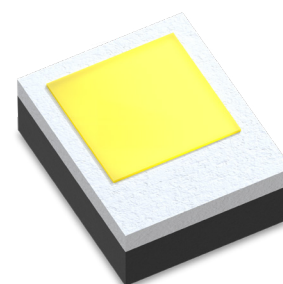


# LUXEON FX2-L Cool White

## Automotive Forward Lighting Source

LUXEON FX2-L Cool White LEDs are designed to support 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 actual automotive operational environments. All LUXEON FX2-L LEDs are AEC-Q102 qualified.



### FEATURES AND BENEFITS

- High drive current capability for increased flux performance
- Compact, robust 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 closer to operating conditions
- IEC/PAS 62707-1 White LED

### PRIMARY APPLICATIONS

- Daytime Running Lamps
- Cornering
- Headlight
  - Low Beam
  - High Beam
- Adaptive Lighting
  - AFS
  - Matrix Beam

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# General Product Information

## Product Test Conditions

LUXEON FX2-L Cool White is binned using a < 20 ms monopulse (MP) of 1000 mA drive current. The case temperature is set to  $T_c = 85^\circ\text{C}$  at the beginning of the pulse. Unless otherwise noted, the same test conditions apply to all data in this document.

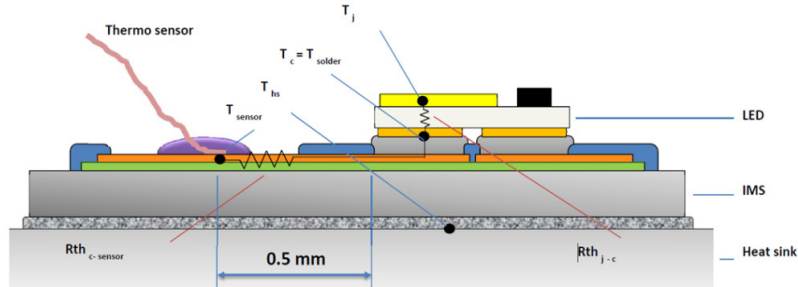


Figure 1. Case temperature measurement point for LUXEON FX2-L Cool White.

## 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 color temperature or wavelength (5850 for cool white)
- C** – designates Lumiramic size (F = 1150  $\mu\text{m}$ )
- 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 (example: 0300 = 300 lumens)
- H** – designates options code for distribution

Therefore, the following part number is used for a LUXEON FX2-L Cool White with a minimum luminous flux of 320 lm:

A 1 F 2 – **5 8 5 0** F 2 A **0 0 3 2 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 selection for LUXEON FX2-L Cool White at < 20 ms MP, 1000 mA,  $T_c = 85^\circ\text{C}$ .

MINIMUM LUMINOUS FLUX <sup>[1]</sup> (lm)	PART NUMBER
310	A1F2-5850F2A003100
320	A1F2-5850F2A003200
330	A1F2-5850F2A003300
340	A1F2-5850F2A003400
350	A1F2-5850F2A003500
360	A1F2-5850F2A003600
370	A1F2-5850F2A003700

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.

PART NUMBER	CORRELATED COLOR TEMPERATURE <sup>[1]</sup> (K)		TYPICAL TOTAL INCLUDED ANGLE <sup>[2]</sup> $2\theta_{0.90V}$	TYPICAL VIEWING ANGLE <sup>[3]</sup> $2\theta_{1/2}$
	MINIMUM	MAXIMUM		
A1F2-5850F2A0xxx0	5180	6680	140°	120°

Notes for Table 2:

1. Correlated color temperature is measured at binning condition.
2.  $2\theta_{0.90V}$  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.
3.  $2\theta_{1/2}$  denotes the viewing angle, with  $\theta_{1/2}$  being the off-axis angle from the LED centerline where the luminous intensity is  $\frac{1}{2}$  of the peak value.

## Thermal Characteristics

Table 3. Thermal characteristics for LUXEON FX2-L Cool White derived from thermal transient measurements at 1000 mA (DC) and  $25^\circ\text{C}$  stage temperature.

PART NUMBER	THERMAL RESISTANCE— JUNCTION TO CASE (K/W)			
	$R\theta_{j-c} \text{ el}^{[1]}$		$R\theta_{j-c} \text{ real}^{[2]}$	
	TYPICAL	MAXIMUM	TYPICAL	MAXIMUM
A1F2-5850F2A0xxx0	4.0	4.8	5.8	6.9

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 Cool White.

PARAMETER	PERFORMANCE
Minimum DC Forward Current	50 mA
Maximum DC Forward Current	1500 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>	JEDEC 020c 260°C
ESD Sensitivity <sup>[4]</sup>	±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 Cool White 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. 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 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

# Characteristic Curves

## Spectral Power Distribution Characteristics

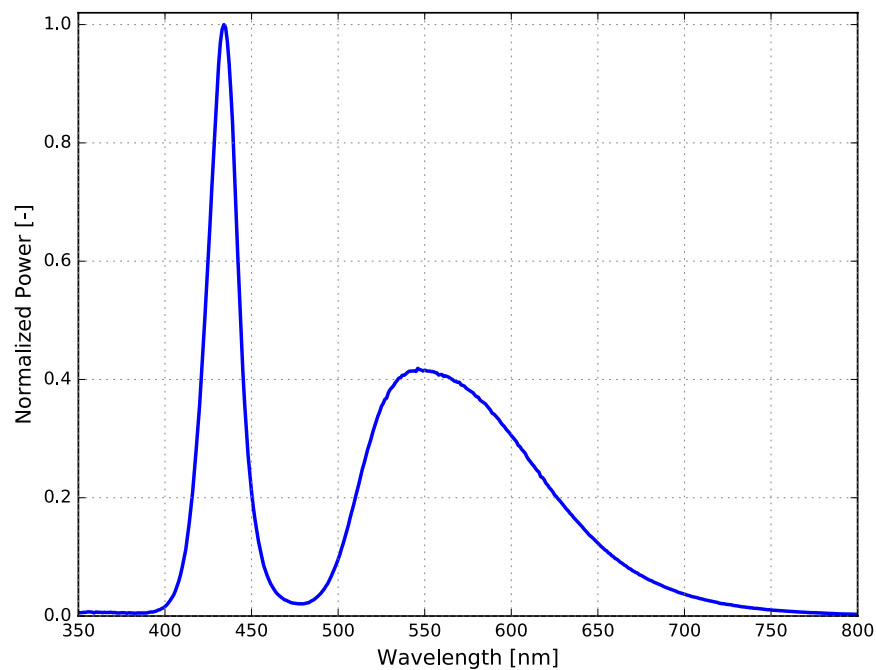


Figure 2. Typical normalized power vs. wavelength for LUXEON FX2-L Cool White at < 20 ms MP, 1000 mA, T<sub>c</sub> = 85°C.

## Light Output Characteristics

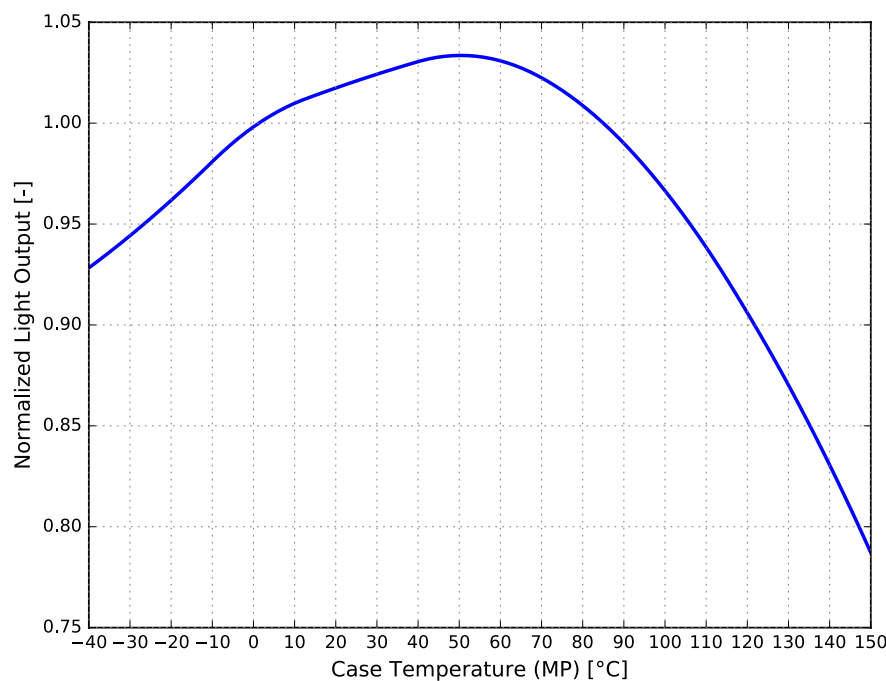


Figure 3a. Typical normalized light output vs. case temperature for LUXEON FX2-L Cool White at < 20 ms MP, 1000 mA.

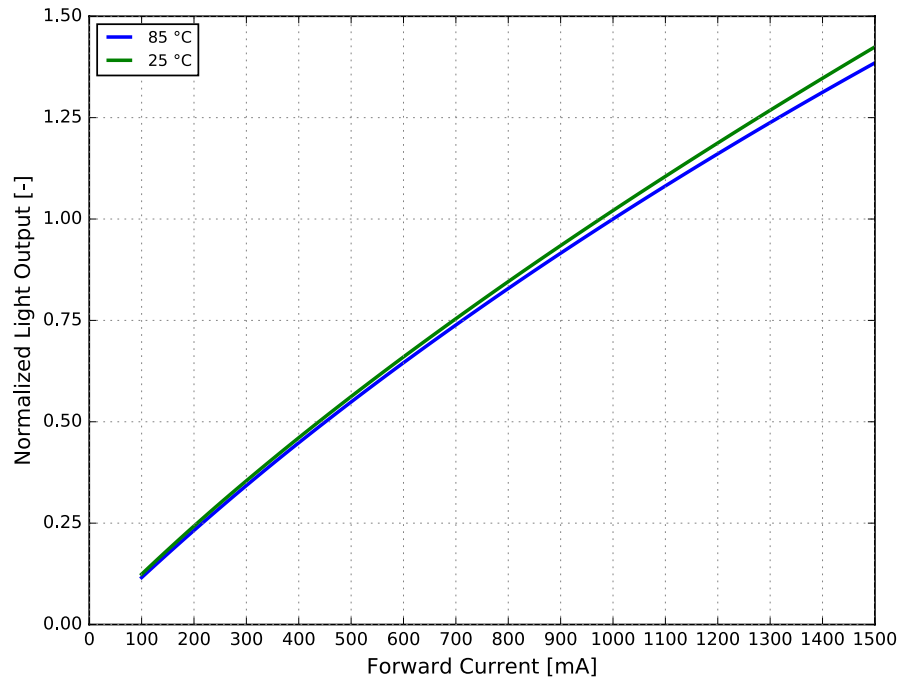


Figure 3b. Typical normalized light output vs. forward current for LUXEON FX2-L Cool White at < 20 ms MP, 25°C and 85°C.

## Forward Current and Forward Voltage Characteristics

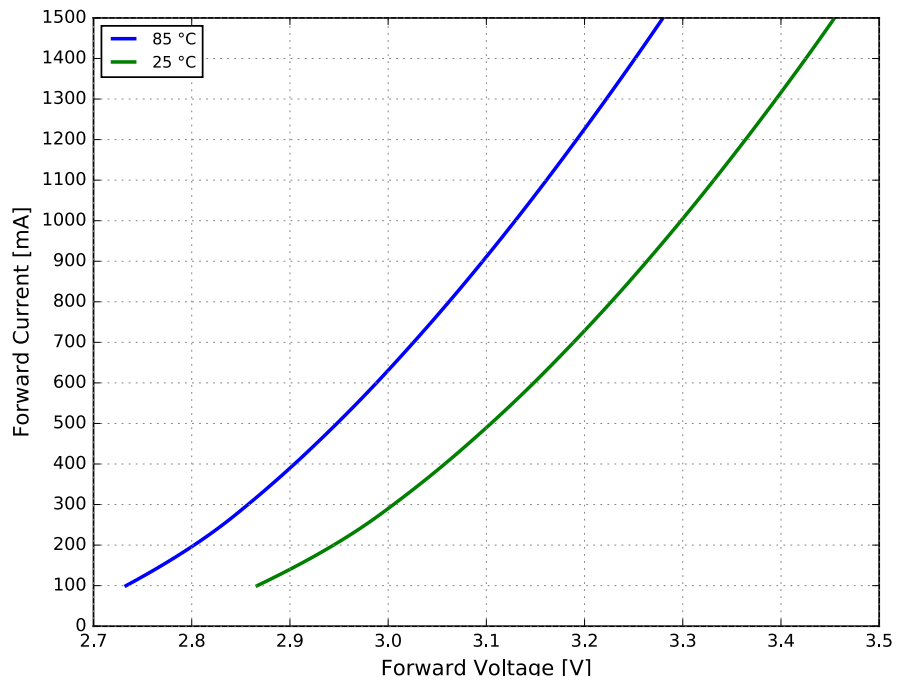


Figure 4a. Typical forward current vs. forward voltage for LUXEON FX2-L Cool White at < 20 ms MP,  $T_c = 85^\circ\text{C}$  and  $25^\circ\text{C}$ .

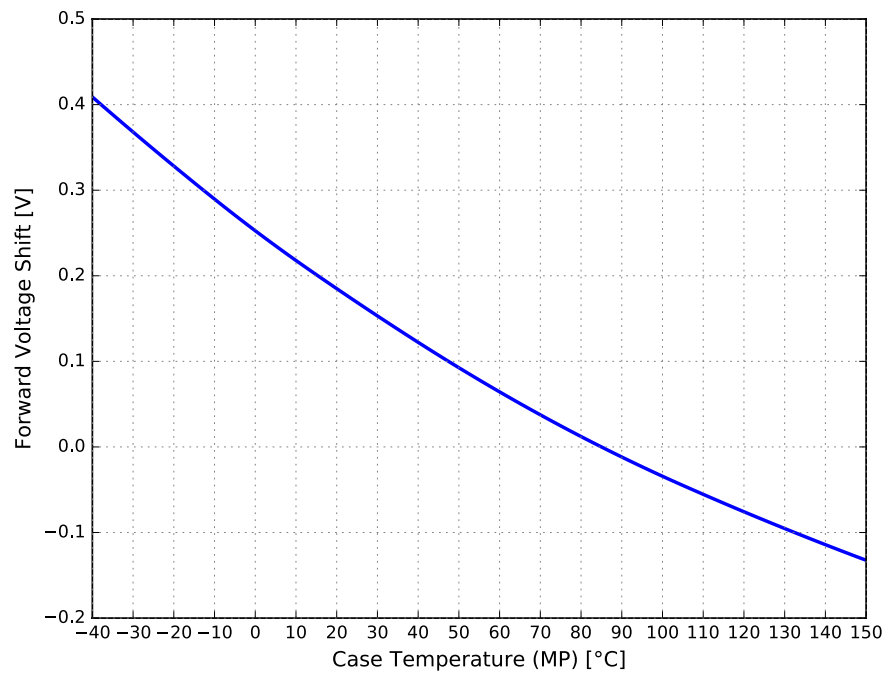


Figure 4b. Typical forward voltage shift vs. case temperature for LUXEON FX2-L Cool White at < 20 ms MP, 1000 mA.



# Color Shift Characteristics

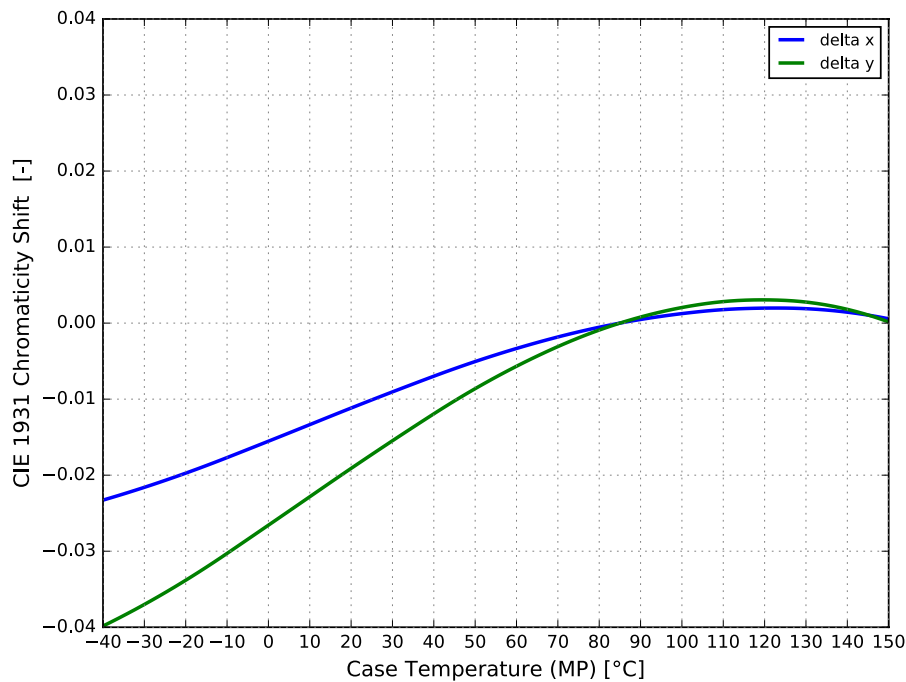


Figure 5a. Typical color shift in CIE 1931 x and y coordinates vs. case temperature for LUXEON FX2-L Cool White at < 20 ms MP, 1000 mA.

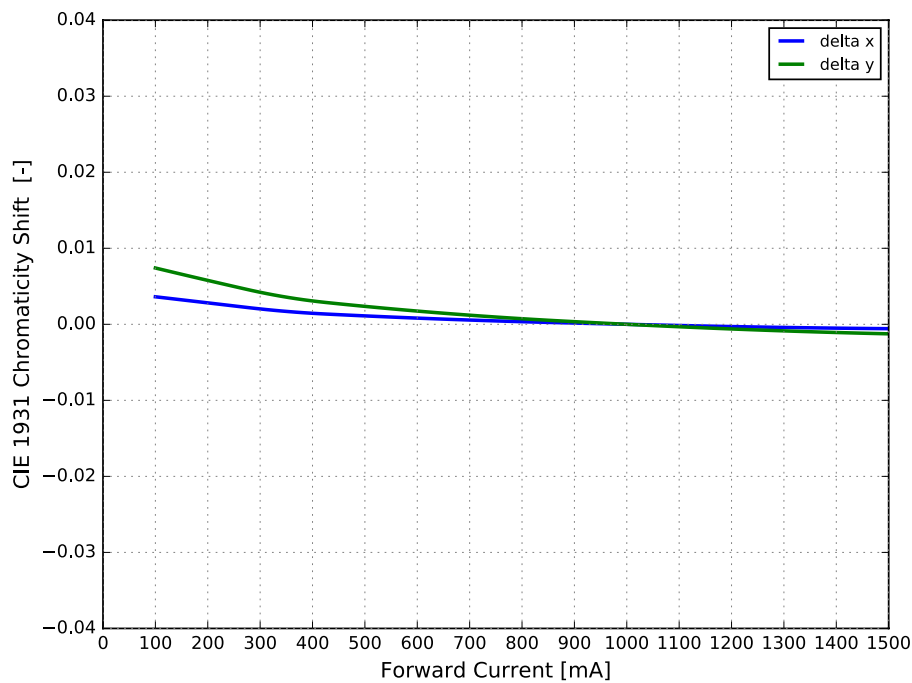


Figure 5b. Typical color shift in CIE 1931 x and y coordinates vs. forward current for LUXEON FX2-L Cool White at < 20 ms MP, T<sub>c</sub> = 85°C.

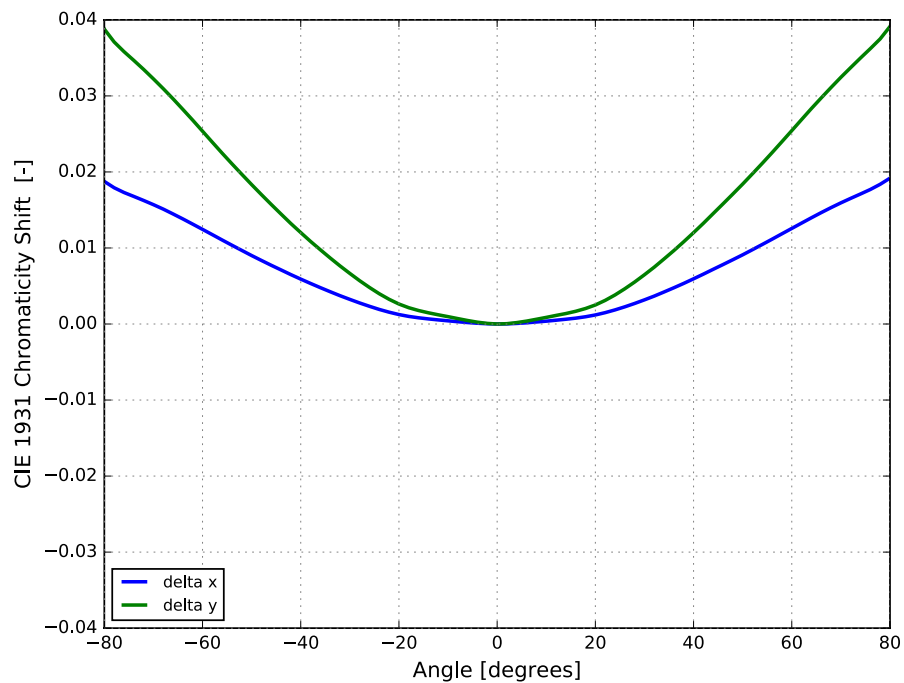


Figure 5c. Typical color shift in CIE 1931 x and y coordinates vs. angle for LUXEON FX2-L Cool White at 1000 mA.

## Radiation Pattern Characteristics

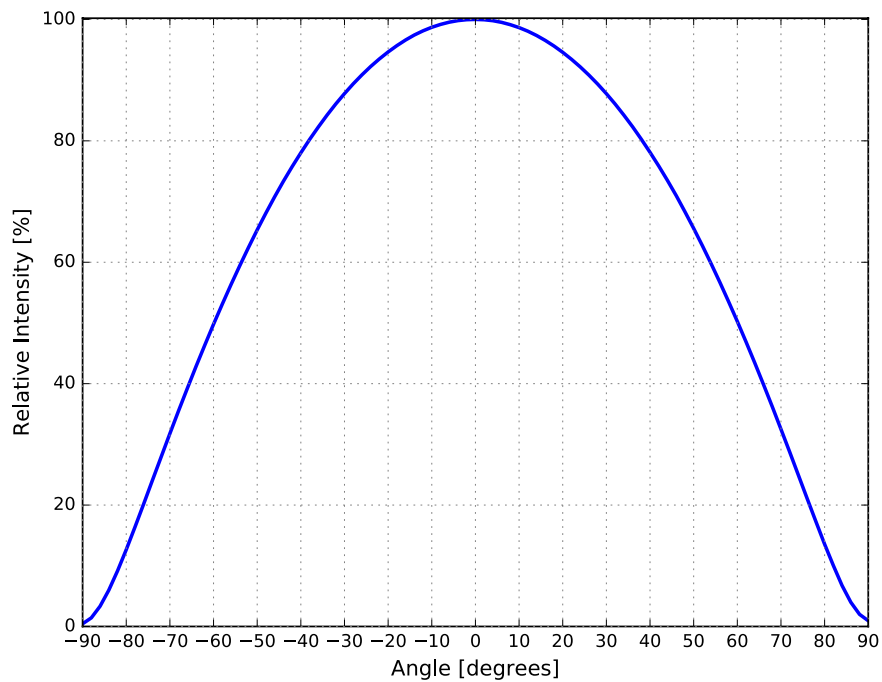


Figure 6. Typical radiation pattern for LUXEON FX2-L Cool White at 1000 mA.

# Operating Limits Characteristics

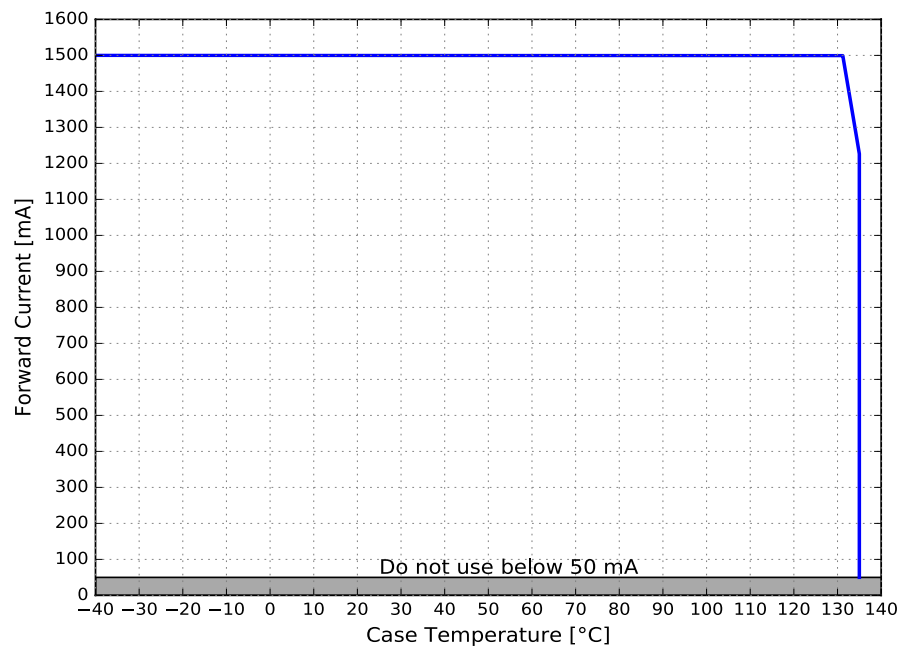


Figure 7. Maximum forward current vs. case temperature for LUXEON FX2-L Cool White.

# Permissible Pulse Handling Characteristics

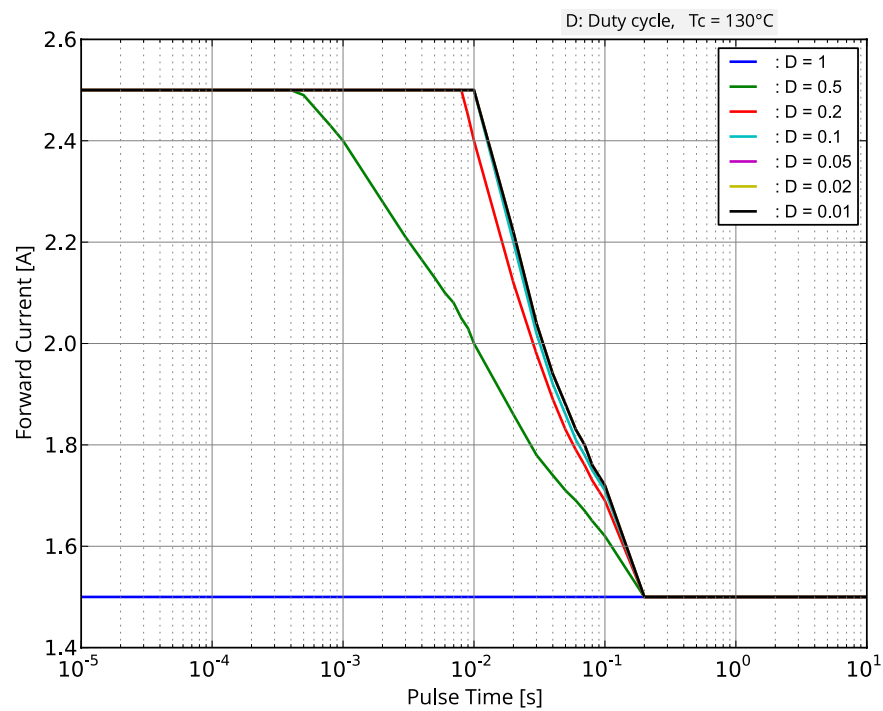


Figure 8. Permissible pulse handling capability for LUXEON FX2-L Cool White.

# Product Bin and Labeling Definitions

## Designing with LUXEON FX2-L Cool White

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 Cool White LEDs are labeled using a 4-digit alphanumeric CAT code following the format below.

**A B C D**

Where:

- A** – designates luminous flux bin (example: K = 320 to 330 lumens) per die
- B C** – designates color bin (example: HC)
- D** – designates forward voltage bin (example: D = 3.03 to 3.27 V)

Therefore, a LUXEON FX2-L Cool White with a lumen range of 320 to 330, color bin of 2C, and a forward voltage range of 3.03 to 3.27 V has the following CAT code:

**K H C D**

## Luminous Flux Bins

Table 6 lists the standard luminous flux bins for LUXEON FX2-L Cool White 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 Cool White at < 20 ms MP, 1000 mA, T<sub>c</sub> = 85°C.**

BIN	LUMINOUS FLUX <sup>[1]</sup> (lm)	
	MINIMUM	MAXIMUM
J	310	320
K	320	330
L	330	340
M	340	350
N	350	360
P	360	370
Q	370	380

Notes for Table 6:

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

# Color Codes

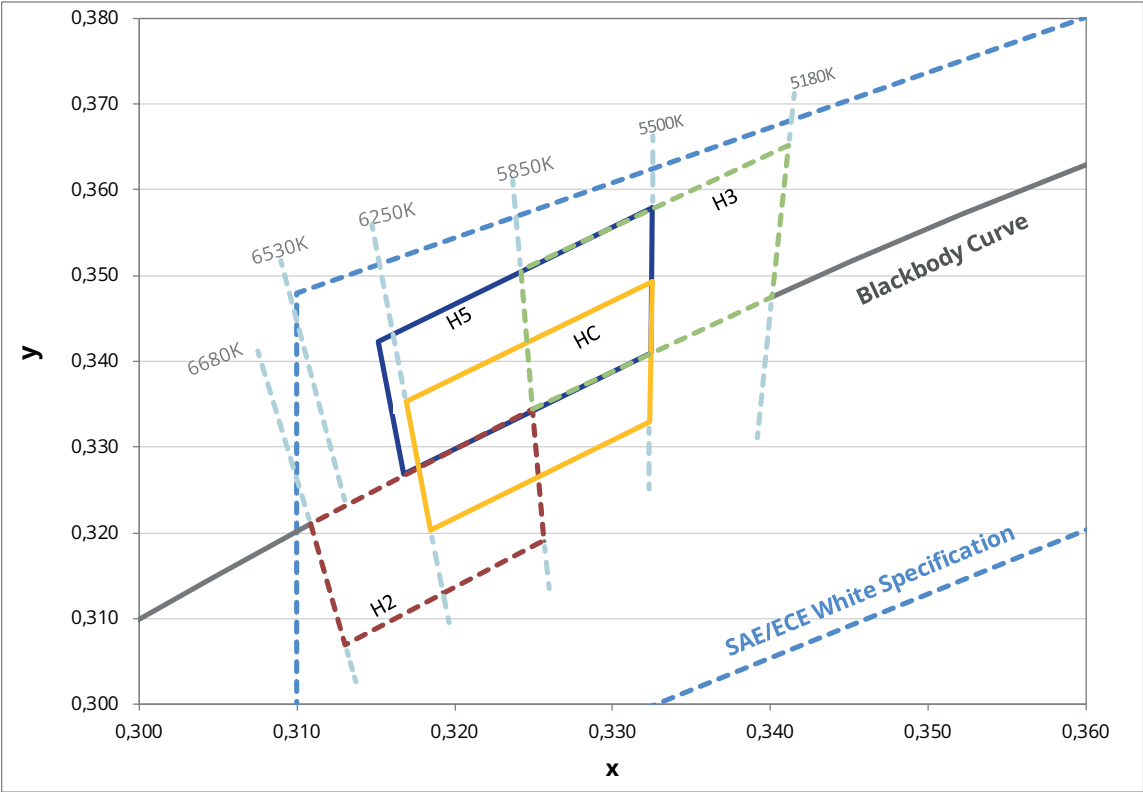


Figure 9. Color bin structure in CIE 1931 color space for LUXEON FX2-L Cool White.

Notes for Figures 9:  
1. Lumileds supports the following bins for LUXEON FX2-L Cool White: H2, H3, HC, H5

# Color Bin Definitions

Table 7a. Color bin definitions for LUXEON FX2-L Cool White.

BIN	x <sup>[1, 2]</sup>	y <sup>[1, 2]</sup>	6-DIGIT IEC CODE	TYPICAL CCT (K)
HC	0.3325	0.3493		5850
	0.3169	0.3353		
	0.3185	0.3203		
H5	0.3323	0.3329		5900
	0.3325	0.3579		
	0.3151	0.3423		
H2	0.3168	0.3268		6250
	0.3324	0.3410		
	0.3109	0.3211		
H3	0.3131	0.3070		5500
	0.3256	0.3191		
	0.3249	0.3344		
H3	0.3249	0.3344		5500
	0.3401	0.3476		
	0.3412	0.3652		
	0.3242	0.3506		

Notes for Table 7a:  
1. LUXEON FX2-L emitters are tested and binned by x and y coordinates.  
2. Lumileds maintains a tester tolerance of ±0.005 on x and y coordinates.

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

CODE	x <sup>[1, 2]</sup>	y <sup>[1, 2]</sup>	TYPICAL CCT (K)	CODE	x <sup>[1, 2]</sup>	y <sup>[1, 2]</sup>	TYPICAL CCT (K)
1A	0.3109	0.3382	6390	3A	0.3242	0.3506	5680
	0.3161	0.3432			0.3325	0.3579	
	0.3169	0.3353			0.3325	0.3493	
	0.3120	0.3306			0.3246	0.3424	
1B	0.3120	0.3306	6390	3B	0.3246	0.3424	5680
	0.3169	0.3353			0.3325	0.3493	
	0.3177	0.3277			0.3324	0.3410	
	0.3131	0.3232			0.3249	0.3344	
1C	0.3161	0.3432	6050	3C	0.3325	0.3579	5350
	0.3242	0.3506			0.3412	0.3652	
	0.3246	0.3424			0.3406	0.3562	
	0.3169	0.3353			0.3325	0.3493	
1D	0.3169	0.3353	6050	3D	0.3325	0.3493	5350
	0.3246	0.3424			0.3406	0.3562	
	0.3249	0.3344			0.3401	0.3476	
	0.3177	0.3277			0.3324	0.3410	
2A	0.3109	0.3211	6460	4A	0.3249	0.3344	5680
	0.3177	0.3277			0.3324	0.3410	
	0.3185	0.3203			0.3323	0.3329	
	0.3120	0.3139			0.3253	0.3266	
2B	0.3120	0.3139	6460	4B	0.3253	0.3266	5680
	0.3185	0.3203			0.3323	0.3329	
	0.3192	0.3131			0.3323	0.3251	
	0.3131	0.3070			0.3256	0.3191	
2C	0.3177	0.3277	6050	4C	0.3324	0.3410	5350
	0.3249	0.3344			0.3401	0.3476	
	0.3253	0.3266			0.3396	0.3392	
	0.3185	0.3203			0.3323	0.3329	
2D	0.3185	0.3203	6050	4D	0.3323	0.3329	5350
	0.3253	0.3266			0.3396	0.3392	
	0.3256	0.3191			0.3392	0.3310	
	0.3192	0.3131			0.3323	0.3251	
1E	0.3169	0.3353	5970	1F	0.3208	0.3388	5780
	0.3285	0.3458			0.3325	0.3493	
	0.3288	0.3298			0.3323	0.3329	
	0.3185	0.3203			0.3219	0.3234	

## Notes for Table 7b:

1. LUXEON FX2-L emitters are tested and binned by x and y coordinates.
2. Lumileds maintains a tester tolerance of  $\pm 0.005$  on x and y coordinates.

# Forward Voltage Bins

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

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 ±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

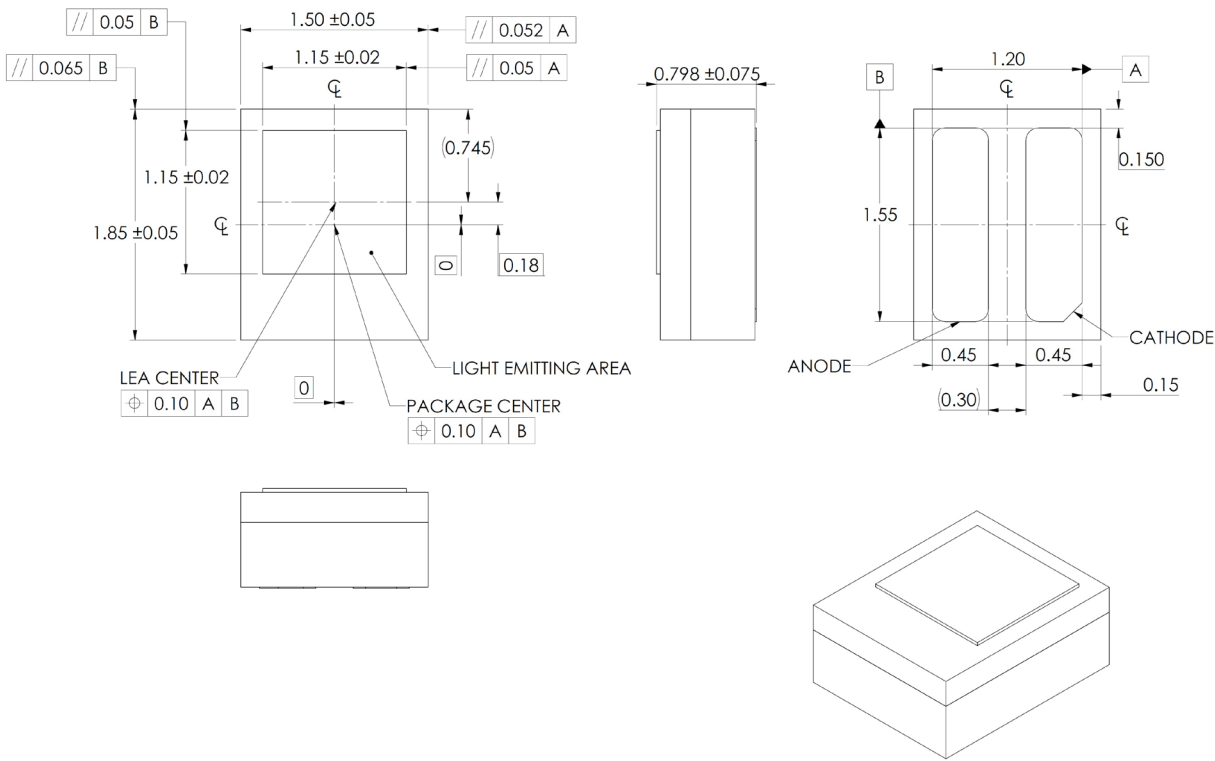


Figure 10. Mechanical dimensions for LUXEON FX2-L Cool White.

Notes for Figure 10:  
 1. Drawings are not to scale.  
 2. All dimensions are in millimeters.





# 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.

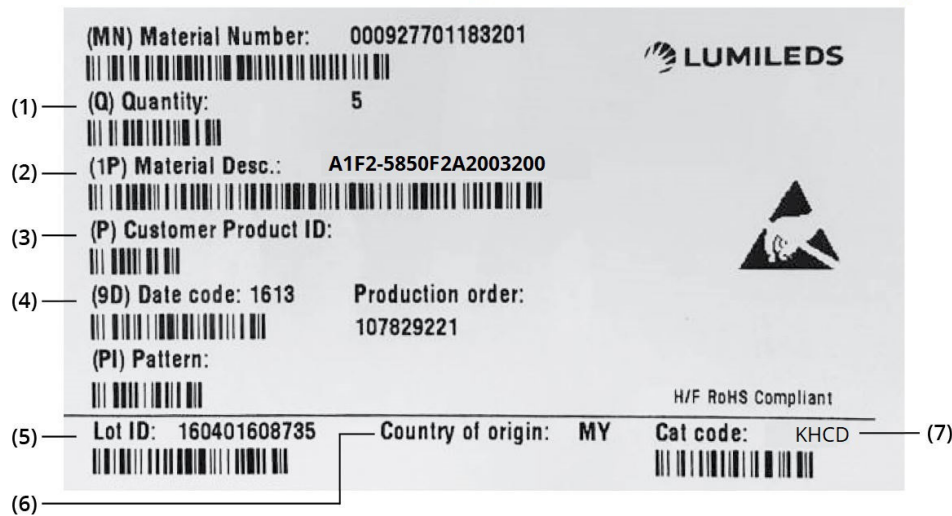


Figure 13. Example of a product label for LUXEON FX2-L Cool White.

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 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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