

LUXEON H

Minimizes driver requirements while delivering superior color stability over temperature and current

Technical Datasheet DS67

LUXEON
NEVER BEFORE POSSIBLE



LUXEON H

High Voltage LED

Introduction

LUXEON[®] H delivers superior color performance and reliability in a high voltage architecture that minimizes driver requirements making it an ideal solution for space constrained and cost sensitive retrofit bulbs and luminaires. With exceptional color stability over temperature and current, LUXEON H simplifies design while providing superior quality of light.

This document contains the performance data and technical information needed to design and develop LUXEON H based solutions. LUXEON H,

- Enables simplified solutions — no DC driver required
- Best choice for thermally constrained retrofit bulb designs
- Delivers quality of light with high R9 values at both 2700K and 3000K warm-white color temperatures
- Ensures exceptional color stability over temperature and current
- Delivers real-world in application performance and reliability
- 50V, 1 watt LED flexibly supports 110V and 230V solutions
- ANSI compliant binning
- Exceeds ENERGY STAR[®] lumen maintenance requirements.

PHILIPS
LUMILEDS

Table of Contents

General Information.....	3
Product Nomenclature	3
Average Lumen Maintenance Characteristics	3
Product Selection Guide for LUXEON H	3
Optical Characteristics.....	4
LUXEON H at Test Current.....	4
Electrical Characteristics at 20 mA for LUXEON H.....	4
Absolute Maximum Ratings	5
JEDEC Moisture Sensitivity.....	5
Reflow Soldering Characteristics.....	6
Mechanical Dimensions	7
Pad Configuration	8
Solder Pad Design.....	8
Relative Spectral Distribution vs. Wavelength Characteristics	9
Light Output Characteristics over Temperature.....	10
Typical Forward Current Characteristics.....	11
Typical Radiation Patterns.....	12
Emitter Pocket Tape Packaging.....	13
Emitter Reel Packaging	14
Product Binning and Labeling	15
LUXEON H ANSI Bin Structure.....	16
LUXEON H ANSI Bin Coordinates.....	17
Forward Voltage Bins.....	18

General Information

Product Nomenclature

LUXEON H is tested and binned at 20 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 A C - A B C D

Where:

- A — designates radiation pattern (value P for Lambertian)
- B — designates color (W for White)
- C, D — designates nominal CCT

Therefore products tested and binned at 2700 K follow the part numbering scheme:

L X A C - P W 2 7

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 H products will deliver, on average, 70% lumen maintenance (L70) at 25,000 hours of operation at a forward current of up to 30 mA. This projection is based on constant current operation with junction temperature maintained at or below 120°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 H is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS directive. Philips Lumileds will not intentionally add the following restricted materials to the LUXEON Rebel: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Product Selection Guide for LUXEON H, Thermal Pad Temperature = 25°C

Table 1.

Color	Nominal CCT	Part Number	Typical CRI	Typical R9	Minimum Luminous Flux (lm)	Typical Luminous Flux (lm)
Warm-white	2700K	LXAC-PW27	83	22	50	63
Warm-white	3000K	LXAC-PW30	83	20	50	67

Notes for Table 1:

1. Philips Lumileds maintains a tolerance of $\pm 6.5\%$ on luminous flux and ± 2 on CRI measurements.
2. Test current is 20 mA for all LXAC-PWxx products.

Optical Characteristics

LUXEON H at Test Current ^[1], Thermal Pad Temperature = 25°C

Table 2.

Color	Nominal CCT	Color Temperature ^[2]			Typical Total Included Angle ^[3] θ_{90V} (degrees)	Typical Viewing Angle ^[4] $2\theta_{1/2}$ (degrees)
		Min.	Typ.	Max.		
Warm-white	2700K	2580K	2725K	2870K	160	120
Warm-white	3000K	2870K	3045K	3220K	160	120

Note for Table 2:

1. Test current is 20 mA for all LXAC-PWxx products.
2. CCT \pm 5% tester tolerance.
3. Total angle at which 90% of total luminous flux is captured.
4. Viewing angle is the off axis angle from lamp centerline where the luminous intensity is $\frac{1}{2}$ of the peak value.
5. All white products are built with Indium Gallium Nitride (InGaN).

Electrical Characteristics at 20 mA for LUXEON H, Thermal Pad Temperature = 25°C

Table 3.

Nominal CCT	Forward Voltage V_f ^[1] (V)			Typical Temperature Coefficient of Forward Voltage ^[2] (mV/°C) $\Delta V_f / \Delta T_j$	Typical Thermal Resistance Junction to Thermal Pad ^[3] ($^{\circ}\text{C}/\text{W}$) $R\theta_{J-C}$
	Min.	Typ.	Max.		
2700K, 3000K	50.0	53.0	60.0	-45.0	12.5

Note for Table 3:

1. Philips Lumileds maintains a tolerance of \pm 0.5% on forward voltage measurements.
2. Measured between $25^{\circ}\text{C} \leq T_j \leq 110^{\circ}\text{C}$ at $I_f = 20$ mA.
3. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs. See Figure 7 for more information.

Absolute Maximum Ratings

Table 4.

Parameter	Maximum Performance
DC Forward Current (mA)	30
RMS Forward Current (mA) ^[2]	30
Peak Current (mA) ^[2]	60
ESD Sensitivity	< 2000V Human Body Model (HBM) Class 2 JESD22-A114-B < 200V Machine Model (MM) Class 2 JESD22-A115-B
LED Junction Temperature ^[1]	125°C
Operating Case Temperature at 20 mA	-40°C - 105°C
Storage Temperature	-40°C - 85°C
Soldering Temperature	JEDEC 020c 260°C
Allowable Reflow Cycles	3
Autoclave Conditions	121°C at 2 ATM 100% Relative Humidity for 96 Hours Maximum
Reverse Voltage (Vr)	LUXEON H LEDs are not designed to be driven in reverse bias

Notes for Table 4:

1. Proper current derating must be observed to maintain junction temperature below the maximum.
2. For AC operation with a minimum of 50Hz.

JEDEC Moisture Sensitivity

Table 5.

Level	Soak Requirements			
	Floor Life		Standard	
	Time	Conditions	Time	Conditions
1	unlimited	≤ 30°C / 85% RH	168h + 5 / - 0	85°C / 85% RH

Reflow Soldering Characteristics

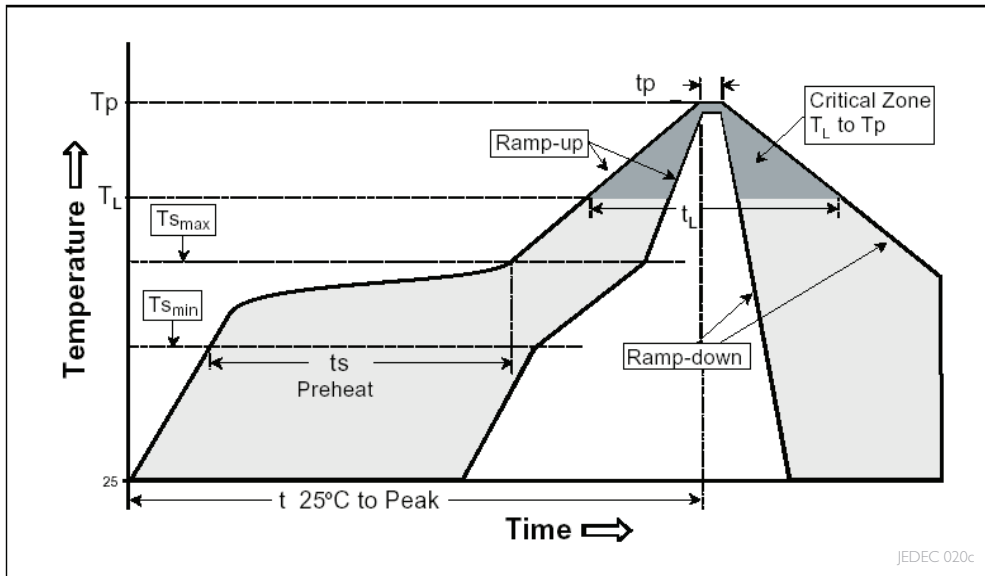


Figure 1. Temperature profile for Table 6.

Table 6.

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	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 6:

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

Mechanical Dimensions

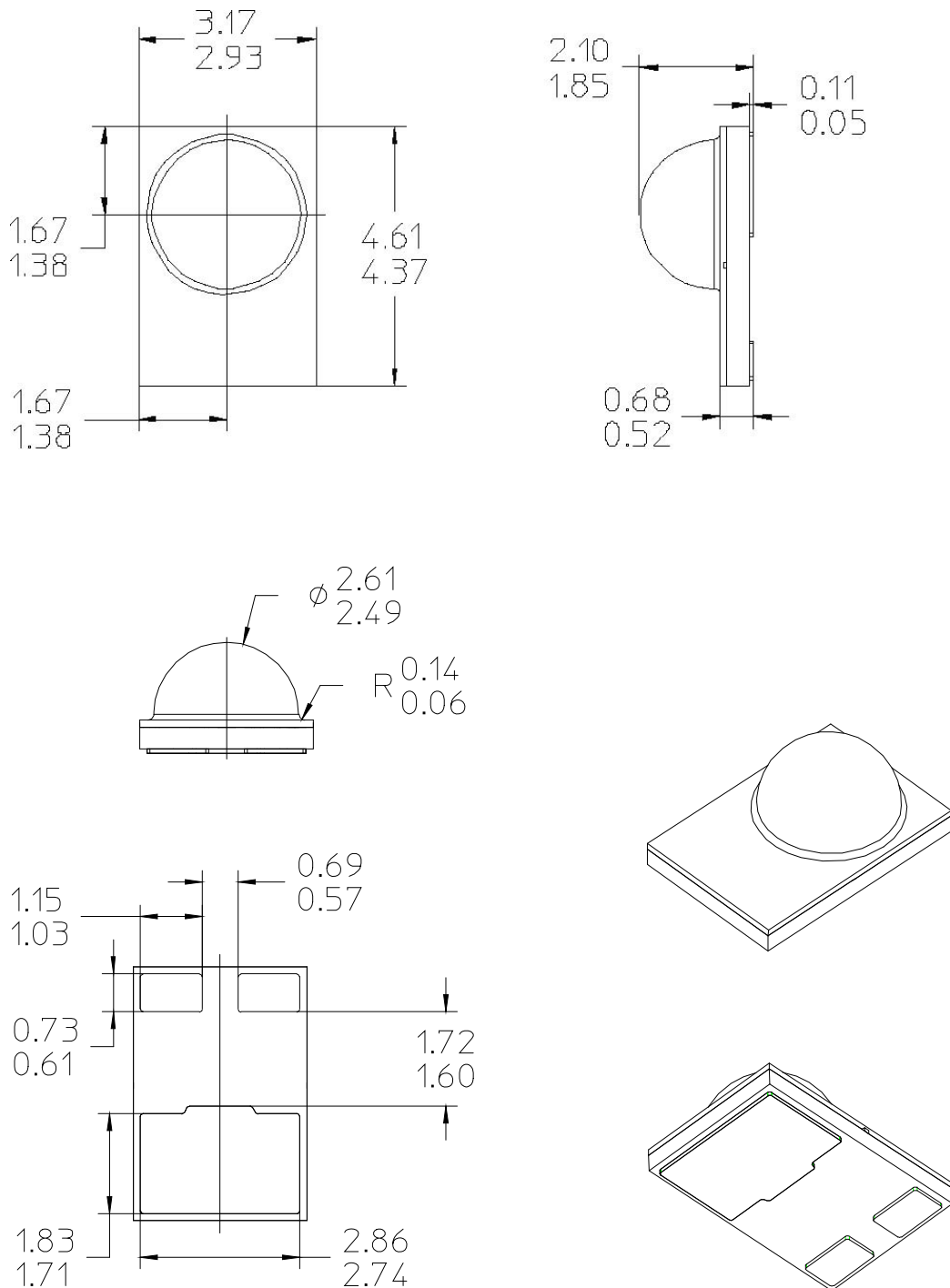
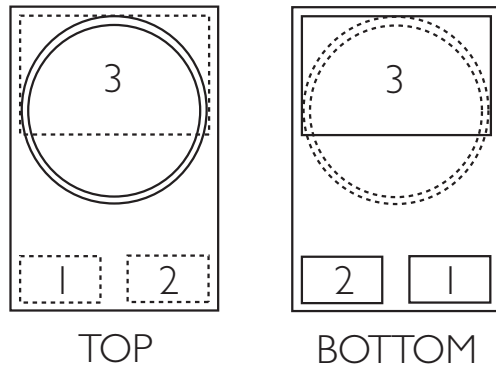


Figure 2.

Notes for Figure 2:

- Care should be taken to avoid damage to the lens or the interior of the device that can be damaged by excessive force to the lens.
- Drawings not to scale.
- All dimensions are in millimeters.
- The thermal pad is electrically isolated from the anode and cathode contact pads.

Pad Configuration



PAD	FUNCTION
1	CATHODE
2	ANODE
3	THERMAL

Figure 3. Pad configuration.

Note for Figure 3:

- The thermal pad is electrically isolated from the anode and cathode contact pads.

Solder Pad Design

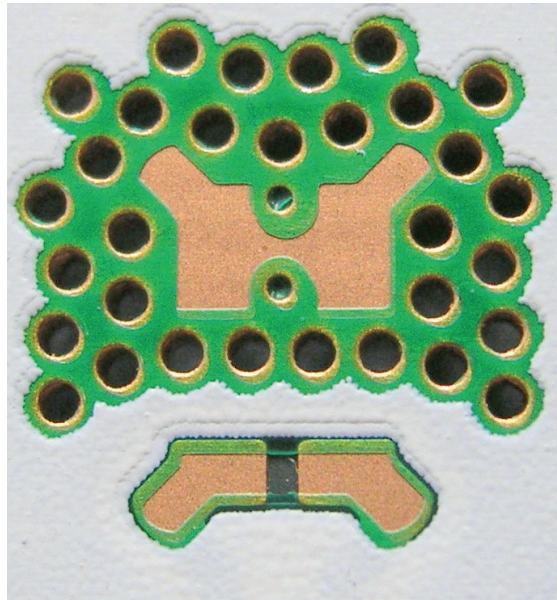


Figure 4. Solder pad layout.

Note for Figure 4:

- The photograph shows the recommended LUXEON H layout on Printed Circuit Board (PCB).
- For more information on assembly and layout, please refer to application brief 32 (AB32) and application brief 67 (AB67).
- The .dwg files are available at www.philipslumileds.com and www.philipslumileds.cn.com.

Relative Spectral Distribution vs. Wavelength Characteristics

Warm-White 2700K at Test Current, Thermal Pad Temperature = 25°C

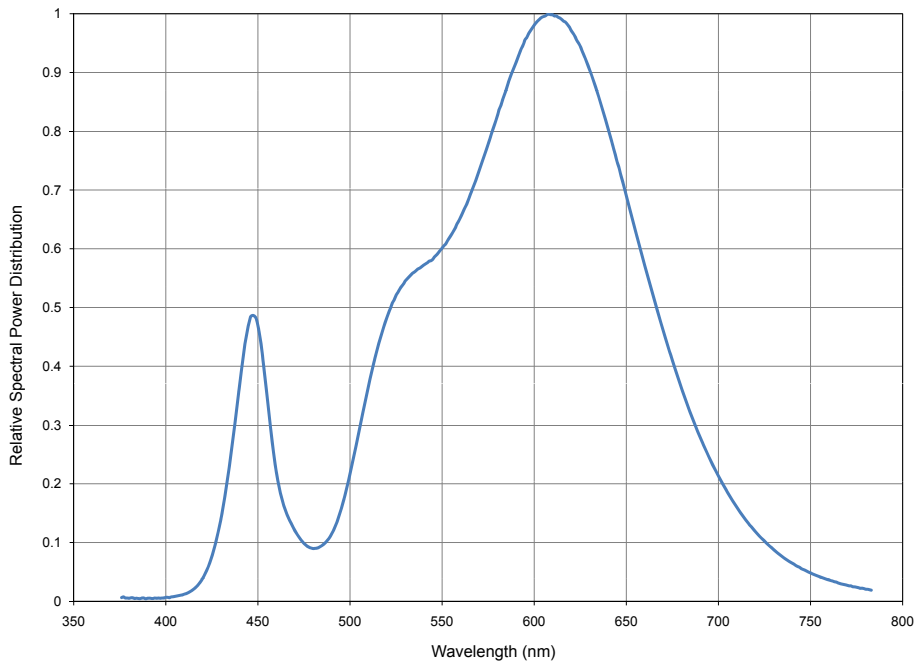


Figure 5. Color spectrum of LXAC-PW27, 2700K emitters, integrated measurement.

Warm-White 3000K at Test Current, Thermal Pad Temperature = 25°C

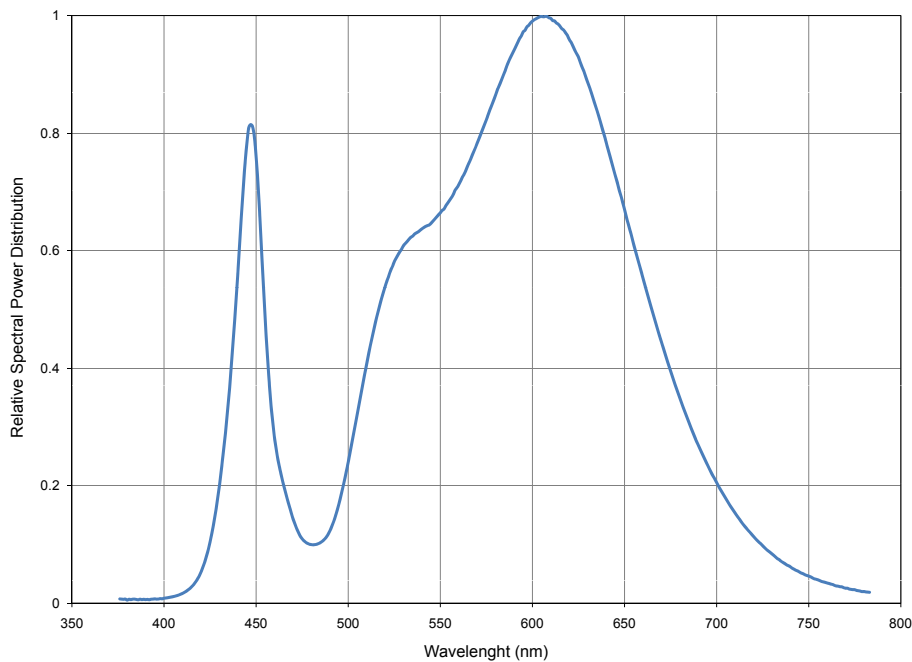


Figure 6. Color spectrum of LXAC-PW30, 3000K emitters, integrated measurement.

Light Output Characteristics over Temperature

Warm-White 2700K and 3000K

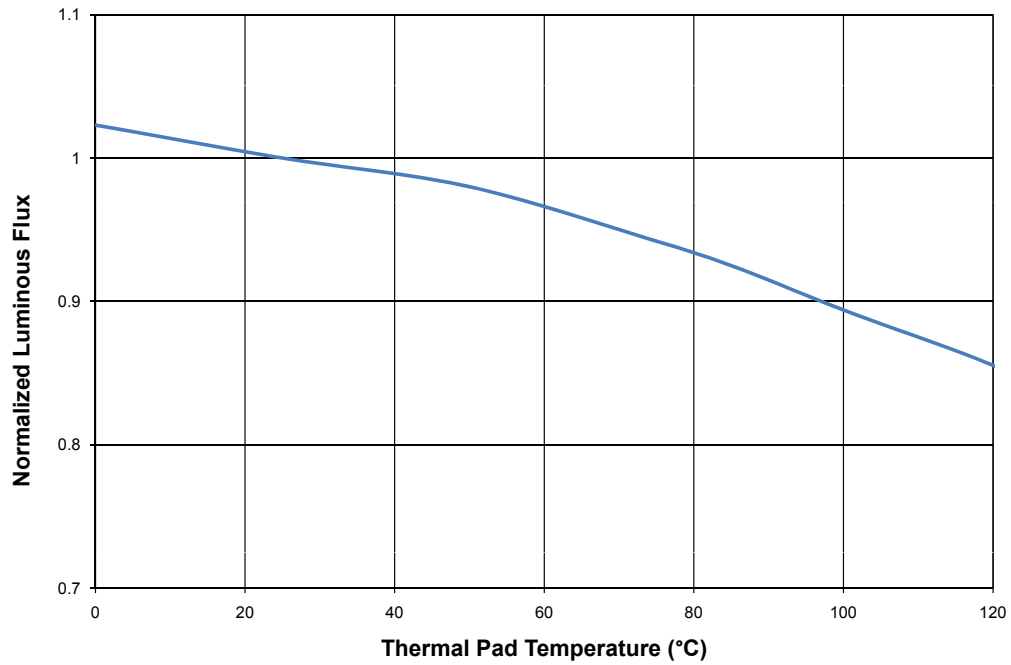


Figure 7. Relative light output vs. thermal pad temperature, LXAC-PW27 & LXAC-PW30.

Typical Forward Current Characteristics

Typical Forward Current Characteristics, Thermal Pad Temperature = 25°C

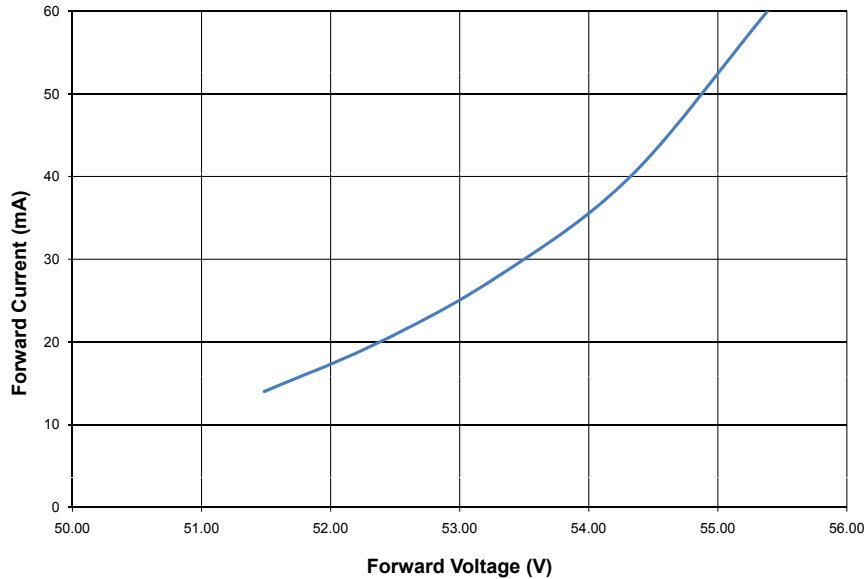


Figure 8. Typical forward current vs. forward voltage, LXAC-PW27 & LXAC-PW30.

Typical Relative Luminous Flux vs. Forward Current, Thermal Pad Temperature = 25°C

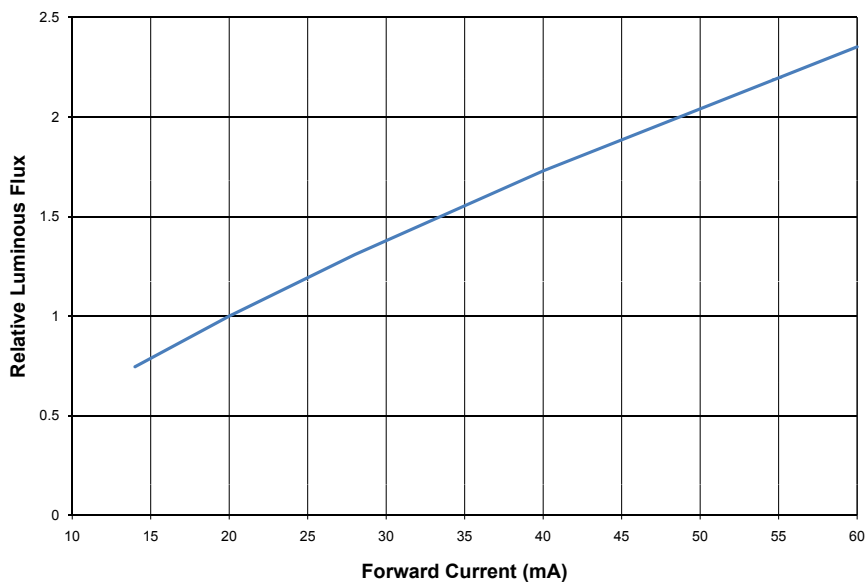


Figure 9. Typical relative luminous flux vs. forward current, LXAC-PW27 & LXAC-PW30.

Typical Radiation Patterns

Typical Spatial Radiation Pattern for Lambertian

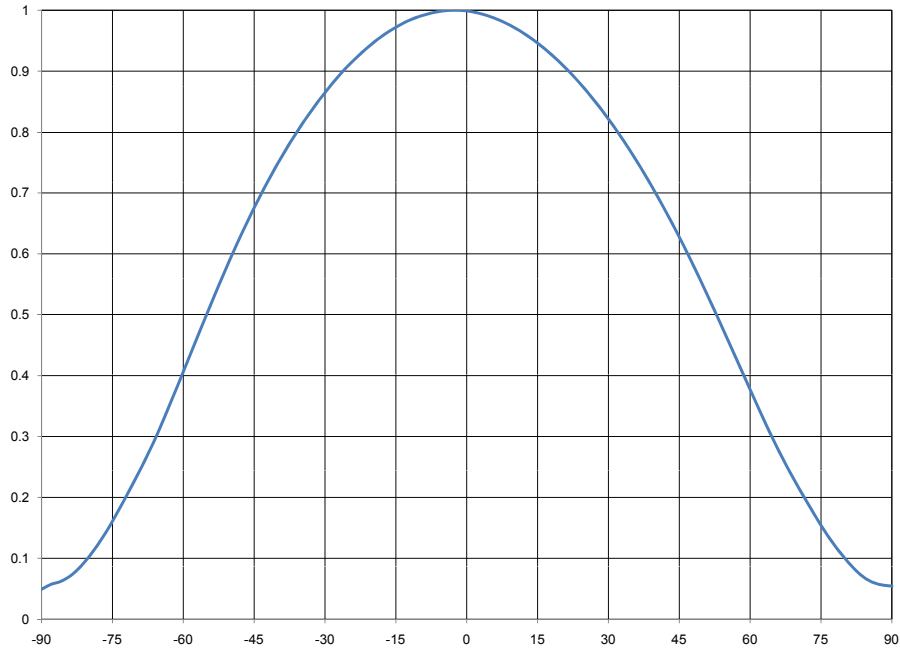


Figure 10. Typical representative spatial radiation pattern for lambertian, LXAC-PW27 & LXAC-PW30.

Typical Polar Radiation Pattern for Lambertian

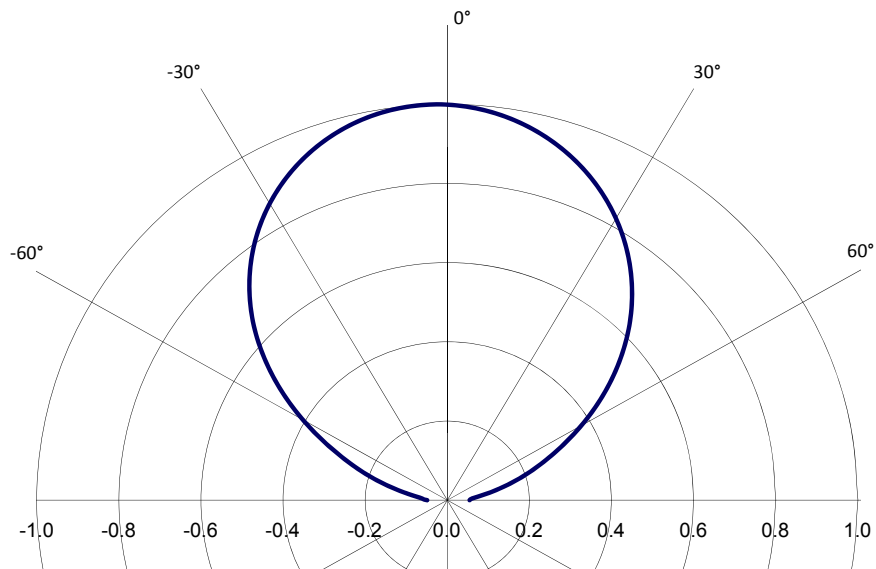


Figure 11. Typical polar radiation pattern for lambertian, LXAC-PW27 & LXAC-PW30.

Emitter Pocket Tape Packaging

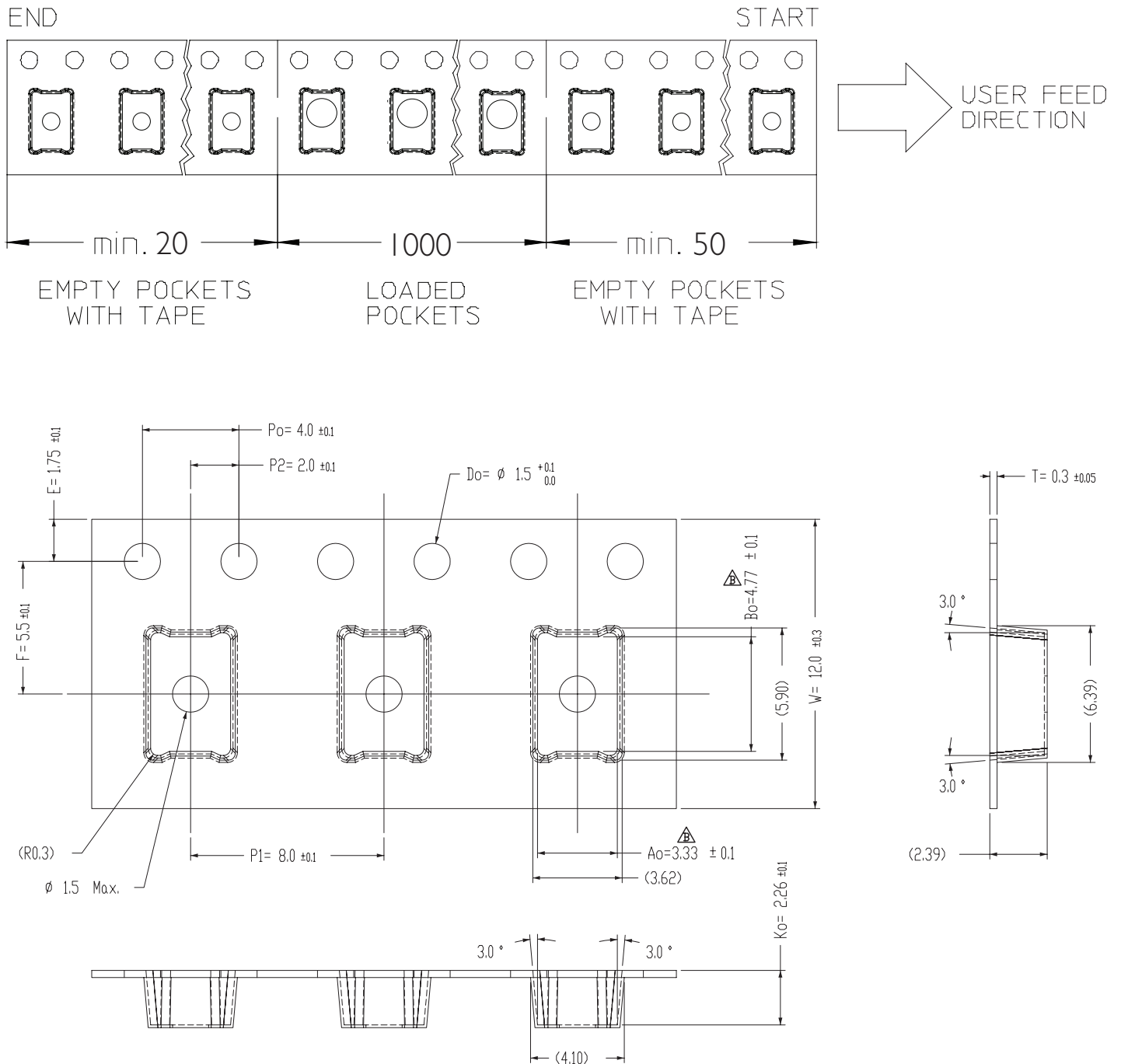


Figure 12. Emitter pocket tape packaging.

Emitter Reel Packaging

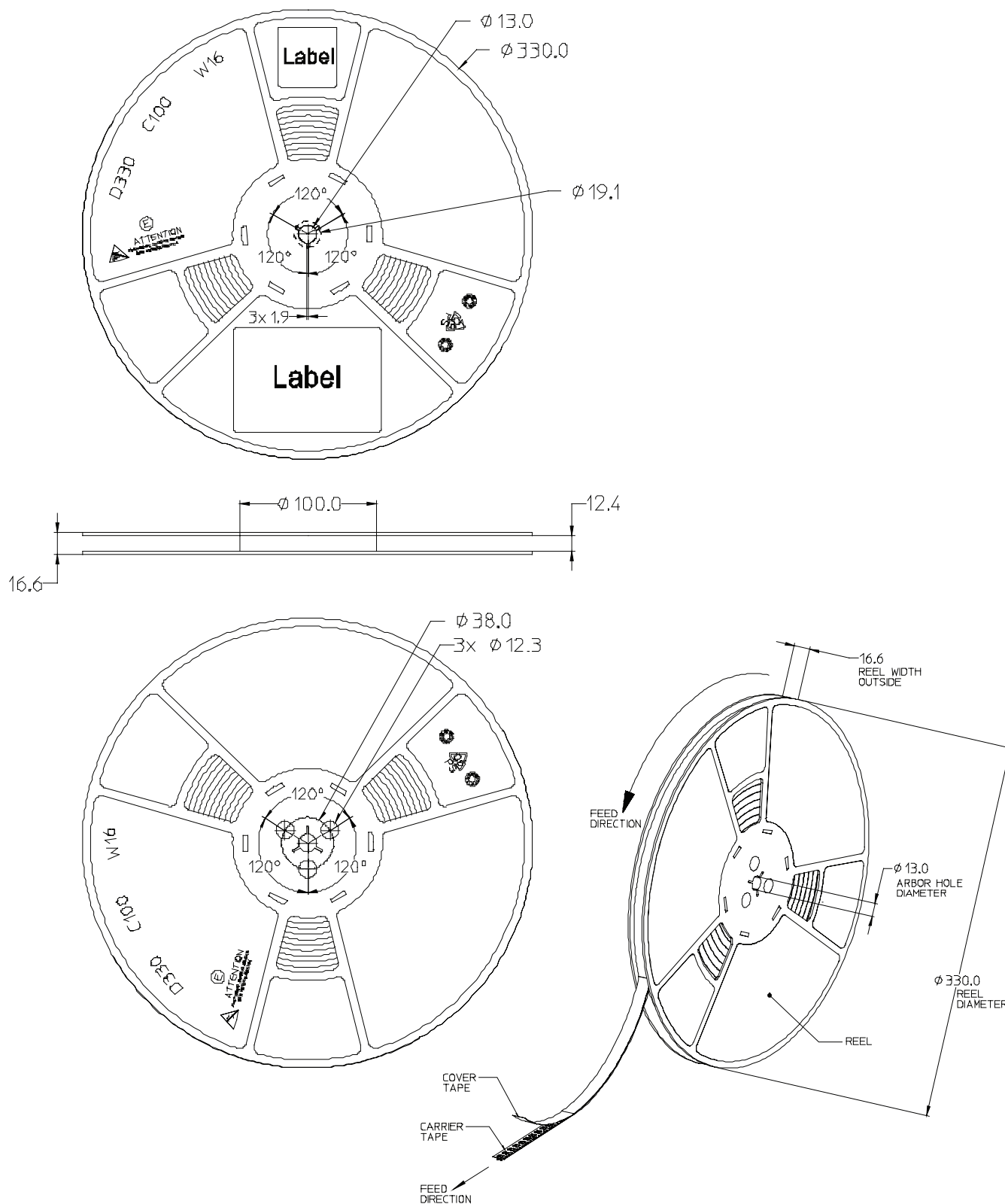


Figure 13. Emitter reel packaging.

Product Binning and Labeling

Purpose of Product Binning

In the manufacturing of semiconductor products, there are variations in 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 H 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 emitters are labeled with a four digit alphanumeric CAT code following the format below.

ABCD

A = Flux bin (H, J etc.)

B and C = Color bin (7A, 7B, 7C etc.)

D = V_f bin (H, J, K etc.)

Luminous Flux Bins

Table 7 lists the standard photometric luminous flux bins for LUXEON H emitters (tested and binned at 20 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.

Table 7.

Flux Bins - All Colors

Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
H	50	60
J	60	70
K	70	80

LUXEON H ANSI Bin Structure

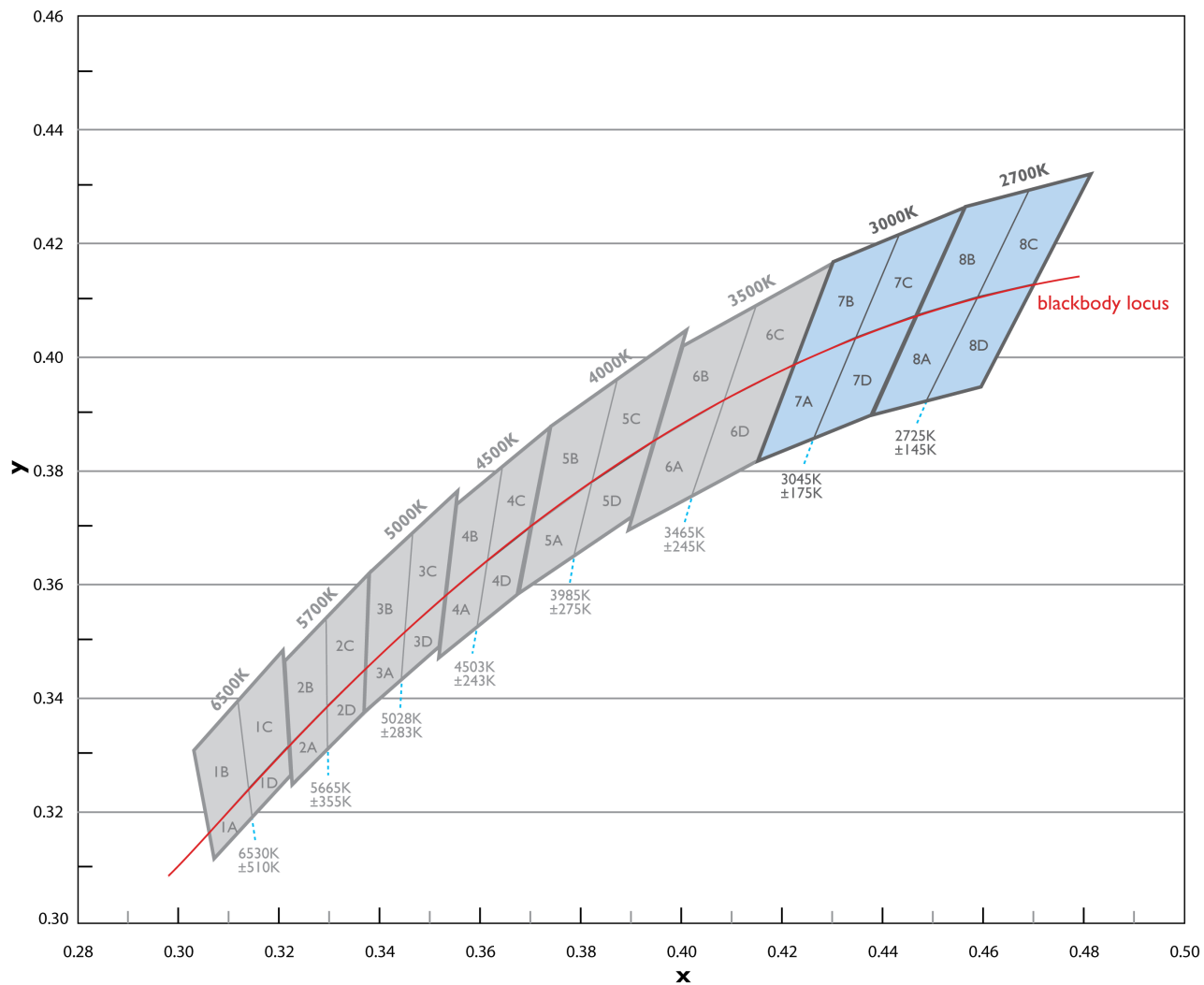


Figure 14. LUXEON H ANSI bin structure

LUXEON H ANSI Bin Coordinates

LUXEON H emitters are tested and binned by x,y coordinates. 8 Color Bins, CCT Range 2580K to 3220K

Table 8.

LUXEON H ANSI Bin Coordinates							
Bin Code	X	Y	Nominal CCT (K)	Bin Code	X	Y	Nominal CCT (K)
8A	0.458614	0.410315	2700	7A	0.434392	0.403186	3000
	0.446470	0.407117			0.422071	0.398417	
	0.437300	0.389300			0.414700	0.381400	
	0.448286	0.391847			0.425959	0.385336	
8B	0.468732	0.428946	2700	7B	0.442994	0.421230	3000
	0.456200	0.426000			0.429900	0.416500	
	0.446470	0.407117			0.422071	0.398417	
8C	0.458614	0.410315	2700	7C	0.434392	0.403186	3000
	0.469954	0.412602			0.446470	0.407117	
	0.481300	0.431900			0.456200	0.426000	
	0.468732	0.428946			0.442994	0.421230	
8D	0.458614	0.410315	2700	7D	0.434392	0.403186	3000
	0.448286	0.391847			0.425959	0.385336	
	0.459300	0.394400			0.437300	0.389300	

Note for Table 8:

- Philips Lumileds maintains a tester tolerance of ± 0.005 on x,y color coordinates.

Forward Voltage Bins

Table 9 lists minimum and maximum V_f bin values per emitter. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance.

Table 9.

V_f Bins

Bin Code	Minimum Forward Voltage (V)	Maximum Forward Voltage (V)
H	50.0	52.5
J	52.5	55.0
K	55.0	57.5
L	57.5	60.0

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 CO₂ 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.

www.philipslumileds.com
www.philipslumileds.cn.com
www.futurelightingsolutions.com

For technical assistance or the location of your nearest sales office contact any of the following:

North America:
1 888 589 3662
americas@futurelightingsolutions.com

Europe:
00 800 443 88 873
europe@futurelightingsolutions.com

Asia Pacific:
800 5864 5337
asia@futurelightingsolutions.com

Japan:
800 5864 5337
japan@futurelightingsolutions.com

©2011 Philips Lumileds Lighting Company. All rights reserved.
Product specifications are subject to change without notice.
LUXEON is a registered trademark of the Philips Lumileds Lighting Company in the United States and other countries.

PHILIPS
LUMILEDS