SBT-70 White LEDs

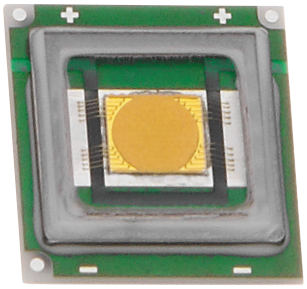

Table of Contents

Features:

- Extremely high optical output from a 7 mm^2 circular source: Upto 1,750 white lumens
- Round emitting aperture provides most efficient match to circular optical systems and narrow beam projectors
- Unencapsulated die with low profile protective window optimizes optical coupling in etendue-limited applications
- High thermal conductivity package - junction to case thermal resistance of only 0.64 °C/W
- Variable drive current: 1 A to 10.5 A for white
- High CRI at tungsten and daylight color temperatures for natural lighting
- Environmentally friendly: RoHS compliant

Applications

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

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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 0.64° C/W, Luminus SBT-70 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 (7.0 A, 10.5 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 from1A to 10.5 A, and duty cycle from <1% to 100%), multiple drive conditions are listed.

SBT-70 White LEDs are production tested at 10.5 A. The values shown at other current conditions are for additional reference at other possible drive conditions.

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SBT-70 White Binning Structure

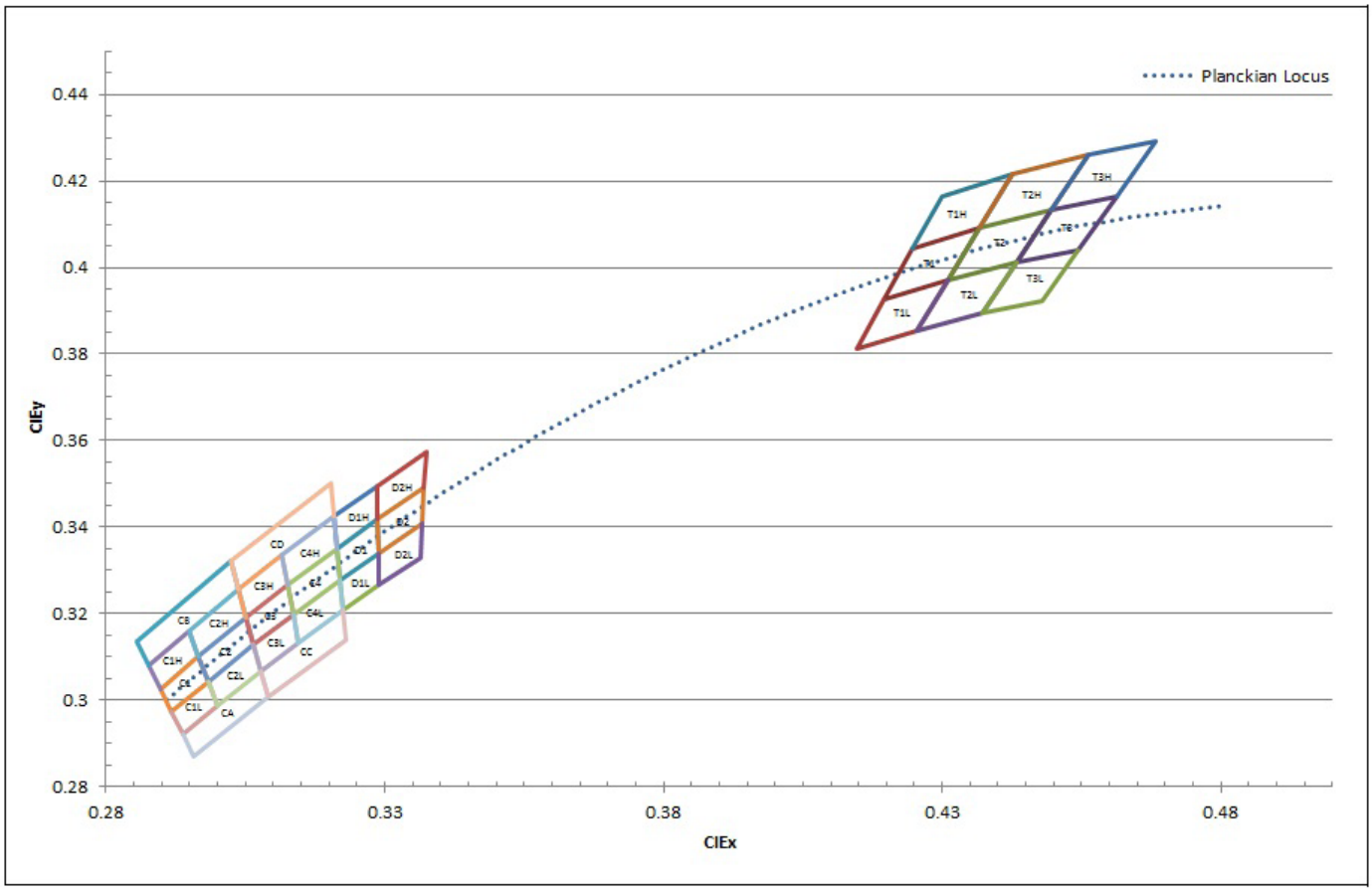
SBT-70 white LEDs are tested for luminous flux and chromaticity at a drive current of 10.5 A (1.5 A/mm^2) and placed into one of the following luminous flux (FF) and chromaticity (WW) bins:

Flux Bins

Color	Flux Bin (FF)	Minimum Flux (lm) at 10.5A	Maximum Flux (lm) at 10.5A
WCS Cool White Standard CRI (typ. 75)	MA	1,380	1,485
	MB	1,485	1,590
	NA	1,590	1,710
WDH Daylight White Standard CRI (typ. 90)	LA	1,200	1,290
	LB	1,290	1,380
WTH Tungsten White High CRI (typ. 95)	GB	730	780
	HA	780	840
	HB	840	900

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

Chromaticity Bins



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SBT-70 White Chromaticity Bins

The following tables describe the four chromaticity points that bound each chromaticity bin. Chromaticity bins are grouped together based on the color temperature.

Daylight Chromaticity Bins		
Bin Code(WW)	CIEx	CIEy
D1	0.321	0.327
	0.321	0.335
	0.328	0.341
	0.328	0.334
D2	0.328	0.334
	0.328	0.341
	0.337	0.348
	0.336	0.340
D1H	0.321	0.335
	0.320	0.342
	0.328	0.349
	0.328	0.341
D2H	0.328	0.341
	0.328	0.349
	0.337	0.357
	0.337	0.348
D1L	0.321	0.327
	0.322	0.320
	0.328	0.326
	0.328	0.334
D2L	0.328	0.334
	0.328	0.326
	0.336	0.333
	0.336	0.340

Cool White Chromaticity Bins		
Bin Code(WW)	CIEx	CIEy
C1	0.291	0.297
	0.289	0.302
	0.296	0.310
	0.298	0.304
C2	0.298	0.304
	0.296	0.310
	0.305	0.319
	0.306	0.312
C3	0.306	0.312
	0.305	0.319
	0.312	0.326
	0.313	0.319
C4	0.313	0.319
	0.312	0.326
	0.321	0.335
	0.321	0.327
C1H	0.289	0.302
	0.287	0.307
	0.294	0.315
	0.296	0.310
C2H	0.296	0.310
	0.294	0.315
	0.303	0.325
	0.305	0.319

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SBT-70 White Chromaticity Bins

The following tables describe the four chromaticity points that bound each chromaticity bin. Chromaticity bins are grouped together based on the color temperature.

Cool White Chromaticity Bins		
Bin Code(WW)	**CIEx**	**CIEy**
C1L	0.291	0.297
	0.293	0.292
	0.299	0.298
	0.298	0.304
C2L	0.298	0.304
	0.299	0.298
	0.307	0.306
	0.306	0.312
C3L	0.306	0.312
	0.307	0.306
	0.314	0.313
	0.313	0.319
C4L	0.313	0.319
	0.314	0.313
	0.322	0.320
	0.321	0.327
CA	0.293	0.292
	0.295	0.287
	0.309	0.300
	0.307	0.306

Tungsten White Chromaticity Bins		
Bin Code(WW)	**CIEx**	**CIEy**
T1	0.419	0.392
	0.424	0.404
	0.436	0.409
	0.430	0.397
T2	0.430	0.397
	0.436	0.409
	0.449	0.413
	0.443	0.401
T3	0.443	0.401
	0.449	0.413
	0.461	0.416
	0.454	0.404
T1H	0.424	0.404
	0.429	0.416
	0.442	0.421
	0.436	0.409
T2H	0.436	0.409
	0.442	0.421
	0.456	0.425
	0.449	0.413
T3H	0.449	0.413
	0.456	0.425
	0.468	0.429
	0.461	0.416
T1L	0.419	0.392
	0.414	0.381
	0.425	0.385
	0.430	0.397
T2L	0.430	0.397
	0.425	0.385
	0.437	0.389
	0.443	0.401
T3L	0.443	0.401
	0.437	0.389
	0.447	0.392
	0.454	0.404

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Product Shipping & Labeling Information

All SBT-70 products are packaged and labeled with their respective bin as outlined in the tables and charts on pages 3, 4. & 5. When shipped, each package will only contain one bin. The part number designation is as follows:

SBT-70 White

SBT — 70 — WNX — F75 — FF — WW

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Chromaticity Bin
Surface Mount (window)	7.0 mm^2	Color & CRI See Note 1 below	Internal Code	See page 3 for bins	See page 4 for bins

Note 1: WNX nomenclature corresponds to the following:
W = White
N = color, where:
C corresponds to Cool White , D corresponds to Daylight, and T corresponds to Tungsten White
X = color rendering index, where:
S (Standard) corresponds to a typical CRI of 75
H (high) corresponds to a typical CRI of 95

Example 1:
The part label SBT-70-WDH-F75-MA-D4 refers to a Daylight high CRI white, SBT-70 emitter, with a flux range from 1,380 to 1,485 lumens and a chromaticity value within the box defined by the four points (0.328, 0.341), (0.328, 0.349), (0.337, 0.357), (0.337, 0.348).

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SBT-70 White Electrical Characteristics[1]

Optical and Electrical Characteristics (T_j = 25°C)

Drive Condition[2]		7.0 A	10.5 A	
Parameter	Symbol	Typical Values at Indicated Current[3]	Values at Test Currents	Unit
Current Density	j	1.0	1.5	A/mm^2
Forward Voltage	$V_{F, min}$		3.5	V
	$V_{F, typ}$	3.3	3.7	V
	$V_{F, max}$		3.9	V

Common Characteristics

Parameter		Symbol	Typical Values	Unit
Emitting Area			7.0	mm^2
Color Rendering Index (Typical)	Cool White	CRI	75	
	Daylight White	CRI	90	
	Tungsten White	CRI	95	
Forward Voltage Temperature Coefficient[4]			-2.45	mV/°C

Absolute Maximum Ratings

Parameter	Symbol	Values	Unit
Maximum Current[5]		10.5	A
Maximum Junction Temperature[6]	T_{j-max}	150	°C
Storage Temperature Range		-40/+100	°C

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

Note 2: Listed drive conditions are typical for common applications. SBT-70 white devices can be driven at currents ranging from 1A to 10.5A 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 +/- 0.005.

Note 5: Forward voltage temperature coefficient at current density of 1.5 A/mm^2. Contact Luminus for value at other drive conditions.

Note 6: SBT-70 White LEDs are designed for operation to an absolute maximum forward drive current density of 1.5 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 9 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.

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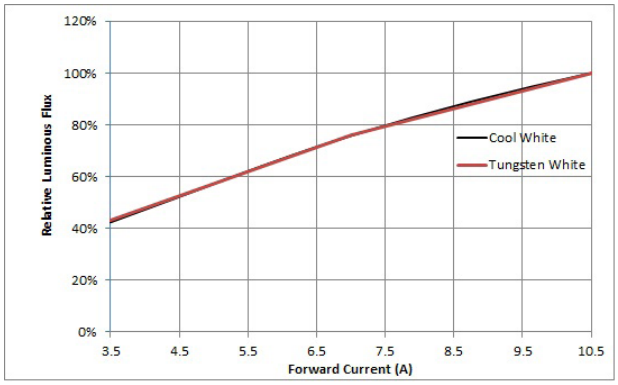
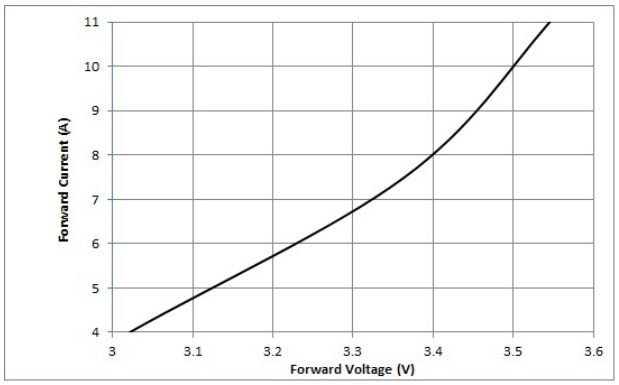
SBT-70 White Optical & Electrical Characteristics

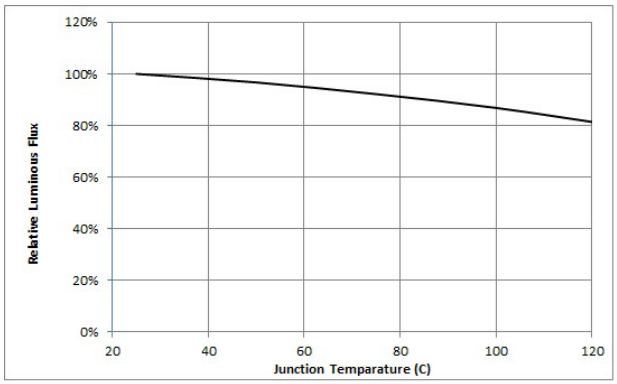
Relative Output Flux vs. Forward Current



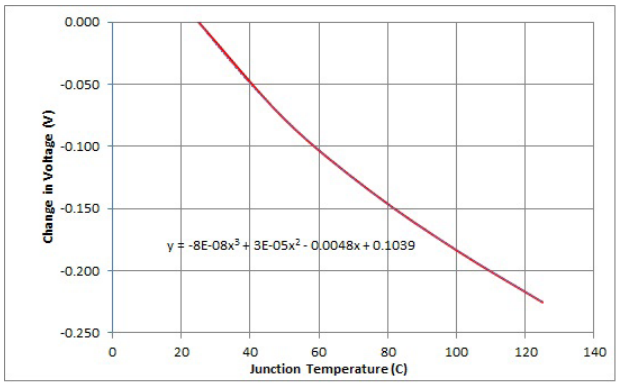
Forward Current vs. Forward Voltage



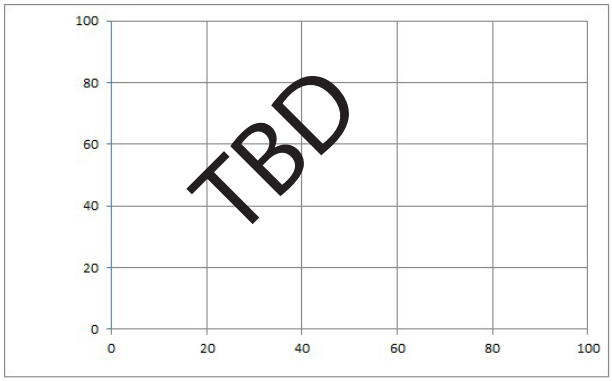
Relative Output Flux vs. Junction Temp



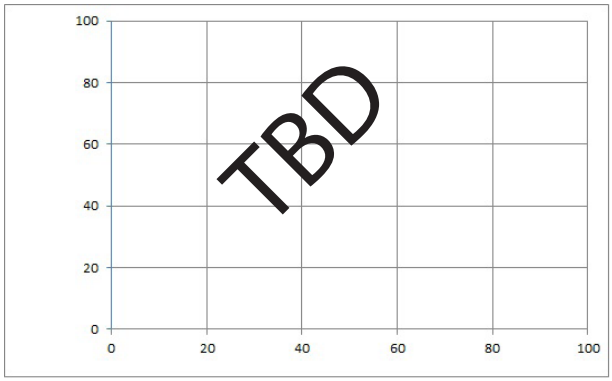
Change in Voltage vs. Junction Temp



Typical Spectrum[1]



Current Derating Curve



Note 1: Typical spectrum at current density of 1.5 A/mm² in continuous operation.

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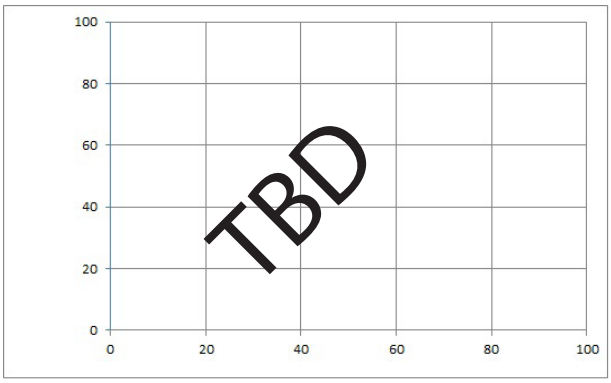
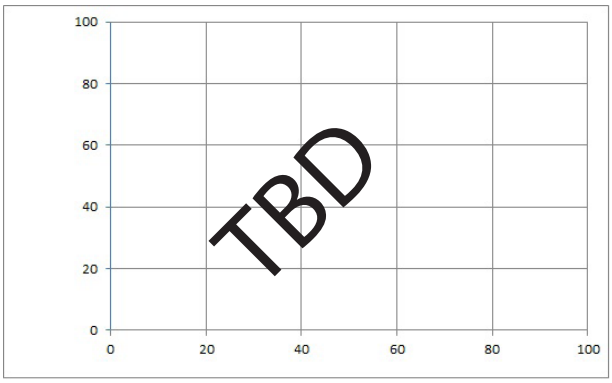
SBT-70 White Optical & Electrical Characteristics

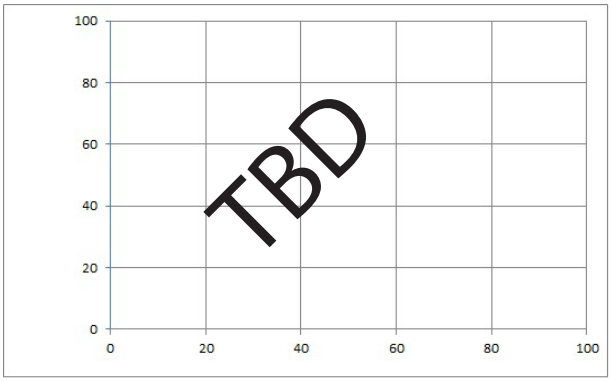
Mean Lifetime[2]



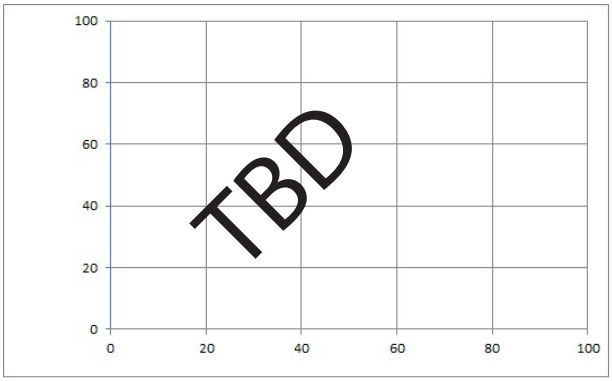
Lumen Maintenance vs. Time[3]



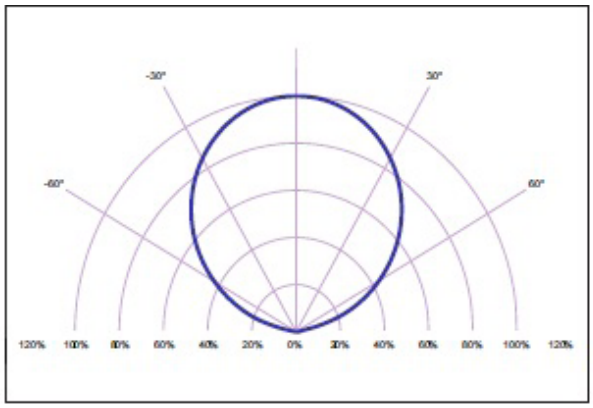
Chromaticity Change vs. Junction Temp



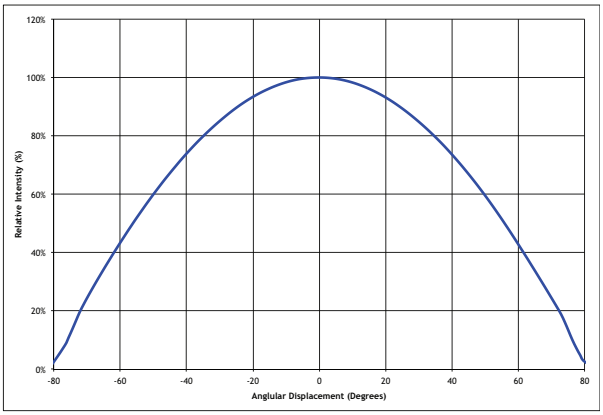
Chromaticity Change vs. Forward Current



Typical Polar Radiation Pattern



Typical Angular Radiation Pattern



Note 2: Mean expected lifetime in dependence of junction temperature at 1.5 A/mm² in continuous operation. Lifetime defined as time to 70% of initial intensity. Based on lifetime test data. Data can be used to model failure rate over typical product lifetime (contact Luminus for lifetime reliability test data for 1A/mm² condition).

Note 3: Lumen maintenance in dependence of time at 1.5 A/mm² in continuous operation with junction temperatures of 130 °C.

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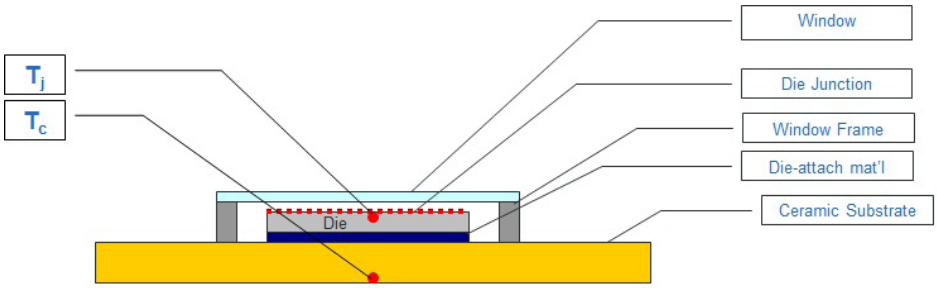
Thermal Resistance



Typical Thermal Resistance

R_{j-c} [1]	0.64 °C/W

Note 1: Thermal resistance values are preliminary based on modeled results.

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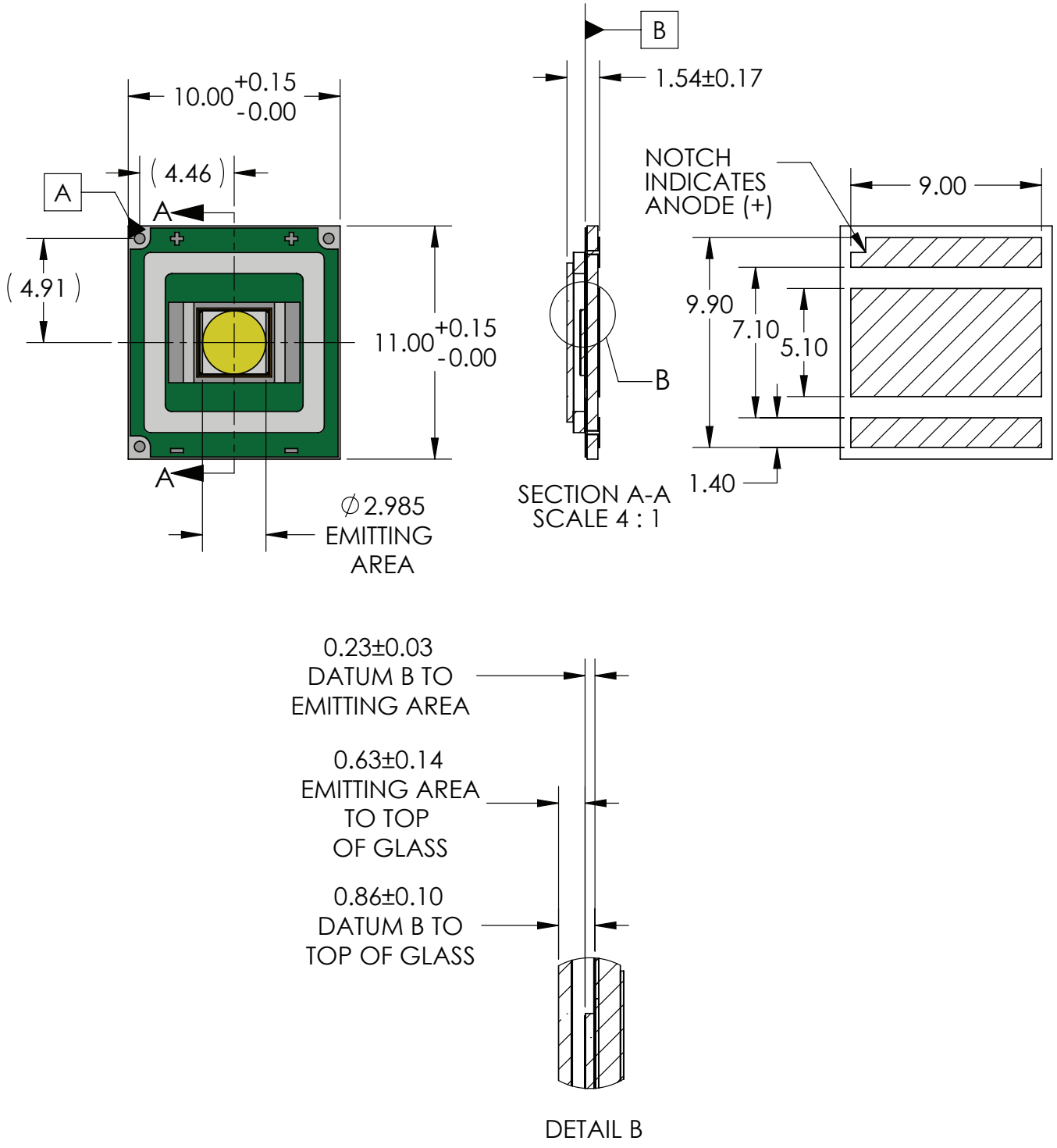
Mechanical Dimensions – SBT-70 Emitter

DIMENSIONS IN MILLIMETERS



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Ordering Information

Ordering Part Number [1,2,3,4]	Color	Description
SBT-70-WCS-F75-MA120	Cool White	White Big Chip LED™ SBT-70 consisting of a 7 mm^2 LED on a ceramic substrate
SBT-70-WDH-F75-LA220	Daylight White	White Big Chip LED™ SBT-70 consisting of a 7 mm^2 LED on a ceramic substrate
SBT-70-WTH-F75-GA720	Tungsten White	White Big Chip LED™ SBT-70 consisting of a 7 mm^2 LED on a ceramic substrate

Note 1: MA120 - denotes a bin kit comprising of all flux bins with a minimum flux of 1,380 lumens and chromaticity bins at cool white color point.

Note 2: LA220 - denotes a bin kit comprising of all flux bins with a minimum flux of 1,200 lumens and chromaticity bins at daylight white color point.

Note 3: GA720 - denotes a bin kit comprising of all flux bins with a minimum flux of 680 lumens and chromaticity bins at tungsten white color point.

Note 4: Standard packaging increment (SPI) is 25.

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- ### Customer Service :

  Email service@ameya360.com

- ### Partnership :

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  Email mkt@ameya360.com