

# LUXEON HL1Z

## High current density Chip Scale Package (CSP) LED

LUXEON HL1Z LEDs offer high flux density performance in a compact footprint, enabling elegant and superior luminaire designs. A wide range of CCTs in 80 and 90CRI options make them ideal for high performance indoor lighting applications, designed into tunable and white color mixing solutions. Best-in-class Color over Angle, and top emission only light output, provides designers with leading Quality of Light performance for dramatic lighting designs and small fixtures. The compact package size and high punch allows design flexibility, beam steering, and white tuning versus traditional LED light sources.



### FEATURES AND BENEFITS

- Small package size (1.4 x 1.4 x 0.36 mm) allows closely packed arrays for narrow beam spots
- Enables color mixing in CCT tunable applications B5
- High current densities for high lumen output and lm/\$ at high lm/W
- CSP 1mm<sup>2</sup> with 2 pads for direct attach enables ease of assembly
- Surface emission only for directional lighting without side light leakage
- High package densities

### PRIMARY APPLICATIONS

- Panel / Soft Lights
- Wall Grazer
- Track Lights
- Linear
- Wall Wash
- Downlights

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# General Product Information

## Product Test Conditions

LUXEON HL1Z LEDs are tested and binned with a DC drive current of 350mA at a junction temperature,  $T_j$ , of 85°C.

## Part Number Nomenclature

Part numbers for LUXEON HL1Z follow the convention below:

L 1 H Z – **x x y y** 1 z z z z z z z z

Where:

- L 1 – designates L1 packaging in Tape and Reel
- x x** – any alphanumeric character that designates nominal ANSI CCT (For example, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57 = 5700K, 65=6500K)
- y y** – any alphanumeric character that designates CRI (80=80CRI, 90=90CRI)
- 1 – designates 1.0mm<sup>2</sup> die size
- zzzz zzzz – any alphanumeric character that designates Option Codes for customization / bin selections / etc

Therefore, the following part number is used for a LUXEON HL1Z, 3000K 80CRI LED:

L 1 H Z – **3 0 8 0** 1 0 0 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 HL1Z is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS Directive 2011/65/EU and REACH Regulation (EC) 1907/2006. Lumileds LLC will not intentionally add the following restricted materials to its products: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

# Performance Characteristics

## Product Selection Guide

Table 1. Product performance of LUXEON HL1Z at 350mA,  $T_j=85^\circ\text{C}$ .

| NOMINAL CCT | MINIMUM CRI <sup>[1, 2]</sup> | LUMINOUS FLUX <sup>[1]</sup> (lm) |         | PART NUMBER        |
|-------------|-------------------------------|-----------------------------------|---------|--------------------|
|             |                               | MINIMUM                           | TYPICAL |                    |
| 3000        | 80                            | 100                               | 126     | L1HZ-3080100000000 |
| 4000        | 80                            | 110                               | 134     | L1HZ-4080100000000 |
| 5000        | 80                            | 110                               | 133     | L1HZ-5080100000000 |
| 6500        | 80                            | 110                               | 133     | L1HZ-6580100000000 |
| 3500        | 90                            | 90                                | 108     | L1HZ-3590100000000 |

**Notes for Table 1:**

- Lumileds maintains a tolerance of  $\pm 2$  on CRI and  $\pm 6.5\%$  on luminous flux measurements.
- Typical CRI is approximately 2 points higher for those parts with minimum 70CRI specified, but this is not guaranteed. Minimum CRI is 68.5 for parts with 70CRI typical.

## Optical Characteristics

Table 2. Optical characteristics for LUXEON HL1Z at 350mA,  $T_j=85^\circ\text{C}$ .

| PART NUMBER          | TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup> | TYPICAL VIEWING ANGLE <sup>[2]</sup> |
|----------------------|---|--------------------------------------|
| L1HZ -xxyy1 zzzzzzzz | 140°  | 120°                                 |

**Notes for Table 2:**

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

## Electrical and Thermal Characteristics

Table 3. Electrical and thermal characteristics for LUXEON HL1Z at 350mA,  $T_j=85^\circ\text{C}$ .

| PART NUMBER          | FORWARD VOLTAGE <sup>[1]</sup> ( $V_f$ ) |         |         | TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE <sup>[2]</sup> (mV/°C) | TYPICAL THERMAL RESISTANCE—JUNCTION TO SOLDER PAD (°C/W) |
|----------------------|--|---------|---------|---|--|
|                      | MINIMUM                                  | TYPICAL | MAXIMUM |   |  |
| L1HZ -xxyy1 zzzzzzzz | 2.65                                     | 2.80    | 3.00    | -2  | 3  |

**Notes for Table 3:**

- Lumileds maintains a tolerance of  $\pm 0.1\text{V}$  on forward voltage measurements.
- Measured between 25°C and 85°C.

# Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON HL1Z.

| PARAMETER  | MAXIMUM PERFORMANCE                                       |
|--|---|
| DC Forward Current <sup>[1, 2]</sup>                 | 700mA   |
| Peak Pulsed Forward Current <sup>[1, 3]</sup>        | 850mA   |
| LED Junction Temperature <sup>[1]</sup> (DC & Pulse) | 135°C   |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)        | 2000V (Class 1C)  |
| Operating Case Temperature <sup>[1]</sup>            | -40°C to 125°C  |
| LED Storage Temperature                              | -40°C to 125°C  |
| Soldering Temperature                                | JEDEC 020D.1 260°C  |
| Allowable Reflow Cycles                              | 3   |
| Autoclave Conditions                                 | NA  |
| Reverse Voltage <sup>[4]</sup> ( $V_{reverse}$ )     | 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," with frequencies  $\geq 100\text{Hz}$  and amplitude  $\leq 850\text{mA}$  are acceptable, assuming the average current throughout each cycle does not exceed the maximum allowable DC forward current at the corresponding maximum junction temperature.
3. Pulsed operation with a peak drive current equal to the stated peak pulsed forward current is acceptable if the pulse on-time is  $\leq 5\text{ms}$  per cycle and the duty cycle is  $\leq 50\%$ .
4. Transient reverse voltages and surge currents due to electrical switching or supply interruptions are acceptable if these events do not last for more than 10ms, the amplitude of the reverse voltage does not exceed 5V and the reverse current is less than 220uA.

# Characteristic Curves

## Spectral Power Distribution Characteristics

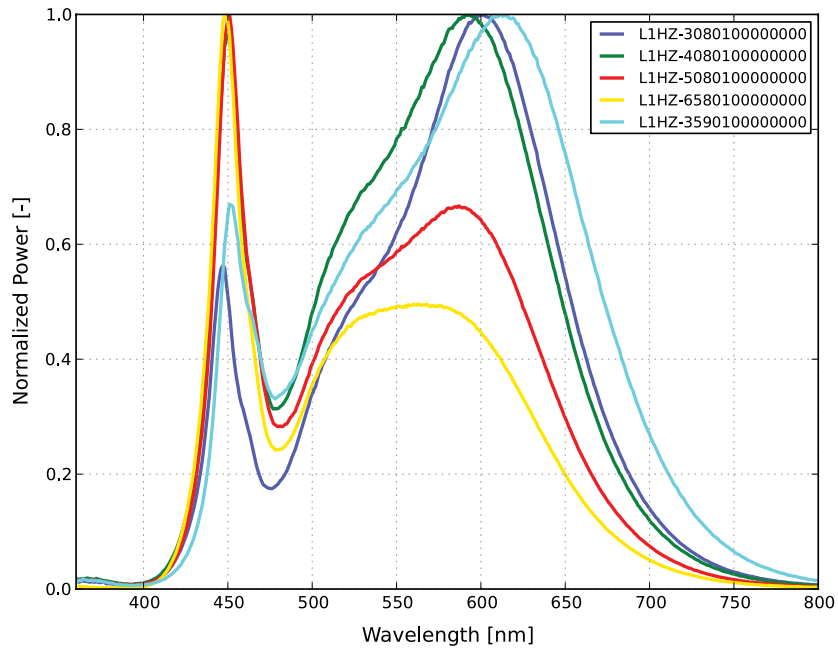


Figure 1. Typical normalized power vs. wavelength for L1HZ -xxyy1zzzzzzzz at 350mA,  $T_j=85^{\circ}\text{C}$ .

## Light Output Characteristics

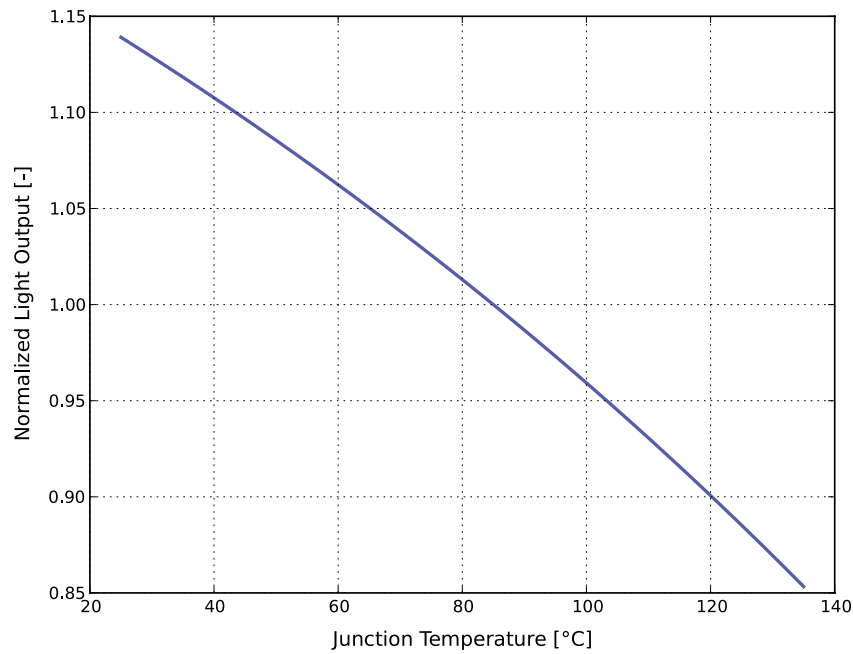


Figure 2. Typical normalized light output vs. junction temperature for LUXEON HL1Z at 350mA.

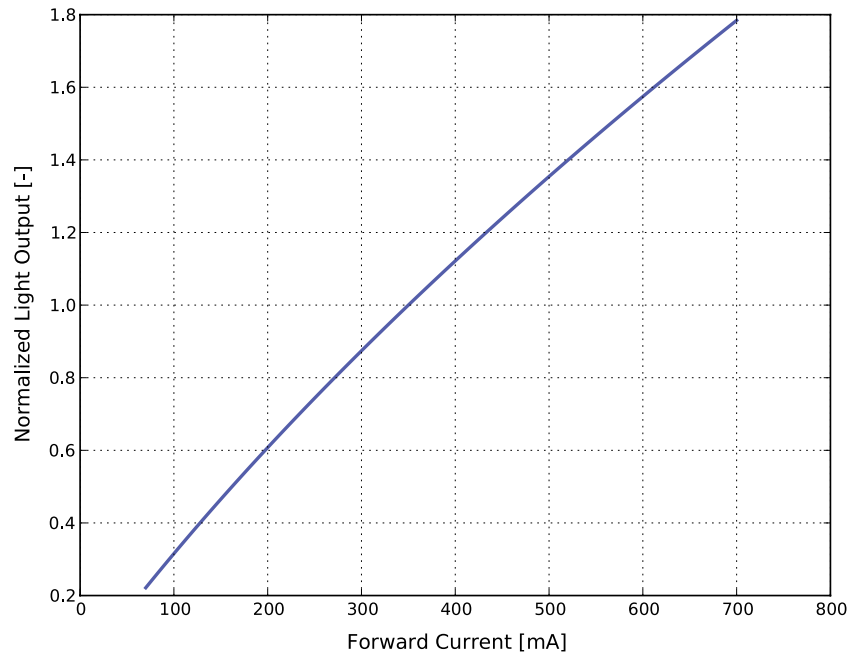


Figure 3. Typical normalized light output vs. forward current for LUXEON HL1Z at  $T_j=85^\circ\text{C}$ .

## Forward Current Characteristics

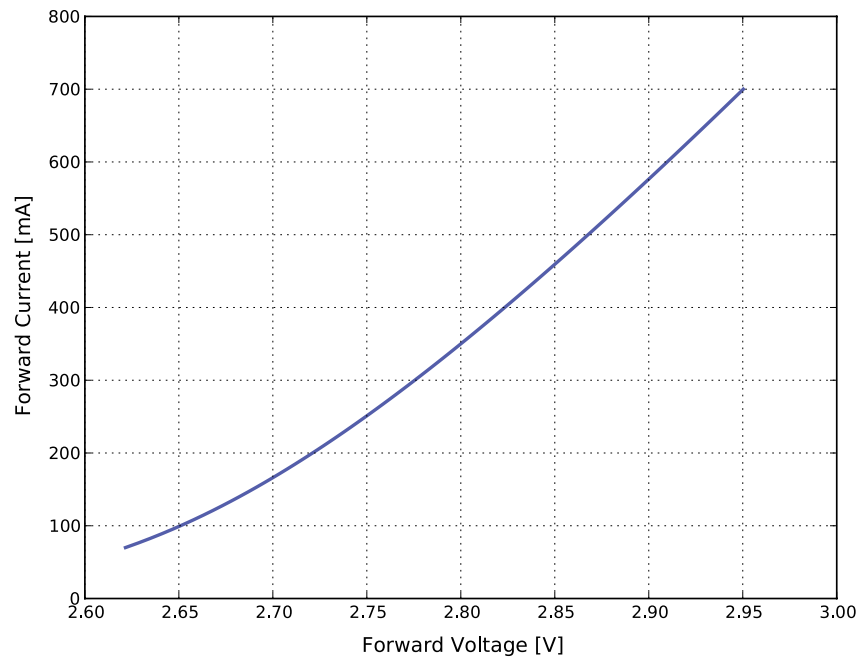


Figure 4. Typical forward current vs. forward voltage for LUXEON HL1Z at  $T_j=85^\circ\text{C}$ .

# Radiation Pattern Characteristics

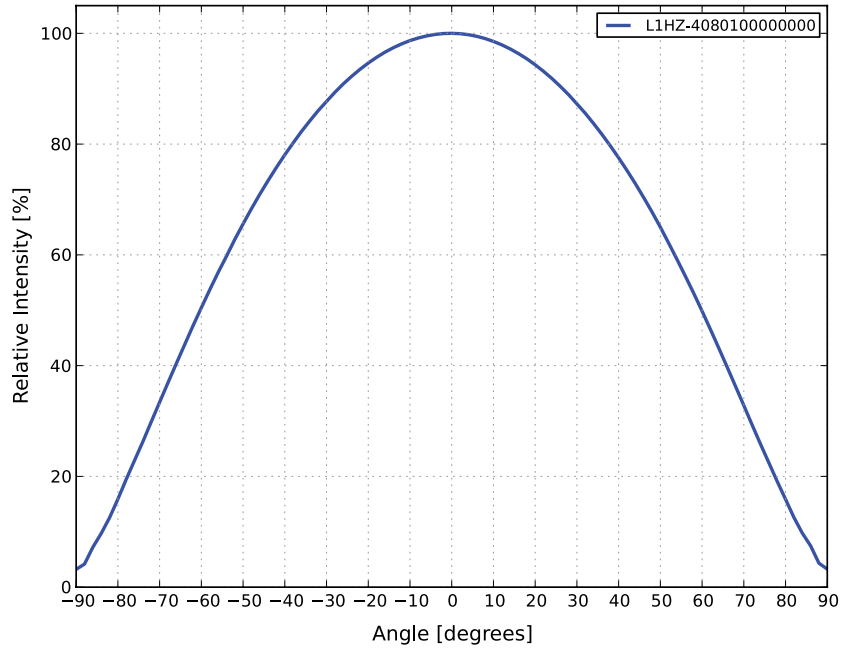


Figure 5. Typical radiation pattern for LUXEON HL1Z at 350mA,  $T_j=85^{\circ}\text{C}$ .

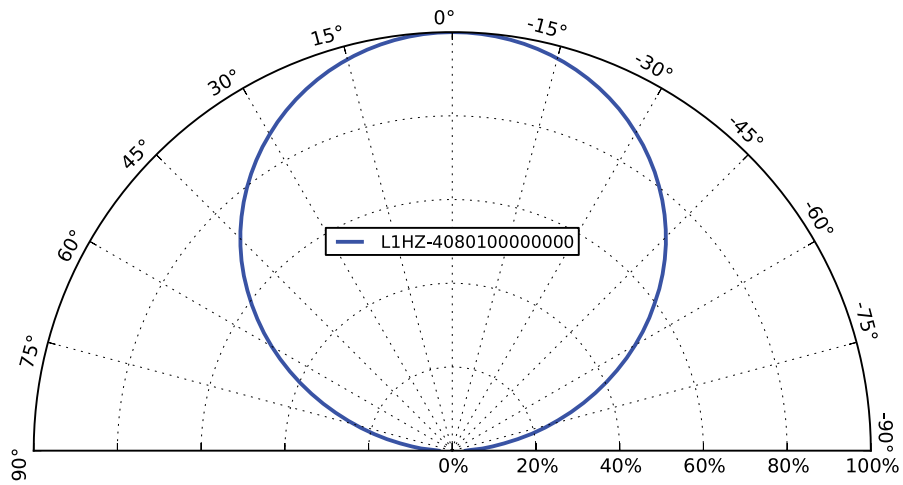


Figure 6. Typical polar radiation pattern for LUXEON HL1Z at 350mA,  $T_j=85^{\circ}\text{C}$ .



# Product Bin and Labeling Definitions

## Decoding Product Bin Labeling

In the manufacturing of semiconductor products, there are variations in performance around the average values given in the technical datasheet. For this reason, Lumileds bins LED components for luminous flux or radiometric power, color point, peak or dominant wavelength and forward voltage.

LUXEON HL1Z 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: H=100 to 110 lm, K=120 to 130 lm)
- B** – designates color bin (example: 1=6500K, 3=5000K, 5=4000K, 6 = 3500K, 7=3000K, 8=2700K)
- C** – designates color space (example: 3, U, or L for 3-step MacAdam ellipse; A, B, C, or D for 5-step MacAdam ellipse)
- D** – designates forward voltage bin (example: X=2.65 to 2.80V, Y=2.80 to 3.00V)

Therefore, a LUXEON HL1Z with a lumen range of 100 to 110 lm, CCT of 5000K, 5-step MacAdam ellipse color bin C, and a forward voltage range of 2.80 to 3.00V has the following CAT code:

### **H 3 C Y**

## Luminous Flux Bins

Table 5 lists the standard luminous flux bins for LUXEON HL1Z 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 HL1Z,  $T_j=85^\circ\text{C}$ .

| BIN | LUMINOUS FLUX <sup>[1]</sup> (lm) |         |
|-----|-----------------------------------|---------|
|     | MINIMUM                           | MAXIMUM |
| A   | 30                                | 40      |
| B   | 40                                | 50      |
| C   | 50                                | 60      |
| D   | 60                                | 70      |
| E   | 70                                | 80      |
| F   | 80                                | 90      |
| G   | 90                                | 100     |
| H   | 100                               | 110     |
| J   | 110                               | 120     |
| K   | 120                               | 130     |
| L   | 130                               | 140     |
| M   | 140                               | 150     |
| N   | 150                               | 160     |
| P   | 160                               | 170     |

**Notes for Table 5:**

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

# Color Bin Definitions

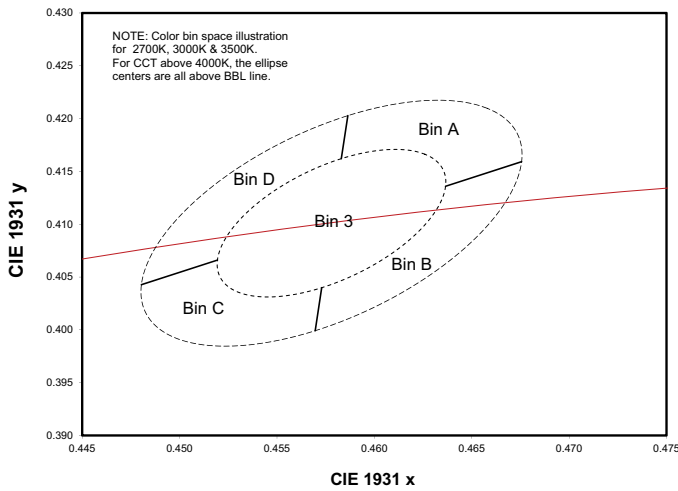


Figure 7. Color space definition for LUXEON HL1Z.

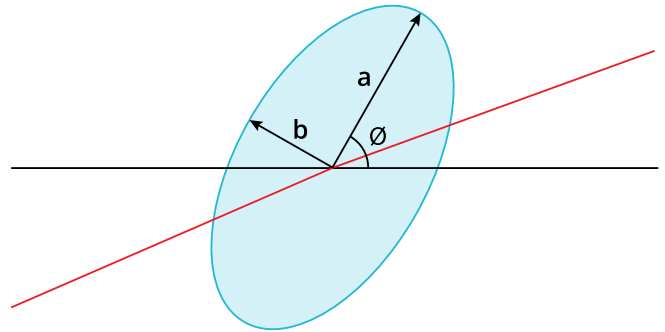


Figure 8. 5-step MacAdam ellipse illustration for Table 6.

Table 6. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON HL1Z.

| NOMINAL CCT | COLOR SPACE                   | CENTER POINT <sup>[1]</sup><br>(cx, cy) | MAJOR AXIS,<br>a | MINOR AXIS,<br>b | ELLIPSE ROTATION<br>ANGLE, θ |
|-------------|-------------------------------|---|------------------|------------------|------------------------------|
| 2700K       | Single 3-step MacAdam ellipse | (0.4578, 0.4101)                        | 0.008 100        | 0.004 200        | 53.70°                       |
|             | Single 5-step MacAdam ellipse |   | 0.013 500        | 0.007 000        |                              |
| 3000K       | Single 3-step MacAdam ellipse | (0.4338, 0.4030)                        | 0.008 340        | 0.004 080        | 53.22°                       |
|             | Single 5-step MacAdam ellipse |   | 0.013 900        | 0.006 800        |                              |
| 3500K       | Single 3-step MacAdam ellipse | (0.4073, 0.3917)                        | 0.009 270        | 0.004 140        | 54.00°                       |
|             | Single 5-step MacAdam ellipse |   | 0.015 450        | 0.006 900        |                              |
| 4000K       | Single 3-step MacAdam ellipse | (0.3818, 0.3797)                        | 0.009 390        | 0.004 020        | 53.72°                       |
|             | Single 5-step MacAdam ellipse |   | 0.015 650        | 0.006 700        |                              |
| 5000K       | Single 3-step MacAdam ellipse | (0.3447, 0.3553)                        | 0.008 220        | 0.003 540        | 59.62°                       |
|             | Single 5-step MacAdam ellipse |   | 0.013 700        | 0.005 900        |                              |
| 6500K       | Single 3-step MacAdam ellipse | (0.3123, 0.3282)                        | 0.006 690        | 0.002 850        | 58.57°                       |
|             | Single 5-step MacAdam ellipse |   | 0.011 150        | 0.004 750        |                              |

**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 HL1Z.

| BIN | CCT   |
|-----|-------|
| 1   | 6500K |
| 3   | 5000K |
| 5   | 4000K |
| 6   | 3500K |
| 7   | 3000K |
| 8   | 2700K |

Table 8. MacAdam ellipse color space definitions for LUXEON HL1Z.

| BIN | SDCM                                 |
|-----|--------------------------------------|
| 3   | 3-step MacAdam ellipse (all CCT-CRI) |
| A   | 5-step MacAdam ellipse (all CCT-CRI) |
| B   | 5-step MacAdam ellipse (all CCT-CRI) |
| C   | 5-step MacAdam ellipse (all CCT-CRI) |
| D   | 5-step MacAdam ellipse (all CCT-CRI) |

# Forward Voltage Bins

Table 9. Forward voltage bin definitions for LUXEON HL1Z.

| BIN | FORWARD VOLTAGE <sup>(1)</sup> (V <sub>f</sub> ) |         |
|-----|--|---------|
|     | MINIMUM  | MAXIMUM |
| R   | 2.65   | 2.80    |
| S   | 2.80   | 2.95    |

Notes for Table 9:

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

# Mechanical Dimensions

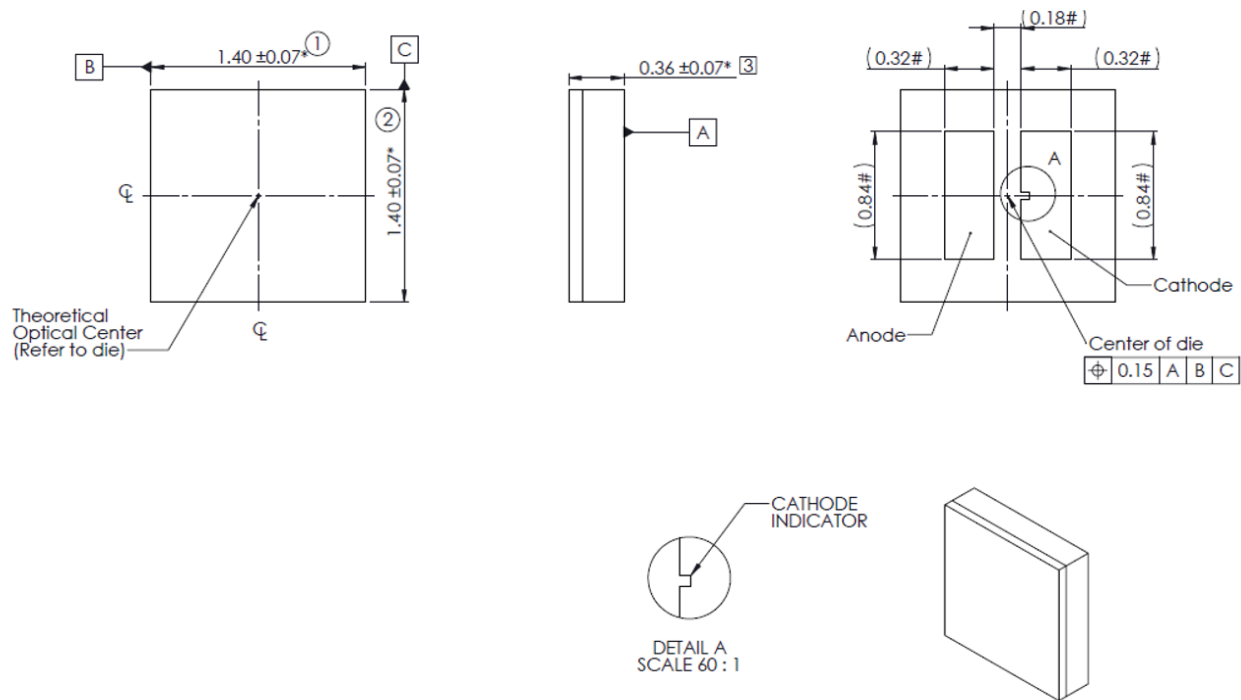


Figure 9. Mechanical dimensions for LUXEON HL1Z.

Notes for Figure 9:

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

# Reflow Soldering Guidelines

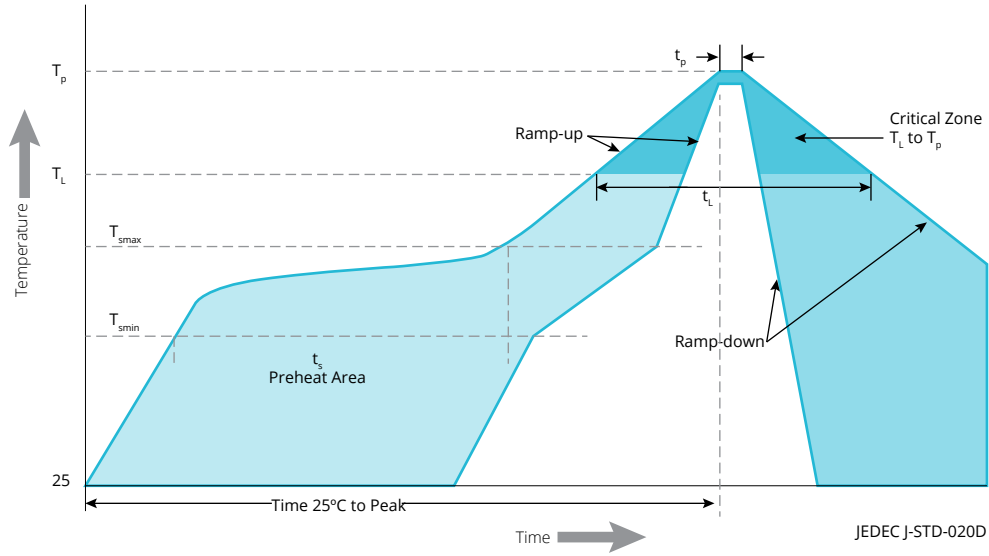


Figure 10. Visualization of the acceptable reflow temperature profile as specified in Table 10.

Table 10. Reflow profile characteristics for LUXEON HL1Z.

| PROFILE FEATURE                                      | LEAD-FREE ASSEMBLY   |
|--|----------------------|
| Preheat Minimum Temperature ( $T_{smin}$ )           | 150°C                |
| Preheat Maximum Temperature ( $T_{smax}$ )           | 200°C                |
| Preheat Time ( $t_{smin}$ to $t_{smax}$ )            | 60 to 180 seconds    |
| Ramp-Up Rate ( $T_L$ to $T_p$ )                      | 3°C / second maximum |
| Liquidous Temperature ( $T_L$ )                      | 217°C                |
| Time Maintained Above Temperature $T_L$ ( $t_t$ )    | 60 to 150 seconds    |
| Peak / Classification Temperature ( $T_p$ )          | 260°C                |
| Time Within 5°C of Actual Peak 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    |

**Notes for Table 10:**

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

## JEDEC Moisture Sensitivity

Table 11. Moisture sensitivity levels for LUXEON HL1Z.

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

# Solder Pad Design

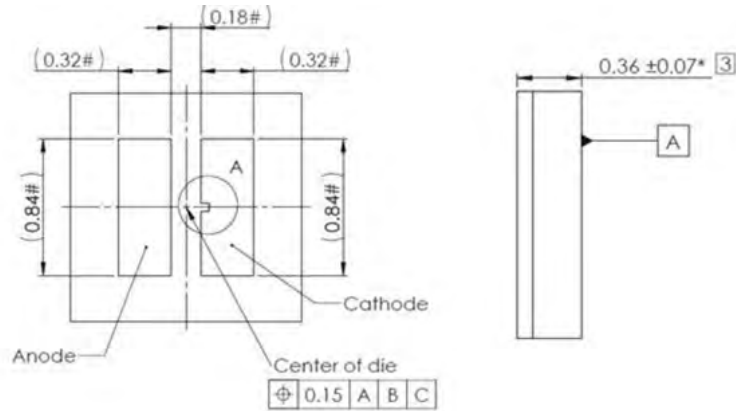


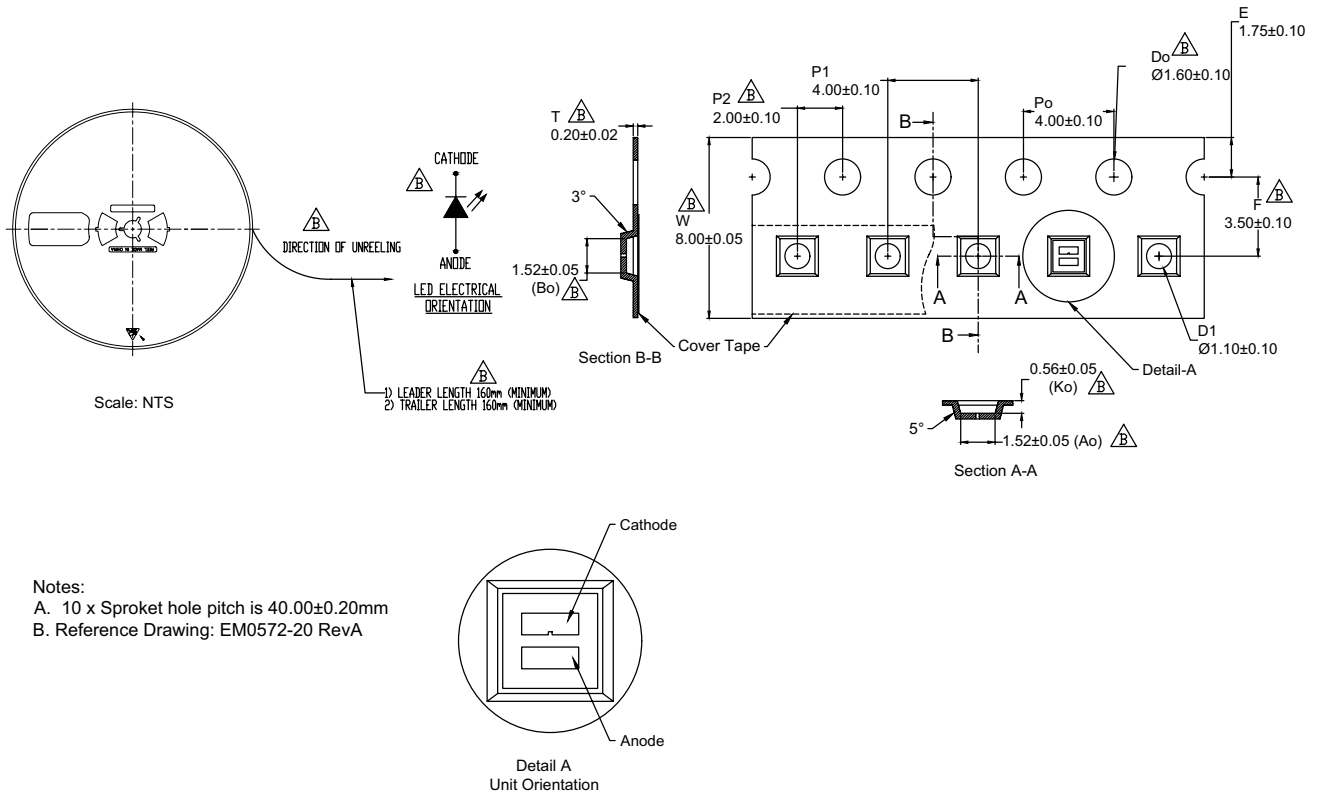
Figure 11. Recommended PCB solder pad layout for LUXEON HL1Z.

**Notes for Figure 11:**

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

# Packaging Information

## Pocket Tape Dimensions



- Notes:**
- A. 10 x Sprocket hole pitch is 40.00 ± 0.20mm
  - B. Reference Drawing: EM0572-20 RevA

Figure 12. Pocket tape dimensions for LUXEON HL1Z.

**Notes for Figure 12:**

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

# Reel Dimensions

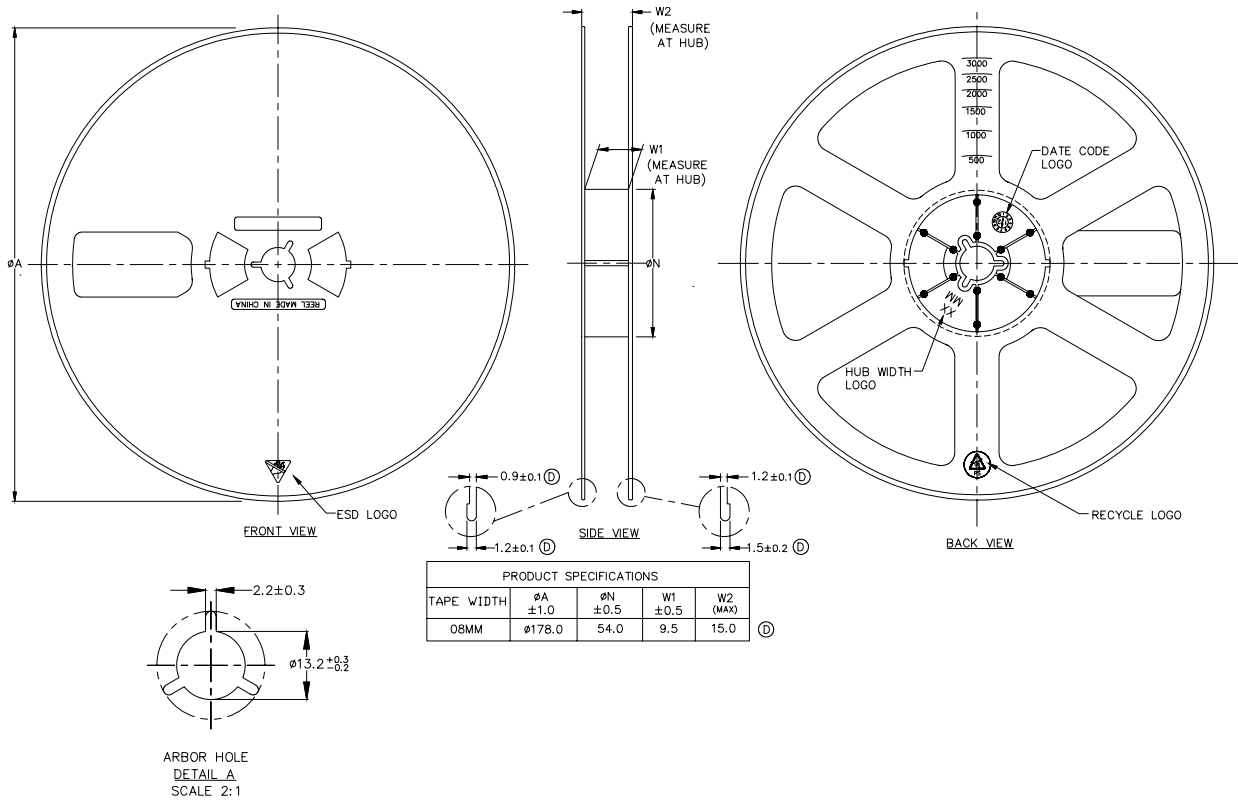


Figure 13. Reel dimensions for LUXEON HL1Z.

**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](http://lumileds.com).



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