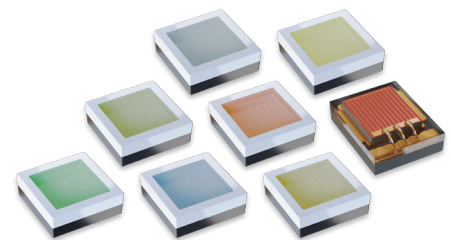


# LUXEON Rubix

## High drive, tiny LED, max performance

LUXEON Rubix is a breakthrough design for the LED industry. Designed with high driving current capability and small form factor, it provides maximum flux in a minimal amount of space making it ideal for entertainment, architecture and emergency vehicle lighting application. This LED provides double the flux at much higher driving current compared to previous generations. It is the smallest form factor in the Lumileds Colors portfolio enabling it to be packaged even closer to achieve higher lumen output at higher lumen densities. The individual emitters and color gamut allow customers to have much better flexibility in their product design.



### FEATURES AND BENEFITS

Tiny footprint 1414 package

High Drive current up to 1.6A DC

Maximized punch (cd/lm)

### PRIMARY APPLICATIONS

Moving Head

Spotlights

Wall Wash

Floodlights

Landscape Lighting

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# General Product Information

## Product Test Conditions

LUXEON Rubix Color Line LEDs are tested and binned with a DC drive current and junction temperature specified below:

LUXEON Rubix Color - 1500mA,  $T_j=85^\circ\text{C}$

LUXEON Rubix Red Option 2 (L1RX-RED2000000000) - 1000mA,  $T_j=85^\circ\text{C}$

LUXEON Rubix White 5700K 60CRI - 1500mA,  $T_j=85^\circ\text{C}$

LUXEON Rubix White for 80CRI and 90CRI - 1000mA,  $T_j=85^\circ\text{C}$

## Part Number Nomenclature

Part numbers for LUXEON Rubix Colors follow the convention below:

L 1 R X - **A A A B** 0 0 0 0 0 0 0 0 0 0

Where:

- A A A** - designates color (RED=Red, PCA=PC Amber, LME=Lime, GRN=Green, CYN=Cyan, BLU=Blue, RYL=Royal Blue)
- B** - designates product option (example 1, 2...etc)

Therefore, the following part number is used for a LUXEON Rubix Red LED:

L 1 R X - **R E D** 2 0 0 0 0 0 0 0 0 0

Part numbers for LUXEON Rubix White follow the convention below:

L 1 R X - **A A B B** 0 0 0 0 0 0 0 0 0 0

Where:

- A A** - designates nominal CCT (22=2200K, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 45=4500K, 57=5700K, 65=6500K)
- B B** - designates minimum CRI (60=60CRI, 80=80CRI, 90=90CRI)

Therefore, the following part number is used for a LUXEON Rubix White 5700K 60CRI LED:

L 1 R X - **5 7 6 0** 0 0 0 0 0 0 0 0 0 0

## Lumen Maintenance

Please contact your local Sales Representative or Lumileds Technical Solutions Manager for more information about the long-term performance of this product.

## Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON Rubix is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the ROHS Directive 2011/65/EU including amendments 2015/863/EU & 2017/2102/EU and REACH Regulation (EC) 1907/2006. Lumileds LLC will not intentionally add the following restricted materials to its products: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

# Performance Characteristics

## Product Selection Guide

Table 1a. Product performance of LUXEON Rubix Colors at 1500mA, T<sub>j</sub>=85°C

COLOR	DOMINANT OR PEAK WAVELENGTH <sup>[1]</sup> (nm)		LUMINOUS FLUX (lm) OR RADIOMETRIC POWER <sup>[2]</sup> (mW)		PART NUMBER
	MINIMUM	MAXIMUM	MINIMUM	TYPICAL	
PC Amber	-	-	240	308	L1RX-PCA1000000000
Lime	-	-	502	591	L1RX-LME1000000000
Green	520	535	280	360	L1RX-GRN1000000000
Cyan	490	510	180	279	L1RX-CYN1000000000
Blue	465	485	80	130	L1RX-BLU1000000000
Royal Blue	440	455	1700	1970	L1RX-RYL1000000000

Notes for Table 1a:

- Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.
- Royal Blue is binned by peak wavelength. All other colors are binned by dominant wavelength.
- Royal Blue is binned by radiometric power. All other colors are binned by luminous flux.

Table 1b. Product performance of LUXEON Rubix L1RX-RED2000000000 at 1000mA, T<sub>j</sub>=85°C

COLOR	DOMINANT WAVELENGTH <sup>[1]</sup> (nm)		LUMINOUS FLUX <sup>[1]</sup> (lm)		PART NUMBER
	MINIMUM	MAXIMUM	MINIMUM	TYPICAL	
Red	620	630	65	78	L1RX-RED2000000000

Notes for Table 1b:

- Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.

Table 1c. Product performance of LUXEON Rubix White 60CRI at 1500mA, T<sub>j</sub>=85°C

COLOR	NOMINAL CCT	MINIMUM CRI <sup>[1]</sup>	LUMINOUS FLUX <sup>[1]</sup> (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	PART NUMBER
			MINIMUM	TYPICAL		
White 60CRI	5700K	60	440	510	108	L1RX-57600000000000

Notes for Table 1c:

- Lumileds maintains a tolerance of ±6.5% on luminous flux and ±2 on CRI measurements for these products.

Table 1d. Product performance of LUXEON Rubix White at 1000mA, T<sub>j</sub>=85°C

COLOR	NOMINAL CCT	MINIMUM CRI <sup>[1]</sup>	LUMINOUS FLUX <sup>[1]</sup> (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	PART NUMBER
			MINIMUM	TYPICAL		
White 80CRI and 90CRI	2200K	80	200	242	80	L1RX-22800000000000
	2700K	80	240	282	93	L1RX-27800000000000
	3000K	80	260	295	98	L1RX-30800000000000
	3500K	80	260	317	105	L1RX-35800000000000
	4000K	80	280	320	106	L1RX-40800000000000
	4500K	80	280	323	107	L1RX-45800000000000
	6500K	80	280	325	108	L1RX-65800000000000
	2700K	90	200	230	76	L1RX-27900000000000

Notes for Table 1d:

- Lumileds maintains a tolerance of ±6.5% on luminous flux and ±2 on CRI measurements for these products.

# Optical Characteristics

Table 2a. Optical characteristics for LUXEON Rubix Colors at 1500mA, T<sub>j</sub>=85°C

COLOR	PART NUMBER	TYPICAL SPECTRAL HALF-WIDTH <sup>[1]</sup> (nm)	TYPICAL TEMPERATURE COEFFICIENT OF DOMINANT OR PEAK WAVELENGTH (nm/°C)	TYPICAL TOTAL INCLUDED ANGLE <sup>[2]</sup>	TYPICAL VIEWING ANGLE <sup>[3]</sup>
PC Amber	L1RX-PCA1000000000	78	-0.01	140	125
Lime	L1RX-LME1000000000	101	0.02	140	125
Green	L1RX-GRN1000000000	36	0.05	140	125
Cyan	L1RX-CYN1000000000	29	0.03	140	125
Blue	L1RX-BLU1000000000	28	0.04	140	125
Royal Blue	L1RX-RYL1000000000	22	0.05	140	125

**Notes for Table 2a:**

1. Spectral half-width is the spectral bandwidth at 50% of the peak intensity.
2. Total angle at which 90% of total luminous flux is captured.
3. Viewing angle is the off axis angle from the LED centerline where the luminous intensity is ½ of the peak value.

Table 2b. Optical characteristics for LUXEON Rubix L1RX-RED2000000000 at 1000mA, T<sub>j</sub>=85°C

COLOR	PART NUMBER	TYPICAL SPECTRAL HALF-WIDTH <sup>[1]</sup> (nm)	TYPICAL TEMPERATURE COEFFICIENT OF DOMINANT WAVELENGTH (nm/°C)	TYPICAL TOTAL INCLUDED ANGLE <sup>[2]</sup>	TYPICAL VIEWING ANGLE <sup>[3]</sup>
Red	L1RX-RED2000000000	20	0.05	140	124

**Notes for Table 2b:**

1. Spectral half-width is the spectral bandwidth at 50% of the peak intensity.
2. Total angle at which 90% of total luminous flux is captured.
3. Viewing angle is the off axis angle from the LED centerline where the luminous intensity is ½ of the peak value.

Table 2c. Optical characteristics for LUXEON Rubix White 60CRI at 1500mA, T<sub>j</sub>=85°C

COLOR	PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup>	TYPICAL VIEWING ANGLE <sup>[2]</sup>
White 60CRI	L1RX-5760000000000	140	125

**Notes for Table 2c:**

1. Total angle at which 90% of total luminous flux is captured.
2. Viewing angle is the off axis angle from the LED centerline where the luminous intensity is ½ of the peak value.

Table 2d. Optical characteristics for LUXEON Rubix White at 1000mA, T<sub>j</sub>=85°C

COLOR	PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup>	TYPICAL VIEWING ANGLE <sup>[2]</sup>
White 80CRI and 90CRI	L1RX-2280000000000	137	118
	L1RX-2780000000000		
	L1RX-3080000000000		
	L1RX-3580000000000		
	L1RX-4080000000000		
	L1RX-4580000000000		
	L1RX-6580000000000		
L1RX-2790000000000			

**Notes for Table 2d:**

1. Total angle at which 90% of total luminous flux is captured.
2. Viewing angle is the off axis angle from the LED centerline where the luminous intensity is ½ of the peak value.

# Electrical and Thermal Characteristics

Table 3a. Electrical and thermal characteristics for LUXEON Rubix at 1500mA, T<sub>j</sub>=85°C

COLOR	PART NUMBER	FORWARD VOLTAGE <sup>[1]</sup> (V <sub>f</sub> )			TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE <sup>[2]</sup> (mV/°C)	TYPICAL THERMAL RESISTANCE—JUNCTION TO SOLDER PAD (°C/W)
		MINIMUM	TYPICAL	MAXIMUM		
PC Amber	L1RX-PCA1000000000	2.85	3.15	3.50	-1.8	2.3
Lime	L1RX-LME1000000000	2.85	3.15	3.50	-1.8	2.1
Green	L1RX-GRN1000000000	2.55	2.89	4.50	-3.3	2.4
Cyan	L1RX-CYN1000000000	2.65	2.96	4.00	-3.3	2.2
Blue	L1RX-BLU1000000000	2.65	3.08	4.00	-1.9	1.8
Royal Blue	L1RX-RYL1000000000	2.85	3.15	3.50	-1.8	1.7
White	L1RX-5760000000000	2.85	3.15	3.50	-1.9	1.9

**Notes for Table 3a:**

1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Measured between 25°C and 85°C.

Table 3b. Electrical and thermal characteristics for LUXEON Rubix at 1000mA, T<sub>j</sub>=85°C

COLOR	PART NUMBER	FORWARD VOLTAGE <sup>[1]</sup> (V <sub>f</sub> )			TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE <sup>[2]</sup> (mV/°C)	TYPICAL THERMAL RESISTANCE — JUNCTION TO SOLDER PAD (°C/W)
		MINIMUM	TYPICAL	MAXIMUM		
Red	L1RX-RED2000000000	2.65	3.02	3.50	-1.6	2.0
	L1RX-2280000000000					
	L1RX-2780000000000					
	L1RX-3080000000000					
	L1RX-3580000000000					
	L1RX-4080000000000					
	L1RX-4580000000000					
	L1RX-6580000000000					
L1RX-2790000000000						

**Notes for Table 3b:**

1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Measured between 25°C and 85°C.

# Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON Rubix Color Line

PARAMETER	RED		GREEN AND BLUE	CYAN AND ROYAL BLUE	WHITE 60CRI, PC AMBER AND LIME	WHITE 80CRI AND 90CRI
DC Forward Current <sup>[1, 2]</sup>	1600mA	1400mA	1600mA	1600mA	1600mA	1600mA
Peak Pulsed Forward Current <sup>[1, 3]</sup>	1600mA	1400mA	3000mA	3000mA	3000mA	2600mA
LED Junction Temperature <sup>[1]</sup> (DC & Pulse)	120°C	135°C	150°C	150°C	150°C	150°C
ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)	Class 1A					
Operating Case Temperature <sup>[1, 4]</sup>	-40°C to 110°C		-40°C to 125°C	-40°C to 125°C	-40°C to 125°C	-40°C to 125°C
LED Storage Temperature	-40°C to 135°C					
Soldering Temperature	JEDEC 020c 260°C					
Allowable Reflow Cycles	3					
Reverse Voltage ( $V_{reverse}$ )	LUXEON LEDs are not designed to be driven in reverse bias					

**Notes for Table 4:**

- Proper current derating must be observed to maintain the junction temperature below the maximum allowable junction temperature.
- Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple," are acceptable if the following conditions are met:
  - The frequency of the ripple current is 100Hz or higher
  - The average current for each cycle does not exceed the maximum allowable DC forward current
  - The maximum amplitude of the ripple does not exceed the maximum peak pulsed forward current
- At 10% duty cycle with pulse width of 10ms.
- The maximum operating case temperature is based on respective typical current (binning current) of each color being used. At higher than typical currents, the user would have to use the thermal resistance of the device to calculate an appropriate maximum operating case temperature.

## Characteristic Curves

### Spectral Power Distribution Characteristics

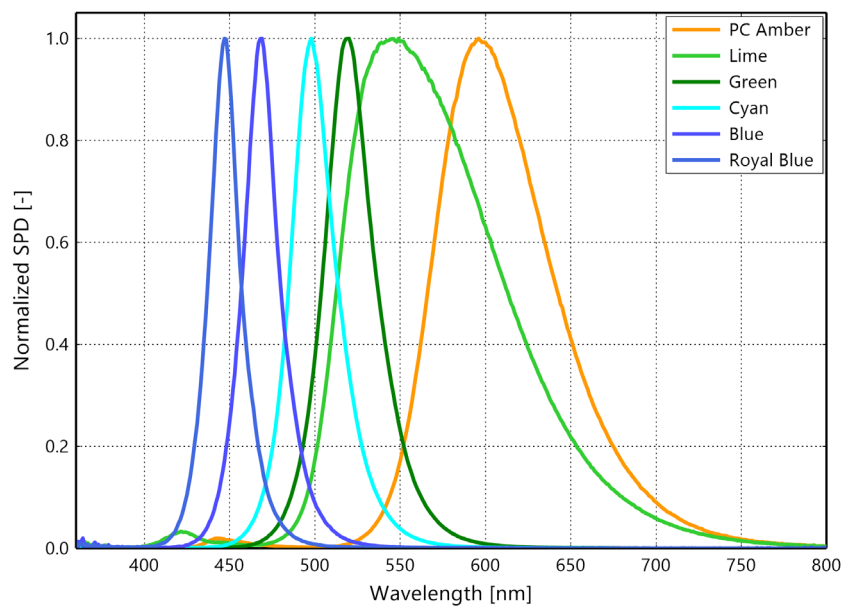


Figure 1a. Typical normalized power vs. wavelength for LUXEON Rubix Colors at 1500mA,  $T_j=85^\circ\text{C}$

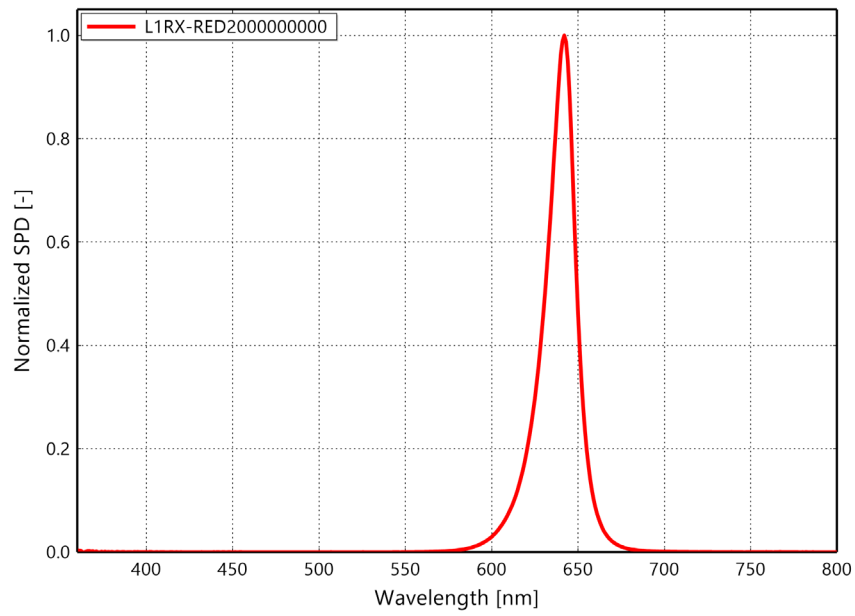


Figure 1b. Typical normalized SPD vs. wavelength for LUXEON Rubix L1RX-RED2000000000 at 1000mA,  $T_j=85^{\circ}\text{C}$

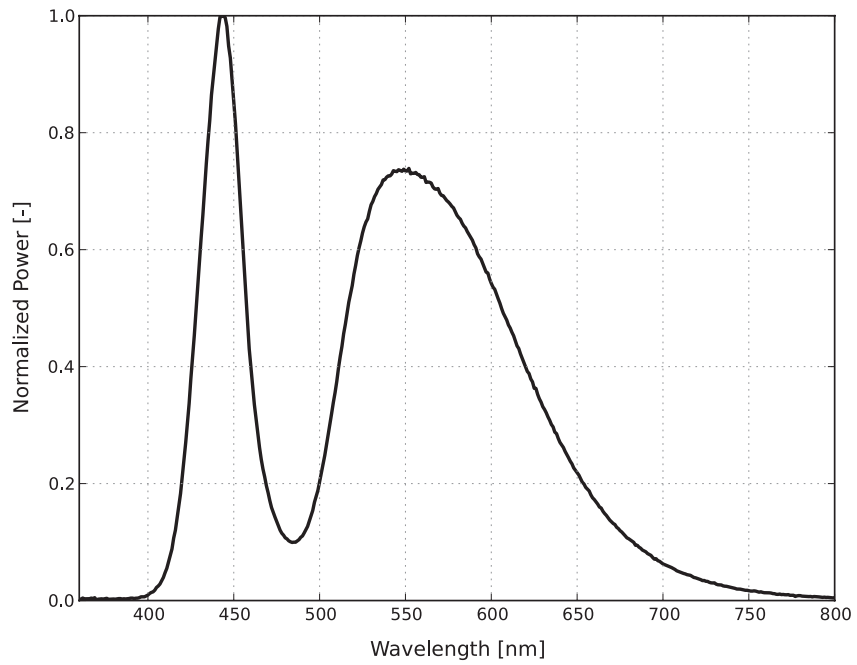


Figure 1c. Typical normalized power vs. wavelength for LUXEON Rubix White 5700K 60CRI at 1500mA,  $T_j=85^{\circ}\text{C}$

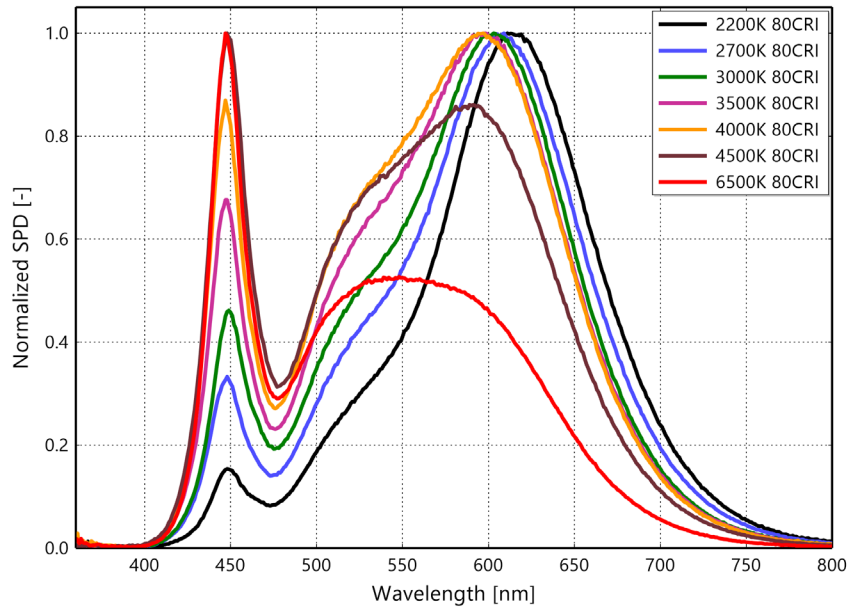


Figure 1d. Typical normalized power vs. wavelength for LUXEON Rubix White 80CRI at 1000mA,  $T_j=85^\circ\text{C}$

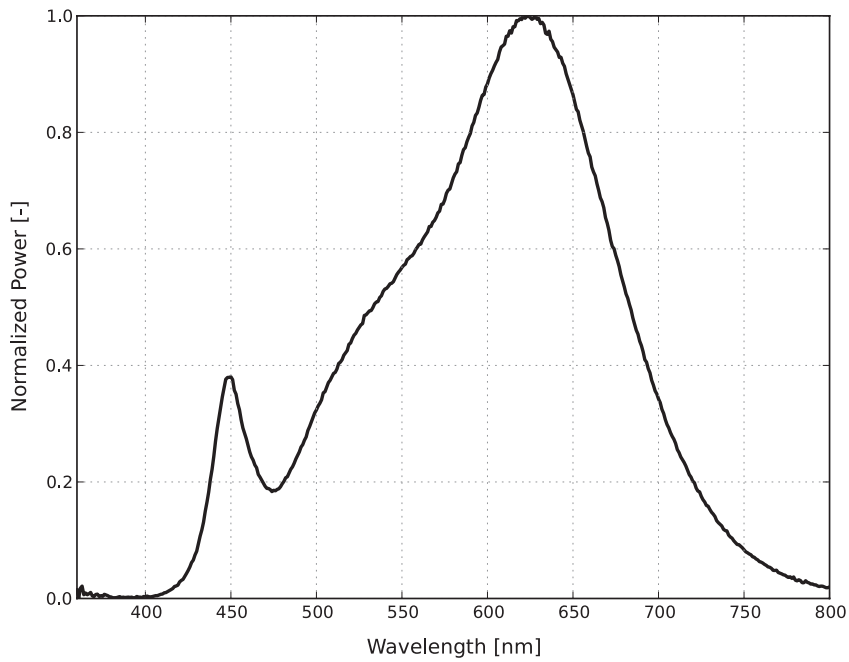


Figure 1e. Typical normalized power vs. wavelength for LUXEON Rubix White 2700K 90CRI at 1000mA,  $T_j=85^\circ\text{C}$

# Light Output Characteristics

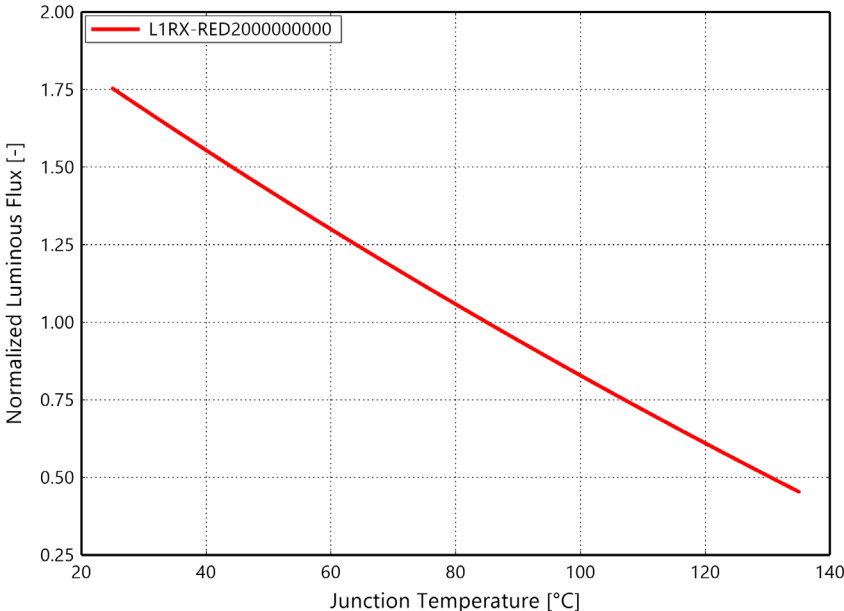


Figure 2a. Typical normalized luminous flux vs. junction temperature for LUXEON Rubix L1RX-RED2000000000 at 1000mA

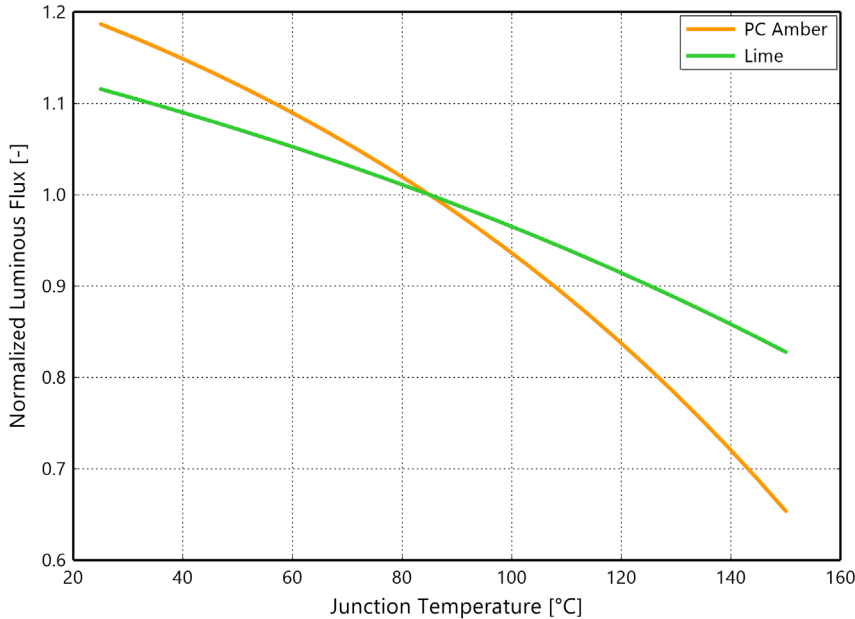


Figure 2b. Typical normalized luminous flux vs. junction temperature for LUXEON Rubix PC Amber and Lime at 1500mA

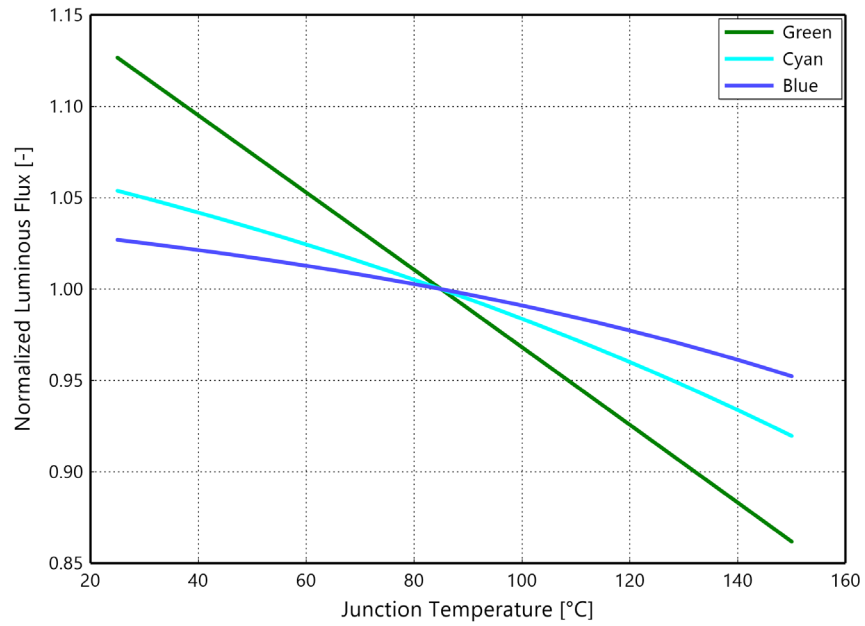


Figure 2c. Typical normalized luminous flux vs. junction temperature for LUXEON Rubix Green, Cyan and Blue at 1500mA

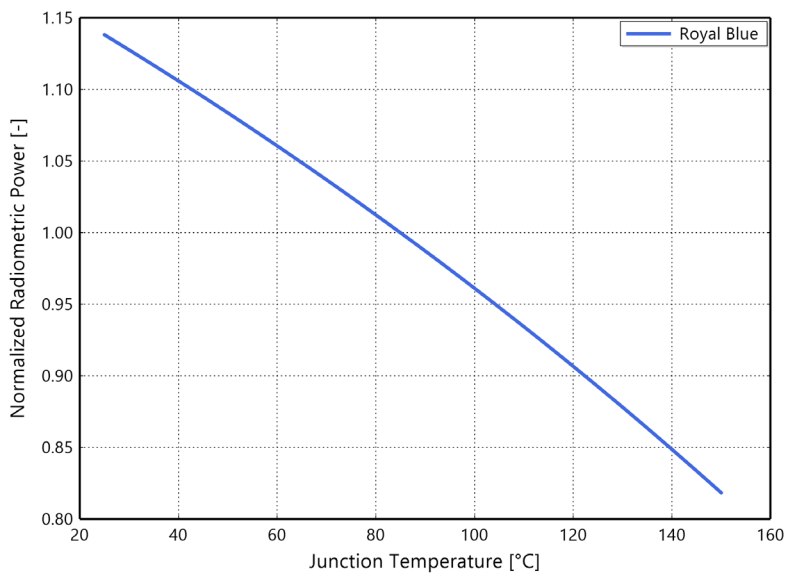


Figure 2d. Typical normalized radiometric power vs. junction temperature for LUXEON Rubix Royal Blue at 1500mA

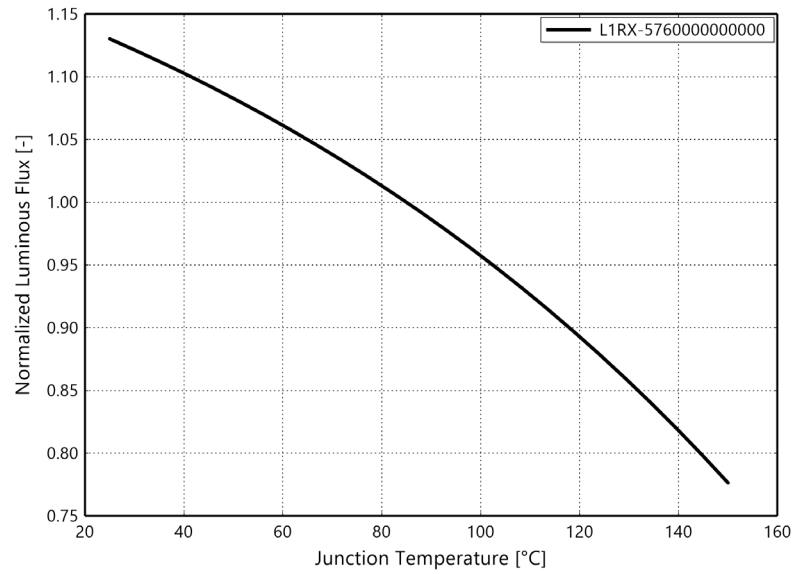


Figure 2e. Typical normalized luminous flux vs. junction temperature for LUXEON Rubix White 60CRI at 1500mA

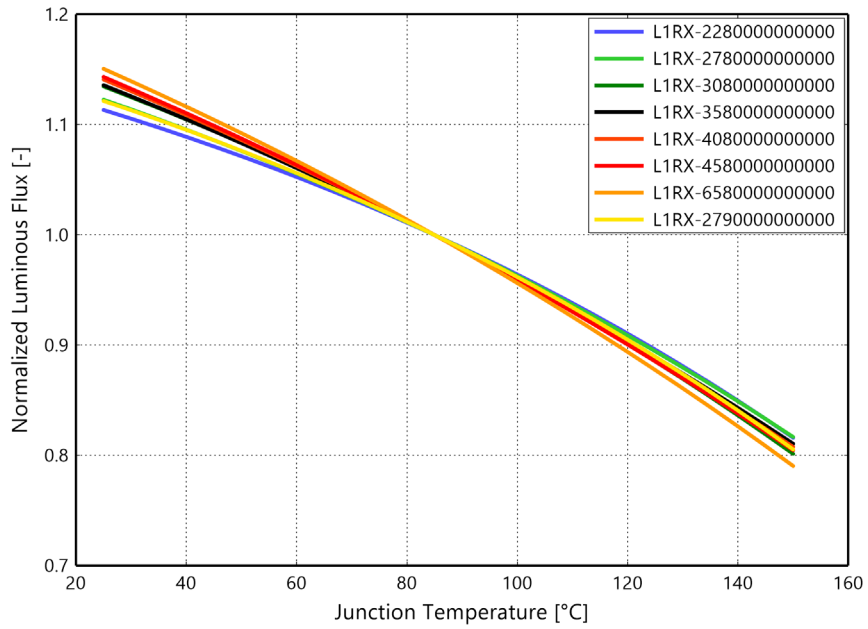


Figure 2f. Typical normalized luminous flux vs. junction temperature for LUXEON Rubix White 80CRI and 90CRI at 1000mA

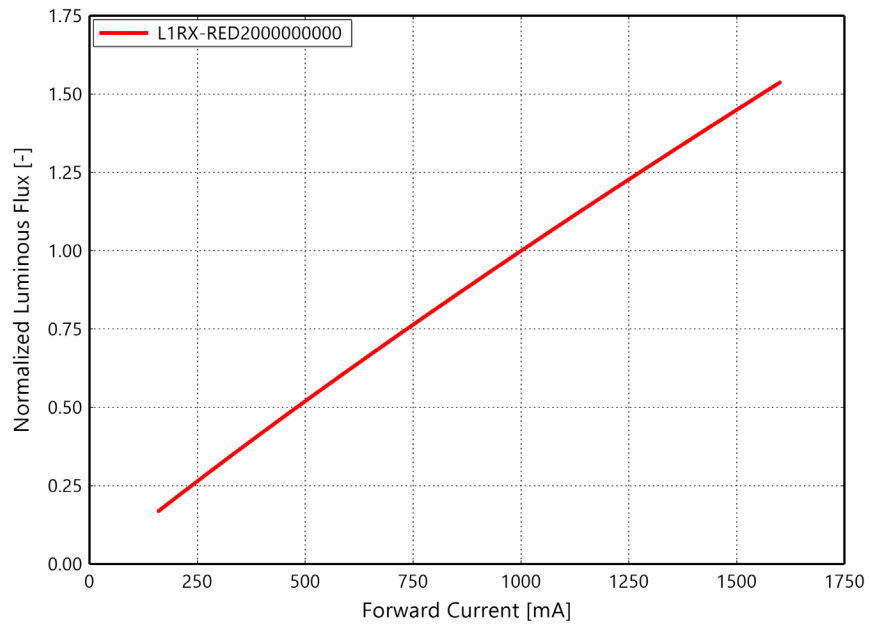


Figure 3a. Typical normalized luminous flux vs. forward current for LUXEON Rubix L1RX-RED2000000000 at  $T_j=85^\circ\text{C}$

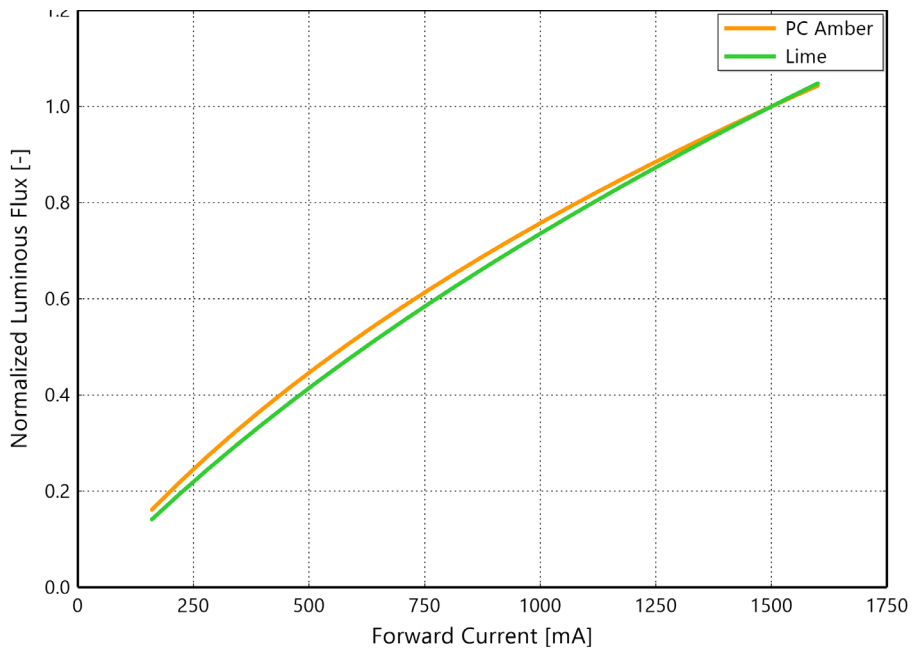


Figure 3b. Typical normalized luminous flux vs. forward current for LUXEON Rubix PC Amber and Lime at  $T_j=85^\circ\text{C}$

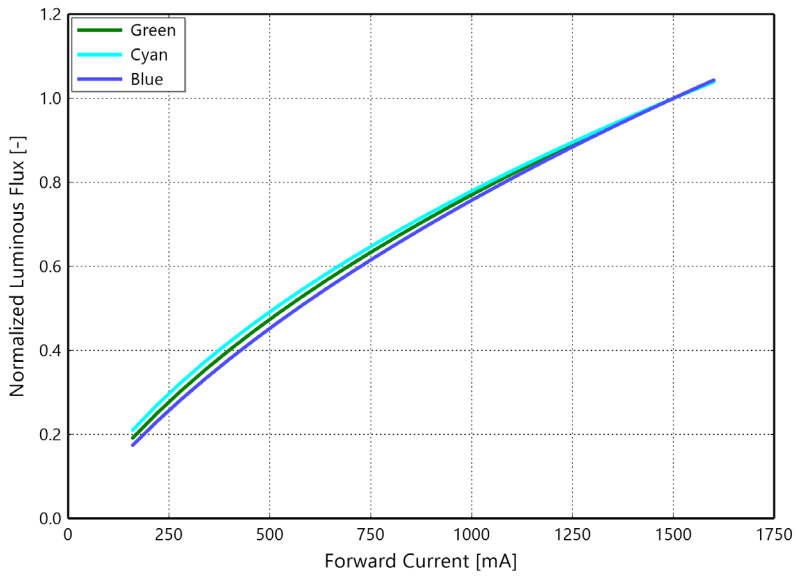


Figure 3c. Typical normalized luminous flux bin vs. forward current for LUXEON Rubix Green, Cyan and Blue at  $T_j=85^\circ\text{C}$

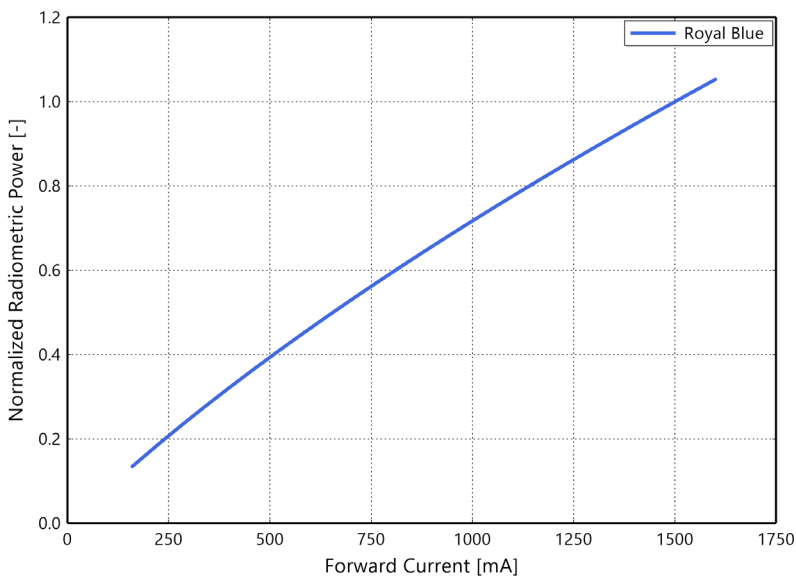


Figure 3d. Typical normalized radiometric power vs. forward current for LUXEON Rubix Royal Blue at  $T_j=85^\circ\text{C}$

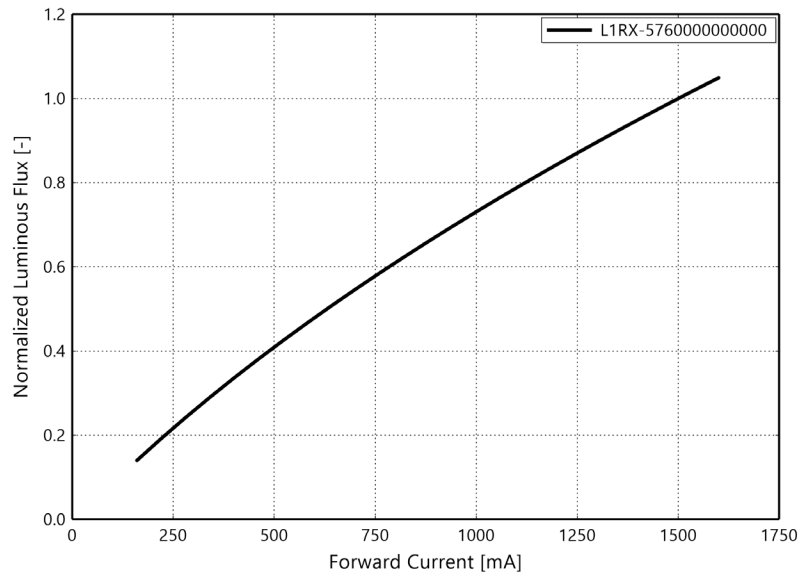


Figure 3e. Typical normalized luminous flux vs. forward current for LUXEON Rubix White 60CRI at  $T_j=85^\circ\text{C}$

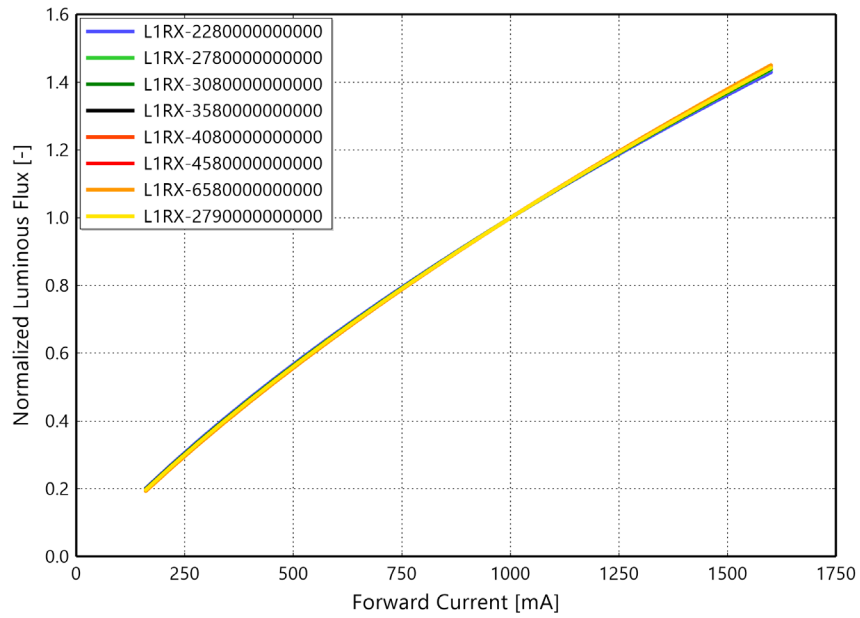


Figure 3f. Typical normalized luminous flux vs. forward current for LUXEON Rubix White 80CRI and 90CRI at  $T_j=85^\circ\text{C}$

# Forward Current Characteristics

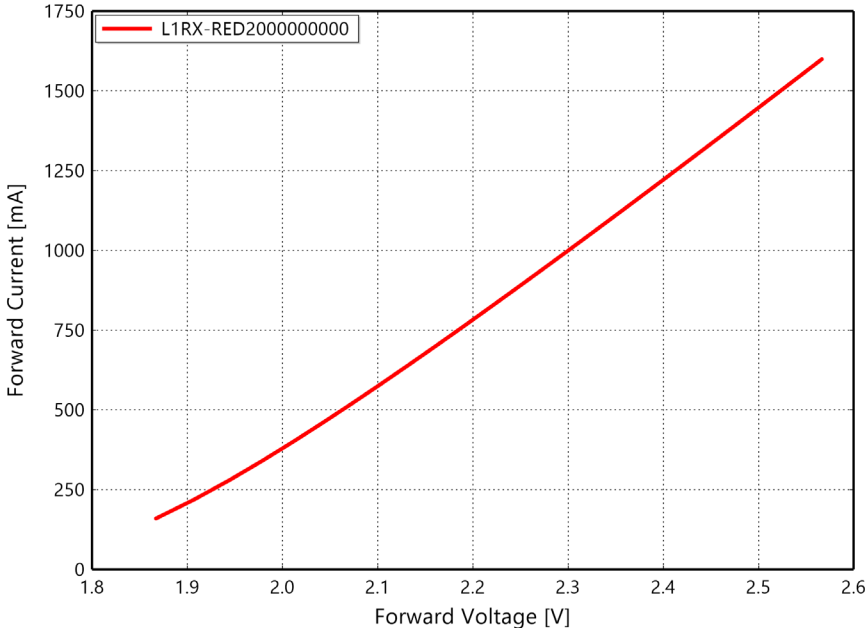


Figure 4a. Typical forward current vs. forward voltage for LUXEON Rubix L1RX-RED2000000000 at  $T_j=85^\circ\text{C}$

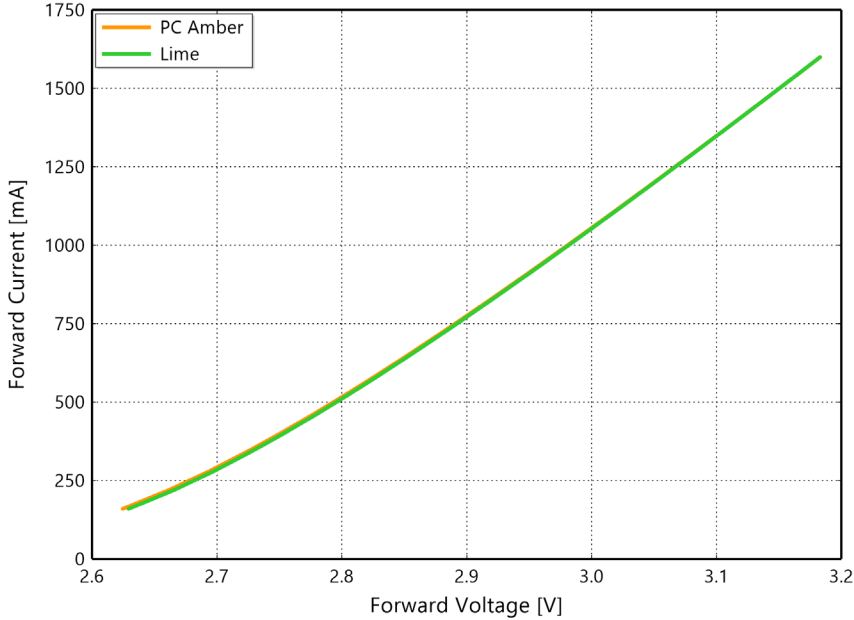


Figure 4b. Typical forward current vs. forward voltage for LUXEON Rubix PC Amber and Lime at  $T_j=85^\circ\text{C}$

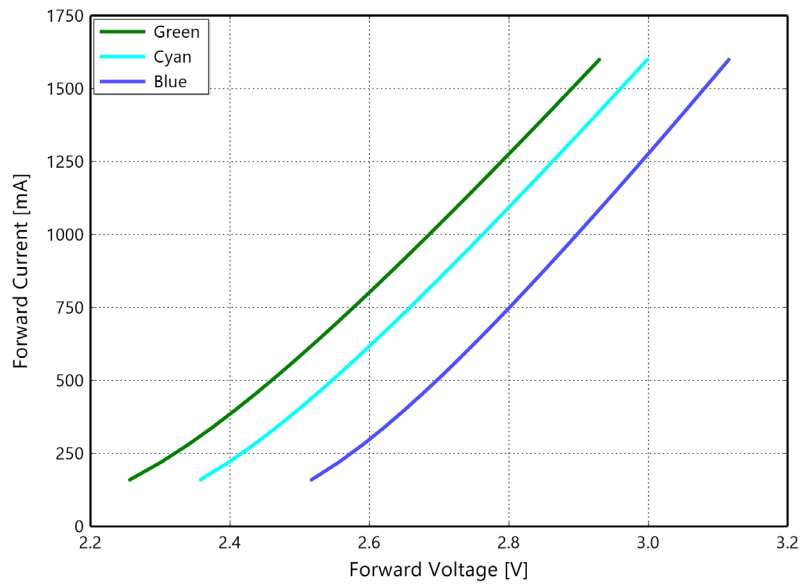


Figure 4c. Typical forward current vs. forward voltage for LUXEON Rubix Green, Cyan and Blue at  $T_j=85^\circ\text{C}$

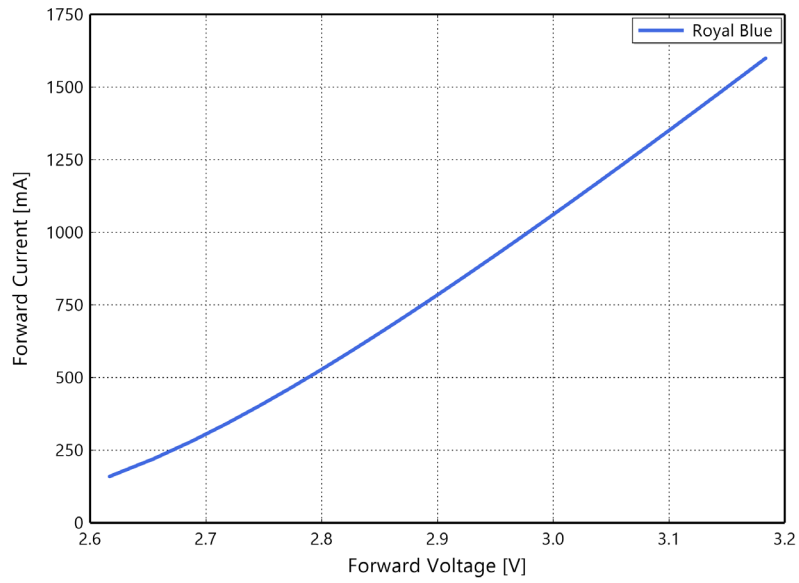


Figure 4d. Typical forward current vs. forward voltage for LUXEON Rubix Royal Blue at  $T_j=85^\circ\text{C}$

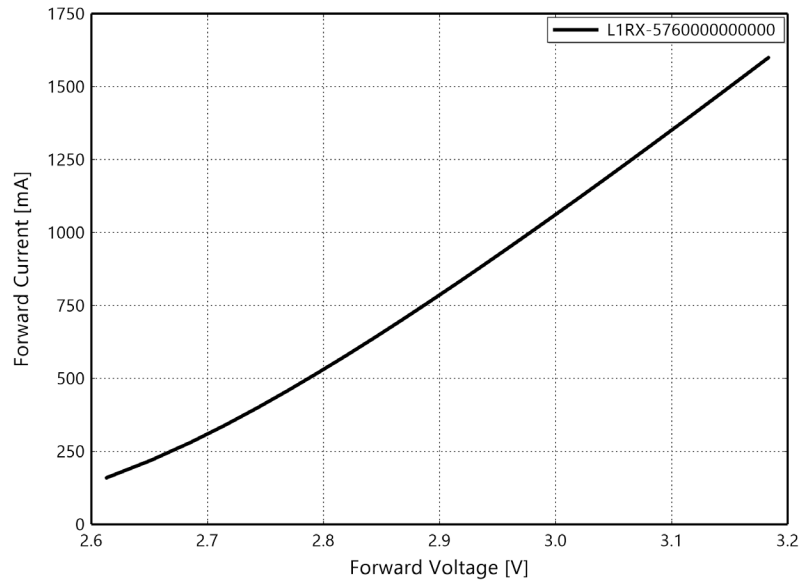


Figure 4e. Typical forward current vs. forward voltage for LUXEON Rubix White 60CRI at  $T_j=85^\circ\text{C}$

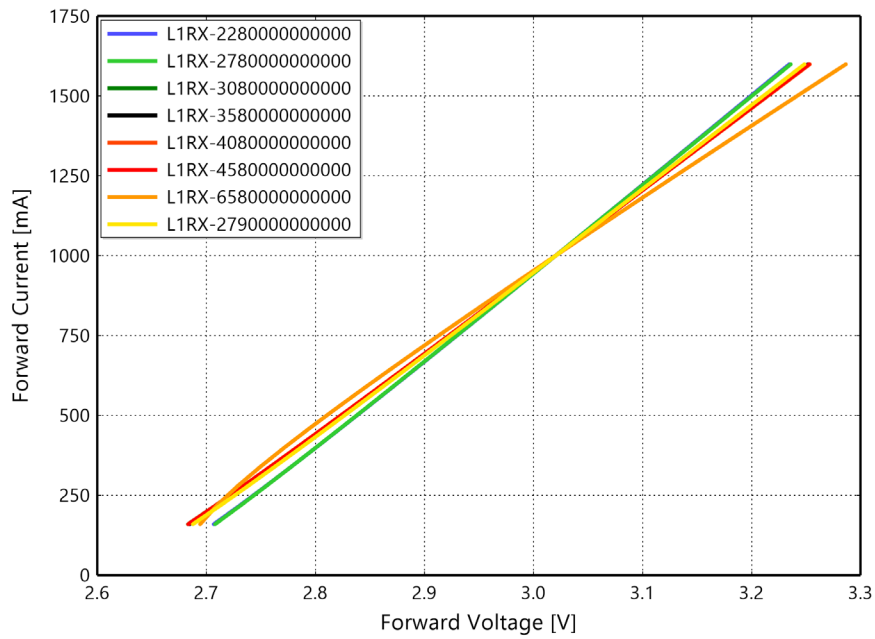


Figure 4f. Typical forward current vs. forward voltage for LUXEON Rubix White 80CRI and 90CRI at  $T_j=85^\circ\text{C}$

# Radiation Pattern Characteristics

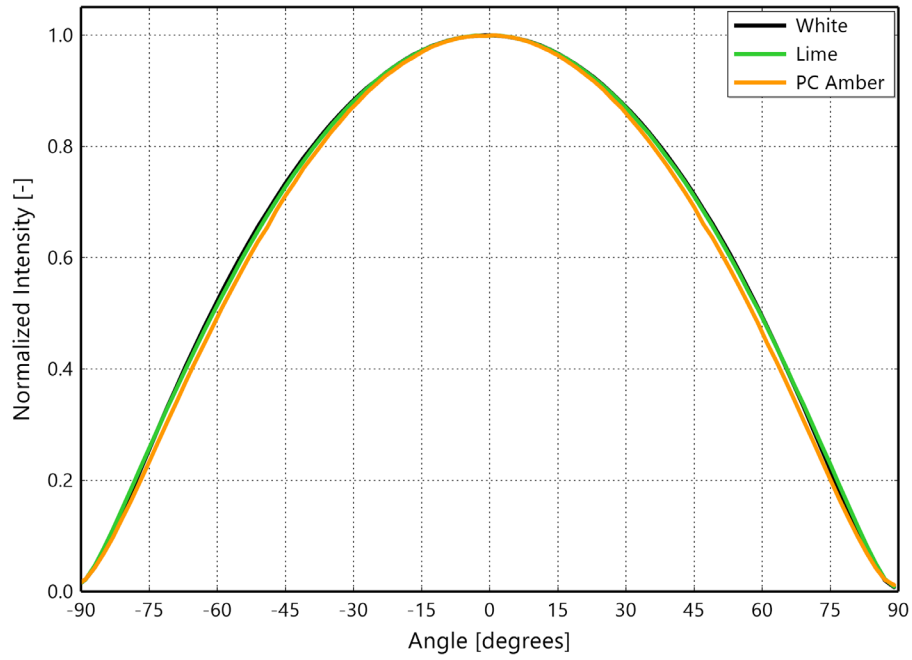


Figure 5a. Typical radiation pattern for LUXEON Rubix PC Amber, Lime and White 60CRI at 1500mA,  $T_j=85^\circ\text{C}$

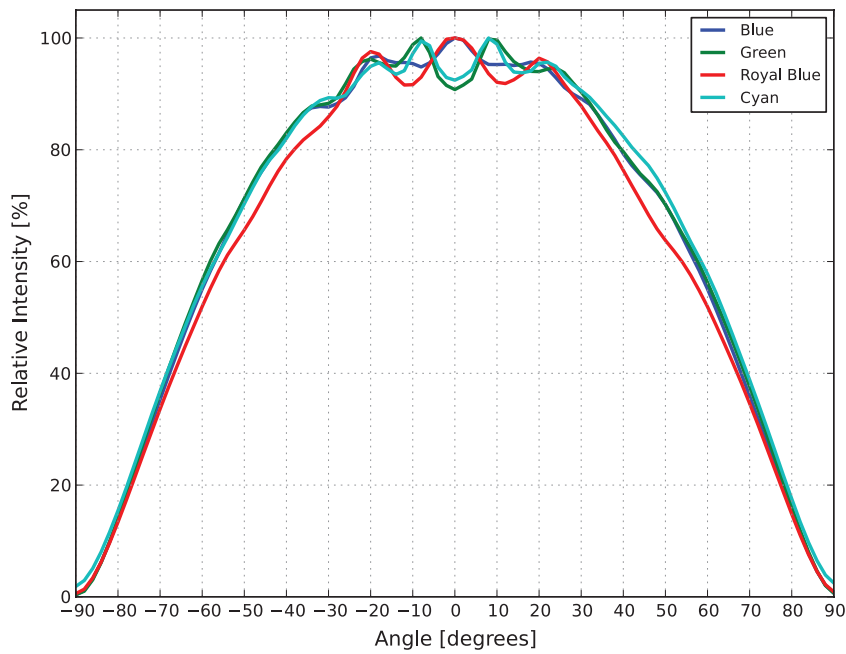


Figure 5b. Typical radiation pattern for LUXEON Rubix Green, Cyan, Blue and Royal Blue at 1500mA,  $T_j=85^\circ\text{C}$

Notes for Figure 5a and 5b:  
1. The normalized intensity around  $0^\circ$  to  $\pm 30^\circ$  may fluctuate between the upper and lower bound limits.

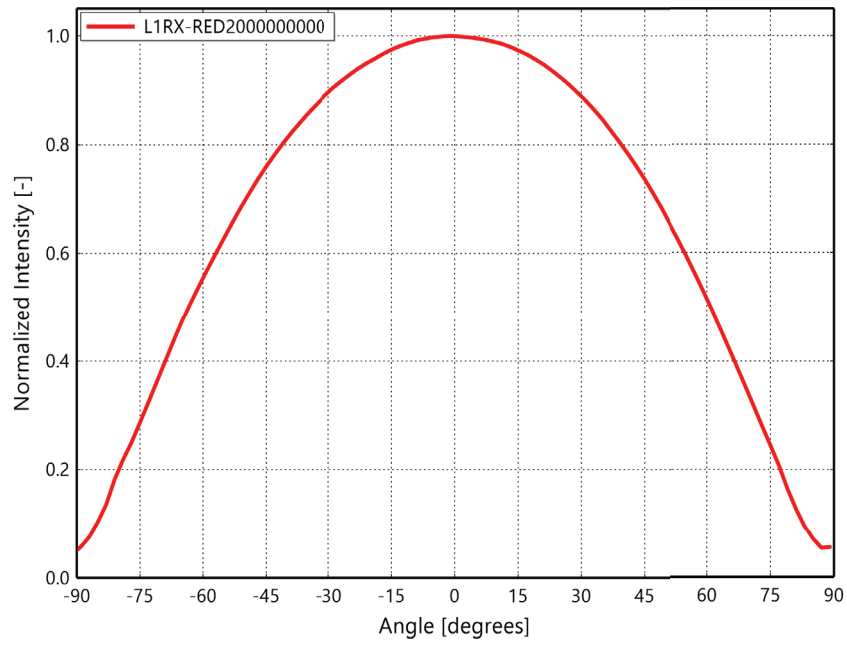


Figure 5c. Typical radiation pattern for LUXEON Rubix L1RX-RED2000000000 at 1000mA,  $T_j=85^\circ\text{C}$

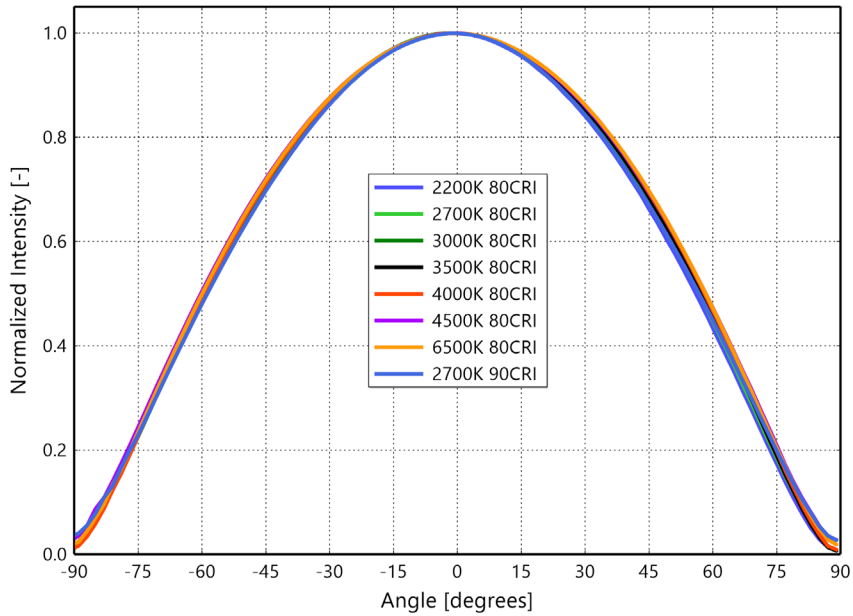


Figure 5d. Typical radiation pattern for LUXEON Rubix White 80CRI and 90CRI at 1000mA,  $T_j=85^\circ\text{C}$

Notes for Figures 5c and 5d:

1. The normalized intensity around  $0^\circ$  to  $\pm 30^\circ$  may fluctuate between the upper and lower bound limits.

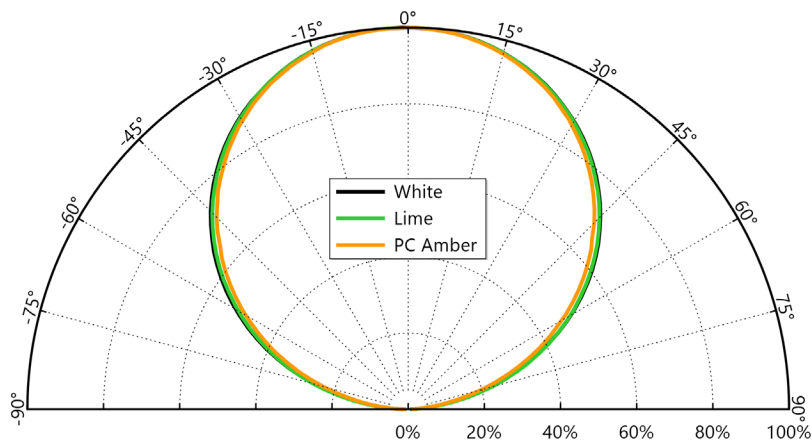


Figure 5e. Typical polar radiation pattern for LUXEON Rubix PC Amber, Lime and White 60CRI at 1500mA,  $T_j=85^\circ\text{C}$

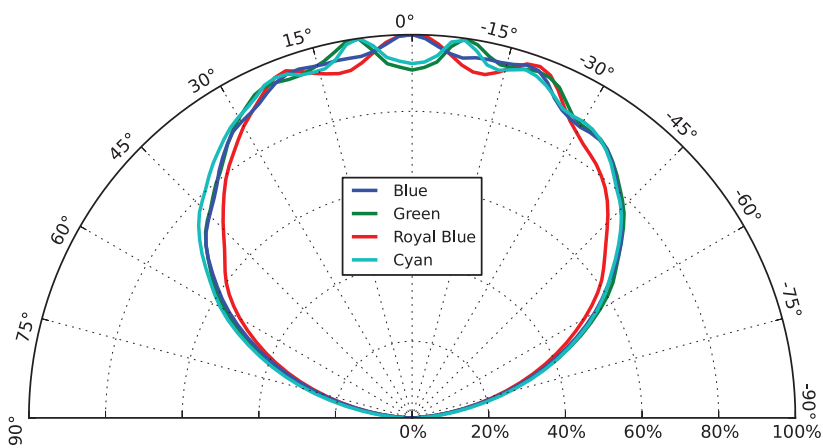


Figure 5f. Typical polar radiation pattern for LUXEON Rubix Green, Cyan, Blue and Royal Blue at 1500mA,  $T_j=85^\circ\text{C}$

Notes for Figures 5e and 5f:

1. The normalized intensity around  $0^\circ$  to  $\pm 30^\circ$  may fluctuate between the upper and lower bound limits.

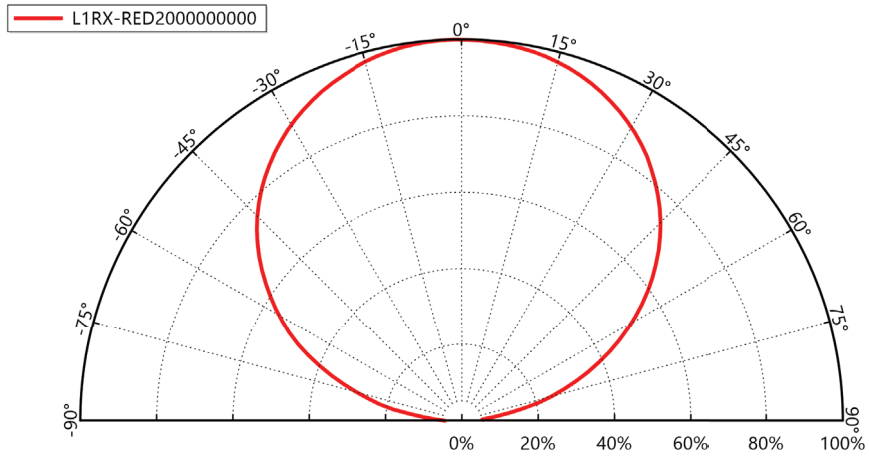


Figure 5g. Typical polar radiation pattern for LUXEON Rubix L1RX-RED2000000000 at 1000mA,  $T_j=85^\circ\text{C}$

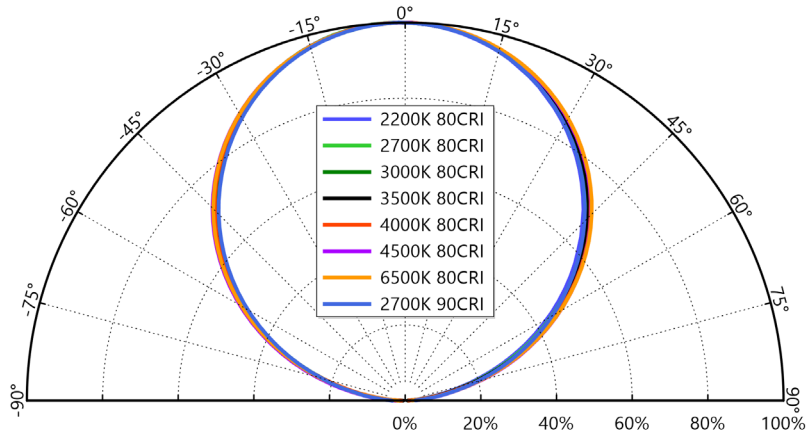


Figure 5h. Typical polar radiation pattern for LUXEON Rubix White 80CRI and 90CRI at 1000mA,  $T_j=85^\circ\text{C}$

Notes for Figures 5g and 5h:

1. The normalized intensity around  $0^\circ$  to  $\pm 30^\circ$  may fluctuate between the upper and lower bound limits.

# Product Bin and Labeling Definitions

## Decoding Product Bin Labeling

In the manufacturing of semiconductor products, there are variations in performance around the average values given in the technical datasheet. For this reason, Lumileds bins LED components for luminous flux, radiometric power, color point, peak wavelength, dominant wavelength and forward voltage.

LUXEON Rubix LEDs are labeled using a 4-digit alphanumeric CAT code following the format below:

### **A B C D**

Where:

- A** – designates luminous flux bin or radiometric power bin (luminous flux bin example: A=60 to 70 lm, B= 70 to 80 lm; radiometric power bin example: Royal Blue C=1500 to 1600mW)
- B C** – designates color bin, peak wavelength bin or dominant wavelength bin (peak wavelength bin example: Royal Blue 30=440 to 445nm; dominant wavelength bin example: Red 40=620 to 630nm)
- D** – designates forward voltage bin (example: A=1.80 to 2.00V, B=2.00 to 2.20V)

Therefore, a LUXEON Rubix Red LED with a lumen range of 80 to 90 lm, a dominant wavelength of 620 to 630nm and a forward voltage range of 3.00 to 3.20V has the following CAT code:

### **C 4 0 G**

## Luminous Flux Bins

Table 5 lists the standard photometric luminous flux bins for LUXEON Rubix emitters. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all CCTs.

Table 5. Luminous flux bin definitions for LUXEON Rubix

BIN	LUMINOUS FLUX <sup>[1]</sup> (lm)	
	MINIMUM	MAXIMUM
9	50	60
A	60	70
B	70	80
C	80	90
D	90	100
E	100	110
F	110	120
G	120	140
H	140	160
J	160	180
K	180	200
L	200	220
M	220	240
N	240	260
P	260	280
Q	280	300
R	300	320
S	320	340
T	340	360
U	360	380
V	380	400
W	400	420
X	420	440
Y	440	460
Z	460	480
1	480	500
2	500	520
3	520	540
4	540	570
5	570	600
6	600	640
7	640	680

Notes for Table 5:

1. Lumileds maintains a tolerance of  $\pm 6.5\%$  on luminous flux measurements.

## Radiometric Power Bins

Table 6. Radiometric power bin definitions for LUXEON Rubix Royal Blue

COLOR	BIN	RADIOMETRIC POWER <sup>[1]</sup> (mW)	
		MINIMUM	MAXIMUM
Royal Blue	A	1300	1400
	B	1400	1500
	C	1500	1600
	D	1600	1700
	E	1700	1800
	F	1800	1900
	G	1900	2000
	H	2000	2150
	J	2150	2300

Notes for Table 6:

1. Lumileds maintains a tolerance of  $\pm 6.5\%$  on radiometric power measurements.

## Color Bin Definitions

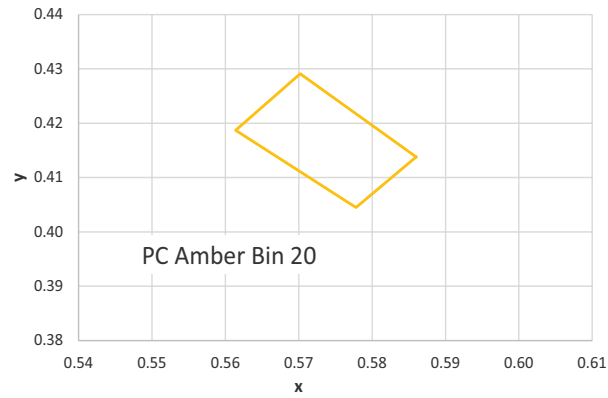


Figure 6. Color bin structure for LUXEON Rubix PC Amber for Table 7

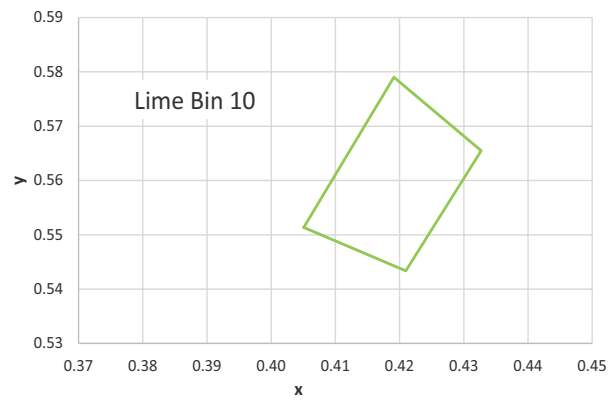


Figure 7. Color bin structure for LUXEON Rubix Lime for Table 7

Table 7. Color bin definitions for LUXEON Rubix PC Amber and Lime at 1500mA,  $T_j = 85^\circ\text{C}$

COLOR	PART NUMBER	BIN	x	y
PC Amber	L1RX-PCA1000000000	20	0.5860	0.4138
			0.5778	0.4045
			0.5614	0.4187
			0.5702	0.4291
Lime	L1RX-LME1000000000	10	0.4051	0.5514
			0.4191	0.5790
			0.4327	0.5655
			0.4210	0.5434

**Notes for Table 7:**

1. Lumileds maintains a tolerance of  $\pm 0.005$  on x and y color coordinates measurements.

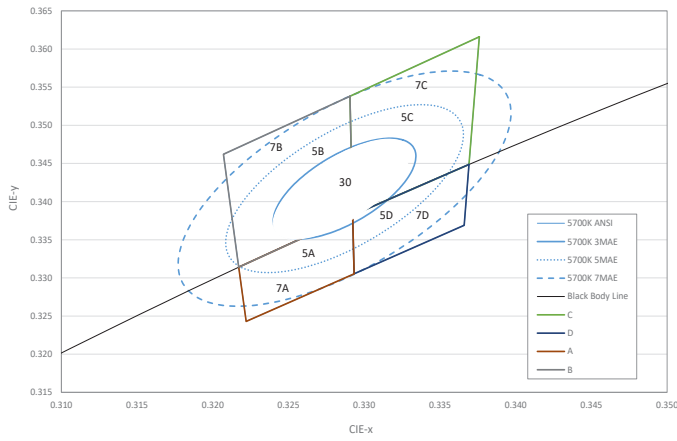


Figure 8a. Color bin structure for LUXEON Rubix White 5700K 60CRI

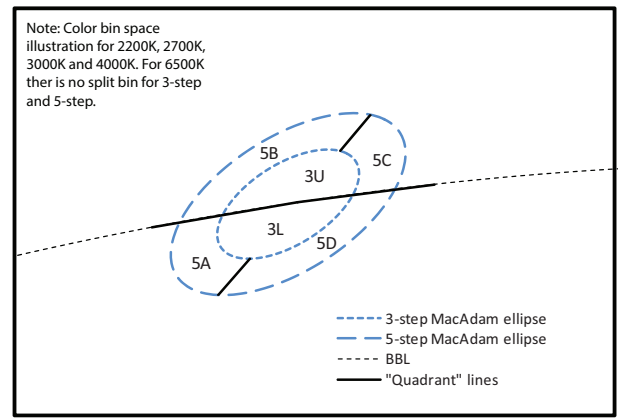


Figure 8b. Color bin structure for LUXEON Rubix White 70CRI, 80CRI and 90CRI

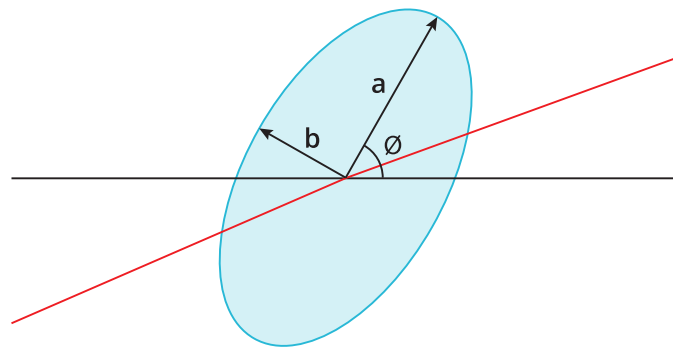


Figure 9. 3- and 5-step MacAdam ellipse illustration for Tables 8a and 8b

Table 8a. 3-, 5- and 7-step MacAdam ellipse color bin definitions for LUXEON Rubix White at 1500mA,  $T_j = 85^\circ\text{C}$

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>[1]</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, $\theta$
5700K	Single 3-step MacAdam ellipse	(0.3287, 0.3417)	0.00746	0.00320	59.1°
5700K	Single 5-step MacAdam ellipse	(0.3287, 0.3417)	0.01243	0.00533	59.1°
5700K	Single 7-step MacAdam ellipse	(0.3287, 0.3417)	0.01740	0.00746	59.1°

Notes for Table 8a:

1. Lumileds maintains a tolerance of  $\pm 0.005$  on x and y coordinates in the CIE 1931 color space.

Table 8b. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON Rubix White at 1000mA, T<sub>j</sub> = 85°C

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>(1)</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, θ
2200K	Single 3-step MacAdam ellipse	(0.5020, 0.4156)	0.00863	0.00398	49.3°
2700K	Single 3-step MacAdam ellipse	(0.4578, 0.4101)	0.00810	0.00420	53.7°
3000K	Single 3-step MacAdam ellipse	(0.4338, 0.4030)	0.00834	0.00408	53.2°
3500K	Single 3-step MacAdam ellipse	(0.4073, 0.3917)	0.00927	0.00414	54.0°
4000K	Single 3-step MacAdam ellipse	(0.3818, 0.3797)	0.00939	0.00402	53.7°
4500K	Single 3-step MacAdam ellipse	(0.3611, 0.3658)	0.00881	0.00378	56.7°
6500K	Single 3-step MacAdam ellipse	(0.3123, 0.3282)	0.00669	0.00285	58.6°
2200K	Single 5-step MacAdam ellipse	(0.5020, 0.4156)	0.01438	0.00663	49.3°
2700K	Single 5-step MacAdam ellipse	(0.4578, 0.4101)	0.01350	0.00700	53.7°
3000K	Single 5-step MacAdam ellipse	(0.4338, 0.4030)	0.01390	0.00680	53.2°
3500K	Single 5-step MacAdam ellipse	(0.4073, 0.3917)	0.01545	0.00690	54.0°
4000K	Single 5-step MacAdam ellipse	(0.3818, 0.3797)	0.01565	0.00670	53.7°
4500K	Single 5-step MacAdam ellipse	(0.3611, 0.3658)	0.01468	0.00630	56.7°
6500K	Single 5-step MacAdam ellipse	(0.3123, 0.3282)	0.01115	0.00475	58.6°

Notes for Table 8b:

1. Lumileds maintains a tolerance of ±0.005 on x and y coordinates in the CIE 1931 color space.

Table 8c. MacAdam ellipse color bin definitions for LUXEON Rubix White

BIN	SDCM
30	Single 3-step MacAdam ellipse (For 5700K and 6500K)
3U	Single 3-step MacAdam ellipse (For 2200K, 2700K, 3000K, 3500K, 4000K, 4500K)
3L	Single 3-step MacAdam ellipse (For 2200K, 2700K, 3000K, 3500K, 4000K, 4500K)
50	Single 5-step MacAdam ellipse (For 6500K)
5A	Single 5-step MacAdam ellipse (For 2200K, 2700K, 3000K, 3500K, 4000K, 4500K, 5700K)
5B	Single 5-step MacAdam ellipse (For 2200K, 2700K, 3000K, 3500K, 4000K, 4500K, 5700K)
5C	Single 5-step MacAdam ellipse (For 2200K, 2700K, 3000K, 3500K, 4000K, 4500K, 5700K)
5D	Single 5-step MacAdam ellipse (For 2200K, 2700K, 3000K, 3500K, 4000K, 4500K, 5700K)
7A	Single 7-step MacAdam ellipse (For 5700K 60CRI)
7B	Single 7-step MacAdam ellipse (For 5700K 60CRI)
7C	Single 7-step MacAdam ellipse (For 5700K 60CRI)
7D	Single 7-step MacAdam ellipse (For 5700K 60CRI)

## Peak Wavelength Bins

Table 9. Peak wavelength bin definitions for LUXEON Rubix Royal Blue

COLOR	PART NUMBER	BIN	PEAK WAVELENGTH <sup>(1)</sup> (nm)	
			MINIMUM	MAXIMUM
Royal Blue	L1RX-RYL1000000000	30	440	445
		40	445	450
		50	450	455

Notes for Table 9:

1. Lumileds maintains a tolerance of ±2.0nm on peak wavelength measurements.

## Dominant Wavelength Bins

Table 10a. Dominant wavelength bin definitions for LUXEON Rubix Green, Cyan and Blue at 1500mA, T<sub>j</sub>=85°C

COLOR	PART NUMBER	BIN	DOMINANT WAVELENGTH <sup>(1)</sup> (nm)	
			MINIMUM	MAXIMUM
Green	L1RX-GRN1000000000	10	520	525
		20	525	530
		30	530	535
Cyan	L1RX-CYN1000000000	10	490	495
		20	495	500
		30	500	505
		40	505	510
Blue	L1RX-BLU1000000000	20	465	470
		30	470	475
		40	475	480
		50	480	485

Notes for Table 10a:

1. Lumileds maintains a tolerance of ±0.5nm on dominant wavelength measurements.

Table 10b. Dominant wavelength bin definitions for LUXEON Rubix L1RX-RED2000000000 at 1000mA, T<sub>j</sub>=85°C

COLOR	PART NUMBER	BIN	DOMINANT WAVELENGTH <sup>(1)</sup> (nm)	
			MINIMUM	MAXIMUM
Red	L1RX-RED2000000000	40	620	630

Notes for Table 10b:

1. Lumileds maintains a tolerance of ±0.5nm on dominant wavelength measurements.

## Forward Voltage Bins

Table 11. Forward voltage bin definitions for LUXEON Rubix

BIN	FORWARD VOLTAGE <sup>(1)</sup> (V <sub>f</sub> )	
	MINIMUM	MAXIMUM
A	1.80	2.00
B	2.00	2.20
C	2.20	2.40
D	2.40	2.60
E	2.60	2.80
F	2.80	3.00
G	3.00	3.20
H	3.20	3.40
J	3.40	3.60
K	3.60	3.80
L	3.80	4.00
M	4.00	4.20
N	4.20	4.40
P	4.40	4.50

Notes for Table 11:

1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.

# Mechanical Dimensions

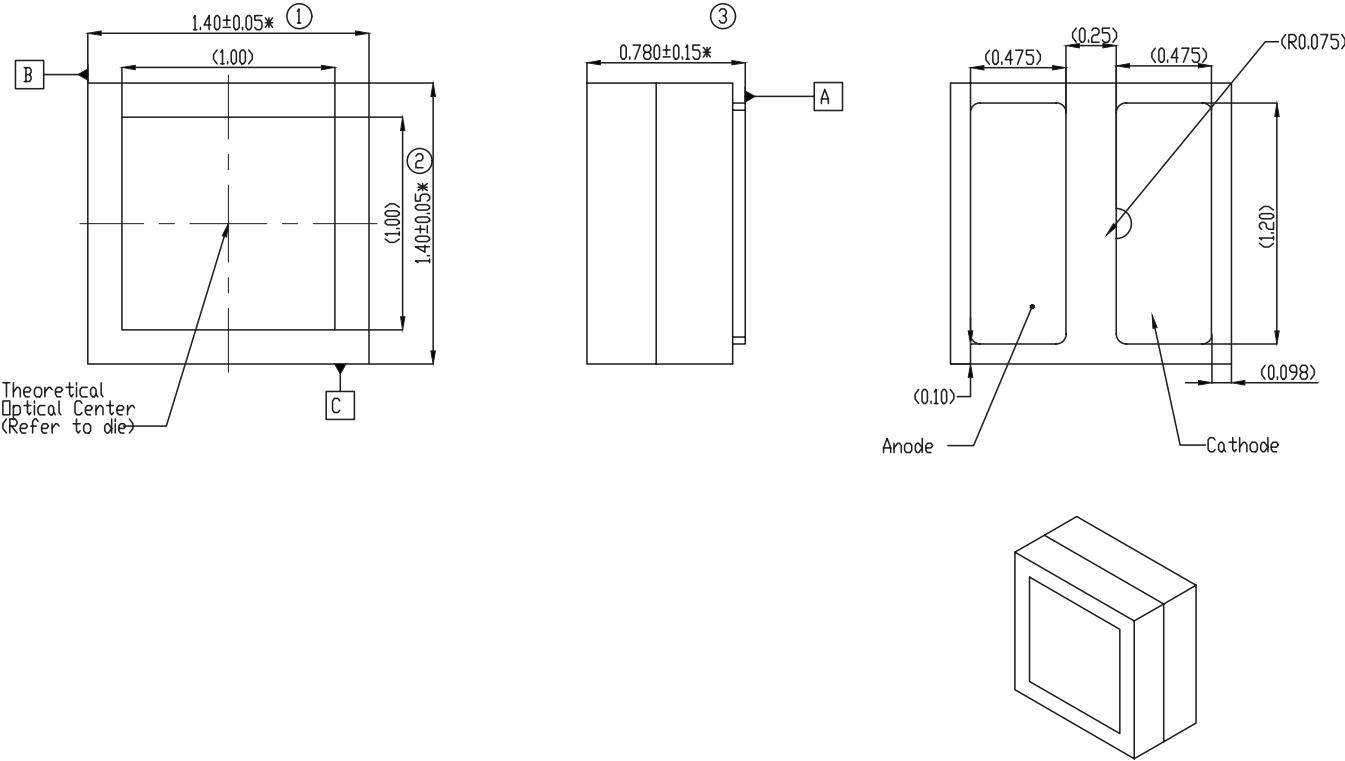


Figure 10a. Mechanical dimensions for LUXEON Rubix PC Amber, Lime, Green, Cyan, Blue, Royal Blue and White Colors

- Notes for Figure 10a:
1. Drawings are not to scale.
  2. All dimensions are in millimeters.

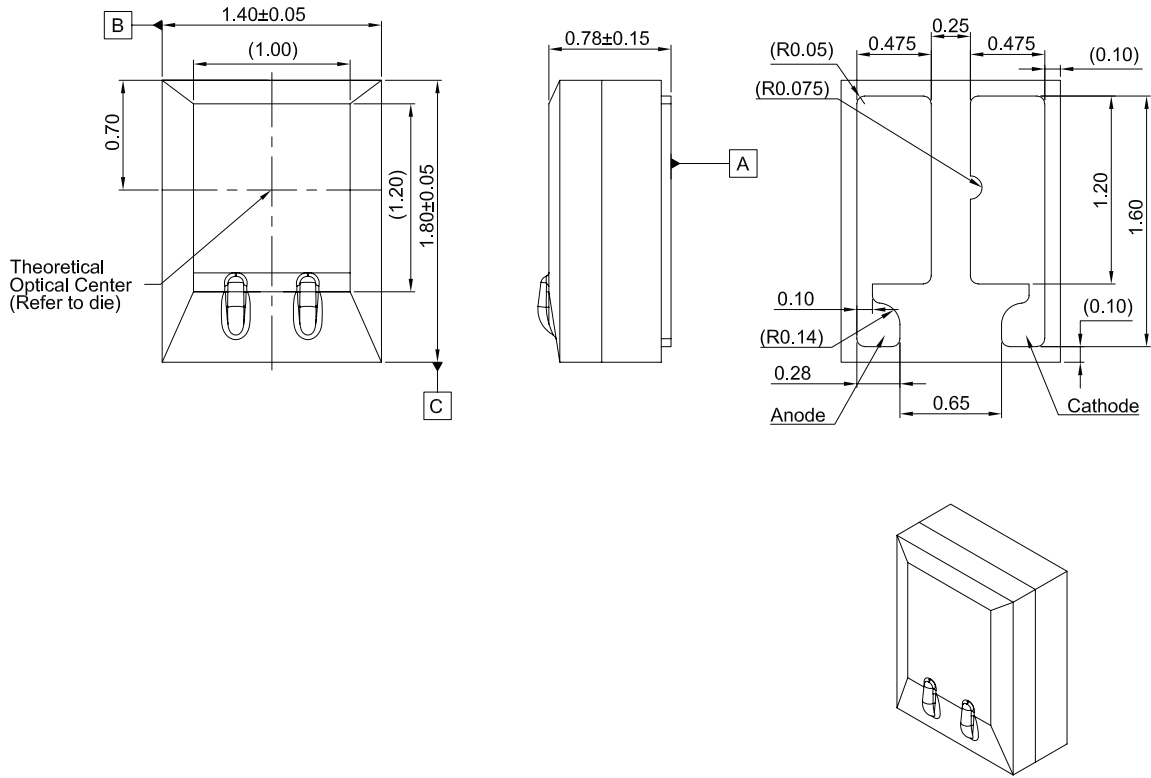


Figure 10b. Mechanical dimensions for LUXEON Rubix L1RX-RED2000000000 Color

Notes for Figures 10b:

1. Drawings are not to scale.
2. All dimensions are in millimeters.

# Reflow Soldering Guidelines

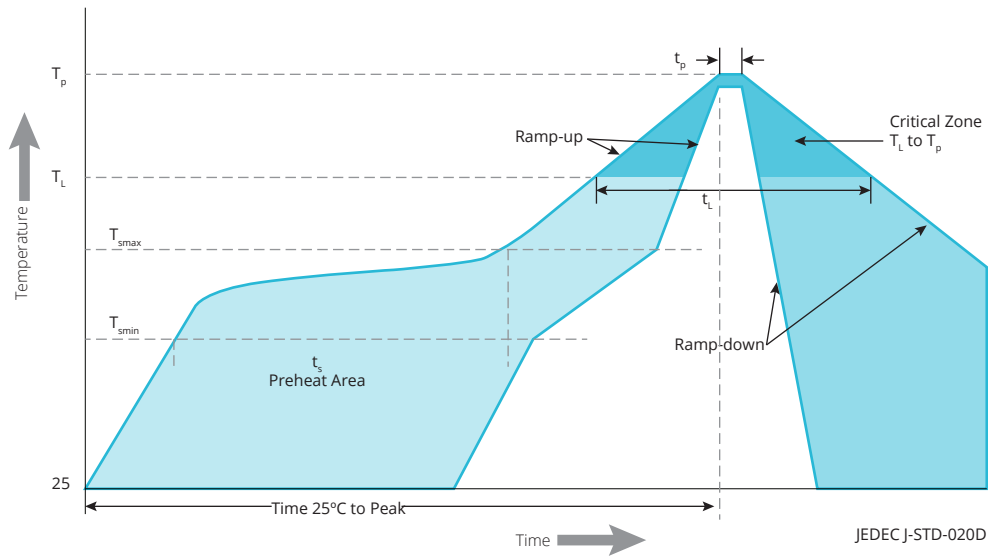


Figure 11. Visualization of the acceptable reflow temperature profile as specified in Table 12

Table 12. Reflow profile characteristics for LUXEON Rubix

PROFILE FEATURE	LEAD-FREE ASSEMBLY
Preheat Minimum Temperature ( $T_{smin}$ )	150°C
Preheat Maximum Temperature ( $T_{smax}$ )	200°C
Preheat Time ( $t_{smin}$ to $t_{smax}$ )	60 to 120 seconds
Ramp-Up Rate ( $T_L$ to $T_p$ )	3°C / second maximum
Liquidus Temperature ( $T_L$ )	217°C
Time Maintained Above Temperature $T_L$ ( $t_t$ )	60 to 150 seconds
Peak / Classification Temperature ( $T_p$ )	260°C
Time Within 5°C of Actual Temperature ( $t_p$ )	20 to 40 seconds
Ramp-Down Rate ( $T_p$ to $T_L$ )	6°C / second maximum
Time 25°C to Peak Temperature	8 minutes maximum

## JEDEC Moisture Sensitivity

Table 13. Moisture sensitivity levels for LUXEON Rubix

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS STANDARD	
	TIME	CONDITIONS	TIME	CONDITIONS
1	Unlimited	≤30°C / 85% RH	168 Hours +5 / -0	85°C / 85% RH

# Solder Pad Design

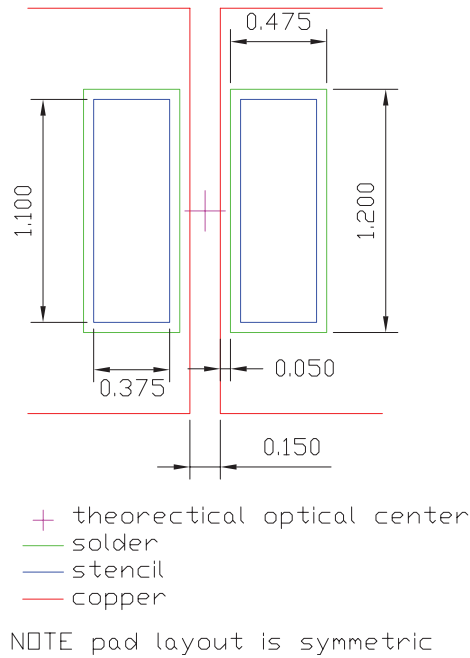


Figure 12. Recommended PCB solder pad layout for all LUXEON Rubix

Notes for Figure 12:

1. Drawings are not to scale.
2. All dimensions are in millimeters.

# Packaging Information

## Pocket Tape Dimensions

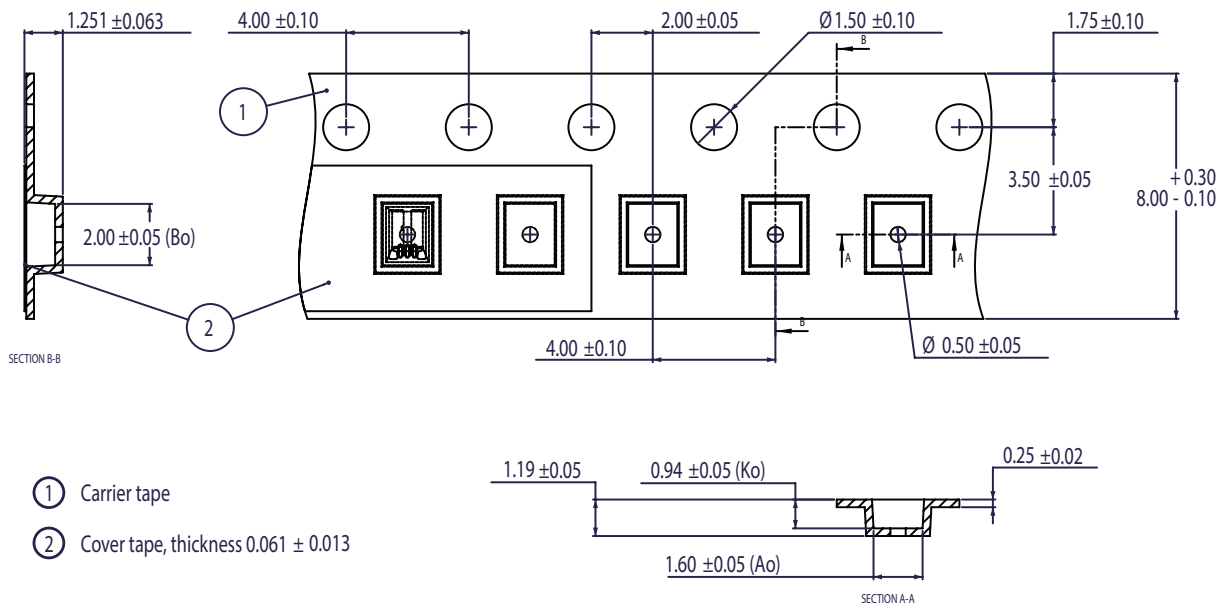


Figure 13a. Pocket Tape dimensions for LUXEON Rubix Red

Notes for Figure 13a:

1. Drawings are not to scale.
2. All dimensions are in millimeters.

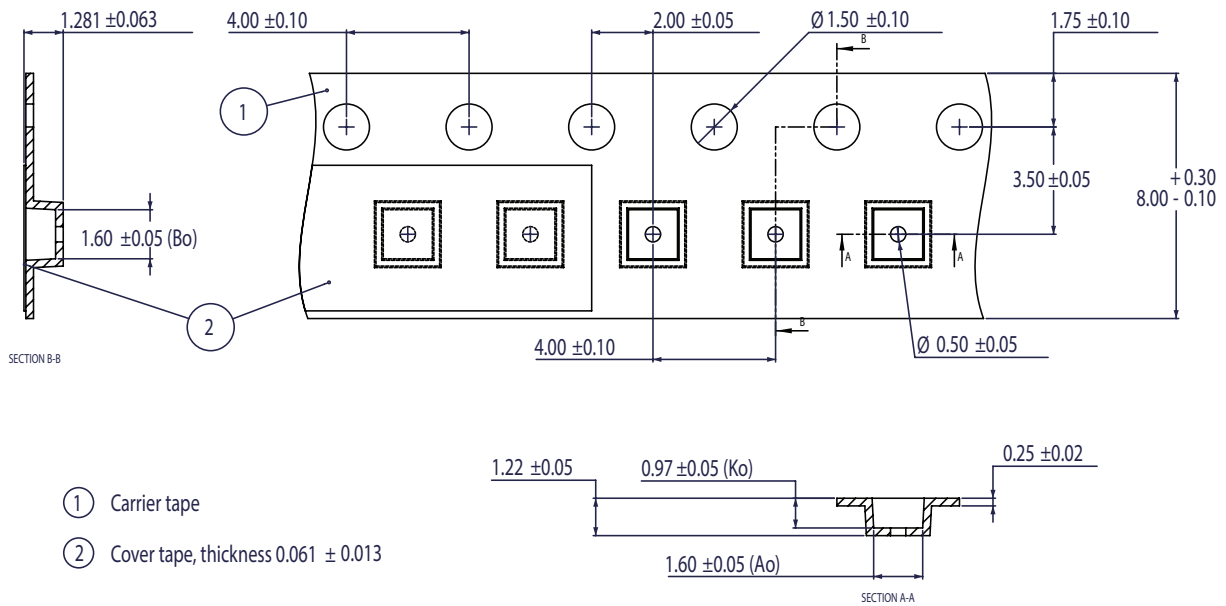


Figure 13b. Pocket Tape dimensions for LUXEON Rubix PC Amber, Lime, Green, Cyan, Blue, Royal Blue and White

Notes for Figure 13b:

1. Drawings are not to scale.
2. All dimensions are in millimeters.

## Reel Dimensions

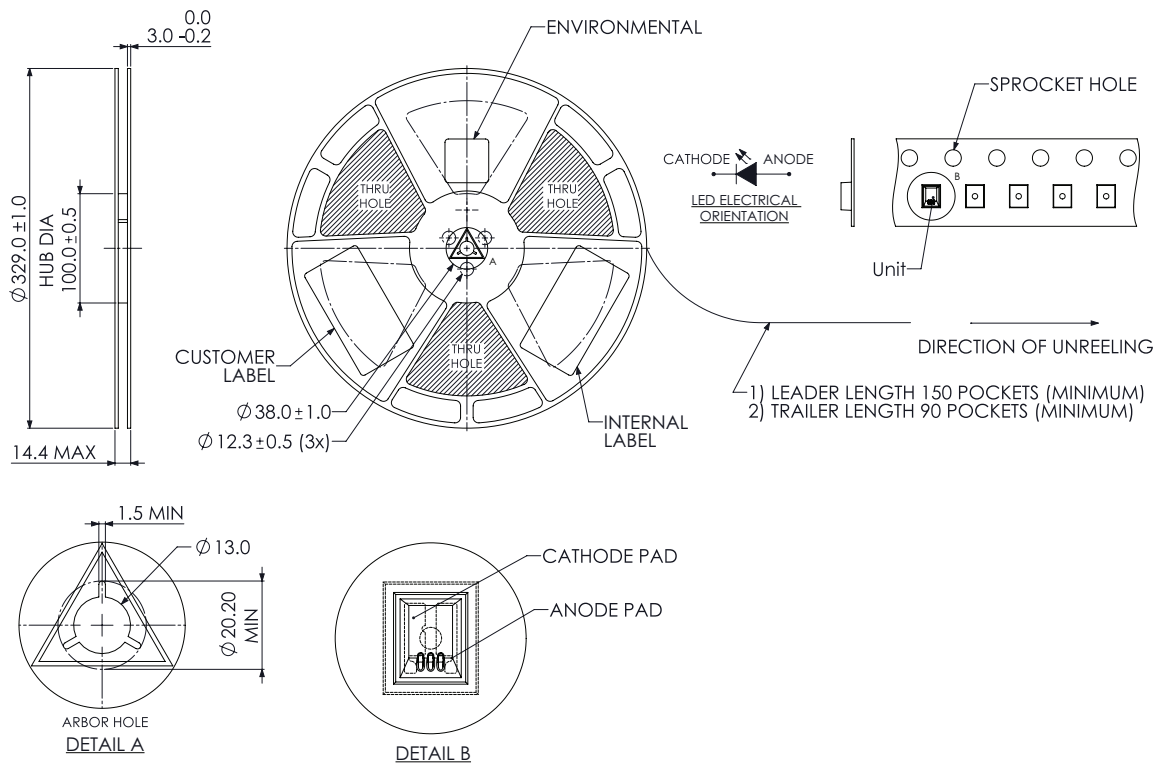


Figure 14a. Reel dimensions for LUXEON Rubix Red

Notes for Figure 14a:

1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Maximum 1,000 pieces per reel.

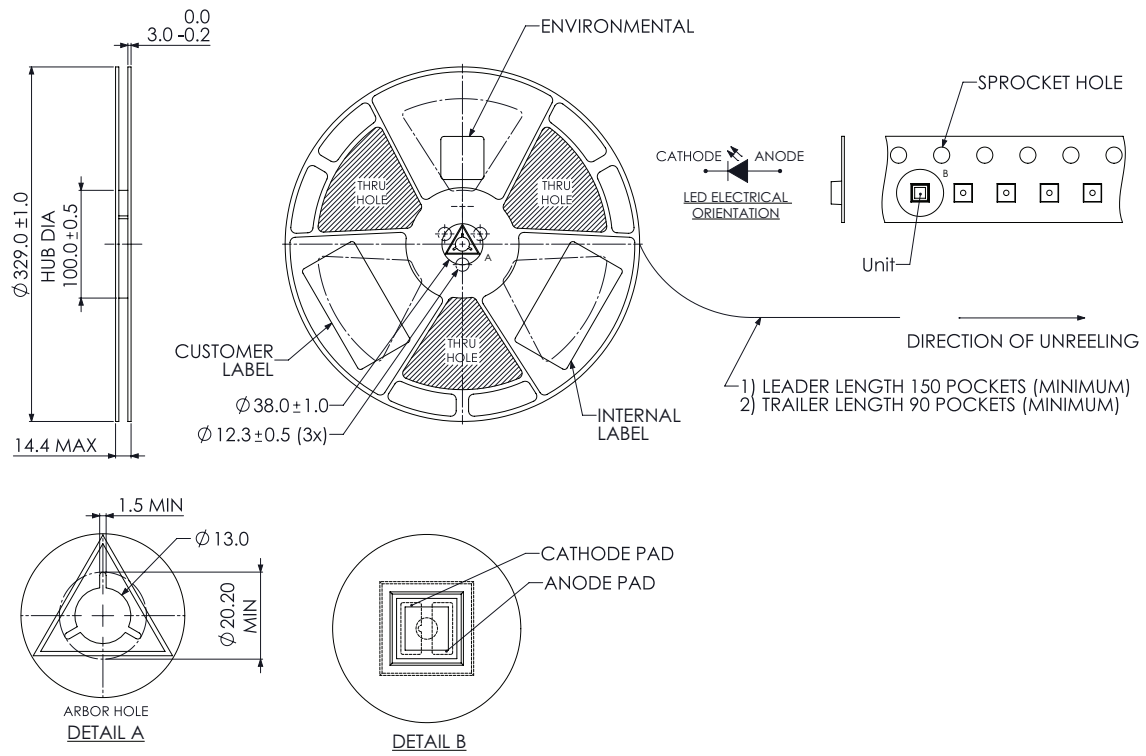


Figure 14b. Reel dimensions for LUXEON Rubix PC Amber, Lime, Green, Cyan, Blue, Royal Blue and White

Notes for Figure 14b:

1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Maximum 1,000 pieces per reel.

## About Lumileds

Lumileds is a global leader in LED and microLED technology, innovation, and solutions for the automotive, display, illumination, mobile, and other markets where light sources are essential. Our approximately 3,500 employees operate in over 15 countries and partner with our customers to deliver never before possible solutions for lighting, safety, and well-being.

To learn more about our lighting solutions, visit [lumileds.com](https://lumileds.com).



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