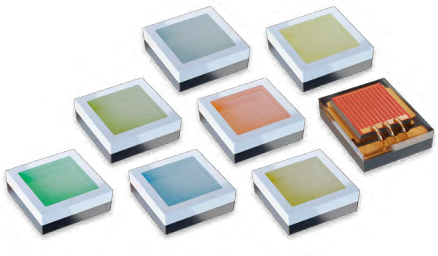
LUMILEDS

ILLUMINATION

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 3 Amps DC
- Maximized punch (cd/lm)

PRIMARY APPLICATIONS

- Moving Head
- Spotlights
- Wall Wash
- Floodlights
- Landscape Lighting

c UL us No. E352519 RoHS COMPLIANT

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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=85ºC
LUXEON Rubix Red Option 2 (L1RX-RED2000000000) - 1000mA, T_j=85ºC
LUXEON Rubix White 5700K 60CRI - 1500mA, T_j=85ºC
LUXEON Rubix White for 70CRI, 80CRI and 90CRI - 1000mA, T_j=85ºC

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

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 Option 1 LED:

L 1 R X – **R E D** 1 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

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, 70=70CRI, 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

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_j=85°C.

COLOR	DOMINANT OR PEAK WAVELENGTH [1] (nm)		LUMINOUS FLUX (lm) OR RADIOMETRIC POWER [2] (mW)		PART NUMBER
	MINIMUM	MAXIMUM	MINIMUM	TYPICAL	
Red	620	630	75	85	L1RX-RED1000000000
PC Amber	-	-	220	250	L1RX-PCA1000000000
Lime	-	-	420	510	L1RX-LME1000000000
Green	520	535	260	310	L1RX-GRN1000000000
Cyan	490	510	180	230	L1RX-CYN1000000000
Blue	465	485	70	112	L1RX-BLU1000000000
Royal Blue	440	455	1300	1635	L1RX-RYL1000000000

Notes for Table 1a:
1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.
2. Royal Blue is binned by peak wavelength. All other colors are binned by dominant wavelength.
3. 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_j=85°C.

COLOR	DOMINANT OR PEAK WAVELENGTH [1] (nm)		LUMINOUS FLUX [1] (lm) or RADIOMETRIC POWER [2] (mW)		PART NUMBER
	MINIMUM	MAXIMUM	MINIMUM	TYPICAL	
Red	620	630	52	71	L1RX-RED2000000000

Notes for Table 1b:
1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.

Table 1c. Product performance of LUXEON Rubix White 60CRI at 1500mA, T_j=85°C.

COLOR	NOMINAL CCT	MINIMUM CRI [1]	LUMINOUS FLUX [1] (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	PART NUMBER
			MINIMUM	TYPICAL		
White 60CRI	5700K	60	360	440	93	L1RX-5760000000000

Notes for Table 1c:
1. 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_j=85°C.

COLOR	NOMINAL CCT	MINIMUM CRI [1]	LUMINOUS FLUX [1] (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	PART NUMBER
			MINIMUM	TYPICAL		
White 70CRI, 80CRI and 90CRI	6500K	70	220	315	106	L1RX-6570000000000
	2200K	80	140	208	70	L1RX-2280000000000
	2700K	80	180	239	81	L1RX-2780000000000
	3000K	80	200	263	89	L1RX-3080000000000
	3500K	80	200	270	91	L1RX-3580000000000
	4000K	80	200	274	93	L1RX-4080000000000
	4500K	80	200	278	94	L1RX-4580000000000
	6500K	80	220	280	95	L1RX-6580000000000
	2700K	90	140	205	69	L1RX-2790000000000

Notes for Table 1d:
1. 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_j=85°C.

COLOR	PART NUMBER	TYPICAL SPECTRAL HALF-WIDTH [1] (nm)	TYPICAL TEMPERATURE COEFFICIENT OF DOMINANT OR PEAK WAVELENGTH (nm/°C)	TYPICAL TOTAL INCLUDED ANGLE [2]	TYPICAL VIEWING ANGLE [3]
Red	L1RX-RED1000000000	22	0.15	140	125
PC Amber	L1RX-PCA1000000000	78	-0.01	140	125
Lime	L1RX-LME1000000000	101	0.08	140	125
Green	L1RX-GRN1000000000	36	0.04	140	125
Cyan	L1RX-CYN1000000000	29	0.03	140	125
Blue	L1RX-BLU1000000000	28	0.05	140	125
Royal Blue	L1RX-RYL1000000000	22	0.07	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_j=85°C.

COLOR	PART NUMBER	TYPICAL SPECTRAL HALF-WIDTH [1] (nm)	TYPICAL TEMPERATURE COEFFICIENT OF DOMINANT or PEAK WAVELENGTH (nm/°C)	TYPICAL TOTAL INCLUDED ANGLE [2]	TYPICAL VIEWING ANGLE [3]
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_j=85°C.

COLOR	PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE [1]	TYPICAL VIEWING ANGLE [2]
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_j=85°C.

COLOR	PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE [1]	TYPICAL VIEWING ANGLE [2]
White 70CRI, 80CRI and 90CRI	L1RX-6570000000000	137	118
	L1RX-2280000000000		
	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_j=85°C.

COLOR	PART NUMBER	FORWARD VOLTAGE [1] (V_f)			TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE [2] (mV/°C)	TYPICAL THERMAL RESISTANCE—JUNCTION TO SOLDER PAD (°C/W)
		MINIMUM	TYPICAL	MAXIMUM		
Red	L1RX-RED1000000000	2.00	2.30	2.80	-2.0	3.7
PC Amber	L1RX-PCA1000000000	2.50	3.04	3.50	-2.3	4.8
Lime	L1RX-LME1000000000	2.50	3.09	3.50	-2.3	4.5
Green	L1RX-GRN1000000000	3.00	3.80	4.50	-3.8	5.4
Cyan	L1RX-CYN1000000000	3.00	3.64	4.00	-3.5	5.4
Blue	L1RX-BLU1000000000	3.00	3.67	4.00	-3.9	4.5
Royal Blue	L1RX-RYL1000000000	2.50	3.16	3.50	-2.3	4.1
White	L1RX-5760000000000	2.50	3.16	3.50	-2.3	4.1

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_j=85°C.

COLOR	PART NUMBER	FORWARD VOLTAGE [1] (V_f)			TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE [2] (mV/°C)	TYPICAL THERMAL RESISTANCE — JUNCTION TO SOLDER PAD (°C/W)
		MINIMUM	TYPICAL	MAXIMUM		
Red	L1RX-RED2000000000	2.00	2.30	2.80	-1.3	3.8
White	L1RX-6570000000000	2.50	2.96	3.50	-2.6	5.3
	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 (L1RX-RED1000000000)		RED (L1RX-RED2000000000)		GREEN AND BLUE	CYAN AND ROYAL BLUE	WHITE 60CRI, PC AMBER AND LIME	WHITE 70CRI, 80CRI AND 90CRI
DC Forward Current [1, 2]	2400mA	2200mA	1600mA	1400mA	3000mA	3000mA	3000mA	1600mA
Peak Pulsed Forward Current [1, 3]	2500mA	2500mA	1600mA	1400mA	3500mA	3500mA	3500mA	2600mA
LED Junction Temperature [1] (DC & Pulse)	135°C	150°C	120°C	135°C	150°C	135°C	150°C	150°C
ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)	Class 1A							
Operating Case Temperature [1, 4]	-40°C to 120°C		-40°C to 110°C		-40°C to 120°C	-40°C to 105°C	-40°C to 125°C	-40°C to 135°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:
1. Proper current derating must be observed to maintain the junction temperature below the maximum allowable junction temperature.
2. 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
3. At 10% duty cycle with pulse width of 10ms.
4. 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

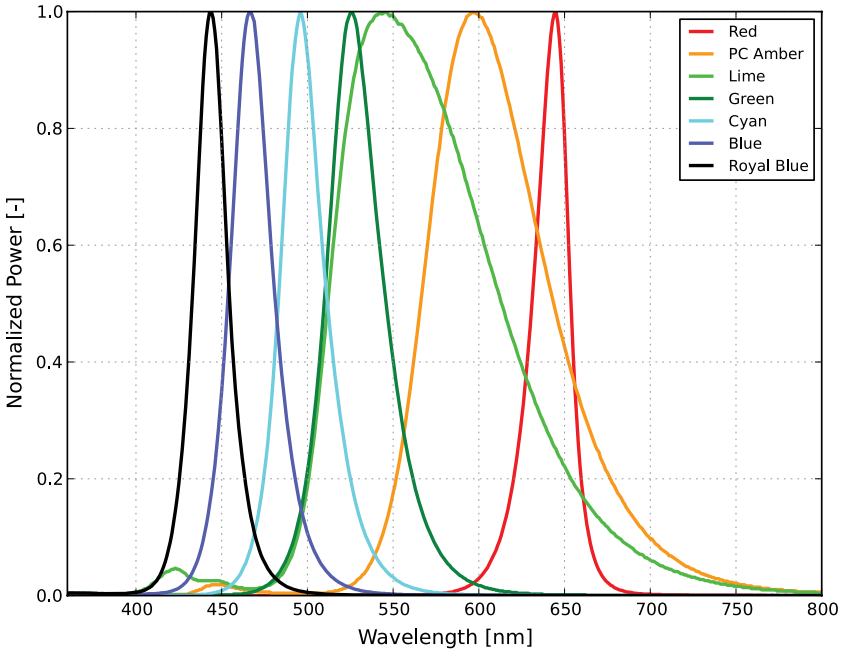

Figure 1a. Typical normalized power vs. wavelength for LUXEON Rubix Colors at 1500mA, T_j=85°C.

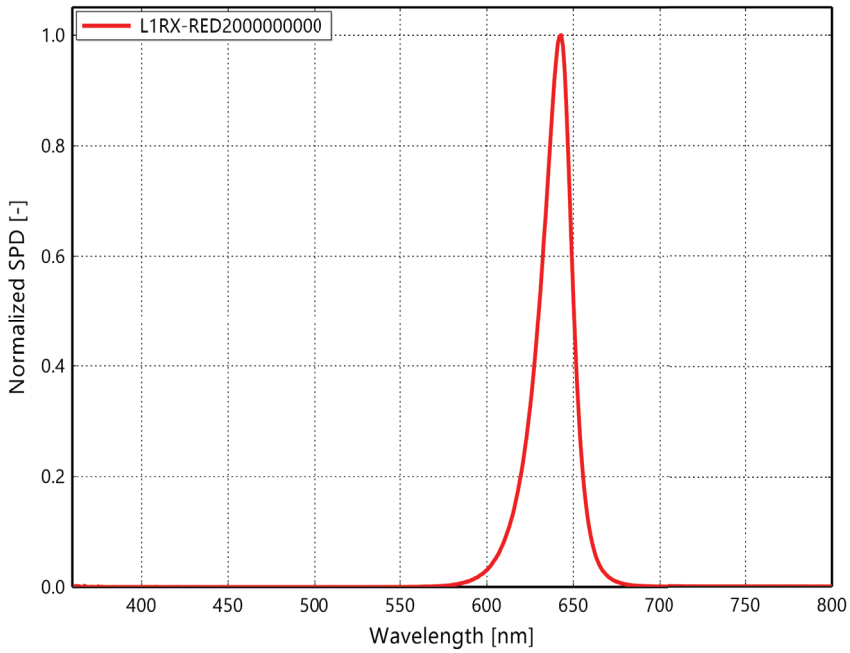

Figure 1b. Typical normalized SPD vs. wavelength for LUXEON Rubix L1RX-RED2000000000 at 1000mA, T_j=85°C.

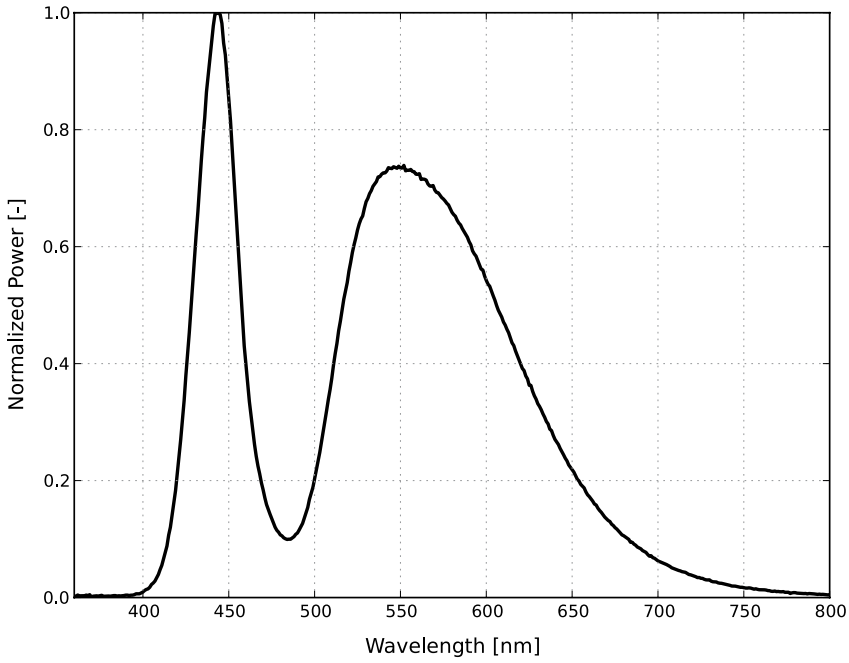

Figure 1c. Typical normalized power vs. wavelength for LUXEON Rubix White 5700K 60CRI at 1500mA, T_j=85°C.

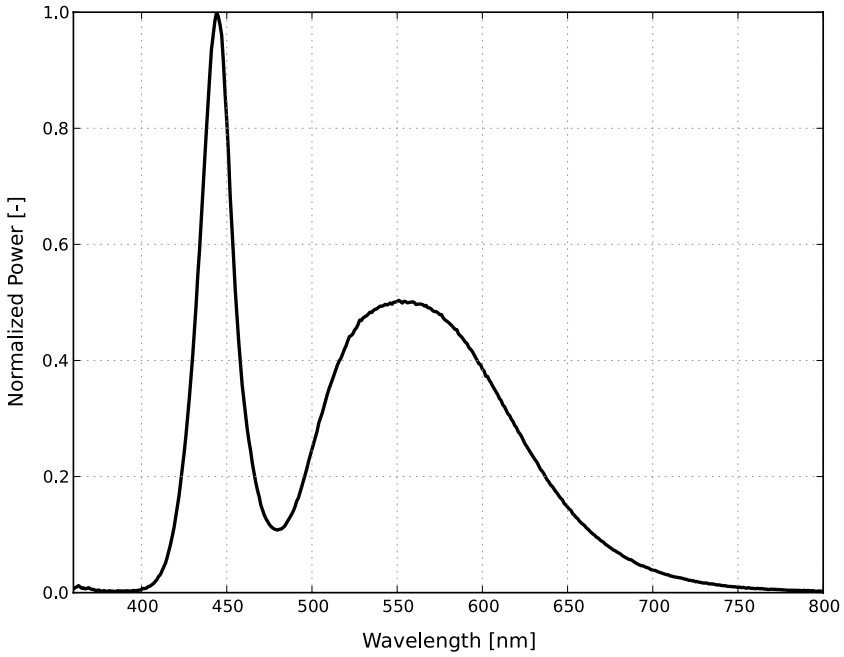

Figure 1d. Typical normalized power vs. wavelength for LUXEON Rubix White 6500K 70CRI at 1000mA, T_j=85ºC.

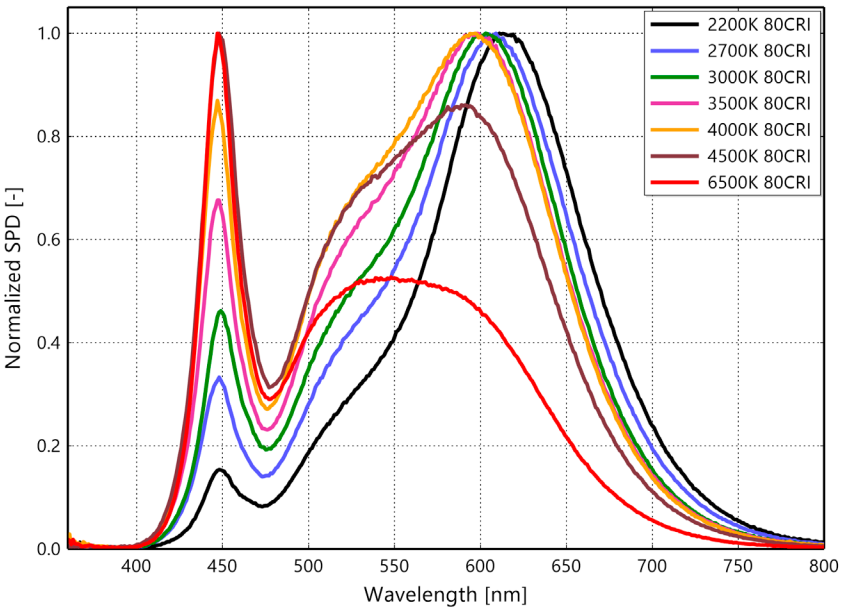

Figure 1e. Typical normalized power vs. wavelength for LUXEON Rubix White 80CRI at 1000mA, T_j=85ºC.

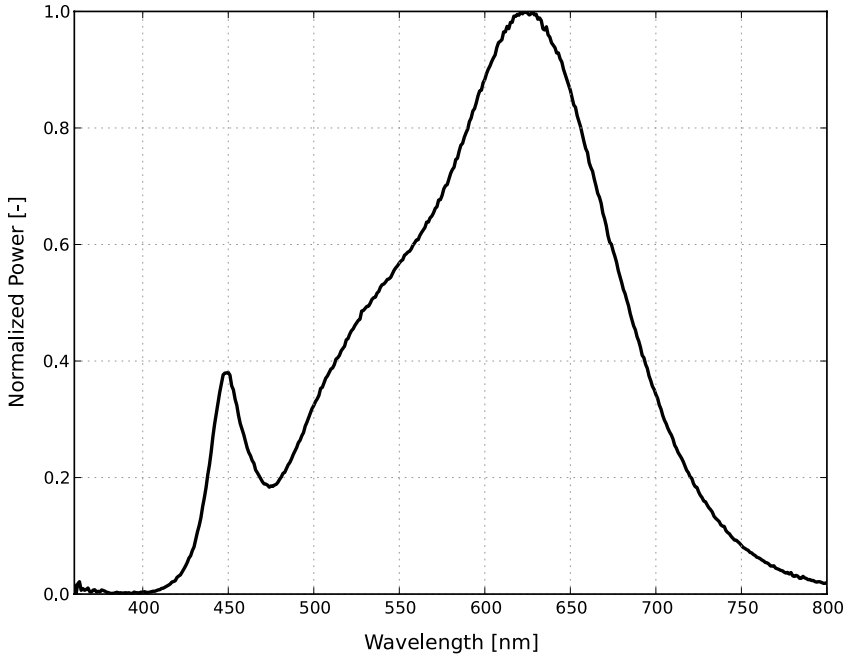

Figure 1f. Typical normalized power vs. wavelength for LUXEON Rubix White 2700K 90CRI at 1000mA, T_j=85°C.

Light Output Characteristics

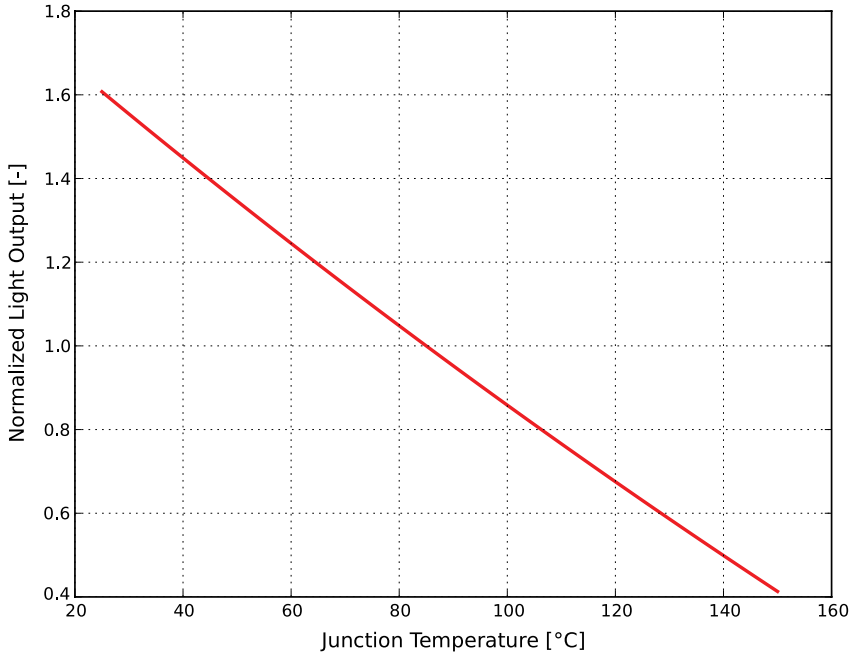

Figure 2a. Typical normalized light output vs. junction temperature for LUXEON Rubix Red at 1500mA.

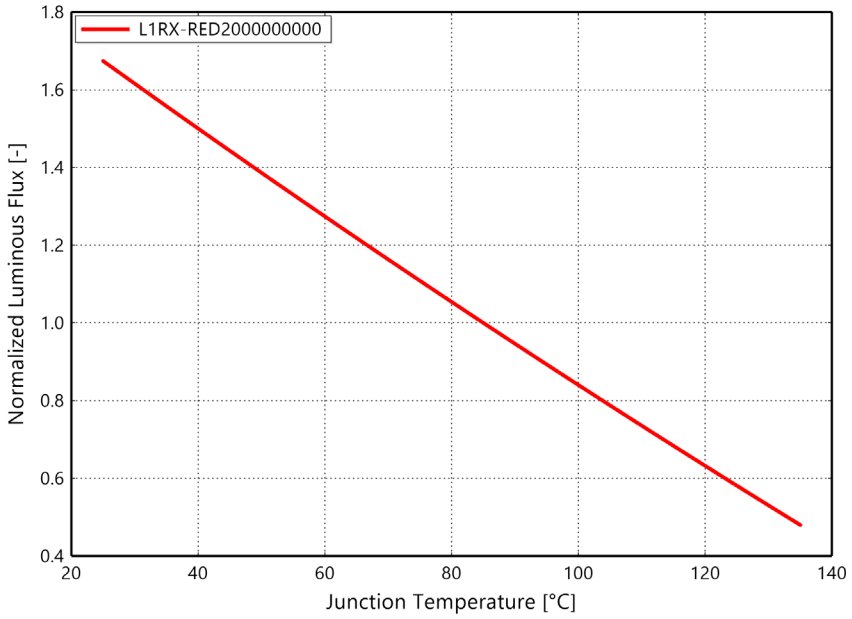

Figure 2b. Typical normalized luminous flux vs. junction temperature for LUXEON Rubix L1RX-RED2000000000 at 1000mA.

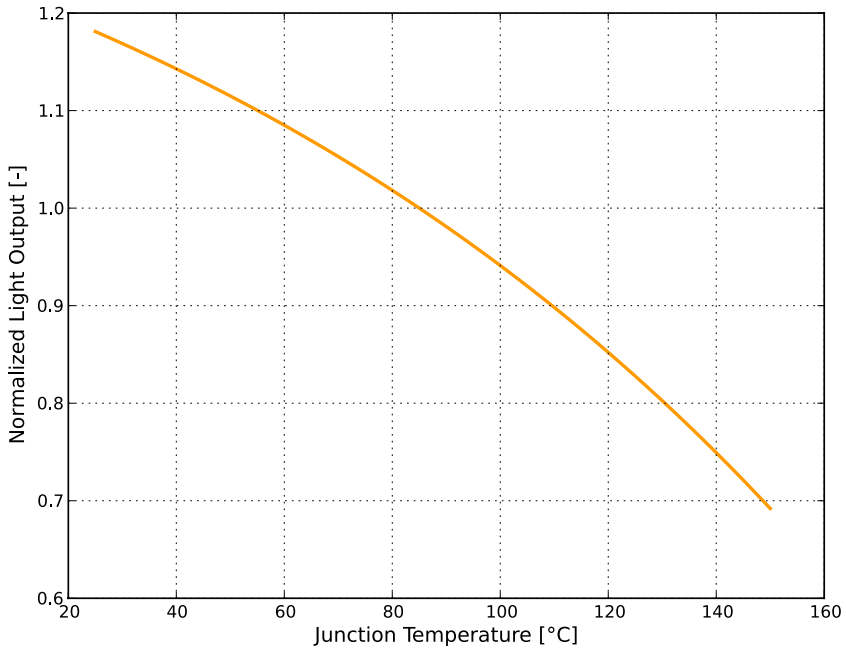

Figure 2c. Typical normalized light output vs. junction temperature for LUXEON Rubix PC Amber at 1500mA.

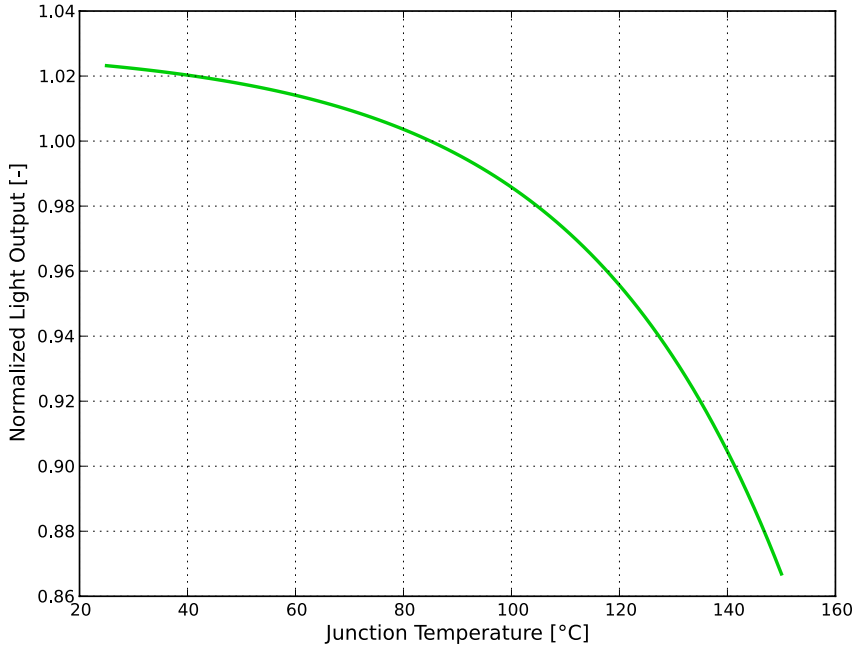

Figure 2d. Typical normalized light output vs. junction temperature for LUXEON Rubix Lime at 1500mA.

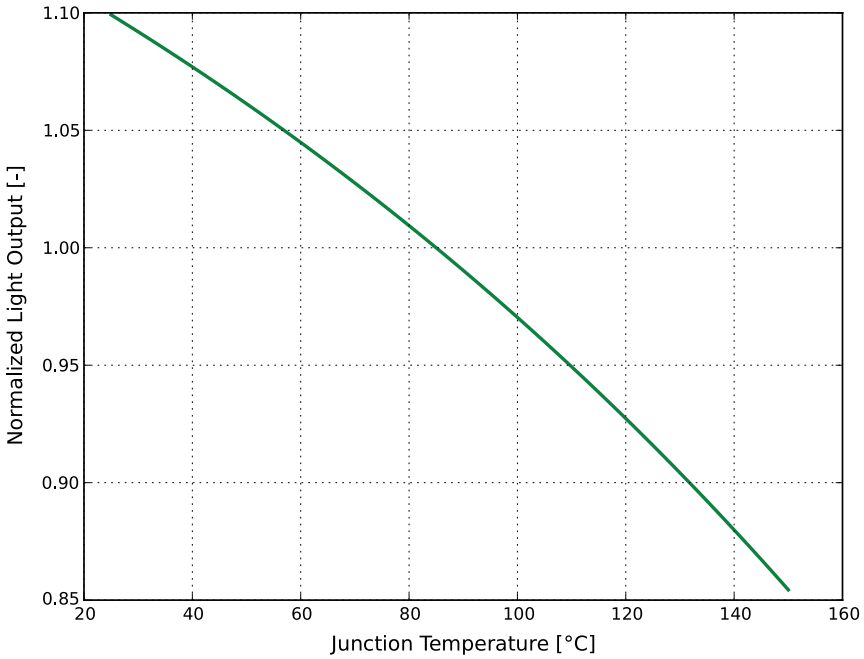

Figure 2e. Typical normalized light output vs. junction temperature for LUXEON Rubix Green at 1500mA.

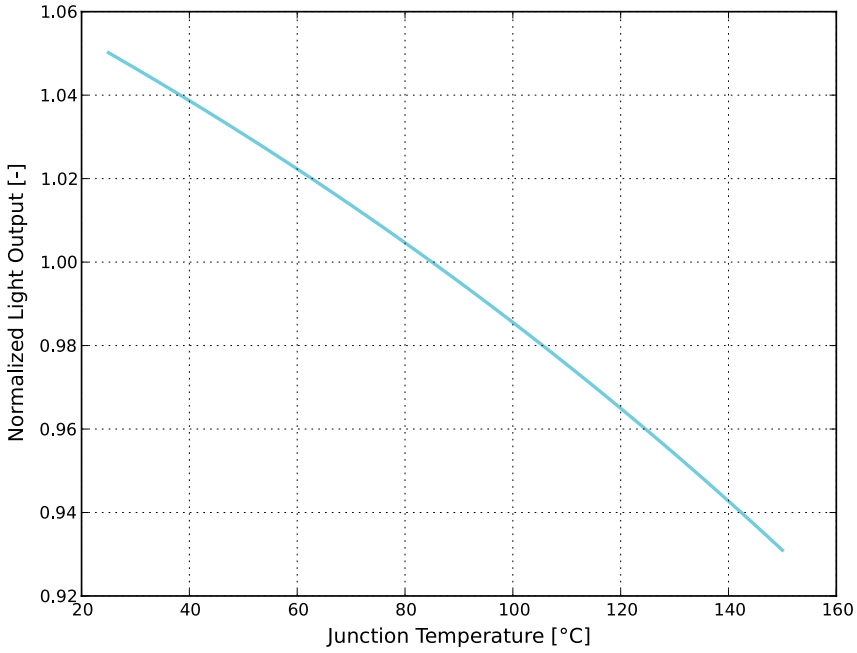

Figure 2f. Typical normalized light output vs. junction temperature for LUXEON Rubix Cyan at 1500mA.

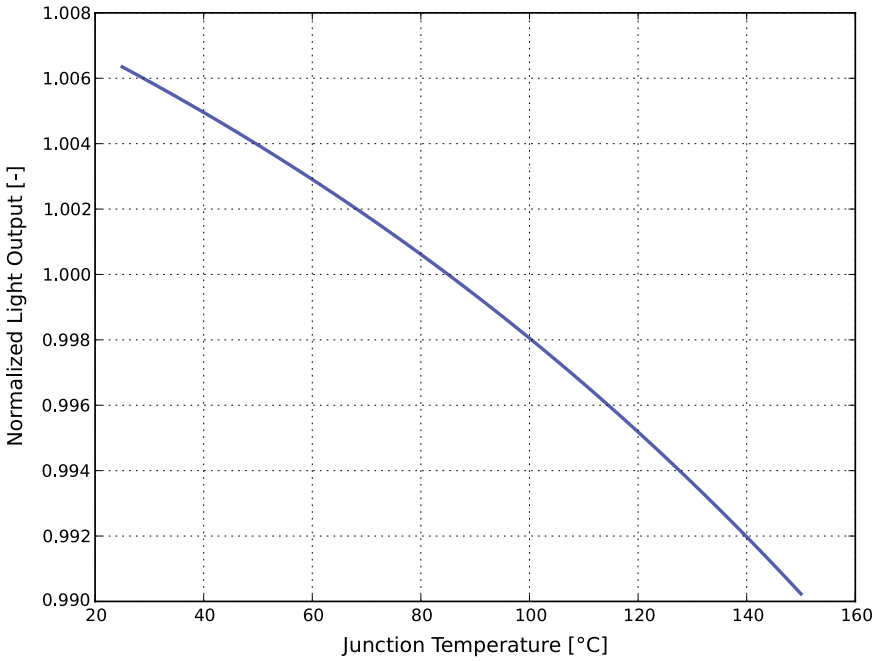

Figure 2g. Typical normalized light output vs. junction temperature for LUXEON Rubix Blue at 1500mA.

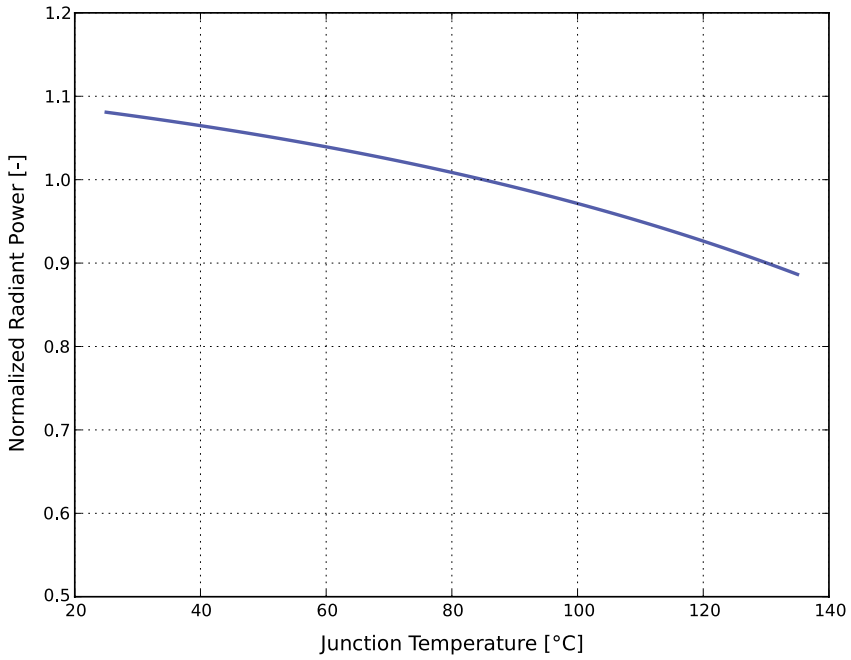

Figure 2h. Typical normalized radiant power vs. junction temperature for LUXEON Rubix Royal Blue at 1500mA.

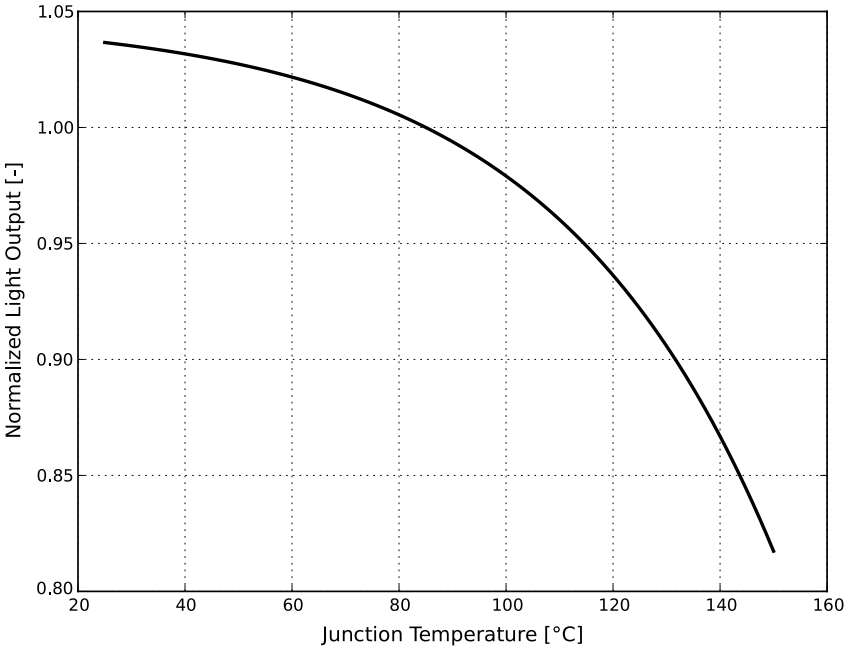

Figure 2i. Typical normalized light output vs. junction temperature for LUXEON Rubix White 60CRI at 1500mA.

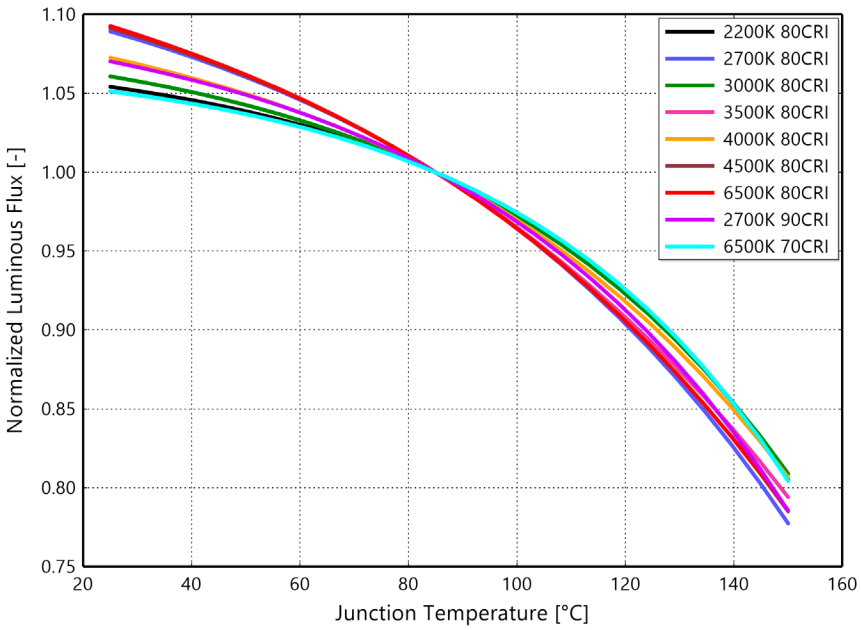

Figure 2j. Typical normalized light output vs. junction temperature for LUXEON Rubix White 70CRI, 80CRI and 90CRI at 1000mA.

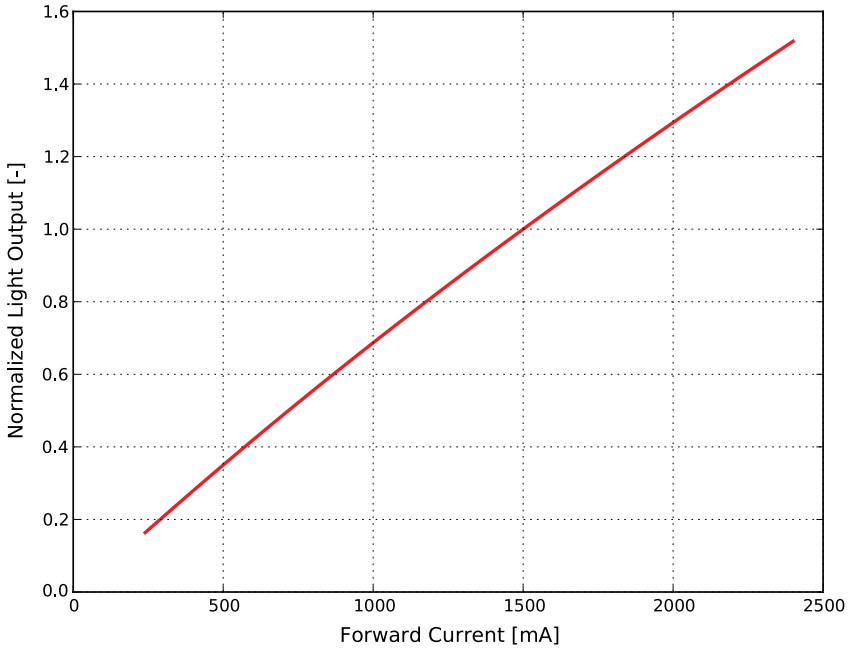

Figure 3a. Typical normalized light output vs. forward current for LUXEON Rubix Red at T_j=85°C.

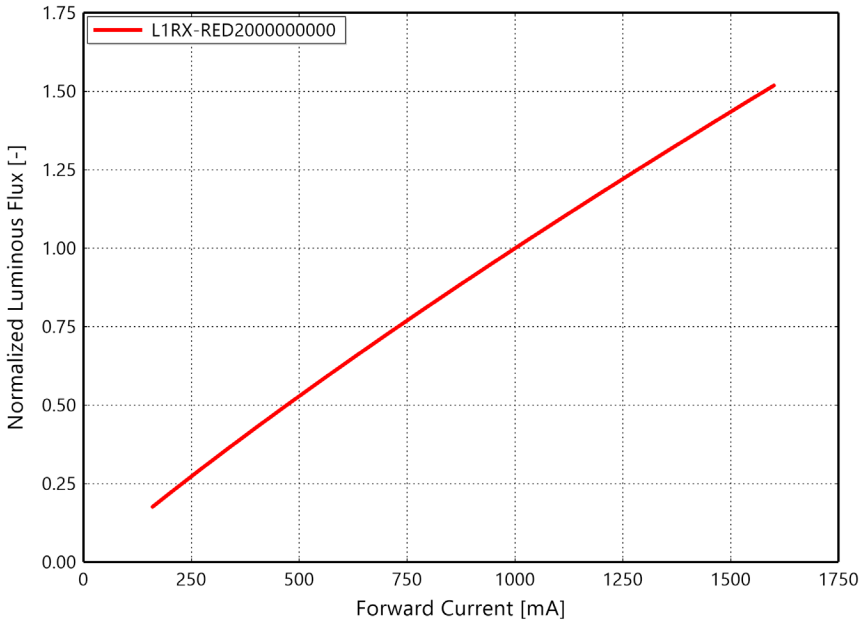

Figure 3b. Typical normalized luminous flux vs. forward current for LUXEON Rubix L1RX-RED2000000000 at T_j=85°C.

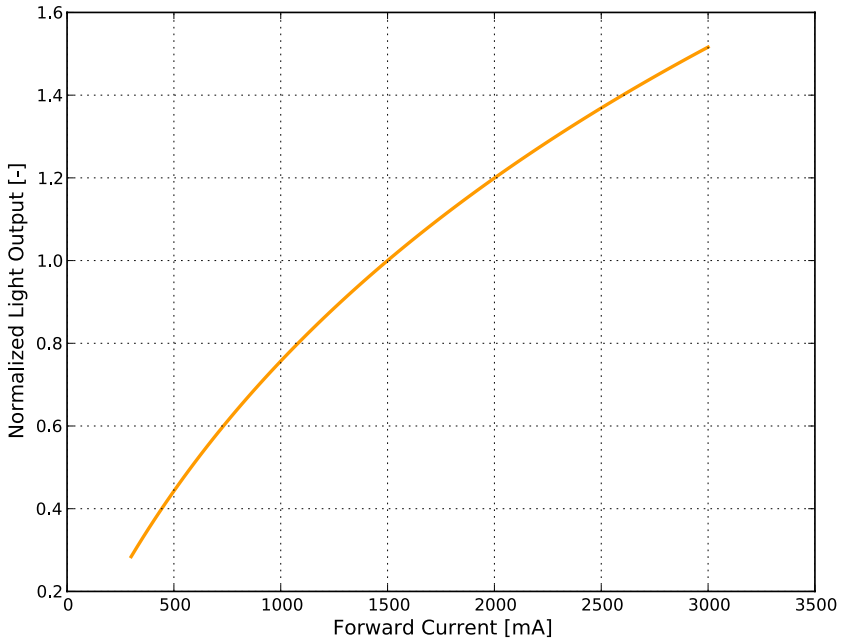

Figure 3c. Typical normalized light output vs. forward current for LUXEON Rubix PC Amber at T_j=85°C.

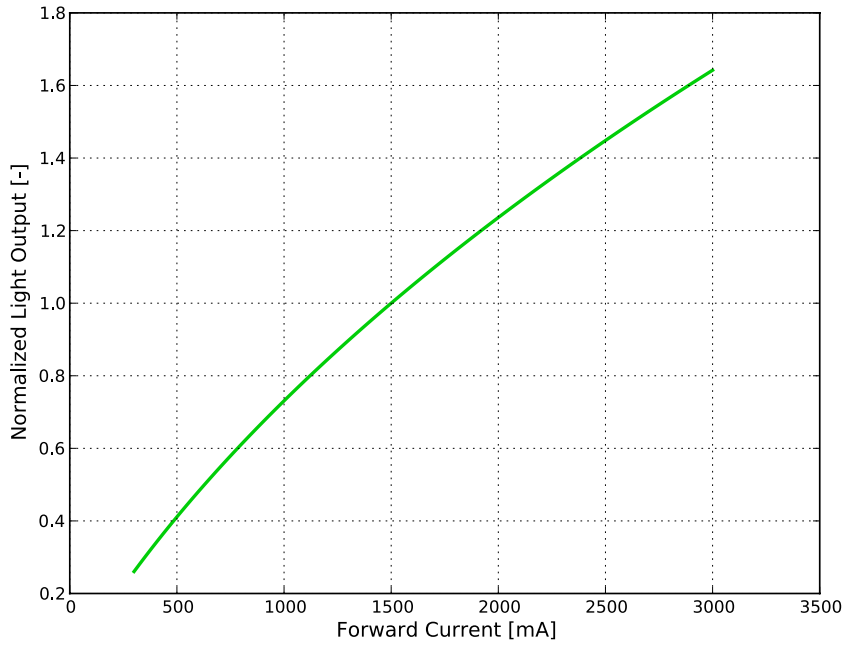

Figure 3d. Typical normalized light output vs. forward current for LUXEON Rubix Lime at T_j=85°C.

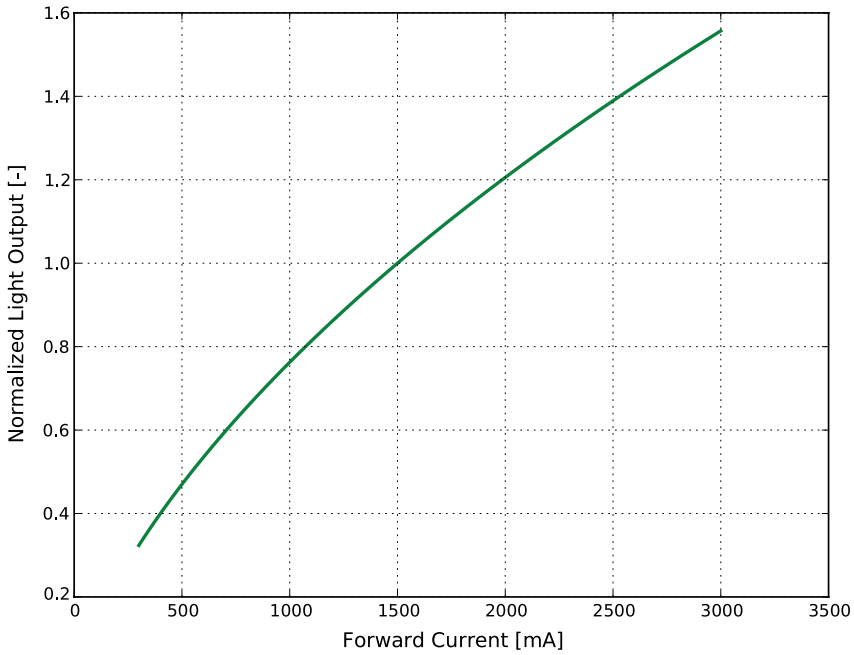

Figure 3e. Typical normalized light output vs. forward current for LUXEON Rubix Green at T_j=85°C.

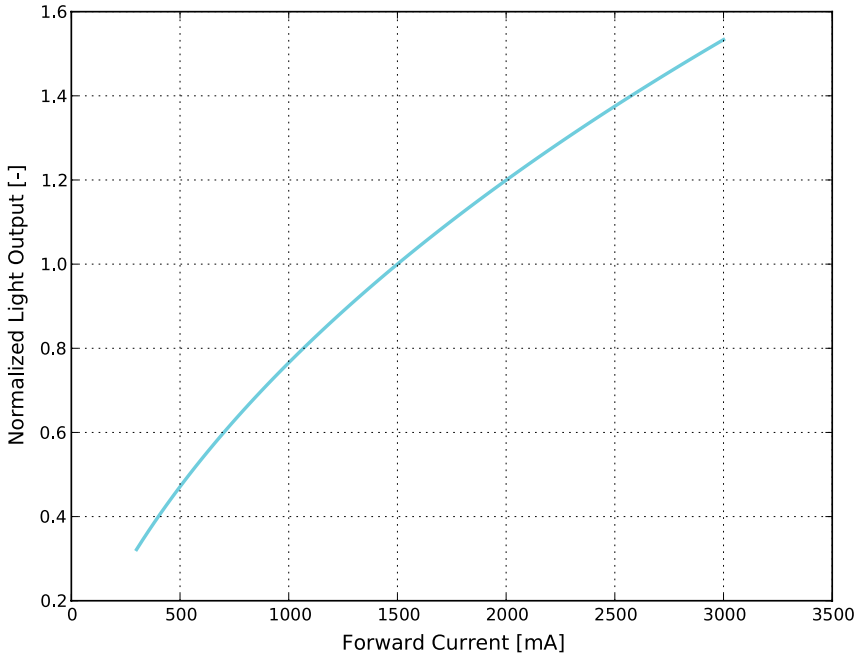

Figure 3f. Typical normalized light output vs. forward current for LUXEON Rubix Cyan at T_j=85°C.

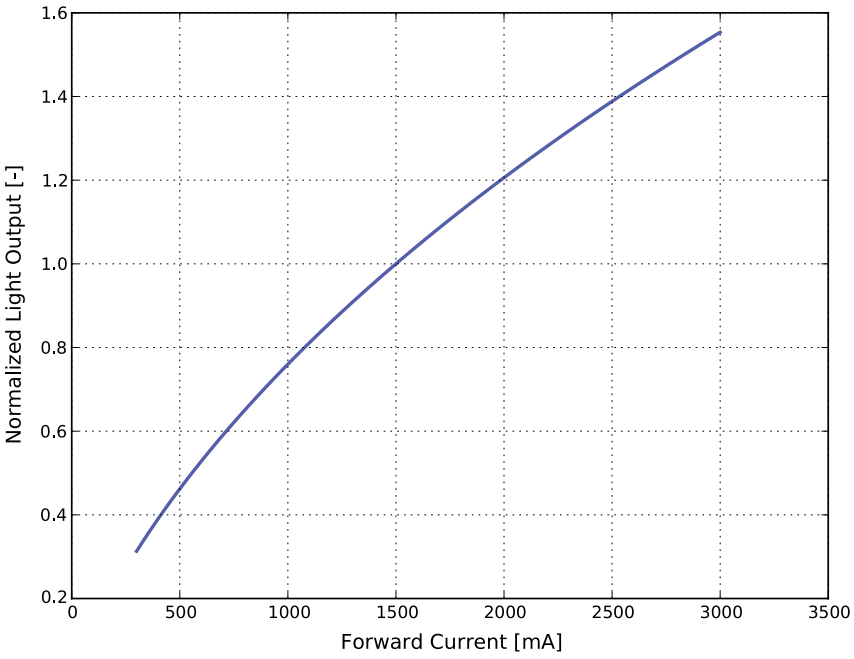

Figure 3g. Typical normalized light output vs. forward current for LUXEON Rubix Blue at T_j=85°C.

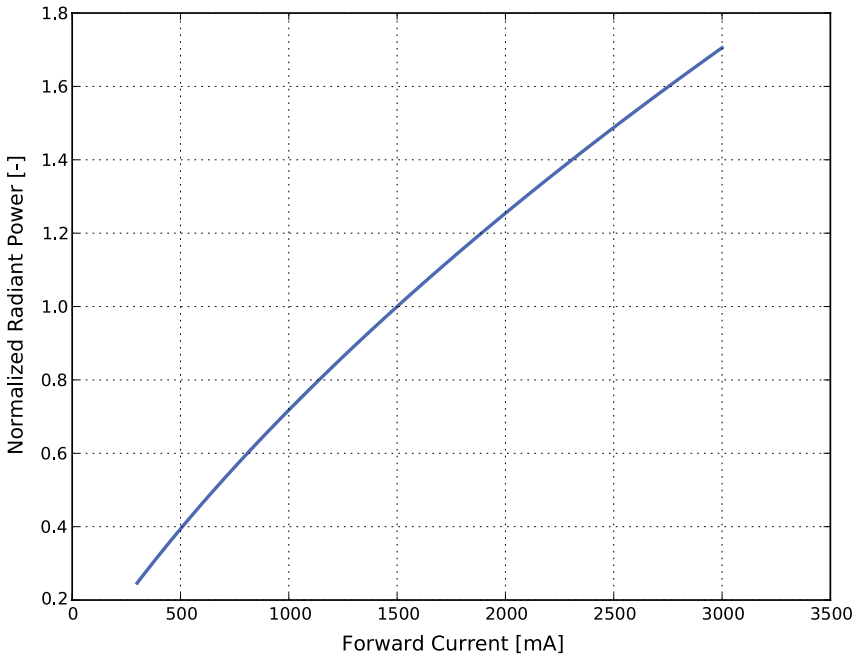

Figure 3h. Typical normalized radiant power vs. forward current for LUXEON Rubix Royal Blue at T_j=85°C.

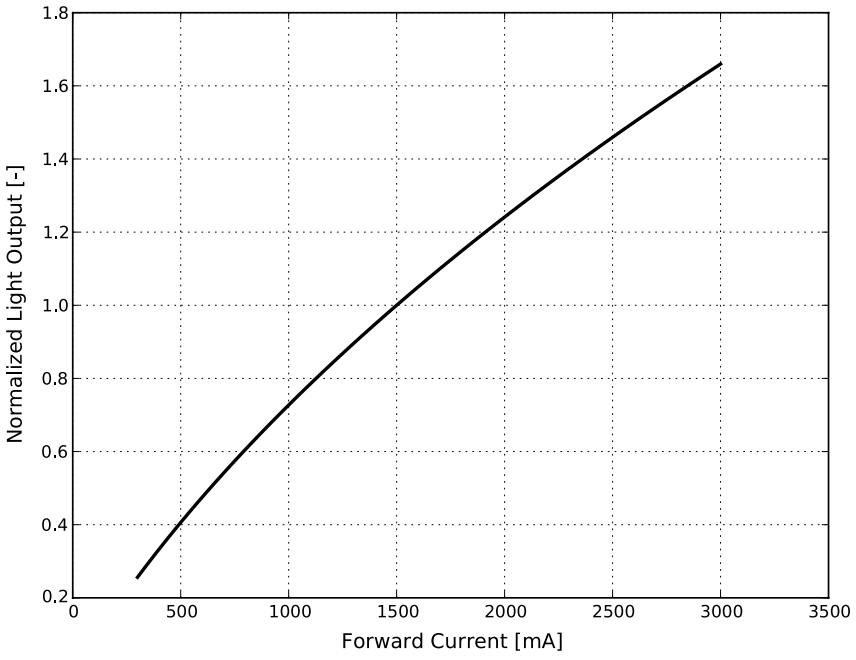

Figure 3i. Typical normalized light output vs. forward current for LUXEON Rubix White 60CRI at T_j=85°C.

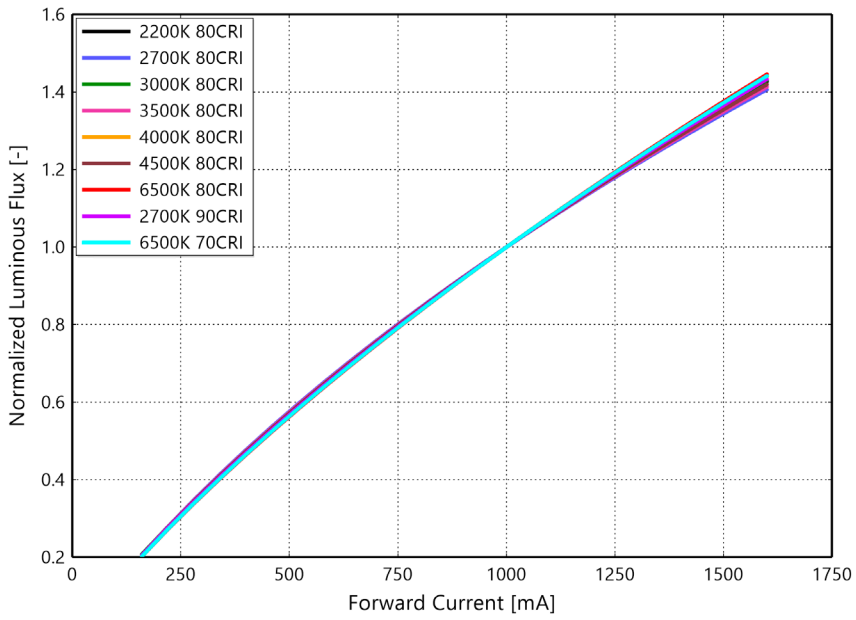

Figure 3j. Typical normalized light output vs. forward current for LUXEON Rubix White 70CRI, 80CRI and 90CRI at T_j=85°C.

Forward Current Characteristics

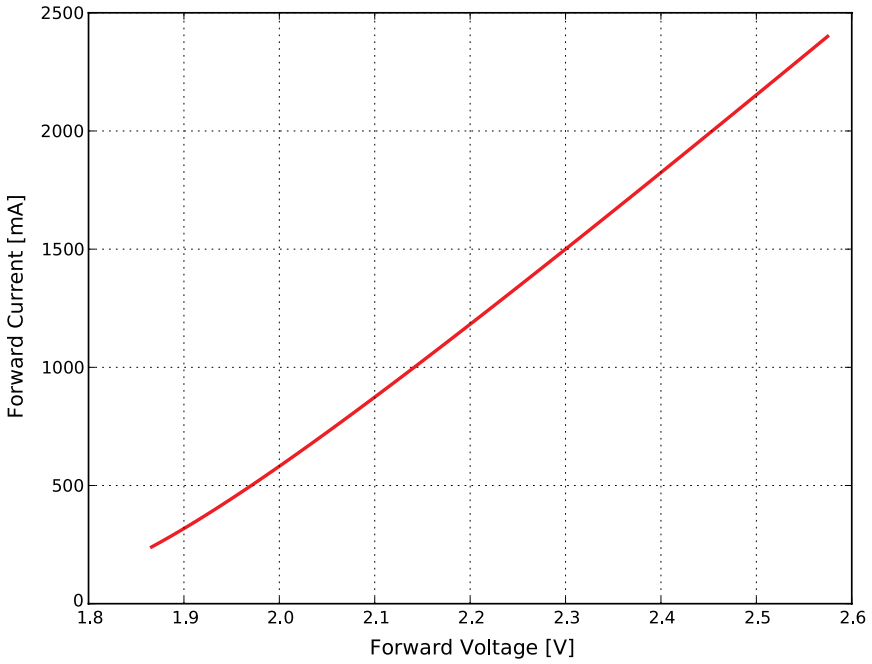

Figure 4a. Typical forward current vs. forward voltage for LUXEON Rubix Red at T_j=85°C.

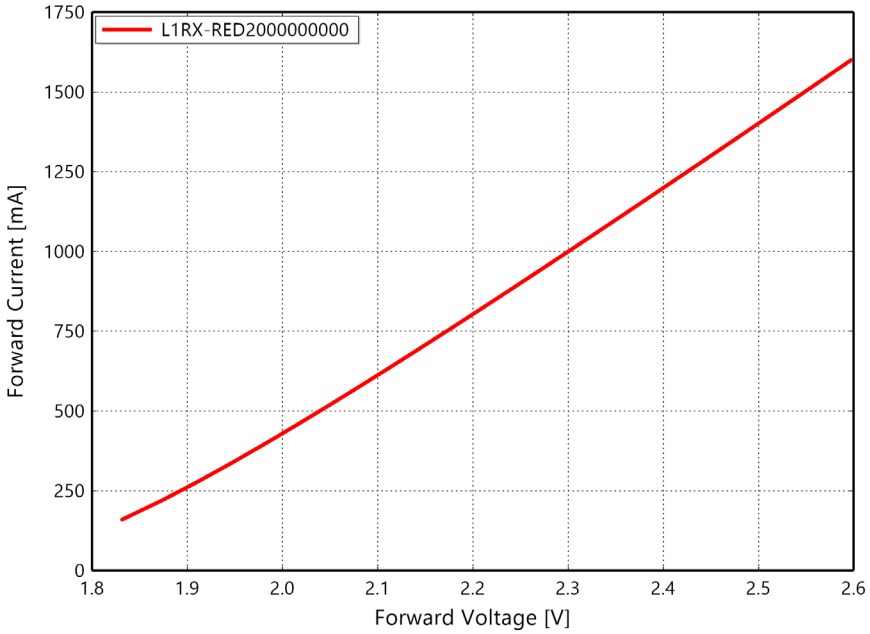

Figure 4b. Typical forward current vs. forward voltage for LUXEON Rubix L1RX-RED2000000000 at T_j=85°C.

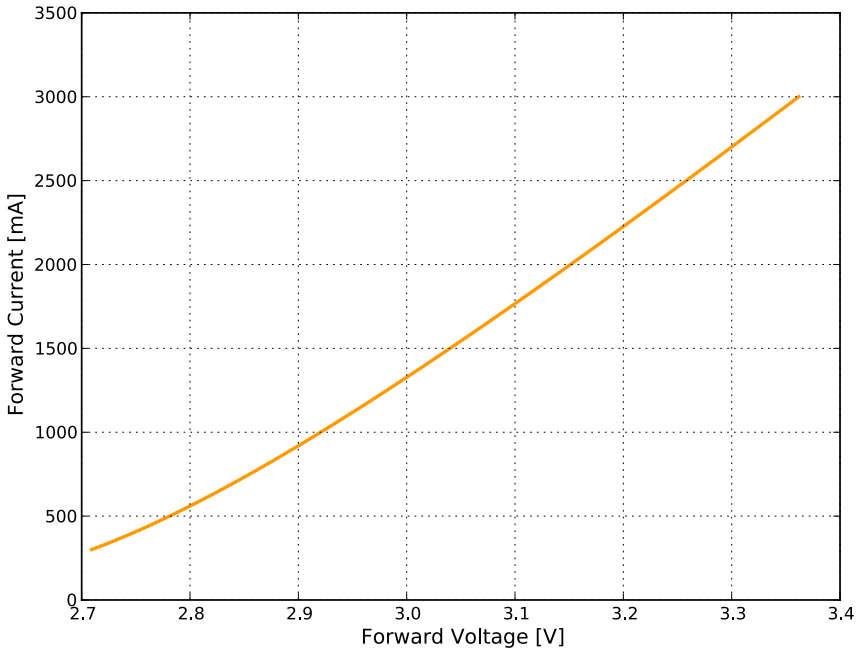

Figure 4c. Typical forward current vs. forward voltage for LUXEON Rubix PC Amber at T_j=85°C.

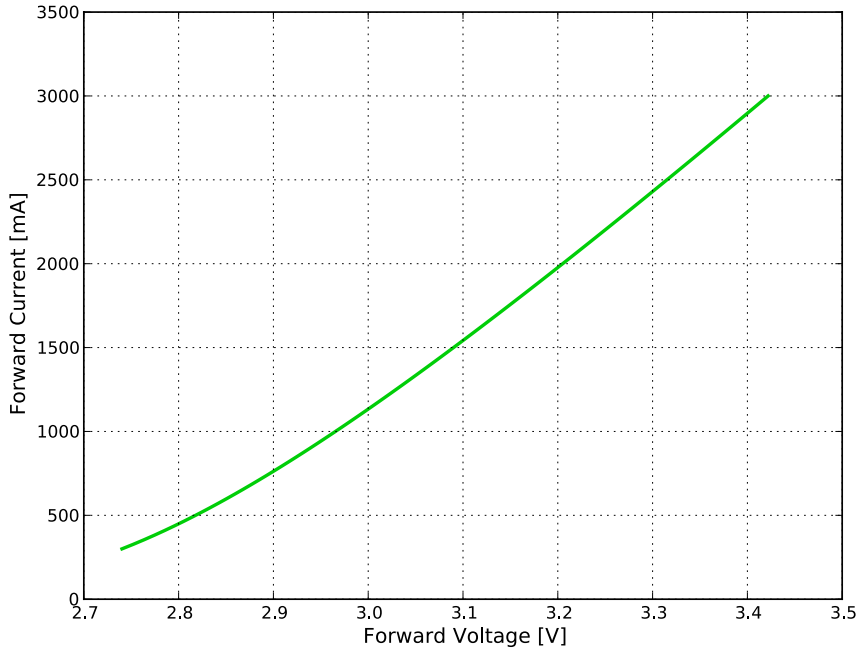

Figure 4d. Typical forward current vs. forward voltage for LUXEON Rubix Lime at T_j=85ºC.

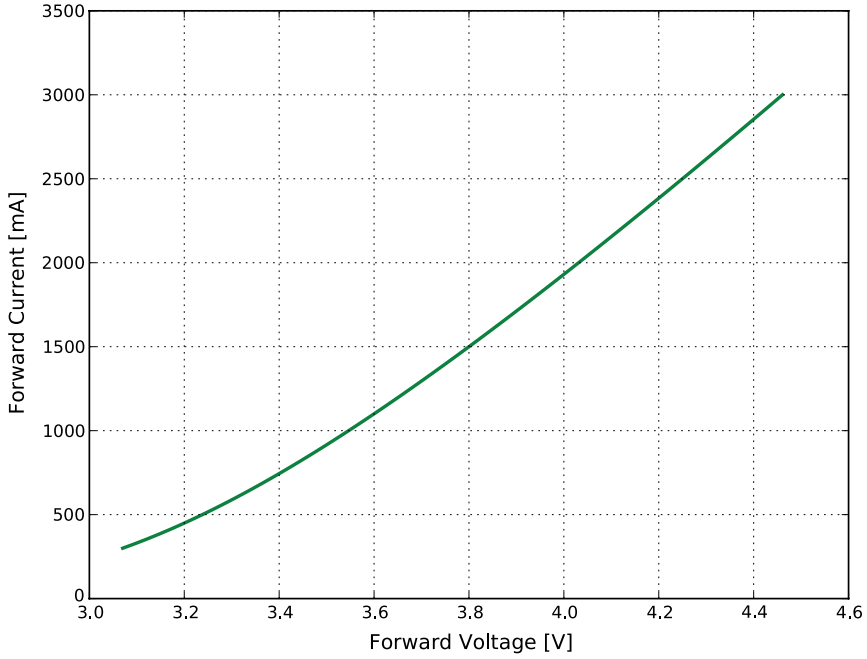

Figure 4e. Typical forward current vs. forward voltage for LUXEON Rubix Green at T_j=85ºC.

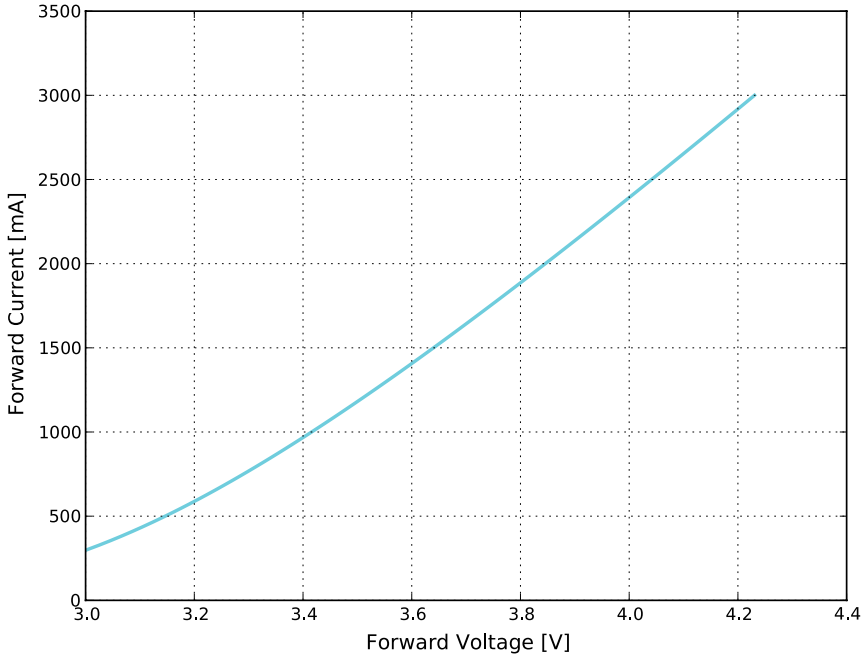

Figure 4f. Typical forward current vs. forward voltage for LUXEON Rubix Cyan at T_j=85°C.

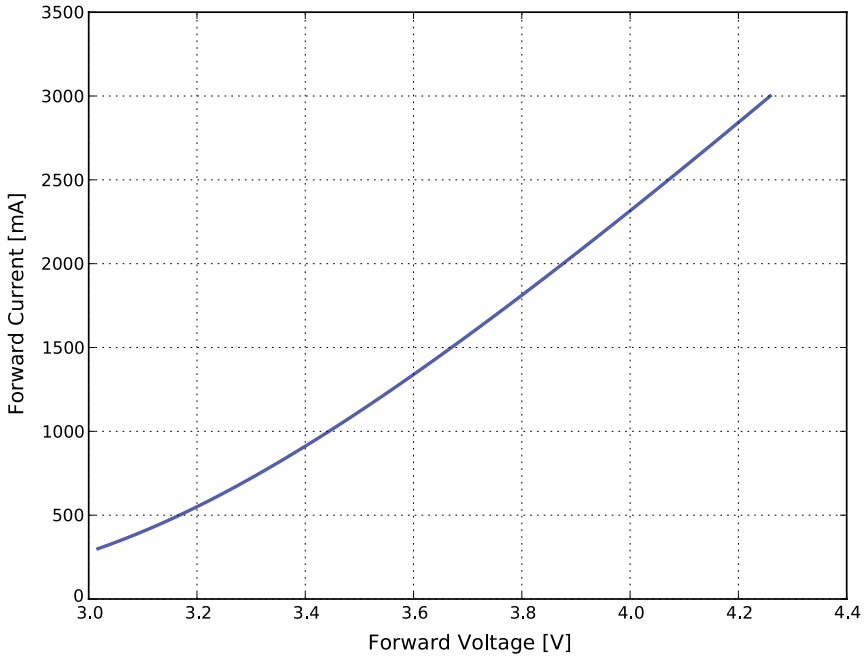

Figure 4g. Typical forward current vs. forward voltage for LUXEON Rubix Blue at T_j=85°C.

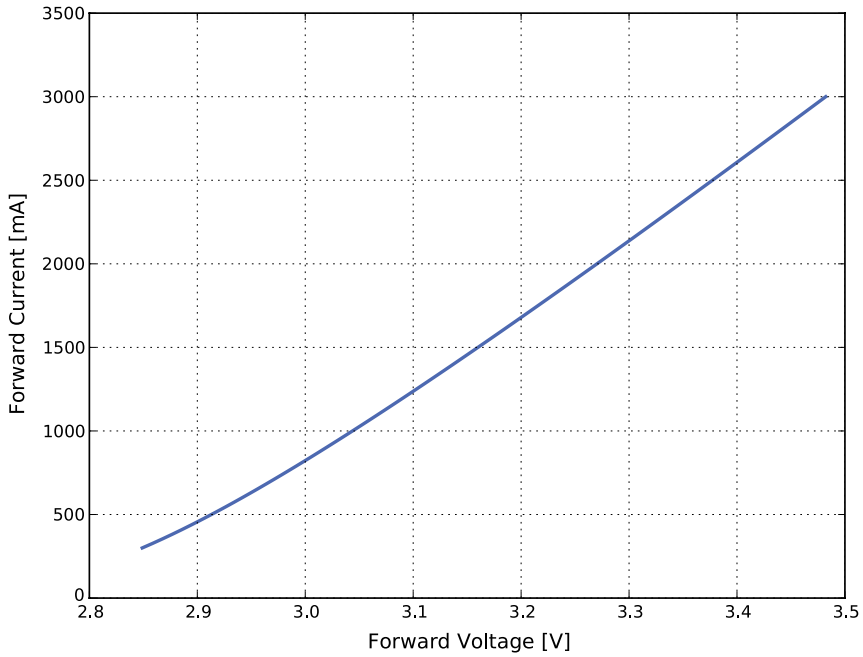

Figure 4h. Typical forward current vs. forward voltage for LUXEON Rubix Royal Blue at T_j=85°C.

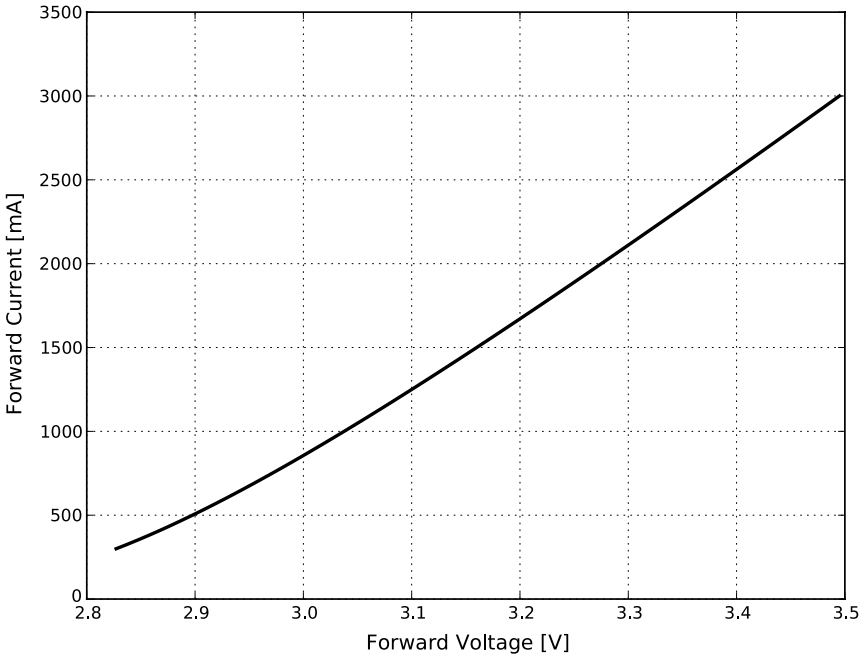

Figure 4i. Typical forward current vs. forward voltage for LUXEON Rubix White 60CRI at T_j=85°C.

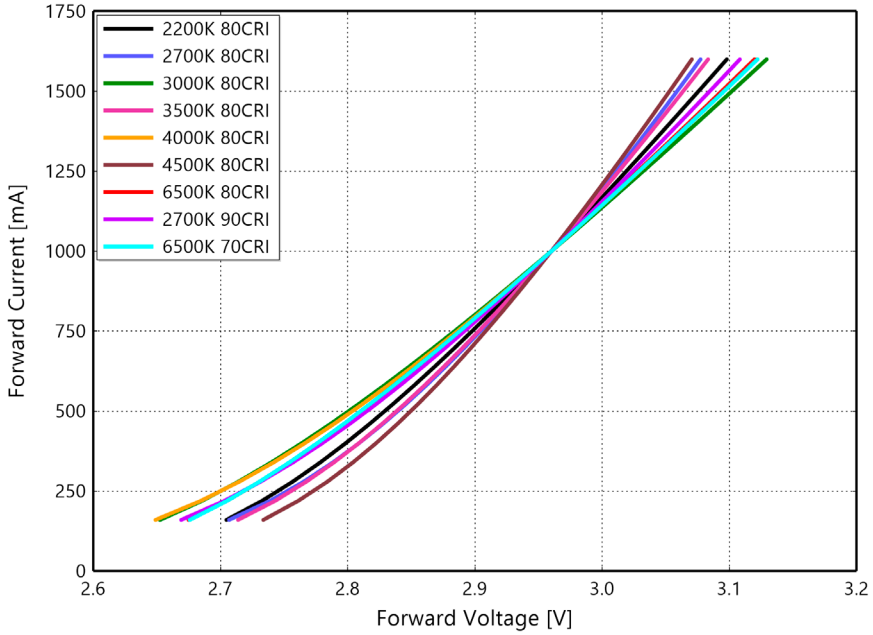

Figure 4j. Typical forward current vs. forward voltage for LUXEON Rubix White 70CRI, 80CRI and 90CRI at T_j=85°C.

Radiation Pattern Characteristics

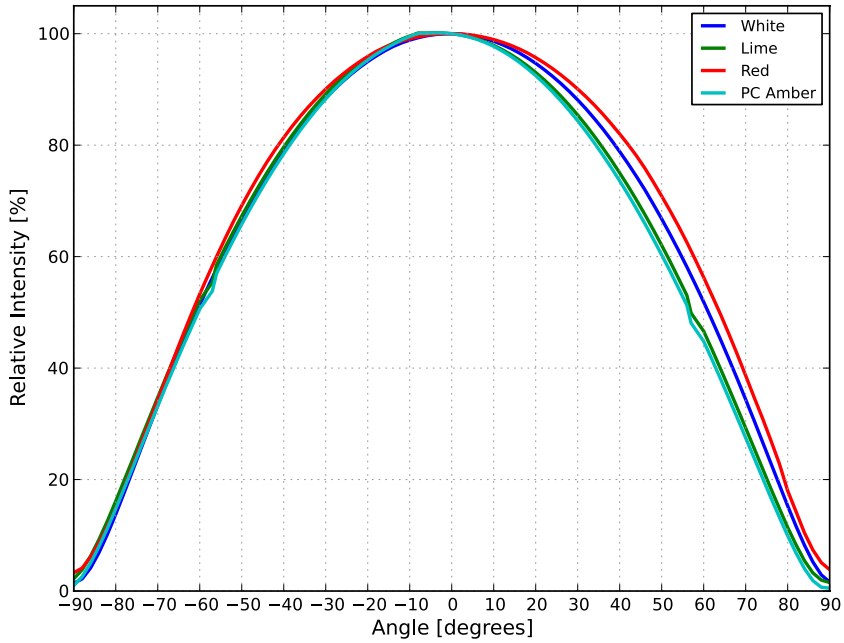

Figure 5a. Typical radiation pattern for LUXEON Rubix Red, PC Amber, Lime and White 60CRI at 1500mA, T_j=85°C.

Notes for Figure 5a:
1. The normalized intensity around 0° to ±30° may fluctuate between the upper and lower bound limits.

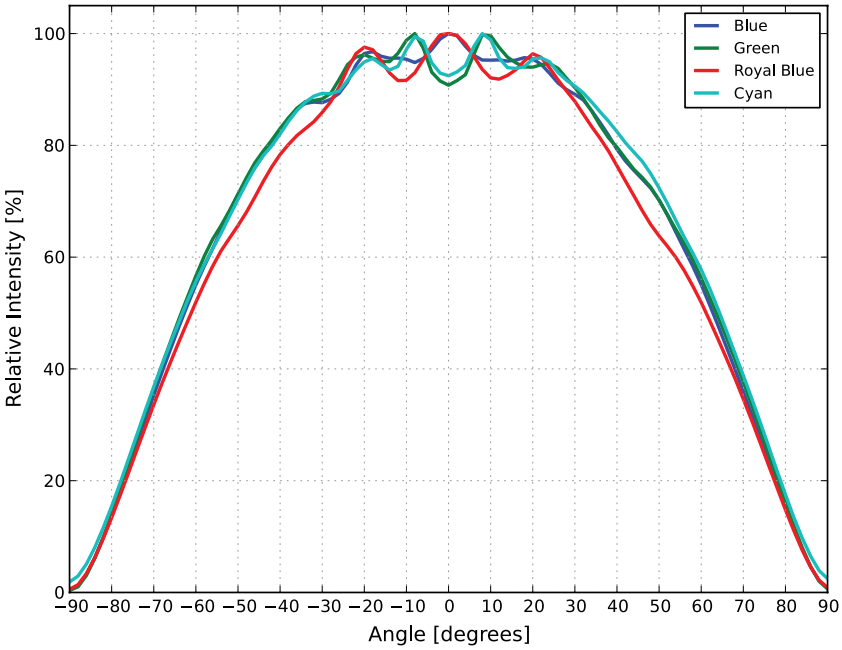

Figure 5b. Typical radiation pattern for LUXEON Rubix Green, Cyan, Blue and Royal Blue at 1500mA, T_j=85°C.

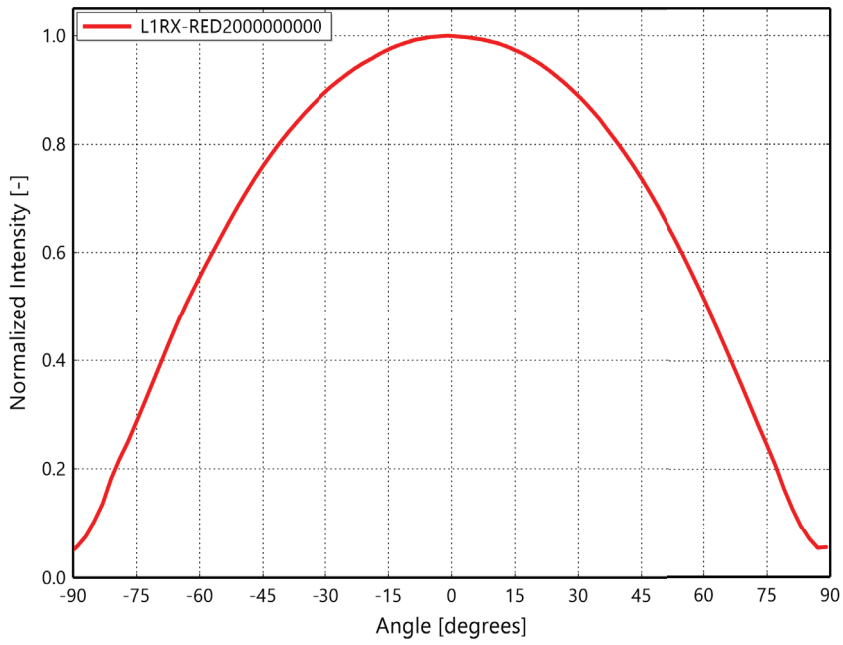

Figure 5c. Typical radiation pattern for LUXEON Rubix L1RX-RED2000000000 at 1000mA, T_j=85°C.

Notes for Figures 5b and 5c:
1. The normalized intensity around 0° to ±30° may fluctuate between the upper and lower bound limits.

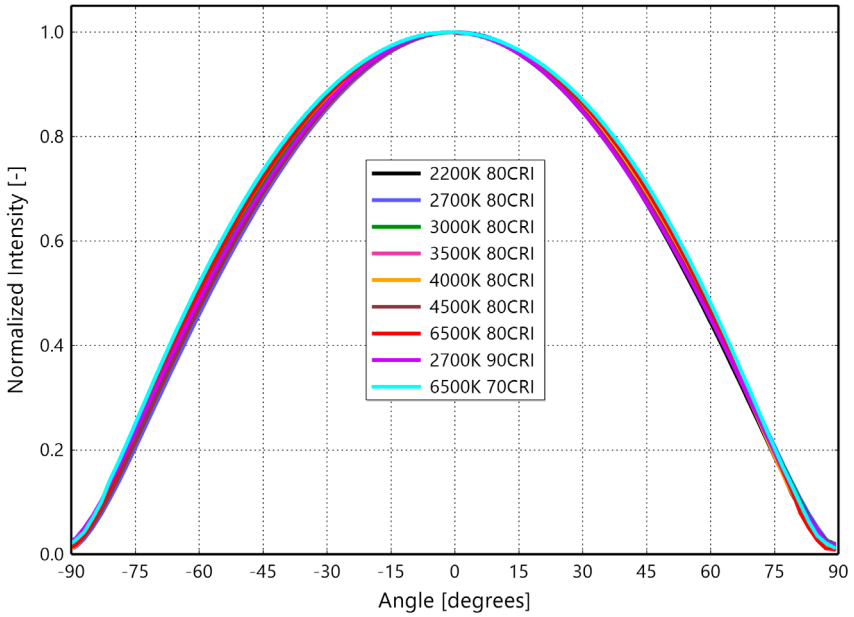

Figure 5d. Typical radiation pattern for LUXEON Rubix White 70CRI, 80CRI and 90CRI at 1000mA, T_j=85°C.

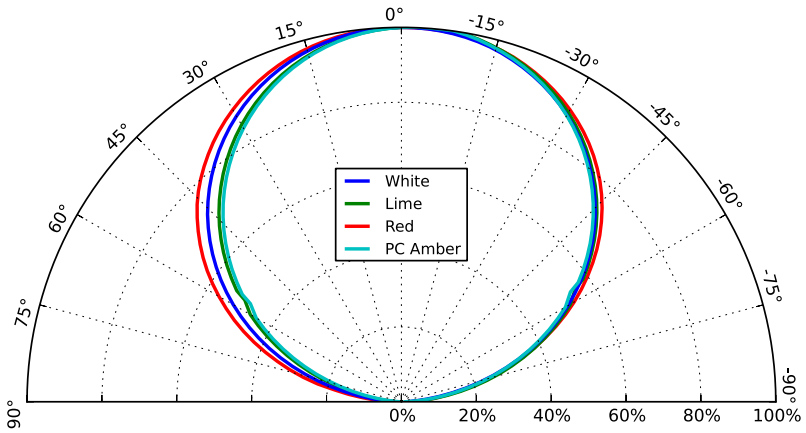

Figure 6a. Typical polar radiation pattern for LUXEON Rubix Red, PC Amber, Lime and White 60CRI at 1500mA, T_j=85°C.

Notes for Figures 5d and 6a:
1. The normalized intensity around 0° to ±30° may fluctuate between the upper and lower bound limits.

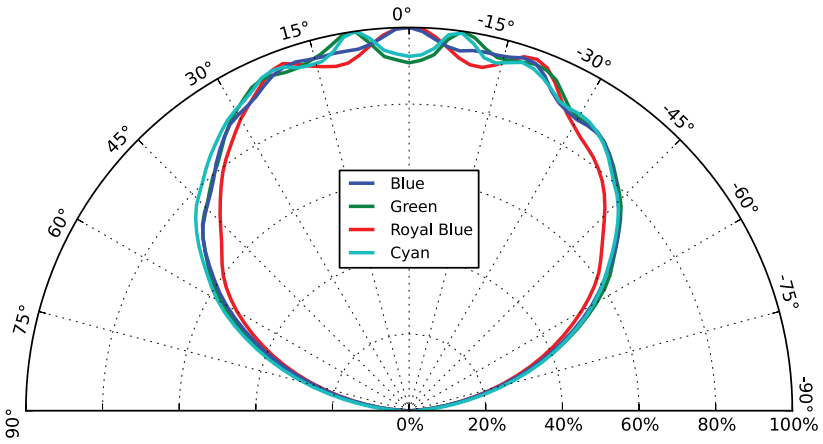

Figure 6b. Typical polar radiation pattern for LUXEON Rubix Green, Cyan, Blue and Royal Blue at 1500mA, T_j=85°C.

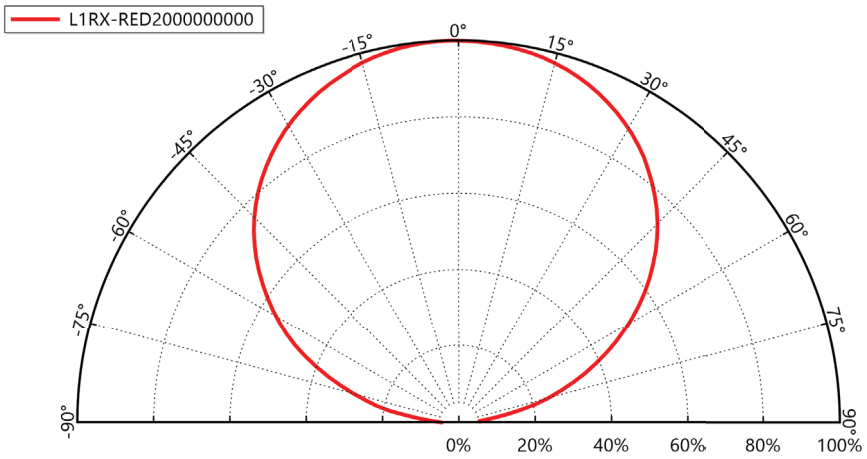

Figure 6c. Typical polar radiation pattern for LUXEON Rubix L1RX-RED2000000000 at 1000mA, T_j=85°C.

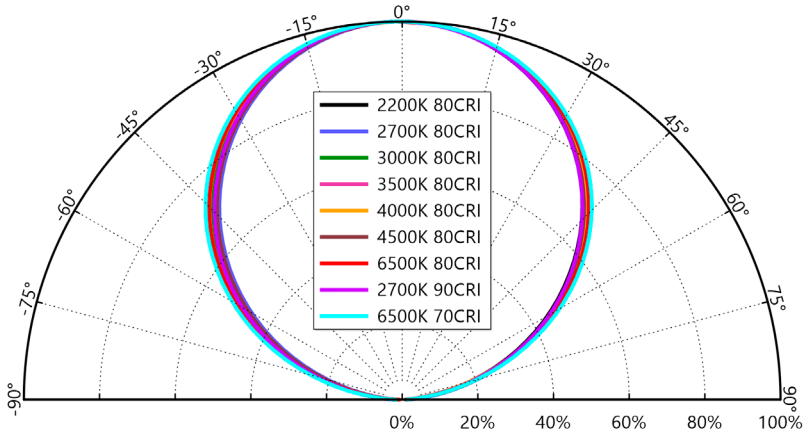

Figure 6d. Typical polar radiation pattern for LUXEON Rubix White 70CRI, 80CRI and 90CRI at 1000mA, T_j=85°C.

Notes for Figures 6b, 6c and 6d:
1. The normalized intensity around 0° to ±30° 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 [1] (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

Notes for Table 5:
1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.

Radiometric Power Bins

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

COLOR	BIN	RADIOMETRIC POWER [1] (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

Notes for Table 6:
1. Lumileds maintains a tolerance of ±6.5% on radiometric power measurements.

Color Bin Definitions

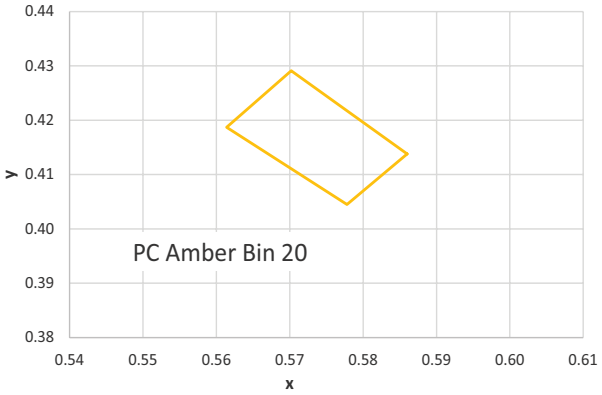

Figure 7. Color bin structure for LUXEON Rubix PC Amber for Table 7.

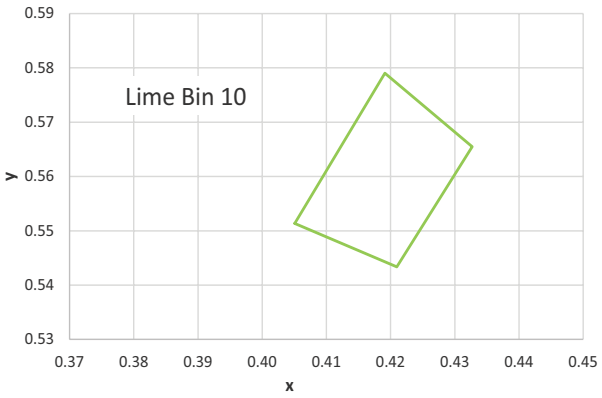

Figure 8. Color bin structure for LUXEON Rubix Lime for Table 7.

Table 7. Color bin definitions for LUXEON Rubix PC Amber and Lime at 1500mA, T_j = 85°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 ±0.005 on x and y color coordinates measurements.

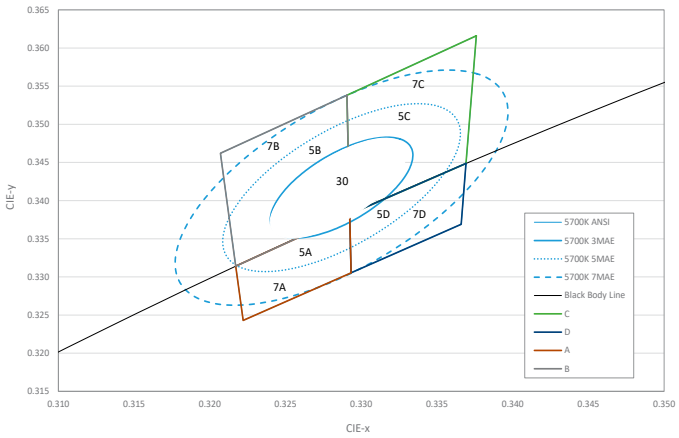

Figure 9a. Color bin structure for LUXEON Rubix White 5700K 60CRI.

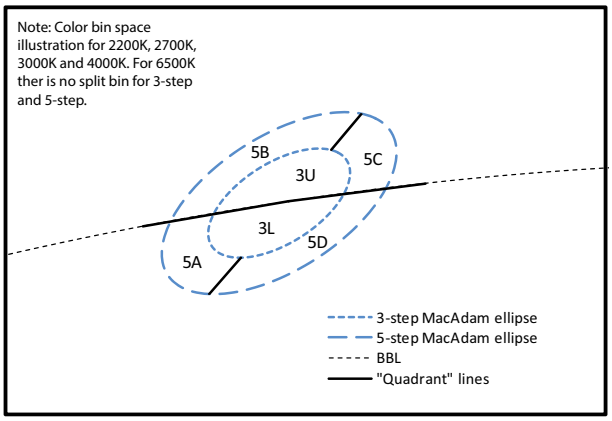

Figure 9b. Color bin structure for LUXEON Rubix White 70CRI, 80CRI and 90CRI.

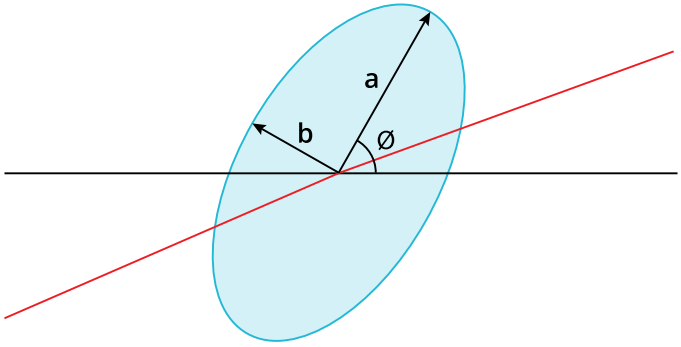

Figure 10. 3- and 5-step MacAdam ellipse illustration for Tables 8a and 8b.

Table 8a. 3-, 5- and 7-step MacAdam ellipse color bin definitions for LUXEON Rubix White at 1500mA, T_j = 85°C.

NOMINAL CCT	COLOR SPACE	CENTER POINT [1] (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, θ
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 ±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_j = 85°C.

NOMINAL CCT	COLOR SPACE	CENTER POINT [1] (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 [1] (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 Red, Green, Cyan and Blue at 1500mA, T_j=85°C.

COLOR	PART NUMBER	BIN	DOMINANT WAVELENGTH [1] (nm)	
			MINIMUM	MAXIMUM
Red	L1RX-RED1000000000	40	620	630
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_j=85°C.

COLOR	PART NUMBER	BIN	DOMINANT WAVELENGTH [1](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 [1] (V_f)	
	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

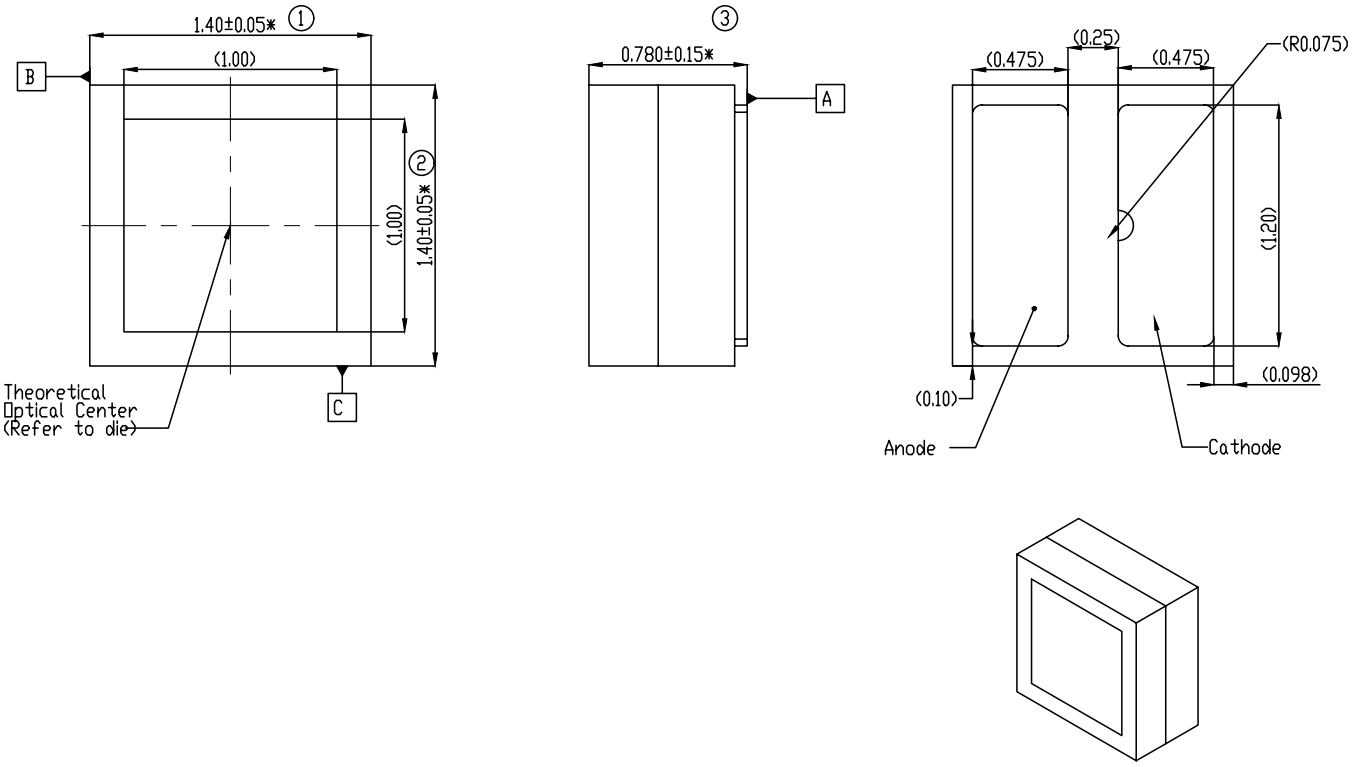

Figure 11a. Mechanical dimensions for LUXEON Rubix PC Amber, Lime, Green, Cyan, Blue, Royal Blue and White Colors.

Notes for Figure 11a:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

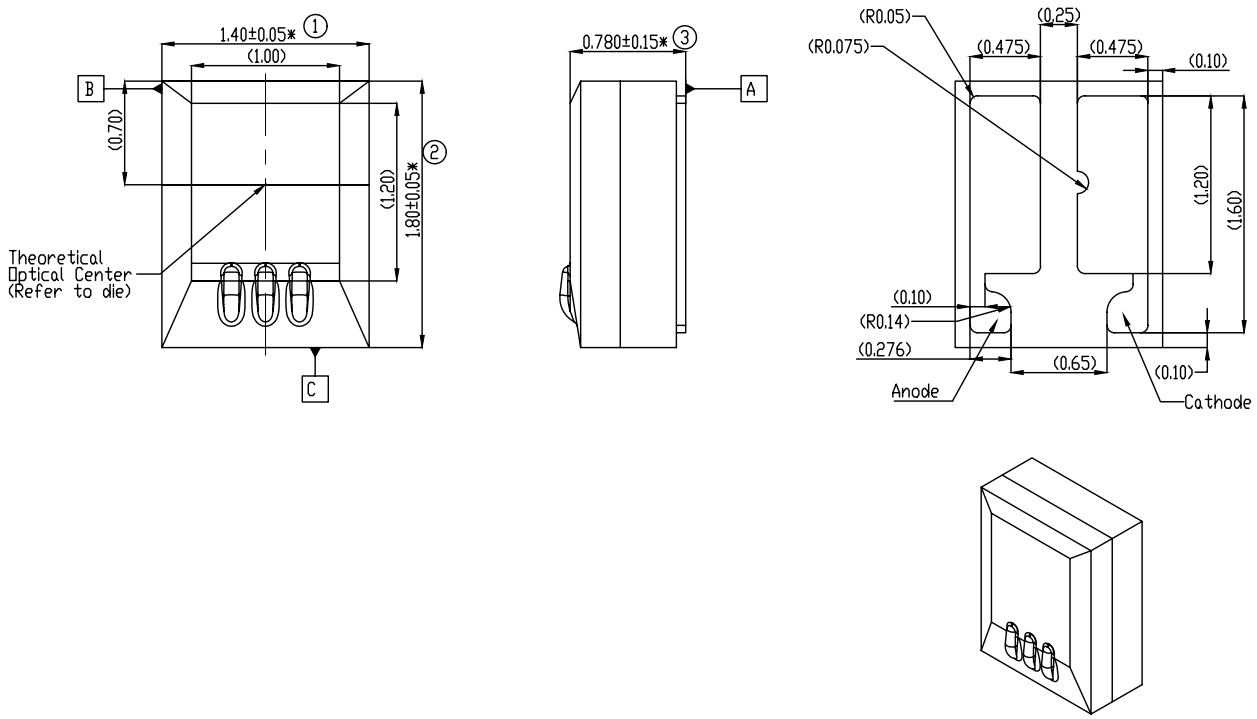

Figure 11b. Mechanical dimensions for LUXEON Rubix L1RX-RED1000000000 Color.

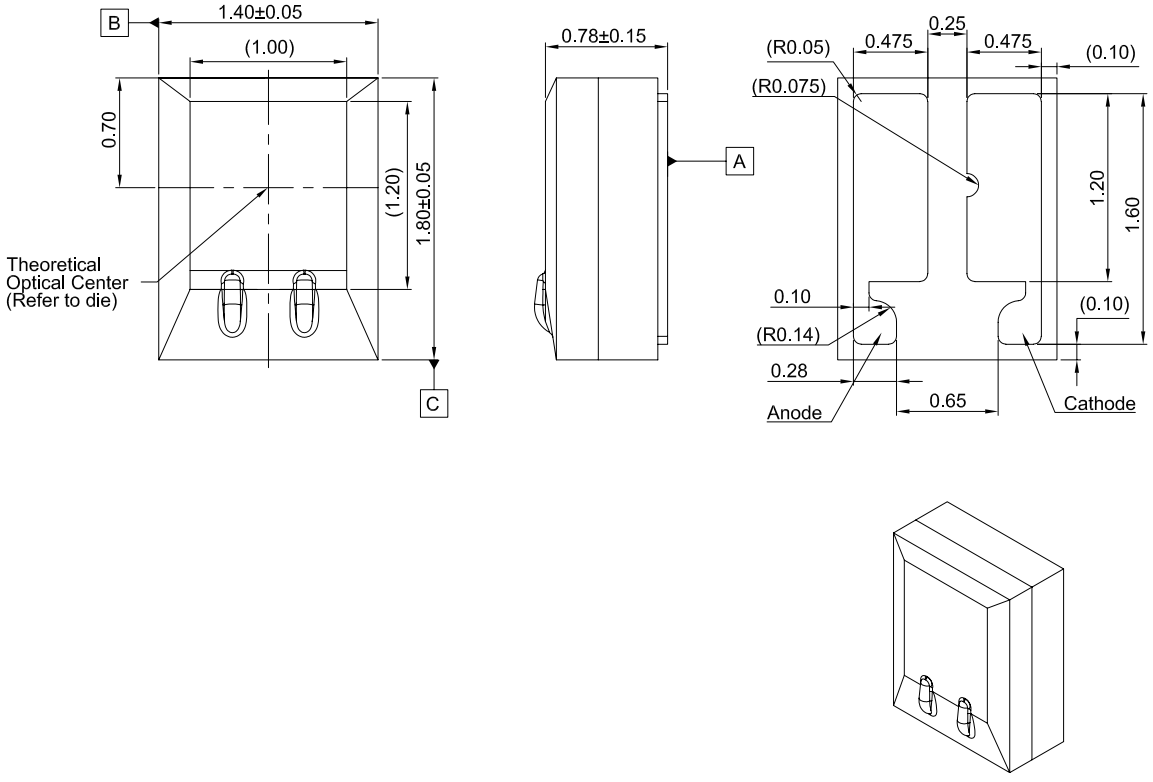

Figure 11c. Mechanical dimensions for LUXEON Rubix L1RX-RED2000000000 Color.

Notes for Figures 11b and 11c:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

Reflow Soldering Guidelines

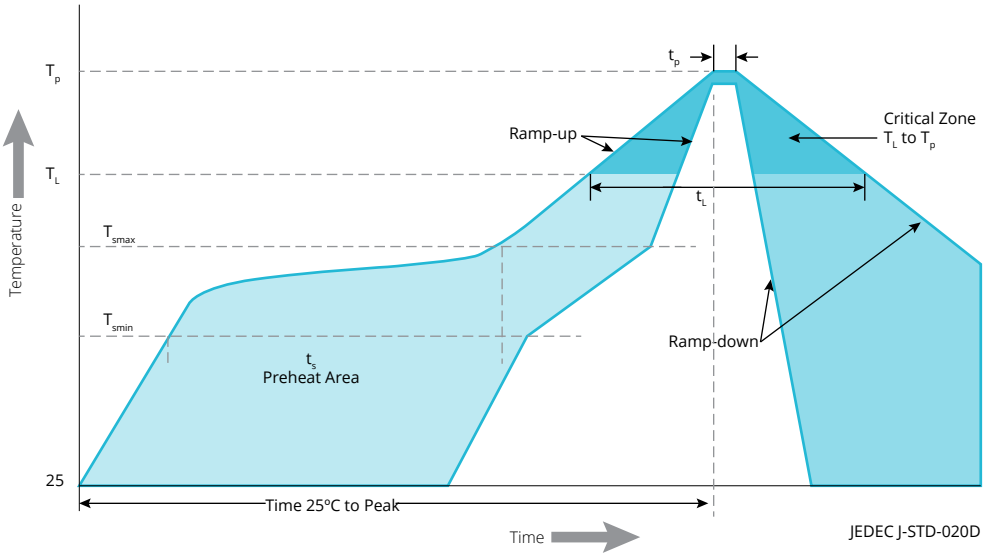

Figure 12. Visualization of the acceptable reflow temperature profile as specified in Table 12.

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_L)	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

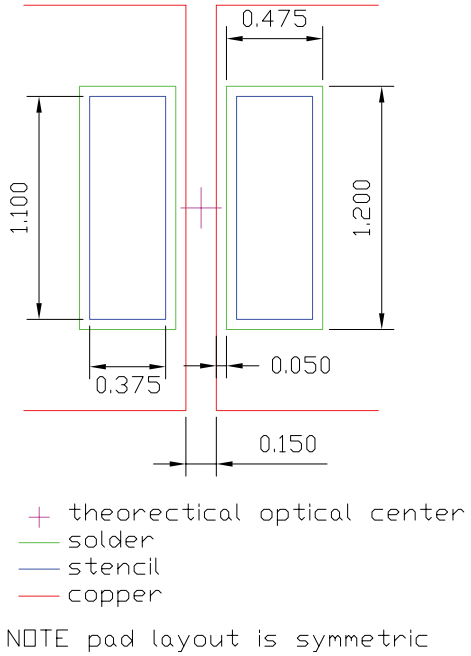

Figure 13. Recommended PCB solder pad layout for all LUXEON Rubix.

Notes for Figure 13:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

Packaging Information

Pocket Tape Dimensions

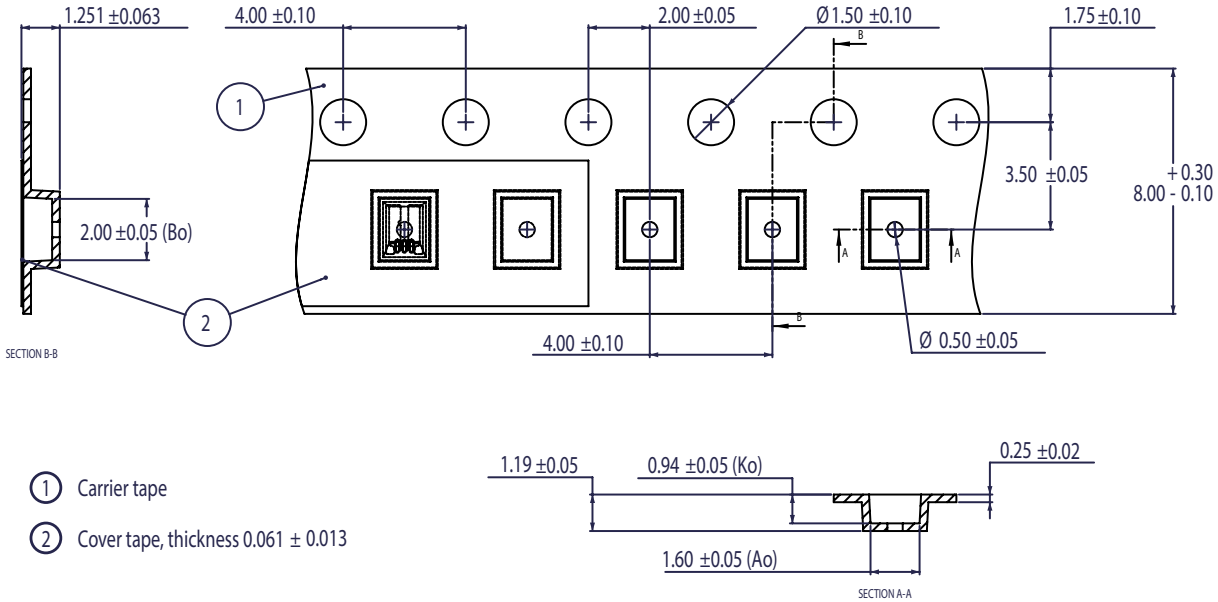

Figure 14a. Pocket Tape dimensions for LUXEON Rubix Red.

Notes for Figure 14a:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

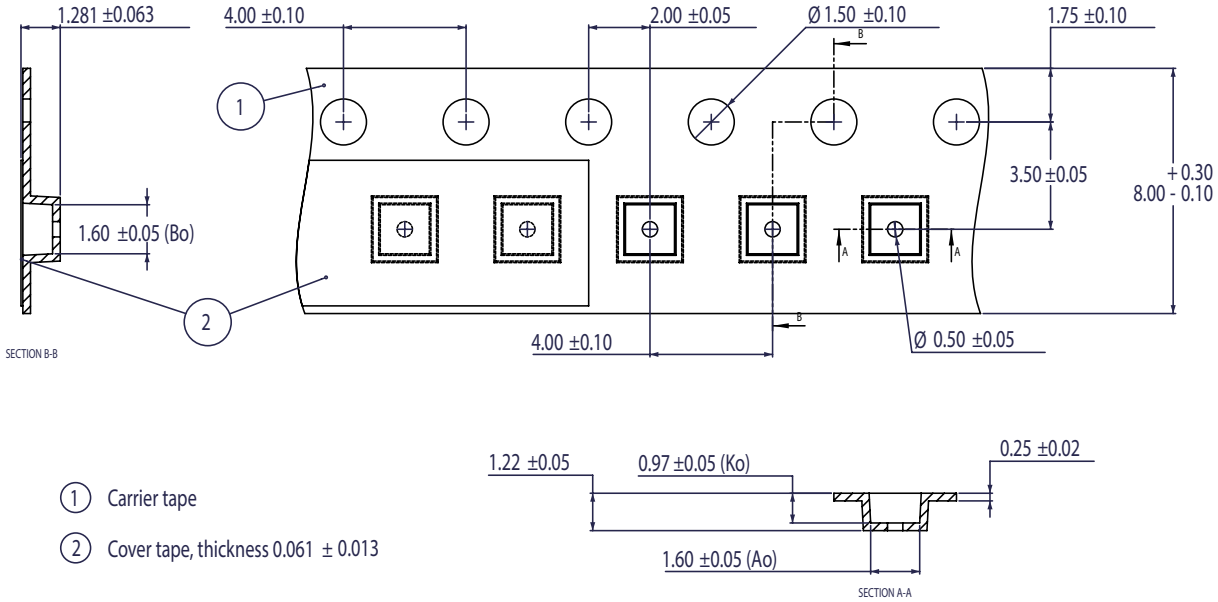

Figure 14b. Pocket Tape dimensions for LUXEON Rubix PC Amber, Lime, Green, Cyan, Blue, Royal Blue and White.

Notes for Figure 14b:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

Reel Dimensions

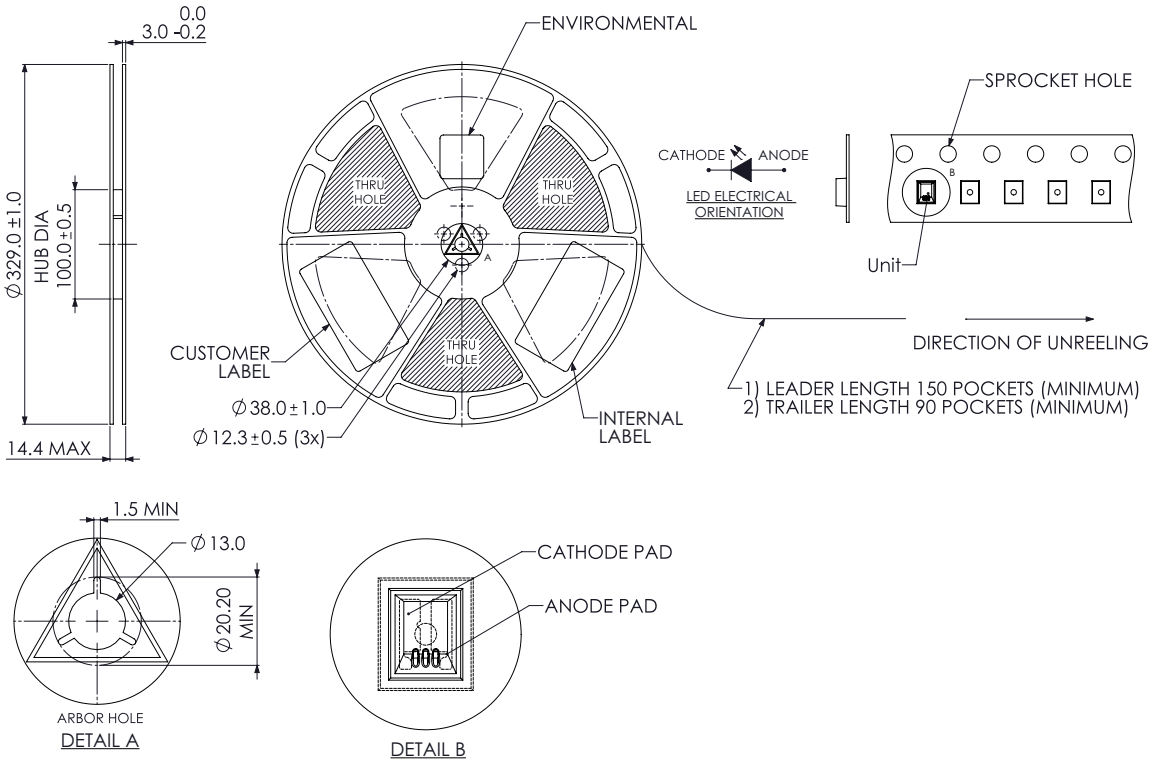

Figure 15a. Reel dimensions for LUXEON Rubix Red.

Notes for Figure 15a:
1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Maximum 1,000 pieces per reel.

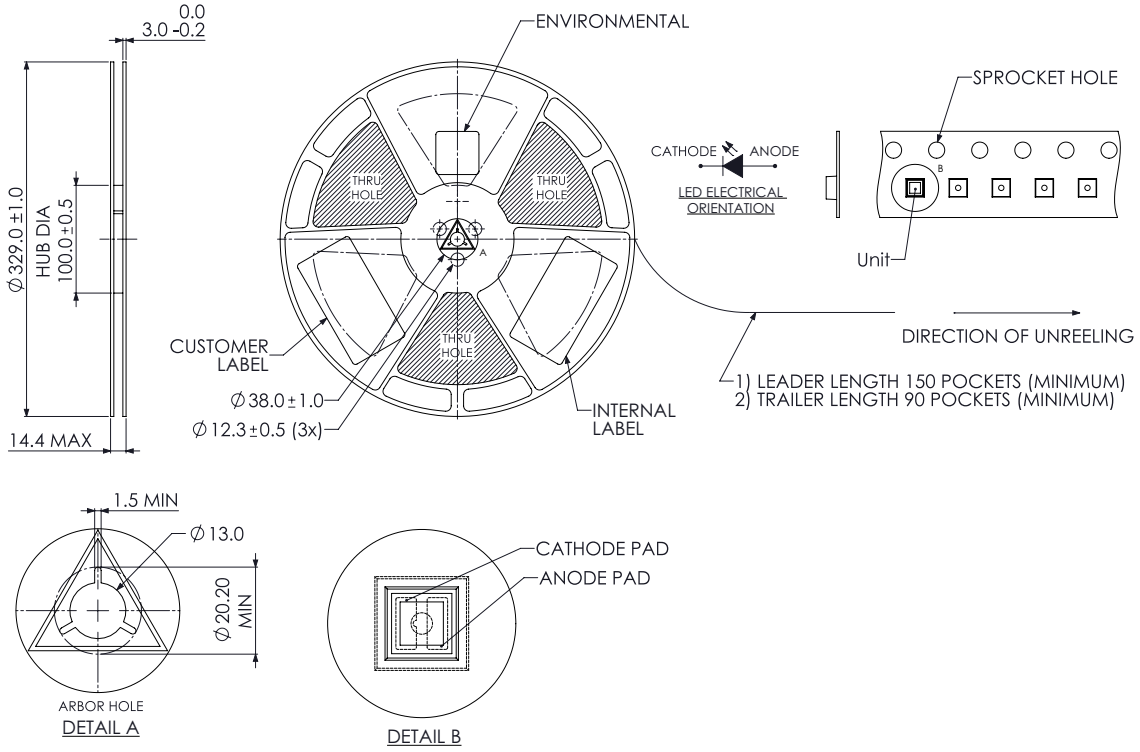

Figure 15b. Reel dimensions for LUXEON Rubix PC Amber, Lime, Green, Cyan, Blue, Royal Blue and White.

Notes for Figure 15b:
1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Maximum 1,000 pieces per reel.

About Lumileds

Companies developing automotive, mobile, IoT and illumination lighting applications need a partner who can collaborate with them to push the boundaries of light. With over 100 years of inventions and industry firsts, Lumileds is a global lighting solutions company that helps customers around the world deliver differentiated solutions to gain and maintain a competitive edge. As the inventor of Xenon technology, a pioneer in halogen lighting and the leader in high performance LEDs, Lumileds builds innovation, quality and reliability into its technology, products and every customer engagement. Together with its customers, Lumileds is making the world better, safer, more beautiful—with light.

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