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# LUXEON 2835 with CrispColor Technology™

Fashion retail lighting that makes an impact, highlighting rich colors and increasing contrast



LUXEON 2835 with CrispColor Technology is the ultimate solution that makes fabrics come to life. With efficient solid state lighting technology, the contrast of colors has never been so vivid. Our special phosphor technology has created a higher gamut color rendering than existing solutions with a specific color point below the Black Body Line to allow for Class A products. Combined with industry leading performance in a common 2835 platform, LUXEON 2835 with CrispColor Technology creates a highly impactful retail experience with all of the advantages of LUXEON 2835, including leading performance, lower voltage, higher driving current, and excellent reliability.

## FEATURES AND BENEFITS

- Industry standard footprint for drop-in replacement designs
- Maximum drive current of up to 240mA allows for reduction of LED count
- 3- and 5-step MacAdam ellipse color kits available

## PRIMARY APPLICATIONS

- Downlights
- Indoor Area Lighting
  - TLEDs
  - Troffers
- Lamps

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# General Product Information

## Product Test Conditions

LUXEON 2835 with CrispColor Technology LEDs are tested and binned with a 20ms monopulse of 120mA at a junction temperature,  $T_j$ , of 25°C.

## Part Number Nomenclature

Part numbers for LUXEON 2835 with CrispColor Technology follow the convention below:

L 1 2 8 – **A A H G C A** 3 5 0 0 0 0 0

Where:

- A A** – designates nominal ANSI CCT (27=2700K, 30=3000K, 33=3250, 35=3500K, 40=4000K, 50=5000K)
- H G** – designates CrispColor (HG=High Gamut)
- C** – designates binning current (C=120mA)
- A** – designates voltage of the part (A=3V)

Therefore, the following part number is used for a LUXEON 2835C with CrispColor Technology 3000K, 3V:

L 1 2 8 – **3 0 H G C A** 3 5 0 0 0 0 0

## Lumen Maintenance

Please contact your local Sales Representative or Lumileds Technical Solutions Manager for more information about the long-term performance of this product.

## Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON 2835 with CrispColor Technology 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 of LUXEON 2835 with CrispColor Technology at 120mA, T<sub>j</sub>=25°C.

PRODUCT	VOLTAGE	NOMINAL CCT	MINIMUM CRI <sup>[1, 2]</sup>	LUMINOUS FLUX <sup>[1, 2]</sup> (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	PART NUMBER
				MINIMUM	TYPICAL		
LUXEON 2835C	3V	2700K	90	36	42	117	L128-27HGCA3500000
		3000K	90	38	43	120	L128-30HGCA3500000
		3250K	90	40	45	125	L128-33HGCA3500000
		3500K	90	40	46	128	L128-35HGCA3500000
		4000K	90	42	47	131	L128-40HGCA3500000
		5000K	90	44	50	139	L128-50HGCA3500000

**Notes for Table 1:**

1. Lumileds maintains a tolerance of ±2 on CRI and ±7.5% on luminous flux measurements.
2. Luminous flux and CRI specs are based upon mounted package on highly reflective surface at T<sub>j</sub>=25°C. Typical CRI is approximately 2 points higher than the minimum CRI specified, but this is not guaranteed.

## Optical Characteristics

Table 2. Optical characteristics for LUXEON 2835 with CrispColor Technology at 120mA, T<sub>j</sub>=25°C.

PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup>	TYPICAL VIEWING ANGLE <sup>[2]</sup>
L128-xxHGCA3500000	160°	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 and Thermal Characteristics

Table 3. Electrical and thermal characteristics for LUXEON 2835 with CrispColor Technology at 120mA, T<sub>j</sub>=25°C.

PART NUMBER	FORWARD VOLTAGE <sup>[1]</sup> (V <sub>f</sub> )			TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE <sup>[2]</sup> (mV/°C)	TYPICAL THERMAL RESISTANCE—JUNCTION TO SOLDER PAD (°C/W)
	MINIMUM	TYPICAL	MAXIMUM		
L128-xxHGCA3500000	2.9	3.0	3.2	-3.0 to -6.0	21

**Notes for Table 3:**

1. Lumileds maintains a tolerance of ±0.1V on forward voltage measurements.
2. Measured between 25°C and 85°C.

## Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON 2835 with CrispColor Technology.

PARAMETER	MAXIMUM PERFORMANCE
DC Forward Current <sup>[1,2]</sup>	240mA
Peak Pulsed Forward Current <sup>[1,3]</sup>	300mA
LED Junction Temperature <sup>[1]</sup> (DC & Pulse)	125°C
ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)	Class 2
Operating Case Temperature <sup>[1]</sup>	-40°C to 105°C
LED Storage Temperature	-40°C to 105°C
Soldering Temperature	JEDEC 020c 260°C
Allowable Reflow Cycles	3
Reverse Voltage <sup>[4,5]</sup> (V <sub>reverse</sub> )	5

**Notes for Table 4:**

1. Proper current derating must be observed to maintain the junction temperature below the maximum allowable junction temperature.
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple," are acceptable if the following conditions are met:
  - The frequency of the ripple current is 100Hz or higher
  - The average current for each cycle does not exceed the maximum allowable DC forward current
  - The maximum amplitude of the ripple does not exceed the maximum peak pulsed forward current
3. At ≤50% duty cycle with pulse width of 5ms.
4. Transient reverse voltages and surge currents due to electrical switching or supply interruptions are acceptable if these events do not last for more than 10ms, the amplitude of the reverse voltage does not exceed 5V and the reverse current is less than 220uA.
5. Max 5V reverse for up to 10s is an acceptable beginning of life, one time test condition.

# Characteristics Curves

## Spectral Power Distribution Characteristics

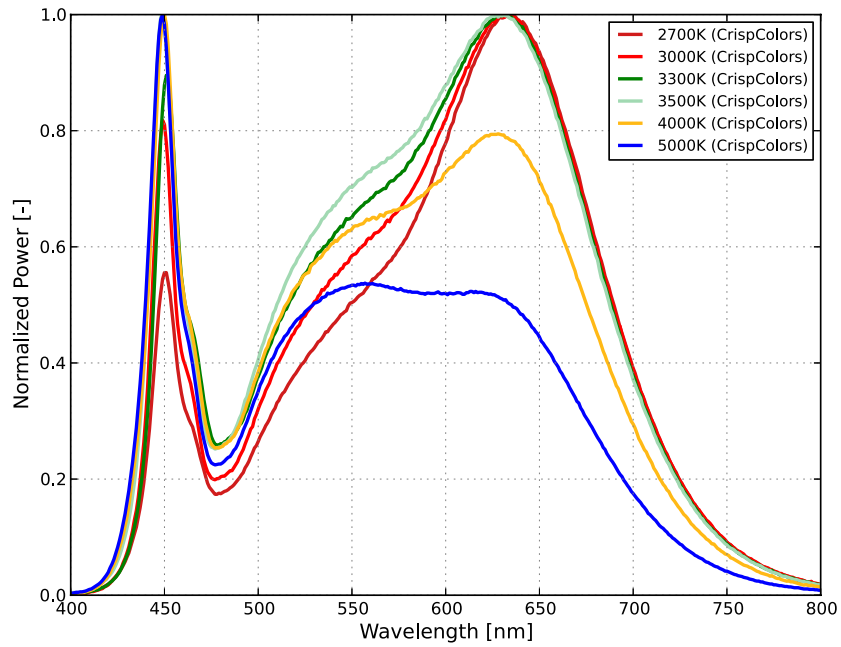


Figure 1. Typical normalized power vs. wavelength for LUXEON 2835 with CrispColor Technology at 120mA, T<sub>J</sub>=25°C.

## Light Output Characteristics

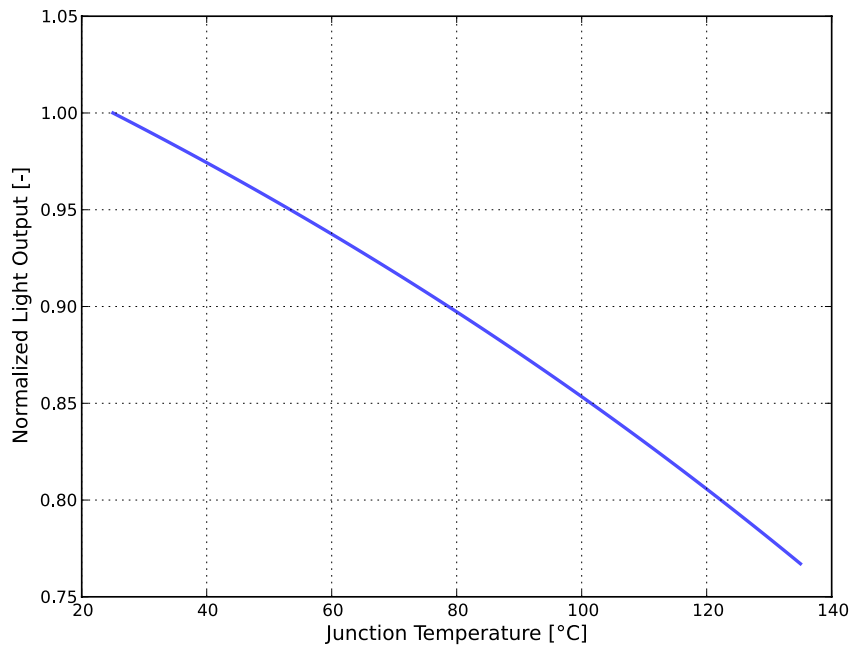


Figure 2. Typical normalized light output vs. junction temperature for LUXEON 2835 with CrispColor Technology at 120mA.

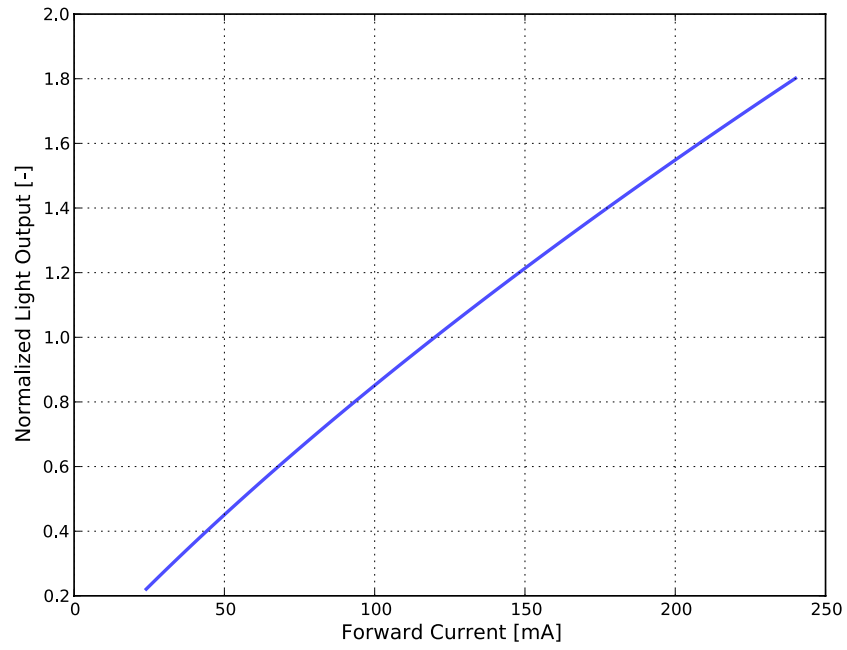


Figure 3. Typical normalized light output vs. forward current for LUXEON 2835 with CrispColor Technology at  $T_j=25^{\circ}\text{C}$ .

## Forward Current Characteristics

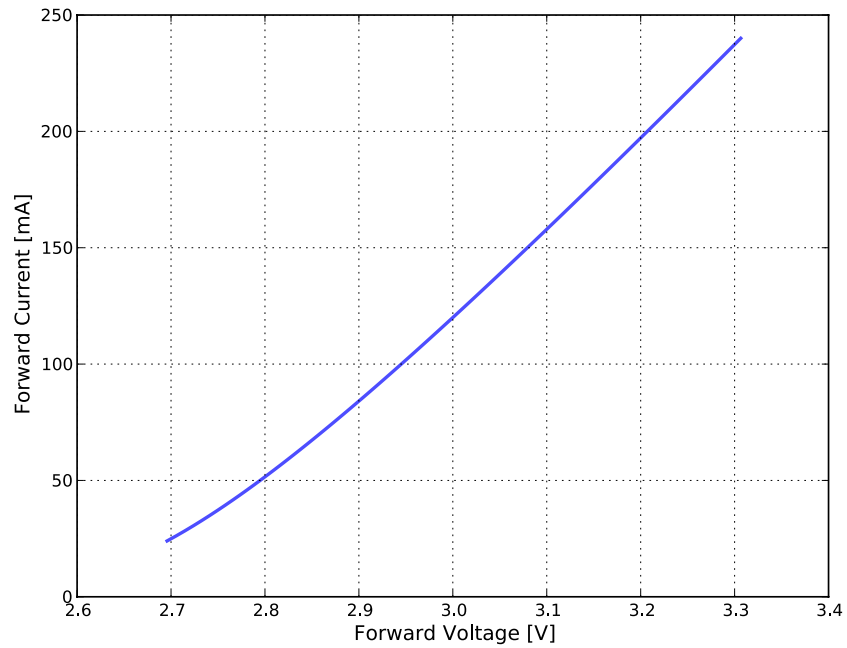


Figure 4. Typical forward current vs. forward voltage for LUXEON 2835 with CrispColor Technology at  $T_j=25^{\circ}\text{C}$ .



# Radiation Pattern Characteristics

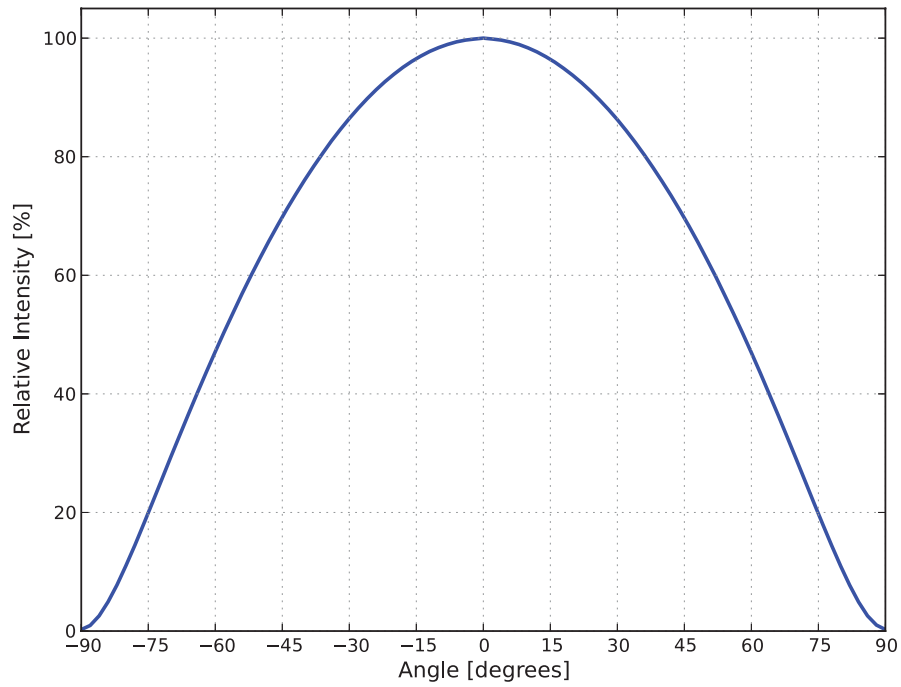


Figure 5. Typical radiation pattern for LUXEON 2835 with CrispColor Technology at 120mA,  $T_j=25^{\circ}\text{C}$ .

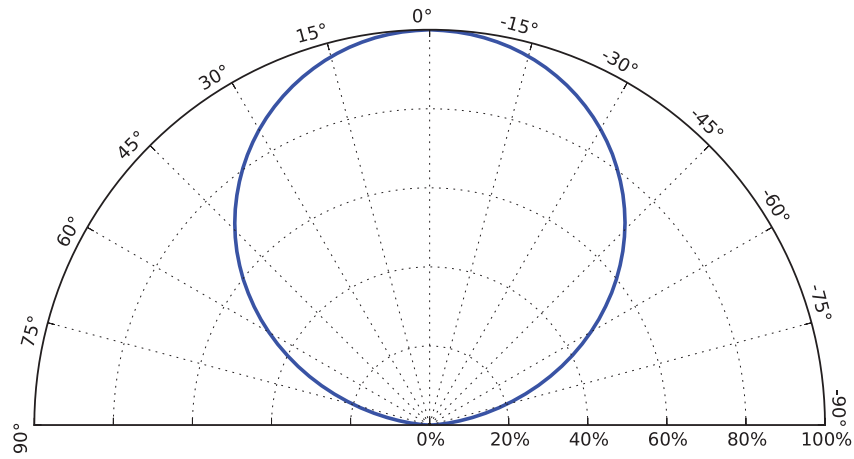


Figure 6. Typical polar radiation pattern for LUXEON 2835 with CrispColor Technology at 120mA,  $T_j=25^{\circ}\text{C}$ .

# 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 LED components for luminous flux or radiometric power, color point, peak or dominant wavelength and forward voltage.

LUXEON 2835 with CrispColor Technology LEDs are labeled using a 4-digit alphanumeric CAT code following the format below:

Where:

### A B C D

- A** – designates luminous flux bin (example: R=48 to 52 lumens, T=56 to 60 lumens)
- B C** – designates correlated color bin (example: 5D, 5E, 5F, 5G, 5H for 4000K parts)
- D** – designates forward voltage bin (example: W=3.0 to 3.1V, X=3.1 to 3.2V)

Therefore, a LUXEON 2835 with CrispColor Technology with a lumen range of 48 to 52, color bin of 5D and a forward voltage range of 3.0 to 3.1V has the following CAT code:

### R 5 D W

## Luminous Flux Bins

Table 5 lists the standard luminous flux bins for LUXEON 2835 with CrispColor Technology 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 CCTs.

**Table 5. Luminous flux bin definitions for LUXEON 2835 with CrispColor Technology,  $T_j=25^\circ\text{C}$ .**

PRODUCT	BIN	LUMINOUS FLUX <sup>(1)</sup> (lm)	
		MINIMUM	MAXIMUM
LUXEON 2835C	M	36	40
	P	40	44
	Q	44	48
	P	40	44
	Q	44	48
	R	48	52
	S	52	56
	T	56	60

**Notes for Table 5:**

1. Lumileds maintains a tolerance of  $\pm 7.5\%$  on luminous flux measurements.

# Color Bin Definition

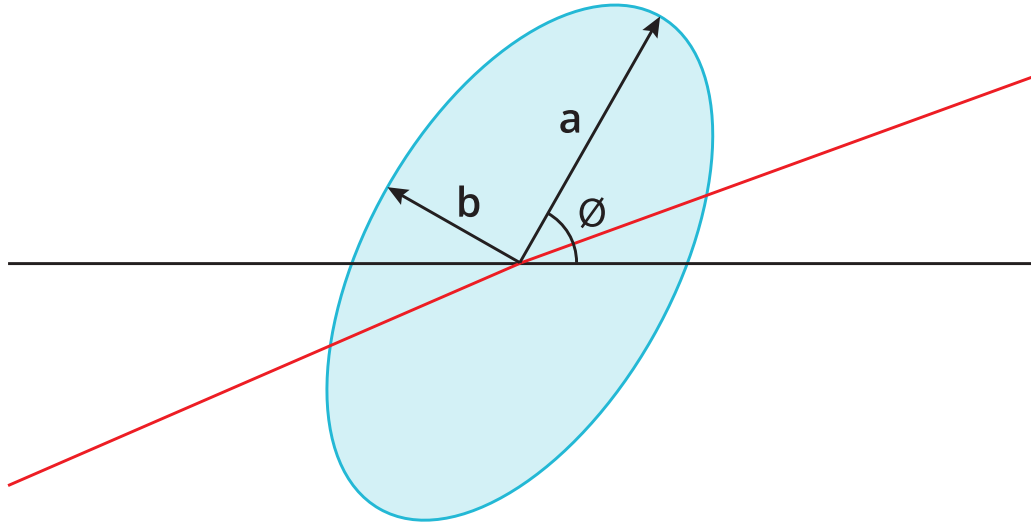


Figure 7. 3- and 5-step MacAdam ellipse illustration for Tables 6a–6f.

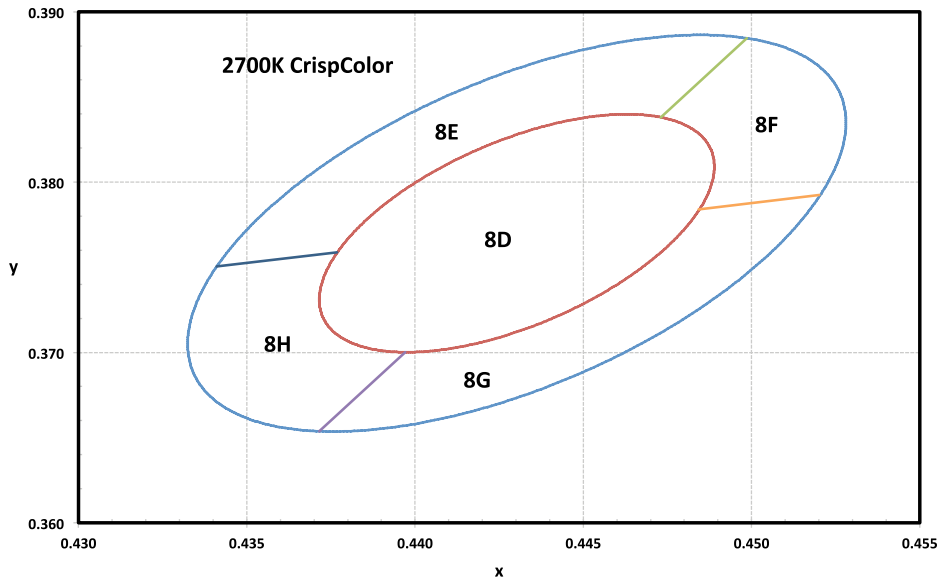


Figure 8a. 1/5<sup>th</sup> color bin structure for LUXEON 2835 with CrispColor Technology 2700K at  $T_j=25^\circ\text{C}$ .

Table 6a. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON 2835 with CrispColor Technology 2700K at  $T_j=25^\circ\text{C}$ .

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>[1]</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, $\theta$
2700K	Single 3-step MacAdam ellipse	(0.443 0.377)	0.0081	0.0042	53.70°
2700K	Single 5-step MacAdam ellipse	(0.443 0.377)	0.0135	0.0070	53.70°

Notes for Table 6a:

1. Lumileds maintains a tolerance of  $\pm 0.007$  on x and y color coordinates in the CIE 1931 color space.

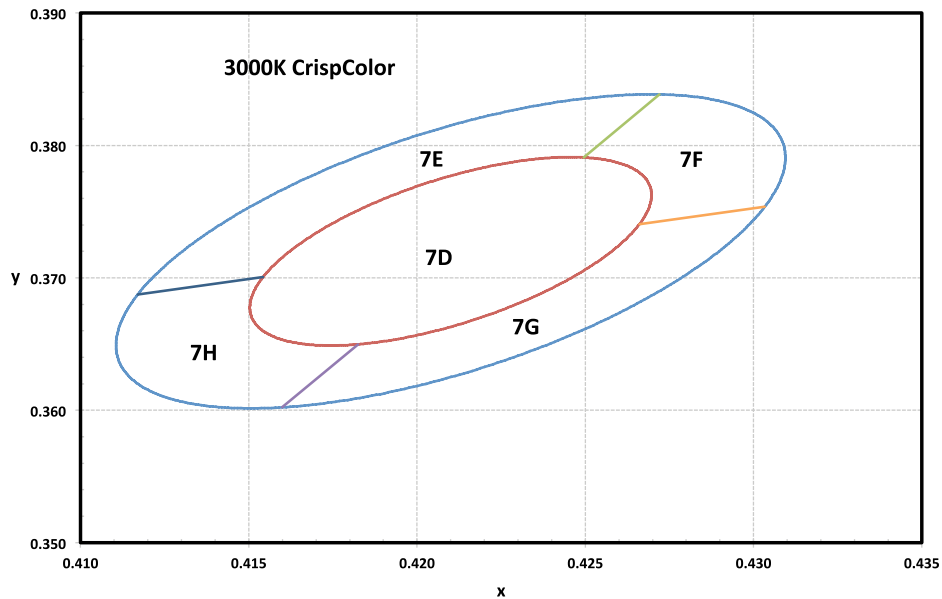


Figure 8b. 1/5<sup>th</sup> color bin structure for LUXEON 2835 with CrispColor Technology 3000K at  $T_j=25^\circ\text{C}$ .

Table 6b. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON 2835 with CrispColor Technology 3000K at  $T_j=25^\circ\text{C}$ .

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>[1]</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, $\theta$
3000K	Single 3-step MacAdam ellipse	(0.421, 0.372)	0.00834	0.00408	53.22°
3000K	Single 5-step MacAdam ellipse	(0.421, 0.372)	0.01390	0.00680	53.22°

Notes for Table 6b:

1. Lumileds maintains a tolerance of  $\pm 0.007$  on x and y color coordinates in the CIE 1931 color space.

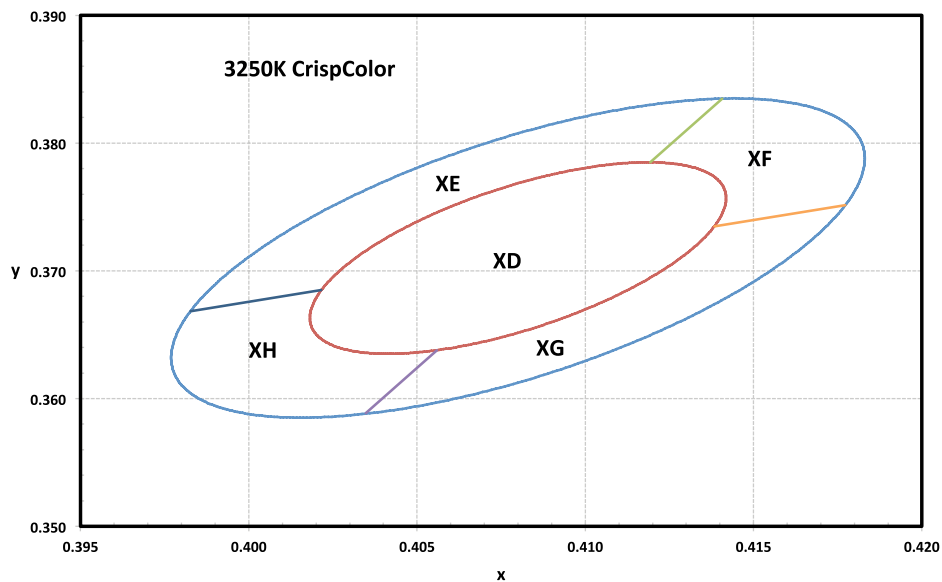


Figure 8c. 1/5<sup>th</sup> color bin structure for LUXEON 2835 with CrispColor Technology 3250K at  $T_j=25^\circ\text{C}$ .

Table 6c. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON 2835 with CrispColor Technology 3250K at  $T_j=25^\circ\text{C}$ .

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>[1]</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, $\theta$
3250K	Single 3-step MacAdam ellipse	(0.408, 0.371)	0.00881	0.00411	53.61°
3250K	Single 5-step MacAdam ellipse	(0.408, 0.371)	0.01468	0.00685	53.61°

Notes for Table 6c:

1. Lumileds maintains a tolerance of  $\pm 0.007$  on x and y color coordinates in the CIE 1931 color space.

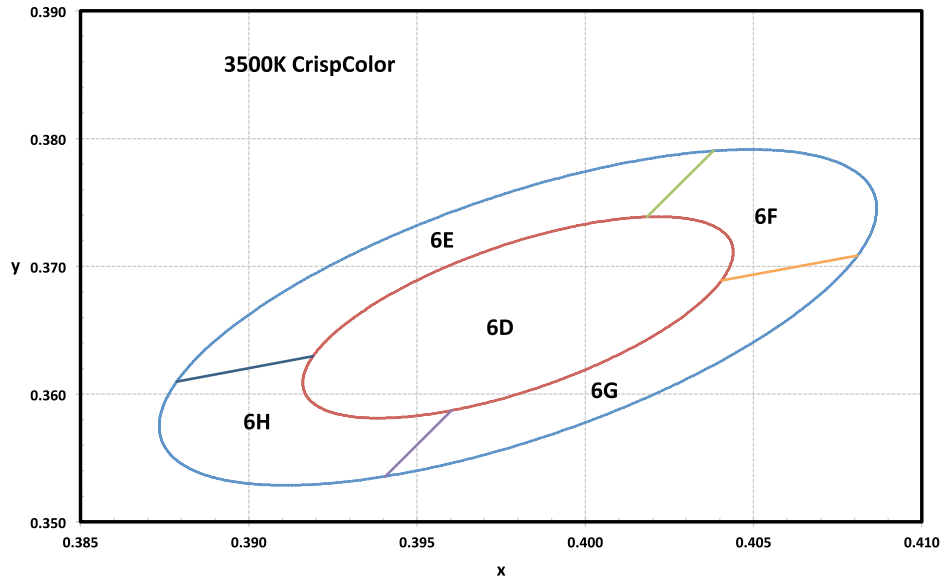


Figure 8d. 1/5<sup>th</sup> color bin structure for LUXEON 2835 with CrispColor Technology 3500K at  $T_j=25^\circ\text{C}$ .

Table 6d. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON 2835 with CrispColor Technology 3500K at  $T_j=25^\circ\text{C}$ .

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>[1]</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, $\Theta$
3500K	Single 3-step MacAdam ellipse	(0.398, 0.366)	0.00927	0.00414	54.00°
3500K	Single 5-step MacAdam ellipse	(0.398, 0.366)	0.01545	0.00690	54.00°

Notes for Table 6d:

1. Lumileds maintains a tolerance of  $\pm 0.007$  on x and y color coordinates in the CIE 1931 color space.

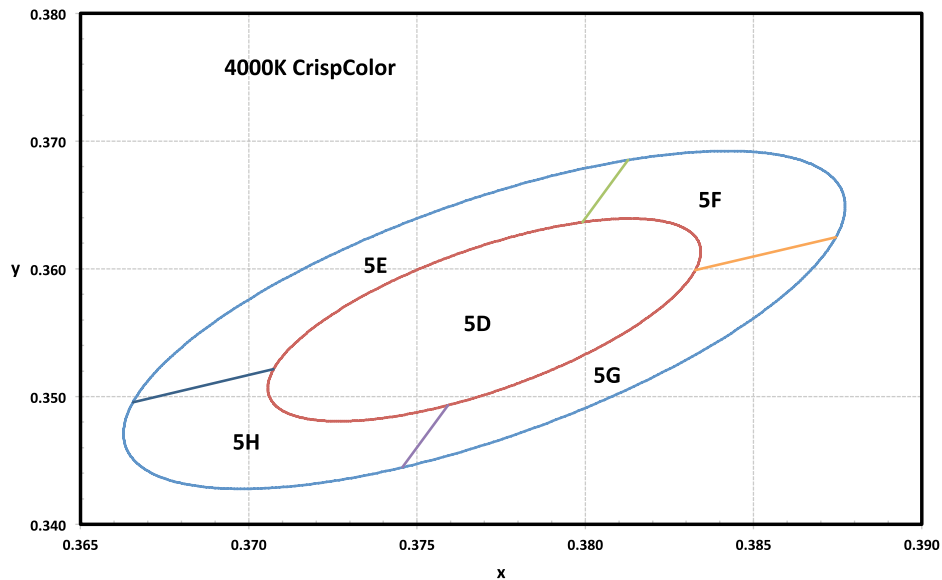


Figure 8e. 1/5<sup>th</sup> color bin structure for LUXEON 2835 with CrispColor Technology 4000K at  $T_j=25^\circ\text{C}$ .

Table 6e. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON 2835 with CrispColor Technology 4000K at  $T_j=25^\circ\text{C}$ .

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>[1]</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, $\Theta$
4000K	Single 3-step MacAdam ellipse	(0.377, 0.356)	0.00939	0.00402	53.72°
4000K	Single 5-step MacAdam ellipse	(0.377, 0.356)	0.01565	0.00670	53.72°

Notes for Table 6e:

1. Lumileds maintains a tolerance of  $\pm 0.007$  on x and y color coordinates in the CIE 1931 color space.

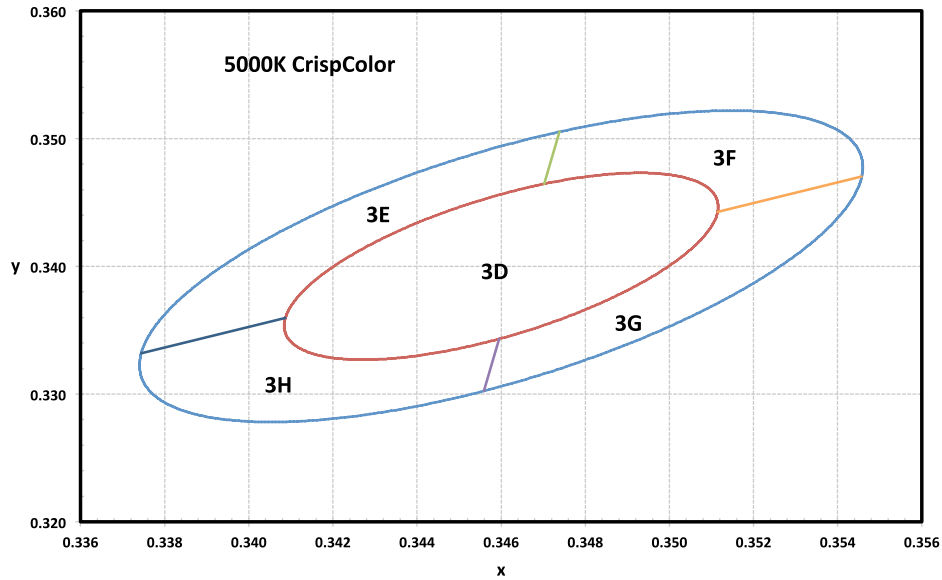


Figure 8f. 1/5<sup>th</sup> color bin structure for LUXEON 2835 with CrispColor Technology 5000K at  $T_j=25^\circ\text{C}$ .

Table 6f. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON 2835 with CrispColor Technology 5000K at  $T_j=25^\circ\text{C}$ .

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>[1]</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, $\theta$
5000K	Single 3-step MacAdam ellipse	(0.346, 0.340)	0.00822	0.00354	59.62°
5000K	Single 5-step MacAdam ellipse	(0.346, 0.340)	0.01370	0.00590	59.62°

Notes for Table 6f:

1. Lumileds maintains a tolerance of  $\pm 0.007$  on x and y color coordinates in the CIE 1931 color space.

## Forward Voltage Bins

Table 7. Forward voltage bin definitions for LUXEON 2835 with CrispColor Technology,  $T_j=25^\circ\text{C}$ .

PRODUCT	BIN	FORWARD VOLTAGE <sup>[1]</sup> ( $V_f$ )	
		MINIMUM	MAXIMUM
LUXEON 2835C	V	2.9	3.0
	W	3.0	3.1
	X	3.1	3.2
	Y	3.2	3.3

Notes for Table 7:

1. Lumileds maintains a tolerance of  $\pm 0.10\text{V}$  on forward voltage measurements.

# Mechanical Dimensions

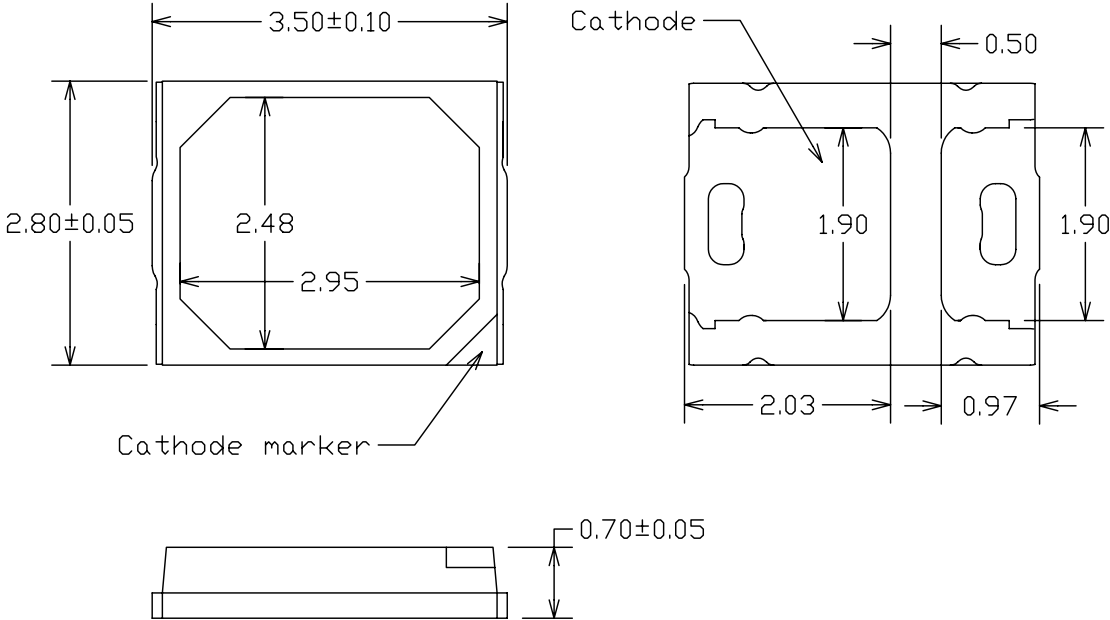


Figure 9. Mechanical dimensions for LUXEON 2835 with CrispColor Technology.

- Notes for Figure 9:
1. Drawings are not to scale.
  2. All dimensions are in millimeters.

# Reflow Soldering Guidelines

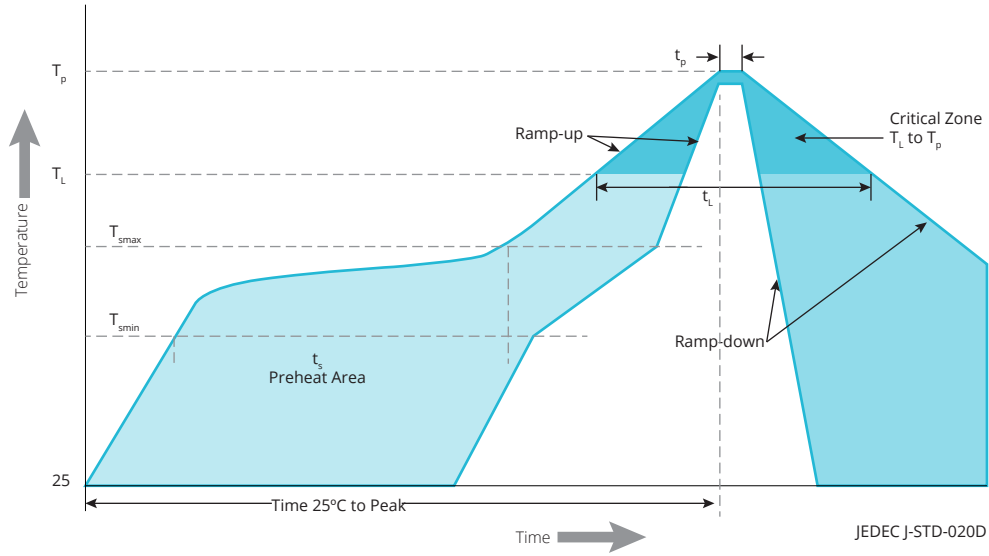


Figure 10. Visualization of the acceptable reflow temperature profile as specified in Table 8.

Table 8. Reflow profile characteristics for LUXEON 2835 with CrispColor Technology.

PROFILE FEATURE	LEAD-FREE ASSEMBLY
Preheat Minimum Temperature ( $T_{smin}$ )	150°C
Preheat Maximum Temperature ( $T_{smax}$ )	200°C
Preheat Time ( $t_{smin}$ to $t_{smax}$ )	60 to 120 seconds
Ramp-Up Rate ( $T_L$ to $T_p$ )	3°C / second maximum
Liquidus Temperature ( $T_L$ )	217°C
Time Maintained Above Temperature $T_L$ ( $t_t$ )	60 to 150 seconds
Peak / Classification Temperature ( $T_p$ )	260°C
Time Within 5°C of Actual Temperature ( $t_p$ )	20 to 40 seconds
Ramp-Down Rate ( $T_p$ to $T_L$ )	6°C / second maximum
Time 25°C to Peak Temperature	8 minutes maximum

## JEDEC Moisture Sensitivity

Table 9. Moisture sensitivity levels for LUXEON 2835 with CrispColor Technology.

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS STANDARD	
	TIME	CONDITIONS	TIME	CONDITIONS
3	168 Hours	≤30°C / 60% RH	192 Hours +5 / -0	30°C / 60% RH



## Solder Pad Design

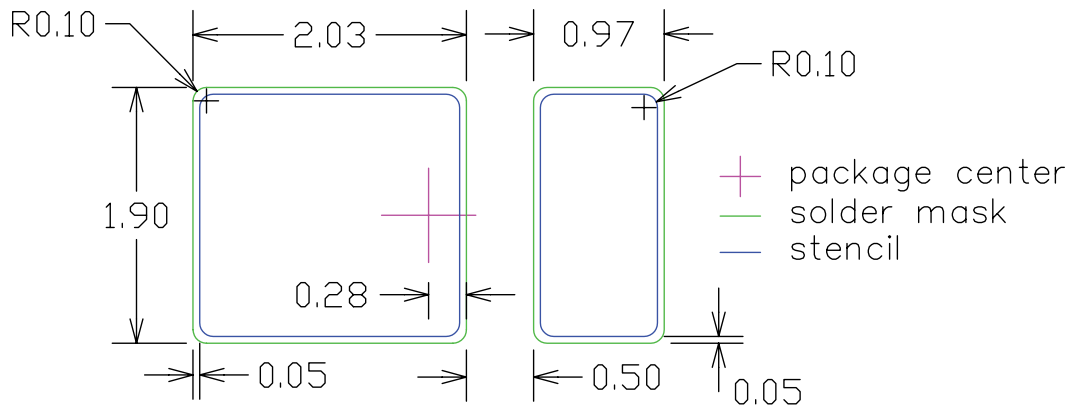


Figure 11. Recommended PCB solder pad layout for LUXEON 2835 with CrispColor Technology.

### Notes for Figure 11:

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

## Packaging Information

### Pocket Tape Dimensions

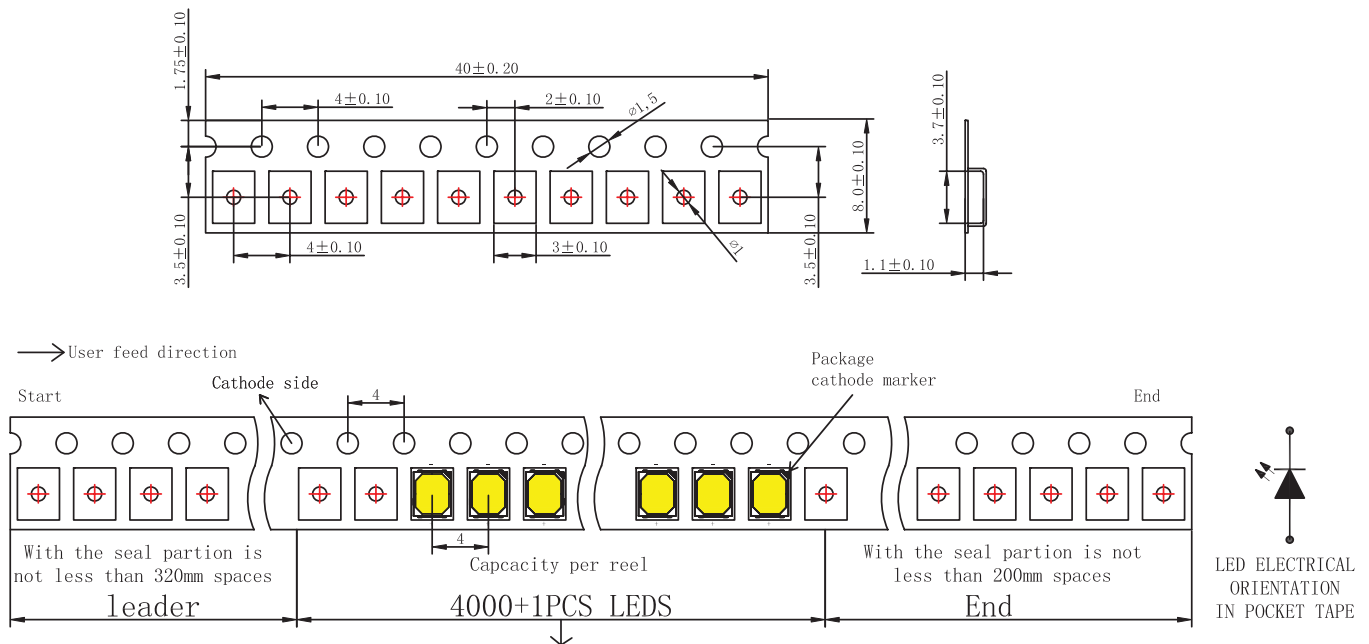


Figure 12. Pocket tape dimensions for LUXEON 2835 with CrispColor Technology.

### Notes for Figure 12:

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

# Reel Dimensions

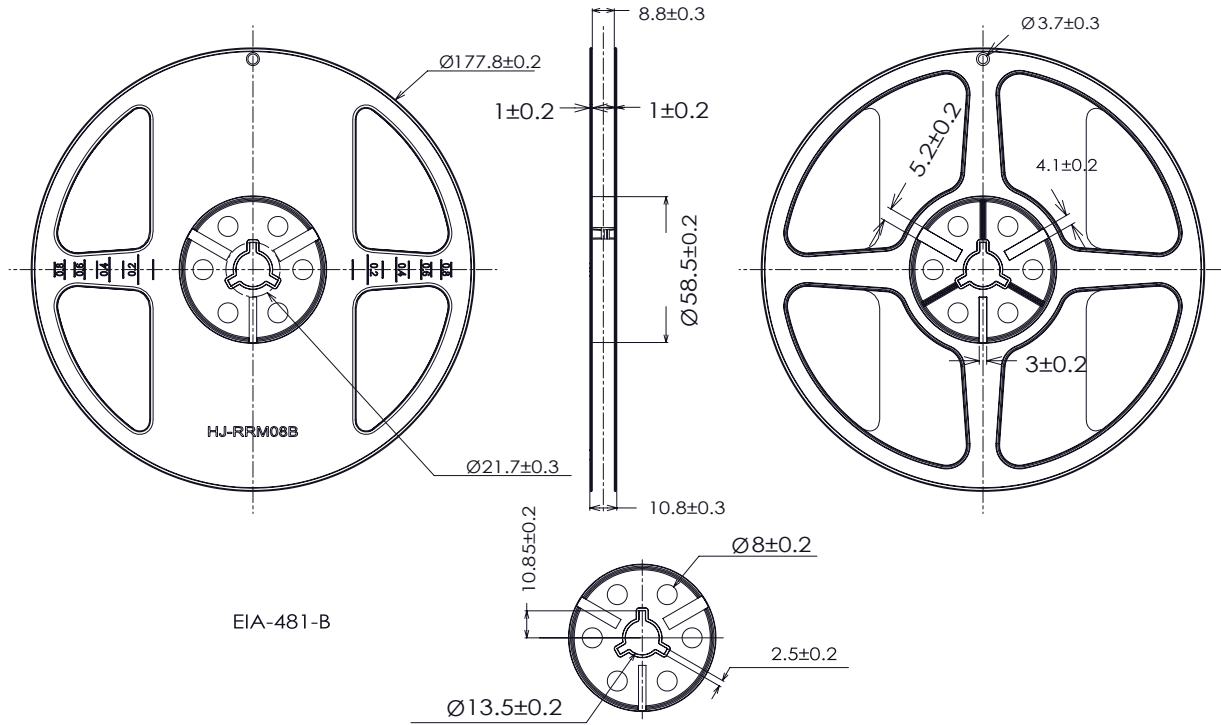


Figure 13. Reel dimensions for LUXEON 2835 with CrispColor Technology.

**Notes for Figure 13:**

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

## 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 safer, better and more beautiful—with light.

To learn more about our lighting solutions, visit [lumileds.com](http://lumileds.com).



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