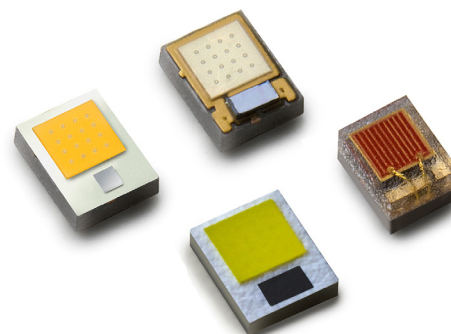


LUXEON Z Color Line

High power color LEDs in a micro footprint package for ultimate design flexibility

The LUXEON Z Color Line comprises a broad portfolio of LEDs that enable never before seen lumen density, flexibility and freedom of design. Available in the full spectrum of colors from 440nm to 670nm, including Lime, enabling highly efficient color mixing with a convenient above-blackbody color point. The LUXEON Z Color Line is ideal for entertainment and stage lighting, indoor and outdoor architectural lighting, emergency vehicle lighting, remote phosphor applications and a wide spectrum of specialty lighting applications.



FEATURES AND BENEFITS

- Broad selection spanning 440–670nm, including a unique Lime color
- 2.2mm² footprint enables unique arrangements in space constrained applications
- 4-up RGBW pixel in 9.5mm² — four colors in less area than one regular high power color emitter
- Undomed design allows better optical management
- Enables customizable light sources: linear, rectangular, circular

PRIMARY APPLICATIONS

- Architectural
- Lamps
 - Remote Phosphor
- Specialty Lighting

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General Product Information

Product Test Conditions

LUXEON Z Color Line LEDs are tested and binned with a DC drive current of 500mA at a junction temperature, T_j , of 25°C or 85°C, depending on the product.

Part Number Nomenclature

Part numbers for LUXEON Z Color Line follow the convention below:

L X Z 1 – P **A** 0 **B**

Where:

- A** – designates color (A=Deep Red, D=Red, H=Red-Orange, L=Amber and PC Amber, X=Lime, M=Green, E=Cyan, B=Blue and R=Royal Blue)
- B** – designates color version (example: 1, 2, 3)

Therefore, the following part number is used for a LUXEON Z version 2 Red:

L X Z 1 – P **D** 0 **2**

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 Z Color Line is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS Directive 2011/65/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 Z Color Line at 500mA, T_j=25°C.

COLOR	DOMINANT ^[1] or PEAK WAVELENGTH ^[2] (nm)		LUMINOUS FLUX ^[1] (lm) or RADIOMETRIC POWER ^[3] (mW)		PART NUMBER
	MINIMUM	MAXIMUM	MINIMUM	TYPICAL	
Deep Red	650	670	250	350	LXZ1-PA01
Red	620	645	40	52	LXZ1-PD01
Red-Orange	610	620	56	65	LXZ1-PH01
Green	520	540	80	118	LXZ1-PM01
Cyan	490	510	48	82	LXZ1-PE01
Blue	460	480	24	38	LXZ1-PB01
Royal Blue	440	460	500	575	LXZ1-PR01

Table 1b. Product performance of LUXEON Z Color Line at 500mA, T_j=85°C.

COLOR	DOMINANT WAVELENGTH ^[1] (nm)		LUMINOUS FLUX ^[1] (lm)		PART NUMBER
	MINIMUM	MAXIMUM	MINIMUM	TYPICAL	
Red	624	634	24	43	LXZ1-PD02
Red-Orange	614	624	40	47	LXZ1-PH02
Amber	594	604	16	24	LXZ1-PL03
PC Amber	588	592	72	107	LXZ1-PL02
Lime	566	569	144	175	LXZ1-PX01

Notes for Tables 1a and 1b:

1. Lumileds maintains a tolerance of ±0.5nm for dominant wavelength and ±6.5% on luminous flux measurements.
2. Deep Red and Royal Blue are binned by peak wavelength. All other colors are binned by dominant wavelength.
3. Deep Red and Royal Blue are binned by radiometric power. All other colors are binned by luminous flux.

Optical Characteristics

Table 2. Optical characteristics for LUXEON Z Color Line at 500mA and specified junction temperature.

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]
Deep Red	LXZ1-PA01 ^[4]	20	0.06	150°	145°
Red	LXZ1-PD01 ^[4]	20	0.06	150°	145°
	LXZ1-PD02 ^[4, 6]	20	0.06	150°	145°
Red-Orange	LXZ1-PH01 ^[4]	20	0.06	150°	145°
	LXZ1-PH02 ^[4, 6]	20	0.06	150°	145°
Amber	LXZ1-PL03 ^[4, 6]	20	0.10	150°	145°
PC Amber	LXZ1-PL02 ^[5]	80	0.01	140°	125°
Lime	LXZ1-PX01 ^[5]	100	0.01	140°	125°
Green	LXZ1-PM01 ^[5]	30	0.04	140°	125°
Cyan	LXZ1-PE01 ^[5]	30	0.03	140°	125°
Blue	LXZ1-PB01 ^[5]	20	0.03	140°	125°
Royal Blue	LXZ1-PR01 ^[5]	20	0.03	140°	125°

Notes for Table 2:

1. Spectral width at ½ 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.
4. All Deep Red, Red, Red-orange and Amber products are built with Aluminum Indium Gallium Phosphide (AlInGaP).
5. All PC Amber, Lime, Green, Cyan, Blue and Royal Blue products are built with Indium Gallium Nitride (InGaN).
6. Wavelength ranges for hot tested Red, Red-Orange and Amber have been defined to align with typical changes in spectral output at increased temperature, which are inherent to AlInGaP LEDs. At T_j=25°C these hot-tested parts will have the same typical spectral outputs as their cold-tested counterparts.

Electrical and Thermal Characteristics

Table 3. Electrical and thermal characteristics for LUXEON Z Color Line at 500mA and specified junction temperature.

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		
Deep Red	LXZ1-PA01	1.75	2.20	2.75	-2 to -4	8
Red	LXZ1-PD01	1.75	2.20	2.75	-2 to -4	8
	LXZ1-PD02	1.75	2.20	2.75	-2 to -4	8
Red-Orange	LXZ1-PH01	1.75	2.20	2.75	-2 to -4	8
	LXZ1-PH02	1.75	2.20	2.75	-2 to -4	8
Amber	LXZ1-PL03	1.75	2.25	2.75	-2 to -4	8
PC Amber	LXZ1-PL02	2.50	2.85	3.50	-2 to -4	5
Lime	LXZ1-PX01	2.50	2.85	3.50	-2 to -4	5
Green	LXZ1-PM01	2.50	3.27	3.50	-2 to -4	5
Cyan	LXZ1-PE01	2.50	3.27	3.50	-2 to -4	5
Blue	LXZ1-PB01	2.50	2.85	3.50	-2 to -4	5
Royal Blue	LXZ1-PR01	2.50	2.85	3.50	-2 to -4	5

Notes for Table 3:

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

Absolute Maximum Ratings

Table 4a. Absolute maximum ratings for LUXEON Z Color Line tested at $T_j=25^{\circ}\text{C}$.

PARAMETER	GREEN/CYAN/ BLUE/ROYAL BLUE	COLD-TESTED RED/DEEP-RED/ RED-ORANGE
DC Forward Current ^[1,2]	1000mA	700mA
Peak Pulsed Forward Current ^[1,3]	1000mA	700mA
LED Junction Temperature ^[1] (DC & Pulse)	150°C	135°C
ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)	Class 3B	Class 3B
Operating Case Temperature ^[1]	-40°C to 135°C	-40°C to 120°C
LED Storage Temperature	-40°C to 135°C	-40°C to 135°C
Soldering Temperature	JEDEC 020c 260°C	JEDEC 020c 260°C
Allowable Reflow Cycles	3	3
Autoclave Conditions	-121°C at 2 ATM	100% Relative Humidity for 96 hours Maximum
Reverse Voltage (V_{reverse})	LUXEON LEDs are not designed to be driven in reverse bias	

Notes for Table 4a:

1. Proper current derating must be observed to maintain junction temperature below the maximum.
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple," with frequencies $\geq 100\text{Hz}$ and amplitude $\leq 15\%$ of the maximum allowable DC forward current are acceptable, assuming the average current throughout each cycle does not exceed the maximum allowable DC forward current at the corresponding maximum junction temperature.
3. Pulsed operation with a peak drive current equal to the stated peak pulsed forward current is acceptable if the pulse on-time is $\leq 5\text{ms}$ per cycle and the duty cycle is $\leq 50\%$.

Table 4b. Absolute maximum ratings for LUXEON Z Color Line tested at $T_j=85^{\circ}\text{C}$.

PARAMETER	HOT-TESTED RED/ RED-ORANGE/AMBER ^[4]	PC AMBER/LIME
DC Forward Current ^[1,2]	1000/700mA	700mA
Peak Pulsed Forward Current ^[1,3]	1000/700mA	700mA
LED Junction Temperature ^[1] (DC & Pulse)	120°C/135°C	135°C
ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)	Class 3B	Class 3B
Operating Case Temperature ^[1]	-40°C to 120°C	-40°C to 110°C
LED Storage Temperature	-40°C to 120°C	-40°C to 135°C
Soldering Temperature	JEDEC 020c 260°C	JEDEC 020c 260°C
Allowable Reflow Cycles	3	3
Autoclave Conditions	100% Relative Humidity for 96 hours Maximum	
Reverse Voltage (V_{reverse})	LUXEON LEDs are not designed to be driven in reverse bias	

Notes for Table 4b:

1. Proper current derating must be observed to maintain junction temperature below the maximum.
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple," with frequencies $\geq 100\text{Hz}$ and amplitude $\leq 15\%$ of the maximum allowable DC forward current are acceptable, assuming the average current throughout each cycle does not exceed the maximum allowable DC forward current at the corresponding maximum junction temperature.
3. Pulsed operation with a peak drive current equal to the stated peak pulsed forward current is acceptable if the pulse on-time is $\leq 5\text{ms}$ per cycle and the duty cycle is $\leq 50\%$.
4. Hot Tested LUXEON Z Red (LXZ1-PD02), Red-Orange (LXZ1-PH02) and Amber (LXZ1-PL03) products have two boundary points for maximum conditions: $I_f=1\text{A}$ and $T_j=120^{\circ}\text{C}$ or $I_f=700\text{mA}$ and $T_j=135^{\circ}\text{C}$.

Characteristics Curves

Spectral Power Distribution Characteristics

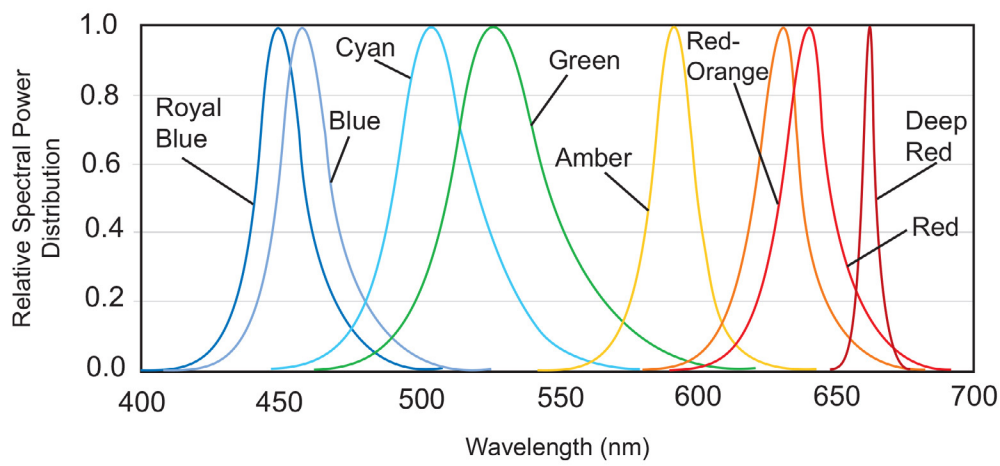


Figure 1a. Typical normalized power vs. wavelength for LUXEON Z Red, Red-Orange, Amber, Green, Cyan, Blue and Royal Blue, at 500mA, $T_j=25^{\circ}\text{C}$.

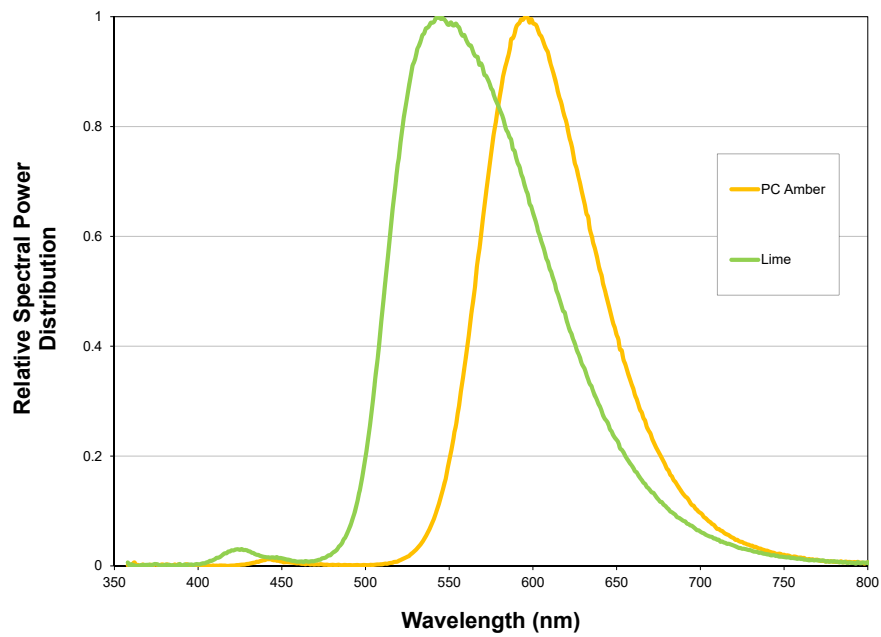


Figure 1b. Typical normalized power vs. wavelength for LUXEON Z PC Amber and Lime at 500mA, $T_j=85^{\circ}\text{C}$.

Light Output Characteristics

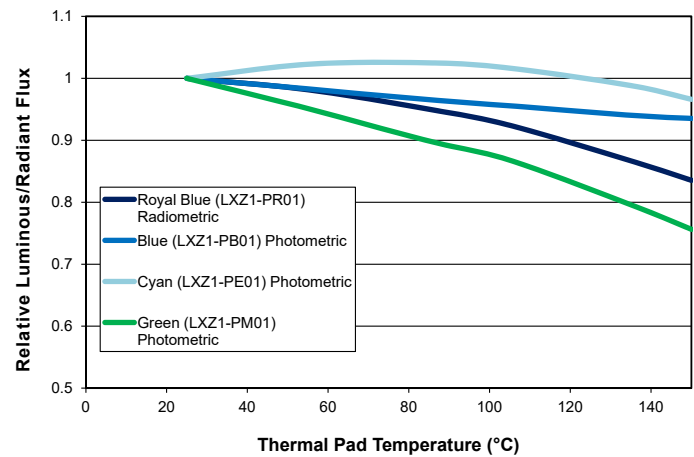


Figure 2a. Typical normalized light output vs. junction temperature for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01 at 500mA.

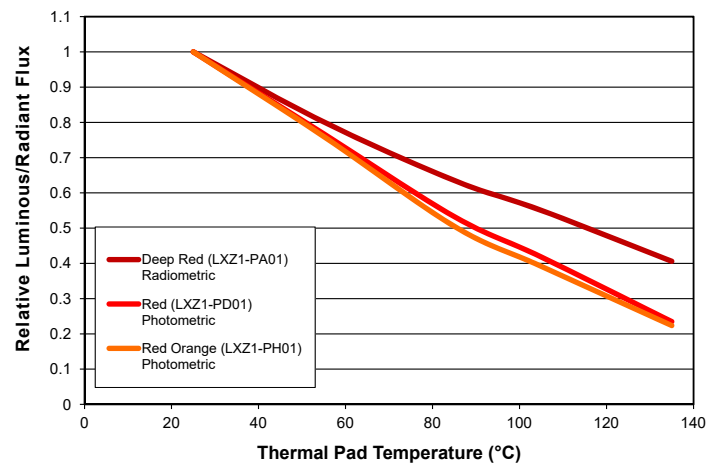


Figure 2b. Typical normalized light output vs. junction temperature for LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01 at 500mA.

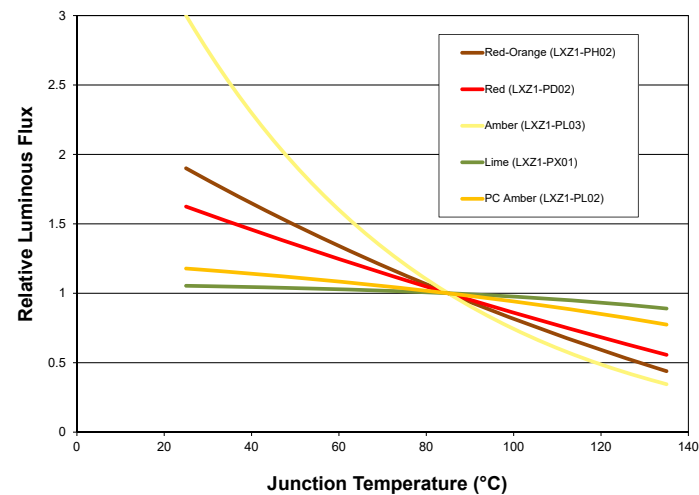


Figure 2c. Typical normalized light output vs. junction temperature for LXZ1-PX01, LXZ1-PL02, LXZ1-PD02, LXZ1-PH02 and LXZ1-PL03 at 500mA.

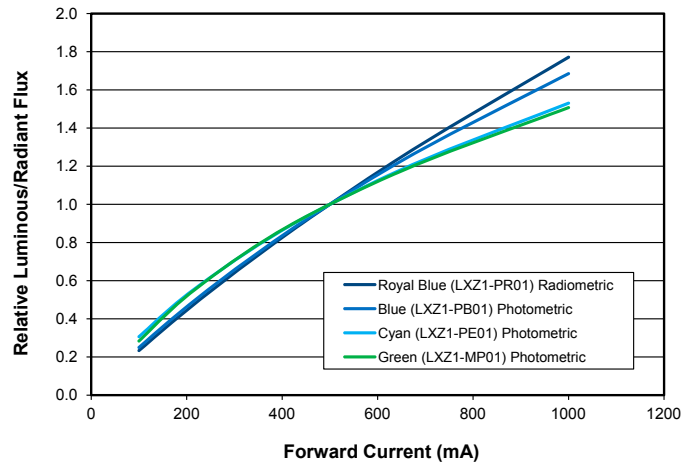


Figure 3a. Typical normalized light output vs. forward current for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01 at $T_j=25^{\circ}\text{C}$.

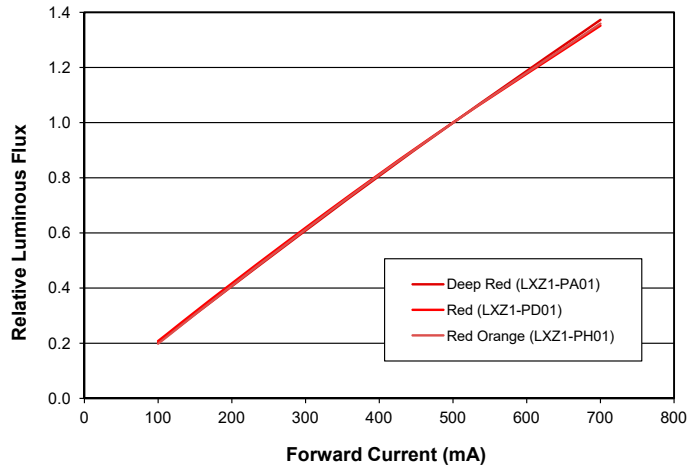


Figure 3b. Typical normalized light output vs. forward current for LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01 at $T_j=25^{\circ}\text{C}$.

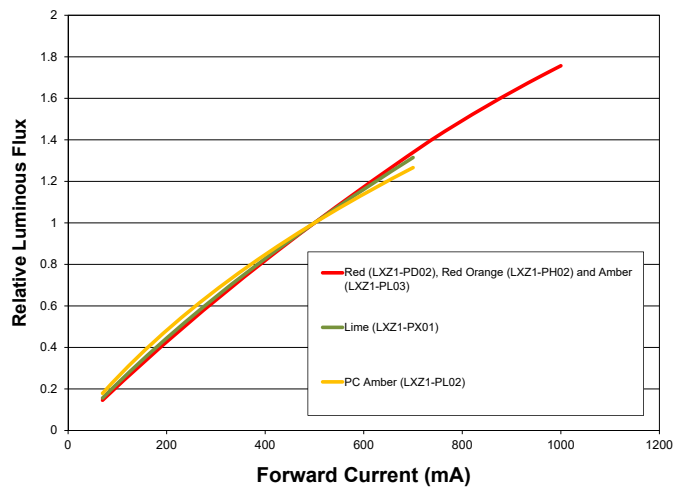


Figure 3c. Typical normalized light output vs. forward current for LXZ1-PX01, LXZ1-PL02, LXZ1-PD02, LXZ1-PH02, and LXZ1-PL03 at $T_j=85^{\circ}\text{C}$.

Forward Current Characteristics

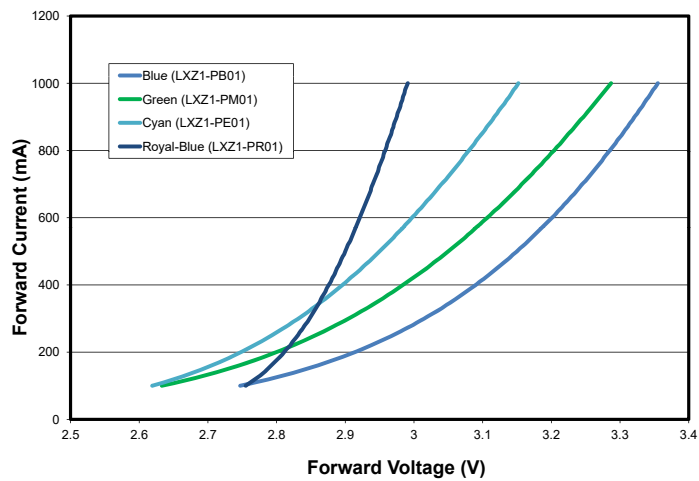


Figure 4a. Typical forward current vs. forward voltage for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01 at $T_j=25^{\circ}\text{C}$.

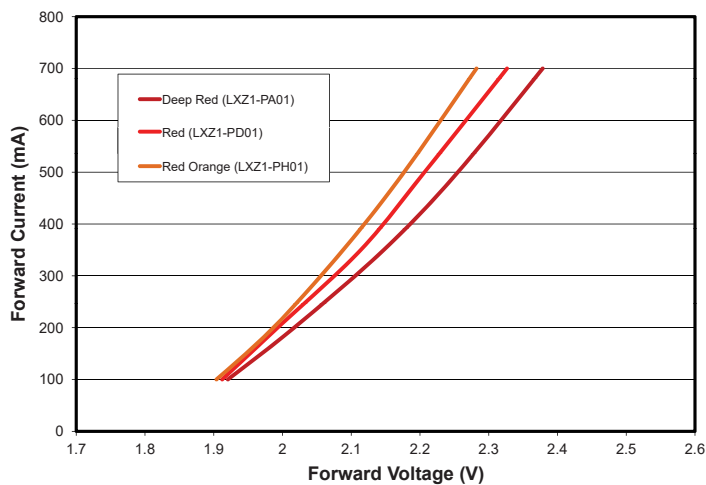


Figure 4b. Typical forward current vs. forward voltage for LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01 at $T_j=25^{\circ}\text{C}$.

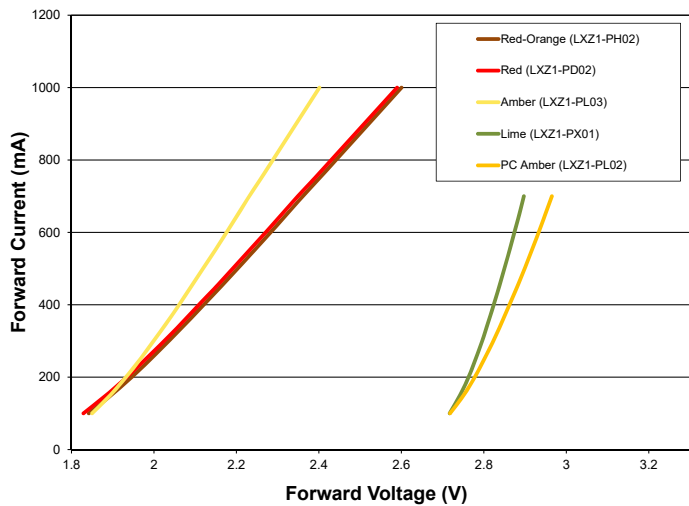


Figure 4c. Typical forward current vs. forward voltage for LXZ1-PX01, LXZ1-PL02, LXZ1-PD02, LXZ1-PH02, and LXZ1-PL03 at $T_j=85^{\circ}\text{C}$.

Radiation Pattern Characteristics

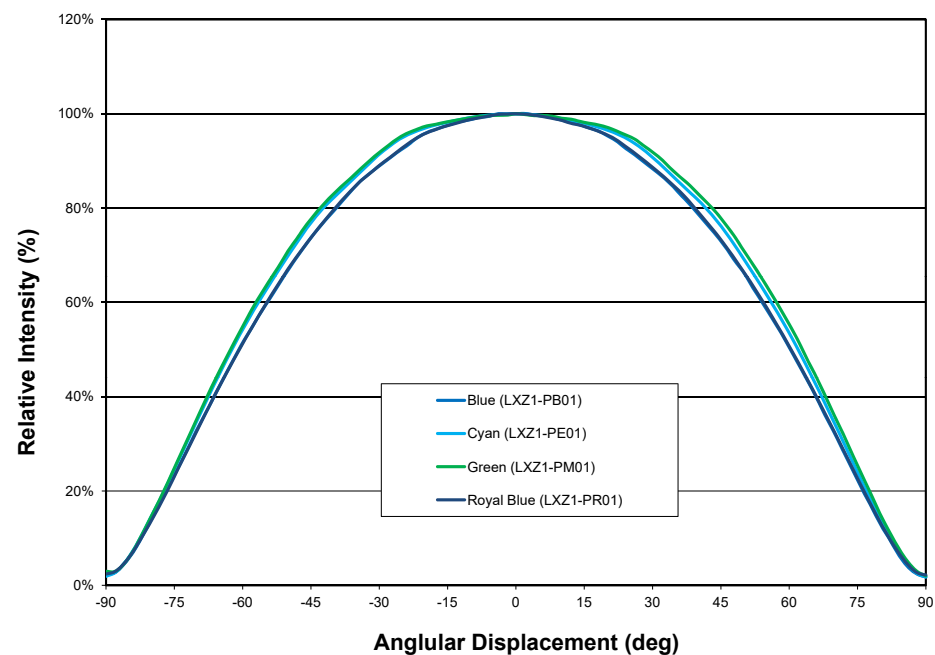


Figure 5a. Typical radiation pattern for LUXEON Z LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01 at 500mA, $T_j=25^{\circ}\text{C}$.

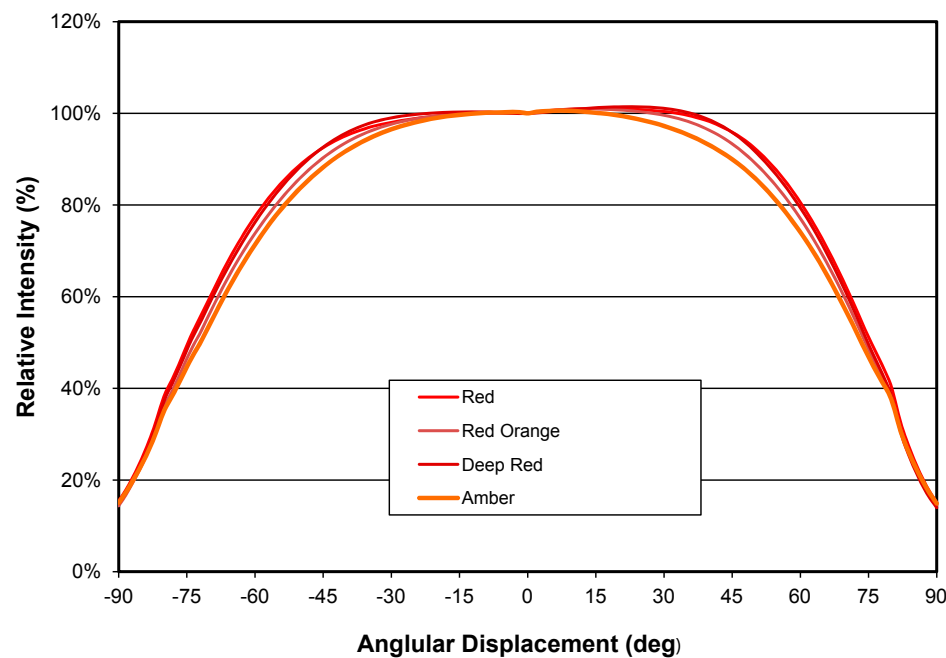


Figure 5b. Typical radiation pattern for LUXEON Z LXZ1-PA01, LXZ1-PD01, LXZ1-PH01, LXZ1-PL03, LXZ1-PH02 and LXZ1-PD02 at 500mA, $T_j=25^{\circ}\text{C}$.

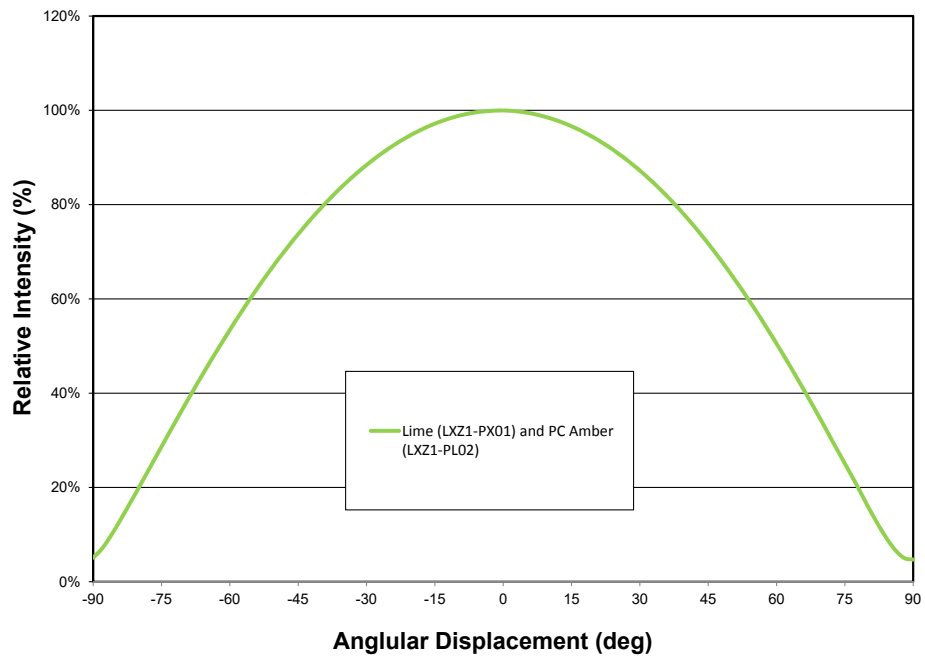


Figure 5c. Typical radiation pattern for LUXEON Z LXZ1-PX01 and LXZ1-PL02 at 500mA, $T_j=85^\circ\text{C}$.

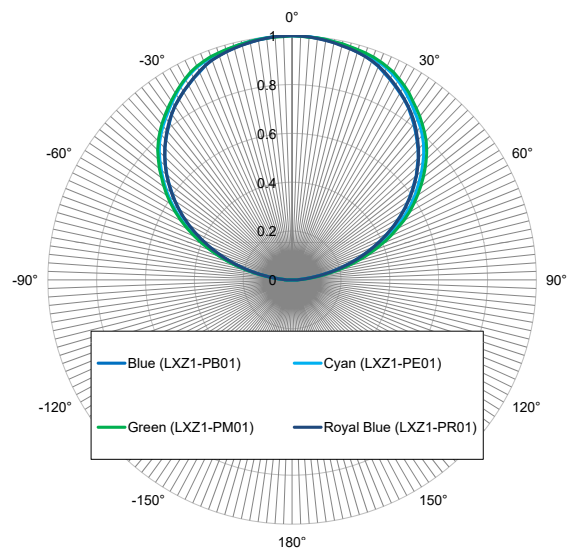


Figure 6a. Typical polar radiation pattern for LUXEON Z LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01 at 500mA, $T_j=25^\circ\text{C}$.

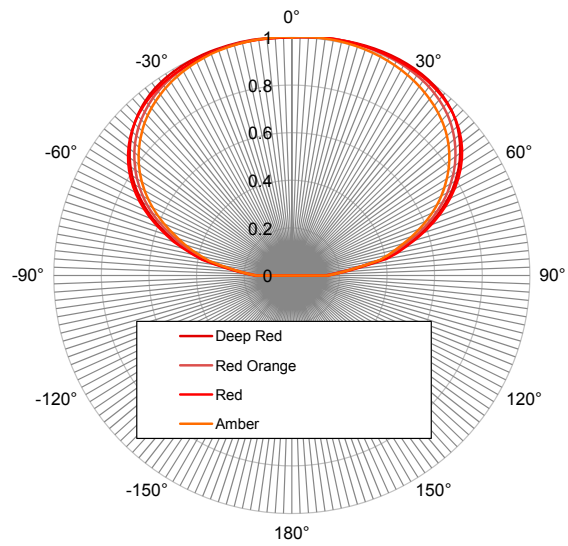


Figure 6b. Typical polar radiation pattern for LUXEON Z LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01, LXZ1-PL03, LXZ1-PH02 and LXZ1-PD02 at 500mA, $T_j = 25^\circ\text{C}$.

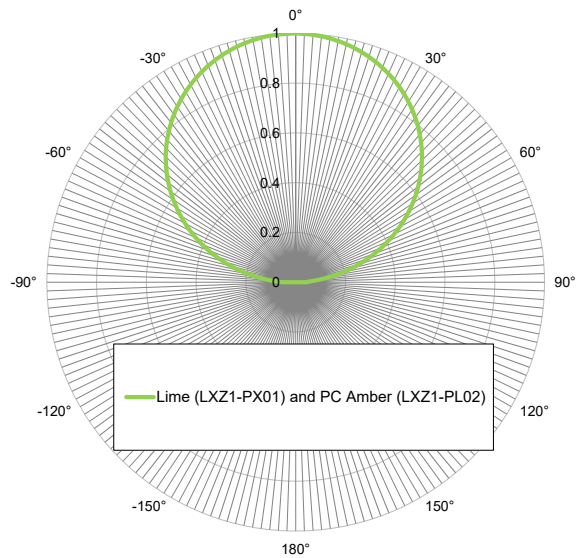


Figure 6c. Typical polar radiation pattern for LUXEON Z LXZ1-PX01 and LXZ1-PL02 at 500mA, $T_j = 85^\circ\text{C}$.

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 or radiometric power, color point, peak or dominant wavelength and forward voltage.

Reels of LUXEON Z Deep Red, Red, Red-Orange, Amber, Lime, Green, Cyan, Blue and Royal Blue are labeled using a 3-digit alphanumeric CAT code following the format below.

A B C

- A** – designates luminous flux or radiometric power bins (example: K=96 to 104 lumens, V=194 to 204 lumens)
- B** – designates peak or dominant wavelength bin (example: Green 2=525 to 530nm, Cyan 7=495 to 500nm, Blue 4=475 to 480nm)
- C** – designates forward voltage bin (example: 2=2.50 to 2.75V, 6=3.00 to 3.25V)

Therefore, a LUXEON Z Green LED with a lumen range of 96 to 104, a dominant wavelength of 525 to 530nm and a forward voltage range of 2.50 to 2.75V has the following CAT code:

K 2 4

Reels of LUXEON Z PC Amber are labeled using a 4-digit alphanumeric CAT code following the format below.

A B C D

- A** – designates luminous flux bin (example: K=96 to 104 lumens, L=104 to 114 lumens)
- B C** – designates peak wavelength bin (example: A1)
- D** – designates forward voltage bin (example: 3=2.25 to 2.50V, 5=2.75 to 3.00V)

Therefore, a LUXEON Z PC Amber LED with a lumen range of 104 to 114, color bin of A1 and a forward voltage range of 2.75 to 3.00V has the following CAT code:

L A 1 5

Luminous Flux Bins

Table 5a and Table 5b list the standard luminous flux bins for LUXEON Z Color Line 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 5a. Luminous flux bin definitions for LUXEON Z Red (LXZ1-PD02), Red-Orange (LXZ1-PH02) and Amber (LXZ1-PL03).

BIN	LUMINOUS FLUX ^[1,2] (lm)	
	MINIMUM	MAXIMUM
A	16	24
B	24	32
C	32	40
D	40	48
E	48	56
F	56	64
G	64	72

Notes for Table 5a:

1. Lumileds maintains a tolerance of $\pm 6.5\%$ on luminous flux measurements.
2. Tested and binned at junction temperature of 85°C.

Table 5b. Luminous flux bin definitions for LUXEON Z Red (LXZ1-PD01), Red-Orange (LXZ1-PH01), Amber (LXZ1-PL03), PC Amber (LXZ1-PL02), Lime (LXZ1-PX01), Green (LXZ1-PM01), Cyan (LXZ1-PE01), and Blue (LXZ1-PB01).

BIN	LUMINOUS FLUX ^[1,2] (lm)	
	MINIMUM	MAXIMUM
A	24	32
B	32	40
C	40	48
D	48	56
E	56	64
F	64	72
G	72	80
H	80	88
J	88	96
K	96	104
L	104	114
M	114	124
N	124	134
P	134	144
Q	144	154
R	154	164
S	164	174
T	174	184
U	184	194
V	194	204

Notes for Table 5b:

1. Lumileds maintains a tolerance of $\pm 6.5\%$ on luminous flux measurements.
2. Tested and binned at junction temperature of 25°C.

Radiometric Power Bins

Table 6. Radiometric power bins for LUXEON Z Deep Red (LXZ1-PA01) and Royal Blue (LXZ1-PR01).

BIN	RADIOMETRIC POWER ^[1] (mW)	
	MINIMUM	MAXIMUM
A	250	300
B	300	350
C	350	400
D	400	450
E	450	500
F	500	550
G	550	600
H	600	650
J	650	700

Notes for Table 6:

1. Lumileds maintains a tolerance of ±6.5% on radiometric power measurements.

Dominant and Peak Wavelength Bins

Table 7. Dominant wavelength bin definitions for LUXEON Z Color Line.

COLOR	PART NUMBER	BIN	DOMINANT WAVELENGTH ^[1] (nm)	
			MINIMUM	MAXIMUM
Red	LXZ1-PD02	4	624	634
	LXZ1-PD01	4	620	630
Red-Orange	LXZ1-PH02	2	614	624
	LXZ1-PH01	2	610	620
Amber	LXZ1-PL03	2	594	599
		4	599	604
Green	LXZ1-PM01	1	520	525
		2	525	530
		3	530	535
		4	535	540
Cyan	LXZ1-PE01	1	490	498
		2	498	508
		6	490	495
		7	495	500
		8	500	505
		9	505	510
Blue	LXZ1-PB01	1	460	465
		2	465	470
		3	470	475
		4	475	480
		5	480	485

Notes for Table 7:

1. Lumileds maintains a tolerance of $\pm 0.5\text{nm}$ for dominant wavelength measurements.

Table 8. Peak wavelength bin definitions for LUXEON Z Deep Red and Royal Blue.

COLOR	PART NUMBER	BIN	PEAK WAVELENGTH ^[1] (nm)	
			MINIMUM	MAXIMUM
Deep Red	LXZ1-PA01	6	650	660
		7	660	670
Royal Blue	LXZ1-PR01	3	440	445
		4	445	450
		5	450	455
		6	455	460

Notes for Table 8:

1. Lumileds maintains a tolerance of $\pm 2\text{nm}$ for peak wavelength measurements

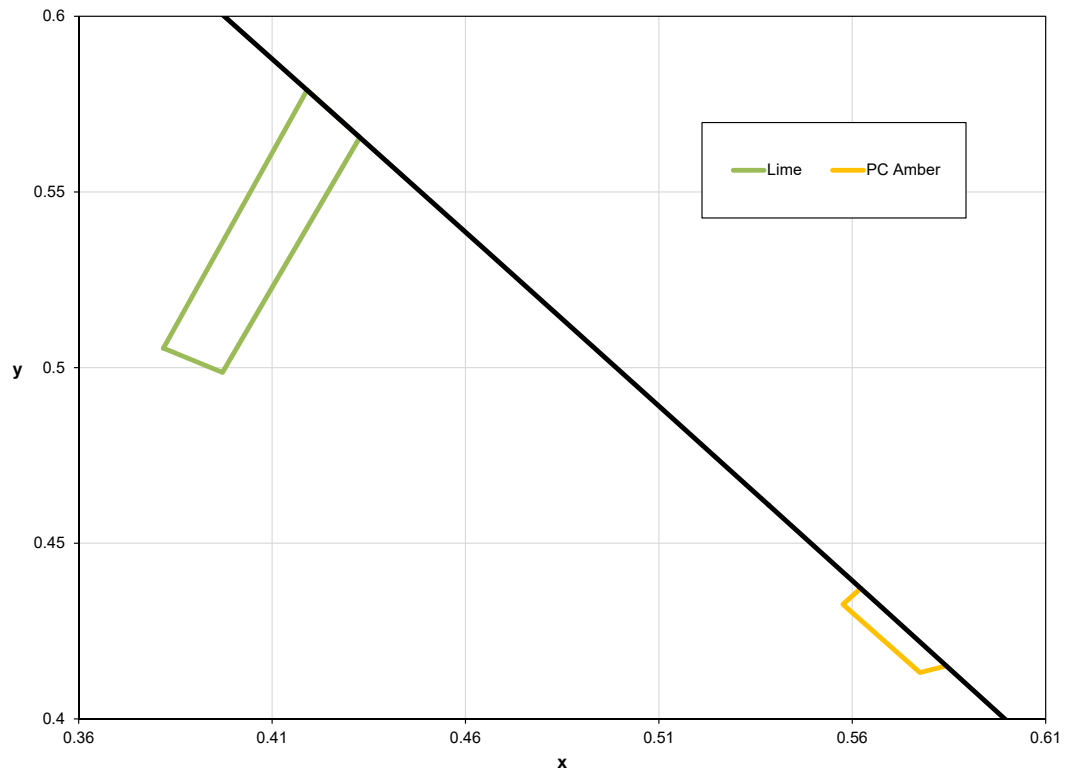


Figure 7. Color bin structure for LXZ1-PX01 and LXZ1-PL02 for Table 9.

Table 9. Color bin definitions for LUXEON Z PC Amber and Lime.

COLOR	PART NUMBER	BIN	x	y
PC Amber	LXZ1-PL02	A1	0.5622	0.4372
			0.5576	0.4326
			0.5775	0.4132
			0.5843	0.4151
Lime	LXZ1-PX01	1	0.3819	0.5055
			0.4191	0.5790
			0.4327	0.5655
			0.3972	0.4986

Notes for Table 9:

1. Lumileds maintains a tolerance of ± 0.005 on x and y color coordinates measurements.

Forward Voltage Bins

Table 10. Forward voltage bin definitions for LUXEON Z Color Line.

BIN	FORWARD VOLTAGE ⁽¹⁾ (V _f)	
	MINIMUM	MAXIMUM
1	1.75	2.00
2	2.00	2.25
3	2.25	2.50
4	2.50	2.75
5	2.75	3.00
6	3.00	3.25
7	3.25	3.50

Notes for Table 10:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.

Mechanical Dimensions

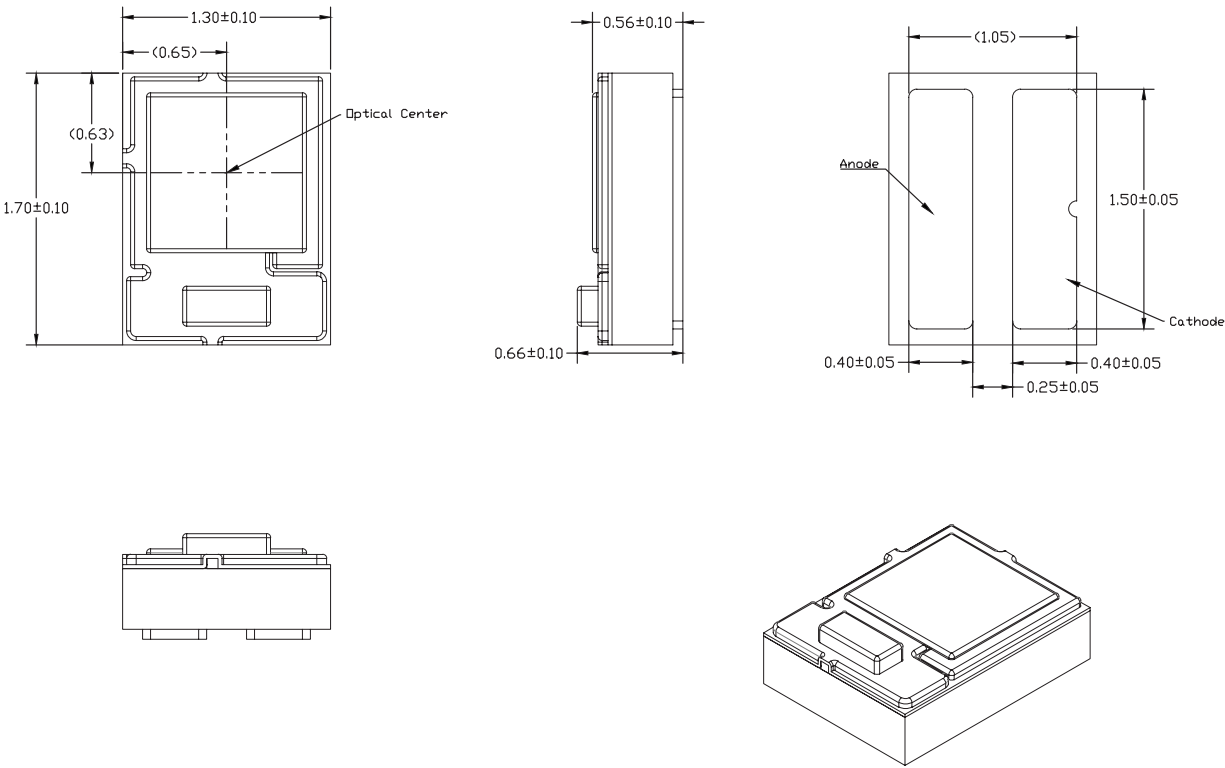


Figure 8. Mechanical dimensions for LUXEON Z Green, Cyan, Blue and Royal Blue.

Notes for Figure 8:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

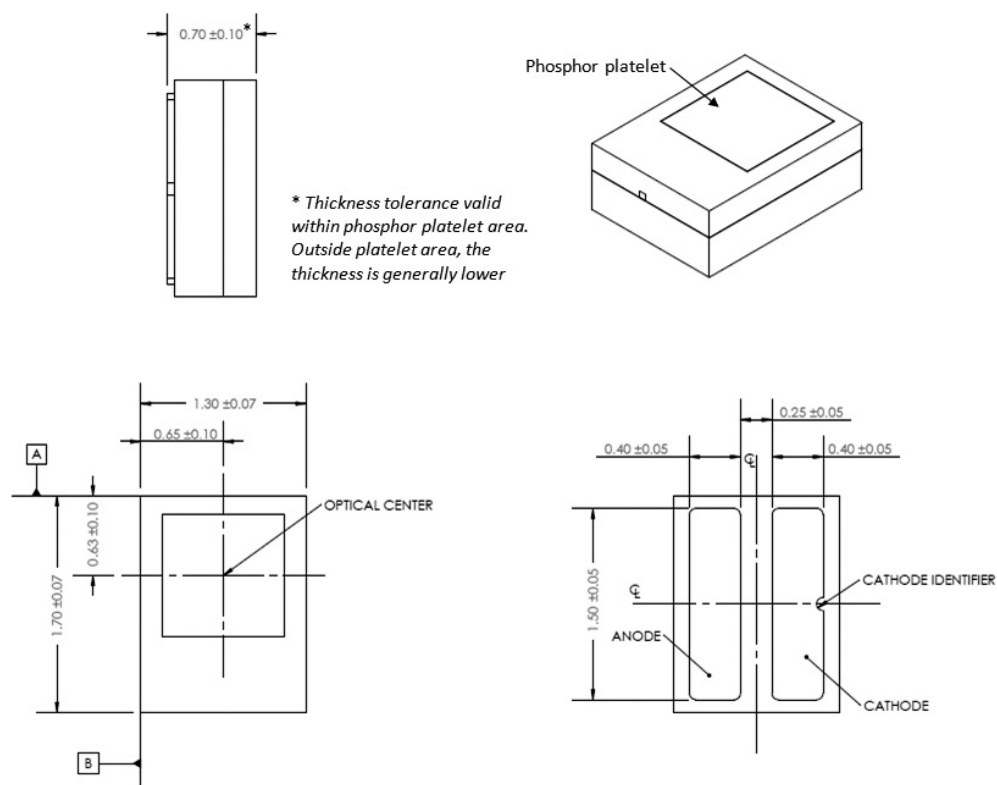


Figure 9. Mechanical dimensions for LUXEON Z PC Amber and Lime.

Notes for Figure 9:

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

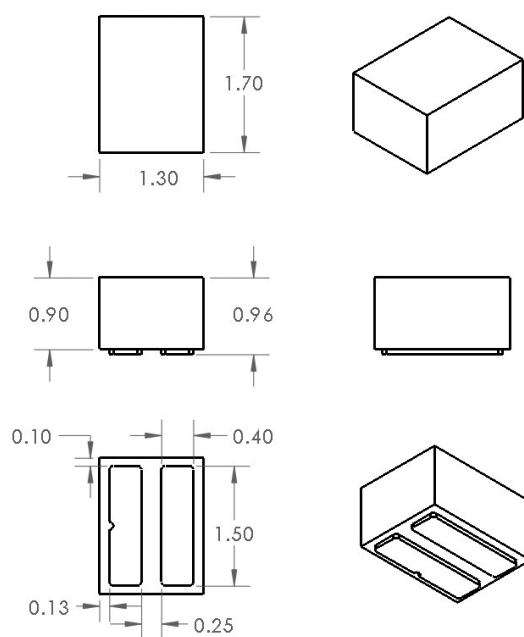


Figure 10. Mechanical dimensions for LUXEON Z Deep Red, Red, Red-Orange and Amber.

Notes for Figure 10:

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

Reflow Soldering Guidelines

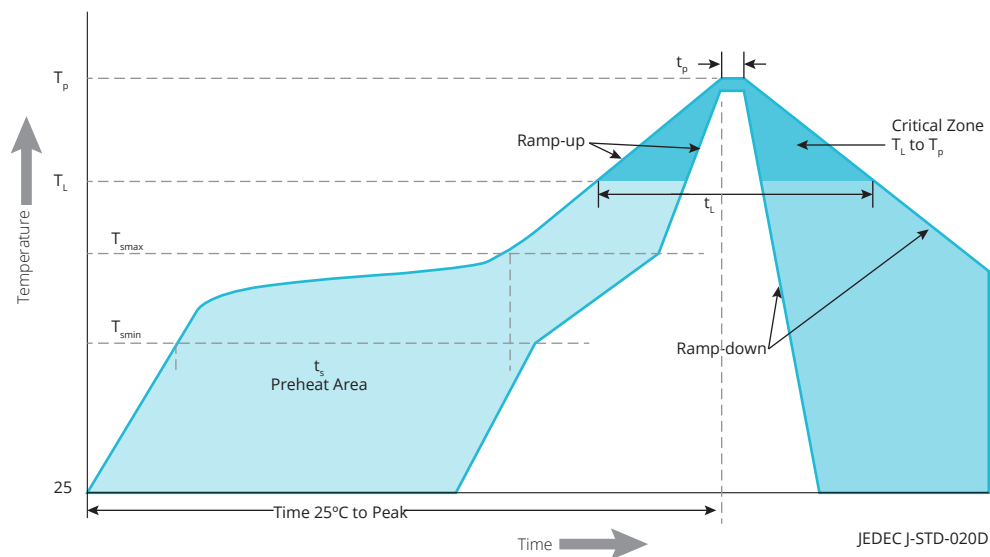


Figure 11. Visualization of the acceptable reflow temperature profile as specified in Table 11.

Table 11. Reflow profile characteristics for LUXEON Z Color Line.

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 180 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 12. Moisture sensitivity levels for LUXEON Z Color Line.

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

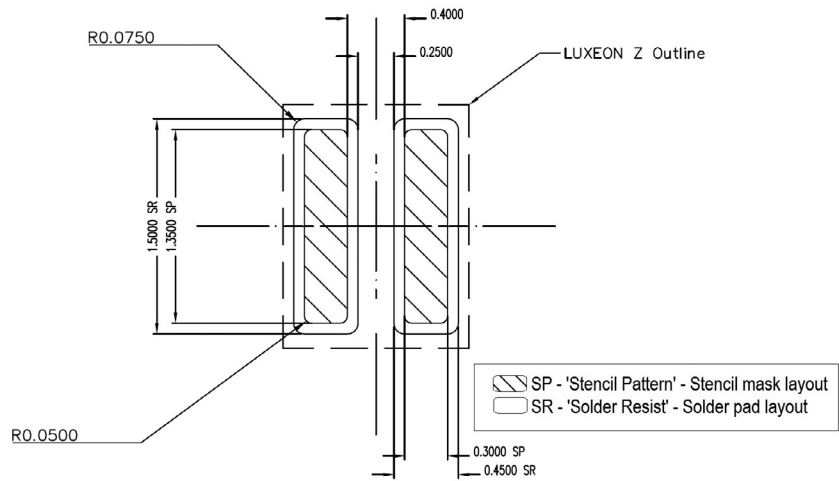


Figure 12. Recommended PCB solder pad layout for LUXEON Z Color Line.

Notes for Figure 12:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

Packaging Information

Pocket Tape Dimensions

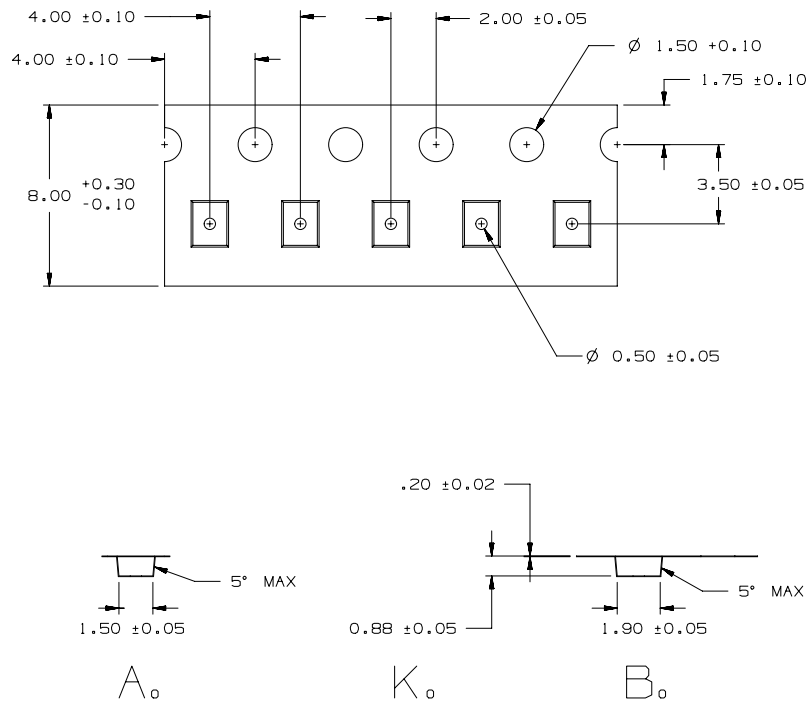


Figure 13. Pocket tape dimensions for LUXEON Z Blue, Green, Royal Blue, Cyan, Lime and PC Amber.

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

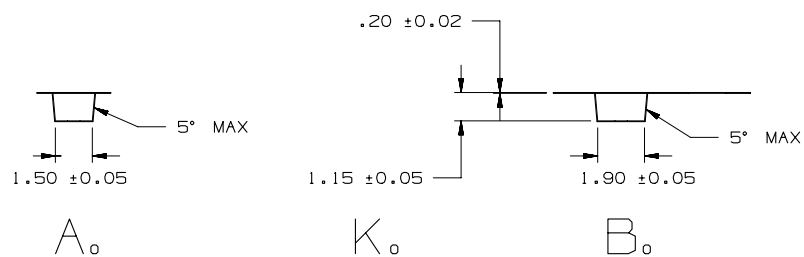
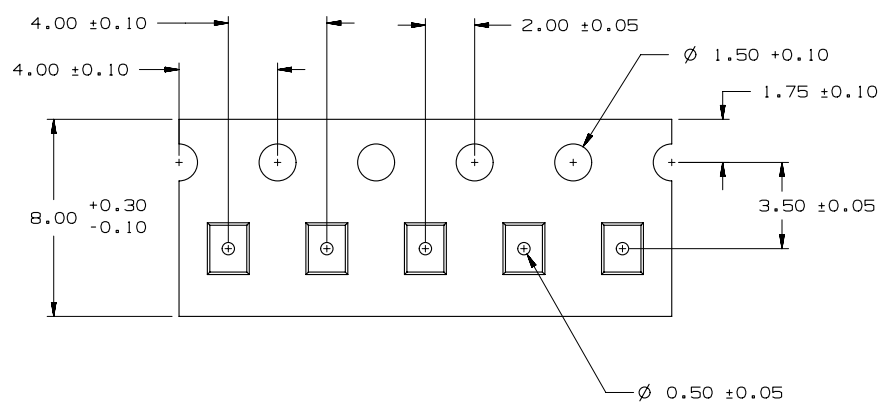


Figure 14. Pocket tape dimensions for LUXEON Z Red, Red-Orange, Amber and Deep Red.

Notes for Figure 14:

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

Reel Dimensions

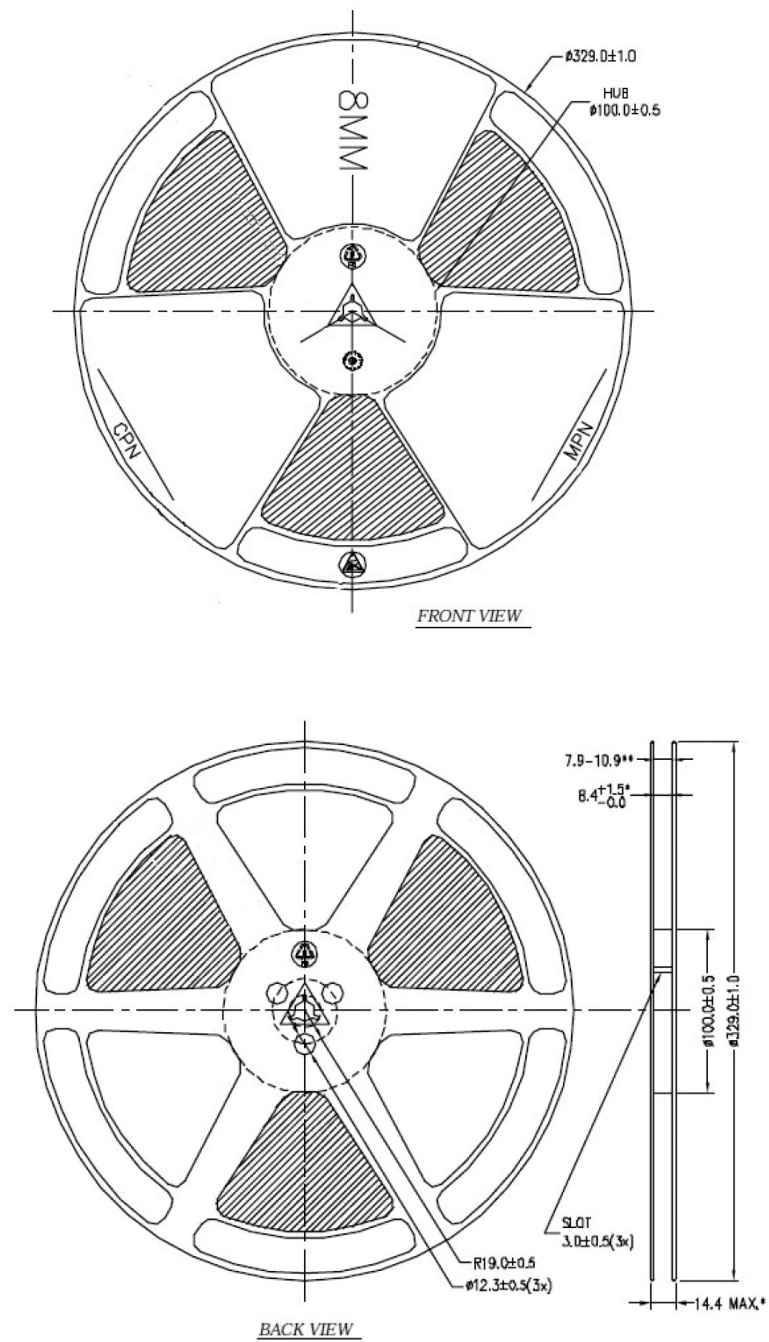


Figure 15. Reel dimensions for LUXEON Z Color Line.

Notes for Figure 15:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

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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