SBM-40-LC

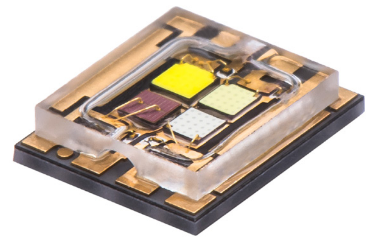

Table of Contents

Features:

- High optical output at 1 A:
  up to 133 Red lumens
  up to 281 Green lumens
  up to 1474 Blue mWatts
  up to 295 White lumens
- High thermal conductivity package
- Four chips with emitting area of 1 mm^2 each
- Environmentally friendly: RoHS compliant
- Variable drive currents: 0.1 A to 1.0 A
- Available in RGBW combination

Applications:

- Entertainment /Stage Lighting
- Architectural Ligthing
- Spot Lighting
- Pool and Fountain Lighting
- Medical Lighting
- Fiber-coupled Illumination
- Machine Vision

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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.

Packaging Technology

Thermal management is critical in high power LED applications. With a thermal resistance from junction to case of 0.8° C/W (electrical), Luminus SBM-40-LC LEDs have industry-leading thermal resistance. This allows the LED to be driven at higher current while maintaining a low junction temperature, thereby resulting in brighter solutions and longer lifetimes.

Reliability

Designed from the ground up, Luminus 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.

Static Electricity

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

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

Understanding Luminus LED Test Specifications

Every 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 case temperature of 25 °C. Expected flux values in real world operation can be extrapolated based on the information contained within this product data sheet.

This method of measurement ensures that Luminus LEDs perform in the field just as they are specified.

Multiple Operating Points

The tables on the following pages provide typical optical and electrical characteristics. Since the LEDs can be operated over a wide range of drive conditions (currents from 0.1 A to 1.0 A, and duty cycle from <1% to 100%), multiple drive conditions are listed.

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Ordering Information

All SBM-40-LC RGBW products are sold in sets of flux and chromaticity bins called bin kits. Each bin kit specifies a minimum flux bin and a specific selection of chromaticity bins. The ordering part number designation is as follows:

Ordering Part Number

Color	Min. Flux/ Power	Wavelength		White Chromaticity Bin	Ordering Part Number
		Bin	Range (nm)		
Red	45 lm	RW	620-625		SBM-40-RGBW-LC41-QC100
Green	112 lm	GW	524-529		
Blue	630 mW	BW	452-457		
White	140 lm			1A	

For other bin kits, please contact a Luminus representative.

Example:

The ordering part number SBM-40-RGBW-LC41-QC100 refers to bin kit which consists of a RGBW, SBM-40-LC emitter, with Red Flux > 45 lm and Red DWL range of 620nm-625 nm; Green flux > 112 lm and Green DWL range of 524nm to 529nm; Blue power > 630 mW and Blue DWL range of 452nm to 457nm; White flux >140 lm and chromaticity values within the boxes defined by the four points (0.3211, 0.3548), (03287, 0.3411), (0.3087, 0.3002), (0.2999, 0.3137) measured at drive current =0.7A.

Part Number Nomenclature

SBM — 40 — RGBW — LC41 — <Bin kit>

Product Family	LED Emission Area	Color	Package Configuration	Bin kit[1]
SBM: Multi-Chip Surface mount device, Protective window	40: 4 dies - each 1.0 mm^2	<Y>: Color R = Red G = Green B = Blue W = White	LC41: Surface mount, shipped in tape & reel	Bin code - See available ordering part number

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

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Binning Structure[1,2,3]

All SBM-40-LC LEDs are tested at 0.7 A at T_c=25ºC for luminous flux, radiometric flux and dominant wavelength and placed into one of the following wavelength and flux bins. The binning structure is universally applied across each color of the SBM-40-LC product line.

Flux Bins

Color	Binning @ 0.7A, T_c = 25ºC		Binning @ 1A, T_c = 25ºC	
	Minmum Flux/ Power	Maximum Flux/ Power	Minmum Flux/ Power (Correlated Values)	Maximum Flux/ Power (Correlated Values)
Red	45 lm	90 lm	60 lm	133 lm
Green	112 lm	224 lm	140 lm	281 lm
Blue	630 mW	1100 mW	844 mW	1474 mW
White	140 lm	224 lm	184 lm	295 lm

Dominant Wavelength Bins[3]

Color	Wavelength Bin (FF)	Binning @ 0.7A, T_c = 25ºC	
		Minumum Wavelength	Maximum Wavelength
Red	RW	620	625
Green	GW	524	529
Blue	BW	452	457

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

Note 2: Contact Luminus sales team for specific bin requirements.

Note 3: Devices are binned at standard 0.7A, 20ms pulse , T_c =25ºC condition.

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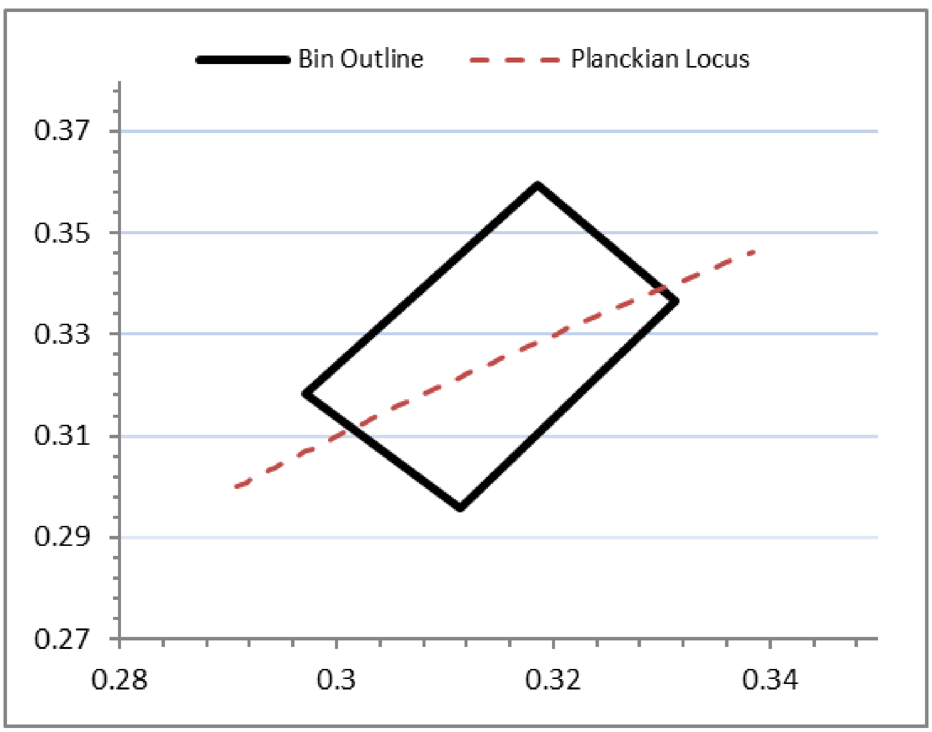
White Chromaticity Coordinates

Chromaticity Coordinates		
Bin Code (WW)	CIEx	CIEy
1A	0.3186	0.3594
	0.3312	0.3365
	0.3114	0.2957
	0.2971	0.3182



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Typical Device Performance [1,2]

Parameter		Symbol	Red	Green	Blue	White	Unit
Drive Condition[3]		I	0.7	0.7	0.7	0.7	A
Emitting Area			1.0	1.0	1.0	1.0	mm^2
Dominant Wavelength	min	$\lambda_{d\ min}$	620	524	452		nm
	typ	$\lambda_{d\ typ}$	622	527	455		nm
	max	$\lambda_{d\ max}$	625	529	457		nm
FWHM	typ	$\Delta\lambda_{1/2}$	17	32	21		nm
Chromaticity Coordinates[4]	typ	x				0.31	
	typ	y				0.32	
Forward Voltage	min	$V_{F\ min}$	2.0	2.8	2.8	2.8	V
	typ	$V_{F\ typ}$	2.3	3.2	3.2	3.2	V
	max	$V_{F\ max}$	3.0	3.6	3.6	3.6	V

Absolute Maximum Ratings [1,2]

Parameter		Symbol	Red	Green	Blue	White	Unit
Minimum Current [5]			0.1	0.1	0.1	0.1	A
Maximum Current [5]			1.0	1.0	1.0	1.0	A
Maximum Operating Junction Temperature [5,6]	max	$T_{j\ operating,max}$	100	140	130	130	ºC
Absolute Maximum Junction Temperature [5,6]	max	$T_{j\ absolute\ max}$	115	150	150	150	ºC
Storage Temperature Range			-40/+100	-40/+100	-40/+100	-40/+100	ºC

Note 1: All ratings are based on test conditions of I_f = 700 mA, T_c=25 ºC, 20 millisecond pulse. T_c is temperature at bottom of ceramic substrate.

Note 2: Unless otherwise noted, values listed are typical. Devices are production tested and specified at 0.7 A for red, green, blue and white. Values provided at 1 A based on characterization and measurements at 1 A.

Note 3: SBM-40-LC RGBW devices can be driven at currents ranging from 0.1 A to 1 A depending on color and at duty cycles ranging from 1% to 100%. Drive current and duty cycle should be adjusted as necessary to maintain the junction temperature desired to meet application lifetime requirements.

Note 4: In CIE 1931 chromaticity diagram coordinates, normalized to x+y+z=1.

Note 5: SBM-40-LC RGBW devices are designed for continuous operation to a maximum current as specified above. Product lifetime data is specified at recommended forward drive currents. Sustained operation at or beyond 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.

Note 6: Maximum Operating Junction Temperature and Absolute Maximum Junction Temperature assume that with all four (RGBW) LEDs operating simultaneously at 1 A.

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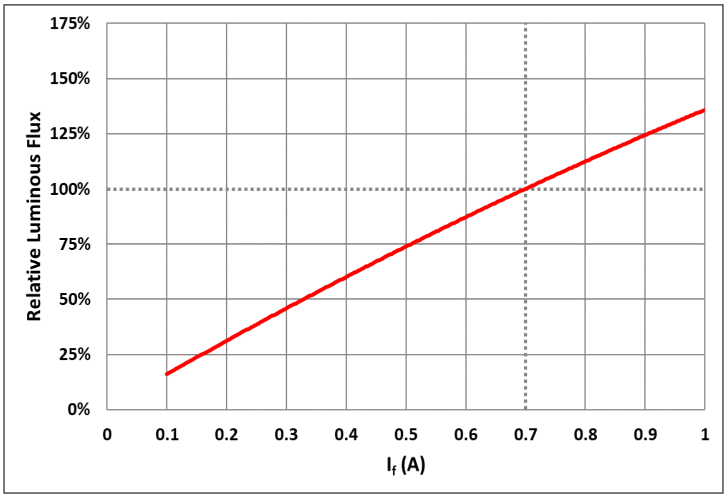
Optical & Electrical Characteristics[7]

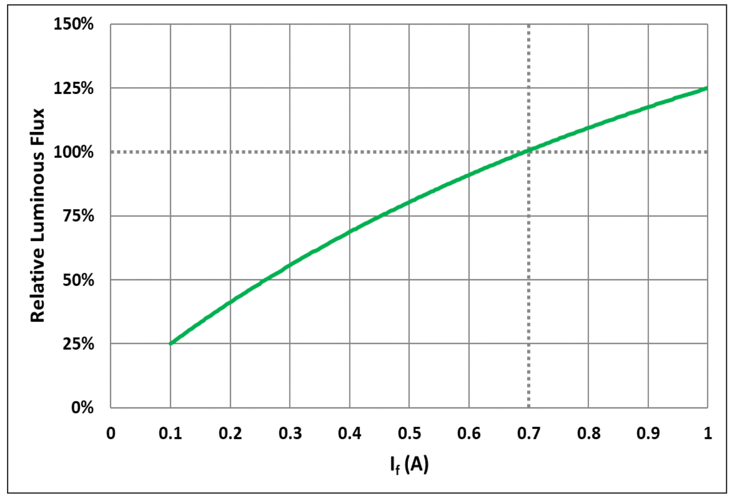
Relative Luminous Flux - Red

Relative Luminous Flux vs. If
φv/φv(0.7A), Single Pulse 20ms, Tc = 25°



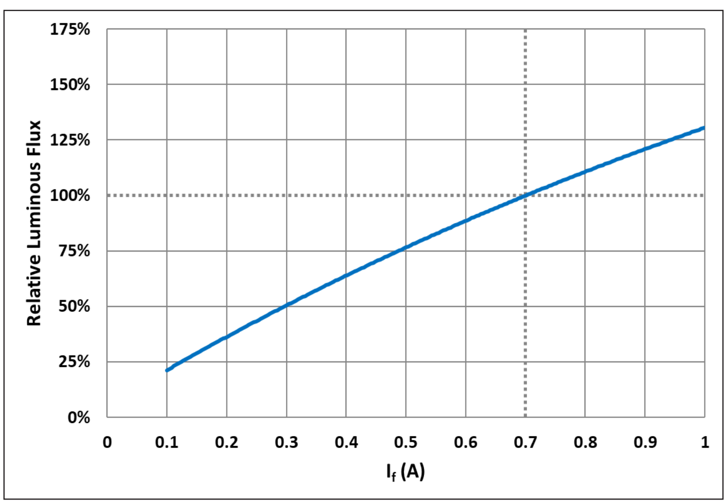
Relative Luminous Flux - Green

Relative Luminous Flux vs. If
φv/φv(0.7A), Single Pulse 20ms, Tc = 25°



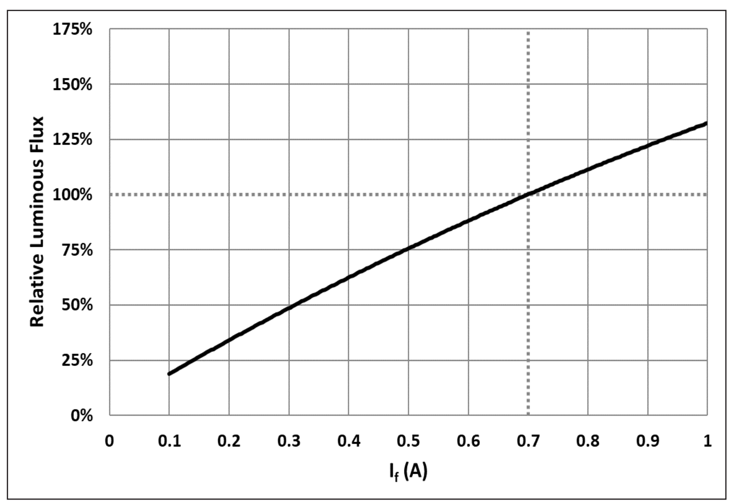
Relative Luminous Flux - Blue

Relative Luminous Flux vs. If
φv/φv(0.7A), Single Pulse 20ms, Tc = 25°



Relative Luminous Flux - White

Relative Luminous Flux vs. If
φv/φv(0.7A), Single Pulse 20ms, Tc = 25°



Note 7: Flux and power values are measured using a current pulse of typical 20 ms. Luminus maintains a test measurement accuracy for LED flux and power of ±6%.

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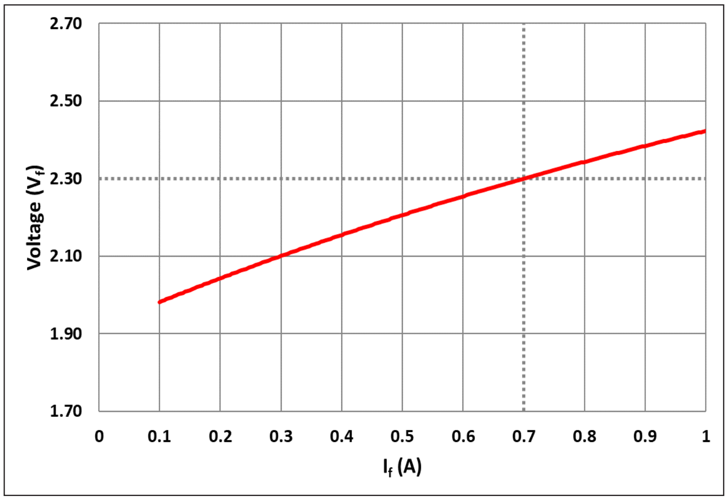
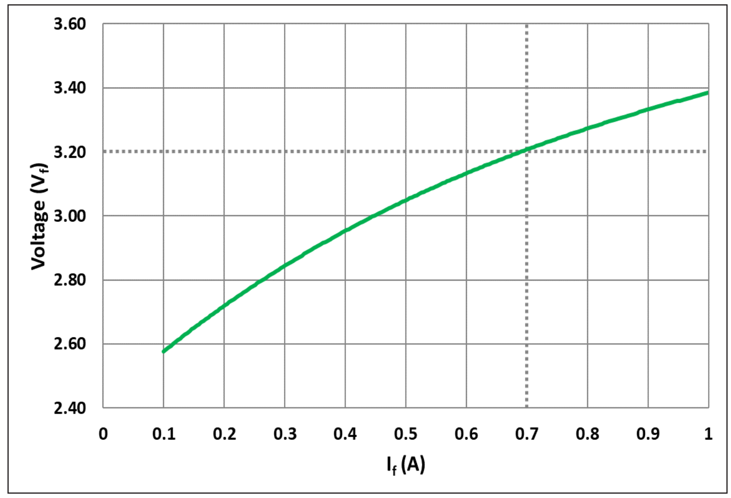
Voltage as function of Forward Current - Red

Vf vs. If
Vf(If), Single Pulse 20ms, Tc = 25°



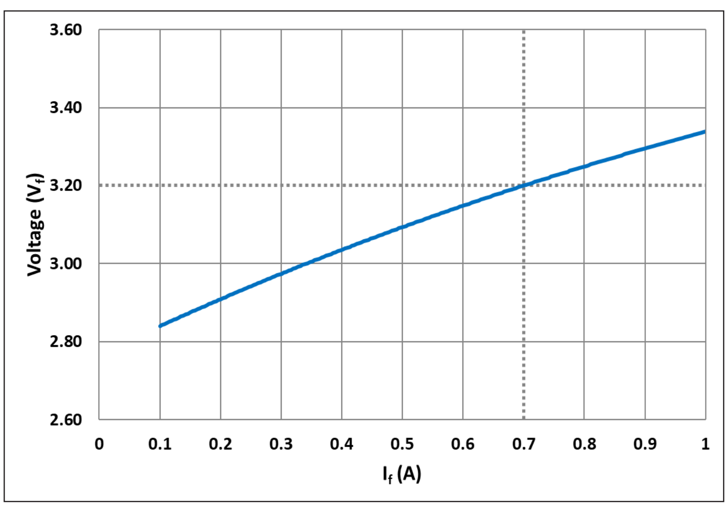
Voltage as function of Forward Current - Green

Vf vs. If
Vf(If), Single Pulse 20ms, Tc = 25°



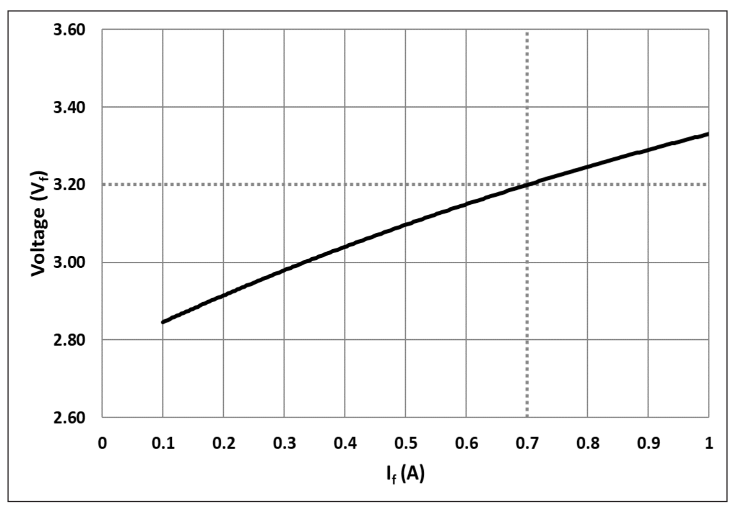
Voltage as function of Forward Current - Blue

Vf vs. If
Vf(If), Single Pulse 20ms, Tc = 25°



Voltage as function of Forward Current - White

Vf vs. If
Vf(If), Single Pulse 20ms, Tc = 25°



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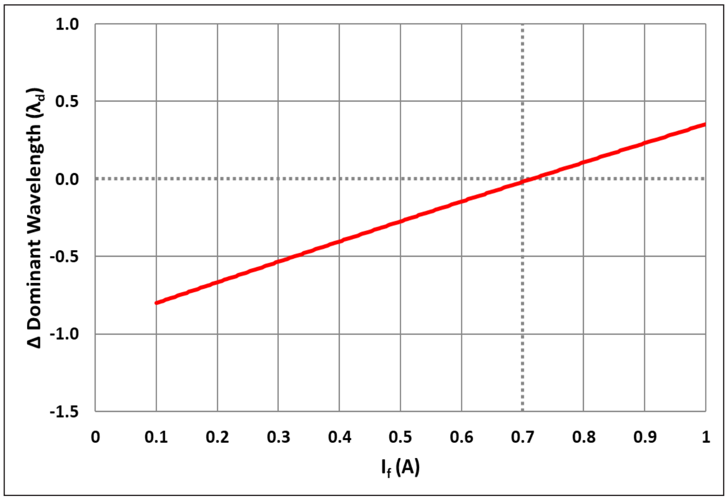
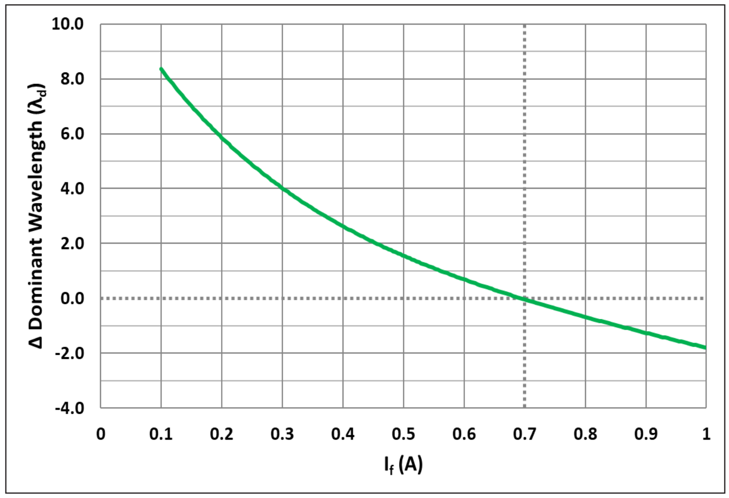
Wavelength change as function of Current - Red

Δ Dominant Wavelength (λd) vs. If
λd(If) - λd(0.7A), Tc = 25°



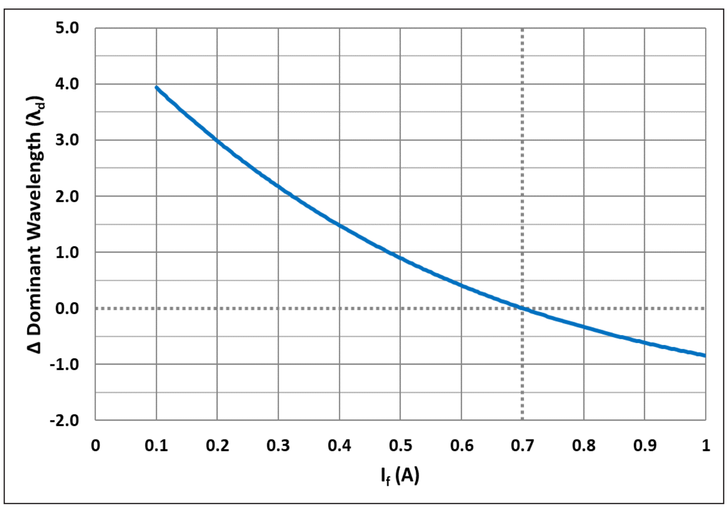
Wavelength change as function of Current - Green

Δ Dominant Wavelength (λd) vs. If
λd(If) - λd(0.7A), Tc = 25°



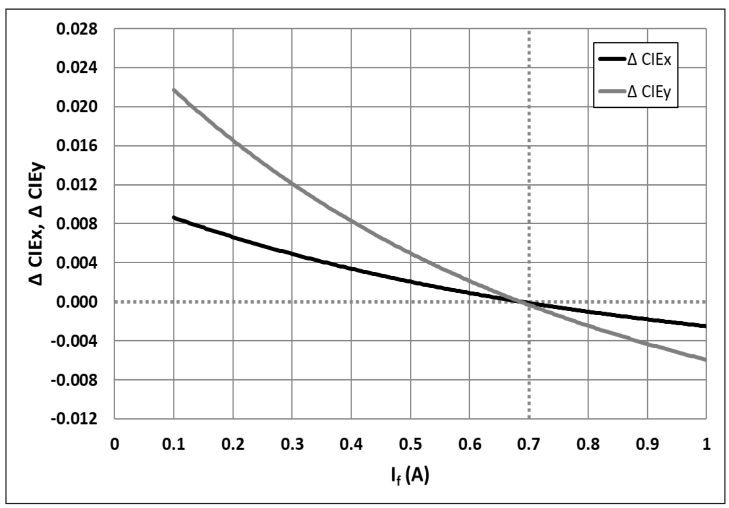
Wavelength change as function of Current - Blue

Δ Dominant Wavelength (λd) vs. If
λd(If) - λd(0.7A), Tc = 25°



CIEx, y change as function of Current - White

Chromaticity Shift vs. If
ΔCIEx,y = CIEx,y(If) - CIEx,y (0.7A), Single Pulse 20ms, Tc = 25°C



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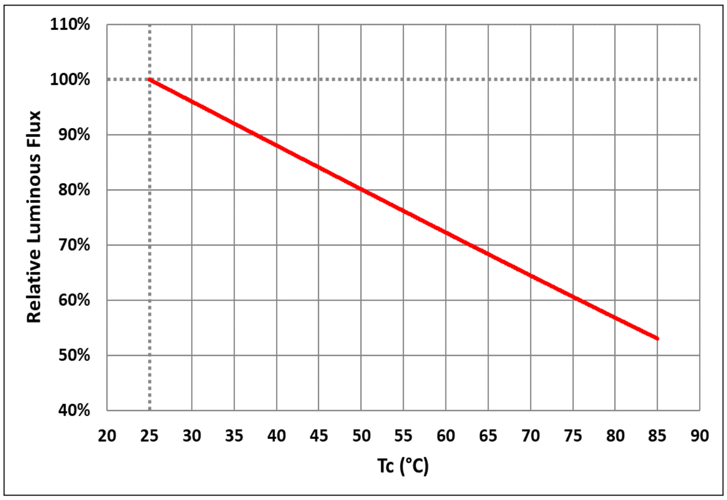
Optical & Electrical Characteristics

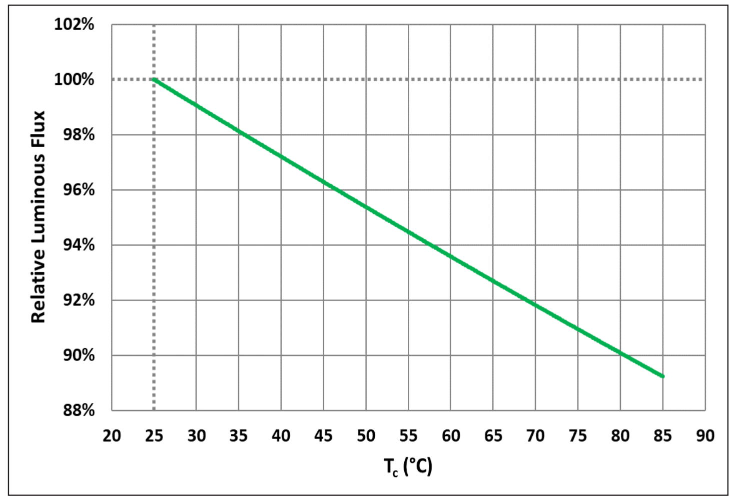
Relative Luminous Flux - Red

Relative Luminous Flux vs. Tc
φv/φv(25 °C), Single Pulse 20ms, If = 0.7A



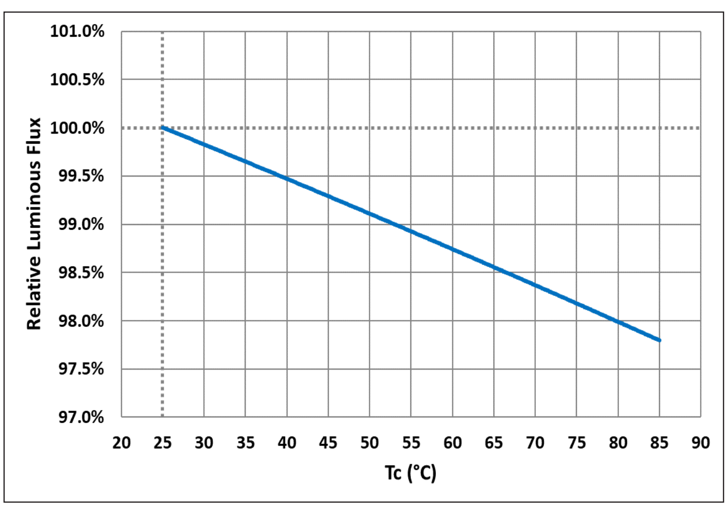
Relative Luminous Flux - Green

Relative Luminous Flux vs. Tc
φv/φv(25 °C), Single Pulse 20ms, If = 0.7A



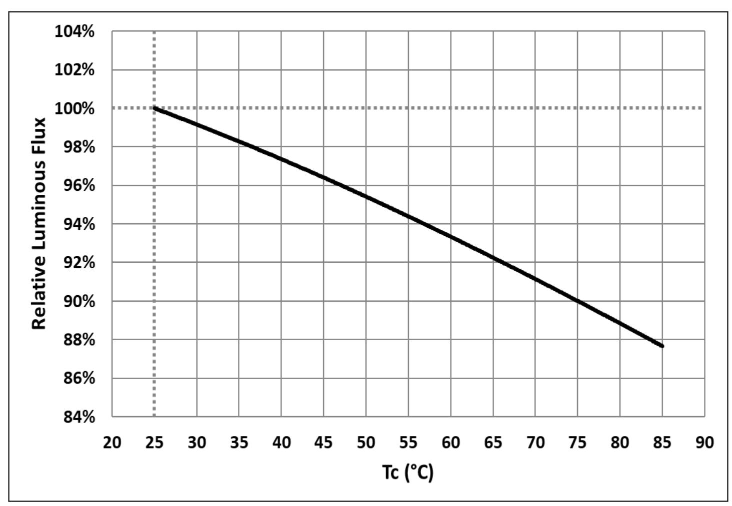
Relative Luminous Flux - Blue

Relative Luminous Flux vs. Tc
φv/φv(25 °C), Single Pulse 20ms, If = 0.7A



Relative Luminous Flux - White

Relative Luminous Flux vs. Tc
φv/φv(25 °C), Single Pulse 20ms, If = 0.7A



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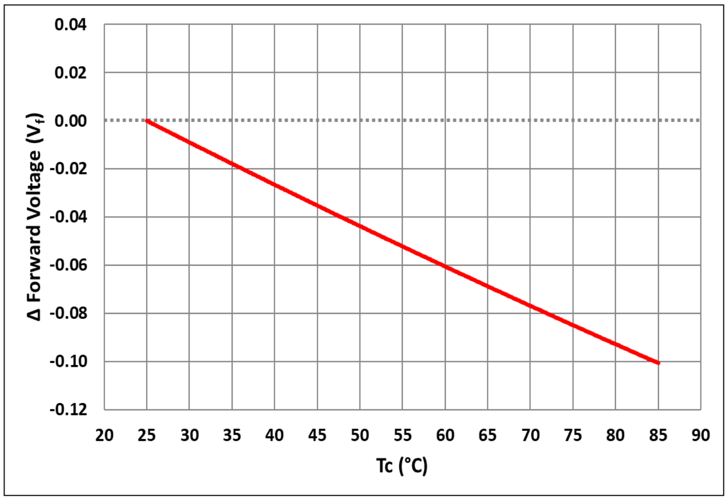
Optical & Electrical Characteristics

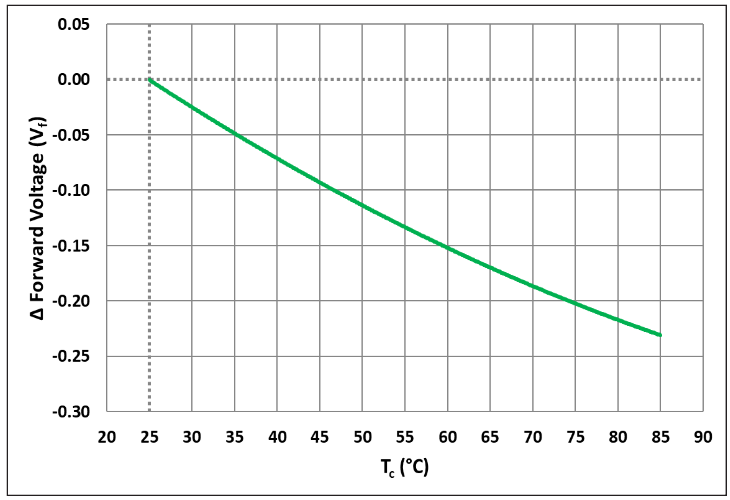
Voltage change as function of Case Temperaure - Red

Δ Forward Voltage (Vf) vs. Tc
Vf(Tc) - Vf(25°), Single Pulse 20ms, If = 0.7A



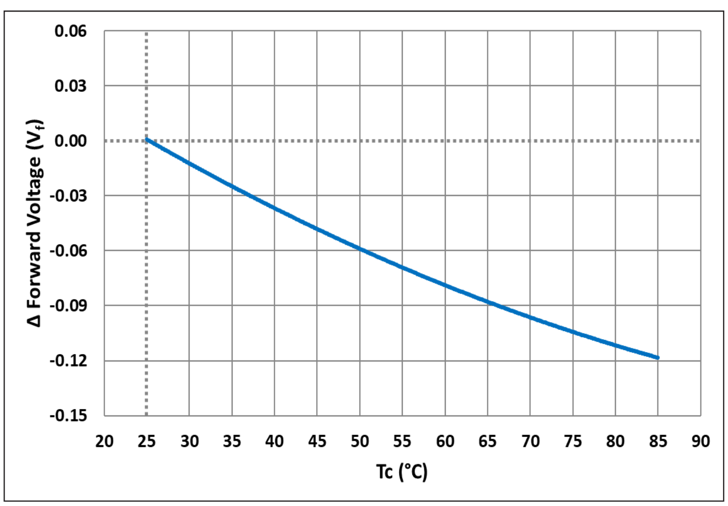
Voltage change as function of Case Temperaure - Green

Δ Forward Voltage (Vf) vs. Tc
Vf(Tc) - Vf(25°), Single Pulse 20ms, If = 0.7A



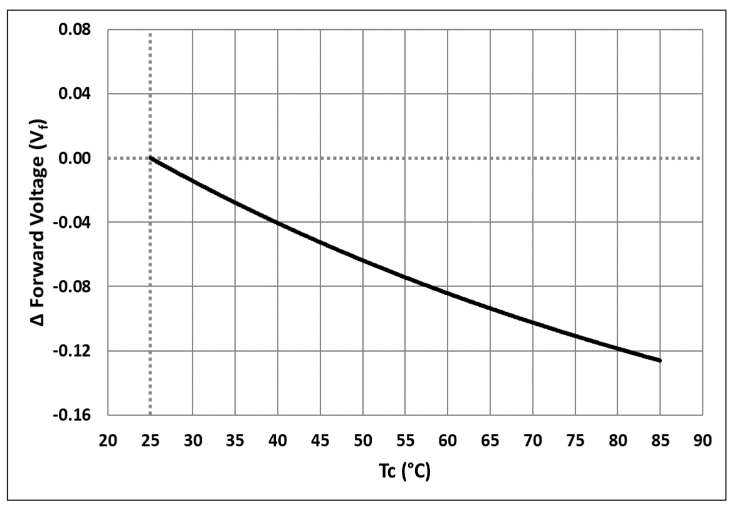
Voltage change as function of Case Temperaure - Blue

Δ Forward Voltage (Vf) vs. Tc
Vf(Tc) - Vf(25°), Single Pulse 20ms, If = 0.7A



Voltage change as function of Case Temperaure - White

Δ Forward Voltage (Vf) vs. Tc
Vf(Tc) - Vf(25°), Single Pulse 20ms, If = 0.7A



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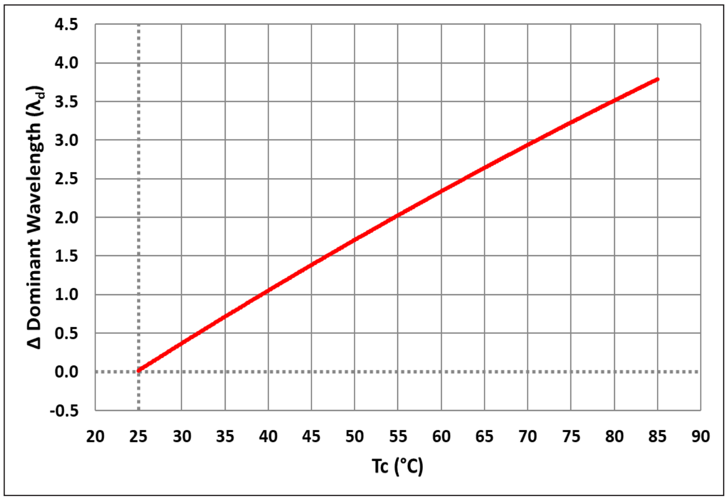
Optical & Electrical Characteristics

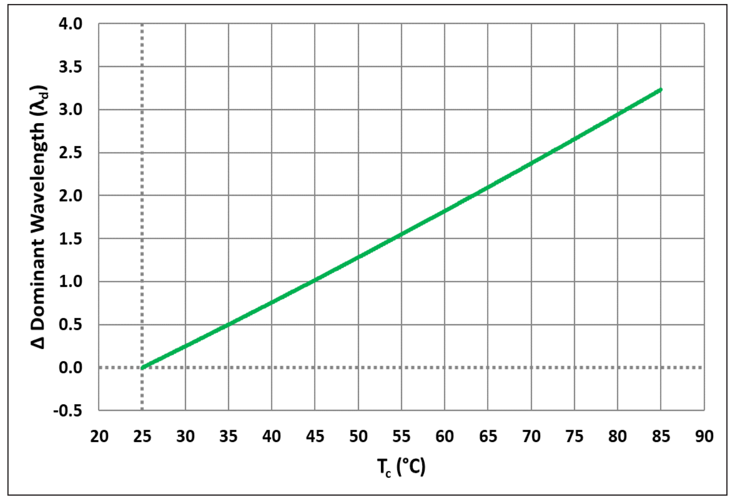
Wavelength change as function of Case Temperature - Red

Δ Dominant Wavelength (λd) vs. Tc
λd(Tc) - λd(25°), If = 0.7A



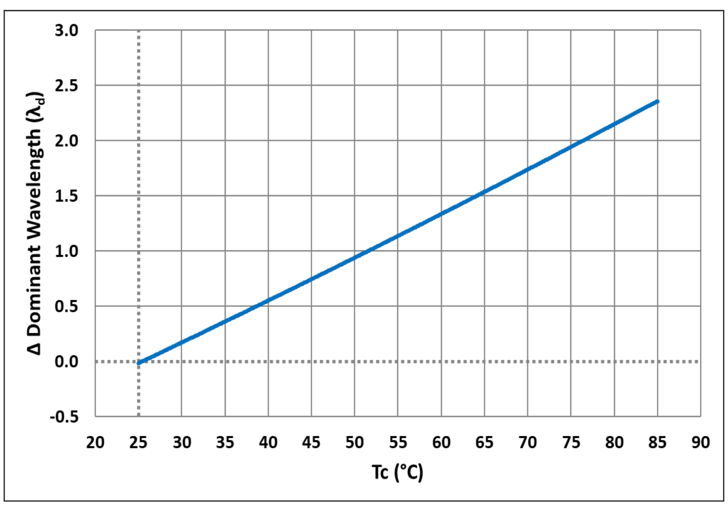
Wavelength change as function of Case Temperature - Green

Δ Dominant Wavelength (λd) vs. Tc
λd(Tc) - λd(25°), If = 0.7A



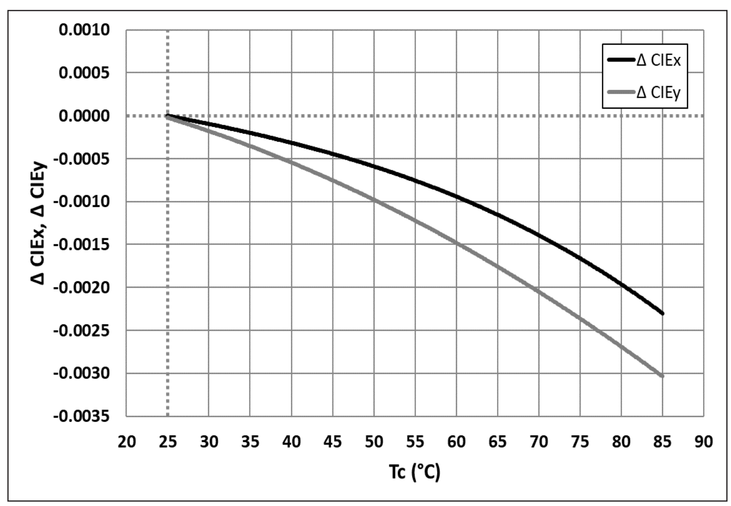
Wavelength change as function of Case Temperature - Blue

Δ Dominant Wavelength (λd) vs. Tc
λd(Tc) - λd(25°), If = 0.7A



CIEx, y change as function of Case Temperature - White

Δ Dominant Wavelength (λd) vs. Tc
λd(Tc) - λd(25°), If = 0.7A



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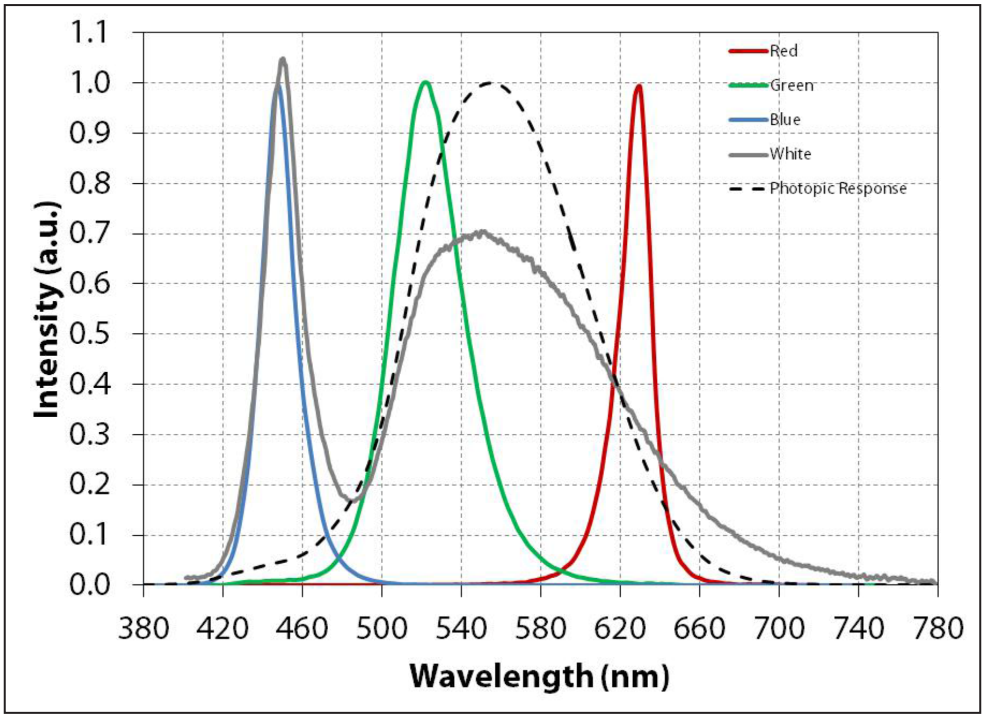
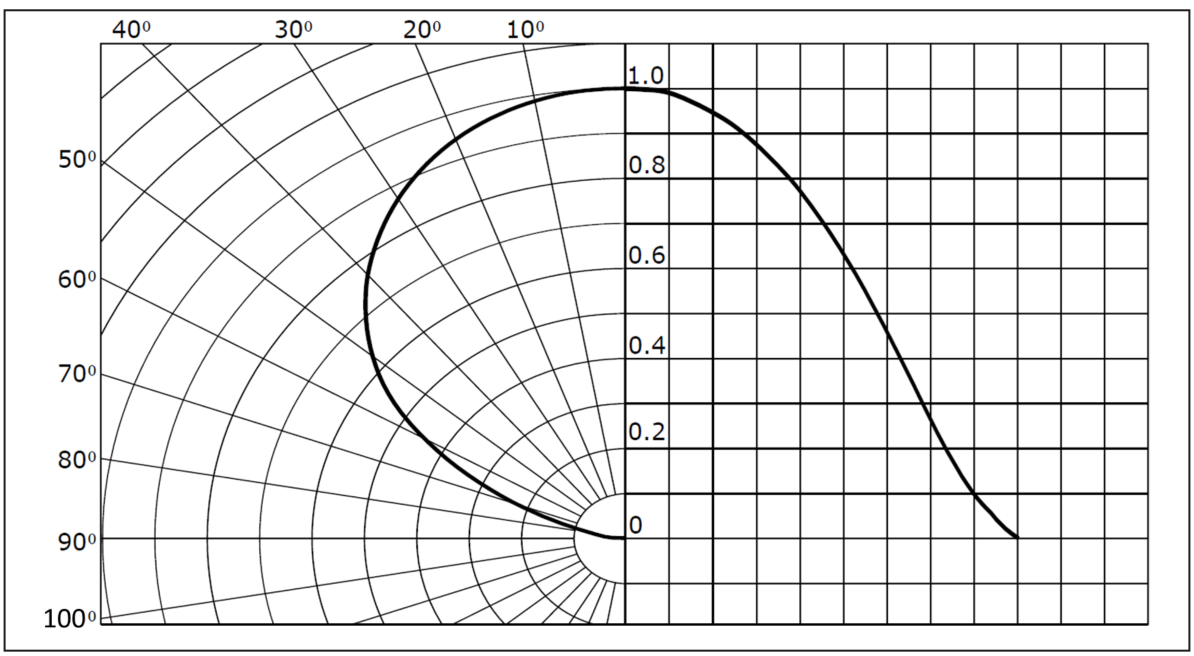
Typical Spectrum



Angular Intensity Distribution (Typical)



Note 8: Typical spectrum from Red, Green, Blue and White LEDs at reference current of 0.7 A, CW. Please contact Luminus to obtain data in Excel format.

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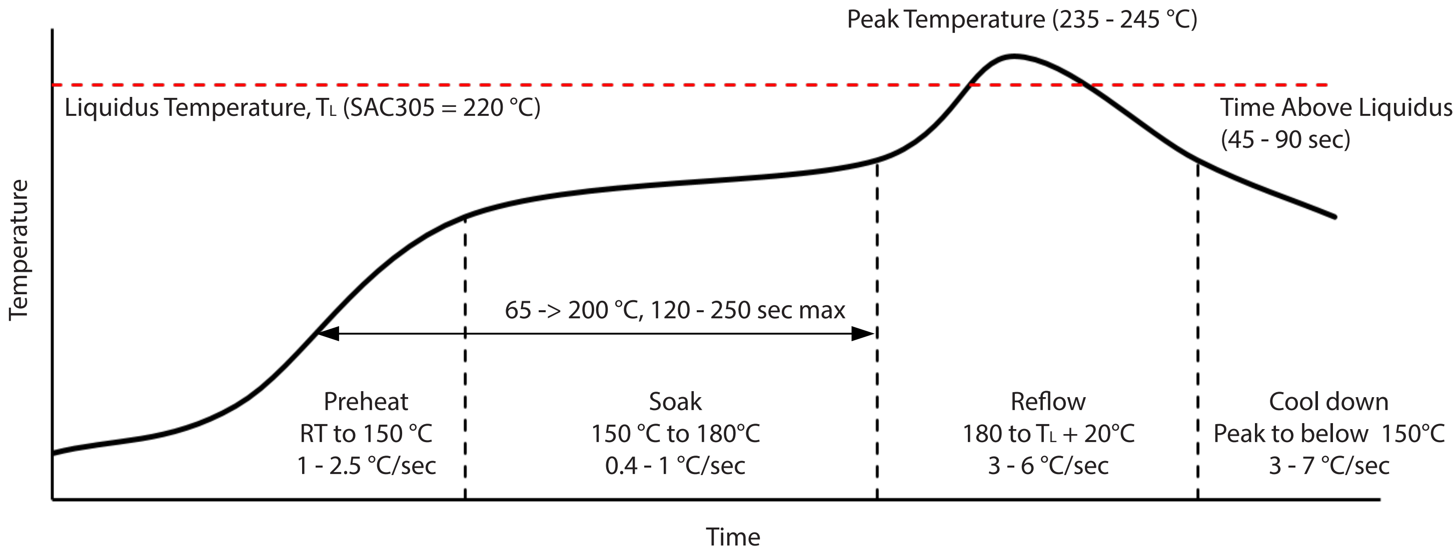
Solder Profile



SMT Rework Guideline	Manual Hotplate Reflow	Hot Air Gun Reflow
Heating Time	< 60 sec	
Hotplate Temperature	< 245°C	< 150°C

Note 1: Product complies to Moisture Sensitivity Level 3 (MSL 3)

Note 2: The numbers in the table are specific to SAC305. Luminus recommends using an SAC305 solder paste with a no-clean flux for RoHS compliant products.

Note 3: During the pick and place process, axial forces on the dome (or window) should not exceed 0.5 Newtons (N)

Note 4: Use of a multi-zone IR reflow oven with a nitrogen blanket is recommended.

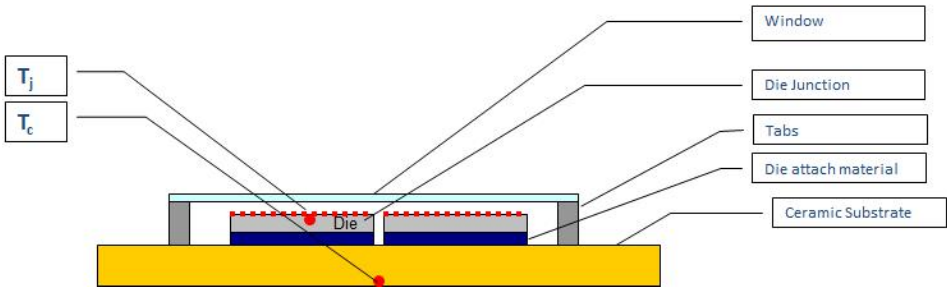
Note 5: Time-temperature profile of the reflow process showing the four functional profile zones are defined in IPC-7801. Temperature is referenced to the center of the PCB.

Note 6: Luminus recommends to use the solder paste data sheet information as a starting point in time-temperature process development.

Note 7: These are general guidelines. Consult the solder paste manufacturer's datasheet for guidelines specific to the alloy and flux combination used in your application. For more information, please refer to: https://luminusdevices.zendesk.com/hc/en-us/articles/360060306692-How-do-I-Reflow-Solder-Luminus-SMD-Components-

Note 8: For any technical questions about soldering process, please contact Luminus at techsupport@luminus.com.

SBM-40-LC Thermal Resistance



Thermal resistance junction to case, $R_{th(j-c)\_real}$ = 1.0 °C/W (typ.),(All chips operated simultaneously)
Thermal resistance junction to case, $R_{th(j-c)\_electrical}$ = 0.8 °C/W (typ.) (All chips operated simultaneously)

Case Temperature (T_c) = Temperature at bottom of ceramic substrate.

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

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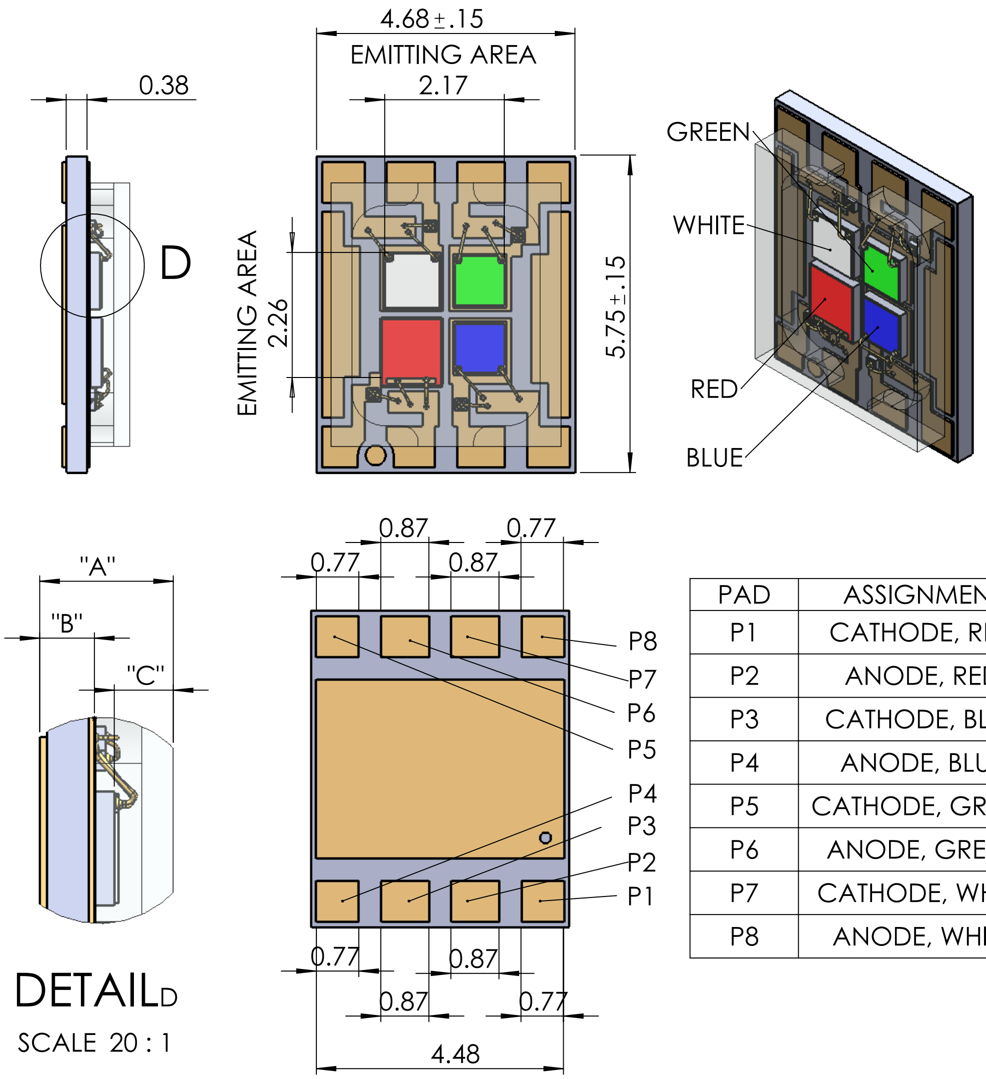
Mechanical Dimensions – SBM-40-LC Emitter



PAD	ASSIGNMENT
P1	CATHODE, RED
P2	ANODE, RED
P3	CATHODE, BLUE
P4	ANODE, BLUE
P5	CATHODE, GREEN
P6	ANODE, GREEN
P7	CATHODE, WHITE
P8	ANODE, WHITE

DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	BOTTOM OF SUBSTRATE TO TOP OF WINDOW	1.21	±.10
"B"	BOTTOM OF SUBSTRATE TO TOP OF COPPER TRACE	0.52	±.05
"C"	TOP OF DIE EMITTING AREA TO TOP OF WINDOW	0.48	±.07

For prototyping purposes, please see Bergquist thermal clad boards, part #803807 (square board) or part # 803808 (star board). Available from Digi-Key or Mouser.

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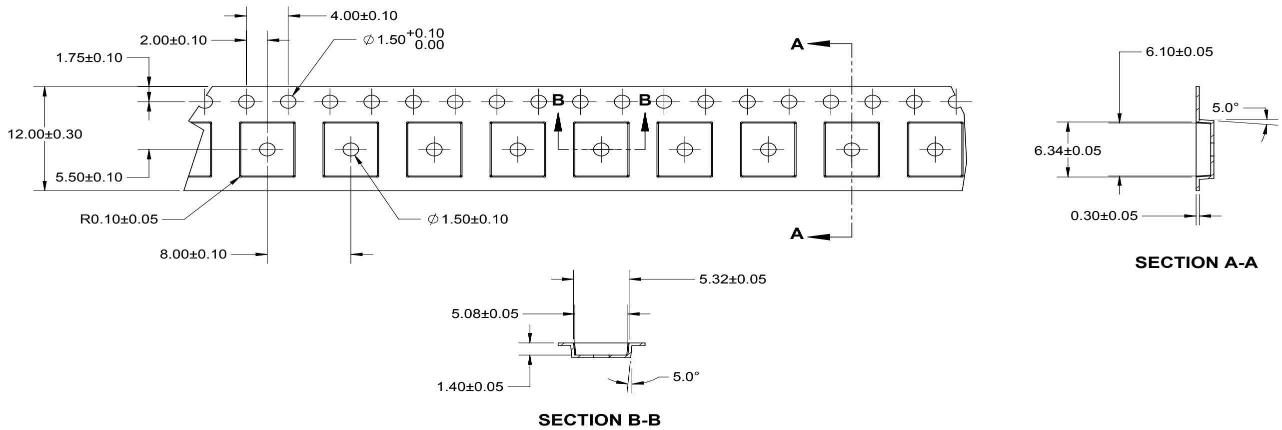
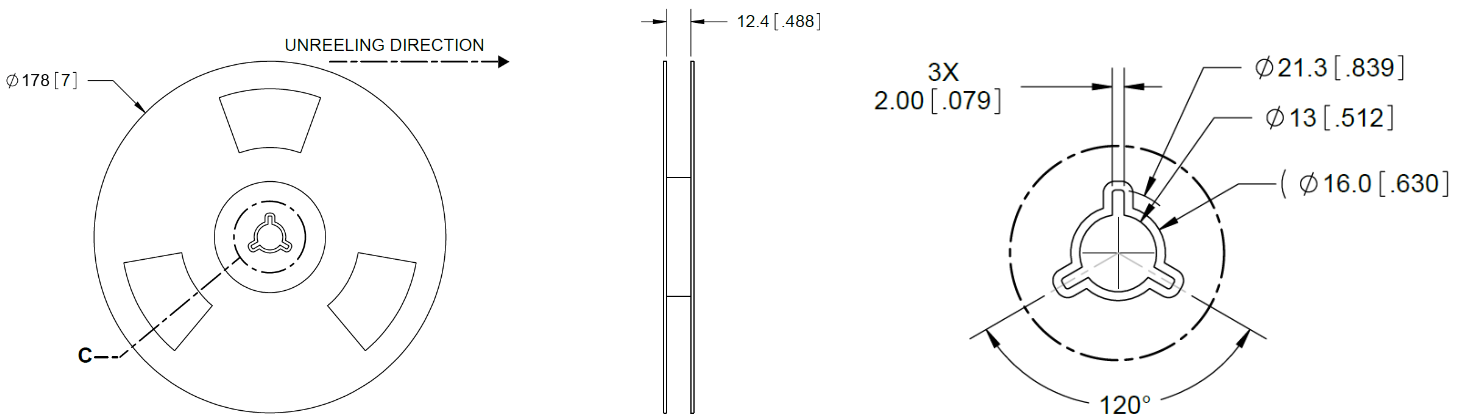
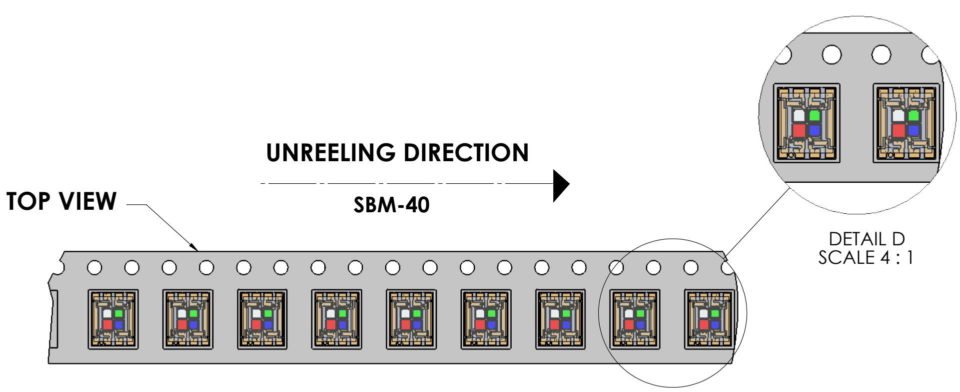
Shipping Reel Outline

Packing Unit = 500 pcs per reel







Note: For detailed drawing, please refer to drawing number: TO-1156.

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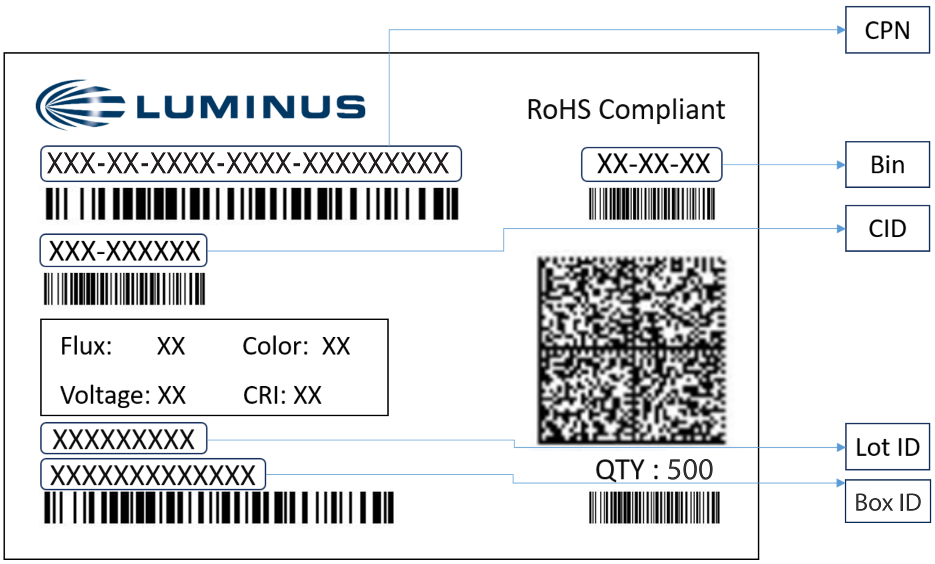
Shipping Label



Label Fields:

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

Packing Configuration:

- Maximum 500 devices per reel
- Partial reel may be shipped
- Each pack is enclosed in anti-static bag
- Shipping label is placed on top of each pack

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Revision History

Rev	Date	Description of Change
01	05/08/2016	Preliminary Datasheet release
02	04/03/2017	Update binning structure and maximum current
03	04/07/2017	Refine binning structure
04	08/15/2018	Update white chromaticity bins, switch to monolithic window and change ordering part number
05	10/26/2018	Update blue maximum radiometric power to 1100mW
06	04/28/2022	Update white bin definition, characteristic graphs and solder profile, add shipping label, and some editorial changes
07	06/08/2022	Update characteristic graphs

This product is protected by U.S. Patents 6,831,302; 7,074,631; 7,083,993; 7,084,434; 7,098,589; 7,105,861; 7,138,666; 7,166,870; 7,166,871; 7,170,100; 7,196,354; 7,211,831; 7,262,550; 7,274,043; 7,301,271; 7,341,880; 7,344,903; 7,345,416; 7,348,603; 7,388,233; 7,391,059 Patents Pending in the U.S. and other countries.

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