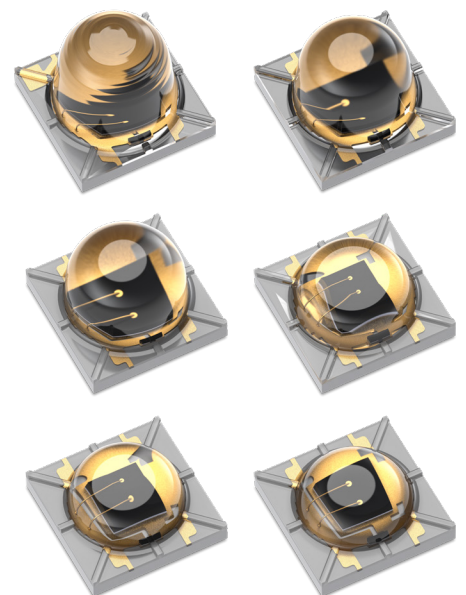


LUXEON IR Domed for Automotive Gen 2

High power infrared emitters with engineered primary optics for high efficiency and beam control

The LUXEON IR Domed Gen 2 for Automotive is a family of high power infrared emitters tailored to application needs by offering a variety of products at multiple infrared wavelengths and optical radiation patterns. Through best-in-class thermal conductivity, LUXEON IR Domed Gen 2 has excellent performance at actual operating conditions. The LUXEON IR Domed Gen 2 uses an industry standard footprint for ease of integration and upgrading existing system designs.

All LUXEON IR Domed Gen 2 LEDs are AEC-Q102 qualified and are designed with innovative LUXEON technology to provide industry leading performance.



FEATURES AND BENEFITS

Available in 930 nm and 950 nm wavelengths to provide optimized performance for each type of application.

Radiant Power: 1400 mW (930 nm) for a greater system performance.

Six emission patterns to address diverse application needs, high punch, long range and high uniformity.

3.7 mm x 3.7 mm package with a 3 pad configuration that is compatible with the industry standard footprint to enable a direct upgrade in existing designs.

Ultra-low Rth of 1.6 °C/W, the industry's best thermal conductivity, solves thermal challenges and supports space saving designs.

PRIMARY APPLICATIONS

Driver Monitoring Systems

Biometric Identification

Exterior Sensing Applications

Interior Presence Detection

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General Product Information

LUXEON IR Domed for Automotive Gen 2 LEDs are infrared emitters consisting of dual-junction high intensity near infrared chips mounted on a ceramic substrate. The products have primary optics designed to deliver a variety of radiation patterns. All LUXEON IR LEDs contain a TVS chip for ESD protection.

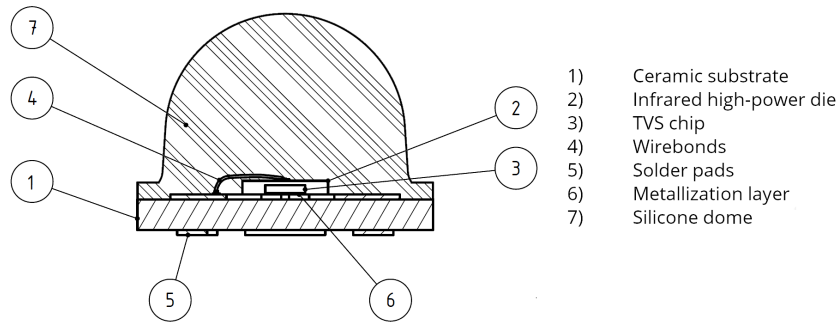


Figure 1. Schematic cross section LUXEON IR Domed Gen 2

Product Test Conditions

LUXEON IR Domed Gen 2 emitters are tested and binned with a 20 ms monopulse of 1A at a junction temperature, T_j , of 25 °C.

Part Number Nomenclature

Part numbers for LUXEON IR Domed Gen 2 follow the convention below:

L 1 I 0 – A B B B C C C 0 2 0 0 0 0

Where:

- B B B** – designates nominal peak wavelength
- C C C** – designates emitter’s radiation pattern design
- 0 2** – designates 2nd generation
- 0 0 0 0 – reserved for further customization

Therefore, the following part number is used for a LUXEON IR Domed Gen 2 emitter with a peak wavelength of 930 nm and a beam angle of ~90°:

L 1 I 0 – A 9 3 0 0 9 0 0 2 0 0 0 0

Radiometric Power Maintenance

Please contact your local Sales Representative or Lumileds Business Development 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 IR Domed Gen 2 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

LUXEON IR Domed Gen 2 emitters are tested and binned with a 20 ms monopulse of 1A at a junction temperature, T_j , of 25 °C.

Table 1. Typical product performance and optical characteristics of LUXEON IR Domed Gen 2 at 1000 mA, $T_j = 25$ °C

| PEAK WAVELENGTH ^[1] (nm) | TYPICAL FWHM BEAM ANGLE ^[3] (°) | RADIOMETRIC POWER ^[2] (mW) | | TYPICAL RADIANT INTENSITY ^[4] (mW/sr) | PART NUMBER |
|-------------------------------------|--|---------------------------------------|------------------------|--|--------------------|
| | | MINIMUM | TYPICAL ^[4] | | |
| 927 | 136 ^[5] | 1300 | 1400 | 255 | L110-A930135020000 |
| 927 | 146 ^[5] | 1300 | 1400 | 310 | L110-A930145020000 |
| 927 | 139 | 1300 | 1400 | 340 | L110-A930150020000 |
| 950 | 45 | 1200 | 1375 | 1265 | L110-A940050020000 |
| 950 | 61 | 1200 | 1375 | 1130 | L110-A940060020000 |
| 950 | 90 | 1200 | 1375 | 740 | L110-A940090020000 |
| 950 | 136 ^[5] | 1200 | 1375 | 250 | L110-A940135020000 |
| 950 | 146 ^[5] | 1200 | 1375 | 305 | L110-A940145020000 |
| 950 | 139 | 1200 | 1375 | 330 | L110-A940150020000 |

Notes for Table 1:

1. Lumileds maintains a tolerance of ± 2 nm on peak wavelength measurements.
2. Lumileds maintains a tolerance of $\pm 7\%$ on radiometric power measurements.
3. FWHM denotes the viewing angle off-axis angle from the LED center where the luminous intensity is $\frac{1}{2}$ of the peak value.
4. Typical performance represents the average long term performance and may not be reflected in individual batches.
5. Full Width Half Center

Optical Characteristics

Table 2. Optical characteristics for LUXEON IR Domed Gen 2 at 1000 mA, $T_j = 25$ °C

| PART NUMBER | PEAK WAVELENGTH (nm) ^[1,2] | | | TYPICAL SPECTRUM FWHM (nm) |
|--------------------|---------------------------------------|---------|---------|----------------------------|
| | MINIMUM | TYPICAL | MAXIMUM | |
| L110-A930xxx020000 | 920 | 927 | 935 | 29 |
| L110-A940xxx020000 | 940 | 950 | 960 | 36 |

Notes for Table 2:

1. Lumileds maintains a tolerance of ± 2 nm on peak wavelength measurements.
2. Typical performance represents the average long term performance and may not be reflected in individual batches

Thermal Characteristics

Table 3. Thermal characteristics for LUXEON IR Domed Gen 2 at 1000 mA, $T_j = 25$ °C

| PART NUMBER | THERMAL RESISTANCE JUNCTION-TO-CASE (K/W) | | | | TYPICAL TEMPERATURE COEFFICIENT OF PEAK WAVELENGTH ^[3,4] (nm/°C) |
|--------------------|---|---------|---|---------|---|
| | $R\theta_{j-c} \text{ el} \text{ }^{[1,4]}$ | | $R\theta_{j-c} \text{ real} \text{ }^{[2,4]}$ | | |
| | TYPICAL | MAXIMUM | TYPICAL | MAXIMUM | |
| L110-A9xxxxx020000 | 1.6 | 2.0 | 3.2 | 3.8 | 0.29 |

Notes for Table 3:

1. Ratio between temperature difference (junction « case) and electrical input power (references JE5D51-51, JE5D51-14).
2. Ratio between temperature difference (junction « case) and dissipated heat, i.e. emitted light taken into account (references JE5D51-51, JE5D51-14).
3. Measured between 25°C and 85°C.
4. Typical performance represents the average long term performance and may not be reflected in individual batches

Electrical Characteristics

Table 4. Electrical characteristics for LUXEON IR Domed Gen 2 at 1000 mA, $T_j = 25\text{ }^\circ\text{C}$

| PART NUMBER | FORWARD VOLTAGE (V_f) ^[1,3] | | | TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE ^[2] (mV/°C) | RISE TIME (at 5A, ns) | FALL TIME (at 5A, ns) |
|--------------------|--|---------|---------|---|-----------------------|-----------------------|
| | MINIMUM | TYPICAL | MAXIMUM | | | |
| L110-A9xxxxx020000 | 2.5 | 2.9 | 3.5 | -1.50 | 9.9 | 14.5 |

Notes for Table 4:

1. Lumileds maintains a tolerance of $\pm 1\%$ on forward voltage measurements.
2. Measured between 25°C and 85°C.
3. Typical performance represents the average long term performance and may not be reflected in individual batches

Absolute Ratings

Table 5. Absolute ratings for LUXEON IR Domed Gen 2

| PARAMETER | MAXIMUM PERFORMANCE |
|--|--|
| Minimum DC Forward Current ^[1,2] | 50 mA |
| Maximum DC Forward Current ^[1,2] | 1500 mA |
| Maximum Peak Pulsed Forward Current ^[1,3] | 5000 mA |
| Maximum Emitter Junction Temperature ^[1] (DC & Pulse) | 145 °C |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012) | Class 3B |
| Operating Case Temperature ^[1] | -40 °C to 125 °C |
| Emitter Storage Temperature | -40 °C to 125 °C |
| SMD Process Classification Temperature | 260 °C per JEDEC J-STD-020E |
| Allowable Reflow Cycles | 3 |
| Reverse Voltage ($V_{reverse}$) | LUXEON IR LEDs are not designed to be driven in reverse bias |

Notes for Table 5:

1. Proper current derating must be observed to maintain junction temperature below the maximum allowable temperature. LUXEON IR Domed for Automotive LEDs driven above maximum LED case temperature may have shorter lifetime.
2. Please consult with Lumileds for more information on maximum time durations and forward currents for these temperatures.
3. For pulse handling capability details see Figure 11.

Characteristic Curves

Spectral Power Distribution Characteristics

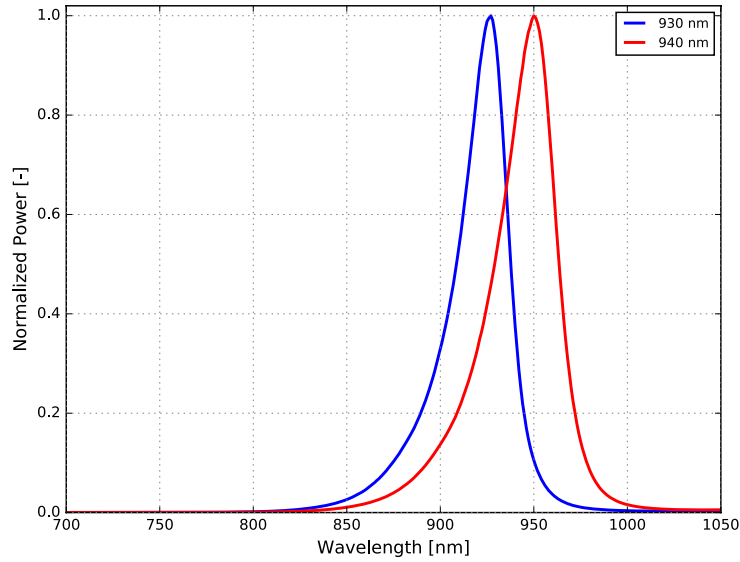


Figure 2. Typical normalized power vs. wavelength for LUXEON IR Domed Gen 2 at 1000 mA, $T_j = 25\text{ }^\circ\text{C}$

Light Output Characteristics

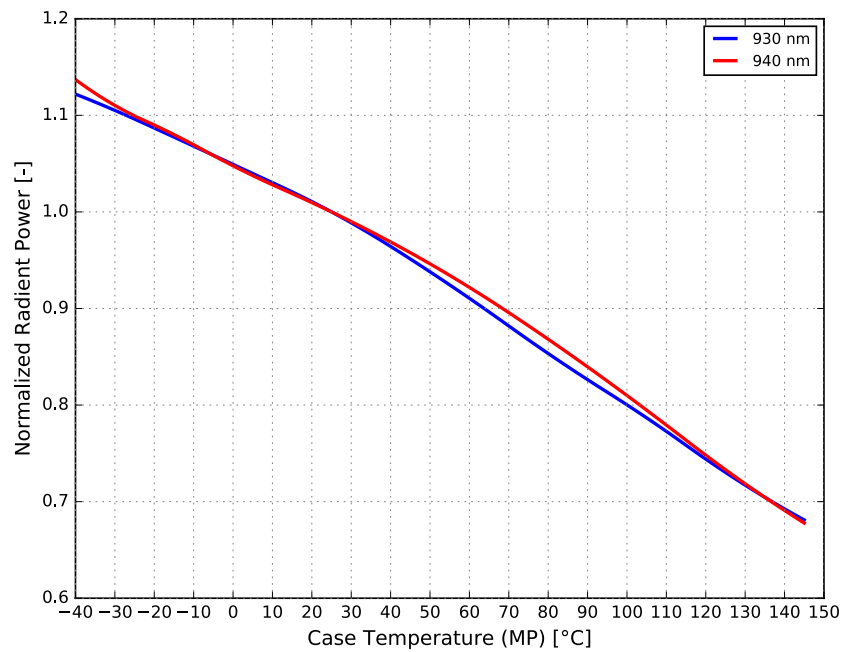


Figure 3. Typical radiant power vs. case temperature for LUXEON IR Domed Gen 2 at 1000 mA

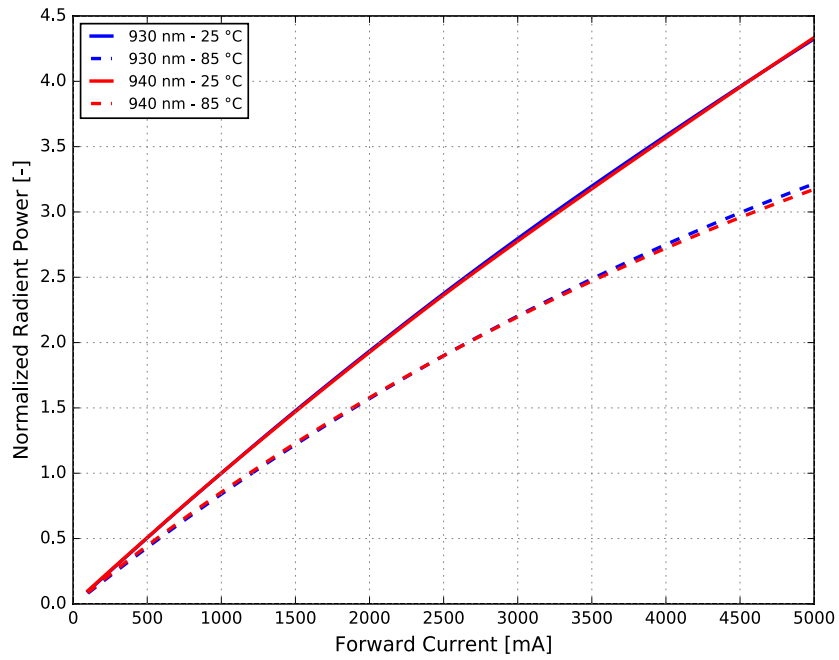


Figure 4. Typical normalized radiant power vs. forward current for LUXEON IR Domed Gen 2 $T_j = 25\text{ °C}$ and 85 °C

Electrical Characteristics

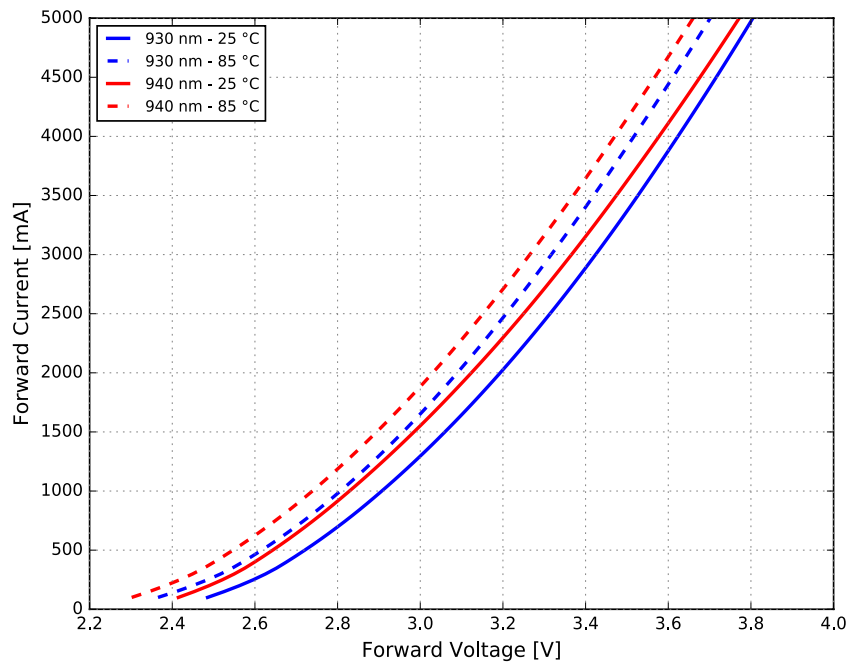


Figure 5. Typical forward current vs. forward voltage for LUXEON IR Domed Gen 2 at $T_j = 25\text{ °C}$

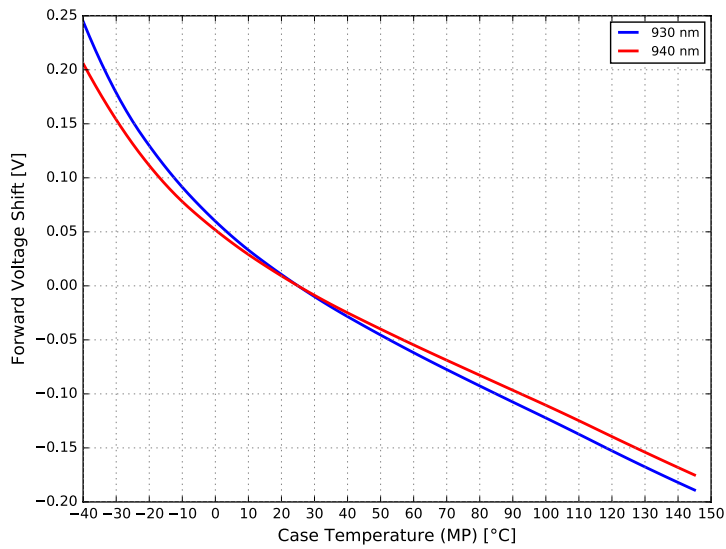


Figure 6. Typical forward voltage shift vs. case temperature for LUXEON IR Domed Gen 2 at 1000 mA

Wavelength Shift Characteristics

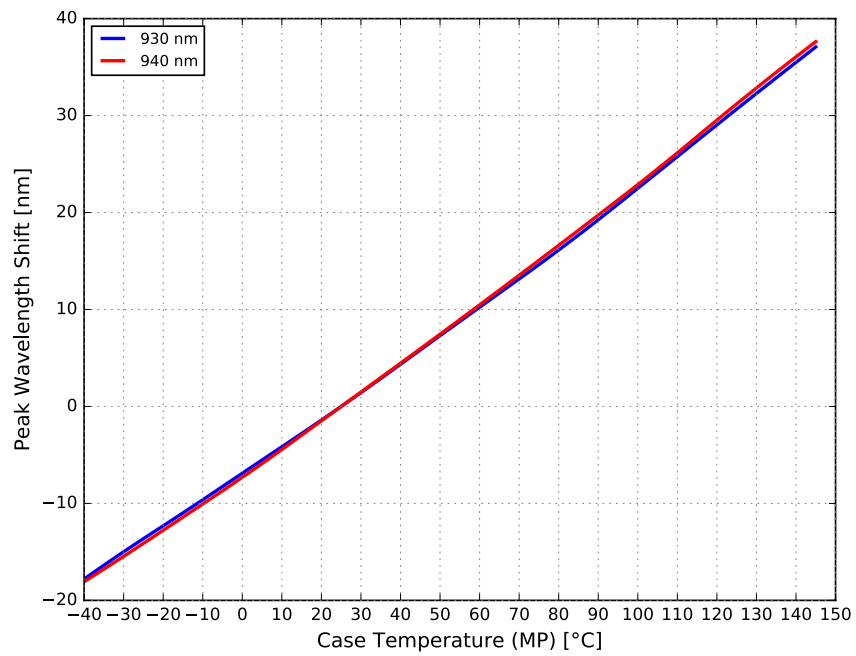


Figure 7. Typical peak wavelength shift vs. case temperature for LUXEON IR Domed Gen 2 at 1000 mA

Radiation Pattern Characteristics

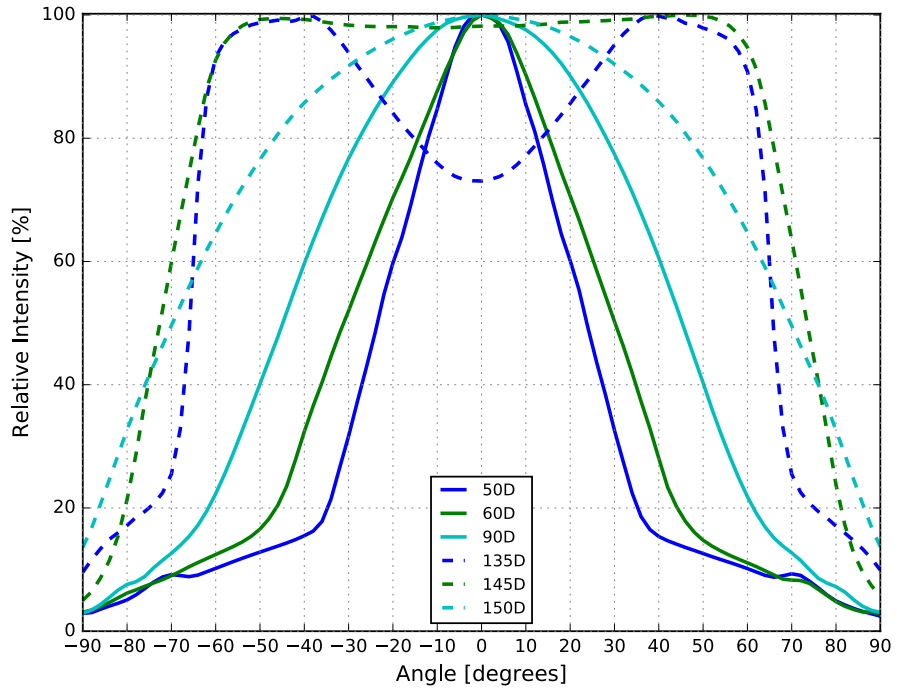


Figure 8. Typical radiation pattern for LUXEON IR Domed Gen 2 at 1000 mA, $T_j = 25\text{ }^\circ\text{C}$

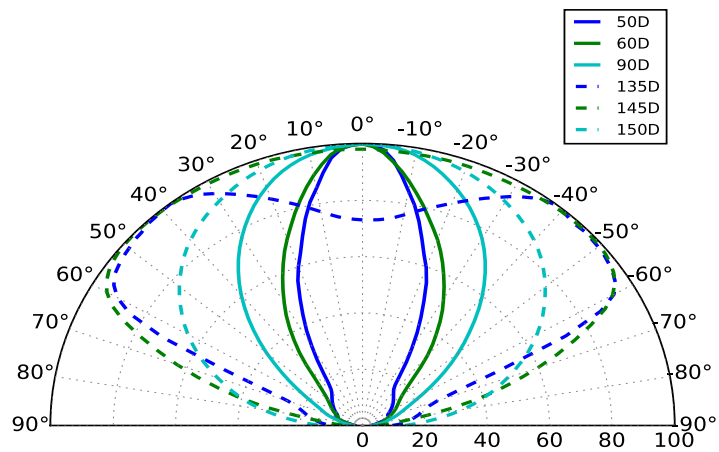


Figure 9. Typical polar radiation pattern (Intensity %) for LUXEON IR Domed Gen 2 at 1000 mA, $T_j = 25\text{ }^\circ\text{C}$

Operating Limit Characteristics

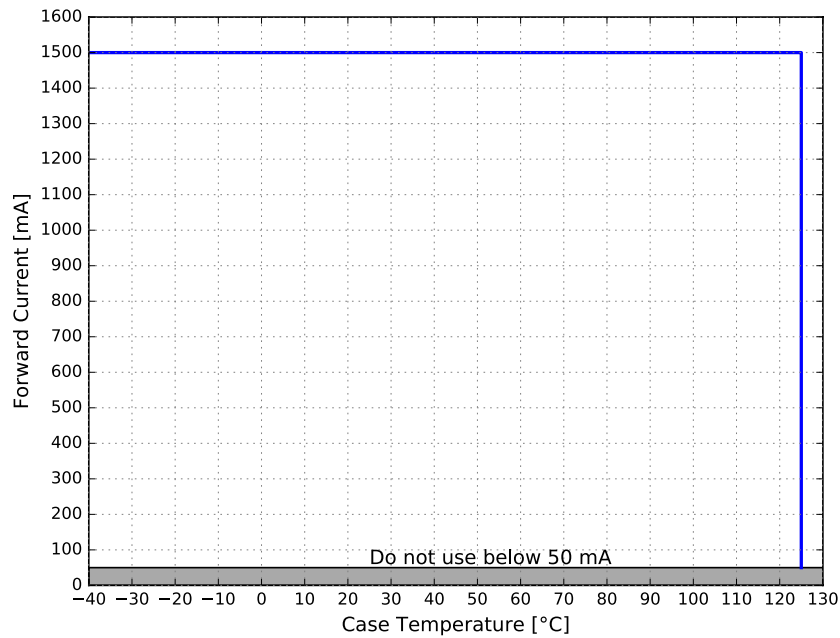


Figure 10. Maximum forward current vs. case temperature for LUXEON IR Domed Gen 2

Permissible Pulse Handling Characteristics

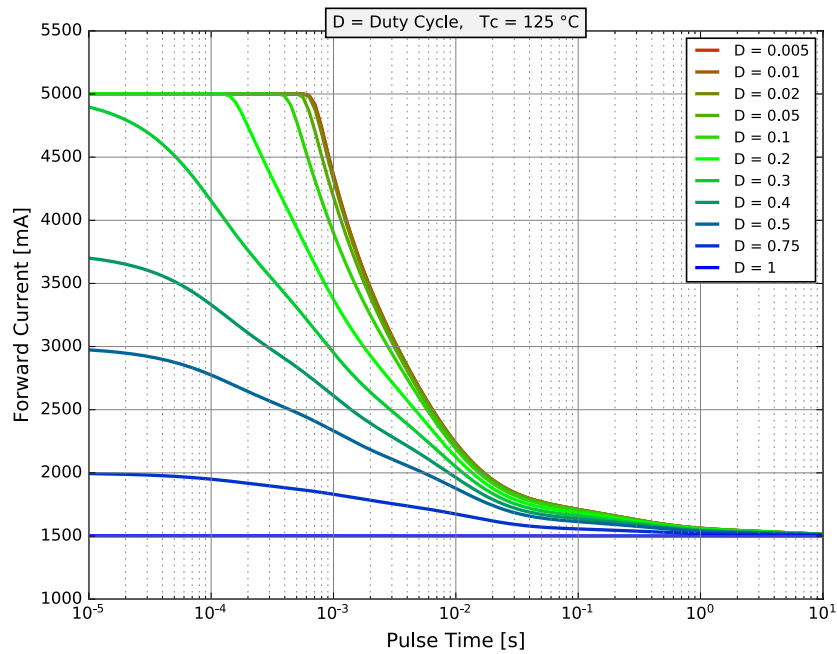


Figure 11. Permissible pulse handling capability for LUXEON IR Domed Gen 2 at T_c = up to 125 °C

Notes for Figure 11:

1. Data available in other parametrization available upon request.

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 components for luminous flux or radiometric power, color point, peak or dominant wavelength and forward voltage.

LUXEON IR Domed Gen 2 emitters are labeled using a 4-digit alphanumeric CAT code following the format below:

A B C D

Where:

- A** – designates radiometric power bin (example: N = 1200 to 1300 mW)
- B C** – designates peak wavelength bin (example: 9H = 935 nm to 940 nm)
- D** – designates forward voltage bin (example: D = 2.5 to 3.0 V)

Therefore, a LUXEON IR Domed emitter with a radiometric power range of 1200 to 1300 mW, peak wavelength range of 935 to 940 nm and a forward voltage range of 2.5 to 3.0 V has the following CAT code:

N 9 H D

Radiometric Power Bins

Table 7 lists the standard radiometric power bins for LUXEON IR Domed Gen 2 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 proliferations.

Table 7. Radiometric power bin definitions for LUXEON IR Domed Gen 2 at 1 A, $T_j = 25\text{ °C}$

| BIN | RADIOMETRIC POWER ⁽¹⁾ (mW) | |
|-----|---------------------------------------|---------|
| | MINIMUM | MAXIMUM |
| N | 1200 | 1300 |
| P | 1300 | 1400 |
| Q | 1400 | 1500 |
| R | 1500 | 1600 |

Notes for Table 7:

1. Lumileds maintains a tolerance of $\pm 7\%$ on radiometric power measurements.

Peak Wavelength Bins

Table 8 lists the standard peak wavelength bins for LUXEON IR Domed Gen 2 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 proliferations.

Table 8. Peak wavelength bin definitions for LUXEON IR Domed Gen 2 at 1 A, $T_j = 25\text{ }^\circ\text{C}$

| BIN | PEAK WAVELENGTH ^[1] (nm) | |
|-----|-------------------------------------|---------|
| | MINIMUM | MAXIMUM |
| 9E | 920 | 925 |
| 9F | 925 | 930 |
| 9G | 930 | 935 |
| 9J | 940 | 945 |
| 9K | 945 | 950 |
| 9L | 950 | 955 |
| 9M | 955 | 960 |

Notes for Table 8:

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

Forward Voltage Bins

Table 9 lists the standard forward voltage bins for LUXEON IR Domed Gen 2 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 proliferations.

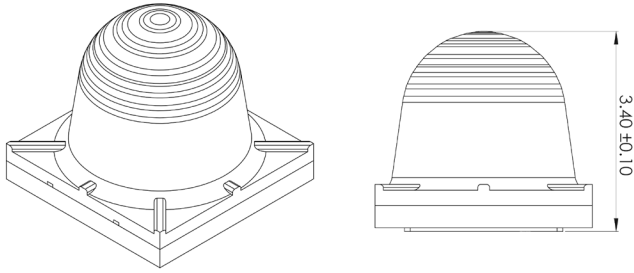
Table 9. Forward voltage bin definitions for LUXEON IR Domed Gen 2 at 1 A, $T_j = 25\text{ }^\circ\text{C}$

| BIN | FORWARD VOLTAGE ^[1] (V_f) | |
|-----|--|---------|
| | MINIMUM | MAXIMUM |
| D | 2.5 | 3.0 |
| E | 3.0 | 3.5 |

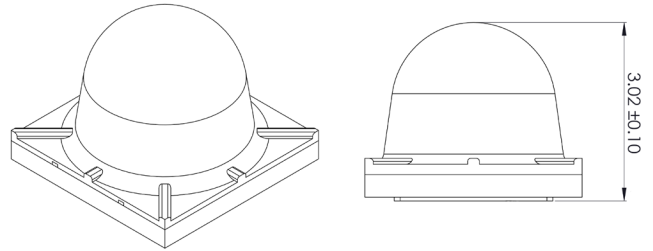
Notes for Table 9:

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

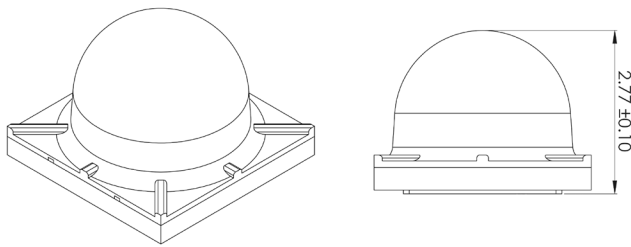
Mechanical Dimensions



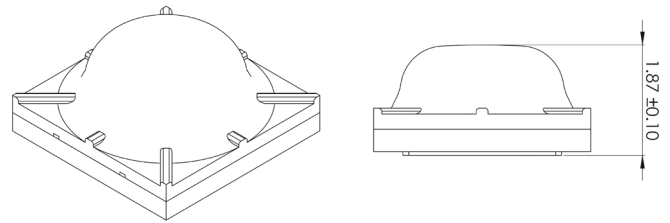
L110-Axxx050020000



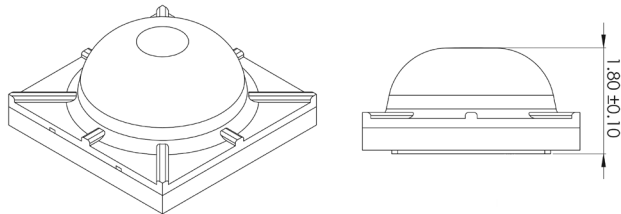
L110-Axxx060020000



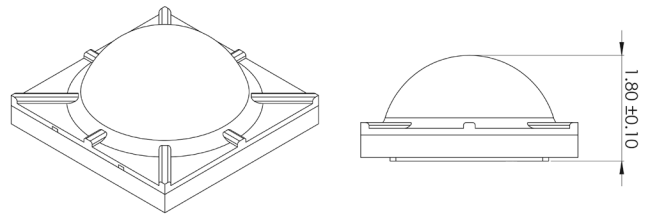
L110-Axxx090020000



L110-Axxx135020000



L110-Axxx145020000



L110-Axxx150020000

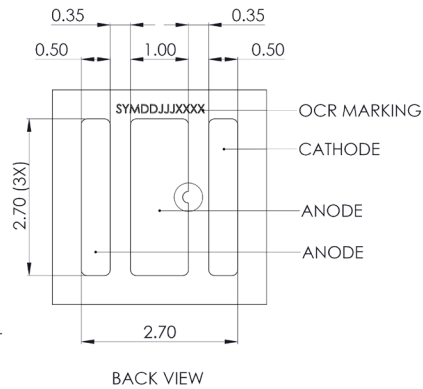
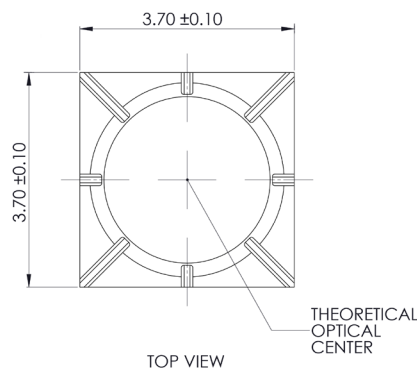


Figure 12. Mechanical Dimensions for LUXEON IR Domed Gen 2

Notes for Figure 12:

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

Package Weight

Table 10. Approximate weight of LUXEON IR Domed Gen 2

| PART NUMBER | PACKAGE WEIGHT [mg] |
|--------------------|---------------------|
| L110-A940050020000 | 46.3 |
| L110-A940060020000 | 40.2 |
| L110-A940090020000 | 38.7 |
| L110-Axxx135020000 | 32.5 |
| L110-Axxx145020000 | 31.6 |
| L110-Axxx150020000 | 30.7 |

Electrical Internal Circuit

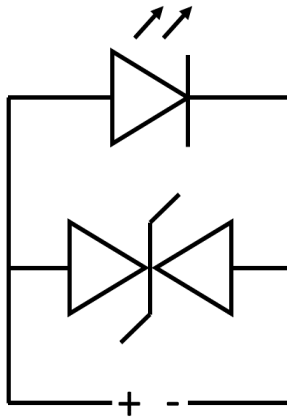


Figure 13. Electrical Internal Circuit for LUXEON IR Domed Gen 2

JEDEC Moisture Sensitivity

Table 11. Moisture sensitivity levels for LUXEON IR Domed Gen 2

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

Packaging Information

Pocket Tape Dimensions

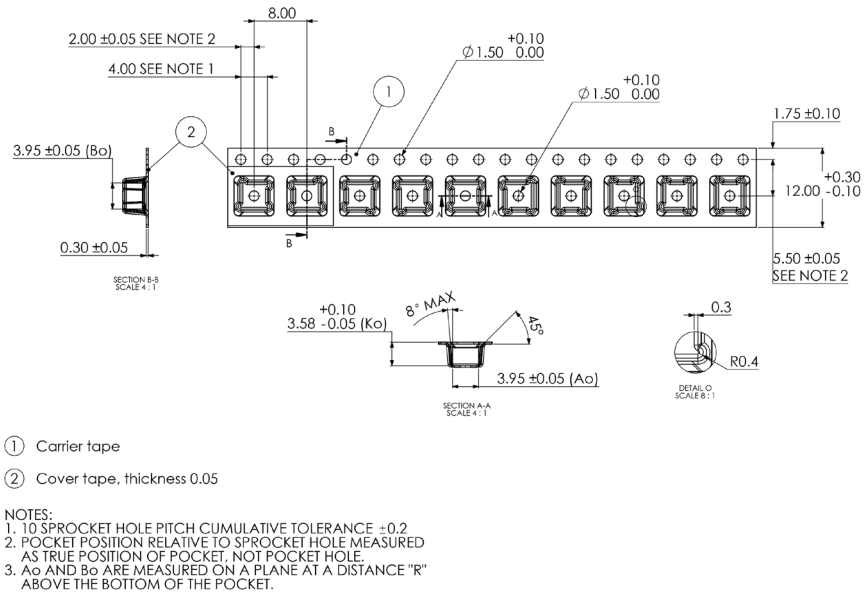


Figure 14a. Pocket tape dimensions for L110-Axxx050020000

Notes for Figure 14a:

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

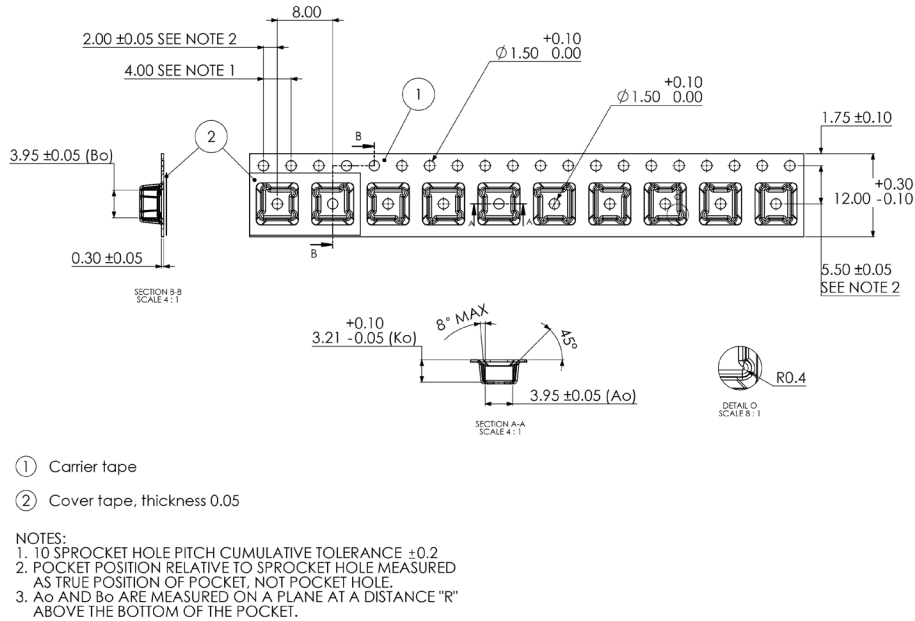
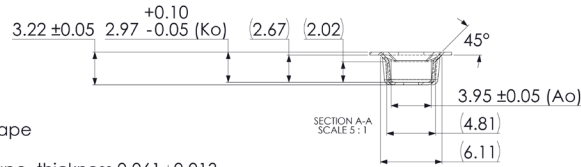
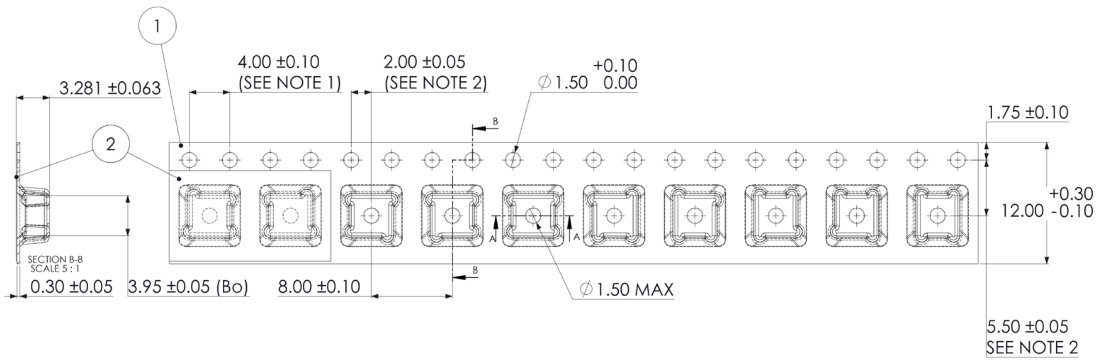


Figure 14b. Pocket tape dimensions for L110-Axxx060020000

Notes for Figure 14b:

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

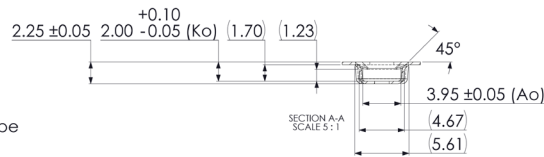
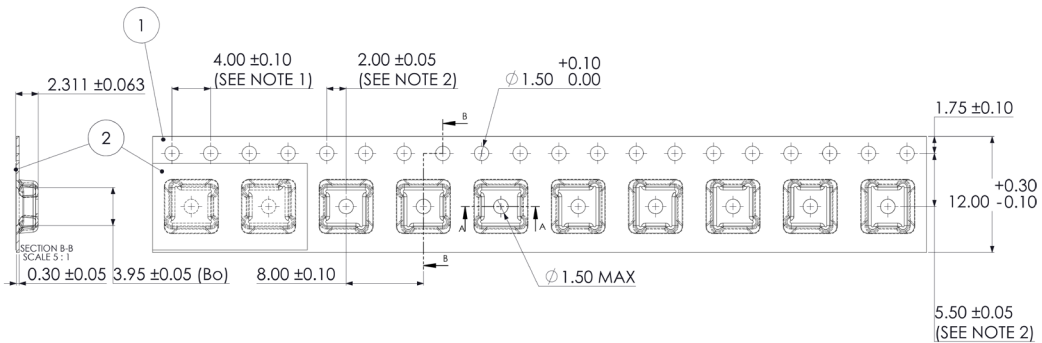


- ① Carrier tape
- ② Cover tape, thickness 0.061 ± 0.013

NOTES:
 1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ± 0.2
 2. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT SPROCKET HOLE.
 3. A₀ AND B₀ ARE MEASURED ON A PLANE AT A DISTANCE "R" ABOVE THE BOTTOM OF THE POCKET.

Figure 14c. Pocket tape dimensions for L110-Axxx090020000

Notes for Figure 14c:
 1. Drawings are not to scale.
 2. All dimensions are in millimeters.



- ① Carrier tape
- ② Cover tape, thickness 0.061 ± 0.013

NOTES:
 1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ± 0.2
 2. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT SPROCKET HOLE.
 3. A₀ AND B₀ ARE MEASURED ON A PLANE AT A DISTANCE "R" ABOVE THE BOTTOM OF THE POCKET.

Figure 14d. Pocket tape dimensions for L110-Axxx145020000 and L110-Axxx150000000

Notes for Figure 14d:
 1. Drawings are not to scale.
 2. All dimensions are in millimeters.

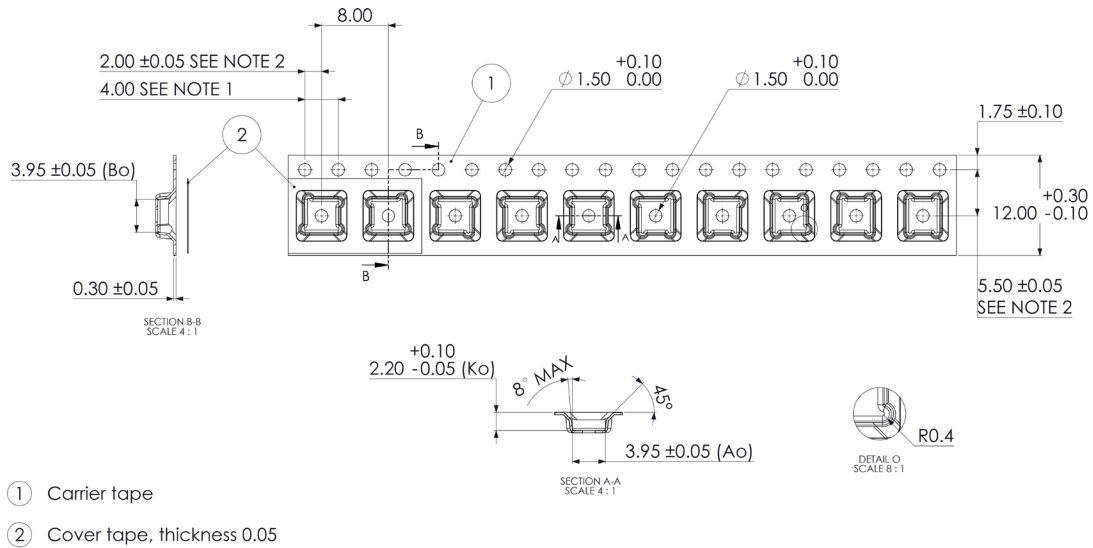


Figure 14e. Pocket tape dimensions for L110-AXXX135020000

Notes for Figure 14e:

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

Reel Dimensions

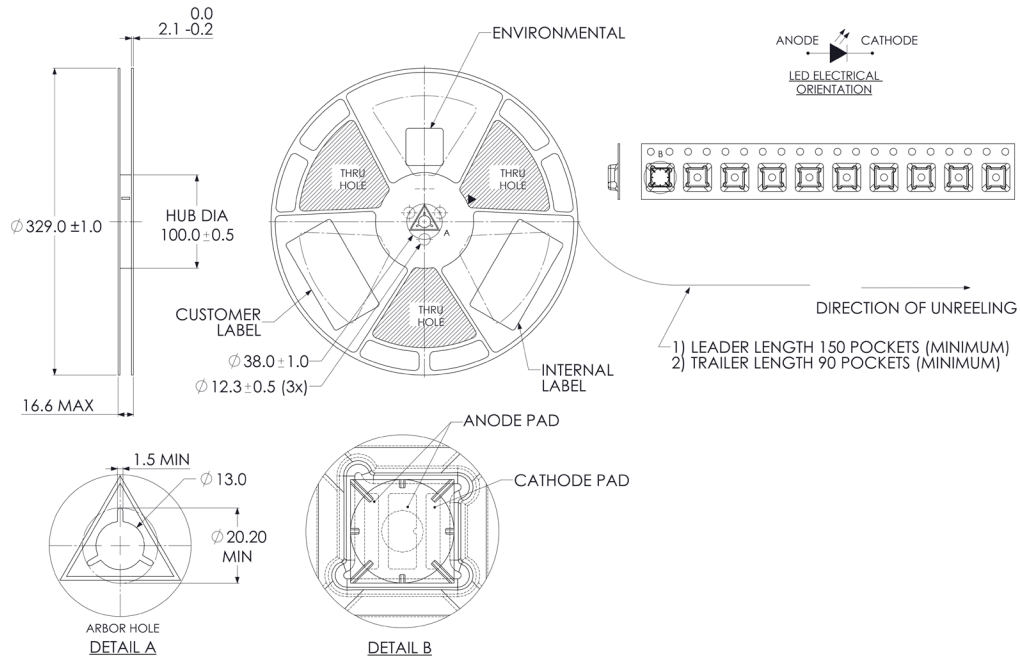


Figure 15. Reel dimensions for LUXEON IR Domed Gen 2

Notes for Figure 15:

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

Product Labeling

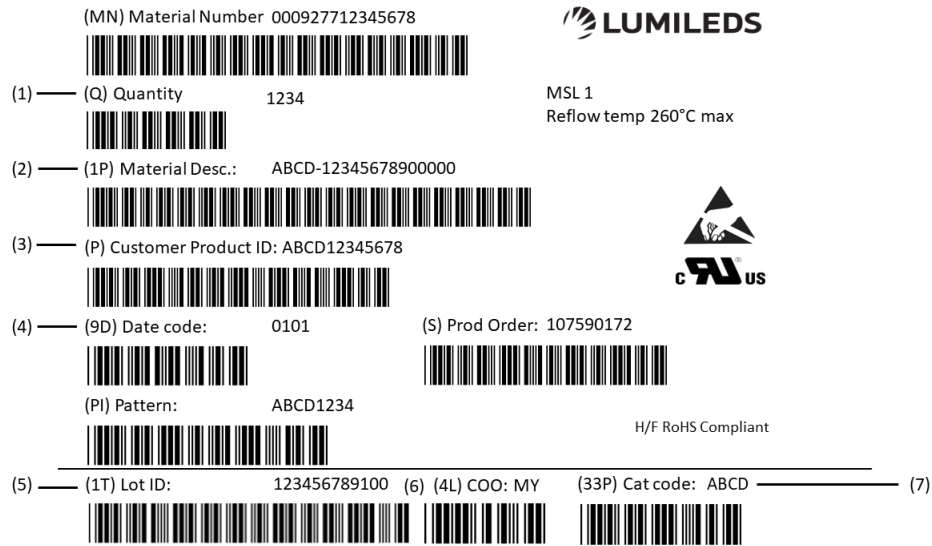


Figure 16. Example of a reel label LUXEON IR Domed Gen 2

Notes for Figure 16: - Reel label descriptions for customer use:

Field labels not described are for Lumileds internal use only.

1. Total number of LED emitters in a shipment box.
2. Lumileds part number
3. Customer part number for custom requests only.
4. LED test date in YYYY format.
5. Unique product lot identification number. This number is required for traceability purposes.
6. Country code of origin of manufacturing of part (e.g. MY for Malaysia, CN for China) according to ISO 3166-1 alpha-2 document.
7. Product bin 4-digit alphanumeric CAT code.

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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