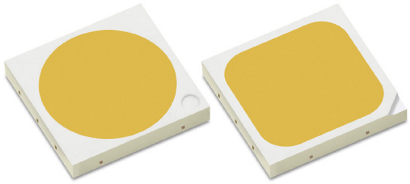
LUXEON 5050

High efficacy and superior robustness in a multi-die, high power package, enabling cost-effective system design



LUXEON 5050 is a multi-die, high power package that provides high luminance from a super robust package to enable cost effective, single optic and directional fixture designs. LUXEON 5050 uses an industry standard 5050 surface mount package with a small 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

- Superior lm/W enables outstanding efficacy in end application
- Extremely reliable package design affirms long lifetime in harsh environments [1]
- Two voltage configurations are compatible with low cost high efficacy drivers
- Low R_{th} enables effective thermal dissipation design for higher efficiency
- Hot-color targeting ensures color is within ANSI bin at 85°C
- 3-step and 5-step MacAdam ellipse binning structure ensures excellent color uniformity

PRIMARY APPLICATIONS

- High Bay
- Low Bay
- Floodlights
- Wall Pack
- More...

1. Refer to reliability datasheet for more details.

No. E352519

DS174 LUXEON 5050 Product Datasheet ©2019 Lumileds Holding B.V. All rights reserved.

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General Product Information

Product Test Conditions

LUXEON 5050 LEDs are tested with a 20ms monopulse specified below 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 hot-targeted at a T_j of 85°C.

160mA – LUXEON 5050 (Round LES) – 24V and LUXEON 5050 (Square LES) – 30V
640mA – LUXEON 5050 (Round LES) – 6V
800mA – LUXEON 5050 (Square LES) – 6V

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 **D** 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, 30=30V)

D – designates product type (0=Round LES, S=Square LES)

Therefore, the following part number is used for a LUXEON 5050 Square LES, 3000K 80CRI, 30V:

L 1 5 0 – **3 0 8 0** 5 0 **3 0** 0 0 0 **S** 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 specified test current, T_j=25°C.

PRODUCT	NOMINAL CCT [1]	MINIMUM CRI [2, 3]	LUMINOUS FLUX [2, 3] (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	TEST CURRENT (mA)	PART NUMBER
			MINIMUM	TYPICAL			
LUXEON 5050 (Round LES) 24V	2200K	70	515	550	140	160	L150-2270502400000
	2700K	70	535	605	154	160	L150-2770502400000
	3000K	70	553	625	159	160	L150-3070502400000
	3500K	70	600	635	162	160	L150-3570502400000
	4000K	70	580	655	167	160	L150-4070502400000
	5000K	70	580	655	167	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	550	140	160	L150-2780502400000
	3000K	80	516	590	151	160	L150-3080502400000
	3500K	80	527	595	152	160	L150-3580502400000
	4000K	80	539	615	157	160	L150-4080502400000
	5000K	80	539	615	157	160	L150-5080502400000
	5700K	80	539	615	157	160	L150-5780502400000
	6500K	80	539	615	157	160	L150-6580502400000
	2700K	90	414	475	121	160	L150-2790502400000
	3000K	90	428	490	125	160	L150-3090502400000
	3500K	90	445	510	130	160	L150-3590502400000
	4000K	90	456	530	135	160	L150-4090502400000
	5000K	90	456	530	135	160	L150-5090502400000
	5700K	90	456	530	135	160	L150-5790502400000
LUXEON 5050 (Round LES) 6V	2200K	70	515	550	140	640	L150-2270500600000
	2700K	70	535	605	154	640	L150-2770500600000
	3000K	70	553	625	159	640	L150-3070500600000
	3500K	70	600	635	162	640	L150-3570500600000
	4000K	70	580	655	167	640	L150-4070500600000
	5000K	70	580	655	167	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	550	140	640	L150-2780500600000
	3000K	80	516	590	151	640	L150-3080500600000
	3500K	80	527	595	152	640	L150-3580500600000
	4000K	80	539	615	157	640	L150-4080500600000
	5000K	80	539	615	157	640	L150-5080500600000
	5700K	80	539	615	157	640	L150-5780500600000
	6500K	80	539	615	157	640	L150-6580500600000
	2700K	90	414	475	121	640	L150-2790500600000
	3000K	90	428	490	125	640	L150-3090500600000
	3500K	90	445	510	130	640	L150-3590500600000
	4000K	90	456	530	135	640	L150-4090500600000
	5000K	90	456	530	135	640	L150-5090500600000
	5700K	90	456	530	135	640	L150-5790500600000

Table 1 continued on next page:

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

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Table 1. Product performance of LUXEON 5050 at specified test current, T_j=25°C, Continued.

PRODUCT	NOMINAL CCT [1]	MINIMUM CRI [2, 3]	LUMINOUS FLUX [2, 3] (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	TEST CURRENT (mA)	PART NUMBER
			MINIMUM	TYPICAL			
LUXEON 5050 (Square LES) 30V	2200K	70	621	690	141	160	L150-22705030000S0
	2700K	70	693	770	158	160	L150-27705030000S0
	3000K	70	720	800	164	160	L150-30705030000S0
	3500K	70	729	810	166	160	L150-35705030000S0
	4000K	70	743	825	169	160	L150-40705030000S0
	5000K	70	743	825	169	160	L150-50705030000S0
	5700K	70	738	820	168	160	L150-57705030000S0
	6500K	70	720	800	164	160	L150-65705030000S0
LUXEON 5050 (Square LES) 6V	2200K	70	621	690	141	800	L150-22705006000S0
	2700K	70	693	770	158	800	L150-27705006000S0
	3000K	70	720	800	164	800	L150-30705006000S0
	3500K	70	729	810	166	800	L150-35705006000S0
	4000K	70	743	825	169	800	L150-40705006000S0
	5000K	70	743	825	169	800	L150-50705006000S0
	5700K	70	738	820	168	800	L150-57705006000S0
	6500K	70	720	800	164	800	L150-65705006000S0

Notes for Table 1:
1. Correlated color temperature is hot targeted at T_j=85°C.
2. Luminous flux and CRI are based upon mounted package on highly reflective surface at T_j=25°C. Typical CRI is approximately 2 points higher than the minimum CRI specified, but this is not guaranteed.
3. Lumileds maintains a tolerance of ±2 on CRI and ±7% on luminous flux measurements.

Optical Characteristics

Table 2. Optical characteristics for LUXEON 5050 at test current, T_j=25°C.

PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE [1]	TYPICAL VIEWING ANGLE [2]
L150-xxxx50xx000x0	138°	116°

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 5050 at test current, T_j=25°C.

PART NUMBER	FORWARD VOLTAGE [1] (V_f)			TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE [2] (mV/°C)	TYPICAL THERMAL RESISTANCE—JUNCTION TO SOLDER PAD (°C/W)
	MINIMUM	TYPICAL	MAXIMUM		
L150-xxxx502400000	23.5	24.5	26.5	-12	2.4
L150-xxxx500600000	5.8	6.1	6.6	-3	2.4
L150-xxxx5030000S0	29.0	30.5	32.0	-15	1.4
L150-xxxx5006000S0	5.8	6.1	6.6	-3	1.4

Notes for Table 3:
1. Lumileds maintains a tolerance of ±1% on forward voltage measurements.
2. Measured between 25°C and 85°C.

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Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON 5050.

PARAMETER	MAXIMUM PERFORMANCE
DC Forward Current [1, 2]	240mA for L150-xxxx502400000 800mA for L150-xxxx500600000 240mA for L150-xxxx5030000S0 1000mA for L150-xxxx5006000S0
Peak Pulsed Forward Current [1, 3]	300mA for L150-xxxx502400000 1000mA for L150-xxxx500600000 300mA for L150-xxxx5030000S0 1250mA for L150-xxxx5006000S0
LED Junction Temperature [1] (DC & Pulse)	125°C
ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)	Class 2
Operating Case Temperature [1]	105°C
LED Storage Temperature	-40°C to 105°C
Allowable Reflow Cycles	3
Reverse Voltage ($V_{reverse}$)	LUXEON LEDs are not designed to be driven in reverse bias

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 10% duty cycle with pulse width of 10ms.

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Characteristic Curves

Spectral Power Distribution Characteristics

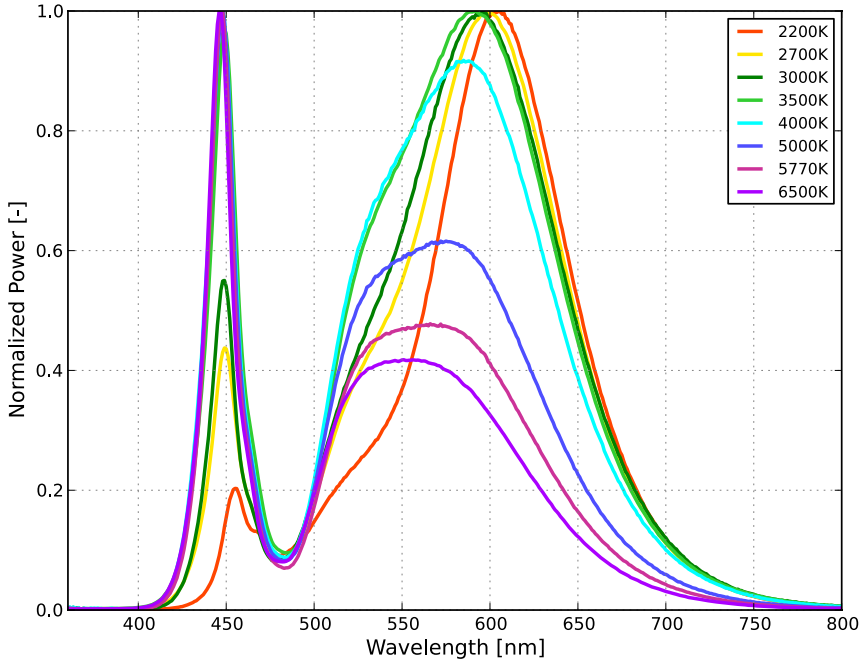

Figure 1a. Typical normalized power vs. wavelength for L150-xx7050xx000x0 at test current, T_j=25°C.

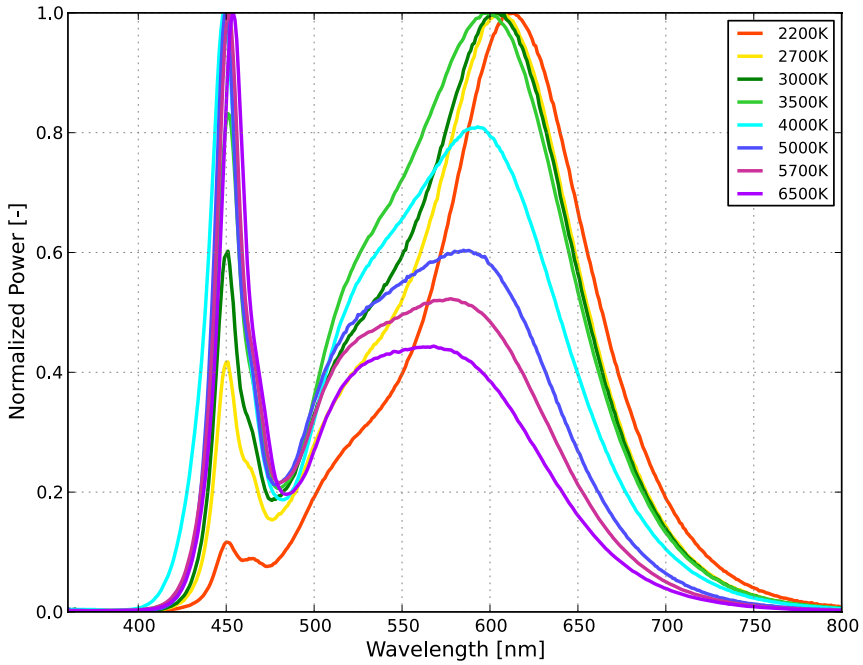

Figure 1b. Typical normalized power vs. wavelength for L150-xx8050xx00000 at test current, T_j=25°C.

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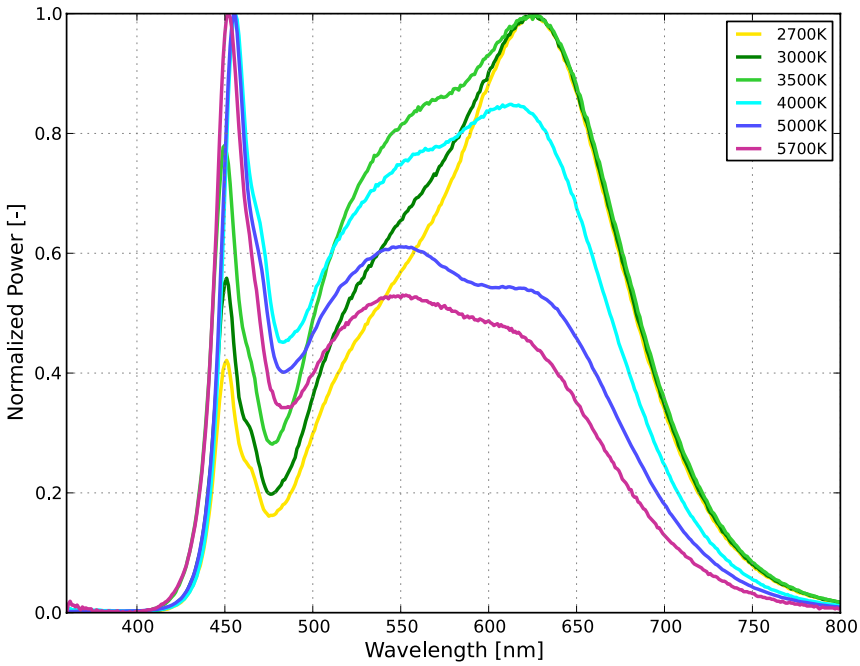

Figure 1c. Typical normalized power vs. wavelength for L150-xx9050xx00000 at test current, T_j=25°C.

Light Output Characteristics

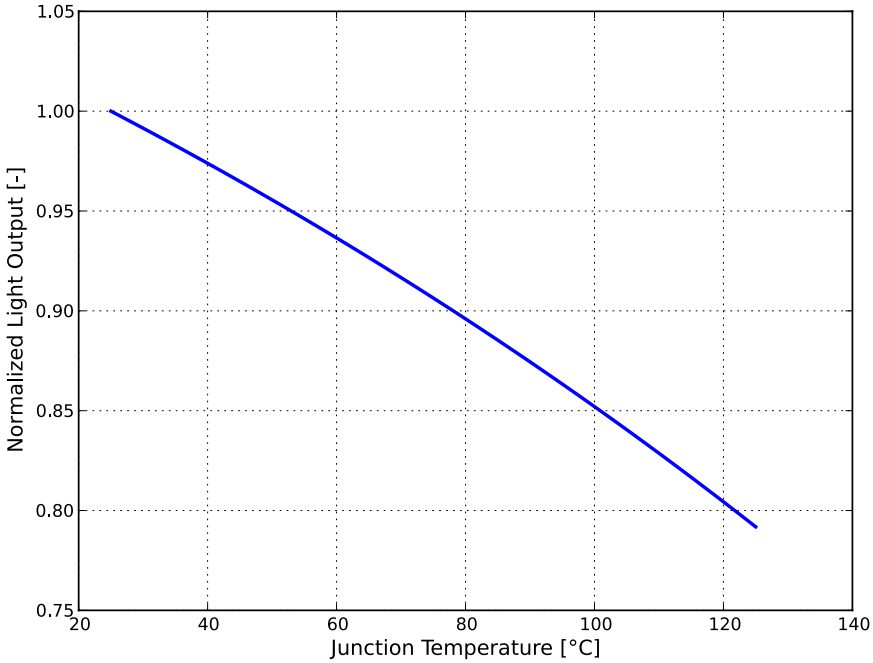

Figure 2. Typical normalized light output vs. junction temperature for L150-xxxx50xx000x0 at specified test current.

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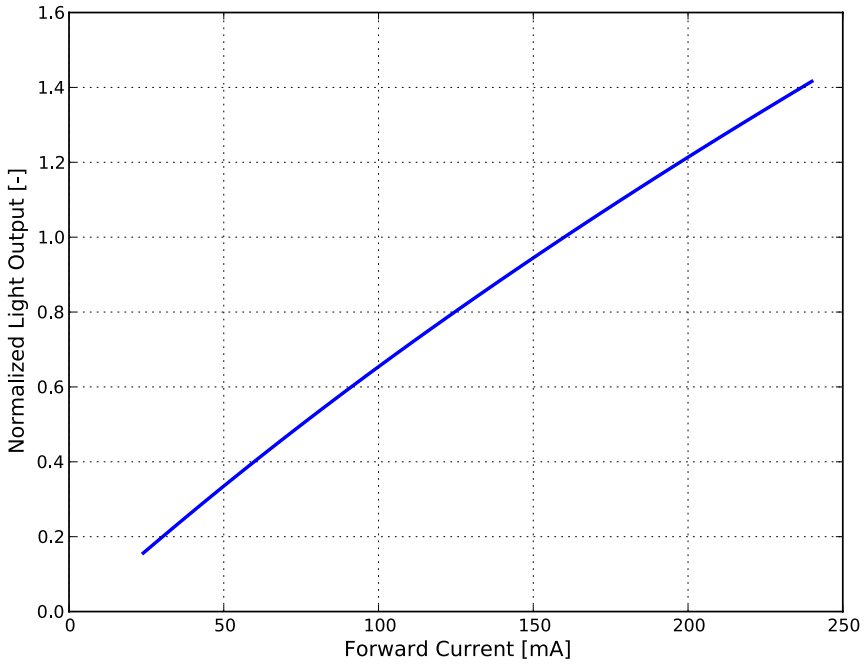

Figure 3a. Typical normalized light output vs. forward current for L150-xxxx50xx000x0, T_j=25°C.

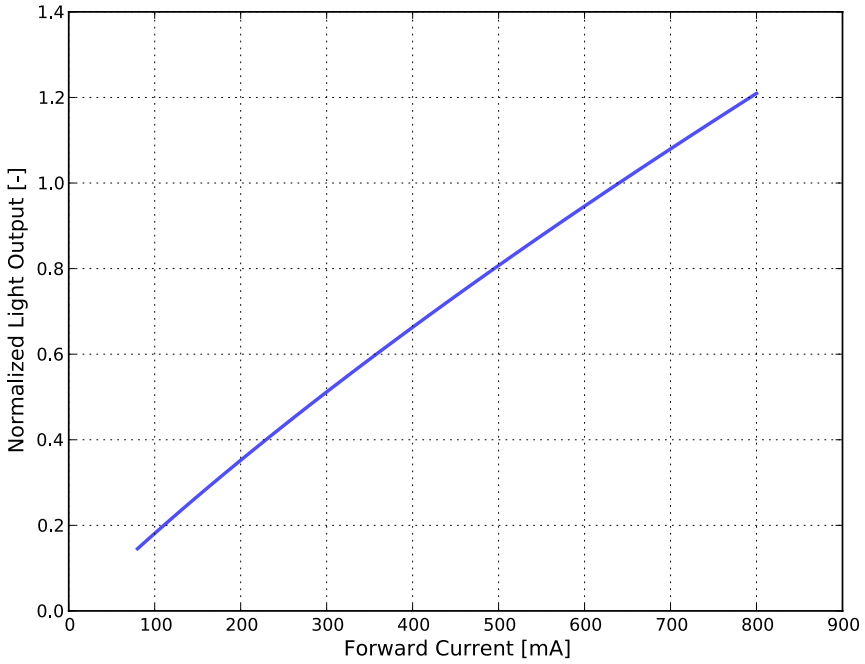

Figure 3b. Typical normalized light output vs. forward current for L150-xxxx500600000, T_j=25°C.

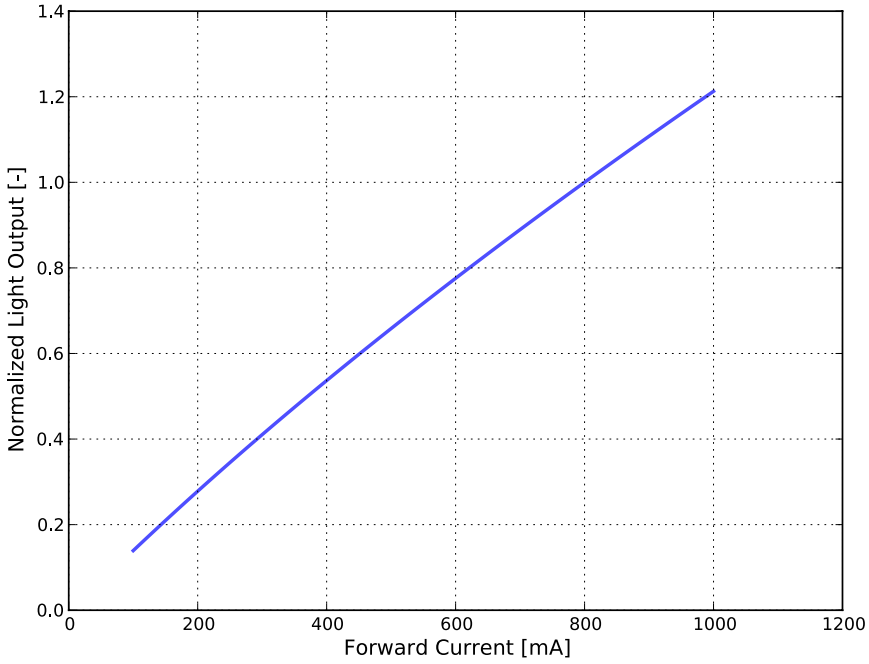

Figure 3c. Typical normalized light output vs. forward current for L150-xxxx5006000S0, T_j=25°C.

Forward Current Characteristics

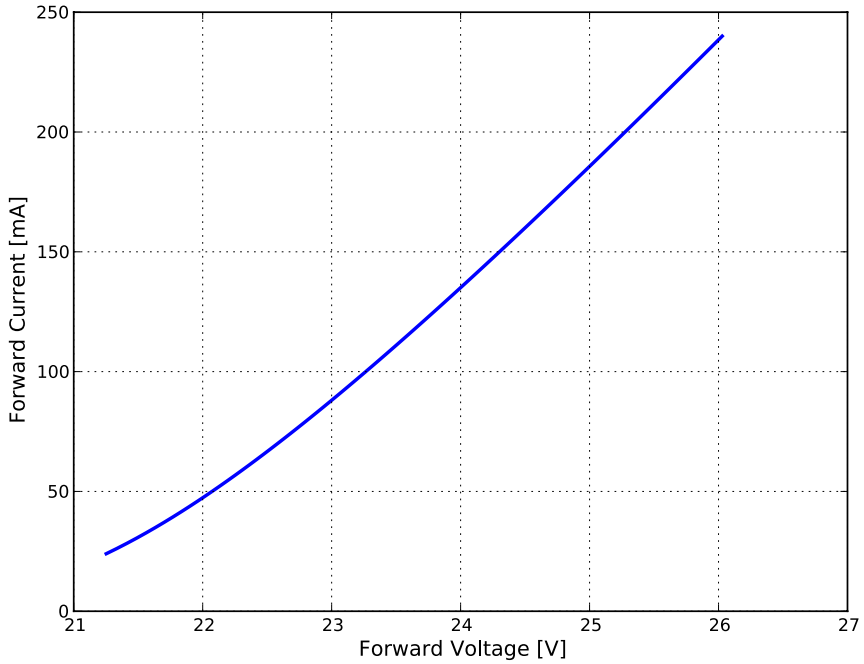

Figure 4a. Typical forward current vs. forward voltage for L150-xxxx502400000, T_j=25°C.

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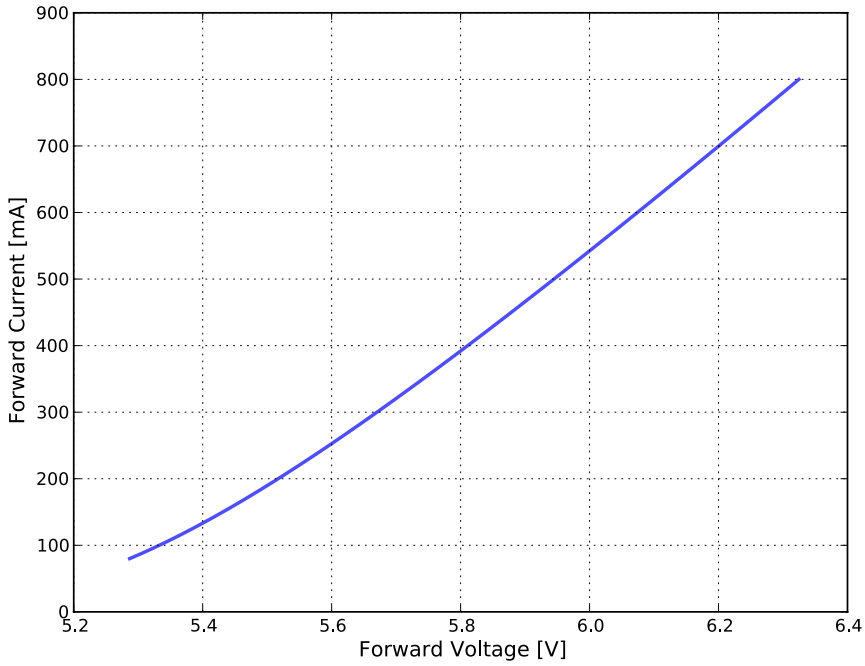

Figure 4b. Typical forward current vs. forward voltage for L150-xxxx500600000, T_j=25°C.

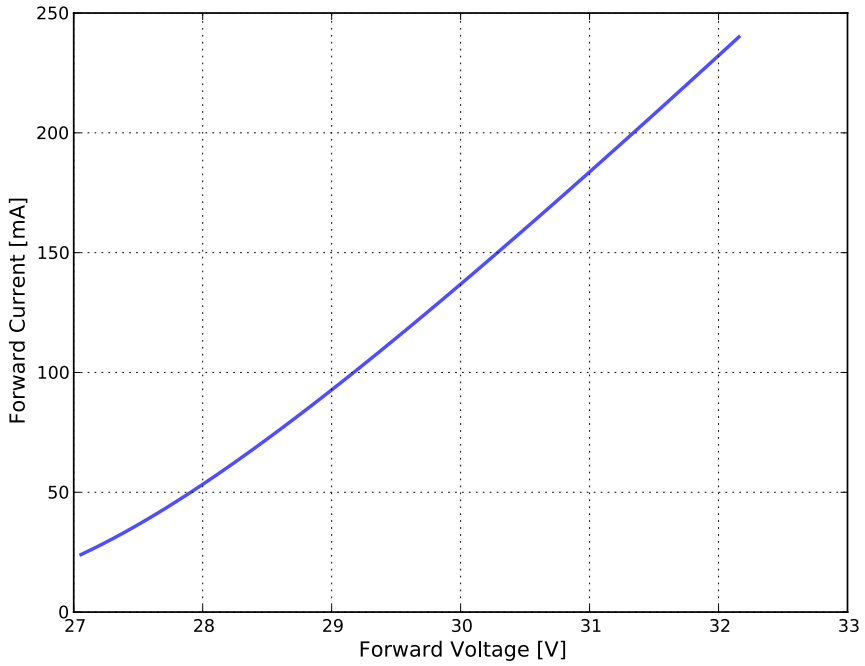

Figure 4c. Typical forward current vs. forward voltage for L150-xxxx5030000S0, Tj=25°C.

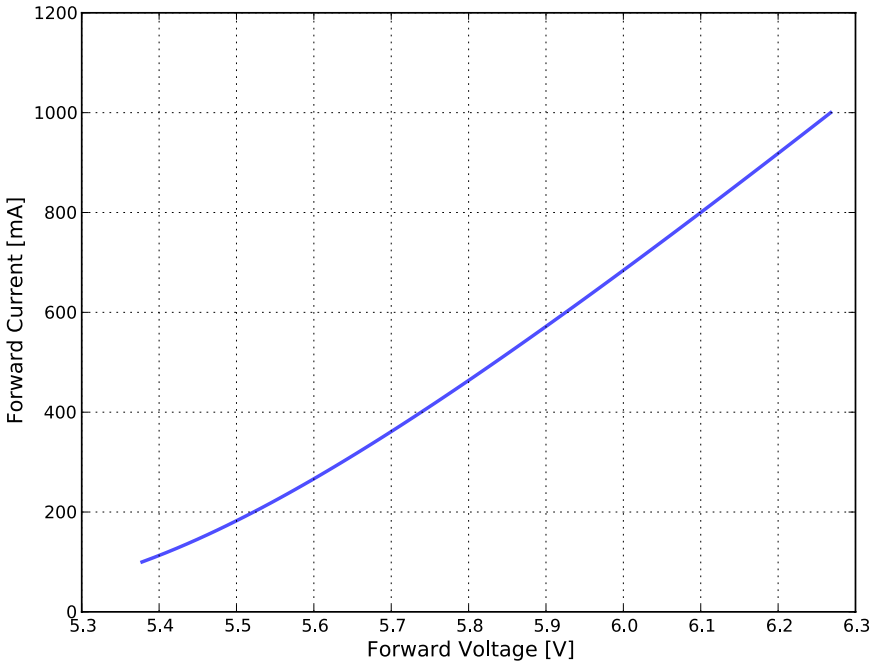

Figure 4d. Typical forward current vs. forward voltage for L150-xxxx5006000S0, T_j=25°C.

Radiation Pattern Characteristics

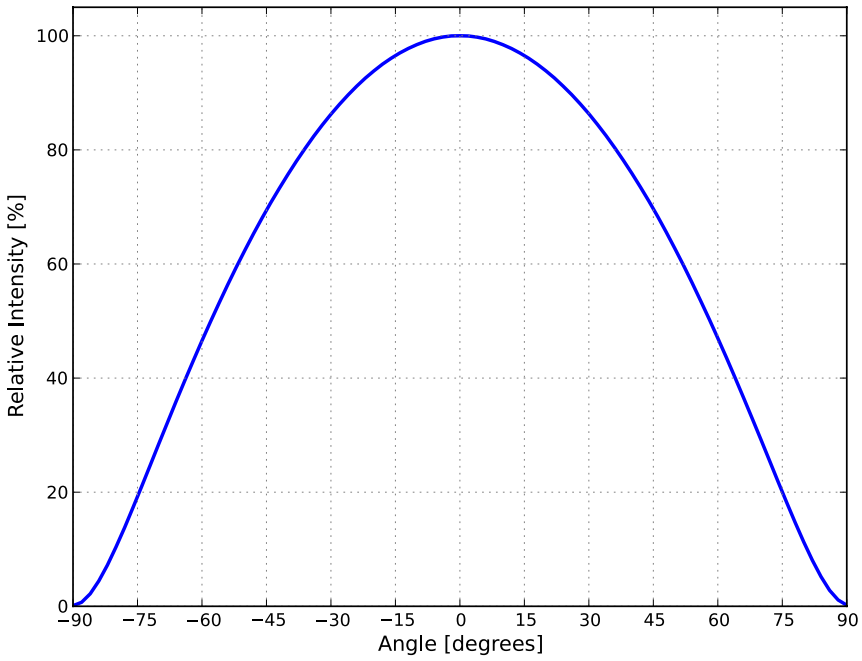

Figure 5. Typical radiation pattern for L150-xxxx50xx000x0 at specified test current, T_j=25°C.

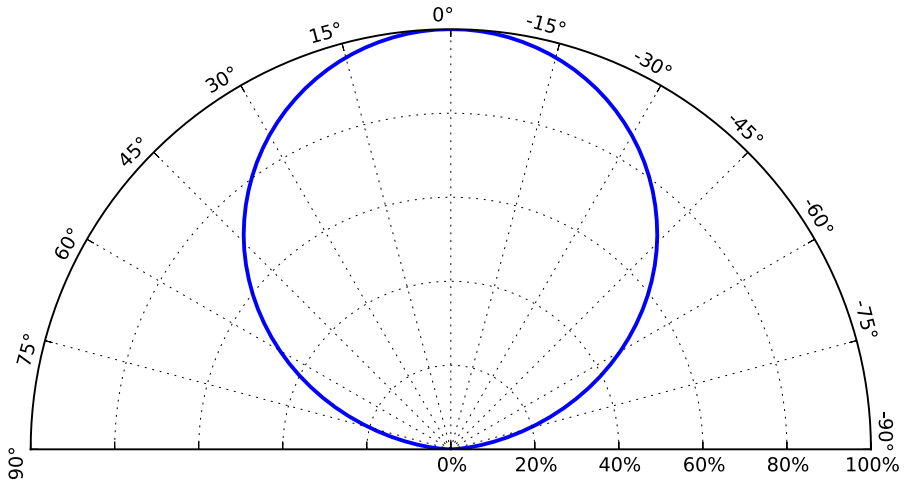

Figure 6. Typical polar radiation pattern for L150-xxxx50xx000x0 at specified test current, T_j=25°C.

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 (Round LES) 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: L=600 to 650 lm, M=650 to 700 lm)
- **B** – designates color bin (example: 3=3 SDCM, 5=5 SDCM parts)
- **C C** – designates forward voltage bin (example: A1, A2, B1, B2)

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

L 3 A 1

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LUXEON 5050 (Square LES) LEDs are labeled using a 4-digit alphanumeric CAT code following the format below:

A B B C

Where:

A – designates luminous flux bin (example: L=600 to 650 lm, M=650 to 700 lm)

B B – designates color bin: (example: 83=2700K and 3 SDCM, 35=5000K and 5 SDCM)

C – designates forward voltage bin (example: A, B, C, D)

Therefore, a LUXEON 5050 (Square LES) with a lumen range of 600 to 650 lm, color bin of 83 and forward voltage range of 29.0 to 30.0V has the following CAT code:

L 8 3 A

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°C.

BIN	LUMINOUS FLUX [1] (lm)	
	MINIMUM	MAXIMUM
G	400	450
H	450	500
J	500	550
K	550	600
L	600	650
M	650	700
N	700	750
P	750	800
Q	800	850
R	850	900
S	900	950
T	950	1000

Notes for Table 5:
1. Lumileds maintains a tolerance of ±7% on luminous flux measurements.

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Color Bin Definitions

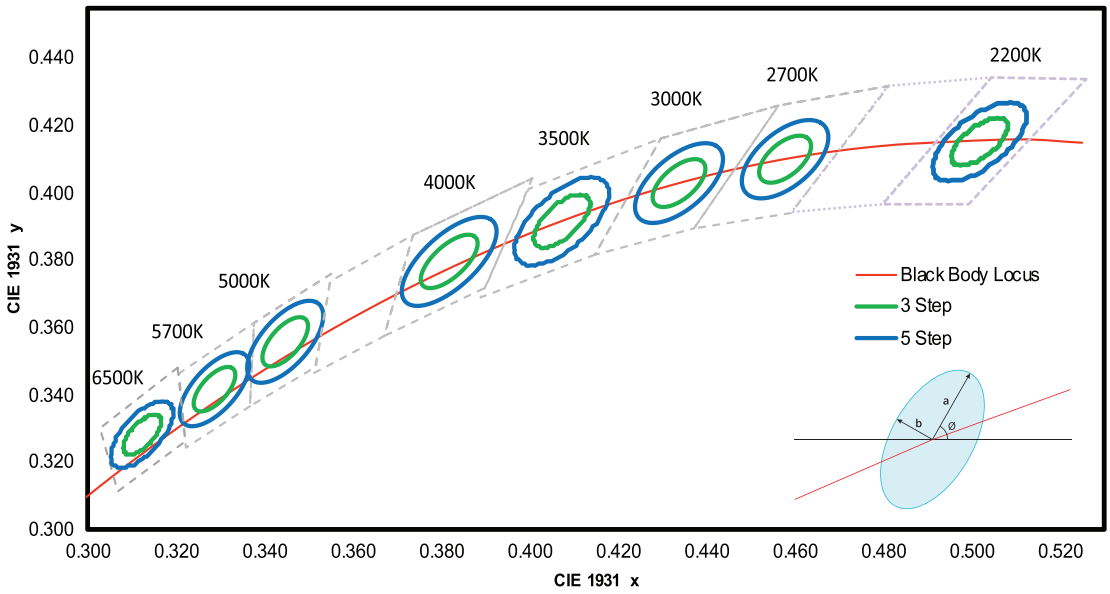

Figure 7. 3- and 5-step MacAdam ellipse illustration for hot-color targeting expected at 85°C.

Table 6. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON 5050 at test current, hot-color targeted at T_j=85°C.

NOMINAL CCT	COLOR SPACE	CENTER POINT [1] (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION ANGLE, θ	MAJOR AXIS, a	MINOR AXIS, b
2200K	Single 3-step MacAdam ellipse	(0.5018, 0.4153)	0.00863	0.00398	49.27°	3	A3
2700K	Single 3-step MacAdam ellipse	(0.4578, 0.4101)	0.00810	0.00420	53.70°	3	83
3000K	Single 3-step MacAdam ellipse	(0.4338, 0.4030)	0.00834	0.00408	53.22°	3	73
3500K	Single 3-step MacAdam ellipse	(0.4073, 0.3917)	0.00927	0.00414	54.00°	3	63
4000K	Single 3-step MacAdam ellipse	(0.3818, 0.3797)	0.00939	0.00402	53.72°	3	53
5000K	Single 3-step MacAdam ellipse	(0.3447, 0.3558)	0.00822	0.00354	59.62°	3	33
5700K	Single 3-step MacAdam ellipse	(0.3287, 0.3417)	0.00745	0.00320	59.09°	3	23
6500K	Single 3-step MacAdam ellipse	(0.3123, 0.3282)	0.00669	0.00285	58.57°	3	13
2200K	Single 5-step MacAdam ellipse	(0.5018, 0.4153)	0.01438	0.00663	49.27°	5	A5
2700K	Single 5-step MacAdam ellipse	(0.4578, 0.4101)	0.01350	0.00700	53.70°	5	85
3000K	Single 5-step MacAdam ellipse	(0.4338, 0.4030)	0.01390	0.00680	53.22°	5	75
3500K	Single 5-step MacAdam ellipse	(0.4073, 0.3917)	0.01545	0.00690	54.00°	5	65
4000K	Single 5-step MacAdam ellipse	(0.3818, 0.3797)	0.01565	0.00670	53.72°	5	55
5000K	Single 5-step MacAdam ellipse	(0.3447, 0.3558)	0.01370	0.00590	59.62°	5	35
5700K	Single 5-step MacAdam ellipse	(0.3287, 0.3417)	0.01243	0.00533	59.09°	5	25
6500K	Single 5-step MacAdam ellipse	(0.3123, 0.3282)	0.01115	0.00475	58.57°	5	15

Notes for Table 6:
1. Lumileds maintains a tolerance of ±0.005 on x and y coordinates in the CIE 1931 color space.

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Forward Voltage Bins

Table 7. Forward voltage bin definitions for LUXEON 5050, T_j=25°C.

PART NUMBER	BIN	FORWARD VOLTAGE [1] (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
L150-xxxx5030000S0	A	29.0	30.0
	B	30.0	31.0
	C	31.0	32.0
L150-xxxx5006000S0	A	5.8	6.0
	B	6.0	6.2
	C	6.2	6.4
	D	6.4	6.6

Notes for Table 7:
1. Lumileds maintains a tolerance of ±0.1V on forward voltage measurements.

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Mechanical Dimensions

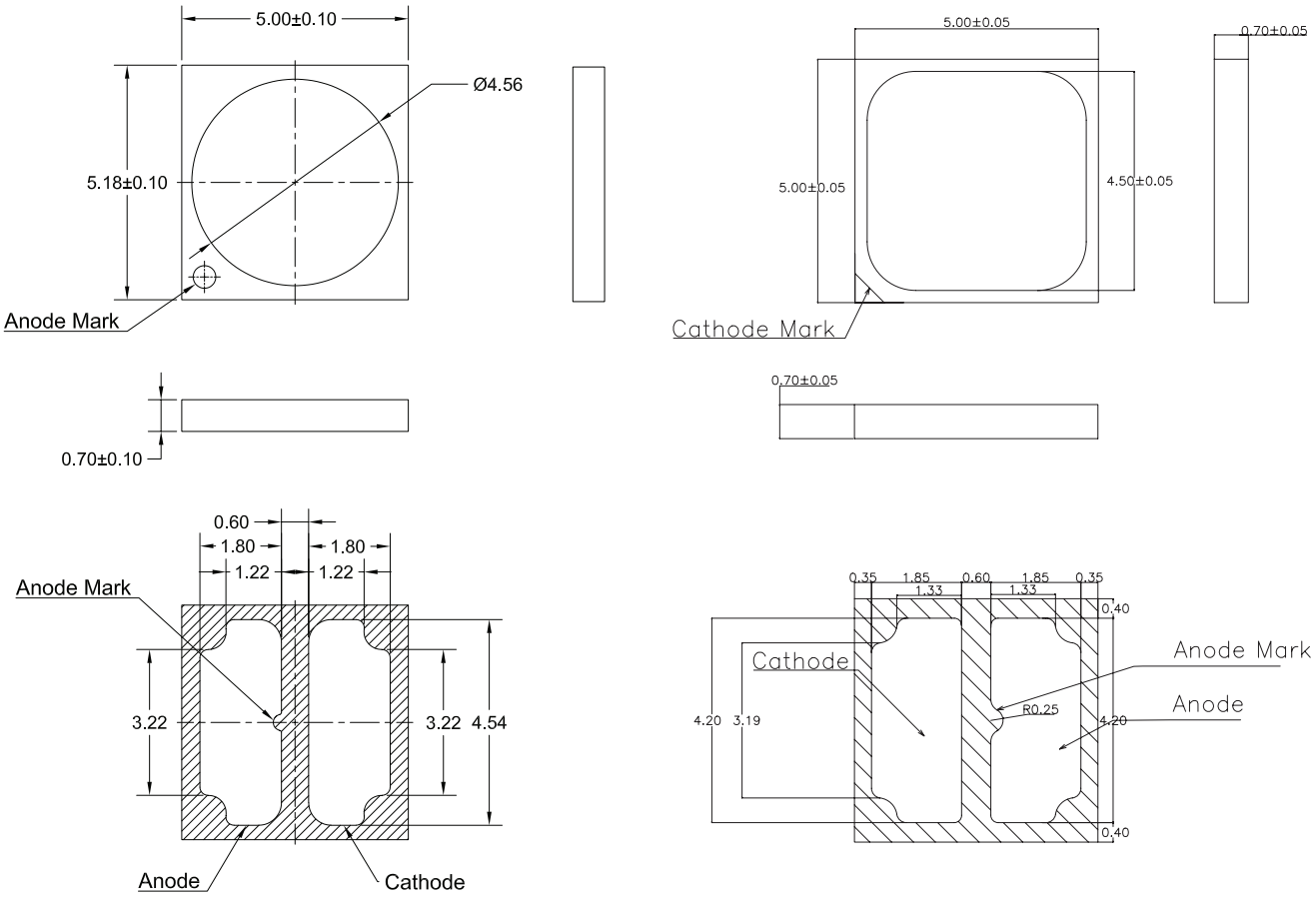

Figure 8. Mechanical dimensions for LUXEON 5050 (Round LES), left, and LUXEON 5050 (Square LES), right.

Notes for Figure 8:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

Reflow Soldering Guidelines

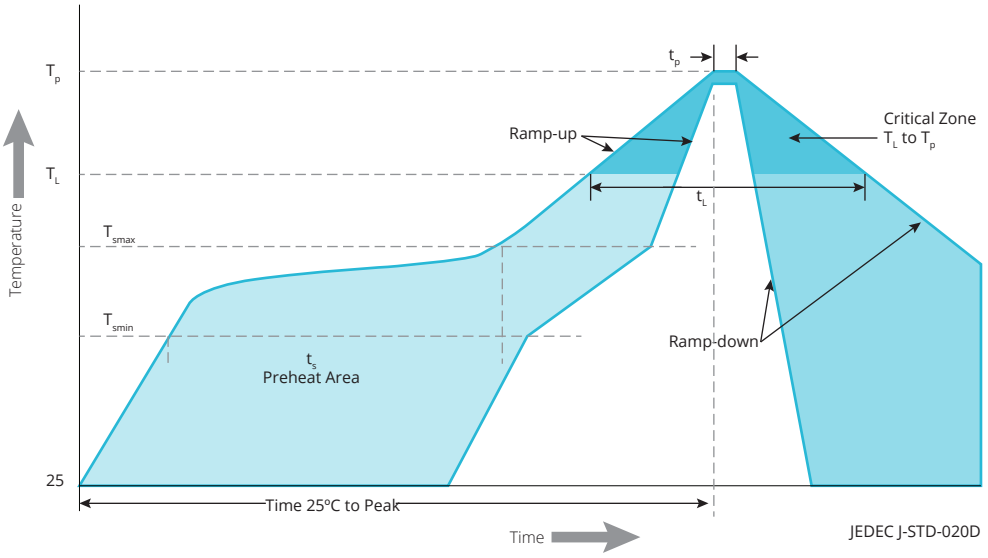

Figure 9. Visualization of the acceptable reflow temperature profile as specified in Table 8.

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
Liquidous Temperature (T_L)	217°C
Time Maintained Above Temperature T_L (t_L)	60 to 150 seconds
Peak / Classification Temperature (T_p)	260°C
Time Within 5°C of Actual Peak 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

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Solder Pad Design

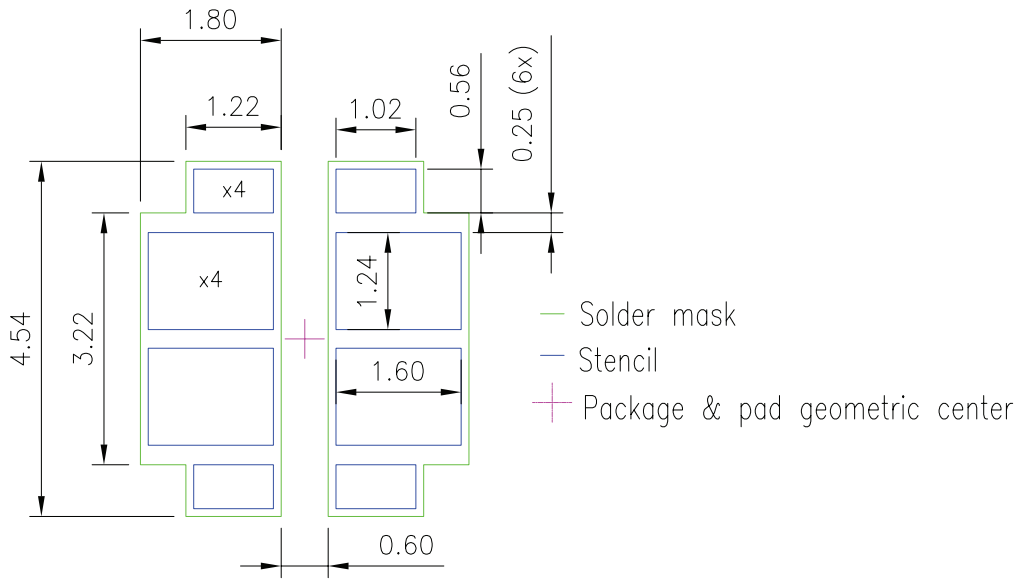


Figure 10. Recommended PCB solder pad layout for LUXEON 5050 (Round LES) and LUXEON 5050 (Square LES).

Notes for Figure 10:
1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Refer to application brief AB174 for additional details regarding recommended PCB layout design.

Packaging Information

Pocket Tape Dimensions

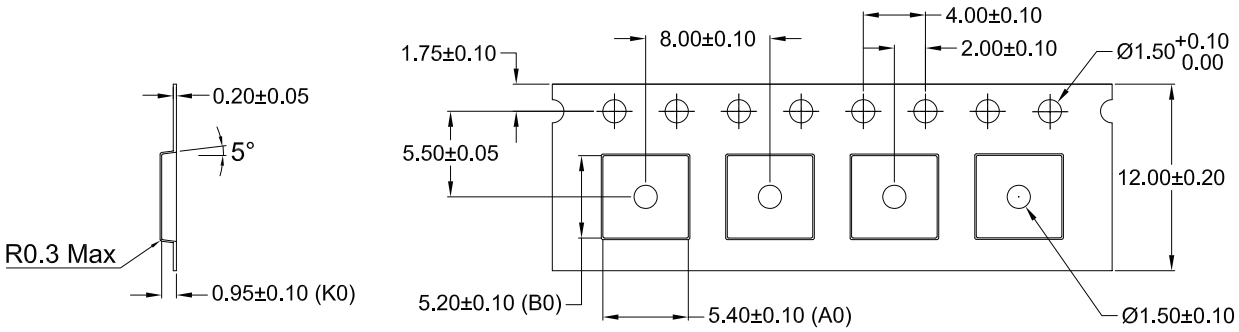
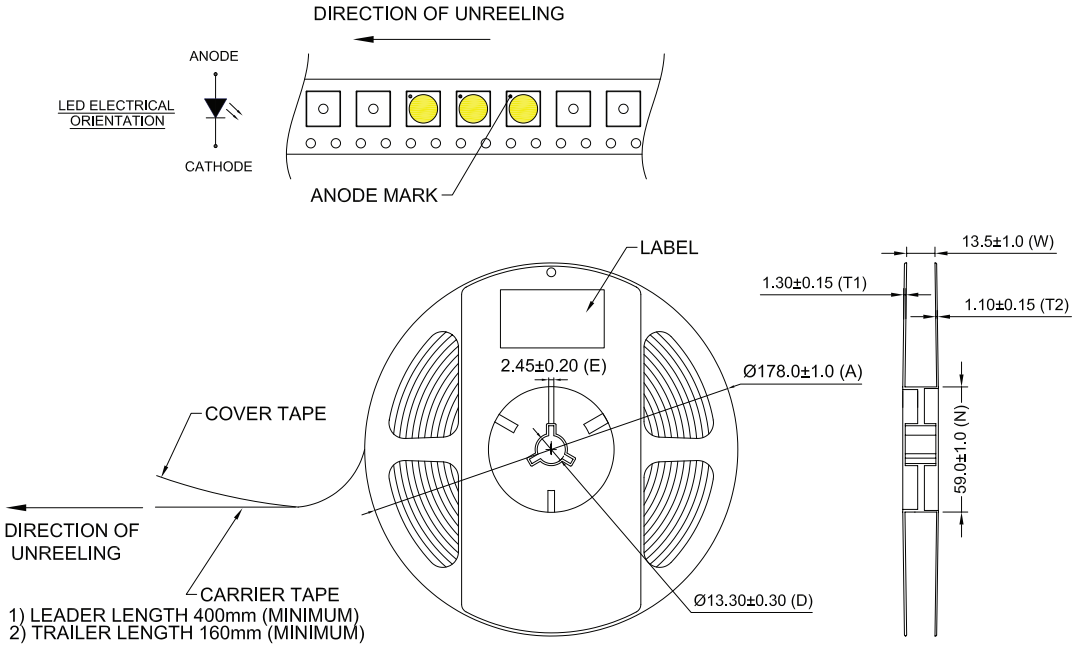


Figure 11. Pocket tape dimensions for LUXEON 5050 (Round LES) and LUXEON 5050 (Square LES).

Notes for Figure 11:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

Reel Dimensions



12a. Reel dimensions for LUXEON 5050 (Round LES).

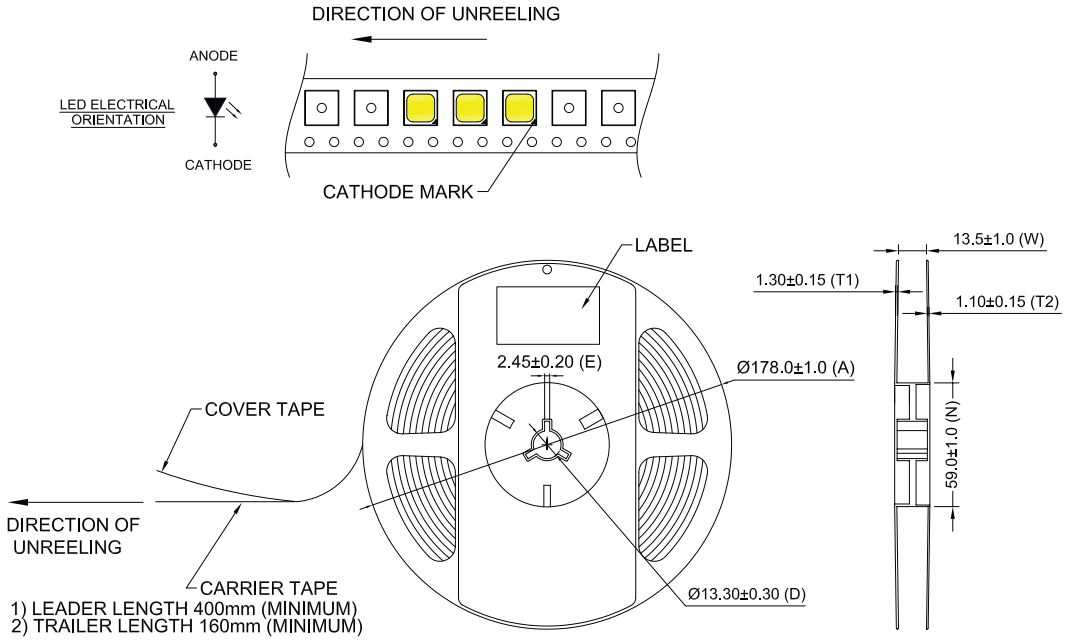


Figure 12b. Reel dimensions for LUXEON 5050 (Square LES).

Notes for Figures 12a and 12b:
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.

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