

# LUXEON SunPlus Series for Horticulture

LEDs engineered to deliver the precise wavelengths of light needed to improve crop yield

The LUXEON SunPlus Series is purpose-built to enable ease of system design for Horticulture applications. The LUXEON SunPlus Series offers the only LEDs available today that are binned and tested based on Photosynthetic Photon Flux (PPF). The LUXEON SunPlus Series includes two different packages: LUXEON SunPlus 20 Line, which is 2.0mm x 2.0mm and LUXEON SunPlus 35 Line, which is 3.5mm x 3.5mm. The LUXEON SunPlus Series includes options for single driver solutions and multi-channel, color tunable solutions.



## FEATURES AND BENEFITS

120° and 150° viewing angle of choice for various design needs

Two package options 2.0mm x 2.0mm and 3.5mm x 3.5mm for design freedom

## PRIMARY APPLICATIONS

Horticulture

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# General Product Information

## Product Test Conditions

LUXEON SunPlus Series LEDs are tested and binned with a DC drive current and junction temperature specified below:

LUXEON SunPlus 20 Line – 350mA,  $T_j=85^\circ\text{C}$

LUXEON SunPlus 35 Line – 100mA,  $T_j=25^\circ\text{C}$

## Part Number Nomenclature

Part numbers for LUXEON SunPlus Series follow the convention below:

L 1 S P – **A A A B B 0 C C D 0 0 0 0**

Where:

- A A A** – designates color (FRD=Far Red, DRD=Deep Red, PRP=Purple, RYL=Royal Blue, LME=Lime and CW9=Cool White)
- B B** – designates typical percentage of PPF in the blue spectrum (420 to 480nm) vs. the total PPF in the Photosynthetic Active Radiation (PAR) region (400 to 700nm), which applies only to purple LEDs (00=2.5%, 10=12.5% and 20=25%)
- C C** – designates package size (20=2.0mm<sup>2</sup> in 150° dome, 2F=2.0mm<sup>2</sup> in 120° dome and 35=3.5mm<sup>2</sup>)
- D** – designates polarity (R=reverse polarity)

Therefore, the following part number is used for a LUXEON SunPlus 20 Royal Blue LED with a package size of 2.0mm<sup>2</sup> in 150° dome:

L 1 S P – **R Y L 0 0 0 2 0 0 0 0 0 0**

## Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON SunPlus Series 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 SunPlus 20 Line at 350mA,  $T_j=85^{\circ}\text{C}$ .

| COLOR      | PEAK WAVELENGTH (nm) |         | PPF ( $\mu\text{mol/s}$ ) <sup>[1]</sup> in PAR (400 to 700nm) <sup>[2]</sup> |                     | PPF/W TYPICAL ( $\mu\text{mol/J}$ ) | PART NUMBER        |
|------------|----------------------|---------|---|---------------------|-------------------------------------|--------------------|
|            | MINIMUM              | MAXIMUM | MINIMUM   | TYPICAL             |                                     |                    |
| Far Red    | 720                  | 750     | 1.10  | 1.37 <sup>[3]</sup> | 2.26                                | L1SP-FRD0002000000 |
|            |                      |         | 1.60  | 1.96                | 2.95                                | L1SP-FRD0002F00000 |
| Deep Red   | 655                  | 670     | 1.60  | 1.81                | 2.65                                | L1SP-DRD0002000000 |
|            |                      |         | 1.70  | 2.08                | 2.90                                | L1SP-DRD0002F00000 |
| Royal Blue | 445                  | 455     | 1.90  | 2.04                | 2.11                                | L1SP-RYL0002000000 |
|            |                      |         | 1.90  | 2.25                | 2.30                                | L1SP-RYL0002F00000 |
| Lime       | -                    | -       | 1.50  | 1.59                | 1.66                                | L1SP-LME0002000000 |
|            |                      |         | 1.50  | 1.62                | 1.66                                | L1SP-LME0002F00000 |
| Cool White | -                    | -       | 1.40  | 1.51                | 1.57                                | L1SP-CW90002000000 |
|            |                      |         | 1.60  | 1.70                | 1.73                                | L1SP-CW90002F00000 |

Table 1b. Product performance of LUXEON SunPlus 35 Line at 100mA,  $T_j=25^{\circ}\text{C}$ .

| COLOR                              | PEAK WAVELENGTH (nm) |         | PPF ( $\mu\text{mol/s}$ ) <sup>[1]</sup> in PAR (400 to 700nm) <sup>[2]</sup> |         | PPF/W TYPICAL ( $\mu\text{mol/J}$ ) | PART NUMBER        |
|------------------------------------|----------------------|---------|---|---------|-------------------------------------|--------------------|
|                                    | MINIMUM              | MAXIMUM | MINIMUM   | TYPICAL |                                     |                    |
| Purple (2.5% Blue) <sup>[4]</sup>  | -                    | -       | 0.45  | 0.51    | 1.80                                | L1SP-PRP0003500000 |
| Purple (12.5% Blue) <sup>[5]</sup> | -                    | -       | 0.50  | 0.58    | 2.02                                | L1SP-PRP1003500000 |
| Purple (25% Blue) <sup>[6]</sup>   | -                    | -       | 0.55  | 0.63    | 2.24                                | L1SP-PRP2003500000 |
| Lime                               | -                    | -       | 0.60  | 0.65    | 2.13                                | L1SP-LME0003500000 |

**Notes for Tables 1a and 1b:**

- Lumileds maintains a tolerance of  $\pm 6.5\%$  on  $\mu\text{mol/s}$  for LUXEON SunPlus 20 Line and  $\pm 7.5\%$  on  $\mu\text{mol/s}$  measurements for LUXEON SunPlus 35 Line.
- PAR is the photosynthetic active radiation from 400 to 700nm.
- Far Red typical PPF is measured from 700 to 800nm.
- PPF in blue spectrum (420–480nm) ranges from 0–5% of total PPF in PAR (400–700nm). Typical PPF in the blue spectrum is 2.5%.
- PPF in blue spectrum (420–480nm) ranges from 10–15% of total PPF in PAR (400–700nm). Typical PPF in the blue spectrum is 12.5%.
- PPF in blue spectrum (420–480nm) ranges from 20–30% of total PPF in PAR (400–700nm). Typical PPF in the blue spectrum is 25%.

# Optical Characteristics

Table 2. Optical characteristics for LUXEON SunPlus Series at specified test conditions.

| PART NUMBER        | TYPICAL SPECTRAL HALF-WIDTH <sup>[1]</sup> (nm) | TYPICAL TEMPERATURE COEFFICIENT OF PEAK WAVELENGTH (nm/°C) | TYPICAL TOTAL INCLUDED ANGLE <sup>[2]</sup> | TYPICAL VIEWING ANGLE <sup>[3]</sup> |
|--------------------|---|--|---|--------------------------------------|
| L1SP-FRD0002000000 | 34  | 0.18   | 175°  | 162°                                 |
| L1SP-FRD0002F00000 | 34  | 0.18   | 161°  | 122°                                 |
| L1SP-DRD0002000000 | 22  | 0.16   | 175°  | 162°                                 |
| L1SP-DRD0002F00000 | 22  | 0.16   | 160°  | 122°                                 |
| L1SP-RYL0002000000 | 20  | 0.07   | 175°  | 165°                                 |
| L1SP-RYL0002F00000 | 20  | 0.07   | 163°  | 123°                                 |
| L1SP-LME0002000000 | -   | -  | 170°  | 145°                                 |
| L1SP-LME0002F00000 | -   | -  | 160°  | 114°                                 |
| L1SP-CW90002000000 | -   | -  | 170°  | 150°                                 |
| L1SP-CW90002F00000 | -   | -  | 152°  | 110°                                 |
| L1SP-PRPxx03500000 | -   | -  | 140°  | 115°                                 |
| L1SP-LMExxx3500000 | 110   | 0.01   | 140°  | 115°                                 |

**Notes for Table 2:**

1. Spectral half-width is the spectral bandwidth at 50% of the peak intensity.
2. Total angle at which 90% of the total luminous flux is captured.
3. 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 SunPlus Series at specified test conditions.

| PART NUMBER        | FORWARD VOLTAGE <sup>[1]</sup> (V <sub>f</sub> ) |         |         | TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE <sup>[2]</sup> (mV/°C) | TYPICAL THERMAL RESISTANCE—JUNCTION TO SOLDER PAD (°C/W) |
|--------------------|--|---------|---------|---|--|
|                    | MINIMUM  | TYPICAL | MAXIMUM |   |  |
| L1SP-FRD0002x00000 | 1.50   | 1.90    | 2.30    | -2.8  | 3.5  |
| L1SP-DRD0002x00000 | 1.50   | 2.05    | 2.30    | -2.3  | 3.5  |
| L1SP-RYL0002x00000 | 2.50   | 2.80    | 3.50    | -2.2  | 2.8  |
| L1SP-LME0002x00000 | 2.50   | 2.80    | 3.50    | -2.8  | 2.8  |
| L1SP-CW90002x00000 | 2.50   | 2.80    | 3.50    | -2.2  | 2.8  |
| L1SP-PRPxx03500000 | 2.70   | 2.80    | 3.10    | -2.0 to -4.0  | 8.0  |
| L1SP-LME0003500000 | 2.80   | 3.05    | 3.50    | -1.7  | 25.0   |

**Notes for Table 3:**

1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Measured between 25°C and 85°C.

# Absolute Maximum Ratings

Table 4a. Absolute maximum ratings for LUXEON SunPlus 20 Line.

| PARAMETER  | FAR RED   | DEEP RED     | ROYAL BLUE   | LIME         | COOL WHITE   |
|--|---|--------------|--------------|--------------|--------------|
| DC Forward Current <sup>[1, 2]</sup>                 | 700mA   | 1050mA       | 700mA        | 1050mA       | 1225mA       |
| Peak Pulsed Forward Current <sup>[1, 3]</sup>        | 875mA   | 1300mA       | 875mA        | 1300mA       | 1550mA       |
| LED Junction Temperature <sup>[1]</sup> (DC & Pulse) | 135°C   | 120°C        | 135°C        | 120°C        | 135°C        |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)        | Class 3B  |              |              |              |              |
| Operating Case Temperature <sup>[1]</sup>            | -40 to 125°C  | -40 to 125°C | -40 to 125°C | -40 to 110°C | -40 to 125°C |
| LED Storage Temperature                              | -40°C to 135°C  |              |              |              |              |
| Soldering Temperature                                | 20°C to 260°C   |              |              |              |              |
| Allowable Reflow Cycles                              | 3   |              |              |              |              |
| Reverse Voltage ( $V_{reverse}$ )                    | LUXEON LEDs are not designed to be driven in reverse bias |              |              |              |              |

Table 4b. Absolute maximum ratings for LUXEON SunPlus 35 Line.

| PARAMETER  | PURPLE  | LIME           |
|--|---|----------------|
| DC Forward Current <sup>[1, 2]</sup>                 | 300mA   | 200mA          |
| Peak Pulsed Forward Current <sup>[1, 3]</sup>        | 350mA   | 240mA          |
| LED Junction Temperature <sup>[1]</sup> (DC & Pulse) | 125°C   | 125°C          |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)        | Class 2   |                |
| Operating Case Temperature <sup>[1]</sup>            | -40°C to 105°C  | -40°C to 105°C |
| LED Storage Temperature                              | -40°C to 105°C  | -40°C to 105°C |
| Soldering Temperature                                | 20°C to 260°C   |                |
| Allowable Reflow Cycles                              | 3   |                |
| Reverse Voltage ( $V_{reverse}$ )                    | LUXEON LEDs are not designed to be driven in reverse bias |                |

**Notes for Tables 4a and 4b:**

- Proper current derating must be observed to maintain the junction temperature below the maximum allowable junction temperature.
- 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 of  $\leq 15\%$  of the maximum allowable DC forward current are acceptable, assuming the average current throughout each cycle does not exceed the maximum allowable DC forward current at the corresponding maximum junction temperature.
- 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  $\leq 50\%$ .
- 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.
- Max 5V reverse for up to 10s is an acceptable beginning of life, one time test condition.

# Characteristic Curves

## Spectral Power Distribution Characteristics

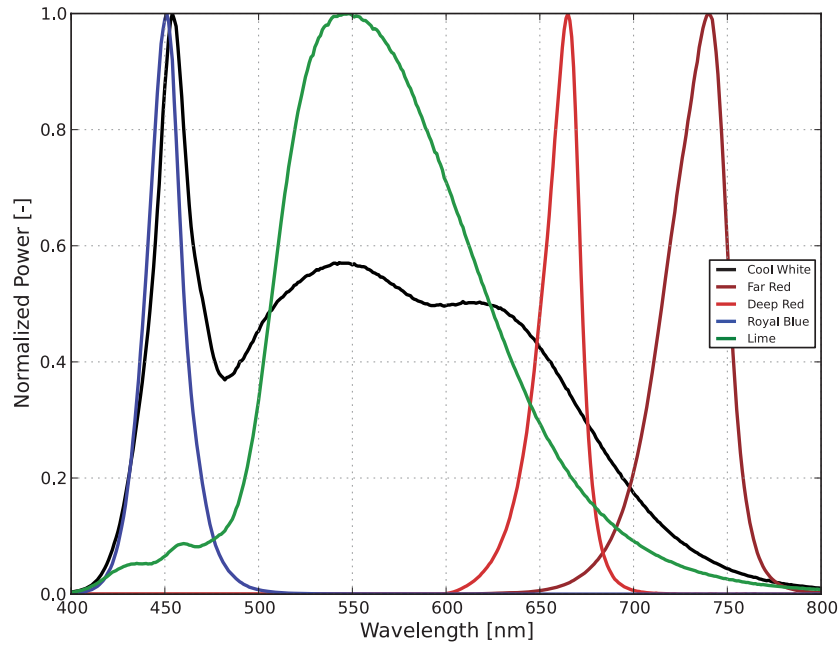


Figure 1a. Typical normalized power vs. wavelength for LUXEON SunPlus 20 Line at 350mA,  $T_j=85^{\circ}\text{C}$ .

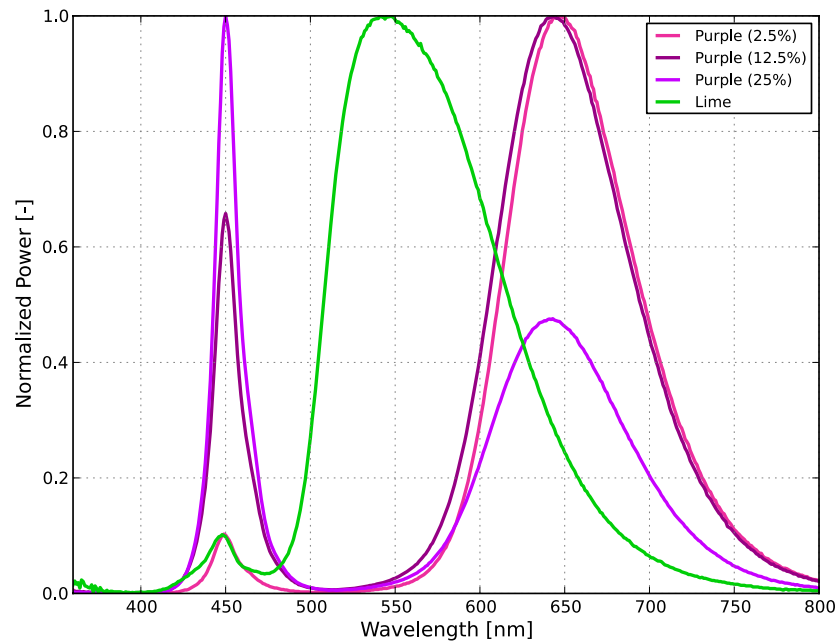


Figure 1b. Typical normalized power vs. wavelength for LUXEON SunPlus 35 Line at 100mA,  $T_j=25^{\circ}\text{C}$ .

# Photon Output Characteristics

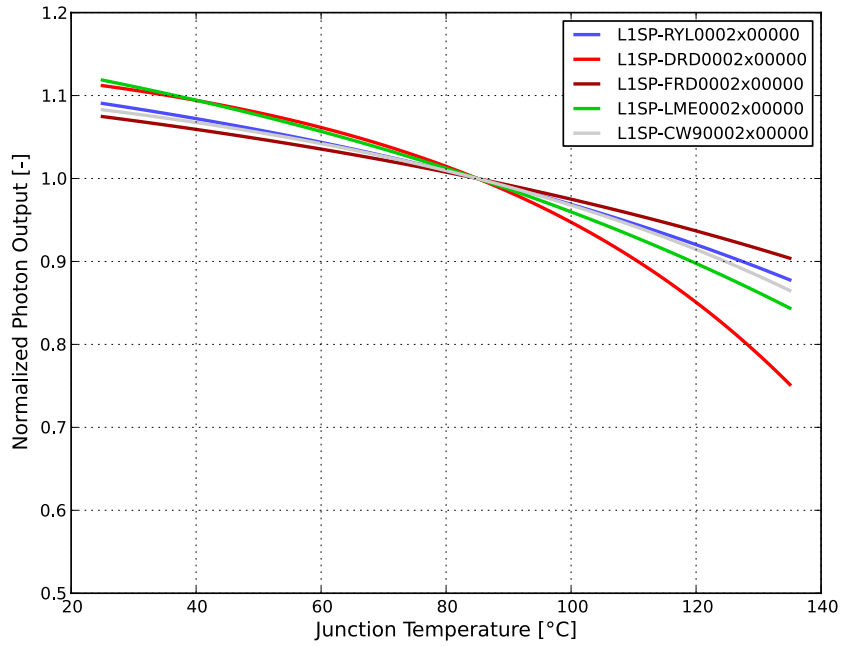


Figure 2a. Typical normalized photon output vs. junction temperature for LUXEON SunPlus 20 Line at 350mA.

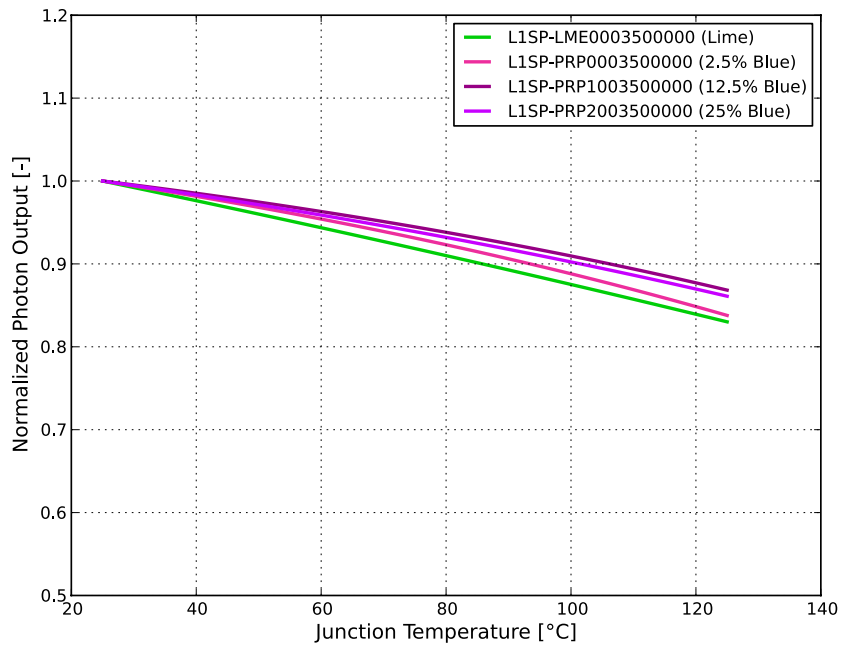


Figure 2b. Typical normalized photon output vs. junction temperature for LUXEON SunPlus 35 Line at 100mA.



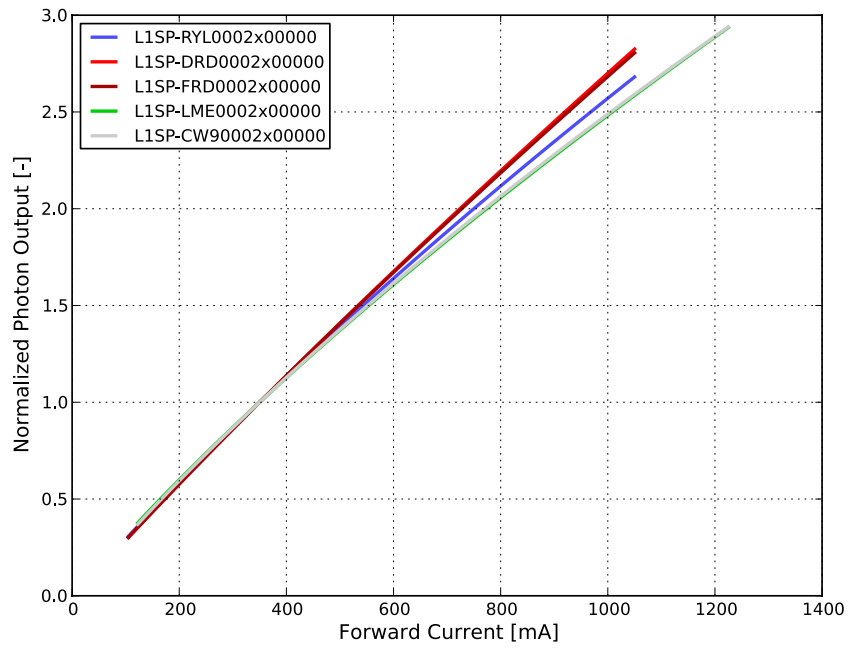


Figure 2c. Typical normalized photon output vs. forward current for LUXEON SunPlus 20 Line at  $T_j=85^\circ\text{C}$ .

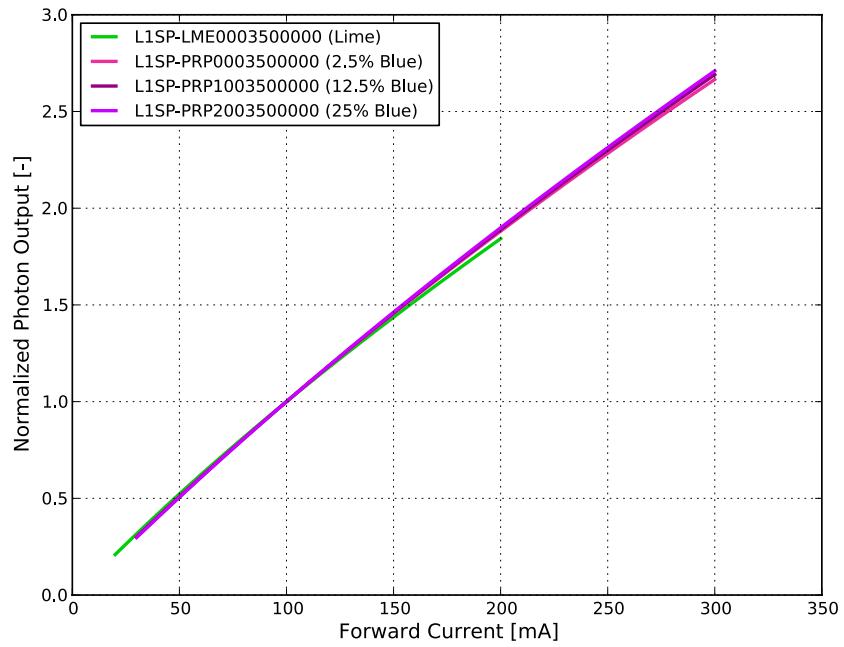


Figure 2d. Typical normalized photon output vs. forward current for LUXEON SunPlus 35 Line at  $T_j=25^\circ\text{C}$ .

# Forward Current Characteristics

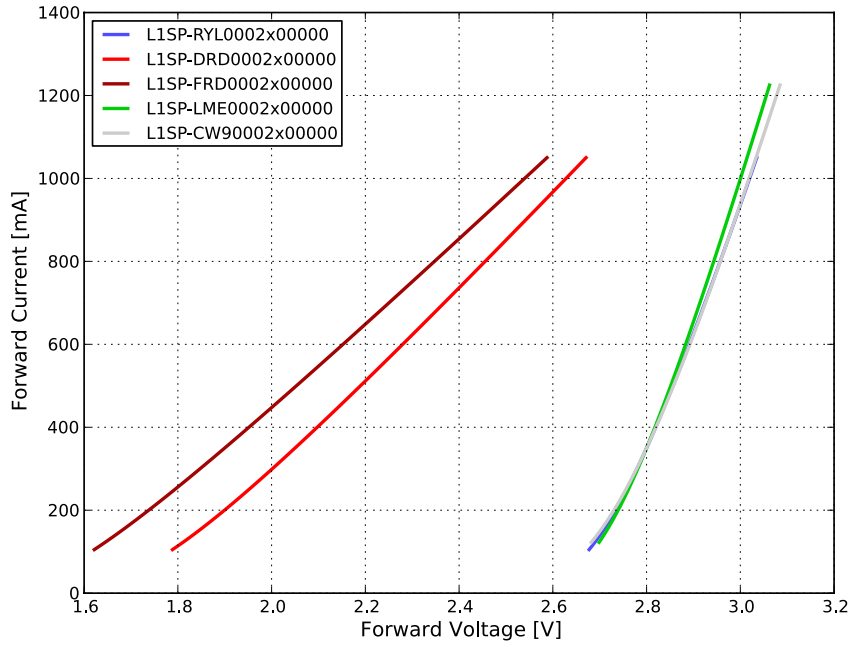


Figure 3a. Typical forward current vs. forward voltage for LUXEON SunPlus 20 Line at  $T_j=85^\circ\text{C}$ .

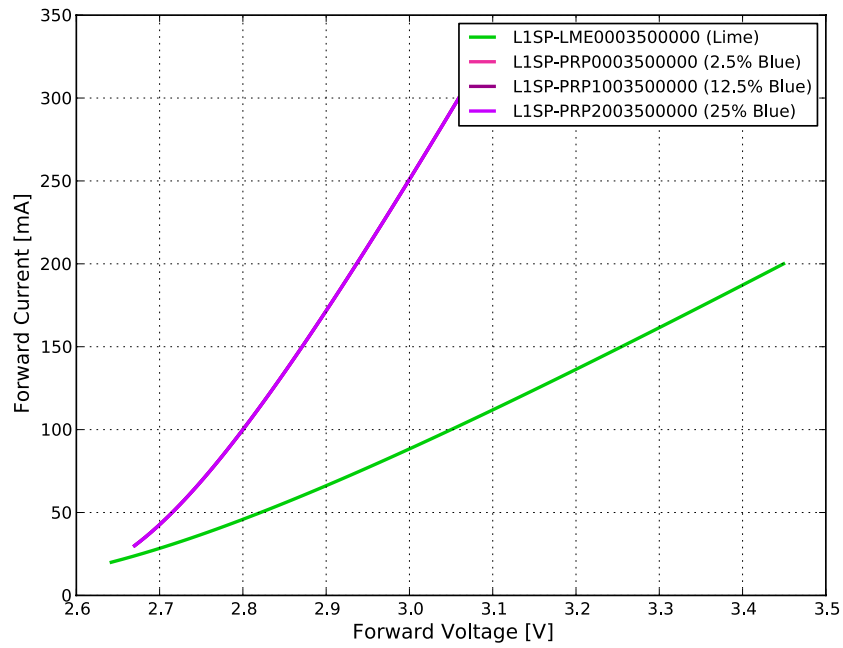


Figure 3b. Typical forward current vs. forward voltage for LUXEON SunPlus 35 Line at  $T_j=25^\circ\text{C}$ .

# Radiation Pattern Characteristics

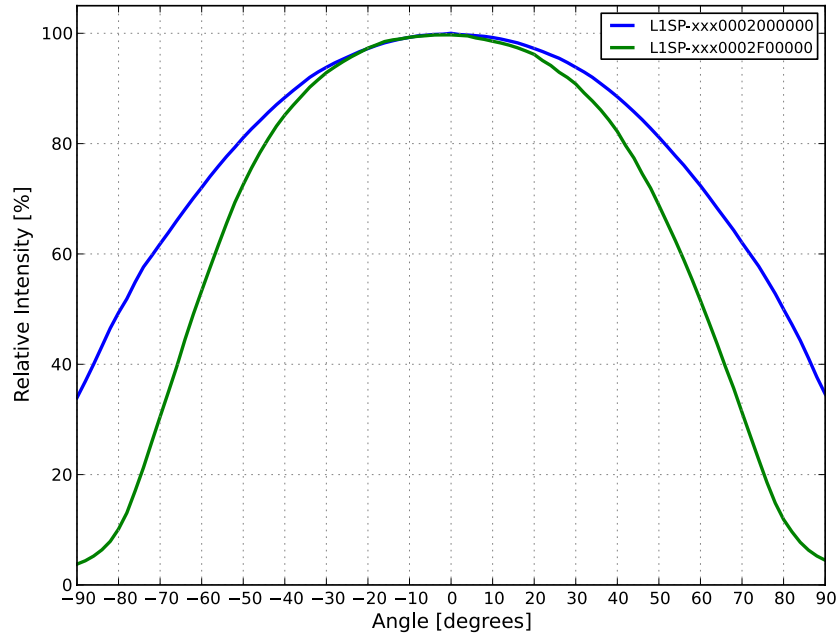


Figure 4a. Typical radiation pattern for LUXEON SunPlus 20 Line at 350mA,  $T_j=85^\circ\text{C}$ .

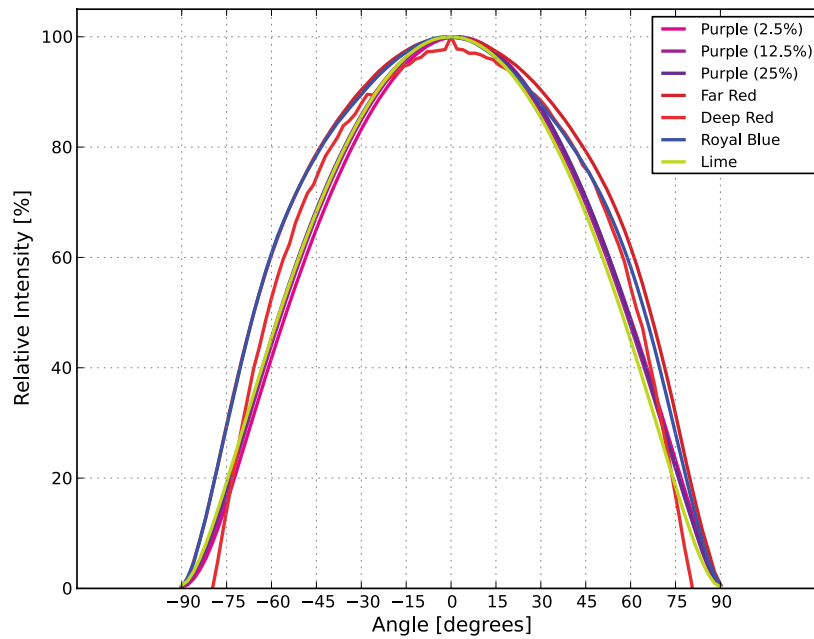


Figure 4b. Typical radiation pattern for LUXEON SunPlus 35 Line at 100mA,  $T_j=25^\circ\text{C}$ .

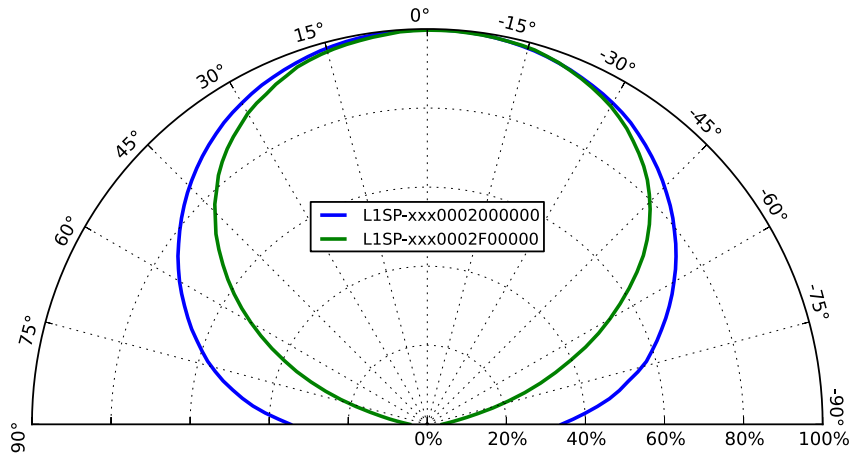


Figure 5a. Typical polar radiation pattern for LUXEON SunPlus 20 Line at 350mA,  $T_j=85^\circ\text{C}$ .

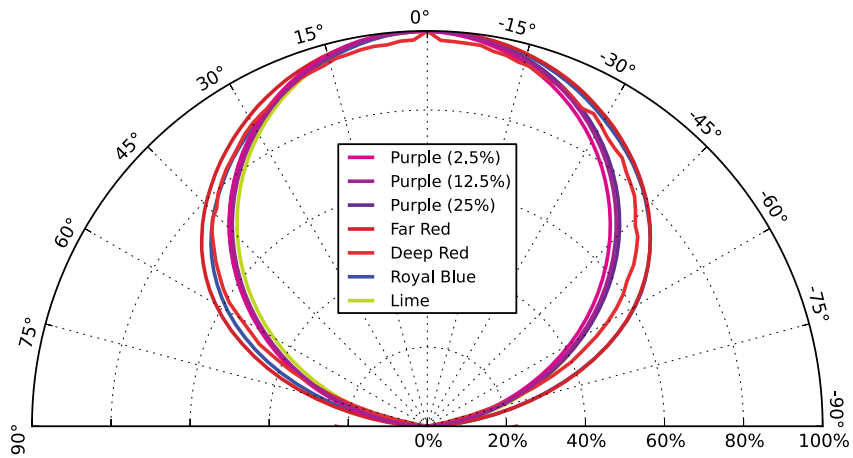


Figure 5b. Typical polar radiation pattern for LUXEON SunPlus 35 Line at 100mA,  $T_j=25^\circ\text{C}$ .

# 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.

All emitters packaged within a reel are of the same bin combination.

LUXEON SunPlus 20 Line and LUXEON SunPlus 35 Line LEDs are labeled using a 4-digit alphanumeric CAT code following the format below:

**A B B C**

Where:

- A** – designates PPF bin (example: L=1.80 to 1.90  $\mu\text{mol/s}$ , M=1.90 to 2.00  $\mu\text{mol/s}$ )
- B B** – designates color or peak wavelength bin (example: 40=445 to 450nm, 50=450 to 455nm)
- C** – designates forward voltage bin (example: E=2.50 to 2.70V, F=2.70 to 2.90V)

Therefore, LUXEON SunPlus 20 Royal Blue with a PPF range of 1.90 to 2.00  $\mu\text{mol/s}$ , peak wavelength of 445 to 450nm and a forward voltage range of 2.70 to 2.90V has the following CAT code:

**M 4 0 F**

## PPF Bins

Tables 5a and 5b list the standard PPF bins for LUXEON SunPlus Series. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance.

**Table 5a. PPF bin definitions for LUXEON SunPlus 20 Line.**

| BIN | PPF <sup>[1]</sup> (μmol/s) |         |
|-----|-----------------------------|---------|
|     | MINIMUM                     | MAXIMUM |
| A   | 0.80                        | 0.90    |
| B   | 0.90                        | 1.00    |
| C   | 1.00                        | 1.10    |
| D   | 1.10                        | 1.20    |
| E   | 1.20                        | 1.30    |
| F   | 1.30                        | 1.40    |
| G   | 1.40                        | 1.50    |
| H   | 1.50                        | 1.60    |
| J   | 1.60                        | 1.70    |
| K   | 1.70                        | 1.80    |
| L   | 1.80                        | 1.90    |
| M   | 1.90                        | 2.00    |
| N   | 2.00                        | 2.10    |
| P   | 2.10                        | 2.20    |
| Q   | 2.20                        | 2.30    |
| R   | 2.30                        | 2.40    |
| S   | 2.40                        | 2.50    |

**Notes for Table 5a:**

1. Lumileds maintains a tolerance of ±6.5% on μmol/s measurements.

**Table 5b. PPF bin definitions for LUXEON SunPlus 35 Line.**

| BIN | PPF <sup>[1]</sup> (μmol/s) |         |
|-----|-----------------------------|---------|
|     | MINIMUM                     | MAXIMUM |
| X   | 0.30                        | 0.35    |
| Y   | 0.35                        | 0.40    |
| Z   | 0.40                        | 0.45    |
| A   | 0.45                        | 0.50    |
| B   | 0.50                        | 0.55    |
| C   | 0.55                        | 0.60    |
| D   | 0.60                        | 0.65    |
| E   | 0.65                        | 0.70    |
| F   | 0.70                        | 0.75    |
| G   | 0.75                        | 0.80    |
| H   | 0.80                        | 0.85    |
| J   | 0.85                        | 0.90    |
| K   | 0.90                        | 0.95    |
| L   | 0.95                        | 1.00    |

**Notes for Table 5b:**

1. Lumileds maintains a tolerance of ±7.5% on μmol/s measurements.

## Color Bin Definitions

Table 6. Color bin definitions for LUXEON SunPlus Series.

| PRODUCT           | COLOR               | BIN <sup>(1)</sup> |
|-------------------|---------------------|--------------------|
| LUXEON SunPlus 20 | Lime                | 10                 |
|                   | Cool White          | 50                 |
| LUXEON SunPlus 35 | Purple (2.5% Blue)  | H1                 |
|                   | Purple (12.5% Blue) | H3                 |
|                   | Purple (25% Blue)   | H5                 |
|                   | Lime                | L1                 |

Notes for Table 6:

1. Lumileds maintains a tester tolerance of + 0.005 on color bin coordinates

## Peak Wavelength Bins

Table 7. Peak wavelength bins for LUXEON SunPlus Series at specified test conditions.

| PRODUCT           | COLOR      | BIN | PEAK WAVELENGTH <sup>(1)</sup> (nm) |         |
|-------------------|------------|-----|-------------------------------------|---------|
|                   |            |     | MINIMUM                             | MAXIMUM |
| LUXEON SunPlus 20 | Far Red    | 10  | 720                                 | 750     |
|                   | Deep Red   | 10  | 655                                 | 670     |
|                   | Royal Blue | 40  | 445                                 | 450     |
|                   |            | 50  | 450                                 | 455     |

Notes for Table 7:

1. Lumileds maintains a tolerance of  $\pm 2.0$ nm on peak wavelength measurements.

## Forward Voltage Bins

Table 8. Forward voltage bin definitions for LUXEON SunPlus Series at specified test conditions.

| PRODUCT                | COLOR   | BIN | FORWARD VOLTAGE <sup>(1)</sup> (V <sub>f</sub> ) |         |
|------------------------|---|-----|--|---------|
|                        |   |     | MINIMUM  | MAXIMUM |
| LUXEON SunPlus 20 Line | Far Red<br>Deep Red<br>Royal Blue<br>Lime<br>Cool White | Z   | 1.50   | 1.70    |
|                        |   | A   | 1.70   | 1.90    |
|                        |   | B   | 1.90   | 2.10    |
|                        |   | C   | 2.10   | 2.30    |
|                        |   | D   | 2.30   | 2.50    |
|                        |   | E   | 2.50   | 2.70    |
|                        |   | F   | 2.70   | 2.90    |
|                        |   | G   | 2.90   | 3.10    |
|                        |   | H   | 3.10   | 3.30    |
|                        |   | J   | 3.30   | 3.50    |
| LUXEON SunPlus 35 Line | Purple<br>Lime  | S   | 2.70   | 2.80    |
|                        |   | T   | 2.80   | 2.90    |
|                        |   | V   | 2.90   | 3.00    |
|                        |   | W   | 3.00   | 3.10    |
|                        |   | X   | 3.10   | 3.20    |
|                        |   | Y   | 3.20   | 3.30    |
|                        |   | Z   | 3.30   | 3.50    |

Notes for Table 8:

1. Lumileds maintains a tolerance of  $\pm 0.06$ V on forward voltage measurements for LUXEON SunPlus 20 Line and  $\pm 0.1$ V for LUXEON SunPlus 35 Line.

# Mechanical Dimensions

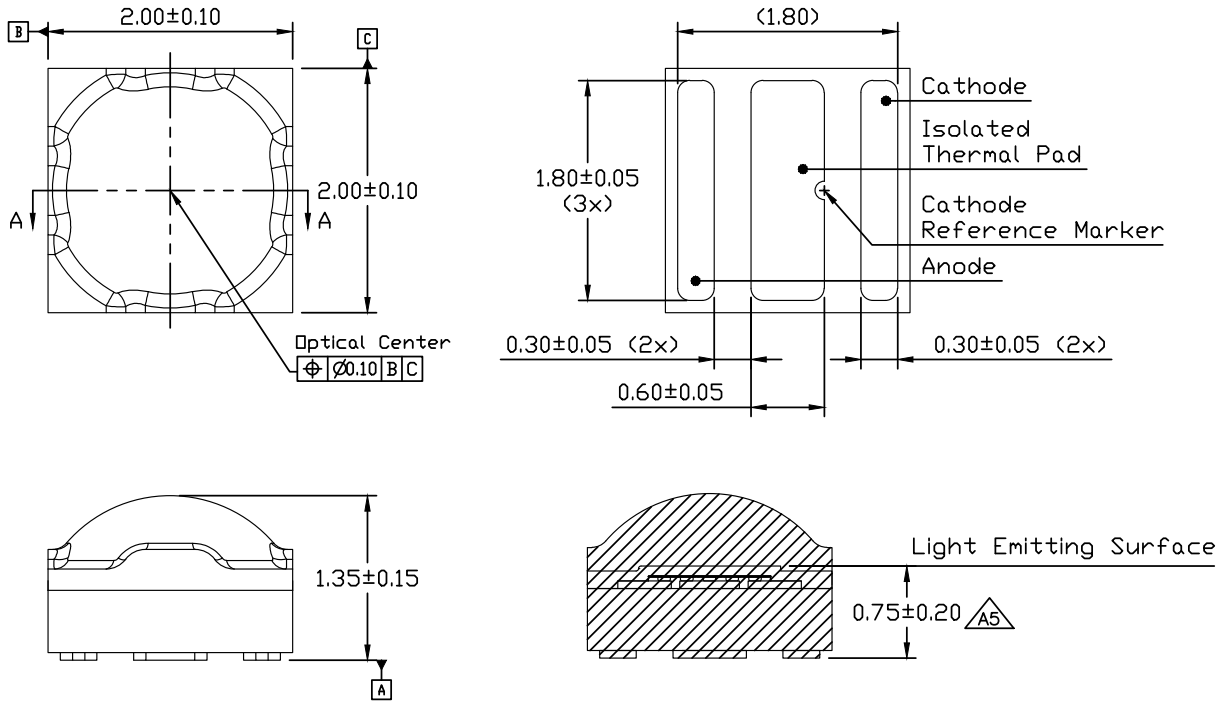


Figure 6a. Mechanical dimensions for L1SP-xxx0002000000.

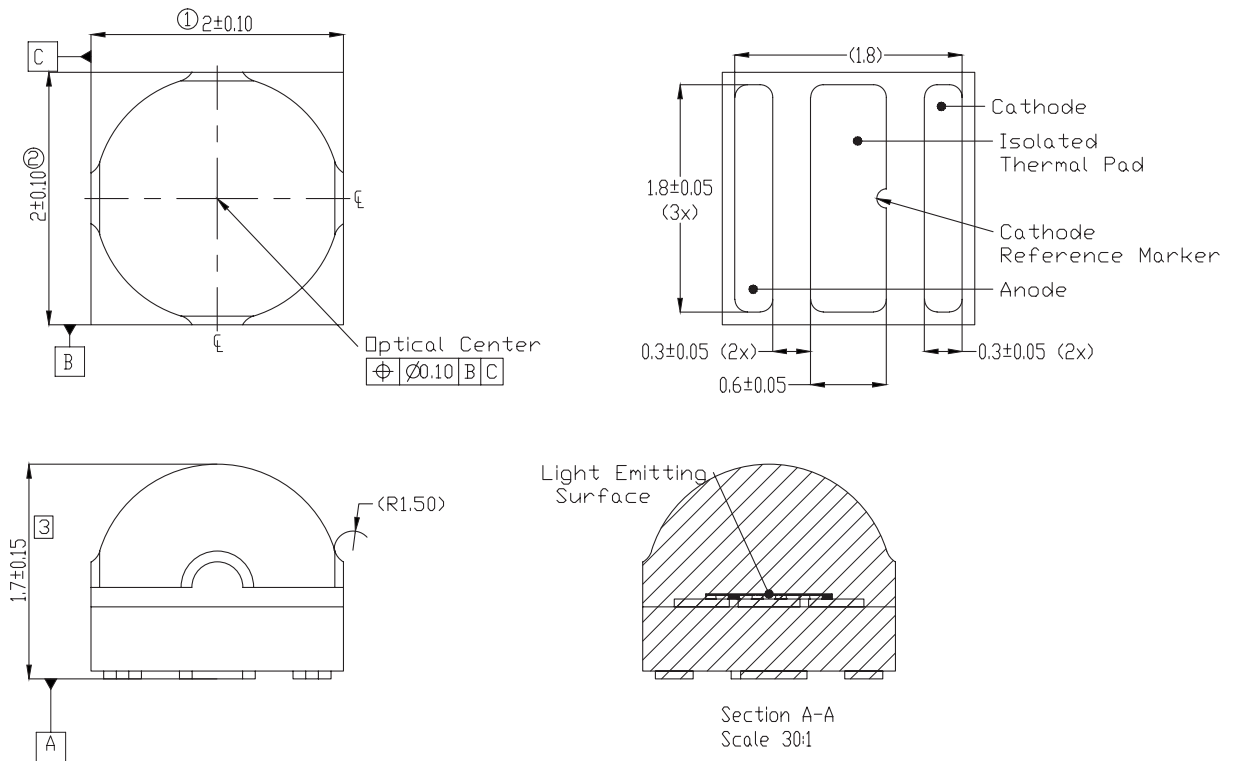


Figure 6b. Mechanical dimensions for L1SP-xxx0002F00000.

Notes for Figures 6a and 6b:  
 1. Drawings are not to scale.  
 2. All dimensions are in millimeters.



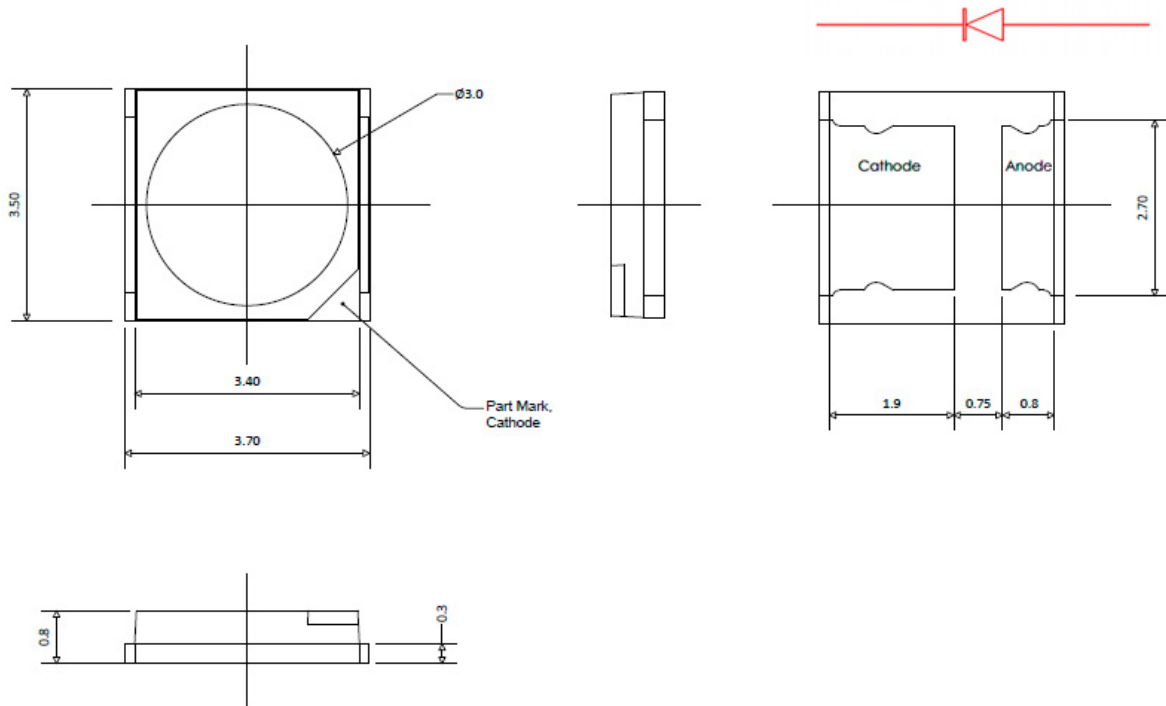


Figure 6c. Mechanical dimensions for L1SP-PRPxx03500000.

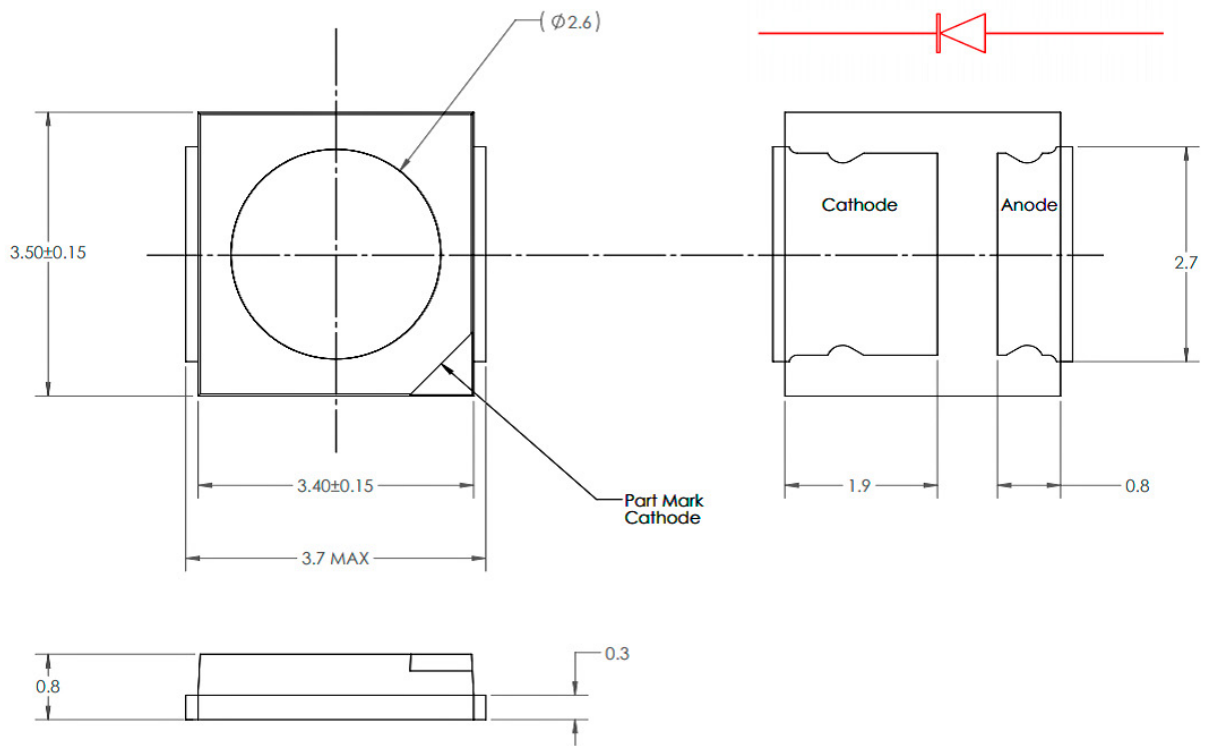


Figure 6d. Mechanical dimensions for L1SP-LME0003500000.

- Notes for Figures 6c and 6d:
1. Drawings are not to scale.
  2. All dimensions are in millimeters.

# Reflow Soldering Guidelines

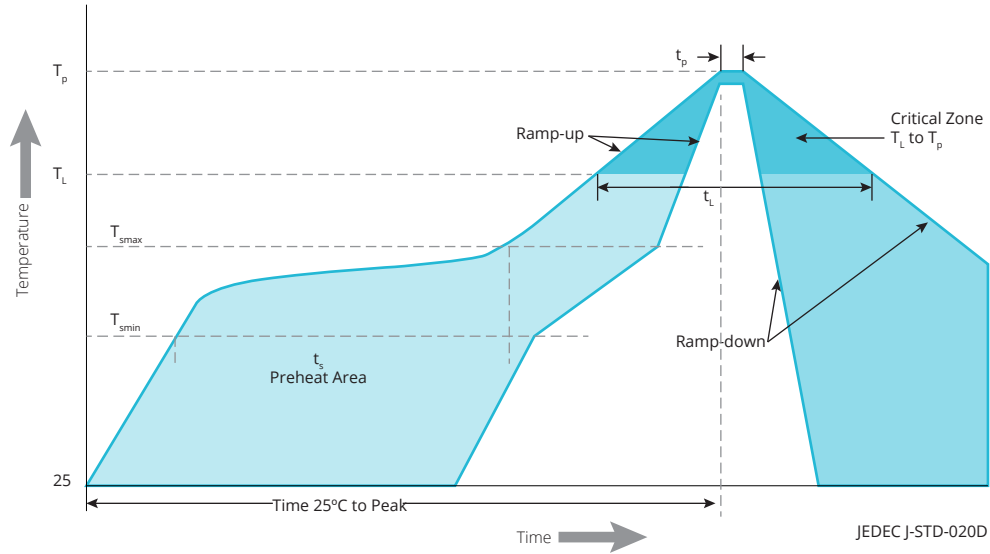


Figure 7. Visualization of the acceptable reflow temperature profile as specified in Table 9.

Table 9. Reflow profile characteristics for LUXEON SunPlus Series.

| PROFILE FEATURE                                   | LEAD-FREE ASSEMBLY     |                        |
|---|------------------------|------------------------|
|   | LUXEON SUNPLUS 20 LINE | LUXEON SUNPLUS 35 LINE |
| 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 ( $T_p$ )       | 260°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 10. Moisture sensitivity levels for LUXEON SunPlus Series.

| PRODUCT                | LEVEL | FLOOR LIFE |   | SOAK REQUIREMENTS STANDARD |               |
|------------------------|-------|------------|---|----------------------------|---------------|
|                        |       | TIME       | CONDITIONS                                | TIME                       | CONDITIONS    |
| LUXEON SunPlus 20 Line | 1     | Unlimited  | $\leq 30^\circ\text{C} / 85\% \text{ RH}$ | 168 Hours +5 / -0          | 85°C / 85% RH |
| LUXEON SunPlus 35 Line | 2     | 1 Year     | $\leq 30^\circ\text{C} / 60\% \text{ RH}$ | 168 Hours +5 / -0          | 85°C / 60% RH |

# Solder Pad Design

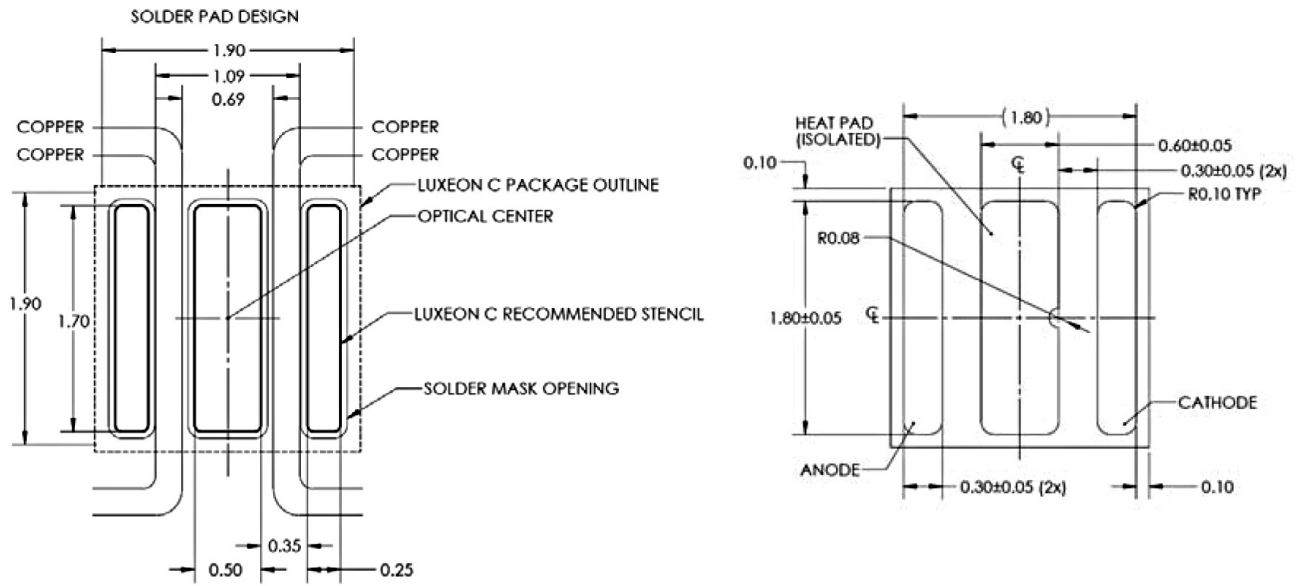


Figure 8a. Recommended PCB solder pad layout for LUXEON SunPlus 20 Line.

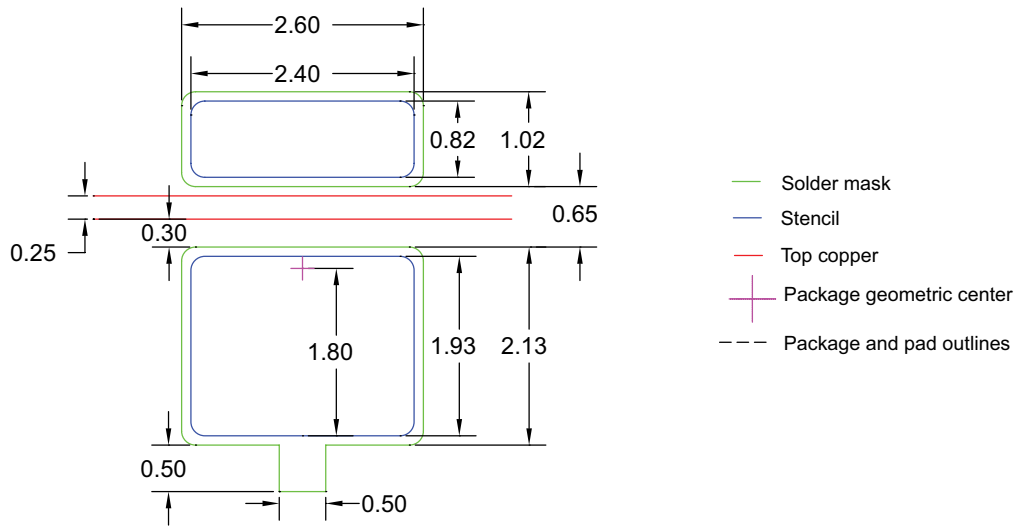


Figure 8b. Recommended PCB solder pad layout for LUXEON SunPlus 35 Line.

Notes for Figures 8a and 8b:  
 1. Drawings are not to scale.  
 2. All dimensions are in millimeters.

# Packaging Information

## Pocket Tape Dimensions

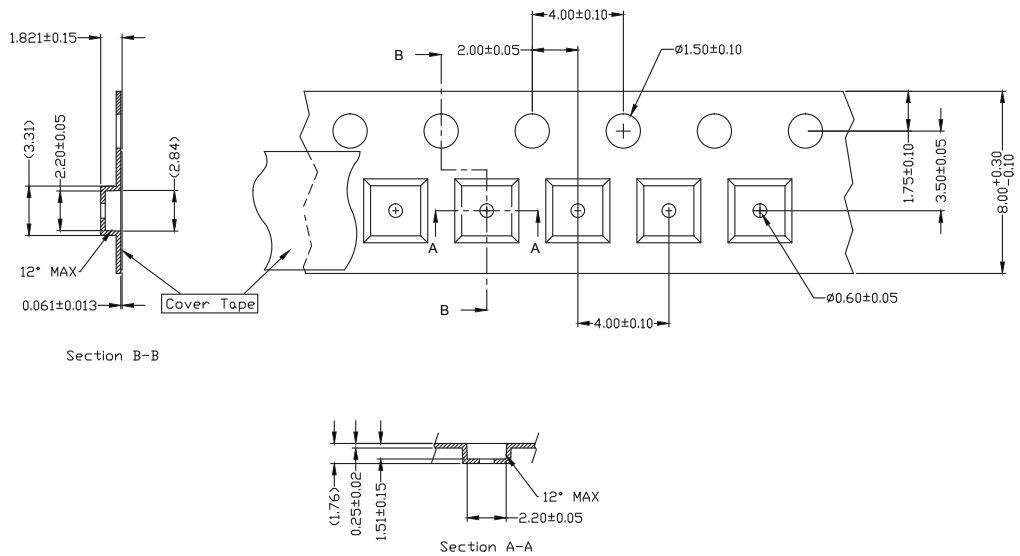


Figure 9a. Pocket tape dimensions for L1SP-xxx0002000000.

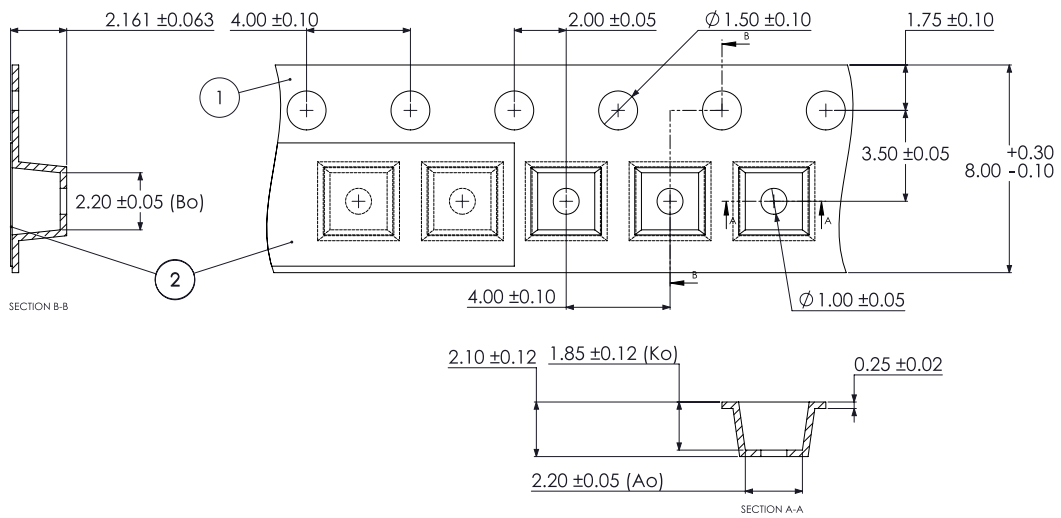


Figure 9b. Pocket tape dimensions for L1SP-xxx0002F00000.

- Notes for Figures 9a and 9b:
1. Drawings are not to scale.
  2. All dimensions are in millimeters.

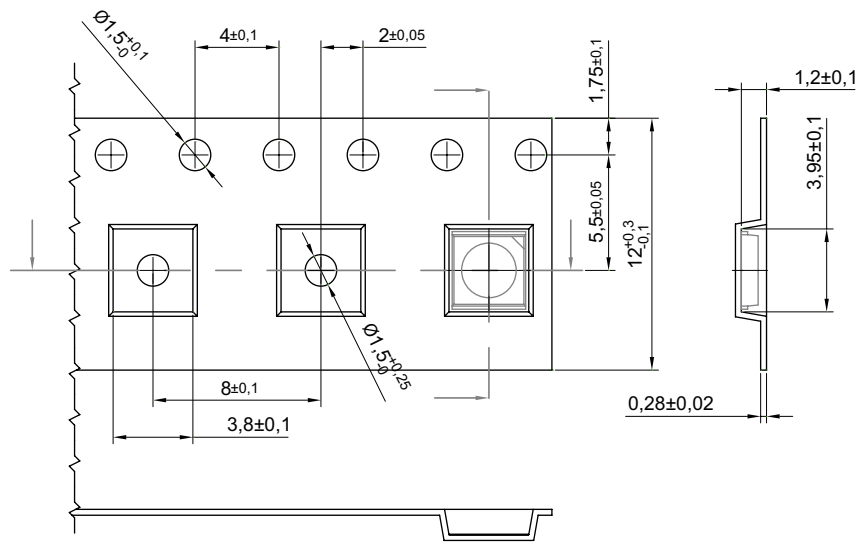


Figure 9c. Pocket tape dimensions for LUXEON SunPlus 35 Line.

Notes for Figure 9c:

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

## Reel Dimensions

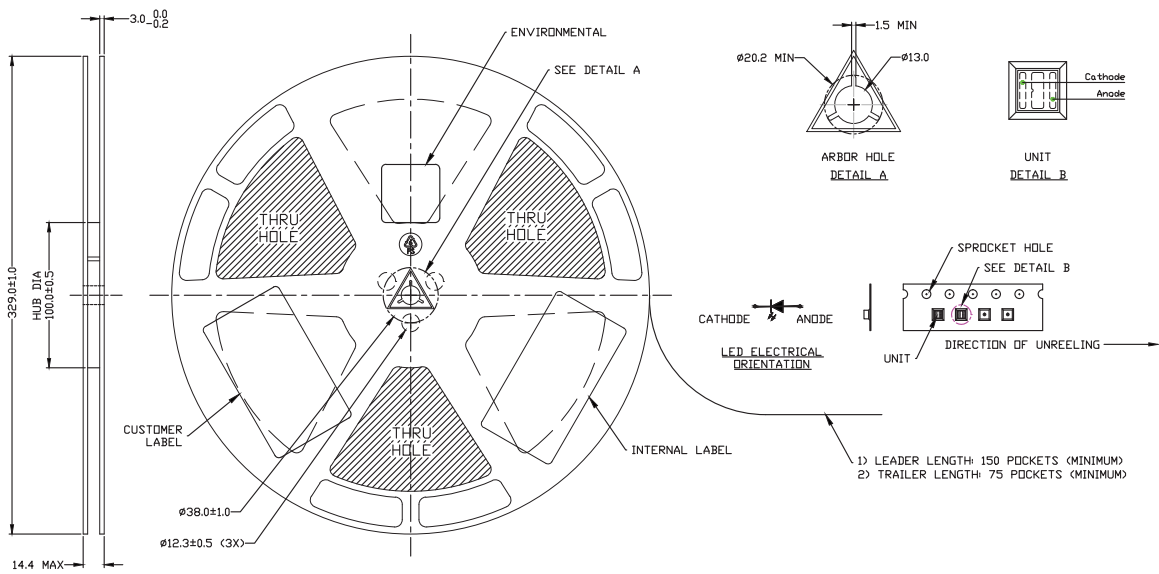


Figure 10a. Reel dimensions for LUXEON SunPlus 20 Line.

Notes for Figure 10a:

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

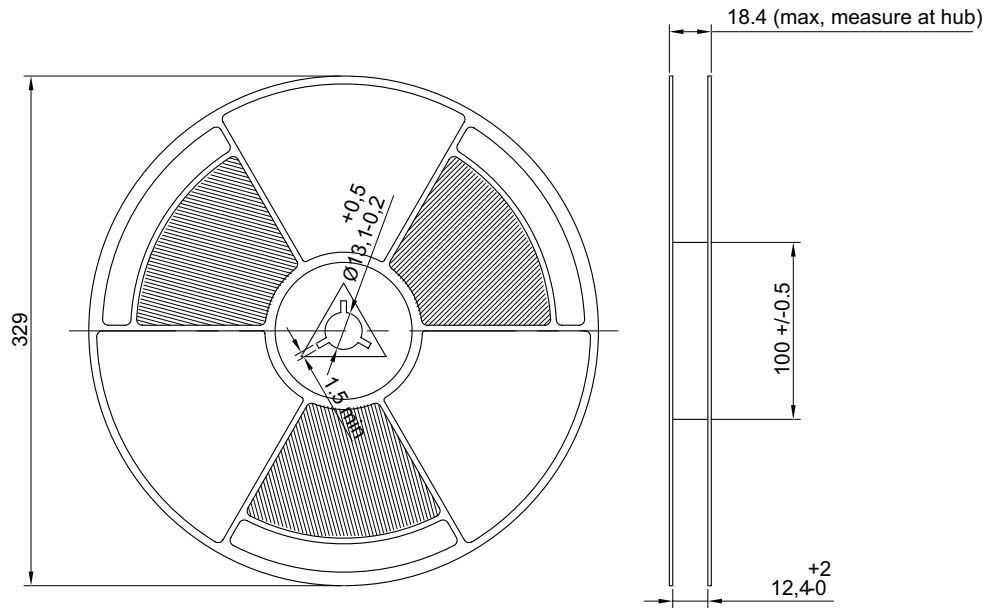


Figure 10b. Reel dimensions for LUXEON SunPlus 35 Line.

Notes for Figure 10b:

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

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