PRODUCT DATA SHEET

PhlatLight® LED Illumination Products

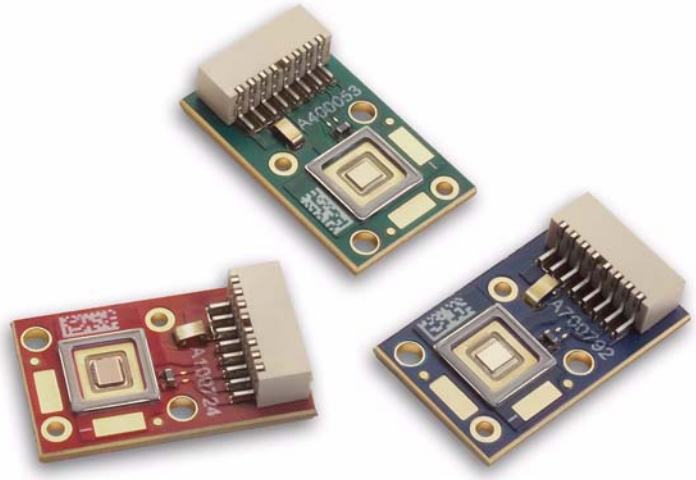
CBT-54 Series

Features

- Extremely high optical output: Over 560 Red Lumens
  Over 925 Green lumens
  Over 220 Blue Lumens
- High thermal conductivity package - junction to heat sink thermal resistance of only 1.3 °C/W
- Photonic lattice technology for very high surface brightness and uniform emission
- Large, monolithic chip with surface emitting area of 5.4 mm^2
- High luminous efficacy
- Lumen maintenance of greater than 70% after 60,000 hours
- Environmentally friendly: RoHS compliant
- Variable drive currents: less than 1 A through 13 A
- Currently available in Red, Green and Blue; other colors to follow

Applications

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



PhlatLight® LEDs, based on Photonic Lattice Technology, enable a new class of illumination applications.

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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. PhlatLight devices use photonic lattice patterns to extract more light from the LED chip, and to create radiation patterns that are collimated compared to typical Lambertian emitters. Optical collection efficiencies improve and optical designs become simplified with a more collimated light source.

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 1.3 °C/W, PhlatLight CBT-54 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 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 PhlatLight LEDs perform in the field just as they are specified.

Multiple Operating Points (1.9 A, 8.1 A, 13.5 A)

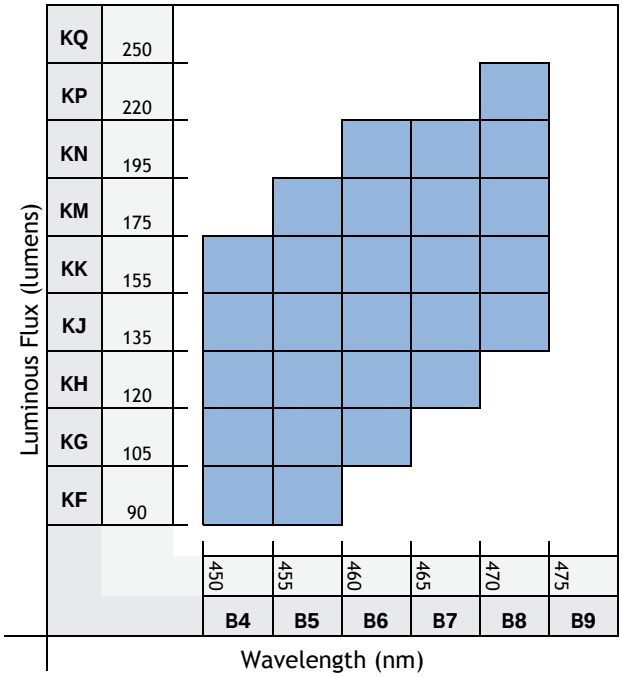
The tables on the following pages provide typical optical and electrical characteristics. Since the LEDs can be operated over a wide range of drive conditions (currents from 0.01 A to 30 A, and duty cycle from <1% to 100%) multiple drive conditions are listed.

PhlatLight CBT-54 devices are specified at 8.1 A. The values shown at 1.9 A and 13.5 A are for additional reference at other possible drive conditions.

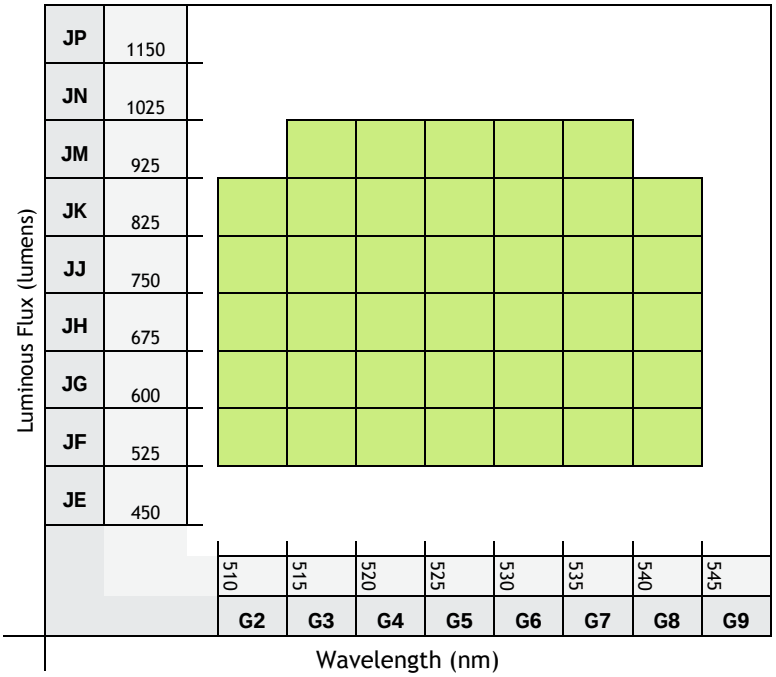
PhlatLight CBT-54 Bins

PhlatLight LEDs are specified for luminous flux and wavelength at a drive current of 8.1 A (1.5 A/mm^2) and placed into one of the following luminous flux (FF) and wavelength (WW) bins:

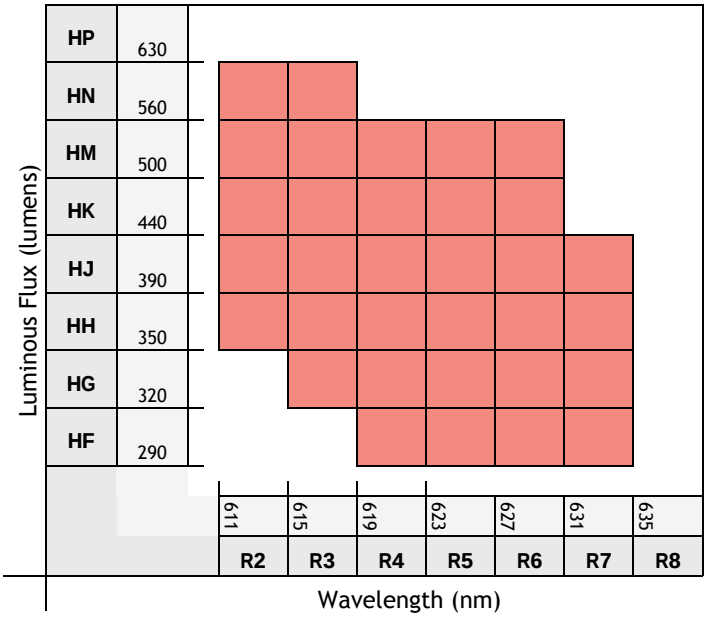
Blue Bins



Green Bins



Red Bins



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 — **54** — X — **C21** — FF — WW

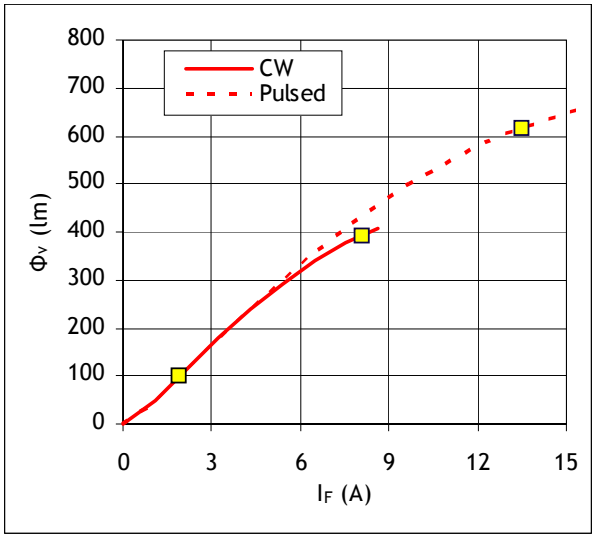
Product Family	Chip Area	Color	Package Configuration	Flux Bin	Wavelength Bin
CBT: Chip on Board	54: 5.4 mm^2	R: Red	C21: 16 x 26.5 mm board	See page 3 for bins	See page 3 for bins
		G: Green			
		B: Blue			

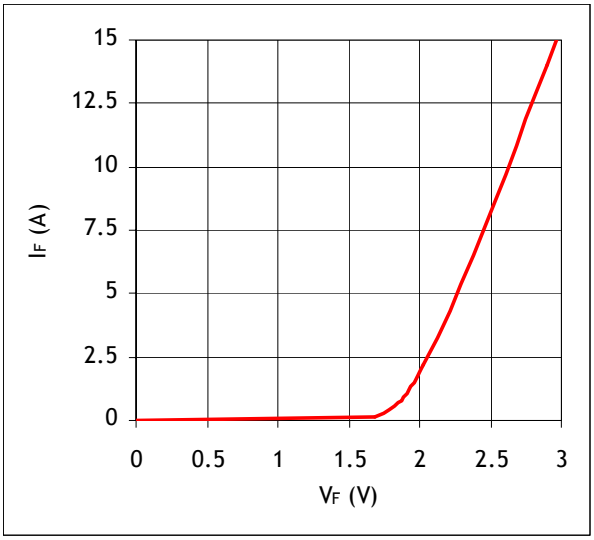
Example: The part number CBT-54-R-C21-HM-R4 refers to a red, CBT-54 module, with a flux range of 500 - 560 lumens and a wavelength range of 619 nm to 623 nm.

Note: Some flux and wavelength bins may have limited availability. Application specific bin kits, consisting of multiple bins, may be available. For ordering information, please refer to page 12 or contact your local Luminus sales representative.

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

Red					
Drive Condition[2]		1.9 A Continuous	8.1 A Continuous	13.5A Pulsed 50% D.F.[3]	
Parameter	**Symbol**	**Values[4]**			**Unit**
Current Density	j	0.35	1.5	2.5	A/mm^2
Forward Voltage	$V_{F\ min}$		2.0		V
	V_F	1.8	2.3	2.5	V
	$V_{F\ max}$		2.6		V
Luminous Flux[5]	$\Phi_{V\ typ}$	100	400	625	lm
Radiometric Flux	Φ_r	0.6	2.3	3.4	W
Luminous Efficacy	η	26	20	18	lm/W
Dominant Wavelength[6]	λ_d	622	623	623	nm
Peak Wavelength	λ_p	625	628	629	nm
Color Saturation	-	1.00	1.00	1.00	-
FWHM	$\Delta\lambda_{1/2}$	16	19	20	nm
Chromaticity Coordinates[7,8]	x	0.695	0.699	0.702	-
	y	0.305	0.301	0.298	-

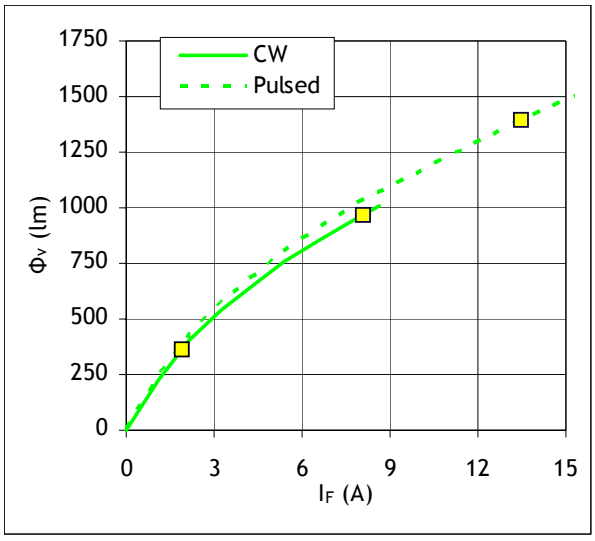


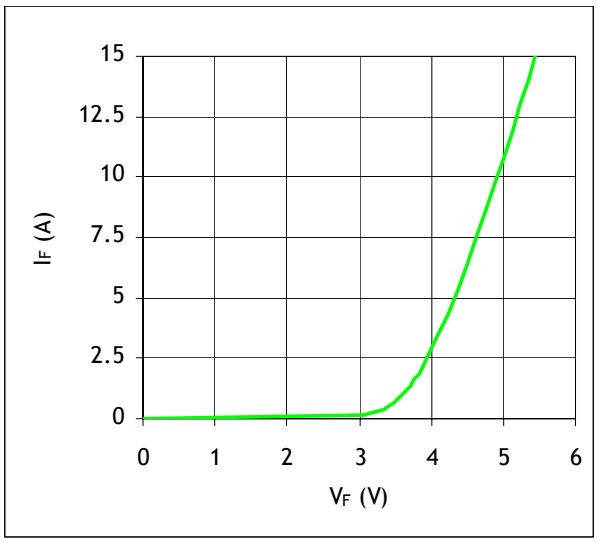


Yellow squares indicate reference drive conditions

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

Green					
Drive Condition[2]		**1.9 A Continuous**	**8.1 A Continuous**	**13.5 A Pulsed 50% D.F.[3]**	
Parameter	**Symbol**	**Values[4]**			**Unit**
Current Density	j	0.35	1.5	2.5	A/mm^2
Forward Voltage	V_{Fmin}		3.8		V
	V_F	3.5	4.3	4.9	V
	V_{Fmax}		4.9		V
Luminous Flux[5]	Φ_V	375	950	1400	lm
Radiometric Flux	Φ_r	0.7	1.8	2.8	W
Luminous Efficacy	η	55	28	21	lm/W
Dominant Wavelength[6]	λ_d	535	528	526	nm
Peak Wavelength	λ_p	530	524	521	nm
Color Saturation	-	0.91	0.83	0.79	-
FWHM	$\Delta\lambda_{1/2}$	35	39	40	nm
Chromaticity Coordinates[7,8]	x	0.205	0.175	0.161	-
	y	0.740	0.730	0.722	-

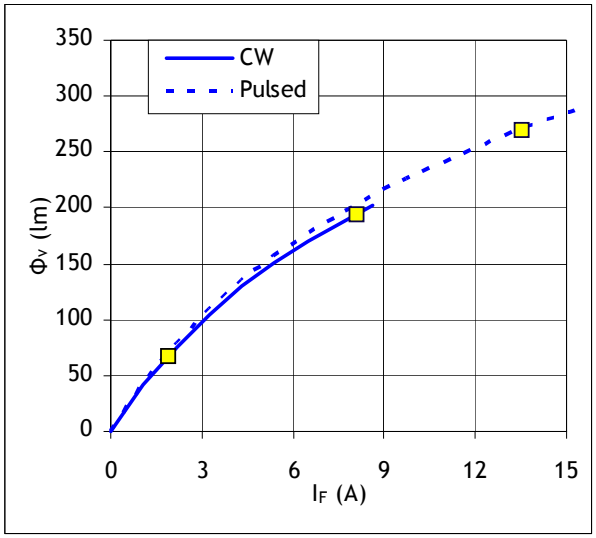


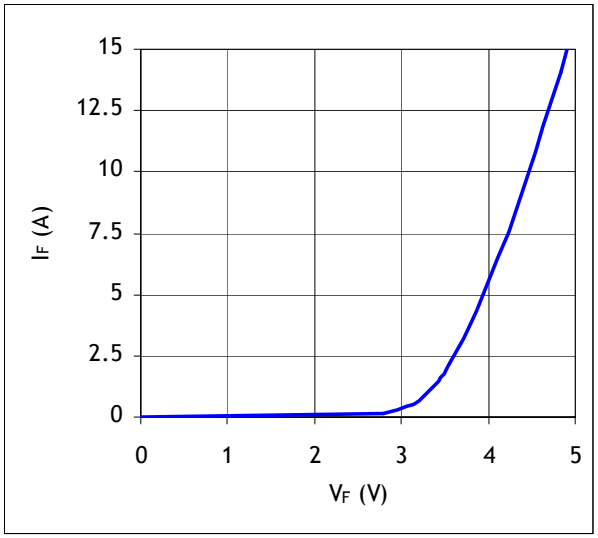


Yellow squares indicate reference drive conditions

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

Blue					
Drive Condition[2]		1.9 A Continuous	8.1 A Continuous	13.5 A Pulsed 50% D.F.[3]	
Parameter	Symbol	Values[4]			Unit
Current Density	j	0.35	1.5	2.5	A/mm^2
Forward Voltage	V_{Fmin}		3.5		V
	V_F	3.4	4.1	4.5	V
	V_{Fmax}		5.0		V
Luminous Flux[5]	Φ_V	70	190	275	lm
Radiometric Flux	Φ_r	1.3	3.5	5.5	W
Luminous Efficacy	η	11	6	5	lm/W
Dominant Wavelength[6]	λ_d	462	462	462	nm
Peak Wavelength	λ_p	459	460	460	nm
Color Saturation	-	0.99	0.99	0.99	-
FWHM	$\Delta\lambda_{1/2}$	22	25	27	nm
Chromaticity Coordinates[7,8]	x	0.142	0.142	0.142	-
	y	0.036	0.038	0.038	-





Yellow squares indicate reference drive conditions

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

Common Characteristics

	Symbol	Red	Green	Blue	Unit
Emitting Area		5.4	5.4	5.4	mm^2
Emitting Area Dimensions		2.7x2.0	2.7x2.0	2.7x2.0	mmxmm
Dynamic Resistance	Ω_{dyn}	0.06	0.09	0.07	Ω
Photometric Thermal Efficiency Coefficient		-0.69	-0.18	-0.007	%/°C
Radiometric Thermal Efficiency Coefficient		-0.52	-0.20	-0.17	%/°C
Forward Voltage Temperature Coefficient		-1.3	-4.6	-3.5	mV/°C

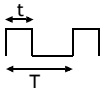
Absolute Maximum Ratings

	Symbol	Red	Green	Blue	Unit
Maximum Current[9]		16	16	16	A
Maximum Junction Temperature[10]	T_{jmax}	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°C. See Thermal Resistance section for T_{hs} definition.

Note 2: Listed drive conditions are typical for common applications. PhlatLight devices can be driven at current densities ranging from 0.01 A/mm^2 to 2.5 A/mm^2 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: Current Density of 2.5 A/mm^2. Rated at 50% duty cycle and Pulsed operation frequency of f>360Hz; $DC = \frac{t}{T}$



Note 4: Unless otherwise noted, values listed are typical. Devices are production tested and specified at 8.1 A. Values at 1.9 A and 13.5 A are for reference only.

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

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

Note 8: For reference only.

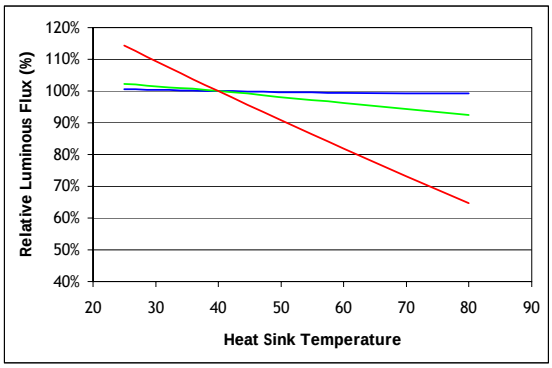
Note 9: Based on maximum allowed current density. Sustained operation beyond recommended drive current values may result in reduced life time. Thermal calculations should be performed to ensure T_j is maintained below T_{jmax} rating or device life may be reduced.

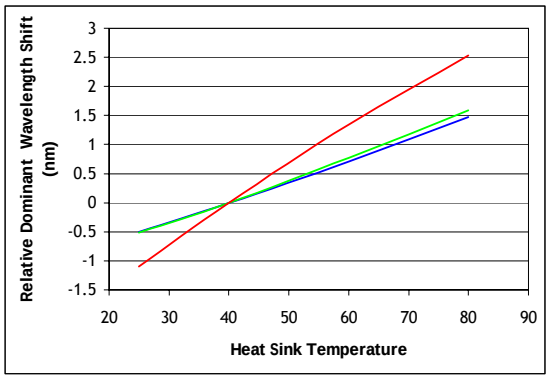
Note 10: Lifetime dependent on LED junction temperature. Input power and thermal system must be properly managed to ensure lifetime. See charts on pg 7 for further information.

Note 11: Special design considerations must be observed for operation under 1.3 A. Please contact Luminus for further information.

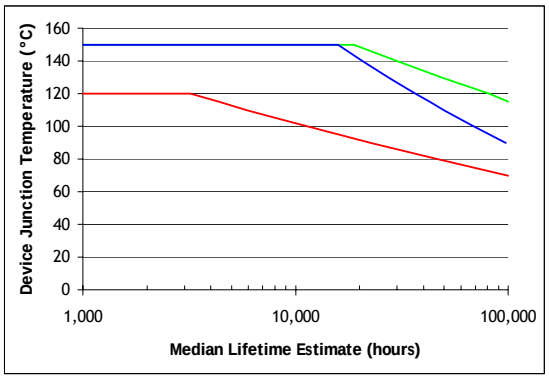
Note 12: Caution must be taken not to stare at the light emitted from these LEDs. Under special circumstances, the high intensity could damage the eye.

Light Output and Spectral Characteristics Over Heat Sink Temperature

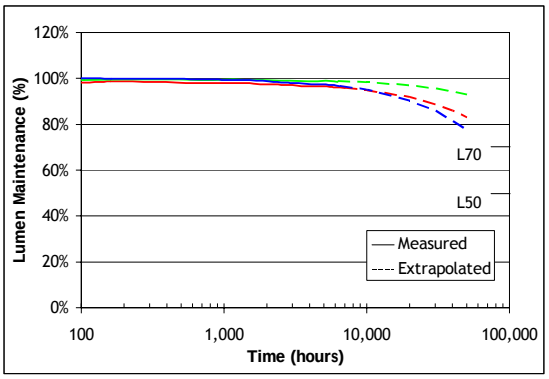




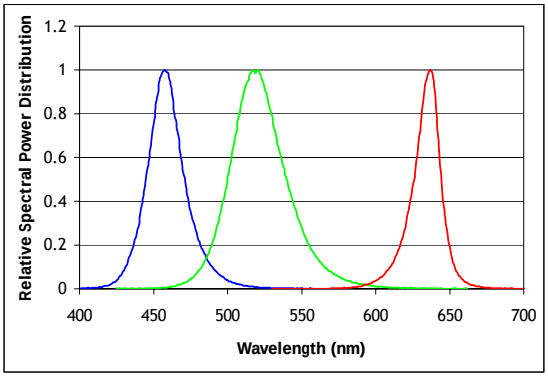
Median Lifetime Estimate vs. Tj[13]



Lumen Maintenance[14]



Typical Spectrum[15]



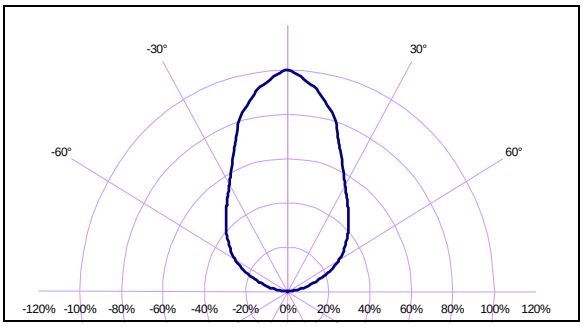
Note 13. Median lifetime estimate as a function of junction temperature at 1.5A/mm^2 in continuous operation. Lifetime defined as time to 70% of initial intensity. Based on preliminary lifetime test data. Data can be used to model failure rate over typical product lifetime.

Note 14. Lumen maintenance vs. time at 1.5A/mm^2 in continuous operation, Red junction temperature of 70^{o}C, Green junction temperatures of 120^{o}C, Blue junction temperatures of 100^{o}C.

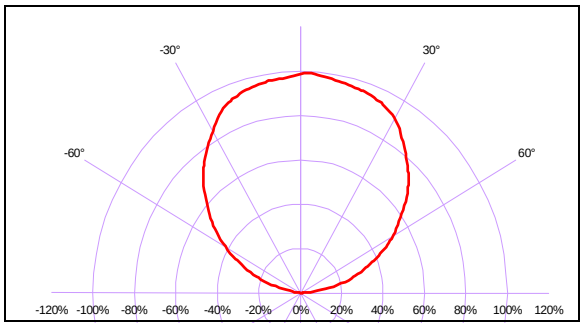
Note 15. Typical spectrum at current density of 1.5 A/mm^2 in continuous operation.

Typical Radiation Pattern

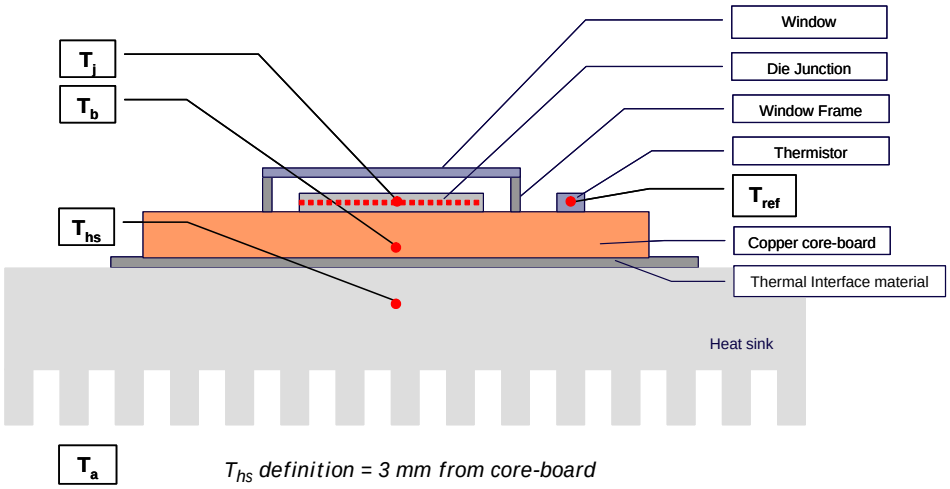
Typical Polar Radiation Pattern for Blue and Green



Typical Polar Radiation Pattern for Red



Thermal Resistance



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

Typical Thermal Resistance

$R_{\theta j\text{-}b}$ [1]	1.12 °C/W
$R_{\theta b\text{-}hs}$ [1]	0.20 °C/W
$R_{\theta j\text{-}hs}$ [1]	1.32 °C/W
$R_{\theta j\text{-}ref}$ [1]	1.2 °C/W

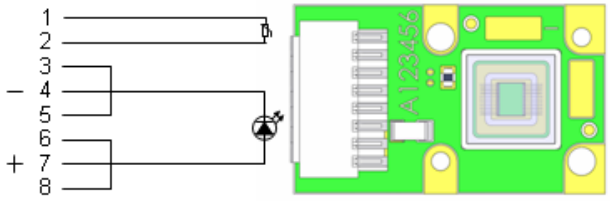
Note 1: Thermal Resistance is based on eGraf 1205 Thermal interface.

Thermistor Information

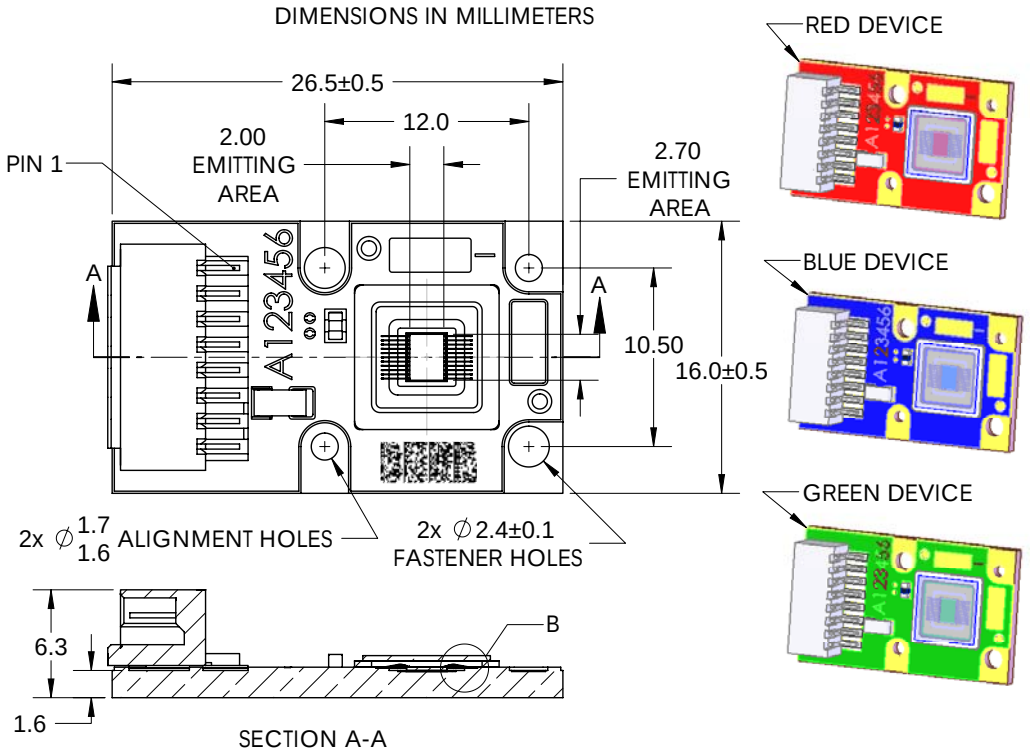
The thermistor used in PhlatLight devices mounted on core-boards is from Murata Manufacturing Co. The global part number is NCP15XH103J03RC. Please see http://www.murata.com/ for details on calculating thermistor temperature.

For more information on use of the thermistor, please contact Luminus directly.

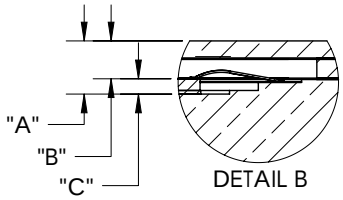
Electrical Pinout



Mechanical Dimensions



PIN #	FUNCTION
1	THERMISTOR (+)
2	THERMISTOR (-)
3-5	POWER (-)
6-8	POWER (+)



DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF GLASS	0.94	±0.13
"B"	EMITTING AREA TO TOP OF GLASS	0.67	±0.16
"C"	TOP OF METAL SUBSTRATE TO EMITTING AREA	0.27	±0.05

For detailed drawing of package, please refer to Luminus drawing #DWG-001200.

Connector: MOLEX Part Number 874380843. Please refer to page 10 or detailed drawing for pin-out information.

Ordering Information

Ordering Part Number[1,2,3]	Color	Description
CBT-54-R-C21-XXXX	**Red**	Red PhlatLight CBT-54 consisting of a 5.4 mm^2 LED, thermistor, and connector, mounted on a copper-core PCB.
CBT-54-G-C21-XXXX	**Green**	Green PhlatLight CBT-54 consisting of a 5.4 mm^2 LED, thermistor, and connector, mounted on a copper-core PCB.
CBT-54-B-C21-XXXX	**Blue**	Blue PhlatLight CBT-54 consisting of a 5.4 mm^2 LED, thermistor, and connector, mounted on a copper-core PCB.

Note 1: XXXX denotes a bin kit comprising of all flux and wavelength bins as listed on page 3.
Note 2: For info on ordering bin kits, contact your local Luminus sales representative.
Note 3: Standard packaging increment (SPI) is 10.

www.luminus.com