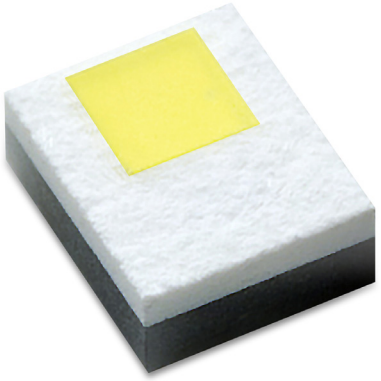
LUMILEDS

AUTOMOTIVE

LUXEON FX Plus Cool White

Industry-leading CSP solutions for low and high beam lamps



LUXEON FX Plus Cool White LEDs, with their Chip Scale Packaging (CSP) form factor, are designed to support low and high beam applications, daytime running lamps and front fog. 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 FX LEDs are AEC-Q102 qualified.

FEATURES AND BENEFITS

- Higher drive current capability for increased flux performance
- Low thermal resistance for better hot lumen performance
- Chip Scale Packaging for low cost and ease of manufacturability
- Hot binned at 85°C MP to match closer to operating conditions
- IEC/PAS 62707-1 White LED

PRIMARY APPLICATIONS

- Daytime Running Lights
- Front Fog
- Headlight
  - Low Beam
  - High Beam
  - Cornering Light

RoHS COMPLIANT

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General Product Information

Product Test Conditions

LUXEON FX Plus Cool White LEDs are tested and binned using a 20ms monopulse (MP) at 1000mA drive current, case temperature, T_c, of 85ºC.

Part Number Nomenclature

Part numbers for LUXEON FX Plus Cool White follow the convention below:

A 1 F X – **A B C D E F G** H **J K M N** P

Where:

A B C D	–	designates CCT or wavelength (example: 5850 for white)
E	–	designates product generation (example: A=Gen 1, B=Gen 6)
F	–	designates test current (A=350mA, B=500mA, C=700mA, D=1000mA)
G	–	designates test temperature (C=25°C, H=85°C)
H	–	designates future product offerings
J K M N	–	designates minimum luminous flux (example: 0270=270 lumens, 0300=300 lumens, etc.)
P	–	designates option code for distribution

Therefore, the following part number is used for a first generation LUXEON FX Plus Cool White LED with a test current of 1000mA, test temperature of 85°C and a minimum luminous flux of 320 lumens:

A 1 F X – **5 8 5 0 B D H** 0 **0 3 2 0** 0

Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON F 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 FX Plus Cool White at 20ms MP test current, T_c=85°C.

MINIMUM LUMINOUS FLUX [1] (lm)	TEST CURRENT (mA)	PART NUMBER
290	1000	A1FX-5850BDH002900
300	1000	A1FX-5850BDH003000
310	1000	A1FX-5850BDH003100
320	1000	A1FX-5850BDH003200
330	1000	A1FX-5850BDH003300
340	1000	A1FX-5850BDH003400
350	1000	A1FX-5850BDH003500
360	1000	A1FX-5850BDH003600
370	1000	A1FX-5850BDH003700
380	1000	A1FX-5850BDH003800

Notes for Table 1:
1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.

Optical Characteristics

Table 2. Optical Characteristics for LUXEON FX Plus Cool White at 20ms MP test current, T_c=85°C.

PART NUMBER	CORRELATED COLOR TEMPERATURE		TOTAL INCLUDED ANGLE [1] $\theta_{0.90V}$	VIEWING ANGLE [2] $2\theta_{1/2}$
	MINIMUM	MAXIMUM		
A1FX-5850BDH0xxxxx	5500K	6250K	142°	120°

Notes for Table 2:
1. Total angle at which 90% of total luminous flux is captured.
2. Viewing angle is the off axis angle from the LED centerline where the luminous intensity is ½ of the peak value.

Electrical Characteristics

Table 3. Electrical characteristics for LUXEON FX Plus Cool White at 20ms MP test current, T_C=85°C.

PART NUMBER	FORWARD VOLTAGE [1] (V)		THERMAL RESISTANCE— JUNCTION TO CASE (°C/W)			
			$R\theta_{j\text{-}c}$ el [2]		$R\theta_{j\text{-}c}$ real [3]	
	MINIMUM	MAXIMUM	TYPICAL	MAXIMUM	TYPICAL	MAXIMUM
A1FX-5850BDH0xxxxx	2.55	3.51	3.5	4.2	5.0	6.0

Notes for Table 3:
1. Lumileds maintains a tolerance of ±0.06 V on forward voltage measurements.
2. $R\theta_{j\text{-}c}$ el: Electrical thermal resistance (junction to case).
3. $R\theta_{j\text{-}c}$ real: Real thermal resistance (junction to case) with wall plug efficiency included. Reference JESD51-51, JESD51-14, 4.1.3.
4. Calculated (5s).

Absolute Ratings

Table 4. Absolute ratings for LUXEON FX Plus Cool White.

PARAMETER	PERFORMANCE
Minimum DC Forward Current	50mA
Maximum DC Forward Current	1500mA
Maximum Junction Temperature [1]	150°C
Maximum Junction Temperature for <200 Hours	180°C
Operating Case Temperature at Test Current	-40°C to 130°C
Operating Case Temperature at Maximum Current	-40°C to 130°C
LED Storage Temperature	-40°C to 130°C
Maximum Soldering Temperature	260°C
Allowable Reflow Cycles	3
ESD Sensitivity [2]	±8kV HBM, ±400V MM, ±2kV CDM
Reverse Voltage ($V_{reverse}$)	LUXEON LEDs are not designed to be driven in reverse bias
Autoclave Conditions	121°C at 2 ATM 100% Relative Humidity for 96 Hours Maximum

Notes for Table 4:
1. Given for reference only. LUXEON FX LEDs driven above maximum LED case temperature and/or maximum I_f may have a shorter lifetime.
2. Measured using human body model (per JESD22 A114), machine model (per JESD22 A115) and charged device model (per JESD22 C101).

JEDEC Moisture Sensitivity

Table 5. Moisture sensitivity levels for LUXEON FX 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

Characteristic Curves

Spectral Power Distribution Characteristics

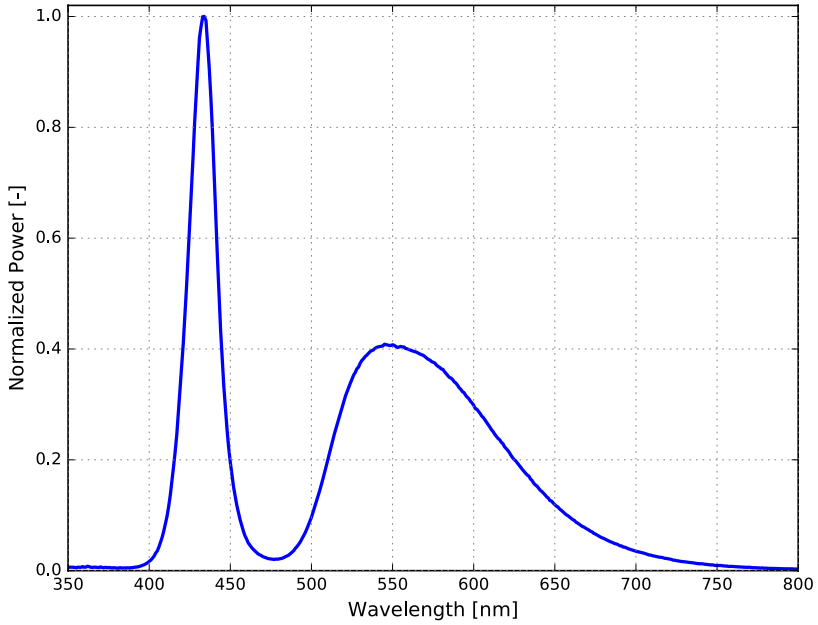

Figure 1. Typical normalized power vs. wavelength for LUXEON FX Plus Cool White at 20ms MP, 1000mA, T_c=85°C.

Light Output Characteristics

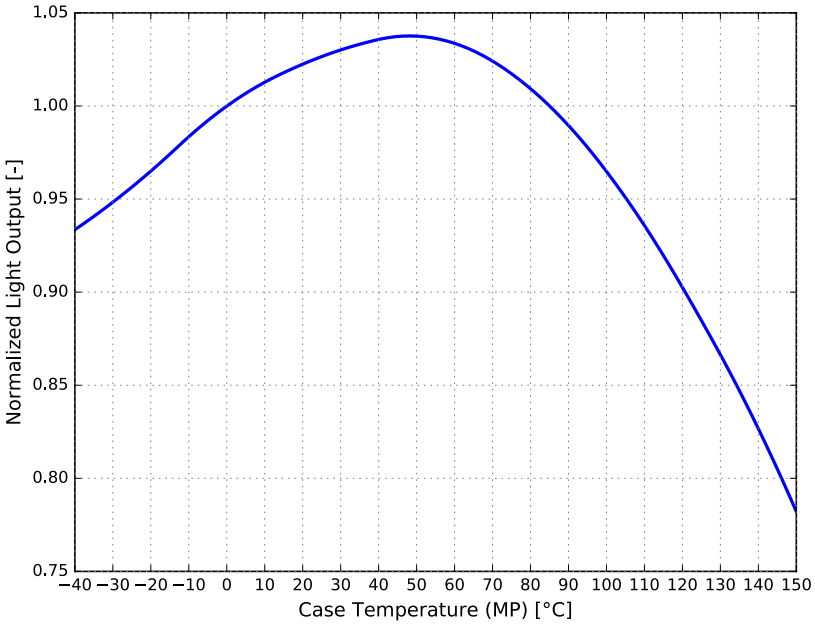

Figure 2. Typical normalized light output vs. case temperature for LUXEON FX Plus Cool White at 20ms MP, 1000mA.

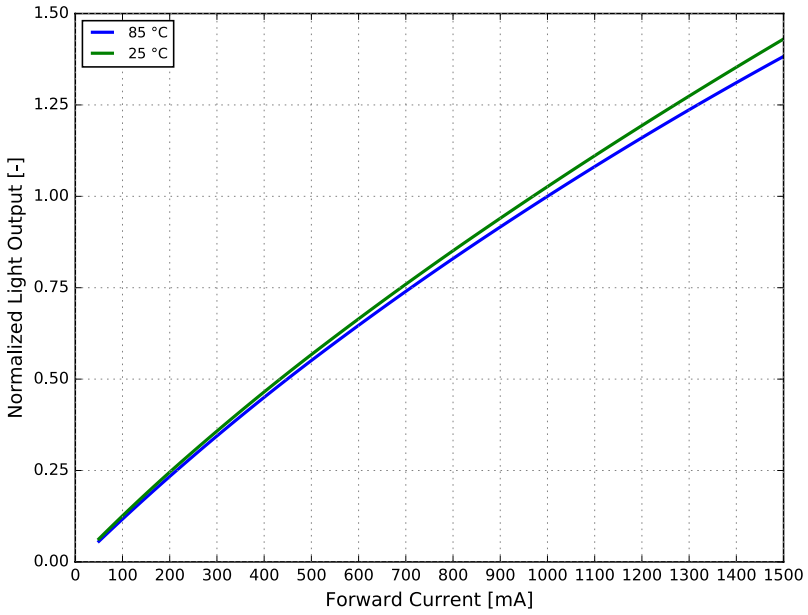

Figure 3. Typical normalized light output vs. forward current for LUXEON FX Plus Cool White at T_C=85°C.

Forward Current and Forward Voltage Characteristics

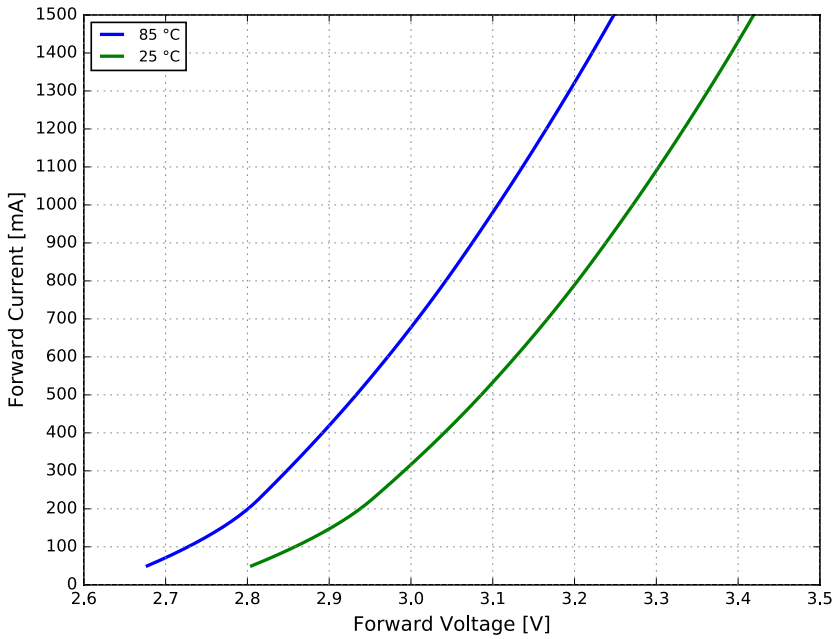

Figure 4. Typical forward current vs. forward voltage for LUXEON FX Plus Cool White at T_C=85°C.

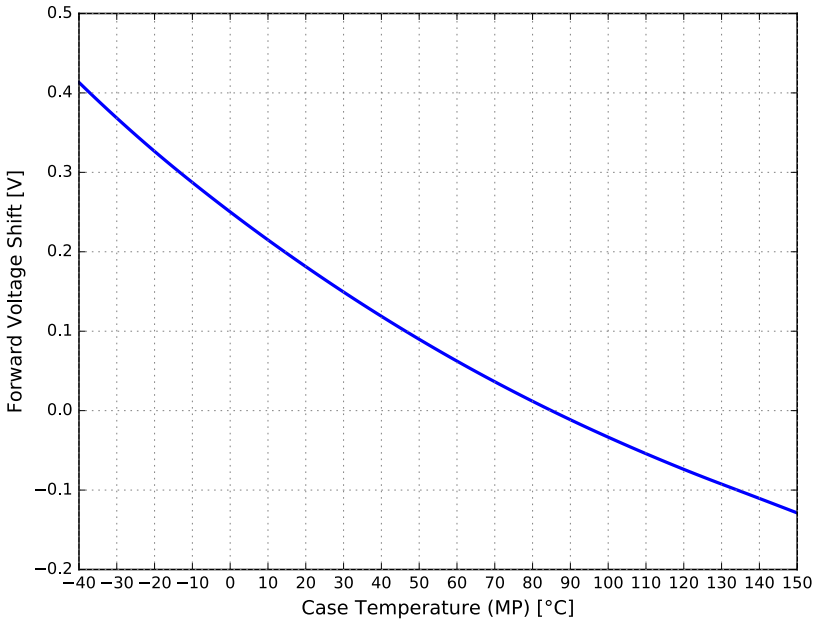

Figure 5. Typical forward voltage shift vs. case temperature for LUXEON FX Plus Cool White.

Color Shift Characteristics

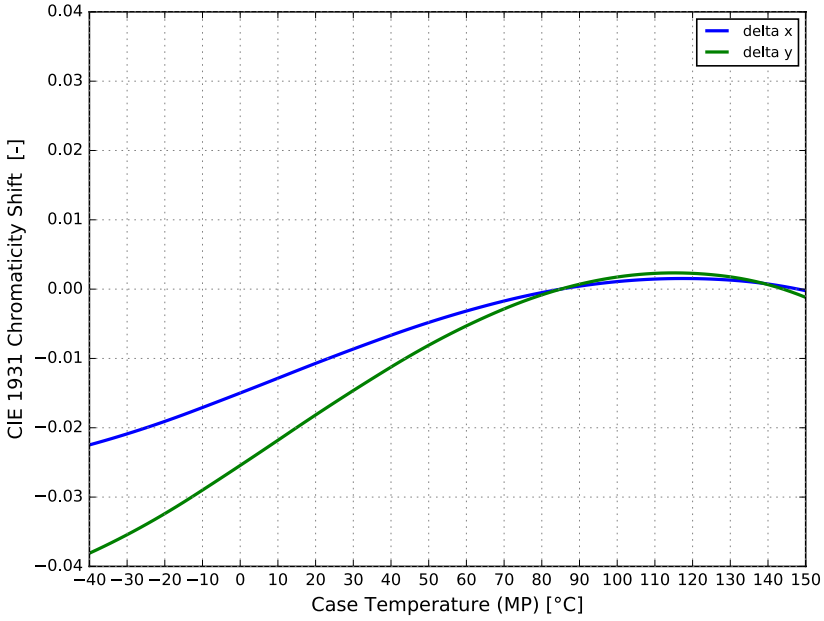

Figure 6. Typical color shift in CIE 1931 x and y coordinates for LUXEON FX Plus Cool White at 20ms MP, 1000mA.

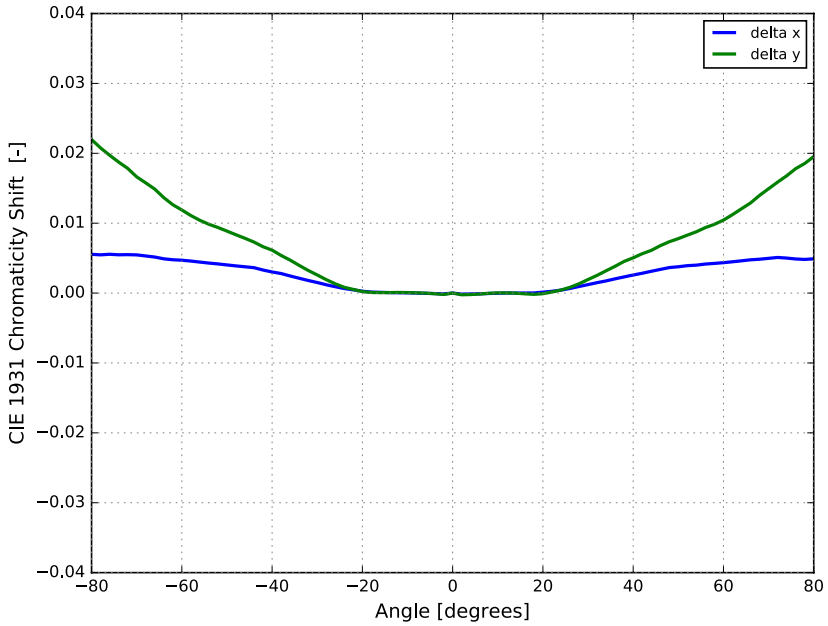

Figure 7. Typical color shift in CIE 1931 x and y coordinates over angle for LUXEON FX Plus Cool White at 20ms MP, 1000mA.

Radiation Pattern Characteristics

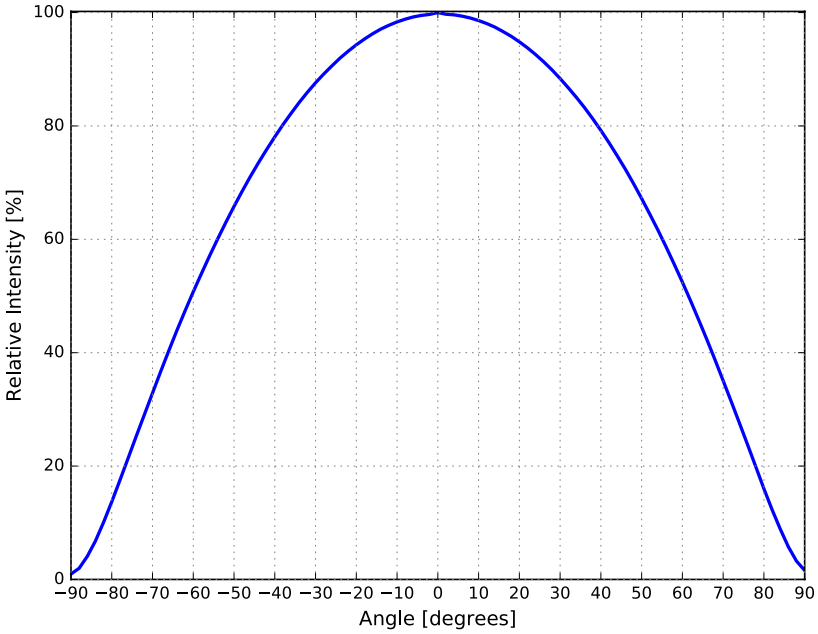

Figure 8. Typical radiation pattern for LUXEON FX Plus Cool White at 20ms MP, 1000mA, T_c=85°C.

Operating Limits Characteristics

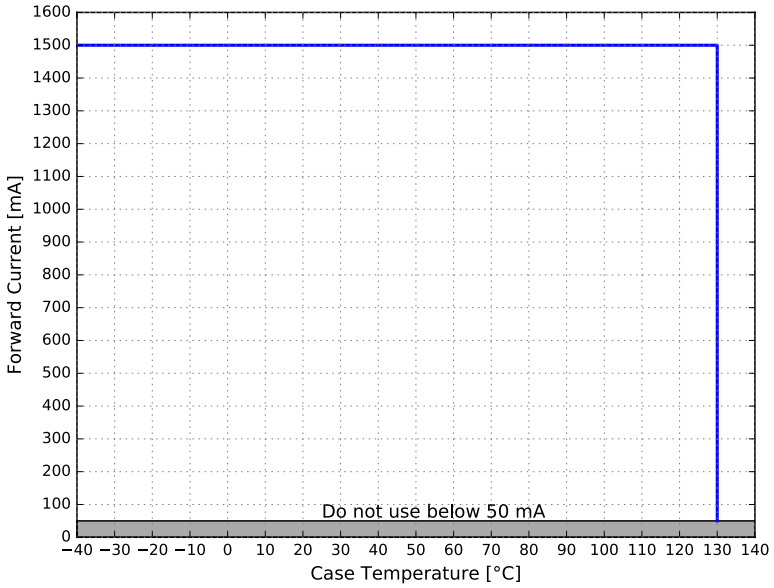

Figure 9. Maximum forward current vs. case temperature for LUXEON FX Plus Cool White.

Notes for Figure 9:
1. -40°C to 130°C (upgrade to 135°C under consideration).

Permissible Pulse Handling Characteristics

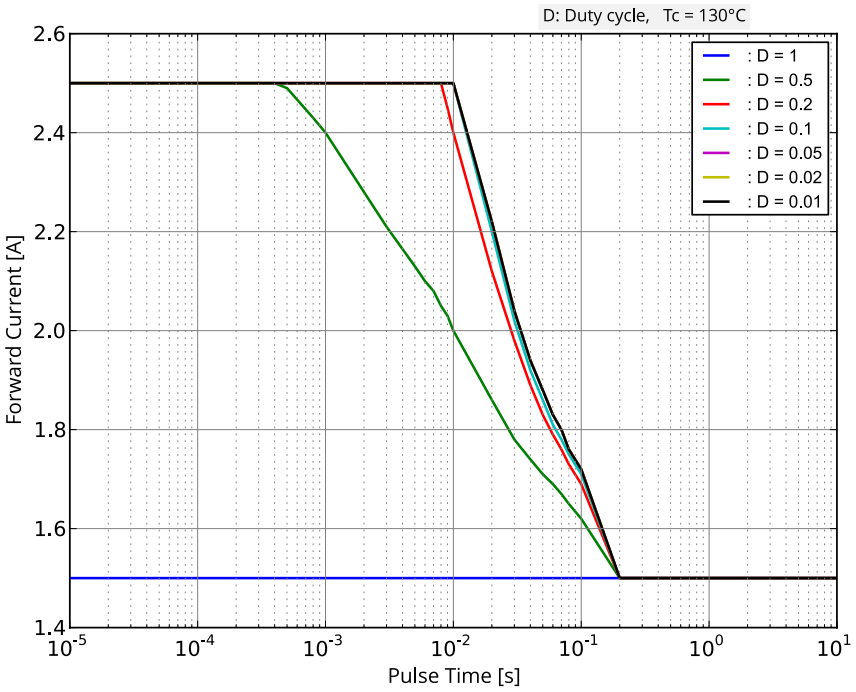

Figure 10. Permissible pulse handling capability for LUXEON FX Plus Cool White.

Product Bin and Labeling Definitions

Designing with LUXEON FX Plus Cool White

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 FX Plus 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: E=270 to 280 lumens, H=300 to 310 lumens)

B C – designates color bin (example: H2, H5, H3, HC)

D – designates forward voltage bin (example: B=2.55V to 2.79V, D=3.03V to 3.27V)

Therefore, a LUXEON FX Plus Cool White with a lumen range of 300 to 310, color bin of HC, and a forward voltage range of 2.55V to 2.79V has the following CAT code:

H H C D

Luminous Flux Bins

Table 6 lists the standard luminous flux bins for LUXEON FX emitters. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors

Table 6. Luminous flux bin definitions for LUXEON FX Plus Cool White at 20ms MP test current, T_C=85°C.

BIN	LUMINOUS FLUX [1] (lm)	
	MINIMUM	MAXIMUM
G	290	300
H	300	310
J	310	320
K	320	330
L	330	340
M	340	350
N	350	360
P	360	370
Q	370	380
R	380	390

Notes for Table 6:
1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.

Color Codes

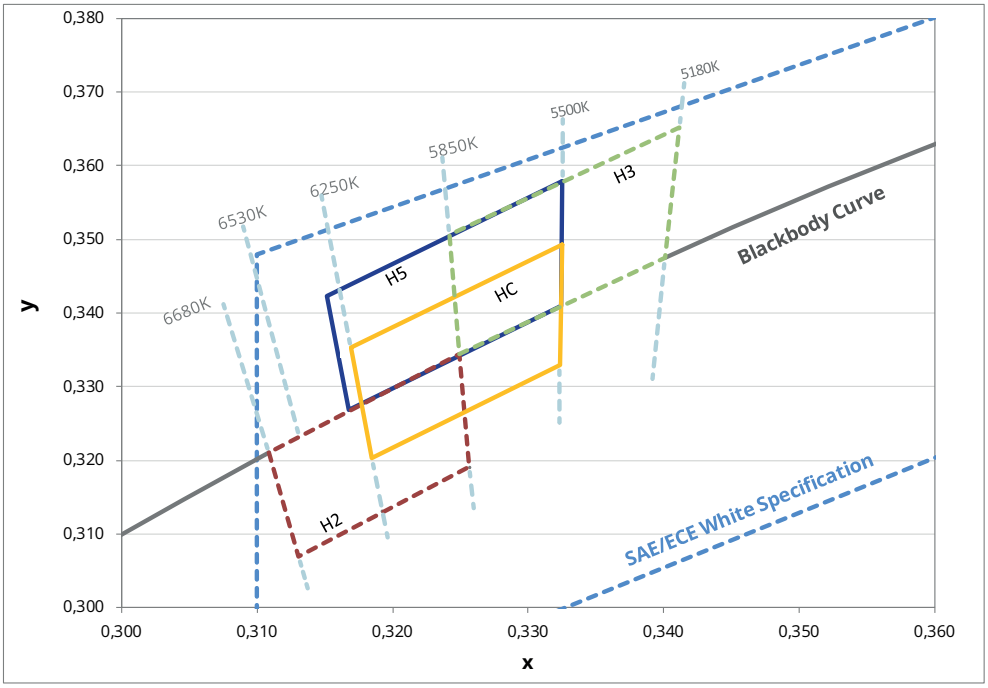

Figure 11. Color bin structure in CIE 1931 color space for LUXEON FX Plus Cool White.

Notes for Figure 11:
- Lumileds supports the following bins for LUXEON FX Plus Cool White: H2, H3, HC, H5

Color Bin Definitions

Table 7a. Color bin definitions for LUXEON FX Plus Cool White.

BIN	x [1, 2]	y [1, 2]	6-DIGIT IEC CODE	TYPICAL CCT
HC	0.3325	0.3493		5850
	0.3169	0.3353		
	0.3185	0.3203		
	0.3323	0.3329		
H5	0.3325	0.3579		5900
	0.3151	0.3423		
	0.3168	0.3268		
	0.3324	0.3410		
H2	0.3109	0.3211		6250
	0.3131	0.3070		
	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 FX 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 FX Plus Cool White.

CODE	x [1, 2]	y [1, 2]	TYPICAL CCT	CODE	x [1, 2]	y [1, 2]	TYPICAL CCT
1A	0.3109	0.3382	6390K	3A	0.3242	0.3506	5680K
	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	6390K	3B	0.3246	0.3424	5680K
	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	6050K	3C	0.3325	0.3579	5350K
	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	6050K	3D	0.3325	0.3493	5350K
	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	6460K	4A	0.3249	0.3344	5680K
	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	6460K	4B	0.3253	0.3266	5680K
	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	6050K	4C	0.3324	0.3410	5350K
	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	6050K	4D	0.3323	0.3329	5350K
	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	5970K	1F	0.3208	0.3388	5780K
	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 FX 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

Table 8. Forward voltage bin definitions for LUXEON FX Plus Cool White.

BIN	FORWARD VOLTAGE [1] (V_f)	
	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

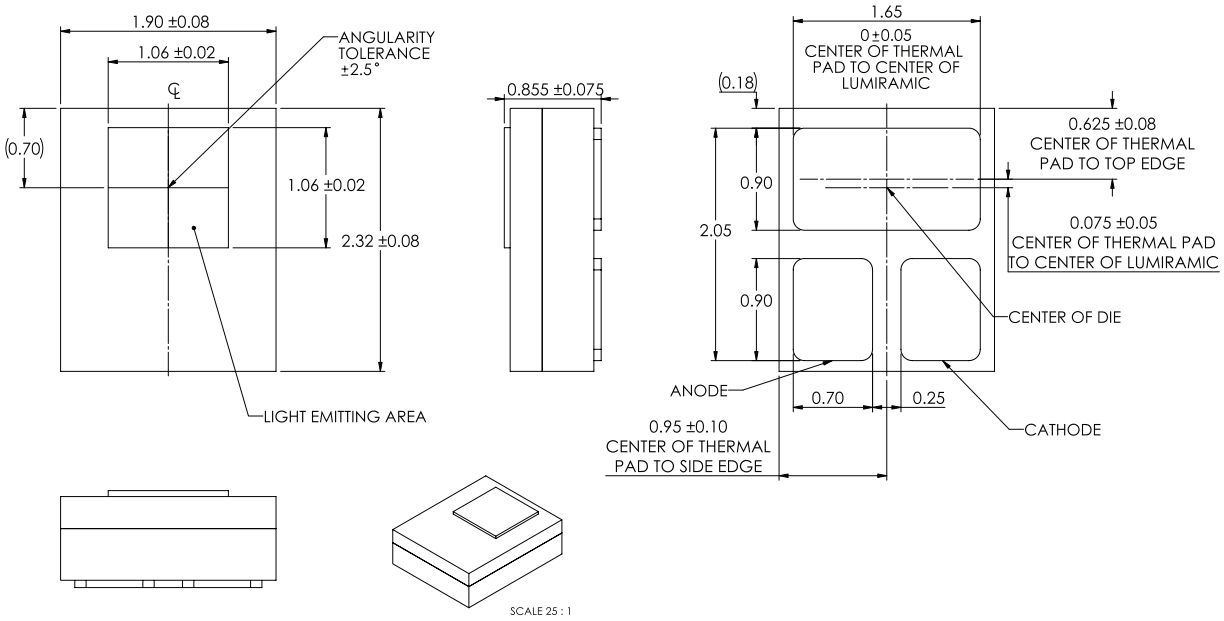

Figure 12. Mechanical dimensions for LUXEON FX Plus Cool White.

Notes for Figure 12:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

Packaging Information

Pocket Tape Dimensions

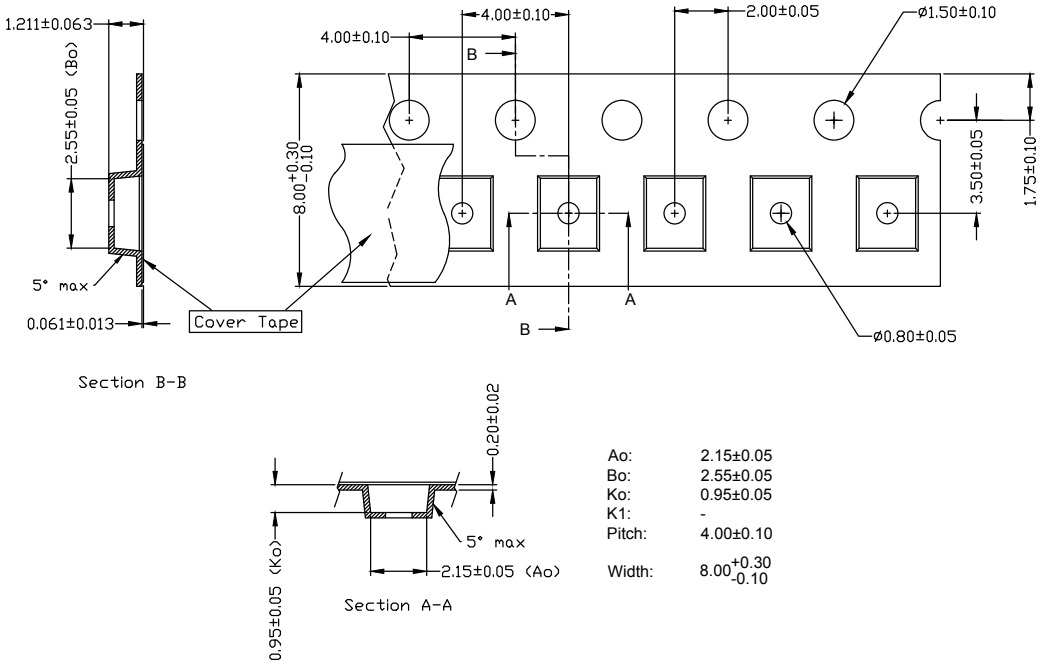

Figure 13. Pocket tape dimensions for LUXEON FX Plus Cool White.

Notes for Figure 13:
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

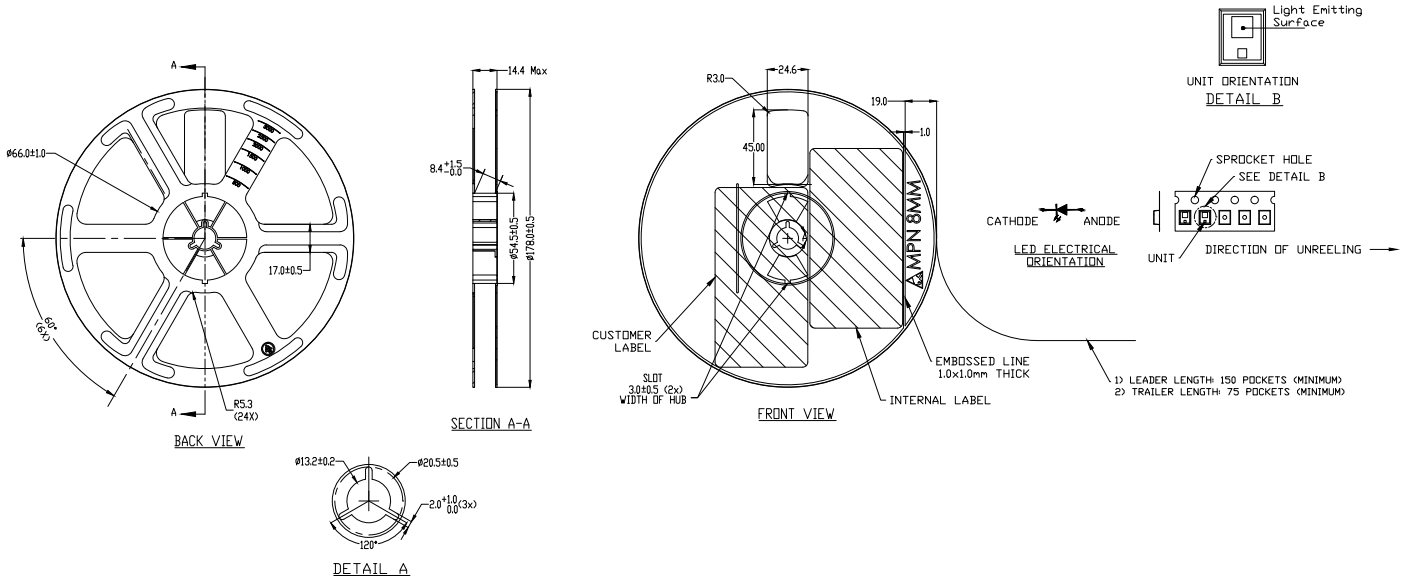

Figure 14. Reel dimensions for LUXEON FX Plus Cool White.

Notes for Figure 14.
1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. SPI=3,000 (SPI is the number of LEDs per reel).

Product Labeling

LUXEON FX 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.

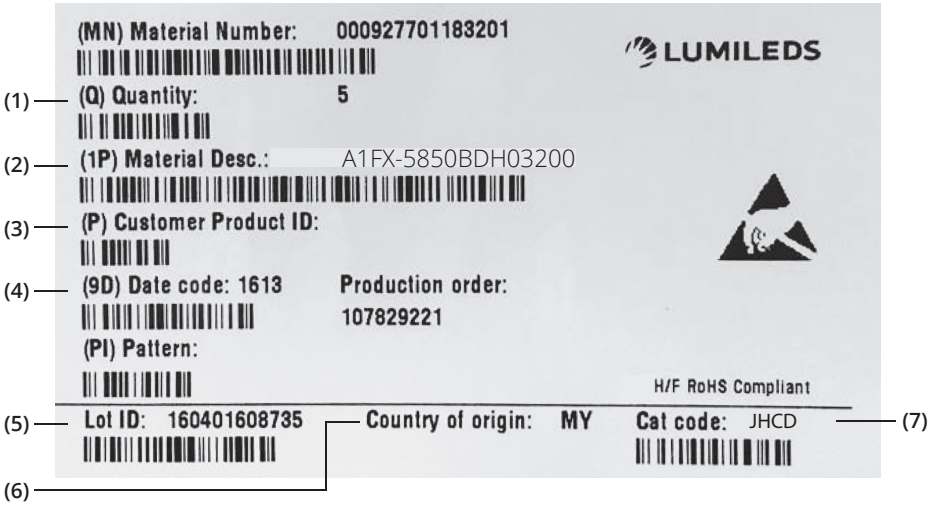

Figure 15. Example of a product label for LUXEON FX Cool White.

Notes for Figure 15 – 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.

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