

LUXEON 4014

Compact footprint delivering high-efficacy and just the right amount of light



Introduction

The LUXEON® 4014 low-power package is the first of its kind from Philips Lumileds. Initial offering in 4000K/80 CRI in a compact 4.0x1.4x0.7mm footprint, it delivers quality of light needed for indoor applications with outstanding light uniformity. The LUXEON 4014 offers an ideal solution when uniformity and a smooth lighting appearance are critical in luminaire designs. Full range of CCT proliferations coming soon.

Features

- QFN package
- 1/6 ANSI color bin
- Efficacy of 138 lm/W @ 30 mA

Benefits

- Unique phosphor technology enables high efficacy
- Rectangular package design increases uniformity
- Superior heat dissipation enables cost effective thermal design
- Flexible platform for a cost and performance roadmap

Key Applications

- Indoor area lighting
- Wall grazer
- Under cabinet
- Cove
- Integrated lay-in
- Retrofit lamps
- Refrigerator lighting

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General Information

Product Nomenclature

LUXEON 4014 is tested and binned hot at $T_j = 25^\circ\text{C}$ and 30 mA DC.

The part number designation is explained as follows:

M X Z A – B C D D – E E E E

Where:

- A — designates minimum CRI (value 8 for 80, 9 for 90)
- B — designates radiation pattern (value P for Lambertian)
- C — designates color (W for White)
- D D — designates nominal CCT (27 for 2700K, 30 for 3000K, 35 for 3500K, 40 for 4000K and 50 for 5000K)
- E E E E — additional part number designation

Therefore 4000K, 80 CRI LUXEON 4014 product will be:

M X Z 8 – P W 4 0 – 0 0 0 0

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. Philips Lumileds projects that LUXEON 4014 MXZ8-PW40-00 products will deliver, on average, 70% lumen maintenance (L70) at >30,000 hours of operation at a forward current of up to 30 mA. *This projection and detailed operating condition will be further validated and disclosed respectively at the time of product launch.* Observation of design limits included in this data sheet is required in order to achieve this projected lumen maintenance.

Environmental Compliance

Philips Lumileds is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON 4014 MXZ8-PW40-00 is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS and REACH directives. Philips Lumileds will not intentionally add the following restricted material to the LUXEON 4014 MXZ8-PW40-00: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Product Performance and Characterization Guide

Junction Temperature = 25°C; Test Current at 30 mA and 60 mA

Table 1. Performance Characteristics at $T_j = 25^\circ\text{C}$, $I_f = 30\text{ mA}$

Nominal CCT	Part Number	Luminous Flux @ 30 mA, 25°C		Luminous Flux @ 60 mA, 25°C		CRI	
		Minimum (lm)	Typical (lm)	Minimum (lm)	Typical (lm)	Minimum	Typical
4000K	MXZ8-PW40-0000	10	12	18	22	80	82

Notes for Table 1:

- Philips Lumileds maintains a tolerance of $\pm 6.5\%$ on luminous flux, ± 2 on CRI, ± 2 on R9 measurements.
- Measured at $T_s = 25^\circ\text{C}$, $I_f = 30\text{ mA}$.

Absolute Maximum Ratings

Table 2. Operating Condition and Ratings PCB

Parameter	Maximum Performance
DC Forward Current	60 mA ^[2]
Peak Pulsed Forward Current	80 mA ^[3]
ESD Sensitivity	< 2000V Human Body Model (HBM) Class 2A JESD22-A114-E < 400V Machine Model (MM) Class C JESD22-A115-B
Storage Temperature	-40°C - 100°C
LED Junction Temperature ^[1]	115°C
Operating Case Temperature at 60 mA	-40°C - 85°C
Reverse Voltage (V_r)	-5V

Notes for Table 2:

- Proper current derating must be observed to maintain junction temperature below the maximum, please see preliminary application brief for additional information on thermal measurement guidelines.
- Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple", with frequencies $\geq 100\text{ Hz}$ and amplitude $\leq 60\text{ mA}$ are acceptable, assuming the average current throughout each cycle does not exceed 60 mA.
- Pulsed operation with a peak drive current of 80 mA is acceptable if the pulse on-time is $\leq 5\text{ ms}$ per cycle and the duty cycle is $\leq 50\%$.

Material Information & Mechanical Dimensions

MXZx-PWxx-0000

Table 3. Material Information

Material/Component	Specification
Lead Frame Base:	Copper Alloy
Reflector Plating:	Ni/Ag
Electrode Plating:	Ni/Ag
Package Body:	High Temperature Thermal Plastic
Encapsulant:	Silicone Resin, with Phosphor
LED Chip:	InGaN

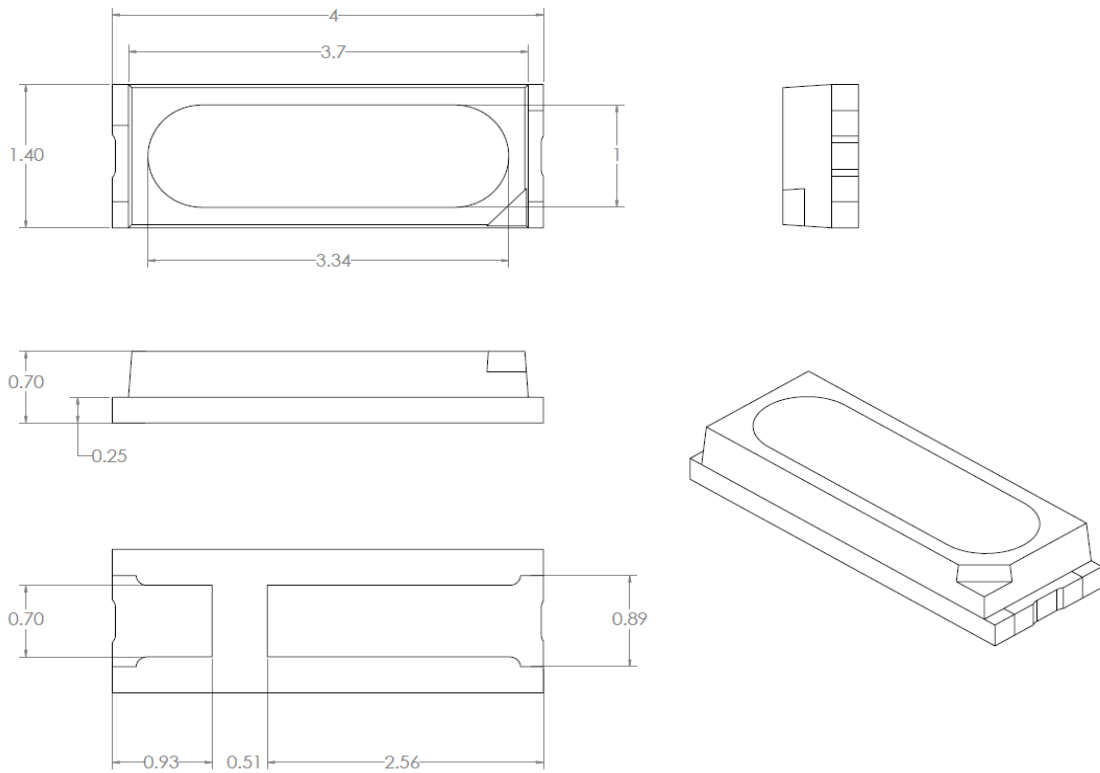


Figure 1. Package outline dimensions.

Characteristic Curves

Relative Spectral Distribution vs. Wavelength

Junction Temperature at 25°C; Test Current = 30 mA

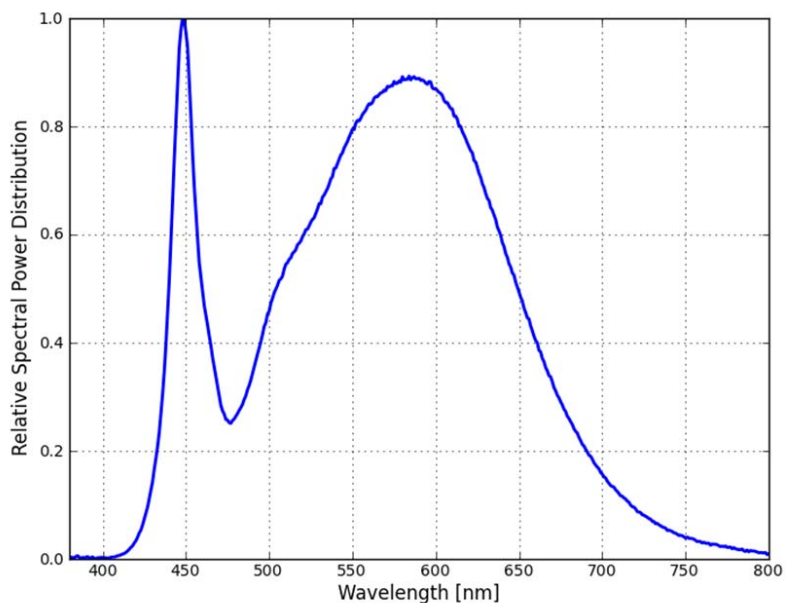


Figure 2. Emission color spectrum for MXZx-PWxx.

Relative Light Output Characteristics over Temperature

Test Current = 30 mA

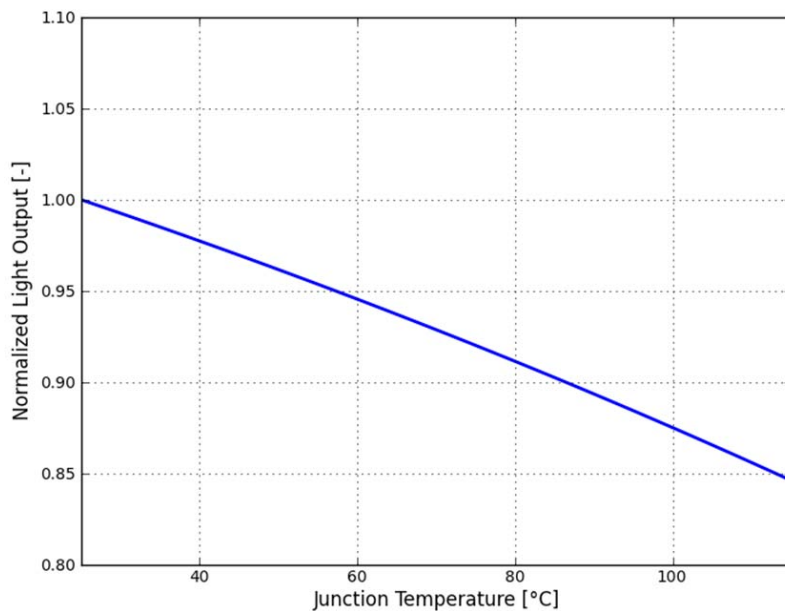


Figure 3. Relative light output vs. junction temperature for MXZx-PWxx.

Typical Forward Current

Junction Temperature at 25°C

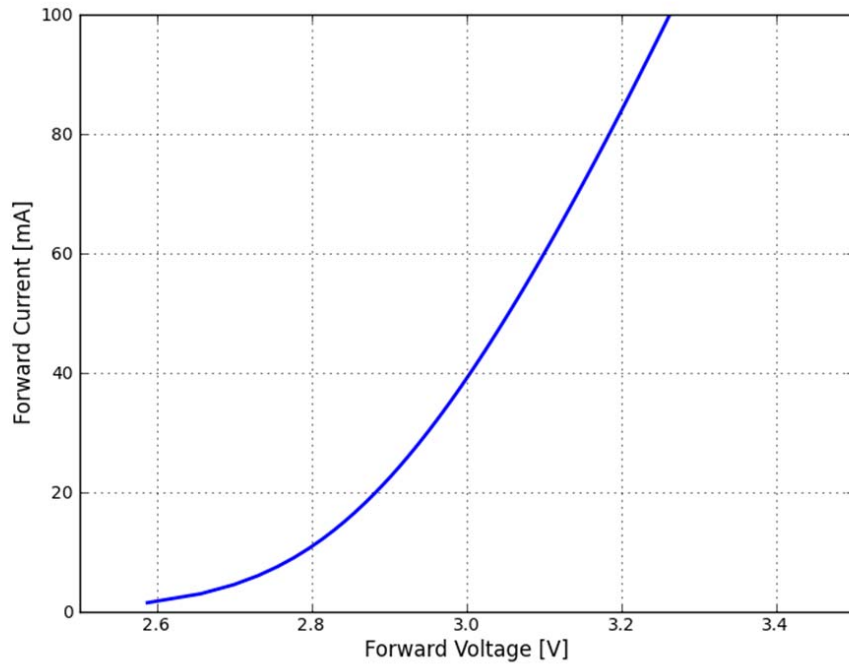


Figure 4. Forward current vs. forward voltage for MXZx-PWxx.

Typical Radiation

Junction Temperature at 25°C

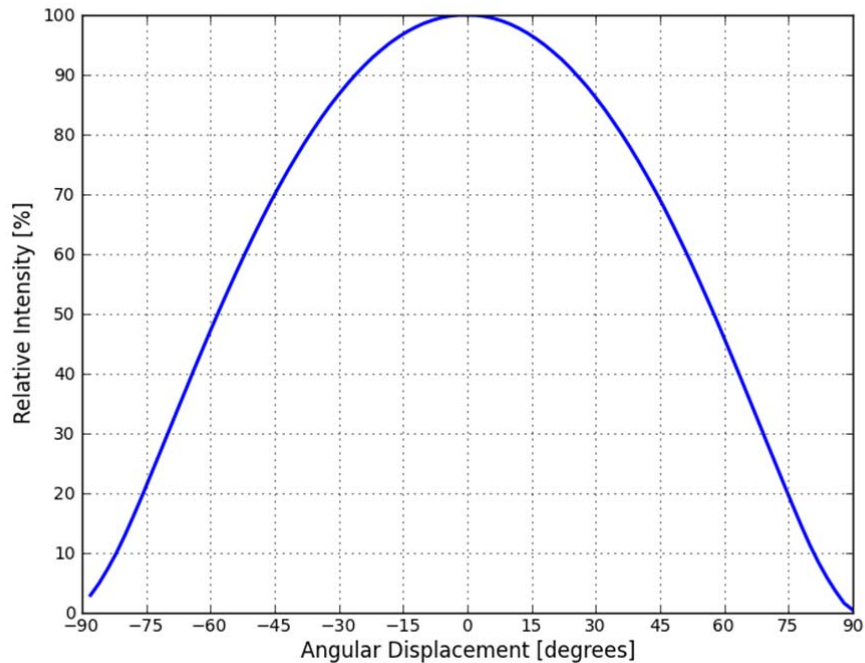


Figure 5. Radiation pattern for MXZx-PWxx.

Light Output Characteristics

Relative Light Output Characteristics over Forward Current Junction Temperature at 25°C

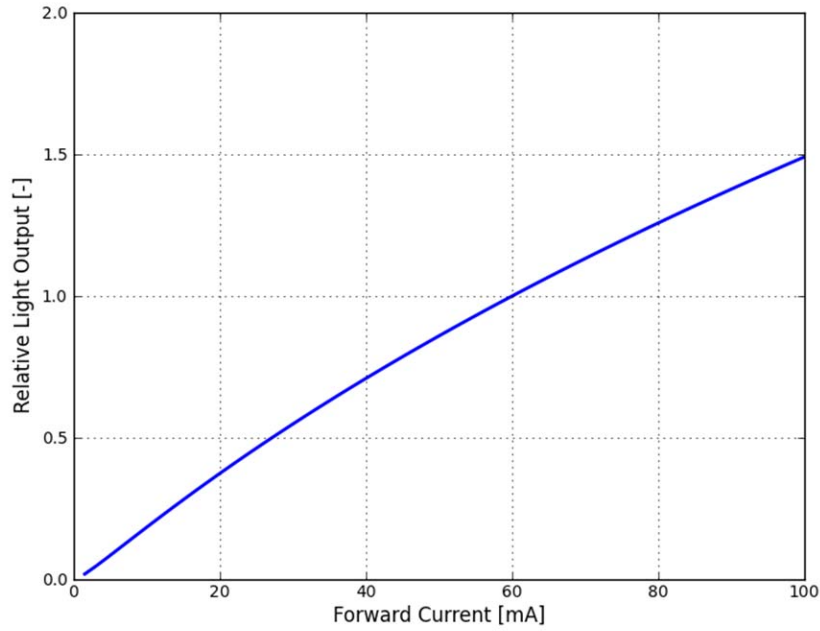


Figure 6. Forward current vs. forward voltage for MXZx-PWxx.

Typical Relative Efficiency vs. Forward Current Junction Temperature at 25°C

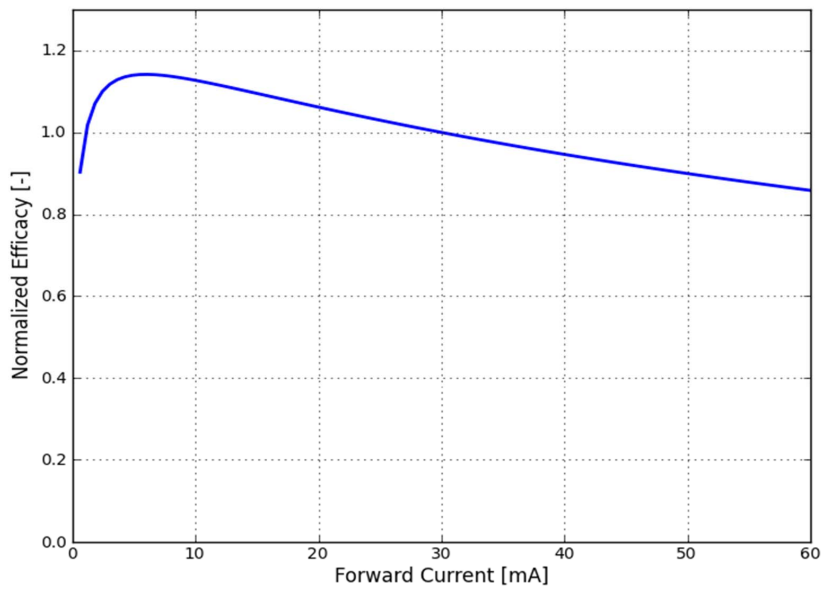


Figure 7. Typical relative efficiency vs. forward current for MXZx-PWxx.

Typical Radiation Pattern

Radiation Pattern in Polar
Junction Temperature at 25°C

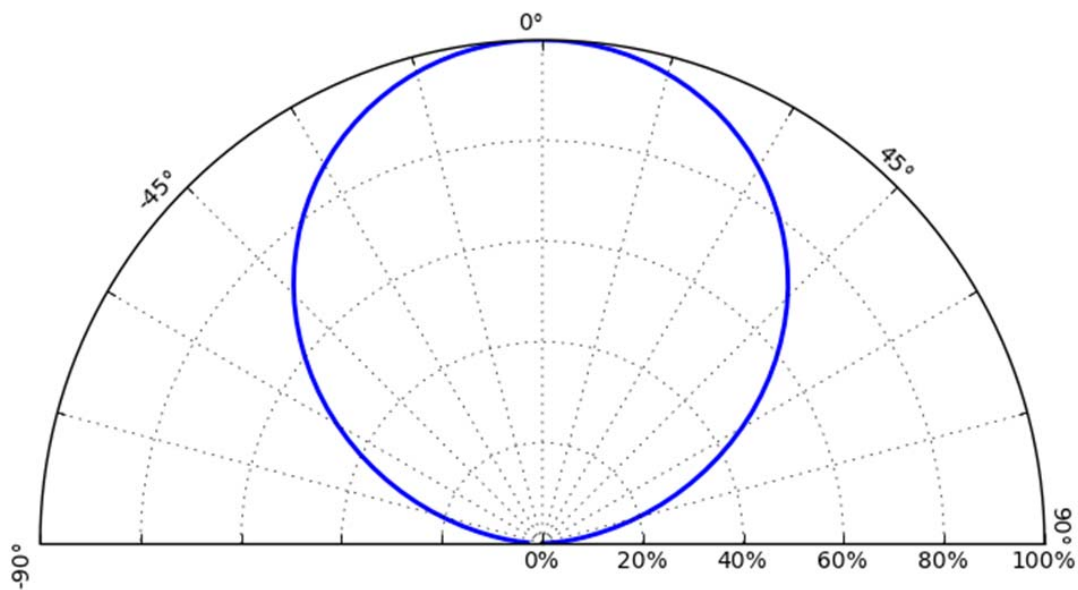


Figure 8. Radiation pattern in polar for MXZx-PWxx.

Emitter Pocket Tape Packaging

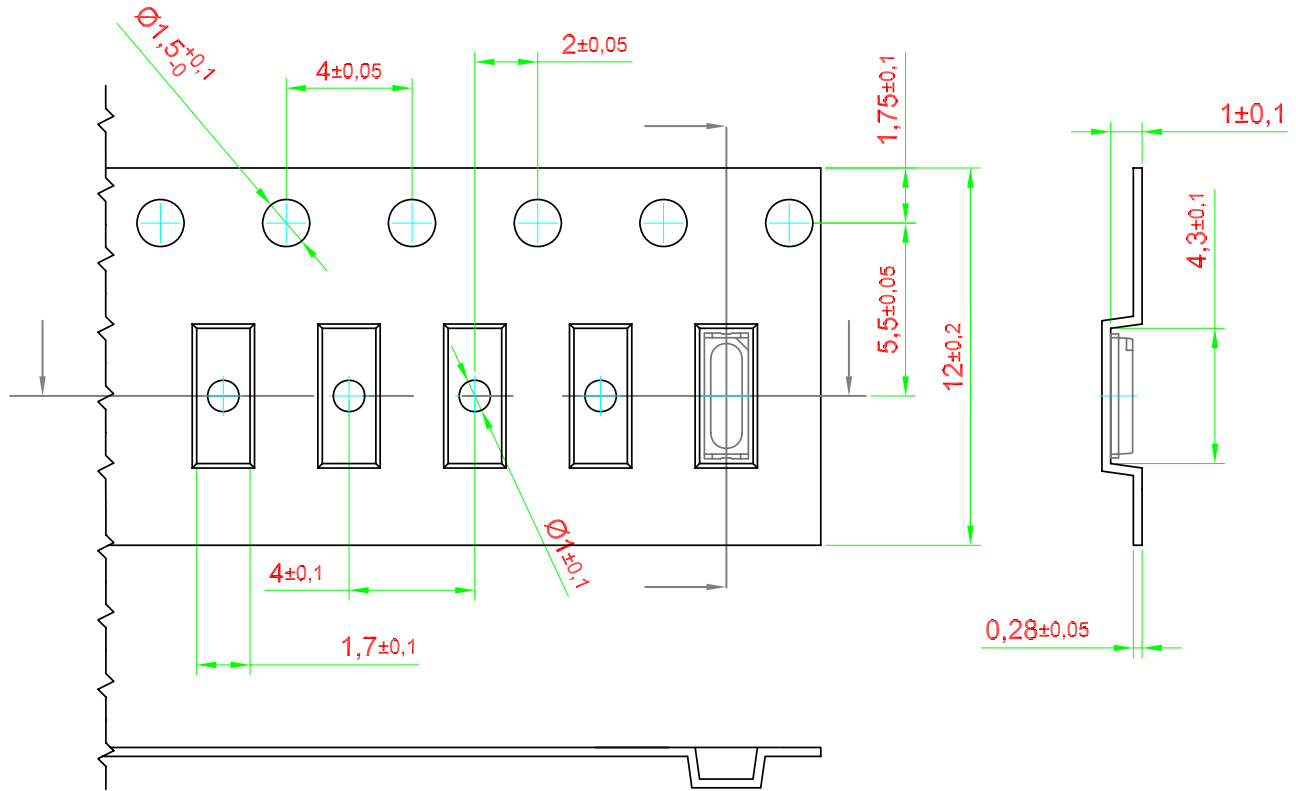


Figure 9. Emitter pocket tape packaging.

Notes for Figure 9:

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

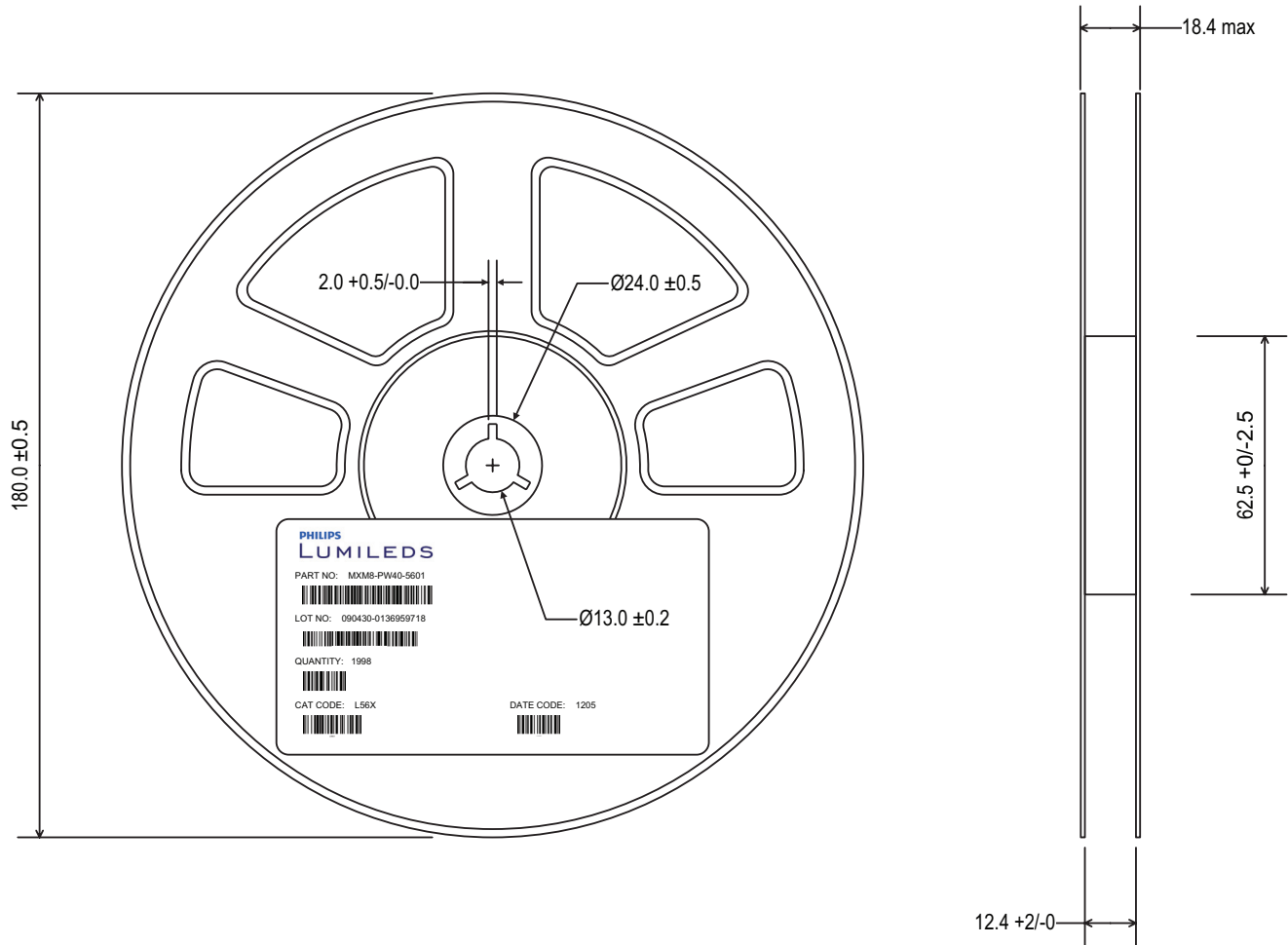


Figure 10. Emitter reel packaging.

Notes for Figure 10:

1. All dimensions are in millimeters.
2. Empty component pockets sealed with top cover tape.
3. 7 inch reel-3000 pieces per reel.
4. Minimum packing quantity is 1000 pieces.
5. The maximum number of consecutive missing LEDs is two.
6. In accordance with EIA-481-I-B specification.

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, Philips Lumileds bins the LED components for luminous flux, color and forward voltage (V_f).

Decoding Product Bin Labeling

LUXEON 4014 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 3000K, 3500K, 4000K, 5000K, 6500K emitters are labeled with a four digit alphanumeric CAT code following the format below.

ABCD

A = Flux bin (L etc.)

B and C = Color bin (For example 51, 52, 53, 54, 55, 56)

D = V_f bin

Luminous Flux and Forward Voltage Bins

Tables 4 and 5 list the standard photometric luminous flux bins for LUXEON 4014 emitters (tested and binned at 30 mA). 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.

Table 4. Flux Bins

Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
A	8.5	10.0
B	10.0	11.5
C	11.5	13.0
D	13.0	15.0

Tested and binned at 25°C, $I_f=30$ mA. Tester tolerance: $\pm 7\%$.

Table 5. V_f Bins

Bin Code	Minimum Forward Voltage (V)	Maximum Forward Voltage (V)
S	2.7	2.8
T	2.8	2.9
V	2.9	3.0
W	3.0	3.1
X	3.1	3.2

Tested and binned at 25°C, $I_f=30$ mA. Tester tolerance: $\pm 0.10V$.

Color Bin Structure

MXZ8-PW40-xxxx Color Bin Structure

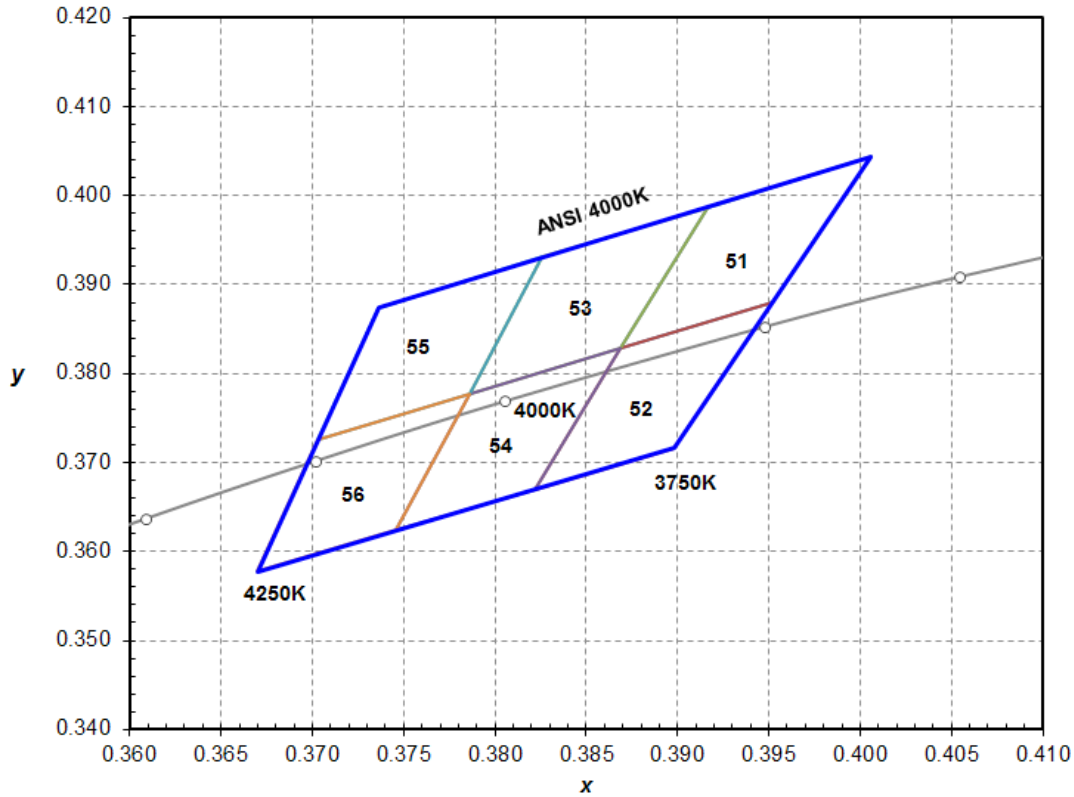


Figure 11. ANSI 4000K 1/6th color bin structure, forwards current = 30 mA, thermal pad temperature = 25°C.

LUXEON 4014 Emitters are tested and binned by x, y coordinates.

Table 6.

LUXEON Mid-Power ANSI 1/6 Color Bin Coordinates for MXZ8-PW40-xxxx Emitter					
Bin Code	x	y	Bin Code	x	y
51	0.3869	0.3829	54	0.3746	0.3624
	0.3916	0.3987		0.3786	0.3777
	0.4006	0.4044		0.3869	0.3829
	0.3952	0.3880		0.3822	0.3670
52	0.3822	0.3670	55	0.3703	0.3726
	0.3869	0.3829		0.3736	0.3874
	0.3952	0.3880		0.3826	0.3931
	0.3898	0.3716		0.3786	0.3777
53	0.3786	0.3777	56	0.3670	0.3578
	0.3826	0.3931		0.3703	0.3726
	0.3916	0.3987		0.3786	0.3777
	0.3869	0.3829		0.3746	0.3624

Notes for Table 6:

I. Tested and binned at 25°C, I_f=30 mA. Tester tolerance: ±0.01 in x and y coordinates.

Company Information

Philips Lumileds is a leading provider of LEDs for everyday lighting applications. The company's records for light output, efficacy and thermal management are direct results of the ongoing commitment to advancing solid-state lighting technology and enabling lighting solutions that are more environmentally friendly, help reduce CO2 emissions and reduce the need for power plant expansion. Philips Lumileds LUXEON® LEDs are enabling never before possible applications in outdoor lighting, shop lighting, home lighting, digital imaging, display and automotive lighting.

Philips Lumileds is a fully integrated supplier, producing core LED material in all three base colors, (Red, Green, Blue) and white. Philips Lumileds has R&D centers in San Jose, California and in the Netherlands, and production capabilities in San Jose, Singapore and Penang, Malaysia. Founded in 1999, Philips Lumileds is the high flux LED technology leader and is dedicated to bridging the gap between solid-state technology and the lighting world. More information about the company's LUXEON LED products and solid-state lighting technologies can be found at www.philipslumileds.com.

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LUXEON 4014 Datasheet DS205 20130502