



## LUXEON K

Easy to use array solutions  
for omni-directional  
applications requiring  
high flux and efficacy

Technical Datasheet DS102

**LUXEON**  
NEVER BEFORE POSSIBLE



# LUXEON K

## High Efficiency Arrays

### Introduction

The LUXEON® K arrays in this datasheet deliver high flux at high efficacy in a small, easy to use package. The high efficiency delivers high light output in thermally constrained systems like retrofit lamps and high efficiency in systems like downlights aiming for high energy efficiency. The small size bolt down package enables simple assembly in space constrained systems. LUXEON K is specified at real world operating conditions,  $T_j$  85°C. With Freedom From Binning, every LUXEON K falls within a single 3 McAdam ellipse positioned around the center point of the ANSI nominal CCT bins to deliver tight Correlated Color Temperature control to ensure consistency in system color point. In addition, these parts deliver the lumen maintenance and reliability that all LUXEON LEDs are renowned for. This document contains the performance data needed to design and engineer LUXEON K based applications.

LUXEON K,

- Family of modules covering 400 to over 2000 lumens
- *Freedom From Binning* with single 3 step MacAdam ellipse color performance
- Exceed ENERGY STAR® lumen maintenance requirements
- High efficacy for sustainable design
- Simplifies system design/assembly
- Guaranteed performance at 350 mA, 85°C.

**PHILIPS**  
**LUMILEDS**

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# General Information

## Product Nomenclature

LUXEON K products are specified and binned “hot” under conditions comparable to those found in “real-world” lighting products. The test conditions are at 350 mA D.C. with junction temperature at 85°C.

The part number designation is explained as follows:

L X K A - P B C D - E F G H

Where:

- A — designates minimum CRI performance (value 8 = 80 minimum, value 9 = 90 minimum)
- B — designates color (value W = White)
- C, D — designates nominal ANSI CCT (value 27 = 2700K, 30 = 3000K, 35 = 3500K, 40 = 4000K, and 50 = 5000K)
- E, F — custom spec designation
- G, H — emitter count

Therefore, 3000K products specified at 350 mA 85°C follow the part numbering scheme:

L X K 8 - P W 3 0 - 0 0 0 4 for LUXEON K 3000K 4-up

L X K 8 - P W 3 0 - 0 0 0 8 for LUXEON K 3000K 8-up

## 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 K products will deliver, on average, 70% lumen maintenance (L70) at 50,000 hours of operation at a forward current of up to 700 mA. This projection is based on constant current operation with junction temperature maintained at or below 125°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 K 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 K: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

# Product Selection

## Product Selection Guide for LUXEON K, Junction Temperature = 85°C, Current = 350 mA

Table 1.

Nominal CCT	Emitter Count	Part Number	Minimum CRI	Typical CRI	Minimum Flux (lm) (350 mA)	Typical Flux (lm) (350 mA)	Maximum Flux (lm) (350 mA)
2700K	4	LXK8-PW27-0004	80	85	310	345	TBD
2700K	8	LXK8-PW27-0008	80	85	680	690	TBD
2700K	12	LXK8-PW27-0012	80	85	990	1045	TBD
2700K	16	LXK8-PW27-0016	80	85	1380	1395	TBD
2700K	24	LXK8-PW27-0024	80	85	1960	2090	TBD
3000K	4	LXK8-PW30-0004	80	85	330	370	TBD
3000K	8	LXK8-PW30-0008	80	85	730	740	TBD
3000K	12	LXK8-PW30-0012	80	85	1070	1125	TBD
3000K	16	LXK8-PW30-0016	80	85	1475	1500	TBD
3000K	24	LXK8-PW30-0024	80	85	2100	2250	TBD
4000K	4	LXK8-PW40-0004	80	85	355	410	TBD
4000K	8	LXK8-PW40-0008	80	85	800	815	TBD
4000K	12	LXK8-PW40-0012	80	85	1175	1240	TBD
4000K	16	LXK8-PW40-0016	80	85	1620	1650	TBD
4000K	24	LXK8-PW40-0024	80	85	2300	2475	TBD

Notes for Table 1:

- Philips Lumileds maintains a tolerance of  $\pm 6.5\%$  on luminous flux and  $\pm 2$  on CRI measurements.
- LUXEON K products with even higher luminous flux levels will become available in the future. Please consult Philips Lumileds or Future Lighting Solutions for more information.

# Optical Characteristics

## LUXEON K at Test Current <sup>[1]</sup>, Junction Temperature = 85°C

Table 2.

Part Number	Nominal CCT	Color Temperature <sup>[2]</sup> CCT Typical	Typical Total Included Angle <sup>[3]</sup> (degrees) $\theta_{90V}$	Typical Viewing Angle <sup>[4]</sup> $2\theta_{1/2}$ (degrees)
LXKx-PW27-xxxx	2700K	2725K	125	100
LXKx-PW30-xxxx	3000K	3045K	125	100
LXKx-PW40-xxxx	4000K	3985K	125	100

Notes for Table 2:

1. Test current is 350 mA for all LXKx-PWxx 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  $\frac{1}{2}$  of the peak value.
4. All white products are built with Indium Gallium Nitride (InGaN).

# Electrical Characteristics

## Electrical Characteristics at 350 mA for LUXEON K, Junction Temperature = 85°C

Table 3.

Model	Forward Voltage $V_f$ <sup>[1]</sup> (V)			Typical Temperature Coefficient of Forward Voltage <sup>[2]</sup> (mV/°C) $\Delta V_f / \Delta T_j$	Typical Thermal Resistance Junction to Case <sup>[3]</sup> $R\theta_{j-c}$ (°C/W)
	Min.	Typ.	Max.		
LXKx-PWxx-xx04	10	10.5	11	-6.25	3.0
LXKx-PWxx-xx08	20	21	22	-12.5	1.5
LXKx-PWxx-xx12	30	31.5	33	-18.75	1.0
LXKx-PWxx-xx16	40	42	44	-25	0.75
LXKx-PWxx-xx24	60	63	66	-37.5	0.5

Notes for Table 3:

1. Philips Lumileds maintains a tolerance of  $\pm 0.06V$  per single emitter on forward voltage measurements. ( $\pm 0.24V$  for LXKx-PWxx-xx04,  $\pm 0.48V$  for LXKx-PWxx-xx08,  $\pm 0.72V$  for LXKx-PWxx-xx12,  $\pm 0.96V$  for LXKx-PWxx-xx16, and  $\pm 1.44V$  for LXKx-PWxx-xx24).
2. Measured between  $T_j = 25^\circ C$  and  $T_j = 110^\circ C$  at  $I_f = 350$  mA.
3. Junction temperature to back of the PCB.

## Typical Electrical Characteristics at 700 mA for LUXEON K, Junction Temperature = 85°C

Table 4.

Model	Typical Forward Voltage $V_f$ (V)
LXKx-PWxx-xx04	11
LXKx-PWxx-xx08	22
LXKx-PWxx-xx12	33
LXKx-PWxx-xx16	44
LXKx-PWxx-xx24	66

Notes for Table 4:

1. Philips Lumileds maintains a tolerance of  $\pm 0.5\%$  on forward voltage measurements.

## Absolute Maximum Ratings

**Table 5.**

Parameter	Maximum Performance
DC Forward Current (mA) <sup>[3]</sup>	1050
Peak Pulsed Forward Current (mA) <sup>[3]</sup>	1050
Average Forward Current (mA) <sup>[3]</sup>	1050
ESD Sensitivity	< 8000V Human Body Model (HBM) Class 3A JESD22-A114-E < 400V Machine Model (MM) Class B JESD22-A115-B
LED Junction Temperature <sup>[1]</sup>	125°C
Operating Case Temperature at 350 mA	-40°C - 125°C
Storage Temperature	-40°C - 125°C
Reverse Voltage (V <sub>r</sub> )	See Note 2

Notes for Table 5:

1. Proper current derating must be observed to maintain junction temperature below the maximum.
2. LUXEON Power LEDs are not designed to be driven in reverse bias.

## Electrical Lead Soldering Characteristics

Please refer to Application Brief for LUXEON® K.

# Mechanical Dimensions

## LXKx-PWxx-xx04

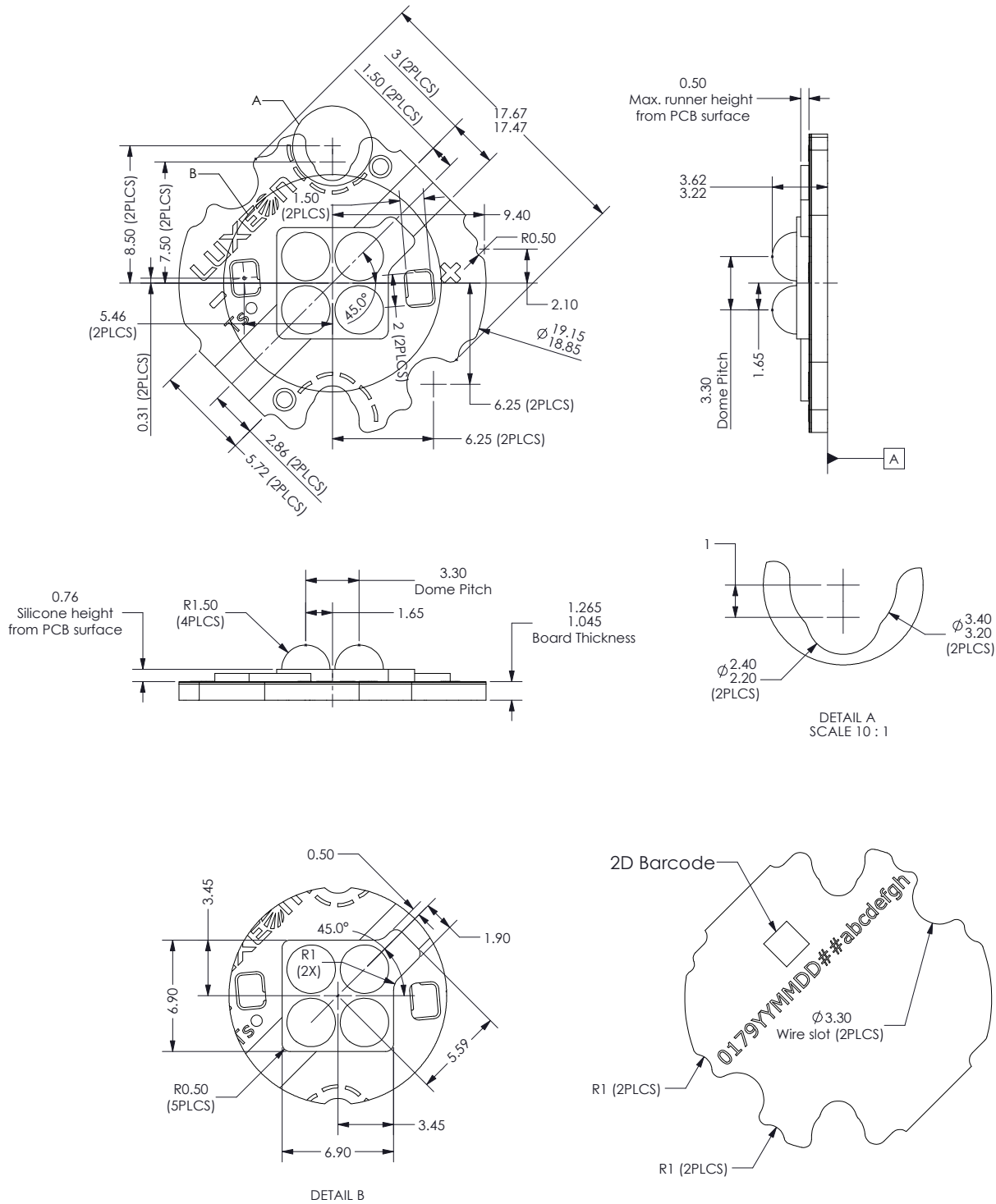


Figure I. Dimensions for LXK8-PW27-0004, LXK8-PW30-0004, LXK8-PW40-0004.

Note for Figure I:

- All dimensions are in millimeters.



# LXKx-PWxx-xx08

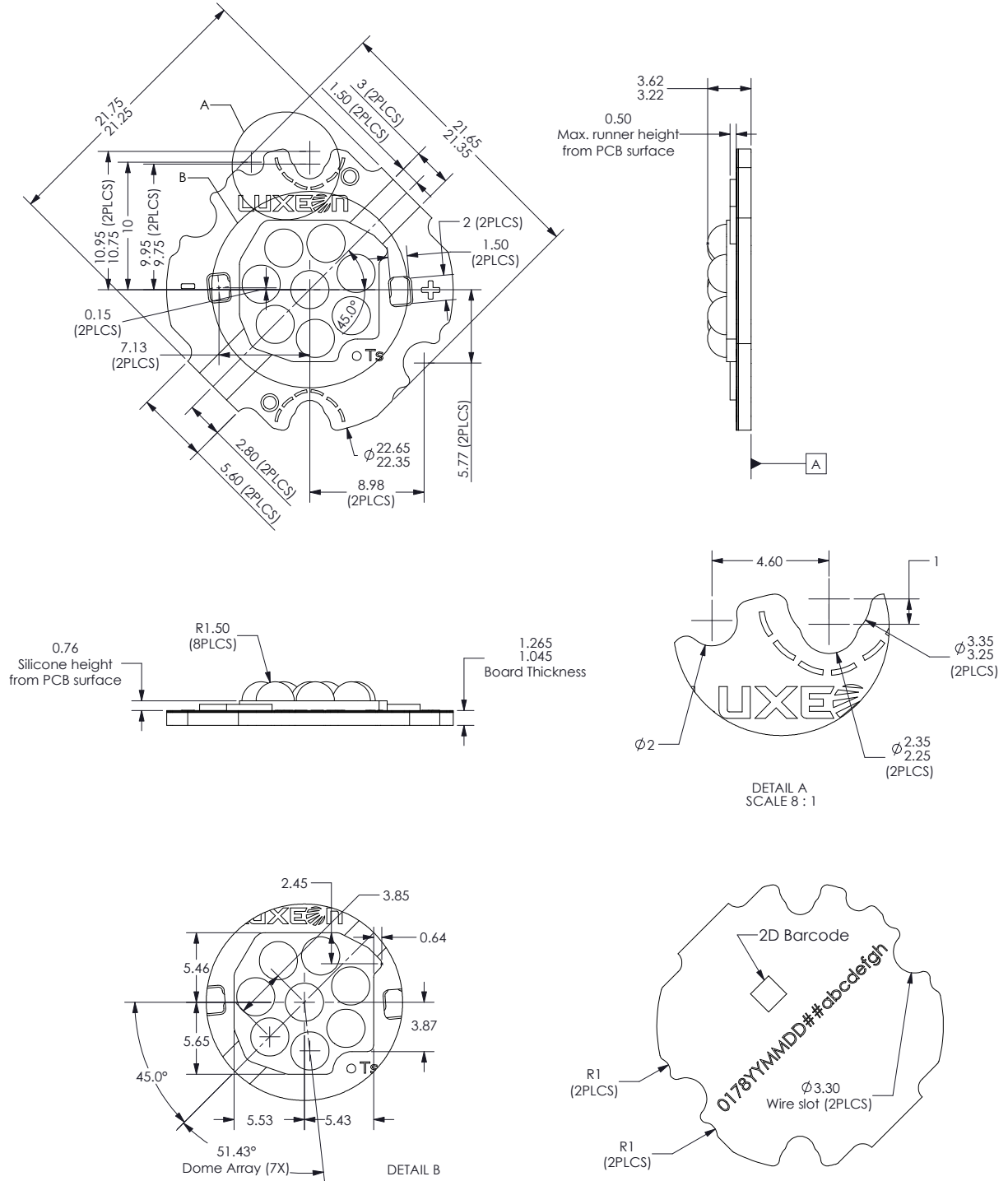


Figure 2. LXK8-PW27-0008, LXK8-PW30-0008, LXK8-PW40-0008.

Note for Figure 2:

- All dimensions are in millimeters.

# LXKx-PWxx-xx12

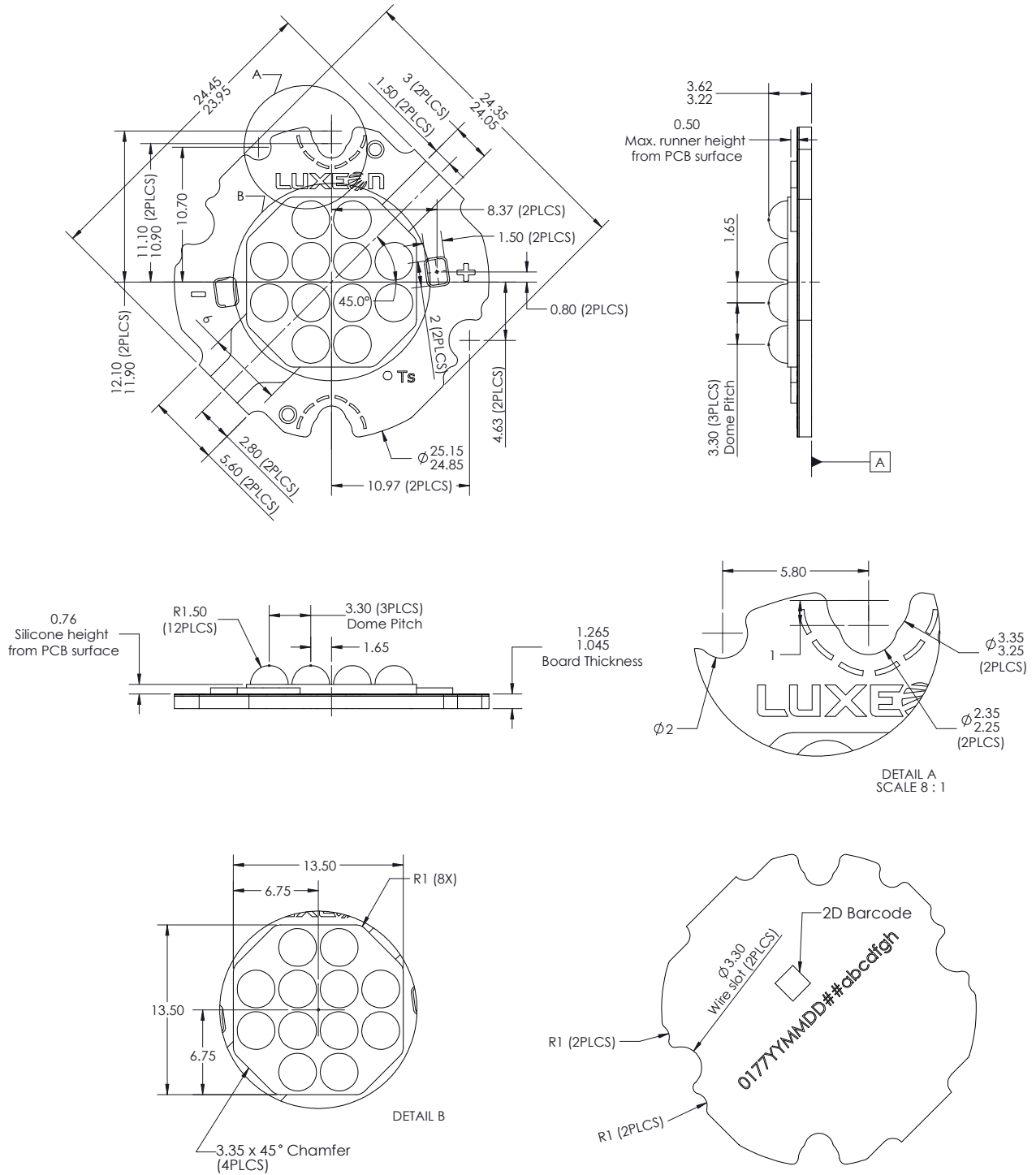


Figure 3. LXK8-PW27-0012, LXK8-PW30-0012, LXK8-PW40-0012.

Note for Figure 3:

- All dimensions are in millimeters.

# LXKx-PWxx-xx16

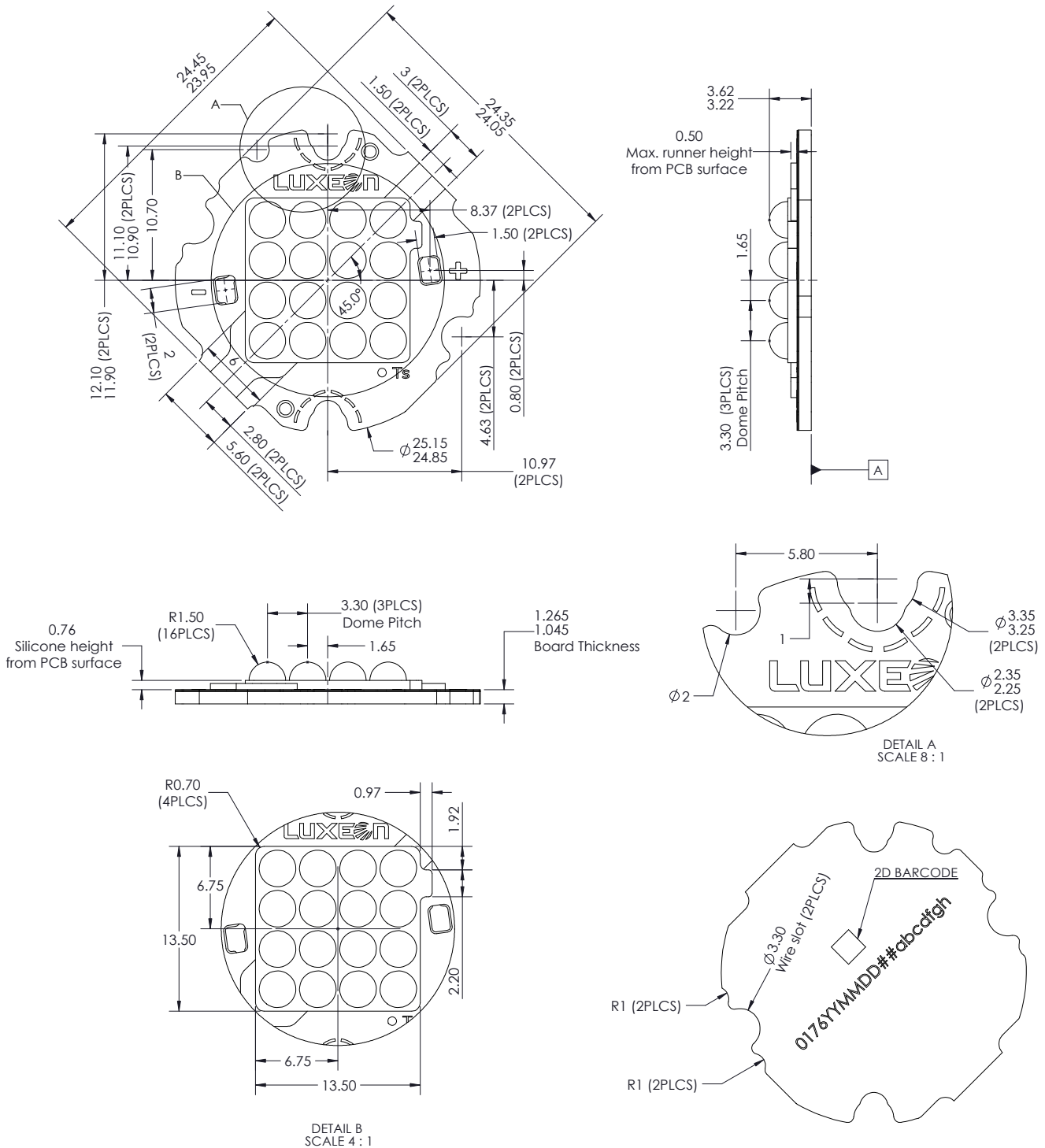


Figure 4. LXK8-PW27-0016, LXK8-PW30-0016, LXK8-PW40-0016.

Note for Figure 4:

- All dimensions are in millimeters.



# Relative Spectral Distribution vs. Wavelength Characteristics

LXK8-PW27-xxxx (2700K) at Test Current, Junction Temperature = 85°C

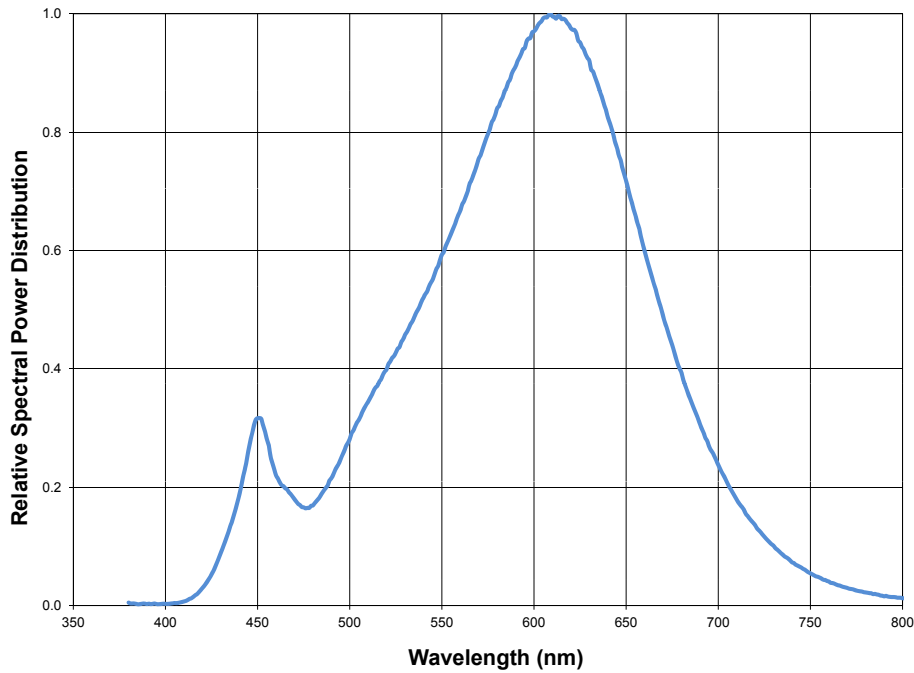


Figure 6. Color spectrum of LXK8-PW27-xxxx product, integrated measurement.

LXK8-PW30-xxxx (3000K) at Test Current, Junction Temperature = 85°C

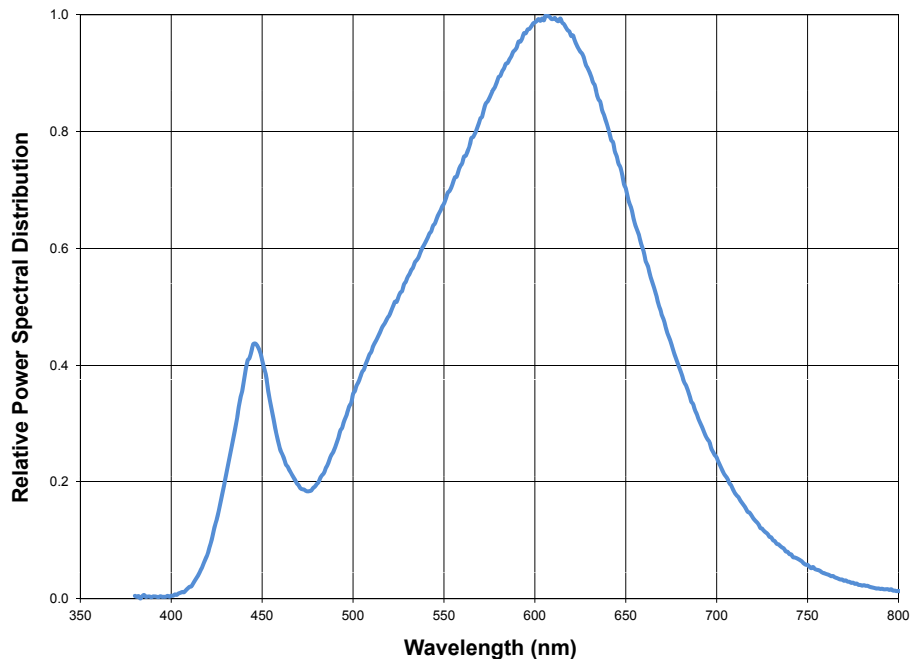


Figure 7. Color spectrum of LXK8-PW30-xxxx product, integrated measurement.

## LXK8-PW40-xxxx (4000K) at Test Current, Junction Temperature = 85°C

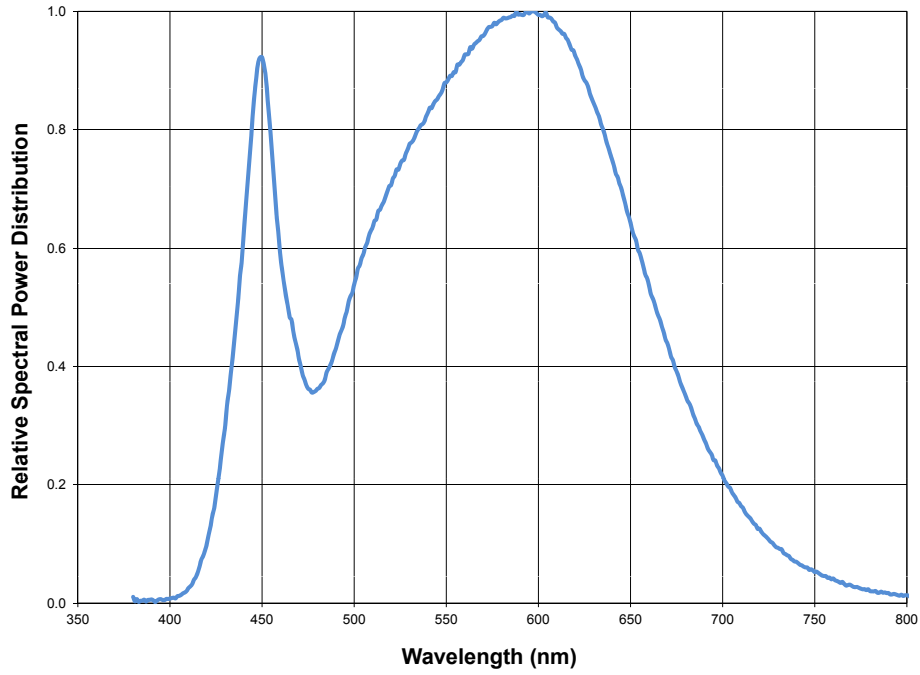


Figure 8. Color spectrum of LXK8-PW40-xxxx product, integrated measurement.

# Light Output Characteristics over Temperature

All LUXEON K products at Test Current, Normalized at 350 mA, 85°C

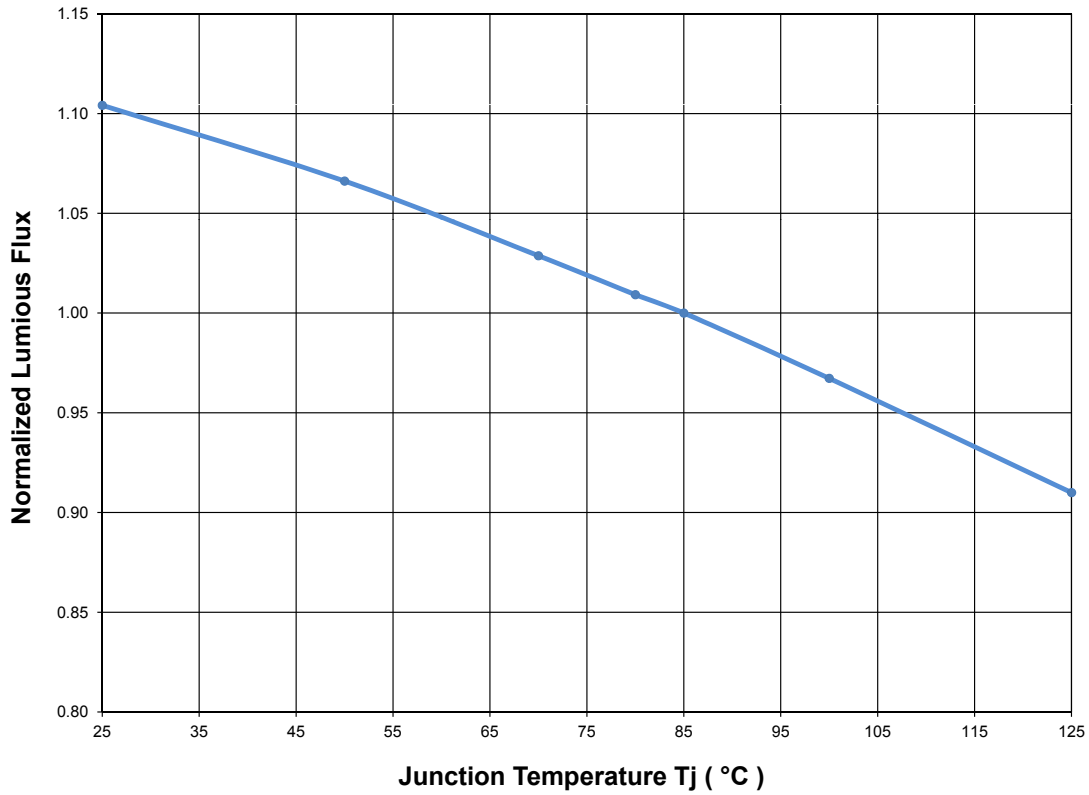


Figure 9. Typical relative flux vs. junction temperature at test current.

# Typical Forward Current Characteristics

## Typical Forward Current vs. Forward Voltage LUXEON K 4-up Products, Junction Temperature = 85°C

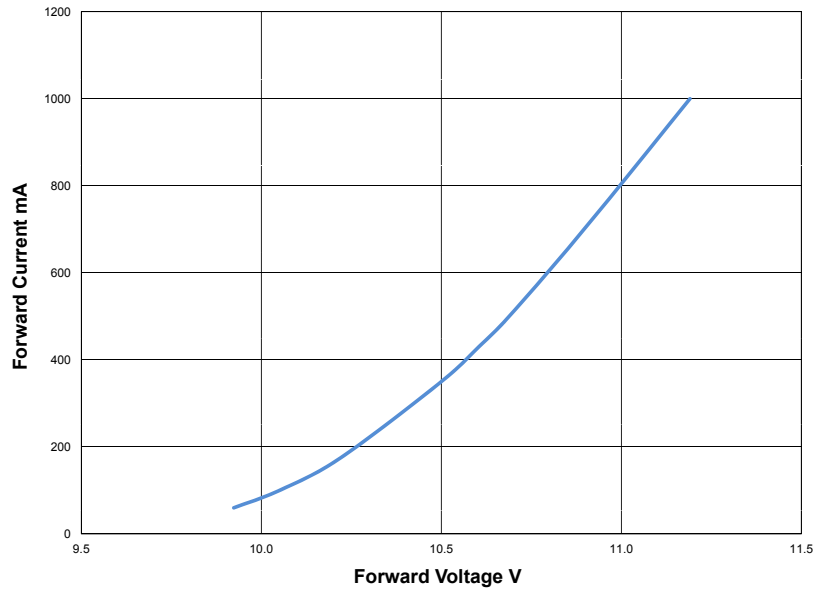


Figure 10. Forward current vs. forward voltage for LXX8-PW27-0004, LXX8-PW30-0004, LXX8-PW40-0004 4-up products.

## Typical Forward Current vs. Forward Voltage LUXEON K 8-up Products, Junction Temperature = 85°C

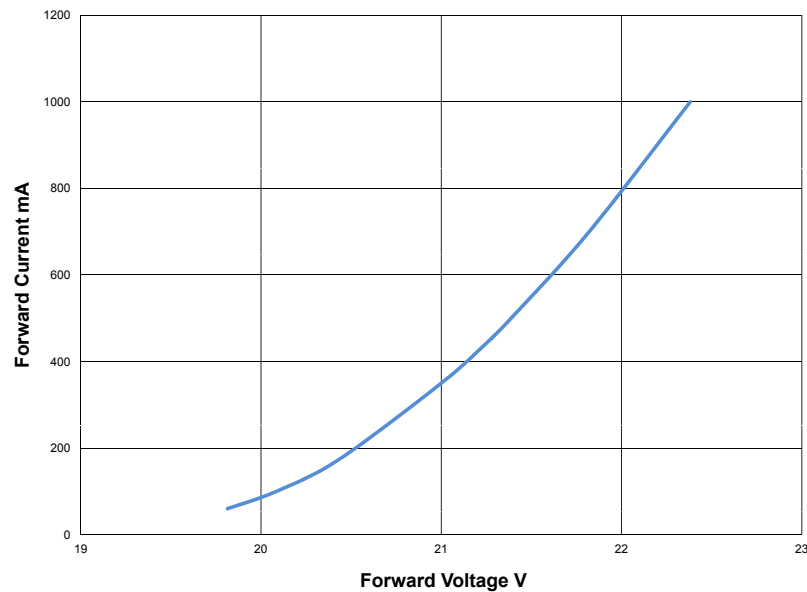


Figure 11. Forward current vs. forward voltage for LXX8-PW27-0008, LXX8-PW30-0008, LXX8-PW40-0008 8-up products.



## Typical Forward Current vs. Forward Voltage LUXEON K 12-up Products, Junction Temperature = 85°C

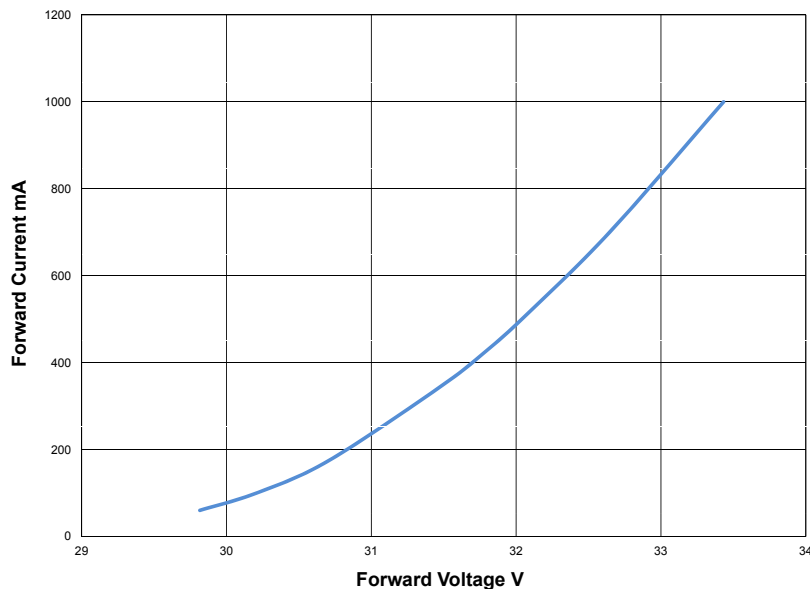


Figure 12. Forward current vs. forward voltage for LXX8-PW27-0012, LXX8-PW30-0012, LXX8-PW40-0012 12-up products.

## Typical Forward Current vs. Forward Voltage LUXEON K 16-up Products, Junction Temperature = 85°C

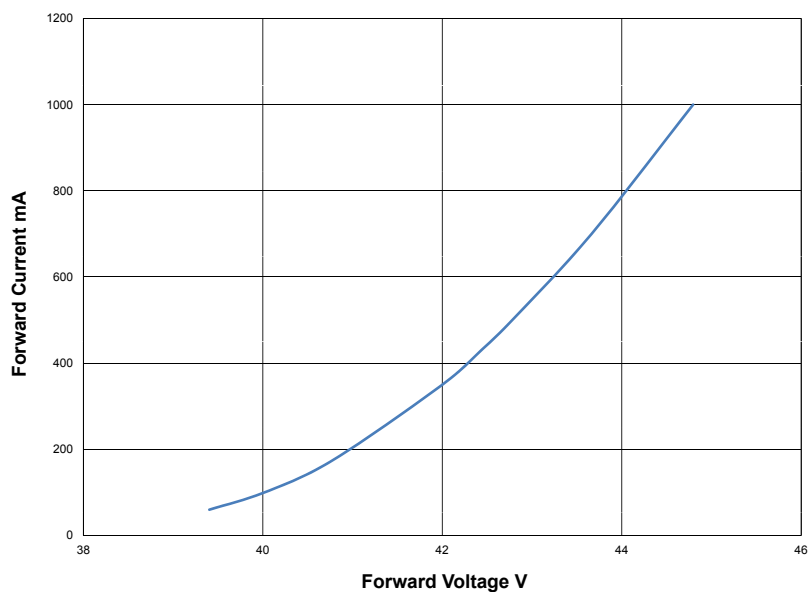


Figure 13. Forward current vs. forward voltage for LXX8-PW27-0016, LXX8-PW30-0016, LXX8-PW40-0016 16-up products.

## Typical Forward Current vs. Forward Voltage LUXEON K 24-up Products, Junction Temperature = 85°C

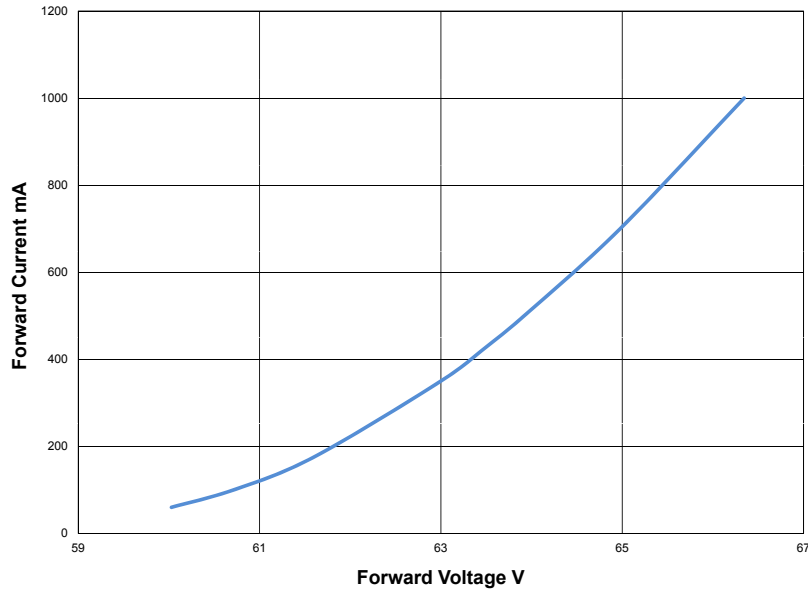


Figure 14. Forward current vs. forward voltage for LXX8-PW27-0024, LXX8-PW30-0024, LXX8-PW40-0024 24-up products.

## Typical Relative Luminous Flux vs. Forward Current for All LUXEON K Products at Junction Temperature 85°C

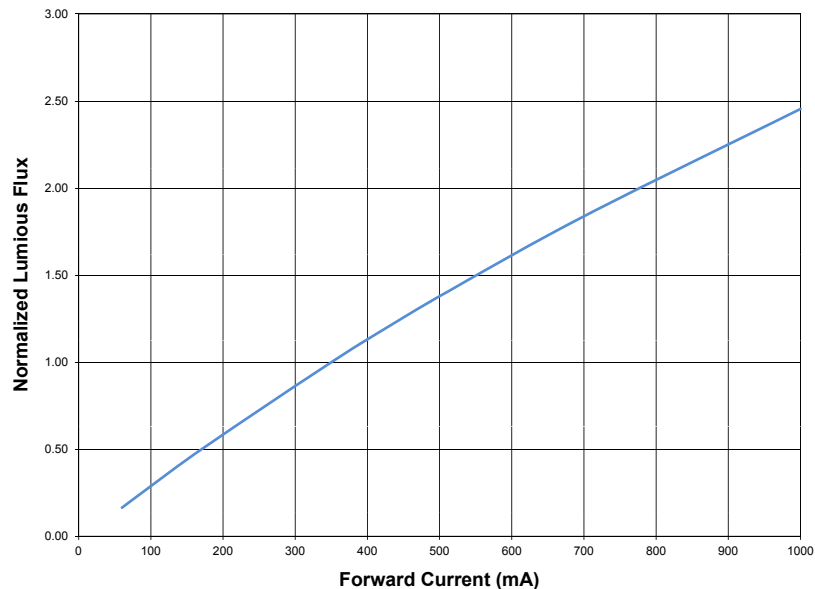


Figure 15. Typical relative luminous flux vs. forward current, junction temperature = 85°C.

# Current Derating Curves

## Current Derating Curve for IA Drive Current for 4-up LXK8-PW27-0004, LXK8-PW30-0004, LXK8-PW40-0004

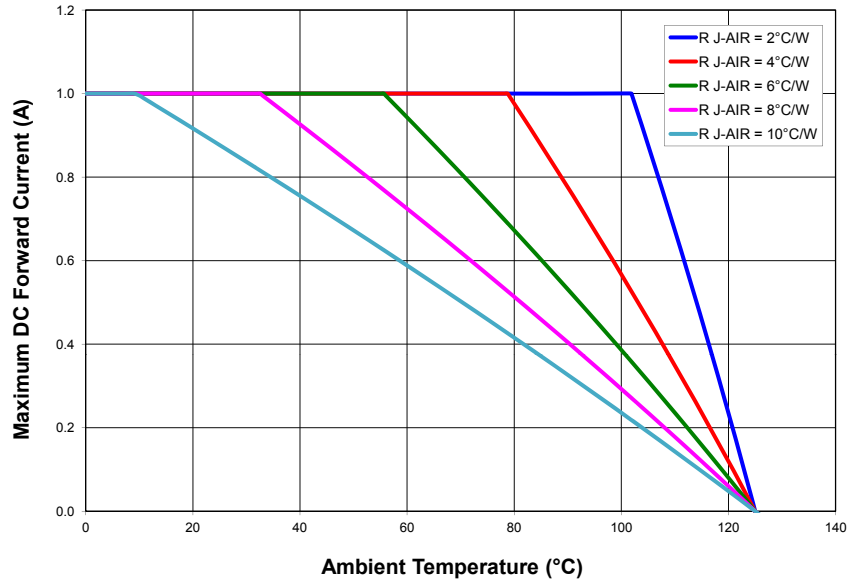


Figure 16. Maximum forward current vs. ambient temperature, based on  $T_{JMAX} = 125^{\circ}\text{C}$ .

## Current Derating Curve for IA Drive Current for 8-up LXK8-PW27-0008, LXK8-PW30-0008, LXK8-PW40-0008

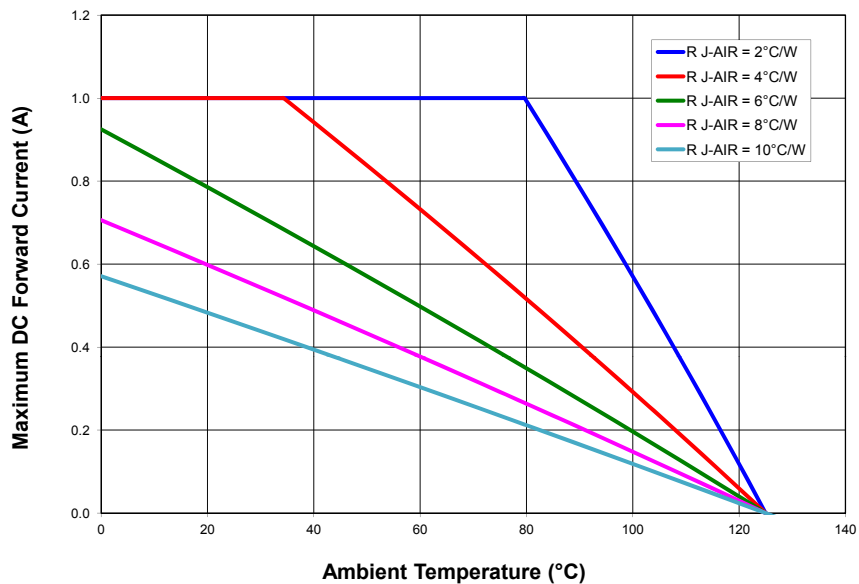


Figure 17. Maximum forward current vs. ambient temperature, based on  $T_{JMAX} = 125^{\circ}\text{C}$ .

## Current Derating Curve for IA Drive Current for I2-up LXK8-PW27-00I2, LXK8-PW30-00I2, LXK8-PW40-00I2

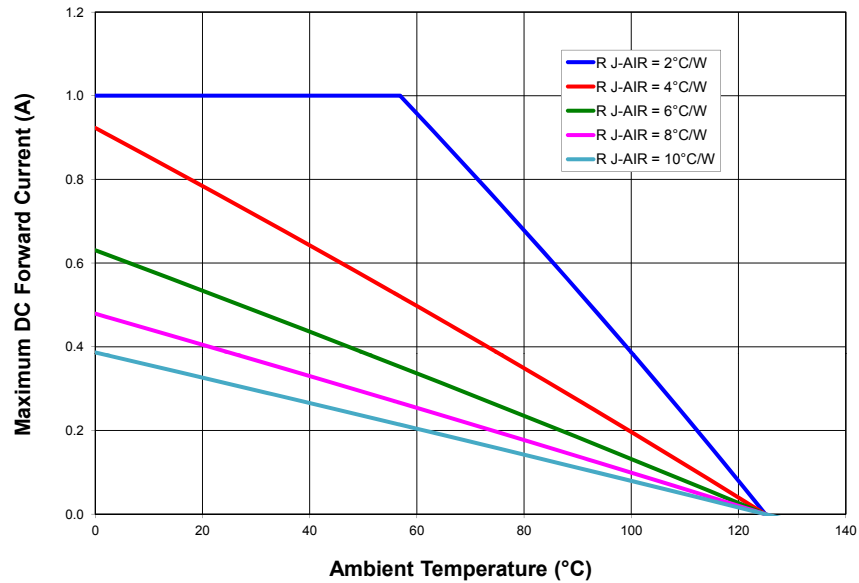


Figure 18. Maximum forward current vs. ambient temperature, based on  $T_{JMAX} = 125^{\circ}\text{C}$ .

## Current Derating Curve for IA Drive Current for I6-up LXK8-PW27-00I6, LXK8-PW30-00I6, LXK8-PW40-00I6

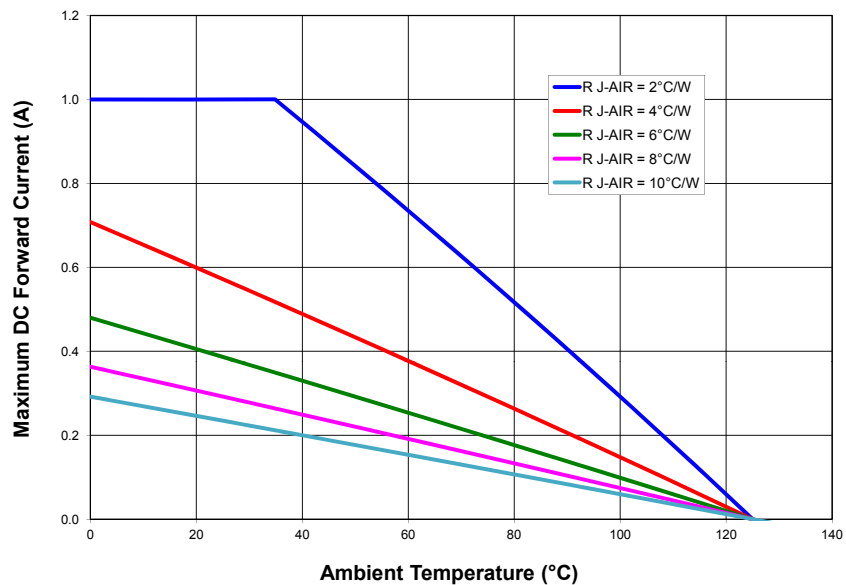


Figure 19. Maximum forward current vs. ambient temperature, based on  $T_{JMAX} = 125^{\circ}\text{C}$ .

## Current Derating Curve for IA Drive Current for 24-up LXK8-PW27-0024, LXK8-PW30-0024, LXK8-PW40-0024

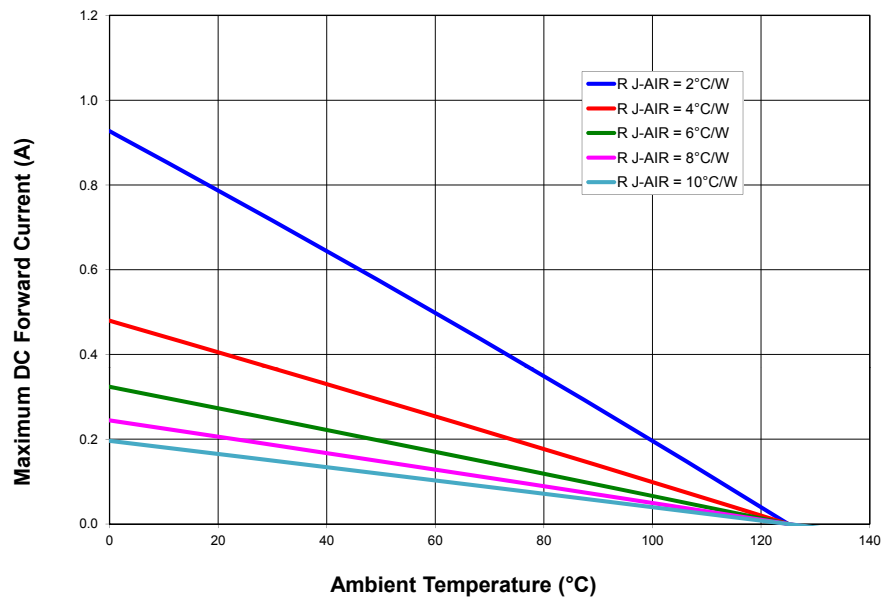


Figure 20. Maximum forward current vs. ambient temperature, based on  $T_{JMAX} = 125^{\circ}\text{C}$ .

# Typical Radiation Patterns

## Typical Spatial Radiation Pattern for LUXEON K

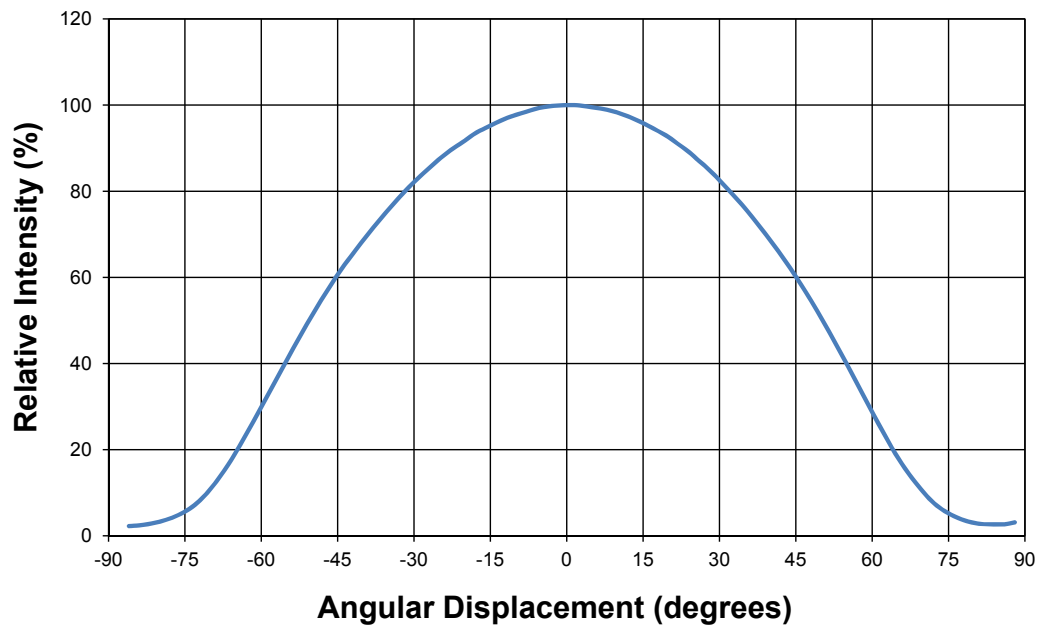


Figure 21. Typical representative spatial radiation pattern for LUXEON K.

# Packaging on Trays

LUXEON K products will be securely packaged in trays.

**Table 6.**

Part Number	Tray Dimensions	Quantity per Tray	Number of Trays per Box
LXK8-PW27-0004 LXK8-PW30-0004 LXK8-PW40-0004	315mm width x 135.9mm length x 12.11mm depth	40	10
LXK8-PW27-0008 LXK8-PW30-0008 LXK8-PW40-0008	315mm width x 135.9mm length x 12.11mm depth	27	10
LXK8-PW27-0012 LXK8-PW30-0012 LXK8-PW40-0012	315mm width x 135.9mm length x 12.11mm depth	24	10
LXK8-PW27-0016 LXK8-PW30-0016 LXK8-PW40-0016	315mm width x 135.9mm length x 12.11mm depth	24	10
LXK8-PW27-0024 LXK8-PW30-0024 LXK8-PW40-0024	315mm width x 135.9mm length x 12.11mm depth	21	10

## Tray Dimensions – LXXx-PWxx-xx04

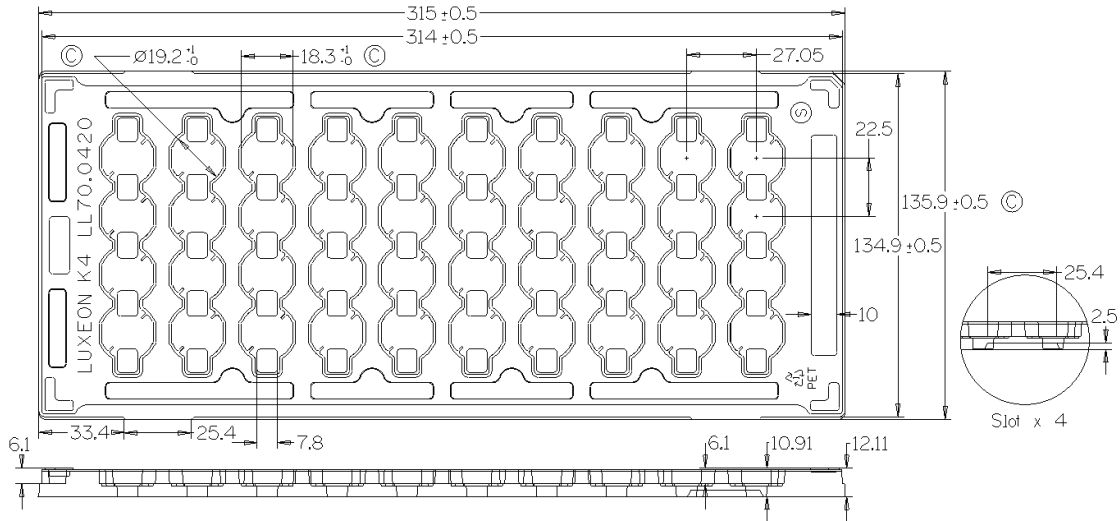


Figure 22.

## Tray Dimensions – LXXx-PWxx-xx08

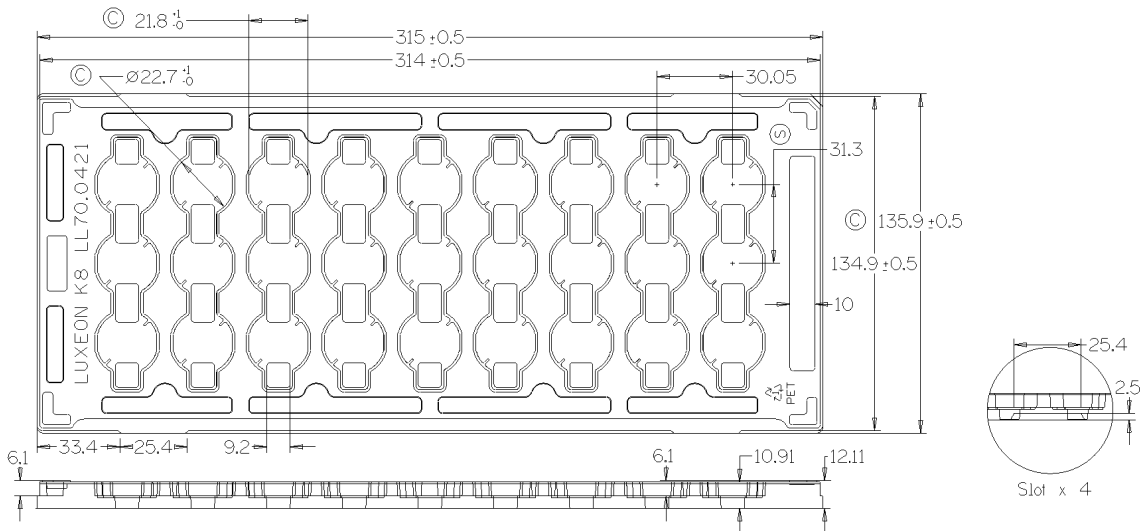


Figure 23.



## Tray Dimensions – LXX8-PWxx-0012

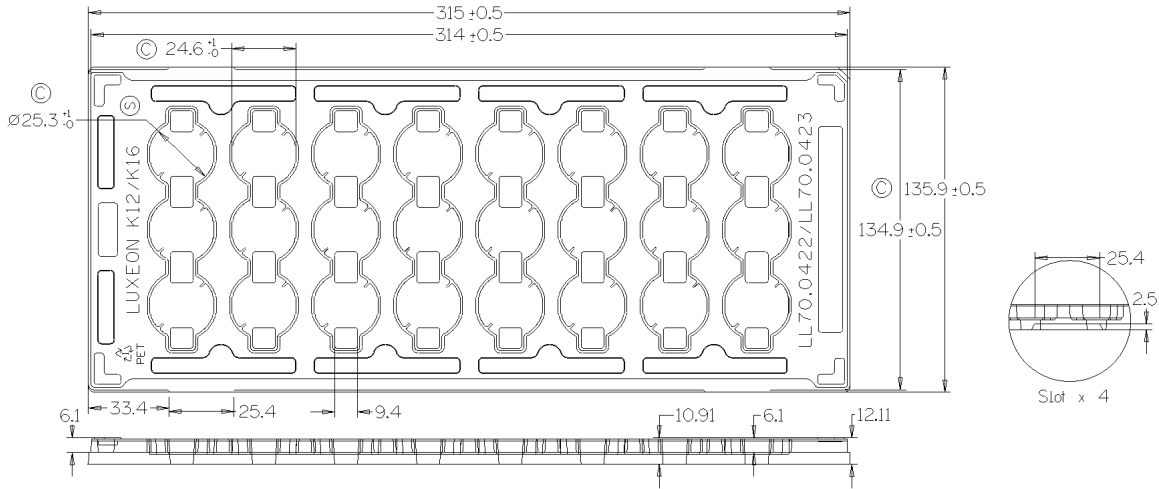


Figure 24.

## Tray Dimensions – LXX8-PWxx-xx24

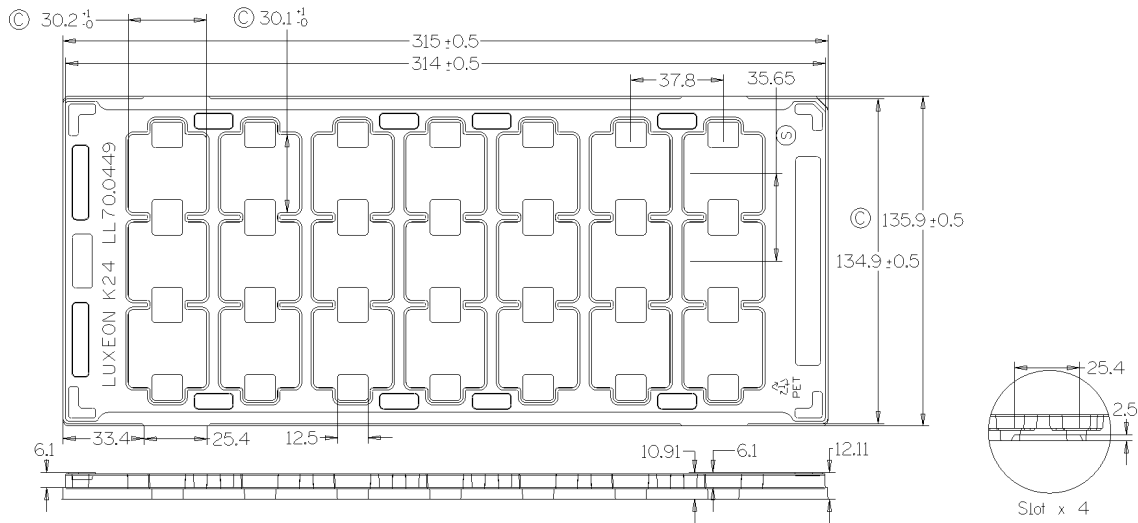


Figure 25.

# LUXEON K ANSI Color Bin Definition

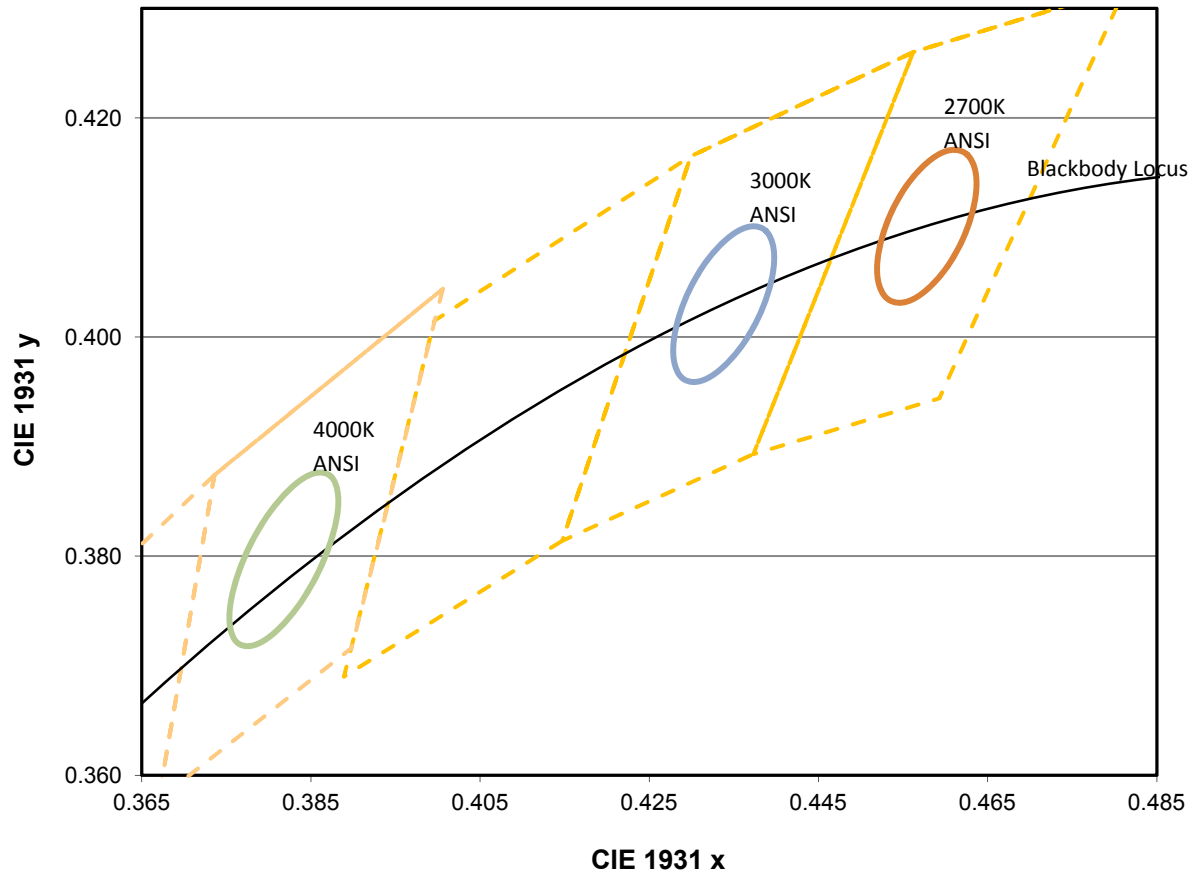


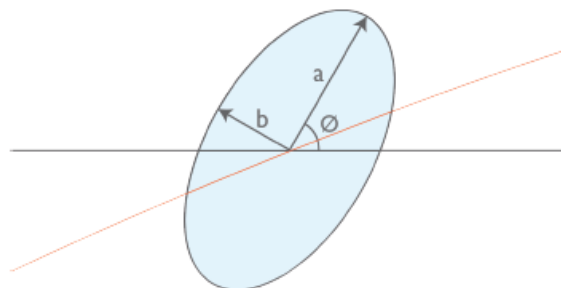
Figure 26.

Table 7. LUXEON K 3-step MacAdams Ellipse Color Definition

	2700K	3000K	4000K
Center Point (cx, cy) <sup>[1]</sup>	(0.4578, 0.4101)	(0.4338, 0.4030)	(0.3818, 0.3797)
Major Axis, a	0.00810	0.00834	0.00939
Minor Axis, b	0.00420	0.00408	0.00402
Ellipse rotation angle	53.7°	53.22°	53.72°

Note for Table 7:

- I. Philips Lumileds maintains a tester tolerance of  $\pm 0.05$  on x, y color coordinates.



# Company Information

Philips Lumileds is a leading provider of 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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[www.futurelightingsolutions.com](http://www.futurelightingsolutions.com)

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