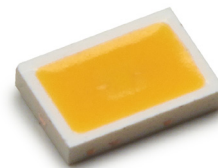


# LUXEON 3020

*Hot targeted leading lm/\$ QFN  
with superior lumen maintenance*



## Introduction

LUXEON 3020 is the first and only hot color targeted EMC based 3.0mm x 2.0mm QFN delivering up to 155 lm/W with superior lumen maintenance and assurance of ANSI compliance at operating conditions. Make mass production of affordable and reliable bulbs/lamps possible and simplify system design and integration with hot color targeting.

### Features

- Up to 155 lm/W
- Reliable QFN EMC package
- Hot targeted at 85°C
- 1/9 micro color binning
- High lumen output and compact 3020 footprint

### Benefits

- Enable affordable and efficient fixtures
- Deliver superior lumen maintenance
- Assure ANSI compliance at operating condition
- Provide design flexibility
- Make high lumen density design feasible

### Key Applications

- Downlights
- High bay & low bay
- Indoor Area Lighting
  - Troffer
  - Linear fixtures
  - Wall Grazer
  - Cove Lighting
- Retrofit Lamps

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# General Information

## Product Nomenclature

LUXEON 3020 is tested and binned at  $T_j = 25^\circ\text{C}$  and 120 mA DC.

The part number designation is explained as follow:

L 13 0 – A A B B 0 0 2 0 1 1 0 0 1

Where:

AA — designates CCT (2700 = 27, 3000 = 30, 3500 = 35, 4000 = 40, 5000 = 50, 5700 = 57, 6500 = 65)

BB — designates CRI (70, 80 and 90)

Therefore the part number for a 4000K, 80 CRI, LUXEON 3020 product will be:

L 13 0 – 4 0 8 0 0 0 2 0 1 1 0 0 1

## Average Lumen Maintenance Characteristics

Lumen maintenance for solid-state lighting devices (LEDs) is typically defined in terms of the percentage of initial light output remaining after a specified period of time. Please visit the following website for detailed operating conditions: <http://www.philipslumileds.com/support/documentation/lumen-maintenance>. Or contact your local Philips Lumileds Technical Solutions Manager for TM-21 extrapolations or other support. Observation of design limits included in this data sheet is required in order to achieve this projected lumen maintenance.

## Environmental Compliance

Philips Lumileds is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON 3020 is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS and REACH directives. Philips Lumileds will not intentionally add the following restricted material to the LUXEON 3020 L130-xx80002011001: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

# Product Selection

## Product Selection Guide for LUXEON 3020 LEDs Junction Temperature = 25°C

Table 1.

| Nominal CCT | Part Number        | Luminous Flux (lm) <sup>[1]</sup><br>@ 120 mA, 25°C |         | Luminous Flux (lm) <sup>[2]</sup><br>@ 100 mA, 25°C |         | CRI <sup>[1]</sup> | R <sub>th,J-c</sub><br>(°C/W) <sup>[3]</sup> |
|-------------|--------------------|-----------------------------------------------------|---------|-----------------------------------------------------|---------|--------------------|----------------------------------------------|
|             |                    | Minimum                                             | Typical | Minimum                                             | Typical |                    |                                              |
| 2700K       | L130-2780002011001 | 39.0                                                | 44.5    | 33.5                                                | 37.0    | 80                 | 13                                           |
| 3000K       | L130-3080002011001 | 40.0                                                | 46.0    | 34.5                                                | 38.0    |                    |                                              |
| 3500K       | L130-3580002011001 | 41.0                                                | 46.5    | 35.0                                                | 38.5    |                    |                                              |
| 4000K       | L130-4080002011001 | 43.0                                                | 48.5    | 37.0                                                | 40.0    |                    |                                              |
| 5000K       | L130-5080002011001 | 43.0                                                | 49.0    | 37.0                                                | 40.5    |                    |                                              |
| 5700K       | L130-5780002011001 | 43.0                                                | 49.0    | 37.0                                                | 40.5    |                    |                                              |
| 6500K       | L130-6580002011001 | 43.0                                                | 48.5    | 37.0                                                | 40.0    |                    |                                              |

Notes for Table 1:

1. Philips Lumileds maintains a tolerance of ± 7.5% on luminous flux, ± 2 on CRI.
2. Calculated and interpolated values.
3. Typical thermal resistance is measured from junction to solder pads.

## Electrical Characteristics

### Electrical Characteristics

Thermal Pad Temperature = 25°C, Test Current @ 120 mA

Table 2.

| Part Number        | Forward Voltage V <sub>f</sub> <sup>[1]</sup> (V) |         |         | Temperature Coefficient of<br>Forward Voltage between 25°C and 85°C<br>$\Delta V_F / \Delta T_J$ |
|--------------------|---------------------------------------------------|---------|---------|--------------------------------------------------------------------------------------------------|
|                    | Minimum                                           | Typical | Maximum |                                                                                                  |
| L130-2780002011001 | 2.85                                              | 3.05    | 3.30    | -2.0 to -4.0                                                                                     |
| L130-3080002011001 |                                                   |         |         |                                                                                                  |
| L130-3580002011001 |                                                   |         |         |                                                                                                  |
| L130-4080002011001 |                                                   |         |         |                                                                                                  |
| L130-5080002011001 |                                                   |         |         |                                                                                                  |
| L130-5780002011001 |                                                   |         |         |                                                                                                  |
| L130-6580002011001 |                                                   |         |         |                                                                                                  |

Notes for Table 2:

1. Philips Lumileds maintains a tolerance of ± 0.1V on forward voltage measurements.
2. Measured between T<sub>J</sub> = 25°C and T<sub>J</sub> = 85°C.

# Absolute Maximum Ratings

Table 3.

| Parameter                               | Maximum Performance                                                          |
|-----------------------------------------|------------------------------------------------------------------------------|
| DC Forward Current                      | 240 mA                                                                       |
| Peak Pulsed Forward Current             | 300 mA <sup>[1, 2]</sup>                                                     |
| LED Junction Temperature <sup>[1]</sup> | 125°C                                                                        |
| ESD Sensitivity                         | < 1000V Human Body Model (HBM) Class 2A JS-001-2012<br>Class C JESD22-A115-B |
| Operating Case Temperature at 15 mA     | -40°C - 100°C                                                                |
| Storage Temperature                     | -40°C - 100°C                                                                |
| Soldering Temperature                   | JEDEC 020D 260°C                                                             |
| Allowable Reflow Cycles                 | 3                                                                            |
| Reverse Voltage (Vr) <sup>[3, 4]</sup>  | -5V                                                                          |

Notes for Table 3:

1. Ripple current with a frequency of 50-150 Hz is allowed as long as the average of the current waveform is below 240 mA and the maximum of the current waveform is lower than 300 mA.
2. At 10% duty cycle and pulse width < 100µs.
3. LUXEON 3020 LEDs are not designed to be driven in reverse bias.
4. At a maximum reverse current of 10 µA.

## JEDEC Moisture Sensitivity

Table 4.

| Level | Floor Life |                 | Soak Requirements Standard |                |
|-------|------------|-----------------|----------------------------|----------------|
|       | Time       | Conditions      | Time                       | Conditions     |
| 2     | 1 year     | ≤ 30°C / 60% RH | 168 Hrs. ± 5/0 Hrs.        | ≤85°C / 60% RH |

# Reflow Soldering Characteristics

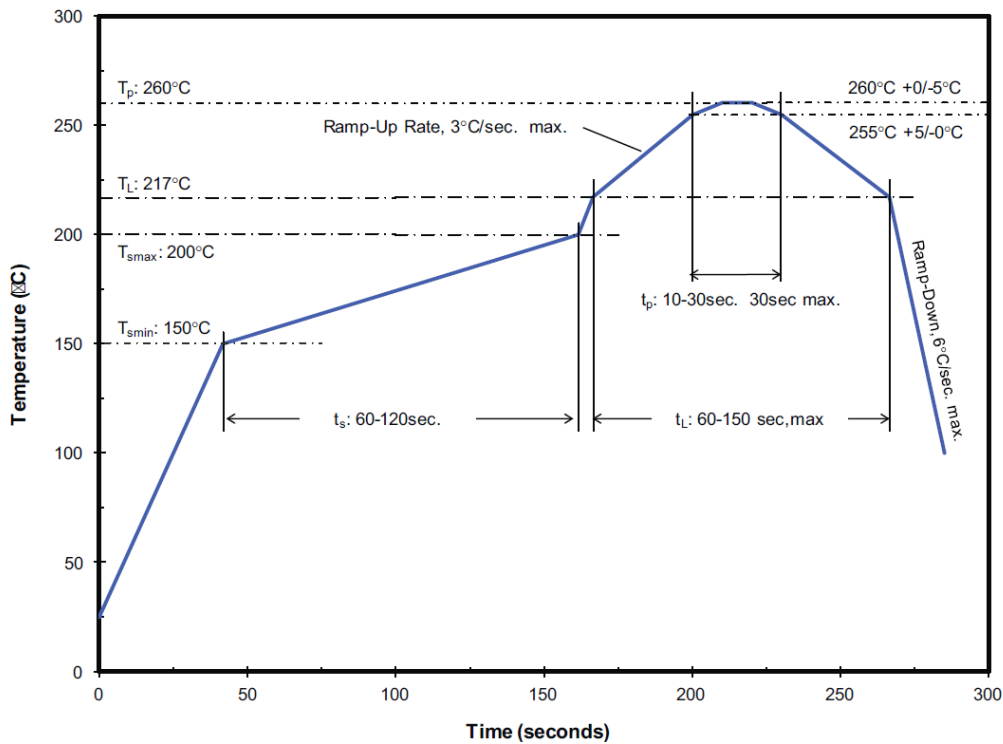


Figure 1. Temperature profile for Table 5.

Table 5. Reflow Profile in Accordance with J-Std-020D

| Profile Feature                                                  | Lead Free Assembly |
|------------------------------------------------------------------|--------------------|
| Preheat/Soak:                                                    |                    |
| Temperature Min ( $T_{smin}$ )                                   | 150°C              |
| Temperature Max ( $T_{smax}$ )                                   | 200°C              |
| Maximum Time ( $t_s$ ) from $T_{smin}$ to $T_{smax}$             | 120 seconds        |
| Ramp-up Rate ( $T_L$ to $T_p$ )                                  | 3°C / second       |
| Liquidous Temperature ( $T_L$ )                                  | 217°C              |
| Maximum Time ( $t_L$ ) Maintained $T_L$                          | 150 seconds        |
| Maximum Peak Package Body Temperature ( $T_p$ )                  | 260°C              |
| Time ( $t_p$ ) within 5°C of the specified temperature ( $T_c$ ) | 10 - 30 seconds    |
| Maximum Ramp-Down Rate ( $T_p$ to $T_L$ )                        | 6°C / second       |
| Maximum Time 25°C to Peak Temperature                            | 8 minutes          |

Notes for Table 5:

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

# Mechanical Dimensions and Package Information

## Mechanical Dimensions

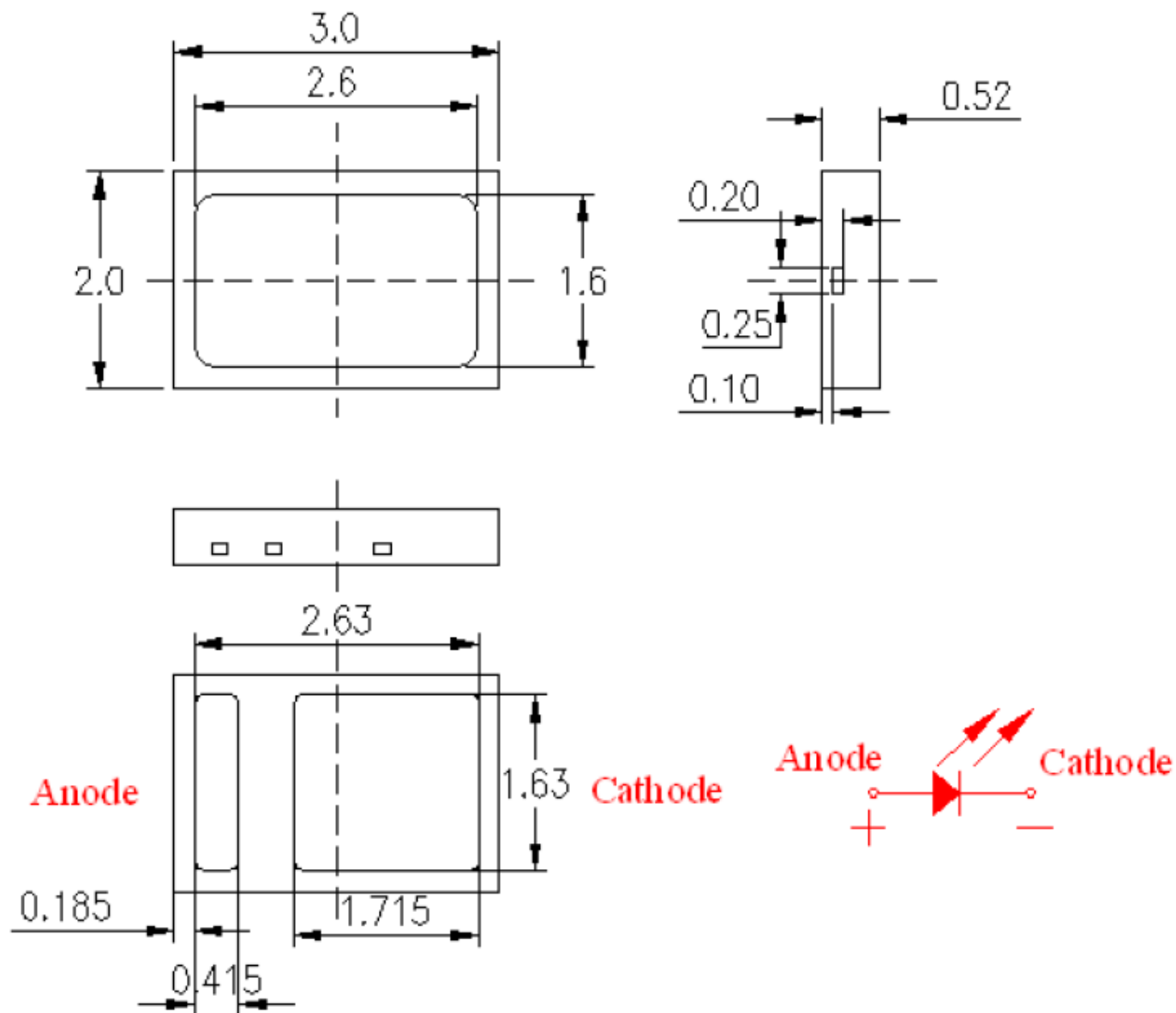


Figure 2.

### Notes for Figure 2:

1. All dimensions are in millimeters.
2. Tolerance: XX:  $\pm 0.1\text{mm}$ , XXX:  $\pm 0.05\text{mm}$ .

# Solder Pad Design

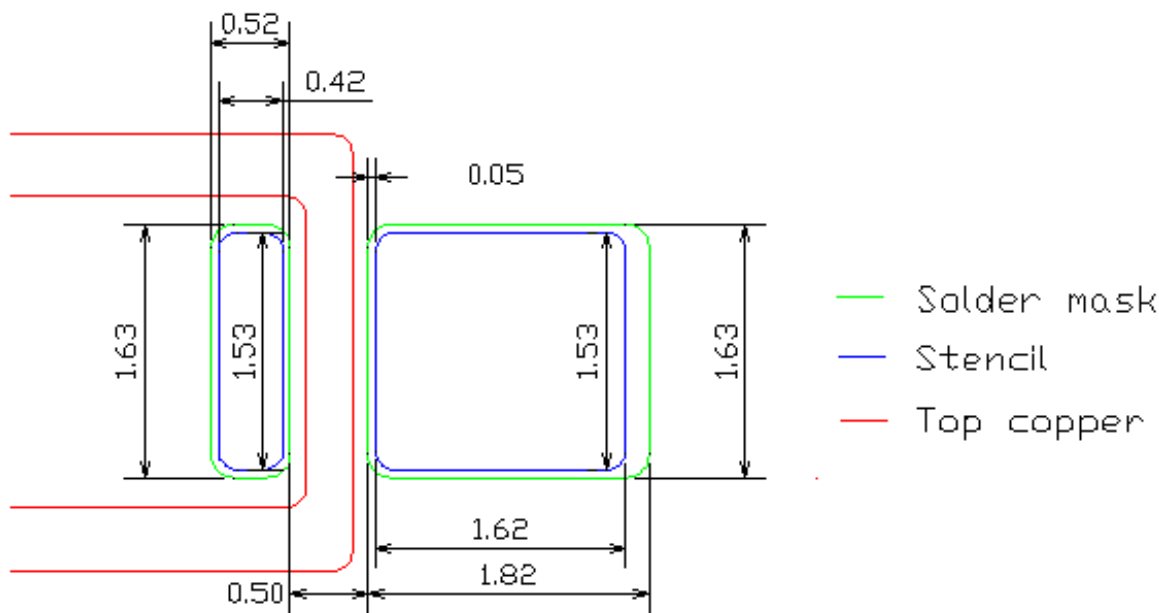


Figure 3. Solder pad layout.

Notes for Figure 3:

1. All dimensions are in millimeters.
2. The drawing above shows the recommend solder pad layout on the Printed Circuit Board (PCB).
3. Application Brief AB209 provides details for this layout. In addition, the .drawing files are available at [www.philipslumileds.com](http://www.philipslumileds.com) and [www.philipslumileds.cn.com](http://www.philipslumileds.cn.com).

## Package Information

Table 6. Package Information for L130-xx80002011001

| Material/Component | Specification                    |
|--------------------|----------------------------------|
| Lead Frame Base    | Copper Alloy                     |
| Package Body       | High Temperature Thermal Plastic |
| Encapsulate        | Silicone Resin, with Phosphor    |
| Weight             | 0.01 gram                        |

Notes for Table 6:

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$ .

# Characteristic Curves

Relative Spectral Distribution vs. Wavelength  
Junction Temperature = 25°C; Test Current = 120 mA

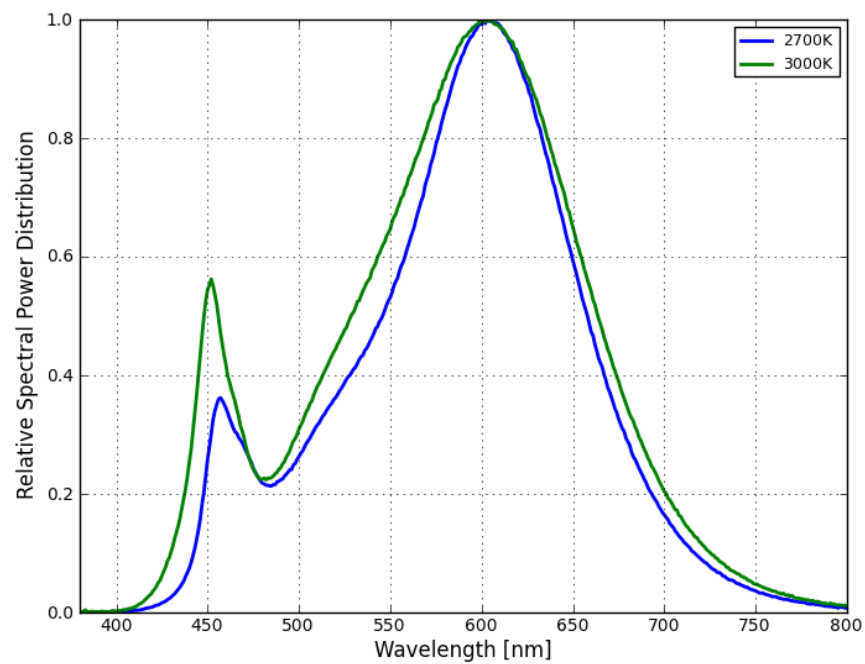


Figure 4. Color spectrum, L130-xx80002011001.

Relative Light Output Characteristics over Junction Temperature  
Test Current = 120 mA

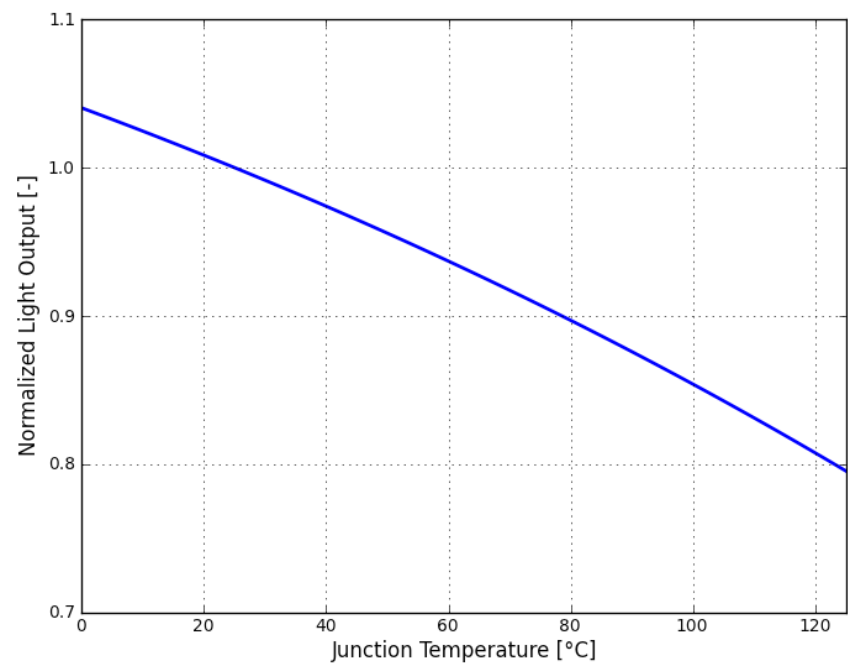


Figure 5. Relative light output vs. junction temperature, L130-xx80002011001.

# Typical Forward Current Characteristics

Forward Current vs. Forward Voltage for L130-xx80002011001  
Junction Temperature = 25°C

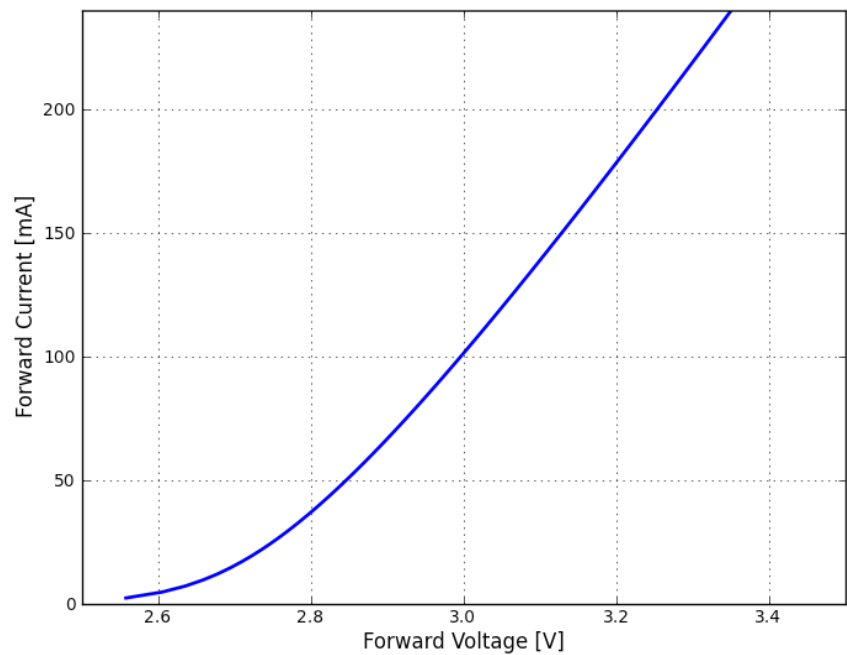


Figure 6. Typical forward current vs. forward voltage, L135-xx80-OBHV-00001.

# Typical Light Output Characteristics

Relative Light Output vs. Forward Current  
Junction Temperature = 25°C

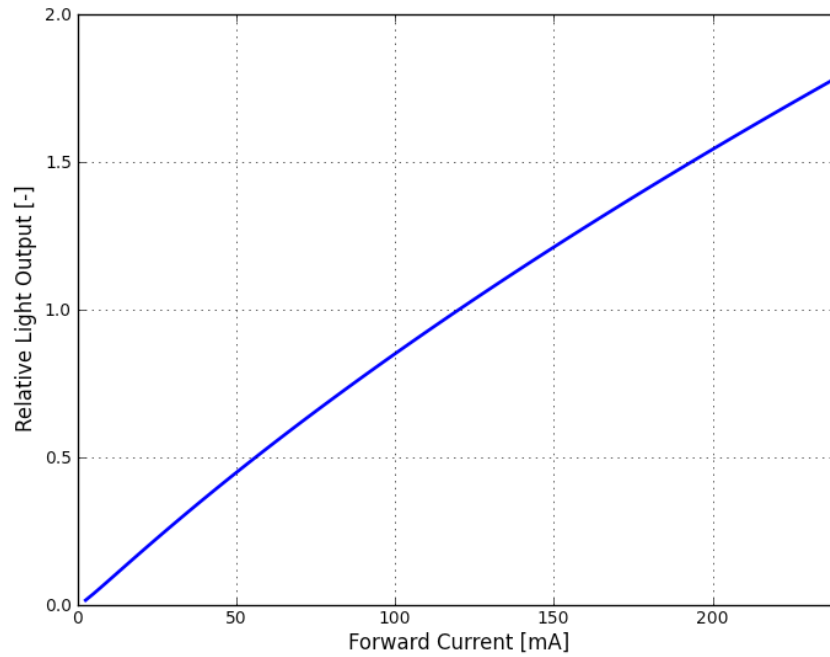


Figure 7. Relative light output vs. forward current, L130-xx80002011001.

# Typical Radiation Patterns

## Radiation Pattern in Cartesian Coordinate System

Junction Temperature = 25°C

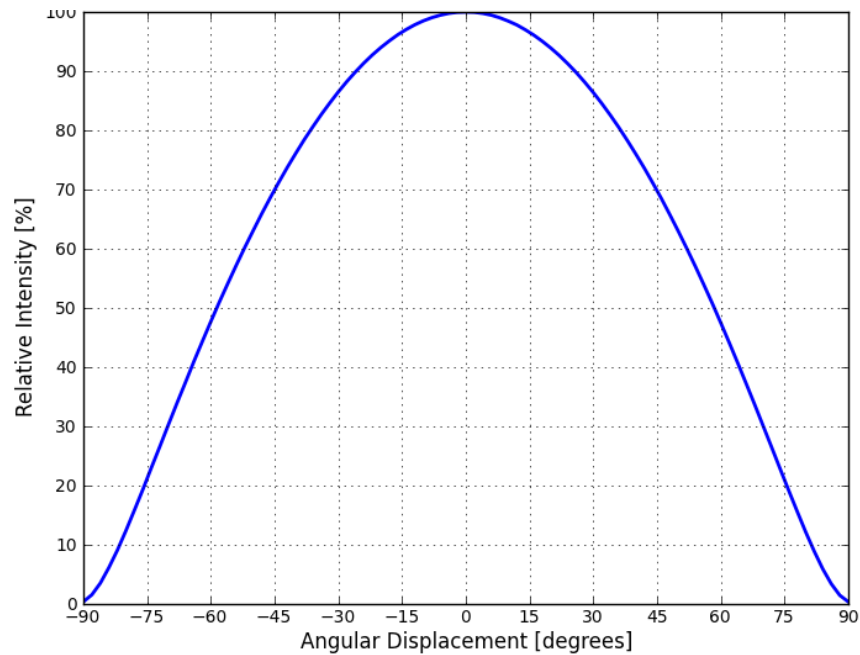


Figure 8. Typical spatial radiation pattern, L130-xx80002011001.

## Radiation Pattern in Polar Coordinate System

Junction Temperature = 25°C

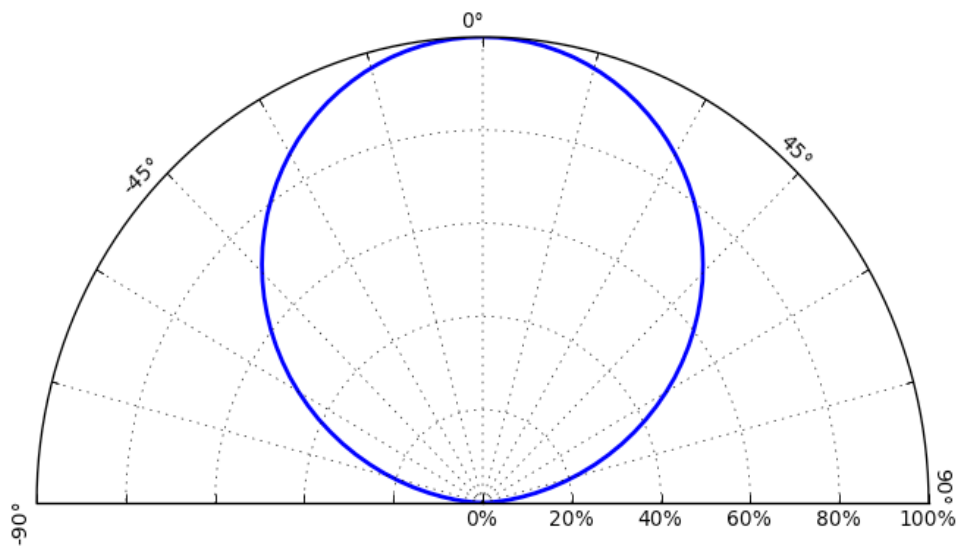


Figure 9. Typical polar radiation pattern, L130-xx80002011001.



# Emitter Reel Packaging

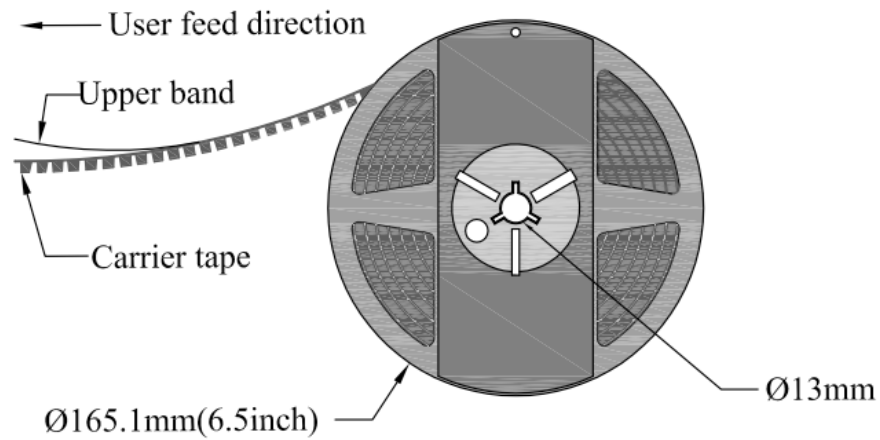


Figure 11. Emitter reel packaging.

## Notes for Figure 11:

1. All dimensions are in millimeters.
2. Empty component pockets sealed with top cover tape.
3. 6.5 inch reel-5000 pieces per reel.

# Emitter Reel Label

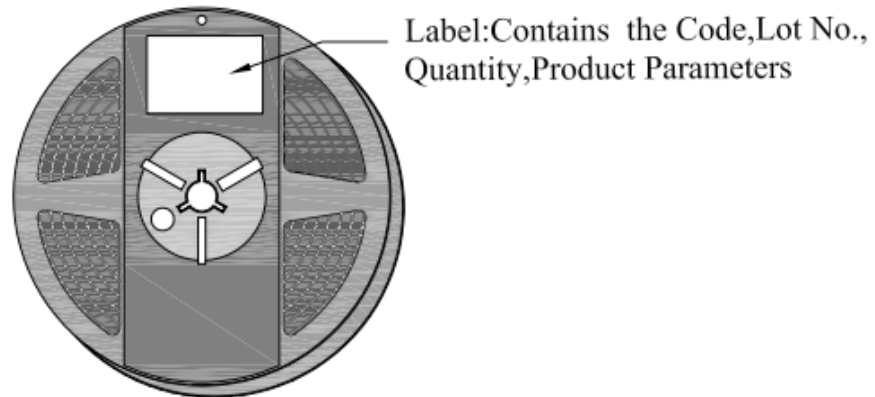


Figure 12. Emitter reel label.

# Product Binning and Labeling

## Purpose of Product Binning

In the manufacturing of semiconductor products, there is a variation of performance around the average values given in the technical data sheets. For this reason, Philips Lumileds bins the LED components for luminous flux, color and forward voltage ( $V_f$ ).

## Decoding Product Bin Labeling

LUXEON mid-power emitters are labeled using a four digit alphanumeric code (CAT code) depicting the bin values for emitters packaged on a single reel. All emitters packaged within a reel are of the same 3-variable bin combination. Using these codes, it is possible to determine optimum mixing and matching of products for consistency in a given application.

Reels of 2700K, 3000K, 3500K, 4000K, 5000K, 5700K, 6500K emitters are labeled with a four digit alphanumeric CAT code following the format below.

ABCD

Where:

A — Flux bin (L etc.)

B & C — Color bin (For example 2700K 80CRI has the following 9 color bins: 8D, 8E, 8F, 8G, 8H, 8J, 8K, 8L, 8M)

D —  $V_f$  bin

### Luminous Flux Bins

Table 7 and Table 8 list the standard photometric luminous flux bins for LUXEON mid-power emitters (tested and binned at 120 mA). 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 colors. Please contact your Philips Lumileds representative for the L130-xx80002011001 flux bins.

## Flux Bins

Table 7. Flux Bins for L130-xx80002011001

| Bin Code | Minimum Photometric Flux (lm) | Maximum Photometric Flux (lm) |
|----------|-------------------------------|-------------------------------|
| M        | 36                            | 40                            |
| P        | 40                            | 44                            |
| Q        | 44                            | 48                            |
| R        | 48                            | 52                            |
| S        | 52                            | 56                            |
| T        | 56                            | 60                            |
| U        | 60                            | 65                            |

Note for Table 7:

1. Tested and binned at 25°C,  $I_f = 120$  mA. Tester tolerance:  $\pm 7.5\%$ .

# Forward Voltage Bins

Table 8.  $V_f$  Bins for L130-xx80002011001

| Bin Code | Minimum Forward Voltage (V) | Maximum Forward Voltage (V) |
|----------|-----------------------------|-----------------------------|
| T        | 2.8                         | 2.9                         |
| V        | 2.9                         | 3.0                         |
| W        | 3.0                         | 3.1                         |
| X        | 3.1                         | 3.2                         |
| Y        | 3.2                         | 3.3                         |
| Z        | 3.3                         | 3.4                         |

Note for Table 8:  
1. Tested and binned at 25°C,  $I_f$  = 120 mA.

# Color Bin Structure

## Typical Bin Structure at Junction Temperature = 85°C

In actual application operating conditions, the LED temperature rises. The LUXEON 3020 is hot color targeted, so the typical color is within ANSI at 85°C. Typical color bins at 85°C will be as shown.

Note: Bin \*N will represent the entire ANSI bin for that corresponding CCT. For example:

- Bin 8N will represent the entire ANSI bin for 2700K
- Bin 7N will represent the entire ANSI bin for 3000K

## L130-278002011001 Color Bin Structure – 2700K 80CRI

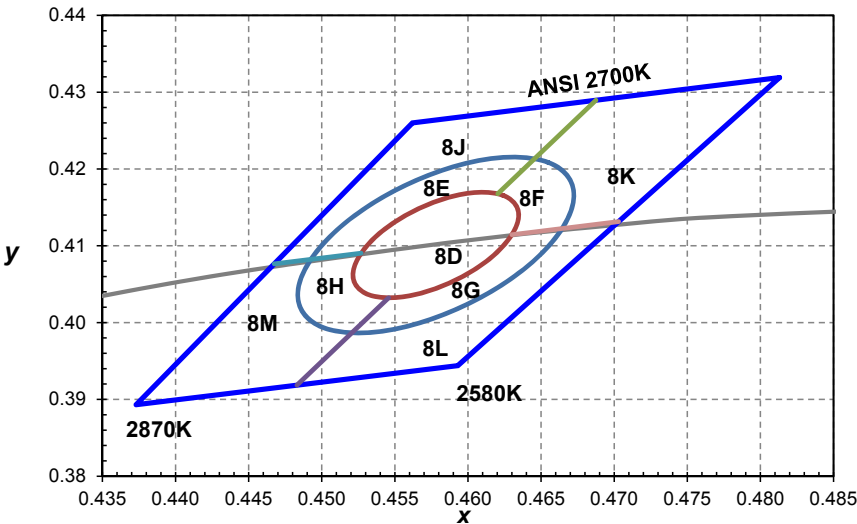


Figure 13. 2700K 1/9<sup>th</sup> color bin structure.

Table 9. Color Coordinates I for L130-2780002011001

| Nominal ANSI CCT | Color Space                   | Target Center Point (cx, cy) | Major Axis, a | Minor Axis, b | Ellipse Rotation Angle |
|------------------|-------------------------------|------------------------------|---------------|---------------|------------------------|
| 2700K            | Single 3-step MacAdam ellipse | (0.4578, 0.4101)             | 0.00810       | 0.00420       | 53.70°                 |
| 2700K            | Single 5-step MacAdam ellipse | (0.4578, 0.4101)             | 0.01350       | 0.00700       | 53.70°                 |

# Color Bin Structure, Continued

## L130-3080002011001 Color Bin Structure – 3000K 80CRI

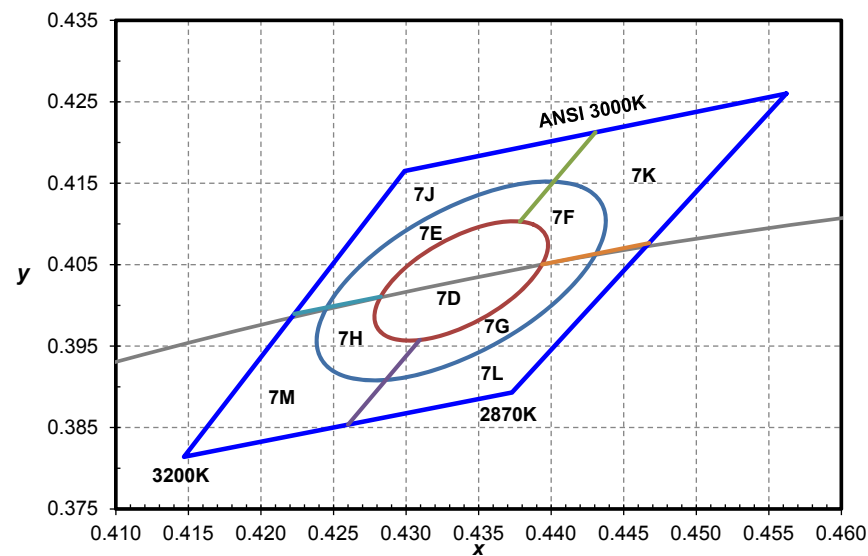


Figure 14. 3000K 1/9<sup>th</sup> color bin structure.

Table 10. Color Coordinates I for L130-3080002011001

| Nominal ANSI CCT | Color Space                   | Target Center Point (cx, cy) | Major Axis, a | Minor Axis, b | Ellipse Rotation Angle |
|------------------|-------------------------------|------------------------------|---------------|---------------|------------------------|
| 3000K            | Single 3-step MacAdam ellipse | (0.4338, 0.4030)             | 0.00834       | 0.00408       | 53.22°                 |
| 3000K            | Single 5-step MacAdam ellipse | (0.4338, 0.4030)             | 0.01390       | 0.06800       | 53.22°                 |

# Color Bin Structure, Continued

## L130-3580002011001 Color Bin Structure – 3500K 80CRI

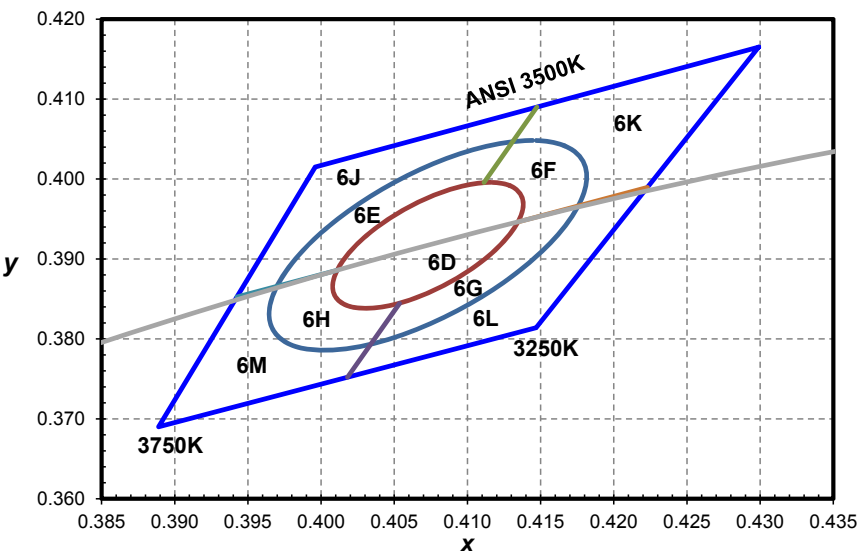


Figure 15. 3500K 1/9<sup>th</sup> color bin structure.

Table 11. Color Coordinates I for L135-3080002011001

| Nominal<br>ANSI CCT | Color Space                   | Target Center Point<br>(cx, cy) | Major Axis,<br>a | Minor Axis,<br>b | Ellipse<br>Rotation Angle |
|---------------------|-------------------------------|---------------------------------|------------------|------------------|---------------------------|
| 3500K               | Single 3-step MacAdam ellipse | (0.4073, 0.3917)                | 0.00927          | 0.00414          | 54.00°                    |
| 3500K               | Single 5-step MacAdam ellipse | (0.4073, 0.3917)                | 0.01545          | 0.0690           | 54.00°                    |

# Color Bin Structure, Continued

## L130-4080002011001 Color Bin Structure – 4000K 80CRI

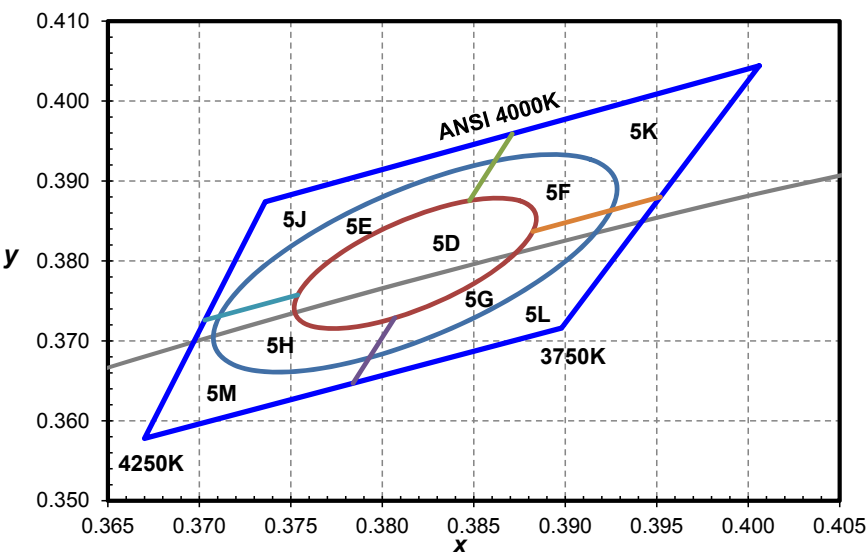


Figure 16. 4000K 1/9<sup>th</sup> color bin structure.

Table 12. Color Coordinates I for L130-4080002011001

| Nominal ANSI CCT | Color Space                   | Target Center Point (cx, cy) | Major Axis, a | Minor Axis, b | Ellipse Rotation Angle |
|------------------|-------------------------------|------------------------------|---------------|---------------|------------------------|
| 4000K            | Single 3-step MacAdam ellipse | (0.3818, 0.3797)             | 0.00939       | 0.00402       | 53.72°                 |
| 4000K            | Single 5-step MacAdam ellipse | (0.3818, 0.3797)             | 0.01565       | 0.00670       | 53.72°                 |

# Color Bin Structure, Continued

## L130-5080002011001 Color Bin Structure – 5000K 80CRI

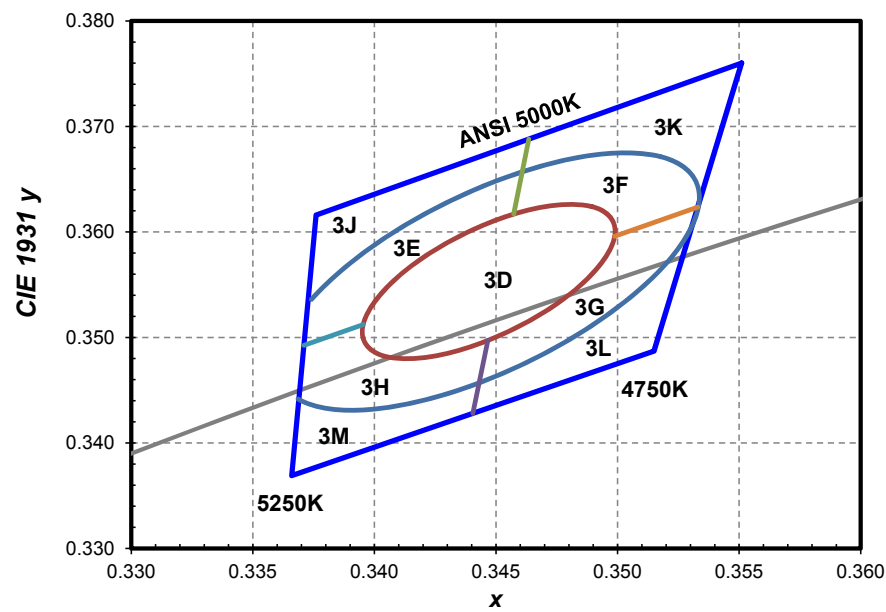


Figure 17. 5000K 1/9<sup>th</sup> color bin structure.

Table 13. Color Coordinates II for L130-5080002011001

| Nominal ANSI CCT | Color Space                   | Target Center Point (cx, cy) | Major Axis, a | Minor Axis, b | Ellipse Rotation Angle |
|------------------|-------------------------------|------------------------------|---------------|---------------|------------------------|
| 5000K            | Single 3-step MacAdam ellipse | (0.3447, 0.3558)             | 0.00822       | 0.00354       | 59.62°                 |
| 5000K            | Single 5-step MacAdam ellipse | (0.3447, 0.3558)             | 0.01370       | 0.00590       | 59.62°                 |

# Color Bin Structure, Continued

## L130-5780002011001 Color Bin Structure – 5700K 80CRI

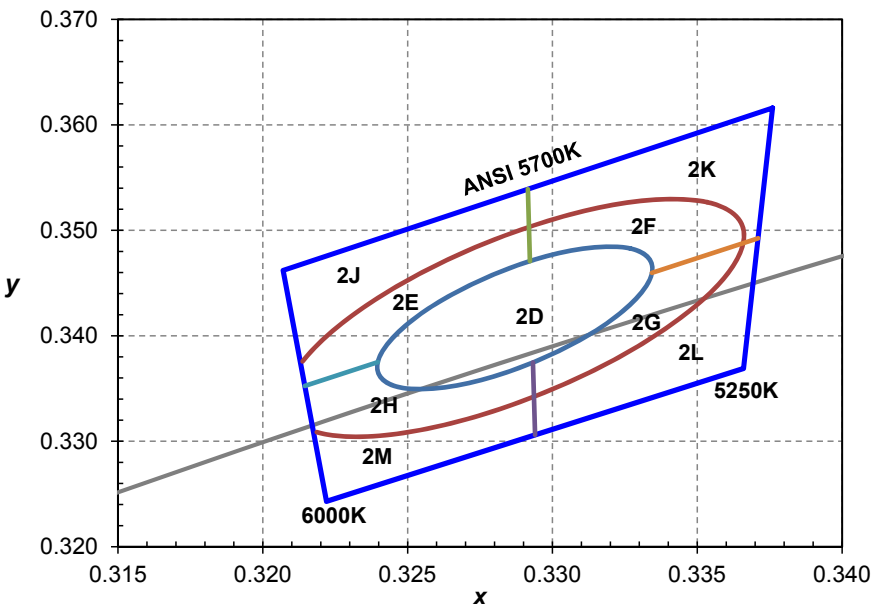


Figure 18. 5700K 1/9<sup>th</sup> color bin structure.

Table 14. Color Coordinates I for L130-5780002011001

| Nominal ANSI CCT | Color Space                   | Target Center Point (cx, cy) | Major Axis, a | Minor Axis, b | Ellipse Rotation Angle |
|------------------|-------------------------------|------------------------------|---------------|---------------|------------------------|
| 5700K            | Single 3-step MacAdam ellipse | (0.3287, 0.3417)             | 0.00746       | 0.00320       | 59.09°                 |
| 5700K            | Single 5-step MacAdam ellipse | (0.3287, 0.3417)             | 0.01243       | 0.00533       | 59.09°                 |

# Color Bin Structure, Continued

## L130-6580002011001 Color Bin Structure – 6500K 80CRI

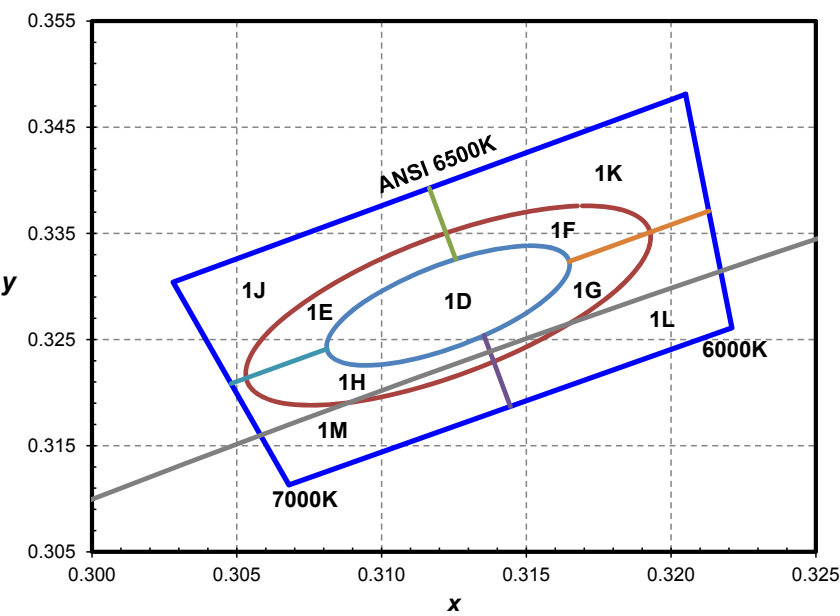


Figure 19. 6500K 1/9<sup>th</sup> color bin structure.

Table 15. Color Coordinates I for L130-6580002011001

| Nominal ANSI CCT | Color Space                   | Target Center Point (cx, cy) | Major Axis, a | Minor Axis, b | Ellipse Rotation Angle |
|------------------|-------------------------------|------------------------------|---------------|---------------|------------------------|
| 6500K            | Single 3-step MacAdam ellipse | (0.3123, 0.3282)             | 0.00669       | 0.00285       | 58.57°                 |
| 6500K            | Single 5-step MacAdam ellipse | (0.3123, 0.3282)             | 0.01115       | 0.00475       | 58.57°                 |

## Who We Are

Philips Lumileds focuses on one goal: Creating the world's highest performing LEDs. The company pioneered the use of solid-state lighting in breakthrough products such as the first LED backlit TV, the first LED flash in camera phones, and the first LED daytime running lights for cars. Today we offer the most comprehensive portfolio of high quality LEDs and uncompromising service.

Philips Lumileds brings LED's qualities of energy efficiency, digital control and long life to spotlights, downlights, high bay and low bay lighting, indoor area lighting, architectural and specialty lighting as well as retrofit lamps. Our products are engineered for optimal light quality and unprecedented efficacy at the lowest overall cost. By offering LEDs in chip, packaged and module form, we deliver supply chain flexibility to the inventors of next generation illumination.

Philips Lumileds understands that solid state lighting is not just about energy efficiency. It is about elegant design. Reinventing form. Engineering new materials. Pioneering markets and simplifying the supply chain. It's about a shared vision. Learn more about our comprehensive portfolio of LEDs at [www.philipslumileds.com](http://www.philipslumileds.com).



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