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-2835D1W-3C-S1-08L-PCT-HR5

Report Type: 12000 Hours Test Report	**Product Type:** LED Package
Reviewed By:	Pote Wang
Report Number:	2202X45920-EE-12000-M1
Test Date:	2022-09-02 to 2024-01-15
Report Date:	2024-05-30
Approved by:	Blake Zhang / EE Engineer
Revised Note:	The previous report 2202X45920-EE-12000 is replaced by this report on 2024-05-30
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax:+86-0769-86858588

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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 2022-09-02. The samples were numbered from 1 to 25 and 26 to 50.

Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Part Number:	HL-AS-2835D1W-3C-S1-08L-PCT-HR5
Part Type:	LED Package
Drive Level:	DC 120mA
Nominal CCT:	2700K
Power:	1.2W
Average Current Density per LED die:	826.668mA/mm^2
Average Power Density per LED die:	2.756W/mm^2
CRI:	90
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-2835D1W-3C-S1-08L-PCT-HR5	90	2700K	3	1	0.118	826.668	120	0.15	120
Multiple models	HL-**-2835D***W-3C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	3	1	0.118	826.668	120	0.15	120
Multiple models	HL-**-2835H***W-3C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	3	1	0.118	826.668	120	0.15	120
Multiple models	HL-**-2835F***W-3C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	3	1	0.118	826.668	120	0.15	120
Multiple models	HL-**-2835D***CBW-3C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	3	1	0.118	826.668	120	0.15	120
Multiple models	HL-**-2835H***W-3-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	3	0.118	826.668	100	0.15	300
Multiple models	HL-**-2835D***W-3-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	3	0.118	826.668	100	0.15	300

Multiple models	HL-**-2835F***W-3-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	3	0.118	826.668	100	0.15	300
Multiple models	HL-**-2835D***CBW-3-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	3	0.118	826.668	100	0.15	300
Multiple models	HL-**-2835H***W-2C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	2	1	0.118	826.668	150	0.15	150
Multiple models	HL-**-2835D***W-2C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	2	1	0.118	826.668	150	0.15	150
Multiple models	HL-**-2835F***W-2C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	2	1	0.118	826.668	150	0.15	150
Multiple models	HL-**-2835H466WD***VW-2C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	2	1	0.118	826.668	150	0.15	150
Multiple models	HL-**-2835H421WD***VW-2C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	2	1	0.118	826.668	150	0.15	150
Multiple models	HL-**-2835D4WD***VW-2C-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	2	1	0.118	826.668	150	0.15	150
Multiple models	HL-**-2835H***W-2-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	2	0.118	826.668	150	0.15	300
Multiple models	HL-**-2835D***W-2-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	2	0.118	826.668	150	0.15	300
Multiple models	HL-**-2835F***W-2-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	2	0.118	826.668	150	0.15	300
Multiple models	HL-**-2835H466D***W-2-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	2	0.118	826.668	150	0.15	300
Multiple models	HL-**-2835H421D***W-2-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	2	0.118	826.668	150	0.15	300
Multiple models	HL-**-2835D4WD***VW-2-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	2	0.118	826.668	150	0.15	300
Multiple models	HL-**-2835H***W-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	1	0.118	826.668	300	/	300
Multiple models	HL-**-2835D***W-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	1	0.118	826.668	300	/	300

Multiple models	HL-**-2835F***W-S1-08*-PCT-HR*-**-***-**	90	2200K-6500K	1	1	0.118	826.668	300	/	300

Note:

The model name begins with "HL", such as “HL-**-2835D***W-3C-S1-08*-PCT-HR*-**-***-**”, " *" is described in detail as follows:
1. The first “**” is a letter A or AS which stands for the process type.
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 number 3 or 4 or 5 which stands for the CRI style.
5. The fifth “**” is a letter T6 or K3 or K0 or L1 or None, which stands for the frame type.
6. The sixth “***” is a letter SPHO or P5 or P6 or None, which stands for the phosphor solution.
7. The seventh “**” is the letter, which stands for the customer code.

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
0.5m Integrating Sphere/CCD Spectrometer	Hangzhouyuming	0.5m /SPM-5000	C612012A	2023-09-02	2024-09-01
CC&CV DC Power Supply	Hangzhouyuming	DPS-500	W412022M	2023-09-02	2024-09-01
Standard Light Source	EVERFINE	D062	M133799CM1381112	2023-05-12	2025-05-11
Multilayer aging machine	BACL	B2-270	20022	2023-10-16	2024-10-15
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090008	2023-09-02	2024-09-01

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, 120mA

Part Number:	HL-AS-2835D1W-3C-S1-08L-PCT-HR5
Number of Units:	25
Case Temperature:	>53°C
Ambient Temperature:	>50°C
Life Test Drive Current:	120mA
Measurement Current:	120mA

Data Set 2: 105°C, 120mA

Part Number:	HL-AS-2835D1W-3C-S1-08L-PCT-HR5
Number of Units:	25
Case Temperature:	>103°C
Ambient Temperature:	>100°C
Life Test Drive Current:	120mA
Measurement Current:	120mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM-21 L_{70} Lifetime	Reported TM-21 L_{90} Lifetime
1	25	0	1000hrs	12000hrs	1.529E-06	1.003	>102000 hours	71000 hours
2	25	0	1000hrs	12000hrs	1.780E-06	1.001	>102000 hours	60000 hours

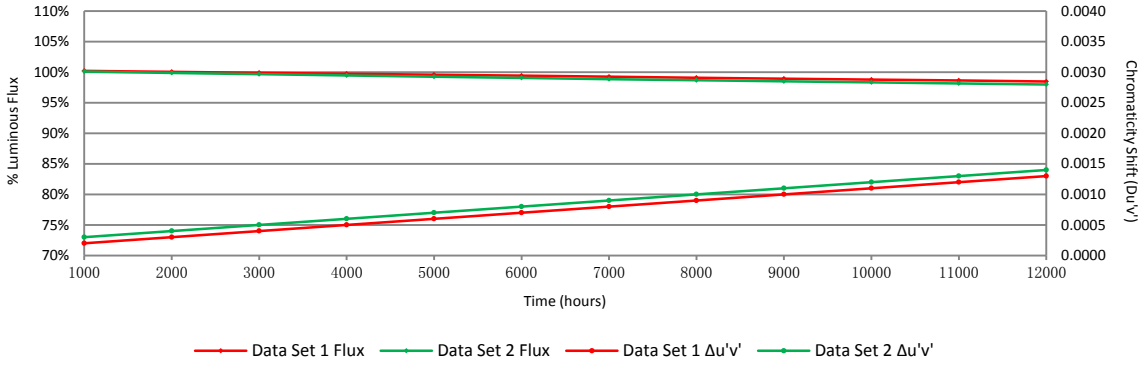
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
1	100.22%	100.06%	99.90%	99.75%	99.59%	99.44%	99.27%	99.09%	98.94%	98.79%	98.65%	98.48%
2	100.11%	99.88%	99.68%	99.47%	99.26%	99.07%	98.86%	98.69%	98.51%	98.34%	98.16%	97.99%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
1	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0013
2	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0013	0.0014

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 55°C, 120mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)											
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
1	136.60	100.15	99.93	99.71	99.56	99.49	99.34	99.19	98.98	98.68	98.61	98.54	98.46
2	134.50	100.22	100.07	99.85	99.63	99.48	99.26	99.11	98.88	98.81	98.51	98.29	98.07
3	133.60	100.15	99.93	99.85	99.70	99.63	99.55	99.40	99.25	99.18	99.10	99.03	98.95
4	134.80	100.15	99.93	99.85	99.63	99.33	99.11	98.81	98.59	98.29	98.07	97.85	97.70
5	133.50	100.30	100.07	99.85	99.78	99.48	99.25	99.10	98.88	98.58	98.28	98.05	97.83
6	134.40	100.15	100.07	99.93	99.85	99.70	99.55	99.48	99.33	99.26	99.18	99.11	98.96
7	134.60	100.15	99.93	99.85	99.70	99.33	99.11	98.89	98.66	98.51	98.44	98.14	97.92
8	132.80	100.23	100.08	99.70	99.47	99.10	98.95	98.72	98.57	98.49	98.34	98.19	98.04
9	133.40	100.15	99.93	99.70	99.48	99.33	99.18	99.10	99.03	98.65	98.50	98.35	98.13
10	135.60	100.22	100.15	100.07	99.93	99.78	99.71	99.63	99.56	99.41	99.26	99.19	98.82
11	132.40	100.15	100.08	99.92	99.70	99.55	99.47	99.32	99.17	98.94	98.79	98.64	98.56
12	133.70	100.15	99.93	99.55	99.33	99.25	99.10	98.88	98.65	98.35	98.28	98.13	97.98
13	134.00	100.15	100.07	99.93	99.85	99.70	99.63	99.55	99.40	99.25	99.10	98.96	98.81
14	133.90	100.22	100.15	100.07	99.93	99.85	99.78	99.70	99.48	99.40	99.03	98.88	98.81
15	133.70	100.22	100.07	99.93	99.85	99.78	99.63	99.48	99.25	99.18	99.10	99.03	98.80
16	136.10	100.22	100.07	99.85	99.71	99.49	99.41	99.19	98.90	98.60	98.31	98.16	97.87
17	135.00	100.22	100.07	99.93	99.85	99.56	99.48	99.33	99.11	99.04	98.89	98.81	98.67
18	134.10	100.22	99.93	99.85	99.70	99.55	99.40	99.25	99.03	98.96	98.88	98.81	98.73
19	133.50	100.30	100.22	99.85	99.78	99.63	99.40	99.18	99.03	98.88	98.65	98.43	98.28
20	133.90	100.37	100.30	100.22	100.15	100.07	99.93	99.78	99.63	99.55	99.48	99.33	99.18
21	134.30	100.45	100.22	100.07	99.93	99.85	99.78	99.63	99.48	99.40	99.33	99.18	99.03
22	135.10	100.37	100.07	100.00	99.93	99.78	99.63	99.41	99.26	99.19	99.04	98.96	98.89
23	133.50	100.22	100.07	99.93	99.70	99.63	99.25	99.10	98.88	98.73	98.58	98.43	98.13
24	134.30	100.22	99.93	99.85	99.63	99.48	99.26	98.96	98.81	98.73	98.59	98.51	98.36
25	133.90	100.22	100.15	100.07	99.93	99.85	99.78	99.63	99.55	99.40	99.33	99.18	99.03
Avg.	134.21	100.22	100.06	99.90	99.75	99.59	99.44	99.27	99.09	98.94	98.79	98.65	98.48
Med.	134.00	100.22	100.07	99.85	99.71	99.56	99.41	99.25	99.03	98.94	98.79	98.64	98.56
st dev	0.96	0.08	0.11	0.14	0.18	0.22	0.26	0.29	0.32	0.37	0.40	0.43	0.45
Min.	132.40	100.15	99.93	99.55	99.33	99.10	98.95	98.72	98.57	98.29	98.07	97.85	97.70
Max.	136.60	100.45	100.30	100.22	100.15	100.07	99.93	99.78	99.63	99.55	99.48	99.33	99.18

3.2 Data Set 1, 55°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)												
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
1	9.176	9.178	9.174	9.173	9.174	9.171	9.179	9.177	9.177	9.176	9.176	9.172	9.181
2	9.231	9.236	9.236	9.226	9.226	9.223	9.235	9.228	9.228	9.227	9.228	9.225	9.234
3	9.200	9.208	9.202	9.195	9.195	9.192	9.204	9.195	9.197	9.196	9.195	9.193	9.235
4	9.248	9.252	9.250	9.242	9.242	9.238	9.255	9.244	9.244	9.244	9.244	9.239	9.251
5	9.212	9.213	9.210	9.204	9.206	9.199	9.216	9.207	9.211	9.205	9.209	9.204	9.214
6	9.257	9.266	9.257	9.249	9.249	9.243	9.255	9.254	9.256	9.251	9.254	9.249	9.259
7	9.237	9.248	9.244	9.238	9.238	9.232	9.242	9.243	9.247	9.238	9.243	9.236	9.252
8	9.253	9.266	9.264	9.256	9.256	9.251	9.260	9.261	9.263	9.256	9.257	9.255	9.271
9	9.232	9.238	9.238	9.229	9.232	9.226	9.238	9.236	9.238	9.231	9.233	9.232	9.241
10	9.188	9.203	9.202	9.193	9.194	9.190	9.205	9.199	9.201	9.195	9.198	9.199	9.205
11	9.225	9.230	9.233	9.222	9.223	9.222	9.233	9.226	9.228	9.223	9.229	9.229	9.237
12	9.236	9.247	9.250	9.242	9.242	9.235	9.254	9.247	9.247	9.242	9.253	9.248	9.253
13	9.222	9.235	9.235	9.227	9.225	9.220	9.239	9.231	9.231	9.226	9.233	9.232	9.239
14	9.174	9.186	9.189	9.177	9.177	9.172	9.186	9.183	9.181	9.175	9.183	9.180	9.191
15	9.186	9.196	9.199	9.189	9.187	9.182	9.201	9.191	9.193	9.186	9.198	9.192	9.204
16	9.201	9.211	9.213	9.208	9.204	9.197	9.215	9.207	9.210	9.206	9.213	9.207	9.266
17	9.197	9.210	9.212	9.205	9.210	9.196	9.211	9.208	9.210	9.203	9.213	9.204	9.225
18	9.180	9.192	9.196	9.187	9.192	9.180	9.195	9.192	9.199	9.186	9.190	9.192	9.194
19	9.189	9.201	9.203	9.195	9.202	9.188	9.203	9.199	9.206	9.196	9.198	9.199	9.206
20	9.202	9.221	9.217	9.207	9.218	9.199	9.219	9.213	9.218	9.209	9.210	9.216	9.217
21	9.187	9.206	9.203	9.195	9.203	9.189	9.209	9.199	9.204	9.196	9.198	9.204	9.202
22	9.201	9.219	9.217	9.209	9.214	9.205	9.223	9.213	9.217	9.208	9.213	9.220	9.216
23	9.175	9.185	9.182	9.172	9.178	9.166	9.196	9.178	9.182	9.175	9.177	9.183	9.178
24	9.232	9.242	9.240	9.232	9.240	9.225	9.246	9.238	9.239	9.232	9.233	9.239	9.241
25	9.217	9.235	9.230	9.222	9.226	9.216	9.236	9.228	9.228	9.223	9.224	9.228	9.229
Avg.	9.210	9.221	9.220	9.212	9.214	9.206	9.222	9.216	9.218	9.212	9.216	9.215	9.226
Med.	9.202	9.219	9.217	9.208	9.214	9.199	9.219	9.213	9.217	9.208	9.213	9.216	9.229
st dev	0.026	0.025	0.024	0.024	0.024	0.024	0.023	0.024	0.024	0.024	0.024	0.023	0.026
Min.	9.174	9.178	9.174	9.172	9.174	9.166	9.179	9.177	9.177	9.175	9.176	9.172	9.178
Max.	9.257	9.266	9.264	9.256	9.256	9.251	9.260	9.261	9.263	9.256	9.257	9.255	9.271

3.3 Data Set 1, 55°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')											
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
1	0.2585	0.5326	2761	0.0002	0.0004	0.0003	0.0006	0.0004	0.0008	0.0007	0.0007	0.0009	0.0010	0.0011	0.0014
2	0.2602	0.5317	2731	0.0002	0.0003	0.0005	0.0008	0.0008	0.0006	0.0009	0.0012	0.0014	0.0014	0.0012	0.0010
3	0.2607	0.5327	2716	0.0001	0.0003	0.0004	0.0006	0.0006	0.0005	0.0007	0.0010	0.0011	0.0013	0.0013	0.0010
4	0.2593	0.5321	2748	0.0001	0.0002	0.0003	0.0004	0.0006	0.0004	0.0005	0.0008	0.0010	0.0012	0.0012	0.0011
5	0.2620	0.5312	2695	0.0001	0.0002	0.0004	0.0004	0.0005	0.0005	0.0007	0.0007	0.0009	0.0012	0.0011	0.0012
6	0.2617	0.5331	2694	0.0001	0.0003	0.0004	0.0004	0.0005	0.0005	0.0008	0.0008	0.0011	0.0013	0.0014	0.0015
7	0.2591	0.5319	2751	0.0001	0.0002	0.0004	0.0005	0.0005	0.0005	0.0007	0.0007	0.0009	0.0010	0.0012	0.0011
8	0.2598	0.5310	2742	0.0002	0.0003	0.0003	0.0006	0.0006	0.0007	0.0009	0.0010	0.0012	0.0012	0.0009	0.0013
9	0.2599	0.5322	2733	0.0002	0.0003	0.0004	0.0004	0.0005	0.0008	0.0008	0.0008	0.0010	0.0009	0.0008	0.0012
10	0.2597	0.5320	2740	0.0002	0.0002	0.0003	0.0004	0.0006	0.0006	0.0007	0.0008	0.0011	0.0008	0.0008	0.0012
11	0.2613	0.5317	2708	0.0003	0.0002	0.0004	0.0005	0.0006	0.0008	0.0008	0.0008	0.0009	0.0011	0.0008	0.0016
12	0.2583	0.5315	2772	0.0003	0.0002	0.0004	0.0006	0.0006	0.0008	0.0008	0.0008	0.0009	0.0009	0.0012	0.0015
13	0.2593	0.5305	2754	0.0002	0.0004	0.0003	0.0005	0.0006	0.0009	0.0010	0.0010	0.0011	0.0011	0.0013	0.0016
14	0.2605	0.5326	2719	0.0002	0.0003	0.0006	0.0007	0.0007	0.0009	0.0010	0.0009	0.0009	0.0011	0.0012	0.0016
15	0.2598	0.5311	2741	0.0002	0.0004	0.0005	0.0007	0.0007	0.0009	0.0009	0.0010	0.0011	0.0011	0.0010	0.0013
16	0.2587	0.5332	2754	0.0002	0.0005	0.0005	0.0006	0.0006	0.0008	0.0010	0.0009	0.0010	0.0009	0.0011	0.0014
17	0.2601	0.5325	2729	0.0002	0.0005	0.0004	0.0005	0.0005	0.0008	0.0008	0.0008	0.0009	0.0010	0.0014	0.0014
18	0.2606	0.5307	2727	0.0003	0.0003	0.0003	0.0004	0.0006	0.0009	0.0010	0.0010	0.0012	0.0011	0.0015	0.0016
19	0.2612	0.5312	2712	0.0004	0.0004	0.0004	0.0006	0.0006	0.0008	0.0010	0.0010	0.0011	0.0012	0.0015	0.0016
20	0.2600	0.5320	2733	0.0002	0.0005	0.0004	0.0006	0.0006	0.0007	0.0009	0.0009	0.0012	0.0012	0.0014	0.0015
21	0.2589	0.5333	2750	0.0002	0.0005	0.0003	0.0004	0.0006	0.0007	0.0009	0.0008	0.0008	0.0009	0.0014	0.0015
22	0.2586	0.5307	2767	0.0002	0.0005	0.0004	0.0005	0.0006	0.0008	0.0009	0.0009	0.0010	0.0010	0.0015	0.0009
23	0.2614	0.5334	2698	0.0003	0.0004	0.0004	0.0006	0.0006	0.0008	0.0009	0.0008	0.0009	0.0010	0.0014	0.0009
24	0.2606	0.5329	2716	0.0004	0.0004	0.0004	0.0004	0.0006	0.0008	0.0009	0.0010	0.0010	0.0011	0.0014	0.0010
25	0.2623	0.5324	2685	0.0003	0.0003	0.0003	0.0006	0.0006	0.0008	0.0008	0.0009	0.0009	0.0010	0.0014	0.0009
Avg.	0.2601	0.5320	2731	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0013
Med.	0.2600	0.5320	2733	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.0009	0.0010	0.0011	0.0012	0.0013
st dev	0.0011	0.0009	24	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002
Min.	0.2583	0.5305	2685	0.0001	0.0002	0.0003	0.0004	0.0004	0.0004	0.0005	0.0007	0.0008	0.0008	0.0008	0.0009
Max.	0.2623	0.5334	2772	0.0004	0.0005	0.0006	0.0008	0.0008	0.0009	0.0010	0.0012	0.0014	0.0014	0.0015	0.0016

3.4 Data Set 2, 105°C, 120mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)											
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
26	133.80	100.15	99.85	99.63	99.48	99.10	98.88	98.65	98.58	98.43	98.28	98.21	98.06
27	133.50	100.15	100.07	99.78	99.63	99.48	99.18	98.95	98.88	98.58	98.50	98.35	98.28
28	132.50	100.15	100.08	99.92	99.85	99.62	99.47	99.40	99.17	99.02	98.72	98.57	98.19
29	131.90	100.08	99.77	99.55	99.32	99.17	98.94	98.79	98.71	98.56	98.33	98.26	98.18
30	136.00	100.22	100.07	99.85	99.78	99.71	99.56	99.49	99.26	99.04	98.75	98.60	98.31
31	134.20	100.15	100.07	99.70	99.40	99.25	99.03	98.81	98.51	98.29	98.14	97.99	97.76
32	135.00	100.07	99.93	99.70	99.41	99.11	98.89	98.67	98.44	98.30	98.22	98.00	97.78
33	132.10	100.08	99.92	99.77	99.39	99.24	98.94	98.71	98.49	98.41	98.26	98.11	97.96
34	135.80	100.15	99.85	99.63	99.48	99.41	99.26	99.12	98.90	98.67	98.53	98.38	98.31
35	135.70	100.22	99.85	99.63	99.19	99.12	98.82	98.45	98.31	98.23	97.94	97.72	97.27
36	132.70	100.08	99.70	99.47	99.32	98.87	98.57	98.34	98.12	97.97	97.81	97.44	97.21
37	133.70	100.15	99.70	99.63	99.25	99.10	99.03	98.95	98.88	98.73	98.58	98.43	98.35
38	134.50	100.07	99.78	99.70	99.48	99.33	99.26	99.18	98.96	98.74	98.66	98.44	98.36
39	134.20	100.15	99.85	99.55	99.40	99.11	98.88	98.51	98.36	98.29	98.21	98.06	97.91
40	136.60	100.15	99.93	99.85	99.71	99.56	99.34	99.19	99.05	98.83	98.68	98.46	98.24
41	135.30	100.15	99.85	99.63	99.41	99.19	99.04	98.82	98.74	98.67	98.52	98.37	98.30
42	133.40	100.07	99.85	99.70	99.33	98.95	98.65	98.50	98.28	98.05	97.83	97.75	97.60
43	132.10	100.15	99.77	99.62	99.39	99.24	99.17	99.02	98.94	98.79	98.71	98.56	98.41
44	134.60	100.07	99.93	99.78	99.55	99.26	98.96	98.66	98.51	98.37	98.07	97.85	97.77
45	132.50	100.08	99.92	99.77	99.40	99.17	98.94	98.64	98.49	98.04	97.89	97.81	97.66
46	133.30	100.15	100.08	99.92	99.77	99.62	99.47	99.40	99.25	99.02	98.87	98.72	98.42
47	134.40	100.07	99.93	99.55	99.48	99.18	98.96	98.81	98.36	98.07	97.92	97.77	97.62
48	133.00	100.08	99.92	99.62	99.55	99.25	99.10	98.57	98.35	98.27	98.12	97.89	97.74
49	134.50	100.07	99.85	99.55	99.41	99.26	99.18	99.03	98.88	98.66	98.51	98.44	98.22
50	133.20	99.92	99.55	99.47	99.40	99.32	99.17	98.95	98.80	98.72	98.35	97.90	97.75
Avg.	133.94	100.11	99.88	99.68	99.47	99.26	99.07	98.86	98.69	98.51	98.34	98.16	97.99
Med.	133.80	100.15	99.85	99.63	99.41	99.24	99.03	98.81	98.71	98.56	98.33	98.21	98.06
st dev	1.31	0.06	0.13	0.13	0.17	0.21	0.24	0.31	0.32	0.32	0.32	0.34	0.35
Min.	131.90	99.92	99.55	99.47	99.19	98.87	98.57	98.34	98.12	97.97	97.81	97.44	97.21
Max.	136.60	100.22	100.08	99.92	99.85	99.71	99.56	99.49	99.26	99.04	98.87	98.72	98.42

3.5 Data Set 2, 105°C, 120mA (Forward Voltage)

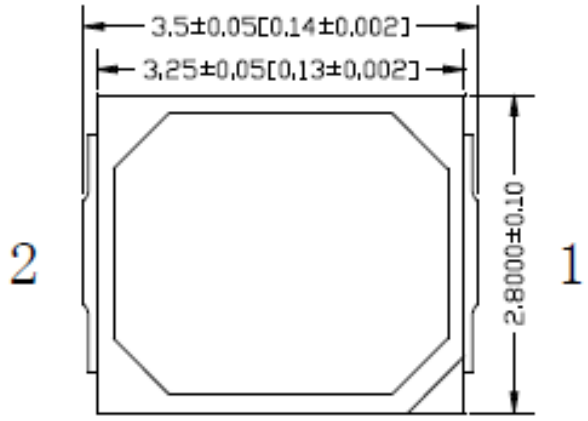
No.	Forward Voltage (V)												
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
26	9.182	9.198	9.199	9.192	9.195	9.184	9.201	9.196	9.198	9.191	9.192	9.195	9.196
27	9.229	9.245	9.243	9.238	9.240	9.229	9.249	9.241	9.240	9.235	9.242	9.242	9.244
28	9.225	9.238	9.235	9.227	9.229	9.219	9.235	9.233	9.232	9.226	9.229	9.232	9.234
29	9.215	9.235	9.226	9.221	9.223	9.213	9.230	9.229	9.225	9.222	9.226	9.226	9.230
30	9.262	9.263	9.253	9.250	9.253	9.241	9.260	9.257	9.252	9.251	9.254	9.258	9.259
31	9.238	9.249	9.236	9.236	9.236	9.227	9.241	9.242	9.238	9.237	9.235	9.240	9.238
32	9.185	9.193	9.183	9.181	9.186	9.176	9.188	9.186	9.183	9.181	9.181	9.183	9.187
33	9.295	9.289	9.278	9.272	9.281	9.272	9.284	9.281	9.280	9.275	9.277	9.279	9.285
34	9.210	9.205	9.195	9.193	9.198	9.192	9.204	9.200	9.197	9.195	9.193	9.204	9.202
35	9.262	9.253	9.242	9.241	9.244	9.244	9.255	9.249	9.242	9.243	9.244	9.247	9.250
36	9.261	9.249	9.237	9.236	9.238	9.229	9.248	9.244	9.233	9.236	9.236	9.241	9.241
37	9.237	9.226	9.214	9.221	9.213	9.208	9.225	9.222	9.212	9.217	9.215	9.222	9.222
38	9.246	9.251	9.242	9.244	9.242	9.236	9.257	9.253	9.240	9.244	9.240	9.247	9.246
39	9.264	9.249	9.236	9.242	9.238	9.228	9.246	9.248	9.235	9.241	9.237	9.250	9.242
40	9.228	9.193	9.184	9.187	9.184	9.177	9.194	9.193	9.187	9.186	9.184	9.196	9.190
41	9.208	9.191	9.182	9.186	9.185	9.172	9.190	9.193	9.187	9.187	9.184	9.195	9.194
42	9.270	9.256	9.246	9.253	9.247	9.240	9.253	9.259	9.249	9.250	9.247	9.256	9.254
43	9.252	9.234	9.228	9.232	9.229	9.224	9.238	9.239	9.232	9.231	9.231	9.236	9.236
44	9.182	9.176	9.171	9.178	9.169	9.166	9.181	9.180	9.175	9.174	9.174	9.178	9.181
45	9.279	9.247	9.241	9.248	9.239	9.235	9.250	9.248	9.245	9.242	9.247	9.248	9.245
46	9.253	9.230	9.224	9.228	9.220	9.233	9.234	9.233	9.231	9.227	9.235	9.232	9.230
47	9.260	9.251	9.247	9.253	9.245	9.256	9.256	9.253	9.253	9.249	9.259	9.257	9.256
48	9.283	9.273	9.265	9.269	9.263	9.272	9.270	9.268	9.270	9.263	9.274	9.271	9.268
49	9.224	9.225	9.217	9.222	9.217	9.225	9.225	9.223	9.225	9.219	9.226	9.225	9.225
50	9.213	9.204	9.197	9.202	9.196	9.207	9.202	9.209	9.204	9.201	9.205	9.205	9.204
Avg.	9.239	9.233	9.225	9.226	9.224	9.220	9.233	9.231	9.227	9.225	9.227	9.231	9.230
Med.	9.238	9.238	9.235	9.232	9.229	9.227	9.238	9.239	9.232	9.231	9.235	9.236	9.236
st dev	0.031	0.029	0.028	0.027	0.028	0.029	0.028	0.027	0.027	0.027	0.029	0.027	0.027
Min.	9.182	9.176	9.171	9.178	9.169	9.166	9.181	9.180	9.175	9.174	9.174	9.178	9.181
Max.	9.295	9.289	9.278	9.272	9.281	9.272	9.284	9.281	9.280	9.275	9.277	9.279	9.285

3.6 Data Set 2, 105°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')											
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs	11000hrs	12000hrs
26	0.2595	0.5310	2748	0.0004	0.0002	0.0006	0.0006	0.0007	0.0008	0.0009	0.0010	0.0014	0.0012	0.0014	0.0012
27	0.2610	0.5312	2716	0.0004	0.0003	0.0004	0.0006	0.0006	0.0008	0.0009	0.0010	0.0013	0.0011	0.0015	0.0013
28	0.2618	0.5330	2693	0.0004	0.0006	0.0006	0.0007	0.0009	0.0010	0.0010	0.0011	0.0012	0.0011	0.0013	0.0013
29	0.2621	0.5321	2690	0.0002	0.0006	0.0004	0.0005	0.0005	0.0008	0.0007	0.0008	0.0009	0.0011	0.0012	0.0013
30	0.2595	0.5325	2741	0.0004	0.0006	0.0005	0.0006	0.0006	0.0007	0.0008	0.0009	0.0011	0.0013	0.0012	0.0013
31	0.2605	0.5312	2727	0.0002	0.0005	0.0005	0.0008	0.0008	0.0010	0.0010	0.0011	0.0010	0.0014	0.0013	0.0015
32	0.2609	0.5322	2714	0.0002	0.0004	0.0005	0.0006	0.0006	0.0009	0.0009	0.0010	0.0011	0.0013	0.0013	0.0014
33	0.2612	0.5325	2706	0.0003	0.0004	0.0003	0.0003	0.0004	0.0005	0.0009	0.0005	0.0006	0.0008	0.0009	0.0012
34	0.2585	0.5324	2763	0.0003	0.0004	0.0005	0.0006	0.0006	0.0009	0.0013	0.0010	0.0011	0.0013	0.0012	0.0014
35	0.2595	0.5327	2740	0.0002	0.0004	0.0004	0.0004	0.0005	0.0004	0.0008	0.0004	0.0005	0.0007	0.0008	0.0011
36	0.2584	0.5324	2765	0.0002	0.0003	0.0004	0.0005	0.0004	0.0007	0.0009	0.0007	0.0008	0.0009	0.0010	0.0013
37	0.2606	0.5328	2718	0.0003	0.0004	0.0006	0.0006	0.0006	0.0009	0.0012	0.0006	0.0012	0.0013	0.0012	0.0015
38	0.2621	0.5329	2686	0.0003	0.0004	0.0004	0.0005	0.0005	0.0006	0.0009	0.0010	0.0009	0.0009	0.0009	0.0012
39	0.2598	0.5315	2739	0.0002	0.0004	0.0005	0.0006	0.0006	0.0007	0.0010	0.0012	0.0011	0.0011	0.0011	0.0013
40	0.2594	0.5319	2747	0.0002	0.0004	0.0004	0.0006	0.0006	0.0008	0.0008	0.0012	0.0011	0.0011	0.0009	0.0013
41	0.2597	0.5311	2743	0.0002	0.0003	0.0005	0.0006	0.0006	0.0008	0.0009	0.0013	0.0012	0.0013	0.0012	0.0015
42	0.2589	0.5308	2760	0.0002	0.0004	0.0003	0.0005	0.0005	0.0007	0.0008	0.0010	0.0010	0.0011	0.0015	0.0015
43	0.2617	0.5314	2700	0.0002	0.0004	0.0003	0.0004	0.0005	0.0006	0.0007	0.0009	0.0010	0.0009	0.0012	0.0015
44	0.2594	0.5318	2746	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0011	0.0015	0.0013	0.0016	0.0018
45	0.2610	0.5309	2717	0.0002	0.0003	0.0004	0.0006	0.0006	0.0008	0.0009	0.0012	0.0014	0.0013	0.0016	0.0018
46	0.2616	0.5315	2702	0.0002	0.0003	0.0005	0.0006	0.0007	0.0008	0.0009	0.0012	0.0014	0.0013	0.0016	0.0016
47	0.2610	0.5323	2711	0.0003	0.0004	0.0007	0.0006	0.0008	0.0007	0.0008	0.0012	0.0017	0.0013	0.0016	0.0018
48	0.2611	0.5334	2704	0.0003	0.0004	0.0006	0.0006	0.0007	0.0007	0.0008	0.0013	0.0014	0.0014	0.0016	0.0019
49	0.2591	0.5314	2755	0.0002	0.0004	0.0007	0.0006	0.0011	0.0007	0.0009	0.0012	0.0010	0.0014	0.0017	0.0018
50	0.2589	0.5296	2767	0.0002	0.0004	0.0004	0.0005	0.0013	0.0005	0.0007	0.0010	0.0009	0.0010	0.0012	0.0015
Avg.	0.2603	0.5319	2728	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0013	0.0014
Med.	0.2605	0.5319	2727	0.0002	0.0004	0.0005	0.0006	0.0006	0.0007	0.0009	0.0010	0.0011	0.0012	0.0012	0.0014
st dev	0.0012	0.0009	25	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0002	0.0003	0.0002	0.0003	0.0002
Min.	0.2584	0.5296	2686	0.0002	0.0002	0.0003	0.0003	0.0004	0.0004	0.0007	0.0004	0.0005	0.0007	0.0008	0.0011
Max.	0.2621	0.5334	2767	0.0004	0.0006	0.0007	0.0008	0.0013	0.0010	0.0013	0.0013	0.0017	0.0014	0.0017	0.0019

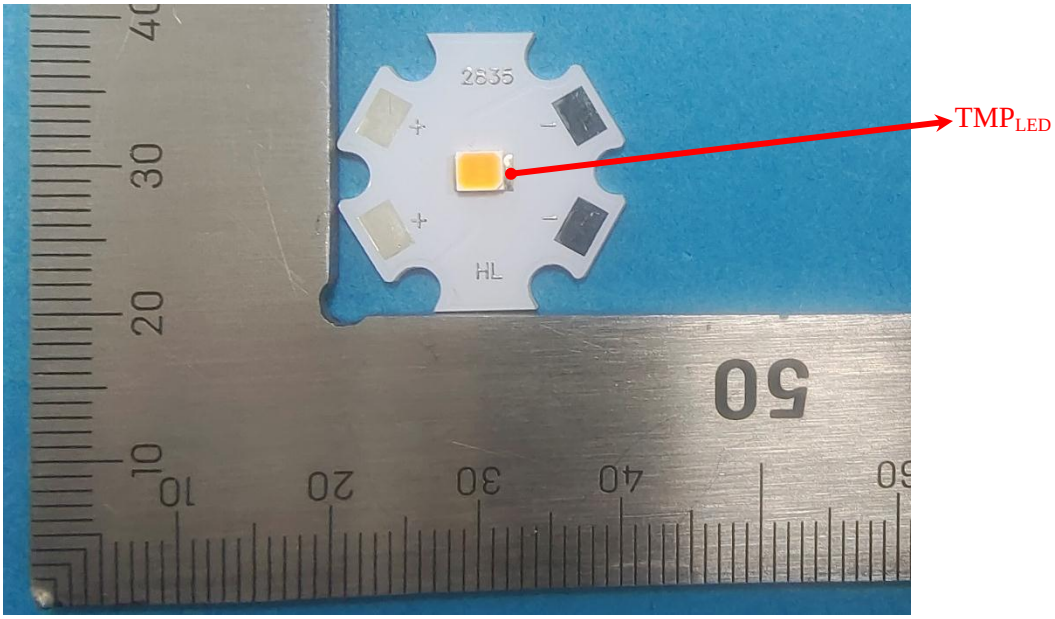
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



5 - Report Revision

Report Number	Report Date	Contents
2202X45920-EE-12000	2024-05-22	Original report.
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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**********