CBM-380 LEDs

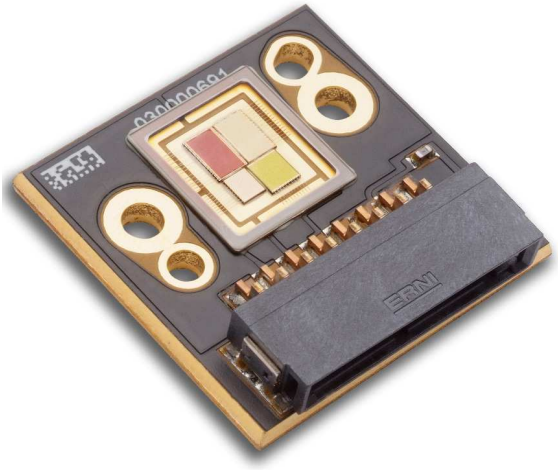

Table of Contents

Features:

- Extremely high optical output: up to 700 Red lumens
  up to 2,000 Green lumens
  up to 300 Blue lumens
  up to 1,600 White lumens
- High thermal conductivity package - junction to case thermal resistance of only 0.8 °C/W
- Large, monolithic chip with emitting area of 12 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 12 A
- Environmentally friendly: RoHS compliant
- Available in RGBW combination

Applications

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

PDS-001362Rev 05

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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' photonic lattice 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.

For red, green and blue LEDs, the photonic lattice structures extract more light and create radiation patterns that are more collimated than traditional LEDs. Having higher collimation from the source increases optical collection efficiencies and simplifies optical designs.

Packaging Technology

Thermal management is critical in high power LED applications. With a thermal resistance from junction to heat sink of 0.8° C/W, Luminus CBM-380 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 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.

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 compliant and free of hazardous materials, including lead and mercury.

Understanding 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 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 Big Chip 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. Since the LEDs can be operated over a wide range of drive conditions (currents from less than 1A to 12A, and duty cycle from <1% to 100%), multiple drive conditions are listed.

Red and green are tested and specified at 12 A (1.0 A/mm^2), blue is tested at 8.1 A (1.5 A/mm^2) and white is tested at 9.0 A (1.0A/mm^2).

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CBM-380 White Binning Structure

White die of CBM-380 LEDs is 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:

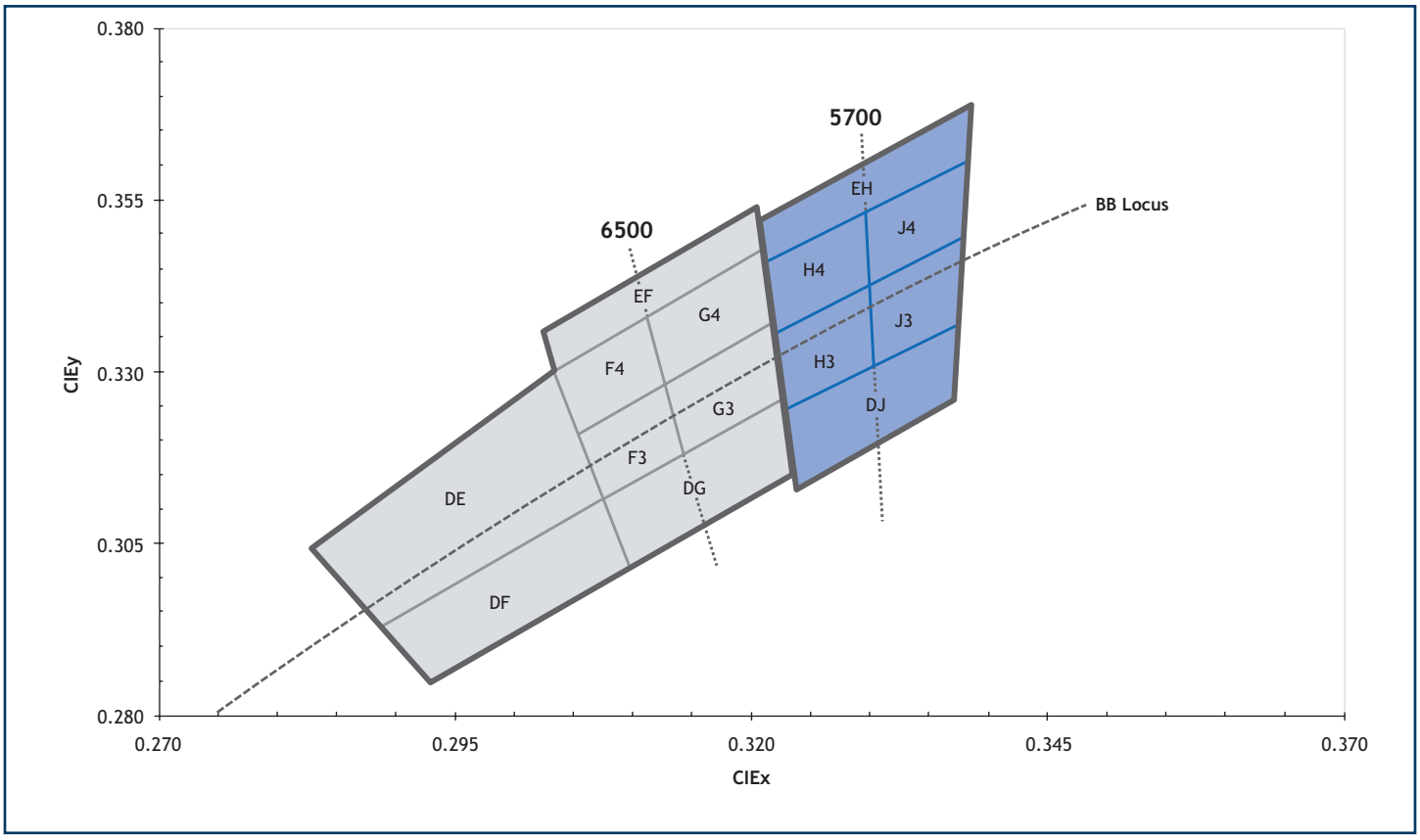
Flux Bins

Flux Bin Code (FF)	Minumum Flux (lm) @ 9.0 A	Maximum Flux (lm) @ 9.0 A
M	700	850
N	850	1,000

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

Chromaticity Bins

Luminus' Standard Chromaticity Bins: 1931 CIE Curve



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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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CBM-380 Monochromatic Binning Structure

All CBM-380 monochromatic LEDs are specified for luminous flux and wavelength at different drive conditions for each color. Red and green are specified at 12 A (1.0 A/mm^2), and blue is specified at 8.1 A (1.5 A/mm^2) . Once tested, devices are placed into one of the following luminous flux (FF) and wavelength (WW) bins:

Flux Bins

Color	Luminous Flux Bin (FF)	Minumum Flux (lm)	Minumum Flux (lm)
Red	BH	350	475
	BJ	475	600
Green	CH	940	1,200
	CJ	1,200	1,500
Blue	DD	70	90
	DE	90	120

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

Wavelength Bins

Color	Wavelength Bin (FF)	Minumum Wavelength	Maximum Wavelength
Red	R2	611	615
	R3	615	619
	R4	619	623
	R5	623	627
	R6	627	631
Green	G2	510	515
	G3	515	520
	G4	520	525
	G5	525	530
	G6	530	535
	G7	535	540
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 CBM-380 RGBW products are packaged and labeled with their respective bin as outlined in the tables on pages 3 & 4. When shipped, each package will only contain one bin. The part number designation is as follows:

CBM — 380 — RGBW — D11 — FF — WW

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Chromaticity Bin
C hip on Board (window)	38.0 mm^2	**R**: Red **G**: Green **B**: Blue **W**: White	Internal Code	See page 3 for bins	See page 4 for bins

Note : 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 15 and reference PDS-001695: CBM-380 Binning & Labeling document.

Example:
The part number CBM-380-RGBW-D11-QF-G4 refers to a RGBW, CBM-380 emitter, with a white flux above 850 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).

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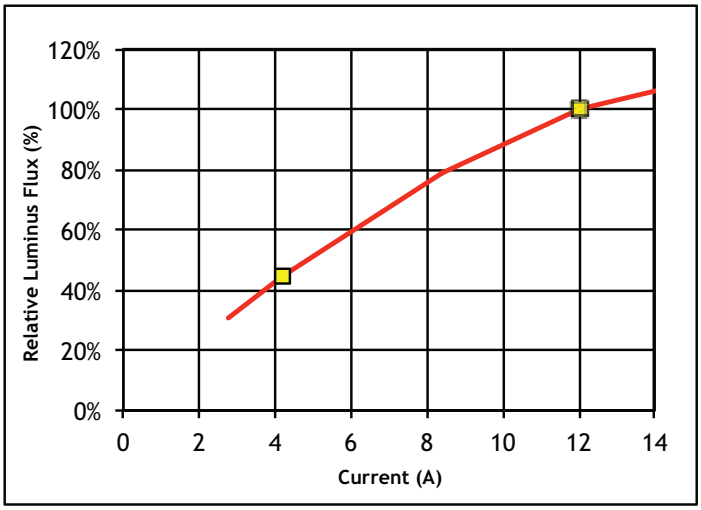
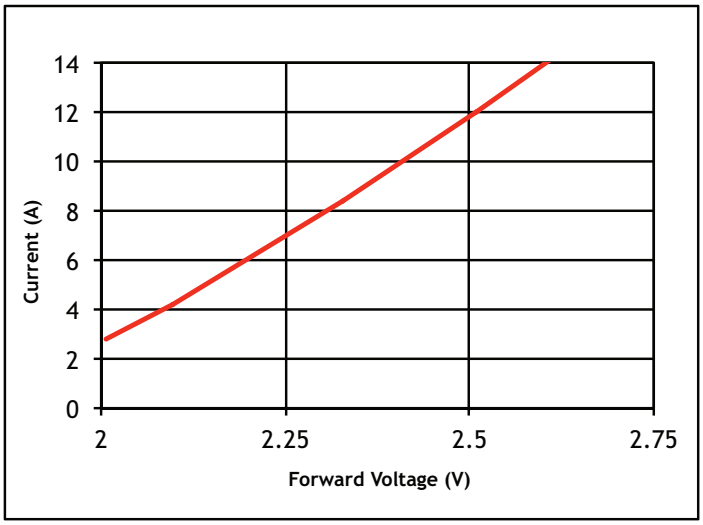
Optical & Electrical Characteristics

($T_{heat\ sink}$ = 40°C)[1]

Red				
Drive Condition[2]		4.2 A	12 A	
Parameter	Symbol	Typical Values at Indicated Current	Values at Test Currents	Unit
Current Density	j	0.35	1.0	A/mm²
Forward Voltage	$V_{F\ min}$		2.0	V
	$V_{F\ typ}$	2.15	2.5	V
	$V_{F\ typ}$		3.0	V
Luminous Flux[4]	$\Phi_{v\ typ}$	260	600	lm
Dominant Wavelength	λ_d	622	624	nm
FWHM	$\Delta\lambda_{1/2}$	16	18	nm
Chromaticity Coordinates[5, 6]	x	0.697	0.700	
	y	0.303	0.300	





Note 1: Yellow squares indicate reference drive conditions

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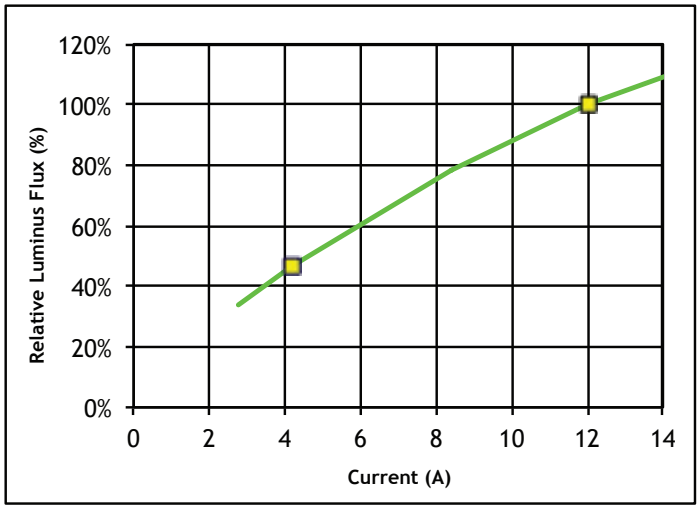
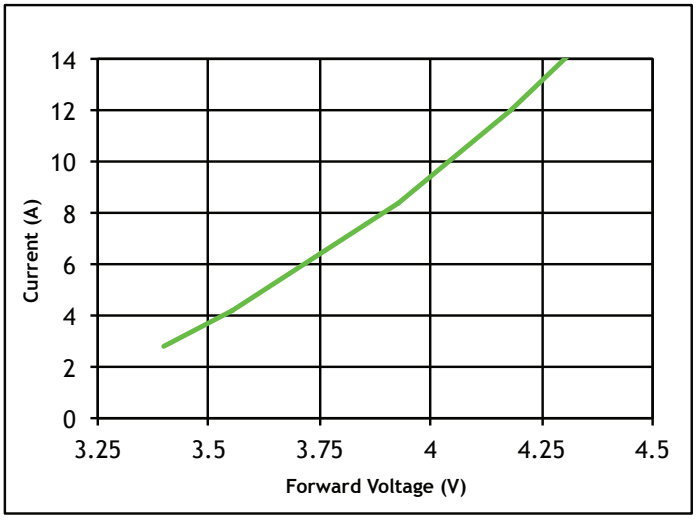
Optical & Electrical Characteristics

($T_{heat\ sink}$ = 40°C)[1]

Green				
Drive Condition[2]		4.2 A	12 A	
Parameter	**Symbol**	**Typical Values at Indicated Current**[0]	**Values at Test Currents**	**Unit**
Current Density	j	0.35	1.0	A/mm²
Forward Voltage	$V_{F\ min}$		3.5	V
	$V_{F\ typ}$	3.6	4.0	V
	$V_{F\ typ}$		4.9	V
Luminous Flux[4]	$\Phi_{v\ typ}$	800	1700	lm
Dominant Wavelength	λ_d	537	533	nm
FWHM	$\Delta\lambda_{1/2}$	35	38	nm
Chromaticity Coordinates[5, 6]	x	0.223	0.196	
	y	0.720	0.709	





Note 1: Yellow squares indicate reference drive conditions

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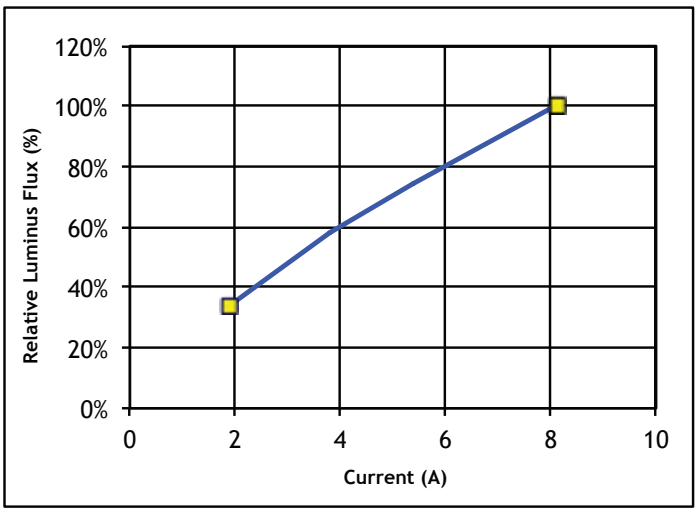
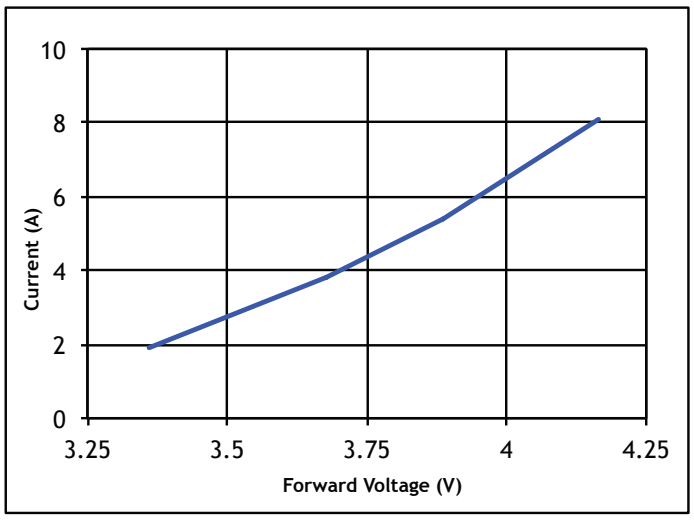
Optical & Electrical Characteristics

($T_{heat\ sink}$ = 40°C)[1]

Blue				
Drive Condition[2]		1.9 A	8.1 A	
Parameter	**Symbol**	**Typical Values at Indicated Current**[0]	**Values at Test Currents**	**Unit**
Current Density	j	0.35	1.5	A/mm²
Forward Voltage	$V_{F\ min}$		3.5	V
	$V_{F\ typ}$	3.3	4.1	V
	$V_{F\ typ}$		5.0	V
Luminous Flux[4]	$\Phi_{v\ typ}$	70	190	lm
Dominant Wavelength	λ_d	465	464	nm
FWHM	$\Delta\lambda_{1/2}$	21	24	nm
Chromaticity Coordinates[5, 6]	x	0.139	0.140	
	y	0.047	0.049	





Note 1: Yellow squares indicate reference drive conditions

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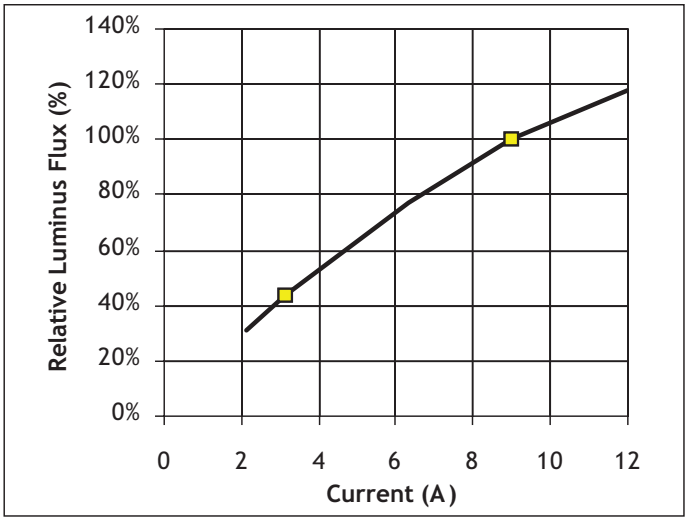
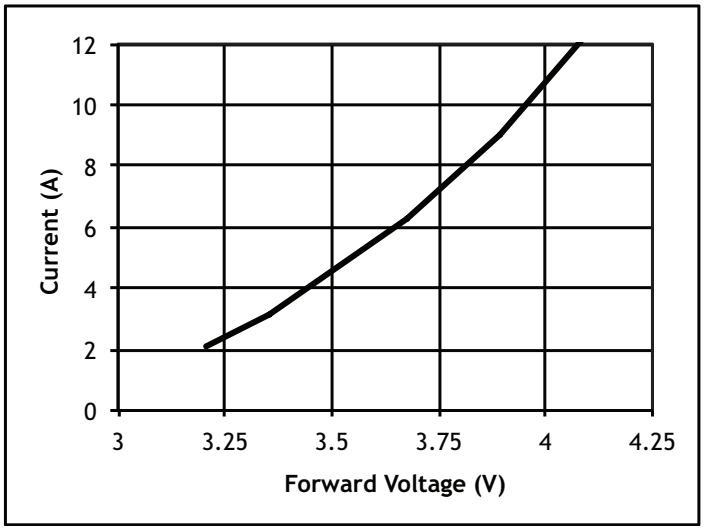
Optical & Electrical Characteristics

($T_{heat\ sink}$ = 40°C)[1]

White				
Drive Condition[2]		**3.2 A**	**9.0 A**	
Parameter	**Symbol**	**Typical Values at Indicated Current[0]**	**Values at Test Currents**	**Unit**
Current Density	j	0.35	1.0	A/mm²
Forward Voltage	$V_{F\ min}$		3.1	V
	$V_{F\ typ}$	3.35	3.6	V
	$V_{F\ typ}$		4.6	V
Luminous Flux[4]	$\Phi_{v\ typ}$	650	1400	lm
FWHM	$\Delta\lambda_{1/2}$	6300	6500	nm
Chromaticity Coordinates[5, 6]	x	0.317	0.312	
	y	0.336	0.328	





Note 1: Yellow squares indicate reference drive conditions

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Optical & Electrical Characteristics

($T_{heat\ sink}$ = 40ºC)[1]

Common Characteristics						
Parameter	**Symbol**	**Red**	**Green**	**Blue**	**White**	**Unit**
Emitting Area		12.0	12.0	5.4	9.0	mm^2
Emitting Area Dimensions		4.6x2.6	4.6x2.6	2.7x2.0	3.0x3.0	V
Dynamic Resistance	Ω_{dyn}	0.05	0.07	0.08	0.08	Ω
Thermal Coefficient of Photometric Flux		-1.14	-0.17	-0.008	-0.20	%/ºC
Thermal Coefficient of Radiometric Flux		-0.69	-0.18	-0.13	-0.18	%/ºC
Thermal Coefficient of Junction Voltage		-2.1	-3.9	-5.1	-4.5	mV/ºC

Absolute Maximum Ratings						
Parameter	**Symbol**	**Red**	**Green**	**Blue**	**White**	**Unit**
Maximum Current[7]		12	12	8.1	9	A
Maximum Junction Temperature[8]	T_{jmax}	125	150	150	150	ºC
Storage Temperature Range		-40/+100	-40/+100	-40/+100	-40/+100	ºC
Maximum Total Current (RMS)[9,10]				32		A

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

Note 2: Listed drive conditions are typical for common applications. CBM-380 RGBW devices can be driven at currents ranging from <1 A to 8-12 A depending on color 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. Devices are production tested and specified at 1.0A/mm^2 for red, green and white and 1.5 A/mm^2 for blue. Other values are for reference only.

Note 4: 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 5: In CIE 1931 chromaticity diagram coordinates, normalized to X+Y+Z=1.

Note 6: For reference only.

Note 7: CBM-380 RGBW devices 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 12 for further information.

Note 9: Maximum current dependent on board temperature and operating condition. Specified value assumes continuous operation and Tboard=60ºC. See maximum current application note for PWM equivalent maximum currents and derating curve for board temperature.

Note 10: Max total RMS power allowed in operation. RMS current is defined as $I_{rms} = I_{peak}$ * sqrt(duty cycle). Total RMS current through anode is equal to I_{anode} = sqrt (SUM (I_{rms}/I_{color}). See application note for further information.

Note 11: Special design considerations must be observed for operation under 1 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.

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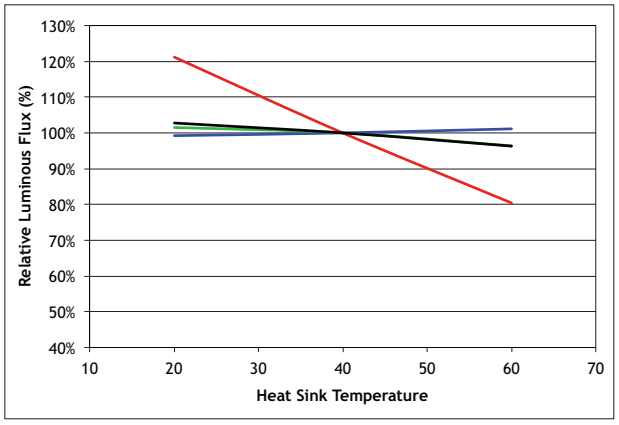
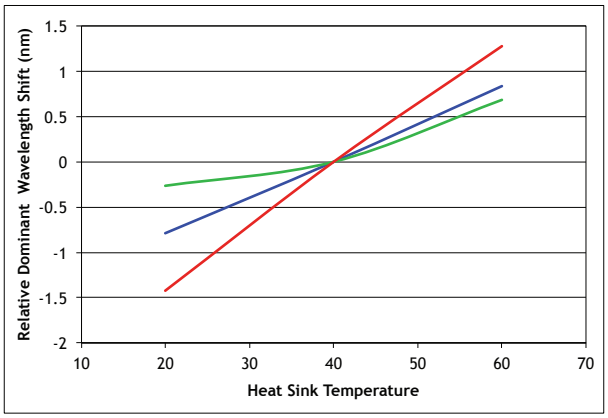
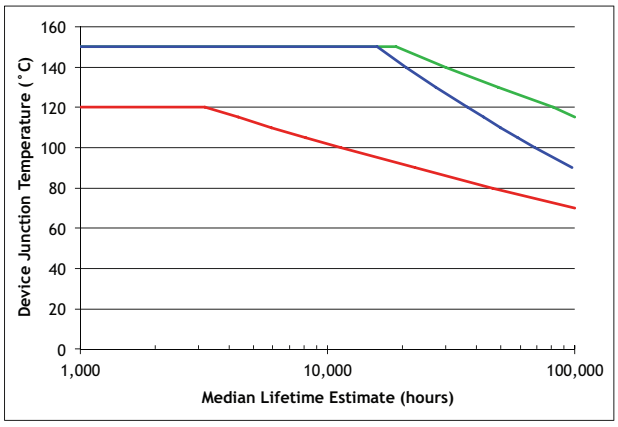
Light Output and Spectral Characteristics Over Heat Sink Temperature

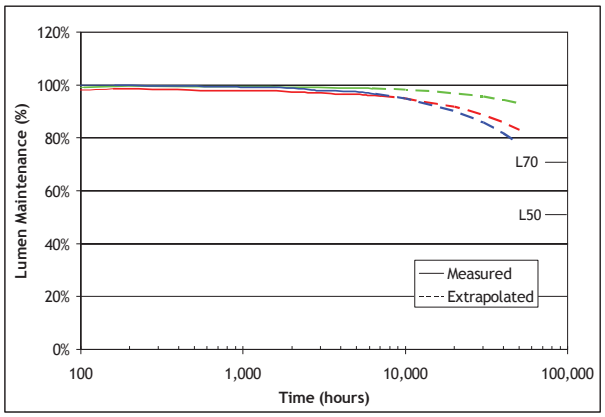




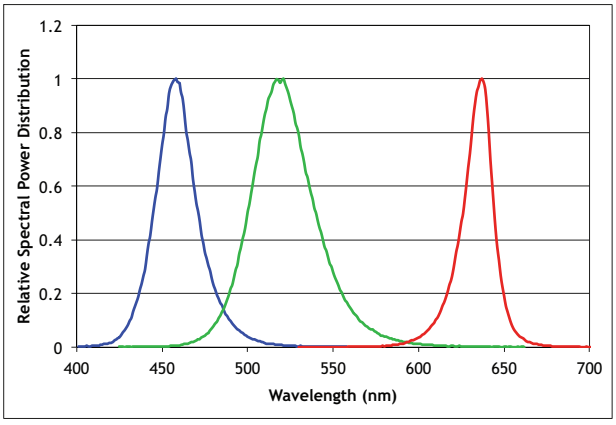
Median Lifetime Estimate vs. Tj[13]

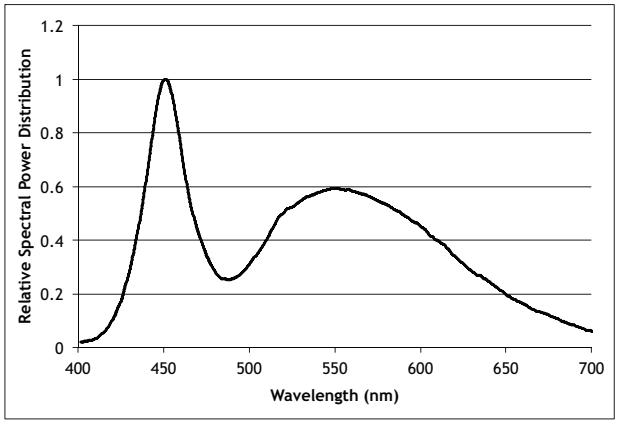


Lumen Maintenance[14]



Typical Spectrum[15]





Note 13: Median lifetime estimate as a function of junction temperature at 1.0A/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.

Note 14: Lumen maintenance vs. time at 1.0A/mm^2 in continuous operation, Red junction temperature of 70°C, Green junction temperatures of 120°C, Blue and White junction temperatures of 100°C.

Note 15: Typical spectrum at current density of 1.0 A/mm^2 in continuous operation for white, green and red. Blue at current density of 1.5 A/mm^2.

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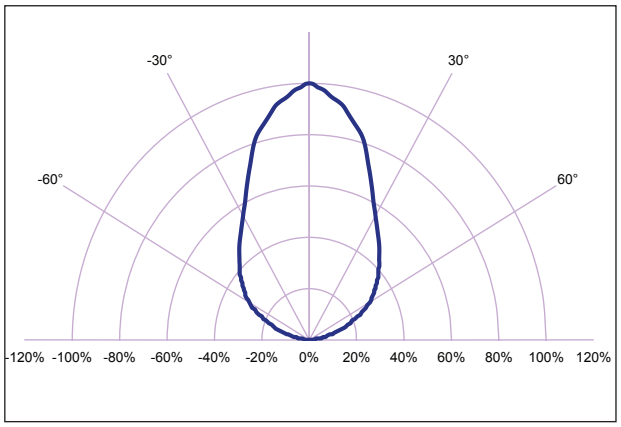
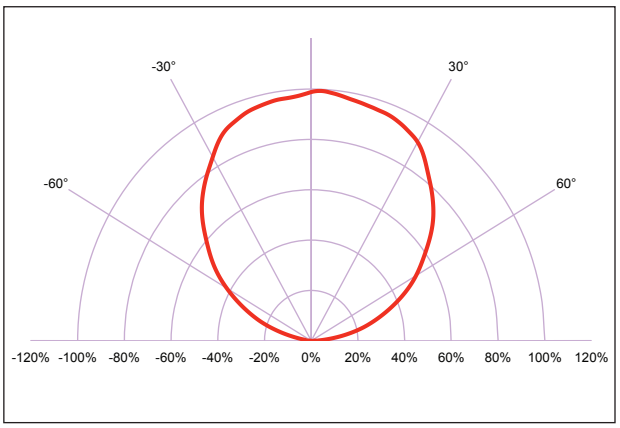
Typical Radiation Pattern

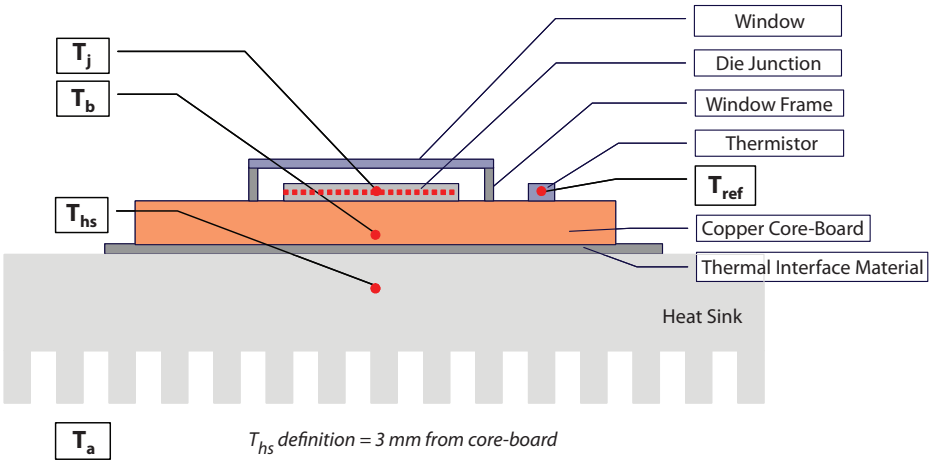
Typical Polar Radiation Pattern for Blue and Green



Typical Polar Radiation Pattern for Red and White



Thermal Resistance



Typical Thermal Resistance

Chip	R/G	B	W
$R_{\theta j\text{-}hs}$ [1]	0.80 °C/W	1.20 °C/W	0.83 °C/W
$R_{\theta j\text{-}ref}$ [2]	0.61 °C/W	1.1 °C/W	0.74 °C/W

Note 1: Thermal Resistance includes eGraf 1205 Thermal interface.

Note 2: Thermal resistance values are based on FEA model results correlated to measured $R_{\theta j\text{-}hs}$ data.

Note 3: Table only for single color operation. Contact Luminus for complete thermal

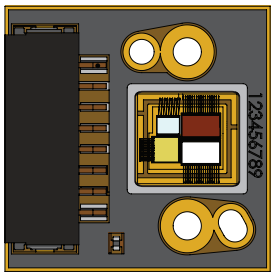
Thermistor Information

The thermistor used in CBM-380 RGBW devices mounted on coreboards is a10 kOhm part 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 the use of the thermistor, please contact Luminus directly.

Electrical Pinout

1: Anode (+)
2: Red (-)
3: Blue (-)
4: White (-)
5: Green (-)
6: Thermistor
7: Thermistor
8: Anode (+)



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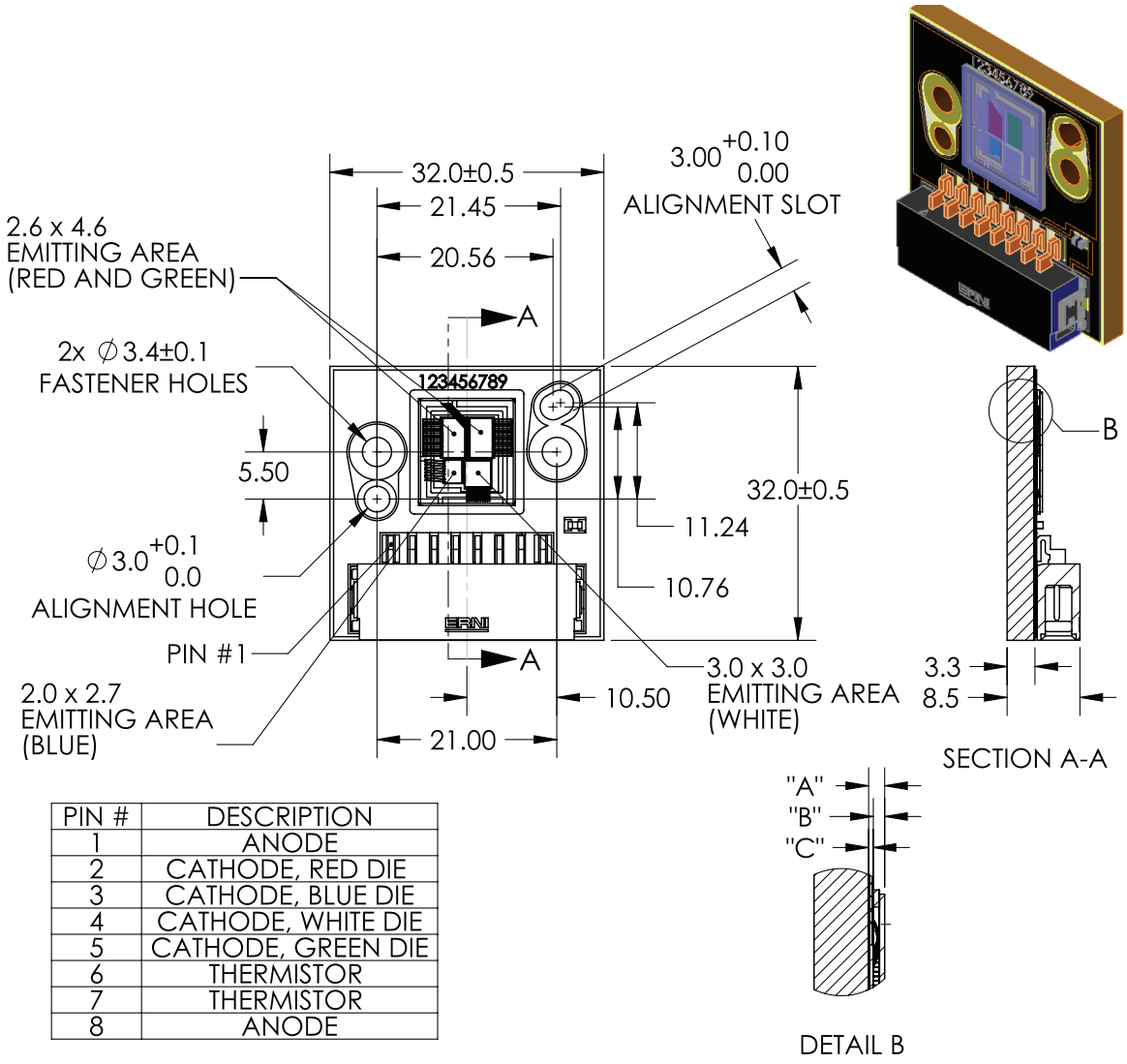
Mechanical Dimensions – CBM-380 RGBW Emitter

DIMENSIONS IN MILLIMETERS



PIN #	DESCRIPTION
1	ANODE
2	CATHODE, RED DIE
3	CATHODE, BLUE DIE
4	CATHODE, WHITE DIE
5	CATHODE, GREEN DIE
6	THERMISTOR
7	THERMISTOR
8	ANODE

DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF SUBSTRATE TO TOP OF GLASS	1.00	±0.13
"B"	EMITTING AREA TO TOP OF GLASS	0.73	±0.16
"C"	TOP OF METAL SUBSTRATE TO EMITTING AREA	0.27	±0.05

For detailed drawing please refer to Luminus drawing #DWG-001288.
Recommended connector: ERNI MaxiBridge p/n 284117. Please refer to page 13 or above for pin-out information.

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Ordering Information

Ordering Part Number [1,2]	Color	Description
CBM-380-RGBW-D11-QF100	RGBW	CBM-380-RGBW module consisting of a red 12 mm^2 LED, a green 12 mm^2 LED, a blue 5.4 mm^2 LED, a white 9 mm^2 LED, thermistor, connector, and copper-core PCB

Note 1: CBM-380-RGBW-D11-QF100 denotes a bin kit comprising of all flux and wavelength bins as listed on page 3 and all flux and chromaticity bins listed on page 4 and 5.

Note 2: For info on ordering bin kits, contact your local Luminus sales representative.

Note 3: Standard packaging increment (SPI) is 10.

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