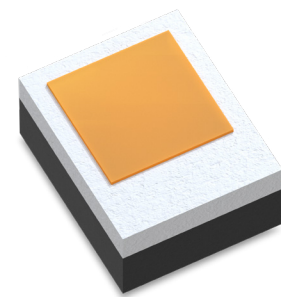


# LUXEON FX2-L PC Amber

Industry leading solutions for exterior automotive lighting

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

- High drive current capability for increased flux performance
- Compact, robust 2-pad design enables reliable interconnect to AI-IMS boards
- Advanced CSP technology provides leading performance in a cost effective package
- Hot binned at 85°C MP to match operating conditions

## PRIMARY APPLICATIONS

- Sidemarker
- Turn indicator
  - Front
  - Rear
  - Mirror

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## General Product Information

LUXEON FX2-L PC Amber emitters are high-power Lumiramic® Phosphor converted InGaN emitters mounted on an AlN package. All LUXEON FX2-L PC Amber emitters contain a TVS chip for ESD protection.

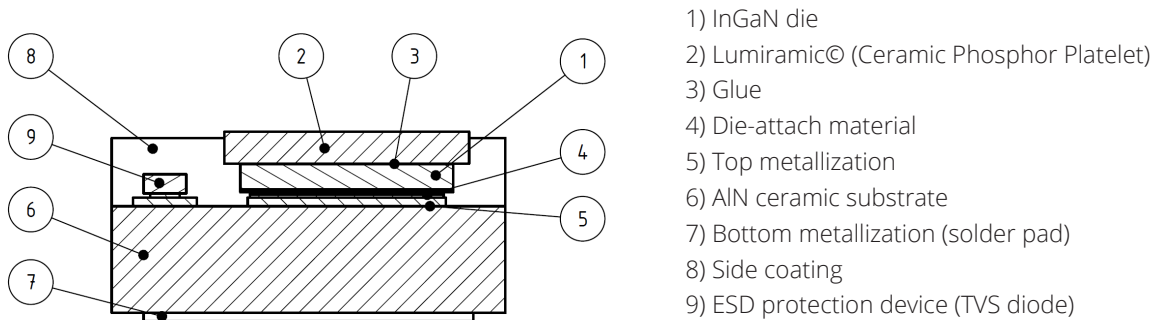


Figure 1. Schematic cross section LUXEON FX2-L Plus PC Amber

## Product Test and Binning Conditions

Monopulse (MP) testing for LUXEON FX2L Plus PC Amber is done with a pulse of 7 ms. The binning conditions for LUXEON FX2-L PC Amber are MP testing at 1000 mA at a temperature of 85 °C:

## 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
- F** – designates future product offering (default = 0)
- G G G G** – designates minimum luminous flux (example: 0280 = 280 lumens)
- H** – designates options code for distribution (default = 0)

Therefore, the following part number is used for a LUXEON FX2-L PC Amber with a minimum luminous flux of 280 lumens:

A 1 F 2 – **0 5 9 1** F 2 C **0 0 2 8 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 performance and optical characteristics of LUXEON FX2-L PC Amber at MP binning conditions

MINIMUM LUMINOUS FLUX <sup>[1]</sup> (lm)	PART NUMBER
250	A1F2-0591F2C002500
260	A1F2-0591F2C002600
270	A1F2-0591F2C002700
280	A1F2-0591F2C002800

**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 at MP binning conditions and far-field optical characteristics.

PART NUMBER	Dominant Wavelength (nm) <sup>[1]</sup>		SPECTRAL HALF-WIDTH (NM) <sup>[2]</sup> $\Delta\lambda/2$	TYPICAL TOTAL INCLUDED ANGLE <sup>[3]</sup>	TYPICAL VIEWING ANGLE <sup>[4]</sup> $2\theta_{1/2}$
	MINIMUM	MAXIMUM			
A1F2-0591F2Cxxxxxx	588.8	592.6	77	140°	120°

**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

## Electrical and Thermal Characteristics

Table 3. Electrical and thermal characteristics for LUXEON FX2-L PC Amber. Electrical characteristics at MP binning condition, thermal characteristics at binning current and 25°C stage temperature

PART NUMBER	FORWARD VOLTAGE ( $V_f$ ) <sup>[1]</sup> [V]			THERMAL RESISTANCE— JUNCTION TO CASE (K/W)			
	MIN.	TYP.	MAX.	$R\theta_{j-c} \text{ el}$ <sup>[2]</sup>		$R\theta_{j-c} \text{ real}$ <sup>[3]</sup>	
				TYPICAL	MAXIMUM	TYPICAL	MAXIMUM
A1F2-0591F2Cxxxxxx	2.90	3.16	3.35	4.6	5.5	6.2	7.5

**Notes for Table 3:**

1. Lumileds maintains a tolerance of  $\pm 0.06V$  on forward voltage measurements.
2. Ratio between temperature difference (junction to case) and electrical input power (references JESD51-51, JESD51-14).
3. 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 <sup>[1]</sup>	1000 mA
Maximum Peak Pulsed Forward Current <sup>[1]</sup>	2000 mA
Maximum Emitter Junction Temperature <sup>[1]</sup> (DC & Pulse)	150 °C
Maximum Emitter Junction Temperature <sup>[1, 2]</sup> (DC & Pulse), short term	180 °C
ESD Sensitivity <sup>[3]</sup>	HBM ±8 kV CDM ±2 kV
Operating Case Temperature <sup>[1]</sup>	-40 °C to 135 °C
Emitter Storage Temperature	-40 °C to 135 °C
SMD Process Classification Temperature	260 °C
Allowable Reflow Cycles	3
Reverse Voltage (Vreverse)	Not designed to be driven in reverse bias

**Notes for Table 4:**

1. Proper current derating must be observed to maintain the junction temperature below the maximum allowable junction temperature.
2. Short time operations of less than 200 hours,
3. Measured using human body model (per ANSI/ANSI/ESDA/JEDEC JS-001-2010), charged device model (AEC Q101-005 rev A).

# Characteristic Curves

## Spectral Power Distribution Characteristics

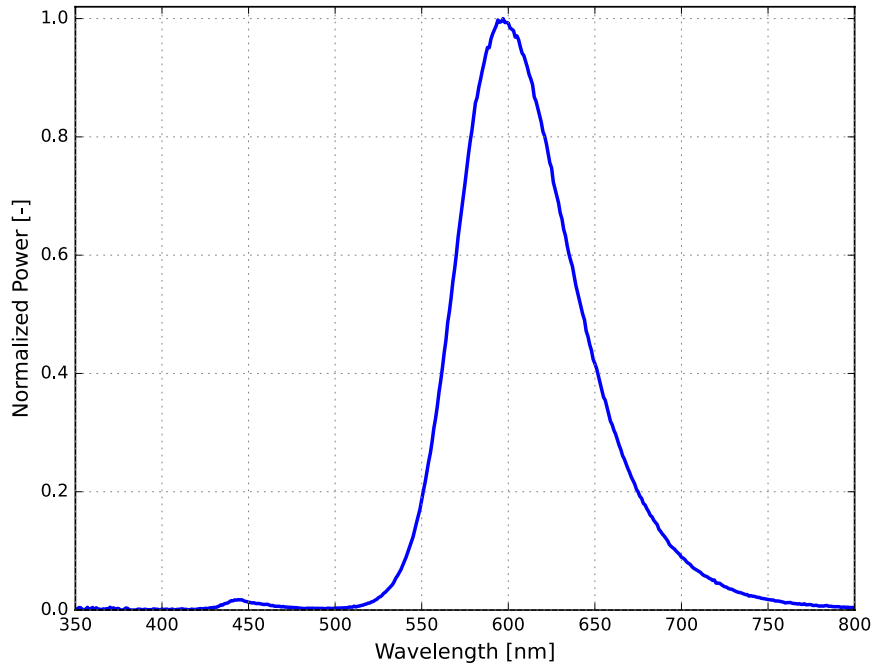


Figure 2. Typical normalized power vs. wavelength for LUXEON FX2-L PC Amber at MP binning conditions

## Light Output Characteristics

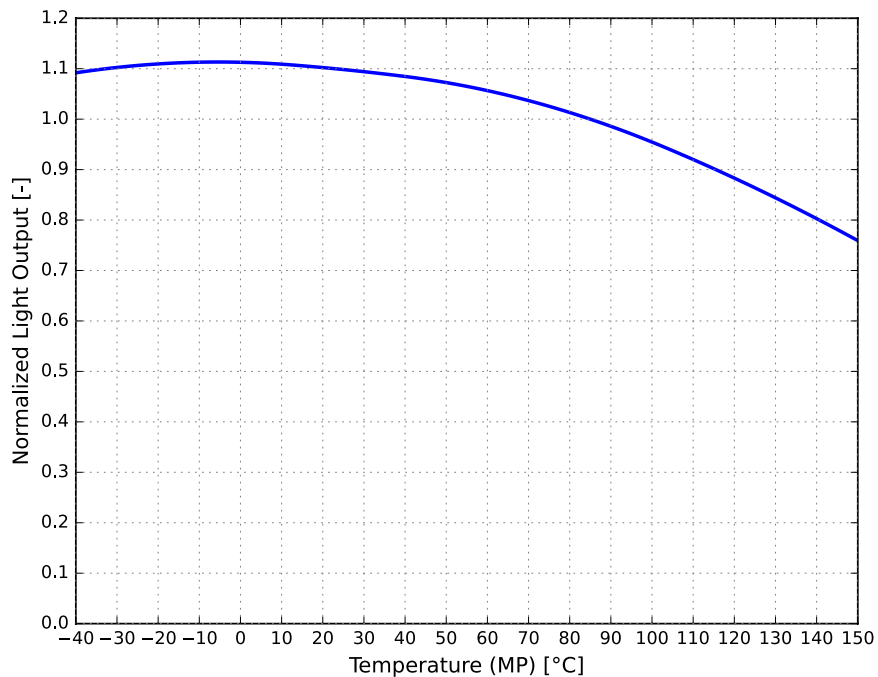


Figure 3. Typical normalized light output vs. temperature for LUXEON FX2-L PC Amber at MP binning current

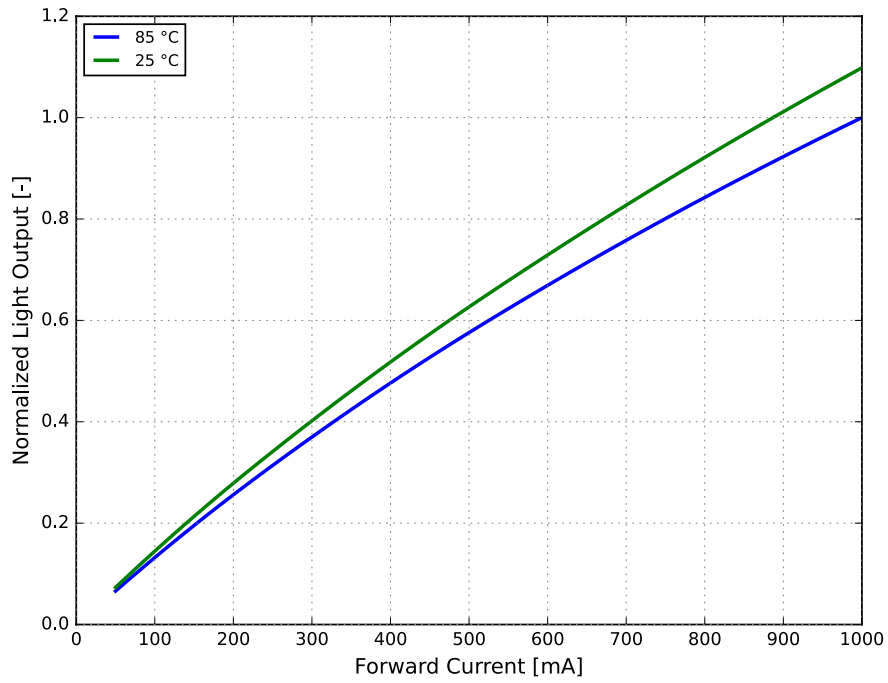


Figure 4. Typical normalized light output vs. forward current for LUXEON FX2-L PC Amber at MP binning temperature and at room temperature

## Forward Current and Forward Voltage Characteristics

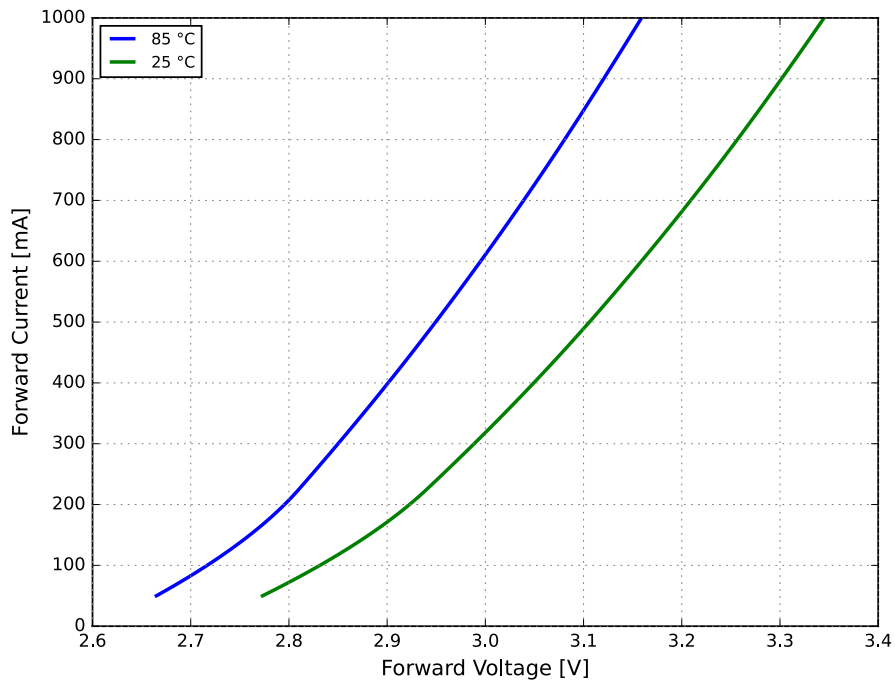


Figure 5. Typical forward current vs. forward voltage for LUXEON FX2-L PC Amber at MP binning temperature and at room temperature

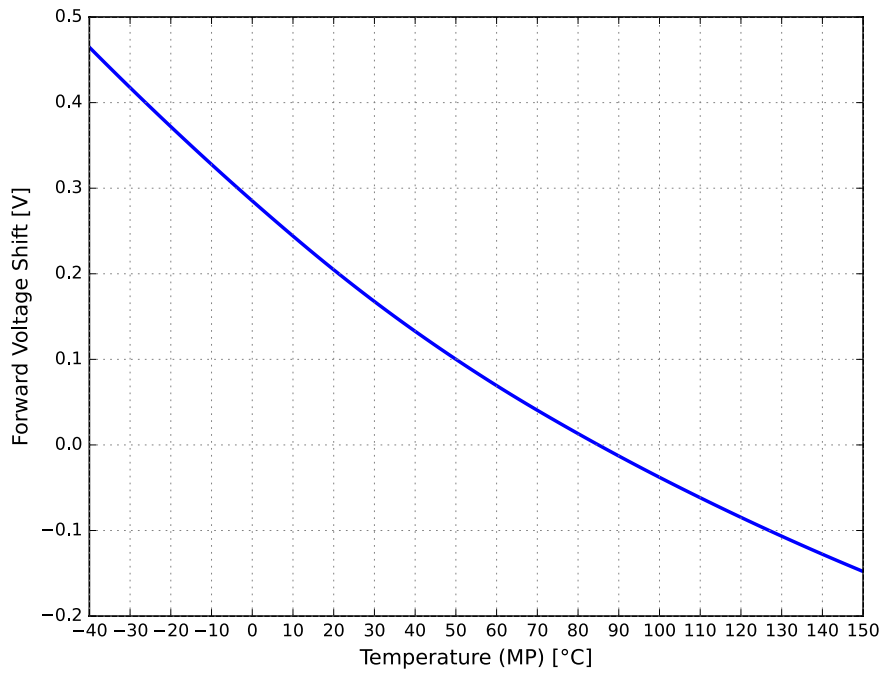


Figure 6. Typical forward voltage shift vs. temperature for LUXEON FX2-L PC Amber at MP binning current



# Color Shift Characteristics

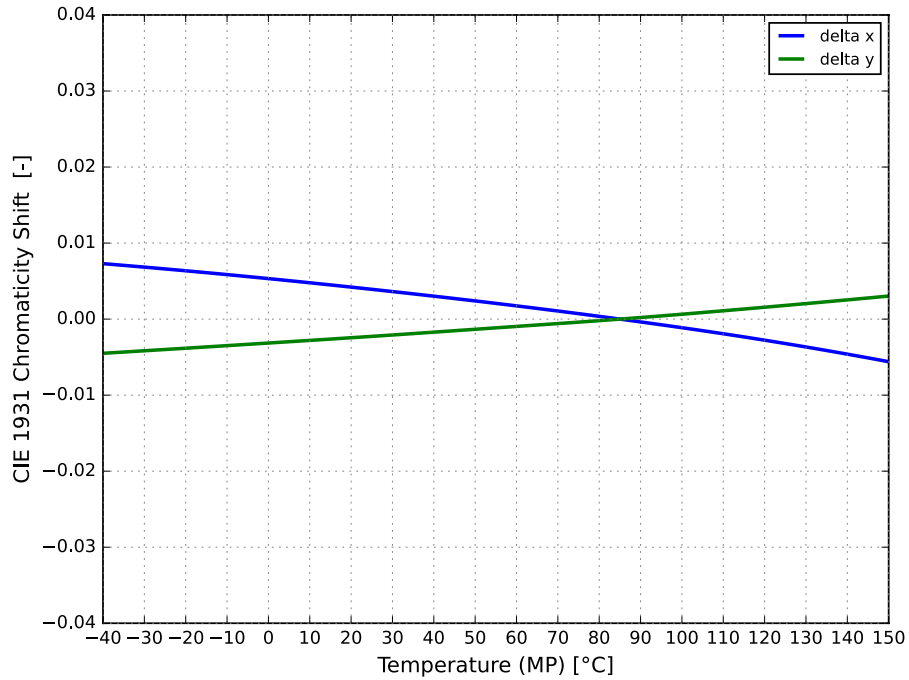


Figure 7. Typical color shift in CIE 1931 x, y coordinates vs. temperature for LUXEON FX2-L PC Amber at MP binning current

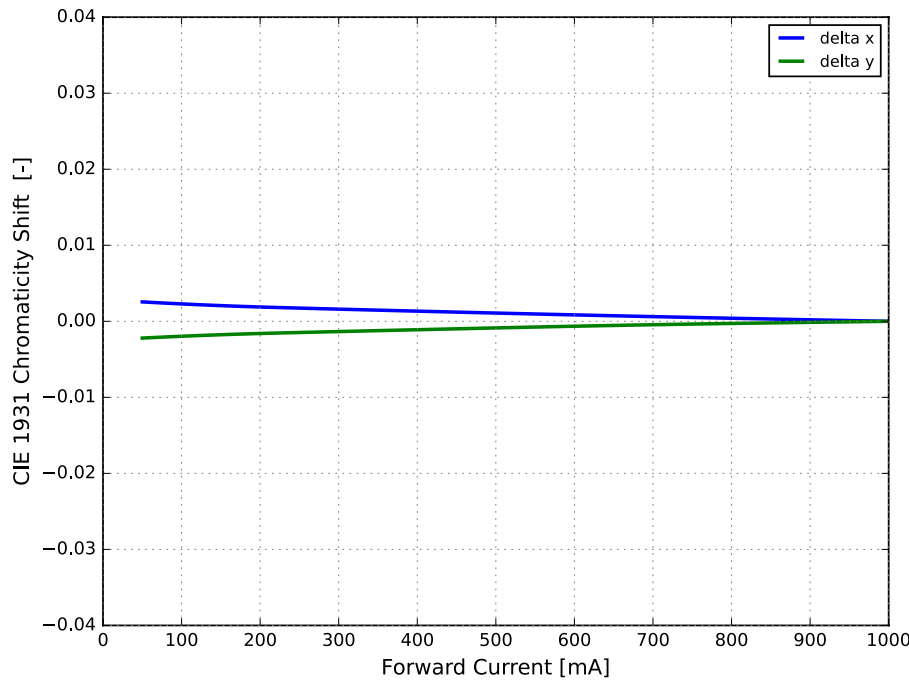


Figure 8. Typical color shift in CIE 1931 x, y coordinates vs. forward current for LUXEON FX2-L PC Amber at MP binning temperature

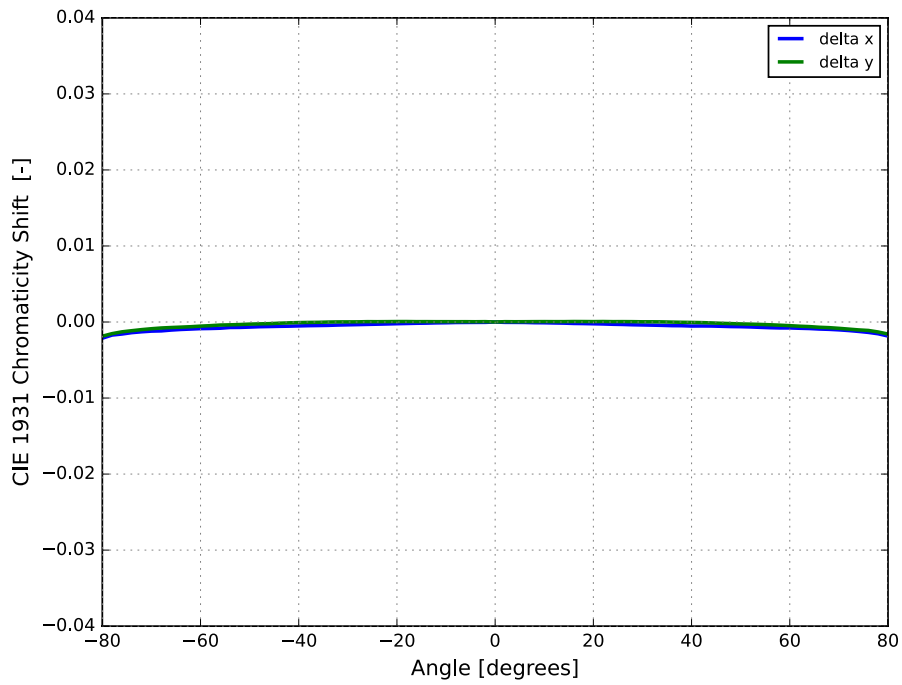


Figure 9. Typical color shift over angle for LUXEON FX2-L PC Amber

## Radiation Pattern Characteristics

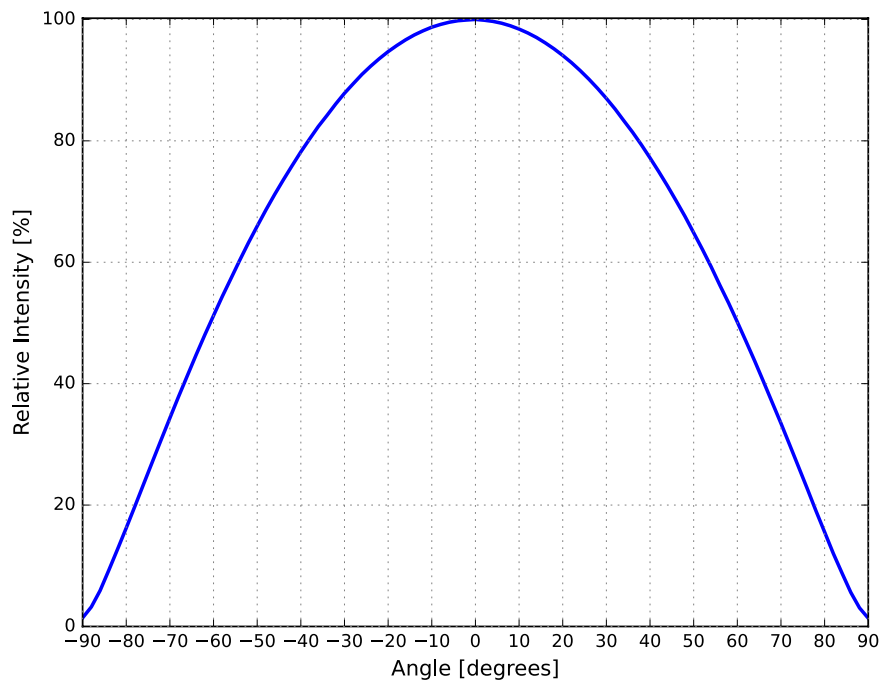


Figure 10. Typical Radiation Pattern for LUXEON FX2-L PC Amber

## Operating Limits Characteristics

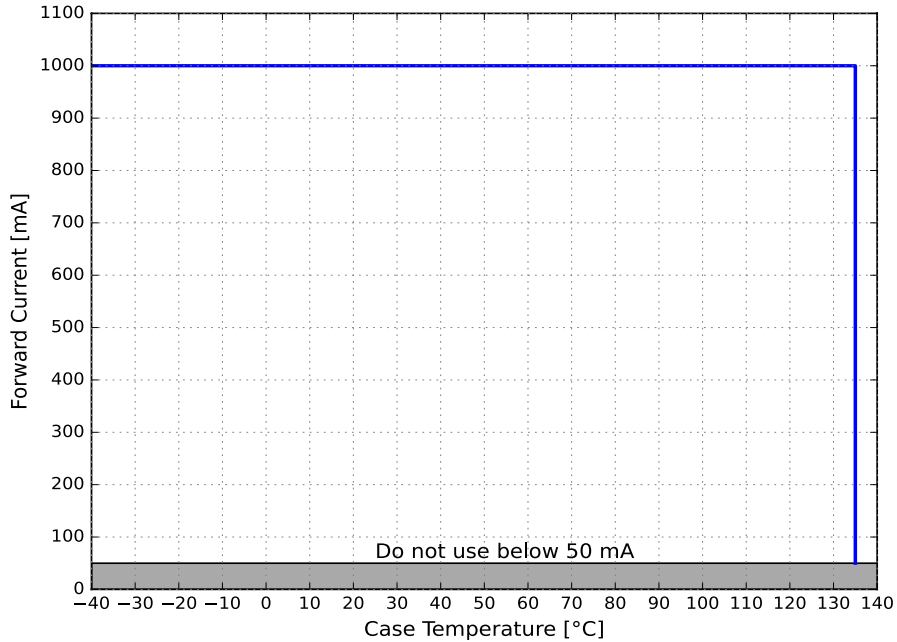


Figure 11. Maximum forward current vs. case temperature for LUXEON FX2-L PC Amber

## Permissible Pulse Handling Characteristics

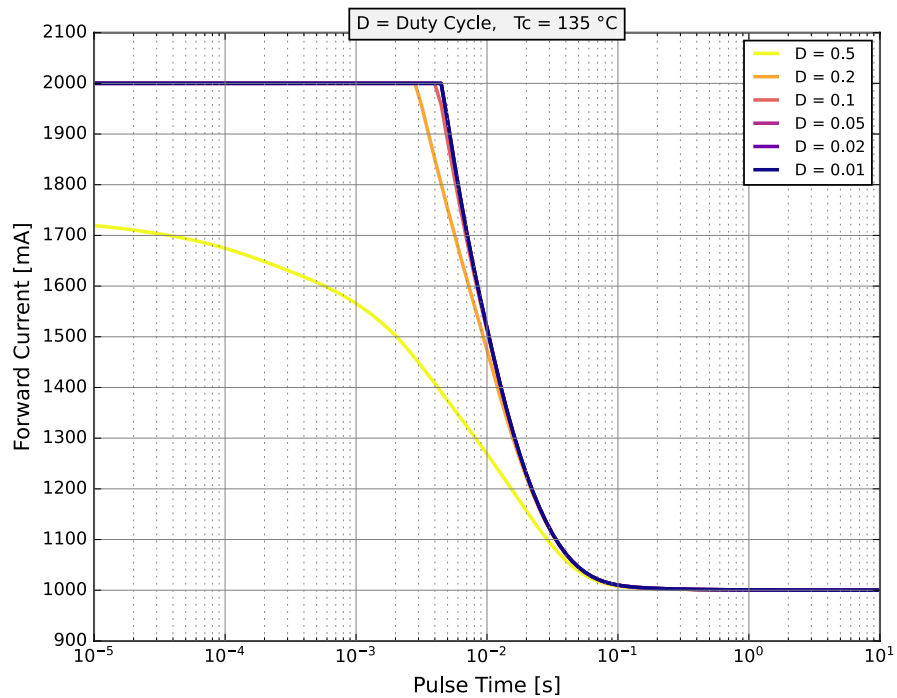


Figure 12. Pulse handling capability for LUXEON FX2-L PC Amber at maximum case temperature

# Product Bin and Labeling Definitions

## 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 components for luminous flux or radiometric power, color point, peak or dominant wavelength and forward voltage.

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

**A B C**

Where:

- A** – designates luminous flux bin (example: M = 270 to 280 lumens)
- B** – designates color bin (example: A = color bin A)
- C** – designates forward voltage bin (example: B = 2.90 V to 3.20 V)

Therefore, a LUXEON FX2-L PC Amber with a lumen range of 270 to 280 lumens, color code A and a forward voltage of 2.90 V to 3.20 V has the following CAT code:

**M A B**

## Luminous Flux Bins

Table 5 lists the standard luminous flux bins for LUXEON FX2-L PC Amber emitters. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance

**Table 5. Luminous flux bin definitions for LUXEON FX2-L PC Amber at MP binning conditions**

BIN	LUMINOUS FLUX <sup>[1]</sup> (lm)	
	MINIMUM	MAXIMUM
K	250	260
L	260	270
M	270	280
N	280	290
P	290	300
Q	300	310

Notes for Table 5:

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

## Color Codes

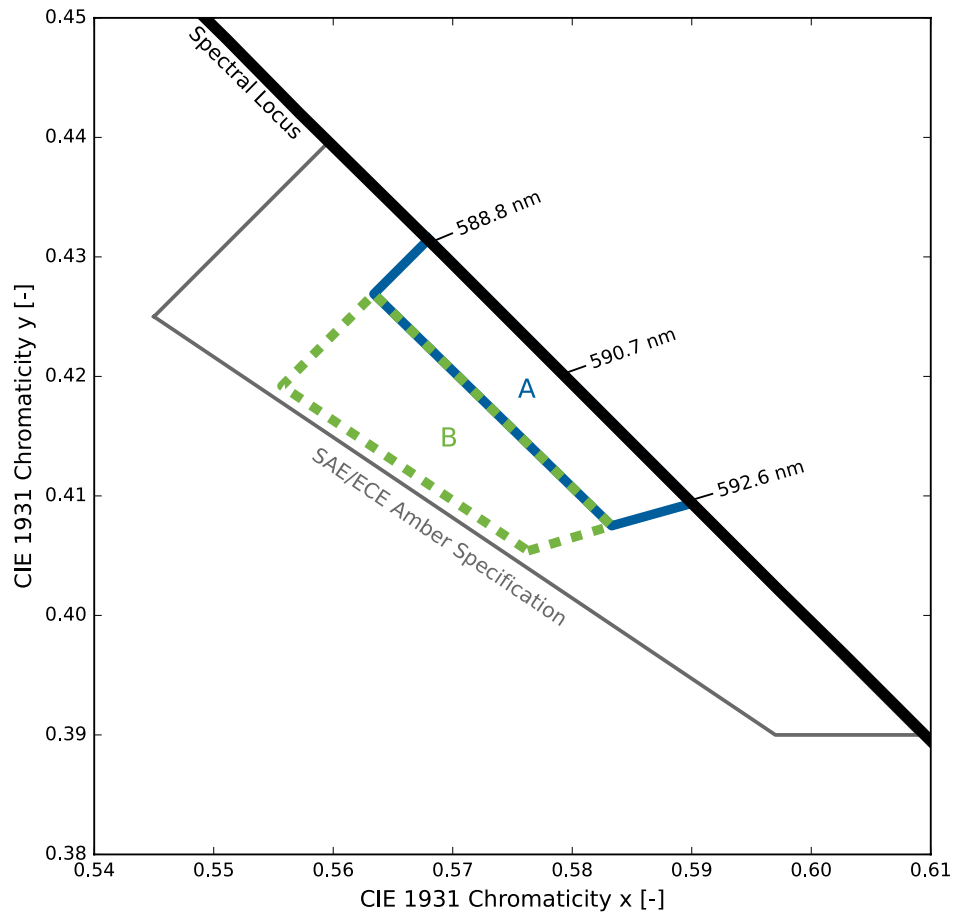


Figure 13. Color bin structure for LUXEON FX2-L PC Amber

## Color Bin Definitions

Table 6. Color bin definitions for LUXEON FX2-L PC Amber<sup>(1)</sup>

BIN	x	y
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 6:**

1. Lumileds maintains a tester tolerance of  $\pm 0.005$  on CIE1931 x, y color coordinates.

# Forward Voltage Bins

Forward voltage distribution of Lumileds LEDs is very narrow, nevertheless for some applications the restriction of forward voltage is beneficial. On request individual bins are available according to Table 7.

**Table 7. Forward voltage bin definitions for LUXEON FX2-L PC Amber at MP binning conditions**

BIN	FORWARD VOLTAGE <sup>(1)</sup> (V <sub>f</sub> )	
	MINIMUM	MAXIMUM
B	2.90	3.20
C	3.20	3.35

**Notes for Table 7:**

1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.

# Mechanical Dimensions

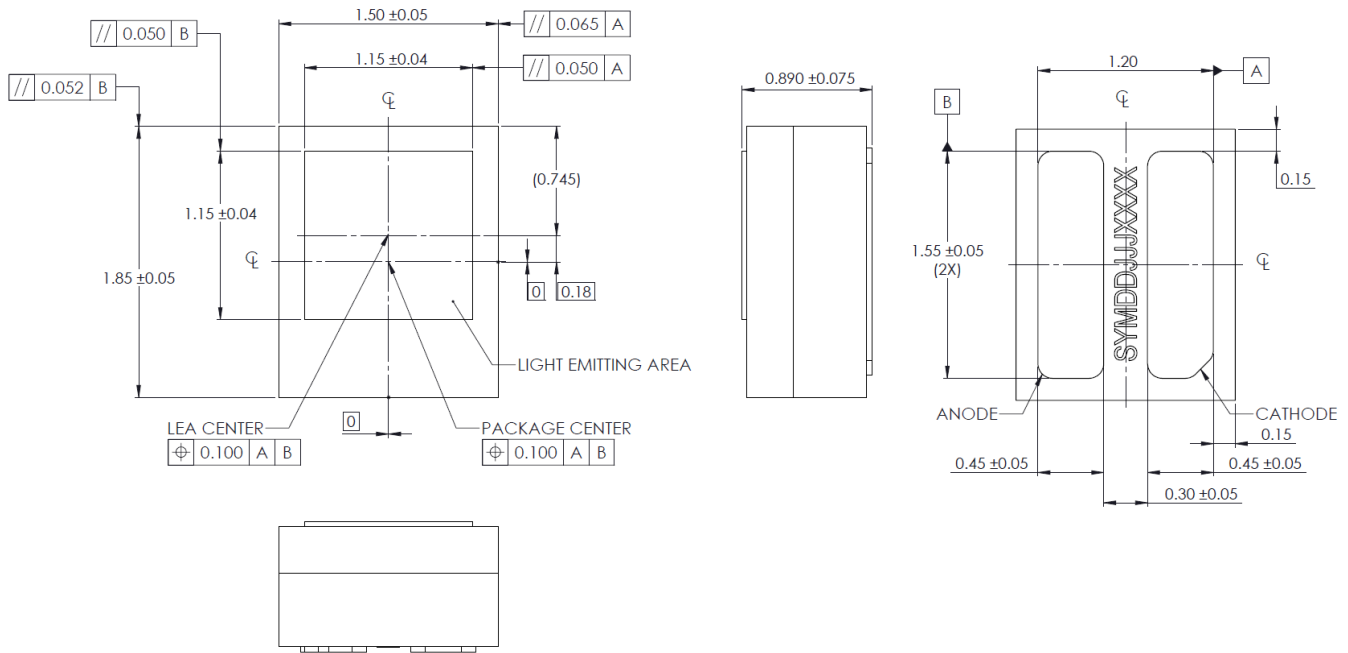


Figure 14. Mechanical dimensions for LUXEON FX2-L PC Amber

**Notes for Figure 14:**

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

## Package Weight

Table 8. Approximate weight of LUXEON FX2-L PC Amber

PART NUMBER	PACKAGE WEIGHT [mg]
A1F2-0591F2Cxxxxxx	7.7

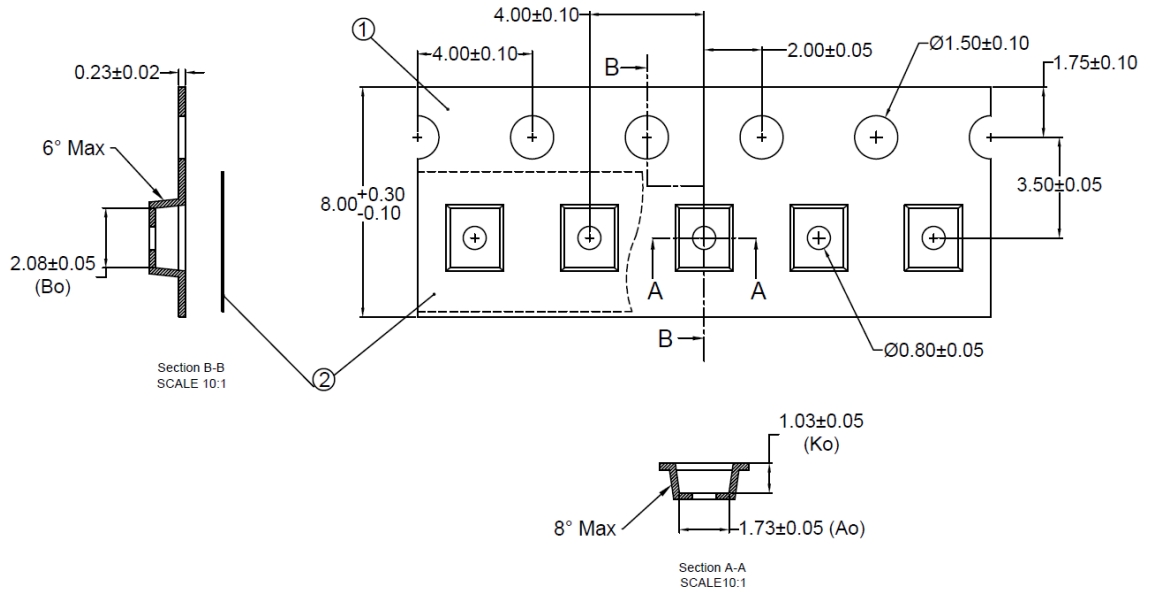
## JEDEC Moisture Sensitivity

Table 9. 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

# Packaging Information

## Pocket Tape Dimensions



- ① Carrier Tape
- ② Cover Tape

Figure 15. Pocket tape dimensions for LUXEON FX2-L PC Amber

Notes for Figure 15:

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

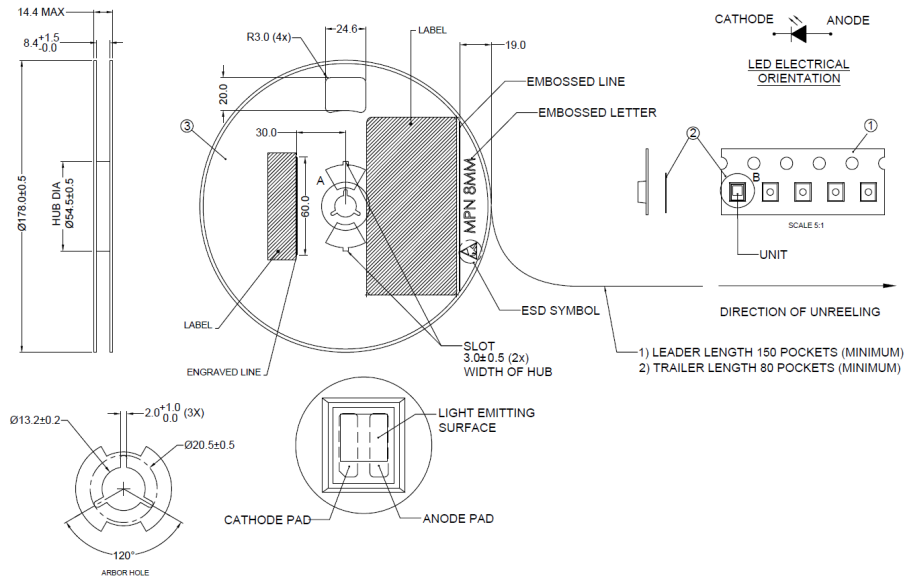


Figure 12. Reel dimensions for LUXEON FX2-L PC Amber

Notes for Figure 12:

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



# Product Labeling

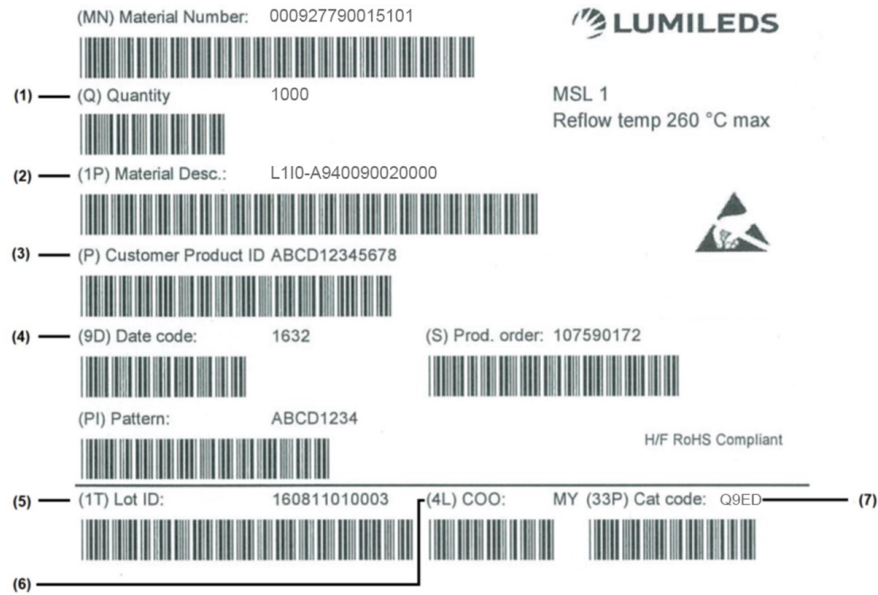


Figure 13. Example of a product label for LUXEON FX2-L PC Amber

Notes for Figure 13 – Reel 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 4-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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