SBM-160 LEDs

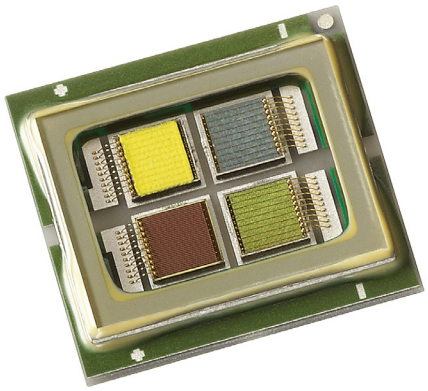

Table of Contents

Features:

- Extremely high optical output: up to 350 Red lumens
  up to 860 Green lumens
  up to 180 Blue lumens
  up to 760 White lumens
- High thermal conductivity package - junction to case thermal resistance as low as 1.46°C/W
- Photonic lattice technology for very high surface brightness and uniform emission
- Four big chips with emitting area of 4 mm^2 each
- Environmentally friendly: RoHS compliant
- Variable drive currents:1 A to 4 A
- Available in RGBW combination

Applications

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

PDS-001432Rev 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.

Packaging Technology

Thermal management is critical in high power LED applications. With a thermal resistance from junction to case of 1.46° C/W. Luminus SBM-160 LEDs have the lowest thermal resistance of any LED on the market. This allows the LED to be driven at higher current 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 surface mount LEDs are typically tested with a 20 ms input pulse and a junction temperature of 25°C. Expected flux values in real world operation can be extrapolated based on the information contained within this product data sheet.

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 4A, and duty cycle from <1% to 100%), multiple drive conditions are listed.

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SBM-160 White Binning Structure

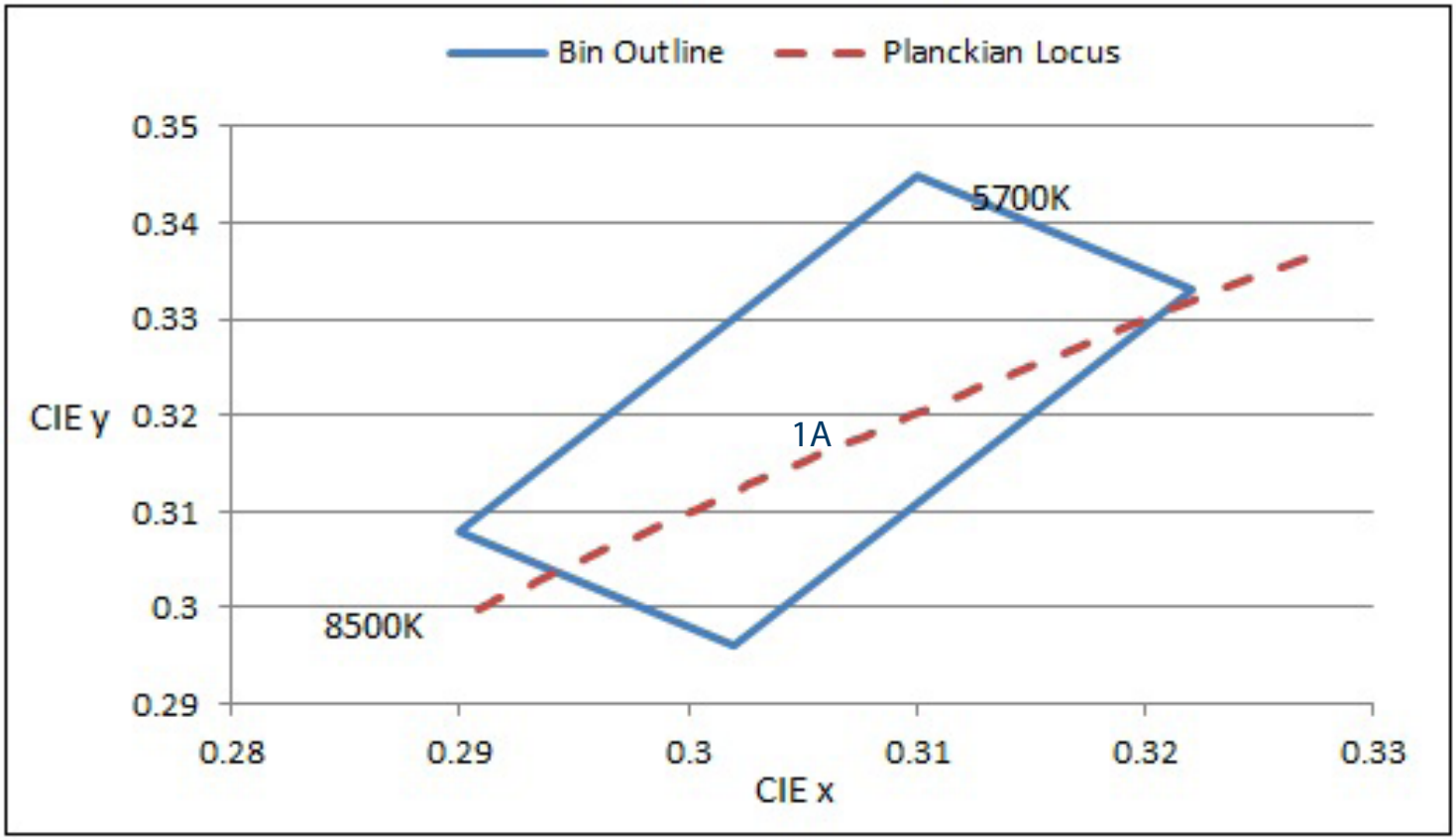
White die of SBM-160 LEDs is tested for luminous flux and chromaticity at a drive current of 4.0 A (1.0 A/mm^2) and placed into one of the following luminous flux (FF) and chromaticity (WW) bins:

Flux Bins

Flux Bin Code (FF)	Minimum Flux (lm) @ 4.0 A	Maximum Flux (lm) @ 4.0 A
F	590	680
G	680	780

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

Chromaticity Bins



Chromaticity Bins				
Bin Code (WW)	CIEx	CIEy	CIEx	CIEy
1A	0.302	0.296	0.310	0.345
	0.290	0.308	0.322	0.333

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Product Shipping & Labeling Information

All SBM-160 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:

SBM — 160 — RGBW — H41 — FF

Product Family	Chip Area	Color	Package Configuration	Bin Kit Identifier
Surface Mount (window)	16.0 mm^2	**R**: Red **G**: Green **B**: Blue **W**: White	Internal Code	GX: RF100 G4: RG101 G5: RG101 G6: RG102 G7: RG102

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 14 and reference PDS-001792: SBM-160 Binning & Labeling document.

Example:

The part number SBM-160-RGBW-H41-GX refers to bin kit SBM-160-RGBW-H41-RF100 which consists of a RGBW, SBM-160 emitter, with a white flux greater than 590 lumens and a chromaticity value within the box defined by the four points (0.302, 0.296), (0.290, 0.308), (0.310, 0.345), (0.322, 0.333).

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Optical & Electrical Characteristics [1,2]

Parameter	Symbol	Red	Green	Blue	White	Unit
Drive Condition[3]	I	4.0	4.0	4.0	4.0	A
Current Density	j	1.0	1.0	1.0	1.0	A/mm^2
Forward Voltage	$V_{F\,min}$	2.3	4.0	3.2	3.2	V
	$V_{F\,typ}$	2.6	4.6	3.8	3.8	V
	$V_{F\,max}$	3.0	5.0	4.0	4.2	V
Typical Luminous Flux[4]	$\Phi_{v\,typ}$	320	820	150	730	lm
Minimum Luminous Flux	$\Phi_{V\,min}$	260	740	110	590	lm
Wavelength min-max	λ_d	619-626	520-540	450-465	N/A	nm
FWHM	$\Delta\lambda_{1/2}$	18	38	24	N/A	nm
Chromaticity Coordinates[5]	x	0.695	0.165	0.142	0.300	-
	y	0.304	0.708	0.043	0.310	-
Radiometric Efficiency	η_{rad}	21	6	15	13	%
Emitting Area	-	4.0	4.0	4.0	4.0	mm^2
Emitting Area Dimensions	-	2.09 x 1.87	2.09 x 1.87	2.09 x 1.87	2.09 x 1.87	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
Temp. Coefficient of Forward Voltage	-	-2.1	-3.9	-5.1	-4.5	mV/ºC
Maximum Current[6]	-	4	4	4	4	A
Maximum Junction Temperature[7]	T_{jmax}	110	150	150	150	ºC
Storage Temperature Range	-	-40/+100	-40/+100	-40/+100	-40/+100	ºC

Note 1: All ratings are based on test conditions of T_j=25ºC, 20 millisecond pulse. See Thermal Resistance section for T_{hs} definition.

Note 2: Unless otherwise noted, values listed are typical. Devices are production tested and specified at 1.0A/mm^2 for red, green, blue and white.

Note 3: Listed drive conditions are typical for common applications. SBM-160 RGBW devices can be driven at currents ranging from <1 A to 4 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 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: SBM-160 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 7: Lifetime dependent on LED junction temperature. Input power and thermal system must be properly managed to ensure lifetime. See charts on pg 8 for further information.

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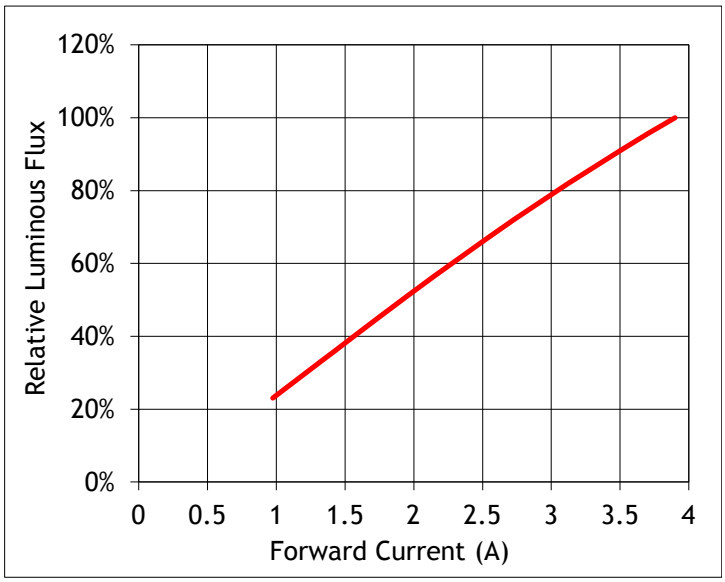
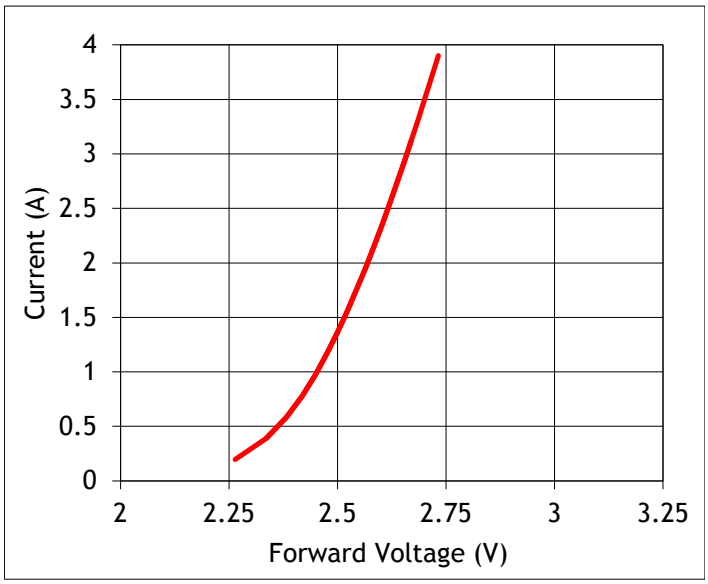
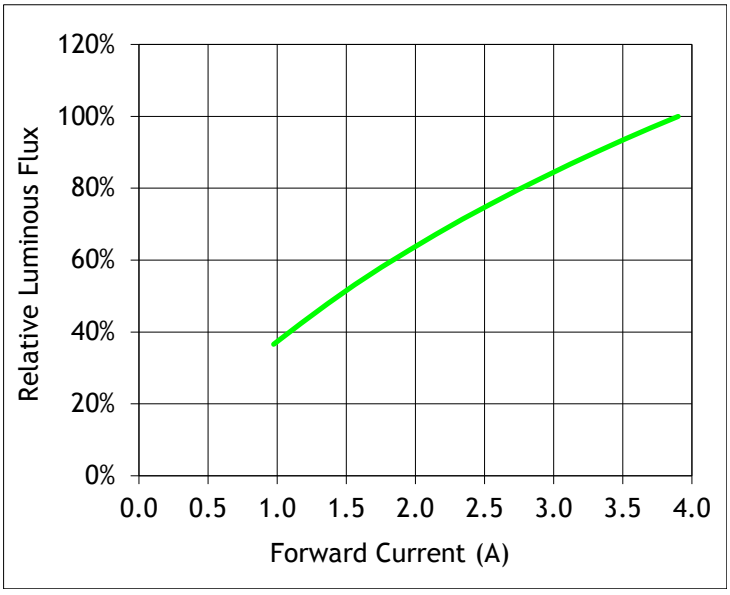
Optical & Electrical Characteristics

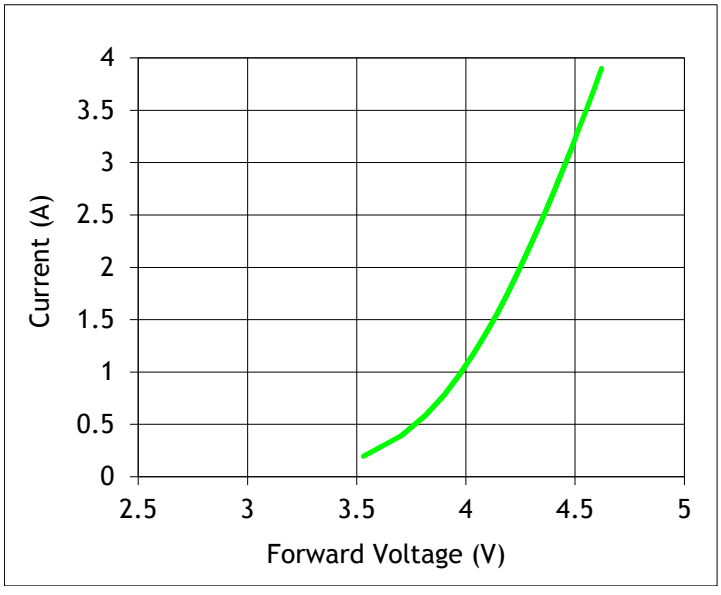
Characteristics Curves for Red





Characteristics Curves for Green





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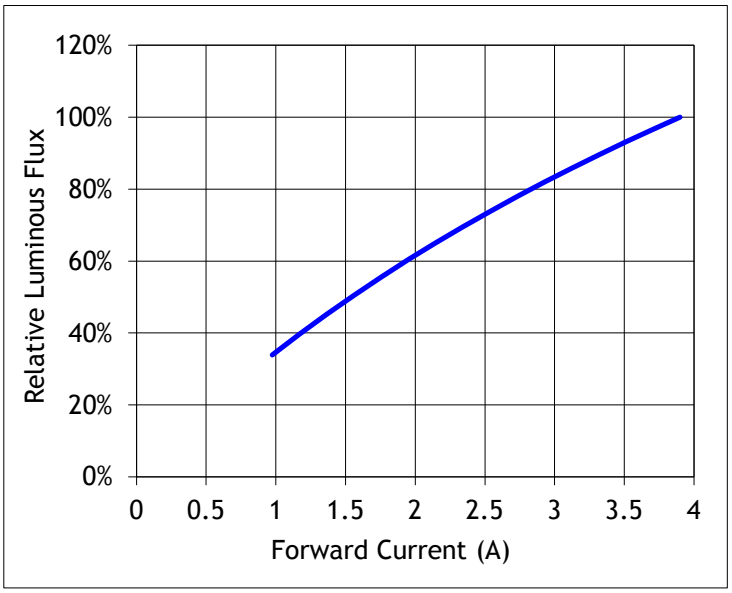
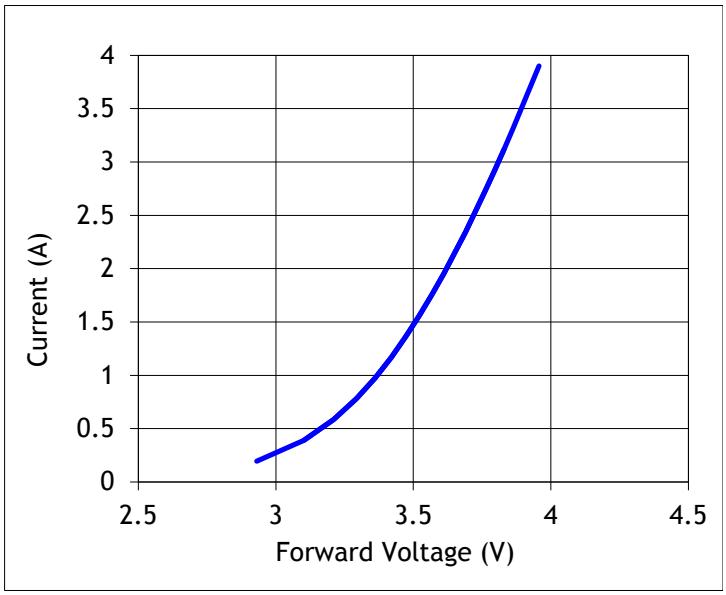
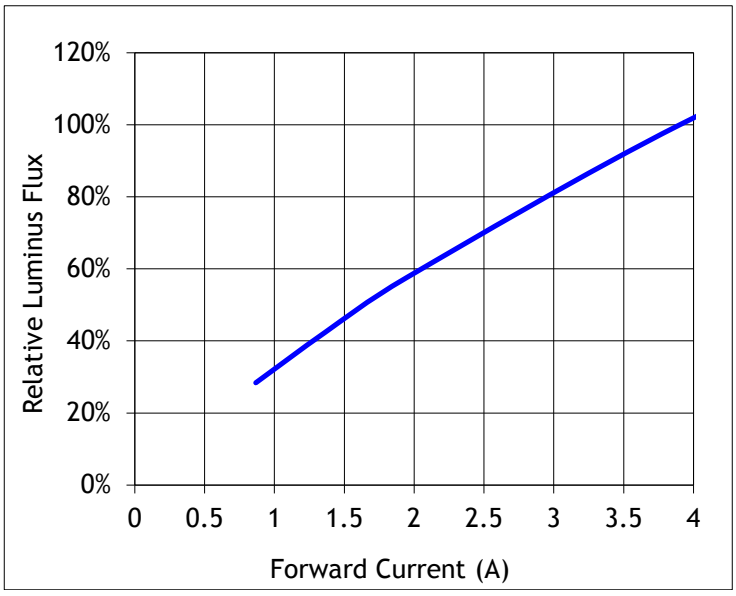
Optical & Electrical Characteristics

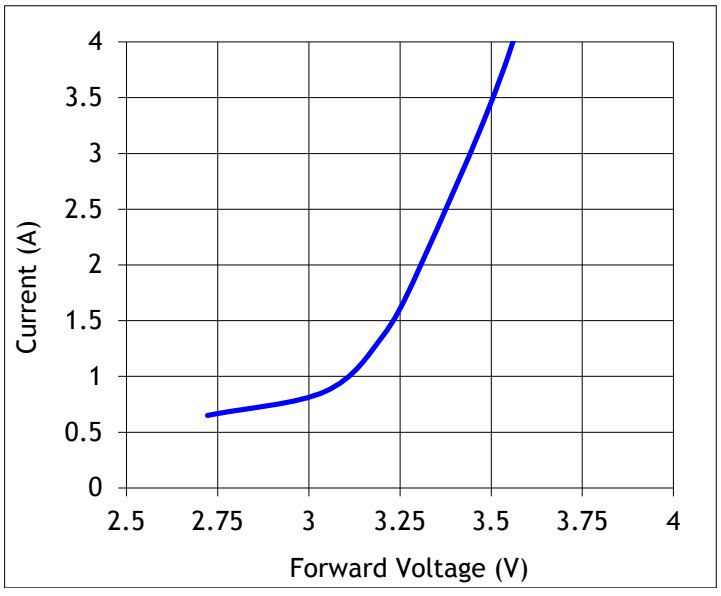
Characteristics Curves for Blue





Characteristics Curves for White





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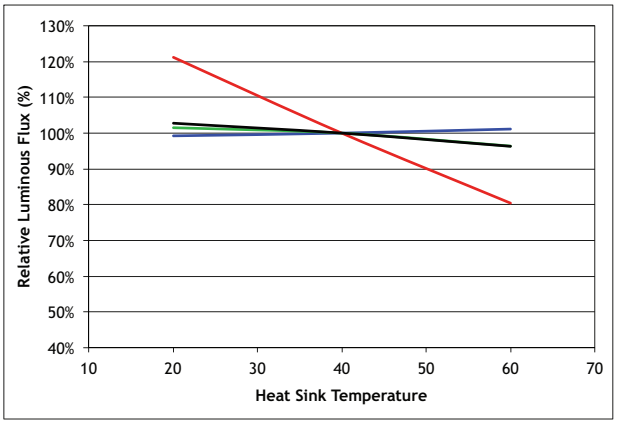
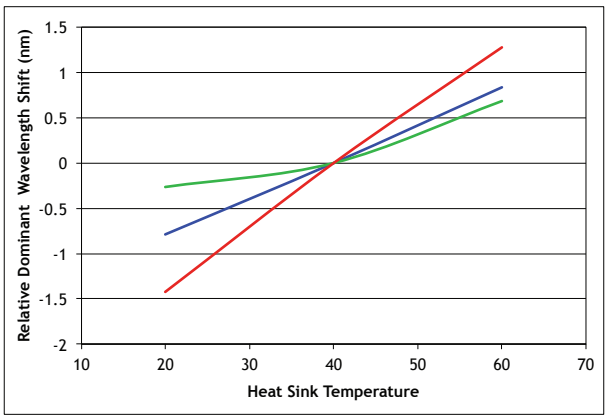
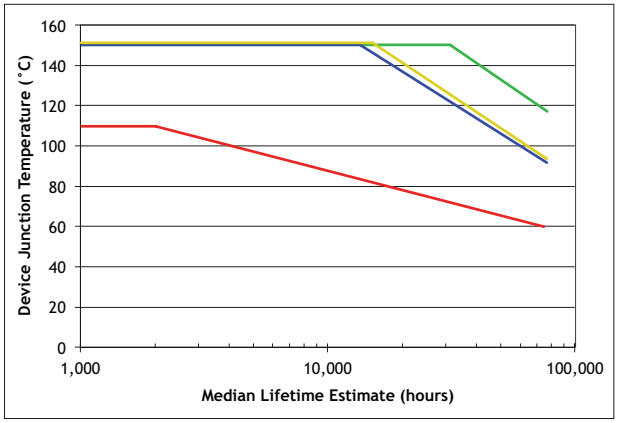
Light Output and Spectral Characteristics Over Heat Sink Temperature

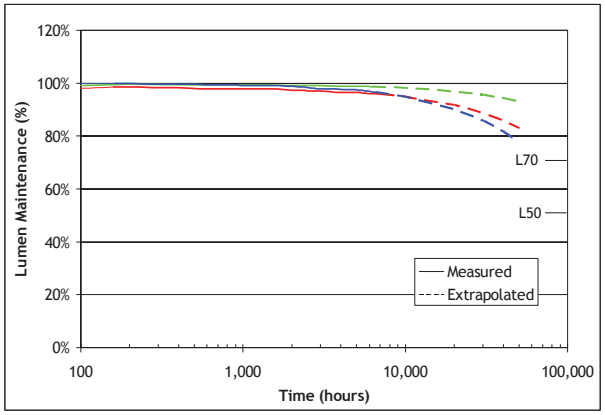




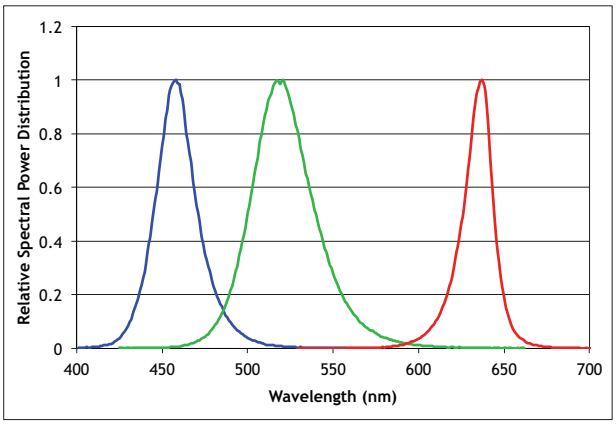
Median Lifetime Estimate vs. Tj[13]

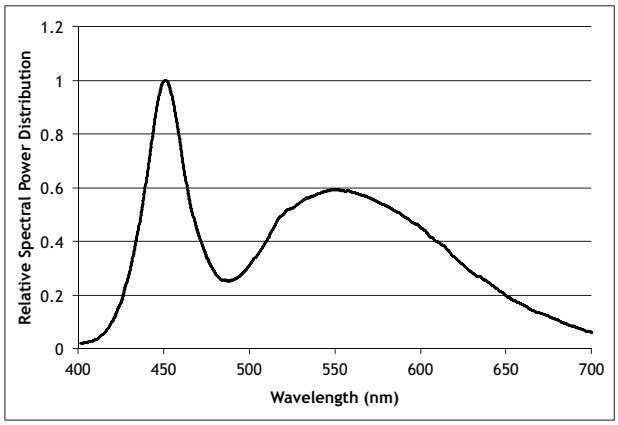


Lumen Maintenance[14]



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 from single-chip modules. 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 70ºC, Green junction temperatures of 120ºC, Blue and White junction temperatures of 100ºC.

Note 15: Typical spectrum at current density of 1.0 A/mm^2 in continuous operation.

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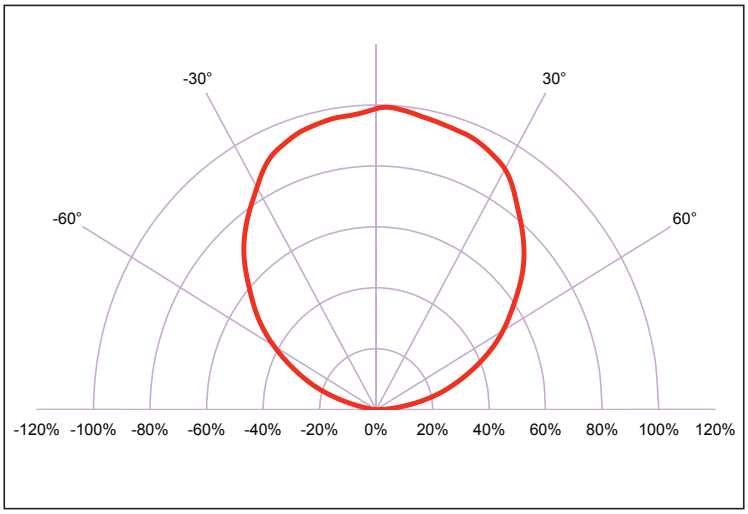
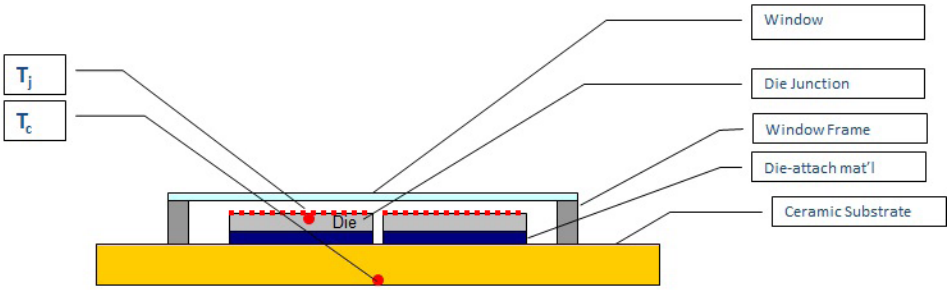
Typical Radiation Patterns (R, G, B, W)



Thermal Resistance



Thermal resistance (R_{th}) from the LED junction (T_j) to the case (T_c) is 1.46ºC/W. A more detailed model accouting for thermal cross-talk can be found in the Application Note APN-002127.

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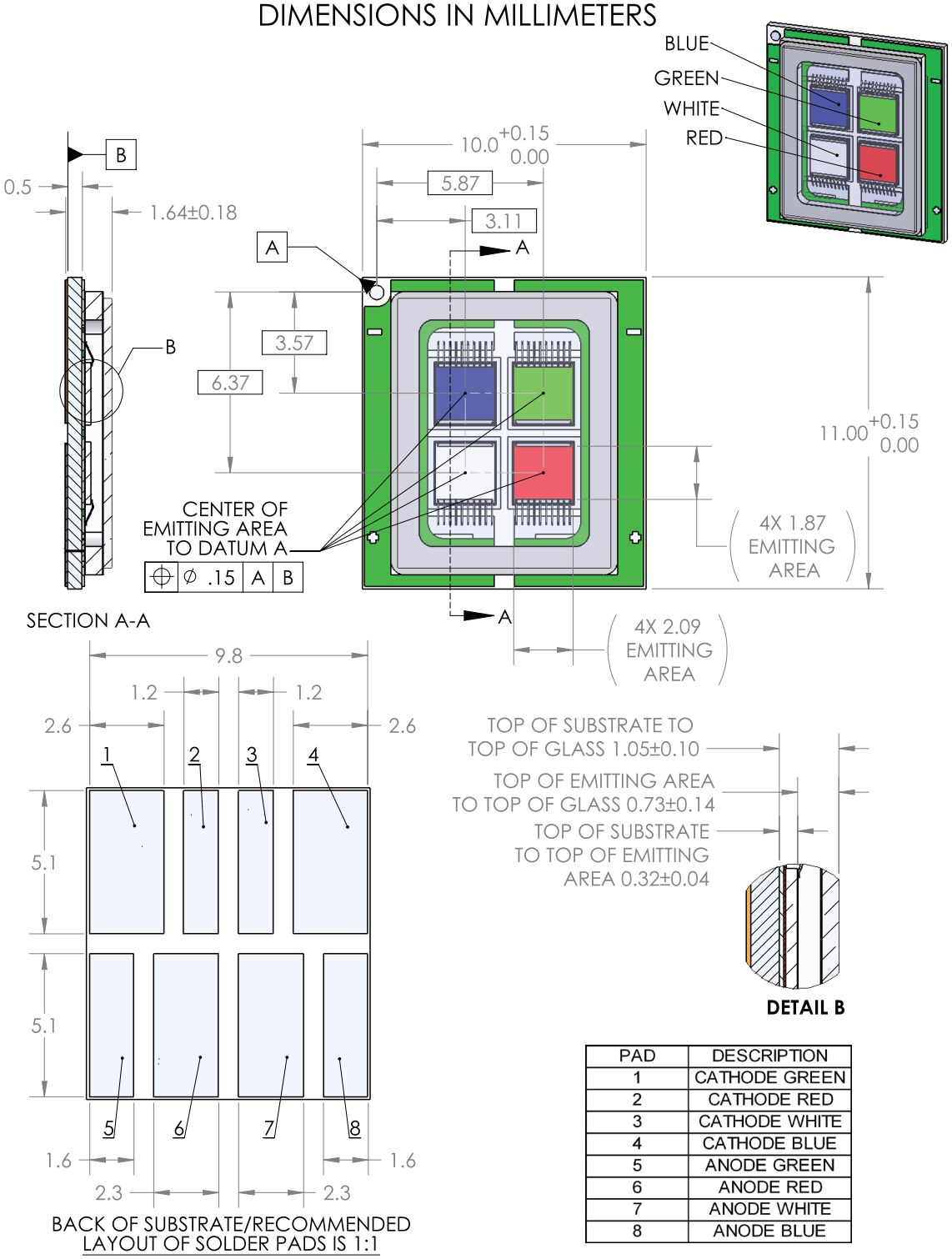
Mechanical Dimensions – SBM-160 Emitter

DIMENSIONS IN MILLIMETERS



PAD	DESCRIPTION
1	CATHODE GREEN
2	CATHODE RED
3	CATHODE WHITE
4	CATHODE BLUE
5	ANODE GREEN
6	ANODE RED
7	ANODE WHITE
8	ANODE BLUE

For a detailed drawing, please refer drawing number: DWG: 001374

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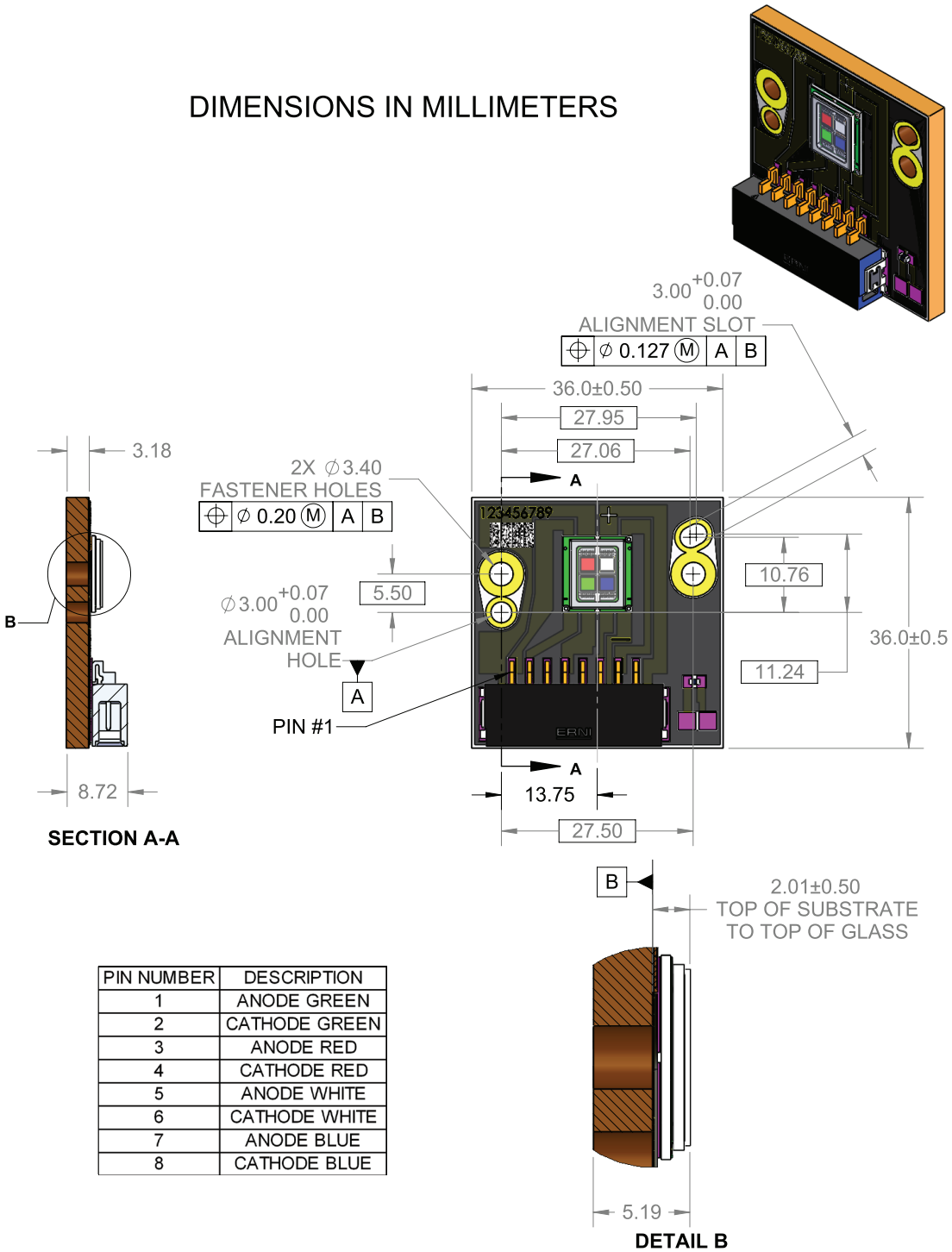
Mechanical Dimensions – SBR-160 Development Board

SBM-160 devices are available premounted on a copper-clad MCPCB for prototyping purposes. Please see page 14 for ordering information.



PIN NUMBER	DESCRIPTION
1	ANODE GREEN
2	CATHODE GREEN
3	ANODE RED
4	CATHODE RED
5	ANODE WHITE
6	CATHODE WHITE
7	ANODE BLUE
8	CATHODE BLUE

Thermistor Information

The thermistor used in SBM-160 RGBW devices is from Murata Manufacturing Co. The global part number is NCP18XH103J03RB. Please see http://www.murata.com/ for details on calculating thermistor temperature.

For a detailed drawing, refer drawing number: DWG-001381

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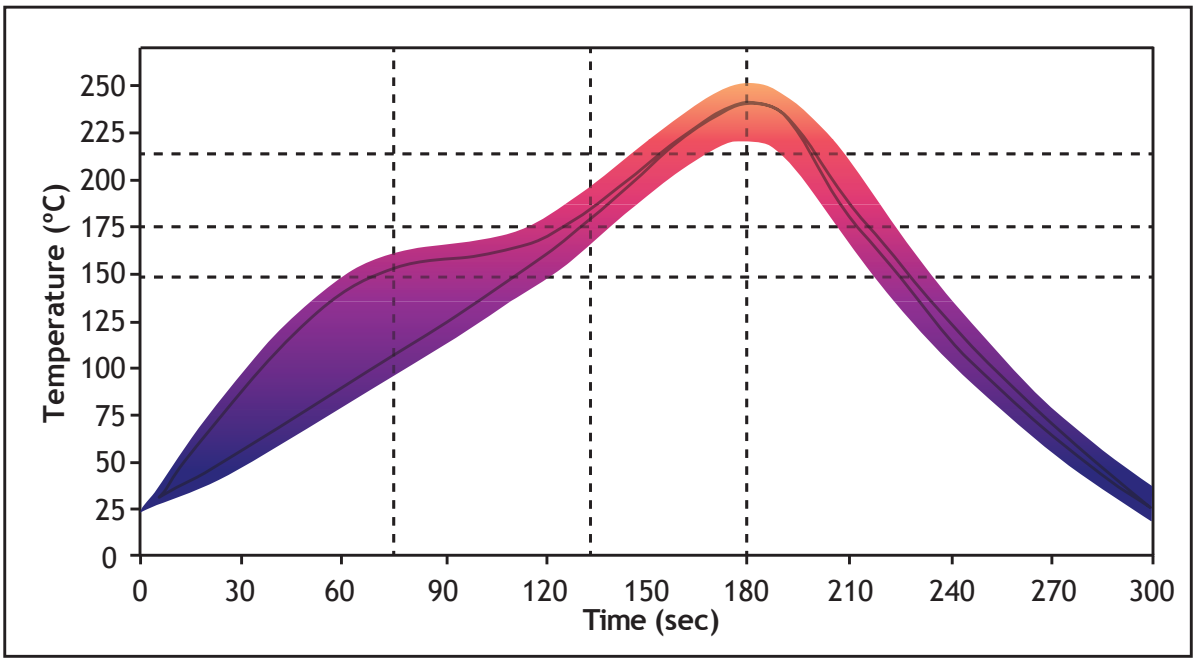
Solder Profile

SAC 305 Reflow Profile Window For Low Density Boards



Solder Profile Stage	Lead-Free Solder	Lead-based Solder
Rate of Rise	2°C/sec max	2°C/sec max
Preheat Min Temp ($T_{i,min}$)	100°C	120°C
Preheat Max Temp ($T_{i,max}$)	175°C	130°C
Preheat Time ($T_{i,min}$ to $T_{i,max}$)	90 seconds	120 seconds
Liquidus Min Temp (T_L)	185°C	160°C
Liquidus to Liquidus Time (T_L to T_{L2})	30-60 seconds	30 seconds
Liquidus Peak Temp (T_p)	240°C max	220°C max
Cooldown	≤ 4°C/sec	≤ 6°C/sec
Profile Length (Ambient to Peak)	4 min	3.5 - 4 min

Note 1: Temperatures are taken and monitored at the component copper layer.

Note 2: Optimum profile may differ due to oven type, circuit board or assembly layout.

Note 3: Recommended lead free, no-clean solder: AIM NC254-SAC305.

Note 4: Refer to soldering and handling application note for additional solder profiles and details.

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Ordering Information

Ordering Part Number [1,2]	Color	Description
SBM-160-RGBW-H41-RF100	RGBW	SBM-160 RGBW Big Chip LED™ surface mount LED consisting of a red 4 mm^2 LED, a green 4 mm^2 LED, a blue 4 mm^2 LED, a white 4 mm^2 LED , tray pack
SBR-160-RGBW-R41-RF100	RGBW	SBR-160 evaluation module consisting of a SBM-160 RGBW surface mount LED mounted on a development board

Note 1: SBM-160-RGBW-H41-RF100 denotes a bin kit comprising of all flux bins as listed on page 3 and chromaticity bins listed on page 3 and 4.

Note 1: For ordering information on all available bin kits, please see PDS-001792: SBM-160 Binning & Labeling document.

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