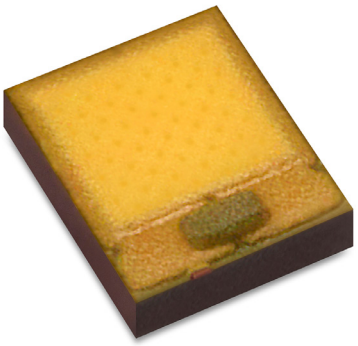
LUMILEDS

ILLUMINATION

LUXEON Z ES

Extreme flux density in a micro footprint package for precise optical control



LUXEON Z ES is a high power 1.6mm x 2.0mm LED that enables never before seen color consistency, luminance, flux density and design flexibility for lighting solutions. LUXEON Z ES is undomed, a feature that provides unmatched optical flexibility for precise beam angle control. Tested and binned at application conditions, 85°C, LUXEON Z ES emitters are an ideal choice for indoor and outdoor light sources requiring superior beam angles, higher efficacy and lower costs.

FEATURES AND BENEFITS

- Micro footprint enables close packaging
- Undomed design allows precise optical control
- 3- and 5-step MacAdam ellipse: *Freedom from Binning* enabling color consistency
- LM-80 test report available

PRIMARY APPLICATIONS

- Wall Grazer
- Linear
- Wall Wash
- Lamps
- High Bay
- Low Bay
- More...

Table of Contents

General Product Information

Product Test Conditions

LUXEON Z ES LEDs are tested and binned with a DC drive current of 700mA at a junction temperature, T_j, of 85°C.

Part Number Nomenclature

Part numbers for LUXEON Z ES follow the convention below:

L X Z **A – B C D E – F**

Where:

- **A** – designates voltage (2=3V)
- **B C** – designates nominal ANSI CCT or color (22=2200K, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K)
- **D E** – designates minimum CRI (70=70CRI, 7T=70CRI Typical, 80=80CRI, 90=90CRI)
- **F** – designates color space definition (3=3 SDCM and 5=5 SDCM)

Therefore, the following part number is used for a LUXEON Z ES 3V, 3000K 80CRI, which is binned within a 3-step MacAdam ellipse:

L X Z **2 – 3 0 8 0 – 3**

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 Z ES 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 Z ES 3V at 700mA and 350mA, T_j=85°C.

NOMINAL CCT	MINIMUM CRI [1]	LUMINOUS FLUX [1] (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	TYPICAL LUMINOUS FLUX (lm)	TYPICAL LUMINOUS EFFICACY (lm/W)	PART NUMBER [2]
		MINIMUM	TYPICAL				
		700mA			350mA		
4000K	70	220	260	133	143	150	LXZ2-4070
5000K	70	220	260	133	143	150	LXZ2-5070
5700K	70	220	270	138	149	156	LXZ2-5770
5700K	70 [3]	250	270	138	149	156	LXZ2-577T
6500K	70	220	270	138	149	156	LXZ2-6570
6500K	70 [3]	250	270	138	149	156	LXZ2-657T
2200K	80	140	188	96	103	109	LXZ2-2280-x
2700K	80	170	216	110	119	125	LXZ2-2780-x
3000K	80	180	230	117	127	133	LXZ2-3080-x
3500K	80	190	240	122	132	139	LXZ2-3580-x
4000K	80	190	248	127	136	144	LXZ2-4080-x
5000K	80	190	250	128	138	145	LXZ2-5080-x
2700K	90	140	180	92	99	104	LXZ2-2790-x
3000K	90	150	190	97	105	110	LXZ2-3090-x
3500K	90	150	197	101	108	114	LXZ2-3590-x
4000K	90	150	205	105	113	119	LXZ2-4090-x
5700K	90	170	215	110	118	124	LXZ2-5790-x

Notes for Table 1:
1. Lumileds maintains a tolerance of ±6.5% on both luminous flux and radiometric power and ±2 on CRI measurements.
2. In the part number the -x is the designation for the white color space requirement. On 80CRI and 90CRI versions 3 designates 3 SDCM and 5 designates 5 SDCM. For 70 CRI parts or lower, they will not have an SDCM designation and all parts are binned within a 5-step SDCM.
3. Typical CRI.

Optical Characteristics

Table 2. Optical characteristics for LUXEON Z ES at 700mA.

PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE [1]	TYPICAL VIEWING ANGLE [2]
LXZ2-xxxx	140°	116°
LXZ2-xxxx-x	140°	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 Z ES at 700mA.

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		
LXZ2-xxxx	2.5	2.8	3.25	-1.6	3
LXZ2-xxxx-x	2.5	2.8	3.25	-1.6	3

Notes for Table 3:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Measured between 25°C and 110°C.

Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON Z ES.

PARAMETER	MAXIMUM PERFORMANCE		
DC Forward Current [1, 2]	1050mA	1200mA	1500mA
Peak Pulsed Forward Current [1, 3]	1200mA	1350mA	1650mA
LED Junction Temperature [1] (DC & Pulse)	150°C	135°C	85°C
ESD Sensitivity	Class 3B		
Operating Case Temperature	-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 ($V_{reverse}$) [4, 5]	LUXEON LEDs are not designed to be driven in reverse bias		

Notes for Table 4:
1. Proper current derating must be observed to maintain 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. Pulsed operation with the maximum 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 200uA.
5. A maximum 5V reverse voltage for up to 10s is an acceptable beginning of life, one time, test condition.

Characteristic Curves

Spectral Power Distribution Characteristics

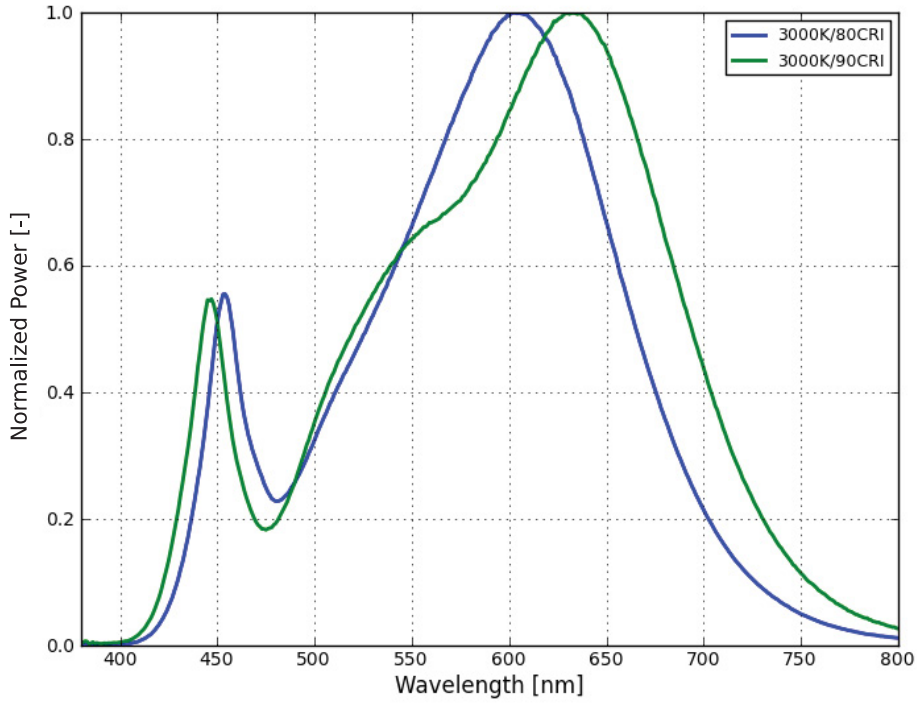


Figure 1. Typical normalized power vs. wavelength for LXZx-xxxx at test current, T_j=85ºC.

Light Output Characteristics

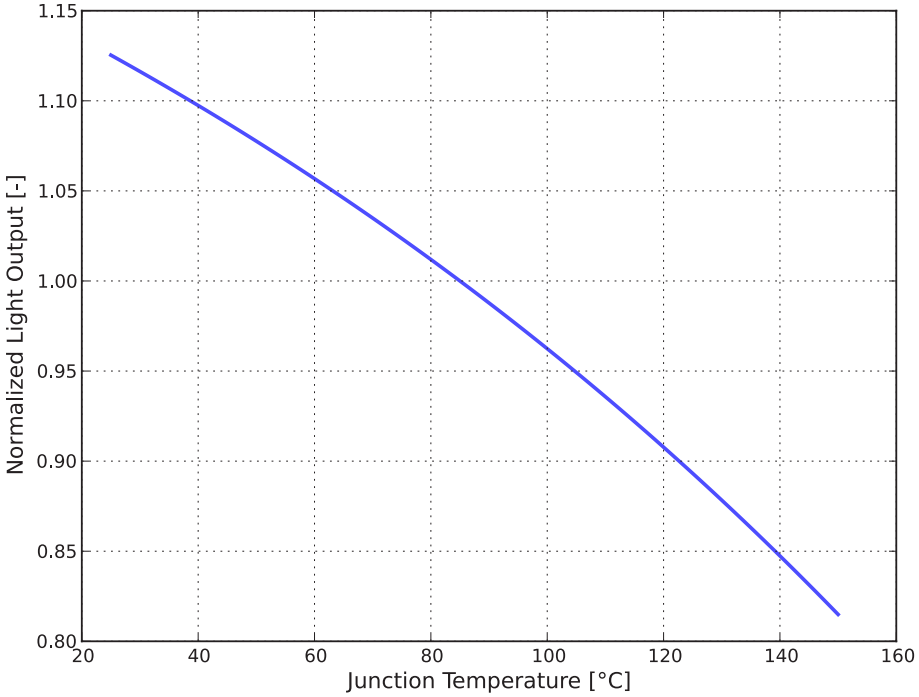


Figure 2. Typical normalized light output vs. junction temperature for LXZx-xxxx, at test current.

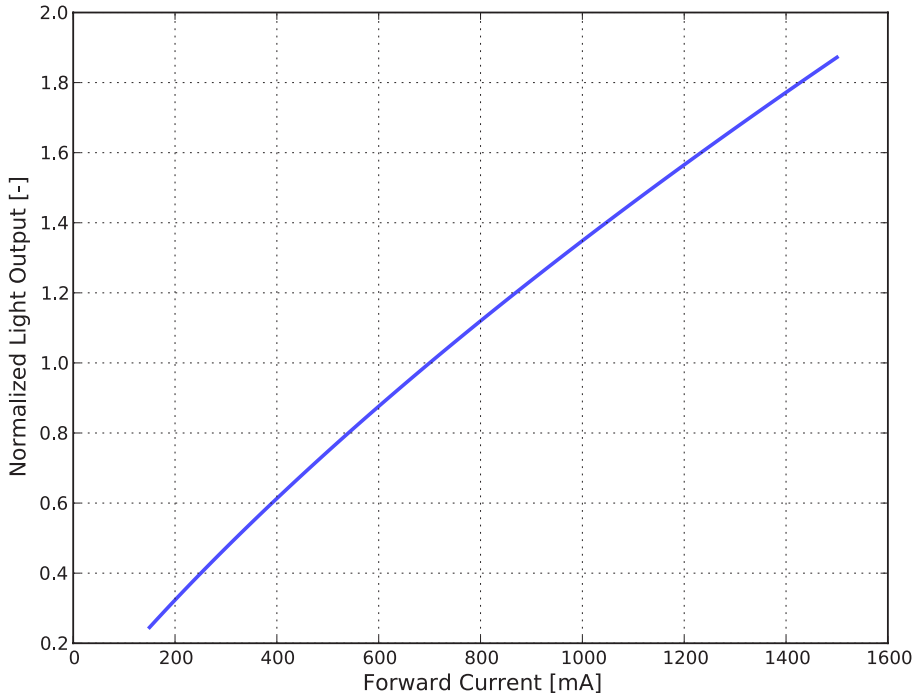


Figure 3. Typical normalized light output vs. forward current for LXZx-xxxx, T_j=85°C.

Forward Current Characteristics

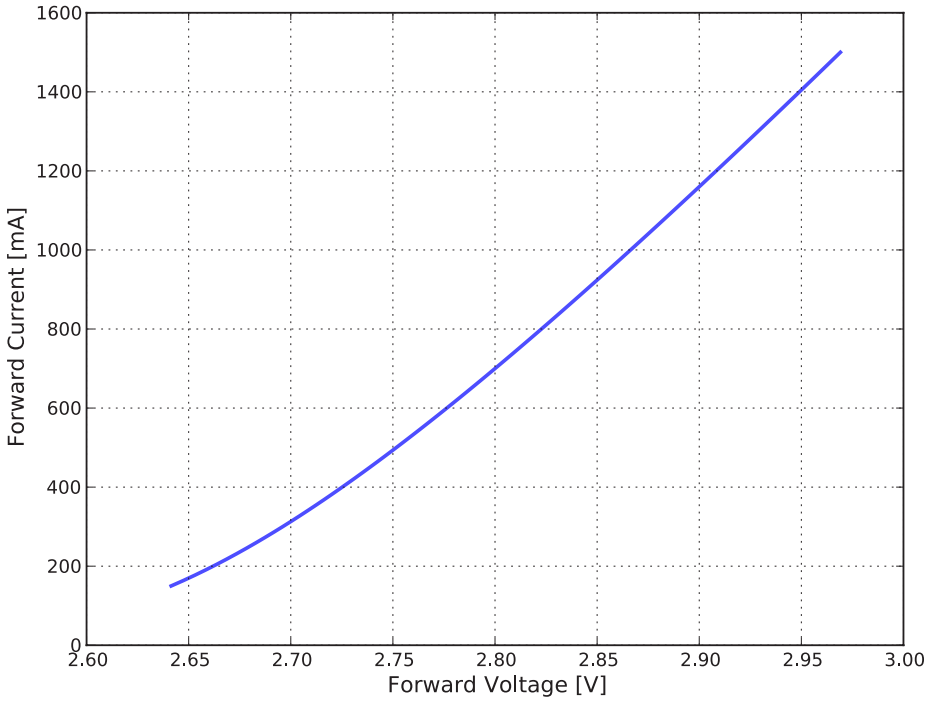


Figure 4. Typical forward current vs. forward voltage for LXZx-xxxx, T_j=85°C.

Radiation Pattern Characteristics

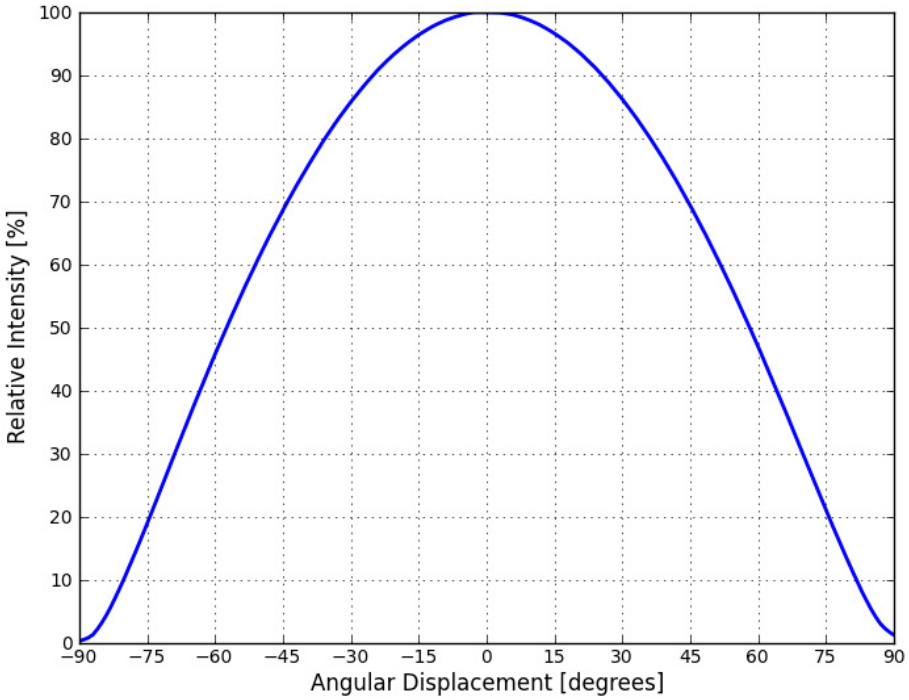


Figure 5. Typical radiation pattern for LXZx-xxxx (white only) at test current, T_j=85°C.

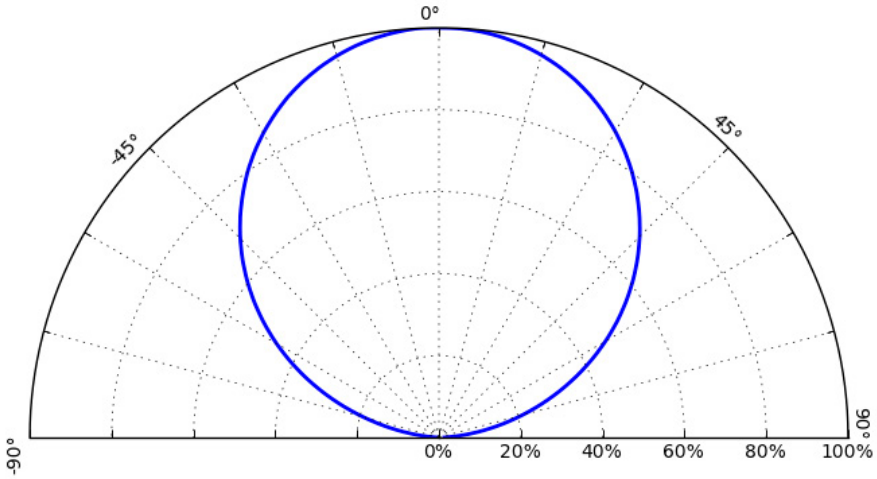


Figure 6. Typical polar radiation pattern for LXZx-xxxx (white only) at test current, T_j=85°C.

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 Z ES LEDs are labeled using a 4-digit alphanumeric CAT code following the format below.

A B C D

A – designates luminous flux/radiometric power bin (example: L=200 to 210 lm, M=210 to 220 lm)

B C – designates white color bins (example: 5A, 5B, 5C, 5D, 3U, 3L for 3000K parts)

D – designates forward voltage bin (example: X =2.65 to 2.85V, Y=2.85 to 3.00V)

Therefore, a LUXEON Z ES LED with a lumen range of 200 lm to 210 lm, color bin of 5D and a forward voltage range of 2.65 to 2.85V has the following CAT code:

L 5 D X

Luminous Flux Bins

Table 5 lists the standard photometric luminous flux bins for LUXEON Z ES 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 Z ES, T_j=85°C.

BIN	LUMINOUS FLUX [1] (lm)	
	MINIMUM	MAXIMUM
D	130	140
E	140	150
F	150	160
G	160	170
H	170	180
J	180	190
K	190	200
L	200	210
M	210	220
N	220	230
P	230	240
Q	240	250
R	250	260
S	260	270
T	270	280
U	280	290
V	290	300
W	300	310

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

Color Bin Definitions

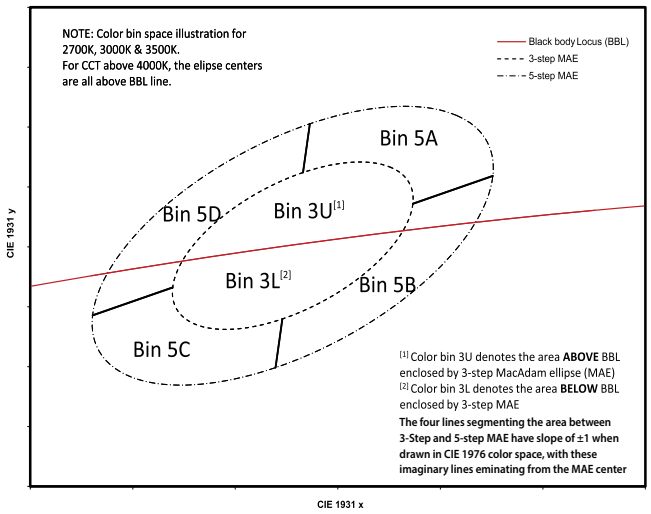


Figure 7. Color space definition for LUXEON Z ES.

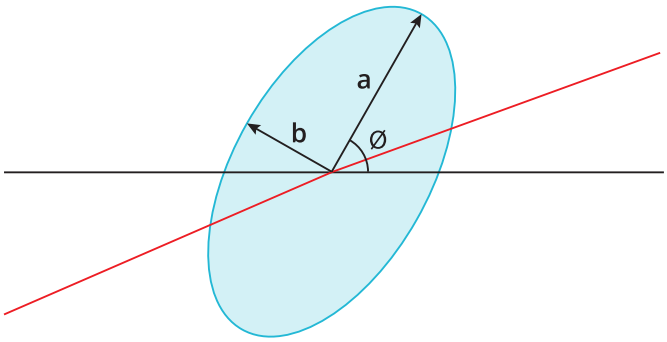


Figure 8. 3- and 5-step MacAdam ellipse illustration for Table 6.

Table 6. 3- and 5-step MacAdam ellipse color bin definitions for LUXEON Z ES.

NOMINAL CCT	COLOR SPACE [1]	CENTER POINT [2] (cx, cy)	MAJOR AXIS, a	MINOR AXIS, b	ELLIPSE ROTATION
2200K	Single 3-step MacAdam ellipse	(0.5020, 0.4156)	0.00863	0.00398	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	53.20°
3500K	Single 3-step MacAdam ellipse	(0.4073, 0.3917)	0.00927	0.00414	54.0°
4000K	Single 3-step MacAdam ellipse	(0.3818, 0.3797)	0.00939	0.00402	53.70°
5000K	Single 3-step MacAdam ellipse	(0.3447, 0.3553)	0.00822	0.00354	59.60°
5700K	Single 3-step MacAdam ellipse	(0.3287, 0.3417)	0.00746	0.00320	59.09°
2200K	Single 5-step MacAdam ellipse	(0.5020, 0.4156)	0.01438	0.00663	49.27°
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	53.20°
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	53.70°
5000K	Single 5-step MacAdam ellipse	(0.3447, 0.3553)	0.01370	0.00590	59.60°
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. 3-step is available in 80CRI and 90CRI, and 5-step is available in 70CRI, 80CRI and 90CRI.
2. Lumileds maintains a tolerance of ±0.005 on x and y color coordinates in the CIE color space.

Table 7. MacAdam ellipse color bin definitions for LXZ2-xxxx, T_j=85°C.

BIN	SDCM
30	3-step MacAdam ellipse (70CRI, 80CRI, 90CRI)
3U	3-step MacAdam ellipse (80, 90CRI)
3L	3-step MacAdam ellipse (80, 90CRI)
5A	5-step MacAdam ellipse (70, 80, 90CRI)
5B	5-step MacAdam ellipse (70, 80, 90CRI)
5C	5-step MacAdam ellipse (70, 80, 90CRI)
5D	5-step MacAdam ellipse (70, 80, 90CRI)

Forward Voltage Bins

Table 8. Forward voltage bin definitions for LXZ2-xxxx.

BIN	FORWARD VOLTAGE [1] (V_F)	
	MINIMUM	MAXIMUM
P	2.50	2.75
R	2.75	3.00
S	3.00	3.25
X	2.65	2.85
Y	2.85	3.00

Notes for Table 8:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.

Mechanical Dimensions

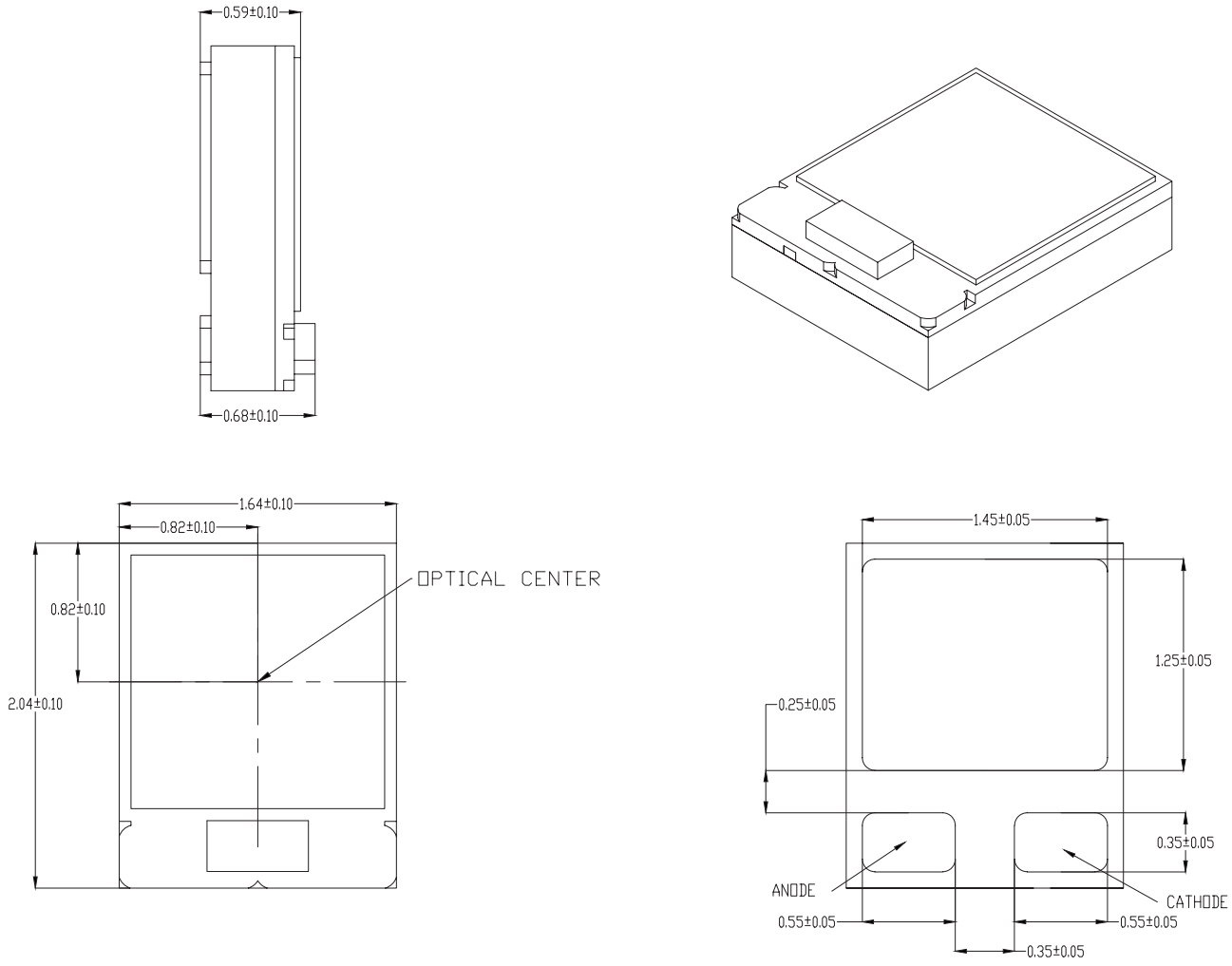


Figure 9. Mechanical dimensions for LUXEON Z ES.

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

Soldering Reflow Guidelines

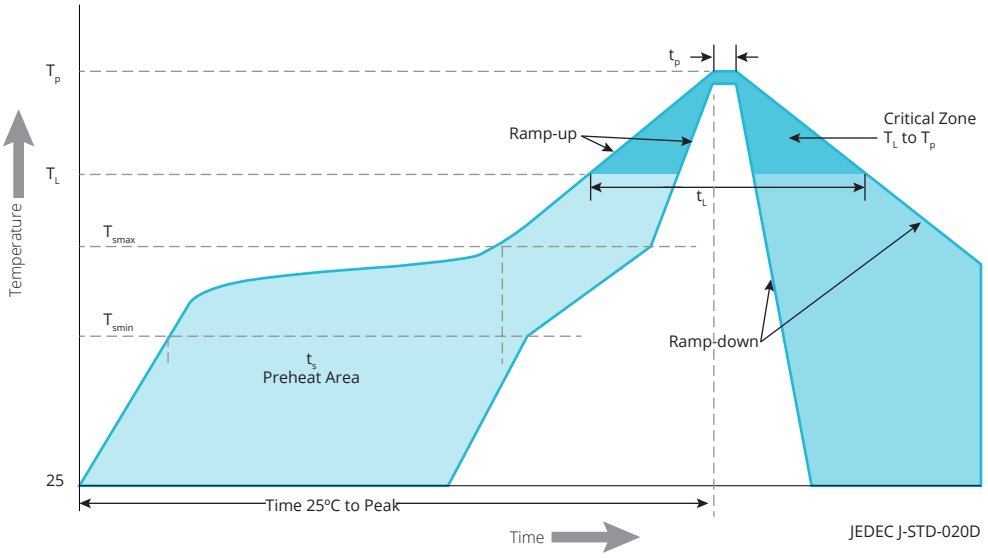


Figure 10. Visualization of the acceptable reflow temperature profile as specified in Table 9.

Table 9. Reflow profile characteristics for LUXEON Z ES.

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
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 10. Moisture sensitivity levels for LUXEON Z ES.

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

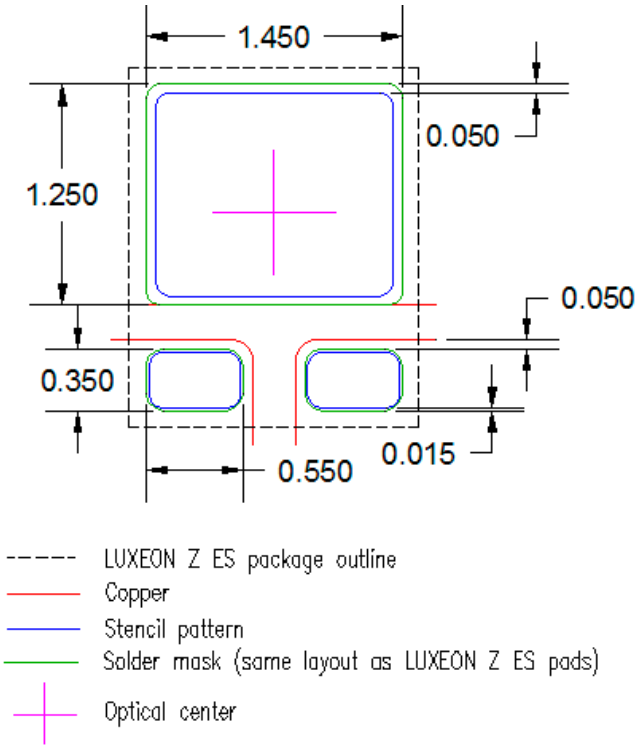


Figure 11. Solder pad layout for LUXEON Z ES.

Notes for Figure 11:
1. All dimensions are in millimeters.
2. The figure shows one of the LUXEON Z ES layouts for close-packing design on Printed Circuit Board (PCB). For more information on assembly and additional layouts, please refer to LUXEON Z ES Application Brief (AB120).
3. The *.dwg files are available at lumileds.com.

Packaging Information

Pocket Tape Dimensions

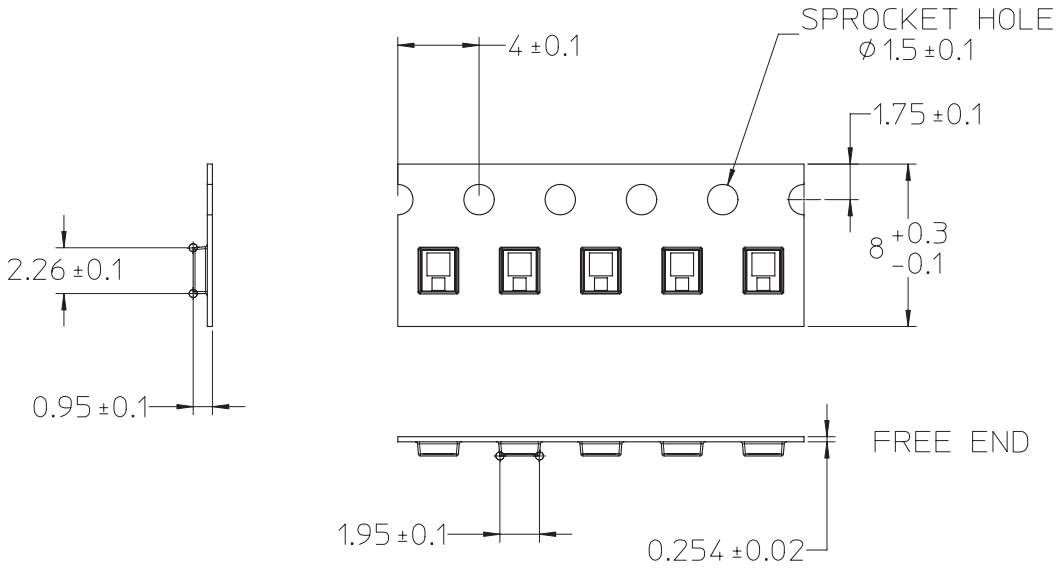


Figure 12. Tape dimensions for LUXEON Z ES.

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

Reel Dimensions

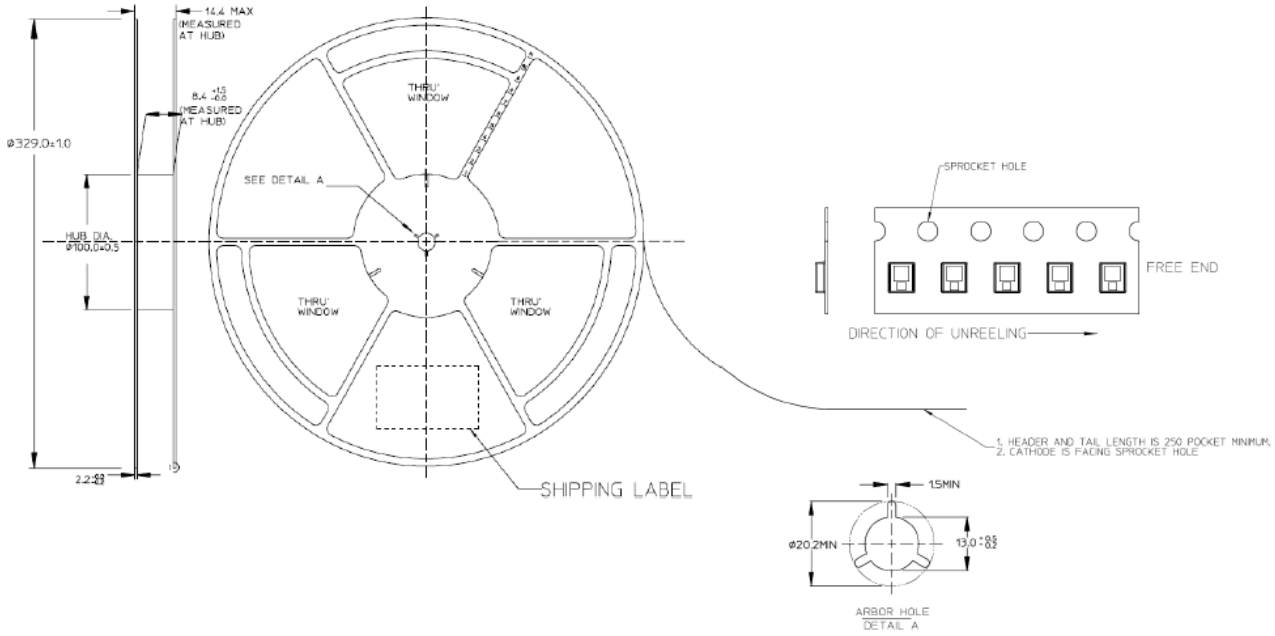


Figure 13. Reel dimensions for LUXEON Z ES.

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 better, safer, more beautiful—with light.

To learn more about our lighting solutions, visit lumileds.com.

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