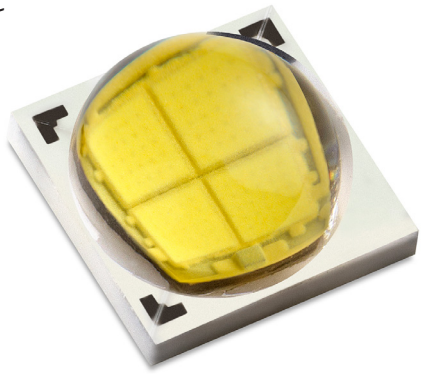
LUMILEDS

ILLUMINATION

# LUXEON MX

## Unmatched performance in a proven package



LUXEON MX is a high power emitter enabling cost effective, high reliability fixtures for High Bay and Outdoor applications requiring system efficiency of up to 157 lm/W. This breakthrough LED provides double the flux compared to previous generations with an even more robust high power design. Designed to be optically compatible with LUXEON M, LUXEON MX enables luminaire manufacturers to instantly upgrade their systems to market leading efficiency without investing design resources.

### FEATURES AND BENEFITS

- 2,000 lumens at 130 lm/W enables cost effective 100 lm/W fixtures
- 1,200 lumens at 150 lm/W enables high performance 120 lm/W fixtures
- Double the flux vs. comparable emitters in 120 lm/W systems
- More robust package for improved reliability at higher drive currents
- Same footprint and optically compatible with LUXEON M for an instant upgrade

### PRIMARY APPLICATIONS

- High Bay & Low Bay
  - Industrial
- Outdoor
  - Streetlights
  - Spotlights
- Architectural

c UL us No. E352519 RoHS COMPLIANT

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# Table of Contents


**General Product Information** . . . . . **2**
- Product Test Conditions . . . . . 2
- Part Number Nomenclature . . . . . 2
- Lumen Maintenance . . . . . 2
- Environmental Compliance . . . . . 2

**Performance Characteristics** . . . . . **3**
- Product Selection Guide . . . . . 3
- Optical Characteristics . . . . . 4
- Electrical and Thermal Characteristics . . . . . 4

**Absolute Maximum Ratings** . . . . . **4**

**Operating Conditions** . . . . . **5**

**Characteristic Curves** . . . . . **5**
- Spectral Power Distribution Characteristics . . . . . 5
- Light Output Characteristics . . . . . 6
- Forward Current Characteristics . . . . . 8
- Radiation Pattern Characteristics . . . . . 9

**Product Bin and Labeling Definitions** . . . . . **10**
- Decoding Product Bin Labeling . . . . . 10
- Luminous Flux Bins . . . . . 10
- Color Bin Definitions . . . . . 11
- Forward Voltage Bins . . . . . 12

**Mechanical Dimensions** . . . . . **12**

**Reflow Soldering Guidelines** . . . . . **13**
- JEDEC Moisture Sensitivity . . . . . 13
- Solder Pad Design . . . . . 14

**Packaging Information** . . . . . **15**
- Pocket Tape Dimensions . . . . . 15
- Reel Dimensions . . . . . 16


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# General Product Information

## Product Test Conditions

LUXEON MX LEDs are tested and binned with a DC drive current specified below at a junction temperature, $T_j$, of 85°C:

700mA – LUXEON MX 12V
1400mA – LUXEON MX 6V

## Part Number Nomenclature

Part numbers for LUXEON MX follow the convention below:

L 1 M X – **A A B B C C C D E E E E** 0

Where:

**A A** – designates CCT (40=4000K, 50=5000K, 57=5700K, 65=6500K)

**B B** – designates minimum CRI (70=70CRI, 80=80CRI, 90=90CRI)

**C C C** – designates voltage (12V=12V, 06V=6V)

**D** – designates color (0=full distribution, 3=3-step, 5=5-step, 7=7-step)

**E E E E** – designates Lumileds internal classification

Therefore, the following part number is used for a LUXEON MX 4000K 70CRI, 12V full distribution LED:

L 1 M X – **4 0 7 0 1 2 V 0 0 0 0 0** 0

## Lumen Maintenance

Please contact your local Sales Representative or Lumileds Technical Solutions Manager for more information about the long-term performance of this product.

## Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON MX 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).

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# Performance Characteristics

## Product Selection Guide

Table 1. Product performance of LUXEON MX at specified test current, $T_j$=85ºC.

| VOLTAGE | NOMINAL CCT | MINIMUM CRI [1, 2] | LUMINOUS FLUX [1] (lm) | | | TEST CURRENT (mA) | PART NUMBER |
|---|---|---|---|---|---|---|---|
| | | | MINIMUM | TYPICAL | TYPICAL $T_j$=25°C | | |
| 12V | 2700K | 70 | 970 | 1050 | 1095 | 700 | L1MX-277012V000000 |
| | 3000K | 70 | 1040 | 1161 | 1270 | 700 | L1MX-307012V000000 |
| | 4000K | 70 | 1160 | 1232 | 1345 | 700 | L1MX-407012V000000 |
| | 5000K | 70 | 1160 | 1232 | 1345 | 700 | L1MX-507012V000000 |
| | 5700K | 70 | 1160 | 1232 | 1345 | 700 | L1MX-577012V000000 |
| | 6500K | 70 | 1160 | 1232 | 1345 | 700 | L1MX-657012V000000 |
| | 2700K | 80 | 900 | 988 | 1095 | 700 | L1MX-278012V000000 |
| | 3000K | 80 | 970 | 1000 | 1110 | 700 | L1MX-308012V000000 |
| | 4000K | 80 | 1040 | 1115 | 1220 | 700 | L1MX-408012V000000 |
| | 5000K | 80 | 1040 | 1115 | 1220 | 700 | L1MX-508012V000000 |
| | 2700K | 90 | 730 | 800 | 872 | 700 | L1MX-279012V000000 |
| | 3000K | 90 | 730 | 835 | 910 | 700 | L1MX-309012V000000 |
| | 4000K | 90 | 900 | 965 | 1046 | 700 | L1MX-409012V000000 |
| | 5700K | 90 | 900 | 965 | 1046 | 700 | L1MX-579012V000000 |
| 6V | 2700K | 70 | 970 | 1050 | 1095 | 1400 | L1MX-277006V000000 |
| | 3000K | 70 | 1040 | 1161 | 1270 | 1400 | L1MX-307006V000000 |
| | 4000K | 70 | 1160 | 1232 | 1345 | 1400 | L1MX-407006V000000 |
| | 5000K | 70 | 1160 | 1232 | 1345 | 1400 | L1MX-507006V000000 |
| | 5700K | 70 | 1160 | 1232 | 1345 | 1400 | L1MX-577006V000000 |
| | 6500K | 70 | 1160 | 1232 | 1345 | 1400 | L1MX-657006V000000 |
| | 2700K | 80 | 900 | 988 | 1095 | 1400 | L1MX-278006V000000 |
| | 3000K | 80 | 970 | 1000 | 1110 | 1400 | L1MX-308006V000000 |
| | 4000K | 80 | 1040 | 1115 | 1220 | 1400 | L1MX-408006V000000 |
| | 5000K | 80 | 1040 | 1115 | 1220 | 1400 | L1MX-508006V000000 |
| | 2700K | 90 | 730 | 800 | 872 | 1400 | L1MX-279006V000000 |
| | 3000K | 90 | 730 | 835 | 910 | 1400 | L1MX-309006V000000 |
| | 4000K | 90 | 900 | 965 | 1046 | 1400 | L1MX-409006V000000 |
| | 5700K | 90 | 900 | 965 | 1046 | 1400 | L1MX-579006V000000 |

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.

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# Optical Characteristics

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

| PART NUMBER | TYPICAL TOTAL INCLUDED ANGLE [1] | TYPICAL VIEWING ANGLE [2] |
|---|---|---|
| L1MX-xxxxxxxxxxx0 | 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 MX at specified test current, $T_j$=85°C.**

| 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 | | |
| L1MX-xxxx12Vxxxxx0 | 10.50 | 11.30 | 11.70 | -5.50 | 1.25 |
| L1MX-xxxx06Vxxxxx0 | 5.25 | 5.65 | 6.00 | -2.75 | 1.25 |

Notes for Table 3:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Measured between 25°C and 135°C.

# Absolute Maximum Ratings

**Table 4. Absolute maximum ratings for LUXEON MX.**

| PARAMETER | MAXIMUM PERFORMANCE |
|---|---|
| DC Forward Current [1, 2] | 1500mA for L1MX-xxxx12Vxxxxx0<br>3000mA for L1MX-xxxx06Vxxxxx0 |
| Peak Pulsed Forward Current [1, 3] | 1750mA for L1MX-xxxx12Vxxxxx0<br>3500mA for L1MX-xxxx06Vxxxxx0 |
| 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 120°C at 700mA for L1MX-xxxxxxxxxxx0 |
| LED Storage Temperature | -40°C to 120°C |
| Soldering Temperature | JEDEC 020D 250°C |
| Allowable Reflow Cycles | 3 |
| Reverse Voltage ($V_{reverse}$) | LUXEON LEDs are not designed to be driven in reverse bias |

Notes for Table 4:
1. Proper current derating must be observed to maintain the junction temperature below the maximum allowable junction temperature.
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple," are acceptable if the following conditions are met:
   – The frequency of the ripple current is 100Hz or higher
   – The average current for each cycle does not exceed the maximum allowable DC forward current
   – The maximum amplitude of the ripple does not exceed the maximum peak pulsed forward current
3. At 10% duty cycle with pulse width of 10ms.

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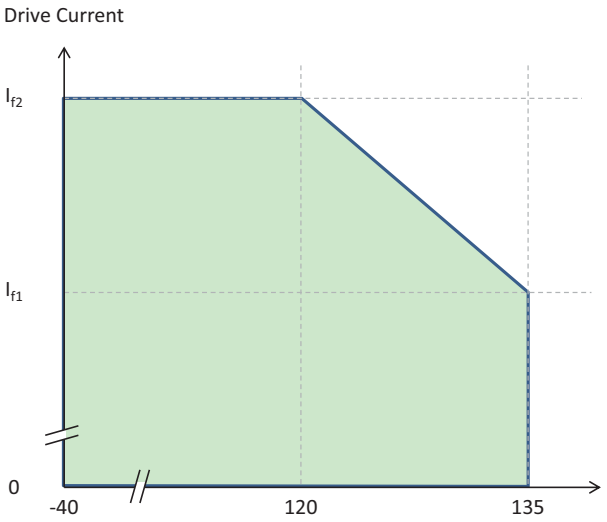
## Operating Conditions




| | $I_{f1}$ [mA] | $I_{f2}$ [mA] |
|---|---|---|
| LUXEON MX 6V | 2400 | 3000 |
| LUXEON MX 12V | 1200 | 1500 |

**Figure 1. Maximum permissible operating conditions for LUXEON MX.**

Notes for Figure 1:
1. The shaded area in this graph reflects the maximum permissible operating conditions for LUXEON MX.

# Characteristic Curves

## Spectral Power Distribution Characteristics

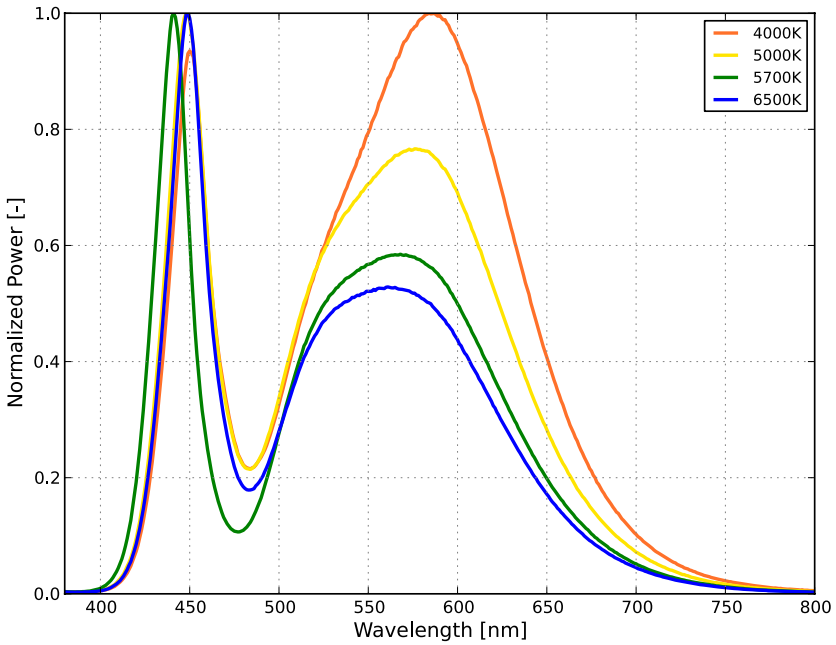



**Figure 2. Typical normalized power vs. wavelength for L1MX-xx70xxxxxxx0 at specified test current, $T_j$=85°C.**

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# Light Output Characteristics

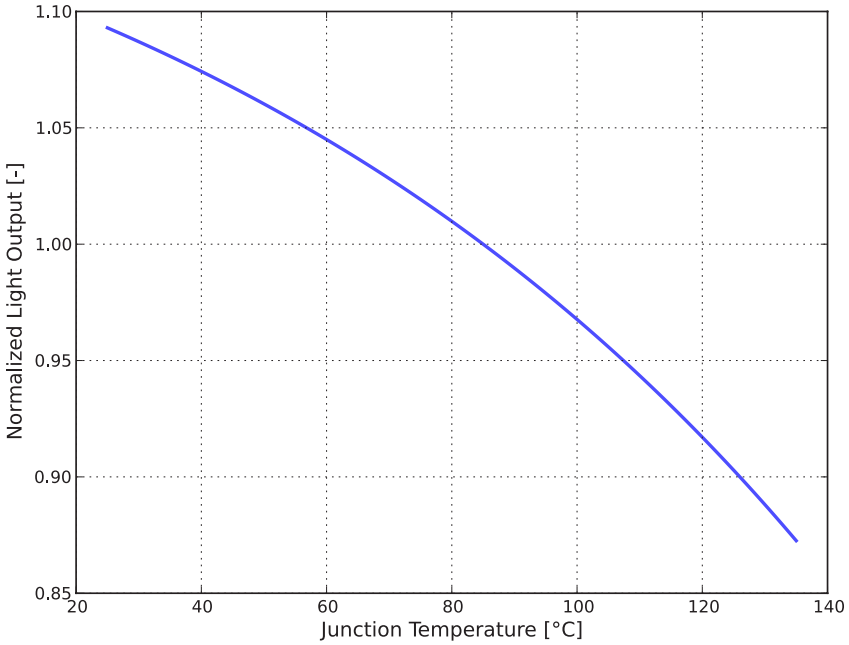


**Figure 3. Typical normalized light output vs. junction temperature for L1MX-xxxxxxxxxxxx0 at specified test current.**

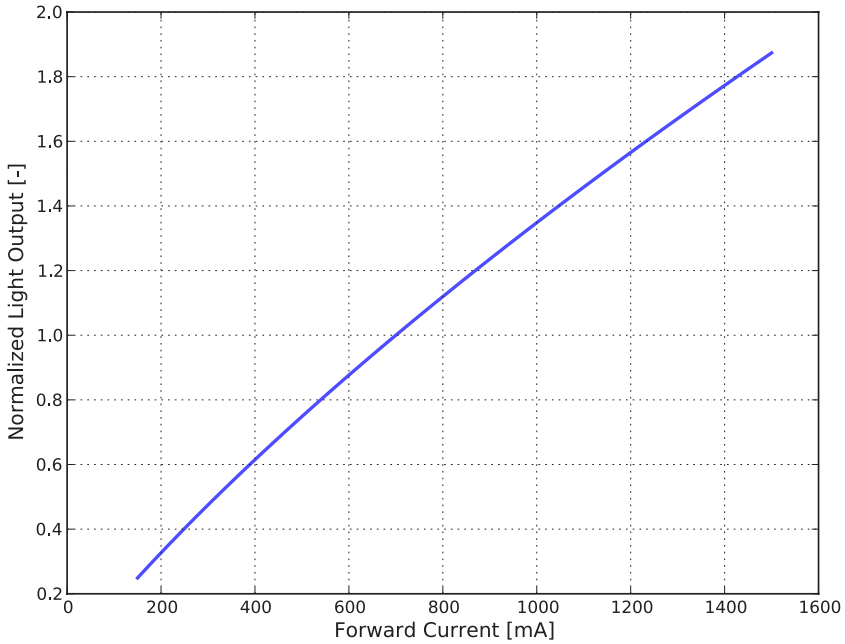


**Figure 4a. Typical normalized light output vs. forward current for L1MX-xxxx12Vxxxxx0 at $T_j$=85°C.**

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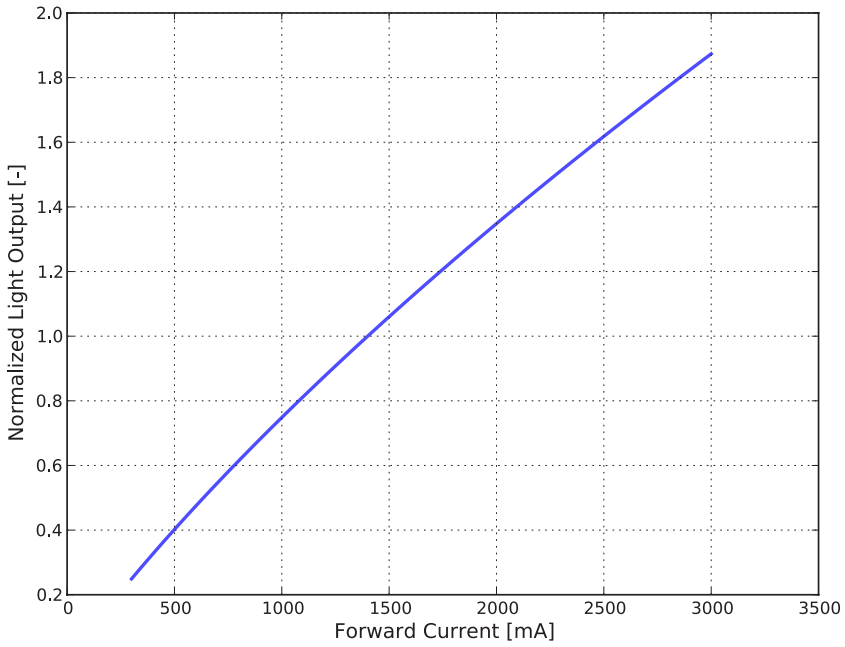


**Figure 4b. Typical normalized light output vs. forward current for L1MX-xxxx06Vxxxxx0 at $T_j$=85°C.**

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# Forward Current Characteristics

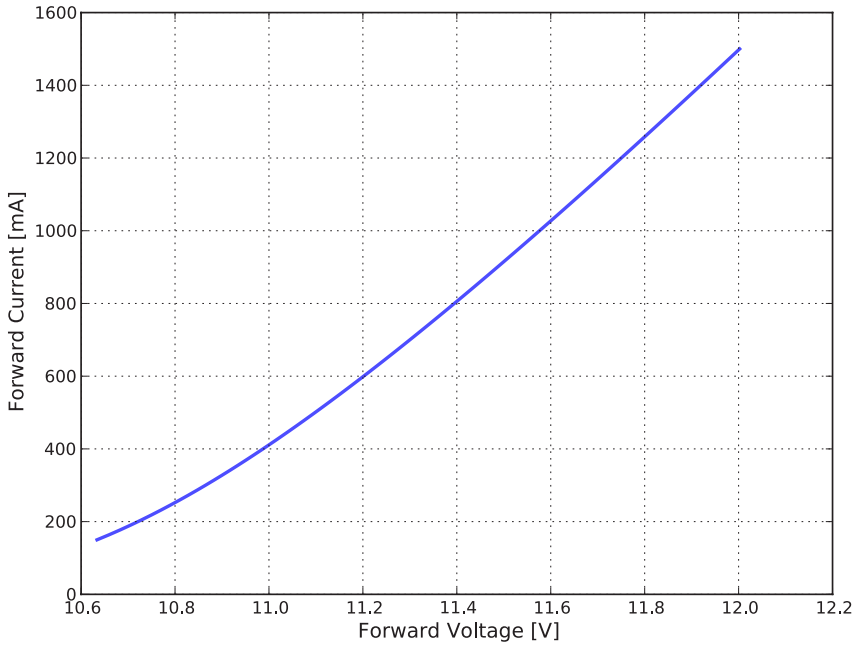


Figure 5a. Typical forward current vs. forward voltage for L1MX-xxxx12Vxxxxx0 at $T_j$=85°C.

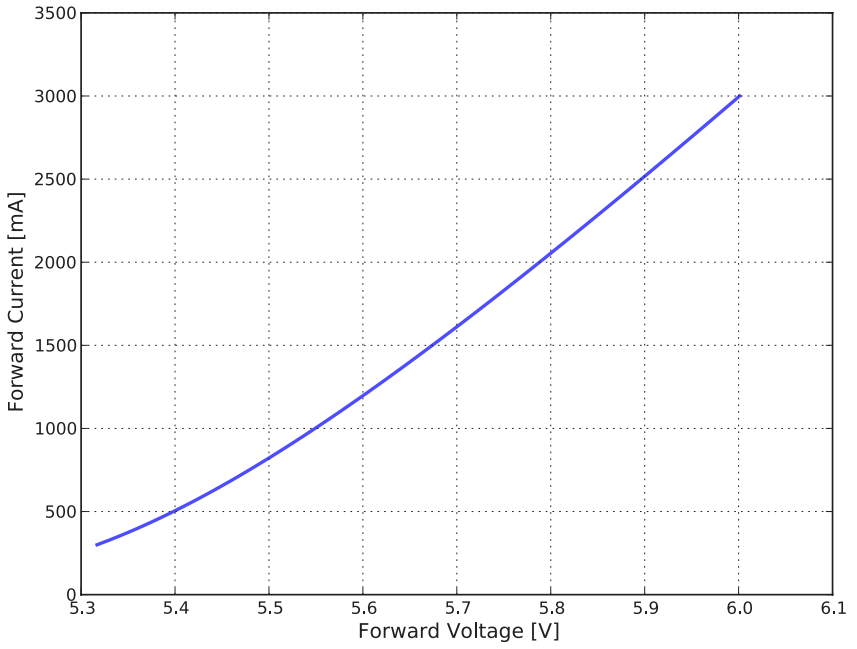


Figure 5b. Typical forward current vs. forward voltage for L1MX-xxxx06Vxxxxx0 at $T_j$=85°C.

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# Radiation Pattern Characteristics

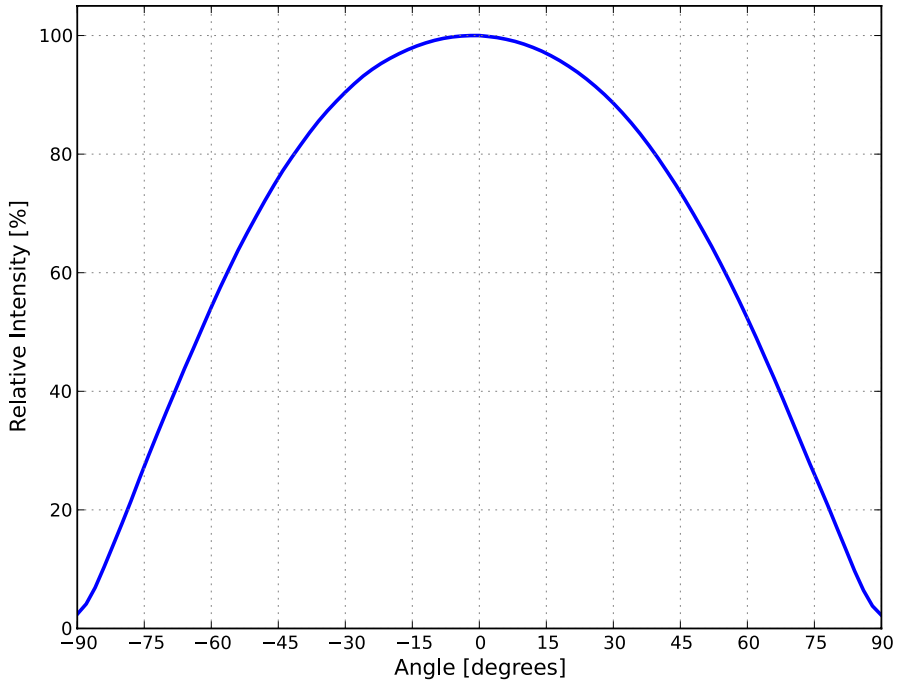


Figure 6. Typical radiation pattern for L1MX-xxxxxxxxxxxx0 at specified test current, $T_j$=85°C.

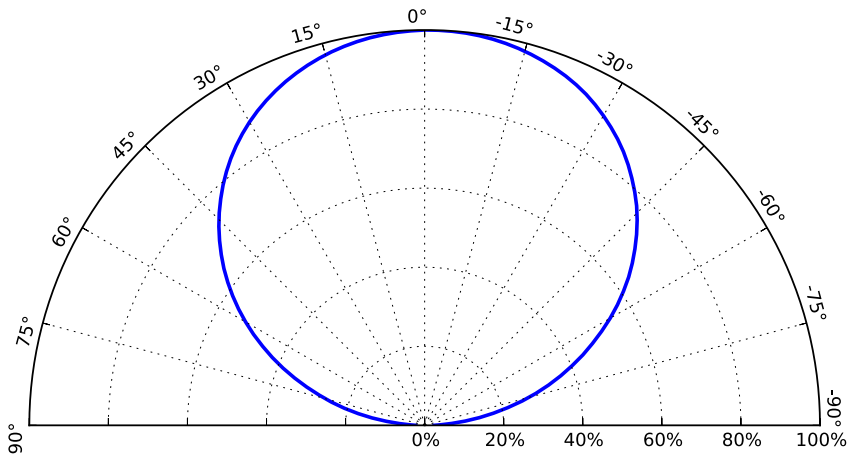


Figure 7. Typical polar radiation pattern for L1MX-xxxxxxxxxxxx0 at specified test current, $T_j$=85°C.

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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.

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

**A B C D**

Where:

- **A** – designates luminous flux bin (example: V=1,120 to 1,200 lumens, W=1,200-1,240 lumens)
- **B** – designates correlated color temperature (CCT) bin (example: 1=6500K, 2=5700K, 3=5000K, 5=4000K, 7=3000K, 8=2700K)
- **C** – designates color bin (example: 3=3-step, 5/A/B/C/D=5-step)
- **D** – designates forward voltage bin (example: F=10.50 to 11.00V, G=11.00 to 11.50V)

Therefore, a LUXEON MX 12V LED with a lumen range of 630 to 680 lumens, color bin of 4000K, 5-step MacAdam ellipse and a forward voltage range of 10.50 to 11.00V has the following CAT code:

**M 5 5 F**

## Luminous Flux Bins

Table 5 lists the standard luminous flux bins for LUXEON MX 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 MX, $T_j$=85°C.**

| BIN | LUMINOUS FLUX [1] (lm) | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| J | 510 | 550 |
| 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 | 1240 |
| X | 1240 | 1280 |
| Y | 1280 | 1320 |

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

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# Color Bin Definitions

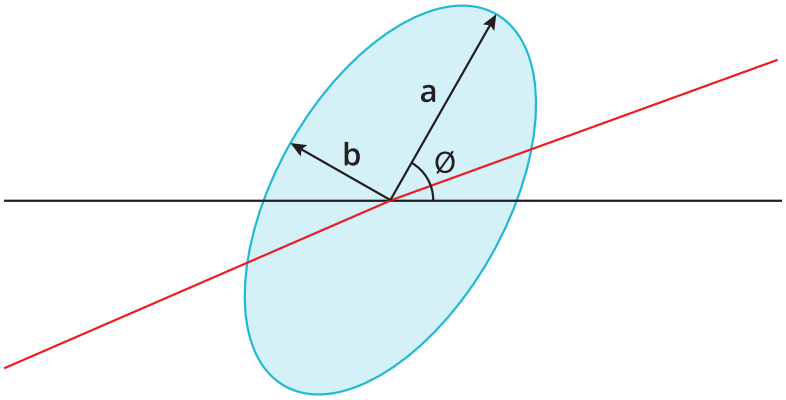


Figure 8. 3-, 5- and 7-step MacAdam ellipse illustration for Table 6.

Table 6. 3-, 5- and 7-step MacAdam ellipse color bin definitions for LUXEON MX, $T_j$=85°C.

| 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 | 53.22° |
| 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° |
| 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 | 53.22° |
| 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° |
| 6500K | Single 7-step MacAdam ellipse | 0.3123, 0.3282 | 0.01561 | 0.00665 | 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.

Table 7. Correlated color temperature bin definitions for LUXEON MX.

| BIN | CCT |
|---|---|
| 1 | 6500K |
| 2 | 5700K |
| 3 | 5000K |
| 5 | 4000K |
| 7 | 3000K |
| 8 | 2700K |

Table 8. MacAdam ellipse color bin definitions for LUXEON MX.

| BIN | SDCM |
|---|---|
| 3 | 3-step MacAdam ellipse (80CRI and 90CRI) |
| 5 | 5-step MacAdam ellipse (70CR, 80CRI and 90 CRI below 4000K) |
| A | 5-step MacAdam ellipse (80CRI and 90CRI 4000K and above) |
| B | 5-step MacAdam ellipse (80CRI and 90CRI 4000K and above) |
| C | 5-step MacAdam ellipse (80CRI and 90CRI 4000K and above) |
| D | 5-step MacAdam ellipse (80CRI and 90CRI 4000K and above) |

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# Forward Voltage Bins

**Table 9. Forward voltage bin definitions for LUXEON MX, $T_j$=85°C.**

| PART NUMBER | BIN | FORWARD VOLTAGE [1] ($V_f$) | |
|---|---|---|---|
| | | MINIMUM | MAXIMUM |
| L1MX-xxxx12Vxxxxx0 | F | 10.50 | 11.00 |
| | G | 11.00 | 11.50 |
| | H | 11.50 | 11.70 |
| L1MX-xxxx06Vxxxxx0 | F | 5.25 | 5.50 |
| | G | 5.50 | 5.75 |
| | H | 5.75 | 6.00 |

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

# Mechanical Dimensions

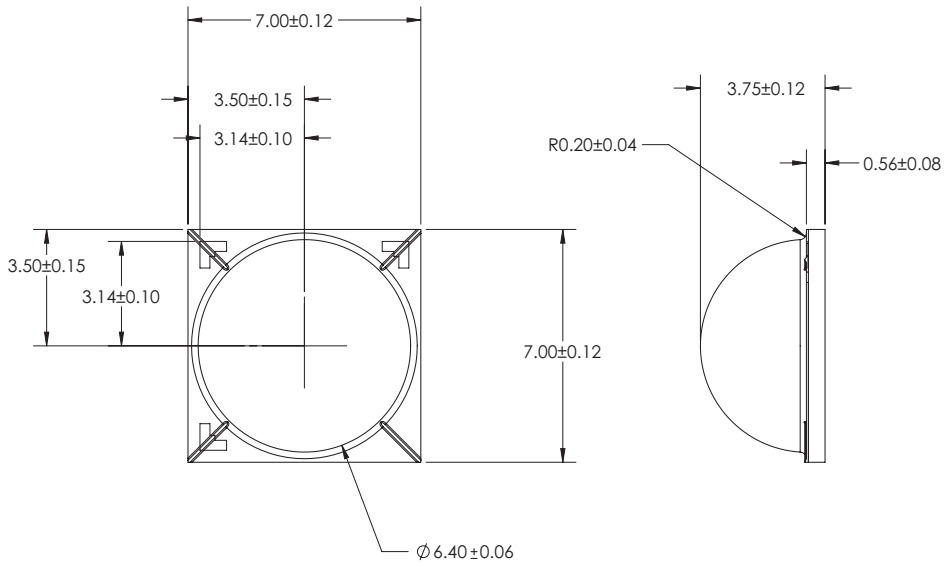


**Figure 9. Mechanical dimensions for LUXEON MX.**

Notes for Figure 9:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

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# Reflow Soldering Guidelines

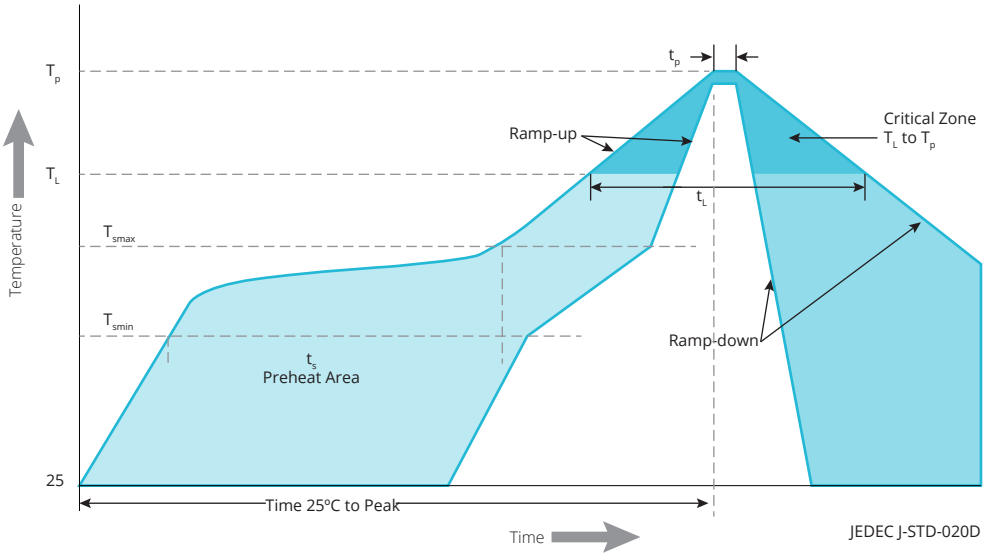


**Figure 10. Visualization of the acceptable reflow temperature profile as specified in Table 9.**

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

| PROFILE FEATURE | LEAD-FREE ASSEMBLY |
|---|---|
| Preheat Minimum Temperature ($T_{smin}$) | 150°C |
| Preheat Maximum Temperature ($T_{smax}$) | 200°C |
| Preheat Time ($t_{smin}$ to $t_{smax}$) | 60 to 120 seconds |
| Ramp-Up Rate ($T_L$ to $T_p$) | 3°C / second maximum |
| Liquidus Temperature ($T_L$) | 217°C |
| Time Maintained Above Temperature $T_L$ ($t_L$) | 60 to 150 seconds |
| Peak / Classification Temperature ($T_p$) | 250°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 11. Moisture sensitivity levels for LUXEON MX.**

| 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

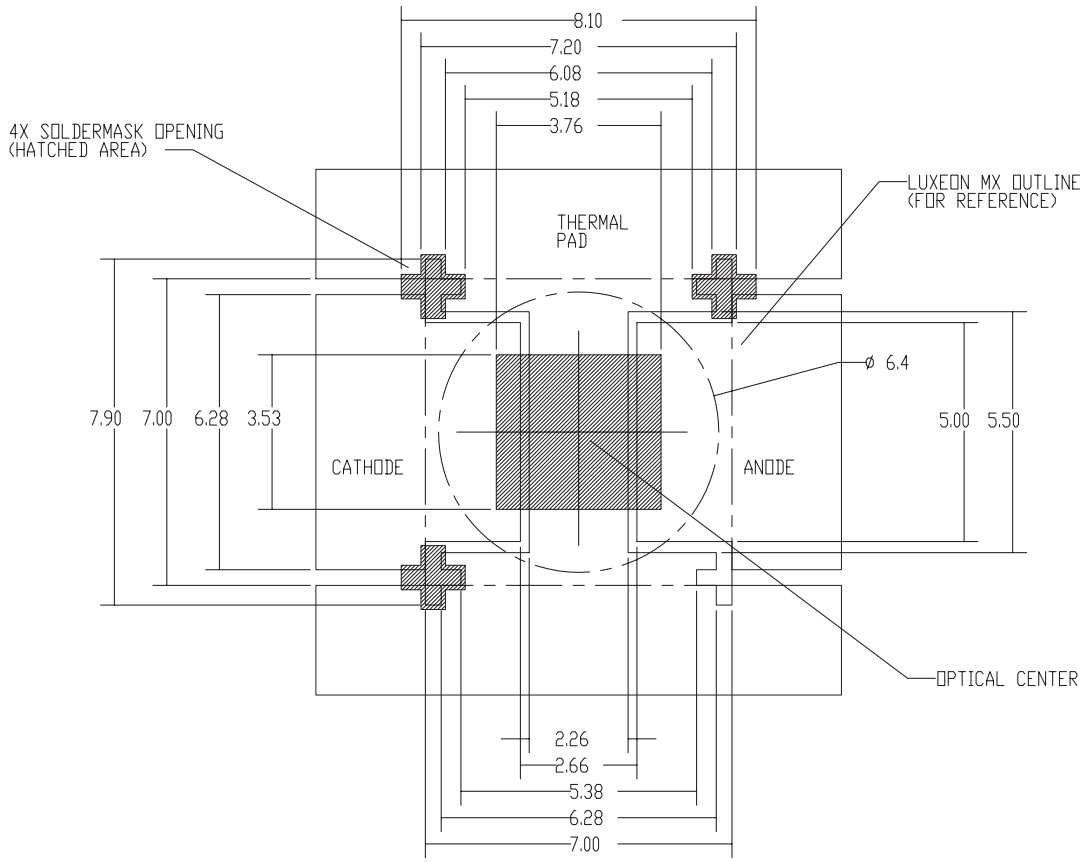


**Figure 11. Recommended PCB solder pad layout for LUXEON MX.**

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

# Packaging Information

## Pocket Tape Dimensions

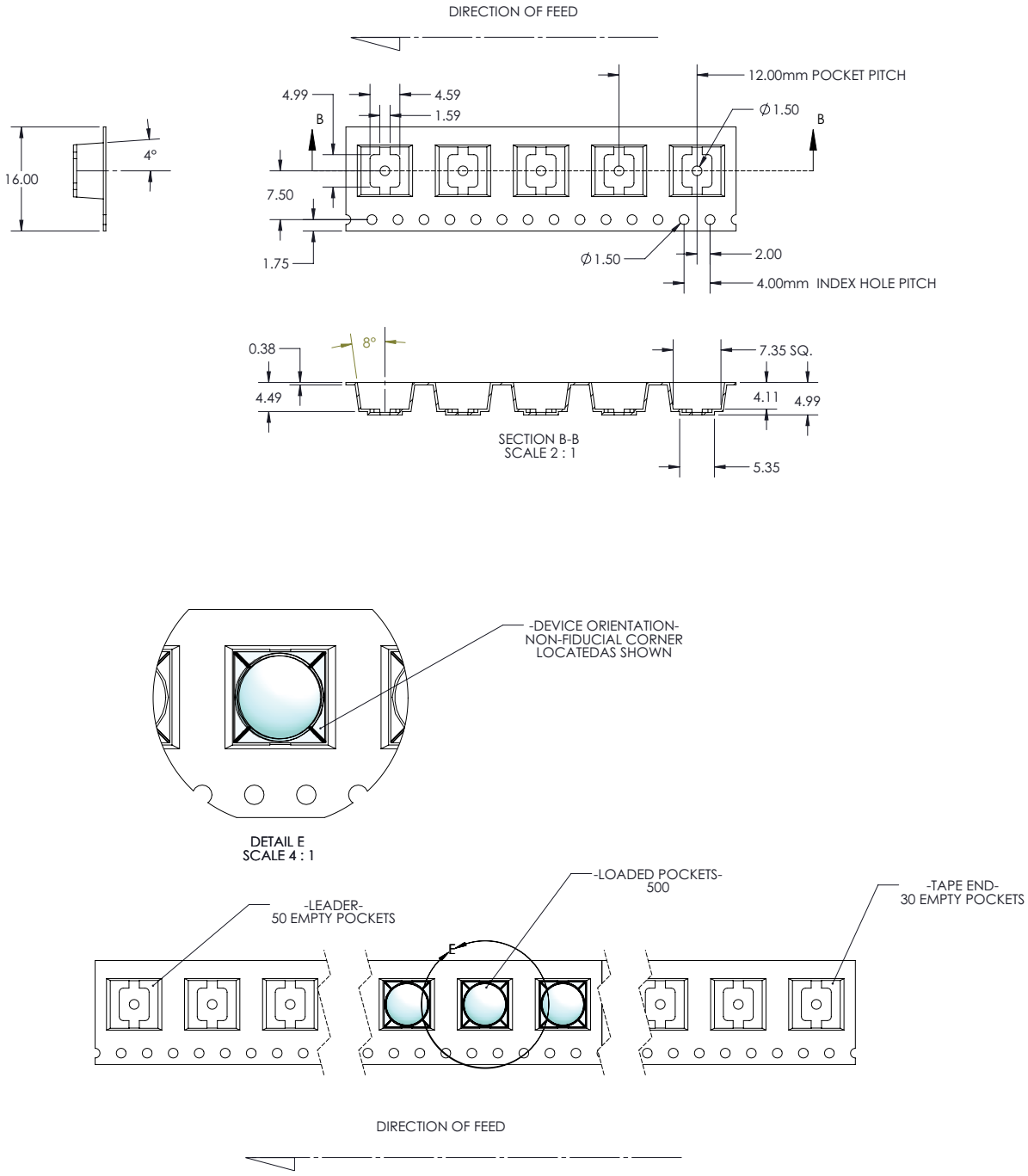


**Figure 12. Pocket tape dimensions for LUXEON MX.**

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

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# Reel Dimensions

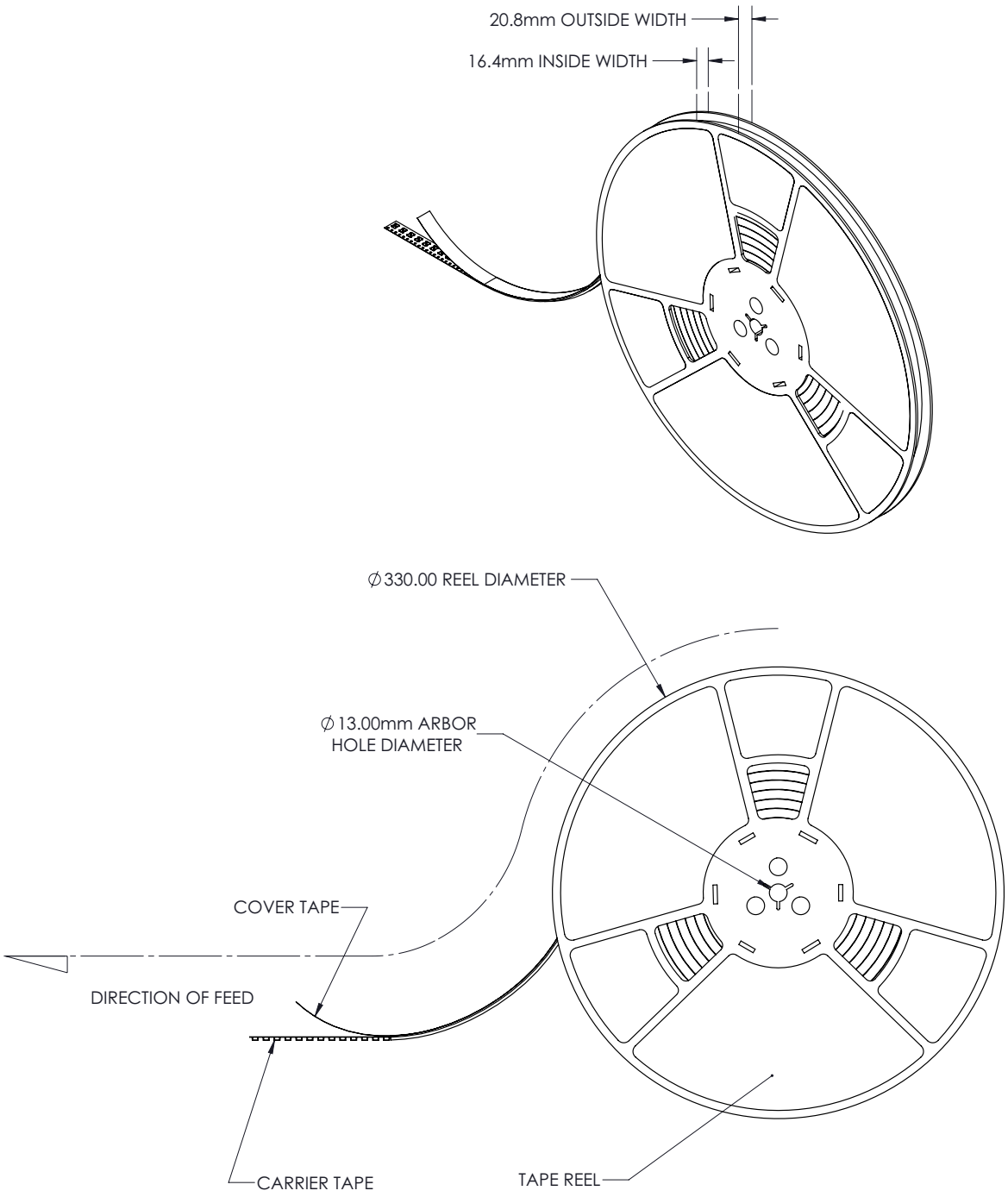


**Figure 13. Reel dimensions for LUXEON MX.**

Notes for Figure 13:
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.

To learn more about our lighting solutions, visit lumileds.com.

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