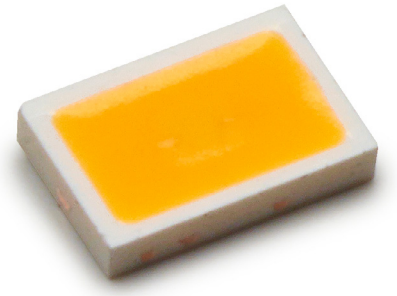
LUMILEDS

GENERAL ILLUMINATION

LUXEON 3020

Hot-color targeted with leading lm/$ 3V LED



LUXEON 3020 is the first and only hot-color targeted EMC-based 3.0mm x 2.0mm QFN, delivering superior efficacy with superior lumen maintenance and assurance of ANSI color compliance at operating conditions — 85°C. Lumileds enables mass production of affordable and reliable bulbs and lamps by simplifying system designs and integration with leading lm/$ and hot-color targeting.

FEATURES AND BENEFITS

- High efficacy delivers superior lumen maintenance
- Reliable QFN EMC package delivers superior thermal properties and reliability
- 1/9th ANSI micro-color binning enables tight color control
- Hot-color targeted at 85°C which leads to better color accuracy
- Drive at max current for superior value

PRIMARY APPLICATIONS

- Architectural
- Downlights
- Indoor Area Lighting
- Lamps
- Specialty Lighting

Table of Contents

General Information

Part Number Nomenclature

LUXEON 3020 is tested and binned at T_j = 25°C and 120mA DC.

The part number designation is explained as follow:

L 1 3 0 - A A B B 0 0 2 0 1 0 2 R 1

Where:

AA — designates CCT (2700 = 27, 3000 = 30, 3500 = 35, 4000 = 40, 5000 = 50, 5700 = 57, 6500 = 65)

BB — designates CRI (70, 80 and 90)

Therefore the part number for a 4000K, 80CRI, LUXEON 3020 product will be:

L 1 3 0 – 4 0 8 0 0 0 2 0 1 0 2 R 1

Average Lumen Maintenance Characteristics

Lumen maintenance for solid-state lighting devices (LEDs) is typically defined in terms of the percentage of initial light output remaining after a specified period of time. Please contact your local Lumileds Technical Solutions Manager for TM-21 extrapolations or other support. Observation of design limits included in this data sheet is required in order to achieve this projected lumen maintenance.

Environmental Compliance

Lumileds is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON 3020 is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS and REACH directives. Lumileds will not intentionally add the following restricted material to the LUXEON 3020 L130-xx800020102R1: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Product Selection

Product Selection Guide for LUXEON 3020 LEDs
Junction Temperature = 25°C

Table 1.

Nominal CCT	CRI [1]	Luminous Flux (lm) [1] @ 120mA, 25°C		Luminous Flux (lm) [2] @ 100mA, 25°C		$R_{th\_J\_c}$ (°C/W)[3]	Part Number
	Minimum	Minimum	Typical	Minimum	Typical	Typical	
2700K	80	42	49	36	42	80	L130-2780002011001
2700K	90	36	41	31	35	90	L130-2790002011001
3000K	80	44	50	38	43	80	L130-3080002011001
3000K	90	37	42	31	36	90	L130-3090002011001
3500K	80	45	51.5	39	44	80	L130-3580002011001
5000K	90	38	43	32	37	90	L130-3590002011001
4000K	70	51	56	44	48	70	L130-4070002011001
4000K	80	46	53	40	46	80	L130-4080002011001
4000K	90	40	45	34	38	90	L130-4090002011001
5000K	70	51	56	44	48	70	L130-5070002011001
5000K	80	46	53	40	46	80	L130-5080002011001
5700K	70	51	56	44	48	70	L130-5770002011001
5700K	80	46	53	40	46	80	L130-5780002011001
6500K	70	51	56	44	48	70	L130-6570002011001
6500K	80	46	53	40	46	80	L130-6580002011001

Notes for Table 1:

1. Lumileds maintains a tolerance of ±7.5% on luminous flux, ±2 on CRI.
2. Calculated and interpolated values.
3. Typical thermal resistance is measured from junction to solder pads.

Electrical Characteristics

Electrical Characteristics
Thermal Pad Temperature = 25°C, Test Current @ 120mA

Table 2.

Part Number	Forward Voltage V_f [1] (V)			Temperature Coefficient of Forward Voltage between 25°C and 85°C $\Delta V_F / \Delta T_J$
	Minimum	Typical	Maximum	
L130-2780002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-2790002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-3080002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-3090002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-3580002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-3590002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-4070002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-4080002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-4090002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-5070002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-5080002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-5770002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-5780002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-6570002011001	2.85	3.05	3.35	-2.0 to -4.0
L130-6580002011001	2.85	3.05	3.35	-2.0 to -4.0

Notes for Table 2:
1. Lumileds maintains a tolerance of ±0.1V on forward voltage measurements.
2. Measured between T_j = 25°C and T_j = 85°C.

Absolute Maximum Ratings

Table 3.

Parameter	Maximum Performance
DC Forward Current	240mA
Peak Pulsed Forward Current	300mA [1, 2]
LED Junction Temperature [1]	125°C
ESD Sensitivity	8000V, JEDEC 22A-114, Human Body Model (HBM)
Operating Case Temperature	-40°C - 105°C
Storage Temperature	-40°C - 105°C
Soldering Temperature	JEDEC 020D 260°C
Allowable Reflow Cycles	3
Reverse Voltage (Vr) [3, 4]	-10V

Notes for Table 3:
1. Ripple current with a frequency of 50-150 Hz is allowed as long as the average of the current waveform is below 240mA and the maximum of the current waveform is lower than 300mA.
2. At 10% duty cycle and pulse width < 100µS.
3. LUXEON 3020 LEDs are not designed to be driven in reverse bias.
4. At a maximum reverse current of 10µA.

JEDEC Moisture Sensitivity

Table 4.

Level	Floor Life		Soak Requirements Standard	
	Time	Conditions	Time	Conditions
3	168 hours	30°C / 60% RH (Relative Humidity)	192 Hrs. ± 5/0 Hrs.	30°C / 60% RH

Reflow Soldering Characteristics

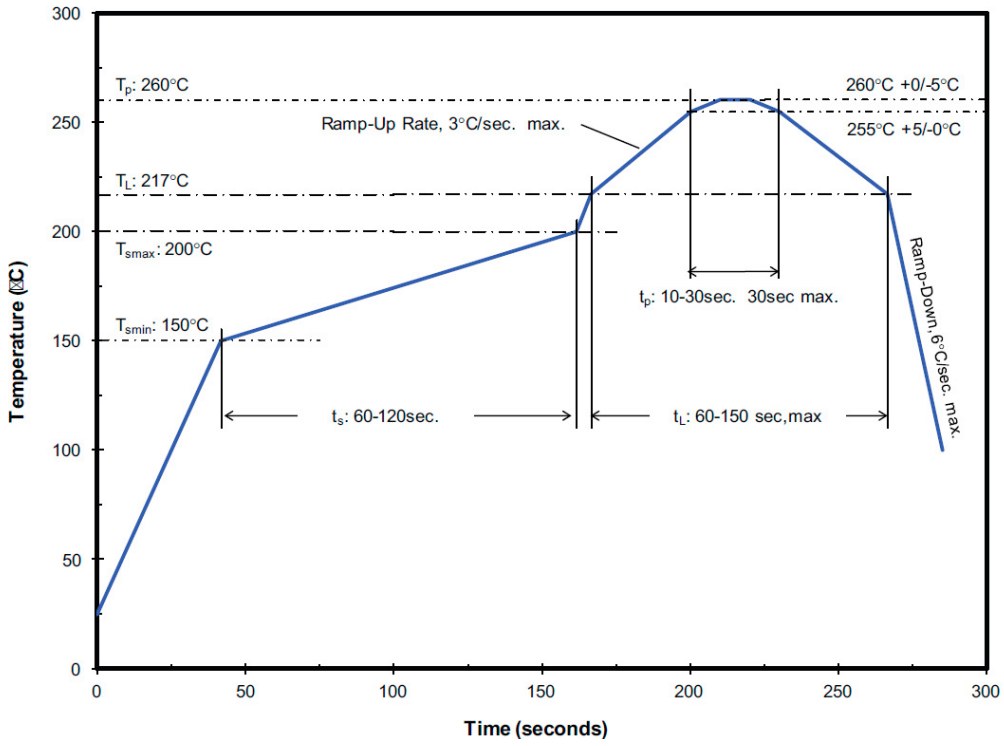


Figure 1. Temperature profile for Table 5.

Table 5. Reflow Profile in Accordance with J-Std-020D

Profile Feature	Lead Free Assembly
Preheat/Soak: Temperature Min (Ts_{min}) Temperature Max (Ts_{max}) Maximum Time (ts) from Ts_{min} to Ts_{max}	 150°C 200°C 120 seconds
Ramp–up Rate (T_L to T_p)	3°C / second
Liquidous Temperature (T_L)	217°C
Maximum Time (t_L) Maintained T_L	150 seconds
Maximum Peak Package Body Temperature (T_p)	260°C
Time (t_p) within 5°C of the specified temperature (T_c)	10 - 30 seconds
Maximum Ramp-Down Rate (T_p to T_L)	6°C / second
Maximum Time 25°C to Peak Temperature	8 minutes

Notes for Table 5:

1. All temperatures refer to the application Printed Circuit Board (PCB), measured on the surface adjacent to the package body.

Mechanical Dimensions and Package Information

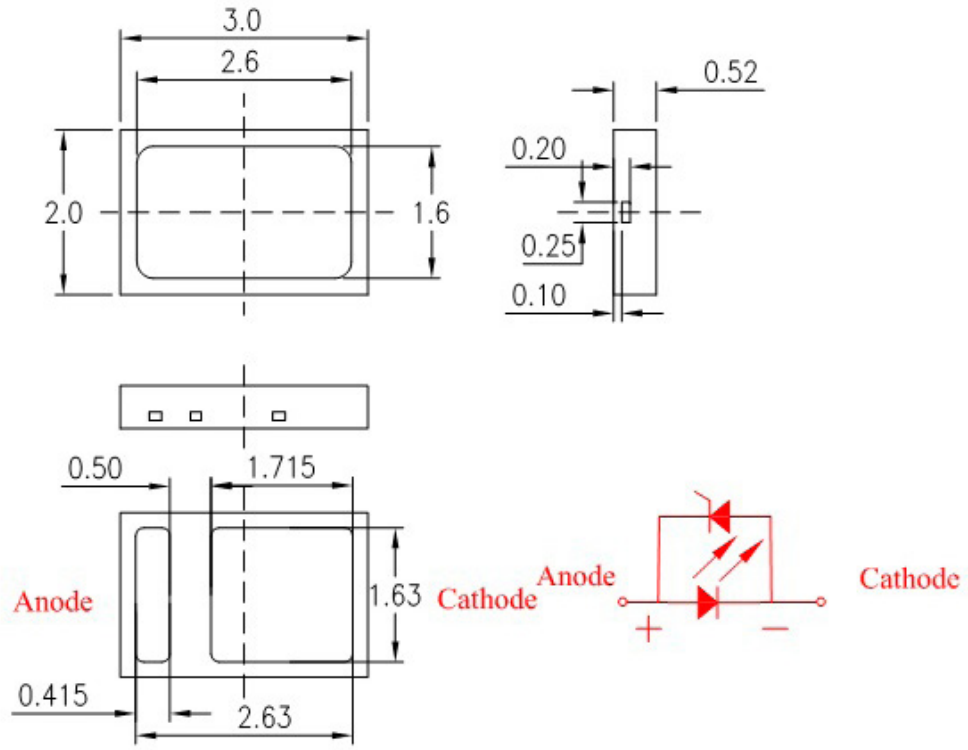


Figure 2. Mechanical dimentions for L130-xx80002011001.

Notes for Figure 2:

1. All dimensions are in millimeters.
2. Tolerance: X.X: ±0.1mm, X.XX: ±0.05mm, X.XXX: ±0.05mm.

Solder Pad Design

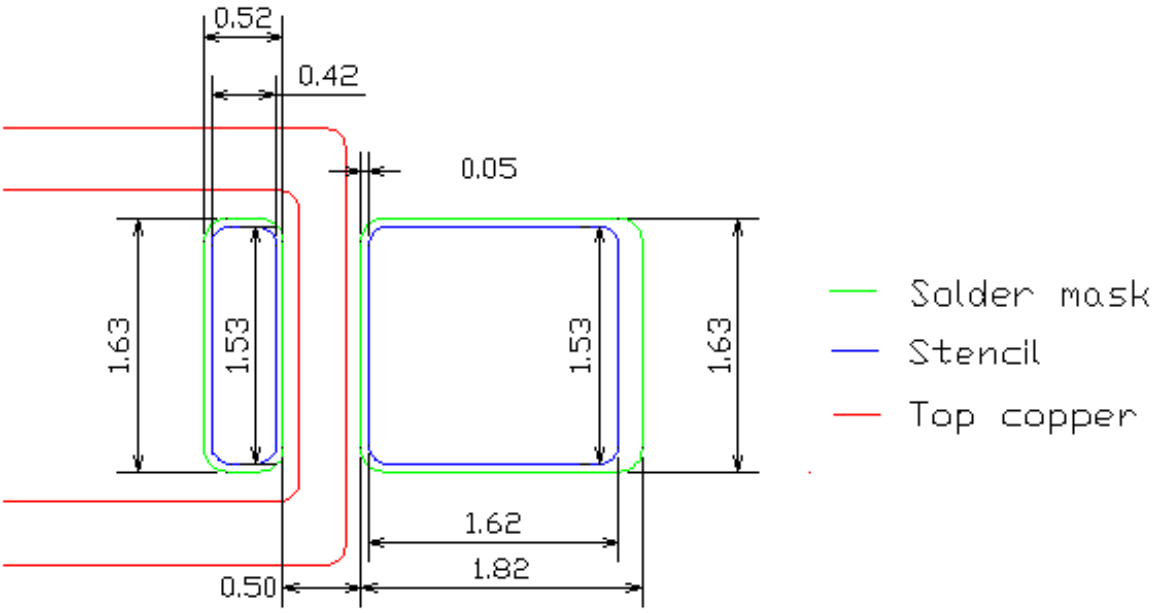


Figure 3. Solder pad layout.

Notes for Figure 3:
1. All dimensions are in millimeters.
2. The drawing above shows the recommend solder pad layout on the Printed Circuit Board (PCB).
3. Application Brief AB209 provides details for this layout. In addition, the .drawing files are available at www.lumileds.com.

Package Information

Table 6. Package Information for L130-xx800020102R1

Material/Component	Specification
Lead Frame Base	Copper Alloy
Package Body	High Temperature Thermal Plastic
Encapsulate	Silicone Resin, with Phosphor
Weight	0.01 gram

Notes for Table 6:
1. All dimensions are in millimeters.
2. Tolerance ±0.10mm.

Characteristic Curves

L130-xx800020102R1 80CRI Relative Spectral Distribution vs. Wavelength Junction Temperature = 25°C; Test Current = 120mA

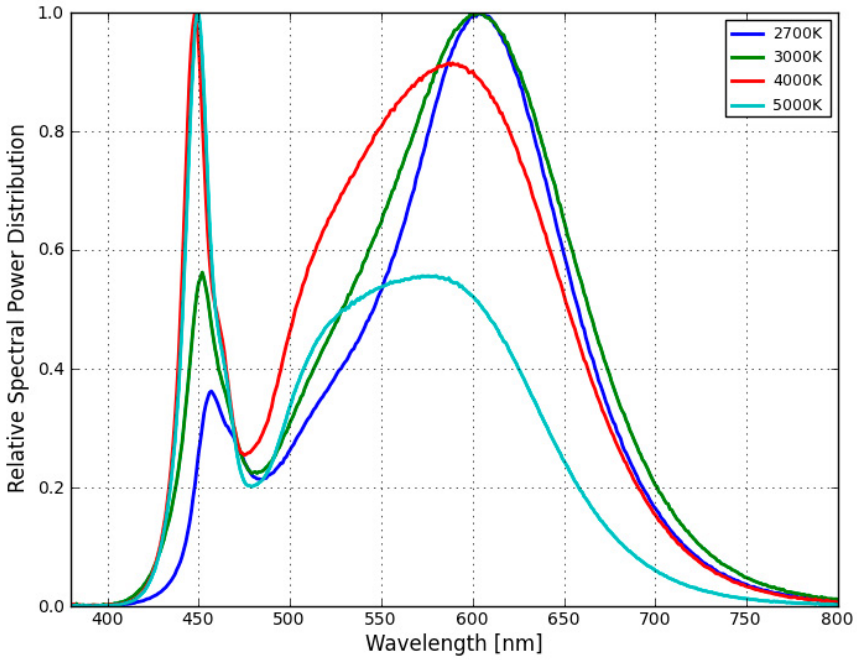


Figure 4. Color spectrum, L130-xx800020102R1 80CRI.

Relative Light Output Characteristics over Junction Temperature Test Current = 120mA

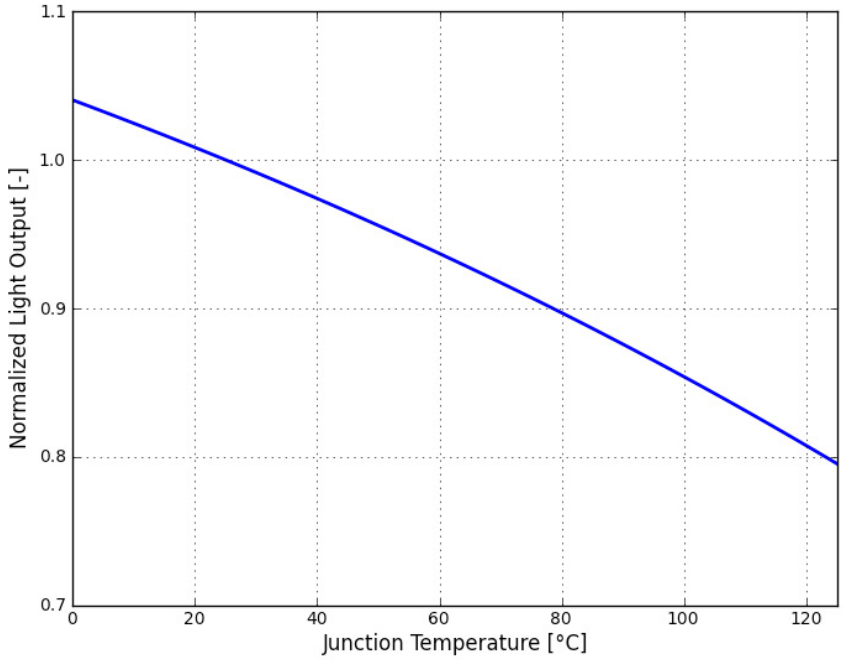


Figure 5. Relative light output vs. junction temperature, L130-xx800020102R1.

Typical Forward Current Characteristics

Forward Current vs. Forward Voltage for L130-xxxx0020102R1 Junction Temperature = 25°C

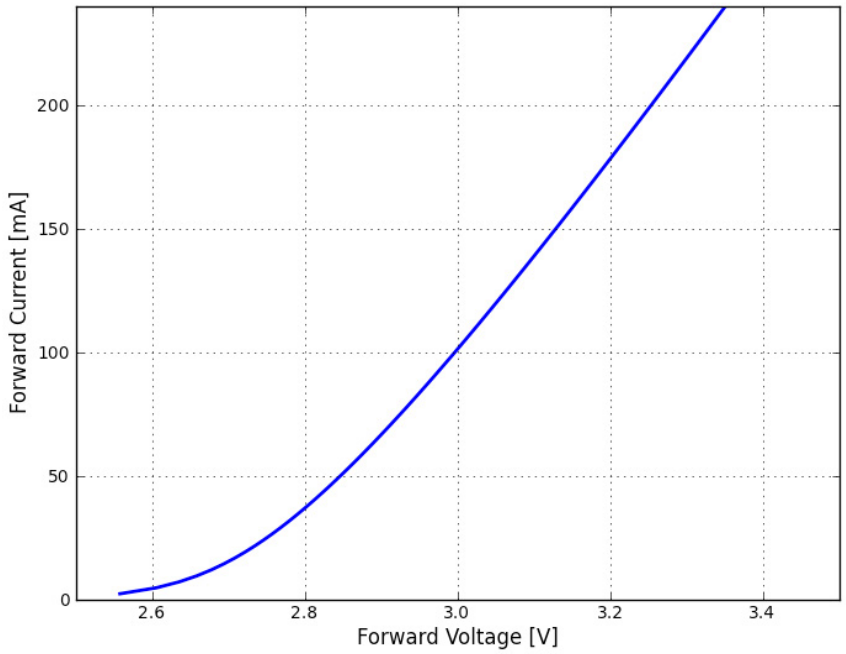


Figure 6. Typical forward current vs. forward voltage, L130-xxxx0020102R1.

Typical Light Output Characteristics

Relative Light Output vs. Forward Current
Junction Temperature = 25°C

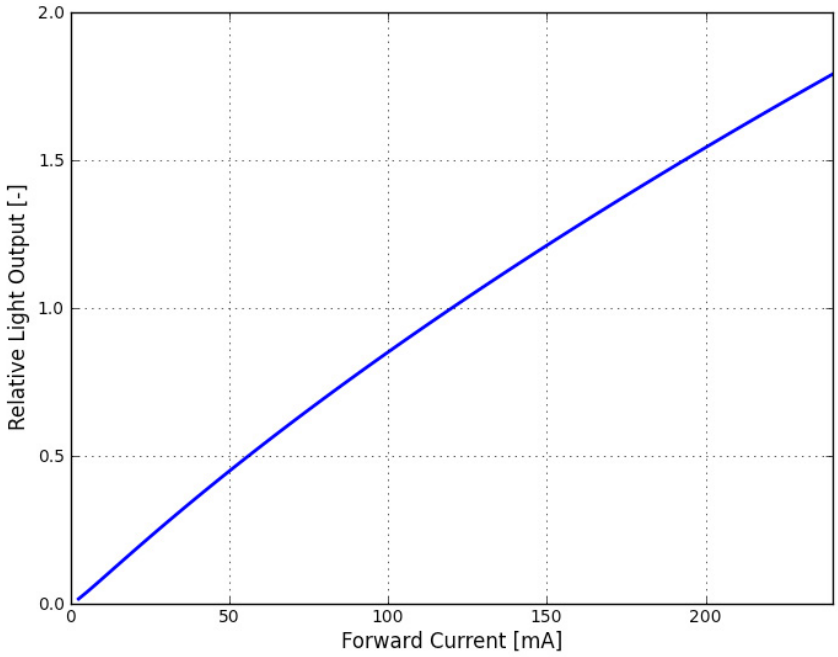


Figure 7. Relative light output vs. forward current, L130-xxxx0020102R1.

Typical Radiation Patterns

Radiation Pattern in Cartesian Coordinate System
Junction Temperature = 25°C

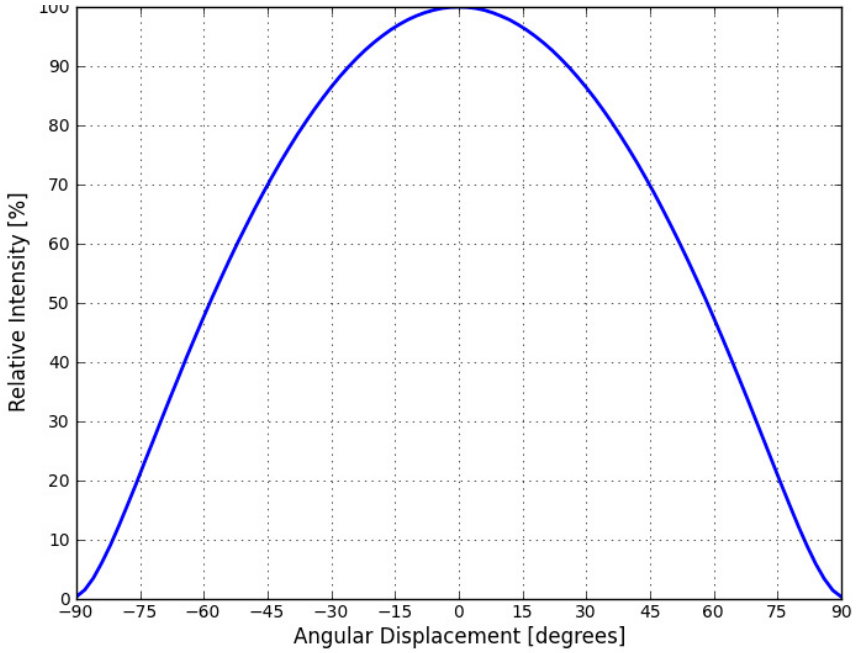


Figure 8. Typical spatial radiation pattern, L130-xxxx0020102R1.

Radiation Pattern in Polar Coordinate System
Junction Temperature = 25°C

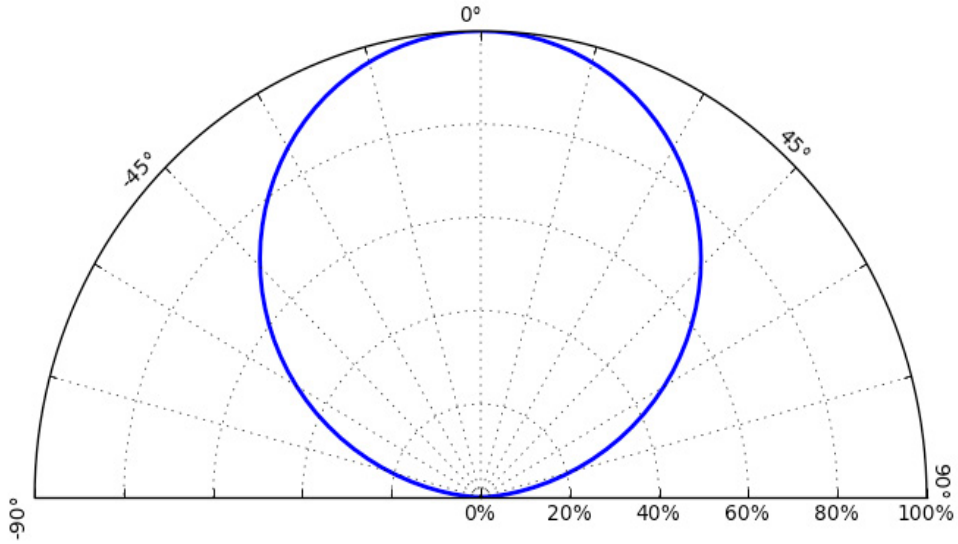


Figure 9. Typical polar radiation pattern, L130-xxxx0020102R1.

Emitter Packaging

Emitter Pocket Tape Packaging

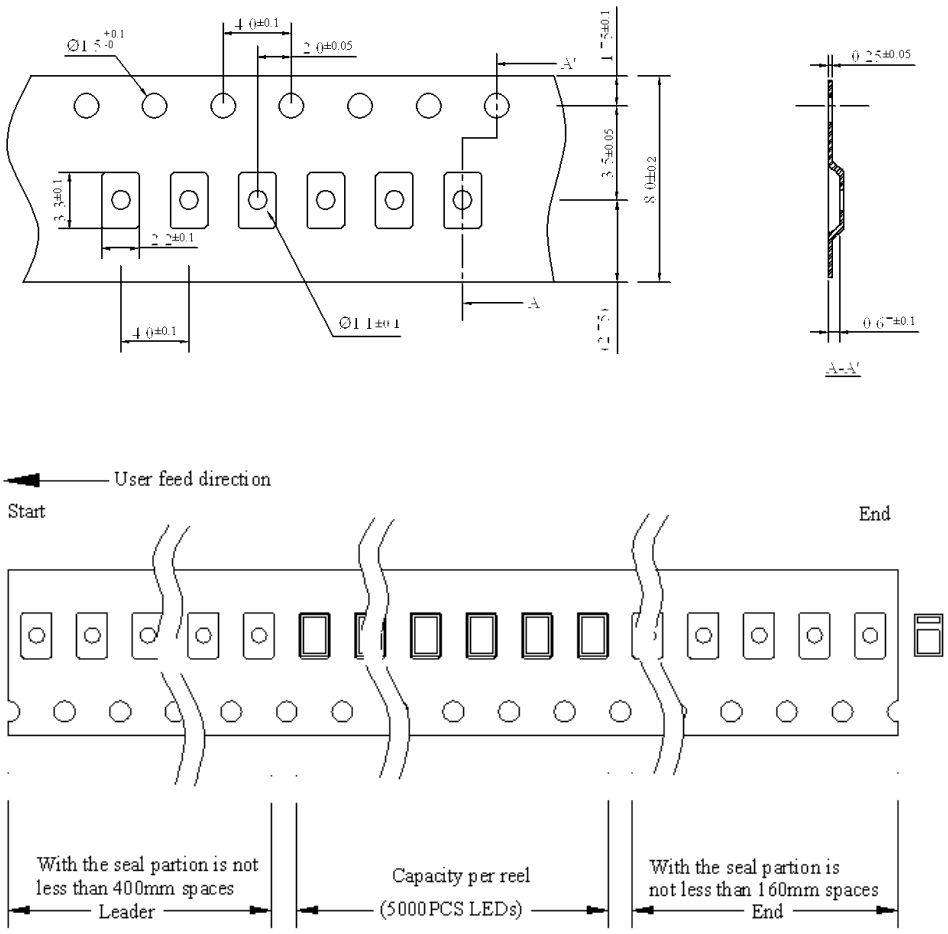


Figure 10. Emitter pocket tape packaging.

Notes for Figure 10:

1. All dimensions are in millimeters.
2. Empty component pockets sealed with top cover tape.
3. The maximum number of consecutive missing LEDs is two.

Emitter Reel Packaging

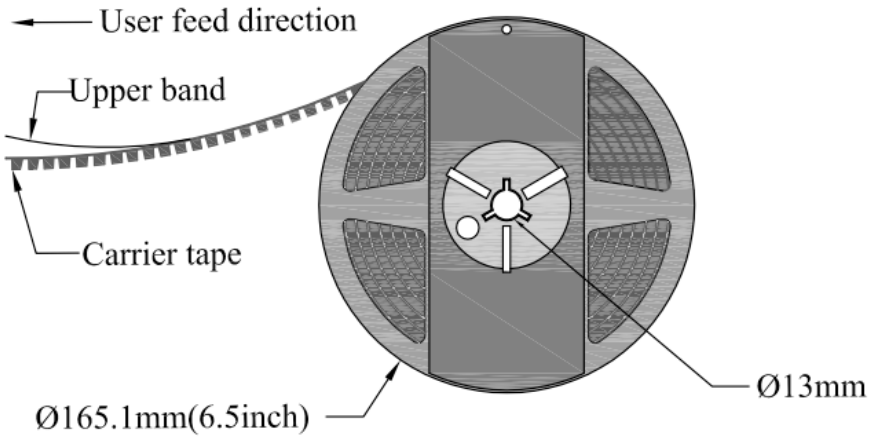


Figure 11. Emitter reel packaging.

Notes for Figure 11:
1. All dimensions are in millimeters.
2. Empty component pockets sealed with top cover tape.
3. 6.5 inch reel-5000 pieces per reel.

Emitter Reel Label

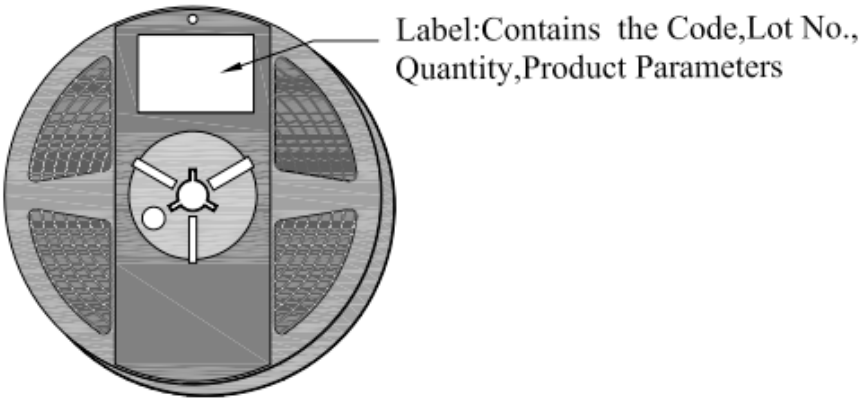


Figure 12. Emitter reel label.

Product Binning and Labeling

Purpose of Product Binning

In the manufacturing of semiconductor products, there is a variation of performance around the average values given in the technical data sheets. For this reason, Lumileds bins the LED components for luminous flux, color and forward voltage (V_f).

Decoding Product Bin Labeling

LUXEON mid-power emitters are labeled using a four digit alphanumeric code (CAT code) depicting the bin values for emitters packaged on a single reel. All emitters packaged within a reel are of the same 3-variable bin combination. Using these codes, it is possible to determine optimum mixing and matching of products for consistency in a given application.

Reels of 2700K, 3000K, 3500K, 4000K, 5000K, 5700K, 6500K emitters are labeled with a four digit alphanumeric CAT code following the format below.

ABCD

Where:

A — Flux bin (L etc.)

B & C — Color bin (For example 2700K 80CRI has the following 9 color bins: 8D, 8E, 8F, 8G, 8H, 8J, 8K, 8L, 8M)

D — V_f bin

Luminous Flux Bins

Table 7 and Table 8 list the standard photometric luminous flux bins for LUXEON mid-power emitters (tested and binned at 120mA). 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. Please contact your Lumileds representative for the L130-xx800020102R1 flux bins.

Flux Bins

Table 7. Flux Bins for L130-xx800020102R1

Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
M	36	40
P	40	44
Q	44	48
R	48	52
S	52	56
T	56	60
U	60	65

Note for Table 7:

1. Tested and binned at 25°C, I_f = 120mA. Tester tolerance: ±7.5%.

Forward Voltage Bins

Table 8. V_f Bins for L130-xx800020102R1

Bin Code	Minimum Forward Voltage (V)	Maximum Forward Voltage (V)
T	2.8	2.9
V	2.9	3.0
W	3.0	3.1
X	3.1	3.2
Y	3.2	3.3
Z	3.3	3.4

Note for Table 8:

1. Tested and binned at 25°C, I_f = 120mA.

Color Bin Structure

Typical Bin Structure at Junction Temperature = 85°C

In actual application operating conditions, the LED temperature rises. The LUXEON 3020 is hot color targeted, so the typical color is within ANSI at 85°C. Typical color bins at 85°C will be as shown.

Note: Bin *N will represent the entire ANSI bin for that corresponding CCT. For example:

- Bin 8N will represent the entire ANSI bin for 2700K
- Bin 7N will represent the entire ANSI bin for 3000K

L130-27xx020102R1 Color Bin Structure – 2700K

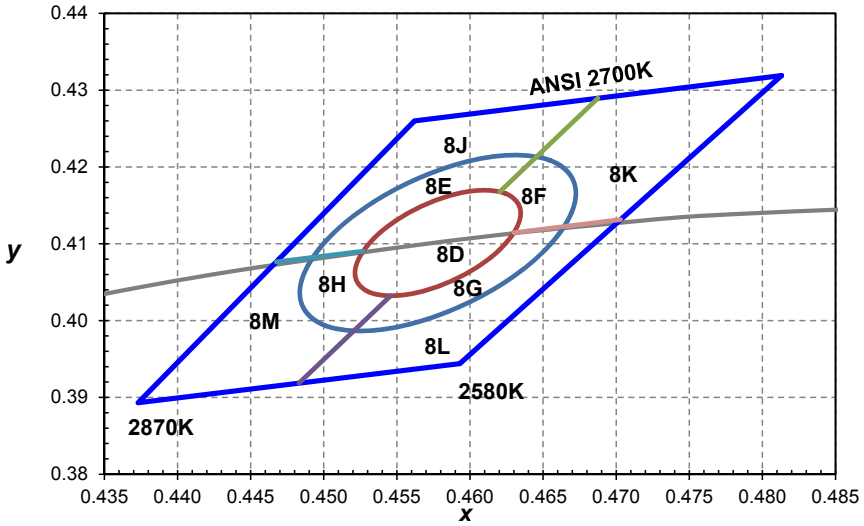


Figure 13. 2700K 1/9th color bin structure.

Table 9. Color Coordinates I for L130-27xx020102R1

Nominal ANSI CCT	Color Space	Target Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
2700K	Single 3-step MacAdam ellipse	(0.4578, 0.4101)	0.00810	0.00420	53.70°
2700K	Single 5-step MacAdam ellipse	(0.4578, 0.4101)	0.01350	0.00700	53.70°

Note for Table 9:

1. Tester tolerance: ±0.007 in x and y coordinates.

Color Bin Structure, Continued

L130-30xx0020102R1 Color Bin Structure – 3000K

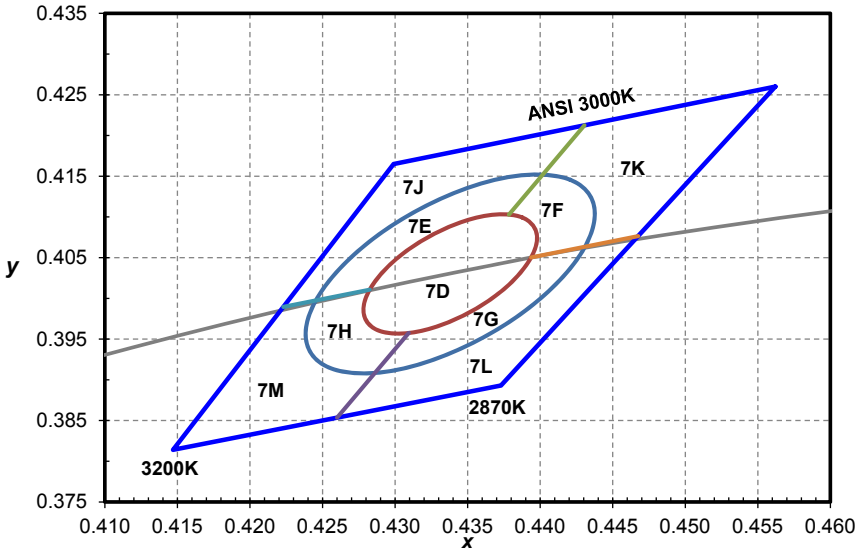


Figure 14. 3000K 1/9th color bin structure.

Table 10. Color Coordinates I for L130-30800020102R1

Nominal ANSI CCT	Color Space	Target Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
3000K	Single 3-step MacAdam ellipse	(0.4338, 0.4030)	0.00834	0.00408	53.22°
3000K	Single 5-step MacAdam ellipse	(0.4338, 0.4030)	0.01390	0.06800	53.22°

Note for Table 10:

1. Tester tolerance: ±0.007 in x and y coordinates.

Color Bin Structure, Continued

L130-35xx0020102R1 Color Bin Structure - 3500K

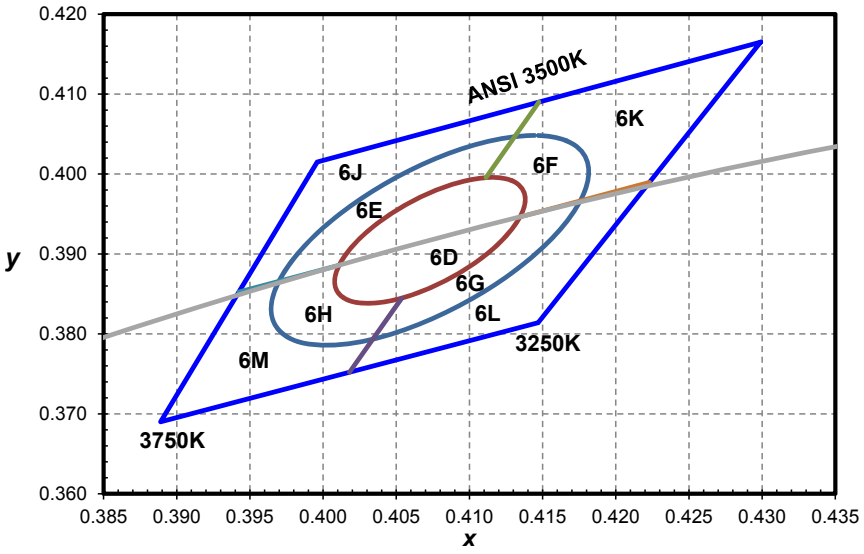


Figure 15. 3500K 1/9th color bin structure.

Table 11. Color Coordinates I for L135-30800020102R1

Nominal ANSI CCT	Color Space	Target Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
3500K	Single 3-step MacAdam ellipse	(0.4073, 0.3917)	0.00927	0.00414	54.00°
3500K	Single 5-step MacAdam ellipse	(0.4073, 0.3917)	0.01545	0.0690	54.00°

Note for Table 11:

1. Tester tolerance: ±0.007 in x and y coordinates.

Color Bin Structure, Continued

L130-40xx0020102R1 Color Bin Structure - 4000K

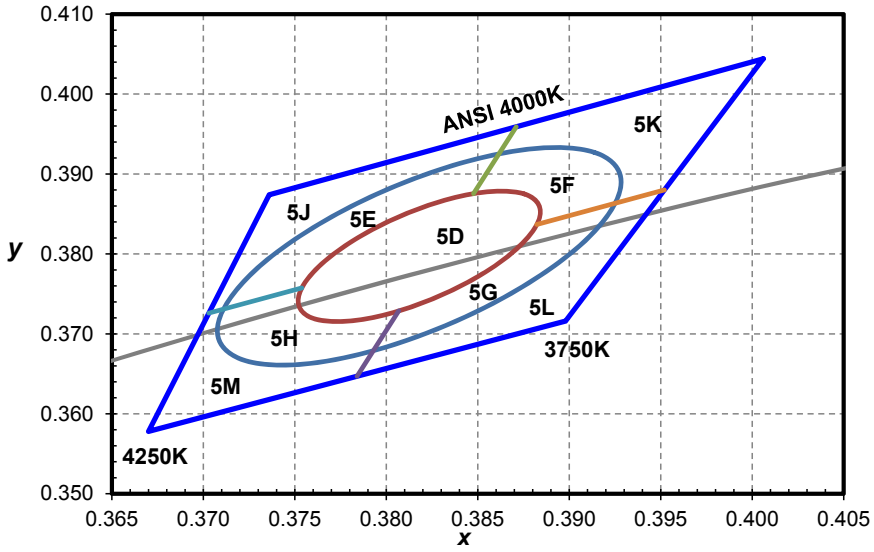


Figure 16. 4000K 1/9th color bin structure.

Table 12. Color Coordinates I for L130-40800020102R1

Nominal ANSI CCT	Color Space	Target Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
4000K	Single 3-step MacAdam ellipse	(0.3818, 0.3797)	0.00939	0.00402	53.72°
4000K	Single 5-step MacAdam ellipse	(0.3818, 0.3797)	0.01565	0.00670	53.72°

Note for Table 12:

1. Tester tolerance: ±0.007 in x and y coordinates.

Color Bin Structure, Continued

L130-50xx0020102R1 Color Bin Structure - 5000K

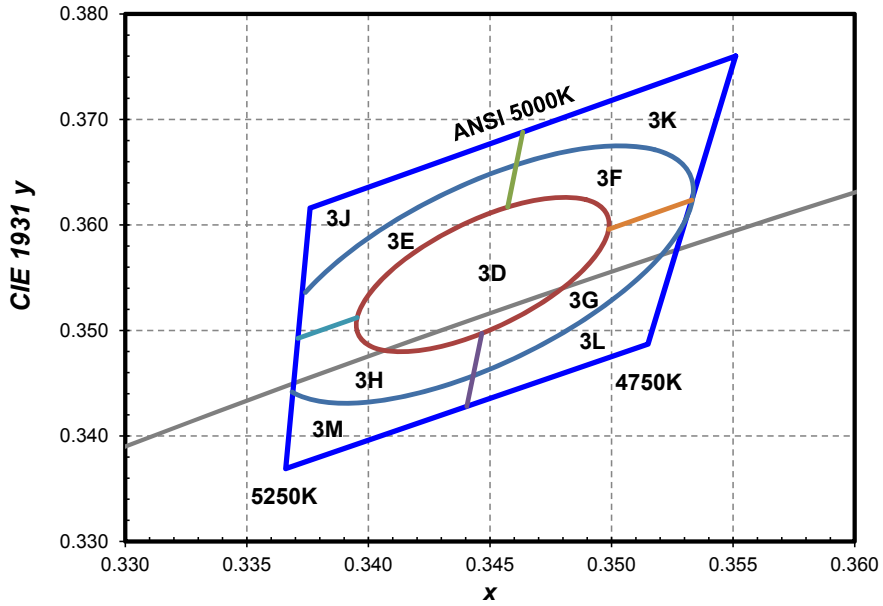


Figure 17. 5000K 1/9th color bin structure.

Table 13. Color Coordinates II for L130-50800020102R1

Nominal ANSI CCT	Color Space	Target Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
5000K	Single 3-step MacAdam ellipse	(0.3447, 0.3558)	0.00822	0.00354	59.62°
5000K	Single 5-step MacAdam ellipse	(0.3447, 0.3558)	0.01370	0.00590	59.62°

Note for Table 13:

1. Tester tolerance: ±0.007 in x and y coordinates.

Color Bin Structure, Continued

L130-57xx0020102R1 Color Bin Structure - 5700K

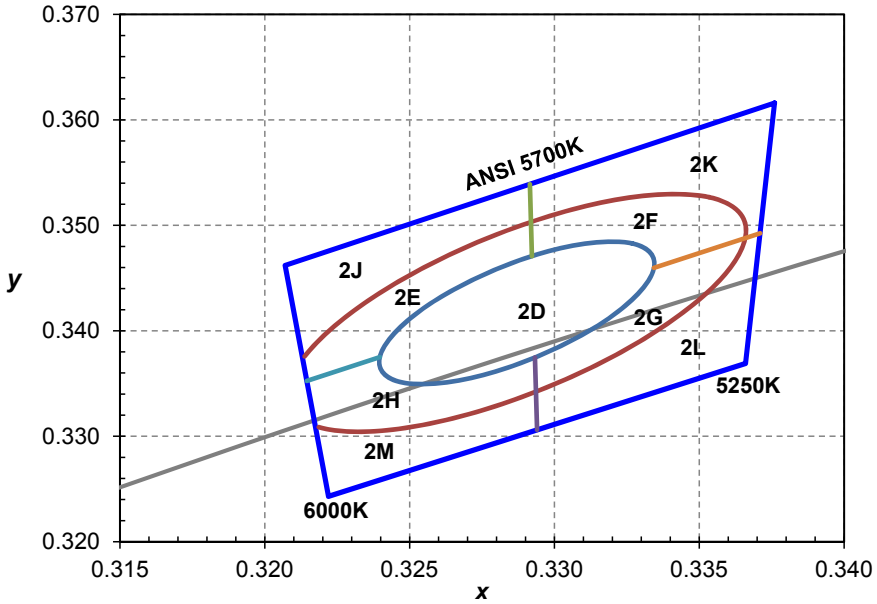


Figure 18. 5700K 1/9th color bin structure.

Table 14. Color Coordinates I for L130-57800020102R1

Nominal ANSI CCT	Color Space	Target Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
5700K	Single 3-step MacAdam ellipse	(0.3287, 0.3417)	0.00746	0.00320	59.09°
5700K	Single 5-step MacAdam ellipse	(0.3287, 0.3417)	0.01243	0.00533	59.09°

Note for Table 14:

1. Tester tolerance: ±0.007 in x and y coordinates.

Color Bin Structure, Continued

L130-65xx0020102R1 Color Bin Structure - 6500K

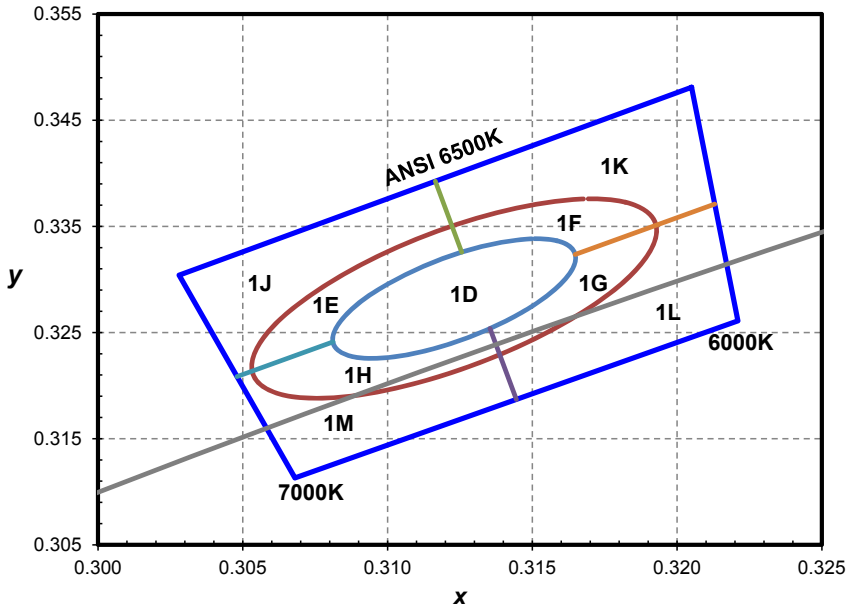


Figure 19. 6500K 1/9th color bin structure.

Table 15. Color Coordinates I for L130-65800020102R1

Nominal ANSI CCT	Color Space	Target Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
6500K	Single 3-step MacAdam ellipse	(0.3123, 0.3282)	0.00669	0.00285	58.57°
6500K	Single 5-step MacAdam ellipse	(0.3123, 0.3282)	0.01115	0.00475	58.57°

Note for Table 15:

1. Tester tolerance: ±0.007 in x and y coordinates.

About Lumileds

Lumileds is the light engine leader, delivering innovation, quality, and reliability.

For 100 years, Lumileds commitment to innovation has helped customers pioneer breakthrough products in the automotive, consumer and illumination markets.

Lumileds is shaping the future of light with our LEDs and automotive lamps, and helping our customers illuminate how people see the world around them.

To learn more about our portfolio of light engines visit www.lumileds.com.

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