

LUXEON Z

High-flux density in a micro footprint package for precise optimal control

LUXEON Z is a high power 1.3mm x 1.7mm LED that enables never before seen color consistency, luminance, flux density and design flexibility for lighting solutions. LUXEON Z is undomed, a feature that provides unmatched optical flexibility for precise beam angle control. Tested and binned at application conditions 85°C and available in 3- and 5-step MacAdam ellipse color bins. LUXEON Z emitters are an ideal choice for indoor and outdoor light sources requiring superior beam angles, higher efficacy and lower costs.



FEATURES AND BENEFITS

- 1.3mm x 1.7mm micro footprint enables a high degree of design flexibility
- Undomed design allows precise optical control
- 1A max drive current allows for more flux per LED
- 3- and 5-step MacAdam ellipse color binning for superior Quality of Light

PRIMARY APPLICATIONS

- Architectural
- Downlights
- Indoor Area Lighting
- Lamps
- Outdoor
- Specialty Lighting
- Spotlights

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General Product Information

Product Test Conditions

LUXEON Z LEDs are tested and binned with a DC drive current of 500mA at a junction temperature, T_j , of 85°C.

Part Number Nomenclature

Part numbers for LUXEON Z follow the convention below:

L X Z 1 – **A A B B** – C

Where:

- A A** – designates nominal ANSI CCT (27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K RB=Royal Blue)
- B B** – designates minimum CRI (65=65CRI, 70=70CRI, 80=80CRI)
- C** – designates SDCM (3=3 SDCM, 5=5 SDCM).

Therefore, the following part number is used for a LUXEON Z 3000K, 80 CRI, 5 SDCM :

L X Z 1 – **3 0 8 0** – 5

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 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 1. Product performance of LUXEON Z at 500mA and 700mA, $T_j=85^\circ\text{C}$.

| NOMINAL CCT | MINIMUM CRI ^[1, 2] | LUMINOUS FLUX ^[1] (lm) | | TYPICAL LUMINOUS EFFICACY (lm/W) | TYPICAL LUMINOUS FLUX (lm) | TYPICAL LUMINOUS EFFICACY (lm/W) | PART NUMBER |
|-------------|-------------------------------|-----------------------------------|---------|----------------------------------|----------------------------|----------------------------------|-------------|
| | | MINIMUM | TYPICAL | | | | |
| | | 500mA | | | | | |
| 6500K | 65 | 140 | 154 | 110 | 197 | 99 | LXZ1-6565 |
| 4000K | 70 | 120 | 134 | 96 | 172 | 86 | LXZ1-4070 |
| 5000K | 70 | 130 | 148 | 106 | 189 | 95 | LXZ1-5070 |
| 5700K | 70 | 140 | 152 | 109 | 195 | 98 | LXZ1-5770 |
| 2700K | 80 | 100 | 115 | 82 | 147 | 74 | LXZ1-2780-y |
| 3000K | 80 | 110 | 124 | 89 | 159 | 80 | LXZ1-3080-y |
| 3500K | 80 | 110 | 124 | 89 | 159 | 80 | LXZ1-3580-y |
| 4000K | 80 | 120 | 130 | 93 | 166 | 83 | LXZ1-4080-y |

Notes for Table 1:

- Lumileds maintains a tolerance of ± 2 on CRI and $\pm 6.5\%$ on luminous flux measurements.
- Typical CRI is approximately 2 points higher than the minimum CRI specified, but this is not guaranteed.

Optical Characteristics

Table 2. Optical characteristics for LUXEON Z at 500mA, $T_j=85^\circ\text{C}$.

| PART NUMBER | TYPICAL TOTAL INCLUDED ANGLE ^[1] | TYPICAL VIEWING ANGLE ^[2] |
|-------------|---|--------------------------------------|
| LXZ1-xxxx-y | 160° | 120° |
| LXZ1-xxxx | 160° | 120° |

Notes for Table 2:

- Total angle at which 90% of total luminous flux is captured.
- Viewing angle is the off axis angle from the LED centerline where the luminous intensity is $\frac{1}{2}$ of the peak value.

Electrical and Thermal Characteristics

Table 3. Electrical and thermal characteristics for LUXEON Z at 500mA, $T_j=85^\circ\text{C}$.

| PART NUMBER | FORWARD VOLTAGE ^[1] (V_f) | | | TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE ($\text{mV}/^\circ\text{C}$) ^[2] | TYPICAL THERMAL RESISTANCE — JUNCTION TO SOLDER PAD ($^\circ\text{C}/\text{W}$) |
|-------------|--|---------|---------|--|---|
| | MINIMUM | TYPICAL | MAXIMUM | | |
| LXZ1-xxxx-y | 2.5 | 2.8 | 3.25 | -1.6 | 6 |
| LXZ1-xxxx | 2.5 | 2.8 | 3.25 | -1.6 | 6 |

Notes for Table 3:

- Lumileds maintains a tolerance of $\pm 0.06\text{V}$ on forward voltage measurements.
- Measured between 25°C and 85°C .

Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON Z.

| PARAMETER | MAXIMUM PERFORMANCE |
|--|---|
| DC Forward Current ^[1,2] | 1000mA |
| Peak Pulsed Forward Current ^[1,3] | 1200mA |
| LED Junction Temperature ^[1] (DC & Pulse) | 135°C |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012) | Class 3B |
| Operating Case Temperature ^[1] | -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:

- 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 of 10ms.

Characteristic Curves

Spectral Power Distribution Characteristics

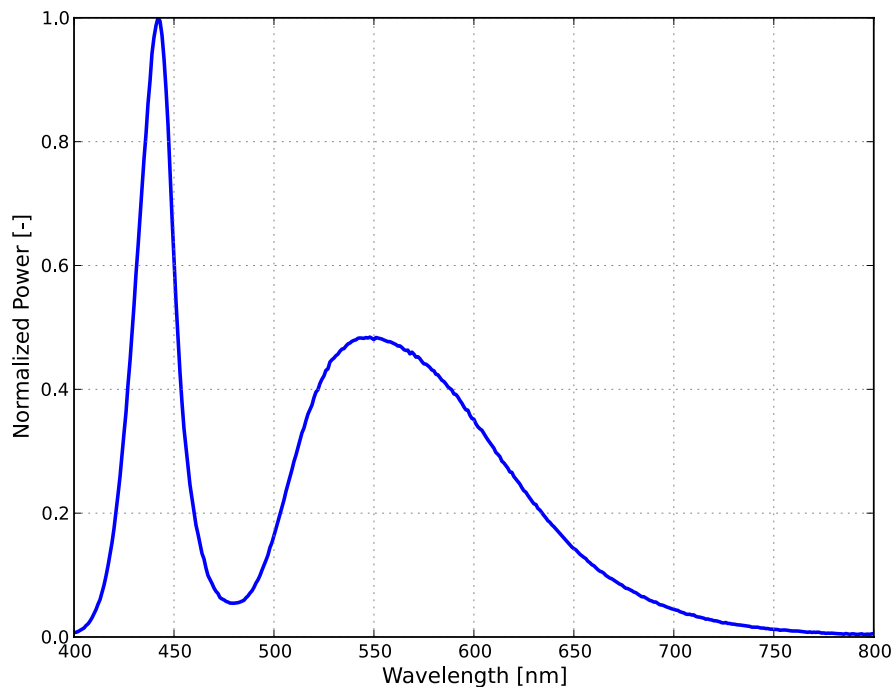


Figure 1a: Typical normalized power vs. wavelength for LXZ1-xx65 at 500mA, T_j=85°C.

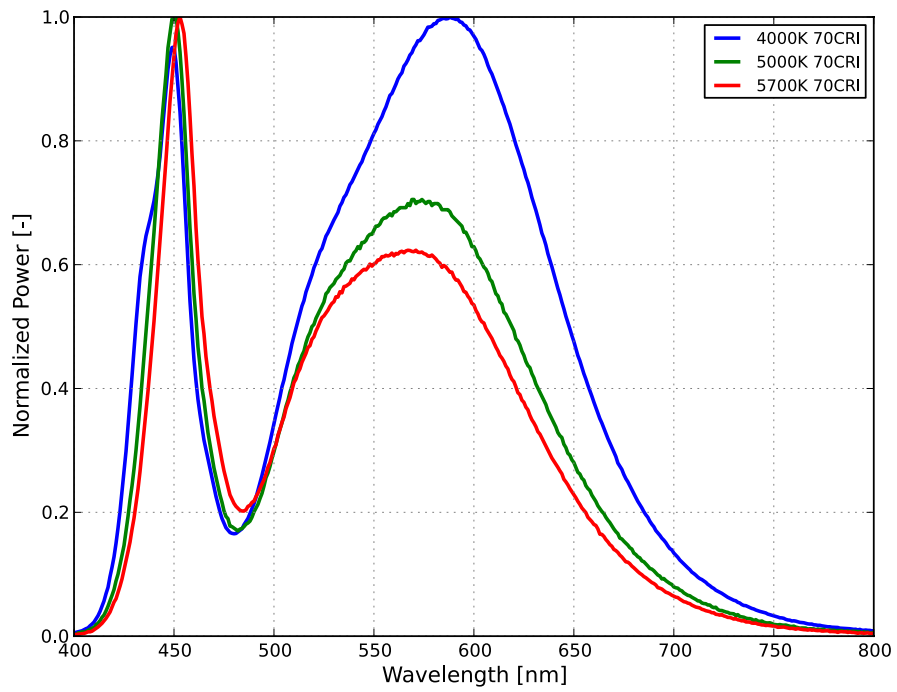


Figure 1b: Typical normalized power vs. wavelength for LXZ1-xx70 at 500mA, $T_j=85^\circ\text{C}$.

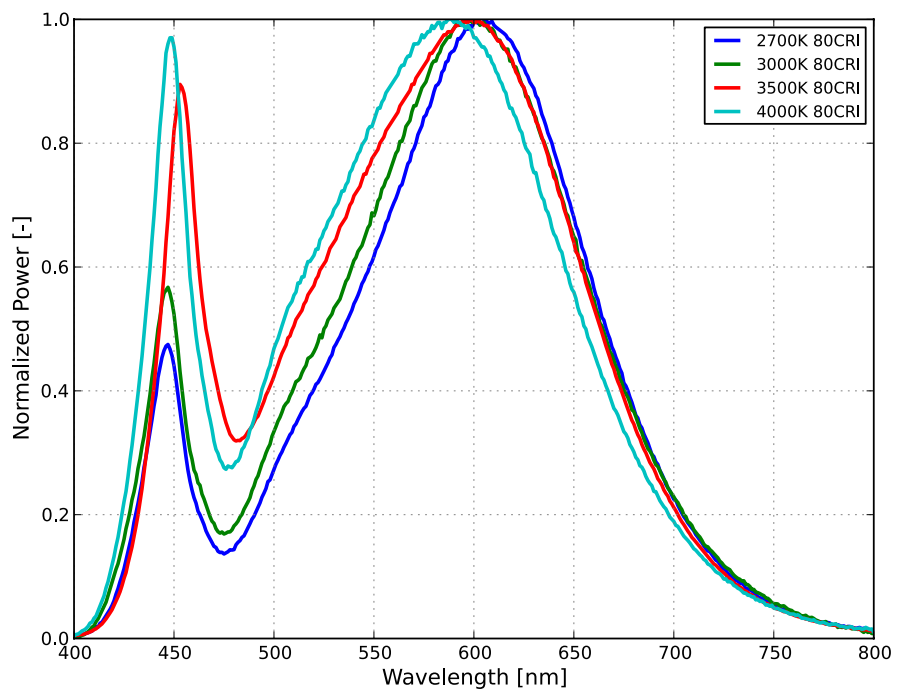


Figure 1c: Typical normalized power vs. wavelength for LXZ1-xx80 at 500mA, $T_j=85^\circ\text{C}$.

Light Output Characteristics

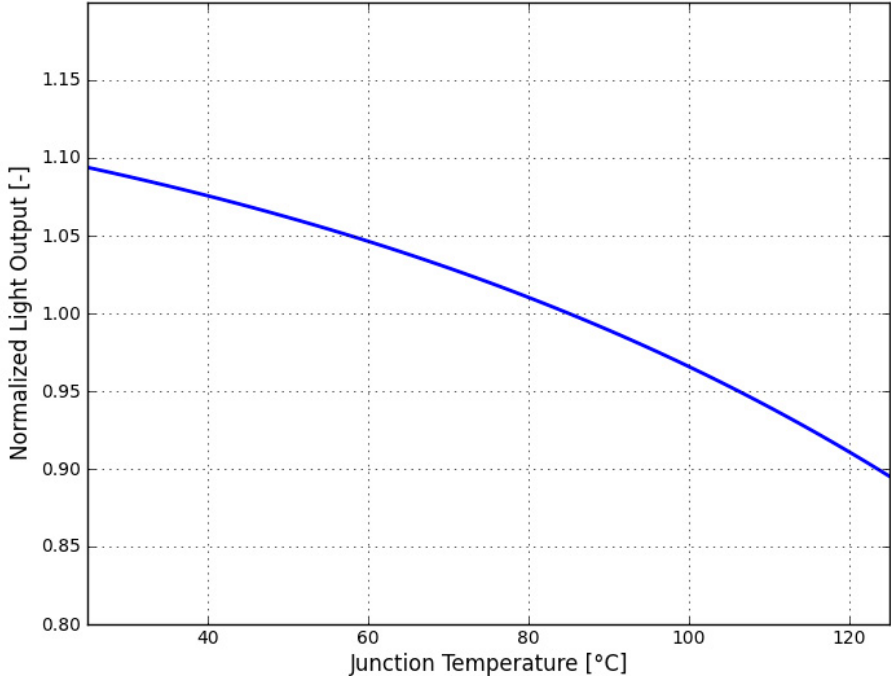


Figure 2: Typical normalized light output vs. junction temperature for LXZ1-xxxx at 500mA.

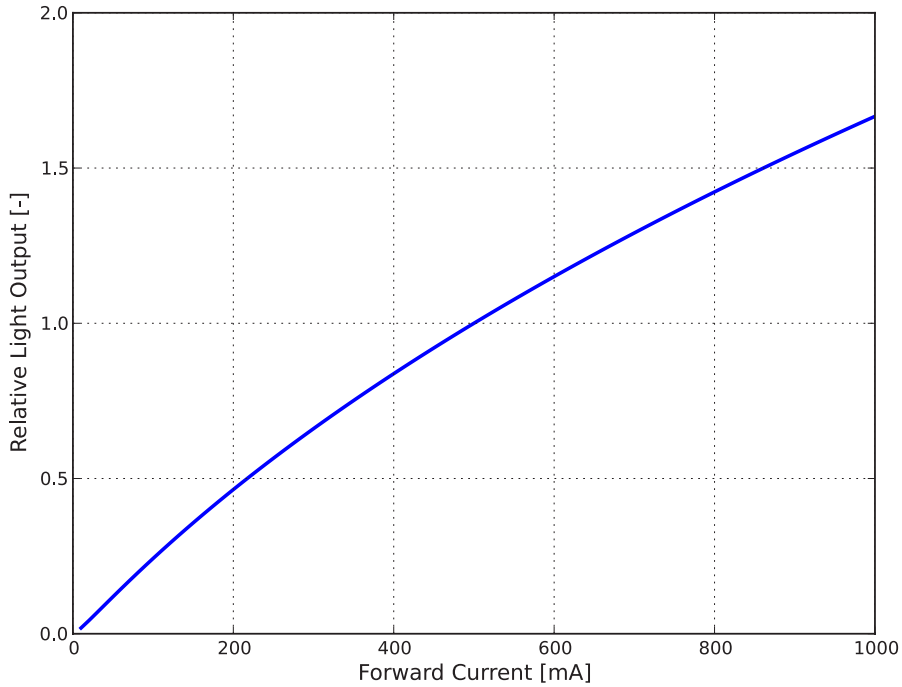


Figure 3: Typical normalized light output vs. forward current for LXZ1-xxxx at $T_j=85^\circ\text{C}$.

Forward Current Characteristics

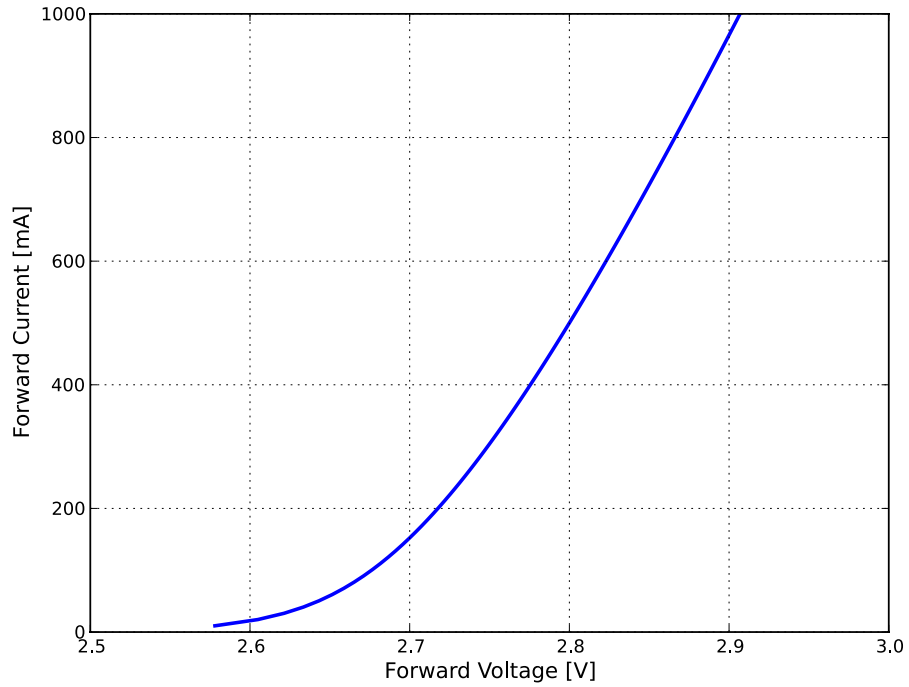


Figure 4: Typical forward current vs. forward voltage for LXZ1-xxxx at $T_j=85^\circ\text{C}$.

Radiation Pattern Characteristics

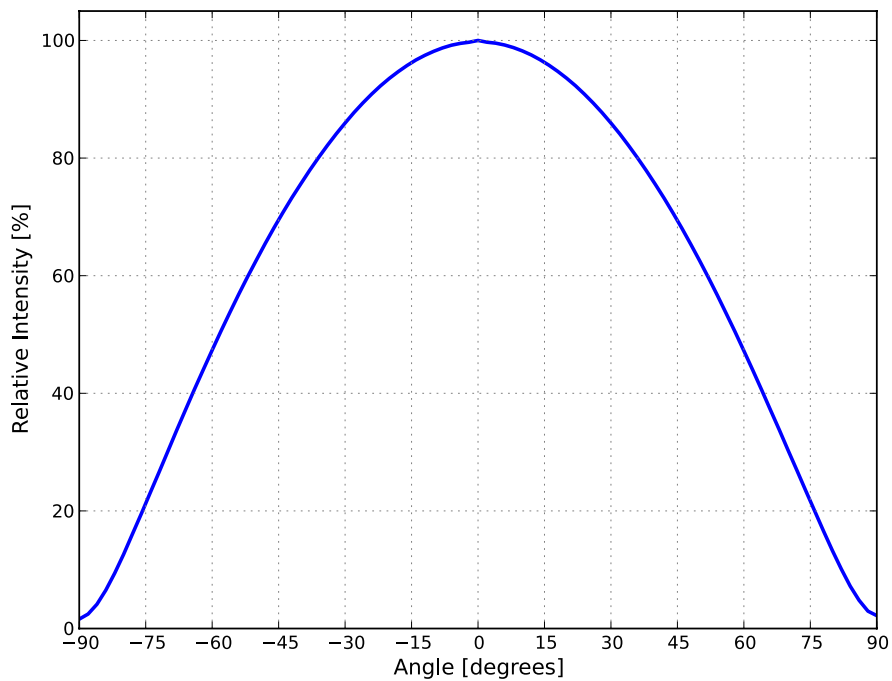


Figure 5: Typical radiation pattern for LXZ1-xxxx at 500mA, $T_j=85^\circ\text{C}$.

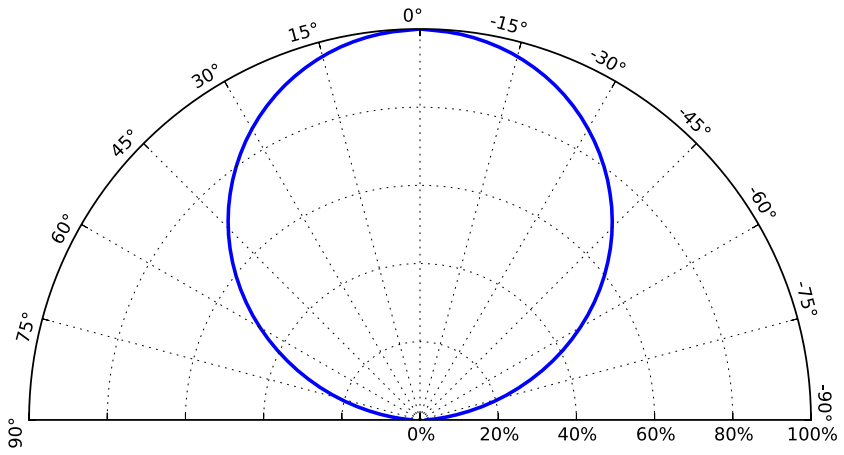


Figure 6: Typical polar radiation pattern for LXZ1-xxxx at 500mA, $T_j=85^\circ\text{C}$.

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.

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

A B C D

- A** – designates luminous fluxbin (example: B=110 to 120 lumens, C=120 to 130 lumens)
- B C** – designates color bin (example: 3L, 3U, 5A, 5B, 5C, 5D)
- D** – designates forward voltage bin (example: P=2.50 to 2.75V, R=2.75 to 3.00V)

Therefore, a LUXEON Z with a lumen range of 110 to 120, color bin of 5A and a forward voltage range of 2.75 to 3.00V has the following CAT code:

B 5 A R

Luminous Flux Bins

Table 5 lists the standard luminous flux bins for LUXEON Z 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.

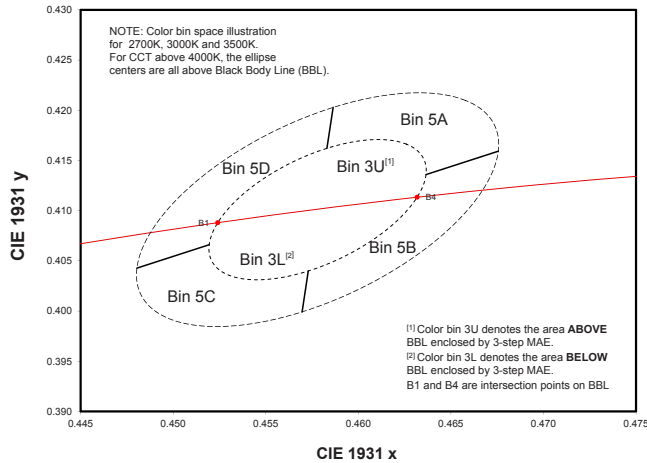
Table 5. Luminous flux bin definitions for LUXEON Z.

| BIN | LUMINOUS FLUX ⁽¹⁾ (lm) | |
|-----|-----------------------------------|---------|
| | MINIMUM | MAXIMUM |
| A | 100 | 110 |
| B | 110 | 120 |
| C | 120 | 130 |
| D | 130 | 140 |
| E | 140 | 150 |
| F | 150 | 160 |
| G | 160 | 170 |
| H | 170 | 180 |
| J | 180 | 190 |
| K | 190 | 200 |

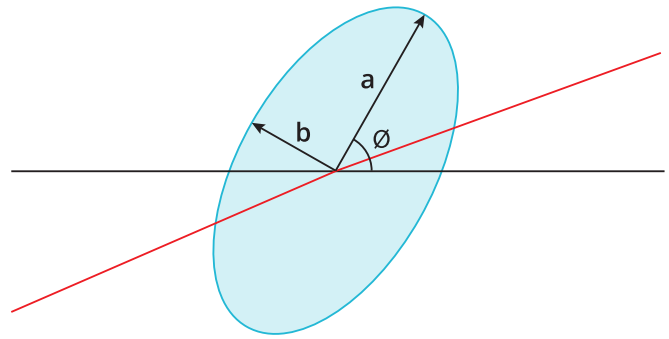
Notes for Table 5:

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

Color Bin Definition



Color Space Definition for Above and Below Black Body Line



Parameter Definition of MacAdam Ellipse

Figure 7: 3- and 5-step MacAdam ellipse illustration for Table 6.

Table 6. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON Z.

| NOMINAL CCT | COLOR SPACE | CENTER POINT ^[1] (cx, cy) | MAJOR AXIS, a | MINOR AXIS, b | ELLIPSE ROTATION ANGLE, θ |
|-------------|-------------------------------|---|------------------|------------------|------------------------------|
| 2700K | Single 3-step MacAdam ellipse | (0.4578, 0.4101) | 0.00810 | 0.00420 | 53.70 |
| 3000K | Single 3-step MacAdam ellipse | (0.4338, 0.4030) | 0.00834 | 0.00408 | 53.20 |
| 3500K | Single 3-step MacAdam ellipse | (0.4073, 0.3917) | 0.00927 | 0.00414 | 54.00 |
| 4000K | Single 3-step MacAdam ellipse | (0.3818, 0.3797) | 0.00939 | 0.00402 | 53.70 |
| 5000K | Single 3-step MacAdam ellipse | (0.3447, 0.3553) | 0.00822 | 0.00354 | 59.60 |
| 2700K | Single 5-step MacAdam ellipse | (0.4578, 0.4101) | 0.01350 | 0.00700 | 53.70 |
| 3000K | Single 5-step MacAdam ellipse | (0.4338, 0.4030) | 0.01390 | 0.00680 | 53.20 |
| 3500K | Single 5-step MacAdam ellipse | (0.4073, 0.3917) | 0.01545 | 0.00690 | 54.00 |
| 4000K | Single 5-step MacAdam ellipse | (0.3818, 0.3797) | 0.01565 | 0.00670 | 53.70 |
| 5000K | Single 5-step MacAdam ellipse | (0.3447, 0.3553) | 0.01370 | 0.00590 | 59.60 |
| 5700K | Single 5-step MacAdam ellipse | (0.3287, 0.3417) | 0.01243 | 0.00533 | 59.09 |
| 6500K | Single 5-step MacAdam ellipse | (0.3123, 0.3282) | 0.01115 | 0.00475 | 58.57 |

Notes for Table 6:

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

Forward Voltage Bins

Table 7. Forward voltage bin definitions for LUXEON Z.

| BIN | FORWARD VOLTAGE ^[1] (V _f) | |
|-----|--|---------|
| | MINIMUM | MAXIMUM |
| P | 2.50 | 2.75 |
| R | 2.75 | 3.00 |
| S | 3.00 | 3.25 |

Notes for Table 7:

1. Lumileds maintains a tolerance of $\pm 0.06V$ on forward voltage measurements.

Mechanical Dimensions

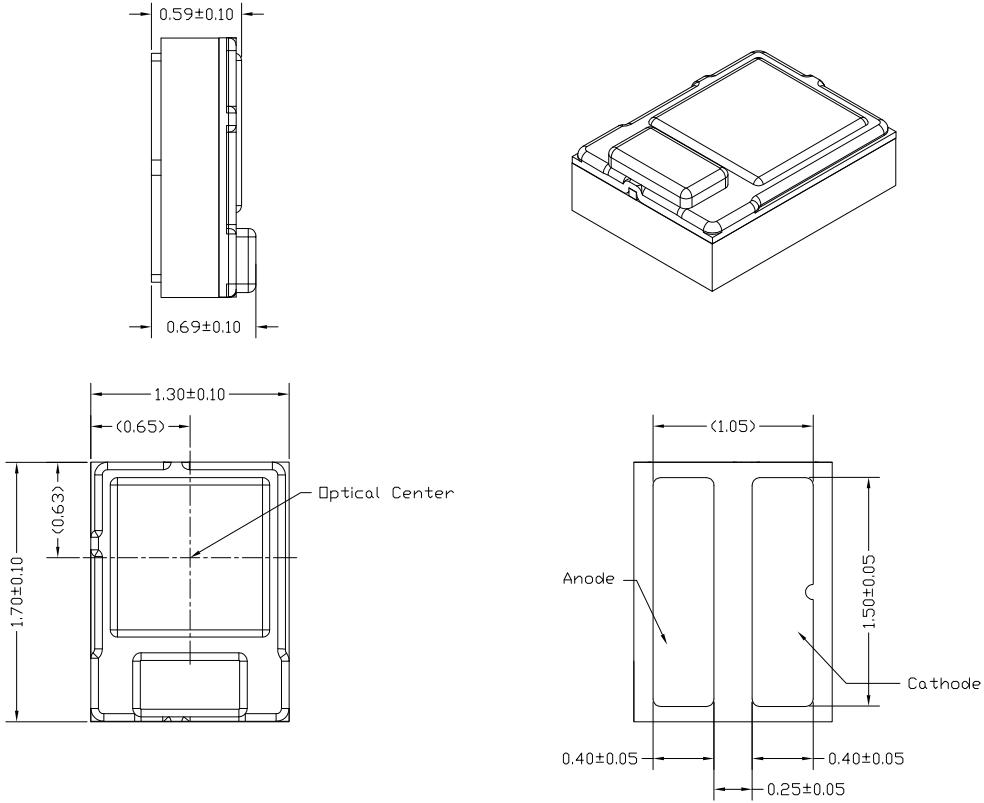


Figure 8: Mechanical dimensions for LUXEON Z.

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

Reflow Soldering Guidelines

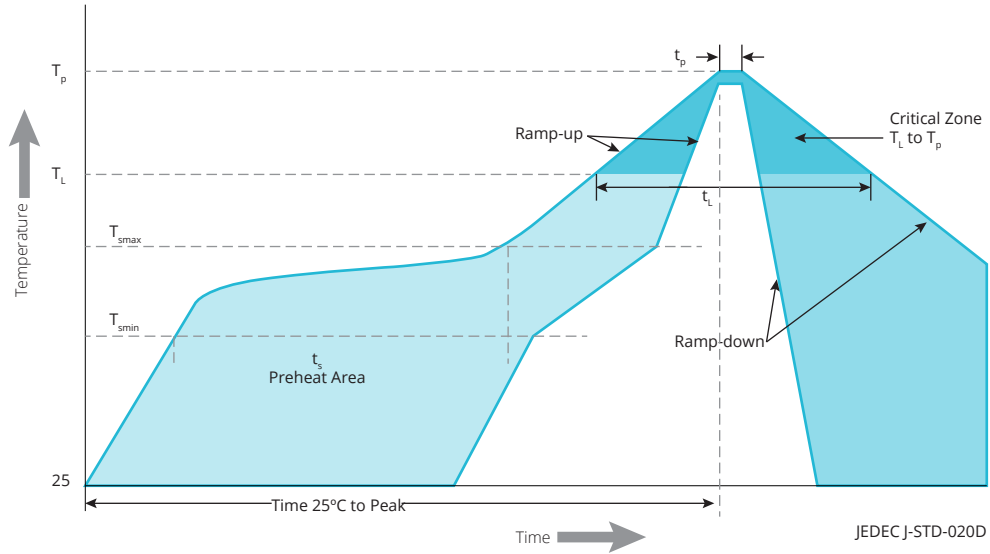


Figure 9: Visualization of the acceptable reflow temperature profile as specified in Table 8.

Table 8. Reflow profile characteristics for LUXEON Z.

| 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 9. Moisture sensitivity levels for LUXEON Z.

| 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

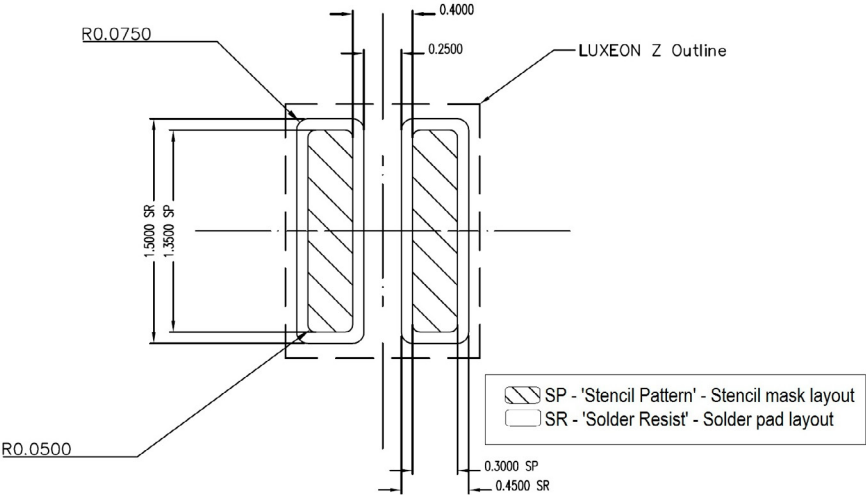


Figure 10: Recommended PCB solder pad layout for LUXEON Z.

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

Packaging Information

Pocket Tape Dimensions

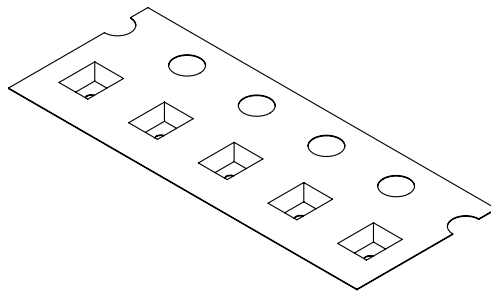
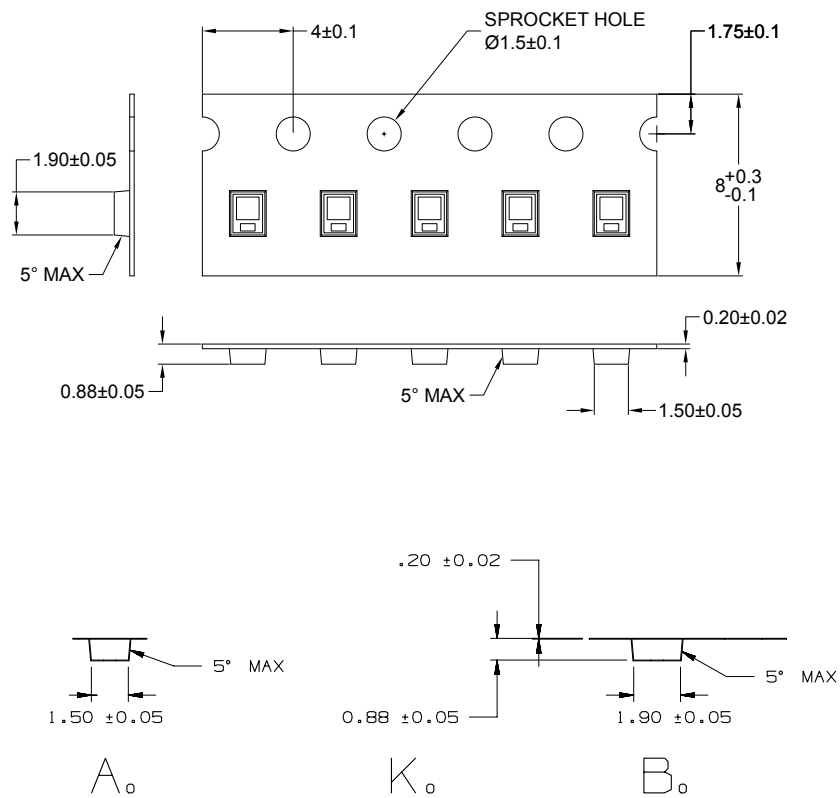


Figure 11: Pocket tape dimensions for LUXEON Z.

Notes for Figure 11:

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

Reel Dimensions

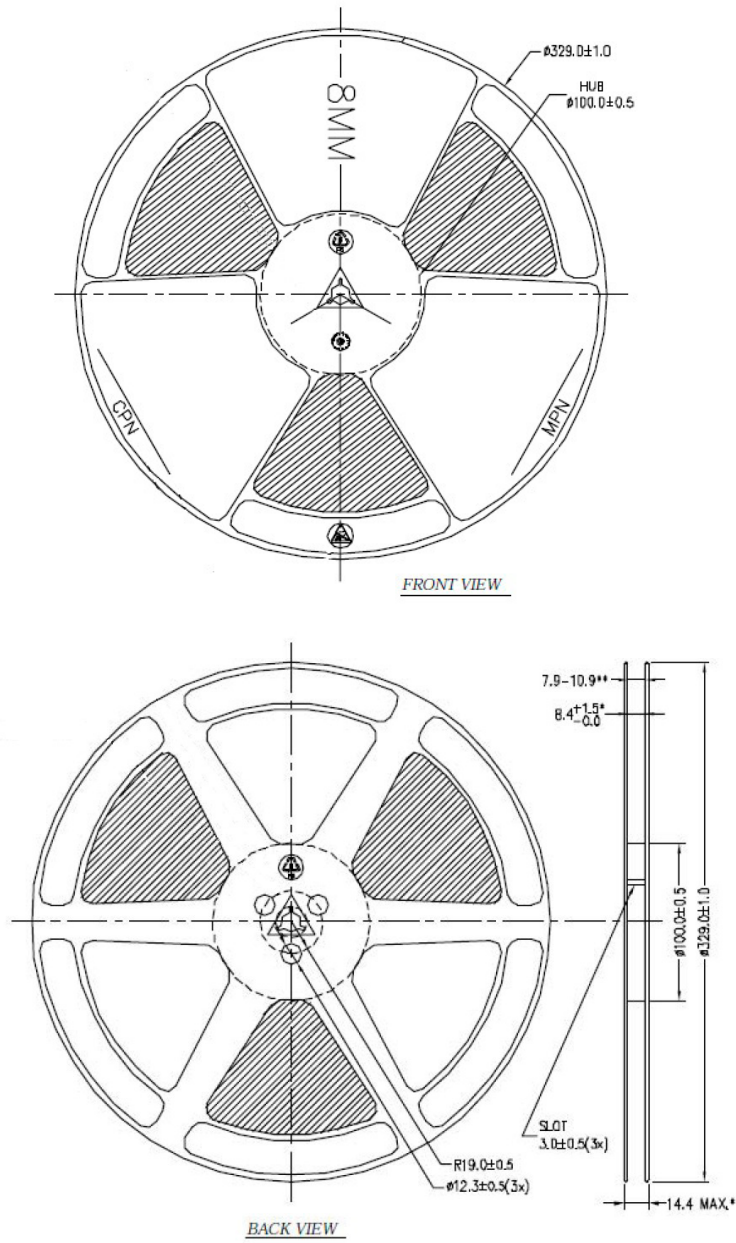


Figure 12: Reel dimensions for LUXEON Z.

Notes for Figure 12:

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

About Lumileds

Lumileds is the global leader in light engine technology. The company develops, manufactures and distributes groundbreaking LEDs and automotive lighting products that shatter the status quo and help customers gain and maintain a competitive edge.

With a rich history of industry “firsts,” Lumileds is uniquely positioned to deliver lighting advancements well into the future by maintaining an unwavering focus on quality, innovation and reliability.

To learn more about our portfolio of light engines, visit lumileds.com.



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