

Test Report

Report No.: SHES1107041295605

Page 1 of 10

APPLICATION FOR LUMEN MAINTENANCE TESTING ACCORDING TO THE IESNA LM-80 TEST STANDARD

Prepared for: Shen zhen Runlite Technology Co., Ltd
5F east, 3 building, Tian Fu An Industry Zone, Le ZhuJiao, Xi Xiang,
BaoAn District, ShenZhen, Guangdong Province, CHINA

Description of the submitted sample(s):

Sample Name : White SMD LED
Sample Model : YL-T3528 W-AA-60C
Ratings : 20mA, 6.5lm, 75(Ra), 6000K
State of Sample(s) : Normal
Sample Quantity : 60pcs
Manufacturer : Shen zhen Runlite Technology Co., Ltd
Reference Standard : IESNA LM-80-2008 Approved Method: Measuring Lumen Maintenance of LED Light Sources

Sample Received Date : Jul. 14, 2011
Sample Tested Date : Jul. 15, 2011 to April 23, 2012
Tested by : Kaiser Lee

Prepared by: Centre Testing International Corporation
NO.1996, Xin jin qiao Road, Pudong New District, Shanghai, 201206, China

Note: The laboratory that conducted the testing items in this report has been accredited by the National Voluntary Laboratory Accreditation Program (NVLAP LAB CODE: 200889-0), for LM-80 testing of LED Light Sources.

Reviewed by: Heven Lin, Approved by: Spring Peng, Approved date: Apr 24, 2012
Engineer Supervisor



CENTRE TESTING INTERNATIONAL CORPORATION
NO.1996, Xin jin qiao Road, Pudong New District, Shanghai, 201206, China

Test Report

Report No.: SHES1107041295605

Page 2 of 10

1 SUMMARY

	LM-80 Required Temperature		Specified Temperature of the manufacturer
	55°C	85°C	105°C
Number of LED tested	20	20	20
Drive Current [I_F]	20 mA	20 mA	20 mA
Measurement Current [I_F]	20 mA	20 mA	20 mA
Actual Case Temp. [T_s]	54.5°C	84.8°C	104.9°C
Actual Ambient Temp. [T_A]	54.0°C	84.3°C	104.2°C
$\Delta[T_s - T_A]$	0.5°C	0.5°C	0.7°C
Average Lumen Maintenance at 6000 hours	99.33%	95.02%	47.09%
Ave. Chromaticity Shift ($\Delta u'v'$) at 6000 hours	0.0042	0.0059	0.0175
Failures observed	None	None	None

2 EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due Date
Spectroradiometer	CDS 2100	ATTEELSH00111	Oct. 11, 2011	Oct. 10, 2012
Integrating Sphere	LMS-200	ATTEELSH00115	Oct. 11, 2011	Oct. 10, 2012
Digital Recorder	HIOKI LR8400-21	TTE20100242	Aug. 02, 2011	Oct. 10, 2012
Digital CC&CV DC Power Supply	GPD-3303S	TTE20110239	Aug. 02, 2011	Dec. 01, 2012
High Temperature Chamber	NMT-1001	ATTEELSH00149	--	--
High Temperature Chamber	NMT-1200	TTE20100237	--	--
High Temperature Chamber	NMT-1200	TTE20100240	--	--
Digital Power Meter	WT-210	ATTEELSH00150	Sept. 14, 2011	Sept. 13, 2012
Digital CC&CV DC Power Supply	GPR-30H10D	TTF20110389	Feb. 10, 2012	Feb. 09, 2013

Test Report

Report No.: SHES1107041295605

Page 3 of 10

3 TEST METHODS

3.1 Requirements of Environmental Conditions

Operation of the LED light sources between photometric measurements shall be at a minimum of three case temperatures, T_s , using the same drive current. The three case temperatures, T_s , shall be 55°C and 85°C with a third temperature selected by the manufacturer. Case temperatures shall be controlled to -2°C during life testing. The temperature of the surrounding air should be maintained to within -5°C of the case temperature during testing. The surrounding air temperature should be monitored within the test chamber. Humidity shall be maintained to less than 65%RH throughout the life test.

The case temperature T_s is the cathode lead temperature of the LED mounted on a reliability test board. The ambient temperature T_A is the temperature of the air at a distance of 50mm above the reliability test board.

The ambient temperature during lumen and chromaticity measurements shall be set to $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The LED light source shall be required to cool to room temperature prior to measurement.

Airflow shall be minimized for proper light source starting and operation.

The operating orientation of the LED light sources under test should be as specified by the manufacturer.

3.2 Lumen Maintenance Testing Method

Samples under test shall be driven for at least 6,000 hours with data collection at a minimum of every 1000 hours. 10,000 hours are preferred for the purposes of improved predictive modeling.

LED light sources are driven at constant current.

Checking for LED light source failures either by visual observation or automatic monitoring shall be done at a minimum of every measurement interval. Catastrophic LED light source failure shall be reported and included in the test report.

The chromaticity shift shall be measured and reported over the course of the lumen maintenance test time by measuring chromaticity at each photometric test interval.

3.3 Photometric and Electrical Measurements

A Labsphere Model CDS 2100 CCD Spectroradiometer and 50cm Integrating Sphere was used to measure total luminous flux, correlated color temperature, color rendering index, and chromaticity coordinates for each sample.

Ambient temperature was measured at a position inside the integrating sphere. Electrical measurements including voltage, current, and power were measured using the Digital Power Meter.

The uncertainty of the light output measurement is $U=1.5\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurement is $U=14\text{K}$ ($K=2$), at the 95% confidence level. This calibration results traceable to the NATIONAL INSTITUTE OF METROLOGY (NIM).

Test Report

Report No.: SHES1107041295605

Page 4 of 10

4 TEST RESULTS

4.1 55°C, 20mA

Case Temperature [T_s] : 54.5°C
 Ambient Temperature [T_A] : 54.0°C
 Drive Current [I_F] : 20 mA
 Measurement Current : 20 mA
 Failures Observed : None

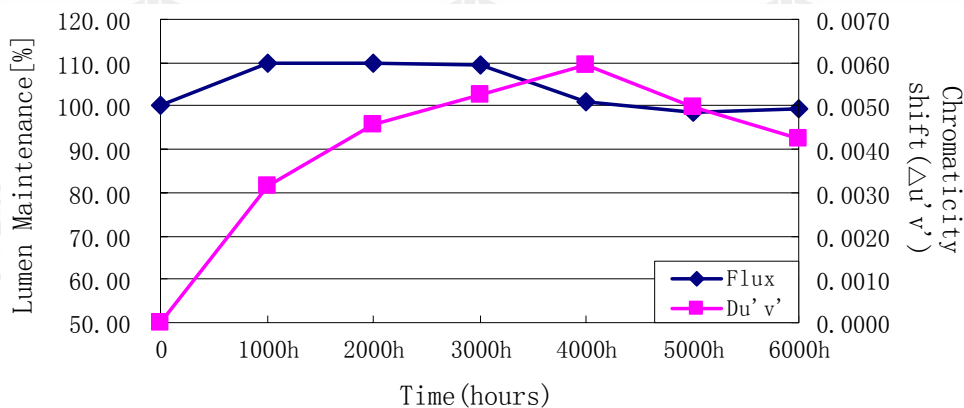
No.	Φ _v [lm]	V _F [V]	Lumen Maintenance [%]					
			0 h (Initial)	1000 h	2000 h	3000 h	4000 h	5000 h
1	6.979	3.131	105.80	108.80	107.79	99.64	96.92	97.84
2	6.834	3.129	111.95	110.05	109.13	100.91	98.33	99.41
3	6.626	3.117	112.35	110.13	109.61	101.03	98.49	99.62
4	6.788	3.116	112.27	109.99	109.52	100.78	98.08	99.38
5	6.948	3.127	112.62	109.99	109.80	100.76	97.93	99.25
6	7.016	3.129	110.73	108.87	108.58	100.33	99.19	98.16
7	7.153	3.125	109.37	107.98	107.56	99.44	97.89	97.85
8	6.817	3.125	110.31	109.62	108.99	100.94	98.87	98.74
9	6.877	3.127	107.71	109.77	109.51	101.53	98.85	99.49
10	6.863	3.116	107.01	109.31	109.41	101.02	98.18	99.27
11	7.038	3.108	106.01	107.60	107.36	99.16	96.52	97.34
12	6.728	3.113	107.34	109.05	108.62	100.28	98.22	99.29
13	6.489	3.129	109.46	111.62	111.36	102.97	100.45	101.34
14	6.349	3.113	108.77	111.92	111.61	103.59	100.24	101.51
15	6.902	3.118	112.33	108.66	108.35	100.35	97.19	98.20
16	6.493	3.125	113.66	111.18	110.67	102.68	99.49	100.88
17	6.448	3.170	115.63	113.23	112.92	104.31	100.87	102.42
18	6.883	3.117	107.67	109.71	108.83	100.51	97.60	98.75
19	6.654	3.109	107.56	110.16	109.36	101.25	98.03	99.58
20	6.845	3.121	105.81	108.59	107.82	99.65	97.14	98.35
n	20	20	20	20	20	20	20	20
Mean	6.787	3.123	109.72	109.81	109.34	101.06	98.42	99.33
Median	6.840	3.123	109.42	109.74	109.25	100.85	98.20	99.28
St. dev.	0.216	0.013	2.87	1.37	1.42	1.37	1.17	1.33
Min.	6.349	3.108	105.80	107.60	107.36	99.16	96.52	97.34
Max.	7.153	3.170	115.63	113.23	112.92	104.31	100.87	102.42

Test Report

Report No.: SHES1107041295605

Page 5 of 10

No.	u'	v'	Chromaticity Shift $\Delta u'v'$					
	0 h (Initial)		1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.1994	0.4776	0.0028	0.0045	0.0049	0.0055	0.0048	0.0040
2	0.1987	0.4763	0.0034	0.0048	0.0053	0.0059	0.0051	0.0045
3	0.1981	0.4722	0.0032	0.0046	0.0054	0.0060	0.0051	0.0043
4	0.1992	0.4725	0.0033	0.0047	0.0054	0.0060	0.0052	0.0042
5	0.2001	0.4768	0.0032	0.0045	0.0051	0.0055	0.0047	0.0040
6	0.2000	0.4771	0.0032	0.0045	0.0051	0.0056	0.0052	0.0042
7	0.2000	0.4818	0.0025	0.0038	0.0044	0.0050	0.0043	0.0036
8	0.1993	0.4767	0.0028	0.0043	0.0051	0.0056	0.0050	0.0040
9	0.1987	0.4759	0.0028	0.0048	0.0056	0.0063	0.0053	0.0046
10	0.1994	0.4767	0.0030	0.0044	0.0047	0.0056	0.0045	0.0039
11	0.1999	0.4771	0.0026	0.0039	0.0047	0.0049	0.0040	0.0037
12	0.1980	0.4719	0.0030	0.0048	0.0058	0.0065	0.0054	0.0047
13	0.1991	0.4712	0.0036	0.0053	0.0061	0.0070	0.0059	0.0050
14	0.1970	0.4694	0.0038	0.0051	0.0061	0.0068	0.0057	0.0049
15	0.1983	0.4733	0.0034	0.0044	0.0053	0.0061	0.0045	0.0040
16	0.1972	0.4731	0.0034	0.0048	0.0056	0.0065	0.0051	0.0043
17	0.2001	0.4773	0.0032	0.0043	0.0050	0.0057	0.0046	0.0041
18	0.1998	0.4745	0.0030	0.0047	0.0053	0.0061	0.0049	0.0043
19	0.1973	0.4727	0.0032	0.0048	0.0055	0.0065	0.0051	0.0043
20	0.1980	0.4723	0.0034	0.0047	0.0052	0.0061	0.0048	0.0042
n	0.1989	0.4748	0.0031	0.0046	0.0053	0.0060	0.0050	0.0042
Average	0.1992	0.4752	0.0032	0.0047	0.0053	0.0060	0.0050	0.0042
Median	0.0010	0.0030	0.0003	0.0004	0.0004	0.0006	0.0004	0.0004
St. dev.	0.1970	0.4694	0.0025	0.0038	0.0044	0.0049	0.0040	0.0036
Min.	0.2001	0.4818	0.0038	0.0053	0.0061	0.0070	0.0059	0.0050
Max.	0.1989	0.4748	0.0031	0.0046	0.0053	0.0060	0.0050	0.0042



Test Report

Report No.: SHES1107041295605

Page 6 of 10

4.2 85°C, 20mA

Case Temperature [T_s] : 84.8°C
 Ambient Temperature [T_A] : 84.3°C
 Drive Current [I_F] : 20 mA
 Measurement Current : 20 mA
 Failures Observed : None

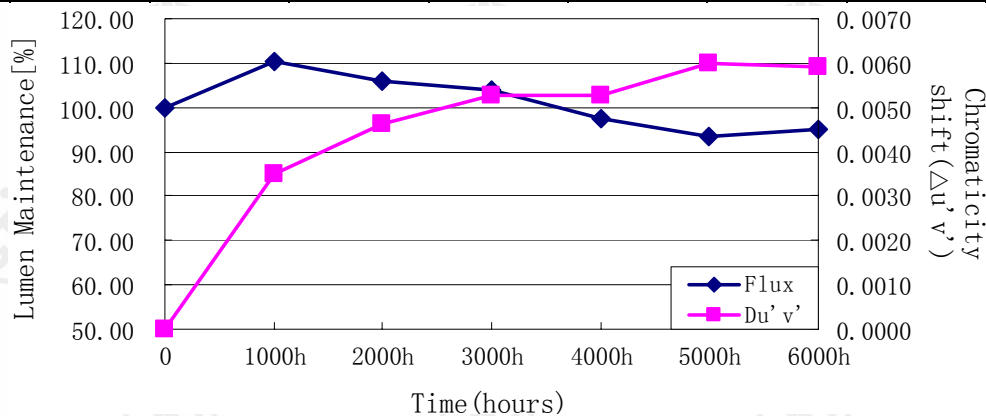
No.	Φ _v [lm]	V _F [V]	Lumen Maintenance [%]					
			0 h (Initial)	1000 h	2000 h	3000 h	4000 h	5000 h
1	7.027	3.132	110.83	106.02	104.13	98.98	96.53	94.45
2	6.971	3.125	109.15	104.05	102.02	97.16	93.79	92.01
3	6.598	3.122	111.26	106.84	105.18	99.80	97.21	95.42
4	6.784	3.126	112.62	107.61	106.00	98.88	93.96	96.12
5	6.680	3.124	110.96	106.44	104.94	98.08	93.67	95.58
6	6.989	3.126	110.29	105.59	103.72	96.94	92.09	94.56
7	7.031	3.125	109.40	104.51	102.45	96.43	91.61	94.04
8	7.140	3.129	108.67	103.60	101.61	95.34	94.78	92.83
9	7.085	3.128	110.16	105.18	103.08	96.97	92.27	94.26
10	6.630	3.125	111.63	107.06	105.23	98.76	94.57	96.73
11	6.759	3.121	111.72	106.82	105.12	99.02	94.36	97.25
12	6.865	3.127	110.94	106.95	105.08	98.28	93.66	96.30
13	6.648	3.130	109.78	107.58	105.96	99.04	94.13	97.17
14	6.819	3.126	111.15	106.92	105.19	98.34	94.22	96.85
15	7.377	3.130	106.90	102.53	100.56	94.12	90.00	92.19
16	6.640	3.125	110.51	106.55	104.91	98.46	93.92	96.39
17	6.859	3.126	109.52	105.26	103.27	96.78	92.42	94.84
18	7.124	3.128	109.29	105.03	102.44	96.41	92.04	94.46
19	6.659	3.117	110.53	106.44	103.71	98.27	93.21	95.58
20	6.669	3.118	108.83	104.38	102.59	96.57	91.21	93.37
n	20	20	20	20	20	20	20	20
Mean	6.868	3.126	110.21	105.77	103.86	97.63	93.48	95.02
Median	6.839	3.126	110.40	106.23	103.93	98.18	93.73	95.13
St. dev.	0.217	0.004	1.30	1.41	1.55	1.43	1.71	1.60
Min.	6.598	3.117	106.90	102.53	100.56	94.12	90.00	92.01
Max.	7.377	3.132	112.62	107.61	106.00	99.80	97.21	97.25

Test Report

Report No.: SHES1107041295605

Page 7 of 10

No.	u'	v'	Chromaticity Shift $\Delta u'v'$					
	0 h (Initial)		1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.1997	0.4766	0.0039	0.0046	0.0054	0.0054	0.0059	0.0057
2	0.1992	0.4730	0.0037	0.0046	0.0053	0.0053	0.0057	0.0058
3	0.1983	0.4699	0.0034	0.0045	0.0053	0.0053	0.0058	0.0058
4	0.1984	0.4755	0.0039	0.0049	0.0055	0.0055	0.0060	0.0060
5	0.1977	0.4729	0.0038	0.0049	0.0056	0.0056	0.0063	0.0061
6	0.1985	0.4743	0.0033	0.0042	0.0048	0.0048	0.0052	0.0052
7	0.1985	0.4772	0.0031	0.0040	0.0047	0.0047	0.0055	0.0057
8	0.1998	0.4782	0.0031	0.0041	0.0048	0.0048	0.0055	0.0057
9	0.1993	0.4778	0.0031	0.0040	0.0047	0.0047	0.0056	0.0056
10	0.1986	0.4716	0.0042	0.0052	0.0058	0.0058	0.0068	0.0065
11	0.1986	0.4765	0.0037	0.0046	0.0052	0.0052	0.0061	0.0060
12	0.1989	0.4740	0.0033	0.0048	0.0054	0.0054	0.0063	0.0062
13	0.1979	0.4737	0.0035	0.0058	0.0065	0.0065	0.0081	0.0065
14	0.2009	0.4785	0.0036	0.0048	0.0054	0.0054	0.0062	0.0063
15	0.1972	0.4796	0.0032	0.0043	0.0050	0.0050	0.0056	0.0056
16	0.1986	0.4719	0.0038	0.0049	0.0056	0.0056	0.0063	0.0062
17	0.1977	0.3147	0.0031	0.0042	0.0048	0.0048	0.0059	0.0058
18	0.1992	0.4775	0.0032	0.0045	0.0050	0.0050	0.0055	0.0056
19	0.1984	0.4693	0.0039	0.0052	0.0055	0.0055	0.0061	0.0061
20	0.1994	0.4715	0.0033	0.0045	0.0051	0.0051	0.0057	0.0059
n	20	20	20	20	20	20	20	20
Average	0.1987	0.4667	0.0035	0.0046	0.0053	0.0053	0.0060	0.0059
Median	0.1986	0.4742	0.0035	0.0046	0.0053	0.0053	0.0059	0.0058
St. dev.	0.0009	0.0359	0.0003	0.0005	0.0004	0.0004	0.0006	0.0003
Min.	0.1972	0.3147	0.0031	0.0040	0.0047	0.0047	0.0052	0.0052
Max.	0.2009	0.4796	0.0042	0.0058	0.0065	0.0065	0.0081	0.0065



Test Report

Report No.: SHES1107041295605

Page 8 of 10

4.3 105°C, 20mA

Case Temperature [T_s] : 104.9°C

Ambient Temperature [T_A] : 104.2°C

Drive Current [I_F] : 20 mA

Measurement Current : 20 mA

Failures Observed : None

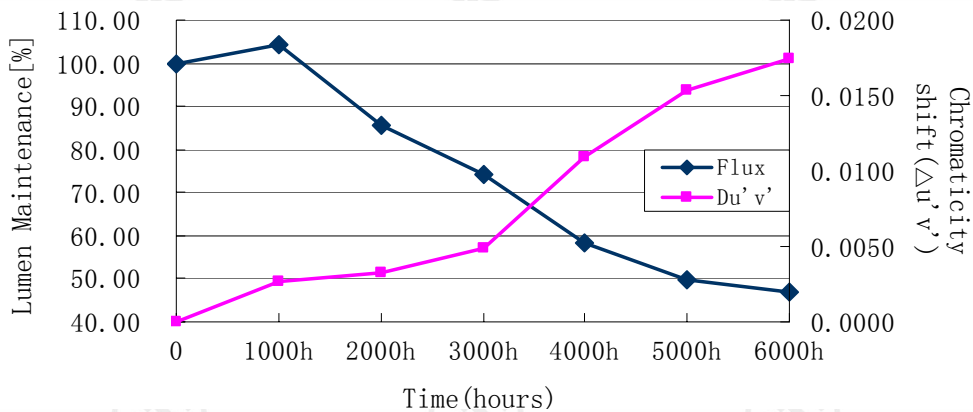
No.	Φ _v [lm]	V _F [V]	Lumen Maintenance [%]					
			0 h (Initial)	1000 h	2000 h	3000 h	4000 h	5000 h
1	6.832	3.116	104.13	85.90	76.67	61.71	49.99	47.45
2	7.348	3.121	101.82	85.91	74.07	55.82	48.46	47.39
3	6.929	3.123	105.47	83.91	80.26	62.71	52.29	49.18
4	6.927	3.128	106.21	85.35	75.59	56.43	50.41	49.26
5	6.907	3.125	104.39	85.52	74.42	56.29	53.84	50.41
6	7.069	3.125	104.95	85.91	76.38	60.35	46.64	46.85
7	7.123	3.126	102.51	85.62	71.16	58.19	50.44	47.55
8	6.704	3.124	107.34	85.63	75.24	61.98	52.48	48.79
9	7.104	3.126	103.66	86.33	74.90	58.52	51.75	47.47
10	7.033	3.122	102.80	85.52	73.33	58.99	49.55	46.86
11	7.129	3.128	103.44	86.60	75.33	59.21	50.65	46.42
12	7.039	3.136	104.59	85.51	72.25	57.05	47.89	46.24
13	7.314	3.128	102.00	85.95	73.69	57.85	45.95	44.16
14	6.916	3.124	103.98	84.58	70.76	58.88	47.61	45.36
15	7.062	3.133	103.00	86.03	70.94	53.48	47.05	45.04
16	6.697	3.126	105.03	85.95	72.69	55.91	48.90	46.98
17	6.777	3.123	104.88	85.28	71.43	56.38	49.11	46.23
18	7.210	3.131	103.20	86.47	74.49	59.13	47.81	44.97
19	6.726	3.124	105.29	86.64	76.39	61.23	50.34	47.41
20	6.741	3.122	105.25	85.98	74.53	58.72	50.20	47.78
n	20	20	20	20	20	20	20	20
Mean	6.979	3.126	104.20	85.73	74.23	58.44	49.57	47.09
Median	6.981	3.125	104.26	85.91	74.46	58.62	49.77	47.18
St. dev.	0.197	0.004	1.42	0.65	2.34	2.38	2.08	1.56
Min.	6.697	3.116	101.82	83.91	70.76	53.48	45.95	44.16
Max.	7.348	3.136	107.34	86.64	80.26	62.71	53.84	50.41

Test Report

Report No.: SHES1107041295605

Page 9 of 10

No.	u'	v'	Chromaticity Shift $\Delta u'v'$					
	0 h (Initial)		1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.1986	0.4735	0.0021	0.0030	0.0052	0.0122	0.0183	0.0195
2	0.1994	0.4794	0.0023	0.0033	0.0055	0.0117	0.0188	0.0200
3	0.1989	0.4746	0.0030	0.0039	0.0049	0.0086	0.0178	0.0218
4	0.1980	0.4763	0.0029	0.0031	0.0051	0.0119	0.0134	0.0148
5	0.1980	0.4748	0.0026	0.0034	0.0060	0.0119	0.0099	0.0118
6	0.1993	0.4778	0.0026	0.0033	0.0039	0.0090	0.0166	0.0199
7	0.1989	0.4755	0.0026	0.0037	0.0061	0.0134	0.0153	0.0160
8	0.1979	0.4722	0.0033	0.0032	0.0045	0.0101	0.0139	0.0167
9	0.1975	0.4767	0.0025	0.0033	0.0040	0.0099	0.0112	0.0146
10	0.1993	0.4755	0.0025	0.0033	0.0040	0.0077	0.0154	0.0185
11	0.1997	0.4782	0.0027	0.0034	0.0036	0.0088	0.0094	0.0125
12	0.2000	0.4786	0.0027	0.0032	0.0047	0.0128	0.0166	0.0171
13	0.2001	0.4802	0.0023	0.0031	0.0052	0.0115	0.0173	0.0188
14	0.1989	0.4749	0.0026	0.0036	0.0066	0.0128	0.0180	0.0197
15	0.1998	0.4774	0.0027	0.0033	0.0058	0.0130	0.0139	0.0160
16	0.1986	0.4710	0.0023	0.0028	0.0052	0.0118	0.0162	0.0179
17	0.1998	0.4734	0.0030	0.0034	0.0060	0.0111	0.0149	0.0166
18	0.1975	0.4755	0.0027	0.0030	0.0034	0.0108	0.0167	0.0193
19	0.1989	0.4729	0.0027	0.0027	0.0026	0.0096	0.0158	0.0183
20	0.1991	0.4738	0.0027	0.0032	0.0044	0.0100	0.0164	0.0193
n	20	20	20	20	20	20	20	20
Average	0.1989	0.4756	0.0026	0.0033	0.0048	0.0109	0.0153	0.0175
Median	0.1989	0.4755	0.0027	0.0033	0.0050	0.0113	0.0160	0.0181
St. dev.	0.0008	0.0025	0.0003	0.0003	0.0010	0.0016	0.0027	0.0026
Min.	0.1975	0.4710	0.0021	0.0027	0.0026	0.0077	0.0094	0.0118
Max.	0.2001	0.4802	0.0033	0.0039	0.0066	0.0134	0.0188	0.0218



Test Report

Report No.: SHES1107041295605

Page 10 of 10

Photos of the sample

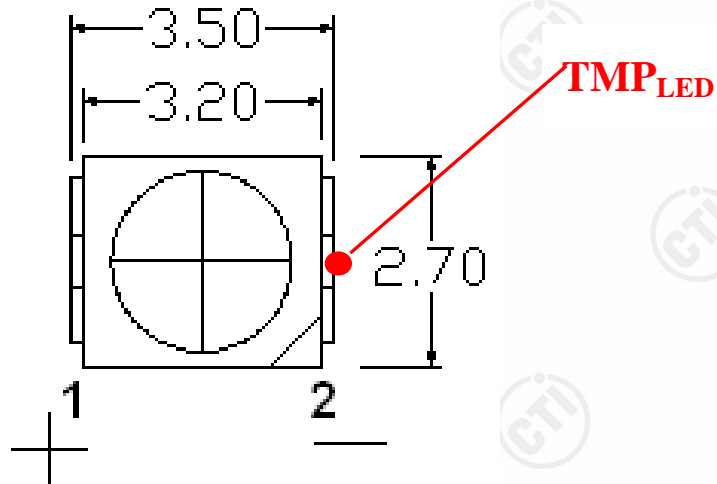


Fig.1- Mechanical Dimensions

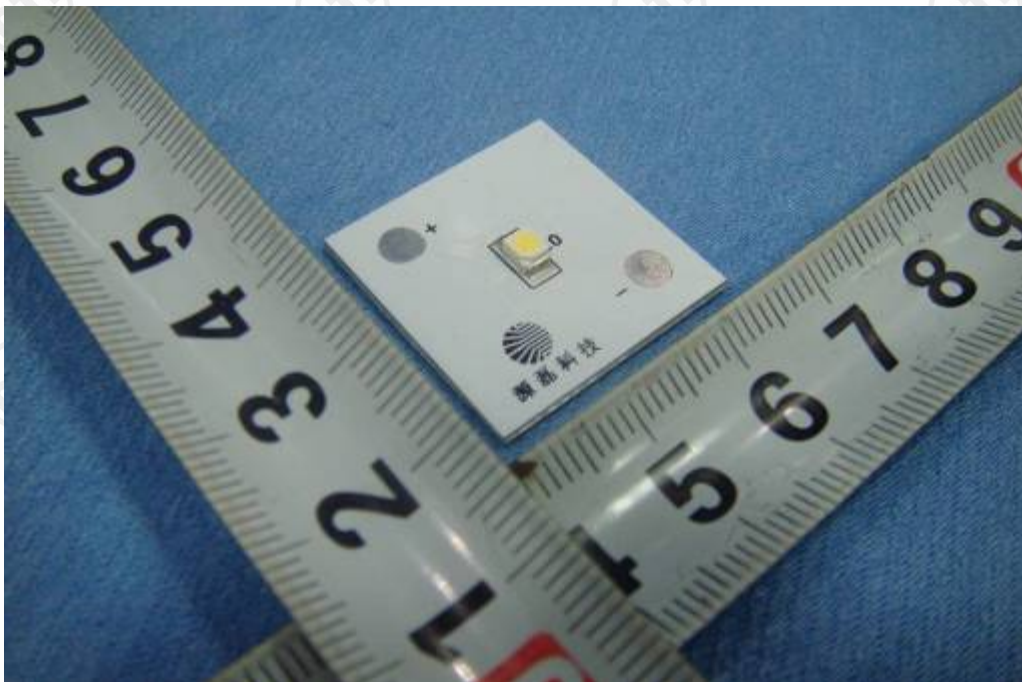


Fig.2- Overall view

** End of Report **

This report is considered invalidated without the Special Seal for Inspection of the CTI. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of CTI, this test report shall not be copied except in full and published as advertisement.