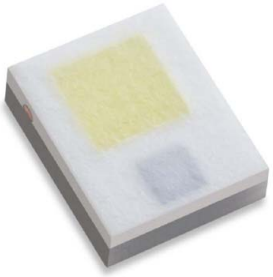
# LUXEON Flash 6

Power Light Source



LXCL-EW06

## Introduction

LUXEON® Flash 6 is a family of ultra-compact LEDs specifically designed and tested for use as a camera flash in space-constrained and portable digital imaging applications. LUXEON Flash emitters are designed with innovative LUXEON technology to provide industry-leading intensity and uniformity. The uniquely bright source density characteristics of LUXEON Flash products put more light on scene, enabling higher quality pictures in low ambient lighting conditions at greater distances. Portable imaging devices including camera-equipped smart phones, tablets and digital still cameras can easily incorporate the slim form factor of the LUXEON Flash into sleek designs while maintaining high levels of light output.

The compact and well-defined light source geometry of LUXEON Flash 6 LEDs allows their light to be easily coupled into secondary optics or integrated into a stand-alone camera Flash module so that time-to-market can be accelerated with simplified designs. An integrated transient voltage suppression (TVS) chip provides ESD protection up to 8kV.

### Features

- High flux density with compact light emitting source
- Off-State White appearance
- Rated 1.5A max pulse current
- Tight Correlated Color Temperature (CCT) control
- Pb Free / RoHS compliant
- MSL (moisture sensitivity level) class 1 rating

### Benefits

- Enables efficient illuminating optics with compact footprint
- Aesthetically pleasing for device industrial design
- Enables maximum utilization of output capabilities
- Ensures consistency in system color point
- Free of hazardous materials
- Indefinite shelf life*

* Per IPC/JEDEC J-STD-20 MSL Classifications

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# General Information

## Product Nomenclature

The part number designation is explained as follows:

L X C L – A B C D – E F G H

Where:

A — designates die size (value E for 1mm$^2$)

B — designates off-state color (W for white)

C — designates on-state color (0 for cool-white)

D — designates family (Flash 6)

EFGH — reserved for customer codes

Therefore LUXEON Flash 6, off-state white, 1mm$^2$ die will follow the product code:

L X C L – E W 0 6 – x x x x

## Ordering Information

| Part Number | Description | Package Quantity |
|---|---|---|
| LXCL-EW06-xxxx | LUXEON Flash 6 Emitter, off-state white, on-state cool-white, 1mm$^2$ die size | 5000 |

## Environmental Compliance

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

# Product Performance and Characterization Guide

## Optical Characteristics

**Table 1.**

| Part Number | Luminous Flux[2] (Lm) | | Color Temperature[3] (CCT) | | | Typical Viewing Angle[4] (degrees) |
|---|---|---|---|---|---|---|
| | Min, | Typ. | Min. | Typ. | Max. | 2θ 1/2 |
| LXCL-EW06-xxxx | 200 | 220 | 5000 | 5500 | 6000 | 120 |

Notes for Table 1:

1. Electro-optical testing conducted in single pulse mode, $T_{ON}$ = 20ms, $T_j$ = 25°C, $I_F$=1000 mA.
2. Philips Lumileds maintains a tester tolerance of ± 10% on luminous flux measurements.
3. Philips Lumileds maintains a tester tolerance of ± 5% on CCT measurements.
4. Viewing angle is the off axis angle from LED centerline where the luminous intensity is ½ of the peak value.

# Electrical Characteristics

**Table 2.**

| Part Number | Forward Voltage $V_f$ [2] (V) | | | Typical Temperature Coefficient of Forward Voltage [3] (mV/°C) $\Delta V_F / \Delta T_J$ | Typical Thermal Resistance Junction to Thermal Pad (°C/W) $R\theta_{J-C}$ | Typical Dynamic Resistance [4] (Ω) $\Delta V_F / \Delta I_F$ |
|---|---|---|---|---|---|---|
| | Minimum | Typical | Maximum | | | |
| LXCL-EW06-xxxx | 2.7 | 3.2 | 3.6 | -2 | 10 | 0.17 |

Notes for Table 2:

1. Electro-optical testing conducted in single pulse mode, $T_{ON}$ = 20ms, $T_j$ = 25°C, $I_F$=1000 mA.
2. Philips Lumileds maintains a tolerance of ± 0.06V on forward voltage measurements.
3. Measured between $T_j$ = 25°C and $T_j$ = 85°C at $I_f$ = 1000 mA.
4. Dynamic resistance is the inverse of the slope in the $I_f$ vs. $V_f$ curve and is measured at $I_f$ = 1000 mA (see Figure 11).

# Absolute Maximum Ratings

**Table 3.**

| Parameter | LUXEON Flash 6 |
|---|---|
| DC (Torch Mode) Forward Current | 500 mA |
| Peak Pulsed (Flash Mode) Forward Current [1] | 1500 mA |
| ESD Sensitivity | ≤ 8000V Human Body Model (HBM)<br>Class 3B JESD22-A114<br>≤ 500V Charged-Device Model (CDM)<br>Class 3 JESD22-C101 |
| Storage Temperature [2] | -40°C - 85°C |
| LED Junction Temperature [3, 4] (DC / pulse) | 135°C / 150°C |
| LED Case Temperature [4] (DC / pulse) | 115°C / 135°C |
| LED Operating Temperature (Ambient) | -30°C - 85°C |
| Reverse Voltage | LUXEON Flash LEDs are not designed to be driven in reverse bias |

Notes for Table 3:

1. Peak pulsed forward current applies to $T_{ON}$ ≤ 200ms and 30% maximum duty cycle or $T_{ON}$ ≤ 500ms and 10% maximum duty cycle.
2. Maximum storage temperature with RH < 85%
3. Junction Temperature is based on calculation from measured LED case temperature.
4. Pulse conditions assume 10% duty cycle.

# JEDEC Moisture Sensitivity

**Table 4. IPC/JEDEC J-STD-20 (MSL)**

| Level | Floor Life | | Soak Requirements Standard | |
|---|---|---|---|---|
| | Time | Conditions | Time | Conditions |
| 1 | Unlimited | ≤ 30°C / 85% RH | 168 Hrs. | 85°C / 85% RH |

# Forward Current Characteristics

## Maximum Current vs. Forward Current Pulse On-Time

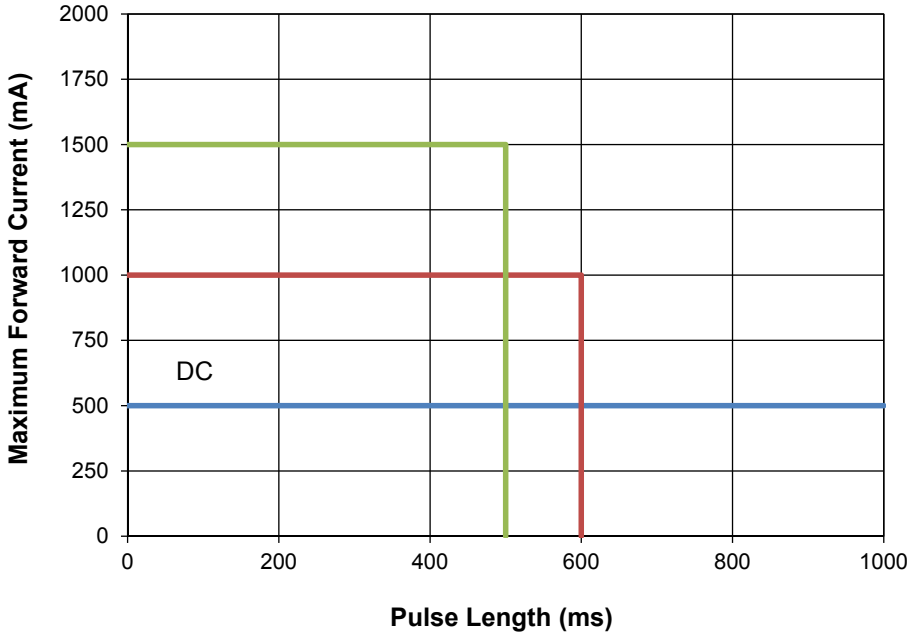



**Figure 1.**

## Maximum Current vs. LED Junction Temperature

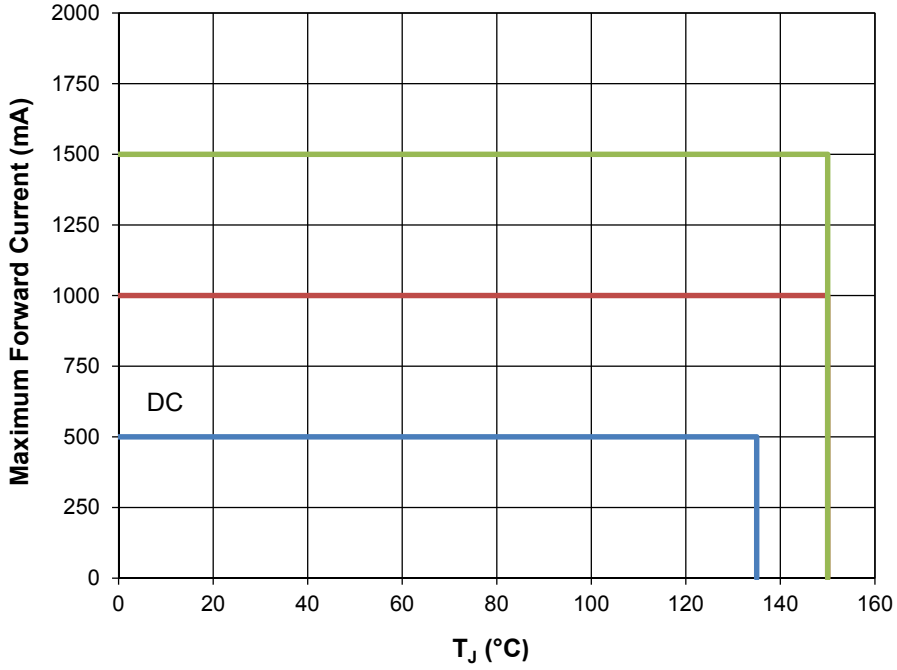



**Figure 2.**

Note for Figures 1 and 2:

1. Peak pulsed forward current of 1500 mA applies to $T_{ON} \leq 200$ms and 30% maximum duty cycle or $T_{ON} \leq 500$ms and 10% maximum duty cycle.
2. Peak pulsed forward current of 1000 mA applies to $T_{ON} \leq 600$ms and 10% maximum duty cycle.

# Reflow Soldering Temperature Profile

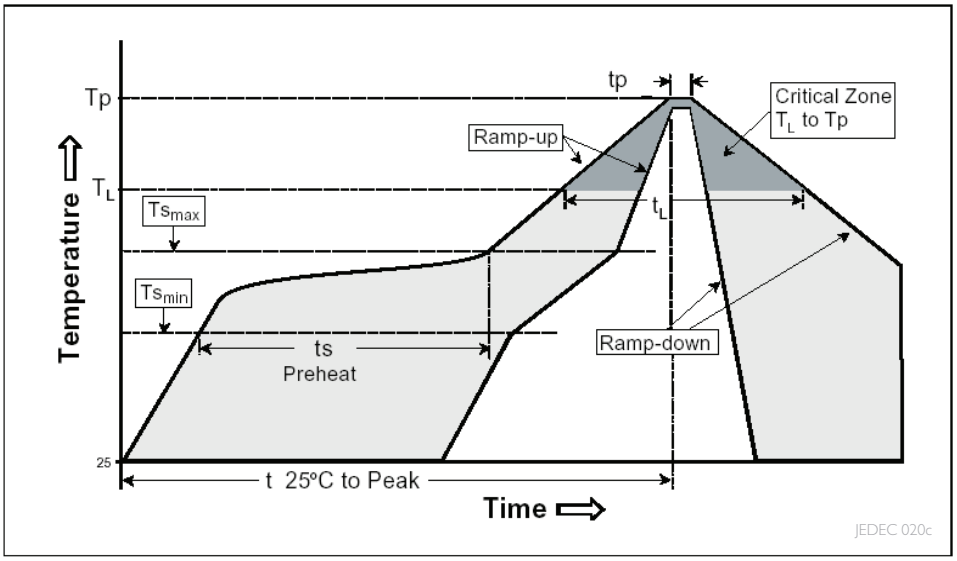



**Table 5.**

| Profile Feature | Lead Free Assembly |
|---|---|
| Average Ramp-Up Rate ($Ts_{max}$ to $T_p$) | 3°C / second max |
| Preheat Temperature Min ($Ts_{min}$) | 150°C |
| Preheat Temperature Max ($Ts_{max}$) | 200°C |
| Preheat Time ($ts_{min}$ to $ts_{max}$) | 60 - 180 seconds |
| Temperature ($T_L$) | 217°C |
| Time Maintained Above Temperature ($t_L$) | 60 - 150 seconds |
| Peak / Classification Temperature ($T_p$) | 260°C |
| Time Within 5°C of Actual Peak Temperature ($t_p$) | 20 - 40 seconds |
| Ramp-Down Rate | 6°C / second max |
| Time 25°C to Peak Temperature | 8 minutes max |

**Note for Table 5:**

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

# Mechanical Dimensions

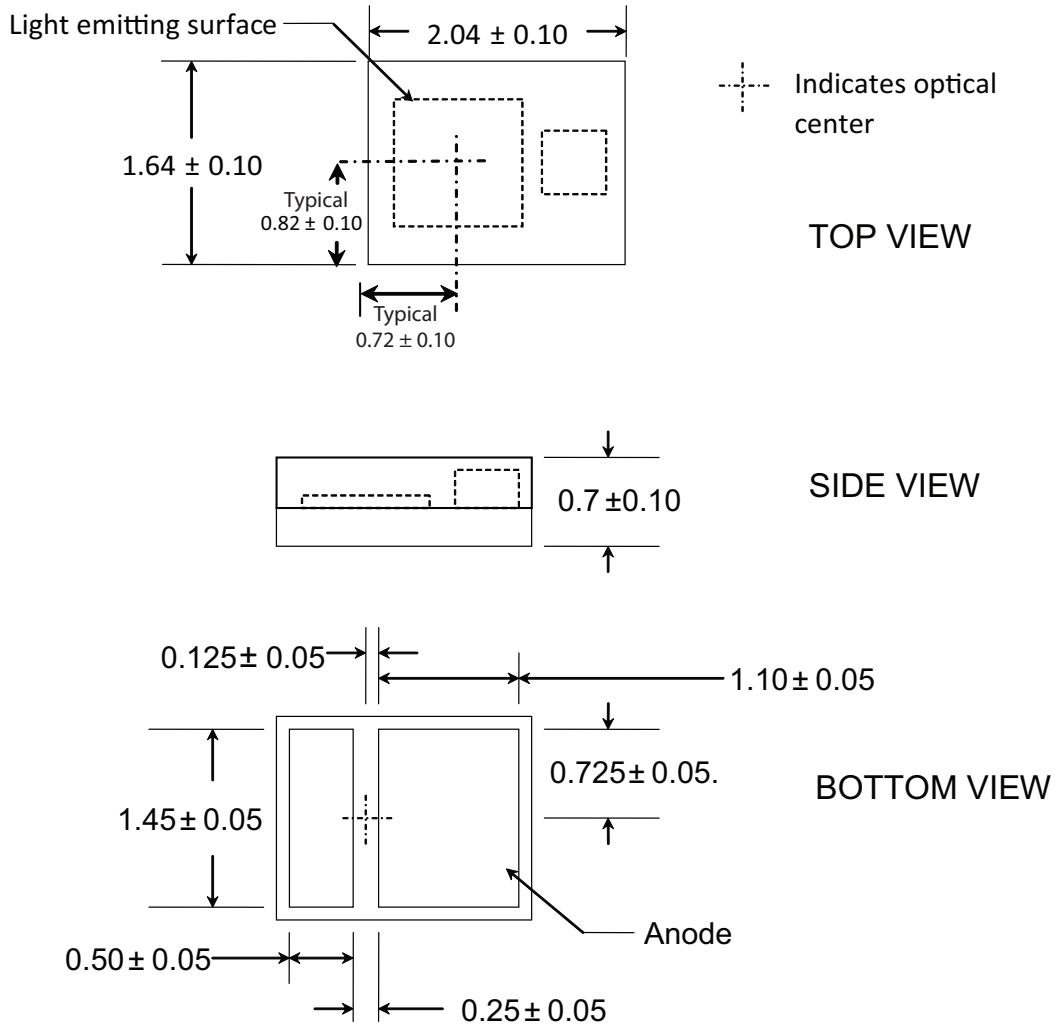



**Figure 3. Dimensions for LXCL-EW06-xxxx.**

Note for Figure 3:

1. All dimensions in millimeters.

# Circuit Diagram

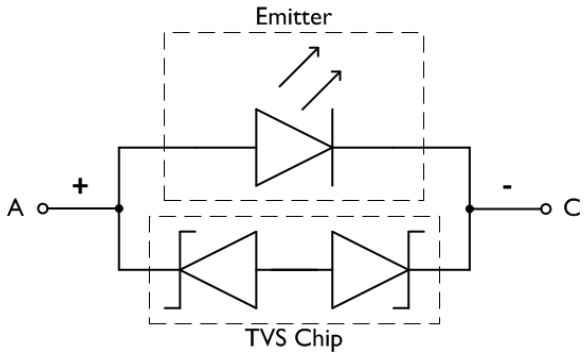



**Figure 4.**

# Solder Pad Design

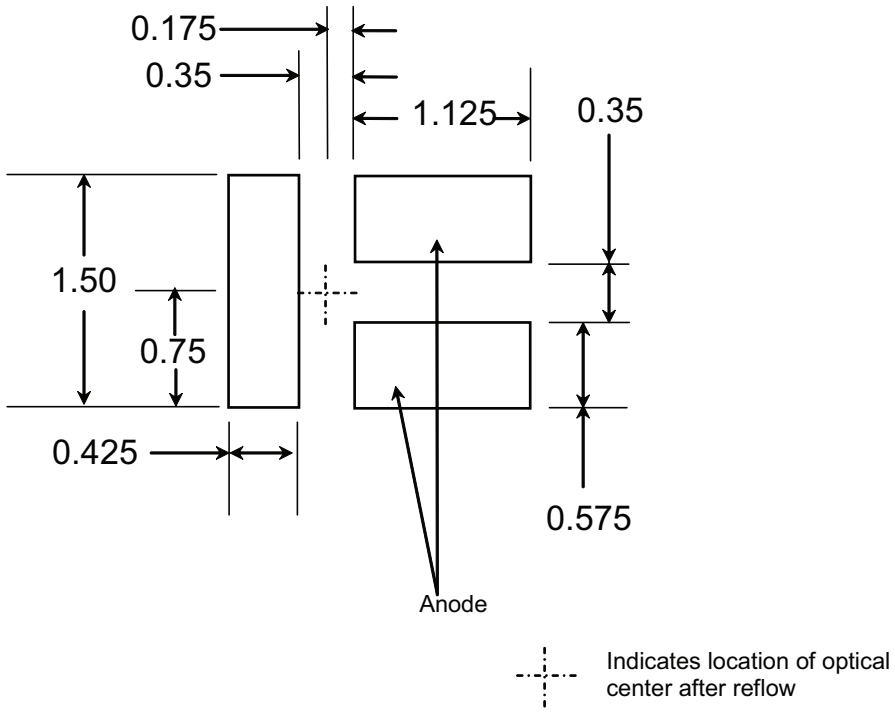



**Figure 5.**

Note for Figure 5:

1. Recommended layout for LXCL-EW06-xxxx on printed circuit board (PCB).
2. All dimensions are in millimeters.
3. All tolerances ± 0.05 mm.
4. Solder pads are designed to achieve optimum positional accuracy using standard reflow processes.
5. Design should include adequate thermal heat sinking.

# Typical Relative Spectral Distribution vs. Wavelength

## Test Current at 1000 mA, Junction Temperature = 25°C

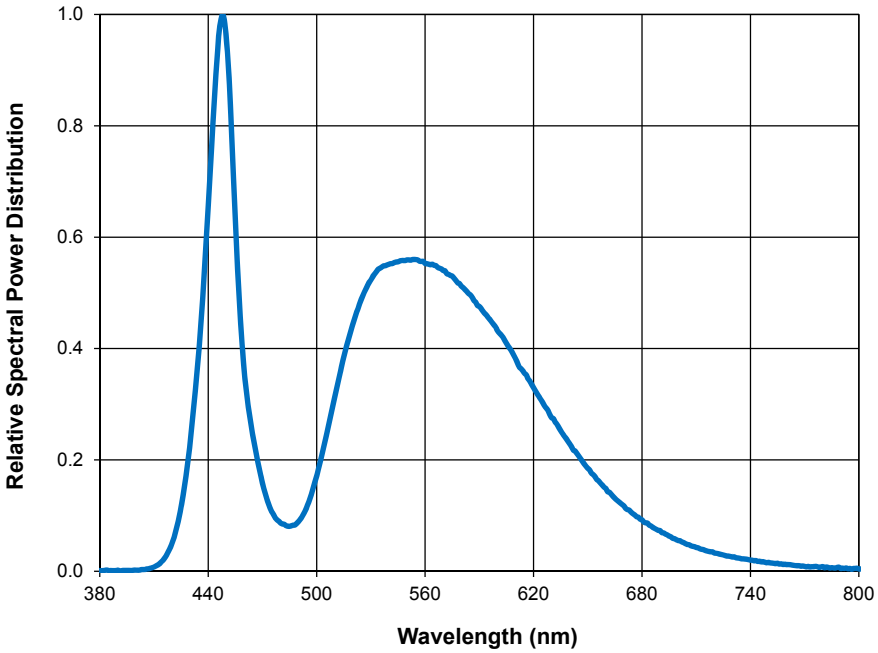



**Figure 6.**

# Typical Relative Radiation Pattern

## Test Current at 1000 mA, Junction Temperature = 25°C

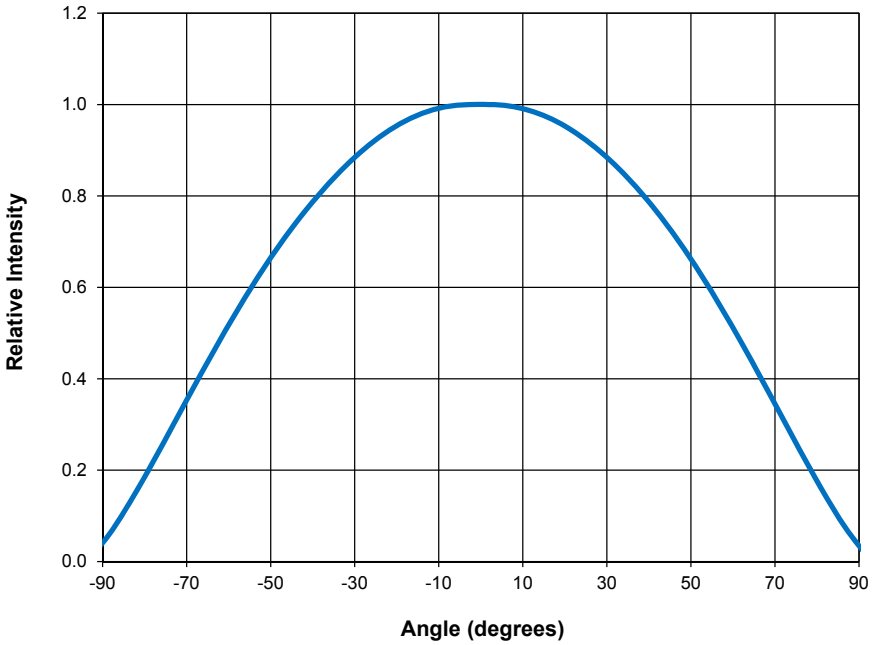



**Figure 7.**

# Typical Light Output Characteristics

## Typical Relative Light Output vs. Junction Temperature, Test Current at 1000 mA

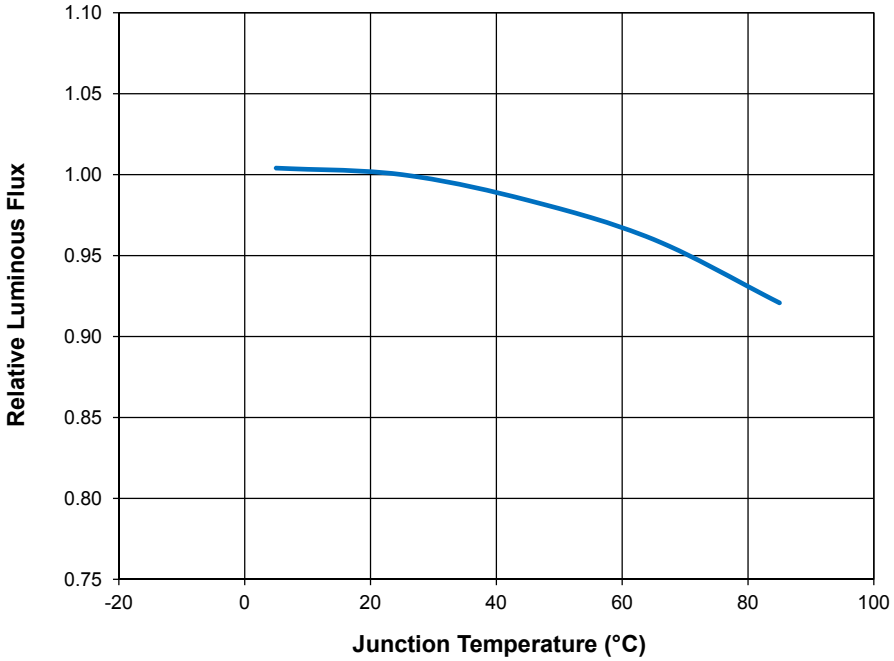



**Figure 8.**

## Relative Light Output vs. Forward Current, Junction Temperature = 25°C

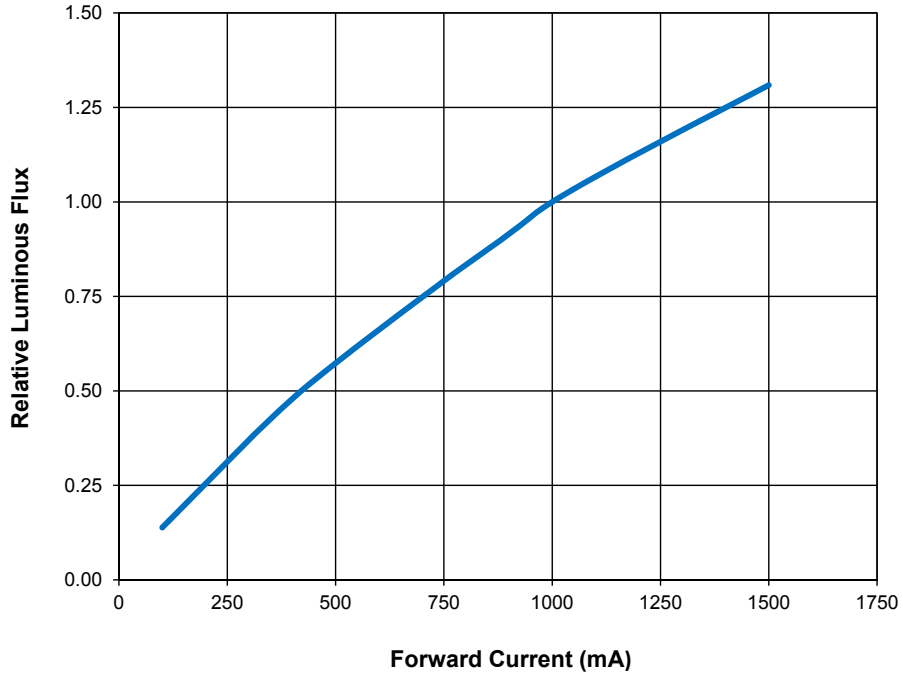



**Figure 9.**

Note for Figures 8 and 9:

1. A typical relative luminous flux of 1.0 refers to nominal conditions (see Table 1).

# Typical Forward Voltage Characteristics

## Typical Forward Current vs. Forward Voltage, Junction Temperature = 25°C

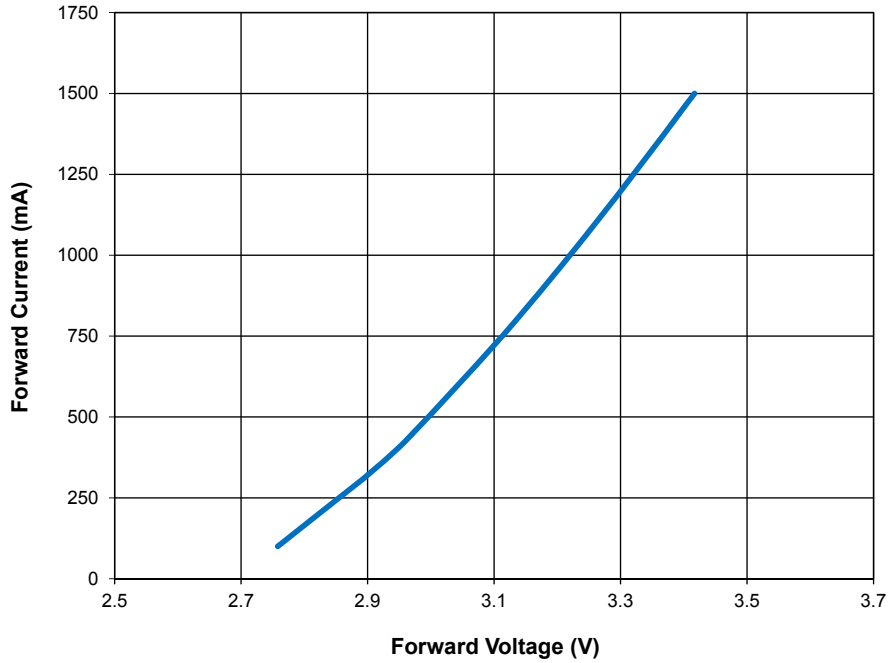



**Figure 10.**

## Forward Voltage Shift vs. Junction Temperature, Test Current at 1000 mA

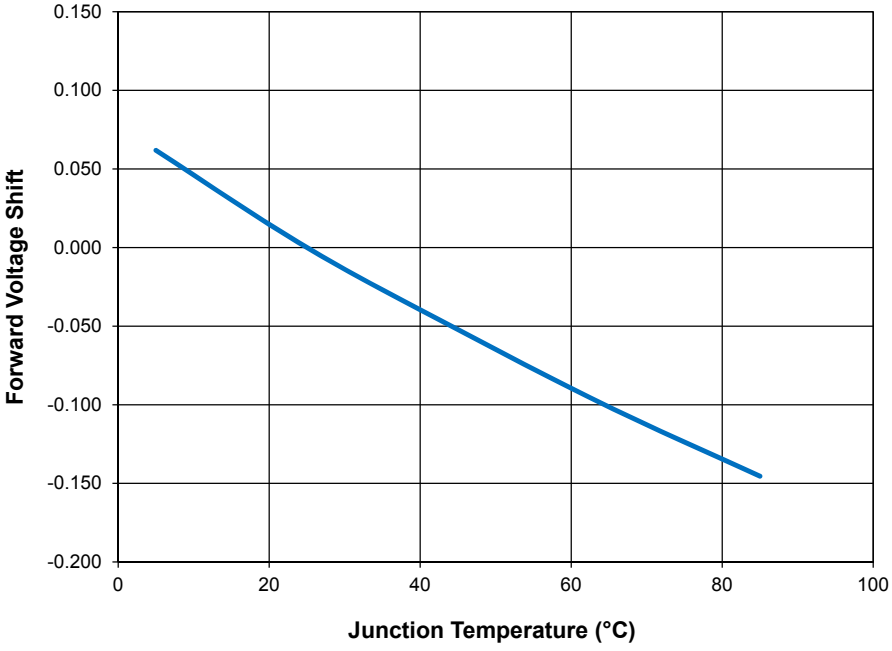



**Figure 11.**

Note for Figure 11:

1. A forward voltage shift of 0.0 refers to nominal conditions (see Table 2).

# CCT Shift vs. Forward Current

## Junction Temperature = 25°C

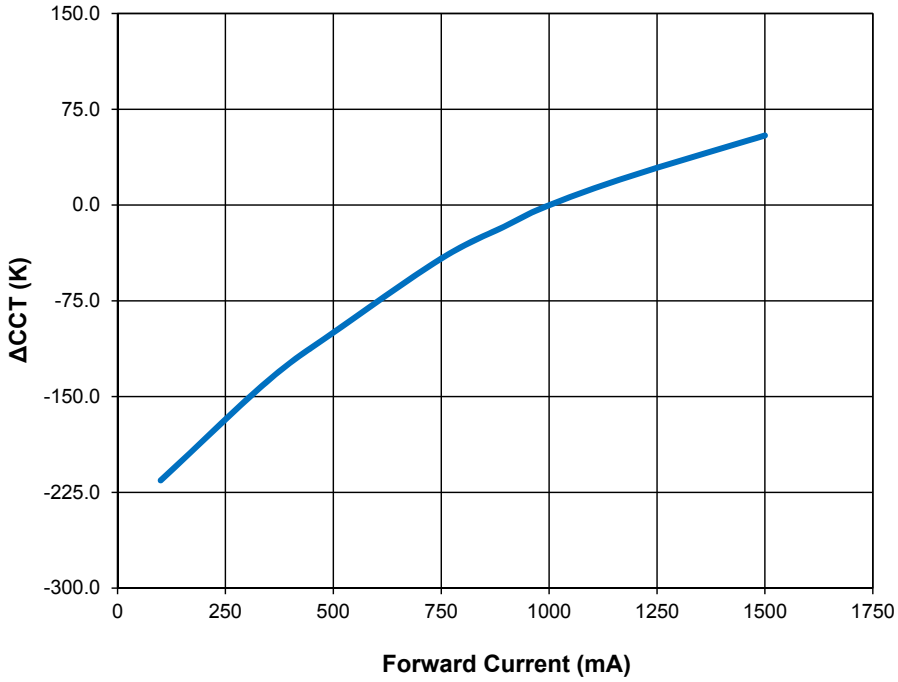



**Figure 12.**

Note for Figure 12:

1. A CCT shift of 0.0 refers to nominal conditions (see Table 1).

# Color Specifications

## Test Current at 1000 mA, Junction Temperature = 25°C

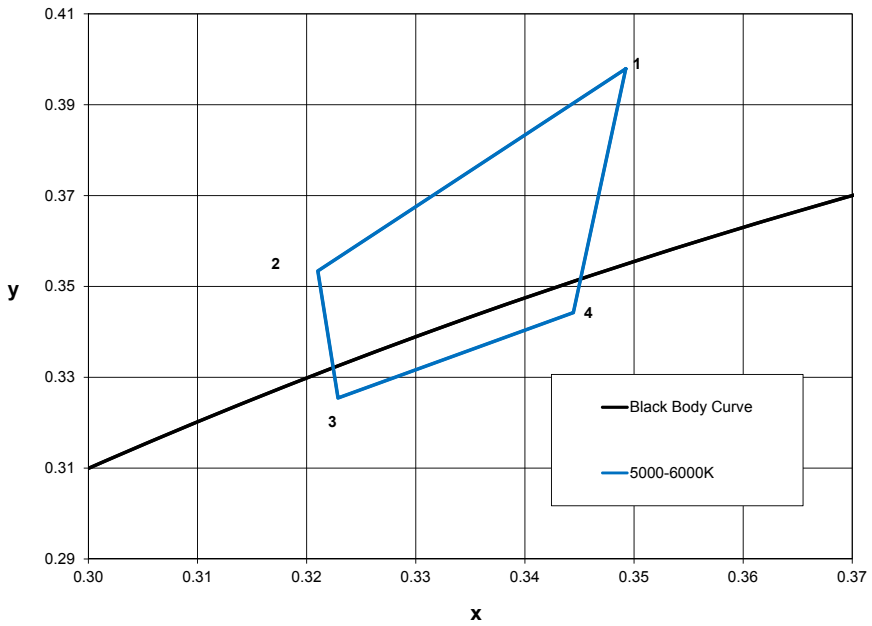



**Figure 13. C.I.E. 1931 Chromaticity diagram.**

**Table 6. Chromaticity Coordinates**

| Point | x | y |
|---|---|---|
| 1 | 0.3492 | 0.3979 |
| 2 | 0.3210 | 0.3534 |
| 3 | 0.3229 | 0.3254 |
| 4 | 0.3444 | 0.3442 |

# Chromaticity Coordinate Shift vs. Forward Current

## Junction Temperature = 25°C

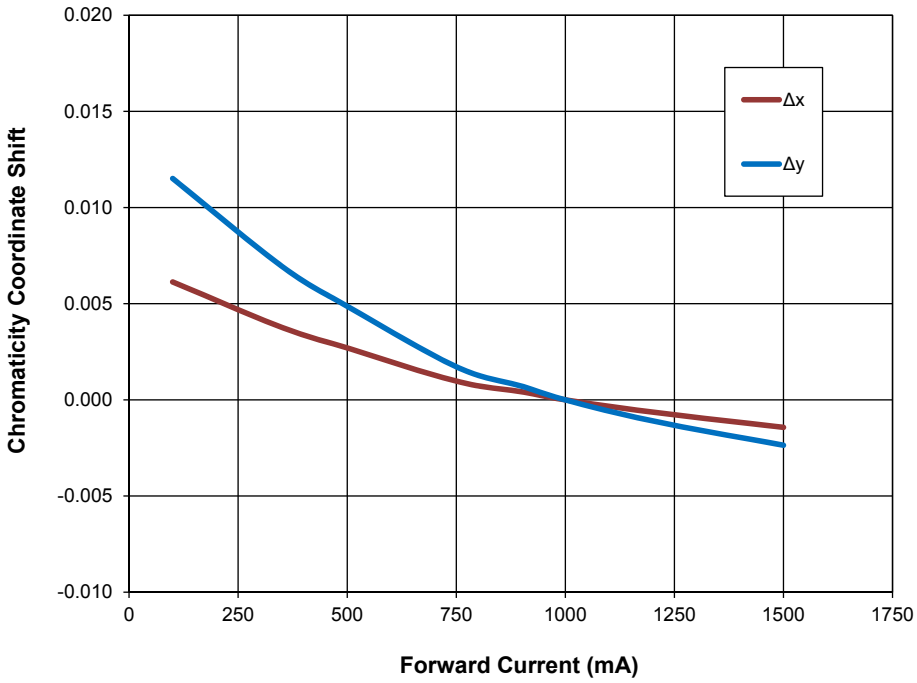



**Figure 14.**

# Color Over Angle

## Test Current at 1000 mA, Junction Temperature = 25°C

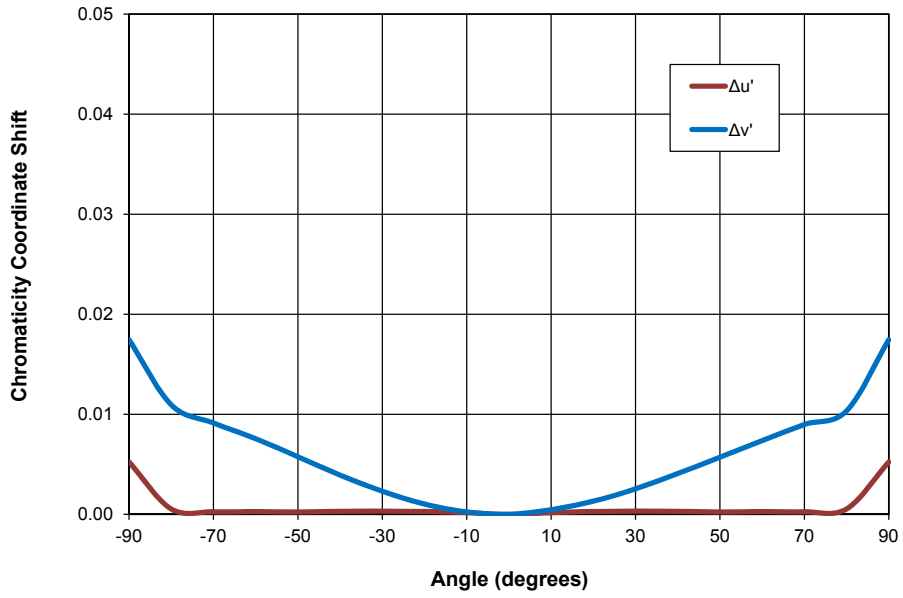



**Figure 15.**

Notes for Figure 15:

1. u'v' coordinates based on C.I.E. 1976 Chromaticity Diagram.
2. Philips Lumileds optimizes its phosphor composition to achieve uniform conversion of white colored light as a function of emission angle.
3. Angle corresponds to the spatial radiation pattern of the emitter (see Figure 7).

# Emitter Pocket Tape Packaging

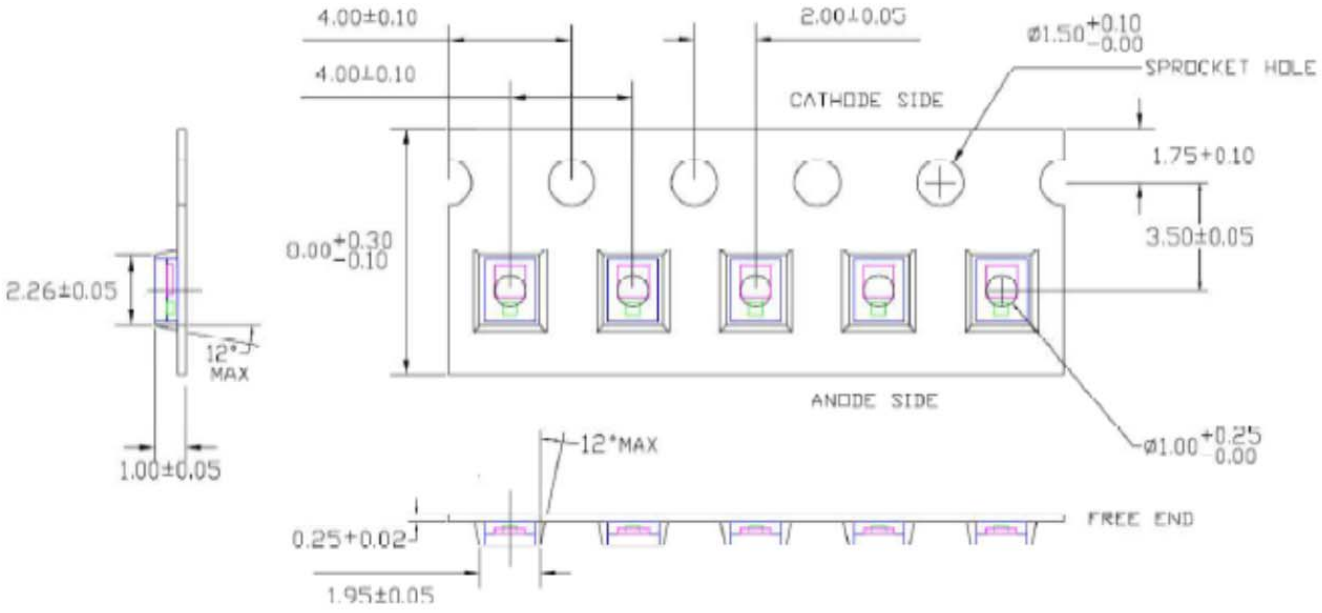



**Figure 16. Tape dimensions.**

# Emitter Reel Packaging

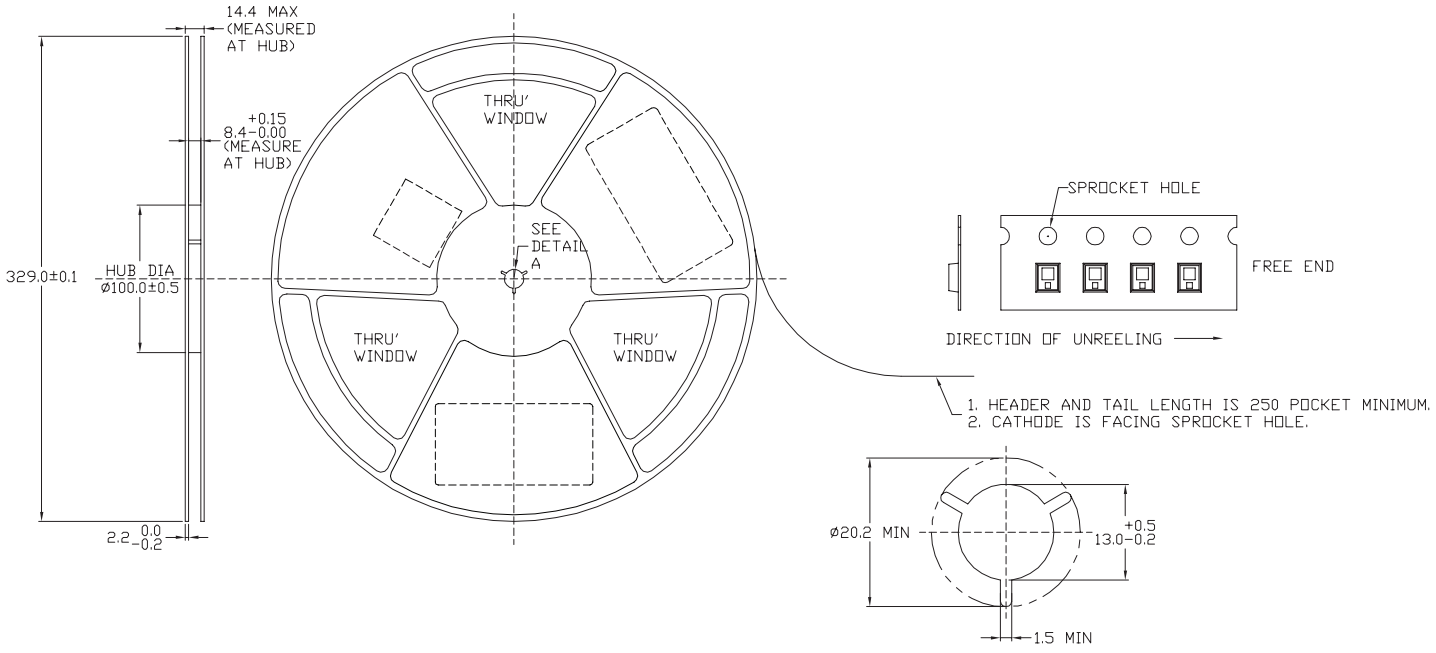



**Figure 17. Emitter reel packaging.**

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# 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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