



TEST REPORT

ACCORDING TO IES LM-80-2015
For

Hongli Zhihui Group Co.,Ltd.

No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

Model: HL-ES-3032DW-2C-S1-HR3

Report Type: 6000 Hours Test Report		Product Type: LED Package	
Test Engineer:	Pote Wang	<i>Pote Wang</i>	
Report Number:	RSZ151230501-10		
Test Date:	2015-12-30 to 2016-09-05		
Report Date:	2016-09-20		
Reviewed By:	Daniel Duan / EE Manager	<i>Daniel Duan</i>	
Test Facility:	Test facility was located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.		
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Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

50 PCS samples were received on 2015-12-30. The samples were numbered from 1 to 25 and 26 to 50.

Manufacturer: Hongli Zhihui Group Co.,Ltd.
Part Number: HL-ES-3032DW-2C-S1-HR3
Part Type: LED Package
Drive Level: DC 150mA
Nominal CCT: 2700K

1.2 Standards Used:

- IESNA LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- ENERGY STAR® Program Guidance Regarding LED Array, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products(This test method was not accredited by IAS)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Integral Sphere	EVERFINE	Diameter 0.3m	1011119	0.3m	2016-03-10	2017-03-09
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2016-03-04	2017-03-03
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2016-03-10	2017-03-09
Standard Light Source	EVERFINE	D062	1011093	3000K	2015-09-17	2016-09-16
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987C J7321114	300VA	2016-03-04	2017-03-03
Multilayer aging machine	BACL	B2-270	20015	25°C~110°C	2016-03-04	2017-03-03
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060010	(50/15A)	2016-03-04	2017-03-03
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090008	(50/15A)	2016-07-07	2017-07-06

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 $\pm 3\%$ of the specified value of the manufacturer during maintenance test, and was within $\pm 0.5\%$ 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 $\pm 3\%$ 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 $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, RH $< 65\%$.

1.6 Measurement Uncertainty

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 $U=21\text{K}$ ($K=2$), at the 95% confidence level.

The uncertainty of the temperature is $U=0.8671^{\circ}\text{C}$ ($K=2$), 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, 150mA

Part Number: HL-ES-3032DW-2C-S1-HR3
Number of Units: 25
Case Temperature: >83°C
Ambient Temperature: >80°C
Life Test Drive Current: 150mA
Measurement Current: 150mA

Data Set 2: 105°C, 150mA

Part Number: HL-ES-3032DW-2C-S1-HR3
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	Reported TM-21 L ₇₀ Lifetime
1	25	0	1000	6000	>36000 hours
2	25	0	1000	6000	>36000 hours

Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000	2000	3000	4000	5000	6000
1	100.20	99.92	99.62	99.24	98.86	98.50
2	100.18	99.75	99.32	98.84	98.36	97.88

Average Color Maintenance

Data Set:	1000	2000	3000	4000	5000	6000
1	0.0006	0.0007	0.0010	0.0011	0.0013	0.0016
2	0.0004	0.0009	0.0013	0.0014	0.0016	0.0018

3 - Test Data

3.1 Data Set 1, 85°C, 150mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	136.6	100.29	99.85	99.56	99.19	98.76	98.32
2	135.2	100.37	100.15	99.85	99.33	98.74	98.30
3	135.9	99.85	99.63	99.41	99.12	98.68	98.31
4	135.9	100.07	99.78	99.48	99.04	98.53	98.23
5	135.7	100.29	99.93	99.56	99.34	98.89	98.53
6	133.4	100.15	99.85	99.63	99.25	98.95	98.58
7	134.6	99.78	99.55	99.11	98.81	98.44	98.14
8	133.0	100.38	100.15	99.92	99.55	99.17	98.80
9	134.0	100.22	100.07	99.85	99.48	99.18	98.81
10	135.1	100.07	99.70	99.26	98.96	98.59	98.30
11	133.8	100.15	99.93	99.55	99.03	98.58	98.21
12	134.1	100.07	99.93	99.70	99.25	98.73	98.51
13	135.7	100.22	99.85	99.56	99.19	98.75	98.38
14	134.5	99.93	99.70	99.55	99.18	98.88	98.44
15	133.7	100.30	99.93	99.55	99.10	98.88	98.50
16	134.2	100.37	100.15	100.00	99.70	99.33	99.03
17	134.9	100.30	99.93	99.63	99.18	98.74	98.52
18	135.4	100.30	99.93	99.56	99.11	98.67	98.30
19	134.3	100.15	99.85	99.55	99.18	98.88	98.44
20	135.8	100.29	100.07	99.85	99.41	99.12	98.82
21	135.2	100.37	99.93	99.56	99.26	98.89	98.59
22	134.5	100.30	100.07	99.78	99.26	98.96	98.51
23	134.6	100.45	100.15	99.78	99.55	99.18	98.81
24	132.6	100.15	99.92	99.55	99.25	98.87	98.57
25	134.8	100.22	99.93	99.70	99.33	99.04	98.66
Ave.	134.7	100.20	99.92	99.62	99.24	98.86	98.50
Med.	134.6	100.22	99.93	99.56	99.25	98.88	98.51
st dev	0.9802	0.1679	0.1620	0.1997	0.1967	0.2251	0.2246
Min.	132.6	99.78	99.55	99.11	98.81	98.44	98.14
Max.	136.6	100.45	100.15	100.00	99.70	99.33	99.03

TM-21 Projection:

Test Duration: 6000 hours

Failures Observed: 0

α: 3.464E-06

β: 1.006

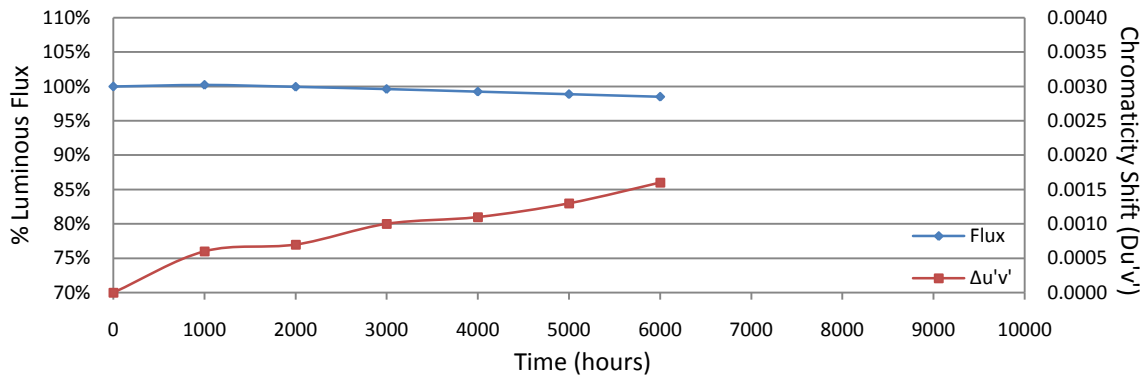
Reported L₇₀: >36000 hours

3.2 Data Set 1, 85°C, 150mA (Forward Voltage)

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	6.614	6.658	6.493	6.492	6.493	6.489	6.491
2	6.563	6.560	6.534	6.512	6.511	6.508	6.515
3	6.460	6.491	6.420	6.408	6.408	6.406	6.410
4	6.458	6.538	6.452	6.433	6.429	6.428	6.434
5	6.496	6.571	6.449	6.429	6.426	6.422	6.426
6	6.671	6.676	6.550	6.526	6.529	6.526	6.531
7	6.575	6.580	6.535	6.496	6.496	6.496	6.500
8	6.494	6.568	6.490	6.457	6.453	6.448	6.452
9	6.620	6.658	6.492	6.467	6.466	6.466	6.470
10	6.522	6.623	6.547	6.494	6.499	6.500	6.502
11	6.552	6.659	6.479	6.456	6.451	6.458	6.461
12	6.620	6.671	6.521	6.482	6.478	6.479	6.484
13	6.408	6.471	6.367	6.320	6.312	6.312	6.317
14	6.439	6.487	6.464	6.421	6.422	6.419	6.428
15	6.476	6.513	6.488	6.459	6.455	6.457	6.465
16	6.484	6.502	6.533	6.478	6.470	6.478	6.474
17	6.503	6.683	6.580	6.482	6.482	6.484	6.481
18	6.465	6.484	6.516	6.450	6.442	6.447	6.451
19	6.481	6.528	6.599	6.470	6.462	6.466	6.467
20	6.403	6.434	6.447	6.386	6.380	6.379	6.384
21	6.467	6.630	6.547	6.452	6.450	6.454	6.457
22	6.417	6.399	6.518	6.408	6.404	6.415	6.415
23	6.569	6.556	6.644	6.537	6.533	6.544	6.540
24	6.470	6.567	6.572	6.445	6.442	6.444	6.451
25	6.575	6.625	6.641	6.484	6.473	6.477	6.487
Ave.	6.512	6.565	6.515	6.458	6.455	6.456	6.460
Med.	6.494	6.567	6.518	6.459	6.455	6.458	6.465
st dev	0.0727	0.0805	0.0651	0.0468	0.0481	0.0487	0.0478
Min.	6.403	6.399	6.367	6.320	6.312	6.312	6.317
Max.	6.671	6.683	6.644	6.537	6.533	6.544	6.540

3.3 Data Set 1, 85°C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs
1	0.2619	0.5281	2710	0.0004	0.0007	0.0008	0.0010	0.0014	0.0016
2	0.2612	0.5280	2724	0.0010	0.0011	0.0013	0.0013	0.0016	0.0020
3	0.2587	0.5253	2789	0.0002	0.0006	0.0009	0.0009	0.0011	0.0015
4	0.2597	0.5239	2774	0.0002	0.0008	0.0010	0.0011	0.0013	0.0016
5	0.2592	0.5291	2762	0.0006	0.0006	0.0008	0.0009	0.0011	0.0014
6	0.2615	0.5305	2708	0.0008	0.0008	0.0009	0.0011	0.0013	0.0016
7	0.2600	0.5274	2752	0.0004	0.0007	0.0010	0.0010	0.0013	0.0016
8	0.2615	0.5286	2716	0.0003	0.0011	0.0014	0.0015	0.0017	0.0020
9	0.2584	0.5253	2796	0.0004	0.0012	0.0014	0.0015	0.0018	0.0021
10	0.2585	0.5265	2788	0.0004	0.0006	0.0009	0.0011	0.0013	0.0016
11	0.2597	0.5247	2772	0.0003	0.0006	0.0009	0.0011	0.0013	0.0017
12	0.2605	0.5276	2742	0.0007	0.0008	0.0011	0.0012	0.0014	0.0018
13	0.2582	0.5266	2795	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015
14	0.2628	0.5287	2689	0.0007	0.0007	0.0010	0.0011	0.0013	0.0016
15	0.2603	0.5281	2743	0.0006	0.0006	0.0009	0.0009	0.0012	0.0015
16	0.2607	0.5268	2741	0.0005	0.0006	0.0009	0.0009	0.0012	0.0015
17	0.2599	0.5304	2741	0.0009	0.0009	0.0011	0.0012	0.0014	0.0017
18	0.2622	0.5303	2694	0.0008	0.0006	0.0009	0.0008	0.0010	0.0015
19	0.2606	0.5242	2753	0.0002	0.0006	0.0009	0.0011	0.0012	0.0015
20	0.2604	0.5281	2741	0.0006	0.0008	0.0011	0.0010	0.0013	0.0016
21	0.2606	0.5275	2740	0.0006	0.0006	0.0009	0.0010	0.0012	0.0015
22	0.2593	0.5283	2764	0.0006	0.0006	0.0009	0.0009	0.0012	0.0014
23	0.2614	0.5302	2710	0.0007	0.0004	0.0008	0.0008	0.0010	0.0013
24	0.2610	0.5308	2717	0.0008	0.0006	0.0009	0.0010	0.0012	0.0015
25	0.2603	0.5262	2750	0.0004	0.0006	0.0009	0.0010	0.0012	0.0015
Ave.	0.2603	0.5276	2744	0.0006	0.0007	0.0010	0.0011	0.0013	0.0016
Med.	0.2604	0.5280	2742	0.0006	0.0006	0.0009	0.0010	0.0013	0.0016
st dev	0.0012	0.0020	30.9194	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2582	0.5239	2689	0.0002	0.0004	0.0008	0.0008	0.0010	0.0013
Max.	0.2628	0.5308	2796	0.0010	0.0012	0.0014	0.0015	0.0018	0.0021



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

No.	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	133.7	100.07	99.63	99.18	98.80	98.43	97.98
27	134.9	100.22	99.78	99.26	98.59	98.15	97.70
28	136.1	99.85	99.41	98.97	98.46	98.02	97.50
29	134.6	100.22	99.70	99.18	98.66	98.14	97.62
30	136.9	100.29	99.85	99.42	98.90	98.32	97.88
31	136.6	100.37	100.07	99.71	99.27	98.90	98.39
32	134.9	100.30	99.93	99.48	99.04	98.44	98.00
33	136.7	100.22	99.71	99.34	98.98	98.46	97.88
34	133.7	100.30	99.93	99.48	99.03	98.58	98.13
35	133.8	100.30	99.85	99.33	98.80	98.43	97.83
36	133.7	100.15	99.93	99.55	98.88	98.43	97.91
37	134.0	100.30	99.85	99.40	98.88	98.36	97.84
38	133.3	100.30	99.92	99.47	98.95	98.42	97.97
39	135.2	100.07	99.56	99.11	98.59	98.08	97.56
40	134.3	100.15	99.78	99.33	98.73	98.29	97.69
41	136.8	100.37	99.93	99.49	99.05	98.39	97.88
42	133.6	100.45	100.07	99.63	99.18	98.65	98.20
43	133.6	100.07	99.55	99.18	98.73	98.43	97.98
44	133.7	99.85	99.40	98.95	98.43	97.98	97.61
45	135.1	99.93	99.48	98.96	98.45	98.00	97.56
46	135.2	100.15	99.70	99.26	98.82	98.22	97.71
47	134.3	100.30	99.85	99.55	99.18	98.66	98.06
48	133.4	100.07	99.70	99.33	98.88	98.43	98.05
49	136.4	100.29	99.78	99.34	98.97	98.53	98.09
50	136.7	99.93	99.49	99.12	98.83	98.24	97.88
Ave.	134.8	100.18	99.75	99.32	98.84	98.36	97.88
Med.	134.6	100.22	99.78	99.33	98.88	98.42	97.88
st dev	1.2517	0.1643	0.1920	0.2045	0.2272	0.2232	0.2209
Min.	133.3	99.85	99.40	98.95	98.43	97.98	97.50
Max.	136.9	100.45	100.07	99.71	99.27	98.90	98.39

TM-21 Projection:

Test Duration: 6000 hours

Failures Observed: 0

α: 4.669E-06

β: 1.007

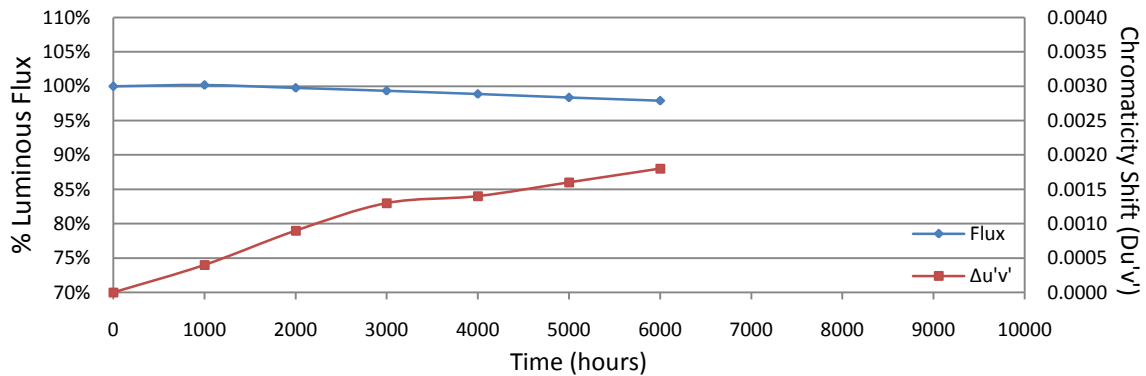
Reported L₇₀: >36000 hours

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

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	6.469	6.505	6.514	6.453	6.445	6.444	6.451
27	6.514	6.642	6.571	6.500	6.505	6.502	6.507
28	6.434	6.498	6.571	6.415	6.413	6.425	6.417
29	6.515	6.518	6.559	6.506	6.509	6.509	6.508
30	6.453	6.520	6.495	6.439	6.436	6.436	6.443
31	6.494	6.505	6.557	6.485	6.504	6.592	6.487
32	6.502	6.555	6.601	6.490	6.496	6.495	6.494
33	6.316	6.307	6.406	6.304	6.306	6.312	6.310
34	6.523	6.516	6.638	6.514	6.516	6.518	6.517
35	6.385	6.381	6.446	6.370	6.376	6.374	6.374
36	6.474	6.486	6.579	6.470	6.472	6.474	6.471
37	6.482	6.559	6.576	6.451	6.449	6.450	6.453
38	6.425	6.513	6.518	6.409	6.415	6.417	6.414
39	6.518	6.594	6.637	6.501	6.503	6.509	6.508
40	6.485	6.589	6.440	6.477	6.478	6.481	6.476
41	6.491	6.611	6.636	6.481	6.480	6.495	6.485
42	6.465	6.545	6.565	6.451	6.457	6.458	6.454
43	6.458	6.570	6.498	6.428	6.431	6.434	6.431
44	6.469	6.598	6.493	6.440	6.436	6.441	6.440
45	6.495	6.608	6.517	6.440	6.442	6.440	6.443
46	6.431	6.513	6.508	6.412	6.411	6.412	6.411
47	6.475	6.518	6.573	6.468	6.475	6.471	6.466
48	6.539	6.520	6.603	6.530	6.527	6.531	6.526
49	6.331	6.372	6.397	6.301	6.298	6.302	6.303
50	6.557	6.604	6.570	6.422	6.424	6.428	6.423
Ave.	6.468	6.526	6.539	6.446	6.448	6.454	6.448
Med.	6.475	6.520	6.559	6.451	6.449	6.450	6.453
st dev	0.0577	0.0786	0.0676	0.0576	0.0586	0.0638	0.0571
Min.	6.316	6.307	6.397	6.301	6.298	6.302	6.303
Max.	6.557	6.642	6.638	6.530	6.527	6.592	6.526

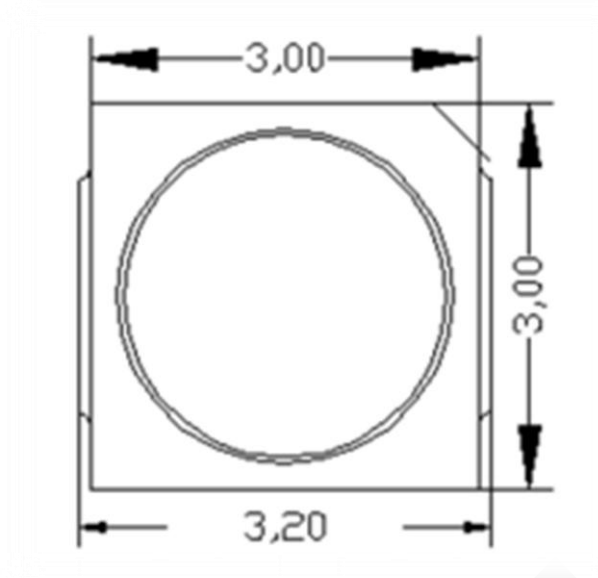
3.6 Data Set 2, 105°C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs
26	0.2596	0.5304	2749	0.0007	0.0009	0.0011	0.0012	0.0015	0.0017
27	0.2615	0.5266	2725	0.0005	0.0009	0.0013	0.0014	0.0016	0.0018
28	0.2580	0.5247	2808	0.0003	0.0009	0.0012	0.0015	0.0015	0.0017
29	0.2617	0.5302	2704	0.0006	0.0008	0.0012	0.0013	0.0014	0.0017
30	0.2597	0.5284	2755	0.0004	0.0009	0.0013	0.0013	0.0016	0.0018
31	0.2581	0.5242	2808	0.0003	0.0011	0.0015	0.0017	0.0017	0.0020
32	0.2593	0.5226	2788	0.0001	0.0009	0.0013	0.0016	0.0016	0.0018
33	0.2622	0.5287	2701	0.0004	0.0010	0.0014	0.0015	0.0017	0.0018
34	0.2612	0.5306	2713	0.0006	0.0009	0.0012	0.0014	0.0015	0.0017
35	0.2610	0.5270	2732	0.0003	0.0010	0.0014	0.0015	0.0016	0.0018
36	0.2603	0.5265	2749	0.0002	0.0009	0.0013	0.0013	0.0016	0.0017
37	0.2597	0.5249	2770	0.0002	0.0009	0.0013	0.0015	0.0016	0.0018
38	0.2591	0.5283	2767	0.0005	0.0009	0.0013	0.0013	0.0015	0.0017
39	0.2600	0.5289	2745	0.0006	0.0009	0.0013	0.0013	0.0015	0.0017
40	0.2612	0.5285	2722	0.0005	0.0009	0.0012	0.0013	0.0014	0.0017
41	0.2577	0.5274	2802	0.0005	0.0009	0.0013	0.0015	0.0017	0.0018
42	0.2607	0.5275	2736	0.0004	0.0009	0.0012	0.0013	0.0014	0.0017
43	0.2599	0.5282	2751	0.0006	0.0009	0.0013	0.0014	0.0015	0.0017
44	0.2604	0.5305	2731	0.0007	0.0009	0.0013	0.0014	0.0015	0.0017
45	0.2604	0.5230	2764	0.0004	0.0011	0.0015	0.0017	0.0018	0.0021
46	0.2609	0.5256	2741	0.0003	0.0009	0.0013	0.0015	0.0016	0.0018
47	0.2596	0.5260	2768	0.0004	0.0010	0.0014	0.0016	0.0017	0.0019
48	0.2593	0.5291	2759	0.0005	0.0008	0.0012	0.0013	0.0014	0.0016
49	0.2594	0.5255	2773	0.0002	0.0009	0.0012	0.0013	0.0015	0.0017
50	0.2585	0.5246	2797	0.0002	0.0011	0.0014	0.0015	0.0017	0.0019
Ave.	0.2600	0.5271	2754	0.0004	0.0009	0.0013	0.0014	0.0016	0.0018
Med.	0.2599	0.5274	2751	0.0004	0.0009	0.0013	0.0014	0.0016	0.0017
st dev	0.0012	0.0023	30.7865	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2577	0.5226	2701	0.0001	0.0008	0.0011	0.0012	0.0014	0.0016
Max.	0.2622	0.5306	2808	0.0007	0.0011	0.0015	0.0017	0.0018	0.0021



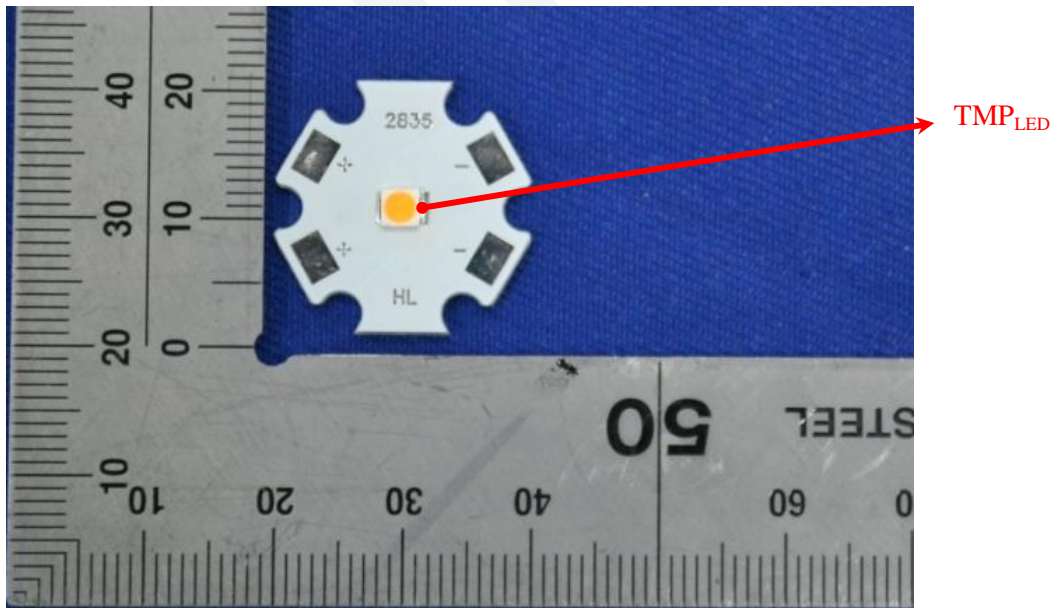
4 - EUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 EUT Photo



*****END OF REPORT*****