LUMILEDS

ILLUMINATION

LUXEON HL4X

Maximized lumen output performance & increased system efficacy, with high driving current capabilities.

LUXEON HL4X is a specially designed high-power domed emitter suitable for outdoor and industrial applications like streetlights and high bay luminaires.

LUXEON HL4X provides maximum lumen outputs, and overall system efficacy in an industry standard 3535 package with 3-stripe footprint. With plenty of light coming from a small LES device and an ability to sustain high drive currents, it is perfect for cost efficient single optic, directional fixture designs.

FEATURES AND BENEFITS

- High lumens per emitter
- Ability to drive at high maximum current
- Industry standard 3535 package with 3-stripe footprint, suitable for existing designs with higher efficacy requirements
- Special materials selection enables long lasting reliability in harsh environments

PRIMARY APPLICATIONS

- Outdoor High Mast
- Floodlights
- Spotlights
- High Bay
- Low Bay
- Torch
- More...

c UL us No. E352519 RoHS COMPLIANT

Table of Contents

General Product Information

Product Test Conditions

LUXEON HL4X LEDs are tested and binned with a DC drive current of 1400mA, at a junction temperature, T_j , of 85°C.

Part Number Nomenclature

Part numbers for LUXEON HL4X follow the convention below:

L 1 H X – **A A B B** 4 **C** z z z z z z z

Where:

- **A A** – can be any alphanumeric character that designates nominal ANSI CCT (for example, 18=1800K, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K
- **B B** – can be any alphanumeric character that designates minimum CRI (for example, 70=70CRI, 80=80CRI, 90=90CRI)
- **C** – can be alphanumeric character that designates performance options (for example, 0=Standard full distribution)
- zzzzzzz – can be any alphanumeric character that can be used to designate customer-specific options

Therefore, the following part number is used for a LUXEON HL4X 4000K 70CRI LED:

L 1 H X – **4 0 7 0** 4 **0** 0 0 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 HL4X 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 HL4X at 1400mA, T_j=85°C

NOMINAL CCT	MINIMUM R9 [3]	MINIMUM CRI [1]	LUMINOUS FLUX [2] (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	PART NUMBER
			MINIMUM	TYPICAL		
			1400mA			
2700K	-40	70	591	642	160	L1HX-2770400000000
3000K	-40	70	600	658	164	L1HX-3070400000000
4000K	-40	70	645	699	174	L1HX-4070400000000
5000K	-40	70	650	704	175	L1HX-5070400000000
5700K	-40	70	655	710	177	L1HX-5770400000000
6500K	-40	70	658	713	177	L1HX-6570400000000
3000K	0	80	534	588	146	L1HX-3080400000000
4000K	0	80	575	616	153	L1HX-4080400000000
5000K	0	80	585	632	157	L1HX-5080400000000
5700K	0	80	590	637	159	L1HX-5780400000000
3000K	50	90	420	460	114	L1HX-3090400000000
4000K	50	90	477	528	131	L1HX-4090400000000
5000K	50	90	480	520	129	L1HX-5090400000000
5700K	50	90	518	575	143	L1HX-5790400000000

Notes for Table 1:
1. Lumileds maintains a tolerance of ±2 on CRI.
2. Lumileds maintains a tester tolerance of ±6.5% on luminous flux measurements.
3. Lumileds maintains a tester tolerance of ±6.5 on R9 measurements.

Optical Characteristics

Table 2. Optical characteristics for LUXEON HL4X at 1400mA, T_j=85°C

PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE [1]	TYPICAL VIEWING ANGLE [2]
L1HX-xxxx4x0000000	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 HL4X at 1400mA, T_j=85°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		
L1HX-xxxx400000000	2.70	2.87	3.10	-1.6	1.0

Notes for Table 3:
1. Lumileds maintains a tolerance of ±0.1V on forward voltage measurements.
2. Measured between 25°C and 110°C.

Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON HL4X

PARAMETER	MAXIMUM PERFORMANCE	
DC Forward Current [1, 2, 5]	2.0 A	4.0 A
Peak Pulsed Forward Current [1, 3]	2.0 A	4.0 A
LED Junction Temperature [1] (DC & Pulse)	160 °C	150 °C
ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)	Class 3B	
Operating Case Temperature [1]	-40°C to 135°C	
LED Storage Temperature	-40°C to 135°C	
Soldering Temperature	JEDEC 020c 260°C	
Allowable Reflow Cycles	3	
Reverse Voltage [4] ($V_{reverse}$)	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," with frequencies ≥100Hz and amplitude ≤15% of the maximum allowable DC forward current are acceptable, assuming the average current throughout each cycle does not exceed the maximum allowable DC forward current at the corresponding maximum junction temperature.
3. Pulsed operation with a peak drive current equal to the stated peak pulsed forward current is acceptable if the pulse on-time is ≤5ms per cycle and the duty cycle is ≤50%.
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.

Characteristic Curves

Spectral Power Distribution Characteristics

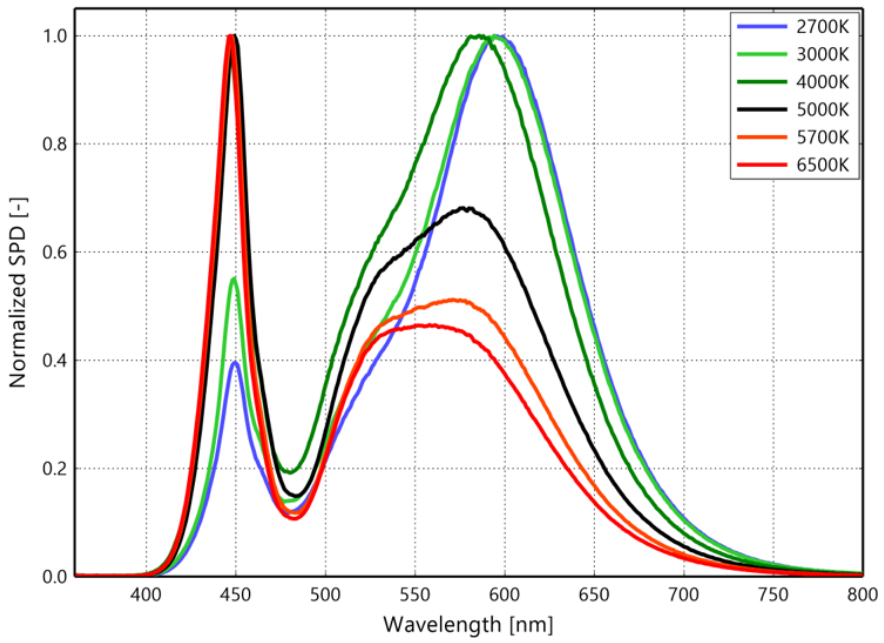


Figure 1a. Typical normalized power vs. wavelength for LUXEON HL4X 70 CRI at 1400mA, T_j=85°C

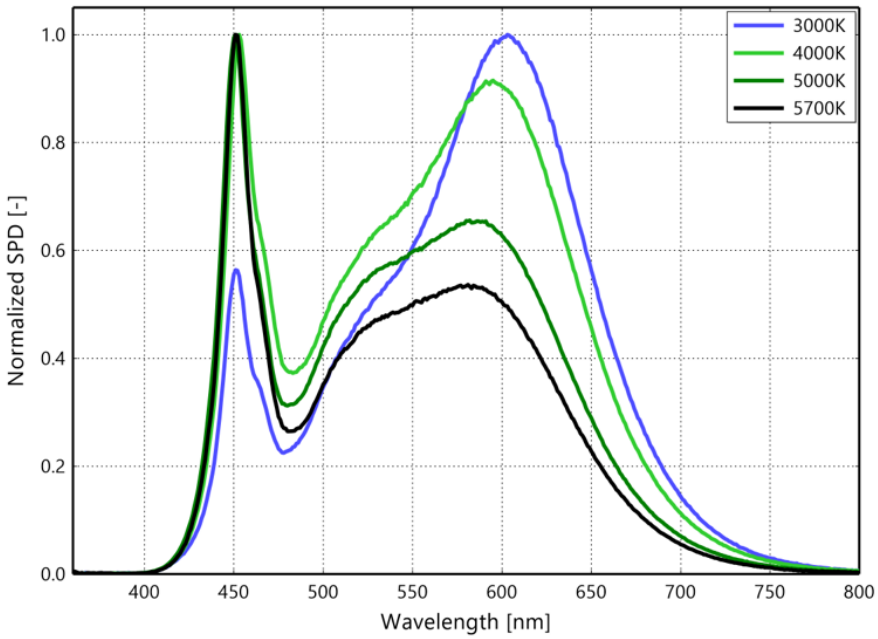


Figure 1b. Typical normalized power vs. wavelength for LUXEON HL4X 80 CRI at 1400mA, T_j=85°C

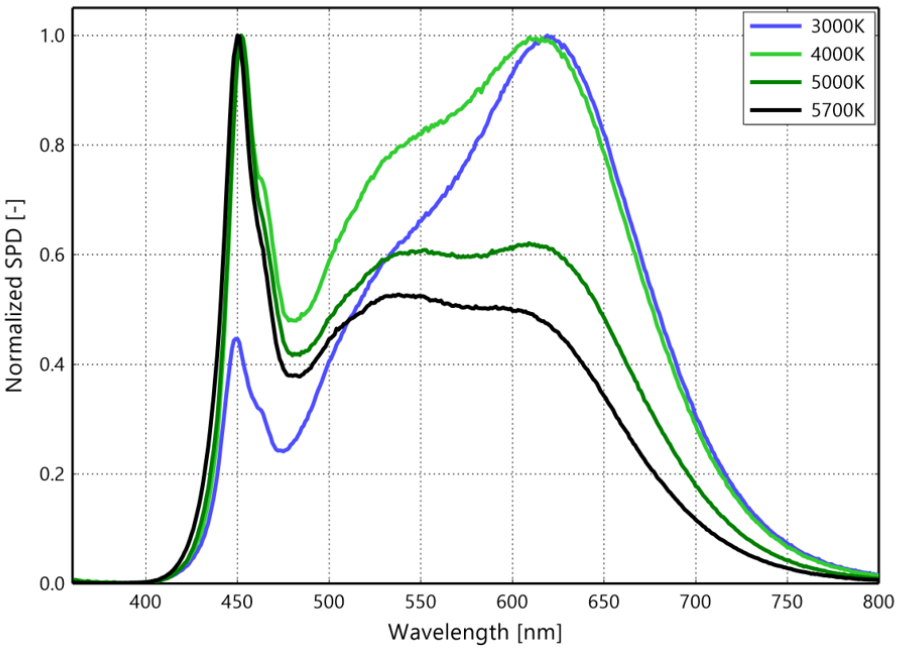


Figure 1c. Typical normalized power vs. wavelength for LUXEON HL4X 90 CRI at 1400mA, T_j=85°C

Light Output Characteristics

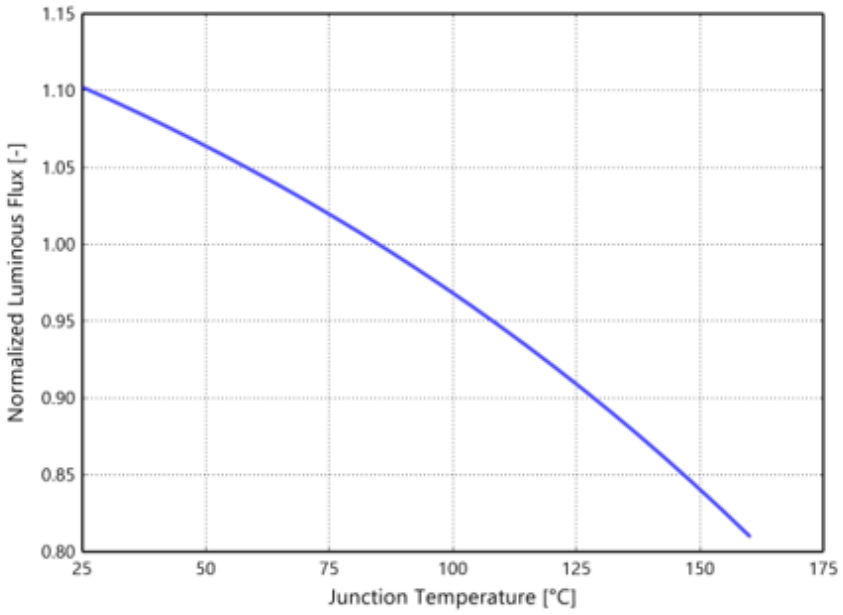


Figure 2. Typical normalized light output vs. junction temperature for LUXEON HL4X at 1400mA

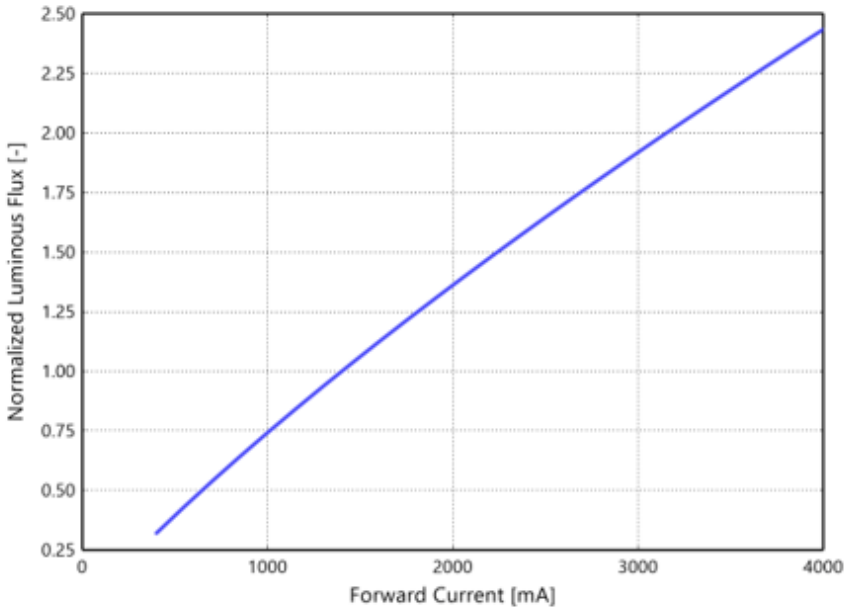


Figure 3. Typical normalized light output vs. forward current for LUXEON HL4X at 1400mA, T_j=85°C

Forward Current Characteristics

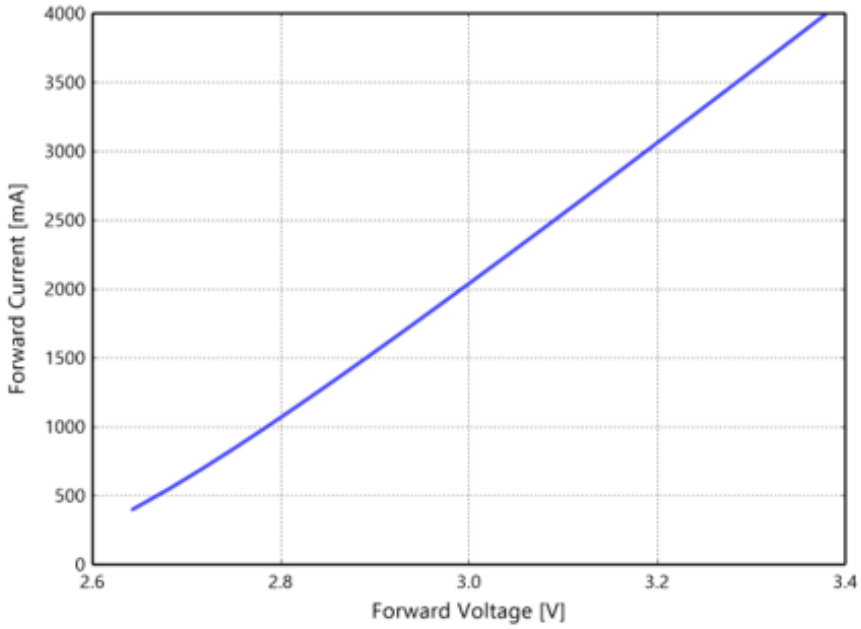


Figure 4. Typical forward current vs. forward voltage for LUXEON HL4X at T_j=85°C

Radiation Pattern Characteristics

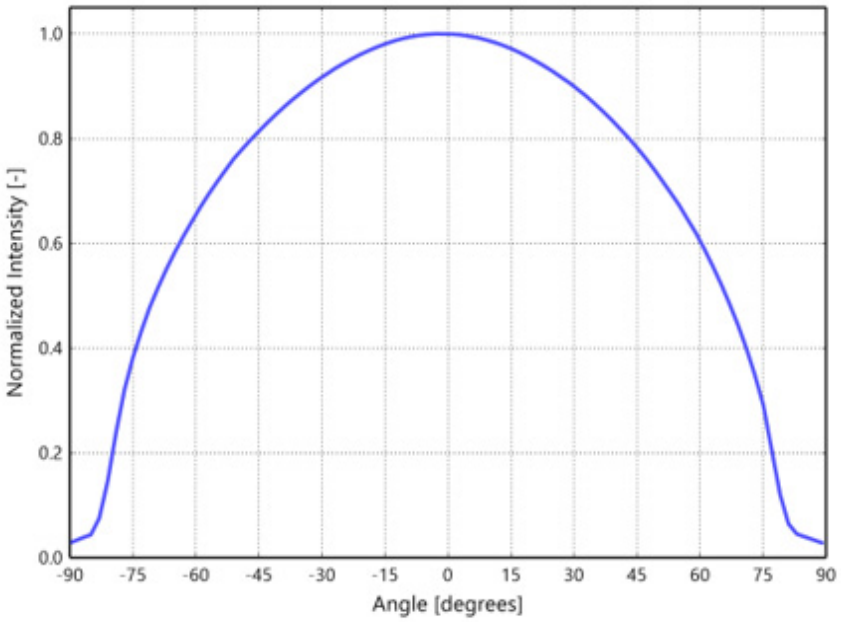


Figure 5. Typical radiation pattern for LUXEON HL4X at 1400mA, T_j=85°C

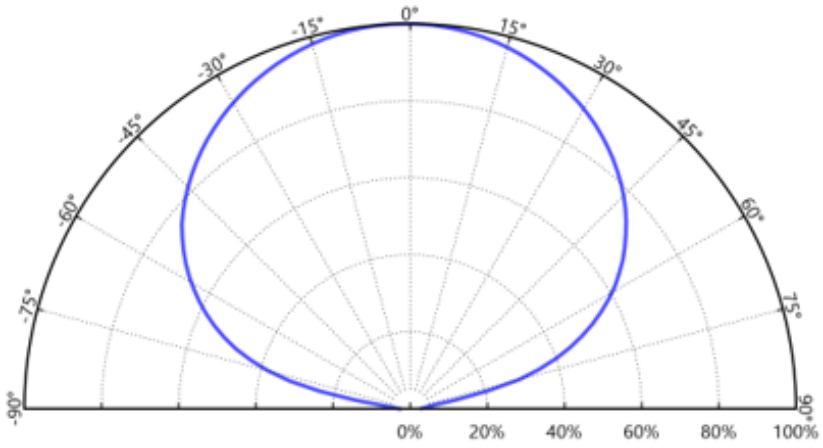


Figure 6. Typical polar radiation pattern for LUXEON HL4X at 1400mA, T_j=85°C

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 HL4X 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: T=480 to 510 lm, B=720 to 750 lm)
- **B** – designates color bin (example: 1=6500K, 2=5700K, 3=5000K, 5=4000K, 7=3000K)
- **C** – designates color space example: 5/A/B/C/D=5-step MacAdam ellipse, 3=3-step MacAdam ellipse)
- **D** – designates forward voltage bin (example: V= 2.70 to 2.90V, W=2.90 to 3.10V)

Therefore, a LUXEON HL4X 4000K 70CRI with a lumen range of 660 to 690 lm, color bin of 55 and a forward voltage range of 2.70 to 2.90V has the following CAT code:

Z 5 5 V

Luminous Flux Bins

Table 5 lists the standard luminous flux bins for LUXEON HL4X 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 HL4X

BIN	LUMINOUS FLUX [1] (lm)	
	MINIMUM	MAXIMUM
L	270	300
M	300	330
N	330	360
P	360	390
Q	390	420
R	420	450
S	450	480
T	480	510
U	510	540
V	540	570
W	570	600
X	600	630
Y	630	660
Z	660	690
A	690	720
B	720	750
C	750	780
D	780	790
E	790	800
F	800	810

Notes for Table 5:
1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.

Color Bin Definitions

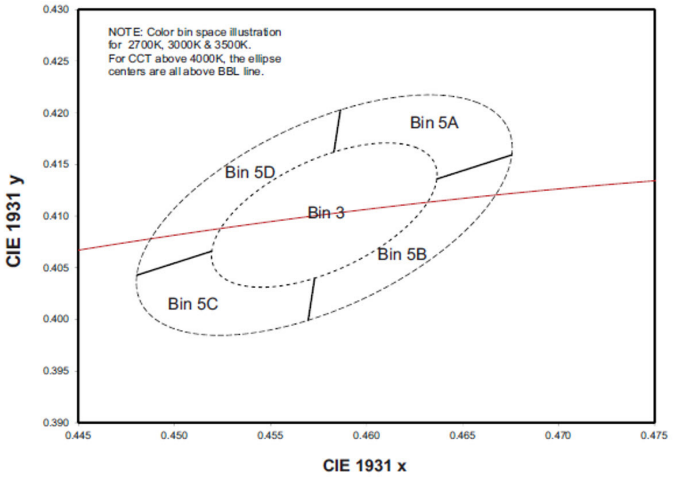


Figure 7. Color space definition for LUXEON HL4X

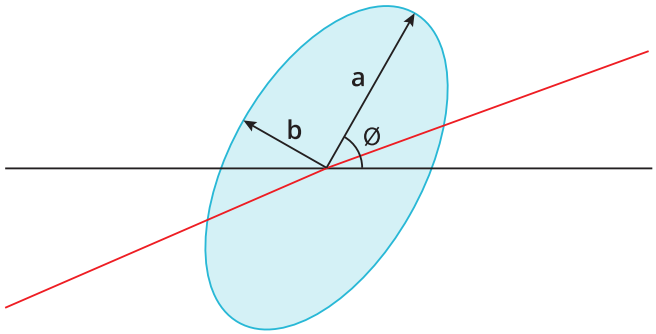


Figure 8. 3-, 5-step MacAdam ellipse illustration for Table 6

Table 6. 5-step MacAdam ellipse color bin definitions for LUXEON HL4X

NOMINAL CCT	COLOR SPACE	CENTER POINT [1] (cx, cy)	MAJOR AXIS, a		MINOR AXIS, b		ELLIPSE ROTATION ANGLE, θ
			3-step	5-step	3-step	5-step	
2700K	Single 3-step, 5-step MacAdam ellipse	(0.4578, 0.4101)	0.00810	0.01350	0.00420	0.00700	53.70°
3000K	Single 3-step, 5-step MacAdam ellipse	(0.4338, 0.4030)	0.00834	0.01390	0.00408	0.00680	53.22°
4000K	Single 3-step, 5-step MacAdam ellipse	(0.3818, 0.3797)	0.00939	0.01565	0.00402	0.00670	53.72°
5000K	Single 3-step, 5-step MacAdam ellipse	(0.3447, 0.3553)	0.00822	0.01370	0.00354	0.00590	59.62°
5700K	Single 3-step, 5-step MacAdam ellipse	(0.3287, 0.3417)	0.00745	0.01243	0.00320	0.00533	59.09°
6500K	Single 3-step, 5-step MacAdam ellipse	(0.3123, 0.3282)	0.06690	0.01115	0.00285	0.00475	58.57°

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

Table 7. Correlated color temperature bin definitions for LUXEON HL4X

BIN	CCT
1	6500K
2	5700K
3	5000K
5	4000K
7	3000K
8	2700K

Table 8. MacAdam ellipse color space definitions for LUXEON HL4X

BIN	SDCM
3	3-step MacAdam ellipse (70,80,90 CRI)
5	5-step MacAdam ellipse (70 CRI)
A	5-step MacAdam ellipse (80,90 CRI)
B	5-step MacAdam ellipse (80,90 CRI)
C	5-step MacAdam ellipse (80,90 CRI)
D	5-step MacAdam ellipse (80,90 CRI)

Forward Voltage Bins

Table 9. Forward voltage bin definitions for LUXEON HL4X

BIN	FORWARD VOLTAGE [1] (V_f)	
	MINIMUM	MAXIMUM
V	2.70	2.90
W	2.90	3.10

Notes for Table 9:
1. Lumileds maintains a tolerance of ±0.1V on forward voltage measurements.

Mechanical Dimensions

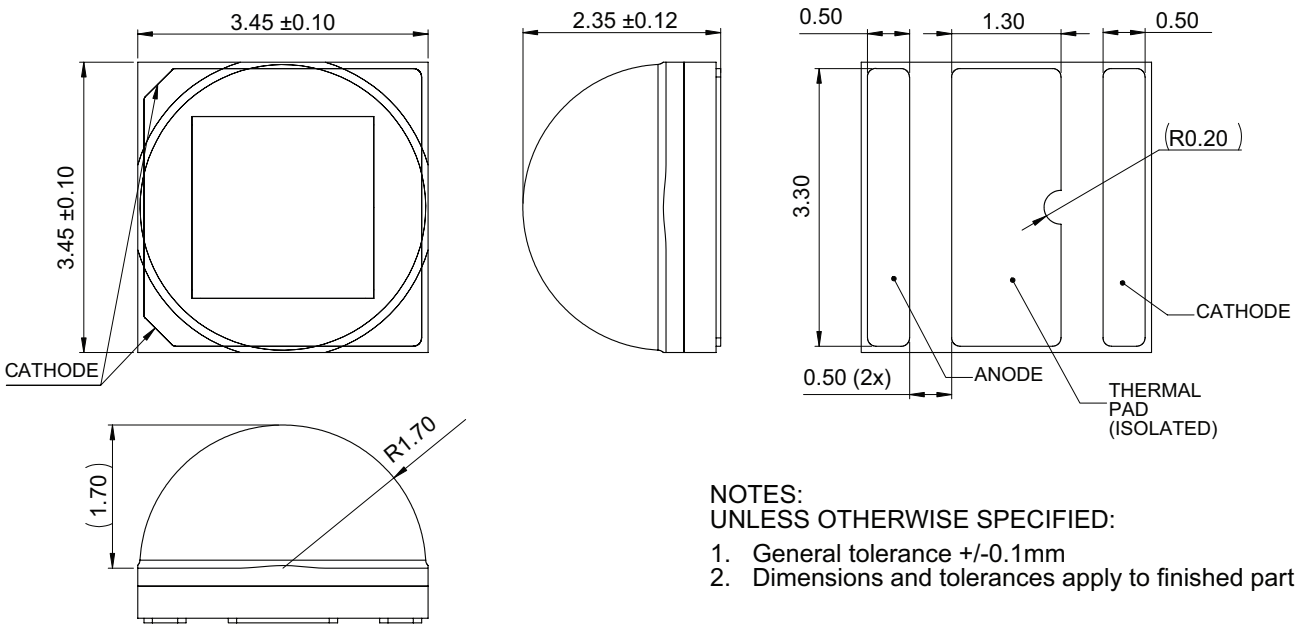


Figure 9. Mechanical dimensions for LUXEON HL4X

Notes for Figure 9:
1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Do not handle the device by the dome. Excessive force on the dome may damage the dome itself or the interior of the device.

Reflow Soldering Guidelines

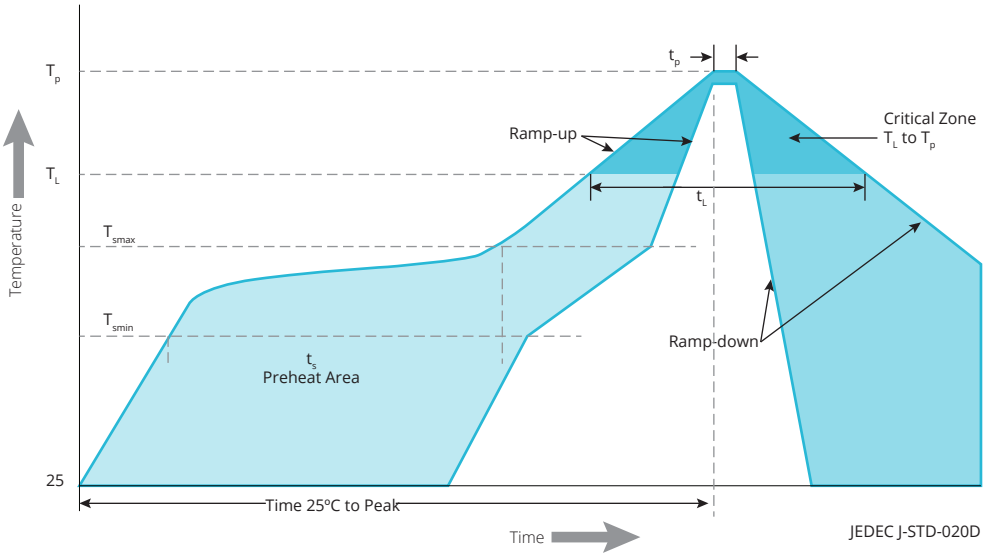


Figure 10. Visualization of the acceptable reflow temperature profile as specified in Table 10

Table 10. Reflow profile characteristics for LUXEON HL4X

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

Notes for Table 10:
1. All temperatures refer to the application Printed Circuit Board (PCB), measured on the surface adjacent to the package body.

JEDEC Moisture Sensitivity

Table 11. Moisture sensitivity levels for LUXEON HL4X

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS STANDARD	
	TIME	CONDITIONS	TIME	CONDITIONS
1	Unlimited	≤30°C / 85% RH	168 Hours +5 / -0	85°C / 85% RH

Solder Pad Design

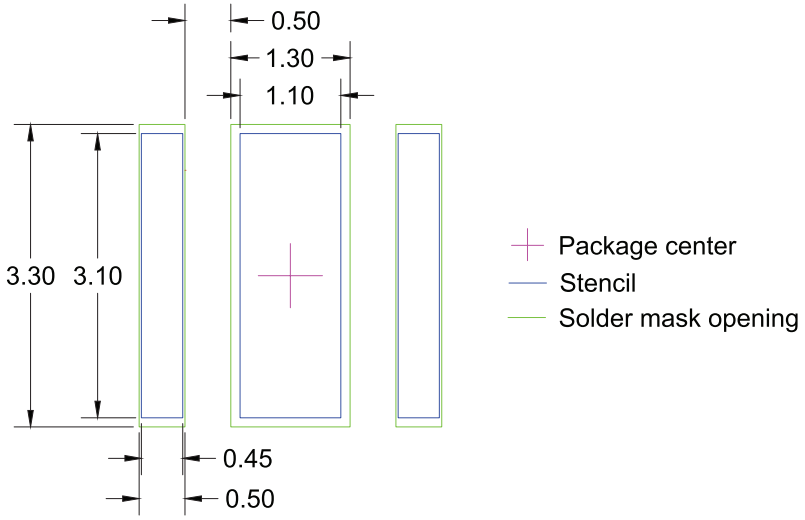
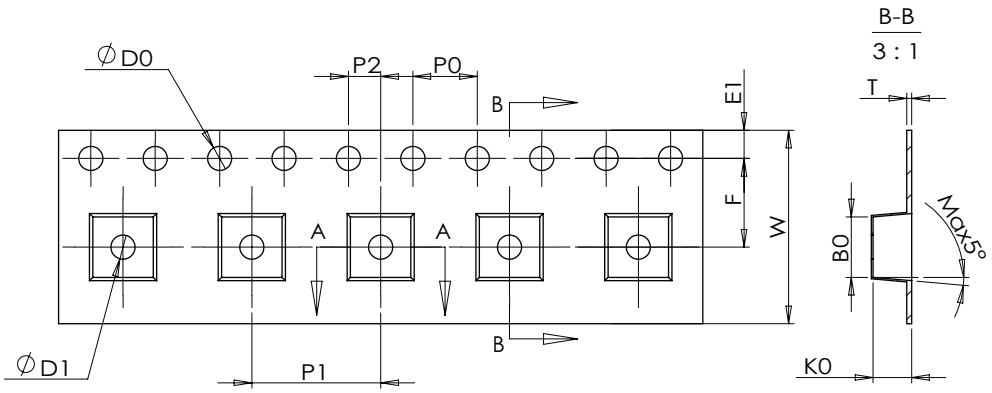


Figure 11. Recommended PCB solder pad layout for LUXEON HL4X

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

Packaging Information

Pocket Tape Dimensions

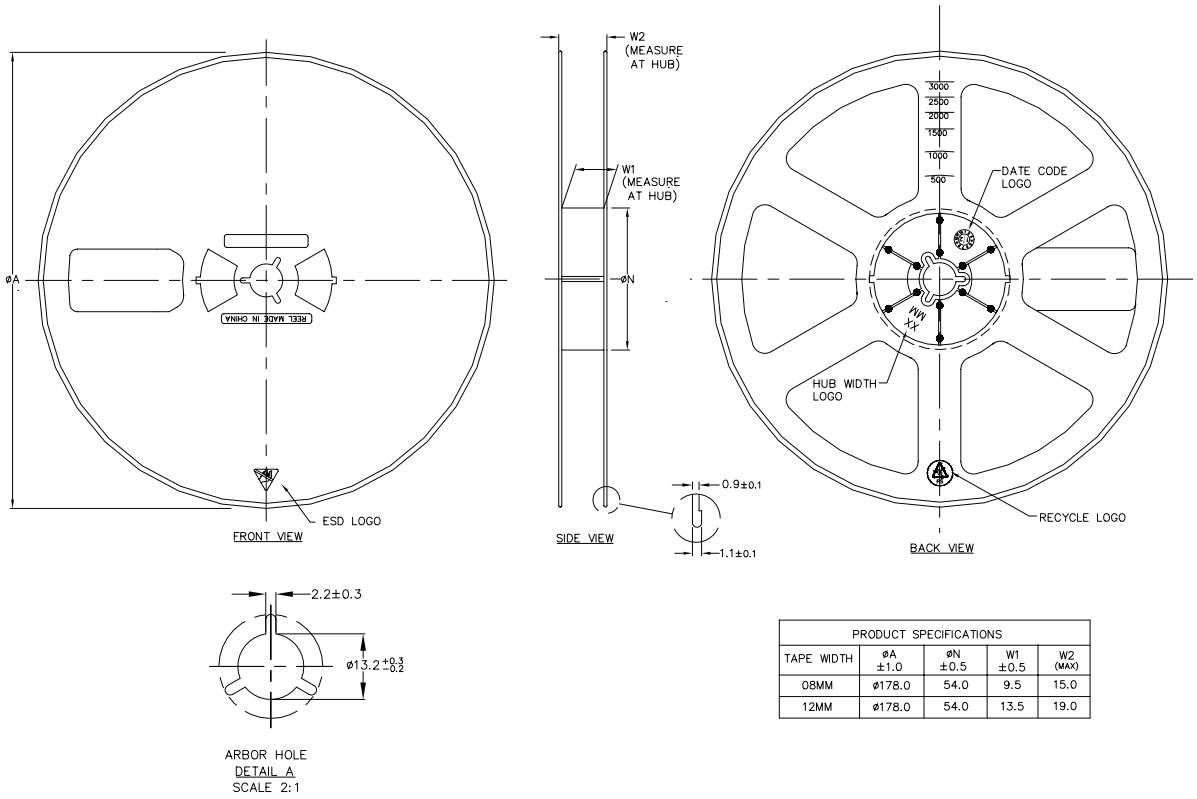


Item	Spec
W	12.00+0.30/-0.10
P_1	8.00±0.10
E_1	1.75±0.10
F	5.50±0.10
D_0	1.50+0.10/0
D_1	1.50±0.10
P_0	4.00±0.10
$P_0$10	40.00±0.20
P_2	2.00±0.10
A_0	3.65±0.10
B_0	3.65±0.10
K_0	2.45±0.10
T	0.30±0.05
	Unit: mm

Figure 12. Pocket tape dimensions for LUXEON HL4X

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

Reel Dimensions



PRODUCT SPECIFICATIONS				
TAPE WIDTH	øA ±1.0	øN ±0.5	W1 ±0.5	W2 (MAX)
08MM	ø178.0	54.0	9.5	15.0
12MM	ø178.0	54.0	13.5	19.0

Figure 13. Reel dimensions for LUXEON HL4X

Notes for Figure 13:
1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. 800 pieces per reel for LUXEON HL4X.

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.

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