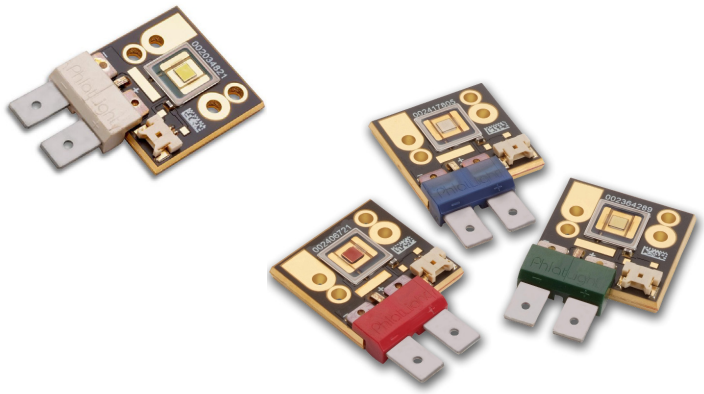
# CBT-90 LEDs



## Table of Contents



## Features:

- Extremely high optical output:
  - Over 2,250 White Lumens
  - Over 900 Red Lumens
  - Over 1,800 Green lumens
  - Over 650 Blue Lumens
- High thermal conductivity package - junction to heat sink thermal resistance of only 0.92°C/W
- Large, monolithic chip with uniform emitting area of 9 $mm^2$
- Unencapsulated die with low profile protective window optimizes optical coupling in etendue-limited applications
- Lumen maintenance of greater than 70% after 60,000 hours
- Variable drive current: less than 1 A through 18 A.
- Environmentally friendly: RoHS compliant

## Applications

- Fiber-coupled Illumination
- Architectural and Entertainment Lighting
- Medical Lighting
- Machine Vision
- Microscopy
- Displays and Signage
- General Illumination
- Spot Lighting
- Emergency Vehicle Lighting
- Projection Systems


PDS-001230 Rev 12

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## Technology Overview

Luminus Big Chip 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.

### Photonic Lattice Technology

Luminus' Big Chip LED™ technology enables large area LED chips with uniform brightness over the entire LED chip surface. The optical power and brightness produced by these large monolithic chips enable solutions which replace arc and halogen lamps where arrays of traditional high power LEDs cannot.

### Packaging Technology

Thermal management is critical in high power LED applications. With a thermal resistance from junction to heat sink of 0.92° C/W, Luminus CBT-90 LEDs have the lowest thermal resistance of any LED on the market. This allows the LED to be driven at higher current densities while maintaining a low junction temperature, thereby resulting in brighter solutions and longer lifetimes.

### Reliability

Luminus Big Chip LEDs are one of the most reliable light sources in the world today. Big Chip 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 Big Chip LEDs are ready for even the most demanding applications. (Refer to Luminus' Reliability application note for more information.)

### Environmental Benefits

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

## Big Chip 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 core board products are measured in an equivalent way the devices will operate in a system. The device is mounted on a 40°C heat sink and allowed to reach thermal equilibrium under full power. The measurement is taken after equilibrium is reached. This method of measurement ensures that Luminus Big Chip LEDs perform in the field just as they are specified.

### Specification Measurement Condition (9A,13.5 A)

The tables on the following pages provide typical optical and electrical characteristics measured at 9A for white, 13.5A for RGB. The associated junction temperature is $T_J$ = 70 °C for white and $T_J$ = 75 ° - 90 ° C for RGB. The CBT-90 can be operated over a wide range of current drive conditions from less than 1A to 18A and duty cycle from <1% to 100%).



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## CBT-90 White Binning Structure

CBT-90 white LEDs are tested for luminous flux and chromaticity at a drive current of 9.0 A (1.0 A/mm$^2$) and placed into one of the following luminous flux (FF) and chromaticity (WW) bins:

### Flux Bins ( $T_J$ = 70°C)

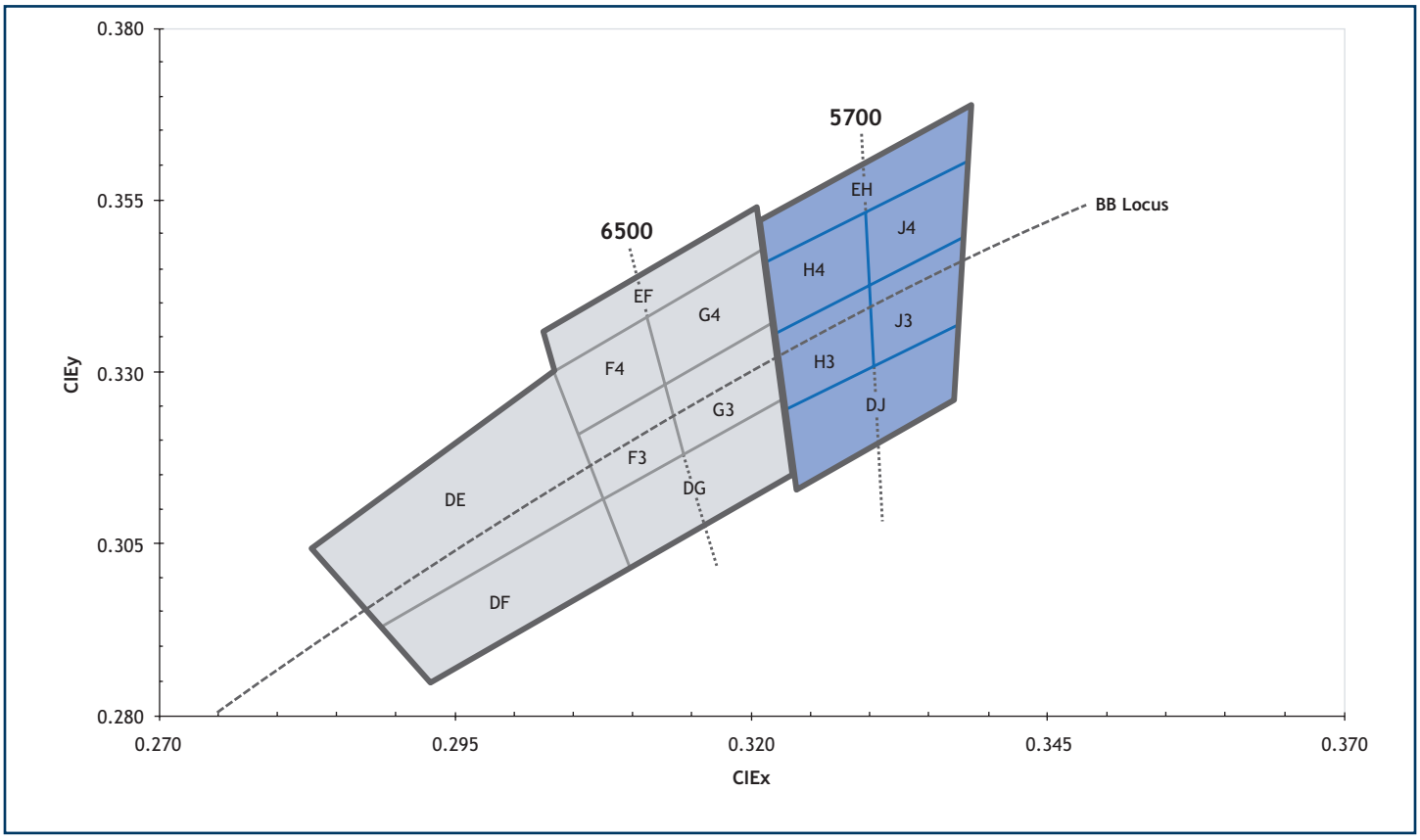
| Color | Flux Bin (FF) | Minimum Flux (lm) at 9.0A | Maximum Flux (lm) at 9.0A |
|---|---|---|---|
| W65S 6500K, Standard CRI (typ. 70) | NA | 1,590 | 1,710 |
| | NB | 1,710 | 1,830 |
| W57H (Preliminary Available Bins) 5700K, High CRI (typ. 92) | KA | 1,080 | 1,120 |
| | KB | 1,120 | 1,200 |

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

Luminus maintains a +/- 2% tolerance on CRI measurements.

### Chromaticity Bins

Luminus' Standard Chromaticity Bins: 1931 CIE Curve



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## CBT-90 White Chromaticity Bins

The following tables describe the four chromaticity points that bound each chromaticity bin. Chromaticity bins are grouped together based on the color temperature.

| 6500K Chromaticity Bins | | |
|---|---|---|
| Bin Code (WW) | CIEx | CIEy |
| DG | 0.307 | 0.311 |
| | 0.322 | 0.326 |
| | 0.323 | 0.316 |
| | 0.309 | 0.302 |
| F3* | 0.305 | 0.321 |
| | 0.313 | 0.329 |
| | 0.315 | 0.319 |
| | 0.307 | 0.311 |
| F4* | 0.303 | 0.330 |
| | 0.312 | 0.339 |
| | 0.313 | 0.329 |
| | 0.305 | 0.321 |
| G3* | 0.313 | 0.329 |
| | 0.321 | 0.337 |
| | 0.322 | 0.326 |
| | 0.315 | 0.319 |
| G4* | 0.312 | 0.339 |
| | 0.321 | 0.348 |
| | 0.321 | 0.337 |
| | 0.313 | 0.329 |
| EF | 0.302 | 0.335 |
| | 0.320 | 0.354 |
| | 0.321 | 0.348 |
| | 0.303 | 0.330 |
| DE | 0.283 | 0.304 |
| | 0.303 | 0.330 |
| | 0.307 | 0.311 |
| | 0.289 | 0.293 |
| DF | 0.289 | 0.293 |
| | 0.307 | 0.311 |
| | 0.309 | 0.302 |
| | 0.293 | 0.285 |

| 5700K Chromaticity Bins | | |
|---|---|---|
| Bin Code (WW) | CIEx | CIEy |
| DJ | 0.322 | 0.324 |
| | 0.337 | 0.337 |
| | 0.336 | 0.326 |
| | 0.323 | 0.314 |
| H3* | 0.321 | 0.335 |
| | 0.329 | 0.342 |
| | 0.329 | 0.331 |
| | 0.322 | 0.324 |
| H4* | 0.321 | 0.346 |
| | 0.329 | 0.354 |
| | 0.329 | 0.342 |
| | 0.321 | 0.335 |
| J3* | 0.329 | 0.342 |
| | 0.337 | 0.349 |
| | 0.337 | 0.337 |
| | 0.330 | 0.331 |
| J4* | 0.329 | 0.354 |
| | 0.338 | 0.362 |
| | 0.337 | 0.349 |
| | 0.329 | 0.342 |
| EH | 0.320 | 0.352 |
| | 0.338 | 0.368 |
| | 0.338 | 0.362 |
| | 0.321 | 0.346 |

*Sub-bins within ANSI defined quadrangles per ANSI C78.377-2008



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## CBT-90 Red/Green/Blue Bin Structure

All CBT-90 monochromatic LEDs are tested for luminous flux/ dominant wavelength and placed into one of the following flux/ wave length bins. The binning structure is universally applied across each monochromatic color of the CBT-90 product line. Consult the local sales person for the available flux/ wavelength bins for the product:

### Flux Bins ($T_J$; Red =75°C, Green =90°C, Blue =80°C)

| Color | Luminous Flux Bin (FF) | Minumum Flux (lm) @ 13.5A | Maximum Flux (lm) @ 13.5A |
|---|---|---|---|
| Red | BK | 600 | 770 |
| | BM | 770 | 970 |
| Green | CK | 1,500 | 2,000 |
| | CM | 2,000 | 2,300 |
| Blue | DJ | 250 | 350 |
| | DK | 350 | 450 |
| | DM | 450 | 575 |

### Wavelength Bins

| Color | Wavelength Bin (FF) | Minumum Wavelength @ 13.5A | Maximum Wavelength @ 13.5A |
|---|---|---|---|
| Red | R1 | 607 | 611 |
| | R2 | 611 | 615 |
| | R3 | 615 | 619 |
| | R4 | 619 | 623 |
| | R5 | 623 | 627 |
| | R6 | 627 | 631 |
| | R7 | 631 | 635 |
| Green | G2 | 510 | 515 |
| | G3 | 515 | 520 |
| | G4 | 520 | 525 |
| | G5 | 525 | 530 |
| | G6 | 530 | 535 |
| | G7 | 535 | 540 |
| | G8 | 540 | 545 |
| Blue | B4 | 450 | 455 |
| | B5 | 455 | 460 |
| | B6 | 460 | 465 |
| | B7 | 465 | 470 |
| | B8 | 470 | 475 |

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



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## Product Shipping & Labeling Information

All CBT-90 products are packaged and labeled with their respective bin as outlined in the tables and charts on pages 3, 4. & 5. When shipped, each package will only contain one bin. The part number designation is as follows:

### CBT-90 White

**CBT — 90 — WNNX — C11 — FF — WW**

| Product Family | Chip Area | Color | Package Configuration | Flux Bin | Chromaticity Bin |
|---|---|---|---|---|---|
| CBT: Chip on Board (window) | 90: 9.0 mm$^2$ | CCT & CRI See Note 1 below | Internal Code | See page 3 for bins | See page 4 for bins |

*Note 1: WNNX nomenclature corresponds to the following:*

*W = White*

*NN = color temperature, where:*

*65 corresponds to 6500K*

*X = color rendering index, where:*

*S (standard) corresponds to a typical CRI of 70*

*H (High) corresponds to a typical CRI of 92*

**Example 1:**

The part label CBT-90-W65S-C11-NA-G4 refers to a 6500K standard CRI white, CBT-90 emitter, with a flux range from 1,590 to 1,710 lumens and a chromaticity value within the box defined by the four points (0.313, 0.329), (0.321, 0.337), (0.321, 0.348), (0.312, 0.339).

### CBT-90 Red/Green/Blue[2]

**CBT — 90 — X — C11 — FF — WW**

| Product Family | Chip Area | Color | Package Configuration | Flux Bin | Wavelength Bin |
|---|---|---|---|---|---|
| CBT: Chip on Board (window) | 90: 9.0 mm$^2$ | R: Red<br>G: Green<br>B: Blue | Internal Code | See page 5 for bins | See page 5 for bins |

*Note 2: X nomenclature corresponds to the following:*

*R = Red*

*G = Green*

*B = Blue*

**Example 2:**

The part number CBT-90-R-C11-BK-R4 refers to a red, CBT-90 module, with a flux range 600 - 770 lumens and a wavelength range 619 nm to 623 nm.



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## CBT-90 White Electrical Characteristics[1]

### Optical and Electrical Characteristics ($T_J$ = 70 °C)

| Drive Condition[2] | | 9.0 A Continuous | |
|---|---|---|---|
| **Parameter** | **Symbol** | **Values at Test Currents** | **Unit** |
| Current Density | j | 1.0 | A/mm$^2$ |
| Forward Voltage | $V_{F, min}$ | 2.9 | V |
| | $V_{F, typ}$ | 3.3 | V |
| | $V_{F, max}$ | 3.8 | V |

### Common Characteristics

| Parameter | Symbol | Values | Unit |
|---|---|---|---|
| Emitting Area | | 9.0 | mm$^2$ |
| Emitting Area Dimensions | | 3 x 3 | mm×mm |
| Color Temperature[3] | CCT | 6,500 | K |
| Color Rendering Index[4] (Typical) | $R_a$ | 72 | |
| Forward Voltage Temperature Coefficient[5] | | -5.47 | mV/°C |

### Absolute Maximum Ratings

| Parameter | Symbol | Values | Unit |
|---|---|---|---|
| Maximum Current[6] | | 18 | A |
| Maximum Junction Temperature[7] | $T_{j-max}$ | 150 | °C |
| Storage Temperature Range | | -40/+100 | °C |

*Note 1: All measured values are with a constant heat sink temperature $T_{heat\ sinks}$ = 40°C.*

*Note 2: CBT-90 white devices can be driven at currents ranging from 1A to 18A 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 3: CCT value based off of CIE measurement. CIE measurement uncertainty for white devices is estimated to be +/- 0.01.*

*Note 4: Color Rendering Index (CRI) is measured to within + or - 2.*

*Note 5: Forward voltage temperature coefficient at current density of 1.0 A/mm$^2$. Contact Luminus for value at other drive conditions.*

*Note 6: CBT-90 White LEDs are designed for operation to an absolute maximum forward drive current density of 2.0 A/mm$^2$. Product lifetime data is specified at recommended forward drive currents.*

*Note 7: Lifetime dependent on LED junction temperature. Input power and thermal system must be properly managed to ensure lifetime. See charts on pg 8 for further information.*

*Note 8: Special design considerations must be observed for operation under 1 A. Please contact Luminus for further information.*



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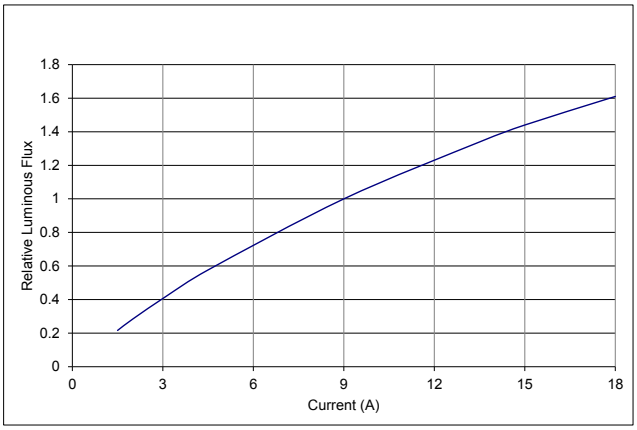
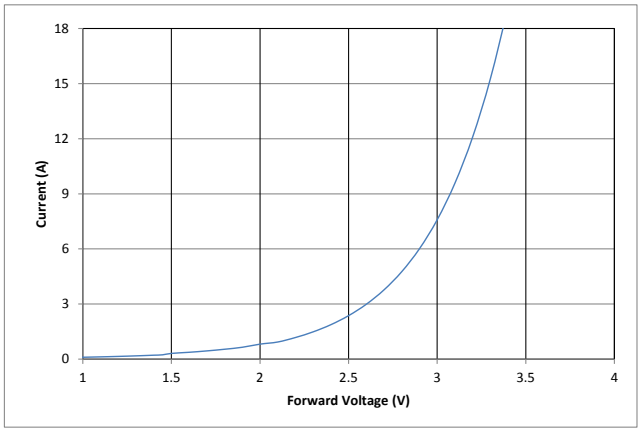
## CBT-90 White Optical & Electrical Characteristics ($T_J$ = 70°C)

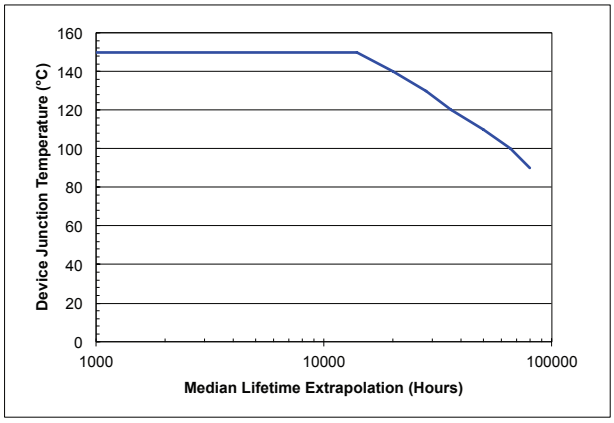
### Relative Output Flux vs. Forward Current



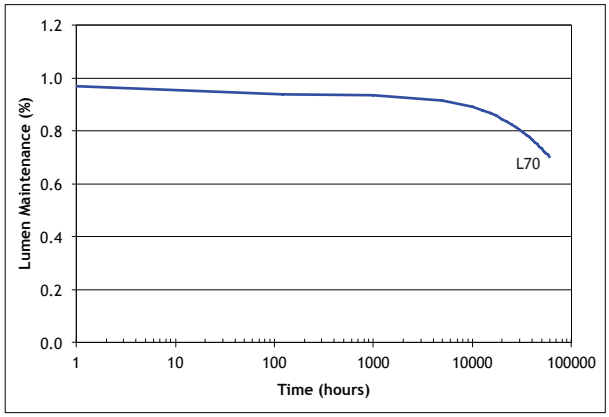

### Forward Current vs. Forward Voltage



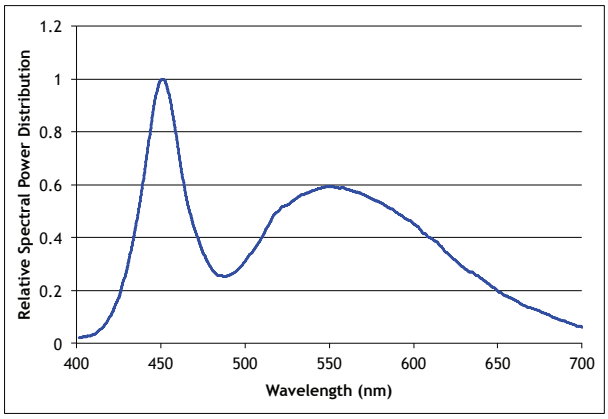

### Mean Lifetime[1]



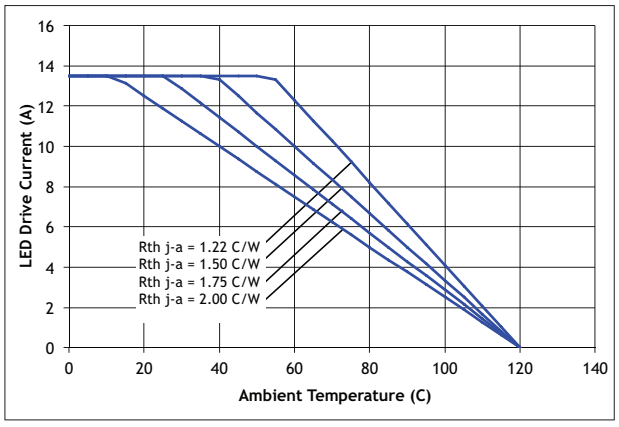

### Lumen Maintenance vs. Time[2]




### Typical Spectrum[3]




### Current Derating Curve




*Note 1:* *Mean expected lifetime in dependence of junction temperature at 1.0 A/mm² in continuous operation. Lifetime defined as time to 70% of initial intensity. Based on lifetime test data. Data can be used to model failure rate over typical product lifetime (contact Luminus for lifetime reliability test data for 1A/mm² condition).*

*Note 2:* *Lumen maintenance in dependence of time at 1.0 A/mm² in continuous operation with junction temperatures of 130 °C.*

*Note 3:* *Typical spectrum at current density of 1.0 A/mm² in continuous operation.*



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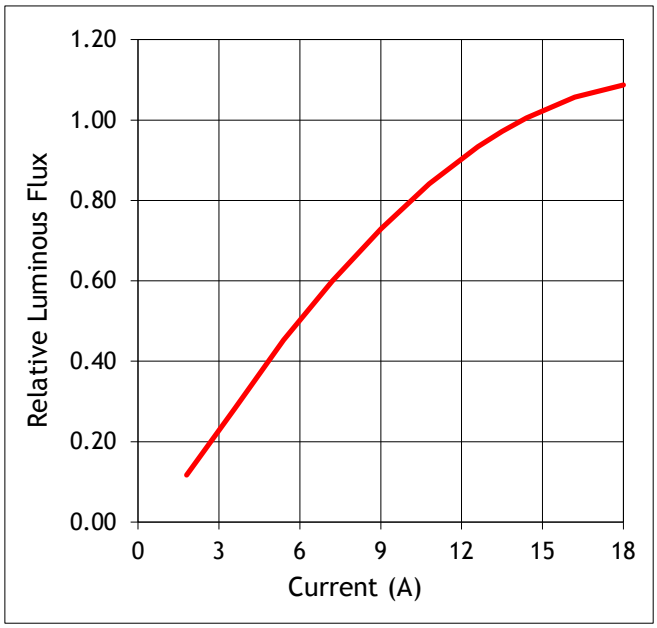
## CBT-90 Red/Green/Blue Optical & Electrical Characteristics

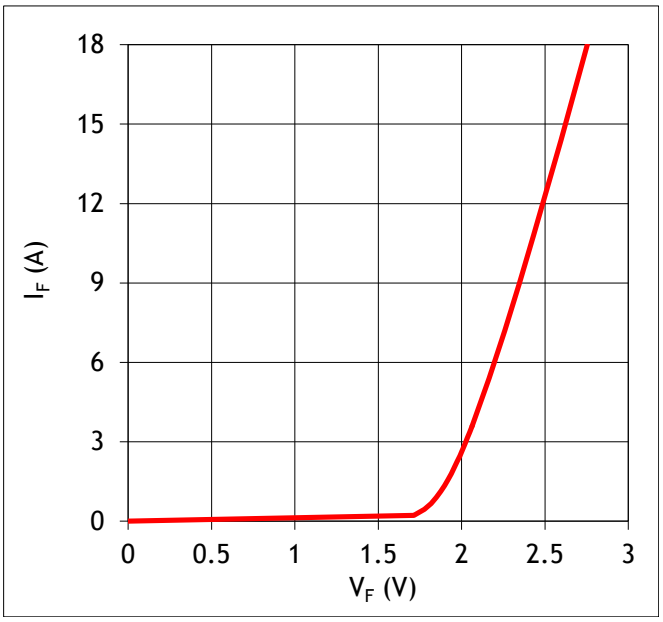
($T_J$ = 75°C)[1]

| Red | | | |
|---|---|---|---|
| **Drive Condition[2]** | | **13.5 A Continuous** | |
| **Parameter** | **Symbol** | **Values[4]** | **Unit** |
| Current Density | J | 1.5 | A/mm² |
| Forward Voltage | $V_F$ min | 2.0 | V |
| | $V_f$ | 2.5 | V |
| | $V_F$ max | 3.0 | V |
| Luminous Flux[3] | $\Phi_{V\,typ}$ | 900 | lm |
| Radiometric Flux | $\Phi_R$ | 3.5 | W |
| Luminous Efficacy | η | 27 | lm/W |
| Dominant Wavelength[4] | $\lambda_d$ | 613 | nm |
| Peak Wavelength | $\lambda_p$ | 624 | nm |
| FWHM | $\Delta\lambda_{1/2}$ | 19 | nm |
| Chromaticity Coordinates[5] | x | 0.674 | - |
| | y | 0.326 | - |

### Relative Output Flux vs. Forward Current[1]




### Forward Current vs. Forward Voltage




*Notes: See page 12*





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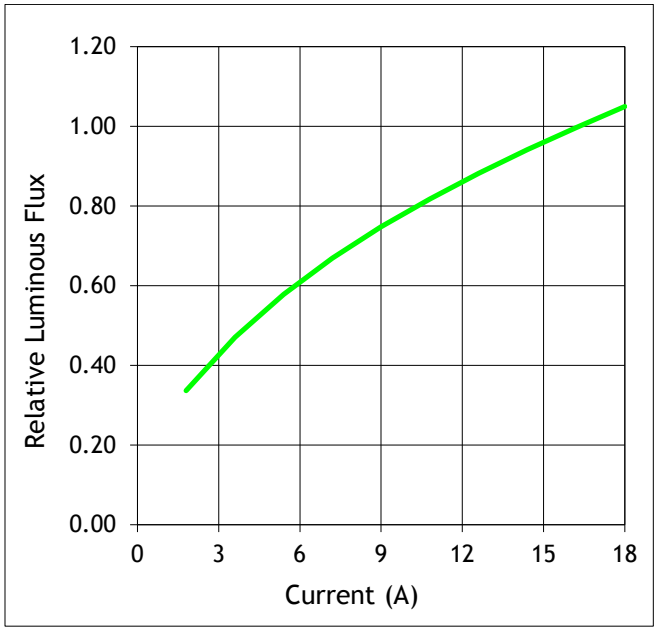
## CBT-90 Red/Green/Blue Optical & Electrical Characteristics

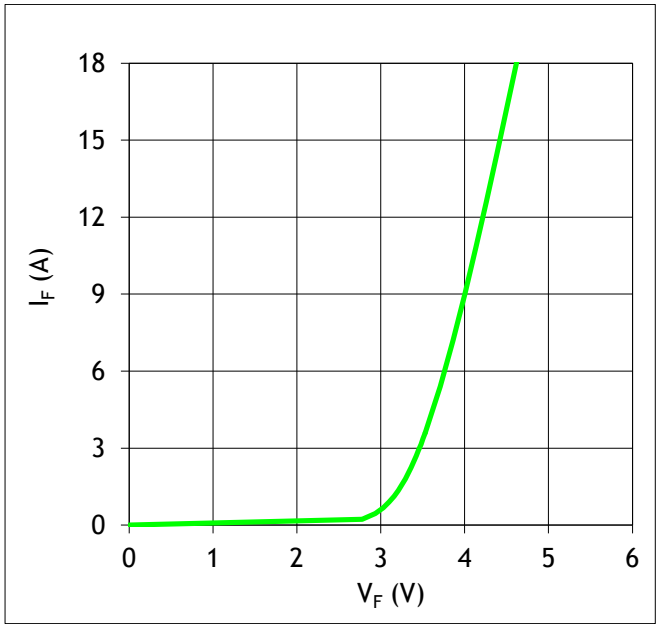
($T_J$ = 90°C)[1]

| Green | | | |
|---|---|---|---|
| **Drive Condition**[2] | | **13.5 A Continuous** | |
| **Parameter** | **Symbol** | **Values**[4] | **Unit** |
| Current Density | J | 1.5 | A/mm² |
| Forward Voltage | $V_F$ min | 3.2 | V |
| | $V_f$ | 4.2 | V |
| | $V_F$ max | 5.2 | V |
| Luminous Flux[3] | $\Phi_V$ | 2,150 | lm |
| Radiometric Flux | $\Phi_r$ | 4.2 | W |
| Luminous Efficacy | η | 38 | lm/W |
| Dominant Wavelength[4] | $\lambda_d$ | 530 | nm |
| Peak Wavelength | $\lambda_p$ | 523 | nm |
| FWHM | $\Delta\lambda_{1/2}$ | 36 | nm |
| Chromaticity Coordinates[5] | x | 0.192 | - |
| | y | 0.700 | - |

### Relative Output Flux vs. Forward Current[1]




### Forward Current vs. Forward Voltage




*Notes: See page 12*



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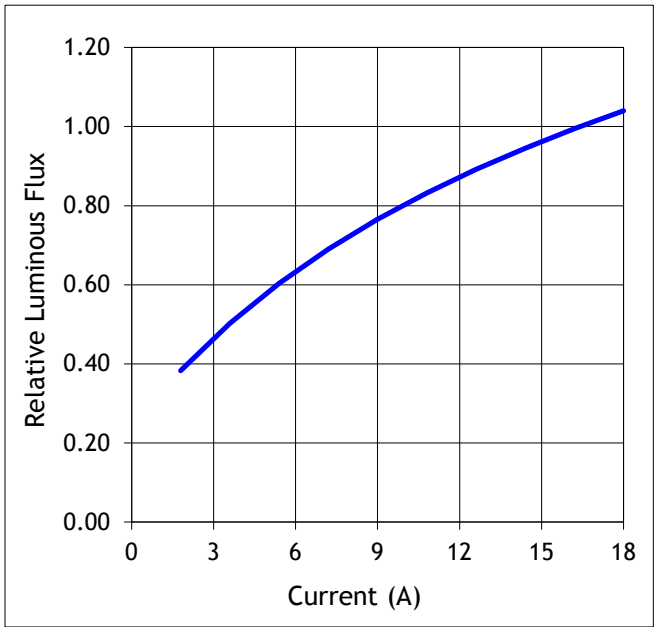
## CBT-90 Red/Green/Blue Optical & Electrical Characteristics

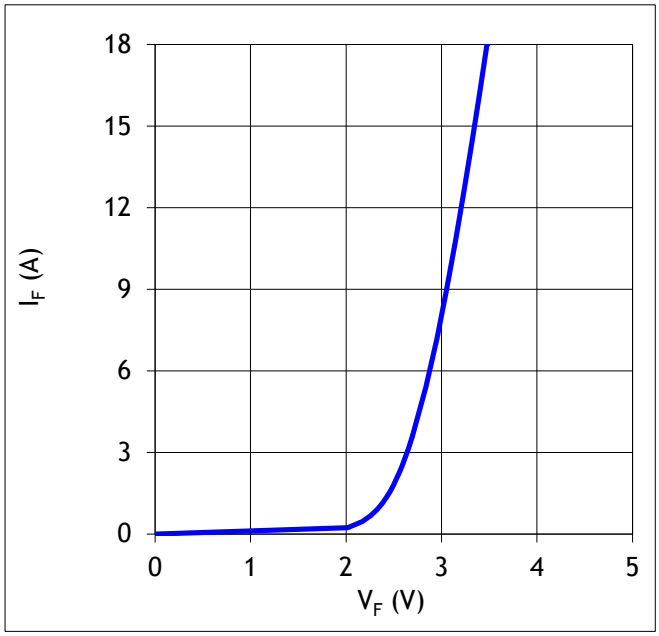
($T_J$ = 80°C)[1]

| Blue | | | |
|---|---|---|---|
| **Drive Condition**[2] | | **13.5 A Continuous** | |
| **Parameter** | **Symbol** | **Values**[4] | **Unit** |
| Current Density | J | 1.5 | A/mm² |
| Forward Voltage | $V_{F\,min}$ | 2.8 | V |
| | $V_f$ | 3.4 | V |
| | $V_{F\,max}$ | 4.0 | V |
| Luminous Flux[3] | $\Phi_{V\,typ}$ | 425 | lm |
| Radiometric Flux | $\Phi_r$ | 9.5 | W |
| Luminous Efficacy | η | 10 | lm/W |
| Dominant Wavelength[4] | $\lambda_d$ | 460 | nm |
| Peak Wavelength | $\lambda_p$ | 455 | nm |
| FWHM | $\Delta\lambda_{1/2}$ | 20 | nm |
| Chromaticity Coordinates[5] | x | 0.144 | - |
| | y | 0.038 | - |

### Relative Output Flux vs. Forward Current[1]




### Forward Current vs. Forward Voltage




*Notes: See page 12*





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## CBT-90 Red/Green/Blue Reference Optical & Electrical Characteristics

### Common Characteristics ($T_j$; Red =75°C, Green =90°C, Blue =80°C)[1]

| | Symbol | Red | Green | Blue | Unit |
|---|---|---|---|---|---|
| Emitting Area | | 9.0 | 9.0 | 9.0 | $mm^2$ |
| Emitting Area Dimensions | | 3.0x3.0 | 3.0x3.0 | 3.0x3.0 | mmxmm |
| Thermal Coefficient of Photometric Flux | | -0.96 | -0.18 | -0.007 | %/ °C |
| Thermal Coefficient of Radiometric Flux | | -0.52 | -0.20 | -0.17 | %/ °C |
| Thermal Coefficient of Junction Voltage[6] | | -1.3 | -4.6 | -3.5 | mV/ °C |

| | Symbol | Red | Green | Blue | Unit |
|---|---|---|---|---|---|
| Maximum Current | | 18 | 18 | 18 | A |
| Maximum Junction Temperature[7,8] | $T_{jmax}$ | 110 | 150 | 150 | °C |
| Storage Temperature Range | | -40/+100 | -40/+100 | -40/+100 | °C |

*Note 1:* *All ratings are based on operation with a constant $T_{heat\ sink} = 40$ °C.*

*Note 2:* *CBT-90 RGB devices can be driven at currents ranging from <1 A to 18 A 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 3:* *Total flux from emitting area at listed dominant wavelength.*

*Note 4:* *Minimum and Maximum Dominant Wavelengths are based on typical values +/- 5nm for Red, +/- 8nm for Green and +/- 6nm for Blue.*

*Note 5:* *For reference only.*

*Note 6:* *Forward voltage temperature coefficient at current density of 1.0 A/$mm^2$. Contact Luminus for value at other drive conditions.*

*Note 7:* *CBT-90 RGB LEDs are designed for operation to an absolute maximum current as specified above. Product lifetime data is specified at recommended forward drive currents. Sustained operation at or beyond absolute 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. In pulsed operation, rise time from 10-90% of forward current should be larger than 0.5 microseconds.*

*Note 8:* *Lifetime dependent on LED junction temperature. Input power and thermal system must be properly managed to ensure lifetime. See charts on pg 13 for further information.*

*Note 9:* *Special design considerations must be observed for operation under 1 A. Please contact Luminus for further information.*

*Note 10:* *Caution must be taken not to stare at the light emitted from these LEDs. Under special circumstances, the high intensity could damage the eye.*



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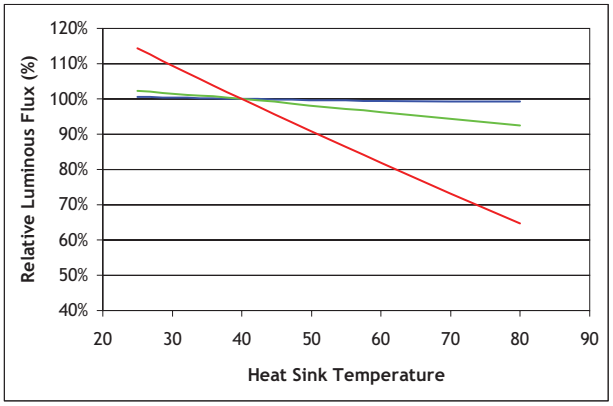
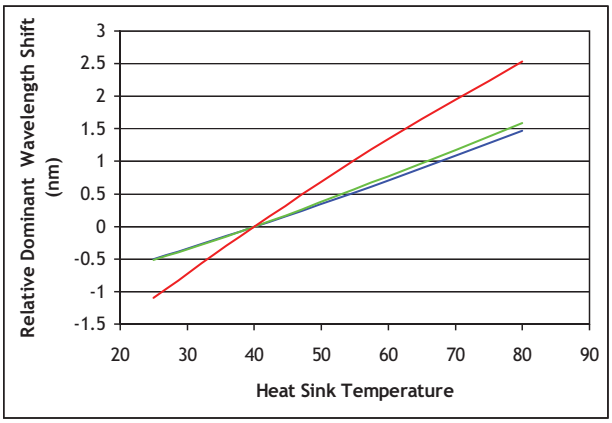
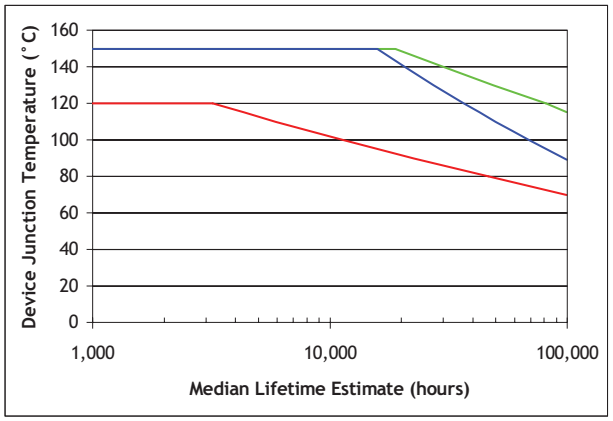
## CBT-90 Red/Green/Blue Lifetime and Lumen Maintenance

### Light Output and Spectral Characteristics Over Heat Sink Temperature

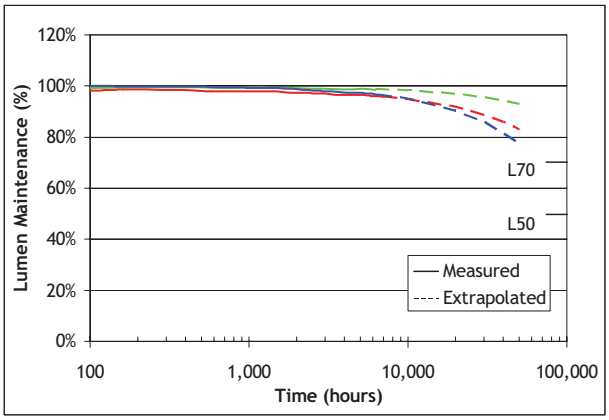


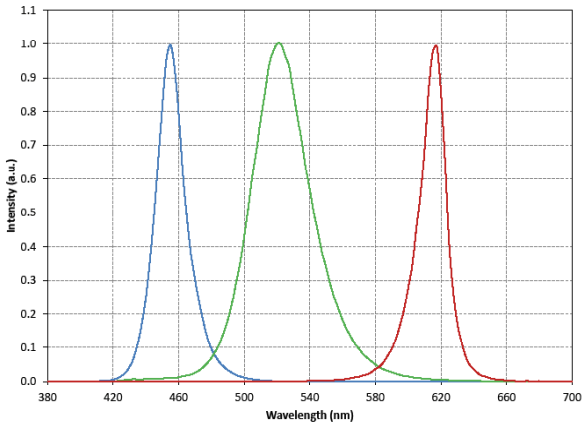

### Median Lifetime Estimate vs. Tj[1]




### Lumen Maintenance[2]




### Typical Spectrum[3]




*Note 1: Median lifetime estimate as a function of junction temperature at 0.35A/mm² in continuous operation. Lifetime defined as time to 70% of initial intensity. Based on preliminary lifetime test data. Data can be used to model failure rate over typical product lifetime.*

*Note 2: Lumen maintenance vs. time at 0.35A/mm² in continuous operation, Red junction temperature of 70°C, Green junction temperatures of 120°C, Blue junction temperatures of 100°C.*

*Note 3: Typical spectrum at current density of 0.35 A/mm² in continuous operation.*



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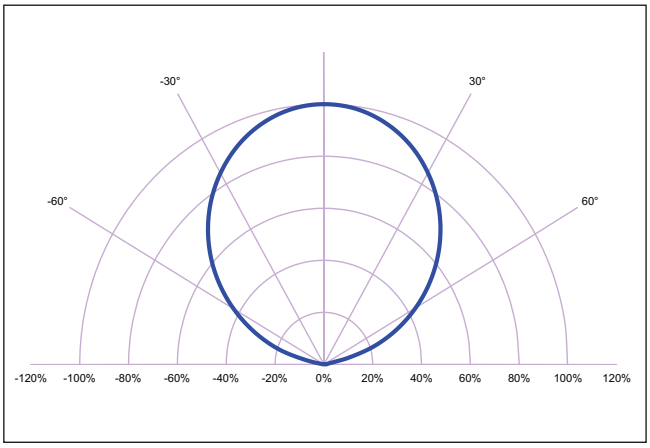
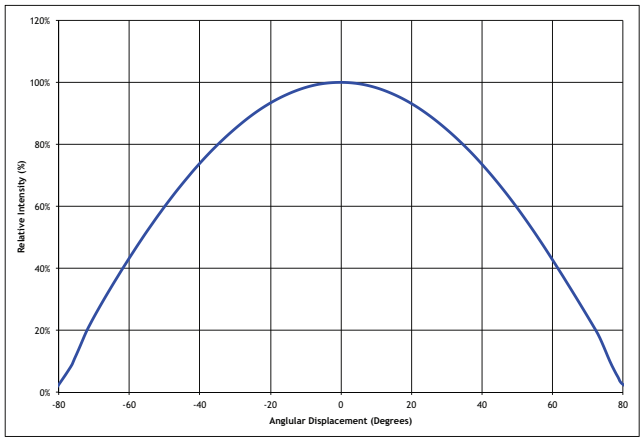
# Typical Radiation Patterns

## Typical Polar Radiation Pattern for White, Red, Green and Blue




## Typical Angular Radiation Pattern for White, Red, Green and Blue



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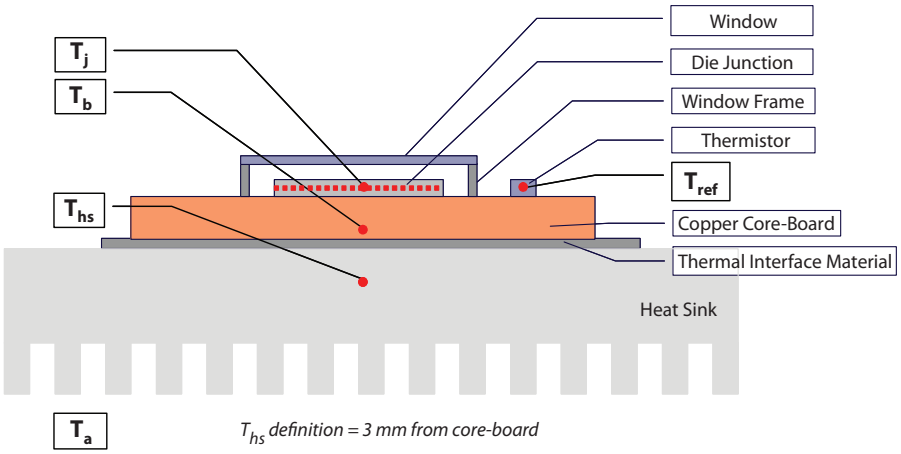
## Thermal Resistance




### Typical Thermal Resistance

| | |
|---|---|
| $R_{\theta j\text{-}b}$ [1] | 0.80 °C/W |
| $R_{\theta b\text{-}hs}$ [1] | 0.12 °C/W |
| $R_{\theta j\text{-}hs}$ [2] | 0.92 °C/W |
| $R_{\theta j\text{-}ref}$ [1] | 0.83 °C/W |

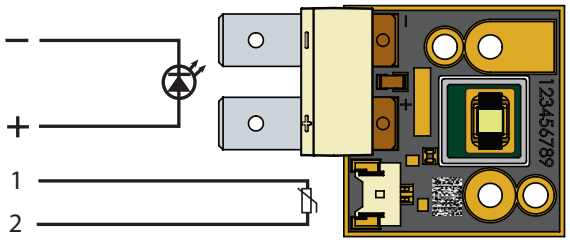
Note 1: Thermal resistance values are based on FEA model results correlated to measured $R_{\theta j\text{-}hs}$ data.

Note 2: Thermal resistance is measured using eGraf 1205 thermal interface material.

## Thermistor Information

The thermistor used in CBT-90 LEDs mounted on core-boards is from Murata Manufacturing Co. The global part number is NCP18XH103J03RB. Please see http://www.murata.com/ for details on calculating thermistor temperature.

## Electrical Pinout



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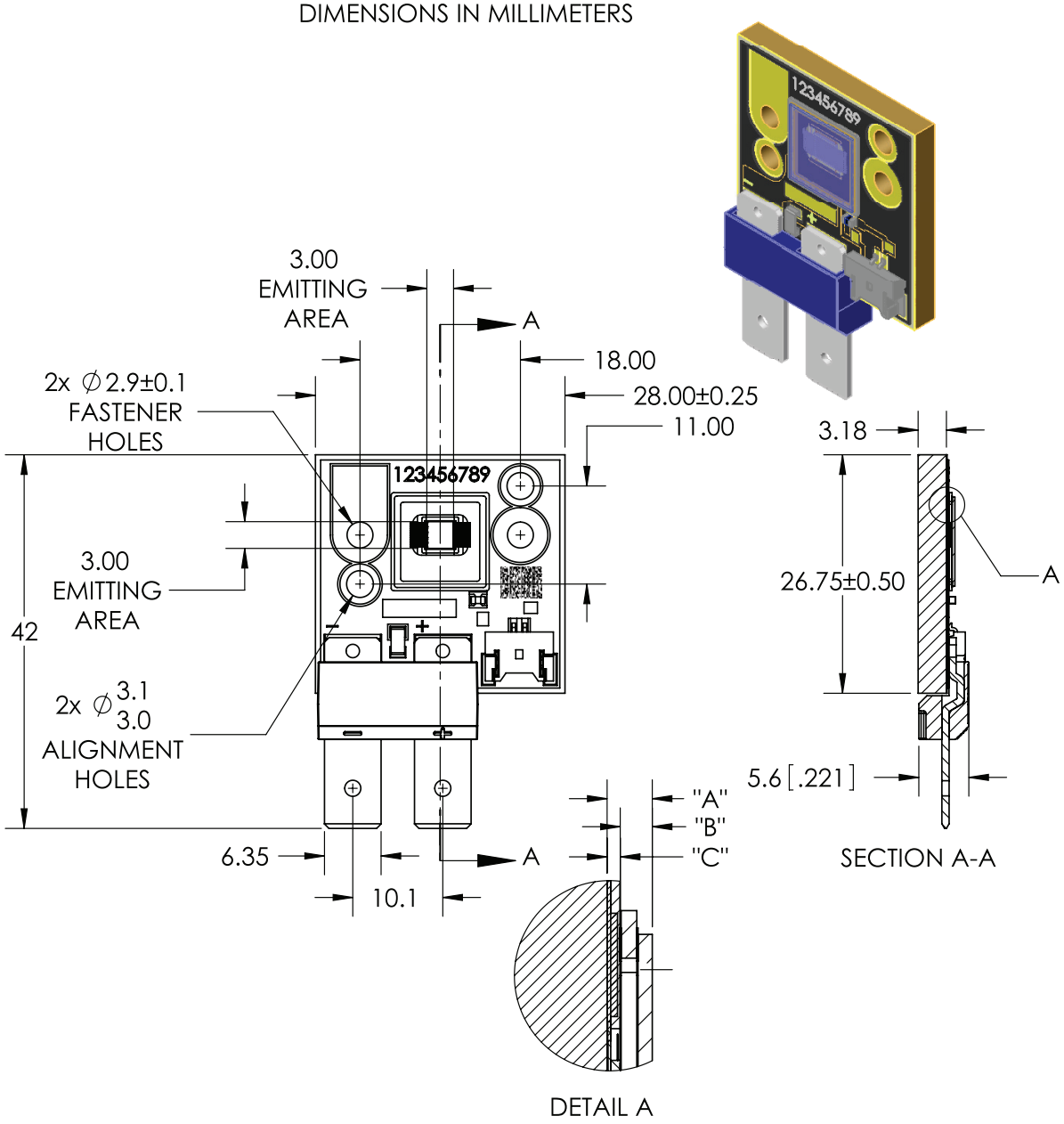
## Mechanical Dimensions – CBT-90 Emitter

DIMENSIONS IN MILLIMETERS




| DIMENSION NAME | DESCRIPTION | NOMINAL DIMENSION | TOLERANCE |
|---|---|---|---|
| "A" | TOP OF METAL SUBSTRATE TO TOP OF GLASS | 0.95 | ±0.13 |
| "B" | EMITTING AREA TO TOP OF GLASS | 0.67 | ±0.16 |

Recommended connectors for Anode and Cathode:

- Panduit Disco Lok™ Series P/N: DNF14-250FIB-C
- JST Manufacturing Co: SPS-61T-250
- Thermistor Connector: MOLEX P/N 53780-0270. Recommended Female: MOLEX P/N 51146-0200 or equivalent.
- For detailed drawing please refer to DWG-001216 document



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## Ordering Information

| Ordering Part Number [1,2] | Color | Description |
|---|---|---|
| CBT-90-W65S-C11-NA100 | 6500K White | White Big Chip LED™ CBT-90 consisting of a 9 mm² LED, thermistor, and connector, mounted on a copper-core PCB |
| CBT-90-W57H-C11-KB200 | 5700K White | |
| CBT-90-R-C11-HK100 | Red | Red Big Chip LED™ CBT-90 consisting of 9 mm² LED, thermistor, and connector, mounted on a copper-core PCB. |
| CBT-90-G-C11-JK200 | Green | Green Big Chip LED™ CBT-90 consisting of 9 mm² LED, thermistor, and connector, mounted on a copper-core PCB. |
| CBT-90-B-C11-KJ300 | Blue | Blue Big Chip LED™ CBT-90 consisting of 9 mm² LED, thermistor, and connector, mounted on a copper-core PCB. |

*Note 1:* *NA100 - denotes a bin kit comprising of all flux bins with a minimum flux of 1,590 lumens and chromaticity bins at the 6500K color point.*

*Note 2:* *KB200 - denotes a bin kit comprising of all flux bins with a minimum flux of 1,120 lumens and chromaticity bins at the 5700K color point.*

*Note 3:* *HK100 - denotes a bin kit comprising of all red flux and wavelength bins as specified on page 5.*
*JK200 - denotes a bin kit comprising of all green flux and wavelength bins as specified on page 5*
*KJ300 - denotes a bin kit comprising of all blue flux and wavelength bins as specified on page 5.*

*Note 4:* *For ordering information on all available bin kits, please reference PDS-001694: CBT-90 Binning & Labeling document.*

*Note 5:* *Standard packaging increment (SPI) is 10.*



 

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