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-AG-2016H421W-LVR5-S1-PCT-HR3

Report Type: 6000 Hours Test Report	**Product Type:** LED Package
Reviewed By:	Pote Wang
Report Number:	SZ2230424-21873E-EE-6000
Test Date:	2023-04-26 to 2024-01-20
Report Date:	2024-02-06
Approved by:	Blake Zhang / EE Engineer
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1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
High Accuracy Array Spectroradiometer	EVERFINE	HAAS 2000	P600674CM5391140	2023-09-02	2024-09-11
0.5M Integrating Sphere	EVERFINE	0.5m	NA	2023-09-02	2024-09-11
LED Test Source	EVERFINE	LTS-300	P185616CJ1391143	2023-09-02	2024-09-11
Standard Light Source	EVERFINE	D062	M133799CM1381112	2023-05-12	2025-05-11
LED device life aging system	BACL	BP0-230-200-3	60103	2023-04-17	2024-04-16
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090006	2023-10-16	2024-10-15

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 F R O G H V W ' 8 7 V ¶ 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 $ 6 7 0 (7 D E O H ³ 6 S H F L D O / L P L W V ´

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 ¶ ¶2 Œmeasurement 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: 85°C, 60mA

Part Number:	HL-AG-2016H421W-LVR5-S1-PCT-HR3
Number of Units:	25
Case Temperature:	>83°C
Ambient Temperature:	>80°C
Life Test Drive Current:	60mA
Measurement Current:	60mA

Data Set 2: 105°C, 60mA

Part Number:	HL-AG-2016H421W-LVR5-S1-PCT-HR3
Number of Units:	25
Case Temperature:	>103°C
Ambient Temperature:	>100°C
Life Test Drive Current:	60mA
Measurement Current:	60mA

2 - Summary of T

Data Set:	Sample Size	st rval	Test Duration	.		Reported TM-21 L_{70} Lifetime	Reported TM-21 L_{90} Lifetime
1	25	0hrs	6000hrs	2.233E-06	1.003	>36000 hours	>36000 hours
2	25	0hrs	6000hrs	2.534E-06	1.002	>36000 hours	>36000 hours

Average Lumen Mainte itial Luminous Flux)

Data Set:	1000hrs

3 - Test Data

3.1 Data Set 1, 85°C, 60mA (Lumen Maintenance)

No.	- O P	Lumen Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	25.67	99.92	99.73	99.61	99.45	99.30	99.14
2	26.27	100.15	100.04	99.81	99.58	99.28	99.05
3	25.36	100.24	100.04	99.80	99.41	99.13	98.86
4	25.92	100.12	99.96	99.77	99.54	99.38	99.00
5	26.20	100.19	99.92	99.66	99.50	99.24	99.05
6	25.37	100.04	99.80	99.57	99.41	99.21	98.94
7	26.20	100.08	99.77	99.62	99.35	99.16	98.82
8	25.44	99.92	99.80	99.57			

3.2 Data Set 1, 85°C, 60mA (Forward Voltage)

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	2.841	2.843	2.841	2.842	2.840	2.842	2.844
2	2.857	2.858	2.855	2.859	2.855	2.858	2.858
3	2.872	2.871	2.870	2.872	2.871	2.874	2.874
4	2.845	2.846	2.845	2.846	2.845	2.849	2.848
5	2.845	2.844	2.845	2.847	2.843	2.848	2.847
6	2.838	2.838	2.837	2.840	2.838	2.839	2.839
7	2.876	2.874	2.874	2.878	2.875	2.878	2.876
8	2.857	2.855	2.855	2.857	2.855	2.857	2.859
9	2.845	2.845	2.845	2.847	2.845	2.845	2.846
10	2.867	2.867	2.867	2.869	2.870	2.868	2.869
11	2.851	2.848	2.849	2.851	2.852	2.851	2.851
12	2.843	2.842	2.844	2.845	2.846	2.846	2.846
13	2.845	2.842	2.847	2.846	2.848	2.847	2.845
14	2.853	2.850	2.853	2.854	2.856	2.853	2.854
15	2.865	2.864	2.868	2.867	2.867	2.867	2.866
16	2.846	2.846	2.847	2.850	2.846	2.851	2.847
17	2.869	2.867	2.871	2.872	2.869	2.870	2.870
18	2.862	2.861	2.864	2.864	2.863	2.863	2.865
19	2.875	2.873	2.877	2.877	2.877	2.874	2.876
20	2.849	2.848	2.850	2.851	2.851	2.851	2.852
21	2.848	2.845	2.849	2.848	2.849	2.848	2.849
22	2.852	2.851	2.852	2.854	2.853	2.852	2.853
23	2.863	2.866	2.864	2.871	2.866	2.863	2.864
24	2.848	2.851	2.848	2.855	2.849	2.850	2.848
25	2.852	2.854	2.855	2.859	2.855	2.854	2.855
Avg.	2.855	2.854	2.855	2.857	2.855	2.856	2.856
Med.	2.852	2.851	2.852	2.854	2.853	2.852	2.853
st dev	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Min.	2.838	2.838	2.837	2.840	2.838	2.839	2.839
Max.	2.876	2.874	2.877	2.878	2.877	2.878	2.876

3.3 Data Set 1, 85°C, 60mA (Chromaticity Shift)

No.	X ¶	Y ¶	CCT(K)	&KURPDWLFLW\ 6KLIW ¨X¶Y¶					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2594	0.5327	2743	0.0001	0.0002	0.0003	0.0004	0.0006	0.0009
2	0.2554	0.5316	2831	0.0001	0.0002	0.0004	0.0005	0.0007	0.0008
3	0.2579	0.5301	2786	0.0001	0.0002	0.0004	0.0006	0.0009	0.0009
4	0.2583	0.5325	2766	0.0001	0.0003	0.0004			

3.4 Data Set 2, 105°C, 60mA (Lumen Maintenance)

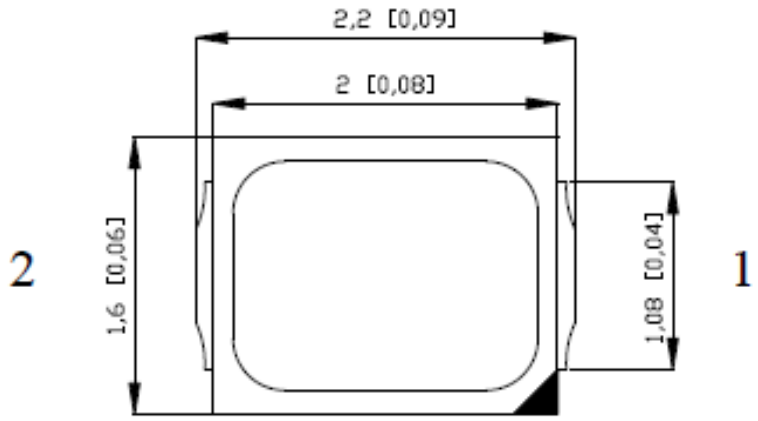
No.	- O P	Lumen Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	25.58	100.16	99.92	99.73	99.41	99.02	98.83
27	25.56	100.12	99.88	99.57	99.37	99.14	98.94
28	24.32	100.08	99.88	99.55	99.30	99.01	98.73
29	25.39	99.84	99.53	99.41	99.17	98.94	98.78

3.6 Data Set 2, 105°C, 60mA (Chromaticity Shift)

No.	X ¶	Y ¶	CCT(K)	& K U R P D W L F L W \ 6 K L I W ¨ X ¶ Y ¶					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	0.2572	0.5302	2799	0.0001	0.0002	0.0003	0.0005	0.0006	0.0008
27	0.2566	0.5277	2825	0.0002	0.0003	0.0004	0.0006	0.0008	0.0008
28	0.2544	0.5266	2880	0.0001	0.0002	0.0003	0.0004	0.0004	0.0006
29	0.2576	0.5287	2799	0.0003	0.0004	0.0005	0.0005	0.0008	0.0009
30	0.2565	0.5284	2825	0.0002	0.0004	0.0004	0.0005	0.0008	0.0009
31	0.2551	0.5301	2847	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008
32	0.2564	0.5305	2816	0.0002	0.0004	0.0005	0.0007	0.0008	0.0009
33	0.2537	0.5302	2876	0.0001	0.0002	0.0004	0.0007	0.0007	0.0008
34	0.2579	0.5279	2794	0.0001	0.0004	0.0007	0.0009	0.0011	0.0012
35	0.2573	0.5293	2803	0.0002	0.0003	0.0004	0.0007	0.0009	0.0009
36	0.2532	0.5305	2887	0.0002	0.0002	0.0003	0.0004	0.0007	0.0008
37	0.2565	0.5264	2832	0.0001	0.0004	0.0004	0.0006	0.0007	0.0009
38	0.2567	0.5278	2821	0.0001	0.0002	0.0003	0.0005	0.0007	0.0008
39	0.2534	0.5274	2898	0.0001	0.0002	0.0004	0.0004	0.0006	0.0007

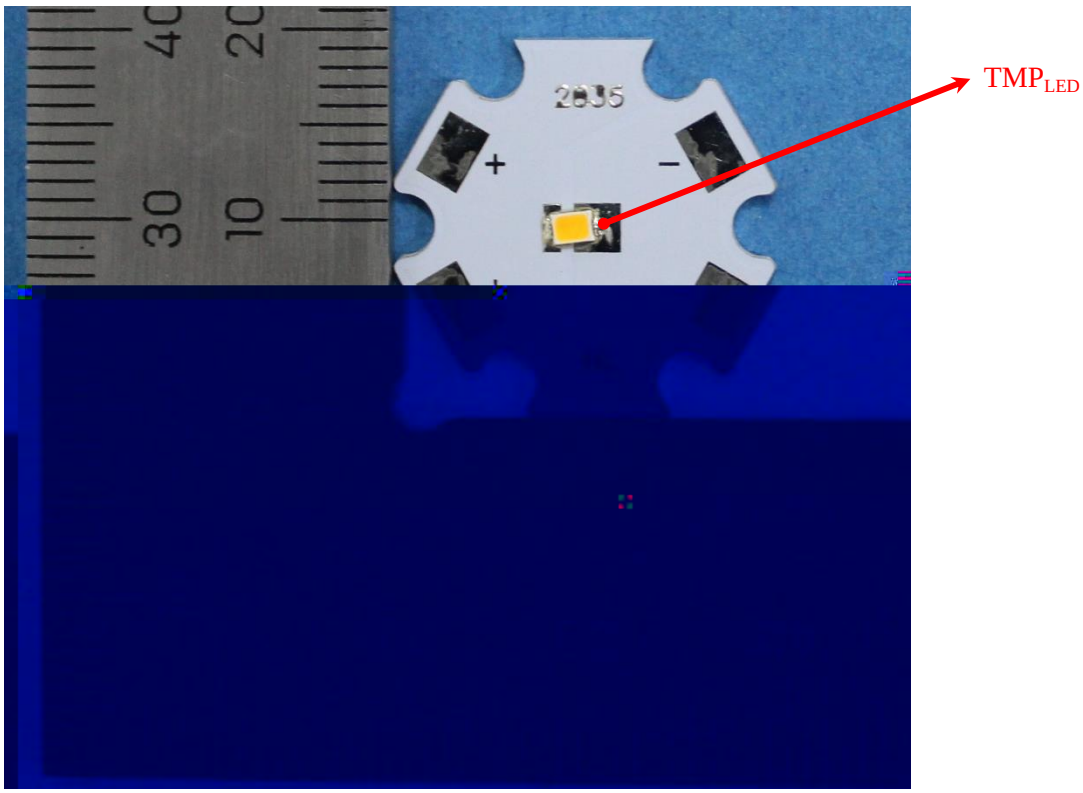
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



Directions

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2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
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