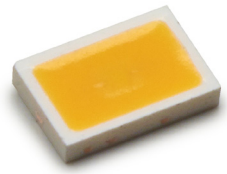
LUXEON 3020

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°C and 120 mA DC.

The part number designation is explained as follow:

L 1 3 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 1 3 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) [1] @ 120 mA, 25°C		Luminous Flux (lm) [2] @ 100 mA, 25°C		CRI [1]	$R_{th\_J\_c}$ (°C/W)[3]
		Minimum	Typical	Minimum	Typical	Minimum	Typical
2700K	L130-2780002011001	39.0	44.5	33.5	37.0		
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	80	13
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_f [1] (V)			Temperature Coefficient of Forward Voltage between 25°C and 85°C $\Delta V_F / \Delta T_J$
	Minimum	Typical	Maximum	
L130-2780002011001				
L130-3080002011001				
L130-3580002011001				
L130-4080002011001	2.85	3.05	3.30	-2.0 to -4.0
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_j = 25°C and T_j = 85°C.

Absolute Maximum Ratings

Table 3.

Parameter	Maximum Performance
DC Forward Current	240 mA
Peak Pulsed Forward Current	300 mA [1, 2]
LED Junction Temperature [1]	125°C
ESD Sensitivity	< 1000V Human Body Model (HBM) Class 2A JS-001-2012 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) [3, 4]	-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

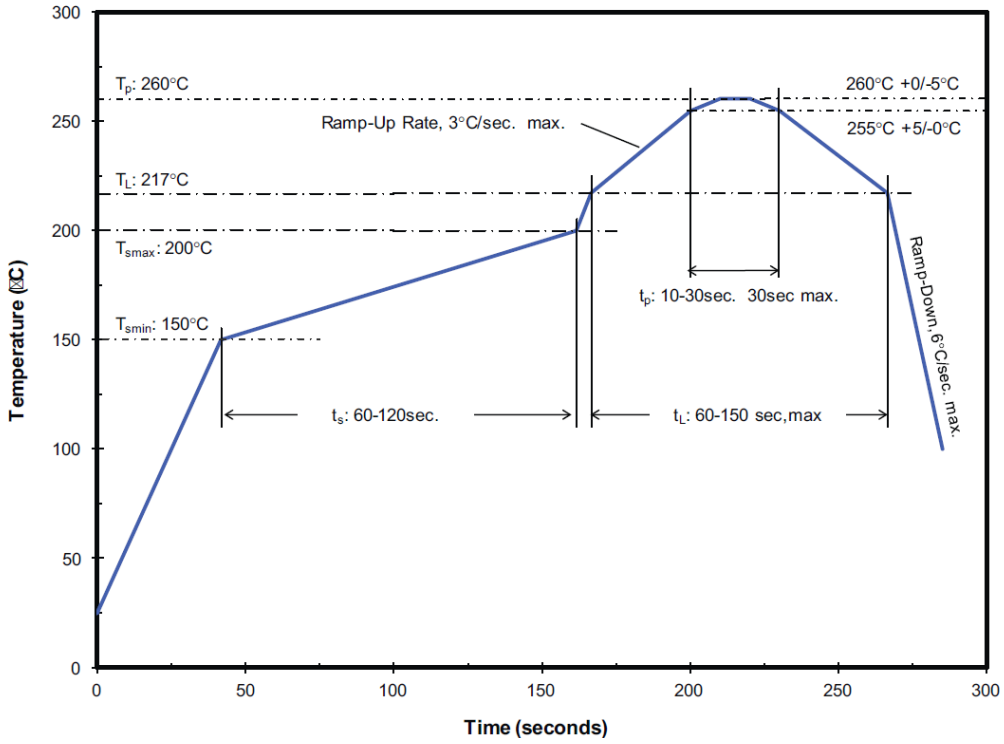

Figure 1. Temperature profile for Table 5.

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

Profile Feature	Lead Free Assembly
Preheat/Soak: Temperature Min (Ts_{min}) Temperature Max (Ts_{max}) Maximum Time (ts) from Ts_{min} to Ts_{max}	 150°C 200°C 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

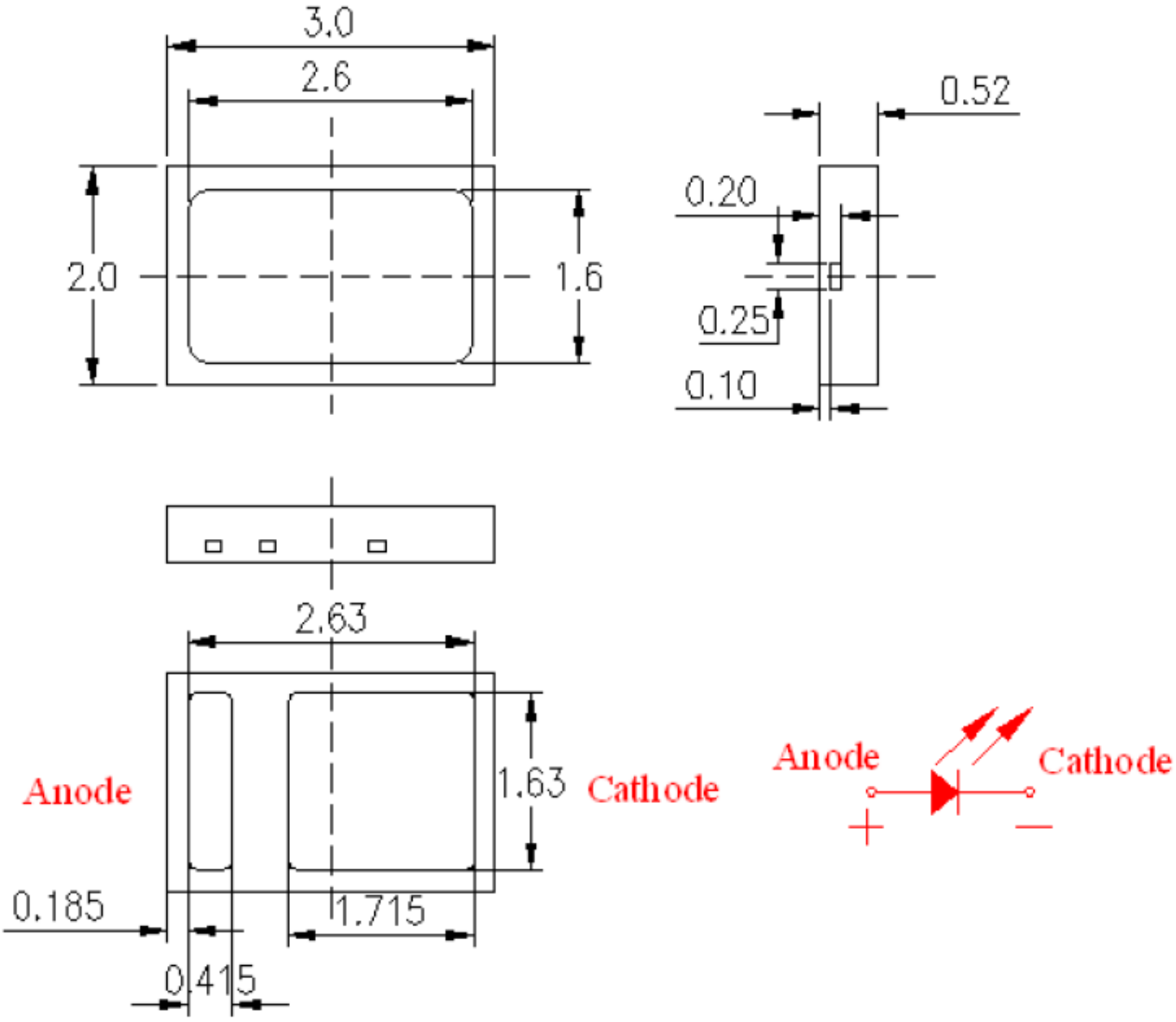

Figure 2.

Notes for Figure 2:

1. All dimensions are in millimeters.
2. Tolerance: X.X: ± 0.1mm, X.XX: ± 0.05mm, X.XXX: ± 0.05mm.

Solder Pad Design

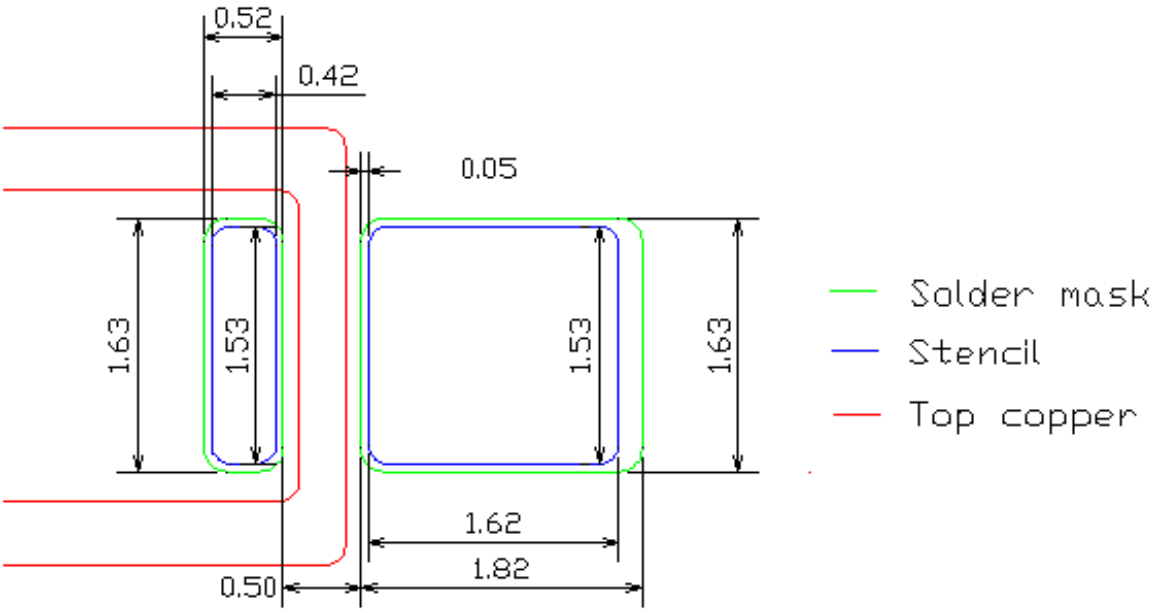

Figure 3. Solder pad layout.

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 and 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 ± 0.10mm.

Characteristic Curves

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

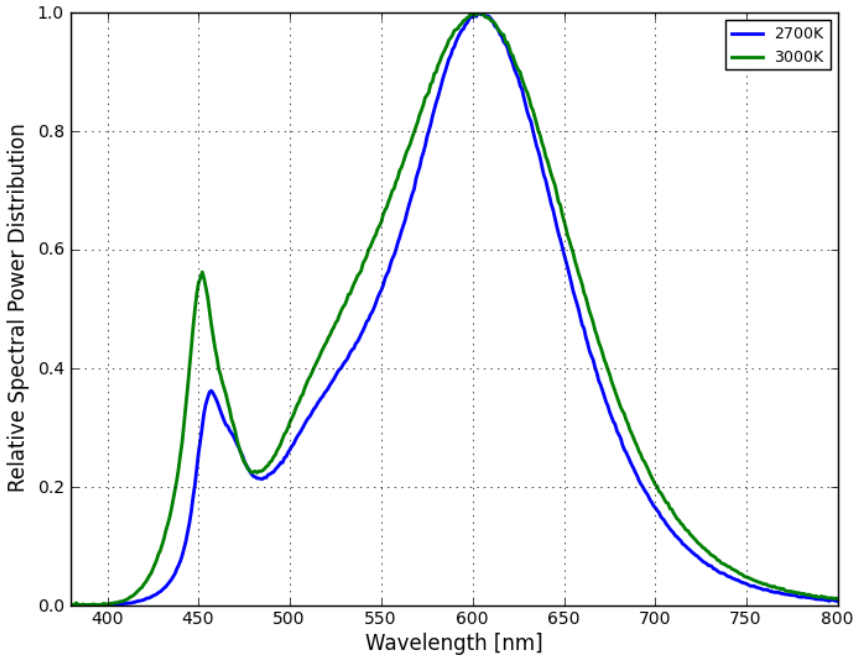

Figure 4. Color spectrum, L130-xx80002011001.

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

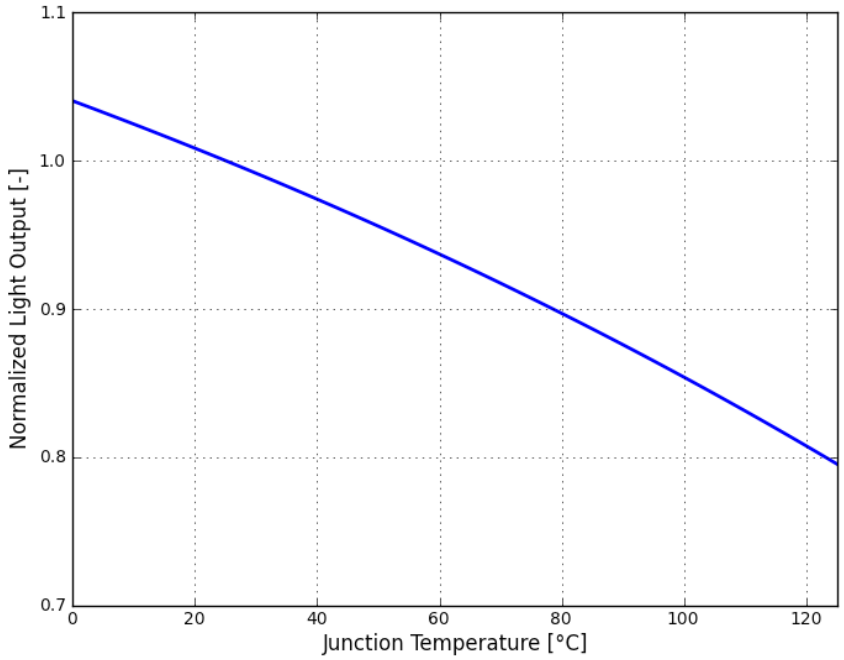

Figure 5. Relative light output vs. junction temperature, L130-xx80002011001.

Typical Forward Current Characteristics

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

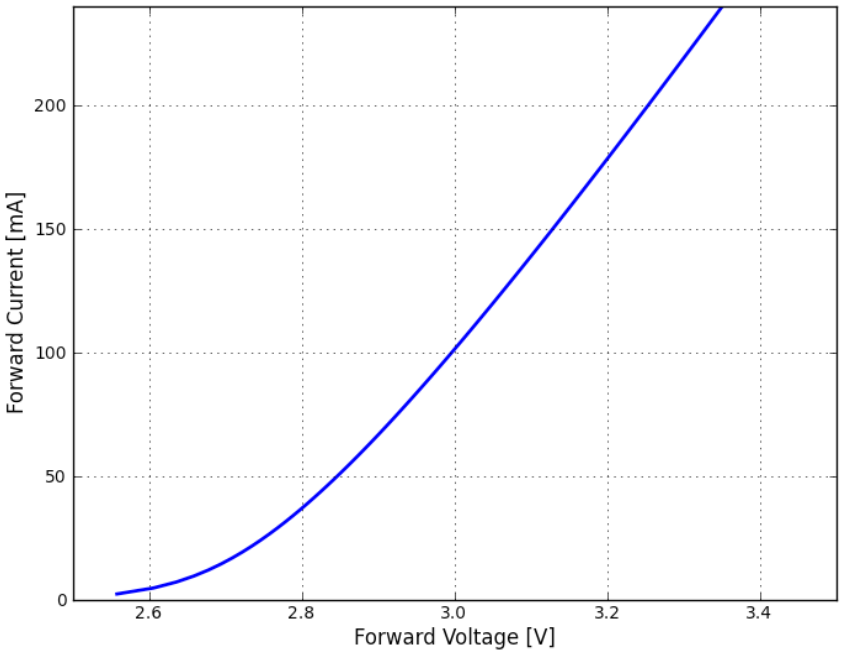

Figure 6. Typical forward current vs. forward voltage, L135-xx80-0BHV-00001.

Typical Light Output Characteristics

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

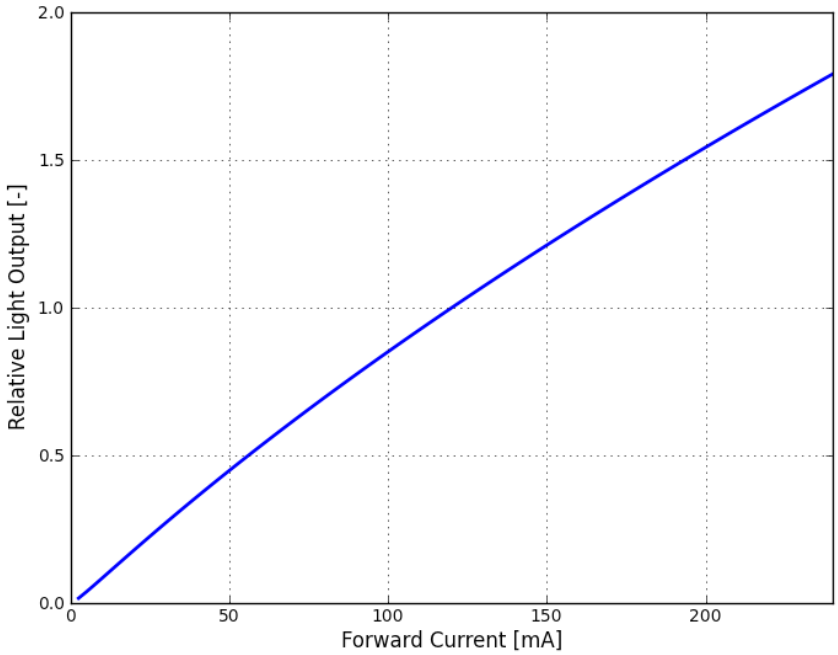

Figure 7. Relative light output vs. forward current, L130-xx80002011001.

Typical Radiation Patterns

Radiation Pattern in Cartesian Coordinate System
Junction Temperature = 25°C

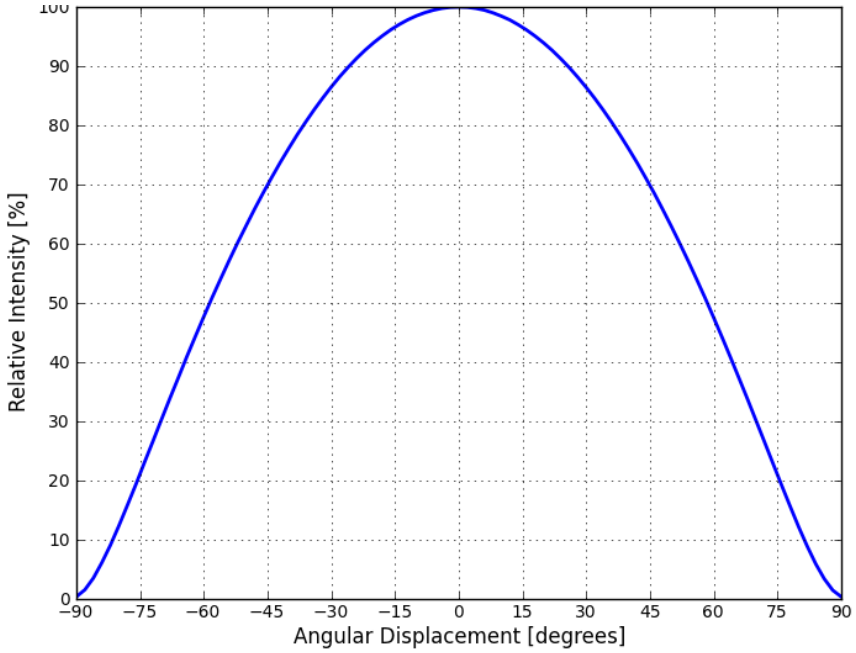

Figure 8. Typical spatial radiation pattern, L130-xx80002011001.

Radiation Pattern in Polar Coordinate System
Junction Temperature = 25°C

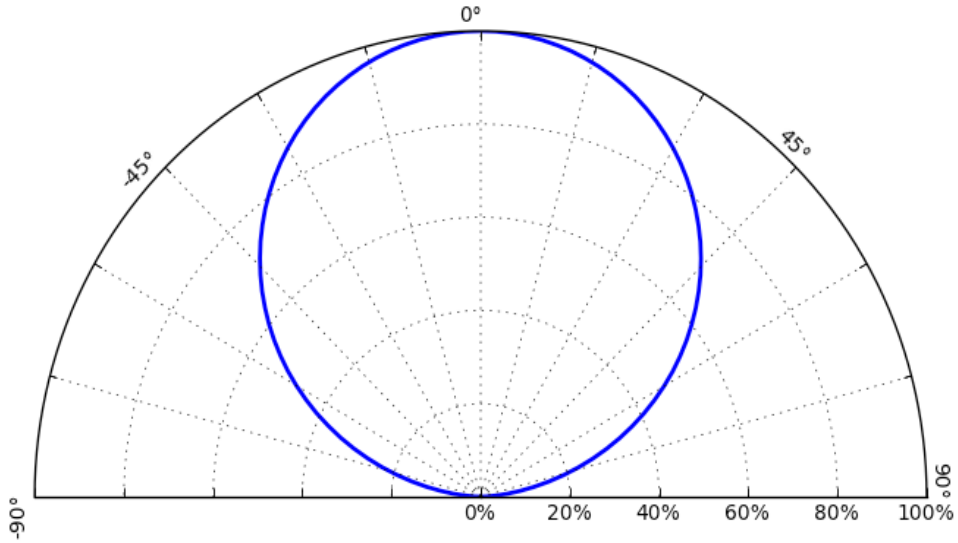

Figure 9. Typical polar radiation pattern, L130-xx80002011001.

Emitter Packaging

Emitter Pocket Tape Packaging

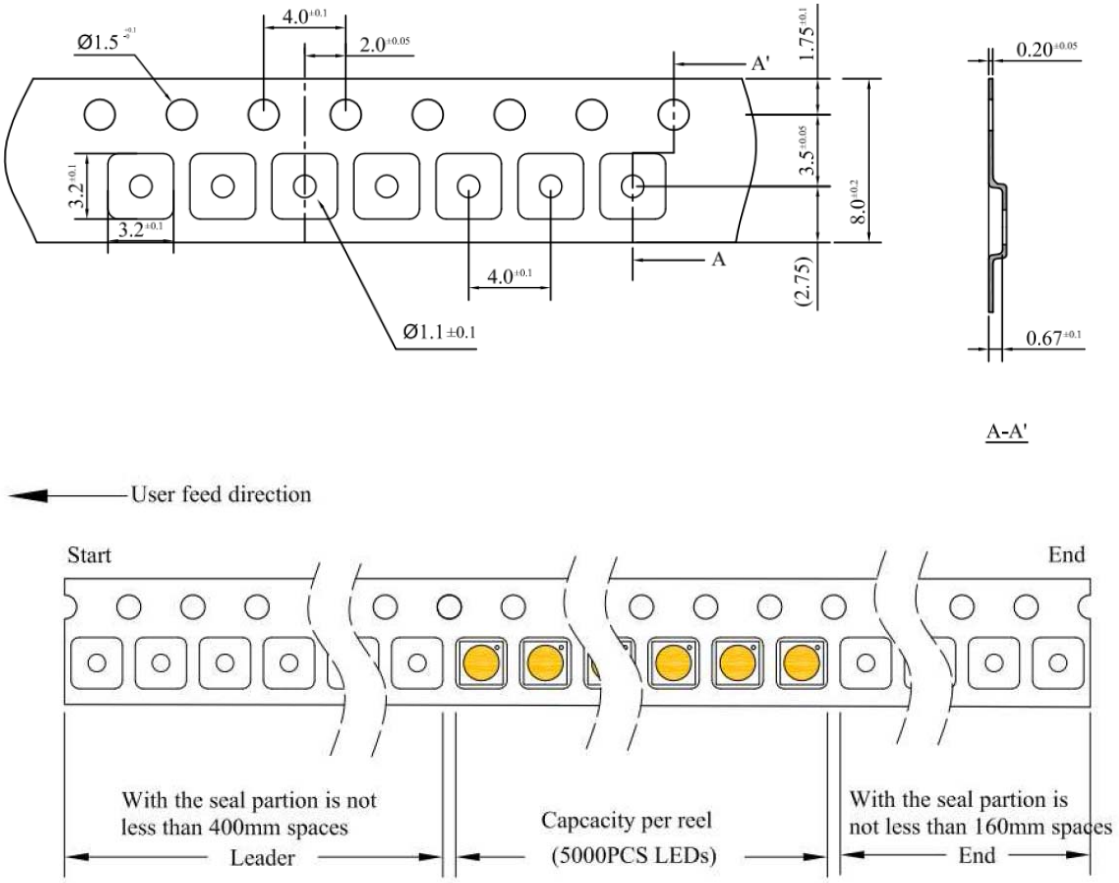

Figure 10. Emitter pocket tape packaging.

Notes for Figure 10:

1. All dimensions are in millimeters.
2. Empty component pockets sealed with top cover tape.
3. The maximum number of consecutive missing LEDs is two.

Emitter Reel Packaging

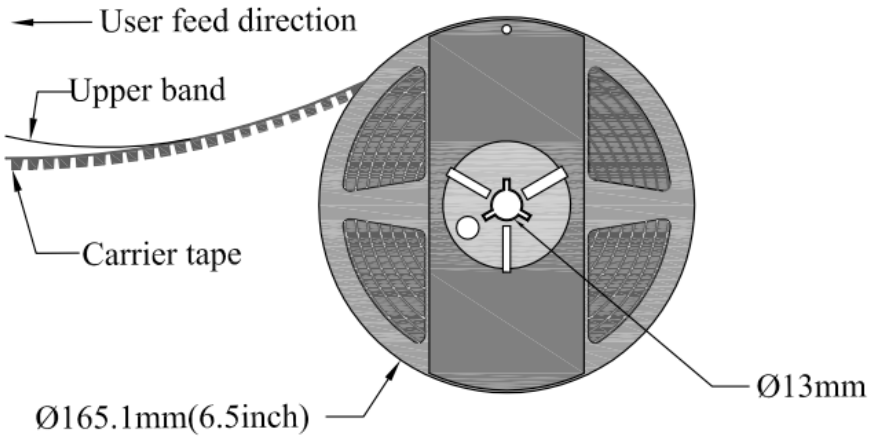

Figure 11. Emitter reel packaging.

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

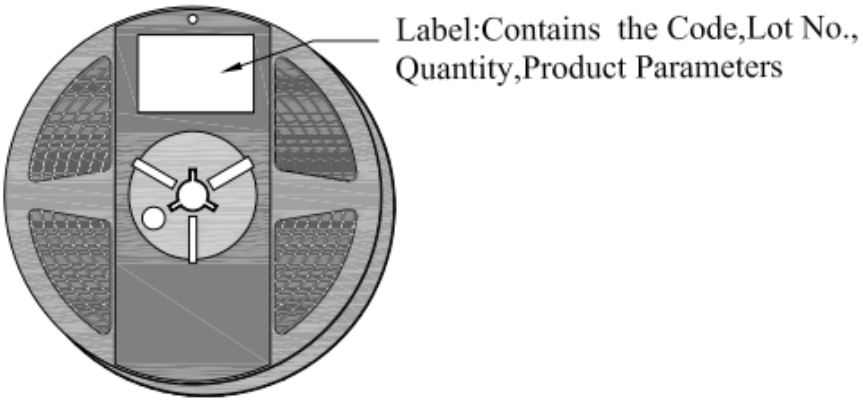

Figure 12. Emitter reel label.

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: ± 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

L130-2780002011001 Color Bin Structure – 2700K 80CRI

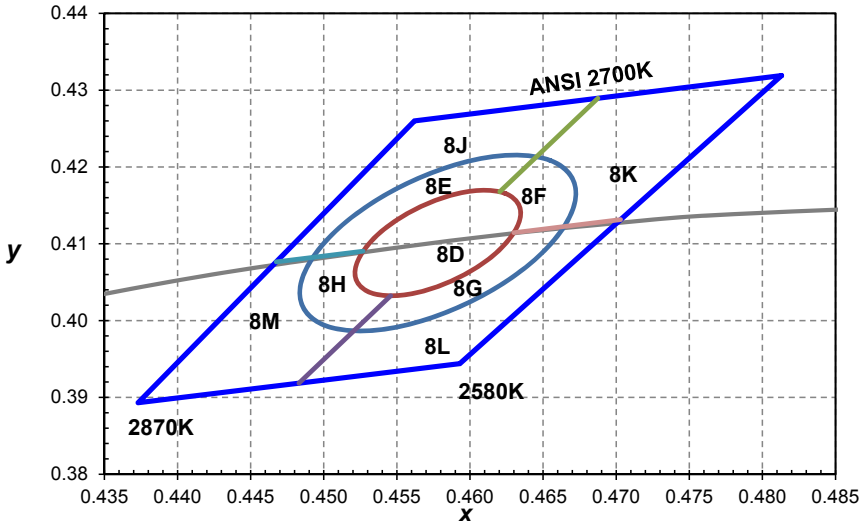

Figure 13. 2700K 1/9th color bin structure.

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

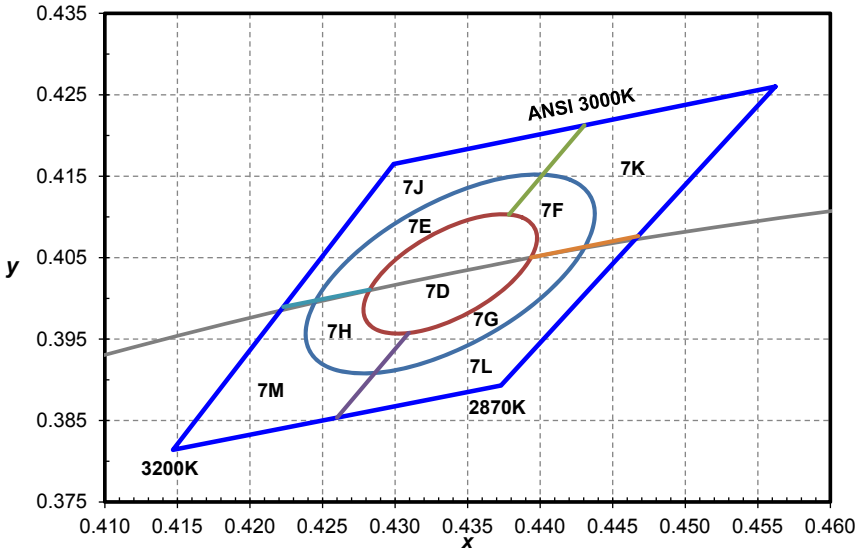

Figure 14. 3000K 1/9th color bin structure.

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

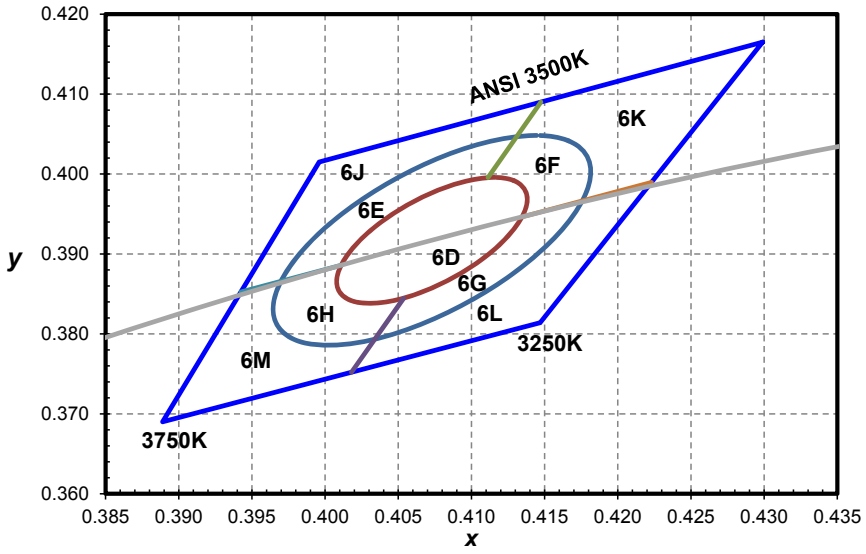

Figure 15. 3500K 1/9th color bin structure.

Table 11. Color Coordinates I for L135-3080002011001

Nominal ANSI CCT	Color Space	Target Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse 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

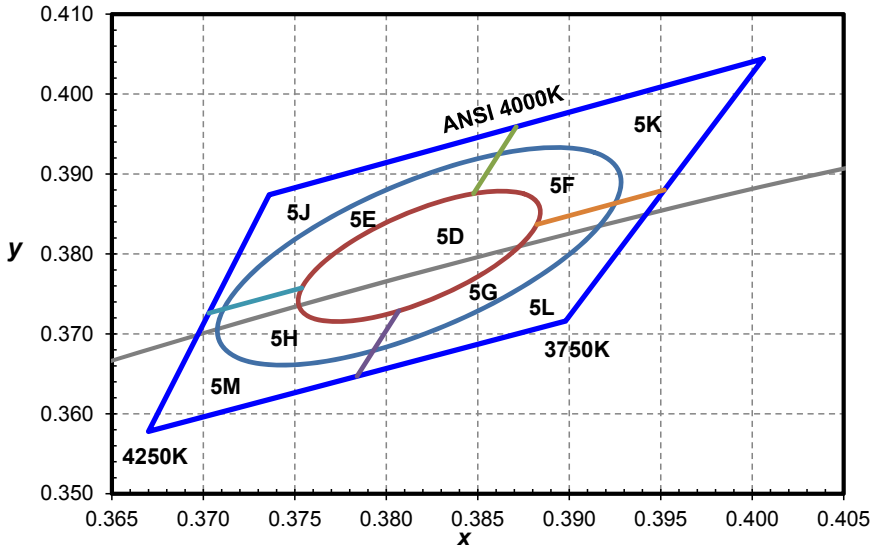

Figure 16. 4000K 1/9th color bin structure.

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

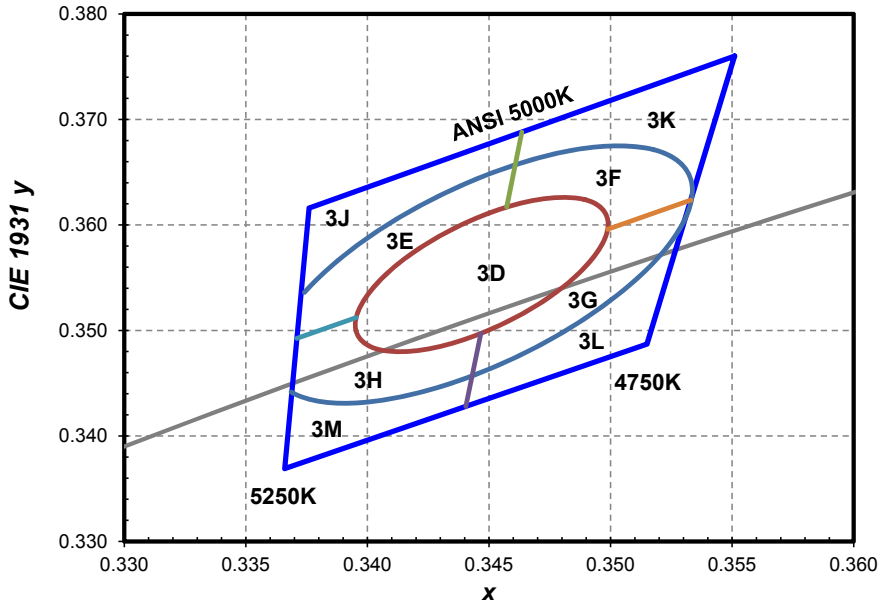

Figure 17. 5000K 1/9th color bin structure.

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

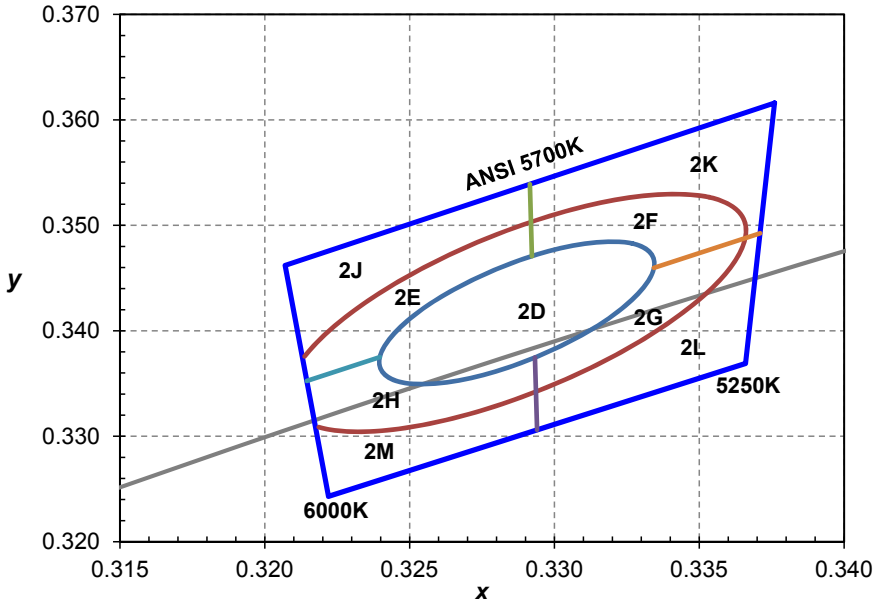

Figure 18. 5700K 1/9th color bin structure.

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

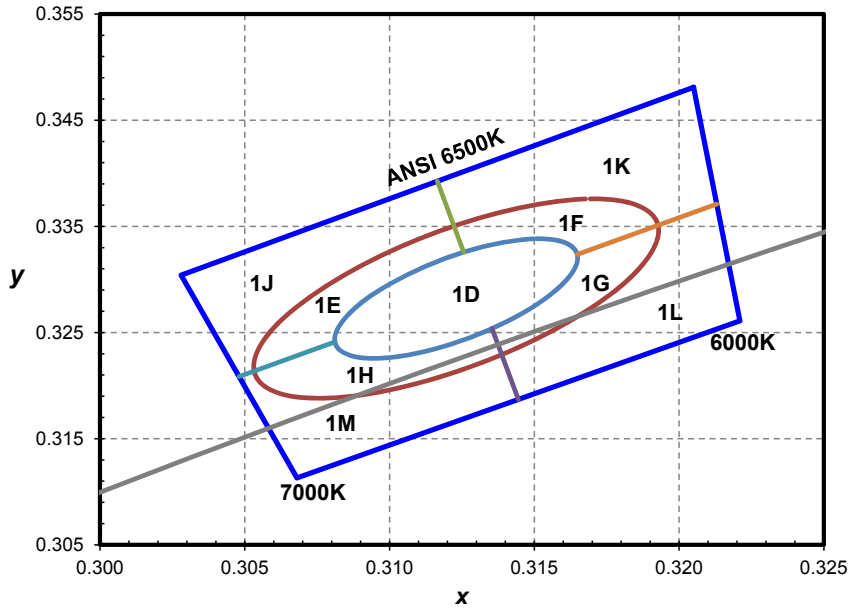

Figure 19. 6500K 1/9th color bin structure.

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°

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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.

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