

# Test Report

Report No.: EED35H000559

Page 1 of 12

## APPLICATION FOR LUMEN MAINTENANCE TESTING ACCORDING TO THE IES LM-80-08 TEST STANDARD

Prepared for: **Shenzhen Kindfairy Semiconductor Co., Ltd**  
**Building B, No. B8, First Rd, First Industrial Area, Baihuadong, New Guangming  
Dist, Shenzhen, P.R.China**

### Description of the submitted sample(s):

Sample Name : 2835  
Sample Model : SMD 2835  
Ratings : 60 mA  
Target CCT : 3000 K  
Manufacturer : Shenzhen Kindfairy Semiconductor Co., Ltd  
State of Sample(s) : Normal  
Sample Quantity : 48 pcs  
Reference Standard : IES LM-80-08 Approved Method: Measuring Lumen Maintenance of LED  
Light Sources

Sample Received Date : Oct. 10, 2014

Sample Tested Date : Oct. 13, 2014 to Mar.26, 2015 and Sept.28,2015 to Dec. 22, 2015

Remark: According to the requirement of the customer, the test was suspended from Mar. 26, 2015 to Sept. 28, 2015.

The laboratory that conducted the testing items in this report has been accredited by the National Voluntary Laboratory Accreditation Program (NVLAP LAB CODE: 200889-0), for LM-80 testing of SSL products. And the report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Complied by

*Huangxiubo*

Reviewed by

*Kaiser Lee*

Approved by

*Vincent Wang*

Date

Dec. 31, 2015

Supervisor

Check No.: 1996243839

# Test Report

Report No.: EED35H000559

Page 2 of 12

## 1 SUMMARY

|  | LM-80 Required Temperature |              | Specified Temperature of the manufacturer |
|--|----------------------------|--------------|---|
|  | 55 °C                      | 85 °C        |   |
| Number of LED tested                                       | 24                         | 24           | ---                                       |
| Drive Current [ $I_F$ ]                                    | 60 mA                      | 60 mA        | ---                                       |
| Measurement Current [ $I_F$ ]                              | 60 mA                      | 60 mA        | ---                                       |
| Actual Case Temp. [ $T_s$ ]                                | $\geq 53$ °C               | $\geq 83$ °C | ---                                       |
| Actual Ambient Temp. [ $T_A$ ]                             | $\geq 50$ °C               | $\geq 80$ °C | ---                                       |
| Relative Humidity  | $\leq 65\%$                | $\leq 65\%$  | ---                                       |
| Average Lumen Maintenance at 6000 hours                    | 98.60                      | 97.56        | ---                                       |
| Average Chromaticity Shift ( $\Delta u'v'$ ) at 6000 hours | 0.0039                     | 0.0032       | ---                                       |
| Calculated L70(6k) (hours)                                 | 63000                      | 50000        | ---                                       |
| Reported L70(6k) (hours)                                   | >36000                     | >36000       | ---                                       |
| Failures observed  | None                       | None         | ---                                       |

| Test Time Points/Average Lumen Maintenance |        |             |             |             |             |             |             |
|--|--------|-------------|-------------|-------------|-------------|-------------|-------------|
| Case Temperature                           | 0 Hour | 1,000 Hours | 2,000 Hours | 3,000 Hours | 4,000 Hours | 5,000 Hours | 6,000 Hours |
| 55 °C                                      | 100.00 | 101.24      | 101.43      | 100.18      | 99.54       | 99.10       | 98.60       |
| 85 °C                                      | 100.00 | 100.77      | 101.43      | 99.83       | 99.21       | 98.27       | 97.56       |
| 105 °C                                     | ---    | ---         | ---         | ---         | ---         | ---         | ---         |

| Test Time Points/Average Color Shift ( $\Delta u'v'$ ) |        |             |             |             |             |             |             |
|--|--------|-------------|-------------|-------------|-------------|-------------|-------------|
| Case Temperature                                       | 0 Hour | 1,000 Hours | 2,000 Hours | 3,000 Hours | 4,000 Hours | 5,000 Hours | 6,000 Hours |
| 55 °C  | 0.0000 | 0.0008      | 0.0022      | 0.0027      | 0.0030      | 0.0035      | 0.0039      |
| 85 °C  | 0.0000 | 0.0004      | 0.0010      | 0.0016      | 0.0020      | 0.0029      | 0.0032      |
| 105 °C   | ---    | ---         | ---         | ---         | ---         | ---         | ---         |

# Test Report

Report No.: EED35H000559

Page 3 of 12

## 2 EQUIPMENT LIST

| Test Equipment           | Model               | Equipment No. | Calibration Date | Calibration Due Date |
|--------------------------|---------------------|---------------|------------------|----------------------|
| Spectroradiometer        | CDS 600             | SHEEDTE012    | Mar. 06, 2014    | Mar. 05, 2015        |
| Spectroradiometer        | CDS 600             | SHEEDTE012    | Mar. 05, 2015    | Mar. 04, 2016        |
| Integrating Sphere       | Φ 1.0m              | SHEEDTE013    | ---              | ---                  |
| Standard Lamp            | FFS-100-1000        | SHEEDTE003    | Sept. 03, 2013   | Sept. 02, 2016       |
| SourceMeter              | 2430                | SHEEDTE002    | Jun. 23, 2014    | Jun. 22, 2015        |
| SourceMeter              | 2430                | SHEEDTE002    | Jun. 23, 2015    | Jun. 22, 2016        |
| Digital Recorder         | 34970A              | ATTEELSH00019 | Jun. 27, 2014    | Jun. 26, 2015        |
| Digital Recorder         | 34970A              | ATTEELSH00019 | Jun. 23, 2015    | Jun. 22, 2016        |
| Digital Recorder         | HIOKI<br>LR81500-21 | TTE20100242   | Jun. 25, 2014    | Jun. 24, 2015        |
| Digital Recorder         | HIOKI<br>LR81500-21 | TTE20100242   | Jun. 23, 2015    | Jun. 22, 2016        |
| DC Power Supply          | GPR-30H10D          | TTF20110389   | Jun. 23, 2014    | Jun. 22, 2015        |
| DC Power Supply          | GPR-30H10D          | TTF20110389   | Jun. 23, 2015    | Jun. 22, 2016        |
| DC Power Supply          | GPR-30H10D          | TTF20110390   | Jun. 23, 2014    | Jun. 22, 2015        |
| DC Power Supply          | GPR-30H10D          | TTF20110390   | Jun. 23, 2015    | Jun. 22, 2016        |
| High Temperature Chamber | NMT-1200            | TTE20100237   | Jun. 25, 2014    | Jun. 24, 2015        |
| High Temperature Chamber | NMT-1200            | TTE20100237   | Jun. 23, 2015    | Jun. 22, 2016        |
| High Temperature Chamber | NMT-1200            | TTE20100240   | Jun. 25, 2014    | Jun. 24, 2015        |
| High Temperature Chamber | NMT-1200            | TTE20100240   | Jun. 23, 2015    | Jun. 22, 2016        |
| Multimeter               | FLUKE189            | ATTEELSH00042 | Jun. 23, 2014    | Jun. 22, 2015        |
| Multimeter               | FLUKE189            | ATTEELSH00042 | Jun. 23, 2015    | Jun. 22, 2016        |

# Test Report

Report No.: EED35H000559

Page 4 of 12

## 3 Photometry Measurement Uncertainty

The uncertainty of the light output measurements is  $U=1.5\%$  ( $K=2$ ), at the 95% confidence level.

## 4 TEST METHODS

### 4.1 Requirements of Environmental Conditions

Operation of the LED light sources between photometric measurements shall be at a minimum of three case temperatures,  $T_s$ , using the same drive current. The three case temperatures,  $T_s$ , shall be 55°C and 85°C with a third temperature selected by the manufacturer. Case temperatures shall be controlled to -2°C during life testing. The temperature of the surrounding air should be maintained to within -5°C of the case temperature during testing. The surrounding air temperature should be monitored within the test chamber. Humidity shall be maintained to less than 65%RH throughout the life test. The case temperature  $T_s$  is the cathode lead temperature of the LED mounted on a reliability test board. The surrounding air temperature ( $T_A$ ) should be monitored within the test chamber. The ambient temperature during lumen and chromaticity measurements shall be set to  $25^\circ\text{C} \pm 2^\circ\text{C}$ . The LED light source shall be required to cool to room temperature prior to measurement. Air flow shall be minimized for proper light source starting and operation. The operating orientation of the LED light sources under test should be as specified by the manufacturer.

### 4.2 Lumen Maintenance Testing Method

Samples under test shall be driven for at least 6,000 hours with data collection at a minimum of every 1000 hours. 10,000 hours are preferred for the purposes of improved predictive modeling. LED light sources are driven at constant current. Checking for LED light source failures either by visual observation or automatic monitoring shall be done at a minimum of every measurement interval. Catastrophic LED light source failure shall be reported and included in the test report. The chromaticity shift shall be measured and reported over the course of the lumen maintenance test time by measuring chromaticity at each photometric test interval.

### 4.3 Photometric and Electrical Measurements

A CCD Spectroradiometer and Integrating Sphere was used to measure total luminous flux, correlated color temperature, color rendering index, and chromaticity coordinates for each sample. Ambient temperature was measured at a position inside the integrating sphere. Electrical measurements including voltage, current, and power were measured.

# Test Report

Report No.: EED35H000559

Page 5 of 12

## 5 TEST DATA

### 5.1 55°C, 60 mA

| No.      | Φ <sub>v</sub> [lm] | VF [V] | CCT (K) | Lumen Maintenance [%] |        |        |        |        |        |
|----------|---------------------|--------|---------|-----------------------|--------|--------|--------|--------|--------|
|          |                     |        |         | 0 h (Initial)         | 1000 h | 2000 h | 3000 h | 4000 h | 5000 h |
| 1        | 22.61               | 2.88   | 3156    | 99.03                 | 99.45  | 97.55  | 96.96  | 96.97  | 96.44  |
| 2        | 21.23               | 2.88   | 3154    | 100.97                | 101.15 | 99.41  | 98.92  | 98.68  | 98.43  |
| 3        | 22.27               | 2.88   | 3112    | 101.66                | 100.93 | 99.94  | 99.50  | 98.14  | 97.66  |
| 4        | 22.08               | 2.88   | 3153    | 101.69                | 99.67  | 97.82  | 97.27  | 97.62  | 96.90  |
| 5        | 22.22               | 2.88   | 3142    | 102.09                | 101.30 | 100.46 | 100.02 | 99.37  | 98.87  |
| 6        | 22.23               | 2.88   | 3035    | 101.33                | 99.40  | 97.09  | 96.83  | 95.77  | 95.16  |
| 7        | 21.91               | 2.89   | 3175    | 101.42                | 101.63 | 100.53 | 100.00 | 99.19  | 99.03  |
| 8        | 22.78               | 2.89   | 3108    | 100.09                | 101.17 | 99.89  | 98.76  | 99.42  | 98.83  |
| 9        | 22.43               | 2.88   | 3067    | 101.69                | 101.98 | 100.90 | 99.88  | 99.37  | 98.87  |
| 10       | 22.01               | 2.88   | 3192    | 101.62                | 102.06 | 100.81 | 99.94  | 100.11 | 100.14 |
| 11       | 22.65               | 2.89   | 3170    | 100.46                | 100.95 | 99.47  | 98.95  | 98.82  | 98.25  |
| 12       | 22.80               | 2.89   | 3125    | 100.56                | 101.30 | 100.02 | 99.33  | 99.58  | 99.11  |
| 13       | 22.37               | 2.88   | 3145    | 101.05                | 102.31 | 101.24 | 100.60 | 99.79  | 99.78  |
| 14       | 22.24               | 2.87   | 3175    | 102.04                | 102.00 | 100.84 | 100.21 | 99.39  | 98.92  |
| 15       | 22.48               | 3.10   | 3181    | 101.75                | 101.81 | 100.90 | 100.19 | 99.56  | 97.46  |
| 16       | 22.40               | 2.88   | 3299    | 101.05                | 102.13 | 100.42 | 100.40 | 99.75  | 99.13  |
| 17       | 22.60               | 2.89   | 3055    | 101.96                | 102.65 | 101.79 | 100.95 | 100.24 | 100.18 |
| 18       | 22.22               | 2.88   | 3191    | 101.16                | 101.76 | 100.64 | 100.23 | 99.43  | 98.89  |
| 19       | 22.59               | 2.89   | 3048    | 101.01                | 102.26 | 101.28 | 100.67 | 99.88  | 99.93  |
| 20       | 22.30               | 2.88   | 3158    | 101.65                | 101.75 | 100.63 | 99.84  | 99.42  | 98.88  |
| 21       | 22.08               | 2.88   | 3048    | 101.39                | 102.07 | 101.10 | 100.03 | 99.55  | 99.08  |
| 22       | 22.61               | 2.88   | 3072    | 101.02                | 101.87 | 100.92 | 99.97  | 99.66  | 98.99  |
| 23       | 22.31               | 2.88   | 3097    | 101.63                | 101.70 | 100.42 | 99.90  | 99.30  | 98.79  |
| 24       | 22.27               | 2.93   | 3195    | 101.45                | 100.97 | 100.15 | 99.52  | 99.38  | 98.74  |
| n        | 24                  | 24     | 24      | 24                    | 24     | 24     | 24     | 24     | 24     |
| Mean     | 22.32               | 2.89   | 3136    | 101.24                | 101.43 | 100.18 | 99.54  | 99.10  | 98.60  |
| Median   | 22.31               | 2.88   | 3149    | 101.41                | 101.73 | 100.49 | 99.92  | 99.40  | 98.88  |
| St. dev. | 0.33                | 0.05   | 61.9    | 0.69                  | 0.87   | 1.18   | 1.11   | 1.03   | 1.17   |
| Min.     | 21.23               | 2.87   | 3035    | 99.03                 | 99.40  | 97.09  | 96.83  | 95.77  | 95.16  |
| Max.     | 22.80               | 3.10   | 3299    | 102.09                | 102.65 | 101.79 | 100.95 | 100.24 | 100.18 |

# Test Report

Report No.: EED35H000559

Page 6 of 12

| No.      | u'            | v'     | Chromaticity Shift $\Delta u'v'$ |        |        |        |        |        |
|----------|---------------|--------|----------------------------------|--------|--------|--------|--------|--------|
|          | 0 h (Initial) |        | 1000 h                           | 2000 h | 3000 h | 4000 h | 5000 h | 6000 h |
| 1        | 0.2464        | 0.5144 | 0.0013                           | 0.0027 | 0.0035 | 0.0037 | 0.0041 | 0.0046 |
| 2        | 0.2470        | 0.5126 | 0.0009                           | 0.0024 | 0.0030 | 0.0032 | 0.0037 | 0.0042 |
| 3        | 0.2467        | 0.5191 | 0.0007                           | 0.0021 | 0.0028 | 0.0031 | 0.0034 | 0.0036 |
| 4        | 0.2467        | 0.5135 | 0.0011                           | 0.0025 | 0.0035 | 0.0029 | 0.0027 | 0.0029 |
| 5        | 0.2474        | 0.5127 | 0.0008                           | 0.0020 | 0.0026 | 0.0029 | 0.0037 | 0.0040 |
| 6        | 0.2497        | 0.5188 | 0.0009                           | 0.0025 | 0.0037 | 0.0039 | 0.0045 | 0.0048 |
| 7        | 0.2470        | 0.5098 | 0.0011                           | 0.0023 | 0.0029 | 0.0030 | 0.0030 | 0.0040 |
| 8        | 0.2471        | 0.5183 | 0.0008                           | 0.0018 | 0.0022 | 0.0025 | 0.0037 | 0.0039 |
| 9        | 0.2487        | 0.5181 | 0.0008                           | 0.0017 | 0.0021 | 0.0030 | 0.0033 | 0.0037 |
| 10       | 0.2459        | 0.5115 | 0.0007                           | 0.0018 | 0.0022 | 0.0028 | 0.0031 | 0.0035 |
| 11       | 0.2461        | 0.5135 | 0.0006                           | 0.0022 | 0.0027 | 0.0036 | 0.0038 | 0.0041 |
| 12       | 0.2470        | 0.5162 | 0.0008                           | 0.0019 | 0.0024 | 0.0026 | 0.0033 | 0.0037 |
| 13       | 0.2469        | 0.5140 | 0.0007                           | 0.0018 | 0.0023 | 0.0026 | 0.0033 | 0.0037 |
| 14       | 0.2466        | 0.5111 | 0.0011                           | 0.0026 | 0.0032 | 0.0033 | 0.0043 | 0.0047 |
| 15       | 0.2465        | 0.5110 | 0.0007                           | 0.0020 | 0.0025 | 0.0028 | 0.0037 | 0.0038 |
| 16       | 0.2436        | 0.5069 | 0.0006                           | 0.0020 | 0.0026 | 0.0028 | 0.0038 | 0.0042 |
| 17       | 0.2494        | 0.5172 | 0.0008                           | 0.0017 | 0.0020 | 0.0020 | 0.0029 | 0.0032 |
| 18       | 0.2450        | 0.5147 | 0.0010                           | 0.0022 | 0.0027 | 0.0030 | 0.0036 | 0.0040 |
| 19       | 0.2499        | 0.5164 | 0.0008                           | 0.0022 | 0.0026 | 0.0029 | 0.0031 | 0.0033 |
| 20       | 0.2466        | 0.5133 | 0.0006                           | 0.0021 | 0.0026 | 0.0031 | 0.0036 | 0.0039 |
| 21       | 0.2492        | 0.5189 | 0.0007                           | 0.0019 | 0.0021 | 0.0030 | 0.0034 | 0.0039 |
| 22       | 0.2489        | 0.5166 | 0.0006                           | 0.0022 | 0.0026 | 0.0029 | 0.0034 | 0.0037 |
| 23       | 0.2481        | 0.5162 | 0.0007                           | 0.0028 | 0.0036 | 0.0037 | 0.0038 | 0.0043 |
| 24       | 0.2459        | 0.5112 | 0.0006                           | 0.0026 | 0.0030 | 0.0031 | 0.0034 | 0.0038 |
| n        | 24            | 24     | 24                               | 24     | 24     | 24     | 24     | 24     |
| Mean     | 0.2472        | 0.5144 | 0.0008                           | 0.0022 | 0.0027 | 0.0030 | 0.0035 | 0.0039 |
| Median   | 0.2469        | 0.5142 | 0.0008                           | 0.0021 | 0.0026 | 0.0030 | 0.0035 | 0.0039 |
| St. dev. | 0.0015        | 0.0032 | 0.0002                           | 0.0003 | 0.0005 | 0.0004 | 0.0004 | 0.0004 |
| Min.     | 0.2436        | 0.5069 | 0.0006                           | 0.0017 | 0.0020 | 0.0020 | 0.0027 | 0.0029 |
| Max.     | 0.2499        | 0.5191 | 0.0013                           | 0.0028 | 0.0037 | 0.0039 | 0.0045 | 0.0048 |

5.2 85°C, 60 mA

# Test Report

Report No.: EED35H000559

Page 7 of 12

| No.      | $\Phi_v$ [lm] | VF [V] | CCT (K) | Lumen Maintenance [%] |        |        |        |        |        |
|----------|---------------|--------|---------|-----------------------|--------|--------|--------|--------|--------|
|          | 0 h (Initial) |        |         | 1000 h                | 2000 h | 3000 h | 4000 h | 5000 h | 6000 h |
| 1        | 22.60         | 2.87   | 3088    | 101.15                | 101.29 | 98.94  | 98.12  | 97.79  | 97.06  |
| 2        | 22.54         | 2.88   | 3079    | 101.74                | 101.84 | 98.14  | 97.73  | 96.40  | 96.13  |
| 3        | 22.53         | 2.88   | 3052    | 100.85                | 101.14 | 99.43  | 98.71  | 97.75  | 96.97  |
| 4        | 22.38         | 2.88   | 3099    | 101.19                | 101.59 | 99.57  | 98.90  | 97.50  | 96.38  |
| 5        | 22.77         | 2.89   | 3162    | 101.11                | 101.10 | 99.43  | 99.27  | 98.13  | 96.44  |
| 6        | 22.70         | 2.88   | 3166    | 101.26                | 101.68 | 99.31  | 99.00  | 97.62  | 97.40  |
| 7        | 22.56         | 2.88   | 3014    | 100.58                | 100.48 | 98.75  | 98.14  | 97.07  | 96.33  |
| 8        | 23.16         | 2.89   | 3143    | 99.60                 | 100.90 | 99.42  | 98.59  | 97.33  | 96.50  |
| 9        | 22.76         | 2.89   | 3122    | 100.76                | 101.57 | 100.44 | 99.37  | 97.89  | 97.14  |
| 10       | 22.69         | 2.89   | 3133    | 101.13                | 102.47 | 100.75 | 99.64  | 98.47  | 97.69  |
| 11       | 22.56         | 2.88   | 3051    | 100.85                | 100.73 | 98.64  | 98.42  | 97.20  | 96.44  |
| 12       | 22.38         | 2.88   | 3082    | 101.11                | 101.60 | 99.44  | 98.88  | 97.61  | 96.80  |
| 13       | 22.02         | 2.88   | 3067    | 98.97                 | 100.95 | 99.89  | 99.39  | 99.26  | 99.10  |
| 14       | 22.64         | 2.87   | 3142    | 100.88                | 102.10 | 100.24 | 99.35  | 99.29  | 99.14  |
| 15       | 22.58         | 3.10   | 3137    | 101.20                | 101.65 | 100.04 | 99.24  | 98.51  | 97.95  |
| 16       | 22.73         | 2.88   | 3172    | 99.75                 | 100.54 | 99.63  | 98.95  | 99.12  | 98.60  |
| 17       | 22.31         | 2.88   | 3027    | 100.69                | 101.27 | 99.77  | 99.55  | 98.14  | 96.85  |
| 18       | 22.93         | 2.88   | 3190    | 101.49                | 101.43 | 100.02 | 99.88  | 98.48  | 97.99  |
| 19       | 22.88         | 2.89   | 3157    | 99.66                 | 100.85 | 100.35 | 99.58  | 98.49  | 97.72  |
| 20       | 22.84         | 2.89   | 3044    | 100.64                | 101.16 | 100.06 | 100.13 | 98.85  | 98.34  |
| 21       | 22.26         | 2.88   | 3017    | 101.40                | 101.33 | 100.26 | 99.32  | 98.92  | 98.24  |
| 22       | 22.52         | 2.88   | 3102    | 100.92                | 101.93 | 100.61 | 99.81  | 99.42  | 98.75  |
| 23       | 22.73         | 2.89   | 3091    | 100.70                | 102.40 | 101.52 | 100.33 | 99.71  | 98.56  |
| 24       | 22.66         | 3.02   | 3038    | 100.87                | 102.25 | 101.30 | 100.63 | 99.60  | 98.96  |
| n        | 24            | 24     | 24      | 24                    | 24     | 24     | 24     | 24     | 24     |
| Mean     | 22.6          | 2.90   | 3099    | 100.77                | 101.43 | 99.83  | 99.21  | 98.27  | 97.56  |
| Median   | 22.6          | 2.88   | 3095    | 100.88                | 101.38 | 99.83  | 99.30  | 98.30  | 97.55  |
| St. dev. | 0.24          | 0.05   | 53.0    | 0.66                  | 0.56   | 0.80   | 0.71   | 0.88   | 0.98   |
| Min.     | 22.0          | 2.87   | 3014    | 98.97                 | 100.48 | 98.14  | 97.73  | 96.40  | 96.13  |
| Max.     | 23.2          | 3.10   | 3190    | 101.74                | 102.47 | 101.52 | 100.63 | 99.71  | 99.14  |

| No. | $u'$          | $v'$ | Chromaticity Shift $\Delta u'v'$ |        |        |        |        |        |
|-----|---------------|------|----------------------------------|--------|--------|--------|--------|--------|
|     | 0 h (Initial) |      | 1000 h                           | 2000 h | 3000 h | 4000 h | 5000 h | 6000 h |
|     |               |      |                                  |        |        |        |        |        |

# Test Report

Report No.: EED35H000559

Page 8 of 12

|          |        |        |        |        |        |        |        |        |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1        | 0.2487 | 0.5152 | 0.0003 | 0.0009 | 0.0018 | 0.0021 | 0.0025 | 0.0029 |
| 2        | 0.2491 | 0.5148 | 0.0005 | 0.0010 | 0.0026 | 0.0026 | 0.0035 | 0.0038 |
| 3        | 0.2498 | 0.5163 | 0.0008 | 0.0012 | 0.0022 | 0.0024 | 0.0034 | 0.0037 |
| 4        | 0.2476 | 0.5176 | 0.0003 | 0.0007 | 0.0013 | 0.0018 | 0.0031 | 0.0036 |
| 5        | 0.2459 | 0.5151 | 0.0003 | 0.0005 | 0.0010 | 0.0020 | 0.0029 | 0.0036 |
| 6        | 0.2461 | 0.5140 | 0.0004 | 0.0010 | 0.0015 | 0.0024 | 0.0033 | 0.0036 |
| 7        | 0.2501 | 0.5206 | 0.0004 | 0.0013 | 0.0019 | 0.0025 | 0.0032 | 0.0035 |
| 8        | 0.2465 | 0.5157 | 0.0005 | 0.0010 | 0.0017 | 0.0024 | 0.0031 | 0.0035 |
| 9        | 0.2474 | 0.5153 | 0.0002 | 0.0010 | 0.0014 | 0.0019 | 0.0030 | 0.0033 |
| 10       | 0.2468 | 0.5158 | 0.0002 | 0.0011 | 0.0018 | 0.0022 | 0.0032 | 0.0035 |
| 11       | 0.2497 | 0.5168 | 0.0003 | 0.0011 | 0.0017 | 0.0023 | 0.0029 | 0.0033 |
| 12       | 0.2481 | 0.5180 | 0.0003 | 0.0012 | 0.0015 | 0.0022 | 0.0029 | 0.0032 |
| 13       | 0.2486 | 0.5184 | 0.0002 | 0.0005 | 0.0008 | 0.0012 | 0.0024 | 0.0027 |
| 14       | 0.2471 | 0.5135 | 0.0003 | 0.0008 | 0.0014 | 0.0017 | 0.0022 | 0.0025 |
| 15       | 0.2478 | 0.5117 | 0.0004 | 0.0011 | 0.0016 | 0.0019 | 0.0027 | 0.0025 |
| 16       | 0.2457 | 0.5148 | 0.0004 | 0.0006 | 0.0012 | 0.0017 | 0.0027 | 0.0030 |
| 17       | 0.2504 | 0.5176 | 0.0003 | 0.0010 | 0.0013 | 0.0021 | 0.0028 | 0.0032 |
| 18       | 0.2449 | 0.5151 | 0.0005 | 0.0011 | 0.0016 | 0.0021 | 0.0027 | 0.0033 |
| 19       | 0.2465 | 0.5138 | 0.0004 | 0.0013 | 0.0015 | 0.0019 | 0.0027 | 0.0032 |
| 20       | 0.2495 | 0.5183 | 0.0003 | 0.0009 | 0.0015 | 0.0018 | 0.0025 | 0.0028 |
| 21       | 0.2508 | 0.5174 | 0.0013 | 0.0022 | 0.0027 | 0.0030 | 0.0034 | 0.0037 |
| 22       | 0.2486 | 0.5134 | 0.0004 | 0.0009 | 0.0011 | 0.0016 | 0.0025 | 0.0029 |
| 23       | 0.2483 | 0.5161 | 0.0002 | 0.0008 | 0.0010 | 0.0015 | 0.0024 | 0.0024 |
| 24       | 0.2496 | 0.5188 | 0.0002 | 0.0008 | 0.0011 | 0.0014 | 0.0024 | 0.0026 |
| n        | 24     | 24     | 24     | 24     | 24     | 24     | 24     | 24     |
| Mean     | 0.2481 | 0.5160 | 0.0004 | 0.0010 | 0.0016 | 0.0020 | 0.0029 | 0.0032 |
| Median   | 0.2482 | 0.5158 | 0.0003 | 0.0010 | 0.0015 | 0.0020 | 0.0029 | 0.0032 |
| St. dev. | 0.0016 | 0.0021 | 0.0002 | 0.0003 | 0.0005 | 0.0004 | 0.0004 | 0.0004 |
| Min.     | 0.2449 | 0.5117 | 0.0002 | 0.0005 | 0.0008 | 0.0012 | 0.0022 | 0.0024 |
| Max.     | 0.2508 | 0.5206 | 0.0013 | 0.0022 | 0.0027 | 0.0030 | 0.0035 | 0.0038 |

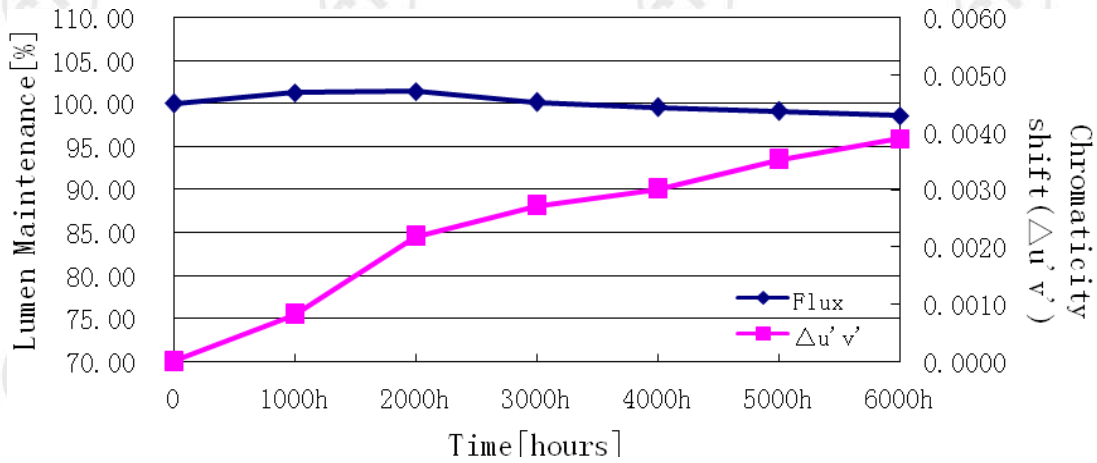
## 6 Graph of Lumen Maintenance and Chromaticity Shift



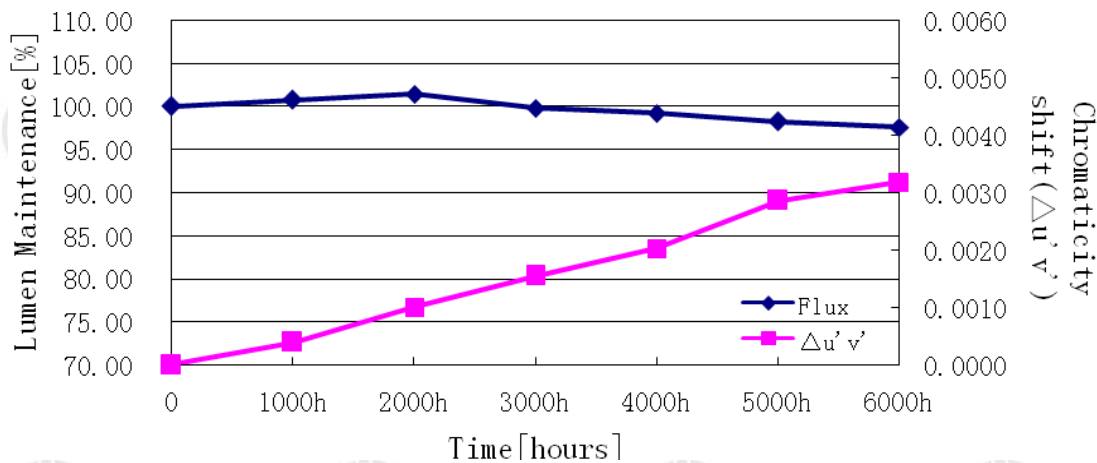
# Test Report

Report No.: EED35H000559

Page 9 of 12



Graph 1 – 55 °C, 60 mA



Graph 2 – 85 °C, 60 mA

## 7 TM-21-11 Report: Projecting Long Term Lumen Maintenance of LED Light Source

# Test Report

Report No.: EED35H000559

Page 10 of 12

**Table 1: Report at each LM-80 Test Condition**

|  | 55°C case Temperature | 85°C case Temperature | Specified case Temperature |
|--|-----------------------|-----------------------|----------------------------|
| Sample size                                      | 24                    | 24                    | ---                        |
| Number of failures                               | 0                     | 0                     | ---                        |
| DUT drive current used in the test (mA)          | 60                    | 60                    | ---                        |
| Test duration (hours)                            | 6,000                 | 6,000                 | ---                        |
| Test duration used for projection (hour to hour) | 1,000 - 6,000         | 1,000 - 6,000         | ---                        |
| Tested case temperature (°C)                     | 55                    | 85                    | ---                        |
| $\alpha$   | 5.950E-06             | 7.516E-06             | ---                        |
| B  | 1.021                 | 1.022                 | ---                        |
| Calculated L70(6k) (hours)                       | 63000                 | 50000                 | ---                        |
| Reported L70(6k) (hours)                         | >36000                | >36000                | ---                        |

# Test Report

Report No.: EED35H000559

Page 11 of 12

## Photos of the sample

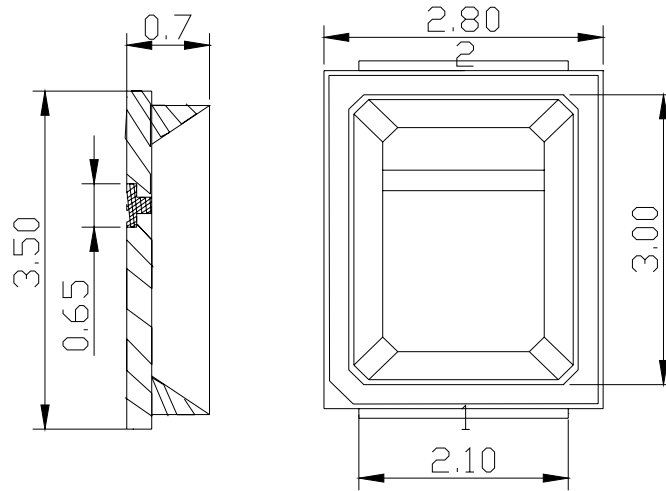


Fig.1- Mechanical Dimension

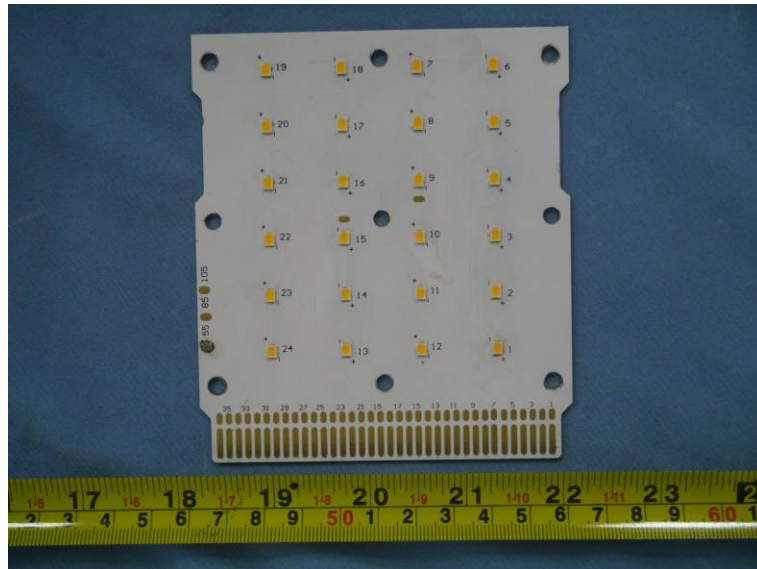


Fig.2- Overall view

# Test Report

Report No.: EED35H000559

Page 12 of 12

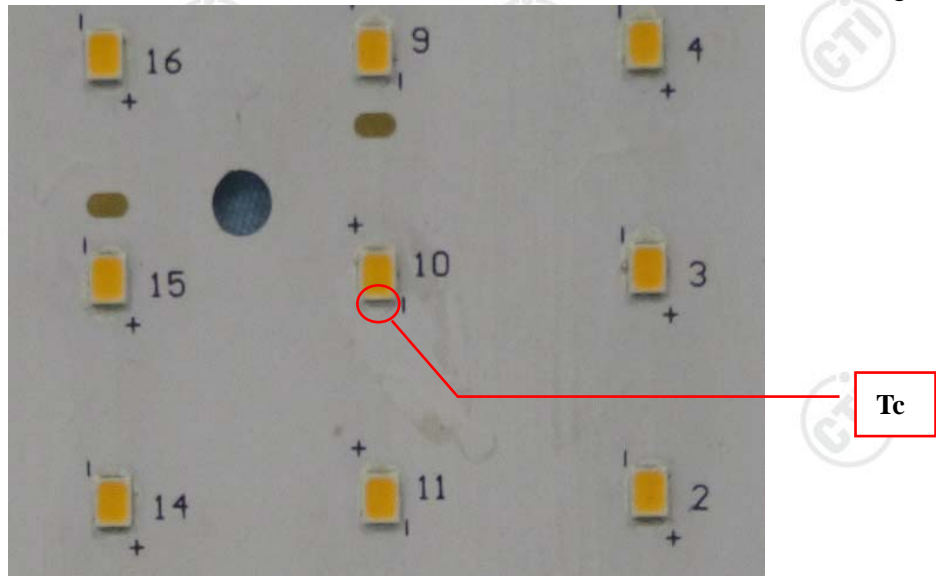


Fig.3- Temperature Measurement Point

\*\*\* End of Report \*\*\*

This test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CTI, this report can't be reproduced except in full.