228	0.5231	0.5231					
20	0.5231	0.5228	0.5230	0.5232	0.5230	0.5233	0.5233	0.5237	0.5233	0.5238	0.5240	0.5240					
21	0.5245	0.5244	0.5246	0.5248	0.5246	0.5249	0.5250	0.5253	0.5249	0.5254	0.5257	0.5256					
22	0.5233	0.5230	0.5232	0.5233	0.5232	0.5235	0.5235	0.5239	0.5234	0.5240	0.5242	0.5241					
23	0.5214	0.5212	0.5213	0.5215	0.5213	0.5216	0.5216	0.5220	0.5215	0.5220	0.5222	0.5222					
24	0.5206	0.5204	0.5205	0.5207	0.5205	0.5208	0.5208	0.5211	0.5207	0.5212	0.5214	0.5214					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.5227	0.5225	0.5227	0.5229	0.5227	0.5230	0.5230	0.5234	0.5230	0.5235	0.5238	0.5238					
Med.	0.5223	0.5220	0.5223	0.5224	0.5224	0.5226	0.5227	0.5231	0.5227	0.5233	0.5236	0.5235					
σ	0.0017	0.0017	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018					
Min.	0.5201	0.5198	0.5197	0.5199	0.5198	0.5201	0.5201	0.5204	0.5201	0.5207	0.5209	0.5209					
Max.	0.5262	0.5260	0.5262	0.5265	0.5263	0.5265	0.5266	0.5270	0.5265	0.5271	0.5274	0.5272					

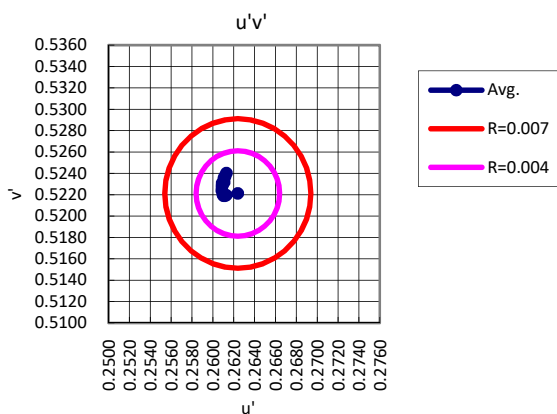
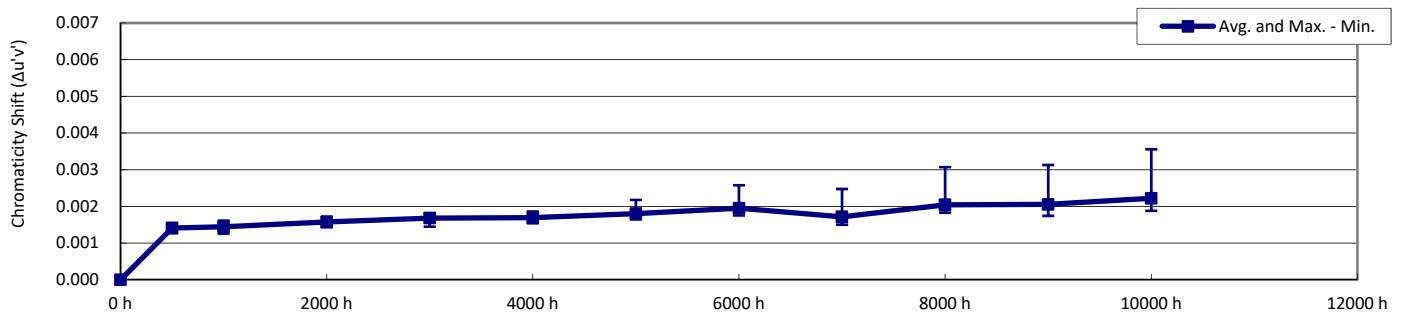
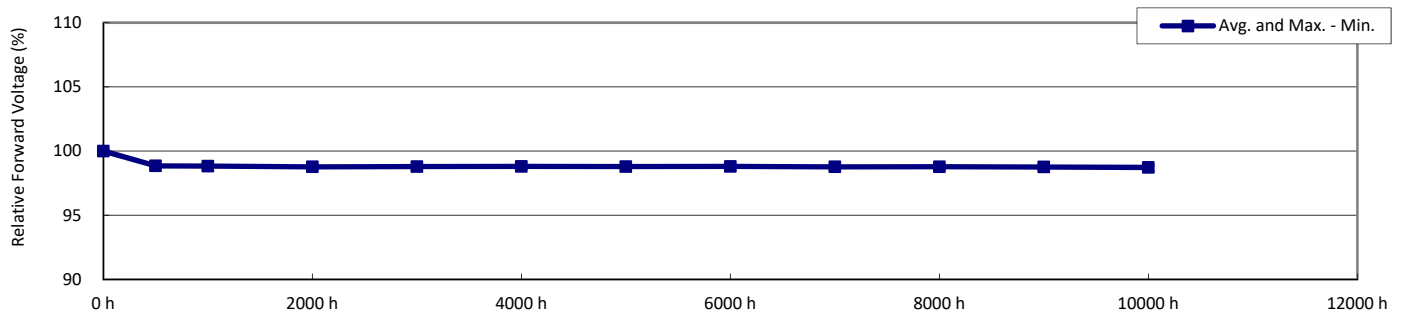
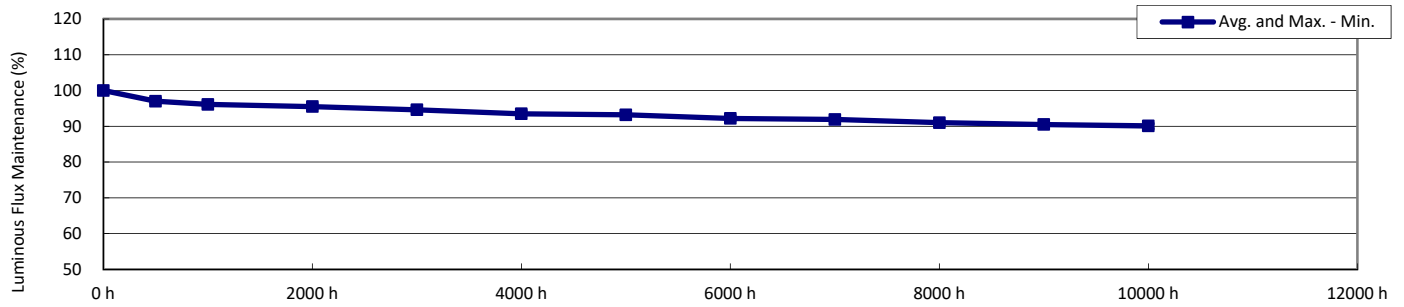
Data Set 8 : 105 °C, 1500 mA

Actual Case Temperature [T_S]	106.0 °C
Actual Ambient Temperature [T_A]	102.7 °C
Drive Current [I_F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 8 : 105 °C, 1500 mA

Actual Case Temperature [T _S]	106.0 °C
Actual Ambient Temperature [T _A]	102.7 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 8-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _V [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	479	3.20	2757	4.81	0.449	0.397	0.261	0.521						
2	483	3.20	2787	4.80	0.447	0.397	0.260	0.520						
3	482	3.20	2759	4.81	0.448	0.397	0.261	0.520						
4	483	3.21	2762	4.81	0.448	0.398	0.261	0.521						
5	483	3.20	2763	4.81	0.448	0.397	0.261	0.520						
6	482	3.21	2750	4.81	0.450	0.399	0.261	0.521						
7	480	3.21	2756	4.81	0.449	0.399	0.261	0.521						
8	479	3.21	2743	4.81	0.450	0.398	0.262	0.521						
9	473	3.20	2675	4.81	0.456	0.401	0.265	0.523						
10	477	3.20	2686	4.81	0.457	0.405	0.264	0.525						
11	478	3.21	2703	4.81	0.455	0.403	0.263	0.524						
12	481	3.21	2725	4.81	0.452	0.399	0.262	0.522						
13	482	3.21	2741	4.81	0.450	0.399	0.262	0.521						
14	483	3.21	2760	4.81	0.449	0.399	0.261	0.521						
15	482	3.21	2738	4.81	0.451	0.399	0.262	0.521						
16	480	3.21	2727	4.81	0.452	0.399	0.262	0.522						
17	478	3.21	2717	4.81	0.453	0.400	0.263	0.522						
18	476	3.21	2705	4.81	0.454	0.402	0.263	0.523						
19	479	3.20	2711	4.80	0.454	0.401	0.263	0.522						
20	477	3.20	2701	4.80	0.454	0.400	0.263	0.522						
21	478	3.21	2686	4.81	0.457	0.403	0.264	0.524						
22	474	3.21	2644	4.81	0.461	0.406	0.266	0.526						
23	477	3.21	2674	4.82	0.460	0.407	0.264	0.526						
24	478	3.20	2714	4.81	0.453	0.400	0.263	0.522						
n	24	24	24	24	24	24	24	24						
Avg.	479	3.21	2724	4.81	0.452	0.400	0.262	0.522						
Med.	479	3.21	2726	4.81	0.452	0.399	0.262	0.522						
σ	2.9	0.002	35.6	0.003	0.0038	0.0027	0.0014	0.0016						
Min.	473	3.20	2644	4.80	0.447	0.397	0.260	0.520						
Max.	483	3.21	2787	4.82	0.461	0.407	0.266	0.526						



Data Set 8 : 105 °C, 1500 mA

Actual Case Temperature [T _S]	106.0 °C
Actual Ambient Temperature [T _A]	102.7 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 8-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	96.8	96.0	95.5	94.4	93.4	93.2	92.2	91.9	91.1	90.6	90.1						
2	100.0	96.8	95.8	94.9	94.3	93.2	93.0	92.0	91.6	90.8	90.3	90.0						
3	100.0	97.8	96.9	96.3	95.0	93.8	93.8	92.5	92.3	91.2	90.5	90.3						
4	100.0	96.9	96.1	95.5	94.6	93.5	93.2	92.3	92.1	91.1	90.9	90.3						
5	100.0	97.0	96.0	95.4	94.5	93.4	93.1	92.1	91.9	91.1	90.8	90.1						
6	100.0	97.6	96.4	95.8	94.8	93.6	93.1	92.1	91.9	90.7	90.1	89.3						
7	100.0	96.7	95.9	95.4	94.4	93.2	93.1	92.1	91.7	91.0	90.5	90.0						
8	100.0	96.7	95.8	95.3	94.3	93.1	93.0	92.0	91.6	90.9	90.3	90.0						
9	100.0	97.3	96.4	95.7	95.2	93.4	93.4	92.2	92.0	90.8	90.2	89.8						
10	100.0	96.5	95.6	95.1	94.0	93.1	92.7	91.6	91.4	90.5	90.3	89.7						
11	100.0	96.6	95.7	95.2	94.0	93.1	92.9	92.0	91.7	90.8	90.7	90.0						
12	100.0	97.4	96.7	95.9	94.7	93.7	93.5	92.4	91.7	90.2	90.2	89.4						
13	100.0	97.0	96.1	95.5	94.6	94.0	93.3	92.4	92.1	91.3	91.0	90.4						
14	100.0	97.0	96.1	95.5	94.5	94.0	93.3	92.5	92.2	91.3	91.1	90.5						
15	100.0	97.6	96.7	96.3	95.2	94.4	93.7	92.6	92.3	91.2	90.7	90.3						
16	100.0	96.9	96.0	95.6	94.6	93.6	93.4	92.3	92.0	91.2	90.7	90.3						
17	100.0	96.9	96.0	95.3	94.4	93.6	93.3	92.3	91.8	91.2	90.6	90.2						
18	100.0	97.5	96.6	96.0	95.5	94.2	94.0	92.9	92.4	91.5	90.7	90.7						
19	100.0	96.8	96.0	95.4	94.4	93.3	93.0	92.2	91.8	90.9	90.5	90.0						
20	100.0	96.7	95.8	95.3	94.3	93.3	93.0	92.0	91.6	90.8	90.4	90.0						
21	100.0	97.5	96.4	95.8	95.3	93.8	93.7	92.5	91.9	91.2	90.3	90.1						
22	100.0	96.6	95.7	95.1	94.1	93.2	92.7	91.6	91.5	90.8	90.3	89.8						
23	100.0	96.6	95.8	95.2	94.3	93.3	93.1	92.2	91.9	91.0	90.6	90.3						
24	100.0	97.2	96.3	95.7	94.8	93.8	93.4	92.5	92.0	91.0	90.3	90.0						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	97.0	96.1	95.5	94.6	93.5	93.2	92.2	91.9	91.0	90.5	90.1						
Med.	100.0	96.9	96.0	95.5	94.5	93.5	93.2	92.2	91.9	91.0	90.5	90.1						
σ	0.00	0.38	0.36	0.36	0.41	0.36	0.33	0.30	0.26	0.28	0.27	0.32						
Min.	100.0	96.5	95.6	94.9	94.0	93.1	92.7	91.6	91.4	90.2	90.1	89.3						
Max.	100.0	97.8	96.9	96.3	95.5	94.4	94.0	92.9	92.4	91.5	91.1	90.7						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	0.9620		
α	6.709E-06		
R ²	0.9795		
Calculated L ₇₀ (10K)	47400	hours	
Reported L ₇₀ (10K)	47400	hours	
Calculated L ₈₀ (10K)	27500	hours	
Reported L ₈₀ (10K)	27500	hours	
Calculated L ₉₀ (10K)	9930	hours	
Reported L ₉₀ (10K)	9930	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.*



Data Set 8 : 105 °C, 1500 mA

Actual Case Temperature [T _s]	106.0 °C
Actual Ambient Temperature [T _A]	102.7 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 8-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.8	98.7	98.6	98.7	98.7	98.6	98.6	98.6	98.5	98.6	98.6						
2	100.0	98.8	98.9	98.8	98.9	98.8	99.0	98.9	98.9	98.9	98.8	98.9						
3	100.0	98.9	99.0	99.0	99.0	98.9	98.9	98.9	98.9	98.9	98.8	98.8						
4	100.0	98.9	98.9	98.9	98.8	98.9	98.9	98.9	98.9	98.9	98.9	98.8						
5	100.0	98.8	98.8	98.7	98.9	98.8	98.8	98.7	98.8	98.7	98.7	98.7						
6	100.0	99.0	98.9	98.9	98.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8						
7	100.0	98.7	98.7	98.6	98.7	98.7	98.7	98.6	98.7	98.7	98.7	98.5						
8	100.0	98.7	98.7	98.6	98.6	98.6	98.6	98.6	98.5	98.7	98.5	98.6						
9	100.0	98.7	98.7	98.7	98.6	98.6	98.6	98.7	98.6	98.6	98.7	98.6						
10	100.0	98.8	98.9	98.9	98.8	98.8	98.8	98.9	98.8	98.8	98.8	98.7						
11	100.0	98.9	98.9	98.9	98.7	98.8	98.9	99.0	98.8	98.8	98.8	98.9						
12	100.0	98.9	98.8	98.8	98.8	98.8	98.9	98.8	98.8	98.7	98.9	98.7						
13	100.0	98.9	98.9	98.9	99.0	99.0	98.9	99.0	98.9	98.9	98.9	98.7						
14	100.0	99.0	99.0	98.9	99.0	99.1	99.0	98.9	98.9	99.0	98.9	98.9						
15	100.0	98.9	98.9	98.8	98.8	99.0	98.8	98.8	98.8	98.8	98.9	98.8						
16	100.0	98.9	98.9	98.8	98.8	98.8	98.8	98.9	98.9	98.9	98.7	98.7						
17	100.0	98.8	98.8	98.8	98.7	98.8	98.7	98.7	98.7	98.7	98.7	98.6						
18	100.0	98.7	98.6	98.6	98.5	98.7	98.6	98.6	98.6	98.6	98.5	98.4						
19	100.0	98.9	98.9	98.8	98.8	98.8	98.9	98.9	98.7	98.8	98.8	98.8						
20	100.0	98.7	98.8	98.8	98.7	98.7	98.7	98.7	98.7	98.8	98.7	98.7						
21	100.0	98.9	98.8	98.9	98.8	98.9	98.9	98.9	98.9	98.8	98.8	98.9						
22	100.0	98.9	98.9	98.8	98.8	98.8	98.8	98.8	98.8	98.9	98.8	98.8						
23	100.0	98.9	98.8	98.7	98.8	98.8	98.8	98.9	98.7	98.8	98.7	98.7						
24	100.0	98.8	98.7	98.7	98.7	98.7	98.7	98.7	98.6	98.7	98.7	98.6						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.7						
Med.	100.0	98.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.7						
σ	0.00	0.09	0.10	0.10	0.12	0.13	0.12	0.12	0.12	0.11	0.12	0.12						
Min.	100.0	98.7	98.6	98.6	98.5	98.6	98.6	98.6	98.5	98.5	98.5	98.4						
Max.	100.0	99.0	99.0	99.0	99.0	99.1	99.0	99.0	98.9	99.0	98.9	98.9						



Data Set 8 : 105 °C, 1500 mA

Actual Case Temperature [T _S]	106.0 °C
Actual Ambient Temperature [T _A]	102.7 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 8-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.0000	0.0014	0.0015	0.0015	0.0018	0.0017	0.0019	0.0019	0.0016	0.0021	0.0020	0.0021						
2	0.0000	0.0014	0.0013	0.0015	0.0018	0.0017	0.0018	0.0019	0.0016	0.0021	0.0021	0.0021						
3	0.0000	0.0015	0.0015	0.0017	0.0018	0.0017	0.0019	0.0020	0.0017	0.0020	0.0020	0.0020						
4	0.0000	0.0015	0.0015	0.0016	0.0017	0.0016	0.0017	0.0019	0.0016	0.0019	0.0019	0.0022						
5	0.0000	0.0015	0.0015	0.0016	0.0016	0.0016	0.0018	0.0018	0.0016	0.0018	0.0017	0.0019						
6	0.0000	0.0013	0.0015	0.0016	0.0017	0.0018	0.0019	0.0023	0.0020	0.0024	0.0024	0.0030						
7	0.0000	0.0014	0.0014	0.0017	0.0018	0.0017	0.0019	0.0019	0.0017	0.0020	0.0021	0.0022						
8	0.0000	0.0015	0.0016	0.0017	0.0018	0.0018	0.0019	0.0020	0.0017	0.0019	0.0021	0.0021						
9	0.0000	0.0013	0.0015	0.0015	0.0018	0.0017	0.0019	0.0019	0.0018	0.0020	0.0022	0.0023						
10	0.0000	0.0013	0.0014	0.0016	0.0017	0.0017	0.0019	0.0020	0.0018	0.0022	0.0021	0.0024						
11	0.0000	0.0015	0.0014	0.0016	0.0017	0.0018	0.0018	0.0020	0.0017	0.0020	0.0019	0.0022						
12	0.0000	0.0014	0.0014	0.0015	0.0017	0.0019	0.0022	0.0026	0.0025	0.0031	0.0031	0.0036						
13	0.0000	0.0013	0.0014	0.0014	0.0014	0.0015	0.0017	0.0019	0.0016	0.0020	0.0019	0.0022						
14	0.0000	0.0015	0.0016	0.0015	0.0016	0.0017	0.0018	0.0018	0.0016	0.0019	0.0019	0.0021						
15	0.0000	0.0014	0.0015	0.0015	0.0016	0.0016	0.0019	0.0021	0.0019	0.0023	0.0023	0.0027						
16	0.0000	0.0015	0.0015	0.0017	0.0017	0.0017	0.0017	0.0018	0.0017	0.0019	0.0020	0.0021						
17	0.0000	0.0014	0.0013	0.0015	0.0016	0.0016	0.0017	0.0018	0.0016	0.0020	0.0019	0.0020						
18	0.0000	0.0013	0.0014	0.0017	0.0017	0.0017	0.0018	0.0019	0.0017	0.0020	0.0019	0.0020						
19	0.0000	0.0014	0.0015	0.0015	0.0016	0.0017	0.0017	0.0018	0.0016	0.0019	0.0020	0.0020						
20	0.0000	0.0014	0.0014	0.0015	0.0016	0.0016	0.0016	0.0018	0.0016	0.0019	0.0021	0.0021						
21	0.0000	0.0014	0.0014	0.0015	0.0017	0.0017	0.0018	0.0019	0.0017	0.0021	0.0020	0.0022						
22	0.0000	0.0014	0.0014	0.0016	0.0017	0.0018	0.0018	0.0019	0.0017	0.0020	0.0021	0.0020						
23	0.0000	0.0015	0.0015	0.0017	0.0017	0.0018	0.0018	0.0019	0.0017	0.0019	0.0019	0.0019						
24	0.0000	0.0013	0.0013	0.0015	0.0016	0.0016	0.0017	0.0018	0.0015	0.0018	0.0018	0.0019						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.0000	0.0014	0.0014	0.0016	0.0017	0.0017	0.0018	0.0020	0.0017	0.0020	0.0021	0.0022						
Med.	0.0000	0.0014	0.0014	0.0015	0.0017	0.0017	0.0018	0.0019	0.0017	0.0020	0.0020	0.0021						
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003	0.0004						
Min.	0.0000	0.0013	0.0013	0.0014	0.0014	0.0015	0.0016	0.0018	0.0015	0.0018	0.0017	0.0019						
Max.	0.0000	0.0015	0.0016	0.0017	0.0018	0.0019	0.0022	0.0026	0.0025	0.0031	0.0031	0.0036						



Data Set 8 : 105 °C, 1500 mA

Actual Case Temperature [T _s]	106.0 °C
Actual Ambient Temperature [T _A]	102.7 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 8-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2615	0.2602	0.2601	0.2600	0.2599	0.2600	0.2599	0.2602	0.2601	0.2601	0.2603	0.2603						
2	0.2602	0.2589	0.2589	0.2587	0.2586	0.2587	0.2587	0.2588	0.2589	0.2589	0.2590	0.2591						
3	0.2614	0.2599	0.2599	0.2597	0.2597	0.2598	0.2597	0.2599	0.2599	0.2601	0.2600	0.2601						
4	0.2613	0.2599	0.2598	0.2596	0.2597	0.2598	0.2597	0.2599	0.2600	0.2599	0.2598	0.2600						
5	0.2613	0.2599	0.2599	0.2597	0.2598	0.2598	0.2597	0.2599	0.2599	0.2599	0.2599	0.2601						
6	0.2616	0.2603	0.2601	0.2600	0.2602	0.2602	0.2602	0.2604	0.2605	0.2605	0.2606	0.2608						
7	0.2613	0.2599	0.2599	0.2597	0.2597	0.2598	0.2597	0.2600	0.2600	0.2600	0.2601	0.2602						
8	0.2620	0.2605	0.2604	0.2604	0.2604	0.2604	0.2604	0.2606	0.2606	0.2607	0.2608	0.2608						
9	0.2647	0.2634	0.2633	0.2633	0.2632	0.2633	0.2632	0.2635	0.2634	0.2636	0.2636	0.2637						
10	0.2641	0.2627	0.2626	0.2625	0.2626	0.2627	0.2627	0.2629	0.2628	0.2628	0.2629	0.2631						
11	0.2634	0.2619	0.2620	0.2619	0.2620	0.2620	0.2620	0.2621	0.2622	0.2621	0.2622	0.2624						
12	0.2626	0.2612	0.2612	0.2611	0.2613	0.2614	0.2614	0.2617	0.2618	0.2617	0.2619	0.2621						
13	0.2619	0.2607	0.2605	0.2605	0.2605	0.2604	0.2605	0.2607	0.2607	0.2608	0.2608	0.2610						
14	0.2612	0.2598	0.2597	0.2597	0.2596	0.2596	0.2596	0.2600	0.2599	0.2600	0.2599	0.2601						
15	0.2621	0.2607	0.2606	0.2606	0.2606	0.2606	0.2607	0.2608	0.2609	0.2610	0.2610	0.2612						
16	0.2627	0.2613	0.2612	0.2610	0.2611	0.2612	0.2611	0.2611	0.2612	0.2614	0.2614	0.2615						
17	0.2629	0.2615	0.2615	0.2614	0.2614	0.2614	0.2613	0.2614	0.2615	0.2615	0.2616	0.2617						
18	0.2633	0.2619	0.2618	0.2616	0.2616	0.2617	0.2617	0.2617	0.2617	0.2618	0.2620	0.2620						
19	0.2632	0.2619	0.2618	0.2617	0.2618	0.2618	0.2618	0.2619	0.2619	0.2620	0.2620	0.2621						
20	0.2637	0.2623	0.2623	0.2622	0.2623	0.2623	0.2623	0.2624	0.2625	0.2626	0.2626	0.2627						
21	0.2641	0.2627	0.2627	0.2626	0.2626	0.2627	0.2626	0.2628	0.2628	0.2628	0.2630	0.2629						
22	0.2659	0.2645	0.2645	0.2644	0.2645	0.2645	0.2644	0.2647	0.2646	0.2647	0.2646	0.2648						
23	0.2643	0.2628	0.2628	0.2627	0.2628	0.2627	0.2627	0.2628	0.2628	0.2629	0.2629	0.2630						
24	0.2630	0.2617	0.2617	0.2615	0.2615	0.2616	0.2615	0.2616	0.2617	0.2618	0.2618	0.2618						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2627	0.2613	0.2612	0.2611	0.2611	0.2612	0.2611	0.2613	0.2613	0.2614	0.2614	0.2616						
Med.	0.2626	0.2612	0.2612	0.2611	0.2612	0.2613	0.2612	0.2613	0.2613	0.2615	0.2615	0.2616						
σ	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014						
Min.	0.2602	0.2589	0.2589	0.2587	0.2586	0.2587	0.2587	0.2588	0.2589	0.2589	0.2590	0.2591						
Max.	0.2659	0.2645	0.2645	0.2644	0.2645	0.2645	0.2644	0.2647	0.2646	0.2647	0.2646	0.2648						

Data Set 8 : 105 °C, 1500 mA

Actual Case Temperature [T _S]	106.0 °C
Actual Ambient Temperature [T _A]	102.7 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 8-6
Chromaticity

LED No.	Chromaticity v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.5202	0.5200	0.5202	0.5204	0.5209	0.5210	0.5211	0.5216	0.5210	0.5217	0.5217	0.5219						
2	0.5199	0.5197	0.5199	0.5200	0.5206	0.5207	0.5208	0.5212	0.5209	0.5215	0.5216	0.5217						
3	0.5197	0.5194	0.5196	0.5199	0.5204	0.5205	0.5206	0.5210	0.5205	0.5212	0.5212	0.5213						
4	0.5203	0.5199	0.5201	0.5204	0.5209	0.5210	0.5211	0.5215	0.5212	0.5215	0.5214	0.5221						
5	0.5198	0.5195	0.5196	0.5200	0.5203	0.5204	0.5204	0.5209	0.5205	0.5209	0.5208	0.5213						
6	0.5204	0.5203	0.5204	0.5208	0.5213	0.5215	0.5217	0.5224	0.5222	0.5226	0.5226	0.5234						
7	0.5208	0.5205	0.5207	0.5211	0.5215	0.5216	0.5217	0.5221	0.5218	0.5222	0.5225	0.5227						
8	0.5207	0.5205	0.5207	0.5210	0.5215	0.5215	0.5216	0.5221	0.5217	0.5221	0.5223	0.5224						
9	0.5224	0.5223	0.5225	0.5229	0.5233	0.5233	0.5235	0.5239	0.5236	0.5240	0.5242	0.5244						
10	0.5243	0.5243	0.5245	0.5249	0.5253	0.5254	0.5256	0.5260	0.5257	0.5261	0.5261	0.5266						
11	0.5232	0.5231	0.5232	0.5236	0.5241	0.5242	0.5243	0.5247	0.5243	0.5247	0.5247	0.5252						
12	0.5208	0.5206	0.5208	0.5212	0.5219	0.5222	0.5226	0.5232	0.5232	0.5238	0.5239	0.5243						
13	0.5209	0.5206	0.5207	0.5210	0.5210	0.5211	0.5218	0.5222	0.5219	0.5225	0.5224	0.5228						
14	0.5207	0.5204	0.5205	0.5208	0.5207	0.5208	0.5215	0.5219	0.5215	0.5221	0.5221	0.5225						
15	0.5206	0.5204	0.5205	0.5208	0.5208	0.5211	0.5218	0.5223	0.5221	0.5226	0.5226	0.5231						
16	0.5215	0.5212	0.5213	0.5216	0.5220	0.5222	0.5222	0.5225	0.5223	0.5229	0.5230	0.5232						
17	0.5220	0.5218	0.5218	0.5222	0.5225	0.5227	0.5227	0.5231	0.5229	0.5234	0.5234	0.5236						
18	0.5224	0.5222	0.5223	0.5226	0.5230	0.5231	0.5232	0.5234	0.5232	0.5238	0.5238	0.5239						
19	0.5222	0.5220	0.5221	0.5224	0.5228	0.5230	0.5230	0.5234	0.5231	0.5236	0.5237	0.5238						
20	0.5218	0.5216	0.5217	0.5221	0.5225	0.5226	0.5226	0.5231	0.5228	0.5233	0.5235	0.5236						
21	0.5232	0.5231	0.5232	0.5236	0.5240	0.5241	0.5242	0.5246	0.5243	0.5248	0.5248	0.5251						
22	0.5253	0.5254	0.5256	0.5259	0.5263	0.5264	0.5264	0.5268	0.5263	0.5270	0.5270	0.5270						
23	0.5255	0.5253	0.5254	0.5258	0.5261	0.5262	0.5262	0.5266	0.5261	0.5267	0.5268	0.5269						
24	0.5214	0.5212	0.5213	0.5217	0.5221	0.5222	0.5222	0.5226	0.5222	0.5228	0.5229	0.5229						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.5217	0.5215	0.5216	0.5220	0.5223	0.5225	0.5226	0.5231	0.5227	0.5232	0.5233	0.5236						
Med.	0.5211	0.5209	0.5210	0.5214	0.5220	0.5222	0.5222	0.5226	0.5223	0.5228	0.5229	0.5233						
σ	0.0016	0.0017	0.0017	0.0018	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0016						
Min.	0.5197	0.5194	0.5196	0.5199	0.5203	0.5204	0.5204	0.5209	0.5205	0.5209	0.5208	0.5213						
Max.	0.5255	0.5254	0.5256	0.5259	0.5263	0.5264	0.5264	0.5268	0.5263	0.5270	0.5270	0.5270						

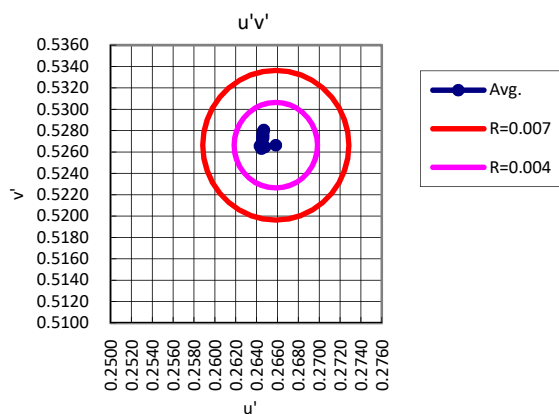
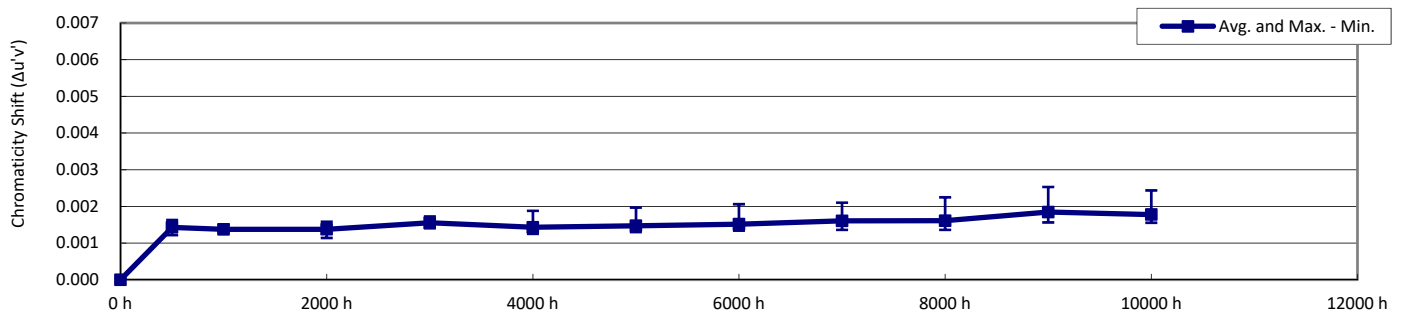
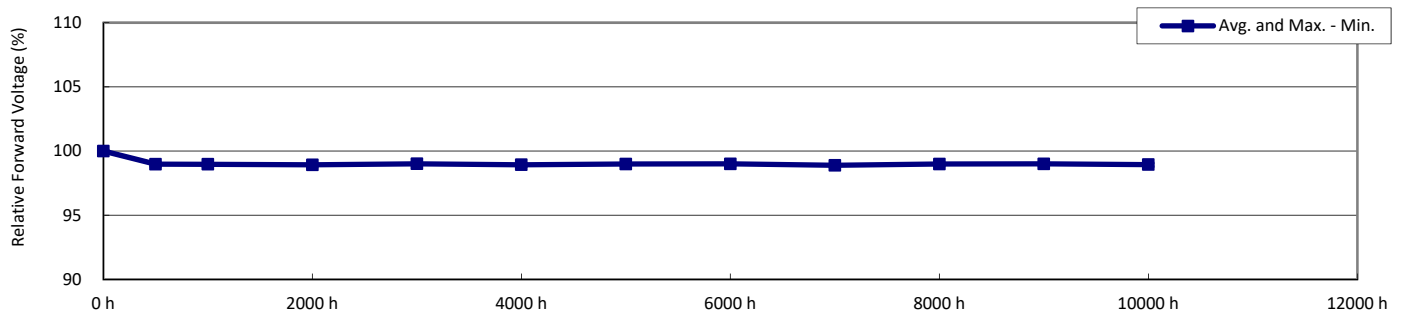
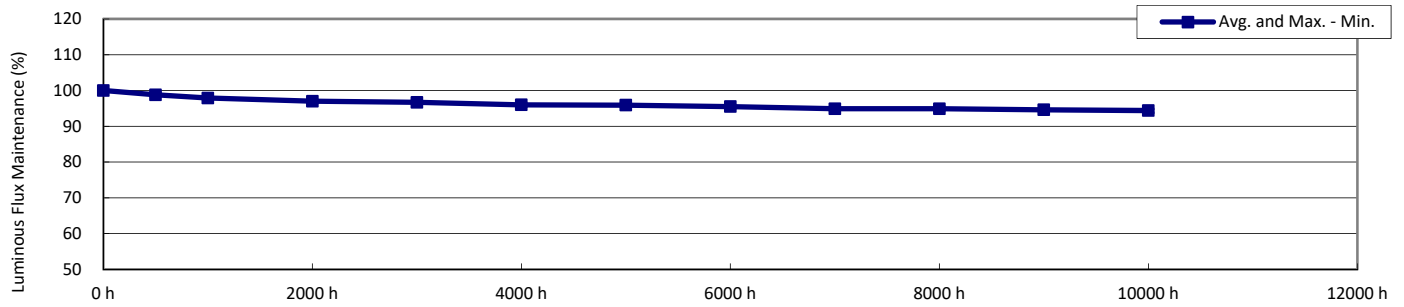
Data Set 9 : 120 °C, 700 mA

Actual Case Temperature [T_S]	121.5 °C
Actual Ambient Temperature [T_A]	117.8 °C
Drive Current [I_F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0



Data Set 9 : 120 °C, 700 mA

Actual Case Temperature [T _S]	121.5 °C
Actual Ambient Temperature [T _A]	117.8 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 9-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _V [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	246	2.99	2667	2.09	0.457	0.401	0.265	0.523						
2	247	2.99	2644	2.09	0.461	0.406	0.266	0.526						
3	246	2.99	2612	2.09	0.467	0.412	0.267	0.529						
4	242	2.99	2600	2.09	0.469	0.414	0.267	0.530						
5	245	2.99	2674	2.09	0.457	0.403	0.264	0.524						
6	244	2.98	2627	2.09	0.465	0.410	0.266	0.528						
7	246	2.99	2648	2.09	0.462	0.408	0.265	0.527						
8	247	2.98	2670	2.09	0.460	0.407	0.264	0.526						
9	247	2.99	2671	2.09	0.460	0.406	0.264	0.526						
10	246	2.99	2639	2.09	0.461	0.405	0.266	0.526						
11	244	2.99	2621	2.09	0.463	0.406	0.267	0.526						
12	247	2.98	2653	2.09	0.461	0.406	0.265	0.526						
13	246	2.98	2650	2.09	0.461	0.407	0.265	0.526						
14	246	2.98	2638	2.09	0.463	0.408	0.266	0.527						
15	246	2.98	2633	2.09	0.464	0.410	0.266	0.528						
16	242	2.99	2589	2.09	0.468	0.410	0.268	0.528						
17	244	2.99	2633	2.09	0.462	0.405	0.266	0.526						
18	244	2.99	2609	2.09	0.466	0.410	0.267	0.528						
19	245	2.99	2619	2.09	0.465	0.409	0.267	0.528						
20	245	2.99	2620	2.09	0.465	0.409	0.267	0.527						
21	247	2.99	2646	2.09	0.463	0.409	0.265	0.527						
22	244	2.99	2601	2.10	0.465	0.407	0.268	0.527						
23	248	2.99	2640	2.10	0.462	0.407	0.266	0.526						
24	246	3.00	2637	2.10	0.463	0.407	0.266	0.526						
n	24	24	24	24	24	24	24	24						
Avg.	245	2.99	2635	2.09	0.463	0.408	0.266	0.527						
Med.	246	2.99	2637	2.09	0.463	0.407	0.266	0.527						
σ	1.4	0.004	23.3	0.002	0.0030	0.0027	0.0010	0.0014						
Min.	242	2.98	2589	2.09	0.457	0.401	0.264	0.523						
Max.	248	3.00	2674	2.10	0.469	0.414	0.268	0.530						



Data Set 9 : 120 °C, 700 mA

Actual Case Temperature [T _S]	121.5 °C
Actual Ambient Temperature [T _A]	117.8 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 9-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.5	98.0	97.1	96.7	96.1	95.9	95.4	95.0	94.8	94.6	94.3						
2	100.0	98.9	97.9	97.0	96.8	95.8	95.7	95.4	94.8	94.8	94.4	94.2						
3	100.0	99.4	97.6	96.7	96.4	95.5	95.5	95.0	94.4	94.4	94.1	93.8						
4	100.0	98.7	98.0	97.0	96.6	96.1	95.9	95.5	95.0	94.8	94.7	94.5						
5	100.0	98.9	97.8	96.9	96.8	95.9	95.7	95.5	94.8	95.1	94.6	94.4						
6	100.0	98.7	97.8	96.9	96.6	96.0	96.0	95.4	94.9	95.0	94.6	94.3						
7	100.0	98.9	98.1	97.1	96.9	96.3	96.0	95.7	95.1	95.1	94.8	94.6						
8	100.0	98.7	97.8	96.9	96.6	95.8	95.8	95.4	94.7	94.8	94.4	94.3						
9	100.0	99.0	98.3	97.4	97.1	96.5	96.7	95.9	95.3	95.5	95.0	94.8						
10	100.0	98.9	98.0	97.0	96.8	96.2	95.8	95.5	94.8	94.9	94.6	94.4						
11	100.0	98.6	98.1	97.2	96.9	96.2	96.1	95.8	95.2	95.1	94.7	94.5						
12	100.0	98.9	98.1	97.2	97.0	96.3	96.4	95.7	95.1	95.3	94.8	94.6						
13	100.0	98.6	97.7	96.8	96.4	95.8	95.5	95.0	94.6	94.4	94.2	94.1						
14	100.0	99.0	98.0	96.8	96.6	95.9	95.8	95.4	94.9	94.9	94.5	94.3						
15	100.0	98.9	97.9	97.0	96.7	96.0	95.9	95.4	94.9	94.9	94.6	94.4						
16	100.0	98.9	98.1	97.1	96.7	96.2	96.1	95.6	95.1	94.9	94.8	94.6						
17	100.0	98.6	98.1	97.0	96.9	96.0	95.8	95.5	94.9	95.1	94.6	94.4						
18	100.0	99.0	98.2	97.2	97.0	96.2	96.1	95.7	95.1	95.1	94.8	94.6						
19	100.0	98.8	98.0	97.0	96.7	96.1	95.9	95.6	94.9	94.9	94.7	94.5						
20	100.0	98.6	97.8	96.9	96.7	95.9	95.8	95.3	94.9	95.0	94.5	94.3						
21	100.0	98.6	97.7	96.6	96.5	95.9	96.0	95.5	94.9	95.0	94.6	94.4						
22	100.0	98.5	97.7	96.5	96.4	95.6	95.3	95.0	94.5	94.4	94.3	94.1						
23	100.0	98.7	97.8	96.9	96.5	95.9	95.6	95.4	94.6	94.8	94.4	94.2						
24	100.0	98.7	97.8	96.9	96.6	96.0	96.1	95.5	94.9	95.1	94.6	94.5						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.8	97.9	97.0	96.7	96.0	95.9	95.5	94.9	94.9	94.6	94.4						
Med.	100.0	98.8	98.0	97.0	96.7	96.0	95.9	95.5	94.9	94.9	94.6	94.4						
σ	0.00	0.21	0.18	0.20	0.20	0.23	0.29	0.23	0.22	0.26	0.21	0.21						
Min.	100.0	98.5	97.6	96.5	96.4	95.5	95.3	95.0	94.4	94.4	94.1	93.8						
Max.	100.0	99.4	98.3	97.4	97.1	96.5	96.7	95.9	95.3	95.5	95.0	94.8						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	0.9724		
α	3.064E-06		
R ²	0.9336		
Calculated L ₇₀ (10K)	107000	hours	
Reported L ₇₀ (10K)	> 60000	hours	
Calculated L ₈₀ (10K)	63700	hours	
Reported L ₈₀ (10K)	> 60000	hours	
Calculated L ₉₀ (10K)	25300	hours	
Reported L ₉₀ (10K)	25300	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.*



Data Set 9 : 120 °C, 700 mA

Actual Case Temperature [T _s]	121.5 °C
Actual Ambient Temperature [T _A]	117.8 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 9-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	99.1	99.1	99.0	99.1	98.9	99.0	99.1	99.0	99.0	99.1	99.0						
2	100.0	99.0	99.0	99.0	99.0	98.9	99.0	99.0	98.9	99.0	99.0	98.9						
3	100.0	99.0	99.0	98.9	98.9	98.8	99.0	99.0	98.9	99.0	99.0	98.9						
4	100.0	99.0	99.0	98.9	99.0	98.9	99.0	99.0	98.9	98.9	99.0	98.9						
5	100.0	99.1	99.0	99.0	99.1	99.0	99.1	99.1	99.0	99.0	99.1	99.0						
6	100.0	99.1	99.0	99.0	99.1	99.0	99.1	99.1	99.0	99.0	99.1	99.0						
7	100.0	99.0	99.0	99.0	99.1	99.0	99.0	99.1	99.0	99.1	99.1	99.0						
8	100.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	98.9	99.0	99.0	99.0						
9	100.0	99.0	99.0	98.9	99.0	99.0	99.0	99.0	98.9	99.0	99.0	99.0						
10	100.0	99.0	99.0	98.9	99.0	99.0	99.1	99.0	98.9	99.0	99.0	99.0						
11	100.0	99.0	99.0	98.9	99.0	99.0	99.0	99.0	98.9	99.0	99.0	99.0						
12	100.0	99.0	99.0	99.0	99.1	99.0	99.1	99.1	98.9	99.1	99.1	99.0						
13	100.0	99.0	99.0	99.0	99.1	99.0	99.1	99.1	98.9	99.1	99.1	99.0						
14	100.0	99.0	99.1	99.0	99.1	99.0	99.1	99.1	99.0	99.1	99.1	99.0						
15	100.0	99.0	99.0	99.0	99.1	99.0	99.1	99.1	99.0	99.1	99.1	99.0						
16	100.0	98.9	98.9	98.9	99.0	98.9	99.0	99.0	98.8	98.9	99.0	98.9						
17	100.0	98.9	98.9	98.9	98.9	98.9	98.9	98.9	98.8	98.9	98.9	98.9						
18	100.0	98.9	98.9	98.9	98.9	98.9	98.9	98.9	98.8	98.9	98.9	98.9						
19	100.0	98.9	98.9	98.9	99.0	98.9	99.0	99.0	98.8	99.0	99.0	98.9						
20	100.0	98.9	98.9	98.9	99.0	98.9	98.9	99.0	98.8	99.0	99.0	98.9						
21	100.0	98.9	98.9	98.9	98.9	98.9	98.9	98.9	98.8	98.9	98.9	98.9						
22	100.0	98.9	98.9	98.8	98.9	98.9	98.9	98.9	98.8	98.9	98.9	98.9						
23	100.0	98.8	98.9	98.8	98.9	98.8	98.9	98.9	98.8	98.9	98.9	98.8						
24	100.0	98.8	98.8	98.8	98.9	98.8	98.8	98.9	98.7	98.9	98.8	98.8						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	99.0	99.0	98.9	99.0	98.9	99.0	99.0	98.9	99.0	99.0	98.9						
Med.	100.0	99.0	99.0	98.9	99.0	98.9	99.0	99.0	98.9	99.0	99.0	99.0						
σ	0.00	0.07	0.07	0.07	0.06	0.07	0.07	0.07	0.08	0.07	0.07	0.07						
Min.	100.0	98.8	98.8	98.8	98.9	98.8	98.8	98.9	98.7	98.9	98.8	98.8						
Max.	100.0	99.1	99.1	99.0	99.1	99.0	99.1	99.1	99.0	99.1	99.1	99.0						



Data Set 9 : 120 °C, 700 mA

Actual Case Temperature [T _S]	121.5 °C
Actual Ambient Temperature [T _A]	117.8 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 9-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.0000	0.0012	0.0013	0.0013	0.0014	0.0014	0.0014	0.0014	0.0017	0.0016	0.0019	0.0018						
2	0.0000	0.0013	0.0013	0.0013	0.0014	0.0014	0.0015	0.0016	0.0018	0.0017	0.0020	0.0020						
3	0.0000	0.0016	0.0014	0.0014	0.0014	0.0014	0.0014	0.0015	0.0016	0.0016	0.0019	0.0019						
4	0.0000	0.0014	0.0015	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0017	0.0020	0.0018						
5	0.0000	0.0016	0.0015	0.0015	0.0017	0.0014	0.0016	0.0015	0.0016	0.0016	0.0018	0.0017						
6	0.0000	0.0012	0.0014	0.0016	0.0016	0.0019	0.0020	0.0021	0.0021	0.0022	0.0025	0.0024						
7	0.0000	0.0014	0.0014	0.0014	0.0016	0.0014	0.0015	0.0015	0.0016	0.0016	0.0018	0.0018						
8	0.0000	0.0015	0.0014	0.0013	0.0016	0.0014	0.0015	0.0015	0.0016	0.0016	0.0018	0.0017						
9	0.0000	0.0014	0.0013	0.0013	0.0015	0.0013	0.0013	0.0015	0.0015	0.0015	0.0018	0.0017						
10	0.0000	0.0014	0.0013	0.0013	0.0015	0.0015	0.0014	0.0015	0.0016	0.0016	0.0019	0.0018						
11	0.0000	0.0014	0.0015	0.0015	0.0017	0.0015	0.0016	0.0016	0.0016	0.0016	0.0019	0.0018						
12	0.0000	0.0016	0.0014	0.0014	0.0016	0.0014	0.0014	0.0016	0.0016	0.0016	0.0018	0.0017						
13	0.0000	0.0013	0.0013	0.0014	0.0015	0.0014	0.0014	0.0015	0.0016	0.0016	0.0019	0.0019						
14	0.0000	0.0014	0.0013	0.0014	0.0015	0.0014	0.0015	0.0014	0.0017	0.0016	0.0019	0.0018						
15	0.0000	0.0014	0.0014	0.0015	0.0016	0.0015	0.0015	0.0016	0.0017	0.0017	0.0020	0.0018						
16	0.0000	0.0015	0.0013	0.0013	0.0015	0.0013	0.0014	0.0014	0.0015	0.0015	0.0017	0.0016						
17	0.0000	0.0015	0.0015	0.0014	0.0017	0.0015	0.0016	0.0015	0.0015	0.0017	0.0018	0.0018						
18	0.0000	0.0016	0.0014	0.0014	0.0016	0.0014	0.0015	0.0015	0.0016	0.0015	0.0018	0.0017						
19	0.0000	0.0015	0.0013	0.0013	0.0015	0.0013	0.0015	0.0015	0.0015	0.0016	0.0017	0.0016						
20	0.0000	0.0015	0.0014	0.0013	0.0016	0.0013	0.0015	0.0014	0.0015	0.0015	0.0017	0.0016						
21	0.0000	0.0014	0.0013	0.0011	0.0014	0.0013	0.0013	0.0013	0.0014	0.0014	0.0016	0.0016						
22	0.0000	0.0014	0.0013	0.0013	0.0015	0.0013	0.0014	0.0014	0.0015	0.0015	0.0018	0.0017						
23	0.0000	0.0016	0.0014	0.0013	0.0016	0.0015	0.0015	0.0014	0.0016	0.0015	0.0017	0.0017						
24	0.0000	0.0013	0.0013	0.0014	0.0015	0.0014	0.0013	0.0015	0.0015	0.0015	0.0018	0.0017						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.0000	0.0014	0.0014	0.0014	0.0016	0.0014	0.0015	0.0015	0.0016	0.0016	0.0018	0.0018						
Med.	0.0000	0.0014	0.0014	0.0014	0.0015	0.0014	0.0015	0.0015	0.0016	0.0016	0.0018	0.0017						
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002						
Min.	0.0000	0.0012	0.0013	0.0011	0.0014	0.0013	0.0013	0.0013	0.0014	0.0014	0.0016	0.0016						
Max.	0.0000	0.0016	0.0015	0.0016	0.0017	0.0019	0.0020	0.0021	0.0021	0.0022	0.0025	0.0024						

Data Set 9 : 120 °C, 700 mA

Actual Case Temperature [T _S]	121.5 °C
Actual Ambient Temperature [T _A]	117.8 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 9-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2637	0.2625	0.2624	0.2625	0.2623	0.2625	0.2625	0.2626	0.2625	0.2625	0.2626	0.2626						
2	0.2643	0.2630	0.2630	0.2631	0.2629	0.2632	0.2631	0.2632	0.2632	0.2631	0.2633	0.2632						
3	0.2656	0.2640	0.2643	0.2644	0.2642	0.2645	0.2645	0.2645	0.2646	0.2645	0.2646	0.2645						
4	0.2655	0.2641	0.2641	0.2642	0.2640	0.2643	0.2642	0.2642	0.2643	0.2642	0.2643	0.2643						
5	0.2636	0.2621	0.2621	0.2621	0.2619	0.2623	0.2621	0.2622	0.2622	0.2622	0.2623	0.2622						
6	0.2650	0.2638	0.2639	0.2641	0.2640	0.2642	0.2642	0.2642	0.2641	0.2642	0.2642	0.2642						
7	0.2639	0.2625	0.2625	0.2625	0.2623	0.2626	0.2625	0.2625	0.2626	0.2625	0.2626	0.2625						
8	0.2630	0.2616	0.2616	0.2617	0.2614	0.2617	0.2616	0.2616	0.2617	0.2616	0.2618	0.2617						
9	0.2634	0.2621	0.2621	0.2621	0.2619	0.2622	0.2622	0.2621	0.2622	0.2622	0.2623	0.2622						
10	0.2647	0.2633	0.2634	0.2634	0.2632	0.2634	0.2634	0.2634	0.2635	0.2634	0.2636	0.2635						
11	0.2655	0.2641	0.2640	0.2640	0.2638	0.2641	0.2640	0.2640	0.2642	0.2641	0.2642	0.2641						
12	0.2641	0.2626	0.2627	0.2627	0.2625	0.2628	0.2628	0.2627	0.2628	0.2628	0.2629	0.2629						
13	0.2639	0.2626	0.2626	0.2626	0.2624	0.2627	0.2627	0.2627	0.2627	0.2627	0.2628	0.2628						
14	0.2644	0.2630	0.2631	0.2631	0.2629	0.2632	0.2631	0.2632	0.2632	0.2631	0.2632	0.2632						
15	0.2648	0.2634	0.2634	0.2634	0.2632	0.2635	0.2635	0.2635	0.2636	0.2635	0.2636	0.2636						
16	0.2665	0.2651	0.2652	0.2652	0.2650	0.2654	0.2652	0.2652	0.2653	0.2652	0.2654	0.2653						
17	0.2650	0.2636	0.2635	0.2636	0.2633	0.2636	0.2635	0.2636	0.2637	0.2635	0.2637	0.2636						
18	0.2660	0.2645	0.2646	0.2646	0.2644	0.2647	0.2646	0.2646	0.2647	0.2647	0.2648	0.2647						
19	0.2652	0.2638	0.2639	0.2639	0.2637	0.2640	0.2638	0.2638	0.2639	0.2638	0.2640	0.2639						
20	0.2652	0.2638	0.2638	0.2639	0.2636	0.2640	0.2638	0.2639	0.2639	0.2639	0.2640	0.2639						
21	0.2642	0.2629	0.2629	0.2631	0.2628	0.2631	0.2630	0.2630	0.2631	0.2631	0.2632	0.2631						
22	0.2662	0.2648	0.2649	0.2649	0.2647	0.2650	0.2649	0.2649	0.2650	0.2649	0.2650	0.2649						
23	0.2645	0.2630	0.2631	0.2632	0.2629	0.2632	0.2631	0.2632	0.2632	0.2632	0.2633	0.2632						
24	0.2648	0.2635	0.2635	0.2635	0.2633	0.2636	0.2636	0.2635	0.2636	0.2636	0.2636	0.2636						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2647	0.2633	0.2634	0.2634	0.2632	0.2635	0.2634	0.2634	0.2635	0.2634	0.2636	0.2635						
Med.	0.2648	0.2634	0.2634	0.2634	0.2632	0.2635	0.2635	0.2635	0.2636	0.2635	0.2636	0.2636						
σ	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009						
Min.	0.2630	0.2616	0.2616	0.2617	0.2614	0.2617	0.2616	0.2616	0.2617	0.2616	0.2618	0.2617						
Max.	0.2665	0.2651	0.2652	0.2652	0.2650	0.2654	0.2652	0.2652	0.2653	0.2652	0.2654	0.2653						



Data Set 9 : 120 °C, 700 mA

Actual Case Temperature [T _S]	121.5 °C
Actual Ambient Temperature [T _A]	117.8 °C
Drive Current [I _F]	700 mA
Measurement Current	700 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 9-6
Chromaticity

LED No.	Chromaticity v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.5226	0.5224	0.5228	0.5230	0.5225	0.5233	0.5233	0.5235	0.5238	0.5236	0.5241	0.5240						
2	0.5244	0.5241	0.5247	0.5250	0.5245	0.5253	0.5253	0.5255	0.5258	0.5256	0.5261	0.5261						
3	0.5279	0.5276	0.5284	0.5286	0.5281	0.5288	0.5288	0.5289	0.5292	0.5291	0.5295	0.5294						
4	0.5288	0.5286	0.5292	0.5294	0.5290	0.5297	0.5297	0.5298	0.5300	0.5299	0.5304	0.5302						
5	0.5237	0.5232	0.5236	0.5239	0.5234	0.5242	0.5241	0.5242	0.5245	0.5244	0.5249	0.5247						
6	0.5266	0.5269	0.5275	0.5279	0.5279	0.5283	0.5284	0.5285	0.5285	0.5287	0.5290	0.5289						
7	0.5255	0.5252	0.5255	0.5257	0.5253	0.5261	0.5259	0.5261	0.5264	0.5263	0.5268	0.5266						
8	0.5249	0.5245	0.5249	0.5251	0.5247	0.5255	0.5254	0.5255	0.5258	0.5257	0.5263	0.5260						
9	0.5247	0.5243	0.5247	0.5249	0.5245	0.5253	0.5253	0.5254	0.5256	0.5256	0.5261	0.5259						
10	0.5243	0.5240	0.5244	0.5246	0.5242	0.5250	0.5249	0.5250	0.5253	0.5253	0.5258	0.5256						
11	0.5248	0.5245	0.5248	0.5250	0.5246	0.5254	0.5253	0.5254	0.5257	0.5256	0.5262	0.5259						
12	0.5247	0.5243	0.5247	0.5249	0.5245	0.5253	0.5253	0.5254	0.5257	0.5257	0.5261	0.5259						
13	0.5249	0.5246	0.5251	0.5254	0.5248	0.5257	0.5256	0.5258	0.5260	0.5259	0.5264	0.5264						
14	0.5255	0.5252	0.5257	0.5259	0.5254	0.5263	0.5262	0.5263	0.5267	0.5265	0.5270	0.5269						
15	0.5269	0.5267	0.5272	0.5274	0.5268	0.5277	0.5276	0.5278	0.5281	0.5280	0.5285	0.5283						
16	0.5273	0.5269	0.5274	0.5276	0.5271	0.5279	0.5278	0.5279	0.5282	0.5281	0.5286	0.5284						
17	0.5244	0.5240	0.5244	0.5246	0.5241	0.5249	0.5248	0.5249	0.5252	0.5251	0.5256	0.5255						
18	0.5270	0.5266	0.5270	0.5273	0.5268	0.5276	0.5275	0.5276	0.5279	0.5278	0.5283	0.5281						
19	0.5265	0.5261	0.5265	0.5267	0.5263	0.5271	0.5269	0.5271	0.5273	0.5273	0.5277	0.5275						
20	0.5263	0.5259	0.5263	0.5265	0.5261	0.5268	0.5267	0.5268	0.5270	0.5270	0.5275	0.5273						
21	0.5262	0.5258	0.5262	0.5265	0.5260	0.5268	0.5267	0.5268	0.5270	0.5270	0.5274	0.5273						
22	0.5255	0.5252	0.5256	0.5258	0.5254	0.5261	0.5260	0.5261	0.5264	0.5263	0.5268	0.5266						
23	0.5251	0.5247	0.5251	0.5254	0.5249	0.5258	0.5256	0.5257	0.5260	0.5259	0.5263	0.5262						
24	0.5254	0.5251	0.5255	0.5258	0.5252	0.5261	0.5260	0.5261	0.5263	0.5263	0.5267	0.5266						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.5256	0.5253	0.5257	0.5260	0.5255	0.5263	0.5262	0.5263	0.5266	0.5265	0.5270	0.5268						
Med.	0.5255	0.5252	0.5255	0.5258	0.5253	0.5261	0.5260	0.5261	0.5264	0.5263	0.5268	0.5266						
σ	0.0014	0.0014	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015						
Min.	0.5226	0.5224	0.5228	0.5230	0.5225	0.5233	0.5233	0.5235	0.5238	0.5236	0.5241	0.5240						
Max.	0.5288	0.5286	0.5292	0.5294	0.5290	0.5297	0.5297	0.5298	0.5300	0.5299	0.5304	0.5302						

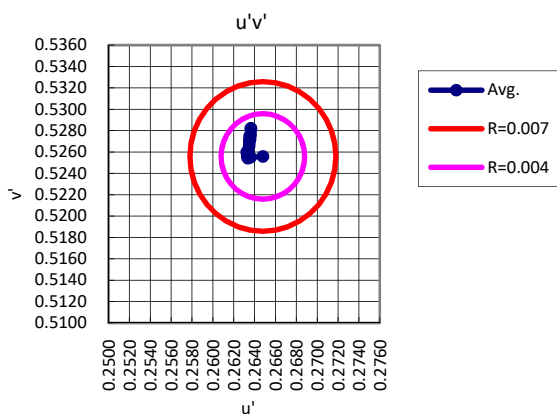
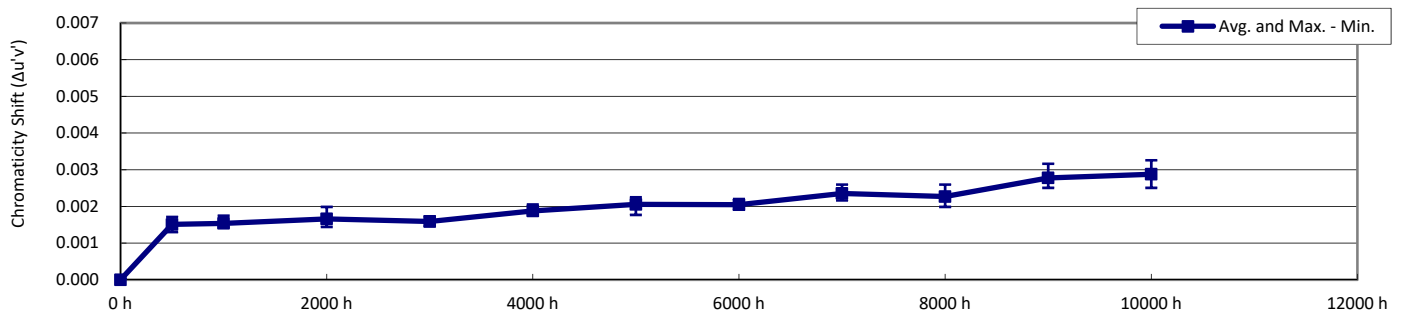
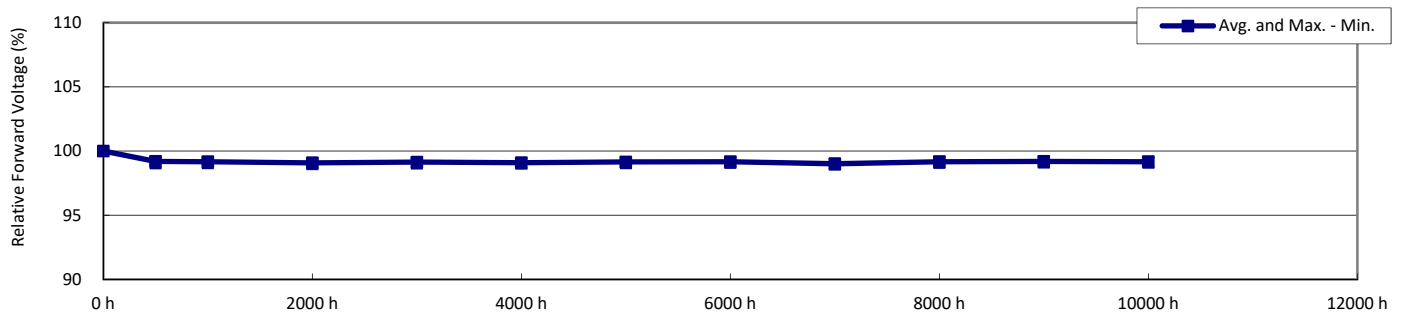
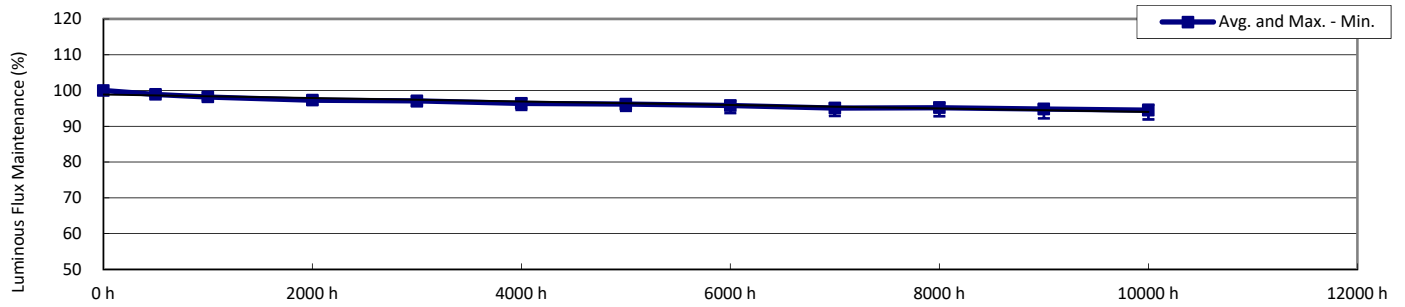
Data Set 10 : 120 °C, 1200 mA

Actual Case Temperature [T_S]	121.1 °C
Actual Ambient Temperature [T_A]	117.7 °C
Drive Current [I_F]	1200 mA
Measurement Current	1200 mA

NOTES:

 T_S and T_A were measured during initial setup.

Number of LED failures: 0



Data Set 10 : 120 °C, 1200 mA

Actual Case Temperature [T _S]	121.1 °C
Actual Ambient Temperature [T _A]	117.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 10-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _V [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	384	3.12	2615	3.75	0.464	0.407	0.267	0.527						
2	387	3.11	2633	3.74	0.465	0.410	0.266	0.528						
3	377	3.10	2631	3.72	0.463	0.407	0.266	0.526						
4	388	3.11	2643	3.73	0.461	0.405	0.266	0.525						
5	392	3.11	2677	3.73	0.458	0.404	0.264	0.525						
6	395	3.11	2687	3.74	0.458	0.405	0.264	0.525						
7	393	3.11	2683	3.73	0.459	0.406	0.264	0.526						
8	394	3.11	2693	3.73	0.457	0.405	0.263	0.525						
9	393	3.11	2668	3.73	0.458	0.404	0.265	0.524						
10	394	3.11	2677	3.74	0.459	0.405	0.264	0.525						
11	387	3.11	2599	3.74	0.467	0.410	0.267	0.528						
12	390	3.12	2653	3.75	0.460	0.405	0.265	0.525						
13	386	3.1	2662	3.71	0.459	0.405	0.265	0.525						
14	389	3.1	2670	3.71	0.459	0.404	0.265	0.525						
15	393	3.1	2695	3.72	0.457	0.405	0.263	0.525						
16	389	3.1	2668	3.71	0.459	0.404	0.265	0.525						
17	390	3.1	2636	3.71	0.464	0.410	0.266	0.528						
18	394	3.1	2728	3.70	0.452	0.400	0.262	0.522						
19	392	3.1	2683	3.71	0.457	0.403	0.264	0.524						
20	393	3.1	2674	3.72	0.459	0.406	0.264	0.525						
21	383	3.1	2608	3.76	0.468	0.412	0.267	0.529						
22	381	3.1	2619	3.77	0.465	0.409	0.267	0.527						
23	387	3.1	2661	3.77	0.460	0.405	0.265	0.525						
24	389	3.1	2685	3.77	0.458	0.405	0.264	0.525						
n	24	24	24	24	24	24	24	24						
Avg.	389	3.11	2660	3.73	0.460	0.406	0.265	0.526						
Med.	390	3.11	2668	3.73	0.459	0.405	0.265	0.525						
σ	4.5	0.016	31.5	0.019	0.0037	0.0027	0.0013	0.0016						
Min.	377	3.09	2599	3.70	0.452	0.400	0.262	0.522						
Max.	395	3.14	2728	3.77	0.468	0.412	0.267	0.529						



Data Set 10 : 120 °C, 1200 mA

Actual Case Temperature [T _S]	121.1 °C
Actual Ambient Temperature [T _A]	117.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 10-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.3	97.7	96.9	96.8	96.1	95.6	95.4	94.8	94.7	94.5	94.1						
2	100.0	99.2	98.3	97.6	97.3	96.6	96.4	96.0	95.4	95.6	95.0	95.0						
3	100.0	99.1	98.6	98.1	97.9	97.1	97.2	96.5	95.8	96.1	95.5	95.2						
4	100.0	98.8	98.4	97.4	97.4	96.7	96.8	96.4	95.6	95.9	95.6	95.3						
5	100.0	99.1	98.2	97.6	97.4	96.7	96.7	96.4	95.7	95.7	95.3	95.0						
6	100.0	98.6	97.9	97.1	97.1	96.4	96.6	96.0	95.3	95.7	95.1	94.9						
7	100.0	98.9	98.2	97.4	97.2	96.6	96.4	96.0	95.2	95.6	95.2	95.1						
8	100.0	98.9	98.1	97.3	97.3	96.6	96.4	96.1	95.5	95.8	95.4	95.2						
9	100.0	99.6	98.9	97.9	97.9	97.2	97.3	96.6	95.9	96.1	95.7	95.5						
10	100.0	99.3	98.4	97.7	97.4	96.7	96.6	96.2	95.7	95.8	95.4	95.2						
11	100.0	99.1	98.4	97.3	97.5	96.8	96.4	96.2	95.3	95.5	95.3	95.0						
12	100.0	100.0	99.3	98.4	98.4	97.7	97.5	97.1	96.4	96.6	96.2	96.0						
13	100.0	99.6	99.2	98.4	98.3	97.5	97.3	96.8	96.2	96.2	95.9	95.7						
14	100.0	99.2	98.5	97.8	97.7	97.2	96.8	96.6	95.8	96.1	95.5	95.2						
15	100.0	99.3	98.7	97.9	98.0	97.3	97.3	96.9	96.1	96.3	95.8	95.7						
16	100.0	98.4	98.0	97.1	97.0	96.2	95.9	95.8	94.9	95.1	94.8	94.5						
17	100.0	99.3	98.2	97.5	97.2	96.7	96.6	96.1	95.5	95.6	95.1	94.8						
18	100.0	98.5	98.0	97.2	97.1	96.4	96.4	95.8	95.1	95.3	94.7	94.5						
19	100.0	98.3	97.7	96.9	96.5	96.0	95.7	95.3	94.6	94.6	94.0	93.9						
20	100.0	98.3	97.7	96.9	96.9	96.1	95.9	95.6	94.8	95.0	94.8	94.3						
21	100.0	98.3	97.3	96.1	95.6	94.7	94.5	93.8	93.0	92.9	92.4	92.1						
22	100.0	98.4	97.7	96.4	95.8	95.0	94.5	94.0	93.3	93.0	92.5	92.3						
23	100.0	98.4	97.4	96.2	95.7	94.8	94.3	93.8	93.0	93.1	92.4	92.0						
24	100.0	98.3	97.3	96.1	95.6	94.6	94.4	93.7	92.9	92.8	92.2	91.9						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.9	98.2	97.3	97.1	96.4	96.2	95.8	95.1	95.2	94.8	94.5						
Med.	100.0	98.9	98.2	97.4	97.3	96.6	96.4	96.1	95.4	95.6	95.2	95.0						
σ	0.00	0.50	0.54	0.66	0.80	0.86	0.96	1.00	1.03	1.14	1.19	1.22						
Min.	100.0	98.3	97.3	96.1	95.6	94.6	94.3	93.7	92.9	92.8	92.2	91.9						
Max.	100.0	100.0	99.3	98.4	98.4	97.7	97.5	97.1	96.4	96.6	96.2	96.0						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	0.9774		
α	3.416E-06		
R ²	0.9320		
Calculated L ₇₀ (10K)	97700	hours	
Reported L ₇₀ (10K)	> 60000	hours	
Calculated L ₈₀ (10K)	58600	hours	
Reported L ₈₀ (10K)	58600	hours	
Calculated L ₉₀ (10K)	24200	hours	
Reported L ₉₀ (10K)	24200	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

*The certificate shall not be reproduced, except in full, without written approval of the laboratory.
The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.*



Data Set 10 : 120 °C, 1200 mA

Actual Case Temperature [T _S]	121.1 °C
Actual Ambient Temperature [T _A]	117.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 10-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.9	98.9	98.8	98.8	98.7	98.8	98.8	98.7	98.8	98.8	98.8						
2	100.0	99.3	99.3	99.2	99.2	99.2	99.3	99.3	99.1	99.3	99.3	99.3						
3	100.0	98.9	98.8	98.7	98.8	98.7	98.8	98.8	98.7	98.8	98.8	98.9						
4	100.0	99.3	99.3	99.2	99.3	99.3	99.3	99.3	99.2	99.3	99.4	99.3						
5	100.0	99.3	99.3	99.2	99.3	99.2	99.3	99.3	99.1	99.3	99.3	99.3						
6	100.0	99.3	99.2	99.2	99.2	99.2	99.2	99.2	99.1	99.2	99.2	99.2						
7	100.0	99.3	99.3	99.2	99.3	99.2	99.3	99.3	99.1	99.3	99.4	99.3						
8	100.0	99.4	99.4	99.3	99.3	99.3	99.3	99.3	99.2	99.4	99.4	99.3						
9	100.0	99.3	99.3	99.2	99.3	99.2	99.3	99.3	99.1	99.3	99.3	99.3						
10	100.0	99.3	99.3	99.2	99.3	99.2	99.3	99.3	99.1	99.3	99.4	99.3						
11	100.0	99.3	99.3	99.2	99.3	99.2	99.3	99.3	99.1	99.3	99.3	99.3						
12	100.0	99.2	99.1	99.0	99.1	99.1	99.1	99.2	98.9	99.1	99.2	99.1						
13	100.0	99.3	99.2	99.1	99.2	99.1	99.2	99.2	99.1	99.2	99.2	99.2						
14	100.0	99.3	99.3	99.2	99.2	99.2	99.2	99.3	99.1	99.3	99.3	99.3						
15	100.0	99.4	99.4	99.3	99.3	99.3	99.3	99.3	99.2	99.3	99.3	99.3						
16	100.0	99.3	99.3	99.2	99.2	99.2	99.2	99.2	99.1	99.2	99.3	99.2						
17	100.0	99.5	99.5	99.4	99.5	99.4	99.5	99.5	99.4	99.5	99.6	99.5						
18	100.0	99.3	99.3	99.1	99.2	99.1	99.2	99.2	99.1	99.2	99.3	99.2						
19	100.0	99.3	99.2	99.2	99.2	99.2	99.2	99.2	99.1	99.2	99.3	99.2						
20	100.0	99.4	99.4	99.3	99.3	99.3	99.3	99.3	99.2	99.3	99.4	99.3						
21	100.0	98.8	98.8	98.7	98.8	98.7	98.8	98.8	98.6	98.8	98.8	98.8						
22	100.0	98.7	98.7	98.7	98.7	98.7	98.7	98.8	98.6	98.8	98.8	98.8						
23	100.0	98.7	98.7	98.6	98.7	98.7	98.7	98.8	98.6	98.8	98.8	98.7						
24	100.0	98.7	98.7	98.6	98.7	98.6	98.7	98.7	98.6	98.7	98.7	98.7						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	99.2	99.2	99.1	99.1	99.1	99.2	99.2	99.0	99.2	99.2	99.2						
Med.	100.0	99.3	99.3	99.2	99.2	99.2	99.2	99.3	99.1	99.3	99.3	99.3						
σ	0.00	0.25	0.24	0.24	0.25	0.23	0.24	0.24	0.23	0.23	0.24	0.23						
Min.	100.0	98.7	98.7	98.6	98.7	98.6	98.7	98.7	98.6	98.7	98.7	98.7						
Max.	100.0	99.5	99.5	99.4	99.5	99.4	99.5	99.5	99.4	99.5	99.6	99.5						



Data Set 10 : 120 °C, 1200 mA

Actual Case Temperature [T _S]	121.1 °C
Actual Ambient Temperature [T _A]	117.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 10-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.0000	0.0015	0.0017	0.0018	0.0017	0.0020	0.0022	0.0021	0.0025	0.0024	0.0029	0.0030						
2	0.0000	0.0015	0.0015	0.0018	0.0016	0.0019	0.0022	0.0021	0.0025	0.0023	0.0029	0.0029						
3	0.0000	0.0016	0.0017	0.0020	0.0017	0.0021	0.0022	0.0022	0.0025	0.0023	0.0028	0.0029						
4	0.0000	0.0015	0.0015	0.0016	0.0016	0.0018	0.0018	0.0020	0.0022	0.0022	0.0027	0.0028						
5	0.0000	0.0015	0.0016	0.0017	0.0015	0.0018	0.0018	0.0020	0.0023	0.0022	0.0028	0.0030						
6	0.0000	0.0014	0.0015	0.0016	0.0015	0.0018	0.0018	0.0021	0.0024	0.0023	0.0028	0.0029						
7	0.0000	0.0015	0.0015	0.0016	0.0016	0.0018	0.0020	0.0021	0.0023	0.0023	0.0027	0.0028						
8	0.0000	0.0014	0.0015	0.0016	0.0015	0.0018	0.0020	0.0019	0.0022	0.0022	0.0026	0.0028						
9	0.0000	0.0015	0.0015	0.0014	0.0015	0.0018	0.0020	0.0020	0.0023	0.0023	0.0028	0.0030						
10	0.0000	0.0016	0.0015	0.0016	0.0015	0.0018	0.0019	0.0019	0.0022	0.0022	0.0027	0.0028						
11	0.0000	0.0016	0.0016	0.0016	0.0017	0.0019	0.0021	0.0021	0.0023	0.0022	0.0028	0.0029						
12	0.0000	0.0017	0.0016	0.0017	0.0017	0.0018	0.0021	0.0020	0.0022	0.0022	0.0027	0.0028						
13	0.0000	0.0016	0.0017	0.0018	0.0017	0.0020	0.0022	0.0022	0.0024	0.0023	0.0028	0.0030						
14	0.0000	0.0015	0.0015	0.0017	0.0016	0.0020	0.0022	0.0021	0.0025	0.0024	0.0029	0.0030						
15	0.0000	0.0015	0.0016	0.0016	0.0016	0.0018	0.0021	0.0021	0.0023	0.0023	0.0028	0.0030						
16	0.0000	0.0015	0.0015	0.0016	0.0016	0.0019	0.0021	0.0021	0.0023	0.0023	0.0029	0.0029						
17	0.0000	0.0014	0.0015	0.0016	0.0016	0.0018	0.0021	0.0020	0.0023	0.0022	0.0027	0.0028						
18	0.0000	0.0015	0.0016	0.0017	0.0016	0.0020	0.0022	0.0021	0.0026	0.0025	0.0030	0.0031						
19	0.0000	0.0014	0.0014	0.0016	0.0015	0.0019	0.0022	0.0022	0.0025	0.0026	0.0032	0.0033						
20	0.0000	0.0013	0.0014	0.0016	0.0015	0.0018	0.0020	0.0020	0.0024	0.0024	0.0029	0.0030						
21	0.0000	0.0016	0.0015	0.0016	0.0016	0.0018	0.0019	0.0019	0.0022	0.0021	0.0025	0.0025						
22	0.0000	0.0016	0.0016	0.0017	0.0017	0.0018	0.0019	0.0019	0.0022	0.0020	0.0025	0.0025						
23	0.0000	0.0015	0.0015	0.0016	0.0015	0.0019	0.0020	0.0020	0.0023	0.0021	0.0027	0.0027						
24	0.0000	0.0015	0.0015	0.0016	0.0015	0.0018	0.0020	0.0020	0.0024	0.0021	0.0027	0.0028						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.0000	0.0015	0.0015	0.0017	0.0016	0.0019	0.0021	0.0020	0.0024	0.0023	0.0028	0.0029						
Med.	0.0000	0.0015	0.0015	0.0016	0.0016	0.0018	0.0020	0.0020	0.0023	0.0023	0.0028	0.0029						
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0002						
Min.	0.0000	0.0013	0.0014	0.0014	0.0015	0.0018	0.0018	0.0019	0.0022	0.0020	0.0025	0.0025						
Max.	0.0000	0.0017	0.0017	0.0020	0.0017	0.0021	0.0022	0.0022	0.0026	0.0026	0.0032	0.0033						



Data Set 10 : 120 °C, 1200 mA

Actual Case Temperature [T _S]	121.1 °C
Actual Ambient Temperature [T _A]	117.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 10-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2653	0.2638	0.2638	0.2639	0.2637	0.2640	0.2641	0.2640	0.2641	0.2640	0.2641	0.2641						
2	0.2639	0.2625	0.2626	0.2628	0.2625	0.2628	0.2629	0.2629	0.2629	0.2629	0.2629	0.2629	0.2630					
3	0.2648	0.2632	0.2632	0.2633	0.2632	0.2634	0.2636	0.2634	0.2636	0.2635	0.2636	0.2636						
4	0.2641	0.2626	0.2627	0.2628	0.2625	0.2628	0.2627	0.2627	0.2628	0.2627	0.2628	0.2628						
5	0.2628	0.2613	0.2614	0.2615	0.2613	0.2615	0.2615	0.2615	0.2616	0.2615	0.2616	0.2616						
6	0.2624	0.2610	0.2611	0.2613	0.2610	0.2612	0.2613	0.2612	0.2613	0.2613	0.2614	0.2614						
7	0.2623	0.2608	0.2609	0.2610	0.2608	0.2610	0.2611	0.2610	0.2611	0.2610	0.2612	0.2612						
8	0.2619	0.2605	0.2605	0.2606	0.2604	0.2606	0.2607	0.2607	0.2608	0.2607	0.2608	0.2608						
9	0.2636	0.2621	0.2622	0.2624	0.2622	0.2624	0.2626	0.2624	0.2625	0.2624	0.2626	0.2625						
10	0.2628	0.2612	0.2614	0.2615	0.2613	0.2615	0.2616	0.2615	0.2616	0.2615	0.2616	0.2616						
11	0.2657	0.2641	0.2642	0.2644	0.2641	0.2643	0.2644	0.2644	0.2645	0.2644	0.2645	0.2645						
12	0.2642	0.2625	0.2626	0.2627	0.2625	0.2628	0.2628	0.2628	0.2629	0.2628	0.2630	0.2630						
13	0.2636	0.2620	0.2620	0.2621	0.2619	0.2621	0.2621	0.2621	0.2622	0.2621	0.2623	0.2622						
14	0.2632	0.2617	0.2618	0.2618	0.2616	0.2618	0.2618	0.2618	0.2619	0.2618	0.2619	0.2620						
15	0.2624	0.2609	0.2609	0.2611	0.2608	0.2611	0.2611	0.2610	0.2612	0.2611	0.2612	0.2612						
16	0.2634	0.2619	0.2620	0.2621	0.2618	0.2621	0.2621	0.2621	0.2622	0.2621	0.2622	0.2623						
17	0.2642	0.2628	0.2629	0.2630	0.2627	0.2630	0.2630	0.2630	0.2631	0.2630	0.2631	0.2631						
18	0.2613	0.2598	0.2598	0.2599	0.2597	0.2600	0.2601	0.2600	0.2601	0.2600	0.2601	0.2601						
19	0.2628	0.2614	0.2615	0.2616	0.2614	0.2616	0.2616	0.2616	0.2617	0.2616	0.2618	0.2618						
20	0.2627	0.2614	0.2614	0.2615	0.2613	0.2615	0.2616	0.2616	0.2617	0.2616	0.2617	0.2617						
21	0.2654	0.2638	0.2640	0.2641	0.2639	0.2642	0.2643	0.2642	0.2643	0.2642	0.2643	0.2643						
22	0.2649	0.2633	0.2634	0.2635	0.2632	0.2635	0.2636	0.2635	0.2637	0.2636	0.2637	0.2637						
23	0.2634	0.2619	0.2620	0.2621	0.2619	0.2621	0.2622	0.2621	0.2623	0.2621	0.2623	0.2623						
24	0.2626	0.2611	0.2612	0.2613	0.2611	0.2614	0.2615	0.2614	0.2615	0.2615	0.2616	0.2615						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2635	0.2620	0.2621	0.2622	0.2620	0.2622	0.2623	0.2622	0.2623	0.2622	0.2623	0.2623						
Med.	0.2634	0.2619	0.2620	0.2621	0.2619	0.2621	0.2621	0.2621	0.2622	0.2621	0.2623	0.2623						
σ	0.0012	0.0011	0.0011	0.0011	0.0011	0.0011	0.0012	0.0012	0.0012	0.0012	0.0011	0.0011						
Min.	0.2613	0.2598	0.2598	0.2599	0.2597	0.2600	0.2601	0.2600	0.2601	0.2600	0.2601	0.2601						
Max.	0.2657	0.2641	0.2642	0.2644	0.2641	0.2643	0.2644	0.2644	0.2645	0.2644	0.2645	0.2645						

Data Set 10 : 120 °C, 1200 mA

Actual Case Temperature [T _S]	121.1 °C
Actual Ambient Temperature [T _A]	117.7 °C
Drive Current [I _F]	1200 mA
Measurement Current	1200 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 10-6
Chromaticity

LED No.	Chromaticity v'																
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h					
1	0.5252	0.5254	0.5259	0.5264	0.5257	0.5267	0.5271	0.5269	0.5274	0.5272	0.5278	0.5279					
2	0.5266	0.5270	0.5274	0.5280	0.5273	0.5282	0.5286	0.5285	0.5289	0.5287	0.5293	0.5294					
3	0.5251	0.5253	0.5258	0.5264	0.5256	0.5266	0.5270	0.5268	0.5273	0.5270	0.5276	0.5277					
4	0.5240	0.5240	0.5246	0.5250	0.5243	0.5252	0.5251	0.5254	0.5258	0.5257	0.5264	0.5265					
5	0.5232	0.5233	0.5239	0.5243	0.5235	0.5245	0.5244	0.5247	0.5252	0.5250	0.5257	0.5259					
6	0.5239	0.5240	0.5247	0.5250	0.5244	0.5253	0.5253	0.5256	0.5260	0.5259	0.5265	0.5266					
7	0.5242	0.5242	0.5247	0.5251	0.5246	0.5255	0.5258	0.5258	0.5262	0.5261	0.5267	0.5268					
8	0.5237	0.5236	0.5241	0.5246	0.5240	0.5249	0.5253	0.5252	0.5256	0.5255	0.5261	0.5263					
9	0.5234	0.5233	0.5238	0.5242	0.5238	0.5247	0.5251	0.5250	0.5254	0.5254	0.5260	0.5262					
10	0.5239	0.5238	0.5243	0.5248	0.5241	0.5251	0.5254	0.5253	0.5258	0.5257	0.5263	0.5264					
11	0.5270	0.5271	0.5276	0.5280	0.5275	0.5283	0.5287	0.5286	0.5290	0.5288	0.5295	0.5296					
12	0.5243	0.5241	0.5247	0.5251	0.5245	0.5255	0.5258	0.5257	0.5261	0.5260	0.5267	0.5268					
13	0.5239	0.5238	0.5244	0.5249	0.5242	0.5252	0.5255	0.5255	0.5259	0.5257	0.5264	0.5265					
14	0.5236	0.5236	0.5241	0.5246	0.5239	0.5250	0.5253	0.5252	0.5257	0.5255	0.5262	0.5263					
15	0.5241	0.5240	0.5245	0.5250	0.5244	0.5254	0.5258	0.5257	0.5261	0.5260	0.5266	0.5268					
16	0.5235	0.5234	0.5240	0.5245	0.5239	0.5249	0.5252	0.5251	0.5255	0.5254	0.5261	0.5262					
17	0.5265	0.5266	0.5272	0.5276	0.5270	0.5279	0.5282	0.5281	0.5285	0.5284	0.5290	0.5291					
18	0.5209	0.5208	0.5214	0.5219	0.5213	0.5224	0.5228	0.5226	0.5232	0.5230	0.5236	0.5238					
19	0.5227	0.5227	0.5233	0.5237	0.5232	0.5242	0.5246	0.5245	0.5250	0.5250	0.5257	0.5258					
20	0.5242	0.5242	0.5248	0.5253	0.5247	0.5256	0.5259	0.5259	0.5264	0.5263	0.5269	0.5270					
21	0.5282	0.5282	0.5288	0.5291	0.5287	0.5295	0.5298	0.5297	0.5301	0.5299	0.5305	0.5305					
22	0.5261	0.5261	0.5266	0.5270	0.5263	0.5273	0.5275	0.5274	0.5279	0.5276	0.5283	0.5283					
23	0.5240	0.5240	0.5246	0.5250	0.5243	0.5254	0.5256	0.5255	0.5260	0.5257	0.5265	0.5265					
24	0.5237	0.5237	0.5242	0.5247	0.5240	0.5251	0.5254	0.5253	0.5258	0.5255	0.5262	0.5263					
n	24	24	24	24	24	24	24	24	24	24	24	24					
Avg.	0.5244	0.5244	0.5250	0.5254	0.5248	0.5258	0.5261	0.5260	0.5265	0.5263	0.5269	0.5271					
Med.	0.5240	0.5240	0.5246	0.5250	0.5244	0.5254	0.5256	0.5256	0.5260	0.5258	0.5265	0.5266					
σ	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0015	0.0015	0.0015	0.0015					
Min.	0.5209	0.5208	0.5214	0.5219	0.5213	0.5224	0.5228	0.5226	0.5232	0.5230	0.5236	0.5238					
Max.	0.5282	0.5282	0.5288	0.5291	0.5287	0.5295	0.5298	0.5297	0.5301	0.5299	0.5305	0.5305					

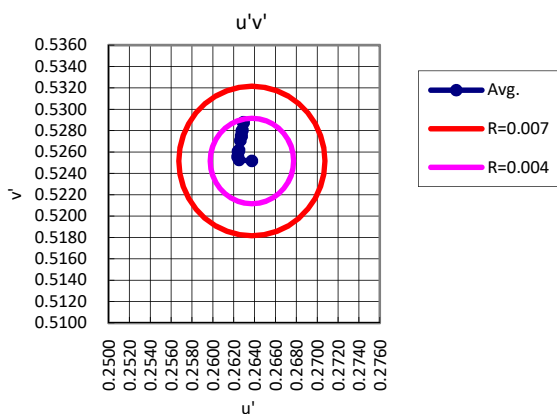
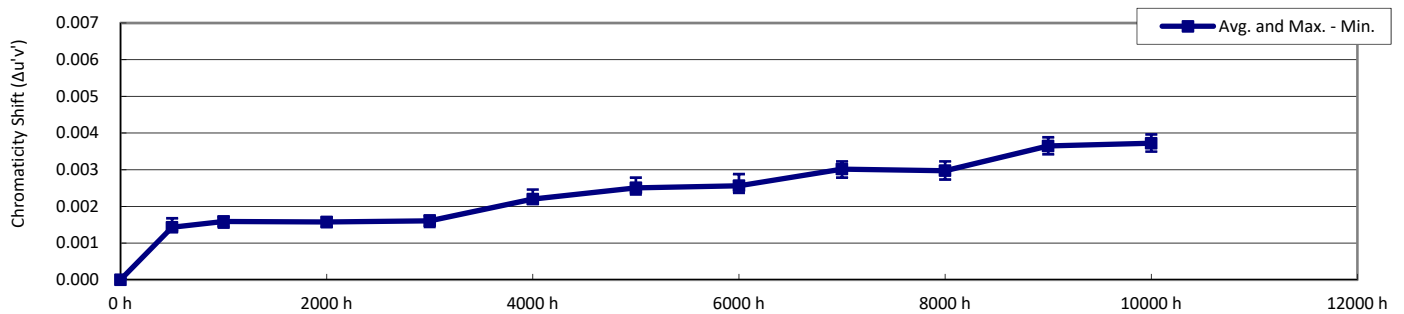
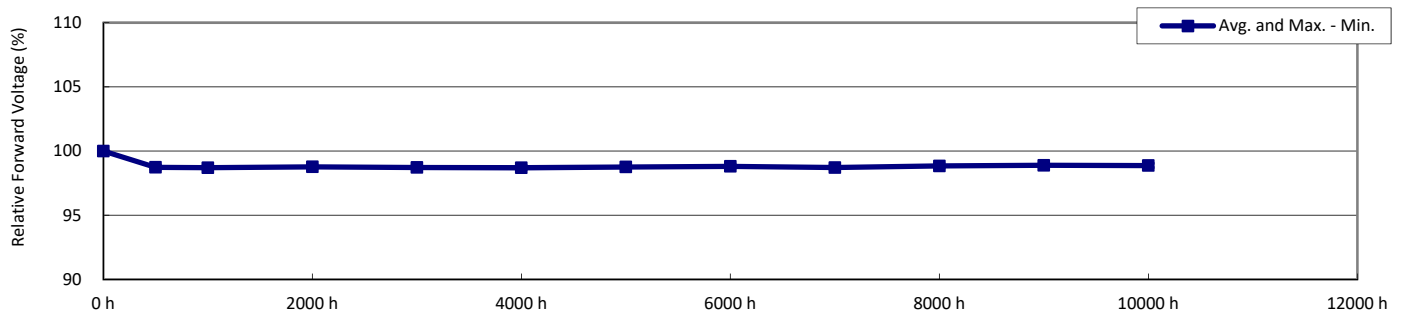
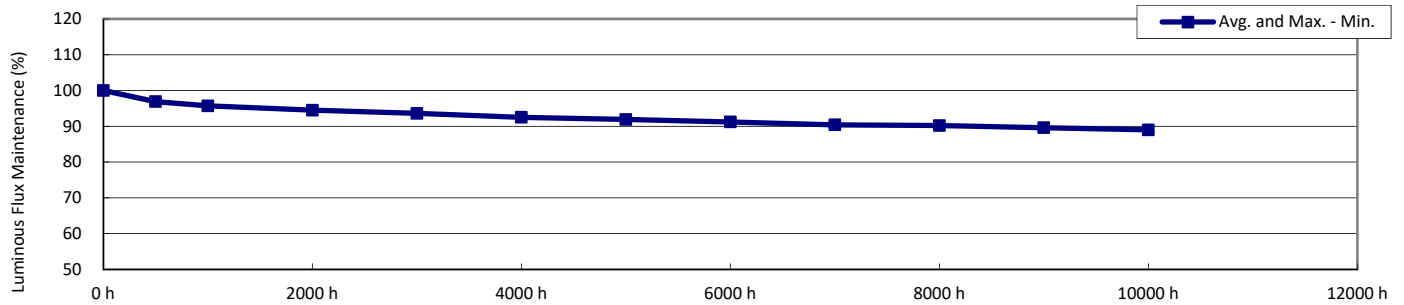
Data Set 11 : 120 °C, 1500 mA

Actual Case Temperature [T_S]	120.5 °C
Actual Ambient Temperature [T_A]	117.5 °C
Drive Current [I_F]	1500 mA
Measurement Current	1500 mA

NOTES:

 T_S and T_A were measured during initial setup.

Number of LED failures: 0





Data Set 11 : 120 °C, 1500 mA

Actual Case Temperature [T _S]	120.5 °C
Actual Ambient Temperature [T _A]	117.5 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 11-1
Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	Input Power	CIE1931		CIE1976							
	Φ _V [lm]	V _F [V]	T _{CP} [K]	P [W]	x	y	u'	v'						
1	465	3.22	2694	4.83	0.457	0.404	0.263	0.524						
2	471	3.22	2723	4.83	0.455	0.405	0.262	0.524						
3	469	3.22	2683	4.83	0.457	0.404	0.264	0.524						
4	469	3.22	2702	4.83	0.455	0.403	0.263	0.524						
5	475	3.22	2749	4.83	0.452	0.403	0.261	0.523						
6	466	3.22	2686	4.84	0.458	0.405	0.264	0.525						
7	461	3.23	2630	4.84	0.464	0.409	0.266	0.528						
8	459	3.22	2617	4.83	0.467	0.412	0.266	0.529						
9	460	3.22	2666	4.83	0.460	0.407	0.264	0.526						
10	461	3.22	2641	4.83	0.461	0.406	0.266	0.526						
11	469	3.22	2724	4.83	0.453	0.402	0.262	0.523						
12	471	3.22	2713	4.83	0.455	0.404	0.263	0.524						
13	472	3.2	2702	4.83	0.456	0.404	0.263	0.524						
14	468	3.2	2700	4.83	0.456	0.404	0.263	0.524						
15	467	3.2	2698	4.84	0.456	0.404	0.263	0.524						
16	467	3.2	2666	4.83	0.460	0.406	0.265	0.526						
17	469	3.2	2686	4.83	0.461	0.410	0.263	0.527						
18	460	3.2	2629	4.82	0.462	0.406	0.266	0.526						
19	464	3.2	2634	4.82	0.463	0.408	0.266	0.527						
20	468	3.2	2686	4.82	0.458	0.406	0.264	0.525						
21	470	3.2	2693	4.82	0.458	0.407	0.263	0.526						
22	468	3.2	2673	4.82	0.459	0.406	0.264	0.526						
23	472	3.2	2708	4.82	0.456	0.405	0.263	0.525						
24	470	3.2	2696	4.81	0.457	0.404	0.263	0.524						
n	24	24	24	24	24	24	24	24						
Avg.	467	3.22	2683	4.83	0.458	0.406	0.264	0.525						
Med.	468	3.22	2690	4.83	0.458	0.405	0.263	0.525						
σ	4.3	0.005	33.5	0.007	0.0035	0.0024	0.0014	0.0014						
Min.	459	3.21	2617	4.81	0.452	0.402	0.261	0.523						
Max.	475	3.23	2749	4.84	0.467	0.412	0.266	0.529						



Data Set 11 : 120 °C, 1500 mA

Actual Case Temperature [T _S]	120.5 °C
Actual Ambient Temperature [T _A]	117.5 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 11-2
Luminous Flux Maintenance

LED No.	Luminous Flux Maintenance % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	96.9	95.7	94.4	93.4	92.5	91.8	91.1	90.3	89.9	89.4	88.8						
2	100.0	97.1	95.7	94.6	93.5	92.4	91.6	91.0	90.3	90.0	89.3	88.9						
3	100.0	96.9	95.6	94.6	93.7	92.6	92.1	91.4	90.6	90.4	89.8	89.2						
4	100.0	97.4	96.3	95.1	94.0	93.0	92.2	91.5	90.6	90.4	89.9	89.5						
5	100.0	96.6	95.3	94.1	93.0	92.0	91.5	90.8	90.0	89.9	88.9	88.5						
6	100.0	97.1	95.9	94.3	93.6	92.6	92.1	91.1	90.4	90.2	89.8	89.0						
7	100.0	96.7	95.5	94.4	93.2	92.4	91.5	90.9	90.2	89.9	89.3	88.8						
8	100.0	97.2	95.8	94.7	93.9	92.6	92.1	91.5	90.7	90.5	89.8	89.5						
9	100.0	97.5	96.4	95.3	94.3	93.4	92.8	92.1	91.2	91.1	90.8	90.0						
10	100.0	96.8	95.8	94.7	93.8	92.8	92.2	91.5	90.7	90.5	90.0	89.5						
11	100.0	96.9	95.5	94.4	93.4	92.5	91.9	91.0	90.3	90.2	89.5	89.1						
12	100.0	96.9	95.7	94.5	93.5	92.5	92.1	91.2	90.4	90.4	89.8	89.1						
13	100.0	96.4	95.4	94.2	93.3	92.3	91.5	90.9	90.1	89.7	89.2	88.8						
14	100.0	97.1	95.9	94.8	93.7	92.8	92.4	91.5	90.7	90.6	89.9	89.4						
15	100.0	96.7	95.7	94.6	93.7	92.7	92.4	91.3	90.5	90.4	89.9	89.2						
16	100.0	97.0	95.8	94.6	93.6	92.4	91.7	91.0	90.2	89.8	89.3	88.8						
17	100.0	96.8	95.4	94.2	93.1	92.2	91.6	90.6	89.8	89.4	88.9	88.4						
18	100.0	96.9	95.7	94.6	93.7	92.7	92.2	91.4	90.6	90.4	89.7	89.2						
19	100.0	96.9	95.8	94.7	93.6	92.6	92.0	91.3	90.5	90.3	89.7	89.2						
20	100.0	97.0	95.6	94.5	93.6	92.6	92.0	91.2	90.3	90.2	89.5	89.0						
21	100.0	97.0	95.7	94.5	93.7	92.6	92.0	91.3	90.5	90.4	89.7	89.2						
22	100.0	96.5	95.5	94.2	93.1	92.1	91.3	90.6	89.8	89.5	88.9	88.4						
23	100.0	97.0	95.6	94.3	93.3	92.1	91.7	90.9	90.1	89.8	89.2	88.7						
24	100.0	96.9	95.7	94.6	93.5	92.5	92.0	91.1	90.4	90.1	89.5	88.9						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	96.9	95.7	94.5	93.6	92.5	91.9	91.2	90.4	90.2	89.6	89.0						
Med.	100.0	96.9	95.7	94.6	93.6	92.6	92.0	91.2	90.4	90.2	89.6	89.1						
σ	0.00	0.25	0.25	0.28	0.30	0.30	0.35	0.33	0.31	0.38	0.43	0.38						
Min.	100.0	96.4	95.3	94.1	93.0	92.0	91.3	90.6	89.8	89.4	88.9	88.4						
Max.	100.0	97.5	96.4	95.3	94.3	93.4	92.8	92.1	91.2	91.1	90.8	90.0						

TM-21 Projection

Test duration used	5000 h	to	10000 h
B	0.9465		
α	6.161E-06		
R ²	0.9832		
Calculated L ₇₀ (10K)	49000	hours	
Reported L ₇₀ (10K)	49000	hours	
Calculated L ₈₀ (10K)	27300	hours	
Reported L ₈₀ (10K)	27300	hours	
Calculated L ₉₀ (10K)	8180	hours	
Reported L ₉₀ (8K)	8330	hours	

Curve-fit equation:

$$\Phi(t) = B \exp(-\alpha t)$$

Luminous flux maintenance life equation:

$$L_{70} = \ln(B/0.7)/\alpha$$

$$L_{80} = \ln(B/0.8)/\alpha$$

$$L_{90} = \ln(B/0.9)/\alpha$$

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The laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.*



Data Set 11 : 120 °C, 1500 mA

Actual Case Temperature [T _S]	120.5 °C
Actual Ambient Temperature [T _A]	117.5 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 11-3
Forward Voltage

LED No.	Relative Forward Voltage % (Normalized to 100 % at 0 hours)																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	100.0	98.6	98.6	98.7	98.6	98.6	98.7	98.7	98.7	98.8	98.8	98.8						
2	100.0	98.6	98.6	98.7	98.6	98.6	98.7	98.7	98.6	98.8	98.8	98.8						
3	100.0	98.6	98.6	98.6	98.6	98.6	98.6	98.7	98.6	98.7	98.8	98.7						
4	100.0	98.7	98.6	98.7	98.6	98.6	98.7	98.7	98.6	98.8	98.8	98.8						
5	100.0	98.6	98.6	98.7	98.7	98.6	98.7	98.7	98.6	98.8	98.8	98.8						
6	100.0	98.6	98.6	98.6	98.6	98.6	98.7	98.7	98.6	98.7	98.8	98.7						
7	100.0	98.6	98.6	98.6	98.6	98.6	98.6	98.7	98.6	98.7	98.8	98.7						
8	100.0	98.8	98.7	98.8	98.8	98.7	98.8	98.8	98.7	98.9	99.0	98.9						
9	100.0	98.8	98.7	98.8	98.7	98.7	98.8	98.8	98.7	98.9	98.9	98.9						
10	100.0	98.8	98.7	98.8	98.7	98.7	98.8	98.8	98.7	98.9	98.9	98.9						
11	100.0	98.7	98.7	98.7	98.7	98.7	98.7	98.8	98.7	98.8	98.9	98.9						
12	100.0	98.7	98.6	98.7	98.6	98.6	98.7	98.7	98.6	98.8	98.8	98.8						
13	100.0	98.7	98.6	98.7	98.6	98.7	98.7	98.7	98.7	98.8	98.8	98.8						
14	100.0	98.7	98.7	98.8	98.7	98.7	98.7	98.8	98.7	98.8	98.8	98.8						
15	100.0	98.6	98.6	98.6	98.6	98.6	98.6	98.7	98.6	98.7	98.7	98.7						
16	100.0	98.7	98.7	98.7	98.7	98.7	98.7	98.8	98.7	98.8	98.8	98.8						
17	100.0	98.8	98.7	98.8	98.8	98.7	98.8	98.9	98.8	98.9	98.9	98.9						
18	100.0	98.8	98.8	98.9	98.8	98.8	98.8	98.9	98.8	98.9	99.0	99.0						
19	100.0	98.9	98.9	98.9	98.9	98.8	98.9	99.0	98.9	99.0	99.0	99.0						
20	100.0	98.9	98.8	98.9	98.8	98.8	98.9	99.0	98.9	99.0	99.0	99.0						
21	100.0	98.9	98.8	98.9	98.9	98.8	98.9	98.9	98.8	98.9	99.0	99.0						
22	100.0	98.9	98.9	98.9	98.9	98.9	98.9	99.0	98.9	99.0	99.0	99.0						
23	100.0	98.9	98.9	98.9	98.9	98.9	98.9	99.0	98.9	99.0	99.0	99.0						
24	100.0	98.9	98.9	98.9	98.9	98.9	98.9	99.0	98.9	99.0	99.0	99.0						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	100.0	98.7	98.7	98.8	98.7	98.7	98.8	98.8	98.7	98.8	98.9	98.9						
Med.	100.0	98.7	98.7	98.8	98.7	98.7	98.7	98.8	98.7	98.8	98.9	98.8						
σ	0.00	0.11	0.10	0.10	0.11	0.10	0.10	0.11	0.11	0.10	0.10	0.11						
Min.	100.0	98.6	98.6	98.6	98.6	98.6	98.6	98.7	98.6	98.7	98.7	98.7						
Max.	100.0	98.9	98.9	98.9	98.9	98.9	98.9	99.0	98.9	99.0	99.0	99.0						

Data Set 11 : 120 °C, 1500 mA

Actual Case Temperature [T _S]	120.5 °C
Actual Ambient Temperature [T _A]	117.5 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 11-4
Chromaticity Shift

LED No.	Chromaticity Shift Δu'v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.0000	0.0015	0.0016	0.0016	0.0016	0.0022	0.0025	0.0026	0.0031	0.0030	0.0036	0.0037						
2	0.0000	0.0014	0.0017	0.0016	0.0017	0.0025	0.0028	0.0029	0.0032	0.0032	0.0039	0.0040						
3	0.0000	0.0015	0.0016	0.0016	0.0016	0.0022	0.0026	0.0025	0.0030	0.0030	0.0036	0.0037						
4	0.0000	0.0014	0.0017	0.0017	0.0017	0.0022	0.0025	0.0026	0.0030	0.0030	0.0037	0.0038						
5	0.0000	0.0013	0.0016	0.0015	0.0015	0.0022	0.0026	0.0026	0.0032	0.0031	0.0038	0.0039						
6	0.0000	0.0015	0.0016	0.0015	0.0016	0.0022	0.0026	0.0026	0.0030	0.0031	0.0038	0.0038						
7	0.0000	0.0017	0.0017	0.0017	0.0017	0.0022	0.0025	0.0025	0.0029	0.0028	0.0034	0.0035						
8	0.0000	0.0015	0.0017	0.0017	0.0017	0.0022	0.0025	0.0025	0.0029	0.0029	0.0035	0.0035						
9	0.0000	0.0015	0.0016	0.0016	0.0016	0.0021	0.0023	0.0024	0.0028	0.0027	0.0035	0.0035						
10	0.0000	0.0015	0.0017	0.0017	0.0017	0.0022	0.0025	0.0025	0.0030	0.0030	0.0036	0.0037						
11	0.0000	0.0014	0.0015	0.0015	0.0015	0.0021	0.0025	0.0025	0.0030	0.0030	0.0036	0.0038						
12	0.0000	0.0014	0.0016	0.0016	0.0016	0.0022	0.0026	0.0026	0.0030	0.0030	0.0038	0.0038						
13	0.0000	0.0014	0.0015	0.0015	0.0015	0.0021	0.0024	0.0025	0.0030	0.0029	0.0036	0.0037						
14	0.0000	0.0013	0.0016	0.0015	0.0015	0.0022	0.0024	0.0025	0.0030	0.0029	0.0036	0.0037						
15	0.0000	0.0014	0.0016	0.0014	0.0014	0.0021	0.0025	0.0026	0.0031	0.0030	0.0037	0.0038						
16	0.0000	0.0014	0.0016	0.0016	0.0017	0.0024	0.0027	0.0028	0.0032	0.0032	0.0039	0.0040						
17	0.0000	0.0014	0.0016	0.0016	0.0017	0.0022	0.0026	0.0027	0.0031	0.0031	0.0038	0.0039						
18	0.0000	0.0014	0.0016	0.0016	0.0016	0.0021	0.0025	0.0025	0.0028	0.0028	0.0035	0.0036						
19	0.0000	0.0014	0.0016	0.0015	0.0016	0.0021	0.0024	0.0025	0.0029	0.0028	0.0036	0.0036						
20	0.0000	0.0014	0.0016	0.0016	0.0016	0.0021	0.0025	0.0025	0.0030	0.0029	0.0036	0.0037						
21	0.0000	0.0014	0.0015	0.0015	0.0015	0.0022	0.0024	0.0025	0.0029	0.0029	0.0036	0.0036						
22	0.0000	0.0014	0.0016	0.0016	0.0016	0.0023	0.0025	0.0026	0.0030	0.0029	0.0036	0.0037						
23	0.0000	0.0013	0.0014	0.0015	0.0016	0.0021	0.0025	0.0025	0.0030	0.0029	0.0036	0.0037						
24	0.0000	0.0013	0.0015	0.0015	0.0017	0.0023	0.0025	0.0026	0.0030	0.0030	0.0037	0.0038						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.0000	0.0014	0.0016	0.0016	0.0016	0.0022	0.0025	0.0026	0.0030	0.0030	0.0036	0.0037						
Med.	0.0000	0.0014	0.0016	0.0016	0.0016	0.0022	0.0025	0.0025	0.0030	0.0030	0.0036	0.0037						
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001						
Min.	0.0000	0.0013	0.0014	0.0014	0.0014	0.0021	0.0023	0.0024	0.0028	0.0027	0.0034	0.0035						
Max.	0.0000	0.0017	0.0017	0.0017	0.0017	0.0025	0.0028	0.0029	0.0032	0.0032	0.0039	0.0040						

Data Set 11 : 120 °C, 1500 mA

Actual Case Temperature [T _s]	120.5 °C
Actual Ambient Temperature [T _A]	117.5 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_s and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 11-5
Chromaticity

LED No.	Chromaticity u'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.2622	0.2608	0.2609	0.2608	0.2608	0.2610	0.2612	0.2611	0.2612	0.2612	0.2612	0.2613						
2	0.2609	0.2596	0.2597	0.2597	0.2597	0.2598	0.2599	0.2599	0.2600	0.2600	0.2601	0.2602						
3	0.2631	0.2617	0.2619	0.2618	0.2618	0.2620	0.2622	0.2620	0.2622	0.2621	0.2623	0.2623						
4	0.2620	0.2606	0.2606	0.2605	0.2605	0.2608	0.2609	0.2608	0.2610	0.2609	0.2611	0.2611						
5	0.2599	0.2586	0.2587	0.2586	0.2586	0.2588	0.2589	0.2588	0.2589	0.2589	0.2591	0.2591						
6	0.2625	0.2611	0.2613	0.2613	0.2612	0.2614	0.2616	0.2615	0.2616	0.2615	0.2618	0.2617						
7	0.2647	0.2631	0.2634	0.2633	0.2632	0.2635	0.2636	0.2635	0.2637	0.2636	0.2638	0.2637						
8	0.2647	0.2633	0.2635	0.2634	0.2634	0.2636	0.2638	0.2637	0.2638	0.2637	0.2639	0.2639						
9	0.2632	0.2617	0.2619	0.2618	0.2618	0.2619	0.2622	0.2621	0.2622	0.2621	0.2624	0.2623						
10	0.2645	0.2630	0.2631	0.2630	0.2630	0.2633	0.2633	0.2633	0.2634	0.2633	0.2635	0.2635						
11	0.2611	0.2597	0.2599	0.2598	0.2598	0.2600	0.2600	0.2601	0.2602	0.2601	0.2602	0.2603						
12	0.2616	0.2602	0.2603	0.2602	0.2603	0.2605	0.2607	0.2607	0.2607	0.2607	0.2609	0.2608						
13	0.2619	0.2605	0.2607	0.2606	0.2606	0.2609	0.2609	0.2609	0.2610	0.2610	0.2611	0.2611						
14	0.2618	0.2605	0.2606	0.2605	0.2605	0.2607	0.2608	0.2608	0.2609	0.2609	0.2610	0.2610						
15	0.2622	0.2609	0.2610	0.2610	0.2610	0.2612	0.2614	0.2613	0.2614	0.2614	0.2616	0.2616						
16	0.2631	0.2618	0.2620	0.2619	0.2618	0.2620	0.2622	0.2621	0.2622	0.2622	0.2624	0.2624						
17	0.2618	0.2605	0.2607	0.2606	0.2606	0.2608	0.2609	0.2609	0.2610	0.2609	0.2611	0.2611						
18	0.2652	0.2639	0.2640	0.2639	0.2639	0.2642	0.2643	0.2642	0.2644	0.2643	0.2644	0.2645						
19	0.2645	0.2632	0.2633	0.2633	0.2632	0.2635	0.2635	0.2635	0.2637	0.2636	0.2637	0.2638						
20	0.2623	0.2609	0.2610	0.2609	0.2609	0.2612	0.2612	0.2612	0.2613	0.2612	0.2615	0.2615						
21	0.2622	0.2608	0.2610	0.2609	0.2609	0.2610	0.2612	0.2612	0.2613	0.2612	0.2614	0.2614						
22	0.2629	0.2615	0.2617	0.2616	0.2616	0.2618	0.2619	0.2619	0.2620	0.2620	0.2621	0.2621						
23	0.2615	0.2602	0.2604	0.2602	0.2602	0.2605	0.2606	0.2606	0.2607	0.2606	0.2607	0.2608						
24	0.2625	0.2612	0.2613	0.2612	0.2611	0.2614	0.2616	0.2615	0.2616	0.2616	0.2616	0.2617						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.2626	0.2612	0.2614	0.2613	0.2613	0.2615	0.2616	0.2616	0.2617	0.2616	0.2618	0.2618						
Med.	0.2623	0.2609	0.2610	0.2610	0.2610	0.2612	0.2613	0.2613	0.2614	0.2613	0.2616	0.2616						
σ	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013						
Min.	0.2599	0.2586	0.2587	0.2586	0.2586	0.2588	0.2589	0.2588	0.2589	0.2589	0.2591	0.2591						
Max.	0.2652	0.2639	0.2640	0.2639	0.2639	0.2642	0.2643	0.2642	0.2644	0.2643	0.2644	0.2645						

Data Set 11 : 120 °C, 1500 mA

Actual Case Temperature [T _S]	120.5 °C
Actual Ambient Temperature [T _A]	117.5 °C
Drive Current [I _F]	1500 mA
Measurement Current	1500 mA

NOTES:

T_S and T_A were measured during initial setup.

Number of LED failures: 0

TABLE 11-6
Chromaticity

LED No.	Chromaticity v'																	
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h						
1	0.5231	0.5235	0.5241	0.5239	0.5239	0.5250	0.5254	0.5255	0.5260	0.5259	0.5266	0.5267						
2	0.5232	0.5238	0.5244	0.5243	0.5244	0.5254	0.5258	0.5259	0.5263	0.5263	0.5270	0.5271						
3	0.5236	0.5240	0.5246	0.5245	0.5245	0.5255	0.5260	0.5259	0.5265	0.5264	0.5271	0.5272						
4	0.5223	0.5226	0.5232	0.5231	0.5231	0.5241	0.5246	0.5246	0.5251	0.5251	0.5259	0.5260						
5	0.5221	0.5224	0.5231	0.5229	0.5229	0.5240	0.5245	0.5245	0.5251	0.5250	0.5258	0.5259						
6	0.5239	0.5243	0.5249	0.5248	0.5248	0.5258	0.5263	0.5263	0.5268	0.5268	0.5276	0.5276						
7	0.5264	0.5269	0.5275	0.5273	0.5273	0.5282	0.5286	0.5286	0.5291	0.5290	0.5297	0.5298						
8	0.5277	0.5283	0.5289	0.5288	0.5288	0.5296	0.5300	0.5300	0.5305	0.5304	0.5311	0.5311						
9	0.5248	0.5250	0.5257	0.5255	0.5255	0.5265	0.5269	0.5269	0.5274	0.5273	0.5282	0.5282						
10	0.5245	0.5248	0.5255	0.5253	0.5253	0.5263	0.5267	0.5267	0.5273	0.5272	0.5280	0.5281						
11	0.5223	0.5225	0.5232	0.5230	0.5231	0.5241	0.5245	0.5246	0.5252	0.5251	0.5258	0.5260						
12	0.5233	0.5236	0.5242	0.5241	0.5242	0.5252	0.5257	0.5257	0.5262	0.5262	0.5270	0.5270						
13	0.5232	0.5235	0.5241	0.5240	0.5240	0.5251	0.5254	0.5255	0.5261	0.5260	0.5267	0.5268						
14	0.5230	0.5233	0.5240	0.5238	0.5238	0.5249	0.5252	0.5253	0.5259	0.5258	0.5265	0.5266						
15	0.5233	0.5237	0.5243	0.5241	0.5241	0.5252	0.5257	0.5257	0.5263	0.5262	0.5270	0.5271						
16	0.5242	0.5248	0.5253	0.5252	0.5253	0.5263	0.5267	0.5268	0.5273	0.5273	0.5280	0.5281						
17	0.5261	0.5267	0.5273	0.5272	0.5273	0.5281	0.5285	0.5286	0.5291	0.5291	0.5298	0.5299						
18	0.5250	0.5254	0.5261	0.5259	0.5259	0.5269	0.5273	0.5273	0.5277	0.5277	0.5284	0.5285						
19	0.5258	0.5262	0.5269	0.5267	0.5268	0.5277	0.5280	0.5281	0.5286	0.5285	0.5293	0.5293						
20	0.5240	0.5243	0.5249	0.5248	0.5248	0.5258	0.5262	0.5262	0.5268	0.5267	0.5275	0.5276						
21	0.5248	0.5251	0.5257	0.5256	0.5256	0.5266	0.5270	0.5271	0.5276	0.5275	0.5283	0.5283						
22	0.5244	0.5247	0.5254	0.5253	0.5253	0.5264	0.5267	0.5268	0.5273	0.5272	0.5279	0.5280						
23	0.5236	0.5239	0.5245	0.5244	0.5245	0.5255	0.5259	0.5259	0.5265	0.5264	0.5271	0.5272						
24	0.5234	0.5237	0.5243	0.5242	0.5243	0.5254	0.5257	0.5258	0.5263	0.5263	0.5270	0.5271						
n	24	24	24	24	24	24	24	24	24	24	24	24						
Avg.	0.5241	0.5245	0.5251	0.5249	0.5250	0.5260	0.5264	0.5264	0.5270	0.5269	0.5276	0.5277						
Med.	0.5238	0.5242	0.5248	0.5247	0.5247	0.5257	0.5261	0.5261	0.5267	0.5266	0.5273	0.5274						
σ	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0013	0.0013	0.0013	0.0013						
Min.	0.5221	0.5224	0.5231	0.5229	0.5229	0.5240	0.5245	0.5245	0.5251	0.5250	0.5258	0.5259						
Max.	0.5277	0.5283	0.5289	0.5288	0.5288	0.5296	0.5300	0.5300	0.5305	0.5304	0.5311	0.5311						