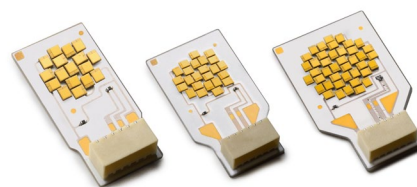


LUXEON S2000/3000/5000

High Flux Density Product



Introduction

LUXEON® S2000/3000/5000 LEDs deliver the highest quality of light with industry leading punch for high center beam intensity and uniformity. The tight beams of light enable crisp, sharp shadows making it ideally suited to retail and hospitality applications like spot lamps. Flux density is maximized with small optical sources to enable the most compact reflectors and narrow beam spots.

The unparalleled quality of light is in part due to *Freedom From Binning*. This means that all LUXEON S2000/3000/5000 emitters fall within a single 3-step MacAdam Ellipse, ensuring uniform optical performance in the application. And because LUXEON S is hot-tested at 85°C—real world operating conditions—luminaire design is simplified and testing can be minimized.

UL rated on-board connector enable elegant solderless electrical and mechanical assembly. Attached NTC chip makes real time temperature monitoring possible. Combine these integration friendly features, UL attuned design, with a full portfolio of ECO System parts (e.g., mechanical clamps, optics,

Features and Benefits

- High flux density with compact light emitting source Enable narrow beam angles at compact footprint
- <15-20 points color over angle shift and tight CCT control enable uniform and consistent system color point
- Single 3-step MacAdam, single V_f , single flux binning eliminate bin management
- UL rated on-board connector enable easy integration
- On-board NTC chip allow real time temp monitoring
- Elegant solderless electric and clamping assembly
- Hot tested at real world operating temp: $T_j = 85^\circ\text{C}$
- High efficacy for sustainable design

Key Applications

- Spotlights
- Architecture
- Downlights
- Specialty Lighting

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General Information

Product Nomenclature

LUXEON S2000/3000/5000 is tested and binned hot at $T_j = 85^\circ\text{C}$ and 700 mA DC.

The part number designation is explained as follow:

L X S A – B C D D – 0 0 E E

Where:

- A — designates minimum CRI (value 8 for 80, 9 for 90)
- B — designates radiation pattern (value P for Lambertian)
- C — designates color (W for White)
- DD — designates nominal CCT (27 for 2700K, 30 for 3000K, 35 for 3500K, 40 for 4000K and 50 for 5000K)
- EE — designates product configuration by total LED count (17 for S2000, 24 for S3000 and 41 for S5000)

Therefore 3000K, 80 CRI LUXEON S2000 product will be:

L X S 8 – P W 3 0 – 0 0 1 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 S2000/S3000/S5000 products will deliver, on average, 70% lumen maintenance (L70) at >35,000 hours of operation at a forward current of up to 700 mA. 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 S2000/3000/5000 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 S2000/3000/5000: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Product Selection

Product Performance and Characterization Guide

Junction Temperature = 85°C; Test Current = 700 mA

Table 1. Performance Characteristics at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Nominal CCT	Part Number	Luminous Flux Lm @ 700 mA, 85°C (V) ^[1,2]		CRI ^[1,2]		R9 ^[1,2]	
		Min.	Typ.	Min.	Typ.	Min.	Typ.
3000K	LXS9-PW30-0017	2150	2200	>90	96	>80	87
3000K	LXS8-PW30-0017	2650	2800	>80	83	>10	18
3000K	LXS9-PW30-0024	3050	3300	>90	96	>80	87
3000K	LXS8-PW30-0024	3725	4000	>80	83	>10	18
3000K	LXS9-PW30-0041	5150	5400	>90	96	>80	87
3000K	LXS8-PW30-0041	6375	6750	>80	83	>10	18

Notes for Table 1:

- Philips Lumileds maintains a tolerance of $\pm 6.5\%$ on luminous flux, ± 2 on CRI, ± 2 on R9 measurements.
- Measured at $T_s = 85^\circ\text{C}$, $I_f = 700\text{ mA}$.

Optical Characteristics

Optical Characteristics at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Table 2. Optical Characteristics at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Nominal CCT	Color Temperature @ 700 mA, 85°C CCT ^[1,2]			Typical Total Included Angle ^[3] (degrees) θ_{90V}	Typical Viewing Angle ^[4] (degrees) $2\theta_{1/2}$
	Minimum	Typical	Maximum		
3000K	2898	3072	3220	129	105

Notes for Table 2:

- Measured at $T_s = 85^\circ\text{C}$, $I_f = 700\text{ mA}$.
- CCT $\pm 5.00\%$ tester tolerance.
- Total angle at which 90% of total luminous flux is captured.
- Viewing angle is the off axis angle from lamp centerline where the luminous intensity is $1/2$ of the peak value.

Electrical Characteristics

Electrical Characteristics at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Table 3. Electrical Characteristics at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Nominal CCT	Part Number	Forward Voltage V_f ^[1] (V)			Typ. Temperature Coefficient of Forward Voltage ^[2] ($\text{mV}/^\circ\text{C}$) $\Delta V_f / \Delta T_j$	Typical Thermal Resistance Junction to Thermal Pad ($^\circ\text{C}/\text{W}$) $R\theta_{j-c}$
		Minimum	Typical	Maximum		
3000K	LXS9-PW30-0017	45.0	47.0	50.0	-28 to -32	0.85
3000K	LXS8-PW30-0017	45.0	47.0	50.0	-28 to -32	0.85
3000K	LXS9-PW30-0024	65.0	67.5	70.0	-41 to -46	0.50
3000K	LXS8-PW30-0024	65.0	67.5	70.0	-41 to -46	0.50
3000K	LXS9-PW30-0041	112	115	119	-71 to -87	0.40
3000K	LXS8-PW30-0041	112	115	119	-71 to -87	0.40

Notes for Table 3:

1. Tolerance of $\pm 0.06\text{V}$ per single emitter ($\pm 1.02\text{V}$ for LXSx-PWxx-0017, $\pm 1.44\text{V}$ for LXSx-PWxx-0024, $\pm 2.46\text{V}$ for LXSx-PWxx-0041).
2. Measured at $25^\circ\text{C} = T_s = 105^\circ\text{C}$ at $I_f = 700\text{ mA}$.
3. Junction temperature to back of the PCB.

Absolute Maximum Ratings

Table 4. Operating Condition and Ratings

Parameter	Maximum Performance
DC Forward Current	1050 mA ^[2]
Peak Pulsed Forward Current	1250 mA ^[3]
ESD Sensitivity	< 8000V Human Body Model (HBM) Class 3A JESD22-A114-E < 400V Machine Model (MM) Class B JESD22-A115-B
Storage Temperature	$-40^\circ\text{C} - 120^\circ\text{C}$
LED Junction Temperature ^[1]	135°C
Operating Case Temperature at 700 mA	$-40^\circ\text{C} - 120^\circ\text{C}$
Reverse Voltage	LUXEON S 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, please see preliminary application brief for additional information on thermal measurement guidelines.
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple", with frequencies $\geq 100\text{ Hz}$ and amplitude $\leq 200\text{ mA}$ are acceptable, assuming the average current throughout each cycle does not exceed 1050 mA.
3. Pulsed operation with a peak drive current of 1250 mA is acceptable if the pulse on-time is $\leq 5\text{ ms}$ per cycle and the duty cycle is ≤ 50 .

Mechanical Dimensions

LUXEON S2000 / LXSx-PWxx-0017

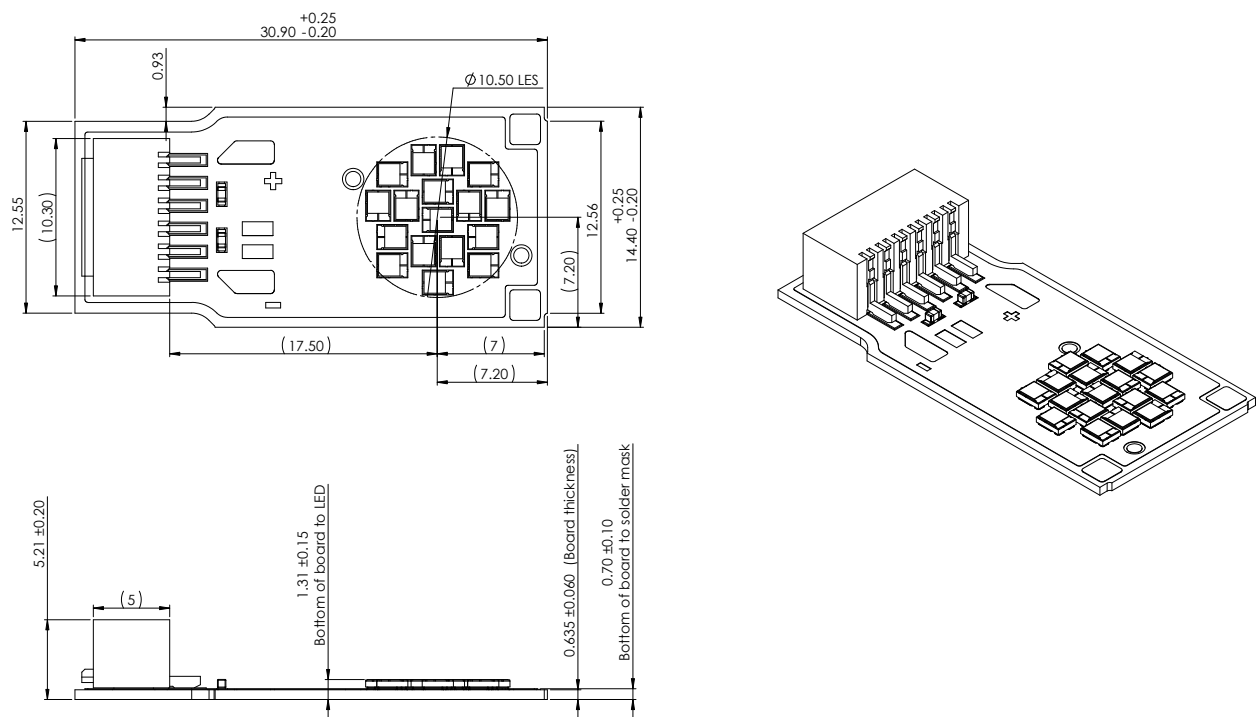


Figure 1. Package outline drawing for LUXEON S2000/LXSx-PWxx-0017.

LUXEON S3000 / LXSx-PWxx-0024

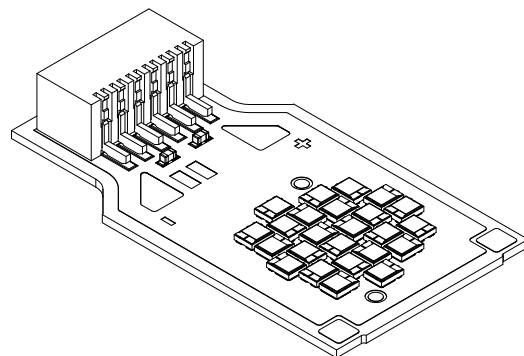
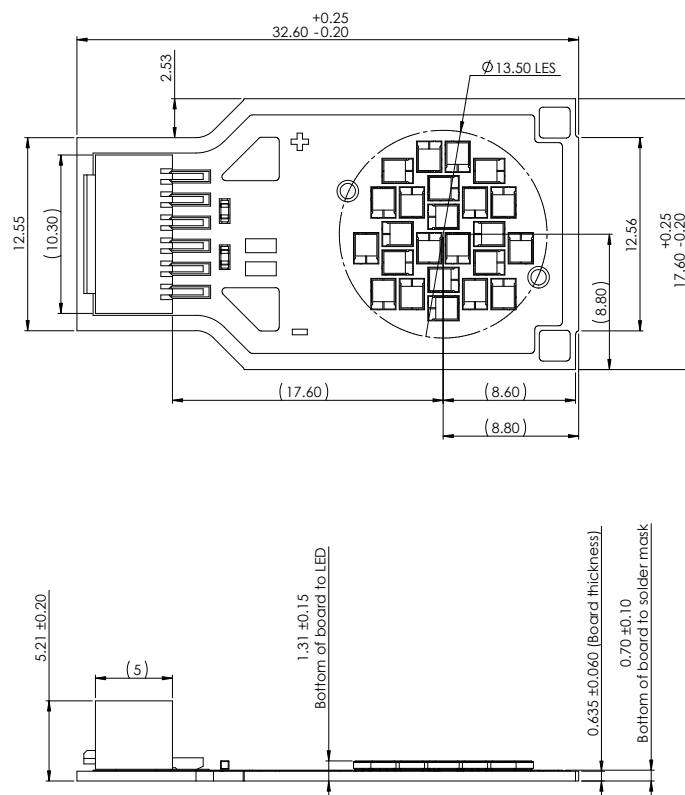


Figure 2. Package outline drawing for LUXEON S3000/LXSx-PWxx-0024.

LUXEON S5000 / LXSx-PWxx-0041

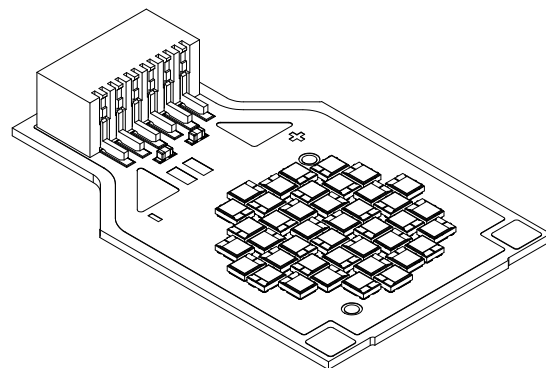
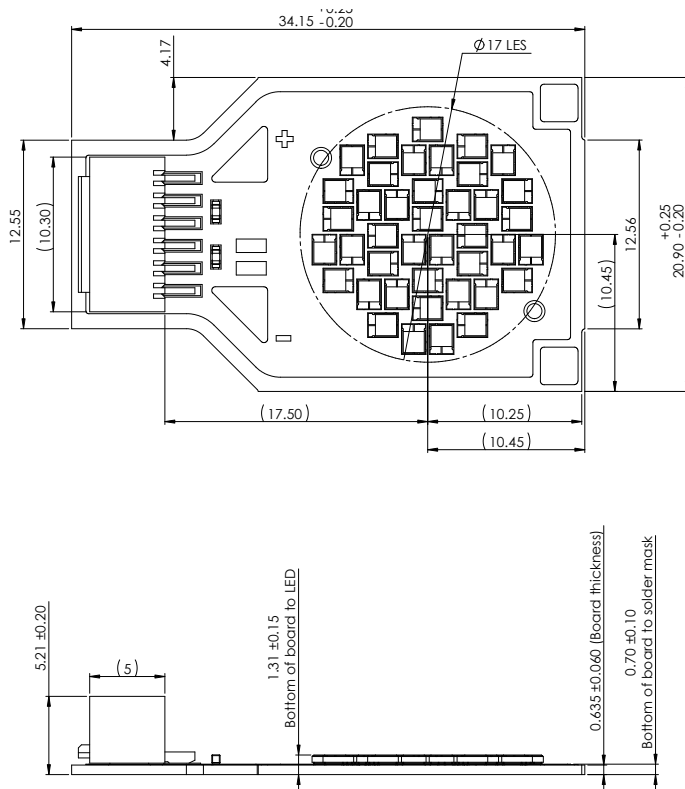


Figure 3. Package outline drawing for LUXEON S5000/LXSx-PWxx-0041.

Relative Spectral Distribution vs. Wavelength Characteristics

LUXEON S2000/3000/5000, Junction Temperature = 85°C; Test Current = 700 mA

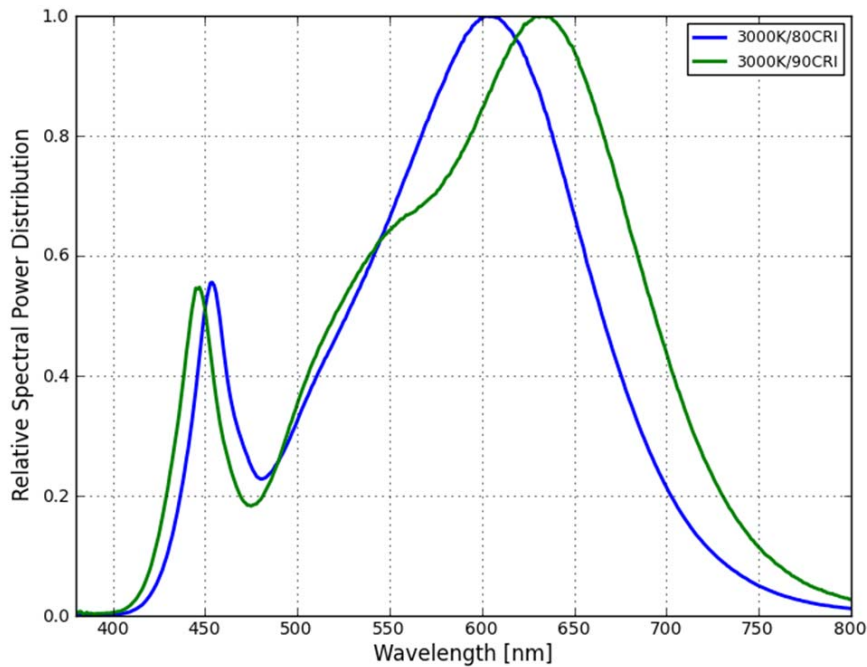


Figure 4. Color spectrum of 3000K, 80/90 minimum CRI, integrated measurement.

Relative Light Output Characteristics over Temperature

LUXEON S2000/3000/5000, Junction Temperature = 85°C; Test Current = 700 mA

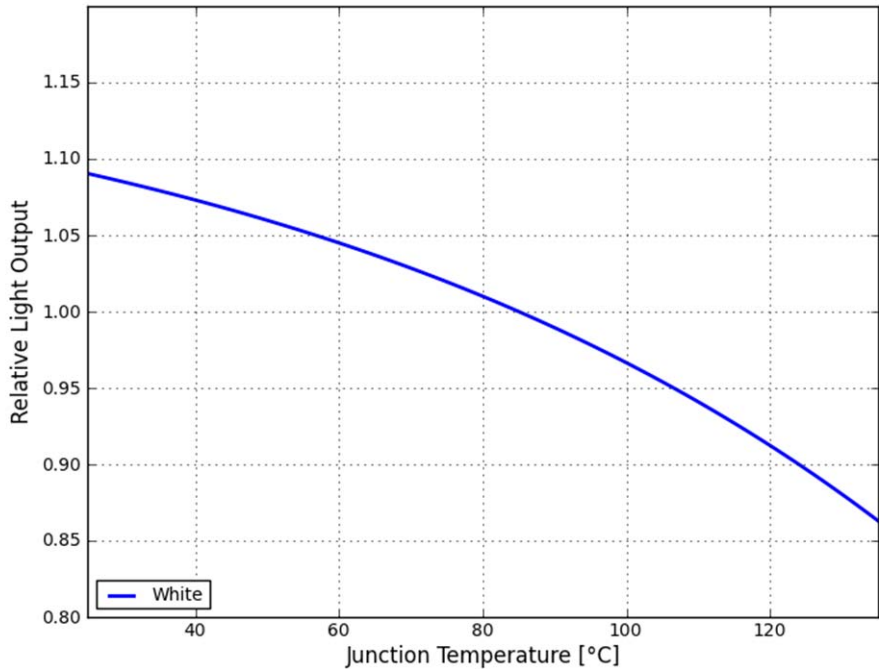


Figure 5. Relative light output vs. junction temperature.

Typical Forward Current Characteristics

LUXEON S2000 / LXSx-PWxx-0017, Junction Temperature = 85°C

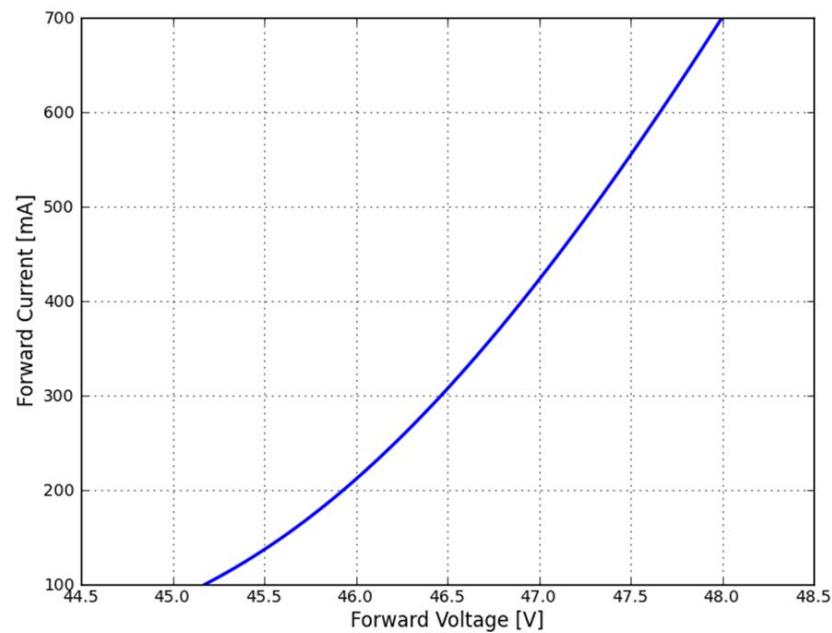


Figure 6. Forward current vs. forward voltage, LUXEON S2000, junction temperature = 85°C.

LUXEON S3000 / LXSx-PWxx-0024, Junction Temperature = 85°C

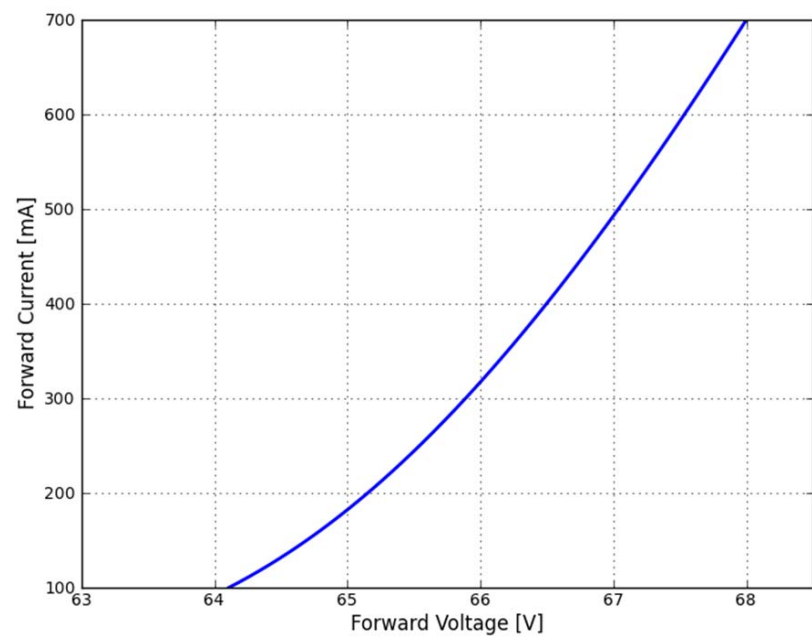


Figure 7. Forward current vs. forward voltage, LUXEON S3000, junction temperature = 85°C.

LUXEON S5000 / LXSx-PWxx-004I, Junction Temperature = 85°C

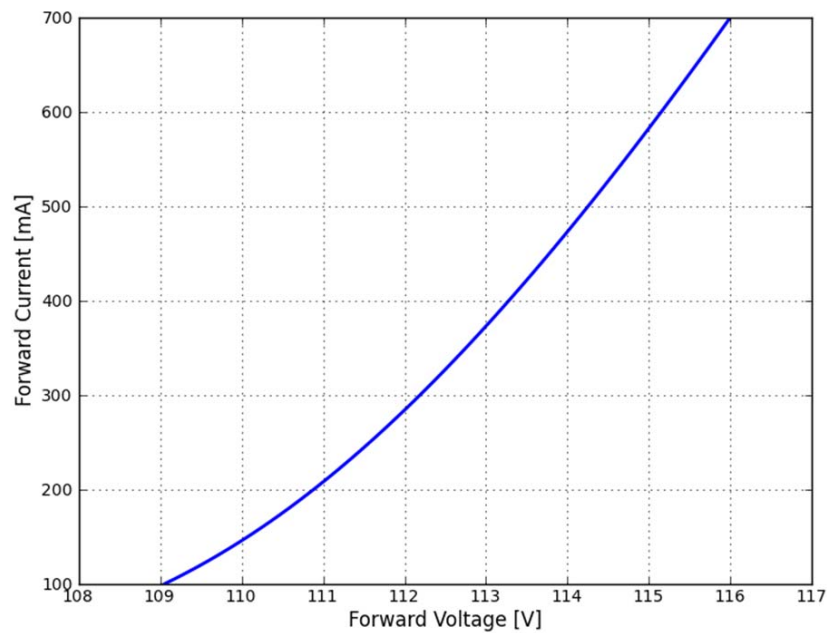


Figure 8. Forward current vs. forward voltage, LUXEON S5000, junction temperature = 85°C.

Typical Relative Luminous Flux vs. Forward Current

LUXEON S2000/3000/5000, Junction Temperature = 85°C

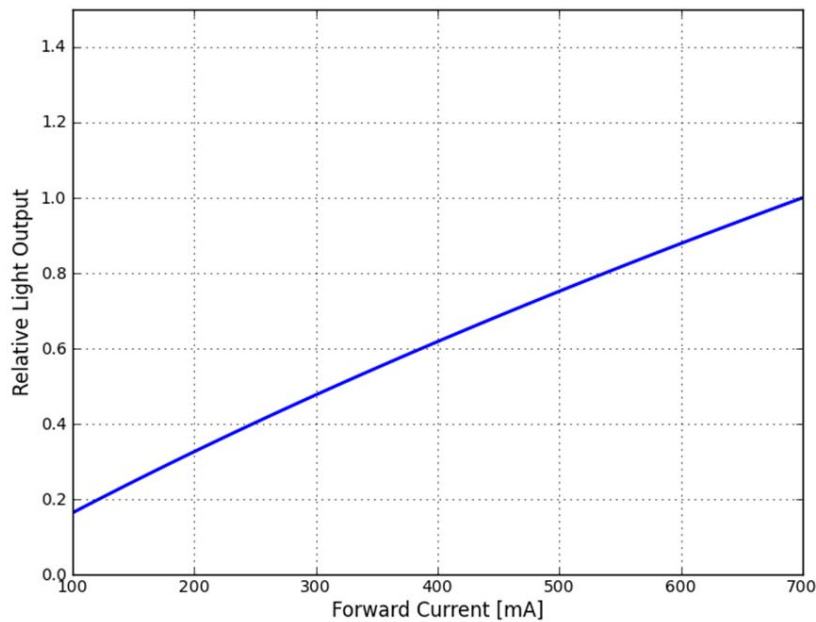


Figure 9. Typical relative luminous flux vs. forward current, junction temperature = 85°C.

Color Bin Definition

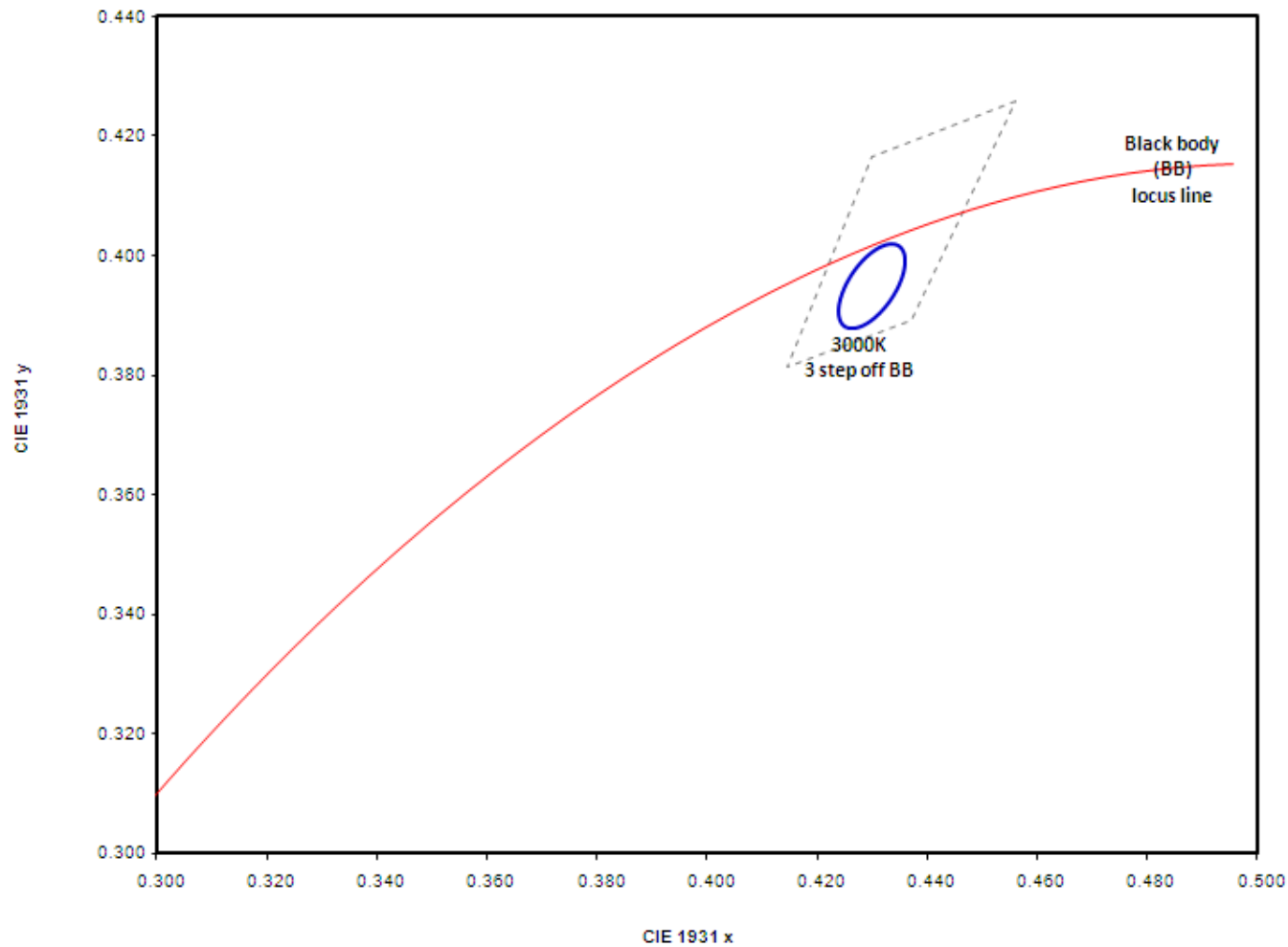


Figure 12. 3-step MacAdams ellipse color bins.

Table 5. 3-step MacAdams Ellipse Color Definition

	3000K
Center Point (X_{center}, Y_{center}) ^[1]	(0.42998, 0.39497)
Major Axis, a ^[1]	0.00834
Minor Axis, b ^[1]	0.00408
Ellipse rotation angle, \varnothing	53.22°

Notes for Table 5:

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

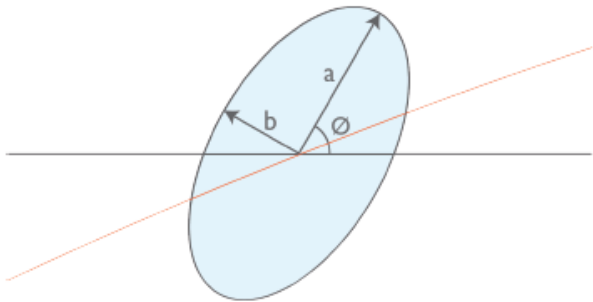


Figure 13. Illustrative figure for MacAdams ellipse color definition.

Final Packaging

Table 6. Packaging Information

	S2000 LXSx-PWxx-0017	S2000 LXSx-PWxx-0017	S2000 LXSx-PWxx-0017
Total Unit per Tray	35	35	30
Total Tray per Box	8	8	8
Total Unit per Box	280	280	240

LUXEON S2000 / LXSx-PWxx-0017

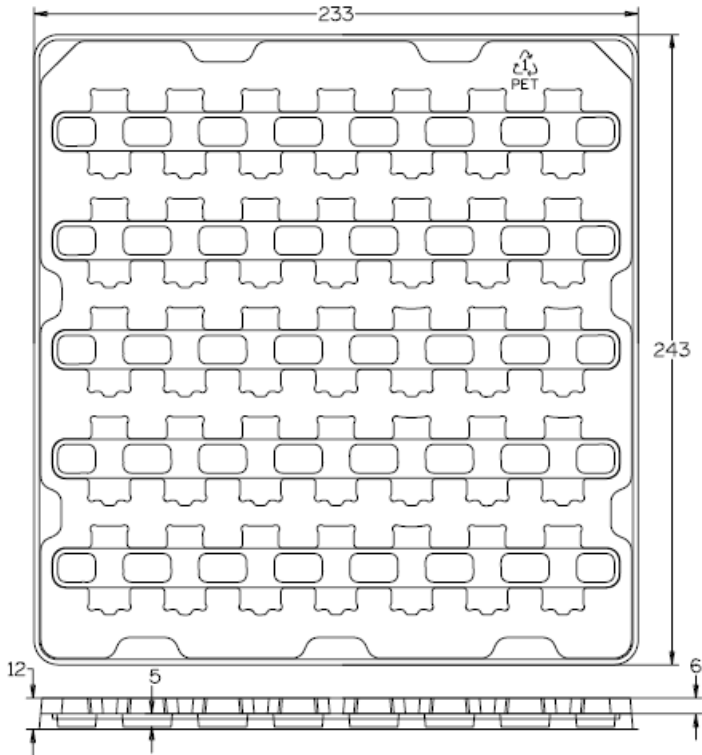


Figure 14. Package ray dimension for S2000 LXSx-PWxx-0017.

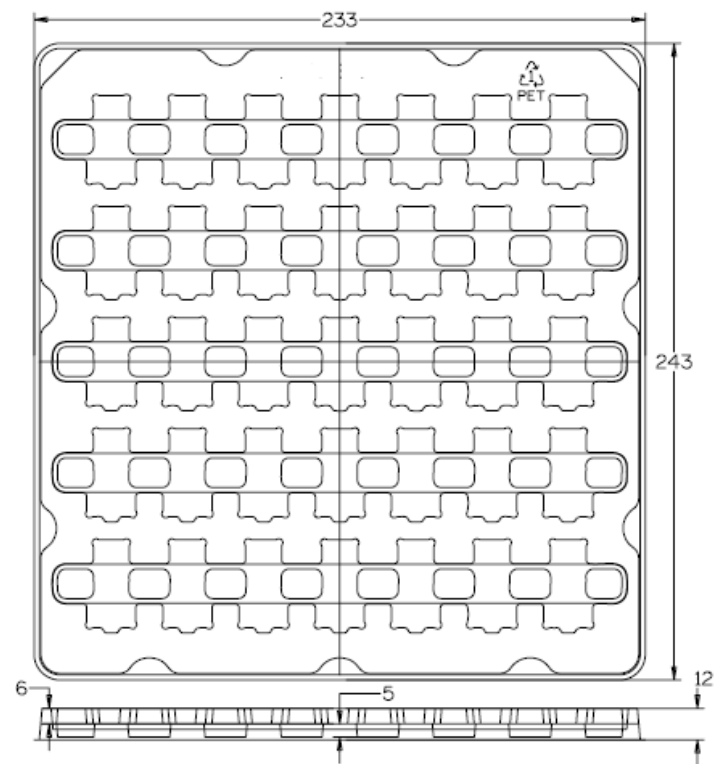


Figure 15. Package ray dimension for S3000 LXSx-PWxx-0024.

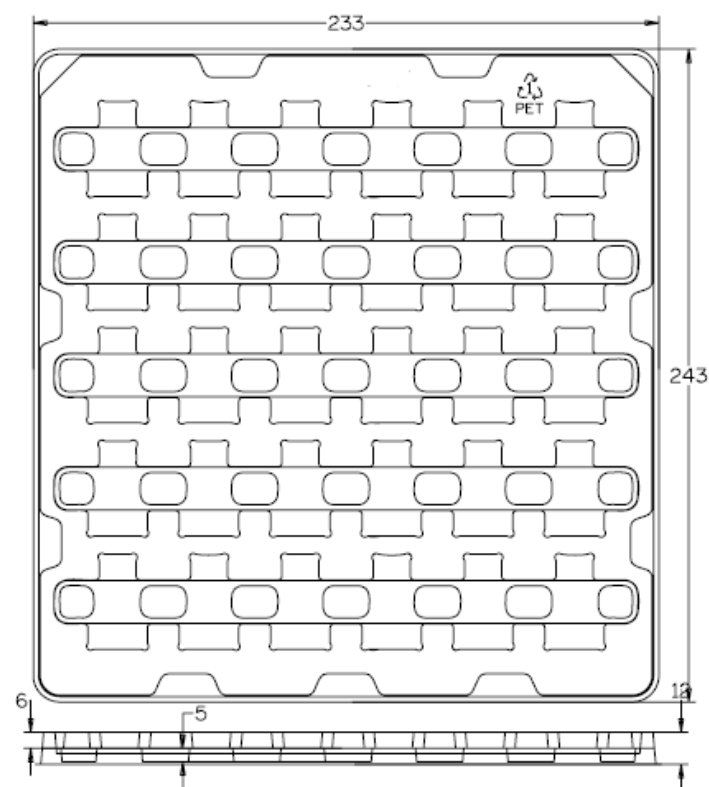


Figure 16. Package ray dimension for S5000 LXSx-PWxx-004I.

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 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, digital imaging, display 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.

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