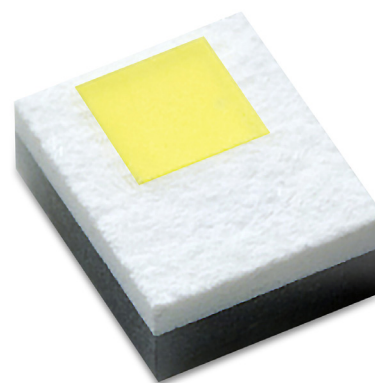


# LUXEON FX Plus Cool White

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

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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 85°C.

## 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,  $T_c=85^\circ\text{C}$ .

| MINIMUM LUMINOUS FLUX <sup>[1]</sup> (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  $\pm 6.5\%$  on luminous flux measurements.

## Optical Characteristics

Table 2. Optical Characteristics for LUXEON FX Plus Cool White at 20ms MP test current,  $T_c=85^\circ\text{C}$ .

| PART NUMBER        | CORRELATED COLOR TEMPERATURE |         | TOTAL INCLUDED ANGLE <sup>[1]</sup><br>$\theta_{0.90V}$ | VIEWING ANGLE <sup>[2]</sup><br>$2\theta_{1/2}$ |
|--------------------|------------------------------|---------|---------------------------------------------------------|-------------------------------------------------|
|                    | 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  $\frac{1}{2}$  of the peak value.

## Electrical Characteristics

Table 3. Electrical characteristics for LUXEON FX Plus Cool White at 20ms MP test current,  $T_c=85^\circ\text{C}$ .

| PART NUMBER        | FORWARD VOLTAGE <sup>[1]</sup> (V) |         | THERMAL RESISTANCE—<br>JUNCTION TO CASE ( $^\circ\text{C}/\text{W}$ ) |         |                                  |         |
|--------------------|------------------------------------|---------|-----------------------------------------------------------------------|---------|----------------------------------|---------|
|                    |                                    |         | $R\theta_{jc\text{ el}}^{[2]}$                                        |         | $R\theta_{jc\text{ real}}^{[3]}$ |         |
|                    | 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  $\pm 0.06\text{ V}$  on forward voltage measurements.

2.  $R\theta_{jc\text{ el}}$ : Electrical thermal resistance (junction to case).

3.  $R\theta_{jc\text{ real}}$ : 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 <sup>[1]</sup>   | 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 <sup>[2]</sup>                | ±8kV HBM, ±400V MM, ±2kV CDM                               |
| Reverse Voltage ( $V_{\text{reverse}}$ )      | 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:**

- Given for reference only. LUXEON FX LEDs driven above maximum LED case temperature and/or maximum  $I_f$  may have a shorter lifetime.
- 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

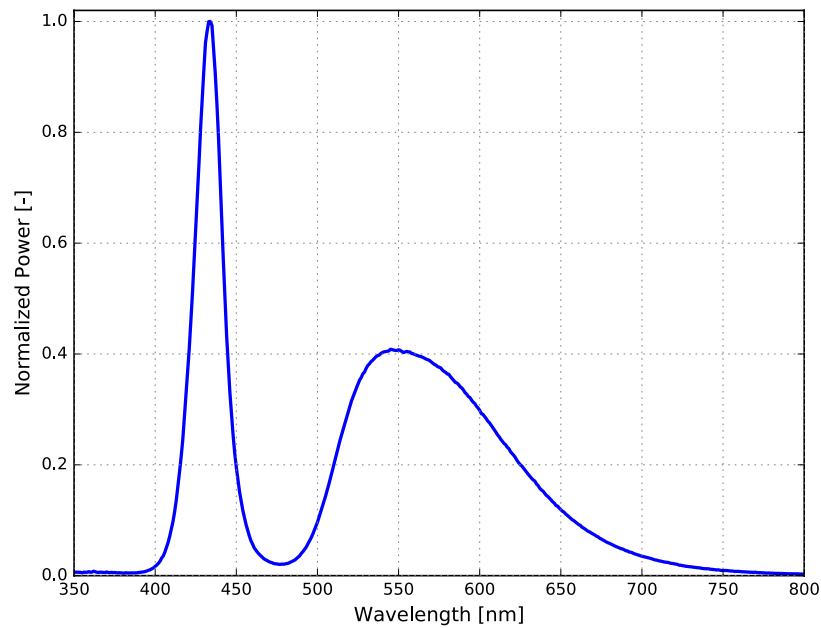


Figure 1. Typical normalized power vs. wavelength for LUXEON FX Plus Cool White at 20ms MP, 1000mA,  $T_c=85^{\circ}\text{C}$ .

## Light Output Characteristics

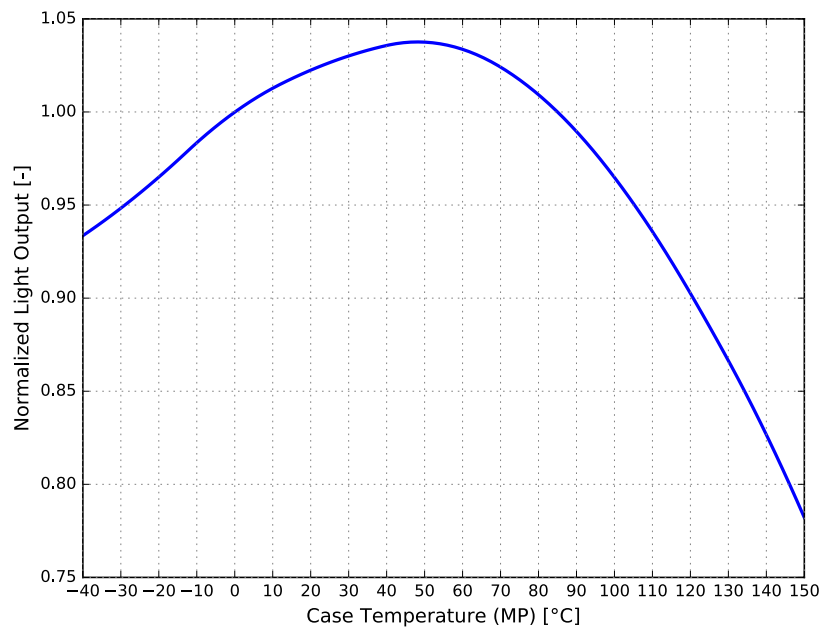


Figure 2. Typical normalized light output vs. case temperature for LUXEON FX Plus Cool White at 20ms MP, 1000mA.

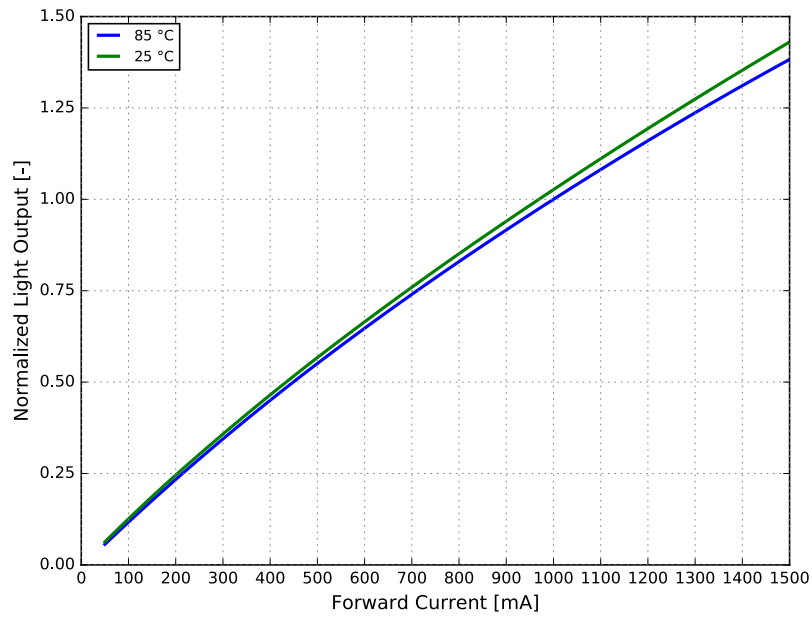


Figure 3. Typical normalized light output vs. forward current for LUXEON FX Plus Cool White at  $T_c=85^{\circ}\text{C}$ .

## Forward Current and Forward Voltage Characteristics

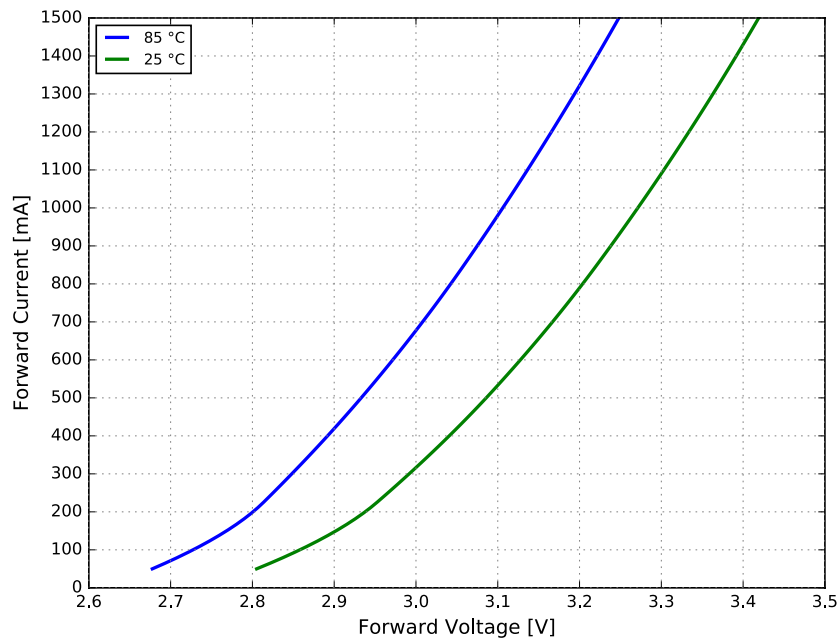


Figure 4. Typical forward current vs. forward voltage for LUXEON FX Plus Cool White at  $T_c=85^{\circ}\text{C}$ .

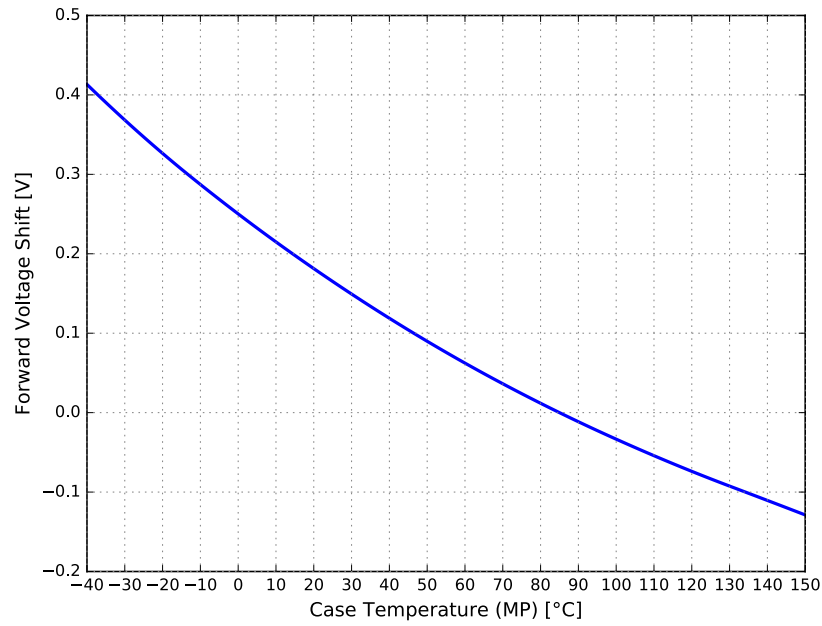


Figure 5. Typical forward voltage shift vs. case temperature for LUXEON FX Plus Cool White.

## Color Shift Characteristics

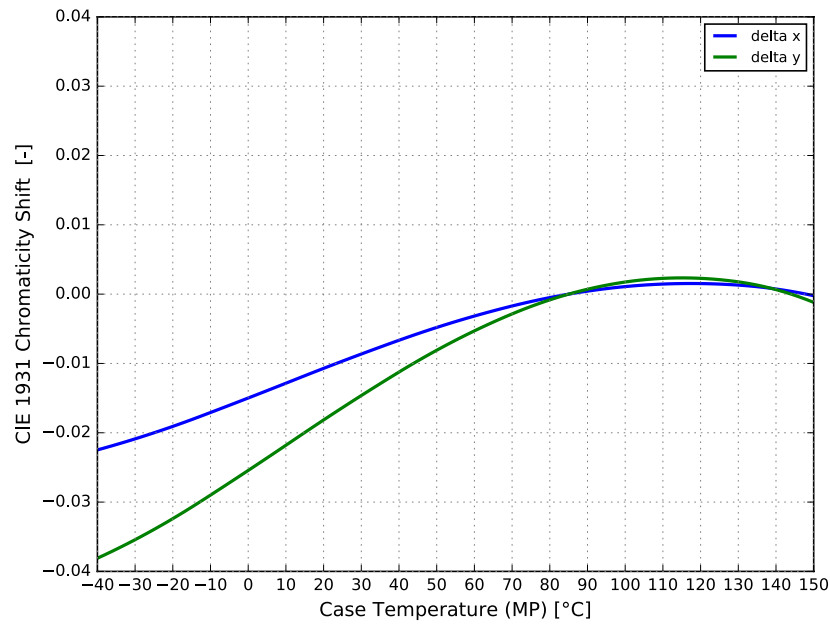


Figure 6. Typical color shift in CIE 1931 x and y coordinates for LUXEON FX Plus Cool White at 20ms MP, 1000mA.



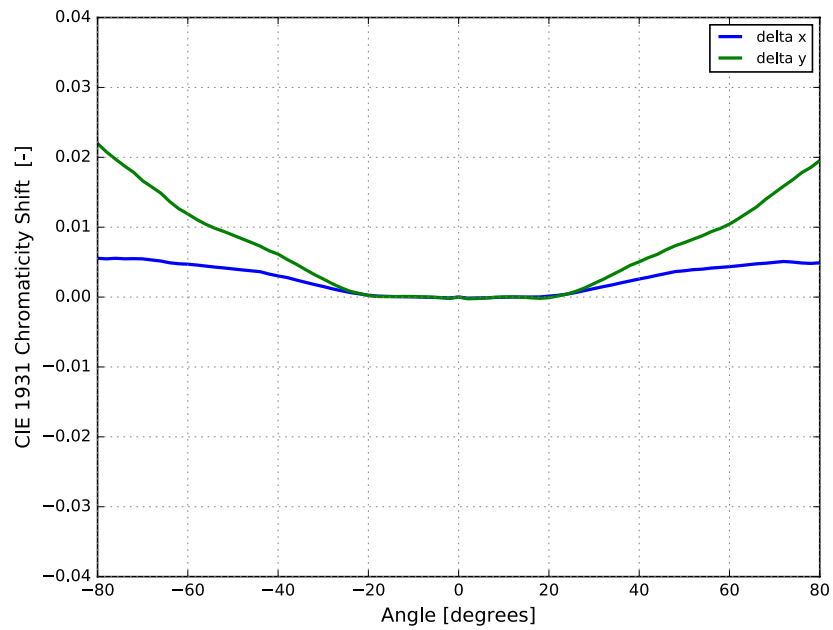


Figure 7. Typical color shift in CIE 1931 x and y coordinates over angle for LUXEON FX Plus Cool White at 20ms MP, 1000mA.

## Radiation Pattern Characteristics

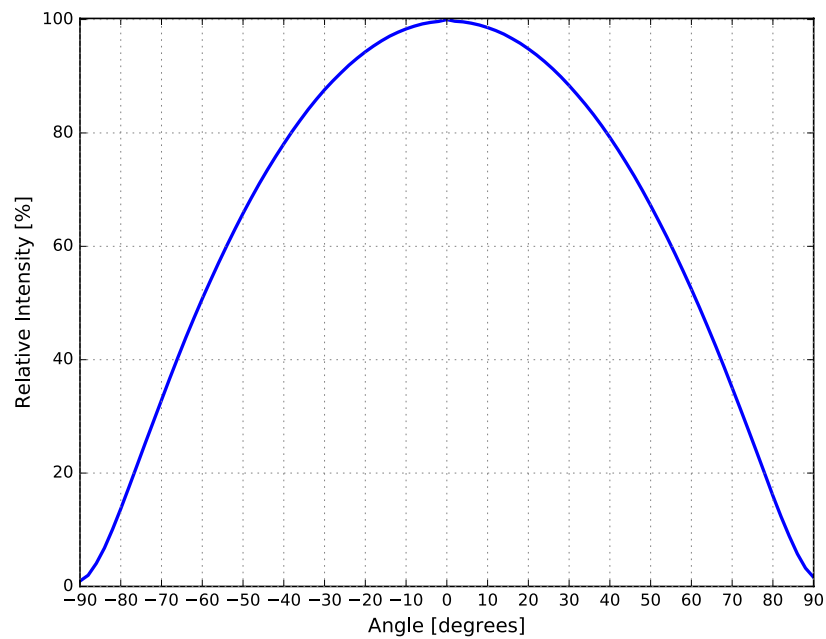


Figure 8. Typical radiation pattern for LUXEON FX Plus Cool White at 20ms MP, 1000mA,  $T_c=85^{\circ}\text{C}$ .

# Operating Limits Characteristics

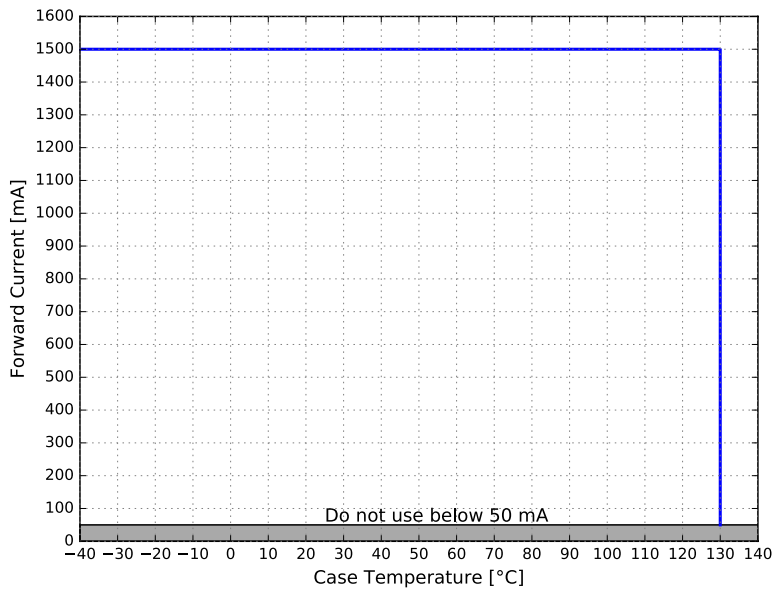


Figure 9. Maximum forward current vs. case temperature for LUXEON FX Plus Cool White.

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

# Permissible Pulse Handling Characteristics

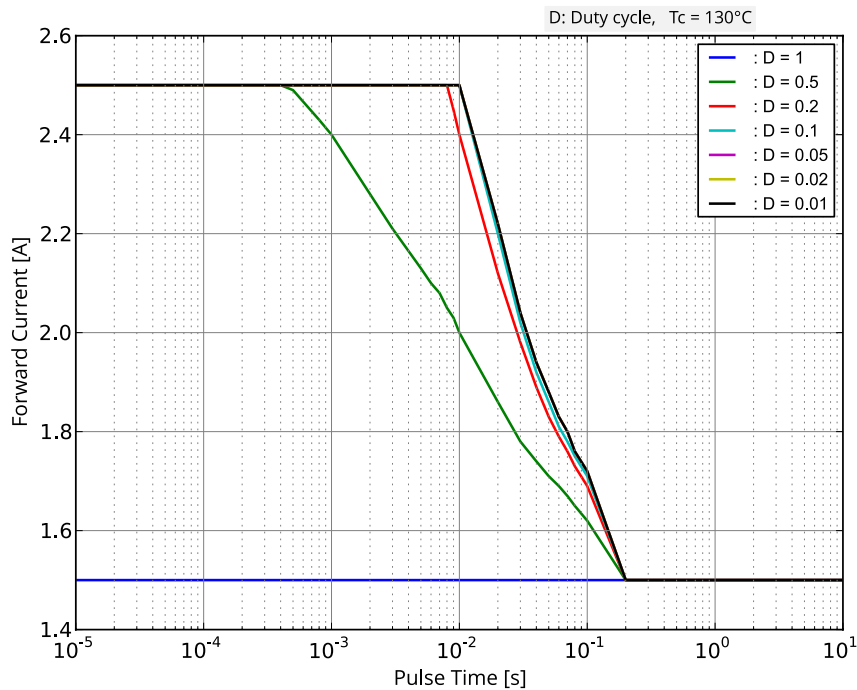


Figure 10. Permissible pulse handling capability for LUXEON FX Plus Cool White.

# 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,  $T_c=85^\circ\text{C}$ .**

| BIN | LUMINOUS FLUX <sup>(1)</sup> (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  $\pm 6.5\%$  on luminous flux measurements.

# Color Codes

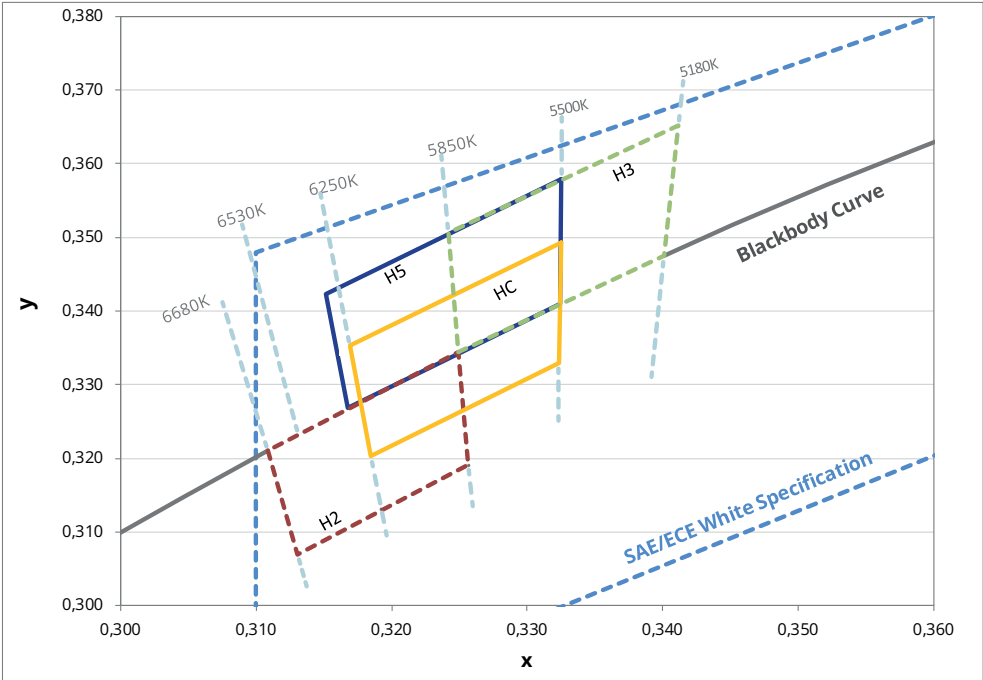


Figure 11. Color bin structure in CIE 1931 color space for LUXEON FX Plus Cool White.

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  $\pm 0.005$  on x and y coordinates.

Table 7b. Optional color bin definitions for LUXEON FX Plus Cool White.

| CODE | x <sup>[1, 2]</sup> | y <sup>[1, 2]</sup> | TYPICAL CCT | CODE | x <sup>[1, 2]</sup> | y <sup>[1, 2]</sup> | 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  $\pm 0.005$  on x and y coordinates.

# Forward Voltage Bins

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

| BIN | FORWARD VOLTAGE <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

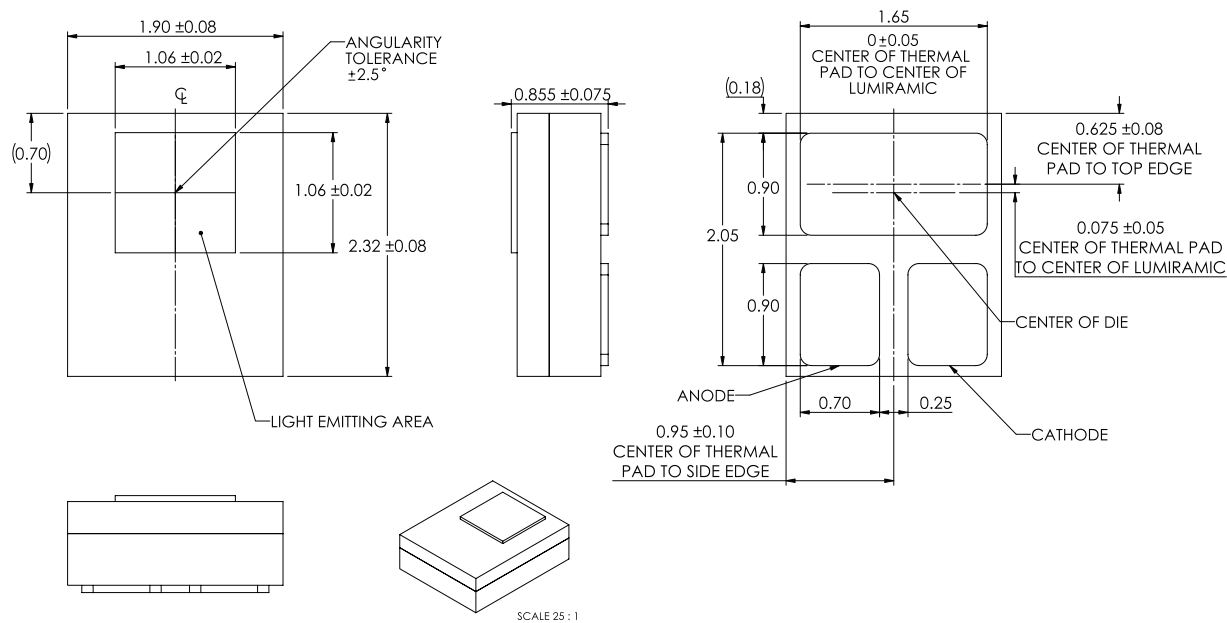


Figure 12. Mechanical dimensions for LUXEON FX Plus Cool White.

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

# Packaging Information

## Pocket Tape Dimensions

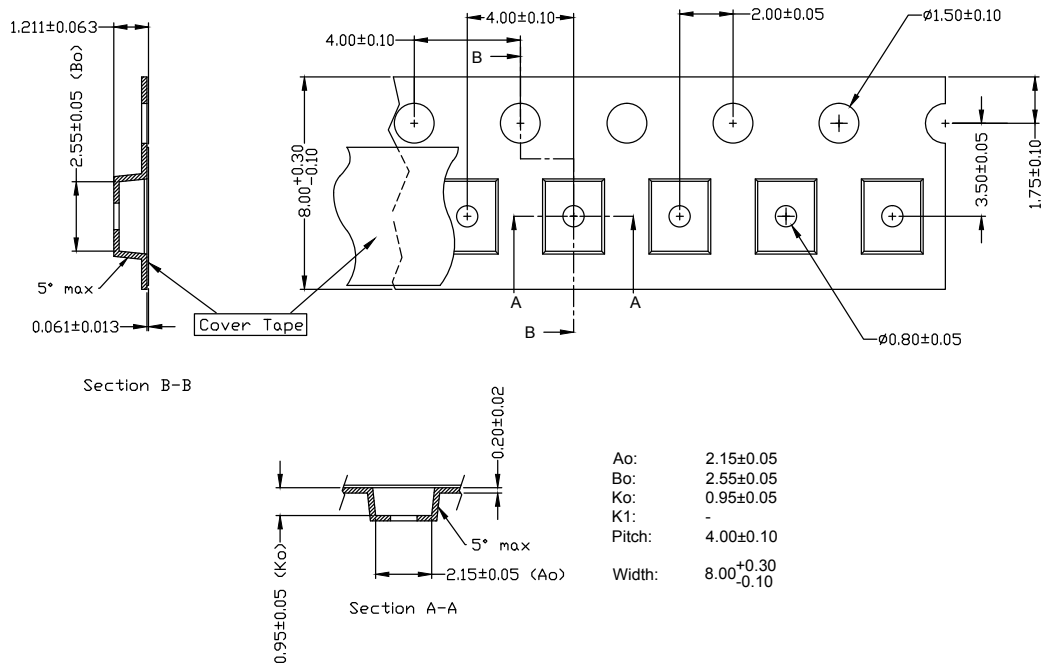


Figure 13. Pocket tape dimensions for LUXEON FX Plus Cool White.

### 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

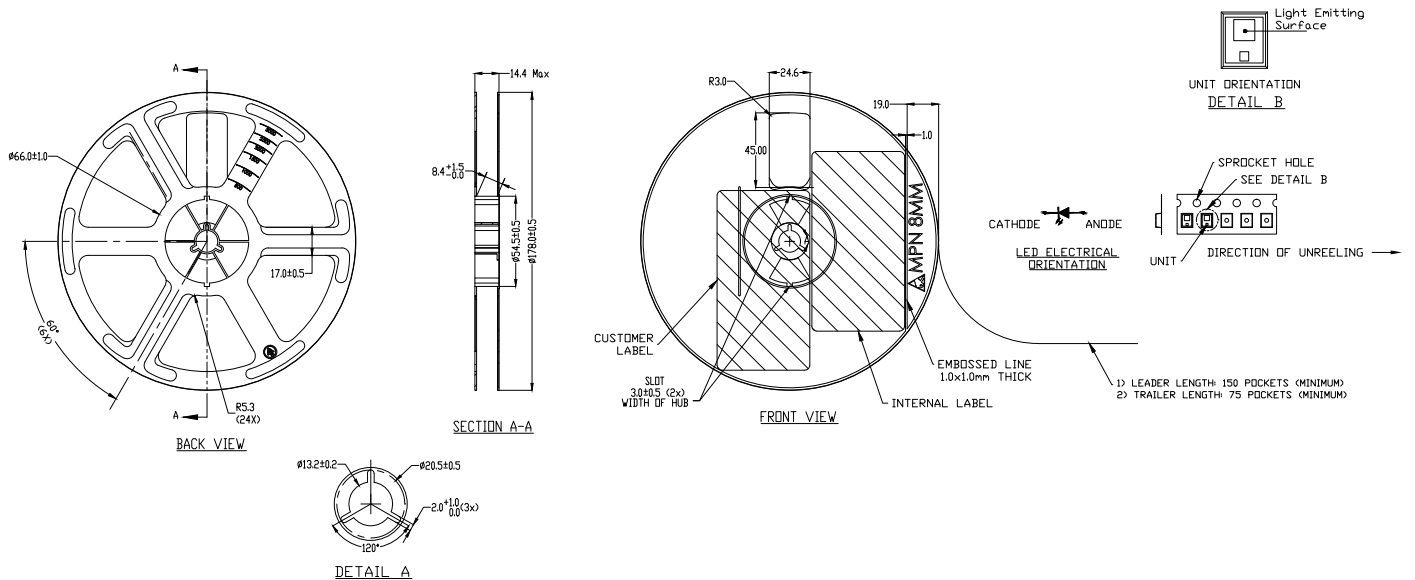


Figure 14. Reel dimensions for LUXEON FX Plus Cool White.

### 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.

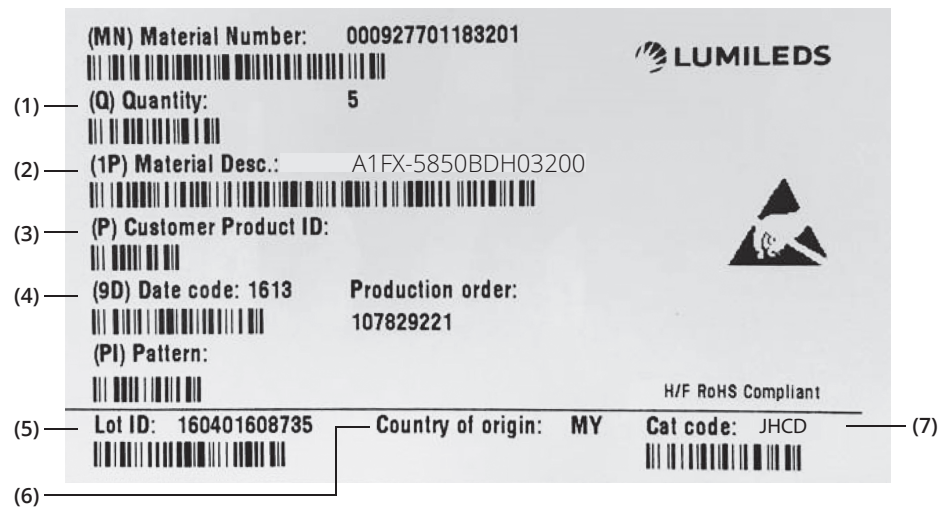


Figure 15. Example of a product label for LUXEON FX Cool White.

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](https://lumileds.com).



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