

Luminus Testing Laboratory**NVLAP Reference Lab Code #500047-0****LM80 Report for CXM-27 at 3.6A****Report Number: RQR-002554 Rev02****Test Method Compliance to IES LM-80-08**
Report Date: April 15, 2015 (8,000 hour report)

Luminus Testing Laboratory (NVLAP lab code #500047-0)
Luminus Devices Inc.,
175 New Boston Street, Woburn, MA 01801 USA

Document Number: RQR-002554 Rev02
Report Title: LM80 Report for CXM-27 at 3.6 A
Report Date: 4/15/2015
Report By: Scot Solimine (Luminus Testing Lab Manager)
Product Family: CXM-27 Series
LED Manufacturer Name: Luminus Devices, Inc.
LED Manufacturer Address: 175 New Boston Street, Woburn, MA 01801 USA

1.0 Introduction

This report shows the test results for the CXM-27 Series LED Array performed per IES LM-80-08, "IES Approved Method for Measuring Lumen Maintenance of LED Light Sources." This report is for 8,000 hours at the LM-80 specified test conditions.

1.1 Test Dates

Test Start Date: 3/19/2014
Test Report Date-Rev 01: 12/22/2014 (6,000 hour report)
Test Report Date-Rev 02: 04/15/2015 (8,000 hour report)

1.2 Device Description and Sample Plan

Testing Model #: CXM-27-27-80-36
Package Description: Chip-on-Board (COB) LED Chip Array
Target Color Temperature: 2700K
Number of LED die/array: 264 (22 LED strings)
Sample Plan: Devices selected at random from ≥ 3 manufacturing lots.

Product qualified by similarity to CXM-27:

Product Series

CXM-27
CHM-22
CXM-22
CHM-18
CXM-18
CHM-14
CXM-14
CHM-9

CXM-9
CLM-9
CXM-7
CXM/CHM-6
CLM-6

This includes all CCT values (2700K, 3000K, 3500K, 4000K, 5000K and 6500K), all CRI values (70, 75, 80, 90, 95) all voltage values (9 V, 12 V, 18 V, 27 V and 36 V) and all form factors (AA00, AA02, AC00, AC02, AP00, and AP02).

2.0 LM-80 Test Description and Results

2.1 Number of LED Arrays Tested

42 LED arrays were tested

- 14 LED arrays at 55 °C
- 14 LED arrays at 85 °C
- 14 LED arrays at 105 °C.

2.2 Description of Auxiliary Equipment

LM80 Stress System: The test devices were bolted to water cooled heat sinks and use thermal compound for heat conduction. Three heat sinks were used, one for each LM-80 specified stress condition. The LEDs were wired in series and operated by constant current source. The water flow and temperature of each heat sink was electronically controlled so that the LED package reached the LM-80 specified stress condition. A cover was placed over each heat sink to restrict air flow. Each stress board (heat sink with LED packages attached) was periodically removed for retest.

Periodic Test System: The test was performed using an integrating sphere with photodiode, spectrometer and programmable current source. The luminous flux, forward voltage and color (u' , v') were measured for each LED at each test interval.

2.3 Operating Cycle

The LED arrays were driven at constant current of 3.6 A.

2.4 Ambient Conditions

Table 1 shows the ambient conditions measured during stress.

Table 1. Ambient Condition for Stress Test¹.

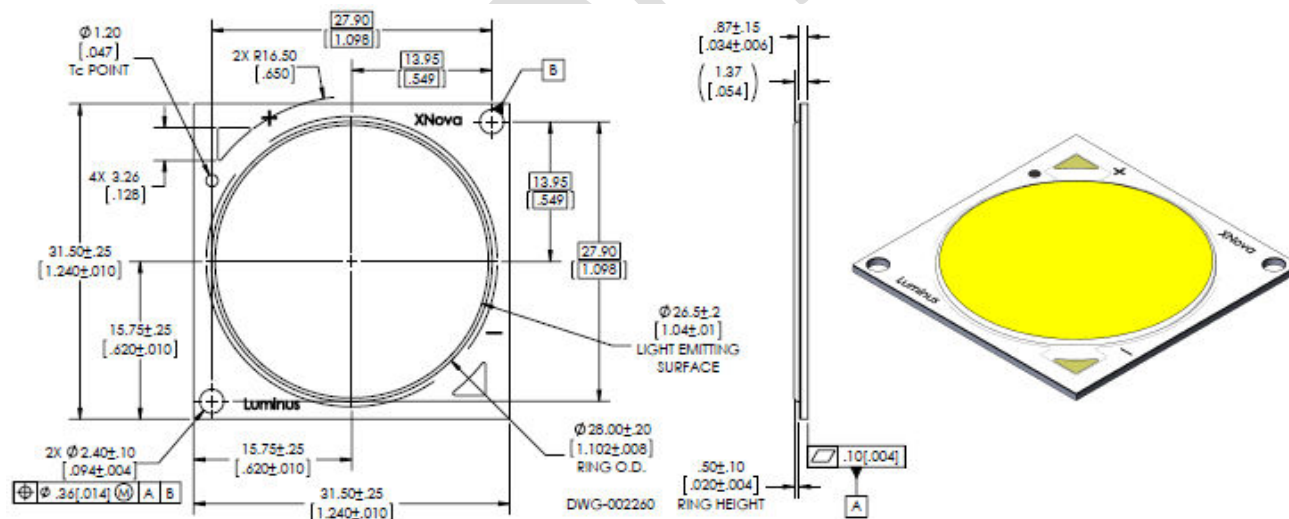
LM-80 Specified Stress Temperature	Operating Current, I_F	Avg. Case Temperature ² , T_c (°C)	Avg. Air Temperature ³ (°C)	Relative Humidity
55 °C	3.6 A	54.4	69.6	< 65% RH
85 °C	3.6 A	86.4	89.4	< 65% RH
105 °C	3.6 A	105.3	106.3	< 65% RH

Notes:

1. Periodic lumen and color measurements made at a test current of $I_F = 3.6\text{A}$ and $T_c = 25^\circ\text{C} \pm 2^\circ\text{C}$.
2. The case temperature was controlled to less than 2°C below the specified test condition.
3. The air temperature surrounding the LEDs was controlled to less than 5°C below the specified temperature.

2.5 Case Temperature Measurement Test Point and Package Dimension

The package dimensions and case temperature (T_c) measurement point is shown in Figure 1.


Figure 1. Package Dimensions and Temperature Test Point

2.6 Drive Current during Lifetime Test

The LEDs were tested at 3.6 A. The current for each LED string and die was 164 mA.

2.7 Initial Luminus Flux, Forward Voltage and Color Temperature.

See test tables.

2.8 Lumen Maintenance Data

Data is provided in the tables and includes individual data, average, median, standard deviation, maximum and minimum values for all LEDs at each stress condition.

2.9 Observation of Failures

There were no failures. The criteria for failure is lumen maintenance < 70% (L70).

2.10 Monitoring Interval

The maximum monitoring interval was 1000 hours. The test times were 0, 500, 1500, 2000, 2500, 3000, 4000, 5000, 6000, 6500, 7000 and 8000 hours.

2.11 Measurement Uncertainty

Photometric measurement uncertainty: 1.4 % (k = 2)

Lumen maintenance measurement repeatability: 0.8 % (2 St. Dev.)

2.12 Chromaticity Shift

The delta u'v' data as calculated per the CIE 1976 color space is shown in the tables.

3.0 Deviations, Additions or Exclusions from the Test Method

There were no deviations, additions or exclusions to the test method.

4.0 Observation and/or Interpretations of Data and Results

Table 2 shows the lumen maintenance life projection calculated using an exponential decay data fit by the TM-21-11 calculator. The maximum reportable lifetime is 5.5 times the test time of 8,000 hours equal to 44,000 hours.

5.0 Statement of Compliance/Noncompliance with Requirements and/or Specifications

The data shown was measured in compliance with the test method specified in IES LM-80-08. The lifetime projection shown in Table 2 is per TM-21-11 using the TM-21 calculator.

The test procedure used by this lab has been accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) in the scope of LM-80-08 Testing under the Energy Efficient Lighting Products Test Methods listing. The Luminus Devices Testing Lab NVLAP reference lab code is #500047-0.

This report may not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Table 2. LM-80 Lumen Maintenance Life Projections.

LED Source Tested	CXM-27	CXM-27	CXM-27
Sample Size	14	14	14
Number of Failures	0	0	0
DUT Drive Current used in Test	3.6 A	3.6 A	3.6 A
Test Duration	8,000 h	8,000 h	8,000 h
Test duration Used for Projection	3000-8000 h	3000-8000 h	3000-8000 h
Tested Case Temperature	55 °C	85 °C	105 °C
α	2.231E-06	6.091E-06	7.330E-06
β	0.992	0.970	0.950
Calculated L70 (8.0 kh)	156,000	54,000	42,000
Reported L70 (8.0 kh)	>44,000	>44,000	42,000

Test Data: Lumen Maintenance

LM80 Specified Stress: 55 °C, I_F = 3600 mA

Sample #	Initial Luminous Flux	Initial CCT (K)	Initial Forward Voltage (V)	Lumen Maintenance													
				0h	500h	1000h	1500h	2000h	2500h	3000h	4000h	5000h	6000h	6500h	7000h	8000h	
1	10,821	2,403	39.0	100.0%	97.9%	99.0%	98.9%	98.2%	98.3%	98.3%	98.0%	97.6%	97.6%	97.2%	97.3%	96.8%	
2	10,288	2,475	38.7	100.0%	98.2%	98.3%	98.5%	97.4%	97.3%	98.3%	97.9%	97.7%	97.8%	96.8%	97.4%	96.9%	
3	10,168	2,753	38.8	100.0%	98.8%	99.2%	99.2%	98.3%	98.3%	99.2%	99.0%	99.1%	99.7%	98.7%	99.4%	98.9%	
4	11,189	2,519	38.9	100.0%	98.6%	99.2%	99.1%	98.5%	98.7%	99.2%	99.0%	98.8%	98.9%	98.4%	98.6%	98.1%	
5	10,346	2,398	38.9	100.0%	97.6%	98.4%	98.2%	97.9%	98.0%	98.3%	97.9%	97.8%	97.8%	97.2%	97.3%	96.9%	
6	10,994	2,445	39.1	100.0%	97.6%	97.8%	97.7%	97.2%	97.1%	96.9%	97.2%	96.8%	96.9%	96.1%	96.3%	95.8%	
7	11,023	2,489	39.3	100.0%	97.7%	98.4%	97.5%	97.2%	97.4%	97.7%	97.8%	97.0%	96.8%	97.0%	97.1%	96.8%	
8	10,394	2,409	38.4	100.0%	102.7%	103.2%	102.2%	102.3%	102.1%	102.3%	101.4%	100.9%	100.7%	100.0%	100.0%	99.4%	
9	9,813	2,750	38.8	100.0%	98.9%	99.6%	99.5%	99.0%	99.1%	98.9%	98.6%	98.8%	99.3%	98.1%	98.6%	98.4%	
10	10,807	2,459	38.3	100.0%	98.8%	99.5%	99.4%	98.1%	98.5%	98.9%	98.3%	97.8%	97.9%	97.5%	97.3%	96.9%	
11	10,904	2,490	38.5	100.0%	98.2%	98.6%	98.7%	98.0%	98.0%	98.4%	98.0%	97.5%	97.8%	97.5%	97.4%	97.1%	
12	11,067	2,517	38.7	100.0%	97.6%	98.0%	98.2%	97.5%	97.7%	97.5%	97.7%	97.3%	97.4%	97.1%	97.2%	96.9%	
13	9,818	2,750	38.9	100.0%	98.1%	98.8%	98.7%	98.3%	98.1%	98.9%	98.5%	98.2%	98.4%	97.7%	98.1%	97.8%	
14	11,463	2,436	38.3	100.0%	97.6%	98.1%	97.7%	97.0%	96.6%	97.4%	97.1%	96.7%	96.8%	95.8%	96.6%	96.3%	
Median	10,814	2,482	38.8	100.0%	98.1%	98.7%	98.7%	98.1%	98.1%	98.4%	98.0%	97.7%	97.8%	97.4%	97.4%	96.9%	
Average	10,650	2,521	38.7	100.0%	98.4%	99.0%	98.8%	98.2%	98.2%	98.6%	98.3%	98.0%	98.1%	97.5%	97.8%	97.4%	
St Dev.	513	131	0.3	0.0%	1.3%	1.3%	1.2%	1.3%	1.3%	1.3%	1.1%	1.1%	1.2%	1.1%	1.1%	1.0%	
Max.	11,463	2,753	39.3	100.0%	102.7%	103.2%	102.2%	102.3%	102.1%	102.3%	101.4%	100.9%	100.7%	100.0%	100.0%	99.4%	
Min.	9,813	2,398	38.3	100.0%	97.6%	97.8%	97.5%	97.0%	96.6%	96.9%	97.1%	96.7%	96.8%	95.8%	96.3%	95.8%	

Test Data: Lumen Maintenance

LM80 Specified Stress: 85 °C, I_F = 3600 mA

Sample #	Initial Luminous Flux	Initial CCT (K)	Initial Forward Voltage (V)	Lumen Maintenance													
				0h	500h	1000h	1500h	2000h	2500h	3000h	4000h	5000h	6000h	6500h	7000h	8000h	
1	10,629	2,488	38.5	100.0%	98.7%	98.4%	97.6%	96.3%	95.8%	95.8%	94.7%	94.3%	94.5%	94.1%	93.1%	92.9%	
2	11,112	2,519	38.7	100.0%	99.1%	99.2%	97.7%	96.9%	95.7%	96.3%	94.5%	94.3%	94.5%	93.8%	93.5%	92.8%	
3	10,768	2,398	38.5	100.0%	98.0%	97.7%	96.7%	95.4%	94.7%	94.8%	93.4%	92.1%	92.5%	92.6%	92.1%	91.2%	
4	11,285	2,516	38.9	100.0%	99.0%	98.5%	98.4%	97.2%	96.3%	96.4%	95.1%	94.3%	95.1%	94.7%	94.1%	93.6%	
5	9,957	2,748	38.7	100.0%	98.6%	98.7%	98.0%	97.0%	96.5%	96.3%	95.2%	95.3%	95.8%	95.2%	93.9%	94.4%	
6	11,535	2,447	39.2	100.0%	97.3%	97.3%	96.4%	95.1%	94.3%	94.1%	93.3%	92.0%	93.0%	92.3%	91.6%	91.3%	
7	11,324	2,434	38.2	100.0%	98.2%	98.2%	97.4%	96.4%	95.9%	96.1%	94.8%	94.6%	94.9%	94.4%	93.6%	93.2%	
8	10,407	2,403	38.3	100.0%	96.3%	95.5%	94.4%	92.8%	92.0%	92.0%	91.0%	90.3%	90.3%	88.9%	89.2%	88.6%	
9	10,377	2,401	38.4	100.0%	98.0%	97.4%	96.3%	94.6%	94.1%	94.2%	92.7%	92.2%	92.2%	91.5%	90.9%	90.6%	
10	11,318	2,511	38.8	100.0%	99.7%	99.8%	99.0%	97.3%	97.7%	97.5%	96.2%	95.7%	95.7%	95.1%	94.3%	94.2%	
11	9,953	2,756	38.7	100.0%	98.4%	98.4%	97.9%	97.5%	97.4%	97.3%	96.6%	95.8%	95.9%	95.5%	95.1%	94.6%	
12	10,704	2,479	38.7	100.0%	98.7%	97.7%	97.3%	96.6%	96.3%	96.0%	94.9%	94.0%	94.3%	93.6%	93.1%	92.6%	
13	10,304	2,484	38.9	100.0%	98.9%	96.7%	97.8%	97.3%	94.3%	96.6%	96.0%	95.1%	95.2%	94.5%	92.2%	93.7%	
14	10,861	2,496	38.4	100.0%	98.1%	97.7%	96.5%	95.4%	94.3%	94.8%	93.5%	93.1%	92.8%	91.6%	91.8%	91.5%	
Median	10,736	2,486	38.7	100.0%	98.5%	97.9%	97.5%	96.5%	95.8%	96.0%	94.7%	94.3%	94.5%	94.0%	93.1%	92.8%	
Average	10,752	2,506	38.6	100.0%	98.4%	97.9%	97.3%	96.1%	95.4%	95.6%	94.4%	93.8%	94.1%	93.4%	92.8%	92.5%	
St Dev.	514	113	0.3	0.0%	0.8%	1.0%	1.1%	1.3%	1.5%	1.5%	1.5%	1.6%	1.6%	1.8%	1.5%	1.7%	
Max.	11,535	2,756	39.2	100.0%	99.7%	99.8%	99.0%	97.5%	97.7%	97.5%	96.6%	95.8%	95.9%	95.5%	95.1%	94.6%	
Min.	9,953	2,398	38.2	100.0%	96.3%	95.5%	94.4%	92.8%	92.0%	92.0%	91.0%	90.3%	90.3%	88.9%	89.2%	88.6%	

Test Data: Lumen Maintenance

LM80 Specified Stress: 105 °C, I_F = 3600 mA

Sample #	Initial Luminous Flux	Initial CCT (K)	Initial Forward Voltage (V)	Lumen Maintenance													
				0h	500h	1000h	1500h	2000h	2500h	3000h	4000h	5000h	6000h	6500h	7000h	8000h	
1	10,985	2,490	39.2	100.0%	96.7%	95.4%	93.4%	93.4%	92.9%	92.2%	91.6%	91.1%	90.3%	90.2%	90.0%	88.6%	
2	9,703	2,755	38.8	100.0%	97.3%	96.0%	94.8%	94.8%	94.3%	93.8%	93.3%	92.8%	92.2%	92.0%	92.0%	90.6%	
3	11,003	2,395	38.3	100.0%	94.1%	91.6%	89.7%	89.5%	88.6%	87.8%	86.8%	86.7%	85.7%	85.5%	85.5%	85.0%	
4	11,196	2,515	38.8	100.0%	97.2%	96.0%	94.4%	94.0%	93.4%	92.7%	92.1%	91.3%	91.3%	90.9%	90.7%	90.2%	
5	10,466	2,395	38.5	100.0%	95.6%	94.1%	92.5%	92.3%	91.4%	90.6%	90.3%	90.7%	89.2%	88.9%	88.9%	87.5%	
6	11,494	2,514	38.9	100.0%	98.0%	96.9%	95.4%	95.2%	94.5%	93.5%	92.9%	92.9%	91.0%	91.8%	91.1%	87.7%	
7	11,415	2,434	38.1	100.0%	97.4%	96.4%	95.3%	95.0%	94.5%	93.1%	93.3%	92.0%	91.7%	90.9%	91.7%	90.7%	
8	11,127	2,446	39.1	100.0%	97.8%	96.5%	95.0%	94.8%	94.1%	93.2%	92.5%	91.9%	91.1%	90.5%	90.6%	90.0%	
9	10,824	2,461	38.4	100.0%	96.4%	94.9%	93.3%	92.4%	91.6%	91.4%	90.6%	90.0%	88.9%	88.6%	88.5%	87.9%	
10	10,817	2,498	39.1	100.0%	96.7%	94.9%	93.5%	92.3%	92.8%	91.1%	91.3%	90.6%	89.3%	89.6%	89.4%	89.2%	
11	9,379	2,757	38.8	100.0%	98.6%	97.6%	97.2%	97.3%	96.8%	96.1%	95.3%	94.2%	94.2%	93.6%	93.5%	93.6%	
12	11,448	2,520	38.7	100.0%	98.1%	97.2%	95.9%	95.6%	95.0%	94.1%	93.7%	93.0%	92.3%	92.0%	91.6%	91.1%	
13	10,865	2,481	38.7	100.0%	98.6%	97.7%	96.6%	96.3%	95.3%	95.2%	93.8%	93.7%	93.0%	92.6%	89.5%	89.1%	
14	10,283	2,452	38.6	100.0%	97.6%	96.4%	94.7%	95.3%	94.2%	93.7%	93.8%	93.1%	92.0%	91.8%	91.4%	90.4%	
Median	10,925	2,485	38.7	100.0%	97.3%	96.2%	94.8%	94.8%	94.2%	93.2%	92.7%	91.9%	91.2%	90.9%	90.6%	89.6%	
Average	10,786	2,508	38.7	100.0%	97.1%	95.8%	94.4%	94.1%	93.5%	92.7%	92.2%	91.7%	90.9%	90.6%	90.3%	89.4%	
St Dev.	634	112	0.3	0.0%	1.2%	1.6%	1.9%	2.0%	2.0%	2.1%	2.1%	1.9%	2.1%	2.0%	1.9%	2.1%	
Max.	11,494	2,757	39.2	100.0%	98.6%	97.7%	97.2%	97.3%	96.8%	96.1%	95.3%	94.2%	94.2%	93.6%	93.5%	93.6%	
Min.	9,379	2,395	38.1	100.0%	94.1%	91.6%	89.7%	89.5%	88.6%	87.8%	86.8%	86.7%	85.7%	85.5%	85.5%	85.0%	

Test Data: Delta u'v'

LM80 Specified Stress: 55 °C, I_F = 3600 mA

Sample #	Initial CCT (K)	Delta u'v'												
		0h	500h	1000h	1500h	2000h	2500h	3000h	4000h	5000h	6000h	6500h	7000h	8000h
1	2,403	0.0000	0.0003	0.0006	0.0007	0.0007	0.0009	0.0010	0.0010	0.0009	0.0012	0.0015	0.0014	0.0016
2	2,475	0.0000	0.0004	0.0007	0.0007	0.0008	0.0010	0.0010	0.0011	0.0011	0.0013	0.0014	0.0015	0.0016
3	2,753	0.0000	0.0005	0.0006	0.0006	0.0006	0.0007	0.0007	0.0009	0.0009	0.0011	0.0012	0.0011	0.0012
4	2,519	0.0000	0.0005	0.0006	0.0009	0.0008	0.0007	0.0009	0.0009	0.0008	0.0010	0.0011	0.0012	0.0013
5	2,398	0.0000	0.0006	0.0006	0.0009	0.0009	0.0010	0.0010	0.0010	0.0011	0.0013	0.0014	0.0014	0.0015
6	2,445	0.0000	0.0008	0.0012	0.0013	0.0013	0.0014	0.0014	0.0015	0.0014	0.0017	0.0020	0.0018	0.0020
7	2,489	0.0000	0.0005	0.0007	0.0006	0.0008	0.0008	0.0008	0.0008	0.0010	0.0011	0.0012	0.0012	0.0014
8	2,409	0.0000	0.0003	0.0002	0.0002	0.0003	0.0003	0.0005	0.0007	0.0006	0.0009	0.0010	0.0011	0.0012
9	2,750	0.0000	0.0003	0.0004	0.0005	0.0004	0.0005	0.0006	0.0005	0.0007	0.0009	0.0010	0.0009	0.0010
10	2,459	0.0000	0.0003	0.0005	0.0007	0.0008	0.0008	0.0009	0.0008	0.0010	0.0011	0.0013	0.0012	0.0015
11	2,490	0.0000	0.0004	0.0007	0.0007	0.0008	0.0009	0.0010	0.0010	0.0010	0.0011	0.0011	0.0013	0.0013
12	2,517	0.0000	0.0005	0.0007	0.0008	0.0009	0.0010	0.0011	0.0010	0.0010	0.0012	0.0013	0.0012	0.0013
13	2,750	0.0000	0.0004	0.0006	0.0006	0.0006	0.0008	0.0008	0.0008	0.0009	0.0011	0.0011	0.0011	0.0012
14	2,436	0.0000	0.0007	0.0010	0.0012	0.0012	0.0013	0.0014	0.0013	0.0014	0.0016	0.0017	0.0015	0.0016
Average	2,482	0.0000	0.0004	0.0006	0.0007	0.0008	0.0008	0.0010	0.0010	0.0010	0.0011	0.0012	0.0012	0.0014
Median	2,521	0.0000	0.0005	0.0006	0.0007	0.0008	0.0009	0.0009	0.0010	0.0010	0.0012	0.0013	0.0013	0.0014
St Dev.	131	0.0000	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002
Max.	2,753	0.0000	0.0008	0.0012	0.0013	0.0013	0.0014	0.0014	0.0015	0.0014	0.0017	0.0020	0.0018	0.0020
Min.	2,398	0.0000	0.0003	0.0002	0.0002	0.0003	0.0003	0.0005	0.0005	0.0006	0.0009	0.0010	0.0009	0.0010

Test Data: Delta u'v'

LM80 Specified Stress: 85 °C, I_F = 3600 mA

Sample #	Initial CCT (K)	Delta u'v'												
		0h	500h	1000h	1500h	2000h	2500h	3000h	4000h	5000h	6000h	6500h	7000h	8000h
1	2,488	0.0000	0.0010	0.0013	0.0017	0.0021	0.0024	0.0025	0.0027	0.0028	0.0030	0.0031	0.0033	0.0034
2	2,519	0.0000	0.0011	0.0014	0.0017	0.0020	0.0025	0.0025	0.0027	0.0029	0.0032	0.0033	0.0036	0.0038
3	2,398	0.0000	0.0010	0.0014	0.0019	0.0023	0.0025	0.0028	0.0029	0.0031	0.0033	0.0034	0.0035	0.0037
4	2,516	0.0000	0.0010	0.0013	0.0016	0.0021	0.0024	0.0026	0.0029	0.0031	0.0032	0.0033	0.0033	0.0036
5	2,748	0.0000	0.0007	0.0009	0.0013	0.0016	0.0017	0.0019	0.0022	0.0023	0.0023	0.0026	0.0027	0.0028
6	2,447	0.0000	0.0011	0.0014	0.0020	0.0024	0.0026	0.0028	0.0031	0.0032	0.0033	0.0035	0.0037	0.0039
7	2,434	0.0000	0.0009	0.0012	0.0015	0.0019	0.0020	0.0022	0.0024	0.0024	0.0026	0.0028	0.0030	0.0032
8	2,403	0.0000	0.0016	0.0022	0.0027	0.0031	0.0033	0.0036	0.0037	0.0039	0.0042	0.0044	0.0043	0.0048
9	2,401	0.0000	0.0014	0.0017	0.0022	0.0026	0.0028	0.0030	0.0033	0.0035	0.0036	0.0038	0.0039	0.0042
10	2,511	0.0000	0.0010	0.0011	0.0016	0.0018	0.0021	0.0023	0.0027	0.0027	0.0031	0.0031	0.0034	0.0035
11	2,756	0.0000	0.0007	0.0009	0.0012	0.0013	0.0016	0.0018	0.0022	0.0021	0.0024	0.0026	0.0026	0.0027
12	2,479	0.0000	0.0011	0.0015	0.0019	0.0022	0.0023	0.0026	0.0028	0.0030	0.0033	0.0033	0.0034	0.0035
13	2,484	0.0000	0.0010	0.0016	0.0019	0.0021	0.0027	0.0027	0.0029	0.0030	0.0033	0.0034	0.0038	0.0038
14	2,496	0.0000	0.0011	0.0015	0.0020	0.0023	0.0026	0.0029	0.0031	0.0033	0.0034	0.0036	0.0039	0.0040
Average	2,486	0.0000	0.0010	0.0014	0.0018	0.0021	0.0024	0.0026	0.0028	0.0030	0.0033	0.0033	0.0035	0.0036
Median	2,506	0.0000	0.0011	0.0014	0.0018	0.0021	0.0024	0.0026	0.0028	0.0029	0.0032	0.0033	0.0035	0.0036
St Dev.	113	0.0000	0.0002	0.0003	0.0004	0.0004	0.0004	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005
Max.	2,756	0.0000	0.0016	0.0022	0.0027	0.0031	0.0033	0.0036	0.0037	0.0039	0.0042	0.0044	0.0043	0.0048
Min.	2,398	0.0000	0.0007	0.0009	0.0012	0.0013	0.0016	0.0018	0.0022	0.0021	0.0023	0.0026	0.0026	0.0027

Test Data: Delta u'v'

LM80 Specified Stress: 105 °C, I_F = 3600 mA

Sample #	Initial CCT (K)	Delta u'v'												
		0h	500h	1000h	1500h	2000h	2500h	3000h	4000h	5000h	6000h	6500h	7000h	8000h
1	2,490	0.0000	0.0018	0.0028	0.0032	0.0034	0.0037	0.0039	0.0040	0.0044	0.0046	0.0047	0.0049	0.0051
2	2,755	0.0000	0.0019	0.0024	0.0028	0.0028	0.0033	0.0033	0.0035	0.0038	0.0041	0.0042	0.0043	0.0046
3	2,395	0.0000	0.0025	0.0036	0.0042	0.0045	0.0049	0.0051	0.0054	0.0055	0.0058	0.0059	0.0061	0.0062
4	2,515	0.0000	0.0016	0.0024	0.0030	0.0033	0.0034	0.0037	0.0039	0.0041	0.0043	0.0043	0.0045	0.0048
5	2,395	0.0000	0.0020	0.0029	0.0033	0.0036	0.0040	0.0041	0.0044	0.0042	0.0047	0.0048	0.0050	0.0052
6	2,514	0.0000	0.0013	0.0020	0.0025	0.0027	0.0031	0.0032	0.0035	0.0036	0.0041	0.0040	0.0041	0.0049
7	2,434	0.0000	0.0014	0.0021	0.0025	0.0027	0.0030	0.0032	0.0034	0.0037	0.0039	0.0040	0.0041	0.0043
8	2,446	0.0000	0.0014	0.0024	0.0026	0.0030	0.0032	0.0034	0.0036	0.0038	0.0042	0.0044	0.0045	0.0047
9	2,461	0.0000	0.0017	0.0025	0.0032	0.0033	0.0037	0.0038	0.0041	0.0044	0.0047	0.0047	0.0050	0.0052
10	2,498	0.0000	0.0017	0.0028	0.0033	0.0037	0.0039	0.0041	0.0044	0.0047	0.0049	0.0051	0.0052	0.0054
11	2,757	0.0000	0.0012	0.0018	0.0020	0.0022	0.0026	0.0027	0.0029	0.0031	0.0034	0.0033	0.0036	0.0037
12	2,520	0.0000	0.0012	0.0019	0.0021	0.0025	0.0028	0.0029	0.0031	0.0032	0.0035	0.0037	0.0039	0.0041
13	2,481	0.0000	0.0013	0.0020	0.0023	0.0025	0.0027	0.0029	0.0031	0.0033	0.0035	0.0035	0.0040	0.0043
14	2,452	0.0000	0.0014	0.0024	0.0027	0.0029	0.0030	0.0033	0.0036	0.0039	0.0041	0.0042	0.0044	0.0048
Average	2,485	0.0000	0.0015	0.0024	0.0027	0.0030	0.0032	0.0033	0.0036	0.0038	0.0042	0.0043	0.0045	0.0048
Median	2,508	0.0000	0.0016	0.0024	0.0028	0.0031	0.0034	0.0035	0.0038	0.0040	0.0043	0.0044	0.0045	0.0048
St Dev.	112	0.0000	0.0004	0.0005	0.0006	0.0006	0.0006	0.0006	0.0007	0.0006	0.0007	0.0007	0.0006	0.0006
Max.	2,757	0.0000	0.0025	0.0036	0.0042	0.0045	0.0049	0.0051	0.0054	0.0055	0.0058	0.0059	0.0061	0.0062
Min.	2,395	0.0000	0.0012	0.0018	0.0020	0.0022	0.0026	0.0027	0.0029	0.0031	0.0034	0.0033	0.0036	0.0037

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Appendix A

Energy Star provides the opportunity to qualify similar parts to the test results for products meeting specific criteria (absolute drive current, power density, number of die per package, etc.). The following table list each product part family, the number of die per package, the maximum current qualified by this LM-80 report, maximum power density and substrate dimension. Please use the values below to determine the maximum operating current related to this LM-80 test result.

Part Number	Number of Die Per Unit	Maximum Drive Current (mA)	Maximum Power Density (W/mm ²)	Substrate Dimension (mm x mm)
CHM-27-XX-XX-36-XXXX-FX-X	264	3,600	0.1270	31.5x31.5
CHM-22-XX-XX-36-XXXX-FX-X	192	2,618	0.1168	28x28
CXM-22-XX-XX-36-XXXX-FX-X	192	2,560	0.1143	28x28
CHM-18-XX-XX-36-XXXX-FX-X	120	1,636	0.1239	21.5x21.5
CXM-18-XX-XX-36-XXXX-FX-X	120	1,600	0.1211	21.5x21.5
CHM-14-XX-XX-36-ACXX-FX-X	72	982	0.0952	19x19
CHM-14-XX-XX-36-AAXX-FX-X	72	982	0.1004	18.5x18.5
CXM-14-XX-XX-36-ACXX-FX-X	72	960	0.0931	19x19
CXM-14-XX-XX-36-AAXX-FX-X	72	960	0.0982	18.5x18.5
CHM-9-XX-XX-36-ACXX-FX-X	36	490	0.0943	13.5x13.5
CHM-9-XX-XX-36-AAXX-FX-X	36	490	0.0764	15x15
CXM-9-XX-XX-36-ACXX-FX-X	36	480	0.0922	13.5x13.5
CXM-9-XX-XX-36-AAXX-FX-X	36	480	0.0747	15x15
CLM-9-XX-XX-36-ACXX-FX-X	24	320	0.0615	13.5x13.5
CLM-9-XX-XX-36-AAXX-FX-X	24	320	0.0498	15x15
CXM-7-XX-XX-36-AAXX-FX-X	24	320	0.0662	13x13
CHM-6-XX-XX-36-AAXX-FX-X	24	320	0.0718	13x12
CXM-6-XX-XX-36-AAXX-FX-X	24	240	0.0538	13x12
CLM-6-XX-XX-27-AAXX-FX-X	18	240 (27V)	0.0415	13x12