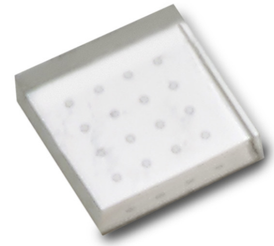
LUXEON Flip Chip

Chip Scale Package LED



Introduction

Philips Lumileds LUXEON® Flip Chip LED Technology enables the next generation of lighting applications. Customers now have complete design flexibility to access Lumileds' industry leading performance at the die level and customize the phosphor and packaging to best suit their lighting applications.

LUXEON Flip Chip is a real Chip Scale Package LED that can be attached by reflow without additional packaging. Traditional wire bonding limits the packing and power density of LEDs. LUXEON Flip Chip LEDs can be packaged closer and can be driven at a higher current density, therefore requiring fewer emitters to achieve a higher lumen output at higher lumen densities.

This document contains the performance data needed to design and engineer Philips Lumileds LUXEON Flip Chip based application.

Features

- High drive current up to 1A/mm^2
- 1.0 mm x 1.0 mm 5-sided emitter
- 440-460 nm wave length
- Low typical forward voltage of 2.9V
- Low thermal resistance
- Symmetric, large bond pads bumped with AuSn solder

Benefits

- High current density for high lumen and lm/$ at high lm/W
- High-packaging density
- 5-sided emitter for dispense and remote phosphor applications
- Surface mount capable
- No wire bonds
- Robust design with proven Lumileds reliability

Key Applications

- High-power LED emitters
- Chip on board applications
- Remote phosphor applications

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Product Nomenclature

The part number designation for LUXEON Flip Chip follows:

L H D F - R B 1 0 a b c d e f g h i

Where:

RB	– designates color (RB for Royal Blue)
10	– designates die dimension (10 for 1.0mm^2)
a	– designates peak wave length bin (Values 3, 4, 5, 6 per description of bin codes)
b	– designates bond pad finish (A for pad bumped with AuSn solder)
cd	– open slot to accommodate additional product requirements
efgh	– minimum radiometric power performance (mW)
i	– additional product designator (default value = 1)

Environmental Compliance

Philips Lumileds is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON Flip Chip 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 Flip Chip: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Product Performance and Characterization Guide

Table 1. Optical Characteristics at T_j = 25°C, I_f = 350 mA

Part Number	Peak Wavelength (nm) [1,2]		Typical Spectra Half-width (nm)	Typical Temperature Coefficient of Peak Wavelength [3] (nm/°C)
	Min.	Max.		
LHDF-RB10300000000	440	445	24	0.05
LHDF-RB10400000000	445	450		
LHDF-RB10500000000	450	455		
LHDF-RB10600000000	455	460		

Notes for Table 1:

1. Philips Lumileds maintains a tolerance of ±2nm for peak wavelength measurements.
2. Please see Figure 8 for typical translation from peak wavelength to dominant wavelength.
3. Measured between 25°C and 85°C at I_f= 350 mA.

Table 2. Performance Characteristics at T_j = 25°C, I_f = 350 mA

Part Number	Min. Radiometric Power (mW) [1,2]	Typical H/C factor [3]
LHDF-RB10300005000	500	0.95
LHDF-RB10400005000	500	
LHDF-RB10500005000	500	
LHDF-RB10600004500	450	

Notes for Table 2:

1. Radiometric power values are based on a die packaged on ceramic tile with high reflective surface and dome encapsulation.
2. Philips Lumileds maintains a tolerance of ± 6.5% on radiometric power measurements.
3. H/C factor is the radiometric power ratio between 25°C and 85°C at I_f= 350 mA.

Table 3. Electrical Characteristics at T_j = 25°C, I_f = 350 mA

Part Number	Forward Voltage (V)[1]			Typical Temperature Coefficient of Forward Voltage[2] (mV/°C) $\Delta V_f/\Delta T_J$
	Min.	Typ.	Max.	
LHDF-RB10400000000	2.7	2.9	3.1	-2 to -3

Notes for Table 3:

1. Philips Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Measured between 25°C and 85°C at I_f= 350 mA.

Absolute Maximum Ratings

Table 4. Operating Condition and Ratings

Parameter	Maximum Performance
DC Forward Current [1] [2]	1050 mA
Peak Pulsed Forward Current [3]	1300 mA
Storage Temperature	-40°C - 135°C
LED Junction Temperature [1]	135°C
ESD Sensitivity[4]	≤ 200V (HBM, CLASS 0B per JS-001-2012)
Reverse Voltage	LUXEON Flip Chip is not designed to be driven in reverse bias

Notes for Table 4:

1. Proper current de-rating must be observed to maintain the junction temperature below the specified maximum 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 ≤ 250 mA are acceptable, assuming the average current throughout each cycle does not exceed the specified maximum DC forward current and the junction temperature is kept below the specified maximum junction temperature.
3. Pulsed operation with a peak drive current of 1300 mA is acceptable if the pulse on-time is ≤ 5ms per cycle and the duty cycle is ≤ 50%.
4. Please see the LUXEON Flip Chip application brief for additional information on ESD protection.

Mechanical Dimensions

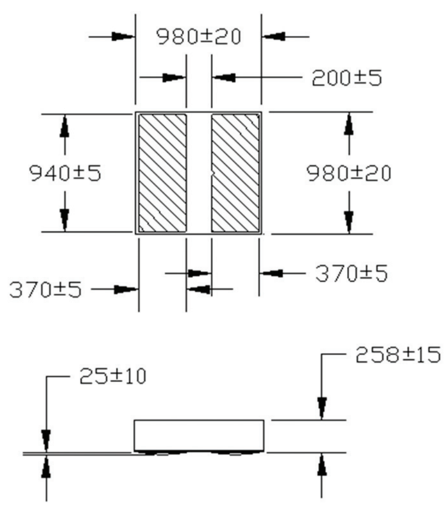

Figure 1. Mechanical Dimensions, LUXEON Flip Chip LHDF-RB10 xxxx xxxx x.

Notes for Figure 1:

1. Drawing is not scale.
2. All dimensions are in micrometers .
3. A notch in the bond pad center indicates the anode.
4. The bond pads are bumped with AuSn solder.
5. LUXEON Flip Chip is qualified for AuSn reflow attach on ceramic and MCPCB substrates.

Characteristic Curves

Relative Spectral Power Distribution vs. Wavelength

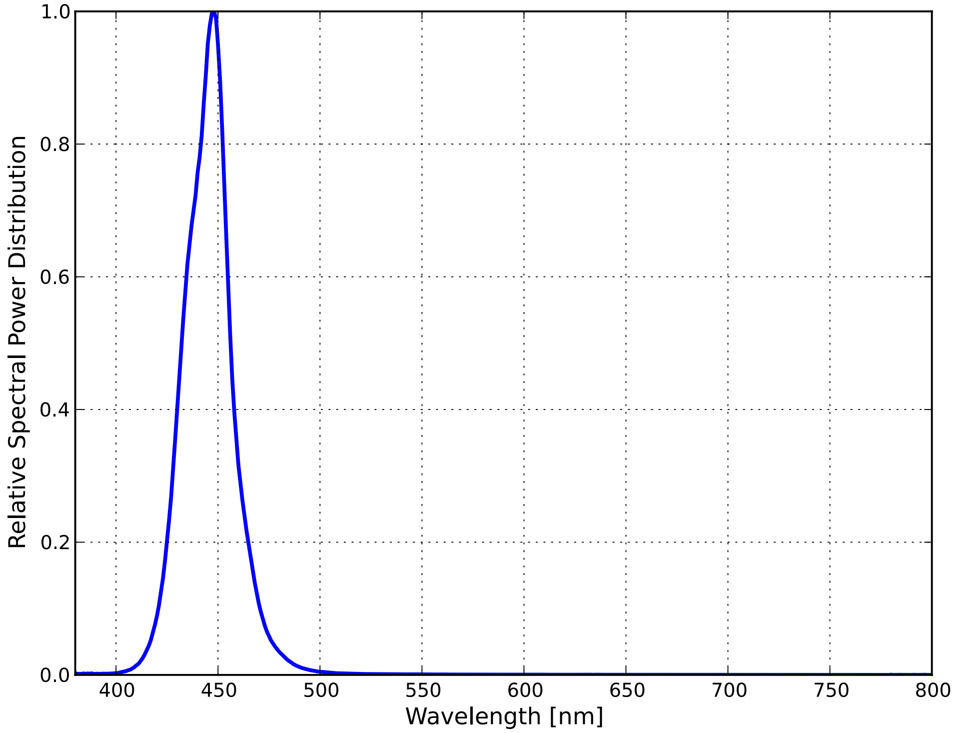

Figure 2. Relative spectral power distribution at T_j = 25°C, I_f = 350 mA.

Forward Current vs. Forward Voltage

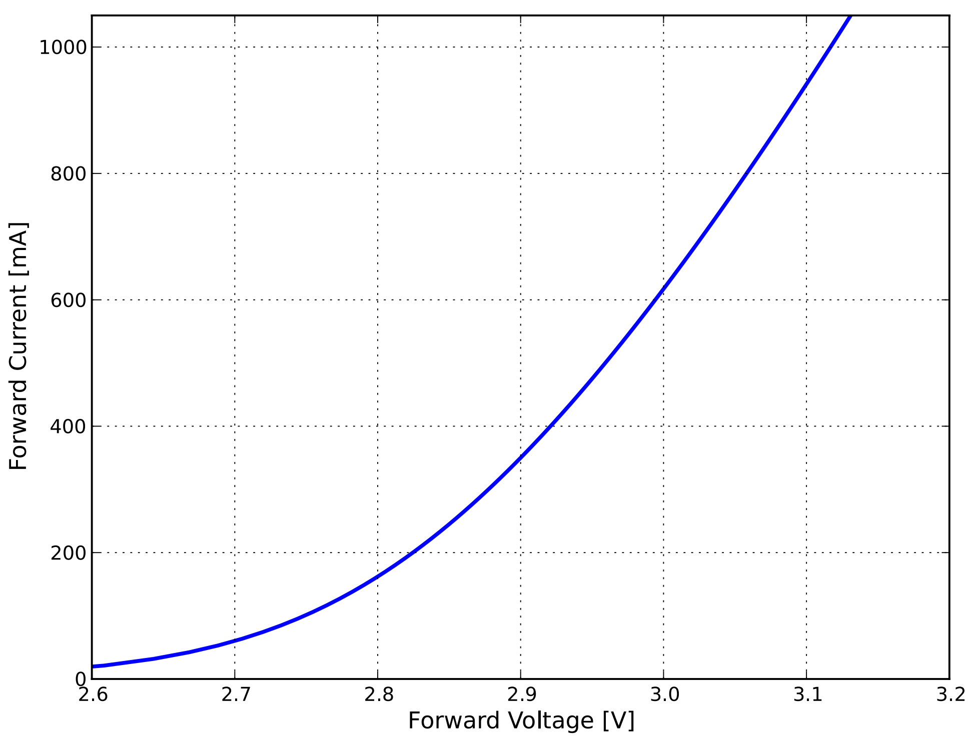

Figure 3. Forward current vs. forward voltage at T_j = 25°C.

Typical Relative Radiometric Power vs. Forward Current

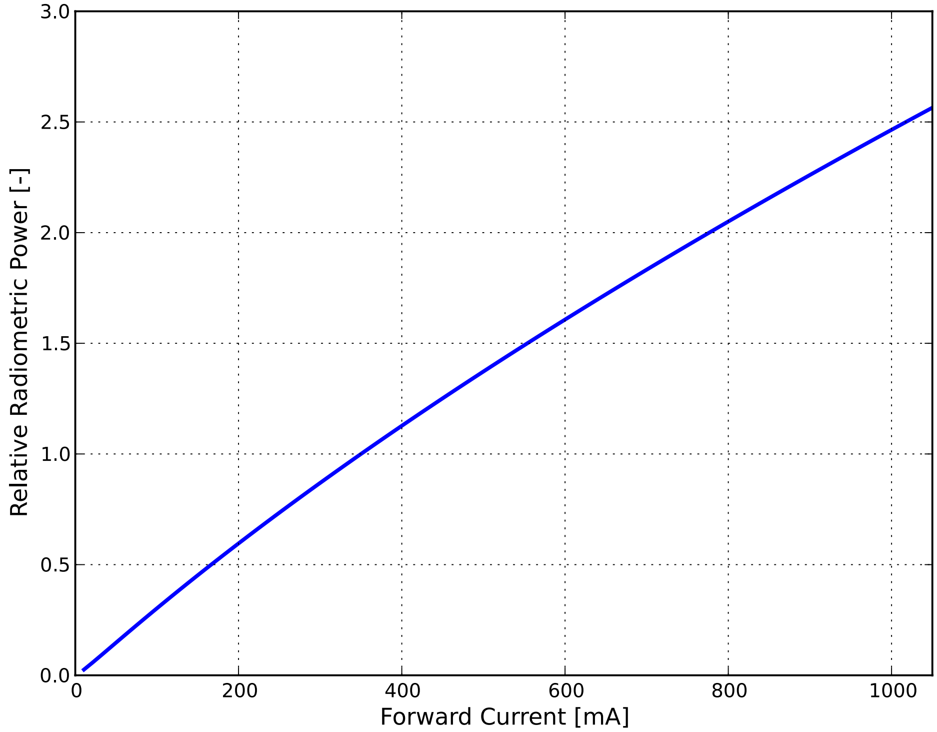

Figure 4. Typical relative radiometric power vs. forward current at T_j = 25°C.

Peak Wavelength Shift vs. Forward Current

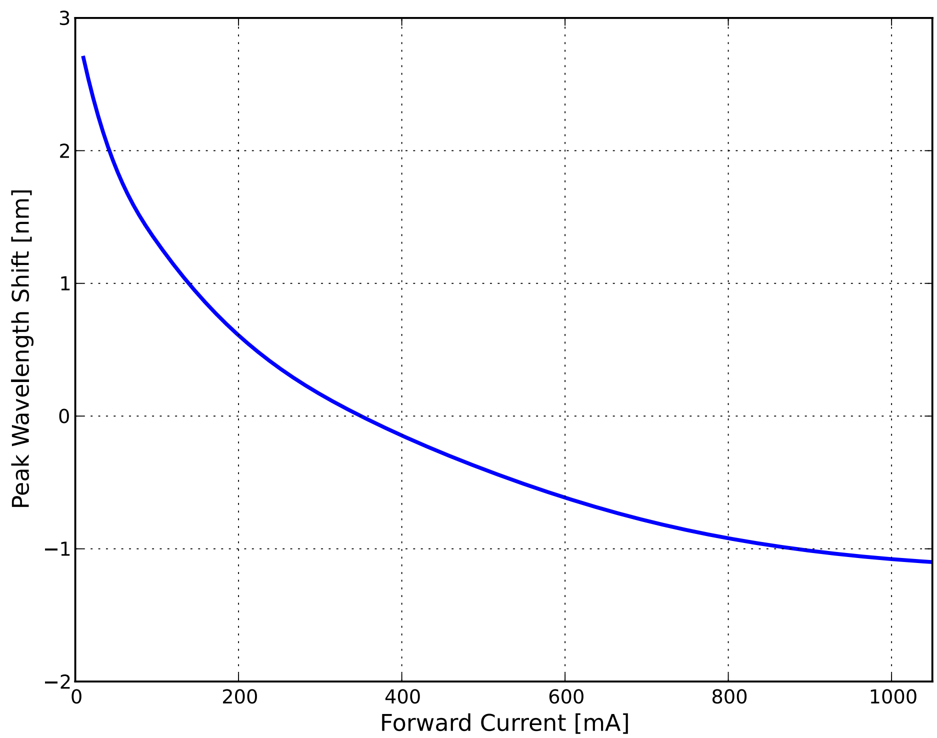

Figure 5. Peak wavelength shift vs. forward current at T_j = 25°C.

Relative Radiometric Power vs. Junction Temperature

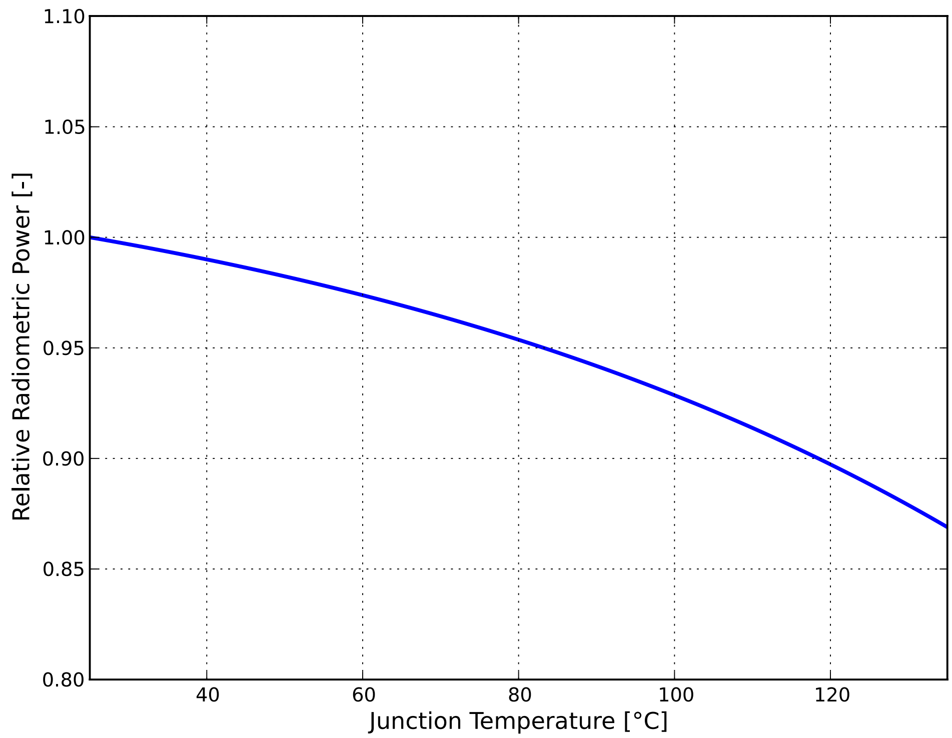

Figure 6. Relative radiometric power vs. junction temperature at I_f = 350 mA.

Peak Wavelength Shift vs. Junction Temperature

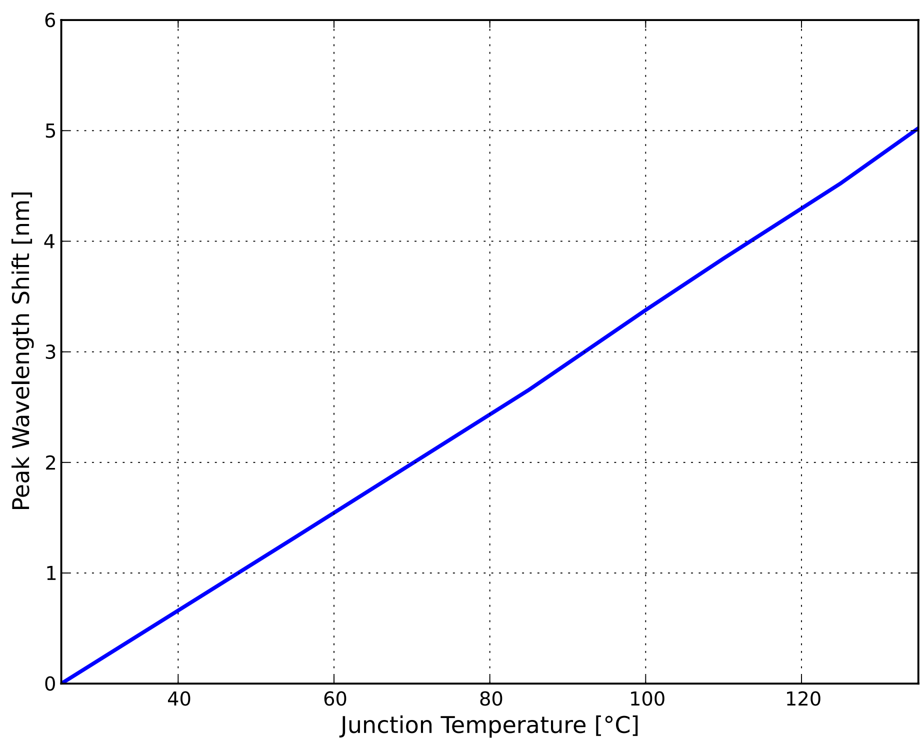

Figure 7. Peak wavelength shift vs. junction temperature at I_f = 350 mA.

Typical Translation from Peak Wavelength to Dominant Wavelength

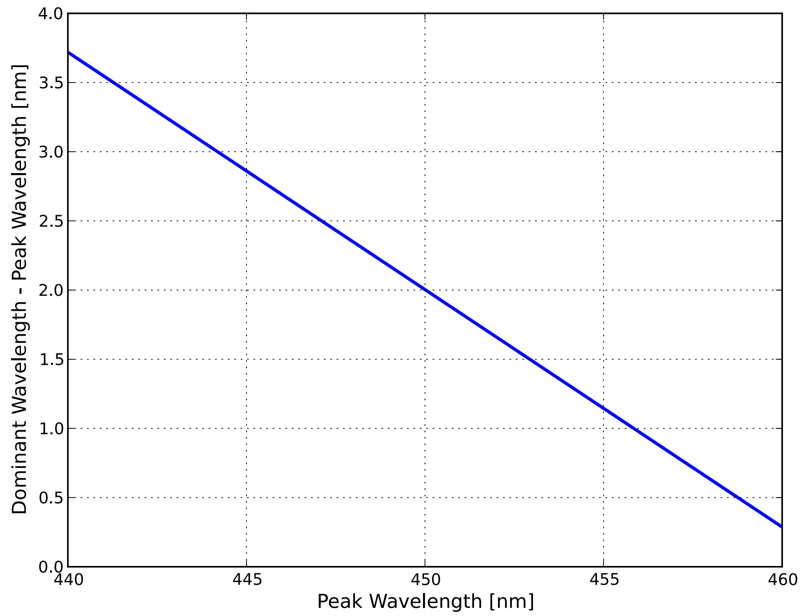

Figure 8. Typical translation from peak wavelength to dominant wavelength at T_j = 25°C, I_f = 350 mA.

Radiation Patterns

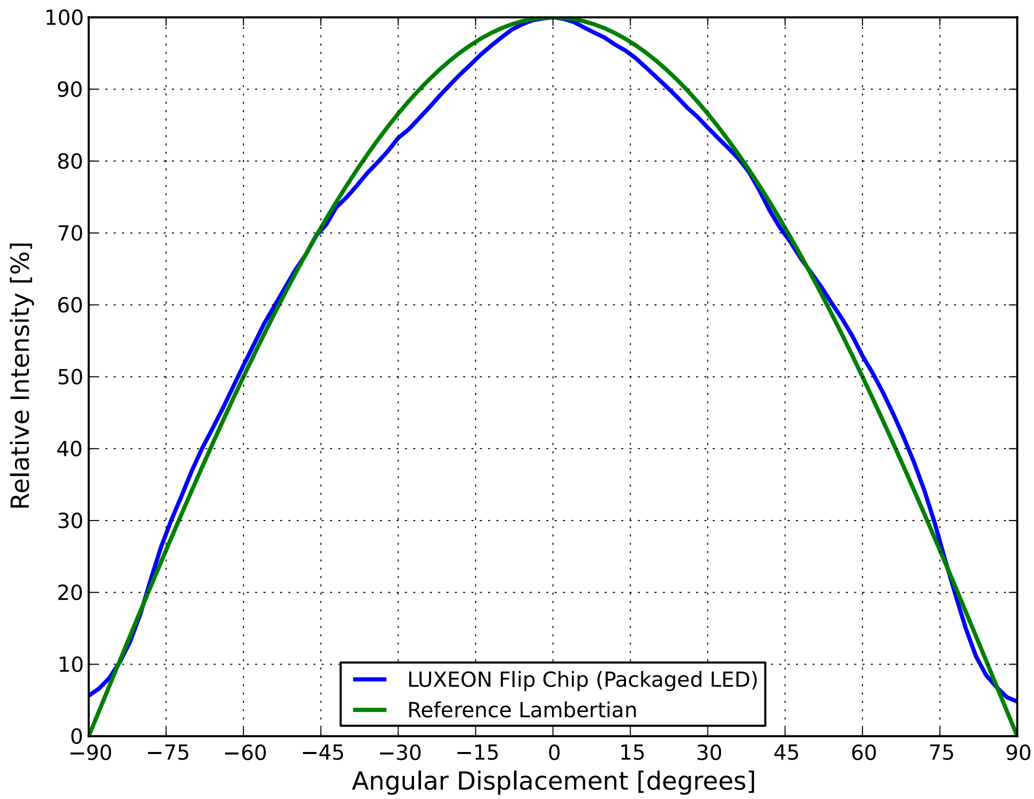

Figure 9. Typical spatial radiation pattern at T_j = 25°C, I_f = 350 mA.

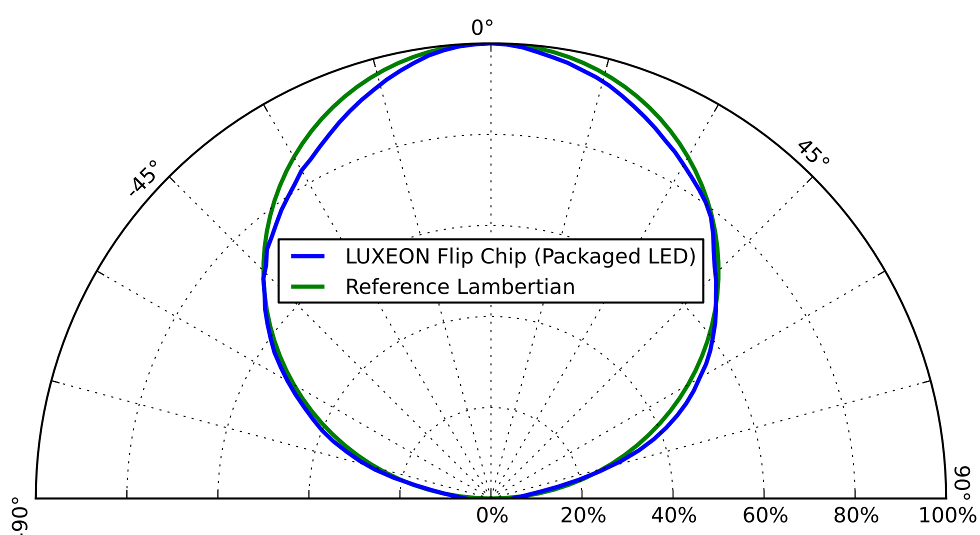

Figure 10. Typical polar radiation pattern for LUXEON Flip Chip.

Note for Figures 9 and 10:

Radiation pattern is measured for the die packaged on ceramic tile with high reflective surface and dome encapsulation.

Bin Structure for LUXEON Flip Chip

LUXEON Flip Chip is characterized at T_j = 25°C, I_f = 350 mA and sorted on bin sheets. A specific bin sheet only contains LUXEON Flip Chip within a single bin for radiometric power, peak wavelength, and forward voltage. An order for a specific part number at a given peak wavelength bin can be filled from any bin combination of radiometric flux and forward voltage.

Bin sheets are labeled by a four digit alphanumeric CAT code ABCD following the format below.

Table 5.

A			BC			D		
Radiometric Power (mW)[1]			Peak Wavelength (nm) [2]			Forward Voltage (V)		
Bin Code	Min.	Max.	Bin Code	Min.	Max.	Bin Code	Min.	Max.
E	450	500	3x	440	445	7	2.7	2.8
F	500	550	4x	445	450	8	2.8	2.9
G	550	600	5x	450	455	9	2.9	3.0
H	600	650	6x	455	460	0	3.0	3.1

Notes for Table 5:

1. Radiometric power values are based on a die packaged on ceramic tile with high reflective surface and dome encapsulation. The availability of flux bins will vary depending on peak wavelength.
2. Limited availability for bin 3x and 6x.

Who We Are

Philips Lumileds focuses on one goal: Creating the world's highest performing LEDs. The company pioneered the use of solid-state lighting in breakthrough products such as the first LED backlit TV, the first LED flash in camera phones, and the first LED daytime running lights for cars. Today we offer the most comprehensive portfolio of high quality LEDs and uncompromising service.

Philips Lumileds brings LED's qualities of energy efficiency, digital control and long life to spotlights, downlights, high bay and low bay lighting, indoor area lighting, architectural and specialty lighting as well as retrofit lamps. Our products are engineered for optimal light quality and unprecedented efficacy at the lowest overall cost. By offering LEDs in chip, packaged and module form, we deliver supply chain flexibility to the inventors of next generation illumination.

Philips Lumileds understands that solid state lighting is not just about energy efficiency. It is about elegant design. Reinventing form. Engineering new materials. Pioneering markets and simplifying the supply chain. It's about a shared vision. Learn more about our comprehensive portfolio of LEDs at **www.philipslumileds.com**.

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