TEST REPORT

According to ANSI/IES LM-80-15
For

Hongli Zhihui Group Co.,Ltd. Guangzhou Branch

Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

Model: HL-AS-3030HW-2C-S1-08L-PCT-HR3(R9)

Report Type: 10000 Hours Test Report	**Product Type:** LED Package
Reviewed By:	Pote Wang
Report Number:	RSZ201203509-10-10000
Test Date:	2020-12-08 to 2022-03-03
Report Date:	2022-03-09
Approved by:	Bill Xiong / EE Engineer
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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

50 PCS test samples were in good condition and received on 2020-12-03. The samples were numbered from 1 to 25 and 26 to 50.

Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Part Number:	HL-AS-3030HW-2C-S1-08L-PCT-HR3(R9)
Part Type:	LED Package
#Drive Level:	DC 150mA
#Nominal CCT:	2700K
#Power:	0.99W
#Average Current Density per LED die:	1033.343mA/mm^2
#Average Power Density per LED die:	3.410W/mm^2
#CRI:	80
#Die Spacing:	0.15mm

Sampling Method:

LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.
These manufacturing lots are picked to represent a wide parametric distribution.

Family products covered by this report:

According to *ENERGY STAR® Requirements for the Use of LM-80 Data*, the following products can be covered by this report base on the information and declaration provided by manufacturer. The information of these models shows that the covered products meet all section 4 requirements of *ENERGY STAR® Requirements for the Use of LM-80 Data* (September 28, 2017)

This report covers the following models:

Model type	Model name	CRI(typ.)	CCT(typ.)	Series	Parallel	Power density (W/mm^2)	Current density per LED die (mA/mm^2)	Current per die (mA)	Distance between of dies (mm)	Current (mA)
Test model	HL-AS-3030H466W-2C-S1-08L-PCT-HR3(R9)	80	2700K	2	1	0.11	1033.343	150	0.15	150
multiple model	HL-AS-3030HW-2C-S1-08L-PCT-HR3(R9)	80	2700K	2	1	0.11	1033.343	150	0.15	150
multiple model	HL-**-3030H***W-2C-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	2	1	0.11	1033.343	150	0.15	150
multiple model	HL-**-3030H***W-2C-S1-08*-PCT-HR3-***	80	2200-6500K	2	1	0.11	1033.343	150	0.15	150
multiple model	HL-**-3030D***W-2C-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	2	1	0.11	861.11	150	0.15	150
multiple model	HL-**-3030D***W-2C-S1-08*-PCT-HR3-***	80	2200-6500K	2	1	0.11	861.11	150	0.15	150
multiple model	HL-**-3030D***W-2-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	2	0.0567	430.56	75	0.15	150
multiple model	HL-**-3030D***W-2-S1-08*-PCT-HR3-***	80	2200-6500K	1	2	0.0567	430.56	75	0.15	150

Model type	Model name	CRI(typ.)	CCT(typ.)	Series	Parallel	Power density (W/mm^2)	Current density per LED die (mA/mm^2)	Current per die (mA)	Distance between of dies (mm)	Current (mA)
multiple model	HL-**-3030D***W-2-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	2	0.11	861.11	150	0.15	300
multiple model	HL-**-3030D***W-2-S1-08*-PCT-HR3-***	80	2200-6500K	1	2	0.11	861.11	150	0.15	300
multiple model	HL-**-3030D***W-2-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	2	0.0244	186.574	32.5	0.15	65
multiple model	HL-**-3030D***W-2-S1-08*-PCT-HR3-***	80	2200-6500K	1	2	0.0244	186.574	32.5	0.15	65
multiple model	HL-**-3030D***W-2-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	2	0.0222	172.22	30	0.15	60
multiple model	HL-**-3030D***W-2-S1-08*-PCT-HR3-***	80	2200-6500K	1	2	0.0222	172.22	30	0.15	60
multiple model	HL-**-3030H***W-2-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	2	0.0567	516.67	75	0.15	150
multiple model	HL-**-3030H***W-2-S1-08*-PCT-HR3-***	80	2200-6500K	1	2	0.0567	516.67	75	0.15	150
multiple model	HL-**-3030H***W-2-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	2	0.11	1033.343	150	0.15	300
multiple model	HL-**-3030H***W-2-S1-08*-PCT-HR3-***	80	2200-6500K	1	2	0.11	1033.343	150	0.15	300
multiple model	HL-**-3030H***W-2-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	2	0.0244	223.889	32.5	0.15	65
multiple model	HL-**-3030H***W-2-S1-08*-PCT-HR3-***	80	2200-6500K	1	2	0.0244	223.889	32.5	0.15	65
multiple model	HL-**-3030H***W-2-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	2	0.0222	206.67	30	0.15	60
multiple model	HL-**-3030H***W-2-S1-08*-PCT-HR3-***	80	2200-6500K	1	2	0.0222	206.67	30	0.15	60
multiple model	HL-**-3030H***W-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	1	0.0567	1033.343	150	/	150
multiple model	HL-**-3030H***W-S1-08*-PCT-HR3-***	80	2200-6500K	1	1	0.0567	1033.343	150	/	150
multiple model	HL-**-3030H***W-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	1	0.0222	413.34	60	/	60
multiple model	HL-**-3030H***W-S1-08*-PCT-HR3-***	80	2200-6500K	1	1	0.0222	413.34	60	/	60
multiple model	HL-**-3030D***W-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	1	0.0567	861.11	150	/	150
multiple model	HL-**-3030D***W-S1-08*-PCT-HR3-***	80	2200-6500K	1	1	0.0567	861.11	150	/	150
multiple model	HL-**-3030D***W-S1-08*-PCT-HR3(R9)-***	80	2200-6500K	1	1	0.0222	344.45	60	/	60

Model type	Model name	CRI(typ.)	CCT(typ.)	Series	Parallel	Power density (W/mm^2)	Current density per LED die (mA/mm^2)	Current per die (mA)	Distance between of dies (mm)	Current (mA)
multiple model	HL-**-3030D***W-S1-08*-PCT-HR3-***	80	2200-6500K	1	1	0.0222	344.45	60	/	60
multiple model	SL-*B3030YTA-21EA*	80	2200-6500K	2	1	0.11	1033.343	150	0.15	150
multiple model	SL-*B3030YTA-21EA*H	80	2200-6500K	2	1	0.11	1033.343	150	0.15	150
multiple model	SL-*B3030YTA-21EA*H-**	80	2200-6500K	2	1	0.11	1033.343	150	0.15	150
multiple model	SL-*B3030YTA-12QA*	80	2200-6500K	1	2	0.11	1033.343	150	0.15	300
multiple model	SL-*B3030YTA-12QA*H	80	2200-6500K	1	2	0.11	1033.343	150	0.15	300
multiple model	SL-*B3030YTA-12QA*H-**	80	2200-6500K	1	2	0.11	1033.343	150	0.15	300

The family models and tested model could meet all the requirements listed as below:

a. The model name begins with "HL", such as "HL-**-3030H***W-2C-S1-08*-PCT-HR3(R9)-***","*" is described in detail as follows :
   1. The first"**" is a letter A or AS which stands for the Market demand.
   2. The second"****" is a number from 1 to 999 which stands for the brightness level.
   3. The third"*" is a letter L or None which stands for the bonding wire style.
   4. The fourth"****"is the letter or blank, which stands for the customer code.

b. The model name begins with "SL", such as" SL-*B3030YTA-21EA*H-**","*" is described in detail as follows:
   1. The first * is the letters I, N, W representing CCT. I means less than 3700K; N means 3700-4700K; W for more than 4700K.
   2. The second * is a different product solution, and the third and fourth * is different version numbers.
   3. The third and fourth * is different version numbers.

1.2 Standards and Reference Documentations

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- CIE 127:2007: Measurement of LEDs
- ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by IAS)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
High Accuracy Array Spectroradiometer	EVERFINE	HAAS 2000	P600674CM5391140	2021-09-27	2022-09-26
0.5M Integrating Sphere	EVERFINE	0.5m	NA	2021-09-27	2022-09-26
LED Test Source	EVERFINE	LTS-300	P185616CJ1391143	2022-01-05	2023-01-04
Standard Light Source	EVERFINE	D062	1011093	2021-10-15	2022-10-14
Multilayer aging machine	BACL	B2-270	20005	2022-01-04	2023-01-03
Program-controlled D.C. Stabilized Voltage Supply	Hanshenpuyuan	HSPY-200-01	N/A	2022-01-04	2023-01-03

1.4 Drive Level

Samples are driven with a constant direct current (DC) during maintenance test, photometric and electrical measurement. The current value was regulated to within ±3% of the specified value of the manufacturer during maintenance test, and was within ±0.5% during photometric and electrical measurement test.

1.5 Ambient Conditions for Maintenance Test

For lumen maintenance test, samples within one data set, were installed on cooling boards in thermal chambers with minimal ambient airflow. The case temperature and ambient temperature was monitored by thermocouples which one was soldered to the coldest DUTs' case (TMP_{LED}) location, while the other is mounted at a distance of 5 mm above the TMP location.

During life testing, TMP_{LED} of the coldest LEDs were maintained at a temperature that was greater than or equal to 2°C below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to 5°C below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within ±3% of the specified value of the manufacturer.

The relative humidity within chamber was kept less than 65% during test.

For photometry measurement, the ambient temperature during test was set to 25°C ± 2°C, RH <65%.

1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate u'v'. 2π measurement was used and sample was drived by DC power supply. The forward current was regulated to within ±0.5% of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to 25°C ± 2°C, RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

The uncertainty of the light output measurements is U=1.59% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=21K (K=2), at the 95% confidence level.

The uncertainty of the temperature is U=0.8671°C (K=2), at the 95% confidence level.

1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.8 Sample Set

Data Set 1: 55°C, 150mA

Part Number:	HL-AS-3030HW-2C-S1-08L-PCT-HR3(R9)
Number of Units:	25
Case Temperature:	>53°C
Ambient Temperature:	>50°C
Life Test Drive Current:	150mA
Measurement Current:	150mA

Data Set 2: 105°C, 150mA

Part Number:	HL-AS-3030HW-2C-S1-08L-PCT-HR3(R9)
Number of Units:	25
Case Temperature:	>103°C
Ambient Temperature:	>100°C
Life Test Drive Current:	150mA
Measurement Current:	150mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM-21 L_{70} Lifetime
1	25	0	1000hrs	10000hrs	2.771E-06	1.009	>60000 hours
2	25	0	1000hrs	10000hrs	3.072E-06	1.007	>60000 hours

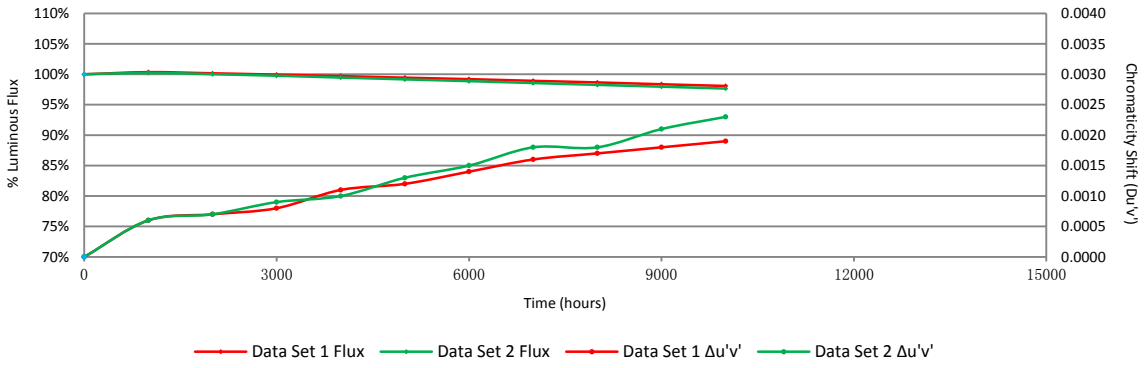
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	100.35%	100.16%	99.94%	99.70%	99.44%	99.20%	98.92%	98.66%	98.36%	98.08%
2	100.22%	100.01%	99.76%	99.46%	99.16%	98.87%	98.56%	98.26%	97.96%	97.65%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.0006	0.0007	0.0008	0.0011	0.0012	0.0014	0.0016	0.0017	0.0018	0.0019
2	0.0006	0.0007	0.0009	0.0010	0.0013	0.0015	0.0018	0.0018	0.0021	0.0023

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 55°C, 150mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	111.70	100.09	99.73	99.55	99.46	99.19	98.93	98.66	98.48	98.03	97.94
2	112.50	100.18	100.09	99.82	99.56	99.38	99.11	98.58	98.40	98.13	97.78
3	112.40	100.36	100.18	99.91	99.38	99.11	98.84	98.58	98.40	98.13	97.69
4	111.10	100.18	100.09	99.91	99.64	99.28	98.92	98.74	98.47	98.11	97.93
5	111.20	100.45	100.18	100.09	99.73	99.37	99.19	99.10	98.74	98.20	97.84
6	110.80	100.54	100.45	100.36	100.18	99.91	99.55	99.10	98.74	98.65	98.01
7	112.00	100.27	100.18	99.91	99.82	99.55	99.38	98.93	98.57	97.95	97.50
8	111.60	100.18	100.00	99.82	99.73	99.37	99.10	98.92	98.75	98.57	98.21
9	111.40	100.09	99.91	99.82	99.73	99.55	99.37	99.10	98.83	98.74	98.65
10	110.60	100.27	100.09	99.91	99.73	99.46	99.28	99.10	98.55	98.46	98.10
11	111.40	100.36	100.09	99.91	99.73	99.46	99.19	98.92	98.83	98.65	98.47
12	112.40	100.27	100.09	99.91	99.29	99.02	98.84	98.49	98.22	97.95	97.86
13	110.10	100.45	100.36	100.18	99.73	99.46	99.18	99.09	98.91	98.82	98.64
14	111.10	100.54	100.36	100.18	99.64	99.46	99.19	98.74	98.47	98.20	97.93
15	111.80	100.18	100.09	99.91	99.73	99.46	99.11	99.02	98.75	98.48	98.39
16	110.90	100.45	100.18	99.73	99.64	99.37	99.19	98.74	98.65	98.38	98.11
17	112.00	100.54	100.27	100.09	99.82	99.55	99.38	99.20	98.84	98.21	97.95
18	112.50	100.36	100.09	99.82	99.47	99.20	98.84	98.67	98.22	97.78	97.24
19	110.50	100.09	99.91	99.82	99.73	99.55	99.28	99.10	98.91	98.37	98.01
20	111.20	100.54	100.27	100.09	99.73	99.46	99.28	99.01	98.74	98.47	98.29
21	112.20	100.53	100.27	99.82	99.73	99.47	99.29	99.11	99.02	98.75	98.48
22	110.30	100.45	100.18	99.91	99.64	99.37	99.18	98.73	98.37	98.19	98.01
23	111.80	100.27	100.18	99.91	99.73	99.55	99.37	99.02	98.75	98.48	98.12
24	111.80	100.54	100.36	100.09	100.00	99.82	99.64	99.28	99.11	98.75	98.48
25	109.90	100.55	100.36	100.09	99.91	99.64	99.45	99.18	98.91	98.64	98.45
Avg.	111.41	100.35	100.16	99.94	99.70	99.44	99.20	98.92	98.66	98.36	98.08
Med.	111.40	100.36	100.18	99.91	99.73	99.46	99.19	99.01	98.74	98.38	98.01
st dev	0.76	0.16	0.17	0.17	0.19	0.20	0.21	0.23	0.24	0.29	0.35
Min.	109.90	100.09	99.73	99.55	99.29	99.02	98.84	98.49	98.22	97.78	97.24
Max.	112.50	100.55	100.45	100.36	100.18	99.91	99.64	99.28	99.11	98.82	98.65

3.2 Data Set 1, 55°C, 150mA (Forward Voltage)

No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	6.211	6.211	6.203	6.213	6.200	6.204	6.204	6.222	6.211	6.211	6.224
2	6.184	6.184	6.169	6.199	6.176	6.173	6.175	6.188	6.186	6.186	6.201
3	6.171	6.169	6.167	6.188	6.168	6.183	6.199	6.171	6.171	6.171	6.185
4	6.196	6.196	6.190	6.209	6.194	6.209	6.203	6.195	6.196	6.196	6.209
5	6.167	6.175	6.167	6.184	6.165	6.175	6.184	6.167	6.169	6.169	6.186
6	6.157	6.207	6.165	6.171	6.161	6.171	6.179	6.165	6.175	6.175	6.180
7	6.171	6.173	6.167	6.181	6.169	6.175	6.173	6.169	6.182	6.182	6.189
8	6.167	6.167	6.165	6.175	6.166	6.167	6.176	6.168	6.173	6.173	6.182
9	6.173	6.186	6.173	6.184	6.173	6.177	6.186	6.172	6.178	6.178	6.192
10	6.194	6.186	6.186	6.201	6.188	6.187	6.179	6.197	6.196	6.196	6.206
11	6.171	6.186	6.165	6.208	6.170	6.183	6.171	6.179	6.173	6.173	6.188
12	6.190	6.196	6.184	6.208	6.188	6.206	6.204	6.198	6.194	6.194	6.212
13	6.142	6.142	6.136	6.162	6.142	6.150	6.172	6.147	6.150	6.150	6.159
14	6.171	6.167	6.163	6.176	6.169	6.172	6.178	6.170	6.178	6.178	6.191
15	6.182	6.192	6.178	6.181	6.180	6.188	6.182	6.192	6.192	6.192	6.202
16	6.165	6.173	6.161	6.187	6.166	6.187	6.183	6.173	6.178	6.178	6.186
17	6.155	6.157	6.157	6.167	6.155	6.165	6.152	6.160	6.169	6.169	6.180
18	6.167	6.175	6.171	6.205	6.169	6.185	6.163	6.173	6.188	6.188	6.193
19	6.148	6.146	6.146	6.166	6.149	6.159	6.150	6.156	6.157	6.157	6.167
20	6.153	6.159	6.157	6.171	6.161	6.167	6.164	6.165	6.171	6.171	6.179
21	6.171	6.165	6.165	6.187	6.162	6.178	6.171	6.178	6.175	6.175	6.196
22	6.165	6.165	6.163	6.177	6.170	6.177	6.161	6.168	6.171	6.171	6.191
23	6.165	6.169	6.169	6.176	6.177	6.174	6.173	6.176	6.182	6.182	6.192
24	6.169	6.167	6.169	6.174	6.179	6.175	6.168	6.174	6.184	6.184	6.192
25	6.161	6.161	6.165	6.179	6.169	6.170	6.166	6.163	6.175	6.175	6.179
Avg.	6.171	6.175	6.168	6.185	6.171	6.178	6.177	6.175	6.179	6.179	6.190
Med.	6.169	6.173	6.167	6.181	6.169	6.175	6.175	6.172	6.178	6.178	6.191
st dev	0.016	0.017	0.013	0.015	0.013	0.014	0.015	0.016	0.013	0.013	0.014
Min.	6.142	6.142	6.136	6.162	6.142	6.150	6.150	6.147	6.150	6.150	6.159
Max.	6.211	6.211	6.203	6.213	6.200	6.209	6.204	6.222	6.211	6.211	6.224

3.3 Data Set 1, 55°C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.2608	0.5325	2715	0.0007	0.0008	0.0010	0.0012	0.0015	0.0018	0.0020	0.0019	0.0018	0.0016
2	0.2595	0.5317	2745	0.0006	0.0006	0.0008	0.0011	0.0013	0.0015	0.0019	0.0018	0.0017	0.0017
3	0.2618	0.5329	2694	0.0006	0.0007	0.0008	0.0011	0.0014	0.0016	0.0020	0.0020	0.0021	0.0020
4	0.2596	0.5330	2736	0.0006	0.0006	0.0007	0.0011	0.0012	0.0013	0.0017	0.0021	0.0022	0.0019
5	0.2608	0.5320	2717	0.0007	0.0008	0.0011	0.0013	0.0015	0.0016	0.0017	0.0020	0.0021	0.0023
6	0.2603	0.5316	2727	0.0006	0.0007	0.0009	0.0009	0.0011	0.0013	0.0016	0.0016	0.0017	0.0018
7	0.2592	0.5330	2746	0.0005	0.0007	0.0007	0.0010	0.0013	0.0015	0.0014	0.0016	0.0017	0.0020
8	0.2607	0.5327	2716	0.0005	0.0008	0.0009	0.0013	0.0014	0.0017	0.0018	0.0020	0.0020	0.0022
9	0.2593	0.5326	2745	0.0004	0.0007	0.0007	0.0011	0.0013	0.0015	0.0013	0.0017	0.0017	0.0016
10	0.2606	0.5322	2720	0.0005	0.0006	0.0008	0.0010	0.0011	0.0014	0.0016	0.0018	0.0018	0.0019
11	0.2602	0.5325	2727	0.0007	0.0007	0.0011	0.0009	0.0011	0.0013	0.0017	0.0016	0.0016	0.0015
12	0.2596	0.5324	2740	0.0006	0.0008	0.0008	0.0011	0.0012	0.0015	0.0017	0.0017	0.0022	0.0022
13	0.2597	0.5313	2743	0.0006	0.0008	0.0009	0.0010	0.0011	0.0012	0.0014	0.0016	0.0018	0.0019
14	0.2600	0.5322	2733	0.0006	0.0007	0.0010	0.0011	0.0014	0.0016	0.0017	0.0019	0.0018	0.0020
15	0.2611	0.5336	2704	0.0006	0.0007	0.0009	0.0012	0.0014	0.0015	0.0016	0.0018	0.0018	0.0021
16	0.2581	0.5332	2768	0.0005	0.0007	0.0007	0.0011	0.0013	0.0015	0.0013	0.0017	0.0017	0.0019
17	0.2594	0.5326	2742	0.0005	0.0007	0.0008	0.0009	0.0011	0.0013	0.0014	0.0015	0.0017	0.0017
18	0.2592	0.5329	2746	0.0006	0.0008	0.0007	0.0012	0.0013	0.0016	0.0016	0.0016	0.0019	0.0021
19	0.2595	0.5315	2745	0.0006	0.0006	0.0007	0.0011	0.0013	0.0015	0.0016	0.0017	0.0016	0.0018
20	0.2587	0.5325	2758	0.0004	0.0005	0.0005	0.0008	0.0009	0.0011	0.0012	0.0015	0.0013	0.0018
21	0.2585	0.5330	2760	0.0005	0.0005	0.0005	0.0009	0.0010	0.0011	0.0013	0.0010	0.0016	0.0017
22	0.2595	0.5332	2738	0.0006	0.0006	0.0007	0.0009	0.0009	0.0012	0.0016	0.0017	0.0016	0.0019
23	0.2598	0.5320	2738	0.0005	0.0006	0.0009	0.0011	0.0013	0.0014	0.0014	0.0013	0.0016	0.0018
24	0.2610	0.5315	2715	0.0005	0.0007	0.0007	0.0012	0.0013	0.0016	0.0014	0.0016	0.0016	0.0020
25	0.2603	0.5321	2725	0.0005	0.0005	0.0007	0.0011	0.0014	0.0015	0.0014	0.0015	0.0014	0.0019
Avg.	0.2599	0.5324	2734	0.0006	0.0007	0.0008	0.0011	0.0012	0.0014	0.0016	0.0017	0.0018	0.0019
Med.	0.2597	0.5325	2738	0.0006	0.0007	0.0008	0.0011	0.0013	0.0015	0.0016	0.0017	0.0017	0.0019
st dev	0.0009	0.0006	18	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2581	0.5313	2694	0.0004	0.0005	0.0005	0.0008	0.0009	0.0011	0.0012	0.0010	0.0013	0.0015
Max.	0.2618	0.5336	2768	0.0007	0.0008	0.0011	0.0013	0.0015	0.0018	0.0020	0.0021	0.0022	0.0023

3.4 Data Set 2, 105°C, 150mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	110.30	100.27	99.91	99.73	99.64	99.46	99.27	99.00	98.64	98.28	97.73
27	110.60	100.36	100.18	99.91	99.82	99.46	99.10	98.73	98.64	98.46	98.10
28	111.30	100.36	100.18	99.73	99.28	99.01	98.65	98.38	98.11	97.84	97.66
29	112.70	100.44	100.27	99.91	99.29	98.94	98.58	98.23	97.87	97.69	97.43
30	110.80	100.54	100.36	99.91	99.82	99.46	99.28	99.10	98.83	98.47	98.19
31	111.40	100.36	100.09	99.91	99.46	99.10	98.83	98.74	98.65	98.38	98.11
32	112.00	100.27	99.91	99.82	99.55	99.29	98.93	98.66	98.13	97.95	97.68
33	112.60	100.36	100.09	99.73	99.38	98.93	98.67	98.31	98.05	97.78	97.69
34	112.10	100.27	100.09	99.82	99.73	99.38	99.11	98.75	98.57	98.31	98.04
35	111.40	100.27	100.09	99.64	99.37	99.01	98.65	98.29	97.85	97.67	97.40
36	111.60	99.91	99.64	99.55	99.28	98.92	98.66	98.57	98.48	98.12	97.85
37	111.10	100.00	99.91	99.73	99.55	99.37	99.01	98.65	98.47	98.11	97.75
38	110.10	100.00	99.91	99.73	99.55	99.27	98.91	98.73	98.37	98.09	97.55
39	111.10	100.09	99.82	99.73	99.55	99.28	98.92	98.65	98.38	98.11	97.84
40	111.50	100.18	100.09	99.73	99.55	99.37	99.01	98.83	98.65	98.48	98.21
41	111.00	100.27	100.09	99.82	99.46	99.10	98.83	98.56	98.47	98.02	97.75
42	111.40	100.09	99.82	99.64	99.28	98.92	98.56	98.20	98.03	97.58	97.40
43	111.80	100.18	99.91	99.82	99.28	99.11	98.93	98.57	98.03	97.76	97.23
44	111.70	100.27	100.18	99.91	99.28	98.93	98.66	98.21	97.76	97.40	97.22
45	111.20	100.09	99.82	99.64	99.55	99.19	98.92	98.38	98.02	97.57	97.30
46	110.00	100.36	100.27	99.82	99.64	99.36	99.09	98.73	98.27	98.00	97.82
47	110.50	100.18	99.82	99.64	99.28	98.91	98.73	98.46	98.19	97.74	97.47
48	111.30	100.00	99.73	99.55	99.19	98.92	98.56	98.29	97.84	97.39	96.86
49	111.20	100.18	99.91	99.64	99.28	99.01	98.74	98.56	98.20	97.93	97.48
50	112.20	100.27	100.09	99.82	99.55	99.20	99.02	98.48	98.04	97.86	97.42
Avg.	111.32	100.22	100.01	99.76	99.46	99.16	98.87	98.56	98.26	97.96	97.65
Med.	111.30	100.27	100.09	99.73	99.46	99.11	98.91	98.57	98.20	97.95	97.68
st dev	0.70	0.15	0.18	0.11	0.18	0.20	0.21	0.24	0.31	0.32	0.34
Min.	110.00	99.91	99.64	99.55	99.19	98.91	98.56	98.20	97.76	97.39	96.86
Max.	112.70	100.54	100.36	99.91	99.82	99.46	99.28	99.10	98.83	98.48	98.21

3.5 Data Set 2, 105°C, 150mA (Forward Voltage)

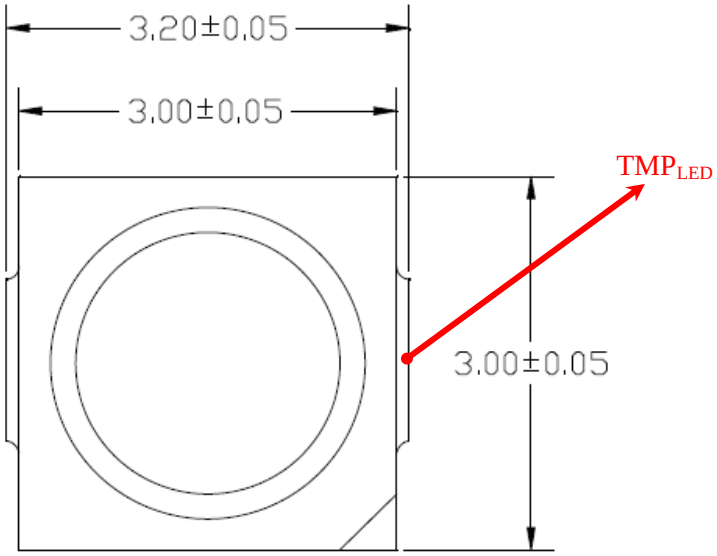
No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	6.146	6.150	6.148	6.155	6.162	6.166	6.168	6.165	6.157	6.159	6.170
27	6.167	6.167	6.165	6.177	6.179	6.183	6.180	6.174	6.171	6.173	6.183
28	6.169	6.169	6.167	6.190	6.182	6.185	6.171	6.176	6.178	6.180	6.189
29	6.194	6.198	6.196	6.203	6.204	6.201	6.201	6.207	6.205	6.203	6.213
30	6.150	6.157	6.150	6.168	6.163	6.181	6.179	6.165	6.167	6.163	6.174
31	6.161	6.167	6.163	6.184	6.171	6.175	6.162	6.175	6.175	6.173	6.181
32	6.159	6.157	6.153	6.163	6.162	6.173	6.171	6.165	6.169	6.163	6.171
33	6.167	6.173	6.173	6.183	6.178	6.184	6.178	6.178	6.178	6.184	6.186
34	6.175	6.184	6.180	6.192	6.190	6.189	6.177	6.184	6.192	6.186	6.195
35	6.171	6.178	6.169	6.184	6.189	6.188	6.184	6.185	6.186	6.184	6.190
36	6.184	6.190	6.188	6.201	6.200	6.201	6.206	6.201	6.201	6.198	6.205
37	6.163	6.163	6.163	6.177	6.174	6.172	6.173	6.175	6.173	6.173	6.179
38	6.163	6.167	6.165	6.176	6.174	6.173	6.179	6.171	6.180	6.175	6.183
39	6.159	6.163	6.163	6.175	6.169	6.166	6.171	6.168	6.169	6.171	6.174
40	6.165	6.161	6.165	6.173	6.172	6.166	6.179	6.165	6.171	6.173	6.181
41	6.173	6.169	6.173	6.182	6.182	6.179	6.166	6.184	6.182	6.190	6.193
42	6.173	6.180	6.178	6.182	6.182	6.185	6.187	6.185	6.182	6.186	6.190
43	6.157	6.159	6.153	6.167	6.167	6.164	6.174	6.163	6.167	6.165	6.175
44	6.159	6.165	6.161	6.173	6.172	6.173	6.178	6.173	6.175	6.169	6.181
45	6.173	6.173	6.175	6.189	6.183	6.187	6.175	6.183	6.184	6.186	6.193
46	6.157	6.157	6.161	6.172	6.165	6.169	6.160	6.166	6.173	6.167	6.175
47	6.182	6.178	6.180	6.198	6.190	6.193	6.186	6.191	6.192	6.192	6.204
48	6.159	6.169	6.167	6.173	6.179	6.176	6.173	6.177	6.175	6.178	6.185
49	6.161	6.167	6.165	6.173	6.171	6.177	6.174	6.170	6.169	6.178	6.183
50	6.173	6.173	6.173	6.185	6.185	6.189	6.179	6.186	6.182	6.192	6.194
Avg.	6.166	6.169	6.168	6.180	6.178	6.180	6.177	6.177	6.178	6.178	6.186
Med.	6.165	6.167	6.165	6.177	6.178	6.179	6.177	6.175	6.175	6.178	6.183
st dev	0.011	0.011	0.011	0.012	0.011	0.010	0.010	0.011	0.011	0.011	0.011
Min.	6.146	6.150	6.148	6.155	6.162	6.164	6.160	6.163	6.157	6.159	6.170
Max.	6.194	6.198	6.196	6.203	6.204	6.201	6.206	6.207	6.205	6.203	6.213

3.6 Data Set 2, 105°C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
26	0.2597	0.5321	2738	0.0007	0.0007	0.0010	0.0011	0.0012	0.0014	0.0016	0.0015	0.0016	0.0017
27	0.2595	0.5326	2741	0.0006	0.0006	0.0008	0.0009	0.0012	0.0013	0.0017	0.0021	0.0022	0.0017
28	0.2594	0.5326	2742	0.0005	0.0006	0.0008	0.0008	0.0011	0.0014	0.0015	0.0017	0.0022	0.0022
29	0.2593	0.5327	2744	0.0005	0.0006	0.0007	0.0010	0.0015	0.0016	0.0018	0.0018	0.0023	0.0022
30	0.2602	0.5318	2730	0.0005	0.0007	0.0009	0.0009	0.0014	0.0017	0.0018	0.0015	0.0022	0.0022
31	0.2608	0.5324	2715	0.0005	0.0007	0.0007	0.0011	0.0012	0.0013	0.0018	0.0019	0.0022	0.0022
32	0.2589	0.5329	2753	0.0004	0.0006	0.0007	0.0009	0.0012	0.0015	0.0017	0.0021	0.0022	0.0023
33	0.2597	0.5333	2734	0.0006	0.0007	0.0009	0.0009	0.0013	0.0015	0.0021	0.0021	0.0025	0.0027
34	0.2604	0.5333	2719	0.0007	0.0008	0.0009	0.0010	0.0013	0.0015	0.0018	0.0021	0.0023	0.0026
35	0.2616	0.5325	2698	0.0006	0.0007	0.0009	0.0011	0.0014	0.0017	0.0018	0.0021	0.0023	0.0027
36	0.2603	0.5334	2721	0.0006	0.0006	0.0009	0.0009	0.0013	0.0015	0.0016	0.0021	0.0022	0.0026
37	0.2593	0.5325	2745	0.0005	0.0007	0.0009	0.0011	0.0014	0.0016	0.0020	0.0021	0.0023	0.0025
38	0.2615	0.5326	2699	0.0006	0.0007	0.0011	0.0010	0.0013	0.0016	0.0020	0.0019	0.0021	0.0024
39	0.2605	0.5333	2718	0.0004	0.0005	0.0007	0.0009	0.0014	0.0015	0.0018	0.0018	0.0021	0.0023
40	0.2604	0.5318	2725	0.0005	0.0006	0.0008	0.0009	0.0012	0.0013	0.0015	0.0019	0.0021	0.0024
41	0.2606	0.5323	2719	0.0006	0.0006	0.0007	0.0009	0.0014	0.0016	0.0018	0.0018	0.0024	0.0025
42	0.2611	0.5332	2706	0.0005	0.0007	0.0009	0.0009	0.0012	0.0015	0.0022	0.0020	0.0021	0.0024
43	0.2589	0.5327	2754	0.0005	0.0007	0.0010	0.0009	0.0012	0.0014	0.0021	0.0018	0.0021	0.0024
44	0.2597	0.5324	2738	0.0005	0.0006	0.0007	0.0009	0.0012	0.0013	0.0018	0.0017	0.0023	0.0023
45	0.2590	0.5326	2750	0.0006	0.0006	0.0009	0.0011	0.0013	0.0015	0.0017	0.0015	0.0019	0.0024
46	0.2604	0.5312	2728	0.0005	0.0007	0.0009	0.0009	0.0011	0.0012	0.0016	0.0014	0.0018	0.0022
47	0.2598	0.5327	2734	0.0006	0.0007	0.0010	0.0011	0.0016	0.0019	0.0019	0.0019	0.0020	0.0025
48	0.2602	0.5320	2729	0.0006	0.0005	0.0009	0.0010	0.0014	0.0017	0.0019	0.0017	0.0020	0.0024
49	0.2612	0.5335	2702	0.0005	0.0007	0.0008	0.0010	0.0014	0.0015	0.0016	0.0015	0.0017	0.0019
50	0.2599	0.5337	2729	0.0005	0.0007	0.0010	0.0007	0.0010	0.0013	0.0017	0.0016	0.0018	0.0017
Avg.	0.2601	0.5326	2728	0.0006	0.0007	0.0009	0.0010	0.0013	0.0015	0.0018	0.0018	0.0021	0.0023
Med.	0.2602	0.5326	2729	0.0005	0.0007	0.0009	0.0009	0.0013	0.0015	0.0018	0.0018	0.0022	0.0024
st dev	0.0008	0.0006	16	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003
Min.	0.2589	0.5312	2698	0.0004	0.0005	0.0007	0.0007	0.0010	0.0012	0.0015	0.0014	0.0016	0.0017
Max.	0.2616	0.5337	2754	0.0007	0.0008	0.0011	0.0011	0.0016	0.0019	0.0022	0.0021	0.0025	0.0027

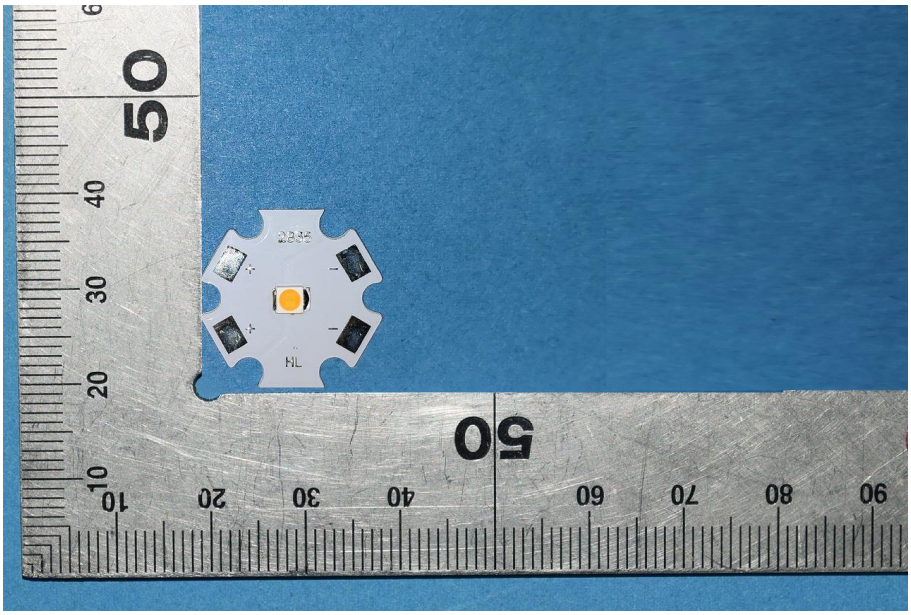
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



Directions

1. The information marked “superscript #” is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
3. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
4. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K=2 with the 95% confidence interval.
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**********END OF REPORT**********