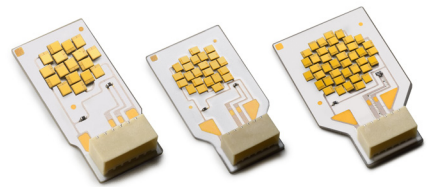


LUXEON S2000/3000/5000

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.

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

- Architecture
- Downlights
- Specialty Lighting
- Spotlights

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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 follows:

L X S A – B C D D – 0 0 E E (F)

Where:

- A — designates minimum CRI (value 0 for Royal Blue, value 7 for 70, 8 for 80 and 9 for 90)
- B — designates radiation pattern (value P for Lambertian)
- C — designates color (W for White and R for Royal Blue)
- DD — designates nominal CCT (00 for Royal Blue, 27 for 2700K, 30 for 3000K, 35 for 3500K, 40 for 4000K, 50 for 5000K and 57 for 5700K)
- EE — designates product configuration by total LED count (17 for S2000, 24 for S3000 and 41 for S5000)
- F — designates product connector configuration (N for no connectors, left empty with no notation for parts with connectors)

Therefore 3000K, 80 CRI LUXEON S2000 with connector will be:

L X S 8 – P W 3 0 – 0 0 I 7

Therefore 5700K, 70CRI LUXEON S5000 with no connector will be:

L X S 7 - P W 5 7 - 0 0 4 I N

Therefore Royal Blue LUXEON S3000 with connector will be:

L X S 0 - P R 0 0 - 0 0 2 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 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

Table 1. Performance Characteristics for LUXEON S2000 / LXSx-PWxx-0017(N) at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Nominal CCT	Part Number	Luminous Flux (Lm) @ 700 mA, 85°C (V)		CRI		R9	
		Minimum	Typical	Minimum	Typical	Minimum	Typical
2700K	LXS9-PW27-0017(N)	2350	2550	>90	96	>80	87
2700K	LXS8-PW27-0017(N)	2700	2850	>80	83	>10	18
3000K	LXS9-PW30-0017(N)	2400	2600	>90	96	>80	87
3000K	LXS8-PW30-0017(N)	2725	2900	>80	83	>10	18
3500K	LXS8-PW35-0017(N)	3000	3200	>80	83	>10	18
4000K	LXS7-PW40-0017(N)	3375	3600	>70	72	n/a	n/a
4000K	LXS8-PW40-0017(N)	3100	3300	>80	83	>10	18
5000K	LXS7-PW50-0017(N)	3550	3800	>70	72	n/a	n/a
5000K	LXS8-PW50-0017(N)	3100	3300	>80	83	>10	18
5700K	LXS7-PW57-0017(N)	3550	3800	>70	72	n/a	n/a

Note for Table 1:

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

Table 2. Performance Characteristics for LUXEON S3000 / LXSx-PWxx-0024(N) at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Nominal CCT	Part Number	Luminous Flux (Lm) @ 700 mA, 85°C (V)		CRI		R9	
		Minimum	Typical	Minimum	Typical	Minimum	Typical
2700K	LXS9-PW27-0024(N)	3300	3350	>90	96	>80	87
2700K	LXS8-PW27-0024(N)	3800	4050	>80	83	>10	18
3000K	LXS9-PW30-0024(N)	3350	3600	>90	96	>80	87
3000K	LXS8-PW30-0024(N)	3850	4100	>80	83	>10	18
3500K	LXS8-PW35-0024(N)	4250	4550	>80	83	>10	18
4000K	LXS7-PW40-0024(N)	4775	5100	>70	72	n/a	n/a
4000K	LXS8-PW40-0024(N)	4375	4650	>80	83	>10	18
5000K	LXS7-PW50-0024(N)	5000	5400	>70	72	n/a	n/a
5000K	LXS8-PW50-0024(N)	4375	4650	>80	83	>10	18
5700K	LXS7-PW57-0024(N)	5000	5400	>70	72	n/a	n/a

Note for Table 2:

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

Table 3. Performance Characteristics for LUXEON S5000 / LXSx-PWxx-0041 (N) at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Nominal CCT	Part Number	Luminous Flux (Lm) @ 700 mA, 85°C (V)		CRI		R9	
		Minimum	Typical	Minimum	Typical	Minimum	Typical
2700K	LXS9-PW27-0041 (N)	5650	6000	>90	96	>80	87
2700K	LXS8-PW27-0041 (N)	6500	6900	>80	83	>10	18
3000K	LXS9-PW30-0041 (N)	5700	6050	>90	96	>80	87
3000K	LXS8-PW30-0041 (N)	6600	7000	>80	83	>10	18
3500K	LXS8-PW35-0041 (N)	7300	7750	>80	83	>10	18
4000K	LXS7-PW40-0041 (N)	8175	8700	>70	72	n/a	n/a
4000K	LXS8-PW40-0041 (N)	7500	8000	>80	83	>10	18
5000K	LXS7-PW50-0041 (N)	8600	9200	>70	72	n/a	n/a
5000K	LXS8-PW50-0041 (N)	7500	8000	>80	83	>10	18
5700K	LXS7-PW57-0041 (N)	8600	9200	>70	72	n/a	n/a

Note for Table 3:

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

Table 4. Royal Blue Performance Summary at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

Nominal CCT	Part Number	@ $I_f = 700\text{ mA}$, $T_j = 85^\circ\text{C}$		
		Minimum Radiometric Power (mW)	Typical Radiometric Power (mW)	Typical Radiant Efficacy (%)
Royal Blue	LXV0-PR00-0017 (N)	12925	13860	42.3%
Royal Blue	LXV0-PR00-0024 (N)	18250	19600	42.3%
Royal Blue	LXV0-PR00-0041 (N)	31200	34000	42.3%

Note for Table 4:

1. Philips Lumileds maintains a tolerance of $\pm 6.5\%$ on luminous flux.

Optical Characteristics

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

Table 5. 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) $\theta_{90\%}$	Typical Viewing Angle ^[4] (degrees) $2\theta_{1/2}$
	Minimum	Typical	Maximum		
2700K	2602	2725	2847	129	105
3000K	2898	3072	3220	129	105
3500K	3309	3465	3620	129	105
4000K	3805	3985	4164	129	105
5000K	4801	5028	5254	129	105
5700K	5410	5665	5919	129	105

Notes for Table 5:

1. Measured at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$.
2. CCT $\pm 5.00\%$ 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 $1/2$ of the peak value.

Electrical Characteristics

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

Table 6. Electrical Characteristics at $T_j = 85^\circ\text{C}$, $I_f = 700\text{ mA}$

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		
LXSx-Pxxx-0017(N)	45.0	47.0	50.0	-28 to -32	0.85
LXSx-Pxxx-0024(N)	65.0	67.5	70.0	-41 to -46	0.50
LXSx-Pxxx-0041(N)	112	115	119	-71 to -87	0.40

Notes for Table 6:

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 $25^\circ\text{C} < T_j < 105^\circ\text{C}$ at $I_f = 700\text{ mA}$.
3. Junction temperature to back of the PCB.

Absolute Maximum Ratings

Table 7. 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 7:

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-Pxxx-0017

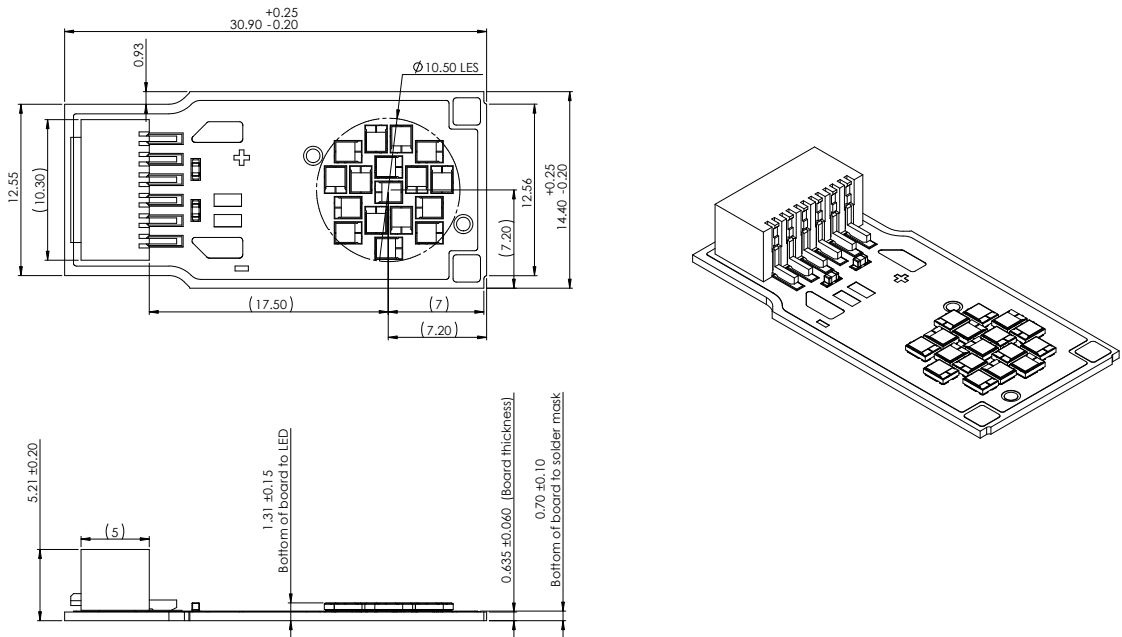


Figure 1. Package outline drawing for LUXEON S2000 / LXSx-Pxxx-0017.

LUXEON S2000 / LXSx-Pxxx-0017N (Connector-less)

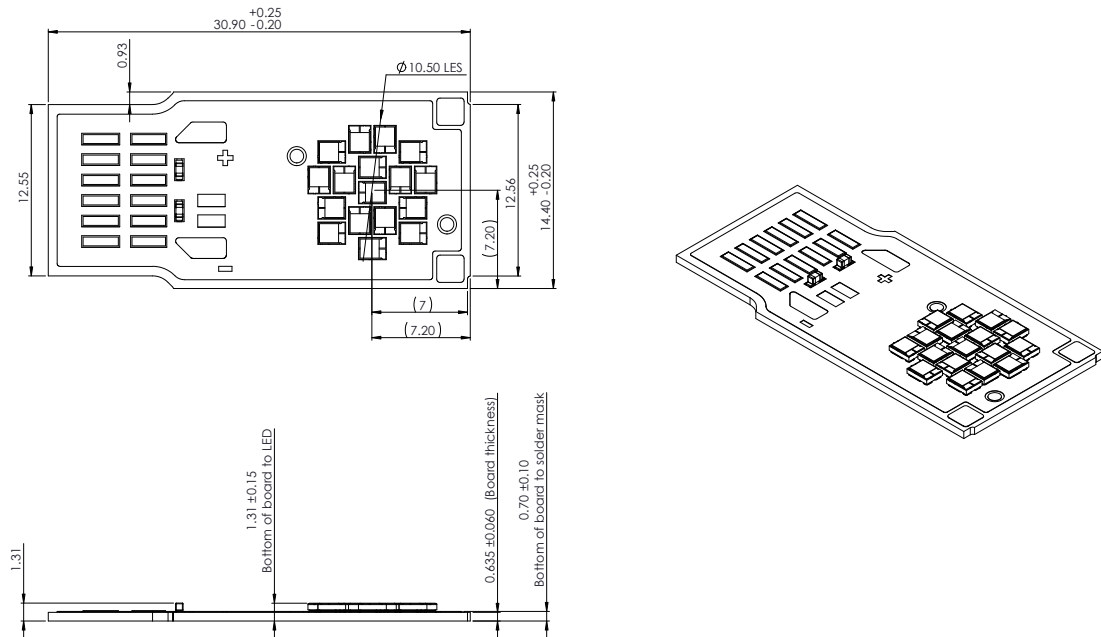


Figure 2. Package outline drawing for LUXEON S2000 / LXSx-Pxxx-0017N (Connector-less).

LUXEON S3000 / LXSx-Pxxx-0024

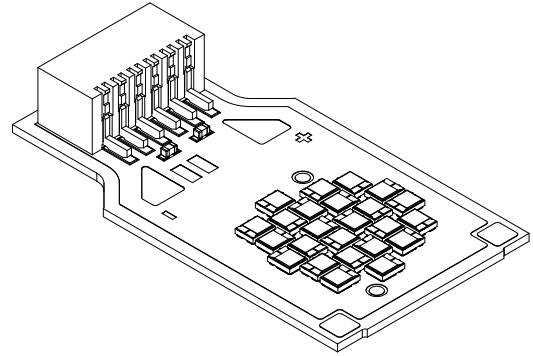
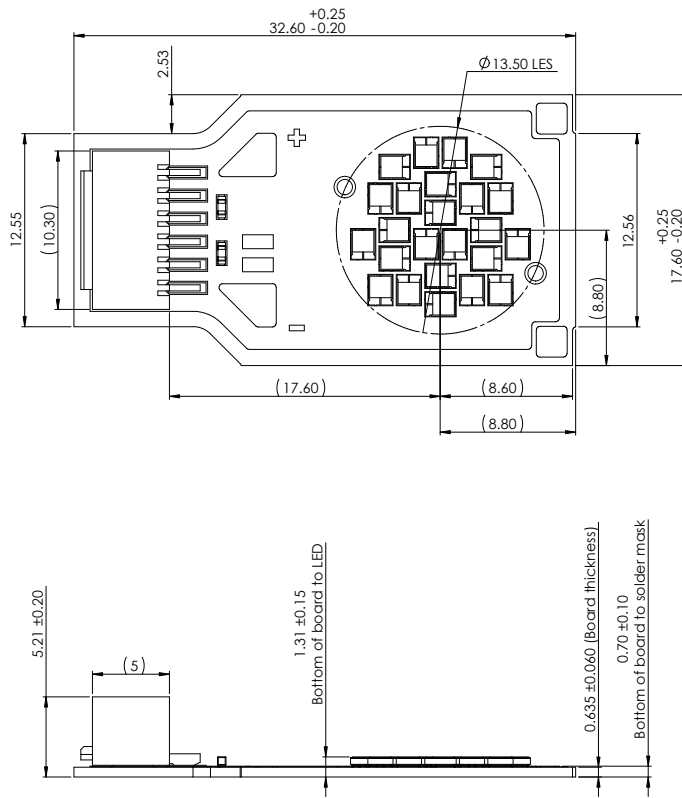


Figure 3. Package outline drawing for LUXEON S3000 / LXSx-Pxxx-0024.

LUXEON S3000 / LXSx-Pxxx-0024N (Connector-less)

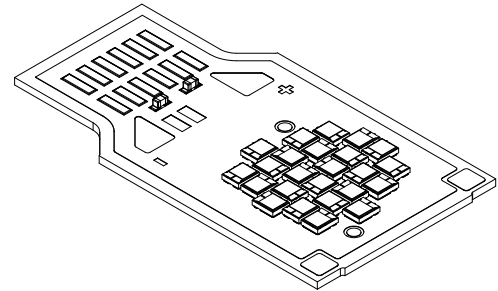
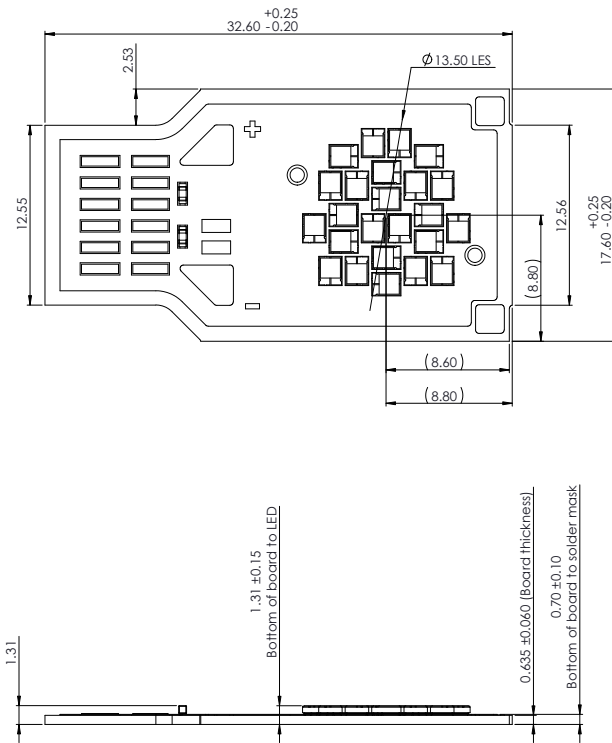


Figure 4. Package outline drawing for LUXEON S3000 / LXSx-Pxxx-0024N (Connector-less).

LUXEON S5000 / LXSx-Pxxx-004I

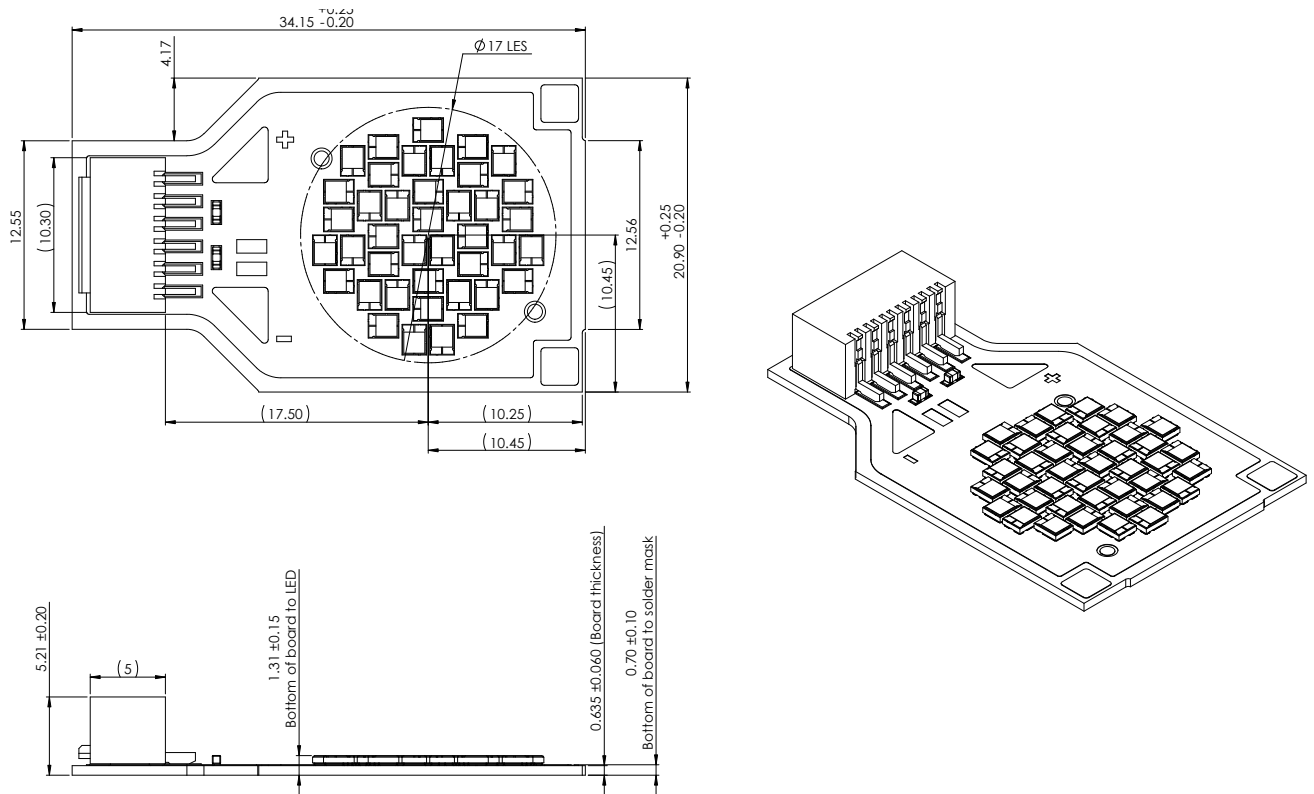


Figure 5. Package outline drawing for LUXEON S5000 / LXSx-Pxxx-004I.

LUXEON S5000 / LXSx-Pxxx-004IN (Connector-less)

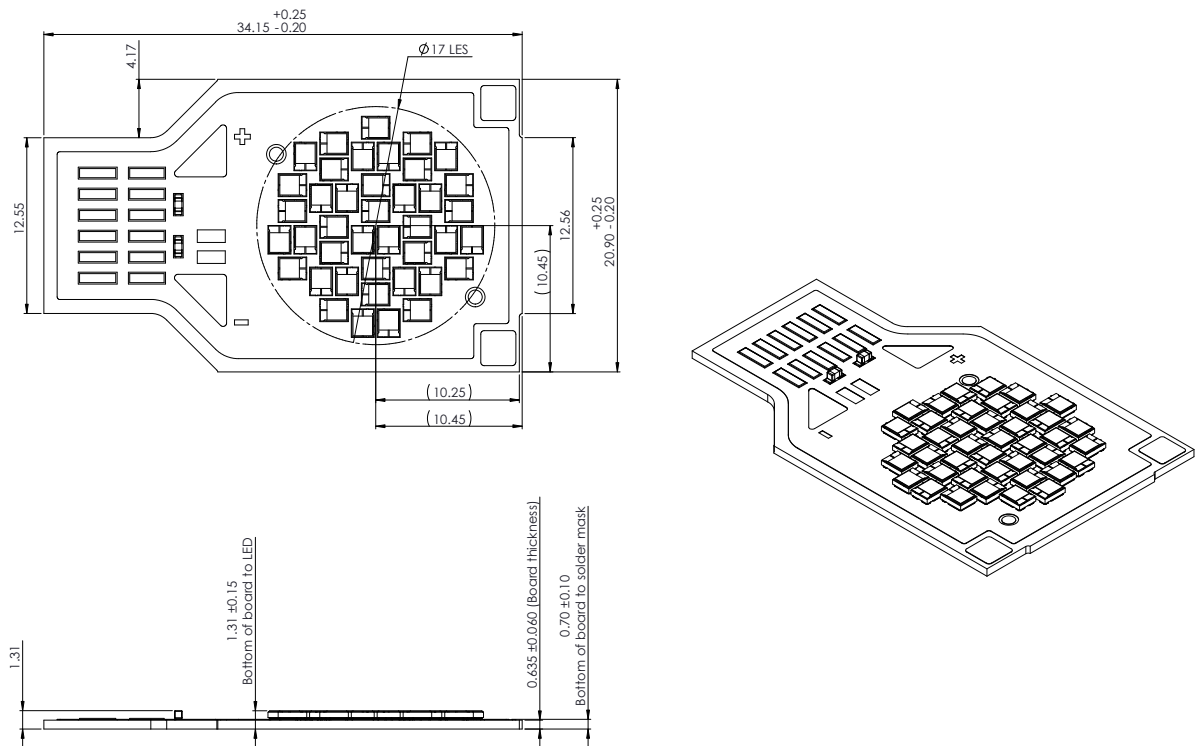


Figure 6. Package outline drawing for LUXEON S5000 / LXSx-Pxxx-004IN (Connector-less).

Relative Spectral Distribution vs. Wavelength Characteristics

LUXEON S2000/3000/5000 90CRI, Junction Temperature = 85°C; Test Current at 700 mA

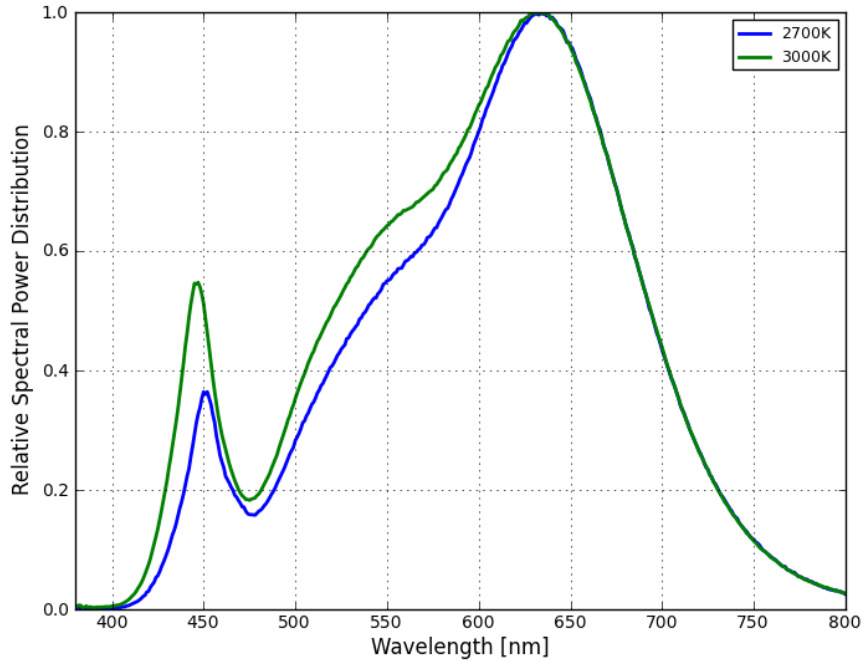


Figure 7. Color spectrum of 90 minimum CRI integrated measurement.

LUXEON S2000/3000/5000 80CRI, Junction Temperature = 85°C; Test Current at 700 mA

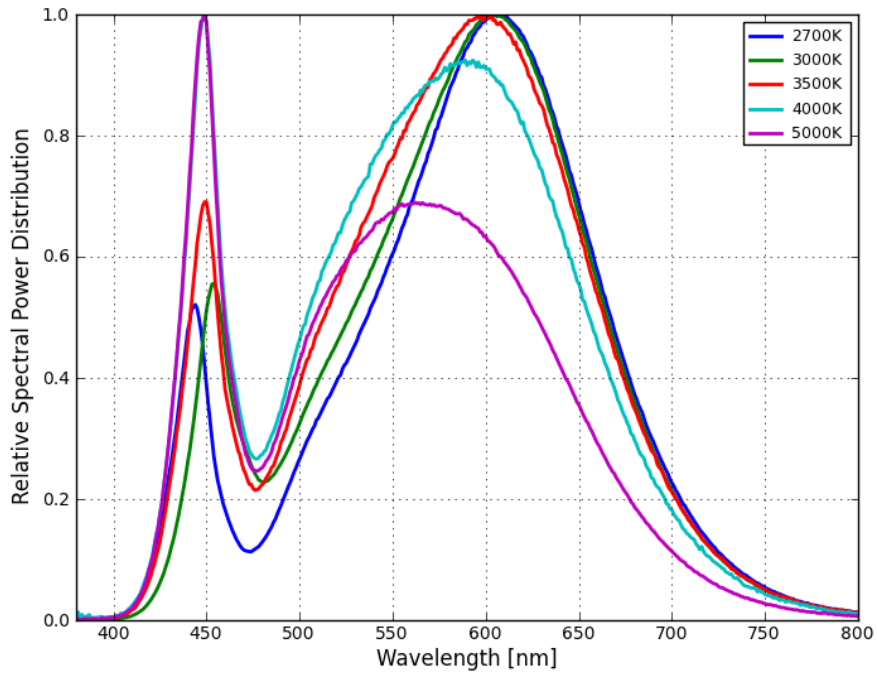


Figure 8. Color spectrum of 80 minimum CRI integrated measurement.

LUXEON S2000/3000/5000 70CRI, Junction Temperature = 85°C; Test Current at 700 mA

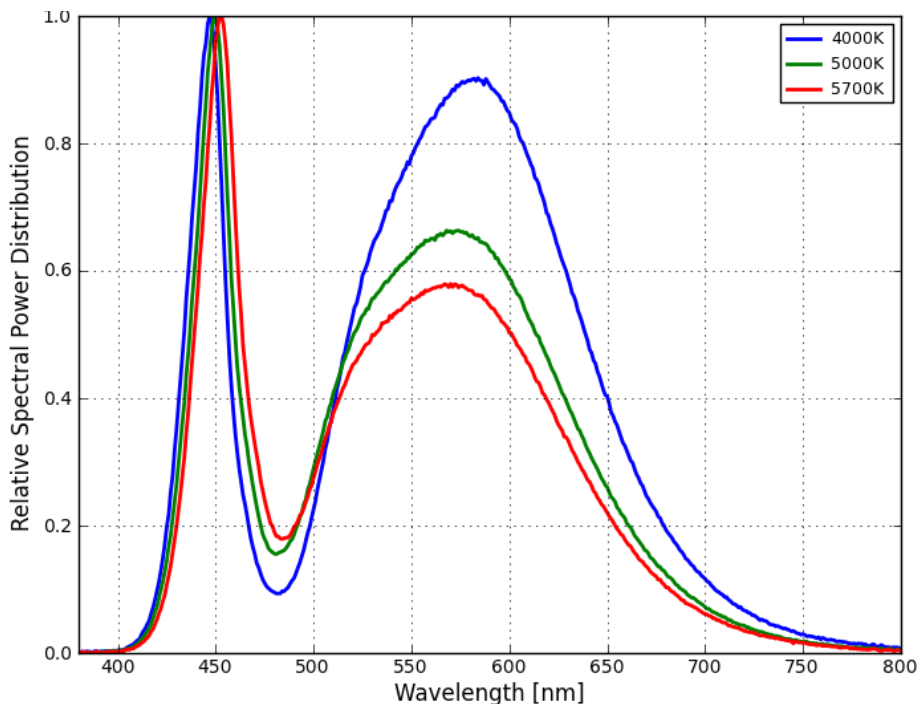


Figure 9. Color spectrum of 70 minimum CRI integrated measurement.

Relative Light Output Characteristics over Temperature

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

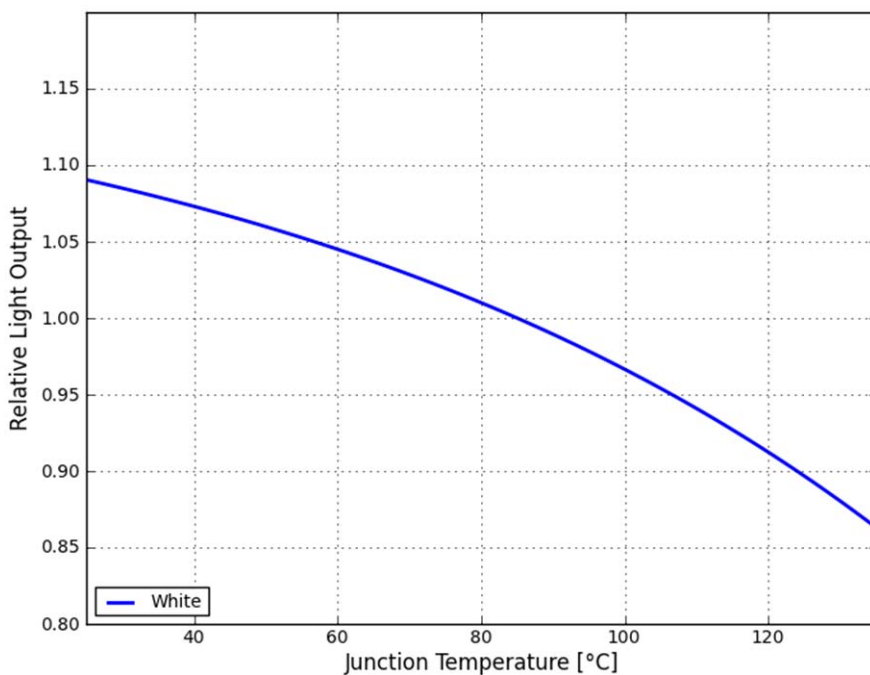


Figure 10. Color spectrum of 70 minimum CRI integrated measurement.

Typical Forward Current Characteristics

LUXEON S2000 / LXSx-Pxxx-0017(N), Junction Temperature = 85°C

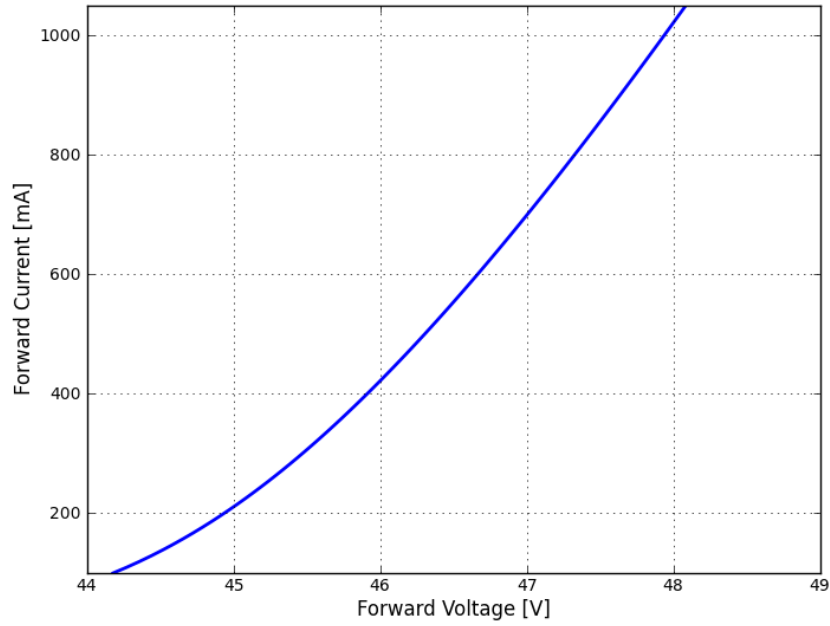


Figure 11. Forward current vs. forward voltage, LUXEON S2000, junction temperature = 85°C.

LUXEON S3000 / LXSx-Pxxx-0024(N), Junction Temperature = 85°C

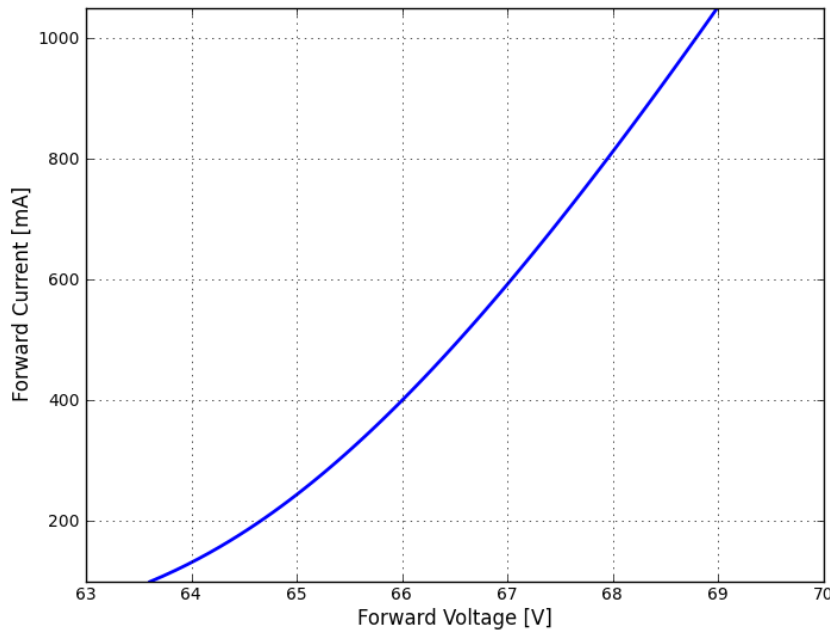


Figure 12. Forward current vs. forward voltage, LUXEON S3000, junction temperature = 85°C.

LUXEON S5000 / LXSx-Pxxx-004I(N), Junction Temperature = 85°C

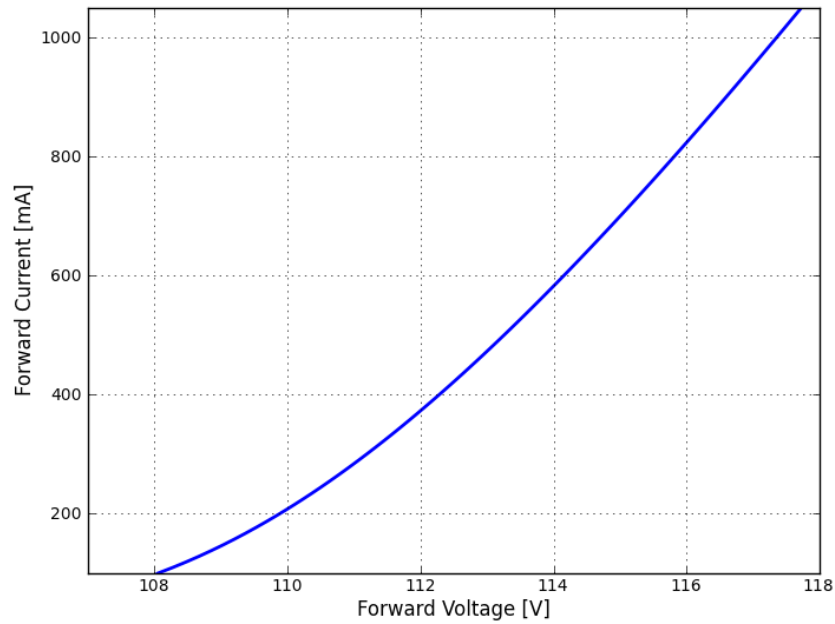


Figure 13. Forward current vs. forward voltage, LUXEON S5000, junction temperature = 85°C.

Typical Relative Luminous Flux vs. Forward Current

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

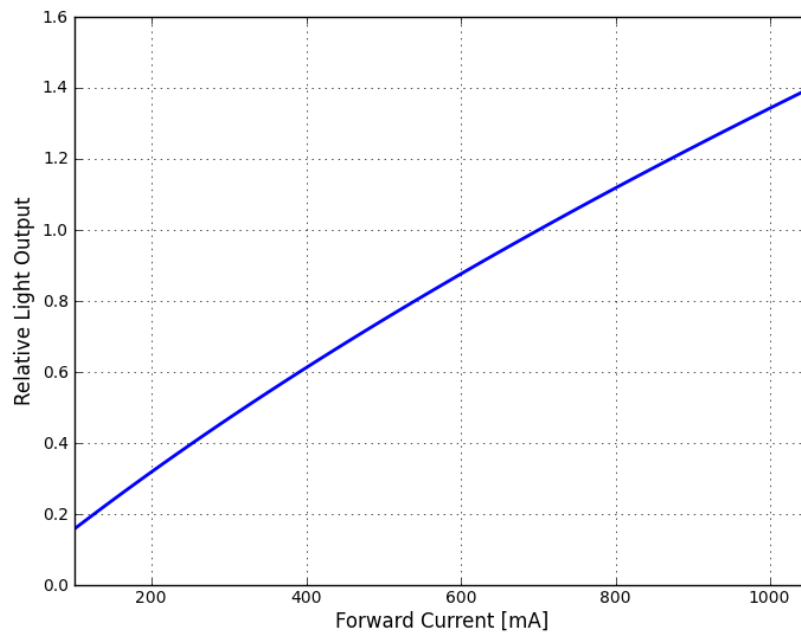


Figure 14. Typical relative luminous flux vs. forward current, junction temperature = 85°C.

Typical Radiation Patterns

Typical Spatial Radiation Pattern

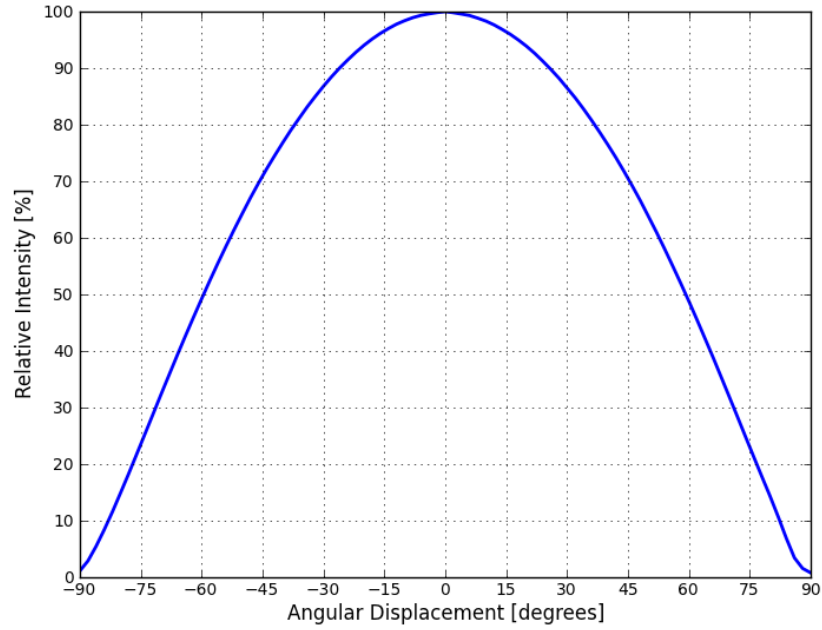


Figure 15. Typical spatial radiation pattern.

Typical Polar Radiation Pattern

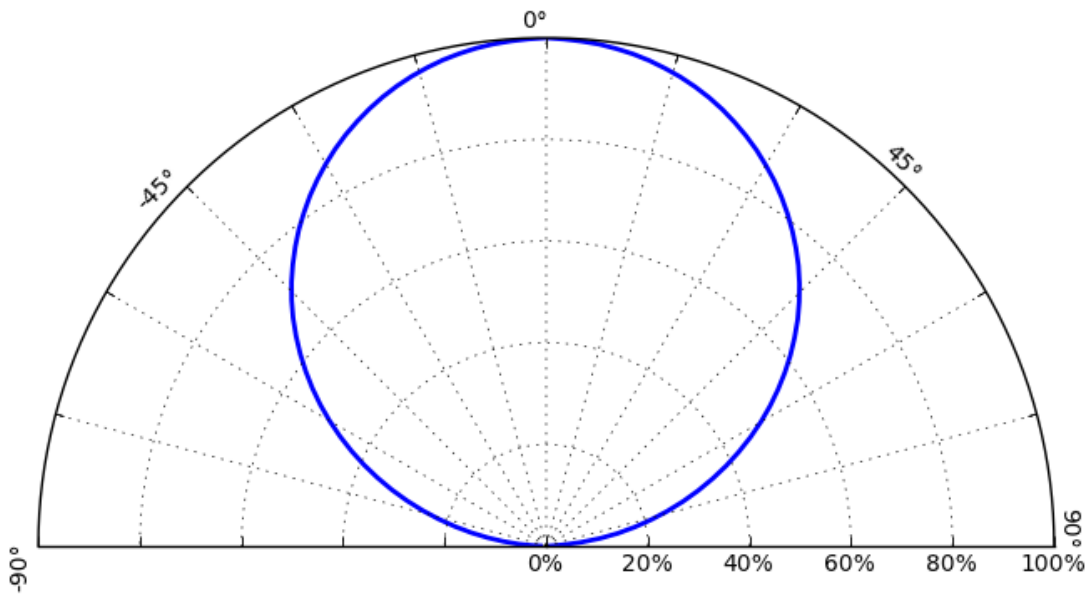


Figure 16. Typical polar radiation pattern.

Color Bin Definition

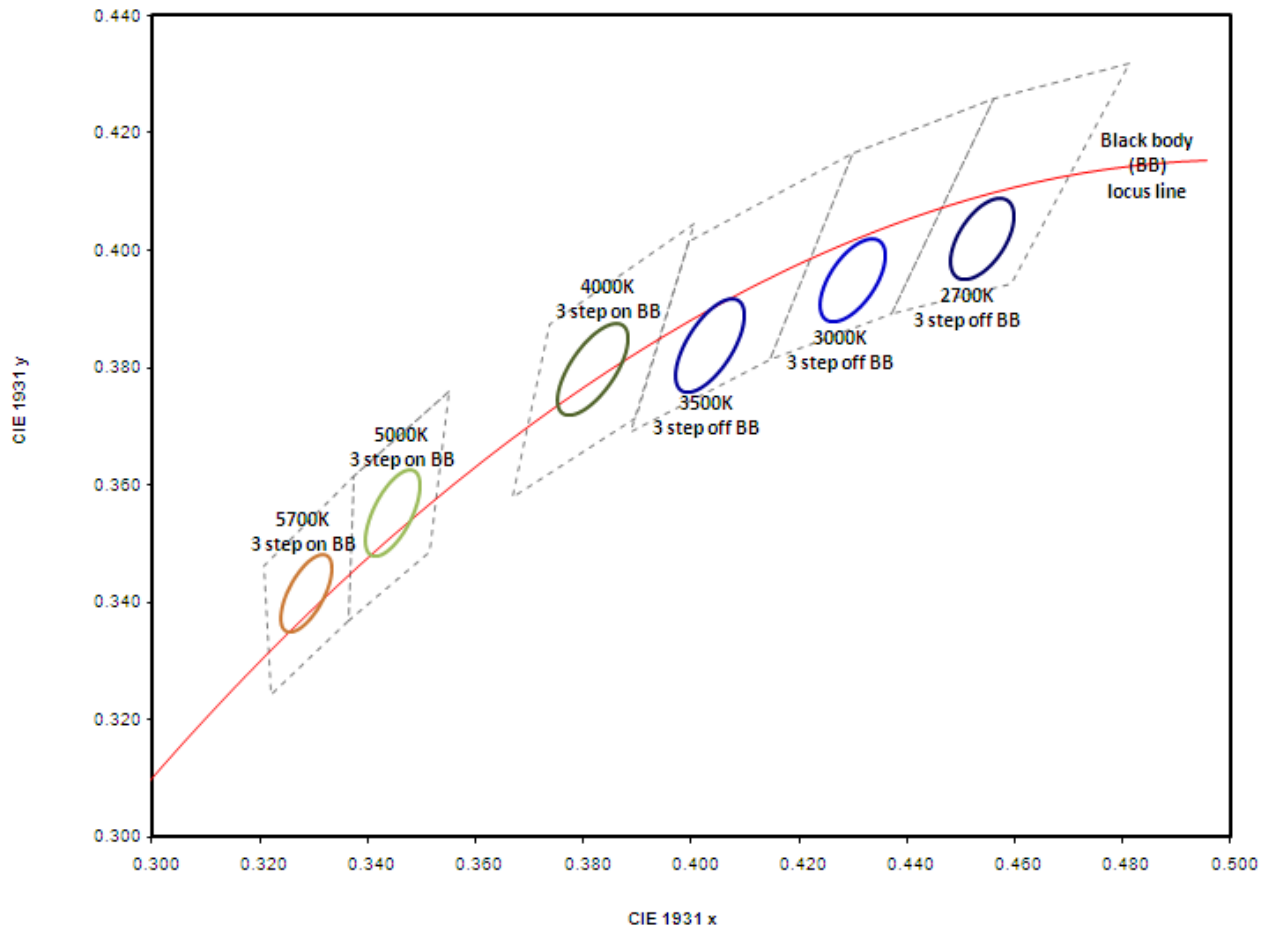


Figure 17. 3-step MacAdams ellipse color bins.

Table 8. 3-step MacAdams Ellipse Color Definition

	2700K	3000K	3500K	4000K	5000K	5700K
Center Point (X_{center}, Y_{center}) ^[1]	(0.45398, 0.40207)	(0.42998, 0.39497)	(0.40348, 0.38367)	(0.38180, 0.37970)	(0.34470, 0.35530)	(0.32870, 0.34170)
Major Axis, a ^[1]	0.00810	0.00834	0.00927	0.00939	0.00822	0.00745
Minor Axis, b ^[1]	0.00420	0.00408	0.00414	0.00402	0.00354	0.00319
Ellipse rotation angle, \emptyset	53.70°	53.22°	54.00°	53.72°	59.62°	59.09°

Notes for Table 8:

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

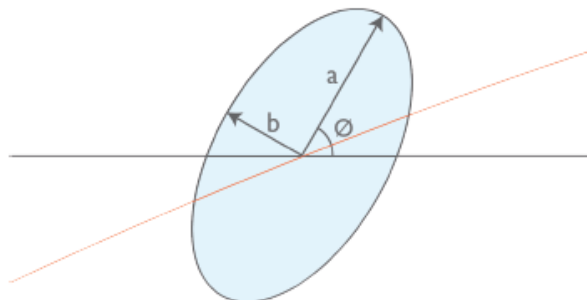


Figure 18. Illustrative figure for MacAdams ellipse color definition.

Final Packaging

Table 9. Packaging Information

	S2000 LXSx-PWxx-0017(N)	S3000 LXSx-PWxx-0024(N)	S5000 LXSx-PWxx-0041(N)
Total Unit per Tray	35	35	30
Total Tray per Box	8	8	8
Total Unit per Box	280	280	240

LUXEON S2000 / LXSx-Pxxx-0017(N)

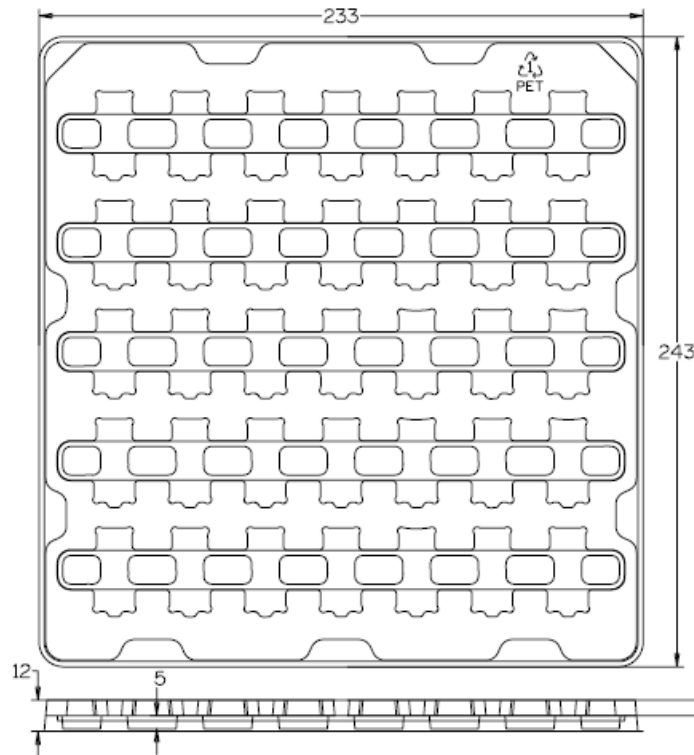


Figure 19. Package ray dimensions for LUXEON S2000 LXSx-Pxxx-0017(N).

LUXEON S3000 / LXSx-Pxxx-0024(N)

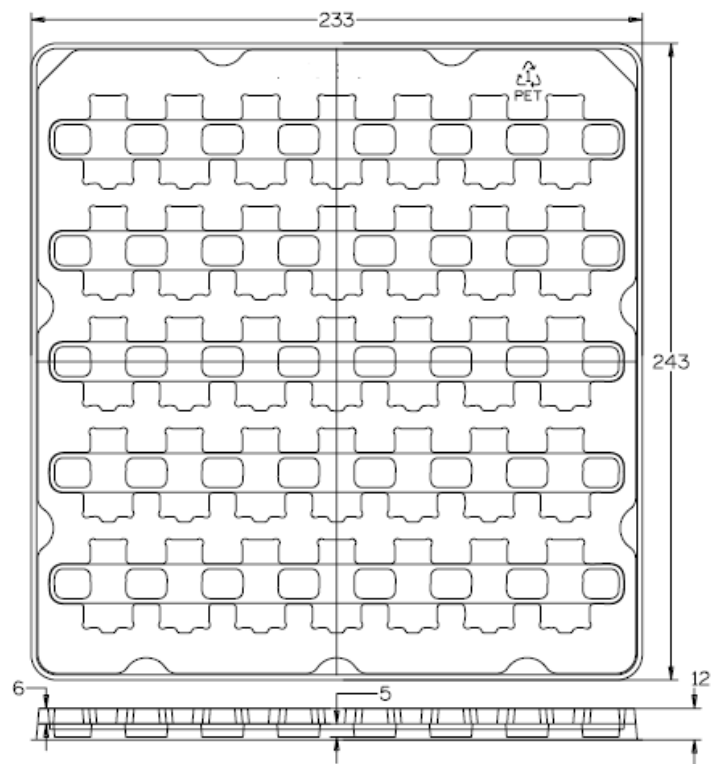


Figure 20. Package ray dimensions for LUXEON S3000 LXSx-Pxxx-0024(N).

LUXEON S5000 / LXSx-Pxxx-0041(N)

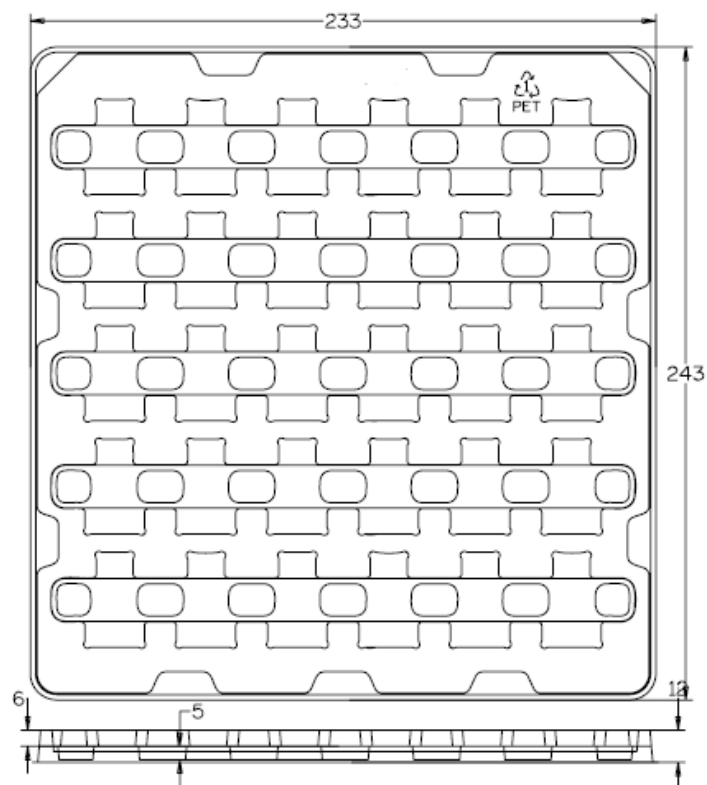


Figure 21. Package ray dimensions for LUXEON S5000 LXSx-Pxxx-0041(N).

Who We Are

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.

Philips Lumileds brings LED's qualities of energy efficiency, digital control and long life to spotlights, downlights, high bay and low bay lighting, indoor area lighting, architectural and specialty lighting as well as retrofit lamps. Our products are engineered for optimal light quality and unprecedented efficacy at the lowest overall cost. By offering LEDs in chip, packaged and module form, we deliver supply chain flexibility to the inventors of next generation illumination.

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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LUXEON S2000 3000 5000 Datasheet DS113 20131029