





# TEST REPORT

ACCORDING TO IES LM-80-2015  
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-ES-3032DW-3C-S1-HR3**

<b>Report Type:</b> 9000 Hours Test Report		<b>Product Type:</b> LED Package	
<b>Test Engineer:</b>	Pote Wang 		
<b>Report Number:</b>	RSZ160804502-10-M1		
<b>Test Date:</b>	2016-08-07 to 2017-08-27		
<b>Report Date:</b>	2019-01-14		
<b>Revised Note:</b>	The previous report RSZ160804502-10 is replaced by this report on 2019-01-14		
<b>Reviewed By:</b>	Daniel Duan / EE Manager 		
<b>Test Facility:</b>	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, 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:

75 PCS samples were received on 2016-08-04. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Part Number:	HL-ES-3032DW-3C-S1-HR3
Part Type:	LED Package
Drive Level:	CC 150mA
Nominal CCT:	2700K
Power:	1.62W
Average Current Density per LED die:	639.31mA/mm <sup>2</sup>
Average Power Density per LED die:	2.3 W/mm <sup>2</sup>
CRI:	80
Die Spacing:	0.15mm

#### 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)

Testing Products	Multiple Models	Details
HL-ES-3032DW-3C-S1-HR3	HL-ES-3032DW-3C-S1-HR3(R9)	Only different Model name for different market.
	HL-ES-PU3032DW-3C-S1-HR3	
	HL-ES-PU3032DW-3C-S1-HR3(R9)	
	HL-ES-3032HW-3C-S1-HR3	
	HL-ES-3032HW-3C-S1-HR3(R9)	
	HL-ES-PU3032HW-3C-S1-HR3	
	HL-ES-PU3032HW-3C-S1-HR3(R9)	

#### Disclaimer:

The truthfulness and accuracy of all the technical information above for the covered LED products is ensured by manufacturer of LED light source. Bay Area Compliance Laboratories any guarantees for the truthfulness of the technical information.

## 1.2 Standards Used:

IESNA 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	Test Range	Calibration date	Calibration due date
0.3m integrating sphere	EVERFINE	Diameter 0.3m	1011119	0.3m	2017-03-09	2018-03-09
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2017-03-03	2018-03-03
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2017-03-09	2018-03-09
Standard Light Source	EVERFINE	D062	1011093	3000K	2016-09-13	2017-09-13
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987CJ73 21114	300VA	2017-03-03	2018-03-03
Multilayer aging machine	BACL	B3-900	20030	25°C~130°C	2017-03-03	2018-03-03
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090005	(50V/15A)	2017-03-03	2018-03-03

## 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  $\pm 3\%$  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 <sup>LED)</sup> 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  $2^{\circ}C$  below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to  $5^{\circ}C$  below the corresponding

nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and

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 Photometric Measurement Method and Uncertainty**

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate  $uv$ . 2 measurement was used and sample was driven by DC power supply. Luminous flux and chromaticity coordinate was scaled by halogen reference lamp. The ambient temperature during test was set to  $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , RH <65%.

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-3C-S1-HR3  
Number of Units: 30  
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-3C-S1-HR3  
Number of Units: 30  
Case Temperature: >103°C  
Ambient Temperature: >100°C  
Life Test Drive Current: 150mA  
Measurement Current: 150mA

### Data Set 3: 115°C,150mA

Part Number: HL-ES-3032DW-3C-S1-HR3  
Number of Units: 30  
Case Temperature: >113°C  
Ambient Temperature: >110°C  
Life Test Drive Current: 150mA  
Measurement Current: 150mA



### 3 - Test Data

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

No.	0hr(Initial)	Lumen Maintenance (%)								
		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	192.6	100.31	100.10	99.74	99.48	99.22	98.91	98.70	98.44	98.08
2	185.6	100.38	100.22	99.89	99.78	99.68	99.52	99.25	99.03	98.81
3	190.1	100.47	100.11	99.79	99.63	99.37	99.16	98.90	98.84	98.58
4	188.8	100.16	99.89	99.63	99.31	99.10	98.73	98.46	98.20	98.04
5	190.1	100.26	99.84	99.47	99.37	99.16	98.84	98.53	98.26	98.00
6	186.8	100.48	100.32	100.21	100.05	99.73	99.46	99.41	99.25	98.88
7	185.8	100.43	100.22	99.89	99.68	99.46	99.25	99.09	98.92	98.76
8	188.5	100.27	99.89	99.63	99.31	99.10	98.94	98.67	98.41	98.30
9	186.5	100.11	99.79	99.41	99.14	98.93	98.55	98.18	97.91	97.53
10	190.9	100.31	100.10	99.84	99.58	99.32	99.00	98.85	98.59	98.22
11	189.2	100.21	99.89	99.68	99.52	99.31	99.05	98.78	98.57	98.31
12	188.6	100.32	100.05	99.79	99.42	99.15	98.83	98.41	98.25	98.09
13	187.4	100.37	100.16	99.95	99.79	99.63	99.36	99.15	99.04	98.93
14	188.4	100.21	99.95	99.63	99.31	99.04	98.78	98.46	98.20	97.98
15	189.3	100.42	100.05	99.68	99.42	99.00	98.73	98.47	98.15	97.89
16	186.2	100.16	99.79	99.41	99.03	98.76	98.44	98.12	97.96	97.74
17	191.0	100.26	99.90	99.63	99.37	99.16	98.95	98.69	98.48	98.22
18	187.4	100.32	100.11	99.84	99.41	99.20	98.88	98.72	98.45	98.24
19	188.2	100.27	99.95	99.73	99.42	99.10	98.83	98.57	98.41	98.09

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

No.			CCT(K)										
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	
1	0.2568	0.5288	2816	0.0005	0.0008	0.0011	0.0012	0.0015	0.0017	0.0019	0.0020	0.0023	
2	0.2598	0.5296	2747	0.0002	0.0006	0.0009	0.0010	0.0014	0.0016	0.0018	0.0019	0.0023	
3	0.2579	0.5279	2796	0.0003	0.0006	0.0009	0.0011	0.0013	0.0016	0.0017	0.0018	0.0021	
4	0.2575	0.5269	2809	0.0002	0.0005	0.0008	0.0012	0.0013	0.0016	0.0017	0.0018	0.0021	
5	0.2566	0.5265	2830	0.0002	0.0005	0.0009	0.0010	0.0013	0.0016	0.0018	0.0018	0.0020	
6	0.2595	0.5293	2754	0.0002	0.0005	0.0009	0.0010	0.0013	0.0015	0.0017	0.0016	0.0019	
7	0.2564	0.5281	2826	0.0003	0.0006	0.0010	0.0013	0.0014	0.0018	0.0019	0.0021	0.0022	
8	0.2549	0.5293	2854	0.0002	0.0005	0.0007	0.0011	0.0013	0.0016	0.0017	0.0019	0.0020	
9	0.2607	0.5298	2728	0.0002	0.0005	0.0007	0.0011	0.0013	0.0015	0.0017	0.0018	0.0019	
10	0.2576	0.5283	2797	0.0002	0.0005	0.0007	0.0011	0.0013	0.0015	0.0017	0.0018	0.0021	
11	0.2576	0.5283	2797	0.0002	0.0005	0.0007	0.0011	0.0013	0.0015	0.0017	0.0018	0.0021	
12	0.2576	0.5283	2797	0.0002	0.0005	0.0007	0.0011	0.0013	0.0015	0.0017	0.0018	0.0021	
13	0.2584	0.5300	2775	0.0003	0.0006	0.0010	0.0013	0.0014	0.0017	0.0019	0.0021	0.0024	
14	0.2563	0.5283	2828	0.0002	0.0005	0.0007	0.0011	0.0013	0.0015	0.0018	0.0019	0.0021	
15	0.2578	0.5270	2803	0.0003	0.0006	0.0009	0.0011	0.0014	0.0016	0.0019	0.0021	0.0022	
16	0.2577	0.5273	2803	0.0002	0.0005	0.0007	0.0010	0.0012	0.0015	0.0017	0.0020	0.0022	
17	0.2556	0.5280	2845	0.0002	0.0006	0.0009	0.0011	0.0013	0.0016	0.0018	0.0021	0.0023	
18	0.2576	0.5283	2797	0.0002	0.0005	0.0007	0.0011	0.0013	0.0015	0.0017	0.0018	0.0021	
19	0.2579	0.5265	2801	0.0002	0.0006	0.0008	0.0011	0.0014	0.0016	0.0018	0.0020		

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

No.	Ohr(Initial)	Lumen Maintenance (%)								
		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	189.0	100.21	99.84	99.42	99.10	98.84	98.52	98.15	97.94	97.72
32	186.0	100.16	99.78	99.52	99.14	98.82	98.60	98.17	97.90	97.69
33	189.4	100.11	99.74	99.21	98.79	98.47	98.26	97.94	97.78	97.62
34	187.0	100.16	99.73	99.30	98.93	98.72	98.45	98.02	97.75	97.43
35	186.1	100.21	99.84	99.36	99.03	98.71	98.44	98.17	97.90	97.47
36	190.9	100.05	99.90	99.42	99.06	98.85	98.64	98.32	98.06	97.70
37	189.5	100.11	99.89	99.63	99.37	98.89	98.63	98.21	97.89	97.63
38	188.3	99.95	99.58	99.31	99.10	98.78	98.62	98.25	97.82	97.50
39	189.2	100.21	99.84	99.37	99.05	98.63	98.41	98.31	97.89	97.62
40	191.6	100.16	99.74	99.37	99.06	98.70	98.38	98.17	97.96	97.44
41	184.4	100.22	99.84	99.35	99.08	98.92	98.54	98.26	98.05	97.83
42	190.7	100.16	99.90	99.48	99.16	98.85	98.48	98.11	97.80	97.59
43	183.4	100.05	99.78	99.62	99.18	98.85	98.53	98.26	97.87	97.38
44	187.5	100.11	99.63	99.31	99.04	98.72	98.35	98.24	97.87	97.44
45	190.3	100.16	99.79	99.42	99.16	98.84	98.42	98.16	97.95	97.69
46	186.2	100.27	99.84	99.52	99.19	98.98	98.50	98.23	98.12	97.91
47	186.8	100.05	99.79	99.46	99.14	98.82	98.45	98.07	97.75	97.43
48	185.9	100.16	99.78	99.62	99.25	99.09	98.82	98.44	98.22	97.96
49	193.4	100.05	99.69	99.33	98.97	98.71	98.29	98.04	97.72	97.47
50	186.4	100.21	99.89	99.62	99.30	99.09	98.82	98.66	98.34	98.12
51	185.1	100.05	99.78	99.51	99.19	98.97	98.65	98.54	98.38	98.11
52	186.4	100.16	99.84	99.52	99.30	99.03	98.82	98.66	98.44	98.12
53	185.4	100.05	99.68	99.41	99.08	98.76	98.44	98.06	97.84	97.68
54	189.6	100.16	99.89	99.58	99.16	98.95	98.68	98.42	98.26	98.00
55	187.8	99.95	99.63	99.31	99.15	98.83	98.56	98.35	98.19	97.87
56	189.1	100.16	99.74	99.26	98.84	98.47	98.10	97.78	97.51	97.36
57	189.1	100.26	99.95	99.68	99.37	99.00	98.68	98.31	98.04	97.78
58	187.4	100.16	99.84	99.63	99.36	99.04	98.61	98.29	97.97	97.76
59	188.1	100.27	99.89	99.57	99.31	98.94	98.62	98.35	98.03	97.71
60	187.9	100.16	99.73	99.47	99.10	98.78	98.46	98.24	97.92	97.71
Ave.	187.9	100.14	99.79	99.45	99.13	98.83	98.52	98.24	97.97	97.69
Med.	187.9	100.16	99.79	99.44	99.14	98.84	98.52	98.24	97.93	97.69
st dev	2.2550	0.0835	0.0918	0.1293	0.1434	0.1567	0.1657	0.1909	0.2101	0.2232
Min.	183.4	99.95	99.58	99.21	98.79	98.47	98.10	97.78	97.51	97.36
Max.	193.4	100.27	99.95	99.68	99.37	99.09	98.82	98.66	98.44	98.12

TM-21 Projection:

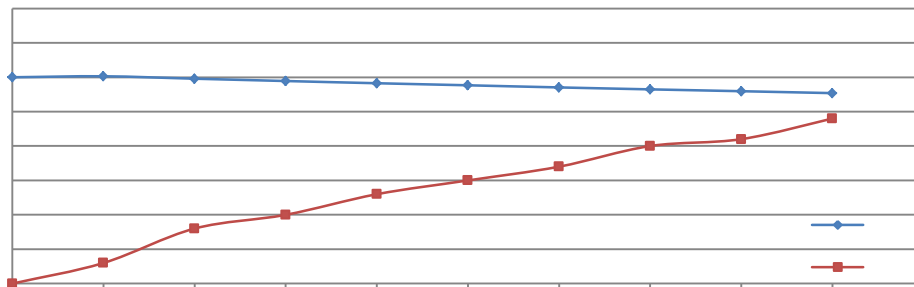
**Test Duration:** 9,000 hours  
**Failures Observed:** 0  
 2.921E-06  
 1.003  
**Reported L<sub>70</sub>:** >54,000 hours

### 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
31	9.410	9.413	9.414	9.428	9.442	9.448	9.425	9.401	9.414	9.402
32	9.375	9.377	9.383	9.389	9.393	9.410	9.395	9.378	9.385	9.377
33	9.398	9.405	9.407	9.420	9.418	9.434	9.414	9.398	9.414	9.394
34	9.382	9.382	9.383	9.400	9.406	9.415	9.406	9.383	9.385	9.383
35	9.417	9.413	9.421	9.436	9.432	9.456	9.433	9.414	9.414	9.417
36	9.446	9.439	9.449	9.459	9.465	9.478	9.482	9.438	9.446	9.441
37	9.352	9.348	9.355	9.358	9.358	9.384	9.361	9.339	9.351	9.341
38	9.393	9.401	9.408	9.410	9.418	9.428	9.418	9.389	9.396	9.391
39	9.448	9.451	9.457	9.463	9.466	9.486	9.456	9.442	9.445	9.441
40	9.434	9.442	9.445	9.454	9.449	9.466	9.451	9.436	9.436	9.439
41	9.409	9.407	9.413	9.419	9.423	9.435	9.429	9.406	9.401	9.408
42	9.432	9.440	9.450	9.451	9.458	9.480	9.454	9.435	9.436	9.444
43	9.403	9.394	9.409	9.423	9.413	9.425	9.413	9.394	9.400	9.406
44	9.434	9.439	9.442	9.463	9.454	9.477	9.450	9.430	9.434	9.426
45	9.520	9.443	9.445	9.461	9.457	9.476	9.459	9.435	9.429	9.428
46	9.562	9.489	9.494	9.505	9.499	9.515	9.494	9.474	9.475	9.483
47	9.472	9.480	9.486	9.499	9.496	9.510	9.485	9.460	9.470	9.457
48	9.534	9.466	9.465	9.478	9.480	9.495	9.468	9.451	9.485	9.447
49	9.543	9.544	9.549	9.558	9.556	9.572	9.548	9.540	9.540	9.537
50	9.508	9.434	9.444	9.458	9.460	9.475	9.441	9.443	9.444	9.425
51	9.532	9.447	9.452	9.465	9.464	9.471	9.449	9.441	9.436	9.430
52	9.558	9.466	9.470	9.478	9.480	9.501	9.478	9.462	9.463	9.462
53	9.873	9.473	9.471	9.494	9.488	9.511	9.478	9.461	9.467	9.453
54	9.529	9.378	9.387	9.399	9.403	9.411	9.384	9.366	9.369	9.369
55	9.569	9.426	9.428	9.443	9.444	9.454	9.439	9.413	9.422	9.411
56	9.509	9.510	9.521	9.529	9.527	9.558	9.522	9.504	9.508	9.506
57	9.519	9.381	9.378	9.398	9.405	9.408	9.386	9.370	9.378	9.366
58	9.577	9.433	9.428	9.453	9.451	9.475	9.435	9.428	9.429	9.428
59	9.509	9.422	9.434	9.439	9.439	9.454	9.431	9.412	9.424	9.420
60	9.507	9.420	9.417	9.438	9.447	9.459	9.420	9.404	9.409	9.411
Ave.	9.485	9.432	9.437	9.449	9.450	9.466	9.443	9.425	9.430	9.425
Med.	9.490	9.434	9.438	9.452	9.450	9.469	9.440	9.429	9.429	9.426
st dev	0.0986	0.0423	0.0425	0.0427	0.0409	0.0431	0.0406	0.0417	0.0411	0.0410
Min.	9.352	9.348	9.355	9.358	9.358	9.384	9.361	9.339	9.351	9.341
Max.	9.873	9.544	9.549	9.558	9.556	9.572	9.548	9.540	9.540	9.537

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

No.	CCT(K)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	
	Ohr(Initial)											
31	0.2583	0.5285	2783	0.0003	0.0008	0.0012	0.0014	0.0015	0.0019	0.0020	0.0021	0.0025
32	0.2563	0.5287	2826	0.0002	0.0008	0.0011	0.0014	0.0015	0.0017	0.0020	0.0020	0.0024
33	0.2568	0.5273	2822	0.0004	0.0008	0.0010	0.0013	0.0016	0.0017	0.0020	0.0021	0.0024
34	0.2582	0.5288	2785	0.0002	0.0007	0.0009	0.0013	0.0014	0.0016	0.0019	0.0021	0.0023
35	0.2561	0.5277	2835	0.0002	0.0007	0.0009	0.0013	0.0014	0.0016	0.0019	0.0021	0.0023
36	0.2569	0.5268	2823	0.0004	0.0008	0.0011	0.0014	0.0015	0.0018	0.0020	0.0022	0.0025
37	0.2579	0.5291	2789	0.0003	0.0008	0.0010	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023
38	0.2574	0.5285	2803	0.0003	0.0008	0.0010	0.0013	0.0015	0.0018	0.0020	0.0022	0.0024
39	0.2572	0.5279	2811	0.0004	0.0008	0.0010	0.0013	0.0015	0.0018	0.0020	0.0022	0.0024
40	0.2566	0.5266	2831	0.0002	0.0007	0.0010	0.0012	0.0015	0.0017	0.0019	0.0022	0.0023
41	0.2591	0.5284	2766	0.0003	0.0008	0.0010	0.0013	0.0016	0.0018	0.0020	0.0022	0.0024
42	0.2579	0.5267	2802	0.0003	0.0007	0.0010	0.0013	0.0015	0.0017	0.0020	0.0022	0.0024
43	0.2584	0.5266	2790	0.0002	0.0007	0.0009	0.0012	0.0015	0.0017	0.0019	0.0022	0.0023
44	0.2572	0.5269	2816	0.0003	0.0008	0.0010	0.0013	0.0015	0.0017	0.0020	0.0022	0.0025
45	0.2567	0.5272	2825	0.0002	0.0007	0.0009	0.0012	0.0014	0.0016	0.0019	0.0021	0.0024
46	0.2597	0.5288	2752	0.0003	0.0007	0.0009	0.0012	0.0015	0.0016	0.0019	0.0022	0.0023
47	0.2565	0.5271	2830	0.0004	0.0008	0.0010	0.0013	0.0015	0.0017	0.0020	0.0022	0.0025
48	0.2577	0.5292	2794	0.0003	0.0008	0.0010	0.0013	0.0015	0.0017	0.0020	0.0023	0.0025
49	0.2553	0.5268	2859	0.0004	0.0009	0.0011	0.0013	0.0015	0.0018	0.0020	0.0022	0.0024
50	0.2572	0.5290	2805	0.0003	0.0007	0.0012	0.0014	0.0015	0.0017	0.0019	0.0022	0.0024
51	0.2590	0.5281	2770	0.0004	0.0008	0.0010	0.0013	0.0015	0.0017	0.0020	0.0022	0.0025
52	0.2584	0.5306	2772	0.0002	0.0007	0.0009	0.0011	0.0014	0.0017	0.0018	0.0022	0.0022
53	0.2582	0.5268	2793	0.0003	0.0007	0.0009	0.0013	0.0014	0.0017	0.0019	0.0021	0.0023
54	0.2562	0.5272	2836	0.0004	0.0008	0.0010	0.0014	0.0015	0.0018	0.0020	0.0022	0.0023
55	0.2572	0.5289	2806	0.0003	0.0007	0.0010	0.0012	0.0014	0.0017	0.0019	0.0022	0.0023
56	0.2581	0.5269	2796	0.0003	0.0007	0.0009	0.0013	0.0014	0.0017	0.0019	0.0021	0.0023
57	0.2569	0.5267	2824	0.0003	0.0009	0.0010	0.0013	0.0015	0.0019	0.0021	0.0022	0.0025
58	0.2583	0.5287	2783	0.0003	0.0007	0.0009	0.0013	0.0014	0.0017	0.0019	0.0021	0.0024
59	0.2551	0.5285	2854	0.0003	0.0007	0.0010	0.0012	0.0014	0.0017	0.0019	0.0022	0.0023
60	0.2593	0.5295	2758	0.0002	0.0008	0.0010	0.0012	0.0015	0.0018	0.0020	0.0022	0.0024
Ave.	0.2575	0.5280	2805	0.0003	0.0008	0.0010	0.0013	0.0015	0.0017	0.0020	0.0021	0.0024
Med.	0.2573	0.5280	2804	0.0003	0.0008	0.0010	0.0013	0.0015	0.0017	0.0020	0.0022	0.0024
st dev	0.0011	0.0011	27.2340	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2551	0.5266	2752	0.0002	0.0007	0.0009	0.0011	0.0014	0.0016	0.0018	0.0020	0.0022
Max.	0.2597	0.5306	2859	0.0004	0.0009	0.0012	0.0014	0.0016	0.0019	0.0021	0.0023	0.0025



### 3.7 Data Set 3, 115°C, 150mA (Lumen Maintenance)

No.	Ohr(Initial)	Lumen Maintenance (%)								
		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
61	186.6	99.95	99.57	99.20	98.87	98.55	98.29	97.96	97.70	97.53
62	189.6	99.84	99.47	99.05	98.58	98.36	98.10	97.89	97.57	97.26
63	185.4	100.11	99.46	99.14	98.65	98.27	97.90	97.63	97.52	97.25
64	185.7	99.89	99.41	98.87	98.55	98.28	97.79	97.52	97.20	96.98
65	188.1	100.11	99.63	99.10	98.72	98.30	97.87	97.66	97.40	97.24
66	188.5	99.95	99.68	99.10	98.62	98.14	97.77	97.35	97.08	96.71
67	189.2	100.16	99.58	99.15	98.73	98.36	97.89	97.46	97.15	96.83
68	185.7	100.05	99.62	99.25	98.82	98.38	98.12	97.68	97.36	97.09
69	185.2	99.95	99.51	98.97	98.43	98.06	97.79	97.46	97.14	96.76
70	188.2	99.84	99.47	99.15	98.83	98.51	98.19	97.93	97.72	97.34
71	187.1	100.05	99.57	99.14	98.82	98.56	98.18	97.97	97.65	97.22
72	187.1	99.95	99.47	99.09	98.72	98.50	98.13	97.86	97.59	97.33
73	188.8	99.84	99.31	98.89	98.52	98.25	98.04	97.72	97.46	97.19
74	185.6	99.95	99.41	98.98	98.60	98.38	98.01	97.74	97.47	97.20
75	190.4	99.84	99.37	98.90	98.48	98.27	97.79	97.43	97.06	96.69
76	188.9	100.05	99.74	99.36	98.94	98.57	98.36	98.09	97.72	97.46
77	186.6	100.16	99.57	99.30	98.82	98.29	98.02	97.70	97.53	97.21
78	189.4	99.84	99.47	99.21	98.79	98.36	97.84	97.47	97.15	96.94
79	186.2	100.05	99.52	99.09	98.87	98.50	98.07	97.58	97.31	97.05
80	186.9	99.95	99.52	98.93	98.56	98.23	97.91	97.54	97.27	97.06
81	186.7	100.05	99.46	99.09	98.61	98.29	97.91	97.59	97.21	96.95
82	183.0	99.89	99.51	99.18	98.63	98.25	97.92	97.54	97.10	96.72
83	191.3	99.90	99.48	99.06	98.69	98.27	98.12	97.75	97.44	97.07
84	187.7	99.89	99.57	99.09	98.67	98.24	98.03	97.76	97.60	97.12
85	188.4	99.95	99.58	99.15	98.78	98.30	98.04	97.66	97.29	97.03
86	189.2	99.68	99.15	98.73	98.31	97.89	97.46	97.25	96.93	96.41
87	187.3	100.11	99.68	99.36	98.99	98.56	98.29	97.92	97.76	97.28
88	186.9	100.16	99.73	99.25	98.88	98.56	98.29	98.07	97.86	97.70
89	185.5	100.11	99.57	99.08	98.71	98.54	98.11	97.90	97.57	97.04
90	188.6	100.05	99.52	99.20	98.73	98.52	98.25	97.93	97.56	97.24
Ave.	187.5	99.98	99.52	99.10	98.70	98.35	98.02	97.70	97.41	97.10
Med.	187.2	99.95	99.52	99.10	98.71	98.33	98.03	97.69	97.45	97.11
st dev	1.7930	0.1198	0.1216	0.1453	0.1562	0.1644	0.1982	0.2185	0.2438	0.2730
Min.	183.0	99.68	99.15	98.73	98.31	97.89	97.46	97.25	96.93	96.41
Max.	191.3	100.16	99.74	99.36	98.99	98.57	98.36	98.09	97.86	97.70

TM-21 Projection:

**Test Duration:** 9,000 hours

**Failures Observed:** 0

3.251E-06

1.000

**Reported L<sub>70</sub>:** >54,000 hours

### 3.8 Data Set 3, 115°C, 150mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
61	9.519	9.437	9.446							

FINAL

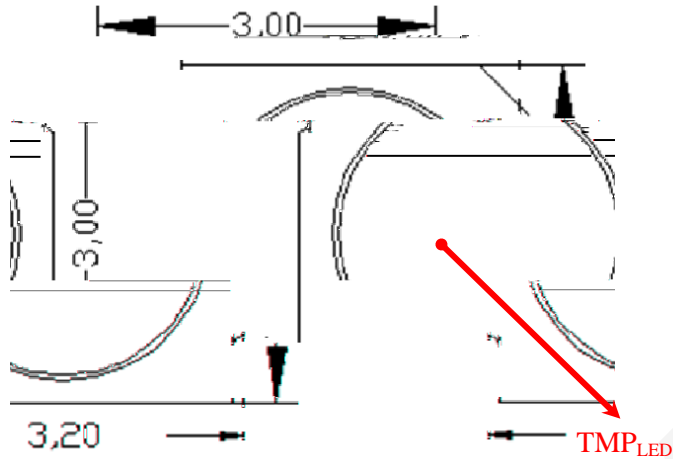
### 3.9 Data Set 3, 115°C, 150mA (Chromaticity Shift)

No.			CCT(K)										
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	
61	0.2589	0.5278	2774	0.0004	0.0009	0.0013	0.0016	0.0017	0.0020	0.0022	0.0022	0.0026	
62	0.2585	0.5296	2775	0.0004	0.0009	0.0011	0.0015	0.0017	0.0019	0.0022	0.0022	0.0026	
63	0.2582	0.5286	2785	0.0004	0.0009	0.0012	0.0016	0.0018	0.0019	0.0022	0.0023	0.0024	
64	0.2586	0.5283	2779	0.0004	0.0010	0.0013	0.0016	0.0018	0.0019	0.0021	0.0023	0.0027	
65	0.2569	0.5283	2816	0.0005	0.0010	0.0012	0.0015	0.0017	0.0020	0.0022	0.0022	0.0025	
66	0.2587	0.5288	2774	0.0004	0.0009	0.0012	0.0015	0.0017	0.0019	0.0022	0.0024	0.0025	
67	0.2576	0.5290	2797	0.0004	0.0009	0.0011	0.0015	0.0017	0.0019	0.0022	0.0024	0.0026	
68	0.2584	0.5293	2779	0.0004	0.0009	0.0012	0.0015	0.0017	0.0019	0.0022	0.0024	0.0026	
69	0.2556	0.5288	2840	0.0003	0.0009	0.0011	0.0014	0.0016	0.0018	0.0019	0.0022	0.0022	
70	0.2584	0.5294	2776	0.0005	0.0010	0.0012	0.0016	0.0018	0.0019	0.0021	0.0024	0.0026	
71	0.2582	0.5294	2782	0.0004	0.0009	0.0011	0.0015	0.0017	0.0018	0.0020	0.0024	0.0026	
72	0.2576	0.5275	2803	0.0006	0.0009	0.0009	0.0012	0.0017	0.0018	0.0021	0.0024	0.0026	
73	0.2569	0.5281	2816	0.0005	0.0010	0.0012	0.0016	0.0017	0.0019	0.0021	0.0025	0.0027	
74	0.2578	0.5299	2788	0.0004	0.0009	0.0012	0.0014	0.0016	0.0018	0.0020	0.0024	0.0026	
75	0.2558	0.5271	2845	0.0005	0.0009	0.0012	0.0016	0.0016	0.0018	0.0021	0.0025	0.0027	
76	0.2561	0.5273	2837	0.0004	0.0009	0.0011	0.0014	0.0016	0.0018	0.0020	0.0023	0.0026	
77	0.2579	0.5297	2786	0.0004	0.0009	0.0012	0.0015	0.0017	0.0019	0.0021	0.0024	0.0025	
78	0.2584	0.5289	2780	0.0004	0.0009	0.0011	0.0015	0.0016	0.0018	0.0020	0.0024	0.0026	
79	0.2569	0.5279	2817	0.0006	0.0010	0.0013	0.0016	0.0018	0.0020	0.0022	0.0025	0.0027	
80	0.2588	0.5289	2771	0.0004	0.0009	0.0011	0.0015	0.0017	0.0018	0.0020	0.0023	0.0025	
81	0.2574	0.5283	2804	0.0004	0.0010	0.0012	0.0016	0.0018	0.0019	0.0022	0.0024	0.0026	
82	0.2597	0.5279	2757	0.0004	0.0009	0.0011	0.0015	0.0017	0.0019	0.0021	0.0011	0.0026	
83	0.2565	0.5271	2830	0.0005	0.0010	0.0012	0.0016	0.0018	0.0019	0.0022	0.0026	0.0027	
84	0.2561	0.5275	2836	0.0004	0.0009	0.0012	0.0016	0.0018	0.0019	0.0021	0.0025	0.0026	
85	0.2581	0.5272	2795	0.0005	0.0010	0.0012	0.0016	0.0018	0.0019	0.0022	0.0025	0.0027	
86	0.2559	0.5265	2846	0.0005	0.0009	0.0012	0.0016	0.0017	0.0018	0.0021	0.0024	0.0026	
87	0.2579	0.5291	2791	0.0005	0.0010	0.0013	0.0016	0.0019	0.0021	0.0022	0.0025	0.0031	
88	0.2581	0.5296	2783	0.0005	0.0010	0.0013	0.0016	0.0017	0.0020	0.0023	0.0025	0.0031	
89	0.2579	0.5292	2790	0.0005	0.0011	0.0014	0.0017	0.0019	0.0021	0.0025	0.0027	0.0031	
90	0.2585	0.5295	2776	0.0005	0.0012	0.0014	0.0017	0.0020	0.0021	0.0025	0.0025	0.0031	
Ave.	0.2577	0.5285	2798	0.0004	0.0010	0.0012	0.0015	0.0018	0.0019	0.0021	0.0024	0.0026	
Med.	0.2579	0.5287	2789	0.0004	0.0009	0.0012	0.0016	0.0017	0.0019	0.0021	0.0024	0.0026	
st dev	0.0011	0.0009	25.2253	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0002	
Min.	0.2556	0.5265	2757	0.0003	0.0009	0.0009	0.0012	0.0016	0.0018	0.0019			



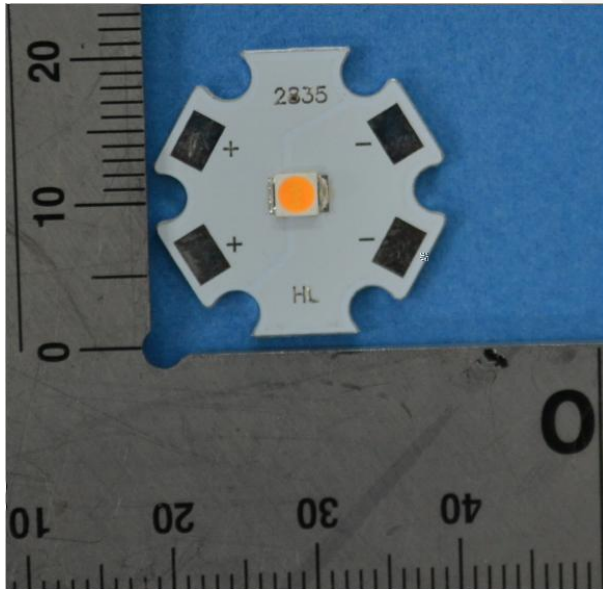
## 4 - EUT Photo

### 4.1 Mechanical Dimensions



All dimensions are in millimeter

### 4.2 EUT Photo



### 4.3 Report Revision

Report Number	Report Date	Contents
RSZ160804502-10	2017-09-04	Original report.
RSZ160804502-10-M1	2019-01-14	Update the Logo of lab on the Page1 Update Company name and address on page 1. Add DUT Characteristics on page 3 according to ENERGY STAR requirements

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