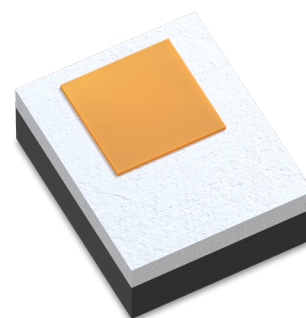


LUXEON FX2-L Plus PC Amber

Industry-leading high power CSP solutions for front lighting applications

LUXEON FX2-L Plus 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 Plus PC Amber provides industry-leading solutions for your front and rear turn applications. All Luxeon FX2-L Plus PC Amber are AEC-Q102 qualified.



FEATURES AND BENEFITS

- Higher drive current capability for increased flux performance
- Low thermal resistance and power consumption results in simplified thermal management and system costs
- Hot binned at 85°C MP to match actual operating conditions
- High flux output provides flexibility in styling and optical design

PRIMARY APPLICATIONS

- Side Marker
- Turn
 - Front Turn
 - Rear Turn

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General Product Information

Product Test Conditions

LUXEON FX2-L Plus 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.

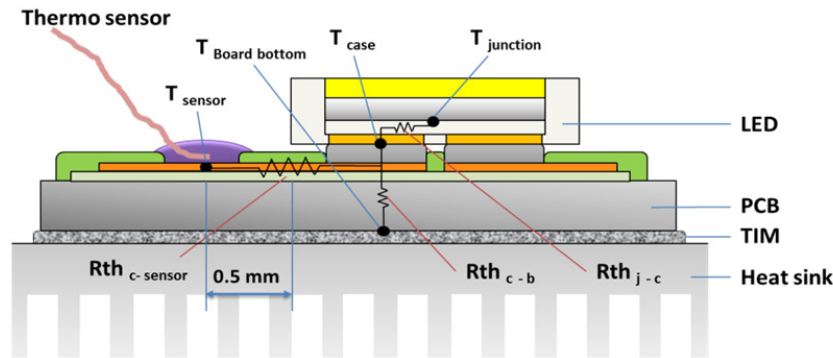


Figure 1. Example of case temperature location on sample board for LUXEON FX2-L

Part Number Nomenclature

Part numbers for LUXEON FX2-L Plus 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 (0591 = Amber)
- C** – designates lumiramic size (F = 1150um)
- D** – designates form factor (3 = 3PAD)
- E** – designates product generation (A = Gen1)
- F** – designates future product offering
- G G G G** – designates minimum luminous flux or custom part number (example:0210 = 210 lumens)
- H** – designates options for detailed product specification (default 0)

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

A 1 F 2 – 0 5 9 1 F 3 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 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 of LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1A, T_c = 85 °C

PRODUCT	MINIMUM LUMINOUS FLUX ^[1] (lm)	PART NUMBER
LUXEON FX2-L Plus PC Amber	200	A1F2-0591F3A002000
	210	A1F2-0591F3A002100
	220	A1F2-0591F3A002200
	230	A1F2-0591F3A002300
	240	A1F2-0591F3A002400
	250	A1F2-0591F3A002500
	260	A1F2-0591F3A002600
	270	A1F2-0591F3A002700

Notes for Table 1:

1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.

Optical Characteristics

Table 2. Typical optical characteristics for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1A, T_c = 85 °C

PART NUMBER	DOMINANT WAVELENGTH (nm) ^[1]		SPECTRAL HALF-WIDTH ^[2] (nm) $\Delta\lambda_{1/2}$	TOTAL INCLUDED ANGLE ^[3] $\theta_{0.90V}$	TYPICAL VIEWING ANGLE ^[4] $2\theta_{1/2}$
	MINIMUM	MAXIMUM			
A1F2-0591F3Axxxxx0	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.

Electrical and Thermal Characteristics

Table 3. Typical electrical and thermal characteristics for LUXEON FX2-L Plus PC Amber at MP, 1A, $T_c = 85^\circ\text{C}$

PART NUMBER	THERMAL RESISTANCE— JUNCTION TO CASE ($^\circ\text{C/W}$)			
	$R\theta_{j-c\text{ el}}^{[2]}$		$R\theta_{j-c\text{ real}}^{[3]}$	
	TYPICAL	MAXIMUM	TYPICAL	MAXIMUM
A1FX2-0591F3Axxxxx0	3.8	4.6	5.1	6.2

Notes for Table 3:

1. Ratio between temperature difference (junction<->case) and electrical input power (references JESD51-51, JESD51-14)
2. Ratio between temperature difference (junction<->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 Plus PC Amber

PARAMETER	PERFORMANCE
Minimum DC Forward Current	50 mA
Maximum DC Forward Current	1000 mA
Maximum Junction Temperature ^[1]	150 $^\circ\text{C}$
Operating Case Temperature at Test Current	-40 $^\circ\text{C}$ to 135 $^\circ\text{C}$
Operating Case Temperature at Maximum Current	-40 $^\circ\text{C}$ to 135 $^\circ\text{C}$
Maximum Junction Temperature for <200 Hours (1000mA) ^[1]	180 $^\circ\text{C}$
LED Storage Temperature	-40 $^\circ\text{C}$ to 135 $^\circ\text{C}$
Soldering Temperature	IPC/JEDEC J-STD-020E 260 $^\circ\text{C}$
ESD Sensitivity ^[2]	± 8 kV HBM, ± 2 kV 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 Plus PCA 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 Plus PC Amber

LEVEL	FLOOR LIFE		STANDARD SOAK REQUIREMENTS	
	TIME	CONDITIONS	TIME	CONDITIONS
1	Unlimited	$\leq 30^\circ\text{C}$ / 85 % RH	168 Hours +5/-0	85 $^\circ\text{C}$ /85 % RH

Characteristic Curves

Spectral Power Distribution Characteristics

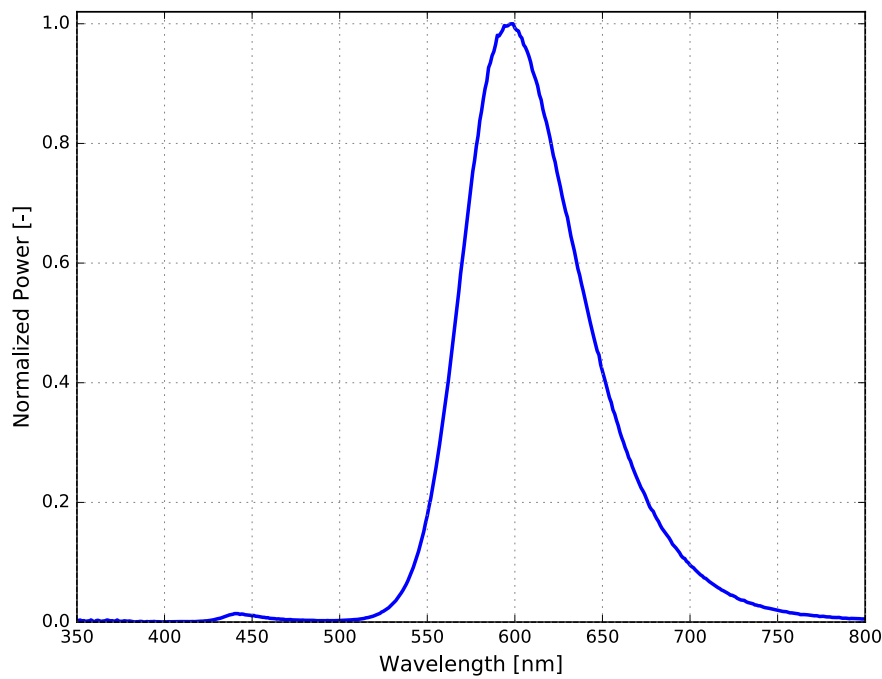


Figure 2a. Typical normalized power vs. wavelength for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000mA, $T_c = 85\text{ }^{\circ}\text{C}$

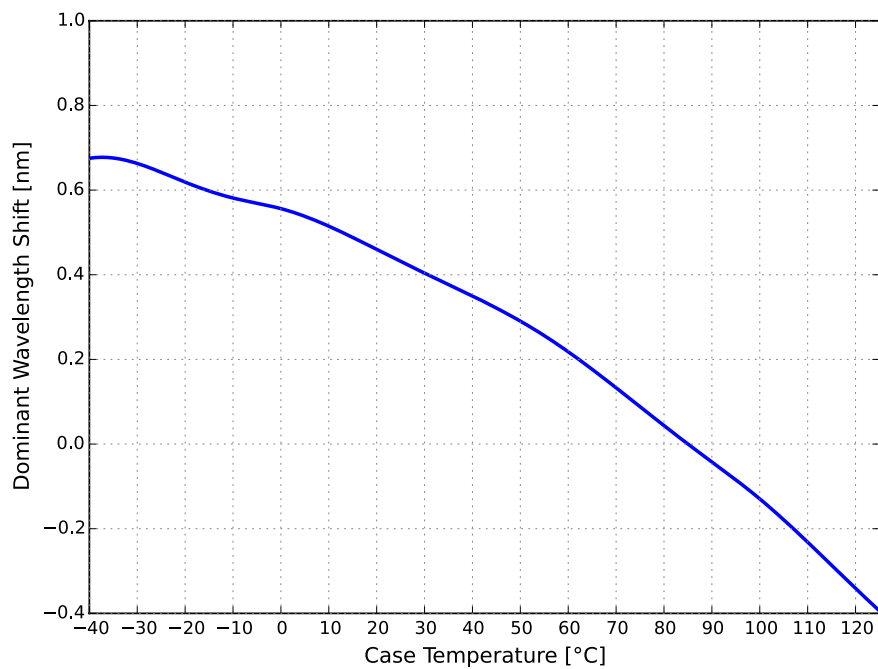


Figure 2b. Typical dominant wavelength shift vs. case temperature for LUXEON FX2-L Plus PC Amber LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000 mA

Light Output Characteristics

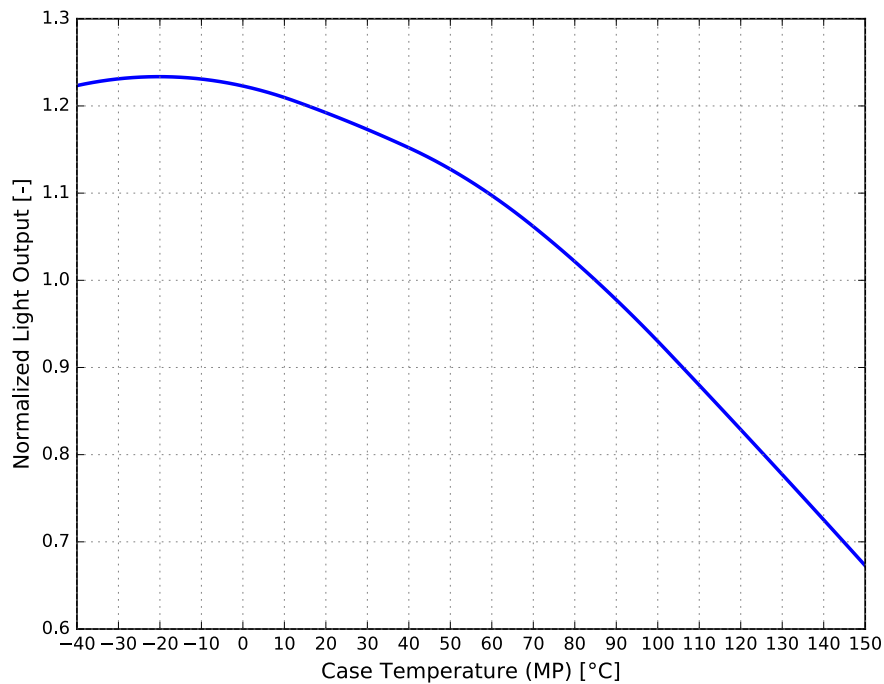


Figure 3a. Typical normalized light output vs. case temperature for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000 mA

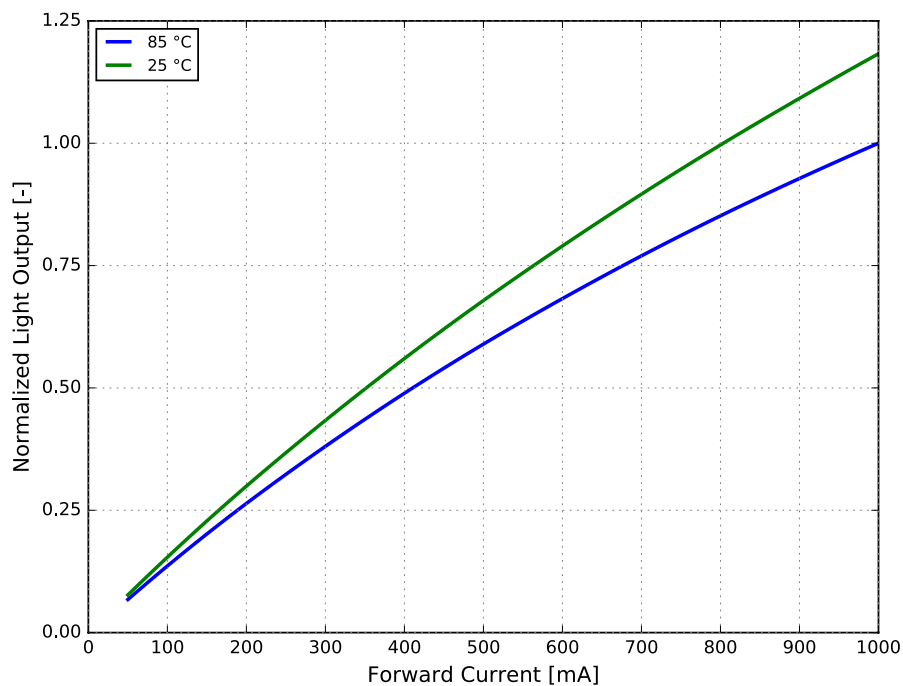


Figure 3b. Typical normalized light output vs. forward current for LUXEON FX2-L Plus PC Amber at $T_c = 85\text{ °C}$

Forward Current Characteristics

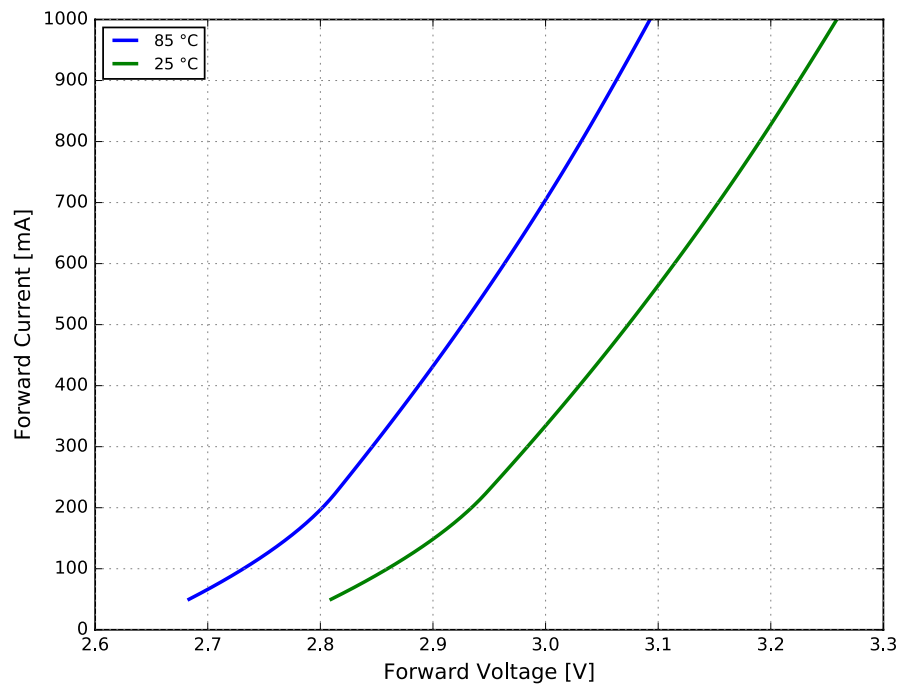


Figure 4a. Typical forward current vs. forward voltage for LUXEON FX2-L Plus PC Amber, LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000 mA

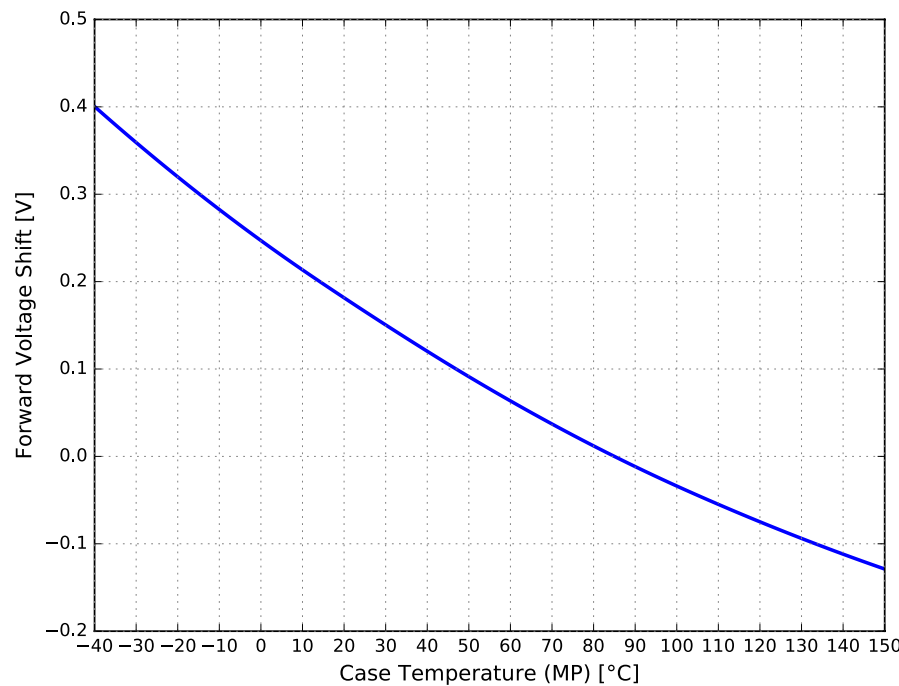


Figure 4b. Typical forward voltage shift vs. case temperature for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000 mA

Color Shift Characteristics

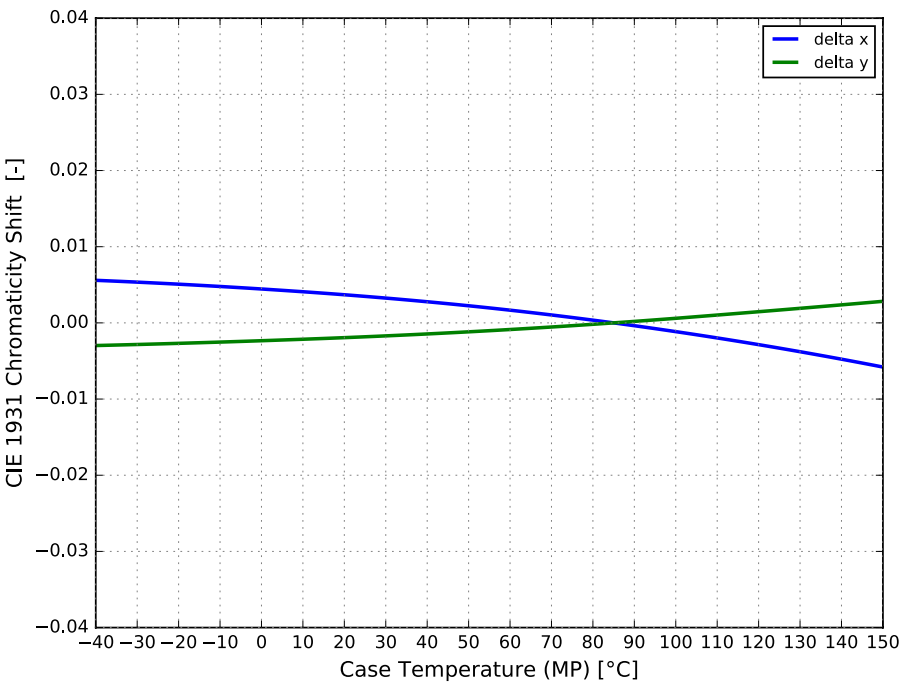


Figure 5a. Typical color shift in CIE 1931 x and y coordinates over temperature for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000 mA

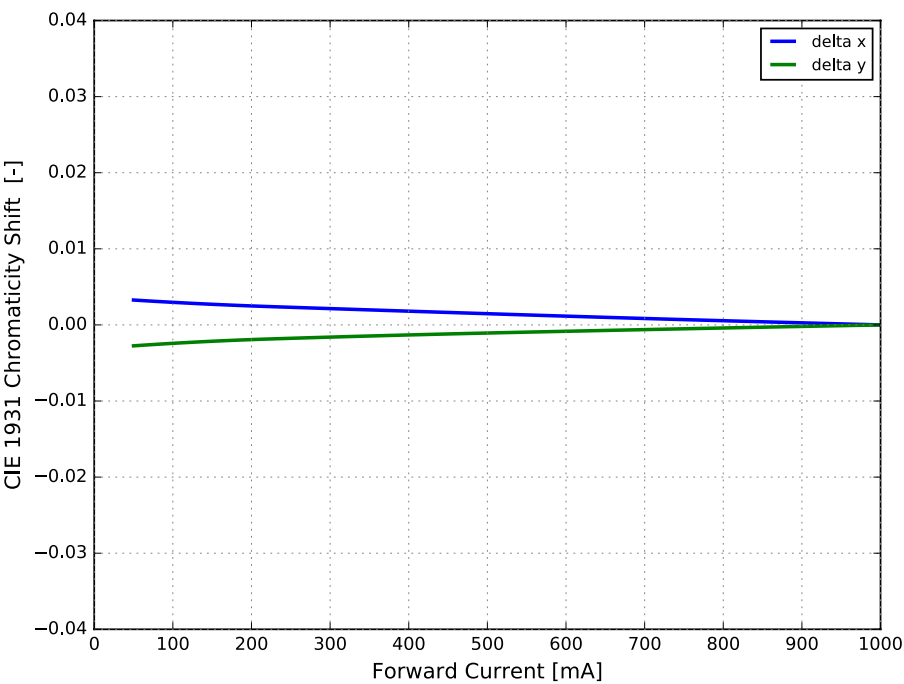


Figure 5b. Typical color shift in CIE 1931 x and y coordinates over current for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 85 °C

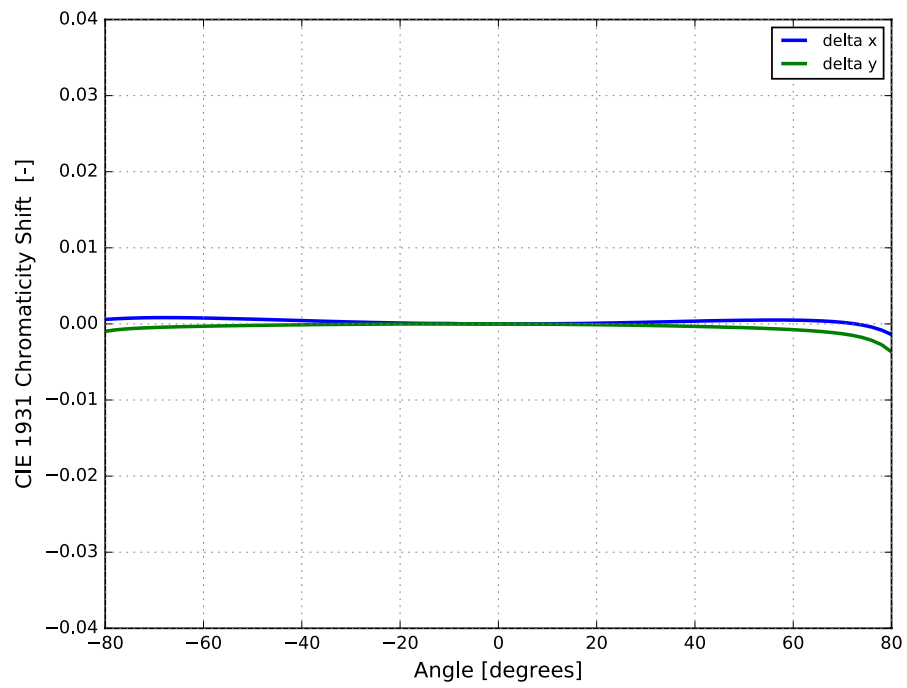


Figure 5c. Typical color shift in CIE 1931 x and y coordinates over angle for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000 mA

Radiation Pattern Characteristics

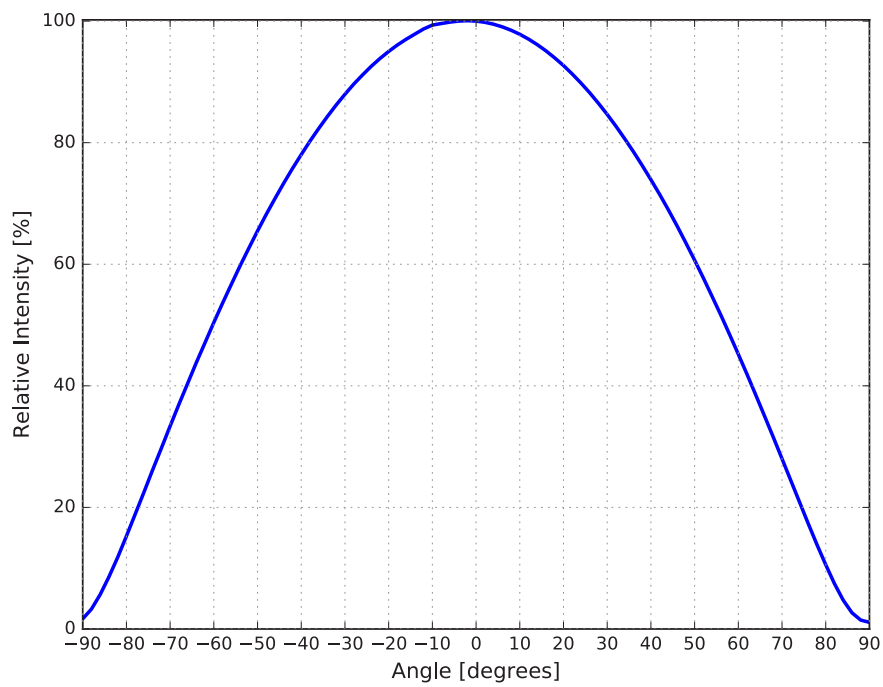


Figure 6. Typical Radiation Pattern for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000 mA

Operating Limits Characteristics

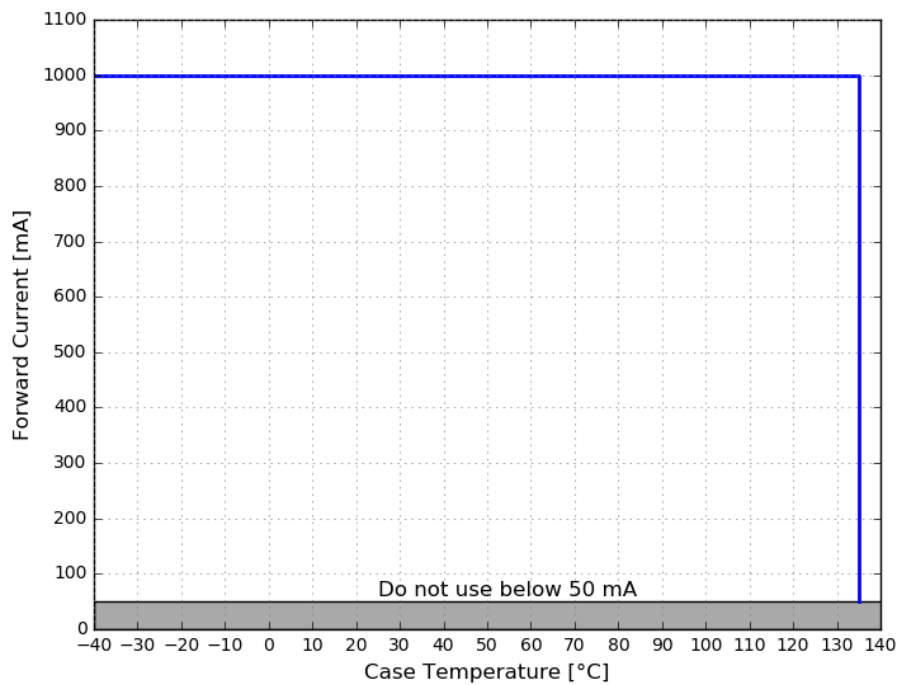


Figure 7. Maximum forward current vs. case temperature for LUXEON FX2-L Plus PC-Amber

Permissible Pulse Handling Characteristics

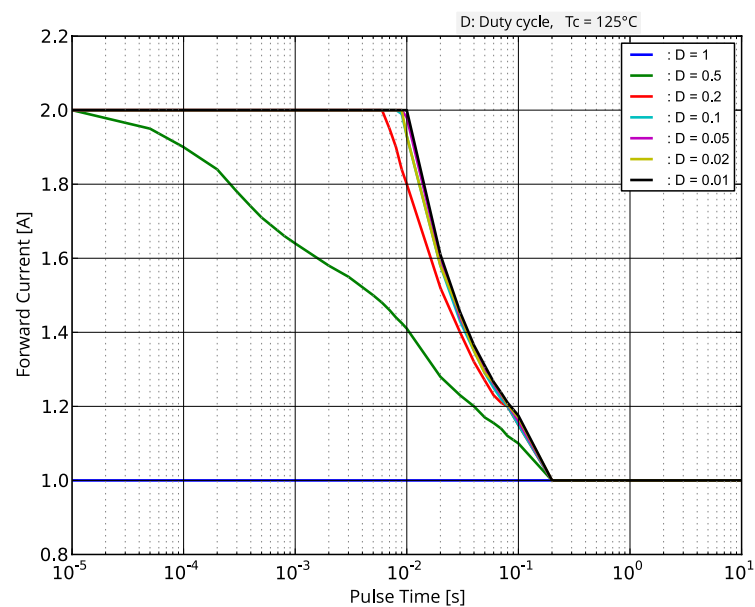


Figure 8. Permissible pulse handling capability for LUXEON FX2-L Plus PC Amber

Product Bin and Labeling Definitions

Designing with LUXEON FX2-L Plus PC Amber

Flux bins supportable for car programs depend on product color and program start- and end-of-production date. Flux roadmaps by year and product color are maintained and available from the sales representative. Please contact your 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 datasheets. For this reason, Lumileds bins the LED components for luminous flux, color and forward voltage.

LUXEON FX2-L Plus PC Amber are labeled using a 4-digit alphanumeric CAT code following the format below.

A B C

Where:

- A** – designates luminous flux bin (example: E = 200 lumens to 210 lumens)
- B** – designates color code (example: A, B)
- C** – designates forward voltage bin (example: C = 3.03 V to 3.72 V)

Therefore, a LUXEON FX2-L Plus PC Amber with a lumen range of 200 to 210, color bin of A, and a forward voltage range of 3.03 V to 3.72 V has the following CAT code:

E A C

Luminous Flux Bins

Table 6 lists the standard luminous flux bins for LUXEON FX2-L Plus PC Amber emitters. 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 Plus PC Amber at < 20 ms MP specified test current, $T_c = 85^\circ\text{C}$ ^[1]

BIN	LUMINOUS FLUX (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

Notes for Table 6:

1. Lumileds maintains a tolerance of ± 6.5 on luminous flux measurements.

Color Codes

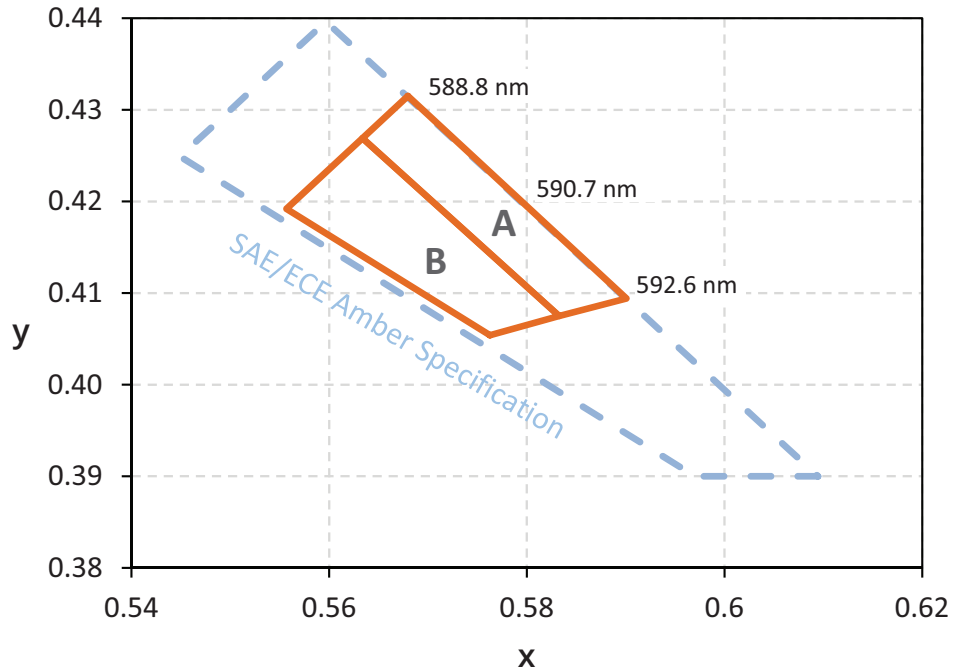


Figure 9. Color bin structure in CIE 1931 color space for LUXEON FX2-L Plus PC Amber

Table 7. Color code definitions for LUXEON FX2-L Plus PC Amber at < 20 ms MP, 1000 mA

CODE	x ^[1]	y ^[2]
A	0.5680	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 7:

1. Lumileds maintains a tolerance of ± 0.005 on x and y coordinates in the CIE 1931 color space.

Forward Voltage Bins

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

BIN ^[1]	FORWARD VOLTAGE (V _f) ^[2]	
	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. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance.

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

Mechanical Dimensions

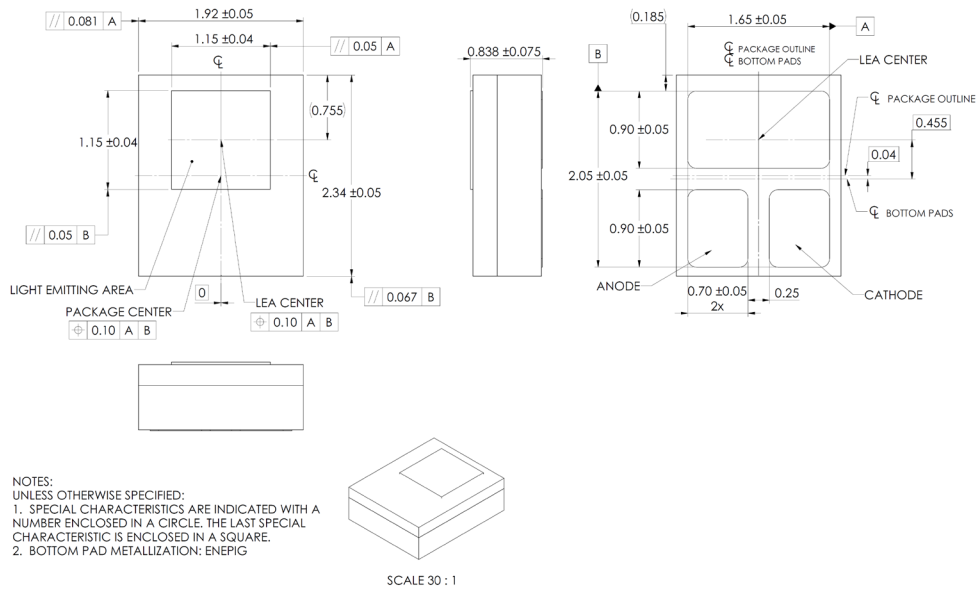


Figure 10. Mechanical dimensions for LUXEON FX2-L Plus PC Amber

Notes for Figure 10:

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

Packaging Information

Pocket Tape Dimensions

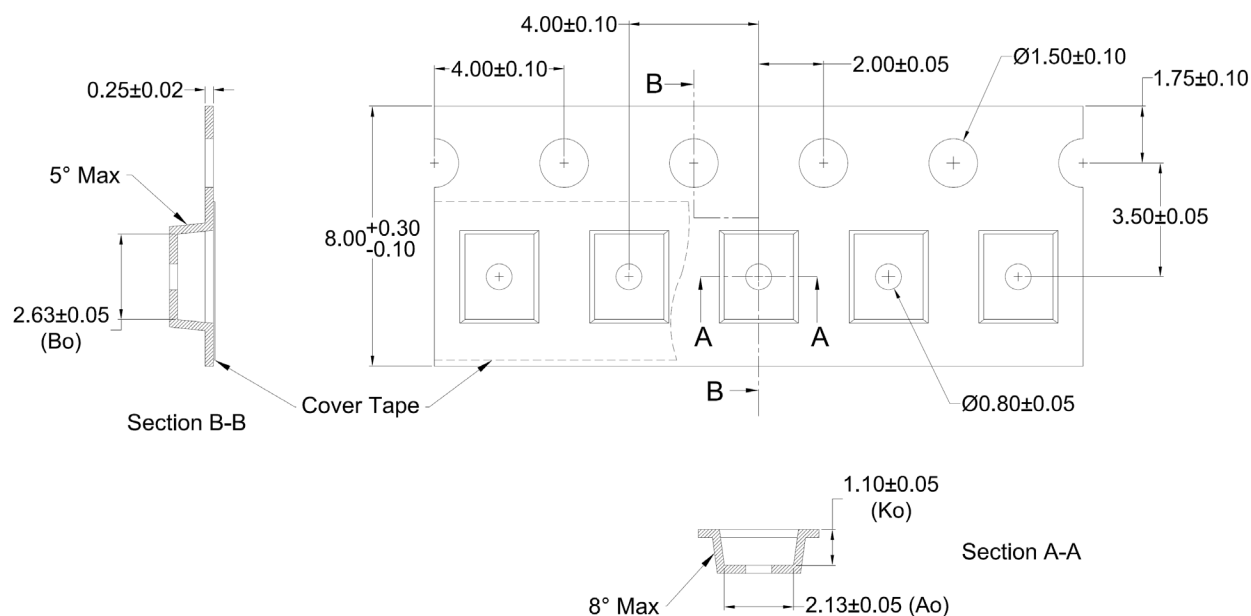


Figure 11. Emitter pocket tape dimensions for LUXEON FX2-L Plus PC Amber

Reel Dimensions

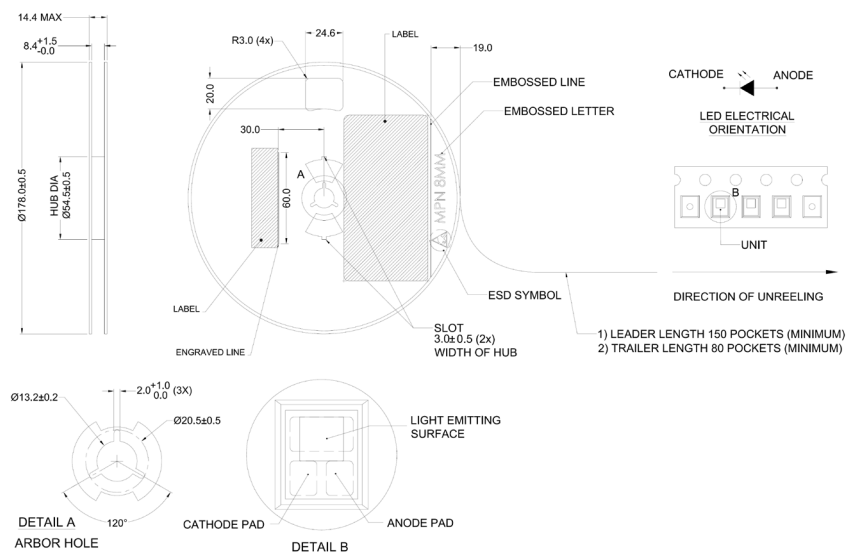


Figure 12. Reel dimensions for LUXEON FX2-L Plus PC Amber

Notes for Figures 11 and 12:

1. All dimensions are in millimeters.
2. A_p is the width of pocket. K_p is the depth of pocket. B_p is the height of pocket.
3. SPI is the number of LEDs per reel.
4. For LUXEON FX2-L, all reels ship with 3000 LEDs.

Product Labeling

LUXEON FX2-L Plus 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.

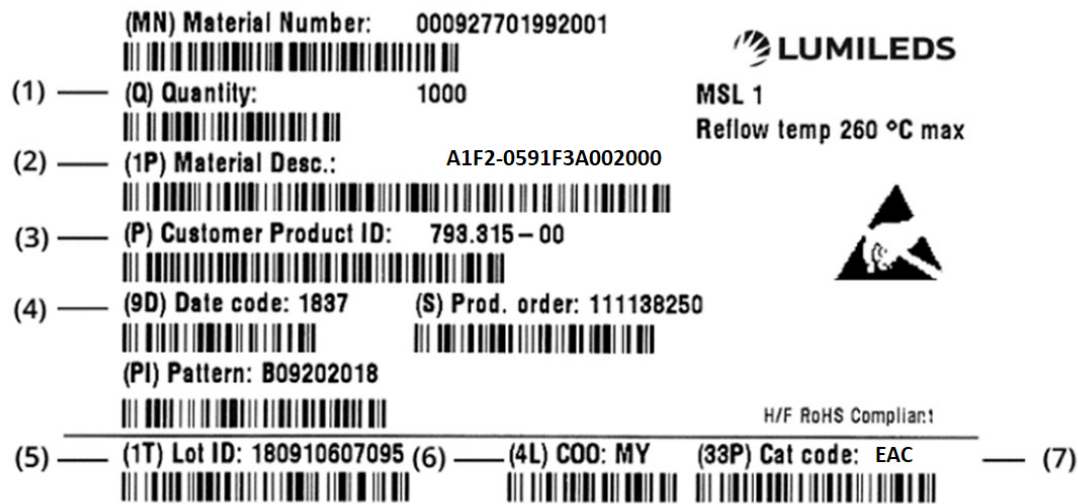


Figure 13. Example of a product label for LUXEON FX2-L PC Amber

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 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.



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