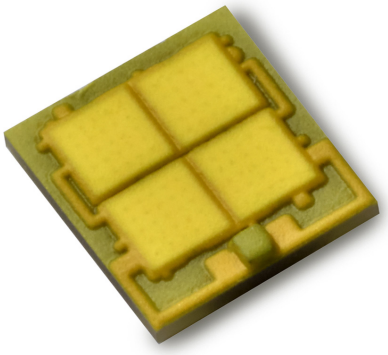
# LUXEON MZ

## Best combination of brightness, uniformity and luminance enabling precision light control



LUXEON MZ is an undomed multi-die LED designed to enable outdoor and industrial applications with all of the features of LUXEON M including the identical solder footprint, but allowing for tighter beam control and higher punch due to a smaller apparent source size. With *Freedom from Binning* and leading performance, LUXEON MZ falls within a single 3- or 5-step MacAdam ellipse centered in ANSI to ensure color consistency from LED to LED, delivering high efficacy and high flux density from a unif orm source with tight correlated color temperature control. The superior quality of light, volume of lumens, and real world efficacy enable leading performance and efficient solution development in a wide variety of lighting segments.

### FEATURES AND BENEFITS

- Undomed package for improved punch and exceptional luminance
- Common footprint as LUXEON M for compatibility with existing designs
- Industry leading 11.2V package delivers exceptional efficacy
- Leading thermal resistance enables flexible system design to optimize for lm/$ and lm/W
- Exceeds ENERGY STAR® lumen maintenance requirements

### PRIMARY APPLICATIONS

- Architectural
- High Bay & Low Bay
- Lamps
- Outdoor
- Specialty Lighting
- Spotlights

c UL us No. E352519 RoHS COMPLIANT

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# General Product Information

## Product Test Conditions

LUXEON MZ LEDs are tested and binned with a drive current of 700mA for LUXEON MZ 12V, 1400mA for LUXEON MZ 6V and 2800mA for LUXEON M 3V at a junction temperature, $T_j$, of 85ºC.

## Part Number Nomenclature

Part numbers for LUXEON MZ follow the convention below:

L M Z **A** – **B C D D** – **E E E E**

Where:

- **A** – designates minimum CRI (7=70, 8=80, 9=90CRI, 0=Royal Blue)
- **B** – designates voltage (S=12V, R=6V, Q=3V)
- **C** – designates color (W=White, R=Royal Blue)
- **D D** – designates CCT (27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K , 00=Royal Blue)
- **E E E E** – designates minimum flux lumen (optional)

Therefore, the following part number is used for a white LUXEON MZ 12V 3000K 80CRI:

L M Z **8** – **S W 3 0** – **x x x x**

## 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 MZ 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 MZ White at test current, $T_j$=85°C.**

| VOLTAGE | NOMINAL CCT [2] | MINIMUM CRI | LUMINOUS FLUX [1] (lm) | | TEST CURRENT (mA) | PART NUMBER |
|---|---|---|---|---|---|---|
| | | | MINIMUM | TYPICAL | | |
| 12V | 3000K | 70 | 805 | 840 | 700 | LMZ7-SW30 |
| | 4000K | 70 | 870 | 940 | 700 | LMZ7-SW40 |
| | 5000K | 70 | 870 | 950 | 700 | LMZ7-SW50 |
| | 5700K | 70 | 900 | 980 | 700 | LMZ7-SW57 |
| | 6500K | 70 | 900 | 980 | 700 | LMZ7-SW65 |
| | 2700K | 80 | 710 | 760 | 700 | LMZ8-SW27 |
| | 3000K | 80 | 730 | 781 | 700 | LMZ8-SW30 |
| | 3500K | 80 | 730 | 800 | 700 | LMZ8-SW35 |
| | 4000K | 80 | 840 | 880 | 700 | LMZ8-SW40 |
| | 5000K | 80 | 840 | 890 | 700 | LMZ8-SW50 |
| | 2700K | 90 | 560 | 600 | 700 | LMZ9-SW27 |
| | 3000K | 90 | 600 | 640 | 700 | LMZ9-SW30 |
| | 5700K | 90 | 700 | 770 | 700 | LMZ9-SW57 |
| 6V | 3000K | 70 | 805 | 840 | 1400 | LMZ7-RW30 |
| | 4000K | 70 | 870 | 940 | 1400 | LMZ7-RW40 |
| | 5000K | 70 | 870 | 950 | 1400 | LMZ7-RW50 |
| | 5700K | 70 | 900 | 980 | 1400 | LMZ7-RW57 |
| | 6500K | 70 | 900 | 980 | 1400 | LMZ7-RW65 |
| | 2700K | 80 | 710 | 760 | 1400 | LMZ8-RW27 |
| | 3000K | 80 | 730 | 781 | 1400 | LMZ8-RW30 |
| | 3500K | 80 | 730 | 800 | 1400 | LMZ8-RW35 |
| | 4000K | 80 | 840 | 880 | 1400 | LMZ8-RW40 |
| | 5000K | 80 | 840 | 890 | 1400 | LMZ8-RW50 |
| | 2700K | 90 | 560 | 600 | 1400 | LMZ9-RW27 |
| | 3000K | 90 | 600 | 640 | 1400 | LMZ9-RW30 |
| | 5700K | 90 | 700 | 770 | 1400 | LMZ9-RW57 |
| 3V | 3000K | 70 | 805 | 840 | 2800 | LMZ7-QW30 |
| | 4000K | 70 | 870 | 940 | 2800 | LMZ7-QW40 |
| | 5000K | 70 | 870 | 950 | 2800 | LMZ7-QW50 |
| | 5700K | 70 | 900 | 980 | 2800 | LMZ7-QW57 |
| | 6500K | 70 | 900 | 980 | 2800 | LMZ7-QW65 |
| | 2700K | 80 | 710 | 760 | 2800 | LMZ8-QW27 |
| | 3000K | 80 | 730 | 781 | 2800 | LMZ8-QW30 |
| | 3500K | 80 | 730 | 800 | 2800 | LMZ8-QW35 |
| | 4000K | 80 | 840 | 880 | 2800 | LMZ8-QW40 |
| | 5000K | 80 | 840 | 890 | 2800 | LMZ8-QW50 |
| | 2700K | 90 | 560 | 600 | 2800 | LMZ9-QW27 |
| | 3000K | 90 | 600 | 640 | 2800 | LMZ9-QW30 |
| | 5700K | 90 | 700 | 770 | 2800 | LMZ9-QW57 |

Notes for Table 1:
1. Lumileds maintains a tolerance of ±2 on CRI and ±6.5% on luminous flux measurements.
2. Typical CRI is approximately 2 points higher than the minimum CRI specified, but this is not guaranteed.

**Table 1b. Product performance for LUXEON MZ Royal Blue at test current, $T_j$=85°C.**

| VOLTAGE | DOMINANT WAVELENGTH (nm) | | RADIOMETRIC POWER (mW) | | TEST CURRENT (mA) | PART NUMBER |
|---|---|---|---|---|---|---|
| | MINIMUM | MAXIMUM | MINIMUM | TYPICAL | | |
| 12V | 445 | 460 | 3500 | 3600 | 700 | LMZ0-SR00 |
| 6V | 445 | 460 | 3500 | 3600 | 1400 | LMZ0-RR00 |
| 3V | 445 | 460 | 3500 | 3600 | 2800 | LMZ0-QR00 |

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

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# Optical Characteristics

**Table 2. Optical characteristics for LUXEON MZ at test current, $T_j$=85°C.**

| PART NUMBER | TYPICAL TOTAL INCLUDED ANGLE [1] | TYPICAL VIEWING ANGLE [2] |
|---|---|---|
| LMZx-xWxx | 140° | 120° |

Notes for Table 2:
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 3. Electrical and thermal characteristics for LUXEON MZ at test current, $T_j$=85°C.**

| PART NUMBER | FORWARD VOLTAGE (V) [1] | | | TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE (mV/°C) [2] | TYPICAL THERMAL RESISTANCE – JUNCTION TO SOLDER PAD (°C/W) |
|---|---|---|---|---|---|
| | MINIMUM | TYPICAL | MAXIMUM | | |
| LMZx-Sxxx | 10.50 | 11.20 | 11.70 | -7.00 | 1.25 |
| LMZx-Rxxx | 5.25 | 5.60 | 6.00 | -3.50 | 1.25 |
| LMZx-Qxxx | 2.63 | 2.80 | 3.00 | -1.75 | 1.25 |

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 4. Absolute maximum ratings for LUXEON MZ.**

| PARAMETER | MAXIMUM PERFORMANCE |
|---|---|
| DC Forward Current [1,2] | 1200mA for LMZx-Sxxx<br>2400mA for LMZx-Rxxx<br>4800mA for LMZx-Qxxx |
| Peak Pulsed Forward Current [1,3] | 1375mA for LMZx-Sxxx<br>2750mA for LMZx-Rxxx<br>5500mA for LMZx-Qxxx |
| LED Junction Temperature [1] (DC & Pulse) | -40°C to 135°C |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012) | Class 3B |
| Operating Case Temperature [1] | -40°C to 120°C |
| Storage Temperature | -40°C to 120°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 15% of the maximum allowable DC forward current
3. At 10% duty cycle with pulse width of 10ms.

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# Characteristic Curves

## Spectral Power Distribution Characteristics

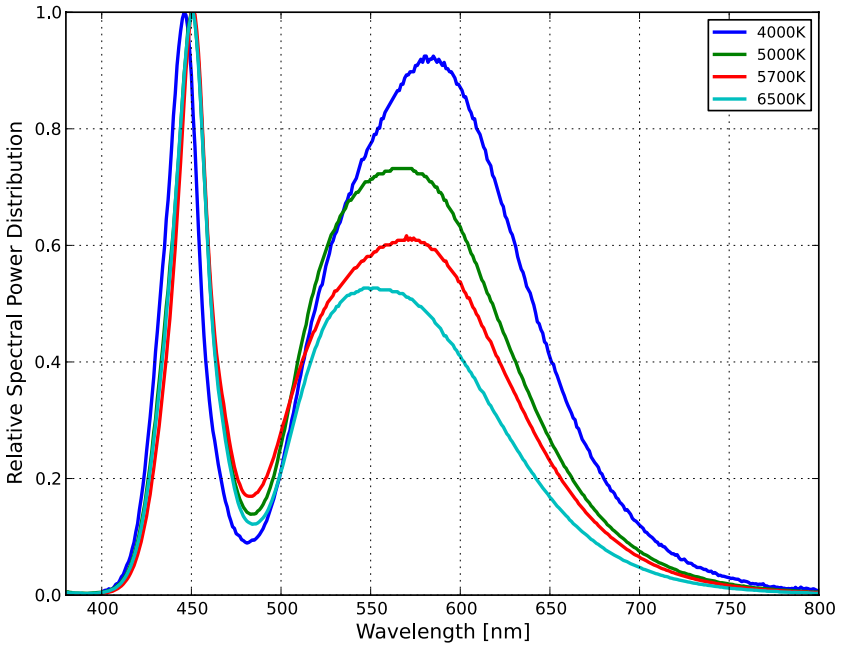


Figure 1a: Typical normalized power vs. wavelength for LMZ7-xWxx at specified test current, $T_j$=85°C.

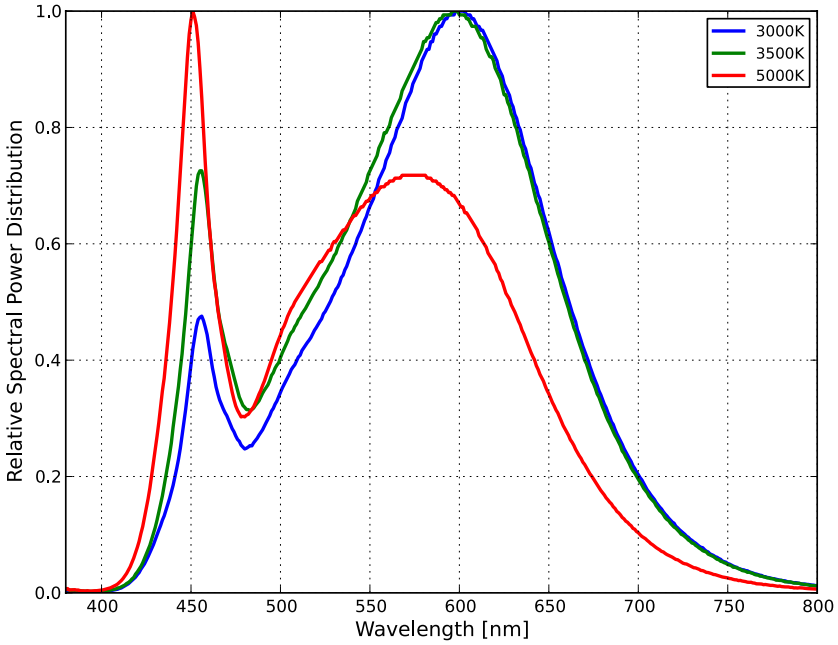


Figure 1b: Typical normalized power vs. wavelength for LMZ8-xWxx at specified test current, $T_j$=85°C.

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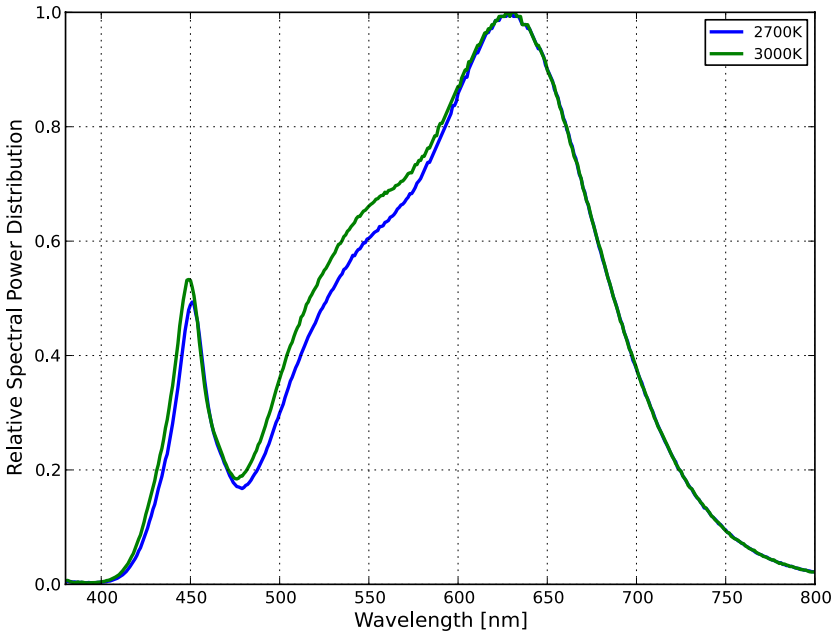


Figure 1c: Typical normalized power vs. wavelength for LMZ9-xWxx at specified test current, $T_j$=85°C.

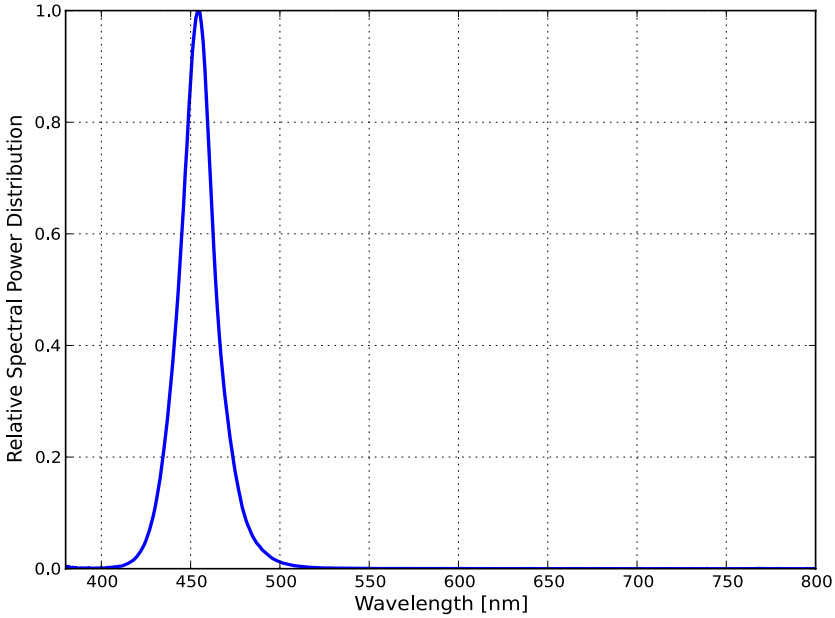


Figure 1d: Typical normalized power vs. wavelength for LMR0-xR00 at specified test current, $T_j$=85°C.

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# Light Output Characteristics

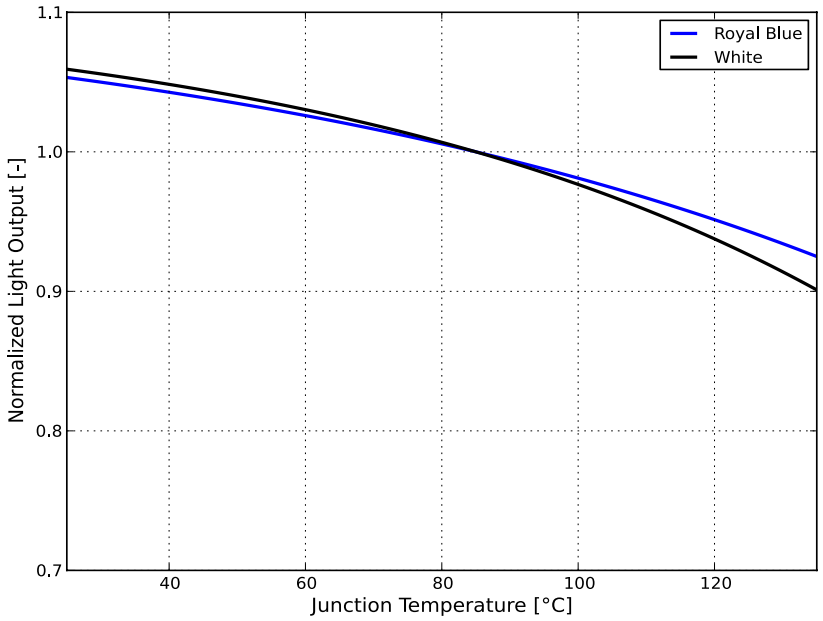


**Figure 2: Typical normalized light output vs. junction temperature for LMZx-xxxx at specified test current.**

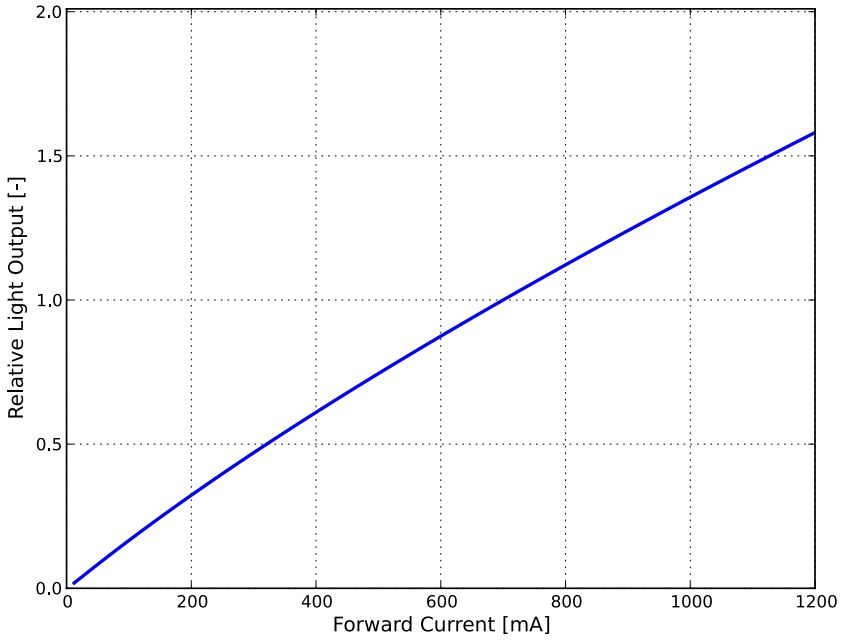


**Figure 3a: Typical normalized light output vs. forward current for LMZx-Sxxx at $T_j$=85°C.**

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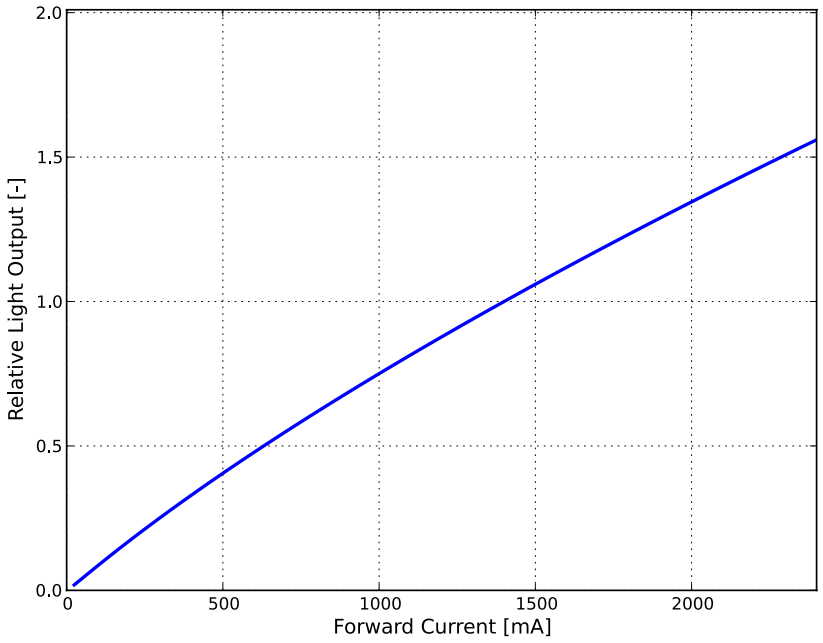


Figure 3b: Typical normalized light output vs. forward current for LMZx-Rxxx at $T_j$=85ºC.

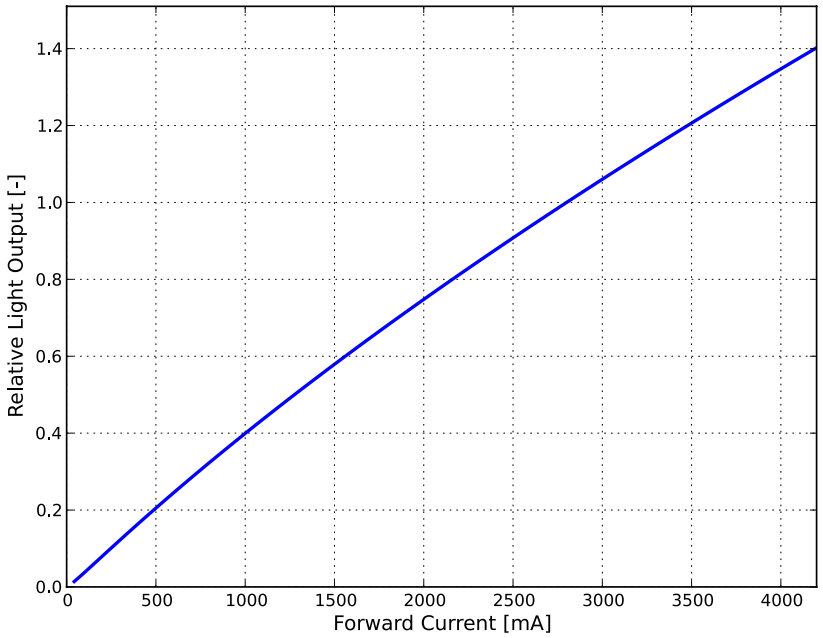


Figure 3c: Typical normalized light output vs. forward current for LMZx-Qxxx at $T_j$=85ºC.

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# Forward Current Characteristics

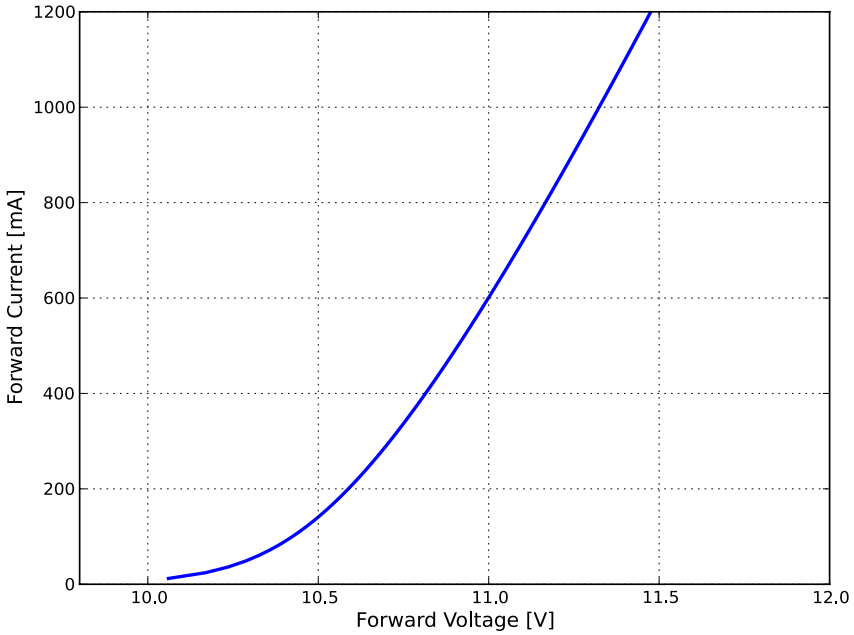


Figure 4a: Typical forward current vs. forward voltage for LMZx-Sxxx at $T_j$=85ºC.

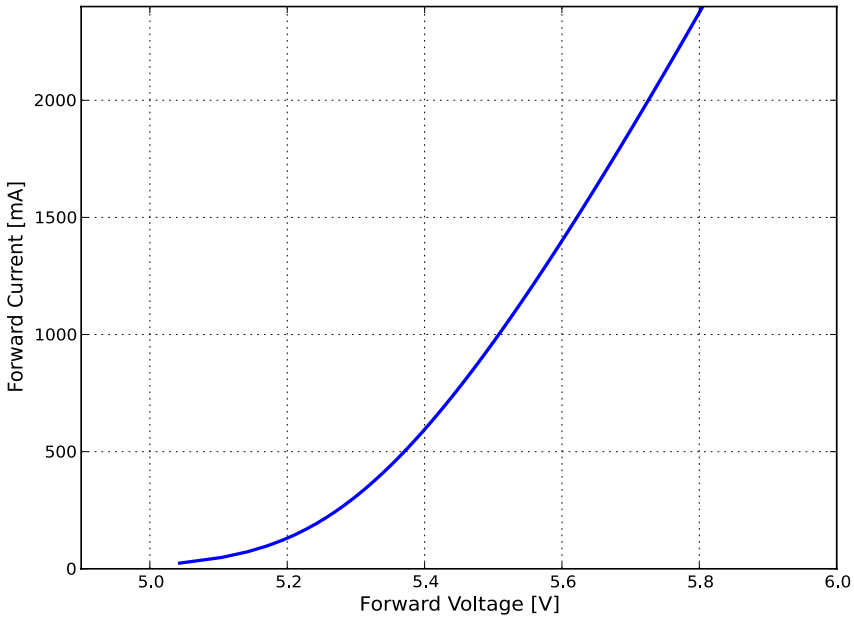


Figure 4b: Typical forward current vs. forward voltage for LMZx-Rxxx at $T_j$=85ºC.

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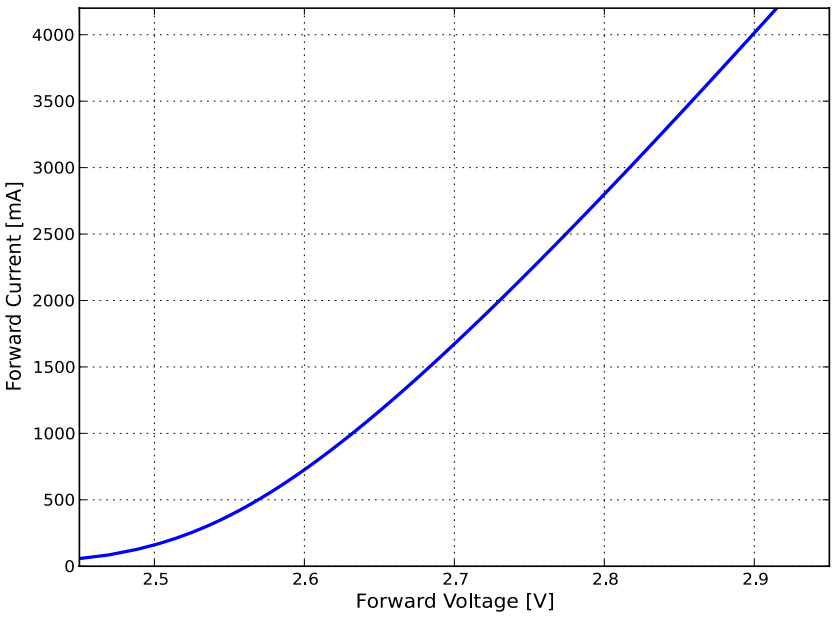


**Figure 4c: Typical forward current vs. forward voltage for LMZx-Qxxx at $T_j$=85ºC.**

# Radiation Patterns

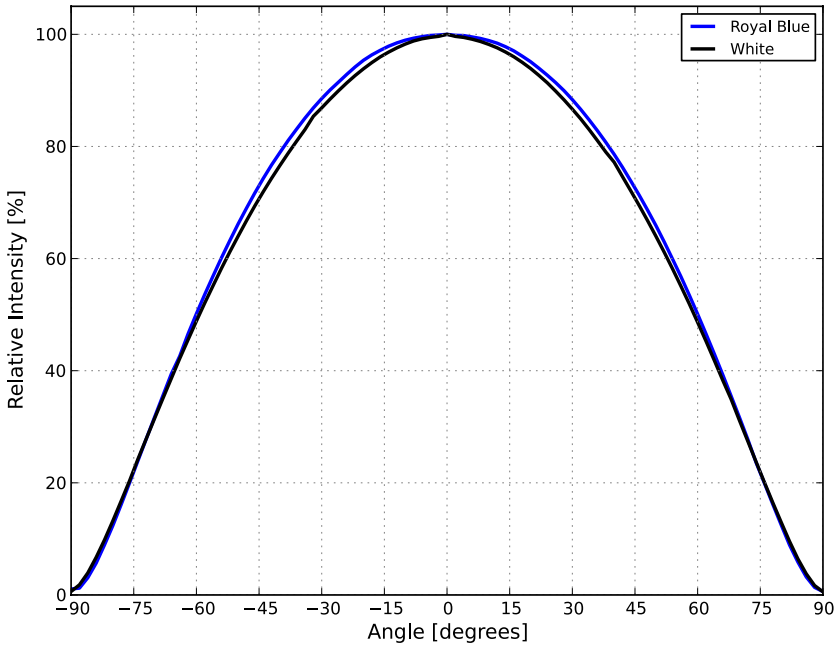


Figure 5: Typical radiation pattern for LMZx-xxxx at specified test current, $T_j$=85ºC.

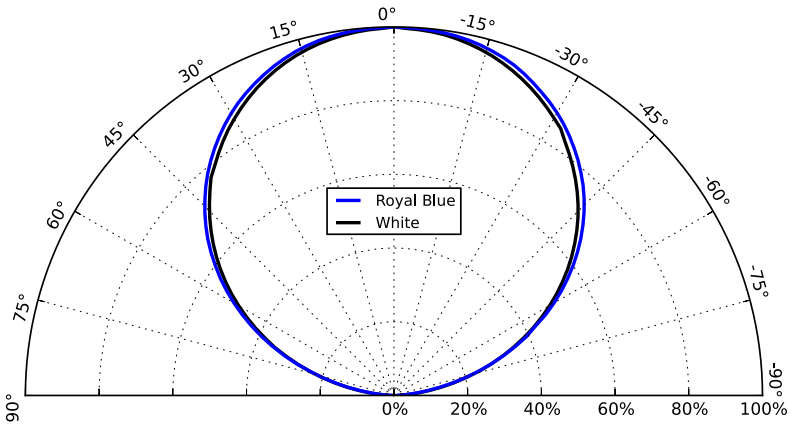


Figure 6: Typical polar radiation pattern for LMZx-xxxx at specified test current, $T_j$=85ºC.

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

**A B C D**

**A** – designates color (W=White, R=Royal Blue)

**B** – designates color bin (example: 1=6500K, 2=5700K, 3=5000K, 5=4000K, 6=3500K, 7=3000K, 8=2700K, 00= Royal Blue)

**C** – designates color space (example: 5=5-step MacAdam Ellipse, 3=3-step MacAdam Ellipse)

**D** – designates forward voltage bin (example: F, G, H)

Therefore, LUXEON MZ with a lumen range of 630 to 680, color bin of 3000K, 5-step MacAdam ellipse and a forward voltage range of 2.63 to 2.75V for 3 volt parts has the following CAT code:

**M 7 5 F**

Reels of LUXEON MZ Royal Blue LEDs are labeled using a 3-digit alphanumeric CAT code following the format below:

**A B C**

**A** – designates radiometric power bin (example: B=4200 to 4400mW, D=4600 to 4800mW)

**B** – designates dominant wavelength bin (example: 5=450 to 455nm, 6=455 to 460nm)

**C** – designates forward voltage bin (example: F, G, H)

Therefore, a Royal Blue LUXEON MZ with a radiometric power range of 4200 to 4400mW, dominant wavelength 450 to 455nm a forward voltage range of 11.50 to 11.70V for 12 volt parts has the following CAT code:

**B 5 H**

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# Luminous Flux Bins

Table 5 lists the standard photometric luminous flux bins for LUXEON MZ 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 MZ White.**

| BIN | LUMINOUS FLUX (lm) | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| K | 550 | 590 |
| L | 590 | 630 |
| M | 630 | 680 |
| N | 680 | 730 |
| P | 730 | 780 |
| Q | 780 | 840 |
| R | 840 | 900 |
| S | 900 | 970 |
| T | 970 | 1040 |
| U | 1040 | 1120 |
| V | 1120 | 1200 |
| W | 1200 | 1290 |

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 MZ Royal Blue.**

| BIN | RADIOMETRIC POWER (mW) | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| 3 | 3500 | 3600 |
| 4 | 3600 | 3800 |
| 5 | 3800 | 4000 |
| A | 4000 | 4200 |
| B | 4200 | 4400 |

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

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# Color Bin Definition

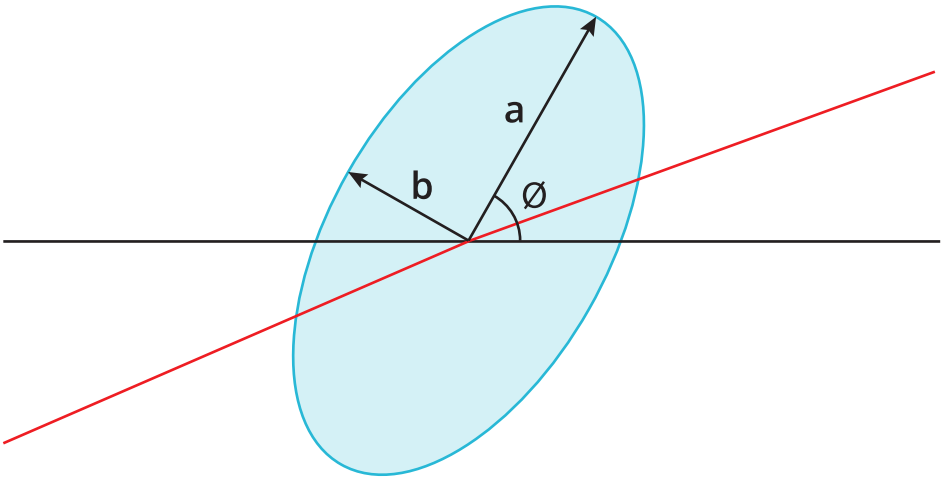


Figure 7: 3- and 5-step MacAdam ellipse illustration for Table 7.

Table 7. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON MZ.

| NOMINAL CCT | COLOR SPACE | CENTER POINT (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 | 53.22 |
| 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 | 53.72 |
| 5000K | Single 3-step MacAdam ellipse | 0.3447, 0.3553 | 0.00822 | 0.00354 | 59.62 |
| 3000K | Single 5-step MacAdam ellipse | 0.4338, 0.4030 | 0.01390 | 0.00680 | 53.22 |
| 4000K | Single 5-step MacAdam ellipse | 0.3818, 0.3797 | 0.01565 | 0.00670 | 53.72 |
| 5000K | Single 5-step MacAdam ellipse | 0.3447, 0.3553 | 0.01370 | 0.00590 | 59.62 |
| 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 7:
1. Lumileds maintains a tolerance of ±0.005 on x and y coordinates in the CIE 1931 color space.

# Dominant Wavelength Bins

Table 8. Dominant wavelength bin definition for LUXEON MZ Royal Blue.

| BIN | DOMINANT WAVELENGTH (nm) | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| 4 | 445 | 450 |
| 5 | 450 | 455 |
| 6 | 455 | 460 |

Notes for Table 8:
1. Lumileds maintains a tolerance of ±0.5nm on dominant wavelength measurements.

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# Forward Voltage Bins

**Table 9. Forward voltage bin definitions for LUXEON MZ.**

| PART NUMBER | BIN | FORWARD VOLTAGE (V) [1] | |
|---|---|---|---|
| | | MINIMUM | MAXIMUM |
| LMZx-Sxxx | F | 10.5 | 11.0 |
| | G | 11.0 | 11.5 |
| | H | 11.5 | 11.7 |
| LMZx-Rxxx | F | 5.25 | 5.50 |
| | G | 5.50 | 5.75 |
| | H | 5.75 | 6.00 |
| LMZx-Qxxx | F | 2.63 | 2.75 |
| | G | 2.75 | 2.88 |
| | H | 2.88 | 3.00 |

Notes for Table 9:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.

# Mechanical Dimensions

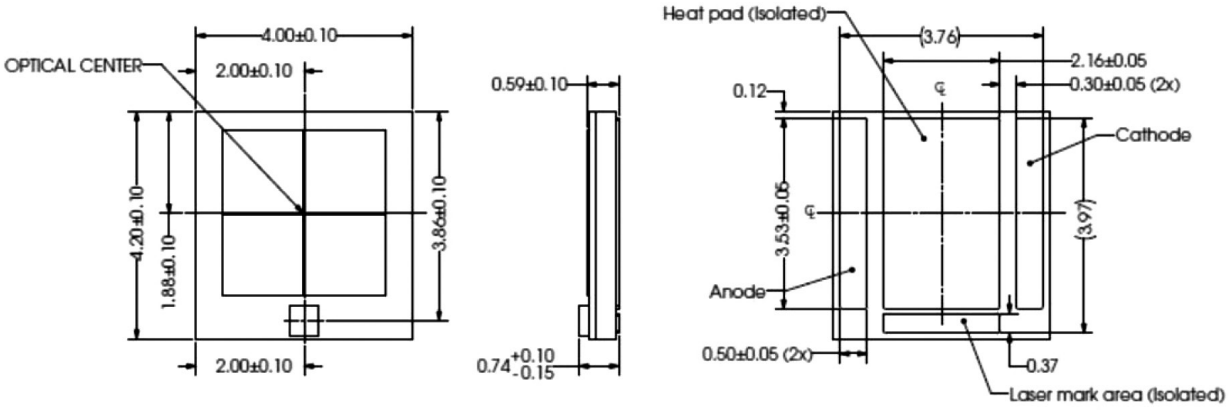


**Figure 8: Mechanical dimensions for LUXEON MZ.**

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

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# Reflow Soldering Guidelines

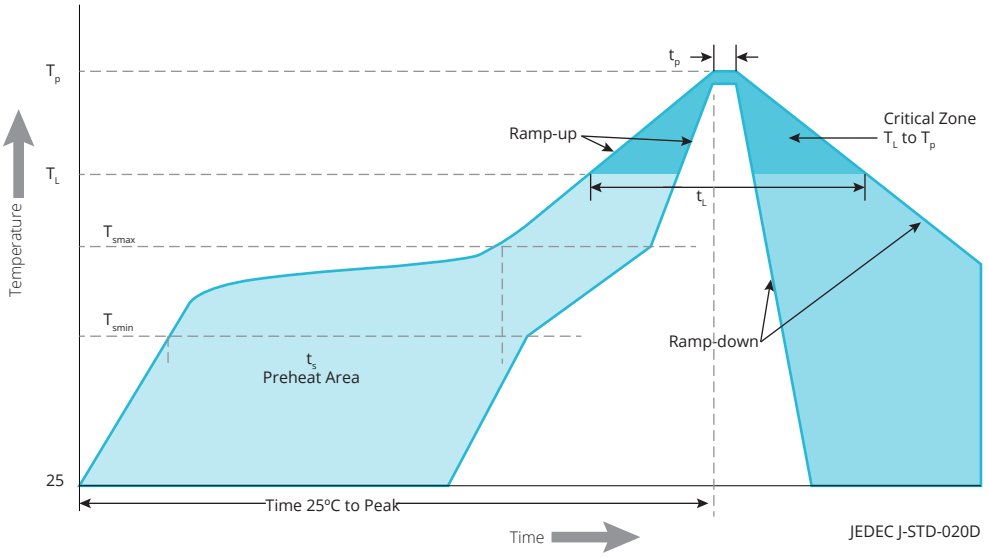


**Figure 9: Visualization of the acceptable reflow temperature profile as specified in Table 10.**

**Table 10. Reflow profile characteristics for LUXEON MZ.**

| 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 ($T_{smax}$ 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 | 6°C / second maximum |
| Time 25°C to Peak Temperature | 8 minutes maximum |

## JEDEC Moisture Sensitivity

**Table 11. Moisture sensitivity levels for LUXEON MZ.**

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

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# Solder Pad Design

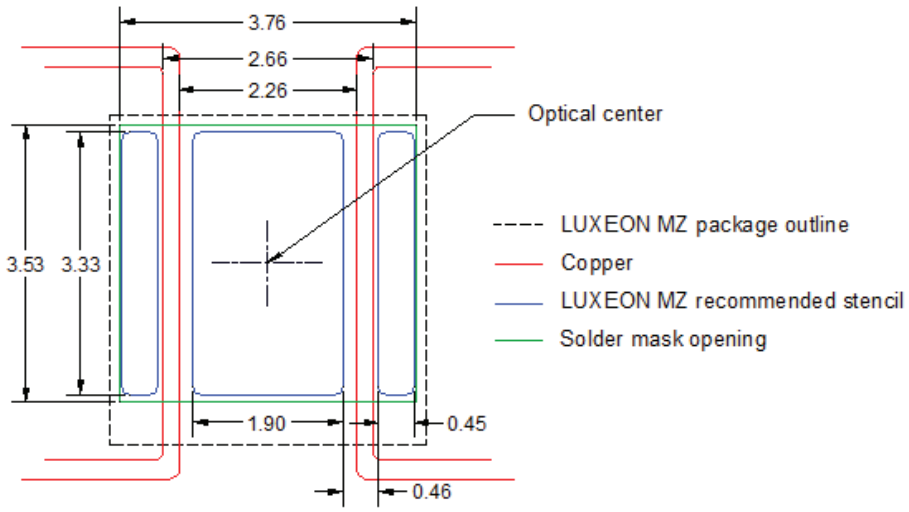


**Figure 10: Recommended PCB solder pad layout for LUXEON MZ.**

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

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# Packaging Information

## Pocket Tape Dimensions

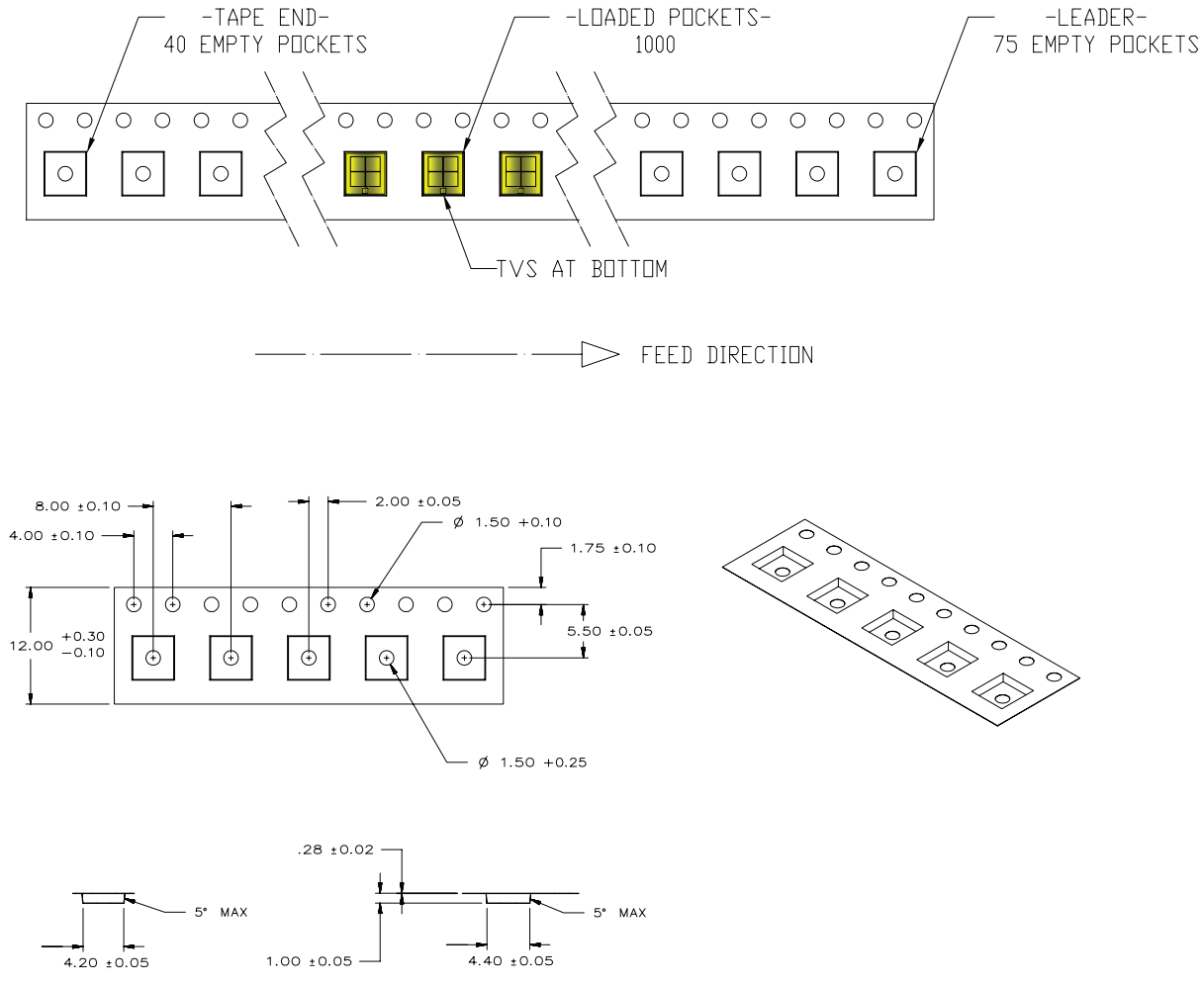


**Figure 11: Pocket Tape dimensions for LUXEON MZ.**

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

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# Reel Dimensions

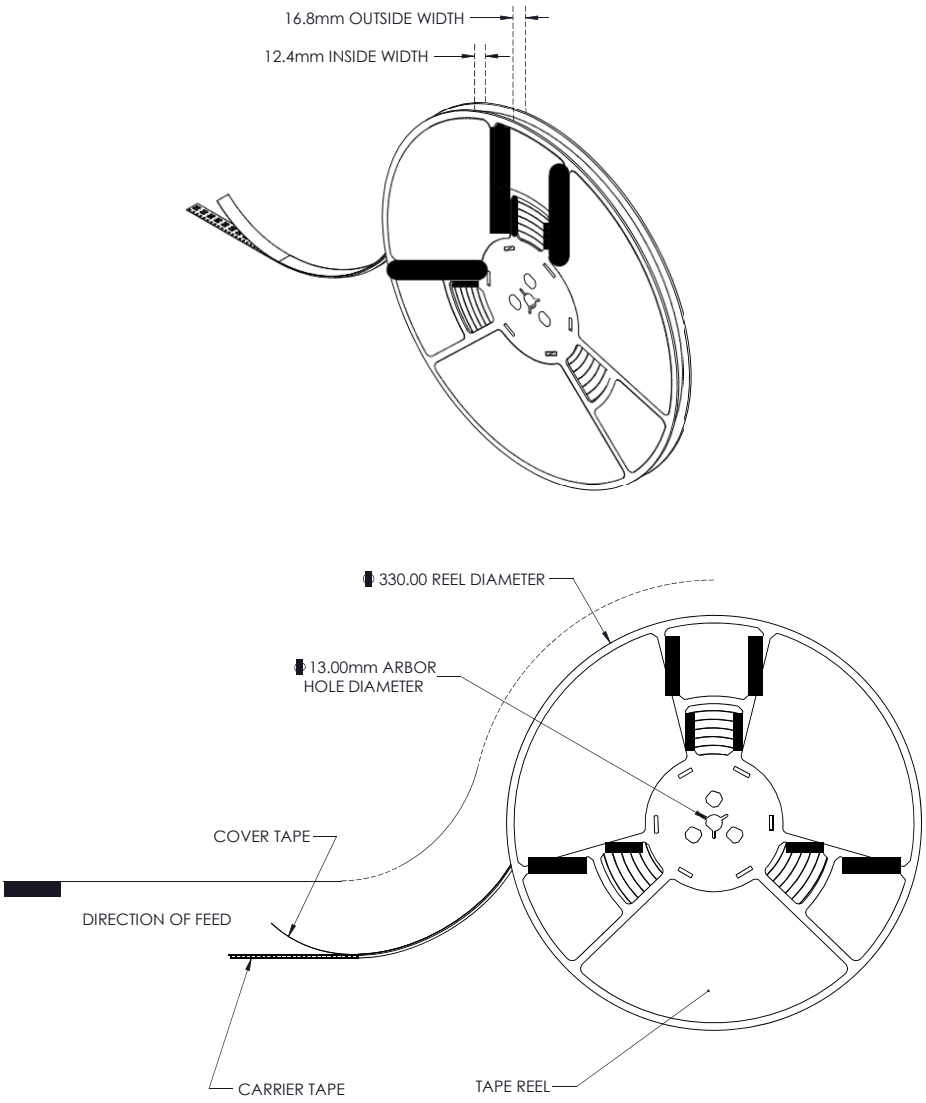


**Figure 12: Reel dimensions for LUXEON MZ.**

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

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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.

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