



# LUXEON 5050

High efficacy and lumens in a multi-die, high power package, enabling low system costs



LUXEON 5050 is a multi-die, high power package that provides high luminance from a single package to enable cost effective, single optic and directional fixture designs. LUXEON 5050 uses an industry standard 5050 surface mount package with the smallest round Light Emitting Surface (LES). LUXEON 5050 comes in 70CRI, 80CRI and 90CRI with a wide range of CCTs, and offers hot-color targeting to ensure that the LEDs are within color target at application conditions of 85°C.

## FEATURES AND BENEFITS

- Small LES (4.6mm) enables good optic design for great punch
- Enables highest efficacy system design by driving at low current
- Hot-color targeting ensures color is within ANSI bin at 85°C
- Binned within 3-step and 5-step MacAdam ellipse, ensuring color uniformity
- Compatible with low cost and high efficacy drivers

## PRIMARY APPLICATIONS

- Downlights
- High Bay & Low Bay
- Lamps
- Outdoor
- Spotlights

# Table of Contents

<b>General Product Information</b> .....	<b>2</b>
Product Test Conditions .....	2
Part Number Nomenclature .....	2
Lumen Maintenance .....	2
Environmental Compliance .....	2
<b>Performance Characteristics</b> .....	<b>3</b>
Product Selection Guide .....	3
Optical Characteristics .....	4
Electrical and Thermal Characteristics .....	4
<b>Absolute Maximum Ratings</b> .....	<b>4</b>
<b>Characteristic Curves</b> .....	<b>5</b>
Spectral Power Distribution Characteristics .....	5
Light Output Characteristics .....	6
Forward Current Characteristics .....	8
Radiation Pattern Characteristics .....	9
<b>Product Bin and Labeling Definitions</b> .....	<b>10</b>
Decoding Product Bin Labeling .....	10
Luminous Flux Bins .....	10
Color Bin Definitions .....	11
Forward Voltage Bins .....	12
<b>Mechanical Dimensions</b> .....	<b>12</b>
<b>Reflow Soldering Guidelines</b> .....	<b>13</b>
JEDEC Moisture Sensitivity .....	13
Solder Pad Design .....	14
<b>Packaging Information</b> .....	<b>14</b>
Pocket Tape Dimensions .....	14
Reel Dimensions .....	15

# General Product Information

## Product Test Conditions

LUXEON 5050 LEDs are tested with a 20ms monopulse of 160mA for LUXEON 5050 24V and 640mA for LUXEON 5050 6V at a junction temperature,  $T_j$ , of 25°C. Forward voltage and luminous flux are binned at a  $T_j$  of 25°C, while color is not targeted at a  $T_j$  of 85°C.

## Part Number Nomenclature

Part numbers for LUXEON 5050 follow the convention below:

L 1 5 0 – **A A B B** 5 0 **C C** 0 0 0 0 0

Where:

- A A** – designates nominal ANSI CCT (22=2200K, 27=2700K, 30=3000K, 35=3500K 40=4000K, 50=5000K, 57=5700K, 65=6500K)
- B B** – designates minimum CRI (70=70CRI, 80=80CRI, 90=90CRI)
- C C** – designates voltage (06=6V, 24=24V)

Therefore, the following part number is used for a LUXEON 5050, 3000K 80CRI, 24V:

L 1 5 0 – **3 0 8 0** 5 0 **2 4** 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 5050 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 5050 at test current,  $T_j=25^\circ\text{C}$ .

VOLTAGE	NOMINAL CCT <sup>[1]</sup>	MINIMUM CRI <sup>[2, 3]</sup>	LUMINOUS FLUX <sup>[2, 3]</sup> (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	TEST CURRENT (mA)	PART NUMBER
			MINIMUM	TYPICAL			
24V	2200K	70	515	550	140	160	L150-2270502400000
	2700K	70	535	600	153	160	L150-2770502400000
	3000K	70	553	620	158	160	L150-3070502400000
	3500K	70	600	635	162	160	L150-3570502400000
	4000K	70	580	650	166	160	L150-4070502400000
	5000K	70	580	650	166	160	L150-5070502400000
	5700K	70	570	650	166	160	L150-5770502400000
	6500K	70	570	650	166	160	L150-6570502400000
	2200K	80	440	475	121	160	L150-2280502400000
	2700K	80	500	560	143	160	L150-2780502400000
	3000K	80	516	585	149	160	L150-3080502400000
	3500K	80	527	595	152	160	L150-3580502400000
	4000K	80	539	610	156	160	L150-4080502400000
	5000K	80	539	610	156	160	L150-5080502400000
	5700K	80	539	610	156	160	L150-5780502400000
	6500K	80	539	610	156	160	L150-6580502400000
	2700K	90	414	471	120	160	L150-2790502400000
	3000K	90	428	486	124	160	L150-3090502400000
	3500K	90	445	506	129	160	L150-3590502400000
	4000K	90	456	526	134	160	L150-4090502400000
	5000K	90	456	526	134	160	L150-5090502400000
5700K	90	456	526	134	160	L150-5790502400000	
6V	2200K	70	515	550	140	640	L150-2270500600000
	2700K	70	535	600	153	640	L150-2770500600000
	3000K	70	553	620	158	640	L150-3070500600000
	3500K	70	600	635	162	640	L150-3570500600000
	4000K	70	580	650	166	640	L150-4070500600000
	5000K	70	580	650	166	640	L150-5070500600000
	5700K	70	570	650	166	640	L150-5770500600000
	6500K	70	570	650	166	640	L150-6570500600000
	2200K	80	440	475	121	640	L150-2280500600000
	2700K	80	500	560	143	640	L150-2780500600000
	3000K	80	516	585	149	640	L150-3080500600000
	3500K	80	527	595	152	640	L150-3580500600000
	4000K	80	539	610	156	640	L150-4080500600000
	5000K	80	539	610	156	640	L150-5080500600000
	5700K	80	539	610	156	640	L150-5780500600000
	6500K	80	539	610	156	640	L150-6580500600000
	2700K	90	414	471	120	640	L150-2790500600000
	3000K	90	428	486	124	640	L150-3090500600000
	3500K	90	445	506	129	640	L150-3590500600000
	4000K	90	456	526	134	640	L150-4090500600000
	5000K	90	456	526	134	640	L150-5090500600000
5700K	90	456	526	134	640	L150-5790500600000	

**Notes for Table 1:**

1. Correlated color temperature is not targeted at  $T_j=85^\circ\text{C}$ .
2. Luminous flux and CRI are based upon mounted package on highly reflective surface at  $T_j=25^\circ\text{C}$ . Typical CRI is approximately 2 points higher than the minimum CRI specified, but this is not guaranteed.
3. Lumileds maintains a tolerance of  $\pm 2$  on CRI and  $\pm 7\%$  on luminous flux measurements.

## Optical Characteristics

Table 2. Optical characteristics for LUXEON 5050 at test current,  $T_j=25^{\circ}\text{C}$ .

PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup>	TYPICAL VIEWING ANGLE <sup>[2]</sup>
L150-xxxx50xx00000	138°	116°

Notes for Table 2:

- Total angle at which 90% of total luminous flux is captured.
- 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 5050 at test current,  $T_j=25^{\circ}\text{C}$ .

PART NUMBER	FORWARD VOLTAGE <sup>[1]</sup> ( $V_f$ )			TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE <sup>[2]</sup> (mV/°C)	TYPICAL THERMAL RESISTANCE—JUNCTION TO SOLDER PAD (°C/W)
	MINIMUM	TYPICAL	MAXIMUM		
L150-xxxx502400000	23.5	24.5	26.5	-12	2
L150-xxxx500600000	5.8	6.1	6.6	-3	2

Notes for Table 3:

- Lumileds maintains a tolerance of  $\pm 1\%$  on forward voltage measurements.
- Measured between  $25^{\circ}\text{C}$  and  $85^{\circ}\text{C}$ .

## Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON 5050.

PARAMETER	MAXIMUM PERFORMANCE
DC Forward Current <sup>[1,2]</sup>	240mA for 24V 800mA for 6V
Peak Pulsed Forward Current <sup>[1,3]</sup>	300mA for 24V 1000mA for 6V
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>	105°C
LED Storage Temperature	-40°C to 105°C
Allowable Reflow Cycles	3
Reverse Voltage ( $V_{\text{reverse}}$ )	LUXEON LEDs are not designed to be driven in reverse bias

Notes for Table 4:

- Proper current derating must be observed to maintain the junction temperature below the maximum allowable junction temperature.
- 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
- At 10% duty cycle with pulse width of 10ms.

# Characteristic Curves

## Spectral Power Distribution Characteristics

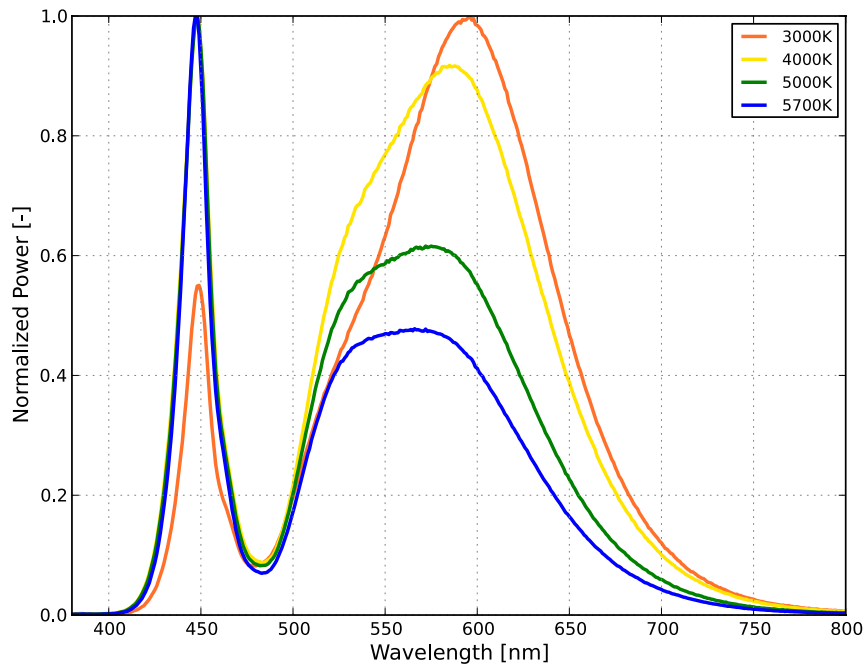


Figure 1a. Typical normalized power vs. wavelength for L150-xx7050xx00000 at test current,  $T_j = 25^\circ\text{C}$ .

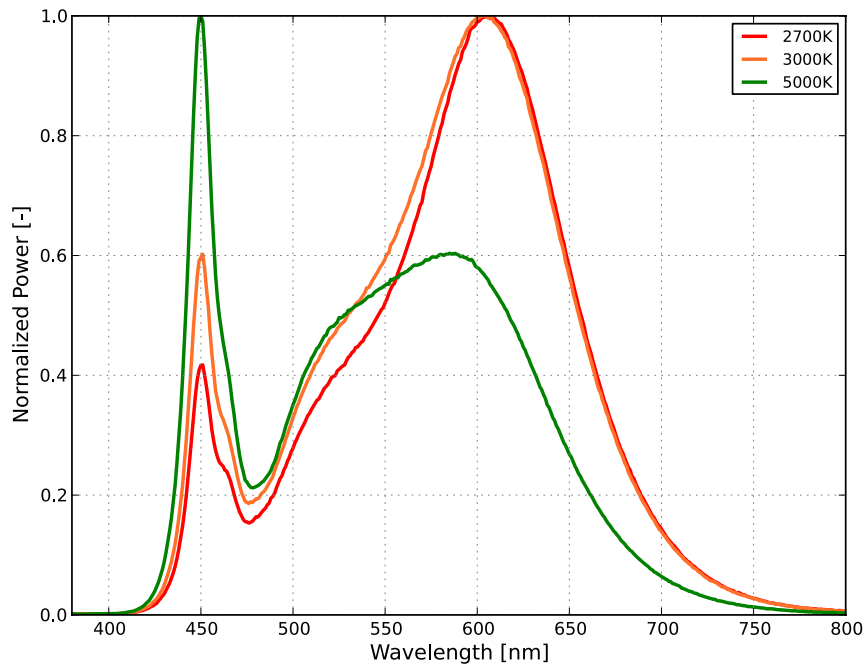


Figure 1b. Typical normalized power vs. wavelength for L150-xx8050xx00000 at test current,  $T_j = 25^\circ\text{C}$ .

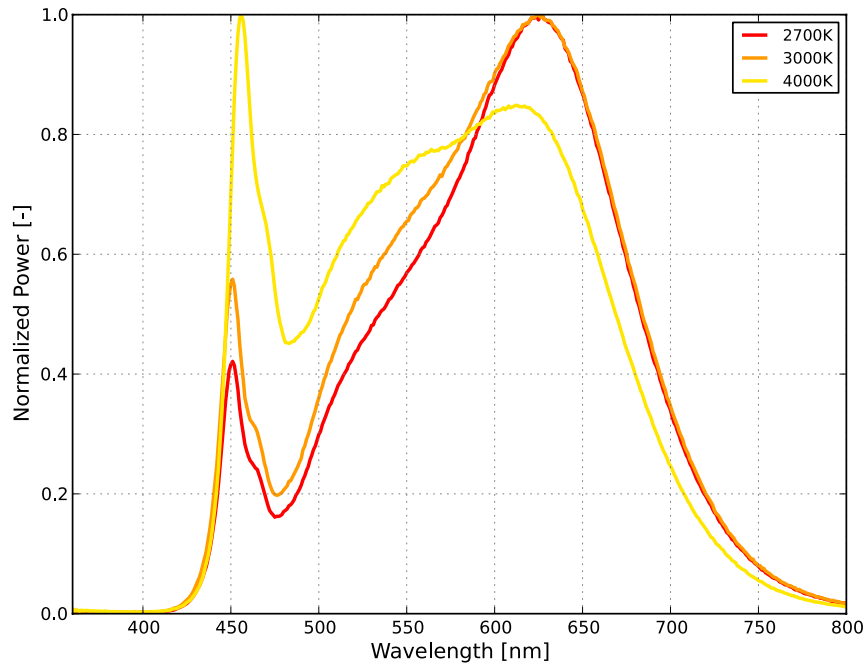


Figure 1c. Typical normalized power vs. wavelength for L150-xx9050xx00000 at test current,  $T_j=25^\circ\text{C}$ .

## Light Output Characteristics

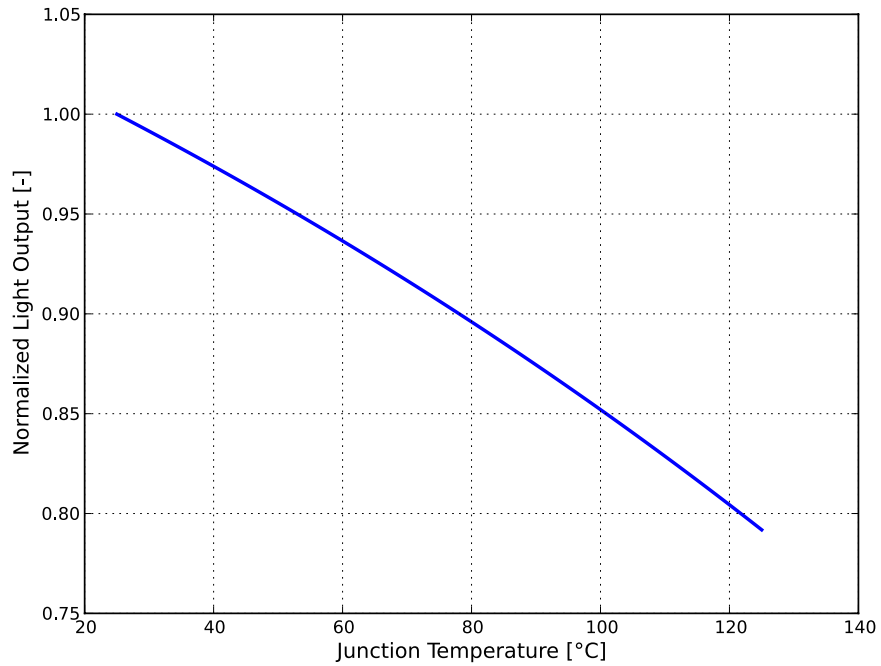


Figure 2. Typical normalized light output vs. junction temperature for L150-xxx50xx00000 at test current.

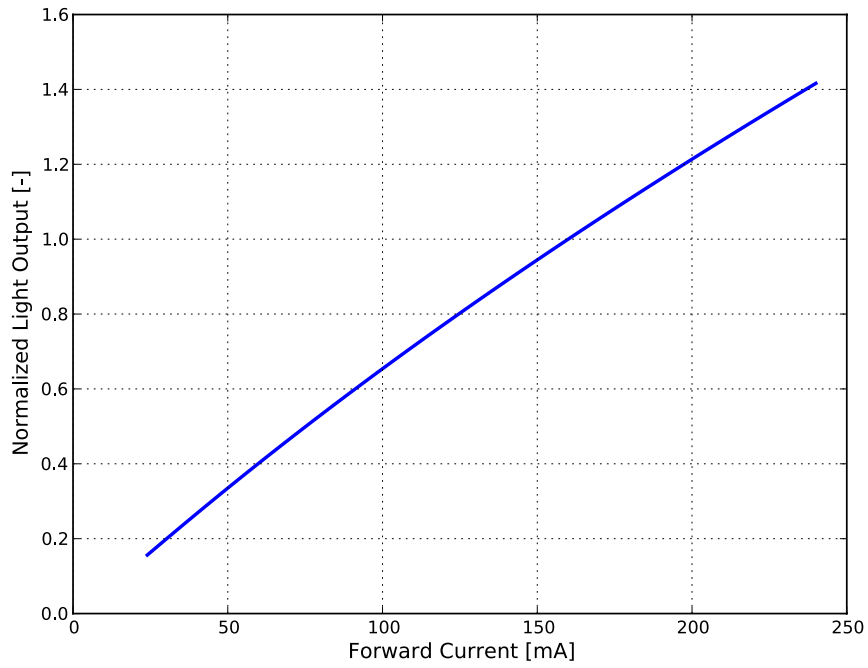


Figure 3a. Typical normalized light output vs. forward current for L150-xxxx502400000,  $T_j=25^\circ\text{C}$ .

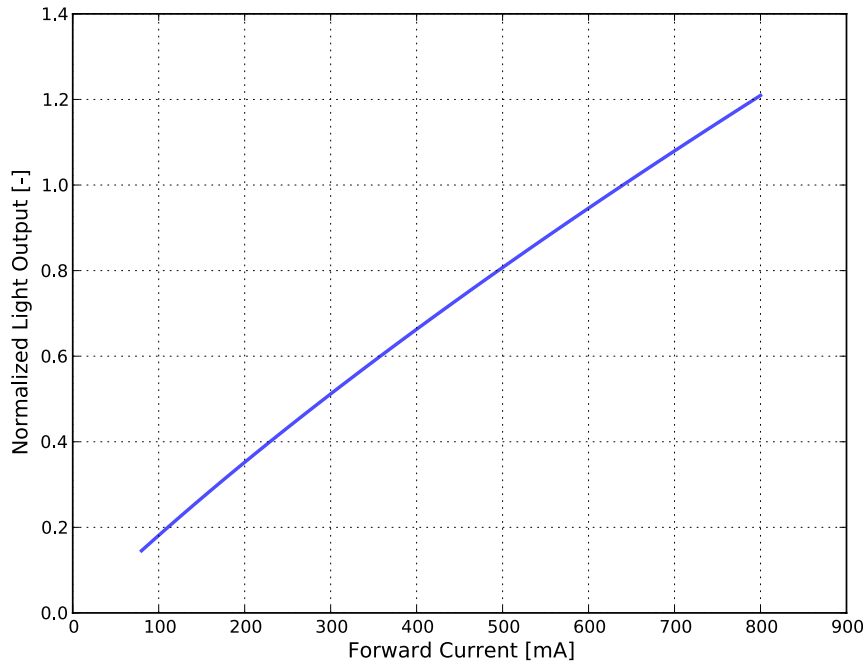


Figure 3b. Typical normalized light output vs. forward current for L150-xxxx500600000,  $T_j=25^\circ\text{C}$ .



# Forward Current Characteristics

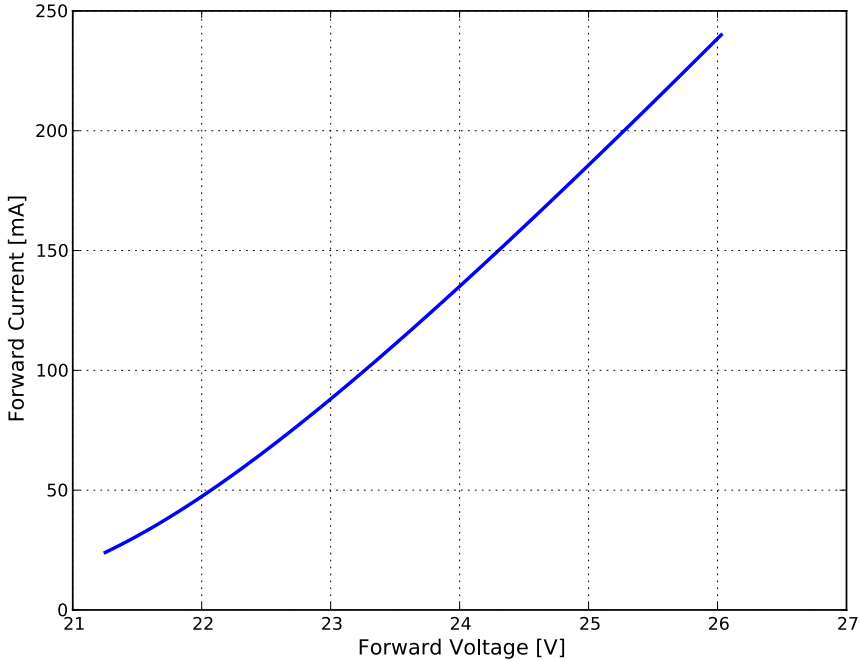


Figure 4a. Typical forward current vs. forward voltage for L150-xxxx502400000,  $T_j=25^\circ\text{C}$ .

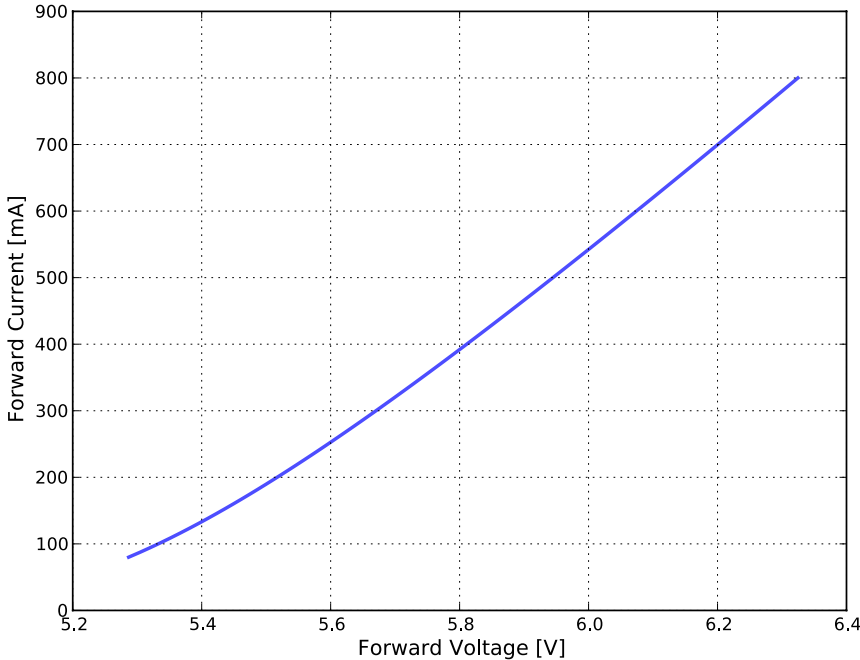


Figure 4b. Typical forward current vs. forward voltage for L150-xxxx500600000,  $T_j=25^\circ\text{C}$ .

# Radiation Pattern Characteristics

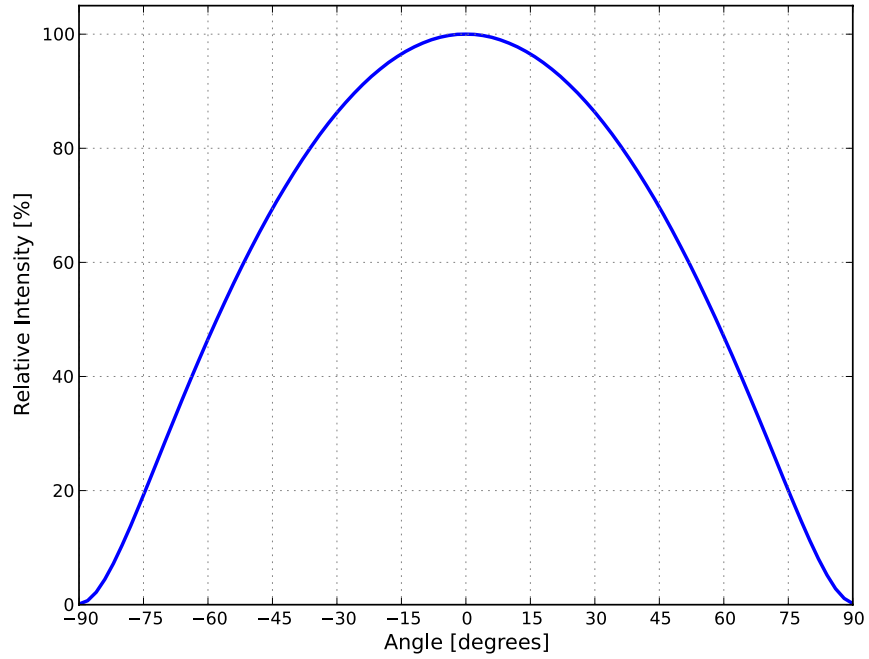


Figure 5. Typical radiation pattern for L150-xxxx50xx00000 at test current,  $T_j=25^{\circ}\text{C}$ .

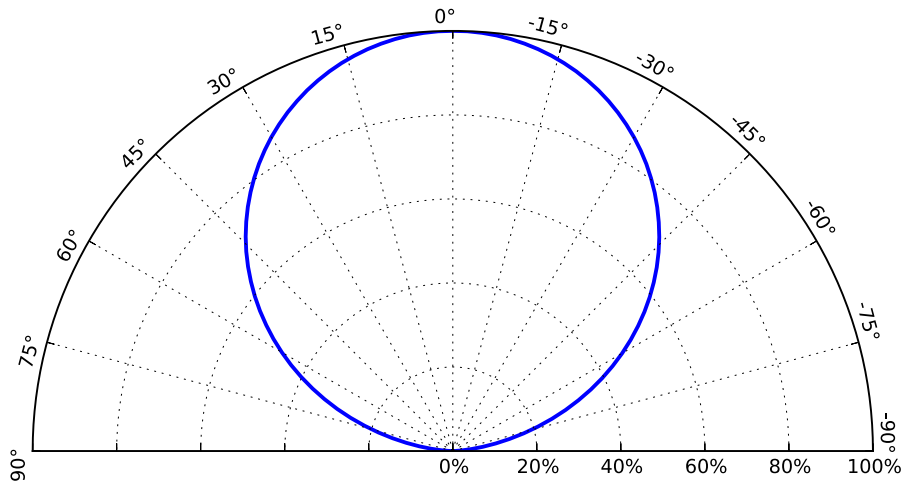


Figure 6. Typical polar radiation pattern for L150-xxxx50xx00000 at test current,  $T_j=25^{\circ}\text{C}$ .

# 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 5050 LEDs are labeled using a 4-digit alphanumeric CAT code following the format below:

**A B C C**

Where:

- A** – designates luminous flux bin (example: H=450 to 500 lumens, L=600 to 650 lumens)
- B** – designates color bin (example: (example: 3=3 SDCM, 5=5 SDCM parts)
- C C** – designates forward voltage bin (example: A1, A2, B1, B2)

Therefore, a LUXEON 5050 with a lumen range of 600 to 650, color bin of 3 and forward voltage range of 23.5 to 24.2V has the following CAT code:

**L 3 A 1**

## Luminous Flux Bins

Table 5 lists the standard luminous flux bins for LUXEON 5050 LEDs. 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 5050,  $T_j=25^\circ\text{C}$ .

BIN	LUMINOUS FLUX <sup>[1]</sup> (lm)	
	MINIMUM	MAXIMUM
G	400	450
H	450	500
J	500	550
K	550	600
L	600	650
M	650	700
N	700	750

**Notes for Table 5:**

1. Lumileds maintains a tolerance of  $\pm 7\%$  on luminous flux measurements.

## Color Bin Definitions

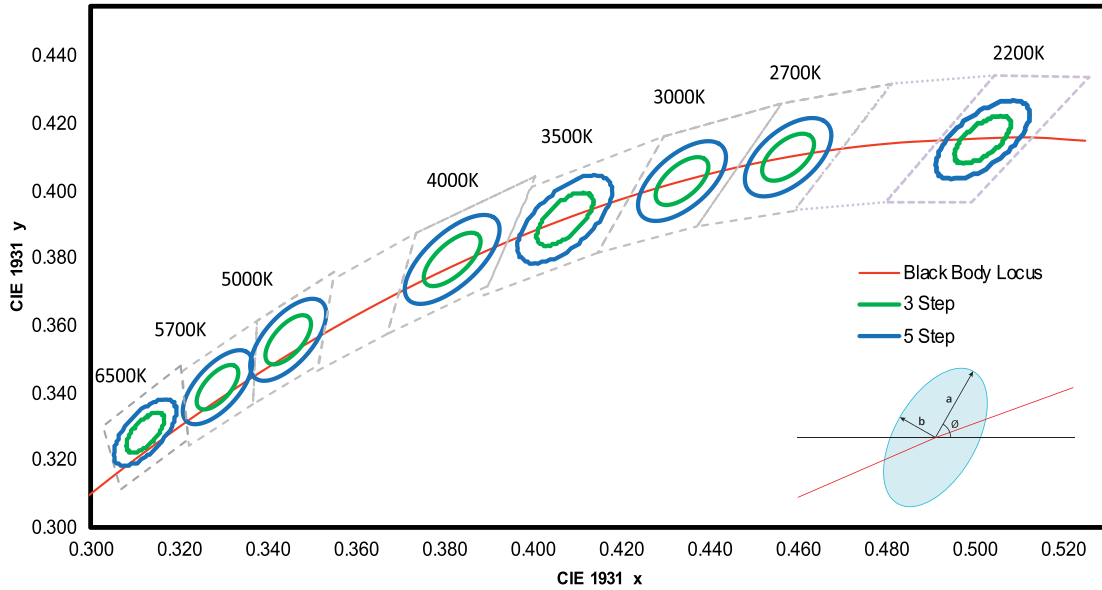


Figure 7. 3- and 5-step MacAdam ellipse illustration for hot-color targeting expected at 85°C.

Table 6. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON 5050 at test current, hot-color targeted at  $T_j=85^\circ\text{C}$ .

NOMINAL CCT	COLOR SPACE	CENTER POINT <sup>[1]</sup> (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, $\theta$
2200K	Single 3-step MacAdam ellipse	(0.5018, 0.4153)	0.008625	0.003975	49.27°
2700K	Single 3-step MacAdam ellipse	(0.4578, 0.4101)	0.00810	0.00420	53.70°
3000K	Single 3-step MacAdam ellipse	(0.4338, 0.4030)	0.00834	0.00408	53.22°
3500K	Single 3-step MacAdam ellipse	(0.4073, 0.3917)	0.00927	0.00414	54.00°
4000K	Single 3-step MacAdam ellipse	(0.3818, 0.3797)	0.00939	0.00402	53.72°
5000K	Single 3-step MacAdam ellipse	(0.3447, 0.3558)	0.00822	0.00354	59.62°
5700K	Single 3-step MacAdam ellipse	(0.3287, 0.3417)	0.00745	0.00320	59.09°
6500K	Single 3-step MacAdam ellipse	(0.3123, 0.3282)	0.00669	0.00285	58.57°
2700K	Single 5-step MacAdam ellipse	(0.4578, 0.4101)	0.01350	0.00700	53.70°
3000K	Single 5-step MacAdam ellipse	(0.4338, 0.4030)	0.01390	0.00680	53.22°
3500K	Single 5-step MacAdam ellipse	(0.4073, 0.3917)	0.01545	0.00690	54.00°
4000K	Single 5-step MacAdam ellipse	(0.3818, 0.3797)	0.01565	0.00670	53.72°
5000K	Single 5-step MacAdam ellipse	(0.3447, 0.3558)	0.01370	0.00590	59.62°
5700K	Single 5-step MacAdam ellipse	(0.3287, 0.3417)	0.01243	0.00533	59.09°
6500K	Single 5-step MacAdam ellipse	(0.3123, 0.3282)	0.01115	0.00475	58.57°

**Notes for Table 6:**

1. Lumileds maintains a tolerance of  $\pm 0.01$  on x and y coordinates in the CIE 1931 color space.

# Forward Voltage Bins

Table 7. Forward voltage bin definitions for LUXEON 5050,  $T_j=25^{\circ}\text{C}$ .

PART NUMBER	BIN	FORWARD VOLTAGE <sup>(1)</sup> ( $V_f$ )	
		MINIMUM	MAXIMUM
L150-xxxx502400000	A1	23.5	24.2
	A2	24.2	25.0
	B1	25.0	25.8
	B2	25.8	26.5
L150-xxxx500600000	A1	5.8	6.0
	A2	6.0	6.2
	B1	6.2	6.4
	B2	6.4	6.6

**Notes for Table 7:**

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

# Mechanical Dimensions

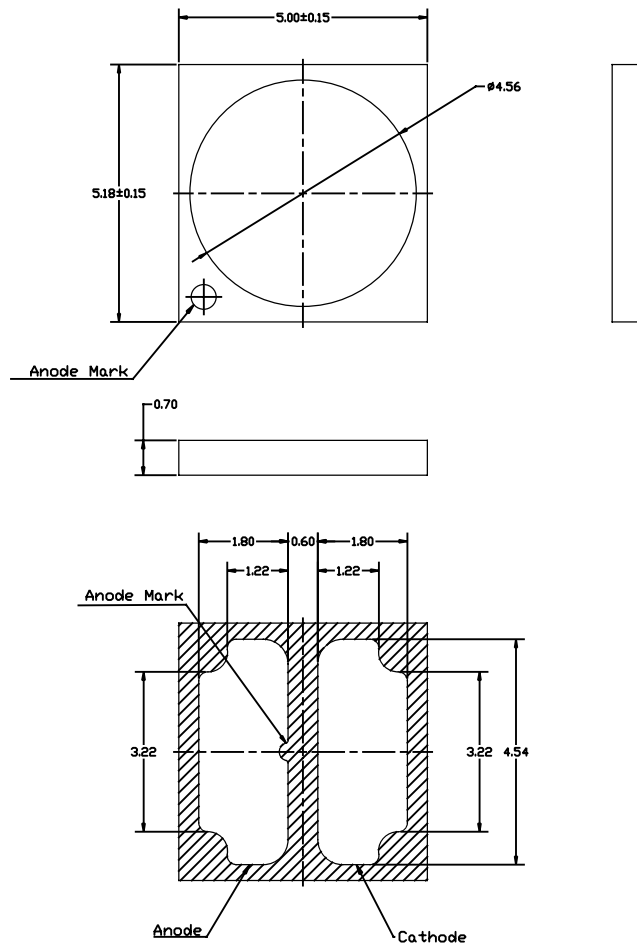


Figure 8. Mechanical dimensions for LUXEON 5050.

**Notes for Figure 8:**

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

# Reflow Soldering Guidelines

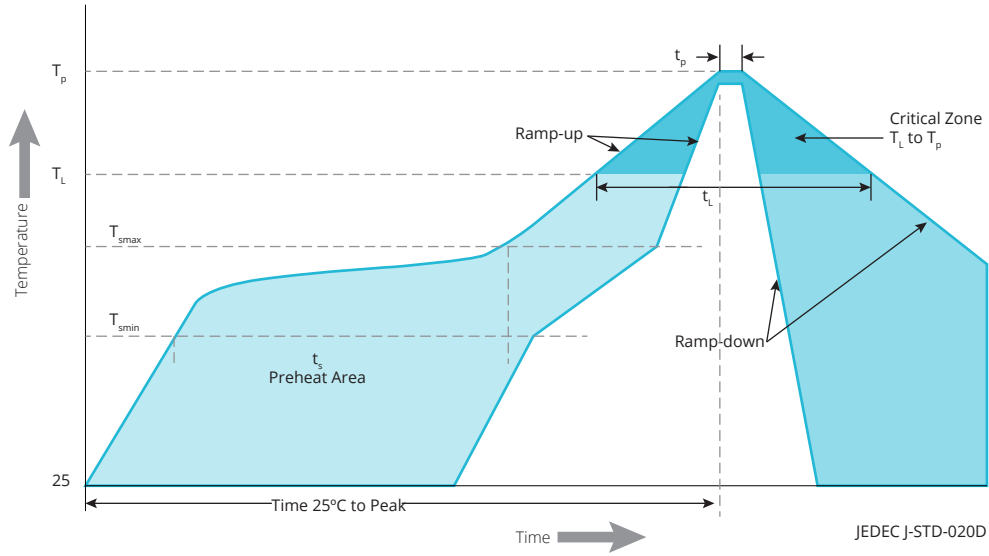


Figure 9. Visualization of the acceptable reflow temperature profile as specified in Table 8.

Table 8. Reflow profile characteristics for LUXEON 5050.

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 180 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 5050.

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

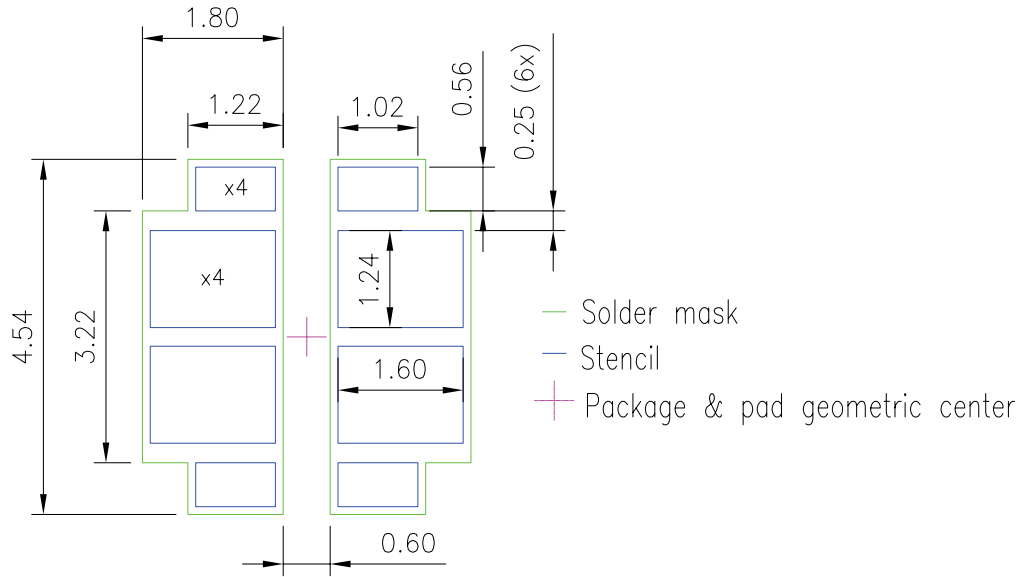


Figure 10. Recommended PCB solder pad layout for LUXEON 5050.

Notes for Figure 10:

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

# Packaging Information

## Pocket Tape Dimensions

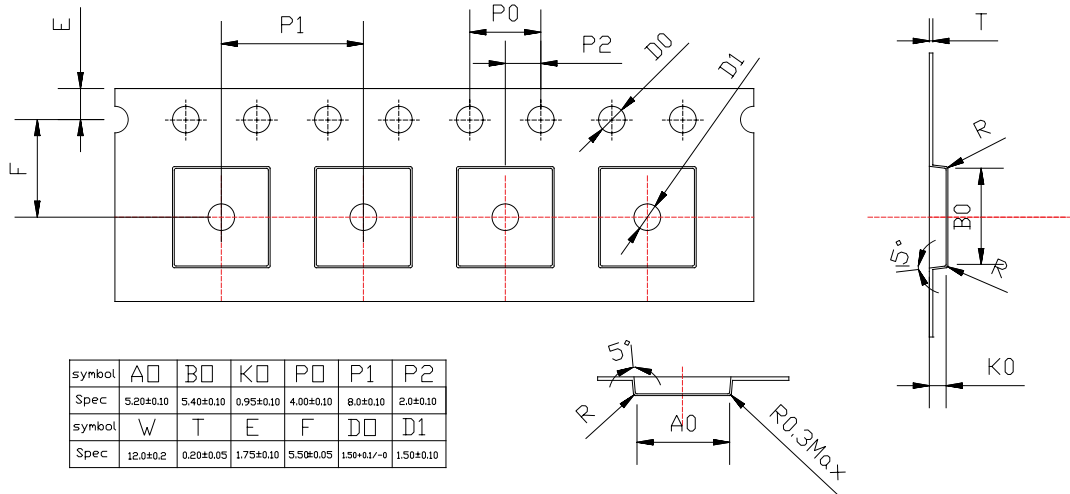


Figure 11. Pocket tape dimensions for LUXEON 5050.

Notes for Figure 11:

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

# Reel Dimensions

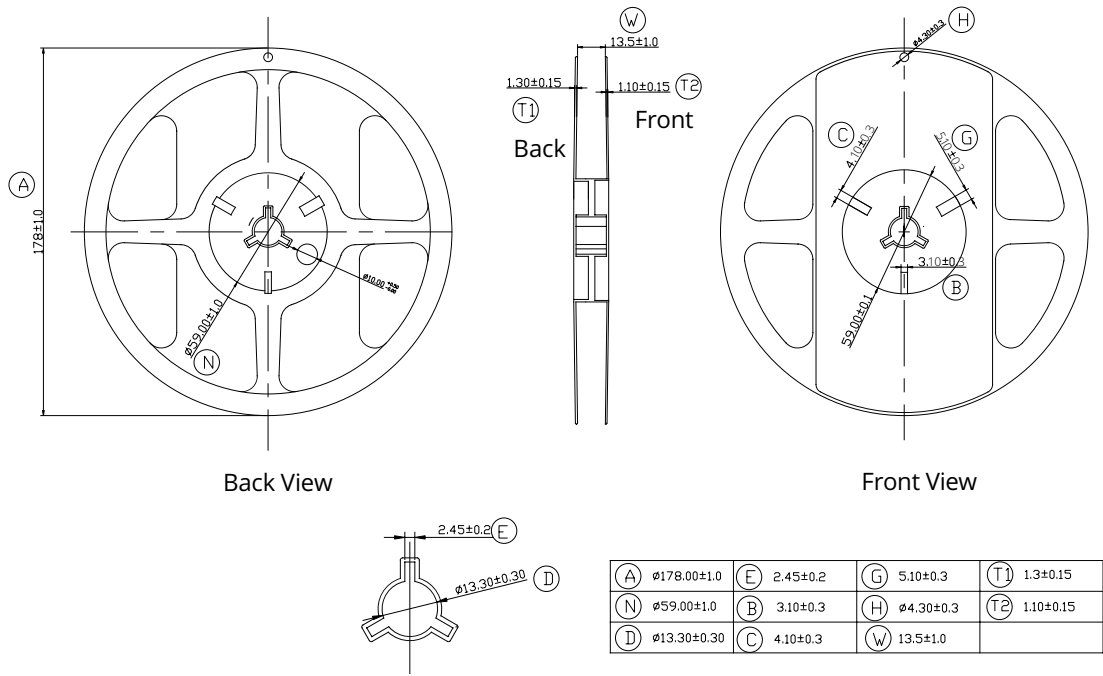


Figure 12. Reel dimensions for LUXEON 5050.

**Notes for Figure 12:**

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 better, safer, more beautiful—with light.

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



©2018 Lumileds Holding B.V. All rights reserved.  
LUXEON is a registered trademark of the Lumileds Holding B.V. in the United States and other countries.

[lumileds.com](http://lumileds.com)

Neither Lumileds Holding B.V. nor its affiliates shall be liable for any kind of loss of data or any other damages, direct, indirect or consequential, resulting from the use of the provided information and data. Although Lumileds Holding B.V. and/or its affiliates have attempted to provide the most accurate information and data, the materials and services information and data are provided "as is," and neither Lumileds Holding B.V. nor its affiliates warrants or guarantees the contents and correctness of the provided information and data. Lumileds Holding B.V. and its affiliates reserve the right to make changes without notice. You as user agree to this disclaimer and user agreement with the download or use of the provided materials, information and data. A listing of Lumileds product/patent coverage may be accessed at [lumileds.com/patents](http://lumileds.com/patents).