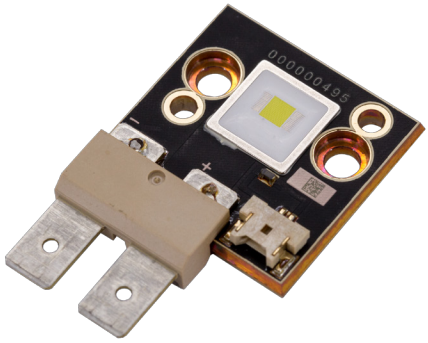
LUMINUS

CFT-90-W Product Datasheet

CFT-90-W
Specialty White LED



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Features:

- Second generation monolithic 9 mm^2 specialty white LED delivers increased peak lumens and drive current over CBT-90-W
- High current operation: up to 27 A DC
- Over 5500 lumens at maximum drive current
- Available in 5700K, 6500K and 7800K (typ) color temperatures
- Window-less package design improves optical coupling efficiency
- Low thermal resistance chip-on-board packaging technology: 0.45 °C/W typical junction to back of core board.
- New common cathode chip technology delivers increased performance and simplifies system design
- Hot lumens specification, production tested at 22.5 A DC, 90 °C junction temperature
- Environmentally friendly, compliant with RoHS and REACH requirements

Applications

- Fiber illumination including:
  - -medical endoscopy
  - -machine vision
  - -microscopy and other instrumentation
- Inspection and industrial applications
- Stage and Entertainment spot lights, narrow beam projectors
- Architectural Lighting
- Off-road vehicle and truck projector lights
- Search Lights
- Beacons

General Considerations

Environmental Considerations:

As a leading provider of solid-state Lighting solutions, Luminus implements strict substance control policies to ensure all of its products are environmentally friendly. As with all Luminus LEDs, the CFT-90-W series are compliant with the Restriction of Hazardous Substances (RoHS) and REACH directives from the European Community.

Product Testing:

Every CFT-90-W LED is fully production tested to ensure it meets the high quality standards customers have come to expect from Luminus products. Devices are tested and binned at a controlled 40°C heat sink temperature and with a 22.5 A DC current, corresponding to a nominal junction temperature of 90°C. As a result, the devices lumens and chromaticity are binned "hot" and their characteristics are close to in-system operating conditions. Current and temperature curves are provided in this document allowing users to predict the LED performance and characteristics under their own driving and thermal conditions.

Reliability:

Luminus CFT-90-W LED series are required to pass a rigorous suite of environmental and mechanical stress tests, including mechanical shock, vibration, temperature cycling and humidity. These tests ensure that the devices deliver high performance and achieve reliable long term operation in demanding high power applications. Please contact Luminus for further information.

PDS-002888 Rev 03

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Flux Binning Structure[1,2]

CFT-90-W LED series are production tested and binned at 22.5A DC, 40°C heat sink temperature (90°C nominal junction temperature).

Flux Bins[3]

Flux Bin	Minumum Flux (lm)	Maximum Flux (lm)
UA	3,680	3,955
UB	3,955	4,230
VA	4,230	4,545
VB	4,545	4,860
WA	4,860	5,225
WB	5,225	5,590
XA	5590	6011
XB	6011	6430

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.

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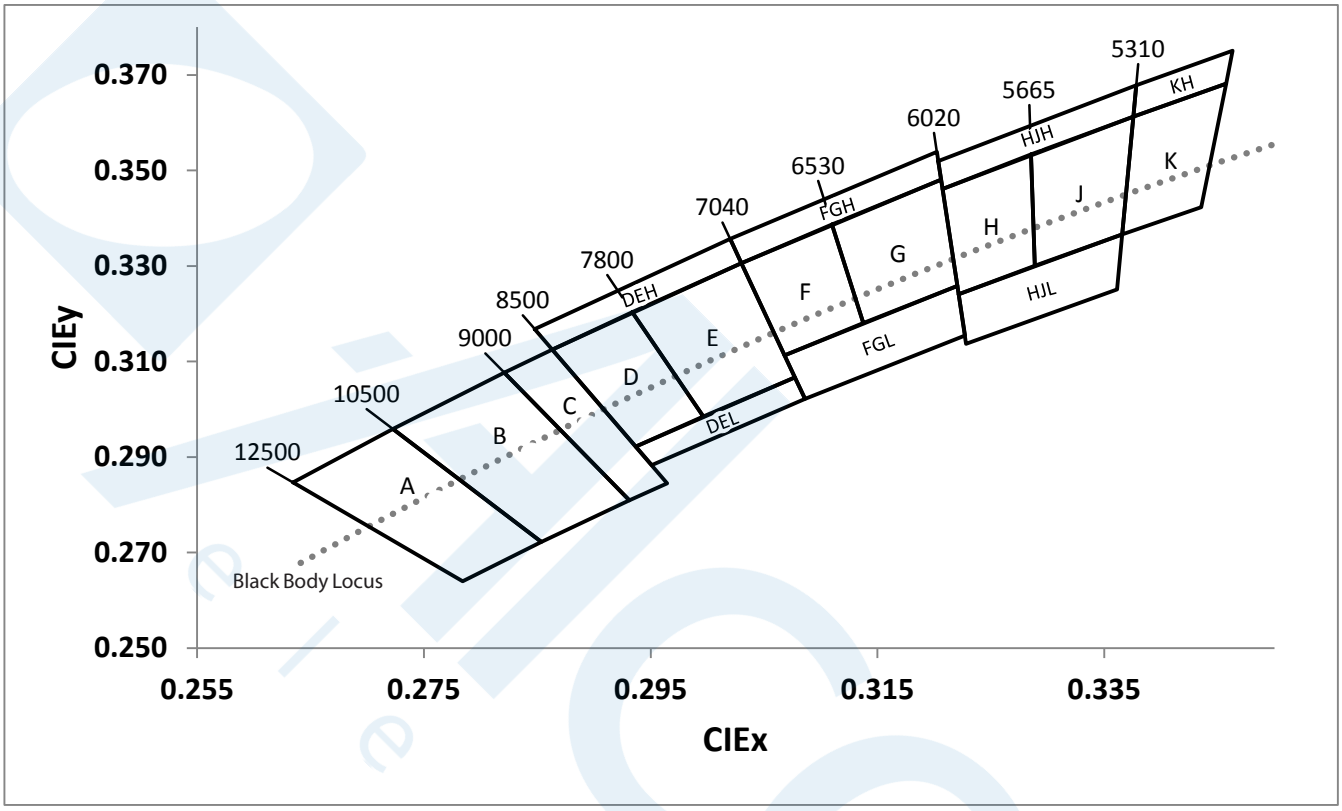
Chromaticity Bins



Refer to the next page for bin definitions

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The following tables describe the four chromaticity points that bound each chromaticity bin.[1]

Chromaticity Bins		
Bin Code	x	y
A	0.263	0.285
	0.272	0.296
	0.285	0.272
	0.278	0.264
B	0.272	0.296
	0.282	0.308
	0.293	0.281
	0.285	0.272
C	0.282	0.308
	0.286	0.313
	0.296	0.285
	0.293	0.281
D	0.286	0.313
	0.293	0.320
	0.300	0.298
	0.294	0.292
DEL	0.294	0.292
	0.308	0.307
	0.309	0.302
	0.295	0.288
DEH	0.285	0.317
	0.302	0.336
	0.303	0.331
	0.286	0.313
E	0.293	0.320
	0.303	0.331
	0.308	0.307
	0.300	0.298
F	0.303	0.331
	0.311	0.339
	0.314	0.318
	0.307	0.311
FGH	0.302	0.336
	0.320	0.354
	0.321	0.348
	0.303	0.331

Chromaticity Bins		
Bin Code	x	y
FGL	0.307	0.311
	0.322	0.326
	0.323	0.315
	0.309	0.302
G	0.311	0.339
	0.321	0.348
	0.322	0.326
	0.314	0.318
H	0.321	0.346
	0.329	0.353
	0.329	0.330
	0.322	0.324
HJL	0.322	0.324
	0.337	0.337
	0.336	0.325
	0.323	0.314
HJH	0.320	0.352
	0.338	0.368
	0.338	0.361
	0.321	0.346
J	0.329	0.353
	0.338	0.361
	0.337	0.337
	0.329	0.330
K	0.338	0.361
	0.346	0.368
	0.344	0.342
	0.337	0.337
KH	0.338	0.368
	0.346	0.375
	0.346	0.368
	0.338	0.361

Note 1: Based on production test conditions: 22.5 A DC, 90°C junction temperature.

Note 2: Chromaticity bin code A is defined but not offered in a bin kit.

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Ordering Information

CFT — <XX> ——— W<tc> ——— X11 — <BinKit>

Part Numbering Nomenclature

Product Family	LED Emission Area	Color Code	Package Configuration	Bin Kit
C: Chip on board F: Flat-top window-less package T: Single monolithic emitter	90 = 9.0 mm^2	W = White t : Color temperature - D : Daylight - C : Cool White - S : Stage White c: CRI - S = Standard	Internal package code	Refer to ordering codes table in this document

Ordering Part Numbers

Color Point	Code of Minimum Bin	Minimum Flux (lm)[1,2]	Chromaticity Bins[1]	Bin Kit	Ordering Part Number
WDS	UA	3,680	H, J, HJH, HJL, K, KH	UA500	CFT-90-WDS-X11-UA500
			H, J, HJH, HJL	UA501	CFT-90-WDS-X11-UA501
			H, J	UA502	CFT-90-WDS-X11-UA502
	UB	3,955	H, J, HJH, HJL, K, KH	UB500	CFT-90-WDS-X11-UB500
			H, J, HJH, HJL	UB501	CFT-90-WDS-X11-UB501
			H, J	UB502	CFT-90-WDS-X11-UB502
	VA	4230	H, J, HJH, HJL, K, KH	VA500	CFT-90-WDS-X11-VA500
			H, J, HJH, HJL	VA501	CFT-90-WDS-X11-VA501
	VB	4545	H, J, HJH, HJL, K, KH	VB500,	CFT-90-WDS-X11-VB500
WCS	UA	3,680	D, E, F, G, DEH, DEL, FGH, FGL	UA600	CFT-90-WCS-X11-UA600
			F, G, FGH, FGL	UA601	CFT-90-WCS-X11-UA601
	UB	3,955	D, E, F, G, DEH, DEL, FGH, FGL	UB600	CFT-90-WCS-X11-UB600
			F, G, FGH, FGL	UB601	CFT-90-WCS-X11-UB601
	VA	4230	D, E, F, G, DEH, DEL, FGH, FGL	VA600	CFT-90-WCS-X11-VA600
			F, G, FGH, FGL	VA601	CFT-90-WCS-X11-VA601
	VB	4545	D, E, F, G, DEH, DEL, FGH, FGL	VB600	CFT-90-WCS-X11-VB600
WSS	UA	3,680	B, C, D	UA900	CFT-90-WCS-X11-UA900
			C, D, E, DEH, DEL	UA700	CFT-90-WSS-X11-UA700
			D, E, DEH, DEL	UA701	CFT-90-WSS-X11-UA701
	UB	3,955	B, C, D	UB900	CFT-90-WSS-X11-UB900
			C, D, E, DEH, DEL	UB700	CFT-90-WSS-X11-UB700
			D, E, DEH, DEL	UB701	CFT-90-WSS-X11-UB701
	VA	4230	C, D, E, DEH, DEL	VA700	CFT-90-WSS-X11-VA700
			D, E, DEH, DEL	VA701	CFT-90-WSS-X11-VA701
	VB	4545	C, D, E, DEH, DEL	VB700	CFT-90-WSS-X11-VB700

Note 1: Based on production test conditions : 22.5 A DC, 90°C junction temperature.

Note 2: The minimum flux of each bin kit is determined by the minimum flux bin. Higher flux bins are eligible to ship against shown bin kits and part numbers.

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Product Characteristics and Ratings

Product Characteristics

Unless specified otherwise, all characteristics are based on nominal T_j = 90°C, I_f = 22.5 A DC.

Parameter	Symbol		Value			Unit
			WSS	WCS	WDS	
Emitting Area Dimension[1]	A_e	typ	3 x 3	3 x 3	3 x 3	mm x mm
Luminous Flux	Φ_v	typ	4750	4775	4800	lumens
Radiometric flux	Φ_e	typ	15.1	15.4	15.7	watts
Viewing angle (50% of peak flux)	$2\,\emptyset_{1/2}$	typ	120	120	120	degrees
Forward Voltage	V_F	min	2.9	2.9	2.9	V
		typ	3.5	3.5	3.5	V
		max	4.2	4.2	4.2	V
Color Rendering Index	CRI	typ	70	70	65	

Note 1: Please refer to mechanical drawing for dimensions and tolerancing.

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Maximum Current (CW)[1]	I_F	27	A
Minimum Current (CW)[2]	I_F	0.2	A
Maximum surge Current (t < 10 ms, Duty cycle < 0.1)	I_S	36	A
Maximum reverse Current[3]	I_R	N/A	A
Maximum Junction operating temperature[4]	T_j	150	°C
Storage Temperature range		-40 to 130	°C
Operating Temperature range		-40 to 85	°C

Note 1: Sustained operation at maximum current will result in shortened lifetime.

Note 2: Special design considerations must be observed for operation at low current density. Please contact Luminus for further information.

Note 3: Not designed for reverse current operation.

Note 4: Sustained operation at maximum operating T_j will result is shortened lifetime and may cause premature product failure.

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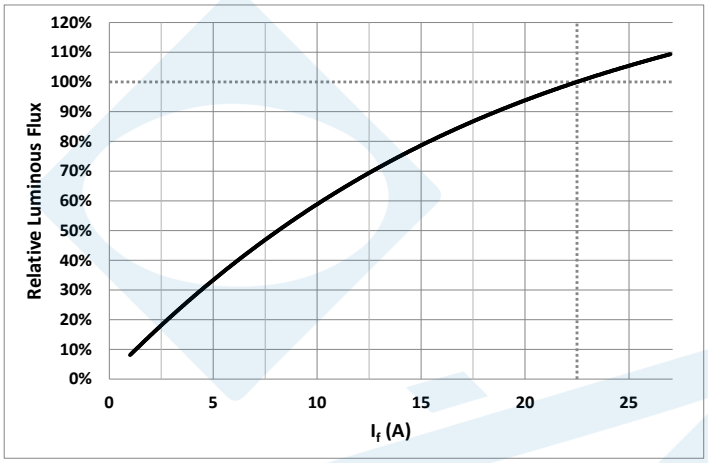
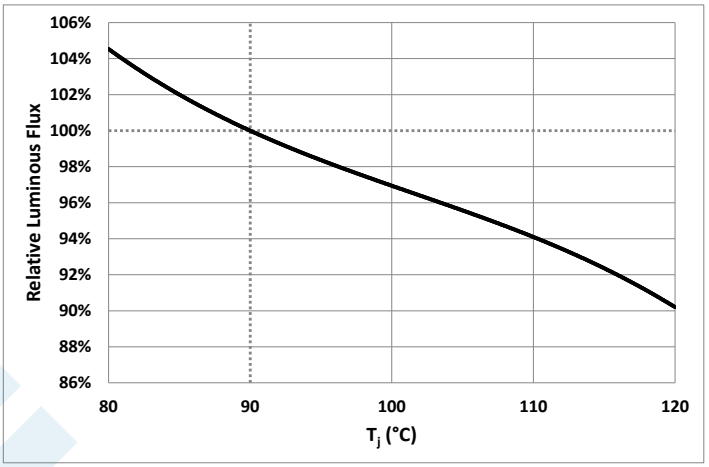
Relative Luminous Flux vs. I_f

$\varphi_v/\varphi_v(22.5A)$, DC - $T_{Heatsink}$: 40°C



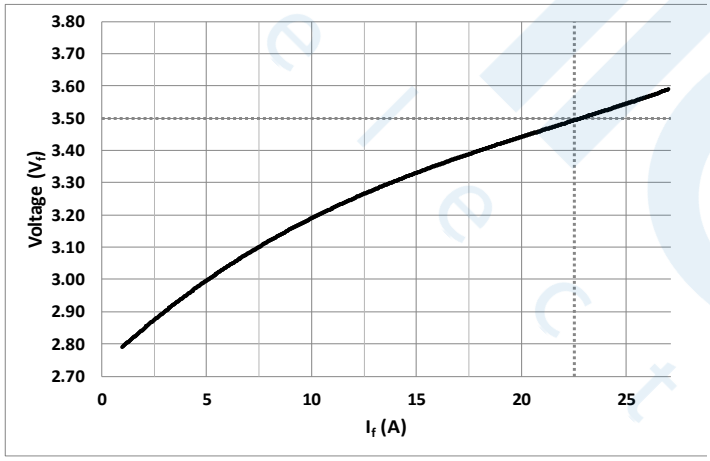
Relative Luminous Flux vs. T_j

$\varphi v/\varphi v_{(90°C)}$ I_f = 22.5 A DC



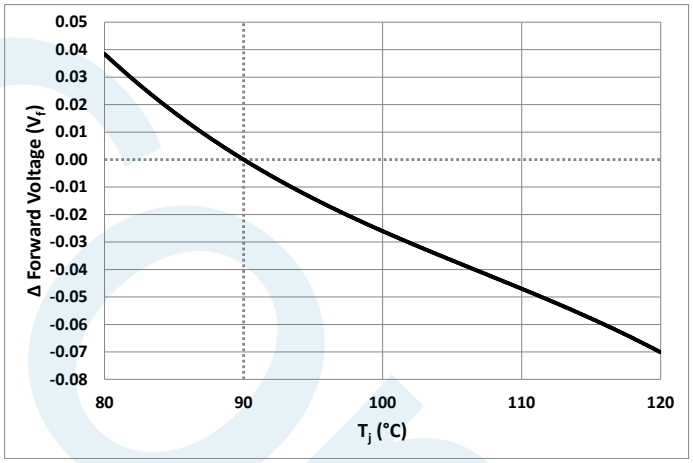
Forward Voltage vs. I_f

$V_f = f(I_f)$, DC - $T_{Heatsink}$ = 40°C



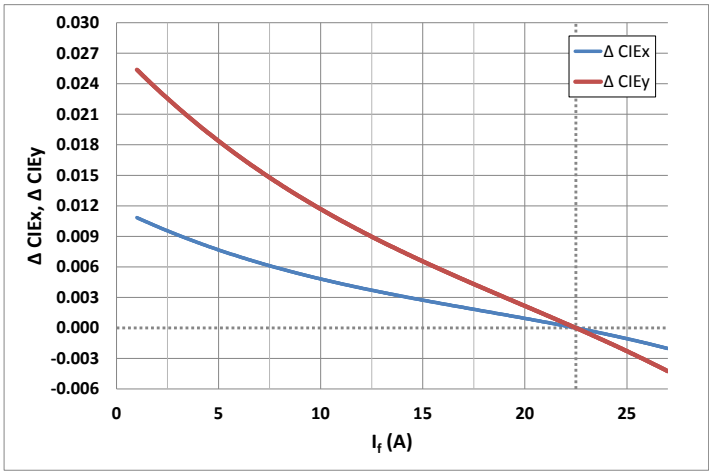
Relative Forward Voltage vs. T_j

$\Delta V_f = V(T_j) - V(90°C)$ I_f = 22.5 A DC



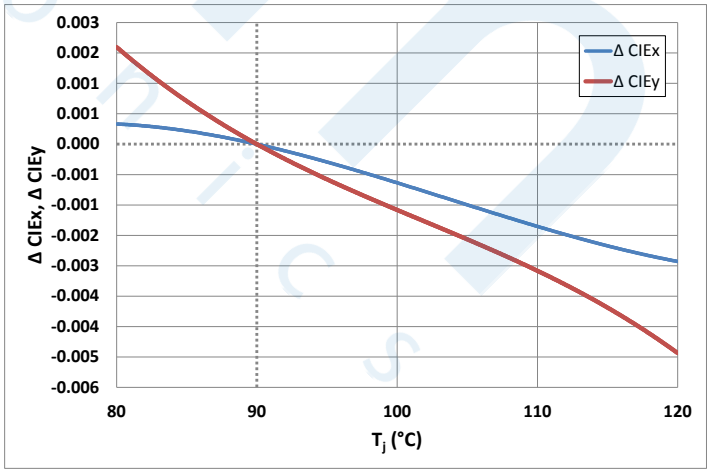
Relative Chromaticity Shift vs. I_f

$\Delta CIEx,y = CIEx,y(I_f) - CIEx,y(22.5A)$ - DC , Heatsink Temperature: 40°C



Relative Chromaticity Shift vs. T_j

$\Delta CIEx,y = CIEx,y(T_j) - CIEx,y(90°C)$ I_f = 22.5 A DC



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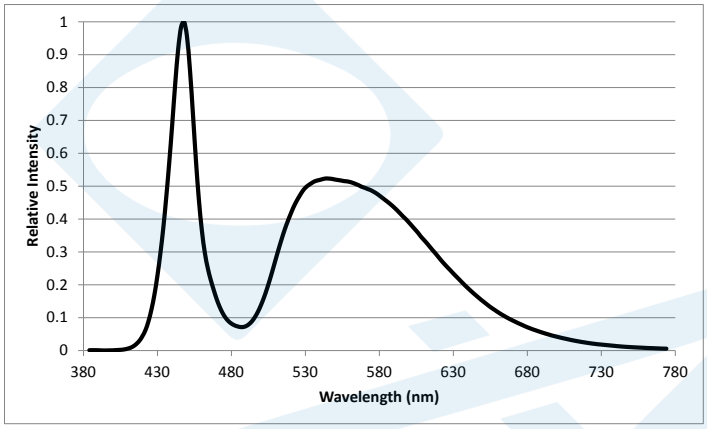
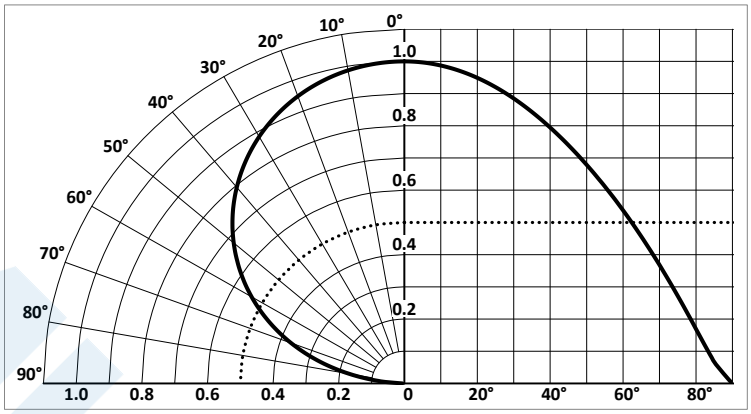
Optical and Thermal Characteristics

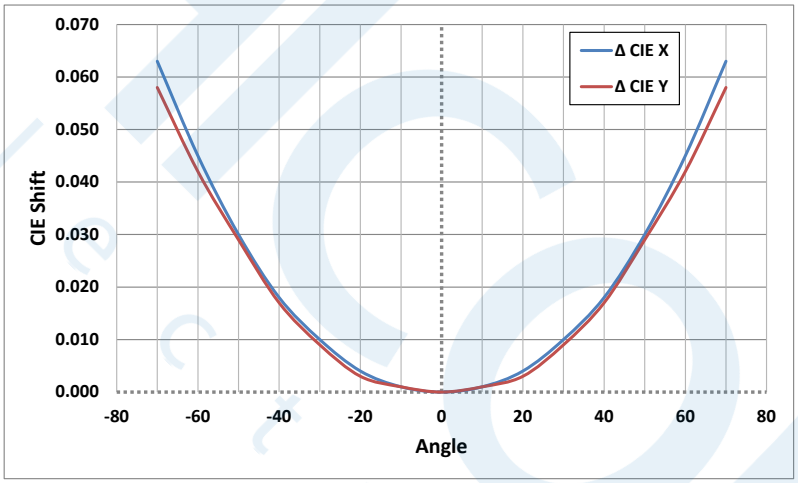
Typical Spectrum



Typical Angular Distribution

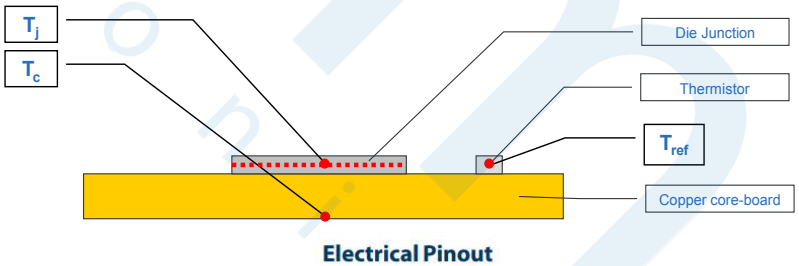


Color Over Angle



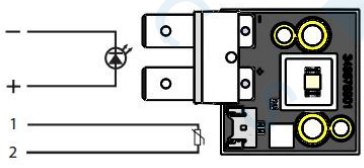
Thermal Information

Rth [j-c] , Electrical	0.45 °C/W
Rth [j-ref] , Electrical	0.5 °C/W



The thermistor used in CFT-90 LEDs mounted on core-boards is from Murata Manufacturing Co. The global part number is NCP18XH103J03RB. Please see http://www.murata.com/ for details on calculating thermistor temperature.

Electrical Pinout



Important notice: please note that the CFT-90-W copper PCB is electrically active with a common cathode polarity

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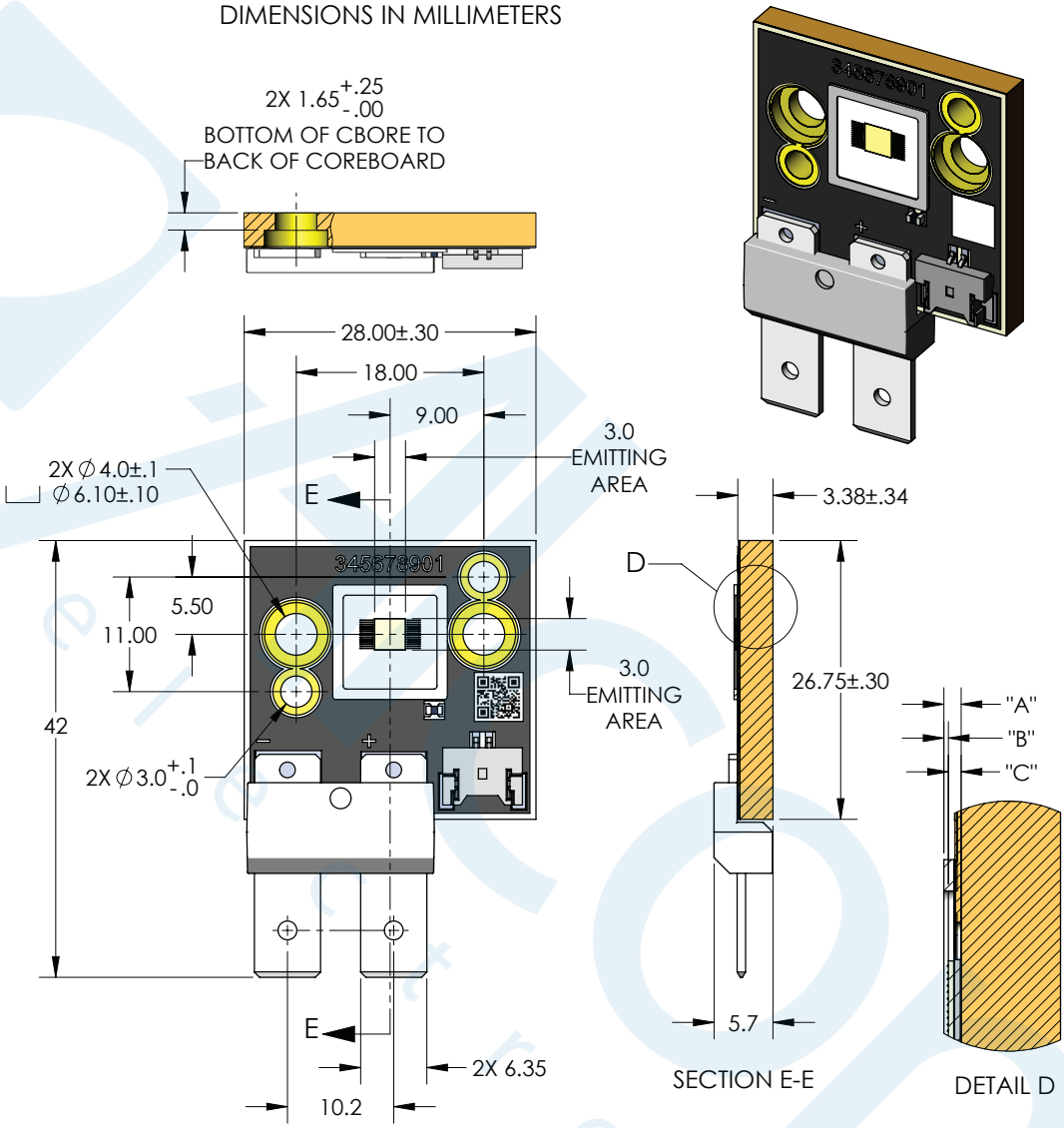
Mechanical Dimensions[1,2]



DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF FRAME	.55	±.08
"B"	TOP OF EMITTING AREA TO TOP OF FRAME	.14	±.12
"C"	TOP OF METAL SUBSTRATE TO TOP OF EMITTING AREA	.41	±.04

Note 1: Recommended connector for Anode and Cathode: Panduit Disco Lok™ Series P/N: DNG14-250FL-C .
Thermistor connector on Luminus coreboard: MOLEX P/N 53780-0270 (alternate: GCT P/N WTBO8-021S-F) .
Recommended female thermistor connector: MOLEX P/N 51146-0200 (alternate : GCT P/N WTBO6-021S or equivalent) .
For detailed drawing please refer to document DWG-002705.

Note 2: Some discoloration on the back of the coreboard is possible and is an expected consequence of the assembly process. The discoloration does not affect the thermal properties or reliability of the product.

Note 3: Due to the nature of the manufacturing process used for this product, the phosphor element may exhibit localized cosmetic edge irregularities of up to 100 um compared to nominal drawings.

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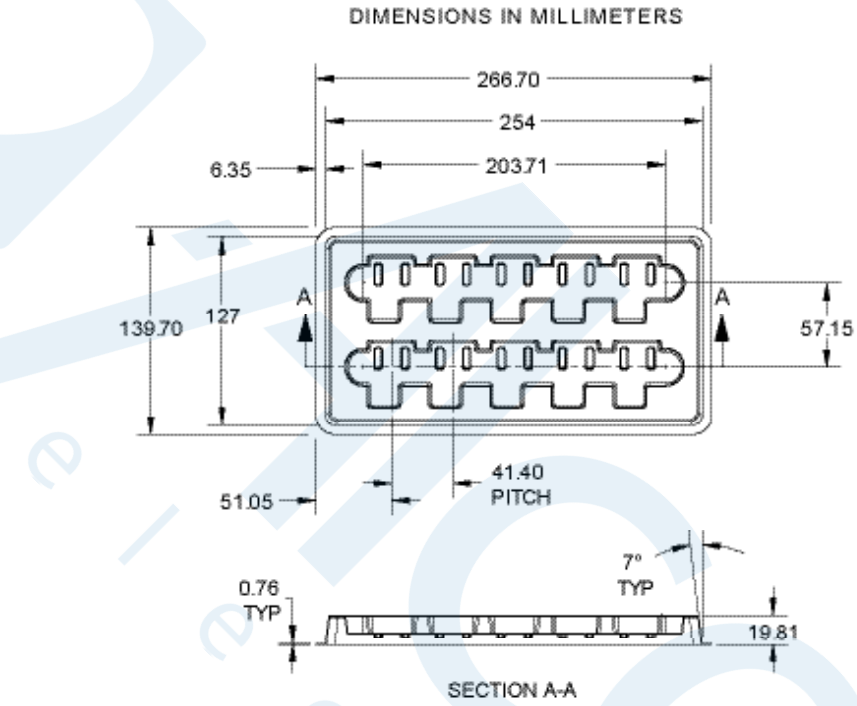
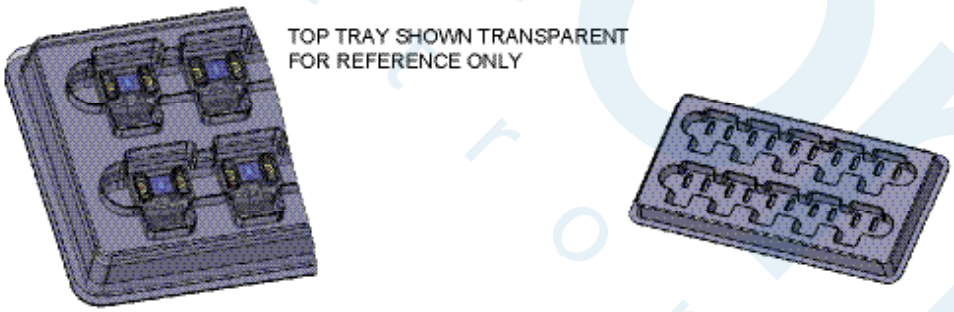
Shipping Tray Outline





For detailed drawing of shipping trays, please refer to document TO-0479, available upon request.

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Packing and Shipping Specification

Packing Specification

Packing Configuration	Qty /Pack	Dimensions (mm)	Gross Weight (kg)
Stack of 5 trays with 10 devices per tray Each pack is enclosed in ESD bag	50	150 x 280 x 85	2.7

Product Label Specification

Label Fields (subject to change):

- 6-8 digit Box number (for Luminus internal use)
- Luminus ordering part number
- Quantity of devices in pack
- Part number revision (for Luminus internal use)
- Customer's part number (optional)
- Bin (FF-WW) as defined page 3
- 2D Bar code

Sample label –for illustration only

Shipping Box

Shipping Box	Quantity	Material	Dimensions (L x W x H, mm)
Carton Box	1 -20 packs (50 - 1000 Devices)	S4651	560 x 560 x 200

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History Of Changes

Revision	Date	Description
PDS-002888 Rev 01	01/18/2017	Initial release.
PDS-002888 Rev 02	06/14/2017	Remove preliminary. Add B chromaticity bin and eliminated TB flux bin. Updated ordering bin kits
PDS-002888 Rev 03	07/07/2017	Add comment on mechanical drawing page.

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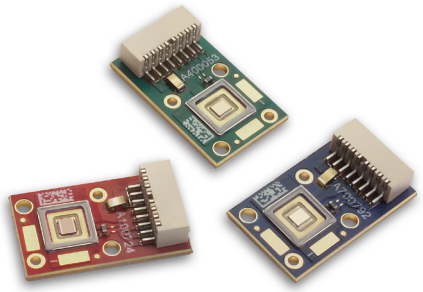
PT39 LEDs

Thermally Enhanced



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Features:

- Matched RGB Chipset with 3.9 mm^2 emitting area designed for LED projector applications
- Enhanced thermal performance allows for operation up to 12 A (3A/mm^2)
- Ultra low thermal resistance, common anode copper-core PCB package
- Photonic lattice technology for very high surface brightness and uniform surface emission
- Wide color gamut: Red-Amber 613nm, GREEN 525 nm, Blue 460nm typical dominant wavelength
- Single emitting area per color allows for collection with single lens for simplified optics
- LED mounted on MC-PCB for easier thermal and optical integration
- Aspect ratio optimized and compatible with micro-display diagonal sizes ranging from 0.45" to 0.55"
- RoHS (EU-2002/95/EC Directive) and REACH compliant

Applications

- Specifically engineered for high brightness pocket-size, ultra portable front projectors, head-up projection displays and hybrid projectors
- Optimized for Micro-Display diagonal sizes ranging from 0.45" to 0.55"
- Suitable for DLP™ (0.45"WXGA, 0.55" SVGA), LCoS and HTPS /3LCD microdisplays

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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 system 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 1.0° C/W, Luminus PT39 LEDs can be driven at higher current densities while maintaining a low junction temperature, thereby resulting in brighter solutions and longer lifetimes.

Reliability

For high power operation, 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. (Please refer to Luminus' Reliability application note for more information.)

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

Understanding Big Chip LED Test Specifications

Every Luminus LED is extensively tested at rated current to ensure that it meets the high quality standards expected from Luminus products.

Testing of Big Chip LEDs

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 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.

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Ordering Information

Ordering Part Number [1]	Color	Min Flux or Power Bin [2]	Description
PT-39-RA-L21-MPF	Red-Amber (Discontin-ued)	2E	Red-Amber LED, consisting of a 3.9 mm² Red-Amber LED chip, thermistor and connector mounted on a copper-core PCB.
PT-39-RA-L21-MPG		2F	
PT-39-RA-L21-MPH		2G	
PT-39-RA-L21-MPJ		2H	
PT-39-G-L21-MPF	Green	2F	Green LED, consisting of a 3.9 mm² Green LED chip, thermistor and connector mounted on a copper-core PCB.
PT-39-G-L21-MPG		2G	
PT-39-G-L21-MPH		2H	
PT-39-G-L21-MPJ		2J	
PT-39-B-L21-EPD	Blue	2G	Blue LED, consisting of a 3.9 mm² Blue LED chip, thermistor and connector mounted on a copper-core PCB.
PT-39-B-L21-EPE		2H	

Note 1: Ordering part numbers represent bin kits (group of bins that are shippable for a given ordering part number)

Note 2: See Bin Kit and Flux / Power bin definitions on page 4

Ordering Part Number Nomenclature

XXX — 00 — XXXX — X00 — XXX

Product Family	Chip Area	Color	Package Configuration	Bin Kit [1]
PT: Metal Coreboard PCB	39: 3.9 mm²	RA= Red -Amber (615nm, typ) G= Green B= Blue	L21: 26.5mm x 16.0 mm (standard) L22: 26.5mm x 16.0 mm (die-rotated configuration) See Mechanical Drawing section	See page 4 for bin kit definition

Note 1: A Bin Kit represents a group of individual flux or power bins that are shippable for a given ordering part number. Individual flux bins are not orderable.

EXAMPLE:

PT-39-RA-L21-MPF i s comprised of Red-Amber Flux Bins 2E, 2F, 2G, 2H, 2J.

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PT39 Bin Kit[1] and Flux Bin[2,3,4] Definitions

Note: Please refer to ordering part number table on page 3 for Bin Kit availability

Red -Amber Flux Bins	Bin 2E	Bin 2F	Bin 2G	Bin 2H	Bin 2J	Bin 2K	Bin 2L	Bin 2M	
Red -Amber Bin Flux Range (lm) (Discontinued)	635-690	690-745	745-800	800-860	860-925	925-990	990-1055	1055 -1125	
PT-39-RA-L21-MPF	☑	☑	☑	☑	☑				
PT-39-RA-L21-MPG		☑	☑	☑	☑	☑			
PT-39-RA-L21-MPH			☑	☑	☑	☑	☑		
PT-39-RA-L21-MPJ				☑	☑	☑	☑	☑	
Green Flux Bins	**Bin 2F**	**Bin 2G**	**Bin 2H**	**Bin 2J**	**Bin 2K**	**Bin 2L**	**2M**		
Green Bin Flux Range (lm)	1250 -1330	1330 -1450	1450 -1550	1550 -1660	1660 -1780	1780 -1900	1900 -2020		
PT-39-G-L21-MPF	☑	☑	☑	☑	☑				
PT-39-G-L21-MPG		☑	☑	☑	☑	☑			
PT-39-G-L21-MPH			☑	☑	☑	☑	☑		
PT-39-G-L21-MPJ				☑	☑	☑	☑		
Blue Flux Bins	**Bin 2G**	**Bin 2H**	**Bin 2J**	**Bin 2K**	**Bin 2L**	**Bin 2M**			
Blue Bin Flux Range (lm)	255-280	280-300	300-320	320-345	345-370	370-400			
PT-39-B-L21-EPD	☑	☑	☑	☑	☑				

Note 1: Bin Kits are defined by a group of flux or power bins. Only one flux bin will be shipped in each individual pack. A shipment will contain packs of different allowed flux bins for a particular ordering part number. Individual Flux or Power bins are not ordereable.

Note 2: PT39 LEDs are tested for luminous flux at 9.8 A at 25% duty cycle for Red, Red-Amber and Blue. and at 50% duty cycle for Green Devices Devices are sorted and packed by flux bin. Not all flux bins are are currrently populated.

Note 3: Luminus maintains a test measurement accuracy for LED flux and power of +/- 6%.

Note 4: Blue Flux bin limits are defined at reference dominant wavelength of 462nm. See table on page 7 for Blue bin limits at other dominant wavelengths.

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Optical & Electrical Characteristics

General Characteristics		Symbol	Red -Amber (Discontinued)	Green	Blue	Unit
Emitting Area		x	3.9	3.9	3.9	mm^2
Emitting Area Dimensions		x	2.09 x 1.87	2.09 x 1.87	2.09 x 1.87	mmxmm
Characteristics at Recommended Test Drive Current , I_f [1, 2]						
Reference Duty Cycle [3]			25	50	25	%
Test Peak Drive Current [1,2,4]	typ	I_F	9.8	9.8	9.8	A
Peak Luminuous Flux [1,2,5]	typ	Φ_v	800	1660	300	lm
Peak Radiometric Flux [1,2]	typ	Φ_r	3.2	3.5	6.2	W
Dominant Wavelength	min	λ_{dmin}	609	516	450	nm
	typ	λ_d	613	525	460	nm
	max	λ_{dmax}	620	540	468	nm
FWHM- Spectral bandwidth at 50% of Φ_r	typ		19	34	20	nm
Chromaticity Coordinates [6,7]	typ	x	0.675	0.167	0.147	
	typ	y	0.325	0.704	0.033	
Forward Voltage	min	$V_{F\,min}$	2.2	3.5	3.2	V
	typ	V_F	2.6	5.2	3.9	V
	max	$V_{F\,max}$	3.2	5.9	5.2	V
Dynamic Resistance	typ		0.1	0.12	0.09	Ω
Device Thermal Characteristics						
Thermal Coefficient of Photometric Flux	typ		-1.0	-0.2	~0	% / °C
Thermal Coefficient of Radiometric Flux	typ		-0.7	-0.2	-0.2	% / °C
Forward Voltage Temperature Coefficient	typ		-2	-4.7	-3	mV/ °C
Characteristics at Reference Continuous Drive Current I_F (continuous wave)[1]						
Reference Drive Current	typ	I_F	5.9	5.9	5.9	A
Luminous Flux	typ	Φ_v	450	1175	210	lm
Radiometric Flux	typ	Φ_r	1.8	2.5	4.3	W
Dominant Wavelength	typ	λ_d	612	528	461	nm
FWHM -Spectral bandwidth at 50% of Φ_r	typ		18	36	21	nm
Chromaticity Coordinates [6,7]	typ	x	0.677	0.177	0.144	nm
	typ	y	0.322	0.713	0.034	nm
Forward Voltage	typ	V_F	2.3	4.5	3.4	V

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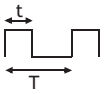
Optical & Electrical Characteristics

Note 1: All ratings are based on testing conditions with a constant heat sink temperature T_{hs} = 40° C. See Thermal Resistance section for T_{hs} definition.

Note 2: Parameters rated at test duty cycle and Pulsed operation frequency f>240 Hz; $DC = \frac{t}{T}$



Note 3: Duty Cycle used to specify device ratings under Pulsed operation. Big Chip LED devices can operate at duty cycles ranging from 1% to 100%. At higher duty cycles, drive current should be adjusted to maintain the junction temperature at desired levels to meet the application lifetime requirements.

Note 4: In pulsed operation, rise time from 10% to 90% of forward current should be larger than 0.5 microseconds

Note 5: For Blue devices, total flux from emitting area at typical dominant wavelength. Refer to page 7 for brightness specifications at other wavelength

Note 6: In CIE 1931 chromaticity diagram coordinates, normalized to X+Y+Z=1

Note 7: For Reference only

Absolute Maximum Ratings

	Symbol	Red -Amber (Discontinued)	Green	Blue	Unit
Absolute Minimum Current (CW or Pulsed)[1]		200	200	200	mA
Absolute Maximum Current (CW) [2]		9.8	9.8	9.8	A
Absolute Maximum Current (Pulsed) [2,3] (frequency > 240Hz, duty cycle <50%)		13.7	13.7	13.7	A
Absolute Maximum Surge Current [2,3] (Frequency > 240 Hz, duty cycle =tbd, t=tbd)		TBD	TBD	TBD	A
Absolute Maximum Junction Temperature [4]	T_{jmax}	125	170	170	°C
Storage Temperature Range		-40 / +100	-40 / +100	-40 / +100	°C

Note 1: Product performance and lifetime data is specified at recommended forward drive currents. Sustained operation at or near absolute minimum currents may result in a reduction of device performance and device lifetime compared to recommended foward drive currents.

Note 2: Luminus LEDs' absolute maximum forward drive current density is 2.5 A/mm^2 CW, and 3.5A/mm^2 pulsed (f>240 Hz, duty cycle <50%). Please refer to absolute maximum rating table above for specific absolute maximum currents for the products covered in this datasheet. Product lifetime data is specified at recommended forward drive currents. (See Reliability Application Note, APN-001444.) Sustained operation at or above 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. Please refer to lifetime derating curves (available from Luminus) for further information.

Note 3: In pulsed operation, rise time from 10 to 90% of forward current should be larger than 0.5 microseconds.

Note 4: Sustained operation at or above Maximum Operating Junction Temperature (Tjmax) will result in reduced device life time.

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Blue Bin Flux Ranges by Dominant Wavelength [1,2]

	Bin 2G		Bin2H		Bin 2J		Bin 2K		Bin 2L		Bin 2M	
DWL (nm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)
450	125	137	137	147	147	156	156	169	169	181	181	196
451	136	149	149	159	159	170	170	183	183	197	197	213
452	146	161	161	172	172	184	184	198	198	212	212	230
453	157	173	173	185	185	197	197	213	213	228	228	247
439	168	185	185	198	198	211	211	227	227	244	244	264
455	179	197	197	211	211	225	225	242	242	260	260	281
456	190	208	208	223	223	238	238	257	257	275	275	298
457	201	220	220	236	236	252	252	272	272	291	291	315
458	212	232	232	249	249	265	265	286	286	307	307	332
459	222	244	244	262	262	279	279	301	301	323	323	349
460	233	256	256	274	274	293	293	316	316	338	338	366
461	244	268	268	287	287	306	306	330	330	354	354	383
462	255	280	280	300	300	320	320	345	345	370	370	400
463	266	292	292	313	313	334	334	360	360	386	386	417
464	277	304	304	326	326	347	347	374	374	402	402	434
465	288	316	316	338	338	361	361	389	389	417	417	451
466	298	328	328	351	351	375	375	404	404	433	433	468
467	309	340	340	364	364	388	388	418	418	449	449	485
468	320	352	352	377	377	402	402	433	433	465	465	502

Note 1: Flux Min, Max values are continuous as function of dominant wavelength values. For illustration purposes, flux Min and Max values are provided at discrete dominant wavelength values.

Note 2: Luminus maintains a test measurement accuracy for LED flux and power of +/- 6%.

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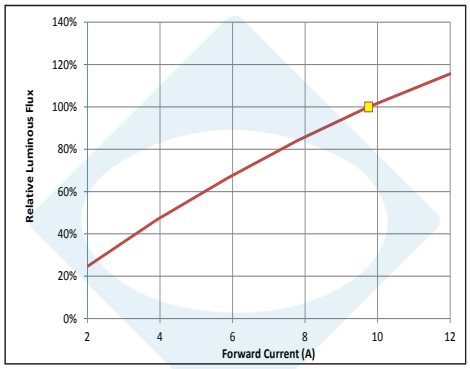
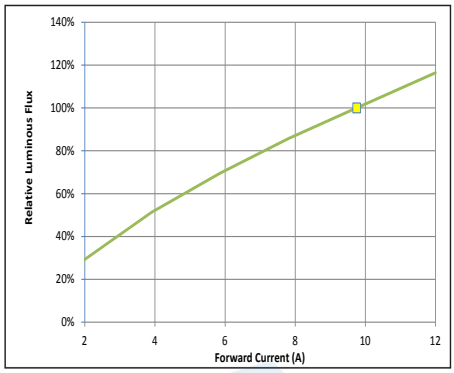
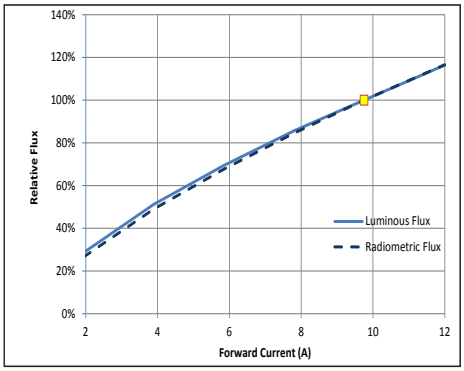
Normalized Luminous Flux variation with Forward Current: $\Phi_v / \Phi_F = f(I_F)$

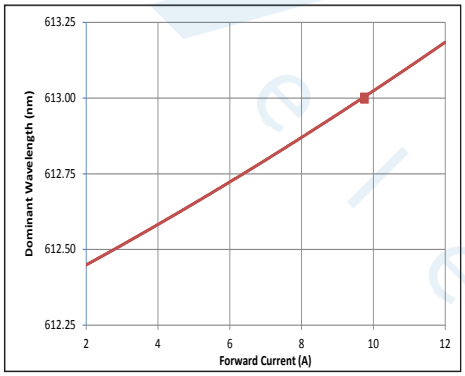


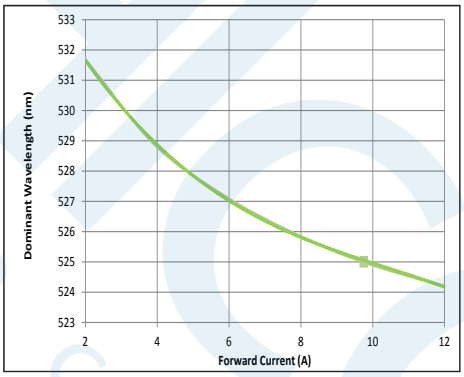


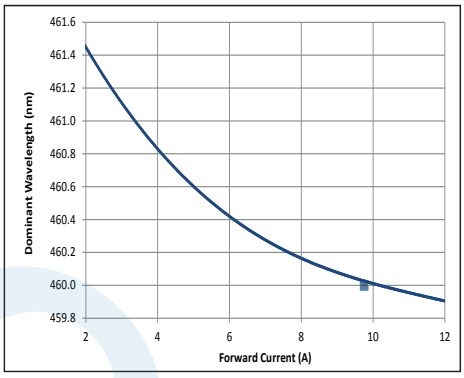


See notes 1, 2 on page 9.

Dominant Wavelength variation with Forward Current - $\lambda_d = f(I_F)$ - Typical

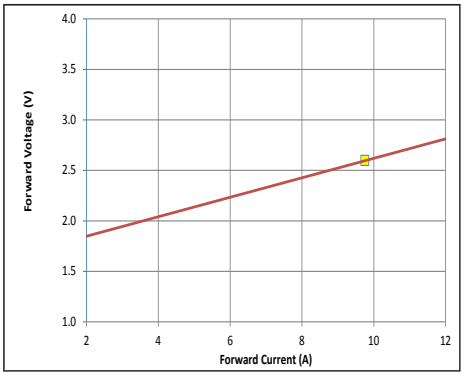


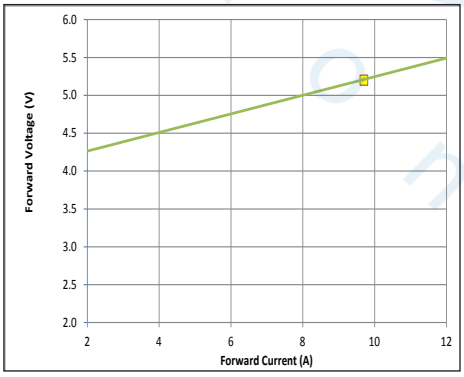


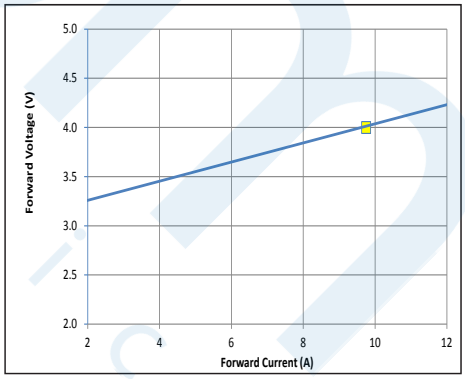


See notes 1, 2 on page 9.

Forward Voltage variation with Drive current - $V_F = f(I_F)$ - Typical







See notes 1, 2 on page 9.

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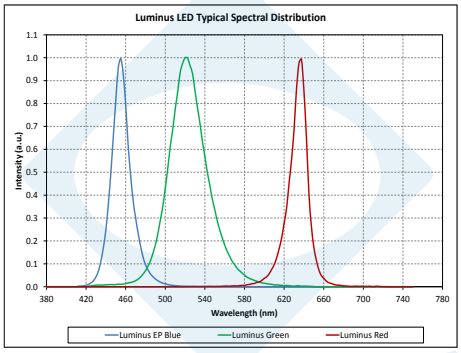
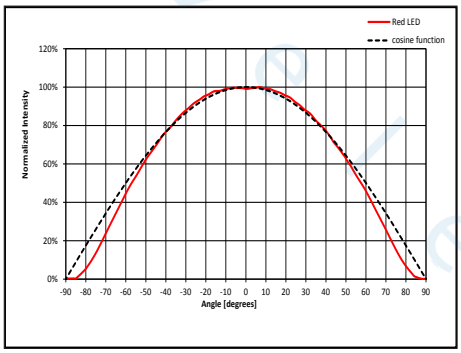
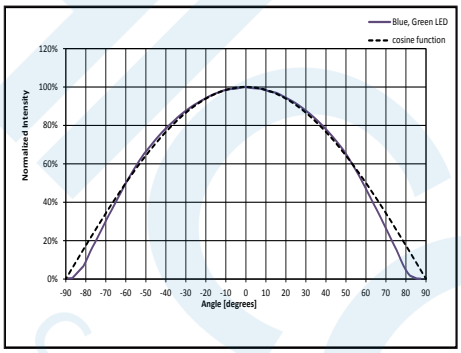
Optical Spectrum (Typical)



See notes 1, 3 on page 9.

Angular Intensity Distribution (Typical)





See note 4 on page 9.

Note 1: For Pulsed operation, the reference R,G, and B duty cycles used are 25%, 50% and 25% respectively (T_{hs}=40° C; Frequency =720 Hz).

Note 2: Square on curves indicate device operating current point (9.8A) under reference conditions listed in the Optical and Electrical Characteristics table.

Note 3: Typical spectrum at recommended peak drive current . Please contact Luminus to obtain data in Excel format.

Note 4: Curves (solid) represent the angular radiation pattern of a typical (Red, Green or Blue) device. Discontinuous line represents cosine function. For any specific device, slight variations may be expected.

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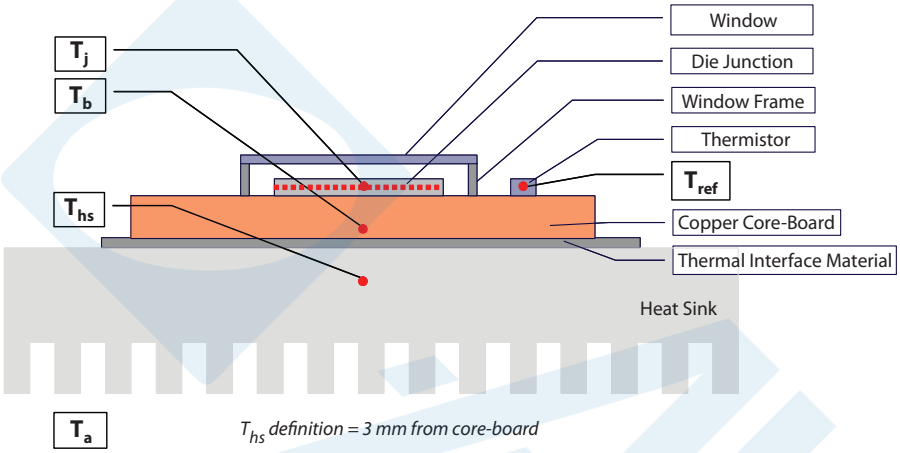
Thermal Resistance



Typical Thermal Resistance

$R_{\theta j\text{-}b}$ [1]	1.0°C/W
$R_{\theta b\text{-}hs}$ [2]	0.2 °C/W
$R_{\theta j\text{-}hs}$ [1,2]	1.2 °C/W
$R_{\theta j\text{-}ref}$ [2]	1.0 °C/W

Note 1: Thermal resistance values are based on modeled results correlated to measured $R_{\theta j\text{-}hs}$ data using the wavelength shift method. Verification of compliance with the recent releases of JEDEC Standards JESD51-14 and JESD51-5x series is pending.

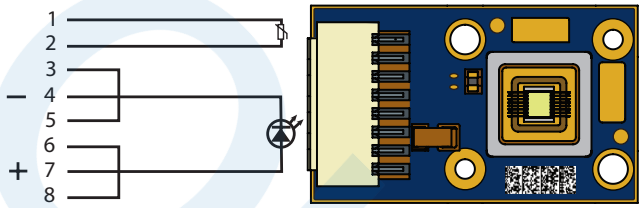
Note 2: Thermal Resistance is based on eGraf 1205 Thermal interface.

Thermistor Information

The thermistor used in PT39 devices are mounted on coreboards is from Murata Manufacturing Co. The global part number is NCP15XH103J03RC.

Please contact Luminus for information on use of the thermistor and for data in Excel format for temperature vs. resistance plot below.

Electrical Pinout



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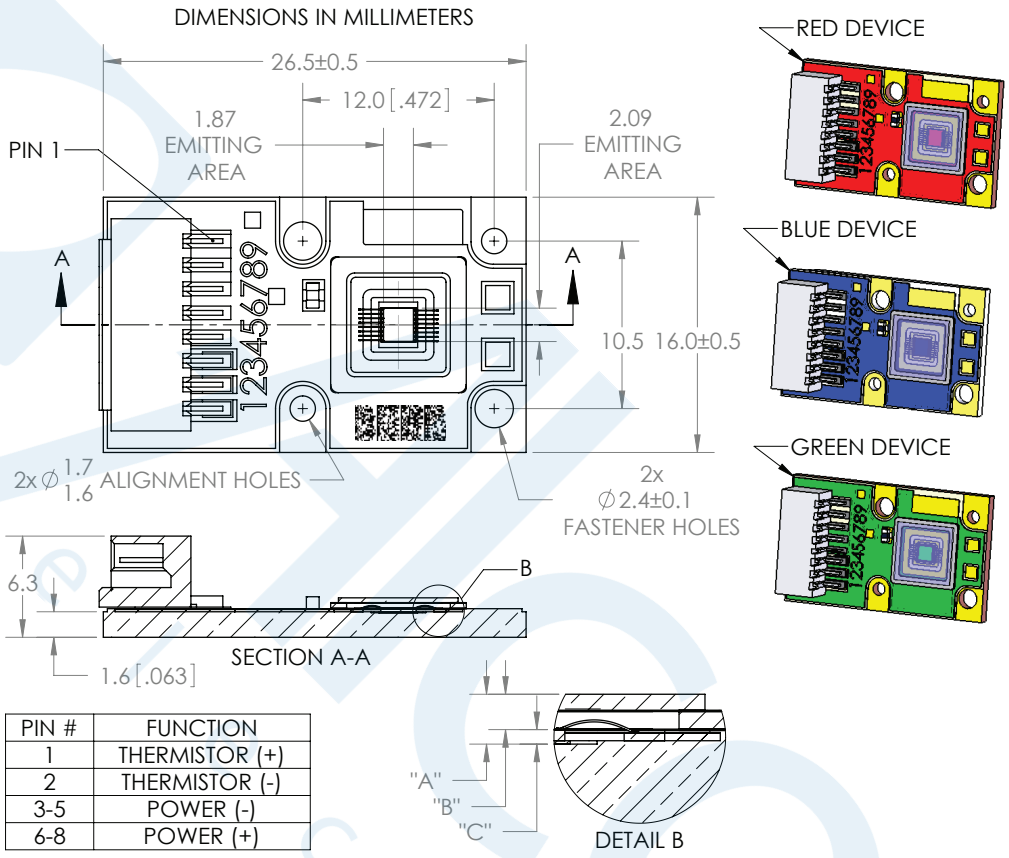
Mechanical Dimensions -Standard Die Configuration



PIN #	FUNCTION
1	THERMISTOR (+)
2	THERMISTOR (-)
3-5	POWER (-)
6-8	POWER (+)

DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF GLASS	0.90	±0.13
"B"	EMITTING AREA TO TOP OF GLASS	0.67	± 0.16
"C"	TOP OF METAL SUBSTRATE TO EMITTING AREA	0.23	± 0.05

DWG-001989

Notes:
1) Red, Green and Blue PT39 Big Chip LEDs are individually assembled into a common anode copper core- board with a footprint of 26.5 mm x 16 mm.
2) Dimensions above are for information only. Please refer to the latest revision of the DWG- 001989 package outline mechanical specifications.
3) Connector- MOLEX Part Number: 874380843 or Global Part Number: WTB16-081SF.

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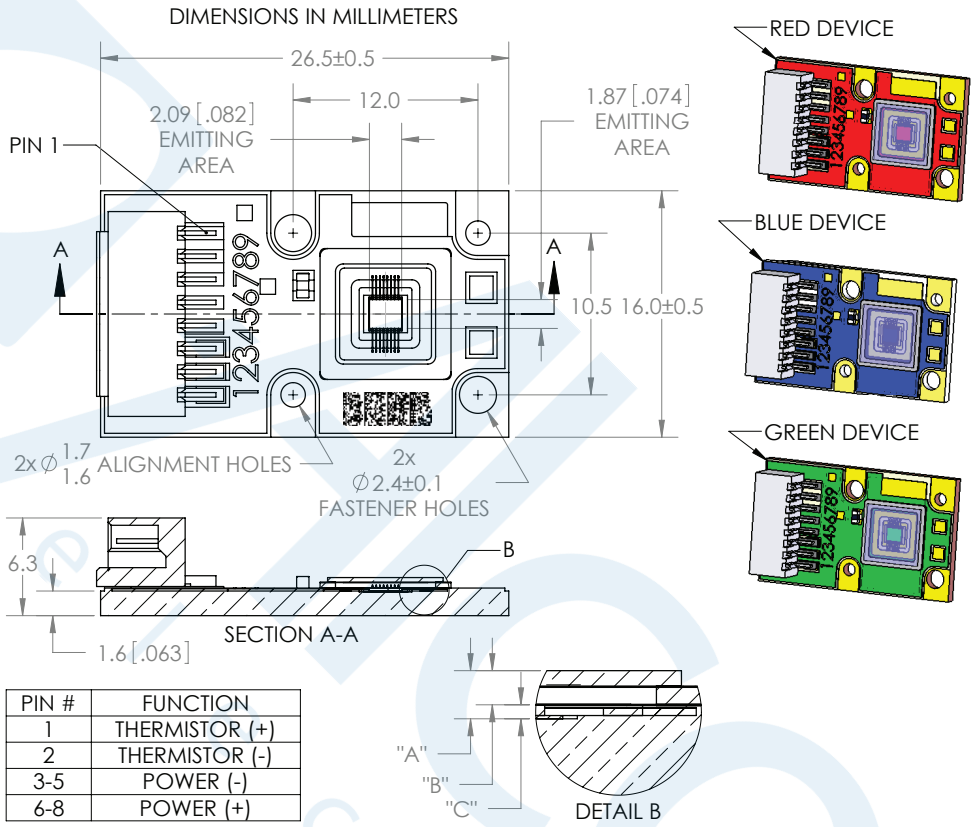
Mechanical Dimensions –Rotated Die Configuration



PIN #	FUNCTION
1	THERMISTOR (+)
2	THERMISTOR (-)
3-5	POWER (-)
6-8	POWER (+)

DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF GLASS	0.90	±0.13
"B"	EMITTING AREA TO TOP OF GLASS	0.67	± 0.16
"C"	TOP OF METAL SUBSTRATE TO EMITTING AREA	0.23	± 0.05

DWG-001991

Notes:
1) Red, Green and Blue PT39 Big Chip LEDs are individually assembled into a common anode copper core- board with a footprint of 26.5 mm x 16 mm.
2) Dimensions above are for information only. Refer to the latest revision of the DWG- 001991, package outline mechanical specifications
3) Connector- MOLEX Part Number: 874380843 or Global Part Number: WTB16-081SF.

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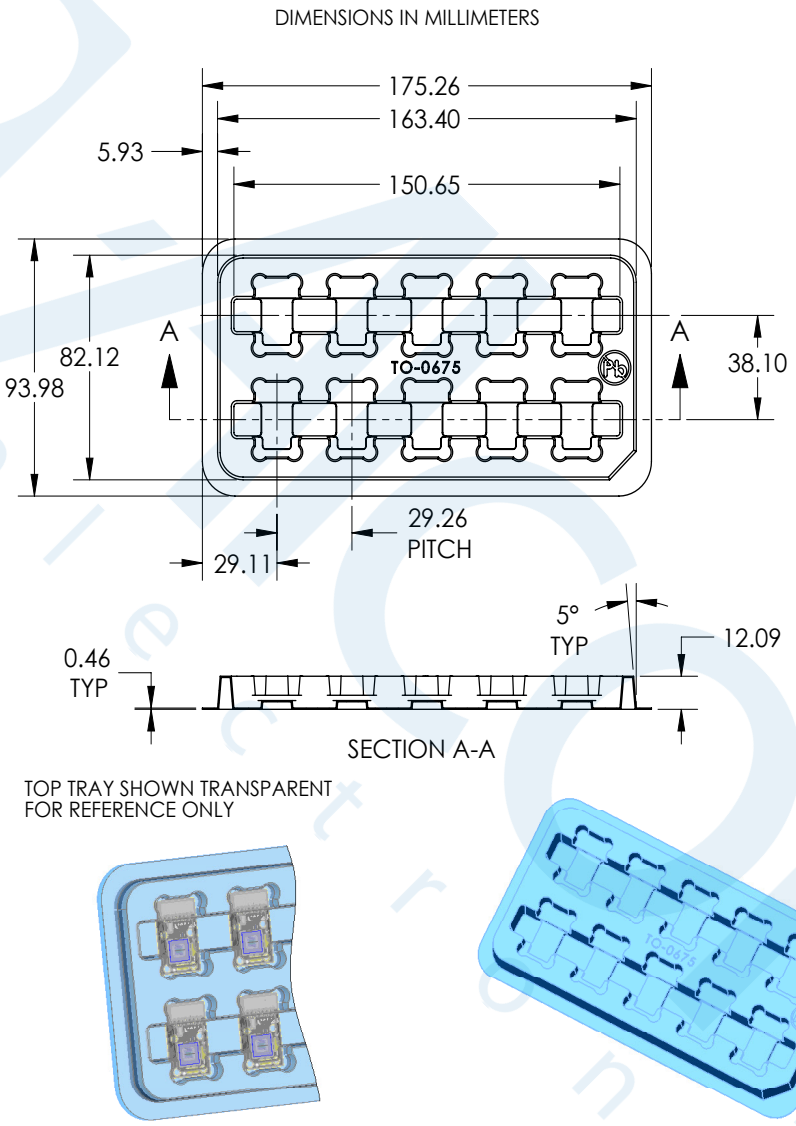
Shipping Tray Outline



For detailed drawing of shipping trays, please refer to document TO-0675 , available upon request.

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Packing and Shipping Specifications

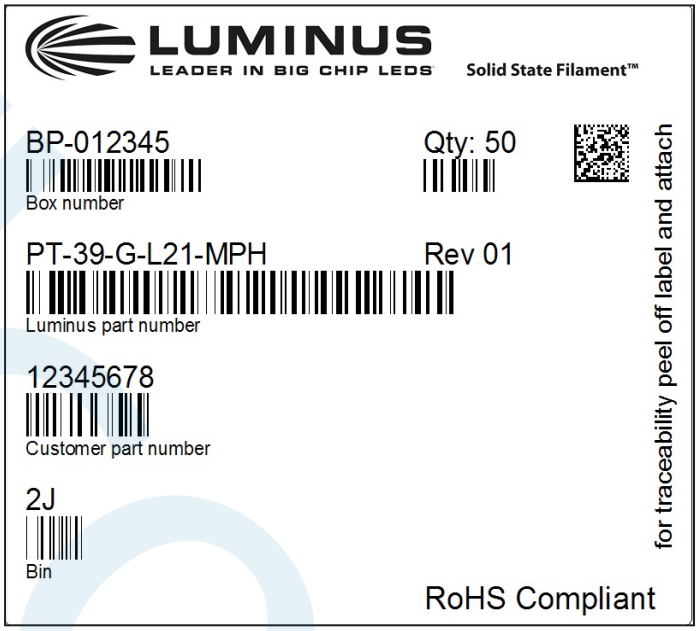
Packing Specification

Packing Configuration	Qty /Pack	Reel Dimensions (diameter x W, mm)	Gross Weight (kg)
Stack of 5 trays with 10 devices per tray Each pack is enclosed in ESD bag	50	95 x 176 x 50	0.45

Product Label Specification

Label Fields:

- 6-8 digit Box number (for Luminus internal use)
- Luminus ordering part number
- Quantity of devices in pack
- Part number revision (for Luminus internal use)
- Customer's part number (optional)
- Flux Bin
- 2D Bar code



Sample label –for illustration only

Shipping Box

Shipping Box	Quantity	Material	Dimensions (L x W x H, mm)
Carton Box	1 -20 packs	S4651	560 x 560 x 200

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History of Changes

Rev	Date	Description of Change
X	03/23/12	Preliminary Draft
01	05/15/12	Preliminary Specification
02	08/28/12	Add product characterization curves
03	02/17/15	Update address and year, remove preliminary marks

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SBT-70 LEDs

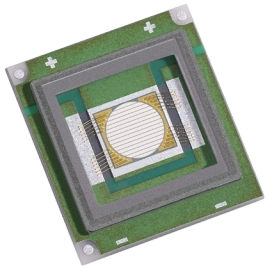

Table of Contents

Features:

- Extremely high optical output from a 7 mm^2 circular emitter:
  - Over 2,000 green lumens at 10.5A
  - Over 200 blue lumens at 10.5A and 445nm
  - Refer to SBT-90-R for companion red product
- 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 up to 10.5 A continuous wave. Up to 2A/mm^2 in pulsed conditions
- Environmentally friendly: RoHS compliant

Applications

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

PDS-002014 Rev 09

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Technology Overview

Luminus LEDs™ benefit from a suite of innovations in the fields of LED die technology, packaging and thermal management. These breakthroughs allow illumination engineers and designers to achieve solutions that are high brightness and high efficiency.

Luminus Technology

Luminus' 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 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.

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.

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.

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SBT-70 G, B Binning Structure (T_j= 25°C)

SBT-70 monochromatic LEDs are tested for luminous flux and dominant wavelength at a 10.5 A (1.5 A/mm^2) drive current and placed into one of the following flux and wavelength bins. The binning structure is universally applied across each monochromatic color.

Flux Bins (measured at 10.5A drive current)

Color	Luminous Flux Bin (FF)	Minimum Flux	Maximum Flux
Green	CK	1500	2000
	CM	2000	2300
	CN	2300	2600
Blue	DF	120	160
	DG	160	200
	DH	200	250

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

Wavelength Bins

Measured at 10.5 A drive current

Color	Wavelength Bin (WW)	Minimum Wavelength	Maximum Wavelength
Green	G4	520	525
	G5	525	530
	G6	530	535
	G7	535	540
Blue	B1	435	440
	B2	440	445
	B3	445	450
	B4	450	455

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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 on page 3. When shipped, each package will only contain one bin. The part number designation is as follows:

SBT-70-G, B

SBT — 70 — N — F75 — FF — WW

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Wavelength Bin
Surface Mount (window)	7.0 mm^2	G: Green B: Blue	Internal Code	See page 3 for flux bins	See page 3 for wavelength bins

Example:

The part number SBT-70-B-F75-DH-B2 refers to a BLUE, SBT-70 surface mount, with a flux range of 200 - 250 lumens and a wavelength range of 440 nm to 445 nm.

Note: Some flux and wavelength bins may have limited availability. Application specific bin kits, consisting of multiple bins, may be available.

Table of Products

Products	Ordering Part Number	Description
SBT-70-G	SBT-70-G-F75-xx123	SBT-70 surface mount device consisting of a 7.0 mm^2 LED on ceramic substrate
SBT-70-B	SBT-70-B-F75-xx123	
SBR-70-G	SBR-70-G-R75-xx123	SBR-70 evaluation module consisting of a SBT-70 surface mount device mounted on an aluminum star board
SBR-70-B	SBR-70-B-R75-xx123	

Please refer to page 5 for orderable bin kits.

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SBT-70 and SBR-70 Bin Kit Order Codes

Color	Luminous Flux		Wavelength Bins	Kit Number
	Bin Kit Flux Code	Min. Flux		
Green	JK	1500	G4, G5, G6, G7	JK200
			G4, G5	JK201
			G6, G7	JK202
	JM	2000	G4, G5, G6, G7	JM200
			G4, G5	JM201
			G6, G7	JM202
Blue	KF	120	B1,B2,B3,B4	KF300
			B2,B3	KF301
	KG	160	B1,B2,B3,B4	KG300
			B2,B3	KG301

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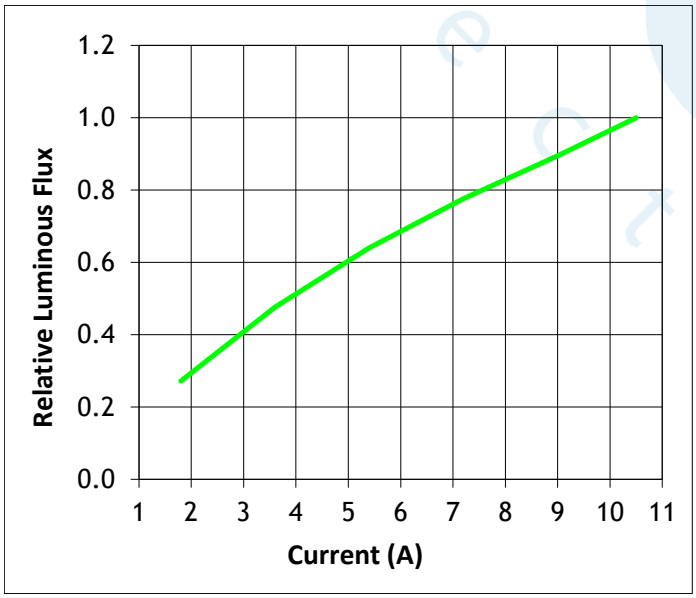
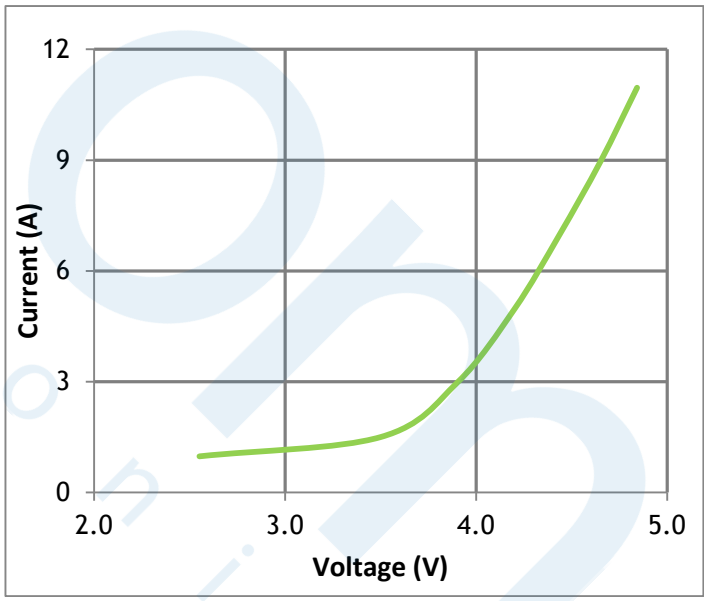
SBT-70 G, B, Optical & Electrical Characteristics

Green			
Drive Condition[1]		10.5 A	
Parameter	Symbol	Values[3]	Unit
Current Density	j	1.5	A/mm²
Forward Voltage	$V_{F\,min}$	3.9	V
	V_F	4.5	V
	$V_{F\,max}$	5.3	V
Luminous Flux[4]	$\Phi_{V\,typ}$	2100	lm
Dominant Wavelength[6]	λ_d	530	nm
FWHM	$\Delta\lambda_{1/2}$	32	nm
Chromaticity Coordinates[5,6]	x	0.182	-
	y	0.732	-

Relative Luminous Flux vs. Forward Current[2]



Forward Current vs. Forward Voltage



For notes see page 8.

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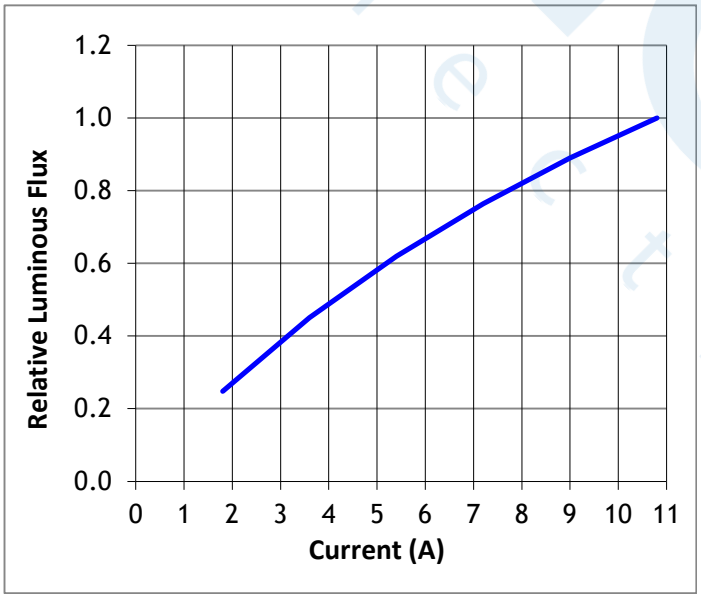
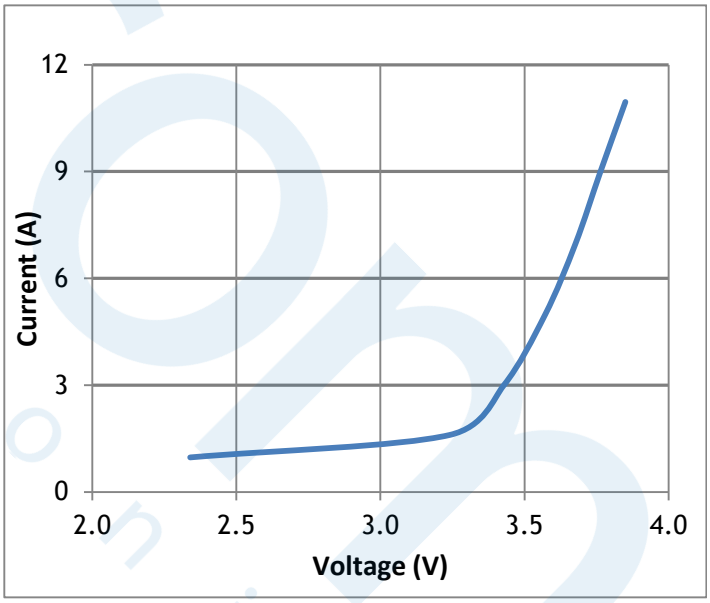
SBT-70 G, B, Optical & Electrical Characteristics

Blue			
Drive Condition[1]		**10.5 A**	
Parameter	**Symbol**	**Values**[3]	**Unit**
Current Density	j	1.5	A/mm²
Forward Voltage	$V_{F\,min}$	3.2	V
	V_F	3.8	V
	$V_{F\,max}$	4.2	V
Luminous Flux[4]	$\Phi_{V\,typ}$	200	lm
Dominant Wavelength[6]	λ_d	445	nm
Radiometric Flux	$\Phi_{p\,typ}$	9.5	W
FWHM	$\Delta\lambda_{1/2}$	19	nm
Chromaticity Coordinates[5,6]	x	0.158	-
	y	0.018	-

Relative Luminous Flux vs. Forward Current[2]



Forward Current vs. Forward Voltage



For notes see page 8.

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SBT-70, G, B, Optical & Electrical Characteristics Notes

Note 1: Listed drive conditions are typical for common applications. SBT-70 G,B devices can be driven at currents ranging from 1 A to 10.5 A 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 2: All ratings are based on a junction test temperature Tj = 25ºC. See Thermal Resistance section for Tj definition.

Note 3: Unless otherwise noted, values listed are typical. Devices are production tested and specified at 10.5A. 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.

SBT-70-G, B

Common Characteristics

	Symbol	Green	Blue	Unit
Emitting Area		7.0	7.0	mm^2
Emitting Area (Diameter)		3	3	mm
Thermal Coefficient of Photometric Flux		-0.2	-0.2	%/ ºC
Thermal Coefficient of Radiometric Flux		-0.2	-0.2	%/ ºC
Thermal Coefficient of Junction Voltage		-4.6	-3.5	mV/ ºC

Absolute Maximum Ratings

	Symbol	Green	Blue	Unit
Minimum Current		0.2	0.2	A
Maximum Current[7]		14	14	A
Maximum Junction Temperature[8]	T_{jmax}	150	150	ºC
Storage Temperature Range		-40/+100	-40/+100	ºC

Note 7: Luminus LEDs 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 9 for further information.

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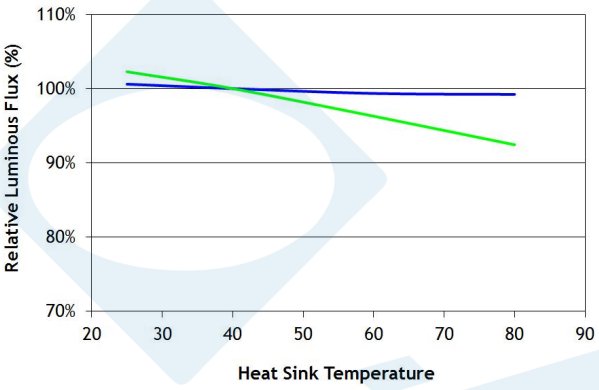
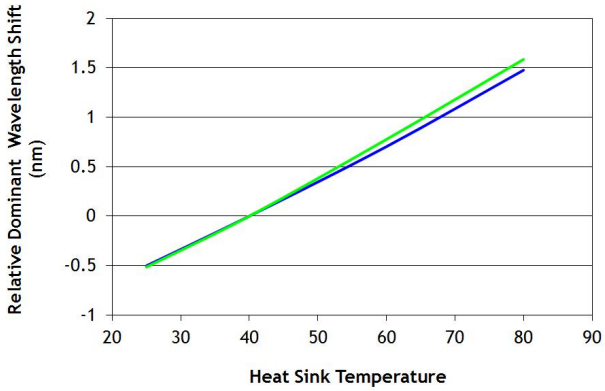
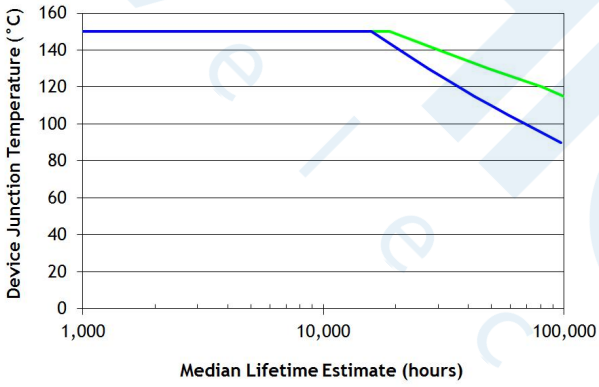
SBT-70- G, B Output vs. Temp., Lifetime and Spectrum

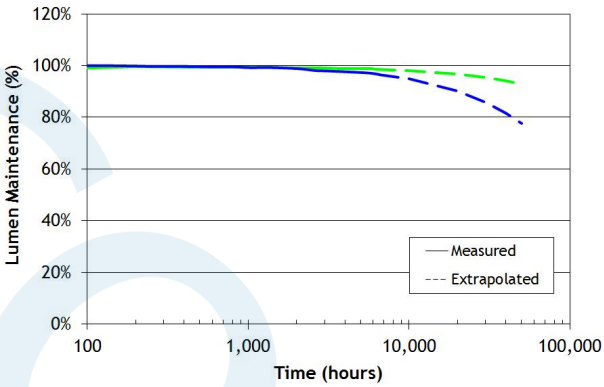




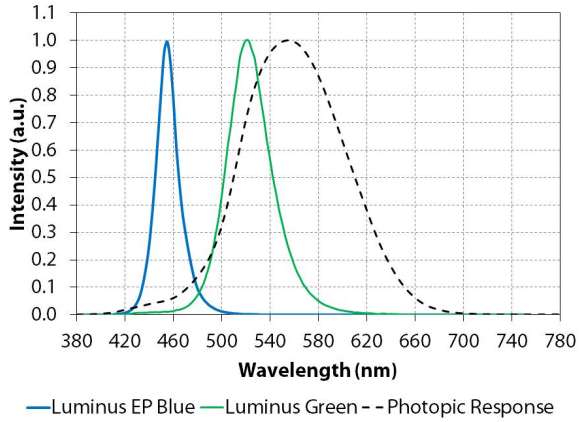
Median Lifetime Estimate vs. Tj[1]



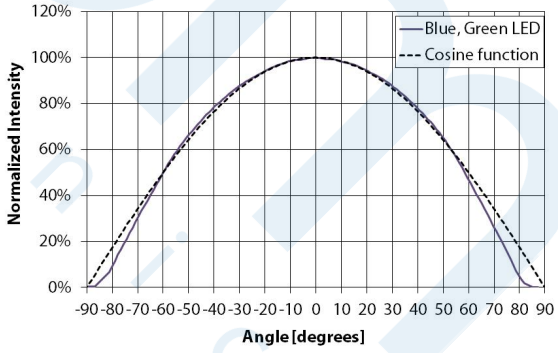
Lumen Maintenance[2]



Typical Spectrum[3]



Angular Distribution



Note 1. Median lifetime estimate as a function of junction temperature at 1.5A/mm² 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 2. Lumen maintenance vs. time at 1.5A/mm² in continuous operation, junction temperature equal to 25°C.

Note 3. Typical spectrum at current density of 1.5 A/mm² in continuous operation.

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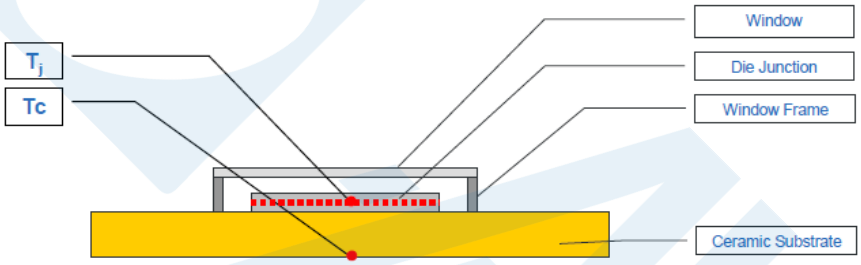
Thermal Resistance

Thermal Resistance Model



Typical Thermal Resistance :

$R_{j\text{-}c}$ [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.

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

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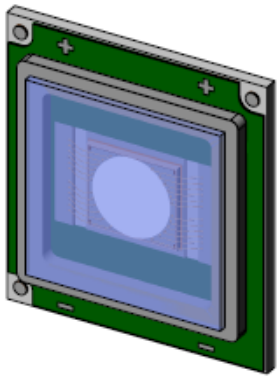
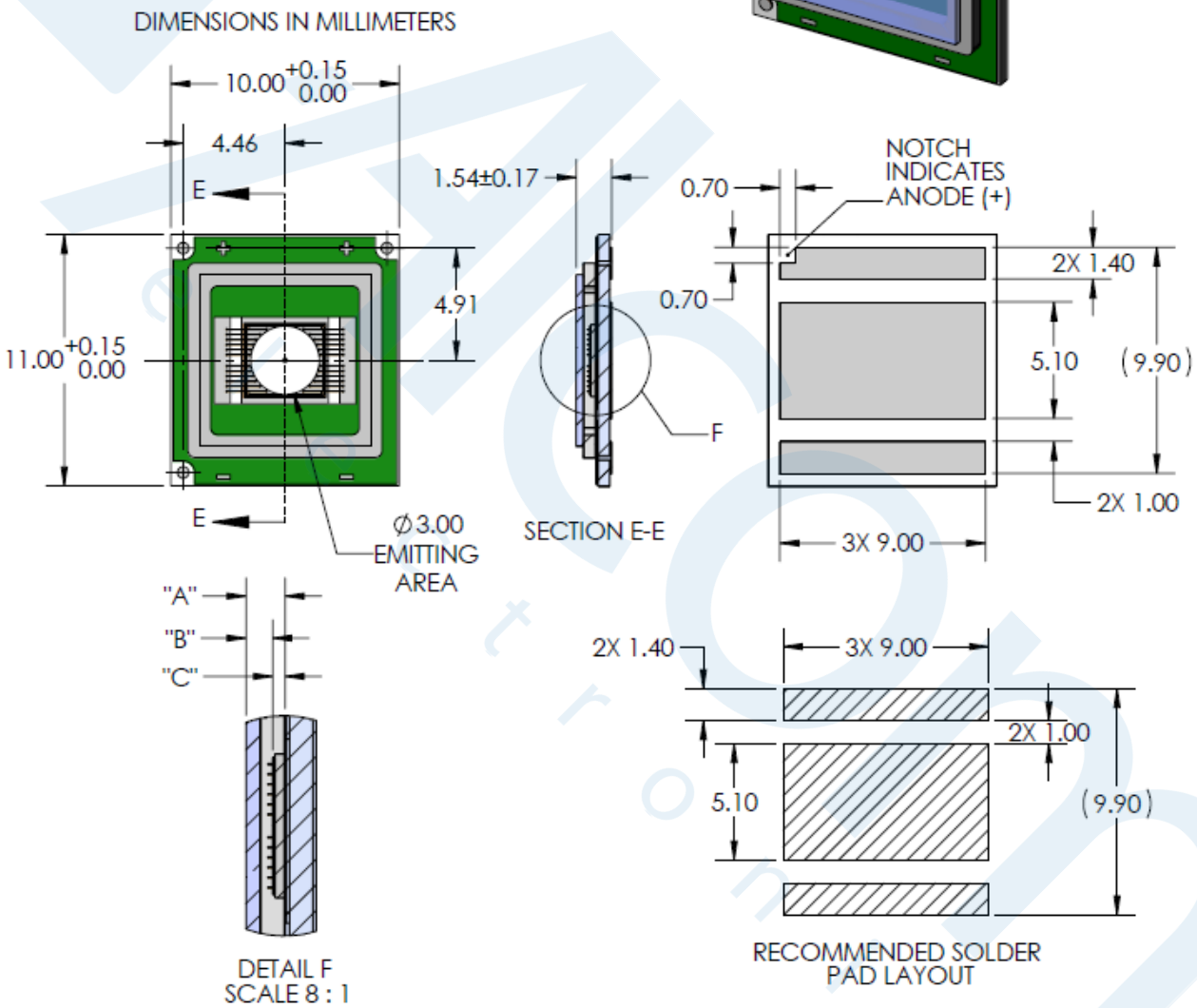
Mechanical Dimensions – SBT-70 Emitter





DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF CERAMIC SUBSTRATE TO TOP OF GLASS	.86	±0.10
"B"	TOP OF EMITTING AREA TO TOP OF GLASS	.58	±0.14
"C"	TOP OF CERAMIC SUBSTRATE TO TOP OF EMITTING AREA	.28	±0.03

DWG-002087

PDS-002014 Rev 09

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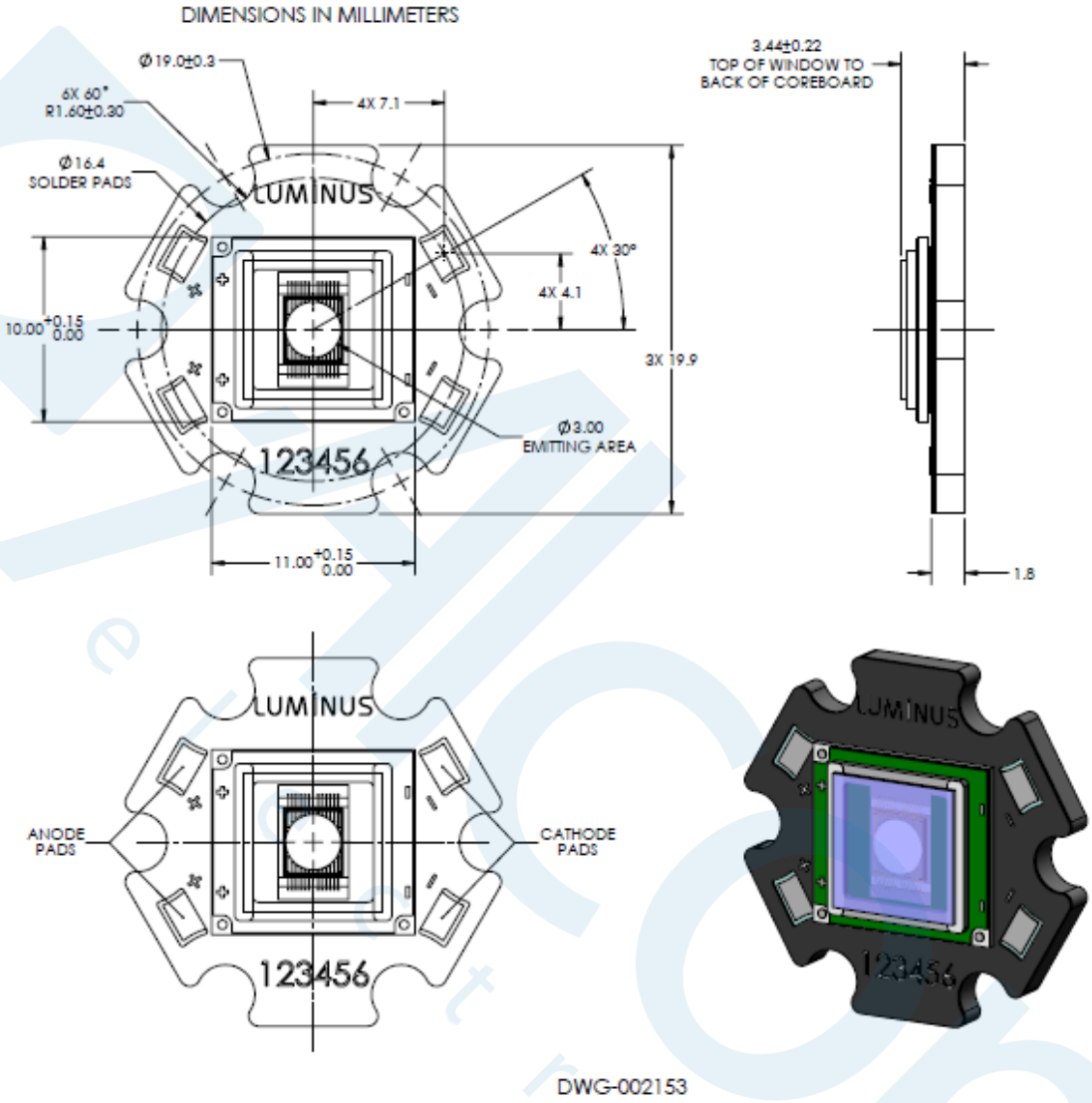
Mechanical Dimensions – SBT-70 Star Board



Note 1: Tolerances per IPC-610, Class 2. All dimensions in millimeters

Note 2: For detail drawing of SBT-70, please see DWG-002087

Note 3: Recommended mounting screw: M3 or #4

Note 4: All anode pads and all cathode pads on board are interconnected.

PDS-002014 Rev 09

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History of Changes

Rev	Date	Description of Change
08	07/20/2015	Added Angular Distribution Pattern on Page 9
09	04/10/2016	Updated Vf min for SBT-70-G from 4.5V to 3.9V and typical Vf from 4.9V to 4.5V Corrected maximum current value to 14A (2A/mm^2) on page 8

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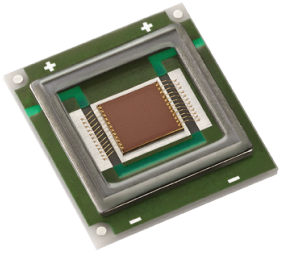
SBT-90 LEDs



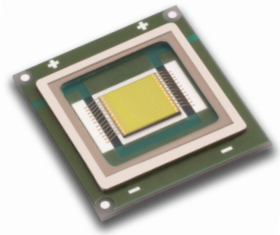


Table of Contents

Features:

- Extremely high optical output from a 9 mm^2 square emitter:
  - Up to 2300 lumens at 13.5A from a single chip (White)
  - Over 1,600 lumens at 13.5A (Red)
  - Choice of 5700K or 6500K color point
- High thermal conductivity package - junction to case thermal resistance of only 0.5 °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
- 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 16

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Technology Overview

Luminus LED 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 Technology

Luminus' 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 0.5° 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 LEDs are one of the most reliable light sources in the world today. They 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.

Environmental Benefits

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

Understanding Luminus 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 msec 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

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 13.5A, and duty cycle from <1% to 100%), multiple drive conditions
are listed.

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

SBT-90 Red LEDs are productions tested of 13.5A

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SBT-90 Binning Structure

SBT-90 LEDs are tested for luminous flux and chromaticity of the drive current specified below and placed into one of the following luminous flux (FF) and chromaticity (WW) bins:

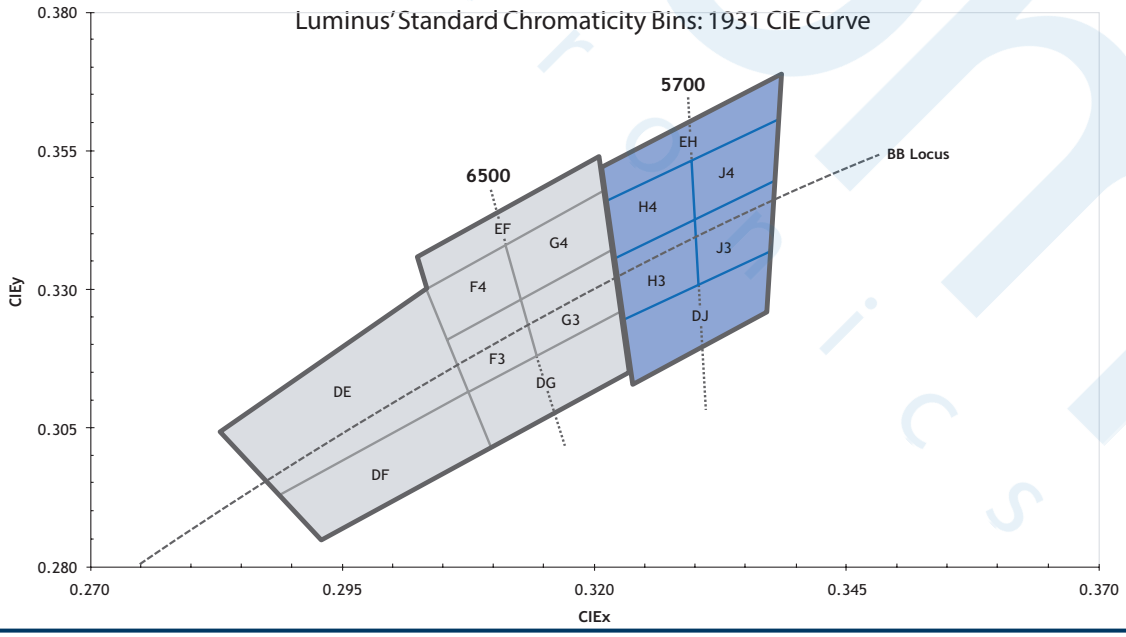
Flux Bins

Color	Flux Bin (FF)	Minumum Flux (lm) @ 9.0A	Maximum Flux (lm) @ 9.0A
W57S / W65S 5700K / 6500K, Standard CRI (typ. 70)	NA	1,590	1,710
	NB	1,710	1,830
	PA	1830	1966
	PB	1966	2100
	QA	2100	2260
	QB	2260	2420
	RA	2420	2600
Red	**Flux Bin (FF)**	**Minumum Flux (lm) @ 13.5A**	**Minumum Flux (lm) @ 13.5A**
	BM	770	970
	BN	970	1150
	BP	1150	1350
	BQ	1350	1570
	BR	1570	1850
Color	**Wavelength Bin (WW)**	**Minimum Wavelength @ 13.5A**	**Maximum Wavelength @ 13.5A**
Red	R3	615	619
	R4	619	623
	R5	623	627

*Note: Luminus maintains a +/- 6% tolerance on flux measurements. Luminus maintains a +/- 2% tolerance on CRI 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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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 White

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 3 for bins

Note 1: WNNX nomenclature corresponds to the following:

W = White

NN = color temperature, where:

65 corresponds to 6500K

57 corresponds to 5700K

X = color rendering index, where:

S (standard) corresponds to a typical CRI of 70

SBT-90- Red

SBT — 90 — R — F75 — FF — WW

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Wavlength Bin
Surface Mount (window)	9.0 mm^2	R: Red	Internal Code	See bins page	See bins page

Example:

The part number SBT-90-R-F75-BK-R4 refers to a red part, with a flux range of 600 - 770 lumens and a wavelength range of 619 nm to 623 nm.

Note 2: Some flux and chromaticity bins may have limited availability. Application specific bin kits, consisting of multiple bins, may be available.

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Ordering Information

Ordering Part Number [1,2]	Color	Description
SBT-90-W57S-F71-NA100	5700K White	White SBT-90 consisting of a 9mm^2 LED on ceramic substrate
SBT-90-W65S-F71-NA100	6500K White	
SBR-90-W57S-R71-NA100	5700K White	SBR-90 evaluation module consisting of a SBT-90 surface mount device mounted on an aluminum star board
SBR-90-W65S-R71-NA100	6500K White	

Ordering Part Number [2]	Color	Description
SBT-90-R-F75-HN100	Red	Red SBT-90 consisting of a 9 mm^2 LED on a ceramic substrate
SBR-90-R-R75-HN100	Red	SBR-90 evaluation module consisting of a SBT-90 surface mount device mounted on an aluminum star board

Note 1: NA100 - denotes a bin kit comprising of all flux bins with a minimum flux of 1,590 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.

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SBT- 90- Electrical Characteristics[1]

White			
Drive Condition[2]		**9.0 A**	
Parameter	**Symbol**	**Values at Test Currents**	**Unit**
Current Density	j	1.0	A/mm^2
Forward Voltage	V_F	3.5	V

Common Characteristics

Parameter	Symbol	White	Red	Unit
Emitting Area		9.0	9.0	mm^2
Emitting Area Dimensions		3 x 3	3 x 3	mm
Forward Voltage Temperature Coefficient[3]		-2.45	-1.3	mV/C
Thermal Coefficient of Photometric Flux			-0.96	%/C

Absolute Maximum Ratings

Parameter	Symbol	White	Red	Unit
Absolute Minimum Operating Current		0.2	0.2	A
Maximum Current[4]		13.5	13.5	A
Maximum Junction Temperature[5]	$T_{j\text{-}max}$	150	125	°C
Storage Temperature Range		-40/+100	-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-90 devices can be driven at currents ranging from 1A to 13.5A 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: Forward voltage temperature coefficient at current density of 1 A/mm^2 and heat sink temperature of 40°C. Contact Luminus for value at other drive conditions.

Note 4: Luminus SBT-90 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 5: 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 page 9 and lifetime and reliability application note for further information.

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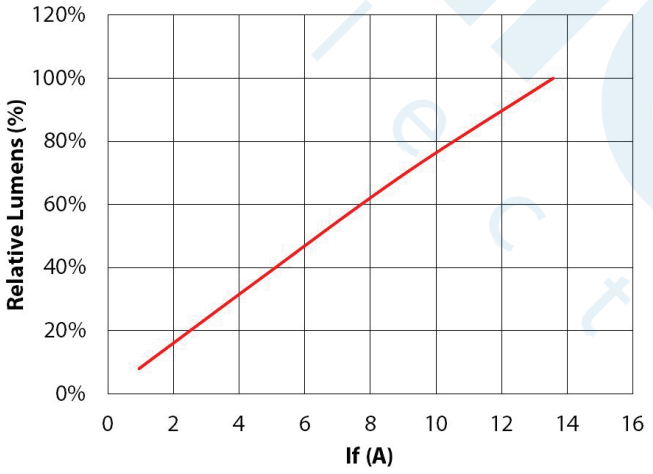
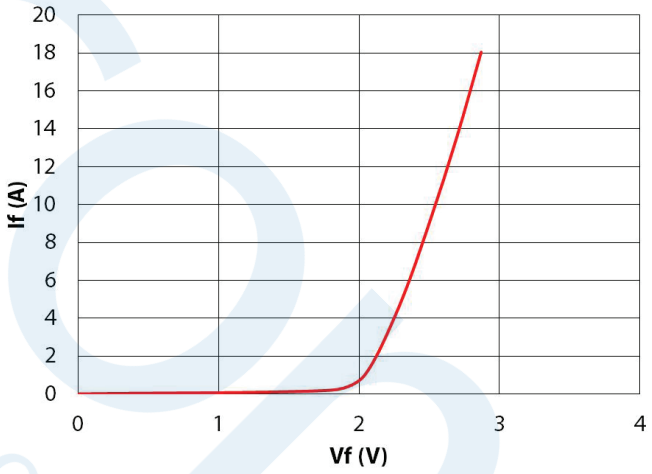
SBT-90-R Optical & Electrical Characteristics

Red			
Drive Condition[2]		**13.5A**	
Parameter	**Symbol**	**Values**[3]	**Unit**
Current Density	j	1.5	A/mm^2
Forward Voltage	$V_{F\,min}$	2.3	V
	V_F	2.7	V
	$V_{F\,max}$	3.6	V
Luminous Flux[4]	$\Phi_{V\,typ}$	1350	lm
Dominant Wavelength[5]	λ_d	620	nm
FWHM	$\Delta\lambda_{1/2}$	18	nm
Chromaticity Coordinates[6,7]	x	0.695	-
	y	0.305	-

Relative Luminous Flux vs. Forward Current[1]



Forward Current vs. Forward Voltage



Note 1: All ratings are based on a junction test temperature Tj = 25°C. See Thermal Resistance section for Tj definition.

Note 2: Listed drive conditions are typical for common applications. SBT-90 devices can be driven at currents ranging from <1 A to 13.5 A 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 13.5A. 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: Minimum and Maximum Dominant Wavelengths are based on typical values +/- 5nm for Red.

Note 6: In CIE 1931 chromaticity diagram coordinates, normalized to X+Y+Z=1.

Note 7: For reference only.

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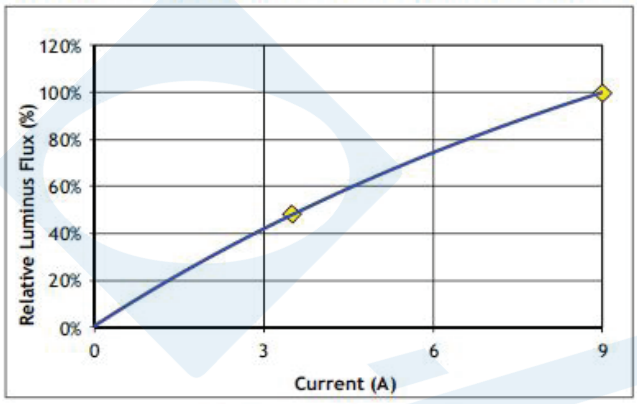
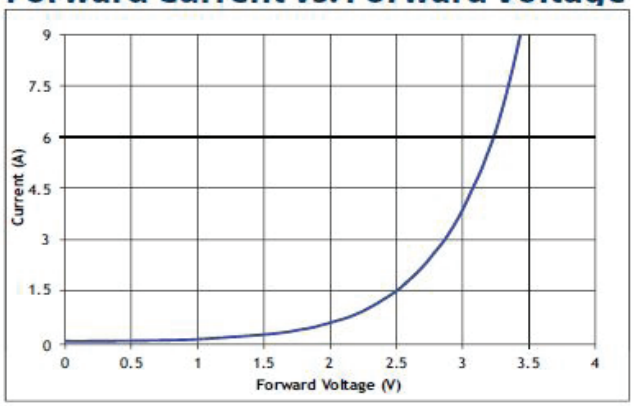
SBT-90-W Characteristics

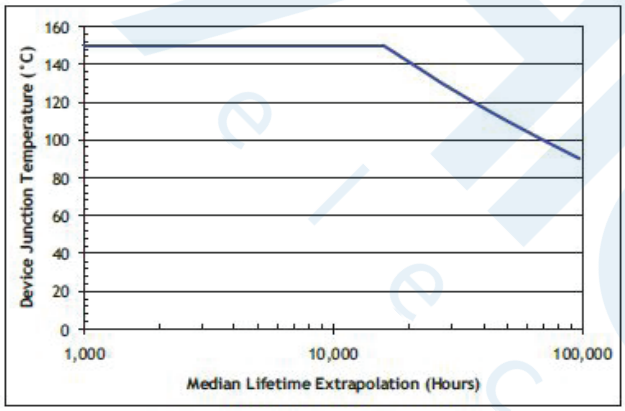
Relative Output Flux vs. Forward Current[1]



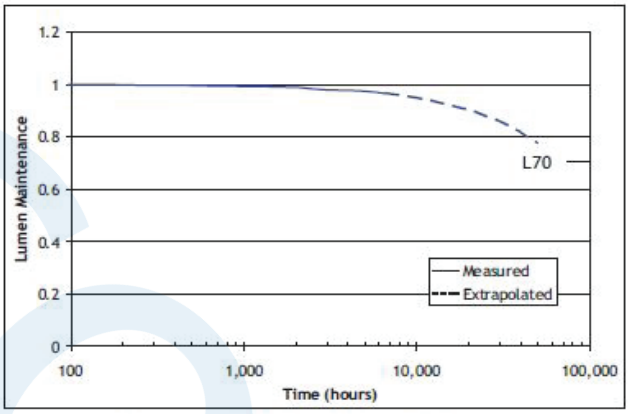
Forward Current vs. Forward Voltage



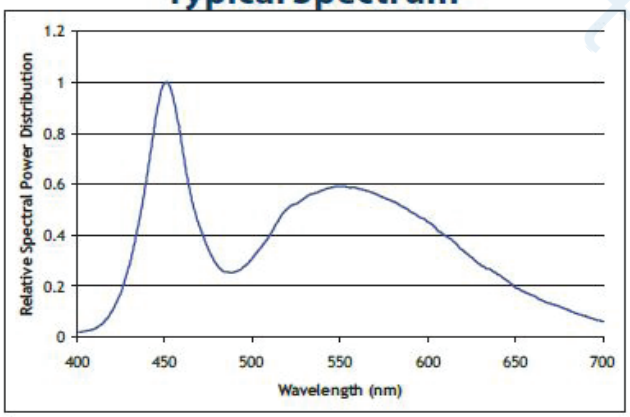
Median Lifetime[2]



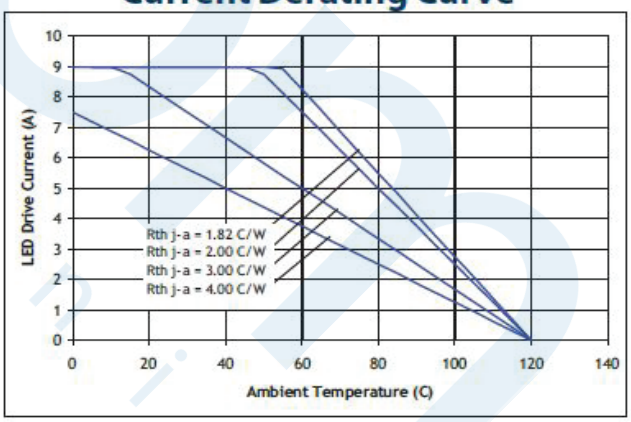
Lumen Maintenance vs. Time[3]



Typical Spectrum[4]



Current Derating Curve



Note 1: Yellow squares indicate typical operating conditions.

Note 2: Median 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. Lumen maintenance calculation doesn't consider open and short circuit failure modes into account.

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

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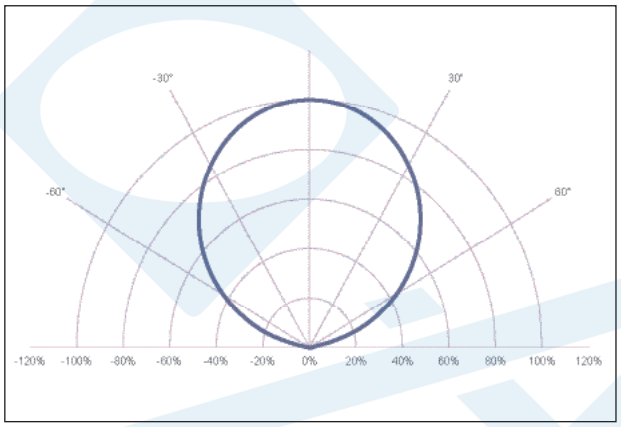
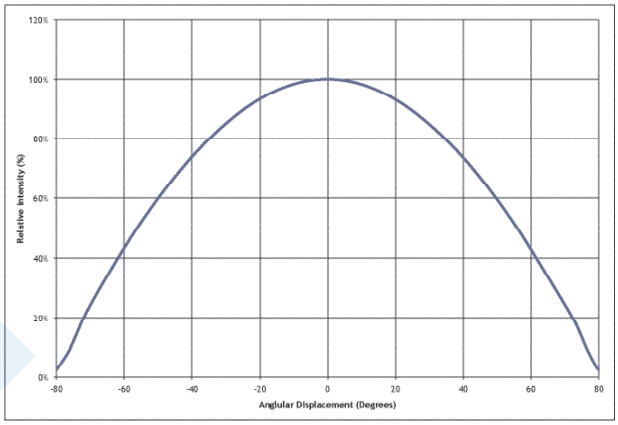
Typical Radiation Patterns

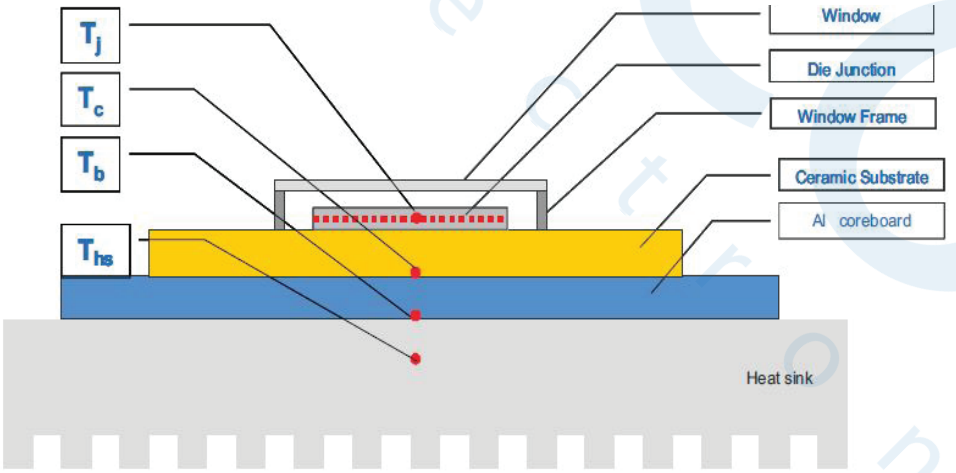
Typical Polar Radiation Pattern for White



Typical Angular Radiation Pattern for White



Thermal Resistance



Typical Thermal Resistance :

$R_{j\text{-}c}$ [1]	0.5 °C/W
$R_{j\text{-}b}$ [1]	1.2 °C/W
$R_{j\text{-}hs}$ [2]	1.4 °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.

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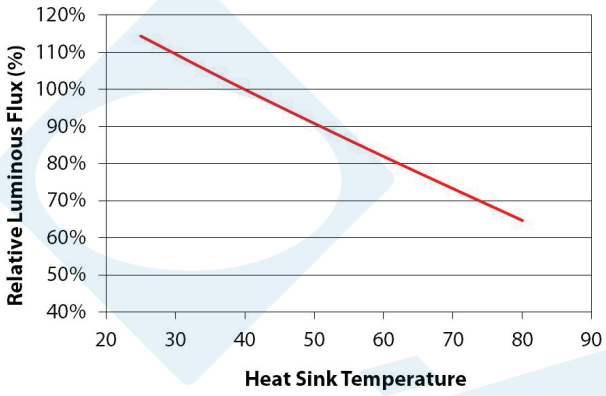
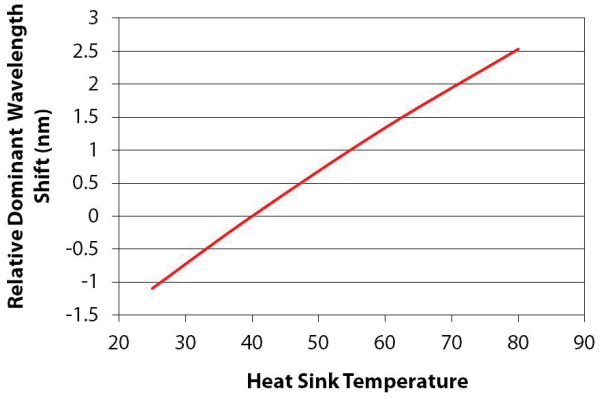
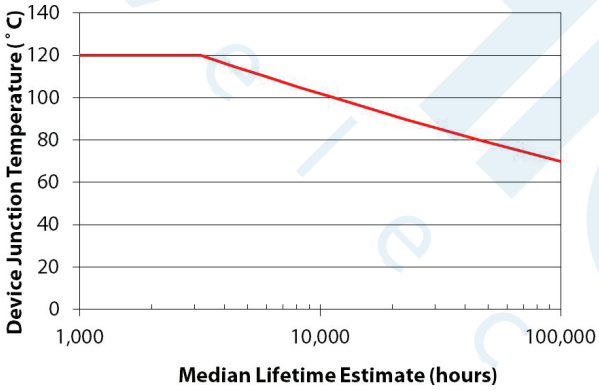
SBT-90-R Output vs. Temp., Lifetime and Spectrum

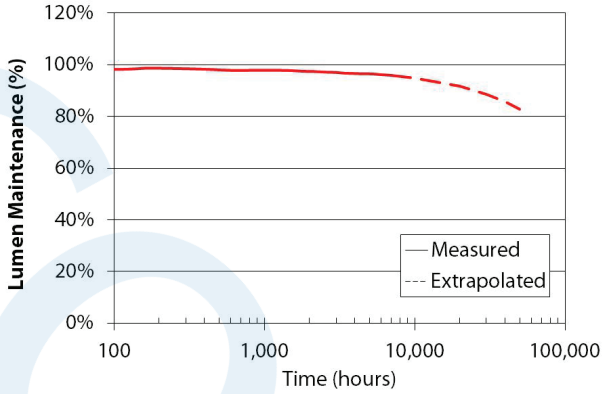




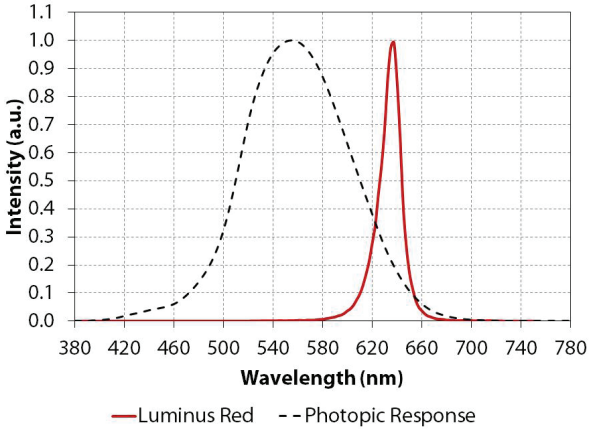
Median Lifetime Estimate vs. Tj[1]



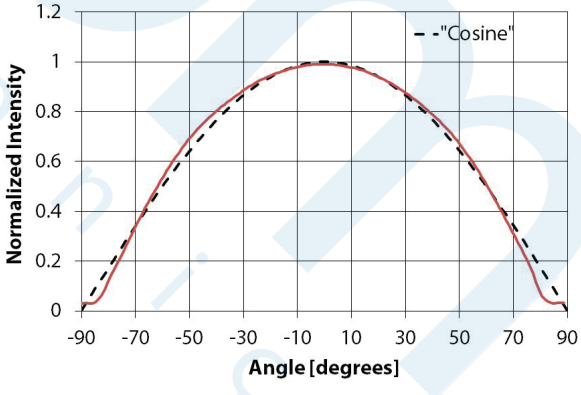
Lumen Maintenance[2]



Typical Spectrum[3]



Angular Distribution



Note 1. Median lifetime estimate as a function of junction temperature at 1.5A/mm² 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 2. Lumen maintenance vs. time at 1.5A/mm² in continuous operation, junction temperature equal to 25ºC.

Note 3. Typical spectrum at current density of 1.5 A/mm² in continuous operation.

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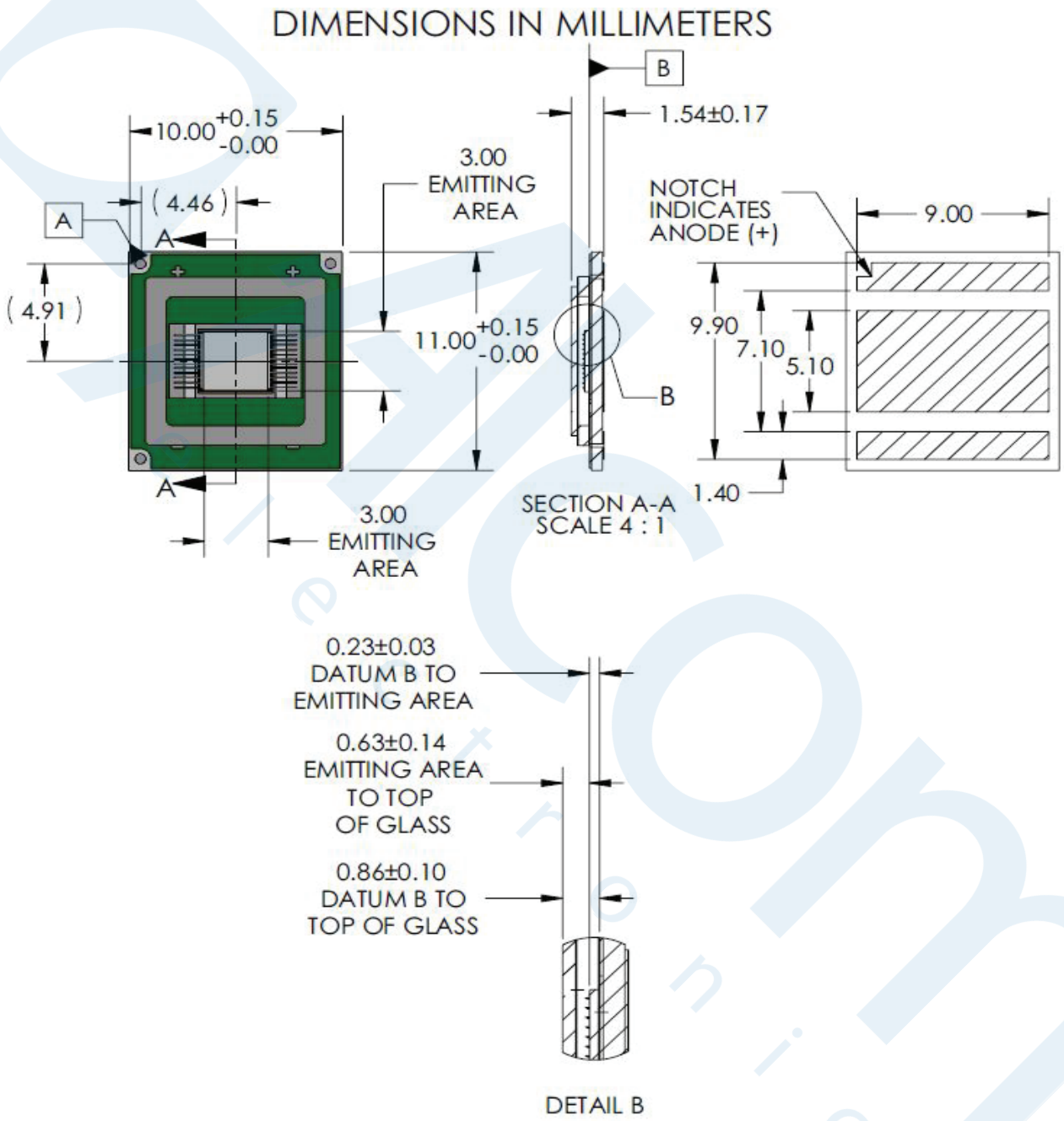
Mechanical Dimensions – SBT-90 Emitter



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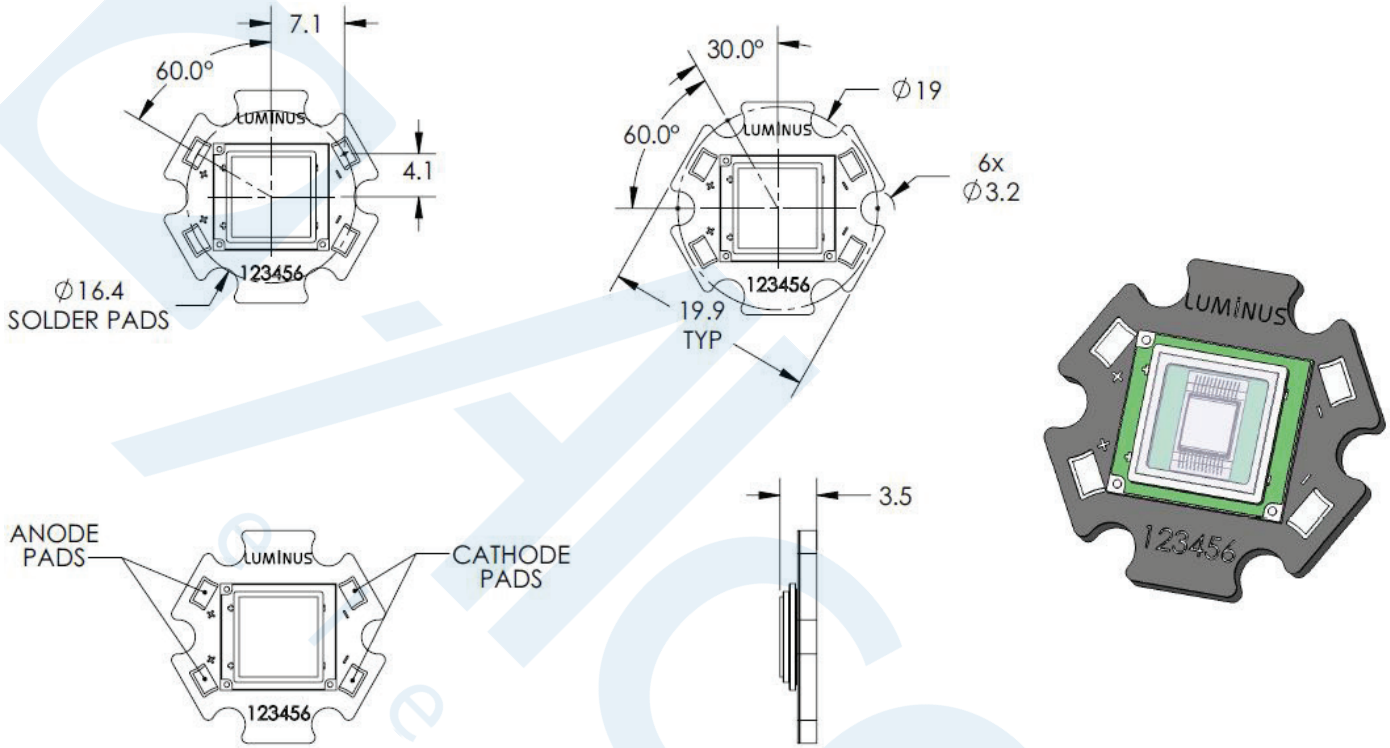
Mechanical Dimensions – SBT-90 Star Board



Note 1: Tolerances per IPC-610, Class 2

Note 2: For detail drawing of SBT-90, please see DWG-001553

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

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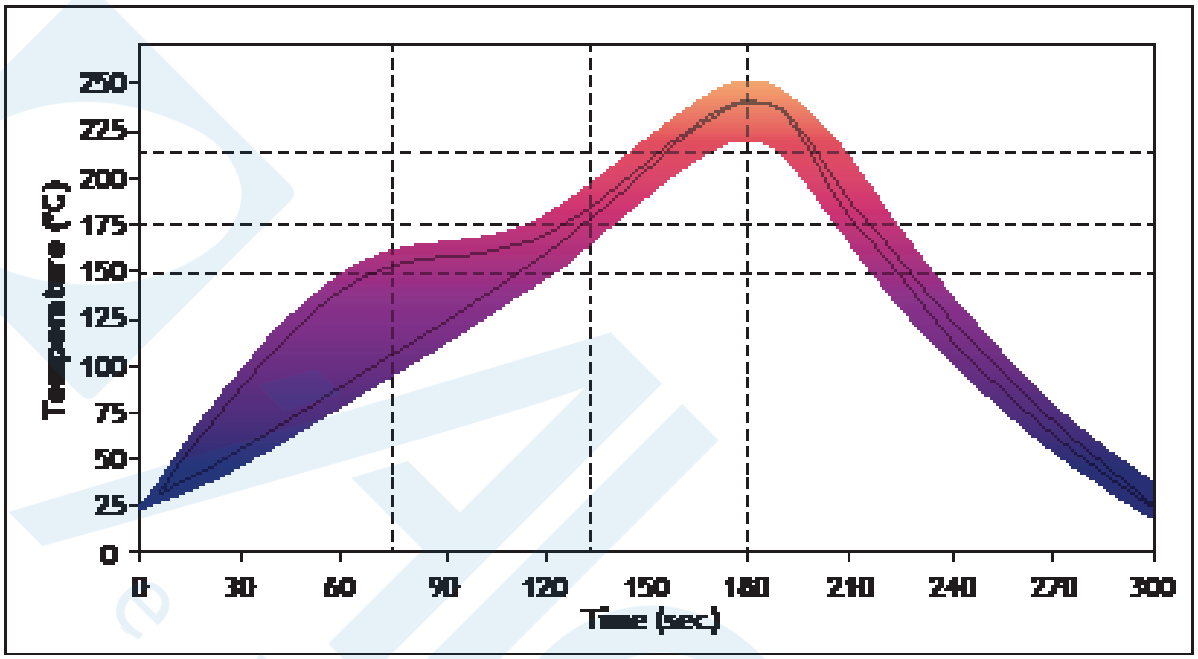
Solder Profile

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

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SFT-10
LED Chipset in SMT and Starboard Configurations

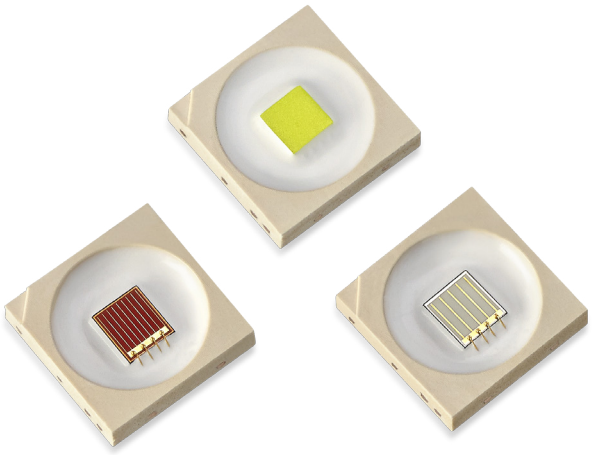

Table of Contents

Features:

- Matched R/CG/B Chipset with 1.0mm^2 emitting area designed for mid to high current-density 0.2" / 0.3" Pico projection applications
- Thermally efficient SMT Package: $R_{TH\ J\text{-}C} = 3.0^{o}$ C/W
- Available either in "Standard" (SMT) or Pre-Mounted "Starboard" Configurations
- Available "Starboard" Packaging Configuration allows ease of evaluation and/or immediate system integration
- 100% surface emission for high collection efficiency and low optical losses
- Wide color gamut with the most desireable dominant wavelengths: Red-Amber 613 nm, Converted Green (filtered spectrum) 555nm, and Blue 455 nm
- Single emitting area per color allows for efficiency of collection with simplified optics
- Environmentally friendly: RoHS and REACH compliant
- Characterized correlation between "Test" and real-world Display applications are provided.

Applications

- Specifically engineered for stand alone, embedded, or battery-assisted projection display applications.
- Entertainment / Stage Lighting
- Medical / Life Science
- Industrial
- Transportaion / Beacons
- High performance illumination

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Technology Overview

Luminus Devices' SFT series of illuminators is an innovative small form factor solid-state light source created for applications requiring high current density in a small area. With its thermally effiicent package, the SFT-10 chipset allows the end-product to deliver all the benefits of small, high performing solid state light sources.

The SFT series is environmentally friendly (Mercury-free), enables instant start and re-start with no wait time, high reliability, and long life requiring no end-user or field replacement. Response time is quick enabling frame-by-frame color control with compatible ASIC control chipsets for projection applications.

Innovative Packaging Technology

Thermal management is critical in high power LED applications. With a low thermal resistance from junction SFT-10 LEDs can 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 and REACH compliant and free of hazardous materials, including lead and mercury.

Reliability

SFT-10 has 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 high power / small form factor / high current applications pico applications.

With very low failure rates and median lifetimes that typically exceed 60,000 hours, Luminus SFT-Series LEDs are ready for even the most demanding applications. (Please refer to Luminus' Reliability application note for more information.)

Understanding SMT Test Specifications

Every Luminus LED is tested to ensure that it meets the high quality standards expected from Luminus' products.

Testing of SMT LEDs

The Luminus SFT series of products are measured in such a way that allows high volume / fast paced (single pulse) production but accurate measurement that correlates with real world operating conditions.

Luminus makes available to it's customers correlation curves (page 8) that allow one to predict with significant accuracy performance in typical "Display" applications.

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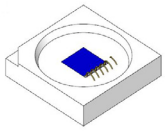
Ordering Information (SMT Configuration)[1,3]

Ordering Part Number[1,3]	Color	Min Flux Bin[2]	Description	Configuration
SFT-10-RA-F35-MPA	Red Amber	1A	Red-Amber LED consisting of a 1.0 mm² die mounted on a small 3.5 x 3.5mm high-performance package with directional indicator.	
SFT-10-CG-F35-MPC	Converted Green	2C	Converted Green consisting of a 1.0 mm² die Blue die mounted on a small 3.5 x 3.5mm high-performance package driving a Green Phosphor Platelet, with directional indicator.	
SFT-10-CG-F35-MPD		2D		
SFT-10-B-F35-EPC	Blue	4C	Blue LED consisting of a 1.0 mm² die mounted on a small 3.5 x 3.5mm high-performance package with directional indicator.	
SFT-10-B-F35-EPD		4D		

Ordering Information (Starboard Configuration)[1, 3, 4]

Ordering Part Number[1,3]	Color	Min Flux Bin[2]	Description	Configuration
SFT-10-RA-R35-MPA	Red Amber	1A	Red-Amber LED consisting of a 1.0 mm² die in a small 3.5 x 3.5mm package mounted on a thermally efficient and pedestal, common cathode designed starboard.	
SFT-10-CG-R35-MPC	Converted Green	2C	Converted Green LED consisting of a 1.0 mm² die with Green Phosphor Platelet in a small 3.5 x 3.5mm package	
SFT-10-CG-R35-MPD		2D		
SFT-10-B-R35-EPC	Blue	4C	Blue LED consisting of a 1.0 mm² die in a small 3.5 x 3.5mm package mounted on a thermally efficient and pedestal, common cathode designed starboard.	
SFT-10-B-R35-EPD		4D		

Note 1: Ordering part numbers represent bin kits (group of bins that are shippable for a given ordering part number)
Note 2: See Bin Kit and Flux bin definitions on page 5.
Note 3: Bin Kits are defined by a group of flux or power bins. Only one flux / power bin will be shipped in each indivdiual pack or reel. Each shipment will contain reels of different allowed bins for a specific orderable part number (See page 5)
Indivdual Flux or Power bins are not orderable
Note 4: Starboard Configuration are available for sample quantity only. For additional quantity, contact Luminus representitive.

Ordering Part Number Nomenclature

SFT — nn — XXXX — XXX — XYZ

Product Family	Chip Area	Color	Package Configuration	Bin Kit[1]
SFT: Small Flat-Top windowless format	10: 1.0 mm²	RA = Red - Amber CG = Converted Green B= Blue	F35: 3.5mm x 3.5mm See Mechanical Drawing section R35: SFT-10 mounted on Starboard Starboard only in sample quantity	See page 5 for bin kit definition

Note : A Bin Kit represents a group of individual flux or power bins that are shippable for a given ordering part number. Individual flux bins are not orderable.
EXAMPLES: SFT-10-CG-F35-MPC is comprised of Converted Green Flux Bins 2C, 2D, 2E , and 2F,

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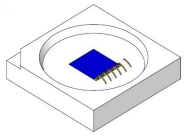
PACKAGE CONFIGURATIONS

Package Configuration [1]	Type	Picture	Description
F35	SMT		Standard configuration A 1.0 mm^2 die mounted on a small 3.5 x 3.5mm high-performance package with directional indicator.
R35	STARBOARD		Pre-Mounted Configuration. The standard SFT-10 SMT Package pre-mounted on a Luminus thermally efficient and pedestal, common cathode designed copper 19.9 x 19.9mm starboard. See page 15. Starboard only in sample quantity. Contact Luminus representitive for additional requirements. Starboard requires electrical isolation in most system designs. Starboard backside is connected to LED cathode.

Note 1:
The packaging configuration must be specified within the orderable part number.
If not specified, or invalid, the order may be rejected or default to the "F35" (Standard) configuration.

Ordering Part Number Nomenclature

SFT — nn — XXXX — XXX — XYZ

Product Family	Chip Area	Color	Package Configuration [2]	Bin Kit [1]
SFT: Small Flat-Top windowless format	10: 1.0 mm^2	RA = Red - Amber CG = Converted Green B= Blue	F35: 3.5mm x 3.5mm See Mechanical Drawing section R35: SFT-10 mounted on Starboard Starboard only in sample quantity	See page 5 for bin kit definition

Note 1: A Bin Kit represents a group of individual flux or power bins that are shippable for a given ordering part number. Individual flux bins are not orderable.
EXAMPLES: SFT-10-CG-F35-MPC is comprised of Converted Green Flux Bins 2C, 2D, 2E , and 2F,

Note 2: Starboard only in sample quantity. Contact Luminus representitive for additional requirements.

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SFT-10 Bin Kit[1] and Flux Bin[3,4] Definitions

Note: Please refer to ordering part number table on page 3 for Bin Kit availability

Red -Amber Flux Bins	Bin 1Z	Bin 1A	Bin 1B	Bin 1C	Bin 1D	Bin 1E	Bin 1F	Bin 1G	Bin 1H		
Red -Amber Bin Flux Range (lm)	80 - 90	90 - 100	100 - 110	110 - 120	120 - 130	130 - 145	145 - 155	155 - 170	170 - 185		
SFT-10-RA-F35-MPA		☑	☑	☑	☑	☑					
Conv Green Flux Bins		Bin 2A	Bin 2B	Bin 2C	Bin 2D	Bin 2E	Bin 2F	Bin 2G	Bin 2H		
Conv Green Bin Flux Range (lm)		200 - 215	215 - 240	240 - 260	260 - 285	285 - 305	305 - 325	325 - 350	350 - 380		
SFT-10-CG-F35-MPC				☑	☑	☑	☑				
SFT-10-CG-F35-MPD					☑	☑	☑	☑			
Blue Power Bins		Bin 4A	Bin 4B	Bin 4C	Bin 4D	Bin 4E	Bin 4F	Bin 4G	Bin 4H		
Blue Optical Power Range (W/mm2)		0.65 - 0.70	0.70 - 0.75	0.75 - 0.85	0.85 - 0.95	0.95 - 1.05	1.05 - 1.15	1.15 - 1.25	1.25 - 1.35		
SFT-10-B-F35-EPC				☑	☑	☑	☑				
SFT-10-B-F35-EPD					☑	☑	☑	☑			

Wavelength Dominent Bin[2] Definitions

Color	Bin	Minimum WLD (nm)	Maximum WLD (nm)
Red-Amber	R1	609	615
Red-Amber	R2	615	621
Blue	B1	449	455
Blue	B2	455	460

Note 1: Bin Kits are defined by a group of flux or power bins. Only one flux / power bin will be shipped in each individual pack or reel. Each shipment will contain reels of different allowed bins for a specific orderable part number. Individual Flux or Power bins are not ordereable.

Note 2: Wavelength bins are not orderable. Wavelength bins are displayed in product label.

Note 3: Packaging configuration must be specified in purchase order. Otherwise, order will either be rejected or default to the "F35" (Standard) configuration. For "StarBoard" configuration, "R35" should be used as package configuration code. Refer to Ordering Part Number Nomenclature on Page 4.

Note 4: SFT-10 LEDs are tested according to the process outlined on page 6. Devices are sorted and packed by flux bin. Not all flux bins are populated. Contact your local LDI representative for current production population.

Note 5: Luminus maintains a test measurement accuracy for LED flux and power of +/- 6%.

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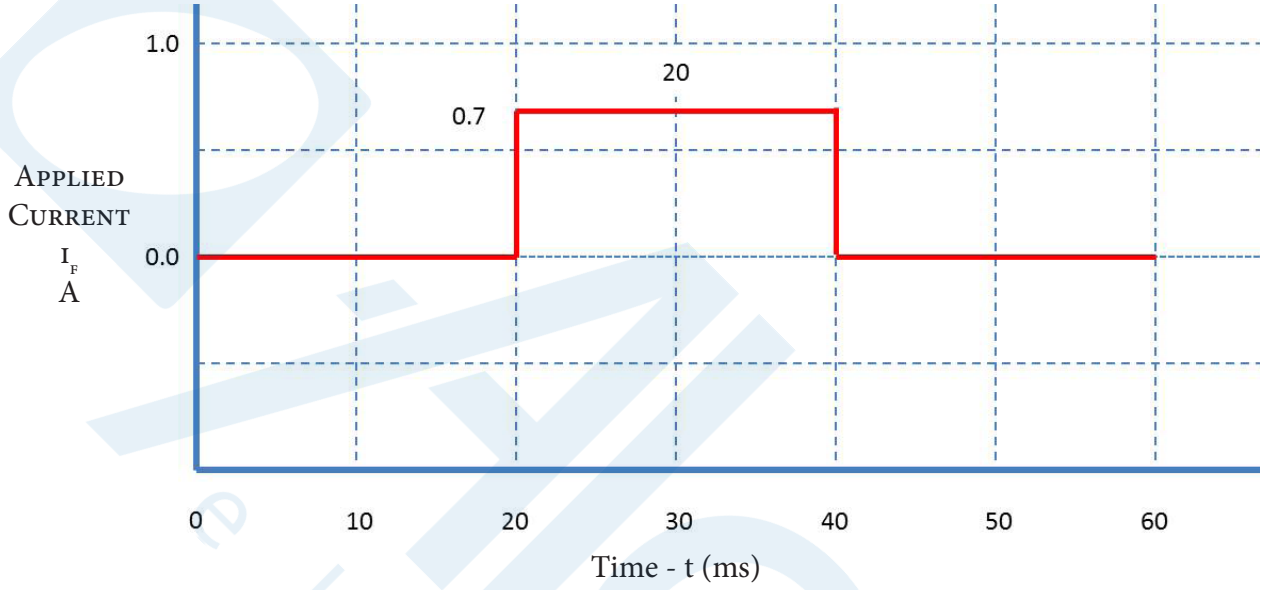
STANDARD TEST CONDITION

All performance metrics of the SFT-Series of LED's are characterized from a single current "PULSE" [1, 2, 3]
The pulse duration is 20ms, and the applied current is 0.7A.
Rise and Fall times of the signal are negligible.



Note 1: Environmental temperature is assumed to be Ambient. (25C typ)

Note 2: Due to the brief nature of this test, Tj (Junction Temperature) is assumed to be ambient or approx 25C.

Note 3: Luminus maintains a tolerance of +/- 6% on flux measurements

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Optical & Electrical Characteristics

General Characteristics		Symbol	Red -Amber	Converted Green	Blue*	Unit
Emitting Area			1.0	1.0	1.0	mm^2
Emitting Area Dimensions			1.0 x 1.0	1.0 x 1.0	1.0 x 1.0	mm x mm
Performance at Standard Test Conditions (See definition on p5)						
Peak Luminuous Flux [1,2,5]	typ	Φ_v	120	259	34	lm
Peak Radiometric Flux [1,2]	typ	Φ_r	0.42	0.55	0.88	W
Dominant Wavelength	min	λ_{dmin}	609	545	449	nm
	typ	λ_d	613	555	455	
	max	λ_{dmax}	621	565	461	
FWHM- Spectral bandwidth at 50% of Φv	typ		16	98	19	
Chromaticity Coordinates [6,7]	typ	x	0.66	0.33	0.14	CIE x
	typ	y	0.32	0.56	0.04	CIE y
Forward Voltage	min	$V_{F\,min}$	2.2	2.5	2.5	V
	typ	V_F	2.5	3.0	3.0	
	max	$V_{F\,max}$	3.0	3.6	3.6	
Correlated Performance in Typical Display Application ($2.5A/mm^2$ @ 40C) [Reference Only]. See curves starting on p8.						
Reference Drive Current	typ	I_F	2.5	2.5	2.5	A
Reference Duty Cycle	typ		25	50	25	%
Luminous Flux	typ	Φ_v	300	650	100	lm
Radiometric Flux	typ	Φ_r	1.1	1.4	2.0	W
Dominant Wavelength	typ	λ_d	613	555	453	nm
FWHM -Spectral bandwidth at 50% of Φv	typ		15	99	19	
Chromaticity Coordinates [6,7]	typ	x	0.66	0.32	0.14	
	typ	y	0.33	0.55	0.04	
Forward Voltage	typ	V_F	3.6	3.5	3.4	V

Note 1: All ratings are based on standard testing conditions unless specified otherwise.

Note 2: Parameters rated at Standard Test condition as defined on page 6.

Note 3: Duty Cycle used to specify device ratings under Pulsed operation. SFT-Series of LEDs can operate at duty cycles ranging from 1% to 100%. At higher duty cycles, drive current should be adjusted to maintain the junction temperature at desired levels to meet the application lifetime requirements.

Note 4: In pulsed operation, rise time from 10 to 90% of forward current should be larger than 0.5 microseconds.

Note 6: CIE 1931 chromaticity diagram coordinates, normalized to X+Y+Z=1.

Note 7: For Reference only.

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Optical & Electrical Characteristics

Absolute Maximum Ratings

	Symbol	Red - Amber	Converted Green	Blue	Unit
Absolute Minimum Current (CW or Pulsed)[1]		200	200	200	mA
Absolute Maximum Current (CW)[2]		2.5	3.0	3.0	A
Absolute Maximum Reverse Drive Drive Current (CW or Pulsed)		0, REVERSE CURRENT OPERATION IS NOT ALLOWED			
Absolute Maximum Current (Pulsed) [2,3] (Frequency > 240 Hz, duty cycle <70%)		3.0	4.0	4.0	
Absolute Maximum Surge Current [2,3] (Frequency > 240 Hz, duty cycle =10%, t= 1ms)		4.0	4.0	4.0	
Absolute Maximum Junction Temperature [4]	T_{jmax}	110	150	150	°C
Storage Temperature Range		-40 / +100	-40 / +100	-40 / +100	

Note 1: Product performance and lifetime data is specified at recommended forward drive currents. Sustained operation at or near absolute minimum currents may result in a reduction of device performance and device lifetime compared to recommended forward drive currents.

Note 2: Sustained operation above maximum currents is not recommended and will result in a reduction of device lifetime compared to specified maximum forward drive currents. Device lifetimes will depend on junction temperature. (See Reliability Application Note, APN-001444 for product lifetimes as function of junction temperature.) Please refer to lifetime de-rating curves (available from Luminus) for further information.

Note 3: In pulsed operation, rise time from 10 to 90% of forward current should be larger than 0.5 microseconds.

Note 4: Sustained operation at Absolute Maximum Operating Junction Temperature (T_{jmax}) will result in reduced device life time.

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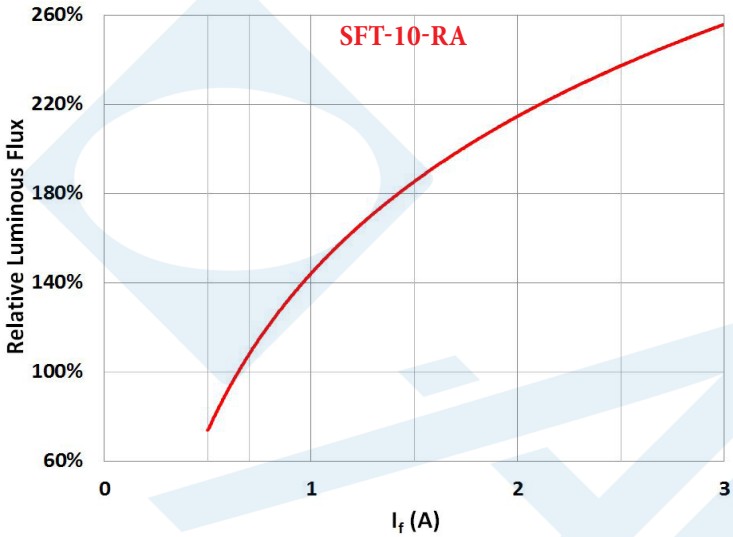
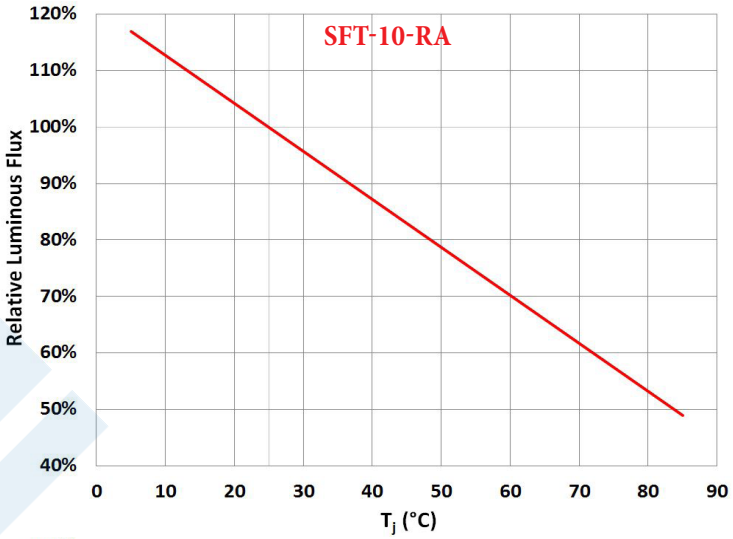
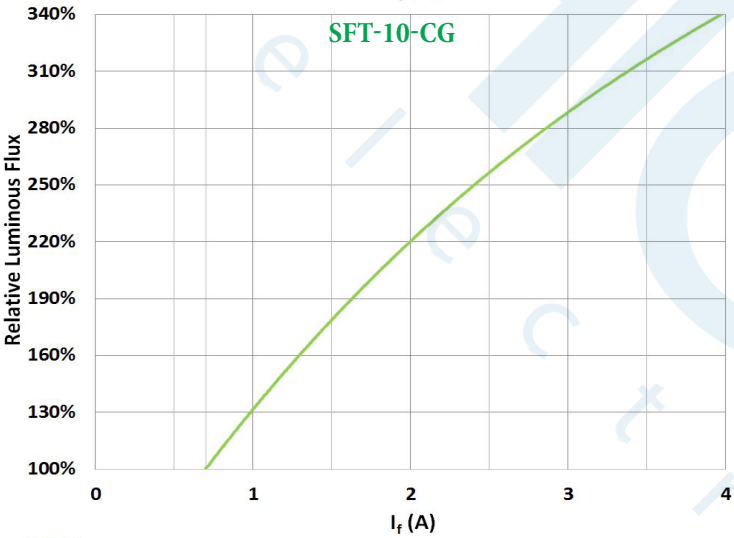
Normalized Luminous Flux

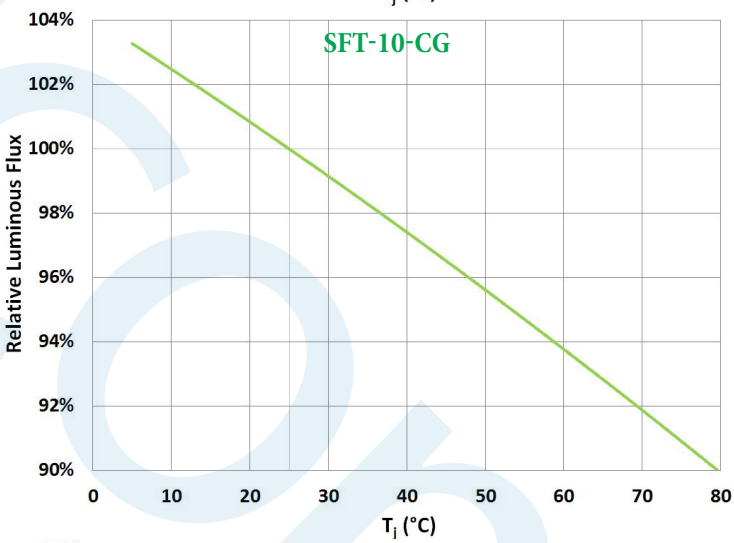
vs. Forward Current (T_{hs} = 25°C, I_f = Pulse)

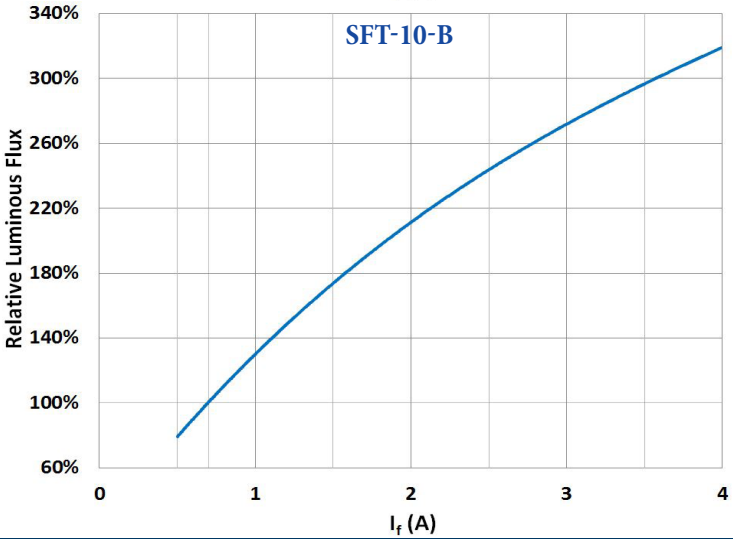


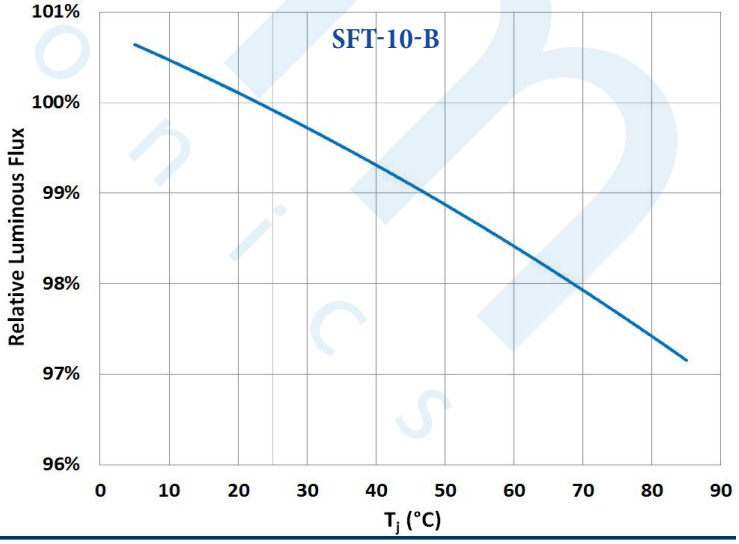
vs. Tj (I_f = 0.7A Pulse)











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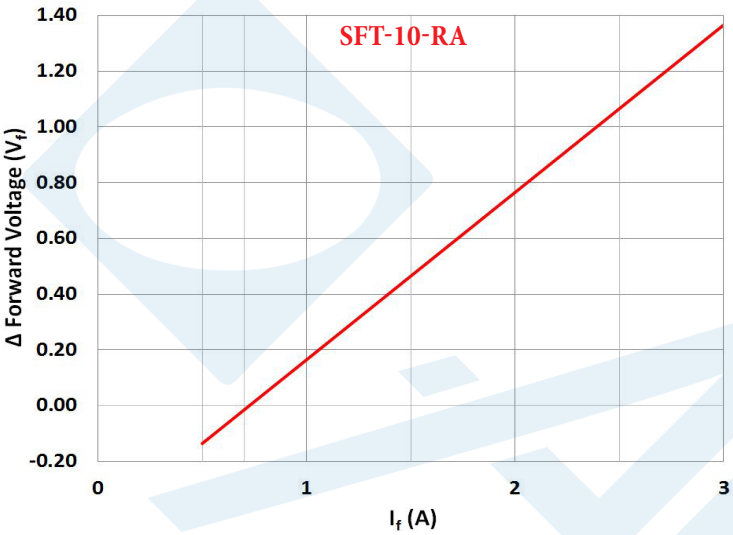
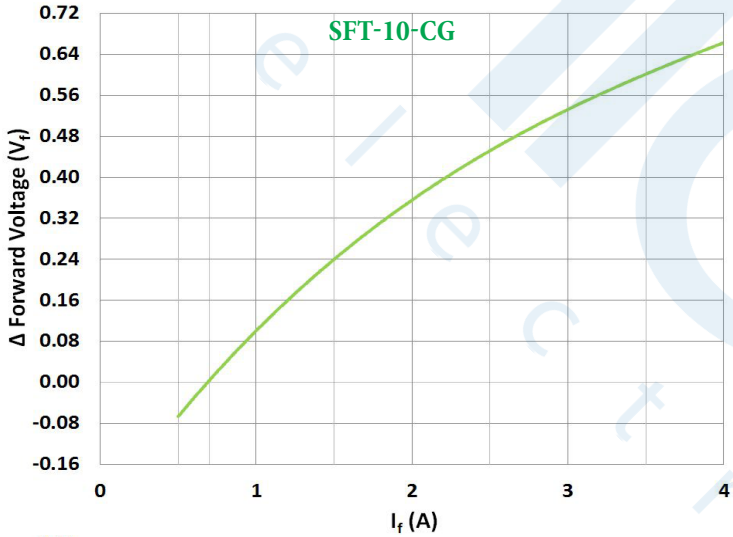
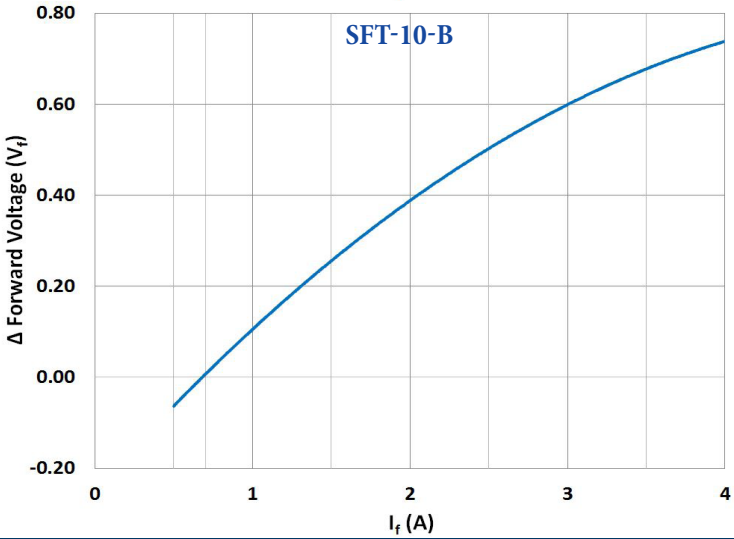
Relative Forward Voltage

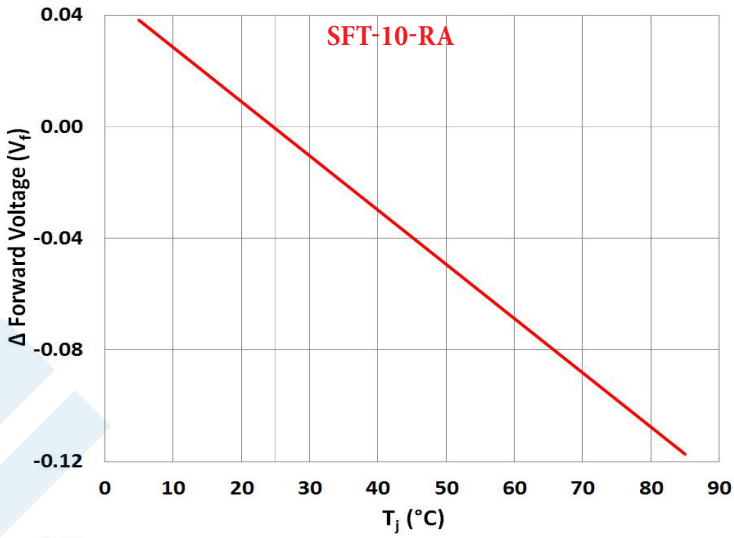
vs. Forward Current (T_{hs} = 25°C, I_f = Pulse)

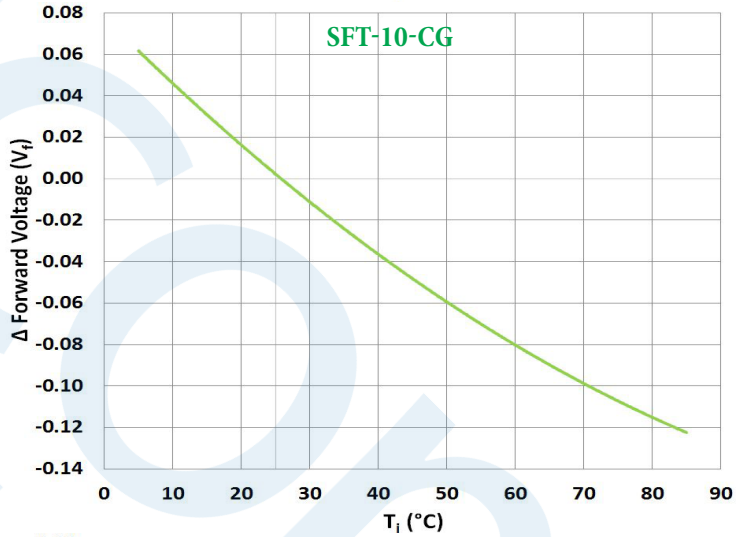


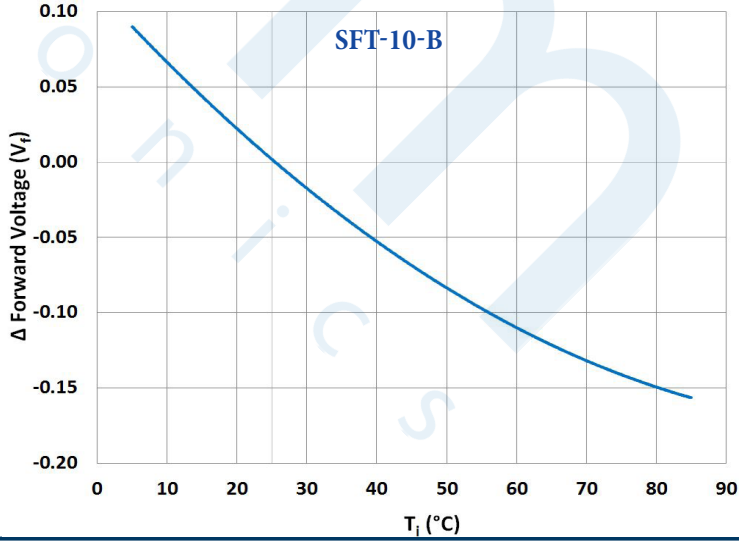




vs. Tj (I_f = 0.7A Pulse)







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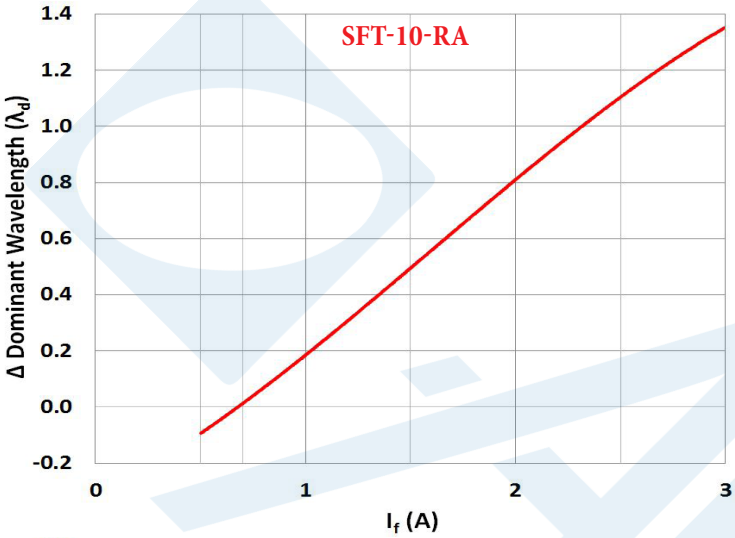
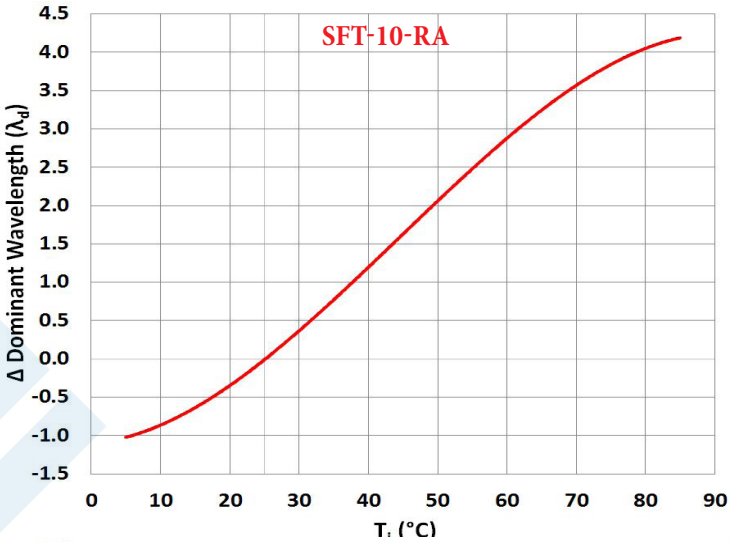
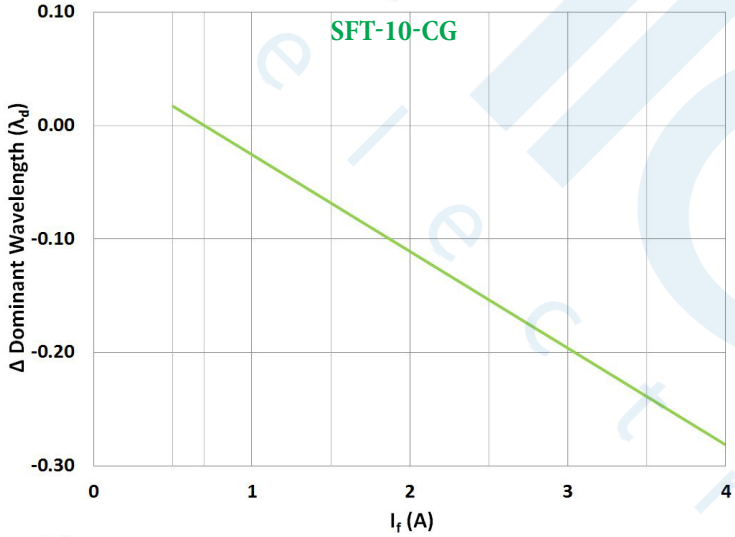
RELATIVE DOMINANT WAVELENGTH

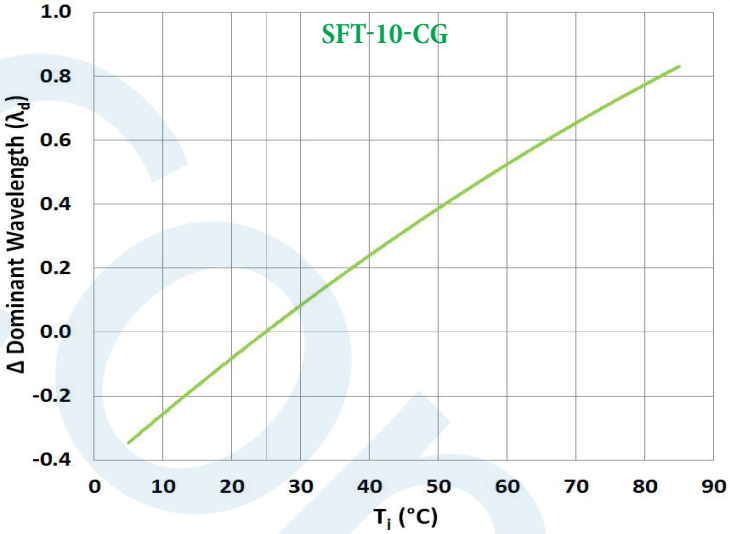
vs. Forward Current (T_{hs} = 25°C, I_f = Pulse)

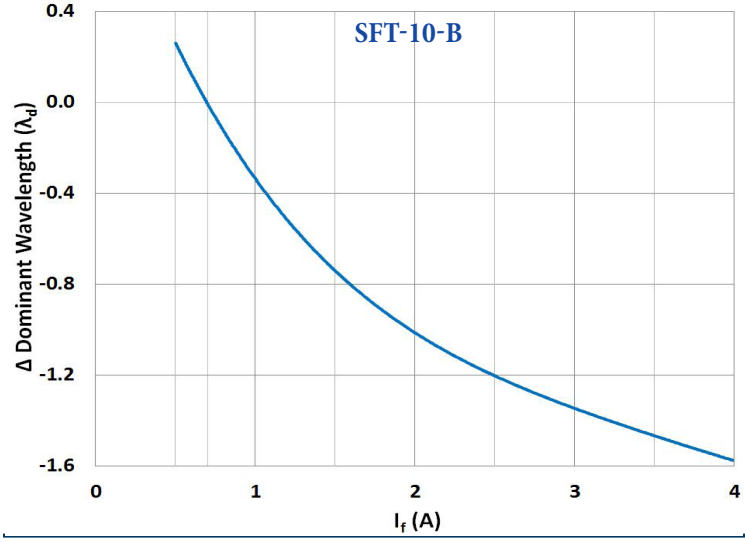


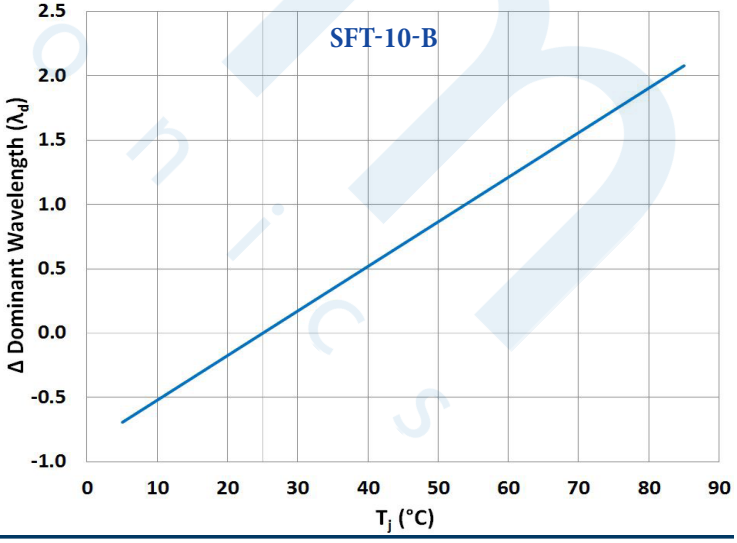
vs. Tj (I_f = 0.7A Pulse)











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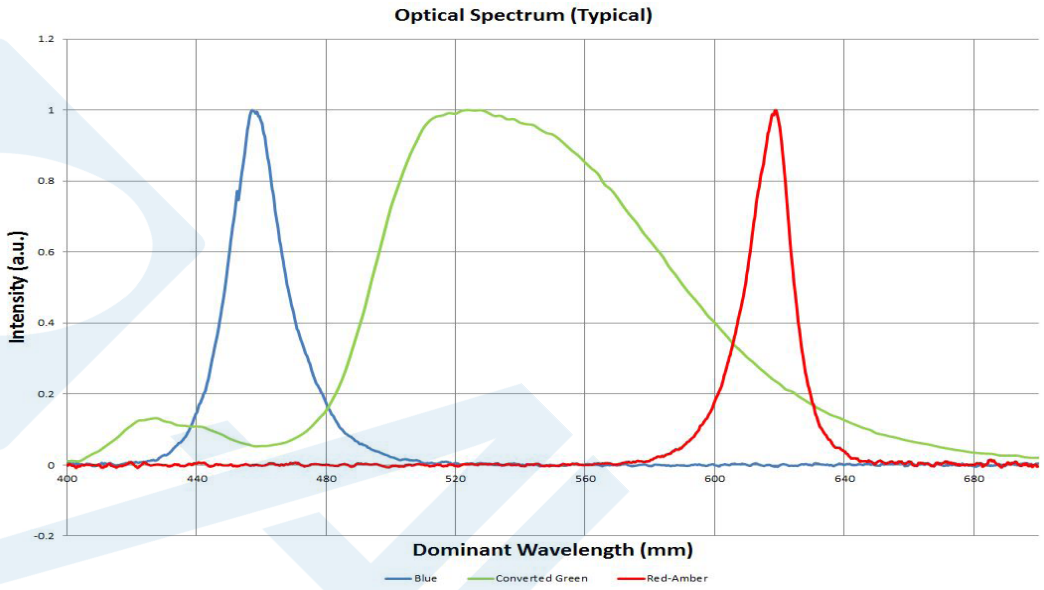
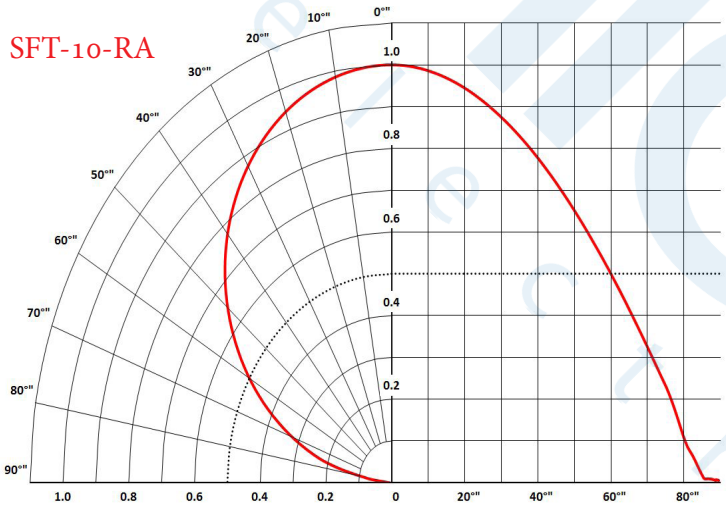
SFT-Series Optical Spectrum (Typical) [1]

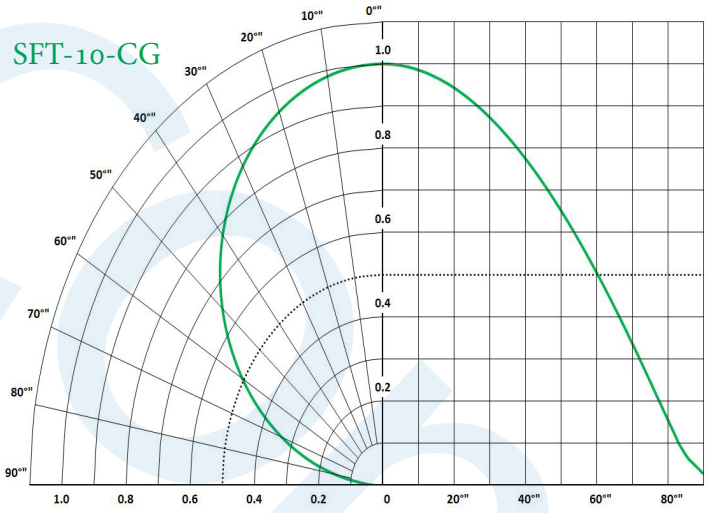


Angular Intensity Distribution (Typical) [1]

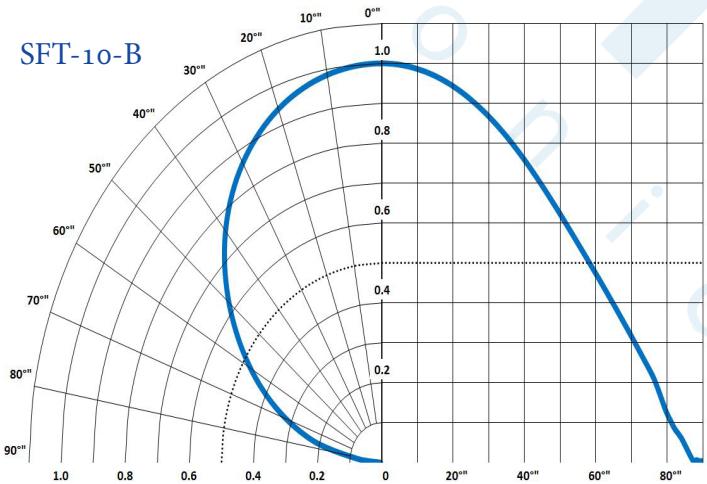
SFT-10-RA



SFT-10-CG



SFT-10-B



Note 1: Data is recorded using standard test conditions and tolerances as described on page 6.

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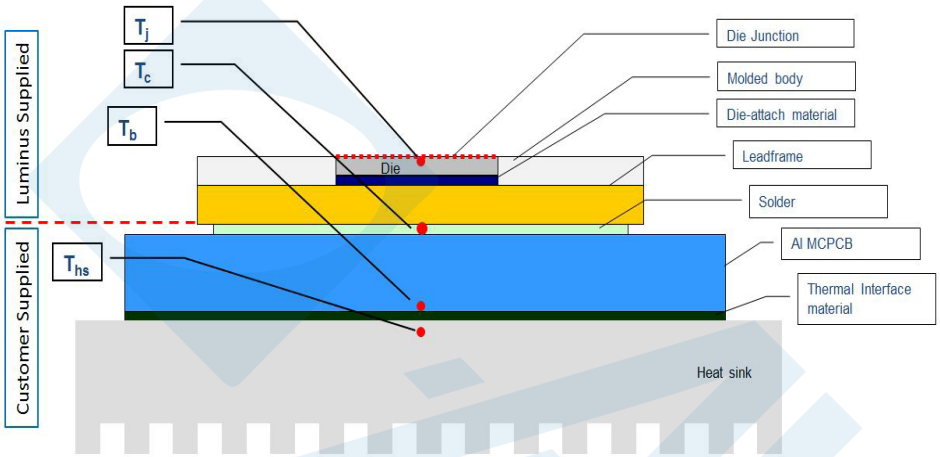
Thermal Resistance



Typical Thermal Resistance

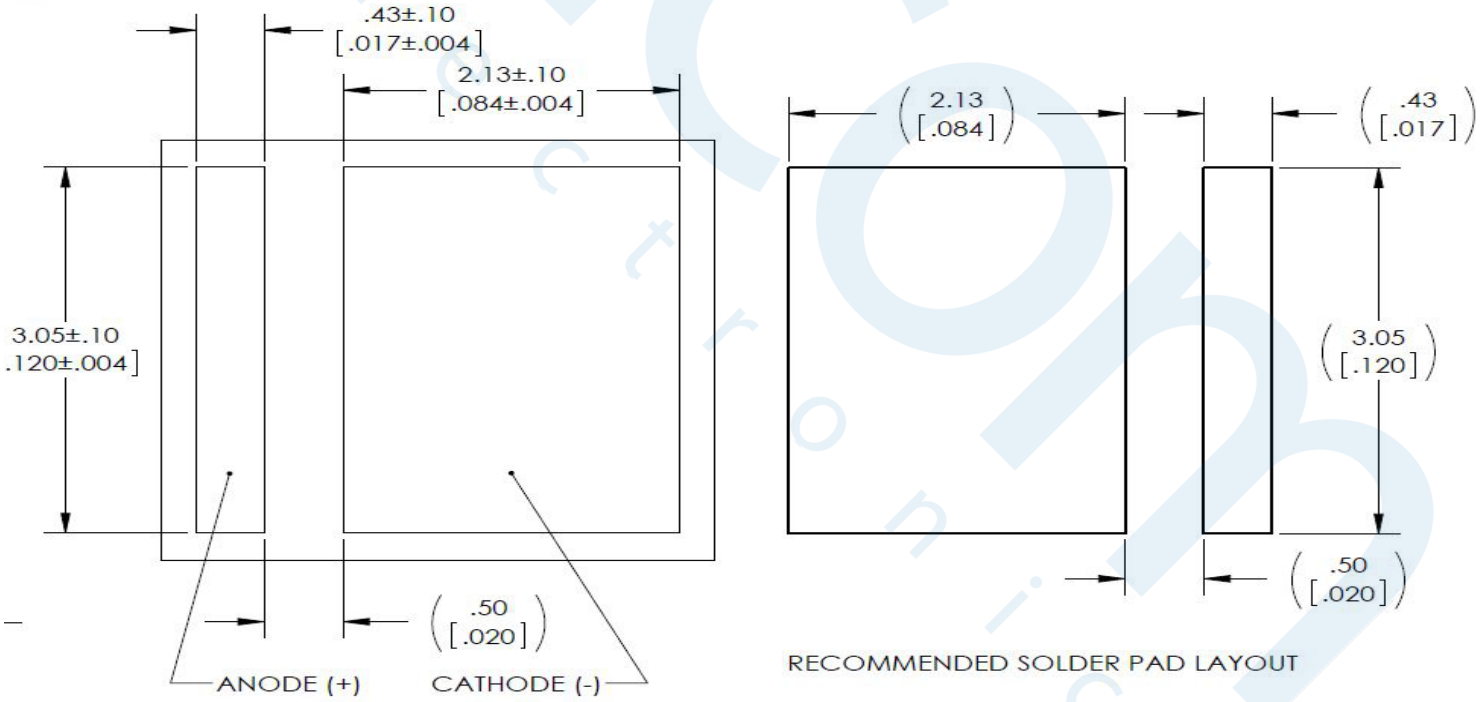
R_{J-C} [1, 2]	3.0° C/W

Note 1: Thermal resistance values are based on FEA model results correlated to measured $R_{\theta j\text{-}hs}$ data.

Note 2: System Thermal Characteristics will be dependent on customer-side thermal strategy.

Note 3: For optimal results, Luminus recommends customer PCB Design in accordance with suggestion provided by the Luminus application note, "Design Guidelines for SFT Chipset Assembly".

Electrical Pinout / Solder Pad Layout



Note: Layout is common to all colors.
For recommended solder profiles, see page 16

Optimal LED performance is dependent on a proper system design. Please review the Luminus application note, "Design Guidelines for SFT Chipset Assembly." Contact Luminus for more detail.

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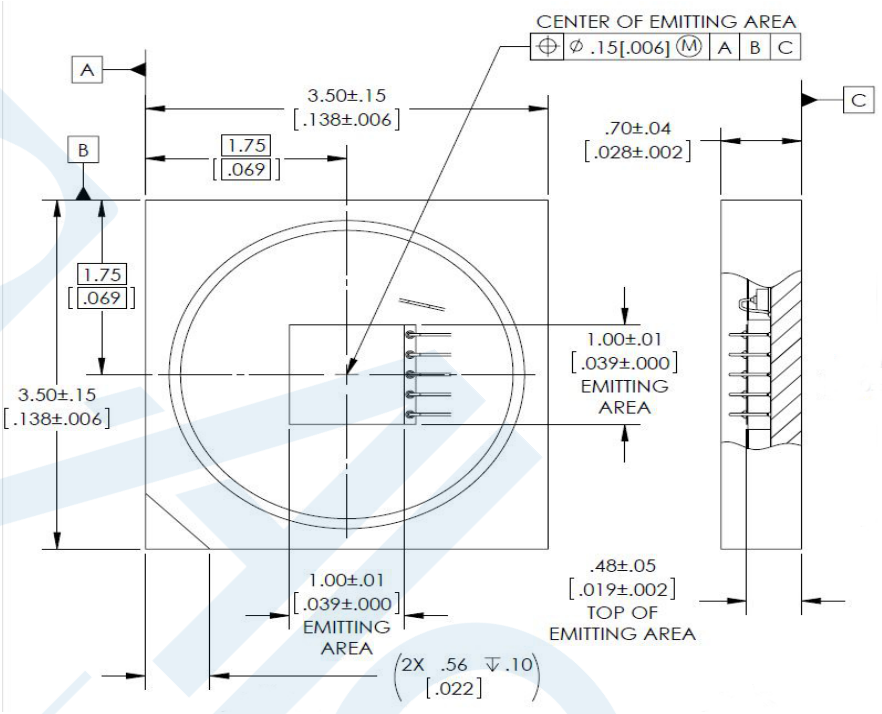
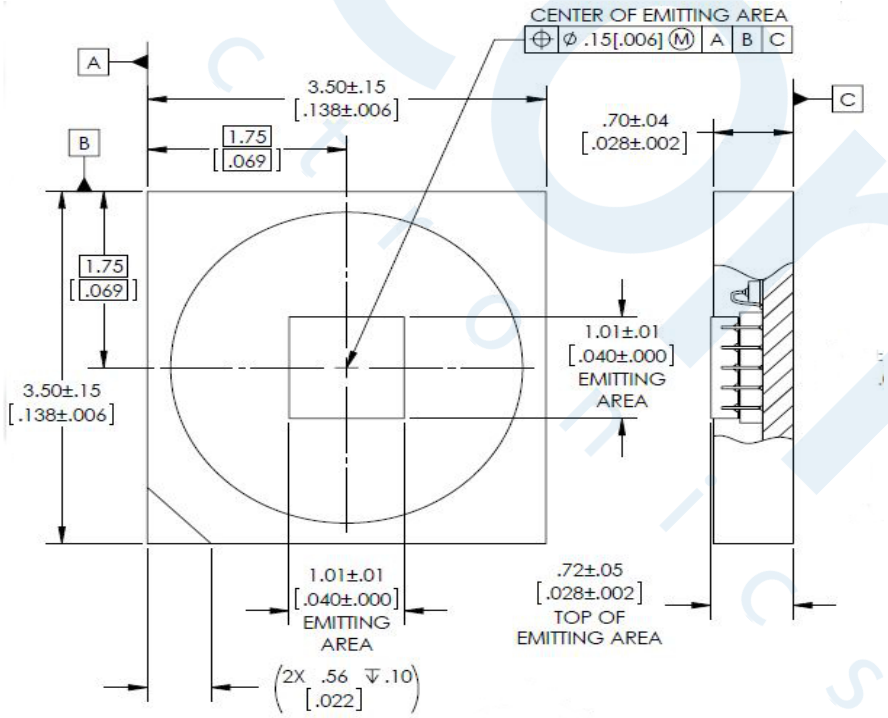
Mechanical Dimensions - SFT-10 [Red / Blue]



Mechanical Dimensions - SFT-10 [Converted Green]



Notes: Converted Green differs from RED/BLUE in only the emitting surface is slightly larger than the underlaying die.

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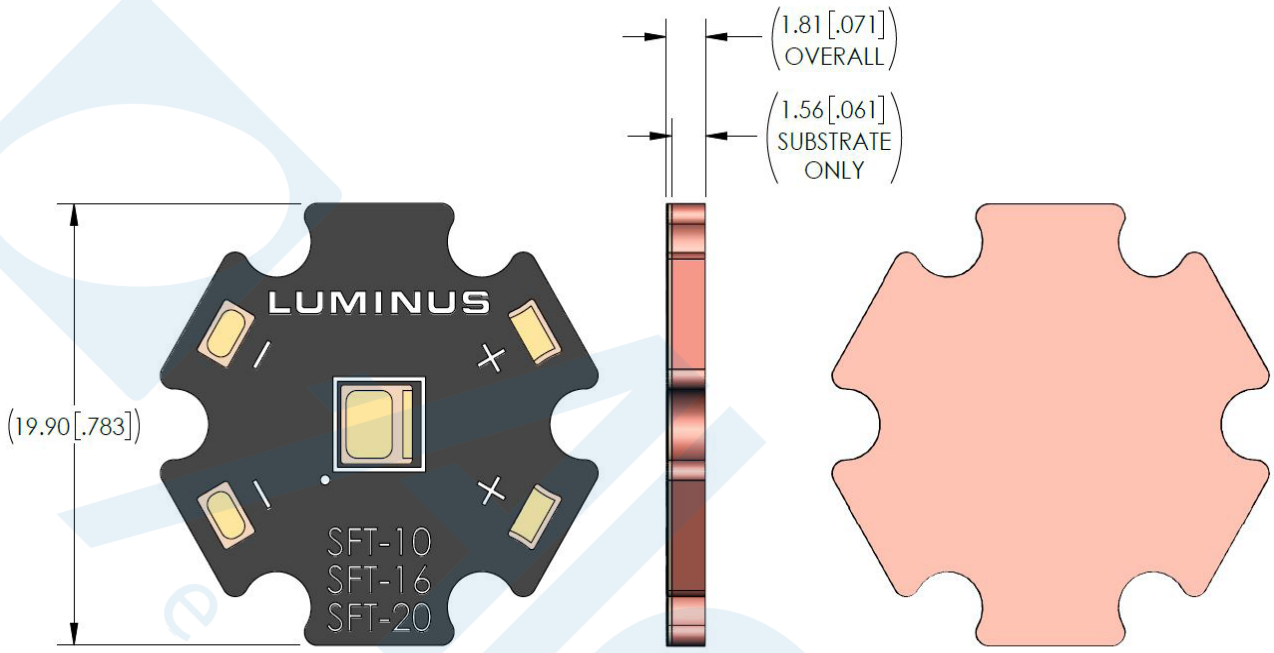
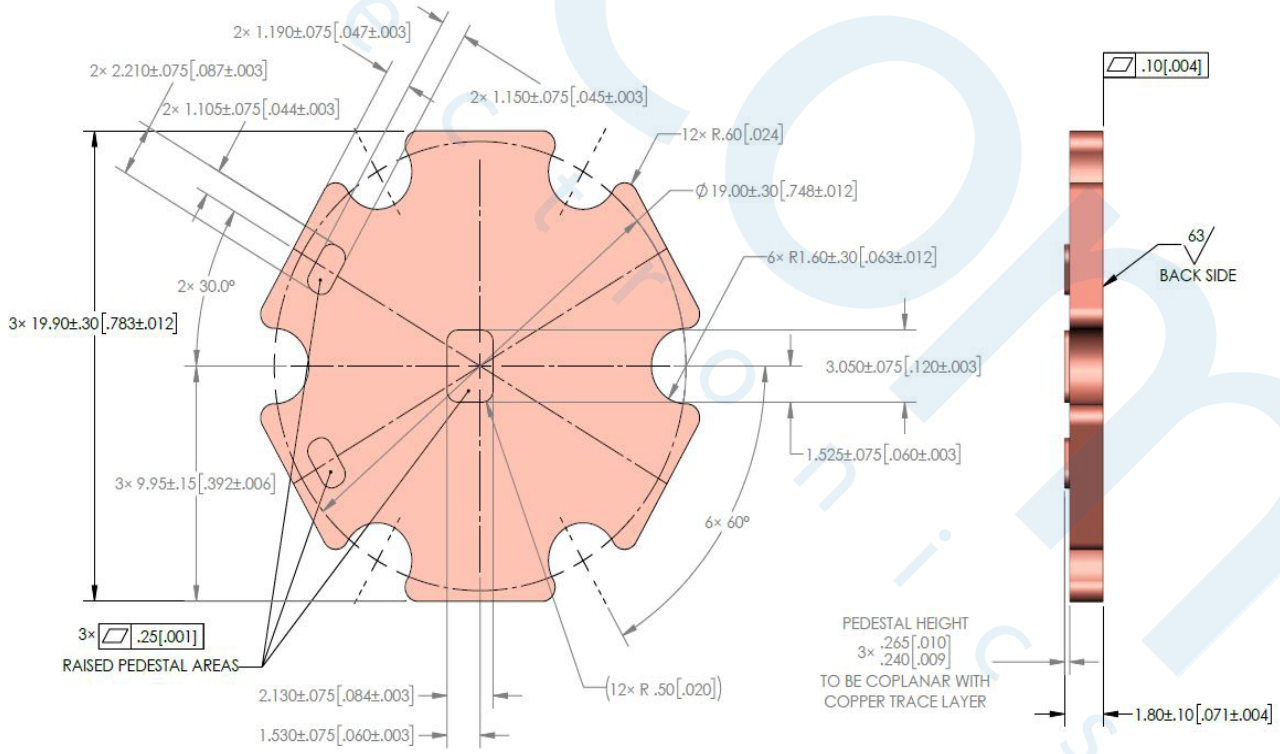
Mechanical Dimensions - "Starboard" Package Configuration





Notes:

Dimensions shown are of bare Starboard. For full detail, please see DWG 400845 available from your local Luminus represenative or web site.

This Starboard is not electrically isolated. It is active and connected to the LED cathode.

Starboard requires electrical isolation is most customer designs. Please see application note APN

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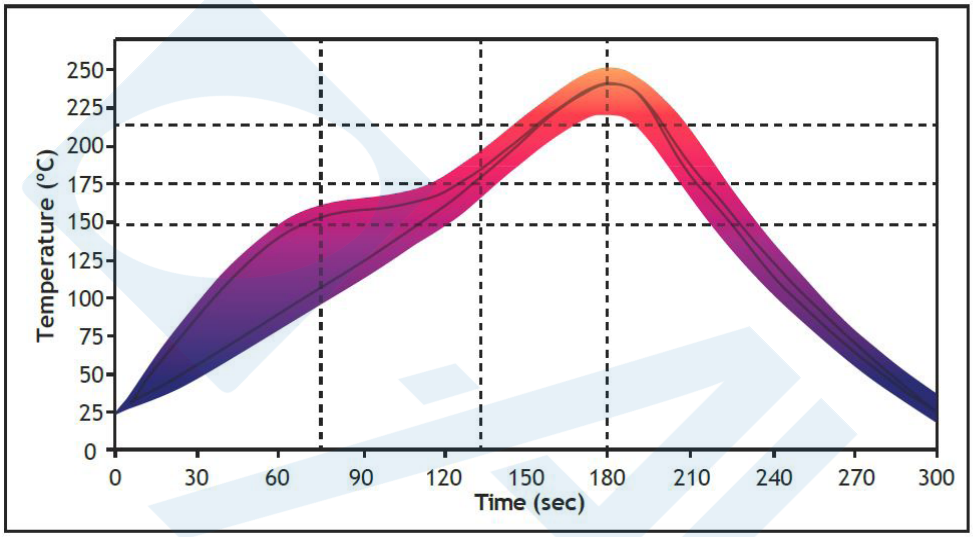
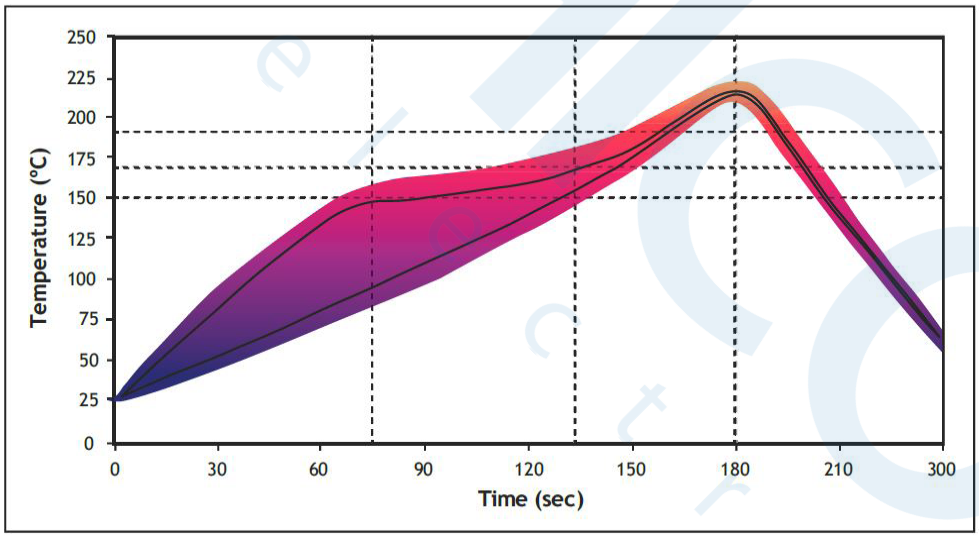
SOLDER PROFILE INFORMATION



SAC305 Solder Profile Graph



Sn63 & Sn62 Solder Profile Graph

SAC 305 and Sn63 & Sn62 Solder Profile			
Feature	**SAC 305**	**Sn63 & Sn62**	**Unit**
Ramp Up Rate Ambient to Preheat (min)	1.15	1	Degrees Celsius Per Second (°C/s)
Preheat Temperature	175	150	Degrees Celsius (°C)
Profile Length (Preheat to Peak)	165-210	165-210	Seconds (s)
Ramp Up Rate Preheat to Peak (min)	1.5	0.84	Degrees Celsius Per Second (°C/s)
Liquid Temperature	217	183	Degrees Celsius (°C)
Peak Temperature	235	225	Degrees Celsius (°C)
Time Above Liquid Temperature	30-60	30-60	Seconds (s)
Time Within 5C of Peak	20	10	Seconds (s)
Cool down Rate	<4	<4	Degrees Celsius Per Second (°C/s)
Cool Down Duration	30-60	30-60	Seconds (s)
25 C to peak Temperature	180	180	Seconds (s)

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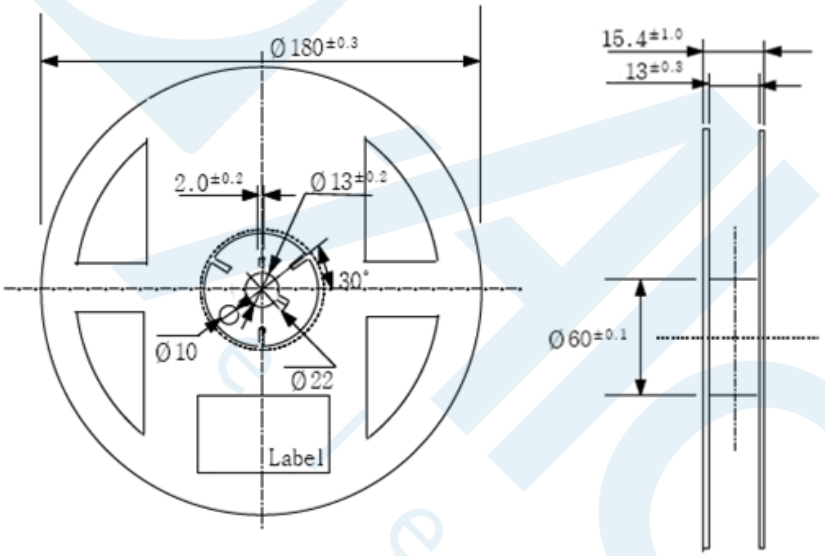
SHIPPING / PACKAGING INFORMATION

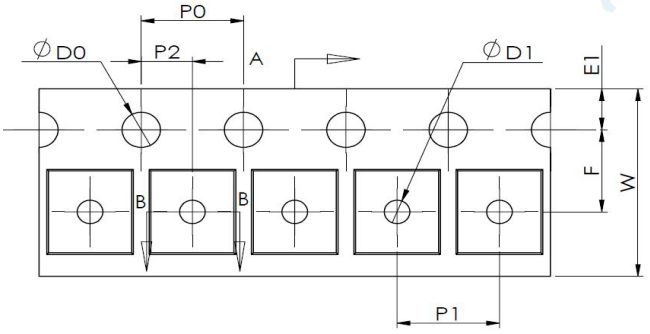
ITEM	Reel	Box	
		Packing Spec	Box Dimension
Packaging	250 pcs / Reel	5 reels per box = 1250 pcs per Box	225 x 245 x 65mm



Reel Diagram

Box Diagram

Tape Dimensioning Diagram and Table



Dimension	Spec (mm)
A0	3.80 +/- 0.10
B0	4.00 +/- 0.10
K0	1.20 +/- 0.10
P0	4.00 +/- 0.10
P1	8.00 +/- 0.10
P2	2.00 +/- 0.05
T	0.30 +/- 0.05
E1	1.75 +/- 0.10
F	5.50 +/- 0.05
D0	1.55 +/- 0.05
D1	1.55 +/- 0.05
W	12.00 +/- 0.01

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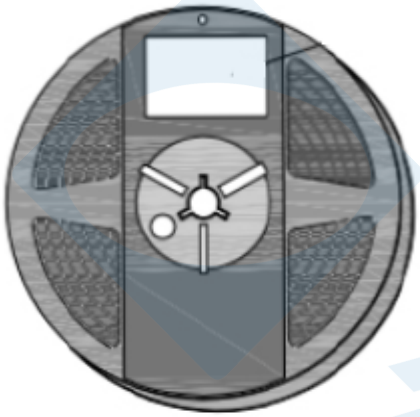
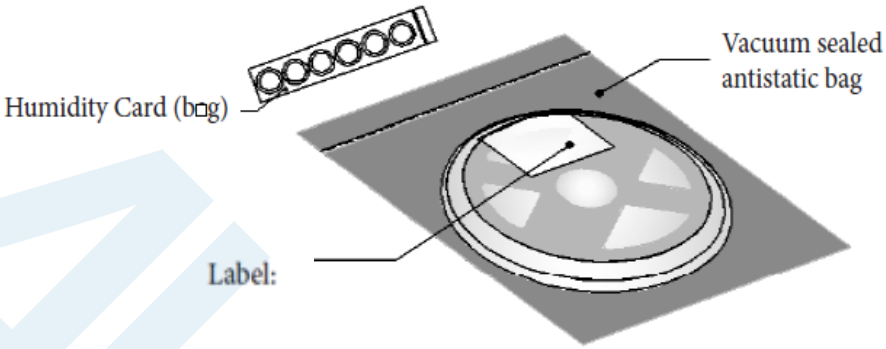
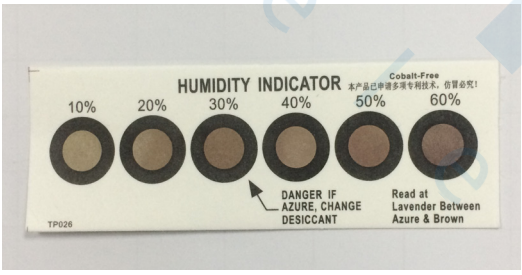
REEL PACKAGING



Desiccant (bag)





HUMIDITY CARD

The Humidity Indicator is included within each Anti-static bag. If Humidity indicator is triggered replace desiccant and/or pre-bake prior to system assembly.

LDI recommends all SFT-series LED are stored "SEALED" until time of use. See Application Note.

LABEL

LUMINUS

CPN: SFT-10-B-F35

MPN: 113148

QTY: 250

BIN INFO	
Flux:	4A
Voltage:	V1
Color:	B

MFG INFO
Rev: 01
Lot#: TOR-1607034

RoHS Compliant

Label Fields:

- **CPN:** Customer orderable Part Number (as defined on P3)
- **MPN:** Manufacturer Part Number (Internal Luminus use)
- **QTY:** Quantity of Devices
- **Bin/Flux:** Flux Bin
- **Bin/Voltage:** Vf Bin (Internal Luminus use)
- **Bin/Color:** Color or Wavelength
- **MFG INFO:** Luminus Internal Use

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History of Changes

Rev		Description of Change
1	07/21/2017	Release version Removed "Preliminary" Updated flux and wavelength bin tables
2	11/22/2017	Ordering information updated

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CBT-90 LEDs

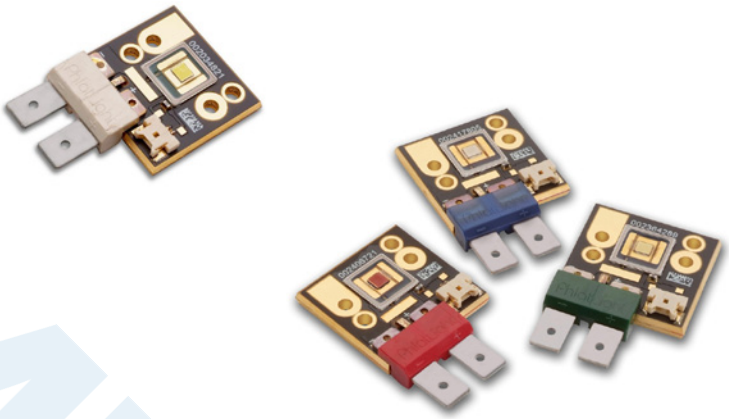

Table of Contents

Features:

- Extremely high optical output:
  Over 1,800 White Lumens
  Over 810 Red Lumens
  Over 1,800 Green lumens
  Over 450 Blue Lumens
- High thermal conductivity package - junction to heat sink thermal resistance of only 0.9 2°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 60,000 hours
- Variable drive current: less than 1 A through 13.5 A for white and 22.5 A for RGB
- Environmentally friendly: RoHS compliant

Applications

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

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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 0.92° C/W, Luminus CBT-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 (3.15 A, 9.0 A, 13.5 A, 22.5 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 from less than 1A to 22.5A, and duty cycle from <1% to 100%), multiple drive conditions are listed.

CBT-90 White and RGB LEDs are production tested at 9.0 A and 13.5 A respectively. The values shown at other current conditions such as 3.15 A and 22.5 are for additional reference at other possible drive conditions.

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CBT-90 White Binning Structure

CBT-90 white 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:

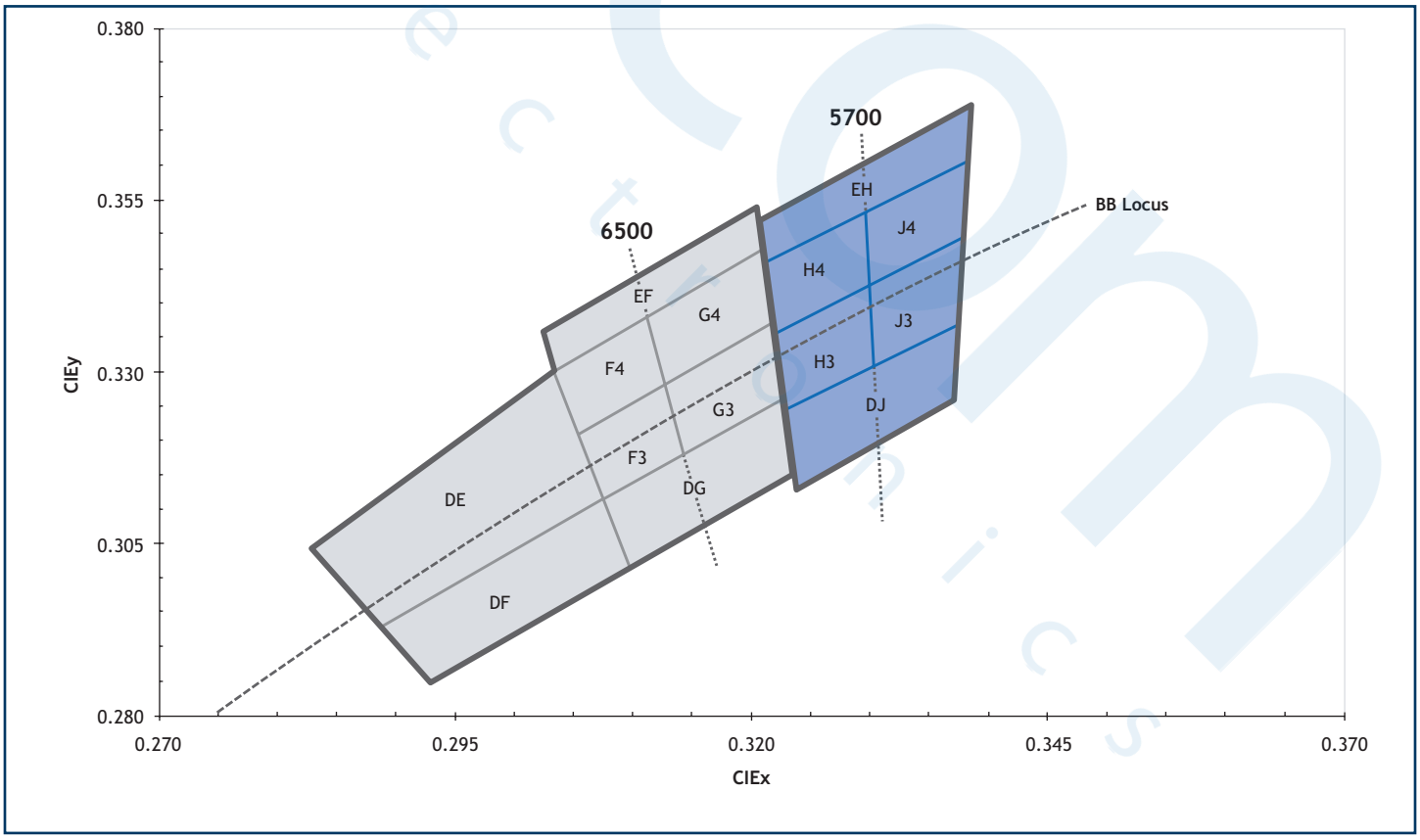
Flux Bins

Color	Flux Bin (FF)	Minimum Flux (lm) at 9.0A	Maximum Flux (lm) at 9.0A
W65S 6500K, Standard CRI (typ. 70)	MA	1,380	1,485
	MB	1,485	1,590
	NA	1,590	1,710

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

Chromaticity Bins

Luminus' Standard Chromaticity Bins: 1931 CIE Curve



PDS-001230 Rev 08

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CBT-90 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.

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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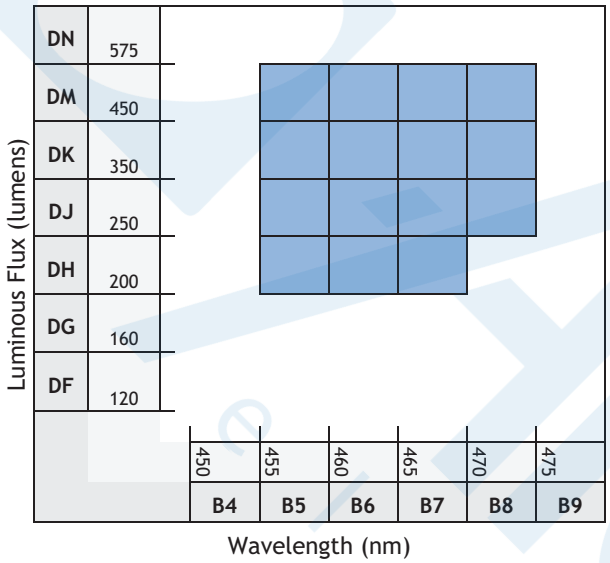
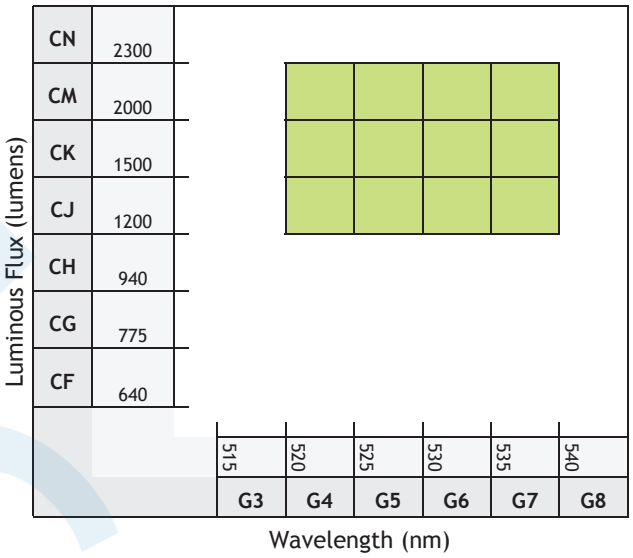
CBT-90 Red/Green/Blue Bin Structure

CBT-90 RGB LEDs are specified for luminous flux and wavelength at a drive current of 13.5 A (1.5 A/mm^2) and placed into one of the following luminous flux (FF) and wavelength (WW) bins:

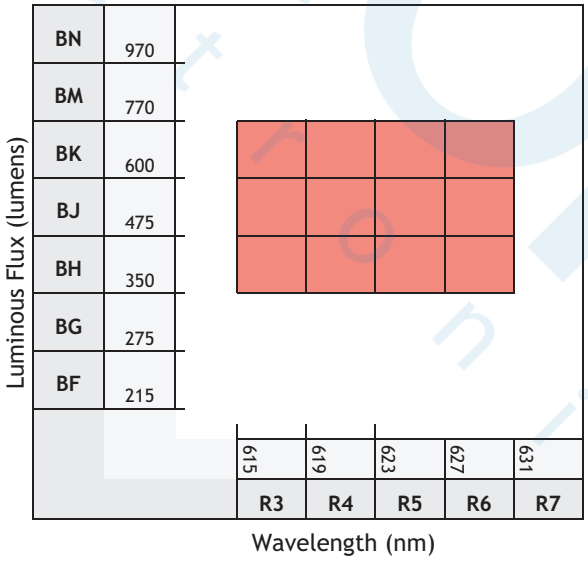
Blue Bins



Green Bins



Red Bins



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

Note 2: Only specific bins are available for large orders, contact Luminus sales team for more information.

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Product Shipping & Labeling Information

All CBT-90 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:

CBT-90 White

CBT — 90 — WNNX — C11 — FF — WW

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Chromaticity Bin
CBT: Chip on Board (window)	90: 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

Example 1:
The part label CBT-90-W65S-C11-LA-G4 refers to a 6500K standard CRI white, CBT-90 emitter, with a flux range from 1,200 to 1,290 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).

CBT-90 Red/Green/Blue

CBT — 90 — X — C11 — FF — WW

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Wavelength Bin
CBT: Chip on Board (window)	90: 9.0 mm^2	R: Red G: Green B: Blue	Internal Code	See page 5 for bins	See page 5 for bins

Note 2: Some flux and chromaticity/ wavelength bins may have limited availability. Application specific bin kits, consisting of multiple bins, may be available.
For ordering information, please refer to page 17 and reference PDS-001694: CBT-90 Binning & Labeling document.

Example 2:
The part number CBT-90-R-C11-BK-R4 refers to a red, CBT-90 module, with a flux range of 770-970 lumens and a wavelength range of 619 nm to 623 nm.

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CBT-90 White Electrical Characteristics[1]

Optical and Electrical Characteristics ($T_{heat\ sink}$ = 40 °C)

Drive Condition[2]		3.15 A Continuous	9.0 A Continuous	13.5 A Continuous	
Parameter	Symbol	Typical Values at Indicated Current[3]	Values at Test Currents	Typical Values at Indicated Current[3]	Unit
Current Density	j	0.35	1.0	1.5	A/mm²
Forward Voltage	$V_{F,min}$		2.9		V
	$V_{F,typ}$	3.2	3.6	3.7	V
	$V_{F,max}$		4.3		V

Common Characteristics

Parameter	Symbol	Values	Unit
Emitting Area		9.0	mm²
Emitting Area Dimensions		3 x 3	mm×mm
Color Temperature[4]	CCT	6,500	K
Color Rendering Index (Typical)	R_a	70	
Dynamic Resistance	Ω_{dyn}	0.050	Ω
Forward Voltage Temperature Coefficient[4]		-5.47	mV/°C

Absolute Maximum Ratings

Parameter	Symbol	Values	Unit
Maximum Current[5]		18.0	A
Maximum Junction Temperature[6]	T_{j-max}	150	°C
Storage Temperature Range		-40/+100	°C

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

Note 2: Listed drive conditions are typical for common applications. CBT-90 white devices can be driven at currents ranging from 1A to 13.5A 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 +/- 0.01.

Note 5: Forward voltage temperature coefficient at current density of 1.0 A/mm². Contact Luminus for value at other drive conditions.

Note 6: CBT-90 White LEDs are designed for operation to an absolute maximum forward drive current density of 2.0 A/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 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.

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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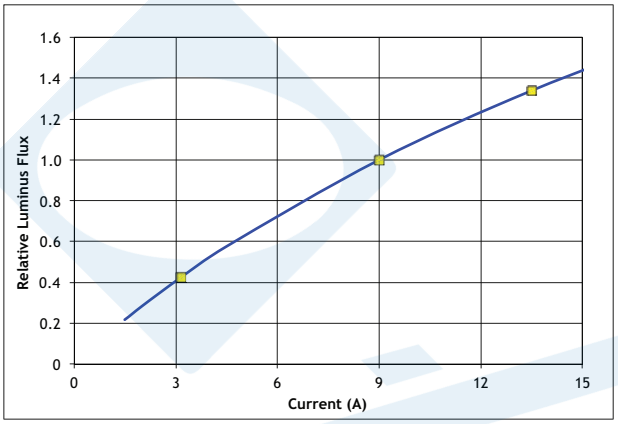
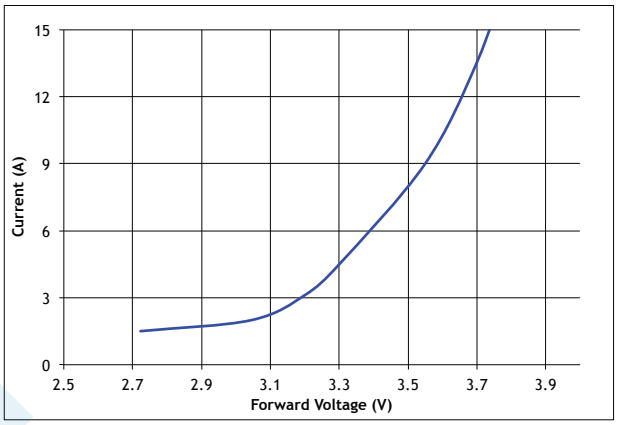
CBT-90 White Optical & Electrical Characteristics[1]

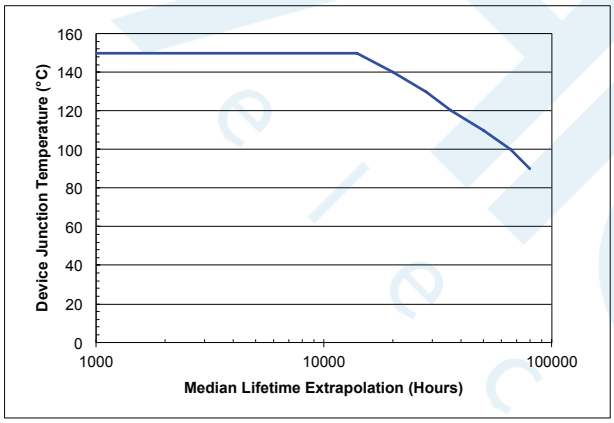
Relative Output Flux vs. Forward Current[1]



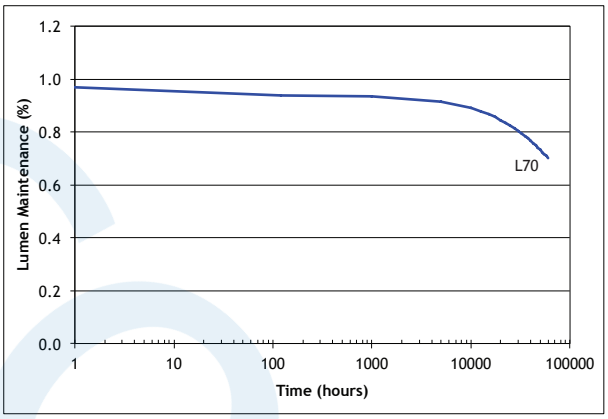
Forward Current vs. Forward Voltage



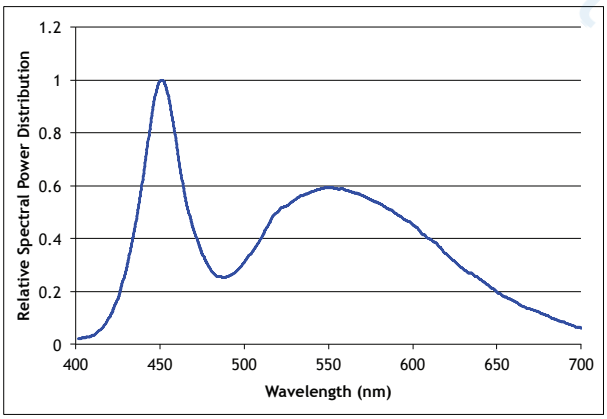
Mean Lifetime[2]



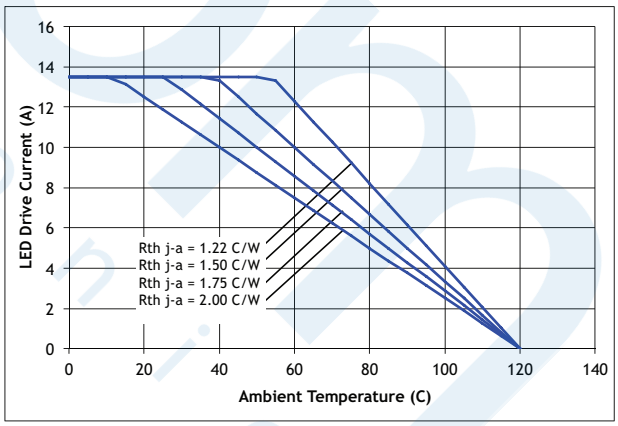
Lumen Maintenance vs. Time[3]



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 1.0 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 1.0 A/mm² in continuous operation with junction temperatures of 130 °C.*

Note 4: *Typical spectrum at current density of 1.0 A/mm² in continuous operation.*

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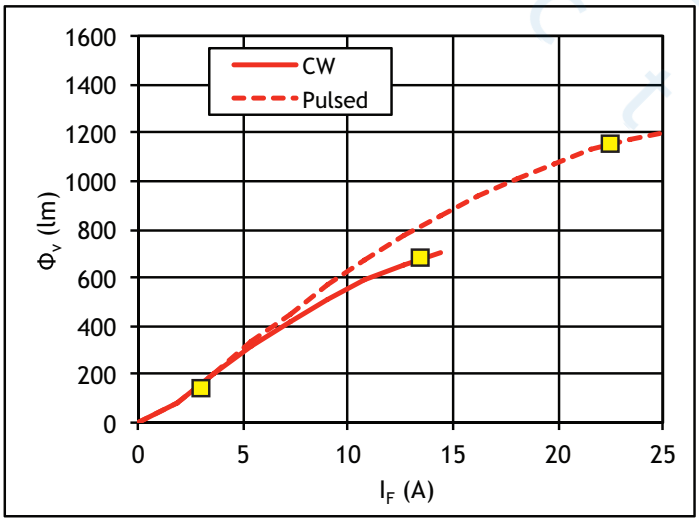
CBT-90 Red/Green/Blue Optical & Electrical Characteristics

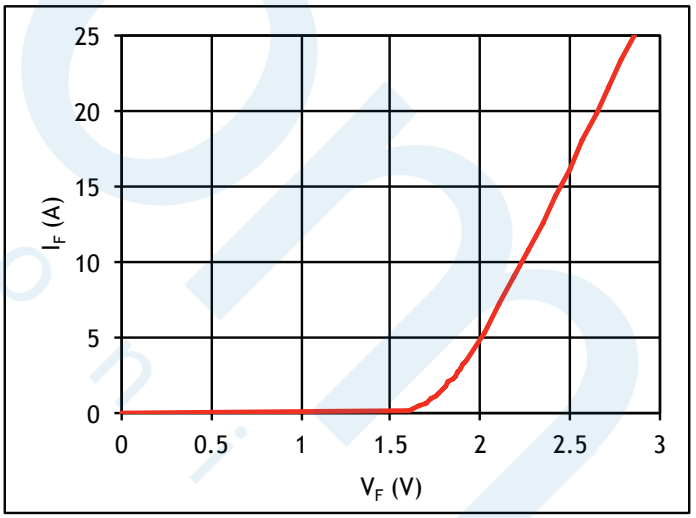
($T_{heat\ sink}$ = 40°C)[1]

Red					
Drive Condition[2]		3.2 A Continuous	13.5 A Continuous	22.5 A Pulsed 50% D.F.[3]	
Parameter	Symbol	Values[4]			Unit
Current Density	J	0.35	1.5	2.5	A/mm²
Forward Voltage	V_F min		2.0		V
	V_f	1.8	2.4	2.7	V
	V_F max		3.0		V
Luminous Flux[5]	$\Phi_{V\,typ}$	170	650	1150	lm
Radiometric Flux	Φ_R	TBD	3.9	TBD	W
Luminous Efficacy	η	26	20	18	lm/W
Dominant Wavelength[6]	λ_d	624	624	623	nm
Peak Wavelength	λ_p	625	628	629	nm
FWHM	$\Delta\lambda_{1/2}$	16	19	20	nm
Chromaticity Coordinates[7,8]	x	0.695	0.699	0.702	-
	y	0.305	0.301	0.298	-

Relative Output Flux vs. Forward Current[1]



Forward Current vs. Forward Voltage



Yellow squares indicate reference drive conditions

Notes: See page 12

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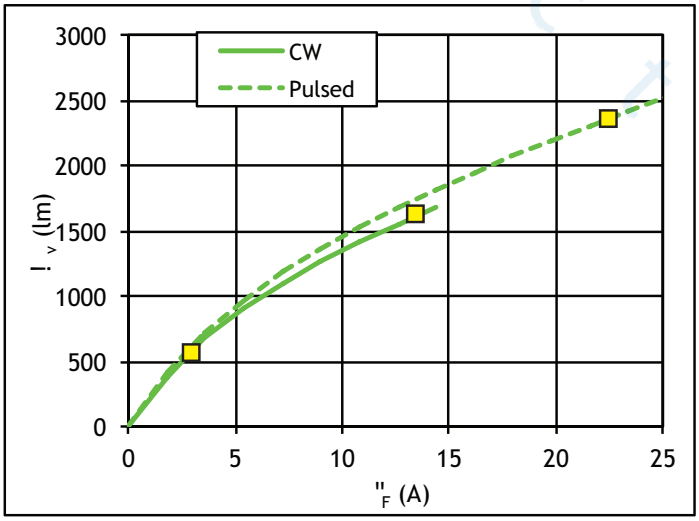
CBT-90 Red/Green/Blue Optical & Electrical Characteristics

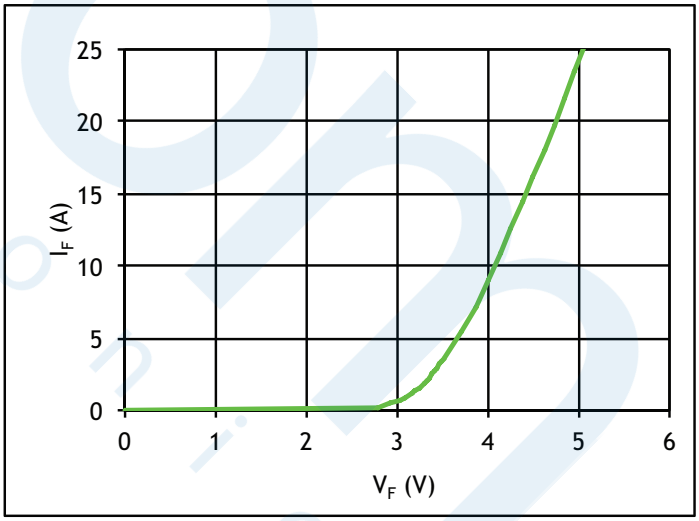
($T_{heat\ sink}$ =40°C)[1]

Green					
Drive Condition[2]		3.2 A Continuous	13.5 A Continuous	22.5 A Pulsed 50% D.F.[3]	
Parameter	Symbol	Values[4]			Unit
Current Density	J	0.35	1.5	2.5	A/mm²
Forward Voltage	V_F min		3.6		V
	V_f	3.5	4.3	4.9	V
	V_F max		5.3		V
Luminous Flux[5]	Φ_V	600	1,650	2,350	lm
Radiometric Flux	Φ_r	TBD	3.7	TBD	W
Luminous Efficacy	η	55	28	21	lm/W
Dominant Wavelength[6]	λ_d	535	529	526	nm
Peak Wavelength	λ_p	530	524	521	nm
FWHM	$\Delta\lambda_{1/2}$	35	39	40	nm
Chromaticity Coordinates[7,8]	x	0.205	0.175	0.161	-
	y	0.740	0.730	0.722	-

Relative Output Flux vs. Forward Current[1]



Forward Current vs. Forward Voltage



Yellow squares indicate reference drive conditions

Notes: See page 12

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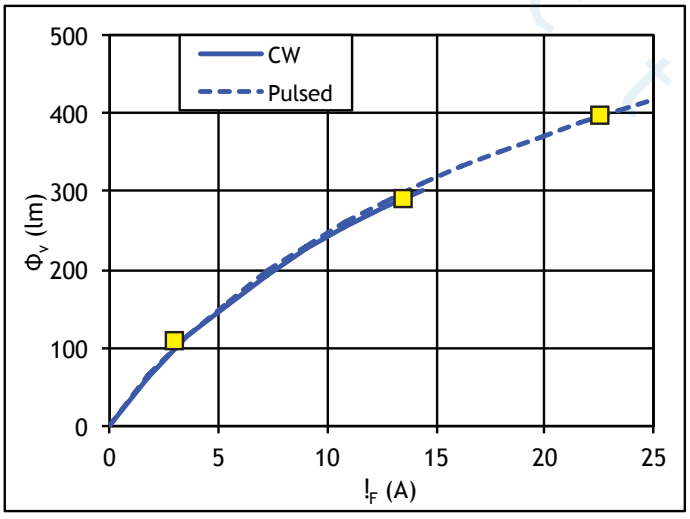
CBT-90 Red/Green/Blue Optical & Electrical Characteristics

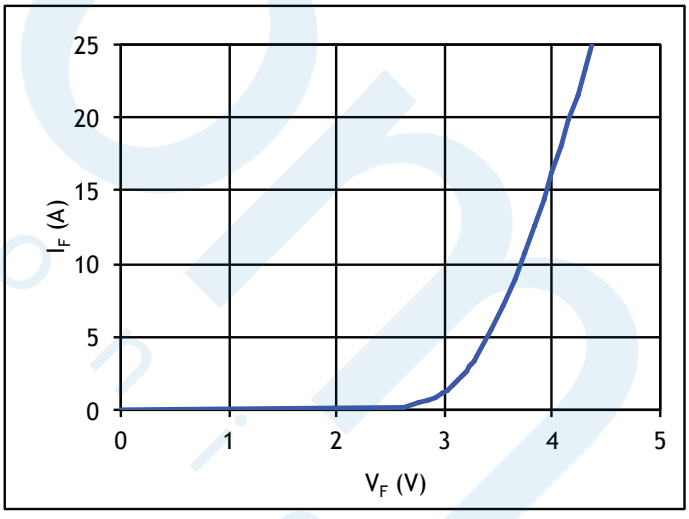
($T_{heat\ sink}$ = 40°C)[1]

Blue					
Drive Condition[2]		3.2 A Continuous	13.5 A Continuous	22.5 A Pulsed 50% D.F.[3]	
Parameter	Symbol	Values[4]			Unit
Current Density	J	0.35	1.5	2.5	A/mm²
Forward Voltage	$V_{F\ min}$		3.2		V
	V_f	3.4	3.9	4.5	V
	$V_{F\ max}$		4.8		V
Luminous Flux[5]	$\Phi_{V\ typ}$	100	310	400	lm
Radiometric Flux	Φ_r	TBD	6.7	TBD	W
Luminous Efficacy	η	11	6	5	lm/W
Dominant Wavelength[6]	λ_d	464	464	462	nm
Peak Wavelength	λ_p	459	460	460	nm
FWHM	$\Delta\lambda_{1/2}$	22	25	27	nm
Chromaticity Coordinates[7,8]	x	0.142	0.142	0.142	-
	y	0.036	0.038	0.038	-

Relative Output Flux vs. Forward Current[1]



Forward Current vs. Forward Voltage



Yellow squares indicate reference drive conditions

Notes: See page 12

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CBT-90 Red/Green/Blue Reference Optical & Electrical Characteristics ($T_{heat\ sink}$ = 40 °C)[1]

Common Characteristics

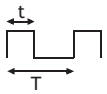
	Symbol	Red	Green	Blue	Unit
Emitting Area		9.0	9.0	9.0	mm^2
Emitting Area Dimensions		3.0x3.0	3.0x3.0	3.0x3.0	mmxmm
Dynamic Resistance	Ω_{dyn}	0.03	0.04	0.02	Ω
Thermal Coefficient of Photometric Flux		-0.96	-0.18	-0.007	%/ °C
Thermal Coefficient of Radiometric Flux		-0.52	-0.20	-0.17	%/ °C
Thermal Coefficient of Junction Voltage		-1.3	-4.6	-3.5	mV/ °C

	Symbol	Red	Green	Blue	Unit
Maximum Current		27	27	27	A
Maximum Junction Temperature	T_{jmax}	125	150	150	°C
Storage Temperature Range		-40/+100	-40/+100	-40/+100	°C

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

Note 2: *Listed drive conditions are typical for common applications. CBT-90 RGB devices can be driven at currents ranging from <1 A to 13.5 A 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: *Current Density of 2.5 A/mm^2. Rated at 50% duty cycle and Pulsed operation frequency of f>360Hz;* $DC = \frac{t}{T}$



Note 4: *Unless otherwise noted, values listed are typical. Devices are production tested and specified at 13.5 A. Values at 3.2 A and 22.5 A are for reference only.*

Note 5: *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 6: *Minimum and Maximum Dominant Wavelengths are based on typical values +/- 5nm for Red, +/- 8nm for Green and +/- 6nm for Blue.*

Note 7: *In CIE 1931 chromaticity diagram coordinates, normalized to X+Y+Z=1.*

Note 8: *For reference only.*

Note 9: *CBT-90 RGB LEDs 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 10: *Lifetime dependent on LED junction temperature. Input power and thermal system must be properly managed to ensure lifetime. See charts on pg 13 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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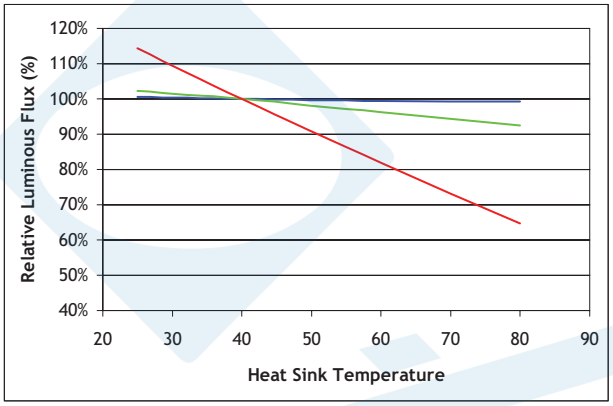
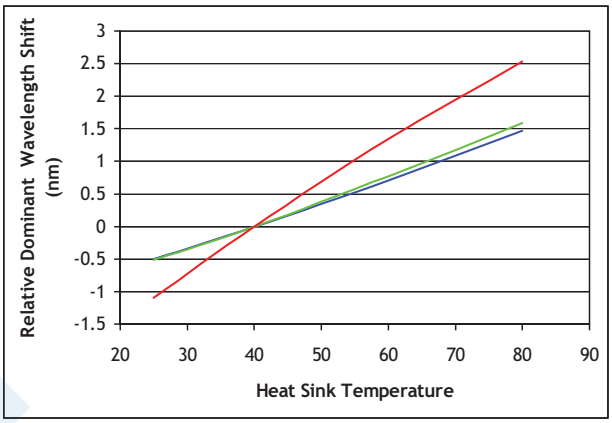
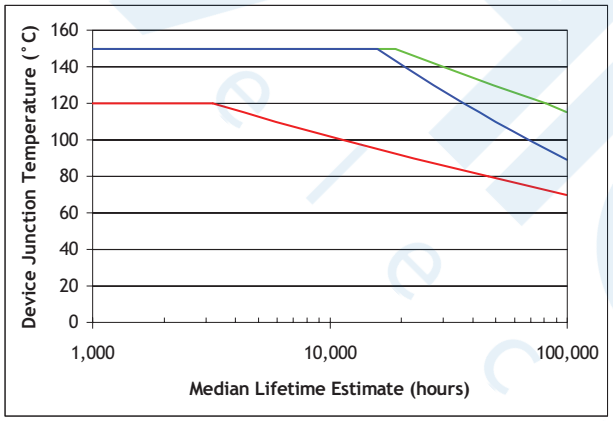
CBT-90 Red/Green/Blue Electrical Characteristics

Light Output and Spectral Characteristics Over Heat Sink Temperature

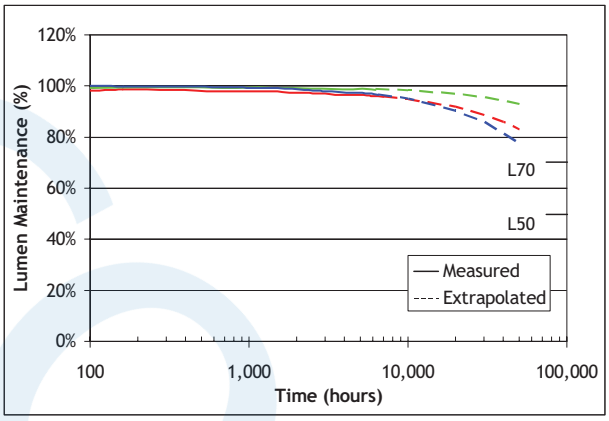




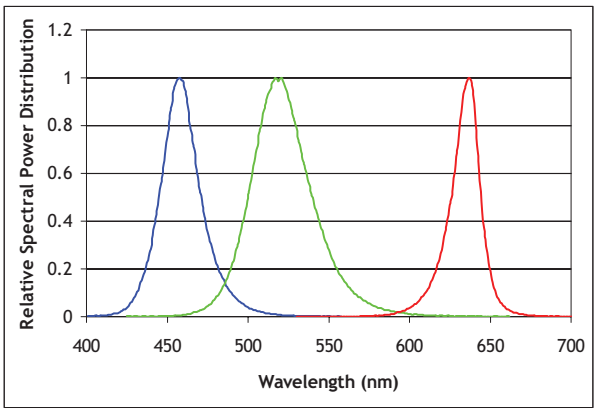
Median Lifetime Estimate vs. Tj[13]



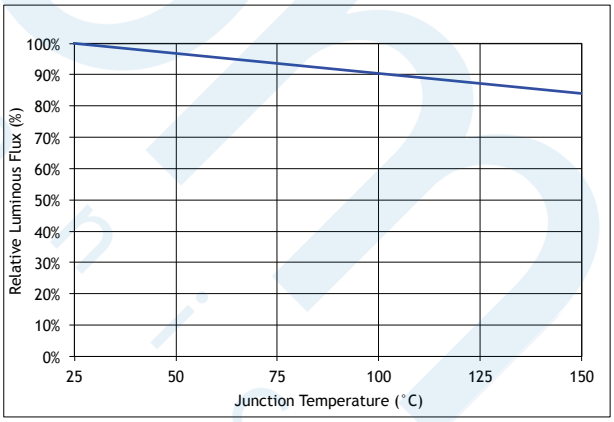
Lumen Maintenance[14]



Typical Spectrum[15]



Luminous Flux vs. Junction Temp



Note 13. Median lifetime estimate as a function of junction temperature at 0.35A/mm² 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 0.35A/mm² in continuous operation, Red junction temperature of 70°C, Green junction temperatures of 120°C, Blue junction temperatures of 100°C.

Note 15. Typical spectrum at current density of 0.35 A/mm² in continuous operation.

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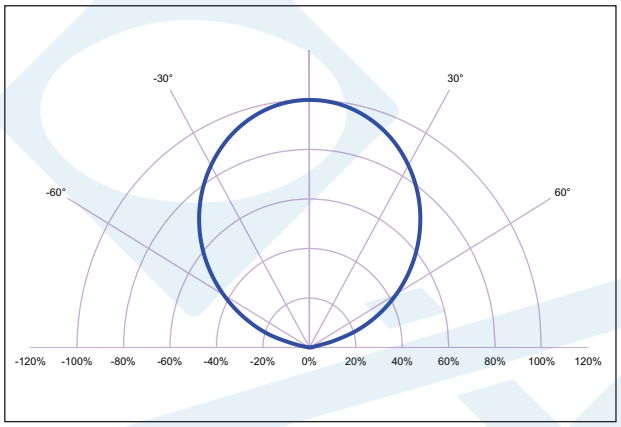
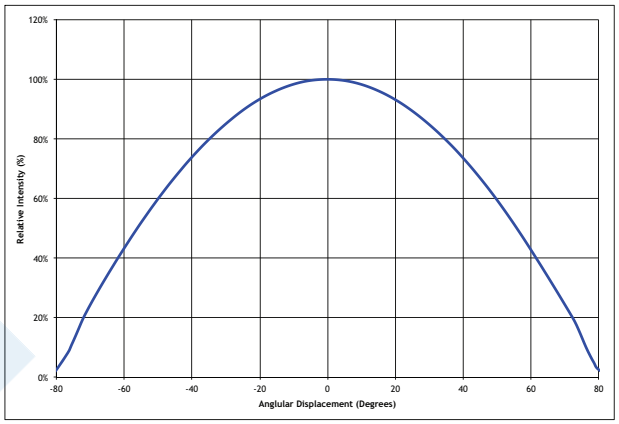
Typical Radiation Patterns

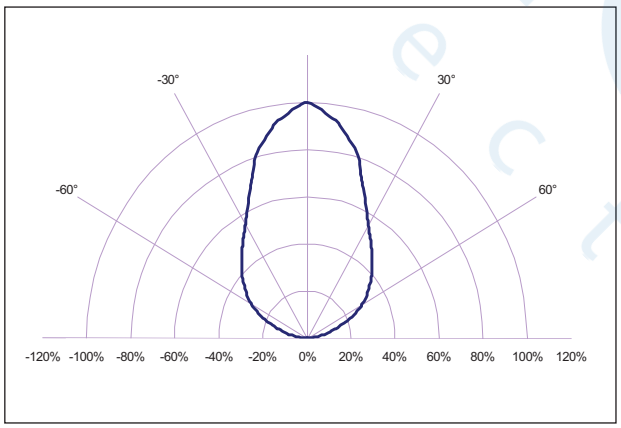
Typical Polar Radiation Pattern for White



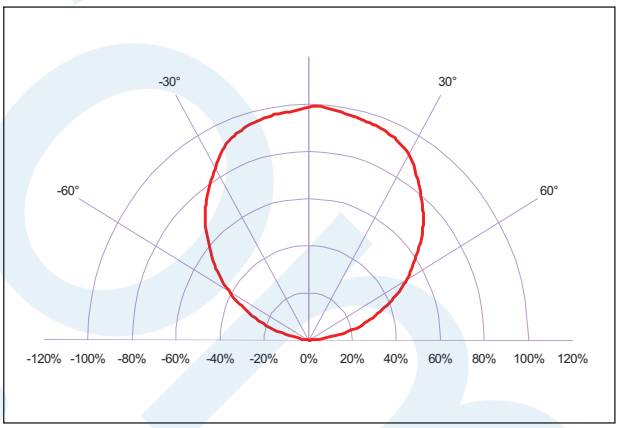
Typical Angular Radiation Pattern for White



Typical Polar Radiation Pattern for Blue and Green



Typical Polar Radiation Pattern for Red



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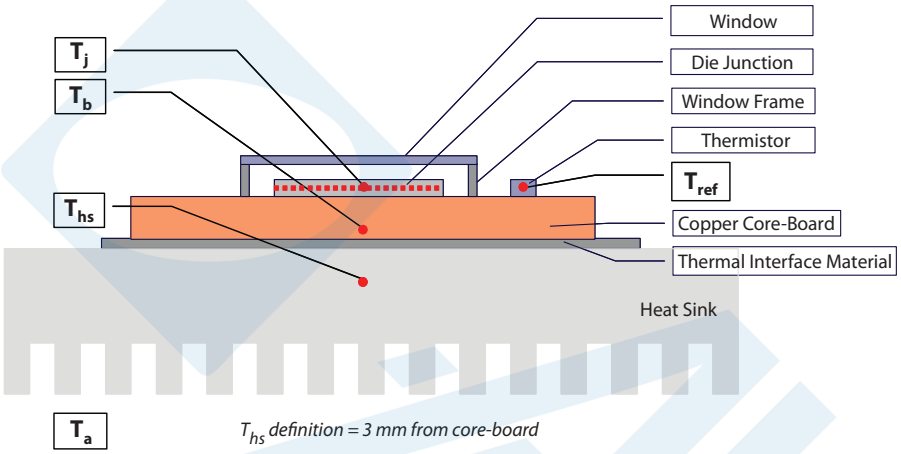
Thermal Resistance



Typical Thermal Resistance

$R_{\theta j\text{-}b}$ [1]	0.80 °C/W
$R_{\theta b\text{-}hs}$ [1]	0.12 °C/W
$R_{\theta j\text{-}hs}$ [2]	0.92 °C/W
$R_{\theta j\text{-}ref}$ [1]	0.83 °C/W

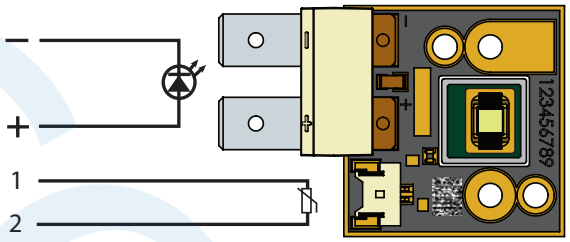
Note 1: Thermal resistance values are based on FEA model results correlated to measured $R_{\theta j\text{-}hs}$ data.

Note 2: Thermal resistance is measured using eGraf 1205 thermal interface material.

Thermistor Information

The thermistor used in CBT-90 LEDs mounted on core-boards is from Murata Manufacturing Co. The global part number is NCP15XH103J03RC. Please see http://www.murata.com/ for details on calculating thermistor temperature.

Electrical Pinout



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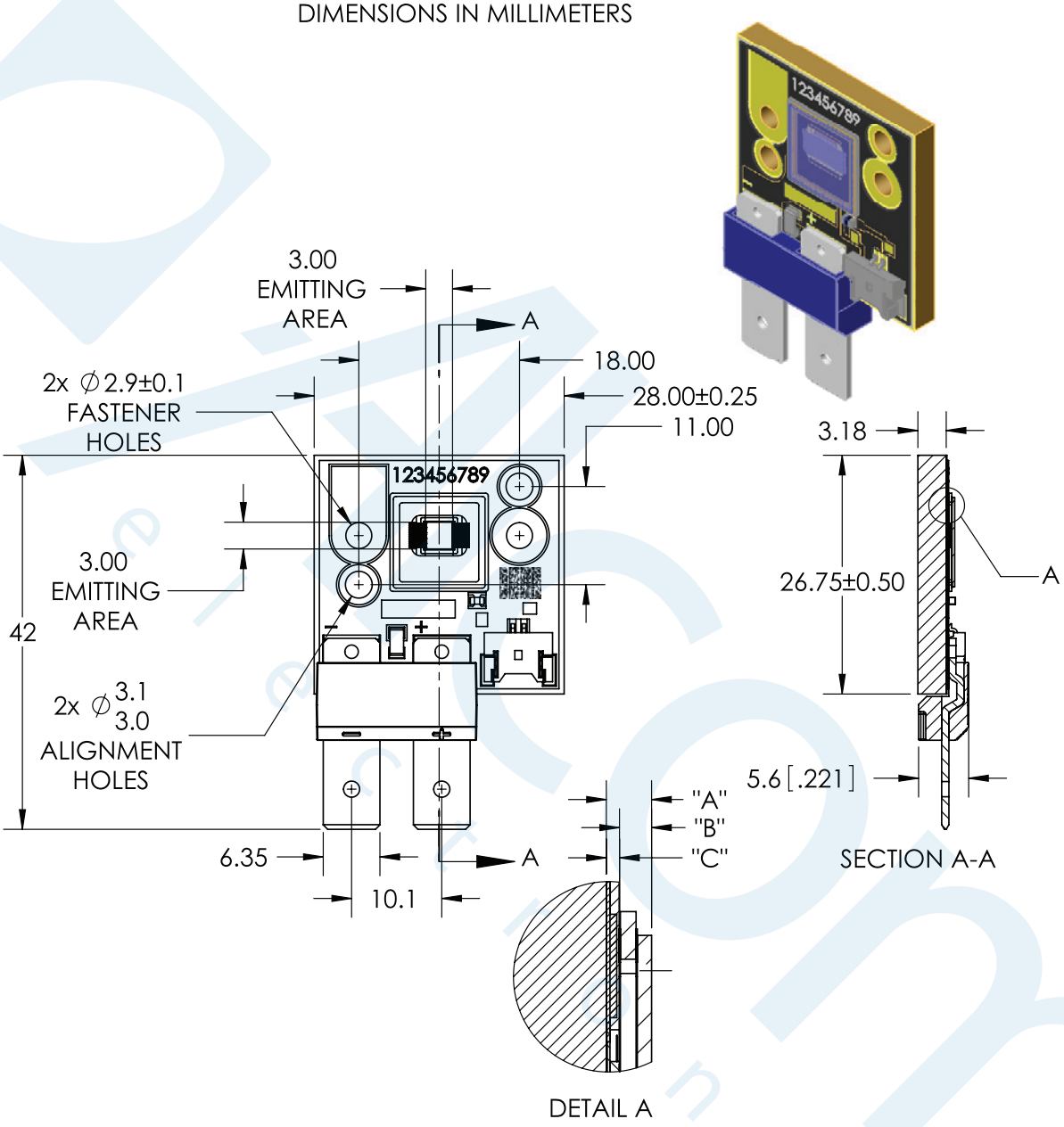
Mechanical Dimensions – CBT-90 Emitter

DIMENSIONS IN MILLIMETERS



DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF GLASS	0.95	±0.13
"B"	EMITTING AREA TO TOP OF GLASS	0.67	±0.16

Recommended connector for Anode and Cathode: Panduit Disco Lok™ Series P/N: DNG14-250FL-C
Thermistor Connector: MOLEX P/N 53780-0270. Recommended Female: MOLEX P/N 51146-0200 or equivalent
For detailed drawing please refer to DWG-001216 document

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Ordering Information

Ordering Part Number [1,2]	Color	Description
CBT-90-W65S-C11-MA100	6500K White	White Big Chip LED™ CBT-90 consisting of a 9 mm² LED, thermistor, and connector, mounted on a copper-core PCB
CBT-90-R-C11-HG100	Red	Red Big Chip LED™ CBT-90 consisting of 9 mm² LED, thermistor, and connector, mounted on a copper-core PCB.
CBT-90-G-C11-JG200	Green	Green Big Chip LED™ CBT-90 consisting of 9 mm² LED, thermistor, and connector, mounted on a copper-core PCB.
CBT-90-B-C11-KF300	Blue	Blue Big Chip LED™ CBT-90 consisting of 9 mm² LED, thermistor, and connector, mounted on a copper-core PCB.

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: *HG100 - denotes a bin kit comprising of all red flux and wavelength bins as specified on page 5.*
JG200 - denotes a bin kit comprising of all green flux and wavelength bins as specified on page 5
KF300 - denotes a bin kit comprising of all blue flux and wavelength bins as specified on page 5.

Note 3: *For ordering information on all available bin kits, please reference PDS-001694: CBT-90 Binning & Labeling document.*

Note 4: *Standard packaging increment (SPI) is 10.*

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CBT-140 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.

Monolithic Large Chip Technology

Luminus' 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 board of 0.25° C/W, Luminus CBT-140 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 LEDs are one of the most reliable light sources in the world today. 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.

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.

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 data sheet.

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 White LEDs are production tested at 21.0 A.

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CBT-140 White Binning Structure

CBT-140 white 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	Flux Bin (FF)	Minimum Flux (lm) at 21.0A	Maximum Flux (lm) at 21.0A
WCS (7500K-6500K, 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: Luminus maintains a +/- 6% tolerance on flux measurements.

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

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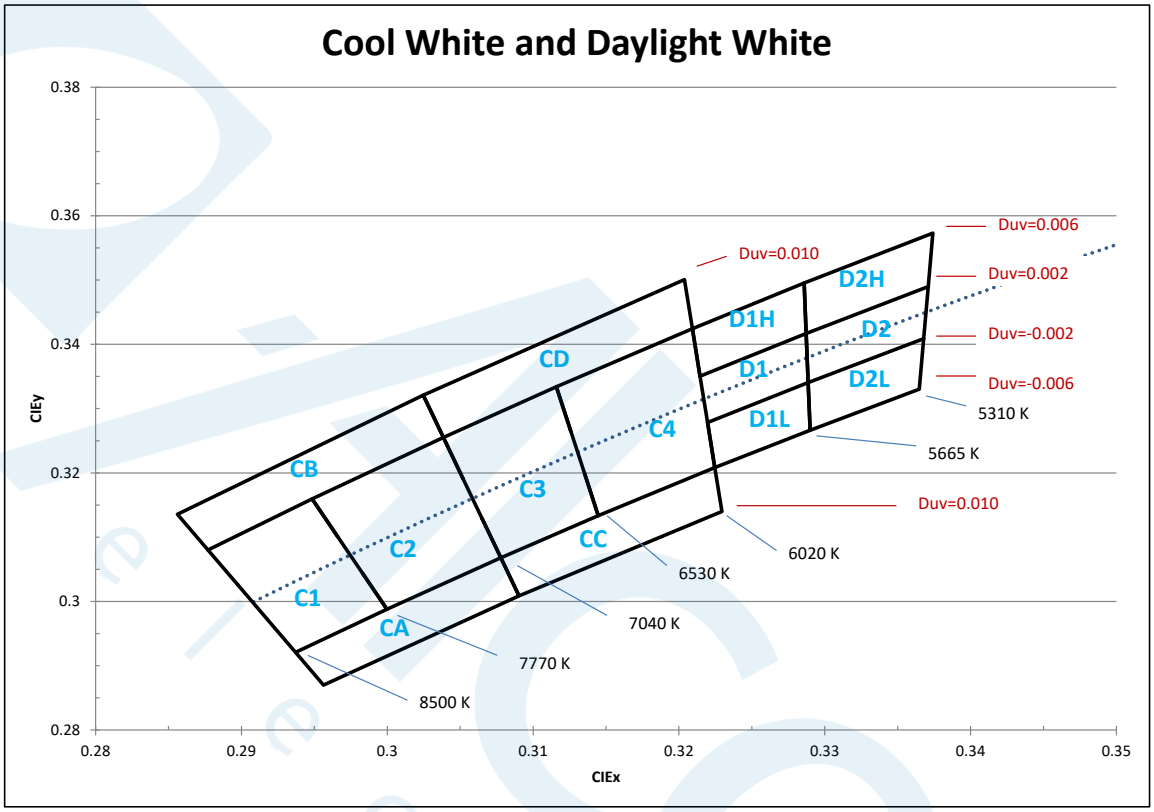
Chromaticity Bins



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CBT-140 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**
C1	0.293	0.292
	0.299	0.298
	0.294	0.315
	0.287	0.307
C2	0.299	0.298
	0.307	0.306
	0.303	0.325
	0.294	0.315
C3	0.307	0.306
	0.314	0.313
	0.311	0.333
	0.303	0.325
C4	0.314	0.313
	0.322	0.32
	0.32	0.342
	0.311	0.333
CA	0.293	0.292
	0.295	0.287
	0.309	0.300
	0.307	0.306
CB	0.287	0.307
	0.285	0.313
	0.302	0.332
	0.303	0.325
CC	0.307	0.306
	0.309	0.300
	0.322	0.313
	0.322	0.320
CD	0.303	0.325
	0.302	0.332
	0.320	0.350
	0.320	0.342

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

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Ordering Information

Products	Ordering Part Number	Description
CBT-140-WCS	CBT-140-WCS-L16-xx123	Monolithic LED with 14 mm2 circular emission area, un-encapsulated and integrated on a common anode copper-core PCB
CBT-140-WDH	CBT-140-WDH-L16-xx123	

Part Number Nomenclature

CBT — 140 — <ABC> — L16 — <FF###>

Product Family	LED Emission Area	Color	Package Configuration	Bin kit
CBT: Copper-core PCB, No Encapsulation	140: 14.0 mm^2	<A>: Color W = White <B> : Temperature C = Cool White D = Daylight White <C> : Color Rendering Index S = Standard H = High CRI	L16: 28 mm x 26.75 mm - Common Anode Package, counter-bores	Flux and Chromaticity bin kit code - See available ordering codes next pages

Examples

QB220 - denotes a bin kit comprising of all flux bins with a minimum flux of 2,260 lumens and chromaticity bins at daylight white color point.

QA720 - denotes a bin kit comprising of all flux bins with a minimum flux of 2,100 lumens and chromaticity bins at tungsten white color point.

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CBT-140 Bin Kit Order Codes

The following tables describe the bin kit ordering codes available for the CBT-140 product family. Each bin kit specifies a minimum flux as well as specific chromaticity bins allowed. Please note that within each kit a maximum flux is not specified and as a result Luminus may ship any part meeting or exceeding the minimum flux specification. Shipments will always meet the listed chromaticity bins. For information on ordering bin kits not listed below, please contact Luminus or an official distributor.

CBT-140 Cool White Bin Kit Order Codes

Color	Luminous Flux		Chromaticity Bins	Kit Number
	Bin Kit Flux Code	Min. Flux		
WCS 7500K-6500K 70CRI	TB	3,440	C1, C2, C3, C4, CA, CB, CC, CD	TB120
			C1, C2, C3, C4	TB121
			C3, C4	TB122
			C1, C2	TB123
	UA	3,680	C1, C2, C3, C4, CA, CB, CC, CD	UA120
			C1, C2, C3, C4	UA121
			C3, C4	UA122
			C1, C2	UA123

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CBT-140 Daylight White Bin Kit Order Codes

Color	Luminous Flux		Chromaticity Bins	Kit Number
	Bin Kit Flux Code	Min. Flux		
WDH Daylight white, High CRI (typ. 92)	QA	2,100	D1, D2, D1H, D2H, D1L, D2L	QA220
	QB	2,260	D1, D2, D1H, D2H, D1L, D2L	QB220
	RA	2,420	D1, D2, D1H, D2H, D1L, D2L	RA220

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Product Shipping & Labeling Information

All CBT-140 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:

CBT-140 White

CBT — 140 — WNX — L16 — FF — WW

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Chromaticity Bin
CBT: Chip on Board (window)	140: 14.0 mm^2	Color & CRI See Note 1 below	Internal Code	See page 3 for bins	See page 4-5 for bins

Note 1: WNX nomenclature corresponds to the following:

W = White

N = color, where:

C corresponds to Cool White ,

D corresponds to Daylight White.

X = color rendering index, where:

S (Standard) corresponds to a typical CRI of 75

H (high) corresponds to a typical CRI of 92

Example :

The part label CBT-140-WDH-L16-RA-D1 refers to a Daylight high CRI white, CBT-140 emitter, with a flux range from 2,420 to 2,600 lumens and a

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CBT-140 White Electrical Characteristics[1]

Optical and Electrical Characteristics

Drive Condition[2]		21.0 A Continuous	
Parameter	**Symbol**	**Values at Test Currents**	**Unit**
Current Density	j	1.5	A/mm^2
Forward Voltage	$V_{F, min}$	3.4	V
	$V_{F, typ}$	3.6	V
	$V_{F, max}$	4.2	V

Common Characteristics

Parameter		Symbol	Typical Values	Unit
Emitting Area			14.0	mm^2
Color Rendering Index (Typical)	Cool White	CRI	75	
	Daylight White	CRI	92	
Forward Voltage Temperature Coefficient			-5.47	mV/ºC

Absolute Maximum Ratings

Parameter	Symbol	Values	Unit
Minimum Drive Current [7]		0.2	A
Maximum Current[5]		28.0	A
Maximum Junction Temperature[6]	T_{j-max}	150	ºC
Storage Temperature Range		-40/+100	ºC

Note 1: Ratings are based on operation with a constant junction temperature of $T_j = 85$ºC.

Note 2: Listed drive conditions are typical for common applications. CBT-140 white 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 3: Unless otherwise noted, values listed are typical.

Note 4: CCT value based off of CIE measurement. CIE X and CIE Y measurement uncertainty for white devices is estimated to be +/- 0.01.

Note 5: CBT-140 White LEDs are designed for operation to an absolute maximum forward drive current density of 2.0A/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 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 7: Special design considerations must be observed for operation under 1 A. Please contact Luminus for further information.

Note 8: 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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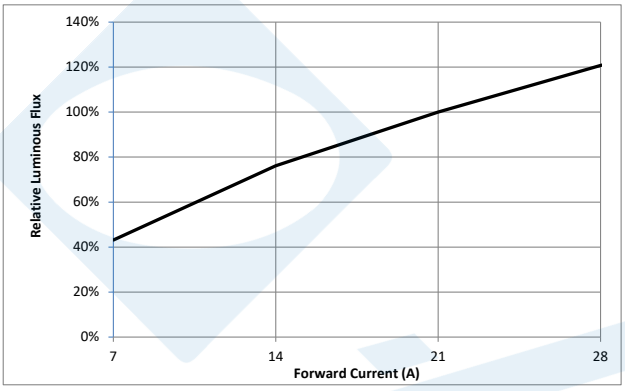
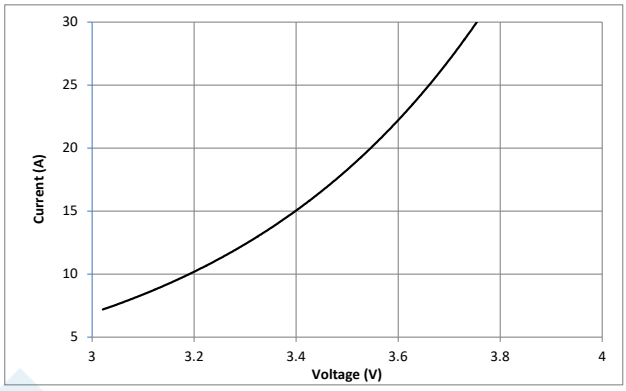
CBT-140 White Optical & Electrical Characteristics

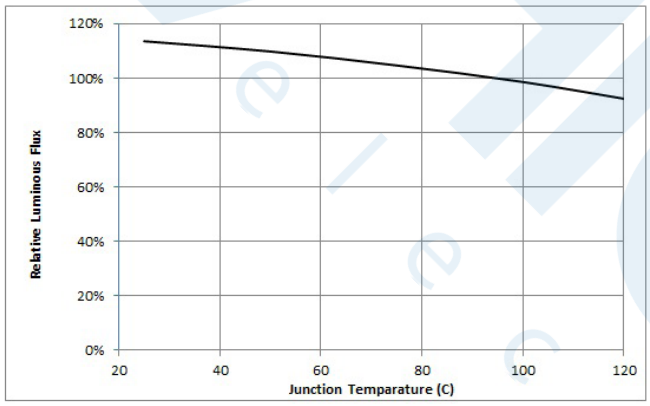
Relative Output Flux vs. Forward Current



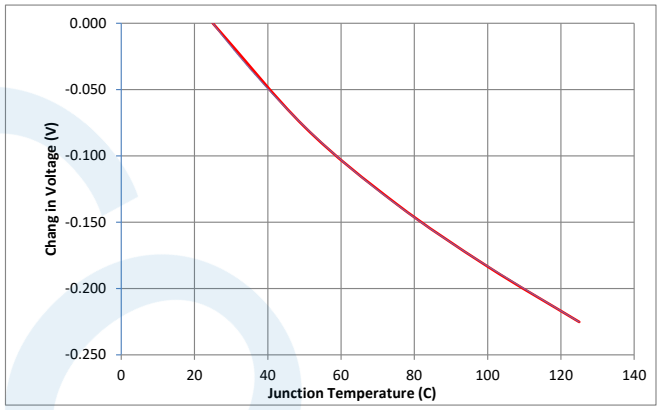
Forward Current vs. Forward Voltage



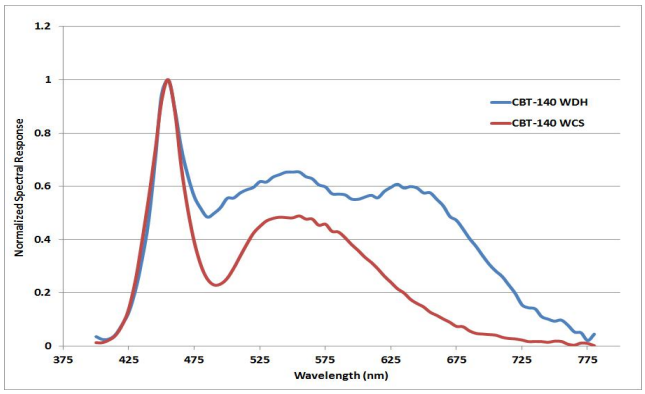
Relative Output Flux vs. Junction Temp



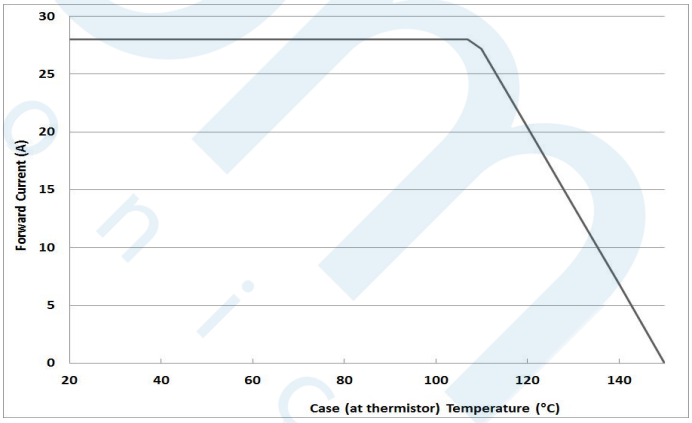
Change in Voltage vs. Junction Temp



Typical Spectrum[1]



Current Derating Curve[2]



Note 1: Typical spectrum at current density of 1.5 A/mm² 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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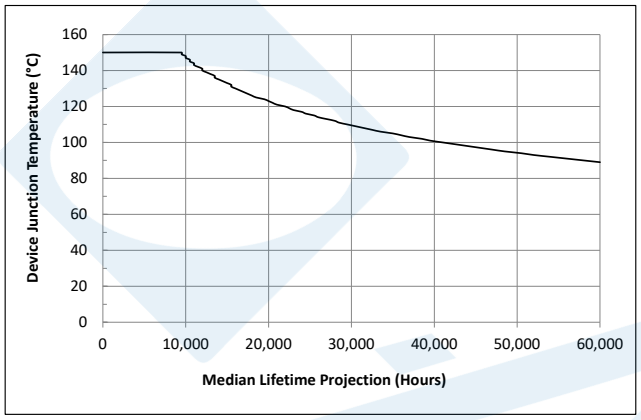
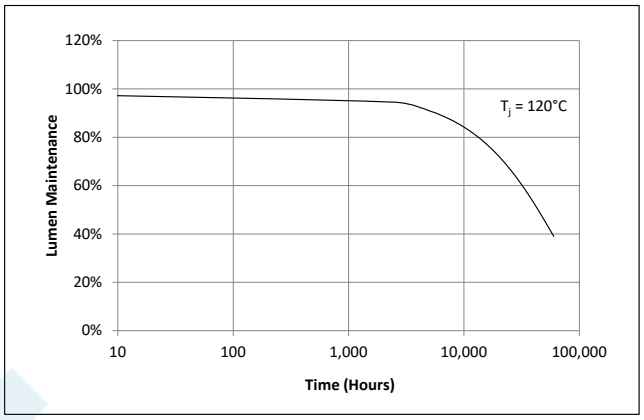
CBT-140 White Optical & Electrical Characteristics

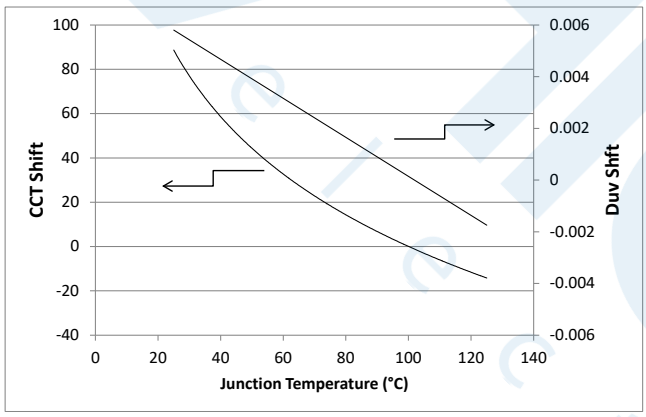
Median Lifetime[2]



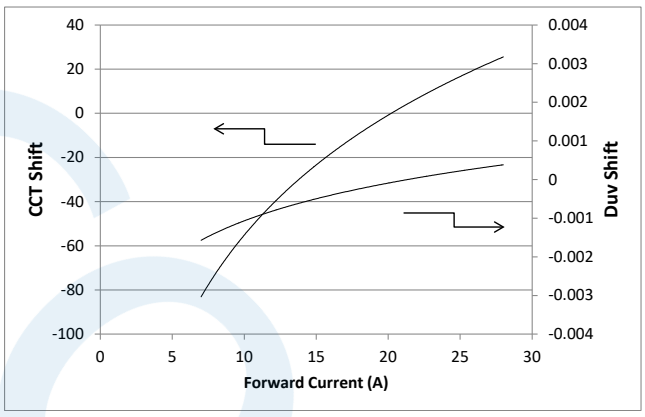
Lumen Maintenance vs. Time[3]



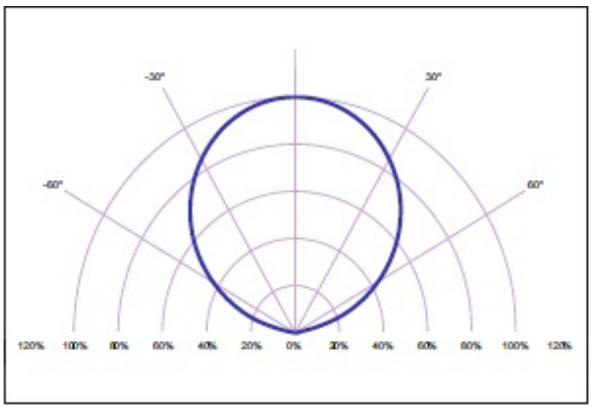
Chromaticity Change vs. Junction Temp



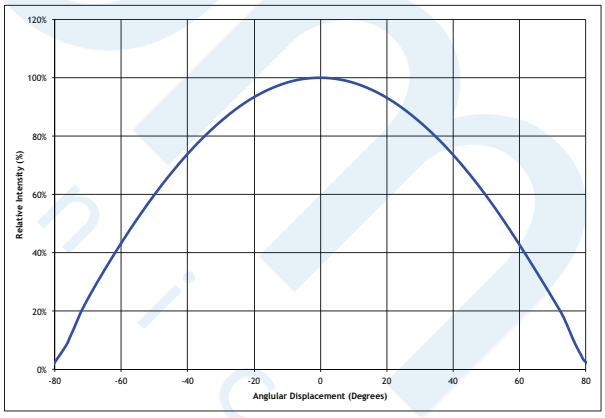
Chromaticity Change vs. Forward Current



Typical Polar Radiation Pattern



Typical Angular Radiation Pattern



Note 2: Median 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 120 °C.

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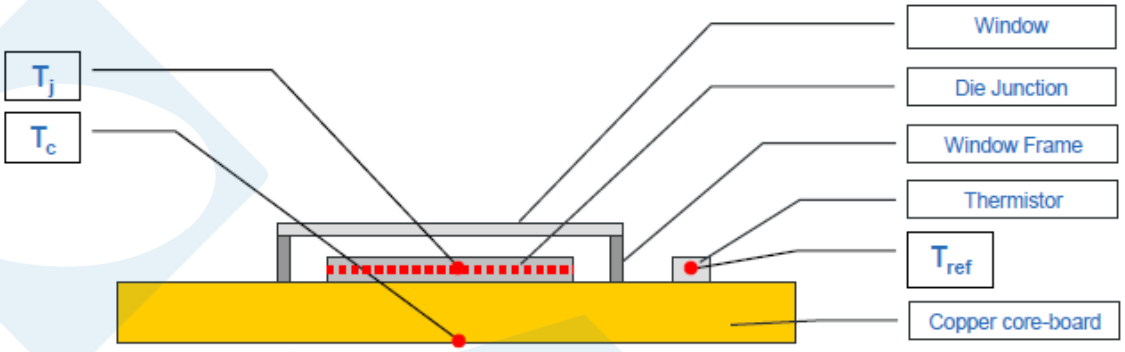
Thermal Resistance



Typical Thermal Resistance

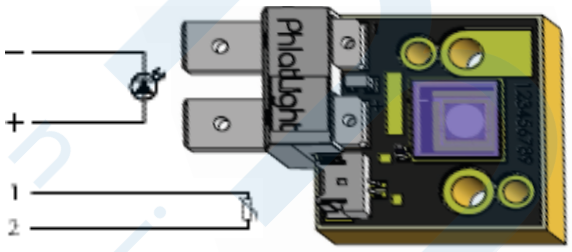
$R_{j\text{-}c}$ [1]	0.30 °C/W
$R_{j\text{-}ref}$ [1]	0.33 °C/W
Electrical$_{j\text{-}c}$ [1]	0.25 °C/W

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

Thermistor Information

The on-board thermistor used in CBT-140 LEDs mounted on core-boards is from Murata Manufacturing Co. The global part number is NCP18XH103J03RB. Please see http://www.murata.com/ for details on calculating thermistor temperature.

Electrical Pinout



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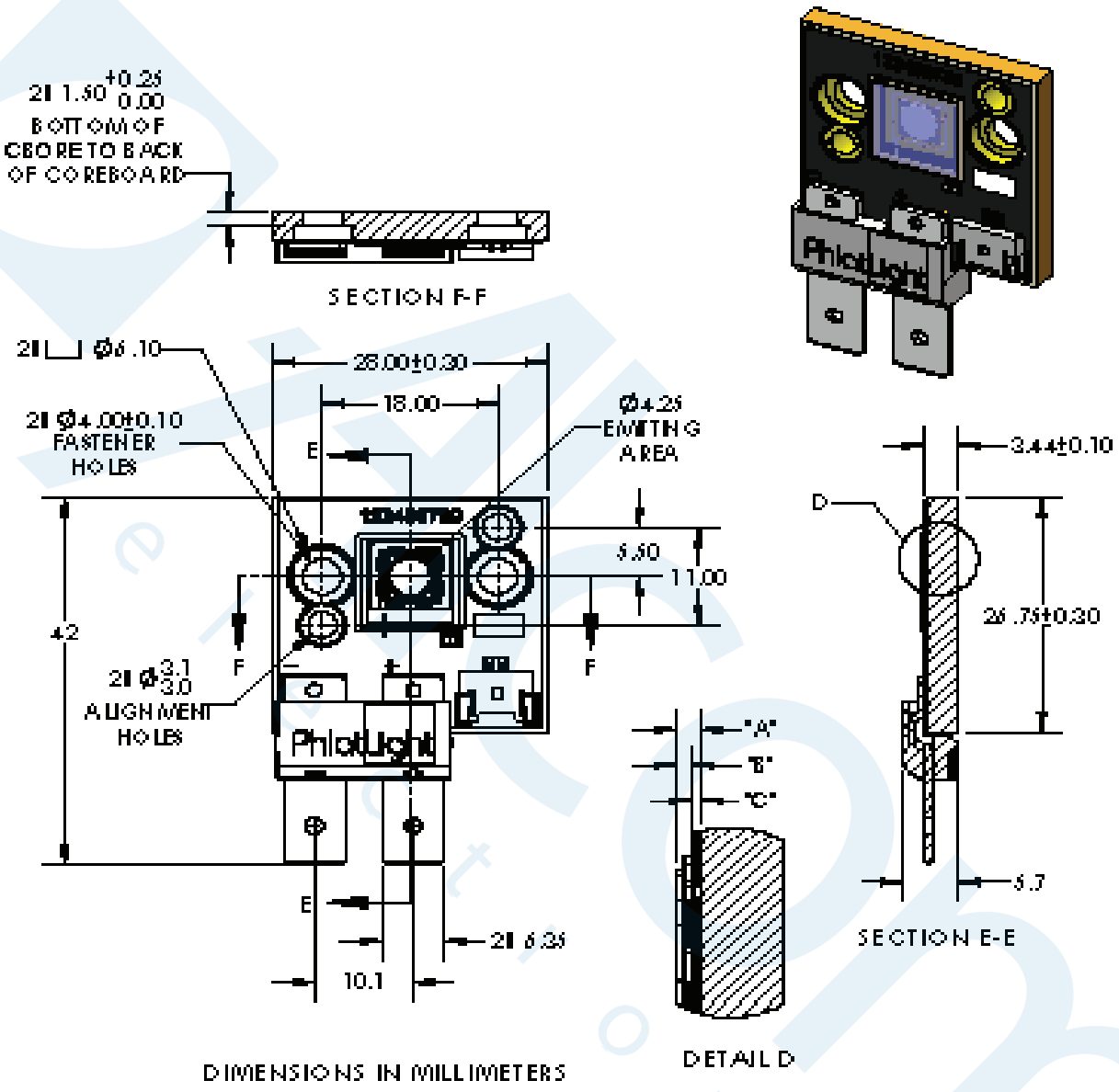
Mechanical Dimensions – CBT-140 Emitter



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

Re
Thermistor Connector: MOLEX P/N 53780-0270 or GCT P/N WTB08-021S-F
Recommended Female: MOLEX P/N 51146-0200,GCT P/N WTB06-021S-F or equivalent
For detailed drawing please refer to DWG-001997 document

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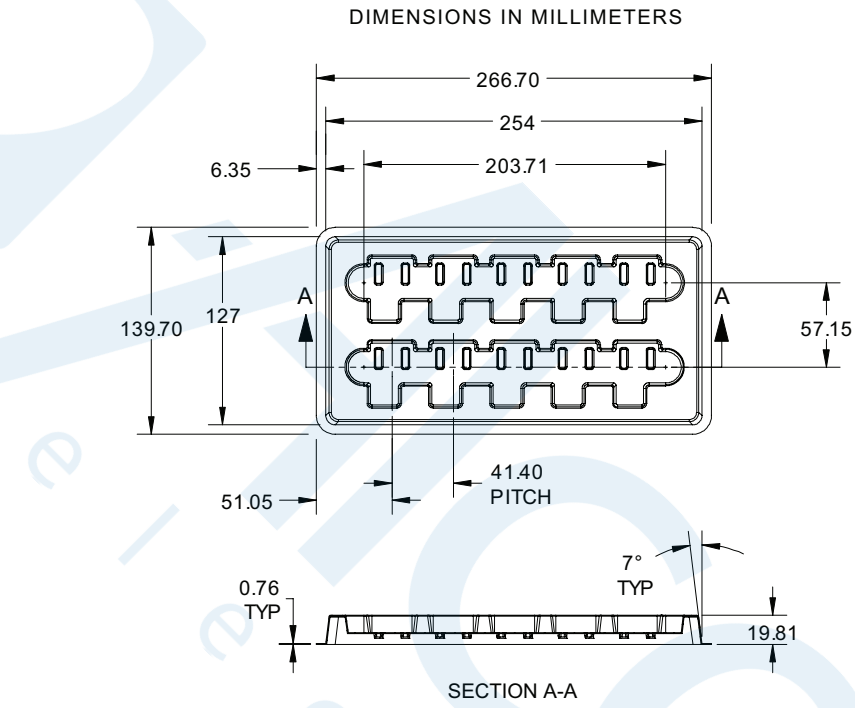
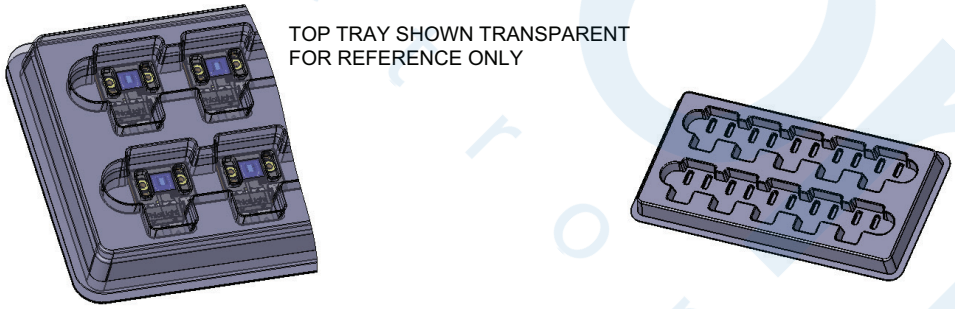
Shipping Tray Outline





For detailed drawing of shipping trays, please refer to document TO-0479, available upon request.

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Packing and Shipping Specification (CBT-140)

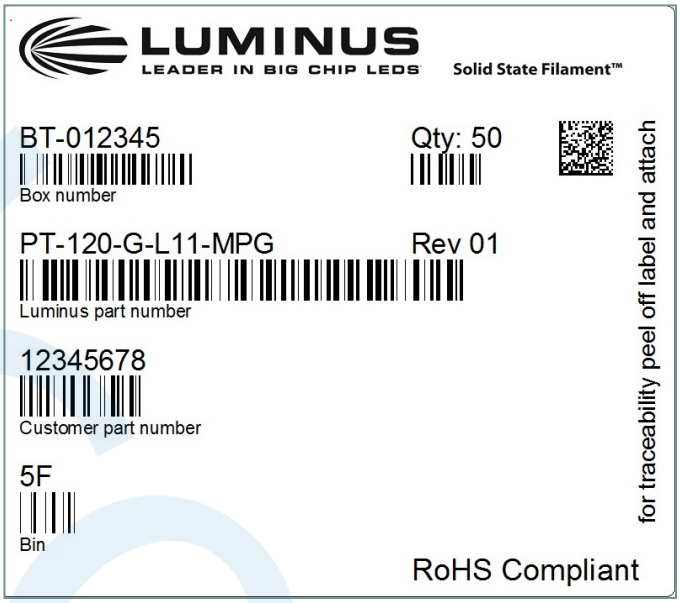
Packing Specification

Packing Configuration	Qty /Pack	Reel Dimensions (diameter x W, mm)	Gross Weight (kg)
Stack of 5 trays with 10 devices per tray Each pack is enclosed in ESD bag	50	150 x 280 x 85	2.7

Product Label Specification

Label Fields (subject to change):

- 6-8 digit Box number (for Luminus internal use)
- Luminus ordering part number
- Quantity of devices in pack
- Part number revision (for Luminus internal use)
- Customer's part number (optional)
- Bin (FF-WW) as defined page 3
- 2D Bar code



Sample label –for illustration only

Shipping Box

Shipping Box	Quantity	Material	Dimensions (L x W x H, mm)
Carton Box	1 -20 packs (50 - 1000 Devices)	S4651	560 x 560 x 200

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History of Changes

Rev	Date	Description of Change
07	7/13/2015	o Removed discontinued Tungsten White color point – CBT-140-WTH o Clarified absolute minimum drive current o Editorial fixes o Added change history o Added shipping tray outline o Added packing and shipping specs o Merged Binning and Labelling document (PDS-002040) into the product datasheet. PDS-002040 has been obsoleted.
08	11/25/2015	o Remove references to obsolete flux bin TA
09	2/12/2019	o Documented higher flux for CBT-140-W products

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