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Opto Semiconductors

# DURIS® E 2835
# White (CCT 2200 K – 6500 K)

IES LM-80-15 Test Report

Test Documentation No.:
180304W5 ( Document no. R2DG170918052-10-1-10000) – 19th Apr 2019

# TEST REPORT

According to ANSI/IES LM-80-15
For

## Osram Opto Semiconductors (Malaysia) Sdn. Bhd

Bayan Lepas Free Industrial Zone Phase 1,11900 Bayan Lepas, Penang, Malaysia.

## Model: GW JTLPS1.EM

| | |
|---|---|
| **Report Type:**<br>10000 Hours Test Report | **Product Type:**<br>LED Package |
| **Test Engineer:** | Pote Wang |
| **Report Number:** | R2DG170918052-10-1-10000 |
| **Test Date:** | 2017-09-27 to 2019-04-01 |
| **Report Date:** | 2019-04-11 |
| **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).<br>No.69,Pulongcun, Puxinhu Industrial Area, Tangxia ,<br>Dongguan, Guangdong, China.<br>Tel: +86-0769-86858888<br>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:

90 PCS samples were received on 2017-09-18. The samples were numbered from 1 to 30, 31 to 60 and 61 to 90.

| | |
|---|---|
| Manufacturer: | Osram Opto Semiconductors (Malaysia) Sdn. Bhd |
| Part Number: | GW JTLPS1.EM |
| Part Type: | LED Package |
| Drive Level: | DC 150mA |
| Nominal CCT: | 2700K |
| Power: | 0.46W |
| Average Current Density per LED die: | 308mA/mm$^2$ |
| Average Power Density per LED die: | 0.94W/mm$^2$ |
| Average Power Density per LED Package: | 0.05W/mm$^2$ |
| CRI: | 80 |
| Die Spacing: | 0.27mm |

### 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.

## 1.2 Standards Used:

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- CIE 127:2007: Measurement of LEDs (This standard was not accredited by IAS)
- 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 |
|---|---|---|---|---|---|
| 0.3m integrating sphere | EVERFINE | Diameter 0.3m | 1011119 | 2019-03-18 | 2020-03-17 |
| Programmable Test Power for LEDs | EVERFINE | LED300E | 1008002 | 2019-03-26 | 2020-03-25 |
| High accuracy array spectroradiometer | EVERFINE | HAAS-2000 | 1012016T | 2019-03-18 | 2020-03-17 |
| Standard Light Source | EVERFINE | D062 | G100278CJ7351206 | 2018-12-24 | 2019-12-24 |
| Precision digital stabilized DC power supply | EVERFINE | WY605-V110 | G115987CJ7321114 | 2019-03-26 | 2020-03-25 |
| Multilayer aging machine | BACL | B2-270 | 20015 | 2019-03-13 | 2020-03-12 |
| DC Power Supply | BACL | B12001-12 | 90023 | 2018-12-17 | 2019-12-17 |

## 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 luminous flux and chromaticity coordinate u'v'. 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.

The uncertainty of the light output measurements is U=1.59% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=21K (K=2), at the 95% confidence level.

The uncertainty of the temperature is U=0.8671°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: 55°C, 150mA**

| | |
|---|---|
| Part Number: | GW JTLPS1.EM |
| Number of Units: | 30 |
| Case Temperature: | >53°C |
| Ambient Temperature: | >50°C |
| Life Test Drive Current: | 150mA |
| Measurement Current: | 150mA |

**Data Set 2: 85°C, 150mA**

| | |
|---|---|
| Part Number: | GW JTLPS1.EM |
| Number of Units: | 30 |
| Case Temperature: | >83°C |
| Ambient Temperature: | >80°C |
| Life Test Drive Current: | 150mA |
| Measurement Current: | 150mA |

**Data Set 3: 105°C, 150mA**

| | |
|---|---|
| Part Number: | GW JTLPS1.EM |
| Number of Units: | 30 |
| Case Temperature: | >103°C |
| Ambient Temperature: | >100°C |
| Life Test Drive Current: | 150mA |
| Measurement Current: | 150mA |

## 2 - Summary of Test Result

| Data Set: | Sample Size | Failures Observed: | Test Interval | Test Duration | Reported TM-21 $L_{70}$ Lifetime |
|---|---|---|---|---|---|
| 1 | 30 | 0 | 1000hrs | 10000hrs | >60000hours |
| 2 | 30 | 0 | 1000hrs | 10000hrs | >60000 hours |
| 3 | 30 | 0 | 1000hrs | 10000hrs | >60000 hours |

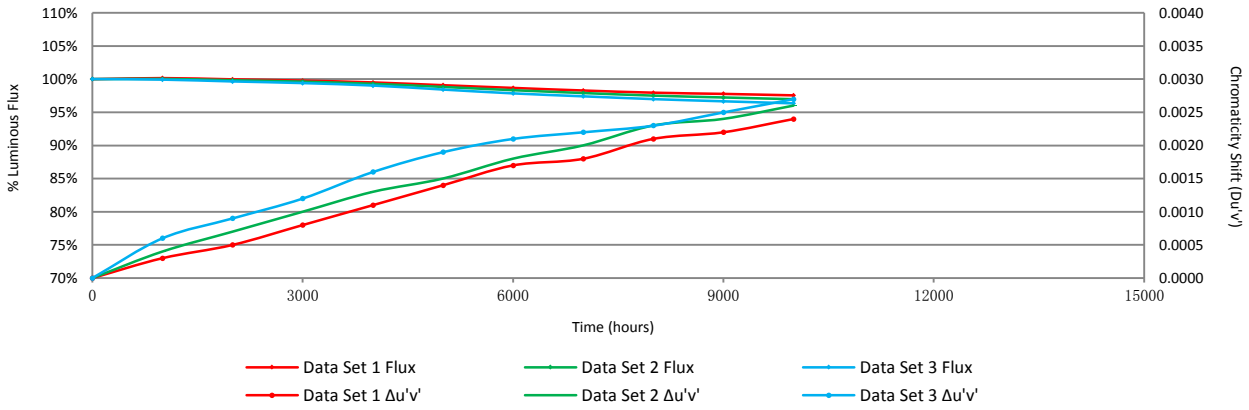
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

| Data Set: | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 100.16% | 99.97% | 99.78% | 99.51% | 99.09% | 98.68% | 98.29% | 97.96% | 97.78% | 97.56% |
| 2 | 100.03% | 99.83% | 99.61% | 99.29% | 98.82% | 98.33% | 97.90% | 97.51% | 97.23% | 96.97% |
| 3 | 99.91% | 99.64% | 99.39% | 99.02% | 98.42% | 97.84% | 97.40% | 96.98% | 96.65% | 96.34% |

Average Chromaticity Shift

| Data Set: | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.0003 | 0.0005 | 0.0008 | 0.0011 | 0.0014 | 0.0017 | 0.0018 | 0.0021 | 0.0022 | 0.0024 |
| 2 | 0.0004 | 0.0007 | 0.001 | 0.0013 | 0.0015 | 0.0018 | 0.0020 | 0.0023 | 0.0024 | 0.0026 |
| 3 | 0.0006 | 0.0009 | 0.0012 | 0.0016 | 0.0019 | 0.0021 | 0.0022 | 0.0023 | 0.0025 | 0.0027 |

Average Lumen Maintenance and Chromaticity Shift VS. Time



## 3 - Test Data

### 3.1 Data Set 1, 55°C, 150mA (Lumen Maintenance)

| No. | Φ(lm) | Lumen Maintenance (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 1 | 71.71 | 100.07 | 99.85 | 99.60 | 99.33 | 98.90 | 98.52 | 98.12 | 97.84 | 97.70 | 97.46 |
| 2 | 73.35 | 100.08 | 99.86 | 99.55 | 99.30 | 99.02 | 98.57 | 98.21 | 97.83 | 97.63 | 97.30 |
| 3 | 72.37 | 100.28 | 100.01 | 99.89 | 99.59 | 99.01 | 98.58 | 98.11 | 97.68 | 97.53 | 97.36 |
| 4 | 72.52 | 100.23 | 100.01 | 99.94 | 99.75 | 99.37 | 98.81 | 98.32 | 98.06 | 97.93 | 97.84 |
| 5 | 72.16 | 100.22 | 100.03 | 99.82 | 99.50 | 98.99 | 98.57 | 98.18 | 97.80 | 97.60 | 97.38 |
| 6 | 72.89 | 100.10 | 99.99 | 99.78 | 99.59 | 98.97 | 98.52 | 98.04 | 97.79 | 97.71 | 97.60 |
| 7 | 72.77 | 100.12 | 100.04 | 99.81 | 99.56 | 99.07 | 98.78 | 98.36 | 98.01 | 97.77 | 97.51 |
| 8 | 72.09 | 100.15 | 99.89 | 99.60 | 99.40 | 99.02 | 98.57 | 98.18 | 97.78 | 97.56 | 97.20 |
| 9 | 72.52 | 100.36 | 100.23 | 100.06 | 99.79 | 99.32 | 98.98 | 98.62 | 98.18 | 98.00 | 97.74 |
| 10 | 70.84 | 100.34 | 100.23 | 100.16 | 99.73 | 99.35 | 98.94 | 98.53 | 98.26 | 98.04 | 97.81 |
| 11 | 73.02 | 100.05 | 99.84 | 99.60 | 99.37 | 98.92 | 98.52 | 98.16 | 97.86 | 97.66 | 97.33 |
| 12 | 72.72 | 100.14 | 99.96 | 99.89 | 99.57 | 99.22 | 98.98 | 98.60 | 98.18 | 98.05 | 97.74 |
| 13 | 73.55 | 100.27 | 100.05 | 99.76 | 99.35 | 98.84 | 98.50 | 98.04 | 97.66 | 97.46 | 97.17 |
| 14 | 73.82 | 100.22 | 99.97 | 99.85 | 99.53 | 99.13 | 98.71 | 98.35 | 98.13 | 97.91 | 97.63 |
| 15 | 73.29 | 100.25 | 100.05 | 99.82 | 99.40 | 99.24 | 98.79 | 98.36 | 97.99 | 97.83 | 97.68 |
| 16 | 72.32 | 100.03 | 99.82 | 99.71 | 99.50 | 99.29 | 98.94 | 98.51 | 98.20 | 98.09 | 97.88 |
| 17 | 74.05 | 100.28 | 100.14 | 99.93 | 99.55 | 99.04 | 98.66 | 98.24 | 97.89 | 97.76 | 97.45 |
| 18 | 72.85 | 100.07 | 99.93 | 99.89 | 99.56 | 99.05 | 98.71 | 98.39 | 98.11 | 97.90 | 97.63 |
| 19 | 72.68 | 100.28 | 100.14 | 99.99 | 99.68 | 99.48 | 98.93 | 98.58 | 98.34 | 98.13 | 97.88 |
| 20 | 72.22 | 99.96 | 99.81 | 99.63 | 99.35 | 99.10 | 98.74 | 98.35 | 98.02 | 97.87 | 97.70 |
| 21 | 73.98 | 100.12 | 99.77 | 99.58 | 99.42 | 98.92 | 98.50 | 98.18 | 97.80 | 97.72 | 97.49 |
| 22 | 70.47 | 100.37 | 100.26 | 100.11 | 99.90 | 99.60 | 99.30 | 98.85 | 98.52 | 98.28 | 98.11 |
| 23 | 73.12 | 100.16 | 99.92 | 99.77 | 99.40 | 98.81 | 98.40 | 98.00 | 97.77 | 97.61 | 97.39 |
| 24 | 73.54 | 100.12 | 99.77 | 99.43 | 99.16 | 98.64 | 98.14 | 97.70 | 97.47 | 97.24 | 97.06 |
| 25 | 73.14 | 99.92 | 99.66 | 99.23 | 99.02 | 98.46 | 97.92 | 97.59 | 97.31 | 97.09 | 96.88 |
| 26 | 73.23 | 100.12 | 99.95 | 99.78 | 99.63 | 99.28 | 98.84 | 98.50 | 98.03 | 97.80 | 97.61 |
| 27 | 73.33 | 100.03 | 99.88 | 99.52 | 99.28 | 98.62 | 98.13 | 97.75 | 97.53 | 97.31 | 97.16 |
| 28 | 73.00 | 100.22 | 100.12 | 99.96 | 99.70 | 99.33 | 99.08 | 98.73 | 98.36 | 98.18 | 97.99 |
| 29 | 73.76 | 100.19 | 100.12 | 100.04 | 99.72 | 99.28 | 99.12 | 98.81 | 98.40 | 98.17 | 98.05 |
| 30 | 73.00 | 100.08 | 99.90 | 99.73 | 99.58 | 99.33 | 98.78 | 98.34 | 98.11 | 97.88 | 97.66 |
| Avg. | 72.81 | 100.16 | 99.97 | 99.78 | 99.51 | 99.09 | 98.68 | 98.29 | 97.96 | 97.78 | 97.56 |
| Med. | 72.95 | 100.15 | 99.97 | 99.79 | 99.54 | 99.06 | 98.71 | 98.33 | 98.00 | 97.79 | 97.60 |
| st dev | 0.8240 | 0.1142 | 0.1487 | 0.2098 | 0.1951 | 0.2615 | 0.3014 | 0.3048 | 0.2857 | 0.2856 | 0.2990 |
| Min. | 70.47 | 99.92 | 99.66 | 99.23 | 99.02 | 98.46 | 97.92 | 97.59 | 97.31 | 97.09 | 96.88 |
| Max. | 74.05 | 100.37 | 100.26 | 100.16 | 99.90 | 99.60 | 99.30 | 98.85 | 98.52 | 98.28 | 98.11 |

### 3.2 Data Set 1, 55°C, 150mA (Forward Voltage)

| No. | Forward Voltage (V) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 1 | 3.111 | 3.113 | 3.122 | 3.128 | 3.119 | 3.123 | 3.120 | 3.099 | 3.125 | 3.110 | 3.117 |
| 2 | 3.114 | 3.117 | 3.127 | 3.125 | 3.122 | 3.126 | 3.120 | 3.102 | 3.124 | 3.113 | 3.121 |
| 3 | 3.123 | 3.122 | 3.135 | 3.136 | 3.130 | 3.133 | 3.126 | 3.108 | 3.131 | 3.122 | 3.139 |
| 4 | 3.115 | 3.116 | 3.127 | 3.132 | 3.123 | 3.126 | 3.120 | 3.102 | 3.123 | 3.114 | 3.128 |
| 5 | 3.121 | 3.123 | 3.135 | 3.143 | 3.130 | 3.133 | 3.125 | 3.110 | 3.126 | 3.123 | 3.132 |
| 6 | 3.109 | 3.107 | 3.121 | 3.126 | 3.115 | 3.118 | 3.111 | 3.097 | 3.112 | 3.106 | 3.118 |
| 7 | 3.114 | 3.113 | 3.125 | 3.128 | 3.124 | 3.121 | 3.115 | 3.098 | 3.118 | 3.113 | 3.134 |
| 8 | 3.118 | 3.118 | 3.132 | 3.136 | 3.125 | 3.127 | 3.120 | 3.106 | 3.125 | 3.117 | 3.131 |
| 9 | 3.113 | 3.115 | 3.129 | 3.135 | 3.121 | 3.124 | 3.116 | 3.103 | 3.123 | 3.113 | 3.111 |
| 10 | 3.115 | 3.115 | 3.130 | 3.136 | 3.121 | 3.123 | 3.117 | 3.101 | 3.118 | 3.113 | 3.132 |
| 11 | 3.117 | 3.118 | 3.131 | 3.136 | 3.124 | 3.126 | 3.116 | 3.104 | 3.120 | 3.114 | 3.126 |
| 12 | 3.118 | 3.119 | 3.131 | 3.139 | 3.124 | 3.125 | 3.116 | 3.102 | 3.122 | 3.114 | 3.116 |
| 13 | 3.122 | 3.124 | 3.137 | 3.139 | 3.129 | 3.133 | 3.124 | 3.106 | 3.128 | 3.119 | 3.111 |
| 14 | 3.111 | 3.116 | 3.126 | 3.126 | 3.121 | 3.127 | 3.113 | 3.097 | 3.118 | 3.111 | 3.115 |
| 15 | 3.113 | 3.113 | 3.127 | 3.125 | 3.120 | 3.125 | 3.118 | 3.099 | 3.120 | 3.108 | 3.104 |
| 16 | 3.115 | 3.115 | 3.128 | 3.128 | 3.124 | 3.129 | 3.124 | 3.100 | 3.122 | 3.111 | 3.113 |
| 17 | 3.127 | 3.126 | 3.139 | 3.138 | 3.132 | 3.138 | 3.127 | 3.108 | 3.121 | 3.122 | 3.150 |
| 18 | 3.116 | 3.121 | 3.133 | 3.135 | 3.123 | 3.136 | 3.124 | 3.104 | 3.121 | 3.114 | 3.131 |
| 19 | 3.113 | 3.116 | 3.131 | 3.128 | 3.121 | 3.126 | 3.119 | 3.102 | 3.116 | 3.115 | 3.124 |
| 20 | 3.118 | 3.122 | 3.132 | 3.127 | 3.124 | 3.126 | 3.121 | 3.107 | 3.127 | 3.114 | 3.142 |
| 21 | 3.111 | 3.112 | 3.126 | 3.120 | 3.116 | 3.121 | 3.111 | 3.095 | 3.116 | 3.105 | 3.118 |
| 22 | 3.117 | 3.118 | 3.130 | 3.126 | 3.124 | 3.157 | 3.115 | 3.099 | 3.121 | 3.112 | 3.128 |
| 23 | 3.115 | 3.113 | 3.128 | 3.123 | 3.121 | 3.130 | 3.112 | 3.097 | 3.120 | 3.113 | 3.121 |
| 24 | 3.113 | 3.114 | 3.128 | 3.123 | 3.119 | 3.123 | 3.122 | 3.094 | 3.120 | 3.108 | 3.120 |
| 25 | 3.118 | 3.118 | 3.132 | 3.127 | 3.126 | 3.138 | 3.121 | 3.104 | 3.124 | 3.116 | 3.130 |
| 26 | 3.130 | 3.125 | 3.140 | 3.135 | 3.130 | 3.134 | 3.124 | 3.109 | 3.132 | 3.121 | 3.127 |
| 27 | 3.130 | 3.120 | 3.135 | 3.129 | 3.126 | 3.130 | 3.120 | 3.105 | 3.128 | 3.115 | 3.129 |
| 28 | 3.126 | 3.114 | 3.130 | 3.128 | 3.121 | 3.128 | 3.114 | 3.100 | 3.128 | 3.112 | 3.144 |
| 29 | 3.109 | 3.110 | 3.123 | 3.121 | 3.111 | 3.117 | 3.109 | 3.092 | 3.132 | 3.101 | 3.119 |
| 30 | 3.119 | 3.121 | 3.133 | 3.135 | 3.124 | 3.126 | 3.117 | 3.100 | 3.132 | 3.114 | 3.132 |
| Avg. | 3.117 | 3.117 | 3.130 | 3.130 | 3.123 | 3.128 | 3.119 | 3.102 | 3.123 | 3.113 | 3.125 |
| Med. | 3.116 | 3.117 | 3.130 | 3.128 | 3.124 | 3.126 | 3.120 | 3.102 | 3.123 | 3.114 | 3.127 |
| st dev | 0.0057 | 0.0045 | 0.0047 | 0.0060 | 0.0046 | 0.0076 | 0.0048 | 0.0046 | 0.0051 | 0.0050 | 0.0106 |
| Min. | 3.109 | 3.107 | 3.121 | 3.120 | 3.111 | 3.117 | 3.109 | 3.092 | 3.112 | 3.101 | 3.104 |
| Max. | 3.130 | 3.126 | 3.140 | 3.143 | 3.132 | 3.157 | 3.127 | 3.110 | 3.132 | 3.123 | 3.150 |

### 3.3 Data Set 1, 55°C, 150mA (Chromaticity Shift)

| No. | u' | v' | CCT(K) | Chromaticity Shift (Δu'v') | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | | | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 1 | 0.2605 | 0.5269 | 2744 | 0.0002 | 0.0007 | 0.0012 | 0.0013 | 0.0018 | 0.0020 | 0.0021 | 0.0018 | 0.0018 | 0.0020 |
| 2 | 0.2584 | 0.5243 | 2800 | 0.0002 | 0.0005 | 0.0009 | 0.0012 | 0.0015 | 0.0018 | 0.0018 | 0.0021 | 0.0022 | 0.0024 |
| 3 | 0.2593 | 0.5250 | 2778 | 0.0003 | 0.0002 | 0.0007 | 0.0011 | 0.0014 | 0.0014 | 0.0016 | 0.0019 | 0.0020 | 0.0022 |
| 4 | 0.2590 | 0.5274 | 2773 | 0.0003 | 0.0006 | 0.0009 | 0.0013 | 0.0017 | 0.0018 | 0.0019 | 0.0022 | 0.0023 | 0.0025 |
| 5 | 0.2587 | 0.5251 | 2790 | 0.0001 | 0.0004 | 0.0003 | 0.0005 | 0.0009 | 0.0011 | 0.0013 | 0.0015 | 0.0016 | 0.0018 |
| 6 | 0.2611 | 0.5267 | 2732 | 0.0003 | 0.0004 | 0.0005 | 0.0007 | 0.0011 | 0.0012 | 0.0014 | 0.0017 | 0.0019 | 0.0020 |
| 7 | 0.2603 | 0.5271 | 2747 | 0.0004 | 0.0005 | 0.0009 | 0.0011 | 0.0016 | 0.0018 | 0.0020 | 0.0023 | 0.0024 | 0.0025 |
| 8 | 0.2600 | 0.5254 | 2762 | 0.0003 | 0.0002 | 0.0004 | 0.0009 | 0.0013 | 0.0016 | 0.0017 | 0.0021 | 0.0022 | 0.0024 |
| 9 | 0.2597 | 0.5252 | 2769 | 0.0004 | 0.0004 | 0.0004 | 0.0008 | 0.0014 | 0.0015 | 0.0017 | 0.0021 | 0.0021 | 0.0023 |
| 10 | 0.2593 | 0.5235 | 2785 | 0.0006 | 0.0006 | 0.0004 | 0.0008 | 0.0013 | 0.0015 | 0.0015 | 0.0020 | 0.0021 | 0.0022 |
| 11 | 0.2577 | 0.5254 | 2810 | 0.0006 | 0.0006 | 0.0006 | 0.0011 | 0.0016 | 0.0018 | 0.0019 | 0.0023 | 0.0025 | 0.0026 |
| 12 | 0.2602 | 0.5249 | 2760 | 0.0003 | 0.0005 | 0.0007 | 0.0009 | 0.0014 | 0.0016 | 0.0017 | 0.0021 | 0.0023 | 0.0025 |
| 13 | 0.2584 | 0.5245 | 2799 | 0.0002 | 0.0004 | 0.0007 | 0.0008 | 0.0014 | 0.0016 | 0.0016 | 0.0020 | 0.0022 | 0.0023 |
| 14 | 0.2593 | 0.5255 | 2776 | 0.0002 | 0.0003 | 0.0005 | 0.0008 | 0.0011 | 0.0016 | 0.0017 | 0.0021 | 0.0023 | 0.0024 |
| 15 | 0.2588 | 0.5264 | 2783 | 0.0004 | 0.0004 | 0.0004 | 0.0008 | 0.0011 | 0.0018 | 0.0018 | 0.0021 | 0.0023 | 0.0026 |
| 16 | 0.2600 | 0.5259 | 2759 | 0.0001 | 0.0004 | 0.0006 | 0.0013 | 0.0013 | 0.0014 | 0.0014 | 0.0019 | 0.0021 | 0.0023 |
| 17 | 0.2570 | 0.5250 | 2829 | 0.0003 | 0.0004 | 0.0010 | 0.0014 | 0.0015 | 0.0016 | 0.0017 | 0.0021 | 0.0021 | 0.0023 |
| 18 | 0.2609 | 0.5268 | 2736 | 0.0001 | 0.0005 | 0.0009 | 0.0014 | 0.0015 | 0.0017 | 0.0019 | 0.0019 | 0.0021 | 0.0022 |
| 19 | 0.2599 | 0.5262 | 2759 | 0.0004 | 0.0005 | 0.0007 | 0.0011 | 0.0015 | 0.0018 | 0.0019 | 0.0021 | 0.0023 | 0.0024 |
| 20 | 0.2588 | 0.5261 | 2783 | 0.0002 | 0.0004 | 0.0009 | 0.0012 | 0.0015 | 0.0018 | 0.0019 | 0.0019 | 0.0021 | 0.0023 |
| 21 | 0.2588 | 0.5276 | 2778 | 0.0003 | 0.0002 | 0.0008 | 0.0012 | 0.0012 | 0.0018 | 0.0019 | 0.0020 | 0.0022 | 0.0024 |
| 22 | 0.2618 | 0.5268 | 2716 | 0.0005 | 0.0007 | 0.0011 | 0.0015 | 0.0018 | 0.0023 | 0.0024 | 0.0025 | 0.0028 | 0.0029 |
| 23 | 0.2576 | 0.5255 | 2813 | 0.0004 | 0.0004 | 0.0009 | 0.0013 | 0.0016 | 0.0019 | 0.0021 | 0.0023 | 0.0025 | 0.0028 |
| 24 | 0.2584 | 0.5277 | 2786 | 0.0006 | 0.0011 | 0.0011 | 0.0015 | 0.0018 | 0.0020 | 0.0021 | 0.0023 | 0.0025 | 0.0028 |
| 25 | 0.2578 | 0.5251 | 2812 | 0.0004 | 0.0010 | 0.0012 | 0.0015 | 0.0018 | 0.0020 | 0.0021 | 0.0023 | 0.0027 | 0.0028 |
| 26 | 0.2584 | 0.5270 | 2788 | 0.0002 | 0.0004 | 0.0008 | 0.0010 | 0.0014 | 0.0017 | 0.0019 | 0.0021 | 0.0023 | 0.0024 |
| 27 | 0.2591 | 0.5267 | 2776 | 0.0002 | 0.0003 | 0.0008 | 0.0012 | 0.0014 | 0.0017 | 0.0018 | 0.0021 | 0.0023 | 0.0025 |
| 28 | 0.2594 | 0.5253 | 2775 | 0.0004 | 0.0005 | 0.0011 | 0.0014 | 0.0015 | 0.0018 | 0.0020 | 0.0024 | 0.0025 | 0.0027 |
| 29 | 0.2585 | 0.5275 | 2784 | 0.0002 | 0.0006 | 0.0007 | 0.0011 | 0.0013 | 0.0016 | 0.0019 | 0.0022 | 0.0023 | 0.0025 |
| 30 | 0.2592 | 0.5256 | 2777 | 0.0003 | 0.0003 | 0.0006 | 0.0014 | 0.0015 | 0.0016 | 0.0020 | 0.0021 | 0.0023 | 0.0025 |
| Avg. | 0.2592 | 0.5259 | 2776 | 0.0003 | 0.0005 | 0.0008 | 0.0011 | 0.0014 | 0.0017 | 0.0018 | 0.0021 | 0.0022 | 0.0024 |
| Med. | 0.2592 | 0.5258 | 2778 | 0.0003 | 0.0004 | 0.0008 | 0.0012 | 0.0015 | 0.0017 | 0.0019 | 0.0021 | 0.0023 | 0.0024 |
| st dev | 0.0011 | 0.0011 | 25.2689 | 0.0001 | 0.0002 | 0.0003 | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.0003 |
| Min. | 0.2570 | 0.5235 | 2716 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0009 | 0.0011 | 0.0013 | 0.0015 | 0.0016 | 0.0018 |
| Max. | 0.2618 | 0.5277 | 2829 | 0.0006 | 0.0011 | 0.0012 | 0.0015 | 0.0018 | 0.0023 | 0.0024 | 0.0025 | 0.0028 | 0.0029 |

### 3.4 Data Set 2, 85°C, 150mA (Lumen Maintenance)

| No. | Φ(lm) | Lumen Maintenance (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 31 | 72.71 | 100.21 | 100.11 | 99.93 | 99.75 | 99.31 | 98.94 | 98.47 | 98.17 | 97.98 | 97.65 |
| 32 | 71.46 | 99.94 | 99.69 | 99.52 | 99.30 | 99.05 | 98.60 | 98.15 | 97.72 | 97.50 | 97.23 |
| 33 | 73.59 | 99.89 | 99.66 | 99.31 | 98.98 | 98.55 | 97.91 | 97.46 | 97.28 | 97.05 | 96.71 |
| 34 | 73.48 | 99.88 | 99.52 | 99.21 | 98.88 | 98.56 | 98.11 | 97.73 | 97.41 | 97.24 | 97.02 |
| 35 | 73.31 | 99.99 | 99.67 | 99.44 | 99.05 | 98.55 | 98.02 | 97.59 | 97.23 | 96.75 | 96.59 |
| 36 | 73.72 | 100.05 | 99.84 | 99.63 | 99.32 | 98.66 | 97.97 | 97.54 | 97.00 | 96.83 | 96.60 |
| 37 | 73.71 | 100.22 | 100.20 | 100.03 | 99.86 | 99.38 | 98.96 | 98.52 | 97.95 | 97.69 | 97.46 |
| 38 | 73.92 | 100.28 | 100.07 | 99.96 | 99.69 | 99.32 | 98.81 | 98.32 | 97.85 | 97.59 | 97.43 |
| 39 | 73.03 | 99.95 | 99.66 | 99.44 | 99.07 | 98.90 | 98.43 | 98.04 | 97.63 | 97.40 | 97.10 |
| 40 | 73.23 | 100.23 | 99.96 | 99.52 | 99.33 | 98.73 | 98.33 | 97.90 | 97.47 | 97.06 | 96.94 |
| 41 | 72.72 | 99.92 | 99.63 | 99.44 | 99.22 | 98.90 | 98.51 | 98.09 | 97.77 | 97.41 | 97.26 |
| 42 | 72.60 | 99.83 | 99.63 | 99.48 | 99.12 | 98.80 | 98.28 | 97.78 | 97.31 | 97.07 | 96.90 |
| 43 | 74.18 | 99.97 | 99.74 | 99.41 | 99.04 | 98.45 | 97.99 | 97.52 | 97.22 | 96.94 | 96.68 |
| 44 | 73.91 | 100.01 | 99.93 | 99.70 | 99.46 | 98.97 | 98.42 | 98.00 | 97.59 | 97.32 | 97.04 |
| 45 | 73.28 | 100.30 | 100.04 | 99.77 | 99.44 | 99.03 | 98.62 | 98.19 | 97.79 | 97.56 | 97.26 |
| 46 | 72.92 | 100.05 | 99.86 | 99.62 | 99.22 | 98.77 | 98.38 | 97.96 | 97.67 | 97.44 | 97.17 |
| 47 | 73.40 | 99.95 | 99.74 | 99.43 | 98.98 | 98.65 | 98.26 | 97.81 | 97.44 | 97.21 | 96.91 |
| 48 | 74.08 | 99.99 | 99.88 | 99.70 | 99.37 | 98.93 | 98.42 | 97.96 | 97.50 | 97.11 | 96.75 |
| 49 | 74.18 | 100.04 | 99.68 | 99.50 | 99.29 | 99.10 | 98.65 | 98.22 | 97.72 | 97.53 | 97.25 |
| 50 | 71.30 | 100.21 | 99.94 | 99.52 | 99.14 | 98.53 | 97.95 | 97.56 | 97.12 | 96.86 | 96.59 |
| 51 | 71.10 | 100.32 | 100.25 | 100.04 | 99.72 | 99.09 | 98.64 | 98.17 | 97.61 | 97.19 | 96.85 |
| 52 | 73.97 | 99.93 | 99.76 | 99.41 | 99.00 | 98.55 | 98.03 | 97.62 | 97.24 | 96.86 | 96.49 |
| 53 | 72.57 | 99.82 | 99.66 | 99.59 | 99.17 | 98.81 | 98.40 | 98.03 | 97.67 | 97.41 | 97.09 |
| 54 | 73.55 | 99.89 | 99.63 | 99.48 | 99.02 | 98.42 | 97.91 | 97.46 | 97.20 | 96.85 | 96.71 |
| 55 | 73.42 | 99.95 | 99.88 | 99.69 | 99.31 | 98.90 | 98.24 | 97.75 | 97.28 | 97.14 | 96.77 |
| 56 | 73.18 | 99.99 | 99.73 | 99.62 | 99.40 | 98.63 | 98.13 | 97.70 | 97.31 | 96.83 | 96.62 |
| 57 | 72.92 | 100.23 | 100.03 | 99.81 | 99.40 | 98.89 | 98.33 | 97.94 | 97.50 | 97.20 | 96.96 |
| 58 | 72.99 | 100.01 | 99.88 | 99.75 | 99.42 | 98.95 | 98.36 | 97.96 | 97.52 | 97.26 | 97.05 |
| 59 | 71.44 | 99.72 | 99.61 | 99.51 | 99.05 | 98.33 | 98.00 | 97.58 | 97.28 | 97.10 | 96.88 |
| 60 | 70.50 | 100.26 | 100.07 | 99.89 | 99.57 | 98.79 | 98.41 | 97.99 | 97.67 | 97.59 | 97.25 |
| Avg. | 73.01 | 100.03 | 99.83 | 99.61 | 99.29 | 98.82 | 98.33 | 97.90 | 97.51 | 97.23 | 96.97 |
| Med. | 73.26 | 99.99 | 99.80 | 99.56 | 99.29 | 98.81 | 98.34 | 97.95 | 97.50 | 97.20 | 96.95 |
| st dev | 0.9674 | 0.1615 | 0.1942 | 0.2122 | 0.2550 | 0.2709 | 0.2980 | 0.2928 | 0.2677 | 0.3013 | 0.2944 |
| Min. | 70.50 | 99.72 | 99.52 | 99.21 | 98.88 | 98.33 | 97.91 | 97.46 | 97.00 | 96.75 | 96.49 |
| Max. | 74.18 | 100.32 | 100.25 | 100.04 | 99.86 | 99.38 | 98.96 | 98.52 | 98.17 | 97.98 | 97.65 |

### 3.5 Data Set 2, 85°C, 150mA (Forward Voltage)

| No. | Forward Voltage (V) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 31 | 3.117 | 3.119 | 3.133 | 3.131 | 3.121 | 3.128 | 3.121 | 3.101 | 3.132 | 3.116 | 3.123 |
| 32 | 3.115 | 3.112 | 3.128 | 3.126 | 3.119 | 3.118 | 3.115 | 3.098 | 3.127 | 3.111 | 3.121 |
| 33 | 3.115 | 3.115 | 3.130 | 3.136 | 3.122 | 3.127 | 3.123 | 3.102 | 3.142 | 3.114 | 3.124 |
| 34 | 3.108 | 3.110 | 3.128 | 3.127 | 3.115 | 3.124 | 3.108 | 3.090 | 3.112 | 3.106 | 3.114 |
| 35 | 3.110 | 3.115 | 3.126 | 3.129 | 3.118 | 3.119 | 3.117 | 3.098 | 3.115 | 3.110 | 3.116 |
| 36 | 3.121 | 3.118 | 3.132 | 3.130 | 3.121 | 3.127 | 3.132 | 3.100 | 3.116 | 3.114 | 3.120 |
| 37 | 3.119 | 3.118 | 3.133 | 3.131 | 3.123 | 3.128 | 3.121 | 3.105 | 3.117 | 3.116 | 3.126 |
| 38 | 3.107 | 3.109 | 3.128 | 3.124 | 3.113 | 3.118 | 3.117 | 3.094 | 3.110 | 3.108 | 3.111 |
| 39 | 3.116 | 3.118 | 3.131 | 3.132 | 3.121 | 3.125 | 3.120 | 3.105 | 3.116 | 3.112 | 3.141 |
| 40 | 3.114 | 3.117 | 3.129 | 3.134 | 3.120 | 3.121 | 3.116 | 3.099 | 3.091 | 3.112 | 3.118 |
| 41 | 3.117 | 3.117 | 3.132 | 3.133 | 3.125 | 3.125 | 3.120 | 3.104 | 3.106 | 3.113 | 3.134 |
| 42 | 3.112 | 3.113 | 3.126 | 3.126 | 3.119 | 3.118 | 3.112 | 3.100 | 3.093 | 3.110 | 3.132 |
| 43 | 3.111 | 3.111 | 3.126 | 3.125 | 3.117 | 3.117 | 3.111 | 3.097 | 3.098 | 3.106 | 3.103 |
| 44 | 3.113 | 3.115 | 3.129 | 3.130 | 3.120 | 3.119 | 3.115 | 3.099 | 3.100 | 3.113 | 3.113 |
| 45 | 3.113 | 3.116 | 3.132 | 3.128 | 3.121 | 3.125 | 3.117 | 3.100 | 3.108 | 3.113 | 3.117 |
| 46 | 3.113 | 3.113 | 3.129 | 3.130 | 3.122 | 3.130 | 3.116 | 3.099 | 3.108 | 3.111 | 3.110 |
| 47 | 3.125 | 3.126 | 3.141 | 3.139 | 3.132 | 3.140 | 3.124 | 3.111 | 3.114 | 3.124 | 3.124 |
| 48 | 3.117 | 3.117 | 3.133 | 3.129 | 3.123 | 3.123 | 3.117 | 3.103 | 3.115 | 3.114 | 3.110 |
| 49 | 3.112 | 3.112 | 3.128 | 3.126 | 3.119 | 3.125 | 3.111 | 3.097 | 3.109 | 3.111 | 3.106 |
| 50 | 3.116 | 3.123 | 3.131 | 3.124 | 3.119 | 3.125 | 3.111 | 3.097 | 3.117 | 3.108 | 3.110 |
| 51 | 3.116 | 3.117 | 3.131 | 3.128 | 3.122 | 3.117 | 3.115 | 3.101 | 3.086 | 3.111 | 3.112 |
| 52 | 3.117 | 3.116 | 3.130 | 3.129 | 3.122 | 3.121 | 3.115 | 3.101 | 3.085 | 3.114 | 3.110 |
| 53 | 3.116 | 3.116 | 3.131 | 3.126 | 3.122 | 3.120 | 3.115 | 3.100 | 3.085 | 3.110 | 3.116 |
| 54 | 3.120 | 3.121 | 3.135 | 3.133 | 3.128 | 3.126 | 3.118 | 3.107 | 3.107 | 3.114 | 3.116 |
| 55 | 3.119 | 3.119 | 3.135 | 3.132 | 3.126 | 3.125 | 3.118 | 3.102 | 3.122 | 3.114 | 3.127 |
| 56 | 3.117 | 3.116 | 3.133 | 3.133 | 3.123 | 3.123 | 3.117 | 3.101 | 3.128 | 3.112 | 3.118 |
| 57 | 3.117 | 3.117 | 3.133 | 3.131 | 3.123 | 3.130 | 3.123 | 3.101 | 3.125 | 3.112 | 3.116 |
| 58 | 3.118 | 3.117 | 3.134 | 3.133 | 3.124 | 3.131 | 3.128 | 3.103 | 3.125 | 3.113 | 3.116 |
| 59 | 3.110 | 3.111 | 3.126 | 3.124 | 3.117 | 3.125 | 3.111 | 3.094 | 3.123 | 3.104 | 3.110 |
| 60 | 3.112 | 3.114 | 3.128 | 3.127 | 3.117 | 3.117 | 3.117 | 3.098 | 3.126 | 3.106 | 3.107 |
| Avg. | 3.115 | 3.116 | 3.131 | 3.130 | 3.121 | 3.124 | 3.117 | 3.100 | 3.112 | 3.112 | 3.117 |
| Med. | 3.116 | 3.116 | 3.131 | 3.130 | 3.121 | 3.125 | 3.117 | 3.100 | 3.115 | 3.112 | 3.116 |
| st dev | 0.0039 | 0.0037 | 0.0033 | 0.0037 | 0.0038 | 0.0052 | 0.0052 | 0.0041 | 0.0144 | 0.0038 | 0.0087 |
| Min. | 3.107 | 3.109 | 3.126 | 3.124 | 3.113 | 3.117 | 3.108 | 3.090 | 3.085 | 3.104 | 3.103 |
| Max. | 3.125 | 3.126 | 3.141 | 3.139 | 3.132 | 3.140 | 3.132 | 3.111 | 3.142 | 3.124 | 3.141 |

### 3.6 Data Set 2, 85°C, 150mA (Chromaticity Shift)

| No. | u' | v' | CCT(K) | Chromaticity Shift (Δu'v') | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | | | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 31 | 0.2584 | 0.5263 | 2791 | 0.0004 | 0.0006 | 0.0010 | 0.0013 | 0.0015 | 0.0019 | 0.0021 | 0.0022 | 0.0023 | 0.0026 |
| 32 | 0.2613 | 0.5264 | 2729 | 0.0004 | 0.0004 | 0.0010 | 0.0014 | 0.0016 | 0.0018 | 0.0021 | 0.0023 | 0.0025 | 0.0027 |
| 33 | 0.2590 | 0.5257 | 2781 | 0.0005 | 0.0007 | 0.0008 | 0.0013 | 0.0014 | 0.0020 | 0.0022 | 0.0021 | 0.0023 | 0.0025 |
| 34 | 0.2588 | 0.5283 | 2773 | 0.0004 | 0.0002 | 0.0006 | 0.0011 | 0.0011 | 0.0017 | 0.0019 | 0.0020 | 0.0022 | 0.0025 |
| 35 | 0.2588 | 0.5249 | 2790 | 0.0004 | 0.0004 | 0.0006 | 0.0011 | 0.0011 | 0.0016 | 0.0018 | 0.0019 | 0.0019 | 0.0021 |
| 36 | 0.2589 | 0.5251 | 2787 | 0.0004 | 0.0004 | 0.0008 | 0.0012 | 0.0012 | 0.0016 | 0.0019 | 0.0020 | 0.0023 | 0.0024 |
| 37 | 0.2579 | 0.5253 | 2808 | 0.0005 | 0.0008 | 0.0009 | 0.0014 | 0.0017 | 0.0021 | 0.0023 | 0.0027 | 0.0028 | 0.0030 |
| 38 | 0.2579 | 0.5269 | 2800 | 0.0004 | 0.0008 | 0.0007 | 0.0013 | 0.0014 | 0.0016 | 0.0018 | 0.0021 | 0.0023 | 0.0025 |
| 39 | 0.2578 | 0.5271 | 2801 | 0.0004 | 0.0006 | 0.0012 | 0.0014 | 0.0016 | 0.0017 | 0.0018 | 0.0022 | 0.0023 | 0.0025 |
| 40 | 0.2598 | 0.5279 | 2754 | 0.0004 | 0.0010 | 0.0011 | 0.0014 | 0.0016 | 0.0017 | 0.0015 | 0.0022 | 0.0023 | 0.0025 |
| 41 | 0.2576 | 0.5254 | 2814 | 0.0004 | 0.0005 | 0.0004 | 0.0010 | 0.0011 | 0.0014 | 0.0016 | 0.0019 | 0.0021 | 0.0022 |
| 42 | 0.2602 | 0.5272 | 2749 | 0.0004 | 0.0011 | 0.0011 | 0.0016 | 0.0017 | 0.0020 | 0.0022 | 0.0026 | 0.0028 | 0.0030 |
| 43 | 0.2588 | 0.5280 | 2775 | 0.0004 | 0.0007 | 0.0013 | 0.0015 | 0.0016 | 0.0018 | 0.0020 | 0.0023 | 0.0026 | 0.0028 |
| 44 | 0.2573 | 0.5265 | 2816 | 0.0004 | 0.0006 | 0.0009 | 0.0012 | 0.0014 | 0.0016 | 0.0018 | 0.0022 | 0.0023 | 0.0026 |
| 45 | 0.2593 | 0.5273 | 2767 | 0.0004 | 0.0008 | 0.0013 | 0.0014 | 0.0016 | 0.0018 | 0.0022 | 0.0023 | 0.0024 | 0.0026 |
| 46 | 0.2588 | 0.5268 | 2782 | 0.0005 | 0.0008 | 0.0011 | 0.0016 | 0.0016 | 0.0020 | 0.0023 | 0.0025 | 0.0026 | 0.0029 |
| 47 | 0.2575 | 0.5266 | 2811 | 0.0006 | 0.0009 | 0.0012 | 0.0016 | 0.0017 | 0.0019 | 0.0022 | 0.0025 | 0.0025 | 0.0028 |
| 48 | 0.2586 | 0.5253 | 2792 | 0.0004 | 0.0004 | 0.0012 | 0.0013 | 0.0014 | 0.0016 | 0.0019 | 0.0021 | 0.0021 | 0.0023 |
| 49 | 0.2578 | 0.5261 | 2806 | 0.0004 | 0.0006 | 0.0009 | 0.0011 | 0.0013 | 0.0018 | 0.0018 | 0.0021 | 0.0023 | 0.0024 |
| 50 | 0.2587 | 0.5268 | 2782 | 0.0006 | 0.0010 | 0.0016 | 0.0020 | 0.0025 | 0.0023 | 0.0023 | 0.0025 | 0.0027 | 0.0029 |
| 51 | 0.2579 | 0.5252 | 2809 | 0.0009 | 0.0009 | 0.0014 | 0.0013 | 0.0016 | 0.0020 | 0.0023 | 0.0024 | 0.0025 | 0.0027 |
| 52 | 0.2583 | 0.5260 | 2795 | 0.0004 | 0.0006 | 0.0010 | 0.0013 | 0.0014 | 0.0016 | 0.0018 | 0.0023 | 0.0023 | 0.0025 |
| 53 | 0.2580 | 0.5263 | 2800 | 0.0004 | 0.0008 | 0.0010 | 0.0013 | 0.0015 | 0.0017 | 0.0019 | 0.0024 | 0.0024 | 0.0027 |
| 54 | 0.2582 | 0.5257 | 2799 | 0.0004 | 0.0010 | 0.0014 | 0.0016 | 0.0019 | 0.0021 | 0.0023 | 0.0028 | 0.0030 | 0.0031 |
| 55 | 0.2577 | 0.5251 | 2814 | 0.0004 | 0.0007 | 0.0008 | 0.0011 | 0.0014 | 0.0016 | 0.0019 | 0.0021 | 0.0022 | 0.0025 |
| 56 | 0.2588 | 0.5266 | 2782 | 0.0004 | 0.0006 | 0.0011 | 0.0011 | 0.0014 | 0.0016 | 0.0018 | 0.0022 | 0.0024 | 0.0027 |
| 57 | 0.2597 | 0.5264 | 2763 | 0.0004 | 0.0004 | 0.0006 | 0.0011 | 0.0014 | 0.0016 | 0.0018 | 0.0021 | 0.0023 | 0.0026 |
| 58 | 0.2595 | 0.5252 | 2773 | 0.0003 | 0.0008 | 0.0011 | 0.0015 | 0.0018 | 0.0019 | 0.0022 | 0.0025 | 0.0029 | 0.0030 |
| 59 | 0.2594 | 0.5273 | 2765 | 0.0004 | 0.0011 | 0.0013 | 0.0016 | 0.0018 | 0.0021 | 0.0022 | 0.0026 | 0.0030 | 0.0033 |
| 60 | 0.2576 | 0.5269 | 2805 | 0.0004 | 0.0008 | 0.0011 | 0.0011 | 0.0013 | 0.0019 | 0.0019 | 0.0021 | 0.0022 | 0.0024 |
| Avg. | 0.2586 | 0.5264 | 2787 | 0.0004 | 0.0007 | 0.0010 | 0.0013 | 0.0015 | 0.0018 | 0.0020 | 0.0023 | 0.0024 | 0.0026 |
| Med. | 0.2587 | 0.5264 | 2791 | 0.0004 | 0.0007 | 0.0010 | 0.0013 | 0.0015 | 0.0018 | 0.0019 | 0.0022 | 0.0023 | 0.0026 |
| st dev | 0.0009 | 0.0009 | 21.3999 | 0.0001 | 0.0002 | 0.0003 | 0.0002 | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.0003 |
| Min. | 0.2573 | 0.5249 | 2729 | 0.0003 | 0.0002 | 0.0004 | 0.0010 | 0.0011 | 0.0014 | 0.0015 | 0.0019 | 0.0019 | 0.0021 |
| Max. | 0.2613 | 0.5283 | 2816 | 0.0009 | 0.0011 | 0.0016 | 0.0020 | 0.0025 | 0.0023 | 0.0023 | 0.0028 | 0.0030 | 0.0033 |

### 3.7 Data Set 3, 105°C, 150mA (Lumen Maintenance)

| No. | Φ(lm) | Lumen Maintenance (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 61 | 72.75 | 100.11 | 99.82 | 99.63 | 99.22 | 98.79 | 98.25 | 97.83 | 97.33 | 96.89 | 96.60 |
| 62 | 73.23 | 99.89 | 99.40 | 98.99 | 98.61 | 97.88 | 97.34 | 96.87 | 96.31 | 96.09 | 95.73 |
| 63 | 73.93 | 99.82 | 99.63 | 99.47 | 99.15 | 98.59 | 98.03 | 97.52 | 96.88 | 96.47 | 96.02 |
| 64 | 71.81 | 99.89 | 99.64 | 99.51 | 99.11 | 98.50 | 98.12 | 97.65 | 97.28 | 96.96 | 96.77 |
| 65 | 71.96 | 100.14 | 99.71 | 99.49 | 99.21 | 98.57 | 97.90 | 97.48 | 96.93 | 96.61 | 96.28 |
| 66 | 73.95 | 99.81 | 99.66 | 99.47 | 99.07 | 98.42 | 97.81 | 97.44 | 97.07 | 96.80 | 96.42 |
| 67 | 73.85 | 99.69 | 99.51 | 99.43 | 99.03 | 98.36 | 98.05 | 97.66 | 97.35 | 97.03 | 96.78 |
| 68 | 73.97 | 100.19 | 99.35 | 99.13 | 98.80 | 98.11 | 97.53 | 97.11 | 96.61 | 96.24 | 95.92 |
| 69 | 71.54 | 99.79 | 99.58 | 99.19 | 98.70 | 98.28 | 97.76 | 97.29 | 96.91 | 96.48 | 96.23 |
| 70 | 71.11 | 100.03 | 99.73 | 99.59 | 99.34 | 98.73 | 98.13 | 97.65 | 97.44 | 97.17 | 96.95 |
| 71 | 72.95 | 99.84 | 99.62 | 99.34 | 98.99 | 98.25 | 97.64 | 97.14 | 96.64 | 96.29 | 95.98 |
| 72 | 73.37 | 99.75 | 99.55 | 99.30 | 98.88 | 98.13 | 97.37 | 96.96 | 96.72 | 96.40 | 95.99 |
| 73 | 72.13 | 99.68 | 99.47 | 99.28 | 98.97 | 98.27 | 97.57 | 97.07 | 96.55 | 96.19 | 95.90 |
| 74 | 72.82 | 99.86 | 99.53 | 99.20 | 98.78 | 98.20 | 97.47 | 97.05 | 96.43 | 96.11 | 95.77 |
| 75 | 72.73 | 99.96 | 99.88 | 99.55 | 99.13 | 98.56 | 97.98 | 97.55 | 97.18 | 96.91 | 96.54 |
| 76 | 71.83 | 99.89 | 99.75 | 99.50 | 99.11 | 98.45 | 97.79 | 97.37 | 97.02 | 96.73 | 96.46 |
| 77 | 72.91 | 99.84 | 99.70 | 99.38 | 98.99 | 98.09 | 97.38 | 96.94 | 96.53 | 96.24 | 95.97 |
| 78 | 72.98 | 99.97 | 99.86 | 99.77 | 99.26 | 98.67 | 97.97 | 97.57 | 97.18 | 96.83 | 96.55 |
| 79 | 72.78 | 99.86 | 99.67 | 99.48 | 99.24 | 98.67 | 98.16 | 97.69 | 97.42 | 97.07 | 96.66 |
| 80 | 71.80 | 99.94 | 99.69 | 99.62 | 99.25 | 98.82 | 98.45 | 97.99 | 97.52 | 97.28 | 96.96 |
| 81 | 72.38 | 100.18 | 99.74 | 99.36 | 99.16 | 98.40 | 97.79 | 97.33 | 97.02 | 96.75 | 96.46 |
| 82 | 72.35 | 99.90 | 99.60 | 99.28 | 98.89 | 98.48 | 97.90 | 97.42 | 97.18 | 96.78 | 96.49 |
| 83 | 73.03 | 99.78 | 99.30 | 99.10 | 98.73 | 98.23 | 97.80 | 97.33 | 97.10 | 96.80 | 96.36 |
| 84 | 73.99 | 99.88 | 99.54 | 99.22 | 98.85 | 98.24 | 97.47 | 97.01 | 96.74 | 96.42 | 96.19 |
| 85 | 73.18 | 99.96 | 99.73 | 99.60 | 99.30 | 98.80 | 98.18 | 97.70 | 97.25 | 96.82 | 96.62 |
| 86 | 72.41 | 100.07 | 99.94 | 99.57 | 99.14 | 98.72 | 98.11 | 97.71 | 97.18 | 96.82 | 96.59 |
| 87 | 72.59 | 99.96 | 99.60 | 99.27 | 98.88 | 98.14 | 97.64 | 97.16 | 96.56 | 96.20 | 95.96 |
| 88 | 72.06 | 99.72 | 99.53 | 99.28 | 98.92 | 98.32 | 97.74 | 97.28 | 96.74 | 96.34 | 96.02 |
| 89 | 71.67 | 99.93 | 99.71 | 99.34 | 98.91 | 98.35 | 97.92 | 97.46 | 97.04 | 96.72 | 96.48 |
| 90 | 72.59 | 99.86 | 99.61 | 99.39 | 99.01 | 98.51 | 98.04 | 97.67 | 97.27 | 96.97 | 96.60 |
| Avg. | 72.69 | 99.91 | 99.64 | 99.39 | 99.02 | 98.42 | 97.84 | 97.40 | 96.98 | 96.65 | 96.34 |
| Med. | 72.74 | 99.89 | 99.64 | 99.39 | 99.02 | 98.41 | 97.85 | 97.43 | 97.03 | 96.74 | 96.44 |
| st dev | 0.7847 | 0.1344 | 0.1480 | 0.1798 | 0.1924 | 0.2418 | 0.2876 | 0.2916 | 0.3306 | 0.3353 | 0.3488 |
| Min. | 71.11 | 99.68 | 99.30 | 98.99 | 98.61 | 97.88 | 97.34 | 96.87 | 96.31 | 96.09 | 95.73 |
| Max. | 73.99 | 100.19 | 99.94 | 99.77 | 99.34 | 98.82 | 98.45 | 97.99 | 97.52 | 97.28 | 96.96 |

### 3.8 Data Set 3, 105°C, 150mA (Forward Voltage)

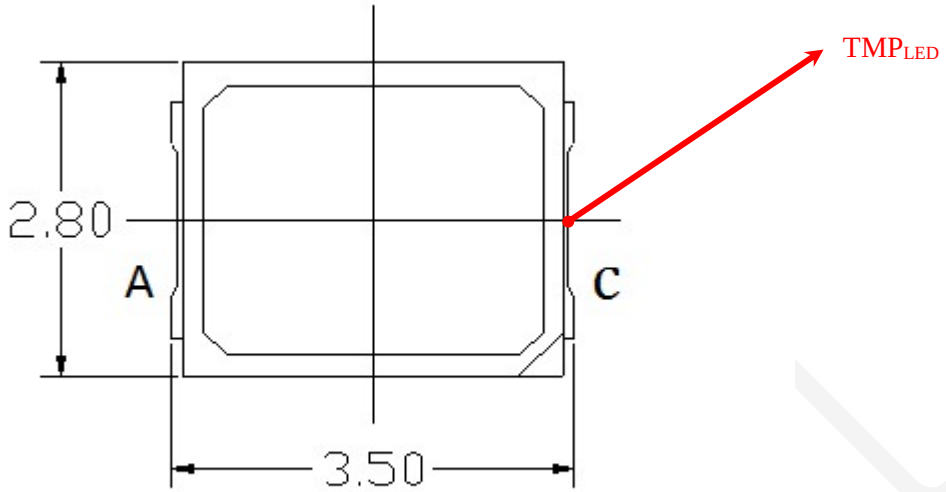
| No. | Forward Voltage (V) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 61 | 3.117 | 3.117 | 3.134 | 3.133 | 3.123 | 3.127 | 3.116 | 3.101 | 3.130 | 3.112 | 3.120 |
| 62 | 3.125 | 3.115 | 3.132 | 3.134 | 3.121 | 3.131 | 3.119 | 3.102 | 3.127 | 3.108 | 3.111 |
| 63 | 3.124 | 3.125 | 3.142 | 3.138 | 3.133 | 3.132 | 3.123 | 3.114 | 3.142 | 3.118 | 3.120 |
| 64 | 3.113 | 3.115 | 3.131 | 3.126 | 3.121 | 3.122 | 3.111 | 3.102 | 3.132 | 3.111 | 3.110 |
| 65 | 3.124 | 3.113 | 3.132 | 3.126 | 3.121 | 3.126 | 3.113 | 3.103 | 3.134 | 3.108 | 3.108 |
| 66 | 3.111 | 3.111 | 3.128 | 3.129 | 3.117 | 3.117 | 3.111 | 3.097 | 3.123 | 3.102 | 3.108 |
| 67 | 3.115 | 3.111 | 3.132 | 3.119 | 3.113 | 3.117 | 3.110 | 3.098 | 3.122 | 3.102 | 3.109 |
| 68 | 3.108 | 3.111 | 3.132 | 3.122 | 3.119 | 3.124 | 3.113 | 3.096 | 3.081 | 3.106 | 3.118 |
| 69 | 3.125 | 3.119 | 3.151 | 3.130 | 3.127 | 3.131 | 3.118 | 3.104 | 3.105 | 3.114 | 3.134 |
| 70 | 3.115 | 3.117 | 3.140 | 3.126 | 3.124 | 3.125 | 3.117 | 3.102 | 3.095 | 3.112 | 3.116 |
| 71 | 3.134 | 3.114 | 3.131 | 3.125 | 3.122 | 3.130 | 3.112 | 3.102 | 3.100 | 3.108 | 3.130 |
| 72 | 3.107 | 3.107 | 3.125 | 3.117 | 3.116 | 3.121 | 3.108 | 3.089 | 3.111 | 3.103 | 3.123 |
| 73 | 3.117 | 3.117 | 3.138 | 3.128 | 3.127 | 3.123 | 3.118 | 3.103 | 3.131 | 3.115 | 3.121 |
| 74 | 3.117 | 3.115 | 3.135 | 3.123 | 3.122 | 3.124 | 3.115 | 3.098 | 3.096 | 3.112 | 3.128 |
| 75 | 3.122 | 3.123 | 3.140 | 3.130 | 3.128 | 3.129 | 3.120 | 3.106 | 3.130 | 3.116 | 3.112 |
| 76 | 3.116 | 3.115 | 3.133 | 3.126 | 3.124 | 3.122 | 3.117 | 3.102 | 3.138 | 3.112 | 3.140 |
| 77 | 3.117 | 3.115 | 3.137 | 3.124 | 3.123 | 3.124 | 3.116 | 3.103 | 3.106 | 3.109 | 3.128 |
| 78 | 3.117 | 3.117 | 3.135 | 3.124 | 3.125 | 3.124 | 3.117 | 3.101 | 3.128 | 3.108 | 3.143 |
| 79 | 3.106 | 3.108 | 3.125 | 3.115 | 3.113 | 3.112 | 3.107 | 3.095 | 3.074 | 3.103 | 3.104 |
| 80 | 3.129 | 3.125 | 3.144 | 3.131 | 3.133 | 3.130 | 3.134 | 3.111 | 3.097 | 3.122 | 3.122 |
| 81 | 3.123 | 3.124 | 3.140 | 3.129 | 3.128 | 3.127 | 3.124 | 3.107 | 3.099 | 3.119 | 3.145 |
| 82 | 3.127 | 3.124 | 3.144 | 3.136 | 3.133 | 3.133 | 3.129 | 3.112 | 3.106 | 3.123 | 3.134 |
| 83 | 3.125 | 3.129 | 3.142 | 3.130 | 3.129 | 3.130 | 3.126 | 3.107 | 3.101 | 3.117 | 3.136 |
| 84 | 3.108 | 3.107 | 3.127 | 3.115 | 3.117 | 3.130 | 3.112 | 3.095 | 3.089 | 3.105 | 3.111 |
| 85 | 3.122 | 3.118 | 3.140 | 3.127 | 3.128 | 3.124 | 3.121 | 3.105 | 3.100 | 3.118 | 3.145 |
| 86 | 3.125 | 3.115 | 3.134 | 3.124 | 3.124 | 3.121 | 3.117 | 3.101 | 3.107 | 3.110 | 3.128 |
| 87 | 3.124 | 3.117 | 3.140 | 3.127 | 3.125 | 3.130 | 3.120 | 3.105 | 3.111 | 3.115 | 3.141 |
| 88 | 3.114 | 3.110 | 3.129 | 3.123 | 3.118 | 3.125 | 3.113 | 3.096 | 3.109 | 3.107 | 3.112 |
| 89 | 3.118 | 3.110 | 3.130 | 3.119 | 3.121 | 3.119 | 3.113 | 3.100 | 3.110 | 3.108 | 3.112 |
| 90 | 3.115 | 3.111 | 3.129 | 3.117 | 3.120 | 3.119 | 3.111 | 3.097 | 3.130 | 3.106 | 3.112 |
| Avg. | 3.119 | 3.116 | 3.135 | 3.126 | 3.123 | 3.125 | 3.117 | 3.102 | 3.112 | 3.111 | 3.123 |
| Med. | 3.117 | 3.115 | 3.134 | 3.126 | 3.123 | 3.125 | 3.117 | 3.102 | 3.110 | 3.111 | 3.121 |
| st dev | 0.0069 | 0.0057 | 0.0063 | 0.0059 | 0.0054 | 0.0051 | 0.0061 | 0.0054 | 0.0176 | 0.0058 | 0.0125 |
| Min. | 3.106 | 3.107 | 3.125 | 3.115 | 3.113 | 3.112 | 3.107 | 3.089 | 3.074 | 3.102 | 3.104 |
| Max. | 3.134 | 3.129 | 3.151 | 3.138 | 3.133 | 3.133 | 3.134 | 3.114 | 3.142 | 3.123 | 3.145 |

### 3.9 Data Set 3, 105°C, 150mA (Chromaticity Shift)

| No. | u' | v' | CCT(K) | Chromaticity Shift (Δu'v') | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0hr(Initial) | | | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs | 10000hrs |
| 61 | 0.2567 | 0.5249 | 2837 | 0.0008 | 0.0008 | 0.0011 | 0.0013 | 0.0015 | 0.0018 | 0.0021 | 0.0023 | 0.0024 | 0.0025 |
| 62 | 0.2572 | 0.5259 | 2819 | 0.0002 | 0.0008 | 0.0015 | 0.0016 | 0.0018 | 0.0021 | 0.0023 | 0.0024 | 0.0026 | 0.0028 |
| 63 | 0.2575 | 0.5271 | 2807 | 0.0002 | 0.0006 | 0.0008 | 0.0011 | 0.0015 | 0.0018 | 0.0018 | 0.0020 | 0.0023 | 0.0024 |
| 64 | 0.2595 | 0.5254 | 2772 | 0.0002 | 0.0008 | 0.0010 | 0.0014 | 0.0017 | 0.0021 | 0.0022 | 0.0026 | 0.0028 | 0.0030 |
| 65 | 0.2584 | 0.5235 | 2806 | 0.0007 | 0.0006 | 0.0013 | 0.0015 | 0.0018 | 0.0022 | 0.0023 | 0.0024 | 0.0025 | 0.0028 |
| 66 | 0.2586 | 0.5269 | 2785 | 0.0006 | 0.0006 | 0.0009 | 0.0014 | 0.0018 | 0.0019 | 0.0023 | 0.0023 | 0.0025 | 0.0027 |
| 67 | 0.2586 | 0.5284 | 2779 | 0.0005 | 0.0005 | 0.0006 | 0.0012 | 0.0014 | 0.0017 | 0.0021 | 0.0021 | 0.0024 | 0.0027 |
| 68 | 0.2567 | 0.5247 | 2837 | 0.0008 | 0.0011 | 0.0012 | 0.0015 | 0.0017 | 0.0022 | 0.0024 | 0.0025 | 0.0025 | 0.0028 |
| 69 | 0.2573 | 0.5248 | 2823 | 0.0006 | 0.0009 | 0.0011 | 0.0012 | 0.0013 | 0.0017 | 0.0019 | 0.0019 | 0.0019 | 0.0021 |
| 70 | 0.2570 | 0.5242 | 2833 | 0.0004 | 0.0006 | 0.0011 | 0.0015 | 0.0017 | 0.0019 | 0.0019 | 0.0021 | 0.0022 | 0.0024 |
| 71 | 0.2564 | 0.5259 | 2838 | 0.0006 | 0.0013 | 0.0013 | 0.0017 | 0.0020 | 0.0021 | 0.0021 | 0.0025 | 0.0028 | 0.0030 |
| 72 | 0.2596 | 0.5265 | 2765 | 0.0006 | 0.0009 | 0.0013 | 0.0015 | 0.0018 | 0.0018 | 0.0019 | 0.0021 | 0.0023 | 0.0024 |
| 73 | 0.2592 | 0.5267 | 2773 | 0.0006 | 0.0009 | 0.0014 | 0.0017 | 0.0019 | 0.0021 | 0.0021 | 0.0023 | 0.0025 | 0.0028 |
| 74 | 0.2587 | 0.5266 | 2784 | 0.0006 | 0.0008 | 0.0013 | 0.0017 | 0.0021 | 0.0021 | 0.0021 | 0.0023 | 0.0025 | 0.0028 |
| 75 | 0.2586 | 0.5261 | 2787 | 0.0005 | 0.0007 | 0.0011 | 0.0014 | 0.0017 | 0.0020 | 0.0021 | 0.0022 | 0.0025 | 0.0027 |
| 76 | 0.2607 | 0.5245 | 2750 | 0.0005 | 0.0009 | 0.0012 | 0.0016 | 0.0019 | 0.0022 | 0.0021 | 0.0024 | 0.0026 | 0.0027 |
| 77 | 0.2592 | 0.5269 | 2773 | 0.0008 | 0.0009 | 0.0016 | 0.0019 | 0.0021 | 0.0025 | 0.0023 | 0.0025 | 0.0028 | 0.0030 |
| 78 | 0.2574 | 0.5265 | 2812 | 0.0006 | 0.0009 | 0.0014 | 0.0017 | 0.0018 | 0.0023 | 0.0023 | 0.0025 | 0.0026 | 0.0028 |
| 79 | 0.2581 | 0.5265 | 2797 | 0.0006 | 0.0009 | 0.0013 | 0.0016 | 0.0016 | 0.0021 | 0.0021 | 0.0024 | 0.0025 | 0.0028 |
| 80 | 0.2586 | 0.5264 | 2788 | 0.0006 | 0.0009 | 0.0013 | 0.0016 | 0.0019 | 0.0021 | 0.0021 | 0.0024 | 0.0025 | 0.0028 |
| 81 | 0.2592 | 0.5267 | 2773 | 0.0007 | 0.0011 | 0.0011 | 0.0019 | 0.0020 | 0.0022 | 0.0022 | 0.0022 | 0.0024 | 0.0026 |
| 82 | 0.2588 | 0.5267 | 2782 | 0.0006 | 0.0008 | 0.0013 | 0.0016 | 0.0020 | 0.0022 | 0.0023 | 0.0023 | 0.0024 | 0.0025 |
| 83 | 0.2595 | 0.5242 | 2778 | 0.0006 | 0.0009 | 0.0011 | 0.0016 | 0.0019 | 0.0022 | 0.0023 | 0.0022 | 0.0025 | 0.0028 |
| 84 | 0.2579 | 0.5261 | 2803 | 0.0005 | 0.0008 | 0.0014 | 0.0019 | 0.0023 | 0.0023 | 0.0023 | 0.0025 | 0.0026 | 0.0028 |
| 85 | 0.2583 | 0.5246 | 2802 | 0.0006 | 0.0009 | 0.0012 | 0.0019 | 0.0023 | 0.0024 | 0.0026 | 0.0029 | 0.0030 | 0.0033 |
| 86 | 0.2583 | 0.5261 | 2794 | 0.0006 | 0.0012 | 0.0016 | 0.0020 | 0.0025 | 0.0025 | 0.0025 | 0.0028 | 0.0028 | 0.0030 |
| 87 | 0.2604 | 0.5258 | 2750 | 0.0006 | 0.0007 | 0.0007 | 0.0015 | 0.0019 | 0.0022 | 0.0021 | 0.0021 | 0.0023 | 0.0025 |
| 88 | 0.2597 | 0.5276 | 2757 | 0.0005 | 0.0013 | 0.0013 | 0.0019 | 0.0023 | 0.0025 | 0.0024 | 0.0025 | 0.0028 | 0.0030 |
| 89 | 0.2590 | 0.5269 | 2776 | 0.0007 | 0.0011 | 0.0016 | 0.0018 | 0.0023 | 0.0024 | 0.0022 | 0.0023 | 0.0025 | 0.0026 |
| 90 | 0.2569 | 0.5257 | 2827 | 0.0008 | 0.0008 | 0.0011 | 0.0017 | 0.0021 | 0.0023 | 0.0022 | 0.0023 | 0.0025 | 0.0027 |
| Avg. | 0.2584 | 0.5260 | 2794 | 0.0006 | 0.0009 | 0.0012 | 0.0016 | 0.0019 | 0.0021 | 0.0022 | 0.0023 | 0.0025 | 0.0027 |
| Med. | 0.2586 | 0.5261 | 2788 | 0.0006 | 0.0009 | 0.0012 | 0.0016 | 0.0019 | 0.0022 | 0.0022 | 0.0023 | 0.0025 | 0.0028 |
| st dev | 0.0011 | 0.0011 | 25.9969 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 |
| Min. | 0.2564 | 0.5235 | 2750 | 0.0002 | 0.0005 | 0.0006 | 0.0011 | 0.0013 | 0.0017 | 0.0018 | 0.0019 | 0.0019 | 0.0021 |
| Max. | 0.2607 | 0.5284 | 2838 | 0.0008 | 0.0013 | 0.0016 | 0.0020 | 0.0025 | 0.0025 | 0.0026 | 0.0029 | 0.0030 | 0.0033 |

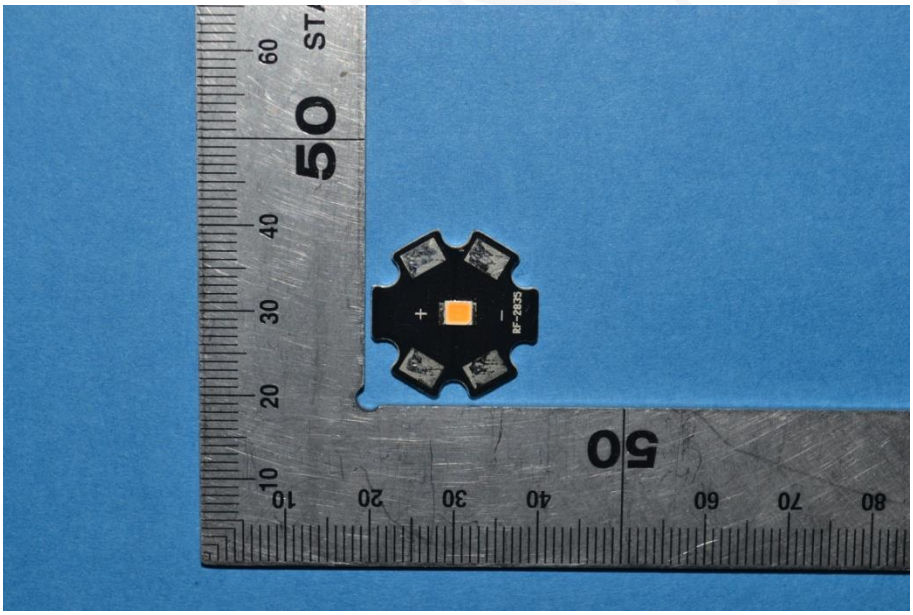
## 4 - DUT Photo

### 4.1 Mechanical Dimensions




All dimensions are in millimeter

### 4.2 DUT Photo



**********END OF REPORT**********

# Appendix A:
# Energy Star® LM-80 Application

## ENERGY STAR® LM-80 Cover Page

### Administrative Information

| | |
|---|---|
| Tested subcomponent series | DURIS E 2835 |
| Tested subcomponent model number | GW JTLPS1.EM |
| Report issue date | 2019-04-11 |
| Report revision date (if applicable) | Not Applicable |
| Testing start date | 2017-09-27 |
| Testing completion date | 2019-04-01 |
| DUT sampling method | According to ANSI/IES LM-80 Test Method |

### DUT Identification

| | |
|---|---|
| DUT manufacturer's name | OSRAM Opto Semiconductors (Malaysia) Sdn. Bhd. |
| DUT identification | GW JTLPS1.EM |
| Description of DUT | LED Package |

### DUT Characteristics

| | |
|---|---|
| Total input power (W) | 0.46 |
| Average current density per LED die (mA/mm²) | 308 |
| Average power density per LED package (W/mm²) | 0.05 |
| Representative CRI (Ra) of the tested sample set | CRI80 |
| Minimum die edge to die edge spacing (mm) | 0.27 |

# Appendix B:
# Lumen Maintenance Projection (IES TM-21-11)

For Information Only!

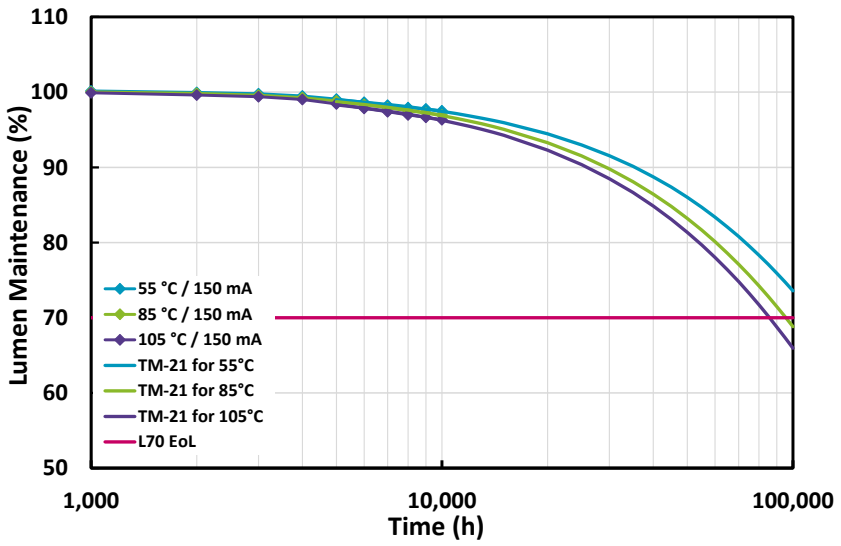
## 1. General Information

| | |
|---|---|
| Description of LED light source tested | DURIS® E 2835 GW JTLPS1.EM |
| Sample size per temperature | 30 |
| LED drive current used in the test | 150 mA |
| Test duration | 10,000 hours |
| Test duration used for projection | 5,000 hours to 10,000 hours |

## 2. Projection Data

| | I | II | III |
|---|---|---|---|
| Case temperature (solder point) | $T_S$ = 55 °C | $T_S$ = 85 °C | $T_S$ = 105 °C |
| α | 3.120E-06 | 3.803E-06 | 4.203E-06 |
| B | 1.005E+00 | 1.006E+00 | 1.004E+00 |
| Reported L70 | >60,000 hours | >60,000 hours | >60,000 hours |
| Reported L90 | 35,457 hours | 29,365 hours | 25,976 hours |

## 3. Graphic chart






OSRAM
Opto Semiconductors

# Appendix C:
# Additional Models Covered By Testing

The 28 September 2017 *ENERGY STAR® Requirements for the Use of LM-80 Data* defines conditons for which a LM-80 report is applied to cover models that have not been directly tested.

The test results in this report applies to the following list of models:

- DURIS® E 2835 GW JTLPS1.EM with CCT 2200 K – 6500 K
- DURIS® E 2835 GW JTLPS2.EM with CCT 2200 K – 6500 K
- DURIS® E 2835 GW JTLPS1.CM with CCT 2200 K – 6500 K
- DURIS® E 2835 GW JTLPS2.CM with CCT 2200 K – 6500 K
- DURIS® E 2835 GW JTLPS1.EM-PLUS with CCT 2200 K – 6500 K
- DURIS® E 2835 GW JTLPS1.CM-PLUS with CCT 2200 K – 6500 K
- DURIS® E 2835 GW JTLPS1.EM GEN 2 with CCT 2200 K – 6500 K
- DURIS® E 2835 GW JTLPS1.CM GEN 2 with CCT 2200 K – 6500 K

# Disclaimer

Please carefully read the below terms and conditions before using the Information.
If you do not agree with any of these terms and conditions, do not use the Information.

The Information contained in this document does not constitute an independent warranty. The committed behavior is described in the Product data sheet.

Further explanations:
Data: The Data used in this Document consider the reliability test results under the mentioned driving conditions only. For Product information on the maximum operating conditions please refer to the Product data sheet or contact your local sales partner.
Conditions: The conditions for the generation of the data are as follows:
1. The Data and curves shown in this Document are based on experiments carried out under laboratory conditions on a random sample size of LED with readouts at discrete readout times (where applicable). Thus, the Data above represent a limited number of production lots only and may differ between different assembly lots over time (including chip or package changes). Thus, the behavior of the LED in the final application may differ from the Data. The behavior of the LED at conditions or readout times deviating from those stated above may not be deduced from the Data.
2. For long term operation additional failure modes of the chip or package can occur which are not shown in this Document.
3. Possible differences in the thermal management of OSRAM OS and customer's setup may lead to a different aging behavior.
4. The lifetime projection data presented in this Document has been evaluated in accordance with the lifetime extrapolation method described and defined in IES TM-21-11. The lifetime projection is based on the Data shown in this Document. The Data had been collected and assembled according to IES LM-80-15.

END OF DOCUMENT

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