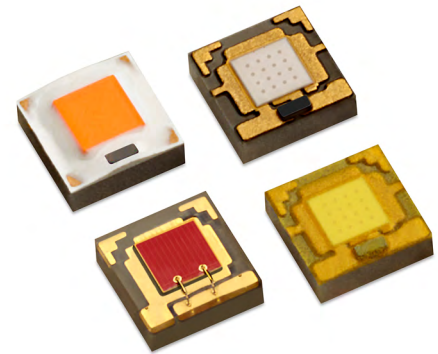




# LUXEON CZ Color Line

## Maximum punch in any application

LUXEON CZ Color Line is an optically advanced portfolio of Color and White LEDs. Designed to maximize punch, the LUXEON CZ Color Line is the optimal LED solution for architecture, entertainment and emergency vehicle lighting applications.



### FEATURES AND BENEFITS

Small and symmetrical 2x2mm<sup>2</sup> package

Industry leading Hot/Cold Factors and the lowest thermal resistance

Maximized punch (cd/lm)

### PRIMARY APPLICATIONS

Spotlights

Wall Wash

Floodlights

Landscape Lighting

[More...](#)

# Table of Contents

|   |           |
|---|-----------|
| <b>General Product Information</b> .....          | <b>2</b>  |
| Product Test Conditions .....                     | 2         |
| Part Number Nomenclature .....                    | 2         |
| Lumen Maintenance .....                           | 2         |
| Environmental Compliance .....                    | 2         |
| <b>Performance Characteristics</b> .....          | <b>3</b>  |
| Product Selection Guide .....                     | 3         |
| Optical Characteristics .....                     | 4         |
| Electrical and Thermal Characteristics .....      | 5         |
| Absolute Maximum Ratings .....                    | 5         |
| <b>Characteristic Curves</b> .....                | <b>6</b>  |
| Spectral Power Distribution Characteristics ..... | 6         |
| Light Output Characteristics .....                | 9         |
| Forward Current Characteristics .....             | 17        |
| Radiation Pattern Characteristics .....           | 21        |
| <b>Product Bin and Labeling Definitions</b> ..... | <b>23</b> |
| Decoding Product Bin Labeling .....               | 23        |
| Luminous Flux Bins .....                          | 24        |
| Radiometric Power Bins .....                      | 24        |
| Color Bin Structure .....                         | 25        |
| Color Bin Structure .....                         | 26        |
| Color Bin Definitions .....                       | 27        |
| Peak Wavelength Bins .....                        | 28        |
| Dominant Wavelength Bins .....                    | 28        |
| Forward Voltage Bins .....                        | 29        |
| <b>Mechanical Dimensions</b> .....                | <b>29</b> |
| <b>Reflow Soldering Guidelines</b> .....          | <b>30</b> |
| JEDEC Moisture Sensitivity .....                  | 30        |
| Solder Pad Design .....                           | 31        |
| <b>Packaging Information</b> .....                | <b>31</b> |
| Pocket Tape Dimensions .....                      | 31        |
| Reel Dimensions .....                             | 32        |

# General Product Information

## Product Test Conditions

LUXEON CZ Color Line 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 CZ Colors follow the convention below:

L 1 C U – **A A A** 1 0 0 0 0 0 0 0 0 0

Where:

**A A A** – designates color (FRD=Far Red, DRD=Deep Red, RED=Red, RNG=Red-Orange, AMB=Amber, PCA=PC Amber, MNT=Mint, LME=Lime, GRN=Green, CYN=Cyan, BLU=Blue, PCB=PC Blue, RYL=Royal Blue, VLT=Violet)

Therefore, the following part number is used for a LUXEON CZ Red LED:

L 1 C U – **R E D** 1 0 0 0 0 0 0 0 0 0

Part numbers for LUXEON CZ White follow the convention below:

L 1 C U – **A A B B** 0 0 0 0 0 0 0 0 0 0

Where:

**A A** – designates nominal CCT (27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K)

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

Therefore, the following part number is used for a LUXEON CZ White 4000K 70CRI LED:

L 1 C U – **5 7 7 0** 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 CZ 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 CZ Colors at 350mA, T<sub>j</sub>=85°C.

| COLOR      | DOMINANT OR PEAK WAVELENGTH RANGE <sup>[1]</sup> (nm) |         | LUMINOUS FLUX (lm) OR RADIOMETRIC POWER <sup>[2]</sup> (mW) |         | PART NUMBER        |
|------------|---|---------|---|---------|--------------------|
|            | MINIMUM   | MAXIMUM | MINIMUM   | TYPICAL |                    |
| Far Red    | 720   | 750     | 150   | 240     | L1CU-FRD1000000000 |
| Deep Red   | 655   | 675     | 190   | 260     | L1CU-DRD1000000000 |
| Red        | 624   | 634     | 20  | 31      | L1CU-RED1000000000 |
| Red-Orange | 614   | 624     | 25  | 37      | L1CU-RNG1000000000 |
| Amber      | 585   | 600     | 10  | 16      | L1CU-AMB1000000000 |
| PC Amber   | -   | -       | 65  | 88      | L1CU-PCA1000000000 |
| Mint       | -   | -       | 120   | 132     | L1CU-MNT1000000000 |
| Lime       | -   | -       | 120   | 138     | L1CU-LME1000000000 |
| Green      | 520   | 540     | 80  | 119     | L1CU-GRN1000000000 |
| Cyan       | 490   | 510     | 60  | 82      | L1CU-CYN1000000000 |
| Blue       | 465   | 485     | 25  | 34      | L1CU-BLU1000000000 |
| PC Blue    | -   | -       | 35  | 44      | L1CU-PCB1000000000 |
| Royal Blue | 440   | 460     | 360   | 432     | L1CU-RYL1000000000 |
| Violet     | 420   | 430     | 400   | 458     | L1CU-VLT1000000000 |

**Notes for Table 1a:**

- Lumileds maintains a tolerance of ±6.5% on luminous flux measurements. PC Amber, Mint, Lime and PC Blue are binned by chromaticity coordinates. Far Red, Deep Red, Royal Blue and Violet are binned by peak wavelength. All other colors are binned by dominant wavelength.
- Far Red, Deep Red, Royal Blue and Violet are binned by radiometric power. All other colors are binned by luminous flux.

Table 1b. Product performance of LUXEON CZ White at 350mA, T<sub>j</sub>=85°C.

| COLOR | NOMINAL CCT | MINIMUM CRI <sup>[1]</sup> | LUMINOUS FLUX <sup>[1]</sup> (lm) |         | TYPICAL LUMINOUS EFFICACY (lm/W) | PART NUMBER         |
|-------|-------------|----------------------------|-----------------------------------|---------|----------------------------------|---------------------|
|       |             |                            | MINIMUM                           | TYPICAL |                                  |                     |
| White | 4000K       | 70                         | 100                               | 109     | 113                              | L1CU-40700000000000 |
|       | 5000K       | 70                         | 100                               | 109     | 113                              | L1CU-50700000000000 |
|       | 5700K       | 70                         | 100                               | 109     | 113                              | L1CU-57700000000000 |
|       | 6500K       | 70                         | 100                               | 109     | 113                              | L1CU-65700000000000 |
|       | 2200K       | 80                         | 75                                | 89      | 92                               | L1CU-22800000000000 |
|       | 2700K       | 80                         | 80                                | 89      | 92                               | L1CU-27800000000000 |
|       | 3000K       | 80                         | 90                                | 95      | 99                               | L1CU-30800000000000 |
|       | 3500K       | 80                         | 90                                | 106     | 110                              | L1CU-35800000000000 |
|       | 4000K       | 80                         | 90                                | 99      | 103                              | L1CU-40800000000000 |
|       | 2700K       | 90                         | 65                                | 74      | 77                               | L1CU-27900000000000 |
|       | 3000K       | 90                         | 65                                | 79      | 82                               | L1CU-30900000000000 |
|       | 3500K       | 90                         | 75                                | 86      | 89                               | L1CU-35900000000000 |
|       | 4000K       | 90                         | 75                                | 89      | 92                               | L1CU-40900000000000 |
|       | 5700K       | 90                         | 70                                | 89      | 92                               | L1CU-57900000000000 |

**Notes for Table 1b:**

- Lumileds maintains a tolerance of ±6.5% on luminous flux and ±2 on CRI measurements for these products.

# Optical Characteristics

Table 2a. Optical characteristics for LUXEON CZ Colors at 350mA, T<sub>j</sub>=85°C.

| COLOR      | PART NUMBER        | TYPICAL SPECTRAL HALF-WIDTH <sup>[1]</sup> (nm) | TYPICAL TEMPERATURE COEFFICIENT OF DOMINANT OR PEAK WAVELENGTH (nm/°C) | TYPICAL TOTAL INCLUDED ANGLE <sup>[2]</sup> | TYPICAL VIEWING ANGLE <sup>[3]</sup> |
|------------|--------------------|---|--|---|--------------------------------------|
| Far Red    | L1CU-FRD1000000000 | 20  | 0.06   | 140°  | 120°                                 |
| Deep Red   | L1CU-DRD1000000000 | 20  | 0.06   | 140°  | 120°                                 |
| Red        | L1CU-RED1000000000 | 20  | 0.06   | 140°  | 120°                                 |
| Red-Orange | L1CU-RNG1000000000 | 20  | 0.06   | 140°  | 120°                                 |
| Amber      | L1CU-AMB1000000000 | 20  | 0.06   | 140°  | 120°                                 |
| PC Amber   | L1CU-PCA1000000000 | 80  | -0.01  | 140°  | 120°                                 |
| Mint       | L1CU-MNT1000000000 | 80  | 0.03   | 140°  | 120°                                 |
| Lime       | L1CU-LME1000000000 | 80  | -0.01  | 140°  | 120°                                 |
| Green      | L1CU-GRN1000000000 | 35  | 0.04   | 140°  | 120°                                 |
| Cyan       | L1CU-CYN1000000000 | 20  | 0.03   | 140°  | 120°                                 |
| Blue       | L1CU-BLU1000000000 | 25  | 0.03   | 140°  | 120°                                 |
| PC Blue    | L1CU-PCB1000000000 | 26  | 0.02   | 140°  | 123°                                 |
| Royal Blue | L1CU-RYL1000000000 | 20  | 0.03   | 140°  | 120°                                 |
| Violet     | L1CU-VLT1000000000 | 20  | 0.03   | 140°  | 120°                                 |

**Notes for Table 2a:**

1. Spectral half-width is the spectral bandwidth at 50% of the peak intensity.
2. Total angle at which 90% of 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.

Table 2b. Optical characteristics for LUXEON CZ White at 350mA, T<sub>j</sub>=85°C.

| COLOR | PART NUMBER        | TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup> | TYPICAL VIEWING ANGLE <sup>[2]</sup> |
|-------|--------------------|---|--------------------------------------|
| White | L1CU-xxx0000000000 | 140°  | 120°                                 |

**Notes for Table 2b:**

1. Total angle at which 90% of total luminous flux is captured.
2. Viewing angle is the off axis angle from the LED centerline where the luminous intensity is ½ of the peak value.

# Electrical and Thermal Characteristics

Table 3. Electrical and thermal characteristics for LUXEON CZ Color Line at 350mA, T<sub>j</sub>=85°C.

| COLOR      | 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 |   |  |
| Far Red    | L1CU-FRD1000000000 | 1.50   | 1.90    | 2.30    | -1.7  | 3.5  |
| Deep Red   | L1CU-DRD1000000000 | 1.50   | 2.05    | 2.30    | -1.7  | 3.5  |
| Red        | L1CU-RED1000000000 | 1.75   | 2.00    | 2.50    | -1.6  | 3.5  |
| Red-Orange | L1CU-RNG1000000000 | 1.75   | 2.05    | 2.50    | -1.6  | 3.5  |
| Amber      | L1CU-AMB1000000000 | 1.75   | 2.05    | 2.50    | -2.0  | 3.5  |
| PC Amber   | L1CU-PCA1000000000 | 2.50   | 2.75    | 3.50    | -1.7  | 3.5  |
| Mint       | L1CU-MNT1000000000 | 2.50   | 2.75    | 3.50    | -2.7  | 3.2  |
| Lime       | L1CU-LME1000000000 | 2.50   | 2.75    | 3.50    | -2.7  | 3.2  |
| Green      | L1CU-GRN1000000000 | 2.50   | 3.13    | 3.50    | -2.4  | 4.0  |
| Cyan       | L1CU-CYN1000000000 | 2.50   | 3.05    | 3.50    | -2.4  | 4.0  |
| Blue       | L1CU-BLU1000000000 | 2.50   | 3.08    | 3.50    | -2.6  | 4.0  |
| PC Blue    | L1C1-PCB1000000000 | 2.50   | 3.08    | 3.50    | -4.0  | 3.4  |
| Royal Blue | L1CU-RYL0000000000 | 2.50   | 2.75    | 3.50    | -1.7  | 3.2  |
| Violet     | L1CU-VLT1000000000 | 2.50   | 2.83    | 3.50    | -1.7  | 3.2  |
| White      | L1CU-xxx000000000  | 2.50   | 2.75    | 3.50    | -1.7  | 3.2  |

**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 4. Absolute maximum ratings for LUXEON CZ Color Line.

| PARAMETER  | DEEP RED  | FAR RED, RED, RED-ORANGE, AMBER AND PC AMBER | GREEN AND CYAN | BLUE, PC BLUE AND ROYAL BLUE | MINT, LIME, VIOLET AND WHITE |
|--|---|--|----------------|------------------------------|------------------------------|
| DC Forward Current <sup>(1,2)</sup>                  | 700mA   | 1050mA                                       | 1050mA         | 1050mA                       | 1225mA                       |
| Peak Pulsed Forward Current <sup>(1,3)</sup>         | 875mA   | 1300mA                                       | 1300mA         | 1300mA                       | 1500mA                       |
| LED Junction Temperature <sup>(1)</sup> (DC & Pulse) | 135°C   | 120°C  | 135°C          | 135°C                        | 135°C                        |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)        | Class 3B  |  |                |                              |                              |
| LED Storage Temperature                              | -40°C to 135°C  |  |                |                              |                              |
| Soldering Temperature                                | JEDEC 020c 260°C  |  |                |                              |                              |
| Allowable Reflow Cycles                              | 3   |  |                |                              |                              |
| Reverse Voltage (V <sub>reverse</sub> )              | LUXEON C LEDs are not designed to be driven in reverse bias |  |                |                              |                              |

**Notes for Table 4:**

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

# Characteristic Curves

## Spectral Power Distribution Characteristics

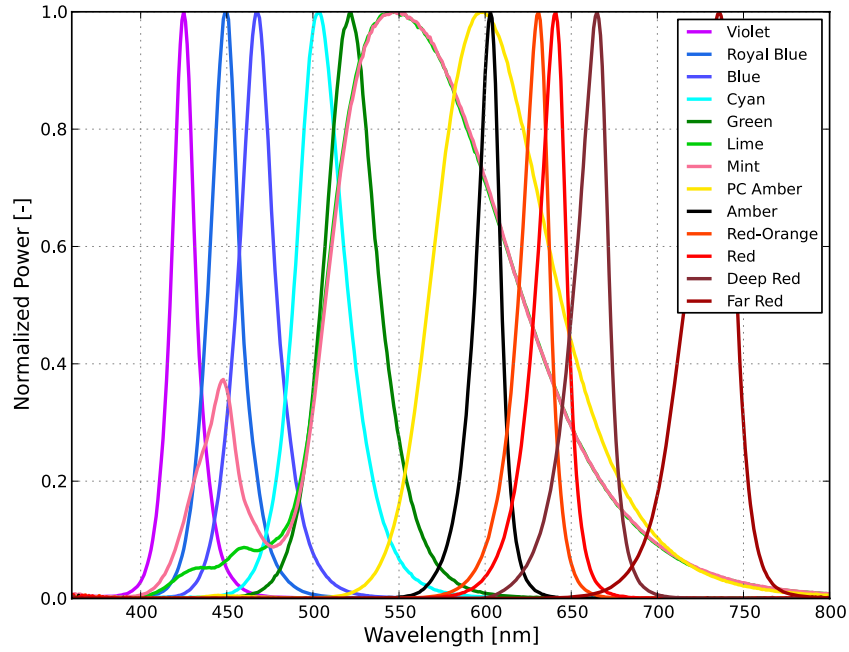


Figure 1a. Typical normalized power vs. wavelength for LUXEON CZ Direct Colors at 350mA,  $T_j=85^{\circ}\text{C}$ .

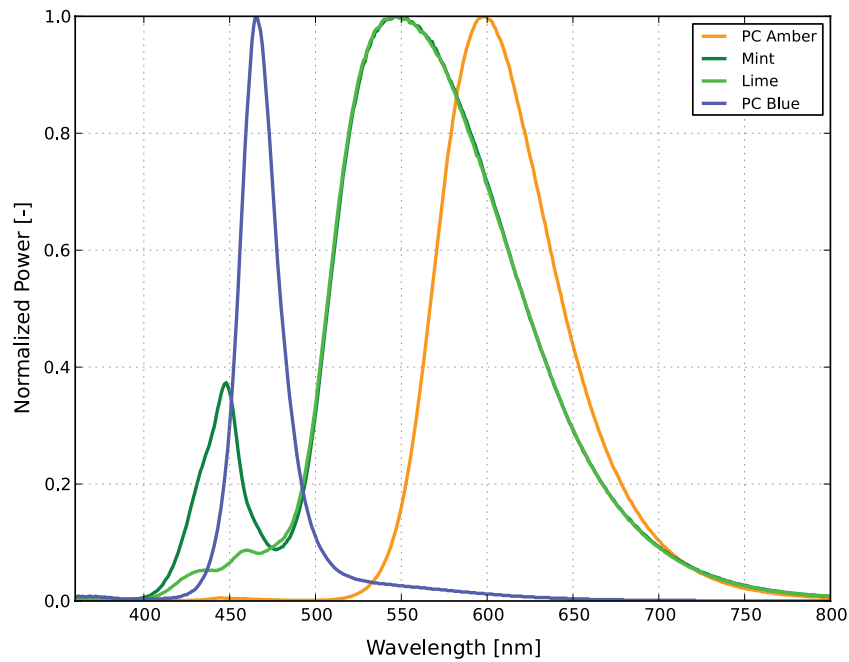


Figure 1b. Typical normalized power vs. wavelength for LUXEON CZ Phosphor Converted Colors at 350mA,  $T_j=85^{\circ}\text{C}$ .

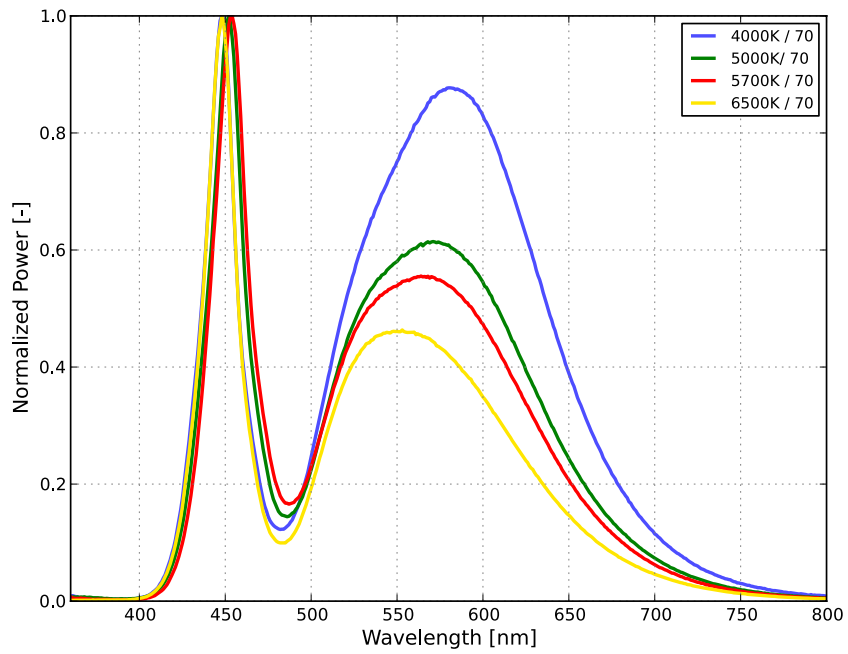


Figure 1c. Typical normalized power vs. wavelength for LUXEON CZ White 70CRI at 350mA,  $T_j=85^\circ\text{C}$ .

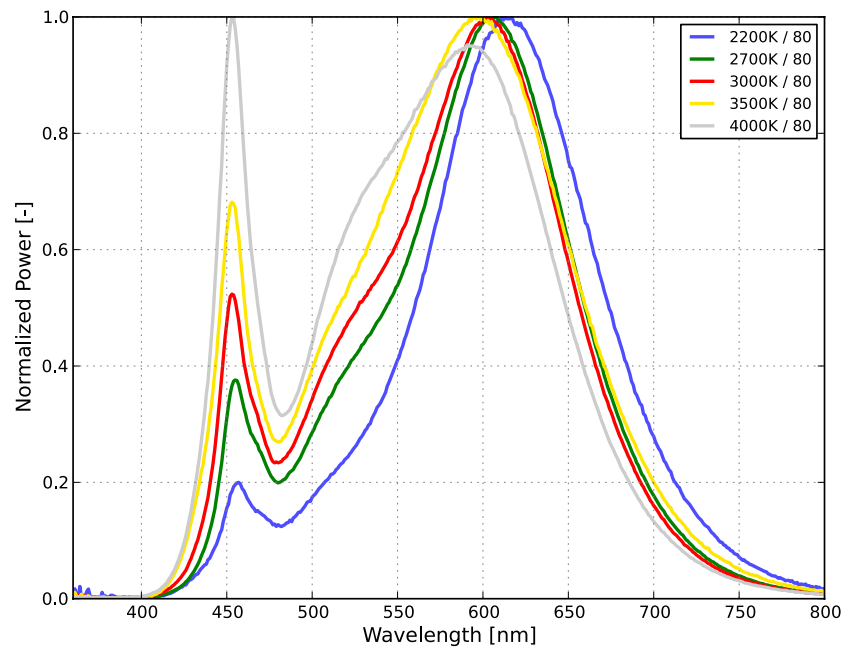


Figure 1d. Typical normalized power vs. wavelength for LUXEON CZ White 80CRI at 350mA,  $T_j=85^\circ\text{C}$ .



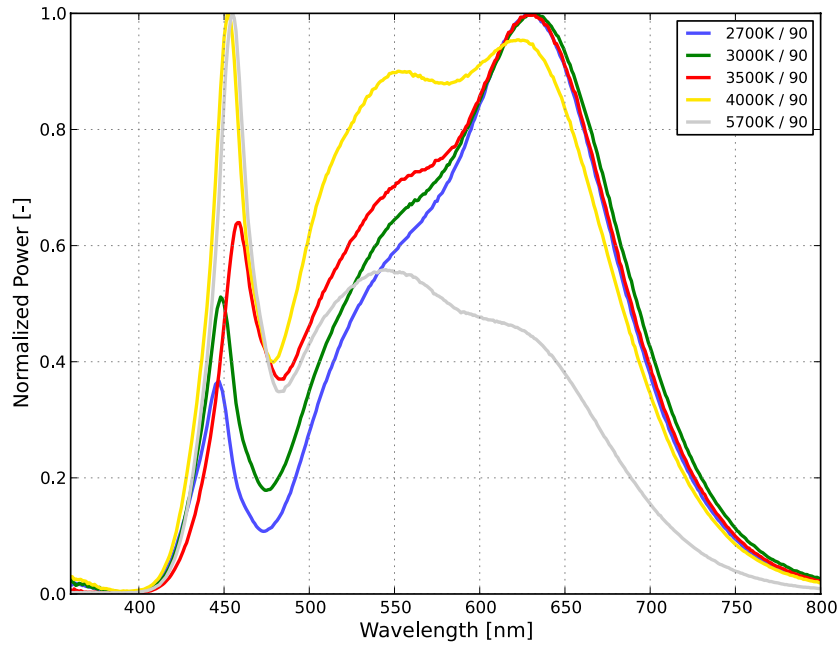


Figure 1e. Typical normalized power vs. wavelength for LUXEON CZ White 90CRI at 350mA,  $T_j=85^\circ\text{C}$ .

# Light Output Characteristics

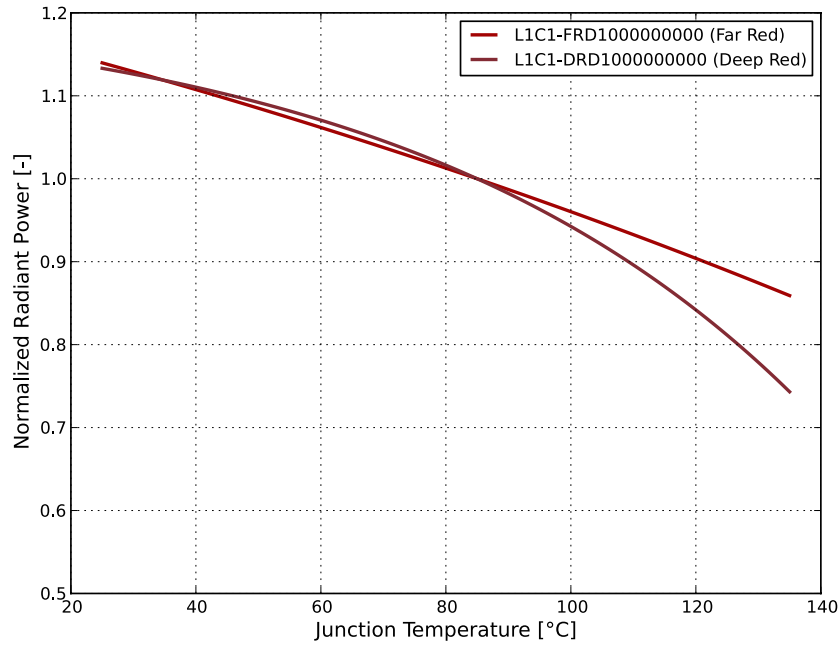


Figure 2a. Typical normalized radiant power vs. junction temperature for LUXEON CZ Far Red and Deep Red at 350mA.

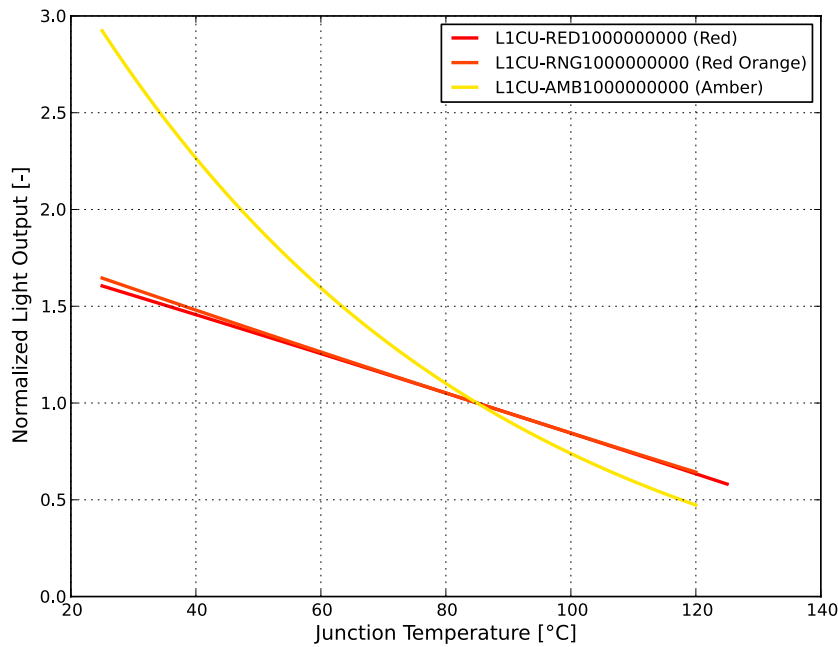


Figure 2b. Typical normalized light output vs. junction temperature for LUXEON CZ Red, Red-Orange and Amber at 350mA.

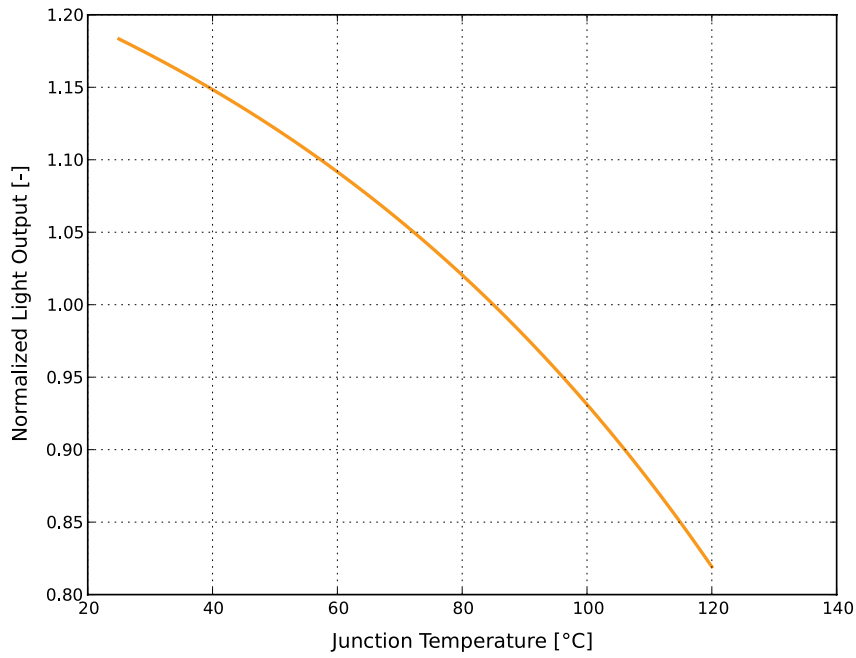


Figure 2c. Typical normalized light output vs. junction temperature for LUXEON CZ PC Amber at 350mA.

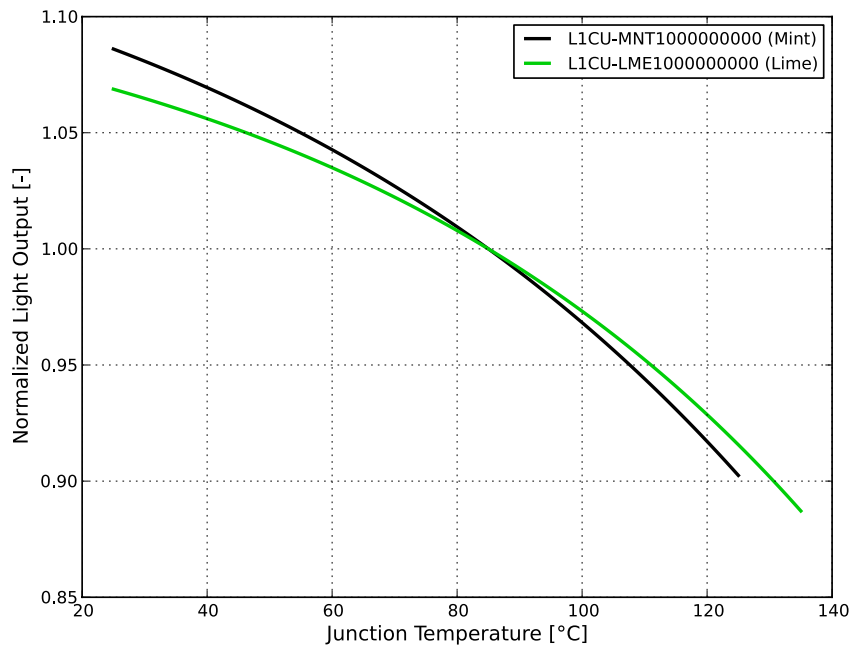


Figure 2d. Typical normalized light output vs. junction temperature for LUXEON CZ Mint and Lime at 350mA.

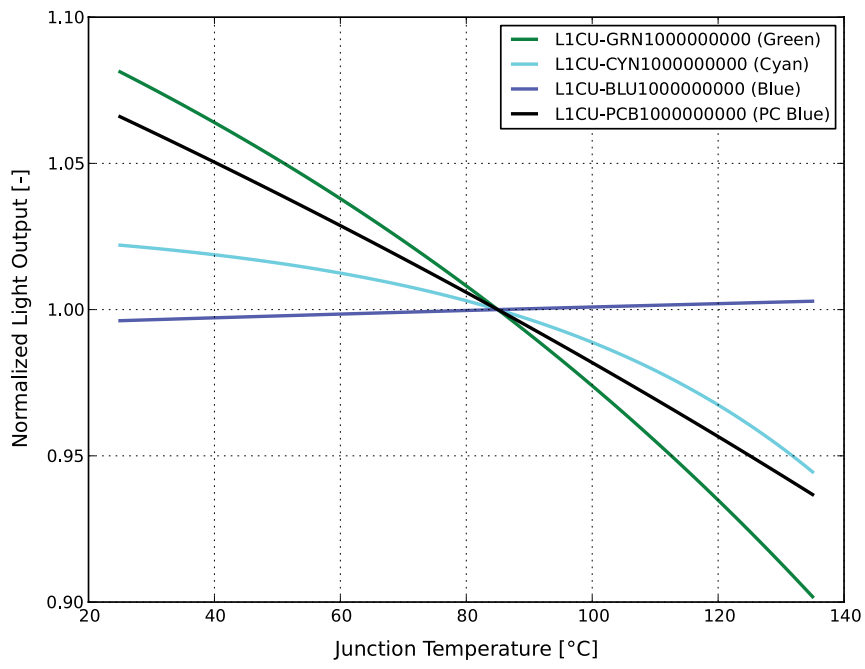


Figure 2e. Typical normalized light output vs. junction temperature for LUXEON CZ Green, Cyan, Blue and PC Blue at 350mA.

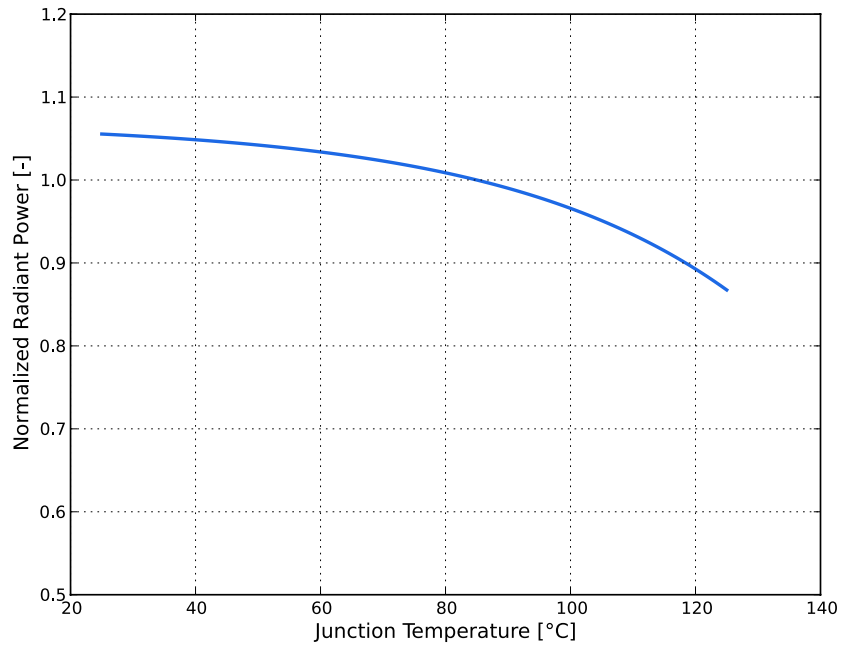


Figure 2f. Typical normalized radiant power vs. junction temperature for LUXEON CZ Royal Blue at 350mA.

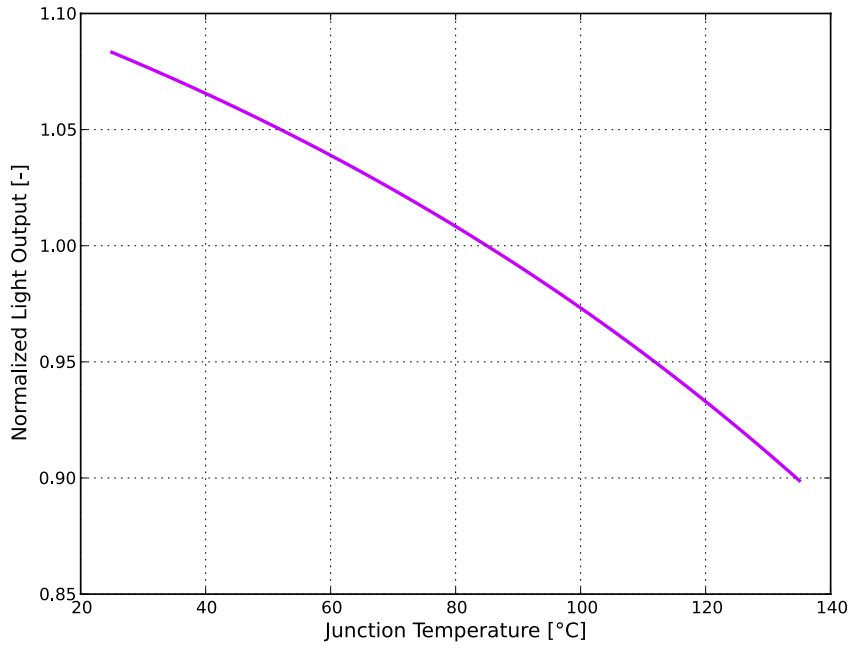


Figure 2g. Typical normalized light output vs. junction temperature for LUXEON CZ Violet at 350mA.

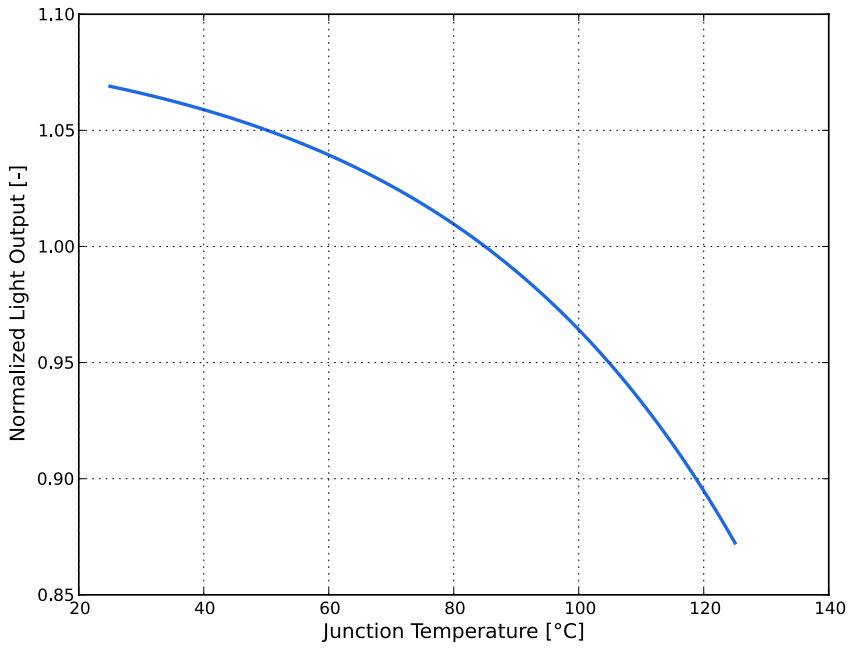


Figure 2h. Typical normalized light output vs. junction temperature for LUXEON CZ White at 350mA.

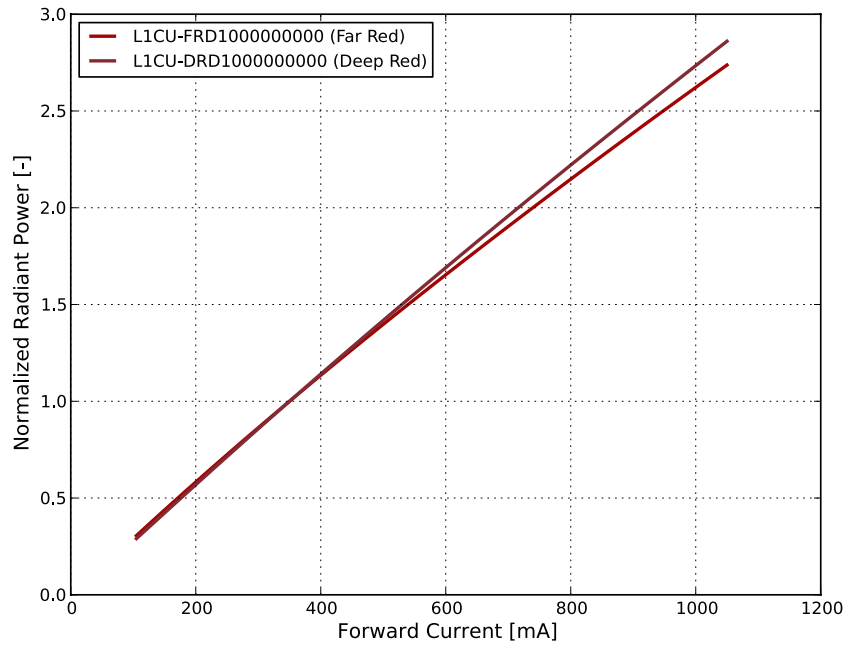


Figure 3a. Typical normalized radiant power vs. forward current for LUXEON CZ Far Red and Deep Red at  $T_j=85^\circ\text{C}$ .

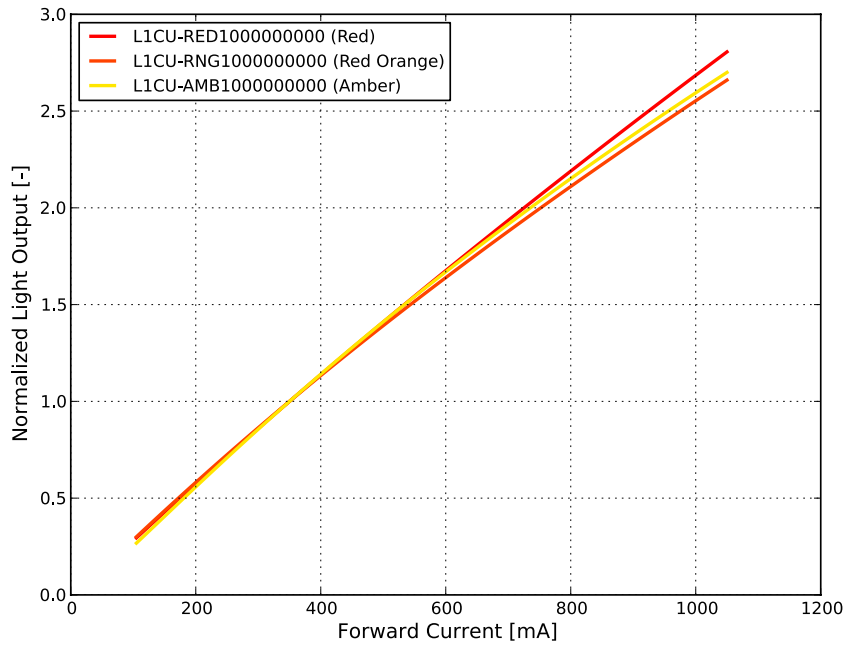


Figure 3b. Typical normalized light output vs. forward current for LUXEON CZ Red, Red-Orange and Amber at  $T_j=85^\circ\text{C}$ .

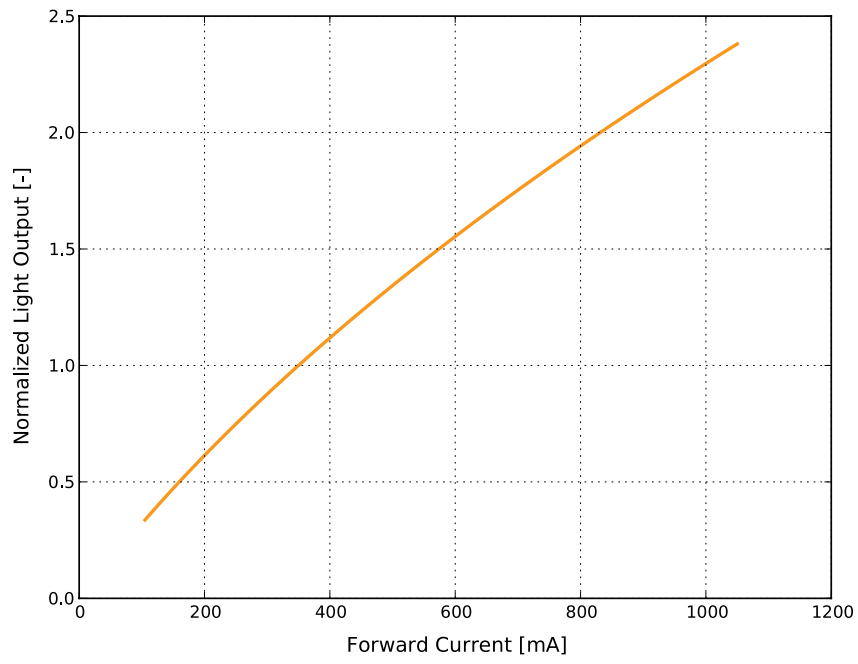


Figure 3c. Typical normalized light output vs. forward current for LUXEON CZ PC Amber at  $T_j=85^\circ\text{C}$ .

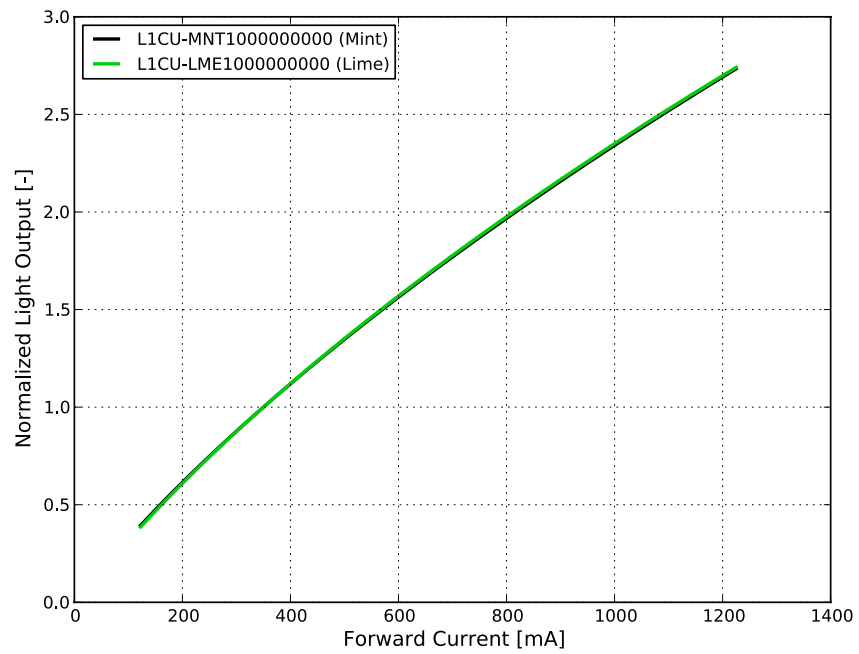


Figure 3d. Typical normalized light output vs. forward current for LUXEON CZ Mint and Lime at  $T_j=85^\circ\text{C}$ .

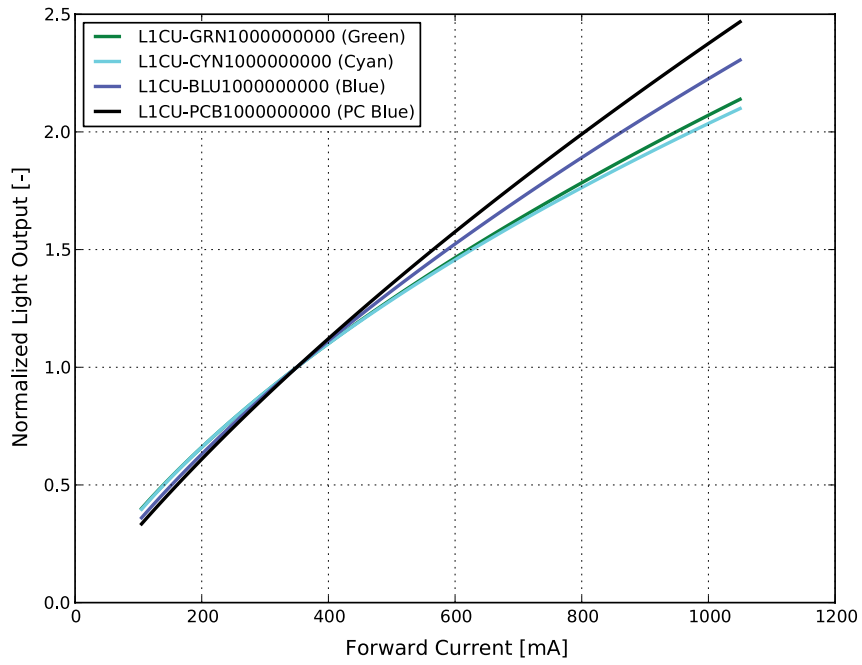


Figure 3e. Typical normalized light output vs. forward current for LUXEON CZ Green, Cyan, Blue and PC Blue at  $T_j=85^\circ\text{C}$ .

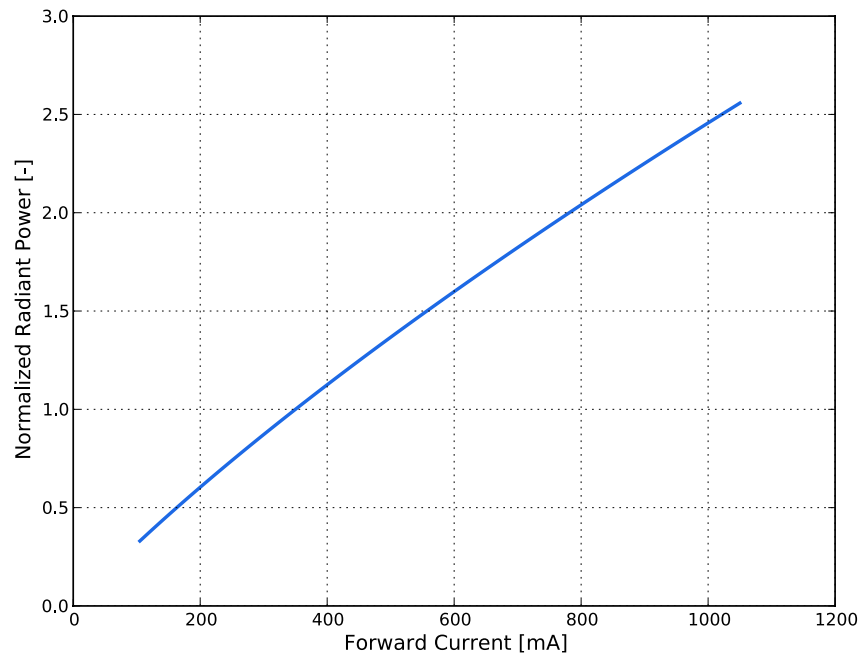


Figure 3f. Typical normalized radiant power vs. forward current for LUXEON CZ Royal Blue at  $T_j=85^\circ\text{C}$ .



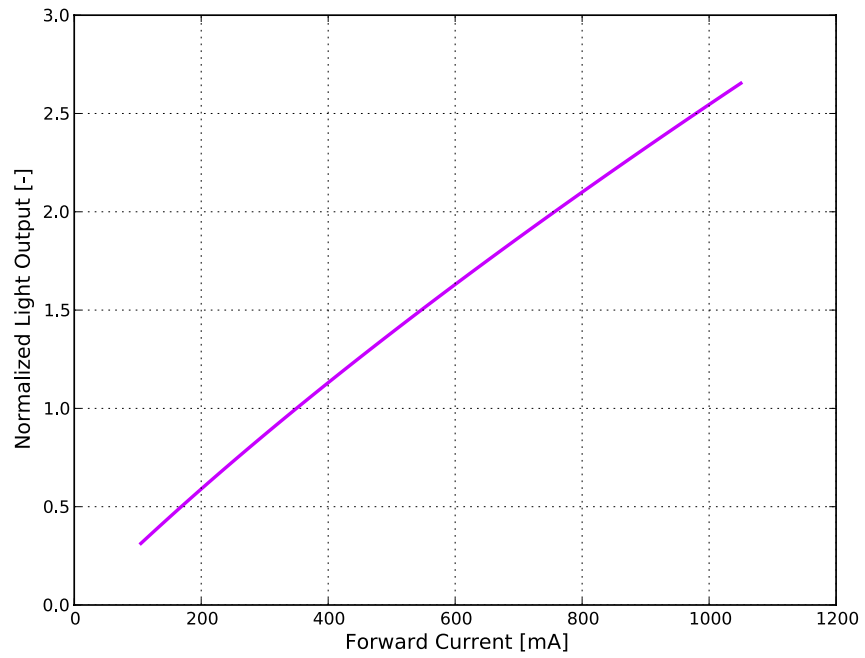


Figure 3g. Typical normalized light output vs. forward current for LUXEON CZ Violet at  $T_j=85^\circ\text{C}$ .

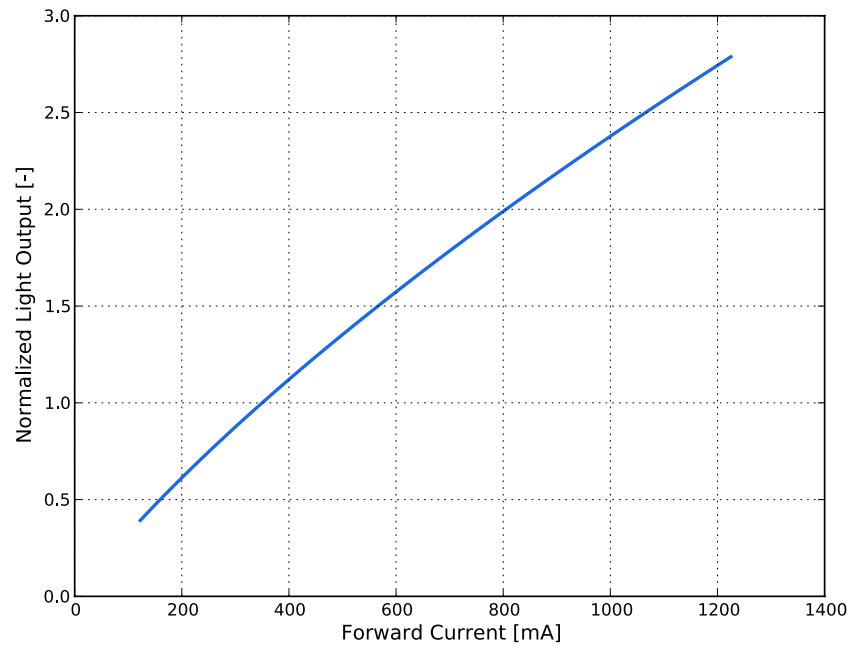


Figure 3h. Typical normalized light output vs. forward current for LUXEON CZ White at  $T_j=85^\circ\text{C}$ .

# Forward Current Characteristics

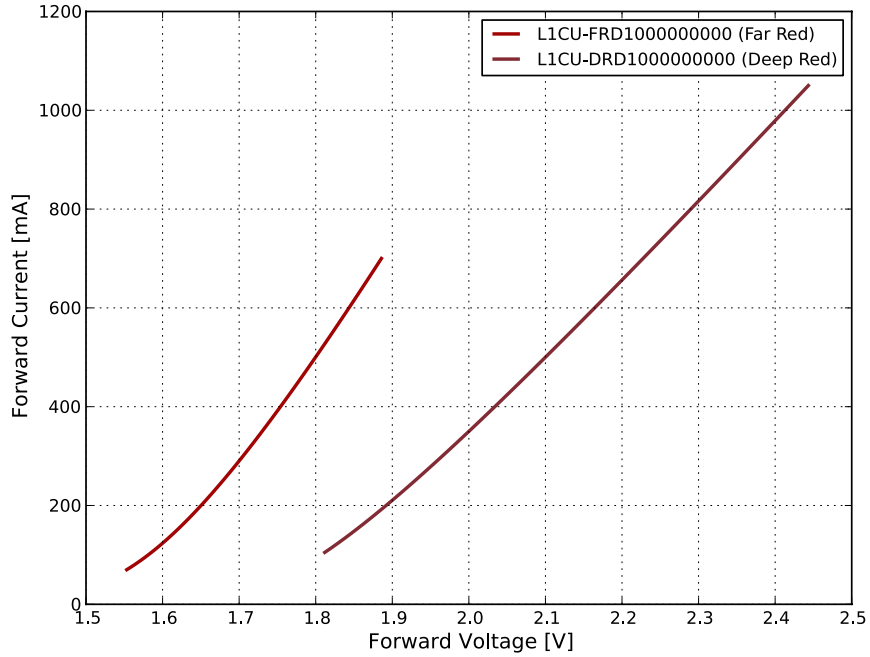


Figure 4a. Typical forward current vs. forward voltage for LUXEON CZ Far Red and Deep Red at  $T_j=85^\circ\text{C}$ .

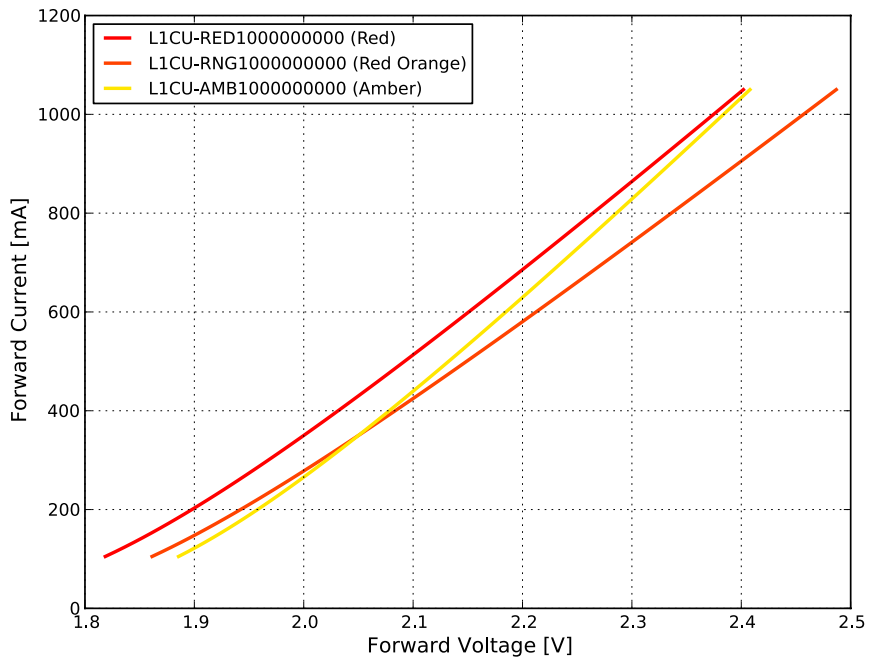


Figure 4b. Typical forward current vs. forward voltage for LUXEON CZ Red, Red-Orange and Amber at  $T_j=85^\circ\text{C}$ .

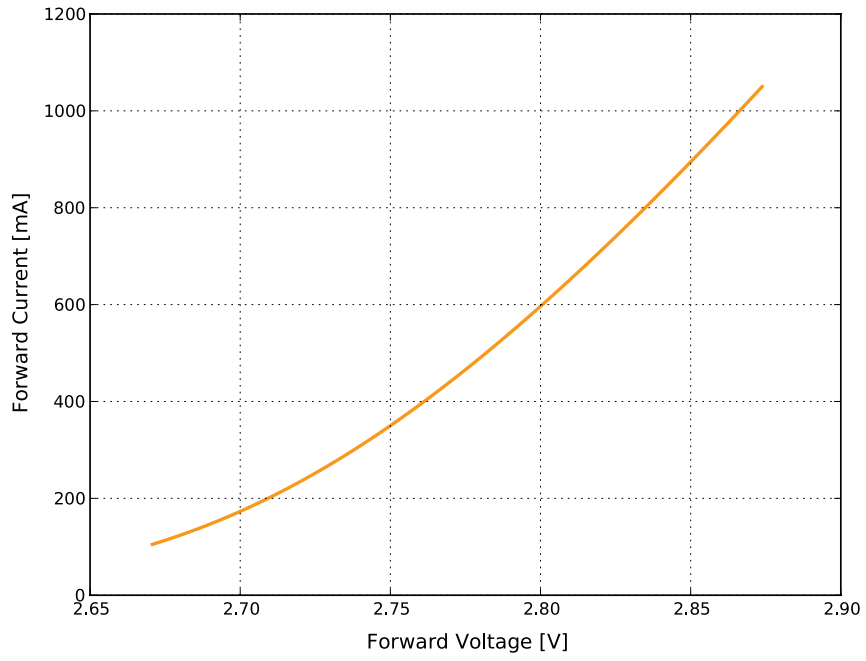


Figure 4c. Typical forward current vs. forward voltage for LUXEON CZ PC Amber at  $T_j=85^{\circ}\text{C}$ .

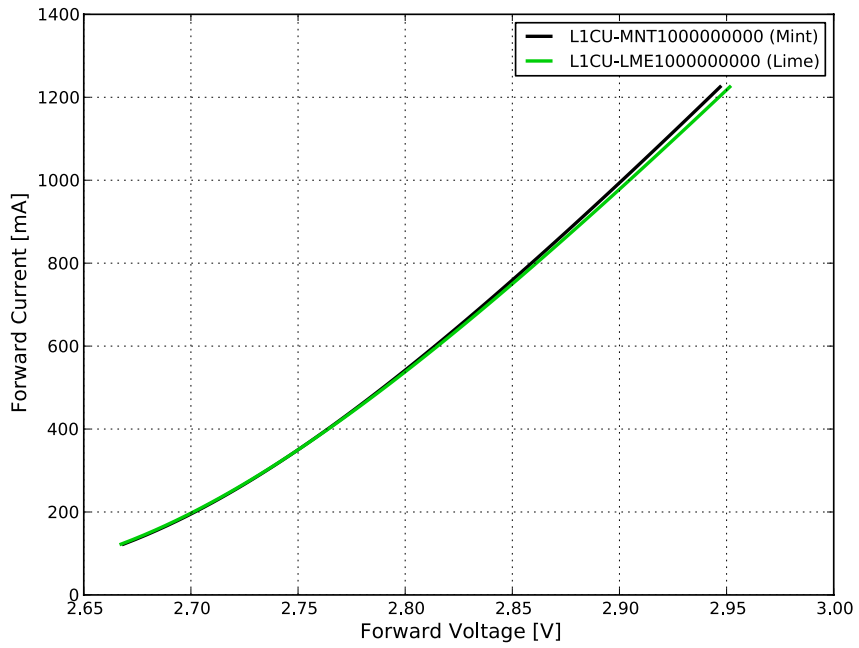


Figure 4d. Typical forward current vs. forward voltage for LUXEON CZ Mint and Lime at  $T_j=85^{\circ}\text{C}$ .

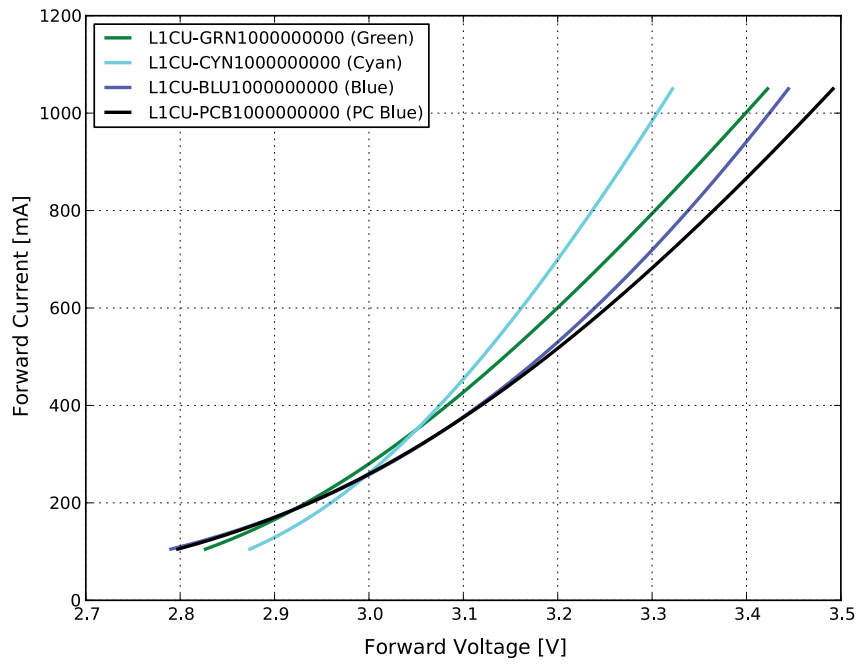


Figure 4e. Typical forward current vs. forward voltage for LUXEON CZ Green, Cyan and Blue at  $T_j=85^\circ\text{C}$ .

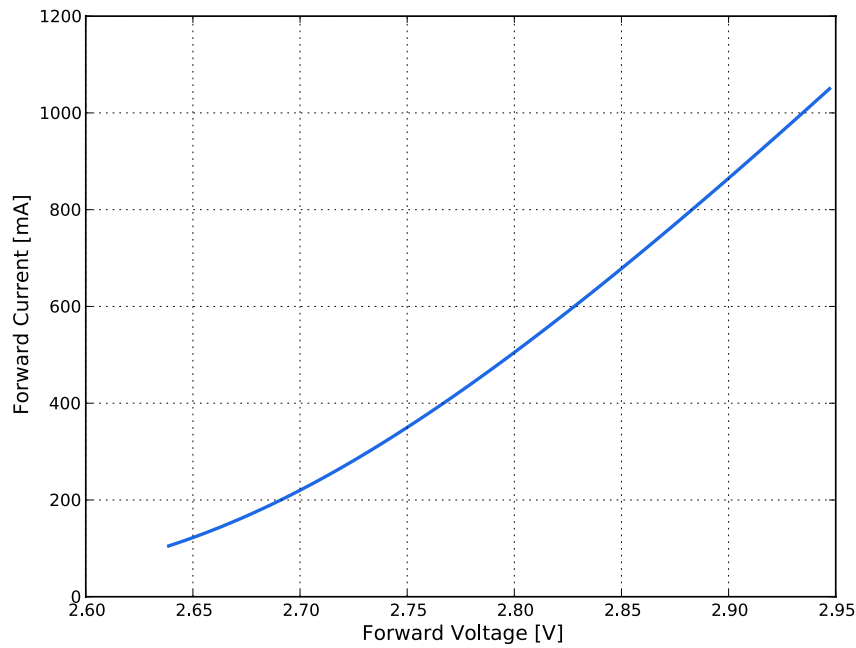


Figure 4f. Typical forward current vs. forward voltage for LUXEON CZ Royal Blue at  $T_j=85^\circ\text{C}$ .

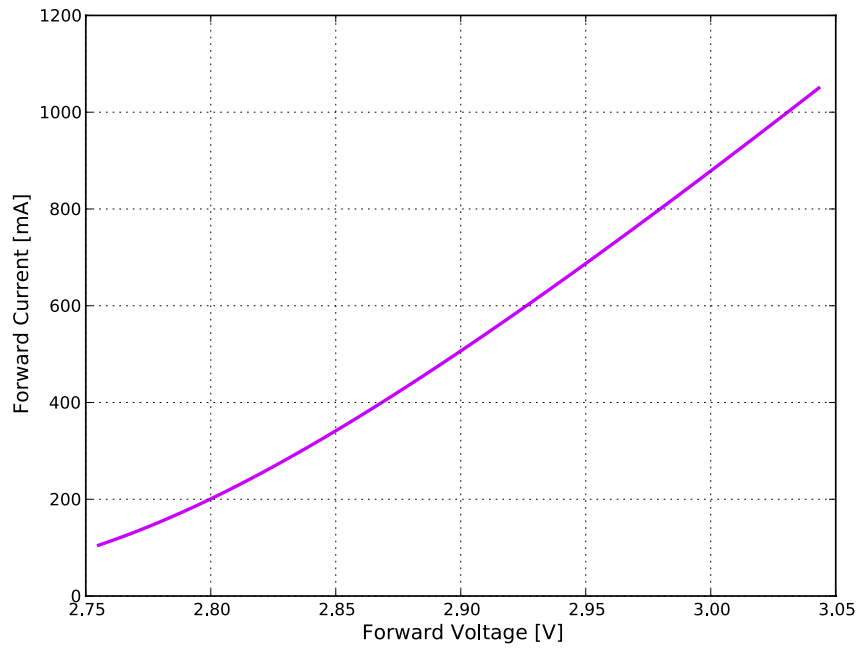


Figure 4g. Typical forward current vs. forward voltage for LUXEON CZ Violet at  $T_j=85^\circ\text{C}$ .

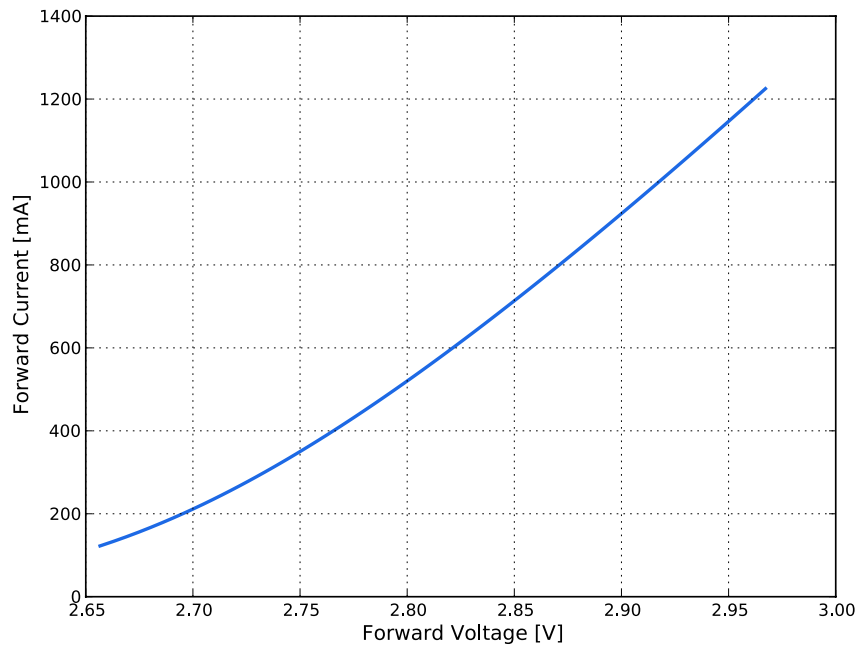


Figure 4h. Typical forward current vs. forward voltage for LUXEON CZ White at  $T_j=85^\circ\text{C}$ .

# Radiation Pattern Characteristics

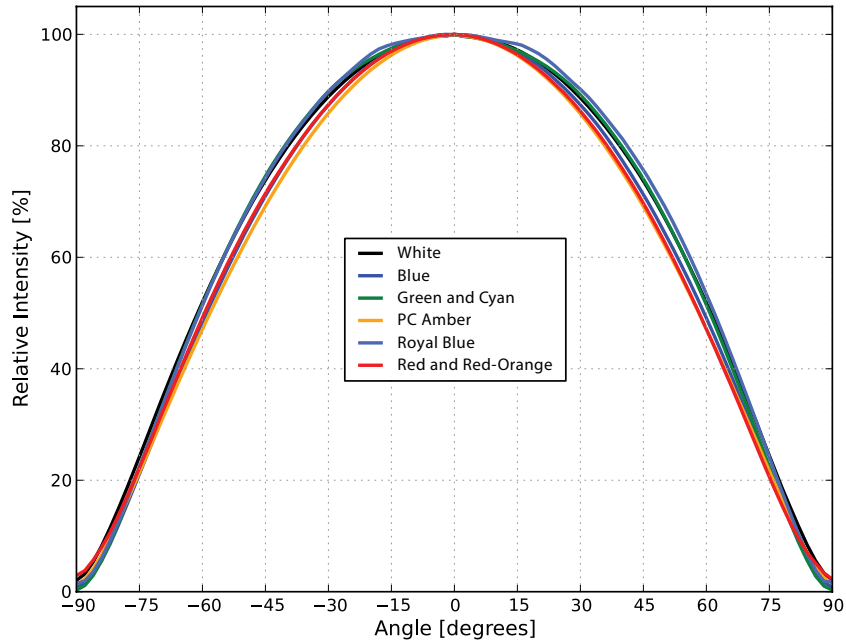


Figure 5a. Typical radiation pattern for LUXEON CZ Red, Red-Orange, PC Amber, Green, Cyan, Blue, Royal Blue and White at 350mA,  $T_j=85^\circ\text{C}$ .

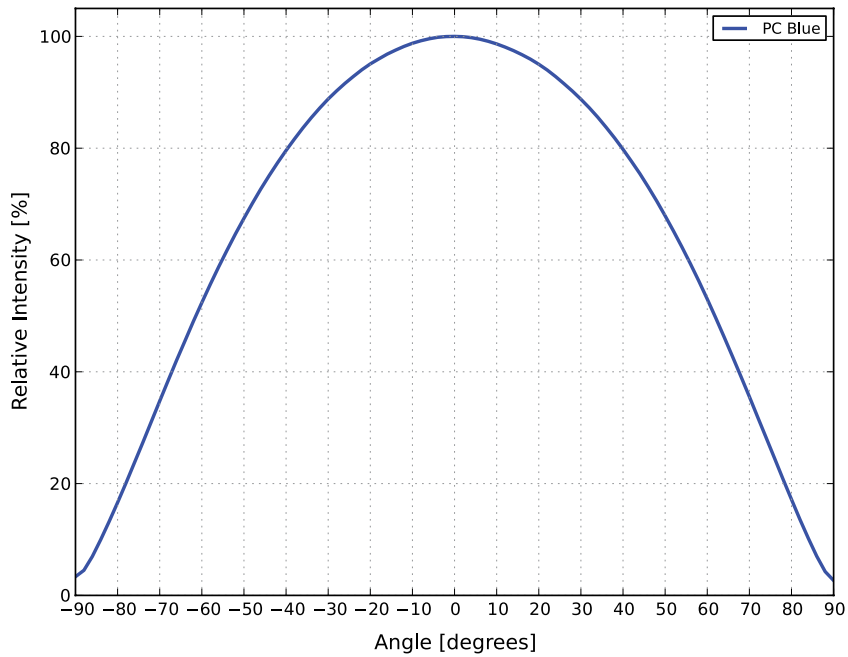


Figure 5b. Typical radiation pattern for LUXEON CZ PC Blue at 350mA,  $T_j=85^\circ\text{C}$ .

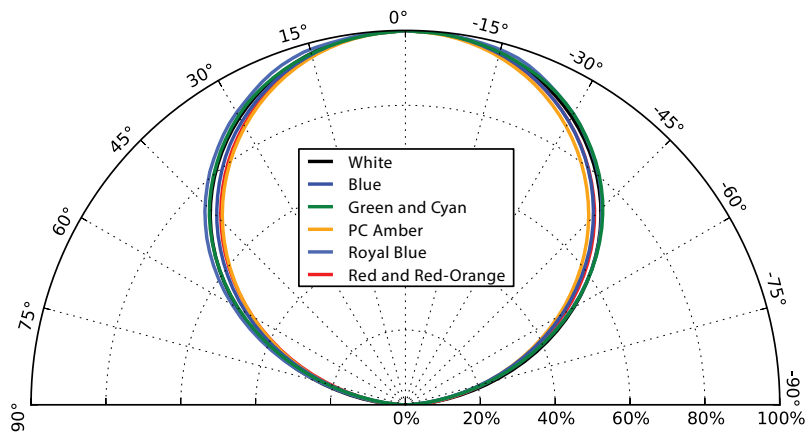


Figure 6a. Typical polar radiation pattern for LUXEON CZ Red, Red-Orange, PC Amber, Green, Cyan, Blue, Royal Blue and White at 350mA,  $T_j=85^\circ\text{C}$ .

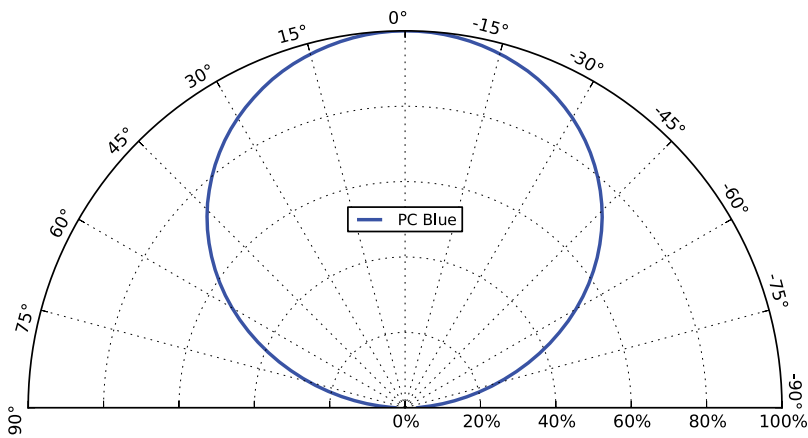


Figure 6b. Typical polar radiation pattern for LUXEON CZ PC Blue at 350mA,  $T_j=85^\circ\text{C}$ .

# 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, radiometric power, color point, peak wavelength, dominant wavelength and forward voltage.

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

**A B C D**

Where:

- A** – designates luminous flux bin or radiometric power bin (luminous flux bin example: A=20 to 25 lumens, B= 25 to 30 lumens; radiometric power bin example: Royal Blue H=480 to 520mW, Violet G=440 to 480mW)
- B C** – designates color bin, peak wavelength bin or dominant wavelength bin (peak wavelength bin example: Deep Red 10=655 to 665nm; dominant wavelength bin example: Red 40=624 to 634nm)
- D** – designates forward voltage bin (example: A=1.70 to 1.90V, B=1.90 to 2.10V)

Therefore, a LUXEON CZ Red LED with a lumen range of 20 to 25 lm, a dominant wavelength of 624 to 634nm and a forward voltage range of 1.70 to 1.90V has the following CAT code:

**A 4 0 A**



## Luminous Flux Bins

Table 5 lists the standard photometric luminous flux bins for LUXEON CZ Color Line 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 CZ Color Line.

| BIN | LUMINOUS FLUX <sup>[1]</sup> (lm) |         |
|-----|-----------------------------------|---------|
|     | MINIMUM                           | MAXIMUM |
| Y   | 10                                | 15      |
| Z   | 15                                | 20      |
| A   | 20                                | 25      |
| B   | 25                                | 30      |
| C   | 30                                | 35      |
| D   | 35                                | 40      |
| E   | 40                                | 45      |
| F   | 45                                | 50      |
| G   | 50                                | 55      |
| H   | 55                                | 60      |
| J   | 60                                | 65      |
| K   | 65                                | 70      |
| L   | 70                                | 75      |
| M   | 75                                | 80      |
| N   | 80                                | 90      |
| P   | 90                                | 100     |
| Q   | 100                               | 110     |
| R   | 110                               | 120     |
| S   | 120                               | 130     |
| T   | 130                               | 140     |
| U   | 140                               | 150     |
| V   | 150                               | 170     |
| W   | 170                               | 190     |

**Notes for Table 5:**

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

## Radiometric Power Bins

Table 6. Radiometric power bin definitions for LUXEON CZ Far Red, Deep Red, Royal Blue and Violet.

| COLOR      | PART NUMBER        | BIN | RADIOMETRIC POWER <sup>[1]</sup> (mW) |         |
|------------|--------------------|-----|---------------------------------------|---------|
|            |                    |     | MINIMUM                               | MAXIMUM |
| Far Red    | L1CU-FRD1000000000 | Z   | 150                                   | 190     |
|            |                    | A   | 190                                   | 240     |
|            |                    | B   | 240                                   | 280     |
| Deep Red   | L1CU-DRD1000000000 | A   | 190                                   | 240     |
|            |                    | B   | 240                                   | 280     |
|            |                    | C   | 280                                   | 320     |
| Royal Blue | L1CU-RYL1000000000 | E   | 360                                   | 400     |
|            |                    | F   | 400                                   | 440     |
|            |                    | G   | 440                                   | 480     |
|            |                    | H   | 480                                   | 520     |
| Violet     | L1CU-VTL1000000000 | F   | 400                                   | 440     |
|            |                    | G   | 440                                   | 480     |
|            |                    | H   | 480                                   | 520     |

**Notes for Table 6:**

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

# Color Bin Structure

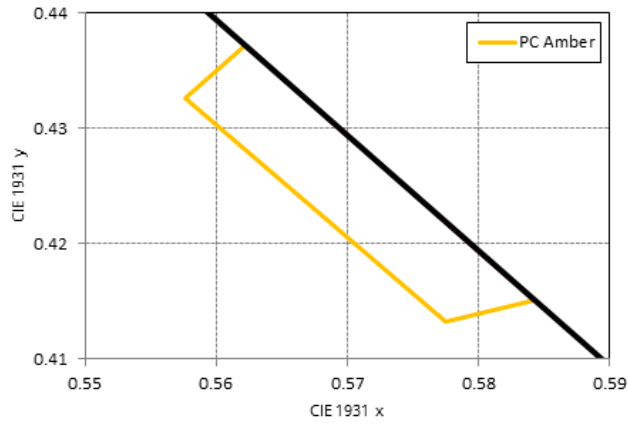


Figure 7. Color bin structure for LUXEON CZ PC Amber for Table 7.

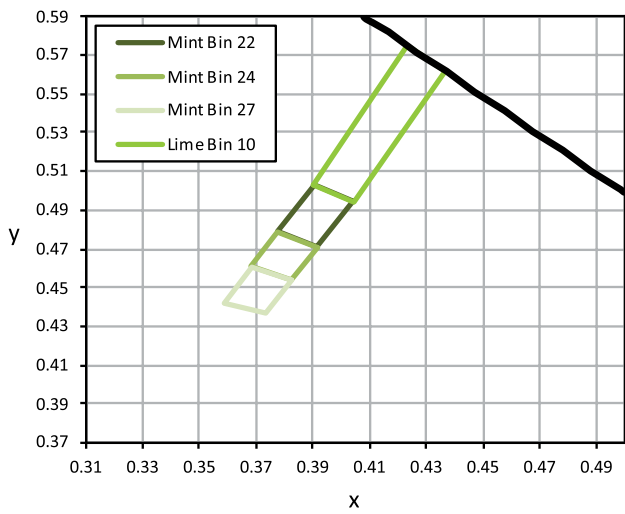


Figure 8. Color bin structure for LUXEON CZ Mint and Lime for Table 7.

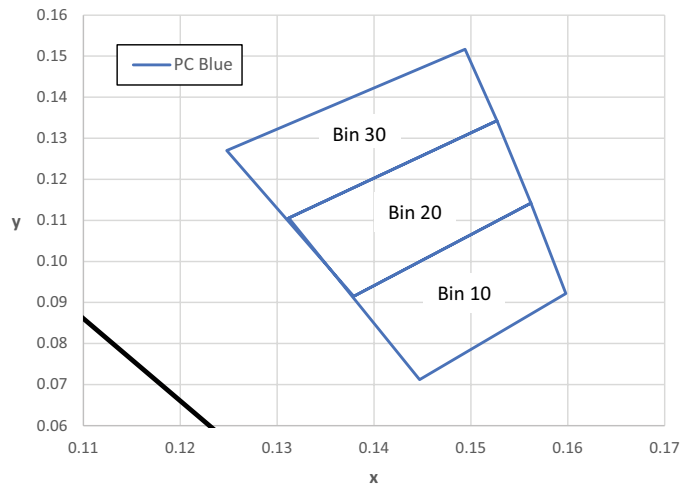


Figure 9. Color bin structure for LUXEON C PC Blue for Table 7.

# Color Bin Structure

Table 7. Color bin definitions for LUXEON CZ PC Amber, Mint, Lime and PC Blue.

| COLOR    | PART NUMBER        | BIN | x      | y      |
|----------|--------------------|-----|--------|--------|
| PC Amber | L1CU-PCA1000000000 | 20  | 0.5622 | 0.4372 |
|          |                    |     | 0.5576 | 0.4326 |
|          |                    |     | 0.5775 | 0.4132 |
|          |                    |     | 0.5843 | 0.4151 |
| Mint     | L1CU-MNT1000000000 | 22  | 0.4041 | 0.4941 |
|          |                    |     | 0.3901 | 0.5030 |
|          |                    |     | 0.3775 | 0.4787 |
|          |                    |     | 0.3916 | 0.4711 |
|          |                    | 24  | 0.3916 | 0.4711 |
|          |                    |     | 0.3775 | 0.4787 |
|          |                    |     | 0.3681 | 0.4606 |
|          |                    |     | 0.3823 | 0.4540 |
|          |                    | 27  | 0.3823 | 0.4540 |
|          |                    |     | 0.3681 | 0.4606 |
|          |                    |     | 0.3587 | 0.4425 |
|          |                    |     | 0.3730 | 0.4369 |
| Lime     | L1CU-LME1000000000 | 10  | 0.3901 | 0.5030 |
|          |                    |     | 0.4232 | 0.5749 |
|          |                    |     | 0.4366 | 0.5616 |
|          |                    |     | 0.4041 | 0.4941 |
| PC Blue  | L1C1-PCB1000000000 | 10  | 0.1379 | 0.0915 |
|          |                    |     | 0.1562 | 0.1142 |
|          |                    |     | 0.1598 | 0.0922 |
|          |                    |     | 0.1447 | 0.0712 |
|          |                    | 20  | 0.1312 | 0.1106 |
|          |                    |     | 0.1527 | 0.1343 |
|          |                    |     | 0.1562 | 0.1142 |
|          |                    |     | 0.1379 | 0.0915 |
|          |                    | 30  | 0.1248 | 0.1270 |
|          |                    |     | 0.1494 | 0.1517 |
|          |                    |     | 0.1527 | 0.1343 |
|          |                    |     | 0.1312 | 0.1106 |

**Notes for Table 7:**

1. Lumileds maintains a tolerance of  $\pm 0.005$  on x and y color coordinates measurements.

# Color Bin Definitions

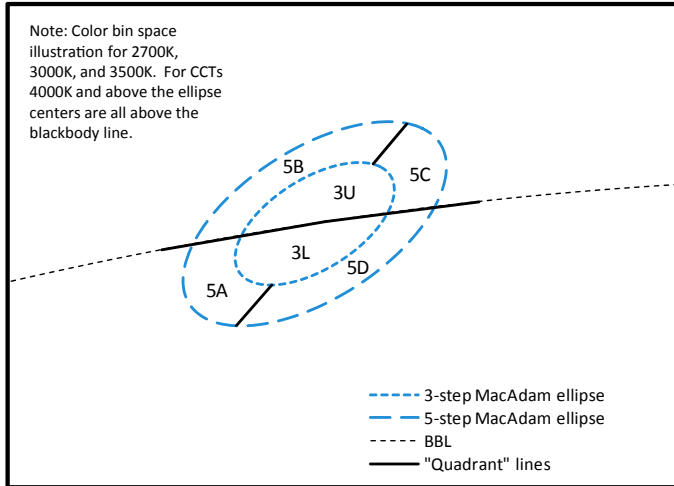


Figure 10. Color bin structure for LUXEON CZ Color Line.

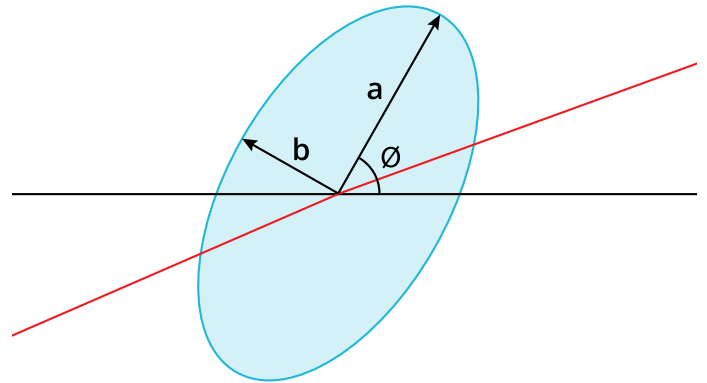


Figure 11. 3- and 5-step MacAdam ellipse illustration for Table 8.

Table 8a. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON CZ White at 350mA,  $T_j=85^\circ\text{C}$

| NOMINAL CCT | COLOR SPACE                   | CENTER POINT <sup>[1]</sup><br>(cx, cy) | MAJOR AXIS,<br>a | MINOR AXIS,<br>b | ELLIPSE ROTATION<br>ANGLE, $\theta$ |
|-------------|-------------------------------|---|------------------|------------------|-------------------------------------|
| 2200K       | Single 3-step MacAdam ellipse | (0.5020, 0.4156)                        | 0.00863          | 0.00398          | 49.3°                               |
| 2700K       | Single 3-step MacAdam ellipse | (0.4578, 0.4101)                        | 0.00810          | 0.00420          | 53.7°                               |
| 3000K       | Single 3-step MacAdam ellipse | (0.4338, 0.4030)                        | 0.00834          | 0.00408          | 53.2°                               |
| 3500K       | Single 3-step MacAdam ellipse | (0.4073, 0.3917)                        | 0.00927          | 0.00414          | 54.0°                               |
| 4000K       | Single 3-step MacAdam ellipse | (0.3818, 0.3797)                        | 0.00939          | 0.00402          | 53.7°                               |
| 5700K       | Single 3-step MacAdam ellipse | (0.3287, 0.3417)                        | 0.00746          | 0.00320          | 59.1°                               |
| 2200K       | Single 5-step MacAdam ellipse | (0.5020, 0.4156)                        | 0.01438          | 0.00663          | 49.3°                               |
| 2700K       | Single 5-step MacAdam ellipse | (0.4578, 0.4101)                        | 0.01350          | 0.00700          | 53.7°                               |
| 3000K       | Single 5-step MacAdam ellipse | (0.4338, 0.4030)                        | 0.01390          | 0.00680          | 53.2°                               |
| 3500K       | Single 5-step MacAdam ellipse | (0.4073, 0.3917)                        | 0.01545          | 0.00690          | 54.0°                               |
| 4000K       | Single 5-step MacAdam ellipse | (0.3818, 0.3797)                        | 0.01565          | 0.00670          | 53.7°                               |
| 5000K       | Single 5-step MacAdam ellipse | (0.3447, 0.3553)                        | 0.01370          | 0.00590          | 59.6°                               |
| 5700K       | Single 5-step MacAdam ellipse | (0.3287, 0.3417)                        | 0.01243          | 0.00533          | 59.1°                               |
| 6500K       | Single 5-step MacAdam ellipse | (0.3123, 0.3282)                        | 0.00115          | 0.00475          | 58.6°                               |

Notes for Table 8a:

1. Lumileds maintains a tolerance of  $\pm 0.005$  on x and y coordinates in the CIE 1931 color space.

Table 8b. MacAdam ellipse color bin definitions for LUXEON CZ Colors.

| BIN | SDCM   |
|-----|--|
| 3U  | Single 3-step MacAdam ellipse (80CRI for all CCTs and 90CRI only for CCTs below 4000K) |
| 3L  | Single 3-step MacAdam ellipse (80CRI for all CCTs and 90CRI only for CCTs below 4000K) |
| 30  | Single 3-step MacAdam ellipse (90CRI for CCTs 4000K and above)                         |
| 50  | 5-step MacAdam ellipse (70CRI)   |
| 5A  | 5-step MacAdam ellipse (80CRI and 90CRI)   |
| 5B  | 5-step MacAdam ellipse (80CRI and 90CRI)   |
| 5C  | 5-step MacAdam ellipse (80CRI and 90CRI)   |
| 5D  | 5-step MacAdam ellipse (80CRI and 90CRI)   |

## Peak Wavelength Bins

Table 9. Peak wavelength bin definitions for LUXEON CZ Far Red, Deep Red, Royal Blue and Violet.

| COLOR      | PART NUMBER        | BIN | PEAK WAVELENGTH <sup>[1]</sup> (nm) |         |
|------------|--------------------|-----|-------------------------------------|---------|
|            |                    |     | MINIMUM                             | MAXIMUM |
| Far Red    | L1CU-FRD1000000000 | 10  | 720                                 | 730     |
|            |                    | 20  | 730                                 | 740     |
|            |                    | 30  | 740                                 | 750     |
| Deep Red   | L1CU-DRD1000000000 | 10  | 655                                 | 665     |
|            |                    | 20  | 665                                 | 675     |
| Royal Blue | L1CU-RYL1000000000 | 30  | 440                                 | 445     |
|            |                    | 40  | 445                                 | 450     |
|            |                    | 50  | 450                                 | 455     |
|            |                    | 60  | 455                                 | 460     |
| Violet     | L1CU-VLT1000000000 | 10  | 420                                 | 430     |

**Notes for Table 9:**

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

## Dominant Wavelength Bins

Table 10. Dominant wavelength bin definitions for LUXEON CZ Red, Red-Orange, Amber, Green, Cyan and Blue at 350mA,  $T_j=85^\circ\text{C}$ .

| COLOR      | PART NUMBER        | BIN | DOMINANT WAVELENGTH <sup>[1]</sup> (nm) |         |
|------------|--------------------|-----|---|---------|
|            |                    |     | MINIMUM                                 | MAXIMUM |
| Red        | L1CU-RED1000000000 | 40  | 624.0                                   | 634.0   |
| Red-Orange | L1CU-RNG1000000000 | 20  | 614.0                                   | 624.0   |
| Amber      | L1CU-AMB1000000000 | 10  | 585.0                                   | 590.0   |
|            |                    | 20  | 590.0                                   | 594.5   |
|            |                    | 30  | 594.5                                   | 600.0   |
| Green      | L1CU-GRN1000000000 | 10  | 520.0                                   | 525.0   |
|            |                    | 20  | 525.0                                   | 530.0   |
|            |                    | 30  | 530.0                                   | 535.0   |
|            |                    | 40  | 535.0                                   | 540.0   |
| Cyan       | L1CU-CYN1000000000 | 10  | 490.0                                   | 496.0   |
|            |                    | 20  | 496.0                                   | 500.0   |
|            |                    | 30  | 500.0                                   | 505.0   |
|            |                    | 40  | 505.0                                   | 510.0   |
| Blue       | L1CU-BLU1000000000 | 10  | 460.0                                   | 465.0   |
|            |                    | 20  | 465.0                                   | 470.0   |
|            |                    | 30  | 470.0                                   | 475.0   |
|            |                    | 40  | 475.0                                   | 480.0   |
|            |                    | 50  | 480.0                                   | 485.0   |

**Notes for Table 10:**

1. Lumileds maintains a tolerance of  $\pm 0.5$ nm on dominant wavelength measurements.

# Forward Voltage Bins

Table 11. Forward voltage bin definitions for LUXEON CZ Color Line.

| BIN | FORWARD VOLTAGE <sup>(1)</sup> (V <sub>f</sub> ) |         |
|-----|--|---------|
|     | MINIMUM  | MAXIMUM |
| 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    |

Notes for Table 11:

1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.

# Mechanical Dimensions

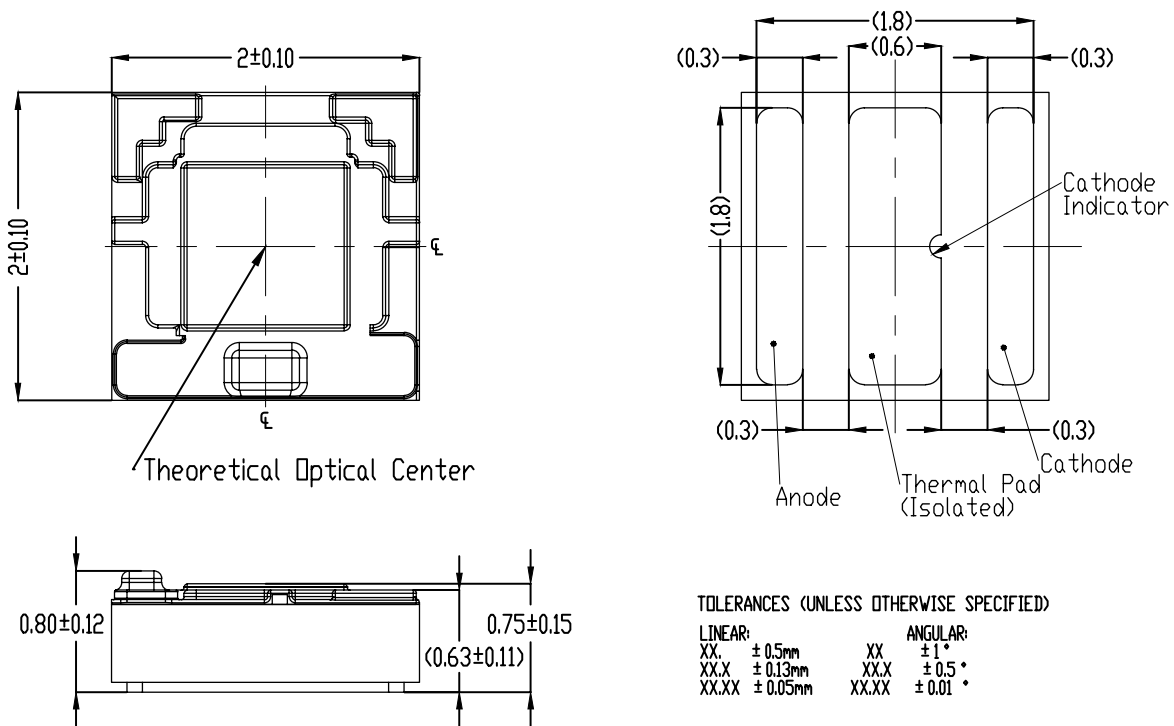


Figure 12. Mechanical dimensions for LUXEON CZ Color Line.

Notes for Figure 12:

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

# Reflow Soldering Guidelines

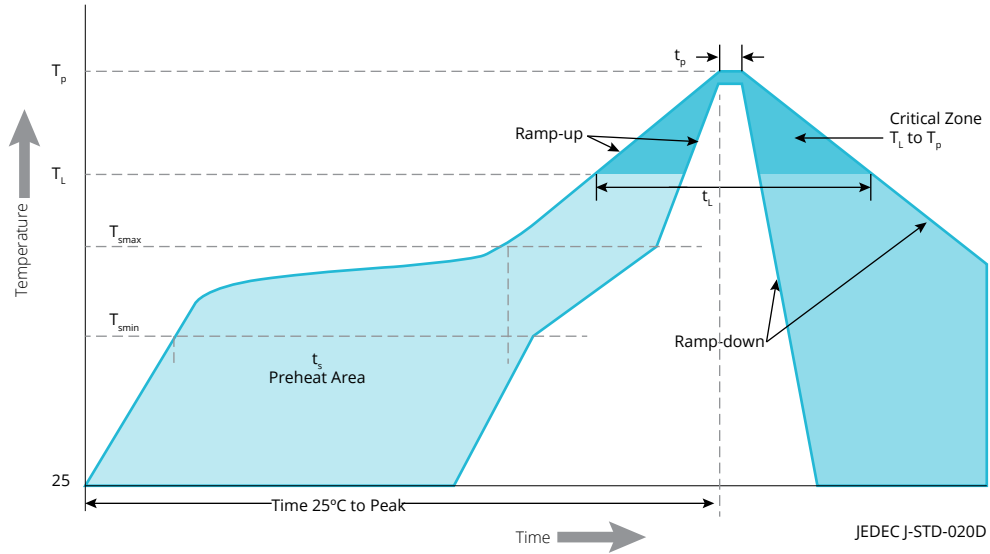


Figure 13. Visualization of the acceptable reflow temperature profile as specified in Table 12.

Table 12. Reflow profile characteristics for LUXEON CZ Color Line.

| PROFILE FEATURE                                   | LEAD-FREE ASSEMBLY   |
|---|----------------------|
| Preheat Minimum Temperature ( $T_{smin}$ )        | 150°C                |
| Preheat Maximum Temperature ( $T_{smax}$ )        | 200°C                |
| Preheat Time ( $t_{smin}$ to $t_{smax}$ )         | 60 to 120 seconds    |
| Ramp-Up Rate ( $T_L$ to $T_p$ )                   | 3°C / second maximum |
| Liquidus Temperature ( $T_L$ )                    | 217°C                |
| Time Maintained Above Temperature $T_L$ ( $t_L$ ) | 60 to 150 seconds    |
| Peak / Classification Temperature ( $T_p$ )       | 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 13. Moisture sensitivity levels for LUXEON CZ Color Line.

| 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

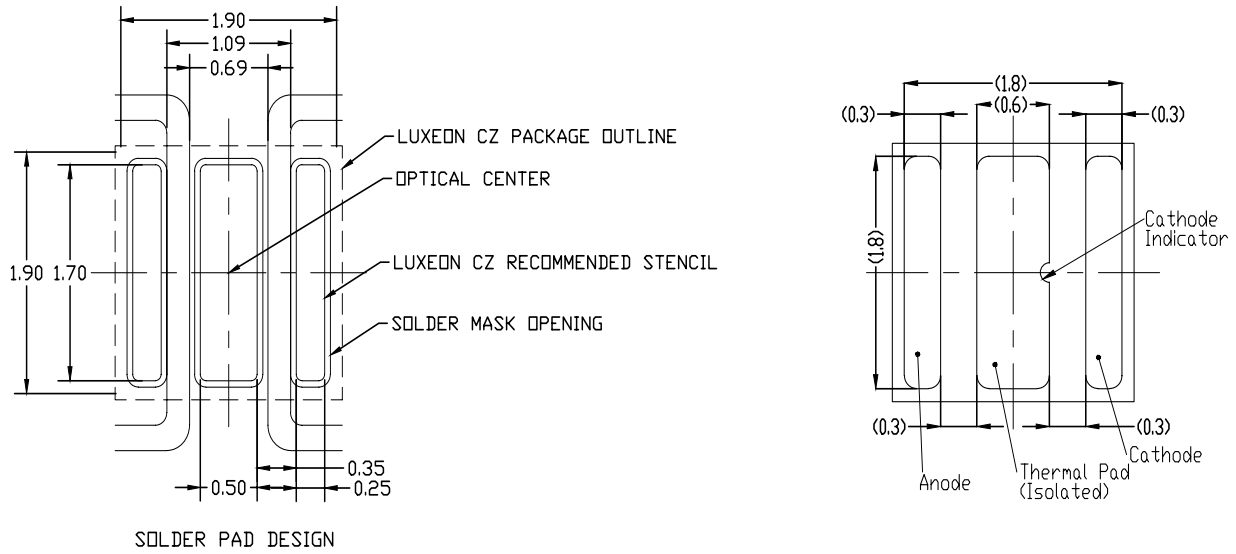


Figure 14. Recommended PCB solder pad layout for LUXEON CZ Color Line.

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

# Packaging Information

## Pocket Tape Dimensions

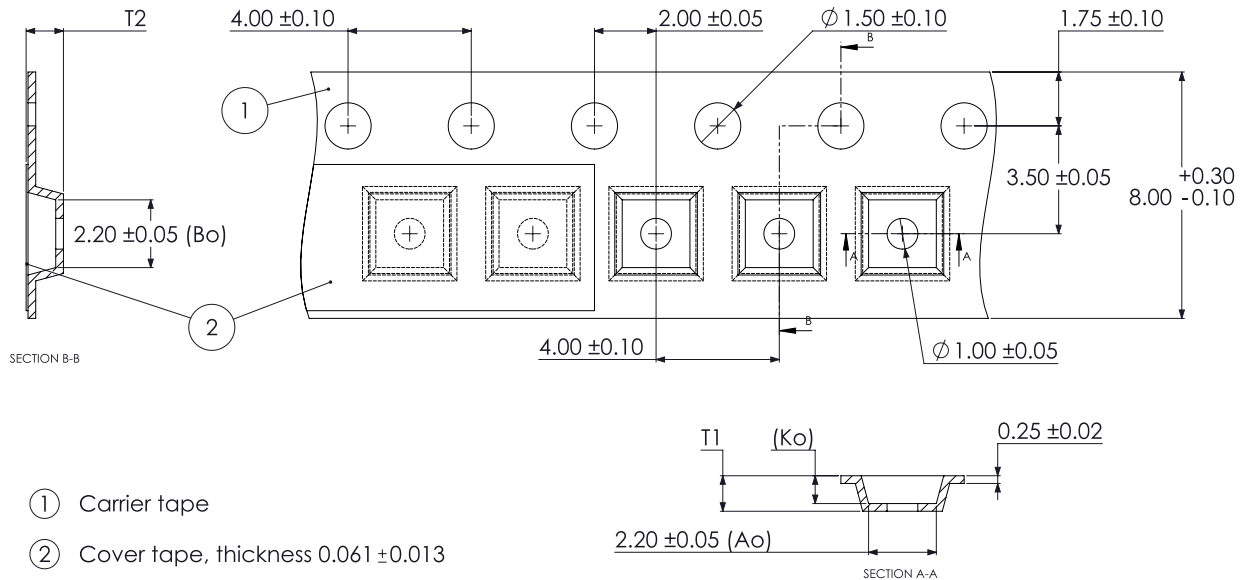


Figure 15. Pocket Tape dimensions for LUXEON CZ Color Line.

- Notes for Figure 15:
1. Drawings are not to scale.
  2. All dimensions are in millimeters.



# Reel Dimensions

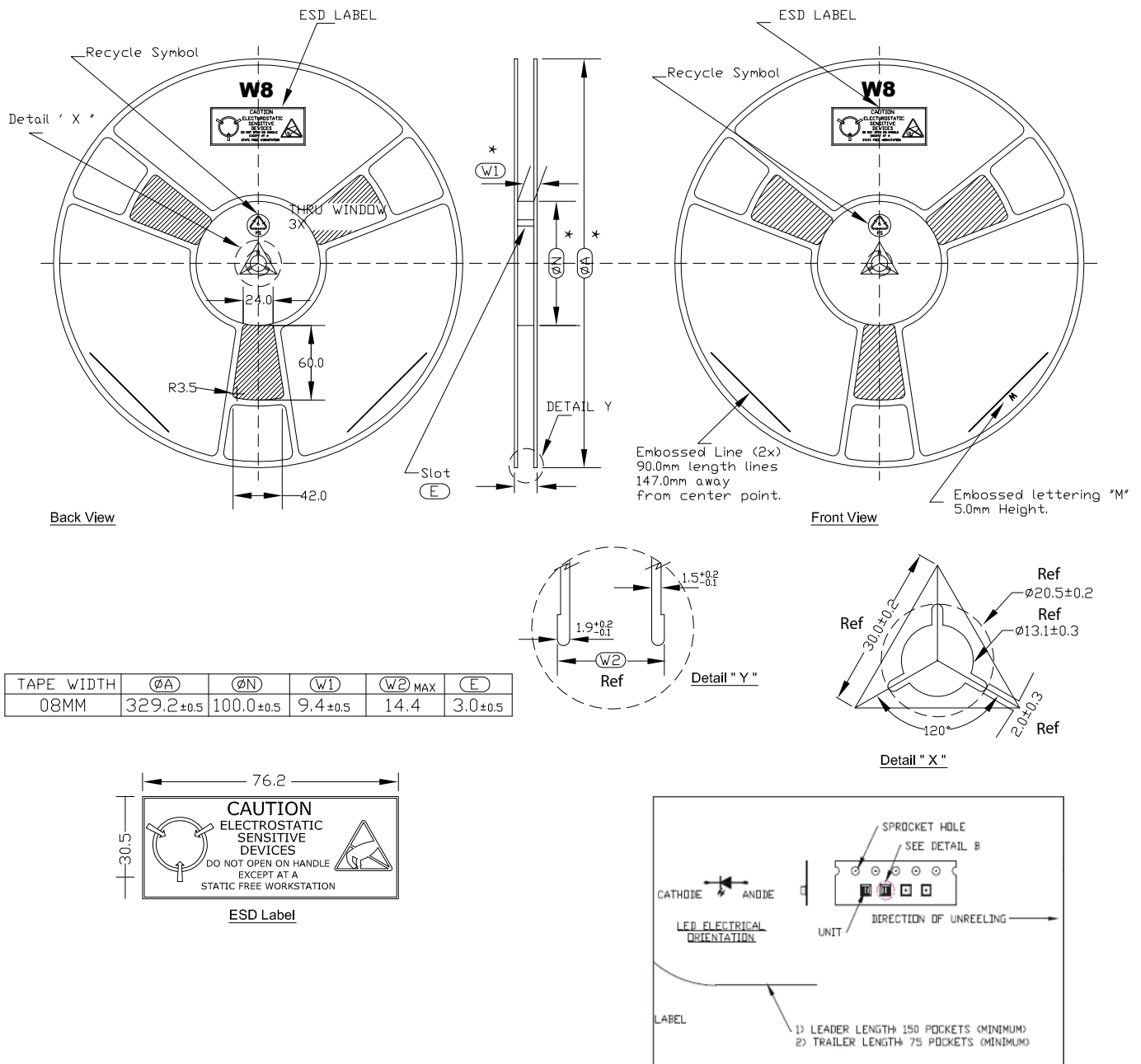


Figure 16. Reel dimensions for LUXEON CZ Color Line.

**Notes for Figure 16:**

1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Maximum 1000 pieces per reel.

## 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](https://lumileds.com).



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