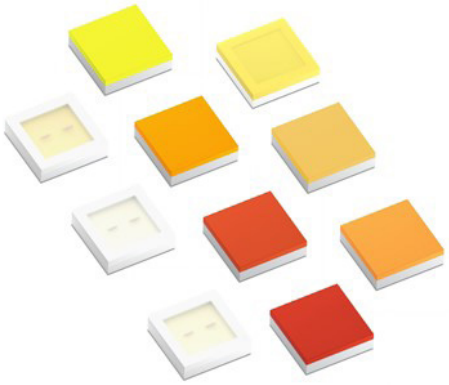
LUMILEDS

ILLUMINATION

LUXEON HL1Z Color Line and LUXEON HL1Z Fusion

Versatile LED family enabling vibrant multicolor lighting



Designed with space and energy efficiency in mind, LUXEON HL1Z Colors deliver deep hues from a small package, with minimal power consumption. This is enabled by CSP (Chip Scale Package) technology with an LED size of only 1.4mm x 1.4mm. This product line is both suited for applications with individual emitters as well as multicolor clusters.

LUXEON HL1Z Fusion Red, Green, and Blue are optimized to create compact, high-output, directional, white-tunable sources between 1,800K and 6,500K that can consistently follow the black body locus or create unique experiences with subtle off-white hues.

FEATURES AND BENEFITS

- Small package size (1414) allows colored spots with small beam angles from a minimal Light Emitting Surface (LES).
- Supports high power density with up to 2W electrical power per LED.
- Superior color stability over temperature with phosphor-converted saturated color LEDs.
- Complementary to the LUXEON HL1Z white LED series.

PRIMARY APPLICATIONS

- Spotlights
- Downlights
- Wall Wash
- Landscape Lighting
- Specialized Lighting

cULus No. E352519 RoHS COMPLIANT

Table of Contents

General Product Information

Product Test Conditions

LUXEON HL1Z Color Line and LUXEON HL1Z Fusion LEDs are tested and binned with a DC drive current of 350mA at a junction temperature, T_j of 85ºC.

Part Number Nomenclature

Part numbers for LUXEON HL1Z Color Line follow the convention below:

L 1 H Z – **A A A** 1 z z z z z z z z z

Where:

A A A	–	designates color (RYL = Royal Blue, BLU = Blue, GRN = Green, PCG = Green, PCA = PC Amber, RNG = PC Red Orange, PCR = PC Red)
1	–	designates 1.0 mm2 die size
zzzzzzzzz	–	any alphanumeric character that designates Option Codes for customization / bin selections / etc

Therefore, the following part number is used for a LUXEON HL1Z Color Blue LED:

L 1 H Z – B **L U** 1 0 0 0 0 0 0 0 0 0

Part numbers for LUXEON HL1Z Fusion follow the convention below:

L 1 H Z – A A A B 1 z z z z z z z z

Where:

A A A	–	designates color (FCR = Fusion Red, FCG = Fusion Green, FCB = Fusion Blue)
B	–	designates product option (example 1, 2... etc)
zzzzzzzz	–	any alphanumeric character that designates Option Codes for customization / bin selections / etc

Therefore, the following part number is used for a LUXEON HL1Z Fusion Blue:

L 1H Z – F C B 1 1 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 Holding B.V. is committed to providing environmentally friendly products to the solid-state lighting market LUXEON HL1Z Color Line 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 Holding B.V. 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 HL1Z Colors at specified test current 350mA, T_j=85°C

COLOR	DOMINANT OR PEAK WAVELENGTH [1] (nm)		LUMINIOUS FLUX (LM) OR RADIOMETRIC POWER [2] (mW)		PART NUMBER
	MINIMUM	MAXIMUM	MINIMUM	TYPICAL	
PC Red	-	-	18	20	L1HZ-PCR1000000000
PC Red Orange	-	-	32	35	L1HZ-RNG1000000000
PC Amber	-	-	110	119	L1HZ-PCA1000000000
PC Green	-	-	180	195	L1HZ-PCG1000000000
Green	520	535	110	145	L1HZ-GRN1000000000
Blue	470	485	42	57	L1HZ-BLU1000000000
Royal Blue	450	460	550	610	L1HZ-RYL1000000000
Fusion Red	-	-	55	70	L1HZ-FCR1100000000
Fusion Green	-	-	134	152	L1HZ-FCG1100000000
Fusion Blue	-	-	111	137	L1HZ-FCB1100000000

Notes for Table 1:
1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements. PC Red, PC Red Orange, PC Amber, PC Green, Fusion Red, Fusion Green and Fusion Blue are binned by chromaticity coordinates. Royal Blue are binned by peak wavelength. All other colors are binned by dominant wavelength.
2. Royal Blue are binned by radiometric power. All other colors are binned by luminous flux.

Optical Characteristics

Table 2. Optical characteristics for LUXEON HL1Z Color at 350mA, T_j=85°C

COLOR	PART NUMBER	TYPICAL SPECTRAL HALF-WIDTH [1] (nm)	TYPICAL TEMPERATURE COEFFICIENT OF DOMINANT OR PEAK WAVELENGTH (nm/°C)	TYPICAL TOTAL INCLUDED ANGLE [2]	TYPICAL VIEWING ANGLE [3]
PC Red	L1HZ-PCR1000000000	56	-0.03	144°	119°
PC Red Orange	L1HZ-RNG1000000000	73	-0.01	142°	119°
PC Amber	L1HZ-PCA1000000000	76	-0.01	141°	120°
PC Green	L1HZ-PCG1000000000	98	0.01	147°	125°
Green	L1HZ-GRN1000000000	30	0.04	145°	125°
Blue	L1HZ-BLU1000000000	24	0.03	144°	123°
Royal Blue	L1HZ-RYL1000000000	21	0.04	144°	124°
Fusion Red	L1HZ-FCR1100000000	-	-	140°	119°
Fusion Green	L1HZ-FCG1100000000	-	-	142°	120°
Fusion Blue	L1HZ-FCB1100000000	-	-	142°	123°

Notes for Table 2:
1. Spectral half-width is the spectral bandwidth at 50% of the peak intensity.
2. Total angle at which 90% of total luminous flux is captured.
3. 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 HL1Z Color Line at 350mA, T_j=85°C

COLOR	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		
PC Red	L1HZ-PCR1000000000	2.65	2.80	2.95	-1.2	3.8
PC Red Orange	L1HZ-RNG1000000000	2.65	2.80	2.95	-1.2	3.7
PC Amber	L1HZ-PCA1000000000	2.65	2.80	2.95	-1.2	3.4
PC Green	L1HZ-PCG1000000000	2.65	2.80	2.95	-1.3	3
Green	L1HZ-GRN1000000000	2.40	2.55	2.75	-1.7	3.6
Blue	L1HZ-BLU1000000000	2.65	2.80	2.95	-1.4	2.3
Royal Blue	L1HZ-RYL1000000000	2.65	2.80	2.95	-1.2	2.0
Fusion Red	L1HZ-FCR1100000000	2.65	2.80	2.95	-1.4	3.4
Fusion Green	L1HZ-FCG1100000000	2.65	2.80	2.95	-1.4	3.1
Fusion Blue	L1HZ-FCB1100000000	2.65	2.80	2.95	-1.4	2.6

Notes for Table 3:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Measured between 25°C and 85°C.

Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON HL1Z Color

PARAMETER	MAXIMUM PERFORMANCE
DC Forward Current [1, 2]	500mA
Peak Pulsed Forward Current [1, 3]	850mA
LED Junction Temperature [1] (DC & Pulse)	135°C
ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012)	Class 1C
LED Storage Temperature	-40°C to 125°C
Soldering Temperature	JEDEC 020D 260°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," 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 220µA.

Characteristic Curves

Spectral Power Distribution Characteristics

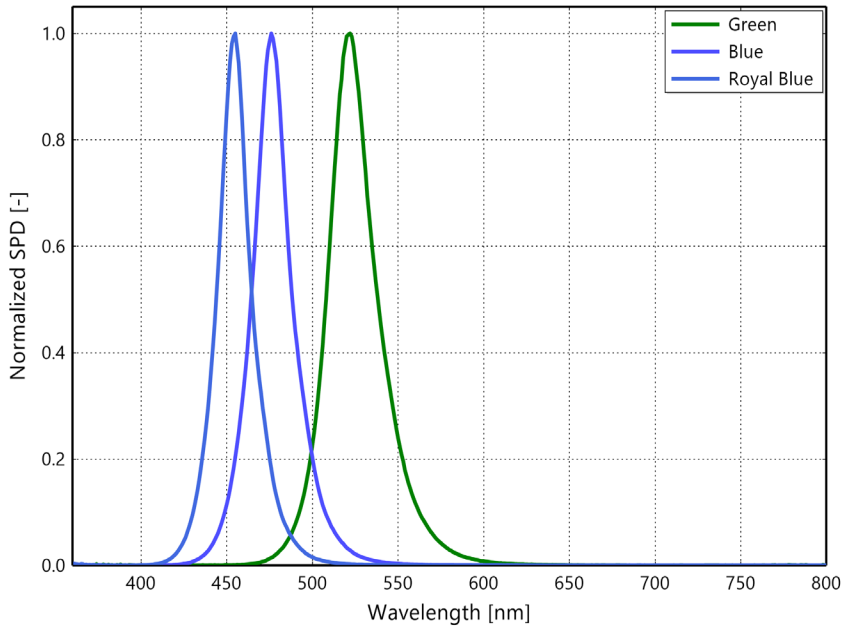


Figure 1a. Typical normalized SPD vs. wavelength for LUXEON HL1Z Color Direct Colors at 350mA, T_j=85°C

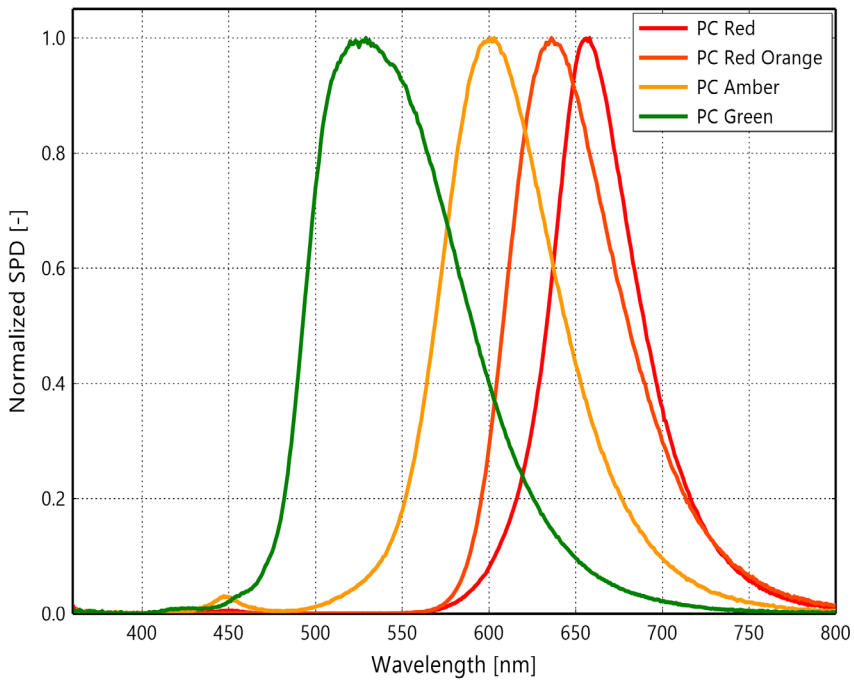


Figure 1b. Typical normalized SPD vs. wavelength for LUXEON HL1Z Color Phosphor Converted Colors at 350mA, T_j=85°C

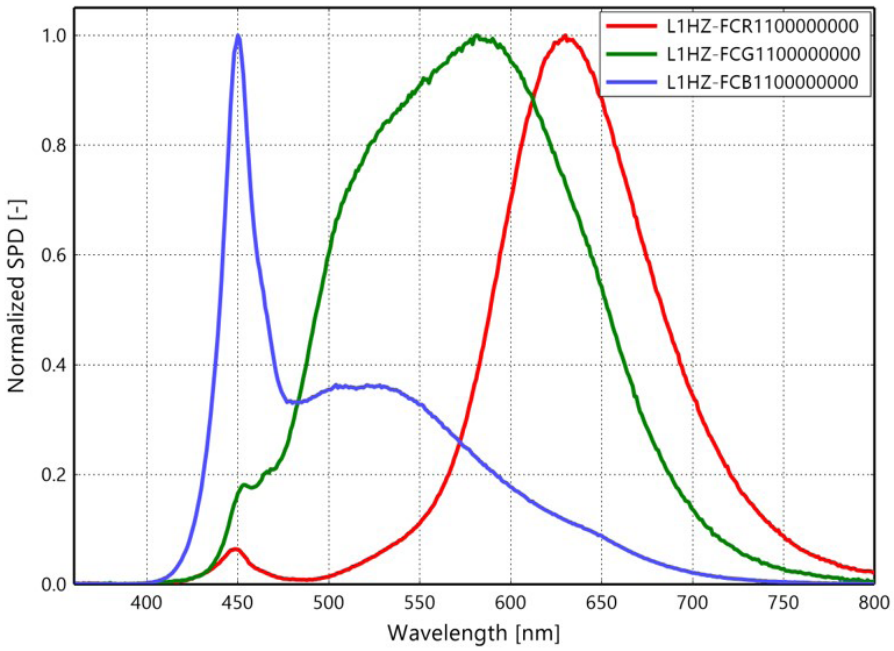


Figure 1c. Typical normalized SPD vs. wavelength for LUXEON HL1Z Fusion at 350mA, T_j=85°C

Light Output Characteristics

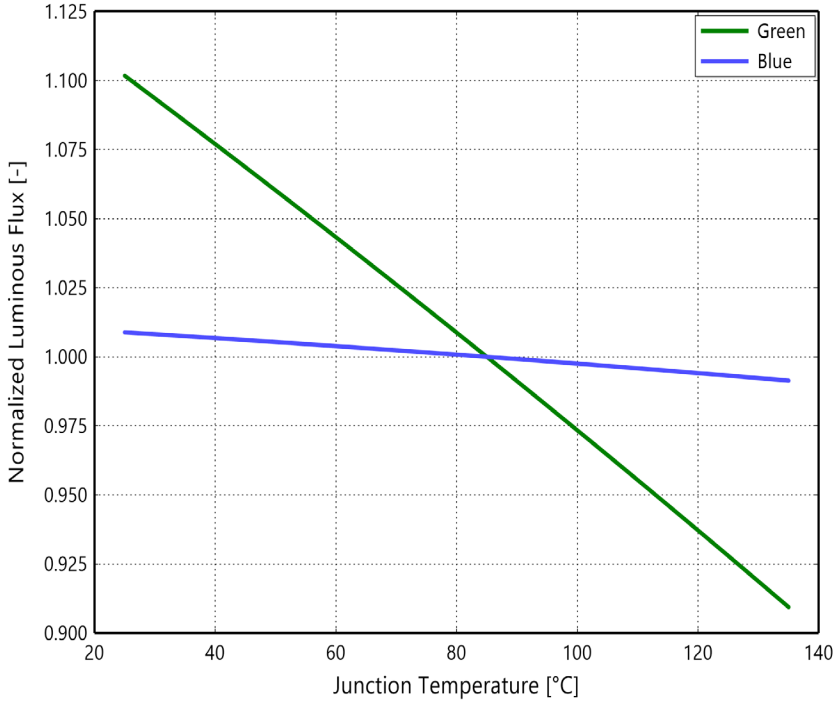


Figure 2a. Typical normalized luminous flux vs. junction temperature for LUXEON HL1Z Green and Blue at 350mA

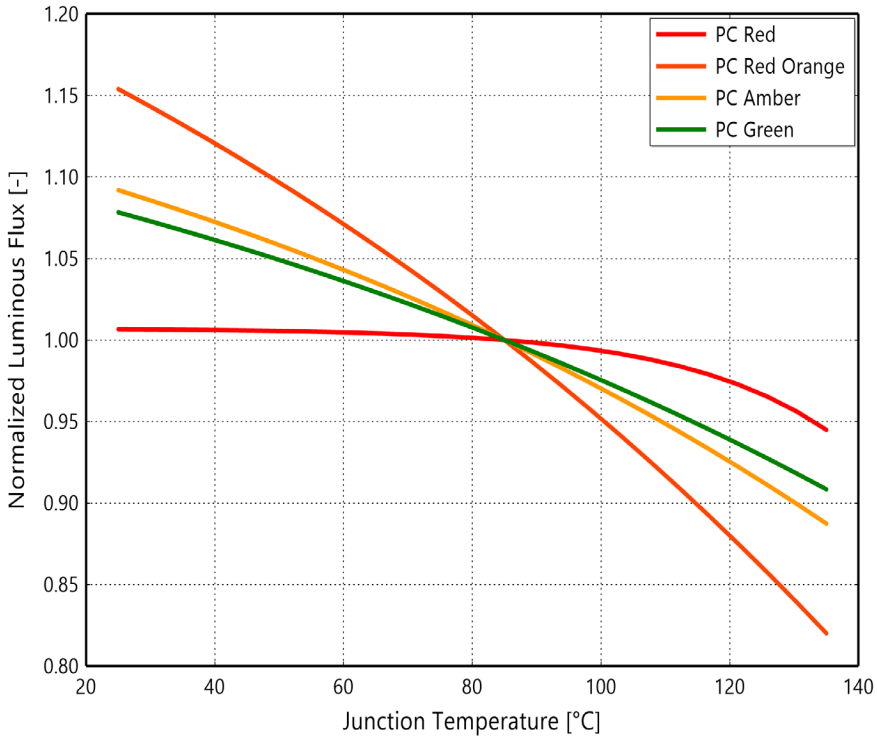


Figure 2b. Typical normalized luminous flux vs. junction temperature for LUXEON HL1Z PC Red, PC Red-Orange, PC Amber and PC Green at 350mA

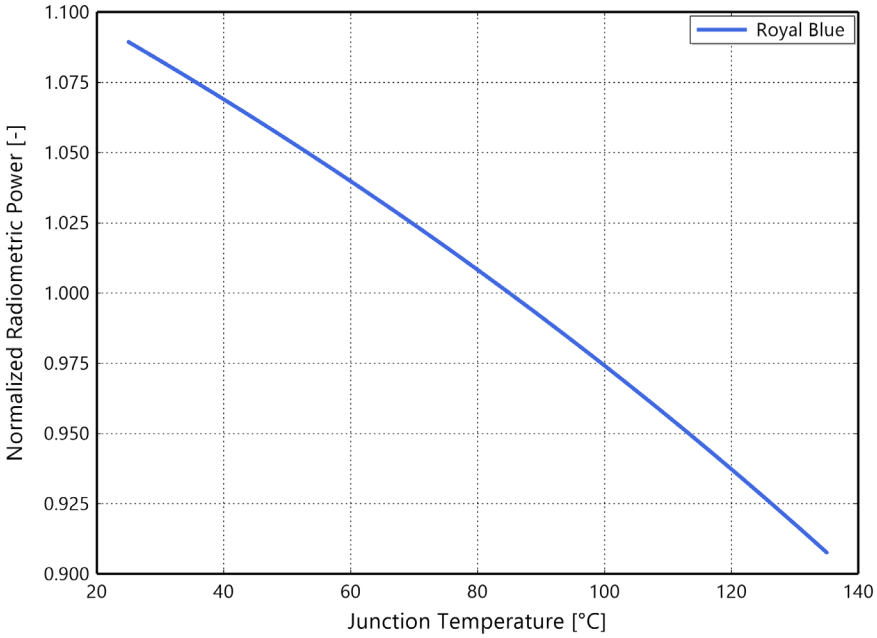


Figure 2c. Typical normalized radiometric power vs. junction temperature for LUXEON HL1Z Royal Blue at 350mA

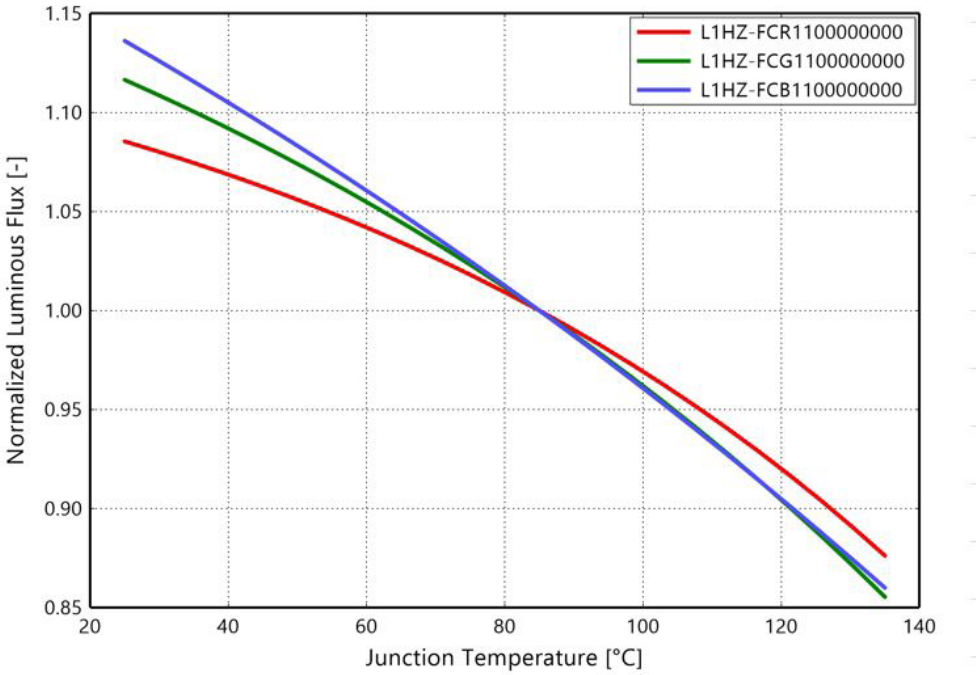


Figure 2d. Typical normalized luminous flux vs. junction temperature for LUXEON HL1Z Fusion at 350mA

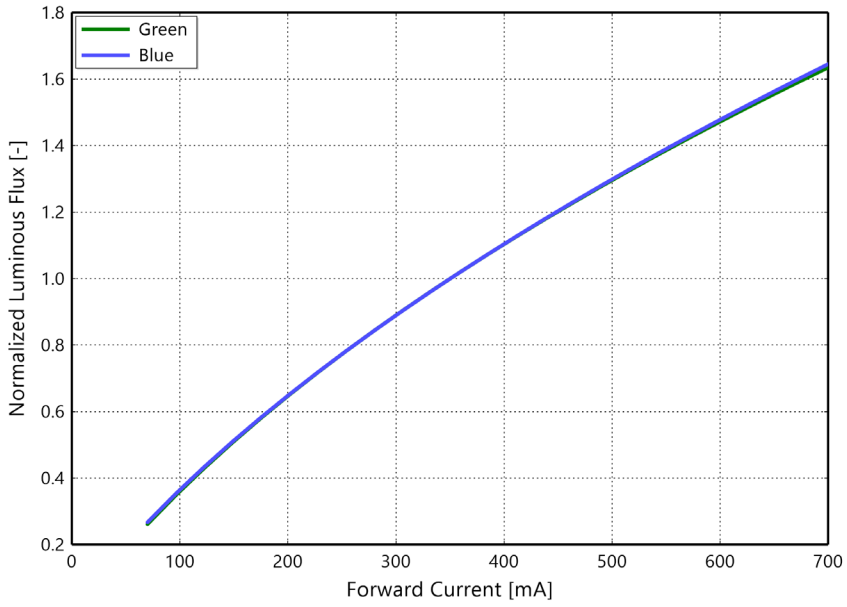


Figure 3a. Typical normalized luminous flux vs. forward current for LUXEON HL1Z Green and Blue at T_j=85°C

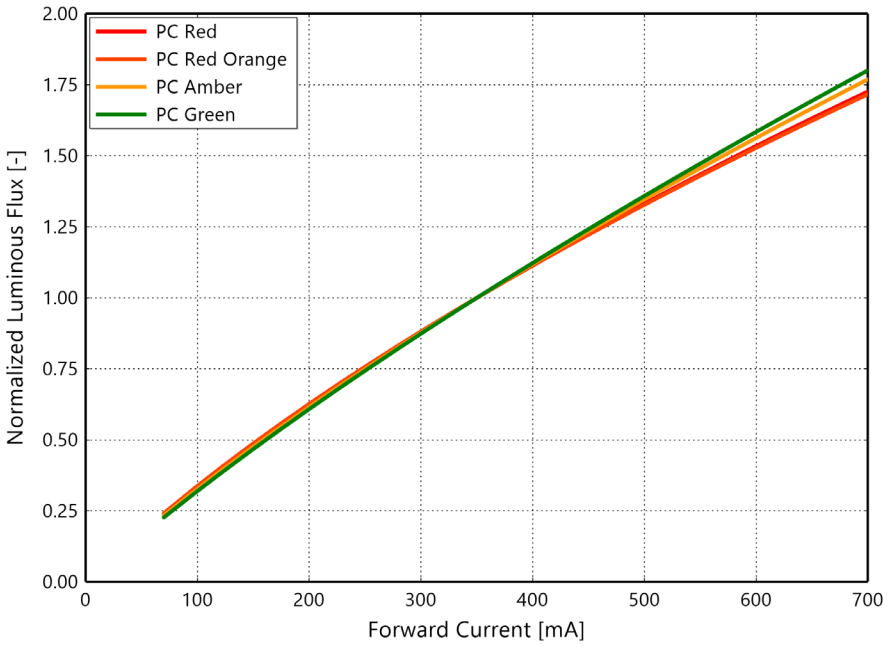


Figure 3b. Typical normalized luminous flux vs. forward current for LUXEON HL1Z PC Red, PC Red-Orange, PC Amber and PC Green at T_j=85°C

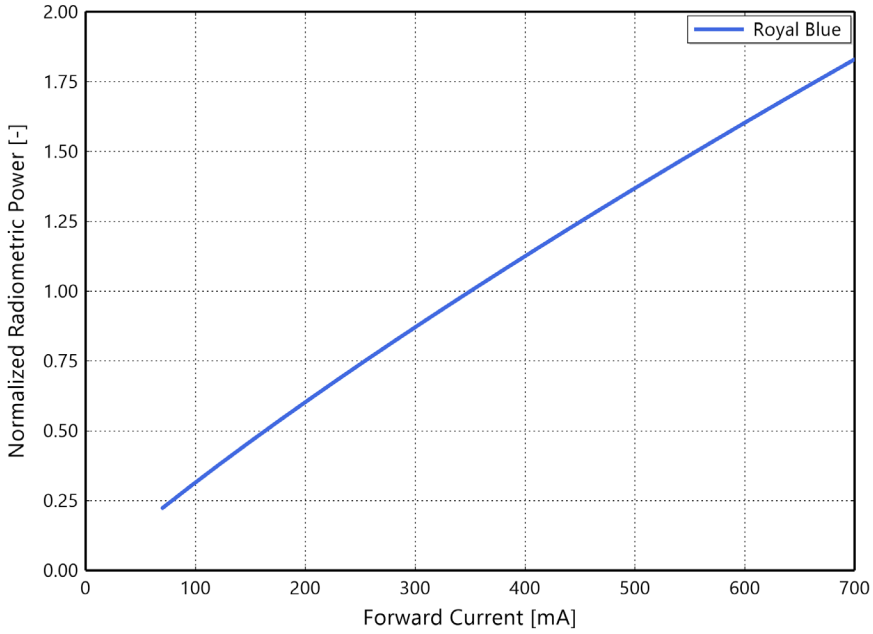


Figure 3c. Typical normalized radiometric power vs. forward current for LUXEON HL1Z Royal Blue at T_j=85°C

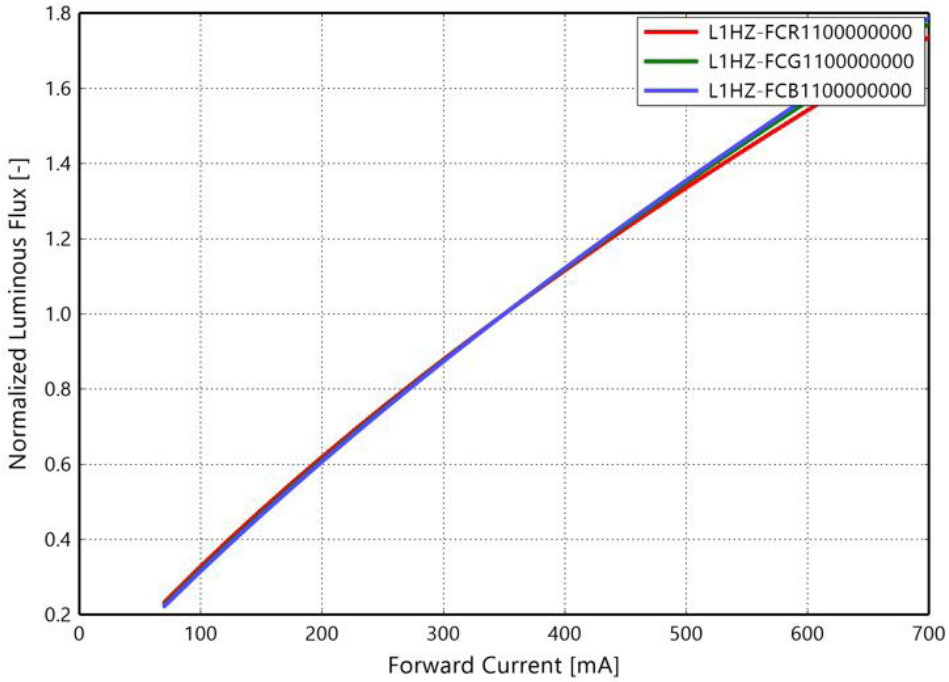


Figure 3d. Typical normalized luminous flux vs. forward current for LUXEON HL1Z Fusion at T_j=85°C

Forward Current Characteristics

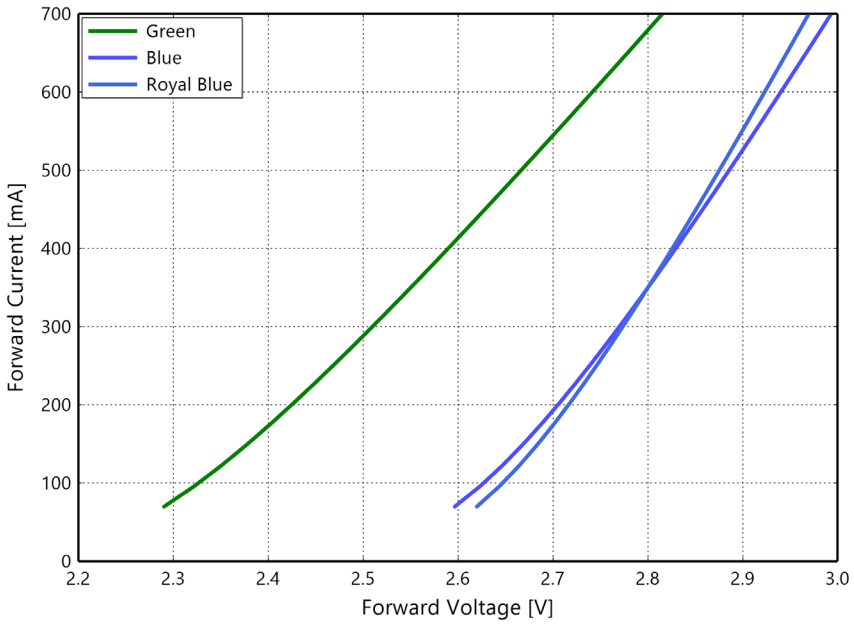


Figure 4a. Typical forward current vs. forward voltage for LUXEON HL1Z Color Green, Blue and Royal Blue at T_j=85°C

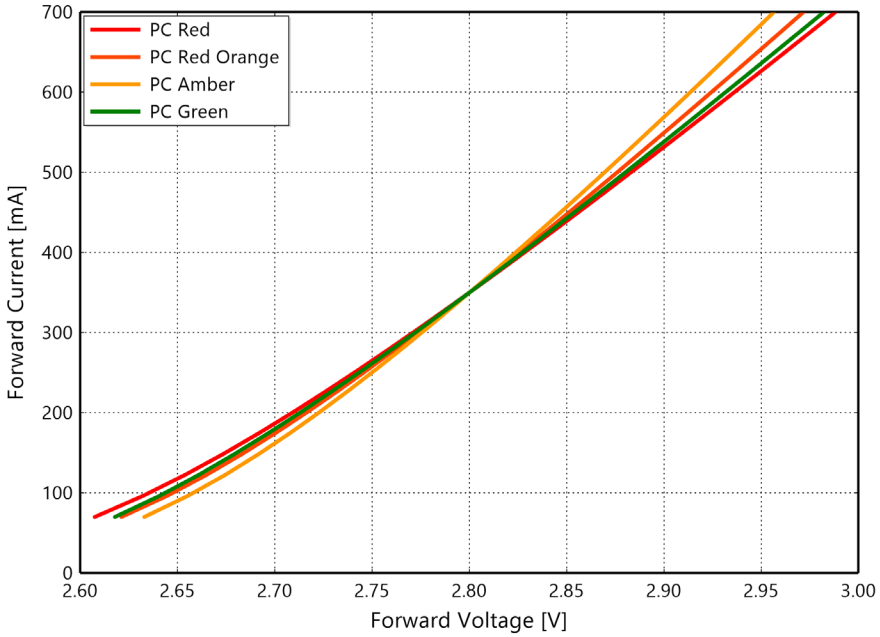


Figure 4b. Typical forward current vs. forward voltage for LUXEON HL1Z Color PC Red, PC Red Orange, PC Amber, PC Green at T_j=85°C

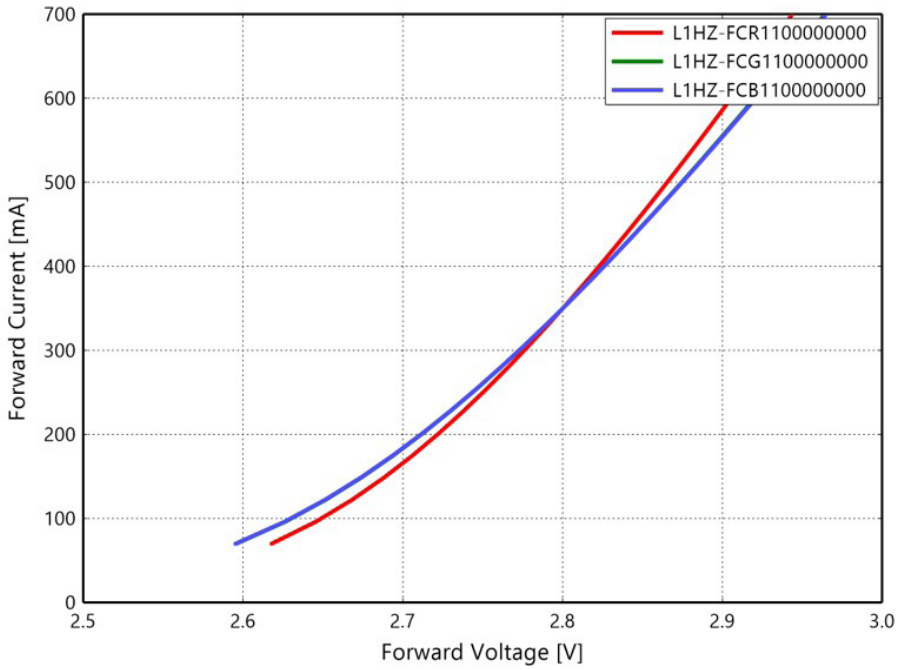


Figure 4c. Typical forward current vs. forward voltage for LUXEON HL1Z Fusion at T_j=85°C

Radiation Patterns Characteristics

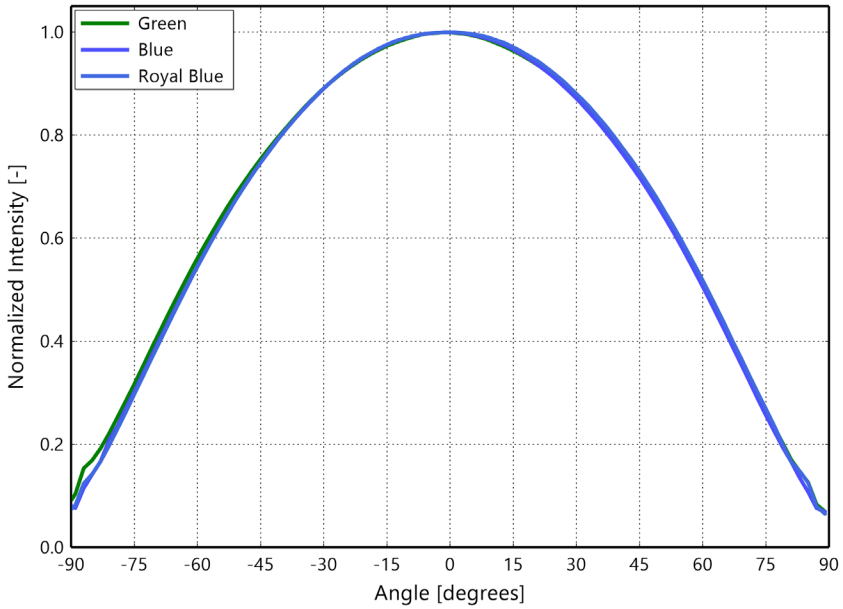


Figure 5a. Typical radiation pattern for LUXEON HL1Z Color Green, Blue and Royal Blue at 350mA, at T_j=85°C

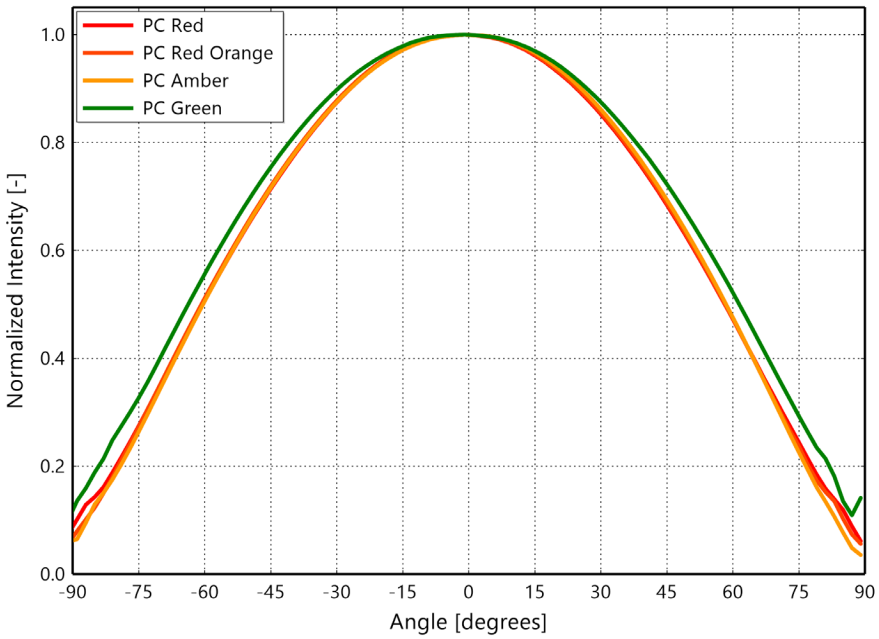


Figure 5b. Typical radiation pattern for LUXEON HL1Z Color PC Red, PC Red Orange, PC Amber, PC Green at 350mA, T_j=85°C

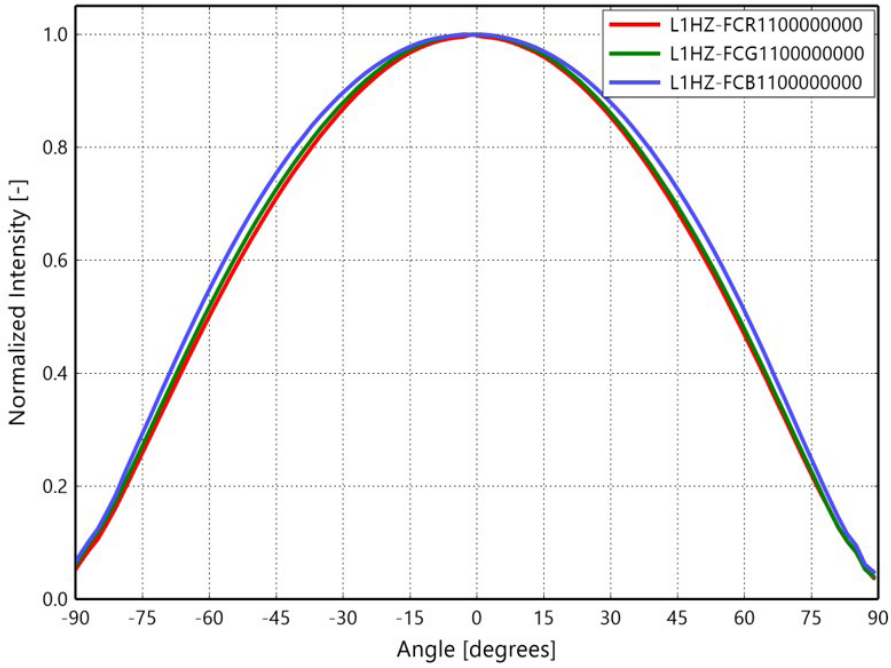


Figure 5c. Typical radiation pattern for LUXEON HL1Z Fusion at 350mA, T_j=85ºC

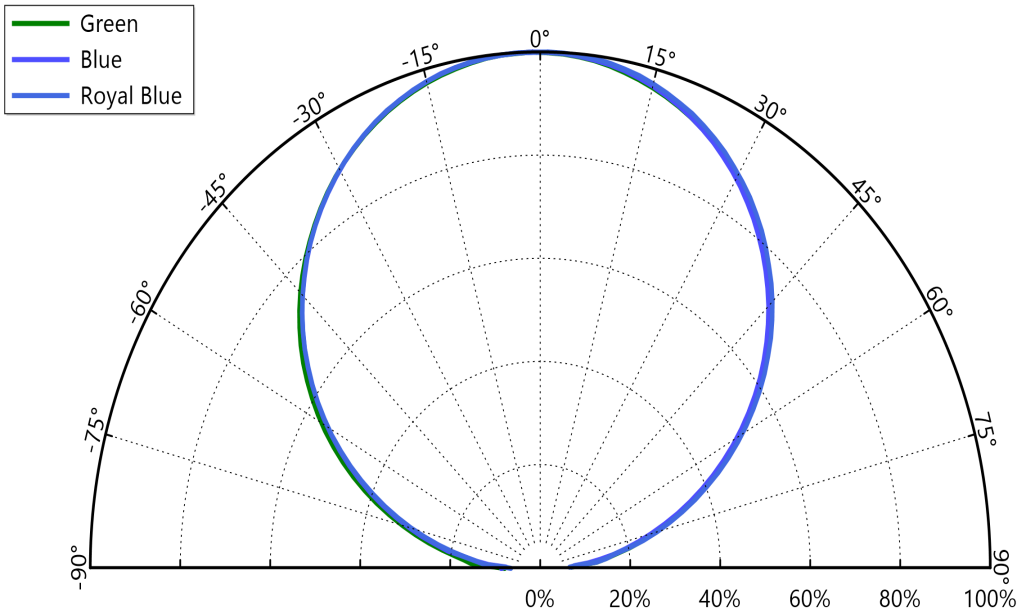


Figure 6a. Typical polar radiation pattern for LUXEON HL1Z Color Green, Blue and Royal Blue at 350mA, T_j=85ºC

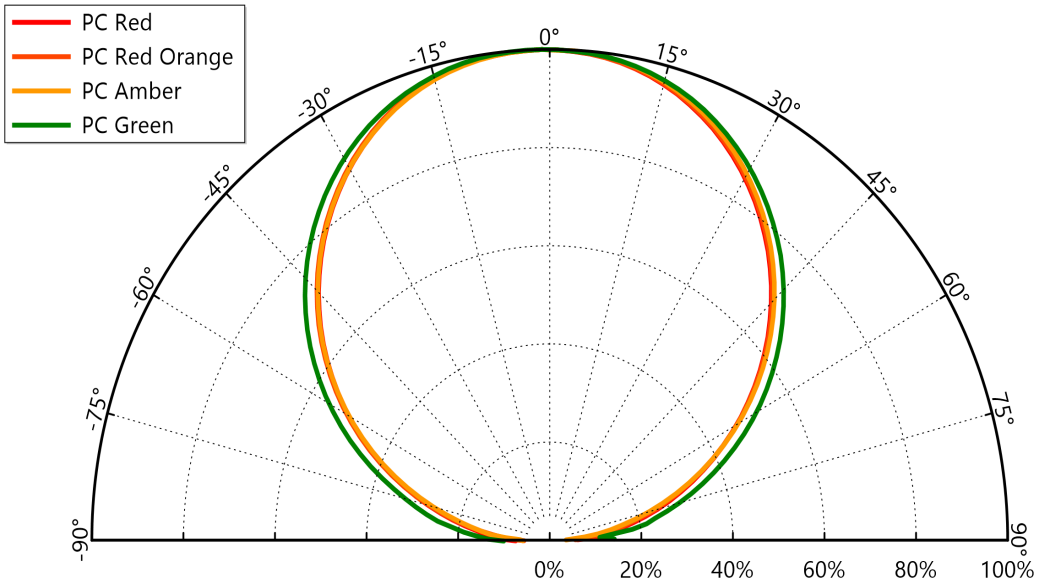


Figure 6b. Typical polar radiation pattern for LUXEON HL1Z Color PC Red, PC Red Orange, PC Amber, PC Green at 350mA, T_j=85°C

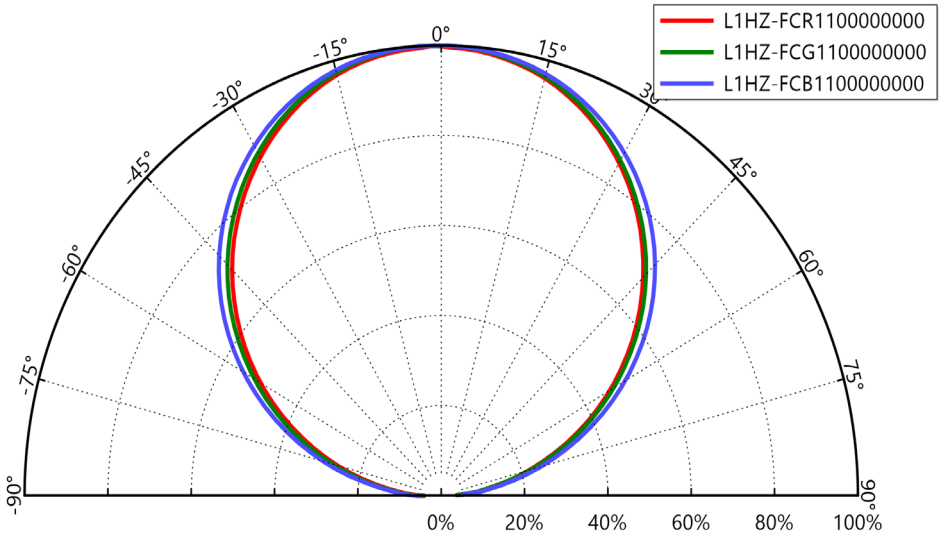


Figure 6c. Typical polar radiation pattern for LUXEON HL1Z Fusion at 350mA, T_j=85°C

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 HL1Z Color Line LEDs are labeled using a 4-digit alphanumeric CAT code following the format below:

A B C D

Where:

- **A** – designates luminous flux bin or radiometric power bin (luminous flux bin example: A=30 to 40 lm, B= 40 to 50 lm; radiometric power bin example: Royal Blue C=600 to 650mW)
- **B C** – designates color bin, peak wavelength bin or dominant wavelength bin (peak wavelength bin example: Royal Blue 10=450 to 455nm; dominant wavelength bin example: Blue 20=475 to 480nm)
- **D** – designates forward voltage bin (example: Q=2.50 to 2.65V, R=2.65 to 2.80V)

Therefore, a LUXEON HL1Z Color Green LED with a lumen range of 123 to 128 lm, a dominant wavelength of 520 to 525nm and a forward voltage range of 2.40 to 2.50V has the following CAT code:

K 1 0 P

Luminous Flux Bins

Table 5 lists the standard photometric luminous flux bins for LUXEON HL1Z Color Line 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 HL1Z Color Line

BIN	LUMINOUS FLUX [1] (lm)	
	MINIMUM	MAXIMUM
1	15	20
2	20	25
3	25	30
A	30	40
B	40	50
C	50	60
D	60	70
E	70	80
F	80	90
G	90	100
H	100	110
J	110	120
K	120	130
L	130	140
M	140	150
N	150	160
P	160	170
Q	170	180
R	180	200
S	200	220
T	220	240

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

Radiometric Power Bins

Table 6. Radiometric power bin definitions for LUXEON HL1Z Color

COLOR	BIN	RADIOMETRIC POWER[1] (mW)	
		MINIMUM	MAXIMUM
Royal Blue	A	500	550
	B	550	600
	C	600	650

Notes for Table 6:
1. Lumileds maintains a tolerance of ±6.5% on radiometric power measurements.

Color Bin Definitions

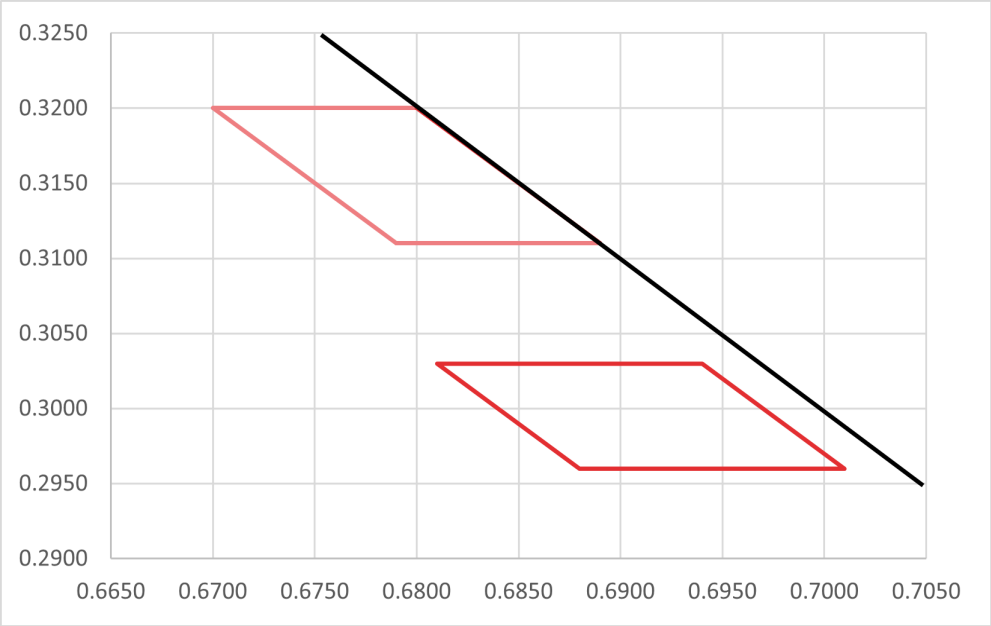


Figure 7a. Color bin structure for LUXEON HL1Z PC Red and PC Red Orange in Table 7

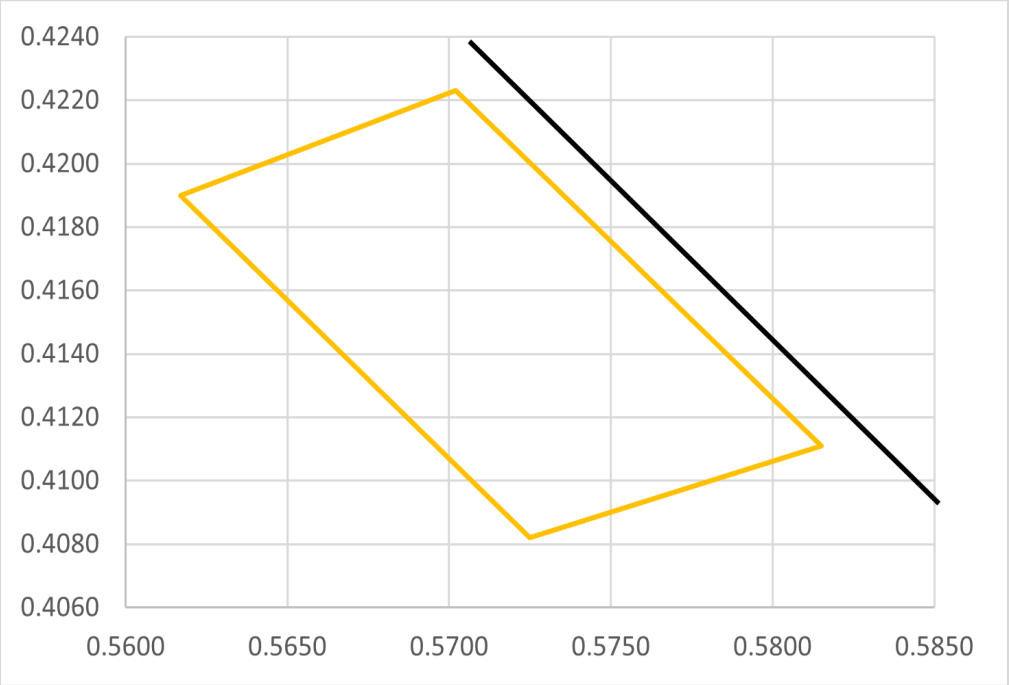


Figure 7b. Color bin structure for LUXEON HL1Z PC Amber in Table 7

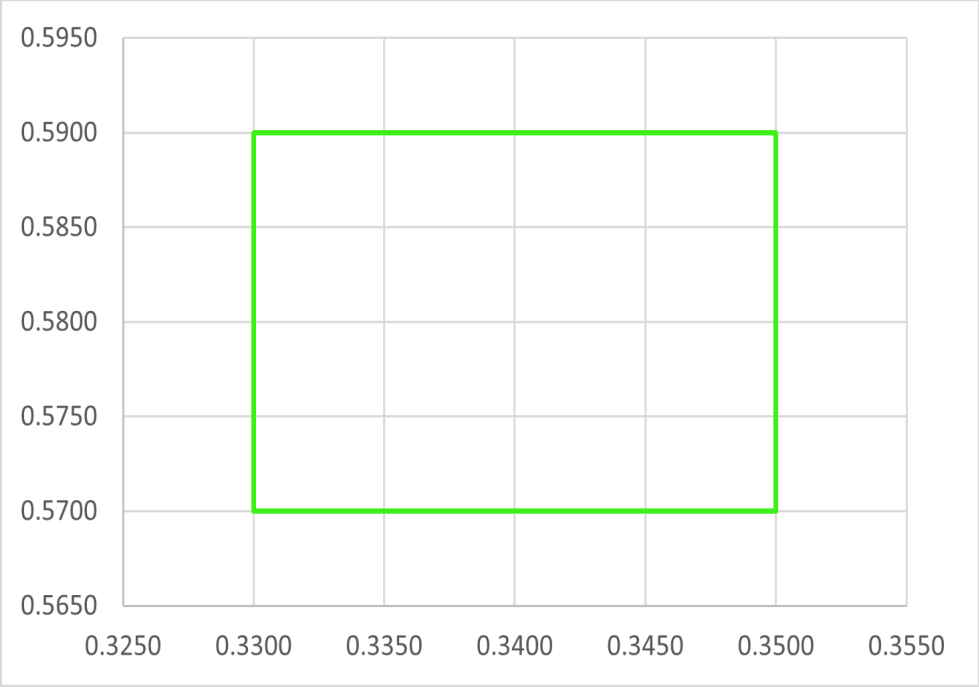


Figure 7c. Color bin structure for LUXEON HL1Z PC Green in Table 7

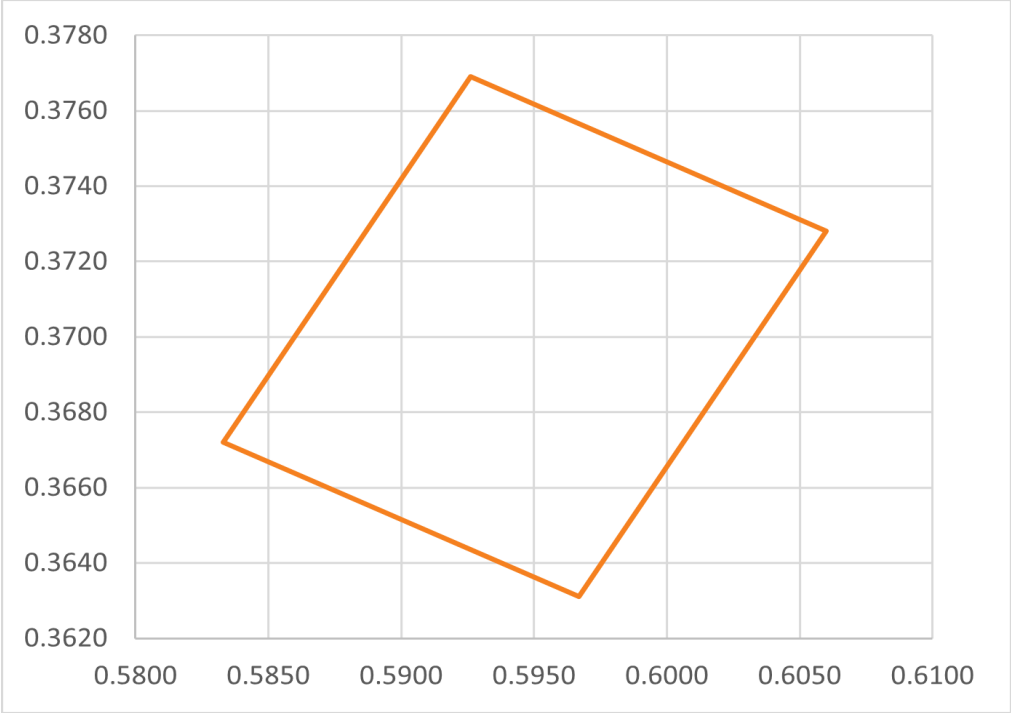


Figure 7d. Color bin structure for LUXEON HL1Z Fusion Red in Table 7

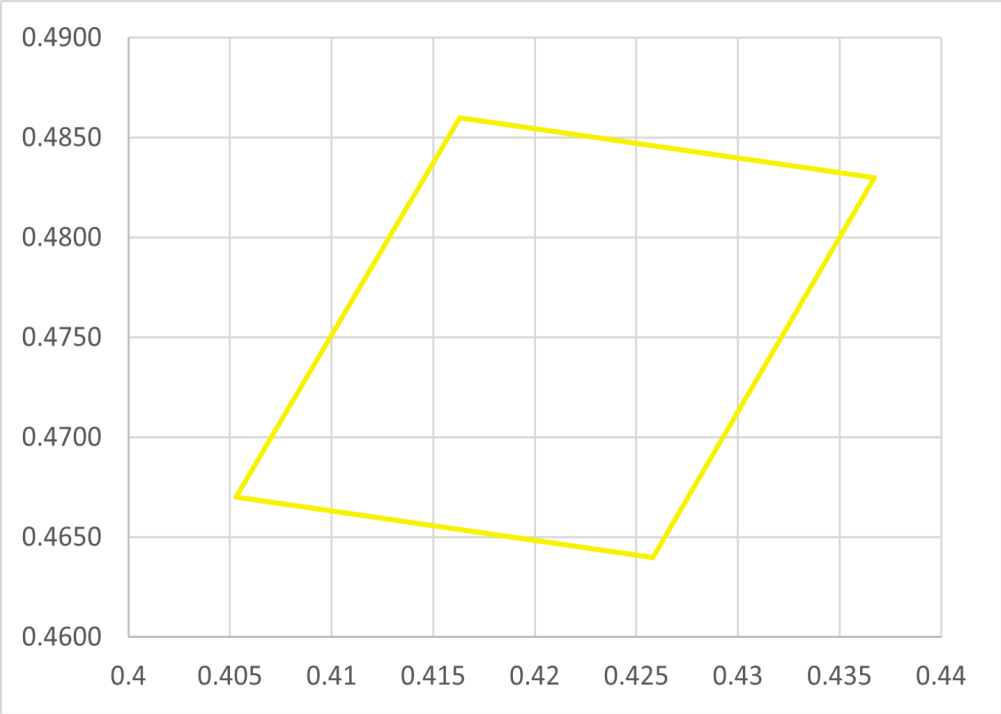


Figure 7e. Color bin structure for LUXEON HL1Z Fusion Green in Table 7

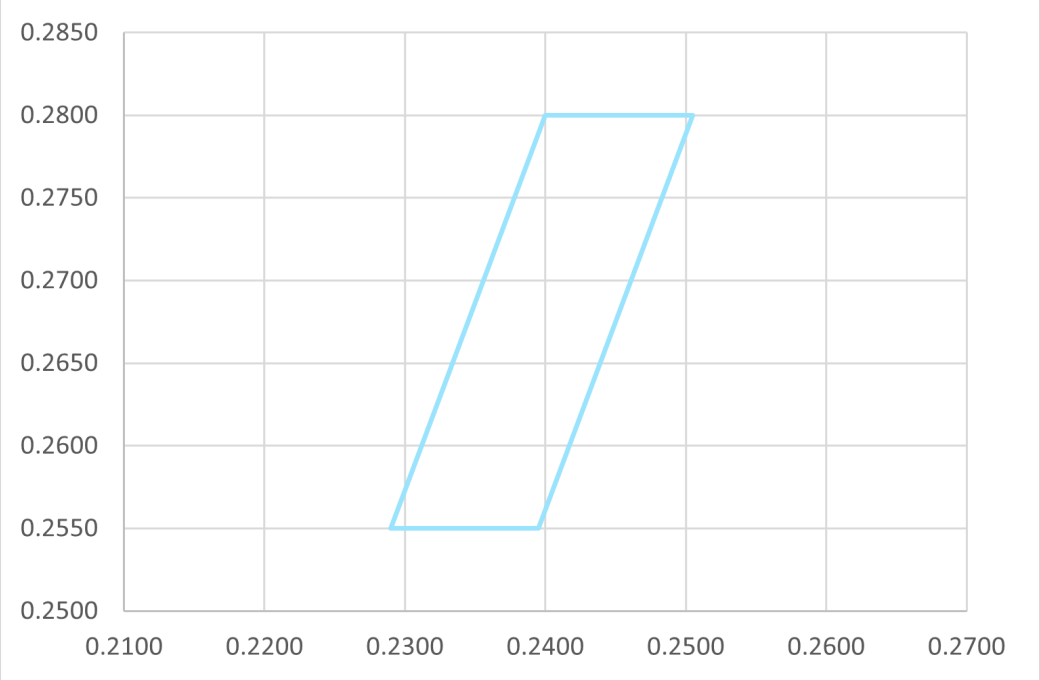


Figure 7f. Color bin structure for LUXEON HL1Z Fusion Blue in Table 7

Table 7. Color bin definitions for LUXEON HL1Z Color

PART NUMBER	PART NUMBER	BIN	x	y
PC Red	L1HZ-PCR1000000000	10	0.6810	0.3030
			0.6940	0.3030
			0.7010	0.2960
			0.6880	0.2960
PC Red Orange	L1HZ-RNG1000000000	20	0.6700	0.3200
			0.6800	0.3200
			0.6890	0.3110
			0.6790	0.3110
PC Amber	L1HZ-PCA1000000000	30	0.5617	0.4190
			0.5702	0.4223
			0.5815	0.4111
			0.5725	0.4082
PC Green	L1HZ-PCG1000000000	40	0.3300	0.5700
			0.3300	0.5900
			0.3500	0.5900
			0.3500	0.5700
Fusion Red	L1HZ-FCR1100000000	10	0.5833	0.3672
			0.5967	0.3631
			0.6060	0.3728
			0.5926	0.3769
Fusion Green	L1HZ-FCG1100000000	20	0.4163	0.4860
			0.4367	0.4830
			0.4258	0.4640
			0.4053	0.4670
Fusion Blue	L1HZ-FCB1100000000	30	0.2400	0.2800
			0.2505	0.2800
			0.2395	0.2550
			0.2290	0.2550

Notes for Table 7:
1. Lumileds maintains a tolerance of ±0.005 on x and y color coordinates measurements.

Table 8. Look up table for LUXEON HL1Z Fusion CCT with color point

	PULSE WIDTH MODULATION (PWM) GAIN FACTORS		
CCT (K)	PWM RED	PWM GREEN	PWM BLUE
2200	63.60%	34.80%	1.60%
2700	50.00%	43.00%	7.00%
3000	43.10%	45.60%	11.30%
3500	36.10%	46.70%	17.20%
4000	28.90%	47.00%	24.00%
5000	20.70%	42.10%	37.20%
5700	18.50%	37.20%	44.30%
6500	15.70%	31.90%	52.30%

Notes for Table 8:
1. Look up table for LUXEON HL1Z Fusion CCT with color points on the ANSI C78.377-2024.
2. Forward current per Red, Green and Blue channel is fixed at 350mA, T_j=85°C.
3. The sum of LED quantities must be equal for each color.

Peak Wavelength Bins

Table 9. Peak wavelength bin definitions for LUXEON HL1Z Color

COLOR	PART NUMBER	BIN	PEAK WAVELENGTH (nm)	
			MINIMUM	MAXIMUM
Royal Blue	L1HZ-RYL1000000000	10	450	455
		20	455	460

Notes for Table 9:
1. Lumileds maintains a tolerance of ±2.0nm on peak wavelength measurements.

Dominant Wavelength Bins

Table 10. Dominant wavelength bin definitions for LUXEON HL1Z Color at 350mA, T_j=85ºC

COLOR	PART NUMBER	BIN	DOMINANT WAVELENGTH [1] (nm)	
			MINIMUM	MAXIMUM
Green	L1HZ-GRN1000000000	10	520	525
		20	525	530
		30	530	535
Blue	L1HZ-BLU1000000000	10	470	475
		20	475	480
		30	480	485

Notes for Table 10:
1. Lumileds maintains a tolerance of ±0.5nm on dominant wavelength measurements.

Forward Voltage Bins

Table 11. Forward voltage bin definitions for LUXEON HL1Z Color Line

BIN	FORWARD VOLTAGE [1] (V_f)	
	MINIMUM	MAXIMUM
P	2.35	2.50
Q	2.50	2.65
R	2.65	2.80
S	2.80	2.95
T	2.95	3.10

Notes for Table 11:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.

Mechanical Dimension

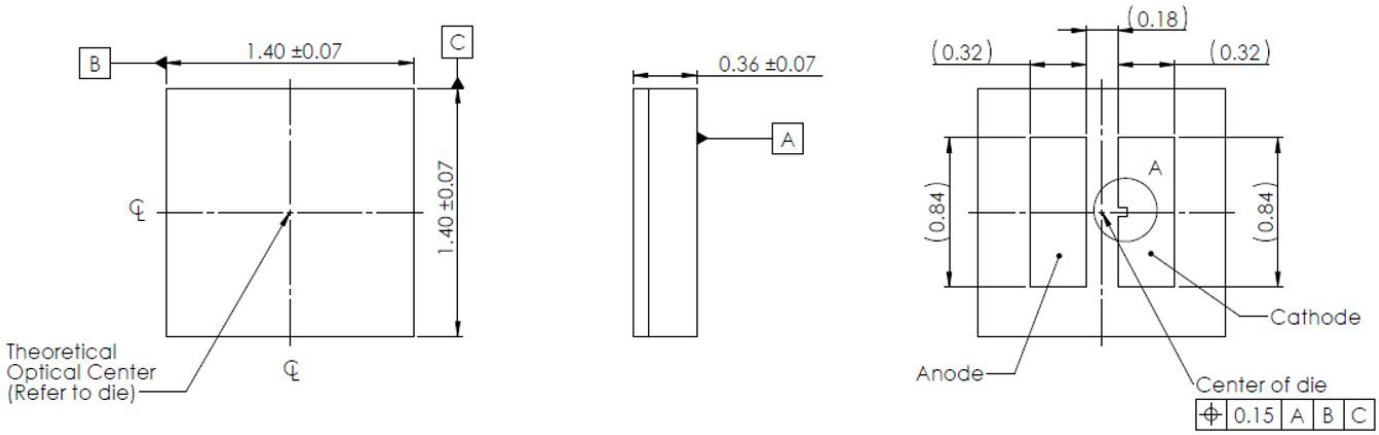


Figure 12. Mechanical dimensions for LUXEON HL1Z Color Line

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

Reflow Soldering Guidelines

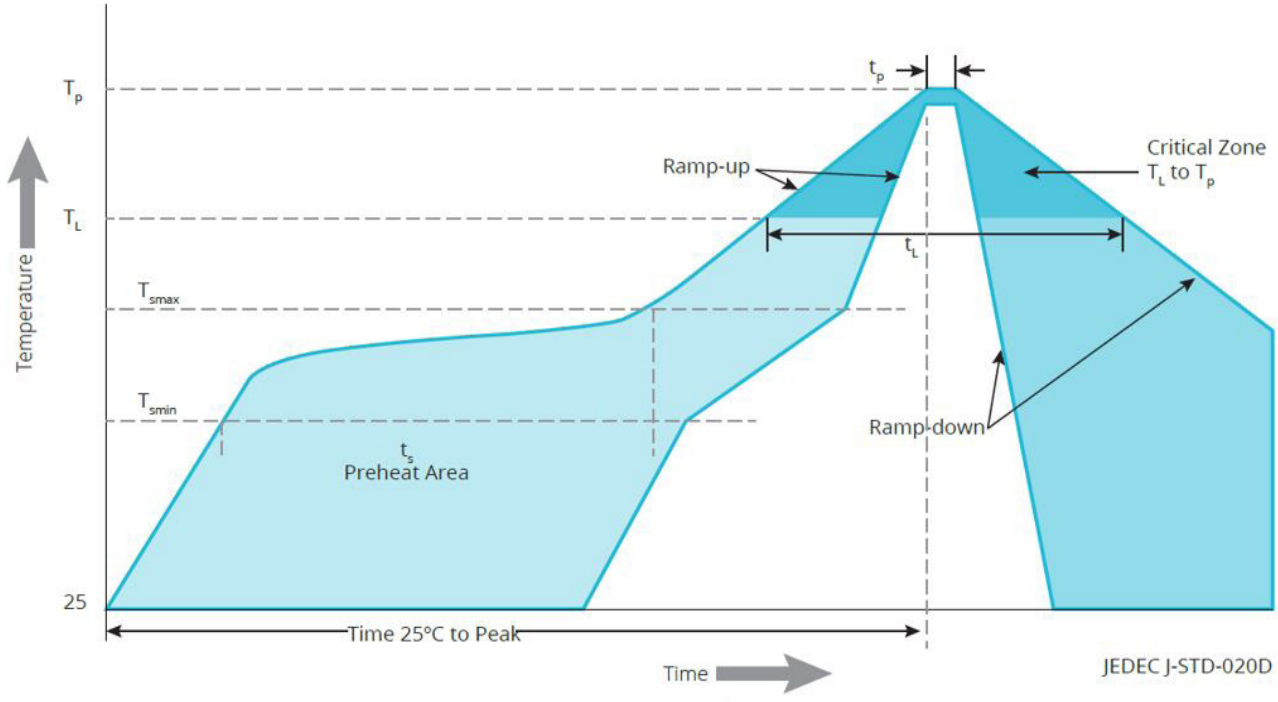


Figure 13. Visualization of the acceptable reflow temperature profile as specified in Table 12

Table 12. Reflow profile characteristics for LUXEON HL1Z Color Line

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_L)	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

Notes for Table 12:
1. All temperatures refer to the application Printed Circuit Board (PCB), measured on the surface adjacent to the package body.

JEDEC Moisture Sensitivity

Table 13. Moisture sensitivity levels for LUXEON HL1Z Color

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

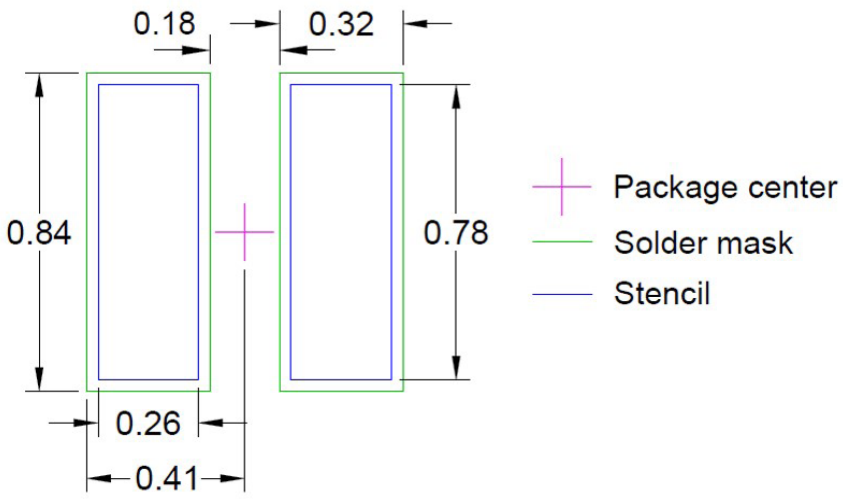


Figure 14. Recommneded PCB solder pad layout for LUXEON HL1Z Color Line

Notes for Figure 14:
1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. The drawing above shows the recommended solder pad layout on Printed Circuit Board (PCB).

Packaging Information

Pocket Tape Dimensions

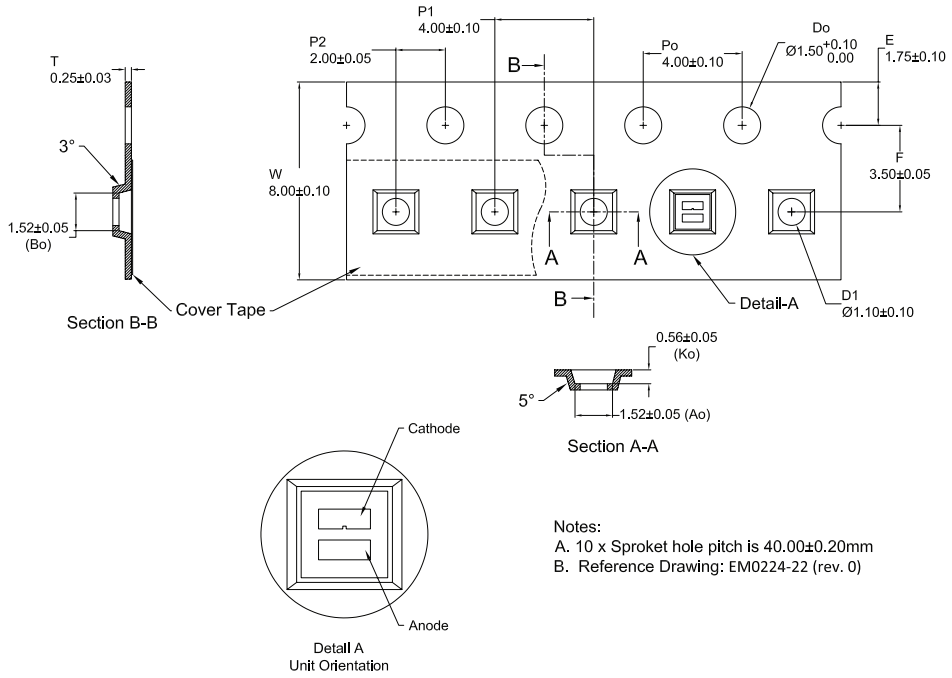


Figure 15. Pocket Tape dimensions for LUXEON HL1Z Color Line

Notes for Figure 15:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

Reel Dimensions

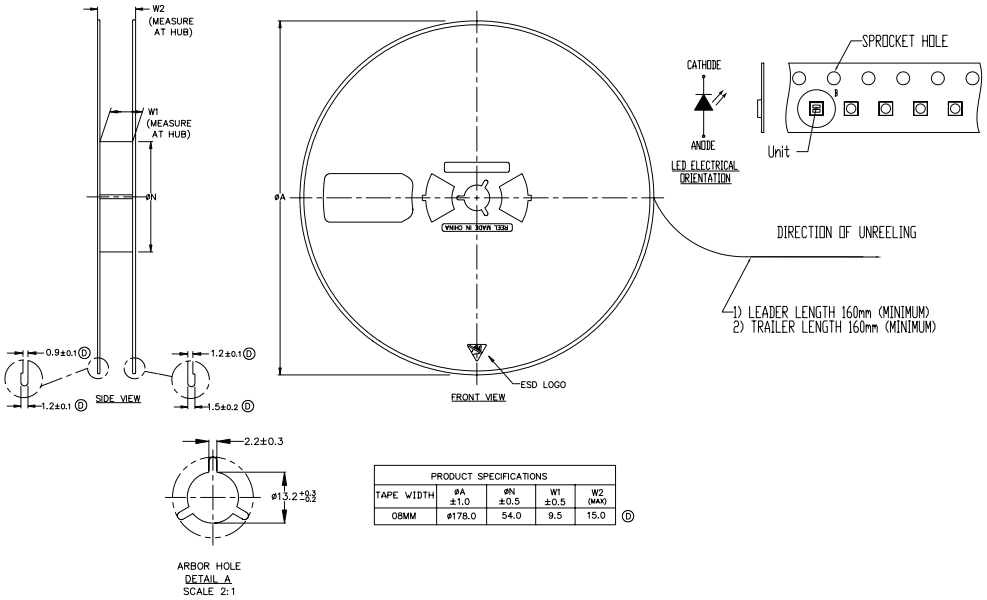


Figure 16: Reel dimensions for LUXEON HL1Z Color Line

Notes for Figure 16:
1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. Maximum 1,000 pieces per reel.

About Lumileds

Lumileds is a global leader in LED and microLED technology, innovation, and solutions for the automotive, display, illumination, mobile, and other markets where light sources are essential. Our approximately 3,500 employees operate in over 15 countries and partner with our customers to deliver never before possible solutions for lighting, safety, and well-being.

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