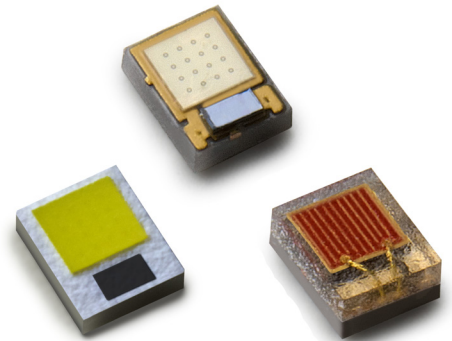


# LUXEON Z Colors

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

LUXEON Z Colors is 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 by providing a convenient above-blackbody color point with optical standalone efficacy. LUXEON Z Colors are 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 gamut, 440-670nm, including unique Lime color
- 2.2mm<sup>2</sup> footprint enables unique arrangements in space constrained applications
- 4-up RGBW pixel in 9.5mm<sup>2</sup> — four colors in less area than one regular high power color emitter
- Undomed design allows better optical management through collimated light output
- Enables customizable light sources: linear, rectangular, circular

## PRIMARY APPLICATIONS

- Architectural
- Lamps
- Specialty Lighting

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# General Information

## Part Number Nomenclature

LUXEON Z Color emitters are tested and binned at 25°C or 85°C, 500mA, depending on the product.

The part number designation for LUXEON Z Color LEDs is explained as follows:

L X Z 1 - A B C D - E F G H

Where:

- A — designates radiation pattern (value P for lambertian)
- B — designates color (see LUXEON Z color binning and labeling section)
- C — designates color variant (0 for color variants)
- D — designates color version (1, 2, etc.)
- E — open slot to accommodate additional requirements per product and part number
- FGH — (optional) minimum luminous flux (lm) or radiometric power (mW) performance

Please see DS120 for LUXEON Z White part number designation.

# Product Selection & Optical Characteristics

## Product Selection Guide for LUXEON Z Color Junction Temperature = 25°C

Table 1.

| Color      | Part Number | Performance @ 500mA                                  |   | Performance @ 700mA                                  |   |
|------------|-------------|--|---|--|---|
|            |             | Minimum Luminous Flux (lm) or Radiometric Power (mW) | Typical Efficacy (lm/W) or Radiant Efficacy | Typical Luminous Flux (lm) or Radiometric Power (mW) | Typical Efficacy (lm/W) or Radiant Efficacy |
| Green      | LXZ1-PM01   | 104  | 71  | 128  | 61  |
|            |             | 96   | 63  | 120  | 53  |
|            |             | 88   | 59  | 113  | 50  |
|            |             | 80   | 54  | 103  | 46  |
| Cyan       | LXZ1-PE01   | 64   | 44  | 84   | 38  |
|            |             | 56   | 39  | 74   | 33  |
|            |             | 48   | 35  | 67   | 30  |
| Blue       | LXZ1-PB01   | 40   | 30  | 57   | 27  |
|            |             | 32   | 26  | 49   | 23  |
|            |             | 24   | 21  | 39   | 19  |
| Royal Blue | LXZ1-PR01   | 600  | 43%   | 823  | 40%   |
|            |             | 550  | 40%   | 757  | 37%   |
|            |             | 500  | 37%   | 704  | 35%   |
| Deep Red   | LXZ1-PA01   | 350  | 34%   | 454  | 31%   |
|            |             | 300  | 32%   | 416  | 29%   |
| Red        | LXZ1-PD01   | 56   | 54  | 77   | 49  |
|            |             | 48   | 50  | 70   | 46  |
|            |             | 40   | 42  | 60   | 38  |
| Red-Orange | LXZ1-PH01   | 72   | 69  | 99   | 66  |
|            |             | 64   | 63  | 90   | 58  |
|            |             | 56   | 57  | 82   | 53  |
| Amber      | LXZ1-PL01   | 64   | 63  | 90   | 59  |
|            |             | 56   | 57  | 82   | 53  |
|            |             | 48   | 51  | 73   | 48  |

Notes for Table 1:

1. Minimum luminous flux or radiometric power performance guaranteed within published operating conditions. Lumileds maintains a tolerance of  $\pm 6.5\%$  on flux and power measurements.
2. Typical luminous flux or radiometric power performance when device is operated within published operating conditions.

# Product Selection & Optical Characteristics

## Product Selection Guide for LUXEON Z Color Junction Temperature = 85°C

Table 2.

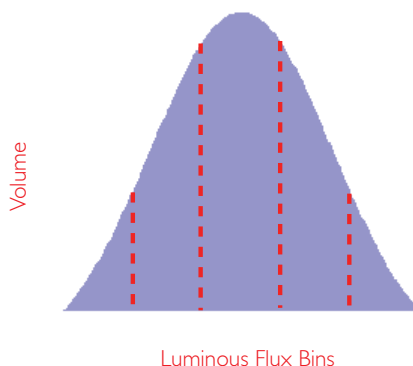
| Color      | Part Number | Binning Performance @ $I_f = 500\text{mA}$ , $T_j = 85^\circ\text{C}$ |                         | Typical Performance @ $I_f = 700\text{mA}$ , $T_j = 85^\circ\text{C}$ |                         |
|------------|-------------|---|-------------------------|---|-------------------------|
|            |             | Minimum Luminous Flux (lm)  | Typical Efficacy (lm/W) | Typical Luminous Flux (lm)  | Typical Efficacy (lm/W) |
| Lime       | LXZ1-PX01   | 194   | 136                     | 255   | 128                     |
|            |             | 184   | 131                     | 245   | 123                     |
|            |             | 174   | 124                     | 233   | 117                     |
|            |             | 164   | 118                     | 221   | 111                     |
|            |             | 154   | 113                     | 212   | 106                     |
|            |             | 144   | 107                     | 200   | 100                     |
| Red        | LXZ1-PD02   | 48  | 47                      | 69  | 42                      |
|            |             | 40  | 43                      | 62  | 38                      |
|            |             | 32  | 36                      | 53  | 32                      |
|            |             | 24  | 29                      | 42  | 25                      |
| Red-Orange | LXZ1-PH02   | 56  | 53                      | 77  | 47                      |
|            |             | 48  | 48                      | 70  | 43                      |
|            |             | 40  | 41                      | 59  | 36                      |
| Amber      | LXZ1-PL03   | 32  | 32                      | 46  | 29                      |
|            |             | 24  | 27                      | 38  | 23                      |
|            |             | 16  | 21                      | 30  | 18                      |
| PC Amber   | LXZ1-PL02   | 104   | 73                      | 135   | 66                      |
|            |             | 96  | 68                      | 126   | 62                      |
|            |             | 88  | 65                      | 119   | 59                      |
|            |             | 80  | 60                      | 109   | 54                      |
|            |             | 72  | 54                      | 99  | 49                      |

Notes for Table 2:

1. Minimum luminous flux or radiometric power performance guaranteed within published operating conditions. Lumileds maintains a tolerance of  $\pm 6.5\%$  on flux and power measurements.
2. Typical luminous flux or radiometric power performance when device is operated at specified conditions.
3. All products shown in Table 2 are tested and binned at  $T_j = 85^\circ\text{C}$ . All other LUXEON Z color emitters are tested and binned at  $T_j = 25^\circ\text{C}$ .

## Flux Performance, Binning, and Supportability

LEDs are produced with semiconductor technology that is subject to process variation, yielding a range of flux performance that is approximately Gaussian in nature. In order to provide customers with fine granularity within the overall flux distribution, Lumileds separates LEDs into fixed, easy to design with, minimum luminous flux bins. To verify supportability of parts chosen for your application design, please consult your Lumileds sales representative.



# Optical Characteristics

## LUXEON Z Color at 500mA, Test Temperature

Table 3.

| Color                             | Part Number | Dominant Wavelength <sup>[1]</sup> , $\lambda_D$<br>or Peak Wavelength <sup>[2]</sup> , $\lambda_P$<br>(nm) |       |       | Typical Spectral<br>Half-width <sup>[3]</sup><br>(nm)<br>$\Delta\lambda_{1/2}$ | Typical Temp<br>Coefficient of<br>Dominant or<br>Peak Wavelength<br>(nm/°C)<br>$\Delta\lambda_D / \Delta T_J$ | Typical<br>Total<br>Included<br>Angle <sup>[4]</sup><br>(degrees)<br>$\theta_{90\%}$ | Typical<br>Viewing<br>Angle <sup>[5]</sup><br>(degrees)<br>$2\theta_{1/2}$ |
|-----------------------------------|-------------|---|-------|-------|--|---|--|--|
|                                   |             | Min   | Typ   | Max   |  |   |  |  |
| Green <sup>[6]</sup>              | LXZ1-PM01   | 520.0   | 530.0 | 540.0 | 30   | 0.04  | 140  | 125  |
| Cyan <sup>[6]</sup>               | LXZ1-PE01   | 490.0   | 505.0 | 510.0 | 30   | 0.03  | 140  | 125  |
| Blue <sup>[6]</sup>               | LXZ1-PB01   | 460.0   | 470.0 | 480.0 | 20   | 0.03  | 140  | 125  |
| Royal Blue <sup>[2] [6]</sup>     | LXZ1-PR01   | 440.0   | 447.5 | 460.0 | 20   | 0.03  | 140  | 125  |
| Red <sup>[7]</sup>                | LXZ1-PD01   | 620.0   | 627.0 | 645.0 | 20   | 0.06  | 150  | 145  |
| Red <sup>[7] [8] [9]</sup>        | LXZ1-PD02   | 624.0   | 626.0 | 634.0 | 20   | 0.06  | 150  | 145  |
| Deep Red <sup>[7]</sup>           | LXZ1-PA01   | 650.0   | 655.0 | 670.0 | 20   | 0.06  | 150  | 145  |
| Red-Orange <sup>[7]</sup>         | LXZ1-PH01   | 610.0   | 617.0 | 620.0 | 20   | 0.06  | 150  | 145  |
| Red-Orange <sup>[7] [8] [9]</sup> | LXZ1-PH02   | 614.0   | 619.0 | 624.0 | 20   | 0.06  | 150  | 145  |
| Amber <sup>[7]</sup>              | LXZ1-PL01   | 585.0   | 590.0 | 595.0 | 20   | 0.10  | 150  | 145  |
| Amber <sup>[7] [8] [9]</sup>      | LXZ1-PL03   | 594.0   | 597.0 | 604.0 | 20   | 0.10  | 150  | 145  |
| PC Amber <sup>[6] [8]</sup>       | LXZ1-PL02   | 588.0   | 590.0 | 592.0 | 80   | 0.01  | 140  | 125  |
| Lime <sup>[8]</sup>               | LXZ1-PX01   | 566.0   | 567.5 | 569.0 | 100  | 0.01  | 140  | 125  |

Notes for Table 3:

- Dominant wavelength is derived from the CIE 1931 Chromaticity diagram and represents the perceived color. Lumileds maintains a tolerance of  $\pm 0.5$  nm for dominant wavelength measurements.
- Royal Blue and Deep Red LEDs are binned by radiometric power and peak wavelength rather than photometric lumens. Lumileds maintains a tolerance of  $\pm 2$ nm for peak wavelength measurements.
- Spectral width at 1/2 of the peak intensity.
- Total angle at which 90% of total luminous flux is captured.
- Viewing angle is the off axis angle from lamp centerline where the luminous intensity is 1/2 of the peak value.
- Green, cyan, blue, royal blue, PC Amber, Lime and white products are built with Indium Gallium Nitride (InGaN).
- All red, deep red, red-orange, and amber are built with Aluminum Indium Gallium Phosphide (AlInGaP).
- LUXEON Z Lime, PC Amber and certain Red, Red-Orange and Amber emitters are tested and binned at  $T_J = 85^\circ\text{C}$ . All other LUXEON Z Color emitters are tested and binned at  $T_J = 25^\circ\text{C}$ .
- 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  $T_J = 25^\circ\text{C}$  these hot-tested parts will have the same typical spectral outputs as their cold-tested counterparts.

# Electrical Characteristics

## Electrical Characteristics for LUXEON Z Colors at Test Current and Temperature

Table 4.

| Color      | Part Number | Forward Voltage $V_f^{(1)}$ (V) @ 500mA |         |         | Typical Forward Voltage @ 700mA<br>$V_f$ | Typical Temperature Coefficient of Forward Voltage (mV/°C)<br>$\Delta V_f / \Delta T_J$ | Typical Thermal Resistance Junction to Case (°C/W)<br>$R\theta_{J-C}$ |
|------------|-------------|---|---------|---------|--|---|---|
|            |             | Minimum                                 | Typical | Maximum |  |   |   |
| Green      | LXZ1-PM01   | 2.50                                    | 3.05    | 3.50    | 3.15                                     | -2 to -4  | 5   |
| Cyan       | LXZ1-PE01   | 2.50                                    | 2.95    | 3.50    | 3.05                                     | -2 to -4  | 5   |
| Blue       | LXZ1-PB01   | 2.50                                    | 3.15    | 3.50    | 3.25                                     | -2 to -4  | 5   |
| Royal Blue | LXZ1-PR01   | 2.50                                    | 2.90    | 3.50    | 2.95                                     | -2 to -4  | 5   |
| Red        | LXZ1-PD01   | 1.75                                    | 2.20    | 2.75    | 2.40                                     | -2 to -4  | 8   |
| Red        | LXZ1-PD02   | 1.75                                    | 2.15    | 2.75    | 2.35                                     | -2 to -4  | 8   |
| Deep Red   | LXZ1-PA01   | 1.75                                    | 2.25    | 2.75    | 2.40                                     | -2 to -4  | 8   |
| Red-Orange | LXZ1-PH01   | 1.75                                    | 2.20    | 2.75    | 2.40                                     | -2 to -4  | 8   |
| Red-Orange | LXZ1-PH02   | 1.75                                    | 2.15    | 2.75    | 2.35                                     | -2 to -4  | 8   |
| Amber      | LXZ1-PL01   | 1.75                                    | 2.15    | 2.75    | 2.35                                     | -2 to -4  | 8   |
| Amber      | LXZ1-PL03   | 1.75                                    | 2.10    | 2.75    | 2.30                                     | -2 to -4  | 8   |
| PC Amber   | LXZ1-PL02   | 2.50                                    | 2.85    | 3.50    | 2.90                                     | -2 to -4  | 5   |
| Lime       | LXZ1-PX01   | 2.50                                    | 2.85    | 3.50    | 2.80                                     | -2 to -4  | 5   |

Notes for Table 4:

1. Measured between  $T_j = 25^\circ\text{C}$  and  $T_j = 85^\circ\text{C}$  at  $I_f = 500\text{mA}$ .
2. Lumileds maintains a tolerance of  $\pm 0.06\text{V}$  on forward voltage measurements.
3. LUXEON Z Lime, PC Amber and certain Red, Red-Orange and Amber emitters are tested and binned at  $T_j = 85^\circ\text{C}$ . All other LUXEON Z Color emitters are tested and binned at  $T_j = 25^\circ\text{C}$ .

## Absolute Maximum Ratings

Table 5.

| Parameter                               | Green/Cyan/<br>Blue/Royal Blue   | Cold-Tested Red/<br>Deep-Red/Red-<br>Orange/Amber | Hot-Tested Red/Red-<br>Orange/Amber <sup>[2]</sup> | PC Amber/Lime    |
|---|--|---|--|------------------|
| DC Forward Current (mA)                 | 1000   | 700   | 1000/700   | 700              |
| Peak Pulsed Forward Current (mA)        | 1000   | 700   | 1000/700   | 700              |
| ESD Sensitivity                         | JESD22-A114-B  |   |  |                  |
| LED Junction Temperature <sup>[1]</sup> | 150°C  | 135°C   | 120°C/135°C  | 135°C            |
| Operating Case Temperature at 500mA     | -40°C - 135°C  | -40°C - 120°C                                     | -40°C - 120°C                                      | -40°C - 110°C    |
| Storage Temperature                     | -40°C - 135°C  | -40°C - 135°C                                     | -40°C - 120°C                                      | -40°C - 135°C    |
| Soldering Temperature                   | JEDEC 020c 260°C   | JEDEC 020c 260°C                                  | JEDEC 020c 260°C                                   | JEDEC 020c 260°C |
| Allowable Reflow Cycles                 | 3  | 3   | 3  | 3                |
| Autoclave Conditions                    | 121°C at 2 ATM   | 100% Relative Humidity for 96 Hours Maximum       |  |                  |
| Reverse Voltage (V <sub>r</sub> )       | LUXEON Z Color Portfolio LEDs are not designed to be driven in reverse bias. |   |  |                  |

Notes for Table 5:

- Proper current derating must be observed to maintain junction temperature below the maximum.
- Hot Tested LUXEON Z Red (LXZ1-PD02), Red-Orange (LXZ1-PH02) and Amber (LXZ1-PL03) products have two boundary points for maximum conditions:  
I<sub>f</sub> = 1A & T<sub>j</sub> = 120°C or I<sub>f</sub> = 700mA & T<sub>j</sub> = 135°C.

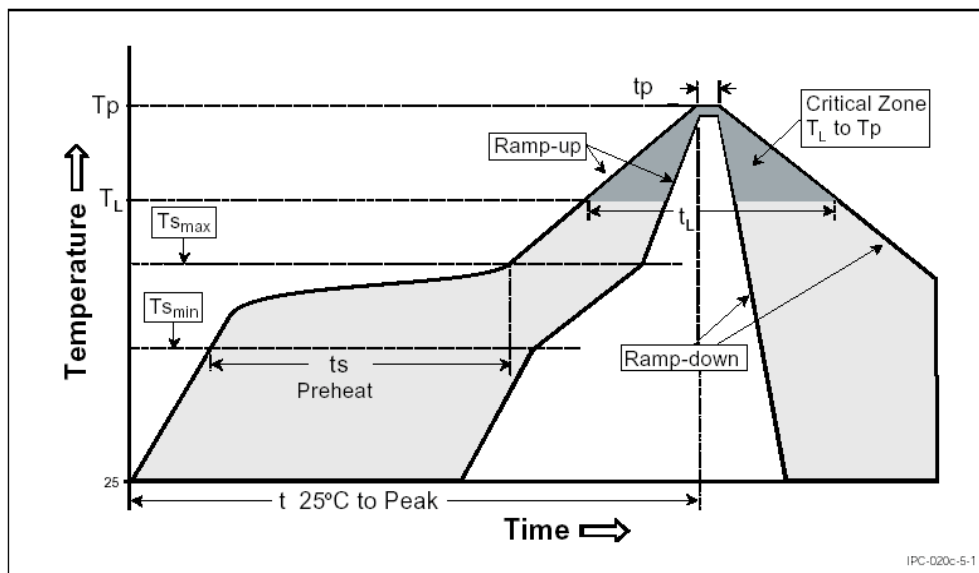
## JEDEC Moisture Sensitivity

Table 6.

| Level | Floor Life |                 | Soak Requirements      |               |
|-------|------------|-----------------|------------------------|---------------|
|       |            |                 | Standard               |               |
|       | Time       | Conditions      | Time                   | Conditions    |
| 1     | unlimited  | ≤ 30°C / 85% RH | 168 Hrs. + 5 / -0 Hrs. | 85°C / 85% RH |



# Reflow Soldering Characteristics



Temperature Profile for Table 7.

Table 7.

| Profile Feature                                      | Lead Free Assembly |
|--|--------------------|
| Average Ramp-Up Rate ( $T_{s_{max}}$ to $T_p$ )      | 3°C / second max   |
| Preheat Temperature Min ( $T_{s_{min}}$ )            | 150°C              |
| Preheat Temperature Max ( $T_{s_{max}}$ )            | 200°C              |
| Preheat Time ( $t_{s_{min}}$ to $t_{s_{max}}$ )      | 60 - 180 seconds   |
| Temperature $T_L$ ( $t_L$ )                          | 217°C              |
| Time Maintained Above Temperature $T_L$ ( $t_L$ )    | 60 - 150 seconds   |
| Peak / Classification Temperature ( $T_p$ )          | 260°C              |
| Time Within 5°C of Actual Peak Temperature ( $t_p$ ) | 20 - 40 seconds    |
| Ramp-Down Rate                                       | 6°C / second max   |
| Time 25°C to Peak Temperature                        | 8 minutes max      |

Note for Table 7:

1. All temperatures refer to the application Printed Circuit Board (PCB), measured on the surface adjacent to the package body.

# Mechanical Dimensions

## LUXEON Z Blue, Green, Royal Blue and Cyan

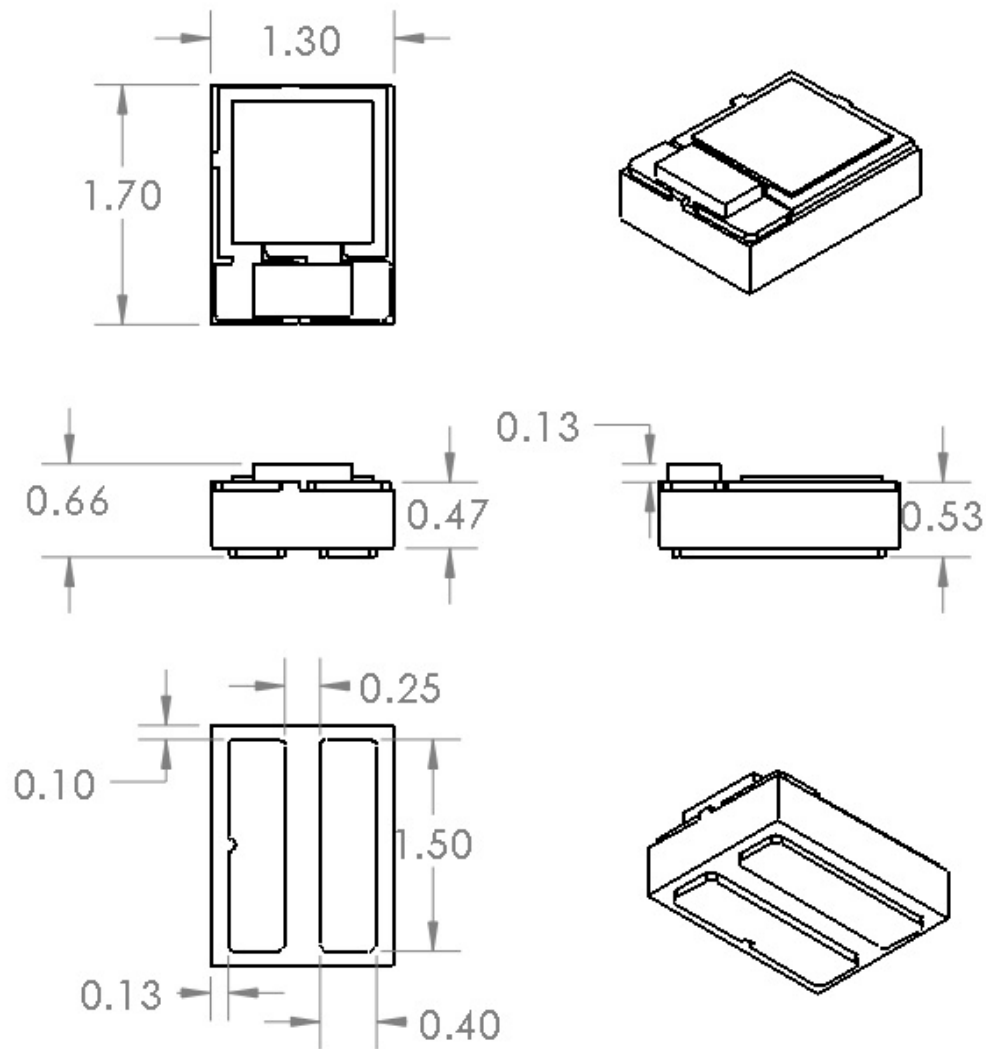


Figure 1. Package outline drawing for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01.

Notes for Figure 1:

1. To avoid damage, do not manually exert any force to the top surface. See AB105 for handling precautions.
2. Drawings not to scale.
3. All dimensions are in millimeters.

# Mechanical Dimensions

## LUXEON Z Lime and PC Amber

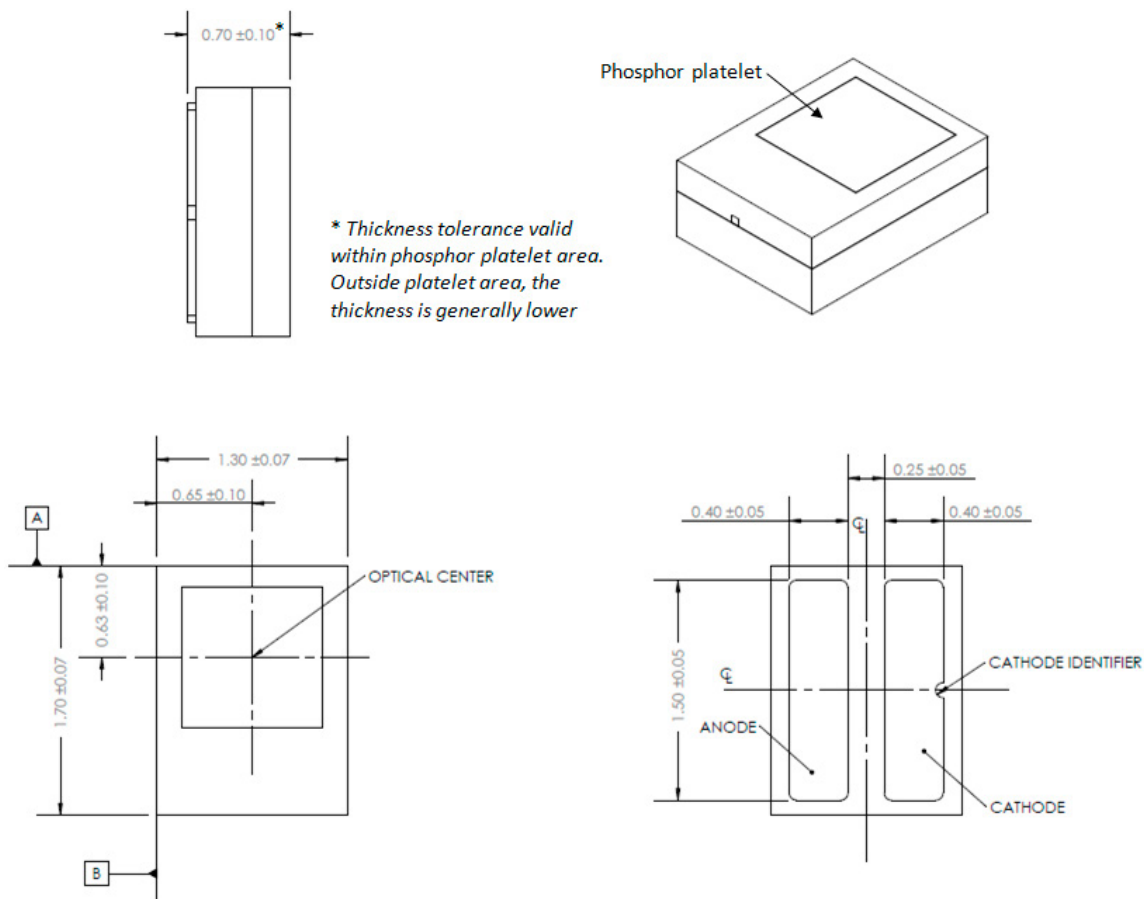


Figure 2. Package outline drawing for LXZ1-PX01 and LXZ1-PL02.

### Notes for Figure 2:

1. To avoid damage, do not manually exert any force to the top surface. See AB105 for handling precautions.
2. Drawings not to scale.
3. All dimensions are in millimeters.

# Mechanical Dimensions

## LUXEON Z Red, Red-Orange, Amber and Deep Red

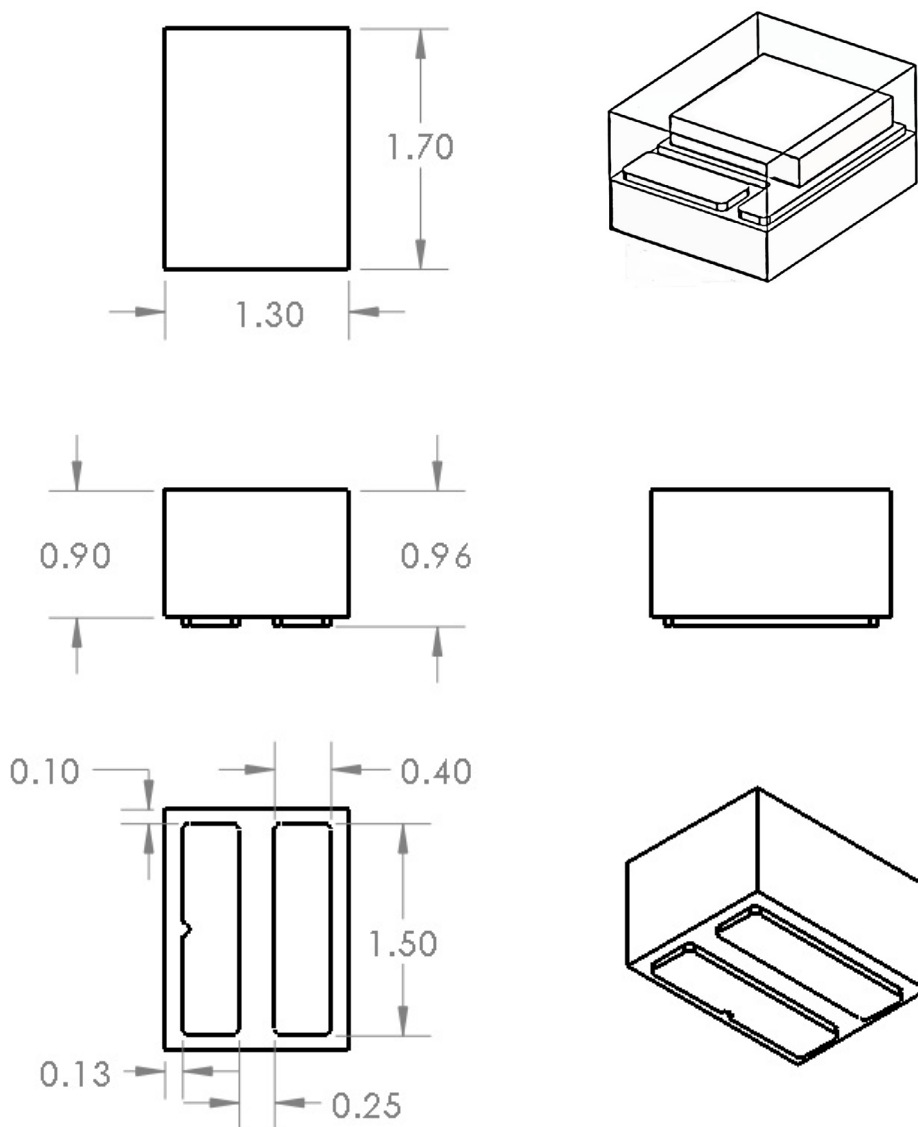


Figure 3. Package outline drawing for LXZ1-PL01, LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01, LXZ1-PL03, LXZ1-PD02 and LXZ1-PH02.

### Notes for Figure 3:

1. To avoid damage, do not manually exert any force to the top surface or handle from the sides of the silicone layer. See AB105 for handling precautions.
2. Drawings not to scale.
3. All dimensions are in millimeters.

# Pad Configuration

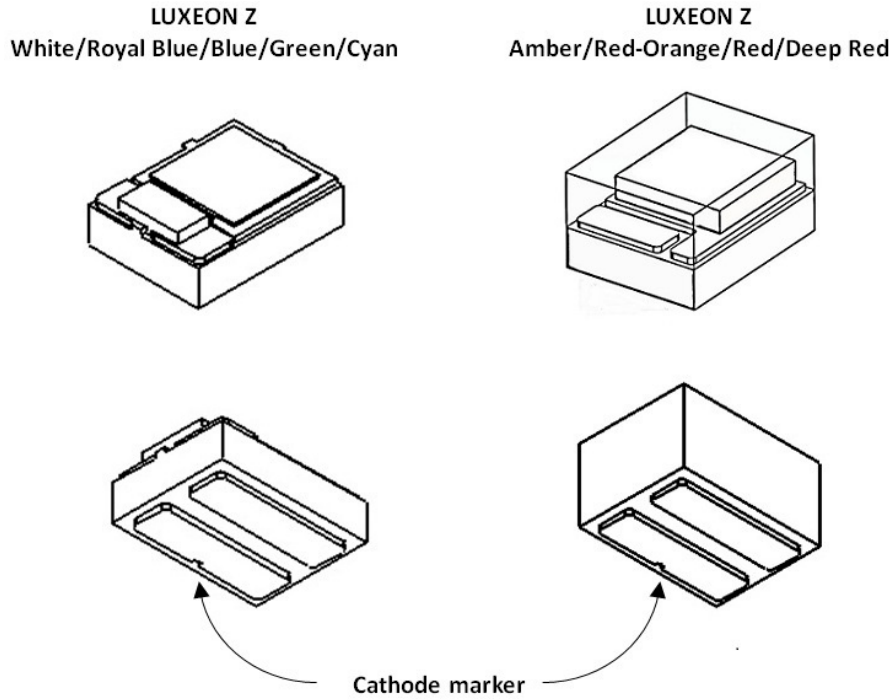


Figure 4. Pad configuration.

# Solder Pad Design

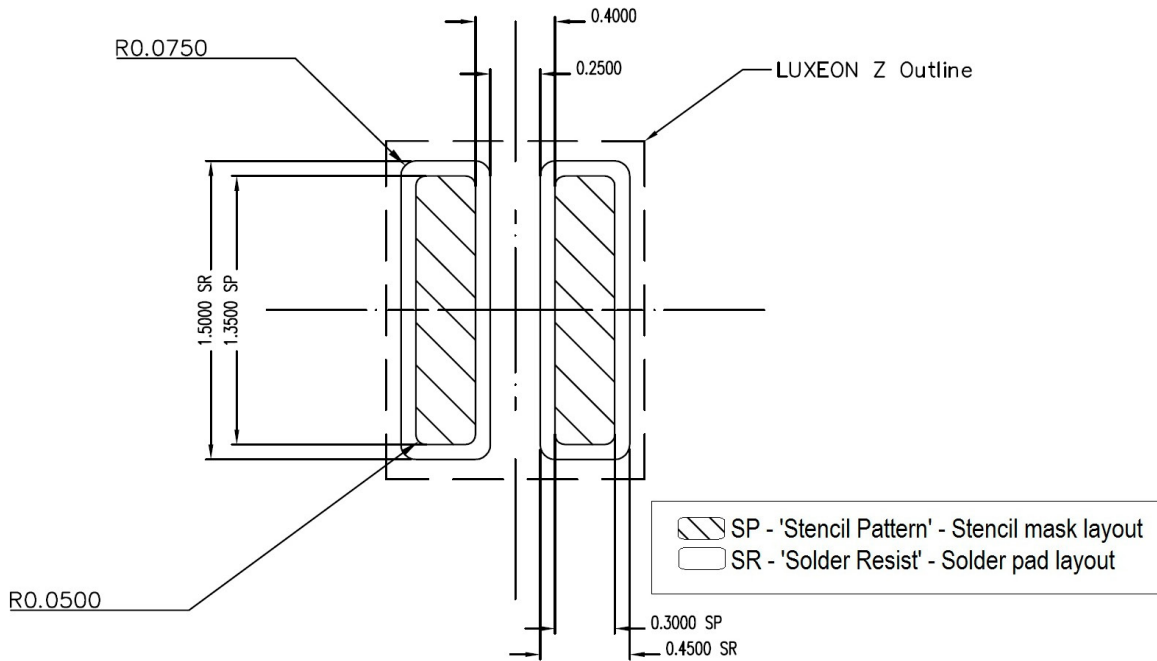


Figure 5. Solder pad layout.

# Wavelength Characteristics

LUXEON Z Green, Cyan, Blue, Royal Blue, Red, Red-Orange and Amber at 500mA, 25°C

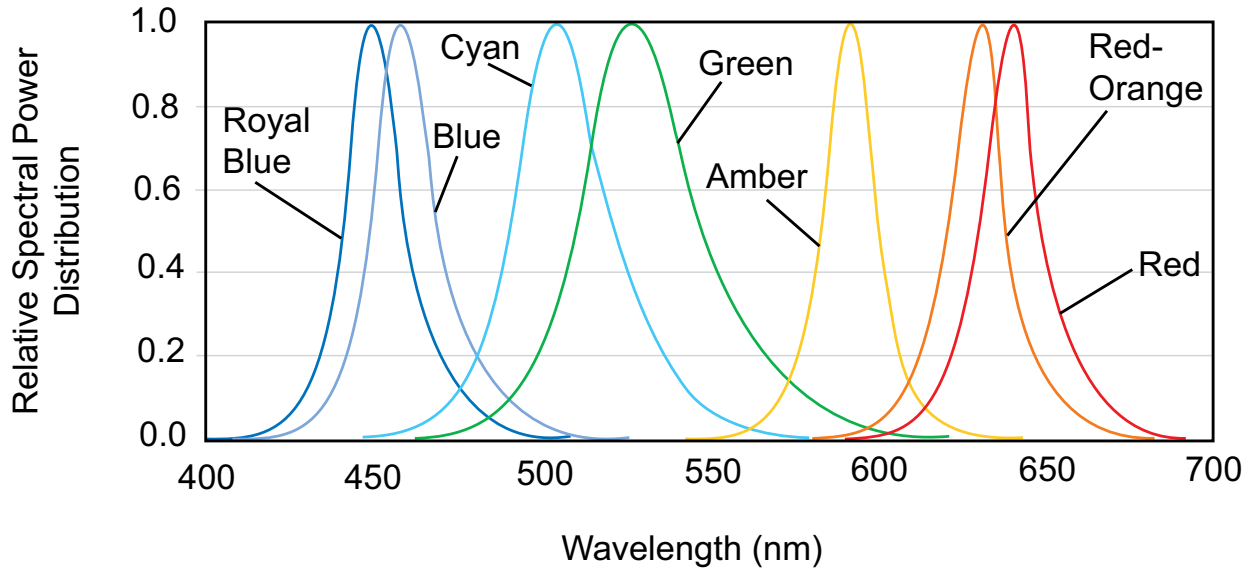


Figure 6. Relative intensity vs. wavelength.

LUXEON Z Lime and PC Amber at 500mA, 85°C

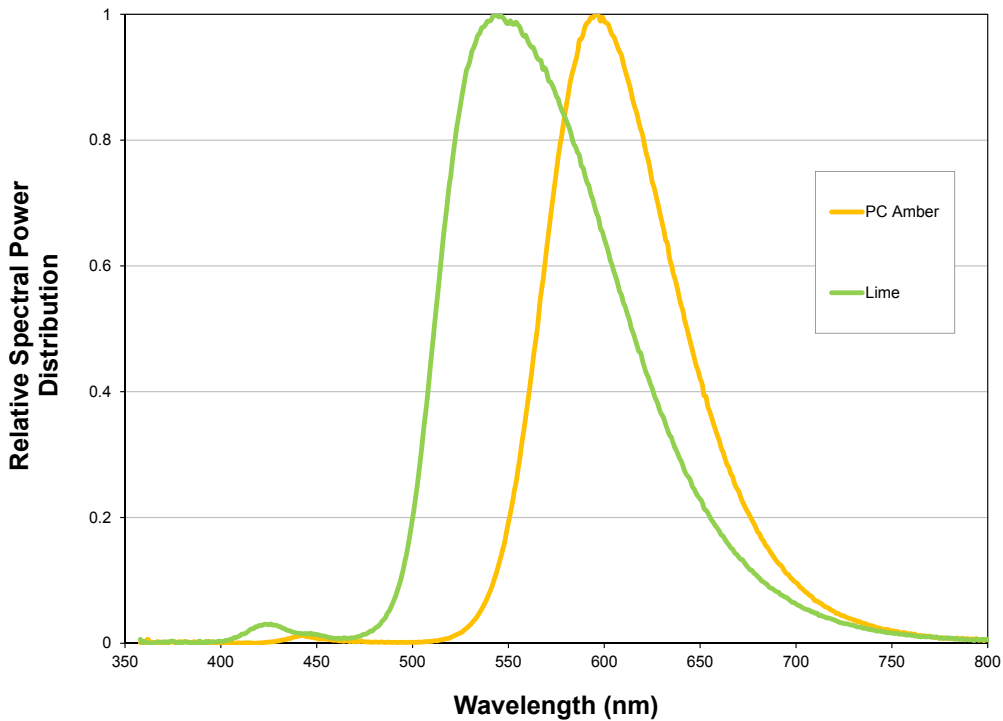


Figure 7. Relative intensity vs. wavelength.

# Typical Light Output Characteristics

## Relative Light Output vs. Thermal Pad Temperature, Test Current = 500mA

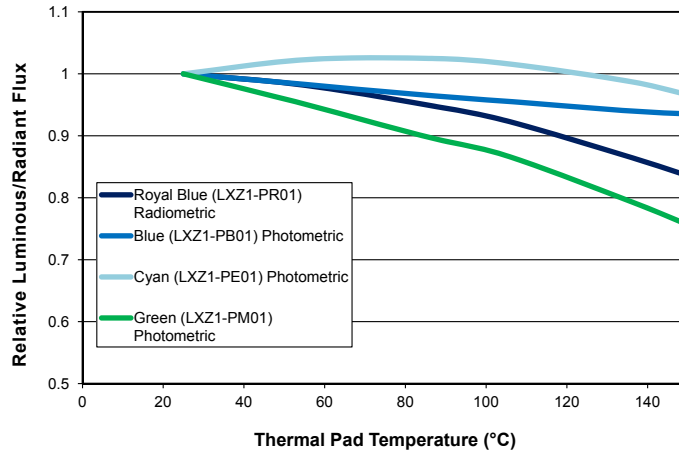


Figure 8. Relative light output vs. thermal pad temperature for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01.

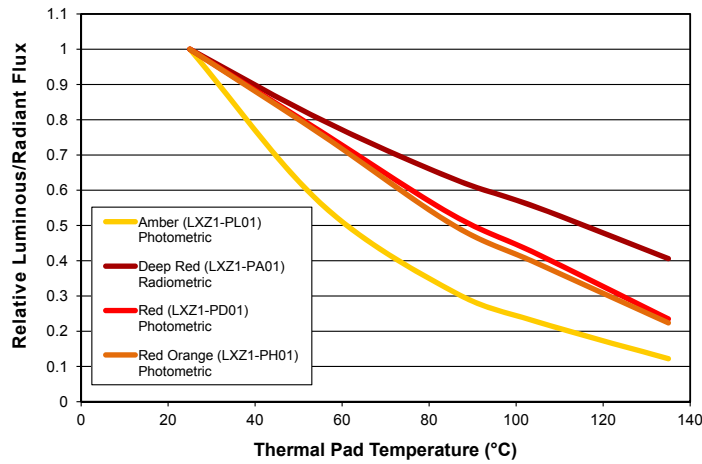


Figure 9. Relative light output vs. thermal pad temperature for LXZ1-PL01, LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01.

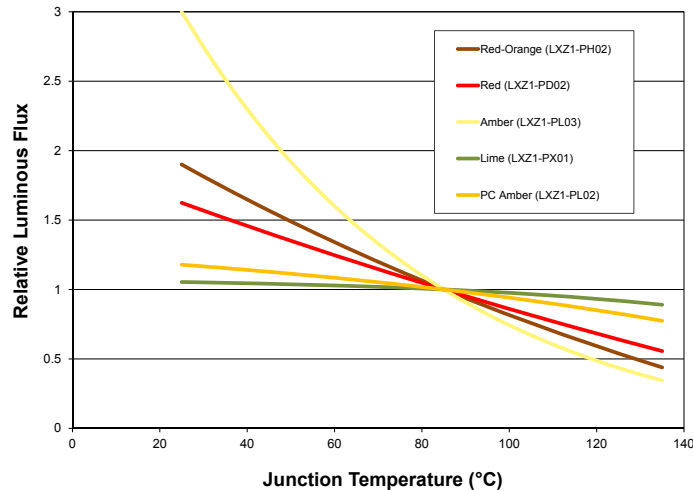


Figure 10. Relative light output vs. thermal pad temperature for LXZ1-PX01, LXZ1-PL02, LXZ1-PD02, LXZ1-PH02 and LXZ1-PL03.

# Typical Forward Current Characteristics

## Forward Current vs. Forward Voltage

Junction Temperature = 25°C

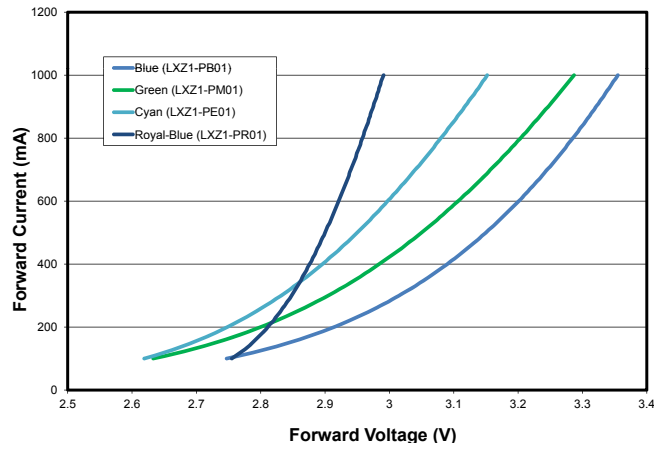


Figure 11. Forward current vs. forward voltage for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01.

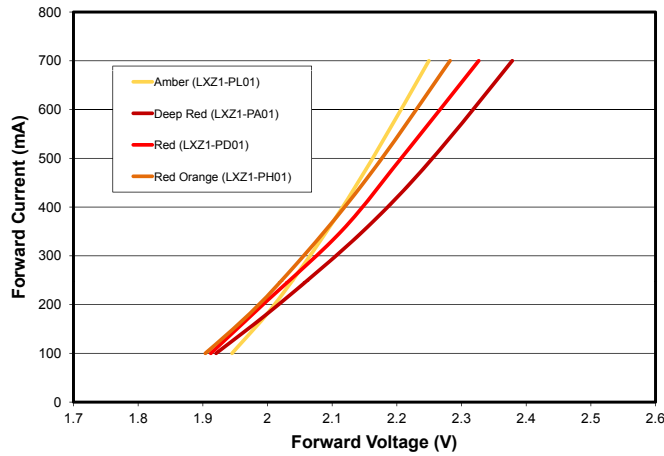


Figure 12. Forward current vs. forward voltage for LXZ1-PL01, LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01.

## Forward Current vs. Forward Voltage

Junction Temperature = 85°C

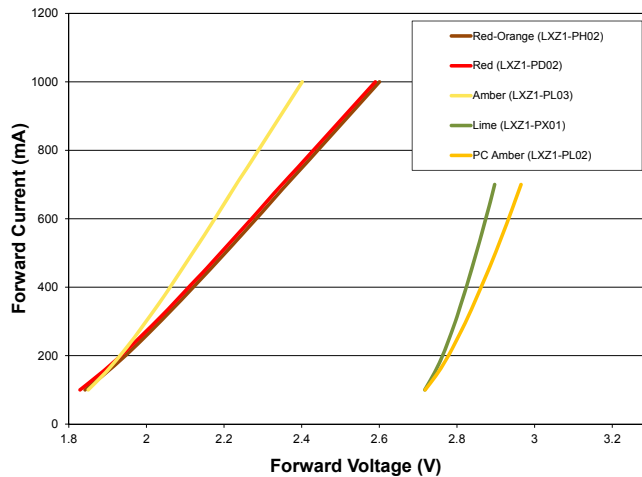


Figure 13. Forward current vs. forward voltage for LXZ1-PX01, LXZ1-PL02, LXZ1-PD02, LXZ1-PH02, and LXZ1-PL03.



# Typical Relative Luminous Flux

Relative Luminous Flux vs. Forward Current  
 Junction Temperature = 25°C

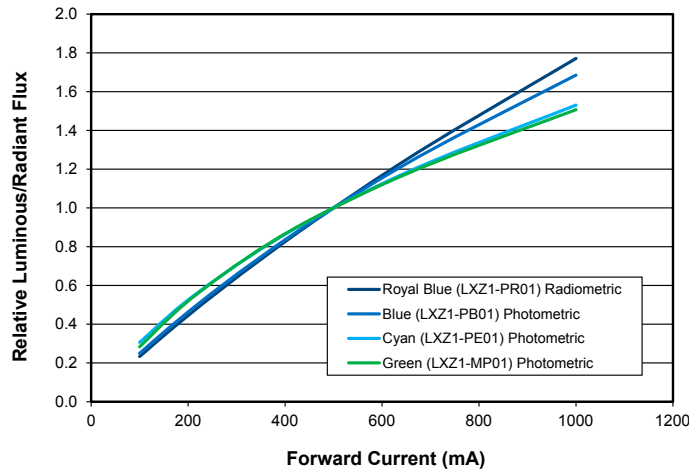


Figure 14. Relative luminous flux vs. forward current for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01.

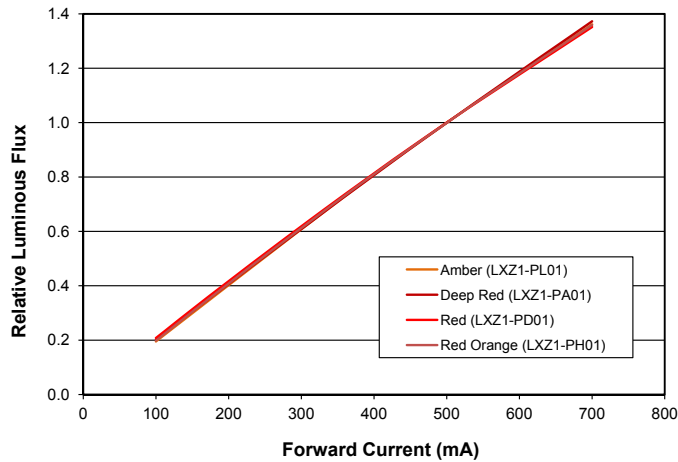


Figure 15. Relative luminous flux vs. forward current for LXZ1-PL01, LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01.

Relative Luminous Flux vs. Forward Current  
 Junction Temperature = 85°C

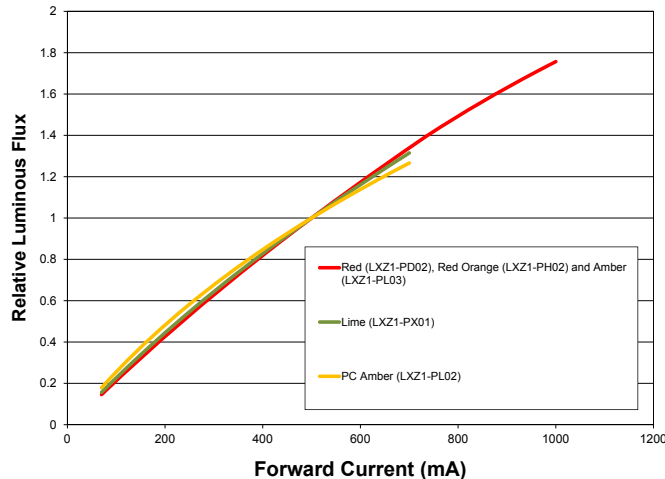


Figure 16. Relative luminous flux vs. forward current for LXZ1-PX01, LXZ1-PL02, LXZ1-PD02, LXZ1-PH02, and LXZ1-PL03.

# Typical Radiation Patterns: LUXEON Z Green, Cyan, Blue and Royal Blue

## Spatial Radiation Pattern

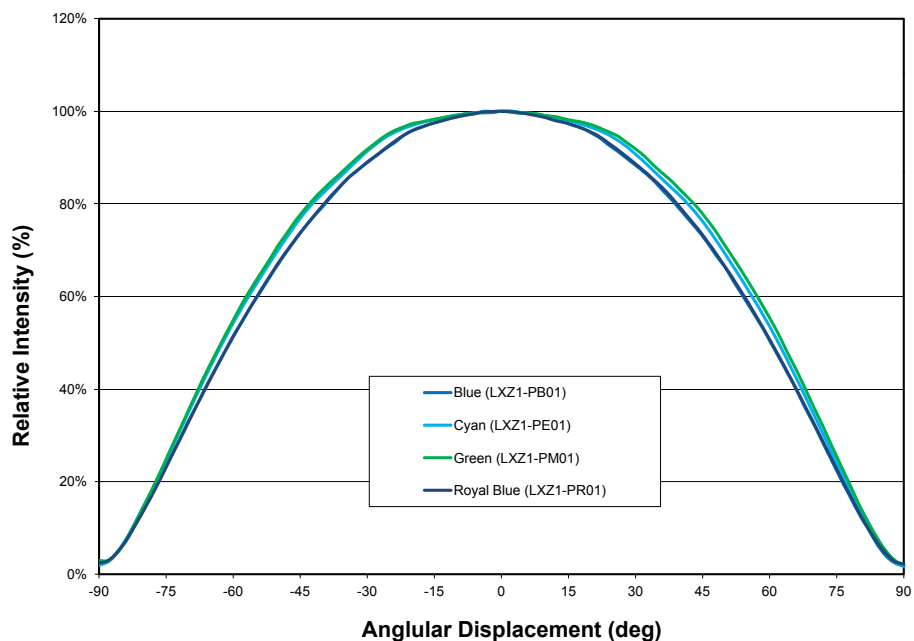


Figure 17. Typical spatial radiation pattern for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01.

## Polar Radiation Pattern

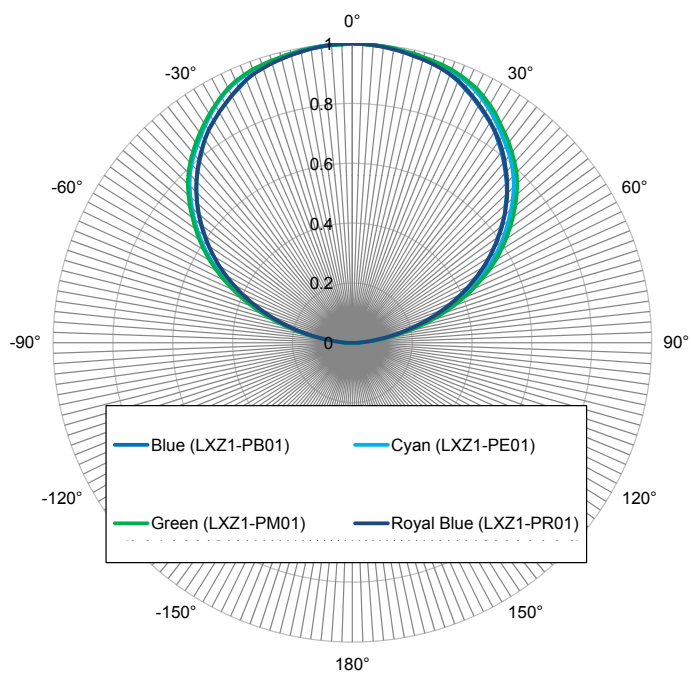


Figure 18. Typical polar radiation pattern for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01 and LXZ1-PM01.

# Typical Radiation Patterns: LUXEON Z Red, Red-Orange, Amber and Deep Red

## Spatial Radiation Pattern

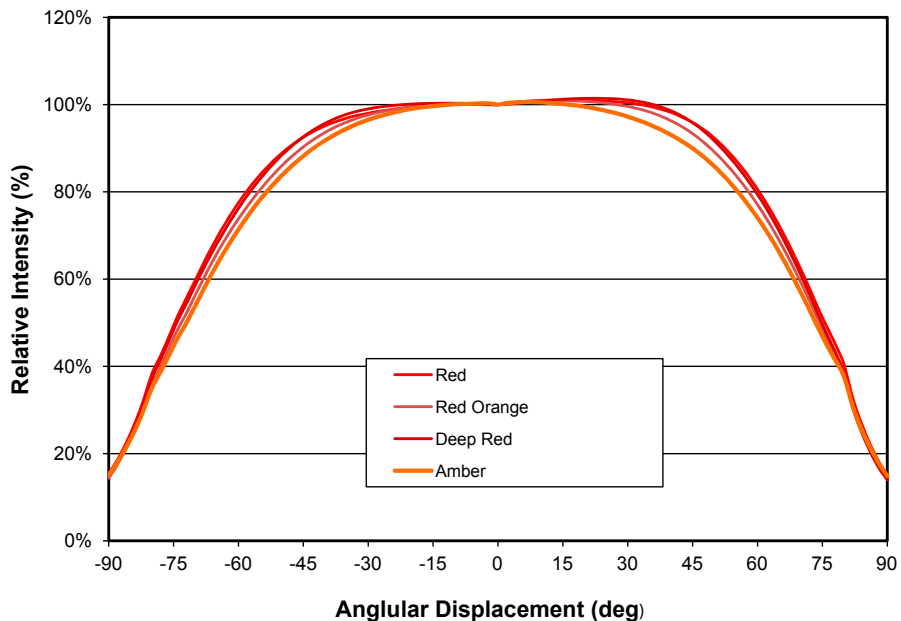


Figure 19. Spatial radiation pattern for LXZ1-PL01, LXZ1-PA01, LXZ1-PD01, LXZ1-PH01, LXZ1-PL03, LXZ1-PH02 and LXZ1-PD02.

## Polar Radiation Pattern

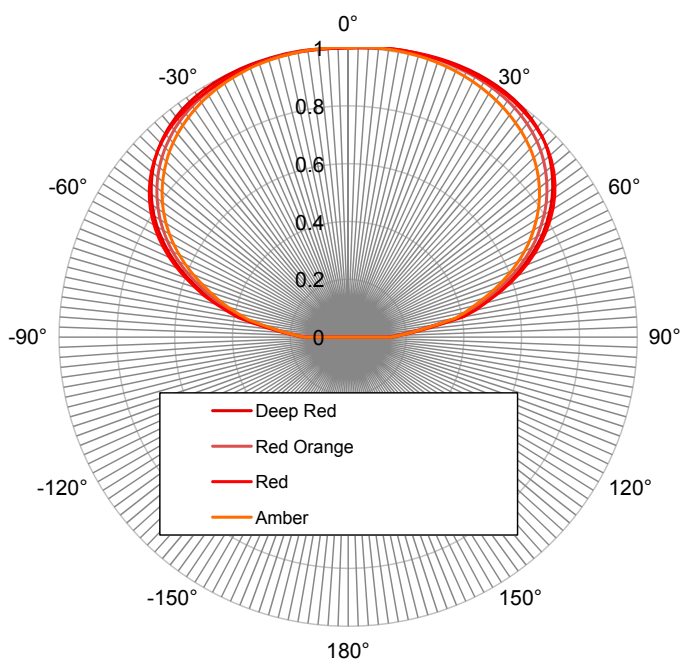


Figure 20. Typical polar radiation pattern for LXZ1-PL01, LXZ1-PA01, LXZ1-PD01 and LXZ1-PH01, LXZ1-PL03, LXZ1-PH02 and LXZ1-PD02.

# Typical Radiation Patterns: LUXEON Z Lime and PC Amber

## Spatial Radiation Pattern

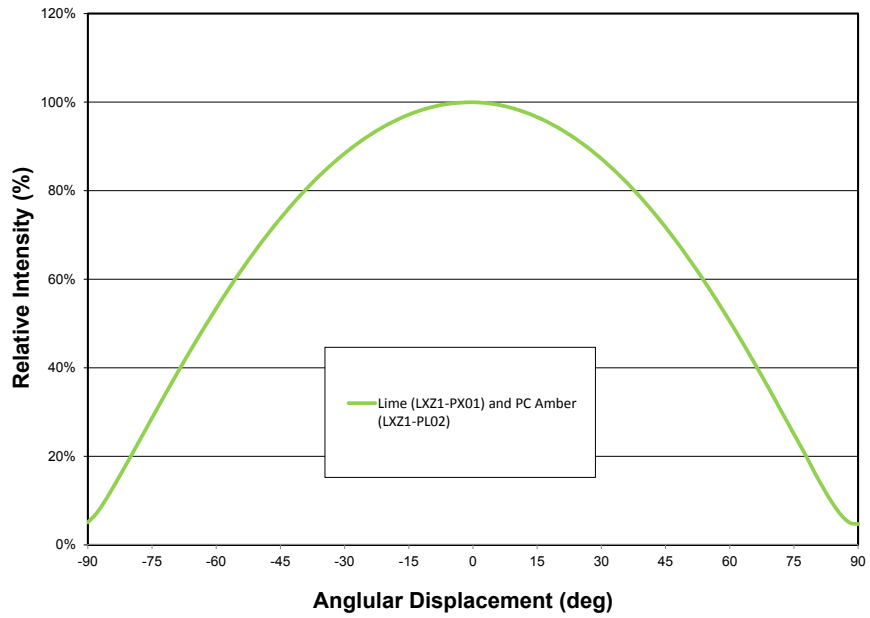


Figure 21. Typical spatial radiation pattern for LXZ1-PX01 and LXZ1-PL02.

## Polar Radiation Pattern

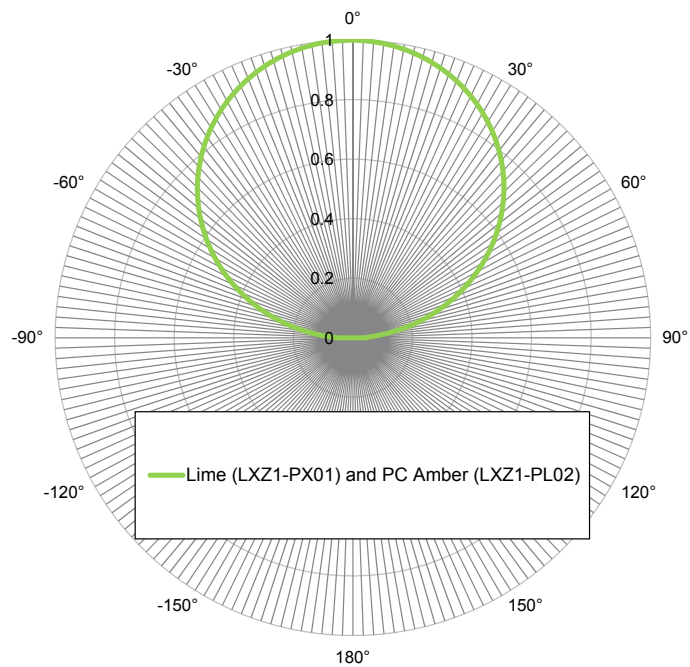


Figure 22. Typical polar radiation pattern for LXZ1-PX01 and LXZ1-PL02.

# Emitter Pocket Tape Packaging

LUXEON Z Blue, Green, Royal Blue, Cyan, Lime and PC Amber

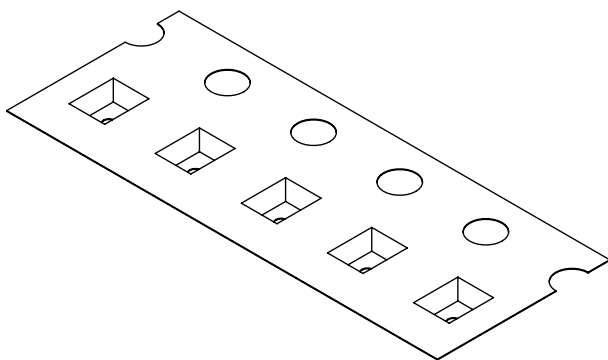
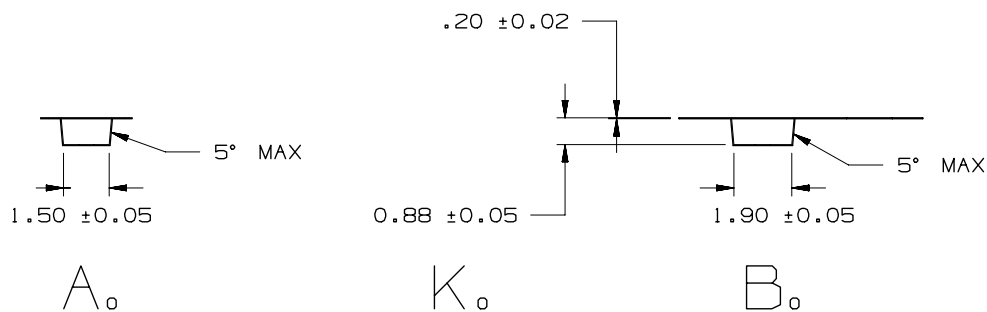
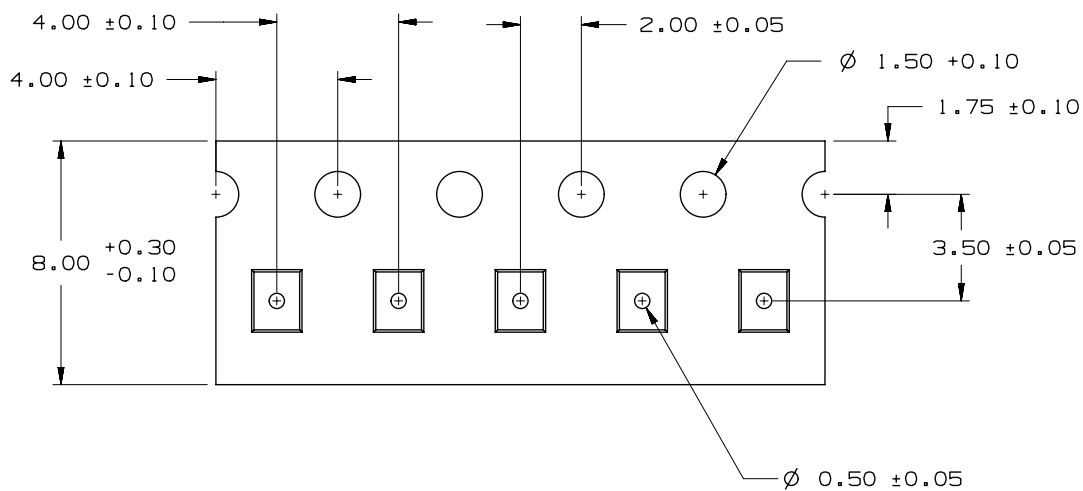


Figure 23. Emitter pocket tape packaging for LXZ1-PR01, LXZ1-PB01, LXZ1-PE01, LXZ1-PM01, LXZ1-PX01 and LXZ1-PL02.

# Red, Red-Orange, Amber and Deep Red

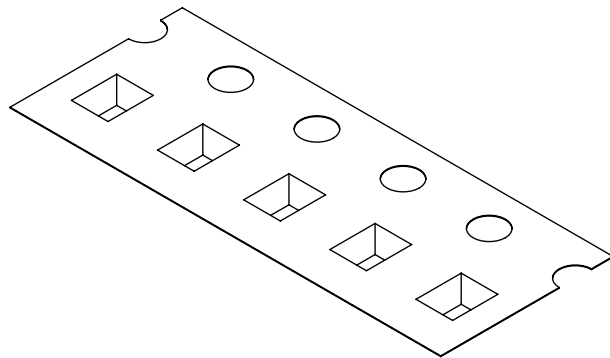
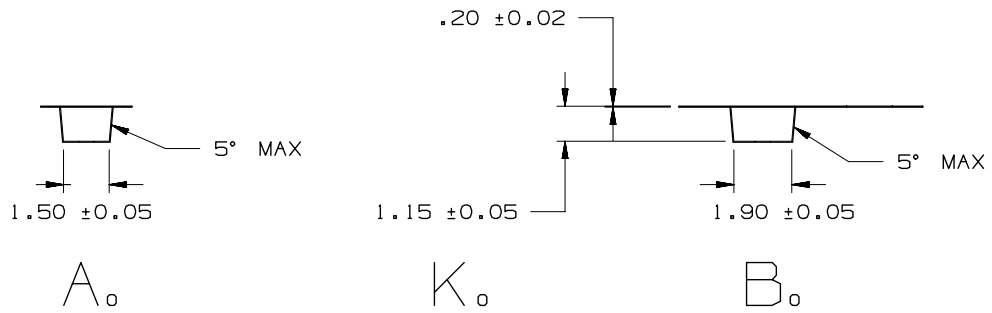
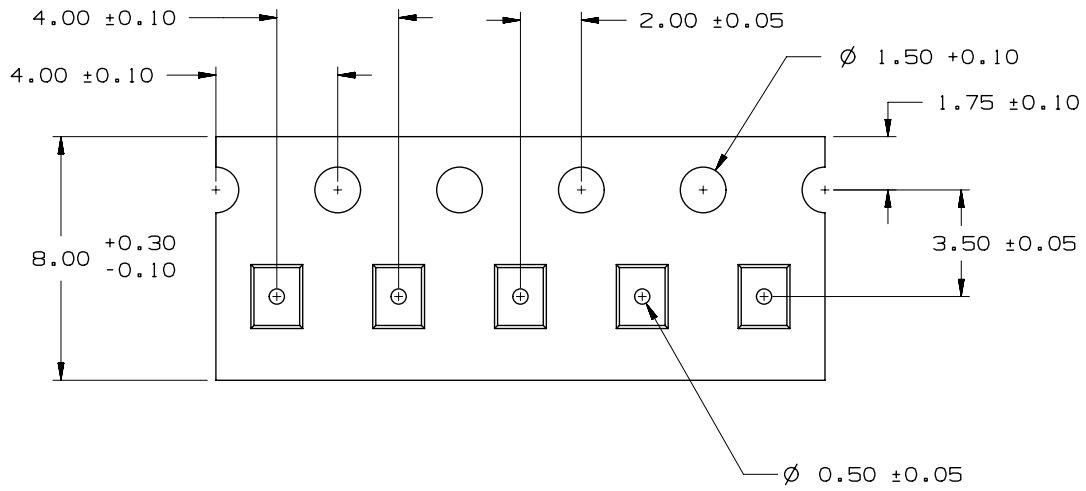


Figure 24. Emitter pocket tape packaging for LXZ1-PL01, LXZ1-PA01, LXZ1-PD01, LXZ1-PH01, LXZ1-PH02, LXZ1-PD02 and LXZ1-PL03.

# Emitter Reel Packaging

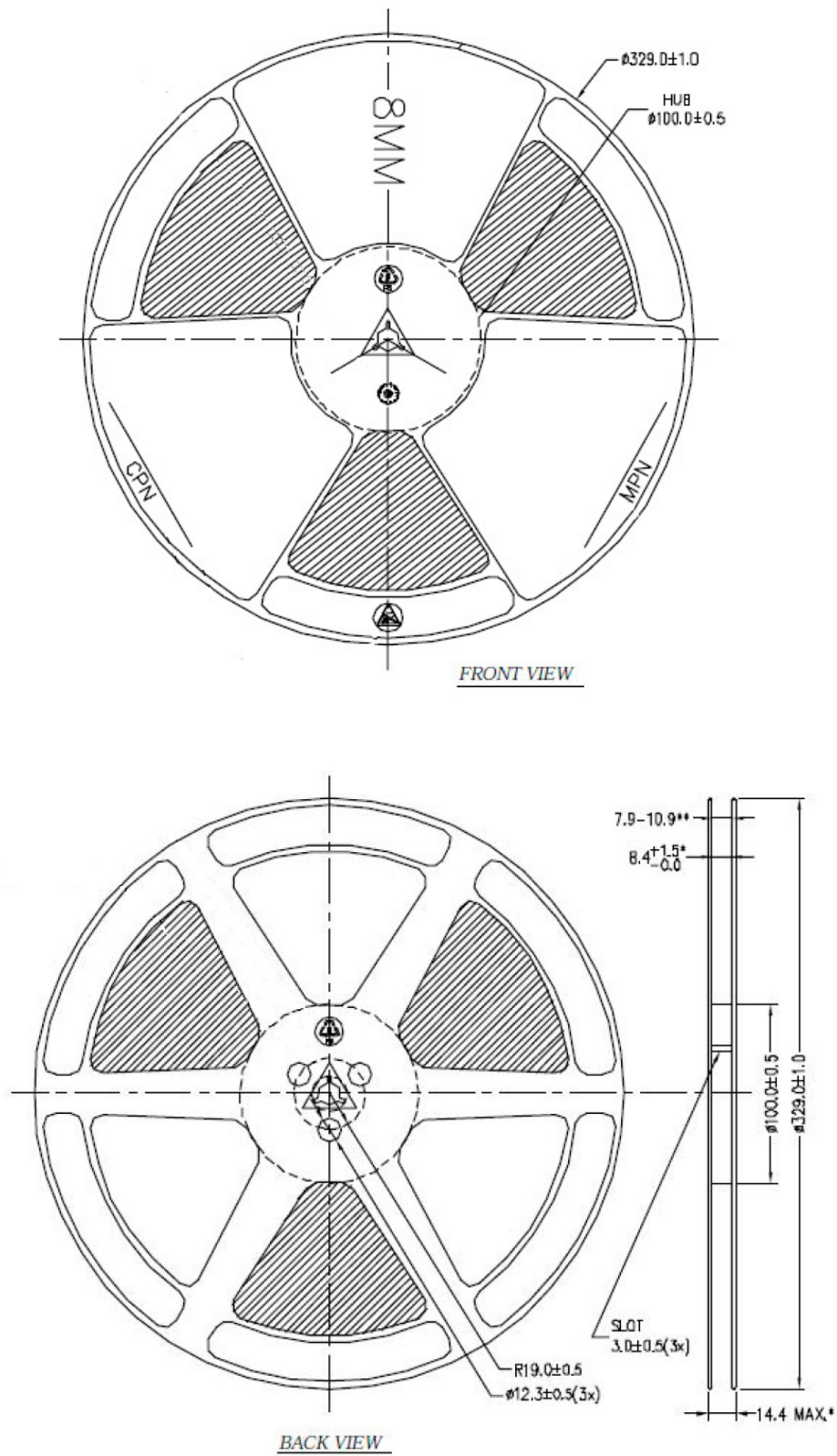


Figure 25. Emitter reel packaging.

# Product Binning and Labeling

## Purpose of Product Binning

In the manufacturing of semiconductor products, there is a variation of performance around the average values given in the technical data sheets. For this reason, Lumileds bins the LED components for luminous flux, color and forward voltage ( $V_f$ ).

## Decoding Product Bin Labeling

LUXEON Z Color Portfolio emitters are labeled using a three or four digit alphanumeric code (CAT code) depicting the bin values for emitters packaged on a single reel. All emitters packaged within a reel are of the same bin combination. Using these codes, it is possible to determine optimum mixing and matching of products for consistency in a given application.

## Format of Labeling for Emitters

Reels of lime, green, cyan, blue, royal blue, red, red-orange, amber and deep red emitters are labeled with a three digit alphanumeric CAT code following the format below.

A B C

A = Flux bin (J, K, L, M, etc.)

B = Color bin (2, 4, 6, etc.)

C =  $V_f$  bin (4, 5, etc.)

Reels of PC Amber are labeled with the following CAT code format below.

A B C D

A = Flux bin (G, H, J etc.)

BC = Color bin (A1)

D =  $V_f$  bin (5, 6 etc.)



# Luminous Flux Bins

Tables 8, 9 and 10 list the standard photometric luminous flux/radiometric power bins for LUXEON Z color emitters (tested and binned at 500mA). 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 colors.

**Table 8. Luminous Flux Bins - All Colors excluding Hot Tested AlInGaP (LXZ1-PD02, LXZ1-PH02, LXZ1-PL03), Royal Blue and Deep Red**

| Bin Code | Minimum Flux (lm) | Maximum Flux (lm) |
|----------|-------------------|-------------------|
| 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               |

**Table 9. Radiometric Power Bins - Royal Blue (LXZ1-PR01) and Deep Red (LXZ1-PA01)**

| Bin Code | Minimum Radiometric Flux (mW) | Maximum Radiometric Flux (mW) |
|----------|-------------------------------|-------------------------------|
| A        | 250                           | 300                           |
| B        | 300                           | 350                           |
| C        | 350                           | 400                           |
| D        | 400                           | 450                           |
| E        | 450                           | 500                           |
| F        | 500                           | 550                           |
| G        | 550                           | 600                           |
| H        | 600                           | 650                           |
| I        | 650                           | 700                           |

**Table 10. Luminous Flux Bins - Hot Tested Red (LXZ1-PD02), Red Orange (LXZ1-PH02) and Amber (LXZ1-PL03)**

| Bin Code | Minimum Radiometric Flux (mW) | Maximum Radiometric Flux (mW) |
|----------|-------------------------------|-------------------------------|
| A        | 16                            | 24                            |
| B        | 24                            | 32                            |
| C        | 32                            | 40                            |
| D        | 40                            | 48                            |
| E        | 48                            | 56                            |
| F        | 56                            | 64                            |
| G        | 64                            | 72                            |

# Color Bins

Table 11. Dominant Wavelength Bin Structure for LUXEON Z Green (LXZ1-PM01)

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 1        | 520                              | 525                              |
| 2        | 525                              | 530                              |
| 3        | 530                              | 535                              |
| 4        | 535                              | 540                              |

Table 12. Dominant Wavelength Bin Structure for LUXEON Z Cyan (LXZ1-PE01)

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 1        | 490                              | 498                              |
| 2        | 498                              | 508                              |
| 6        | 490                              | 495                              |
| 7        | 495                              | 500                              |
| 8        | 500                              | 505                              |
| 9        | 505                              | 510                              |

Table 13. Dominant Wavelength Bin Structure for LUXEON Z Blue (LXZ1-PB01)

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 1        | 460                              | 465                              |
| 2        | 465                              | 470                              |
| 3        | 470                              | 475                              |
| 4        | 475                              | 480                              |
| 5        | 480                              | 485                              |

Table 14. Peak Wavelength Bin Structure for LUXEON Z Royal Blue (LXZ1-PR01)

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 3        | 440                              | 445                              |
| 4        | 445                              | 450                              |
| 5        | 450                              | 455                              |
| 6        | 455                              | 460                              |

# Color Bins, Continued

Table 15. Dominant Wavelength Bin Structure for LUXEON Z Red (LXZ1-PD01)

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 4        | 620                              | 630                              |
| 5        | 630                              | 640                              |

Table 16. Dominant Wavelength Bin Structure for LUXEON Z Red-Orange (LXZ1-PH01)

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 2        | 610                              | 620                              |

Table 17. Dominant Wavelength Bin Structure for LUXEON Z Amber (LXZ1-PL01)

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 1        | 585                              | 587                              |
| 2        | 587                              | 590                              |
| 4        | 590                              | 592                              |
| 6        | 592                              | 595                              |

Table 18. Peak Wavelength Bin Structure for LUXEON Z Deep Red (LXZ1-PA01)

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 6        | 650                              | 660                              |
| 7        | 660                              | 670                              |

Table 19. Peak Wavelength Bin Structure for LUXEON Z Amber (LXZ1-PL03)<sup>[1]</sup>

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 6        | 594                              | 599                              |
| 7        | 599                              | 604                              |

Table 20. Peak Wavelength Bin Structure for LUXEON Z Red-Orange (LXZ1-PH02)<sup>[1]</sup>

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 2        | 614                              | 624                              |

Table 21. Peak Wavelength Bin Structure for LUXEON Z Red (LXZ1-PD02)<sup>[1]</sup>

| Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|----------|----------------------------------|----------------------------------|
| 4        | 624                              | 634                              |

Notes for Tables 19, 20 and 21:

1. 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 technology. At  $T_j = 25^\circ\text{C}$  these hot-tested parts will have the same typical spectral outputs as their cold-tested counterparts.

# Color Bins, Continued

Table 22. Dominant Wavelength Bin Structure for LUXEON Z Lime (LXZ1-PX01) and PC Amber (LXZ1-PL02)

| Color    | Bin Code | x      | y      |
|----------|----------|--------|--------|
| Lime     | 1        | 0.3819 | 0.5055 |
|          |          | 0.4191 | 0.5790 |
|          |          | 0.4327 | 0.5655 |
|          |          | 0.3972 | 0.4986 |
| PC Amber | A1       | 0.5622 | 0.4372 |
|          |          | 0.5576 | 0.4326 |
|          |          | 0.5775 | 0.4132 |
|          |          | 0.5843 | 0.4151 |

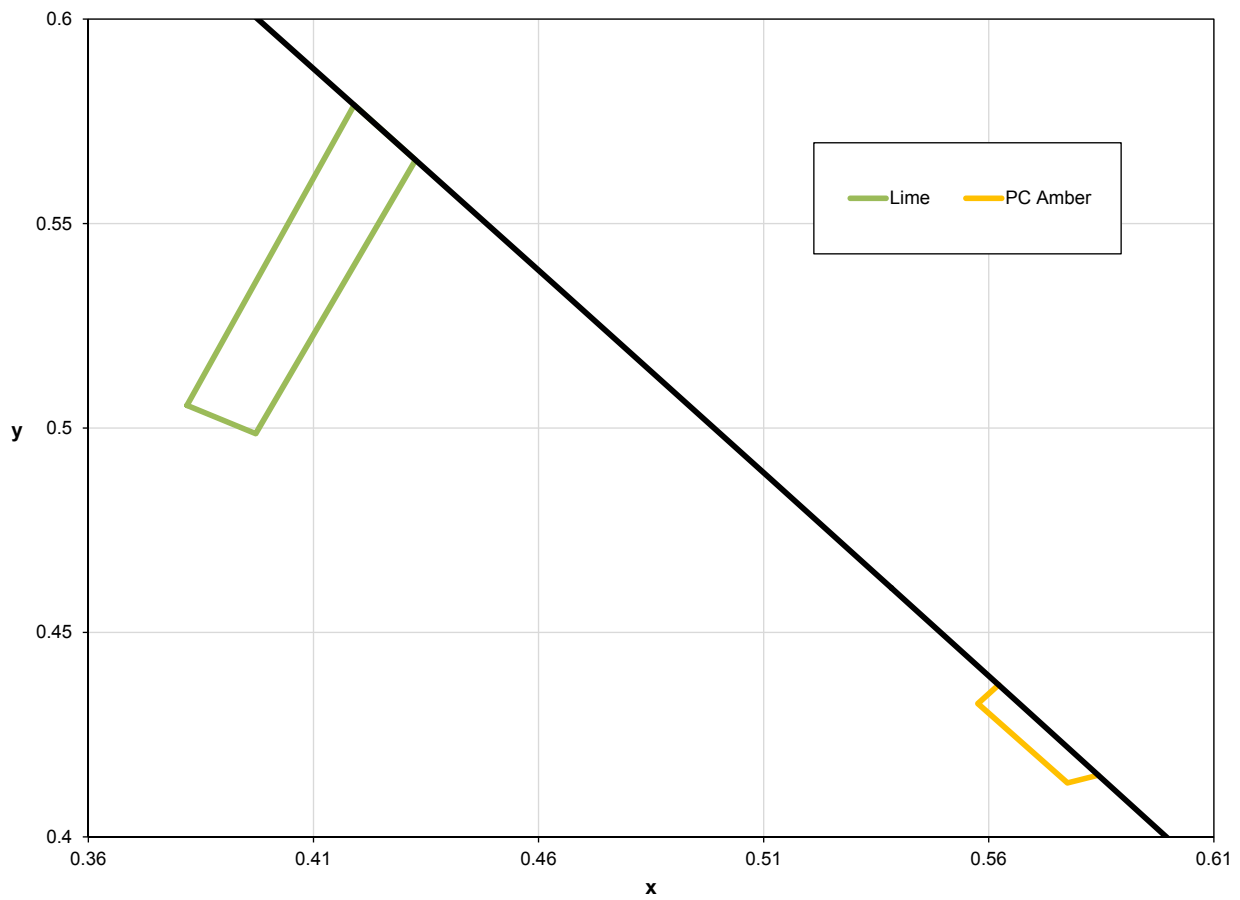


Figure 26. Color bin structure for LXZ1-PX01 and LXZ1-PL02.

## Forward Voltage Bins

The following forward voltage bins include the minimum and maximum  $V_f$  bin values for the emitter. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance.

Table 23. Voltage Bins

| Bin Code | Minimum Forward Voltage (V) | Maximum Forward Voltage (V) |
|----------|-----------------------------|-----------------------------|
| 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                        |

# About Lumileds

Lumileds is the light engine leader, delivering innovation, quality, and reliability.

For 100 years, Lumileds commitment to innovation has helped customers pioneer breakthrough products in the automotive, consumer and illumination markets.

Lumileds is shaping the future of light with our LEDs and automotive lamps, and helping our customers illuminate how people see the world around them.

To learn more about our portfolio of light engines visit [www.lumileds.com](http://www.lumileds.com).



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