CBT-140-W
White LEDs

Table of Contents

Features:

- Extremely high optical output from a14 mm^2 circular source: Up to 5,000 white lumens
- Round emitting aperture provides most efficient match to circular optical systems and narrow beam projectors
- Unencapsulated package preserves small etendue facilitating narrow beam optical system design
- Chip on board package assures straightforward system assembly with the best possible thermal performance for high power devices.
- Integrated thermistor enables consistent temperature monitoring during operation for high system reliability
- High thermal conductivity package - junction to heat sink thermal resistance less than 0.25°C/W
- Variable drive current: 1 A to 28A
- High CRI (92 typical) 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 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.

Luminus LED Technology

Luminus' Devices vertical chip LED 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 heat sink of 0.25° C/W, Luminus CBT-140-W 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.

Environmental Benefits

Luminus LEDs help reduce power consumption and the amount of hazardous waste entering the environment. All LED products manufactured by Luminus are RoHS compliant and free of hazardous materials, including lead and mercury.

Reliability

Designed from the ground up, Luminus LEDs are one of the most reliable light sources in the world today. Luminus 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 LEDs are ready for even the most demanding applications.

Static Electricity

The products are sensitive to static electricity, and care should be taken when handling them. Static electricity or surge voltage willdamage the LEDs. It is recommended to wear an anti-electrostatic wristband or an anti-electrostatic gloves when handling the LEDs. Alldevices, equipment and machinery must be properly grounded. It is recommended that measures be taken against surge voltage to the equipment that mounts the LEDs.

Reference: APN-002815 Electrical Stress Damage to LEDs and How to Prevent It

Understanding Luminus LED Test Specifications

Every 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 LEDs perform in the field just as they are specified.

Expected flux values in real world operation can be extrapolated based on the information contained within this product datasheet.

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 1A to 28.0A, and duty cycles from <1% to 100%), multiple drive conditions may be listed.

CBT-140-W LEDs are production tested at 21.0 A.

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Ordering Information

CBT-140-W LEDs are monolithic LED with 14 mm^2 circular emission area, un-encapsulated and integrated on a common anode copper-core PCB.

Ordering Part Numbers

CRI	Luminous Flux		Chromaticity Bins	Ordering Part Number
	Min. Flux Bin	Min. Flux		
WCS 6500K-7500K 70CRI	TB	3,440 lm	C1, C2, C3, C4, CA, CB, CC, CD	CBT-140-WCS-L16-TB120
			C1, C2, C3, C4	CBT-140-WCS-L16-TB121
			C3, C4	CBT-140-WCS-L16-TB122
			C1, C2	CBT-140-WCS-L16-TB123
	UA	3,680 lm	C1, C2, C3, C4, CA, CB, CC, CD	CBT-140-WCS-L16-UA120
			C1, C2, C3, C4	CBT-140-WCS-L16-UA121
			C3, C4	CBT-140-WCS-L16-UA122
			C1, C2	CBT-140-WCS-L16-UA123
	UB	3955 lm	C1, C2, C3, C4, CA, CB, CC, CD	CBT-140-WCS-L16-UB120
			C1, C2, C3, C4	CBT-140-WCS-L16-UB121
			C3, C4	CBT-140-WCS-L16-UB122
WDH Daylight white High CRI (typ. 92)	QA	2,100 lm	D1, D2, D1H, D2H, D1L, D2L	CBT-140-WDH-L16-QA220
	QB	2,260 lm	D1, D2, D1H, D2H, D1L, D2L	CBT-140-WDH-L16-QB220
	RA	2,420 lm	D1, D2, D1H, D2H, D1L, D2L	CBT-140-WDH-L16-RA220

Part Number Nomenclature

CBT — 140 — <ABC> — L16 — <FF###>

Product Family	Chip Area	Color	Package Configuration	Bin Kit [1]
CBT: Copper-core PCB, No Encapsulation	140: 14.0 mm^2	<A>: Color W = White <B> : Temperature C = Cool White D = Daylight White <C> : CRI S = Standard CRI H = High CRI	L16: 28 mm x 26.75 mm - Common Anode Package, counter-bores	Refer to ordering part numbers above

Note 1: Flux Bin listed is minimum bin shipped, higher bins may be included at Luminus' discretion.

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Binning Structure

CBT-140-W LEDs are tested for luminous flux and chromaticity at a drive current of 21.0 A (1.5 A/mm^2) and placed into one of the following luminous flux (FF) and chromaticity (WW) bins:

Flux Bins

Color	Luminous Flux Bin (FF)[3]	Binning @ 21.0A, T_{hs}= 25°C[5]	
		Minimum Flux (lm)	Maximum Flux (lm)
WCS (6500K-7500K, 70CRI) WDH (5700K, 92CRI)	XA	5,590	6,011
	WB	5,225	5,590
	WA	4,860	5,225
	VB	4,545	4,860
	VA	4,230	4,545
	UB	3,955	4,230
	UA	3,680	3,955
	TB	3,440	3,680
	TA	3,200	3,440
	SB	2,990	3,200
	SA	2,780	2,990
	RB	2,600	2,780
	RA	2,420	2,600
	QB	2,260	2,420
	QA	2,100	2,260

Note 1: Luminus maintains a +/- 6% tolerance on flux measurements.

Note 2: Products are production tested then sorted and packed by bin.

Note 3: Individual bins are not orderable. Please refer to the Product Ordering information page for a list of orderable bin kits.

Note 4: Product test condition: 21.0 A, 25°C heat sink temperature.

Note 5: T_{hs}=Testing Heat Sink Temperature.

Note 6: The 3 digit wavelength bin as marked on the product label may be followed by a letter which is for internal use only.

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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
C1	0.2937	0.2921
	0.3000	0.2988
	0.2948	0.3159
	0.2877	0.3080
C2	0.3000	0.2988
	0.3078	0.3068
	0.3038	0.3255
	0.2948	0.3159
C3	0.3078	0.3068
	0.3145	0.3133
	0.3116	0.3334
	0.3038	0.3255
C4	0.3145	0.3133
	0.3225	0.3208
	0.3209	0.3424
	0.3116	0.3334
CA	0.2937	0.2921
	0.2956	0.2870
	0.3090	0.3009
	0.3078	0.3068
CB	0.2877	0.3080
	0.2856	0.3135
	0.3025	0.3321
	0.3038	0.3255
CC	0.3078	0.3068
	0.3090	0.3009
	0.3225	0.3208
	0.3229	0.3140
CD	0.3038	0.3255
	0.3025	0.3321
	0.3204	0.3501
	0.3209	0.3424

Daylight Chromaticity Bins		
Bin Code(WW)	CIEx	CIEy
D1	0.3220	0.3278
	0.3215	0.3350
	0.3287	0.3417
	0.3289	0.3341
D2	0.3289	0.3341
	0.3287	0.3417
	0.3371	0.3490
	0.3368	0.3409
D1H	0.3215	0.3350
	0.3209	0.3424
	0.3286	0.3495
	0.3287	0.3417
D2H	0.3287	0.3417
	0.3286	0.3495
	0.3374	0.3573
	0.3371	0.3490
D1L	0.3220	0.3278
	0.3225	0.3208
	0.3290	0.3266
	0.3289	0.3341
D2L	0.3289	0.3341
	0.3290	0.3266
	0.3365	0.3330
	0.3368	0.3409

Note 7: Luminus maintains a +/- 2% tolerance on CRI measurements.

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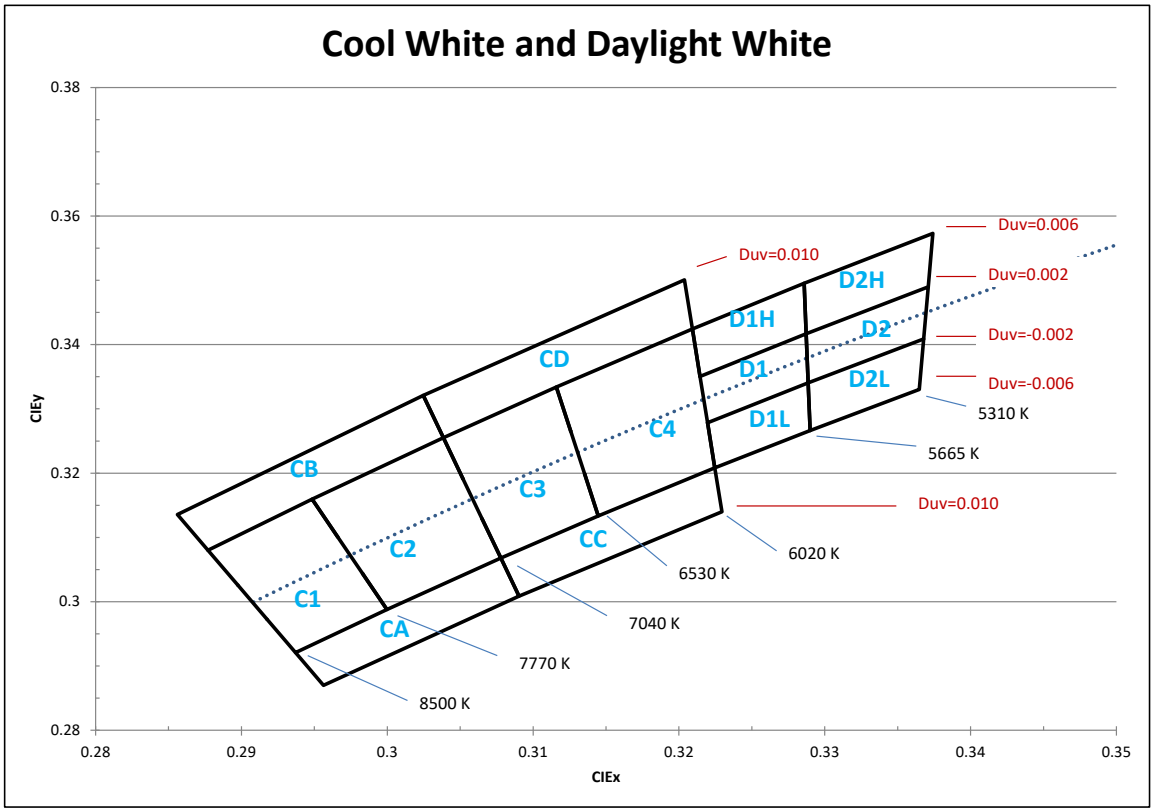
Chromaticity Bins

Chromaticity Bins: 1931 CIE Curve



Note 8: CCT value based off of CIE measurement. CIE X and CIE Y measurement uncertainty for white devices is estimated to be +/- 0.01.

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Typical Device Performance

General Characteristics		Symbol	Value	Unit
Emitting Area		A_e	14.0	mm^2
Characteristics at Recommended Test Drive Current , I_f [1, 2,3]				
Test Peak Drive Current	typ	I_f	21.0	A
Color Rendering Index - Cool White	typ	CRI	75	
Color Rendering Index - Daylight White	typ	CRI	92	
Forward Voltage	min	$V_{F\ min}$	2.75	V
	typ	V_F	3.3	V
	max	$V_{F\ max}$	3.85	V
Device Thermal Characteristics				
Forward Voltage Temperature Coefficient	typ		-5.47	mV/ °C
Thermal Resistance of junction to coreboard[5]	typ	$R_{\theta j\text{-}b}$	0.30	°C/ W
Thermal Resistance of junction to thermistor[5,6]	typ	$R_{\theta j\text{-}ref}$	0.33	°C/ W

Note 1: Ratings are based on operation with a constant heat sink temperature of T_{hs} = 25°C.

Note 2: CBT-140-W LEDs are designed for operation to an absolute maximum forward drive current density of 2.0A/mm2. 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 3: Tested at Current Density of 1.5 A/mm^2.

Note 4: Unless otherwise noted, values listed are typical.

Note 5: Measurements are in accordance with JEDEC 51-14. For more about thermal resistance calculation, please see https://luminusdevices.zendesk.com/hc/en-us/articles/4416807960717-Thermal-Heatsink-Required-Rth-Calculator

Note 6: For more about calculating thermistor temperature, please see https://luminusdevices.zendesk.com/hc/en-us/articles/4412023747341-How-do-I-determine-the-temperature-from-Luminus-on-board-Thermistor-

Note 7: Caution must be taken not to stare at the light emitted from these LEDs. Under special circumstances, the high intensity could damage the eye.

Note 8: 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.

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Absolute Maximum Ratings

	Symbol	Value	Unit
Absolute Minimum Current[8, 9]		0.2	A
Absolute Maximum Current[10]		28.0	A
Absolute Maximum Junction Temperature[11]	T_{jmax}	150	ºC
Storage Temperature Range		-40/+100	ºC

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

Note 9: For reference only.

Note 10: Listed drive conditions are typical for common applications. CBT-140-W devices can be driven at currents ranging from 1A to 28A 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 11: Lifetime dependent on LED junction temperature. Input power and thermal system must be properly managed to ensure lifetime. Sustained operation at or beyond absolute maximum currents or temperatures will result in a reduction of device life ime compared to recommended conditions. Refer to the lifetime derating curves for further information.

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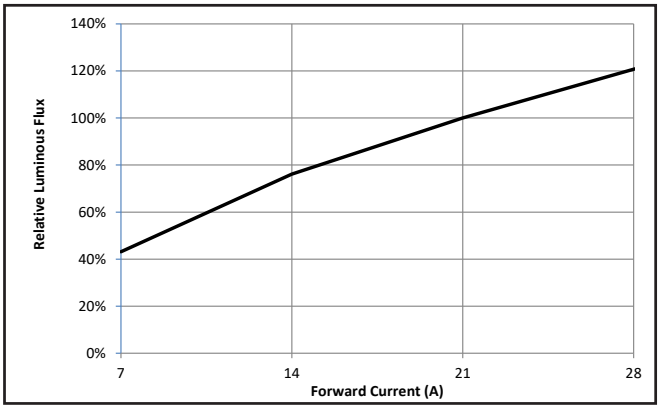
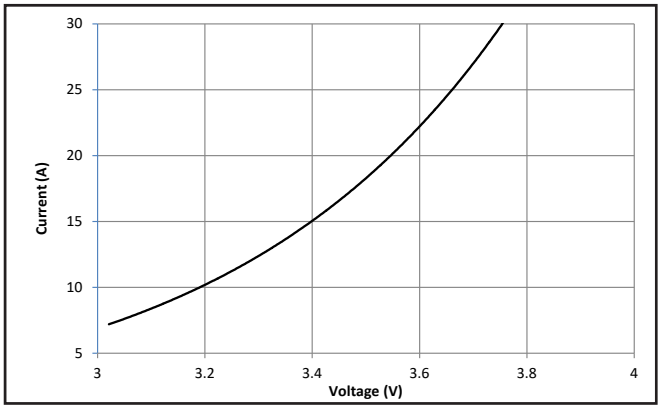
Optical & Electrical Characteristics

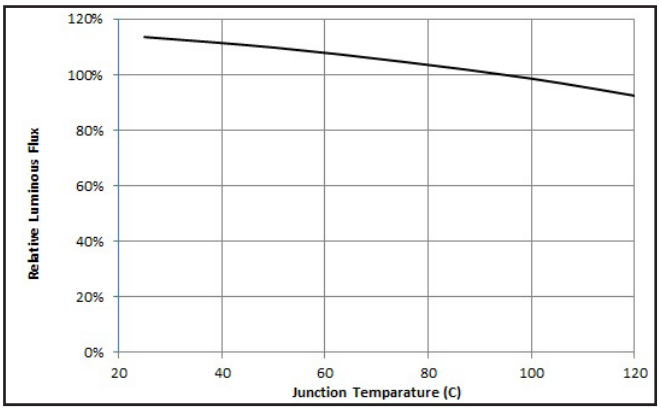
Relative Output Flux vs. Forward Current



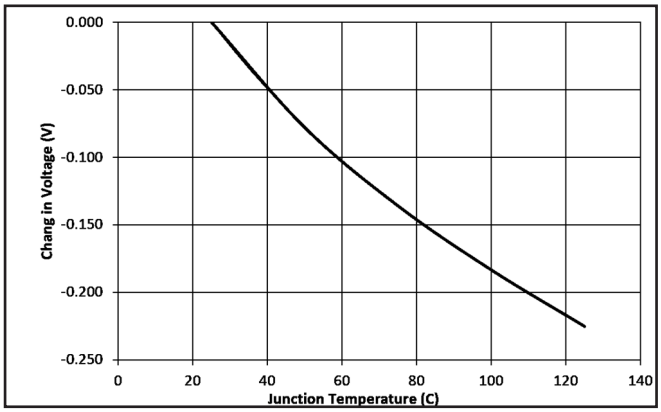
Forward Current vs. Forward Voltage



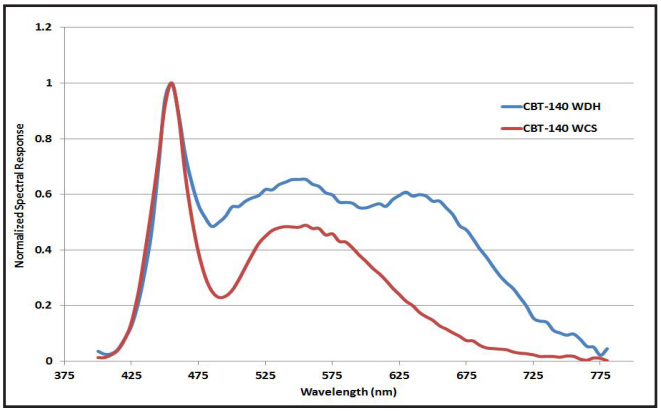
Relative Output Flux vs. Junction Temp



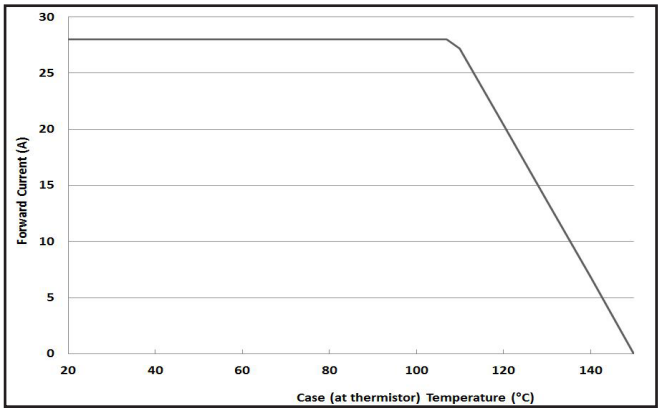
Change in Voltage vs. Junction Temp



Typical Spectrum[1]



Current Derating Curve[2]



Note 1: Typical spectrum at current density of 1.5 A/mm^2 in continuous operation.

Note 2: Maximum drive current to comply with maximum junction temperature in continuous mode. Junction temperature should be maintained at level compatible with lifetime desired with may require further current de-rating

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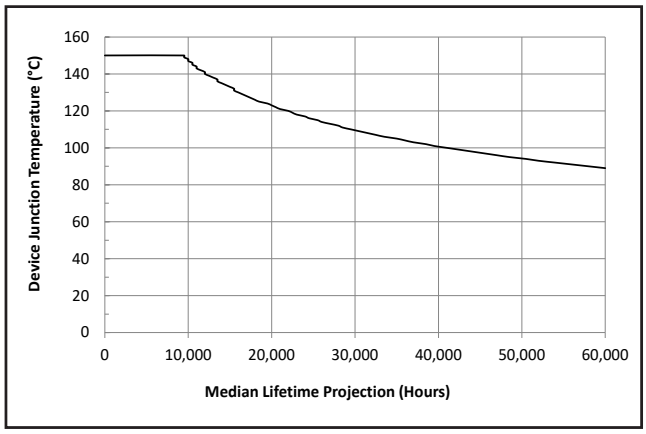
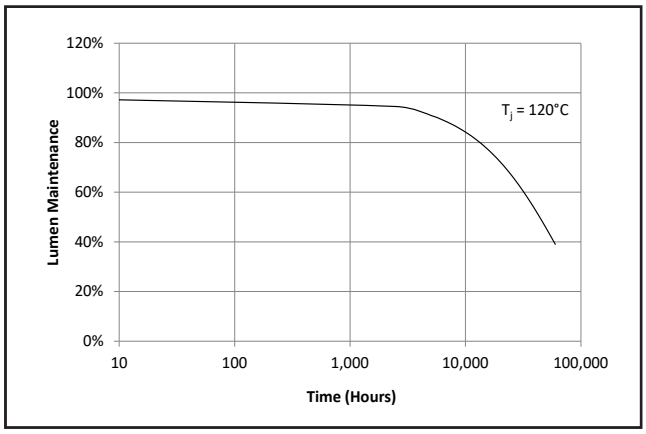
Optical & Electrical Characteristics

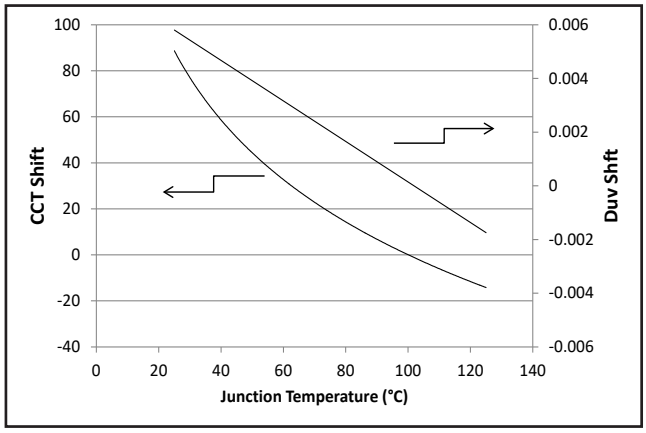
Median Lifetime[3]



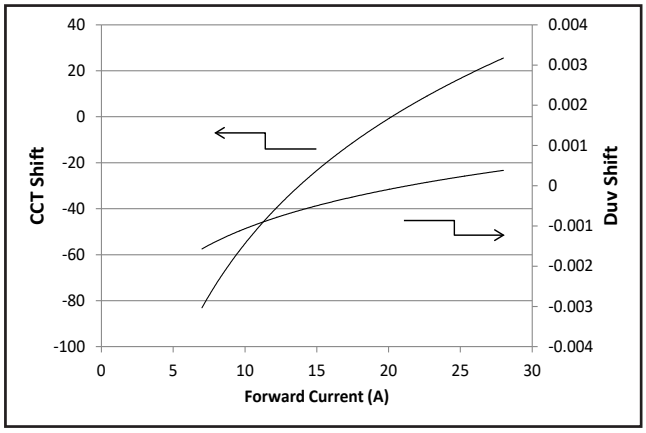
Lumen Maintenance vs. Time[4]



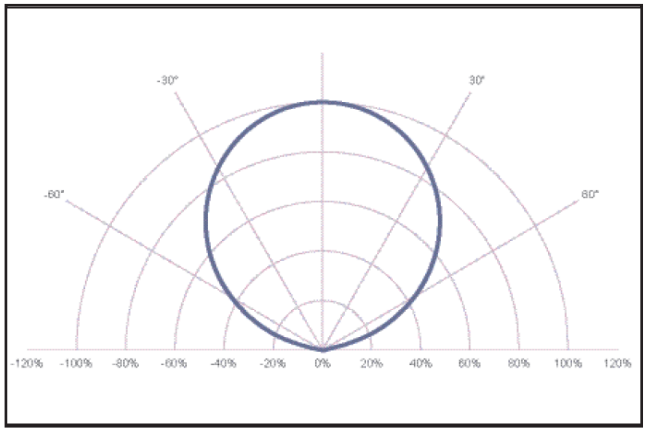
Chromaticity Change vs. Junction Temp



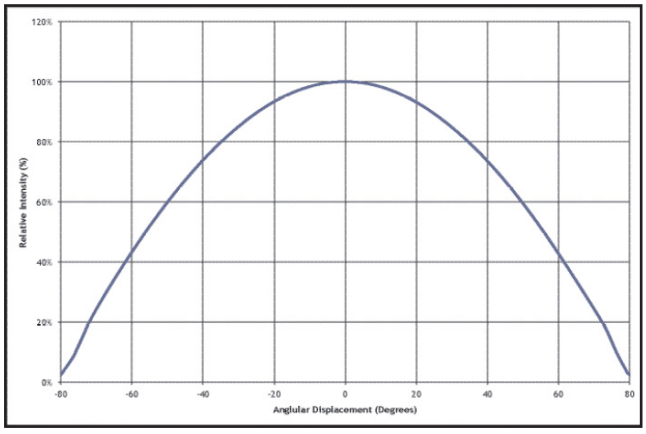
Chromaticity Change vs. Forward Current



Typical Polar Radiation Pattern



Typical Angular Radiation Pattern



Note 3: Median expected lifetime in dependence of junction temperature at 1.5 A/mm^2 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/mm^2 condition).

Note 4: Lumen maintenance in dependence of time at 1.5 A/mm^2 in continuous operation with junction temperatures of 120 °C.

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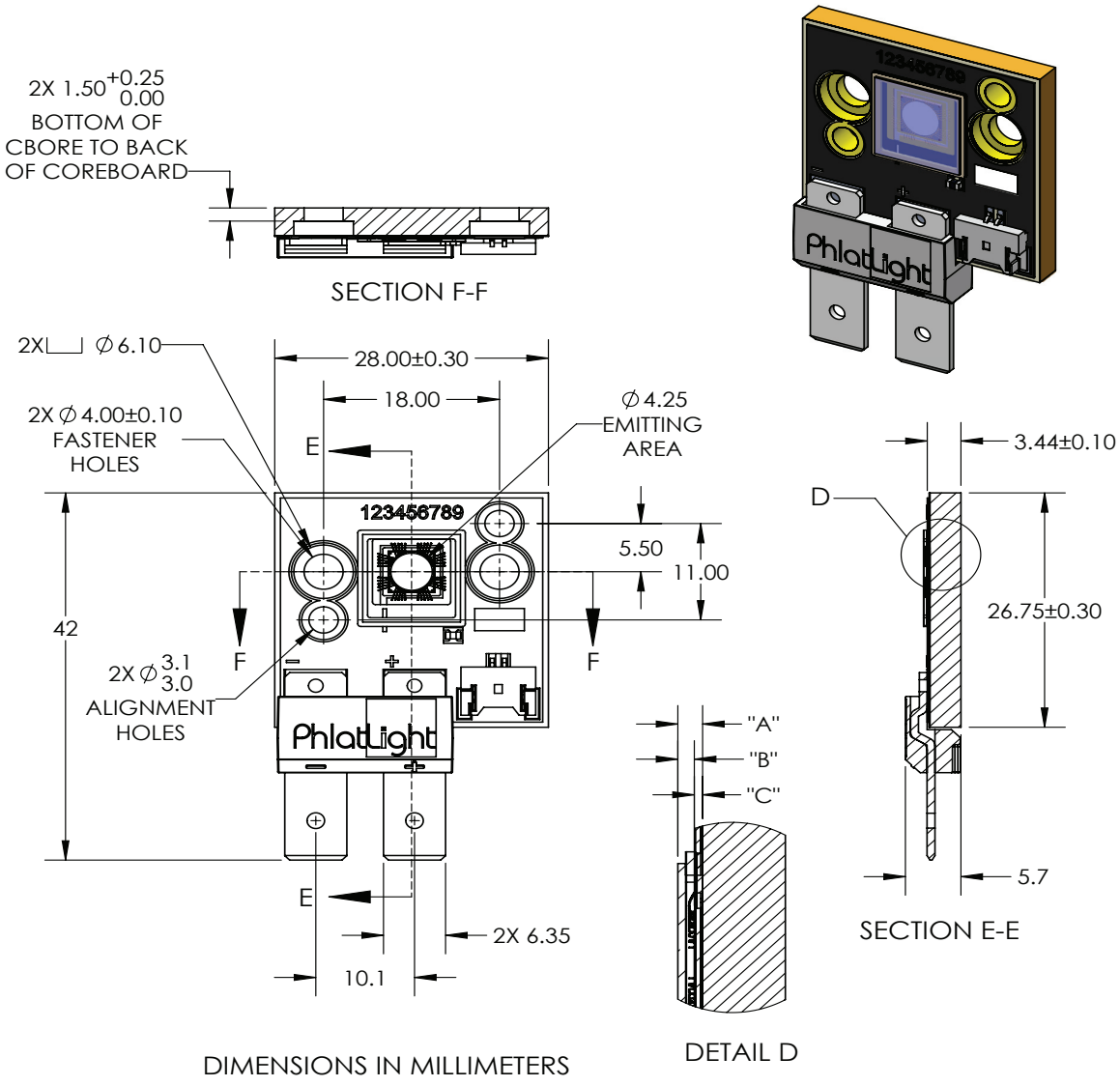
Mechanical Dimensions



DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF WINDOW	0.95	±0.13
"B"	TOP OF DIE EMITTING AREA TO TOP OF WINDOW	0.63	±0.11
"C"	TOP OF METAL SUBSTRATE TO TOP OF DIE EMITTING AREA	0.31	±0.02

DWG-002161

Recommended connector for Anode and Cathode:
Panduit Disco Lok™ Series P/N: DNF14-250FIB-C or JST Manufacturing Co: SPS-61T-250
Panduit Disco Lok™ Series P/N: DNF10-250FIB-L or JST Manufacturing Co: SPS-91T-250
(Check NEC standards for ampacity of the power cable being used)
Recommended Female for Thermistor Connector:
MOLEX P/N 51146-0200 (not recommended for new designs), GCT P/N WTB06-020H-A or equivalent
For detailed drawing, please refer to DWG-002161 document

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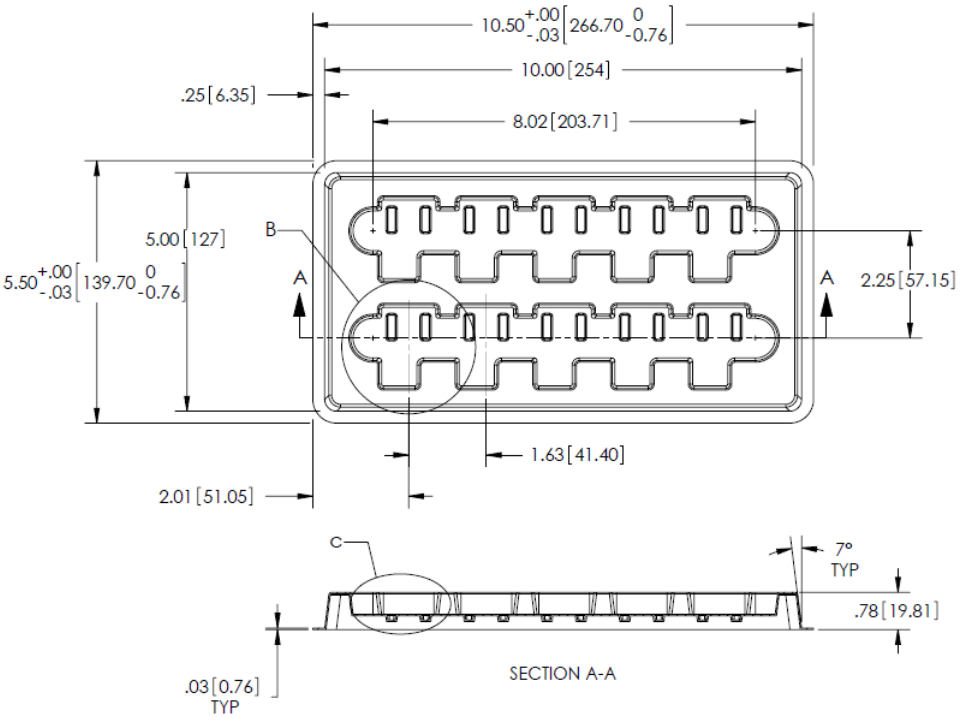
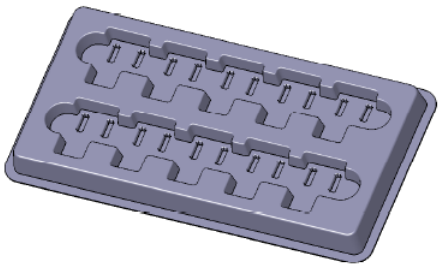
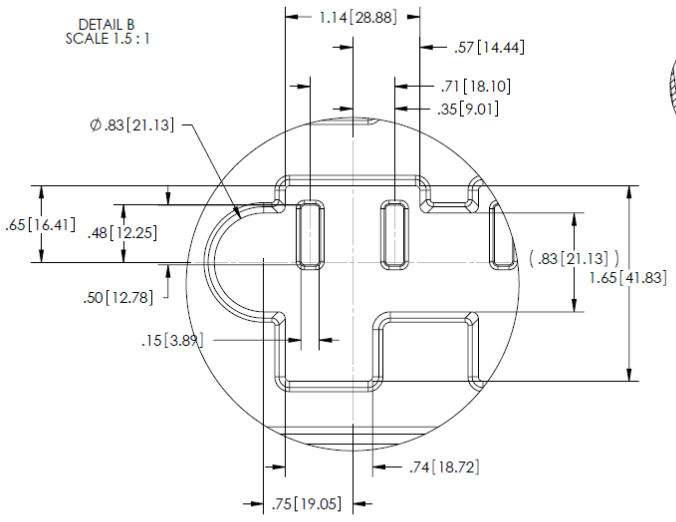
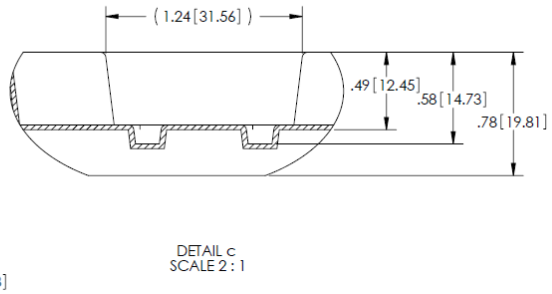
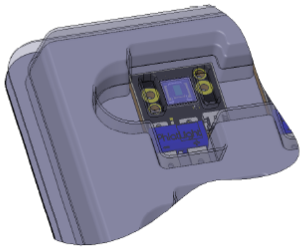
Shipping Tray Outline











TOP TRAY SHOWN TRANSPARENT
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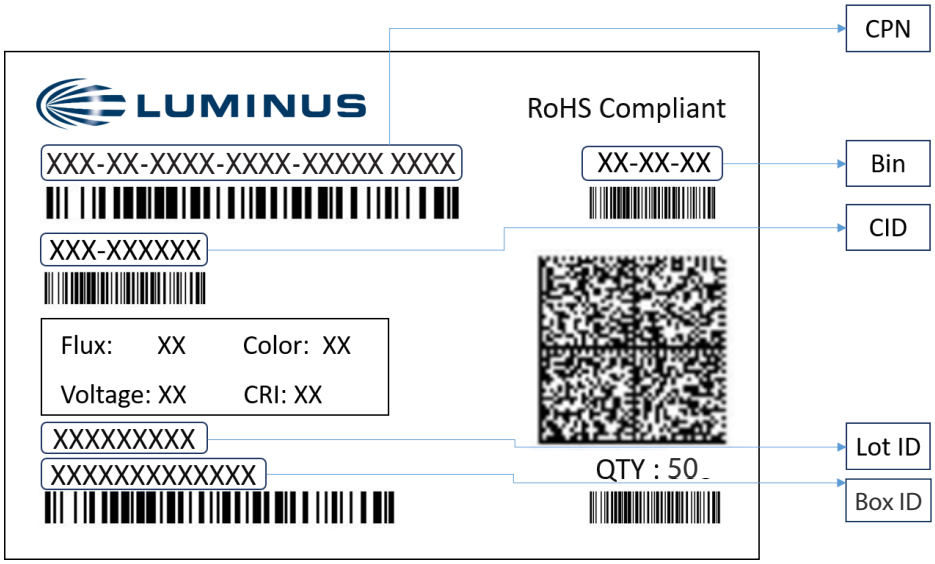
Shipping Label



Label Fields:

- CPN: Luminus ordering part number
- CID: Customer's part number
- QTY: Quantity of devices in pack
- Flux: Bin as defined on page 4
- Color: Bin as defined on page 5
- Voltage: NA
- CRI: NA

Packing Configuration:

- Maximum: stack of 5 trays with 10 devices per tray per pack
- Each pack is enclosed in antistatic bag
- Partial pack or tray may be shipped
- Shipping label is placed on top of each pack

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Revision History

Rev	Date	Description of Change
09	02/12/2019	Documented higher flux for CBT-140-W products.
10	02/08/2022	Add ESD information in technology overview. Update forward voltage, mechanical dimension section, thermistor information, shipping tray outline and shipping label. Rename history of changes to revision history. Editorial fixes and layout adjustment.
11	07/01/2022	Update product photo, ordering part numbers, and chromaticity bin tables.

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