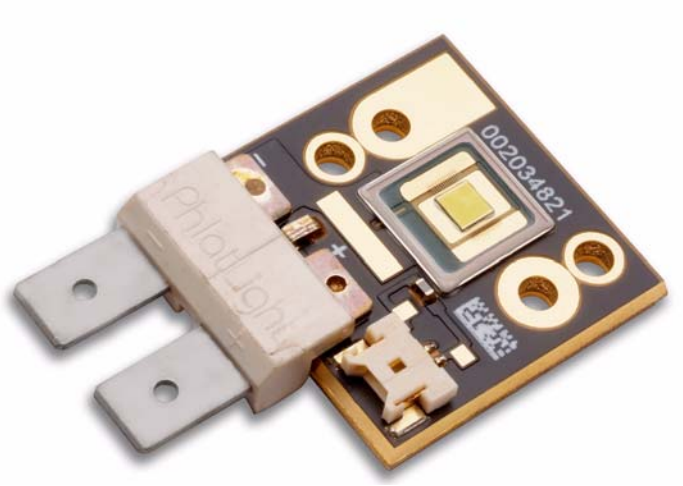
PRODUCT DATA SHEET

PRELIMINARY

PhlatLight® White LED Illumination Products

CBT-90 Series



PhlatLight® LEDs enable a new class of illumination applications.

Features

- Extremely high optical output: Over 2,200 lumens from a single chip (White)
- High thermal conductivity package - junction to heat sink thermal resistance of only 0.9 ºC/W
- Large, monolithic chip with uniform emitting area of 9 mm^2
- Lumen maintenance of greater than 70% after 60,000 hours
- Environmentally friendly: RoHS compliant
- Variable drive currents: less than 1 A through 13.5 A to full reliability specifications
- High reliability

Applications

- Medical Lighting
- Machine Vision
- Microscopy
- Architectural Lighting
- Fiber Coupled Illumination
- Projection systems
- Spot Lighting

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Technology Overview

PhlatLight LEDs benefit from a suite of innovations in the fields of chip technology, packaging, and thermal management. These breakthroughs allow illumination designers to achieve efficient light engine designs and deliver high brightness solutions.

PhlatLight Technology

The name PhlatLight is derived from Photonic Lattice. Photonic lattice technology creates true surface emission from the source, which 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 0.9 ºC/W, PhlatLight CBT-90 devices 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 and longer lifetimes. The package is easy to use, and ready to be mounted in the lighting system.

Reliability

Designed from the ground up, PhlatLight LEDs are one of the most reliable light sources in the world today. PhlatLight 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 are well above 60,000 hours, PhlatLight LEDs are ready for the most demanding applications.

Environmental Benefits

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

Understanding PhlatLight Test Specifications

Every PhlatLight LED device is fully tested to ensure that it meets the high quality standards of Luminus' products.

Testing Temperature

PhlatLight LEDs are 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 40º 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 PhlatLight LEDs perform in the field just as they are specified.

Multiple Operating Points (3.2 A, 9.0 A, 13.5 A)

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 less than 1 A to 13.5 A, and duty cycle from <1% to 100%) multiple drive conditions are listed.

PhlatLight CBT-90 devices are production tested at 9.0 A. The values shown at 3.2 A and 13.5 A are for additional reference at other possible drive conditions.

PhlatLight White Binning Structure

PhlatLight 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

Color	Flux Bin (FF)	Minimum Flux (lm) @ 9.0 A	Maximum Flux (lm) @ 9.0 A
W65S 6500K, Standard CRI (typ. 70)	WN	1,000	1,200
	WP	1,200	1,450
	WQ	1,450	1,750
	WR	1,750	2,100

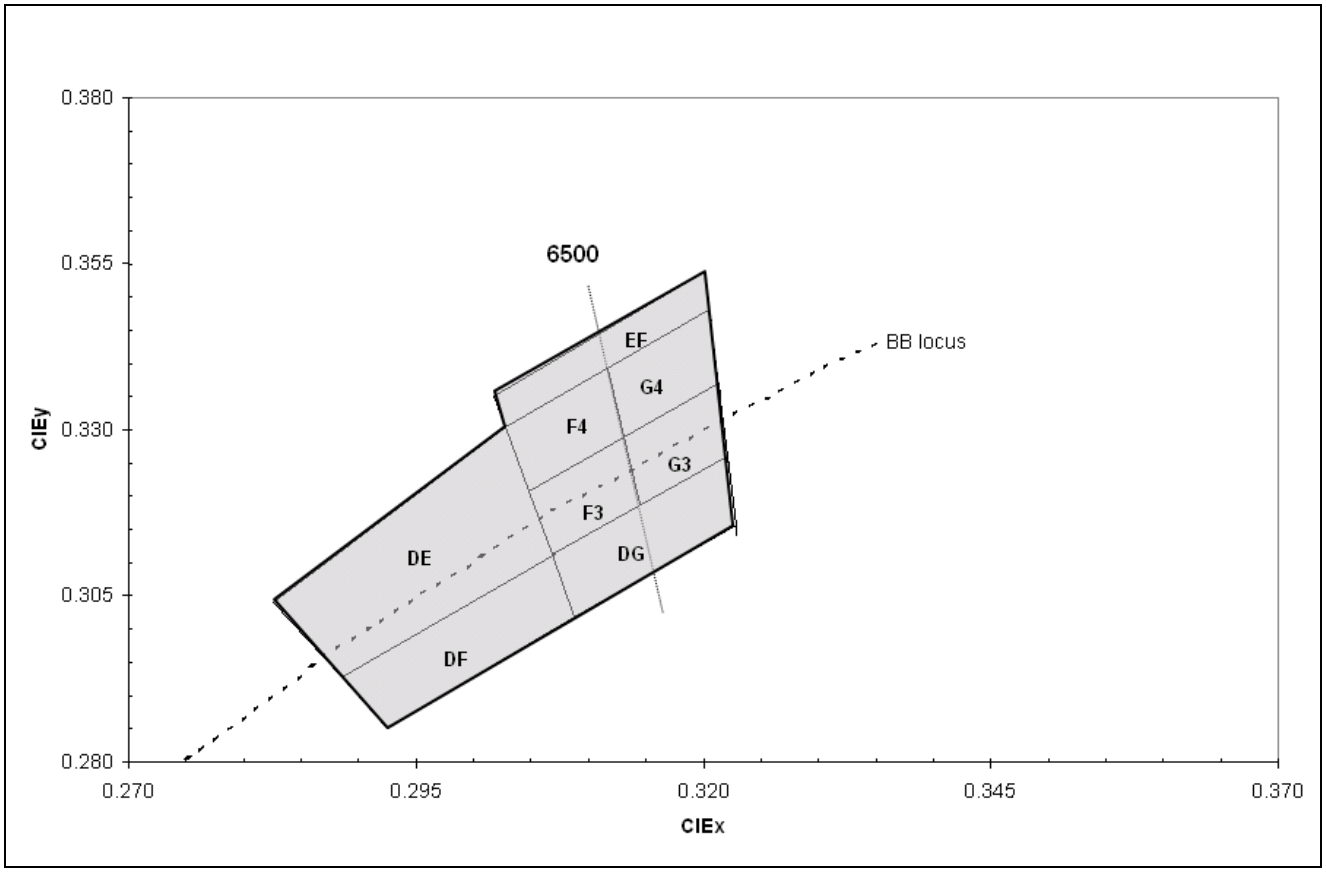
Chromaticity Bins

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

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

Chromaticity Bins

Luminus' Standard Chromaticity Bins: 1931 CIE Curve



PhlatLight Product Shipping and Labeling Information

All PhlatLight products are packaged and labeled with their respective bin as outlined in the tables on page 3. Modules are packaged in trays of 10, with each package only containing one bin. The part number designation is as follows:

CBT —— **90** —— **WNNX** —— **C11** —— **FF** —— **WW**

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Chromaticity Bin
CBT: Window Chip on Board	90: 9.0 mm^2	WNNX: CCT and CRI See Note Below	C11: 28 x 27 mm board	See page 3 for bins	See page 3 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

Note 2. Some flux and chromaticity bins may have limited availability. Application specific bin kits, consisting of multiple bins, may be available. For ordering information, please refer to page 10 and reference the PhlatLight Binning and Labeling document.

Example: The part label CBT-90-W65S-C11-WN-G4 refers to a 6500K standard CRI white, CBT-90 module, C11 package configuration, with a flux range of 1,000 to 1,200 lumens and a chromaticity value within the box defined by the four points (0.313, 0.338), (0.321, 0.348), (0.322, 0.336), (0.312, 0.328).

Optical and Electrical Characteristics at TrueTemp[1] ($T_{heat\ sink}$ = 40 °C)

Cool White					
Drive Condition[2]		**3.2A Continuous**	**9.0 A Continuous**	**13.5 A Continuous**	
Parameter	**Symbol**	**Typ. Values at Indicated Current[3]**	**Values at Test Currents**	**Typ. Values at Indicated Current**	**Unit**
Current Density	j	0.35	1.0	1.5	A/mm^2
Forward Voltage	V_F	3.2	3.6	3.7	V

Common Characteristics

	Symbol	Values	Unit
Emitting Area		9.0	mm^2
Emitting Area Dimensions		3 x 3	mmxmm
Color Temperature[4]	CCT	6,500	K
Color Rendering Index	R_a	>70	
Dynamic Resistance	Ω_{dyn}	0.050	Ω
Forward Voltage Temperature Coefficient[5]		-5.47	mV/ºC

Absolute Maximum Ratings

	Symbol	Values	Unit
Maximum Current[6]		18	A
Maximum Junction Temperature[7]	T_{jtrans}	150	ºC
Storage Temperature Range		-40/+100	ºC

Note 1: All ratings are based on operation with a constant heat sink temperature T_{hs} =40ºC. See Thermal Resistance section for T_{hs} definition.

Note 2: Listed drive conditions are typical for common applications. PhlatLight® CBT-90 devices can be driven at currents ranging from <1 A to 13.5 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: Unless otherwise noted, values listed are typical.

Note 4: CCT value based off of CIE measurement. CIE measurement uncertainty for white devices is estimated to be +/- 0.01.

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

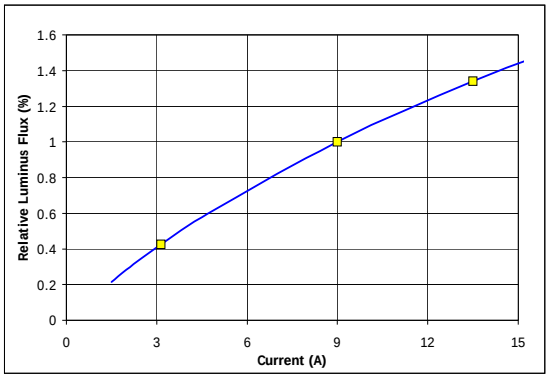
Note 6: Luminus PhlatLight CBT-90-W LEDs are designed for operation to an absolute maximum forward drive current density of 2.0 A/mm^2. Product lifetime data is specified at recommended forward drive currents. Sustained operation at absolute maximum currents will result in a reduction of device lifetime 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 7: Lifetime dependent on LED junction temperature. Input power and thermal system must be properly managed to ensure lifetime. See charts on pg 6 for further information.

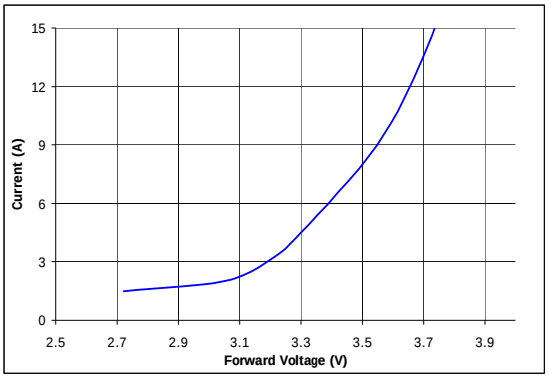
Note 8: Special design considerations must be observed for operation under 1 A. Please contact Luminus for further information.

Note 9: Caution must be taken not to stare at the light emitted from these LEDs. Under special circumstances, the high intensity could damage the eye.

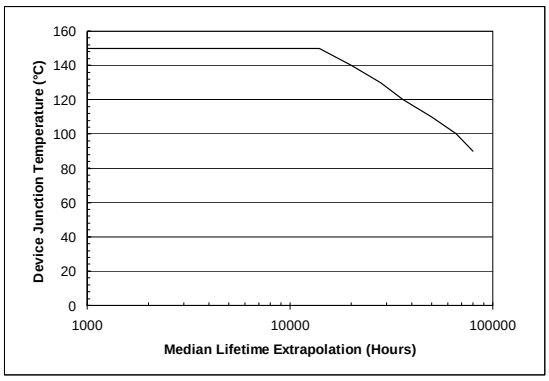
Relative Output Flux vs. Forward Current[1]



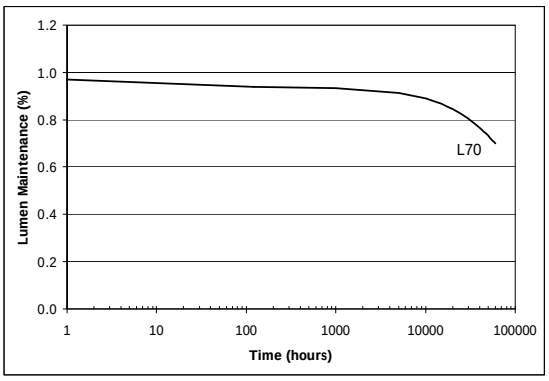
Forward Current vs. Forward Voltage



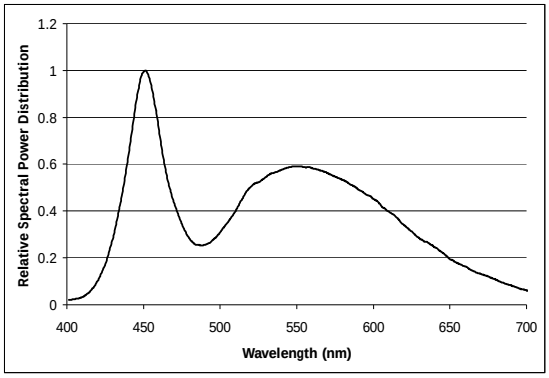
Median Lifetime[2]



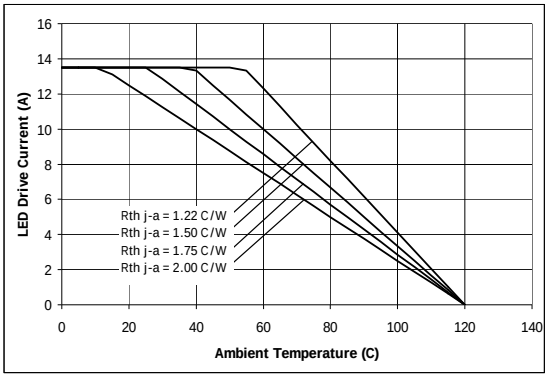
Lumen Maintenance vs. Time[3]



Typical Spectrum[4]



Current Derating Curve



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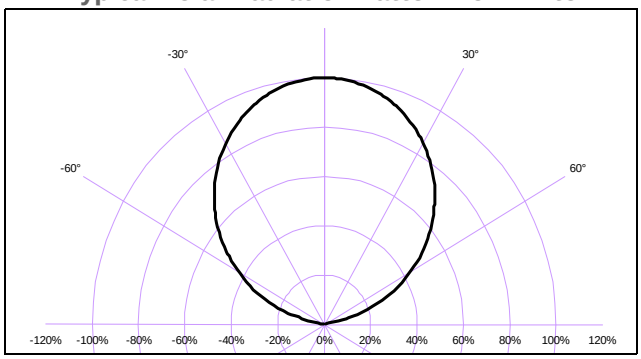
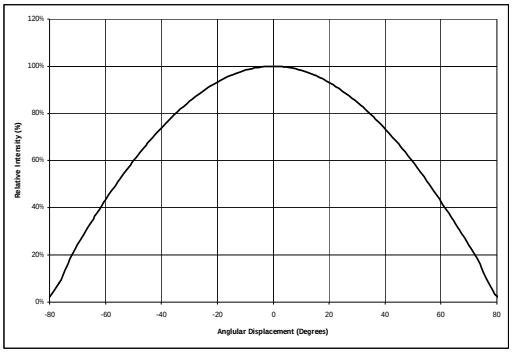
1. *Yellow squares indicate typical operating conditions.*
2. *Mean expected lifetime in dependence of junction temperature at 1.0A/mm^2 in continuous operation. Lifetime defined as time to 70% of initial intensity. Based on preliminary lifetime test data. Data can be used to model failure rate over typical product lifetime.*
3. *Lumen maintenance in dependence of time at 1.0A/mm^2 in continuous operation with junction temperatures of 130 ^{o}C.*
4. *Typical spectrum at current density of 1.0 A/mm^2 in continuous operation.*

Typical Radiation Pattern

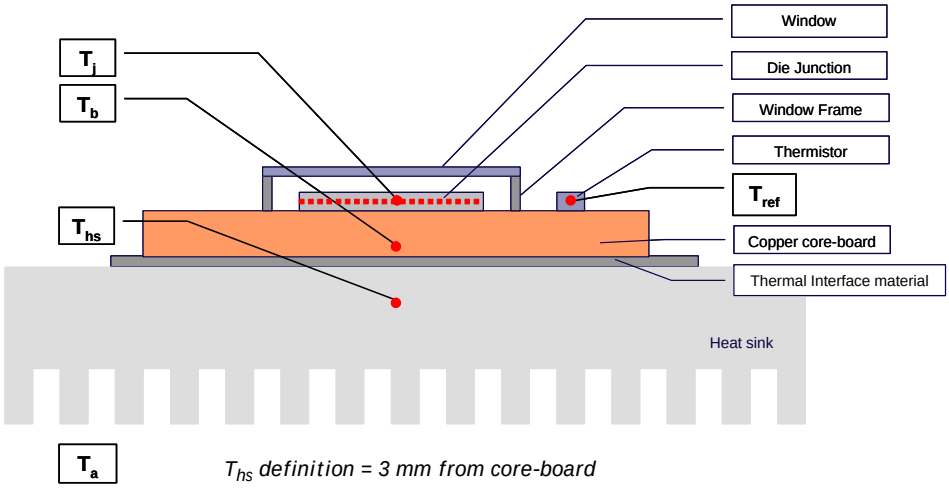
Typical Polar Radiation Pattern for White



Typical Angular Radiation Pattern for White



Thermal Resistance



T_{hs} definition = 3 mm from core-board

Typical Thermal Resistance

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

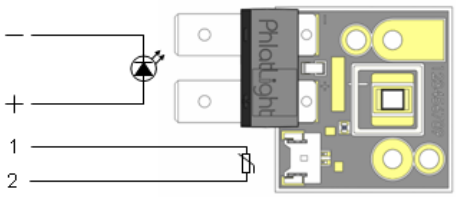
Note 1: Thermal resistance values are based on FEA model results correlated to measured $R_{\theta j\text{-}hs}$ data

Note 2: Thermal Resistance is measured using eGraph 1205 Thermal interface.

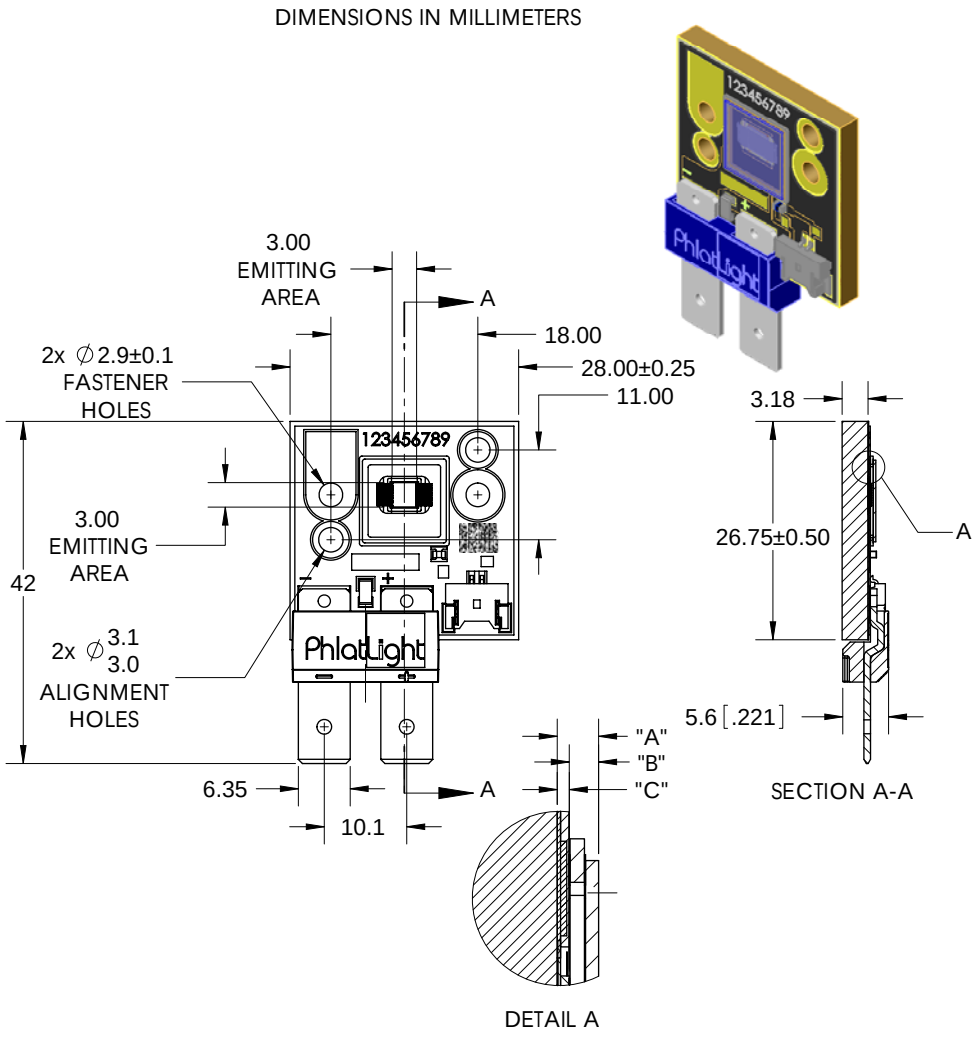
Thermistor Information

The thermistor used in PhlatLight devices 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



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
"C"	TOP OF METAL SUBSTRATE TO EMITTING AREA	0.28	±0.05

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

Ordering Information

Ordering Part Number[1,2,3]	Color	Description
CBT-90-W65S-C11-GN100	6500K White	White PhlatLight CBT-90 consisting of a 9 mm^2 LED, thermistor, and connector, mounted on a copper-core PCB.

Note 1: GN100 - denotes a bin kit comprising of all flux and chromaticity bins at the 6500K color point
See PhlatLight Binning and Labeling document for more information.
Note 2: For ordering information on all available bin kits, please see PhlatLight Binning and Labeling document.
Note 3: Standard packaging increment (SPI) is 10.

www.luminus.com