

LUXEON C  
Power LED

*For appliances, portable  
lighting, tools and more*

Technical Datasheet DS41

**LUXEON**  
NEVER BEFORE POSSIBLE



# LUXEON<sup>®</sup> C

## Power Light Source

### Introduction

The LUXEON<sup>®</sup> C is the power LED that enables manufacturers of appliances, portable lighting solutions and power tools to economically incorporate high quality, high performance LEDs in their applications. LUXEON C delivers high lumens per dollar and 70% lumen maintenance at 20K hours in a very compact package that can be easily integrated into the smallest of spaces.

### LUXEON C features

- Typical light output of 95 lumens at 350 mA
- Small un-encapsulated light source simplifies optic design
- Die on ceramic construction reduces thermal management
- Maximum junction temperature of 135°C
- Maximum drive current 500 mA
- Best moisture sensitivity: JEDEC Level I, unlimited floor life—no need for reconditioning
- RoHS compliant—lead-free reflow solder JEDEC 020c compatible
- Small form factor: 2.04 x 1.64 x 0.7 mm.

**PHILIPS**  
**LUMILEDS**

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## Product Nomenclature

LUXEON C is tested and binned at 350 mA, with current pulse duration of 20 ms. All characteristic charts where the thermal pad is kept at constant temperature (25°C typically) are measured with current pulse duration of 20 ms.

The part number designation is explained as follows:

L X C L – A B C D – E F G H

Where:

- A — designates package and radiation pattern (value E for lambertian emitter)
- B — designates off-state color (value Y for yellow)
- C — designates on-state color (value W for LUXEON C series)
- D — designates generation

EFGH — reserved for future product offerings

Therefore products tested and binned at 350 mA follow the part numbering scheme:

L X C L - E Y W 4

## 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. Philips Lumileds projects that LUXEON C products will deliver, on average, 70% lumen maintenance (L70) at 20,000 hours of operation at a forward current of up to 350 mA. This projection is based on constant current operation with junction temperature maintained at or below 135°C. This performance is based on independent test data, Philips Lumileds historical data from tests run on similar material systems, and internal LUXEON reliability testing. 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 C is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, including the RoHS directive and REACH compliance. Philips Lumileds will not intentionally add the following restricted materials to the LUXEON C : lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

## Product Selection

Product Number	LXCL-EYW4
Description	LUXEON C
Package Quantity	1,000

Notes:

1. Philips Lumileds maintains a tolerance of  $\pm 10\%$  on luminous flux.
2. LUXEON C products with higher performance levels may become available in the future. Please consult Philips Lumileds or Future Lighting Solutions for more information.
3. Test current is 350 mA for all LXCL-EYW4 products.

# Electrical and Optical Characteristics

## LUXEON C at Test Current (350 mA)

Thermal Pad Temperature = 25°C

Table 1.

Parameter	Min.	Typ.	Max.	Units
Luminous Flux <sup>1</sup>	80	95		lm
Forward Voltage <sup>2</sup>	2.80	2.95	3.57	V
Color Temperature <sup>3</sup>	5028K	5310K	5665K	
CRI		75		
Dynamic Resistance <sup>4</sup>		0.64		$\Omega$
Temp Coefficient of Forward Voltage <sup>5</sup>		-3.0		mV/°C
Thermal Resistance, junction-case		8		°C/W
Viewing Angle		120		deg

Notes for Table 1:

1. Philips Lumileds maintains a tester tolerance of  $\pm 10\%$  on flux measurements.
2. Philips Lumileds maintains a tolerance of  $\pm 0.06\text{V}$  on forward voltage measurements.
3. Philips Lumileds maintains a tester tolerance of  $\pm 0.005$  (x,y) color coordinate measurements.
4. Dynamic resistance is the inverse of the slope in linear forward voltage curve and is measured at  $I_f = 350$  mA.
5. Measured between  $25^\circ\text{C} \leq T_j \leq 110^\circ\text{C}$  at  $I_f = 350$  mA.

## Absolute Maximum Ratings

Table 2.

Parameter	Value	Units
DC Forward Current <sup>1</sup>	500	mA
Peak Pulse Forward Current <sup>2</sup>	1500	mA
ESD Sensitivity (JEDEC 3b)	< 8000V Human Body Model (HBM) Class 3B JESD22-A114-E	
Storage Temperature	-40 to +120	°C
Reflow Soldering Temperature	260 for 40 sec. max	°C
LED Junction Temperature	135	°C
Operating Case Temperature at 350 mA	-40 to +85	°C
Moisture Sensitivity Level (MSL) <sup>3</sup>	I	

Notes for Table 2:

1. Operation below 100 mA not recommended.
2. Peak pulse current with a maximum pulse duration not to exceed 500 ms and a maximum duty factor of 10%.
3. Per IPC/JEDEC J-STD-20 MSL.
4. LEDs are not designed to be driven in reverse bias.
5. Stresses in excess of the absolute maximum ratings can cause damage to the emitter. Maximum rating limits apply to each parameter in isolation, all parameters having values within the current derating curves. It should be assumed that limiting values of more than one parameter can be applied to the product at the same time. Exposures to the absolute maximum ratings for extended periods can adversely affect device reliability.

## JEDEC Moisture Sensitivity

Table 3.

Level	Floor Life		Soak Requirements	
	Time	Conditions	Standard	Conditions
			Time (hours)	
I	unlimited	≤ 30°C / 85% RH	168 + 5 / -0	85°C / 85% RH

# Reflow Soldering Characteristics

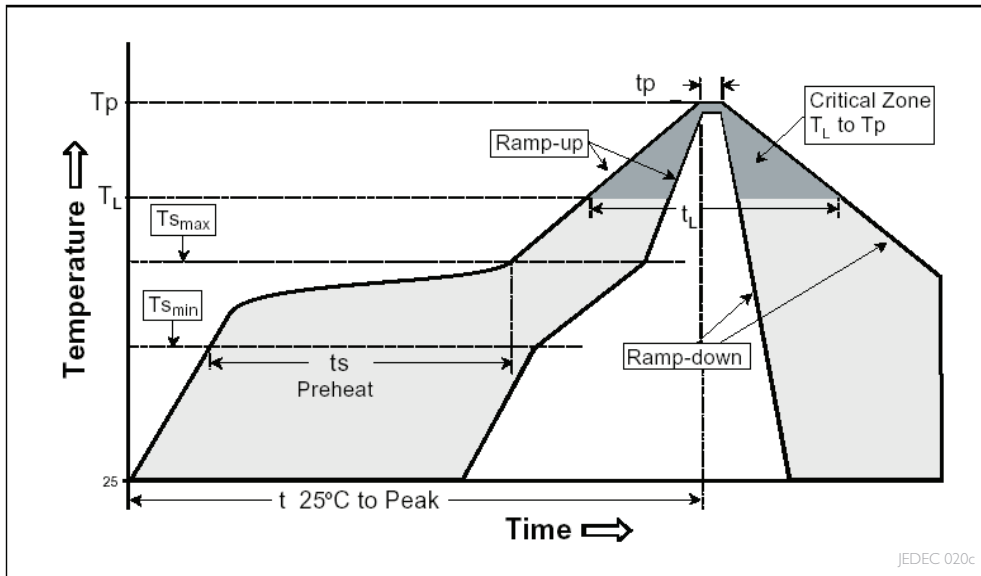


Table 5.

Profile Feature	Lead Free Assembly
Average Ramp-Up Rate ( $T_{s_{max}}$ to $T_p$ )	3°C / second max
Preheat Temperature Min ( $T_{s_{min}}$ )	150°C
Preheat Temperature Max ( $T_{s_{max}}$ )	200°C
Preheat Time ( $t_{s_{min}}$ to $t_{s_{max}}$ )	60 - 180 seconds
Time Maintained Above Temperature $T_L$ ( $t_L$ )	217°C
Time Maintained Above Time ( $t_L$ )	60 - 150 seconds
Peak / Classification Temperature ( $T_p$ )	260°C
Time Within 5°C of Actual Peak Temperature ( $t_p$ )	20 - 40 seconds
Ramp-Down Rate	6°C / second max
Time 25°C to Peak Temperature	8 minutes max

Note for Table 5:

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

# Mechanical Dimensions

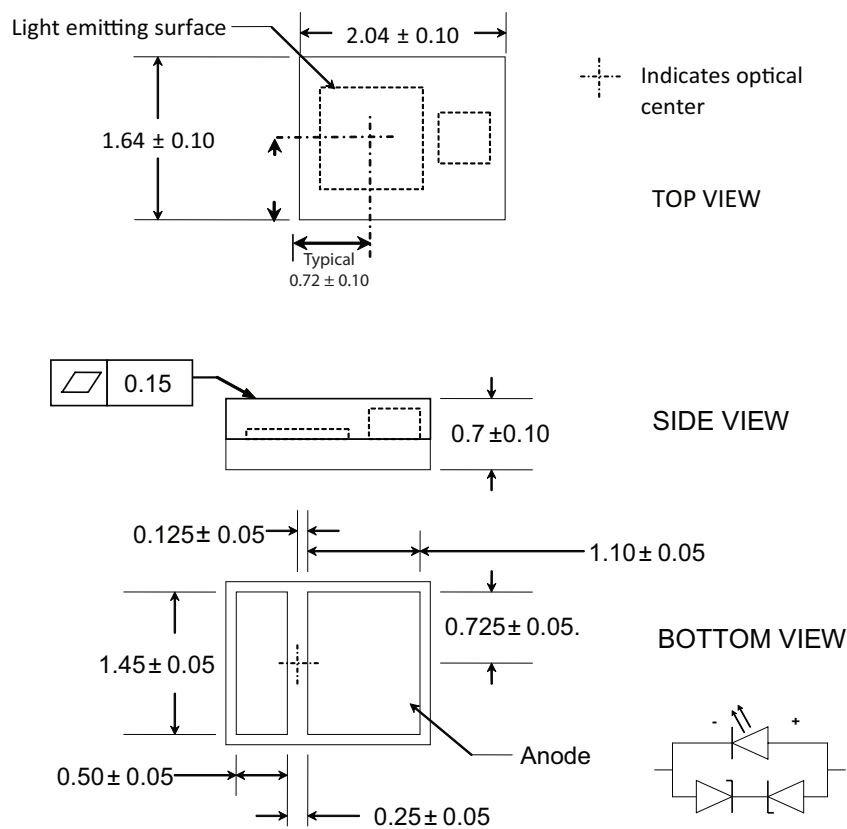


Figure 1. Package outline drawing.

Notes for Figure 1:

1. All dimensions are in millimeters.

## Pad Configuration

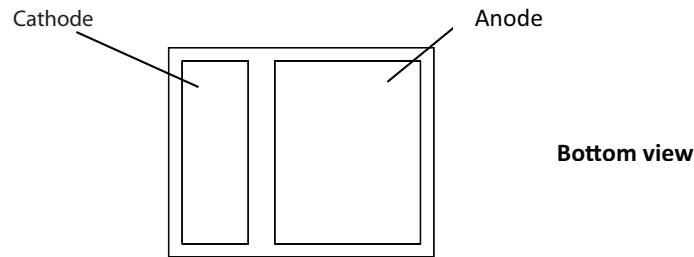


Figure 2. Pad configuration.

## Solder Pad Design

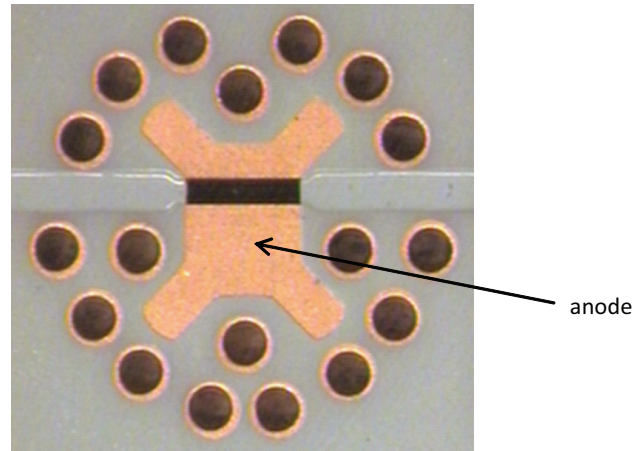


Figure 3. Solder pad layout.

Notes for Figures 2 and 3:

1. The photograph shows the recommended LUXEON C layout on Printed Circuit Board (PCB) with white solder mask.

Application brief AB36 provides extensive details of this layout including the solder stencil mask design. In addition, the \*.dwg files are available upon request.



# Wavelength Characteristics

## LUXEON C at Test Current, Case Temperature = 25°C Typical Spectral Power Distribution

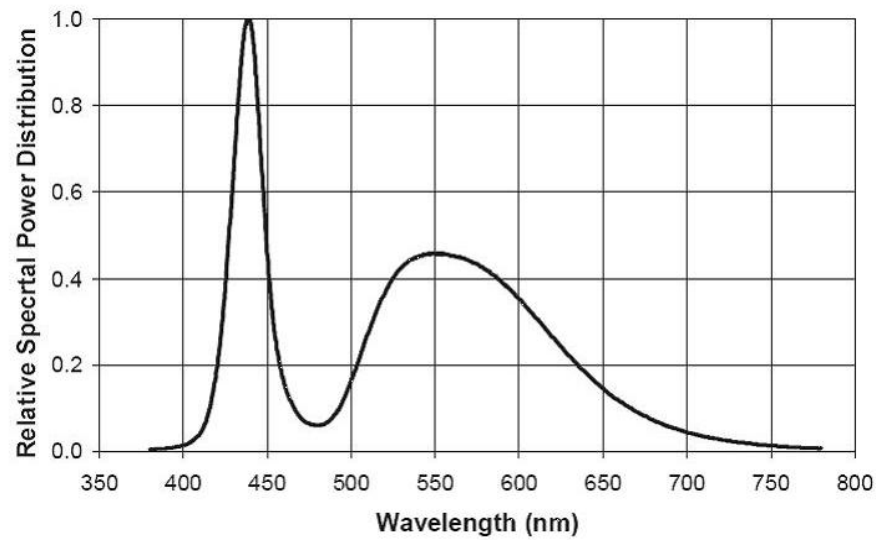


Figure 4. Color spectrum of 5000K to 7000K emitters, integrated measurement.

# Light Output Characteristics over Temperature

## Typical Relative Luminous Flux vs. Case Temperature

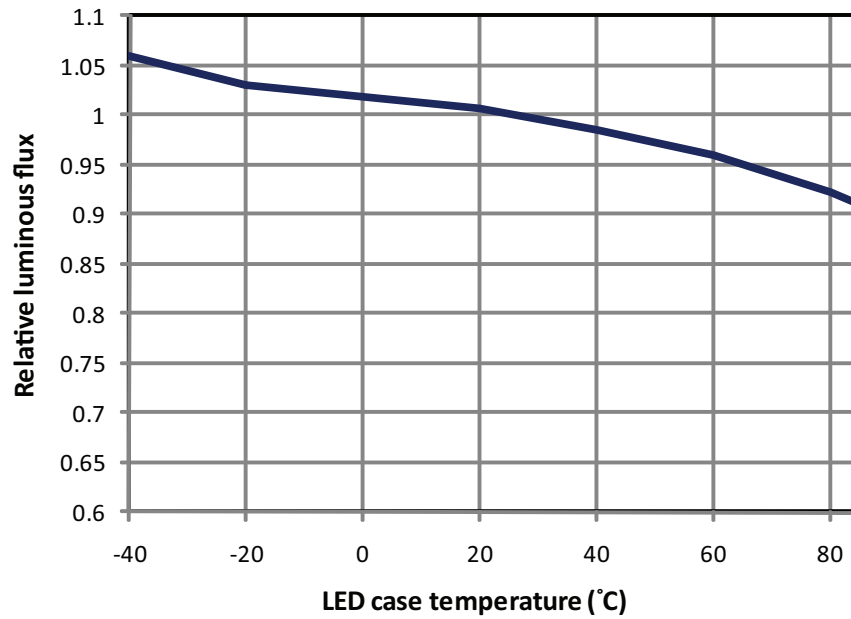


Figure 5. Relative light output vs. temperature.

# Typical Forward Current Characteristics

Typical Forward Current vs. Forward Voltage,  $T_a = 25^\circ\text{C}$   
Thermal Pad Temperature =  $25^\circ\text{C}$

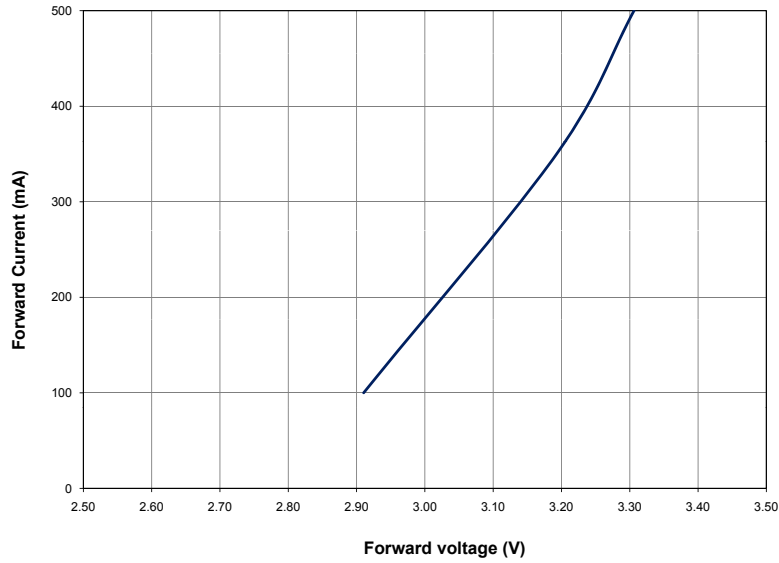


Figure 6. Forward current vs. forward voltage.

Typical Relative Luminous Flux vs. Forward Current  
 $T_a = 25^\circ\text{C}$

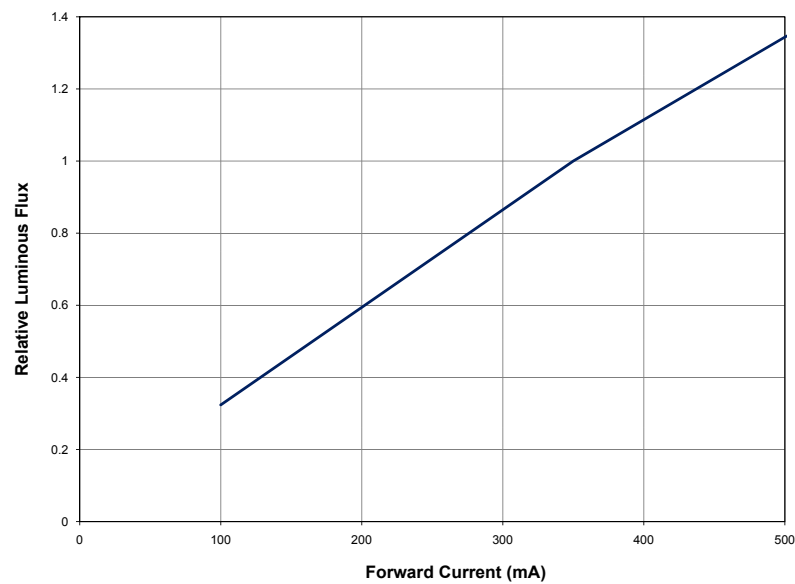


Figure 7. Typical relative luminous flux vs. forward current.

# Current Derating Curves

## Current Derating Curve for 350 mA Drive Current

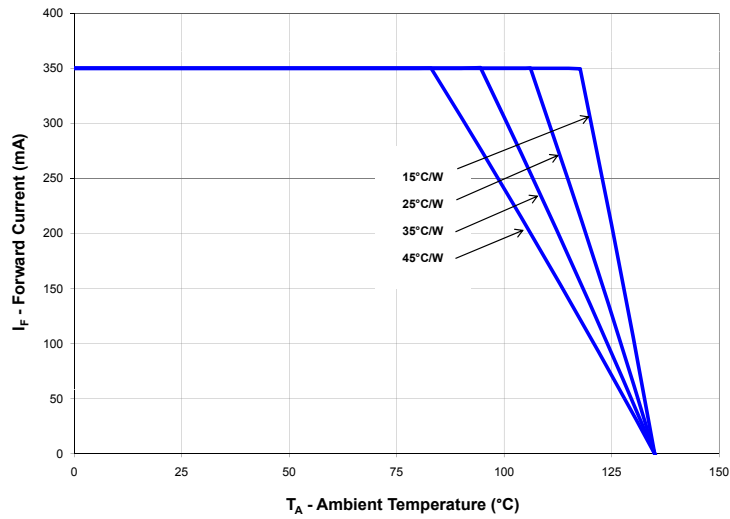


Figure 8. Maximum forward current vs. ambient temperature, based on  $T_{JMAX} = 135^{\circ}\text{C}$ .

## Current Derating Curve for 500 mA Drive Current

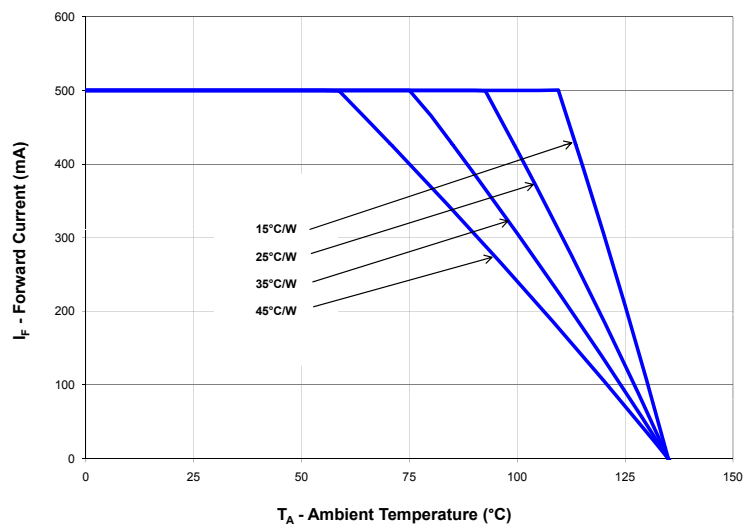


Figure 9. Maximum forward current vs. ambient temperature, based on  $T_{JMAX} = 135^{\circ}\text{C}$ .

# Typical Spatial Radiation Pattern

## Typical Angular Intensity Distribution

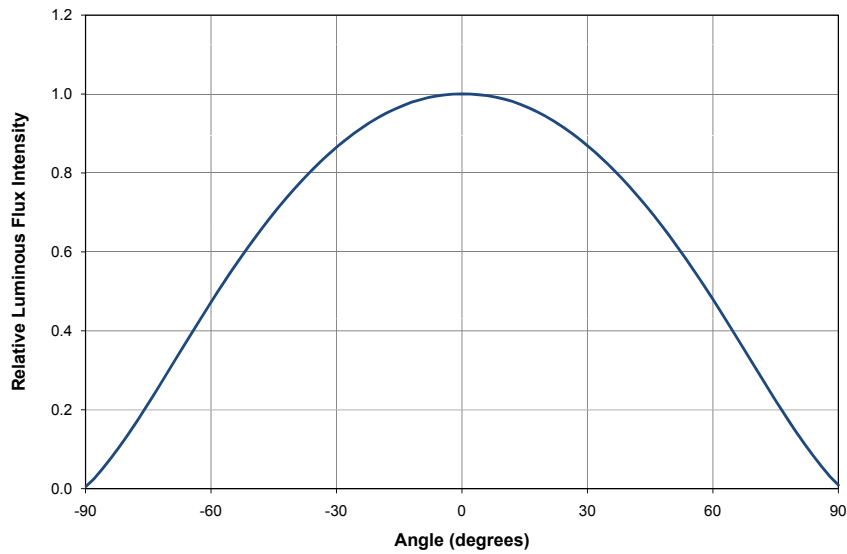


Figure 10. Typical angular intensity distribution.

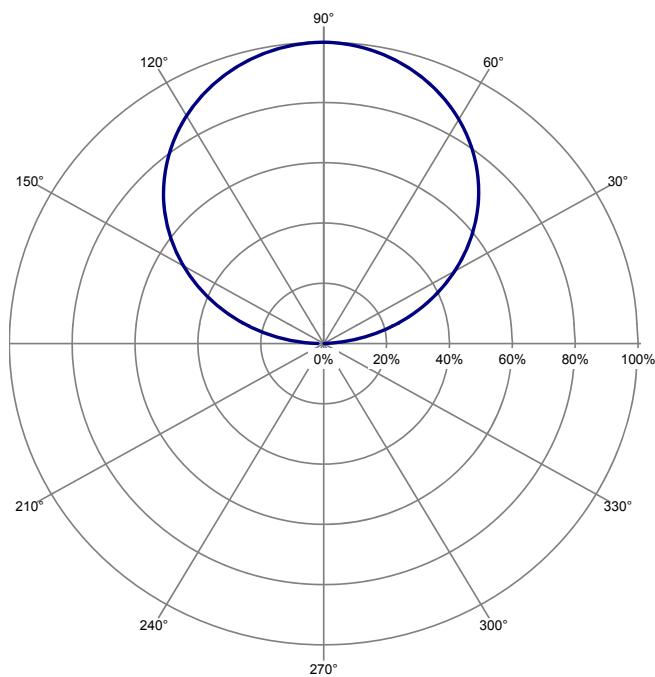


Figure 11. Typical polar radiation pattern.

# Emitter Pocket Tape Packaging

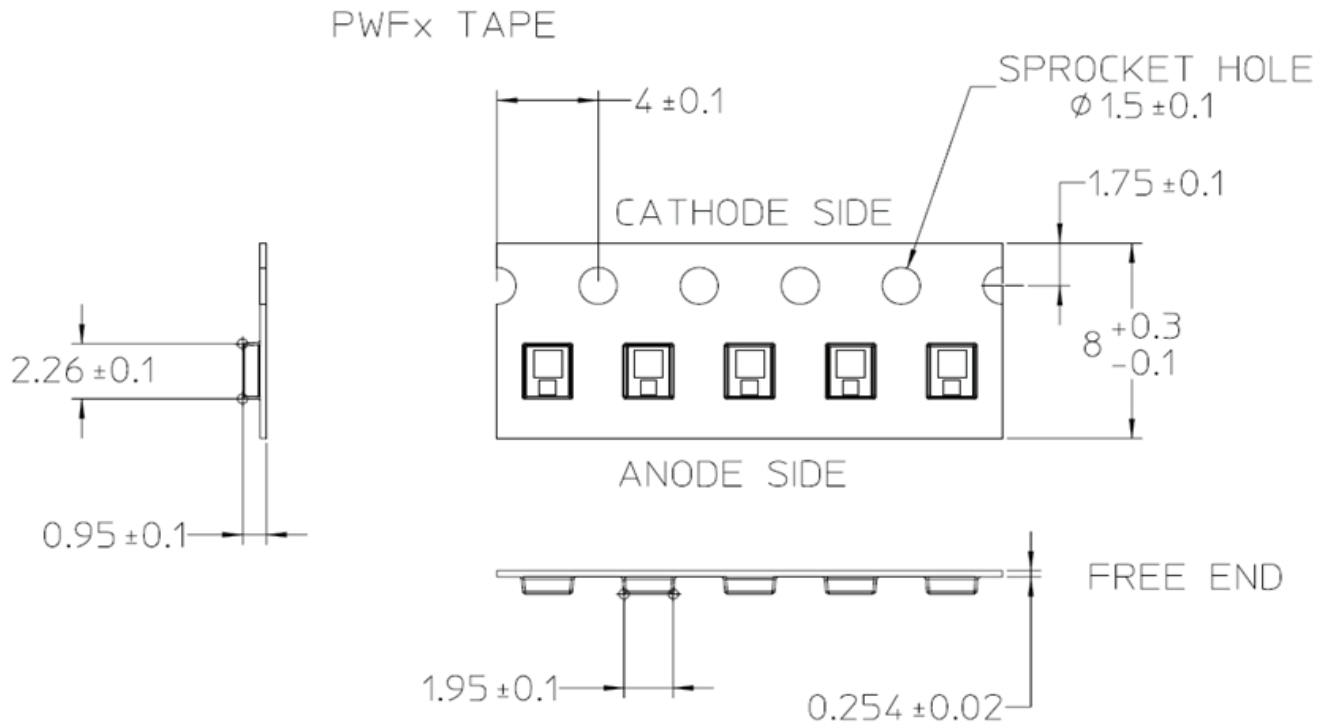


Figure 12. Emitter pocket tape packaging.

# Emitter Reel Packaging

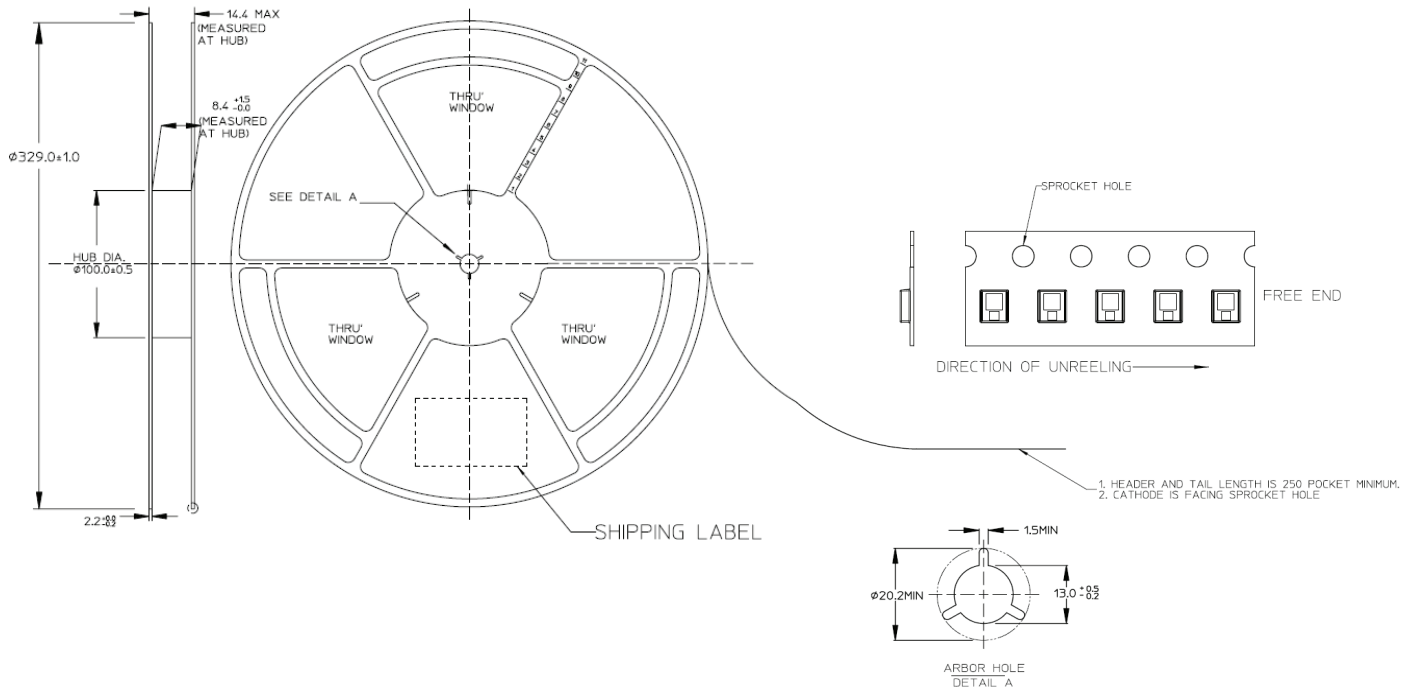


Figure 13. Emitter reel packaging.

# 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 C emitters are labeled using a four digit alphanumeric code (CAT code) depicting the bin values for emitters packaged on a single reel. At this time LUXEON C is binned for color and luminous flux. All emitters packaged within a reel are of the same 2-variable bin combination. Using these codes, it is possible to determine the optimum mixing and matching of products for consistency in a given application. Reels are labeled with a four digit alphanumeric CAT code following the format below.

ABCD

A, B and C = Color bin (84A, 85A, etc.)

D = Flux bin (7 or 8)

Although several bins are outlined, product availability in a particular bin varies by production run and by product performance.

## LUXEON C Bin Structure

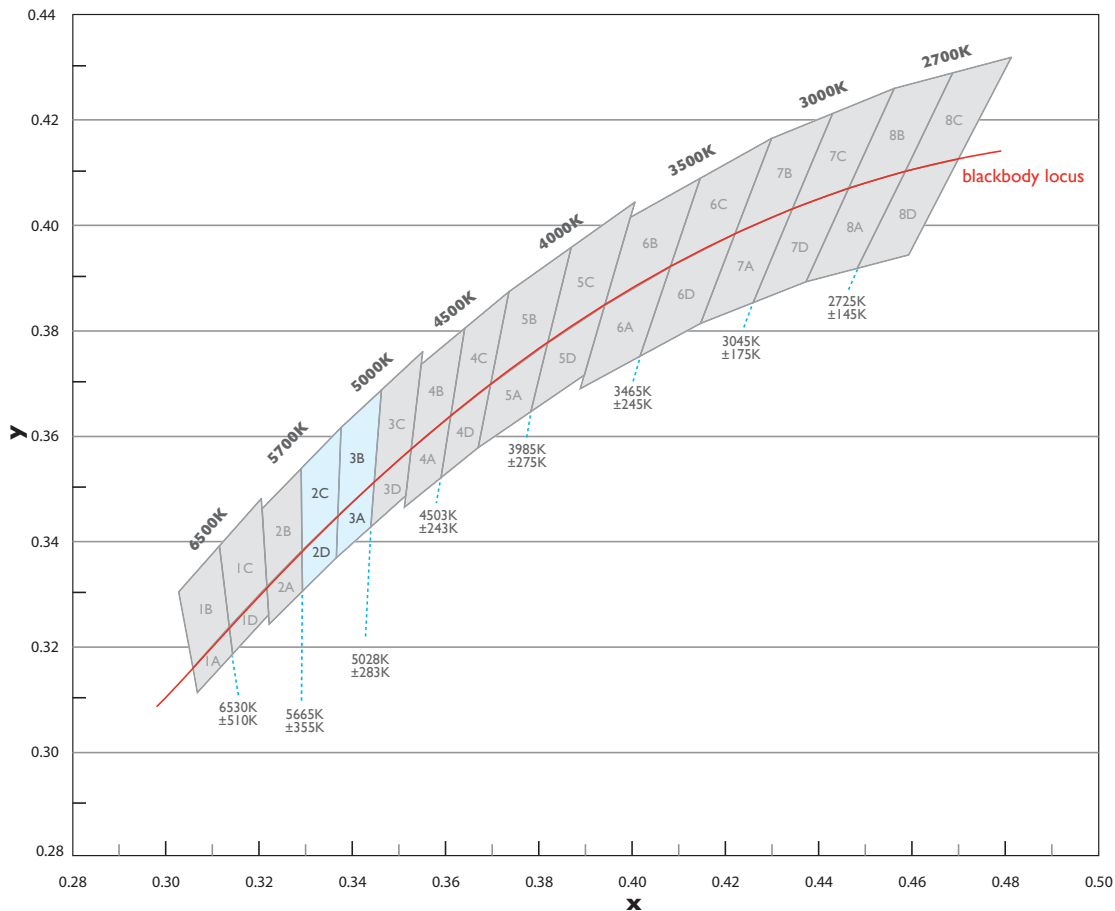


Figure 14. LUXEON C bin structure.



# LUXEON C Bin Coordinates

LUXEON C emitters are tested and binned by x, y coordinates. Four ANSI fine bins cover the CCT range 5028K to 5665K.

## LUXEON C Bin Coordinates

Table 6.

Nominal CCT	ANSI Bins	CAT Bin Codes	X	Y
5000K	3A	86A	0.344719	0.351301
			0.336916	0.344873
			0.336600	0.336900
			0.343985	0.342749
5000K	3B	84A	0.346260	0.368726
			0.337600	0.361600
			0.336916	0.344873
			0.344719	0.351301
5700K	2C	85A	0.337600	0.361600
			0.329053	0.353812
			0.329231	0.338266
			0.336916	0.344873
5700K	2D	87A	0.336916	0.344873
			0.329231	0.338226
			0.329330	0.330539
			0.336600	0.336900

Note for Table 6:

- I. Philips Lumileds maintains a tester tolerance of  $\pm 0.005$  on x,y color coordinates.

## Luminous Flux Bins

Table 7.

Bin Code	Flux Bins - All Colors	
	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
7	80	90
8	90	100

Table 7 lists the standard photometric luminous flux bins for LUXEON C emitters (tested and binned at 350 mA).

# Company Information

Philips Lumileds is a leading provider of power LEDs for everyday lighting applications. The company's records for light output, efficacy and thermal management are direct results of the ongoing commitment to advancing solid-state lighting technology and enabling lighting solutions that are more environmentally friendly, help reduce CO<sub>2</sub> emissions and reduce the need for power plant expansion. Philips Lumileds LUXEON® LEDs are enabling never before possible applications in outdoor lighting, shop lighting, home lighting, consumer electronics, and automotive lighting.

Philips Lumileds is a fully integrated supplier, producing core LED material in all three base colors, (Red, Green, Blue) and white. Philips Lumileds has R&D centers in San Jose, California and in the Netherlands, and production capabilities in San Jose, Singapore and Penang, Malaysia. Founded in 1999, Philips Lumileds is the high flux LED technology leader and is dedicated to bridging the gap between solid-state technology and the lighting world. More information about the company's LUXEON LED products and solid-state lighting technologies can be found at [www.philipslumileds.com](http://www.philipslumileds.com).

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