

# LUXEONTX

Extreme efficacy that will transform  
your next market leading luminaire



## Introduction

LUXEON®TX emitters are illumination grade LEDs designed to deliver high efficacy with high flux density to enable directional and high-lumen applications. With *Freedom from Binning*™ and extreme performance, LUXEONTX emitters ensure system color point accuracy and provide lamp and luminaire designers with the flexibility to optimize for the highest possible efficacy or for low system cost, in vast Correlated Color Temperature (CCT) ranges at 70 CRI from 3000K to 6500K, at 80 and 85 CRI from 2700K to 5000K, and at 90 CRI from 2700K to 3000K.

### Features

- Compact 3737 package
- Typical  $V_f$  of 2.8V and thermal resistance of 3K/W
- Hot tested at  $T_j = 85^\circ\text{C}$
- *Freedom from Binning* - 3 & 5 SDCM
- Exceeds ENERGY STAR lumen maintenance requirements
- UL-recognized component [E352519] with level 4 enclosure consideration

### Benefits

- High luminance for directional applications
- Optimized for extreme efficacy
- Excellent color consistency
- Proven reliability

### Key Applications

- Downlights
- High Bay & Low Bay
- Indoor Area Lighting
- Lamps
- Outdoor

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# General Information

## Product Nomenclature

LUXEON TX emitters are specified and binned “hot” under conditions comparable to those found in “real-world” lighting products. The test conditions for LUXEON TX are 700 mA DC with junction temperature at 85°C.

The base part number designation is explained as follows:

L I T 2 – x x y y s 0 0 0 0 z z z 0

Where:

- xx — designates nominal ANSI CCT (27 for 2700K, 30 for 3000K)
- yy — designates minimum CRI performance (70 for 70 CRI, 80 for 80 CRI)
- s — designates SDCM (0 for full distribution, 3 for 3-step SDCM, 5 for 5-step SDCM)
- zzz — designates minimum flux level at standard binning current and temperature (210 for 210 lm, etc.)

Therefore, 80 CRI 3-step SDCM products tested and binned at 3000K with a 210 lm minimum flux at binning current and temperature will have the part numbering scheme:

L I T 2 – 3 0 8 0 3 0 0 0 0 2 1 0 0

The base part numbers referred to in this document in the following format indicate full flux and color distribution:

L I T 2 – x x y y 0 0 0 0 0 0 0 0

## Average Lumen Maintenance Characteristics

LUXEON TX products are tested in compliance with LM-80. Please visit the LM-80 documentation site at [www.philipslumileds.com/support/documentation/lumen-maintenance](http://www.philipslumileds.com/support/documentation/lumen-maintenance) or contact your local Philips Lumileds Technical Solutions Manager for TM-21 extrapolations or other support.

## Environmental Compliance

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

# Product Selection

## Product Selection Guide for LUXEON TX Emitters, Junction Temperature = 85°C

**Table I.**

| Typical Performance Characteristics |                  |         |                        |                            |        |         |                             |        |         |                         |        |         |
|-------------------------------------|------------------|---------|------------------------|----------------------------|--------|---------|-----------------------------|--------|---------|-------------------------|--------|---------|
| Base Part Number                    | Nominal ANSI CCT | Min CRI | Min Luminous Flux (lm) | Typical Luminous Flux (lm) |        |         | Typical Forward Voltage (V) |        |         | Typical Efficacy (lm/W) |        |         |
|                                     |                  | 700 mA  | 700 mA                 | 350 mA                     | 700 mA | 1000 mA | 350 mA                      | 700 mA | 1000 mA | 350 mA                  | 700 mA | 1000 mA |
| LIT2-3070000000000                  | 3000K            | 70      | 230                    | 135                        | 245    | 327     | 2.71                        | 2.80   | 2.86    | 142                     | 125    | 114     |
| LIT2-4070000000000                  | 4000K            | 70      | 250                    | 147                        | 269    | 360     | 2.71                        | 2.80   | 2.86    | 155                     | 137    | 126     |
| LIT2-5070000000000                  | 5000K            | 70      | 260                    | 151                        | 275    | 369     | 2.71                        | 2.80   | 2.86    | 159                     | 140    | 129     |
| LIT2-5770000000000                  | 5700K            | 70      | 260                    | 151                        | 275    | 369     | 2.71                        | 2.80   | 2.86    | 159                     | 140    | 129     |
| LIT2-6570000000000                  | 6500K            | 70      | 260                    | 151                        | 275    | 369     | 2.71                        | 2.80   | 2.86    | 159                     | 140    | 129     |
| LIT2-2780000000000                  | 2700K            | 80      | 200                    | 118                        | 216    | 289     | 2.71                        | 2.80   | 2.86    | 124                     | 110    | 101     |
| LIT2-3080000000000                  | 3000K            | 80      | 210                    | 124                        | 227    | 304     | 2.71                        | 2.80   | 2.86    | 131                     | 116    | 106     |
| LIT2-3580000000000                  | 3500K            | 80      | 220                    | 130                        | 238    | 319     | 2.71                        | 2.80   | 2.86    | 137                     | 121    | 112     |
| LIT2-4080000000000                  | 4000K            | 80      | 230                    | 136                        | 247    | 331     | 2.71                        | 2.80   | 2.86    | 143                     | 126    | 116     |
| LIT2-5080000000000                  | 5000K            | 80      | 230                    | 135                        | 247    | 332     | 2.71                        | 2.80   | 2.86    | 142                     | 126    | 116     |
| LIT2-2785000000000                  | 2700K            | 85      | 170                    | 102                        | 186    | 249     | 2.71                        | 2.80   | 2.86    | 108                     | 95     | 87      |
| LIT2-3085000000000                  | 3000K            | 85      | 180                    | 108                        | 197    | 264     | 2.71                        | 2.80   | 2.86    | 114                     | 101    | 92      |
| LIT2-3585000000000                  | 3500K            | 85      | 190                    | 114                        | 208    | 279     | 2.71                        | 2.80   | 2.86    | 120                     | 106    | 98      |
| LIT2-4085000000000                  | 4000K            | 85      | 200                    | 120                        | 217    | 291     | 2.71                        | 2.80   | 2.86    | 127                     | 111    | 102     |
| LIT2-5085000000000                  | 5000K            | 85      | 200                    | 118                        | 217    | 292     | 2.71                        | 2.80   | 2.86    | 124                     | 111    | 102     |
| LIT2-2790000000000                  | 2700K            | 90      | 160                    | 96                         | 175    | 234     | 2.71                        | 2.80   | 2.86    | 101                     | 89     | 82      |
| LIT2-3090000000000                  | 3000K            | 90      | 170                    | 103                        | 188    | 252     | 2.71                        | 2.80   | 2.86    | 109                     | 96     | 88      |

**Notes for Table I:**

I. Philips Lumileds maintains a tolerance of  $\pm 6.5\%$  on luminous flux and  $\pm 2$  on CRI measurements.

# Optical Characteristics

## LUXEON TX at 700 mA, Junction Temperature = 85°C

**Table 2.**

| Base Part Number                                                                     | Nominal ANSI CCT | Color Temperature CCT | Typical Total Included Angle <sup>[2]</sup><br>(degrees) $\theta_{0.90V}$ | Typical Viewing Angle <sup>[3]</sup><br>(degrees) $2\theta_{1/2}$ |
|--------------------------------------------------------------------------------------|------------------|-----------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
|                                                                                      |                  | Typical               |                                                                           |                                                                   |
| LIT2-2780000000000<br>LIT2-2785000000000<br>LIT2-2790000000000                       | 2700K            | 2725K                 | 160                                                                       | 120                                                               |
| LIT2-3070000000000<br>LIT2-3080000000000<br>LIT2-3085000000000<br>LIT2-3090000000000 | 3000K            | 3045K                 | 160                                                                       | 120                                                               |
| LIT2-3580000000000<br>LIT2-3585000000000                                             | 3500K            | 3465K                 | 160                                                                       | 120                                                               |
| LIT2-4070000000000<br>LIT2-4080000000000<br>LIT2-4085000000000                       | 4000K            | 3985K                 | 160                                                                       | 120                                                               |
| LIT2-5070000000000<br>LIT2-5080000000000<br>LIT2-5085000000000                       | 5000K            | 5028K                 | 160                                                                       | 120                                                               |
| LIT2-5770000000000                                                                   | 5700K            | 5665K                 | 160                                                                       | 120                                                               |
| LIT2-6570000000000                                                                   | 6500K            | 6530K                 | 160                                                                       | 120                                                               |

**Notes for Table 2:**

1. Test current is 700 mA D.C. for all LIT2-xyxy000000000 emitters.
2. Total angle at which 90% of total luminous flux is captured.
3. Viewing angle is the off axis angle from lamp centerline where the luminous intensity is  $\frac{1}{2}$  of the peak value.

# Electrical Characteristics

## Electrical Characteristics at 700 mA for LUXEONTX Junction Temperature = 85°C

**Table 3.**

| Nominal ANSI CCT | Base Part Number                                                                     | Forward Voltage $V_f$ <sup>[1]</sup> (V) |         | Typical Temperature Coefficient of Forward Voltage <sup>[2]</sup> (mV/°C)<br>$\Delta V_f / \Delta T_j$ | Typical Thermal Resistance Junction to Thermal Pad (°C/W)<br>$R\theta_{j-c}$ |
|------------------|--------------------------------------------------------------------------------------|------------------------------------------|---------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
|                  |                                                                                      | Minimum                                  | Maximum |                                                                                                        |                                                                              |
| 2700K            | LIT2-2780000000000<br>LIT2-2785000000000<br>LIT2-2790000000000                       | 2.5                                      | 3.25    | -1.6                                                                                                   | 3                                                                            |
| 3000K            | LIT2-3070000000000<br>LIT2-3080000000000<br>LIT2-3085000000000<br>LIT2-3090000000000 | 2.5                                      | 3.25    | -1.6                                                                                                   | 3                                                                            |
| 3500K            | LIT2-3580000000000<br>LIT2-3585000000000                                             | 2.5                                      | 3.25    | -1.6                                                                                                   | 3                                                                            |
| 4000K            | LIT2-4070000000000<br>LIT2-4080000000000<br>LIT2-4085000000000                       | 2.5                                      | 3.25    | -1.6                                                                                                   | 3                                                                            |
| 5000K            | LIT2-5070000000000<br>LIT2-5080000000000<br>LIT2-5085000000000                       | 2.5                                      | 3.25    | -1.6                                                                                                   | 3                                                                            |
| 5700K            | LIT2-5770000000000                                                                   | 2.5                                      | 3.25    | -1.6                                                                                                   | 3                                                                            |
| 6500K            | LIT2-6570000000000                                                                   | 2.5                                      | 3.25    | -1.6                                                                                                   | 3                                                                            |

**Notes for Table 3:**

1. Philips Lumileds maintains a tolerance of  $\pm 0.06V$  on forward voltage measurements.
2. Measured between  $T_j = 25^\circ C$  and  $T_j = 110^\circ C$  at  $I_f = 700$  mA.

## Absolute Maximum Ratings

**Table 4.**

| Parameter                                     | LUXEONTX                                                      |         |
|-----------------------------------------------|---------------------------------------------------------------|---------|
| DC Forward Current <sup>[1][2]</sup>          | 1050 mA                                                       | 1200 mA |
| Peak Pulsed Forward Current <sup>[1][3]</sup> | 1200 mA                                                       | 1350 mA |
| LED Junction Temperature <sup>[1]</sup>       | 150°C                                                         | 135°C   |
| ESD Sensitivity                               | < 8000V Human Body Model (HBM) Class 3A per JEDEC JS-001-2012 |         |
| Operating Case Temperature at 700 mA          | -40°C - 135°C                                                 |         |
| Storage Temperature                           | -40°C - 135°C                                                 |         |
| Soldering Temperature                         | JEDEC 020c 260°C                                              |         |
| Allowable Reflow Cycles                       | 3                                                             |         |
| Reverse Voltage (Vr) <sup>[4][5]</sup>        | LUXEONTX 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. For additional information on thermal measurement guidelines please refer to Application Brief AB106.
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple", with frequencies  $\geq 100$  Hz and amplitude  $\leq 150$  mA 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  $\leq 5$  ms per cycle and the duty cycle is  $\leq 50\%$ .
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 200 $\mu A$ .
5. Max 5V reverse for up to 10s is an acceptable beginning of life, one time test condition.

Table 5.

| Level | Floor Life |                                    | Soak Requirements Standard |               |
|-------|------------|------------------------------------|----------------------------|---------------|
|       | Time       | Conditions                         | Time                       | Conditions    |
| I     | unlimited  | $\leq 30^{\circ}\text{C}$ / 85% RH | 168h + 5 / - 0             | 85°C / 85% RH |

Reflow Soldering Characteristics

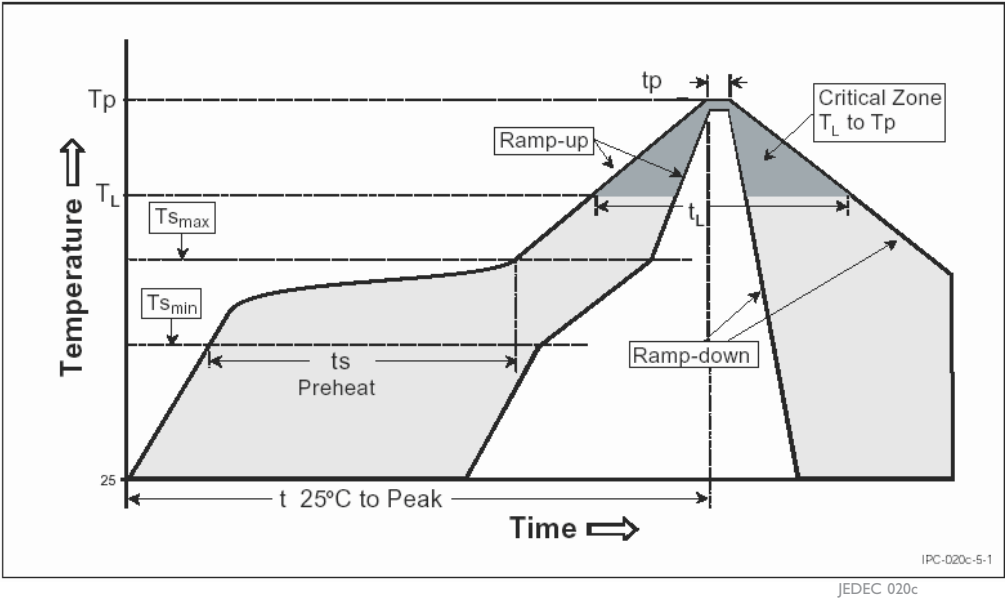


Figure 1. Temperature profile for Table 6.

Table 6.

| Profile Feature                                      | Lead Free Assembly |
|------------------------------------------------------|--------------------|
| Average Ramp-Up Rate ( $T_{s_{max}}$ to $T_p$ )      | 3°C / second max   |
| Preheat Temperature Min ( $T_{s_{min}}$ )            | 150°C              |
| Preheat Temperature Max ( $T_{s_{max}}$ )            | 200°C              |
| Preheat Time ( $t_{s_{min}}$ to $t_{s_{max}}$ )      | 60 - 180 seconds   |
| Liquidus Temperature ( $T_L$ )                       | 217°C              |
| Time Maintained Above Time ( $t_L$ )                 | 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      |

# Mechanical Dimensions

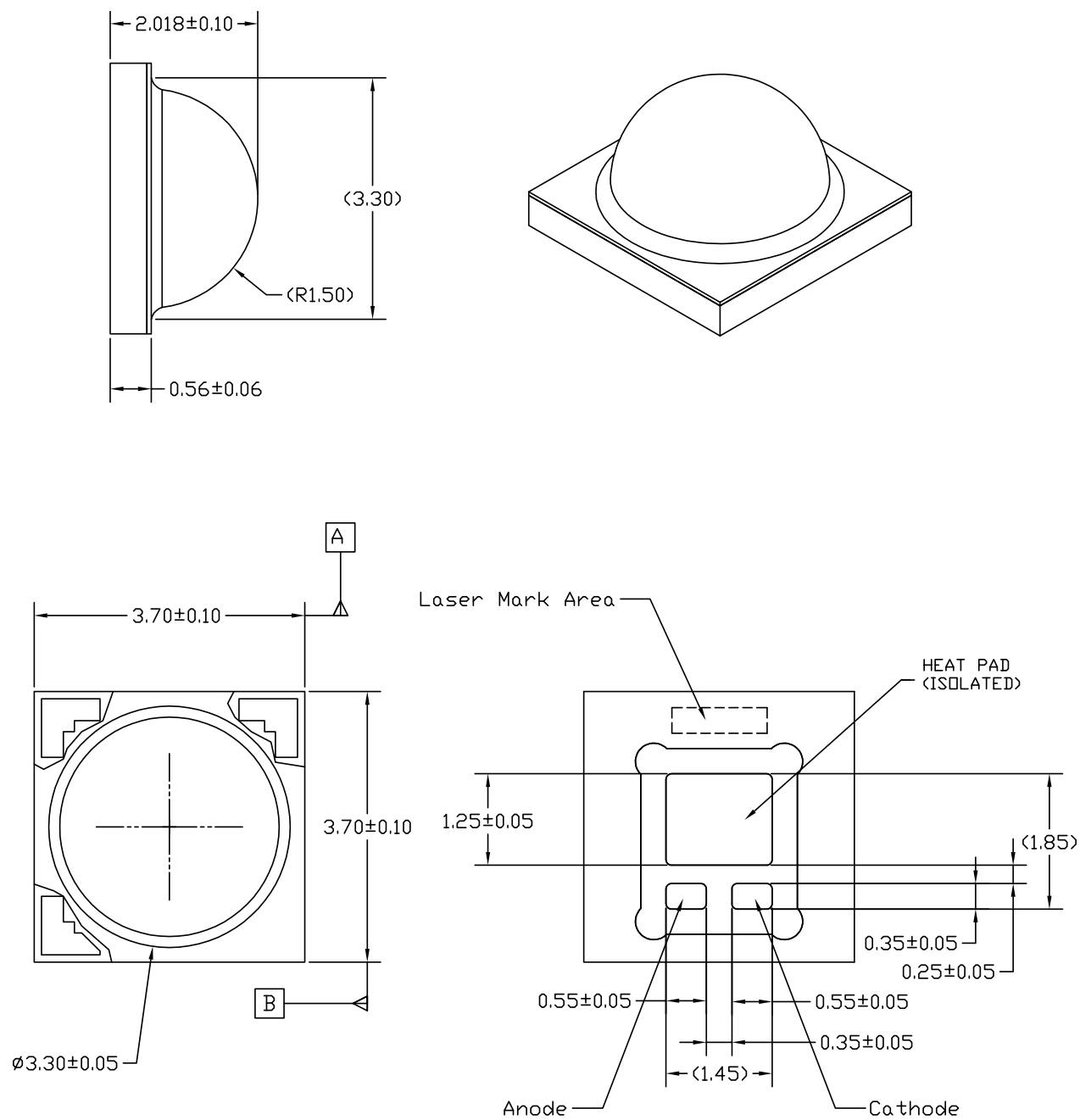


**Figure 2.**

## Notes for Figure 2:

1. Do not handle the device by the lens. Excessive force on the lens may damage the lens itself or the interior of the device.
2. Drawings not to scale.
3. All dimensions are in millimeters.
4. The thermal pad is electrically isolated from the anode and cathode contact pads.

# Solder Pad Design

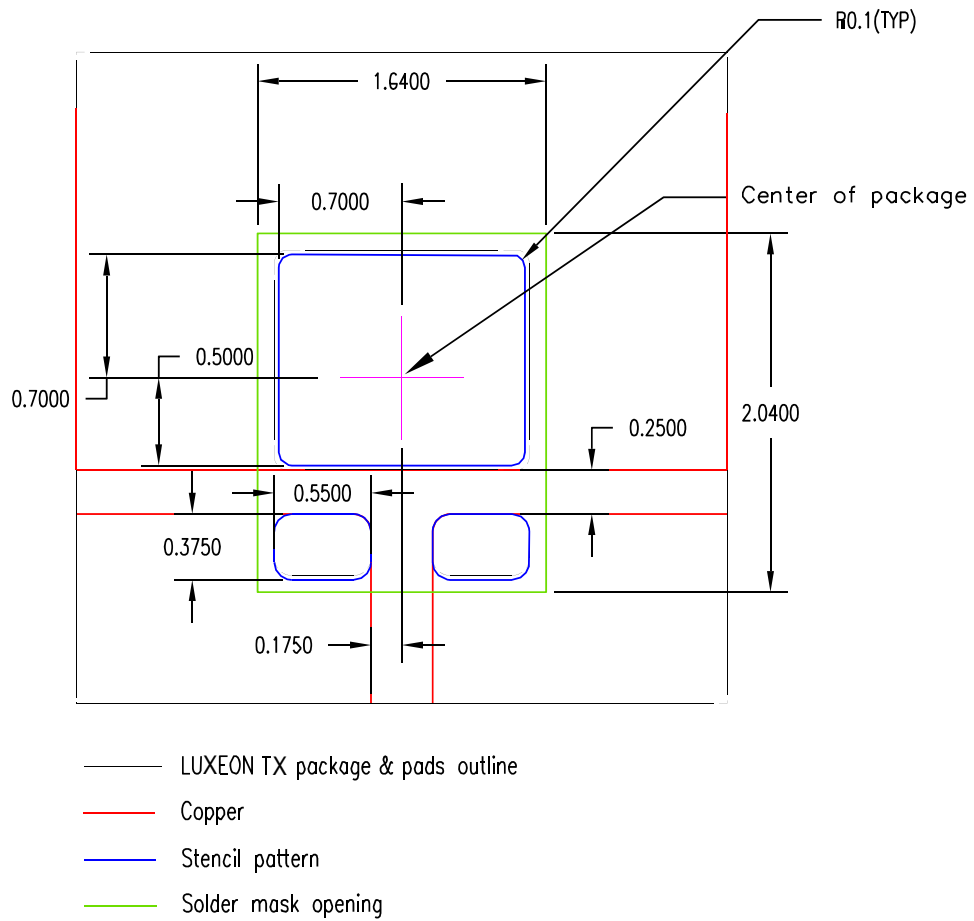


**Figure 3. Solder pad layout.**

## Notes for Figure 3:

1. All dimensions are in millimeters.
2. The figure shows the recommended LUXEON TX layout on Printed Circuit Board (PCB).
3. For more information on assembly and layout, please refer to Application Brief 106 (AB106).
4. The .dwg files are available at [www.philipslumileds.com](http://www.philipslumileds.com) and [www.philipslumileds.cn.com](http://www.philipslumileds.cn.com).

# Typical Relative Spectral Distribution vs. Wavelength Characteristics

LIT2-xx70000000000 (70 CRI, White) at Test Current, Junction Temperature = 85°C

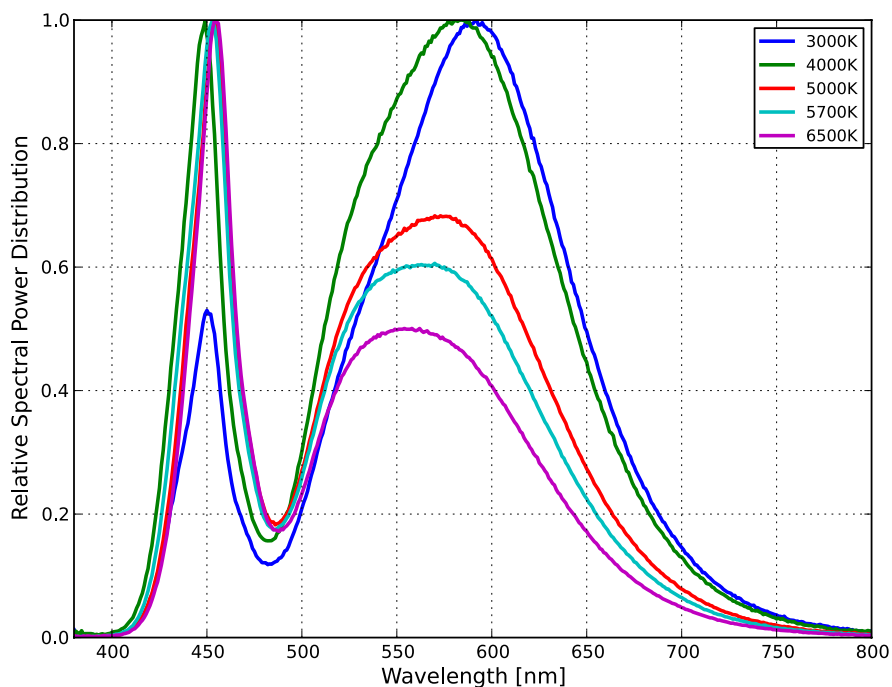


Figure 4. Color Spectrum of LIT2-xx70000000000.

LIT2-xx80000000000 (80 CRI, White) at Test Current, Junction Temperature = 85°C

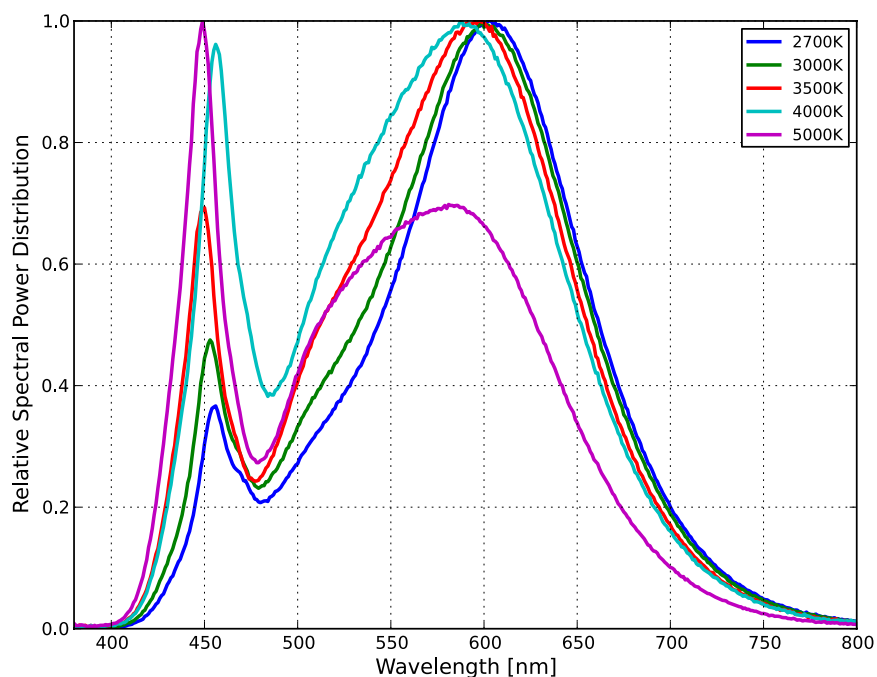


Figure 5. Color Spectrum of LIT2-xx80000000000.

# Typical Relative Spectral Distribution vs. Wavelength Characteristics, Continued

LIT2-xx90000000000 (90 CRI, White) at Test Current, Junction Temperature = 85°C

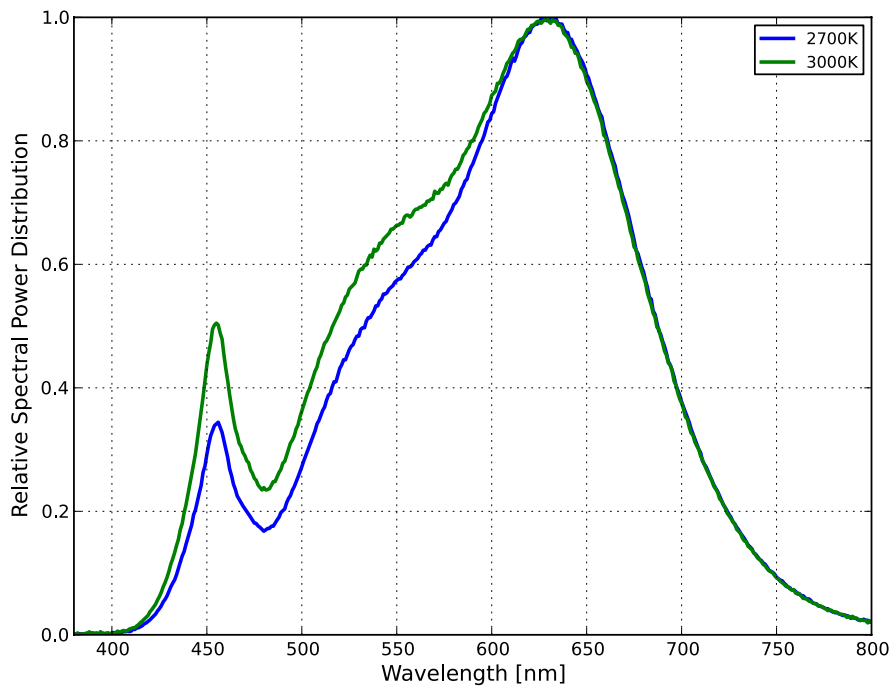


Figure 6. Color Spectrum of LIT2-xx90000000000.

# Typical Relative Light Output

Typical Relative Light Output vs. Junction Temperature for LIT2-xyyy000000000 (White)  
Test Current = 700 mA

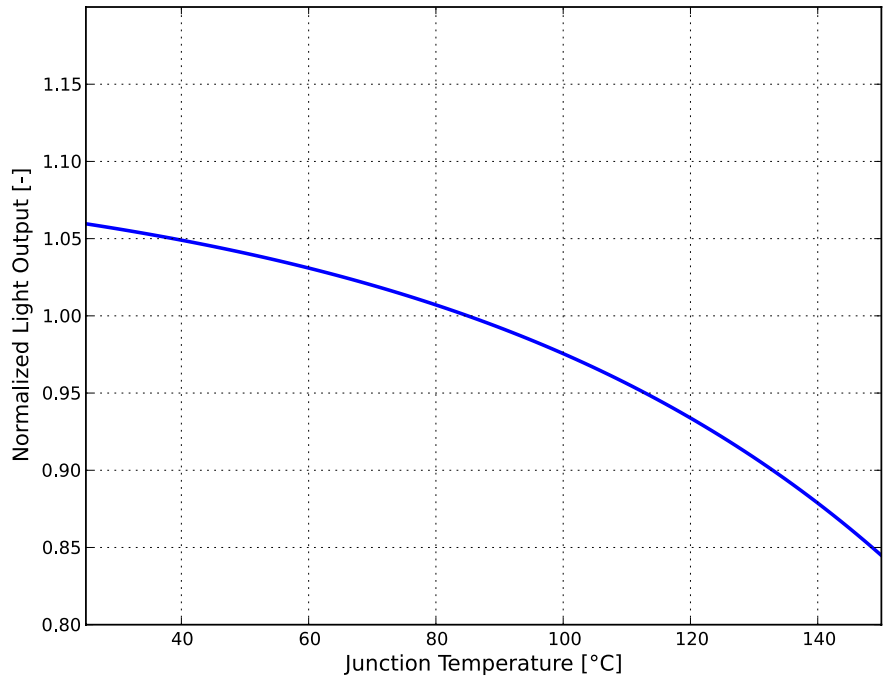


Figure 7. Typical relative light output vs. junction temperature, LIT2-xyyy000000000.

Typical Relative Light Output vs . Forward Current for LIT2-xyyy000000000 (White)  
Junction Temperature = 85°C

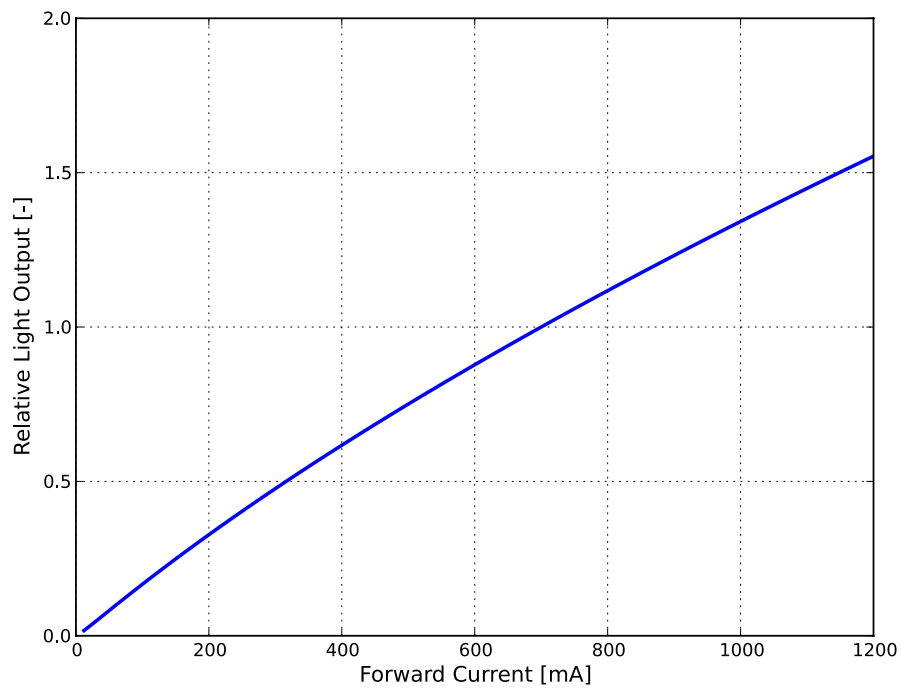


Figure 8. Typical relative luminous flux vs. forward current, LIT2-xyyy000000000.

# Typical Forward Current Characteristics

Forward Current vs. Forward Voltage for L I T2-xyyy000000000 (White)  
Junction Temperature = 85°C

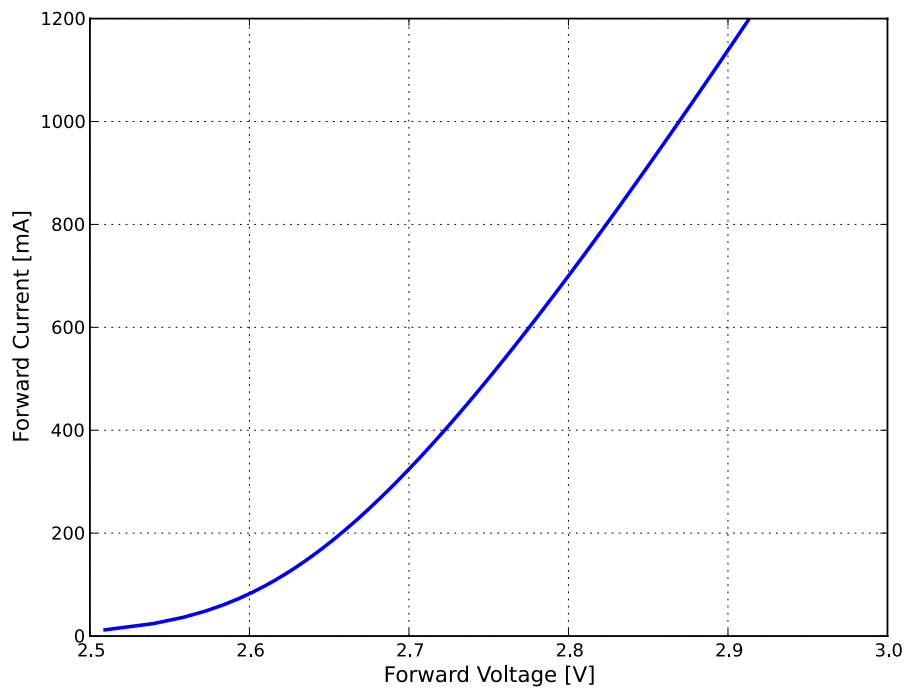


Figure 9. Typical forward current vs. forward voltage, L I T2-xyyy000000000.

# Emitter Pocket Tape Packaging

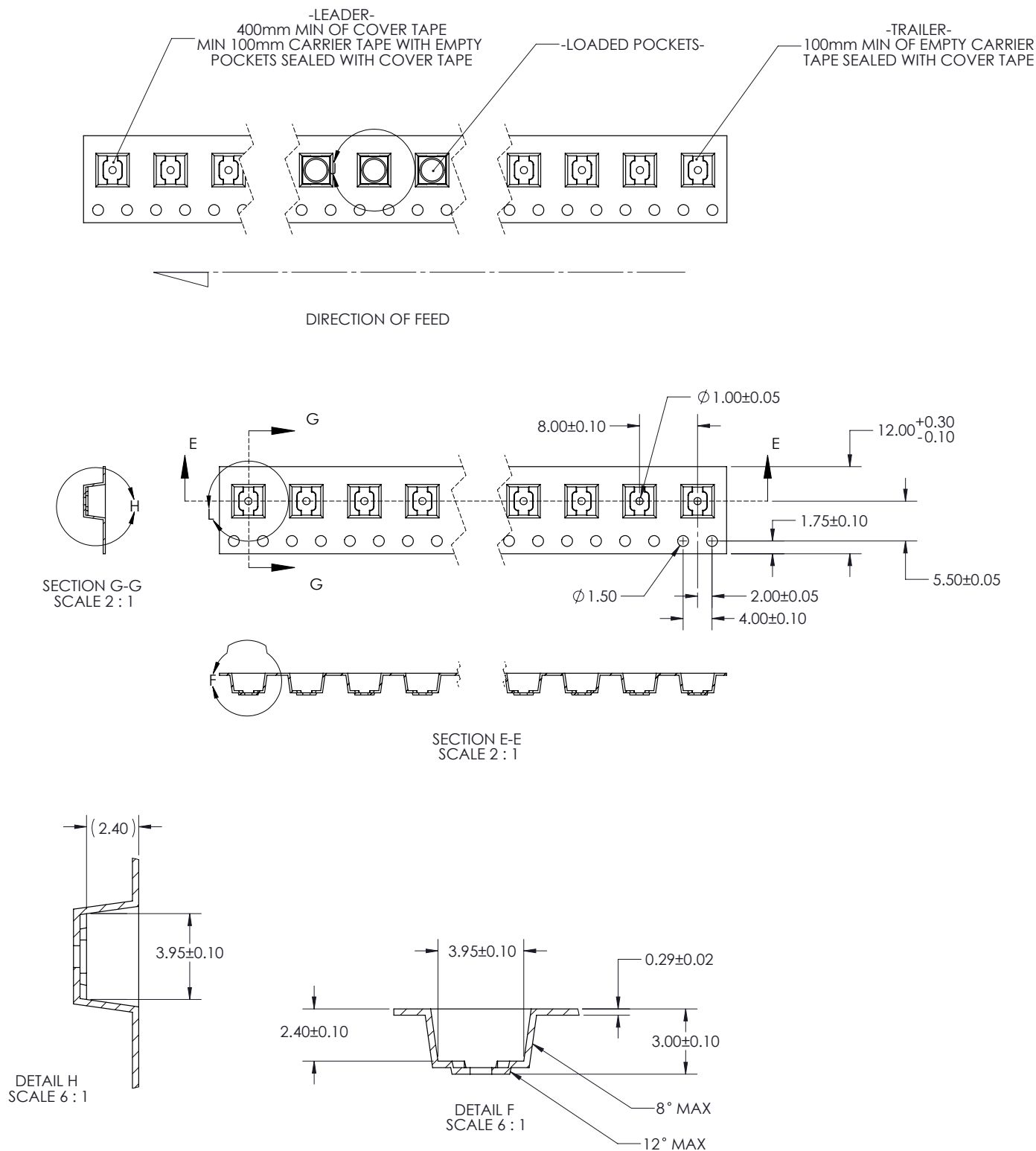


Figure 10. Emitter pocket tape packaging.

# Emitter Reel Packaging

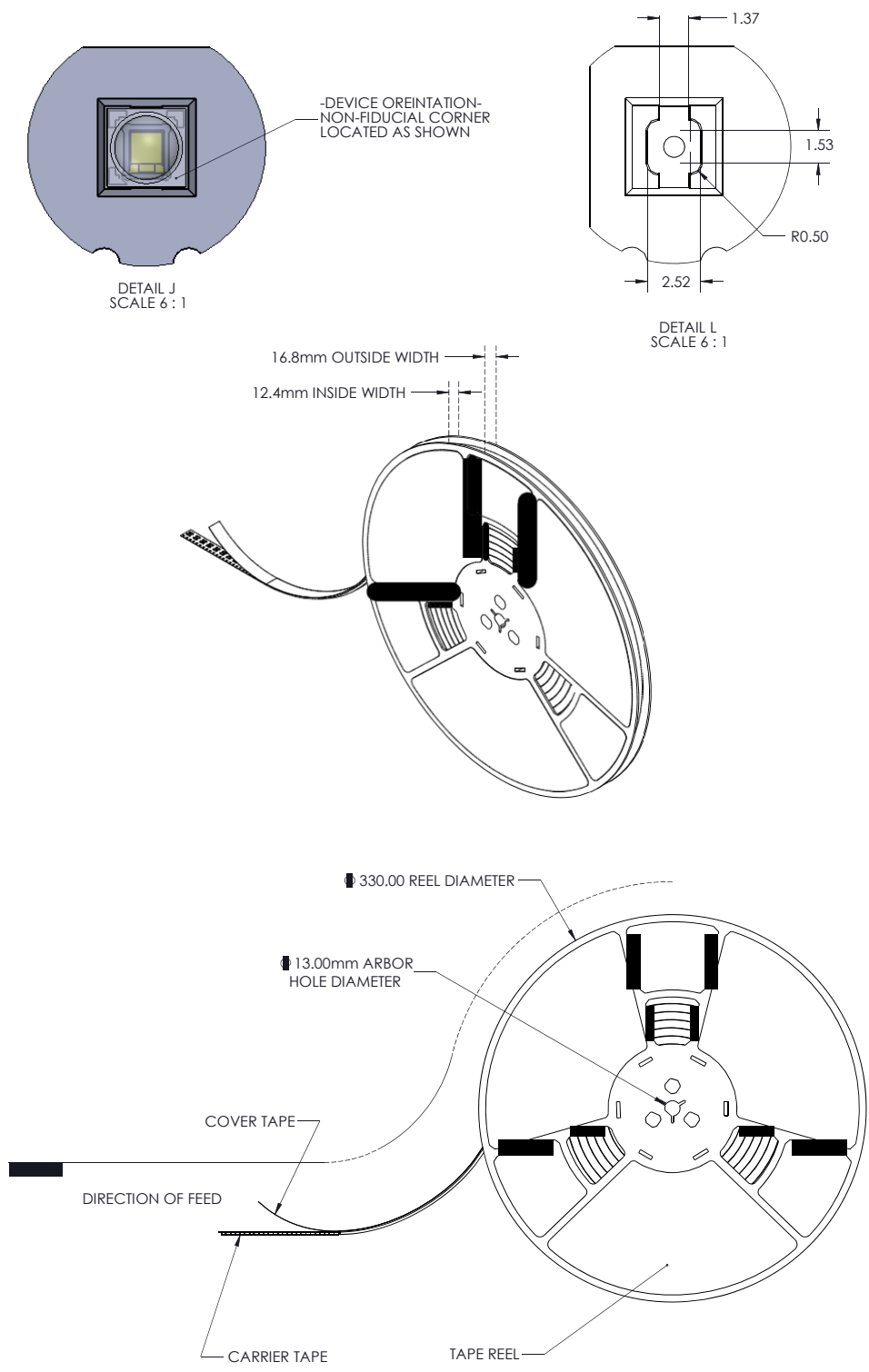


Figure 11. Emitter reel packaging.

# Product Binning and Labeling

## Purpose of Product Binning

In the manufacturing of semiconductor products, there are variations in performance around the average values given in the technical data sheets. For this reason, Philips Lumileds bins the LED components for luminous flux and forward voltage ( $V_f$ ). Color is offered in a single 3-step or 5-step MacAdam ellipse color space centered on the ANSI CCT color bins. For additional information please review the MacAdam ellipse technical definition section.

## Decoding Product Bin Labeling

LUXEON TX emitters are labeled using a four digit alphanumeric CAT code following the format below:

ABCD

| A                  |
|--------------------|
| Flux Bin           |
| see flux bin table |

| B                |       |
|------------------|-------|
| Nominal ANSI CCT |       |
| 1                | 6500K |
| 2                | 5700K |
| 3                | 5000K |
| 5                | 4000K |
| 6                | 3500K |
| 7                | 3000K |
| 8                | 2700K |

| C               |                         |
|-----------------|-------------------------|
| SDCM Definition |                         |
| 3               | 3-step (80, 85, 90 CRI) |
| U               |                         |
| L               |                         |
| 5               | 5-step (70 CRI)         |
| A               | 5-step (80, 85, 90 CRI) |
| B               |                         |
| C               |                         |
| D               |                         |

| D     |       |       |
|-------|-------|-------|
| $V_f$ | min   | max   |
| P     | 2.50V | 2.75V |
| R     | 2.75V | 3.00V |
| S     | 3.00V | 3.25V |

## Product Binning and Labeling, Continued

Table 7 lists the standard photometric luminous flux bins for LUXEON TX emitters (tested and binned at 700 mA and  $T_j = 85^\circ\text{C}$ ). 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 7. Flux Bins – White**

| Bin Code | Minimum Photometric Flux (lm) |
|----------|-------------------------------|
| G        | 160                           |
| H        | 170                           |
| J        | 180                           |
| K        | 190                           |
| L        | 200                           |
| M        | 210                           |
| N        | 220                           |
| P        | 230                           |
| Q        | 240                           |
| R        | 250                           |
| S        | 260                           |
| T        | 270                           |
| U        | 280                           |
| V        | 290                           |
| W        | 300                           |

# LUXEON TX 3-step and 5-step MacAdam Ellipse Color Definition

Tested at 700 mA DC and Junction Temperature = 85°C

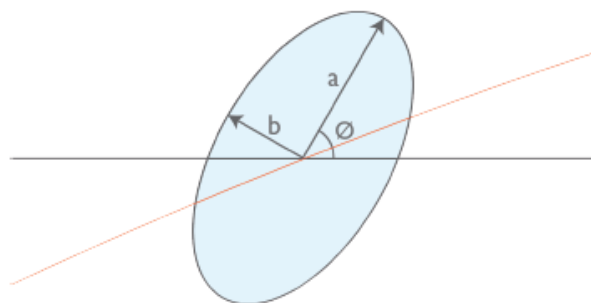


**Table 8. LUXEON TX Product Characteristics for 3-step MacAdam Ellipse**

| Nominal ANSI CCT | Color Space                   | Center Point (cx, cy) | Major Axis, a | Minor Axis, b | Ellipse Rotation Angle |
|------------------|-------------------------------|-----------------------|---------------|---------------|------------------------|
| 2700K            | Single 3-step MacAdam ellipse | (0.4578, 0.4101)      | 0.00810       | 0.00420       | 53.7°                  |
| 3000K            | Single 3-step MacAdam ellipse | (0.4338, 0.4030)      | 0.00834       | 0.00408       | 53.2°                  |
| 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       | 53.7°                  |
| 5000K            | Single 3-step MacAdam ellipse | (0.3447, 0.3553)      | 0.00822       | 0.00354       | 59.6°                  |

**Table 9. LUXEON TX Product Characteristics for 5-step MacAdam Ellipse**

| Nominal ANSI CCT | Color Space                   | Center Point (cx, cy) | Major Axis, a | Minor Axis, b | Ellipse Rotation Angle |
|------------------|-------------------------------|-----------------------|---------------|---------------|------------------------|
| 2700K            | Single 5-step MacAdam ellipse | (0.4578, 0.4101)      | 0.01350       | 0.00700       | 53.7°                  |
| 3000K            | Single 5-step MacAdam ellipse | (0.4338, 0.4030)      | 0.01390       | 0.00680       | 53.2°                  |
| 3500K            | Single 5-step MacAdam ellipse | (0.4073, 0.3917)      | 0.01545       | 0.00690       | 54.0°                  |
| 4000K            | Single 5-step MacAdam ellipse | (0.3818, 0.3797)      | 0.01565       | 0.00670       | 53.7°                  |
| 5000K            | Single 5-step MacAdam ellipse | (0.3447, 0.3553)      | 0.01370       | 0.00590       | 59.6°                  |
| 5700K            | Single 5-step MacAdam ellipse | (0.3287, 0.3417)      | 0.01243       | 0.00533       | 59.1°                  |
| 6500K            | Single 5-step MacAdam ellipse | (0.3123, 0.3282)      | 0.01115       | 0.00475       | 58.6°                  |

**Note for Tables 8 & 9:**

- Philips Lumileds maintains a tester tolerance of  $\pm 0.005$  on x, y color coordinates.

## 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](http://www.philipslumileds.com).



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Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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