





Test Report

IES LM-80-15 Approved Method for Measuring Lumen Maintenance of LED Light Sources

Report no. : SLED-19-030-R02
 Testing start date : 2017.11.28
 Testing completion date : 2019.12.30
 Report issued date : 2019.05.31
 Report revised date : 2020.05.21

| | |
|---|---|
| Client | Testing performed by |
| SAMSUNG ELECTRONICS LED BUSINESS Lighting Marketing Group | SAMSUNG ELECTRONICS LED BUSINESS 1, Samsung-ro, Giheung-gu, Yongin-si, Gyeonggi-do 17113, Korea e-mail) kwon.sc@samsung.com |
| Tested By | Technical Manager |
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| Test Personal Name & Signatory | Approval Name & Signatory |

The above test report is the accredited test result by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

※ If you need confirmation about the authenticity of the test report, please contact the above contact information.

SAMSUNG ELECTRONICS LED BUSINESS
 Accredited by KOLAS, Republic of KOREA

■ Test Report Information ■

1. This test report complies with KS Q ISO/IEC 17025 and KOLAS accreditation regulations.
2. This test report does not comply with KS Q ISO/IEC 17025 and KOLAS accreditation regulations.
3. The test results are limited to samples provided by the client and cannot be partially replicated without the approval of this authority, except as a whole.
4. If a statement of conformity is provided in this report, the applied decision rule does not apply the measurement uncertainty except for the case where the measurement uncertainty is mentioned in the above test method.
5. The test results marked © are not accredited by KOLAS.
6. The test results received from external providers for the test results marked ㉠.

■ Revision History ■

| Data | Revision History | Writer | |
|------------|--------------------------------|----------|----------|
| | | Drawn | Approved |
| 2019.05.31 | Rev.0 : New Version | K.Y.KWAK | D.S.PARK |
| 2020.03.30 | Rev.1 : Typos Correction | K.Y.KWAK | D.S.PARK |
| 2020.05.21 | Rev.2 : Extended Test Duration | K.Y.KWAK | D.S.PARK |
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■ Test Summary ■

| Life test condition | | | Summary of result | | |
|---------------------|--------------|-----------------------|-------------------|-------------------------------|--|
| Test condition | Current (mA) | Case temperature (°C) | Test duration (h) | Average lumen maintenance (%) | Maximum chromaticity shift ($\Delta u'v'$) |
| 1 | 700 | 55.0 | 17 000 | 98.5 | 0.000 6 |
| 2 | 700 | 85.1 | 17 000 | 98.4 | 0.000 8 |
| 3 | 700 | 104.9 | 17 000 | 98.0 | 0.001 2 |

1. Number of the sample

- 20 Packages tested at actual case temperature 55.0 °C
- 20 Packages tested at actual case temperature 85.1 °C
- 20 Packages tested at actual case temperature 104.9 °C
- ※ Sampling method : Minimum three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.

2. Description of LED light sources

- Tested model code : SPHWHTL3D50CE4W***
- Product series : LH351C (SPHWHTL3D50C*****)
- Sample manufacturer : Samsung Electronics
- Sample Type : LED Package
- Package dimension : (3.5 × 3.5) mm
- Minimum die spacing : -
- CCT / CRI (Nominal) : 2 700 K / 70

3. Location of Test

- Permanent Testing Lab On Site Testing

(Address : 1, Samsung-ro, Giheung-gu, Yongin-si, Gyeonggi-do 17113, Korea)

4. Description of auxiliary equipment and Operating time

- 1) Instrument Integrating sphere ISP1000-100
- 2) Instrument CAS140-CT
- 3) Keithley 2425 Sourcemeter
- 4) Electrical condition
 - Drive current : 700 mA
 - Typical voltage : 3 V
 - Total input power : 2.1 W
 - Average current density per LED die : 350 mA/mm²
 - Average power density per LED die : 1.05 W/mm²
- * LED packages are driven with a constant direct current.
- 5) Test duration : 17 000 h

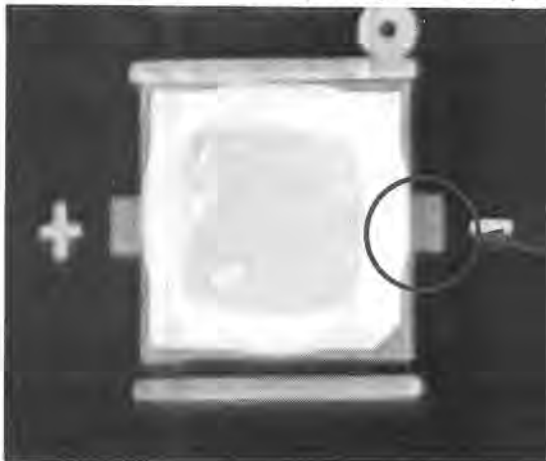
5. Ambient conditions including airflow, temperature and relative humidity

The minimal airflow is maintained in chamber.

The ambient temperature around the LED packages inside chamber is controlled by air flowing and the thermocouple readings are monitored.

- Case temperature : Controlled to $-2\text{ }^{\circ}\text{C}$
- Surrounding air temperature : Controlled to $-5\text{ }^{\circ}\text{C}$
- Relative humidity : $< 65\%$ R.H.

6. Case temperature (Test point temperature)



Case Temperature
Measurement Point

7. Drive current of the LED light source during lifetime test

See Sub-clause 9.1, 9.2 and 9.3

8. Initial luminous flux and forward voltage

See the table

9. Lumen maintenance data for each individual LED light source

See the table

9.1 Test condition 1 55 °C
Drive Current 700 mA
Measurement Current 700 mA

| No. | Flux (lm) | Vf (V) | Lumen Maintenance (%) | | | | | | |
|---------|-----------|--------|-----------------------|---------|---------|---------|---------|---------|---------|
| | 0 h | | 500 h | 1 000 h | 2 000 h | 3 000 h | 4 000 h | 5 000 h | 6 000 h |
| 1 | 254.6 | 3.041 | 99.3 | 99.2 | 99.2 | 98.8 | 98.7 | 98.6 | 98.5 |
| 2 | 250.9 | 3.062 | 99.8 | 99.5 | 99.1 | 99.0 | 98.7 | 98.8 | 98.8 |
| 3 | 257.6 | 2.987 | 99.7 | 99.5 | 99.2 | 99.2 | 99.0 | 99.0 | 98.9 |
| 4 | 252.1 | 2.977 | 99.5 | 99.1 | 99.1 | 98.9 | 98.7 | 98.9 | 98.8 |
| 5 | 251.3 | 2.982 | 99.2 | 99.1 | 99.1 | 99.0 | 98.9 | 98.7 | 98.5 |
| 6 | 257.8 | 3.037 | 99.8 | 99.6 | 99.3 | 98.9 | 98.7 | 98.8 | 98.8 |
| 7 | 253.9 | 3.044 | 99.8 | 99.4 | 99.1 | 99.1 | 98.7 | 98.7 | 98.8 |
| 8 | 256.8 | 3.010 | 99.7 | 99.4 | 99.0 | 99.0 | 98.7 | 98.7 | 98.7 |
| 9 | 256.4 | 2.966 | 99.5 | 99.2 | 98.8 | 98.7 | 98.6 | 98.6 | 98.4 |
| 10 | 260.3 | 2.963 | 99.8 | 99.3 | 99.0 | 99.0 | 98.8 | 98.9 | 98.7 |
| 11 | 255.3 | 3.000 | 99.8 | 99.3 | 99.1 | 99.3 | 99.0 | 99.2 | 99.0 |
| 12 | 258.3 | 3.020 | 99.8 | 99.6 | 99.4 | 99.3 | 99.1 | 99.0 | 98.9 |
| 13 | 256.7 | 3.002 | 99.3 | 99.2 | 99.1 | 99.0 | 98.8 | 98.7 | 98.5 |
| 14 | 261.6 | 2.955 | 99.5 | 99.1 | 99.0 | 98.6 | 98.5 | 98.4 | 98.4 |
| 15 | 249.7 | 2.945 | 99.6 | 99.5 | 99.3 | 99.1 | 99.0 | 98.9 | 98.8 |
| 16 | 255.9 | 3.012 | 99.6 | 99.3 | 99.0 | 99.1 | 98.8 | 98.9 | 98.8 |
| 17 | 257.1 | 3.032 | 99.9 | 99.4 | 99.1 | 99.1 | 98.6 | 98.6 | 98.5 |
| 18 | 261.0 | 2.982 | 99.0 | 98.8 | 98.8 | 98.7 | 98.6 | 98.6 | 98.4 |
| 19 | 254.0 | 3.007 | 99.8 | 99.4 | 99.3 | 99.2 | 99.1 | 99.1 | 98.9 |
| 20 | 260.9 | 2.929 | 99.5 | 99.1 | 99.0 | 99.0 | 98.9 | 98.9 | 98.9 |
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| | | | | | | | | | |
| Mean | 256.1 | 3.00 | 99.6 | 99.3 | 99.1 | 99.0 | 98.8 | 98.8 | 98.7 |
| Median | 256.5 | 3.00 | 99.7 | 99.3 | 99.1 | 99.0 | 98.8 | 98.8 | 98.8 |
| std.dev | 3.5 | 0.04 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Max | 261.6 | 3.06 | 99.9 | 99.6 | 99.4 | 99.3 | 99.1 | 99.2 | 99.0 |
| Min | 249.7 | 2.93 | 99.0 | 98.8 | 98.8 | 98.6 | 98.5 | 98.4 | 98.4 |

9.1 Test condition 1 55 °C
 Drive Current 700 mA
 Measurement Current 700 mA

| No. | Lumen Maintenance (%) | | | | | | | | |
|---------|-----------------------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 98.5 | 98.5 | 98.4 | 98.4 | 98.4 | 98.4 | 98.4 | 98.5 | 98.4 |
| 2 | 98.8 | 98.6 | 98.7 | 98.4 | 98.6 | 98.4 | 98.3 | 98.4 | 98.3 |
| 3 | 99.0 | 98.9 | 99.0 | 98.7 | 98.9 | 98.8 | 98.7 | 98.8 | 98.7 |
| 4 | 98.6 | 98.4 | 98.3 | 98.4 | 98.4 | 98.2 | 98.2 | 98.2 | 98.1 |
| 5 | 98.6 | 98.5 | 98.5 | 98.4 | 98.5 | 98.4 | 98.4 | 98.5 | 98.4 |
| 6 | 99.0 | 98.9 | 99.0 | 98.9 | 99.0 | 98.9 | 98.9 | 99.0 | 99.0 |
| 7 | 98.6 | 98.6 | 98.6 | 98.5 | 98.7 | 98.6 | 98.5 | 98.7 | 98.6 |
| 8 | 98.7 | 98.6 | 98.6 | 98.5 | 98.6 | 98.7 | 98.7 | 98.8 | 98.8 |
| 9 | 98.5 | 98.4 | 98.4 | 98.2 | 98.3 | 98.3 | 98.2 | 98.2 | 98.2 |
| 10 | 98.8 | 98.6 | 98.6 | 98.5 | 98.6 | 98.5 | 98.5 | 98.5 | 98.5 |
| 11 | 98.9 | 98.8 | 98.9 | 98.8 | 98.8 | 98.8 | 98.7 | 98.8 | 98.8 |
| 12 | 98.9 | 98.8 | 98.8 | 98.8 | 98.8 | 98.8 | 98.7 | 98.8 | 98.8 |
| 13 | 98.5 | 98.3 | 98.3 | 98.2 | 98.2 | 98.2 | 98.2 | 98.2 | 98.2 |
| 14 | 98.4 | 98.3 | 98.2 | 98.2 | 98.3 | 98.2 | 98.2 | 98.3 | 98.2 |
| 15 | 98.7 | 98.6 | 98.6 | 98.4 | 98.5 | 98.4 | 98.3 | 98.3 | 98.2 |
| 16 | 98.9 | 98.7 | 98.5 | 98.3 | 98.4 | 98.4 | 98.3 | 98.3 | 98.3 |
| 17 | 98.5 | 98.4 | 98.4 | 98.2 | 98.3 | 98.2 | 98.1 | 98.2 | 98.1 |
| 18 | 98.4 | 98.3 | 98.4 | 98.2 | 98.3 | 98.2 | 98.3 | 98.3 | 98.3 |
| 19 | 99.0 | 98.9 | 98.8 | 98.7 | 98.7 | 98.7 | 98.6 | 98.7 | 98.6 |
| 20 | 98.9 | 98.9 | 98.8 | 98.8 | 98.9 | 98.9 | 98.9 | 98.9 | 98.9 |
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| | | | | | | | | | |
| Mean | 98.7 | 98.6 | 98.6 | 98.5 | 98.6 | 98.5 | 98.4 | 98.5 | 98.5 |
| Median | 98.7 | 98.6 | 98.6 | 98.4 | 98.5 | 98.4 | 98.4 | 98.5 | 98.4 |
| std.dev | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| Max | 99.0 | 98.9 | 99.0 | 98.9 | 99.0 | 98.9 | 98.9 | 99.0 | 99.0 |
| Min | 98.4 | 98.3 | 98.2 | 98.2 | 98.2 | 98.2 | 98.1 | 98.2 | 98.1 |

9.1 Test condition 1 **55 °C**
Drive Current **700 mA**
Measurement Current **700 mA**

| No. | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|---------|--------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 16 000 h | 17 000 h | 18 000 h | 19 000 h | 20 000 h | 21 000 h | 22 000 h | 23 000 h | 24 000 h |
| 1 | 0.000 3 | 0.000 3 | | | | | | | |
| 2 | 0.000 3 | 0.000 3 | | | | | | | |
| 3 | 0.000 4 | 0.000 4 | | | | | | | |
| 4 | 0.000 4 | 0.000 4 | | | | | | | |
| 5 | 0.000 3 | 0.000 3 | | | | | | | |
| 6 | 0.000 3 | 0.000 3 | | | | | | | |
| 7 | 0.000 3 | 0.000 3 | | | | | | | |
| 8 | 0.000 4 | 0.000 4 | | | | | | | |
| 9 | 0.000 3 | 0.000 3 | | | | | | | |
| 10 | 0.000 3 | 0.000 3 | | | | | | | |
| 11 | 0.000 3 | 0.000 3 | | | | | | | |
| 12 | 0.000 3 | 0.000 3 | | | | | | | |
| 13 | 0.000 3 | 0.000 3 | | | | | | | |
| 14 | 0.000 3 | 0.000 3 | | | | | | | |
| 15 | 0.000 4 | 0.000 4 | | | | | | | |
| 16 | 0.000 5 | 0.000 6 | | | | | | | |
| 17 | 0.000 4 | 0.000 3 | | | | | | | |
| 18 | 0.000 2 | 0.000 2 | | | | | | | |
| 19 | 0.000 4 | 0.000 4 | | | | | | | |
| 20 | 0.000 3 | 0.000 4 | | | | | | | |
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| | | | | | | | | | |
| Mean | 0.000 3 | 0.000 3 | | | | | | | |
| Median | 0.000 3 | 0.000 3 | | | | | | | |
| std.dev | 0.000 1 | 0.000 1 | | | | | | | |
| Max | 0.000 5 | 0.000 6 | | | | | | | |
| Min | 0.000 2 | 0.000 2 | | | | | | | |



9.1 Test condition 1

55 °C

Drive Current

700 mA

Measurement Current

700 mA

| No. | CCT (K) | | | | | | | |
|---------|---------|-------|---------|---------|---------|---------|---------|---------|
| | 0 h | 500 h | 1 000 h | 2 000 h | 3 000 h | 4 000 h | 5 000 h | 6 000 h |
| 1 | 2 679 | 2 680 | 2 684 | 2 686 | 2 686 | 2 686 | 2 686 | 2 687 |
| 2 | 2 664 | 2 666 | 2 669 | 2 670 | 2 670 | 2 670 | 2 669 | 2 670 |
| 3 | 2 649 | 2 650 | 2 651 | 2 653 | 2 653 | 2 655 | 2 656 | 2 656 |
| 4 | 2 710 | 2 712 | 2 715 | 2 717 | 2 716 | 2 718 | 2 718 | 2 717 |
| 5 | 2 668 | 2 669 | 2 671 | 2 673 | 2 672 | 2 672 | 2 672 | 2 673 |
| 6 | 2 674 | 2 675 | 2 677 | 2 680 | 2 681 | 2 681 | 2 681 | 2 681 |
| 7 | 2 694 | 2 695 | 2 695 | 2 700 | 2 701 | 2 702 | 2 702 | 2 703 |
| 8 | 2 653 | 2 654 | 2 657 | 2 659 | 2 659 | 2 661 | 2 660 | 2 659 |
| 9 | 2 676 | 2 678 | 2 680 | 2 682 | 2 681 | 2 681 | 2 684 | 2 683 |
| 10 | 2 647 | 2 648 | 2 650 | 2 652 | 2 652 | 2 652 | 2 653 | 2 653 |
| 11 | 2 694 | 2 698 | 2 698 | 2 701 | 2 701 | 2 700 | 2 700 | 2 701 |
| 12 | 2 673 | 2 674 | 2 675 | 2 677 | 2 677 | 2 678 | 2 678 | 2 677 |
| 13 | 2 696 | 2 696 | 2 698 | 2 700 | 2 700 | 2 700 | 2 702 | 2 701 |
| 14 | 2 676 | 2 677 | 2 681 | 2 682 | 2 682 | 2 682 | 2 682 | 2 683 |
| 15 | 2 706 | 2 710 | 2 711 | 2 713 | 2 714 | 2 714 | 2 714 | 2 715 |
| 16 | 2 688 | 2 689 | 2 691 | 2 693 | 2 694 | 2 696 | 2 696 | 2 694 |
| 17 | 2 711 | 2 711 | 2 716 | 2 718 | 2 718 | 2 718 | 2 719 | 2 718 |
| 18 | 2 691 | 2 693 | 2 694 | 2 696 | 2 697 | 2 697 | 2 697 | 2 697 |
| 19 | 2 711 | 2 712 | 2 715 | 2 717 | 2 720 | 2 720 | 2 720 | 2 720 |
| 20 | 2 667 | 2 669 | 2 671 | 2 673 | 2 672 | 2 674 | 2 674 | 2 674 |
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| Mean | 2 681 | 2 683 | 2 685 | 2 687 | 2 687 | 2 688 | 2 688 | 2 688 |
| Median | 2 678 | 2 679 | 2 683 | 2 684 | 2 684 | 2 684 | 2 685 | 2 685 |
| std.dev | 20 | 20 | 21 | 21 | 21 | 21 | 21 | 21 |
| Max | 2 711 | 2 712 | 2 716 | 2 718 | 2 720 | 2 720 | 2 720 | 2 720 |
| Min | 2 647 | 2 648 | 2 650 | 2 652 | 2 652 | 2 652 | 2 653 | 2 653 |

9.1 Test condition 1 55 °C
Drive Current 700 mA
Measurement Current 700 mA

| No. | CCT (K) | | | | | | | | |
|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 2 685 | 2 686 | 2 685 | 2 685 | 2 685 | 2 685 | 2 684 | 2 684 | 2 684 |
| 2 | 2 669 | 2 668 | 2 669 | 2 669 | 2 669 | 2 668 | 2 668 | 2 668 | 2 668 |
| 3 | 2 655 | 2 655 | 2 655 | 2 655 | 2 656 | 2 655 | 2 655 | 2 655 | 2 655 |
| 4 | 2 718 | 2 717 | 2 717 | 2 717 | 2 717 | 2 717 | 2 717 | 2 717 | 2 717 |
| 5 | 2 672 | 2 673 | 2 672 | 2 671 | 2 672 | 2 672 | 2 671 | 2 671 | 2 671 |
| 6 | 2 680 | 2 679 | 2 680 | 2 680 | 2 680 | 2 679 | 2 679 | 2 679 | 2 679 |
| 7 | 2 701 | 2 701 | 2 701 | 2 700 | 2 701 | 2 700 | 2 700 | 2 700 | 2 700 |
| 8 | 2 660 | 2 659 | 2 660 | 2 659 | 2 660 | 2 659 | 2 660 | 2 660 | 2 660 |
| 9 | 2 682 | 2 682 | 2 682 | 2 681 | 2 682 | 2 681 | 2 681 | 2 680 | 2 680 |
| 10 | 2 652 | 2 652 | 2 652 | 2 651 | 2 652 | 2 651 | 2 651 | 2 651 | 2 651 |
| 11 | 2 700 | 2 699 | 2 700 | 2 699 | 2 699 | 2 699 | 2 698 | 2 698 | 2 698 |
| 12 | 2 678 | 2 676 | 2 677 | 2 676 | 2 677 | 2 676 | 2 676 | 2 676 | 2 676 |
| 13 | 2 701 | 2 701 | 2 700 | 2 700 | 2 700 | 2 700 | 2 699 | 2 699 | 2 699 |
| 14 | 2 682 | 2 682 | 2 681 | 2 680 | 2 681 | 2 681 | 2 680 | 2 680 | 2 680 |
| 15 | 2 714 | 2 713 | 2 713 | 2 713 | 2 713 | 2 713 | 2 713 | 2 713 | 2 713 |
| 16 | 2 696 | 2 696 | 2 696 | 2 696 | 2 697 | 2 697 | 2 697 | 2 697 | 2 698 |
| 17 | 2 719 | 2 717 | 2 717 | 2 717 | 2 717 | 2 717 | 2 717 | 2 717 | 2 717 |
| 18 | 2 696 | 2 696 | 2 695 | 2 695 | 2 695 | 2 695 | 2 694 | 2 694 | 2 694 |
| 19 | 2 719 | 2 718 | 2 719 | 2 718 | 2 718 | 2 718 | 2 717 | 2 717 | 2 717 |
| 20 | 2 673 | 2 673 | 2 674 | 2 672 | 2 673 | 2 672 | 2 672 | 2 672 | 2 672 |
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| | | | | | | | | | |
| Mean | 2 688 | 2 687 | 2 687 | 2 687 | 2 687 | 2 687 | 2 687 | 2 686 | 2 686 |
| Median | 2 683 | 2 684 | 2 683 | 2 683 | 2 683 | 2 683 | 2 682 | 2 682 | 2 682 |
| std.dev | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| Max | 2 719 | 2 718 | 2 719 | 2 718 | 2 718 | 2 718 | 2 717 | 2 717 | 2 717 |
| Min | 2 652 | 2 652 | 2 652 | 2 651 | 2 652 | 2 651 | 2 651 | 2 651 | 2 651 |

9.1 Test condition 1 55 °C
Drive Current 700 mA
Measurement Current 700 mA

| No. | CCT (K) | | | | | | | | |
|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 16 000 h | 17 000 h | 18 000 h | 19 000 h | 20 000 h | 21 000 h | 22 000 h | 23 000 h | 24 000 h |
| 1 | 2 684 | 2 683 | | | | | | | |
| 2 | 2 668 | 2 668 | | | | | | | |
| 3 | 2 656 | 2 656 | | | | | | | |
| 4 | 2 717 | 2 717 | | | | | | | |
| 5 | 2 671 | 2 671 | | | | | | | |
| 6 | 2 679 | 2 679 | | | | | | | |
| 7 | 2 700 | 2 699 | | | | | | | |
| 8 | 2 660 | 2 660 | | | | | | | |
| 9 | 2 680 | 2 680 | | | | | | | |
| 10 | 2 650 | 2 650 | | | | | | | |
| 11 | 2 698 | 2 698 | | | | | | | |
| 12 | 2 676 | 2 675 | | | | | | | |
| 13 | 2 699 | 2 699 | | | | | | | |
| 14 | 2 679 | 2 679 | | | | | | | |
| 15 | 2 713 | 2 712 | | | | | | | |
| 16 | 2 698 | 2 698 | | | | | | | |
| 17 | 2 716 | 2 716 | | | | | | | |
| 18 | 2 693 | 2 693 | | | | | | | |
| 19 | 2 717 | 2 717 | | | | | | | |
| 20 | 2 672 | 2 672 | | | | | | | |
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| | | | | | | | | | |
| Mean | 2 686 | 2 686 | | | | | | | |
| Median | 2 682 | 2 682 | | | | | | | |
| std.dev | 21 | 21 | | | | | | | |
| Max | 2 717 | 2 717 | | | | | | | |
| Min | 2 650 | 2 650 | | | | | | | |

9.2 Test condition 2**85 °C****Drive Current****700 mA****Measurement Current****700 mA**

| No. | u' | v' | Chromaticity Shift ($\Delta u'v'$) | | | | | | |
|---------|---------|---------|--------------------------------------|---------|---------|---------|---------|---------|---------|
| | 0 h | | 500 h | 1 000 h | 2 000 h | 3 000 h | 4 000 h | 5 000 h | 6 000 h |
| 1 | 0.264 6 | 0.529 0 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 6 |
| 2 | 0.263 4 | 0.528 1 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 6 |
| 3 | 0.265 3 | 0.530 1 | 0.000 2 | 0.000 3 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 6 |
| 4 | 0.263 7 | 0.527 5 | 0.000 2 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 4 | 0.000 4 |
| 5 | 0.264 1 | 0.528 8 | 0.000 3 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| 6 | 0.262 9 | 0.528 4 | 0.000 2 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| 7 | 0.264 2 | 0.527 6 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| 8 | 0.265 2 | 0.529 9 | 0.000 2 | 0.000 3 | 0.000 4 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 7 |
| 9 | 0.263 3 | 0.528 2 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| 10 | 0.264 5 | 0.529 5 | 0.000 2 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 4 |
| 11 | 0.263 8 | 0.527 6 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 5 | 0.000 5 |
| 12 | 0.263 3 | 0.527 4 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 5 | 0.000 6 |
| 13 | 0.262 9 | 0.526 4 | 0.000 3 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 5 | 0.000 5 |
| 14 | 0.262 0 | 0.527 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| 15 | 0.264 4 | 0.527 1 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| 16 | 0.263 3 | 0.527 0 | 0.000 2 | 0.000 3 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 |
| 17 | 0.264 2 | 0.528 9 | 0.000 2 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 |
| 18 | 0.264 5 | 0.528 7 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 6 |
| 19 | 0.263 8 | 0.527 8 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 5 |
| 20 | 0.263 8 | 0.528 0 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 5 | 0.000 5 |
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| Mean | 0.263 9 | 0.528 2 | 0.000 3 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| Median | 0.263 8 | 0.528 0 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| std.dev | 0.000 8 | 0.001 0 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 |
| Max | 0.265 3 | 0.530 1 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 7 |
| Min | 0.262 0 | 0.526 4 | 0.000 2 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 4 | 0.000 4 |

9.2 Test condition 2 **85 °C**
Drive Current **700 mA**
Measurement Current **700 mA**

| No. | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|---------|--------------------------------------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
| 2 | 0.000 6 | 0.000 4 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 |
| 3 | 0.000 5 | 0.000 3 | 0.000 5 | 0.000 3 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 |
| 4 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 |
| 5 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 |
| 6 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 5 |
| 7 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 5 |
| 8 | 0.000 5 | 0.000 3 | 0.000 4 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 6 |
| 9 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 |
| 10 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 4 |
| 11 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 |
| 12 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 |
| 13 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 |
| 14 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
| 15 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
| 16 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 |
| 17 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 |
| 18 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
| 19 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
| 20 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
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| Mean | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 |
| Median | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 |
| std.dev | 0.000 0 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 |
| Max | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 |
| Min | 0.000 5 | 0.000 3 | 0.000 4 | 0.000 3 | 0.000 4 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 4 |

9.2 Test condition 2**85 °C****Drive Current****700 mA****Measurement Current****700 mA**

| No. | CCT (K) | | | | | | | | |
|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 2 655 | 2 655 | 2 656 | 2 653 | 2 653 | 2 653 | 2 652 | 2 653 | 2 652 |
| 2 | 2 685 | 2 679 | 2 683 | 2 681 | 2 681 | 2 680 | 2 678 | 2 680 | 2 677 |
| 3 | 2 633 | 2 627 | 2 630 | 2 626 | 2 626 | 2 625 | 2 622 | 2 624 | 2 622 |
| 4 | 2 676 | 2 675 | 2 676 | 2 674 | 2 675 | 2 675 | 2 674 | 2 675 | 2 675 |
| 5 | 2 664 | 2 662 | 2 663 | 2 661 | 2 661 | 2 661 | 2 659 | 2 660 | 2 659 |
| 6 | 2 689 | 2 687 | 2 689 | 2 686 | 2 687 | 2 687 | 2 686 | 2 686 | 2 685 |
| 7 | 2 664 | 2 664 | 2 664 | 2 662 | 2 663 | 2 663 | 2 662 | 2 663 | 2 662 |
| 8 | 2 636 | 2 632 | 2 633 | 2 629 | 2 630 | 2 629 | 2 626 | 2 627 | 2 625 |
| 9 | 2 683 | 2 683 | 2 683 | 2 681 | 2 682 | 2 682 | 2 681 | 2 682 | 2 682 |
| 10 | 2 654 | 2 651 | 2 653 | 2 651 | 2 652 | 2 652 | 2 651 | 2 652 | 2 649 |
| 11 | 2 674 | 2 672 | 2 672 | 2 667 | 2 669 | 2 668 | 2 666 | 2 666 | 2 665 |
| 12 | 2 686 | 2 684 | 2 684 | 2 680 | 2 681 | 2 680 | 2 679 | 2 679 | 2 678 |
| 13 | 2 697 | 2 696 | 2 693 | 2 691 | 2 691 | 2 690 | 2 688 | 2 688 | 2 687 |
| 14 | 2 715 | 2 712 | 2 712 | 2 708 | 2 710 | 2 709 | 2 707 | 2 708 | 2 707 |
| 15 | 2 661 | 2 659 | 2 658 | 2 655 | 2 656 | 2 655 | 2 654 | 2 653 | 2 653 |
| 16 | 2 685 | 2 684 | 2 684 | 2 682 | 2 683 | 2 682 | 2 681 | 2 682 | 2 681 |
| 17 | 2 659 | 2 658 | 2 657 | 2 655 | 2 656 | 2 656 | 2 655 | 2 656 | 2 655 |
| 18 | 2 657 | 2 657 | 2 656 | 2 651 | 2 654 | 2 653 | 2 652 | 2 653 | 2 652 |
| 19 | 2 673 | 2 672 | 2 672 | 2 669 | 2 670 | 2 670 | 2 669 | 2 669 | 2 668 |
| 20 | 2 672 | 2 670 | 2 668 | 2 665 | 2 667 | 2 666 | 2 664 | 2 665 | 2 664 |
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| Mean | 2 671 | 2 669 | 2 669 | 2 666 | 2 667 | 2 667 | 2 665 | 2 666 | 2 665 |
| Median | 2 673 | 2 671 | 2 670 | 2 666 | 2 668 | 2 667 | 2 665 | 2 666 | 2 664 |
| std.dev | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Max | 2 715 | 2 712 | 2 712 | 2 708 | 2 710 | 2 709 | 2 707 | 2 708 | 2 707 |
| Min | 2 633 | 2 627 | 2 630 | 2 626 | 2 626 | 2 625 | 2 622 | 2 624 | 2 622 |

9.3 Test condition 3 **105 °C**
Drive Current **700 mA**
Measurement Current **700 mA**

| No. | Flux (lm) | Vf (V) | Lumen Maintenance (%) | | | | | | |
|---------|-----------|--------|-----------------------|---------|---------|---------|---------|---------|---------|
| | 0 h | | 500 h | 1 000 h | 2 000 h | 3 000 h | 4 000 h | 5 000 h | 6 000 h |
| 1 | 259.0 | 3.014 | 99.9 | 99.6 | 99.2 | 98.9 | 98.8 | 98.6 | 98.5 |
| 2 | 255.6 | 3.014 | 99.3 | 99.1 | 98.7 | 98.4 | 98.4 | 98.4 | 98.2 |
| 3 | 262.5 | 2.987 | 99.4 | 99.1 | 98.6 | 98.5 | 98.3 | 98.2 | 98.0 |
| 4 | 258.5 | 2.965 | 99.4 | 99.1 | 98.9 | 98.8 | 98.6 | 98.5 | 98.3 |
| 5 | 260.6 | 2.931 | 99.4 | 99.2 | 98.9 | 98.5 | 98.4 | 98.2 | 98.0 |
| 6 | 256.2 | 3.038 | 99.6 | 99.3 | 99.0 | 98.8 | 98.7 | 98.7 | 98.4 |
| 7 | 259.0 | 3.014 | 99.4 | 99.1 | 98.9 | 98.8 | 98.6 | 98.5 | 98.3 |
| 8 | 262.3 | 2.996 | 99.4 | 99.5 | 98.8 | 98.7 | 98.6 | 98.3 | 98.2 |
| 9 | 259.0 | 2.959 | 99.4 | 99.2 | 98.9 | 98.4 | 98.2 | 98.1 | 97.9 |
| 10 | 259.2 | 2.969 | 99.4 | 99.3 | 99.0 | 98.9 | 98.8 | 98.8 | 98.7 |
| 11 | 261.1 | 3.034 | 99.8 | 99.6 | 99.0 | 98.7 | 98.8 | 98.8 | 98.5 |
| 12 | 252.7 | 2.983 | 99.5 | 99.2 | 98.9 | 98.8 | 98.7 | 98.6 | 98.4 |
| 13 | 256.5 | 3.057 | 99.5 | 99.3 | 99.0 | 99.0 | 98.8 | 98.7 | 98.6 |
| 14 | 257.7 | 3.027 | 99.4 | 99.2 | 98.7 | 98.6 | 98.5 | 98.5 | 98.4 |
| 15 | 262.2 | 2.957 | 99.7 | 99.5 | 99.0 | 98.6 | 98.7 | 98.4 | 98.1 |
| 16 | 257.0 | 3.057 | 99.4 | 99.2 | 98.9 | 98.4 | 98.2 | 98.3 | 98.1 |
| 17 | 258.9 | 3.035 | 99.5 | 99.3 | 98.7 | 98.6 | 98.7 | 98.6 | 98.4 |
| 18 | 259.0 | 3.025 | 99.8 | 99.6 | 99.1 | 99.0 | 99.0 | 98.8 | 98.6 |
| 19 | 256.1 | 2.990 | 99.5 | 99.3 | 98.8 | 98.6 | 98.6 | 98.5 | 98.3 |
| 20 | 253.2 | 3.027 | 99.5 | 99.3 | 99.1 | 98.8 | 98.7 | 98.4 | 98.2 |
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| Mean | 258.3 | 3.00 | 99.5 | 99.3 | 98.9 | 98.7 | 98.6 | 98.5 | 98.3 |
| Median | 258.9 | 3.01 | 99.4 | 99.3 | 98.9 | 98.7 | 98.6 | 98.5 | 98.3 |
| std.dev | 2.8 | 0.04 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| Max | 262.5 | 3.06 | 99.9 | 99.6 | 99.2 | 99.0 | 99.0 | 98.8 | 98.7 |
| Min | 252.7 | 2.93 | 99.3 | 99.1 | 98.6 | 98.4 | 98.2 | 98.1 | 97.9 |

9.3 Test condition 3 **105 °C**
Drive Current **700 mA**
Measurement Current **700 mA**

| No. | Lumen Maintenance (%) | | | | | | | | |
|---------|-----------------------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 98.7 | 98.7 | 98.5 | 98.4 | 98.5 | 98.3 | 98.4 | 98.3 | 98.3 |
| 2 | 98.3 | 98.1 | 97.9 | 97.8 | 97.7 | 97.8 | 97.7 | 97.9 | 97.8 |
| 3 | 98.0 | 97.9 | 97.9 | 97.8 | 97.8 | 97.8 | 97.7 | 97.9 | 97.8 |
| 4 | 98.2 | 98.1 | 98.0 | 97.9 | 97.9 | 97.8 | 97.6 | 97.7 | 97.7 |
| 5 | 98.2 | 98.1 | 98.1 | 97.9 | 98.0 | 98.0 | 97.9 | 98.1 | 98.0 |
| 6 | 98.5 | 98.3 | 98.1 | 98.0 | 97.9 | 97.8 | 97.7 | 97.8 | 97.7 |
| 7 | 98.3 | 98.3 | 98.1 | 98.0 | 98.0 | 97.9 | 97.8 | 98.0 | 97.9 |
| 8 | 98.1 | 98.2 | 98.3 | 98.3 | 98.4 | 98.4 | 98.3 | 98.4 | 98.4 |
| 9 | 97.8 | 97.8 | 98.0 | 97.8 | 97.9 | 97.9 | 97.9 | 98.0 | 97.9 |
| 10 | 98.7 | 98.5 | 98.3 | 98.3 | 98.1 | 98.2 | 98.1 | 98.2 | 98.2 |
| 11 | 98.6 | 98.1 | 98.1 | 98.0 | 98.0 | 98.0 | 97.9 | 98.1 | 98.1 |
| 12 | 98.5 | 98.2 | 98.4 | 98.3 | 98.3 | 98.3 | 98.3 | 98.4 | 98.3 |
| 13 | 98.5 | 98.5 | 98.4 | 98.3 | 98.2 | 98.2 | 98.1 | 98.2 | 98.2 |
| 14 | 98.4 | 98.5 | 98.4 | 98.4 | 98.4 | 98.4 | 98.3 | 98.4 | 98.3 |
| 15 | 98.0 | 97.8 | 98.1 | 98.0 | 98.0 | 98.1 | 98.0 | 98.0 | 98.0 |
| 16 | 98.1 | 98.2 | 98.4 | 98.2 | 98.2 | 98.2 | 98.2 | 98.3 | 98.3 |
| 17 | 98.3 | 98.3 | 98.1 | 98.0 | 97.9 | 97.9 | 97.8 | 97.9 | 98.0 |
| 18 | 98.6 | 98.5 | 98.5 | 98.5 | 98.4 | 98.4 | 98.3 | 98.5 | 98.4 |
| 19 | 98.1 | 98.0 | 98.2 | 98.1 | 98.1 | 98.1 | 98.0 | 98.1 | 98.1 |
| 20 | 98.2 | 97.9 | 98.0 | 97.8 | 97.8 | 97.7 | 97.7 | 97.7 | 97.7 |
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| Mean | 98.3 | 98.2 | 98.2 | 98.1 | 98.1 | 98.1 | 98.0 | 98.1 | 98.1 |
| Median | 98.3 | 98.2 | 98.1 | 98.0 | 98.0 | 98.1 | 97.9 | 98.1 | 98.0 |
| std.dev | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Max | 98.7 | 98.7 | 98.5 | 98.5 | 98.5 | 98.4 | 98.4 | 98.5 | 98.4 |
| Min | 97.8 | 97.8 | 97.9 | 97.8 | 97.7 | 97.7 | 97.6 | 97.7 | 97.7 |

9.3 Test condition 3 105 °C
Drive Current 700 mA
Measurement Current 700 mA

| No. | Lumen Maintenance (%) | | | | | | | | |
|---------|-----------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 16 000 h | 17 000 h | 18 000 h | 19 000 h | 20 000 h | 21 000 h | 22 000 h | 23 000 h | 24 000 h |
| 1 | 98.4 | 98.2 | | | | | | | |
| 2 | 97.9 | 97.9 | | | | | | | |
| 3 | 97.8 | 97.8 | | | | | | | |
| 4 | 97.7 | 97.7 | | | | | | | |
| 5 | 98.1 | 98.0 | | | | | | | |
| 6 | 97.7 | 97.6 | | | | | | | |
| 7 | 97.9 | 97.8 | | | | | | | |
| 8 | 98.4 | 98.3 | | | | | | | |
| 9 | 98.0 | 98.0 | | | | | | | |
| 10 | 98.2 | 98.1 | | | | | | | |
| 11 | 98.1 | 98.1 | | | | | | | |
| 12 | 98.4 | 98.4 | | | | | | | |
| 13 | 98.2 | 98.1 | | | | | | | |
| 14 | 98.4 | 98.3 | | | | | | | |
| 15 | 98.0 | 97.9 | | | | | | | |
| 16 | 98.4 | 98.3 | | | | | | | |
| 17 | 98.0 | 97.9 | | | | | | | |
| 18 | 98.3 | 98.3 | | | | | | | |
| 19 | 98.2 | 98.1 | | | | | | | |
| 20 | 97.6 | 97.7 | | | | | | | |
| Mean | 98.1 | 98.0 | | | | | | | |
| Median | 98.1 | 98.0 | | | | | | | |
| std.dev | 0.3 | 0.2 | | | | | | | |
| Max | 98.4 | 98.4 | | | | | | | |
| Min | 97.6 | 97.6 | | | | | | | |

9.3 Test condition 3 **105 °C**
Drive Current **700 mA**
Measurement Current **700 mA**

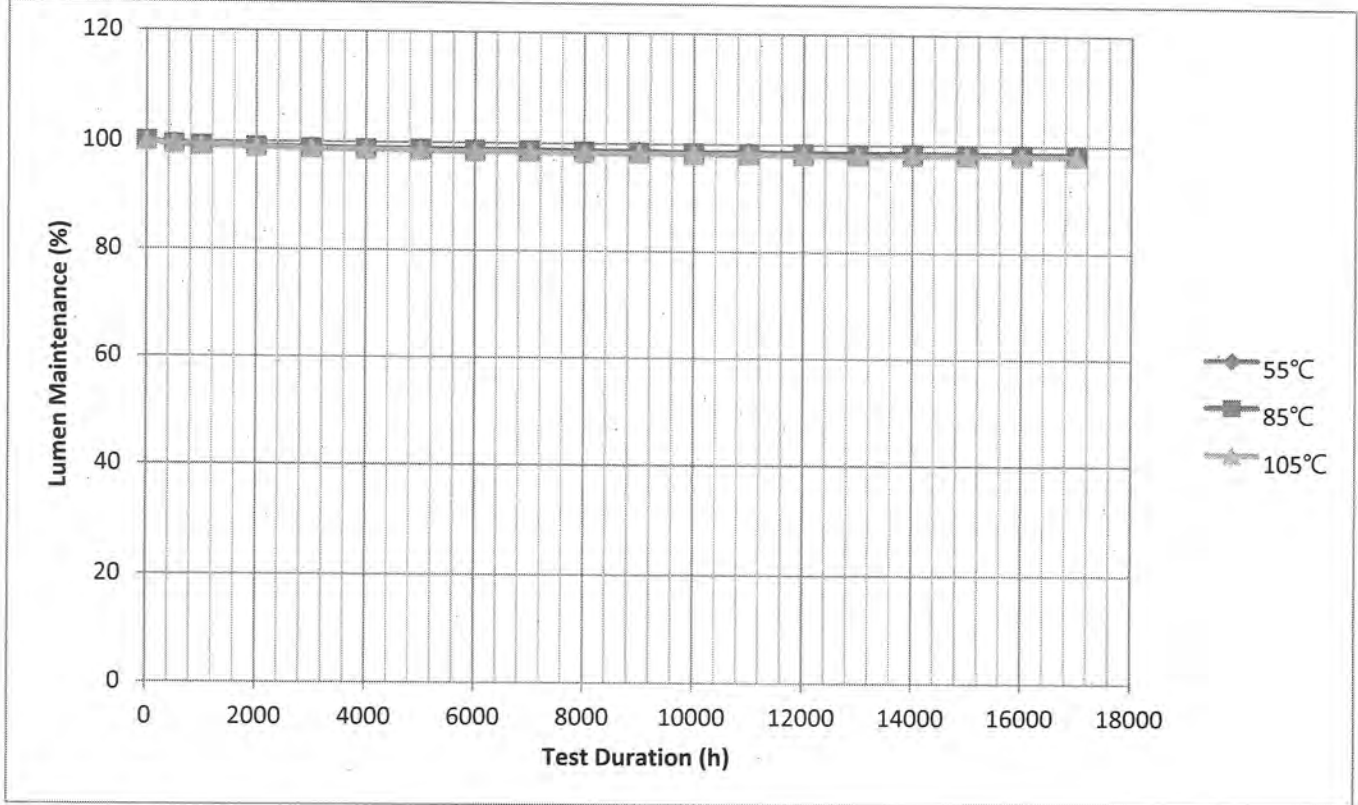
| No. | u' | v' | Chromaticity Shift ($\Delta u'v'$) | | | | | | |
|---------|---------|---------|--------------------------------------|---------|---------|---------|---------|---------|---------|
| | 0 h | | 500 h | 1 000 h | 2 000 h | 3 000 h | 4 000 h | 5 000 h | 6 000 h |
| 1 | 0.261 5 | 0.526 4 | 0.000 4 | 0.000 4 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 6 |
| 2 | 0.263 0 | 0.528 1 | 0.000 3 | 0.000 4 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 |
| 3 | 0.264 2 | 0.528 5 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 8 |
| 4 | 0.264 0 | 0.528 2 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 |
| 5 | 0.265 1 | 0.529 4 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 |
| 6 | 0.263 5 | 0.527 4 | 0.000 3 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 |
| 7 | 0.263 7 | 0.527 4 | 0.000 4 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 |
| 8 | 0.263 1 | 0.529 2 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 |
| 9 | 0.264 6 | 0.530 1 | 0.000 3 | 0.000 3 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 7 |
| 10 | 0.263 5 | 0.529 0 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 |
| 11 | 0.263 4 | 0.527 1 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 |
| 12 | 0.263 8 | 0.528 2 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 |
| 13 | 0.263 7 | 0.527 2 | 0.000 3 | 0.000 3 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 7 |
| 14 | 0.264 7 | 0.529 4 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 4 |
| 15 | 0.261 6 | 0.526 6 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 |
| 16 | 0.262 6 | 0.525 9 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 |
| 17 | 0.262 8 | 0.527 6 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 |
| 18 | 0.263 5 | 0.528 6 | 0.000 3 | 0.000 3 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 |
| 19 | 0.262 1 | 0.527 5 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 |
| 20 | 0.263 0 | 0.527 6 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 |
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| | | | | | | | | | |
| Mean | 0.263 4 | 0.528 0 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 |
| Median | 0.263 5 | 0.527 8 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 |
| std.dev | 0.001 0 | 0.001 1 | 0.000 0 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 |
| Max | 0.265 1 | 0.530 1 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 8 |
| Min | 0.261 5 | 0.525 9 | 0.000 3 | 0.000 3 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 4 |

9.3 Test condition 3 **105 °C**
Drive Current **700 mA**
Measurement Current **700 mA**

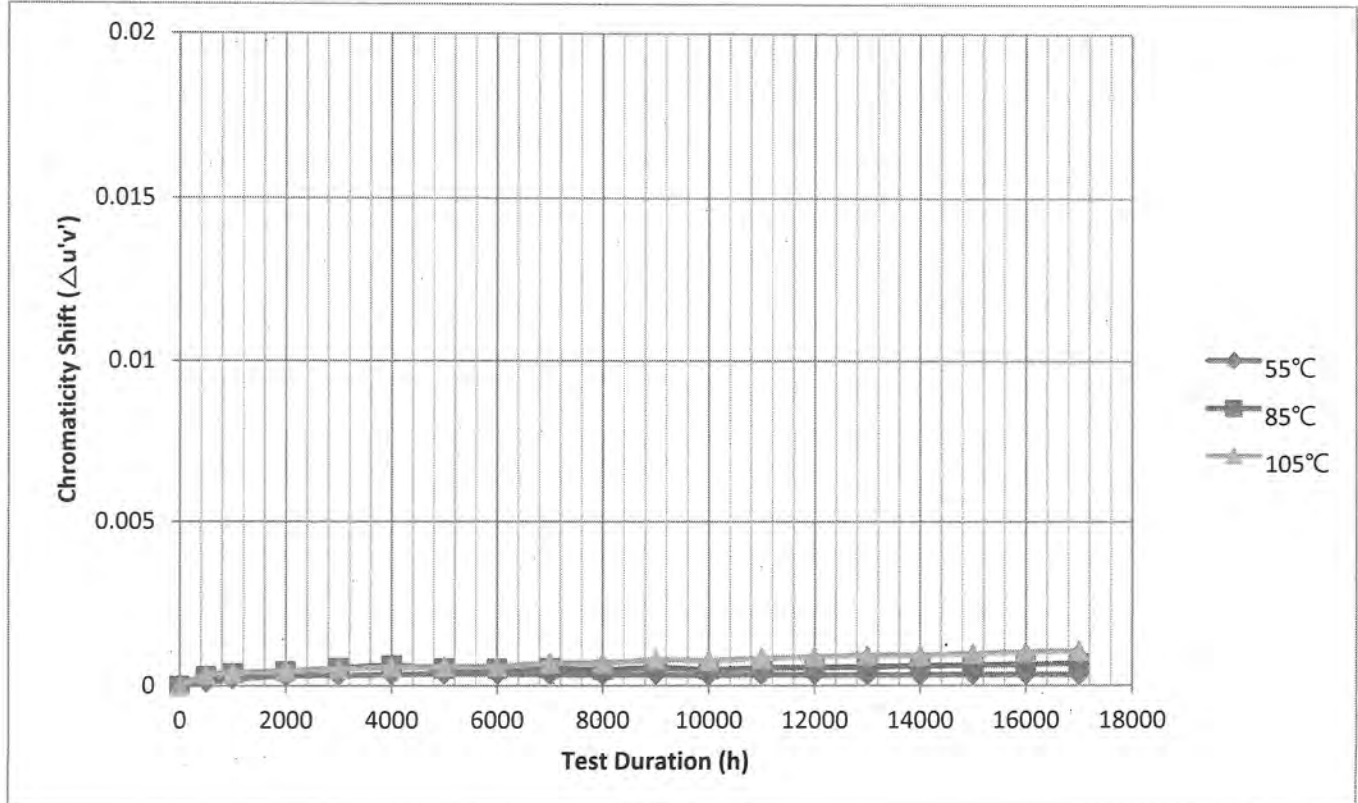
| No. | CCT (K) | | | | | | | | |
|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 16 000 h | 17 000 h | 18 000 h | 19 000 h | 20 000 h | 21 000 h | 22 000 h | 23 000 h | 24 000 h |
| 1 | 2 722 | 2 722 | | | | | | | |
| 2 | 2 686 | 2 686 | | | | | | | |
| 3 | 2 657 | 2 657 | | | | | | | |
| 4 | 2 665 | 2 665 | | | | | | | |
| 5 | 2 635 | 2 635 | | | | | | | |
| 6 | 2 678 | 2 678 | | | | | | | |
| 7 | 2 676 | 2 676 | | | | | | | |
| 8 | 2 681 | 2 681 | | | | | | | |
| 9 | 2 645 | 2 645 | | | | | | | |
| 10 | 2 671 | 2 671 | | | | | | | |
| 11 | 2 679 | 2 678 | | | | | | | |
| 12 | 2 669 | 2 669 | | | | | | | |
| 13 | 2 672 | 2 672 | | | | | | | |
| 14 | 2 647 | 2 647 | | | | | | | |
| 15 | 2 715 | 2 715 | | | | | | | |
| 16 | 2 699 | 2 698 | | | | | | | |
| 17 | 2 692 | 2 692 | | | | | | | |
| 18 | 2 673 | 2 673 | | | | | | | |
| 19 | 2 707 | 2 707 | | | | | | | |
| 20 | 2 685 | 2 685 | | | | | | | |
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| | | | | | | | | | |
| Mean | 2 678 | 2 678 | | | | | | | |
| Median | 2 677 | 2 677 | | | | | | | |
| std.dev | 23 | 23 | | | | | | | |
| Max | 2 722 | 2 722 | | | | | | | |
| Min | 2 635 | 2 635 | | | | | | | |

9.4 Chart

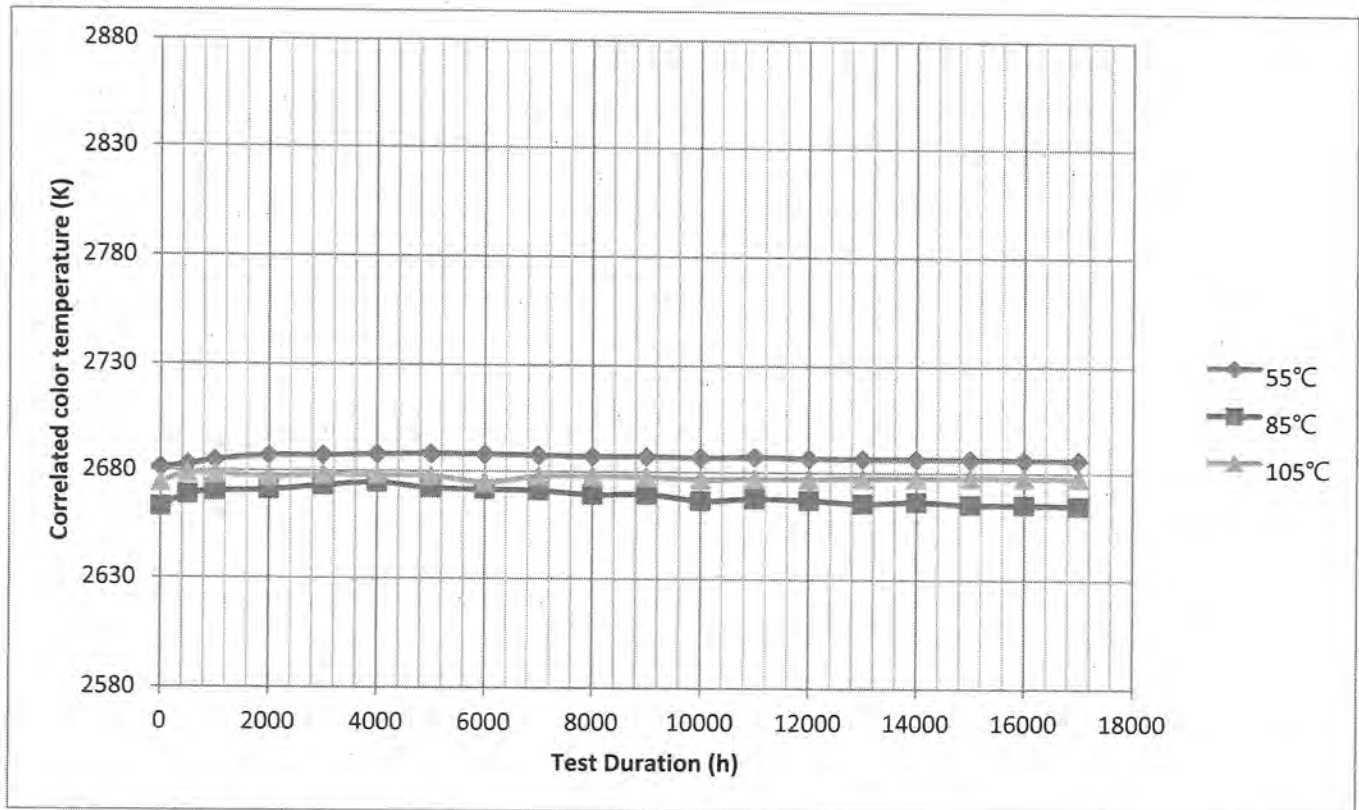
<Lumen Maintenance>



<Chromaticity Shift>



<CCT>



10. Observation of failures

No optical, Electrical or mechanical failure of any LED Package was seen during the lifetime testing.

11. LED light source monitoring interval

0 500 1 000 2 000 3 000 4 000 5 000 6 000 7 000 8 000
 9 000 10 000 11 000 12 000 13 000 14 000 15 000 16 000 17 000

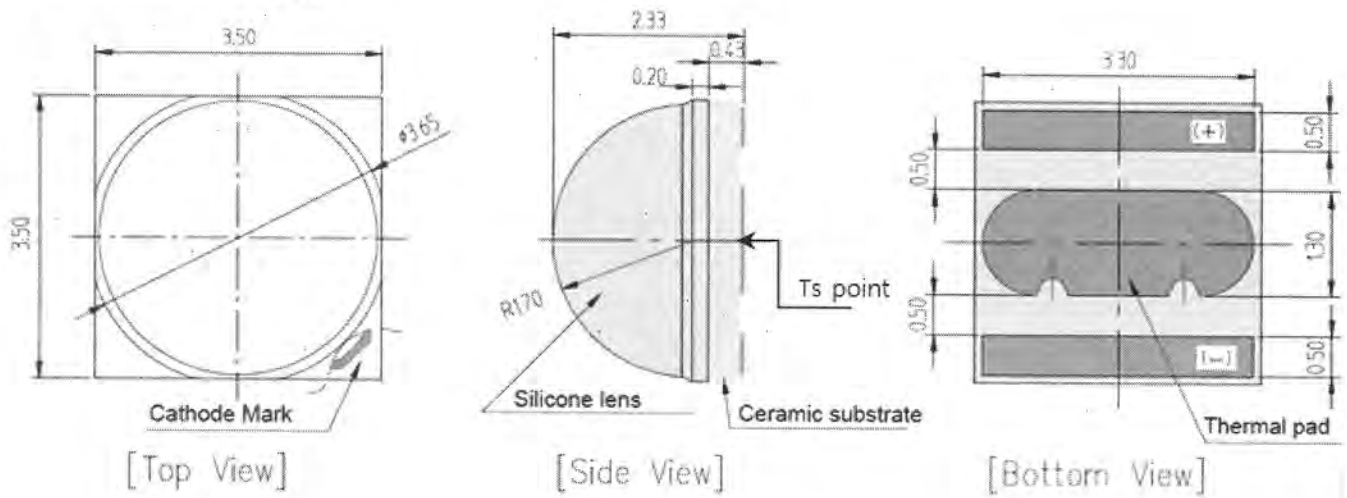
12. Photometric measurement uncertainty

3.5%

13. TM-21-11 Report : Projecting Long Term Lumen Maintenance of LED Light Source

| Table 1: Report at each LM-80 Test Condition | | | | | | | |
|---|----------------|--|----------------|--|----------------|--|----------------|
| Description of LED Light Source Tested (manufacturer, model, catalog number) | | Test Condition 1 - 55°C Case Temp | | Test Condition 2 - 85°C Case Temp | | Test Condition 3 - 105°C Case Temp | |
| Sample size | 20 | Sample size | 20 | Sample size | 20 | Sample size | 20 |
| Number of failures | 0 | Number of failures | 0 | Number of failures | 0 | Number of failures | 0 |
| DUT drive current used in the test (mA) | 700 | DUT drive current used in the test (mA) | 700 | DUT drive current used in the test (mA) | 700 | DUT drive current used in the test (mA) | 700 |
| Test duration (hours) | 17,000 | Test duration (hours) | 17,000 | Test duration (hours) | 17,000 | Test duration (hours) | 17,000 |
| Test duration used for projection (hour to hour) | 8,000 - 17,000 | Test duration used for projection (hour to hour) | 8,000 - 17,000 | Test duration used for projection (hour to hour) | 8,000 - 17,000 | Test duration used for projection (hour to hour) | 8,000 - 17,000 |
| Tested case temperature (°C) | 55 | Tested case temperature (°C) | 85 | Tested case temperature (°C) | 105 | Tested case temperature (°C) | 105 |
| α | 1.230E-07 | α | 7.389E-08 | α | 1.606E-07 | α | 1.606E-07 |
| B | 0.987 | B | 0.985 | B | 0.983 | B | 0.983 |
| Reported L90(17k) (hours) | >102000 | Reported L90(17k) (hours) | >102000 | Reported L90(17k) (hours) | >102000 | Reported L90(17k) (hours) | >102000 |

14. Dimension of samples



15. Cover models



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



Test Report

IES LM-80-15 Approved Method for Measuring Lumen Maintenance of LED Light Sources

Report no. : SLED-19-031-R02
 Testing start date : 2017.07.28
 Testing completion date : 2019.08.27
 Report issued date : 2019.05.31
 Report revised date : 2020.05.21

| | |
|---|---|
| Client | Testing performed by |
| SAMSUNG ELECTRONICS LED BUSINESS Lighting Marketing Group | SAMSUNG ELECTRONICS LED BUSINESS 1, Samsung-ro, Giheung-gu, Yongin-si, Gyeonggi-do 17113, Korea e-mail) kwon.sc@samsung.com |
| Tested By | Technical Manager |
|  KyungYeup Kwak |  DooSung Park |
| Test Personal Name & Signatory | Approval Name & Signatory |

The above test report is the accredited test result by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

※ If you need confirmation about the authenticity of the test report, please contact the above contact information.

SAMSUNG ELECTRONICS LED BUSINESS
 Accredited by KOLAS, Republic of KOREA

■ Test Report Information ■

1. This test report complies with KS Q ISO/IEC 17025 and KOLAS accreditation regulations.
2. This test report does not comply with KS Q ISO/IEC 17025 and KOLAS accreditation regulations.
3. The test results are limited to samples provided by the client and cannot be partially replicated without the approval of this authority, except as a whole.
4. If a statement of conformity is provided in this report, the applied decision rule does not apply the measurement uncertainty except for the case where the measurement uncertainty is mentioned in the above test method.
5. The test results marked © are not accredited by KOLAS.
6. The test results received from external providers for the test results marked ㉠.

■ Revision History ■

| Data | Revision History | Writer | |
|------------|--------------------------------|----------|----------|
| | | Drawn | Approved |
| 2019.05.31 | Rev.0 : New Version | K.Y.KWAK | D.S.PARK |
| 2020.03.30 | Rev.1 : Typos Correction | K.Y.KWAK | D.S.PARK |
| 2020.05.21 | Rev.2 : Extended Test Duration | K.Y.KWAK | D.S.PARK |
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■ Test Summary ■

| Life test condition | | | Summary of result | | |
|---------------------|--------------|-----------------------|-------------------|-------------------------------|--|
| Test condition | Current (mA) | Case temperature (°C) | Test duration (h) | Average lumen maintenance (%) | Maximum chromaticity shift ($\Delta u'v'$) |
| 1 | 1 000 | 55.2 | 17 000 | 98.1 | 0.000 8 |
| 2 | 1 000 | 85.1 | 17 000 | 97.9 | 0.001 4 |
| 3 | 1 000 | 105.1 | 17 000 | 96.5 | 0.002 3 |

1. Number of the sample

- 20 Packages tested at actual case temperature 55.2 °C
- 20 Packages tested at actual case temperature 85.1 °C
- 20 Packages tested at actual case temperature 105.1 °C
- ※ Sampling method : Minimum three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.

2. Description of LED light sources

- Tested model code : SPHWHTL3D50CE4W***
- Product series : LH351C (SPHWHTL3D50C*****)
- Sample manufacturer : Samsung Electronics
- Sample Type : LED Package
- Package dimension : (3.5 × 3.5) mm
- Minimum die spacing : -
- CCT / CRI (Nominal) : 2 700 K / 70

3. Location of Test

- Permanent Testing Lab On Site Testing

(Address : 1, Samsung-ro, Giheung-gu, Yongin-si, Gyeonggi-do 17113, Korea)

4. Description of auxiliary equipment and Operating time

- 1) Instrument Integrating sphere ISP1000-100
- 2) Instrument CAS140-CT
- 3) Keithley 2425 Sourcemeter
- 4) Electrical condition
 - Drive current : 1 000 mA
 - Typical voltage : 3.06 V
 - Total input power : 3.06 W
 - Average current density per LED die : 499 mA/mm²
 - Average power density per LED die : 1.52 W/mm²
 - * LED packages are driven with a constant direct current.
- 5) Test duration : 17 000 h

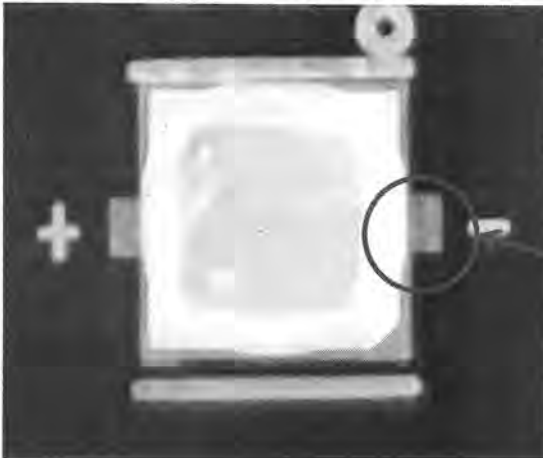
5. Ambient conditions including airflow, temperature and relative humidity

The minimal airflow is maintained in chamber.

The ambient temperature around the LED packages inside chamber is controlled by air flowing and the thermocouple readings are monitored.

- Case temperature : Controlled to $-2\text{ }^{\circ}\text{C}$
- Surrounding air temperature : Controlled to $-5\text{ }^{\circ}\text{C}$
- Relative humidity : $< 65\%$ R.H.

6. Case temperature (Test point temperature)



Case Temperature
Measurement Point

7. Drive current of the LED light source during lifetime test

See Sub-clause 9.1, 9.2 and 9.3

8. Initial luminous flux and forward voltage

See the table

9. Lumen maintenance data for each individual LED light source

See the table

9.1 Test condition 1 55 °C
Drive Current 1 000 mA
Measurement Current 1 000 mA

| No. | Lumen Maintenance (%) | | | | | | | | |
|---------|-----------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 16 000 h | 17 000 h | 18 000 h | 19 000 h | 20 000 h | 21 000 h | 22 000 h | 23 000 h | 24 000 h |
| 1 | 98.5 | 98.6 | | | | | | | |
| 2 | 97.7 | 97.7 | | | | | | | |
| 3 | 97.9 | 97.9 | | | | | | | |
| 4 | 98.5 | 98.5 | | | | | | | |
| 5 | 97.8 | 97.8 | | | | | | | |
| 6 | 98.7 | 98.6 | | | | | | | |
| 7 | 98.6 | 98.6 | | | | | | | |
| 8 | 98.2 | 98.2 | | | | | | | |
| 9 | 97.7 | 97.7 | | | | | | | |
| 10 | 97.5 | 97.6 | | | | | | | |
| 11 | 98.1 | 98.1 | | | | | | | |
| 12 | 98.3 | 98.4 | | | | | | | |
| 13 | 98.5 | 98.4 | | | | | | | |
| 14 | 98.1 | 98.0 | | | | | | | |
| 15 | 97.9 | 97.8 | | | | | | | |
| 16 | 98.1 | 98.2 | | | | | | | |
| 17 | 98.4 | 98.5 | | | | | | | |
| 18 | 98.0 | 97.9 | | | | | | | |
| 19 | 97.8 | 97.7 | | | | | | | |
| 20 | 97.6 | 97.5 | | | | | | | |
| Mean | 98.1 | 98.1 | | | | | | | |
| Median | 98.1 | 98.1 | | | | | | | |
| std.dev | 0.4 | 0.4 | | | | | | | |
| Max | 98.7 | 98.6 | | | | | | | |
| Min | 97.5 | 97.5 | | | | | | | |

9.1 Test condition 1 55 °C
 Drive Current 1 000 mA
 Measurement Current 1 000 mA

| No. | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|---------|--------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 16 000 h | 17 000 h | 18 000 h | 19 000 h | 20 000 h | 21 000 h | 22 000 h | 23 000 h | 24 000 h |
| 1 | 0.000 8 | 0.000 8 | | | | | | | |
| 2 | 0.000 6 | 0.000 6 | | | | | | | |
| 3 | 0.000 5 | 0.000 5 | | | | | | | |
| 4 | 0.000 7 | 0.000 8 | | | | | | | |
| 5 | 0.000 6 | 0.000 6 | | | | | | | |
| 6 | 0.000 6 | 0.000 6 | | | | | | | |
| 7 | 0.000 8 | 0.000 7 | | | | | | | |
| 8 | 0.000 7 | 0.000 7 | | | | | | | |
| 9 | 0.000 8 | 0.000 8 | | | | | | | |
| 10 | 0.000 8 | 0.000 8 | | | | | | | |
| 11 | 0.000 5 | 0.000 5 | | | | | | | |
| 12 | 0.000 6 | 0.000 6 | | | | | | | |
| 13 | 0.000 7 | 0.000 7 | | | | | | | |
| 14 | 0.000 5 | 0.000 5 | | | | | | | |
| 15 | 0.000 6 | 0.000 6 | | | | | | | |
| 16 | 0.000 7 | 0.000 7 | | | | | | | |
| 17 | 0.000 8 | 0.000 8 | | | | | | | |
| 18 | 0.000 6 | 0.000 6 | | | | | | | |
| 19 | 0.000 7 | 0.000 7 | | | | | | | |
| 20 | 0.000 6 | 0.000 6 | | | | | | | |
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| Mean | 0.000 7 | 0.000 7 | | | | | | | |
| Median | 0.000 7 | 0.000 7 | | | | | | | |
| std.dev | 0.000 1 | 0.000 1 | | | | | | | |
| Max | 0.000 8 | 0.000 8 | | | | | | | |
| Min | 0.000 5 | 0.000 5 | | | | | | | |

9.2 Test condition 2. 85 °C
 Drive Current 1 000 mA
 Measurement Current 1 000 mA

| No. | Lumen Maintenance (%) | | | | | | | | |
|---------|-----------------------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 98.0 | 98.0 | 97.9 | 97.9 | 97.7 | 97.7 | 97.6 | 97.7 | 97.7 |
| 2 | 98.2 | 98.0 | 98.0 | 98.2 | 98.0 | 97.9 | 98.0 | 98.1 | 98.3 |
| 3 | 98.5 | 98.4 | 98.4 | 98.3 | 98.2 | 98.2 | 98.3 | 98.2 | 98.4 |
| 4 | 98.6 | 98.3 | 98.3 | 98.2 | 98.1 | 98.0 | 98.0 | 98.1 | 98.1 |
| 5 | 98.5 | 98.5 | 98.2 | 98.4 | 98.1 | 98.1 | 98.2 | 98.3 | 98.2 |
| 6 | 98.4 | 98.3 | 98.2 | 98.4 | 98.1 | 98.2 | 98.2 | 98.1 | 98.3 |
| 7 | 98.2 | 98.2 | 98.1 | 98.1 | 98.0 | 98.1 | 98.1 | 98.2 | 98.3 |
| 8 | 98.1 | 98.1 | 98.0 | 98.1 | 98.0 | 98.1 | 98.2 | 98.2 | 98.4 |
| 9 | 98.0 | 97.8 | 97.8 | 97.8 | 97.6 | 97.7 | 97.7 | 97.8 | 97.8 |
| 10 | 98.5 | 98.4 | 98.4 | 98.3 | 98.1 | 98.1 | 98.2 | 98.3 | 98.3 |
| 11 | 98.4 | 98.2 | 98.0 | 98.0 | 97.8 | 97.8 | 97.8 | 97.9 | 97.9 |
| 12 | 98.3 | 98.3 | 98.2 | 98.1 | 98.2 | 98.0 | 98.2 | 98.1 | 98.1 |
| 13 | 98.1 | 97.9 | 97.9 | 97.8 | 97.8 | 97.9 | 97.9 | 98.0 | 98.1 |
| 14 | 98.1 | 98.0 | 97.9 | 98.0 | 97.8 | 97.7 | 97.5 | 97.5 | 97.7 |
| 15 | 98.1 | 98.0 | 97.9 | 97.9 | 97.7 | 97.6 | 97.7 | 97.7 | 97.9 |
| 16 | 97.9 | 97.8 | 97.7 | 97.7 | 97.6 | 97.5 | 97.5 | 97.5 | 97.6 |
| 17 | 97.8 | 97.6 | 97.5 | 97.5 | 97.5 | 97.4 | 97.4 | 97.4 | 97.5 |
| 18 | 98.3 | 98.2 | 98.1 | 97.9 | 97.9 | 97.9 | 97.9 | 98.0 | 98.1 |
| 19 | 98.1 | 97.8 | 97.7 | 97.6 | 97.4 | 97.3 | 97.3 | 97.3 | 97.4 |
| 20 | 97.9 | 97.8 | 97.7 | 97.6 | 97.4 | 97.3 | 97.3 | 97.4 | 97.3 |
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| | | | | | | | | | |
| Mean | 98.2 | 98.1 | 98.0 | 98.0 | 97.9 | 97.8 | 97.9 | 97.9 | 98.0 |
| Median | 98.1 | 98.1 | 98.0 | 98.0 | 97.9 | 97.9 | 97.9 | 98.0 | 98.1 |
| std.dev | 0.2 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Max | 98.6 | 98.5 | 98.4 | 98.4 | 98.2 | 98.2 | 98.3 | 98.3 | 98.4 |
| Min | 97.8 | 97.6 | 97.5 | 97.5 | 97.4 | 97.3 | 97.3 | 97.3 | 97.3 |

9.2 Test condition 2 **85 °C**
Drive Current **1 000 mA**
Measurement Current **1 000 mA**

| No. | u' | v' | Chromaticity Shift ($\Delta u'v'$) | | | | | | |
|---------|---------|---------|--------------------------------------|---------|---------|---------|---------|---------|---------|
| | 0 h | | 500 h | 1 000 h | 2 000 h | 3 000 h | 4 000 h | 5 000 h | 6 000 h |
| 1 | 0.262 3 | 0.527 9 | 0.000 3 | 0.000 4 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
| 2 | 0.263 3 | 0.529 2 | 0.000 1 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 6 |
| 3 | 0.262 4 | 0.528 2 | 0.000 1 | 0.000 4 | 0.000 4 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 6 |
| 4 | 0.263 5 | 0.527 6 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 |
| 5 | 0.261 9 | 0.528 6 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
| 6 | 0.261 7 | 0.527 2 | 0.000 1 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 |
| 7 | 0.261 3 | 0.527 6 | 0.000 2 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 6 |
| 8 | 0.262 4 | 0.529 1 | 0.000 3 | 0.000 5 | 0.000 7 | 0.000 6 | 0.000 8 | 0.000 7 | 0.000 7 |
| 9 | 0.262 9 | 0.528 4 | 0.000 3 | 0.000 4 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 6 |
| 10 | 0.261 5 | 0.527 8 | 0.000 3 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 |
| 11 | 0.263 7 | 0.529 0 | 0.000 2 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 7 |
| 12 | 0.262 3 | 0.527 8 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 9 | 0.000 9 | 0.000 9 |
| 13 | 0.261 3 | 0.527 0 | 0.000 4 | 0.000 5 | 0.000 7 | 0.000 9 | 0.000 8 | 0.000 9 | 0.000 9 |
| 14 | 0.263 5 | 0.528 7 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 7 | 0.000 8 | 0.000 6 |
| 15 | 0.262 1 | 0.527 7 | 0.000 3 | 0.000 6 | 0.000 8 | 0.000 8 | 0.000 9 | 0.000 8 | 0.000 8 |
| 16 | 0.261 4 | 0.527 1 | 0.000 2 | 0.000 5 | 0.000 6 | 0.000 7 | 0.000 9 | 0.000 8 | 0.000 8 |
| 17 | 0.262 5 | 0.527 3 | 0.000 3 | 0.000 3 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 |
| 18 | 0.261 9 | 0.527 0 | 0.000 3 | 0.000 4 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 8 | 0.000 7 |
| 19 | 0.263 2 | 0.528 1 | 0.000 2 | 0.000 3 | 0.000 5 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 6 |
| 20 | 0.264 0 | 0.529 6 | 0.000 2 | 0.000 4 | 0.000 4 | 0.000 5 | 0.000 6 | 0.000 6 | 0.000 7 |
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| | | | | | | | | | |
| Mean | 0.262 4 | 0.528 0 | 0.000 3 | 0.000 4 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 |
| Median | 0.262 3 | 0.527 8 | 0.000 3 | 0.000 4 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 |
| std.dev | 0.000 8 | 0.000 8 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 | 0.000 1 |
| Max | 0.264 0 | 0.529 6 | 0.000 4 | 0.000 6 | 0.000 8 | 0.000 9 | 0.000 9 | 0.000 9 | 0.000 9 |
| Min | 0.261 3 | 0.527 0 | 0.000 1 | 0.000 3 | 0.000 4 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 6 |

9.2 Test condition 2 85 °C
Drive Current 1 000 mA
Measurement Current 1 000 mA

| No. | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|---------|--------------------------------------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 |
| 2 | 0.000 6 | 0.000 6 | 0.000 7 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 7 |
| 3 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 | 0.000 6 |
| 4 | 0.000 8 | 0.000 8 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 |
| 5 | 0.000 6 | 0.000 8 | 0.000 7 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 |
| 6 | 0.000 7 | 0.000 7 | 0.000 8 | 0.000 7 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 8 |
| 7 | 0.000 6 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 6 |
| 8 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 |
| 9 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 6 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 |
| 10 | 0.000 7 | 0.000 7 | 0.000 8 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 7 | 0.000 8 | 0.000 8 |
| 11 | 0.000 9 | 0.000 9 | 0.001 0 | 0.001 0 | 0.001 0 | 0.001 0 | 0.001 0 | 0.001 1 | 0.001 1 |
| 12 | 0.000 9 | 0.001 0 | 0.001 1 | 0.001 1 | 0.001 2 | 0.001 2 | 0.001 2 | 0.001 3 | 0.001 3 |
| 13 | 0.001 0 | 0.001 0 | 0.001 1 | 0.001 2 | 0.001 2 | 0.001 2 | 0.001 2 | 0.001 2 | 0.001 3 |
| 14 | 0.000 8 | 0.000 8 | 0.001 0 | 0.001 0 | 0.001 1 | 0.001 1 | 0.001 2 | 0.001 2 | 0.001 2 |
| 15 | 0.001 0 | 0.001 0 | 0.001 0 | 0.001 0 | 0.001 0 | 0.001 1 | 0.001 1 | 0.001 1 | 0.001 2 |
| 16 | 0.001 0 | 0.001 0 | 0.001 1 | 0.001 0 | 0.001 1 | 0.001 1 | 0.001 1 | 0.001 1 | 0.001 1 |
| 17 | 0.000 8 | 0.000 9 | 0.000 9 | 0.000 9 | 0.001 0 | 0.001 1 | 0.001 1 | 0.001 1 | 0.001 1 |
| 18 | 0.000 9 | 0.000 9 | 0.001 0 | 0.001 1 | 0.001 1 | 0.001 1 | 0.001 1 | 0.001 2 | 0.001 2 |
| 19 | 0.000 7 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 9 | 0.000 9 | 0.001 0 | 0.001 0 |
| 20 | 0.000 8 | 0.000 7 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 9 | 0.000 9 | 0.000 9 | 0.000 9 |
| Mean | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 9 | 0.000 9 | 0.000 9 | 0.000 9 |
| Median | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 7 | 0.000 8 | 0.000 8 | 0.000 8 | 0.000 9 | 0.000 9 |
| std.dev | 0.000 1 | 0.000 2 | 0.000 2 | 0.000 2 | 0.000 2 | 0.000 2 | 0.000 2 | 0.000 2 | 0.000 2 |
| Max | 0.001 0 | 0.001 0 | 0.001 1 | 0.001 2 | 0.001 2 | 0.001 2 | 0.001 2 | 0.001 3 | 0.001 3 |
| Min | 0.000 6 | 0.000 6 | 0.000 5 | 0.000 6 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 5 | 0.000 6 |

9.2 Test condition 2 **85 °C**
Drive Current **1 000 mA**
Measurement Current **1 000 mA**

| No. | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|---------|--------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 16 000 h | 17 000 h | 18 000 h | 19 000 h | 20 000 h | 21 000 h | 22 000 h | 23 000 h | 24 000 h |
| 1 | 0.000 7 | 0.000 8 | | | | | | | |
| 2 | 0.000 7 | 0.000 7 | | | | | | | |
| 3 | 0.000 7 | 0.000 7 | | | | | | | |
| 4 | 0.000 7 | 0.000 7 | | | | | | | |
| 5 | 0.000 7 | 0.000 8 | | | | | | | |
| 6 | 0.000 9 | 0.000 9 | | | | | | | |
| 7 | 0.000 6 | 0.000 6 | | | | | | | |
| 8 | 0.000 7 | 0.000 7 | | | | | | | |
| 9 | 0.000 7 | 0.000 8 | | | | | | | |
| 10 | 0.000 8 | 0.000 8 | | | | | | | |
| 11 | 0.001 1 | 0.001 1 | | | | | | | |
| 12 | 0.001 3 | 0.001 4 | | | | | | | |
| 13 | 0.001 3 | 0.001 3 | | | | | | | |
| 14 | 0.001 2 | 0.001 2 | | | | | | | |
| 15 | 0.001 2 | 0.001 2 | | | | | | | |
| 16 | 0.001 2 | 0.001 2 | | | | | | | |
| 17 | 0.001 2 | 0.001 2 | | | | | | | |
| 18 | 0.001 2 | 0.001 2 | | | | | | | |
| 19 | 0.001 0 | 0.001 1 | | | | | | | |
| 20 | 0.001 0 | 0.001 0 | | | | | | | |
| Mean | 0.000 9 | 0.001 0 | | | | | | | |
| Median | 0.000 9 | 0.000 9 | | | | | | | |
| std.dev | 0.000 2 | 0.000 2 | | | | | | | |
| Max | 0.001 3 | 0.001 4 | | | | | | | |
| Min | 0.000 6 | 0.000 6 | | | | | | | |

9.2 Test condition 2 **85 °C**
Drive Current **1 000 mA**
Measurement Current **1 000 mA**

| No. | CCT (K) | | | | | | | | |
|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 2 707 | 2 706 | 2 707 | 2 705 | 2 706 | 2 705 | 2 705 | 2 705 | 2 704 |
| 2 | 2 680 | 2 679 | 2 680 | 2 678 | 2 678 | 2 678 | 2 677 | 2 677 | 2 677 |
| 3 | 2 702 | 2 701 | 2 700 | 2 701 | 2 700 | 2 699 | 2 699 | 2 699 | 2 698 |
| 4 | 2 684 | 2 683 | 2 682 | 2 680 | 2 680 | 2 680 | 2 679 | 2 679 | 2 679 |
| 5 | 2 711 | 2 713 | 2 711 | 2 710 | 2 710 | 2 710 | 2 709 | 2 709 | 2 709 |
| 6 | 2 721 | 2 720 | 2 722 | 2 720 | 2 721 | 2 720 | 2 720 | 2 720 | 2 720 |
| 7 | 2 728 | 2 727 | 2 725 | 2 726 | 2 725 | 2 724 | 2 724 | 2 724 | 2 723 |
| 8 | 2 702 | 2 701 | 2 701 | 2 698 | 2 698 | 2 698 | 2 698 | 2 697 | 2 697 |
| 9 | 2 691 | 2 692 | 2 691 | 2 689 | 2 690 | 2 689 | 2 689 | 2 689 | 2 689 |
| 10 | 2 725 | 2 723 | 2 725 | 2 723 | 2 723 | 2 723 | 2 723 | 2 722 | 2 722 |
| 11 | 2 675 | 2 675 | 2 675 | 2 675 | 2 676 | 2 676 | 2 675 | 2 676 | 2 675 |
| 12 | 2 711 | 2 712 | 2 713 | 2 713 | 2 714 | 2 714 | 2 714 | 2 714 | 2 715 |
| 13 | 2 736 | 2 736 | 2 738 | 2 738 | 2 739 | 2 738 | 2 737 | 2 737 | 2 738 |
| 14 | 2 680 | 2 679 | 2 682 | 2 682 | 2 683 | 2 683 | 2 684 | 2 683 | 2 684 |
| 15 | 2 716 | 2 716 | 2 716 | 2 715 | 2 715 | 2 716 | 2 716 | 2 716 | 2 716 |
| 16 | 2 733 | 2 733 | 2 733 | 2 733 | 2 733 | 2 733 | 2 733 | 2 732 | 2 732 |
| 17 | 2 706 | 2 708 | 2 708 | 2 708 | 2 709 | 2 709 | 2 709 | 2 709 | 2 709 |
| 18 | 2 722 | 2 721 | 2 723 | 2 723 | 2 723 | 2 724 | 2 723 | 2 724 | 2 724 |
| 19 | 2 687 | 2 687 | 2 686 | 2 686 | 2 687 | 2 687 | 2 688 | 2 688 | 2 688 |
| 20 | 2 665 | 2 664 | 2 665 | 2 664 | 2 665 | 2 665 | 2 664 | 2 665 | 2 665 |
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| | | | | | | | | | |
| Mean | 2 704 | 2 704 | 2 704 | 2 703 | 2 704 | 2 704 | 2 703 | 2 703 | 2 703 |
| Median | 2 706 | 2 707 | 2 707 | 2 707 | 2 707 | 2 707 | 2 707 | 2 707 | 2 707 |
| std.dev | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| Max | 2 736 | 2 736 | 2 738 | 2 738 | 2 739 | 2 738 | 2 737 | 2 737 | 2 738 |
| Min | 2 665 | 2 664 | 2 665 | 2 664 | 2 665 | 2 665 | 2 664 | 2 665 | 2 665 |

9.3 Test condition 3 **105 °C**
Drive Current **1 000 mA**
Measurement Current **1 000 mA**

| No. | Flux (lm) | Vf (V) | Lumen Maintenance (%) | | | | | | |
|---------|-----------|--------|-----------------------|---------|---------|---------|---------|---------|---------|
| | 0 h | | 500 h | 1 000 h | 2 000 h | 3 000 h | 4 000 h | 5 000 h | 6 000 h |
| 1 | 339.7 | 3.071 | 99.6 | 99.0 | 98.8 | 98.6 | 98.2 | 97.8 | 97.7 |
| 2 | 336.4 | 3.049 | 99.0 | 98.1 | 98.0 | 97.7 | 97.1 | 97.0 | 97.0 |
| 3 | 343.8 | 3.042 | 99.9 | 99.6 | 98.5 | 98.3 | 97.9 | 97.7 | 97.4 |
| 4 | 334.9 | 3.017 | 99.5 | 98.7 | 98.2 | 98.1 | 97.5 | 97.5 | 97.4 |
| 5 | 341.0 | 3.025 | 98.7 | 98.2 | 97.9 | 98.0 | 97.6 | 97.7 | 97.4 |
| 6 | 343.3 | 3.089 | 98.6 | 98.4 | 98.1 | 97.9 | 97.5 | 97.7 | 97.2 |
| 7 | 330.7 | 3.083 | 99.4 | 99.1 | 98.3 | 97.9 | 97.6 | 97.3 | 97.0 |
| 8 | 342.4 | 3.028 | 99.3 | 98.5 | 98.3 | 97.8 | 97.8 | 97.3 | 96.9 |
| 9 | 344.2 | 3.039 | 99.6 | 98.2 | 98.5 | 98.3 | 97.8 | 97.5 | 97.3 |
| 10 | 340.9 | 3.030 | 99.5 | 98.8 | 98.7 | 98.3 | 98.2 | 97.6 | 97.6 |
| 11 | 337.5 | 3.059 | 98.5 | 98.1 | 97.7 | 97.4 | 97.1 | 97.2 | 97.1 |
| 12 | 339.9 | 3.039 | 99.0 | 98.4 | 98.2 | 97.8 | 97.6 | 97.3 | 97.0 |
| 13 | 339.8 | 3.061 | 99.3 | 98.7 | 98.4 | 98.2 | 97.7 | 97.4 | 97.0 |
| 14 | 341.9 | 3.042 | 98.8 | 98.5 | 98.4 | 98.2 | 97.9 | 97.6 | 97.6 |
| 15 | 330.5 | 3.056 | 100.1 | 99.8 | 99.4 | 98.5 | 98.1 | 98.1 | 98.0 |
| 16 | 336.6 | 3.096 | 98.7 | 98.3 | 98.3 | 97.9 | 97.4 | 97.5 | 97.4 |
| 17 | 334.9 | 3.095 | 99.0 | 98.6 | 98.3 | 98.2 | 97.4 | 97.3 | 97.2 |
| 18 | 341.1 | 3.087 | 98.7 | 98.5 | 98.3 | 98.0 | 97.7 | 97.4 | 97.0 |
| 19 | 340.5 | 3.059 | 99.2 | 99.1 | 98.8 | 98.5 | 98.0 | 97.5 | 97.5 |
| 20 | 334.3 | 3.018 | 99.7 | 99.2 | 98.8 | 98.5 | 98.0 | 97.5 | 97.3 |
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| | | | | | | | | | |
| Mean | 338.7 | 3.05 | 99.2 | 98.7 | 98.4 | 98.1 | 97.7 | 97.5 | 97.3 |
| Median | 339.8 | 3.05 | 99.3 | 98.5 | 98.3 | 98.1 | 97.7 | 97.5 | 97.3 |
| std.dev | 4.1 | 0.03 | 0.5 | 0.5 | 0.4 | 0.3 | 0.3 | 0.2 | 0.3 |
| Max | 344.2 | 3.10 | 100.1 | 99.8 | 99.4 | 98.6 | 98.2 | 98.1 | 98.0 |
| Min | 330.5 | 3.02 | 98.5 | 98.1 | 97.7 | 97.4 | 97.1 | 97.0 | 96.9 |

9.3 Test condition 3 105 °C
Drive Current 1 000 mA
Measurement Current 1 000 mA

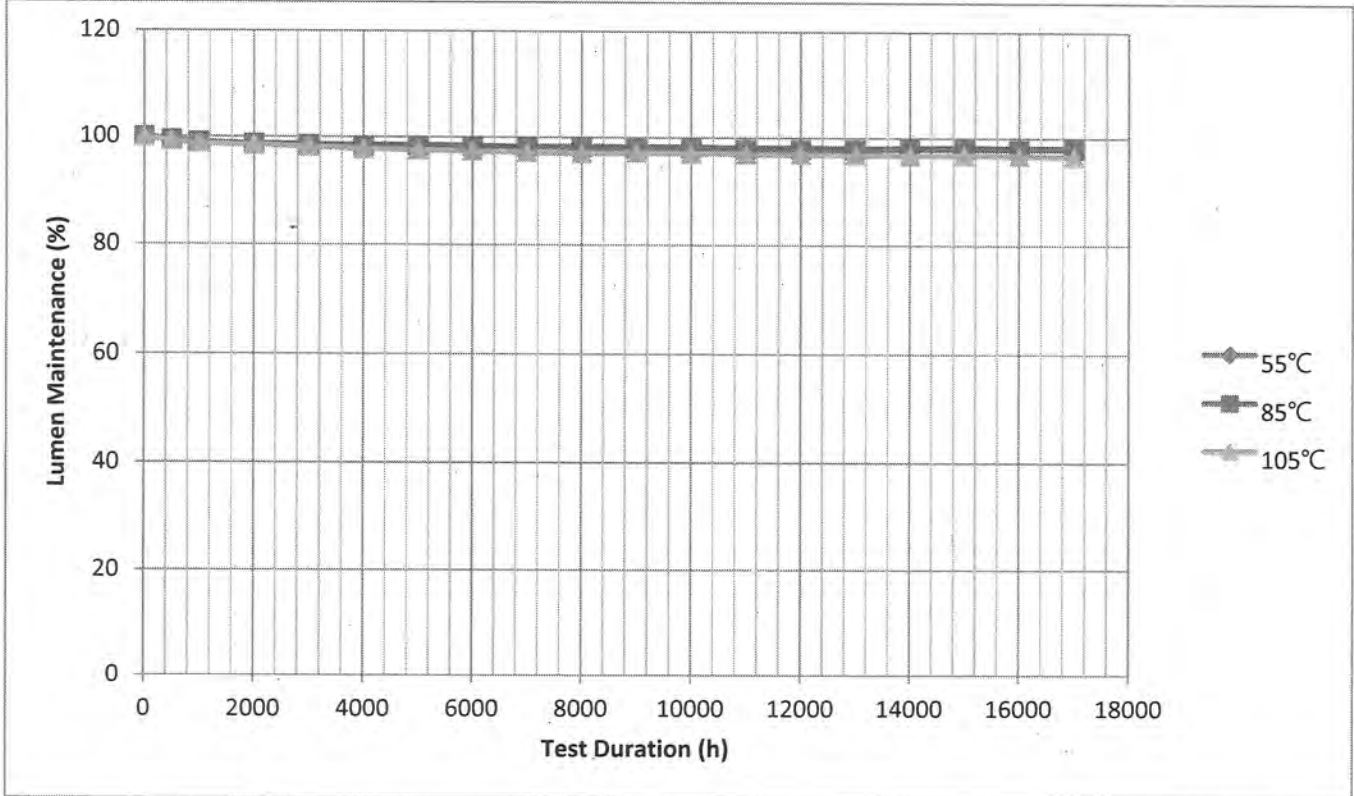
| No. | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|---------|--------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 16 000 h | 17 000 h | 18 000 h | 19 000 h | 20 000 h | 21 000 h | 22 000 h | 23 000 h | 24 000 h |
| 1 | 0.002 3 | 0.002 3 | | | | | | | |
| 2 | 0.001 4 | 0.001 5 | | | | | | | |
| 3 | 0.001 7 | 0.001 7 | | | | | | | |
| 4 | 0.001 7 | 0.001 8 | | | | | | | |
| 5 | 0.002 0 | 0.002 1 | | | | | | | |
| 6 | 0.001 5 | 0.001 6 | | | | | | | |
| 7 | 0.001 4 | 0.001 5 | | | | | | | |
| 8 | 0.001 6 | 0.001 7 | | | | | | | |
| 9 | 0.001 7 | 0.001 8 | | | | | | | |
| 10 | 0.001 5 | 0.001 6 | | | | | | | |
| 11 | 0.001 8 | 0.001 9 | | | | | | | |
| 12 | 0.001 7 | 0.001 7 | | | | | | | |
| 13 | 0.002 1 | 0.002 2 | | | | | | | |
| 14 | 0.001 9 | 0.001 9 | | | | | | | |
| 15 | 0.001 6 | 0.001 7 | | | | | | | |
| 16 | 0.002 2 | 0.002 3 | | | | | | | |
| 17 | 0.001 6 | 0.001 7 | | | | | | | |
| 18 | 0.001 5 | 0.001 6 | | | | | | | |
| 19 | 0.001 8 | 0.001 9 | | | | | | | |
| 20 | 0.001 6 | 0.001 7 | | | | | | | |
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| Mean | 0.001 7 | 0.001 8 | | | | | | | |
| Median | 0.001 7 | 0.001 7 | | | | | | | |
| std.dev | 0.000 3 | 0.000 3 | | | | | | | |
| Max | 0.002 3 | 0.002 3 | | | | | | | |
| Min | 0.001 4 | 0.001 5 | | | | | | | |

9.3 Test condition 3 **105 °C**
Drive Current **1 000 mA**
Measurement Current **1 000 mA**

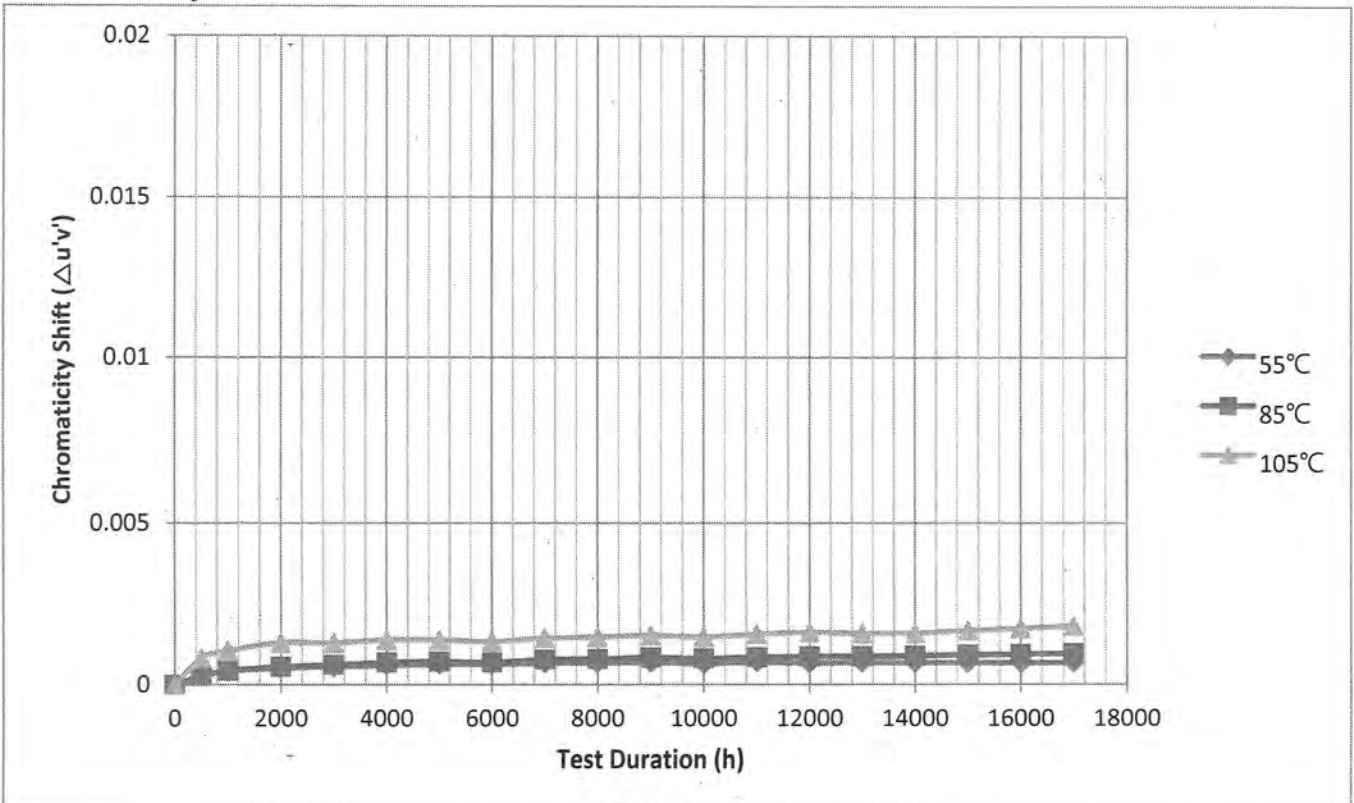
| No. | CCT (K) | | | | | | | | |
|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| | 7 000 h | 8 000 h | 9 000 h | 10 000 h | 11 000 h | 12 000 h | 13 000 h | 14 000 h | 15 000 h |
| 1 | 2 763 | 2 765 | 2 763 | 2 760 | 2 761 | 2 761 | 2 760 | 2 760 | 2 760 |
| 2 | 2 664 | 2 662 | 2 661 | 2 657 | 2 658 | 2 658 | 2 656 | 2 656 | 2 655 |
| 3 | 2 733 | 2 732 | 2 727 | 2 723 | 2 724 | 2 722 | 2 719 | 2 717 | 2 717 |
| 4 | 2 744 | 2 741 | 2 737 | 2 733 | 2 734 | 2 732 | 2 730 | 2 728 | 2 728 |
| 5 | 2 695 | 2 698 | 2 695 | 2 690 | 2 694 | 2 694 | 2 692 | 2 692 | 2 693 |
| 6 | 2 691 | 2 689 | 2 689 | 2 686 | 2 686 | 2 685 | 2 683 | 2 682 | 2 681 |
| 7 | 2 682 | 2 679 | 2 674 | 2 672 | 2 672 | 2 670 | 2 667 | 2 665 | 2 665 |
| 8 | 2 714 | 2 713 | 2 708 | 2 705 | 2 706 | 2 704 | 2 701 | 2 700 | 2 699 |
| 9 | 2 700 | 2 703 | 2 699 | 2 694 | 2 696 | 2 694 | 2 692 | 2 691 | 2 691 |
| 10 | 2 734 | 2 732 | 2 732 | 2 727 | 2 727 | 2 725 | 2 722 | 2 721 | 2 721 |
| 11 | 2 704 | 2 702 | 2 699 | 2 700 | 2 698 | 2 698 | 2 696 | 2 694 | 2 694 |
| 12 | 2 728 | 2 727 | 2 723 | 2 720 | 2 720 | 2 719 | 2 716 | 2 715 | 2 714 |
| 13 | 2 734 | 2 736 | 2 734 | 2 730 | 2 732 | 2 732 | 2 730 | 2 730 | 2 730 |
| 14 | 2 726 | 2 726 | 2 728 | 2 724 | 2 725 | 2 725 | 2 723 | 2 722 | 2 722 |
| 15 | 2 715 | 2 712 | 2 714 | 2 707 | 2 708 | 2 707 | 2 705 | 2 703 | 2 703 |
| 16 | 2 741 | 2 744 | 2 740 | 2 734 | 2 737 | 2 736 | 2 734 | 2 733 | 2 734 |
| 17 | 2 739 | 2 743 | 2 738 | 2 735 | 2 736 | 2 734 | 2 732 | 2 731 | 2 732 |
| 18 | 2 736 | 2 735 | 2 734 | 2 727 | 2 728 | 2 726 | 2 723 | 2 722 | 2 722 |
| 19 | 2 686 | 2 685 | 2 687 | 2 684 | 2 684 | 2 683 | 2 682 | 2 680 | 2 680 |
| 20 | 2 737 | 2 735 | 2 731 | 2 727 | 2 727 | 2 725 | 2 723 | 2 721 | 2 721 |
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| | | | | | | | | | |
| Mean | 2 718 | 2 718 | 2 716 | 2 712 | 2 713 | 2 712 | 2 709 | 2 708 | 2 708 |
| Median | 2 727 | 2 726 | 2 725 | 2 721 | 2 722 | 2 720 | 2 718 | 2 716 | 2 716 |
| std.dev | 25 | 26 | 26 | 25 | 25 | 25 | 26 | 26 | 26 |
| Max | 2 763 | 2 765 | 2 763 | 2 760 | 2 761 | 2 761 | 2 760 | 2 760 | 2 760 |
| Min | 2 664 | 2 662 | 2 661 | 2 657 | 2 658 | 2 658 | 2 656 | 2 656 | 2 655 |

9.4 Chart

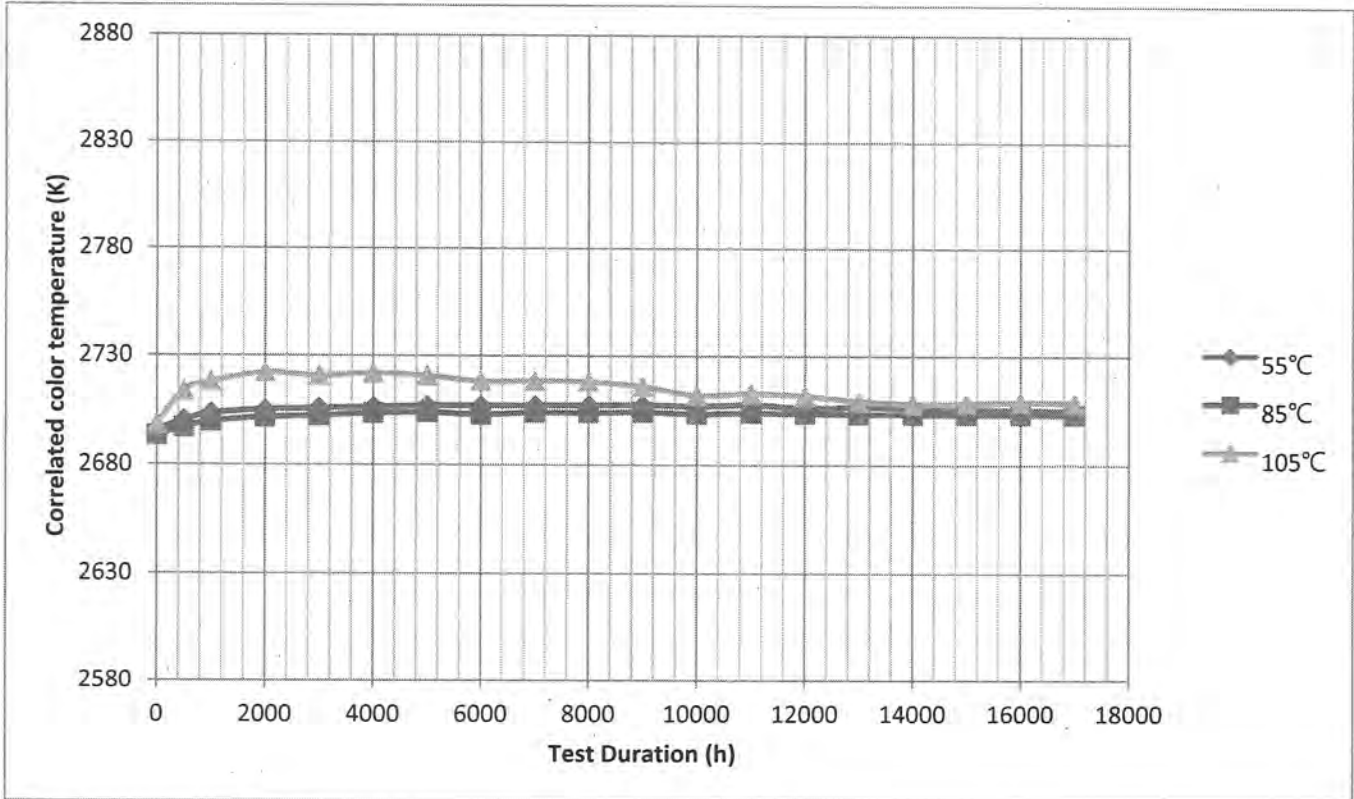
<Lumen Maintenance>



<Chromaticity Shift>



<CCT>



10. Observation of failures

No optical, Electrical or mechanical failure of any LED Package was seen during the lifetime testing.

11. LED light source monitoring interval

0 500 1 000 2 000 3 000 4 000 5 000 6 000 7 000 8 000
 9 000 10 000 11 000 12 000 13 000 14 000 15 000 16 000 17 000

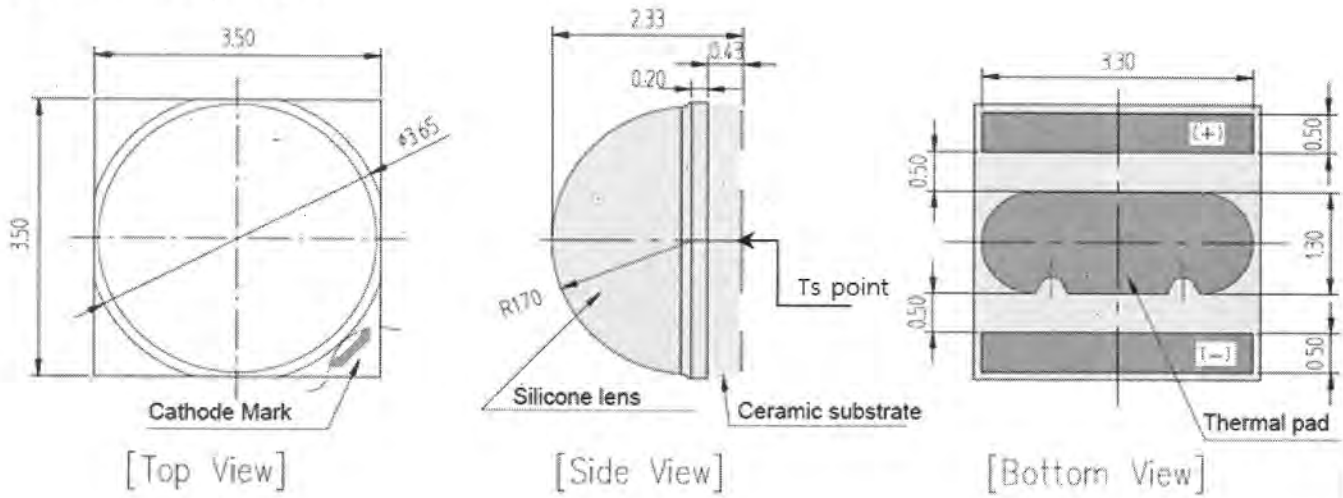
12. Photometric measurement uncertainty

3.5%

13. TM-21-11 Report : Projecting Long Term Lumen Maintenance of LED Light Source

| Table 1: Report at each LM-80 Test Condition | | | | | | | |
|---|----------------|--|----------------|--|----------------|--|----------------|
| Description of LED Light Source Tested (manufacturer, model, catalog number) | | Test Condition 1 - 55°C Case Temp | | Test Condition 2 - 85°C Case Temp | | Test Condition 3 - 105°C Case Temp | |
| Sample size | 20 | Sample size | 20 | Sample size | 20 | Sample size | 20 |
| Number of failures | 0 | Number of failures | 0 | Number of failures | 0 | Number of failures | 0 |
| DUT drive current used in the test (mA) | 1 000 | DUT drive current used in the test (mA) | 1 000 | DUT drive current used in the test (mA) | 1 000 | DUT drive current used in the test (mA) | 1 000 |
| Test duration (hours) | 17,000 | Test duration (hours) | 17,000 | Test duration (hours) | 17,000 | Test duration (hours) | 17,000 |
| Test duration used for projection (hour to hour) | 8,000 - 17,000 | Test duration used for projection (hour to hour) | 8,000 - 17,000 | Test duration used for projection (hour to hour) | 8,000 - 17,000 | Test duration used for projection (hour to hour) | 8,000 - 17,000 |
| Tested case temperature (°C) | 55 | Tested case temperature (°C) | 85 | Tested case temperature (°C) | 105 | Tested case temperature (°C) | 105 |
| α | 1.667E-07 | α | 1.484E-07 | α | 6.010E-07 | α | 6.010E-07 |
| B | 0.984 | B | 0.981 | B | 0.975 | B | 0.975 |
| Reported L90(17k) (hours) | >102000 | Reported L90(17k) (hours) | >102000 | Reported L90(17k) (hours) | >102000 | Reported L90(17k) (hours) | >102000 |

14. Dimension of samples



15. Cover models

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