

LUXEON CoB

High Uniformity and High Efficiency Array



Introduction

Philips Lumileds high uniformity array solution is a new breakthrough in efficacy for arrays. Due to its industry leading small Light Emitting Surfaces (LES), the LUXEON CoB array is very easy to work with and will enable easier and less expensive designs. All LUXEON CoBs are available in a single 3-step as well as a single 5-step MacAdam Ellipse, ensuring uniform optical performance in applications like spotlights, downlights and retrofit lamps. Next to that, LUXEON CoB LEDs are all hot-tested at 85°C—real world operating conditions—which means that luminaire design is simplified and testing can be minimized.

This document contains the performance data needed to design and engineer LUXEON CoB based applications.

Features

- Efficacy: 120 lm/W hot at $T_j = 85^\circ\text{C}$, 36V
- Lumen packages from 1000-6000 lm
- Industry smallest LES (Light Emitting Surface)
- Industry leading thermal resistance
- Best luminous and color uniformity
- Binned within 3-step and 5-step MacAdam Ellipse
- Tested at $T_j = 85^\circ\text{C}$
- Robust MCPCB solution
- Mouse-bites available for M2-M3 screws
- Supported by a comprehensive optical, mechanical, and electrical ecosystem

Benefits

- Breakthrough in LED efficacy
- Enabling halogen and CDM replacement
- Enables smaller and cheaper reflectors
- Enables smaller heatsinks in your system
- More uniform and crisp light beams
- Enabling luminaire to luminaire consistency
- Real world application testing
- Easy to handle in manufacturing and operations
- Easy to screw down the arrays
- Drivers, holders and optics readily available

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General Information

Product Nomenclature

LUXEON CoB is tested and binned hot at $T_j = 85^\circ\text{C}$ with a current pulse duration of 20ms.

The part number designation is explained as follow:

L H C A – B B C C – D D E E

Where:

A — designates the generation of the product family

B B — designates ANSI color point (e.g. 30 for 3000K)

C C — designates minimum CRI level (e.g. 80 for minimum 80 CRI)

D D E E — designates color product configuration (e.g. 1203 for the 1000-2000 lm package)

Therefore 3000K, 80 CRI LUXEON CoB products will be:

L H C 1 – 3 0 8 0 – 1 2 0 3

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 CoB will deliver—on average—70% lumen maintenance (L70) at 50,000 hours of operation at its nominal, tested conditions. 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 CoB 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 CoB: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Product Performance and Characterization Guide

Junction Temperature = 85°C

Table 1. Performance and Electrical Characteristics

Nominal CCT	Part Number	Test Current If	Luminous Flux ^[1]		CRI ^[1]	Efficacy	LES ^[2]
		(mA)	Minimum (lm)	Typical (lm)	Minimum	Typical (lm/W)	(mm)
2700K	LHCI-2780-1203	300	1000	1100	>80	100	9
2700K	LHCI-2780-1204	450	1500	1650	>80	100	13
2700K	LHCI-2780-1205	600	2000	2200	>80	100	13
2700K	LHCI-2780-1208	900	3000	3300	>80	100	15
3000K	LHCI-3080-1203	300	1050	1150	>80	105	9
3000K	LHCI-3080-1204	450	1550	1725	>80	105	13
3000K	LHCI-3080-1205	600	2100	2300	>80	105	13
3000K	LHCI-3080-1208	900	3100	3450	>80	105	15
4000K	LHCI-4080-1203	300	1080	1200	>80	110	9
4000K	LHCI-4080-1204	450	1620	1800	>80	110	13
4000K	LHCI-4080-1205	600	2160	2400	>80	110	13
4000K	LHCI-4080-1208	900	3240	3600	>80	110	15

Notes for Table 1:

- Philips Lumileds maintains a tolerance of $\pm 6.5\%$ on luminous flux, ± 2 on CRI.
- Light Emitting Surface (LES) is the inner diameter (phosphor area) inside the dam.

Table 2. Optical Characteristics

Nominal CCT	Typical Total Included Angle ^[1] (degrees)	Typical Viewing Angle ^[1]
	$\theta_{0.90V}$	$2\theta^{1/2}$
LHCI - xxxx - xxxx	125	100

Notes for Table 2:

- 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 $\frac{1}{2}$ of the peak value.

Electrical Characteristics

Table 3. Electrical Characteristics at Test Current

Nominal CCT	Part Number	Forward Voltage V _F 85°C (V)		Typical Temperature Coefficient of Forward Voltage ^[1] (mV/°C) $\Delta V_F / \Delta T_J$	Typical Thermal Resistance Junction to Case ^[2] (°C/W) R _{θJ-C}
		Typical	Maximum		
3000K	LHCI-xxxx-1203	36.0	39.0	-16	0.49
3000K	LHCI-xxxx-1204	36.0	39.0	-16	0.40
3000K	LHCI-xxxx-1205	36.0	39.0	-16	0.32
3000K	LHCI-xxxx-1208	36.0	39.0	-16	0.22

Notes for Table 2:

1. Measured between T_J = 25°C and T_J = 105°C at test current.
2. Junction temperature to back of PCB.

Absolute Maximum Ratings

Table 4. Operating Condition and Ratings

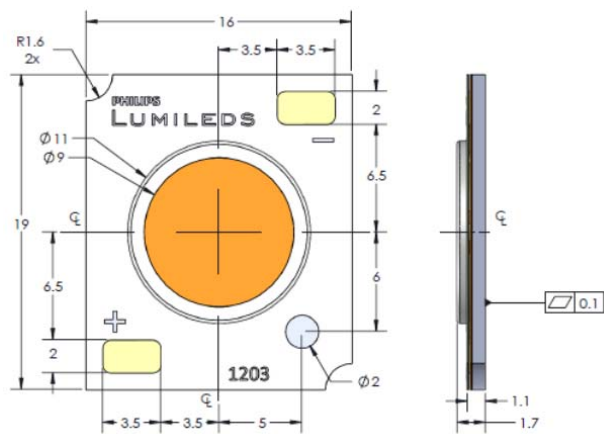
Parameter	Maximum Performance
DC Forward Current	2x test current ^[2]
ESD Sensitivity	< 8000V Human Body Model (HBM) Class 3A JESD22-A114-E < 400V Machine Model (MM) Class B JESD22-A115-B
Storage Temperature	-40°C - 120°C
LED Junction Temperature ^[1]	125°C
Operating Case Temperature at Nominal Current	-40°C - 105°C
Reverse Voltage	LUXEON CoB is not designed to be driven in reverse bias

Notes for Table 4:

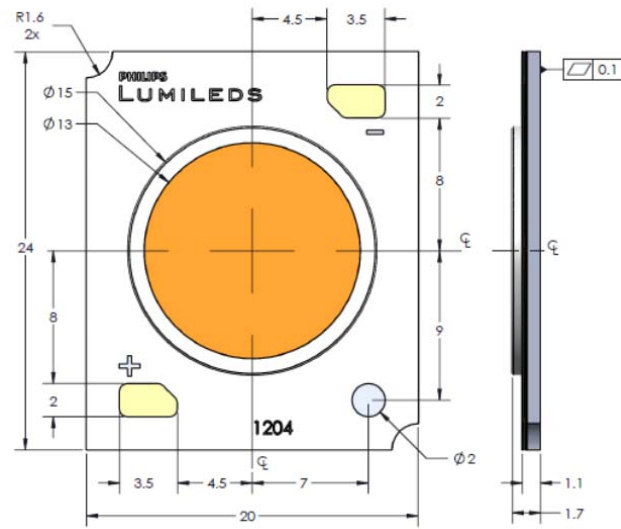
1. Proper current derating must be observed to maintain junction temperature below the maximum, please see preliminary application brief for additional information on thermal measurement guidelines.
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple", with frequencies ≥ 100 Hz and amplitude ±20% are acceptable, assuming the average current throughout each cycle does not exceed 2x test If.

Mechanical Dimensions

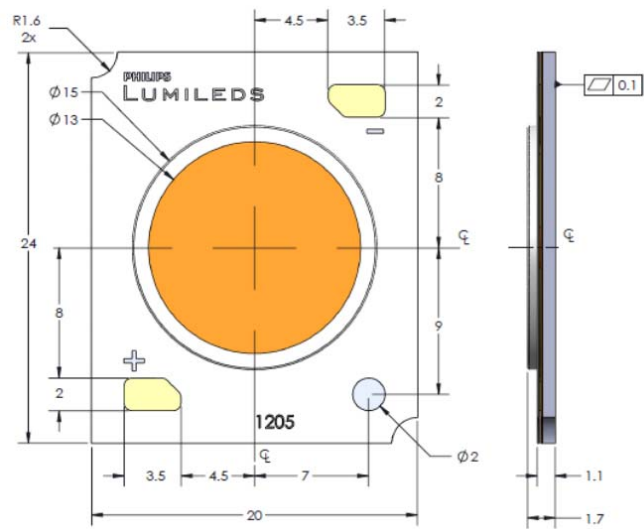
LUXEON CoB: LHCI – xxxx – I203



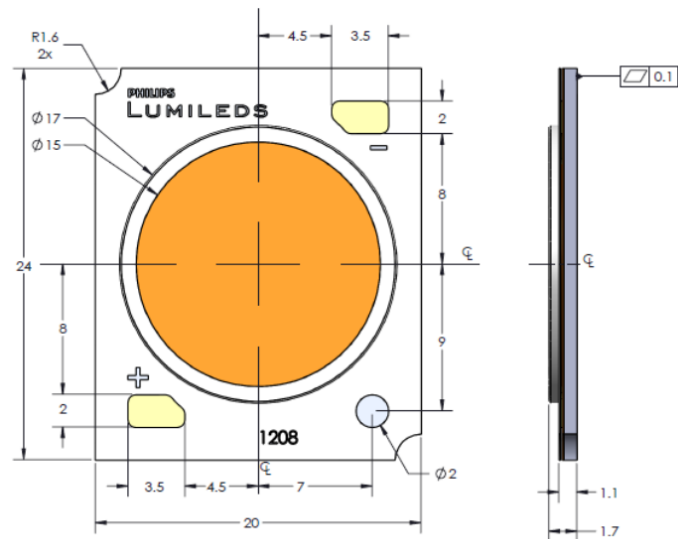
LUXEON CoB: LHCI – xxxx – I204



LUXEON CoB: LHCI – xxxx – I205



LUXEON CoB: LHCI – xxxx – I208



Characteristic Curves

Relative Spectral Distribution vs. Wavelength
Junction Temperature = 85°C, at Test Current

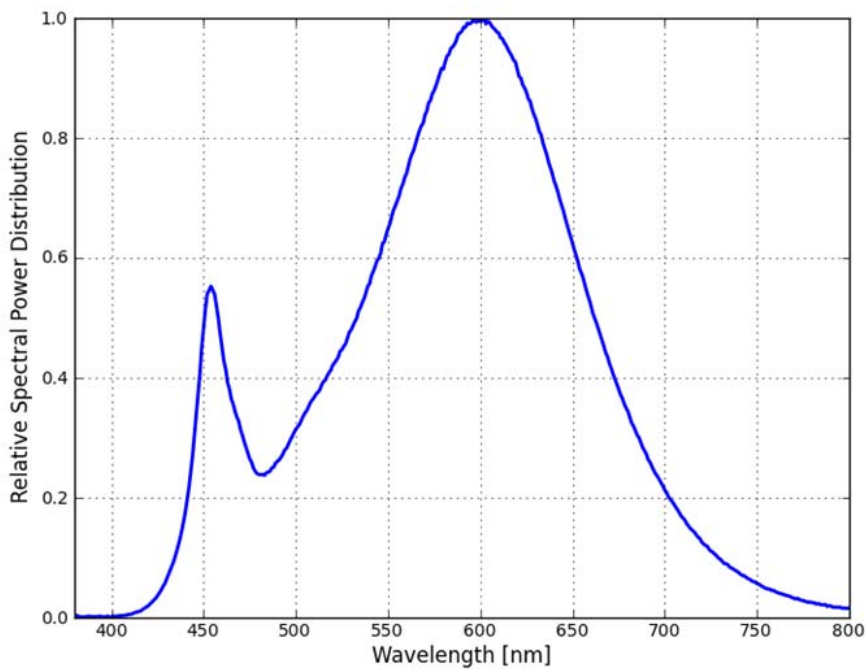


Figure 1. Color spectrum of 3000K, 80 minimum CRI, integrated measurement.

Relative Light Output Characteristics over Temperature at Test Current

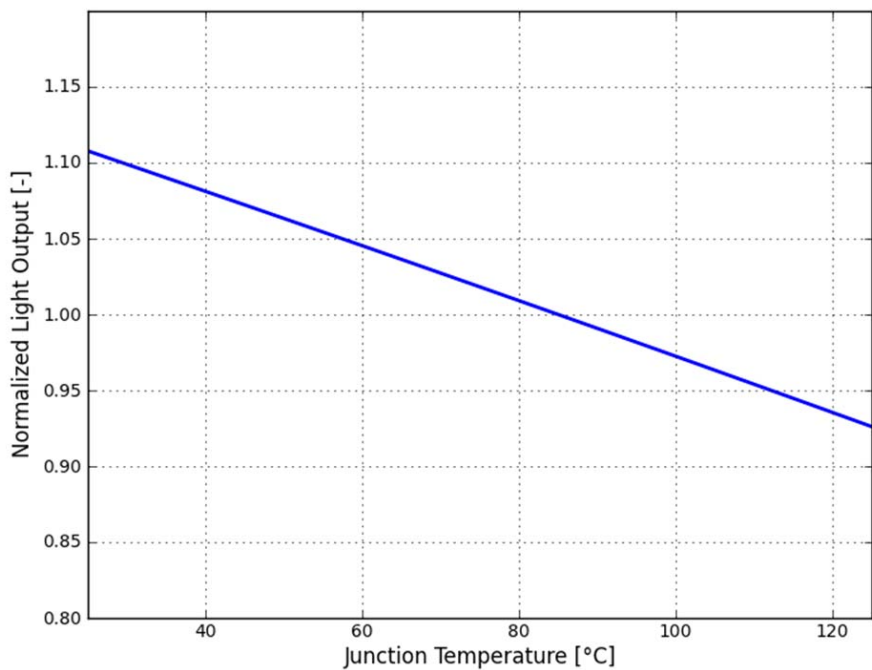
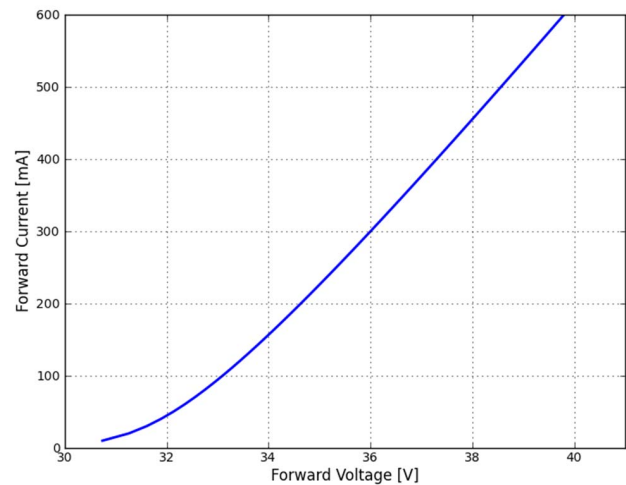


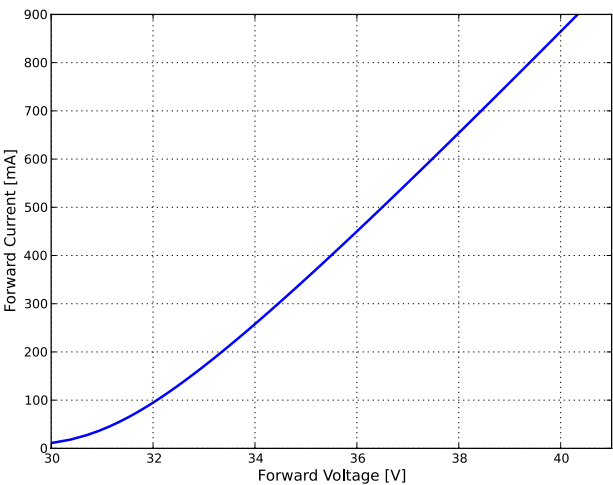
Figure 2. Relative light output vs. junction temperature.

Typical Forward Current Characteristics

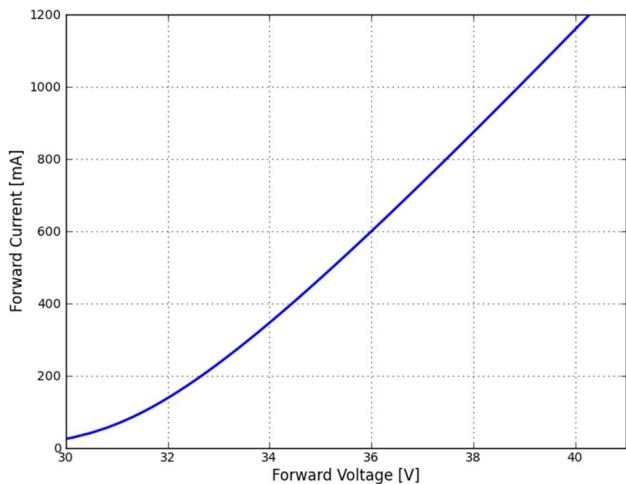
LUXEON CoB LHCI – xxxx – xxxx, Junction Temperature = 85°C



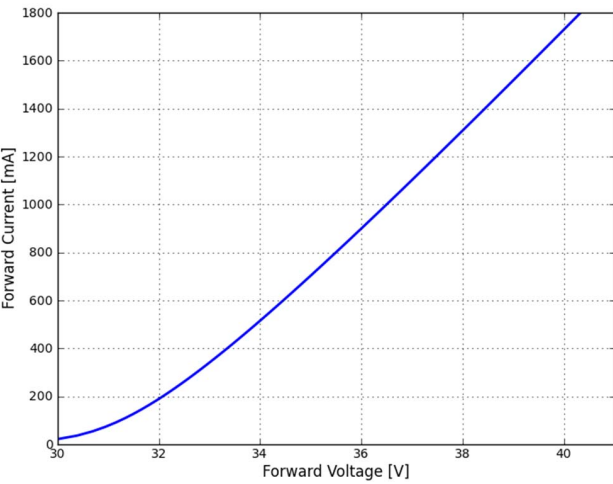
LUXEON CoB: LHCI – xxxx – I203



LUXEON CoB: LHCI – xxxx – I204



LUXEON CoB: LHCI – xxxx – I205

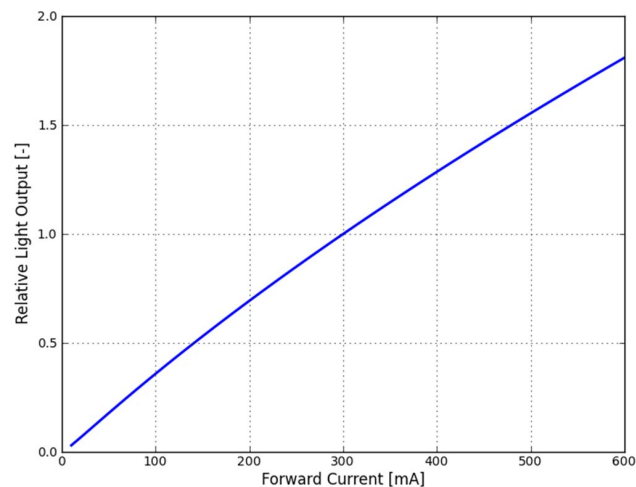


LUXEON CoB: LHCI – xxxx – I208

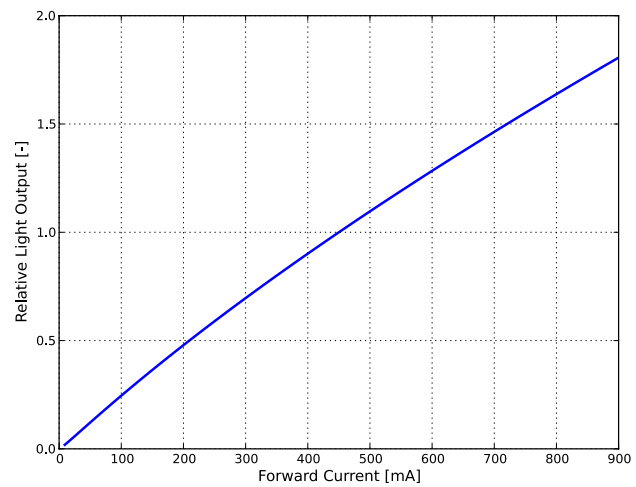
Figure 3. Forward current vs. forward voltage.

Typical Relative Luminous Flux vs. Forward Current

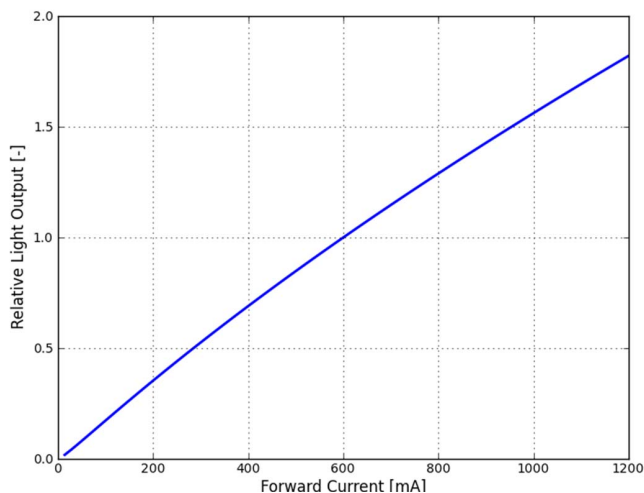
LUXEON CoB LHCI – xxxx – xxxx, Junction Temperature = 85°C



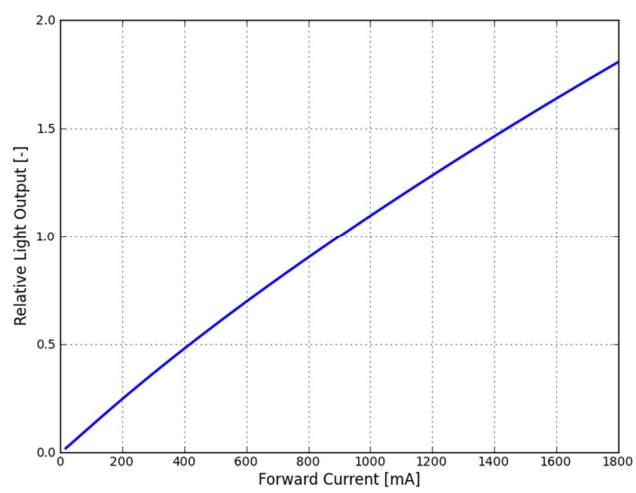
LUXEON CoB: LHCI – xxxx – I203



LUXEON CoB: LHCI – xxxx – I204



LUXEON CoB: LHCI – xxxx – I205



LUXEON CoB: LHCI – xxxx – I208

Figure 4. Typical relative luminous flux vs. current.

Typical Radiation Patterns

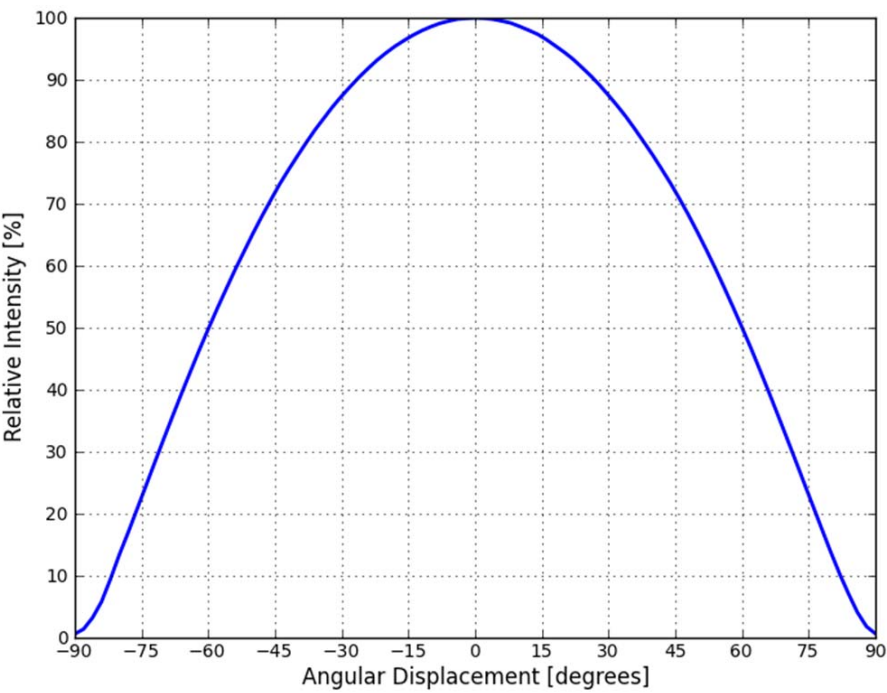


Figure 5. Radiation pattern for LHCI – xxxx – 120x.

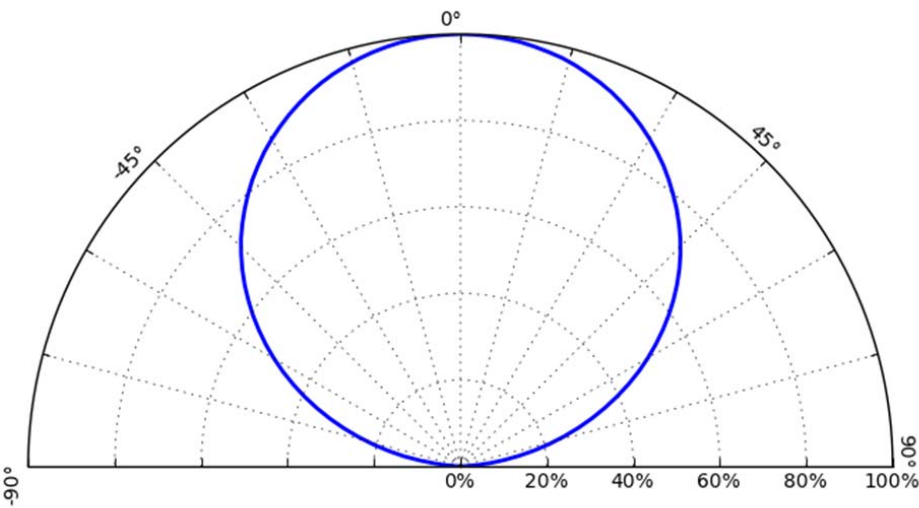


Figure 6. Polar radiation pattern for LHCI – xxxx – 120x.

Color Bin Definition

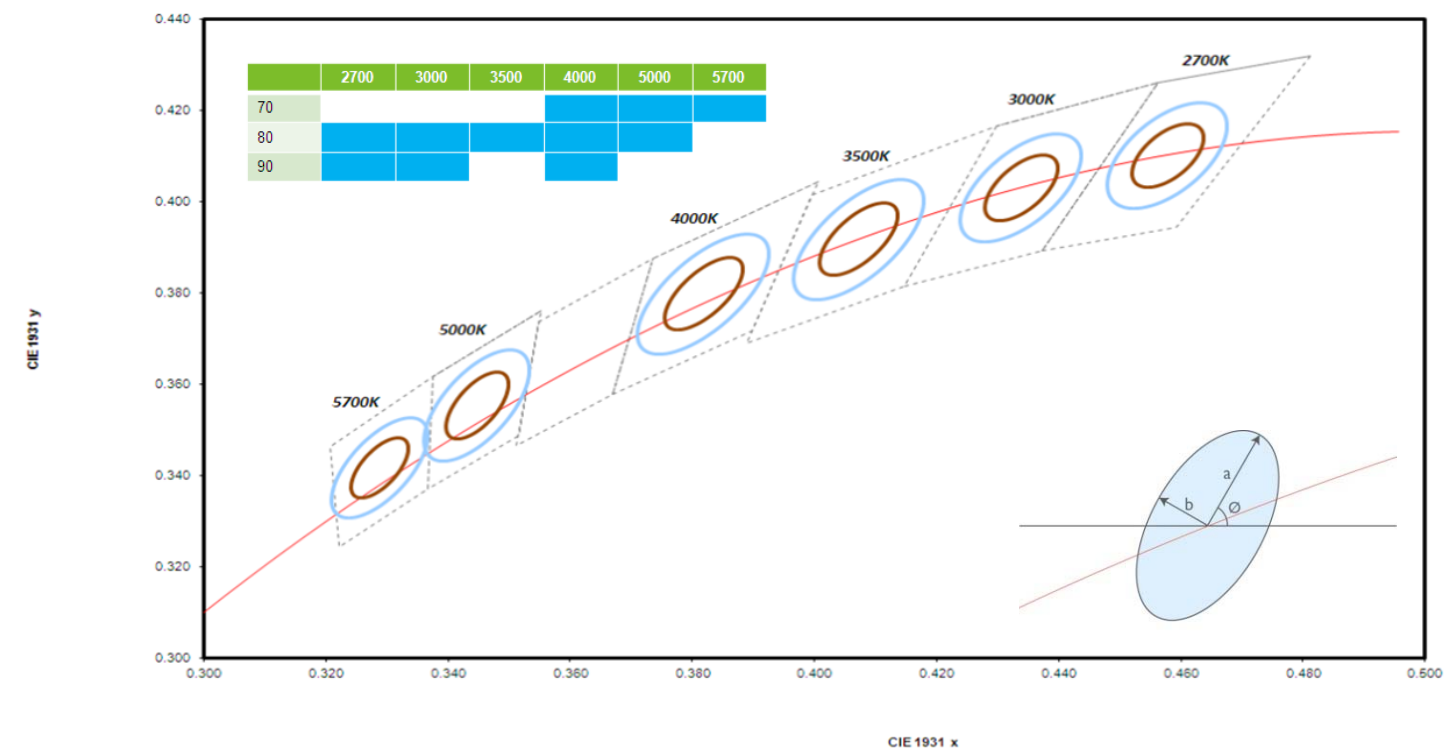


Figure 7. 3-step and 5-step MacAdam ellipse color bins.

Table 5. 3-step and 5-step MacAdam Ellipse Color Definition

Nominal ANSI CCT	Color Space	Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
2700K	Single 3-step MacAdam ellipse	(0.4578, 0.4101)	0.00810	0.00420	53.7
3000K	Single 3-step MacAdam ellipse	(0.4338, 0.4030)	0.00834	0.00408	53.2
3500K	Single 3-step MacAdam ellipse	(0.4073, 0.3917)	0.00927	0.00414	54.0
4000K	Single 3-step MacAdam ellipse	(0.3818, 0.3797)	0.00939	0.00402	53.7
5000K	Single 3-step MacAdam ellipse	(0.3447, 0.3553)	0.00822	0.00354	59.6

Nominal ANSI CCT	Color Space	Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
2700K	Single 5-step MacAdam ellipse	(0.4578, 0.4101)	0.01350	0.00700	53.7
3000K	Single 5-step MacAdam ellipse	(0.4338, 0.4030)	0.01390	0.00680	53.2
3500K	Single 5-step MacAdam ellipse	(0.4073, 0.3917)	0.01545	0.00690	54.0
4000K	Single 5-step MacAdam ellipse	(0.3818, 0.3797)	0.01565	0.00670	53.7
5000K	Single 5-step MacAdam ellipse	(0.3447, 0.3553)	0.01370	0.00590	59.6
5700K	Single 5-step MacAdam ellipse	(0.3287, 0.3417)	0.01243	0.00533	59.09

Note for Table 5:

- 1. Philips Lumileds maintains a tester tolerance of ±0.005 on x,y coordinates.
- 2. Major and minor axis (a,b) from table 5 are a reference as depicted in figure 7.

Package Info and Dimensions

Table 6. Package Info

	LHCI – xxxx - I203	LHCI – xxxx - I204	LHCI – xxxx - I205	LHCI – xxxx - I208
Total Units per Tube	20	20	20	20
Total Tubes per Box	5	5	5	5
Total Units per Box	100	100	100	100

LUXEON CoB LHCI – xxxx - I203

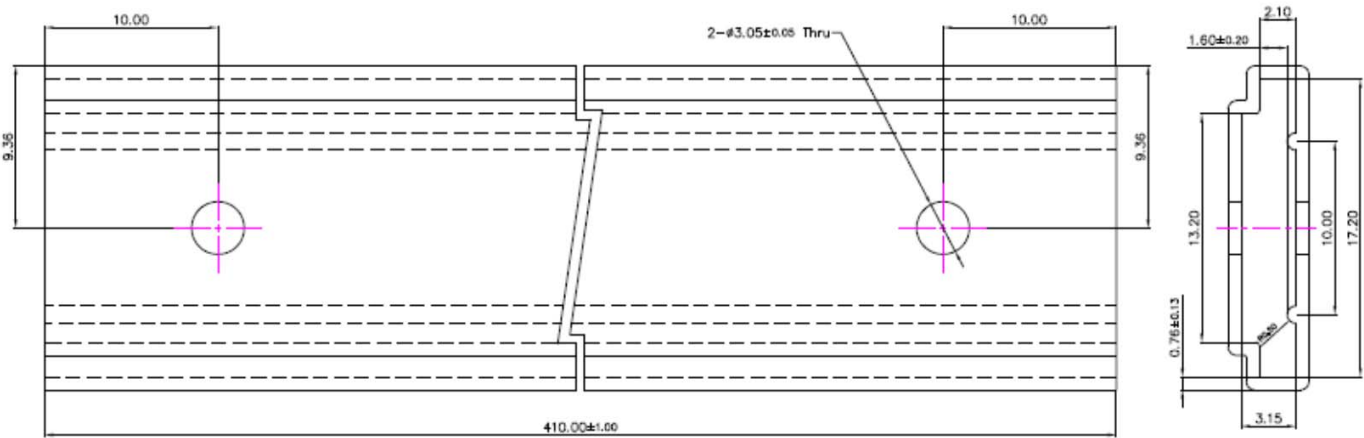


Figure 9. Package ray dimension for LUXEON CoB LHCI – xxxx - I203.

LUXEON CoB LHCI – xxxx – I204, -I205 and -I208

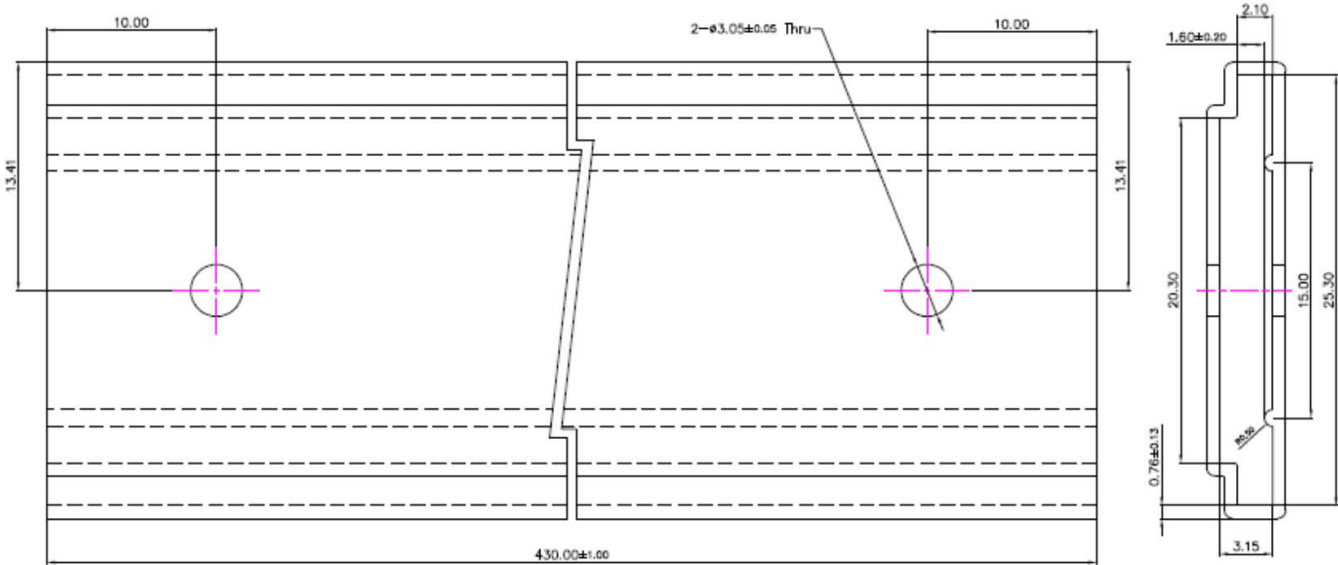


Figure 10. Package ray dimension for LUXEON CoB LHCI – xxxx – I204, -I205 and -I208.

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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LUXEON CoB Datasheet DSI15 20130614