

# CBT-90 TE

## Thermally Enhanced

## LED Chipset



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### Features:

- Large, monolithic chip with uniform emitting area of 9 mm<sup>2</sup>
- Wide color gamut available from Red , Green, Blue single color LEDs. White and UV CBT-90 LEDs are also available with the same package format
- Ultra High thermal conductivity package allows operation at up to 27A CW.
- High precision LEDs placement on copper core PCB for easier thermal management and optical integration
- Unencapsulated die with low profile protective window optimizes optical coupling in etendue-limited applications
- Environmentally friendly: RoHS and Halogen compliant

### Applications

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

## 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.

### Luminus LED Technology

Luminus' Devices vertical 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 0.5° 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

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 of Luminus LEDs

Luminus core board products are typically measured in such a way that the characteristics reported agree with how the devices will actually perform when incorporated into a system. This measurement is accomplished by mounting the devices on a 40°C heat sink and allowing the device to reach thermal equilibrium while fully powered. Only after the device reaches equilibrium are the measurements taken. This method of measurement ensures that Luminus LEDs perform in the field just as they are specified.

Expected flux values in real world operation can be extrapolated based on the information contained within this product data sheet.

## CBT-90 Monochromatic Binning 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.

### Flux Bins\*

| Color | Luminous Flux Bin (FF) | Minumum Flux (lm) @ 13.5A | Maximum Flux (lm) @ 13.5A | Min Power (Watts) @ 13.5A | Max Power (Watts) @ 13.5A |
|-------|------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Red   | BM                     | 770                       | 970                       |                           |                           |
|       | BN                     | 970                       | 1150                      |                           |                           |
|       | BP                     | 1150                      | 1350                      |                           |                           |
|       | BQ                     | 1350                      | 1570                      |                           |                           |
| Green | CK                     | 1,500                     | 2,000                     |                           |                           |
|       | CM                     | 2,000                     | 2,300                     |                           |                           |
|       | CN                     | 2,300                     | 2,600                     |                           |                           |
| Blue  | G                      |                           |                           | 8.3                       | 9.1                       |
|       | H                      |                           |                           | 9.1                       | 10.0                      |
|       | J                      |                           |                           | 10.0                      | 11.0                      |
|       | K                      |                           |                           | 11.0                      | 12.1                      |

### Wavelength Bins

| Color               | Wavelength Bin | Minumum Wavelength @ 13.5A | Maximum Wavelength @ 13.5A |
|---------------------|----------------|----------------------------|----------------------------|
| Red (Dominant WL)   | R2             | 611                        | 615                        |
|                     | R3             | 615                        | 619                        |
|                     | R4             | 619                        | 623                        |
|                     | R5             | 623                        | 627                        |
|                     | R6             | 627                        | 631                        |
| Green (Dominant WL) | G2             | 510                        | 515                        |
|                     | G3             | 515                        | 520                        |
|                     | G4             | 520                        | 525                        |
|                     | G5             | 525                        | 530                        |
|                     | G6             | 530                        | 535                        |
|                     | G7             | 535                        | 540                        |
| Blue (Peak WL)      | 445            | 445                        | 450                        |
|                     | 450            | 450                        | 455                        |
|                     | 455            | 455                        | 460                        |
|                     | 460            | 460                        | 465                        |
|                     | 465            | 465                        | 470                        |

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

## Ordering Information

| Ordering Part Number <sup>1,2,3</sup> | Color | Description                                                                                                    |
|---------------------------------------|-------|----------------------------------------------------------------------------------------------------------------|
| CBT-90-RX-L15-BM100                   | Red   | Red LED™ CBT-90 consisting of 9 mm <sup>2</sup> LED, thermistor, and connector mounted on a copper-core PCB.   |
| CBT-90-G-L11-CK100                    | Green | Green LED™ CBT-90 consisting of 9 mm <sup>2</sup> LED, thermistor, and connector mounted on a copper-core PCB. |
| CBT-90-B-L11-G100                     | Blue  | Blue CBT-90 consisting of 9 mm <sup>2</sup> LED, thermistor, and connector mounted on a copper-core PCB.       |

## Part Number Nomenclature

CBT — 90 — CC — L## — FF###

| Product Family                         | Chip Area             | Color                          | Package Configuration                                                                                                            | Bin Kit <sup>1,2,3</sup>                     |
|----------------------------------------|-----------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| CBT: Copper-core PCB, No Encapsulation | 90: 9 mm <sup>2</sup> | RX= Red<br>G= Green<br>B= Blue | L15: 28 mm x 26.75 mm - Common Cathode Package<br>L11: 28 mm x 26.75 mm - Common Anode Package<br>See Mechanical Drawing section | See page 5 for complete bin definition table |

Note 1: A Bin Kit represents a group of individual flux or power bins that are shippable for a given ordering part number. Individual flux bins are not orderable..

Note 2: Flux Bin listed is minimum bin shipped - higher bins may be included at Luminus' discretion

Note 3: CBT-90-RX-L15-BM100 represents a red CBT-90 Device with a minimum Flux of 770lm and a Dominant Wavelength between 611-631nm  
 CBT-90-G-L11-CK100 represents a green CBT-90 Device with a minimum flux of 1500lm and a Dominant Wavelength between 510-540nm  
 CBT-90-B-L11-J100 represents a blue CBT-90 Device with a minimum Power of 10Watts and a Peak Wavelength between 445-470nm

**CBT-90 Orderable Bin Kits**

| Color | Luminous Flux |                     | Wavelength Bins        | Kit Number |
|-------|---------------|---------------------|------------------------|------------|
|       | Min. Flux Bin | Min. Flux/<br>Power |                        |            |
| Red   | BM            | 770 lm              | R2, R3, R4, R5, R6     | BM100      |
|       |               |                     | R3, R4, R5             | BM101      |
|       | BN            | 970 lm              | R2, R3, R4, R5, R6     | BN100      |
|       |               |                     | R3,R4,R5               | BN101      |
| Green | CK            | 1,500 lm            | G2, G3, G4, G5, G6, G7 | CK100      |
|       |               |                     | G4, G5, G6             | CK101      |
|       | CM            | 2,000 lm            | G2, G3, G4, G5, G6, G7 | CM100      |
|       |               |                     | G4, G5, G6             | CM101      |
| Blue  | G             | 8.30 W              | 445,450,455,460,465    | G100       |
|       |               |                     | 450,455,460            | G101       |
|       | H             | 9.10 W              | 445,450,455,460,465    | H100       |
|       |               |                     | 450,455,460            | H101       |
|       | J             | 10.0 W              | 445,450,455,460,465    | J100       |
|       |               |                     | 450,455,460            | J101       |

## Optical & Electrical Characteristics

### Typical Device Performance

| General Characteristics                                                     |     | Symbol         | Red <sup>8</sup> | Green   | Blue    | Unit            |
|-----------------------------------------------------------------------------|-----|----------------|------------------|---------|---------|-----------------|
| Emitting Area                                                               |     |                | 9.0              | 9.0     | 9.0     | mm <sup>2</sup> |
| Emitting Area Dimensions                                                    |     |                | 3.0x3.0          | 3.0x3.0 | 3.0x3.0 | mm x mm         |
| Characteristics at Recommended Test Drive Current, $I_f$ <sup>1, 2, 3</sup> |     |                |                  |         |         |                 |
| Reference Duty Cycle                                                        |     |                | 100              | 100     | 100     | %               |
| Test Peak Drive Current                                                     | typ | $I_F$          | 13.5             | 13.5    | 13.5    | A               |
| Peak Luminous Flux <sup>4, 5, 6</sup>                                       | typ | $\Phi_v$       | 1,030            | 2,100   | 500     | lm              |
| Peak Radiometric Flux <sup>4, 5, 6</sup>                                    | typ | $\Phi_r$       | 5.3              | 4.4     | 10.3    | W               |
| Dominant Wavelength <sup>4</sup>                                            | typ | $\lambda_d$    | 620              | 527     | 460     | nm              |
| Peak Wavelength <sup>4</sup>                                                | typ | $\lambda_d$    | 631              | 520     | 456     | nm              |
| FWHM- Spectral bandwidth at 50% of $\Phi_v$ <sup>4</sup>                    | typ |                | 17               | 35      | 21      | nm              |
| Chromaticity Coordinates <sup>7</sup>                                       | typ | x              | .694             | .173    | .146    |                 |
|                                                                             | typ | y              | .306             | .712    | .035    |                 |
| Forward Voltage                                                             | min | $V_{Fmin}$     | 2                | 2.9     | 2.9     | V               |
|                                                                             | typ | $V_F$          | 2.8              | 4.5     | 3.5     | V               |
|                                                                             | max | $V_{Fmax}$     | 3.8              | 5.5     | 4.8     | V               |
| Dynamic Resistance                                                          | typ | $\Omega_{dyn}$ | 0.03             | 0.05    | 0.02    | $\Omega$        |
| Device Thermal Characteristics                                              |     |                |                  |         |         |                 |
| Thermal Coefficient of Photometric Flux                                     | typ |                | -1               | -0.2    | -0      | % / °C          |
| Thermal Coefficient of Radiometric Flux                                     | typ |                | -0.7             | -0.2    | -0.2    | % / °C          |
| Forward Voltage Temperature Coefficient                                     | typ |                | -1.6             | -2      | -3      | mV/ °C          |

## Optical & Electrical Characteristics

### Absolute Maximum Ratings

|                                                                                              | Symbol            | Red      | Green    | Blue     | Unit |
|----------------------------------------------------------------------------------------------|-------------------|----------|----------|----------|------|
| Absolute Minimum Current (CW or Pulsed) <sup>8,9</sup>                                       |                   | 0.2      | 0.2      | 0.2      | A    |
| Absolute Maximum Current (CW) <sup>10</sup>                                                  |                   | 27       | 27       | 27       | A    |
| Absolute Maximum Surge Current <sup>10</sup><br>(Frequency > 240 Hz, duty cycle =10%, t=1ms) |                   | 31.5     | 31.5     | 31.5     | A    |
| Absolute Maximum Junction Temperature <sup>10</sup>                                          | T <sub>jmax</sub> | 125      | 150      | 150      | °C   |
| Storage Temperature Range                                                                    |                   | -40/+100 | -40/+100 | -40/+100 | °C   |

**Note 1:** All ratings are based on operation with a constant heat sink temperature  $T_{hs} = 40^{\circ}\text{C}$ . See Thermal Resistance section for  $T_{hs}$  definition.

**Note 2:** CBT-90 RGB devices can be driven at currents ranging from 200mA to 27A 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. In pulsed operation, rise time from 10-90% of forward current should be larger than 0.5 microseconds.

**Note 3:** Tested at Current Density of 1.5 A/mm<sup>2</sup>.

**Note 4:** Unless otherwise noted, values listed are typical. Devices are production tested and specified at 13.5 A.

**Note 5:** Total flux from emitting area at listed dominant wavelength. Reported performance is included to show trends for a selected power level. For specific minimum and maximum values, use bin tables. For product roadmap and future performance of devices, contact Luminus.

**Note 6:** Caution must be taken not to stare at the light emitted from these LEDs. Under special circumstances, the high intensity could damage the eye.

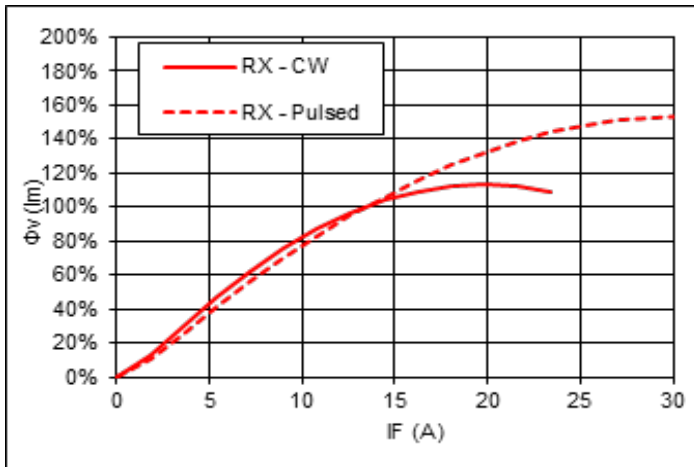
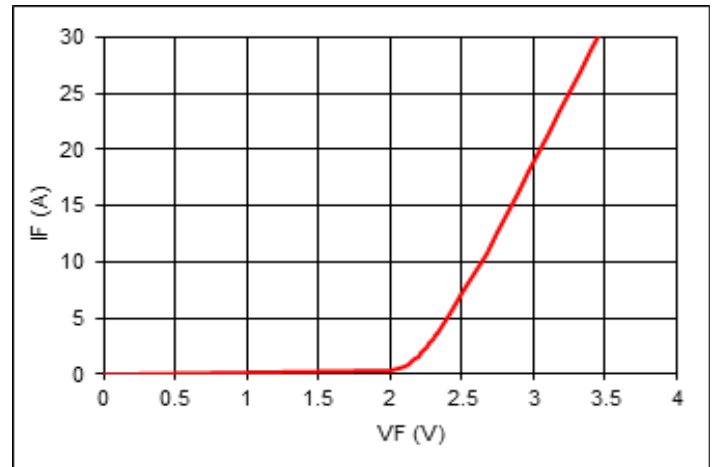
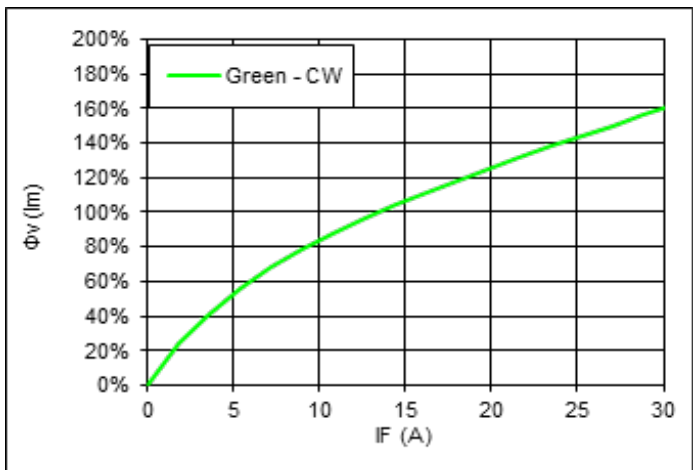
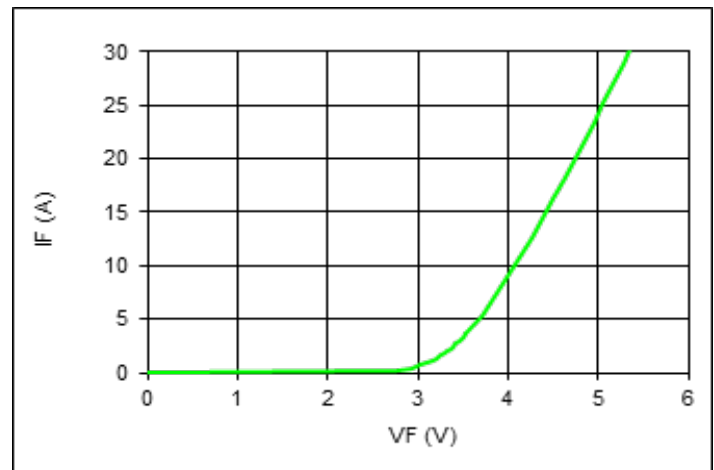
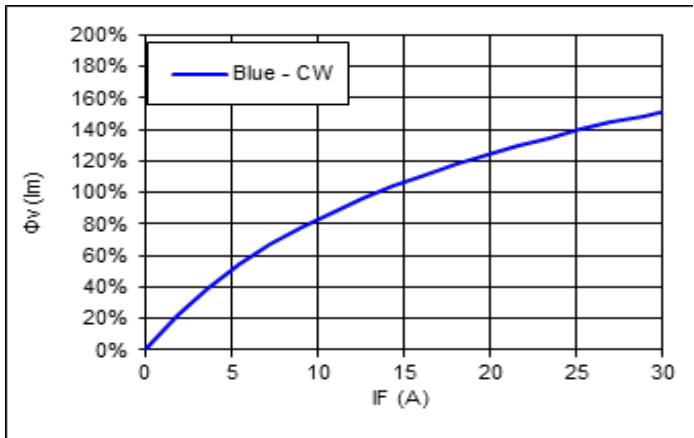
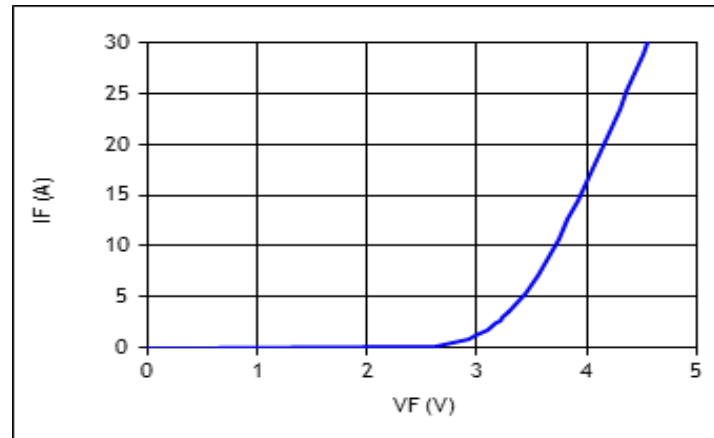
**Note 7:** In CIE 1931 chromaticity diagram coordinates, normalized to  $X+Y+Z=1$ .

**Note 8:** For reference only.

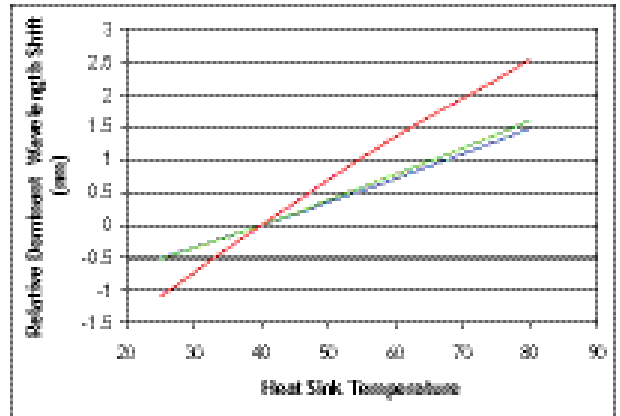
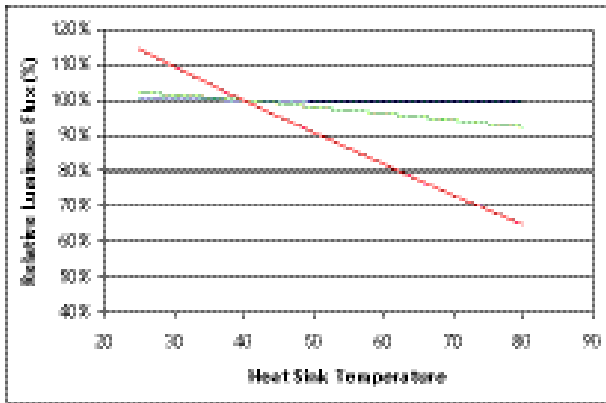
**Note 9:** Special design considerations must be observed for operation under 1 A. Please contact Luminus for further information.

**Note 10:** CBT-90 RGB LEDs are designed for operation to an absolute maximum current and temperature as specified above. Product lifetime data is specified at recommended forward drive currents. Sustained operation at or beyond absolute maximum currents or temperatures will result in a reduction of device life time compared to recommended conditions. Refer to the lifetime derating curves for further information.

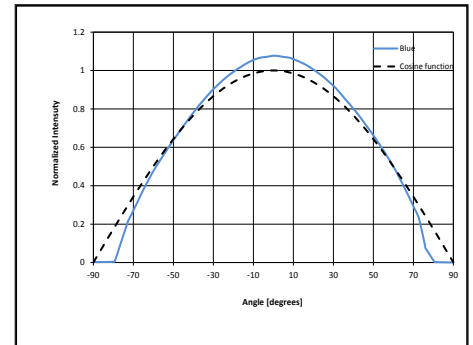
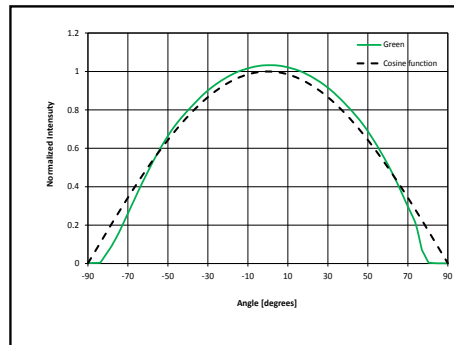
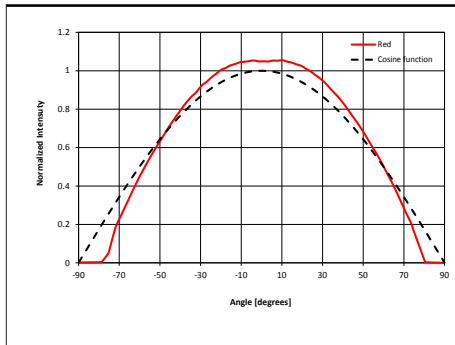
## Optical & Electrical Characteristics

**Relative Output Flux vs. Forward Current<sup>1</sup>**

**Forward Current vs. Forward Voltage**

**Relative Output Flux vs. Forward Current<sup>1</sup>**

**Forward Current vs. Forward Voltage**

**Relative Output Flux vs. Forward Current<sup>1</sup>**

**Forward Current vs. Forward Voltage**


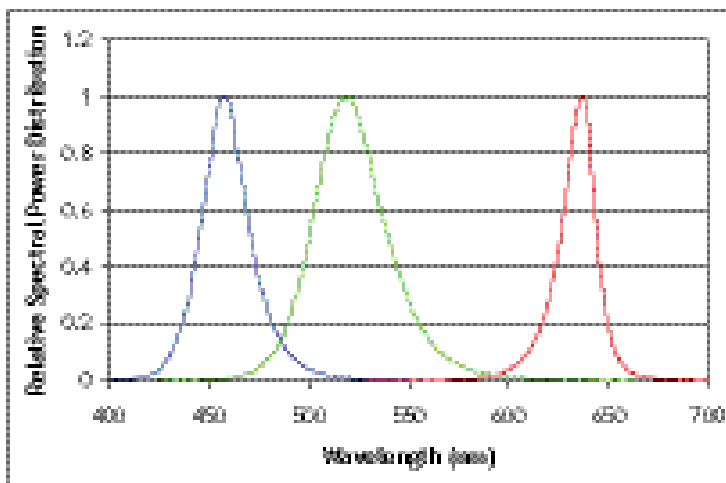
## Light Output and Spectral Characteristics Over Heat Sink Temperature



## Angular Intensity Distribution (Typical)



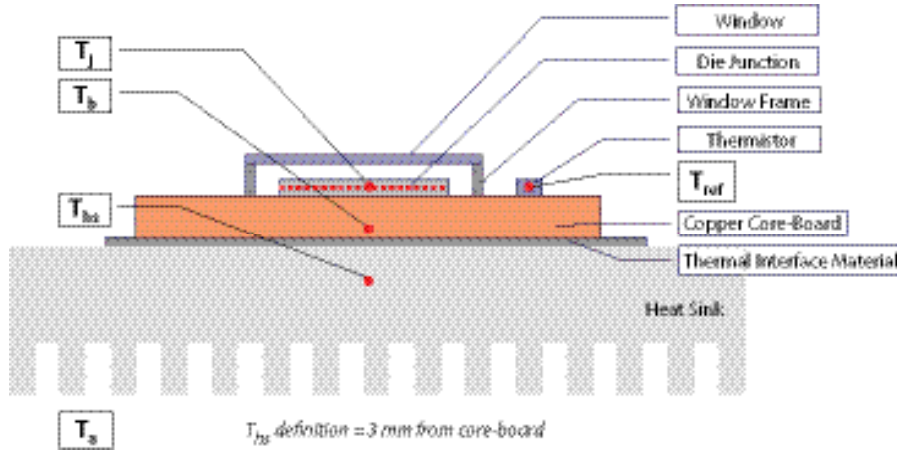
## Typical Spectrum<sup>1</sup>



Note 1: Typical spectrum at current density of 0.35 A/mm<sup>2</sup> in continuous operation.

## Thermal Resistance

### Typical Thermal Resistance



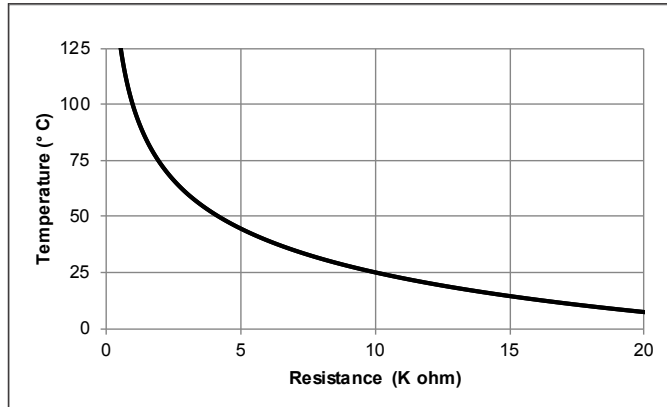
|                      |          |
|----------------------|----------|
| $R_{\theta j-b}^1$   | 0.5 °C/W |
| $R_{\theta b-hs}^1$  | 0.1 °C/W |
| $R_{\theta j-hs}^2$  | 0.6 °C/W |
| $R_{\theta j-ref}^1$ | 0.5 °C/W |

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

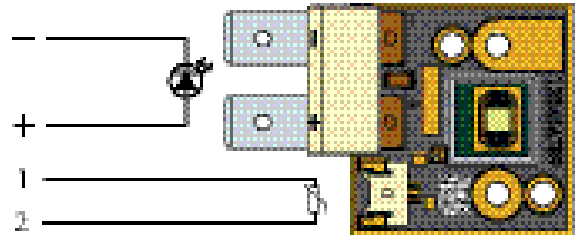
Note 2: Thermal resistance is measured using eGraf 1205 thermal interface material.

## Thermistor Information

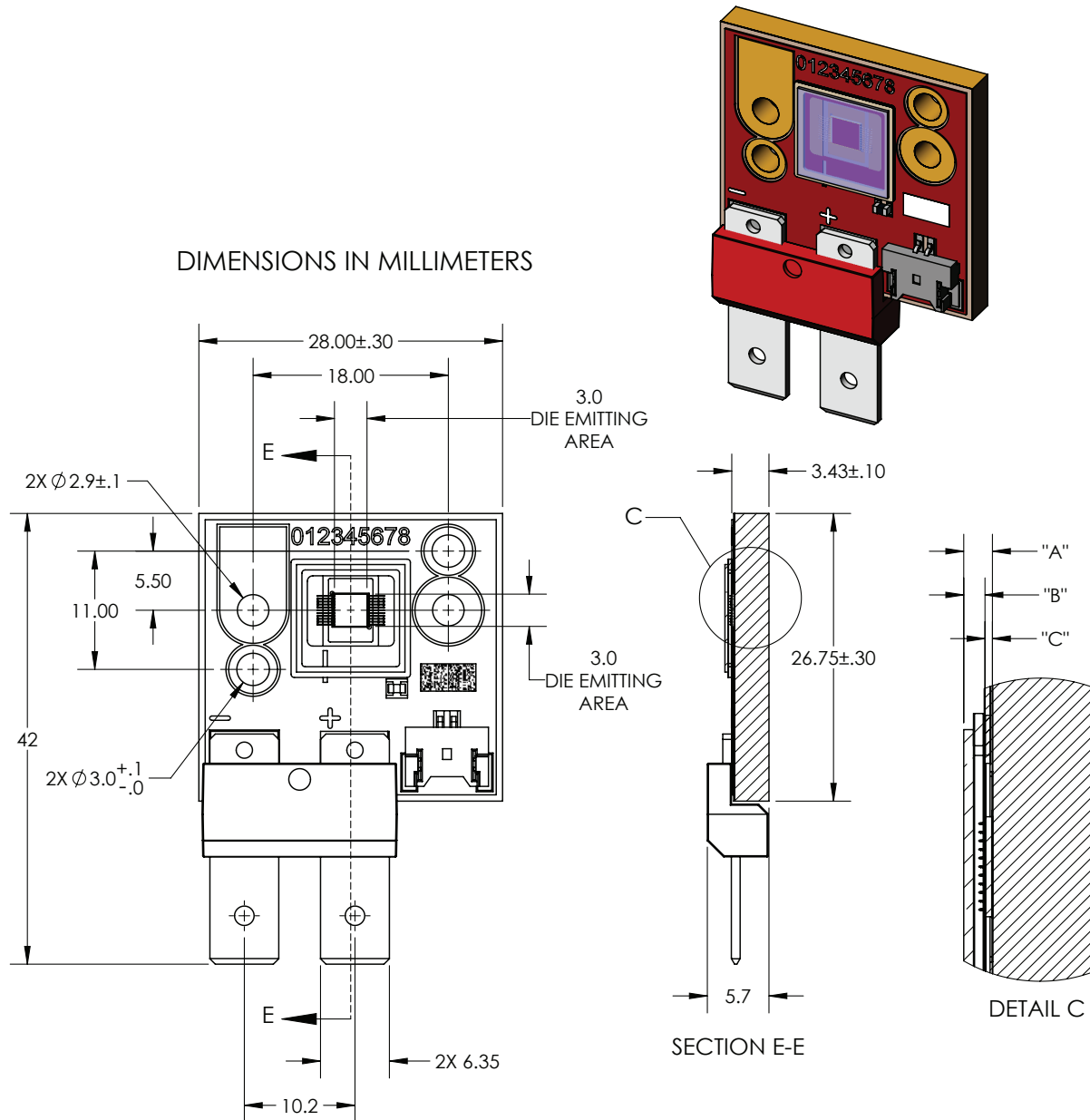
The thermistor used in CBT-90 LEDs mounted on core-boards is from Murata Manufacturing Co. The global part number is NCP15XH103J03RC. Please see <http://www.murata.com/> for details on calculating thermistor temperature.



## Electrical Pinout



## Mechanical Dimensions – CBT-90-RX Common Cathode LED



| DIMENSION NAME | DESCRIPTION                                        | NOMINAL DIMENSION | TOLERANCE |
|----------------|----------------------------------------------------|-------------------|-----------|
| "A"            | TOP OF METAL SUBSTRATE TO TOP OF WINDOW            | .88               | $\pm .13$ |
| "B"            | TOP OF DIE EMITTING AREA TO TOP OF WINDOW          | .65               | $\pm .11$ |
| "C"            | TOP OF METAL SUBSTRATE TO TOP OF DIE EMITTING AREA | .23               | $\pm .02$ |

DWG-002506

Recommended connector for Anode and Cathode: Panduit Disco Lok™ Series P/N: DNG14-250FL-C

Thermistor Connector: MOLEX P/N 53780-0270 or GCT P/N WTB08-021S-F.

Recommended Female: MOLEX P/N 51146-0200, GCT P/N WTB06-021S-F or equivalent

For detailed drawing please refer to DWG-002506 document

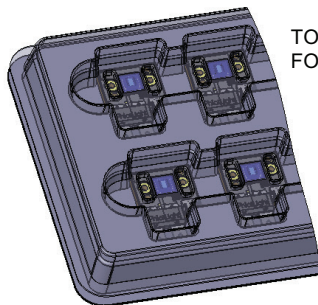
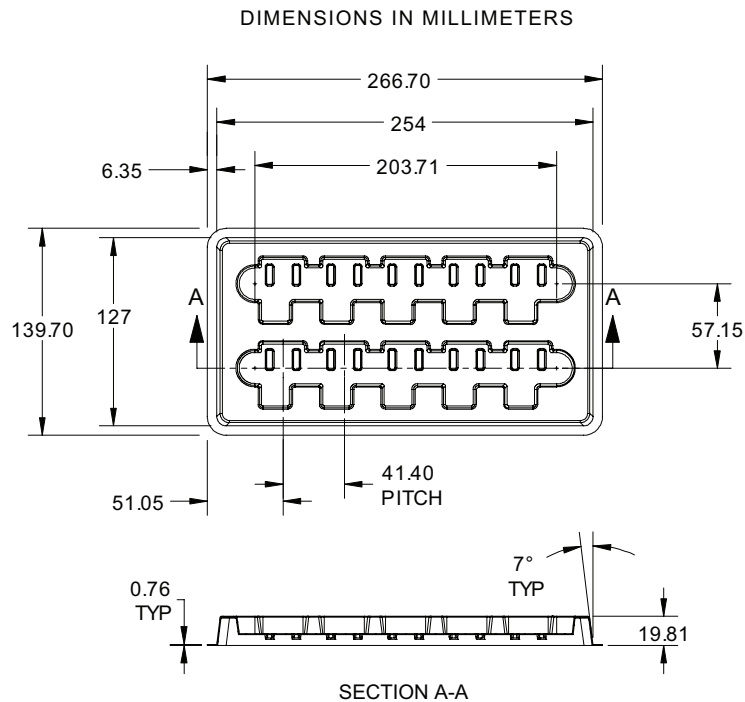


| DIMENSION NAME | DESCRIPTION                                        | NOMINAL DIMENSION | TOLERANCE |
|----------------|----------------------------------------------------|-------------------|-----------|
| "A"            | TOP OF METAL SUBSTRATE TO TOP OF WINDOW            | .88               | ±.13      |
| "B"            | TOP OF DIE EMITTING AREA TO TOP OF WINDOW          | .65               | ±.11      |
| "C"            | TOP OF METAL SUBSTRATE TO TOP OF DIE EMITTING AREA | .23               | ±.02      |

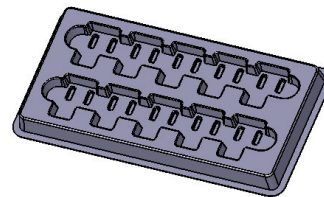
DWG-002309

For detailed drawing please refer to DWG-002309 document

## Shipping Tray Outline



TOP TRAY SHOWN TRANSPARENT  
FOR REFERENCE ONLY



For detailed drawing of shipping trays, please refer to document TO-0479, available upon request.

## Packing and Shipping Specification (CBT-90)

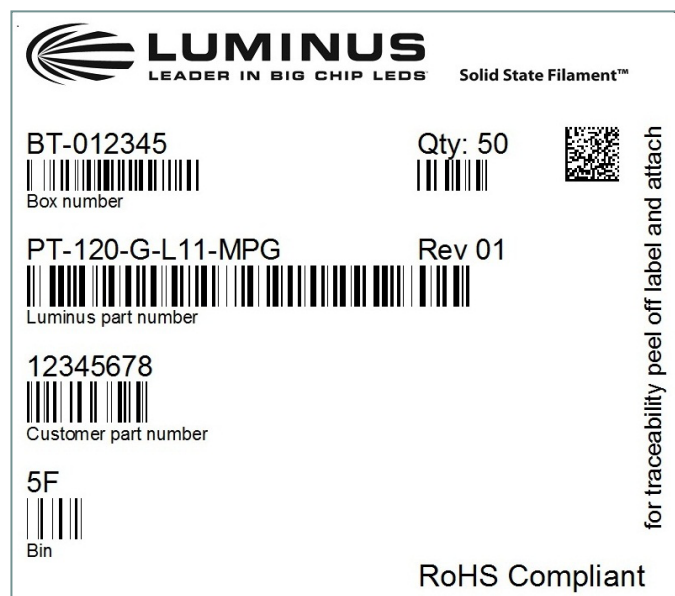
### Packing Specification

| Packing Configuration                                                         | Qty /Pack | Reel Dimensions<br>(diameter x W, mm) | Gross Weight (kg) |
|-------------------------------------------------------------------------------|-----------|---------------------------------------|-------------------|
| Stack of 5 trays with 10 devices per tray<br>Each pack is enclosed in ESD bag | 50        | 150 x 280 x 85                        | 2.7               |

### Product Label Specification

#### Label Fields (subject to change):

- 6-8 digit Box number (for Luminus internal use)
- Luminus ordering part number
- Quantity of devices in pack
- Part number revision (for Luminus internal use)
- Customer's part number (optional)
- Bin (FF-WW) as defined page 3
- 2D Bar code



Sample label –for illustration only

### Shipping Box

| Shipping Box | Quantity                           | Material | Dimensions<br>(L x W x H, mm) |
|--------------|------------------------------------|----------|-------------------------------|
| Carton Box   | 1 -20 packs<br>(50 - 1000 Devices) | S4651    | 560 x 560 x 200               |



## History of Changes

| Rev |            | Description of Change                                 |
|-----|------------|-------------------------------------------------------|
| 01  | 12/01/2015 | Initial Release - Preliminary Specifications          |
| 02  | 02/09/2015 | Editorial Changes and Update of Blue Bin Kit Offering |
| 03  | 02/15/2015 | Corrected Green Bin Kit Definition                    |
| 04  | 06/17/2017 | Revised wording in last page; Removed "Preliminary"   |
| 05  | 07/19/2017 | Updated Red flux bin                                  |

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This product is protected by U.S. Patents 6,831,302; 7,074,631; 7,083,993; 7,084,434; 7,098,589; 7,105,861; 7,138,666; 7,166,870; 7,166,871; 7,170,100; 7,196,354; 7,211,831; 7,262,550; 7,274,043; 7,301,271; 7,341,880; 7,344,903; 7,345,416; 7,348,603; 7,388,233; 7,391,059 Patents Pending in the U.S. and other countries.



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

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- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
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- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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