Report No. : SQETMQ749202

LM-80 Test Report
NFMW488AR

Issue Date: January 7, 2019
Revision Date: January 25, 2019
Test Initiation Date: April 6, 2016
Test Completion Date: January 21, 2019
Test Duration: 11,000 hours
Report Number: SQETMQ749202

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 Array
Model Name: White LED
Model Number: NFMW488AR
Nominal CCT: 2700 K

Test Summary:

Data Set	Case Temperature [°C]	Ambient Temperature [°C]	Drive Current [mA]	Average Current per Die [mA]	Lumen Maintenance at 11K hours [%]	Chromaticity Shift (Δu'v') at 11K hours	TM-21 Projection L70(11K) [hours]	TM-21 Projection L80(11K) [hours]	TM-21 Projection L90(11K) [hours]
1	55	> 50	200	200	95.1	0.0024	> 60500	> 60500	36600
2	55	> 50	250	250	95.3	0.0025	> 60500	> 60500	39600
3	85	> 80	200	200	95.3	0.0028	> 60500	> 60500	39200
4	85	> 80	250	250	94.9	0.0034	> 60500	> 60500	32900
5	105	> 100	150	150	93.3	0.0034	> 60500	48900	20900
6	105	> 100	200	200	92.8	0.0041	> 60500	44100	18600
7	105	> 100	250	250	82.7	0.0051	20200	14000	8590

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Approved Signatory:

H. Hashimoto

Hiroyuki HASHIMOTO, Lab Manager
Nichia Corporation LED Testing Laboratory
1-1,Tatsumi-Cho, Anan-Shi, TOKUSHIMA 774-0001, JAPAN

Applicable Model Numbers:

This LM-80 test report applies to the following models:

Series	Model Number	Case Temperature [°C]	Forward Current [mA]	Nominal CCT * [K]	Data Set Number
48x	NFMW481AR NFMW481ART	55	200	≥ 2200	1
		55	250	≥ 2200	2
		85	200	≥ 2200	3
		85	250	≥ 2200	4
		105	150	≥ 2200	5
		105	200	≥ 2200	6
		105	250	≥ 2200	7
48x	NFMW484AR NFMW484ART	55	200	≥ 2200	1
		55	250	≥ 2200	2
		85	200	≥ 2200	3
		85	250	≥ 2200	4
		105	150	≥ 2200	5
		105	200	≥ 2200	6
		105	250	≥ 2200	7
48x	NFMW486AR NFMW486ART	55	200	≥ 2200	1
		55	250	≥ 2200	2
		85	200	≥ 2200	3
		85	250	≥ 2200	4
		105	150	≥ 2200	5
		105	200	≥ 2200	6
		105	250	≥ 2200	7

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

Applicable Model Numbers:

This LM-80 test report applies to the following models:

Series	Model Number	Case Temperature [°C]	Forward Current [mA]	Nominal CCT * [K]	Data Set Number
48x	NFMW488AR NFMW488ART	55	200	≥ 2200	1
		55	250	≥ 2200	2
		85	200	≥ 2200	3
		85	250	≥ 2200	4
		105	150	≥ 2200	5
		105	200	≥ 2200	6
		105	250	≥ 2200	7

* 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 Ambient temperature is the temperature of the air at a distance of 1.5 mm above the reliability test board
Air flow	< 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

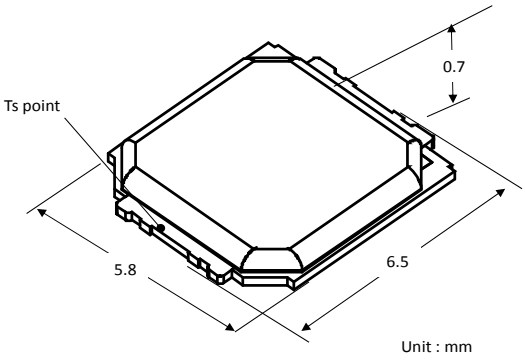

Figure 1: The case temperature (Ts) measurement point

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. Lumen maintenance data for each individual LED light source along with average value,median value, standard deviation, minimum and maximum lumen 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	2.5 % (*k* =2)
Lumen 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

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Report No. : SQETMQ749202

ENERGY STAR® LM-80 Cover Sheet

Administrative Information

Tested subcomponent series :	White LED
Tested subcomponent model number :	NFMW488AR
Report issue date :	January 7, 2019
Report revision date :	January 25, 2019
Testing start date :	April 6, 2016
Testing completion date :	January 21, 2019
LED sampling method :	Comply with LM-80
LED sample size :	12 Arrays

LED Identification

LED manufacturer's name :	Nichia Corporation
LED model number :	NFMW488AR
Description of LED :	LED Array

LED Characteristics

Total input power (W) :

Average current density per LED die (mA/mm^2):

Average power density per LED die (W/mm^2):

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	200	9.1	473	1.54
55	250	11.8	592	2.00
85	200	9.1	473	1.54
85	250	11.8	592	2.00
105	150	6.6	355	1.11
105	200	9.1	473	1.54
105	250	11.8	592	2.00

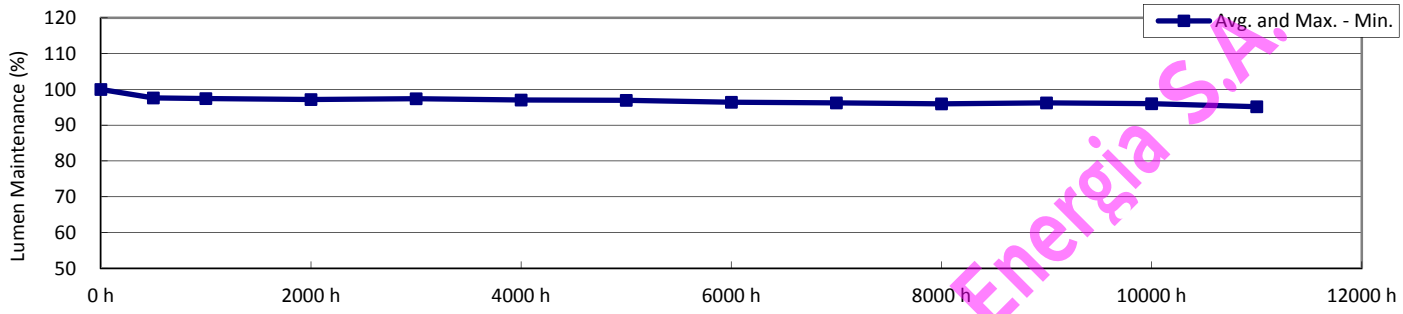
Representative CRI (Ra) of the tested sample set : Ra = 80.2

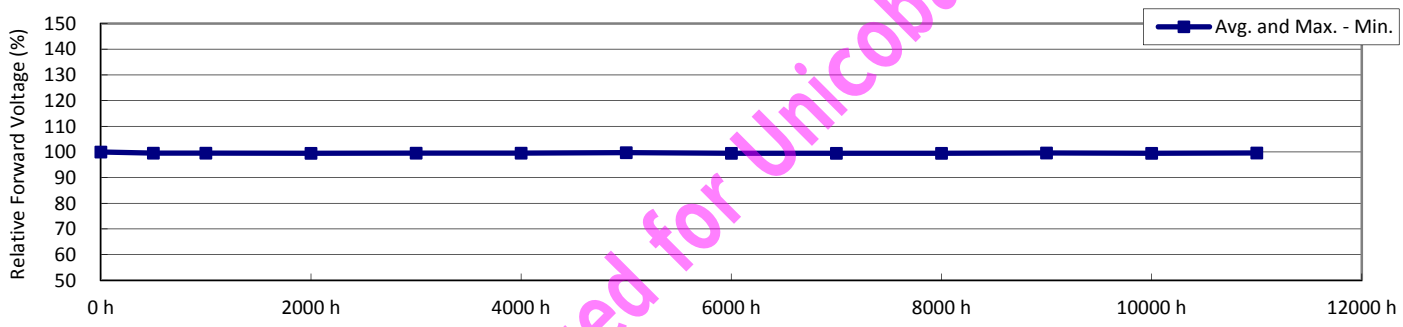
Minimum die edge to die edge spacing : 0.33 mm

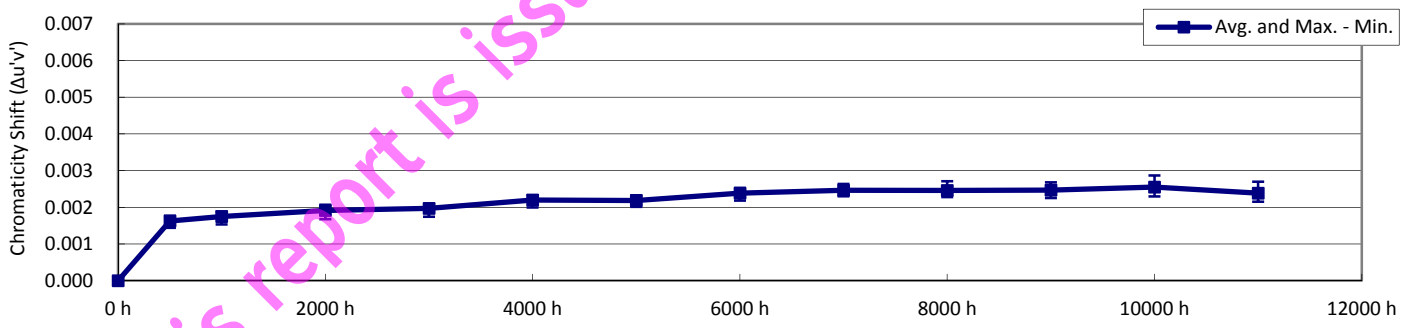
Data Set 1 : 55 °C, 200 mA

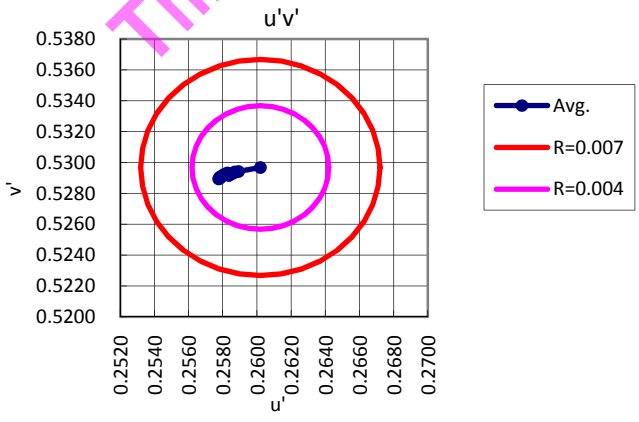
Actual Case Temperature [T_S]	56.6 °C
Actual Ambient Temperature [T_A]	53.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0









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Data Set 1 : 55 °C, 200 mA

Actual Case Temperature [T_S]	56.6 °C
Actual Ambient Temperature [T_A]	53.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	1035	45.4	2755	9.1	0.458	0.415	0.260	0.529				
2	1040	45.4	2722	9.1	0.462	0.418	0.261	0.531				
3	1044	45.4	2745	9.1	0.459	0.416	0.260	0.529				
4	1056	45.4	2730	9.1	0.462	0.419	0.260	0.531				
5	1044	45.4	2742	9.1	0.461	0.418	0.260	0.530				
6	1034	45.5	2736	9.1	0.460	0.416	0.260	0.529				
7	1061	45.6	2725	9.1	0.462	0.417	0.261	0.530				
8	1052	45.5	2703	9.1	0.464	0.418	0.262	0.531				
9	1050	45.6	2756	9.1	0.459	0.416	0.259	0.529				
10	1053	45.5	2749	9.1	0.458	0.413	0.260	0.528				
11	1051	45.4	2746	9.1	0.461	0.418	0.260	0.530				
12	1051	45.5	2751	9.1	0.458	0.414	0.260	0.529				
n	12	12	12	12	12	12	12	12				
Avg.	1048	45.5	2738	9.1	0.460	0.417	0.260	0.530				
Med.	1051	45.5	2744	9.1	0.460	0.417	0.260	0.530				
σ	8.3	0.06	15.7	0.01	0.0019	0.0018	0.0006	0.0009				
Min.	1034	45.4	2703	9.1	0.458	0.413	0.259	0.528				
Max.	1061	45.6	2756	9.1	0.464	0.419	0.262	0.531				

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Data Set 1 : 55 °C, 200 mA

Actual Case Temperature [T_S]	56.6 °C
Actual Ambient Temperature [T_A]	53.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

TABLE 1-2
Lumen Maintenance

LED No.	Lumen 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	11000 h
1	100.0	97.2	96.9	96.9	97.0	96.6	96.4	95.7	95.5	95.1	95.3	95.0	93.9
2	100.0	97.5	97.2	97.0	97.1	96.7	96.7	96.1	95.8	95.6	95.9	95.6	94.8
3	100.0	97.8	97.5	97.2	97.5	97.1	97.0	96.4	96.3	96.0	96.3	96.2	95.3
4	100.0	97.7	97.6	97.3	97.5	97.2	97.1	96.6	96.6	96.3	96.7	96.5	95.7
5	100.0	97.9	97.8	97.4	97.8	97.5	97.5	96.9	96.8	96.6	96.8	96.6	95.9
6	100.0	97.8	97.6	97.3	97.4	97.0	96.9	96.3	96.1	95.8	96.1	95.9	94.9
7	100.0	97.6	97.4	97.2	97.4	97.0	97.0	96.5	96.3	96.1	96.4	96.2	95.4
8	100.0	97.1	96.9	96.9	97.2	96.8	96.6	96.1	96.0	95.7	95.8	95.6	94.6
9	100.0	97.8	97.6	97.3	97.5	97.0	97.0	96.4	96.2	95.9	96.1	95.9	94.9
10	100.0	97.4	97.2	97.0	97.2	96.9	96.8	96.3	96.2	95.8	96.1	96.0	95.1
11	100.0	97.8	97.7	97.4	97.6	97.2	97.2	96.6	96.6	96.3	96.6	96.4	95.6
12	100.0	97.9	97.8	97.3	97.6	97.4	97.3	96.7	96.6	96.3	96.6	96.4	95.6
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	97.6	97.4	97.2	97.4	97.0	96.9	96.4	96.3	96.0	96.2	96.0	95.1
Med.	100.0	97.8	97.6	97.2	97.4	97.0	97.0	96.4	96.2	95.9	96.2	96.1	95.2
σ	0.00	0.27	0.31	0.18	0.23	0.27	0.30	0.33	0.38	0.40	0.44	0.48	0.57
Min.	100.0	97.1	96.9	96.9	97.0	96.6	96.4	95.7	95.5	95.1	95.3	95.0	93.9
Max.	100.0	97.9	97.8	97.4	97.8	97.5	97.5	96.9	96.8	96.6	96.8	96.6	95.9

TM-21 Projection

Time	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
ln(Avg.)	-0.0310	-0.0367	-0.0382	-0.0412	-0.0386	-0.0405	-0.0498

Test duration used	5000 h to 11000 h	
B	0.979	
α	2.30E-06	
R^2	0.771	
Calculated L_{70} (11K)	146000	hours
Reported L_{70} (11K)	> 60500	hours
Calculated L_{80} (11K)	87700	hours
Reported L_{80} (11K)	> 60500	hours
Calculated L_{90} (11K)	36600	hours
Reported L_{90} (11K)	36600	hours

Curve-fit equation:
$\Phi(t)=B\exp(-\alpha t)$

Lumen maintenance life eqation:
$L_{70}=\ln(B/0.7)/\alpha$

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

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

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Data Set 1 : 55 °C, 200 mA

Actual Case Temperature [T_S]	56.6 °C
Actual Ambient Temperature [T_A]	53.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	100.0	99.5	99.5	99.5	99.5	99.5	99.7	99.5	99.4	99.5	99.6	99.5	99.6
2	100.0	99.6	99.6	99.5	99.5	99.6	99.7	99.4	99.4	99.5	99.6	99.5	99.6
3	100.0	99.5	99.5	99.5	99.5	99.5	99.6	99.4	99.5	99.4	99.6	99.4	99.6
4	100.0	99.6	99.6	99.5	99.5	99.5	99.7	99.5	99.4	99.5	99.6	99.4	99.6
5	100.0	99.5	99.5	99.4	99.4	99.5	99.6	99.5	99.4	99.4	99.6	99.5	99.6
6	100.0	99.5	99.5	99.5	99.5	99.5	99.7	99.4	99.4	99.4	99.5	99.4	99.5
7	100.0	99.6	99.6	99.5	99.6	99.6	99.8	99.5	99.6	99.5	99.7	99.5	99.7
8	100.0	99.6	99.6	99.6	99.7	99.6	99.8	99.6	99.6	99.6	99.7	99.6	99.7
9	100.0	99.5	99.5	99.5	99.6	99.6	99.7	99.5	99.5	99.5	99.7	99.6	99.7
10	100.0	99.6	99.6	99.6	99.6	99.6	99.8	99.5	99.5	99.5	99.7	99.5	99.7
11	100.0	99.4	99.5	99.4	99.4	99.4	99.6	99.4	99.4	99.4	99.5	99.4	99.5
12	100.0	99.4	99.4	99.4	99.5	99.5	99.7	99.4	99.4	99.5	99.6	99.5	99.6
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	99.5	99.5	99.5	99.5	99.5	99.7	99.5	99.5	99.5	99.6	99.5	99.6
Med.	100.0	99.5	99.5	99.5	99.5	99.5	99.7	99.5	99.4	99.5	99.6	99.5	99.6
σ	0.00	0.06	0.06	0.07	0.07	0.05	0.06	0.07	0.07	0.06	0.07	0.07	0.07
Min.	100.0	99.4	99.4	99.4	99.4	99.4	99.6	99.4	99.4	99.4	99.5	99.4	99.5
Max.	100.0	99.6	99.6	99.6	99.7	99.6	99.8	99.6	99.6	99.6	99.7	99.6	99.7

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Data Set 1 : 55 °C, 200 mA

Actual Case Temperature [T_S]	56.6 °C
Actual Ambient Temperature [T_A]	53.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	0.0000	0.0014	0.0016	0.0018	0.0019	0.0023	0.0021	0.0025	0.0026	0.0026	0.0026	0.0028	0.0027
2	0.0000	0.0016	0.0018	0.0019	0.0020	0.0021	0.0023	0.0024	0.0025	0.0025	0.0025	0.0025	0.0024
3	0.0000	0.0016	0.0017	0.0019	0.0020	0.0022	0.0022	0.0023	0.0024	0.0024	0.0024	0.0024	0.0023
4	0.0000	0.0016	0.0017	0.0019	0.0019	0.0021	0.0020	0.0022	0.0023	0.0023	0.0023	0.0023	0.0022
5	0.0000	0.0016	0.0017	0.0019	0.0020	0.0021	0.0021	0.0023	0.0024	0.0023	0.0023	0.0023	0.0022
6	0.0000	0.0014	0.0015	0.0017	0.0017	0.0020	0.0020	0.0023	0.0024	0.0024	0.0024	0.0025	0.0024
7	0.0000	0.0018	0.0019	0.0020	0.0021	0.0023	0.0022	0.0025	0.0025	0.0025	0.0024	0.0025	0.0023
8	0.0000	0.0016	0.0018	0.0021	0.0020	0.0023	0.0023	0.0025	0.0026	0.0027	0.0027	0.0029	0.0027
9	0.0000	0.0018	0.0019	0.0019	0.0021	0.0022	0.0023	0.0025	0.0026	0.0026	0.0026	0.0028	0.0025
10	0.0000	0.0017	0.0018	0.0020	0.0021	0.0023	0.0023	0.0025	0.0025	0.0026	0.0026	0.0026	0.0025
11	0.0000	0.0016	0.0018	0.0019	0.0019	0.0021	0.0022	0.0024	0.0024	0.0024	0.0024	0.0024	0.0023
12	0.0000	0.0017	0.0018	0.0020	0.0020	0.0022	0.0022	0.0024	0.0024	0.0024	0.0025	0.0025	0.0023
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.0000	0.0016	0.0017	0.0019	0.0020	0.0022	0.0022	0.0024	0.0025	0.0025	0.0025	0.0026	0.0024
Med.	0.0000	0.0016	0.0018	0.0019	0.0020	0.0022	0.0022	0.0024	0.0024	0.0024	0.0025	0.0025	0.0024
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
Min.	0.0000	0.0014	0.0015	0.0017	0.0017	0.0020	0.0020	0.0022	0.0023	0.0023	0.0023	0.0023	0.0022
Max.	0.0000	0.0018	0.0019	0.0021	0.0021	0.0023	0.0023	0.0025	0.0026	0.0027	0.0027	0.0029	0.0027

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Data Set 1 : 55 °C, 200 mA

Actual Case Temperature [T_S]	56.6 °C
Actual Ambient Temperature [T_A]	53.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	0.2598	0.2584	0.2583	0.2581	0.2580	0.2576	0.2578	0.2575	0.2574	0.2574	0.2573	0.2572	0.2573
2	0.2610	0.2594	0.2593	0.2592	0.2590	0.2589	0.2588	0.2586	0.2586	0.2586	0.2586	0.2586	0.2587
3	0.2601	0.2586	0.2585	0.2583	0.2582	0.2580	0.2580	0.2579	0.2578	0.2579	0.2578	0.2578	0.2579
4	0.2605	0.2590	0.2588	0.2586	0.2586	0.2584	0.2585	0.2584	0.2583	0.2583	0.2583	0.2582	0.2584
5	0.2602	0.2586	0.2585	0.2583	0.2582	0.2580	0.2581	0.2579	0.2578	0.2579	0.2579	0.2579	0.2580
6	0.2606	0.2592	0.2591	0.2590	0.2589	0.2586	0.2586	0.2584	0.2582	0.2583	0.2582	0.2582	0.2583
7	0.2610	0.2592	0.2591	0.2591	0.2589	0.2587	0.2588	0.2586	0.2586	0.2586	0.2586	0.2585	0.2587
8	0.2618	0.2602	0.2600	0.2598	0.2598	0.2595	0.2595	0.2593	0.2592	0.2592	0.2592	0.2590	0.2592
9	0.2596	0.2579	0.2578	0.2577	0.2575	0.2574	0.2574	0.2572	0.2571	0.2571	0.2571	0.2570	0.2572
10	0.2600	0.2584	0.2583	0.2581	0.2580	0.2578	0.2579	0.2576	0.2576	0.2576	0.2576	0.2576	0.2577
11	0.2599	0.2583	0.2581	0.2580	0.2579	0.2578	0.2577	0.2575	0.2575	0.2576	0.2576	0.2575	0.2577
12	0.2600	0.2583	0.2583	0.2582	0.2580	0.2578	0.2579	0.2577	0.2577	0.2578	0.2576	0.2576	0.2578
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.2604	0.2588	0.2587	0.2585	0.2584	0.2582	0.2582	0.2581	0.2580	0.2580	0.2580	0.2579	0.2581
Med.	0.2602	0.2586	0.2585	0.2583	0.2582	0.2580	0.2580	0.2579	0.2578	0.2579	0.2579	0.2579	0.2579
σ	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Min.	0.2596	0.2579	0.2578	0.2577	0.2575	0.2574	0.2574	0.2572	0.2571	0.2571	0.2571	0.2570	0.2572
Max.	0.2618	0.2602	0.2600	0.2598	0.2598	0.2595	0.2595	0.2593	0.2592	0.2592	0.2592	0.2590	0.2592

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Data Set 1 : 55 °C, 200 mA

Actual Case Temperature [T_S]	56.6 °C
Actual Ambient Temperature [T_A]	53.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

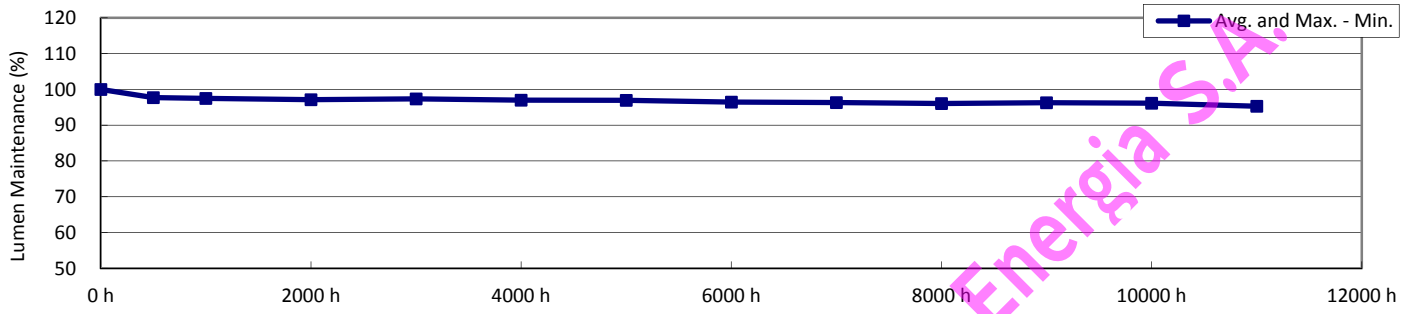
TABLE 1-6
Chromaticity

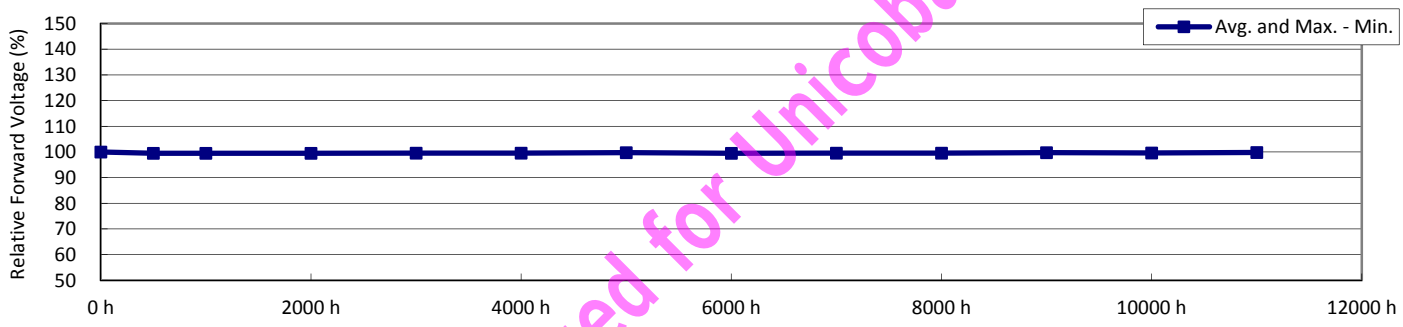
LED No.	Chromaticity v'												
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
1	0.5291	0.5287	0.5287	0.5285	0.5286	0.5285	0.5285	0.5283	0.5282	0.5282	0.5282	0.5281	0.5282
2	0.5307	0.5304	0.5303	0.5302	0.5304	0.5302	0.5302	0.5301	0.5301	0.5300	0.5300	0.5300	0.5301
3	0.5294	0.5291	0.5291	0.5290	0.5291	0.5290	0.5291	0.5290	0.5288	0.5288	0.5288	0.5288	0.5289
4	0.5311	0.5308	0.5308	0.5307	0.5308	0.5307	0.5307	0.5306	0.5306	0.5305	0.5306	0.5305	0.5307
5	0.5304	0.5301	0.5301	0.5300	0.5302	0.5301	0.5300	0.5299	0.5299	0.5299	0.5299	0.5299	0.5300
6	0.5295	0.5292	0.5292	0.5291	0.5292	0.5291	0.5291	0.5290	0.5289	0.5288	0.5289	0.5288	0.5289
7	0.5304	0.5300	0.5300	0.5298	0.5300	0.5299	0.5300	0.5298	0.5297	0.5298	0.5298	0.5297	0.5298
8	0.5312	0.5307	0.5306	0.5305	0.5307	0.5306	0.5305	0.5304	0.5304	0.5303	0.5303	0.5302	0.5303
9	0.5293	0.5290	0.5289	0.5288	0.5290	0.5288	0.5289	0.5287	0.5286	0.5286	0.5286	0.5285	0.5286
10	0.5285	0.5279	0.5279	0.5278	0.5279	0.5278	0.5278	0.5277	0.5277	0.5276	0.5277	0.5276	0.5277
11	0.5304	0.5301	0.5301	0.5300	0.5302	0.5301	0.5301	0.5300	0.5299	0.5299	0.5299	0.5298	0.5300
12	0.5289	0.5284	0.5284	0.5283	0.5285	0.5284	0.5284	0.5283	0.5282	0.5282	0.5282	0.5281	0.5284
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.5299	0.5295	0.5295	0.5294	0.5296	0.5294	0.5294	0.5293	0.5292	0.5292	0.5293	0.5292	0.5293
Med.	0.5299	0.5296	0.5296	0.5295	0.5296	0.5295	0.5296	0.5294	0.5293	0.5293	0.5293	0.5293	0.5294
σ	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Min.	0.5285	0.5279	0.5279	0.5278	0.5279	0.5278	0.5278	0.5277	0.5277	0.5276	0.5277	0.5276	0.5277
Max.	0.5312	0.5308	0.5308	0.5307	0.5308	0.5307	0.5307	0.5306	0.5306	0.5305	0.5306	0.5305	0.5307

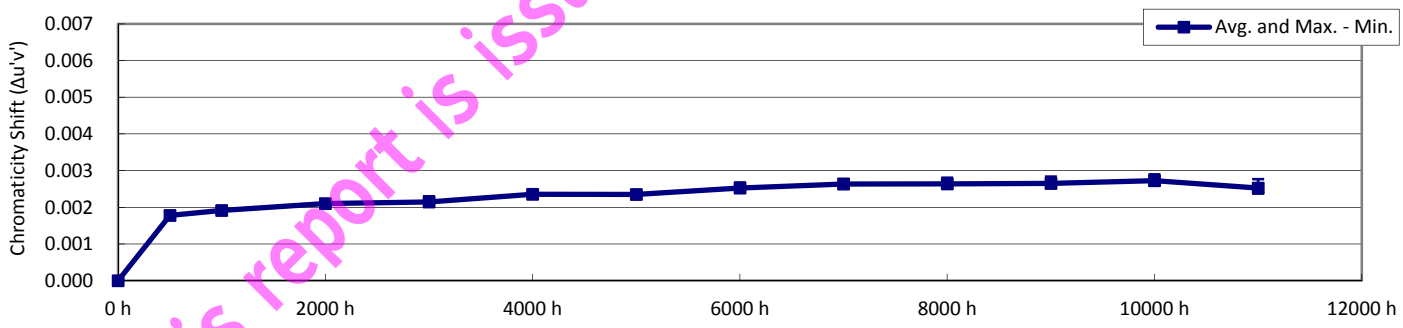
Data Set 2 : 55 °C, 250 mA

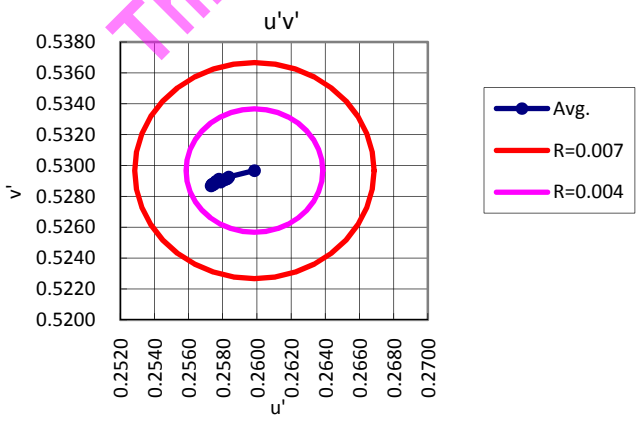
Actual Case Temperature [T_S]	55.7 °C
Actual Ambient Temperature [T_A]	52.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0









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Data Set 2 : 55 °C, 250 mA

Actual Case Temperature [T_S]	55.7 °C
Actual Ambient Temperature [T_A]	52.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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 Φ_V [lm]	Forward voltage V_F [V]	CCT T_{CP} [K]	Input Power P [W]	CIE1931 x	CIE1931 y	CIE1976 u'	CIE1976 v'
1	1266	47.1	2760	11.8	0.458	0.415	0.259	0.529
2	1257	47.4	2729	11.9	0.462	0.419	0.260	0.531
3	1271	47.1	2768	11.8	0.459	0.418	0.259	0.530
4	1259	47.3	2740	11.8	0.462	0.419	0.260	0.531
5	1253	47.3	2712	11.8	0.463	0.417	0.261	0.530
6	1280	47.1	2744	11.8	0.461	0.418	0.260	0.530
7	1265	47.1	2733	11.8	0.461	0.417	0.260	0.530
8	1278	47.1	2722	11.8	0.462	0.418	0.261	0.530
9	1277	47.2	2756	11.8	0.458	0.414	0.260	0.529
10	1262	47.3	2764	11.8	0.458	0.415	0.259	0.528
11	1283	47.2	2787	11.8	0.456	0.414	0.258	0.528
12	1256	47.3	2735	11.8	0.461	0.418	0.260	0.530
n	12	12	12	12	12	12	12	12
Avg.	1267	47.2	2746	11.8	0.460	0.417	0.260	0.530
Med.	1265	47.2	2742	11.8	0.461	0.417	0.260	0.530
σ	10.4	0.10	21.5	0.02	0.0023	0.0018	0.0009	0.0010
Min.	1253	47.1	2712	11.8	0.456	0.414	0.258	0.528
Max.	1283	47.4	2787	11.9	0.463	0.419	0.261	0.531

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Data Set 2 : 55 °C, 250 mA

Actual Case Temperature [T_S]	55.7 °C
Actual Ambient Temperature [T_A]	52.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

TABLE 2-2
Lumen Maintenance

LED No.	Lumen 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	11000 h
1	100.0	97.4	97.1	97.1	97.4	96.9	96.9	96.5	96.3	96.0	96.2	96.0	95.0
2	100.0	97.4	97.1	96.8	96.9	96.5	96.3	95.8	95.5	95.2	95.4	95.2	94.3
3	100.0	97.8	97.6	97.3	97.5	97.1	97.0	96.7	96.5	96.3	96.5	96.4	95.6
4	100.0	97.7	97.3	97.0	97.2	96.8	96.7	96.2	96.0	95.8	96.0	95.8	94.9
5	100.0	97.8	97.6	97.1	97.4	97.1	97.1	96.6	96.5	96.2	96.4	96.3	95.5
6	100.0	97.8	97.6	97.3	97.5	97.2	97.2	96.7	96.6	96.3	96.6	96.5	95.7
7	100.0	97.8	97.7	97.3	97.4	97.0	96.9	96.5	96.3	96.1	96.2	96.1	95.2
8	100.0	97.5	97.2	97.2	97.6	97.2	97.1	96.7	96.5	96.3	96.4	96.3	95.4
9	100.0	97.7	97.5	97.2	97.4	97.0	96.9	96.4	96.3	96.1	96.3	96.2	95.3
10	100.0	97.8	97.6	97.2	97.4	97.0	97.0	96.5	96.4	96.1	96.4	96.3	95.4
11	100.0	97.7	97.5	97.1	97.3	96.9	96.9	96.4	96.3	96.0	96.3	96.2	95.3
12	100.0	98.0	97.7	97.2	97.6	97.2	97.2	96.8	96.5	96.3	96.5	96.4	95.5
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	97.7	97.5	97.1	97.4	97.0	96.9	96.5	96.3	96.1	96.3	96.1	95.3
Med.	100.0	97.7	97.6	97.2	97.4	97.0	97.0	96.5	96.4	96.1	96.3	96.2	95.4
σ	0.00	0.20	0.22	0.14	0.19	0.22	0.25	0.27	0.29	0.32	0.32	0.37	0.38
Min.	100.0	97.4	97.1	96.8	96.9	96.5	96.3	95.8	95.5	95.2	95.4	95.2	94.3
Max.	100.0	98.0	97.7	97.3	97.6	97.2	97.2	96.8	96.6	96.3	96.6	96.5	95.7

TM-21 Projection

Time	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
ln(Avg.)	-0.0312	-0.0359	-0.0375	-0.0402	-0.0381	-0.0393	-0.0484

Test duration used	5000 h to 11000 h	
B	0.978	
α	2.11E-06	
R^2	0.767	
Calculated L_{70} (11K)	158000	hours
Reported L_{70} (11K)	> 60500	hours
Calculated L_{80} (11K)	95300	hours
Reported L_{80} (11K)	> 60500	hours
Calculated L_{90} (11K)	39600	hours
Reported L_{90} (11K)	39600	hours

Curve-fit equation:
$\Phi(t)=B\exp(-\alpha t)$

Lumen maintenance life eqation:
$L_{70}=\ln(B/0.7)/\alpha$

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

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

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Data Set 2 : 55 °C, 250 mA

Actual Case Temperature [T_S]	55.7 °C
Actual Ambient Temperature [T_A]	52.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	100.0	99.4	99.5	99.4	99.5	99.5	99.6	99.4	99.4	99.5	99.6	99.5	99.6
2	100.0	99.4	99.5	99.5	99.5	99.5	99.8	99.4	99.5	99.5	99.7	99.6	99.8
3	100.0	99.4	99.5	99.4	99.5	99.5	99.7	99.4	99.5	99.5	99.7	99.5	99.7
4	100.0	99.4	99.4	99.5	99.5	99.5	99.8	99.5	99.6	99.6	99.8	99.7	99.8
5	100.0	99.4	99.5	99.5	99.6	99.6	99.8	99.5	99.6	99.6	99.8	99.7	99.9
6	100.0	99.5	99.5	99.5	99.5	99.5	99.7	99.5	99.5	99.5	99.6	99.5	99.7
7	100.0	99.4	99.5	99.5	99.5	99.5	99.7	99.5	99.5	99.5	99.7	99.6	99.8
8	100.0	99.5	99.5	99.5	99.5	99.6	99.7	99.5	99.5	99.5	99.7	99.6	99.7
9	100.0	99.6	99.6	99.6	99.6	99.6	99.8	99.6	99.6	99.6	99.8	99.7	99.8
10	100.0	99.4	99.5	99.5	99.5	99.6	99.8	99.5	99.6	99.6	99.8	99.7	99.9
11	100.0	99.5	99.6	99.5	99.6	99.6	99.8	99.5	99.6	99.6	99.8	99.6	99.8
12	100.0	99.4	99.4	99.5	99.6	99.6	99.8	99.6	99.6	99.7	99.8	99.7	99.9
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	99.5	99.5	99.5	99.5	99.5	99.7	99.5	99.5	99.6	99.7	99.6	99.8
Med.	100.0	99.4	99.5	99.5	99.5	99.6	99.8	99.5	99.5	99.6	99.7	99.6	99.8
σ	0.00	0.06	0.05	0.04	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.10
Min.	100.0	99.4	99.4	99.4	99.5	99.5	99.6	99.4	99.4	99.5	99.6	99.5	99.6
Max.	100.0	99.6	99.6	99.6	99.6	99.6	99.8	99.6	99.6	99.7	99.8	99.7	99.9

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Data Set 2 : 55 °C, 250 mA

Actual Case Temperature [T_S]	55.7 °C
Actual Ambient Temperature [T_A]	52.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	0.0000	0.0018	0.0018	0.0021	0.0021	0.0023	0.0023	0.0025	0.0027	0.0026	0.0027	0.0027	0.0025
2	0.0000	0.0017	0.0019	0.0020	0.0021	0.0023	0.0024	0.0025	0.0027	0.0027	0.0028	0.0028	0.0028
3	0.0000	0.0018	0.0019	0.0021	0.0021	0.0023	0.0022	0.0025	0.0025	0.0025	0.0025	0.0026	0.0024
4	0.0000	0.0018	0.0019	0.0022	0.0022	0.0025	0.0024	0.0026	0.0027	0.0028	0.0028	0.0029	0.0027
5	0.0000	0.0017	0.0019	0.0021	0.0020	0.0023	0.0023	0.0025	0.0026	0.0025	0.0026	0.0027	0.0024
6	0.0000	0.0019	0.0020	0.0021	0.0023	0.0024	0.0023	0.0025	0.0026	0.0026	0.0025	0.0026	0.0024
7	0.0000	0.0018	0.0020	0.0021	0.0023	0.0024	0.0024	0.0026	0.0028	0.0028	0.0027	0.0028	0.0026
8	0.0000	0.0017	0.0019	0.0021	0.0021	0.0023	0.0023	0.0025	0.0025	0.0026	0.0026	0.0027	0.0025
9	0.0000	0.0019	0.0020	0.0022	0.0022	0.0024	0.0024	0.0027	0.0027	0.0028	0.0027	0.0028	0.0026
10	0.0000	0.0018	0.0019	0.0022	0.0022	0.0024	0.0023	0.0025	0.0026	0.0026	0.0027	0.0027	0.0025
11	0.0000	0.0018	0.0018	0.0021	0.0021	0.0023	0.0023	0.0025	0.0026	0.0026	0.0027	0.0027	0.0025
12	0.0000	0.0018	0.0019	0.0020	0.0021	0.0023	0.0023	0.0025	0.0025	0.0026	0.0026	0.0026	0.0025
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.0000	0.0018	0.0019	0.0021	0.0021	0.0024	0.0024	0.0025	0.0026	0.0026	0.0027	0.0027	0.0025
Med.	0.0000	0.0018	0.0019	0.0021	0.0021	0.0023	0.0023	0.0025	0.0026	0.0026	0.0027	0.0027	0.0025
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	0.0001
Min.	0.0000	0.0017	0.0018	0.0020	0.0020	0.0023	0.0022	0.0025	0.0025	0.0025	0.0025	0.0026	0.0024
Max.	0.0000	0.0019	0.0020	0.0022	0.0023	0.0025	0.0024	0.0027	0.0028	0.0028	0.0028	0.0029	0.0028

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Data Set 2 : 55 °C, 250 mA

Actual Case Temperature [T_S]	55.7 °C
Actual Ambient Temperature [T_A]	52.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	0.2596	0.2579	0.2578	0.2576	0.2576	0.2574	0.2574	0.2572	0.2571	0.2571	0.2571	0.2570	0.2573
2	0.2605	0.2590	0.2587	0.2586	0.2585	0.2584	0.2583	0.2582	0.2580	0.2581	0.2579	0.2579	0.2579
3	0.2590	0.2572	0.2571	0.2570	0.2569	0.2568	0.2568	0.2566	0.2566	0.2566	0.2566	0.2565	0.2567
4	0.2601	0.2584	0.2584	0.2581	0.2580	0.2578	0.2578	0.2576	0.2575	0.2575	0.2574	0.2574	0.2575
5	0.2615	0.2599	0.2597	0.2596	0.2595	0.2593	0.2593	0.2592	0.2591	0.2592	0.2591	0.2590	0.2593
6	0.2600	0.2582	0.2581	0.2580	0.2578	0.2578	0.2578	0.2576	0.2575	0.2576	0.2576	0.2575	0.2577
7	0.2606	0.2589	0.2588	0.2586	0.2584	0.2583	0.2583	0.2582	0.2580	0.2580	0.2580	0.2579	0.2582
8	0.2611	0.2595	0.2593	0.2591	0.2591	0.2589	0.2589	0.2588	0.2587	0.2587	0.2587	0.2586	0.2588
9	0.2598	0.2580	0.2579	0.2578	0.2577	0.2575	0.2575	0.2573	0.2573	0.2572	0.2573	0.2572	0.2574
10	0.2594	0.2577	0.2576	0.2574	0.2574	0.2571	0.2572	0.2571	0.2570	0.2570	0.2569	0.2569	0.2571
11	0.2584	0.2567	0.2567	0.2565	0.2564	0.2562	0.2562	0.2560	0.2560	0.2560	0.2559	0.2559	0.2561
12	0.2605	0.2588	0.2587	0.2586	0.2584	0.2582	0.2582	0.2581	0.2581	0.2580	0.2580	0.2580	0.2582
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.2600	0.2584	0.2582	0.2581	0.2580	0.2578	0.2578	0.2577	0.2576	0.2576	0.2576	0.2575	0.2577
Med.	0.2601	0.2583	0.2582	0.2581	0.2579	0.2578	0.2578	0.2576	0.2575	0.2575	0.2575	0.2575	0.2576
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	0.0009
Min.	0.2584	0.2567	0.2567	0.2565	0.2564	0.2562	0.2562	0.2560	0.2560	0.2560	0.2559	0.2559	0.2561
Max.	0.2615	0.2599	0.2597	0.2596	0.2595	0.2593	0.2593	0.2592	0.2591	0.2592	0.2591	0.2590	0.2593

Data Set 2 : 55 °C, 250 mA

Actual Case Temperature [T_S]	55.7 °C
Actual Ambient Temperature [T_A]	52.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

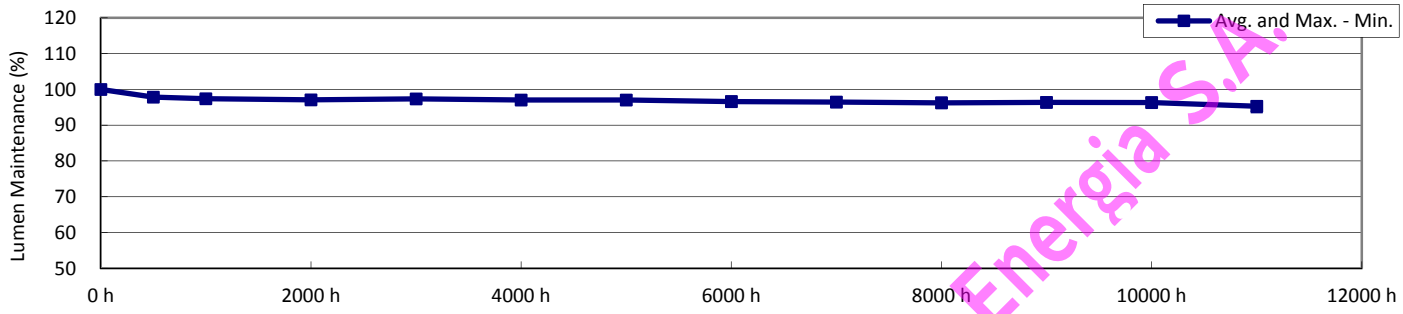
TABLE 2-6
Chromaticity

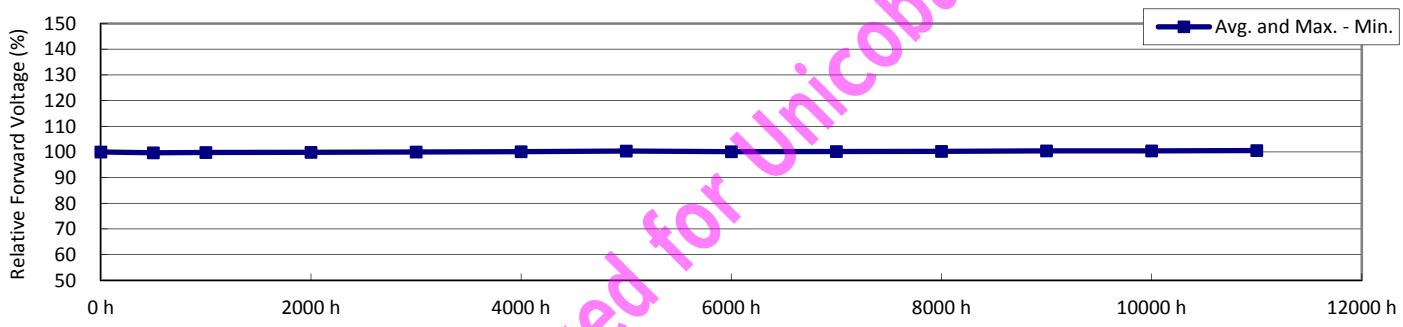
LED No.	Chromaticity v'												
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
1	0.5289	0.5284	0.5283	0.5281	0.5283	0.5282	0.5282	0.5281	0.5280	0.5280	0.5280	0.5279	0.5280
2	0.5310	0.5304	0.5304	0.5303	0.5304	0.5303	0.5303	0.5301	0.5300	0.5300	0.5300	0.5299	0.5300
3	0.5301	0.5296	0.5296	0.5294	0.5296	0.5294	0.5294	0.5294	0.5293	0.5292	0.5292	0.5292	0.5294
4	0.5311	0.5306	0.5305	0.5304	0.5306	0.5304	0.5304	0.5302	0.5302	0.5302	0.5302	0.5301	0.5302
5	0.5304	0.5300	0.5299	0.5298	0.5300	0.5298	0.5298	0.5297	0.5296	0.5296	0.5296	0.5295	0.5296
6	0.5303	0.5299	0.5298	0.5297	0.5298	0.5297	0.5297	0.5296	0.5295	0.5295	0.5295	0.5295	0.5296
7	0.5302	0.5296	0.5296	0.5295	0.5296	0.5294	0.5295	0.5294	0.5293	0.5292	0.5293	0.5292	0.5293
8	0.5307	0.5301	0.5301	0.5300	0.5301	0.5301	0.5300	0.5300	0.5299	0.5298	0.5298	0.5298	0.5299
9	0.5288	0.5281	0.5280	0.5280	0.5282	0.5280	0.5280	0.5278	0.5278	0.5278	0.5277	0.5276	0.5278
10	0.5288	0.5281	0.5281	0.5280	0.5282	0.5280	0.5280	0.5279	0.5279	0.5278	0.5278	0.5277	0.5279
11	0.5282	0.5276	0.5275	0.5274	0.5276	0.5273	0.5274	0.5273	0.5271	0.5271	0.5271	0.5271	0.5272
12	0.5305	0.5300	0.5299	0.5298	0.5300	0.5299	0.5299	0.5298	0.5297	0.5296	0.5297	0.5296	0.5297
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.5299	0.5294	0.5293	0.5292	0.5294	0.5292	0.5292	0.5291	0.5290	0.5290	0.5290	0.5289	0.5290
Med.	0.5303	0.5297	0.5297	0.5296	0.5297	0.5296	0.5296	0.5295	0.5294	0.5294	0.5294	0.5294	0.5295
σ	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Min.	0.5282	0.5276	0.5275	0.5274	0.5276	0.5273	0.5274	0.5273	0.5271	0.5271	0.5271	0.5271	0.5272
Max.	0.5311	0.5306	0.5305	0.5304	0.5306	0.5304	0.5304	0.5302	0.5302	0.5302	0.5302	0.5301	0.5302

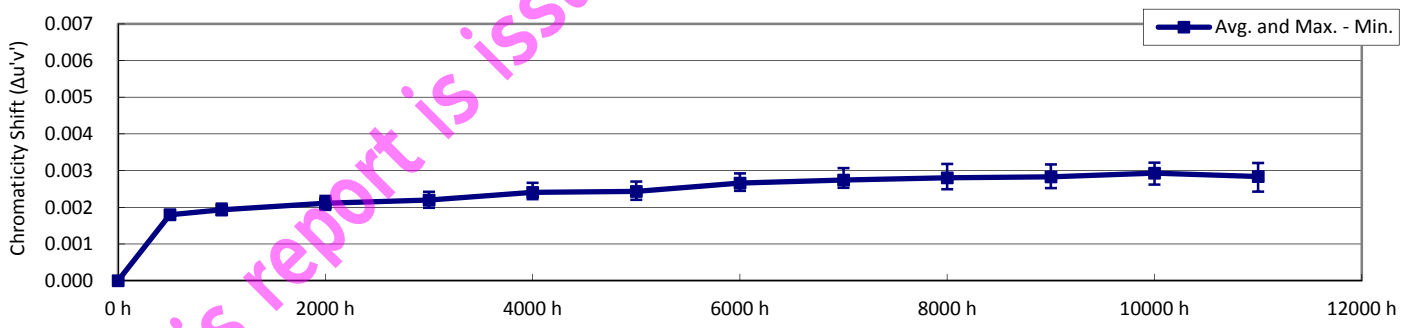
Data Set 3 : 85 °C, 200 mA

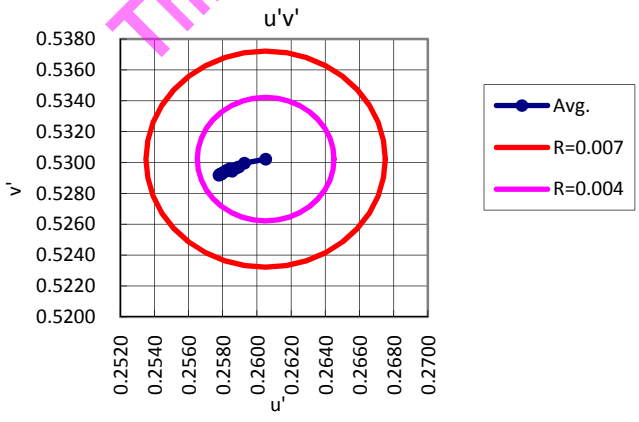
Actual Case Temperature [T_S]	85.4 °C
Actual Ambient Temperature [T_A]	83.4 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0









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Data Set 3 : 85 °C, 200 mA

Actual Case Temperature [T_S]	85.4 °C
Actual Ambient Temperature [T_A]	83.4 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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 Φ_V [lm]	Forward voltage V_F [V]	CCT T_{CP} [K]	Input Power P [W]	CIE1931 x	CIE1931 y	CIE1976 u'	CIE1976 v'
1	1059	45.5	2729	9.1	0.462	0.418	0.261	0.530
2	1045	45.7	2723	9.1	0.463	0.419	0.261	0.531
3	1042	45.7	2737	9.1	0.461	0.418	0.260	0.530
4	1053	45.6	2746	9.1	0.459	0.415	0.260	0.529
5	1056	45.4	2699	9.1	0.464	0.417	0.262	0.530
6	1040	45.7	2719	9.1	0.463	0.419	0.261	0.531
7	1031	45.7	2714	9.1	0.463	0.418	0.261	0.531
8	1033	45.7	2739	9.1	0.461	0.418	0.260	0.530
9	1058	45.5	2716	9.1	0.463	0.418	0.261	0.531
10	1058	45.4	2713	9.1	0.463	0.419	0.261	0.531
11	1041	45.6	2759	9.1	0.459	0.416	0.259	0.529
12	1052	45.5	2763	9.1	0.458	0.415	0.259	0.529
n	12	12	12	12	12	12	12	12
Avg.	1047	45.6	2730	9.1	0.462	0.418	0.261	0.530
Med.	1049	45.6	2726	9.1	0.462	0.418	0.261	0.530
σ	9.9	0.10	19.6	0.02	0.0020	0.0014	0.0008	0.0008
Min.	1031	45.4	2699	9.1	0.458	0.415	0.259	0.529
Max.	1059	45.7	2763	9.1	0.464	0.419	0.262	0.531

Data Set 3 : 85 °C, 200 mA

Actual Case Temperature [T_S]	85.4 °C
Actual Ambient Temperature [T_A]	83.4 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

TABLE 3-2
Lumen Maintenance

LED No.	Lumen 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	11000 h
1	100.0	97.6	97.1	97.3	97.5	97.3	97.4	96.8	96.8	96.5	96.6	96.3	95.1
2	100.0	97.1	96.6	96.1	96.1	95.8	95.7	95.2	95.1	95.0	95.1	95.0	93.7
3	100.0	97.2	96.7	96.2	96.3	95.9	95.9	95.4	95.3	95.2	95.3	95.3	94.4
4	100.0	98.0	97.7	97.4	97.6	97.3	97.4	97.0	96.9	96.7	96.9	96.8	95.8
5	100.0	97.8	97.5	97.0	97.4	97.2	97.1	96.7	96.6	96.3	96.4	96.3	95.3
6	100.0	98.0	97.5	97.2	97.5	97.2	97.2	96.7	96.6	96.4	96.7	96.6	95.7
7	100.0	97.8	97.4	96.9	97.2	96.8	96.8	96.3	96.1	96.0	96.2	96.2	95.3
8	100.0	98.5	98.3	98.3	98.6	98.3	98.4	98.0	97.8	97.6	97.7	97.7	96.6
9	100.0	97.5	97.1	96.7	97.0	96.7	96.7	96.3	96.2	95.8	96.0	95.8	94.7
10	100.0	97.9	97.5	97.2	97.6	97.1	97.2	96.6	96.5	96.3	96.4	96.3	95.3
11	100.0	98.1	97.7	97.3	97.5	97.2	97.3	96.8	96.8	96.5	96.7	96.6	95.7
12	100.0	98.5	97.9	97.2	97.7	97.3	97.3	96.9	96.8	96.6	96.8	96.7	95.8
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	97.8	97.4	97.1	97.3	97.0	97.0	96.6	96.5	96.2	96.4	96.3	95.3
Med.	100.0	97.9	97.5	97.2	97.5	97.2	97.2	96.7	96.6	96.4	96.5	96.3	95.3
σ	0.00	0.44	0.48	0.58	0.66	0.68	0.70	0.72	0.72	0.70	0.70	0.71	0.76
Min.	100.0	97.1	96.6	96.1	96.1	95.8	95.7	95.2	95.1	95.0	95.1	95.0	93.7
Max.	100.0	98.5	98.3	98.3	98.6	98.3	98.4	98.0	97.8	97.6	97.7	97.7	96.6

TM-21 Projection

Time	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
ln(Avg.)	-0.0301	-0.0349	-0.0360	-0.0382	-0.0368	-0.0377	-0.0483

Test duration used	5000 h to 11000 h	
B	0.980	
α	2.18E-06	
R^2	0.732	
Calculated L_{70} (11K)	154000	hours
Reported L_{70} (11K)	> 60500	hours
Calculated L_{80} (11K)	93200	hours
Reported L_{80} (11K)	> 60500	hours
Calculated L_{90} (11K)	39200	hours
Reported L_{90} (11K)	39200	hours

Curve-fit equation:
$\Phi(t)=Bexp(-\alpha t)$

Lumen maintenance life eqation:
$L_{70}=ln(B/0.7)/\alpha$

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

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

Data Set 3 : 85 °C, 200 mA

Actual Case Temperature [T_S]	85.4 °C
Actual Ambient Temperature [T_A]	83.4 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	100.0	99.8	99.9	100.0	100.0	100.1	100.4	100.1	100.2	100.3	100.4	100.3	100.5
2	100.0	99.6	99.7	99.9	100.0	100.1	100.4	100.2	100.3	100.4	100.6	100.5	100.8
3	100.0	99.6	99.7	99.9	100.0	100.1	100.4	100.2	100.3	100.4	100.6	100.6	100.8
4	100.0	99.5	99.7	99.9	100.1	100.3	100.6	100.5	100.6	100.7	101.0	101.0	101.3
5	100.0	99.8	99.9	100.0	100.1	100.1	100.4	100.1	100.2	100.2	100.4	100.3	100.5
6	100.0	99.6	99.7	99.8	99.9	99.9	100.2	99.9	100.0	100.0	100.2	100.2	100.3
7	100.0	99.6	99.7	99.8	99.9	100.0	100.3	100.0	100.0	100.1	100.3	100.2	100.4
8	100.0	99.6	99.6	99.7	99.9	99.9	100.1	99.9	100.0	100.0	100.2	100.1	100.2
9	100.0	99.8	99.9	100.0	100.1	100.2	100.5	100.2	100.3	100.3	100.5	100.5	100.7
10	100.0	99.7	99.8	99.9	99.9	100.0	100.2	99.9	100.0	100.0	100.2	100.2	100.3
11	100.0	99.6	99.7	99.8	100.0	100.1	100.3	100.1	100.1	100.2	100.4	100.4	100.5
12	100.0	99.6	99.7	99.8	99.9	100.0	100.2	100.0	100.1	100.2	100.4	100.3	100.5
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	99.7	99.8	99.9	100.0	100.1	100.3	100.1	100.2	100.2	100.4	100.4	100.6
Med.	100.0	99.6	99.7	99.9	100.0	100.1	100.3	100.1	100.2	100.2	100.4	100.3	100.5
σ	0.00	0.11	0.10	0.09	0.08	0.12	0.14	0.16	0.18	0.21	0.24	0.25	0.28
Min.	100.0	99.5	99.6	99.7	99.9	99.9	100.1	99.9	100.0	100.0	100.2	100.1	100.2
Max.	100.0	99.8	99.9	100.0	100.1	100.3	100.6	100.5	100.6	100.7	101.0	101.0	101.3

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Data Set 3 : 85 °C, 200 mA

Actual Case Temperature [T_S]	85.4 °C
Actual Ambient Temperature [T_A]	83.4 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	0.0000	0.0018	0.0019	0.0020	0.0020	0.0022	0.0022	0.0025	0.0026	0.0027	0.0028	0.0029	0.0029
2	0.0000	0.0019	0.0021	0.0023	0.0024	0.0027	0.0026	0.0028	0.0031	0.0031	0.0032	0.0032	0.0032
3	0.0000	0.0019	0.0021	0.0023	0.0024	0.0027	0.0027	0.0029	0.0030	0.0032	0.0032	0.0032	0.0031
4	0.0000	0.0018	0.0019	0.0021	0.0022	0.0023	0.0024	0.0026	0.0027	0.0027	0.0028	0.0029	0.0028
5	0.0000	0.0018	0.0020	0.0022	0.0022	0.0024	0.0024	0.0027	0.0028	0.0028	0.0028	0.0030	0.0030
6	0.0000	0.0017	0.0018	0.0021	0.0023	0.0024	0.0025	0.0027	0.0028	0.0028	0.0029	0.0029	0.0027
7	0.0000	0.0018	0.0020	0.0022	0.0023	0.0025	0.0026	0.0028	0.0029	0.0029	0.0029	0.0030	0.0028
8	0.0000	0.0017	0.0018	0.0019	0.0020	0.0023	0.0022	0.0025	0.0025	0.0025	0.0025	0.0027	0.0026
9	0.0000	0.0019	0.0020	0.0022	0.0023	0.0025	0.0024	0.0028	0.0028	0.0029	0.0030	0.0032	0.0030
10	0.0000	0.0018	0.0019	0.0021	0.0023	0.0024	0.0025	0.0027	0.0028	0.0028	0.0028	0.0030	0.0029
11	0.0000	0.0017	0.0018	0.0020	0.0020	0.0022	0.0023	0.0024	0.0025	0.0026	0.0025	0.0026	0.0024
12	0.0000	0.0017	0.0019	0.0020	0.0020	0.0022	0.0023	0.0025	0.0025	0.0026	0.0026	0.0027	0.0025
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.0000	0.0018	0.0019	0.0021	0.0022	0.0024	0.0024	0.0027	0.0027	0.0028	0.0028	0.0029	0.0028
Med.	0.0000	0.0018	0.0019	0.0021	0.0022	0.0024	0.0024	0.0027	0.0028	0.0028	0.0028	0.0029	0.0028
σ	0.0000	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.0000	0.0017	0.0018	0.0019	0.0020	0.0022	0.0022	0.0024	0.0025	0.0025	0.0025	0.0026	0.0024
Max.	0.0000	0.0019	0.0021	0.0023	0.0024	0.0027	0.0027	0.0029	0.0031	0.0032	0.0032	0.0032	0.0032

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Data Set 3 : 85 °C, 200 mA

Actual Case Temperature [T_S]	85.4 °C
Actual Ambient Temperature [T_A]	83.4 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	0.2607	0.2590	0.2590	0.2589	0.2588	0.2586	0.2586	0.2584	0.2583	0.2582	0.2581	0.2581	0.2580
2	0.2608	0.2590	0.2589	0.2587	0.2585	0.2583	0.2583	0.2582	0.2580	0.2579	0.2579	0.2578	0.2578
3	0.2604	0.2586	0.2584	0.2583	0.2582	0.2579	0.2579	0.2577	0.2576	0.2574	0.2574	0.2574	0.2575
4	0.2602	0.2585	0.2584	0.2583	0.2582	0.2580	0.2579	0.2578	0.2578	0.2577	0.2577	0.2576	0.2577
5	0.2621	0.2604	0.2602	0.2601	0.2600	0.2598	0.2598	0.2596	0.2595	0.2595	0.2595	0.2593	0.2593
6	0.2610	0.2594	0.2593	0.2591	0.2588	0.2588	0.2587	0.2585	0.2584	0.2584	0.2583	0.2583	0.2584
7	0.2614	0.2596	0.2595	0.2594	0.2592	0.2590	0.2589	0.2587	0.2587	0.2586	0.2586	0.2586	0.2587
8	0.2602	0.2586	0.2585	0.2584	0.2583	0.2580	0.2581	0.2578	0.2578	0.2578	0.2578	0.2576	0.2577
9	0.2612	0.2594	0.2593	0.2592	0.2591	0.2589	0.2589	0.2586	0.2586	0.2585	0.2585	0.2583	0.2584
10	0.2614	0.2596	0.2596	0.2594	0.2592	0.2591	0.2590	0.2589	0.2588	0.2587	0.2588	0.2586	0.2587
11	0.2594	0.2577	0.2576	0.2575	0.2574	0.2572	0.2572	0.2570	0.2569	0.2569	0.2570	0.2569	0.2570
12	0.2595	0.2579	0.2577	0.2577	0.2575	0.2574	0.2573	0.2572	0.2571	0.2571	0.2571	0.2570	0.2571
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.2607	0.2590	0.2589	0.2587	0.2586	0.2584	0.2584	0.2582	0.2581	0.2581	0.2580	0.2580	0.2580
Med.	0.2608	0.2590	0.2589	0.2588	0.2586	0.2584	0.2585	0.2583	0.2581	0.2581	0.2580	0.2579	0.2579
σ	0.0008	0.0008	0.0008	0.0008	0.0007	0.0008	0.0008	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
Min.	0.2594	0.2577	0.2576	0.2575	0.2574	0.2572	0.2572	0.2570	0.2569	0.2569	0.2570	0.2569	0.2570
Max.	0.2621	0.2604	0.2602	0.2601	0.2600	0.2598	0.2598	0.2596	0.2595	0.2595	0.2595	0.2593	0.2593

Data Set 3 : 85 °C, 200 mA

Actual Case Temperature [T_S]	85.4 °C
Actual Ambient Temperature [T_A]	83.4 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

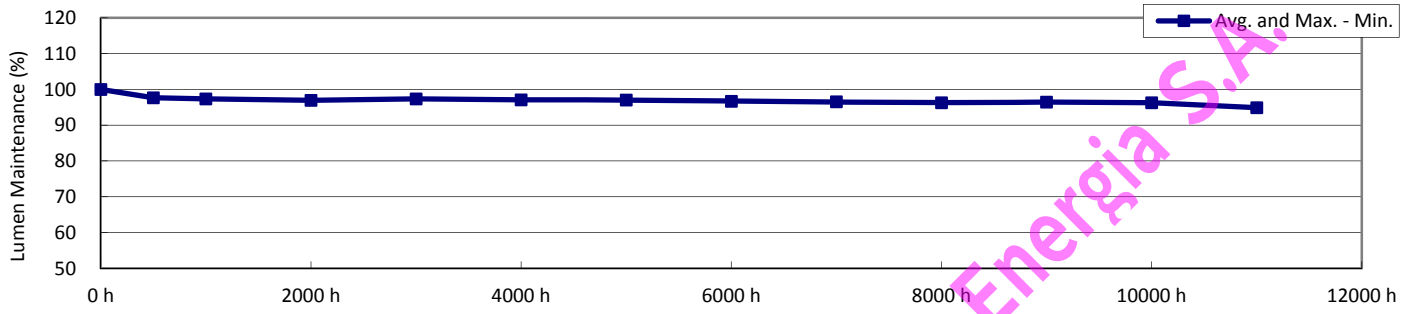
TABLE 3-6
Chromaticity

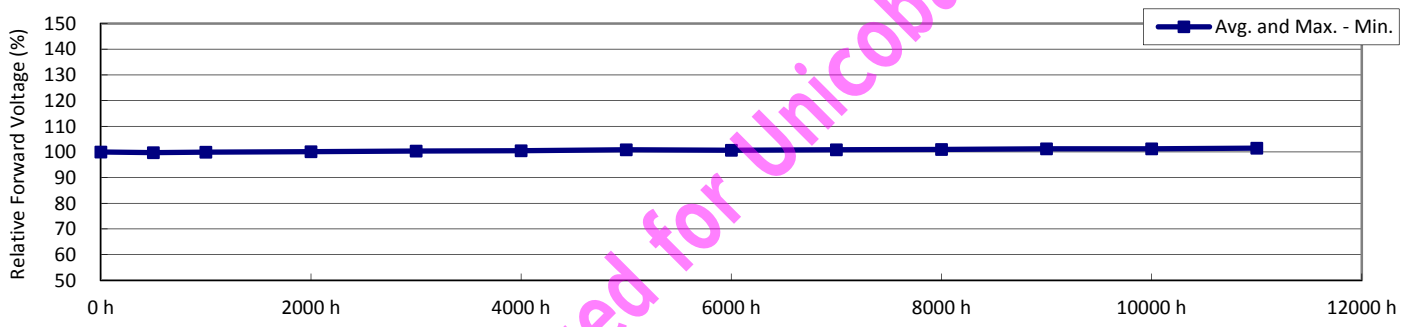
LED No.	Chromaticity v'												
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
1	0.5306	0.5301	0.5301	0.5299	0.5301	0.5300	0.5300	0.5299	0.5298	0.5298	0.5298	0.5296	0.5297
2	0.5311	0.5304	0.5303	0.5302	0.5303	0.5302	0.5301	0.5300	0.5299	0.5300	0.5300	0.5299	0.5299
3	0.5307	0.5301	0.5300	0.5299	0.5300	0.5298	0.5298	0.5297	0.5296	0.5296	0.5296	0.5295	0.5296
4	0.5291	0.5285	0.5284	0.5283	0.5284	0.5283	0.5283	0.5281	0.5280	0.5280	0.5280	0.5279	0.5280
5	0.5306	0.5301	0.5300	0.5299	0.5301	0.5299	0.5299	0.5298	0.5298	0.5297	0.5297	0.5297	0.5297
6	0.5312	0.5306	0.5306	0.5304	0.5305	0.5304	0.5305	0.5303	0.5303	0.5302	0.5303	0.5302	0.5303
7	0.5308	0.5303	0.5303	0.5301	0.5302	0.5302	0.5301	0.5300	0.5299	0.5299	0.5299	0.5299	0.5299
8	0.5306	0.5302	0.5301	0.5300	0.5301	0.5300	0.5300	0.5299	0.5299	0.5298	0.5298	0.5298	0.5298
9	0.5310	0.5304	0.5303	0.5302	0.5304	0.5302	0.5302	0.5301	0.5300	0.5299	0.5299	0.5298	0.5299
10	0.5312	0.5306	0.5306	0.5304	0.5306	0.5305	0.5305	0.5304	0.5303	0.5303	0.5302	0.5302	0.5302
11	0.5295	0.5290	0.5290	0.5289	0.5290	0.5289	0.5289	0.5288	0.5287	0.5287	0.5287	0.5287	0.5288
12	0.5288	0.5282	0.5281	0.5279	0.5281	0.5280	0.5280	0.5278	0.5278	0.5277	0.5277	0.5277	0.5278
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.5304	0.5299	0.5298	0.5297	0.5298	0.5297	0.5297	0.5296	0.5295	0.5295	0.5295	0.5294	0.5295
Med.	0.5307	0.5302	0.5301	0.5299	0.5301	0.5300	0.5300	0.5299	0.5299	0.5298	0.5298	0.5297	0.5298
σ	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
Min.	0.5288	0.5282	0.5281	0.5279	0.5281	0.5280	0.5280	0.5278	0.5278	0.5277	0.5277	0.5277	0.5278
Max.	0.5312	0.5306	0.5306	0.5304	0.5306	0.5305	0.5305	0.5304	0.5303	0.5303	0.5303	0.5302	0.5303

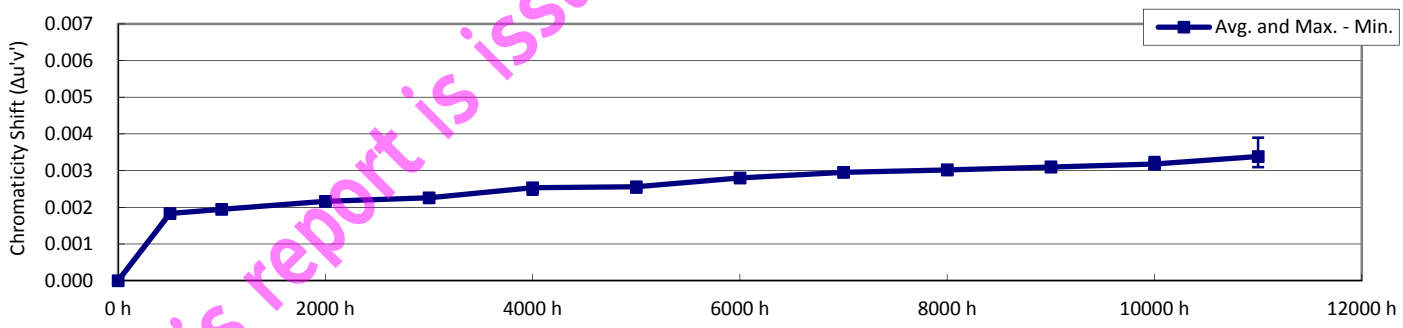
Data Set 4 : 85 °C, 250 mA

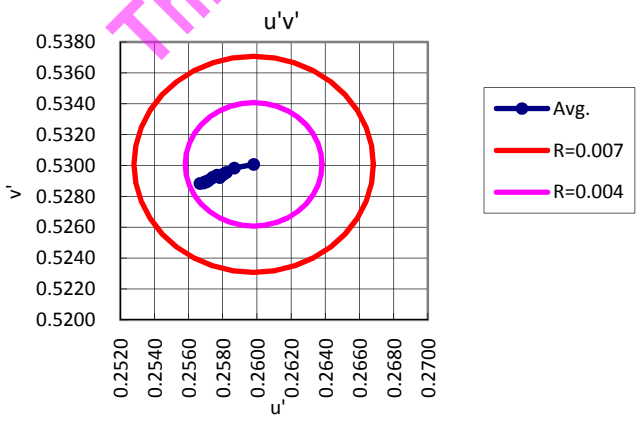
Actual Case Temperature [T_S]	86.0 °C
Actual Ambient Temperature [T_A]	83.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0









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Data Set 4 : 85 °C, 250 mA

Actual Case Temperature [T_S]	86.0 °C
Actual Ambient Temperature [T_A]	83.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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 Φ_V [lm]	Forward voltage V_F [V]	CCT T_{CP} [K]	Input Power P [W]	CIE1931 x	CIE1931 y	CIE1976 u'	CIE1976 v'
1	1284	47.2	2736	11.8	0.462	0.420	0.260	0.531
2	1281	47.1	2764	11.8	0.458	0.416	0.259	0.529
3	1269	47.3	2780	11.8	0.458	0.417	0.258	0.529
4	1252	47.3	2744	11.8	0.460	0.417	0.260	0.530
5	1260	47.4	2734	11.9	0.462	0.419	0.260	0.531
6	1267	47.3	2767	11.8	0.459	0.418	0.259	0.530
7	1253	47.2	2714	11.8	0.463	0.418	0.261	0.531
8	1263	47.2	2774	11.8	0.456	0.414	0.259	0.528
9	1256	47.3	2726	11.8	0.462	0.418	0.261	0.531
10	1267	47.1	2751	11.8	0.459	0.416	0.260	0.529
11	1272	47.2	2717	11.8	0.463	0.419	0.261	0.531
12	1283	47.1	2734	11.8	0.462	0.418	0.260	0.531
n	12	12	12	12	12	12	12	12
Avg.	1267	47.2	2745	11.8	0.461	0.418	0.260	0.530
Med.	1267	47.2	2740	11.8	0.461	0.418	0.260	0.530
σ	11.2	0.09	22.1	0.02	0.0023	0.0017	0.0009	0.0009
Min.	1252	47.1	2714	11.8	0.456	0.414	0.258	0.528
Max.	1284	47.4	2780	11.9	0.463	0.420	0.261	0.531

NICHIA

Data Set 4 : 85 °C, 250 mA

Actual Case Temperature [T_S]	86.0 °C
Actual Ambient Temperature [T_A]	83.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

TABLE 4-2
Lumen Maintenance

LED No.	Lumen 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	11000 h
1	100.0	97.3	97.1	97.0	97.3	97.1	97.2	96.7	96.5	96.3	96.2	95.9	93.8
2	100.0	97.5	97.2	96.9	97.2	97.0	96.9	96.5	96.4	96.0	96.2	95.9	94.2
3	100.0	97.7	97.4	97.0	97.2	97.1	97.0	96.6	96.6	96.3	96.5	96.4	95.2
4	100.0	97.8	97.6	97.2	97.5	97.3	97.2	96.9	96.8	96.6	96.8	96.6	95.5
5	100.0	97.8	97.4	96.8	97.2	97.0	96.9	96.5	96.4	96.2	96.4	96.2	95.3
6	100.0	97.7	97.3	97.0	97.5	97.1	97.1	96.8	96.7	96.5	96.7	96.6	95.6
7	100.0	97.7	97.3	96.9	97.2	96.9	96.9	96.5	96.4	96.1	96.2	96.1	94.9
8	100.0	97.1	96.9	96.8	97.2	97.1	97.0	96.5	96.4	96.2	96.2	96.0	94.2
9	100.0	97.6	97.3	96.8	97.2	96.8	96.7	96.4	96.3	96.1	96.3	96.2	94.9
10	100.0	97.8	97.5	97.1	97.4	97.1	97.1	96.8	96.7	96.5	96.6	96.6	95.3
11	100.0	97.8	97.5	97.1	97.5	97.3	97.3	96.8	96.7	96.5	96.6	96.6	95.3
12	100.0	98.1	97.6	97.0	97.5	97.3	97.2	96.8	96.6	96.3	96.5	96.3	94.5
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	97.7	97.3	97.0	97.3	97.1	97.0	96.7	96.5	96.3	96.4	96.3	94.9
Med.	100.0	97.7	97.3	97.0	97.3	97.1	97.0	96.7	96.6	96.3	96.4	96.3	95.1
σ	0.00	0.25	0.21	0.13	0.13	0.15	0.16	0.17	0.17	0.19	0.23	0.27	0.57
Min.	100.0	97.1	96.9	96.8	97.2	96.8	96.7	96.4	96.3	96.0	96.2	95.9	93.8
Max.	100.0	98.1	97.6	97.2	97.5	97.3	97.3	96.9	96.8	96.6	96.8	96.6	95.6

TM-21 Projection

Time	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
ln(Avg.)	-0.0300	-0.0338	-0.0352	-0.0377	-0.0363	-0.0378	-0.0523

Test duration used	5000 h to 11000 h	
B	0.984	
α	2.72E-06	
R^2	0.697	
Calculated L_{70} (11K)	125000	hours
Reported L_{70} (11K)	> 60500	hours
Calculated L_{80} (11K)	76300	hours
Reported L_{80} (11K)	> 60500	hours
Calculated L_{90} (11K)	32900	hours
Reported L_{90} (11K)	32900	hours

Curve-fit equation:
$\Phi(t)=Bexp(-\alpha t)$

Lumen maintenance life eqation:
$L_{70}=ln(B/0.7)/\alpha$

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

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

Data Set 4 : 85 °C, 250 mA

Actual Case Temperature [T_S]	86.0 °C
Actual Ambient Temperature [T_A]	83.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	100.0	99.8	100.0	100.0	100.2	100.3	100.6	100.3	100.5	100.6	100.8	100.8	101.0
2	100.0	99.9	100.0	100.2	100.3	100.4	100.7	100.5	100.6	100.7	100.9	100.8	101.1
3	100.0	99.8	100.0	100.2	100.5	100.6	101.0	100.9	101.1	101.2	101.5	101.5	101.7
4	100.0	99.7	99.9	100.1	100.3	100.5	100.8	100.6	100.8	100.9	101.1	101.2	101.4
5	100.0	99.7	99.9	100.1	100.3	100.5	100.9	100.8	101.0	101.1	101.4	101.5	101.7
6	100.0	99.6	99.8	100.1	100.3	100.5	100.9	100.9	101.0	101.2	101.5	101.6	101.8
7	100.0	99.7	99.9	100.2	100.4	100.6	101.0	100.9	101.1	101.3	101.5	101.6	101.9
8	100.0	99.8	100.0	100.3	100.5	100.8	101.1	101.1	101.3	101.5	101.8	101.9	102.1
9	100.0	99.7	99.9	100.1	100.4	100.6	100.9	100.8	101.0	101.2	101.5	101.5	101.8
10	100.0	99.7	99.9	100.0	100.2	100.3	100.6	100.5	100.6	100.8	101.0	101.0	101.2
11	100.0	99.7	99.9	100.0	100.1	100.2	100.6	100.3	100.5	100.6	100.8	100.8	100.9
12	100.0	99.8	100.0	100.0	100.2	100.3	100.6	100.3	100.5	100.5	100.8	100.7	100.9
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	99.7	99.9	100.1	100.3	100.5	100.8	100.7	100.8	101.0	101.2	101.2	101.5
Med.	100.0	99.7	99.9	100.1	100.3	100.5	100.8	100.7	100.9	101.0	101.3	101.3	101.5
σ	0.00	0.07	0.06	0.09	0.12	0.17	0.20	0.26	0.28	0.32	0.35	0.40	0.43
Min.	100.0	99.6	99.8	100.0	100.1	100.2	100.6	100.3	100.5	100.5	100.8	100.7	100.9
Max.	100.0	99.9	100.0	100.3	100.5	100.8	101.1	101.1	101.3	101.5	101.8	101.9	102.1

Data Set 4 : 85 °C, 250 mA

Actual Case Temperature [T_S]	86.0 °C
Actual Ambient Temperature [T_A]	83.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	0.0000	0.0017	0.0019	0.0021	0.0021	0.0023	0.0025	0.0027	0.0029	0.0030	0.0032	0.0033	0.0039
2	0.0000	0.0019	0.0020	0.0021	0.0022	0.0025	0.0026	0.0028	0.0029	0.0031	0.0032	0.0034	0.0037
3	0.0000	0.0019	0.0020	0.0023	0.0023	0.0026	0.0026	0.0028	0.0030	0.0029	0.0030	0.0031	0.0032
4	0.0000	0.0018	0.0020	0.0021	0.0022	0.0025	0.0026	0.0027	0.0029	0.0030	0.0030	0.0030	0.0031
5	0.0000	0.0018	0.0019	0.0021	0.0022	0.0025	0.0026	0.0028	0.0029	0.0030	0.0031	0.0031	0.0032
6	0.0000	0.0018	0.0019	0.0022	0.0023	0.0026	0.0026	0.0029	0.0030	0.0031	0.0031	0.0031	0.0032
7	0.0000	0.0019	0.0020	0.0023	0.0024	0.0026	0.0026	0.0029	0.0031	0.0031	0.0032	0.0033	0.0034
8	0.0000	0.0018	0.0020	0.0023	0.0023	0.0026	0.0026	0.0028	0.0031	0.0032	0.0032	0.0033	0.0038
9	0.0000	0.0018	0.0019	0.0022	0.0023	0.0025	0.0026	0.0029	0.0029	0.0030	0.0031	0.0031	0.0032
10	0.0000	0.0019	0.0020	0.0021	0.0023	0.0026	0.0025	0.0029	0.0029	0.0030	0.0030	0.0031	0.0031
11	0.0000	0.0019	0.0020	0.0021	0.0023	0.0025	0.0026	0.0027	0.0029	0.0029	0.0031	0.0031	0.0032
12	0.0000	0.0018	0.0019	0.0021	0.0021	0.0025	0.0024	0.0027	0.0029	0.0029	0.0030	0.0031	0.0036
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.0000	0.0018	0.0019	0.0022	0.0023	0.0025	0.0026	0.0028	0.0030	0.0030	0.0031	0.0032	0.0034
Med.	0.0000	0.0018	0.0020	0.0021	0.0023	0.0025	0.0026	0.0028	0.0029	0.0030	0.0031	0.0031	0.0032
σ	0.0000	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003
Min.	0.0000	0.0017	0.0019	0.0021	0.0021	0.0023	0.0024	0.0027	0.0029	0.0029	0.0030	0.0030	0.0031
Max.	0.0000	0.0019	0.0020	0.0023	0.0024	0.0026	0.0026	0.0029	0.0031	0.0032	0.0032	0.0034	0.0039

Data Set 4 : 85 °C, 250 mA

Actual Case Temperature [T_S]	86.0 °C
Actual Ambient Temperature [T_A]	83.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	0.2601	0.2585	0.2583	0.2582	0.2581	0.2579	0.2578	0.2576	0.2574	0.2573	0.2572	0.2570	0.2565
2	0.2592	0.2573	0.2573	0.2572	0.2570	0.2568	0.2567	0.2565	0.2564	0.2563	0.2561	0.2560	0.2557
3	0.2585	0.2567	0.2566	0.2564	0.2563	0.2560	0.2560	0.2559	0.2558	0.2558	0.2557	0.2557	0.2556
4	0.2601	0.2584	0.2583	0.2582	0.2580	0.2577	0.2576	0.2575	0.2574	0.2573	0.2573	0.2573	0.2571
5	0.2602	0.2586	0.2585	0.2583	0.2582	0.2579	0.2578	0.2577	0.2575	0.2574	0.2574	0.2573	0.2573
6	0.2589	0.2572	0.2571	0.2569	0.2567	0.2565	0.2565	0.2562	0.2561	0.2560	0.2560	0.2560	0.2559
7	0.2614	0.2596	0.2596	0.2594	0.2592	0.2589	0.2590	0.2587	0.2585	0.2586	0.2585	0.2584	0.2582
8	0.2591	0.2574	0.2573	0.2571	0.2569	0.2567	0.2567	0.2565	0.2563	0.2562	0.2562	0.2562	0.2556
9	0.2608	0.2591	0.2590	0.2587	0.2586	0.2584	0.2583	0.2581	0.2581	0.2579	0.2579	0.2579	0.2578
10	0.2597	0.2580	0.2579	0.2578	0.2576	0.2573	0.2574	0.2571	0.2571	0.2570	0.2570	0.2569	0.2569
11	0.2611	0.2593	0.2592	0.2591	0.2589	0.2587	0.2586	0.2585	0.2584	0.2584	0.2583	0.2582	0.2581
12	0.2604	0.2586	0.2586	0.2584	0.2583	0.2580	0.2581	0.2578	0.2576	0.2577	0.2576	0.2574	0.2571
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.2600	0.2582	0.2581	0.2580	0.2578	0.2576	0.2575	0.2574	0.2572	0.2572	0.2571	0.2570	0.2568
Med.	0.2601	0.2584	0.2583	0.2582	0.2580	0.2578	0.2577	0.2576	0.2574	0.2573	0.2572	0.2571	0.2570
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	0.0009
Min.	0.2585	0.2567	0.2566	0.2564	0.2563	0.2560	0.2560	0.2559	0.2558	0.2558	0.2557	0.2557	0.2556
Max.	0.2614	0.2596	0.2596	0.2594	0.2592	0.2589	0.2590	0.2587	0.2585	0.2586	0.2585	0.2584	0.2582

Data Set 4 : 85 °C, 250 mA

Actual Case Temperature [T_S]	86.0 °C
Actual Ambient Temperature [T_A]	83.0 °C
Drive Current [I_F]	250 mA
Measurement Current	250 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

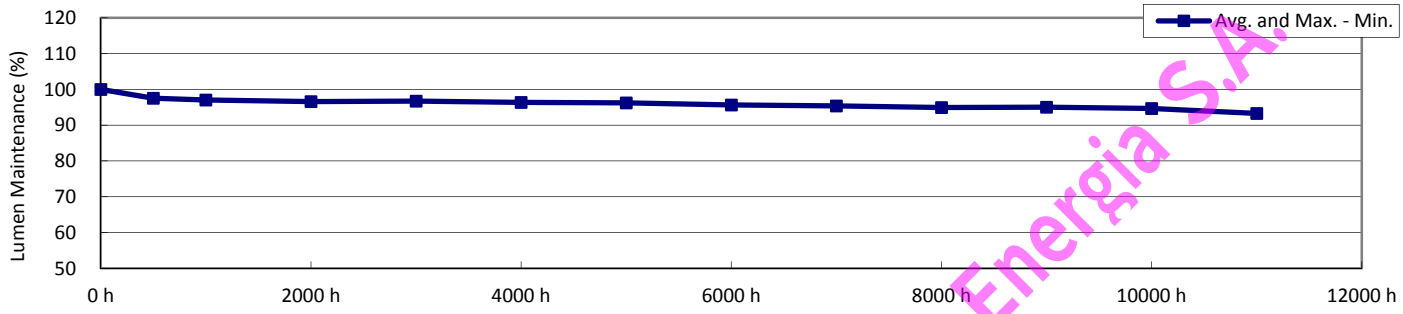
TABLE 4-6
Chromaticity

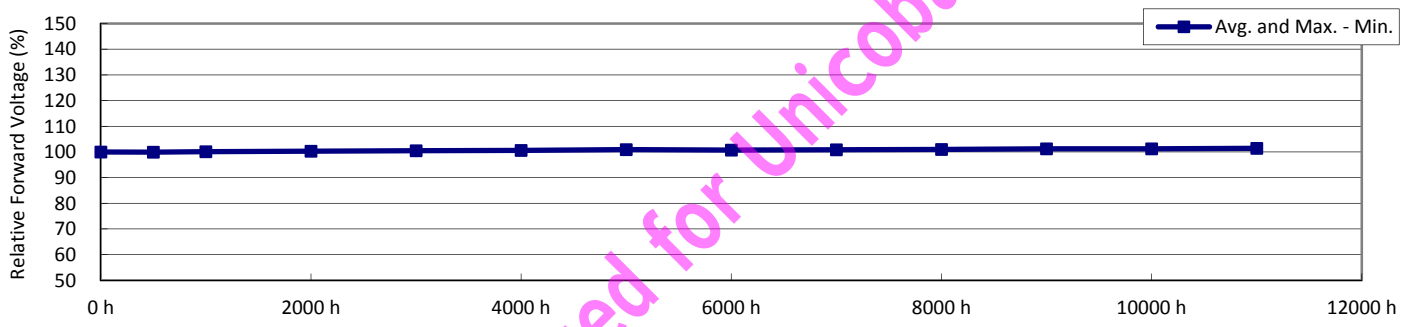
LED No.	Chromaticity v'												
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
1	0.5313	0.5308	0.5307	0.5306	0.5307	0.5306	0.5306	0.5304	0.5303	0.5303	0.5302	0.5302	0.5300
2	0.5293	0.5287	0.5286	0.5284	0.5286	0.5285	0.5285	0.5283	0.5282	0.5282	0.5282	0.5280	0.5280
3	0.5297	0.5291	0.5290	0.5288	0.5289	0.5288	0.5288	0.5286	0.5285	0.5285	0.5284	0.5285	0.5284
4	0.5300	0.5294	0.5293	0.5292	0.5293	0.5292	0.5291	0.5291	0.5290	0.5290	0.5290	0.5289	0.5289
5	0.5312	0.5306	0.5306	0.5304	0.5305	0.5304	0.5304	0.5302	0.5301	0.5301	0.5301	0.5301	0.5301
6	0.5304	0.5299	0.5297	0.5295	0.5297	0.5295	0.5295	0.5294	0.5293	0.5293	0.5293	0.5291	0.5292
7	0.5308	0.5303	0.5301	0.5299	0.5301	0.5300	0.5300	0.5299	0.5298	0.5297	0.5297	0.5296	0.5297
8	0.5284	0.5277	0.5276	0.5274	0.5277	0.5274	0.5274	0.5272	0.5271	0.5271	0.5271	0.5270	0.5269
9	0.5309	0.5303	0.5302	0.5300	0.5302	0.5300	0.5301	0.5298	0.5298	0.5298	0.5298	0.5297	0.5297
10	0.5294	0.5288	0.5288	0.5286	0.5287	0.5285	0.5285	0.5283	0.5283	0.5282	0.5282	0.5282	0.5282
11	0.5314	0.5308	0.5307	0.5306	0.5307	0.5305	0.5306	0.5304	0.5304	0.5303	0.5302	0.5302	0.5303
12	0.5308	0.5302	0.5302	0.5300	0.5301	0.5300	0.5300	0.5299	0.5297	0.5297	0.5297	0.5296	0.5295
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.5303	0.5297	0.5296	0.5295	0.5296	0.5295	0.5295	0.5293	0.5292	0.5292	0.5292	0.5291	0.5291
Med.	0.5306	0.5300	0.5299	0.5297	0.5299	0.5298	0.5297	0.5296	0.5295	0.5295	0.5295	0.5294	0.5293
σ	0.0009	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Min.	0.5284	0.5277	0.5276	0.5274	0.5277	0.5274	0.5274	0.5272	0.5271	0.5271	0.5271	0.5270	0.5269
Max.	0.5314	0.5308	0.5307	0.5306	0.5307	0.5306	0.5306	0.5304	0.5304	0.5303	0.5302	0.5302	0.5303

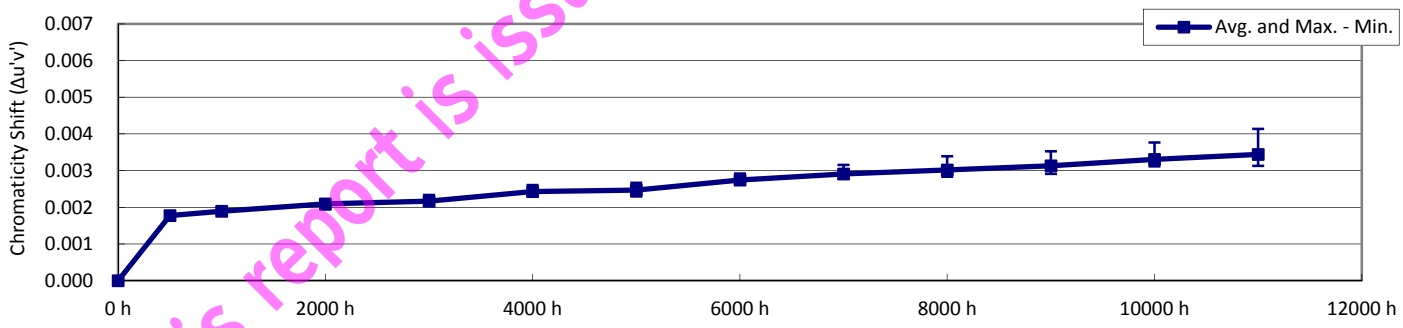
Data Set 5 : 105 °C, 150 mA

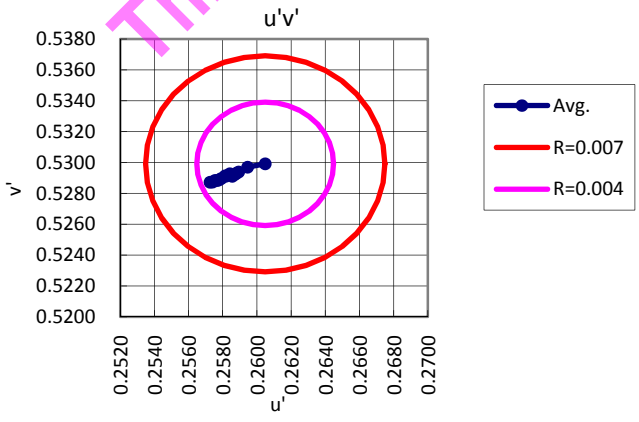
Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	103.2 °C
Drive Current [I_F]	150 mA
Measurement Current	150 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0









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Data Set 5 : 105 °C, 150 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	103.2 °C
Drive Current [I_F]	150 mA
Measurement Current	150 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 Φ_V [lm]	Forward voltage V_F [V]	CCT T_{CP} [K]	Input Power P [W]	CIE1931 x	CIE1931 y	CIE1976 u'	CIE1976 v'
1	826	43.8	2718	6.6	0.463	0.419	0.261	0.531
2	829	43.7	2727	6.6	0.462	0.419	0.261	0.531
3	827	43.7	2714	6.6	0.463	0.419	0.261	0.531
4	820	43.8	2739	6.6	0.460	0.416	0.260	0.529
5	832	43.6	2740	6.5	0.460	0.416	0.260	0.529
6	826	43.8	2713	6.6	0.463	0.418	0.261	0.530
7	823	43.8	2735	6.6	0.461	0.418	0.260	0.530
8	825	43.8	2712	6.6	0.464	0.419	0.261	0.531
9	834	43.7	2746	6.5	0.460	0.417	0.260	0.530
10	824	43.7	2752	6.6	0.459	0.415	0.260	0.529
11	822	43.7	2766	6.6	0.456	0.413	0.259	0.528
12	828	43.6	2717	6.5	0.461	0.416	0.261	0.529
n	12	12	12	12	12	12	12	12
Avg.	826	43.7	2732	6.6	0.461	0.417	0.260	0.530
Med.	826	43.7	2731	6.6	0.461	0.417	0.260	0.530
σ	4.0	0.08	17.6	0.01	0.0021	0.0018	0.0007	0.0010
Min.	820	43.6	2712	6.5	0.456	0.413	0.259	0.528
Max.	834	43.8	2766	6.6	0.464	0.419	0.261	0.531

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Data Set 5 : 105 °C, 150 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	103.2 °C
Drive Current [I_F]	150 mA
Measurement Current	150 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

TABLE 5-2
Lumen Maintenance

LED No.	Lumen 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	11000 h
1	100.0	97.0	96.6	96.5	96.7	96.4	96.2	95.7	95.4	94.9	95.0	94.6	93.2
2	100.0	97.4	97.1	96.7	96.8	96.4	96.4	95.8	95.6	95.2	95.4	95.0	93.6
3	100.0	97.5	97.0	96.5	96.6	96.2	96.0	95.4	95.1	94.6	94.7	94.3	92.9
4	100.0	97.4	96.8	96.2	96.2	95.9	95.7	95.1	95.0	94.6	94.8	94.5	93.4
5	100.0	97.7	97.3	96.7	96.9	96.6	96.5	95.9	95.6	95.1	95.3	95.0	93.5
6	100.0	97.5	97.0	96.5	96.6	96.3	96.1	95.5	95.4	94.9	95.0	94.6	93.2
7	100.0	97.5	96.9	96.4	96.4	96.0	95.8	95.2	94.9	94.3	94.2	93.7	92.1
8	100.0	97.2	96.9	96.7	97.0	96.7	96.5	95.9	95.6	95.2	95.2	94.8	93.4
9	100.0	97.6	97.2	96.8	96.9	96.5	96.4	95.8	95.6	95.1	95.3	95.0	93.5
10	100.0	97.6	97.1	96.7	96.7	96.3	96.1	95.6	95.2	94.7	94.8	94.5	93.1
11	100.0	97.7	97.2	96.6	96.6	96.3	96.1	95.7	95.3	94.9	95.1	94.8	93.6
12	100.0	98.1	97.5	96.8	97.1	96.8	96.7	96.1	95.8	95.3	95.4	95.1	93.8
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	97.5	97.1	96.6	96.7	96.4	96.2	95.6	95.4	94.9	95.0	94.7	93.3
Med.	100.0	97.5	97.0	96.6	96.7	96.3	96.2	95.7	95.4	94.9	95.1	94.7	93.4
σ	0.00	0.29	0.24	0.18	0.25	0.26	0.29	0.28	0.28	0.31	0.35	0.39	0.45
Min.	100.0	97.0	96.6	96.2	96.2	95.9	95.7	95.1	94.9	94.3	94.2	93.7	92.1
Max.	100.0	98.1	97.5	96.8	97.1	96.8	96.7	96.1	95.8	95.3	95.4	95.1	93.8

TM-21 Projection

Time	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
ln(Avg.)	-0.0386	-0.0446	-0.0474	-0.0522	-0.0511	-0.0549	-0.0697

Test duration used	5000 h to 11000 h	
B	0.983	
α	4.20E-06	
R^2	0.861	
Calculated L_{70} (11K)	80700	hours
Reported L_{70} (11K)	> 60500	hours
Calculated L_{80} (11K)	48900	hours
Reported L_{80} (11K)	48900	hours
Calculated L_{90} (11K)	20900	hours
Reported L_{90} (11K)	20900	hours

Curve-fit equation:
$\Phi(t)=Bexp(-\alpha t)$

Lumen maintenance life eqation:
$L_{70}=ln(B/0.7)/\alpha$

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

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

Data Set 5 : 105 °C, 150 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	103.2 °C
Drive Current [I_F]	150 mA
Measurement Current	150 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	11000 h
1	100.0	99.9	100.2	100.4	100.7	101.0	101.4	101.2	101.4	101.6	102.0	102.1	102.2
2	100.0	100.0	100.2	100.3	100.5	100.7	100.9	100.6	100.7	100.8	101.1	101.0	101.2
3	100.0	99.9	100.1	100.2	100.3	100.4	100.6	100.3	100.4	100.5	100.7	100.6	100.8
4	100.0	99.9	100.1	100.4	100.6	100.8	101.0	100.9	101.1	101.1	101.5	101.6	101.8
5	100.0	100.0	100.1	100.3	100.4	100.5	100.7	100.5	100.6	100.7	100.9	100.9	101.0
6	100.0	99.9	100.1	100.2	100.4	100.5	100.7	100.5	100.6	100.7	100.9	100.9	101.0
7	100.0	99.9	100.1	100.3	100.6	100.8	101.2	101.0	101.3	101.5	101.7	101.8	102.0
8	100.0	99.9	100.1	100.4	100.7	100.8	101.2	101.1	101.4	101.5	101.8	102.0	102.2
9	100.0	100.0	100.1	100.3	100.4	100.5	100.7	100.5	100.6	100.7	100.8	100.9	100.9
10	100.0	99.9	100.0	100.2	100.4	100.6	100.8	100.7	100.8	100.9	101.1	101.2	101.3
11	100.0	99.8	100.0	100.2	100.3	100.4	100.7	100.5	100.7	100.8	101.0	101.0	101.1
12	100.0	100.0	100.1	100.3	100.4	100.5	100.7	100.5	100.6	100.6	100.9	100.9	101.0
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	99.9	100.1	100.3	100.5	100.6	100.9	100.7	100.9	101.0	101.2	101.2	101.4
Med.	100.0	99.9	100.1	100.3	100.4	100.5	100.8	100.6	100.7	100.8	101.0	101.0	101.2
σ	0.00	0.05	0.05	0.08	0.14	0.19	0.25	0.28	0.35	0.38	0.44	0.49	0.54
Min.	100.0	99.8	100.0	100.2	100.3	100.4	100.6	100.3	100.4	100.5	100.7	100.6	100.8
Max.	100.0	100.0	100.2	100.4	100.7	101.0	101.4	101.2	101.4	101.6	102.0	102.1	102.2

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Data Set 5 : 105 °C, 150 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	103.2 °C
Drive Current [I_F]	150 mA
Measurement Current	150 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	11000 h
1	0.0000	0.0018	0.0020	0.0022	0.0023	0.0026	0.0026	0.0029	0.0030	0.0032	0.0033	0.0034	0.0035
2	0.0000	0.0019	0.0020	0.0022	0.0022	0.0025	0.0024	0.0027	0.0029	0.0029	0.0031	0.0033	0.0034
3	0.0000	0.0017	0.0018	0.0020	0.0021	0.0024	0.0025	0.0027	0.0029	0.0030	0.0031	0.0033	0.0035
4	0.0000	0.0018	0.0020	0.0021	0.0022	0.0024	0.0025	0.0027	0.0029	0.0029	0.0031	0.0032	0.0031
5	0.0000	0.0017	0.0019	0.0021	0.0021	0.0023	0.0024	0.0027	0.0028	0.0029	0.0030	0.0032	0.0034
6	0.0000	0.0018	0.0018	0.0020	0.0021	0.0023	0.0024	0.0026	0.0028	0.0029	0.0030	0.0032	0.0034
7	0.0000	0.0017	0.0019	0.0022	0.0023	0.0026	0.0027	0.0029	0.0032	0.0034	0.0035	0.0038	0.0041
8	0.0000	0.0018	0.0019	0.0021	0.0022	0.0025	0.0026	0.0028	0.0030	0.0032	0.0032	0.0035	0.0036
9	0.0000	0.0017	0.0018	0.0019	0.0021	0.0023	0.0023	0.0026	0.0028	0.0028	0.0029	0.0031	0.0033
10	0.0000	0.0018	0.0018	0.0021	0.0022	0.0024	0.0025	0.0028	0.0029	0.0031	0.0033	0.0034	0.0035
11	0.0000	0.0018	0.0020	0.0022	0.0022	0.0025	0.0025	0.0027	0.0029	0.0030	0.0031	0.0032	0.0032
12	0.0000	0.0017	0.0019	0.0020	0.0020	0.0024	0.0024	0.0028	0.0028	0.0030	0.0030	0.0032	0.0032
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.0000	0.0018	0.0019	0.0021	0.0022	0.0024	0.0025	0.0027	0.0029	0.0030	0.0031	0.0033	0.0034
Med.	0.0000	0.0018	0.0019	0.0021	0.0022	0.0024	0.0025	0.0027	0.0029	0.0030	0.0031	0.0032	0.0034
σ	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0003
Min.	0.0000	0.0017	0.0018	0.0019	0.0020	0.0023	0.0023	0.0026	0.0028	0.0028	0.0029	0.0031	0.0031
Max.	0.0000	0.0019	0.0020	0.0022	0.0023	0.0026	0.0027	0.0029	0.0032	0.0034	0.0035	0.0038	0.0041

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Data Set 5 : 105 °C, 150 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	103.2 °C
Drive Current [I_F]	150 mA
Measurement Current	150 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	11000 h
1	0.2611	0.2593	0.2592	0.2591	0.2588	0.2586	0.2586	0.2583	0.2582	0.2581	0.2580	0.2579	0.2578
2	0.2608	0.2590	0.2589	0.2587	0.2587	0.2584	0.2585	0.2583	0.2581	0.2580	0.2578	0.2577	0.2576
3	0.2613	0.2596	0.2596	0.2594	0.2592	0.2590	0.2589	0.2587	0.2586	0.2584	0.2584	0.2582	0.2580
4	0.2605	0.2588	0.2587	0.2586	0.2585	0.2582	0.2581	0.2579	0.2577	0.2577	0.2576	0.2575	0.2576
5	0.2604	0.2587	0.2586	0.2585	0.2584	0.2582	0.2581	0.2579	0.2577	0.2577	0.2575	0.2574	0.2572
6	0.2614	0.2598	0.2597	0.2596	0.2594	0.2592	0.2591	0.2590	0.2588	0.2588	0.2586	0.2585	0.2583
7	0.2605	0.2589	0.2587	0.2585	0.2583	0.2581	0.2580	0.2578	0.2576	0.2573	0.2572	0.2570	0.2566
8	0.2613	0.2596	0.2596	0.2593	0.2592	0.2589	0.2588	0.2587	0.2585	0.2584	0.2583	0.2580	0.2579
9	0.2600	0.2583	0.2583	0.2582	0.2579	0.2578	0.2578	0.2575	0.2573	0.2573	0.2572	0.2570	0.2568
10	0.2599	0.2583	0.2582	0.2580	0.2578	0.2576	0.2575	0.2574	0.2573	0.2570	0.2568	0.2568	0.2567
11	0.2596	0.2580	0.2578	0.2576	0.2576	0.2573	0.2573	0.2571	0.2570	0.2569	0.2568	0.2567	0.2566
12	0.2615	0.2598	0.2597	0.2596	0.2595	0.2592	0.2591	0.2588	0.2588	0.2587	0.2586	0.2584	0.2584
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.2607	0.2590	0.2589	0.2588	0.2586	0.2584	0.2583	0.2581	0.2580	0.2579	0.2577	0.2576	0.2575
Med.	0.2607	0.2589	0.2588	0.2587	0.2586	0.2583	0.2583	0.2581	0.2579	0.2579	0.2577	0.2576	0.2576
σ	0.0006	0.0006	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007
Min.	0.2596	0.2580	0.2578	0.2576	0.2576	0.2573	0.2573	0.2571	0.2570	0.2569	0.2568	0.2567	0.2566
Max.	0.2615	0.2598	0.2597	0.2596	0.2595	0.2592	0.2591	0.2590	0.2588	0.2588	0.2586	0.2585	0.2584

Data Set 5 : 105 °C, 150 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	103.2 °C
Drive Current [I_F]	150 mA
Measurement Current	150 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

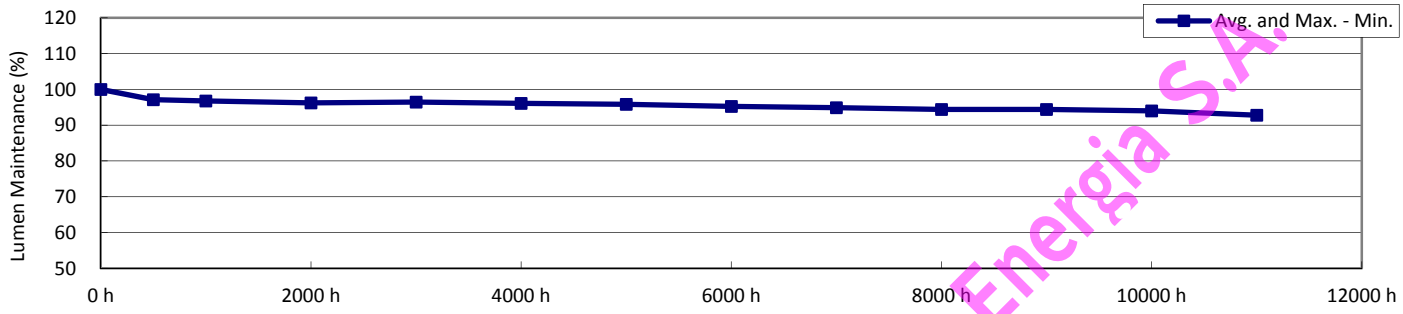
TABLE 5-6
Chromaticity

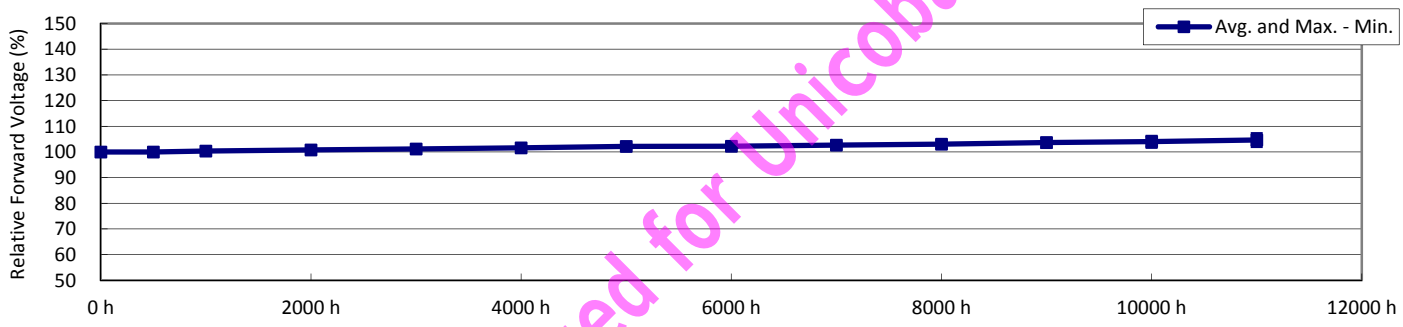
LED No.	Chromaticity v'												
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
1	0.5310	0.5304	0.5303	0.5302	0.5303	0.5302	0.5302	0.5300	0.5300	0.5299	0.5299	0.5298	0.5298
2	0.5309	0.5303	0.5302	0.5301	0.5303	0.5301	0.5302	0.5299	0.5299	0.5299	0.5300	0.5298	0.5298
3	0.5312	0.5307	0.5305	0.5304	0.5306	0.5305	0.5305	0.5303	0.5302	0.5302	0.5302	0.5301	0.5301
4	0.5297	0.5291	0.5290	0.5288	0.5289	0.5289	0.5289	0.5287	0.5287	0.5286	0.5286	0.5286	0.5286
5	0.5297	0.5291	0.5291	0.5289	0.5291	0.5289	0.5289	0.5288	0.5287	0.5287	0.5287	0.5285	0.5285
6	0.5307	0.5301	0.5300	0.5299	0.5301	0.5299	0.5300	0.5298	0.5297	0.5297	0.5297	0.5296	0.5296
7	0.5304	0.5299	0.5297	0.5296	0.5297	0.5296	0.5296	0.5294	0.5293	0.5293	0.5292	0.5291	0.5290
8	0.5312	0.5306	0.5305	0.5304	0.5305	0.5304	0.5304	0.5302	0.5301	0.5301	0.5300	0.5299	0.5299
9	0.5301	0.5295	0.5295	0.5294	0.5296	0.5294	0.5294	0.5292	0.5291	0.5291	0.5291	0.5290	0.5290
10	0.5292	0.5285	0.5285	0.5282	0.5285	0.5283	0.5284	0.5281	0.5280	0.5279	0.5280	0.5278	0.5279
11	0.5280	0.5274	0.5273	0.5272	0.5273	0.5271	0.5271	0.5270	0.5269	0.5269	0.5268	0.5267	0.5268
12	0.5298	0.5292	0.5291	0.5291	0.5292	0.5291	0.5291	0.5289	0.5288	0.5287	0.5288	0.5287	0.5286
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.5302	0.5296	0.5295	0.5293	0.5295	0.5294	0.5294	0.5292	0.5291	0.5291	0.5291	0.5290	0.5290
Med.	0.5302	0.5297	0.5296	0.5295	0.5297	0.5295	0.5295	0.5293	0.5292	0.5292	0.5291	0.5291	0.5290
σ	0.0009	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Min.	0.5280	0.5274	0.5273	0.5272	0.5273	0.5271	0.5271	0.5270	0.5269	0.5269	0.5268	0.5267	0.5268
Max.	0.5312	0.5307	0.5305	0.5304	0.5306	0.5305	0.5305	0.5303	0.5302	0.5302	0.5302	0.5301	0.5301

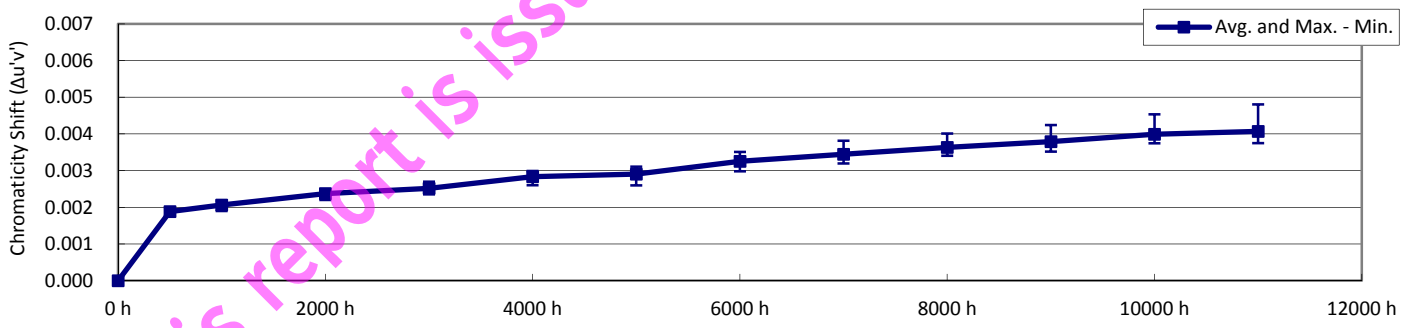
Data Set 6 : 105 °C, 200 mA

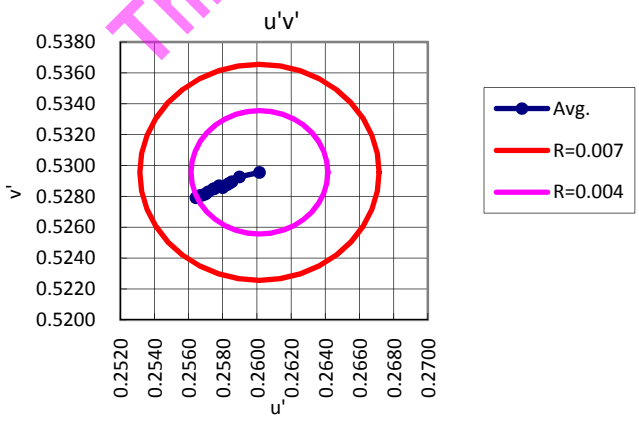
Actual Case Temperature [T_S]	105.9 °C
Actual Ambient Temperature [T_A]	102.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0









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Data Set 6 : 105 °C, 200 mA

Actual Case Temperature [T_S]	105.9 °C
Actual Ambient Temperature [T_A]	102.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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 Φ_V [lm]	Forward voltage V_F [V]	CCT T_{CP} [K]	Input Power P [W]	CIE1931 x	CIE1931 y	CIE1976 u'	CIE1976 v'
1	1049	45.6	2739	9.1	0.461	0.417	0.260	0.530
2	1053	45.6	2769	9.1	0.459	0.417	0.259	0.530
3	1056	45.5	2739	9.1	0.459	0.414	0.260	0.529
4	1043	45.6	2729	9.1	0.461	0.416	0.261	0.530
5	1067	45.4	2755	9.1	0.459	0.416	0.259	0.529
6	1040	45.7	2719	9.1	0.463	0.419	0.261	0.531
7	1052	45.7	2725	9.1	0.461	0.416	0.261	0.530
8	1057	45.5	2749	9.1	0.459	0.416	0.260	0.529
9	1060	45.6	2719	9.1	0.462	0.417	0.261	0.530
10	1063	45.6	2726	9.1	0.462	0.418	0.261	0.530
11	1049	46.0	2763	9.2	0.458	0.415	0.259	0.529
12	1053	45.6	2748	9.1	0.459	0.415	0.260	0.529
n	12	12	12	12	12	12	12	12
Avg.	1054	45.6	2740	9.1	0.460	0.416	0.260	0.530
Med.	1053	45.6	2739	9.1	0.460	0.416	0.260	0.530
σ	7.7	0.13	17.0	0.03	0.0016	0.0013	0.0007	0.0007
Min.	1040	45.4	2719	9.1	0.458	0.414	0.259	0.529
Max.	1067	46.0	2769	9.2	0.463	0.419	0.261	0.531

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Data Set 6 : 105 °C, 200 mA

Actual Case Temperature [T_S]	105.9 °C
Actual Ambient Temperature [T_A]	102.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

TABLE 6-2
Lumen Maintenance

LED No.	Lumen 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	11000 h
1	100.0	97.1	96.8	96.8	97.1	96.8	96.6	96.0	95.7	95.3	95.2	94.8	93.3
2	100.0	97.1	96.6	96.2	96.3	95.9	95.7	95.1	94.8	94.3	94.4	94.1	92.8
3	100.0	97.3	97.0	96.6	96.9	96.6	96.4	95.9	95.5	95.1	95.1	94.7	93.3
4	100.0	97.1	96.7	96.1	96.3	95.9	95.6	95.1	94.8	94.3	94.4	94.1	92.9
5	100.0	97.2	96.8	96.2	96.7	96.3	96.2	95.5	95.1	94.5	94.5	94.0	92.8
6	100.0	97.0	96.6	95.9	96.1	95.6	95.4	94.8	94.6	94.1	94.1	93.7	92.8
7	100.0	97.0	96.6	96.0	96.1	95.7	95.3	94.6	94.1	93.6	93.5	93.0	91.5
8	100.0	96.9	96.6	96.4	96.8	96.4	96.2	95.6	95.2	94.7	94.6	94.2	92.8
9	100.0	97.0	96.6	95.9	96.0	95.6	95.4	94.7	94.4	93.9	93.9	93.5	92.5
10	100.0	97.0	96.5	95.8	95.9	95.5	95.2	94.5	94.3	93.7	93.7	93.3	92.1
11	100.0	97.5	97.2	96.6	96.9	96.6	96.4	95.9	95.5	95.1	95.2	94.7	93.5
12	100.0	97.6	97.0	96.1	96.5	96.1	95.8	95.2	94.9	94.4	94.3	93.9	92.8
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	97.1	96.8	96.2	96.5	96.1	95.8	95.2	94.9	94.4	94.4	94.0	92.8
Med.	100.0	97.1	96.7	96.1	96.4	96.0	95.7	95.1	94.8	94.4	94.4	94.0	92.8
σ	0.00	0.22	0.22	0.32	0.41	0.45	0.49	0.52	0.52	0.56	0.57	0.56	0.56
Min.	100.0	96.9	96.5	95.8	95.9	95.5	95.2	94.5	94.1	93.6	93.5	93.0	91.5
Max.	100.0	97.6	97.2	96.8	97.1	96.8	96.6	96.0	95.7	95.3	95.2	94.8	93.5

TM-21 Projection

Time	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
ln(Avg.)	-0.0425	-0.0487	-0.0523	-0.0575	-0.0575	-0.0619	-0.0751

Test duration used	5000 h to 11000 h	
B	0.981	
α	4.62E-06	
R^2	0.918	
Calculated L_{70} (11K)	73000	hours
Reported L_{70} (11K)	> 60500	hours
Calculated L_{80} (11K)	44100	hours
Reported L_{80} (11K)	44100	hours
Calculated L_{90} (11K)	18600	hours
Reported L_{90} (11K)	18600	hours

Curve-fit equation:
$\Phi(t)=B\exp(-\alpha t)$

Lumen maintenance life eqation:
$L_{70}=\ln(B/0.7)/\alpha$

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

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

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Data Set 6 : 105 °C, 200 mA

Actual Case Temperature [T_S]	105.9 °C
Actual Ambient Temperature [T_A]	102.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	100.0	100.1	100.5	101.1	101.6	102.1	102.8	102.9	103.5	104.1	104.9	105.4	106.3
2	100.0	100.0	100.4	100.7	101.1	101.5	102.0	102.1	102.4	102.7	103.4	103.6	104.2
3	100.0	100.2	100.4	100.6	100.9	101.1	101.4	101.3	101.6	101.7	102.1	102.2	102.5
4	100.0	100.0	100.3	100.6	101.0	101.4	101.8	101.9	102.2	102.5	103.1	103.3	103.8
5	100.0	100.1	100.3	100.5	100.7	100.9	101.2	101.1	101.2	101.4	101.7	101.7	102.0
6	100.0	100.0	100.3	100.7	101.0	101.3	101.7	101.7	102.0	102.3	102.8	103.0	103.4
7	100.0	99.9	100.4	101.0	101.6	102.2	102.9	103.2	103.9	104.6	105.5	106.2	107.2
8	100.0	99.9	100.3	100.7	101.2	101.5	102.1	102.2	102.7	103.0	103.6	103.9	104.4
9	100.0	99.9	100.3	100.7	101.1	101.5	102.1	102.2	102.6	103.0	103.6	103.9	104.5
10	100.0	100.0	100.4	100.7	101.2	101.6	102.1	102.1	102.5	102.9	103.5	103.8	104.3
11	100.0	99.6	100.2	100.9	101.4	102.0	102.8	103.0	103.6	104.2	105.1	105.7	106.5
12	100.0	100.0	100.4	100.9	101.5	102.1	102.7	102.9	103.5	104.1	104.9	105.4	106.3
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	100.0	100.3	100.8	101.2	101.6	102.1	102.2	102.6	103.0	103.7	104.0	104.6
Med.	100.0	100.0	100.4	100.7	101.1	101.5	102.1	102.2	102.6	102.9	103.5	103.8	104.4
σ	0.00	0.14	0.08	0.16	0.28	0.42	0.56	0.69	0.85	1.02	1.21	1.40	1.63
Min.	100.0	99.6	100.2	100.5	100.7	100.9	101.2	101.1	101.2	101.4	101.7	101.7	102.0
Max.	100.0	100.2	100.5	101.1	101.6	102.2	102.9	103.2	103.9	104.6	105.5	106.2	107.2

Data Set 6 : 105 °C, 200 mA

Actual Case Temperature [T_S]	105.9 °C
Actual Ambient Temperature [T_A]	102.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	0.0000	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028	0.0030	0.0033	0.0034	0.0035	0.0038	0.0039
2	0.0000	0.0018	0.0020	0.0024	0.0024	0.0028	0.0028	0.0031	0.0033	0.0035	0.0036	0.0037	0.0039
3	0.0000	0.0019	0.0021	0.0023	0.0025	0.0028	0.0028	0.0032	0.0033	0.0035	0.0037	0.0038	0.0040
4	0.0000	0.0020	0.0021	0.0024	0.0025	0.0028	0.0029	0.0033	0.0034	0.0035	0.0037	0.0038	0.0038
5	0.0000	0.0018	0.0019	0.0022	0.0024	0.0026	0.0026	0.0030	0.0034	0.0035	0.0037	0.0039	0.0040
6	0.0000	0.0019	0.0021	0.0024	0.0025	0.0030	0.0030	0.0033	0.0035	0.0036	0.0037	0.0039	0.0038
7	0.0000	0.0019	0.0022	0.0025	0.0026	0.0030	0.0031	0.0035	0.0038	0.0040	0.0042	0.0045	0.0048
8	0.0000	0.0019	0.0021	0.0024	0.0025	0.0028	0.0028	0.0032	0.0034	0.0035	0.0037	0.0039	0.0042
9	0.0000	0.0019	0.0022	0.0025	0.0026	0.0030	0.0031	0.0034	0.0036	0.0039	0.0040	0.0042	0.0042
10	0.0000	0.0019	0.0021	0.0025	0.0027	0.0030	0.0031	0.0034	0.0036	0.0039	0.0040	0.0043	0.0043
11	0.0000	0.0019	0.0020	0.0023	0.0024	0.0027	0.0029	0.0031	0.0032	0.0034	0.0036	0.0038	0.0037
12	0.0000	0.0020	0.0022	0.0025	0.0027	0.0030	0.0031	0.0035	0.0036	0.0039	0.0040	0.0041	0.0041
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.0000	0.0019	0.0021	0.0024	0.0025	0.0028	0.0029	0.0033	0.0034	0.0036	0.0038	0.0040	0.0041
Med.	0.0000	0.0019	0.0021	0.0024	0.0025	0.0028	0.0029	0.0033	0.0034	0.0035	0.0037	0.0039	0.0040
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003
Min.	0.0000	0.0018	0.0019	0.0022	0.0024	0.0026	0.0026	0.0030	0.0032	0.0034	0.0035	0.0037	0.0037
Max.	0.0000	0.0020	0.0022	0.0025	0.0027	0.0030	0.0031	0.0035	0.0038	0.0040	0.0042	0.0045	0.0048

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Data Set 6 : 105 °C, 200 mA

Actual Case Temperature [T_S]	105.9 °C
Actual Ambient Temperature [T_A]	102.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 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	11000 h
1	0.2601	0.2585	0.2583	0.2582	0.2579	0.2577	0.2576	0.2574	0.2572	0.2570	0.2569	0.2567	0.2566
2	0.2589	0.2573	0.2571	0.2568	0.2566	0.2563	0.2563	0.2561	0.2559	0.2557	0.2556	0.2554	0.2553
3	0.2606	0.2589	0.2587	0.2585	0.2583	0.2580	0.2580	0.2576	0.2576	0.2573	0.2572	0.2571	0.2569
4	0.2608	0.2590	0.2589	0.2587	0.2584	0.2582	0.2581	0.2578	0.2577	0.2576	0.2573	0.2573	0.2573
5	0.2597	0.2580	0.2579	0.2576	0.2574	0.2572	0.2572	0.2568	0.2565	0.2564	0.2562	0.2560	0.2560
6	0.2611	0.2593	0.2591	0.2589	0.2587	0.2583	0.2583	0.2580	0.2578	0.2578	0.2577	0.2575	0.2576
7	0.2610	0.2592	0.2590	0.2588	0.2586	0.2582	0.2582	0.2578	0.2575	0.2574	0.2572	0.2569	0.2566
8	0.2600	0.2582	0.2581	0.2578	0.2577	0.2574	0.2574	0.2570	0.2569	0.2567	0.2566	0.2564	0.2562
9	0.2612	0.2595	0.2592	0.2590	0.2588	0.2584	0.2584	0.2581	0.2579	0.2577	0.2575	0.2573	0.2574
10	0.2608	0.2590	0.2589	0.2585	0.2583	0.2581	0.2579	0.2577	0.2575	0.2573	0.2571	0.2569	0.2568
11	0.2595	0.2577	0.2576	0.2574	0.2572	0.2570	0.2569	0.2566	0.2566	0.2564	0.2563	0.2561	0.2562
12	0.2602	0.2584	0.2582	0.2579	0.2577	0.2575	0.2574	0.2571	0.2570	0.2567	0.2566	0.2565	0.2565
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.2603	0.2586	0.2584	0.2582	0.2580	0.2577	0.2576	0.2573	0.2572	0.2570	0.2568	0.2567	0.2566
Med.	0.2604	0.2587	0.2585	0.2583	0.2581	0.2579	0.2577	0.2575	0.2573	0.2571	0.2570	0.2568	0.2566
σ	0.0007	0.0007	0.0007	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007
Min.	0.2589	0.2573	0.2571	0.2568	0.2566	0.2563	0.2563	0.2561	0.2559	0.2557	0.2556	0.2554	0.2553
Max.	0.2612	0.2595	0.2592	0.2590	0.2588	0.2584	0.2584	0.2581	0.2579	0.2578	0.2577	0.2575	0.2576

Data Set 6 : 105 °C, 200 mA

Actual Case Temperature [T_S]	105.9 °C
Actual Ambient Temperature [T_A]	102.9 °C
Drive Current [I_F]	200 mA
Measurement Current	200 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

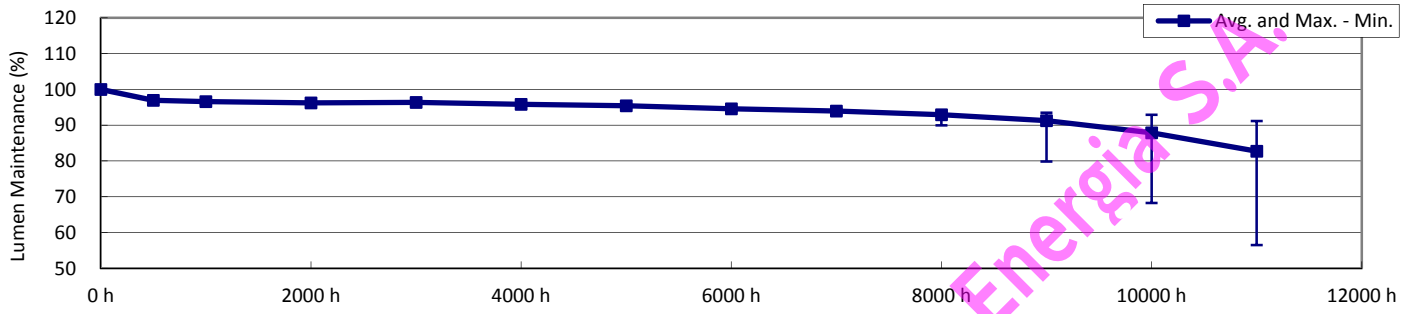
TABLE 6-6
Chromaticity

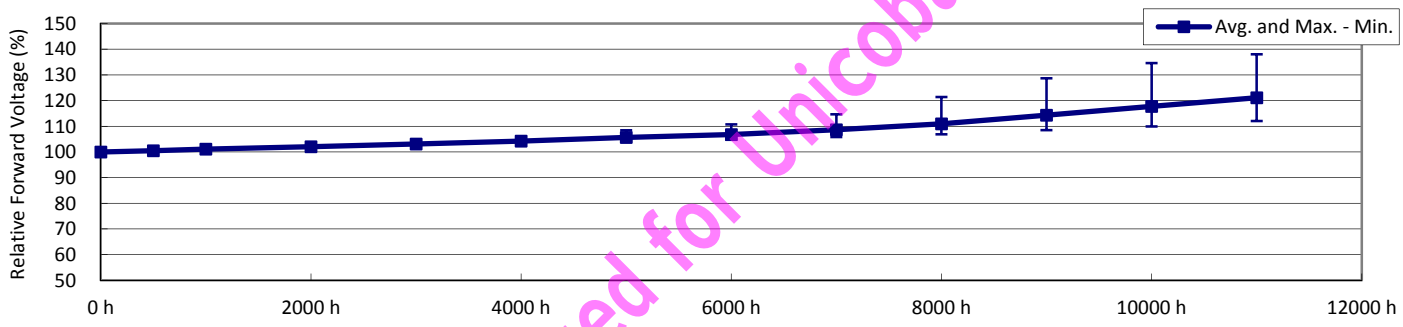
LED No.	Chromaticity v'												
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
1	0.5302	0.5295	0.5294	0.5292	0.5294	0.5292	0.5291	0.5290	0.5288	0.5288	0.5288	0.5286	0.5286
2	0.5299	0.5292	0.5291	0.5289	0.5291	0.5289	0.5289	0.5287	0.5286	0.5285	0.5285	0.5285	0.5284
3	0.5288	0.5281	0.5280	0.5278	0.5280	0.5278	0.5279	0.5276	0.5275	0.5275	0.5275	0.5273	0.5272
4	0.5299	0.5292	0.5291	0.5289	0.5290	0.5289	0.5288	0.5287	0.5286	0.5285	0.5285	0.5285	0.5285
5	0.5295	0.5288	0.5287	0.5286	0.5287	0.5286	0.5286	0.5284	0.5282	0.5282	0.5282	0.5280	0.5280
6	0.5310	0.5303	0.5302	0.5300	0.5301	0.5299	0.5299	0.5297	0.5297	0.5295	0.5295	0.5294	0.5295
7	0.5298	0.5291	0.5290	0.5288	0.5289	0.5287	0.5286	0.5285	0.5283	0.5282	0.5281	0.5280	0.5279
8	0.5297	0.5290	0.5289	0.5288	0.5288	0.5287	0.5287	0.5285	0.5283	0.5283	0.5283	0.5281	0.5280
9	0.5303	0.5296	0.5295	0.5293	0.5294	0.5292	0.5292	0.5290	0.5289	0.5287	0.5287	0.5286	0.5285
10	0.5305	0.5298	0.5297	0.5295	0.5296	0.5294	0.5294	0.5292	0.5290	0.5289	0.5289	0.5288	0.5288
11	0.5287	0.5281	0.5280	0.5277	0.5279	0.5277	0.5276	0.5274	0.5273	0.5272	0.5271	0.5270	0.5270
12	0.5292	0.5284	0.5283	0.5281	0.5281	0.5279	0.5279	0.5277	0.5275	0.5275	0.5274	0.5273	0.5273
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.5298	0.5291	0.5290	0.5288	0.5289	0.5287	0.5287	0.5285	0.5284	0.5283	0.5283	0.5282	0.5282
Med.	0.5298	0.5292	0.5290	0.5288	0.5290	0.5288	0.5287	0.5286	0.5284	0.5284	0.5284	0.5283	0.5282
σ	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
Min.	0.5287	0.5281	0.5280	0.5277	0.5279	0.5277	0.5276	0.5274	0.5273	0.5272	0.5271	0.5270	0.5270
Max.	0.5310	0.5303	0.5302	0.5300	0.5301	0.5299	0.5299	0.5297	0.5297	0.5295	0.5295	0.5294	0.5295

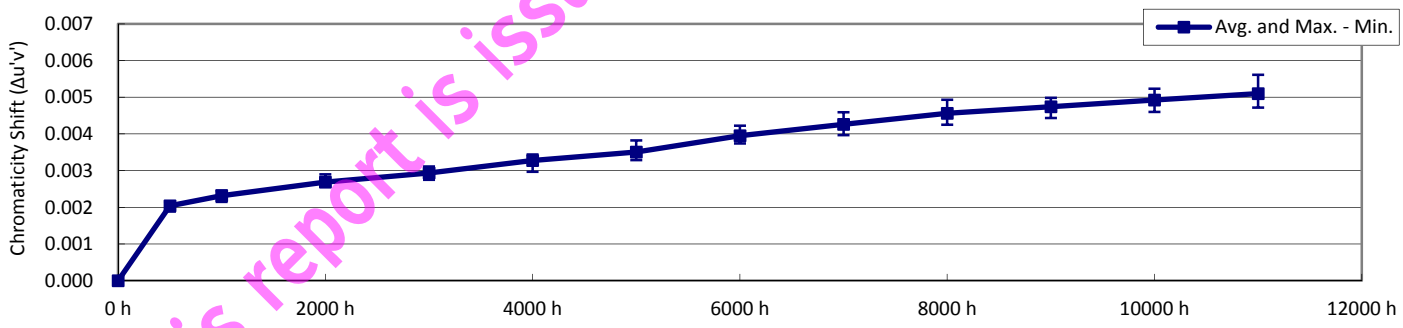
Data Set 7 : 105 °C, 250 mA

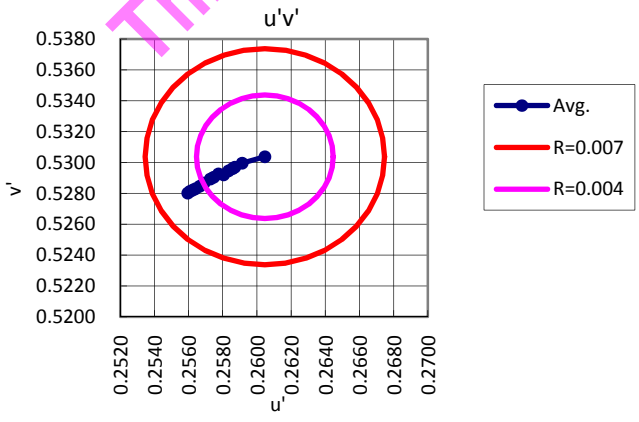
Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	101.9 °C
Drive Current [I_F]	250 mA
Measurement Current	250 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0









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Data Set 7 : 105 °C, 250 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	101.9 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	1270	47.2	2718	11.8	0.463	0.418	0.261	0.531				
2	1271	47.3	2733	11.8	0.461	0.417	0.260	0.530				
3	1269	47.3	2731	11.8	0.462	0.419	0.260	0.531				
4	1285	47.3	2752	11.8	0.459	0.416	0.260	0.529				
5	1277	47.3	2719	11.8	0.463	0.418	0.261	0.531				
6	1268	47.2	2708	11.8	0.463	0.418	0.261	0.531				
7	1282	47.4	2729	11.8	0.461	0.417	0.261	0.530				
8	1270	47.3	2740	11.8	0.461	0.418	0.260	0.530				
9	1279	47.3	2729	11.8	0.463	0.420	0.260	0.531				
10	1274	47.3	2722	11.8	0.462	0.418	0.261	0.530				
11	1284	47.4	2735	11.8	0.462	0.419	0.260	0.531				
12	1278	47.3	2745	11.8	0.460	0.417	0.260	0.530				
n	12	12	12	12	12	12	12	12				
Avg.	1276	47.3	2730	11.8	0.462	0.418	0.260	0.530				
Med.	1276	47.3	2730	11.8	0.462	0.418	0.260	0.530				
σ	6.1	0.04	12.3	0.01	0.0012	0.0010	0.0005	0.0005				
Min.	1268	47.2	2708	11.8	0.459	0.416	0.260	0.529				
Max.	1285	47.4	2752	11.8	0.463	0.420	0.261	0.531				

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Data Set 7 : 105 °C, 250 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	101.9 °C
Drive Current [I_F]	250 mA
Measurement Current	250 mA

NOTES:
T_S and T_A were measured during initial setup.
Number of LED failures: 0

TABLE 7-2
Lumen Maintenance

LED No.	Lumen 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	11000 h
1	100.0	96.6	96.2	96.3	96.4	96.0	95.6	94.7	94.1	93.1	91.0	84.7	73.1
2	100.0	96.7	96.3	95.9	95.9	95.3	94.8	93.9	93.1	92.1	89.4	81.8	71.1
3	100.0	97.0	96.7	96.3	96.5	95.9	95.5	94.7	94.0	92.9	90.3	80.9	68.5
4	100.0	96.8	96.5	96.1	96.1	95.5	95.1	94.3	93.5	92.8	92.4	91.6	89.9
5	100.0	97.1	96.9	96.3	96.5	96.1	95.5	94.8	94.3	93.4	93.2	92.4	90.6
6	100.0	97.2	96.9	96.6	96.7	96.2	95.8	95.1	94.5	93.8	93.5	92.8	90.9
7	100.0	97.0	96.7	96.2	96.4	95.8	95.5	94.7	94.2	93.4	93.1	92.4	90.5
8	100.0	96.5	96.1	96.0	96.1	95.6	94.9	93.9	93.1	89.9	79.8	68.2	56.5
9	100.0	96.9	96.5	96.0	96.0	95.5	95.2	94.4	94.0	93.3	93.1	92.6	91.1
10	100.0	97.0	96.7	96.4	96.5	95.9	95.6	94.8	94.3	93.4	93.0	91.7	88.4
11	100.0	97.1	96.8	96.5	96.6	96.1	95.5	94.6	94.0	93.2	92.9	92.4	90.8
12	100.0	97.3	96.9	96.3	96.6	96.1	95.8	95.0	94.5	93.8	93.5	92.9	91.2
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	96.9	96.6	96.2	96.3	95.8	95.4	94.6	94.0	92.9	91.3	87.9	82.7
Med.	100.0	97.0	96.7	96.3	96.4	95.9	95.5	94.7	94.1	93.3	93.0	92.0	90.2
σ	0.00	0.26	0.29	0.21	0.26	0.31	0.32	0.39	0.49	1.05	3.84	7.64	12.05
Min.	100.0	96.5	96.1	95.9	95.9	95.3	94.8	93.9	93.1	89.9	79.8	68.2	56.5
Max.	100.0	97.3	96.9	96.6	96.7	96.2	95.8	95.1	94.5	93.8	93.5	92.9	91.2

TM-21 Projection

Time	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h
ln(Avg.)	-0.0470	-0.0557	-0.0622	-0.0734	-0.0912	-0.1292	-0.1899

Test duration used	5000 h to 11000 h	
B	1.083	
α	2.16E-05	
R^2	0.840	
Calculated L_{70} (11K)	20200	hours
Reported L_{70} (11K)	20200	hours
Calculated L_{80} (11K)	14000	hours
Reported L_{80} (11K)	14000	hours
Calculated L_{90} (11K)	8590	hours
Reported L_{90} (11K)	8590	hours

Curve-fit equation:
$\Phi(t)=Bexp(-\alpha t)$

Lumen maintenance life eqation:
$L_{70}=ln(B/0.7)/\alpha$

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

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

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Data Set 7 : 105 °C, 250 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	101.9 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	100.0	100.5	101.3	102.4	103.7	105.1	106.9	108.6	111.0	114.2	119.6	126.0	131.2
2	100.0	100.6	101.3	102.5	103.7	105.1	107.1	108.9	111.6	115.2	121.0	127.6	132.0
3	100.0	100.6	101.4	102.5	103.8	105.3	107.2	109.1	111.9	115.6	122.0	128.8	134.1
4	100.0	100.4	101.0	101.9	102.8	103.8	105.1	106.0	107.4	108.8	110.9	113.1	116.0
5	100.0	100.4	101.0	101.8	102.7	103.6	104.8	105.6	106.9	108.1	110.1	112.0	114.5
6	100.0	100.4	100.9	101.7	102.5	103.4	104.5	105.1	106.3	107.4	109.0	110.4	112.3
7	100.0	100.4	101.0	101.6	102.5	103.3	104.5	105.1	106.3	107.5	109.2	110.9	113.4
8	100.0	100.6	101.4	102.8	104.3	106.1	108.4	110.7	114.7	121.4	128.7	134.6	138.0
9	100.0	100.4	100.9	101.6	102.5	103.4	104.6	105.3	106.6	107.9	109.9	111.8	114.9
10	100.0	100.4	101.0	101.8	102.8	103.8	105.2	106.0	107.6	109.2	111.6	114.6	118.4
11	100.0	100.3	100.8	101.5	102.3	103.1	104.1	104.7	105.8	106.9	108.5	109.9	112.1
12	100.0	100.4	101.1	102.0	103.0	104.0	105.2	106.1	107.5	108.9	111.0	113.2	116.5
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	100.0	100.5	101.1	102.0	103.1	104.2	105.6	106.8	108.6	110.9	114.3	117.7	121.1
Med.	100.0	100.4	101.0	101.9	102.8	103.8	105.1	106.0	107.4	108.9	111.0	113.1	116.2
σ	0.00	0.10	0.20	0.42	0.66	0.98	1.39	1.99	2.88	4.57	6.70	8.81	9.69
Min.	100.0	100.3	100.8	101.5	102.3	103.1	104.1	104.7	105.8	106.9	108.5	109.9	112.1
Max.	100.0	100.6	101.4	102.8	104.3	106.1	108.4	110.7	114.7	121.4	128.7	134.6	138.0

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Data Set 7 : 105 °C, 250 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	101.9 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	0.0000	0.0021	0.0023	0.0027	0.0029	0.0032	0.0034	0.0040	0.0041	0.0044	0.0047	0.0049	0.0048
2	0.0000	0.0021	0.0025	0.0029	0.0031	0.0034	0.0038	0.0042	0.0044	0.0047	0.0048	0.0049	0.0049
3	0.0000	0.0021	0.0023	0.0027	0.0029	0.0034	0.0035	0.0038	0.0042	0.0046	0.0047	0.0048	0.0047
4	0.0000	0.0020	0.0023	0.0026	0.0029	0.0032	0.0035	0.0041	0.0045	0.0048	0.0050	0.0052	0.0056
5	0.0000	0.0019	0.0021	0.0026	0.0028	0.0032	0.0033	0.0037	0.0040	0.0043	0.0044	0.0046	0.0049
6	0.0000	0.0020	0.0023	0.0026	0.0030	0.0033	0.0034	0.0038	0.0043	0.0045	0.0047	0.0050	0.0053
7	0.0000	0.0021	0.0023	0.0026	0.0029	0.0033	0.0034	0.0039	0.0041	0.0044	0.0046	0.0049	0.0053
8	0.0000	0.0021	0.0024	0.0028	0.0030	0.0034	0.0038	0.0042	0.0046	0.0049	0.0050	0.0050	0.0047
9	0.0000	0.0021	0.0024	0.0028	0.0030	0.0034	0.0035	0.0039	0.0042	0.0045	0.0046	0.0048	0.0050
10	0.0000	0.0020	0.0022	0.0026	0.0029	0.0033	0.0035	0.0038	0.0041	0.0045	0.0046	0.0050	0.0052
11	0.0000	0.0019	0.0022	0.0026	0.0028	0.0030	0.0034	0.0040	0.0044	0.0047	0.0049	0.0052	0.0055
12	0.0000	0.0021	0.0024	0.0028	0.0030	0.0034	0.0035	0.0039	0.0043	0.0045	0.0047	0.0049	0.0052
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.0000	0.0020	0.0023	0.0027	0.0029	0.0033	0.0035	0.0040	0.0043	0.0046	0.0047	0.0049	0.0051
Med.	0.0000	0.0021	0.0023	0.0027	0.0029	0.0033	0.0035	0.0039	0.0042	0.0045	0.0047	0.0049	0.0051
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003
Min.	0.0000	0.0019	0.0021	0.0026	0.0028	0.0030	0.0033	0.0037	0.0040	0.0043	0.0044	0.0046	0.0047
Max.	0.0000	0.0021	0.0025	0.0029	0.0031	0.0034	0.0038	0.0042	0.0046	0.0049	0.0050	0.0052	0.0056

Data Set 7 : 105 °C, 250 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	101.9 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	0.2611	0.2592	0.2590	0.2587	0.2585	0.2582	0.2580	0.2575	0.2574	0.2572	0.2569	0.2568	0.2569
2	0.2606	0.2587	0.2584	0.2580	0.2578	0.2575	0.2571	0.2568	0.2566	0.2564	0.2563	0.2561	0.2562
3	0.2604	0.2585	0.2583	0.2580	0.2577	0.2574	0.2573	0.2570	0.2568	0.2564	0.2563	0.2563	0.2563
4	0.2598	0.2580	0.2576	0.2575	0.2571	0.2568	0.2566	0.2561	0.2559	0.2556	0.2555	0.2553	0.2550
5	0.2610	0.2592	0.2590	0.2586	0.2584	0.2581	0.2580	0.2576	0.2574	0.2572	0.2570	0.2569	0.2566
6	0.2617	0.2598	0.2595	0.2593	0.2589	0.2587	0.2586	0.2583	0.2579	0.2577	0.2575	0.2573	0.2570
7	0.2607	0.2587	0.2586	0.2584	0.2580	0.2577	0.2576	0.2572	0.2570	0.2568	0.2566	0.2563	0.2560
8	0.2602	0.2582	0.2580	0.2577	0.2574	0.2571	0.2567	0.2565	0.2561	0.2559	0.2558	0.2558	0.2561
9	0.2606	0.2587	0.2583	0.2580	0.2578	0.2575	0.2573	0.2570	0.2568	0.2566	0.2565	0.2563	0.2562
10	0.2609	0.2591	0.2589	0.2586	0.2582	0.2579	0.2577	0.2574	0.2572	0.2568	0.2567	0.2564	0.2561
11	0.2602	0.2584	0.2582	0.2579	0.2576	0.2575	0.2570	0.2565	0.2562	0.2559	0.2557	0.2555	0.2552
12	0.2601	0.2581	0.2579	0.2576	0.2573	0.2570	0.2569	0.2566	0.2562	0.2561	0.2559	0.2557	0.2555
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.2606	0.2587	0.2585	0.2582	0.2579	0.2576	0.2574	0.2570	0.2568	0.2565	0.2564	0.2562	0.2561
Med.	0.2606	0.2587	0.2584	0.2580	0.2578	0.2575	0.2573	0.2570	0.2568	0.2565	0.2564	0.2563	0.2561
σ	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Min.	0.2598	0.2580	0.2576	0.2575	0.2571	0.2568	0.2566	0.2561	0.2559	0.2556	0.2555	0.2553	0.2550
Max.	0.2617	0.2598	0.2595	0.2593	0.2589	0.2587	0.2586	0.2583	0.2579	0.2577	0.2575	0.2573	0.2570

Data Set 7 : 105 °C, 250 mA

Actual Case Temperature [T_S]	106.5 °C
Actual Ambient Temperature [T_A]	101.9 °C
Drive Current [I_F]	250 mA
Measurement Current	250 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	11000 h
1	0.5309	0.5302	0.5300	0.5297	0.5298	0.5296	0.5295	0.5292	0.5291	0.5289	0.5288	0.5288	0.5287
2	0.5302	0.5293	0.5291	0.5288	0.5289	0.5287	0.5286	0.5283	0.5281	0.5280	0.5280	0.5281	0.5280
3	0.5312	0.5304	0.5302	0.5300	0.5300	0.5297	0.5297	0.5295	0.5292	0.5290	0.5290	0.5288	0.5288
4	0.5297	0.5289	0.5288	0.5285	0.5285	0.5283	0.5281	0.5279	0.5275	0.5273	0.5272	0.5270	0.5267
5	0.5308	0.5300	0.5299	0.5297	0.5297	0.5294	0.5294	0.5291	0.5290	0.5288	0.5287	0.5286	0.5285
6	0.5308	0.5301	0.5300	0.5297	0.5298	0.5295	0.5294	0.5292	0.5289	0.5287	0.5287	0.5285	0.5282
7	0.5302	0.5295	0.5293	0.5291	0.5292	0.5289	0.5289	0.5285	0.5284	0.5282	0.5281	0.5281	0.5278
8	0.5307	0.5299	0.5297	0.5294	0.5294	0.5293	0.5290	0.5287	0.5285	0.5283	0.5283	0.5282	0.5283
9	0.5313	0.5306	0.5305	0.5302	0.5303	0.5300	0.5300	0.5297	0.5295	0.5294	0.5292	0.5291	0.5290
10	0.5307	0.5300	0.5299	0.5296	0.5297	0.5295	0.5294	0.5293	0.5290	0.5289	0.5289	0.5288	0.5287
11	0.5311	0.5303	0.5302	0.5300	0.5301	0.5299	0.5298	0.5295	0.5293	0.5292	0.5290	0.5290	0.5288
12	0.5299	0.5292	0.5290	0.5287	0.5288	0.5285	0.5284	0.5282	0.5280	0.5278	0.5278	0.5277	0.5275
n	12	12	12	12	12	12	12	12	12	12	12	12	12
Avg.	0.5306	0.5299	0.5297	0.5295	0.5295	0.5293	0.5292	0.5289	0.5287	0.5285	0.5285	0.5284	0.5283
Med.	0.5307	0.5300	0.5299	0.5296	0.5297	0.5295	0.5294	0.5292	0.5290	0.5288	0.5287	0.5286	0.5284
σ	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007
Min.	0.5297	0.5289	0.5288	0.5285	0.5285	0.5283	0.5281	0.5279	0.5275	0.5273	0.5272	0.5270	0.5267
Max.	0.5313	0.5306	0.5305	0.5302	0.5303	0.5300	0.5300	0.5297	0.5295	0.5294	0.5292	0.5291	0.5290