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# Bridgelux Micro SM4

Product Data Sheet DS27 – PRELIMINARY, Expires 03/31/12

## Introduction

The Bridgelux Micro SM4 delivers high performance, compact and cost-effective solid-state lighting solutions to serve general and specialty lighting applications. These products combine the higher efficacy, lifetime, and reliability benefits of LEDs with the light output levels of low wattage conventional light sources. The Bridgelux Micro SM4 series has been designed to enable a cost-effective design for LED retrofit bulbs, halogen spotlights, consumer luminaires and other general lighting applications.

The Bridgelux Micro SM4 provides a high performance alternative to conventional solid state solutions, delivering between 400 and 500 lumens in warm and cool white color temperatures. These compact high flux density light sources enable both diffuse and directional lamp replacements for a wide range of applications.

Lighting system designs incorporating these products deliver performance comparable to that of a 20-40 Watt incandescent, 20-35 Watt halogen and low wattage compact fluorescent lamps and luminaires and feature increased system level efficacy and service life. Typical applications include replacement lamps, task lighting, under cabinet, accent, pendant, sconces, porch, pathway, landscape, portable, and consumer luminaires.

## Features

- Compact high flux density light source
- Low thermal resistance and electrically neutral thermal path
- Energy Star / ANSI compliant binning with 3-step and 4-step binning options
- Available in 6V and 12V versions
- More energy efficient than incandescent, halogen and fluorescent lamps
- Low voltage DC operation
- Instant light with unlimited dimming
- 5-year warranty
- RoHS compliant and Pb free

## Benefits

- Enhanced optical control
- Increased design flexibility and operating temperature range
- Consistent white light
- Enables driver design flexibility and low voltage lighting products
- Lower operating costs
- Increased safety
- Easy to use with daylight and motion detectors to enable increased energy savings
- Reduced maintenance costs
- Environmentally friendly, no disposal issue



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## Product Nomenclature

The part number designation for the Bridgelux Micro SM4 is explained as follows:

BXPX – AB C DEFG – H – JJKK

Where:

BXPX – Designates product family

AB – Designates the nominal ANSI color temperature; 27 = 2700K; 30 = 3000K, etc.

C - Designates minimum CRI; C = 70, E = 80, G = 90

DEFG - Designates Nominal Flux; 0400 = 400lm, 0520 = 520lm, etc.

H – Designates configuration; A = 350mA; B = 700mA

JJ – Designates CCT Bin options

00 = Full ANSI

03 = 3 SDCM

04 = 4 SDCM

KK – Reserved. Default = 00

## Average Lumen Maintenance Characteristics

Bridgelux projects that its Micro SM4 family of products will deliver, on average, greater than 70% lumen maintenance after 50,000 hours of operation at the rated forward test current. This performance assumes constant current operation with solder pad temperature maintained at or below 70°C. For use beyond these typical operating conditions please consult your Bridgelux sales representative for further assistance.

These projections are based on a combination of package test data, semiconductor chip reliability data, a fundamental understanding of package related degradation mechanisms, and performance observed from products installed in the field using Bridgelux die technology. Bridgelux conducts lumen maintenance tests per LM80. Observation of design limits is required in order to achieve this projected lumen maintenance.

## Environmental Compliance

Bridgelux is committed to providing environmentally friendly products to the solid-state lighting market. Bridgelux LEDs are compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS directive. Bridgelux will not intentionally add the following restricted materials to LED products: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

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## UL Recognition

Bridgelux secures UL Recognition for all the LED products. Bridgelux uses UL Recognized materials with suitable flammability ratings to streamline the process for customers to secure UL listing of the final luminaire product. Bridgelux recommends that luminaires are designed with a Class 2 Driver to facilitate the UL listing process.

## Minor Product Change Policy

The rigorous qualification testing on products offered by Bridgelux provides performance assurance. Slight cosmetic changes that do not affect form, fit, or function may occur as Bridgelux continues product optimization.

## Cautionary Statements

### CAUTION: CONTACT WITH OPTICAL AREA

Contact with the resin area should be avoided. Applying stress to the resin area can result in damage to the product.

### CAUTION: EYE SAFETY

Eye safety classification for the use of the Bridgelux Micro SM4 product series is in accordance with IEC – EN62471 Photobiological Safety of Lamps and Lamp Systems specification. These products are classified as Risk Group 1 (Low Risk) when operated at or below the rated test current. Please use appropriate precautions. It is important that employees working with LEDs are trained to use them safely.

### CAUTION: RISK OF BURN

Do not touch the LED during operation. Allow the LED to cool for a sufficient period of time before handling. The LED may reach elevated temperatures such that it can burn skin when touched.

### CAUTION: CHEMICAL EXPOSURE HAZARD

Exposure to some chemicals commonly used in luminaire manufacturing and assembly can cause damage to the LED. Please consult Bridgelux Application Note AN21 for additional information.

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## Quick Selection Guide

Table 1: Selection Guide for Bridgelux Micro SM4

| <b>Base Part Number</b> | <b>CCT</b><br>(Nominal) | <b>CRI</b><br>(min) | <b>Typical Pulsed Flux</b><br><b>T<sub>j</sub> 25°C</b><br>(lm) | <b>Test Current</b><br>(mA) | <b>V<sub>f</sub></b><br>(Typ)<br>(V) | <b>Power</b><br>(Typ)<br>(W) | <b>Efficacy</b><br>(Typ at T <sub>j</sub><br>25°C)<br>(lm/W) |
|-------------------------|-------------------------|---------------------|---|-----------------------------|--------------------------------------|------------------------------|--|
| BXPX-27E0400-A-0000     | 2700                    | 80                  | 370   | 350                         | 13.0                                 | 4.6                          | 80   |
| BXPX-27E0400-B-0000     | 2700                    | 80                  | 370   | 700                         | 6.5                                  | 4.6                          | 80   |
| BXPX-27G0400-A-0000     | 2700                    | 90                  | 330   | 350                         | 13.0                                 | 4.6                          | 72   |
| BXPX-27G0400-B-0000     | 2700                    | 90                  | 330   | 700                         | 6.5                                  | 4.6                          | 72   |
| BXPX-30E0400-A-0000     | 3000                    | 80                  | 400   | 350                         | 13.0                                 | 4.6                          | 87   |
| BXPX-30E0400-B-0000     | 3000                    | 80                  | 400   | 700                         | 6.5                                  | 4.6                          | 87   |
| BXPX-30G0400-A-0000     | 3000                    | 90                  | 360   | 350                         | 13.0                                 | 4.6                          | 78   |
| BXPX-30G0400-B-0000     | 3000                    | 90                  | 360   | 700                         | 6.5                                  | 4.6                          | 78   |
| BXPX-56C0520-A-0000     | 5600                    | 70                  | 520   | 350                         | 13.0                                 | 4.6                          | 113  |
| BXPX-56C0520-B-0000     | 5600                    | 70                  | 520   | 700                         | 6.5                                  | 4.6                          | 113  |

## Flux Characteristics

Table 2: Flux Characteristics

| Color      | ANSI CCT (K) | Base Part Number    | CRI (min) <sup>(3)</sup> | Typical DC Flux T <sub>J</sub> = 85°C (lm) | Minimum Pulsed Flux T <sub>J</sub> = 25°C (lm) <sup>(1)</sup> | Typical Pulsed Flux T <sub>J</sub> = 25°C (lm) | Test Current (mA) <sup>(2)</sup> |
|------------|--------------|---------------------|--------------------------|--|---|--|----------------------------------|
| Warm White | 2700         | BXPX-27E0400-A-0000 | 80                       | 320  | TBD   | 370  | 350                              |
|            |              | BXPX-27E0400-B-0000 | 80                       | 320  | TBD   | 370  | 700                              |
|            |              | BXPX-27G0400-A-0000 | 90                       | 285  | TBD   | 330  | 350                              |
|            |              | BXPX-27G0400-B-0000 | 90                       | 285  | TBD   | 330  | 700                              |
|            | 3000         | BXPX-30E0400-A-0000 | 80                       | 345  | TBD   | 400  | 350                              |
|            |              | BXPX-30E0400-B-0000 | 80                       | 345  | TBD   | 400  | 700                              |
|            |              | BXPX-30G0400-A-0000 | 90                       | 310  | TBD   | 360  | 350                              |
|            |              | BXPX-30G0400-B-0000 | 90                       | 310  | TBD   | 360  | 700                              |
| Cool White | 5600         | BXPX-56C0520-A-0000 | 70                       | 450  | TBD   | 520  | 350                              |
|            |              | BXPX-56C0520-B-0000 | 70                       | 450  | TBD   | 520  | 700                              |

Notes for Table 2:

1. Bridgelux maintains a  $\pm 7\%$  tolerance of flux measurements.
2. Parts are tested in pulsed conditions, T<sub>J</sub> = 25°C. Pulse width is 10 ms at rated test current.
3. Typical R9 value for 90 CRI product options is 50.

## Optical Characteristics

Table 3: Optical Characteristics

| Color      | ANSI CCT (K) | Base Part Number    | Color Temperature (CCT) <sup>[1], [2], [3]</sup> |        |        | CRI (min) | Typical Viewing Angle (Degrees) $2\theta^{1/2}$ <sup>[4]</sup> |
|------------|--------------|---------------------|--|--------|--------|-----------|--|
|            |              |                     | Min  | Typ    | Max    |           |  |
| Warm White | 2700         | BXPX-27E0400-A-0000 | 2580 K   | 2725 K | 2870 K | 80        | 165  |
|            |              | BXPX-27E0400-B-0000 | 2580 K   | 2725 K | 2870 K | 80        | 165  |
|            |              | BXPX-27G0400-A-0000 | 2580 K   | 2725 K | 2870 K | 90        | 165  |
|            |              | BXPX-27G0400-B-0000 | 2580 K   | 2725 K | 2870 K | 90        | 165  |
|            | 3000         | BXPX-30E0400-A-0000 | 2870 K   | 3045 K | 3220 K | 80        | 165  |
|            |              | BXPX-30E0400-B-0000 | 2870 K   | 3045 K | 3220 K | 80        | 165  |
|            |              | BXPX-30G0400-A-0000 | 2870 K   | 3045 K | 3220 K | 90        | 165  |
|            |              | BXPX-30G0400-B-0000 | 2870 K   | 3045 K | 3220 K | 90        | 165  |
| Cool White | 5600         | BXPX-56C0520-A-0000 | 5310 K   | 5665 K | 6020 K | 70        | 165  |
|            |              | BXPX-56C0520-B-0000 | 5310 K   | 5665 K | 6020 K | 70        | 165  |

Notes for Table 3:

1. Parts are tested in pulsed conditions,  $T_j = 25^\circ\text{C}$ . Pulse width is 10 ms at rated test current.
2. Refer to Flux Characteristic Table for test current data.
3. Product is binned for color in x y coordinates.
4. Viewing angle is the off axis angle from the centerline where  $I_v$  is  $\frac{1}{2}$  of the peak value.



## Electrical Characteristics

Table 4: Electrical Characteristics

| Color      | Base Part Number    | Forward Voltage Vf (V) <sup>[2]</sup> |      |      | Test Current (mA) <sup>[1]</sup> | Typical Coefficient of Forward Voltage (mV/°C) $\Delta V_f / \Delta T_j$ | Typical Thermal Resistance Junction to Solder Point (°C/W) $R_{\theta_{j-s}}$ |
|------------|---------------------|---------------------------------------|------|------|----------------------------------|--|---|
|            |                     | Min                                   | Typ  | Max  |                                  |  |   |
| Warm White | BXPX-27E0400-A-0000 | 11.7                                  | 13.0 | 14.3 | 350                              | -4 to -12  | 1.5   |
|            | BXPX-27E0400-B-0000 | 5.9                                   | 6.5  | 7.1  | 700                              | -2 to -6   | 1.5   |
|            | BXPX-27G0400-A-0000 | 11.7                                  | 13.0 | 14.3 | 350                              | -4 to -12  | 1.5   |
|            | BXPX-27G0400-B-0000 | 5.9                                   | 6.5  | 7.1  | 700                              | -2 to -6   | 1.5   |
|            | BXPX-30E0400-A-0000 | 11.7                                  | 13.0 | 14.3 | 350                              | -4 to -12  | 1.5   |
|            | BXPX-30E0400-B-0000 | 5.9                                   | 6.5  | 7.1  | 700                              | -2 to -6   | 1.5   |
|            | BXPX-30G0400-A-0000 | 11.7                                  | 13.0 | 14.3 | 350                              | -4 to -12  | 1.5   |
|            | BXPX-30G0400-B-0000 | 5.9                                   | 6.5  | 7.1  | 700                              | -2 to -6   | 1.5   |
| Cool White | BXPX-56C0520-A-0000 | 11.7                                  | 13.0 | 14.3 | 350                              | -4 to -12  | 1.5   |
|            | BXPX-56C0520-B-0000 | 5.9                                   | 6.5  | 7.1  | 700                              | -2 to -6   | 1.5   |

Notes for Table 4:

1. Parts are tested in pulsed conditions,  $T_j = 25^\circ\text{C}$ . Pulse width is 10 ms at rated test current.
2. Bridgelux maintains a tester tolerance of  $\pm 0.10$  V on forward voltage measurements.

## Absolute Minimum and Maximum Ratings

Table 5: Maximum Current and Reverse Voltage Ratings

| Color      | Base Part Number    | Maximum DC Forward Current (mA) | Maximum Peak Pulsed Current (mA) <sup>[1]</sup> | Maximum Reverse Voltage (Vr) <sup>[2]</sup> |
|------------|---------------------|---------------------------------|---|---|
| Warm White | BXPX-27E0400-A-0000 | 500                             | 700   | -20 V                                       |
|            | BXPX-27E0400-B-0000 | 1000                            | 1400  | -10 V                                       |
|            | BXPX-27G0400-A-0000 | 500                             | 700   | -20 V                                       |
|            | BXPX-27G0400-B-0000 | 1000                            | 1400  | -10 V                                       |
|            | BXPX-30E0400-A-0000 | 500                             | 700   | -20 V                                       |
|            | BXPX-30E0400-B-0000 | 1000                            | 1400  | -10 V                                       |
|            | BXPX-30G0400-A-0000 | 500                             | 700   | -20 V                                       |
|            | BXPX-30G0400-B-0000 | 1000                            | 1400  | -10 V                                       |
| Cool White | BXPX-56C0520-A-0000 | 500                             | 700   | -20 V                                       |
|            | BXPX-56C0520-B-0000 | 1000                            | 1400  | -10 V                                       |

Notes for Table 5:

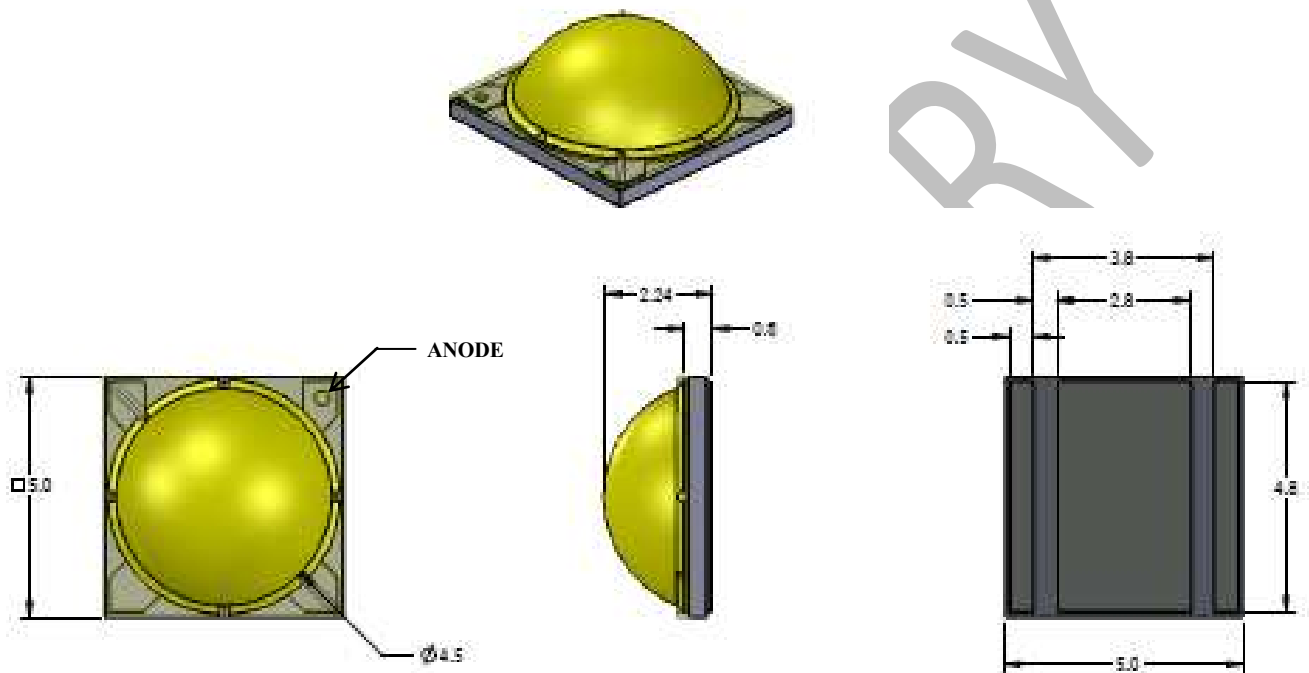
1. Bridgelux recommends a maximum duty cycle of 10% when operating LEDs at the maximum peak pulsed current specified.
2. Light emitting diodes are not designed to be driven in reverse voltage.

Table 6: Maximum Ratings

| Parameter                          | Maximum Rating   |
|------------------------------------|--|
| LED Junction Temperature           | 130°C  |
| Storage Temperature                | -40°C to +135°C  |
| Operating Solder Point Temperature | 105°C at rated test current, 85°C at maximum drive current |
| ESD Classification                 | Class 2 (HBM per JESD22-A114-F)                            |
| Reflow Solderable                  | JEDEC-J-STD-20C  |
| Moisture Sensitivity Rating        | MSL1   |
| Floor Life                         | Unlimited ≤ 30°C / 85% RH                                  |

## Mechanical Dimensions

Figure 1: Mechanical Dimensions for Bridgelux Micro SM4



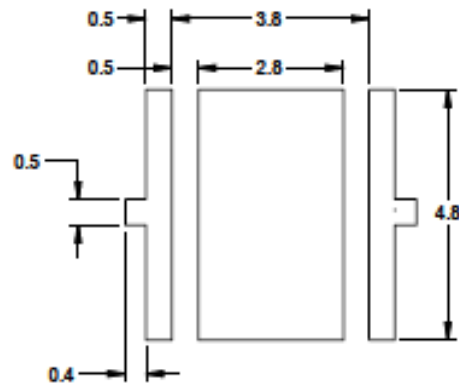
### Notes for Figure 1:

1. Drawings are not to scale.
2. Drawing dimensions are in millimeters.
3. Unless otherwise specified, tolerances are  $\pm 0.20$ mm.
4. Refer to product Application Notes AN21 for product handling and assembly recommendations.
5. The optical center of the LED is defined by the mechanical center of the product.

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## Recommended Solder Pad Dimensions

Figure 2: Recommended Solder Pad Dimensions



### Notes for Figure 2:

1. Drawings are not to scale.
2. Drawing dimensions are in millimeters.
3. Unless otherwise specified, tolerances are  $\pm 0.20\text{mm}$ .
4. Refer to product Application Notes AN21 for product handling and assembly recommendations.

## Reflow Solder Specifications

The Bridgelux Micro SM4 products are compatible with JEDEC J-STD-020C, following the profile and parameters listed below.

Figure 3: Reflow Solder Profile

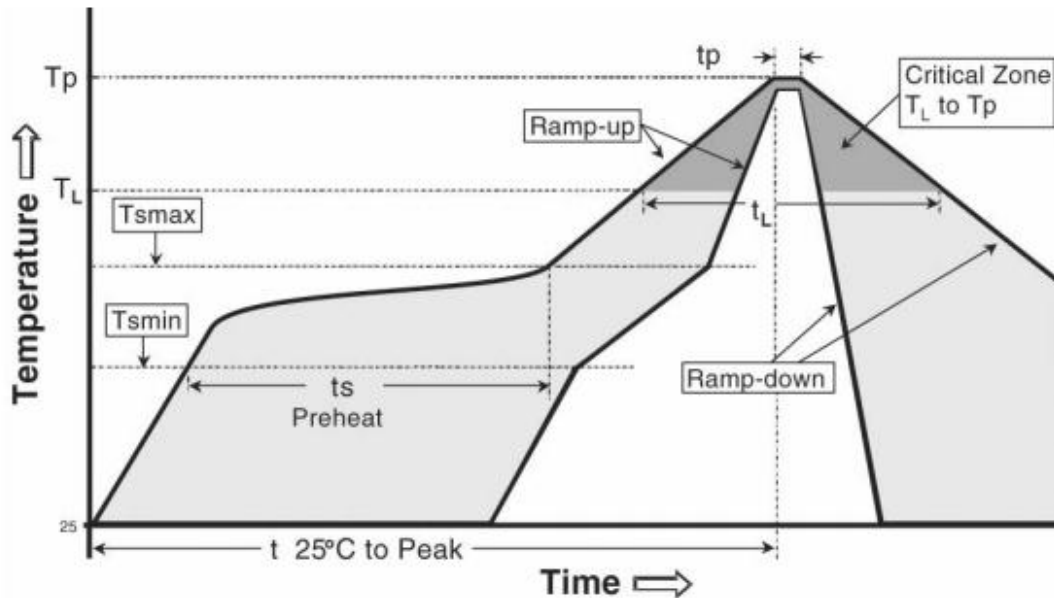


Table 7: Reflow Solder Parameters

| Profile Feature   | Specification Using Lead Free Solder |
|---|--------------------------------------|
| Average Ramp-Up Rate (T <sub>sm</sub> max to T <sub>p</sub> ) | 3°C / second max                     |
| Preheat Temperature Min (T <sub>sm</sub> min)                 | 150°C                                |
| Preheat Temperature Max (T <sub>sm</sub> max)                 | 200°C                                |
| Preheat Time (T <sub>sm</sub> min to T <sub>sm</sub> max)     | 60-180 seconds                       |
| Temperature (T <sub>L</sub> )                                 | 217°C                                |
| Time Maintained Above Temperature (T <sub>L</sub> )           | 60-150 seconds                       |
| Peak/Classification Temperature (T <sub>p</sub> )             | 260°C                                |
| Time Within 5°C of Actual Peak Temperature (t <sub>p</sub> )  | 20-40 seconds                        |
| Ramp Down Rate  | 6°C / second max                     |
| Time 25°C to Peak Temperature                                 | 8 minutes max                        |

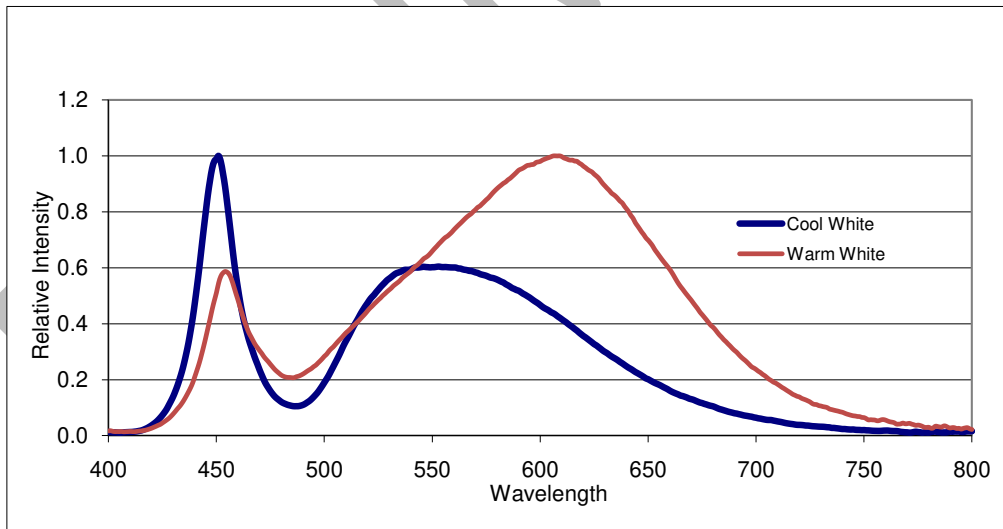
## Typical Radiation Pattern

Figure 4: Typical Far Field Radiation Pattern



## Wavelength Characteristics at Rated Test Current, $T_j=25^\circ\text{C}$

Figure 5: Typical Warm White and Cool White Color Spectrum



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Typical Relative Luminous Flux vs. Current,  $T_j=25^\circ\text{C}$

Figure 6: Typical Light Flux vs. Current  
350mA Devices (BXPX-xxxxxxx-A series products)

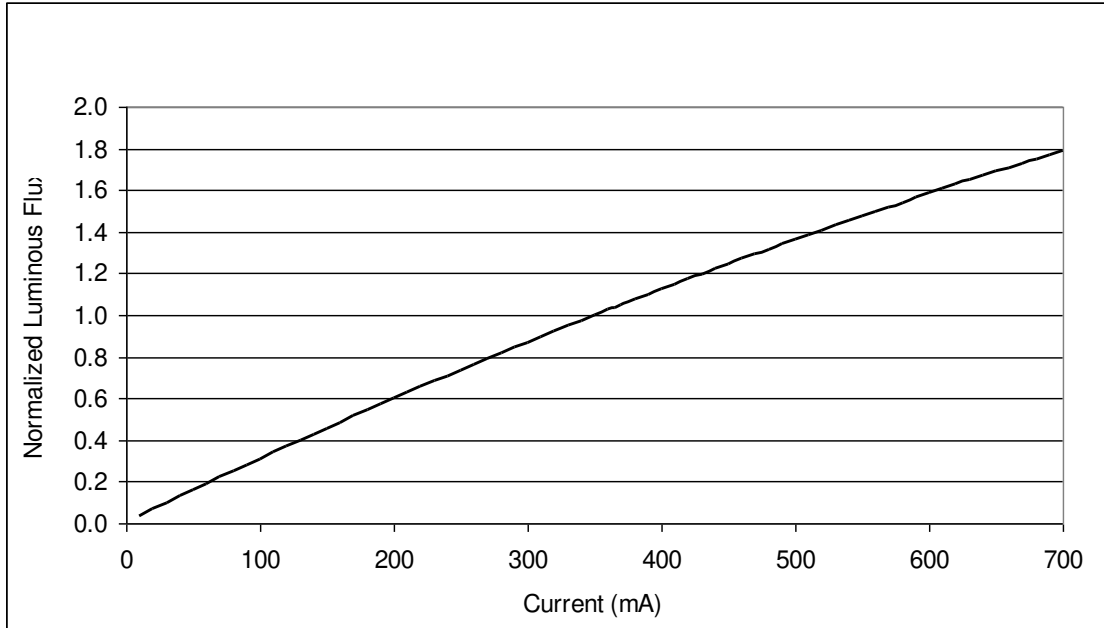
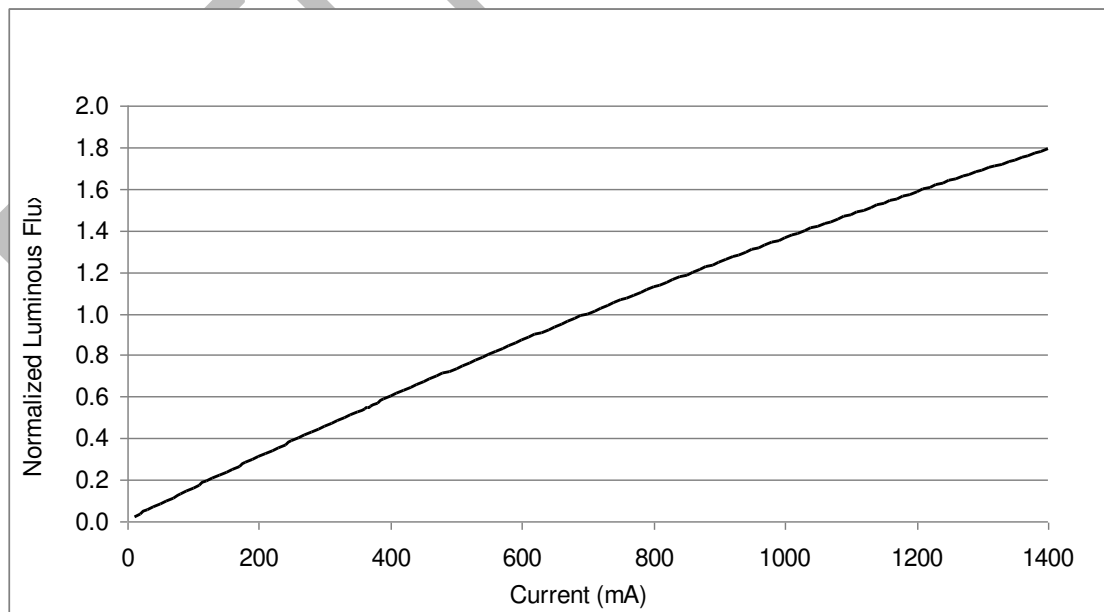
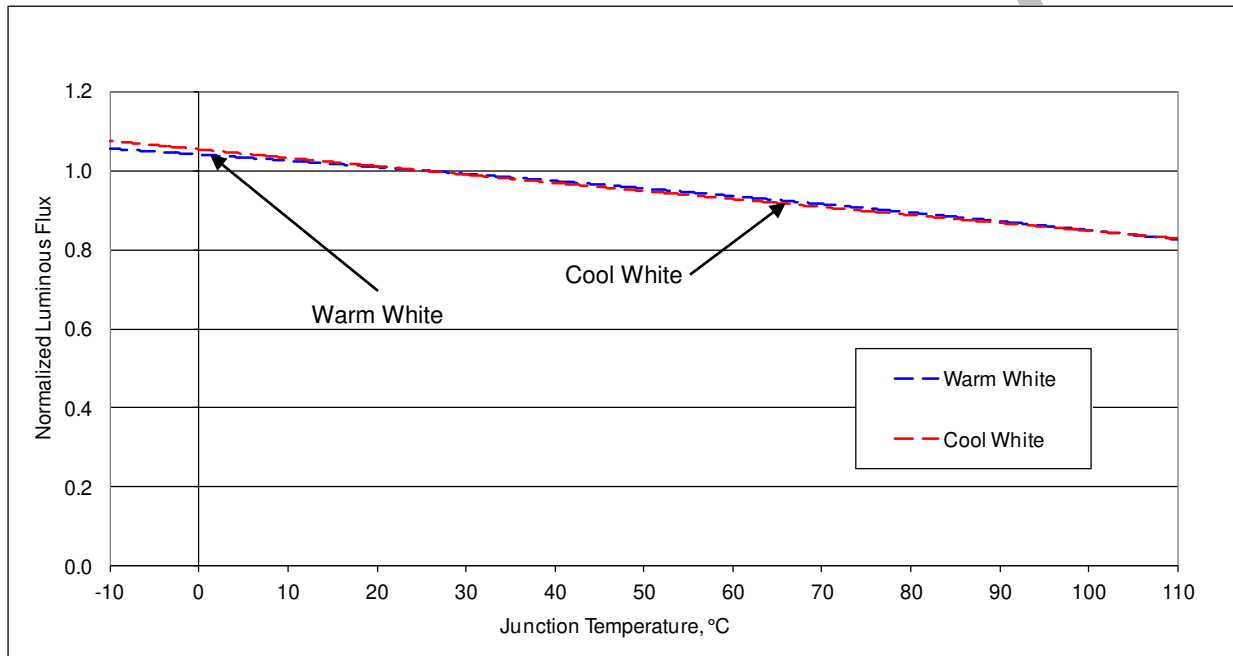


Figure 7: Typical Flux vs. Current  
700mA Devices (BXPX-xxxxxxx-B series products)



## Typical Light Output Characteristics vs. Temperature

Figure 8: Typical Flux vs. Junction Temperature





## Typical Chromaticity Characteristics vs. Temperature

Figure 9: Typical ccx Shift vs. Junction Temperature

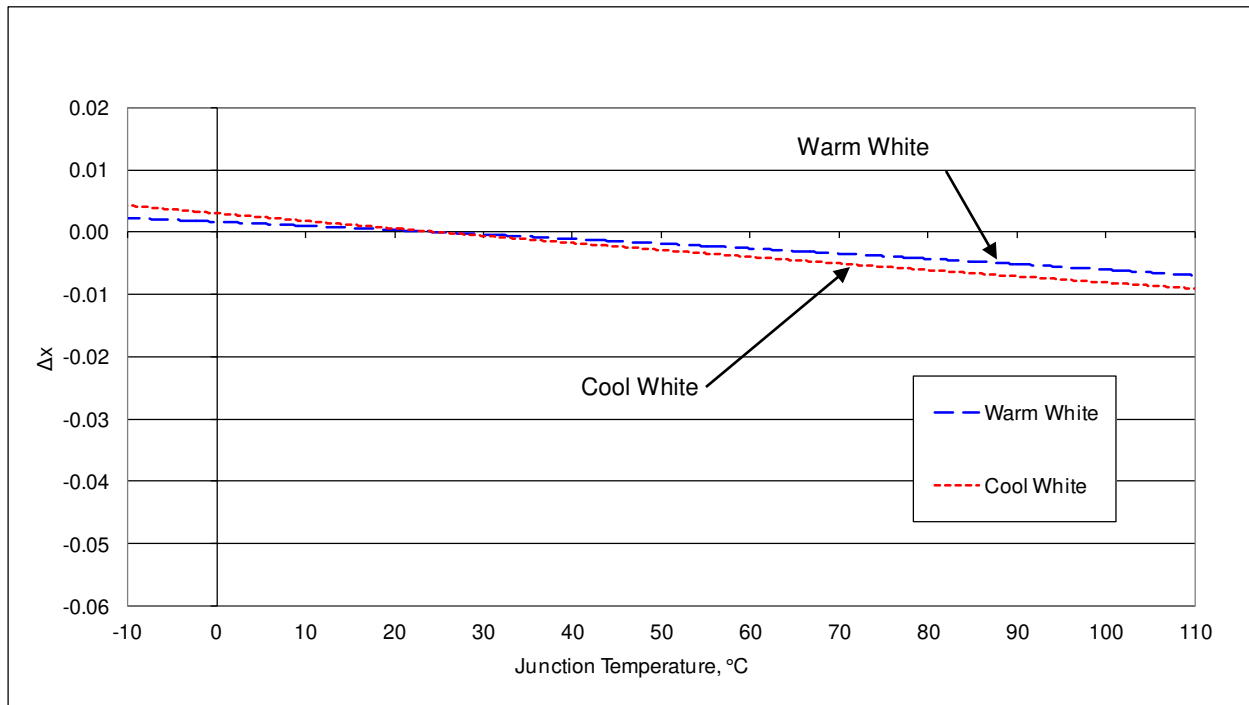
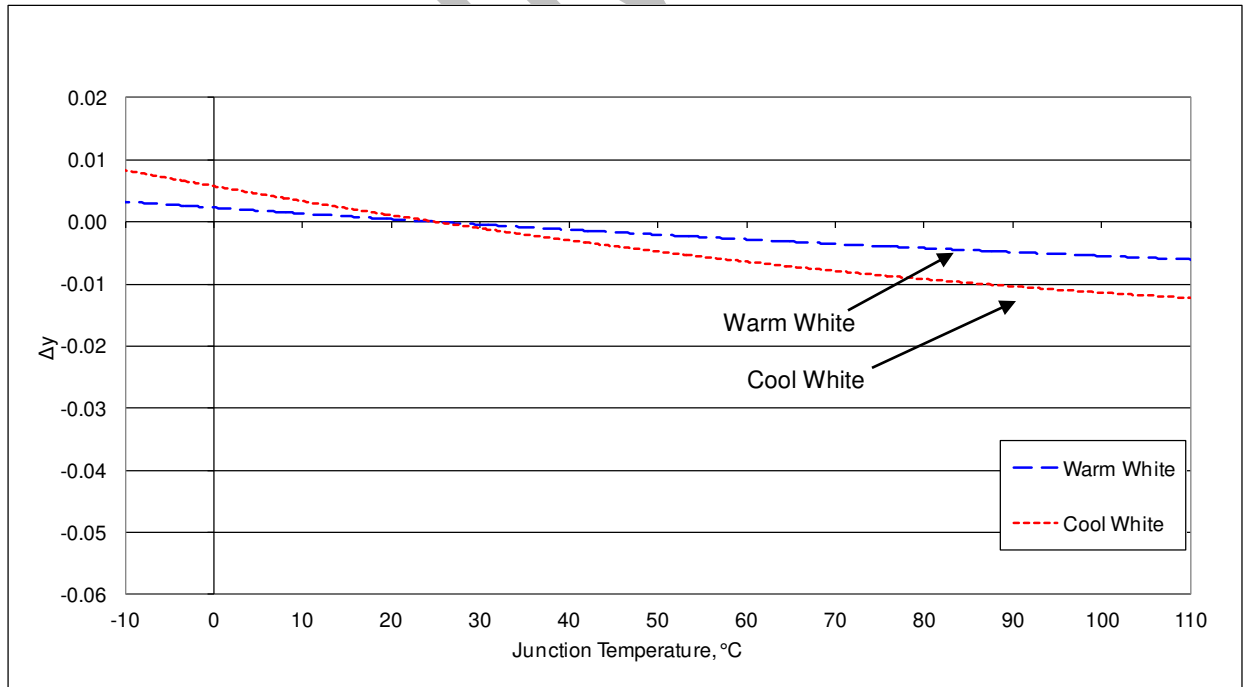


Figure 10: Typical ccy Shift vs. Junction Temperature



## Typical Forward Current Characteristics

Figure 11: Forward Voltage vs. Current  
350mA Devices (BXPX-xxxxxxx-A series products)

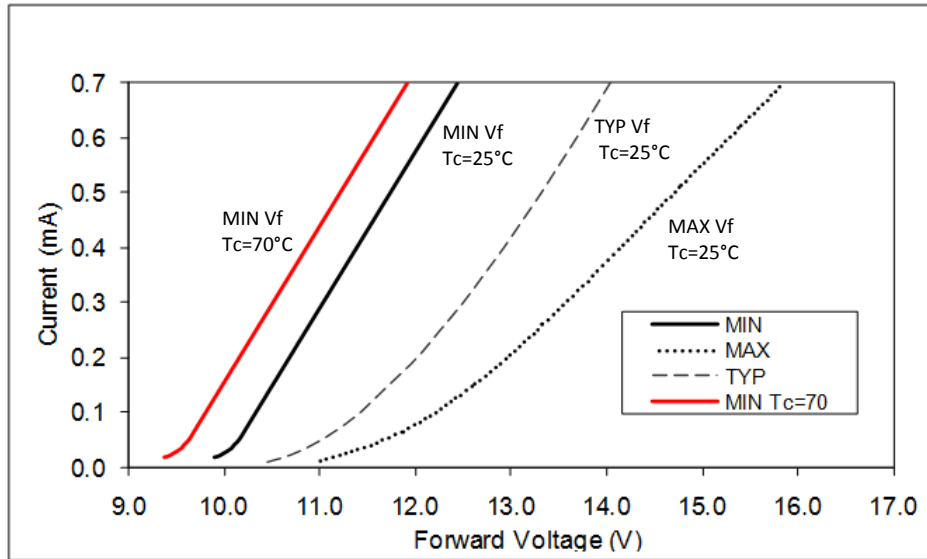
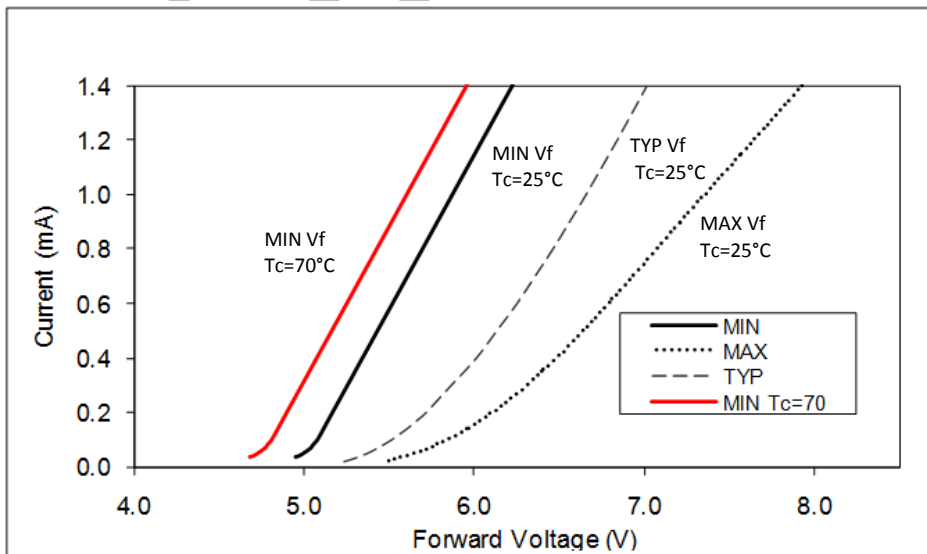


Figure 12: Forward Voltage vs. Current  
700mA Devices (BXPX-xxxxxxx-B series products)



## Color Binning Information

Figure 13: Graph of 2700K Warm White Test Bins in xy Color Space

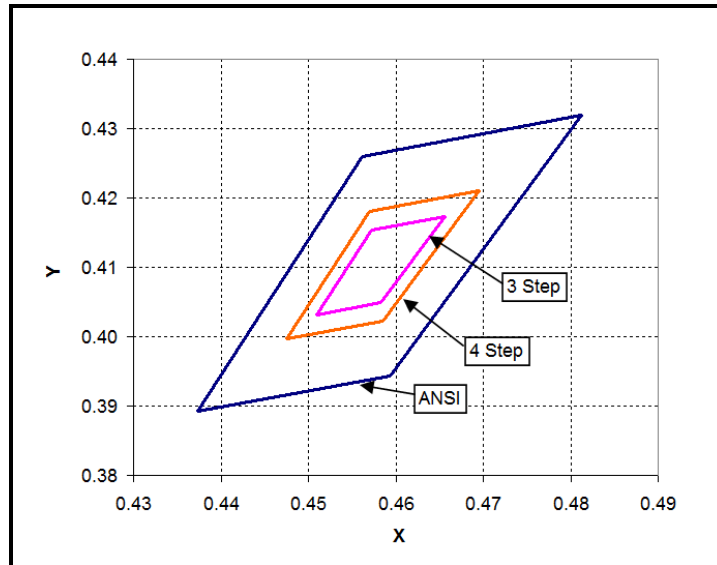
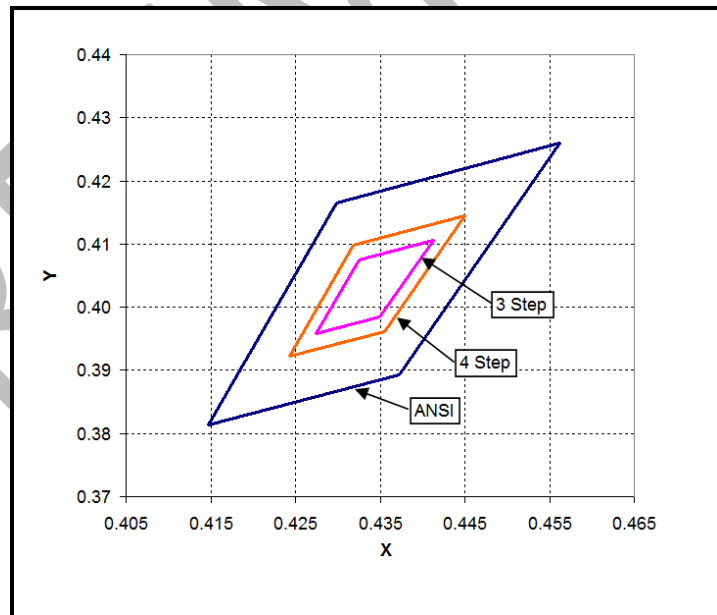


Figure 14: Graph of 3000K Warm White Test Bins in xy Color Space



Color Binning Information (continued)

Figure 15: Graph of 5600K Cool White Test Bins in xy Color Space

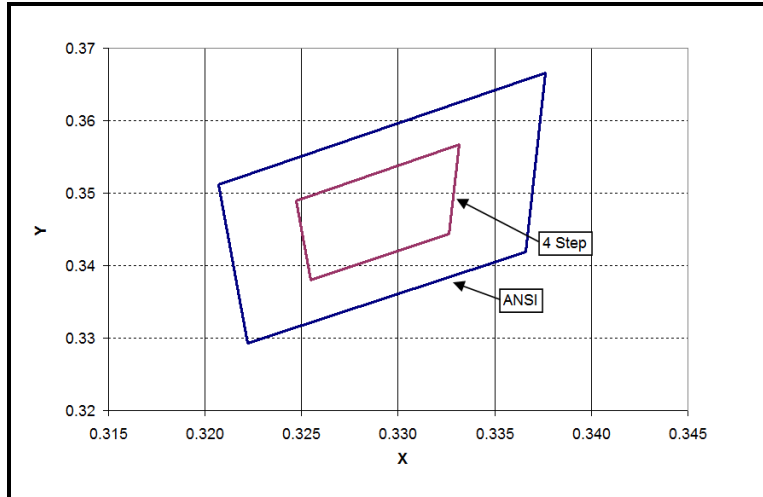


Table 8: ANSI C78.377 Bounding Coordinates

|              | 2700 K |        | 3000 K |        | 5600 K |        |
|--------------|--------|--------|--------|--------|--------|--------|
|              | x      | y      | x      | y      | x      | y      |
| Center point | 0.4578 | 0.4101 | 0.4338 | 0.4030 | 0.3287 | 0.3417 |
| Top Right    | 0.4813 | 0.4319 | 0.4562 | 0.4260 | 0.3376 | 0.3616 |
| Top Left     | 0.4562 | 0.4260 | 0.4299 | 0.4165 | 0.3207 | 0.3462 |
| Bottom Left  | 0.4373 | 0.3893 | 0.4147 | 0.3814 | 0.3222 | 0.3243 |
| Bottom Right | 0.4593 | 0.3944 | 0.4373 | 0.3893 | 0.3366 | 0.3369 |

Table 9: 4 SDCM Bounding Coordinates

|              | 2700 K |        | 3000 K |        | 5600 K |        |
|--------------|--------|--------|--------|--------|--------|--------|
|              | x      | y      | x      | y      | x      | y      |
| Center point | 0.4578 | 0.4101 | 0.4338 | 0.4030 | 0.3287 | 0.3417 |
| Top Right    | 0.4696 | 0.4210 | 0.4450 | 0.4145 | 0.3332 | 0.3517 |
| Top Left     | 0.4570 | 0.4181 | 0.4319 | 0.4098 | 0.3247 | 0.3440 |
| Bottom Left  | 0.4476 | 0.3997 | 0.4243 | 0.3922 | 0.3255 | 0.3330 |
| Bottom Right | 0.4586 | 0.4023 | 0.4356 | 0.3962 | 0.3327 | 0.3393 |

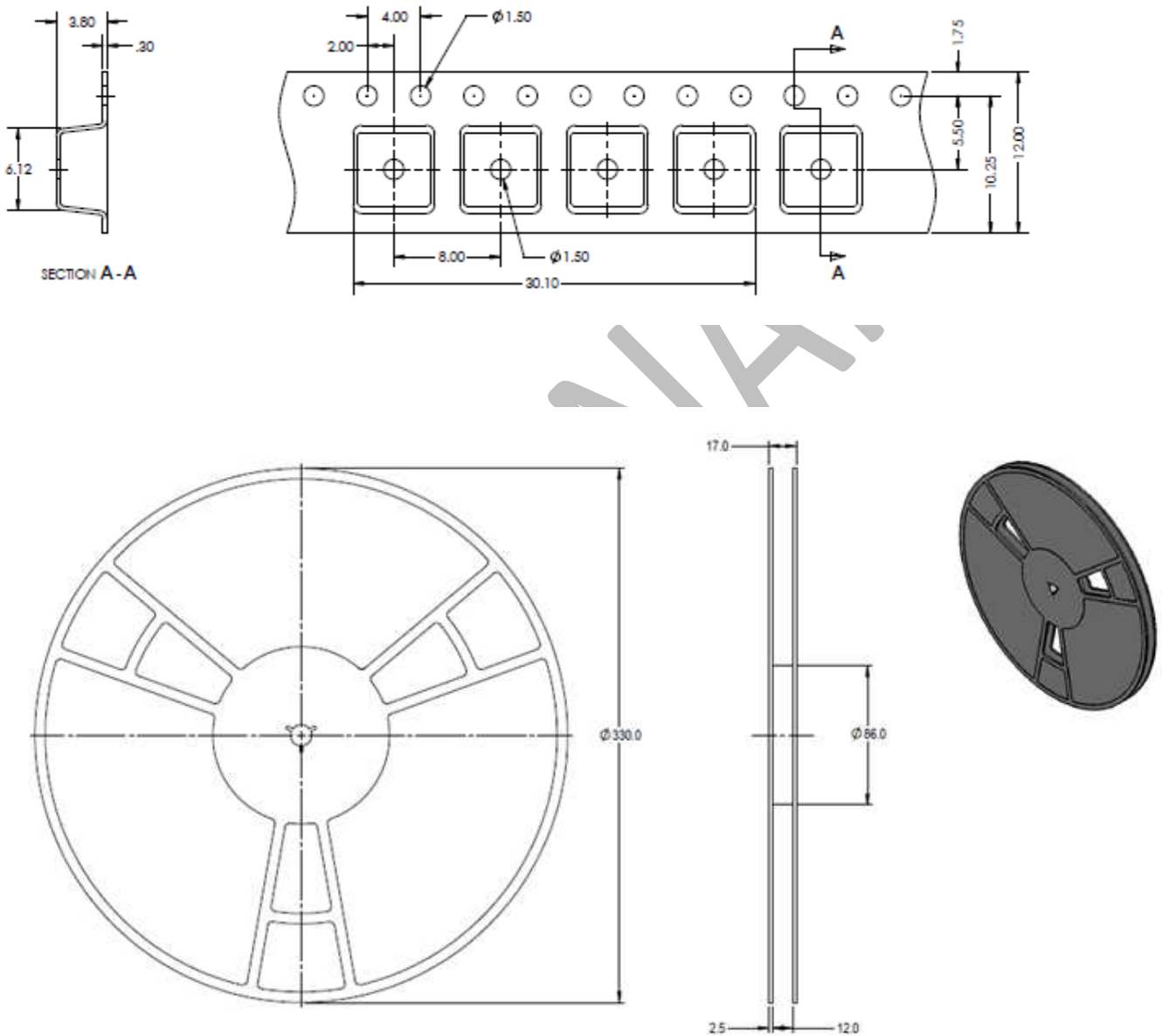
Table 10: 3 SDCM Bounding Coordinates

|              | 2700 K |        | 3000 K |        |
|--------------|--------|--------|--------|--------|
|              | x      | y      | x      | y      |
| Center point | 0.4578 | 0.4101 | 0.4338 | 0.4030 |
| Top Right    | 0.4656 | 0.4174 | 0.4413 | 0.4107 |
| Top Left     | 0.4573 | 0.4154 | 0.4325 | 0.4075 |
| Bottom Left  | 0.4510 | 0.4032 | 0.4274 | 0.3958 |
| Bottom Right | 0.4583 | 0.4049 | 0.4350 | 0.3984 |

PRELIMINARY

## Packaging Drawings

Figure 16: Tape and Reel Dimensions



### Notes for Figure 16:

1. Drawings are not to scale.
2. Drawing dimensions are in millimeters.
3. Unless otherwise specified, tolerances are  $\pm 0.20\text{mm}$ .

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## About Bridgelux

Bridgelux is a leading developer and manufacturer of technologies and solutions transforming the \$40 billion global lighting industry into a \$100 billion market opportunity. Based in Livermore, California, Bridgelux is a pioneer in solid-state lighting (SSL), expanding the market for light-emitting diode (LED) technologies by driving down the cost of LED lighting systems. Bridgelux's patented light source technology replaces traditional technologies (such as incandescent, halogen, fluorescent and high intensity discharge lighting) with integrated, solid-state lighting solutions that enable lamp and luminaire manufacturers to provide high performance and energy-efficient white light for the rapidly growing interior and exterior lighting markets, including street lights, commercial lighting and consumer applications. With more than 500 patent applications filed or granted worldwide, Bridgelux is the only vertically integrated LED manufacturer and developer of solid-state light sources that designs its solutions specifically for the lighting industry.

For more information about the company, please visit [www.bridgelux.com](http://www.bridgelux.com)

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