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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

60 PCS test samples were in good condition and received on 2020-10-26. The samples were numbered from 1 to 30 and 31 to 60.

Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Part Number:	HL-C3535K9W1EA(Ra1)-FC
Part Type:	LED Package
#Drive Level:	DC 800mA
#Wavelength:	601nm
#Power:	2.34 W
#Average Current Density per LED die:	410mA/mm^2
#Average Power Density per LED die:	1.2W/mm^2
#CRI:	70
#Die Spacing:	NA

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 Name	Total Input Current (mA)	Power (W)	CCT (K)	Number of dies	Driver current per die(mA)	Current Density per Die (mA/mm^2)	Power Density per PCB (W/mm^2)	Die Spacing (mm)
HL-C3535K9W1EA(Ra1)-FC	800	2.34	2700	1	800	410	0.1932	/
HL-C3535K9W1EA(Ra1)-FC	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535K9W1EA(Ra1)-FC-LVR	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W1EA(Ra1)-FC	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535F77W1EA(Ra1)-FC-LVR	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W1GA(Ra1)-FC	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535K9W1GA(Ra1)-FC-LVR	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W1GA(Ra1)-FC	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535F77W1GA(Ra1)-FC-LVR	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W1EA(Ra1)-FC(Ag60)	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W1EA(Ra1)-FC(Ag60)	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W1EA(Ra1)-FC(Au120)-CY	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W1EA(Ra1)-FC(Au120)-CY	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W1GA(Ra1)-FC(Au120)-CY	800	2.34	2700-6500	1	800	410	0.1932	/

Model Name	Total Input Current (mA)	Power (W)	CCT (K)	Number of dies	Driver current per die(mA)	Current Density per Die (mA/mm^2)	Power Density per PCB (W/mm^2)	Die Spacing (mm)
HL-C3535F77W1GA(Ra1)-FC(Au120)-CY	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W3GA(Ra1)-FC	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W3GA(Ra1)-FC	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W5GA(Ra1)-FC	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W5GA(Ra1)-FC	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W3GA(Ra1)-FC-LVR	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W3GA(Ra1)-FC-LVR	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W5GA(Ra1)-FC-LVR	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W5GA(Ra1)-FC-LVR	500	1.4	2700-6500	1	500	383	0.1176	/
HL-C3535K9W1GA(Ra1)-FC-LVR-QX	800	2.34	2700-6500	1	800	410	0.1932	/
HL-C3535F77W5GA(Ra1)-FC-LVR-QX	500	1.4	2700-6500	1	500	383	0.1176	/

1.2 Standards and Reference Documentations

- x ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- x CIE 127:2007: Measurement of LEDs
- x ANSI/ASABE S640 JUL2017 Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms) (This standard was not accredited by IAS)
- x ANSI/ASABE S642 SEP2018: Recommended Methods for Measurement and Testing of LED Products for Plant Growth and Development (This standard was not accredited by IAS)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
High Accuracy Array Spectroradiometer	EVERFINE	HAAS 2000	P600674CM5391140	2020-10-22	2021-10-21
0.5M Integrating Sphere	EVERFINE	0.5m	NA	2020-10-22	2021-10-21
LED Test Source	EVERFINE	LTS-300	P185616CJ1391143	2020-10-21	2021-10-20
Standard Light Source	EVERFINE	D062	1011093	2020-10-20	2021-10-19
High Accuracy Array Spectroradiometer	EVERFINE	HAAS 2000	P600674CM5391140	2020-10-22	2021-10-21
Multilayer aging machine	BACL	B2-270	20022	2021-02-24	2022-02-23
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090009	2021-02-24	2022-02-23

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 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 ±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 spectral power distribution and photon flux. 2π measurement 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.

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: 55°C, 800mA

Part Number:	HL-C3535K9W1EA(Ra1)-FC
Number of Units:	30
Case Temperature:	>53°C
Ambient Temperature:	>50°C
Life Test Drive Current:	800mA
Measurement Current:	800mA

Data Set 2: 105°C, 800mA

Part Number:	HL-C3535K9W1EA(Ra1)-FC
Number of Units:	

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3.4 Data Set 2, 105°C, 800mA (400-700nm Photon Flux Maintenance)

No.	Φ_p (μmol × s^{-1})	400-700nm Photon Flux Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
31	4.6640	99.89%	99.53%	99.40%	99.08%	98.65%	98.41%
32	4.6530	100.02%	99.70%	99.55%	99.25%	98.90%	98.73%
33	4.6520	99.85%	99.51%	99.38%	99.08%	98.69%	98.39%
34	4.6380	100.02%	99.57%	99.44%	99.18%	98.77%	98.49%
35	4.6570	99.91%	99.53%	99.42%	99.29%	98.95%	98.60%
36	4.6140	99.93%	99.57%	99.37%	99.13%	98.81%	98.61%
37	4.6440	99.83%	99.72%	99.66%	99.42%	99.07%	98.84%
38	4.6730	99.91%	99.61%	99.51%	99.38%	99.04%	98.84%
39	4.6550	99.94%	99.53%	99.46%	99.25%	98.84%	98.67%
40	4.6490	99.78%	99.44%	99.18%	98.97%	98.54%	98.37%
41	4.6300	99.91%	99.89%	99.11%	98.88%	98.42%	98.12%
42	4.6370	99.91%	99.31%	99.20%	98.99%	98.60%	98.43%
43	4.6540	99.85%	99.53%	99.33%	99.18%	98.93%	98.73%
44	4.7150	99.72%	99.51%	99.34%	99.17%	98.83%	98.56%
45	4.6920	99.87%	99.51%	99.42%	99.10%	98.74%	98.57%
46	4.6350	99.96%	99.57%	99.48%	99.33%	99.03%	98.66%
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