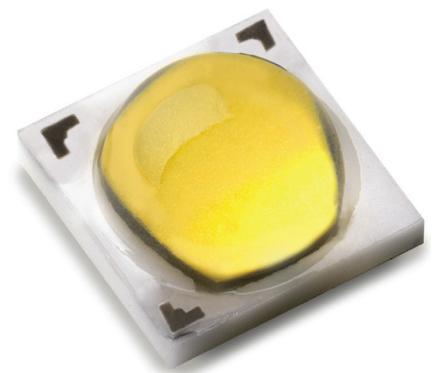


# LUXEON T

A bright, versatile and high efficacy emitter

LUXEON T is designed to deliver high efficacy with high flux density to enable tight beam control in directional and high lumen applications. With *Freedom from Binning* and leading performance, LUXEON T LEDs are specified, targeted and tested hot, at real world operating temperatures, 85°C, to ensure in-application performance. LUXEON T LEDs allow system optimization by blending the perfect combination of high efficacy and low system cost, while tight correlated color temperature ensures consistency in system color point.



## FEATURES AND BENEFITS

3 & 5-step MacAdam ellipse: *Freedom from Binning* for superior Quality of Light

Low  $V_f$  and thermal resistance enables smaller heatsinks and higher lumens

High luminance and small optical source for precise beam control in directional applications

Superior efficacy and light output from a compact source

## PRIMARY APPLICATIONS

Downlights

High Bay & Low Bay

Indoor Area Lighting

Lamps

Outdoor

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# General Product Information

## Product Test Conditions

LUXEON T LEDs are tested and binned with a DC drive current of 700mA at a junction temperature,  $T_j$ , of 85°C.

## Part Number Nomenclature

Part numbers for LUXEON T follow the convention below:

L X H **A** – F W **B B** – **C** and  
L X H **A** – F W **B B** – **D D D D**

Where:

- A** – designates minimum CRI performance (7=70CRI, 8=80CRI, 9=90CRI and I for Royal Blue)
- B B** – designates nominal ANSI CCT (27=2700K, 30=3000K and RB for Royal Blue)
- C** – designates color definition (3=3 SDCM and 5=5 SDCM)
- D D D D** – designates minimum luminous flux output (1000=1000mW)

Therefore, the following part number is used for a LUXEON T White 3-step MacAdam ellipse, 3000K 80CRI:

L X H **8** – F W **3 0** – **3** and

Therefore, the following part number is used for a LUXEON T Royal Blue with a minimum radiometric power of 1000mA:

L X H **1** – F W **R B** – **1 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 T 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 T white at 700mA and 350mA,  $T_j=85^{\circ}\text{C}$ .

| NOMINAL CCT | MINIMUM CRI <sup>(1)</sup> | LUMINOUS FLUX <sup>(2)</sup> (lm) |         | TYPICAL LUMINOUS EFFICACY (lm/W) | TYPICAL LUMINOUS FLUX (lm) | TYPICAL LUMINOUS EFFICACY (lm/W) | PART NUMBER |
|-------------|----------------------------|-----------------------------------|---------|----------------------------------|----------------------------|----------------------------------|-------------|
|             |                            | MINIMUM                           | TYPICAL |                                  |                            |                                  |             |
|             |                            | 700mA                             |         |                                  |                            | 350mA                            |             |
| 3000K       | 70                         | 200                               | 218     | 111                              | 117                        | 123                              | LXH7-FW30   |
| 4000K       | 70                         | 210                               | 249     | 127                              | 133                        | 140                              | LXH7-FW40   |
| 5000K       | 70                         | 220                               | 255     | 130                              | 136                        | 143                              | LXH7-FW50   |
| 5700K       | 70                         | 220                               | 255     | 130                              | 136                        | 143                              | LXH7-FW57   |
| 6500K       | 70                         | 220                               | 255     | 130                              | 136                        | 143                              | LXH7-FW65   |
| 2700K       | 80                         | 170                               | 186     | 95                               | 100                        | 105                              | LXH8-FW27-x |
| 3000K       | 80                         | 180                               | 197     | 101                              | 106                        | 112                              | LXH8-FW30-x |
| 3500K       | 80                         | 190                               | 208     | 106                              | 112                        | 118                              | LXH8-FW35-x |
| 4000K       | 80                         | 190                               | 212     | 108                              | 114                        | 120                              | LXH8-FW40-x |
| 5000K       | 80                         | 190                               | 222     | 113                              | 120                        | 127                              | LXH8-FW50-x |
| 3000K       | 95 typ                     | 130                               | 160     | 82                               | 86                         | 91                               | LXH9-FW30-x |

Notes for Table 1a:

1. Lumileds maintains a tolerance of  $\pm 2$  on CRI.
2. Lumileds maintains a tester tolerance of  $\pm 6.5\%$  on luminous flux measurements.

Table 1b. Product performance for LUXEON T Royal Blue at 700mA,  $T_j=85^{\circ}\text{C}$ .

| DOMINANT WAVELENGTH (nm) |         | RADIOMETRIC POWER (mW) |         | PART NUMBER |
|--------------------------|---------|------------------------|---------|-------------|
| MINIMUM                  | MAXIMUM | MINIMUM                | TYPICAL |             |
| 445                      | 460     | 950                    | 1040    | LXH1-FWRB   |

Notes for Table 1b:

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

## Optical Characteristics

Table 2. Optical characteristics for LUXEON T at 700mA.

| PART NUMBER | TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup> | TYPICAL VIEWING ANGLE <sup>[2]</sup> |
|-------------|---------------------------------------------|--------------------------------------|
| LXH7-FWxx   | 160°                                        | 120°                                 |
| LXHx-FWxx-x | 160°                                        | 120°                                 |
| LXH1-FWRB   | 160°                                        | 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  $\frac{1}{2}$  of the peak value.

## Electrical and Thermal Characteristics

Table 3. Electrical and thermal characteristics for LUXEON T at 700mA,  $T_j=85^\circ\text{C}$ .

| PART NUMBER | FORWARD VOLTAGE (V) <sup>[1]</sup> |         |         | TYPICAL TEMPERATURE<br>COEFFICIENT OF FORWARD<br>VOLTAGE (mV/°C) <sup>[2]</sup> | TYPICAL THERMAL<br>RESISTANCE JUNCTION TO<br>SOLDER PAD (°C/W) |
|-------------|------------------------------------|---------|---------|---------------------------------------------------------------------------------|----------------------------------------------------------------|
|             | MINIMUM                            | TYPICAL | MAXIMUM |                                                                                 |                                                                |
| LXH7-FWxx   | 2.50                               | 2.80    | 3.25    | -1.60                                                                           | 3.00                                                           |
| LXH8-FWxx-x | 2.50                               | 2.80    | 3.25    | -1.60                                                                           | 3.00                                                           |
| LXH1-FWRB   | 2.50                               | 2.80    | 3.25    | -1.60                                                                           | 3.00                                                           |

Notes for Table 3:

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

## Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON T,  $T_j=85^\circ\text{C}$ .

| PARAMETER                                                  | MAXIMUM PERFORMANCE                                       |
|------------------------------------------------------------|-----------------------------------------------------------|
| DC Forward Current <sup>[1, 2]</sup>                       | 1050mA                                                    |
| Peak Pulsed Forward Current <sup>[1, 3]</sup>              | 1200mA                                                    |
| LED Junction Temperature <sup>[1]</sup> (DC & Pulse)       | 150°C                                                     |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)              | Class 3B                                                  |
| Operating Case Temperature <sup>[1]</sup>                  | -40°C to 135°C                                            |
| Storage Temperature                                        | -40°C to 135°C                                            |
| Soldering Temperature                                      | JEDEC 020c 260°C                                          |
| Allowable Reflow Cycles                                    | 3                                                         |
| Reverse Voltage <sup>[4, 5]</sup> ( $V_{\text{reverse}}$ ) | LUXEON LEDs are not designed to be driven in reverse bias |

Notes for 4:

1. Proper current derating must be observed to maintain junction temperature below the maximum. For additional information on thermal measurement guidelines please refer to Application Brief AB106.
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  $\leq 150\text{mA}$  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.
5. Max 5V reverse for up to 10s is an acceptable beginning of life, one time test condition.

# Characteristic Curves

## Spectral Power Distribution Characteristics

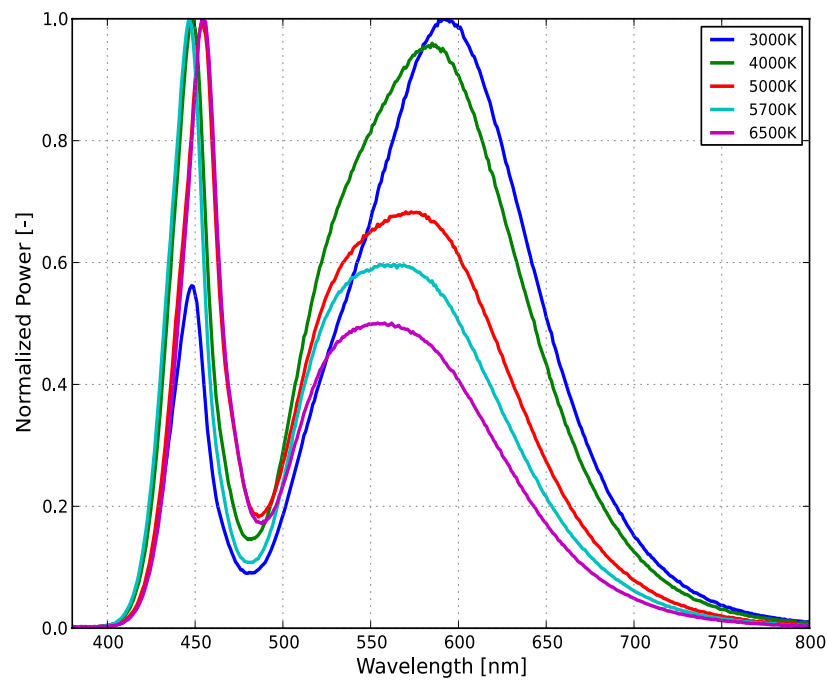


Figure 1a: Typical normalized power vs. wavelength for LXH7-FWxx at 700mA,  $T_j=85^{\circ}\text{C}$ .

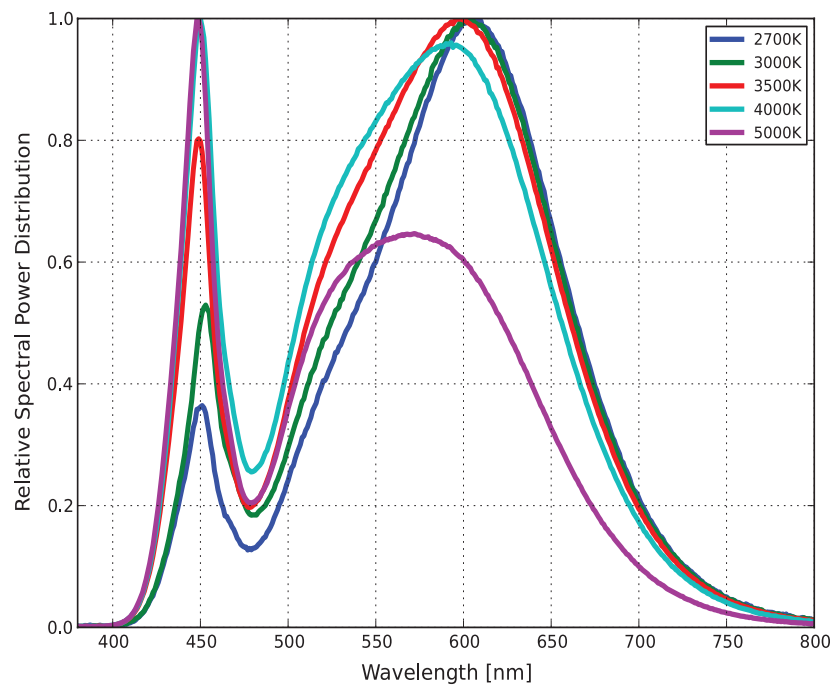


Figure 1b: Typical normalized power vs. wavelength for LXH8-FWxx at 700mA,  $T_j=85^{\circ}\text{C}$ .

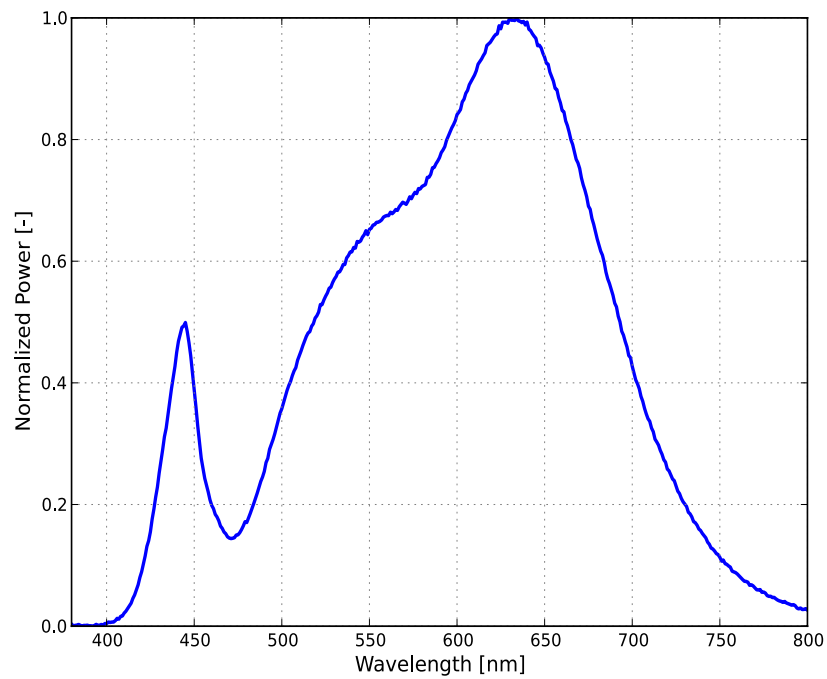


Figure 1c: Typical normalized power vs. wavelength for LXH7-FWxx at 700mA,  $T_j=85^{\circ}\text{C}$ .

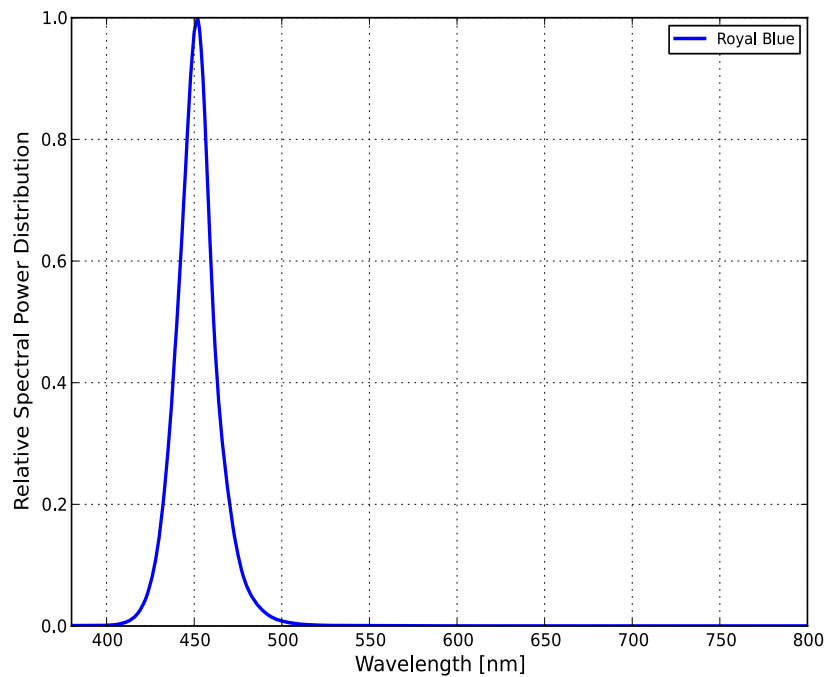


Figure 1d: Typical normalized power vs. wavelength for LXHx-FWRB at 700mA.

# Light Output Characteristics

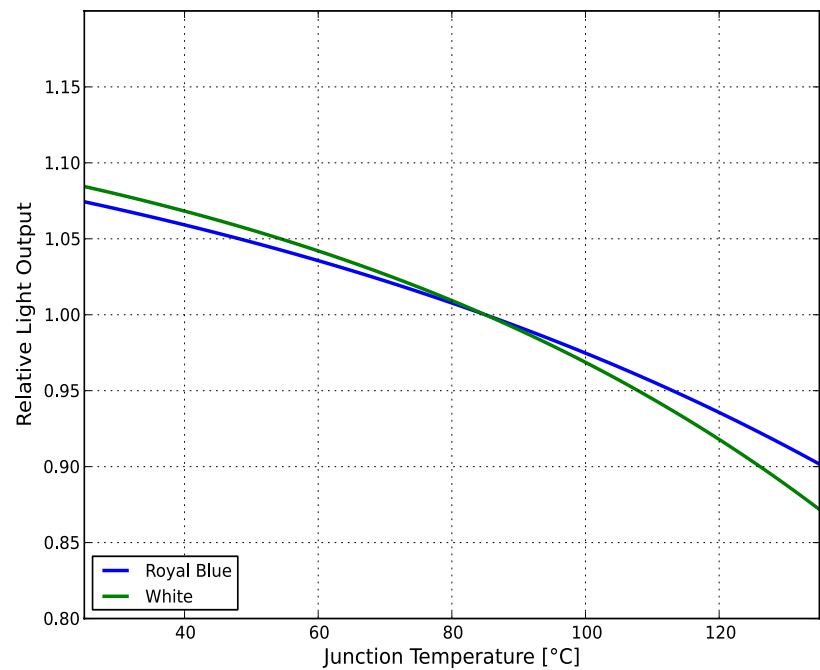


Figure 2a: Typical normalized light output vs. junction temperature for LXFx-FWxx at 700mA.

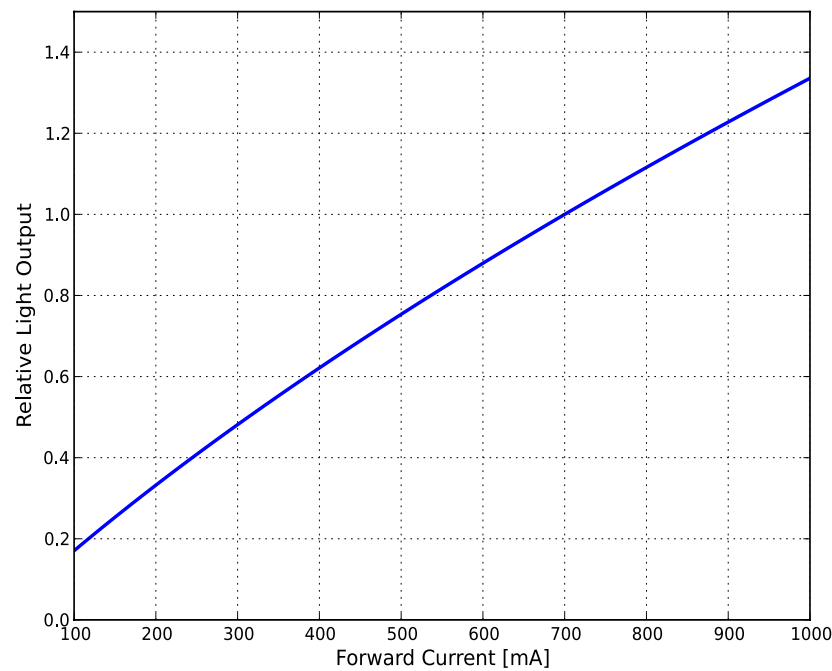


Figure 2b: Typical normalized light output vs. forward current for LXFx-FWxx at T<sub>j</sub>=85°C.

# Forward Current Characteristics

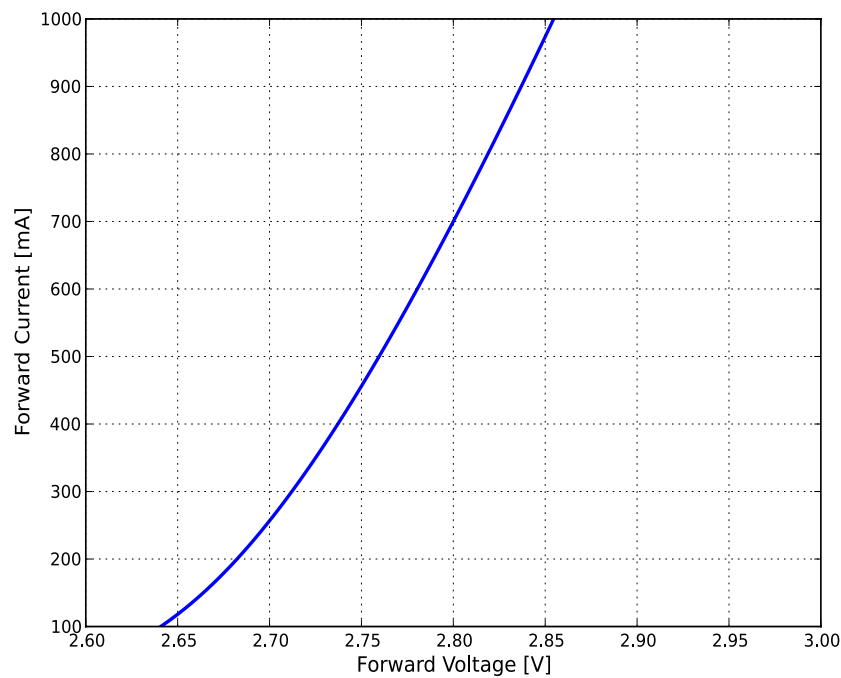


Figure 3a: Typical forward current vs. forward voltage for LXHx-FWxx at T<sub>j</sub>=85°C.

# Radiation Pattern Characteristics

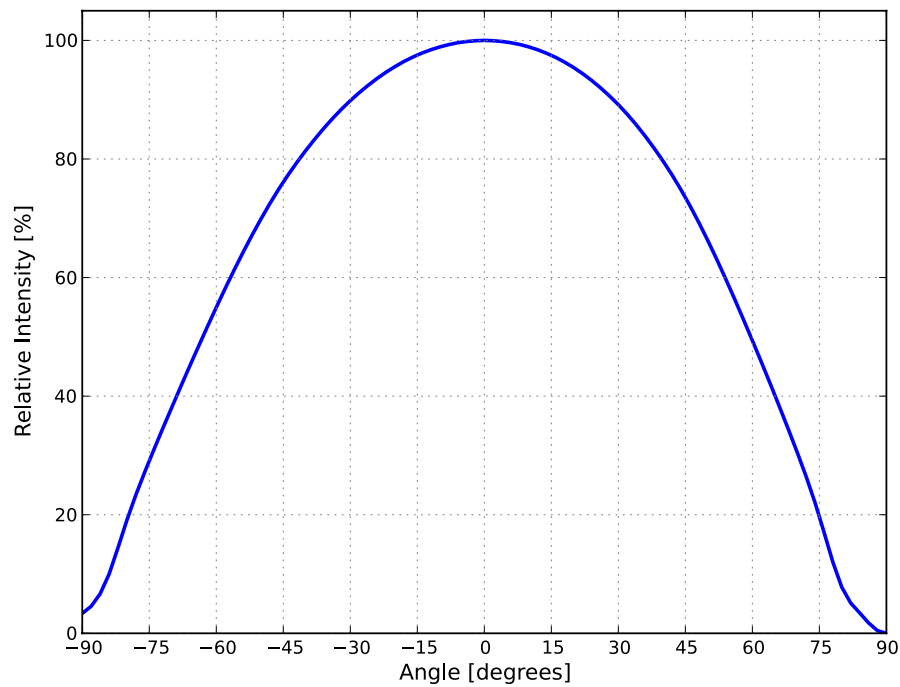


Figure 4a: Typical radiation pattern for LXHx-FWxx at 700mA,  $T_j=85^{\circ}\text{C}$ .

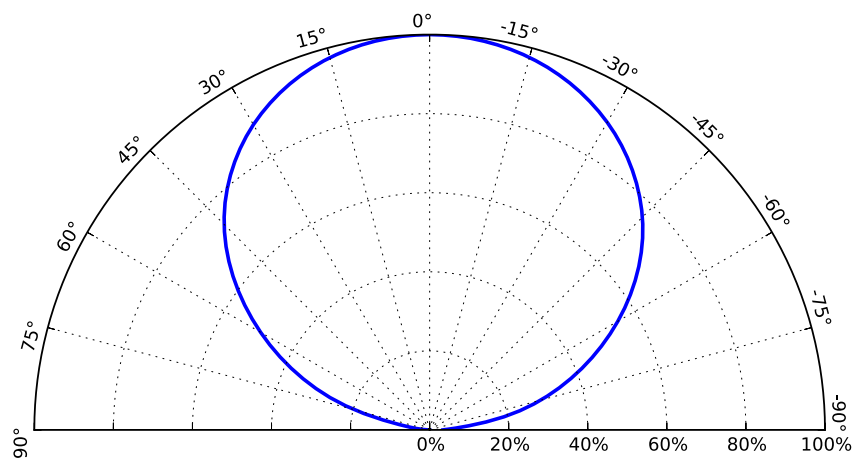


Figure 4b: Typical polar radiation pattern for LXHx-FWxx at 700mA,  $T_j=85^{\circ}\text{C}$ .

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

### A B C D

- A** – designates luminous flux or radiometric power bin (example: M=210 to 220 lumens, R=250 to 260 lumens)
- B** – designates correlated color temperature bin (0=Royal Blue, 1=6500K, 2=5700K, 3=5000K, 5=4000K, 6=3500K, 7=3000K, 8=2700K)
- C** – designates SDCM or wavelength bin (3=3-step MacAdam ellipse, 4=445 to 450nm, 5=450 to 455nm or 5-step MacAdam ellipse, 6=455 to 460nm, A, B, C or D=5-step specified bin)
- D** – designates forward voltage bin (example: P=2.50 to 2.75V, S=3.00 to 3.25V)

Therefore, a LUXEON T with a lumen range of 210 to 220, color bin of 7 designating 3000K parts, 3-step MacAdam ellipse 80CRI and a forward voltage range of 2.50 to 2.75 has the following CAT code:

**M 7 3 P**

## Luminous Flux Bins

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

| BIN | LUMINOUS FLUX (lm) |         |
|-----|--------------------|---------|
|     | MINIMUM            | MAXIMUM |
| C   | 120                | 130     |
| D   | 130                | 140     |
| E   | 140                | 150     |
| F   | 150                | 160     |
| G   | 160                | 170     |
| H   | 170                | 180     |
| J   | 180                | 190     |
| K   | 190                | 200     |
| L   | 200                | 210     |
| M   | 210                | 220     |
| N   | 220                | 230     |
| P   | 230                | 240     |
| Q   | 240                | 250     |
| R   | 250                | 260     |
| S   | 260                | 270     |
| T   | 270                | 280     |
| U   | 280                | 290     |
| V   | 290                | 300     |

Notes for Table 5:

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

## Radiometric Power Bins

**Table 6. Radiometric power bins for LUXEON T Royal Blue.**

| BIN | RADIOMETRIC POWER (mW) |         |
|-----|------------------------|---------|
|     | MINIMUM                | MAXIMUM |
| A   | 950                    | 1000    |
| B   | 1000                   | 1050    |
| C   | 1050                   | 1100    |
| D   | 1100                   | 1150    |
| E   | 1150                   | 1200    |
| F   | 1200                   | 1250    |

Notes for Table 6:

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

# Color Bin Definition

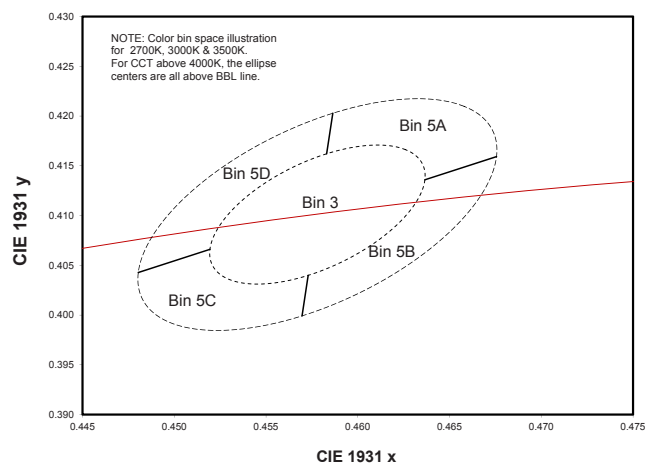


Figure 5: Color space definition for LUXEON T.

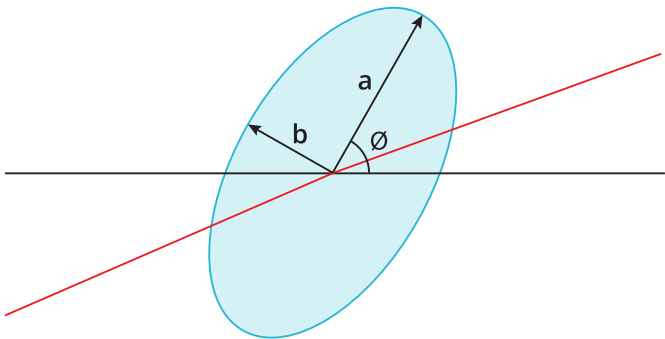


Figure 6: 3- and 5-step MacAdam ellipse illustration for Table 7.

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

| 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       | 53.20°                    |
| 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       | 53.70°                    |
| 5000K       | Single 3-step MacAdam ellipse | (0.3447, 0.3553)      | 0.00822       | 0.00354       | 59.60°                    |
| 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       | 53.20°                    |
| 3500K       | Single 5-step MacAdam ellipse | (0.4073, 0.3917)      | 0.01545       | 0.00690       | 54.00°                    |
| 4000K       | Single 5-step MacAdam ellipse | (0.3818, 0.3797)      | 0.01565       | 0.00670       | 53.70°                    |
| 5000K       | Single 5-step MacAdam ellipse | (0.3447, 0.3553)      | 0.01370       | 0.00590       | 59.60°                    |
| 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 color coordinates in the CIE 1932 color space.

Table 8. Correlated color temperature bin definitions for LUXEON T.

| BIN | CCT        |
|-----|------------|
| 0   | Royal Blue |
| 1   | 6500K      |
| 2   | 5700K      |
| 3   | 5000K      |
| 5   | 4000K      |
| 6   | 3500K      |
| 7   | 3000K      |
| 8   | 2700K      |

Table 9. MacAdam ellipse color bin definitions for LXHx-FWxx (white).

| BIN | SDCM or WAVELENGTH (nm) |
|-----|-------------------------|
| 3   | 3-step MacAdam ellipse  |
| 5   | 5-step MacAdam ellipse  |
| A   | 5-step MacAdam ellipse  |
| B   | 5-step MacAdam ellipse  |
| C   | 5-step MacAdam ellipse  |
| D   | 5-step MacAdam ellipse  |

## Peak of Dominant Wavelength Bins

Table 10. Peak of dominant wavelength bins for LXHx-FWRB at 700mA,  $T_j=85^{\circ}\text{C}$ .

| BIN | PEAK OF DOMINANT WAVELENGTH (nm) <sup>[1]</sup> |         |
|-----|-------------------------------------------------|---------|
|     | MINIMUM                                         | MAXIMUM |
| 4   | 445                                             | 450     |
| 5   | 450                                             | 455     |
| 6   | 455                                             | 460     |

Notes for Table 10:

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

## Forward Voltage Bins

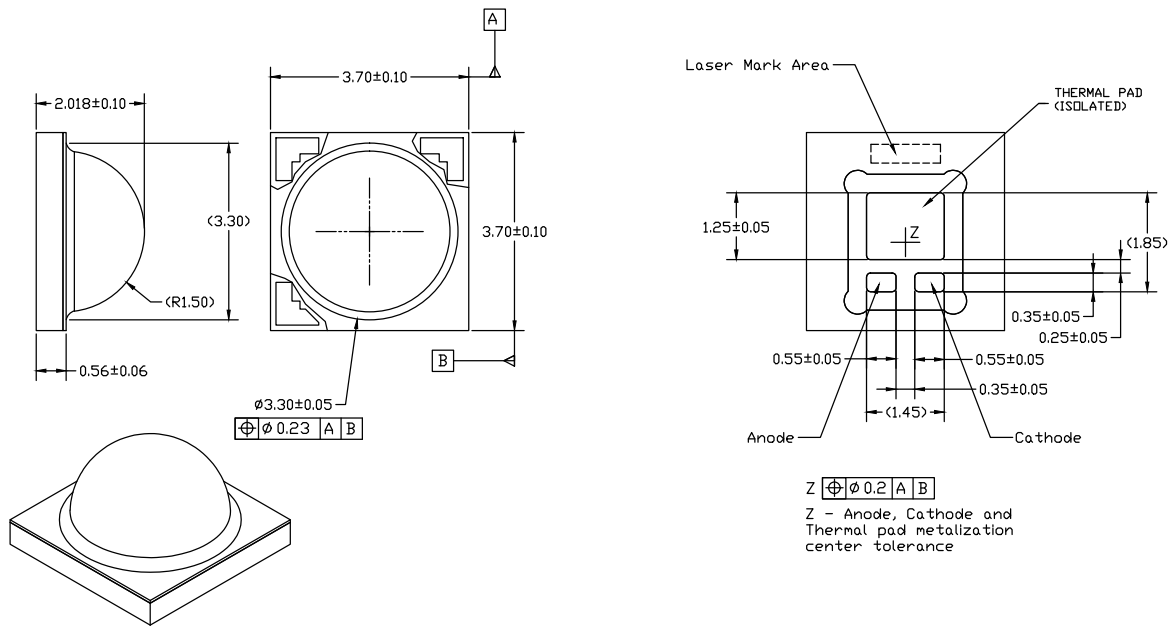
Table 11. Forward voltage bin definitions for LUXEON T.

| BIN | FORWARD VOLTAGE (V) <sup>[1]</sup> |         |
|-----|------------------------------------|---------|
|     | MINIMUM                            | MAXIMUM |
| P   | 2.50                               | 2.75    |
| R   | 2.75                               | 3.00    |
| S   | 3.00                               | 3.25    |
| X   | 2.65                               | 2.85    |
| Y   | 2.85                               | 3.00    |

Notes for Table 11:

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

# Mechanical Dimensions



# Reflow Soldering Guidelines

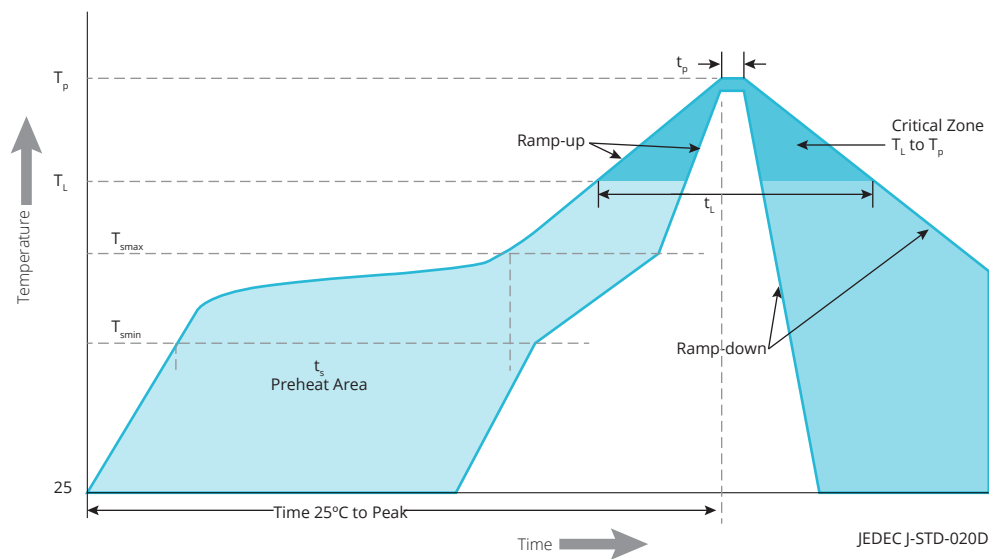


Figure 8: Visualization of the acceptable reflow temperature profile as specified in Table 12.

Table 12. Reflow profile characteristics for LUXEON T.

| PROFILE FEATURE                                                    | LEAD-FREE ASSEMBLY   |
|--------------------------------------------------------------------|----------------------|
| Preheat Minimum Temperature (T <sub>smin</sub> )                   | 150°C                |
| Preheat Maximum Temperature (T <sub>smax</sub> )                   | 200°C                |
| Preheat Time (t <sub>smin</sub> to t <sub>smax</sub> )             | 60 to 120 seconds    |
| Ramp-Up Rate (T <sub>smax</sub> to T <sub>p</sub> )                | 3°C / second maximum |
| Liquidus Temperature (T <sub>L</sub> )                             | 217°C                |
| Time Maintained Above Temperature T <sub>L</sub> (t <sub>L</sub> ) | 60 to 150 seconds    |
| Peak / Classification Temperature (T <sub>p</sub> )                | 260°C                |
| Time Within 5°C of Actual Temperature (t <sub>p</sub> )            | 20 to 40 seconds     |
| Ramp-Down Rate                                                     | 6°C / second maximum |
| Time 25°C to Peak Temperature                                      | 8 minutes maximum    |

## JEDEC Moisture Sensitivity

Table 13. Moisture sensitivity levels for LUXEON T.

| 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

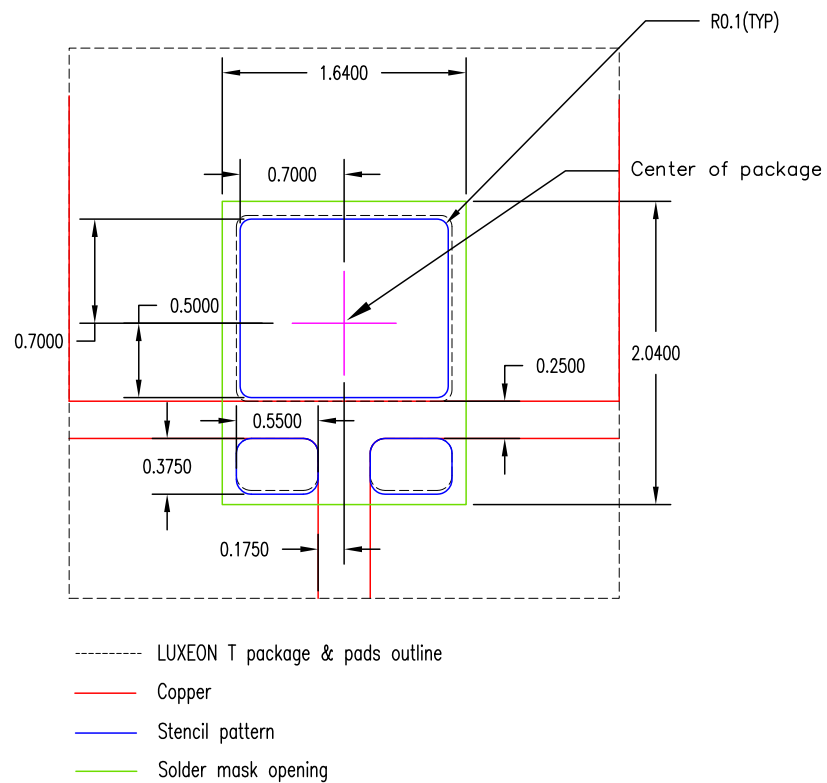


Figure 9: Recommended PCB solder pad layout for LUXEON T.

### Notes for Figure 9:

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

# Packaging Information

## Pocket Tape Dimensions

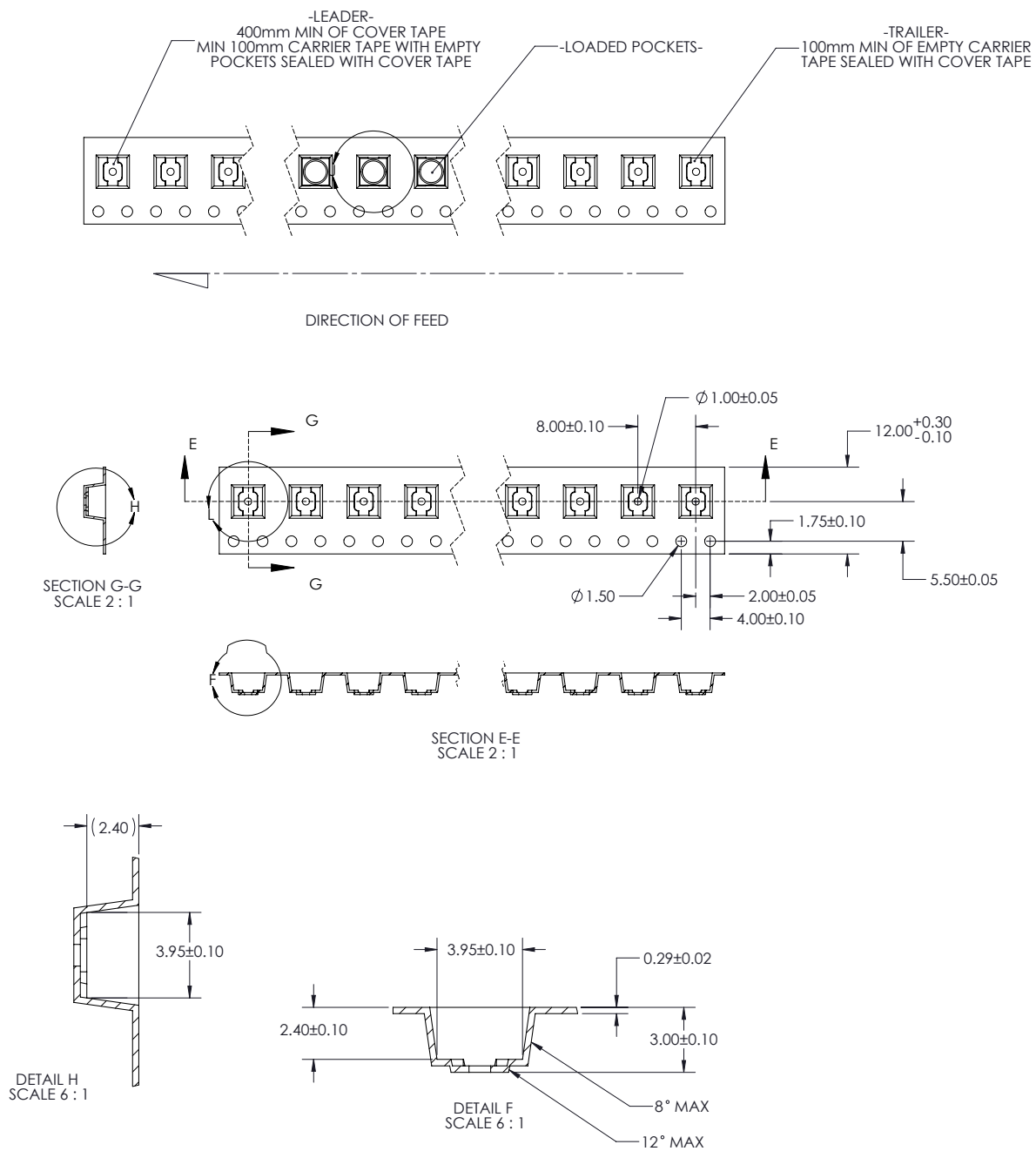


Figure 10: Packaging dimensions for LUXEON T.

### Notes for Figure 10:

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

# Reel Dimensions

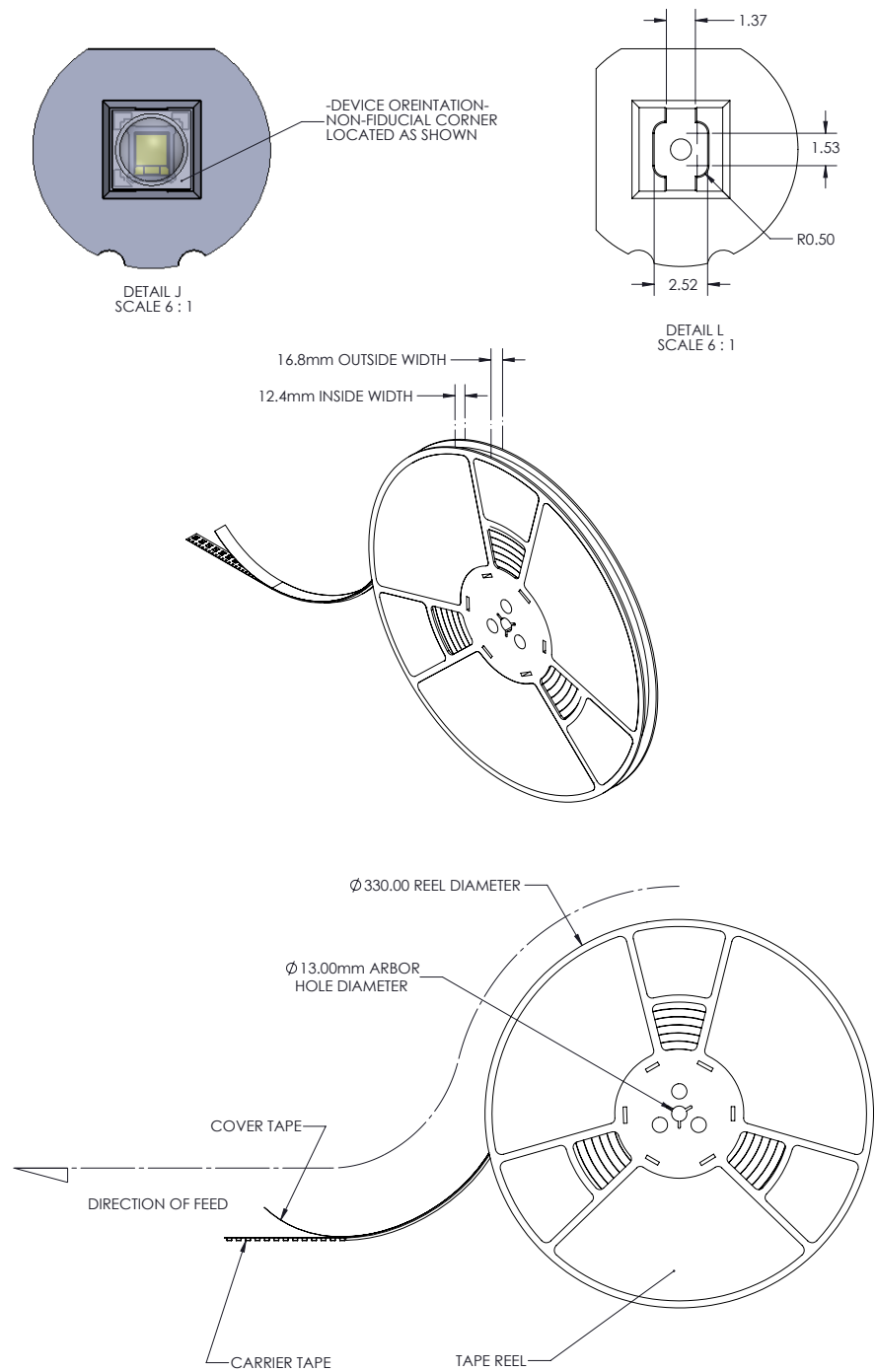


Figure 11: Reel dimensions for LUXEON T.

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

# 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 [lumileds.com](http://lumileds.com).



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