



# IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

## MEASUREMENT AND TEST REPORT

For

### Edison Opto Corporation

4F, No.800, Chung-Cheng Rd., Chung-Ho Dist, New Taipei City, Taiwan

**Model:ET-3528**

|                                               |                                                                                                                                                                                                     |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Report Type:</b><br>6000 Hours Test Report | <b>Product Type:</b><br>LED Package                                                                                                                                                                 |
| <b>Test Engineer:</b> Daniel Duan             | <i>Daniel Duan</i>                                                                                                                                                                                  |
| <b>Report Number:</b> RSZ140207514-10         |                                                                                                                                                                                                     |
| <b>Test Date:</b> 2014-02-10 to 2014-10-18    |                                                                                                                                                                                                     |
| <b>Report Date:</b> 2014-10-31                |                                                                                                                                                                                                     |
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**Note:** The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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# 1 - GENERAL INFORMATION

## 1.1 Description of LED Light Sources

Devices tested

Part Number: ET-3528  
 Part Name: 3528  
 Part Type: LED Package  
 Nominal CCT: 3000K

According to ENERGY STAR® Program Guidance, this report covers the following models:

| Model type  | Model name       | CCT               | CRI | Number of dies | Current (mA) | Power (W) |
|-------------|------------------|-------------------|-----|----------------|--------------|-----------|
| Test model  | 2T03Y6WW01000002 | 3000K             | >80 | 1              | 20           | 0.06      |
| Cover model | 2T03Y6CWxx000xxx | 5000K/5700K/6500K | >80 | 1              | 20           | 0.06      |
|             | 2T03Y6NWxx000xxx | 4000K             | >80 | 1              | 20           | 0.06      |
|             | 2T03Y6WWxx000xxx | 2700K/3000K/3500K | >80 | 1              | 20           | 0.06      |

## 1.2 Standards Used:

- IESNA LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products(This test method was not accredited by IAS)

## 1.3 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan). is located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.

## 1.4 Description of Auxiliary Equipment

| Device                                | Manufacture | Model No      | Serial No | Test Range                           | Calibration date | Calibration due date |
|---------------------------------------|-------------|---------------|-----------|--------------------------------------|------------------|----------------------|
| Integral Sphere                       | EVERFINE    | Diameter 0.3m | 1011119   | 380-780nm, Diameter:0.3m,0-1999Lumen | 2014-03-04       | 2015-03-04           |
| Programmable Test Power for LEDs      | EVERFINE    | LED300E       | 1008002   | 15V/2000mA                           | 2014-03-12       | 2015-03-12           |
| High accuracy array spectroradiometer | EVERFINE    | HAAS-2000     | 1012016T  | 380-780nm                            | 2013-12-26       | 2014-12-26           |

| Device                                                | Manufacture | Model No          | Serial No            | Test Range | Calibration date | Calibration due date |
|-------------------------------------------------------|-------------|-------------------|----------------------|------------|------------------|----------------------|
| Standard Light Source                                 | EVERFINE    | D062              | 1011093              | N/A        | 2014-05-06       | 2015-05-06           |
| Precision digital stabilized DC power supply          | EVERFINE    | WY605             | G115987C<br>J7321114 | 300VA      | 2014-03-12       | 2015-03-12           |
| LM-80 Aging equipment                                 | BACL        | N/A               | #5                   | N/A        | 2014-03-19       | 2015-03-19           |
| Adjustable constant-current DC switching power supply | GOTER       | LLA120011<br>12-U | #4                   | (120V/1A)  | 2013-12-04       | 2014-12-04           |
| Adjustable constant-current DC switching power supply | GOTER       | LLA120011<br>12-U | #5                   | (120V/1A)  | 2013-12-04       | 2014-12-04           |
| Adjustable constant-current DC switching power supply | GOTER       | LLA120011<br>12-U | #6                   | (120V/1A)  | 2013-12-04       | 2014-12-04           |

### 1.5 Operating Cycle

Samples are driven with a constant direct current (DC)

### 1.6 Ambient Conditions

For lumen maintenance test, samples were operated in thermal chambers with minimal ambient airflow. For long term reliability test, the case temperature was controlled by mounting several thermocouples on a sample reliability stress board at the designated thermal measurement point, as shown in APPENDIX. The ambient temperature  $T_A$  was measured by several thermocouples at a distance of 5 mm above the reliability test board. The relative humidity within chamber was less than 65%.

For photometry measurement, temperature was set to  $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ , RH <65%.

### 1.7 Photometry Measurement Uncertainty

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  $U=21\text{K}$  ( $K=2$ ), at the 95% confidence level. This calibration results traceable to the NATIONAL INSTITUTE OF METROLOGY (NIM).

## 1.8 Sample Set

### 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.

Each Sample is soldered to all of the reliability stress boards for a given set of IESNA LM-80 tests.

### Sample Size:

Total 75Pcs;

Each Ts test condition 25Pcs

The samples tested at Ts 55 °C, 70 °C and Ts 85 °C were received at 2014-02-07 and tested during 2014-02-10 to 2014-10-18. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75

#### Data Set 1: 55 °C, 20mA

|                                              |                         |
|----------------------------------------------|-------------------------|
| Part Number:                                 | ET-3528                 |
| Number of Units:                             | 25                      |
| Actual Case Temperature(T <sub>S</sub> ):    | T <sub>S</sub> =54.2 °C |
| Actual Ambient Temperature(T <sub>A</sub> ): | T <sub>A</sub> =52.5 °C |
| Life Test Drive Current:                     | I <sub>F</sub> = 20mA   |
| Measurement Current:                         | I <sub>F</sub> = 20mA   |

#### Data Set 2: 70 °C,20mA

|                                              |                         |
|----------------------------------------------|-------------------------|
| Part Number:                                 | ET-3528                 |
| Number of Units:                             | 25                      |
| Actual Case Temperature(T <sub>S</sub> ):    | T <sub>S</sub> =69.1 °C |
| Actual Ambient Temperature(T <sub>A</sub> ): | T <sub>A</sub> =67.5 °C |
| Life Test Drive Current:                     | I <sub>F</sub> = 20mA   |
| Measurement Current:                         | I <sub>F</sub> = 20mA   |

#### Data Set 3: 85 °C, 20mA

|                                              |                         |
|----------------------------------------------|-------------------------|
| Part Number:                                 | ET-3528                 |
| Number of Units:                             | 25                      |
| Actual Case Temperature(T <sub>S</sub> ):    | T <sub>S</sub> =84.5 °C |
| Actual Ambient Temperature(T <sub>A</sub> ): | T <sub>A</sub> =83.1 °C |
| Life Test Drive Current:                     | I <sub>F</sub> = 20mA   |
| Measurement Current:                         | I <sub>F</sub> = 20mA   |

## 2 - SUMMARY OF TEST RESULT

| <b>Data Set:</b>                                            | <b>Data Set 1, 55 °C, 20mA</b>         |
|-------------------------------------------------------------|----------------------------------------|
| Number of Units:                                            | 25                                     |
| Failures Observed:                                          | 0                                      |
| Test Interval and Test Duration:                            | 0h,1000h,2000h,3000h,4000h,5000h,6000h |
| Average. Lumen Maintenance at 6000 hours:                   | 97.61%                                 |
| Average Chromaticity Shift at 6000 hours ( $\Delta u'v'$ ): | 0.0021                                 |
| Reported TM-21 L <sub>70</sub> Lifetime:                    | >36,000hours                           |

| <b>Data Set:</b>                                           | <b>Data Set 2, 70 °C, 20mA</b>         |
|------------------------------------------------------------|----------------------------------------|
| Number of Units:                                           | 25                                     |
| Failures Observed:                                         | 0                                      |
| Test Interval and Test Duration:                           | 0h,1000h,2000h,3000h,4000h,5000h,6000h |
| Average. Lumen Maintenance at 6000 hours:                  | 97.07%                                 |
| Average Chromaticity Shift at 6000 hours( $\Delta u'v'$ ): | 0.0024                                 |
| Reported TM-21 L <sub>70</sub> Lifetime:                   | >36,000 hours                          |

| <b>Data Set:</b>                                           | <b>Data Set 3, 85 °C, 20mA</b>         |
|------------------------------------------------------------|----------------------------------------|
| Number of Units:                                           | 25                                     |
| Failures Observed:                                         | 0                                      |
| Test Interval and Test Duration:                           | 0h,1000h,2000h,3000h,4000h,5000h,6000h |
| Average. Lumen Maintenance at 6000 hours:                  | 96.66%                                 |
| Average Chromaticity Shift at 6000 hours( $\Delta u'v'$ ): | 0.0026                                 |
| Reported TM-21 L <sub>70</sub> Lifetime:                   | >36,000 hours                          |

### 3 - Test Data

#### 3.1 Data Set 1, 55 °C, 20 mA (Lumen Maintenance)

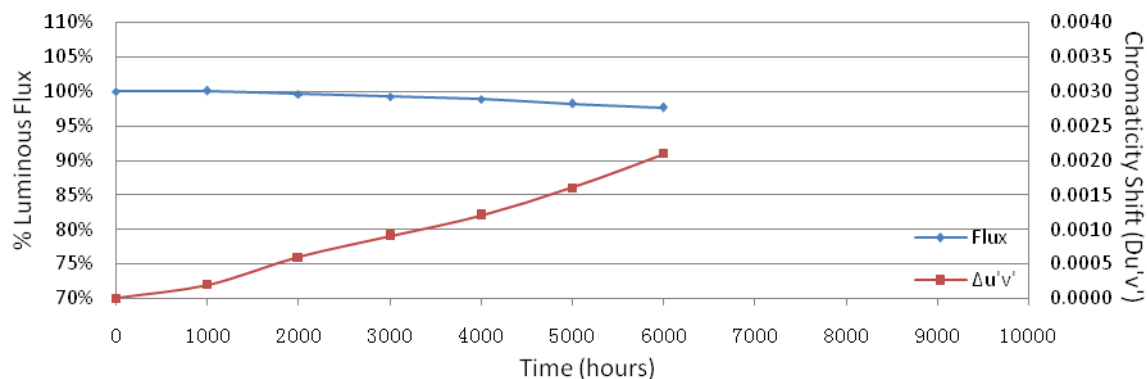
| No.    | V <sub>F</sub> (V) | Φ(lm) | Lumen Maintenance (%) |         |         |         |         |         |
|--------|--------------------|-------|-----------------------|---------|---------|---------|---------|---------|
|        | 0hr(Initial)       |       | 1000hrs               | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs |
| 1      | 3.08               | 6.78  | 99.99                 | 99.32   | 99.09   | 98.70   | 98.05   | 97.89   |
| 2      | 3.10               | 6.48  | 100.14                | 99.57   | 99.29   | 98.12   | 97.52   | 97.45   |
| 3      | 3.08               | 6.66  | 100.03                | 99.58   | 99.22   | 98.59   | 98.02   | 97.43   |
| 4      | 3.08               | 6.62  | 99.83                 | 99.61   | 99.11   | 98.81   | 98.17   | 97.72   |
| 5      | 3.06               | 6.66  | 99.94                 | 99.47   | 99.16   | 98.36   | 97.76   | 97.54   |
| 6      | 3.07               | 6.66  | 100.03                | 99.77   | 99.29   | 99.26   | 98.30   | 97.90   |
| 7      | 3.09               | 6.49  | 99.74                 | 99.54   | 98.84   | 98.20   | 97.52   | 97.19   |
| 8      | 3.07               | 6.70  | 100.01                | 99.88   | 99.79   | 98.88   | 98.06   | 97.70   |
| 9      | 3.08               | 6.68  | 100.37                | 99.84   | 99.58   | 99.43   | 98.56   | 97.58   |
| 10     | 3.08               | 6.59  | 99.88                 | 99.33   | 98.88   | 98.51   | 97.87   | 97.39   |
| 11     | 3.08               | 6.66  | 99.95                 | 99.82   | 99.20   | 99.16   | 98.53   | 97.96   |
| 12     | 3.08               | 6.69  | 99.79                 | 99.09   | 98.34   | 98.21   | 97.59   | 97.25   |
| 13     | 3.08               | 6.62  | 99.95                 | 99.62   | 98.96   | 98.88   | 98.64   | 97.93   |
| 14     | 3.08               | 6.56  | 100.14                | 99.65   | 98.90   | 98.87   | 97.94   | 97.38   |
| 15     | 3.09               | 6.76  | 100.37                | 99.93   | 99.72   | 99.36   | 98.88   | 98.24   |
| 16     | 3.08               | 6.63  | 99.98                 | 99.80   | 99.56   | 99.11   | 98.49   | 97.93   |
| 17     | 3.09               | 6.65  | 100.33                | 99.70   | 99.37   | 99.35   | 99.10   | 98.39   |
| 18     | 3.08               | 6.71  | 99.96                 | 99.36   | 99.15   | 98.72   | 98.30   | 97.33   |
| 19     | 3.08               | 6.63  | 100.15                | 99.89   | 99.62   | 99.11   | 98.32   | 97.13   |
| 20     | 3.09               | 6.68  | 100.48                | 99.90   | 99.84   | 99.60   | 99.01   | 98.10   |
| 21     | 3.08               | 6.62  | 100.03                | 99.64   | 99.24   | 98.31   | 97.96   | 97.10   |
| 22     | 3.10               | 6.52  | 100.00                | 99.56   | 99.17   | 98.88   | 98.22   | 97.53   |
| 23     | 3.09               | 6.53  | 100.14                | 99.89   | 99.04   | 98.56   | 98.04   | 97.49   |
| 24     | 3.07               | 6.71  | 99.97                 | 99.70   | 98.84   | 98.61   | 98.03   | 97.41   |
| 25     | 3.07               | 6.83  | 100.12                | 99.77   | 99.33   | 98.84   | 98.13   | 97.41   |
| Ave.   | 3.08               | 6.64  | 100.05                | 99.65   | 99.22   | 98.82   | 98.20   | 97.61   |
| Med.   | 3.08               | 6.66  | 100.01                | 99.65   | 99.20   | 98.84   | 98.13   | 97.53   |
| st dev | 0.01               | 0.09  | 0.18                  | 0.21    | 0.34    | 0.41    | 0.42    | 0.35    |
| Min.   | 3.06               | 6.48  | 99.74                 | 99.09   | 98.34   | 98.12   | 97.52   | 97.10   |
| Max.   | 3.10               | 6.83  | 100.48                | 99.93   | 99.84   | 99.60   | 99.10   | 98.39   |

TM-21 Projection:

**Test Duration:** 6000 hours  
**Failures Observed:** 0  
**α:** 4.899E-06  
**β:** 1.006  
**Calculated L<sub>70</sub>:** 74,000hours  
**Reported L<sub>70</sub>:** >36,000hours

### 3.2 Data Set 1, 55 °C, 20 mA (Chromaticity Shift)

| No.    | u'           | v'     | CCT(K)  | Chromaticity Shift ( $\Delta u'v'$ ) |         |         |         |         |         |
|--------|--------------|--------|---------|--------------------------------------|---------|---------|---------|---------|---------|
|        | 0hr(Initial) |        |         | 1000hrs                              | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs |
| 1      | 0.2595       | 0.5328 | 2740    | 0.0005                               | 0.0008  | 0.0010  | 0.0012  | 0.0017  | 0.0023  |
| 2      | 0.2586       | 0.5310 | 2767    | 0.0002                               | 0.0006  | 0.0007  | 0.0006  | 0.0008  | 0.0013  |
| 3      | 0.2594       | 0.5344 | 2735    | 0.0001                               | 0.0007  | 0.0009  | 0.0016  | 0.0018  | 0.0024  |
| 4      | 0.2582       | 0.5318 | 2772    | 0.0001                               | 0.0007  | 0.0007  | 0.0014  | 0.0018  | 0.0023  |
| 5      | 0.2583       | 0.5316 | 2769    | 0.0004                               | 0.0009  | 0.0012  | 0.0014  | 0.0019  | 0.0024  |
| 6      | 0.2594       | 0.5311 | 2748    | 0.0001                               | 0.0005  | 0.0010  | 0.0010  | 0.0016  | 0.0021  |
| 7      | 0.2578       | 0.5308 | 2785    | 0.0000                               | 0.0006  | 0.0008  | 0.0015  | 0.0018  | 0.0024  |
| 8      | 0.2594       | 0.5345 | 2734    | 0.0002                               | 0.0007  | 0.0009  | 0.0014  | 0.0019  | 0.0023  |
| 9      | 0.2608       | 0.5341 | 2708    | 0.0002                               | 0.0004  | 0.0010  | 0.0012  | 0.0015  | 0.0020  |
| 10     | 0.2589       | 0.5338 | 2749    | 0.0001                               | 0.0003  | 0.0007  | 0.0014  | 0.0018  | 0.0022  |
| 11     | 0.2600       | 0.5349 | 2721    | 0.0000                               | 0.0005  | 0.0008  | 0.0011  | 0.0016  | 0.0020  |
| 12     | 0.2599       | 0.5340 | 2726    | 0.0001                               | 0.0004  | 0.0009  | 0.0017  | 0.0022  | 0.0026  |
| 13     | 0.2598       | 0.5349 | 2724    | 0.0002                               | 0.0004  | 0.0007  | 0.0009  | 0.0012  | 0.0016  |
| 14     | 0.2606       | 0.5345 | 2710    | 0.0000                               | 0.0005  | 0.0014  | 0.0012  | 0.0016  | 0.0021  |
| 15     | 0.2588       | 0.5330 | 2753    | 0.0005                               | 0.0009  | 0.0012  | 0.0006  | 0.0009  | 0.0015  |
| 16     | 0.2601       | 0.5328 | 2728    | 0.0001                               | 0.0004  | 0.0009  | 0.0014  | 0.0020  | 0.0024  |
| 17     | 0.2604       | 0.5341 | 2717    | 0.0004                               | 0.0008  | 0.0010  | 0.0007  | 0.0010  | 0.0014  |
| 18     | 0.2595       | 0.5347 | 2732    | 0.0003                               | 0.0005  | 0.0011  | 0.0014  | 0.0019  | 0.0023  |
| 19     | 0.2596       | 0.5345 | 2731    | 0.0001                               | 0.0005  | 0.0007  | 0.0009  | 0.0013  | 0.0019  |
| 20     | 0.2588       | 0.5338 | 2751    | 0.0003                               | 0.0004  | 0.0010  | 0.0011  | 0.0015  | 0.0021  |
| 21     | 0.2595       | 0.5344 | 2734    | 0.0001                               | 0.0007  | 0.0008  | 0.0012  | 0.0016  | 0.0022  |
| 22     | 0.2582       | 0.5311 | 2774    | 0.0001                               | 0.0004  | 0.0004  | 0.0008  | 0.0012  | 0.0016  |
| 23     | 0.2581       | 0.5321 | 2772    | 0.0001                               | 0.0003  | 0.0004  | 0.0007  | 0.0011  | 0.0017  |
| 24     | 0.2588       | 0.5315 | 2761    | 0.0002                               | 0.0004  | 0.0008  | 0.0015  | 0.0020  | 0.0025  |
| 25     | 0.2618       | 0.5364 | 2679    | 0.0001                               | 0.0004  | 0.0008  | 0.0013  | 0.0018  | 0.0023  |
| Ave.   | 0.2594       | 0.5333 | 2741    | 0.0002                               | 0.0006  | 0.0009  | 0.0012  | 0.0016  | 0.0021  |
| Med.   | 0.2594       | 0.5338 | 2735    | 0.0001                               | 0.0005  | 0.0009  | 0.0012  | 0.0016  | 0.0022  |
| st dev | 0.0010       | 0.0015 | 25.0267 | 0.0001                               | 0.0002  | 0.0002  | 0.0003  | 0.0004  | 0.0004  |
| Min.   | 0.2578       | 0.5308 | 2679    | 0.0000                               | 0.0003  | 0.0004  | 0.0006  | 0.0008  | 0.0013  |
| Max.   | 0.2618       | 0.5364 | 2785    | 0.0005                               | 0.0009  | 0.0014  | 0.0017  | 0.0022  | 0.0026  |





**3.3 Data Set 2, 70 °C, 20 mA (Lumen Maintenance)**

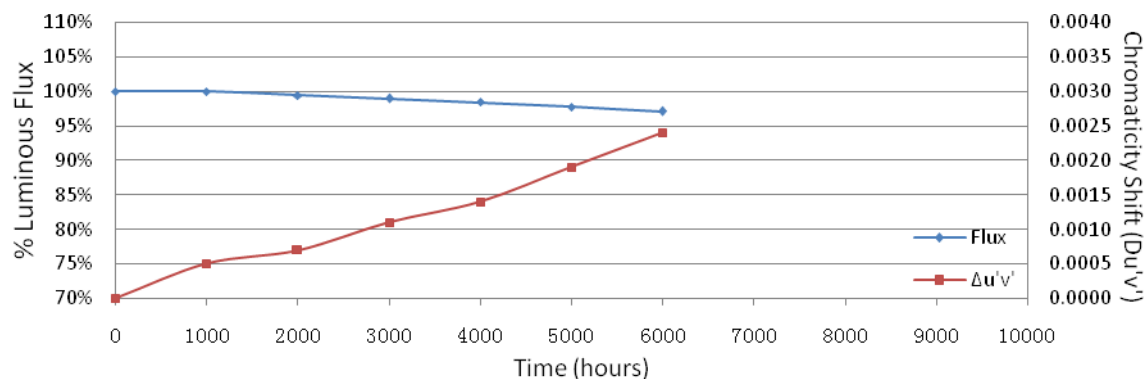
| No.    | V <sub>F</sub> (V) | Φ(lm) | Lumen Maintenance (%) |         |         |         |         |         |
|--------|--------------------|-------|-----------------------|---------|---------|---------|---------|---------|
|        | Ohr(Initial)       |       | 1000hrs               | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs |
| 26     | 3.07               | 6.75  | 100.03                | 99.78   | 99.29   | 98.83   | 98.31   | 97.64   |
| 27     | 3.10               | 6.59  | 100.17                | 99.33   | 98.63   | 98.42   | 97.77   | 96.95   |
| 28     | 3.09               | 6.50  | 99.95                 | 99.91   | 99.48   | 99.25   | 98.31   | 97.28   |
| 29     | 3.07               | 6.62  | 99.62                 | 99.34   | 98.72   | 98.34   | 97.64   | 96.75   |
| 30     | 3.08               | 6.74  | 100.47                | 99.69   | 98.75   | 98.19   | 97.08   | 96.87   |
| 31     | 3.07               | 6.40  | 100.45                | 99.58   | 99.34   | 99.33   | 98.72   | 97.84   |
| 32     | 3.08               | 6.61  | 100.17                | 99.80   | 99.50   | 98.85   | 98.28   | 97.35   |
| 33     | 3.08               | 6.56  | 100.20                | 99.80   | 98.43   | 98.29   | 97.24   | 96.46   |
| 34     | 3.08               | 6.68  | 100.18                | 99.90   | 99.28   | 99.22   | 98.55   | 97.50   |
| 35     | 3.08               | 6.58  | 99.86                 | 99.27   | 98.63   | 98.15   | 97.58   | 96.82   |
| 36     | 3.07               | 6.69  | 99.78                 | 99.61   | 99.03   | 98.03   | 97.19   | 96.67   |
| 37     | 3.08               | 6.50  | 99.83                 | 99.02   | 98.82   | 98.03   | 97.11   | 96.59   |
| 38     | 3.09               | 6.54  | 100.02                | 99.31   | 98.79   | 98.49   | 97.94   | 97.13   |
| 39     | 3.07               | 6.57  | 99.88                 | 99.33   | 98.17   | 97.72   | 97.02   | 96.52   |
| 40     | 3.09               | 6.51  | 99.66                 | 99.31   | 99.22   | 98.11   | 97.59   | 97.20   |
| 41     | 3.08               | 6.61  | 99.65                 | 99.08   | 98.59   | 98.03   | 97.32   | 96.81   |
| 42     | 3.07               | 6.54  | 100.03                | 99.60   | 98.90   | 98.56   | 97.95   | 97.48   |
| 43     | 3.09               | 6.59  | 100.03                | 99.54   | 99.38   | 98.80   | 98.19   | 97.59   |
| 44     | 3.07               | 6.63  | 100.08                | 99.67   | 99.29   | 98.90   | 98.19   | 97.75   |
| 45     | 3.09               | 6.66  | 99.94                 | 99.22   | 98.57   | 97.91   | 97.33   | 96.46   |
| 46     | 3.09               | 6.82  | 99.96                 | 99.24   | 98.90   | 98.33   | 97.46   | 97.08   |
| 47     | 3.07               | 6.53  | 99.94                 | 99.19   | 98.74   | 97.95   | 97.17   | 96.66   |
| 48     | 3.09               | 6.60  | 99.76                 | 99.12   | 98.73   | 98.41   | 97.66   | 97.23   |
| 49     | 3.09               | 6.62  | 99.91                 | 99.30   | 99.09   | 98.35   | 97.51   | 96.80   |
| 50     | 3.07               | 6.67  | 100.18                | 99.67   | 98.80   | 98.46   | 97.57   | 97.27   |
| Ave.   | 3.08               | 6.60  | 99.99                 | 99.46   | 98.92   | 98.44   | 97.71   | 97.07   |
| Med.   | 3.08               | 6.60  | 99.96                 | 99.34   | 98.82   | 98.35   | 97.59   | 97.08   |
| st dev | 0.01               | 0.09  | 0.22                  | 0.27    | 0.35    | 0.44    | 0.49    | 0.42    |
| Min.   | 3.07               | 6.40  | 99.62                 | 99.02   | 98.17   | 97.72   | 97.02   | 96.46   |
| Max.   | 3.10               | 6.82  | 100.47                | 99.91   | 99.50   | 99.33   | 98.72   | 97.84   |

## TM-21 Projection:

**Test Duration:** 6000 hours  
**Failures Observed:** 0  
 $\alpha$ : 5.895E-06  
 $\beta$ : 1.006  
**Calculated L<sub>70</sub>:** 62,000hours  
**Reported L<sub>70</sub>:** >36,000hours

### 3.4 Data Set 2, 70 °C, 20mA (Chromaticity Shift)

| No.    | u'     | v'     | CCT(K)  | Chromaticity Shift ( $\Delta u'v'$ ) |         |         |         |         |         |
|--------|--------|--------|---------|--------------------------------------|---------|---------|---------|---------|---------|
|        |        |        |         | 0hr(Initial)                         | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs |
| 26     | 0.2590 | 0.5319 | 2754    | 0.0002                               | 0.0005  | 0.0005  | 0.0010  | 0.0016  | 0.0020  |
| 27     | 0.2576 | 0.5318 | 2783    | 0.0003                               | 0.0006  | 0.0008  | 0.0012  | 0.0018  | 0.0023  |
| 28     | 0.2579 | 0.5296 | 2789    | 0.0001                               | 0.0011  | 0.0013  | 0.0008  | 0.0013  | 0.0017  |
| 29     | 0.2599 | 0.5349 | 2724    | 0.0006                               | 0.0009  | 0.0010  | 0.0016  | 0.0021  | 0.0027  |
| 30     | 0.2601 | 0.5321 | 2731    | 0.0003                               | 0.0005  | 0.0009  | 0.0014  | 0.0018  | 0.0025  |
| 31     | 0.2575 | 0.5323 | 2784    | 0.0003                               | 0.0007  | 0.0007  | 0.0013  | 0.0018  | 0.0023  |
| 32     | 0.2590 | 0.5351 | 2740    | 0.0001                               | 0.0008  | 0.0012  | 0.0014  | 0.0018  | 0.0023  |
| 33     | 0.2585 | 0.5334 | 2759    | 0.0002                               | 0.0006  | 0.0013  | 0.0016  | 0.0021  | 0.0026  |
| 34     | 0.2599 | 0.5342 | 2726    | 0.0002                               | 0.0007  | 0.0013  | 0.0015  | 0.0023  | 0.0029  |
| 35     | 0.2573 | 0.5321 | 2790    | 0.0003                               | 0.0006  | 0.0011  | 0.0012  | 0.0017  | 0.0021  |
| 36     | 0.2594 | 0.5322 | 2744    | 0.0006                               | 0.0008  | 0.0010  | 0.0014  | 0.0018  | 0.0021  |
| 37     | 0.2590 | 0.5316 | 2755    | 0.0005                               | 0.0009  | 0.0010  | 0.0007  | 0.0013  | 0.0018  |
| 38     | 0.2589 | 0.5300 | 2764    | 0.0006                               | 0.0007  | 0.0010  | 0.0014  | 0.0020  | 0.0025  |
| 39     | 0.2608 | 0.5342 | 2708    | 0.0005                               | 0.0009  | 0.0012  | 0.0019  | 0.0023  | 0.0029  |
| 40     | 0.2578 | 0.5303 | 2787    | 0.0006                               | 0.0010  | 0.0011  | 0.0013  | 0.0019  | 0.0025  |
| 41     | 0.2593 | 0.5346 | 2737    | 0.0004                               | 0.0006  | 0.0013  | 0.0012  | 0.0018  | 0.0021  |
| 42     | 0.2593 | 0.5322 | 2746    | 0.0007                               | 0.0007  | 0.0013  | 0.0016  | 0.0022  | 0.0027  |
| 43     | 0.2586 | 0.5327 | 2759    | 0.0007                               | 0.0008  | 0.0011  | 0.0011  | 0.0016  | 0.0020  |
| 44     | 0.2586 | 0.5313 | 2765    | 0.0006                               | 0.0007  | 0.0010  | 0.0010  | 0.0014  | 0.0019  |
| 45     | 0.2586 | 0.5325 | 2760    | 0.0006                               | 0.0007  | 0.0014  | 0.0016  | 0.0021  | 0.0025  |
| 46     | 0.2602 | 0.5345 | 2719    | 0.0005                               | 0.0005  | 0.0014  | 0.0016  | 0.0023  | 0.0028  |
| 47     | 0.2589 | 0.5307 | 2761    | 0.0006                               | 0.0009  | 0.0013  | 0.0014  | 0.0019  | 0.0025  |
| 48     | 0.2581 | 0.5317 | 2774    | 0.0007                               | 0.0007  | 0.0014  | 0.0016  | 0.0021  | 0.0027  |
| 49     | 0.2577 | 0.5315 | 2784    | 0.0006                               | 0.0007  | 0.0014  | 0.0017  | 0.0023  | 0.0028  |
| 50     | 0.2586 | 0.5341 | 2753    | 0.0005                               | 0.0006  | 0.0014  | 0.0014  | 0.0021  | 0.0027  |
| Ave.   | 0.2588 | 0.5325 | 2756    | 0.0005                               | 0.0007  | 0.0011  | 0.0014  | 0.0019  | 0.0024  |
| Med.   | 0.2589 | 0.5322 | 2759    | 0.0005                               | 0.0007  | 0.0012  | 0.0014  | 0.0019  | 0.0025  |
| st dev | 0.0009 | 0.0016 | 23.3875 | 0.0002                               | 0.0002  | 0.0002  | 0.0003  | 0.0003  | 0.0003  |
| Min.   | 0.2573 | 0.5296 | 2708    | 0.0001                               | 0.0005  | 0.0005  | 0.0007  | 0.0013  | 0.0017  |
| Max.   | 0.2608 | 0.5351 | 2790    | 0.0007                               | 0.0011  | 0.0014  | 0.0019  | 0.0023  | 0.0029  |



**3.5 Data Set 3, 85 °C, 20 mA (Lumen Maintenance)**

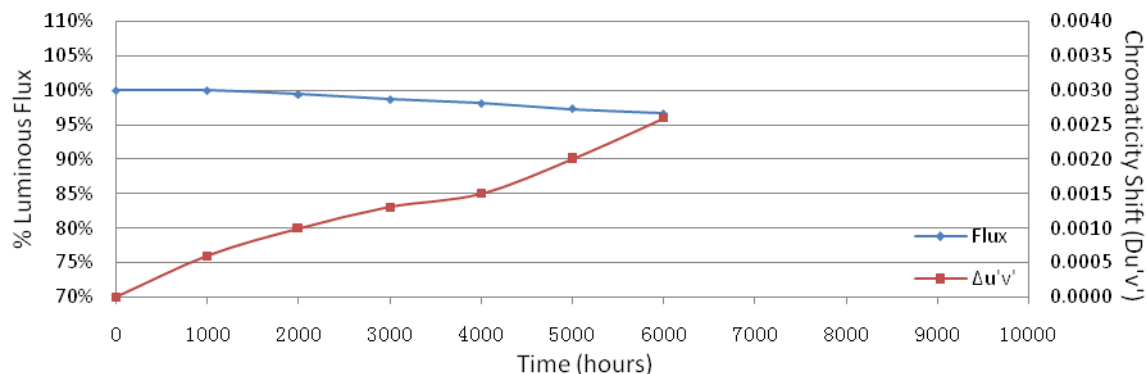
| No.    | V <sub>F</sub> (V) | Φ(lm) | Lumen Maintenance (%) |         |         |         |         |         |
|--------|--------------------|-------|-----------------------|---------|---------|---------|---------|---------|
|        | Ohr(Initial)       |       | 1000hrs               | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs |
| 51     | 3.09               | 6.65  | 100.09                | 99.55   | 98.77   | 98.39   | 97.55   | 96.96   |
| 52     | 3.08               | 6.97  | 100.09                | 99.56   | 99.08   | 97.96   | 97.03   | 96.24   |
| 53     | 3.08               | 6.69  | 100.39                | 99.66   | 99.01   | 97.88   | 97.22   | 96.79   |
| 54     | 3.08               | 6.79  | 100.32                | 99.32   | 98.66   | 97.92   | 96.97   | 96.47   |
| 55     | 3.07               | 6.59  | 99.79                 | 99.07   | 98.33   | 97.75   | 96.92   | 96.34   |
| 56     | 3.06               | 6.66  | 99.89                 | 99.56   | 98.75   | 98.48   | 97.82   | 97.21   |
| 57     | 3.06               | 6.62  | 99.80                 | 99.20   | 98.55   | 98.34   | 97.45   | 97.00   |
| 58     | 3.07               | 6.56  | 100.32                | 99.89   | 98.57   | 98.11   | 97.06   | 96.71   |
| 59     | 3.09               | 6.55  | 99.89                 | 98.99   | 98.38   | 98.03   | 97.10   | 96.80   |
| 60     | 3.08               | 6.65  | 99.91                 | 99.22   | 98.03   | 97.82   | 96.84   | 96.15   |
| 61     | 3.09               | 6.75  | 99.84                 | 99.50   | 99.01   | 98.62   | 97.60   | 96.98   |
| 62     | 3.08               | 6.78  | 100.35                | 99.78   | 98.26   | 97.74   | 97.01   | 96.17   |
| 63     | 3.08               | 6.59  | 99.97                 | 99.23   | 98.32   | 97.74   | 97.01   | 96.41   |
| 64     | 3.08               | 6.64  | 100.06                | 99.11   | 98.75   | 98.54   | 97.73   | 97.12   |
| 65     | 3.07               | 6.68  | 99.94                 | 99.07   | 98.91   | 98.85   | 98.28   | 97.28   |
| 66     | 3.09               | 6.67  | 99.93                 | 99.37   | 98.77   | 98.31   | 97.90   | 97.06   |
| 67     | 3.09               | 6.47  | 99.91                 | 99.32   | 98.73   | 98.64   | 97.64   | 96.80   |
| 68     | 3.07               | 6.64  | 100.00                | 99.49   | 98.92   | 98.66   | 97.97   | 96.93   |
| 69     | 3.08               | 6.82  | 99.91                 | 99.16   | 98.90   | 97.93   | 97.38   | 96.41   |
| 70     | 3.09               | 6.68  | 99.85                 | 99.54   | 99.12   | 97.95   | 96.79   | 96.17   |
| 71     | 3.09               | 6.60  | 99.91                 | 99.48   | 98.83   | 97.82   | 97.00   | 96.18   |
| 72     | 3.05               | 6.66  | 99.68                 | 99.16   | 98.44   | 97.94   | 96.94   | 96.49   |
| 73     | 3.09               | 6.87  | 99.75                 | 99.46   | 98.27   | 97.37   | 96.38   | 96.22   |
| 74     | 3.09               | 6.82  | 99.84                 | 99.40   | 99.06   | 98.22   | 97.40   | 97.10   |
| 75     | 3.10               | 6.58  | 99.79                 | 99.36   | 98.92   | 98.05   | 97.29   | 96.56   |
| Ave.   | 3.08               | 6.68  | 99.97                 | 99.38   | 98.69   | 98.12   | 97.29   | 96.66   |
| Med.   | 3.08               | 6.66  | 99.91                 | 99.37   | 98.75   | 98.03   | 97.22   | 96.71   |
| st dev | 0.01               | 0.11  | 0.19                  | 0.23    | 0.30    | 0.37    | 0.44    | 0.37    |
| Min.   | 3.05               | 6.47  | 99.68                 | 98.99   | 98.03   | 97.37   | 96.38   | 96.15   |
| Max.   | 3.10               | 6.97  | 100.39                | 99.89   | 99.12   | 98.85   | 98.28   | 97.28   |

## TM-21 Projection:

**Test Duration:** 6000 hours  
**Failures Observed:** 0  
 $\alpha$ : 6.797E-06  
 $\beta$ : 1.007  
**Calculated L<sub>70</sub>:** 54,000 hours  
**Reported L<sub>70</sub>:** >36,000 hours

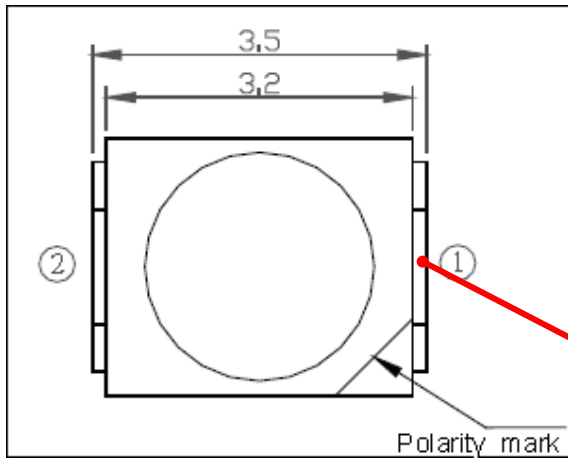
### 3.6 Data Set 3, 85 °C, 20 mA (Chromaticity Shift)

| No.    | u'           | v'     | CCT(K)  | Chromaticity Shift ( $\Delta u'v'$ ) |         |         |         |         |         |
|--------|--------------|--------|---------|--------------------------------------|---------|---------|---------|---------|---------|
|        | 0hr(Initial) |        |         | 1000hrs                              | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs |
| 51     | 0.2592       | 0.5322 | 2749    | 0.0006                               | 0.0008  | 0.0011  | 0.0018  | 0.0023  | 0.0028  |
| 52     | 0.2586       | 0.5322 | 2760    | 0.0005                               | 0.0008  | 0.0010  | 0.0011  | 0.0018  | 0.0023  |
| 53     | 0.2600       | 0.5345 | 2723    | 0.0006                               | 0.0009  | 0.0012  | 0.0011  | 0.0017  | 0.0021  |
| 54     | 0.2597       | 0.5334 | 2733    | 0.0006                               | 0.0009  | 0.0014  | 0.0017  | 0.0022  | 0.0028  |
| 55     | 0.2585       | 0.5332 | 2758    | 0.0006                               | 0.0008  | 0.0013  | 0.0014  | 0.0019  | 0.0025  |
| 56     | 0.2607       | 0.5327 | 2715    | 0.0007                               | 0.0010  | 0.0015  | 0.0015  | 0.0019  | 0.0026  |
| 57     | 0.2584       | 0.5319 | 2768    | 0.0004                               | 0.0008  | 0.0012  | 0.0019  | 0.0023  | 0.0026  |
| 58     | 0.2582       | 0.5316 | 2772    | 0.0006                               | 0.0014  | 0.0014  | 0.0015  | 0.0019  | 0.0023  |
| 59     | 0.2575       | 0.5329 | 2782    | 0.0007                               | 0.0006  | 0.0013  | 0.0015  | 0.0021  | 0.0026  |
| 60     | 0.2577       | 0.5333 | 2775    | 0.0006                               | 0.0011  | 0.0014  | 0.0016  | 0.0022  | 0.0027  |
| 61     | 0.2590       | 0.5328 | 2750    | 0.0006                               | 0.0010  | 0.0013  | 0.0009  | 0.0015  | 0.0022  |
| 62     | 0.2593       | 0.5348 | 2735    | 0.0008                               | 0.0011  | 0.0013  | 0.0013  | 0.0020  | 0.0027  |
| 63     | 0.2573       | 0.5332 | 2784    | 0.0006                               | 0.0011  | 0.0016  | 0.0018  | 0.0024  | 0.0029  |
| 64     | 0.2601       | 0.5343 | 2721    | 0.0007                               | 0.0012  | 0.0015  | 0.0017  | 0.0023  | 0.0027  |
| 65     | 0.2582       | 0.5317 | 2773    | 0.0006                               | 0.0013  | 0.0013  | 0.0014  | 0.0021  | 0.0028  |
| 66     | 0.2586       | 0.5312 | 2765    | 0.0007                               | 0.0014  | 0.0014  | 0.0015  | 0.0017  | 0.0021  |
| 67     | 0.2578       | 0.5316 | 2781    | 0.0006                               | 0.0011  | 0.0012  | 0.0016  | 0.0021  | 0.0026  |
| 68     | 0.2595       | 0.5327 | 2739    | 0.0006                               | 0.0010  | 0.0013  | 0.0009  | 0.0015  | 0.0022  |
| 69     | 0.2588       | 0.5322 | 2757    | 0.0007                               | 0.0012  | 0.0012  | 0.0015  | 0.0020  | 0.0027  |
| 70     | 0.2586       | 0.5316 | 2763    | 0.0006                               | 0.0012  | 0.0016  | 0.0016  | 0.0023  | 0.0027  |
| 71     | 0.2578       | 0.5294 | 2790    | 0.0006                               | 0.0009  | 0.0010  | 0.0021  | 0.0027  | 0.0032  |
| 72     | 0.2589       | 0.5322 | 2756    | 0.0005                               | 0.0012  | 0.0013  | 0.0013  | 0.0022  | 0.0028  |
| 73     | 0.2604       | 0.5345 | 2714    | 0.0006                               | 0.0007  | 0.0013  | 0.0016  | 0.0021  | 0.0026  |
| 74     | 0.2603       | 0.5356 | 2713    | 0.0005                               | 0.0009  | 0.0009  | 0.0013  | 0.0017  | 0.0022  |
| 75     | 0.2582       | 0.5308 | 2776    | 0.0005                               | 0.0009  | 0.0015  | 0.0019  | 0.0024  | 0.0028  |
| Ave.   | 0.2589       | 0.5327 | 2754    | 0.0006                               | 0.0010  | 0.0013  | 0.0015  | 0.0020  | 0.0026  |
| Med.   | 0.2586       | 0.5327 | 2758    | 0.0006                               | 0.0010  | 0.0013  | 0.0015  | 0.0021  | 0.0026  |
| st dev | 0.0010       | 0.0014 | 23.8937 | 0.0001                               | 0.0002  | 0.0002  | 0.0003  | 0.0003  | 0.0003  |
| Min.   | 0.2573       | 0.5294 | 2713    | 0.0004                               | 0.0006  | 0.0009  | 0.0009  | 0.0015  | 0.0021  |
| Max.   | 0.2607       | 0.5356 | 2790    | 0.0008                               | 0.0014  | 0.0016  | 0.0021  | 0.0027  | 0.0032  |



## Appendix A – EUT PHOTO

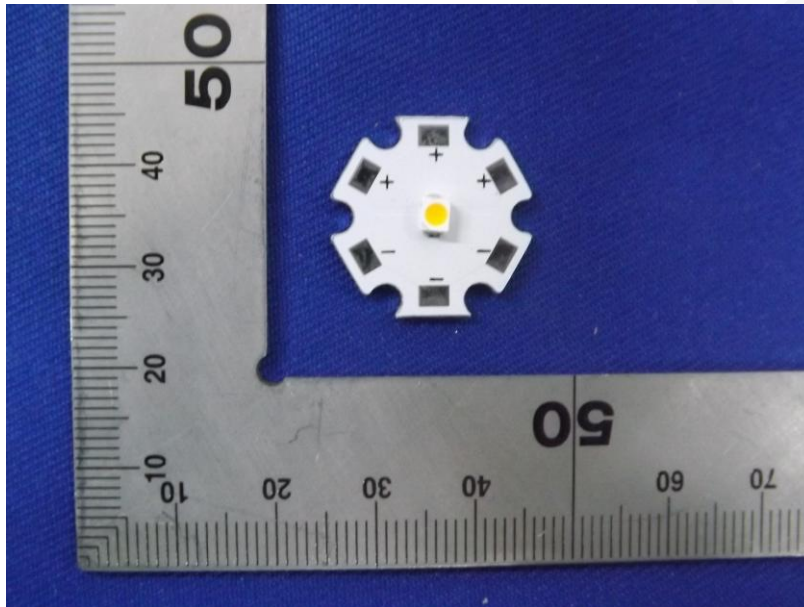
### A.1 Mechanical Dimensions (Ta = 25 °C)



All dimensions are in millimeter

TMP<sub>LED</sub>

### A.2 EUT Photo



## Appendix B-Different Declaration Letter of Manufacturer

Edison Opto Corporation  
 Add: 4F, No.800, Chung-Cheng Rd., Chun-Ho Dist, New Taipei City, Taiwan  
 Tel: +886-2-8227-6996#5406

### Declarations of Identification

Date: 2014-10-11

To whom it may concern

Dear Sir or Madam:

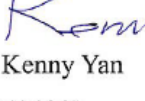
We, Edison Opto Corporation, hereby attest a series of LED Package products, are designed with identical material and construction processes. And the tested model 2T03Y6VW01000002 was tested by BAEL, the results of which are featured in BAEL project: RSZ140207514-10.

The tested model and the other LED package which attest similarity are designed with identical material and identical construction processes. The differences between the tested model and the other LED package which attest similarity are only CCT. In these models, the letter "XX" denotes the internal code and the letter "XXX" denotes the serial number, nothing to do with performance.

The model numbers for the other LED package sizes and series for which the test data is deemed applicable are detailed in the report, and they exhibit each of the following:

| Model type  | Model name       | CCT               | CRI | Number of dies | Current (mA) | Power (W) |
|-------------|------------------|-------------------|-----|----------------|--------------|-----------|
| Test model  | 2T03Y6VW01000002 | 3000K             | >80 | 1              | 20           | 0.06      |
| Cover model | 2T03Y6CWxx000xxx | 5000K/5700K/6500K | >80 | 1              | 20           | 0.06      |
|             | 2T03Y6NWxx000xxx | 4000K             | >80 | 1              | 20           | 0.06      |
|             | 2T03Y6VWxx000xxx | 2700K/3000K/3500K | >80 | 1              | 20           | 0.06      |

Questions or concerns about the attestation of similarity should be directed to my attention.

Signature:   
 Print name: Kenny Yan  
 Title: Sub-manager  
 Edison Opto Corporation

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