

# Cree® XLamp® LED IES LM-80-2008 Testing Results



NVLAP Lab Code 500041-0

Revision: 5 (February 22, 2012)

## INTRODUCTION

This document provides the results of Cree’s IES LM-80-2008 (“LM-80”) testing on XLamp LEDs. Cree is providing this data so that the public can verify the reliability of Cree LEDs as part of a complete LED lighting system.

Note that this document only provides the end results of the LM-80 tests. This is not a complete LM-80 report. Do not use this document to submit luminaires or lamps to an agency. Cree customers who need the full LM-80 reports should contact their Cree sales representative.

Cree’s customers who wish to share LM-80 results with their customers have permission to link to this document from their website. This document is subject to change without notice, so please do not link to a local copy.

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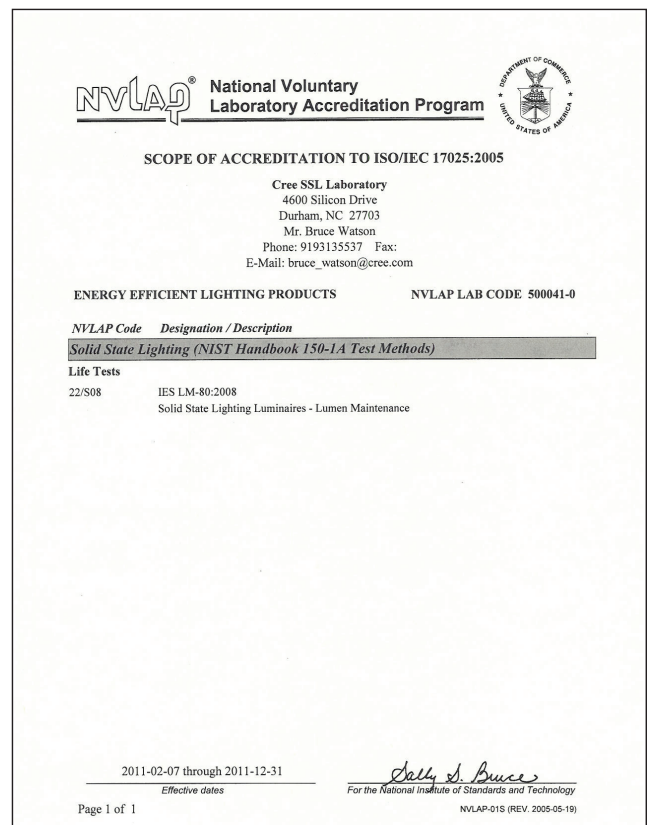
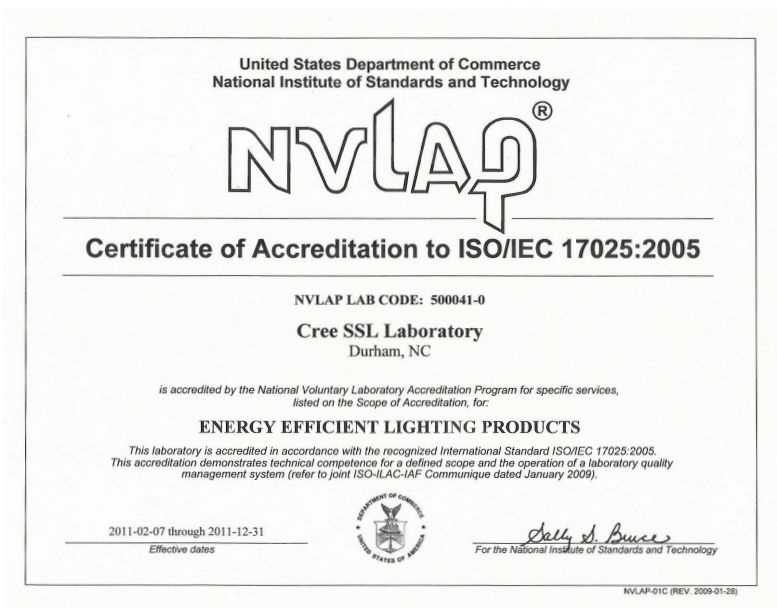
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**NVLAP ACCREDITATION FOR LM-80-2008 TESTING**

Cree's SSL testing laboratory in Durham, NC, USA is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) to perform IES LM-80-2008 testing. All LM-80-2008 results produced by Cree are generated in Cree's accredited laboratory. A copy of the accreditation certificate is provided below.

Approved Signatory:

Amber Abare  
Cree Components Reliability Laboratory Manager



**XLAMP MC-E WHITE LEDS (REV 1)**

Revision: 1 (December 8, 2010)

1. Number of LED light sources tested	<i>See individual test reports.</i>
2. Description of LED light sources	XLamp MC-E White LEDs (MCE4WT) & XLamp MC-E EasyWhite LEDs (MCEEZW)  All measurements provided are LED package measurements with all LEDs on simultaneously.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : <i>See individual test reports</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp MC-E Soldering & Handling document (AP21).
7. Drive current of the LED light source during lifetime test.	<i>See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."</i>  The forward voltage measurements provided are for the series connection of all LEDs in the package.
9. Lumen maintenance data for each individual LED light source	<i>See individual test reports.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual test reports.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual test reports.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>F</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours
1	45°C	45°C	350 mA	98.1%	0.0009
2	45°C	45°C	700 mA	99.0%	0.0015
3	55°C	55°C	350 mA	98.4%	0.0010
4	55°C	55°C	700 mA	95.8%	0.0027
5	85°C	85°C	350 mA	98.2%	0.0014
6	85°C	85°C	700 mA	92.8%	0.0070

**XLAMP ML-B WHITE LEDS (REV 0)**

Revision: 0 (August 22, 2011)

1. Number of LED light sources tested	<i>See individual test reports.</i>
2. Description of LED light sources	XLamp ML-B White LEDs (MLBAWT)  All measurements provided are LED package measurements.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : <i>See individual test reports</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp ML-E Soldering & Handling document (AP50).
7. Drive current of the LED light source during lifetime test.	<i>See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."</i>
9. Lumen maintenance data for each individual LED light source	<i>See individual test reports.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual test reports.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of +/- 2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual test reports.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>r</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours	Reported TM-21 L70 Lifetime
1	45°C	45°C	80 mA	99.0%	0.0009	L70(6k) > 36,300 hrs
2	55°C	55°C	80 mA	98.3%	0.0010	L70(6k) > 36,300 hrs
3	85°C	85°C	80 mA	98.1%	0.0011	L70(6k) > 36,300 hrs

**XLAMP ML-E WHITE LEDS (REV 0)**

Revision: 0 (December 21, 2010)

1. Number of LED light sources tested	<i>See individual test reports.</i>
2. Description of LED light sources	XLamp ML-E White LEDs (MLEAWT)  All measurements provided are LED package measurements.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : <i>See individual test reports</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp ML-E Soldering & Handling document (AP50).
7. Drive current of the LED light source during lifetime test.	<i>See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."</i>
9. Lumen maintenance data for each individual LED light source	<i>See individual test reports.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual test reports.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of +/- 2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual test reports.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>a</sub> ]	Drive Current [I <sub>f</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours
1	45°C	45°C	175 mA	97.9%	0.0008
2	55°C	55°C	175 mA	96.9%	0.0012
3	85°C	85°C	175 mA	95.5%	0.0012

**XLAMP MP-L EASYWHITE LEDS (REV 0)**

Revision: 0 (September 30, 2010)

1. Number of LED light sources tested	See individual test reports.
2. Description of LED light sources	XLamp MP-L EasyWhite LEDs (MPLEZW)  The XLamp MP-L package contains 3 independent strings of LEDs. All measurements provided are LED package measurements with the 3 strings of LEDs connected in series.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : See individual test reports RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp MP-L Soldering & Handling document (AP36).
7. Drive current of the LED light source during life-time test.	See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."
8. Initial luminous flux and forward voltage at photometric measurement current	See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."
9. Lumen maintenance data for each individual LED light source	See individual test reports. Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	See individual test reports.
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	See individual test reports. Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>F</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours
1	45°C	45°C	250 mA	96.9%	0.0007
2	55°C	55°C	250 mA	96.1%	0.0012
3	85°C	85°C	250 mA	96.7%	0.0017

**XLAMP MT-G EASYWHITE LEDS (REV 1)**

Revision: 1 (February 16, 2012)

1. Number of LED light sources tested	<i>See individual data sets.</i>
2. Description of LED light sources	XLamp MT-G EasyWhite LED arrays (Series: MTGEZW) This LM-80 report is applicable to the following order codes: <ul style="list-style-type: none"> <li>• MT-G 6V : MTGEZW-xx-xxxx-xBxxxxxxxx</li> <li>• MT-G 36V : MTGEZW-xx-xxxx-xNxxxxxxxx</li> </ul>
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED arrays are driven at constant current.
5. Ambient conditions	LED arrays are operated in environmental control chambers. The temperature of the ambient air around the LED arrays is actively controlled by air flowing through the chamber.  $T_A$ : <i>See individual data sets</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	<i>See individual data sets.</i>
7. Drive current of the LED light source during life-time test.	<i>See individual data sets.</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual data sets.</i>
9. Lumen maintenance data for each individual LED light source	<i>See individual data sets.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual data sets.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual data sets.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>F</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours	Reported TM-21 L70 Lifetime
1	55°C	55°C	2000 mA (6V); 333 mA (36V)	97.2%	0.0028	L70(6k) > 36,300 hrs
2	85°C	85°C	2000 mA (6V); 333 mA (36V)	95.5%	0.0027	L70(6k) > 36,300 hrs
3	105°C	105°C	2000 mA (6V); 333 mA (36V)	94.0%	0.0022	L70(6k) > 36,300 hrs
4	55°C	55°C	3000 mA (6V); 500 mA (36V)	95.8%	0.0024	L70(6k) > 36,300 hrs
5	85°C	85°C	3000 mA (6V); 500 mA (36V)	92.7%	0.0021	L70(6k) > 36,300 hrs
6	105°C	105°C	3000 mA (6V); 500 mA (36V)	92.5%	0.0019	L70(6k) > 36,300 hrs
7	105°C	105°C	4200 mA (6V); 700 mA (36V)	91.5%	0.0020	L70(6k) > 36,300 hrs

**XLAMP MX-3 WHITE LEDS (REV 0)**

Revision: 0 (March 29, 2011)

1. Number of LED light sources tested	<i>See individual test reports.</i>
2. Description of LED light sources	XLamp MX-3 White LEDs: parallel (MX3AWT) & series (MX3SWT) configurations  All measurements provided are LED package measurements of the parallel (MX3AWT) configuration.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeater
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : <i>See individual test reports</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp MX Family Soldering & Handling document (AP32).
7. Drive current of the LED light source during lifetime test.	<i>See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."</i>
9. Lumen maintenance data for each individual LED light source	<i>See individual test reports.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual test reports.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual test reports.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>F</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours
1	45°C	45°C	400 mA (MX3AWT) 133 mA (MX3SWT)	98.7%	0.0010
2	55°C	55°C	400 mA (MX3AWT) 133 mA (MX3SWT)	97.0%	0.0013
3	85°C	85°C	400 mA (MX3AWT) 133 mA (MX3SWT)	94.9%	0.0009

**XLAMP MX-6 WHITE LEDS (REV 2)**

Revision: 2 (September 2, 2011)

1. Number of LED light sources tested	See individual test reports.
2. Description of LED light sources	XLamp MX-6 White LEDs: parallel (MX6AWT) & series (MX6SWT) configurations  All measurements provided are LED package measurements of the parallel (MX6AWT) configuration.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : See individual test reports RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp MX-6 Soldering & Handling document (AP32).
7. Drive current of the LED light source during lifetime test.	See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."
8. Initial luminous flux and forward voltage at photometric measurement current	See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."
9. Lumen maintenance data for each individual LED light source	See individual test reports. Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	See individual test reports.
12. Photometric measurement uncertainty	Cree maintains a tolerance of +/- 2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	See individual test reports. Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>F</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours	Reported TM-21 L70 Lifetime
1	45°C	45°C	350 mA (MX6AWT) 58 mA (MX6SWT)	97.5%	0.0007	L70(6k) > 36,300 hrs
2	55°C	55°C	350 mA (MX6AWT) 58 mA (MX6SWT)	98.6%	0.0007	L70(6k) > 36,300 hrs
3	85°C	85°C	350 mA (MX6AWT) 58 mA (MX6SWT)	96.5%	0.0014	L70(6k) = 35,600 hrs
4	45°C	45°C	600 mA (MX6AWT) 100 mA (MX6SWT)	98.0%	0.0009	L70(6k) > 36,300 hrs
5	55°C	55°C	600 mA (MX6AWT) 100 mA (MX6SWT)	97.2%	0.0009	L70(6k) > 36,300 hrs
6	85°C	85°C	600 mA (MX6AWT) 100 mA (MX6SWT)	94.5%	0.0008	L70(6k) = 34,400 hrs

**XLAMP XM-L EASYWHITE LEDS (REV 0)**

Revision: 0 (October 31, 2011)

1. Number of LED light sources tested	See individual data sets.
2. Description of LED light sources	XLamp XM-L EasyWhite LED arrays (Series: XMLEZW) This LM-80 report is applicable to the following order codes: <ul style="list-style-type: none"> <li>• XM-L EZW 6V : XMLEZW-xx-xxxx-xBxxxxxxxx</li> <li>• XM-L EZW 12V : XMLEZW-xx-xxxx-xDxxxxxxxx</li> </ul>
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED arrays are driven at constant current.
5. Ambient conditions	LED arrays are operated in environmental control chambers. The temperature of the ambient air around the LED arrays is actively controlled by air flowing through the chamber.  $T_A$ : See individual data sets RH : < 45% Air flow : 800 CFM
6. Case temperature	See individual data sets.
7. Drive current of the LED light source during life-time test.	See individual data sets.
8. Initial luminous flux and forward voltage at photometric measurement current	See individual data sets.
9. Lumen maintenance data for each individual LED light source	See individual data sets. Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	See individual data sets.
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	See individual data sets. Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>F</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours	Reported TM-21 L70 Lifetime
1	55°C	55°C	700 mA (6V); 350 mA (12V)	97.2%	0.0029	L70(6k) > 36,300 hrs
2	85°C	85°C	700 mA (6V); 350 mA (12V)	96.1%	0.0026	L70(6k) > 36,300 hrs
3	105°C	105°C	700 mA (6V); 350 mA (12V)	97.3%	0.0025	L70(6k) > 36,300 hrs
4	55°C	55°C	1000 mA (6V); 500 mA (12V)	97.6%	0.0023	L70(6k) > 36,300 hrs
5	85°C	85°C	1000 mA (6V); 500 mA (12V)	96.6%	0.0019	L70(6k) > 36,300 hrs

**XLAMP XM-L WHITE LEDS (REV 1)**

Revision: 1 (January 27, 2012)

1. Number of LED light sources tested	<i>See individual test reports.</i>
2. Description of LED light sources	XLamp XM-L White LED packages (Series: XMLAWT)  This LM-80 report is applicable to the following order codes: XMLAWT-xx-xxxx-xxxxxxxxxx
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : <i>See individual test reports</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp XM-L Soldering & Handling document (AP54).
7. Drive current of the LED light source during lifetime test.	<i>See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."</i>
9. Lumen maintenance data for each individual LED light source	<i>See individual test reports.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual test reports.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual test reports.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>f</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours	Reported TM-21 L70 Lifetime
4	55°C	55°C	1500 mA	99.4%	0.0026	L70(6k) > 36,300 hrs
5	85°C	85°C	1500 mA	96.0%	0.0022	L70(7k) > 42,300 hrs
6	105°C	105°C	1500 mA	96.9%	0.0017	L70(7k) > 42,300 hrs
1	45°C	45°C	2000 mA	98.4%	0.0021	L70(6k) > 36,300 hrs
2	55°C	55°C	2000 mA	98.3%	0.0021	L70(6k) > 36,300 hrs
3	85°C	85°C	2000 mA	97.2%	0.0022	L70(6k) > 36,300 hrs

**XLAMP XP-E WHITE LEDS (REV 3)**

Revision: 3 (November 9, 2011)

1. Number of LED light sources tested	<i>See individual data sets.</i>
2. Description of LED light sources	XLamp XP-E White LED packages (Series: XPEWHT)  This LM-80 report is applicable to the following order codes: XPEWHT-xx-xxxx-xxxxx
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : <i>See individual data sets</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	<i>See individual data sets.</i>
7. Drive current of the LED light source during lifetime test.	<i>See individual data sets.</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual data sets.</i>
9. Lumen maintenance data for each individual LED light source	<i>See individual data sets.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual data sets.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual data sets.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>F</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours	Reported TM-21 L70 Lifetime
8	55°C	55°C	350 mA	97.7%	0.0022	L70(10k) > 60,500 hrs
9	85°C	85°C	350 mA	98.1%	0.0021	L70(10k) > 60,500 hrs
10	105°C	105°C	350 mA	96.4%	0.0021	L70(6k) > 36,300 hrs
5	45°C	45°C	700 mA	96.6%	0.0013	L70(10k) > 60,500 hrs
6	55°C	55°C	700 mA	96.5%	0.0013	L70(10k) > 60,500 hrs
7	85°C	85°C	700 mA	95.6%	0.0004	L70(10k) > 60,500 hrs

**XLAMP XP-E HIGH EFFICIENCY WHITE LEDS (REV 2)**

Revision: 2 (August 4, 2011)

1. Number of LED light sources tested	<i>See individual test reports.</i>
2. Description of LED light sources	XLamp XP-E High Efficiency White LEDs (XPEHEW) All measurements provided are LED package measurements.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  T <sub>A</sub> : <i>See individual test reports</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp XP Family Soldering & Handling document (AP25).
7. Drive current of the LED light source during lifetime test.	<i>See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."</i>
9. Lumen maintenance data for each individual LED light source	<i>See individual test reports.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual test reports.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual test reports.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>f</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours	Reported TM-21 L70 Lifetime
1	45°C	45°C	700 mA	99.2%	0.0004	L70(6k) > 36,300 hrs
2	55°C	55°C	700 mA	97.4%	0.0004	L70(6k) > 36,300 hrs
3	85°C	85°C	700 mA	95.5%	0.0007	L70(6k) > 36,300 hrs
4	45°C	45°C	350 mA	99.8%	0.0009	L70(6k) > 36,300 hrs
5	55°C	55°C	350 mA	101.0%	0.0007	L70(6k) > 36,300 hrs
6	85°C	85°C	350 mA	100.7%	0.0006	L70(6k) > 36,300 hrs
7	45°C	45°C	500 mA	99.3%	0.0006	L70(8k) > 48,400 hrs
8	55°C	55°C	500 mA	100.0%	0.0008	L70(8k) > 48,400 hrs
9	85°C	85°C	500 mA	97.7%	0.0005	L70(8k) > 48,400 hrs

**XLAMP XP-G WHITE LEDS (REV 4)**

Revision: 4 (July 12, 2011)

1. Number of LED light sources tested	<i>See individual test reports.</i>
2. Description of LED light sources	XLamp XP-G White LEDs (XPGWHT)  All measurements provided are LED package measurements.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  $T_A$ : <i>See individual test reports</i> RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp XP-G Soldering & Handling document (AP25).
7. Drive current of the LED light source during lifetime test.	<i>See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."</i>
8. Initial luminous flux and forward voltage at photometric measurement current	<i>See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."</i>
9. Lumen maintenance data for each individual LED light source	<i>See individual test reports.</i> Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	<i>See individual test reports.</i>
12. Photometric measurement uncertainty	Cree maintains a tolerance of ±2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	<i>See individual test reports.</i> Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>f</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours	Reported TM-21 L70 Lifetime
7	45°C	45°C	500 mA	101.5%	0.0028	L70(10k) > 60,500 hrs
8	55°C	55°C	500 mA	100.7%	0.0028	L70(10k) > 60,500 hrs
9	85°C	85°C	500 mA	101.1%	0.0025	L70(10k) > 60,500 hrs
10	55°C	55°C	1000 mA	100.0%	0.0028	L70(10k) > 60,500 hrs
11	85°C	85°C	1000 mA	99.0%	0.0035	L70(10k) > 60,500 hrs
12	105°C	105°C	1000 mA	97.4%	0.0032	L70(6k) > 36,300 hrs

**XLAMP XR-E WHITE LEADS (REV 1)**

Revision: 1 (September 20, 2010)

1. Number of LED light sources tested	See individual test reports.
2. Description of LED light sources	XLamp XR-E White LEDs (XREWHT) All measurements provided are LED package measurements.
3. Description of auxiliary equipment	Instrument Systems ISP-500 Integrating Sphere Instrument Systems CAS-140 Spectrometer Keithley 2420 Sourcemeter
4. Operating cycle	LED packages are driven at constant current.
5. Ambient conditions	LED packages are operated in environmental control chambers. The temperature of the ambient air around the LED packages is actively controlled by air flowing through the chamber.  T <sub>A</sub> : See individual test reports RH : < 45% Air flow : 800 CFM
6. Case temperature	The case temperature measurement point is shown in the XLamp XR-E Soldering & Handling document (AP16).
7. Drive current of the LED light source during lifetime test.	See individual test reports. The drive current used during lifetime testing is listed as "Drive Current."
8. Initial luminous flux and forward voltage at photometric measurement current	See individual test reports. The drive current used for luminous flux, forward voltage and chromaticity measurements is listed as "Measurement Current."
9. Lumen maintenance data for each individual LED light source	See individual test reports. Ambient temperature during luminous flux testing set to 25°C ±2°C.
10. Observation of LED light source failures	No failures occurred during testing.
11. LED light source monitoring interval	See individual test reports.
12. Photometric measurement uncertainty	Cree maintains a tolerance of +/- 2.0% on flux measurements for LM-80 testing.
13. Chromaticity shift reported over the measurement time	See individual test reports. Ambient temperature during chromaticity testing set to 25°C ±2°C.

**Test Summary**

Data Set	Color	Case Temp. [T <sub>s</sub> ]	Ambient Temp. [T <sub>A</sub> ]	Drive Current [I <sub>F</sub> ]	Average Lumen Maintenance at 6,000 hours	Average Chromaticity Shift (Δu'v') at 6,000 hours
1	Cool White	25°C	25°C	350 mA	98.1%	0.0040
2	Warm White	25°C	25°C	350 mA	98.8%	0.0020
3	Cool White	25°C	25°C	700 mA	98.0%	0.0040
4	Warm White	25°C	25°C	700 mA	97.8%	0.0022
5	Cool White	45°C	45°C	350 mA	97.8%	0.0129
6	Cool White	45°C	45°C	1000 mA	97.9%	0.0017
7	Cool White	55°C	55°C	350 mA	98.0%	0.0031
8	Warm White	55°C	55°C	350 mA	97.7%	0.0019
9	Cool White	55°C	55°C	1000 mA	97.0%	0.0047
10	Warm White	55°C	55°C	1000 mA	96.2%	0.0026
11	Cool White	85°C	85°C	350 mA	94.3%	0.0030
12	Warm White	85°C	85°C	350 mA	96.9%	0.0012
13	Cool White	85°C	85°C	1000 mA	95.0%	0.0022