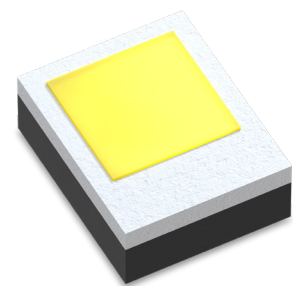
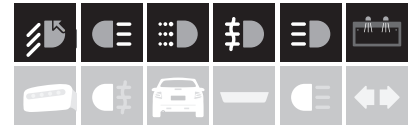


# LUXEON FX2-L Cool White

Industry leading solutions for exterior automotive lighting

LUXEON FX2-L Cool White is a single chip LED suitable for all Automotive applications requiring high flux levels of light, such as low and high beam, daytime running lamps and front fog applications. The Lumileds automotive binning structure meets both, SAE and ECE color specifications, and is hot binned at 85 °C, consistent with typical automotive operating environments. LUXEON FX2-L Cool White LEDs 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
- IEC/PAS 62707-1 White LED

## PRIMARY APPLICATIONS

- Daytime Running Lamps
- Low and High Beam
- ADB (Adaptive Driving Beam)
- AFS (Advanced Front Lighting Systems)
- Cornering Lights
- Fog Lights
- License plate and Back up Lights
- Reverse

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# General Product Information

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

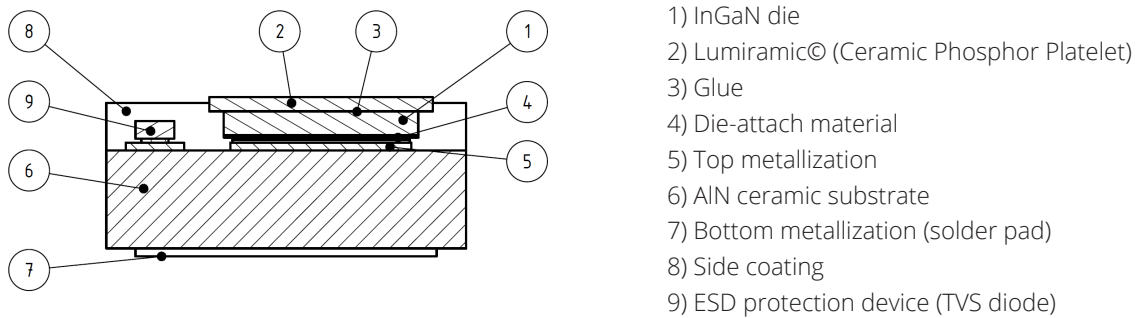


Figure 1. Schematic cross section LUXEON FX2-L Cool White

## Product Test Conditions

Monopulse (MP) testing for LUXEON FX2-L Cool White is done with a pulse of 1 ms. The binning conditions for LUXEON FX2-L Cool White are MP testing at 1000 mA at a temperature of 85 °C.

## Part Number Nomenclature

Part numbers for LUXEON FX2-L Cool White 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 the correlated color temperature (5850 = Cool White)
- C** – designates Lumiramic size (F = 1150 µm)
- 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: 0380 = 380 lumens)
- H** – designates options code for distribution (default = 0)

Therefore, the following part number is used for a LUXEON FX2-L Cool White with a minimum luminous flux of 380 lumens:

A 1 F 2 – **5 8 5 0** F 2 C **0 0 3 8 0 0**

## Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON FX2-L Cool White 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 Cool White at MP binning conditions

MINIMUM LUMINOUS FLUX <sup>[1]</sup> (lm)	PART NUMBER
360	A1F2-5850F2C003600
370	A1F2-5850F2C003700
380	A1F2-5850F2C003800
390	A1F2-5850F2C003900

**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 Cool White at MP binning conditions and far-field optical characteristics

PART NUMBER	CORRELATED COLOR TEMPERATURE (K)		TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup> $2\theta_{0.90V}$	TYPICAL VIEWING ANGLE <sup>[2]</sup> $2\theta_{1/2}$
	MINIMUM	MAXIMUM		
A1F2-5850F2Cxxxxxx	5180	6680	140°	120°

**Notes for Table 2:**

- Total angle at which 90% of total luminous flux is captured.
- $2\theta_{1/2}$  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. Electrical and thermal characteristics for LUXEON FX2-L Cool White. 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.	$R\theta_{j-c,el}$ <sup>[2]</sup>		$R\theta_{j-c,real}$ <sup>[3]</sup>	
				TYPICAL	MAXIMUM	TYPICAL	MAXIMUM
A1F2-5850F2Cxxxxxx	2.90	3.11	3.35	3.7	4.5	6.2	7.5

**Notes for Table 3:**

- Lumileds maintains a tolerance of  $\pm 0.06V$  on forward voltage measurements.
- Ratio between temperature difference (junction to case) and electrical input power (references JESD51-51, JESD51-14)
- 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 Cool White

PARAMETER	PERFORMANCE
Minimum DC Forward Current	50 mA
Maximum DC Forward Current <sup>[1]</sup>	1500 mA
Maximum Peak Pulsed Forward Current <sup>[1]</sup>	2500 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 ( $V_{reverse}$ )	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

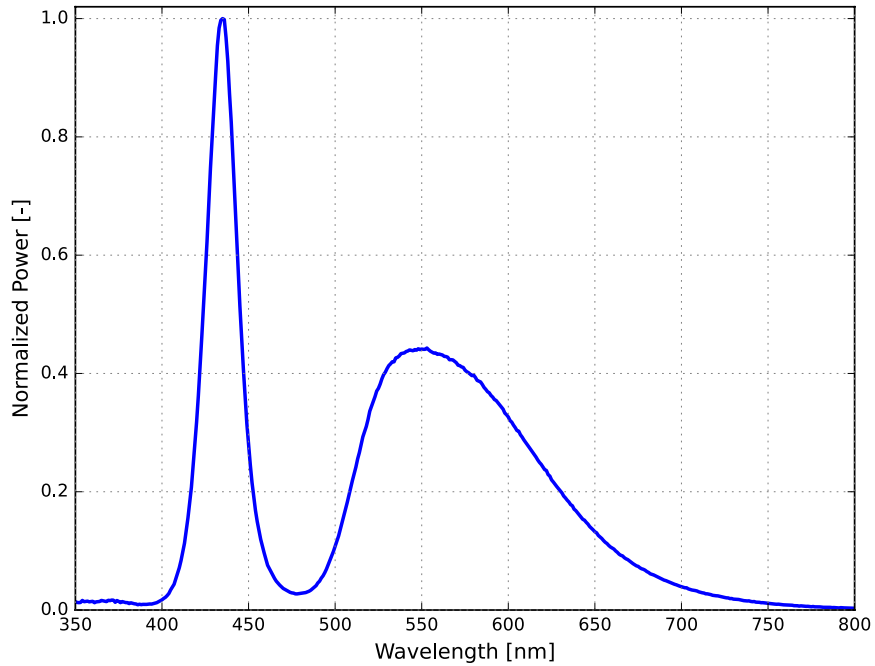


Figure 2. Typical normalized power vs. wavelength for LUXEON FX2-L Cool White at MP binning conditions

## Light Output Characteristics

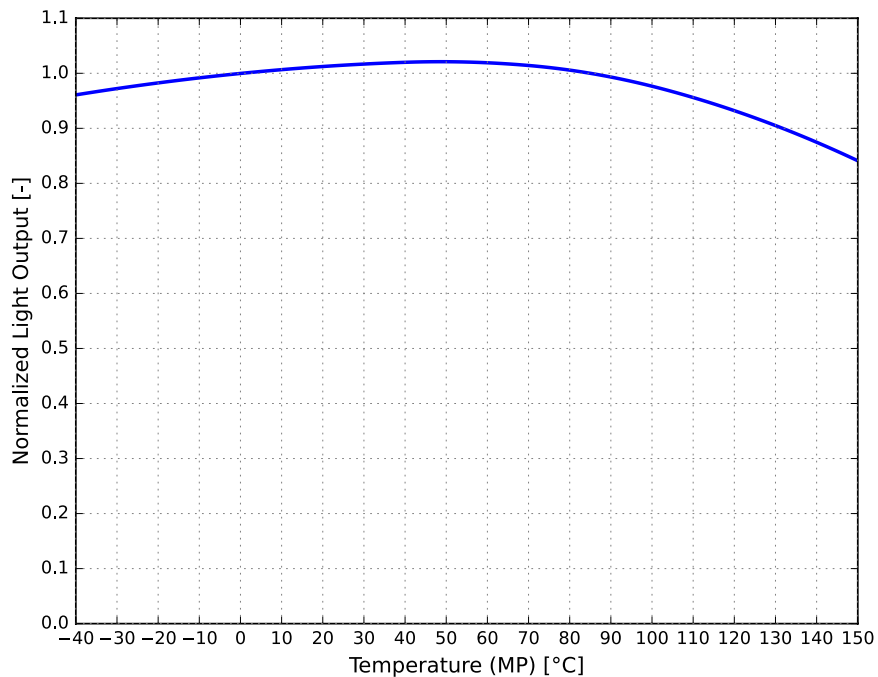


Figure 3. Typical normalized light output vs. temperature for LUXEON FX2-L Cool White at MP binning current

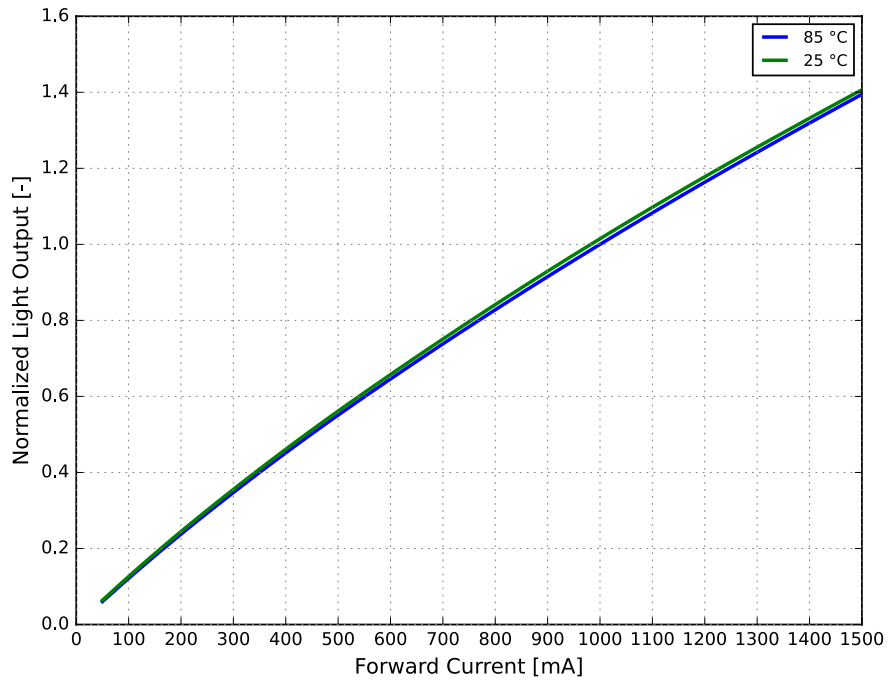


Figure 4. Typical normalized light output vs. forward current for LUXEON FX2-L Cool White at MP binning temperature and at room temperature

## Forward Current and Forward Voltage Characteristics

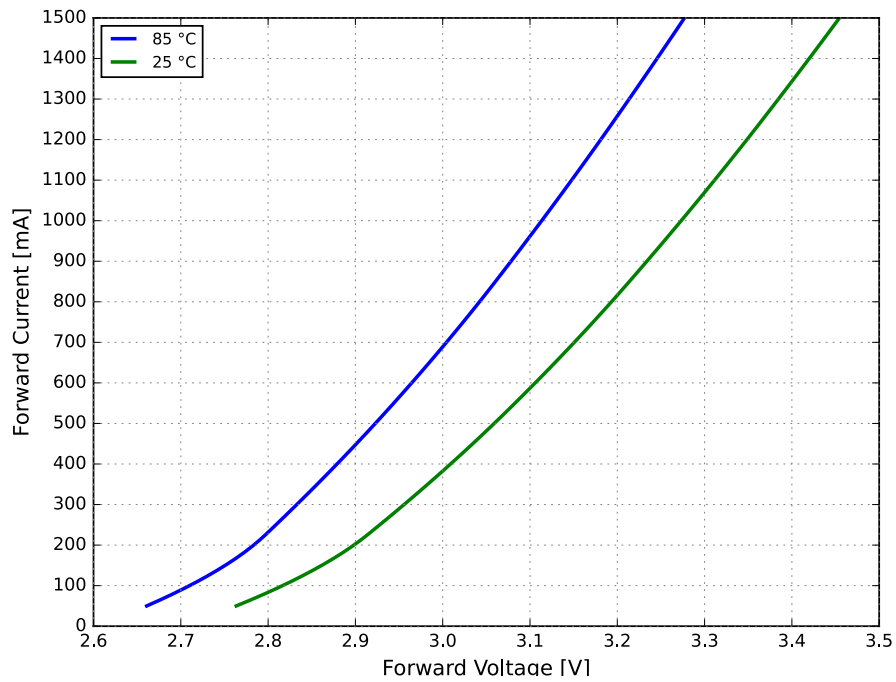


Figure 5. Typical forward current vs. forward voltage for LUXEON FX2-L Cool White at MP binning temperature and at room temperature

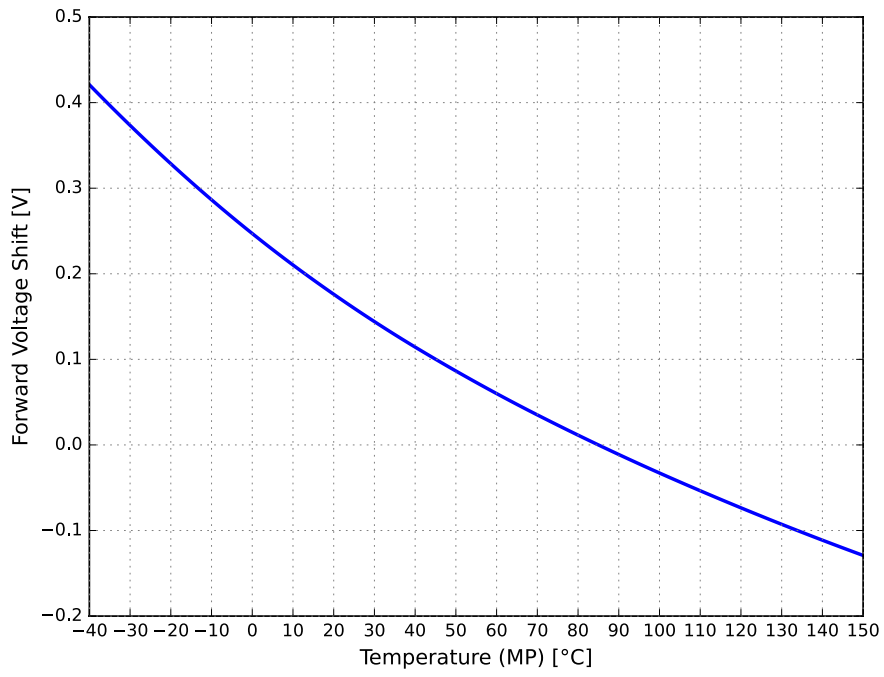


Figure 6. Typical forward voltage shift vs. temperature for LUXEON FX2-L Cool White at MP binning current



# Color Shift Characteristics

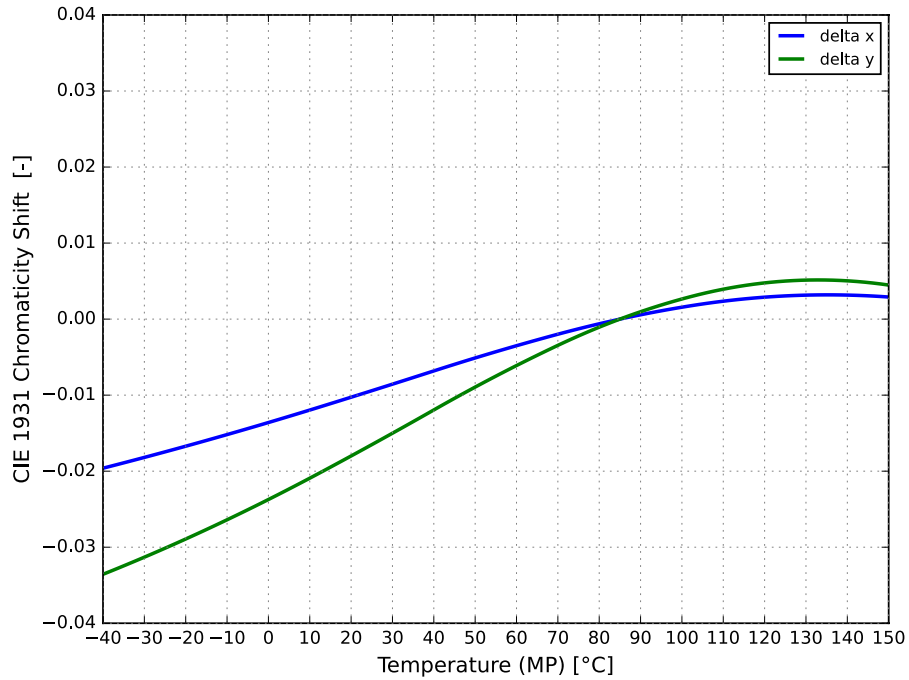


Figure 7. Typical color shift in CIE 1931 x, y coordinates vs. temperature for LUXEON FX2-L Cool White at MP binning current

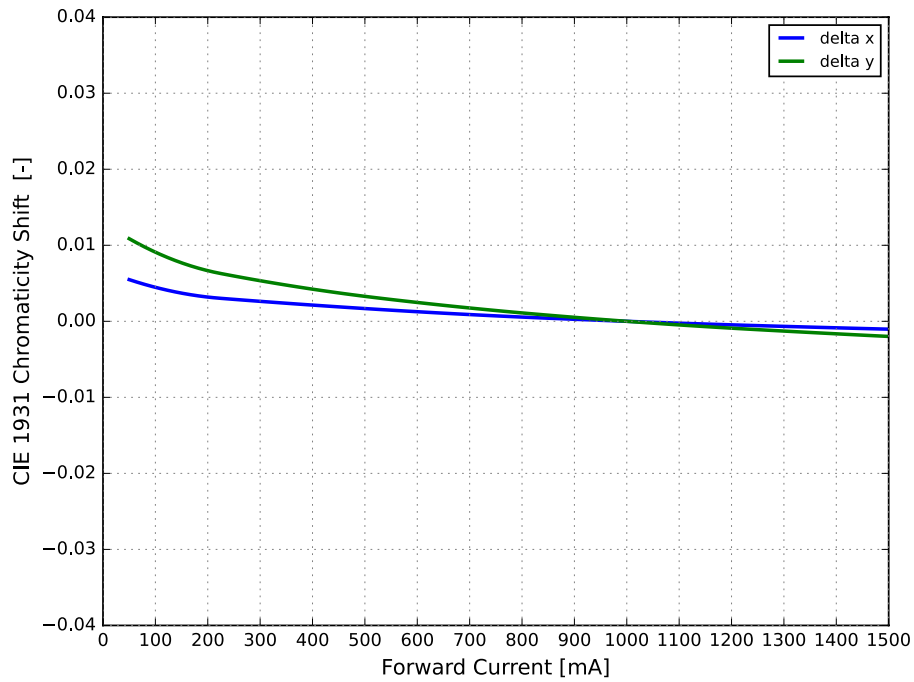


Figure 8. Typical color shift in CIE 1931 x, y coordinates vs. forward current for LUXEON FX2-L Cool White at MP binning temperature

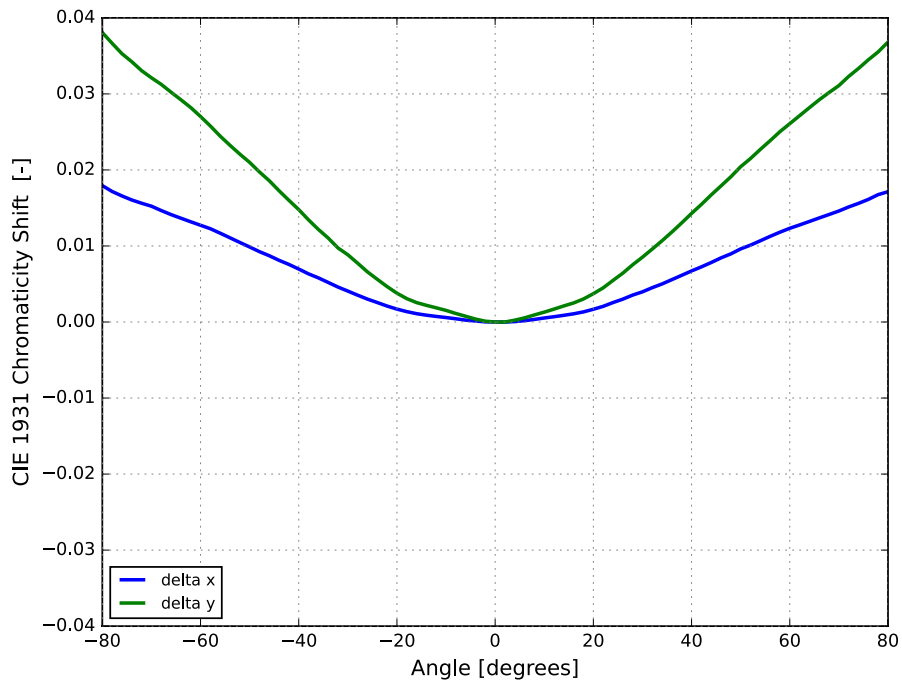


Figure 9. Typical color shift over angle for LUXEON FX2-L Cool White

## Radiation Pattern Characteristics

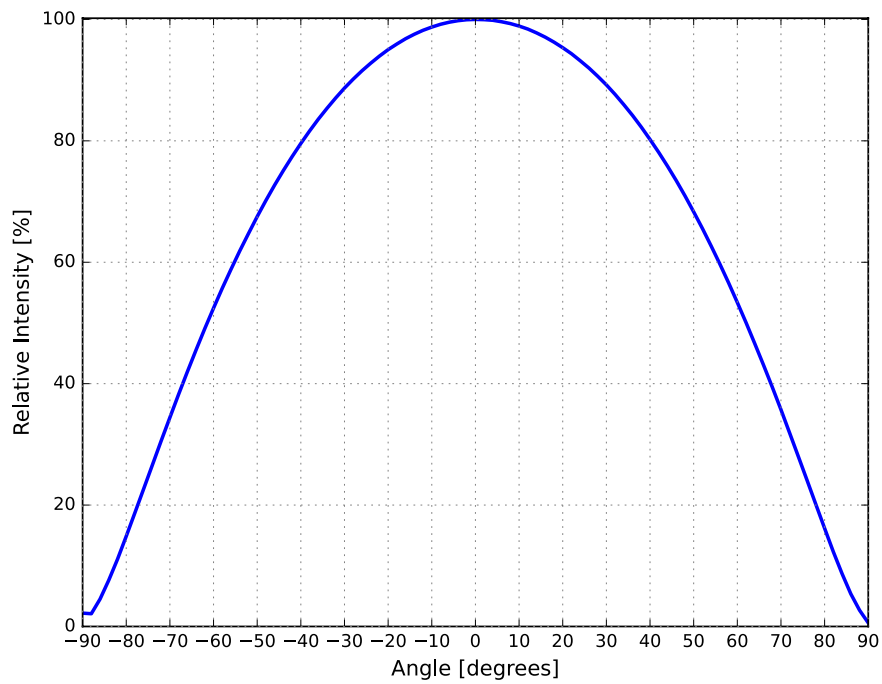


Figure 10. Typical Radiation Pattern for LUXEON FX2-L Cool White

# Operating Limits Characteristics

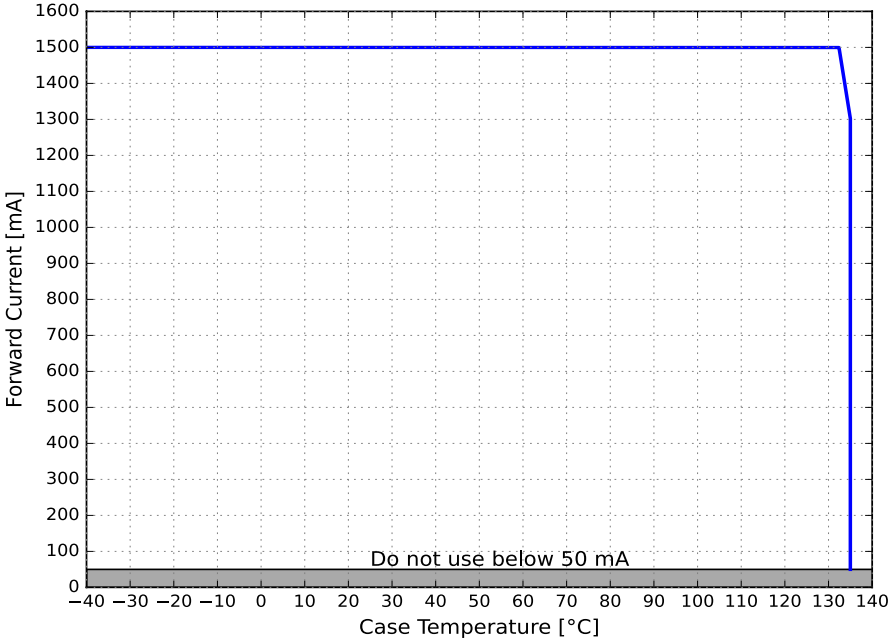


Figure 11. Maximum forward current vs. case temperature for LUXEON FX2-L Cool White

# Permissible Pulse Handling Characteristics

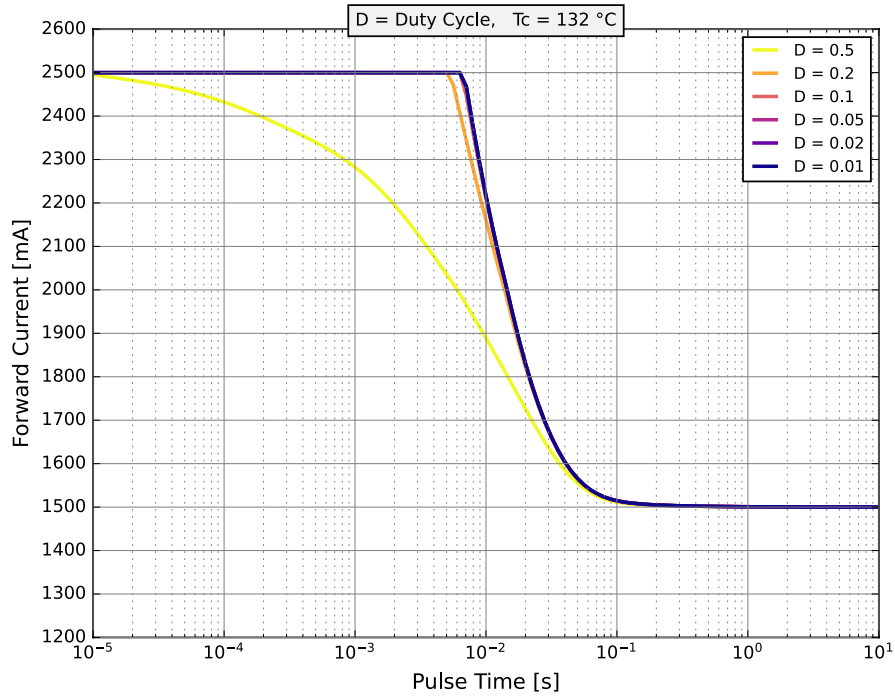


Figure 12a. Pulse handling capability for LUXEON FX2-L Cool White at highest case temperature, where maximum DC current can be applied

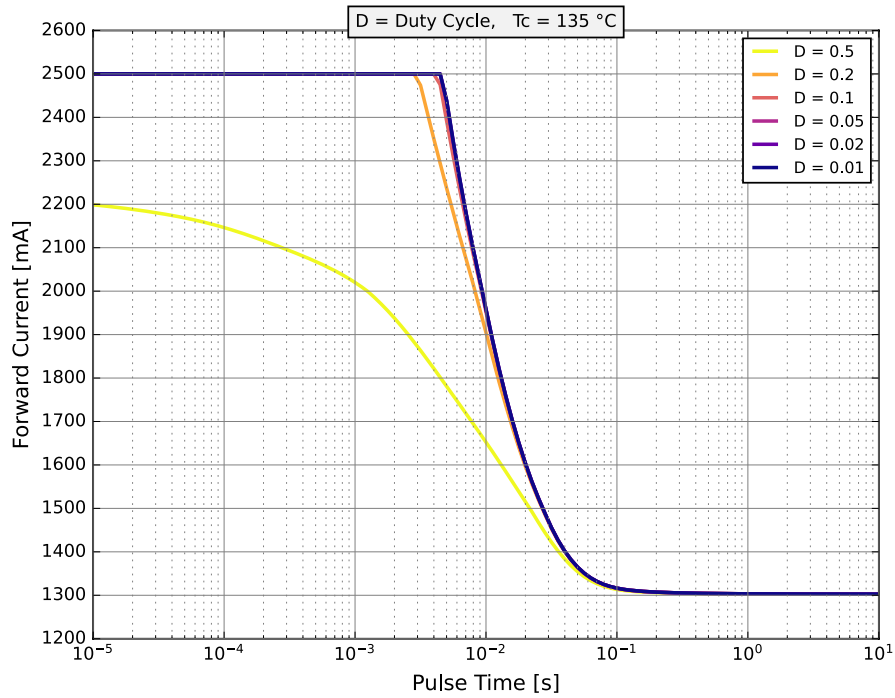


Figure 12b. Pulse handling capability for LUXEON FX2-L Cool White at maximum case temperature

# 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 Cool White emitters are labeled using a 4-digit alphanumeric CAT code following the format below:

**A B C D**

Where:

- A** – designates luminous flux bin (example: Q= 370 to 380 lumens)
- B C** – designates color bin (example: HC)
- D** – designates forward voltage bin (example: B = 2.90 to 3.20 V)

Therefore, a LUXEON FX2-L Cool White emitter with a lumen range of 370 to 380 lumens, color code HC and a forward voltage of 2.90 V to 3.20 V has the following CAT code:

**Q H C B**

## Luminous Flux Bins

Table 5 lists the standard luminous flux bins for LUXEON FX2-L Cool White 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 Cool White at MP binning conditions.

BIN	LUMINOUS FLUX <sup>(1)</sup> (lm)	
	MINIMUM	MAXIMUM
N	350	360
P	360	370
Q	370	380
R	380	390
S	390	400
T	400	410
U	410	420

Notes for Table 6:

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

# Color Codes

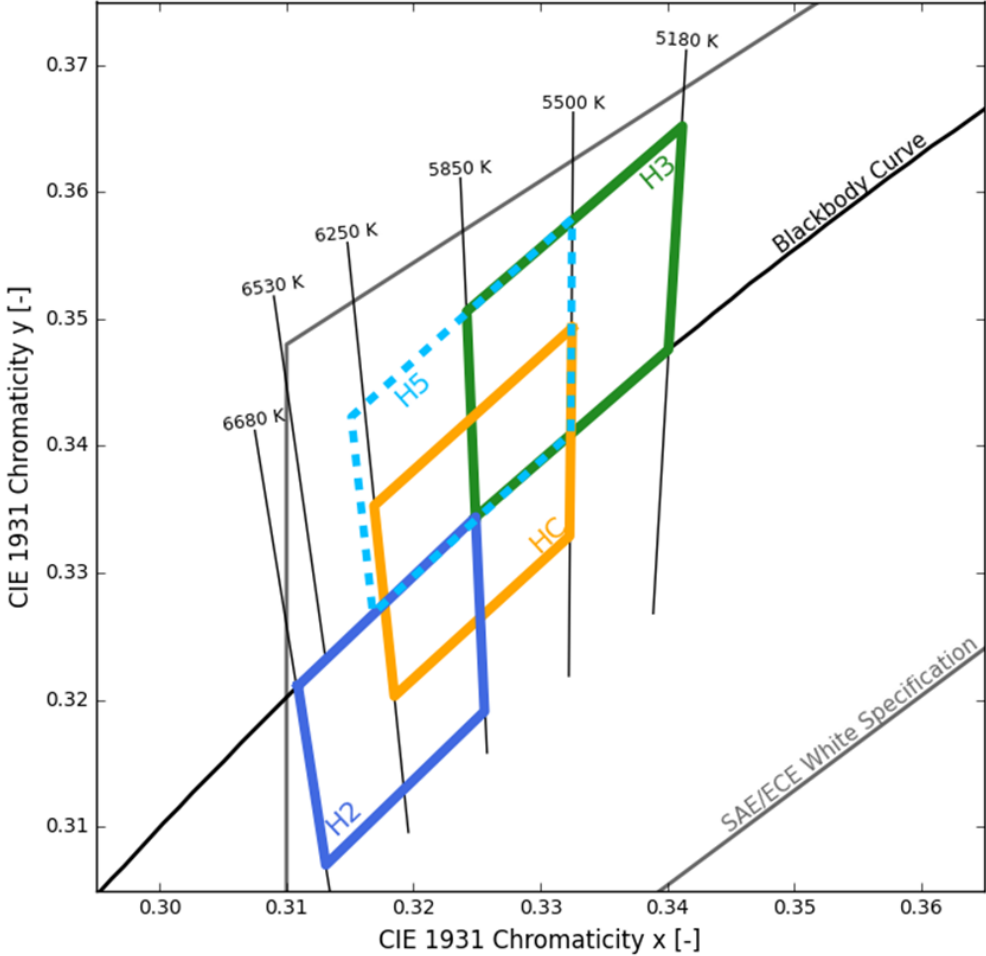


Figure 13. Color bin structure for LUXEON FX2-L Cool White

## Color Bin Definitions

Table 6. Color bin definitions for LUXEON FX2-L Cool White.

BIN	x	y	6-DIGIT IEC CODE	TYPICAL CCT
HC	0.3325	0.3493	ebyD66	5850 K
	0.3169	0.3353		
	0.3185	0.3203		
	0.3323	0.3329		
H5	0.3325	0.3579	NA	5900 K
	0.3151	0.3423		
	0.3168	0.3268		
	0.3324	0.3410		
H2	0.3109	0.3211	ebvG66	6250 K
	0.3131	0.3070		
	0.3256	0.3191		
	0.3249	0.3344		
H3	0.3249	0.3344	fcbA66	5500 K
	0.3401	0.3476		
	0.3412	0.3652		
	0.3242	0.3506		

**Notes for Table 6:**

1. Lumileds maintains a tolerance of  $\pm 0.005$  on (x,y) color coordinates.
2. CIE 1931 x and y coordinate frame

Table 7. Optional color bin definitions for LUXEON FX2-L Cool White

CODE	x	y	6-DIGIT IEC CODE	TYPICAL CCT	CODE	x	y	6-DIGIT IEC CODE	TYPICAL CCT
2B	0.3120	0.3139	ebvG33	6460 K	1B	0.3120	0.3306	fbwA23	6390 K
	0.3185	0.3203				0.3169	0.3353		
	0.3192	0.3131				0.3177	0.3277		
2D	0.3131	0.3070	ebyG33	6050 K	1D	0.3131	0.3232	fbyA33	6050 K
	0.3185	0.3203				0.3169	0.3353		
	0.3253	0.3266				0.3246	0.3424		
	0.3256	0.3191				0.3249	0.3344		
4B	0.3192	0.3131	ecbG33	5680 K	3B	0.3177	0.3277	fcbA33	5680 K
	0.3253	0.3266				0.3246	0.3424		
	0.3323	0.3329				0.3325	0.3493		
	0.3323	0.3251				0.3324	0.341		
4D	0.3256	0.3191	eceG33	5350 K	3D	0.3249	0.3344	fceA33	5350 K
	0.3323	0.3329				0.3325	0.3493		
	0.3396	0.3392				0.3406	0.3562		
	0.3392	0.3310				0.3401	0.3476		
2A	0.3323	0.3251	ebvD33	6460 K	1A	0.3324	0.341	fbwD23	6390 K
	0.3109	0.3211				0.3109	0.3382		
	0.3177	0.3277				0.3161	0.3432		
	0.3185	0.3203				0.3169	0.3353		
2C	0.3120	0.3139	ebyD33	6050 K	1C	0.312	0.3306	fbyD33	6050 K
	0.3177	0.3277				0.3161	0.3432		
	0.3249	0.3344				0.3242	0.3506		
	0.3253	0.3266				0.3246	0.3424		
4A	0.3185	0.3203	ecbD33	5680 K	3A	0.3169	0.3353	fcbD33	5680 K
	0.3249	0.3344				0.3242	0.3506		
	0.3324	0.3410				0.3325	0.3579		
	0.3323	0.3329				0.3325	0.3493		
4C	0.3253	0.3266	eceD33	5350 K	3C	0.3246	0.3424	fceD33	5350 K
	0.3324	0.3410				0.3325	0.3579		
	0.3401	0.3476				0.3412	0.3652		
	0.3396	0.3392				0.3406	0.3562		
	0.3323	0.3329				0.3325	0.3493		

Notes for Table 7:

1. LUXEON FX2 emitters are tested and binned by x and y coordinates.
2. Lumileds maintains a tester tolerance of ±0.005 on x and y 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 8.

**Table 8. Forward voltage bin definitions for LUXEON FX2-L Cool White 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 8:**

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

# Mechanical Dimensions

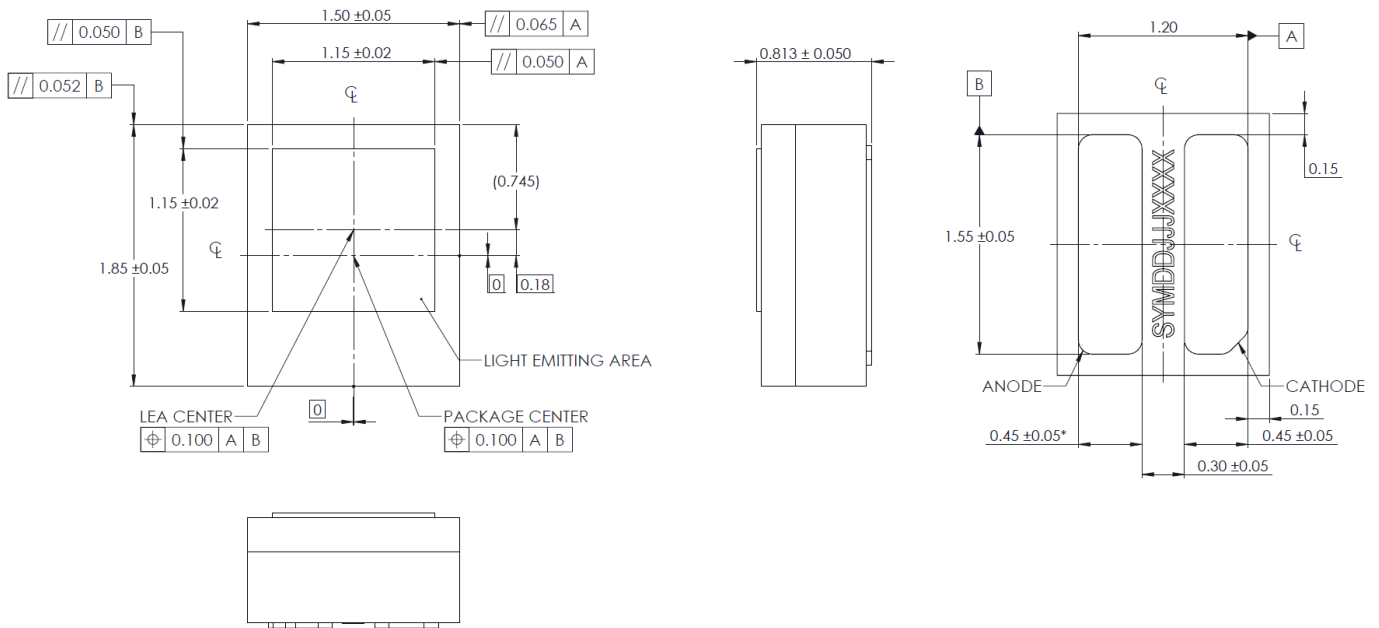


Figure 14. Mechanical dimensions for LUXEON FX2-L Cool White

**Notes for Figure 14:**

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

## Package Weight

Table 9. Approximate weight of LUXEON FX2-L Cool White

PART NUMBER	PACKAGE WEIGHT [mg]
A1F2-5850F2Cxxxxxx	7.8

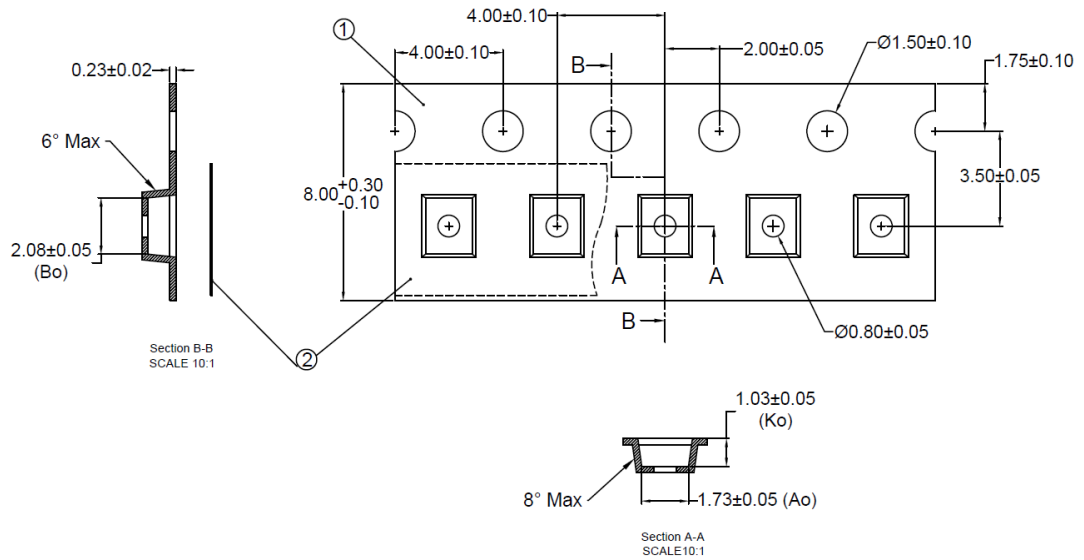
## JEDEC Moisture Sensitivity

Table 10. Moisture sensitivity levels for LUXEON FX2-L Cool White

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 Cool White

### 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

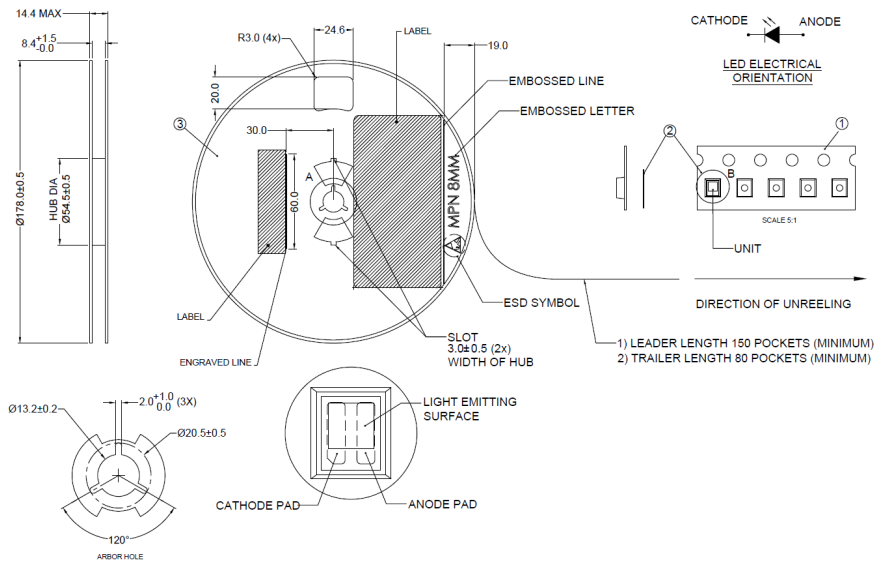


Figure 16. Reel dimensions for LUXEON FX2-L Cool White

### Notes for Figure 16:

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

# Product Labeling

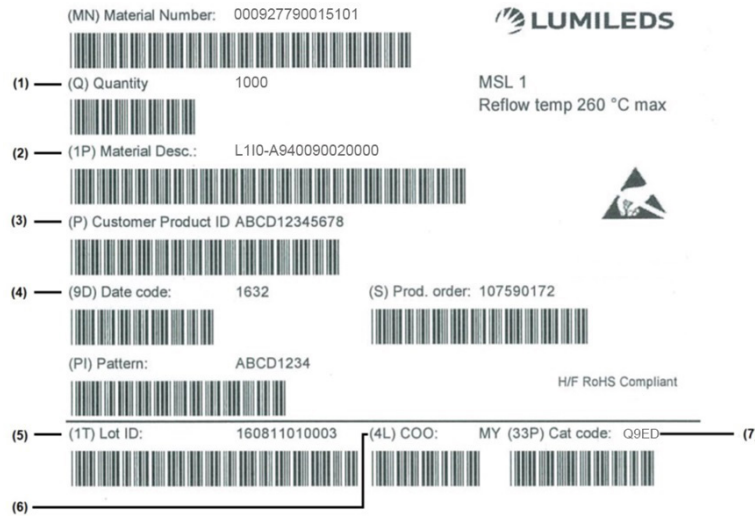


Figure 17. Example of a product label for LUXEON FX2-L Cool White

Notes for Figure 17 – 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 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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