



Great One Global Certification Co., Ltd.

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Measuring Luminous Flux and Color Maintenance of LED Package, Arrays and Modules Test Report



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

Standard used :	IESNA LM-80-15 Approved Method for Measuring Luminous Flux and Color Maintenance of LED Package, Arrays and Modules
Date of issue :	March 27, 2020
Report number :	GO20030604

Reviewed by : _____

1. The test results of this report relate only to the tested sample identified in this report.
2. This report shall not be reproduced, in full or in portion, except for having written approval from Great One Global Certification Co., Ltd.
3. The data in report cannot be used for advertisement, publication and promotion.
4. Our laboratory is accredited to ISO 17025. It is our decision rule that the measurement uncertainty of the test results will not be evaluated.



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*Joint IAF-ILAC-ISO Communiqué
on the
Management Systems Requirements of ISO/IEC 17025:2005,
General requirements for the competence of testing and calibration
laboratories*

A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means the laboratory meets both the technical competence requirements and **management system requirements** that are necessary for it to consistently deliver technically valid test results and calibrations. The **management system requirements** in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 **Quality Management Systems — Requirements** and are aligned with its pertinent requirements.

IAF Chair

ILAC Chair

ISO Secretary General

January 2009



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www.ilac.org



International Laboratory Accreditation Cooperation

Joint ISO-ILAC-IAF Communiqué

8 January 2009

ILAC members will be aware that many of their accredited laboratories have been experiencing difficulty convincing their customers they should be asking laboratories to be accredited to ISO/IEC 17025, (prior to 1999 ISO Guide 25) rather than be certified (registered) to ISO 9001. The situation became more acute with the publication of ISO 9001:2008, as some customers continually asked laboratories to be certified, when they really meant accredited. The confusion is caused by the perception that accredited laboratories do not operate a recognised quality management system.

To address this problem the ILAC Laboratory Committee asked that a statement be put on accreditation (attestation) certificates, issued by their accreditation body, stating that an accredited laboratory's management system meets the principles of ISO 9001:2008. The same statement could also be used by accredited laboratories on their calibration certificates and test reports.

Working through the ISO-ILAC-IAF Joint Working Group (JWG), ILAC is pleased to be able to advise its member accreditation bodies that the problem raised by the Laboratory Committee may now be addressed as follows:-

On accreditation (attestation) certificates, accreditation bodies may add the following:

"This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated January 2009)"

Accreditation Bodies choosing to use the above statement on their accreditation certificates should either supply, or provide access to (via a website), the Joint ISO-ILAC-IAF Communiqué as part of the package. (It may be convenient for accreditation bodies to do this when they issue new accreditation certificates for ISO/IEC 17025:2005 to their accredited laboratories.)

Accredited laboratories choosing to use the above statement on their test reports and calibration certificates should also either supply, or provide access to (via a website), the Joint ISO-ILAC-IAF Communiqué as part of the package for their laboratory customers.

The Joint Communiqué is available on the ILAC website at www.ilac.org on the publications and resources page.

The ILAC Laboratory Committee thanks the members of the ILAC and IAF Executive Committees and the ISO-ILAC-IAF JWG, for developing a solution to a critical market issue facing some accredited laboratories.

Daniel Pierre, ILAC Chair

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TEST REPORT

Applicant's name	Intematix Corporation.
Applicant's Address	46410 Fremont Blvd, Fremont, CA 94538, USA
Testing laboratory	Great One Global Certification Co., Ltd.
Testing Address	9F-2, No. 120, Qiaohe Rd., Zhonghe Dist., New Taipei City 235, Taiwan (R.O.C.)
Tested by	Donald Chang /Joe Chan
Reported by	Julie Hsu
Approved by	David Yuan
Standard used	IESNA LM-80-15 Approved Method for Measuring Luminous Flux and Color Maintenance of LED Package, Arrays and Modules
Brand name	INTEMATIX
Test item description:	
Product Name	LED Package
Model/Type reference	IXEN-27G-13H-9A
Classification	Package
Ratings	9 Vdc, 100 mA, 1 W



Summary of Testing

Reference report:

N/A

Testing:

Date of receipt of test item: September 29, 2017

Date(s) of performance of tests: September 29, 2017 to February 19, 2019

Number of LED light sources tested: 25 pcs per case temperature

Test duration: 12,000 hrs

Operating cycle: Constant direct current

Air flow: < 0.1 m/s

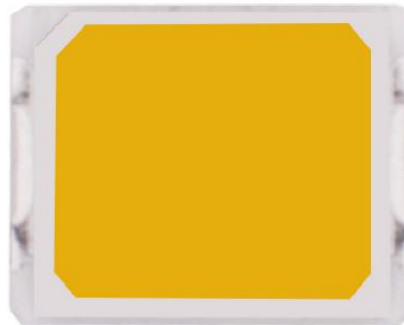
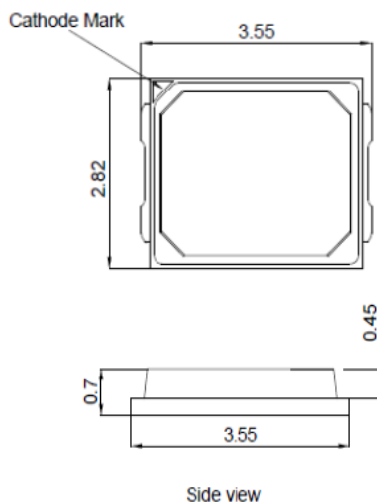
Relative humidity: < 65%

Photometric measurement uncertainty

Flux measurement.....: 2.2 % (k=2)

CCT measurement.....: 0.48 % (k=2)

General product information:





Description of model series:

Tests conducted on Model: IXEN-27G-13H-9A are considered representative of the whole series of IXEN-(A)(B)-(C)(D)(E)-(F)(G)

IXEN-(A)(B)-(C)(D)(E)-(F)(G)

IXEN: Designates product family

(A) CCT Variation, can be 22-65, for 2200K-6500K;

(B) CRI

(C) Parallel connected variation, can be 1-9 (total chip number is less than 9)

(D) Series connected variation, can be 1-9 (total chip number is less than 9)

(E) Power

(F) Voltage

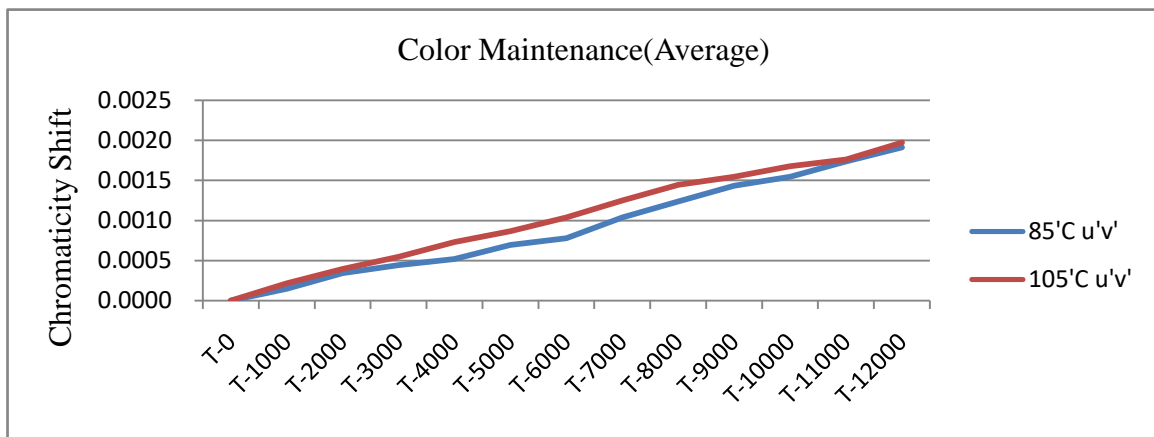
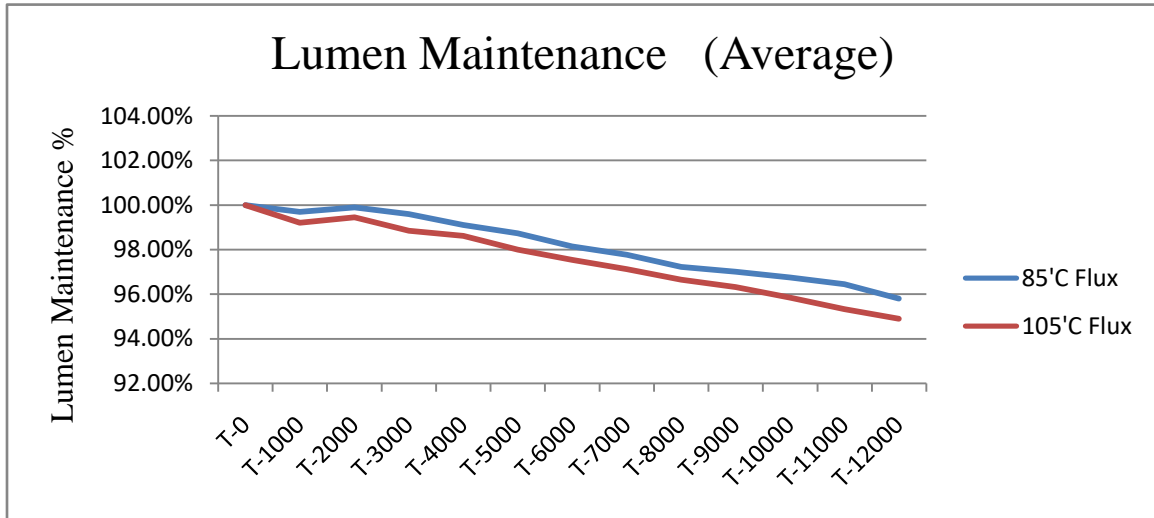
(G) Customer code: can be 0~ZZ

Device under test is LED package model number: IXEN-27G-13H-9A with Nominal CCT 2700K and CRI 90.



Summary of results

Data Set	Case Temperature [Ts]°C	Ambient Temperature [TA]°C	Drive Current [IF] mA	Lumen Maintenance at 12,000 hrs	Chromaticity Shift ($\Delta u'v'$) at 12,000 hrs	TM-21 Projection L70 (12,000 hrs)
1	85	>80	100	95.80 %	0.0019	>72,000
2	105	>100	100	94.89 %	0.0020	>72,000



Observation of LED light sources failures, including the failure conditions and time of failure: No failure observed

~ End of Report ~



Appendix A

LM-80-15

Approved Method for Measuring Luminous Flux and Color Maintenance of LED Package, Arrays and Modules

Report No. :	GO20030604	Test Initiation Date :	2017-09-29
Model No. :	IXEN-27G-13H-9A	Test Completion Date :	2019-02-19
Tested By :	Donald Chang / Joe Chan		
Manufacturer's Name: KAISTAR Lighting (Xiamen) Co., Ltd.			
Rated Voltage :	9 V	Temperature Selected by manufacturer:	105 °C
Rated Current :	100 mA	Number of LED Light Sources tested:	25
Rated CCT	2700 K		

EQUIPMENT USED:					
Inst. ID No.	Instrument Type	Function /Range	Pre Cal. Date	Cal. Date	Due Date
L401	LED current source 1(16 channel)	0~48V dc, 0~5 A	2017/02/23	2018/02/22	2019/02/21
L402	LED current source 2(8 channel)	0~48V dc, 0~5 A	2017/02/23	2018/02/22	2019/02/21
L403	Thermal Plate Controller	0°C to 95°C	-	-	-
L404	Environment Oven	-	-	-	-
L405	PC Controller	-	-	-	-
L406 to L411	Temperature Data Recorder	0°C to 300°C	2017/02/23	2018/02/22	2019/02/21
L412 to L418	Temperature Controller	0°C to 300°C	2017/02/23	2018/02/22	2019/02/21
L419 to L420	Auxiliary Thermal Plate Controller 1 to 2	0°C to 95°C	-	-	-
L238	Thermal Plate Cooler	0°C to 95°C	-	-	-
L240	Integrating Sphere	0.5 M	-	-	-
L244	Standard Lamp	-	2018/01/02	2019/01/03	2020/01/02
L247	Digital CC & CV DC Power Supply	0~150Vdc,0~5A	2017/11/27	2018/12/01	2019/11/30

TEST SAMPLE IDENTIFICATION		
Date Received	Data Set No.	Sample No.
2017-09-29	1	17092901-1 to 17092901-25
2017-09-29	2	17092901-26 to 17092901-50



Appendix A

TEST METHOD

The samples were tested according to the IES LM-80-2015. Lumen maintenance data for each individual LED light source along with median value, standard deviation, minimum and maximum lumen maintenance value for all of the LED light sources were recorded in the following table.

Temperature and Humidity

The two case temperatures, T_s , was 85 °C with a temperatures 105 °C selected by the manufacturer. The case temperature and drive current selected by the manufacturer represented their expectation for customers applications and was within their recommended operating temperature range. Case temperature was controlled to -2 °C during life testing. The temperature of the surrounding air was maintained to within -5 °C of the case temperature during testing.

Humidity was maintained to less the 65 RH throughout the life test.

Airflow was minimized (Air flow : < 0.1m/s) for proper light source starting and operation.

Photometry Measurement

For information on the photometry of the LED light source, see Reference 2.1.2, LM-79.

A Spectroradiometer and Integrating Sphere were used to measure correlated color temperature, chromaticity coordinates, and the luminous flux for each LED light sources. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 5 nm intervals over the range of 380 to 780 nm.

Luminous flux was measured at the drive current used during life testing.

The ambient temperature during lumen and chromaticity measurements was set to 25 °C +/- 2 °C.

Recording failures

Checking for LED light source failures either by visual observation or automatic monitoring was done at every measurement interval.

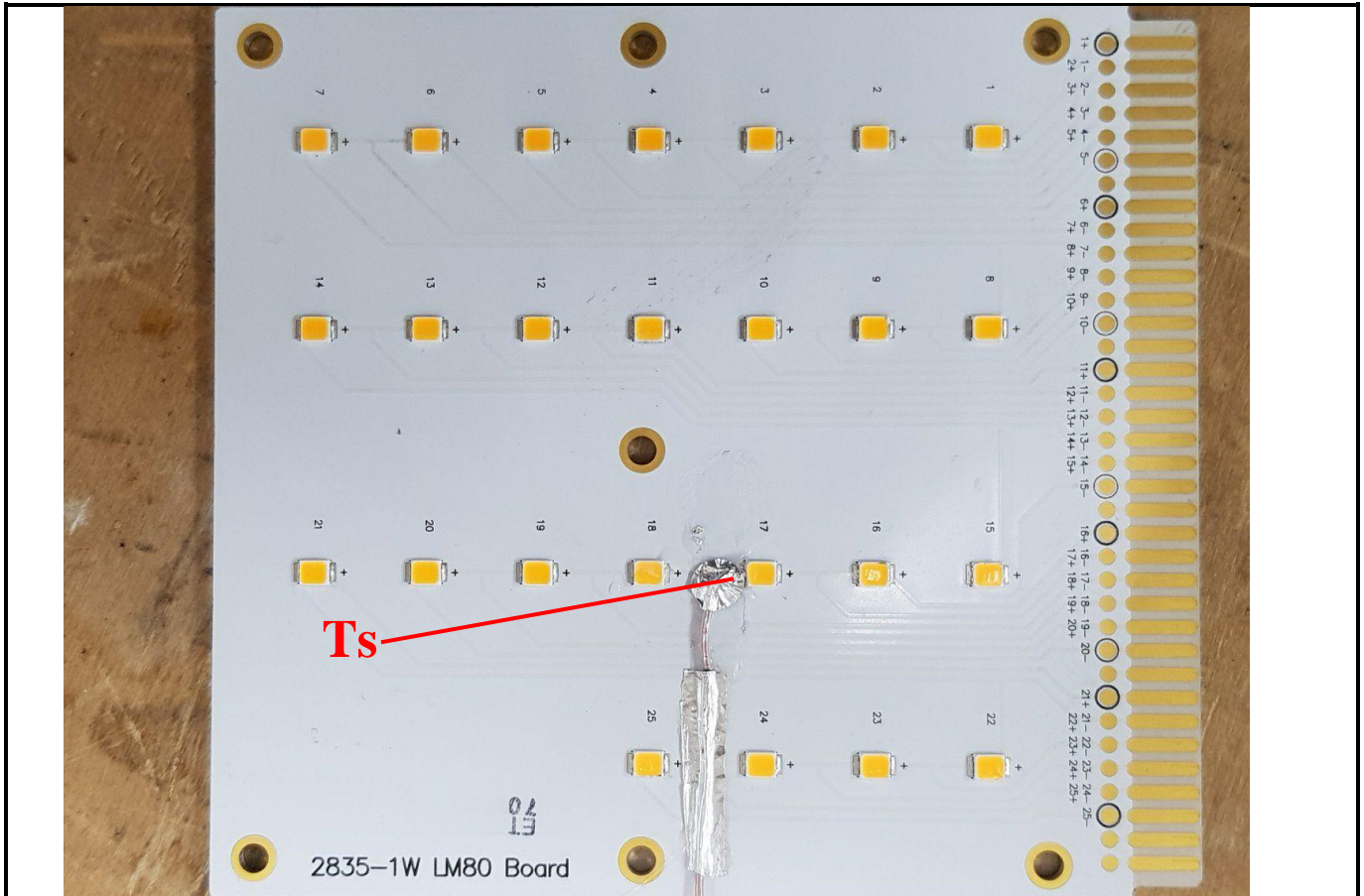
CASE TEMPERATURE, (T_s) ATTACHMENT POINT, CASE SIZE

T_s





Appendix A





Appendix A

Data Set 1	
Case Temperature	85 °C
Measurement Current	100 mA

**Table 1-1
Initial Characteristics**

Sample No.	Luminous Flux (lm)	Forward Voltage	CCT(K)	CIE-1931		CIE-1976	
17092901-1	111.38	9.028	2653	0.4630	0.4101	0.2647	0.5276
17092901-2	112.04	9.030	2641	0.4645	0.4112	0.2652	0.5283
17092901-3	111.02	9.001	2725	0.4577	0.4100	0.2614	0.5268
17092901-4	112.75	9.015	2688	0.4612	0.4115	0.2630	0.5279
17092901-5	112.52	9.029	2702	0.4607	0.4123	0.2623	0.5281
17092901-6	110.96	9.015	2667	0.4609	0.4082	0.2643	0.5266
17092901-7	112.18	9.032	2703	0.4607	0.4125	0.2622	0.5282
17092901-8	111.94	9.056	2665	0.4631	0.4119	0.2640	0.5283
17092901-9	113.07	9.025	2714	0.4599	0.4125	0.2617	0.5281
17092901-10	110.91	9.082	2649	0.4637	0.4109	0.2648	0.5281
17092901-11	112.17	9.026	2694	0.4622	0.4140	0.2625	0.5290
17092901-12	111.64	9.023	2727	0.4575	0.4097	0.2614	0.5266
17092901-13	111.79	9.030	2679	0.4629	0.4133	0.2633	0.5288
17092901-14	111.02	9.037	2663	0.4615	0.4088	0.2644	0.5269
17092901-15	111.05	9.037	2710	0.4594	0.4110	0.2620	0.5274
17092901-16	109.99	9.047	2621	0.4653	0.4100	0.2663	0.5280
17092901-17	110.05	9.073	2648	0.4643	0.4116	0.2649	0.5284
17092901-18	109.56	9.079	2662	0.4645	0.4139	0.2640	0.5293
17092901-19	109.84	9.048	2622	0.4637	0.4073	0.2665	0.5267
17092901-20	110.48	9.004	2702	0.4597	0.4105	0.2624	0.5273
17092901-21	111.63	9.027	2635	0.4653	0.4118	0.2655	0.5286
17092901-22	111.80	9.052	2684	0.4620	0.4124	0.2631	0.5284
17092901-23	111.83	9.026	2640	0.4643	0.4107	0.2653	0.5281
17092901-24	111.84	8.988	2703	0.4607	0.4126	0.2622	0.5282
17092901-25	110.48	9.076	2657	0.4636	0.4117	0.2644	0.5284
Avg.	111.4	9.035	2674	0.4621	0.4112	0.2637	0.5279
Med.	111.6	9.030	2667	0.4622	0.4115	0.2640	0.5281
σ	0.929	0.024	31.50	0.0022	0.0017	0.0015	0.0008
Min.	109.6	8.988	2621	0.4575	0.4073	0.2614	0.5266
Max.	113.1	9.082	2727	0.4653	0.4140	0.2665	0.5293



Appendix A

**Table 1-2
Lumen Maintenance**

Sample No.	Lumen Maintenance% (Normalized to 100% at Initial)												
	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h	12000 h
17092901-1	100.00%	99.55%	99.70%	99.75%	98.66%	98.10%	97.62%	97.54%	97.75%	97.70%	97.46%	97.28%	96.84%
17092901-2	100.00%	99.95%	99.96%	99.96%	99.76%	99.74%	99.53%	99.51%	97.94%	97.82%	97.60%	97.40%	97.13%
17092901-3	100.00%	99.46%	99.80%	98.97%	98.62%	98.16%	97.44%	97.35%	97.42%	97.21%	97.19%	96.90%	96.02%
17092901-4	100.00%	99.73%	100.09%	99.41%	99.19%	99.10%	98.71%	97.55%	97.03%	96.35%	96.16%	95.97%	95.01%
17092901-5	100.00%	99.70%	99.83%	99.52%	99.15%	98.48%	97.75%	97.69%	96.56%	95.87%	95.54%	95.03%	93.91%
17092901-6	100.00%	99.78%	100.11%	99.52%	98.93%	98.52%	97.86%	97.94%	97.50%	97.42%	97.33%	97.17%	96.54%
17092901-7	100.00%	99.66%	99.78%	99.46%	98.83%	98.31%	97.84%	96.85%	96.83%	96.45%	96.32%	96.17%	95.11%
17092901-8	100.00%	99.94%	99.97%	99.95%	99.79%	99.48%	99.10%	98.20%	97.00%	96.94%	96.92%	96.64%	95.83%
17092901-9	100.00%	99.80%	99.98%	99.71%	98.88%	98.63%	98.02%	97.20%	96.27%	95.36%	94.97%	95.13%	94.37%
17092901-10	100.00%	99.38%	99.97%	99.40%	98.82%	98.88%	98.56%	98.16%	98.46%	98.39%	97.97%	97.27%	97.04%
17092901-11	100.00%	99.99%	100.16%	99.07%	99.00%	98.92%	98.80%	97.47%	96.43%	96.21%	95.35%	95.21%	94.59%
17092901-12	100.00%	99.88%	100.00%	99.94%	99.33%	99.21%	98.40%	97.57%	97.54%	97.18%	96.26%	96.01%	95.09%
17092901-13	100.00%	99.45%	99.54%	99.77%	99.26%	99.16%	98.24%	98.15%	96.97%	96.92%	96.14%	96.22%	95.96%
17092901-14	100.00%	99.38%	99.60%	99.66%	98.99%	99.00%	97.90%	97.94%	97.23%	96.98%	96.84%	95.91%	95.19%
17092901-15	100.00%	99.57%	99.88%	99.88%	99.19%	99.01%	98.62%	98.05%	96.49%	96.41%	95.91%	95.79%	94.77%
17092901-16	100.00%	99.72%	99.92%	99.83%	99.40%	98.53%	98.08%	97.84%	97.30%	97.13%	97.04%	96.96%	96.03%
17092901-17	100.00%	99.69%	99.76%	99.64%	99.22%	98.59%	98.29%	97.96%	97.33%	97.20%	97.08%	96.72%	96.47%
17092901-18	100.00%	99.42%	99.74%	99.44%	98.55%	97.63%	97.19%	96.67%	96.45%	96.31%	96.01%	95.02%	94.83%
17092901-19	100.00%	99.97%	99.93%	99.44%	98.91%	98.02%	97.21%	97.32%	97.28%	97.27%	97.13%	96.99%	96.61%
17092901-20	100.00%	99.48%	99.85%	99.43%	98.99%	99.17%	98.28%	97.95%	97.90%	97.76%	97.73%	96.76%	96.64%
17092901-21	100.00%	99.34%	99.95%	99.83%	98.87%	98.14%	97.20%	97.31%	97.02%	96.99%	96.64%	96.46%	95.87%
17092901-22	100.00%	99.91%	99.93%	99.23%	98.95%	98.09%	97.76%	97.48%	97.30%	97.24%	97.22%	97.14%	96.19%
17092901-23	100.00%	99.99%	100.10%	99.85%	99.19%	99.43%	98.92%	98.87%	98.26%	98.12%	98.13%	97.61%	96.65%
17092901-24	100.00%	99.91%	99.99%	99.49%	99.22%	98.34%	97.54%	97.32%	96.45%	96.39%	96.21%	96.33%	95.77%
17092901-25	100.00%	99.88%	100.02%	99.86%	99.81%	99.54%	98.65%	98.50%	97.83%	97.63%	97.51%	97.13%	96.44%
Avg.	100.00%	99.70%	99.90%	99.60%	99.10%	98.73%	98.14%	97.78%	97.22%	97.01%	96.75%	96.45%	95.80%
Med.	100.00%	99.72%	99.93%	99.64%	99.00%	98.63%	98.08%	97.69%	97.28%	97.13%	96.92%	96.64%	95.96%
σ	0.0000	0.0022	0.0016	0.0027	0.0034	0.0055	0.0062	0.0061	0.0060	0.0072	0.0083	0.0078	0.0090
Min.	100.00%	99.34%	99.54%	98.97%	98.55%	97.63%	97.19%	96.67%	96.27%	95.36%	94.97%	95.02%	93.91%
Max.	100.00%	99.99%	100.16%	99.96%	99.81%	99.74%	99.53%	99.51%	98.46%	98.39%	98.13%	97.61%	97.13%

TM-21 Projection

Time	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h	12000 h
ln (Avg.)	0.0000	-0.0030	-0.0010	-0.0040	-0.0090	-0.0128	-0.0188	-0.0225	-0.02817	-0.03036	-0.0331	-0.0362	-0.0429

Test duration used	12,000 hrs	Calculated L70 (12,000 hrs)	96,000 hrs
B	1.003	Report L70 (12,000 hrs)	>72,000 hrs
α	3.737E-06		



Appendix A

Table 1-3 Forward Voltage

Sample No.	Relative Forward Voltage % (Normalized to 100% at Initial)												
	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h	12000 h
17092901-1	100.00%	100.15%	100.08%	100.09%	100.43%	100.28%	99.84%	99.93%	99.83%	99.77%	99.80%	100.07%	99.77%
17092901-2	100.00%	100.08%	100.20%	100.24%	100.07%	100.03%	99.73%	99.99%	99.96%	99.93%	99.95%	100.04%	100.13%
17092901-3	100.00%	98.79%	98.66%	98.87%	99.72%	98.53%	97.76%	100.07%	100.00%	100.09%	100.11%	99.92%	99.80%
17092901-4	100.00%	99.88%	99.94%	99.92%	100.01%	99.53%	99.88%	100.07%	100.17%	100.57%	100.04%	100.02%	99.67%
17092901-5	100.00%	100.11%	99.94%	100.11%	100.06%	100.03%	100.41%	100.17%	100.08%	100.19%	100.19%	99.91%	99.77%
17092901-6	100.00%	99.95%	98.57%	99.97%	100.03%	98.54%	100.03%	100.00%	99.90%	99.86%	99.96%	100.19%	99.85%
17092901-7	100.00%	99.86%	99.90%	99.95%	99.88%	100.05%	100.31%	99.96%	100.08%	99.96%	99.95%	99.98%	99.95%
17092901-8	100.00%	100.09%	100.10%	100.12%	99.95%	100.54%	99.96%	99.91%	99.79%	100.47%	99.91%	99.86%	99.85%
17092901-9	100.00%	100.01%	99.85%	99.92%	99.88%	100.00%	100.20%	99.92%	99.92%	100.04%	99.99%	100.50%	100.22%
17092901-10	100.00%	99.91%	100.05%	100.01%	99.89%	99.85%	100.06%	99.92%	100.01%	100.02%	99.91%	100.15%	100.07%
17092901-11	100.00%	99.71%	99.73%	99.91%	99.86%	100.14%	99.79%	100.16%	100.17%	100.56%	100.13%	100.20%	100.13%
17092901-12	100.00%	99.90%	100.03%	99.93%	100.04%	100.01%	100.23%	99.94%	99.85%	100.23%	99.81%	99.96%	98.71%
17092901-13	100.00%	99.87%	99.82%	99.77%	99.75%	99.93%	100.19%	99.92%	100.11%	100.58%	100.10%	100.12%	99.96%
17092901-14	100.00%	99.95%	100.07%	100.06%	100.22%	100.05%	99.77%	100.13%	100.00%	100.57%	100.23%	99.93%	100.19%
17092901-15	100.00%	100.11%	100.08%	99.97%	100.04%	100.11%	99.95%	99.91%	99.79%	99.89%	99.79%	100.11%	99.88%
17092901-16	100.00%	99.90%	99.92%	99.91%	99.95%	99.97%	99.95%	100.19%	100.07%	100.12%	100.22%	100.13%	99.97%
17092901-17	100.00%	99.76%	99.93%	99.83%	100.05%	100.04%	100.03%	99.92%	99.92%	99.98%	99.81%	99.96%	100.16%
17092901-18	100.00%	99.96%	100.07%	100.09%	99.98%	100.03%	100.09%	99.78%	99.85%	99.75%	99.78%	100.13%	100.03%
17092901-19	100.00%	99.92%	100.10%	99.99%	100.15%	99.99%	100.54%	99.92%	99.83%	99.83%	99.78%	100.03%	100.01%
17092901-20	100.00%	99.96%	100.17%	100.08%	100.28%	100.25%	100.16%	99.81%	101.14%	99.64%	99.81%	99.94%	98.86%
17092901-21	100.00%	99.77%	99.76%	99.89%	99.99%	100.36%	100.29%	99.92%	100.04%	99.92%	99.93%	100.03%	99.62%
17092901-22	100.00%	100.14%	100.26%	100.25%	100.18%	100.00%	99.96%	100.23%	100.16%	100.53%	100.12%	100.15%	99.80%
17092901-23	100.00%	100.09%	100.13%	100.14%	100.14%	98.39%	100.21%	100.35%	100.63%	100.32%	100.24%	100.17%	100.07%
17092901-24	100.00%	100.08%	98.70%	100.04%	100.09%	100.11%	100.07%	99.68%	99.71%	99.67%	99.80%	99.93%	98.66%
17092901-25	100.00%	99.69%	99.98%	99.88%	100.34%	99.93%	100.67%	99.82%	99.73%	99.71%	99.73%	100.06%	99.85%
Avg.	100.00%	99.91%	99.84%	99.96%	100.04%	99.87%	100.00%	99.98%	100.03%	100.09%	99.96%	100.06%	99.80%
Med.	100.00%	99.95%	99.98%	99.97%	100.04%	100.03%	100.06%	99.93%	100.00%	100.02%	99.95%	100.04%	99.88%
σ	0.0000	0.0027	0.0047	0.0026	0.0017	0.0055	0.0052	0.0015	0.0030	0.0031	0.0016	0.0014	0.0043
Min.	100.00%	98.79%	98.57%	98.87%	99.72%	98.39%	97.76%	99.68%	99.71%	99.64%	99.73%	99.86%	98.66%
Max.	100.00%	100.15%	100.26%	100.25%	100.43%	100.54%	100.67%	100.35%	101.14%	100.58%	100.24%	100.50%	100.22%



Appendix A

Table 1-4 Chromaticity Shift

Sample No.	Chromaticity Shift $\Delta u'v'$												
	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h	12000 h
17092901-1	0.0000	0.0002	0.0003	0.0005	0.0003	0.0004	0.0009	0.0010	0.0012	0.0014	0.0015	0.0018	0.0019
17092901-2	0.0000	0.0000	0.0002	0.0002	0.0007	0.0009	0.0009	0.0012	0.0013	0.0014	0.0014	0.0016	0.0017
17092901-3	0.0000	0.0002	0.0005	0.0005	0.0004	0.0004	0.0006	0.0009	0.0013	0.0013	0.0014	0.0016	0.0018
17092901-4	0.0000	0.0001	0.0002	0.0003	0.0005	0.0006	0.0006	0.0008	0.0010	0.0013	0.0014	0.0015	0.0019
17092901-5	0.0000	0.0002	0.0003	0.0004	0.0003	0.0006	0.0008	0.0012	0.0015	0.0017	0.0017	0.0018	0.0021
17092901-6	0.0000	0.0001	0.0003	0.0005	0.0004	0.0007	0.0010	0.0013	0.0015	0.0016	0.0015	0.0017	0.0020
17092901-7	0.0000	0.0002	0.0005	0.0004	0.0004	0.0007	0.0010	0.0013	0.0015	0.0016	0.0018	0.0019	0.0020
17092901-8	0.0000	0.0000	0.0002	0.0002	0.0007	0.0009	0.0005	0.0009	0.0011	0.0013	0.0014	0.0015	0.0016
17092901-9	0.0000	0.0001	0.0003	0.0004	0.0003	0.0004	0.0006	0.0008	0.0009	0.0010	0.0013	0.0013	0.0015
17092901-10	0.0000	0.0002	0.0004	0.0005	0.0004	0.0004	0.0006	0.0010	0.0012	0.0012	0.0013	0.0015	0.0015
17092901-11	0.0000	0.0001	0.0003	0.0004	0.0006	0.0003	0.0008	0.0009	0.0013	0.0014	0.0017	0.0019	0.0021
17092901-12	0.0000	0.0001	0.0003	0.0004	0.0006	0.0008	0.0005	0.0007	0.0009	0.0010	0.0011	0.0014	0.0015
17092901-13	0.0000	0.0002	0.0004	0.0005	0.0003	0.0005	0.0010	0.0012	0.0013	0.0016	0.0016	0.0020	0.0022
17092901-14	0.0000	0.0001	0.0003	0.0005	0.0006	0.0009	0.0010	0.0013	0.0014	0.0014	0.0014	0.0018	0.0015
17092901-15	0.0000	0.0001	0.0002	0.0004	0.0007	0.0009	0.0005	0.0009	0.0011	0.0013	0.0015	0.0017	0.0022
17092901-16	0.0000	0.0002	0.0005	0.0005	0.0007	0.0009	0.0009	0.0011	0.0012	0.0014	0.0015	0.0017	0.0018
17092901-17	0.0000	0.0001	0.0002	0.0004	0.0005	0.0009	0.0011	0.0013	0.0015	0.0020	0.0022	0.0023	0.0024
17092901-18	0.0000	0.0002	0.0003	0.0006	0.0005	0.0008	0.0008	0.0011	0.0012	0.0014	0.0014	0.0016	0.0016
17092901-19	0.0000	0.0001	0.0003	0.0004	0.0003	0.0004	0.0009	0.0011	0.0015	0.0017	0.0018	0.0020	0.0021
17092901-20	0.0000	0.0001	0.0003	0.0005	0.0008	0.0008	0.0009	0.0013	0.0016	0.0019	0.0021	0.0022	0.0022
17092901-21	0.0000	0.0001	0.0004	0.0005	0.0005	0.0006	0.0008	0.0009	0.0013	0.0015	0.0017	0.0019	0.0020
17092901-22	0.0000	0.0002	0.0004	0.0006	0.0007	0.0009	0.0011	0.0012	0.0013	0.0016	0.0016	0.0017	0.0020
17092901-23	0.0000	0.0002	0.0004	0.0005	0.0007	0.0009	0.0005	0.0008	0.0009	0.0012	0.0013	0.0014	0.0022
17092901-24	0.0000	0.0002	0.0005	0.0006	0.0006	0.0010	0.0005	0.0008	0.0009	0.0011	0.0014	0.0016	0.0019
17092901-25	0.0000	0.0001	0.0003	0.0005	0.0004	0.0007	0.0006	0.0008	0.0011	0.0015	0.0016	0.0020	0.0021
Avg.	0.0000	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008	0.0010	0.0012	0.0014	0.0015	0.0017	0.0019
Med.	0.0000	0.0001	0.0003	0.0005	0.0005	0.0007	0.0008	0.0010	0.0013	0.0014	0.0015	0.0017	0.0020
σ	0.0000	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003
Min.	0.0000	0.0000	0.0002	0.0002	0.0003	0.0003	0.0005	0.0007	0.0009	0.0010	0.0011	0.0013	0.0015
Max.	0.0000	0.0002	0.0005	0.0006	0.0008	0.0010	0.0011	0.0013	0.0016	0.0020	0.0022	0.0023	0.0024



Appendix A

Data Set 2	
Case Temperature	105 °C
Measurement Current	100 mA

**Table 2-1
Initial Characteristics**

Sample No.	Luminous Flux (lm)	Forward Voltage	CCT(K)	CIE-1931		CIE-1976	
17092901-26	112.36	9.027	2702	0.4595	0.4102	0.2624	0.5271
17092901-27	111.65	9.013	2718	0.4590	0.4114	0.2616	0.5275
17092901-28	110.51	9.001	2659	0.4622	0.4095	0.2645	0.5273
17092901-29	110.06	9.023	2636	0.4639	0.4095	0.2656	0.5275
17092901-30	109.82	9.066	2622	0.4643	0.4083	0.2664	0.5271
17092901-31	111.45	8.997	2631	0.4649	0.4105	0.2658	0.5281
17092901-32	110.60	8.990	2689	0.4600	0.4095	0.2631	0.5270
17092901-33	109.78	9.054	2656	0.4637	0.4117	0.2645	0.5283
17092901-34	112.05	9.025	2706	0.4593	0.4103	0.2623	0.5271
17092901-35	111.18	8.994	2705	0.4601	0.4116	0.2622	0.5278
17092901-36	112.23	8.994	2726	0.4589	0.4122	0.2612	0.5278
17092901-37	111.59	9.029	2683	0.4603	0.4092	0.2634	0.5269
17092901-38	112.88	9.025	2734	0.4579	0.4114	0.2609	0.5273
17092901-39	111.65	9.041	2675	0.4619	0.4109	0.2636	0.5278
17092901-40	110.17	9.025	2662	0.4624	0.4102	0.2643	0.5276
17092901-41	110.69	9.007	2636	0.4651	0.4117	0.2654	0.5286
17092901-42	111.10	9.027	2642	0.4647	0.4117	0.2651	0.5285
17092901-43	112.18	9.017	2721	0.4584	0.4106	0.2615	0.5271
17092901-44	110.57	8.990	2679	0.4617	0.4112	0.2634	0.5279
17092901-45	113.04	9.022	2645	0.4649	0.4124	0.2649	0.5288
17092901-46	111.44	8.983	2709	0.4596	0.4112	0.2620	0.5275
17092901-47	111.56	9.001	2717	0.4593	0.4117	0.2616	0.5277
17092901-48	110.00	8.984	2649	0.4631	0.4097	0.2650	0.5275
17092901-49	110.36	8.986	2648	0.4611	0.4062	0.2653	0.5258
17092901-50	111.61	9.028	2685	0.4621	0.4128	0.2630	0.5285
Avg.	111.2	9.014	2677	0.4615	0.4106	0.2636	0.5276
Med.	111.4	9.017	2679	0.4617	0.4109	0.2634	0.5275
σ	0.940	0.022	33.92	0.0023	0.0014	0.0016	0.0006
Min.	109.8	8.983	2622	0.4579	0.4062	0.2609	0.5258
Max.	113.0	9.066	2734	0.4651	0.4128	0.2664	0.5288



Appendix A

**Table 2-2
Lumen Maintenance**

Sample No.	Lumen Maintenance% (Normalized to 100% at Initial)												
	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h	12000 h
17092901-26	100.00%	99.02%	99.41%	98.48%	98.10%	97.94%	97.32%	96.84%	96.39%	96.29%	95.46%	94.75%	94.47%
17092901-27	100.00%	99.20%	99.45%	99.17%	99.03%	98.90%	98.06%	98.05%	97.38%	97.07%	96.25%	96.08%	95.66%
17092901-28	100.00%	99.24%	99.42%	98.76%	98.63%	98.27%	97.54%	97.04%	96.87%	96.70%	96.61%	95.05%	94.12%
17092901-29	100.00%	99.09%	99.23%	98.85%	98.70%	97.44%	97.42%	96.83%	96.43%	95.42%	95.49%	95.58%	95.31%
17092901-30	100.00%	99.10%	99.28%	98.61%	98.44%	97.39%	97.46%	97.31%	96.82%	96.32%	95.79%	95.84%	94.95%
17092901-31	100.00%	98.78%	99.89%	98.60%	98.44%	97.88%	97.80%	96.96%	96.91%	96.73%	96.21%	96.01%	95.89%
17092901-32	100.00%	99.25%	99.99%	99.88%	99.48%	99.05%	98.96%	98.70%	97.91%	97.81%	97.63%	96.31%	96.60%
17092901-33	100.00%	99.12%	99.69%	99.11%	99.05%	98.07%	97.44%	97.43%	96.40%	95.93%	96.01%	95.91%	95.61%
17092901-34	100.00%	99.07%	99.53%	99.03%	98.66%	97.69%	97.56%	96.71%	96.13%	95.69%	95.34%	94.66%	94.01%
17092901-35	100.00%	98.87%	99.46%	98.89%	98.80%	98.81%	97.77%	95.96%	95.44%	95.09%	93.95%	94.12%	93.23%
17092901-36	100.00%	99.76%	99.81%	99.15%	99.21%	98.46%	97.87%	98.39%	97.39%	96.98%	96.95%	96.29%	95.82%
17092901-37	100.00%	98.51%	99.03%	98.22%	97.93%	97.26%	97.91%	97.26%	96.31%	96.72%	95.38%	95.44%	95.02%
17092901-38	100.00%	99.18%	99.16%	98.75%	98.56%	98.63%	97.50%	97.37%	96.64%	96.14%	96.02%	95.86%	95.07%
17092901-39	100.00%	99.46%	99.99%	99.78%	99.36%	99.43%	98.41%	97.39%	97.37%	97.09%	95.93%	95.27%	95.07%
17092901-40	100.00%	99.96%	99.04%	98.41%	98.37%	97.14%	97.01%	96.86%	96.79%	95.97%	95.82%	94.85%	94.68%
17092901-41	100.00%	98.52%	99.49%	98.72%	98.23%	98.26%	97.01%	96.66%	96.21%	95.67%	95.58%	94.86%	94.23%
17092901-42	100.00%	99.58%	99.06%	98.91%	98.14%	98.34%	97.77%	97.49%	96.89%	96.64%	95.80%	95.46%	94.57%
17092901-43	100.00%	99.32%	99.10%	98.63%	98.53%	97.42%	97.55%	97.46%	96.68%	96.87%	96.38%	96.05%	95.45%
17092901-44	100.00%	99.47%	99.85%	99.00%	98.53%	98.10%	97.49%	97.28%	96.99%	96.66%	96.67%	95.12%	94.91%
17092901-45	100.00%	99.37%	99.67%	98.61%	98.52%	96.92%	97.38%	96.32%	96.02%	95.82%	95.68%	94.96%	94.58%
17092901-46	100.00%	99.57%	99.31%	98.77%	98.73%	98.47%	96.97%	97.06%	96.75%	96.37%	95.87%	95.45%	95.01%
17092901-47	100.00%	99.22%	99.03%	98.22%	97.93%	97.89%	96.95%	96.17%	95.97%	95.84%	94.44%	93.85%	93.46%
17092901-48	100.00%	98.81%	99.24%	99.15%	98.99%	97.92%	96.73%	97.18%	96.68%	96.13%	95.45%	94.99%	94.73%
17092901-49	100.00%	99.19%	99.48%	98.87%	98.64%	97.25%	97.15%	97.00%	96.90%	96.03%	95.81%	95.30%	95.28%
17092901-50	100.00%	99.37%	99.67%	98.61%	98.52%	96.92%	97.38%	96.32%	96.02%	95.82%	95.68%	94.96%	94.58%
Avg.	100.00%	99.20%	99.45%	98.85%	98.62%	97.99%	97.54%	97.12%	96.65%	96.31%	95.85%	95.32%	94.89%
Med.	100.00%	99.20%	99.45%	98.77%	98.56%	97.94%	97.49%	97.06%	96.68%	96.29%	95.81%	95.30%	94.95%
σ	0.0000	0.0034	0.0031	0.0040	0.0041	0.0068	0.0048	0.0064	0.0054	0.0062	0.0073	0.0064	0.0076
Min.	100.00%	98.51%	99.03%	98.22%	97.93%	96.92%	96.73%	95.96%	95.44%	95.09%	93.95%	93.85%	93.23%
Max.	100.00%	99.96%	99.99%	99.88%	99.48%	99.43%	98.96%	98.70%	97.91%	97.81%	97.63%	96.31%	96.60%

TM-21 Projection

Time	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h	12000 h
ln (Avg.)	0.0000	-0.0080	-0.0055	-0.0116	-0.0139	-0.0203	-0.0249	-0.0292	-0.0341	-0.0376	-0.0424	-0.0479	-0.0524

Test duration used	12,000 hrs	Calculated L70 (12,000 hrs)	78,000 hrs
B	1.003	Report L70 (12,000 hrs)	>72,000 hrs
α	4.584E-06		



Appendix A

Table 2-3 Forward Voltage

Sample No.	Relative Forward Voltage % (Normalized to 100% at Initial)												
	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h	12000 h
17092901-26	100.00%	100.16%	100.11%	100.24%	100.09%	100.06%	100.03%	99.78%	99.82%	100.32%	100.54%	99.69%	99.77%
17092901-27	100.00%	100.05%	100.14%	100.09%	99.67%	99.91%	99.92%	100.15%	100.10%	100.14%	100.10%	99.99%	100.08%
17092901-28	100.00%	99.98%	99.98%	100.23%	98.73%	100.07%	99.99%	99.89%	98.76%	99.92%	99.89%	99.82%	99.97%
17092901-29	100.00%	100.05%	100.03%	100.20%	99.89%	100.07%	99.90%	99.94%	99.75%	99.91%	100.23%	99.91%	99.78%
17092901-30	100.00%	99.81%	99.89%	99.90%	99.74%	99.83%	99.87%	100.23%	99.72%	100.34%	100.75%	100.44%	100.28%
17092901-31	100.00%	99.91%	99.93%	100.07%	99.91%	100.05%	99.94%	100.07%	100.09%	100.15%	100.59%	100.17%	99.93%
17092901-32	100.00%	100.23%	100.15%	100.23%	100.19%	100.15%	100.23%	99.91%	99.98%	98.98%	99.99%	99.85%	99.88%
17092901-33	100.00%	100.02%	100.00%	99.90%	100.01%	100.03%	100.12%	100.43%	99.98%	100.04%	100.35%	99.88%	99.83%
17092901-34	100.00%	99.77%	99.87%	100.02%	99.78%	99.80%	99.85%	100.08%	99.75%	100.08%	100.08%	100.05%	100.14%
17092901-35	100.00%	99.97%	99.87%	100.00%	99.80%	99.80%	99.97%	99.95%	97.81%	100.11%	99.92%	100.06%	100.02%
17092901-36	100.00%	100.04%	99.89%	100.10%	99.93%	99.93%	100.05%	100.01%	100.03%	100.07%	99.92%	100.06%	100.01%
17092901-37	100.00%	100.03%	100.05%	100.22%	100.06%	99.89%	99.89%	100.41%	100.17%	100.55%	100.00%	100.11%	100.10%
17092901-38	100.00%	99.99%	100.02%	100.04%	100.03%	100.15%	100.02%	100.15%	100.12%	100.04%	100.03%	100.02%	100.10%
17092901-39	100.00%	99.79%	99.86%	100.01%	99.91%	99.86%	99.86%	100.21%	100.09%	100.13%	100.53%	100.05%	100.17%
17092901-40	100.00%	99.79%	99.83%	99.96%	99.42%	99.87%	99.82%	99.89%	99.93%	99.99%	99.84%	99.95%	99.97%
17092901-41	100.00%	100.08%	100.17%	100.02%	100.22%	100.16%	100.30%	100.24%	100.19%	100.17%	100.25%	100.17%	100.11%
17092901-42	100.00%	100.09%	100.03%	100.18%	99.96%	99.97%	100.06%	99.85%	99.83%	100.04%	99.94%	99.99%	99.95%
17092901-43	100.00%	100.07%	99.96%	100.24%	99.60%	100.15%	100.15%	100.09%	100.10%	100.32%	100.13%	100.06%	100.09%
17092901-44	100.00%	99.92%	100.01%	99.91%	99.84%	99.99%	99.83%	100.10%	100.11%	100.15%	100.08%	100.17%	100.18%
17092901-45	100.00%	100.17%	100.17%	99.81%	99.91%	100.12%	100.06%	100.35%	99.98%	100.16%	100.71%	100.17%	100.27%
17092901-46	100.00%	99.74%	99.89%	100.03%	99.77%	99.82%	99.87%	99.87%	99.86%	100.14%	100.39%	99.93%	100.26%
17092901-47	100.00%	99.96%	98.88%	100.08%	100.01%	99.82%	99.95%	99.89%	99.85%	100.04%	99.95%	99.96%	99.93%
17092901-48	100.00%	100.05%	100.09%	100.20%	100.08%	100.04%	100.13%	100.06%	100.02%	100.31%	100.07%	100.02%	100.01%
17092901-49	100.00%	99.85%	99.69%	100.11%	99.76%	99.89%	99.78%	99.79%	99.75%	100.10%	100.41%	99.69%	97.62%
17092901-50	100.00%	100.17%	100.17%	99.81%	99.91%	100.12%	100.06%	100.35%	99.98%	100.16%	100.71%	100.17%	100.27%
Avg.	100.00%	99.99%	99.95%	100.06%	99.85%	99.98%	99.99%	100.07%	99.83%	100.09%	100.22%	100.02%	99.95%
Med.	100.00%	100.02%	100.00%	100.07%	99.91%	99.99%	99.97%	100.07%	99.98%	100.13%	100.10%	100.02%	100.02%
σ	0.0000	0.0014	0.0026	0.0013	0.0030	0.0013	0.0013	0.0019	0.0051	0.0027	0.0029	0.0016	0.0051
Min.	100.00%	99.74%	98.88%	99.81%	98.73%	99.80%	99.78%	99.78%	97.81%	98.98%	99.84%	99.69%	97.62%
Max.	100.00%	100.23%	100.17%	100.24%	100.22%	100.16%	100.30%	100.43%	100.19%	100.55%	100.75%	100.44%	100.28%



Appendix A

Table 2-4 Chromaticity Shift

Sample No.	Chromaticity Shift $\Delta u'v'$												
	0 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h	10000 h	11000 h	12000 h
17092901-26	0.0000	0.0001	0.0002	0.0003	0.0007	0.0010	0.0011	0.0016	0.0018	0.0018	0.0022	0.0020	0.0022
17092901-27	0.0000	0.0002	0.0004	0.0004	0.0006	0.0008	0.0009	0.0011	0.0013	0.0014	0.0017	0.0018	0.0019
17092901-28	0.0000	0.0002	0.0005	0.0006	0.0008	0.0011	0.0011	0.0013	0.0016	0.0018	0.0020	0.0017	0.0019
17092901-29	0.0000	0.0001	0.0001	0.0003	0.0004	0.0005	0.0006	0.0008	0.0008	0.0009	0.0011	0.0012	0.0014
17092901-30	0.0000	0.0002	0.0003	0.0007	0.0009	0.0010	0.0011	0.0012	0.0014	0.0015	0.0018	0.0017	0.0020
17092901-31	0.0000	0.0003	0.0004	0.0006	0.0009	0.0010	0.0011	0.0013	0.0015	0.0016	0.0017	0.0018	0.0022
17092901-32	0.0000	0.0003	0.0006	0.0007	0.0007	0.0009	0.0010	0.0012	0.0014	0.0016	0.0016	0.0019	0.0021
17092901-33	0.0000	0.0002	0.0004	0.0006	0.0007	0.0009	0.0010	0.0012	0.0014	0.0015	0.0015	0.0017	0.0019
17092901-34	0.0000	0.0000	0.0003	0.0004	0.0006	0.0008	0.0009	0.0011	0.0014	0.0016	0.0017	0.0021	0.0019
17092901-35	0.0000	0.0002	0.0004	0.0006	0.0008	0.0009	0.0011	0.0012	0.0014	0.0014	0.0017	0.0015	0.0016
17092901-36	0.0000	0.0002	0.0003	0.0005	0.0008	0.0009	0.0010	0.0011	0.0015	0.0016	0.0018	0.0019	0.0023
17092901-37	0.0000	0.0003	0.0005	0.0006	0.0007	0.0008	0.0013	0.0016	0.0017	0.0018	0.0019	0.0018	0.0022
17092901-38	0.0000	0.0002	0.0002	0.0007	0.0008	0.0009	0.0011	0.0014	0.0015	0.0017	0.0018	0.0017	0.0020
17092901-39	0.0000	0.0004	0.0004	0.0005	0.0006	0.0008	0.0010	0.0011	0.0014	0.0016	0.0018	0.0018	0.0023
17092901-40	0.0000	0.0002	0.0004	0.0008	0.0008	0.0009	0.0010	0.0011	0.0012	0.0012	0.0013	0.0016	0.0017
17092901-41	0.0000	0.0003	0.0006	0.0007	0.0008	0.0009	0.0011	0.0014	0.0016	0.0017	0.0016	0.0020	0.0024
17092901-42	0.0000	0.0001	0.0004	0.0007	0.0008	0.0013	0.0013	0.0014	0.0017	0.0016	0.0018	0.0018	0.0021
17092901-43	0.0000	0.0002	0.0005	0.0005	0.0008	0.0014	0.0014	0.0015	0.0016	0.0018	0.0017	0.0018	0.0020
17092901-44	0.0000	0.0001	0.0004	0.0004	0.0006	0.0008	0.0008	0.0010	0.0011	0.0012	0.0011	0.0014	0.0015
17092901-45	0.0000	0.0003	0.0005	0.0004	0.0007	0.0007	0.0010	0.0011	0.0013	0.0014	0.0014	0.0018	0.0017
17092901-46	0.0000	0.0003	0.0004	0.0004	0.0006	0.0008	0.0010	0.0013	0.0015	0.0016	0.0016	0.0019	0.0020
17092901-47	0.0000	0.0002	0.0003	0.0005	0.0007	0.0008	0.0008	0.0011	0.0014	0.0014	0.0018	0.0017	0.0020
17092901-48	0.0000	0.0002	0.0005	0.0007	0.0009	0.0011	0.0012	0.0013	0.0017	0.0016	0.0018	0.0021	0.0024
17092901-49	0.0000	0.0003	0.0005	0.0006	0.0009	0.0011	0.0009	0.0012	0.0014	0.0015	0.0017	0.0016	0.0017
17092901-50	0.0000	0.0001	0.0003	0.0005	0.0007	0.0010	0.0011	0.0014	0.0016	0.0017	0.0018	0.0018	0.0021
Avg.	0.0000	0.0002	0.0004	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014	0.0015	0.0017	0.0018	0.0020
Med.	0.0000	0.0002	0.0004	0.0006	0.0007	0.0009	0.0010	0.0012	0.0014	0.0016	0.0017	0.0018	0.0020
σ	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003
Min.	0.0000	0.0000	0.0001	0.0003	0.0004	0.0005	0.0006	0.0008	0.0008	0.0009	0.0011	0.0012	0.0014
Max.	0.0000	0.0004	0.0006	0.0008	0.0009	0.0014	0.0014	0.0016	0.0018	0.0018	0.0022	0.0021	0.0024



Appendix B



CERTIFICATE OF ACCREDITATION

This is to attest that

GREAT ONE GLOBAL CERTIFICATION CO., LTD.

9F.-2, NO. 120, QIAOHE ROAD, ZHONGHE DISTRICT
NEW TAIPEI CITY 23584
TAIWAN, REPUBLIC OF CHINA

Testing Laboratory TL-531

has met the requirements of AC89, *IAS Accreditation Criteria for Testing Laboratories*, and has demonstrated compliance with ISO/IEC Standard 17025:2005, *General requirements for the competence of testing and calibration laboratories*. This organization is accredited to provide the services specified in the scope of accreditation maintained on the IAS website (www.iasonline.org).

This certificate is valid up to NOVEMBER 1, 2020.



This accreditation certificate supersedes any IAS accreditation bearing an earlier effective date. The certificate becomes invalid upon suspension, cancellation or revocation of accreditation. See www.iasonline.org for current accreditation information, or contact IAS at 562-364-8201.



Raj Nathan
President



Appendix B



SCOPE OF ACCREDITATION

IES LM-66-11	Electrical and Photometric Measurements of Single-Ended Compact Fluorescent Lamps
IES LM-66-14	Electrical and Photometric Measurements of Single-Ended Compact Fluorescent Lamps
IES LM-79-08	Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products, Sections 9, 10 and 12
IES LM-80-08	Measuring Lumen Maintenance of LED Light Sources
IES LM-80-15	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules
IES LM-82-12	Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature
IES LM-84-14	Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires
IES LM-85-14	Method for Electrical & Photometric Measurements of High Power LEDs
LRC ACTV Test 2007	Testing Guideline for the Accelerated Cycling, Thermal, and Voltage (ACTV) Stress Test
NEMA LSD 45-2009	Recommendations for Solid State Lighting Sub-Assembly Interfaces for Luminaires
IES TM 21-11	Projecting Long Term Lumen Maintenance of LED Sources
IES TM-28-14	Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires
IES TM-30-15	Evaluating Light Source Color Rendition
ASTM G 154-2006	Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
CIE 84-1989	The Measurement of Luminous Flux
UL 588	Seasonal and Holiday Decorative Products
Lighting	
IEC/EN 62471	Photobiological Safety of Lamps and Lamp Systems
IEC/TR 62778	Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

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Appendix B





Appendix B





Appendix C

Bridgelux PN	Current (mA)	Vf (V)	Power (W)	Chip number Series/parallel connected	Current per die (mA)	power density (W/mm ²)	current density (mA/mm ²)	CCT	Minimum spacing (mm)	Exterior Dimensions (mm)
IXEN-***-13H-9A*	100	9.4	0.94	3S1P	100	4.4	470	≥ 2200K	0.15	2.8×3.5
IXEN-***-13L-9A*	100	9.4	0.94	3S1P	100	4.4	470	≥2200K	0.15	2.8×3.5