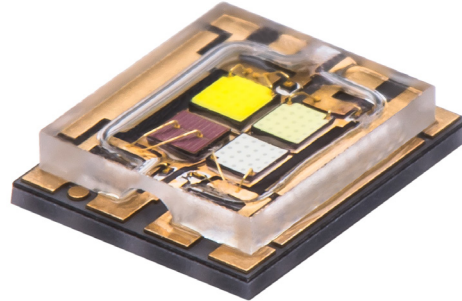


# SBM-40-LC



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## Features:

- High optical output at 1A:
  - up to 133 Red lumens
  - up to 281 Green lumens
  - up to 1474 Blue mWatts
  - up to 295 White lumens
- High thermal conductivity package
- Four chips with emitting area of 1 mm<sup>2</sup> each
- Environmentally friendly: RoHS compliant
- Variable drive currents: 0.1A to 1.0A
- Available in RGBW combination

## Applications:

- Entertainment /Stage Lighting
- Architectural Ligthing
- Spot Lighting
- Pool and Fountain Lighting
- Medical Lighting
- Fiber-coupled Illumination
- Machine Vision

## Technology Overview

Luminus LEDs benefit from a suite of innovations in the fields of chip technology, packaging and thermal management. These breakthroughs allow illumination engineers and designers to achieve solutions that are high brightness and high efficiency.

### Packaging Technology

Thermal management is critical in high power LED applications. With a thermal resistance from junction to case of 0.8° C/W (electrical), Luminus SBM-40-LC LEDs have industry-leading thermal resistance. This allows the LED to be driven at higher current while maintaining a low junction temperature, thereby resulting in brighter solutions and longer lifetimes.

### Reliability

Designed from the ground up, Luminus LEDs are one of the most reliable light sources in the world today. Luminus LEDs have passed a rigorous suite of environmental and mechanical stress tests, including mechanical shock, vibration, temperature cycling and humidity, and have been fully qualified for use in extreme high power and high current applications. With very low failure rates and median lifetimes that typically exceed 60,000 hours, Luminus LEDs are ready for even the most demanding applications.

### Environmental Benefits

Luminus LEDs help reduce power consumption and the amount of hazardous waste entering the environment. All LED products manufactured by Luminus are RoHS compliant and free of hazardous materials, including lead and mercury.

## Understanding Luminus LED Test Specifications

Every Luminus LED is fully tested to ensure that it meets the high quality standards expected from Luminus' products.

### Testing Temperature

Luminus surface mount LEDs are typically tested with a 20 ms input pulse and a junction temperature of 25°C. Expected flux values in real world operation can be extrapolated based on the information contained within this product data sheet.

This method of measurement ensures that Luminus LEDs perform in the field just as they are specified.

### Multiple Operating Points

The tables on the following pages provide typical optical and electrical characteristics. Since the LEDs can be operated over a wide range of drive conditions (currents from 0.1 A to 1.0A, and duty cycle from <1% to 100%), multiple drive conditions are listed.

### SBM-40-LC Red, Green, Blue and White Binning Structure<sup>1,2,3</sup>

All SBM-40-LC LEDs are tested at 0.7A at  $T_{\text{ambient}} = 25^{\circ}\text{C}$  for luminous flux, radiometric flux and dominant wavelength and placed into one of the following wavelength and flux bins. The binning structure is universally applied across each color of the SBM-40-LC product line.

| Color | Min... Max<br>Luminous Flux (lm)<br>@ 0.7 A | Min...Max<br>Radiometric Flux<br>(mW) @ 0.7A | Min... Max<br>Luminous Flux (lm)<br>@ 1 A<br>(Correlated Values) | Min...Max<br>Radiometric Flux<br>(mW) @ 1 A<br>(Correlated Values) |
|-------|---------------------------------------------|----------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------|
| Red   | 45 ... 90                                   |                                              | 60 ... 133                                                       |                                                                    |
| Green | 112 ... 224                                 |                                              | 140 ... 281                                                      |                                                                    |
| Blue  |                                             | 630 ... 1100                                 |                                                                  | 844 ... 1474                                                       |
| White | 140 ... 224                                 |                                              | 184 ... 295                                                      |                                                                    |

### Red, Green and Blue Dominant Wavelength Bins<sup>3</sup>

| Color | Wavelength Bin (FF) | Minumum Wavelength<br>(nm) @ 0.7A | Maximum Wavelength<br>(nm) @ 0.7A |
|-------|---------------------|-----------------------------------|-----------------------------------|
| Red   | RW                  | 620                               | 625                               |
| Green | GW                  | 524                               | 529                               |
| Blue  | BW                  | 452                               | 457                               |

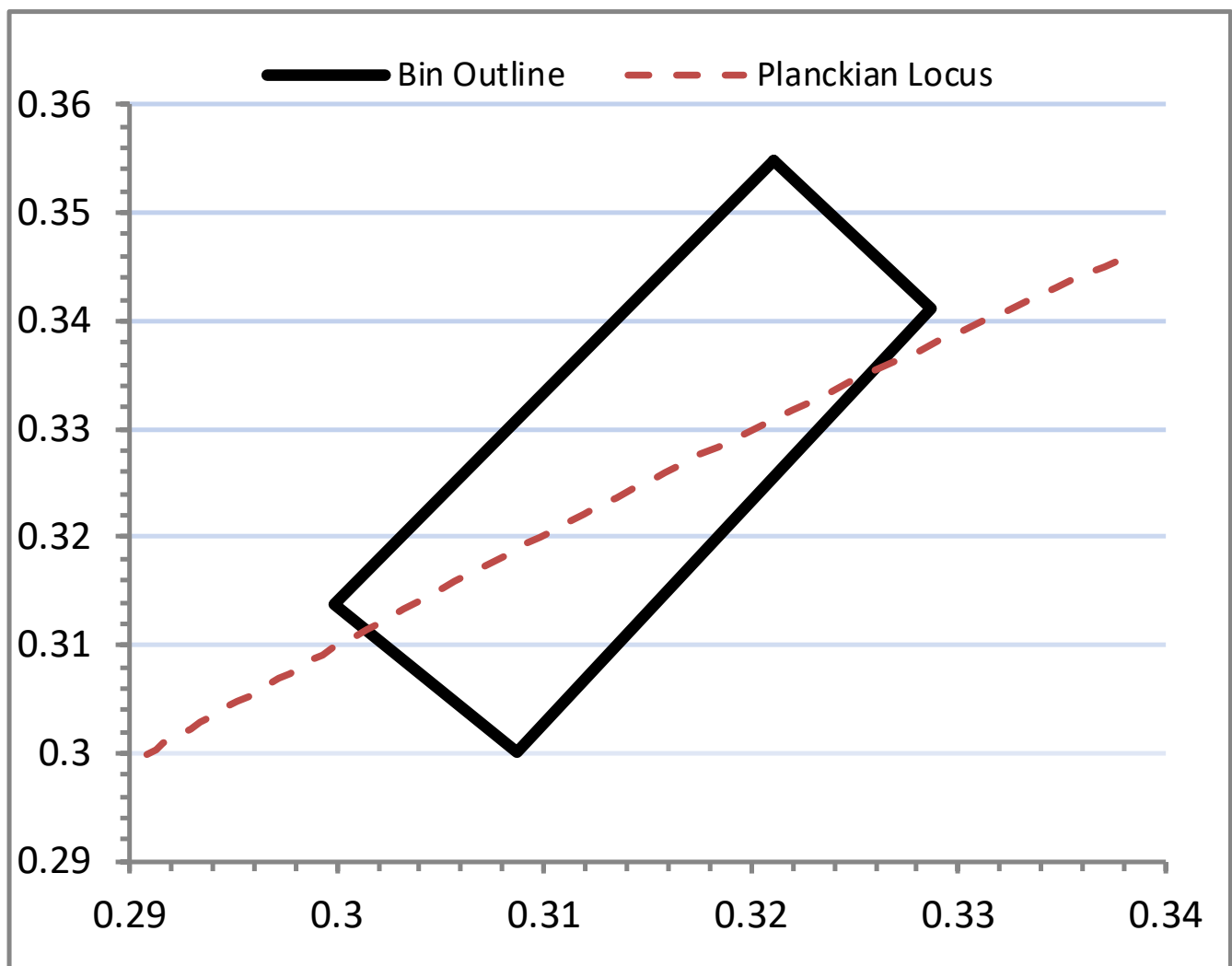
Note 1: Luminus maintains a +/- 6% tolerance on flux measurements.

Note 2: Contact Luminus sales team for specific bin requirements.

Note 3: Devices are binned at standard 0.7A, 20ms pulse,  $T_{\text{ambient}} = 25^{\circ}\text{C}$  condition.

**SBM-40-LC White Chromaticity Coordinates**

| Chromaticity Coordinates |        |        |
|--------------------------|--------|--------|
| Bin Code (WW)            | CIEx   | CIEy   |
| 1A                       | 0.3211 | 0.3548 |
|                          | 0.3287 | 0.3411 |
|                          | 0.3087 | 0.3002 |
|                          | 0.2999 | 0.3137 |



## Part Number Nomenclature

**SBM** — **40** — **RGBW** — **LC41** — **<abnnn>**

| Product Family                                          | LED Emission Area                     | Color                                                       | Package Configuration                       | Bin kit                                                                 |
|---------------------------------------------------------|---------------------------------------|-------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------|
| SBM: Multi-Chip Surface mount device, Protective window | 40: 4 dies - each 1.0 mm <sup>2</sup> | <Y>: Color<br>R = Red<br>G = Green<br>B = Blue<br>W = White | LC41: Surface mount, shipped in tape & reel | Flux and Chromaticity bin kit code - See available ordering codes below |

## SBM-40-LC Bin Kit Ordering Nomenclature and Ordering Part Number

All SBM-40-LC RGBW products are sold in sets of flux and chromaticity bins called bin kits. Each bin kit specifies a minimum flux bin and a specific selection of chromaticity bins. The ordering part number designation is as follows:

| Bin Kit | RGB Wavelength |    |    | RGB Flux          | White Chromaticity | White Flux        | Ordering Part Number   |
|---------|----------------|----|----|-------------------|--------------------|-------------------|------------------------|
|         | RW             | GW | BW |                   |                    |                   |                        |
| QC100   | ✓              | ✓  | ✓  | Full Distribution | 1A                 | Full Distribution | SBM-40-RGBW-LC41-QC100 |

For other bin kits, please contact a Luminus representative.

### Example:

The ordering part number SBM-40-RGBW-LC41-QC100 refers to bin kit which consists of a RGBW, SBM-40-LC emitter, with Red Flux > 45 lm and Red DWL range of 620nm-625 nm; Green flux > 112 lm and Green DWL range of 524nm to 529nm; Blue power > 630 mW and Blue DWL range of 452nm to 457nm; White flux >140 lm and chromaticity values within the boxes defined by the four points (0.3211, 0.3548), (0.3287, 0.3411), (0.3087, 0.3002), (0.2999, 0.3137) measured at drive current =0.7A.

## Product Shipping & Labeling Information

All SBM-40-LC products are packaged and labeled with their respective bin as outlined in the tables on pages 3 & 4. When shipped, each reel will only contain one bin. The part number designation is as follows:

**SBM** — **40** — **RGBW** — **LC41** — **QC<XXX>**

| Product Family                       | Chip Area           | Color                                     | Package Configuration | Bin Kit Identifier |
|--------------------------------------|---------------------|-------------------------------------------|-----------------------|--------------------|
| Surface Mount<br>(monolithic window) | 4.0 mm <sup>2</sup> | R: Red<br>G: Green<br>B: Blue<br>W: White | Internal Code         | QCXXX              |

Note: the SBM-40-RGBW-LC41-QCXXX replaces the SBM-40-RGBW-P41-QCXXX. The LC version implements a more robust window design resulting in increased quality.

## Optical & Electrical Characteristics <sup>1,2</sup>

| Parameter                                             | Symbol                 | Red      | Green    | Blue     | White    | Unit            |
|-------------------------------------------------------|------------------------|----------|----------|----------|----------|-----------------|
| Drive Condition <sup>3</sup>                          | I                      | 0.7      | 0.7      | 0.7      | 0.7      | A               |
| Emitting Area                                         | -                      | 1.0      | 1.0      | 1.0      | 1.0      | mm <sup>2</sup> |
| Dominant Wavelength                                   | $\lambda_{d\ min}$     | 620      | 524      | 452      | -        | nm              |
|                                                       | $\lambda_{d\ typ}$     | 622      | 527      | 455      | -        | nm              |
|                                                       | $\lambda_{d\ max}$     | 625      | 529      | 457      | -        | nm              |
| FWHM (typ.)                                           | $\Delta\lambda_{1/2}$  | 17       | 32       | 21       | N/A      | nm              |
| Chromaticity Coordinates <sup>4</sup> (typ.)          | x                      |          |          |          | 0.31     | -               |
|                                                       | y                      |          |          |          | 0.32     | -               |
| Forward Voltage                                       | $V_{F\ min}$           | 2.0      | 2.8      | 2.8      | 2.8      | V               |
|                                                       | $V_{F\ typ}$           | 2.3      | 3.2      | 3.2      | 3.2      | V               |
|                                                       | $V_{F\ max}$           | 3.0      | 3.6      | 3.6      | 3.6      | V               |
| Minimum Current <sup>5</sup>                          | -                      | 0.1      | 0.1      | 0.1      | 0.1      | A               |
| Maximum Current <sup>5</sup>                          | -                      | 1.0      | 1.0      | 1.0      | 1.0      | A               |
| Maximum Operating Junction Temperature <sup>5,6</sup> | $T_{j\ operating,max}$ | 100      | 140      | 130      | 130      | °C              |
| Absolute Maximum Junction Temperature <sup>5,6</sup>  | $T_{j\ absolute\ max}$ | 115      | 150      | 150      | 150      | °C              |
| Storage Temperature Range                             | -                      | -40/+100 | -40/+100 | -40/+100 | -40/+100 | °C              |

Note 1: All ratings are based on test conditions of  $I_f = 700\text{ mA}$ ,  $T_c = 25^\circ\text{C}$ , 20 millisecond pulse.  $T_{case}$  is defined on Thermal Resistance section, page 12.

Note 2: Unless otherwise noted, values listed are typical. Devices are production tested and specified at 0.7 A for red, green, blue and white. Values provided at 1 A based on characterization and measurements at 1 A.

Note 3: SBM-40-LC RGBW devices can be driven at currents ranging from 0.1 A to 1 A depending on color and at duty cycles ranging from 1% to 100%. Drive current and duty cycle should be adjusted as necessary to maintain the junction temperature desired to meet application lifetime requirements.

Note 4: In CIE 1931 chromaticity diagram coordinates, normalized to  $x+y+z=1$ .

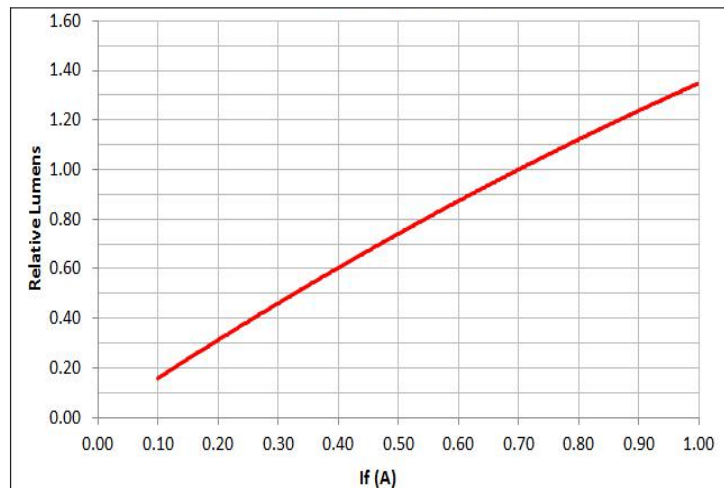
Note 5: SBM-40-LC RGBW devices are designed for continuous operation to a maximum current as specified above. Product lifetime data is specified at recommended forward drive currents. Sustained operation at or beyond maximum currents will result in a reduction of device lifetime compared to recommended forward drive currents. Actual device lifetimes will also depend on junction temperature. Refer to the lifetime derating curves for further information.

Note 6: Maximum Operating Junction Temperature and Absolute Maximum Junction Temperature assume that with all four (RGBW) LEDs operating simultaneously at 1 A.

## Optical & Electrical Characteristics<sup>7</sup>

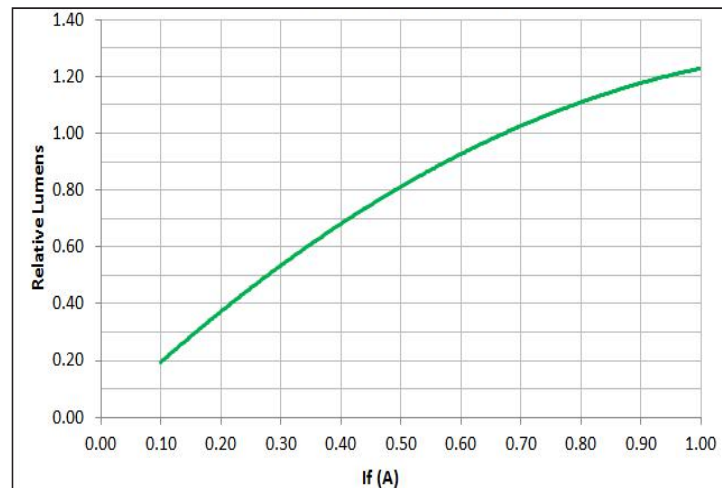
### Relative Luminous Flux - Red

Relative Luminous Flux vs. If  
 $\phi_v/\phi_v(0.7A)$  Single Pulse 20ms  $T_j = 25^\circ$



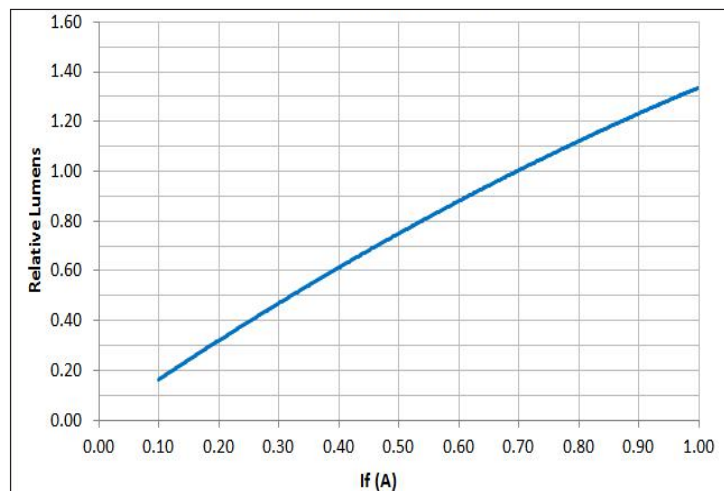
### Relative Luminous Flux - Green

Relative Luminous Flux vs. If  
 $\phi_v/\phi_v(0.7A)$  Single Pulse 20ms  $T_j = 25^\circ$



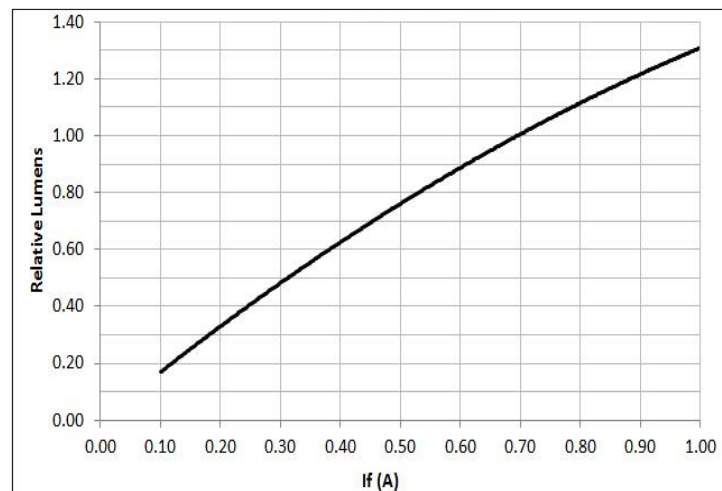
### Relative Luminous Flux - Blue

Relative Luminous Flux vs. If  
 $\phi_v/\phi_v(0.7A)$  Single Pulse 20ms  $T_j = 25^\circ$



### Relative Luminous Flux - White

Relative Luminous Flux vs. If  
 $\phi_v/\phi_v(0.7A)$  Single Pulse 20ms  $T_j = 25^\circ$

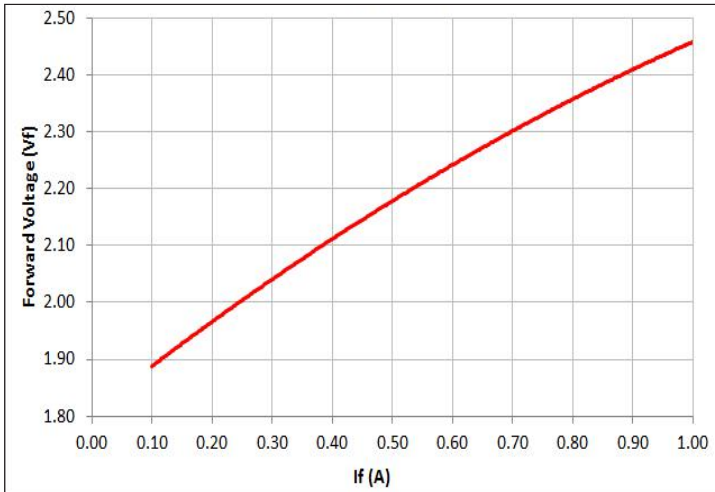


Note 7: Flux and power values are measured using a current pulse of typical 20 ms. Luminus maintains a test measurement accuracy for LED flux and power of  $\pm 6\%$ .

## Optical & Electrical Characteristics

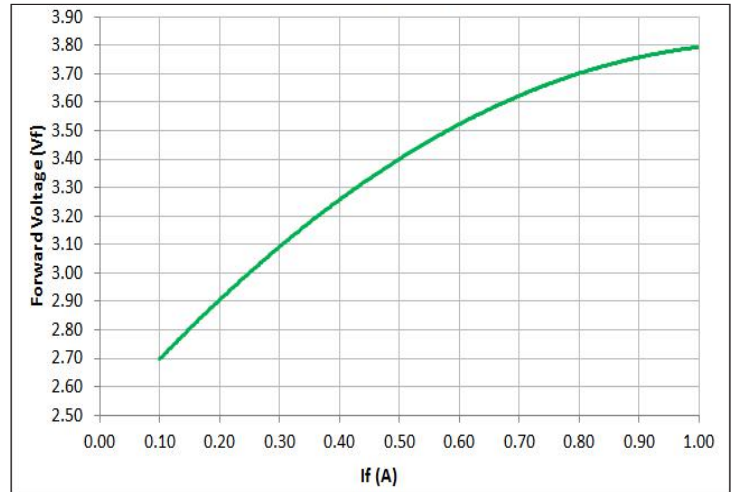
### Voltage as function of Forward Current - Red

Vf vs. If  
Vf(If) Single Pulse 20ms Tj = 25°



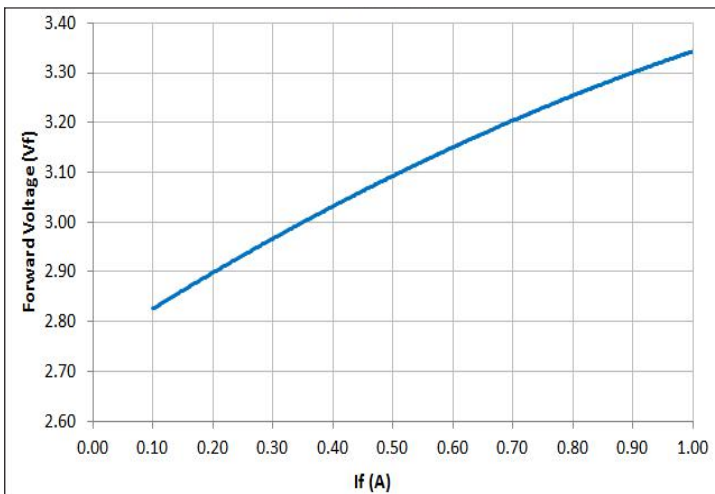
### Voltage as function of Forward Current - Green

Vf vs. If  
Vf(If) Single Pulse 20ms Tj = 25°



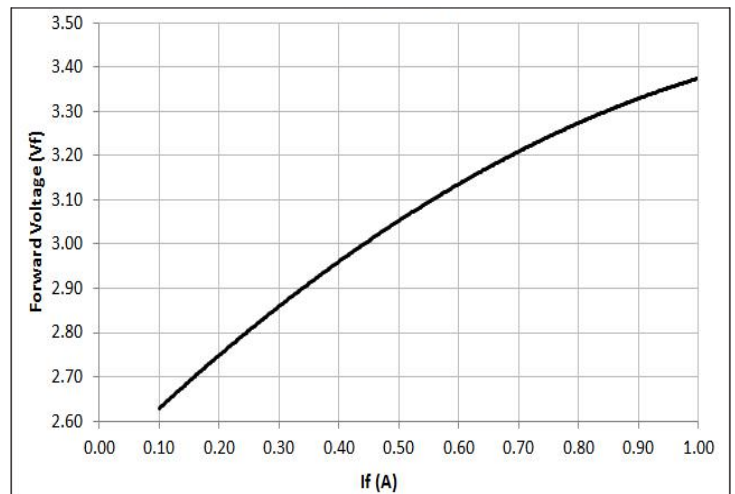
### Voltage as function of Forward Current - Blue

Vf vs. If  
Vf(If) Single Pulse 20ms Tj = 25°



### Voltage as function of Forward Current - White

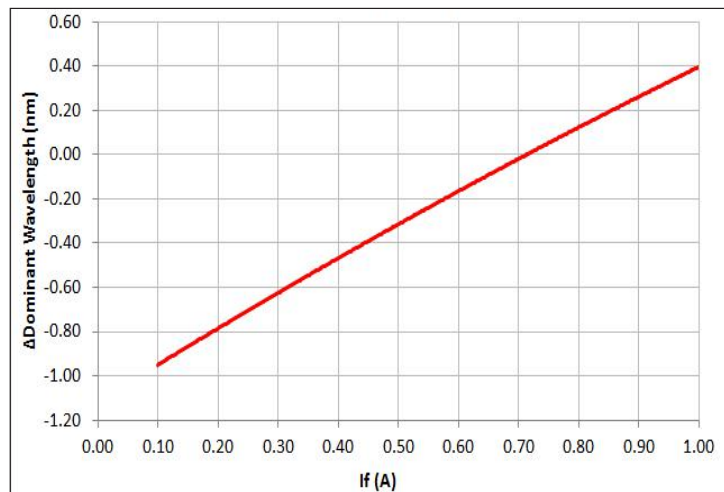
Vf vs. If  
Vf(If) Single Pulse 20ms Tj = 25°



## Optical & Electrical Characteristics

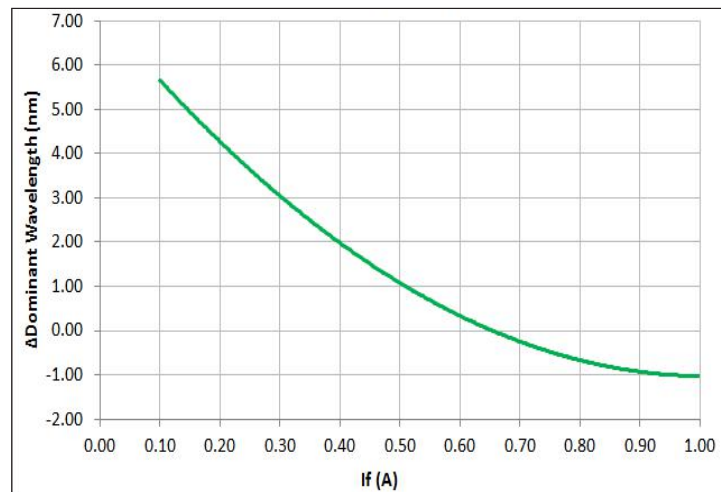
### Wavelength change as function of Current - Red

$\Delta$  Dominant Wavelength ( $\lambda_d$ )  
Red  $T_j=25^\circ$



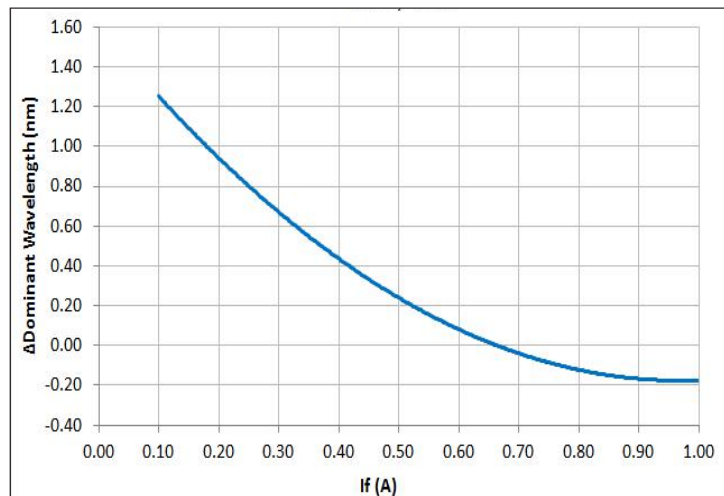
### Wavelength change as function of Current - Green

$\Delta$  Dominant Wavelength ( $\lambda_d$ )  
Green  $T_j=25^\circ$



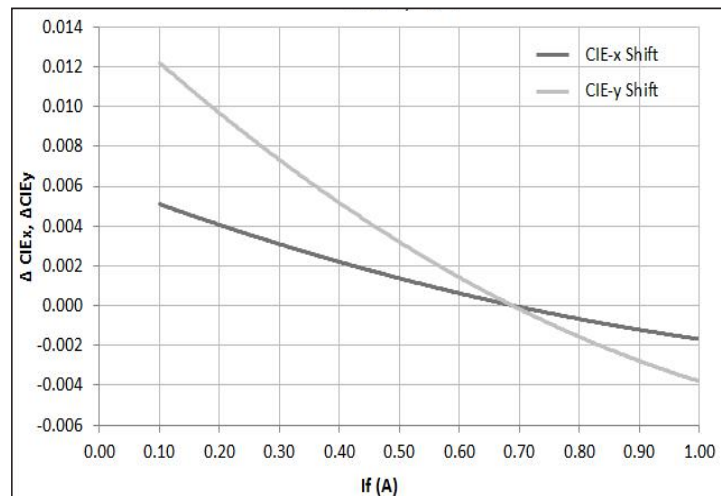
### Wavelength change as function of Current - Blue

$\Delta$  Dominant Wavelength ( $\lambda_d$ )  
Blue  $T_j=25^\circ$



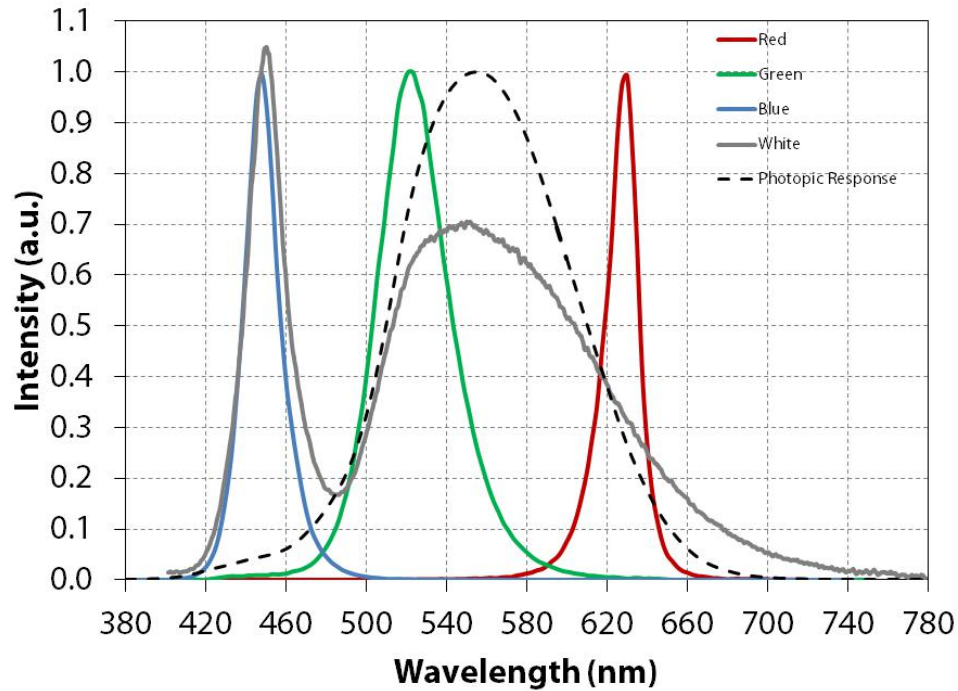
### CIE<sub>x,y</sub> change as function of Current - White

Chromaticity Shift vs. If  
 $\Delta CIE_{x,y} = CIE_{x,y}(If) - CIE_{x,y}(1A)$ , Single Pulse 20ms  $T_j = 25^\circ C$

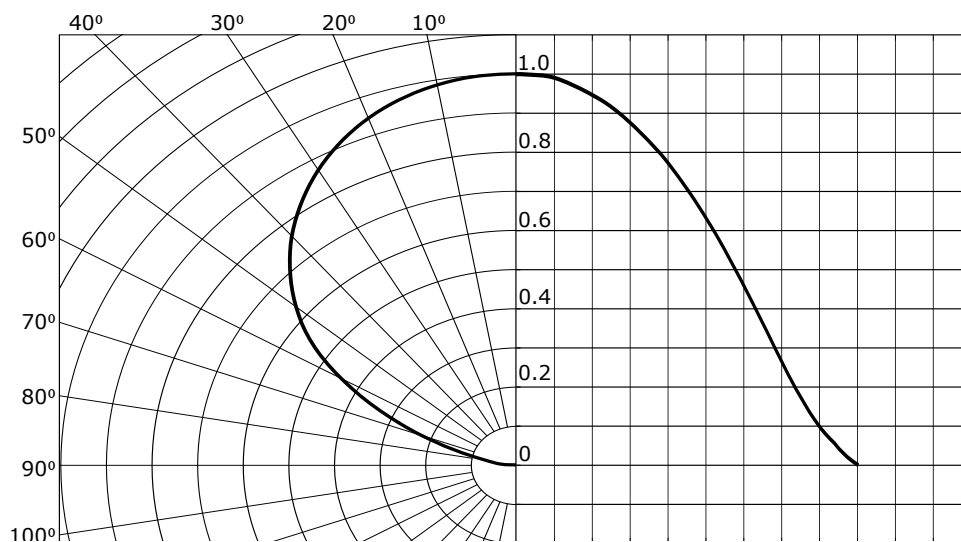


## Optical & Electrical Characteristics

**SBM-40-LC -RGBW Spectrum<sup>8</sup>**

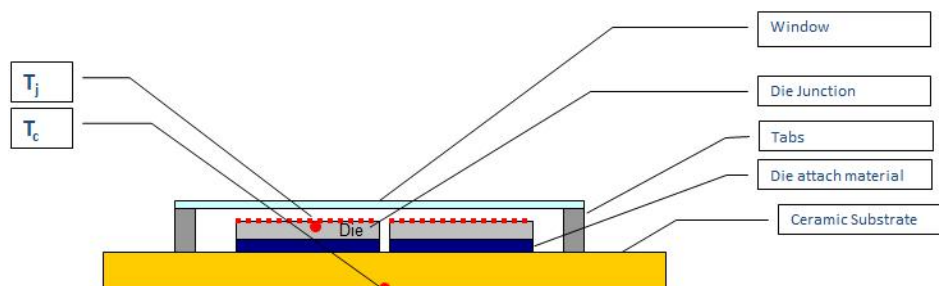


**SBM-40-LC -RGBW Angular Distribution**



Note 8: Typical spectrum from Red, Green, Blue and White LEDs at reference current of 0.7 A, CW. Please contact Luminus to obtain data in Excel format.

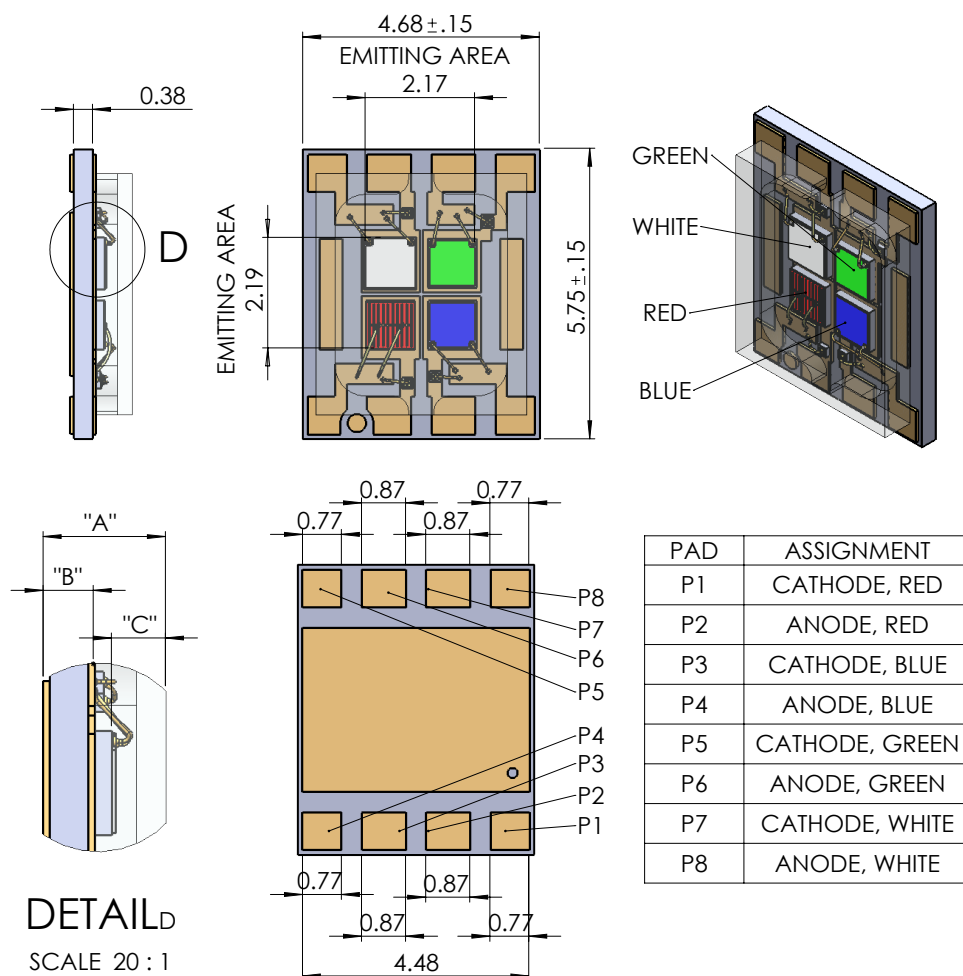
## SBM-40-LC Thermal Resistance



Thermal resistance junction to case,  $R_{th(j-c)_{real}} = 1.0 \text{ }^{\circ}\text{C/W (typ.)}$ , (All chips operated simultaneously)  
 Thermal resistance junction to case,  $R_{th(j-c)_{electrical}} = 0.8 \text{ }^{\circ}\text{C/W (typ.)}$  (All chips operated simultaneously)

Case Temperature ( $T_c$ ) = Temperature at bottom of ceramic substrate.

## Mechanical Dimensions – SBM-40-LC Emitter

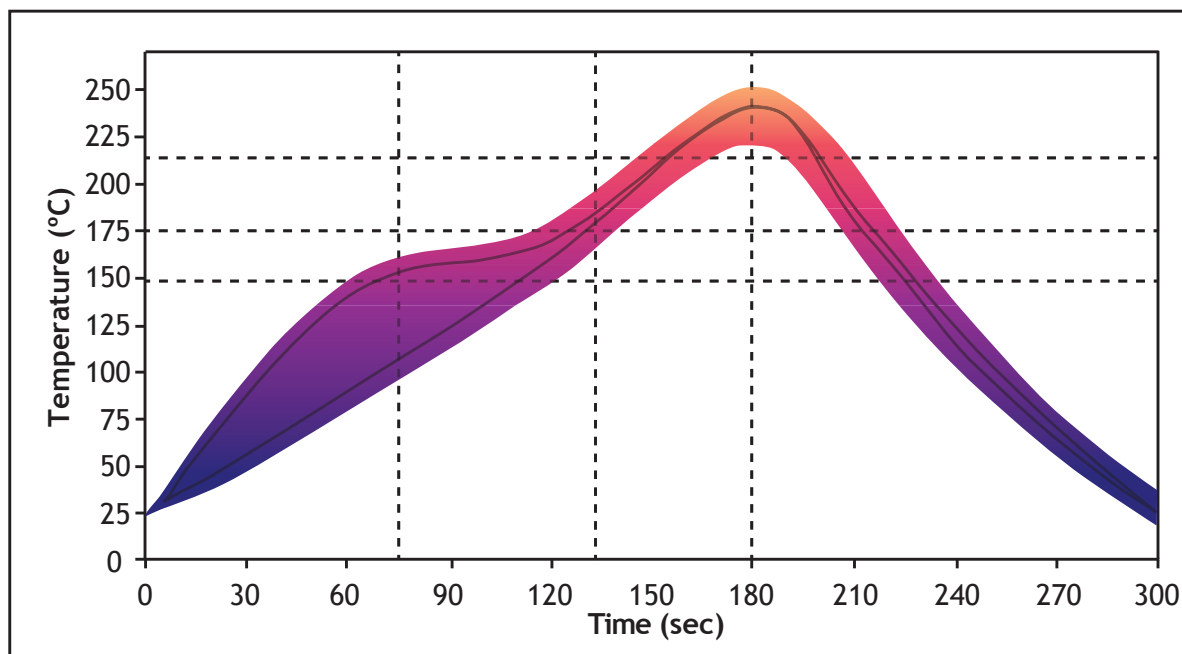


| DIMENSION NAME | DESCRIPTION                                | NOMINAL DIMENSION | TOLERANCE |
|----------------|--------------------------------------------|-------------------|-----------|
| "A"            | BOTTOM OF SUBSTRATE TO TOP OF WINDOW       | 1.21              | ±.10      |
| "B"            | BOTTOM OF SUBSTRATE TO TOP OF COPPER TRACE | 0.52              | ±.05      |
| "C"            | TOP OF DIE EMITTING AREA TO TOP OF WINDOW  | 0.48              | ±.07      |

For prototyping purposes, please see Bergquist thermal clad boards, part #803807 (square board) or part # 803808 (star board). Available from Digi-Key or Mouser.

## Solder Profile

**SAC 305 Reflow Profile Window For Low Density Boards**



| Solder Profile Stage                            | Lead-Free Solder | Lead-based Solder |
|-------------------------------------------------|------------------|-------------------|
| Rate of Rise                                    | 2°C/sec max      | 2°C/sec max       |
| Preheat Min Temp ( $T_{i,min}$ )                | 100°C            | 120°C             |
| Preheat Max Temp ( $T_{i,max}$ )                | 175°C            | 130°C             |
| Preheat Time ( $T_{i,min}$ to $T_{i,max}$ )     | 90 seconds       | 120 seconds       |
| Liquidus Min Temp ( $T_L$ )                     | 185°C            | 160°C             |
| Liquidus to Liquidus Time ( $T_L$ to $T_{L2}$ ) | 30-60 seconds    | 30 seconds        |
| Liquidus Peak Temp ( $T_p$ )                    | 240°C max        | 220°C max         |
| Cooldown                                        | ≤ 4°C/sec        | ≤ 6°C/sec         |
| Profile Length (Ambient to Peak)                | 4 min            | 3.5 - 4 min       |

Note 9: Temperatures are taken and monitored at the component copper layer.

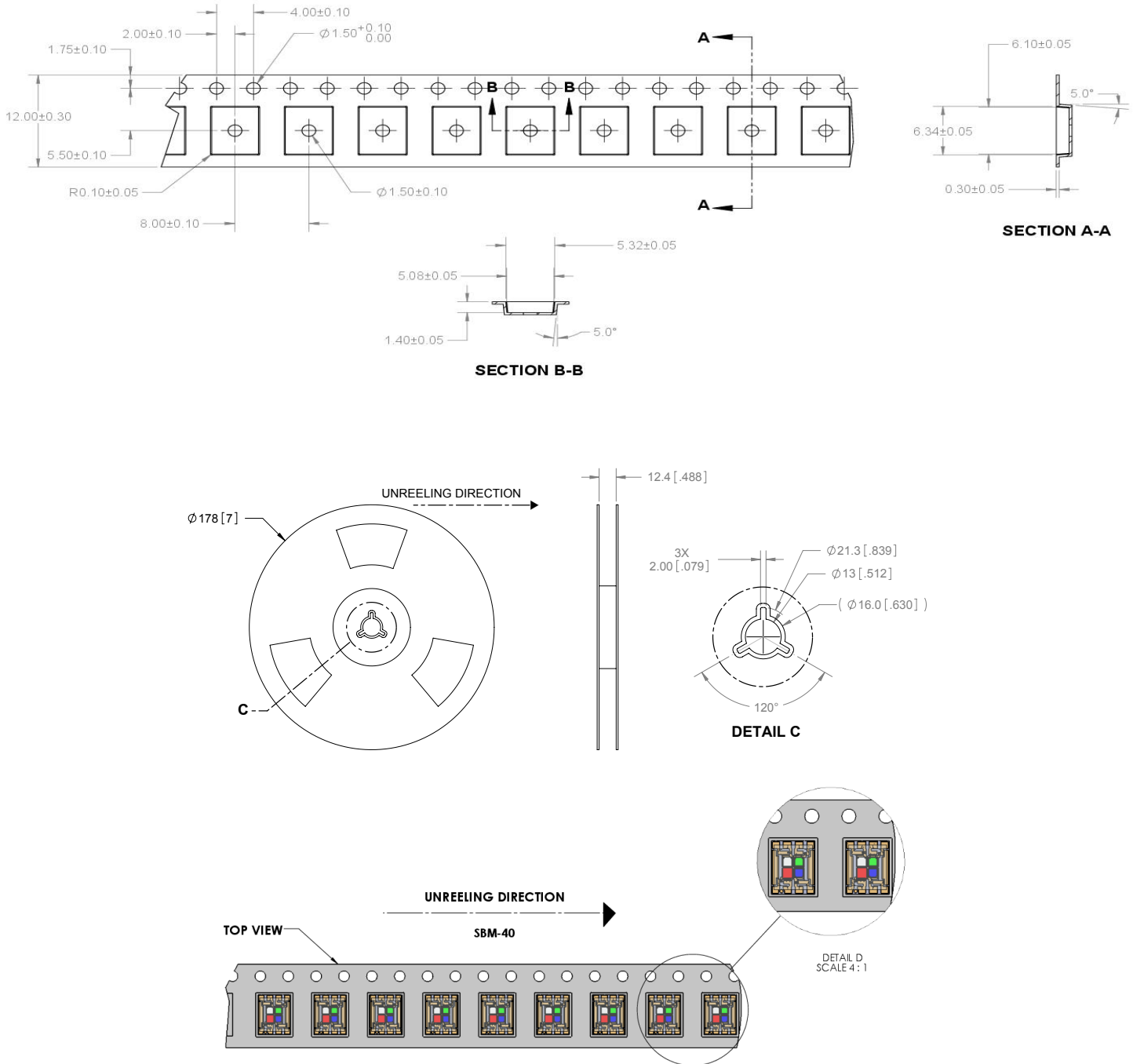
Note 10: Optimum profile may differ due to oven type, circuit board or assembly layout.

Note 11: Recommended lead free, no-clean solder: AIM NC254-SAC305.

Note 12: Refer to soldering and handling application note (APN-001473) for additional solder profiles and details.

## Packaging Specification

Packing Unit = 500 pcs per reel



Note 13: For detailed drawing, please refer to drawing number: TO-1156.

### Revision History

| Revision | Date       | Description                                                                                 |
|----------|------------|---------------------------------------------------------------------------------------------|
| Rev 01   | 05/08/2016 | Preliminary Datasheet release                                                               |
| Rev 02   | 04/03/2017 | Update binning structure and maximum current                                                |
| Rev 03   | 04/07/2017 | Refine binning structure                                                                    |
| Rev 04   | 08/15/2018 | Update white chromaticity bins, switch to monolithic window and change ordering part number |
| Rev 05   | 10/26/2018 | Update blue maximum radiometric power to 1100mW                                             |

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