



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-LH004F95W-48B8C12(Ra2)-CS

Report Type: 7000 Hours Test Report		Product Type: LED Module	
Test Engineer:	Pote Wang	<i>Pote Wang</i>	
Report Number:	RSZ190603512-10		
Test Date:	2019-06-04 to 2020-03-28		
Report Date:	2020-03-30		
Reviewed By:	Blake Zhang / EE Engineer		
Test Facility:	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.		
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax:+86-0769-86858588		
Accreditation:	The IAS Accreditation Number TL-460.		

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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

24 PCS test samples were in good condition and received on 2019-06-03. The samples were numbered from 1 to 12 and 13 to 24.

#Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
#Part Number:	HL-LH004F95W-48B8C12(Ra2)-CS
#Part Type:	LED Module
#Drive Level:	DC 1400mA
#Nominal CCT:	2700K
#Power:	50.4 W
#Average Current Density per LED die:	692 mA/mm ²
#Average Power Density per LED die:	2.145W/mm ²
#CRI:	80
#Die Spacing:	0.48 mm

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)	Die Spacing	Current (mA)
Tested model	HL-LH004F95W-48B8C12(Ra2)-CS	80	2500K	B4C12+B4C12	0.0661	692.0	350	0.48	1400
Multiple models	HL-LH004F95W-48B8C12(Ra2)-CS	80	2700K~6500K	B4C12+B4C12	0.0661	692.0	350	0.48	1400
	LH011F95W-7B2C8(Ra2)-CS	80	2500K~6500K	B1C8+B1C8	0.0395	692.0	300	0.48	300
	LH002F95W-12B2C12(Ra2)-CS	80	2500K~6500K	B1C12+B1C12	0.0592	692.0	300	0.50	300
	LH012F82W-12B2C12(Ra2)-CS	80	2500K~6500K	B1C12+B1C12	0.0592	442.8	300	0.48	300
	LH015F95W-12B2C12(Ra2)-CS	80	2500K~6500K	B1C12+B1C12	0.0430	692.0	300	0.50	300
	LH015F82W-12B2C12(Ra2)-CS	80	2500K~6500K	B1C12+B1C12	0.0430	442.8	300	0.49	300
	LH003F95W-24B4C12(Ra2)-CS	80	2500K~6500K	B2C12+B2C12	0.0598	692.0	300	0.56	600
	LH003F95W-12B2C12(Ra2)-CS	80	2500K~6500K	B1C12+B1C12	0.0299	692.0	300	1.16	300
	LH003F95W-24B2C24(Ra2)-CS	80	2500K~6500K	B1C24+B1C24	0.0598	692.0	300	0.55	300

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)	Die Spacing	Current (mA)
	LH1311D101W-12B4C12(Ra2)-CS	80	2500K~6500K	B2C12+B2C12	0.0592	596.2	150	0.48	300
	LH1307F95W-12B2C12(Ra2)-CS	80	2500K~6500K	B1C12+B1C12	0.0592	692.0	300	0.50	300
	LH029F95W-9B2C18(Ra2)-CS	80	2500K~6500K	B1C18+B1C18	0.0661	692.0	300	0.48	300

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
1.0m integrating sphere	SENSING	SCD-20008	N/A	2019-06-28	2020-06-27
spectroradiometer	SENSING	SCD-20008	N/A	2019-06-28	2020-06-27
DC Power Supply	Hanshenpu yuan	HSPY-100-05	2013010210003	2019-07-23	2020-07-22
Standard Light Source	EVERFINE	D204	N/A	2019-07-19	2020-07-18
DC Power Supply	BACL	B25001	90020	2020-01-07	2021-01-07
Multilayer aging machine	BACL	B2-270	20005	2020-03-10	2021-03-09
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090007	2019-04-10	2020-04-09
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090004	2020-03-10	2021-03-09

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°C \pm 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'. 2 π measurement was used and sample was driven by DC power supply. The forward current was regulated to within $\pm 0.5\%$ of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 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 (luminous flux) measurements is $U=2.1\%$ ($K=2$), 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 CRI is $U=2.1$ ($K=2$), 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, 1400mA

Part Number: HL-LH004F95W-48B8C12(Ra2)-CS
Number of Units: 12
Case Temperature: >83°C
Ambient Temperature: >80°C
Life Test Drive Current: 1400mA
Measurement Current: 1400mA

Data Set 2: 105°C, 1400mA

Part Number: HL-LH004F95W-48B8C12(Ra2)-CS
Number of Units: 12
Case Temperature: >103°C
Ambient Temperature: >100°C
Life Test Drive Current: 1400mA
Measurement Current: 1400mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM-21 L ₇₀ Lifetime
1	12	0	1000hrs	7000hrs	5.711E-06	1.008	>39000 hours
2	12	0	1000hrs	7000hrs	6.457E-06	1.002	>39000 hours

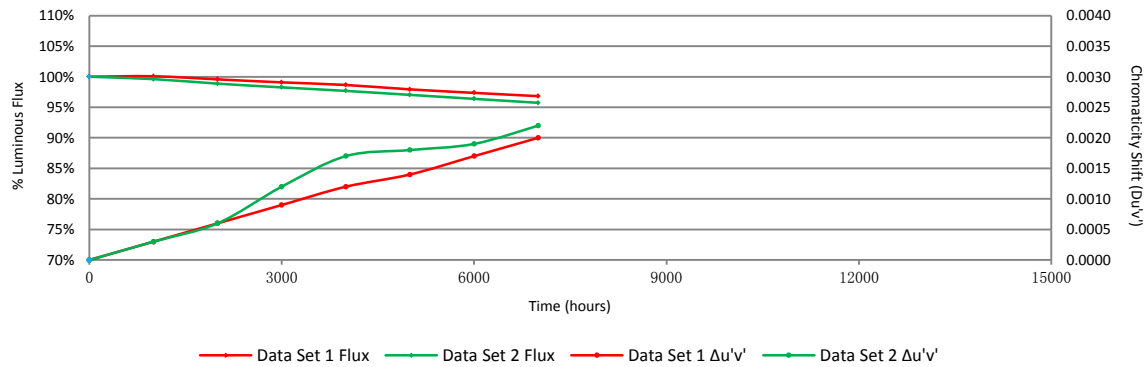
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	100.08%	99.57%	99.08%	98.65%	97.93%	97.36%	96.82%
2	99.61%	98.87%	98.26%	97.68%	97.03%	96.38%	95.73%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	0.0003	0.0006	0.0009	0.0012	0.0014	0.0017	0.0020
2	0.0003	0.0006	0.0012	0.0017	0.0018	0.0019	0.0022

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 85°C, 1400mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	4814.37	99.64	99.13	98.77	98.18	97.43	96.84	96.43
2	5001.42	100.49	99.76	99.16	98.94	98.34	97.79	97.16
3	4996.16	100.24	99.92	99.31	98.67	98.12	97.54	96.91
4	5037.21	99.60	99.12	98.55	98.21	97.50	97.12	96.73
5	4937.52	100.20	99.75	99.25	98.74	98.08	97.87	97.11
6	4943.38	100.24	99.87	99.54	99.07	98.44	97.51	97.24
7	4749.87	100.25	99.49	98.98	98.68	98.00	97.41	96.75
8	4855.42	99.75	99.54	98.95	98.59	97.45	96.97	96.45
9	4884.74	100.25	99.50	98.80	98.34	97.34	96.66	96.43
10	4960.97	99.96	99.51	99.30	98.89	98.02	97.64	96.89
11	5002.02	100.24	99.92	99.31	98.81	98.52	97.54	96.92
12	4966.84	100.12	99.39	99.07	98.74	97.87	97.41	96.78
Avg.	4929.16	100.08	99.57	99.08	98.65	97.93	97.36	96.82
Med.	4952.18	100.22	99.52	99.11	98.71	98.01	97.46	96.83
st dev	86.41	0.28	0.28	0.28	0.28	0.41	0.38	0.28
Min.	4749.87	99.60	99.12	98.55	98.18	97.34	96.66	96.43
Max.	5037.21	100.49	99.92	99.54	99.07	98.52	97.87	97.24

3.2 Data Set 1, 85°C, 1400mA (Forward Voltage)

No.	Forward Voltage (V)							
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	37.38	37.16	37.03	37.38	37.52	36.54	37.16	37.03
2	37.25	37.55	37.42	37.84	37.99	36.66	37.55	37.42
3	37.27	37.11	36.98	37.27	37.39	36.48	37.11	36.98
4	36.80	36.53	36.43	36.80	36.93	36.54	36.53	36.43
5	36.83	36.70	36.56	36.83	36.94	36.56	36.70	36.56
6	37.28	37.11	37.01	37.28	37.42	36.69	37.11	37.01
7	37.44	37.29	37.15	37.44	37.57	36.85	37.29	37.15
8	37.33	37.15	37.02	37.33	37.47	36.37	37.15	37.02
9	36.64	36.48	36.36	36.64	36.76	37.03	36.48	36.36
10	36.57	36.42	36.29	36.57	36.70	36.32	36.42	36.29
11	36.59	36.42	36.31	36.59	36.71	36.84	36.42	36.31
12	37.03	36.84	36.69	37.03	37.15	36.87	36.84	36.69
Avg.	37.03	36.90	36.77	37.08	37.21	36.65	36.90	36.77
Med.	37.14	36.98	36.84	37.15	37.27	36.61	36.98	36.84
st dev	0.33	0.38	0.38	0.40	0.41	0.22	0.38	0.38
Min.	36.57	36.42	36.29	36.57	36.70	36.32	36.42	36.29
Max.	37.44	37.55	37.42	37.84	37.99	37.03	37.55	37.42

3.3 Data Set 1, 85°C, 1400mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)						
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	0.2729	0.5349	2476	0.0003	0.0004	0.0009	0.0011	0.0014	0.0017	0.0018
2	0.2713	0.5360	2505	0.0004	0.0006	0.0015	0.0015	0.0016	0.0018	0.0021
3	0.2686	0.5350	2554	0.0002	0.0004	0.0007	0.0011	0.0013	0.0016	0.0018
4	0.2707	0.5362	2514	0.0006	0.0008	0.0014	0.0014	0.0018	0.0021	0.0023
5	0.2688	0.5344	2552	0.0002	0.0005	0.0007	0.0011	0.0013	0.0016	0.0019
6	0.2686	0.5350	2554	0.0002	0.0004	0.0007	0.0008	0.0013	0.0016	0.0018
7	0.2728	0.5348	2480	0.0004	0.0009	0.0013	0.0011	0.0015	0.0018	0.0022
8	0.2687	0.5349	2552	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017	0.0021
9	0.2704	0.5357	2520	0.0004	0.0005	0.0008	0.0010	0.0015	0.0018	0.0019
10	0.2704	0.5359	2520	0.0003	0.0006	0.0009	0.0011	0.0014	0.0017	0.0021
11	0.2704	0.5359	2518	0.0001	0.0004	0.0007	0.0011	0.0013	0.0016	0.0018
12	0.2707	0.5360	2512	0.0003	0.0005	0.0007	0.0011	0.0014	0.0017	0.0019
Avg.	0.2704	0.5354	2521	0.0003	0.0006	0.0009	0.0012	0.0014	0.0017	0.0020
Med.	0.2704	0.5354	2519	0.0003	0.0005	0.0008	0.0011	0.0014	0.0017	0.0019
st dev	0.0015	0.0006	27	0.0001	0.0002	0.0003	0.0002	0.0001	0.0001	0.0002
Min.	0.2686	0.5344	2476	0.0001	0.0004	0.0007	0.0008	0.0013	0.0016	0.0018
Max.	0.2729	0.5362	2554	0.0006	0.0009	0.0015	0.0015	0.0018	0.0021	0.0023

3.4 Data Set 2, 105°C, 1400mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)						
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	4972.70	99.76	99.03	98.54	97.63	97.07	96.54	95.81
2	5066.53	99.65	99.05	98.41	97.62	97.22	96.49	95.89
3	4984.43	99.76	99.03	98.50	97.70	97.27	96.55	95.82
4	4943.38	99.76	99.02	98.25	97.23	96.64	96.11	95.79
5	5060.66	99.65	98.93	98.37	97.85	96.97	96.48	95.77
6	4919.93	99.52	98.65	98.12	97.41	96.66	95.86	95.20
7	4978.57	99.52	98.68	97.95	97.56	97.05	96.31	95.46
8	5025.48	99.53	98.92	98.09	97.70	96.97	96.34	95.74
9	4808.51	99.50	98.75	98.33	97.75	96.84	96.18	95.42
10	4896.47	99.52	98.65	98.43	97.98	97.39	97.07	96.61
11	4925.79	99.64	98.90	98.37	97.91	97.33	96.39	95.65
12	4955.11	99.52	98.79	97.81	97.84	96.93	96.29	95.56
Avg.	4961.46	99.61	98.87	98.26	97.68	97.03	96.38	95.73
Med.	4963.91	99.58	98.91	98.35	97.70	97.01	96.36	95.75
st dev	71.93	0.10	0.16	0.23	0.21	0.25	0.29	0.34
Min.	4808.51	99.50	98.65	97.81	97.23	96.64	95.86	95.20
Max.	5066.53	99.76	99.05	98.54	97.98	97.39	97.07	96.61

3.5 Data Set 2, 105°C, 1400mA (Forward Voltage)

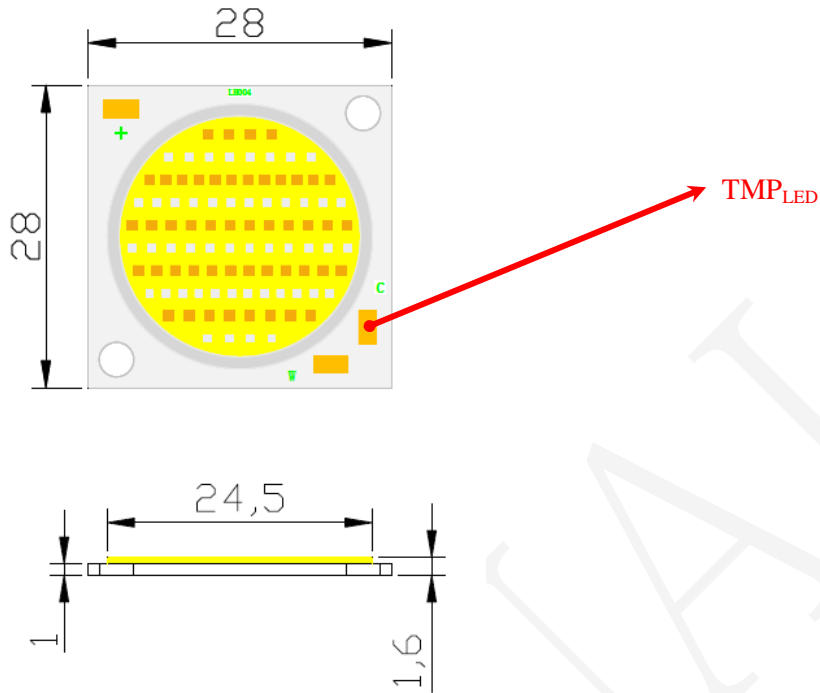
No.	Forward Voltage (V)							
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	36.68	36.54	36.40	36.30	36.77	37.16	36.54	36.40
2	36.85	36.66	36.52	36.39	37.00	37.05	36.66	36.52
3	36.63	36.48	36.36	36.24	36.75	37.11	36.48	36.36
4	36.68	36.54	36.40	36.19	36.83	36.53	36.54	36.40
5	36.72	36.56	36.41	36.17	36.80	36.70	36.56	36.41
6	36.81	36.69	36.55	36.58	36.93	37.11	36.69	36.55
7	37.06	36.85	36.71	36.57	37.04	37.29	36.85	36.71
8	36.51	36.37	36.25	36.00	36.62	37.15	36.37	36.25
9	37.21	37.03	36.89	36.62	37.11	36.88	37.03	36.89
10	36.63	36.32	36.12	35.88	36.75	36.42	36.32	36.12
11	37.01	36.84	36.71	36.59	37.16	36.92	36.84	36.71
12	37.04	36.87	36.72	36.48	37.18	36.84	36.87	36.72
Avg.	36.82	36.65	36.50	36.33	36.91	36.93	36.65	36.50
Med.	36.77	36.61	36.47	36.35	36.88	36.99	36.61	36.47
st dev	0.22	0.22	0.22	0.25	0.18	0.27	0.22	0.22
Min.	36.51	36.32	36.12	35.88	36.62	36.42	36.32	36.12
Max.	37.21	37.03	36.89	36.62	37.18	37.29	37.03	36.89

3.6 Data Set 2, 105°C, 1400mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)						
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs
1	0.2708	0.5360	2512	0.0003	0.0005	0.0009	0.0016	0.0016	0.0018	0.0021
2	0.2690	0.5354	2546	0.0003	0.0004	0.0007	0.0016	0.0016	0.0018	0.0020
3	0.2705	0.5360	2516	0.0002	0.0006	0.0007	0.0017	0.0020	0.0018	0.0021
4	0.2694	0.5345	2540	0.0003	0.0006	0.0014	0.0017	0.0017	0.0018	0.0021
5	0.2691	0.5356	2542	0.0001	0.0005	0.0011	0.0017	0.0019	0.0017	0.0021
6	0.2691	0.5345	2546	0.0004	0.0008	0.0011	0.0016	0.0018	0.0019	0.0023
7	0.2713	0.5362	2502	0.0004	0.0007	0.0011	0.0017	0.0017	0.0020	0.0023
8	0.2704	0.5360	2518	0.0003	0.0006	0.0012	0.0016	0.0017	0.0018	0.0021
9	0.2732	0.5350	2472	0.0005	0.0007	0.0015	0.0017	0.0021	0.0021	0.0023
10	0.2704	0.5354	2520	0.0005	0.0010	0.0018	0.0018	0.0018	0.0021	0.0025
11	0.2690	0.5350	2546	0.0004	0.0006	0.0009	0.0016	0.0018	0.0019	0.0021
12	0.2691	0.5348	2546	0.0003	0.0006	0.0013	0.0016	0.0018	0.0018	0.0021
Avg.	0.2701	0.5354	2526	0.0003	0.0006	0.0012	0.0017	0.0018	0.0019	0.0022
Med.	0.2699	0.5354	2530	0.0003	0.0006	0.0011	0.0017	0.0018	0.0018	0.0021
st dev	0.0013	0.0006	23	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0002
Min.	0.2690	0.5345	2472	0.0001	0.0004	0.0007	0.0016	0.0016	0.0017	0.0020
Max.	0.2732	0.5362	2546	0.0005	0.0010	0.0018	0.0018	0.0021	0.0021	0.0025

4 - DUT Photo

4.1 #Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



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 with the 95% confidence interval.
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