SBT-90 LEDs

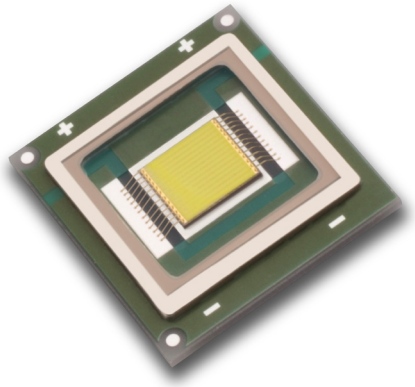


Table of Contents

Features:

- Extremely high optical output: Over 1,300 lumens at 9.0A from a single chip (white)
- High thermal conductivity package - junction to case thermal resistance of only 0.64 °C/W
- Large, monolithic chip with uniform emitting area of 9 mm^2
- Unencapsulated die with low profile protective window optimizes optical coupling in etendue-limited applications
- Lumen maintenance of greater than 70% after 70,000 hours
- Variable drive current: less than 1 A through 9 A
- Electrically isolated thermal path
- Environmentally friendly: RoHS compliant

Applications

- Fiber-coupled Illumination
- Architectural and Entertainment Lighting
- Projection and micro-display based applications
- High-Brightness and large format LCD Back-light Units
- Edge-illuminated lighting guides
- High output, Etendue-Limited Lighting applications

PDS-001540 Rev 07

Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

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 0.64° C/W, Luminus SBT-90 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.

Luminus surface mount LEDs are typically tested with a 20mSec 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.

Multiple Operating Points (3.2 A, 9.0 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 1A to 9A, and duty cycle from <1% to 100%), multiple drive conditions are listed.

SBT-90 LEDs are production tested at 9.0 A. The values shown at 3.2 A are for additional reference at other possible drive conditions.

Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

SBT-90 White Binning Structure

SBT-90 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:

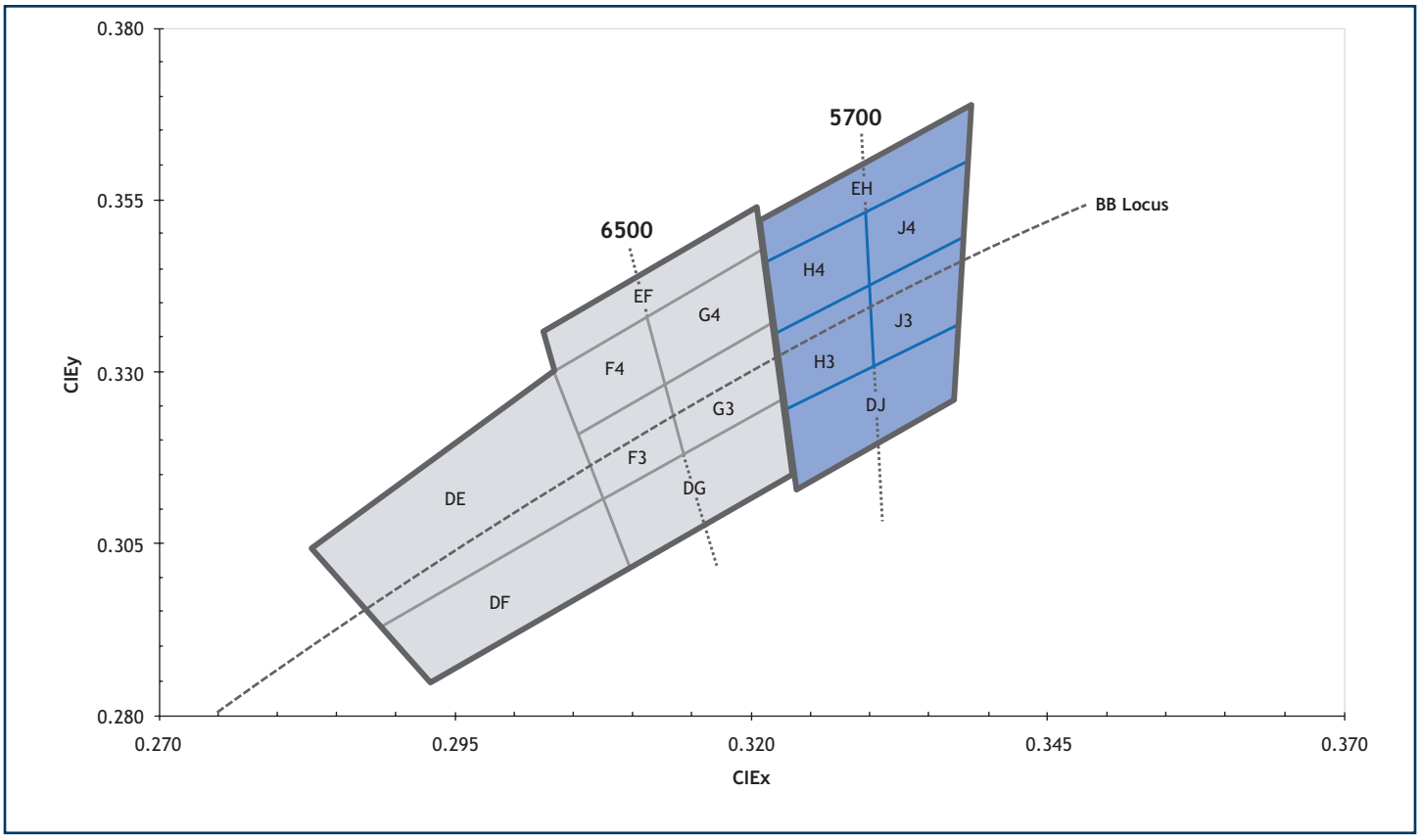
Flux Bins

Color	Flux Bin (FF)	Minumum Flux (lm) @ 9.0A	Maximum Flux (lm) @ 9.0A
W65S 6500K, Standard CRI (typ. 70)	LB	1,290	1,380
	MA	1,380	1,485
	MB	1,485	1,590

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

Chromaticity Bins

Luminus' Standard Chromaticity Bins: 1931 CIE Curve



Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

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

Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

Product Shipping & Labeling Information

All SBT-90 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:

SBT — 90 — WNNX — F71 — FF — WW

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Chromaticity Bin
Surface Mount (window)	9.0 mm^2	CCT & CRI See Note 1 below	Internal Code	See page 3 for bins	See page 4 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 12 and reference PDS-001788: SBT-90 Binning & Labeling document.

Example:

The part label SBT-90-W65S-F71-MA-G4 refers to a 6500K standard CRI white, SBT-90 emitter, with a flux range from 1,380 to 1,485 lumens and a chromaticity value within the box defined by the four points (0.313, 0.329), (0.321, 0.337), (0.321, 0.348),(0.312, 0.339).

Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

Electrical Characteristics[1]

White				
Drive Condition[2]		**3.2 A**	**9.0 A**	
Parameter	**Symbol**	**Typical Values at Indicated Current[3]**	**Values at Test Currents**	**Unit**
Current Density	j	0.35	1.0	A/mm^2
Forward Voltage	V_F	3.3	3.7	V

Common Characteristics

Parameter	Symbol	Values	Unit
Emitting Area		9.0	mm^2
Emitting Area Dimensions		3 x 3	mm×mm
Forward Voltage Temperature Coefficient[4]		-2.45	mV/ºC

Absolute Maximum Ratings

Parameter	Symbol	Values	Unit
Maximum Current[5]		9	A
Maximum Junction Temperature[6]	$T_{j\text{-}max}$	150	ºC
Storage Temperature Range		-40/+100	ºC

Note 1: All ratings are based on operation at room temperature.

Note 2: Listed drive conditions are typical for common applications. SBT-90 devices can be driven at currents ranging from 1A to 9A 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: Forward voltage temperature coefficient at current density of 0.35 A/mm^2 and heat sink temperature of 40ºC. Contact Luminus for value at other drive conditions.

Note 5: Luminus SBT-90 LEDs are designed for operation to an absolute maximum forward drive current density of 1.0 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 6: Lifetime is dependent on LED junction temperature . Thermal calculations based on input power and thermal management system should be performed to ensure T_j is maintained below $T_{j\text{-}max}$ rating or life will be reduced. Refer to lifetime plots on pg 7 and lifetime and reliability application note for further information.

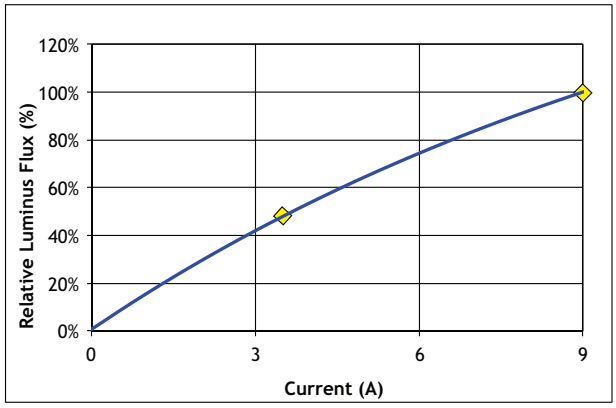
Note 7: CIE measurement uncertainty for white devices is estimated to be +/- 0.01.

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

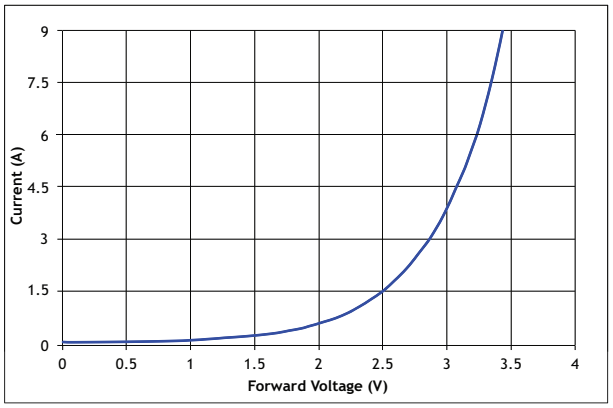
Note 9: Caution must be taken not to stare at the light emitted from these LEDs. Under special circumstances, the high intensity could damage the eye.

Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

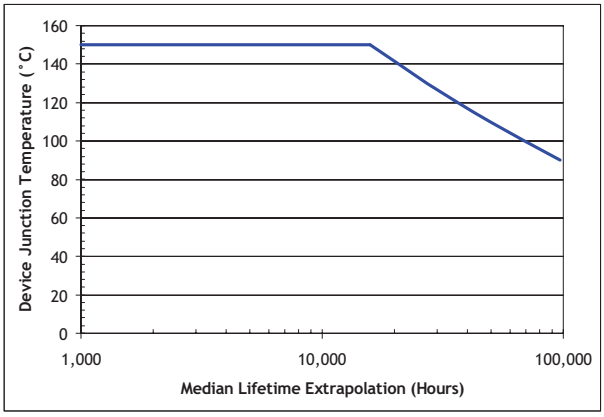
Relative Output Flux vs. Forward Current[1]



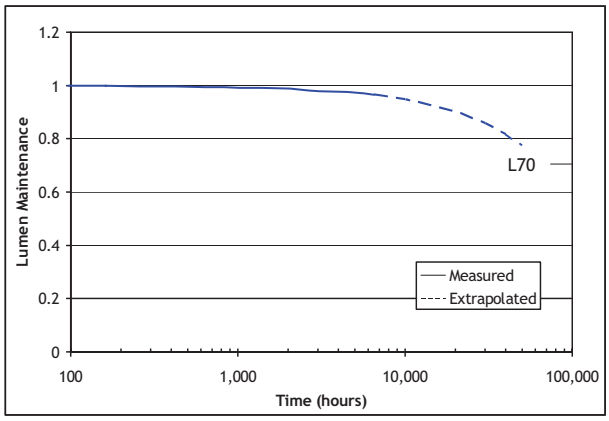
Forward Current vs. Forward Voltage



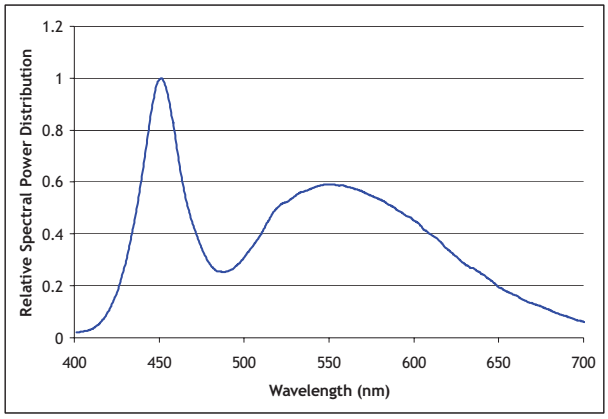
Mean Lifetime[2]



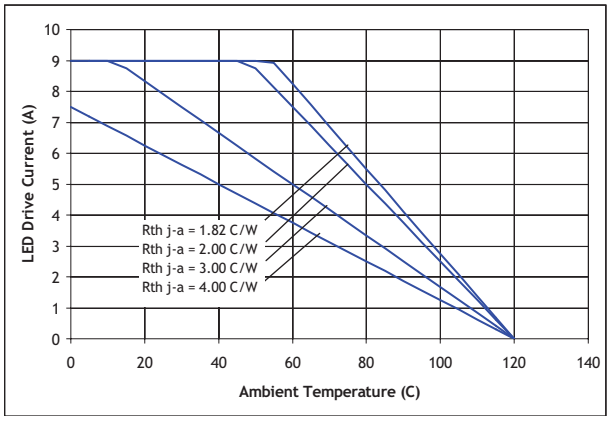
Lumen Maintenance vs. Time[3]



Typical Spectrum[4]



Current Derating Curve



Note 1: Yellow squares indicate typical operating conditions.

Note 2: Mean expected lifetime in dependence of junction temperature at 0.35 A/mm^2 in continuous operation. Lifetime defined as time to 70% of initial intensity. Based on lifetime test data of uncoated GaN devices at this time. Data can be used to model failure rate over typical product lifetime (contact Luminus for lifetime reliability test data for 1A/mm^2 condition).

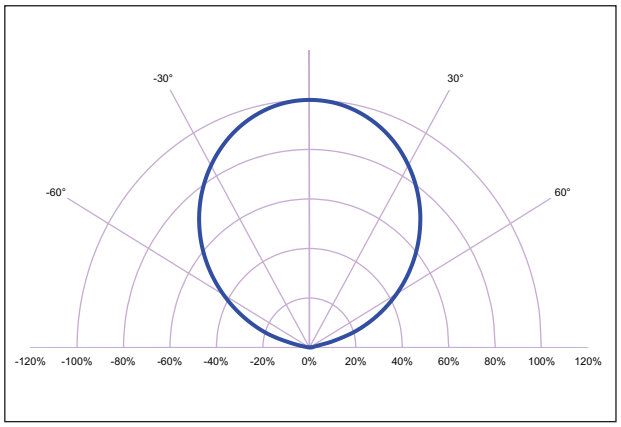
Note 3: Lumen maintenance in dependence of time at 0.35 A/mm^2 in continuous operation with junction temperatures of 100 °C.

Note 4: Typical spectrum at current density of 0.35 A/mm^2 in continuous operation.

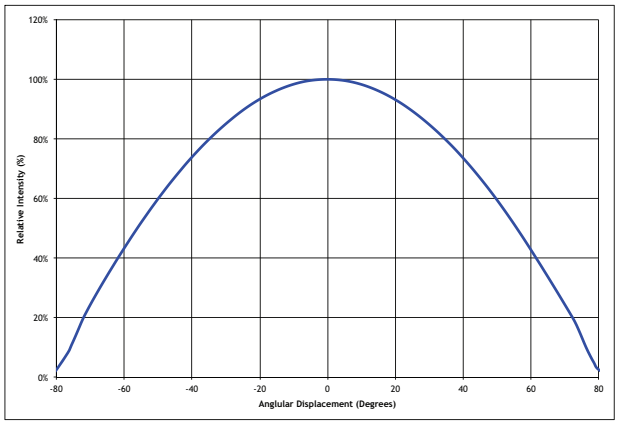
Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

Typical Radiation Patterns

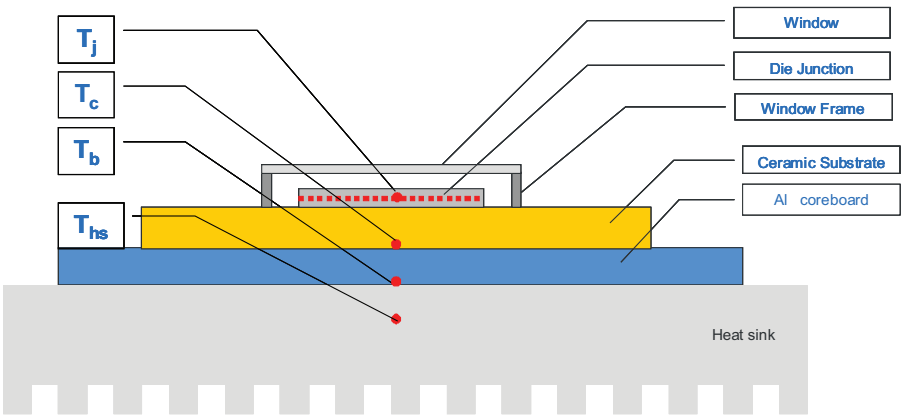
Typical Polar Radiation Pattern for White



Typical Angular Radiation Pattern for White



Thermal Resistance



Typical Thermal Resistance, junction to case

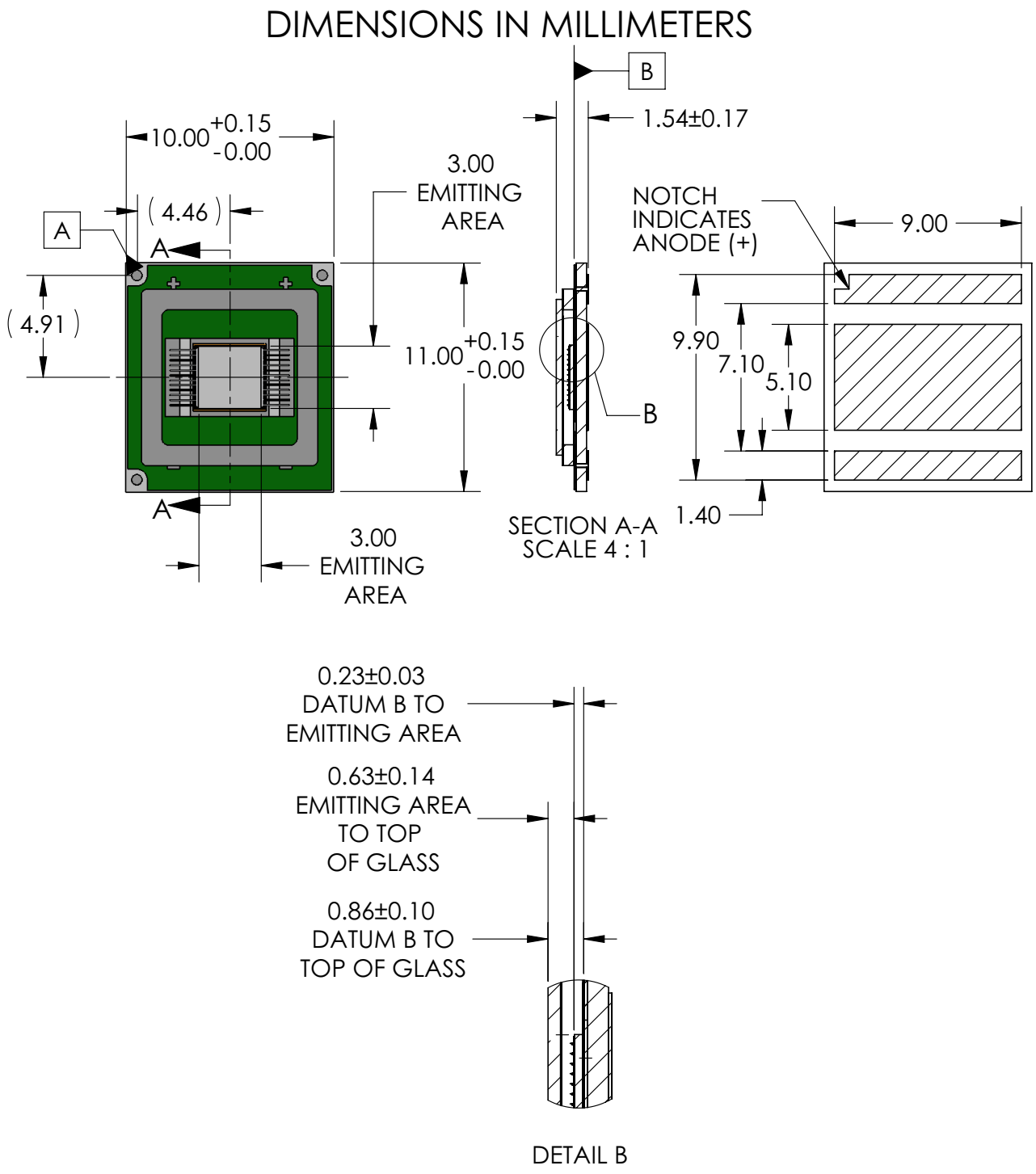
$R_{j\text{-}c}$ [1]	0.64 °C/W
$R_{j\text{-}b}$ [1]	2.02 °C/W
$R_{j\text{-}hs}$ [2]	2.15 °C/W

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 a SAC305 solder, a Bergquist Al-clad MCPCB, and eGraf 1205 thermal interface material.

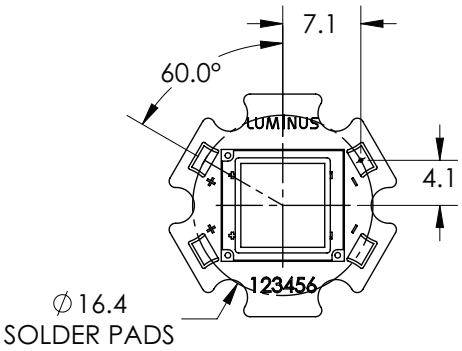
Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

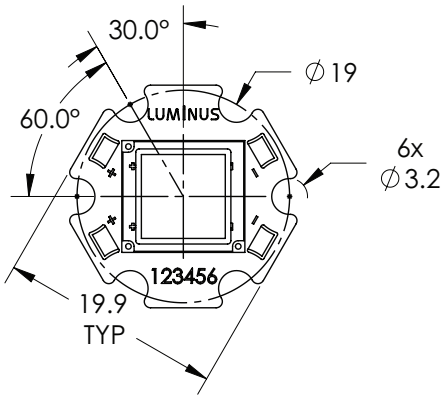
Mechanical Dimensions – SBT-90 Emitter

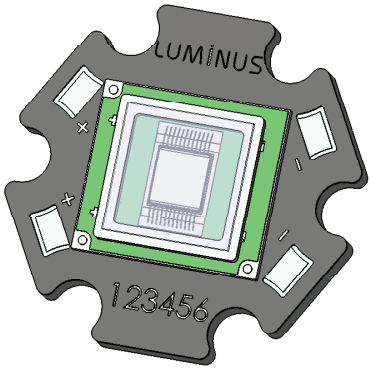


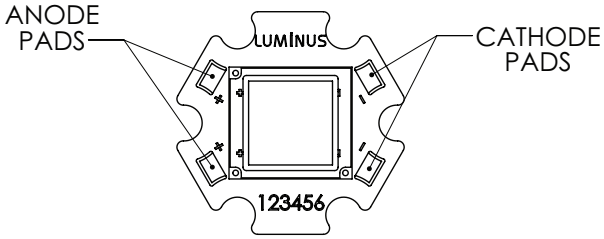
Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

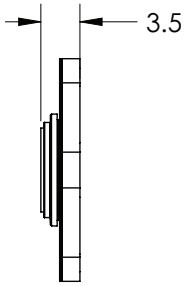
Mechanical Dimensions – SBT-90 Star Board











Note 1: Tolerances per IPC-610, Class 2

Note 2: For detail drawing of SBT-90, please see DWG 1553

Note 3: Recommended mounting screw: M3 or #4

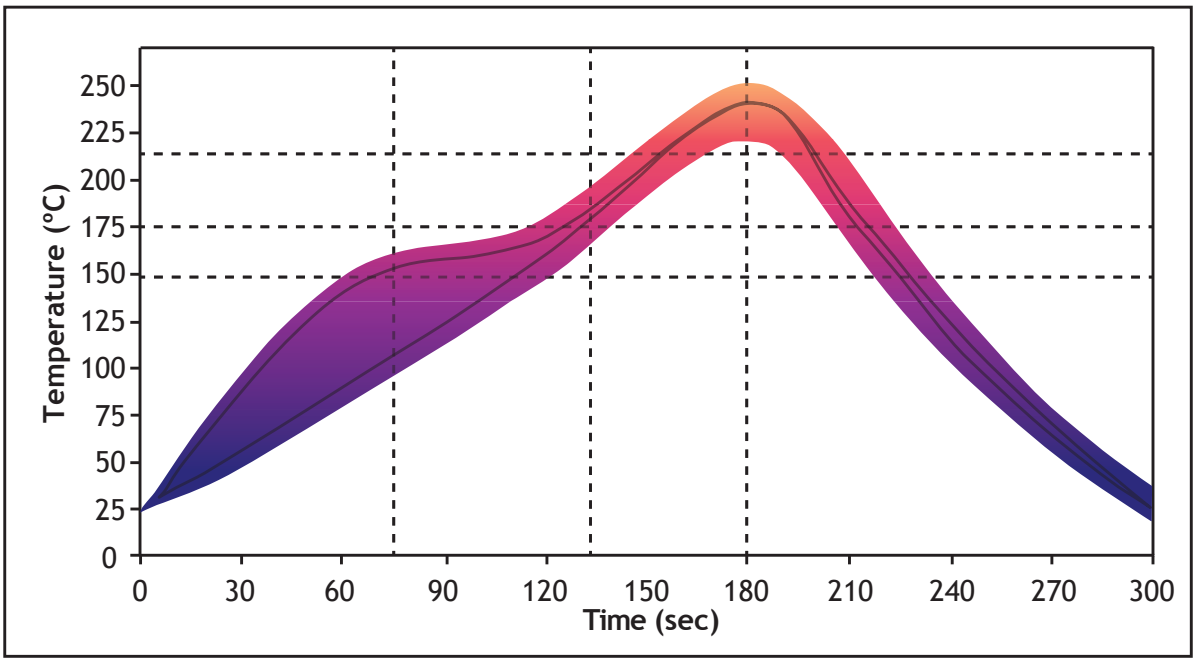
Note 4: All dimensions in millimeters

Note 5: All anode pads on board are interconnected. All cathode pads on board are interconnected

Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

Solder Profile

SAC 305 Reflow Profile Window For Low Density Boards



Lead free solder guideline for low density boards

Solder Profile Stage	Lead-Free Solder
Profile length, Ambient to Peak	2.75 - 3.5 minutes
Time above 217° C	30 - 60 seconds
Cooldown Rate	≤4° C/sec
Cooldown duration	45 ± 15 sec

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 APN-001473 soldering and handling application note for additional solder profiles and details

Note 5: MSL- 1 Level

Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

Ordering Information

Ordering Part Number [1,2]	Color	Description
SBT-90-W65S-F71-MA100	6500K White	White Big Chip LED™ SBT-90 surface mount device consisting of a 9mm² LED on ceramic substrate, tray pack
SBR-90-W65S-R71-MA100	6500K White	SBR-90 evaluation module consisting of a SBT-90 surface mount device mounted on an aluminum star board

Note 1: MA100 - denotes a bin kit comprising of all flux bins with a minimum flux of 1,380 lumens and chromaticity bins at the 6500K color point.

Note 2: For ordering information on all available bin kits, please see PDS-001788: SBT-90 Binning & Labeling document.

Luminus Devices, Inc. • T 978.528.8000 • www.luminus.com
1100 Technology Park Drive • Billerica, MA 01821

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Luminus Devices:

SBT-90-W65S-F71-KB100 SBT-90-W65S-F71-KB101 SBT-90-W65S-F71-KB102 SBT-90-W65S-F71-LA100 SBT-90-W65S-F71-LA101 SBT-90-W65S-F71-LA102 SBR-90-W65S-R71-KB100 SBR-90-W65S-R71-KB101 SBR-90-W65S-R71-KB102 SBR-90-W65S-R71-LA100 SBR-90-W65S-R71-LA101 SBR-90-W65S-R71-LA102