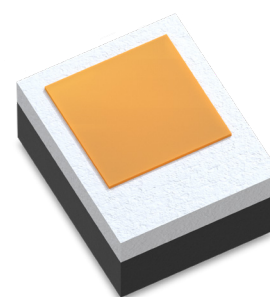


# LUXEON FX2-L PC Amber

Industry-leading high power CSP solutions for front lighting applications

LUXEON FX2-L PC Amber LEDs with their Chip Scale Package (CSP) form factor are designed to meet present and future Automotive requirements. The Lumileds automotive binning structure meets both SAE and ECE color specifications and is hot binned at 85 °C, consistent with actual automotive operational environments. LUXEON FX2-L PC Amber provides industry-leading solutions for your front and rear turn applications. All Luxeon FX2-L PC Amber are AEC-Q102 qualified.



## FEATURES AND BENEFITS

- Higher drive current capability for increased flux performance
- Compact, robust design enables reliable interconnect to AI-IMS boards
- Low thermal resistance and power consumption results in simplified thermal management and system cost
- Hot binned at 85 °C MP to match closer actual operating conditions
- High flux output provides flexibility in styling and optical design

## PRIMARY APPLICATIONS

- Sidemarkers
- Turn
  - Front Turn
  - Rear Turn

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# General Product Information

## Product Test Conditions

LUXEON FX2-L PC Amber is binned using a <20 ms monopulse (MP) of 1A drive current. The case temperature is set to 85 °C at the beginning of the pulse. Unless otherwise noted, the same test conditions apply to all data in this document.

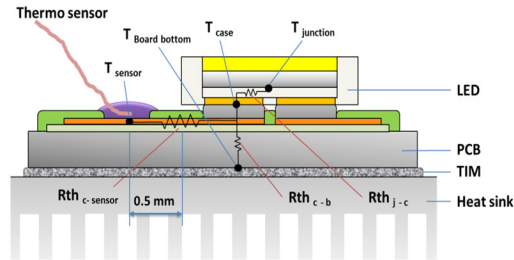


Figure 1. Case temperature measurement point for LUXEON FX2-L PC Amber

## Part Number Nomenclature

Part numbers for LUXEON FX2-L PC Amber follow the convention below:

A 1 F 2 – **B B B B** C D E **F G G G G** H

Where:

- B B B B** – designates color temperature or wavelength (0591 = Amber)
- C – designates lumiramic size (F = 1150 um)
- D – designates form factor (2 = 2PAD)
- E – designates product generation (A = Gen 1)
- F** – designates future product offerings
- G G G G** – designates minimum luminous flux or custom part number (example: 0210 = 2100 lumens)
- H** – designates options for detailed product specification (default 0)

Therefore, the following part number is used for a LUXEON FX2-L PC Amber with a minimum luminous flux of 210 lm:

A 1 F 2 – **0 5 9 1** F 2 A **0 0 2 1 0 0**

## Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON FX2-L PC Amber is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS Directive 2011/65/EU and REACH Regulation (EC) 1907/2006. Lumileds LLC will not intentionally add the following restricted materials to its products: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

# Performance Characteristics

## Product Selection Guide

Table 1. Product selection for LUXEON FX2-L PC Amber at <20 ms MP, 1000 mA,  $T_c = 85^\circ\text{C}$

MINIMUM LUMINOUS FLUX <sup>[1]</sup> (lm)	PART NUMBER
200	A1F2-0591F2A002000
210	A1F2-0591F2A002100
220	A1F2-0591F2A002200
230	A1F2-0591F2A002300
240	A1F2-0591F2A002400
250	A1F2-0591F2A002500
260	A1F2-0591F2A002600
270	A1F2-0591F2A002700

Notes for Table 1:

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

## Optical Characteristics

Table 2. Optical Characteristics for LUXEON FX2-L PC Amber

PART NUMBER	Dominant Wavelength (nm) <sup>[1]</sup>		Spectral Half-Width (nm) <sup>[2]</sup> $\Delta\lambda_{1/2}$	Typical Total Included Angle <sup>[3]</sup> $2\theta_{0.90V}$	Typical Viewing Angle <sup>[4]</sup> $2\theta_{1/2}$
	MINIMUM	MAXIMUM			
A1F2-0591F2Axxxx0	588.8	592.6	77	140°	118°

Notes for Table 2:

1. Dominant wavelength is measured at binning condition.

2. Spectral width at 1/2 of the peak intensity.

3.  $2\theta_{0.90V}$  denotes the total angle at which 90% of total luminous flux is captured, i.e. the cone defined by the off-axis angle  $\theta_{0.90V}$  from the LED centerline includes 90% of the total flux.

4.  $2\theta_{1/2}$  denotes the viewing angle, with  $\theta_{1/2}$  being the off-axis angle from the LED centerline where the luminous intensity is 1/2 of the peak value.

## Thermal Characteristics

Table 3. Thermal characteristics for LUXEON FX2-L PC Amber derived from thermal transient measurements at 1000 mA (DC) and 25°C stage temperature.

PART NUMBER	THERMAL RESISTANCE— JUNCTION TO CASE (K/W)			
	$R\theta_{j-c, el}$ <sup>[1]</sup>		$R\theta_{j-c, real}$ <sup>[2]</sup>	
	TYPICAL	MAXIMUM	TYPICAL	MAXIMUM
A1F2-0591F2Axxxx0	4.4	5.3	5.9	7.1

Notes for Table 3:

1. Ratio between temperature difference (junction to case) and electrical input power (references JESD51-51, JESD51-14).

2. Ratio between temperature difference (junction to case) and dissipated heat, i.e. emitted light taken into account (references JESD51-51, JESD51-14).

## Absolute Ratings

Table 4. Absolute ratings for LUXEON FX2-L PC Amber

PARAMETER	PERFORMANCE
Minimum DC Forward Current	50 mA
Maximum DC Forward Current	1000 mA
Maximum Junction Temperature <sup>[1, 2]</sup>	150 °C
Case Temperature Range <sup>[1]</sup>	-40 °C to 135 °C
Maximum Junction Temperature for Short Time Applications <sup>[3]</sup>	180 °C
LED Storage Temperature	-40 °C to 135 °C
Soldering Temperature <sup>[4]</sup>	C/JEDEC J-STD-020E 260 °C
ESD Sensitivity <sup>[4]</sup>	±8kV HBM, ±2kV CDM
Reverse Voltage ( $V_{reverse}$ )	LUXEON 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 allowable temperature. LUXEON FX2-L PC Amber LEDs driven at or above maximum LED case temperature may have shorter lifetime.
2. Please consult with Lumileds for more information on maximum time durations and forward currents for these temperatures.
3. Short time operations of less than 200 hours.
4. According IPC/JEDEC J-STD-020E
5. Measured using human body model (per ANSI/ANSI/ESDA/JEDEC JS-001-2010), charged device model (AEC Q101-005 rev A).

## JEDEC Moisture Sensitivity

Table 5. Moisture sensitivity levels for LUXEON FX2-L PC Amber

LEVEL	FLOOR LIFE		STANDARD SOAK REQUIREMENTS	
	TIME	CONDITIONS	TIME	CONDITIONS
1	Unlimited	≤30 °C / 85 % RH	168 Hours +5 / -0	85 °C / 85 % RH

# Characteristic Curves

## Spectral Power Distribution Characteristics

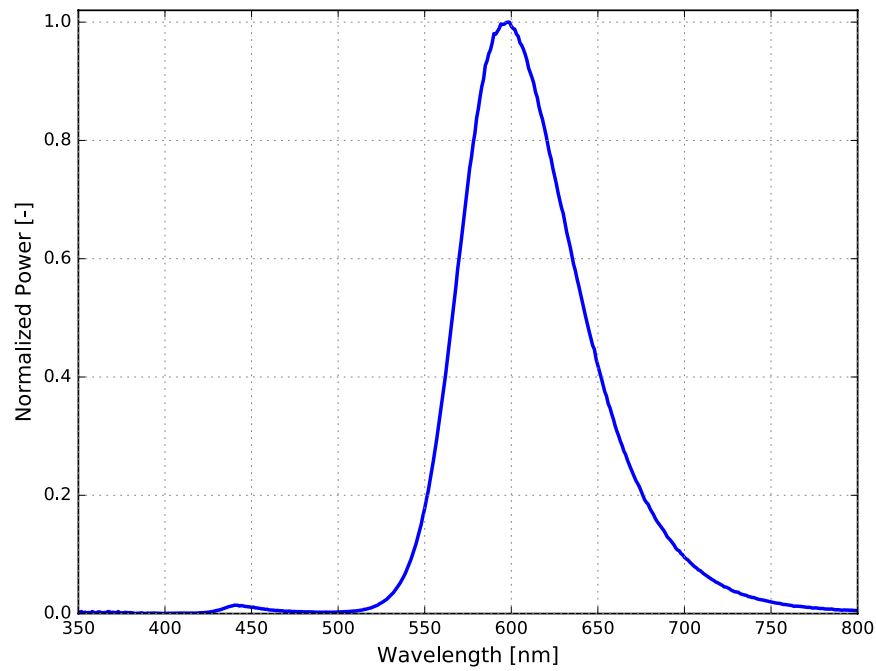


Figure 2. Typical normalized power vs. wavelength for LUXEON FX2-L PC Amber at <20 ms MP, 1000 mA, T<sub>c</sub> = 85 °C

## Light Output Characteristics

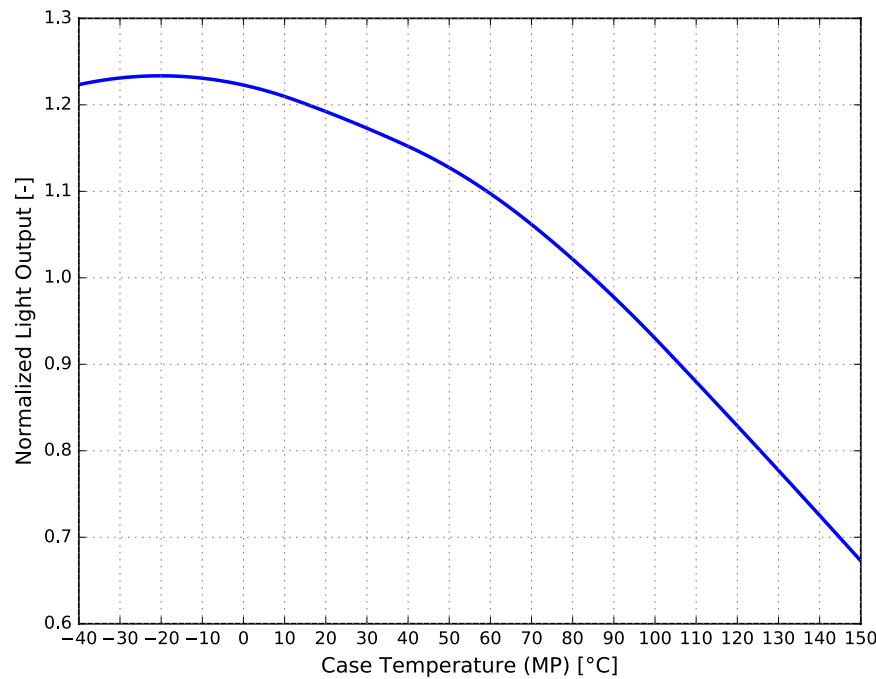


Figure 3a. Typical normalized light output vs. case temperature for LUXEON FX2-L PC Amber at <20 ms MP, 1000 mA

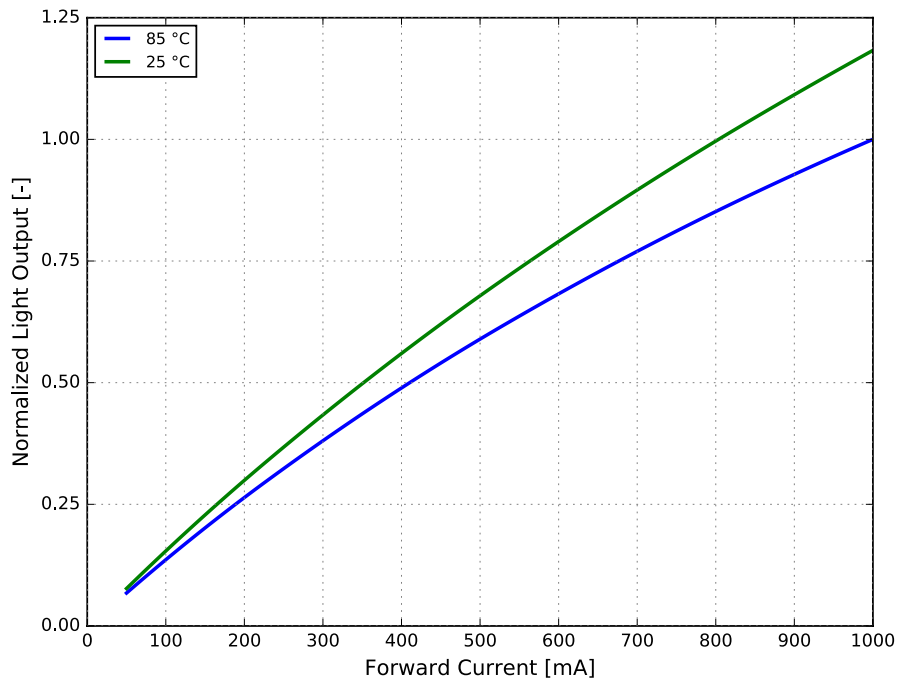


Figure 3b. Typical normalized light output vs. forward current for LUXEON FX2-L PC Amber at <20 ms MP, 25 °C and 85 °C

## Forward Current and Forward Voltage Characteristics

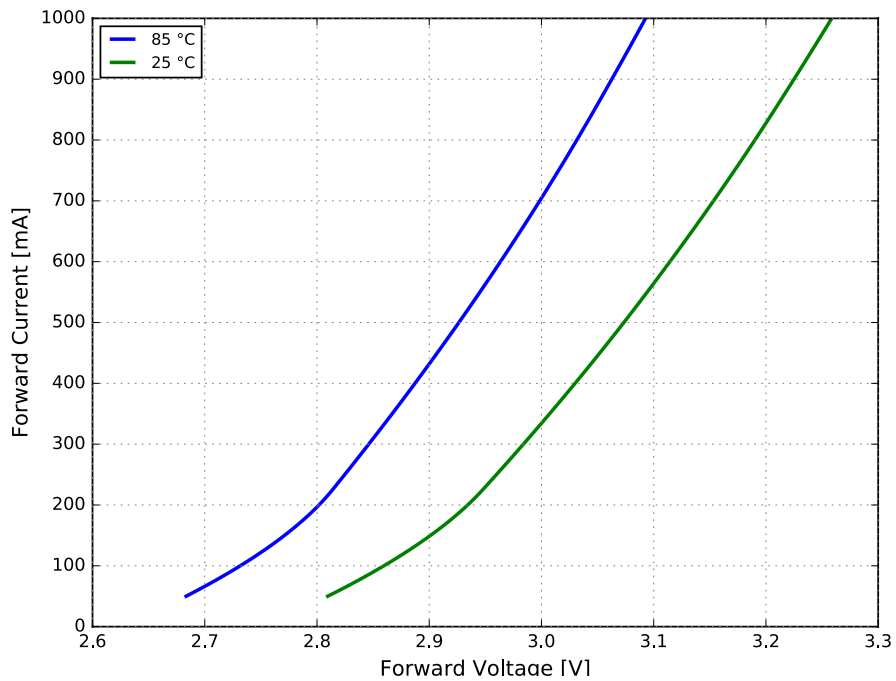


Figure 4a. Typical forward current vs. forward voltage for LUXEON FX2-L PC Amber at <20 ms MP, TC = 85 °C and 25 °C

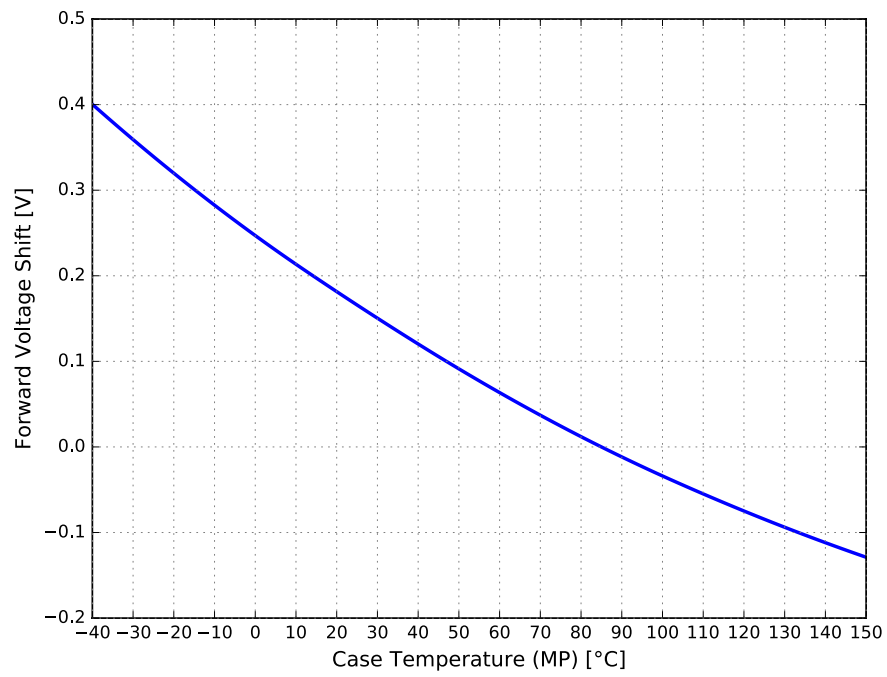


Figure 4b. Typical forward voltage shift vs. case temperature for LUXEON FX2-L PC Amber at <20 ms MP, 1000 mA

# Color Shift Characteristics

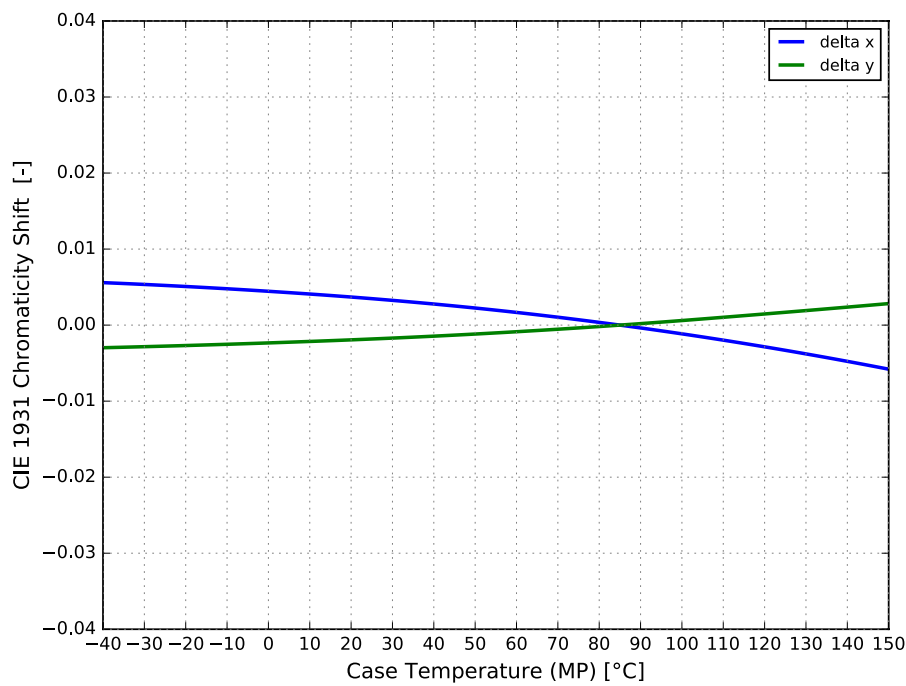


Figure 5a. Typical color shift in CIE 1931 x and y coordinates vs. case temperature for LUXEON FX2-L PC Amber at <20 ms MP, 1000 mA

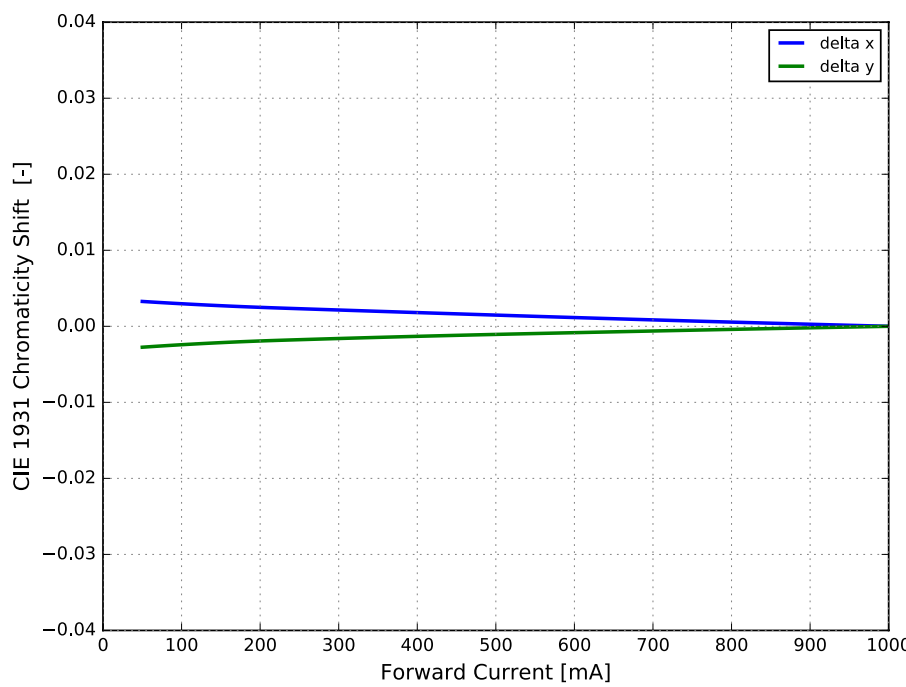


Figure 5b. Typical color shift in CIE 1931 x and y coordinates vs. forward current for LUXEON FX2-L PC Amber at <20 ms MP, TC = 85 °C

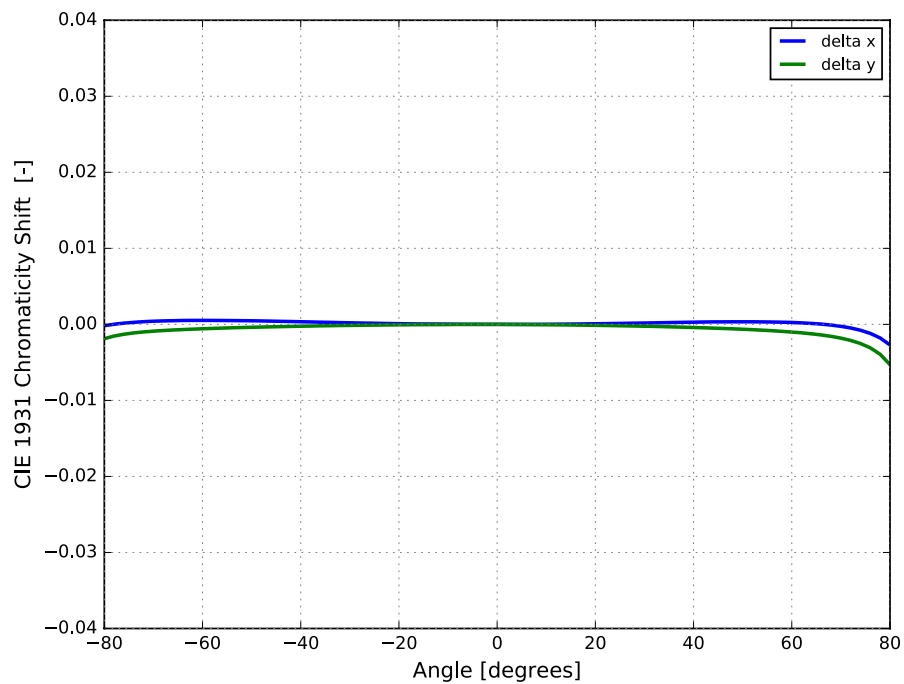


Figure 5c. Typical color shift in CIE 1931 x and y coordinates vs. angle for LUXEON FX2-L PC Amber at 1000 mA

## Radiation Pattern Characteristics

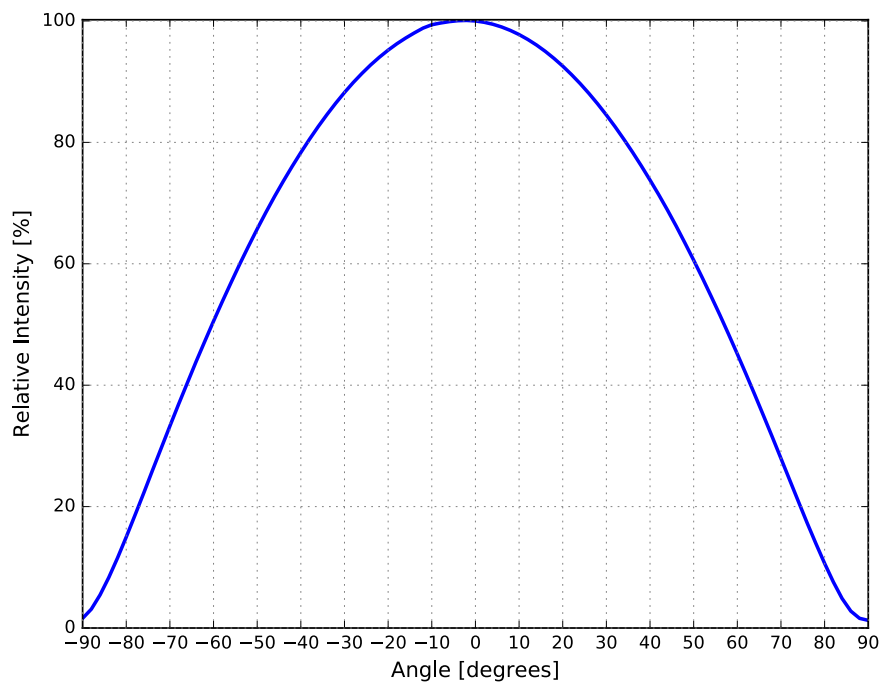


Figure 6. Typical radiation pattern for LUXEON FX2-L PC Amber at 1000 mA

# Operating Limits Characteristics

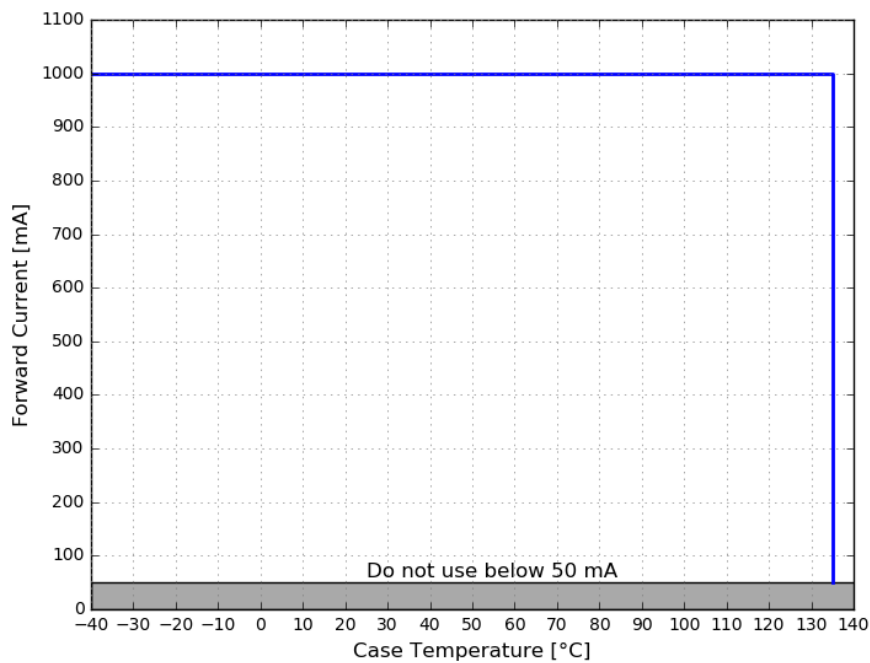


Figure 7. Maximum forward current vs. case temperature for LUXEON FX2-L PC Amber

# Permissible Pulse Handling Characteristics

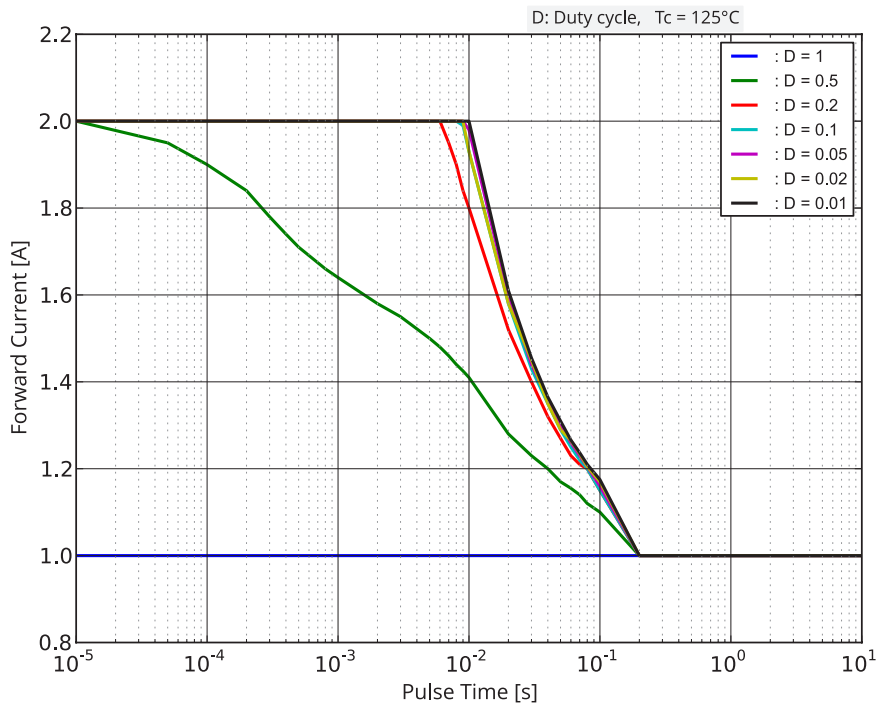


Figure 8. Permissible pulse handling capability for LUXEON FX2-L PC Amber

# Product Bin and Labeling Definitions

## Designing with LUXEON FX2-L PC Amber

Flux bins supportable for car programs depend on product color and program start-of-production and end-of-production dates. Flux roadmaps by year and product color are maintained and available from the sales representative. Please contact a local sales representative to request the flux bin range with best supportability for program timing.

## Decoding Product Bin Labeling

In the manufacturing of semiconductor products, there are variations in performance around the average values given in the technical datasheet. For this reason, Lumileds bins LED components for luminous flux, color and forward voltage.

LUXEON FX2-L PC Amber LEDs are labeled using a 3-digit alphanumeric CAT code following the format below.

**A B C**

Where:

- A** – designates luminous flux bin (example: E = 200 to 210 lumens) per die
- B** – designates color bin (example: A, B)
- C** – designates forward voltage bin (example: C = 3.03V to 3.27V)

Therefore, a LUXEON FX2-L PC Amber with a lumen range of 200 to 210, color bin of A, and a forward voltage range of 3.03V to 3.27V has the following CAT code:

**E A C**

## Luminous Flux Bins

Table 6 lists the standard luminous flux bins for LUXEON FX2-L PC Amber emitters. To obtain the flux of the product this number needs to be multiplied with the chip count. Product availability in a particular bin varies by color and platform start-of-production date. Contact your local sales representative for best supportability of programs.

Table 6. Luminous flux bin definitions for LUXEON FX2-L PC Amber at <20 ms MP, 1000 mA,  $T_c = 85^\circ\text{C}$

BIN	LUMINOUS FLUX <sup>(1)</sup> (lm)	
	MINIMUM	MAXIMUM
E	200	210
F	210	220
G	220	230
H	230	240
J	240	250
K	250	260
L	260	270
M	270	280
N	280	290

Notes for Table 6:

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

# Color Codes

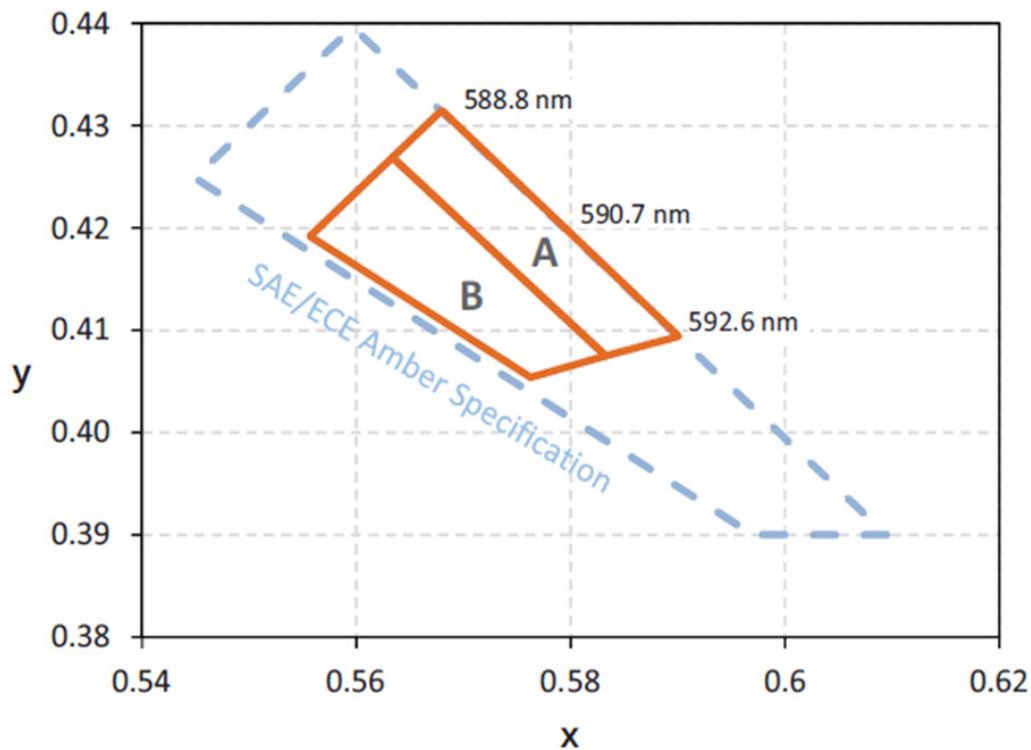


Figure 9. Color bin structure in CIE 1931 color space for LUXEON FX2-L PC Amber

Notes for Figures 9:  
1. Lumileds supports the following bins for LUXEON FX2-L PC Amber: A, B.

# Color Bin Definitions

Table 7a. Color bin definitions for LUXEON FX2-L PC Amber

BIN	x <sup>[1, 2]</sup>	y <sup>[1, 2]</sup>
A	0.568	0.4315
	0.5634	0.4269
	0.5833	0.4075
	0.5901	0.4094
B	0.5763	0.4054
	0.5833	0.4075
	0.5634	0.4269
	0.5557	0.4192

Notes for Table 7a:  
2. Lumileds maintains a tester tolerance of ±0.005 on x and y coordinates.  
3. CIE 1931 x and y coordinate frame.

## Forward Voltage Bins

Table 8. Forward voltage bin definitions for LUXEON FX2-L PC Amber

BIN	FORWARD VOLTAGE <sup>[1]</sup> (V <sub>f</sub> )	
	MINIMUM	MAXIMUM
B	2.55	2.79
C	2.79	3.03
D	3.03	3.27
E	3.27	3.51

## Notes for Table 8:

1. Lumileds maintains a tolerance of  $\pm 0.06V$  on forward voltage measurements.
2. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance.

## Mechanical Dimensions

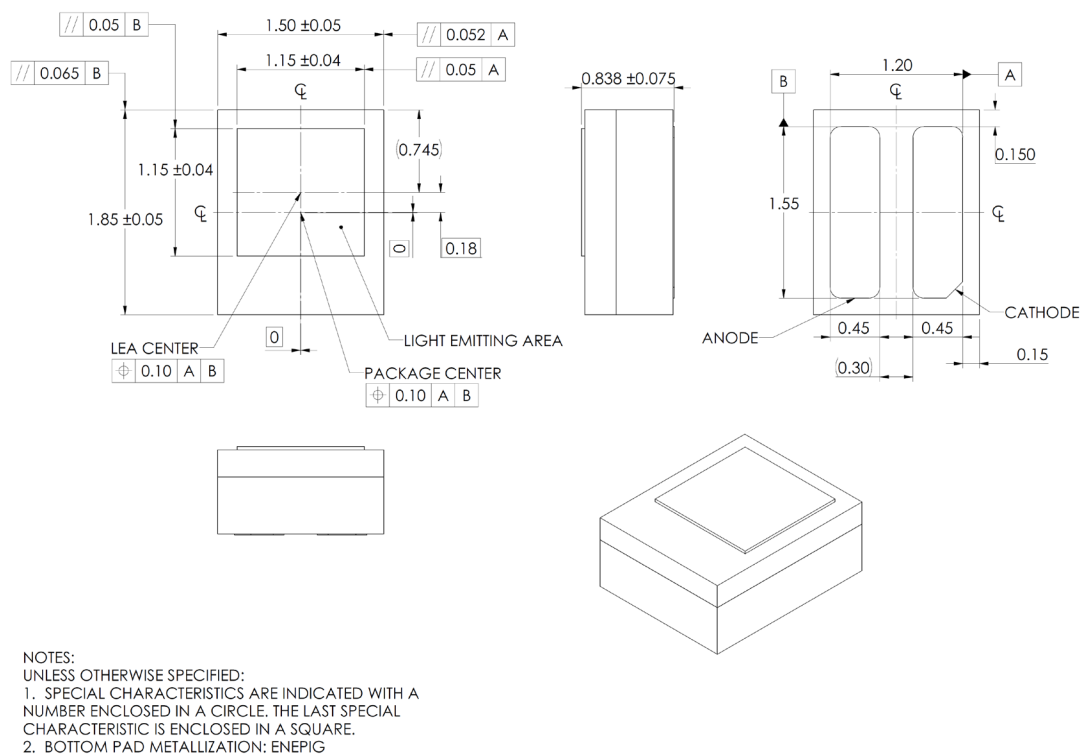


Figure 10. Mechanical dimensions for LUXEON FX2-L PC Amber

Notes for Figure 10:

1. Drawings are not to scale.
2. All dimensions are in millimeters.

# Packaging Information

## Pocket Tape Dimensions

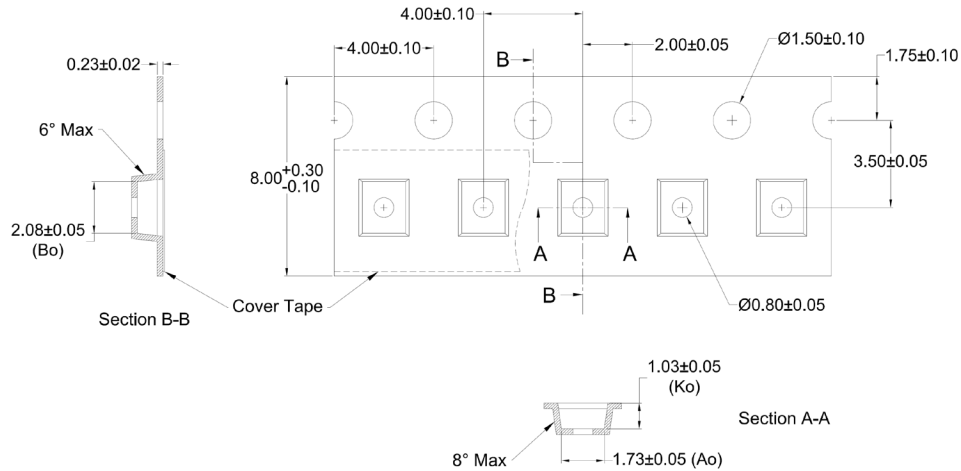


Figure 11. Pocket tape dimensions for LUXEON FX2-L PC Amber

Notes for Figure 11:

1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Ao is the width of pocket and Ko is the depth of pocket. Bo is the height of pocket.

## Reel Dimensions

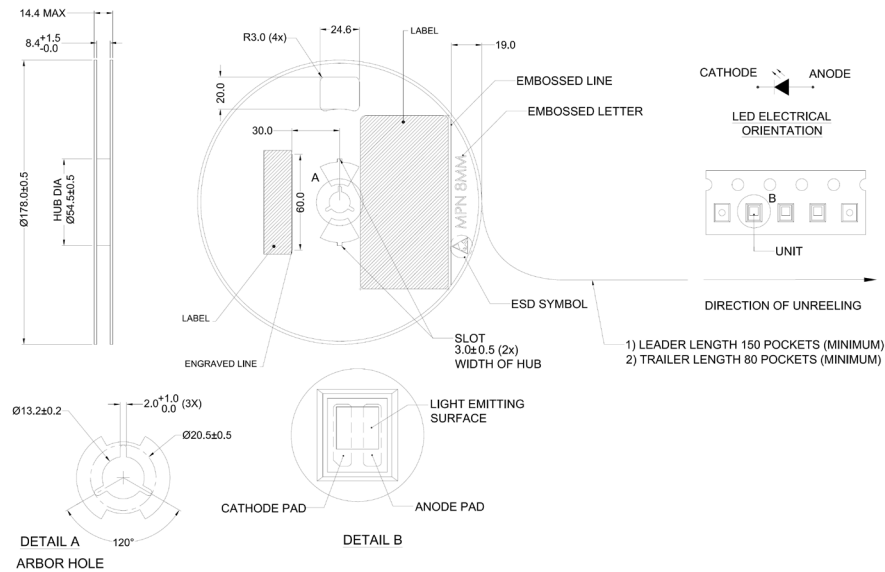


Figure 12. Reel dimensions for LUXEON FX2-L PC Amber

Notes for Figure 12.

1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. SPI=3,000 (SPI is the number of LEDs per reel).

# Product Labeling

LUXEON FX2-L LEDs are packaged in moisture barrier bags on reels. Both moisture barrier bag and reels have printed information providing part numbers with CAT codes that indicate luminous flux, color and forward voltage bins.

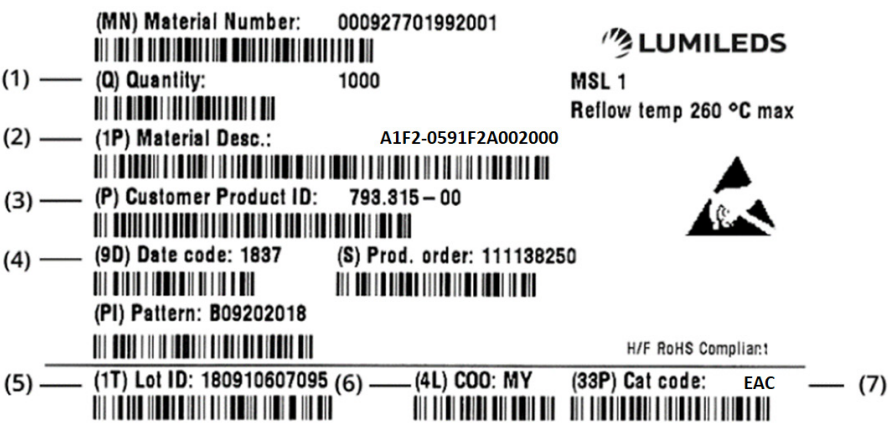


Figure 13. Example of a product label for LUXEON FX2-L PC Amber

Notes for Figure 13 – Box Label descriptions for customer use:  
Field labels not described are for Lumileds internal use only.

- 1. Total number of LED emitters in a shipment box.
- 2. Lumileds part number
- 3. Customer part number for custom requests only.
- 4. LED test date in YYWW format.
- 5. Unique product lot identification number. This number is required for traceability purposes.
- 6. Country code of origin of manufacturing of part (e.g. MY for Malaysia, CN for China) according to ISO 3166-1 alpha-2 document.
- 7. Product bin 3-digit alphanumeric CAT code.

## About Lumileds

Companies developing automotive, mobile, IoT and illumination lighting applications need a partner who can collaborate with them to push the boundaries of light. With over 100 years of inventions and industry firsts, Lumileds is a global lighting solutions company that helps customers around the world deliver differentiated solutions to gain and maintain a competitive edge. As the inventor of Xenon technology, a pioneer in halogen lighting and the leader in high performance LEDs, Lumileds builds innovation, quality and reliability into its technology, products and every customer engagement. Together with its customers, Lumileds is making the world better, safer, more beautiful—with light.

To learn more about our lighting solutions, visit [lumileds.com](https://lumileds.com).



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