CBT-120

Monolithic Die Series

Ultraviolet Chip On Board LEDs

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Features:

- High thermal conductivity package.
  › Junction to heat sink thermal resistance of < 1 °C/W
- UV LED technology for very high power density and uniform emission
- Large, monolithic chip with surface emitting area of 12 mm², 16:9 aspect ratio
- Low-profile window for efficient coupling into small-etendue systems
- High radiometric efficiency
- Environmentally friendly: RoHS compliant, mercury-free
- Variable drive currents up to 30A
- NIST traceable optical and electrical measurement testing

Applications

- Curing:
  › Inks
  › Coatings
  › Adhesives
- Inspection
- Machine Vision
- Fiber-coupled illumination
- Specialty Projection Systems for Maskless Lithography:
  › Optically matched to TI 0.65” and 0.95”DMD chipsets
- Rapid Prototyping and 3D printing
- Medical and Scientific Instrumentation
Technology Overview

Luminus LEDs benefit from innovations in device technology, chip packaging and thermal management. This suite of technologies give engineers and system designers the freedom to develop solutions both high in power and efficiency.

Luminus Technology

Luminus’ technology enables large area LED chips to emit photons uniformly over the entire LED chip surface. The intense optical power density produced by these UV LEDs facilitate designs which replace arc and halogen lamps where arrays of traditional high power LEDs cannot.

For UV devices, Luminus engineers the LEDs to maximize light extraction and to emit with a Lambertian far-field distribution pattern. The design maximizes efficiency and allows for flexible optical designs.

Packaging Technology

Thermal management is critical in high power LED applications. Luminus CBT-120-UV LEDs have the lowest thermal resistance of any LED on the market with a thermal resistance from junction to heat sink of 0.73°C/W or 0.88°C/W. 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 10,000 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 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 measuring the device while fully powered.

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 for the standard drive conditions. Since the LEDs can be operated over a wide range of drive conditions (currents from <1A to 30 A, and duty cycle from <1% to 100%) there are many other potential values attainable. Driving devices beyond recommended driving conditions shortens lifetime (see derating curves on page 6).
Ordering Information

Part Number Nomenclature

CBT — 120 — CC — — C## — FF###-2#

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Chip Area</th>
<th>Color</th>
<th>Package Configuration</th>
<th>Bin Kit(^1,2,3)</th>
</tr>
</thead>
</table>
| CBT: Copper-core PCB, Monolithic Die | 120: 12 mm\(^2\) | UV = Ultraviolet | C14: 44.5 mm x 10 mm - Slim Package  
C31: 28 mm x 26.75 mm - Square Package  
See Mechanical Drawing section | See below for 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.

CBT-120-UV Bin Kit Order Codes

The following tables describe the bin kit ordering codes for the CBT-120-UV. The power and wavelength bins included in the bin kit. Each kit specifies a minimum power and the listed wavelength. A maximum power is not specified. Within each kit, Luminus may ship any part meeting or exceeding the minimum power specification. Shipments will always meet the listed wavelength bin’s range. For information on ordering bin kits not listed below, please contact Luminus or an official distributor.

<table>
<thead>
<tr>
<th>Products</th>
<th>Ordering Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT-120-UV</td>
<td>CBT-120-UV-C31-x123-22</td>
<td>CBT-120-UV consisting of a 12 mm(^2) LED, a thermistor, connectors, and a square copper-core PCB.</td>
</tr>
<tr>
<td></td>
<td>CBT-120-UV-C14-x123-22</td>
<td>CBT-120-UV consisting of a 12 mm(^2) LED, connectors, and a slim (rectangular) copper-core PCB.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Color</th>
<th>Bin Kit Code</th>
<th>Power (W)</th>
<th>Wavelength (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Allowed</td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>UV</td>
<td>N400-22</td>
<td>14.6</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>P400-22</td>
<td>16.1</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Q400-22</td>
<td>17.7</td>
<td>400</td>
</tr>
</tbody>
</table>
CBT-120-UV Binning Structure

CBT-120-UV LEDs are specified for luminous flux and chromaticity/wavelength at a drive current of 18 A (1.5 A/mm²) and placed into one of the following Power Bins and Wavelength Bins:

### Power Bins

<table>
<thead>
<tr>
<th>Color</th>
<th>Power Flux Bin (F)</th>
<th>Minimum Flux (W)</th>
<th>Maximum Flux (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV</td>
<td>N</td>
<td>14.6</td>
<td>16.1</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>16.1</td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>17.7</td>
<td>19.5</td>
</tr>
</tbody>
</table>

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

### Wavelength Bins

<table>
<thead>
<tr>
<th>Color</th>
<th>Wavelength Bin (123)</th>
<th>Minimum Wavelength (nm)</th>
<th>Maximum Wavelength (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV</td>
<td>400</td>
<td>400</td>
<td>405</td>
</tr>
<tr>
<td></td>
<td>405</td>
<td>405</td>
<td>410</td>
</tr>
</tbody>
</table>
## Reference Optical & Electrical Characteristics ($T_{hs} = 40^\circ C$)$^{1,2}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drive Condition</strong>$^3$</td>
<td>$j$</td>
<td>1.5</td>
<td>A/mm$^2$</td>
</tr>
<tr>
<td><strong>Current Density</strong></td>
<td>$V_{F\text{,min}}$</td>
<td>3.2</td>
<td>V</td>
</tr>
<tr>
<td><strong>Forward Voltage</strong></td>
<td>$V_F$</td>
<td>3.4</td>
<td>V</td>
</tr>
<tr>
<td><strong>Radiometric Flux</strong>$^5$</td>
<td>$\Phi_{\text{typ}}$</td>
<td>18.0</td>
<td>W</td>
</tr>
<tr>
<td><strong>Radiometric Flux Density</strong></td>
<td>$\Phi_R$</td>
<td>1.5</td>
<td>W/mm$^2$</td>
</tr>
<tr>
<td><strong>Wavelength Range</strong></td>
<td>$\lambda$</td>
<td>400 - 410</td>
<td>nm</td>
</tr>
<tr>
<td><strong>Peak Wavelength</strong></td>
<td>$\lambda_p$</td>
<td>405</td>
<td>nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>UV</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emitting Area</strong></td>
<td></td>
<td>12.0</td>
<td>mm$^2$</td>
</tr>
<tr>
<td><strong>Emitting Area Dimensions</strong></td>
<td></td>
<td>$4.63 \times 2.6$</td>
<td>mm $\times$ mm</td>
</tr>
<tr>
<td><strong>Dynamic Resistance</strong></td>
<td>$\Omega_{\text{dyn}}$</td>
<td>0.02</td>
<td>$\Omega$</td>
</tr>
</tbody>
</table>

### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>UV</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Current</strong>$^4$</td>
<td></td>
<td>0.2</td>
<td>A</td>
</tr>
<tr>
<td><strong>Maximum Current</strong>$^4$</td>
<td></td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td><strong>Maximum Junction Temperature</strong>$^7$</td>
<td>$T_{\text{j,\text{max}}}$</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td><strong>Storage Temperature Range</strong></td>
<td></td>
<td>-40 to +100</td>
<td>°C</td>
</tr>
</tbody>
</table>

---

**Note 1:** Data verified using NIST traceable calibration standard.

**Note 2:** All data are based on test conditions with a constant heat sink temperature $T_{hs} = 40^\circ C$ under pulse testing conditions. Pulse conditions: 25% duty-cycle and frequency of 360 Hz. Nominal $T_j = 80^\circ C$. See Thermal Resistance section for $T_j$ and $T_{hs}$ definition.

**Note 3:** Listed drive conditions are typical for common applications. CBT-120-UV devices can be driven at currents ranging from 0.2 A to 30 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 4:** Unless otherwise noted, values listed are typical. Devices are production tested and specified at 18 A.

**Note 5:** Typical total flux from emitting area at listed peak 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:** CBT-120-UV 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 life time 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 longer than 0.5 microseconds.

**Note 7:** Lifetime dependent on LED junction temperature. Input power and thermal system must be properly managed to ensure lifetime. See charts on page 5 for further information.

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

Relative Power vs Forward Current, $T_j = 80°C$

Normalized to $I_f = 18$ A

Relative Power vs Junc. Temperature, $I_f = 18$ A

Normalized to $T_j = 80°C$

Peak Wavelength vs Forward Current

Referenced to $I_f = 18$ A

Peak Wavelength vs Junction Temperature

Referenced to $T_j = 80°C$

Forward Voltage vs Forward Current

Referenced to $I_f = 18$ A

Forward Voltage vs Junction Temperature

Referenced to $T_j = 80°C$
Note 9. Typical spectrum at current of 18 A in continuous operation.
Note 10. Lifetime defined as time to 70% of initial intensity. Data can be used to model failure rate over typical product lifetime.
Thermal Resistance CBT-120-UV-C31

Typical Thermal Resistance

| $R_{\theta j-b}^1$ | $0.61 \degree C/W$ |
| $R_{\theta b-hs}^1$ | $0.12 \degree C/W$ |
| $R_{\theta j-hs}^2$ | $0.73 \degree C/W$ |
| $R_{\theta j-ref}^1$ | $0.64 \degree C/W$ |

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

Note 2: Thermal Resistance is based on eGraf 1205 Thermal interface.

Thermal Resistance CBT-120-UV-C14

Typical Thermal Resistance

| $R_{\theta j-b}^1$ | $0.76 \degree C/W$ |
| $R_{\theta b-hs}^1$ | $0.12 \degree C/W$ |
| $R_{\theta j-hs}^2$ | $0.88 \degree C/W$ |

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

Note 2: Thermal Resistance is based on Fujipoly Thermal interface.

Electrical Pinout - C31 Package

The thermistor used in CBT-120 devices mounted on coreboards is from Murata Manufacturing Co. The global part number is NCP18XH103J03RB. Please see http://www.murata.com/ for details on calculating thermistor temperature.

For more information on use of the thermistor, please contact Luminus directly.
Recommended connector for Anode and Cathode: Panduit Disco Lok™ Series P/N: DNG14-250FL-C.
Mechanical Dimensions – CBT-120-UV-C31 Emitter

DIMENSIONS IN MILLIMETERS

<table>
<thead>
<tr>
<th>DIMENSION NAME</th>
<th>DESCRIPTION</th>
<th>NOMINAL DIMENSION</th>
<th>TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;A&quot;</td>
<td>TOP OF METAL SUBSTRATE TO TOP OF WINDOW</td>
<td>0.91</td>
<td>±0.13</td>
</tr>
<tr>
<td>&quot;B&quot;</td>
<td>TOP OF DIE EMITTING AREA TO TOP OF WINDOW</td>
<td>0.61</td>
<td>±0.11</td>
</tr>
<tr>
<td>&quot;C&quot;</td>
<td>TOP OF METAL SUBSTRATE TO TOP OF DIE EMITTING AREA</td>
<td>0.27</td>
<td>±0.02</td>
</tr>
</tbody>
</table>

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
Shipping Tray Outline - CBT-120-C14

TO-1056 REV A

ROTATE TRAYS WHEN STACKING

SECTION D-D
SCALE 2 : 1

0

10X 4.33 [110]
10X 3.67 [93.2]
10X 3.18 [80.6]
2.75 [69.9]
10X 2.33 [59.1]
10X 1.83 [46.5]
10X 1.17 [29.7]

1.31 [33.3]
2.19 [56.6]
3.06 [77.8]
3.94 [100]
4.81 [122.2]
5.69 [144.5]
6.56 [166.7]
7.44 [188.9]
8.31 [211.1]
9.19 [233.4]

4X .36 [9.1]

4X .41 [10.3]

9X .42 [10.6]
9X .84 [21.3]
2X R.42 [10.6]
Shipping Tray Outline - CBT-120-C31

DIMENSIONS IN MILLIMETERS

TOP TRAY SHOWN TRANSPARENT FOR REFERENCE ONLY
Packing and Shipping Specification (CBT-120)

Packing Specification

<table>
<thead>
<tr>
<th>Packing Configuration</th>
<th>Qty /Pack</th>
<th>Box Dimensions (diameter x W, mm)</th>
<th>Gross Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stack of 5 trays with 10 devices per tray Each pack is enclosed in ESD bag</td>
<td>50</td>
<td>140 x 280 x 70</td>
<td>2.7</td>
</tr>
</tbody>
</table>

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)
- Flux Bin
- 2D Bar code

Shipping Box

<table>
<thead>
<tr>
<th>Shipping Box</th>
<th>Quantity</th>
<th>Material</th>
<th>Dimensions (L x W x H, mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carton Box</td>
<td>1 - 20 packs (50 - 1000 Devices)</td>
<td>S4651</td>
<td>560 x 560 x 200</td>
</tr>
</tbody>
</table>
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