



# LUXEON CoB Core Range

High-efficacy LED with a small light emitting surface and greater uniformity of light

LUXEON CoB Core Range consists of high uniformity LEDs that represent a new breakthrough in efficacy for chip-on-boards. Due to its industry leading small Light Emitting Surfaces (LES), LUXEON CoB arrays are very easy to work with and will enable easier and less expensive designs. All emitters within the LUXEON CoB Core Range are available in 3-step (80 and 90CRI) as well as 5-step (70CRI) MacAdam ellipse, ensuring uniform optical performance in general lighting applications. In addition, LUXEON CoB Core Range LEDs are all hot-tested at 85°C — real world operating conditions — which means that luminaire design is simplified and testing can be minimized.



## FEATURES AND BENEFITS

Highest flux densities with industry's smallest LES, 6.5mm

R9 between 80 and 90 for vibrant reds

3-step MacAdam ellipse color definition: *Freedom from Binning* for color consistency from luminaire to luminaire

Up to 4x better thermal resistance than competition, enabling smaller heat sinks and higher lumens

Supported by a comprehensive optical, mechanical and electrical ecosystem

## PRIMARY APPLICATIONS

Architectural

Downlights

High Bay & Low Bay

Lamps

Outdoor

Specialty Lighting

Spotlights

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# General Information

## Part Number 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 follows:

L H C A – B B C C – D D E E (Traditional)

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 80CRI)

D D E E — designates product configuration (e.g. 1203 for the 1000–2000 lumen package)

L 2 C A – B B C C D D E E F F G G G (New Part Number Scheme for New Products)

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 80CRI)

D D E E — designates product configuration (e.g. 1202 for the low lumen package)

F F — designates light emitting surface (e.g. 06 for 6mm LES)

G G G — designates manufacturing technology (e.g. ACO for crisp white)

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

L H C 1 – 3 0 8 0 – 1 2 0 3

L 2 C 1 – 3 0 8 0 1 2 0 2 0 6 A 0 0

CAT codes of LUXEON CoB:

3S: color within 3-step MacAdam ellipse

5S: color within 5-step MacAdam ellipse

## 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. 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. This performance is based on independent test data, Lumileds historical data from tests run on similar material systems, and internal LUXEON reliability testing.

## Environmental Compliance

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. 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 Selection Guide

**Table 1a. Product Selection Guide for LUXEON CoB 1202s**

Product	CRI <sup>[1]</sup>		Nominal CCT	Luminous Flux <sup>[1, 2]</sup>		Efficacy (lm/W)	Test Current (mA)	LES <sup>[3]</sup> (mm)	Part Number
	Min.	Typ.		Min. (lm)	Typ. (lm)				
LUXEON CoB 1202s	80	82	2200K	550	625	88	200	6.5	L2C1-2280120206A00
	80	82	2700K	645	725	101	200	6.5	L2C1-2780120206A00
	80	82	3000K	700	775	109	200	6.5	L2C1-3080120206A00
	80	82	3500K	700	775	109	200	6.5	L2C1-3580120206A00
	80	82	4000K	700	800	113	200	6.5	L2C1-4080120206A00
	80	82	5000K	725	825	116	200	6.5	L2C1-5080120206A00
	90	97	2200K	450	525	75	200	6.5	L2C1-2290120206A00
	90	97	2700K	525	600	85	200	6.5	L2C1-2790120206A00
	90	97	3000K	550	625	88	200	6.5	L2C1-3090120206A00
	90	97	3500K	575	650	92	200	6.5	L2C1-3590120206A00
	90	97	4000K	600	700	100	200	6.5	L2C1-4090120206A00

**Table 1b. Product Selection Guide for LUXEON CoB 1202**

Product	CRI <sup>[1]</sup>		Nominal CCT	Luminous Flux <sup>[1, 2]</sup>		Efficacy (lm/W)	Test Current (mA)	LES <sup>[3]</sup> (mm)	Part Number
	Min.	Typ.		Min. (lm)	Typ. (lm)				
LUXEON CoB 1202	80	82	2200K	575	650	92	200	9.0	LHC1-2280-1202
	80	82	2700K	675	750	106	200	9.0	LHC1-2780-1202
	80	82	3000K	725	800	115	200	9.0	LHC1-3080-1202
	80	82	3500K	750	825	119	200	9.0	LHC1-3580-1202
	80	82	4000K	750	850	122	200	9.0	LHC1-4080-1202
	80	82	5000K	775	875	124	200	9.0	LHC1-5080-1202
	90	97	2200K	475	550	44	200	9.0	LHC1-2290-1202
	90	97	2700K	550	625	90	200	9.0	LHC1-2790-1202
	90	97	3000K	575	650	93	200	9.0	LHC1-3090-1202
	90	97	3500K	578	600	96	200	9.0	LHC1-3590-1202
	90	97	4000K	650	725	100	200	9.0	LHC1-4090-1202

**Notes for Table 1:**

1. Lumileds maintains a tolerance of ±6.5% on luminous flux, ±2 on CRI.
2. Maximum luminous flux is 10% above typical luminous flux.
3. Light Emitting Surface (LES) is the inner diameter (phosphor area) inside the dam.

**Table 1c. Product Selection Guide for LUXEON CoB 1203**

Product	CRI <sup>[1]</sup>		Nominal CCT	Luminous Flux <sup>[1, 2]</sup>		Efficacy (lm/W)	Test Current (mA)	LES <sup>[3]</sup> (mm)	Part Number
	Min.	Typ.		Min. (lm)	Typ. (lm)				
LUXEON CoB 1203	70	73	3000K	1172	1300	122	300	9.0	LHC1-3070-1203
	70	73	3500K	1172	1300	122	300	9.0	LHC1-3570-1203
	70	73	4000K	1225	1375	130	300	9.0	LHC1-4070-1203
	70	73	5000K	1225	1375	130	300	9.0	LHC1-5070-1203
	70	73	5700K	1225	1375	130	300	9.0	LHC1-5770-1203
	80	82	2200K	825	950	92	300	9.0	LHC1-2280-1203
	80	82	2700K	1025	1125	106	300	9.0	LHC1-2780-1203
	80	82	3000K	1100	1225	115	300	9.0	LHC1-3080-1203
	80	82	3500K	1150	1275	119	300	9.0	LHC1-3580-1203
	80	82	4000K	1175	1300	122	300	9.0	LHC1-4080-1203
	80	82	5000K	1175	1325	124	300	9.0	LHC1-5080-1203
	90	97	2200K	700	825	80	300	9.0	LHC1-2290-1203
	90	97	2700K	850	950	90	300	9.0	LHC1-2790-1203
	90	97	3000K	900	1000	93	300	9.0	LHC1-3090-1203
	90	97	3500K	925	1025	96	300	9.0	LHC1-3590-1203
	90	97	4000K	1000	1100	100	300	9.0	LHC1-4090-1203

**Table 1d. Product Selection Guide for LUXEON CoB 1204**

Product	CRI <sup>[1]</sup>		Nominal CCT	Luminous Flux <sup>[1, 2]</sup>		Efficacy (lm/W)	Test Current (mA)	LES <sup>[3]</sup> (mm)	Part Number
	Min.	Typ.		Min. (lm)	Typ. (lm)				
LUXEON CoB 1204	70	73	3000K	1725	1950	122	450	13.0	LHC1-3070-1204
	70	73	3500K	1725	1950	122	450	13.0	LHC1-3570-1204
	70	73	4000K	1825	2050	130	450	13.0	LHC1-4070-1204
	70	73	5000K	1825	2050	130	450	13.0	LHC1-5070-1204
	70	73	5700K	1825	2050	130	450	13.0	LHC1-5770-1204
	80	82	2200K	1325	1475	92	450	13.0	LHC1-2280-1204
	80	82	2700K	1550	1700	106	450	13.0	LHC1-2780-1204
	80	82	3000K	1625	1825	115	450	13.0	LHC1-3080-1204
	80	82	3500K	1725	1900	119	450	13.0	LHC1-3580-1204
	80	82	4000K	1725	1950	122	450	13.0	LHC1-4080-1204
	80	82	5000K	1750	1975	124	450	13.0	LHC1-5080-1204
	90	97	2200K	1075	1250	78	450	13.0	LHC1-2290-1204
	90	97	2700K	1275	1425	90	450	13.0	LHC1-2790-1204
	90	97	3000K	1325	1475	93	450	13.0	LHC1-3090-1204
	90	97	3500K	1400	1525	96	450	13.0	LHC1-3590-1204
	90	97	4000K	1450	1600	100	450	13.0	LHC1-4090-1204

**Notes for Table 1:**

1. Lumileds maintains a tolerance of  $\pm 6.5\%$  on luminous flux,  $\pm 2$  on CRI.
2. Maximum luminous flux is 10% above typical luminous flux.
3. Light Emitting Surface (LES) is the inner diameter (phosphor area) inside the dam.

**Table 1e. Product Selection Guide for LUXEON CoB 1205**

Product	CRI <sup>[1]</sup>		Nominal CCT	Luminous Flux <sup>[1, 2]</sup>		Efficacy (lm/W)	Test Current (mA)	LES <sup>[3]</sup> (mm)	Part Number
	Min.	Typ.		Min. (lm)	Typ. (lm)				
LUXEON CoB 1205	70	73	3000K	2325	2600	122	600	13.0	LHC1-3070-1205
	70	73	3500K	2325	2600	122	600	13.0	LHC1-3570-1205
	70	73	4000K	2450	2750	130	600	13.0	LHC1-4070-1205
	70	73	5000K	2450	2750	130	600	13.0	LHC1-5070-1205
	70	73	5700K	2450	2750	130	600	13.0	LHC1-5770-1205
	80	82	2200K	1700	1950	92	600	13.0	LHC1-2280-1205
	80	82	2700K	2000	2250	106	600	13.0	LHC1-2780-1205
	80	82	3000K	2200	2450	115	600	13.0	LHC1-3080-1205
	80	82	3500K	2250	2550	119	600	13.0	LHC1-3580-1205
	80	82	4000K	2325	2600	122	600	13.0	LHC1-4080-1205
	80	82	5000K	2350	2650	124	600	13.0	LHC1-5080-1205
	90	97	2200K	1400	1600	79	600	13.0	LHC1-2290-1205
	90	97	2700K	1700	1900	90	600	13.0	LHC1-2790-1205
	90	97	3000K	1800	2000	93	600	13.0	LHC1-3090-1205
	90	97	3500K	1850	2075	96	600	13.0	LHC1-3590-1205
	90	97	4000K	1925	2150	100	600	13.0	LHC1-4090-1205

**Table 1f. Product Selection Guide for LUXEON CoB 1208**

Product	CRI <sup>[1]</sup>		Nominal CCT	Luminous Flux <sup>[1, 2]</sup>		Efficacy (lm/W)	Test Current (mA)	LES <sup>[3]</sup> (mm)	Part Number
	Min.	Typ.		Min. (lm)	Typ. (lm)				
LUXEON CoB 1208	70	73	3000K	3500	3900	122	900	15.0	LHC1-3070-1208
	70	73	3500K	3500	3900	122	900	15.0	LHC1-3570-1208
	70	73	4000K	3650	4100	130	900	15.0	LHC1-4070-1208
	70	73	5000K	3700	4100	130	900	15.0	LHC1-5070-1208
	70	73	5700K	3700	4100	130	900	15.0	LHC1-5770-1208
	80	82	2200K	2600	2925	92	900	15.0	LHC1-2280-1208
	80	82	2700K	3050	3400	106	900	15.0	LHC1-2780-1208
	80	82	3000K	3275	3650	115	900	15.0	LHC1-3080-1208
	80	82	3500K	3400	3800	119	900	15.0	LHC1-3580-1208
	80	82	4000K	3500	3900	122	900	15.0	LHC1-4080-1208
	80	82	5000K	3500	3950	124	900	15.0	LHC1-5080-1208
	90	97	2200K	2125	2450	79	900	15.0	LHC1-2290-1208
	90	97	2700K	2550	2850	90	900	15.0	LHC1-2790-1208
	90	97	3000K	2625	2950	93	900	15.0	LHC1-3090-1208
	90	97	3500K	2775	3075	96	900	15.0	LHC1-3590-1208
	90	97	4000K	2900	3200	100	900	15.0	LHC1-4090-1208

**Notes for Table 1:**

1. Lumileds maintains a tolerance of  $\pm 6.5\%$  on luminous flux,  $\pm 2$  on CRI.
2. Maximum luminous flux is 10% above typical luminous flux.
3. Light Emitting Surface (LES) is the inner diameter (phosphor area) inside the dam.

**Table 1g. Product Selection Guide for LUXEON CoB 1211**

Product	CRI <sup>[1]</sup>		Nominal CCT	Luminous Flux <sup>[1,2]</sup>		Efficacy (lm/W)	Test Current (mA)	LES <sup>[3]</sup> (mm)	Part Number
	Min.	Typ.		Min. (lm)	Typ. (lm)				
LUXEON CoB 1211	70	73	3000K	4775	5200	122	1200	19.0	LHC1-3070-1211
	70	73	3500K	4775	5200	122	1200	19.0	LHC1-3570-1211
	70	73	4000K	5050	5600	130	1200	19.0	LHC1-4070-1211
	70	73	5000K	5050	5600	130	1200	19.0	LHC1-5070-1211
	70	73	5700K	5050	5600	130	1200	19.0	LHC1-5770-1211
	80	82	2200K	3550	3975	92	1200	19.0	LHC1-2280-1211
	80	82	2700K	4150	4600	106	1200	19.0	LHC1-2780-1211
	80	82	3000K	4500	5000	115	1200	19.0	LHC1-3080-1211
	80	82	3500K	4675	5200	119	1200	19.0	LHC1-3580-1211
	80	82	4000K	4775	5200	122	1200	19.0	LHC1-4080-1211
	80	82	5000K	4850	5300	124	1200	19.0	LHC1-5080-1211
	90	97	2200K	2925	3425	80	1200	19.0	LHC1-2290-1211
	90	97	2700K	3500	3875	90	1200	19.0	LHC1-2790-1211
	90	97	3000K	3650	4000	93	1200	19.0	LHC1-3090-1211
	90	97	3500K	3775	4200	96	1200	19.0	LHC1-3590-1211
	90	97	4000K	4050	4400	100	1200	19.0	LHC1-4090-1211

**Notes for Table 1:**

1. Lumileds maintains a tolerance of  $\pm 6.5\%$  on luminous flux,  $\pm 2$  on CRI.
2. Maximum luminous flux is 10% above typical luminous flux.
3. Light Emitting Surface (LES) is the inner diameter (phosphor area) inside the dam.

**Table 2. Optical Characteristics**

Nominal CCT	Typical Total Included Angle <sup>[1]</sup> (degrees) $\theta_{0.90v}$	Typical Viewing Angle <sup>[2]</sup> $2\theta^{1/2}$
L2C1 – xxxx120206xxx	135	115
LHC1 – xxxx – xxxx	135	115

**Notes for Table 2:**

1. Total angle at which 90% of total luminous flux is captured.
2. 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**

Nominal CCT	Part Number	Forward Voltage, 85°C (V) <sup>[1, 2]</sup>			Typical Temperature Coefficient of Forward Voltage <sup>[1]</sup> (mV/°C) $\Delta V_F / \Delta T_J$	Typical Thermal Resistance Junction to Case <sup>[3]</sup> (°C/W) $R_{\theta_{J-C}}$
		Min.	Typ.	Max.		
2200K to 5700K	L2CI-xxxx120206xxx	33	35.5	38	-16	0.98
2200K to 5700K	LHC1-xxxx-1202	33	35.5	38	-16	0.98
2200K to 5700K	LHC1-xxxx-1203	33	35.5	38	-16	0.70
2200K to 5700K	LHC1-xxxx-1204	33	35.5	38	-16	0.68
2200K to 5700K	LHC1-xxxx-1205	33	35.5	38	-16	0.51
2200K to 5700K	LHC1-xxxx-1208	33	35.5	38	-16	0.29
2200K to 5700K	LHC1-xxxx-1211	33	35.5	38	-16	0.23

Notes for Table 3:

1. Measured between  $T_j = 25^\circ\text{C}$  and  $T_j = 105^\circ\text{C}$  at test current.
2. Voltage tester tolerance  $\pm 2\%$
3. Junction temperature to back of the PCB and measurement tolerance of  $\sim 10\%$ .

## Absolute Maximum Ratings

**Table 4. Operating Condition and Ratings**

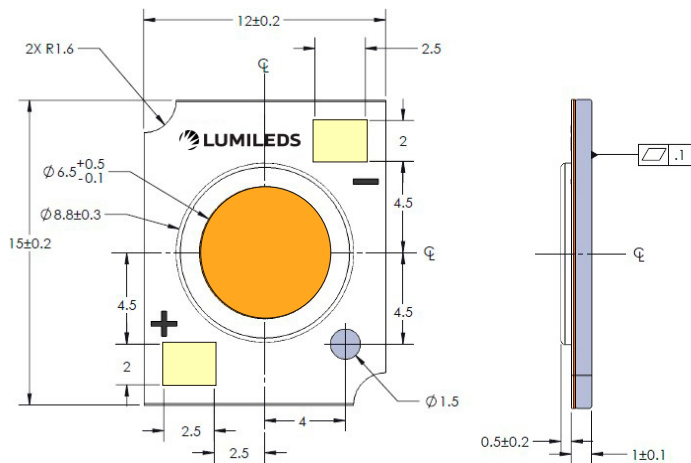
Parameter	Maximum Performance
DC Forward Current	2x test current <sup>[2]</sup>
ESD Sensitivity	< 8000V Human Body Model (HBM) Class 3A JESD22-A114-E < 400V Machine Model (MM) Class B JESD22-A115-B
Storage Temperature	-40°C - 120°C
LED Junction Temperature <sup>[1]</sup>	125°C <sup>[3]</sup>
Operating 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:

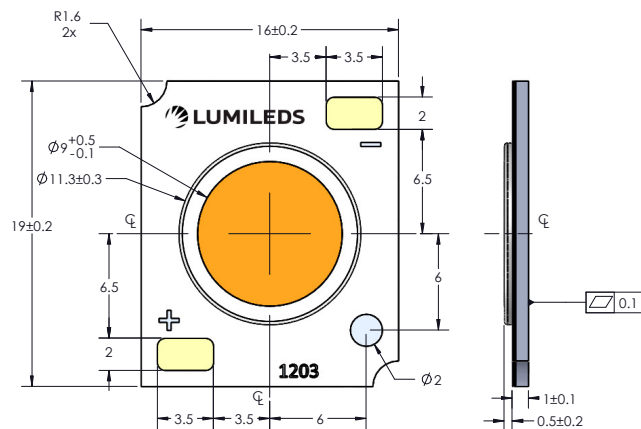
1. Proper current derating must be observed to maintain junction temperature below the maximum, please see preliminary application brief for additional information on thermal measurement guidelines.
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current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



# Mechanical Dimensions

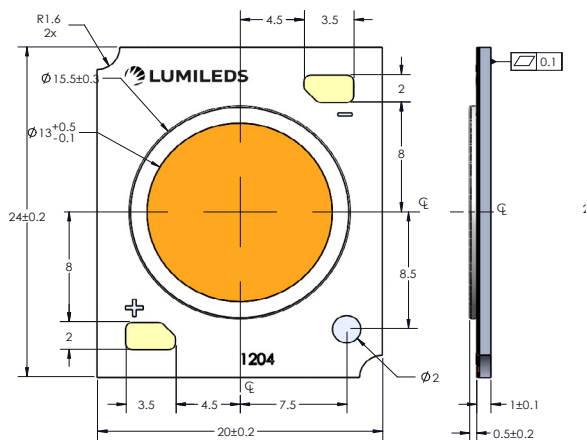


L2C1 – xxxx120206xxx

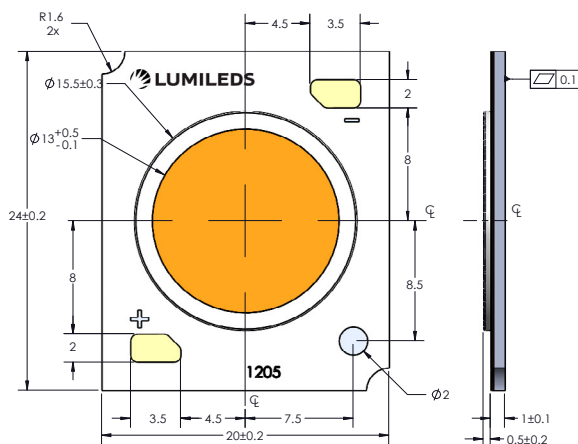


LHC1 – xxxx – 1202

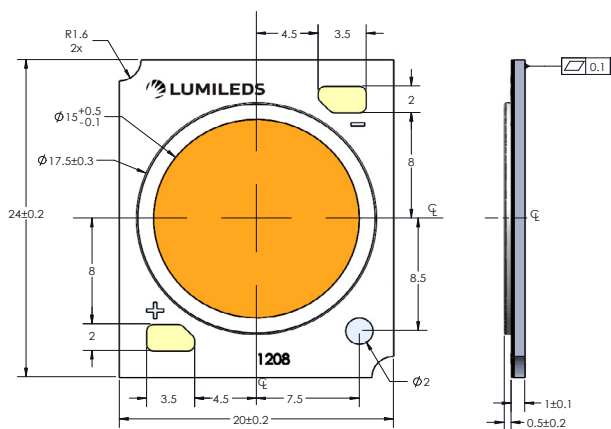
LHC1 – xxxx – 1203



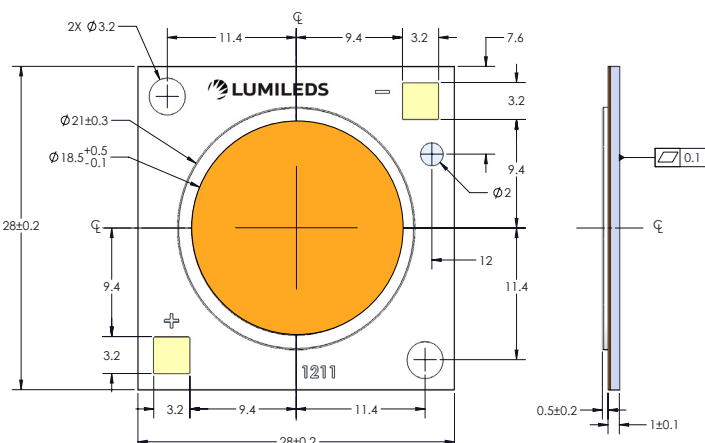
LHC1 – xxxx – 1204



LHC1 – xxxx – 1205



LHC1 – xxxx – 1208



LHC1 – xxxx – 1211

# Characteristic Curves

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

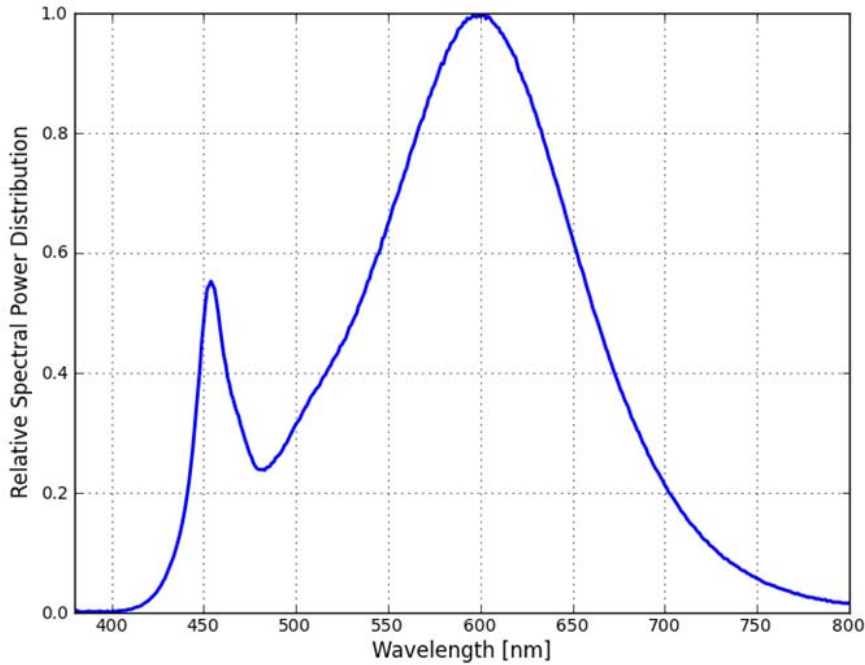


Figure 1. Color spectrum of 3000K, 80 minimum CRI, integrated measurement.

Relative Light Output Characteristics over Temperature at Test Current

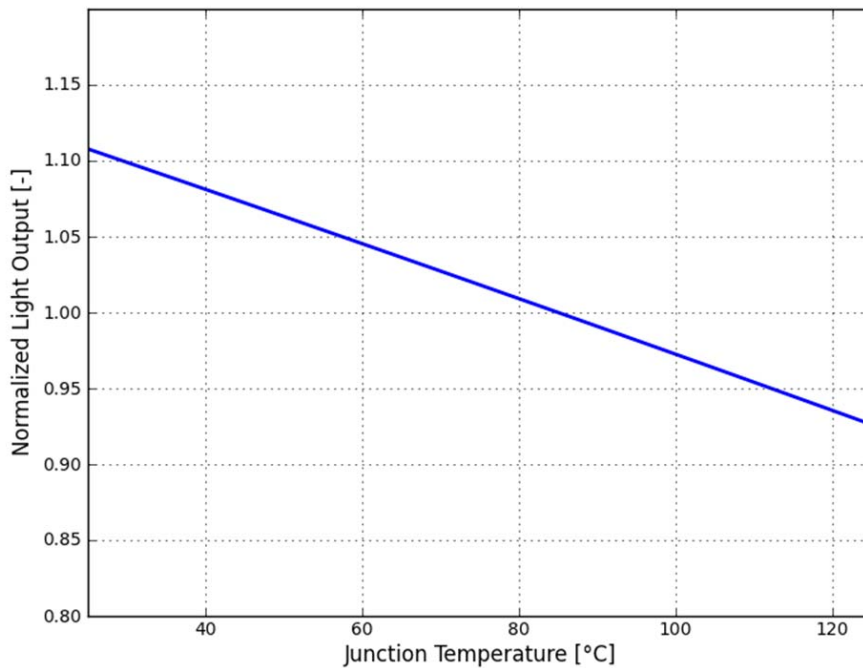
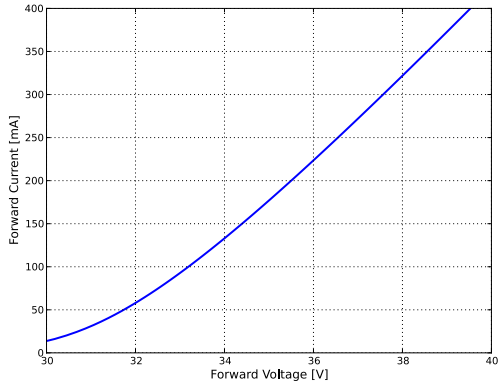


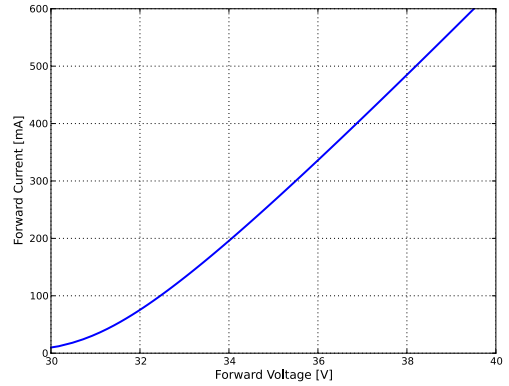
Figure 2. Relative light output vs. junction temperature.

# Typical Forward Current Characteristics

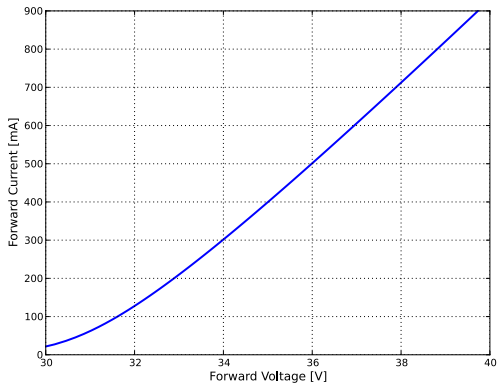
LHC1 – xxxx – xxxx / L2C1 – xxxxxxxxxxxxxx, Junction Temperature = 85°C



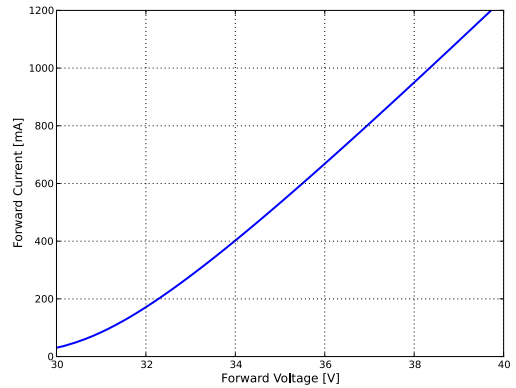
L2C1 – xxxx120206xxx  
LHC1-XXXX-1202



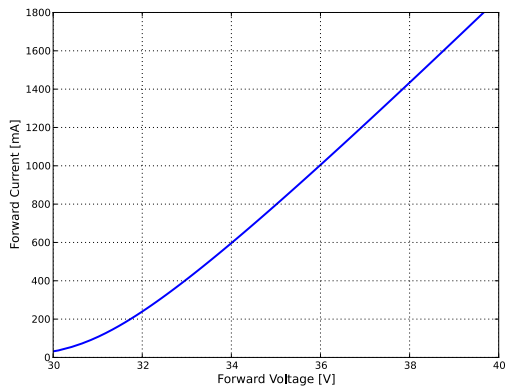
LHC1 – xxxx – 1203



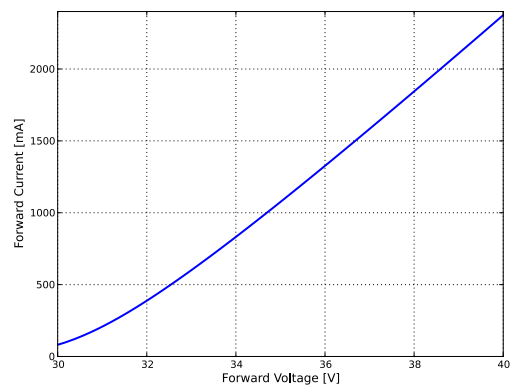
LHC1 – xxxx – 1204



LHC1 – xxxx – 1205



LHC1 – xxxx – 1208

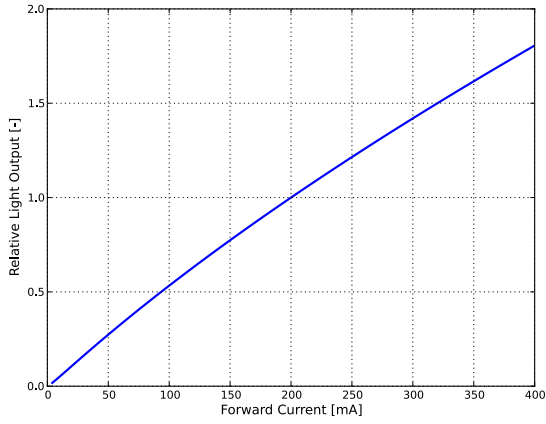


LHC1 – xxxx – 1211

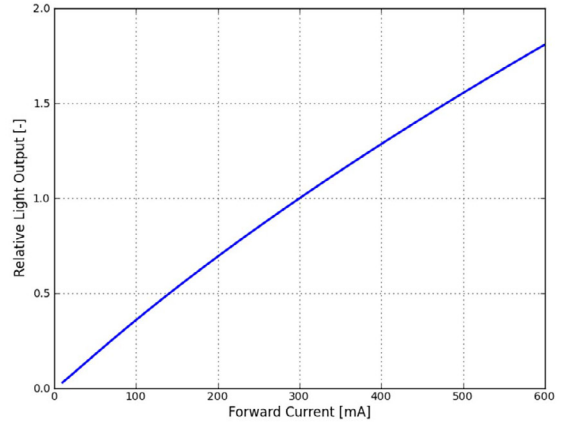
Figure 3. Forward current vs. forward voltage.

# Typical Relative Luminous Flux vs. Forward Current

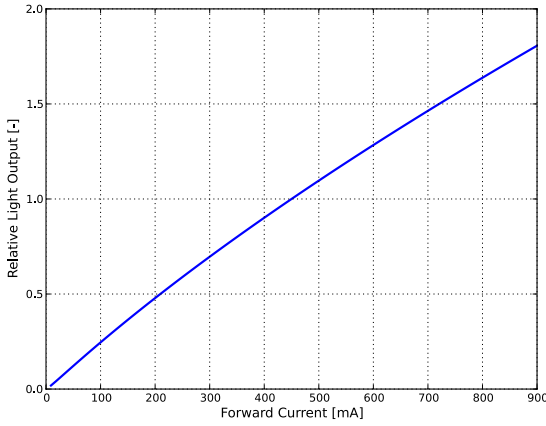
LHC1 – xxxx – xxxx / L2C1 – xxxxxxxxxxxxxx, Junction Temperature = 85°C



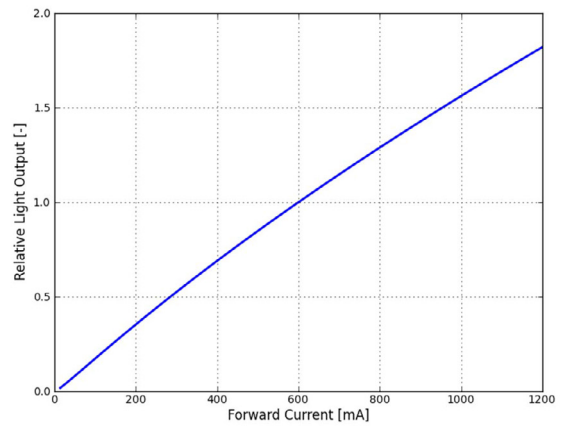
L2C1 – xxxx120206xxx  
LHC1 – xxxx – 1202



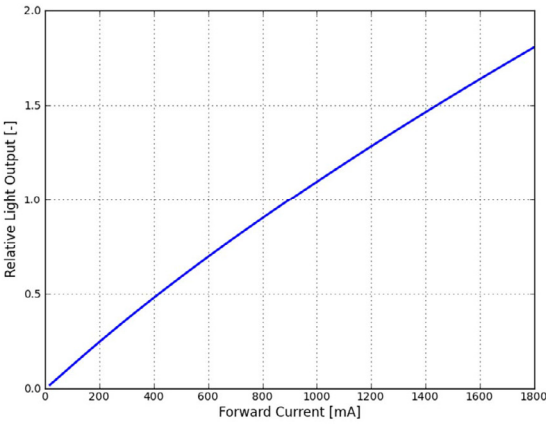
LHC1 – xxxx – 1203



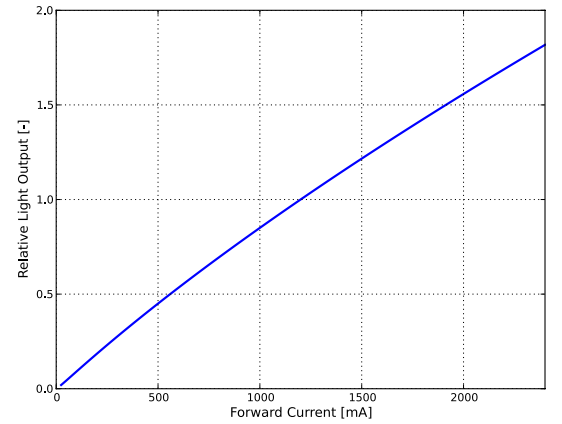
LHC1 – xxxx – 1204



LHC1 – xxxx – 1205



LHC1 – xxxx – 1208



LHC1 – xxxx – 1211

Figure 4. Typical relative luminous flux vs. current.

# Typical Radiation Patterns

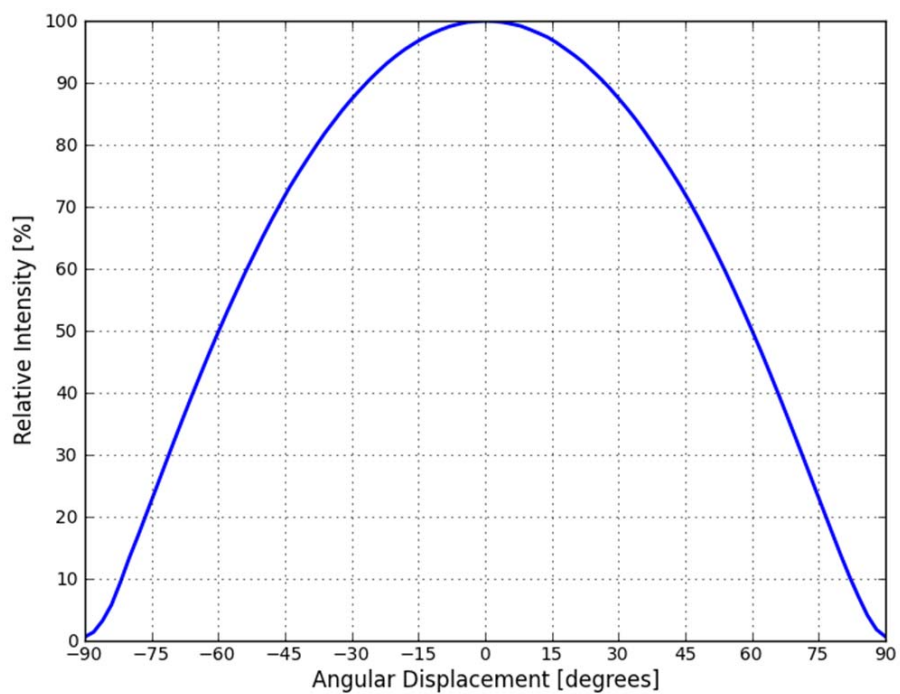


Figure 5. Radiation pattern for LHC1 - xxxx - 120x / L2C1 - xxxx120xxxxxx.

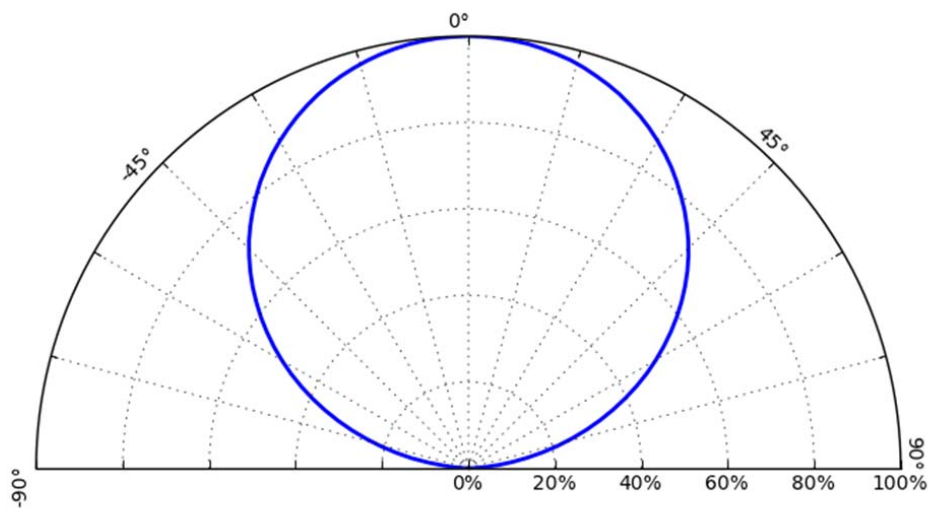


Figure 6. Polar radiation pattern for LHC1 - xxxx - 120x / L2C1 - xxxx120xxxxxx.

# Color Bin Definition

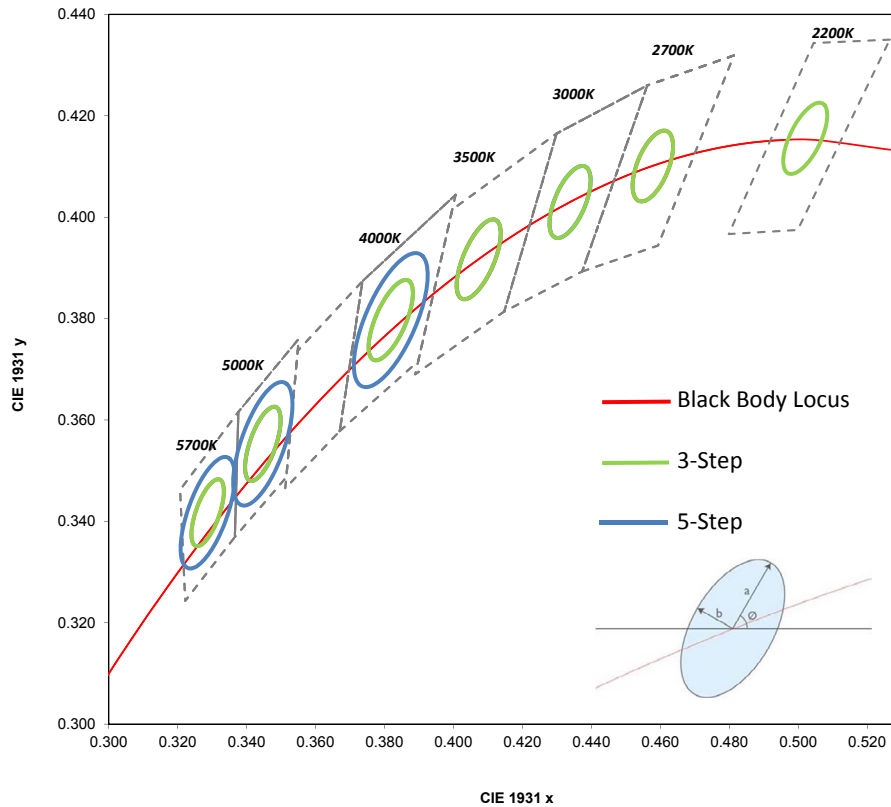


Figure 7. 3-step and 5-step MacAdam ellipse color bins.

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
2200K	Single 3-step MacAdam ellipse	(0.5020, 0.4155)	0.00862	0.00397	39.3°
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°
5700K	Single 3-step MacAdam ellipse	(0.3287, 0.3417)	0.00745	0.003195	59.09°
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°

Notes for Table 5:

- Lumileds maintains a tester tolerance of  $\pm 0.005$  on x,y coordinates.
- Major and minor axis (a,b) from table 5 are a reference as depicted in figure 7.
- 3-step for all 80 and 90CRI part numbers.
- 5-step for all 70CRI part numbers.
- Please contact Lumileds for requests outside 3-step for 80 and 90CRI parts.

# Package Info and Dimensions

Table 6. Package Info

	L2C1 – xxxx120206xxx	LHC1 – xxxx - 1202	LHC1 – xxxx - 1203	LHC1 – xxxx - 1204	LHC1 – xxxx - 1205	LHC1 – xxxx - 1208	LHC1 – xxxx - 1211
Total Units per Tube	20	20	20	20	20	20	10
Total Tubes per Box	5	5	5	5	5	5	5
Total Units per Box	100	100	100	100	100	100	50

## L2C1 – xxxx120206xxx

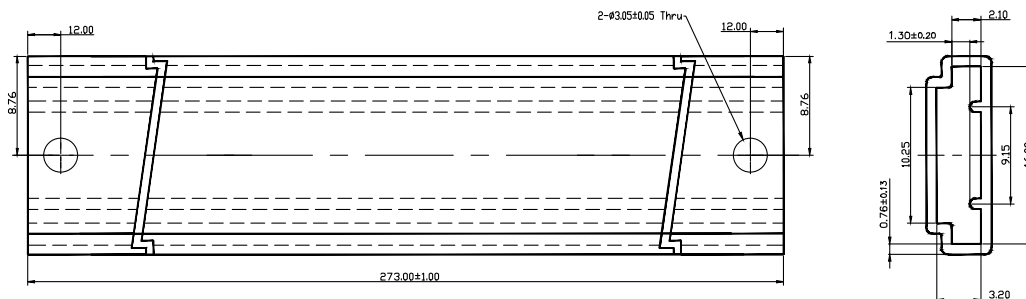


Figure 8. Package ray dimension for LUXEON CoB L2C1-xxxx120206xxx.

## LHC1 – xxxx - 1202 and 1203

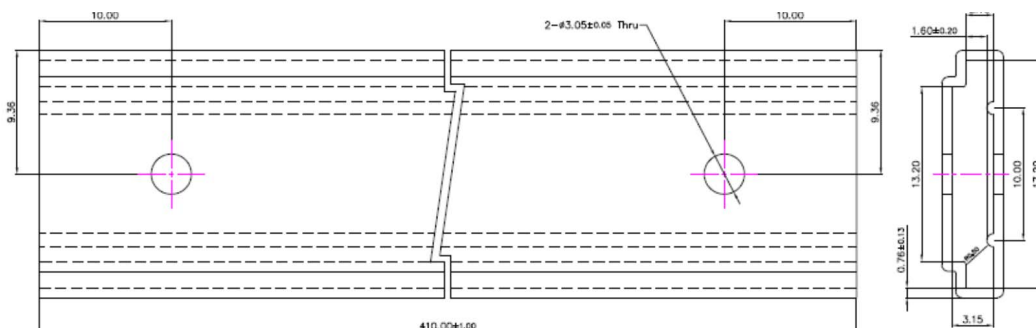


Figure 9. Package ray dimension for LUXEON CoB LHC1 – xxxx - 1202 and 1203.

## LHC1 – xxxx – 1204, 1205 and 1208

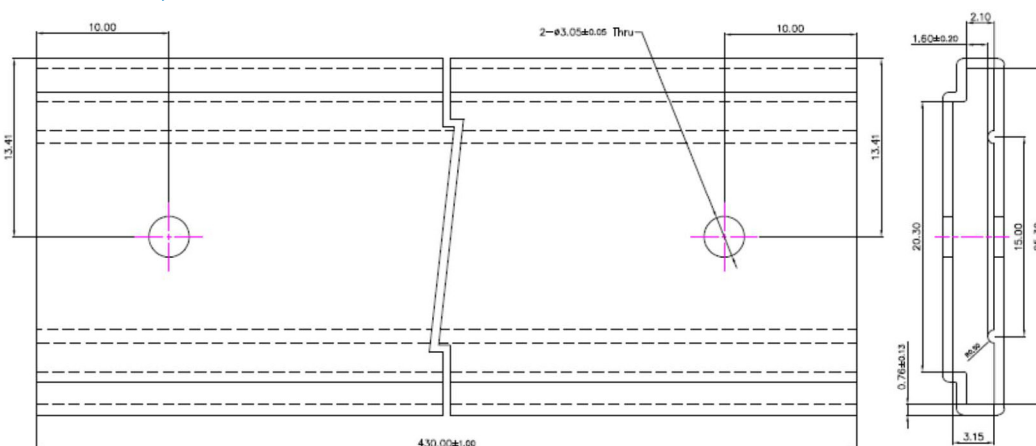


Figure 10. Package ray dimension for LUXEON CoB LHC1 – xxxx – 1204, 1205 and 1208.

# LHC1 – xxxx – 1211

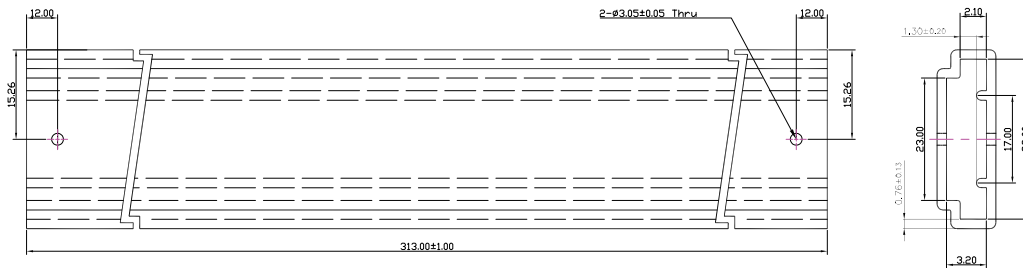


Figure 11. Package ray dimension for LUXEON CoB LHC1 – xxxx – 1211.



# About Lumileds

Lumileds is the light engine leader, delivering innovation, quality and reliability.

For 100 years, Lumileds commitment to innovation has helped customers pioneer breakthrough products in the automotive, consumer and illumination markets.

Lumileds is shaping the future of light with our LEDs and automotive lamps, and helping our customers illuminate how people see the world around them.

To learn more about our portfolio of light engines, visit [lumileds.com](http://lumileds.com).



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