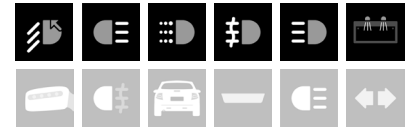


LUXEON FX2-L Plus Cool White (Gen9)

Industry leading solutions for exterior automotive lighting

LUXEON FX2-L Plus 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 current automotive operating environments. All LUXEON FX2-L Plus Cool White LEDs are AEC-Q102 qualified and USCAR-33 tested.



FEATURES AND BENEFITS

- High drive current capability for increased flux performance
- Extremely low thermal resistance optimizes system costs and total efficiency
- Advanced CSP technology provides cost-effective leading performance
- Hot binned at 85°C MP to match operating conditions
- IEC/PAS 62707-1 White LED

PRIMARY APPLICATIONS

- Daytime Running Lights
- Low and High Beam
- Adaptive Driving Beam
- Advanced Front Lighting Systems
- Cornering Lights
- Fog Lights
- License plate and Back-up Lights



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General Product Information

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

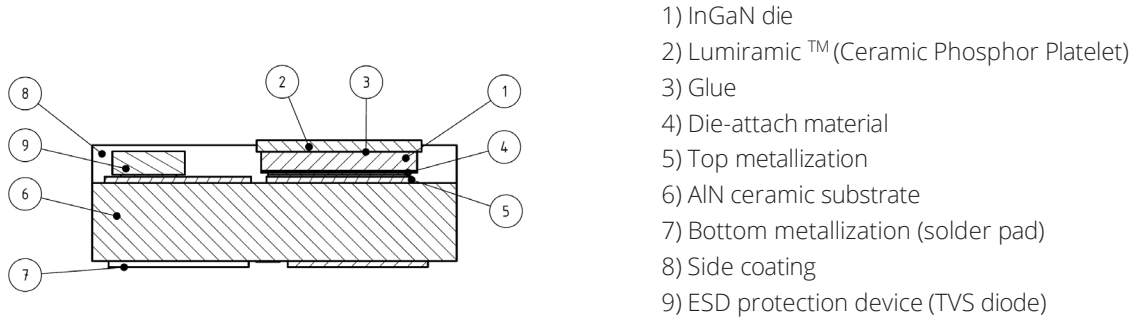


Figure 1. Schematic cross section LUXEON FX2-L Plus Cool White

Product Test and Binning Conditions

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

Part Number Nomenclature

Part numbers for LUXEON FX2-L Plus 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 = Cool White)
- C** – designates Lumiramic™ size (F = 1150 μm)
- D** – designates form factor (3 = 3PAD)
- E** – designates product generation (D = Gen9)
- F** – designates future product offering (default = 0)
- G G G G** – designates minimum luminous flux (example: 0390 = 390 lumens)
- H** – designates options code for distribution (default = 0)

Therefore, the following part number is used for a LUXEON FX2-L Plus Cool White with a minimum luminous flux of 390 lumens:

A 1 F 2 – **5 8 5 0** F 3 D **0 0 3 9 0 0**

Environmental Compliance

Lumileds Holding B.V. is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON FX2-L Plus 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 Holding B.V. 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 Plus Cool White at MP binning condition

MINIMUM LUMINOUS FLUX ^[1] (lm)	PART NUMBER
370	A1F2-5850F3D003700
380	A1F2-5850F3D003800
390	A1F2-5850F3D003900
400	A1F2-5850F3D004000
410	A1F2-5850F3D004100

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 Plus Cool White at MP binning condition and far-field optical characteristics

PART NUMBER	Correlated color temperature		TYPICAL TOTAL INCLUDED ANGLE ^[1] $2\theta_{0.90V}$	TYPICAL VIEWING ANGLE ^[2] $2\theta_{1/2}$
	MINIMUM	MAXIMUM		
A1F2-5850F3Dxxxxxx	5180K	6680K	140°	120°

Notes for Table 2:

1. $2\theta_{0.90V}$ 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.
2. $2\theta_{1/2}$ 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 Characteristics

Table 3 Electrical characteristics for LUXEON FX2-L Plus Cool White at MP binning condition

PART NUMBER	FORWARD VOLTAGE (V_f) ^[1] [V]		
	MIN.	TYP.	MAX.
A1F2-5850F3Dxxxxxx	2.90	3.10	3.35

Notes for Table 3:

1. Lumileds maintains a tolerance of $\pm 0.06V$ on forward voltage measurements.

Thermal Characteristics

Table 4 Thermal characteristics for LUXEON FX2-L Plus Cool White at binning current and 25°C stage temperature

PART NUMBER	THERMAL RESISTANCE— JUNCTION TO CASE (K/W)			
	$R\theta_{j-c,el}$ ^[2]		$R\theta_{j-c,real}$ ^[2]	
	TYPICAL	MAXIMUM	TYPICAL	MAXIMUM
A1F2-5850F3Dxxxxxx	2.8	3.1	4.8	5.3

Notes for Table 4:

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 5. Absolute ratings for LUXEON FX2-L Plus Cool White

PARAMETER	PERFORMANCE
Minimum DC Forward Current	50 mA
Maximum DC Forward Current ^[1]	1500 mA
Maximum Peak Pulsed Forward Current ^[1]	2500 mA
Maximum Emitter Junction Temperature ^[1] (DC & Pulse)	150 °C
Maximum Emitter Junction Temperature ^[1,2] (DC & Pulse), short term	180 °C
ESD Sensitivity ^[3]	HBM ±8 kV CDM ±2 kV
Operating Case Temperature ^[1]	-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 5

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-001-2017), charged device model (AEC Q101-005 rev A).

Characteristic Curves

Spectral Power Distribution Characteristics

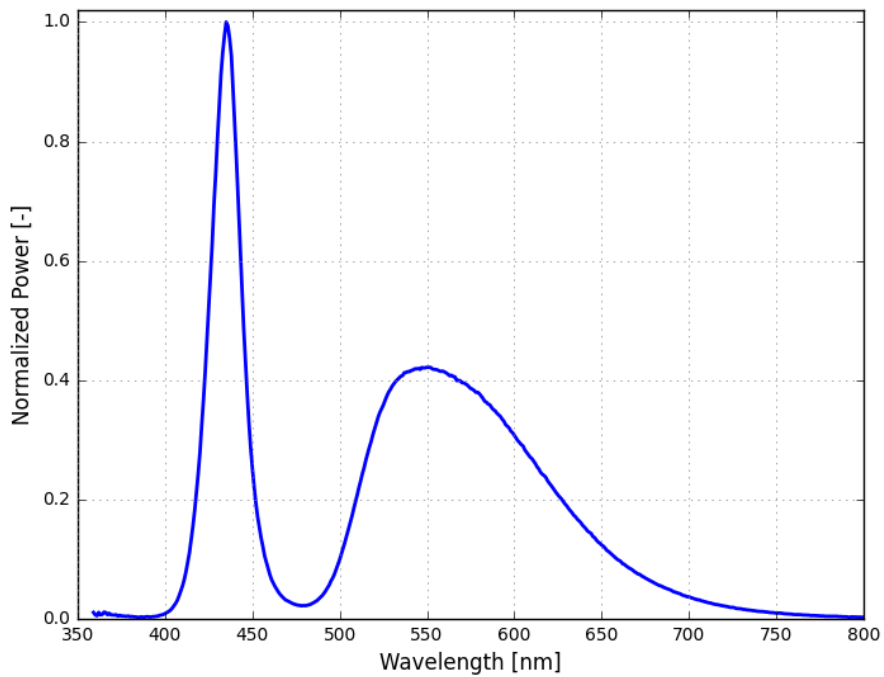


Figure 2 Typical normalized power vs. wavelength for LUXEON FX2-L Plus Cool White at MP binning condition

Light Output Characteristics

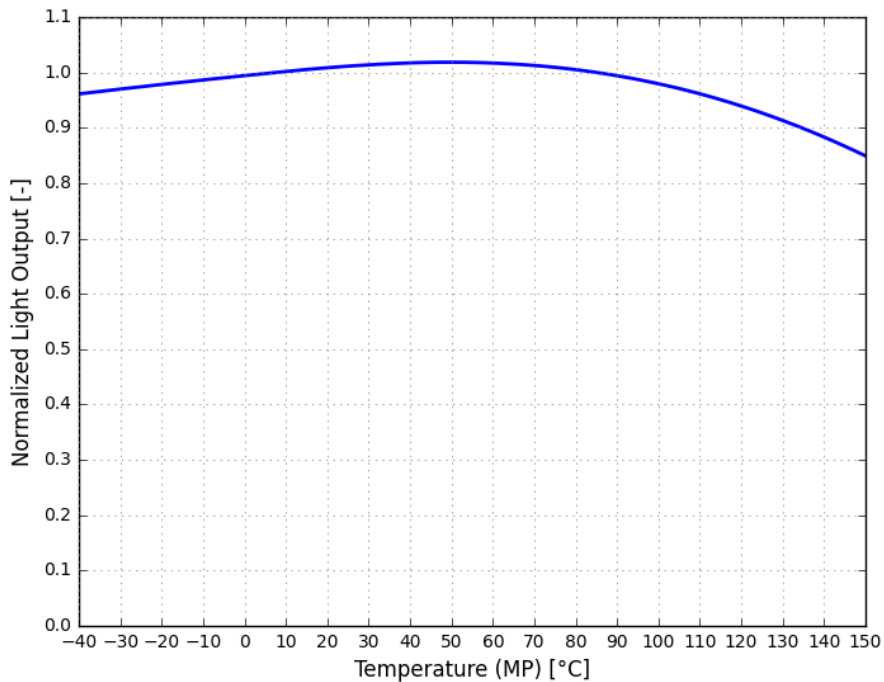


Figure 3 Typical normalized light output vs. temperature for LUXEON FX2-L Plus Cool White at MP binning current

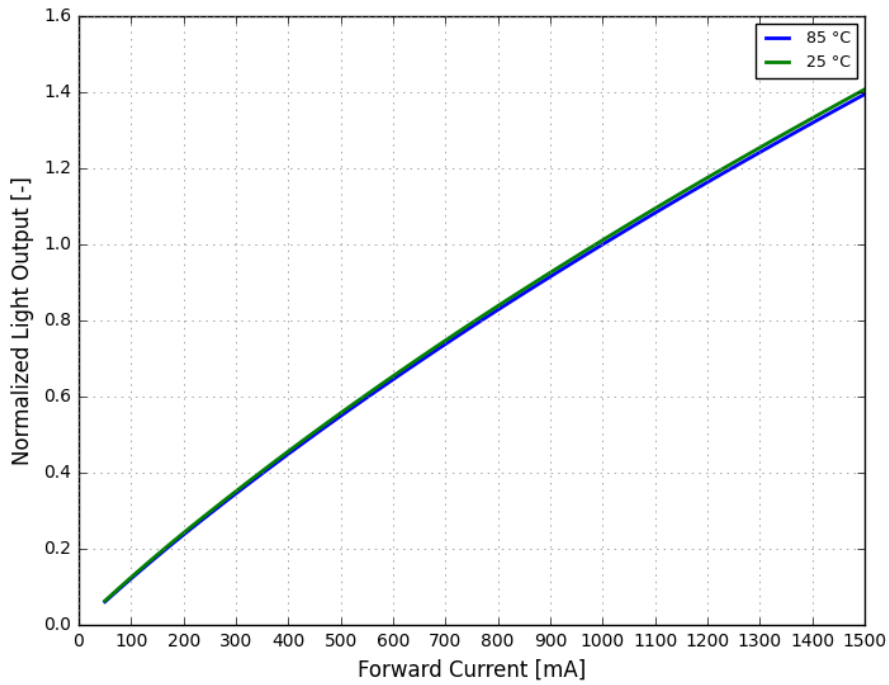


Figure 4 Typical normalized light output vs. forward current for LUXEON FX2-L Plus Cool White at MP binning temperature and at room temperature

Forward Current and Forward Voltage Characteristics

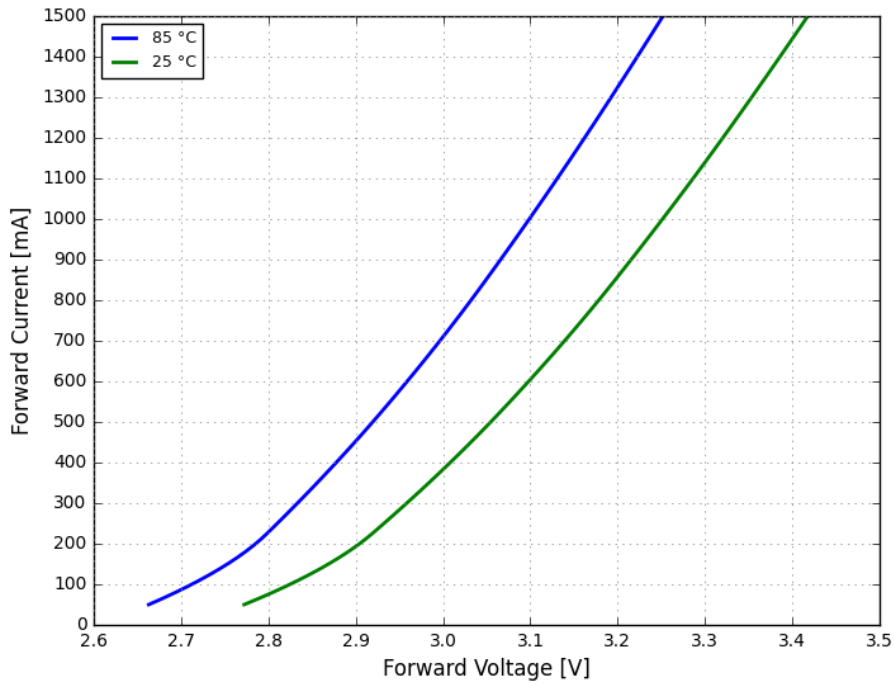


Figure 5 Typical forward current vs. forward voltage for LUXEON FX2-L Plus Cool White at MP binning temperature and at room temperature

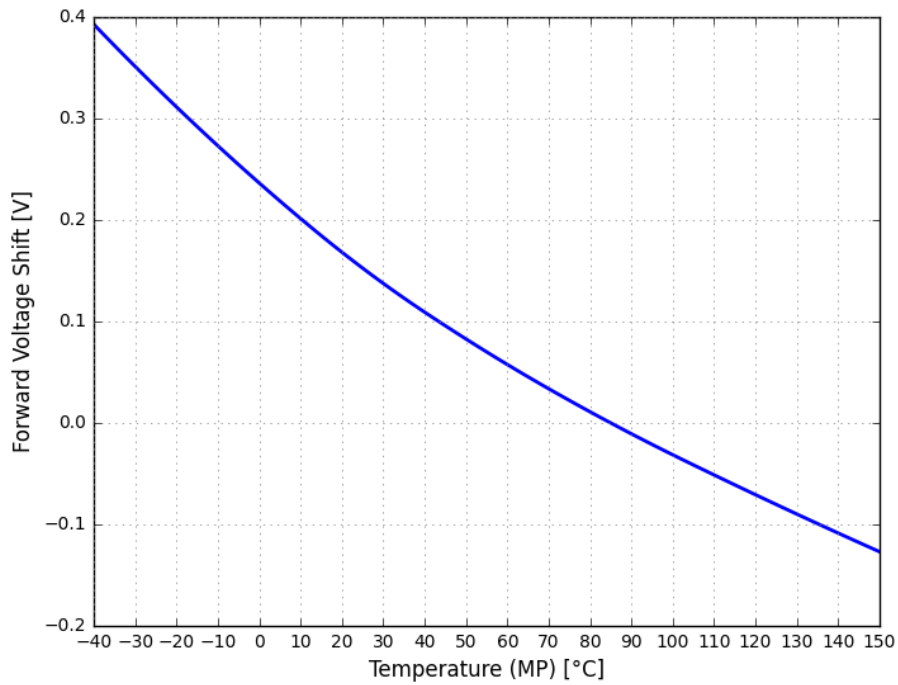


Figure 6 Typical forward voltage shift vs. temperature for LUXEON FX2-L Plus Cool White at MP binning current

Color Shift Characteristics

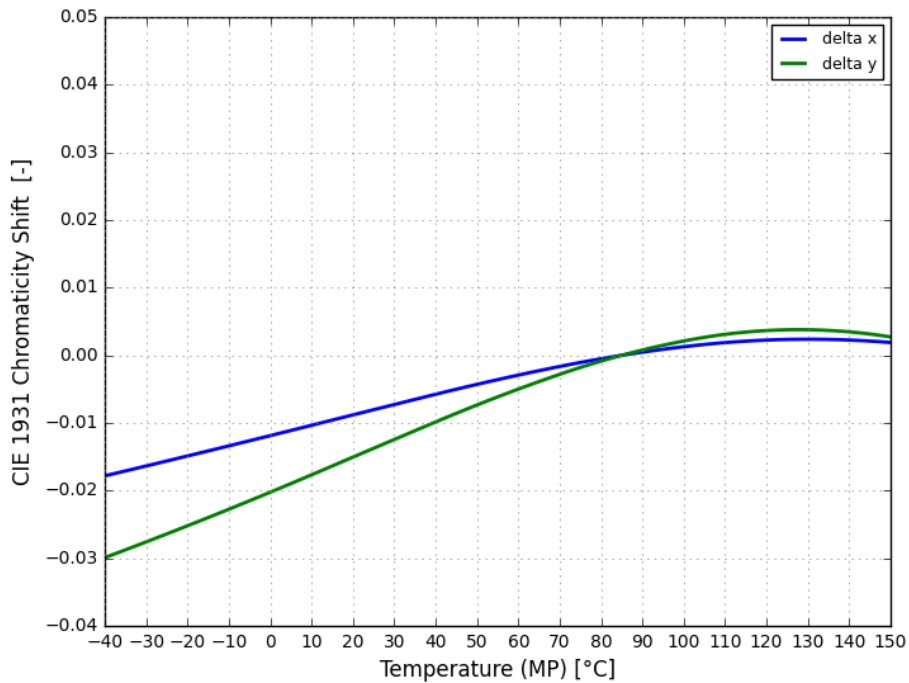


Figure 7 Typical color shift in CIE1931 x, y coordinates vs. temperature for LUXEON FX2-L Plus Cool White at MP binning current

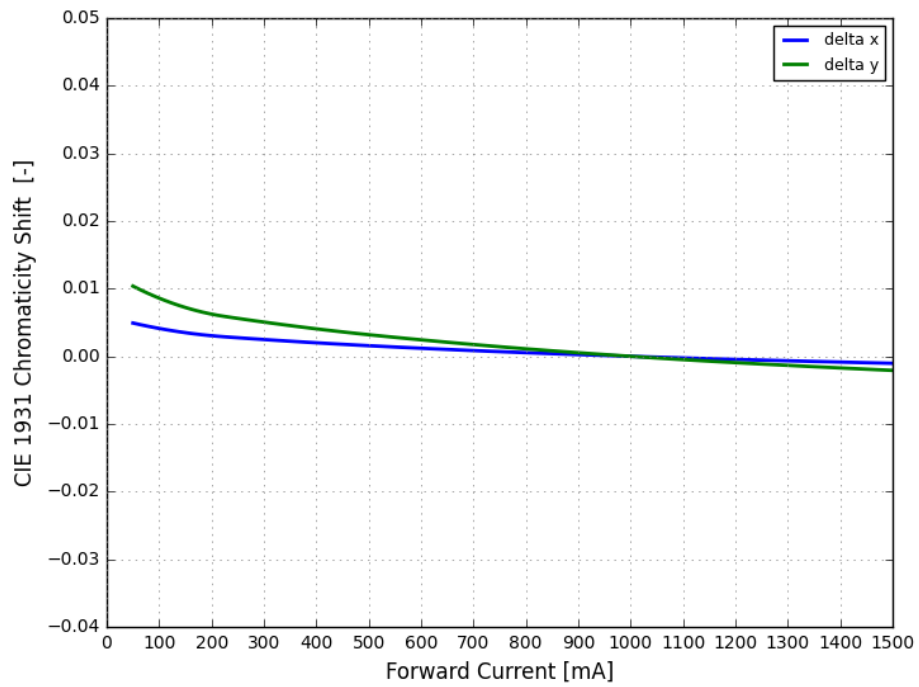


Figure 8 Typical color shift in CIE1931 x, y coordinates vs. forward current for LUXEON FX2-L Plus Cool White at MP binning temperature

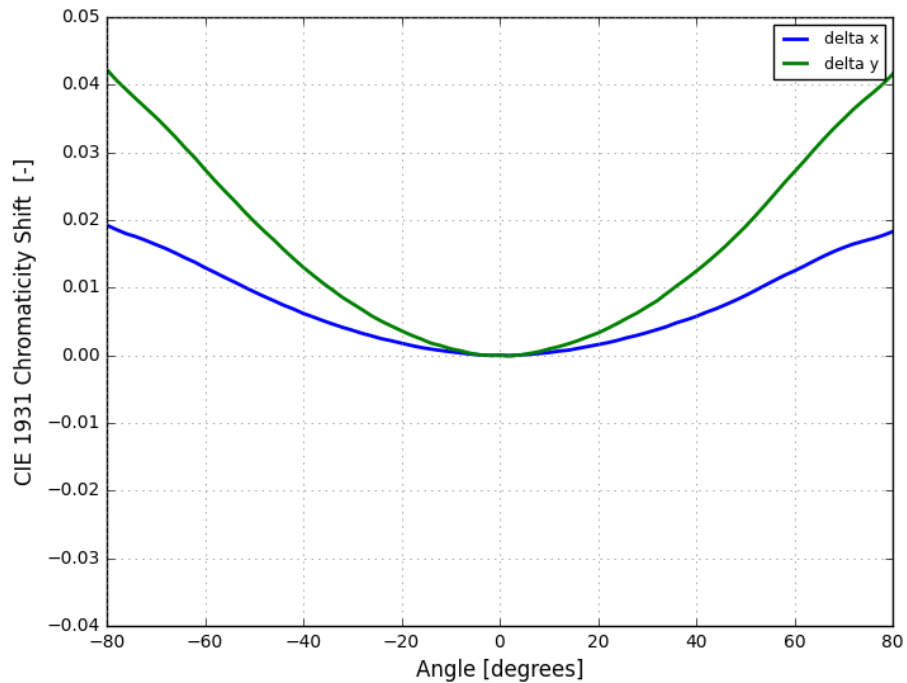


Figure 9 Typical color shift over angle for LUXEON FX2-L Plus Cool White

Radiation Pattern Characteristics

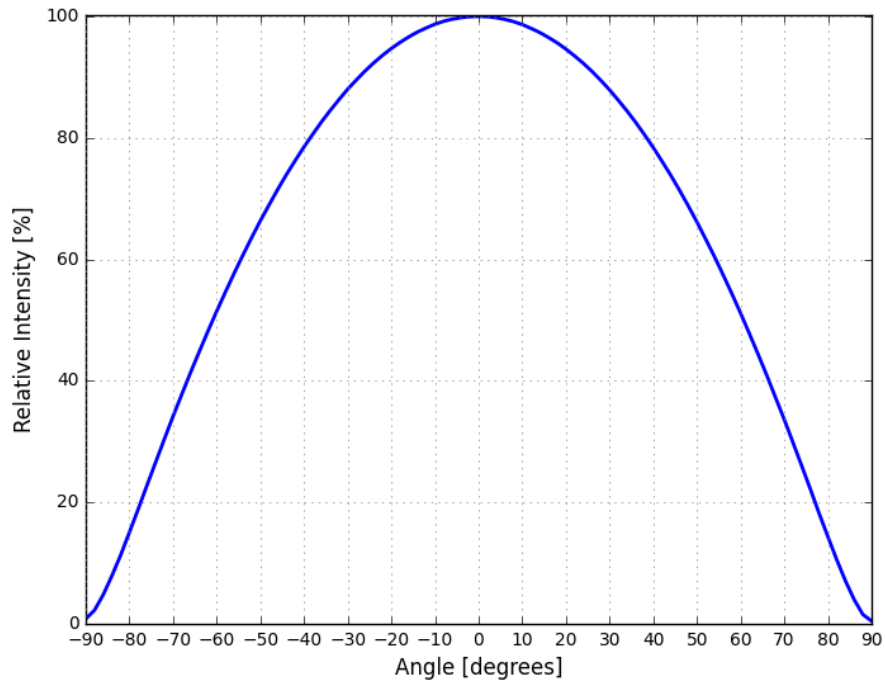


Figure 10 Typical radiation pattern for LUXEON FX2-L Plus Cool White

Operating Limits Characteristics

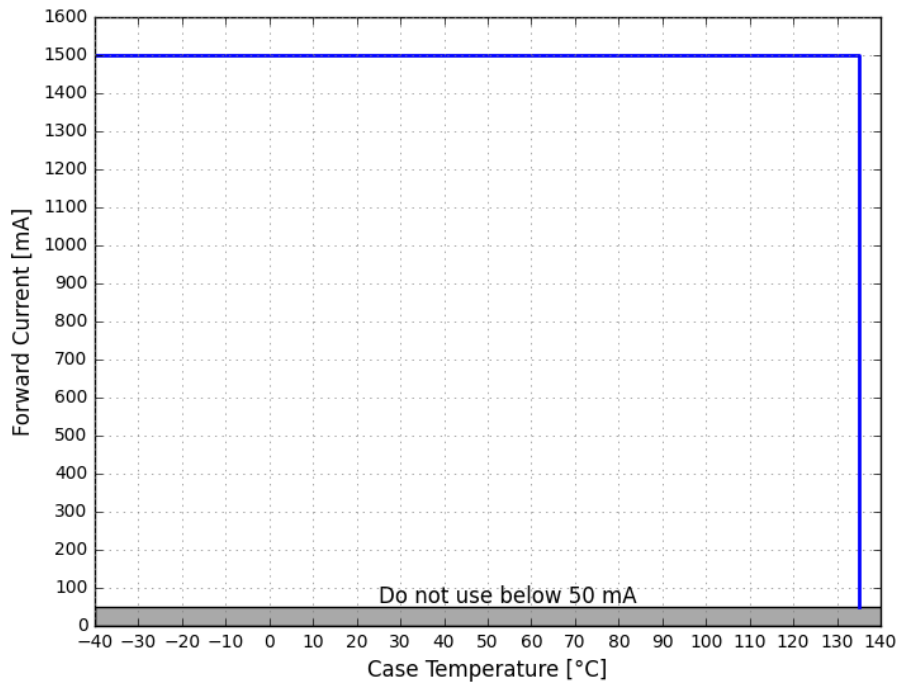


Figure 11 Maximum forward current vs. case temperature for LUXEON FX2-L Plus Cool White

Permissible Pulse Handling Characteristics

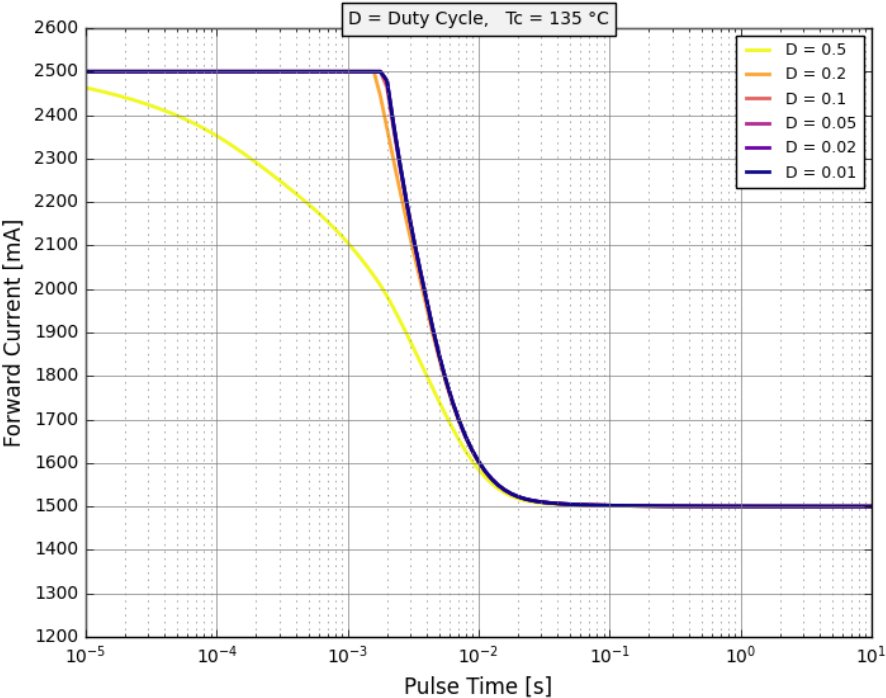


Figure 12 Pulse handling capability for LUXEON FX2-L Plus Cool White at maximum case temperature

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 Plus 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: S = 390 to 400 lumens)
- B C** – designates color bin (example: HC = color bin HC)
- D** – designates forward voltage bin (example: B = 2.90 V to 3.20 V)

Therefore, a LUXEON FX2-L Plus Cool White with a lumen range of 390 to 400 lumens, color code HC and a forward voltage of 2.90 V to 3.20 V has the following CAT code:

S H C B

Luminous Flux Bins

Table 6 lists the standard luminous flux bins for LUXEON FX2-L Plus Cool White emitters. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance.

Table 6. Luminous flux bin definitions for LUXEON FX2-L Plus Cool White at MP binning condition

BIN	LUMINOUS FLUX ⁽¹⁾ (lm)	
	MINIMUM	MAXIMUM
Q	370	380
R	380	390
S	390	400
T	400	410
U	410	420
V	420	430
W	430	440

Notes for Table 6:

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

Color Codes

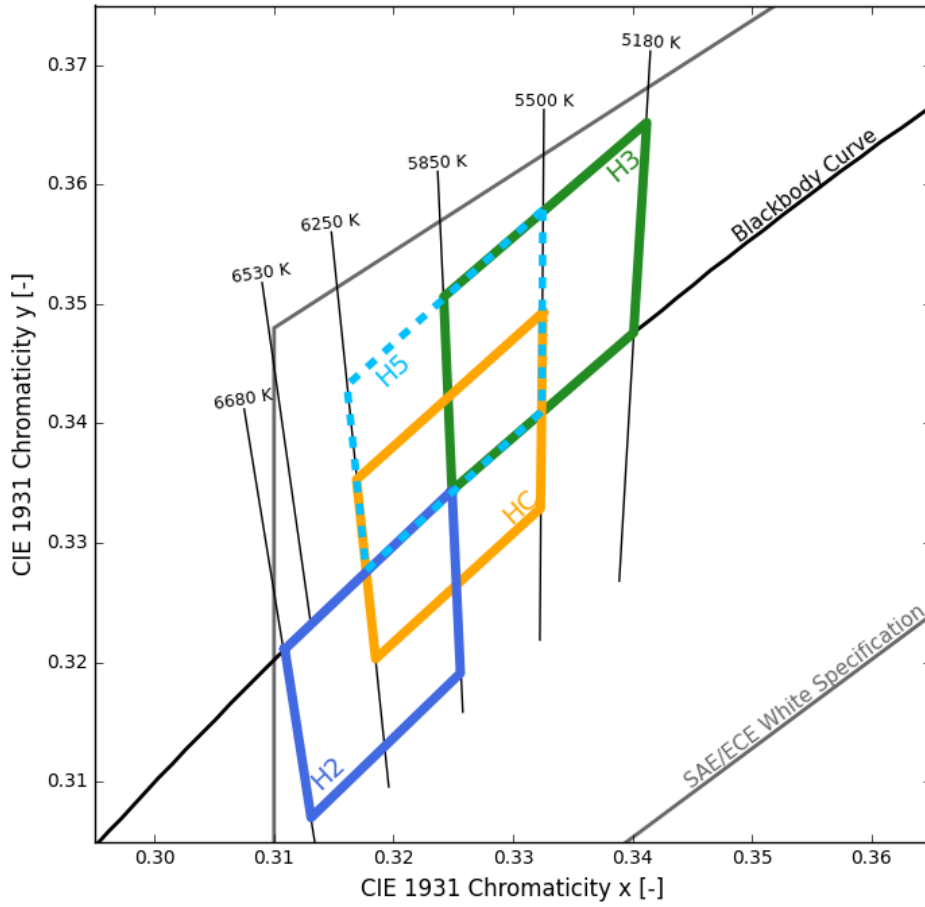


Figure 13 Color bin structure for LUXEON FX2-L Plus Cool White

Color Bin Definitions

Table 7. Color bin definitions for LUXEON FX2-L Plus Cool White^[1]

COLOR BIN	x	y	6-digit IEC CODE	TYPICAL CCT
HC	0.3325	0.3493	ebyD66	5850K
	0.3169	0.3353		
	0.3185	0.3203		
	0.3323	0.3329		
H5	0.3325	0.3579	fbyA66	5850K
	0.3161	0.3432		
	0.3177	0.3277		
	0.3324	0.3410		
H2	0.3109	0.3211	ebvG66	6250K
	0.3131	0.3070		
	0.3256	0.3191		
	0.3249	0.3344		
H3	0.3249	0.3344	fcbA66	5500K
	0.3401	0.3476		
	0.3412	0.3652		
	0.3242	0.3506		

Notes for Table 7:

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

Optional Color Bins

Table 8. Optional color bin definitions for LUXEON FX2-L Plus Cool White

COLOR BIN	x	y	6-digit IEC CODE	TYPICAL CCT	COLOR BIN	x	y	6-digit IEC CODE	TYPICAL CCT
2B	0.312	0.3139	ebvG33	6460K	1B	0.312	0.3306	fbwA23	6390K
	0.3185	0.3203				0.3169	0.3353		
	0.3192	0.3131				0.3177	0.3277		
	0.3131	0.307				0.3131	0.3232		
2D	0.3185	0.3203	ebyG33	6050K	1D	0.3169	0.3353	fbyA33	6050K
	0.3253	0.3266				0.3246	0.3424		
	0.3256	0.3191				0.3249	0.3344		
	0.3192	0.3131				0.3177	0.3277		
4B	0.3253	0.3266	ecbG33	5680K	3B	0.3246	0.3424	fcbA33	5680K
	0.3323	0.3329				0.3325	0.3493		
	0.3323	0.3251				0.3324	0.341		
	0.3256	0.3191				0.3249	0.3344		
4D	0.3323	0.3329	eceG33	5350K	3D	0.3325	0.3493	fceA33	5350K
	0.3396	0.3392				0.3406	0.3562		
	0.3392	0.331				0.3401	0.3476		
	0.3323	0.3251				0.3324	0.341		
2A	0.3109	0.3211	ebvD33	6460K	1A	0.3109	0.3382	fbwD23	6390K
	0.3177	0.3277				0.3161	0.3432		
	0.3185	0.3203				0.3169	0.3353		
	0.312	0.3139				0.312	0.3306		
2C	0.3177	0.3277	ebyD33	6050K	1C	0.3161	0.3432	fbyD33	6050K
	0.3249	0.3344				0.3242	0.3506		
	0.3253	0.3266				0.3246	0.3424		
	0.3185	0.3203				0.3169	0.3353		
4A	0.3249	0.3344	ecbD33	5680K	3A	0.3242	0.3506	fcbD33	5680K
	0.3324	0.341				0.3325	0.3579		
	0.3323	0.3329				0.3325	0.3493		
	0.3253	0.3266				0.3246	0.3424		
4C	0.3324	0.341	eceD33	5350K	3C	0.3325	0.3579	fceD33	5350K
	0.3401	0.3476				0.3412	0.3652		
	0.3396	0.3392				0.3406	0.3562		
	0.3323	0.3329				0.3325	0.3493		

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 9.

Table 9. Forward voltage bin definitions for LUXEON FX2-L Plus Cool White at MP binning condition

BIN	FORWARD VOLTAGE ⁽¹⁾ (V)	
	MINIMUM	MAXIMUM
B	2.90	3.20
C	3.20	3.35

Notes for Table 9:

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

Mechanical Dimensions

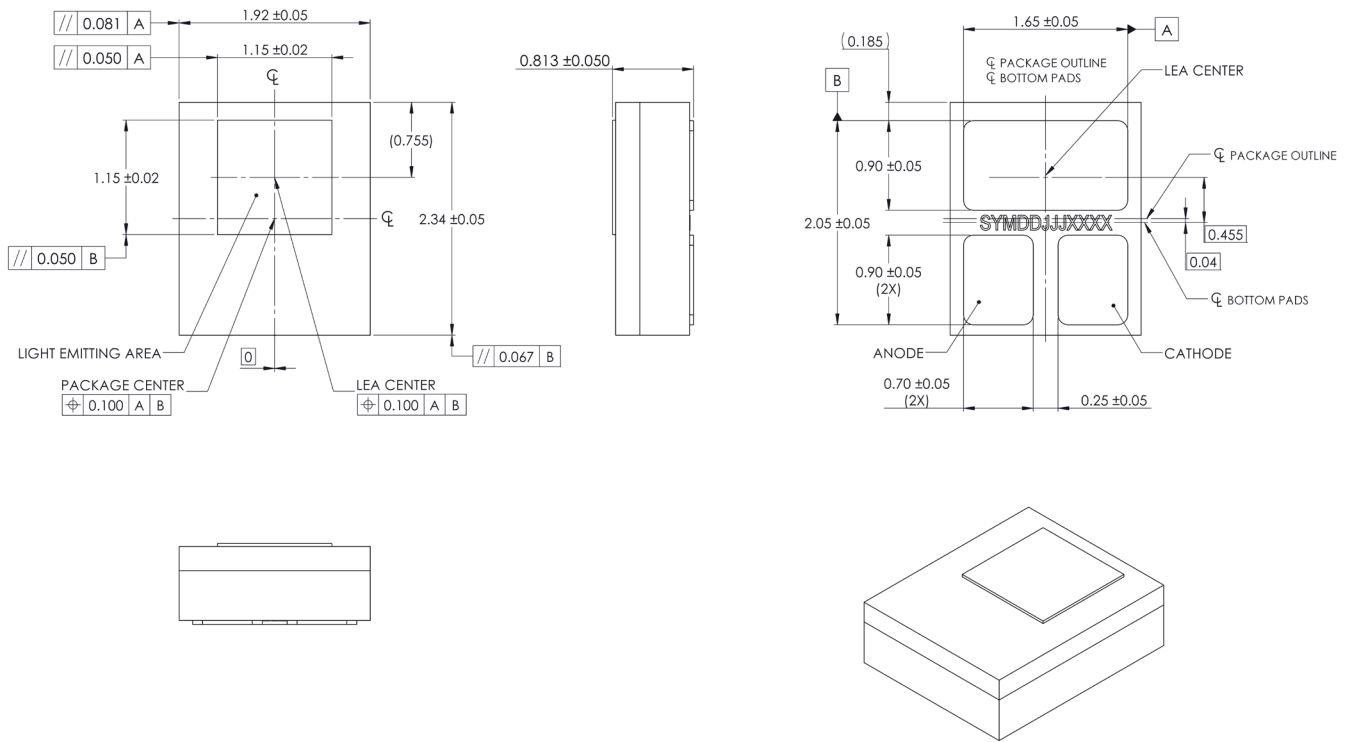


Figure 14. Mechanical dimensions for LUXEON FX2-L Plus Cool White

Notes for Figure 14:

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

Package Weight

Table 10. Approximate weight of LUXEON FX2-L Plus Cool White

PART NUMBER	PACKAGE WEIGHT [mg]
A1F2-5850F3Dxxxxxx	12.5

JEDEC Moisture Sensitivity

Table 11. Moisture sensitivity levels for LUXEON FX2-L Plus 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

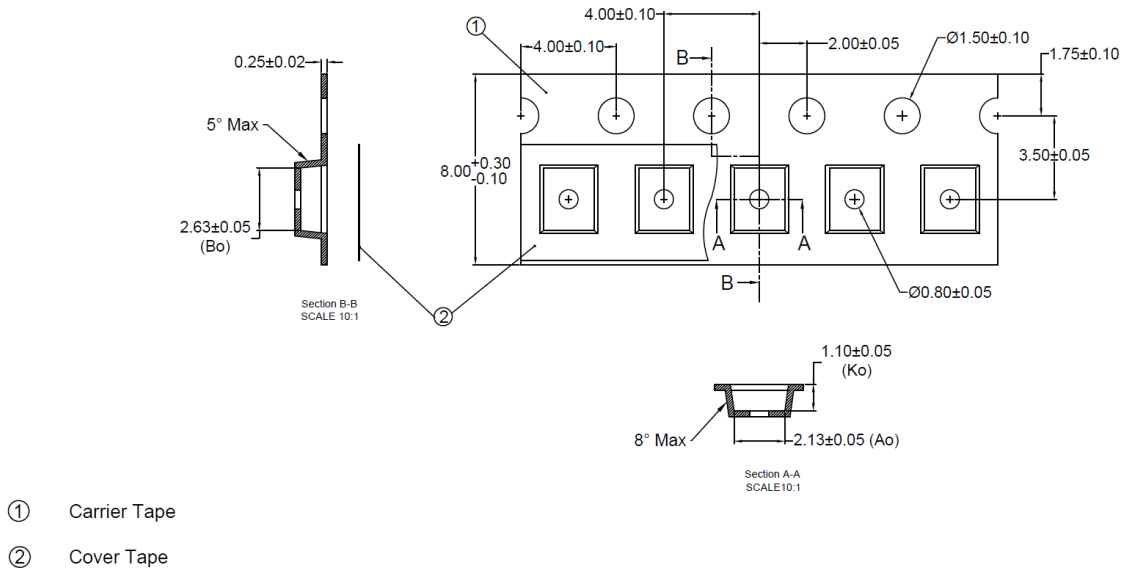


Figure 15. Pocket tape dimensions for LUXEON FX2-L Plus Cool White

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

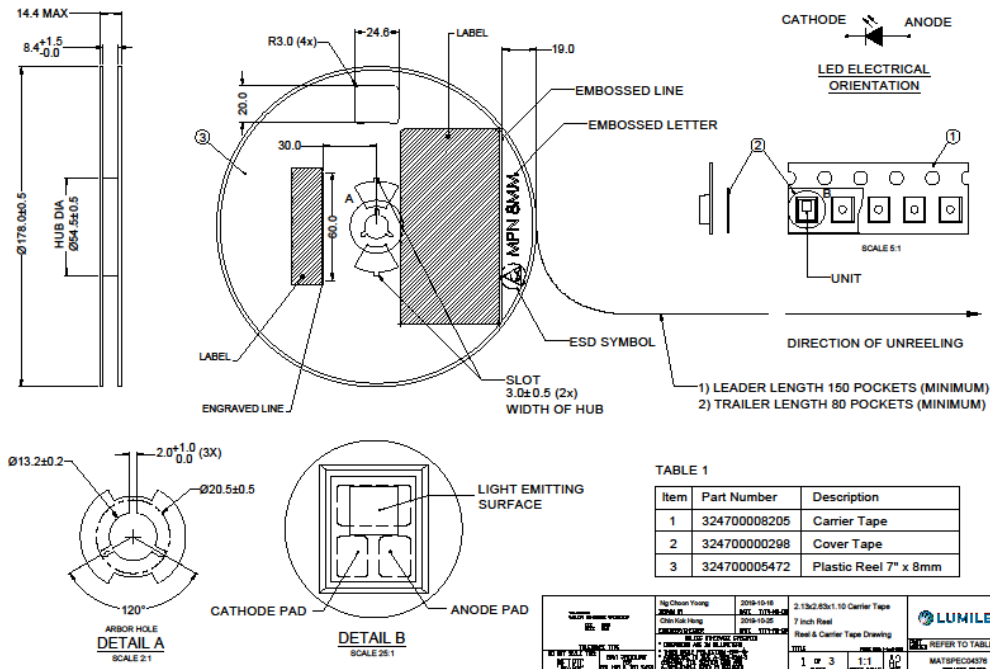


Figure 16. Reel dimensions for LUXEON FX2-L Plus Cool White

Notes for Figure 16:

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

Product Labelling

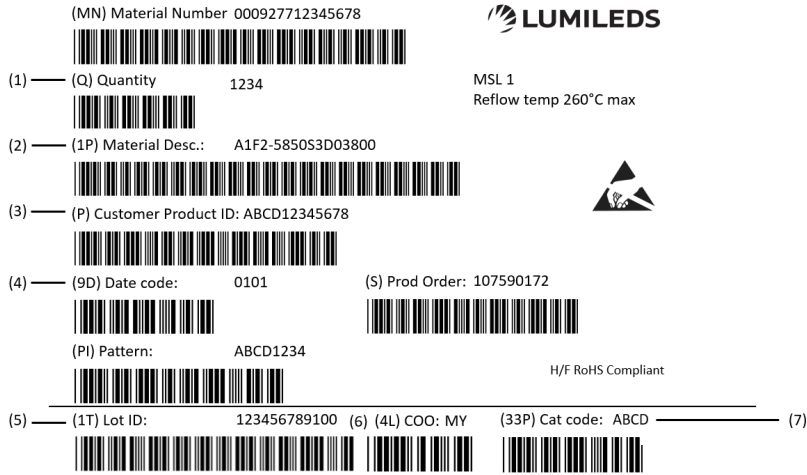


Figure 17 Example of a product label for illustration purposes

Notes for Figure 17 - 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.



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DS463 LUXEON FX2-L Plus Cool White (Gen9)
Product Datasheet 20241030

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