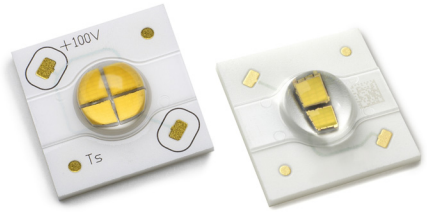
LUXEON H

High Voltage (100V and 200V) LED



Introduction

LUXEON® H delivers superior lumen density, color performance and reliability in a high voltage LED on board architecture. For space constrained and cost sensitive retrofit bulbs and luminaires application, LUXEON H is the ideal solution as it minimizes system cost and space requirements through L2 solution and simpler driver.

This document contains the performance data and technical information needed to design and develop LUXEON H based luminaires with products in 100V and 200V options in royal blue 2700K, 3000K and 4000K.

Features and Benefits

- Provides compact source with single dome for directional lighting designs
- Enables simplified small size solutions with compact, low cost driver
- Ensures exceptional color stability over temperature and current
- Delivers Freedom from CCT binning (3 SDCM), single flux bin and single V_f bin
- Exceed ENERGY STAR® lumen maintenance requirements
- High efficacy for sustainable design
- Guaranteed performance at operating temperature

Key Applications

- Downlights
- Indoor area lighting
- Lamps
- Specialty Lighting

PHILIPS LUMILEDS

Table of Contents

General Information

Product Nomenclature

LUXEON H are specified at 40 mA (100V parts) and at 20 mA (200V parts), with junction temperature stabilized at 85°C.

The part number designation is explained as follows:

L X V a - P b c d - e f g h - i

Where:

- a — minimum CRI (8 = 80, 9 = 90, 0 = Royal Blue)
- b — color designation (R = Royal Blue, W = White)
- c, d — CCT (27 = 2700K, 30 = 3000K, 40 = 4000K, 50 = 5000K, 00 = Royal Blue)
- e — reserved for future proliferations
- f — L2 variant (0 for the L2 defined in this datasheet)
- g — voltage of L2 (1 = 100V, 2 = 200V)
- h — number of emitters under the dome lens
- i — for color binning spec notation excluding 3 SDCM binning (5 for 5 SDCM, left empty with no notation for 3 SDCM)

Please see following part numbering scheme for further illustration:

- LXV8-PW27-0024: 1st generation of 2700K products specified at 20 mA, 200V, and 3 SDCM with 4 emitters under the dome lens
- LXV8-PW27-0014-5: 1st generation of 2700K products specified at 40 mA, 100V, and 5 SDCM with 4 emitters under the dome lens
- LXV8-PW27-1024: 2nd generation of 2700K products specified at 20 mA, 200V, and 3 SDCM with 4 emitters under the dome lens
- LXV8-PW27-1014-5: 2nd generation of 2700K products specified at 40 mA, 100V, and 5 SDCM with 4 emitters under the dome lens
- LXV8-PW27-1012-5: 2nd generation of 2700K products specified at 40 mA, 100V, and 5 SDCM with 2 emitter under the dome lens
- LXV0-PR00-1012-5: 2nd generation of royal blue products specified at 40 mA, 100V, and 5 SDCM with 2 emitter under the dome lens

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 will deliver, on average, 70% lumen maintenance (L70) at 35,000 hours of operation at a forward current of up to 40 mA (LUXEON H 200V) and 80 mA (LUXEON H 100V). 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 H are 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 H: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Product Selection

Product Selection Guide for LUXEON H (White), Junction Temperature = 85°C

Table 1.

Generation 1 - 4 Emitters Under Dome Lens						
Nominal CCT	Part Number	Test Curent (mA)	Minimum CRI	Typical CRI	Minimum Flux (lm) ϕ_v	Typical Flux (lm) ϕ_v
2700K	LXV8-PW27-0014(-x)	40	80	82	330	350
2700K	LXV8-PW27-0024(-x)	20	80	82	330	350
3000K	LXV8-PW30-0014(-x)	40	80	85	350	368
3000K	LXV8-PW30-0024(-x)	20	80	85	350	368
4000K	LXV8-PW40-0014(-x)	40	80	85	370	415
4000K	LXV8-PW40-0024(-x)	20	80	85	370	415

Generation 2 - 4 Emitters Under Dome Lens						
Nominal CCT	Part Number	Test Curent (mA)	Minimum CRI	Typical CRI	Minimum Flux (lm) ϕ_v	Typical Flux (lm) ϕ_v
2700K	LXV8-PW27-1014(-x)	40	80	82	388	415
2700K	LXV8-PW27-1024(-x)	20	80	82	388	415
3000K	LXV8-PW30-1014(-x)	40	80	85	405	435
3000K	LXV8-PW30-1024(-x)	20	80	85	405	435
4000K	LXV8-PW40-1014(-x)	40	80	85	435	460
4000K	LXV8-PW40-1024(-x)	20	80	85	435	460

Note for Table 1:

1. Philips Lumileds maintains a tolerance of ± 6.5% on luminous flux and ± 2 on CRI measurements.

Table 2.

Generation 1 - 2 Emitters Under Dome Lens						
Nominal CCT	Part Number	Test Curent (mA)	Minimum CRI	Typical CRI	Minimum Flux (lm) ϕ_v	Typical Flux (lm) ϕ_v
2700K	LXV8-PW27-0012(-x)	40	80	82	295	310
3000K	LXV8-PW30-0012(-x)	40	80	85	325	345
4000K	LXV8-PW40-0012(-x)	40	80	85	335	350

Note for Table 2:

1. Philips Lumileds maintains a tolerance of ± 6.5% on luminous flux and ± 2 on CRI measurements.

Table 3.

Generation 2 - 2 Emitters Under Dome Lens						
Nominal CCT	Part Number	Test Curent (mA)	Minimum CRI	Typical CRI	Minimum Flux (lm) ϕ_v	Typical Flux (lm) ϕ_v
2700K	LXV8-PW27-1012(-x)	40	80	82	348	370
3000K	LXV8-PW30-1012(-x)	40	80	85	373	398
4000K	LXV8-PW40-1012(-x)	40	80	85	395	415

Note for Table 3:

1. Philips Lumileds maintains a tolerance of ± 6.5% on luminous flux and ± 2 on CRI measurements.

Product Selection Guide for LUXEON H (Royal Blue), Junction Temperature = 85°C

Table 4.

4 Emitters Under Dome Lens					
Nominal CCT	Part Number	Test Curent (mA)	Minimum Radiometric Power (mW)	Typical Radiometric Power (mW)	Typical Radiant Efficacy (%)
Royal Blue	LXV0-PR00-1014	80	4200	4500	56.2
Royal Blue	LXV0-PR00-1024	40	4200	4500	56.2

2 Emitters Under Dome Lens					
Nominal CCT	Part Number	Test Curent (mA)	Minimum Radiometric Power (mW)	Typical Radiometric Power (mW)	Typical Radiant Efficacy (%)
Royal Blue	LXV0-PR00-1012	40	2100	4250	56.2

Note for Table 4:

1. Philips Lumileds maintains a tolerance of ± 6.5% on luminous flux and ± 2 on CRI measurements.

LUXEON H (White) at Elevated Drive Current Junction Temperature = 85°C

Table 5.

Generation 1 - 4 Emitters Under Dome Lens			
Nominal CCT	Part Number	Test Curent (mA)	Typical Flux (lm) ϕ_v
2700K	LXV8-PW27-0014	90	705
2700K	LXV8-PW27-0024	45	705
3000K	LXV8-PW30-0014	90	735
3000K	LXV8-PW30-0024	45	735
4000K	LXV8-PW40-0014	90	785
4000K	LXV8-PW40-0024	45	785

Generation 2 - 4 Emitters Under Dome Lens			
Nominal CCT	Part Number	Test Curent (mA)	Typical Flux (lm) ϕ_v
2700K	LXV8-PW27-1014	90	840
2700K	LXV8-PW27-1024	45	840
3000K	LXV8-PW30-1014	90	845
3000K	LXV8-PW30-1024	45	845
4000K	LXV8-PW40-1014	90	925
4000K	LXV8-PW40-1024	45	925

Notes for Table 5:

1. Philips Lumileds maintains a tolerance of ± 6.5% on luminous flux and ± 2 on CRI measurements.

Optical Characteristics

LUXEON H at Test Current [1] (White)
Junction Temperature = 85°C

Table 6.

Part Number	Nominal CCT	Color Temperature CCT	Typical Total Included Angle [2] (degrees) θ_{90V}	Typical Viewing Angle [3] (degrees) 2θ ½
		Typical		
LXV8-PW27-x0xx(-x)	2700K	2725K	140	120
LXV8-PW30-x0xx(-x)	3000K	3045K	140	120
LXV8-PW40-x0xx(-x)	4000K	3985K	140	120

Notes for Table 6:

1. Test current is 40 mA for 100V LUXEON H products and 20 mA for 200V LUXEON H products.
2. Total angle at which 90% of total luminous flux is captured.
3. Viewing angle is the off axis angle from lamp centerline where the luminous intensity is ½ of the peak value.

Electrical Characteristics

Electrical Characteristics for LUXEON H Junction Temperature = 85°C

Table 7.

Part Number	Test Current (mA)	Forward Voltage V_f [1] (V)			Typ. Temperature Coefficient of Forward Voltage [2] (mV/°C) $\Delta V_F / \Delta T_J$	Typical Thermal Resistance Junction to Thermal Pad (°C/W) $R\theta_{J-C}$
		Minimum	Typical	Maximum		
LXV8-PWxx-0014(-x)	40	94	96	98	-52	2.8
LXV8-PWxx-0024(-x)	20	188	192	196	-104	2.8
LXV8-PWxx-1014(-x)	40	95	98	101	-52	2.8
LXV8-PWxx-1024(-x)	20	190	196	202	-104	2.8
LXV8-PWxx-0012(-x)	40	97	100	103	-52	2.8
LXV8-PWxx-1012(-x)	40	97	100	103	-52	2.8
LXV0-PRxx-1014	80	97	100	103	-52	2.8
LXV0-PRxx-1024	40	194	198	206	-104	2.8
LXV0-PRxx-1012	40	97	100	103	-52	2.8

Notes for Table 7:

1. Philips Lumileds maintains a tolerance of ± 0.5% on forward voltage measurements.
2. Measured between T_j=25°C and T_j =110°C.
3. Use total electrical power as the total heat dissipation.

Typical Electrical Characteristics at High Current for LUXEON H Junction Temperature = 85°C

Table 8.

Part Number	Test Current (mA)	Typical Forward Voltage V_f (V)
LXV8-PWxx-0014(-x)	90	100
LXV8-PWxx-0024(-x)	45	200
LXV8-PWxx-1014(-x)	90	103
LXV8-PWxx-1024(-x)	45	206
LXV8-PWxx-0012(-x)	45	100
LXV8-PWxx-1012(-x)	45	103
LXV0-PRxx-1014	90	103
LXV0-PRxx-1024	45	206
LXV0-PRxx-1012	45	103

Notes for Table 8:

1. Philips Lumileds maintains a tolerance of ± 0.5% on forward voltage measurements.

Absolute Maximum Ratings

Table 9.

Parameter	Maximum Performance	
	LXV8-PWxx-x014(-x) [White 4 Emitters 100V] LXV0-RW00-1014 [Royal Blue 4 Emitters 100V]	LXV8-PWxx-x024(-x) [White 4 Emitters 200V] LXV8-PWxx-x012(-x) [White 2 Emitters 100V] LXV0-RW00-1024 [Royal Blue 4 Emitters 200V] LXV0-RW00-1012 [Royal Blue 2 Emitters 100V]
DC Forward Current (mA) [1]	100	50
Peak Forward Current (mA) [2]	200	100
RMS Forward Current (mA) [2]	100	50
ESD Sensitivity	≤ 2000V Human Body Model (HBM) for LXV8-PWXX-0014 ≤4000V Human Body Model (HBM) for LXV8-PWXX-0024 Class 2 JESD22-A114-E ≤ 400V Machine Model (MM) Class B JESD22-A115-B	
LED Junction Temperature[1]	150°C	
Operating Case Temperature at Current	-40°C - 135°C @ 20 mA	-40°C - 135°C @ 40 mA
Storage Temperature	-40°C - 120°C	
Wire Soldering Temperature	JEDEC 020c 260°C	
Allowable Lead Reflow Cycles	Not applicable, not a SMT product	
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	
Hi-Pot test capability	2.5mm clearance from all electrically active pads to ground allows 2.5kV Hi-Potential test pass	

Notes for Table 9:

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

Mechanical Dimensions

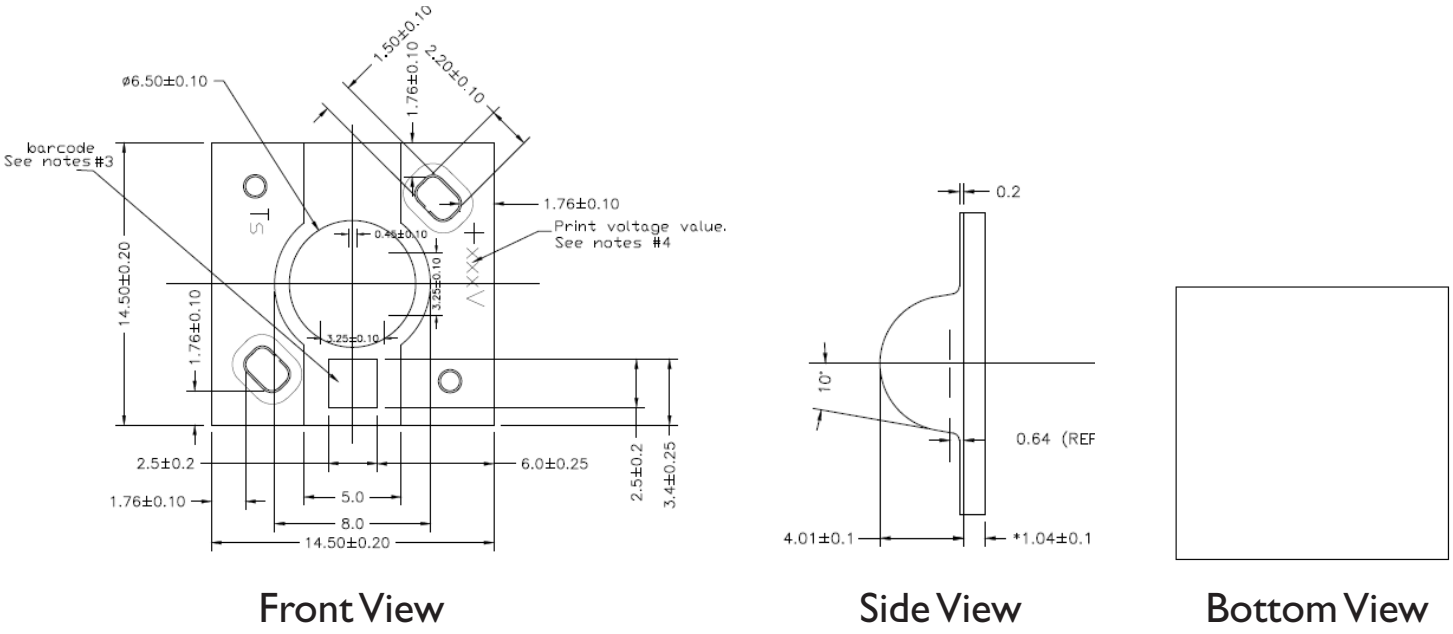


Figure 1. Package outline drawing for LXV8-PWxx-00x4.

Notes for Figure 1:

1. Do not handle the device by the lens. Excessive force on the lens may damage the lens itself or the interior of the device.
2. All dimensions are in millimeters.
3. Dimension
   - Unless otherwise specified, all dimensions have a general tolerance of ± 0.10 mm.
4. Assembly Specifications
   - Mount components in accordance with ANSI/IPC-A-610 CLASS 2.
   - Boards must be functionally tested to verify all LED's light.
5. Board traceability in 2D Matrix Barcode (on bottom surface of PCB)
   - ABCDYYMMDD##abcdefgh
   - ABCD = PCB part number
   - YYMMDD = Date Code (YY = Year; MM = Month; DD = Date)
   - ## = Manufacturer
   - abcde = Panel serial number (subcon define) from 00001 to 99999
   - fgh = Board serial number from 001 to 036
6. Marking regarding voltage value
   - for LXV8-PW27-0014 & LXV8-PW30-0014: xxxV = 100V
   - for LXV8-PW27-0024 & LXV8-PW30-0024: xxxV = 200V
7. All materials must be RoHS compliant.

Relative Spectral Distribution vs. Wavelength Characteristics

LXV8-PW27 (2700K) at Test Current, Junction Temperature = 85°C

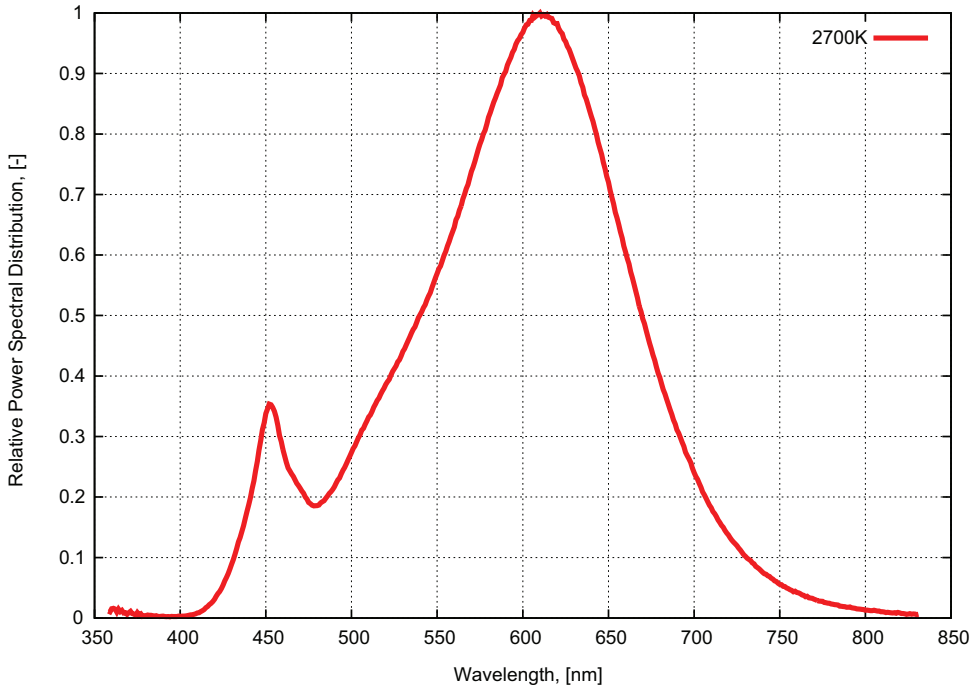


Figure 2. Color spectrum of LXV8-PW27-x0xx, 2700K emitters, integrated measurement.

LXV8-PW30 (3000K) at Test Current, Junction Temperature = 85°C

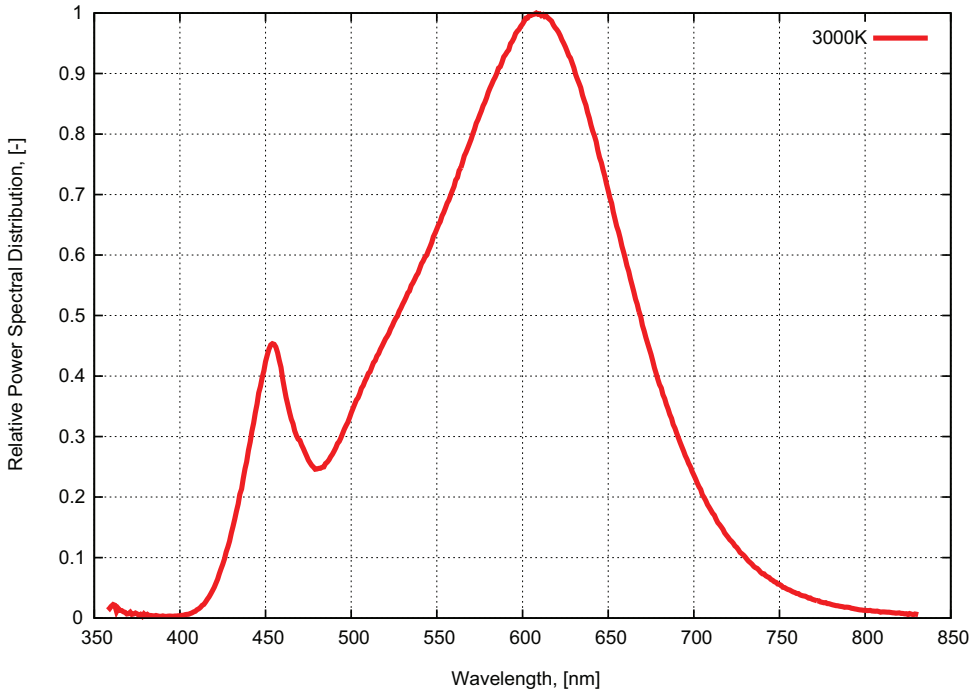


Figure 3. Color spectrum of LXV8-PW30-x0xx, 3000K emitters, integrated measurement.

LXV8-PW40 (4000K) at Test Current, Junction Temperature = 85°C

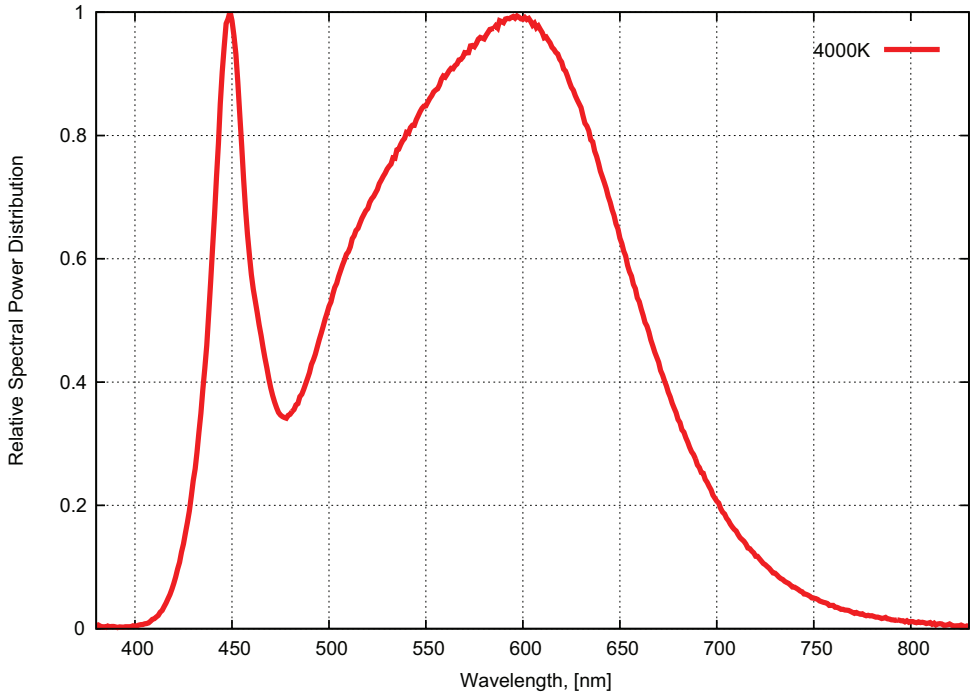


Figure 4. Color spectrum of LXV8-PW40-x0xx, 4000K emitters, integrated measurement.

Light Output Characteristics over Temperature and Current

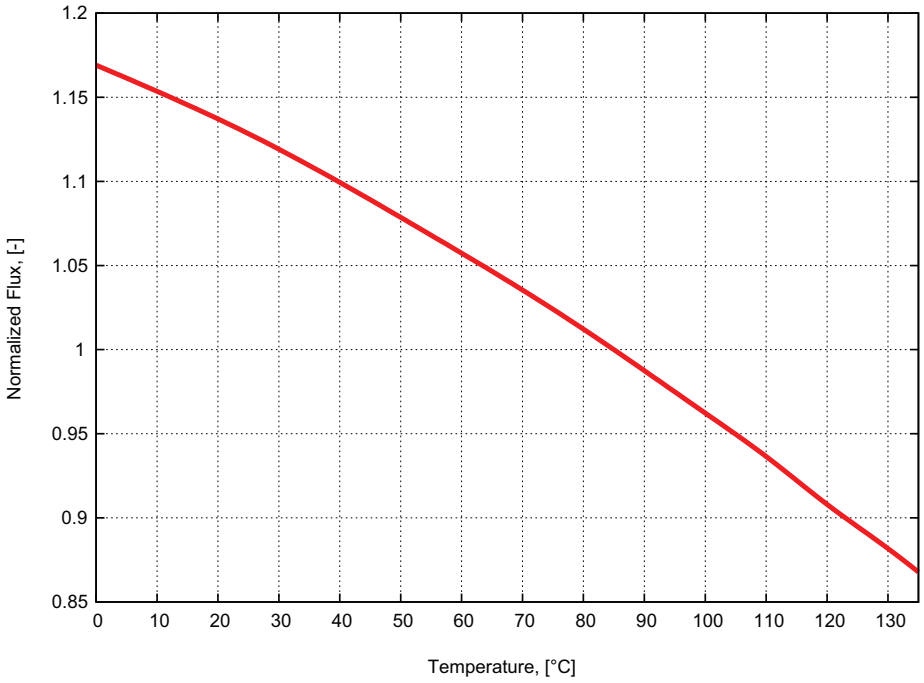


Figure 5. Relative flux vs. junction temperature at test current, applicable to LXV8-PW27-x0xx and LXV8-PW30-x0xx.

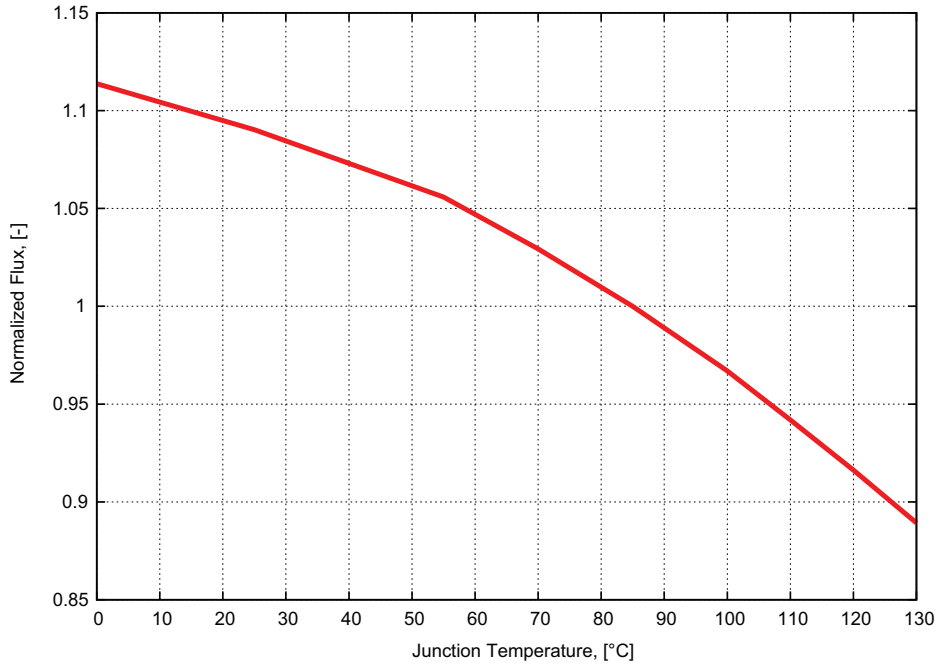


Figure 6. Relative flux vs. junction temperature at test current, applicable to LXV8-PW40-x0xx.

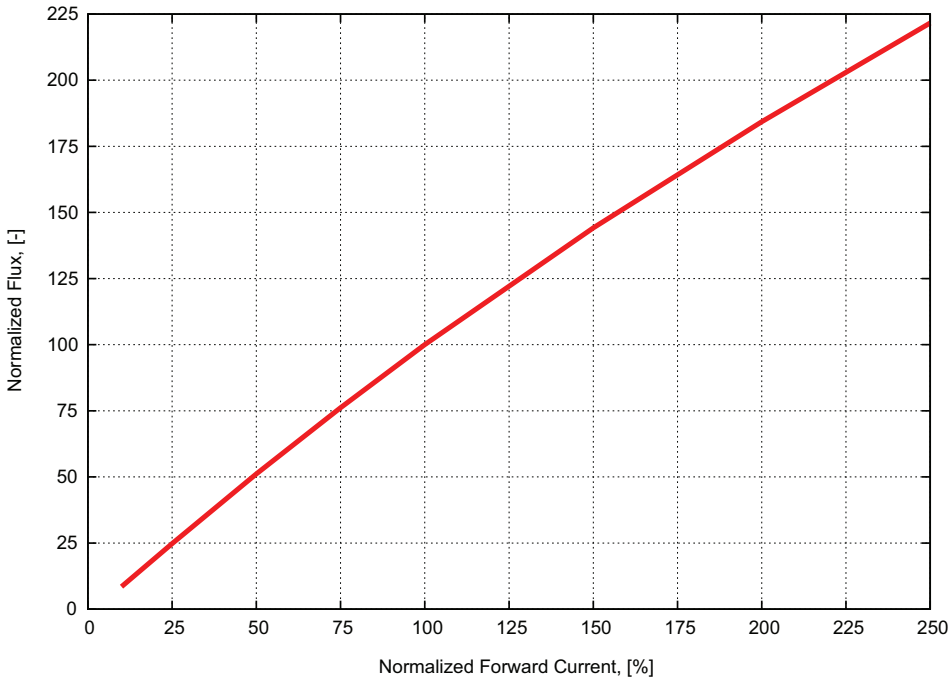


Figure 7. Typical relative luminous flux vs. relative current, normalized at test current, junction temperature = 85°C, applicable to LXV8-PW27-x0xx and LXV8-PW30-x0xx.

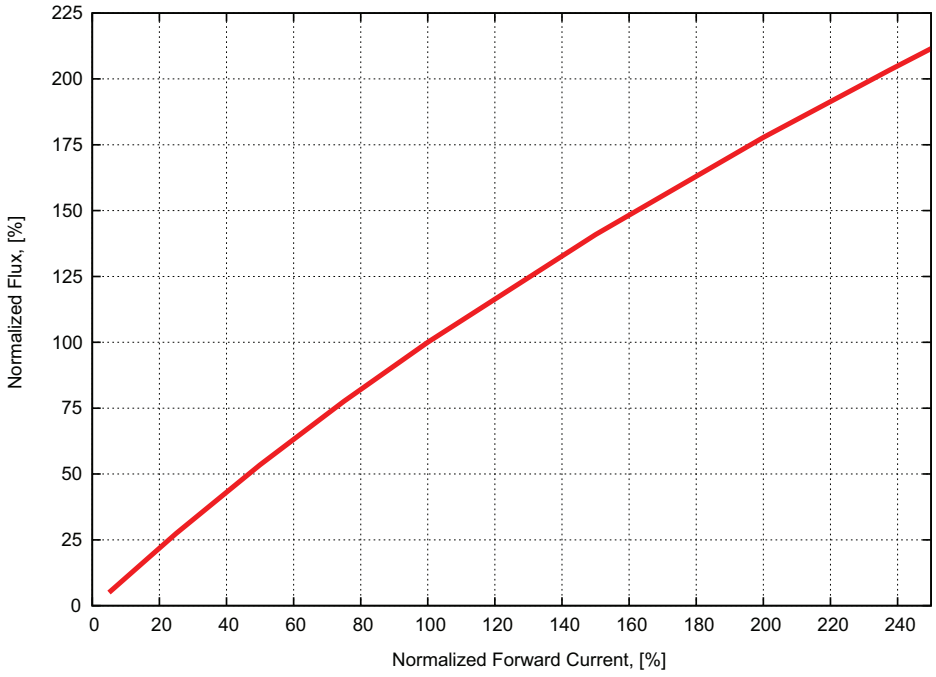


Figure 8. Typical relative luminous flux vs. relative current, normalized at test current, junction temperature = 85°C, applicable to LXV8-PW40-x0xx.

Typical Forward Current Characteristics

Thermal Pad Temperature = 85°C

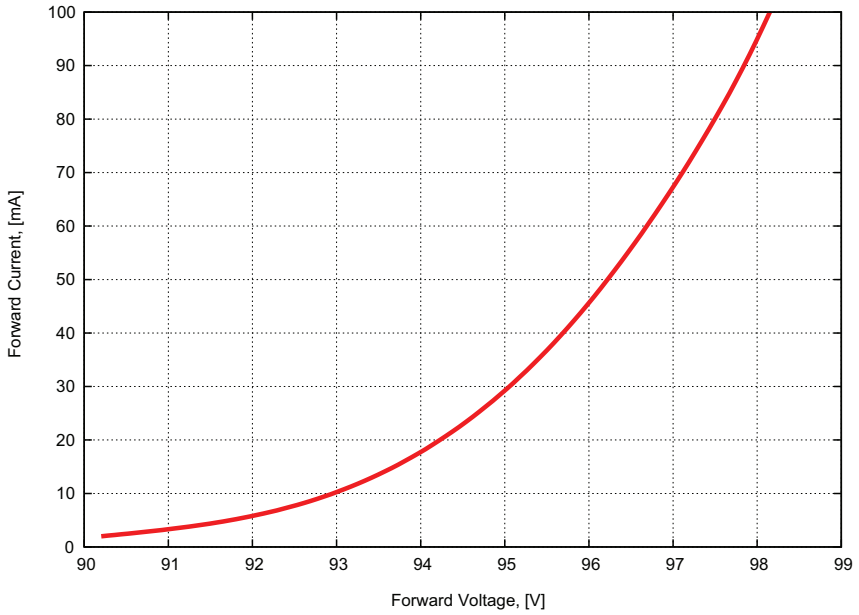


Figure 9. Forward voltage vs. forward current, applicable to LXV8-PWxx-x01x.

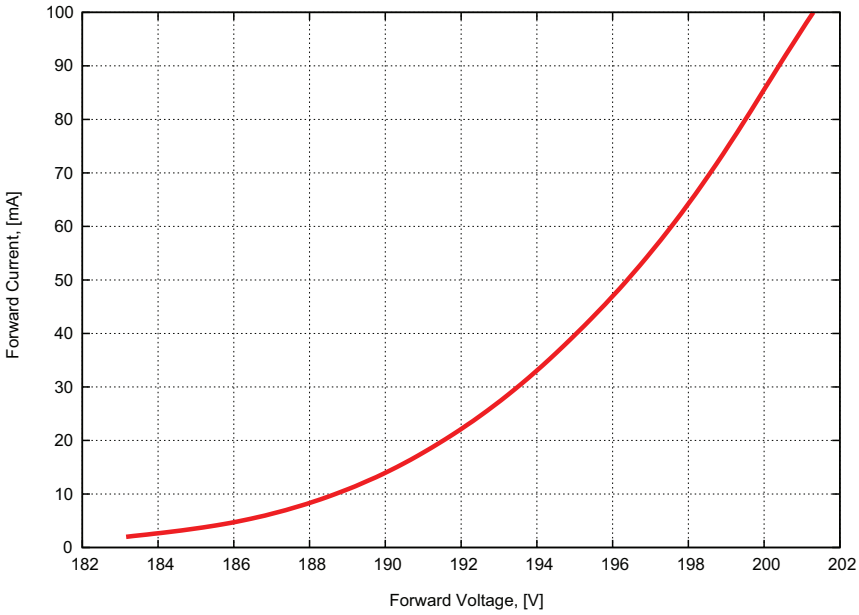


Figure 10. Forward voltage vs. forward current, applicable to LXV8-PWxx-x02x.

Current Derating Curves

Current Derating Curve for LUXEON H Emitters

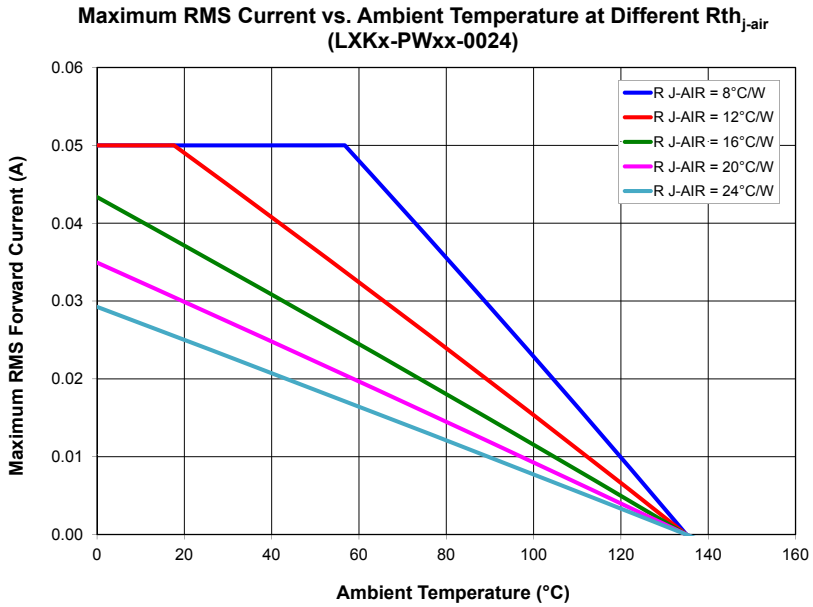


Figure 11. Relative forward current vs. heat sink temperature, based on T_{JMAX} = 150°C. For example, 100% relative forward current for LXV8-PW30-0014 is 40 mA.

Typical Radiation Patterns

Typical Spatial Radiation Patter for LUXEON H White 4 Emitter (LXVx-PWxx-x0x4)

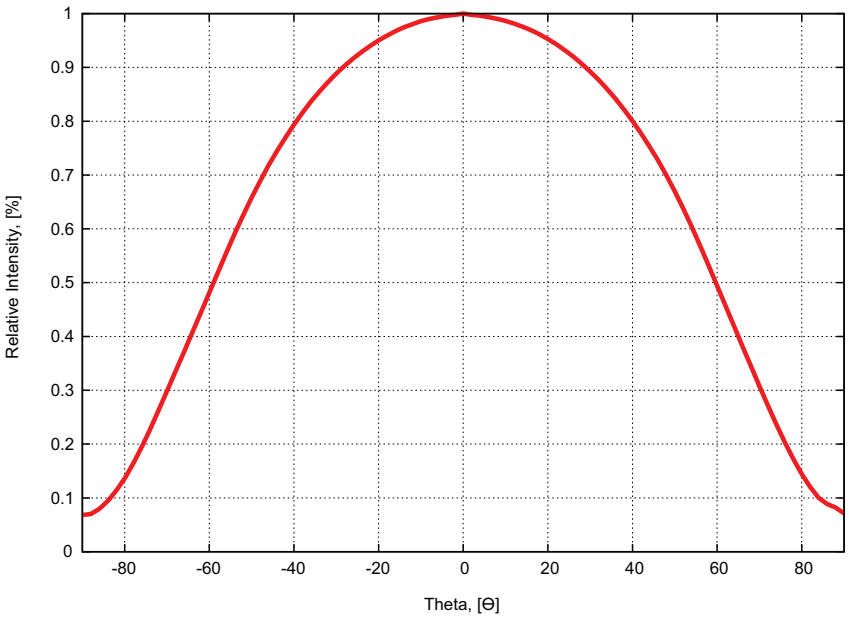


Figure 12. Typical spatial radiation pattern for LUXEON H White 4 emitter (LXV8-PWxx-x0x4).

Typical Polar Radiation Patter for LUXEON H White 4 Emitter (LXVx-PWxx-x0x4)

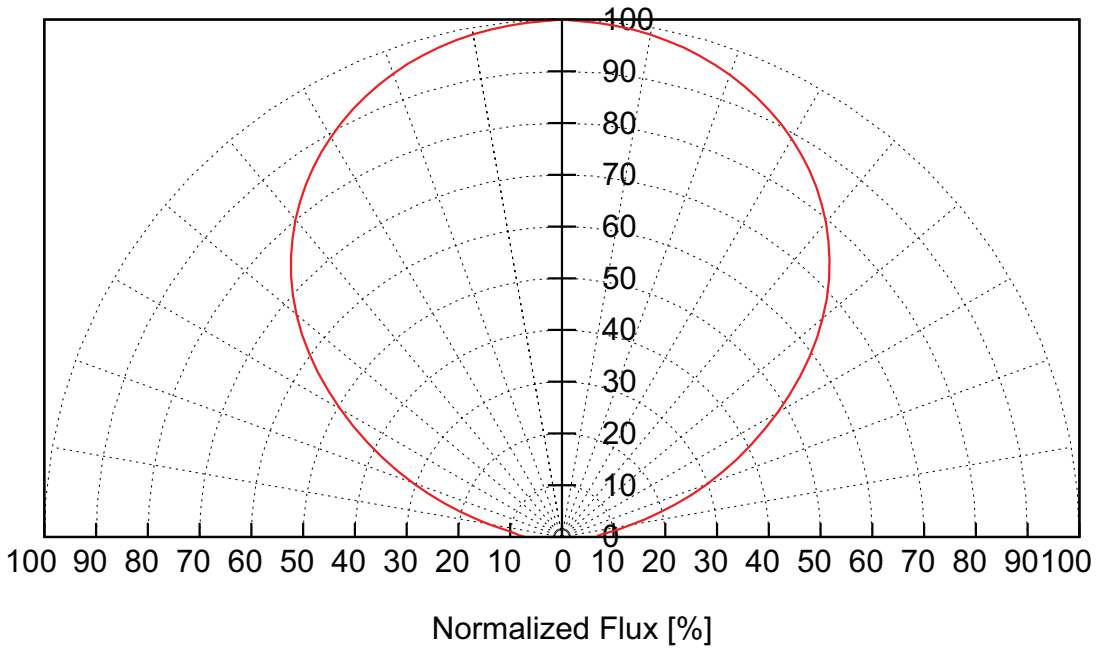


Figure 13. Typical polar radiation pattern for LUXEON H White 4 emitter (LXV8-PWxx-x0x4).

Typical Spatial Radiation Patter for LUXEON H White 2 Emitter (LXV8-PWxx-x012)

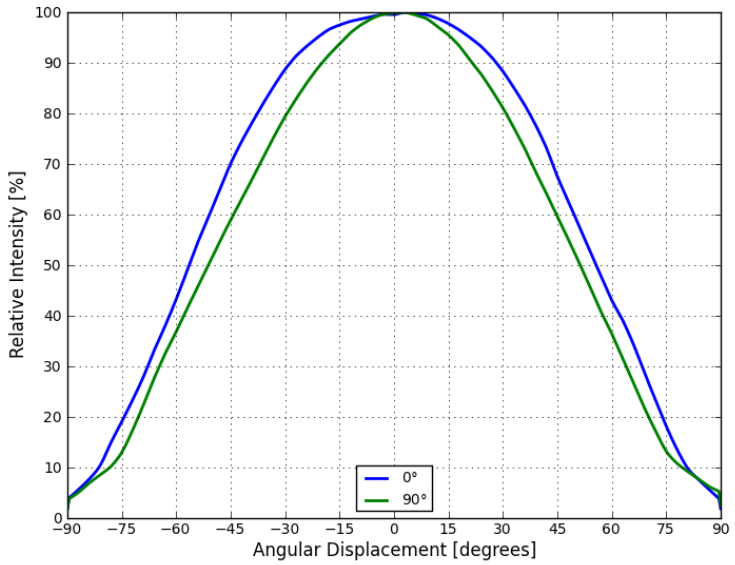


Figure 14. Typical spatial radiation pattern for LUXEON H white 2 emitter (LXV8-PWxx-x012).

Typical Polar Radiation Pattern for LUXEON H White 2 Emitter (LXV8-PWxx-x012)

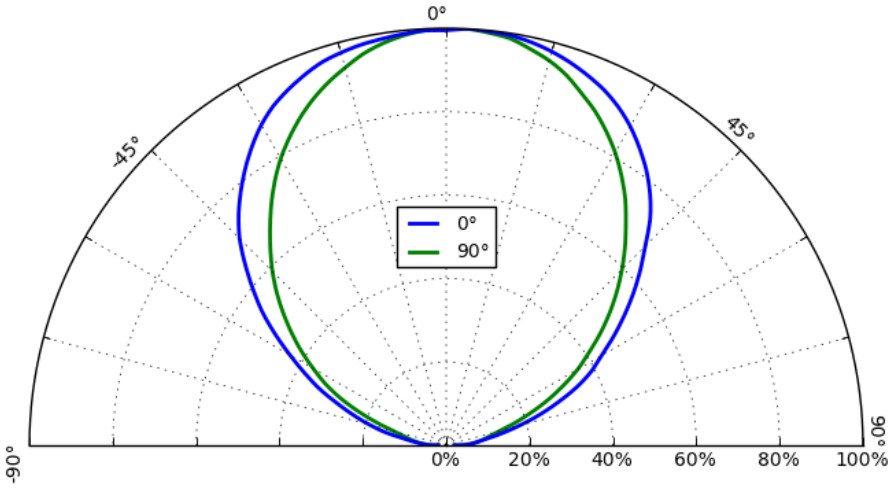


Figure 15. Typical polar radiation pattern for LUXEON H white 2 emitter (LXV8-PWxx-x012).

Typical Spatial Radiation Patter for LUXEON H Royal Blue 4 Emitter (LXV0-PR00-x0x4)

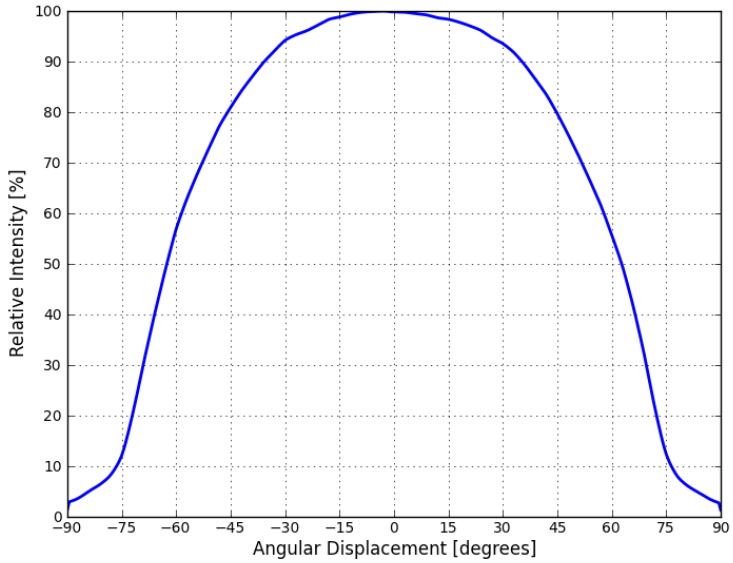


Figure 16. Typical spatial radiation pattern for LUXEON H royal blue 4 emitter (LXV0-PR00-10x4).

Typical Polar Radiation Pattern for LUXEON H Royal Blue 4 Emitter (LXV0-PR00-x0x4)

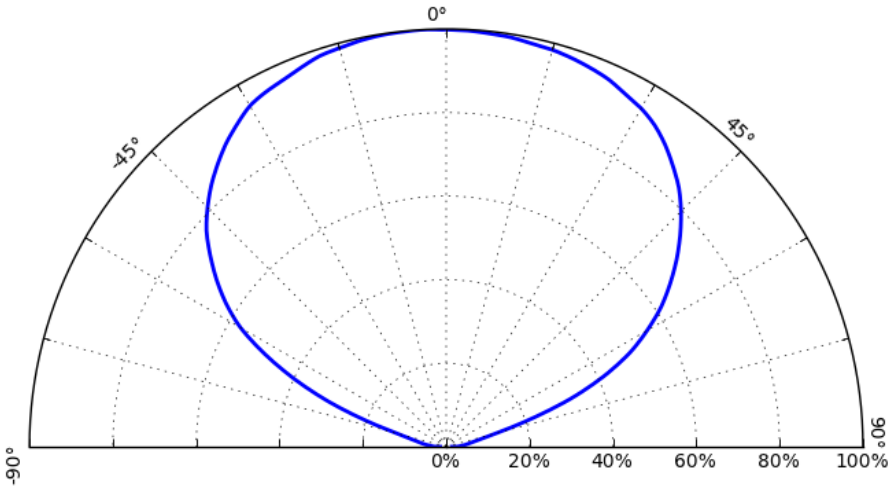


Figure 17. Typical polar radiation pattern for LUXEON H royal blue 4 emitter (LXV0-PR00-10x4).

Typical Spatial Radiation Patter for LUXEON H Royal Blue 2 Emitter (LXV0-PR00-x012)

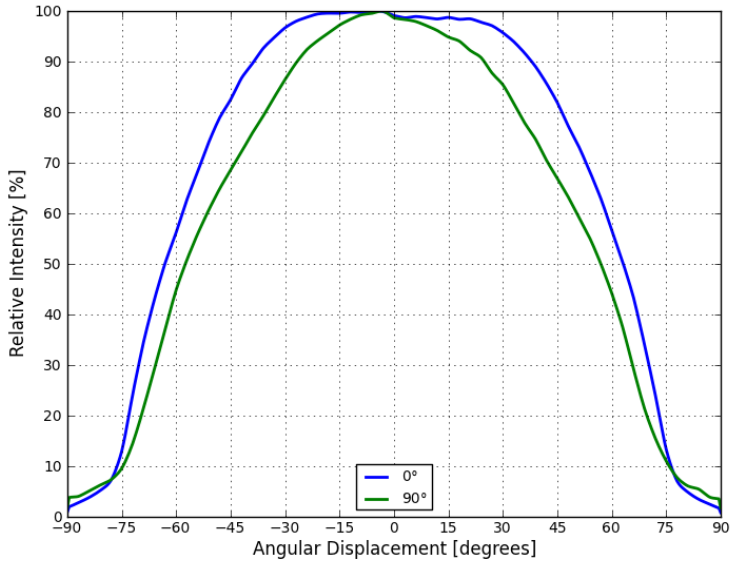


Figure 18. Typical spatial radiation pattern for LUXEON H royal blue 2 emitter (LXV0-PR00-x012).

Typical Polar Radiation Pattern for LUXEON H Royal Blue 2 Emitter (LXV0-PR00-x012)

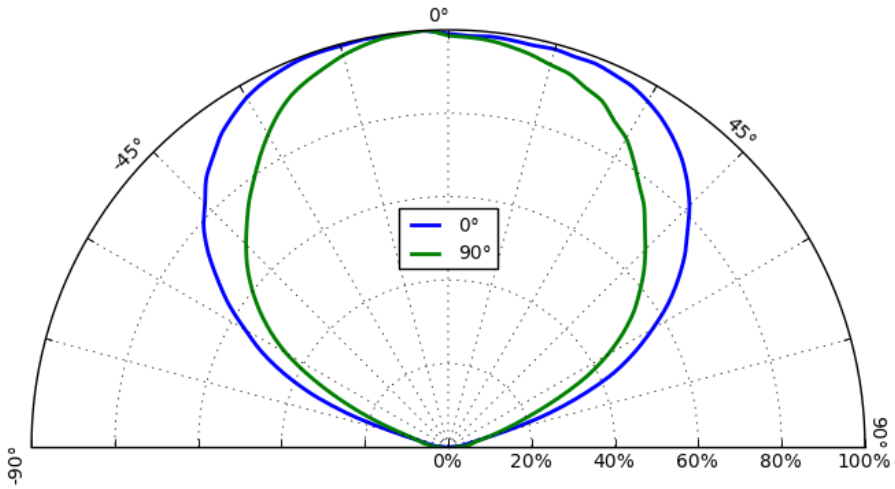


Figure 19. Typical polar radiation pattern for LUXEON H royal blue 2 emitter (LXV0-PR00-x012).

Final Packaging

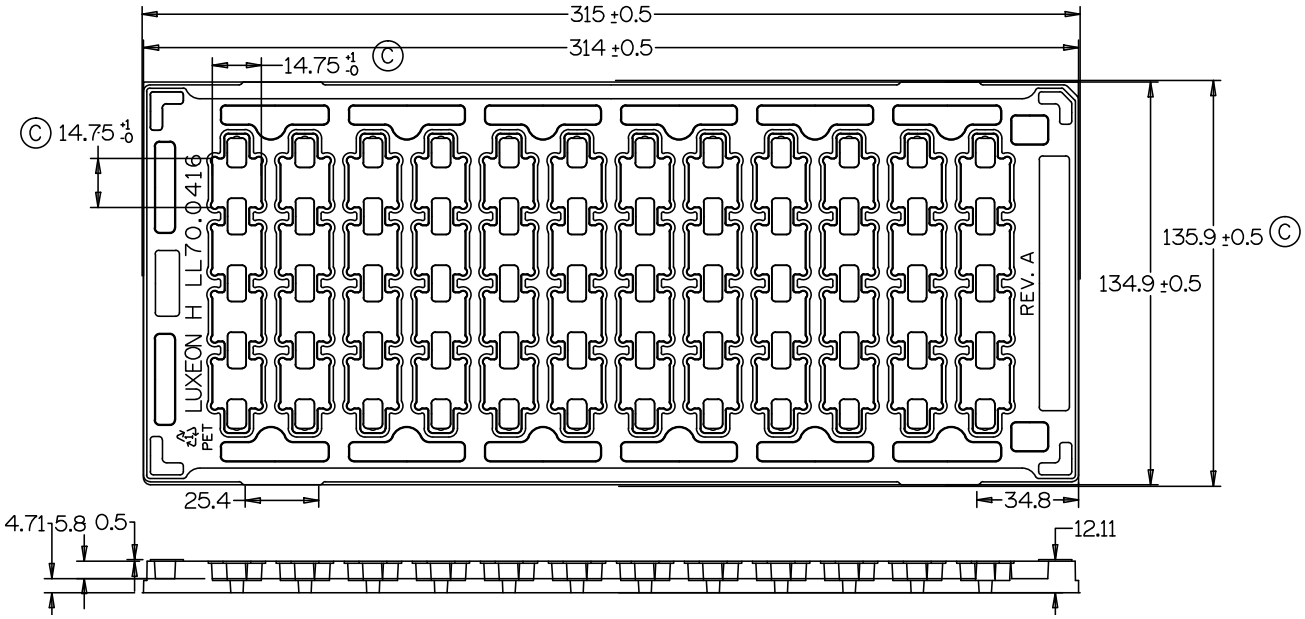


Figure 20. Packing tray for LUXEON H.

Product Binning and Labeling

LUXEON H is a single flux, forward voltage and color bin product. Please refer to table 1 and table 4 for limits and typical for flux and Vf. The color bin structure for LUXEON H is explained on page 21.

LUXEON H Bin Structure

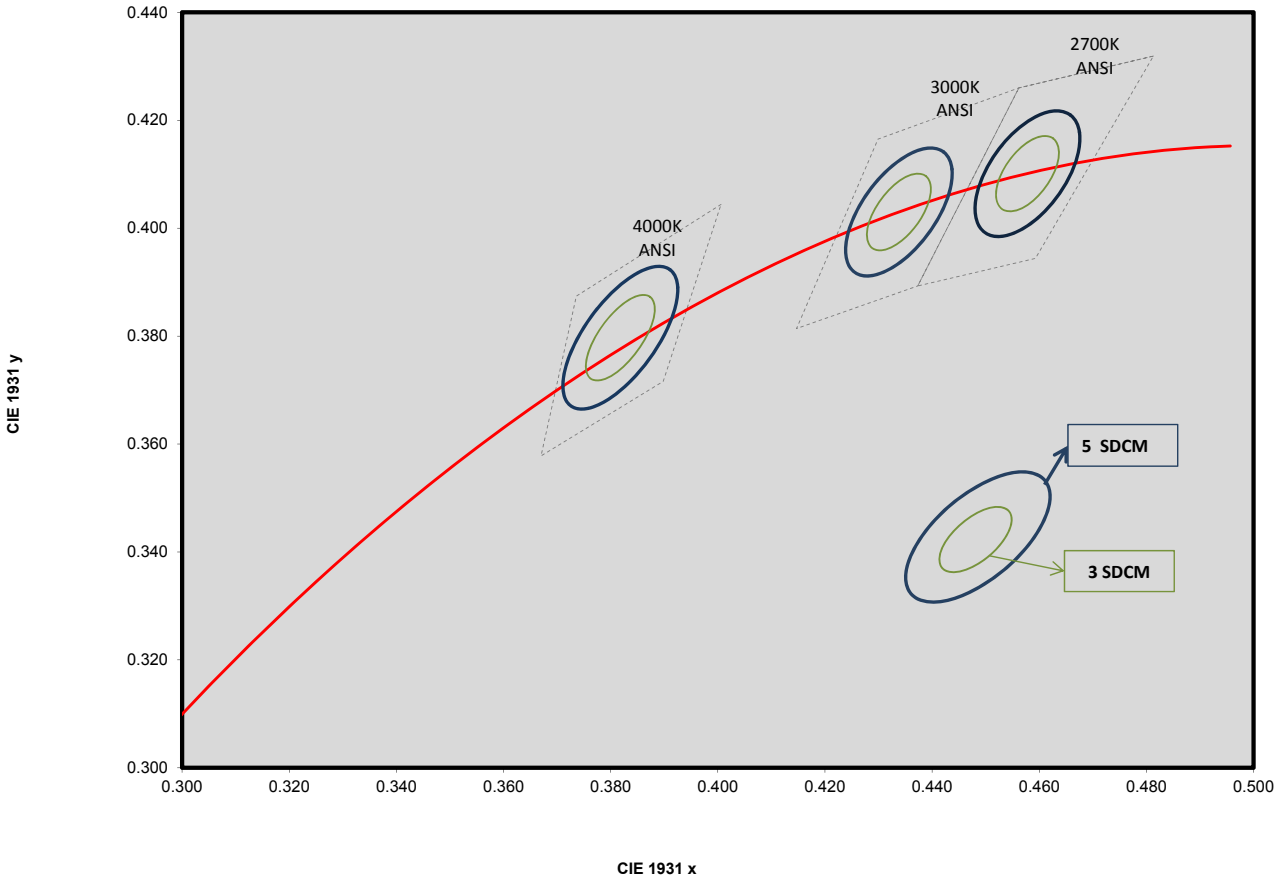


Figure 21. LUXEON H 2700K, 3000K, and 4000K 3-step and 5-step MacAdam ellipse color definition.

Table 10. LUXEON H 3-tep and 5-step MacAdam Ellipse Color Definition

	2700K	3000K	4000K
Center Point (cx, cy) [1]	(0.4578, 0.4101)	(0.4338, 0.4030)	(0.3818,0.3797)
3-step MacAdam major axis, a [1]	0.00810	0.00834	0.00939
3-step MacAdam minor axis, b [1]	0.00420	0.00408	0.00402
5-step MacAdam major axis, a [1]	0.01350	0.01390	0.01565
5-step MacAdam minor axis, b [1]	0.00700	0.00680	0.00670
Ellipse rotation angle	53.7°	53.22°	53.72°

Notes for Table 10:

1. Philips Lumileds maintains a tester tolerence of ± 0.005 on x, y color coordinates.

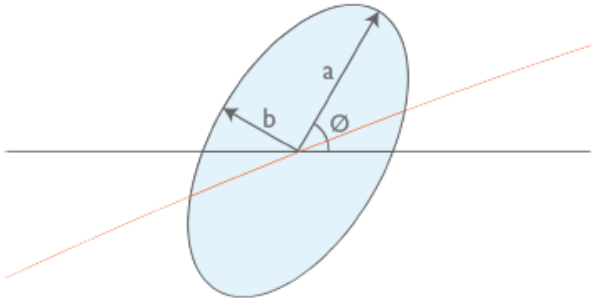


Figure 15. Color bin structure of LXV8-PWxx-x0xx.

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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.

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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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