

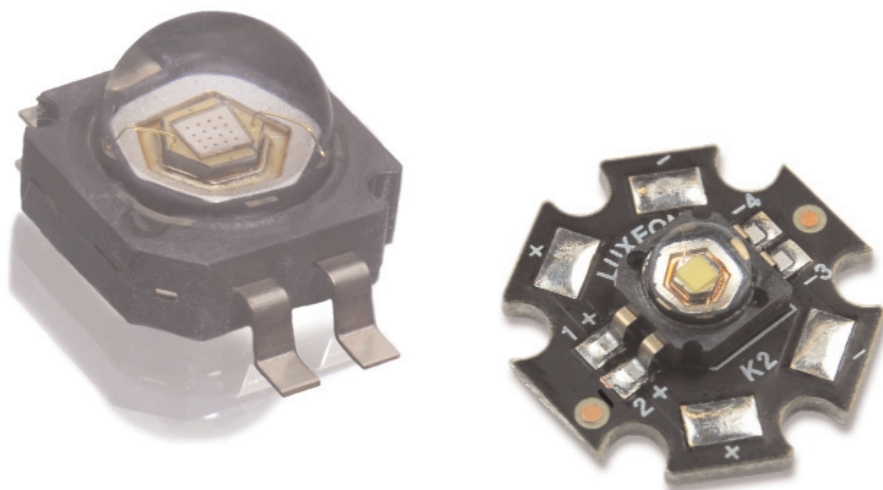
power light source

LUXEON® K2

Introduction

LUXEON® K2 is the most robust and powerful LED available. With unprecedented thermal, drive current and light output capabilities, it offers the lighting industry leading lumens per package and the opportunity to create never before possible lighting solutions. LUXEON K2 is available in all colors including cool-white, neutral-white, warm-white, blue, royal blue, green, cyan, red-orange, red and amber.

- ♦ deliver more useable light
- ♦ optimize applications to reduce size and cost
- ♦ engineer more robust applications
- ♦ reduce thermal management engineering
- ♦ utilize standard FR4 PCB technology in addition to MCPCB solutions
- ♦ simplify manufacturing through the use of surface mount technology.



LUXEON K2 Technology Leadership

- ♦ Highest operating junction temperature available, 185°C
- ♦ Industry leading lumen performance, > 140—175 lumens in 6500K white
- ♦ Highest Drive Currents—1500 mA
- ♦ Lowest Thermal Resistance—9°C/W
- ♦ Industry Best Moisture Sensitivity level—JEDEC 2a
4 week floor life without reconditioning
- ♦ Lead free reflow solder
JEDEC 020c compatible
- ♦ RoHS Compliant
- ♦ Autoclave compliant—
JESD22 A-102
- ♦ Industry Best Lumen Maintenance—50,000 hours life at 1000 mA with 70% lumen maintenance

Table of Contents

| | |
|---|----|
| Product Nomenclature | 3 |
| Average Lumen Maintenance Characteristics | 3 |
| Environmental Compliance | 4 |
| Flux Characteristics for LUXEON K2 | 5 |
| Flux Characteristics for LUXEON K2 Star | 6 |
| Optical Characteristics | 7 |
| Electrical Characteristics | 8 |
| Absolute Maximum Ratings | 11 |
| JEDEC Moisture Sensitivity | 12 |
| Reflow Soldering Characteristics | 12 |
| Mechanical Dimensions—SMT 4-Lead Gullwing Form | 13 |
| Solder Pad Layout—SMT Lead Form | 14 |
| Mechanical Dimensions—2-Lead Gullwing Form | 15 |
| Solder Pad Design—2-Lead Gullwing | 16 |
| Solder Pad Layout—2-Lead Gullwing | 16 |
| Pin Out Diagram—Gullwing Form | 16 |
| Mechanical Dimensions—LUXEON K2 Star | 17 |
| Wavelength Characteristics | 18 |
| Typical Light Output Characteristics Over Temperature | 20 |
| Typical Forward Current Characteristics | 23 |
| Typical Relative Luminous Flux | 24 |
| Current Derating Curves | 26 |
| Typical Radiation Patterns | 30 |
| Emitter Reel Packaging | 33 |
| White Binning Information | 34 |
| LUXEON K2 Cool-White Bin Structure | 35 |
| LUXEON K2 Neutral-White Bin Structure | 37 |
| LUXEON K2 Warm-White Bin Structure | 39 |

Product Nomenclature

The LUXEON K2 is available in two configurations, one tested and binned at 350 mA and a second tested and binned at 1000 mA. Due to production distribution and variance it is difficult to accurately correlate product performance across a broad drive current range. This is one of the reasons Philips Lumileds has elected to offer multiple test current options of the LUXEON K2 to better service our customers.

The part number designation is explained as follows:

L X K 2 - A B C D - E F G for LUXEON K2 Emitter

L 2 K 2 - A B C D - E F G H for LUXEON K2 Star

Where:

A — designates radiation pattern (value P for Lambertian)

B — designates color (see Philips Lumileds AB21)

C — designates color variant (1 for direct colors and Cool-White, N for Neutral-White, and W for Warm-White)

D — designates test current (value 2 for 350 mA, value 4 for 1000 mA)

E — designates minimum flux bin for LUXEON K2 Emitter (see Philips Lumileds AB21)

F — designates minimum flux bin for LUXEON K2 Star product (see Philips Lumileds AB21), Reserved for future product offerings in LUXEON K2 Emitter

G and H — Reserved for future product offerings.

Products tested and binned at 350 mA follow the part numbering scheme:

L X K 2 - x x x 2 - x x x (L2K2 - xxx2 - 11 - Bxxx for LUXEON K2 Star)

For these products typical performance is also listed for 700 mA operation.

Products tested and binned at 1000 mA follow the part numbering scheme:

L X K 2 - x x x 4 - x x x (L2K2 - xxx4 - 11 - Bxxx for LUXEON K2 Star)

For these products typical performance is also listed for 1500 mA operation.

Both versions of this product are capable of operation over the entire drive current range, up to 1500 mA for cool-white, neutral white, warm-white, green, cyan, blue and royal blue and up to 700 mA for red, red-orange and amber.

In addition, multiple minimum performance levels of both products are available. Digit "E" (Digit "F" for K2 Star Product) in the part-numbering scheme above, specifying the minimum performance flux bin, designates the performance option.

Average Lumen Maintenance Characteristics

Lifetime for solid-state lighting devices (LEDs) is typically defined in terms of lumen maintenance—the percentage of initial light output remaining after a specified period of time.

Philips Lumileds projects that white LUXEON K2 products will deliver, on average, 70% lumen maintenance at 50,000 hours of operation at a forward current of 1000 mA. This projection is based on constant current operation with junction temperature maintained at or below 120°C. Philips Lumileds projects that green, blue, cyan and royal blue LUXEON K2 products will deliver, on average, 70% lumen maintenance at 50,000 hours of operation at a forward current of 1000 mA. This projection is based on constant current operation with junction temperature maintained at or below 150°C. Philips Lumileds projects that red, red-orange and amber LUXEON K2 products will deliver, on average, 70% lumen maintenance at 50,000 hours of operation at a forward current of 350 mA. This projection is based on constant current operation with junction temperature maintained at or below 120°C.

This performance is based on independent test data, Philips Lumileds historical data from tests run on similar material systems, and internal LUXEON reliability testing. 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. The LUXEON K2 is compliant to the European Union directives on the Restriction of Hazardous Substances in electronic equipment, namely the RoHS directive. Philips Lumileds will not intentionally add the following restricted materials to the LUXEON K2: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Flux Characteristics for LUXEON K2

Junction Temperature, $T_J = 25^\circ\text{C}$

Table 1.

| Performance at Test Currents | | | | | Typical Performance at Indicated Current | |
|------------------------------|---------------|--|--|-------------------|--|--------------------|
| Color | Part Number | Minimum Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[1] [3]}$ | Typical Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[2] [3]}$ | Test Current (mA) | Typical Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[2] [3]}$ | Drive Current (mA) |
| Cool-White | LXK2-PW12-R00 | 39.8 | 45 | 350 | 75 | 700 |
| | LXK2-PW12-S00 | 51.7 | 60 | 350 | 100 | 700 |
| | LXK2-PW14-T00 | 80 | 85 | 1000 | 110 | 1500 |
| | LXK2-PW14-U00 | 87.4 | 100 | 1000 | 130 | 1500 |
| | LXK2-PW14-V00 | 113.6 | 120 | 1000 | 140 | 1500 |
| Neutral-White | LXK2-PWN2-Q00 | 30.6 | 35 | 350 | 60 | 700 |
| | LXK2-PWN2-R00 | 39.8 | 45 | 350 | 75 | 700 |
| | LXK2-PWN2-S00 | 51.7 | 60 | 350 | 100 | 700 |
| | LXK2-PWN4-T00 | 67.2 | 80 | 1000 | 105 | 1500 |
| | LXK2-PWN4-U00 | 87.4 | 100 | 1000 | 130 | 1500 |
| | LXK2-PWN4-V00 | 113.6 | 120 | 1000 | 140 | 1500 |
| Warm-White | LXK2-PWW2-Q00 | 30.6 | 35 | 350 | 60 | 700 |
| | LXK2-PWW2-R00 | 39.8 | 45 | 350 | 75 | 700 |
| | LXK2-PWW4-T00 | 67.2 | 80 | 1000 | 105 | 1500 |
| | LXK2-PWW4-U00 | 87.4 | 100 | 1000 | 130 | 1500 |
| Green | LXK2-PM12-R00 | 39.8 | 45 | 350 | 75 | 700 |
| | LXK2-PM12-S00 | 51.7 | 60 | 350 | 100 | 700 |
| | LXK2-PM14-U00 | 87.4 | 100 | 1000 | 130 | 1500 |
| Cyan | LXK2-PE12-Q00 | 30.6 | 35 | 350 | 60 | 700 |
| | LXK2-PE12-R00 | 39.8 | 45 | 350 | 75 | 700 |
| | LXK2-PE12-S00 | 51.7 | 60 | 350 | 100 | 700 |
| | LXK2-PE14-T00 | 67.2 | 80 | 1000 | 105 | 1500 |
| | LXK2-PE14-U00 | 87.4 | 100 | 1000 | 130 | 1500 |
| Blue | LXK2-PB12-K00 | 8.2 | 9.5 | 350 | 16 | 700 |
| | LXK2-PB12-L00 | 10.7 | 12.5 | 350 | 21 | 700 |
| | LXK2-PB12-M00 | 13.9 | 16 | 350 | 27 | 700 |
| | LXK2-PB14-N00 | 18.1 | 21 | 1000 | 35 | 1500 |
| | LXK2-PB14-P00 | 23.5 | 27 | 1000 | 35 | 1500 |
| | LXK2-PB14-Q00 | 30.6 | 35 | 1000 | 46 | 1500 |
| Royal Blue | LXK2-PR12-L00 | 175 mW | 200 mW | 350 | 330 mW | 700 |
| | LXK2-PR12-M00 | 225 mW | 290 mW | 350 | 480 mW | 700 |
| | LXK2-PR14-Q00 | 435 mW | 475 mW | 1000 | 620 mW | 1500 |
| | LXK2-PR14-R00 | 515 mW | 575 mW | 1000 | 750 mW | 1500 |

Flux Characteristics for LUXEON K2, Continued

Junction Temperature, $T_J = 25^\circ\text{C}$

Table 1 Continued .

| Performance at Test Currents | | | | | Typical Performance at Indicated Current | |
|------------------------------|---------------|--|--|-------------------|--|--------------------|
| Color | Part Number | Minimum Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[1] [3]}$ | Typical Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[2] [3]}$ | Test Current (mA) | Typical Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[2] [3]}$ | Drive Current (mA) |
| Red | LXK2-PD12-Q00 | 30.6 | 35 | 350 | 60 | 700 |
| | LXK2-PD12-R00 | 39.8 | 45 | 350 | 75 | 700 |
| | LXK2-PD12-S00 | 51.7 | 60 | 350 | 100 | 700 |
| Red-Orange | LXK2-PH12-R00 | 39.8 | 45 | 350 | 75 | 700 |
| | LXK2-PH12-S00 | 51.7 | 60 | 350 | 100 | 700 |
| Amber | LXK2-PL12-P00 | 23.5 | 27 | 350 | 46 | 700 |
| | LXK2-PL12-Q00 | 30.6 | 35 | 350 | 60 | 700 |
| | LXK2-PL12-R00 | 39.8 | 45 | 350 | 75 | 700 |

Flux Characteristics for LUXEON K2 Star,

Junction Temperature, $T_J = 25^\circ\text{C}$

Table 2.

| Performance at Test Currents | | | | | Typical Performance at Indicated Current | |
|------------------------------|-------------------|--|--|-------------------|--|--------------------|
| Color | Flux Bin | Minimum Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[1] [3]}$ | Typical Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[2] [3]}$ | Test Current (mA) | Typical Luminous Flux (lm) or Radiometric Power (mW) $\Phi_V^{[2] [3]}$ | Drive Current (mA) |
| Cool-White | L2K2-MW12-11-BR00 | 39.8 | 45 | 350 | 75 | 700 |
| | L2K2-MW12-11-BS00 | 51.7 | 60 | 350 | 100 | 700 |
| | L2K2-MW14-11-BT00 | 80 | 85 | 1000 | 110 | 1500 |
| | L2K2-MW14-11-BU00 | 87.4 | 100 | 1000 | 130 | 1500 |
| | L2K2-MW14-11-BV00 | 113.6 | 120 | 1000 | 140 | 1500 |
| Neutral-White | L2K2-MWN2-11-BQ00 | 30.6 | 35 | 350 | 60 | 700 |
| | L2K2-MWN2-11-BR00 | 39.8 | 45 | 350 | 75 | 700 |
| | L2K2-MWN2-11-BS00 | 51.7 | 60 | 350 | 100 | 700 |
| | L2K2-MWN4-11-BT00 | 67.2 | 80 | 1000 | 105 | 1500 |
| | L2K2-MWN4-11-BU00 | 87.4 | 100 | 1000 | 130 | 1500 |
| Warm-White | L2K2-MWN4-11-BV00 | 113.6 | 120 | 1000 | 140 | 1500 |
| | L2K2-MWW2-11-BQ00 | 30.6 | 35 | 350 | 60 | 700 |
| | L2K2-MWW2-11-BR00 | 39.8 | 45 | 350 | 75 | 700 |
| | L2K2-MWW4-11-BT00 | 67.2 | 80 | 1000 | 105 | 1500 |
| | L2K2-MWW4-11-BU00 | 87.4 | 100 | 1000 | 130 | 1500 |

Notes for Table 1 and Table 2:

1. Minimum luminous flux or radiometric power performance guaranteed within published operating conditions. Philips Lumileds maintains a tolerance of $\pm 10\%$ on flux and power measurements.
2. Typical luminous flux or radiometric power performance when device is operated within published operating conditions.
3. LUXEON K2 products with even higher luminous flux and radiometric power levels will become available in the future. Please consult Philips Lumileds or Future Electronics for more information.
4. Radiation Pattern for all LUXEON K2 Star products is Lambertian.

Optical Characteristics

LUXEON K2 at Test Current^[1] Junction Temperature, $T_J = 25^\circ\text{C}$

Table 3.

| Color | Dominant Wavelength ^[2] λ_D , Peak Wavelength ^[3] λ_P , or Color Temperature ^[4] CCT | | | Typical Spectral Half-width ^[6] (nm) $\Delta\lambda_{1/2}$ | Typical Temperature Coefficient of Dominant Wavelength (nm/ $^\circ\text{C}$) $\Delta\lambda_D / \Delta T_J$ | Typical Total Included Angle ^[7] (degrees) $\theta_{0.90V}$ | Typical Viewing Angle ^[8] (degrees) $2\theta_{1/2}$ |
|---------------------------|---|--------|----------|---|---|---|--|
| | Min. | Typ. | Max. | | | | |
| Cool White | 4500 K | 6500 K | 10000 K | - | - | 160 | 140 |
| Neutral White | 3500K | 4100K | 4500K | - | - | 160 | 140 |
| Warm White | 2650K | 3000K | 3500K | - | - | 160 | 140 |
| Green | 520 nm | 530 nm | 550 nm | 35 | 0.04 | 160 | 140 |
| Cyan | 490 nm | 505 nm | 520 nm | 30 | 0.04 | 160 | 140 |
| Blue | 460 nm | 470 nm | 490 nm | 25 | 0.04 | 160 | 140 |
| Royal Blue ^[9] | 440 nm | 455 nm | 460 nm | 20 | 0.04 | 160 | 140 |
| Red | 620.5 nm | 627 nm | 645 nm | 20 | 0.05 | 160 | 140 |
| Red-Orange | 613.5 nm | 617 nm | 620.5 nm | 20 | 0.06 | 160 | 140 |
| Amber | 584.5 nm | 590 nm | 597 nm | 14 | 0.09 | 160 | 140 |

Notes for Table 3:

1. Test current is 350 mA for all LXX2 - xxx2 - xxx (L2K2 - xxx2 - 11 - xxxx for K2 Star) products, and 1000 mA for all LXX2 - xxx4 - xxx products (L2K2 - xxx4 - 11 - xxxx for K2 Star).
2. Dominant wavelength is derived from the CIE 1931 Chromaticity diagram and represents the perceived color. Philips Lumileds maintains a tolerance of ± 0.5 nm for dominant wavelength measurements.
3. Royal blue product is binned by radiometric power and peak wavelength rather than photometric lumens and dominant wavelength. Philips Lumileds maintains a tolerance of ± 2 nm for peak wavelength measurements.
4. CCT $\pm 5\%$ tester tolerance
5. Typical CRI (Color Rendering Index) for Cool-White product is 70, Neutral-White is 75, and Warm-White is 80.
6. Spectral width at $\frac{1}{2}$ of the peak intensity.
7. Total angle at which 90% of total luminous flux is captured.
8. Viewing angle is the off axis angle from lamp centerline where the luminous intensity is $\frac{1}{2}$ of the peak value.
9. All white, green, cyan, blue and royal blue products are built with Indium Gallium Nitride (InGaN).
10. All red, red-orange and amber products are built with Aluminum Indium Gallium Phosphide (AlInGaP).
11. Blue and royal blue power light sources represented here are IEC825 class 2 for eye safety.

Electrical Characteristics

Electrical Characteristics at 350mA Part Numbers L XK2-xxx2-xxx, Junction Temperature, $T_J = 25^{\circ}\text{C}$

Table 4.

| Color | Forward Voltage V_f ^[1] | | | Typical Dynamic Resistance ^[2] (Ω) R_D | Typical Temperature Coefficient of Forward Voltage ^[3] (mV/ $^{\circ}\text{C}$) $\Delta V_F / \Delta T_J$ | Typical Thermal Resistance Junction to Case ($^{\circ}\text{C}/\text{W}$) $R\theta_{JC}$ |
|------------------------------|--------------------------------------|-------------|------|--|--|---|
| | Min. | (V) Typ. | Max. | | | |
| Cool-White ^[4] | 2.79 | 3.42 | 4.23 | 1.0 | -2.0 | 9 (13 for Star) |
| Neutral-White ^[4] | 2.79 | 3.42 | 4.23 | 1.0 | -2.0 | 9 (13 for Star) |
| Warm-White ^[4] | 2.79 | 3.42 | 4.23 | 1.0 | -2.0 | 9 (13 for Star) |
| Green ^[4] | 2.79 | 3.42 | 4.23 | 1.0 | -2.0 | 9 |
| Cyan ^[4] | 2.79 | 3.42 | 4.23 | 1.0 | -2.0 | 9 |
| Blue ^[4] | 2.79 | 3.42 | 4.23 | 1.0 | -2.0 | 9 |
| Royal Blue ^[4] | 2.79 | 3.42 | 4.23 | 1.0 | -2.0 | 9 |
| Red | 2.31 | 2.95 | 3.51 | 2.4 | -2.0 | 12 |
| Red-Orange | 2.31 | 2.95 | 3.51 | 2.4 | -2.0 | 12 |
| Amber | 2.31 | 2.95 | 3.51 | 2.4 | -2.0 | 12 |

Notes for Table 4:

1. Philips Lumileds maintains a tolerance of $\pm 0.06\text{V}$ on forward voltage measurements.
2. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs. See figures 14 and 15.
3. Measured between $25^{\circ}\text{C} = T_J = 110^{\circ}\text{C}$ at $I_f = 350\text{ mA}$.
4. The forward voltage of the LUXEON K2 LED will reduce by up to 0.30V at 350mA during the first few hours of operation after SMT reflow. Due to this effect, Philips Lumileds recommends current source drive for consistent and reliable performance. Cross connected series/parallel arrays or voltage drivers which could result in current hogging or variation in drive current are not recommended. Please consult your Philips Lumileds authorized distributor or Philips Lumileds Sales Representative for further information.

Typical Electrical Characteristics at 700mA Part Numbers L XK2-xxx2-xxx, Junction Temperature, $T_J = 25^{\circ}\text{C}$

Table 5.

| Color | Typical Forward Voltage V_f ^[1] (V) |
|---------------|---|
| Cool-White | 3.60 |
| Neutral-White | 3.60 |
| Warm-White | 3.60 |
| Green | 3.60 |
| Cyan | 3.60 |
| Blue | 3.60 |
| Royal Blue | 3.60 |
| Red | 3.60 |
| Red-Orange | 3.60 |
| Amber | 3.60 |

Notes for Table 5:

1. Philips Lumileds maintains a tolerance of $\pm 0.06\text{V}$ on forward voltage measurements.
2. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs. See figures 14 and 15.
3. Measured between $25^{\circ}\text{C} = T_J = 110^{\circ}\text{C}$ at $I_f = 700\text{ mA}$.

Electrical Characteristics at 1000mA

Part Numbers L XK2-xxx4-xxx, Junction Temperature, $T_J = 25^{\circ}\text{C}$

Table 6.

| Color | Forward Voltage V_f ^[1] | | | Typical Dynamic Resistance ^[2] (Ω) R_D | Typical Temperature Coefficient of Forward Voltage ^[3] (mV/ $^{\circ}\text{C}$) $\Delta V_f / \Delta T_J$ | Typical Thermal Resistance Junction to Case ($^{\circ}\text{C}/\text{W}$) $R\theta_{JC}$ |
|------------------------------|--------------------------------------|-------------|------|--|---|---|
| | Min. | (V) Typ. | Max. | | | |
| Cool-White ^[4] | 3.03 | 3.72 | 4.95 | 0.6 | -2.0 | 9 (13 for Star) |
| Neutral-White ^[4] | 3.03 | 3.72 | 4.95 | 0.6 | -2.0 | 9 (13 for Star) |
| Warm-White ^[4] | 3.03 | 3.72 | 4.95 | 0.6 | -2.0 | 9 (13 for Star) |
| Green ^[4] | 3.03 | 3.72 | 4.95 | 0.6 | -2.0 | 9 |
| Cyan ^[4] | 3.03 | 3.72 | 4.95 | 0.6 | -2.0 | 9 |
| Blue ^[4] | 3.03 | 3.72 | 4.95 | 0.6 | -2.0 | 9 |
| Royal Blue ^[4] | 3.03 | 3.72 | 4.95 | 0.6 | -2.0 | 9 |

Notes for Table 6:

1. Philips Lumileds maintains a tolerance of $\pm 0.06\text{V}$ on forward voltage measurements
2. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs. See figure 14.
3. Measured between $25^{\circ}\text{C} = T_J = 110^{\circ}\text{C}$ at $I_f = 1000\text{ mA}$.
4. The forward voltage of the LUXEON K2 LED will reduce by up to 0.50V at 1000mA during the first few hours of operation after SMT reflow. Due to this effect, Philips Lumileds recommends current source drive for consistent and reliable performance. Cross connected series/parallel arrays or voltage drivers which could result in current hogging or variation in drive current are not recommended. Please consult your Philips Lumileds authorized distributor or Philips Lumileds Sales Representative for further information.

Typical Electrical Characteristics at 1500mA

Part Numbers L XK2-xxx4-xxx, Junction Temperature, $T_J = 25^{\circ}\text{C}$

Table 7.

| Color | Typical Forward Voltage V_f ^[1] (V) |
|---------------|---|
| Cool-White | 3.85 |
| Neutral-White | 3.85 |
| Warm-White | 3.85 |
| Green | 3.85 |
| Cyan | 3.85 |
| Blue | 3.85 |
| Royal Blue | 3.85 |

Notes for Table 7:

1. Philips Lumileds maintains a tolerance of $\pm 0.06\text{V}$ on forward voltage measurements.

Absolute Maximum Ratings

Table 8.

| Parameter | Cool-White/Neutral-White/ Warm-White Value | Green/Cyan Blue/Royal Blue Value | Red/Red-Orange /Amber Value |
|--|--|---|---|
| DC Forward Current (mA) | 1500 | 1500 | 700 |
| Peak Pulsed Forward Current (mA) | 1500 | 1500 | 700 |
| Average Forward Current (mA) | 1500 | 1500 | 700 |
| ESD Sensitivity | 2,000 V HBM Class 2 JESD22-A114-B | 2,000 V HBM Class 2 JESD22-A114-B | 2,000 V HBM Class 2 JESD22-A114-B |
| LED Junction Temperature | 150°C | 185°C | 150°C |
| Max Case Temperature | 135°C | 170°C | 135°C |
| Storage Temperature | -40°C - 185°C | -40°C - 185°C | -40°C - 185°C |
| K2 Star Aluminum-Core PCB Temperature | 105°C | N/A | N/A |
| Soldering Temperature | JEDEC 020c 260°C | JEDEC 020c 260°C | JEDEC 020c 260°C |
| Allowable Reflow Cycles | 3 | 3 | 3 |
| Autoclave Conditions | 121°C at 2 ATM, 100% RH for 72 hours max | 121°C at 2 ATM, 100% RH for 72 hours max | 121°C at 2 ATM, 100% RH for 72 hours max |
| Reverse Voltage (Vr) | See Note 2 | See Note 2 | See Note 2 |

Notes for Table 8:

1. Proper current derating must be observed to maintain junction temperature below the maximum.
2. LEDs are not designed to be driven in reverse bias.
3. Stresses in excess of the absolute maximum ratings can cause damage to the emitter. Maximum Rating limits apply to each parameter in isolation, all parameters having values within the Current Derating Curve. It should not be assumed that limiting values of more than one parameter can be applied to the product at the same time. Exposures to the absolute maximum ratings for extended periods can adversely affect device reliability. See Current Derating Curves in this document for more details.

JEDEC Moisture Sensitivity

Table 9.

| Level | Soak Requirements | | | | | |
|-------|-------------------|------------------------------------|---------------------------|-------------------------------|-------------------------|-------------------------------|
| | Floor Life | | Standard | | Accelerated Environment | |
| | Time | Conditions | Time (hours) | Conditions | Time (hours) | Conditions |
| 2a | 4 weeks | $\leq 30^{\circ}\text{C}$ / 60% RH | 696 ⁽¹⁾ + 5/-0 | 30°C / 60% RH | 120 +1/-0 | 60°C / 60% RH |

Notes for Table 9:

- The standard soak time includes a default value of 24 hours for semiconductor manufacturer's exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor's facility.

Reflow Soldering Characteristics

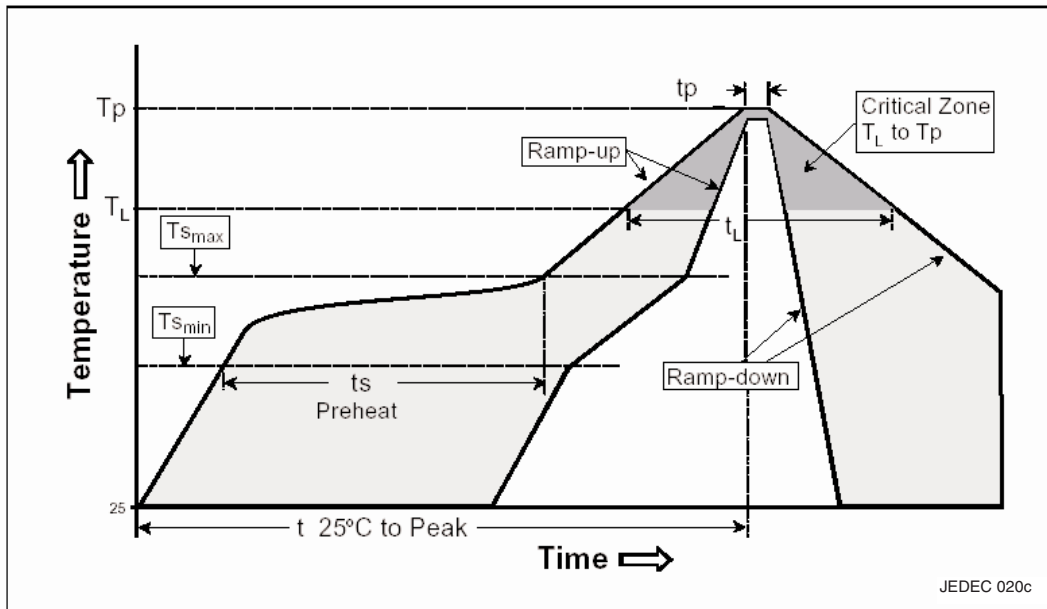


Table 10.

| 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 |
| 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 |

Notes for Table 10:

- All temperatures refer to topside of the package, measured on the package body surface.

Mechanical Dimensions—SMT 4-Lead Gullwing Form

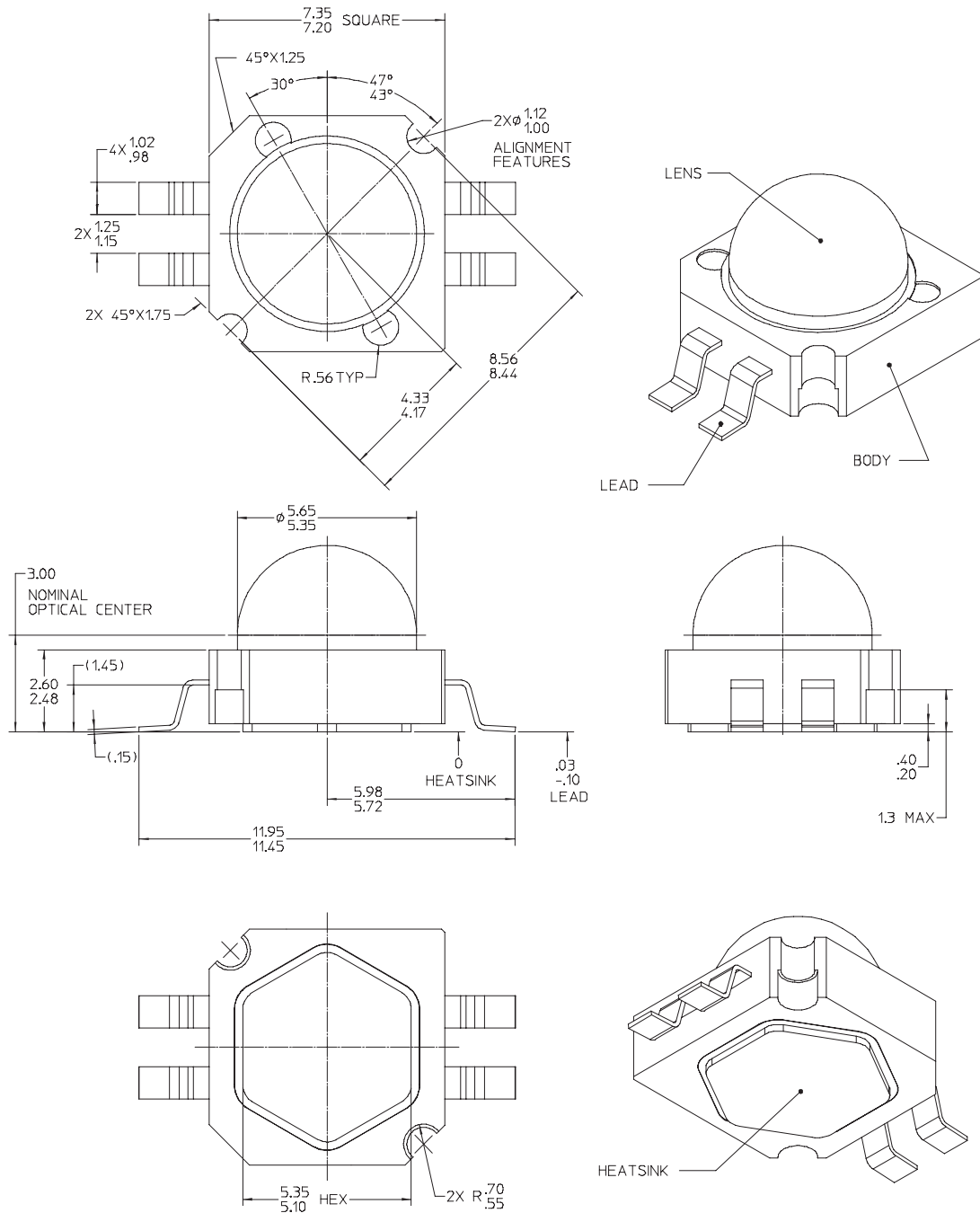


Figure 1. 4-lead Gullwing Package Outline Drawing.

Notes for Figure 1:

1. The anode side of the device is denoted by the chamfer on the part body. Electrical insulation between the case and the board is required—slug of the device is not electrically neutral. Do not electrically connect either the anode or cathode to the slug.
2. Do not handle the device by the lens except as described in Philips Lumileds document AB29.
3. Drawings not to scale.
4. All dimensions are in millimeters.
5. All dimensions without tolerances are for reference only.
6. Recommended solder paste thickness of 0.15mm.

Solder Pad Design—SMT Lead Form

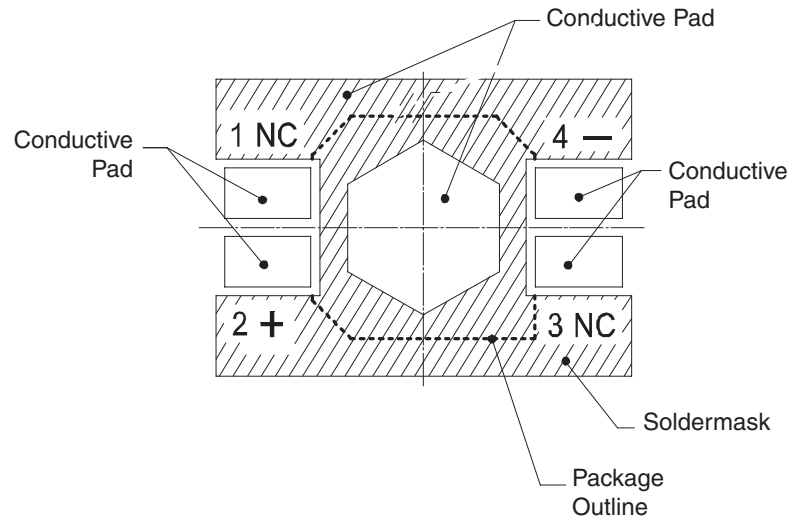


Figure 2. 4-Lead Gullwing Solder Pad Design.

Notes for Figure 2:

1. Electrical isolation is required between signal leads and hexagonal heat slug contact.
2. For optimal thermal performance, maximize board metallization at hexagonal heat slug contact.

Solder Pad Layout—SMT Lead Form

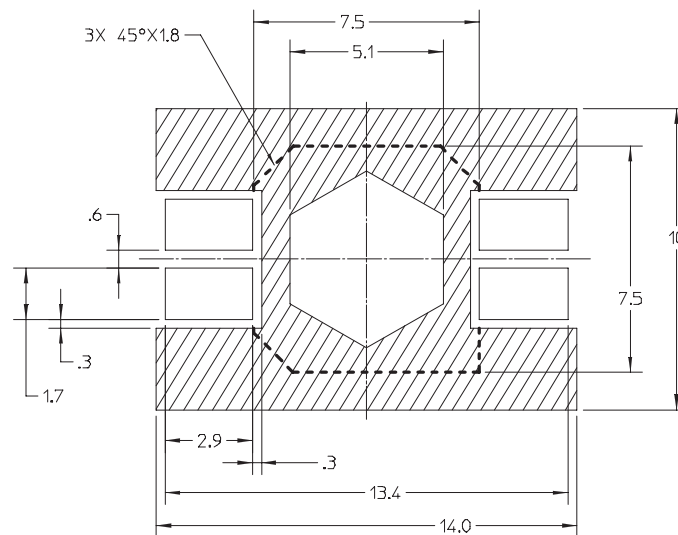


Figure 3. 4-Lead Gullwing Package Solder Pad Layout.

Pin Out Diagram

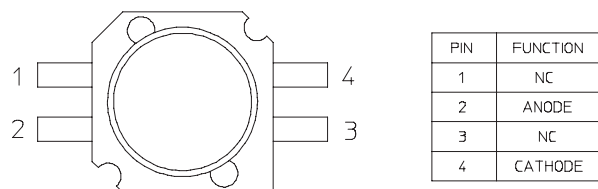


Figure 4. 4-Lead Gullwing Pin Out Diagram.

Mechanical Dimensions—2-Lead Gullwing Form^[8]

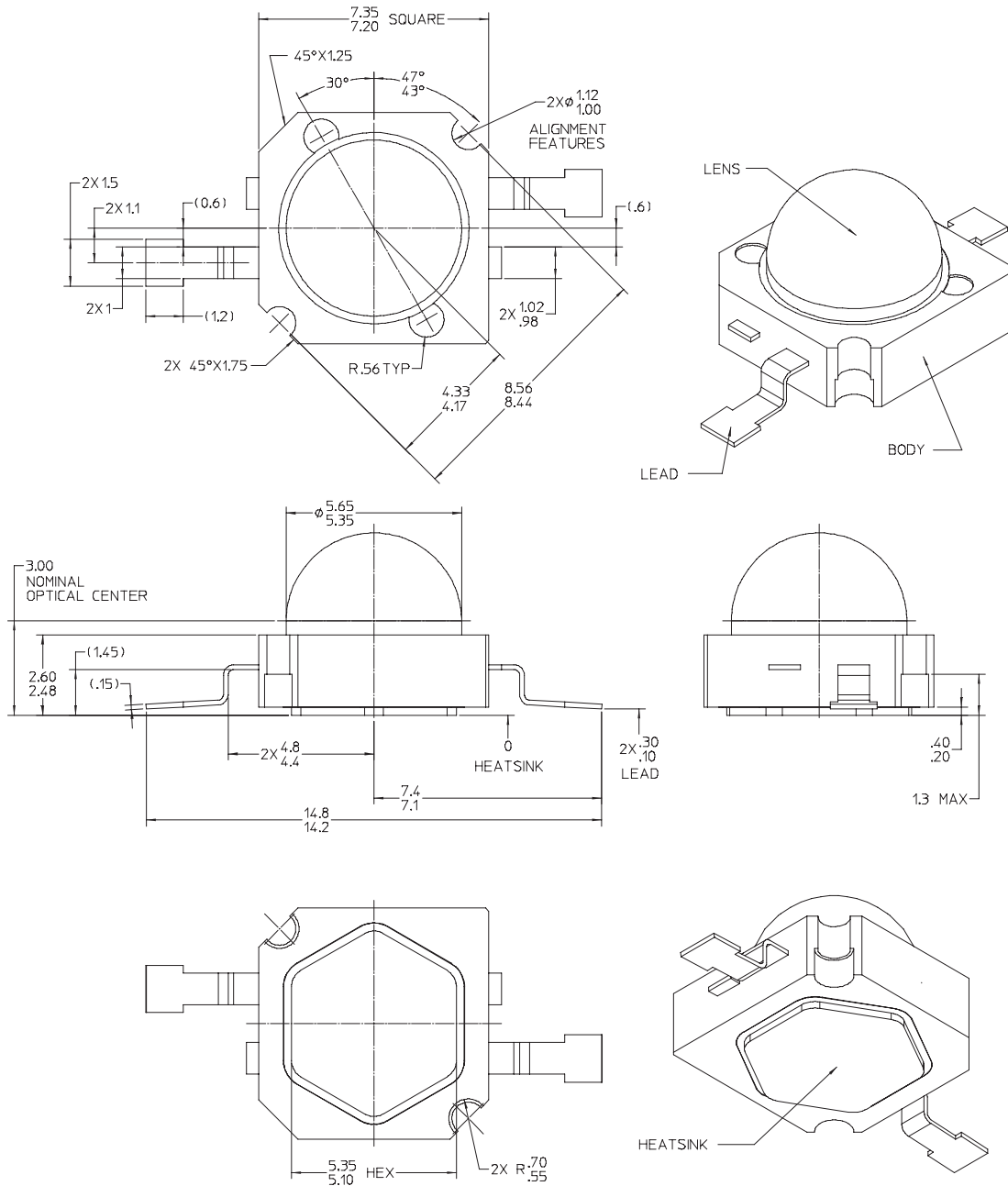


Figure 5. 2-Lead Gullwing Package Outline Drawing.

Notes for Figure 5:

1. The anode side of the device is denoted by the chamfer on the part body. Electrical insulation between the case and the board is required—slug of the device is not electrically neutral. Do not electrically connect either the anode or cathode to the slug.
2. Do not handle the device by the lens except as described in Philips Lumileds document AB29—care must be taken to avoid damage to the lens or the interior of the device that can be damaged by excessive force to the lens.
3. Drawings not to scale.
4. All dimensions are in millimeters.
5. All dimensions without tolerances are for reference only.
6. Recommended solder paste thickness of 0.15mm.
7. Available as a custom part number, contact your local Future Lumileds representative for more information.
8. The 2-Lead Gullwing part is not recommended for use in solder re-flow systems. Mount these parts with a thermal adhesive and hot bar soldering. For conventional reflow surface-mounting, use 4-Lead Gullwing Form.

Solder Pad Design—2-Lead Gullwing

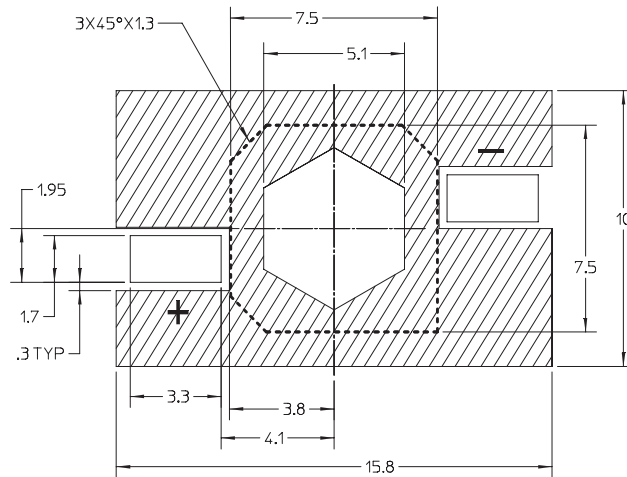


Figure 6. 2-Lead Gullwing Package Solder Pad Layout.

Notes for Figure 6:

1. Electrical isolation is required between signal leads and hexagonal heat slug contact.
2. For optimal thermal performance, maximize board metallization at hexagonal heat slug contact.

Solder Pad Layout—2-Lead Gullwing

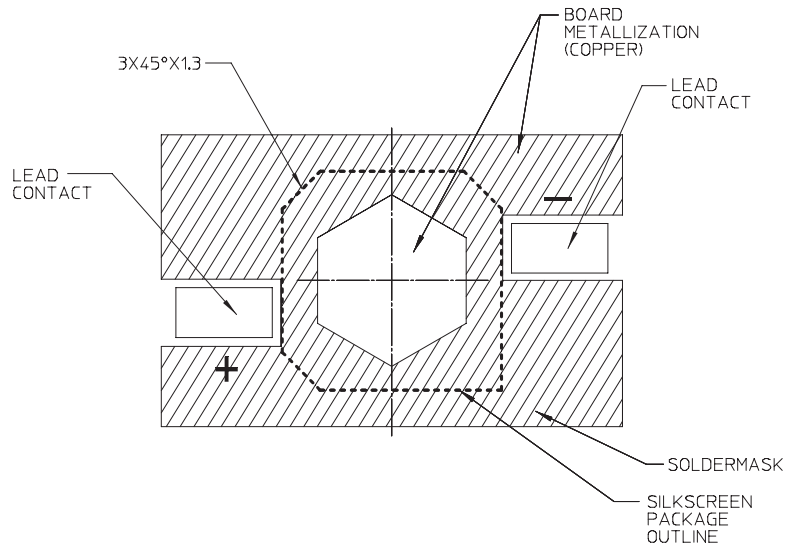


Figure 7. Solder Pad Layout 2-Lead Gullwing.

Pin Out Diagram—Gullwing Form

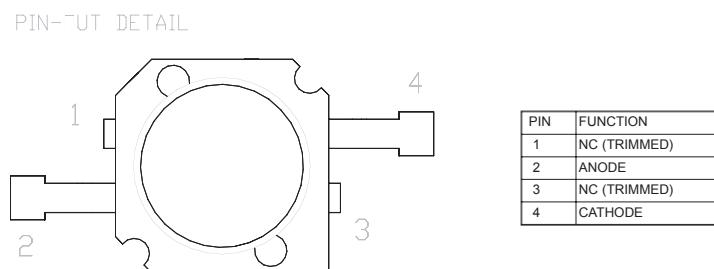


Figure 8. 2-Lead Gullwing Pin Out Diagram.

Mechanical Dimensions—LUXEON K2 Star

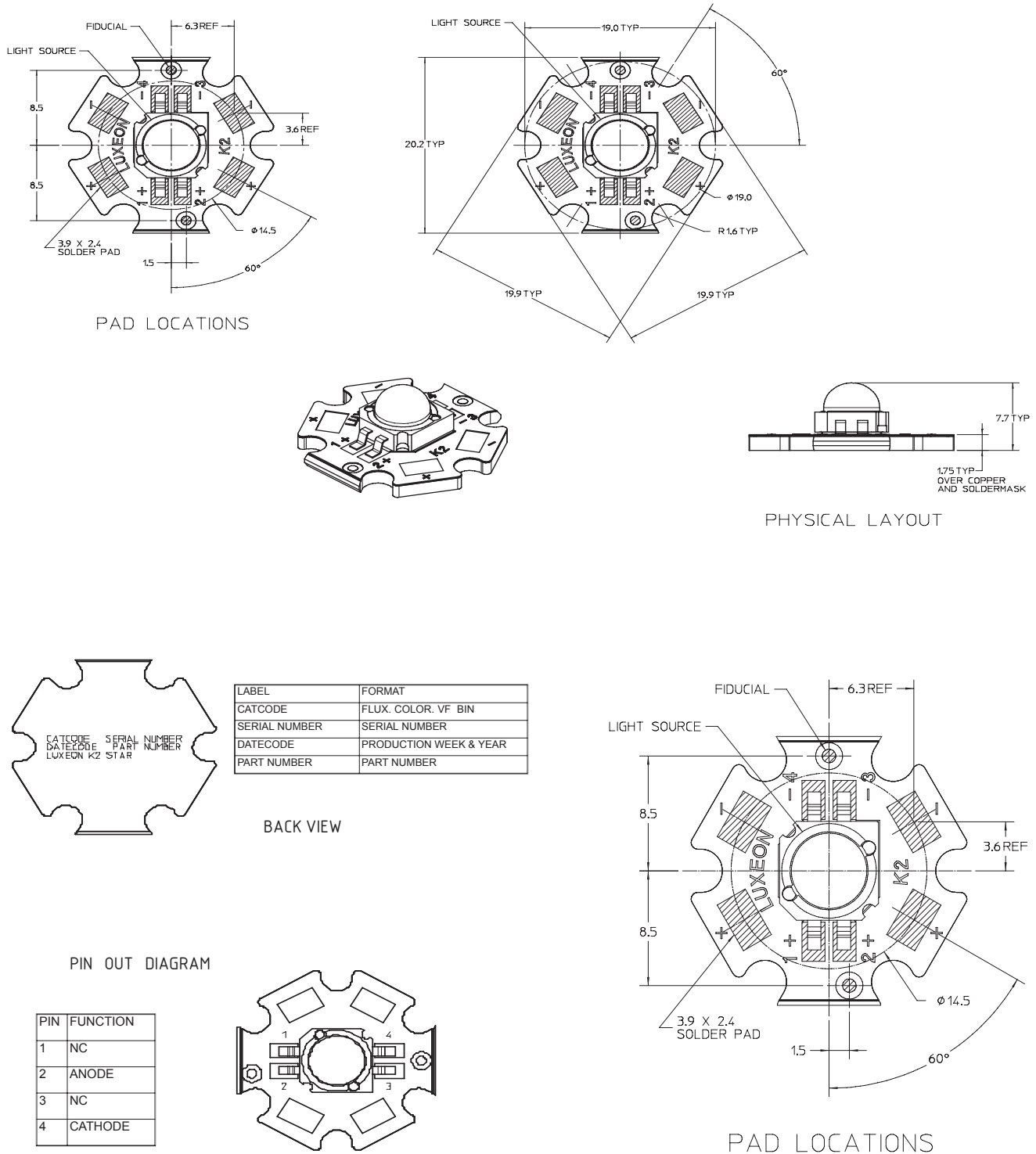


Figure 9. K2 Star Package Outline Drawing.

Notes for Figure 9:

1. Slots in aluminum core PCB for M3 or #4 mounting screw.
2. Electrical interconnection pads labeled on the aluminum core PCB with "+" and "-" to denote positive and negative, respectively. All positive pads are interconnected, as are all negative pads, allowing for flexibility in array interconnection.
3. Drawings not to scale.
4. All dimensions are in millimeters.

Wavelength Characteristics

Green, Cyan, Blue, Royal Blue, Red, Red-Orange and Amber at Test Current
Junction Temperature, $T_J = 25^\circ\text{C}$

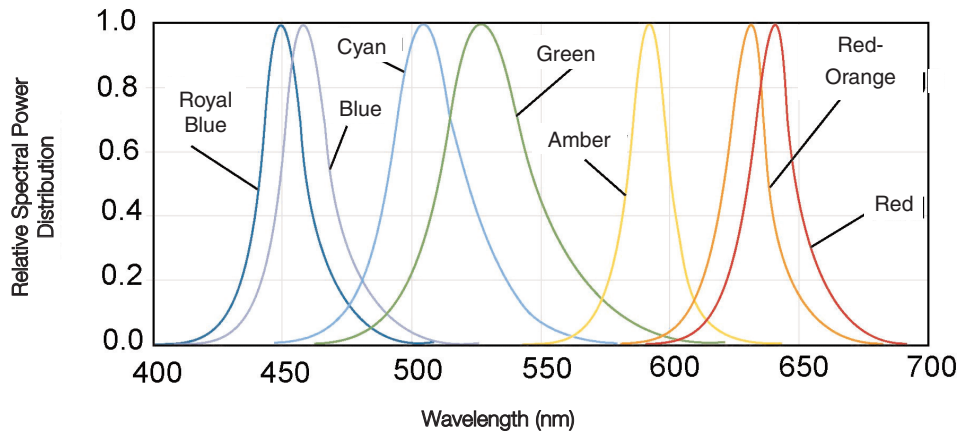


Figure 10. Relative intensity vs. wavelength.

Cool-White at Test Current
Junction Temperature, $T_J = 25^\circ\text{C}$

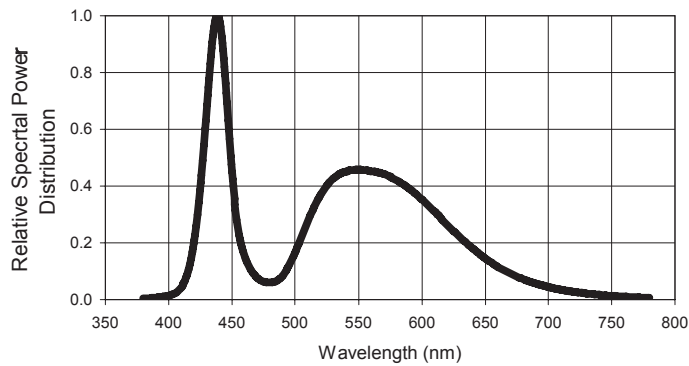


Figure 11a. Cool-White color spectrum of typical CCT part, integrated measurement.

Wavelength Characteristics, Continued

Neutral-White at Test Current Junction Temperature, $T_J = 25^\circ\text{C}$

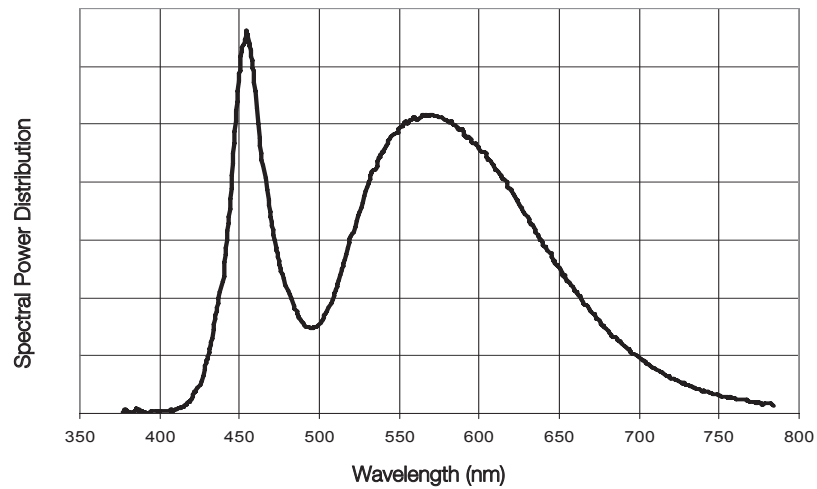


Figure 11b. Neutral-White color spectrum of typical CCT part, integrated measurement.

Warm-White at Test Current Junction Temperature, $T_J = 25^\circ\text{C}$

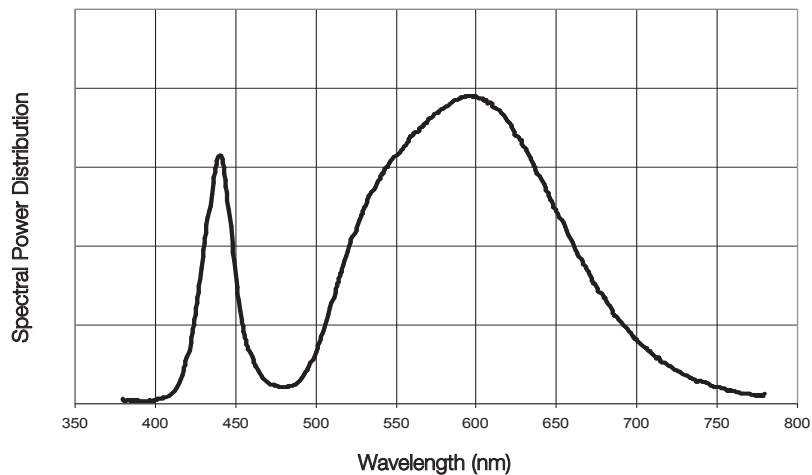


Figure 11c. Warm-White color spectrum of typical CCT part, integrated measurement.

Typical Light Output Characteristics Over Temperature

Cool-White, Neutral-White and Warm-White at Test Current

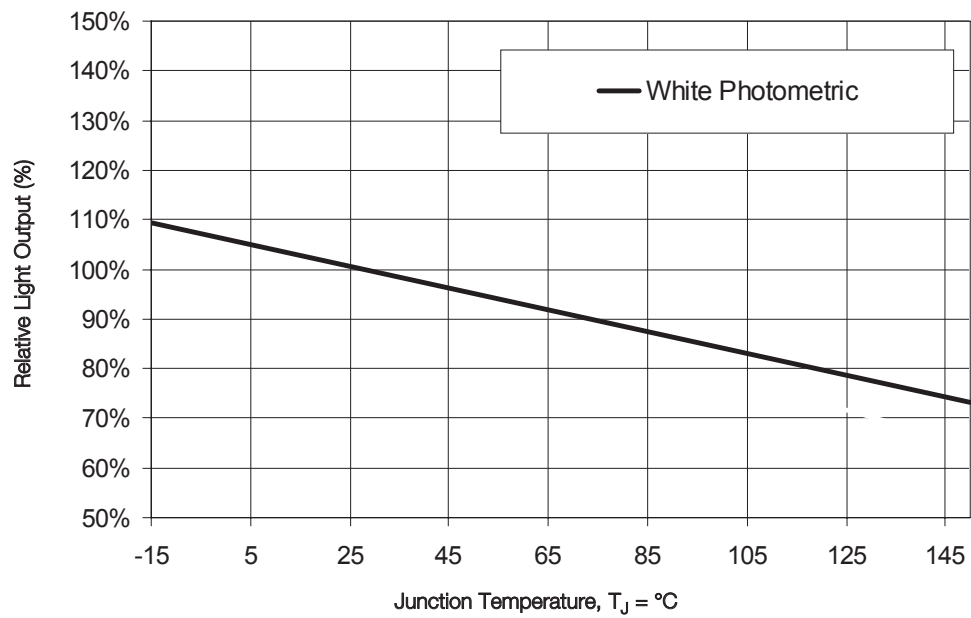


Figure 12a. Relative light output vs. junction temperature for white.

Green at Test Current

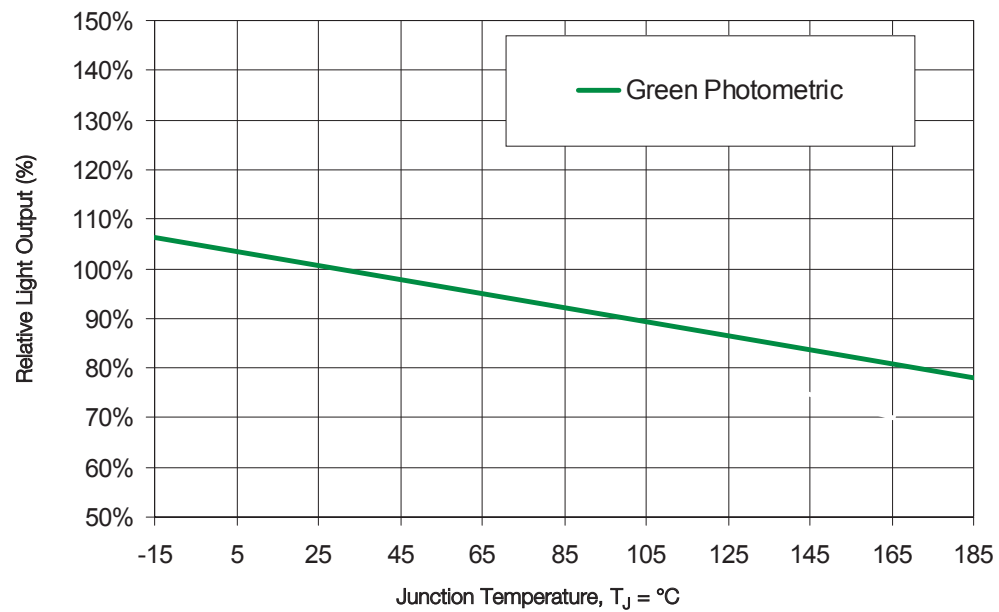


Figure 12b. Relative light output vs. junction temperature for green.

Typical Light Output Characteristics Over Temperature, Continued

Cyan at Test Current

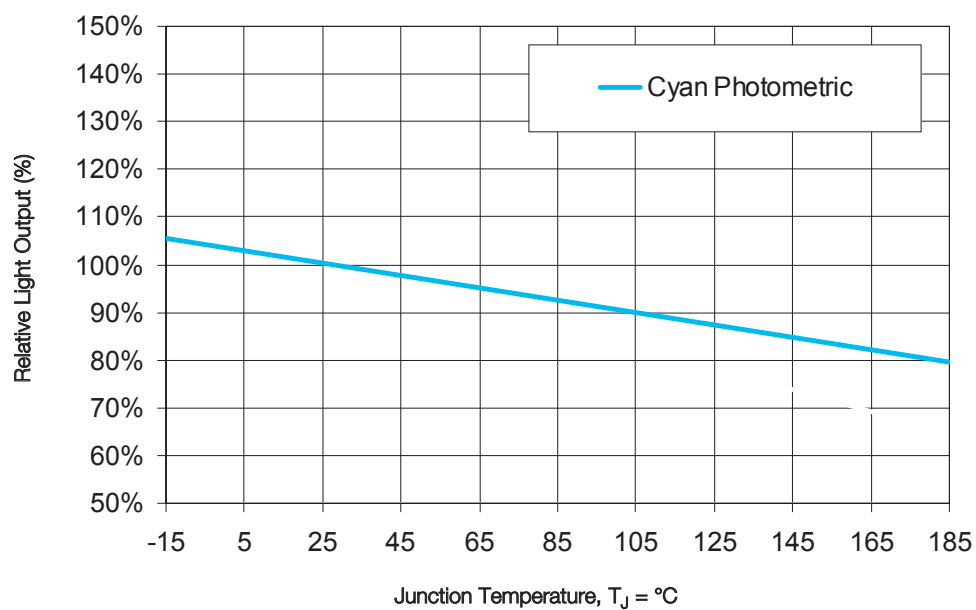


Figure 12c. Relative light output vs. junction temperature for cyan.

Blue at Test Current

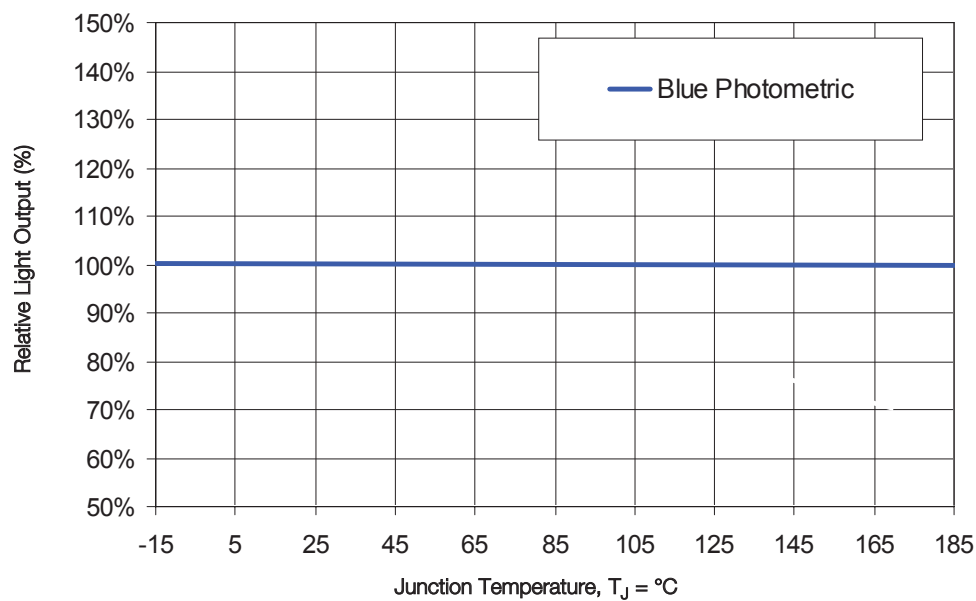


Figure 12d. Relative light output vs. junction temperature for blue.

Typical Light Output Characteristics Over Temperature, Continued

Royal Blue at Test Current

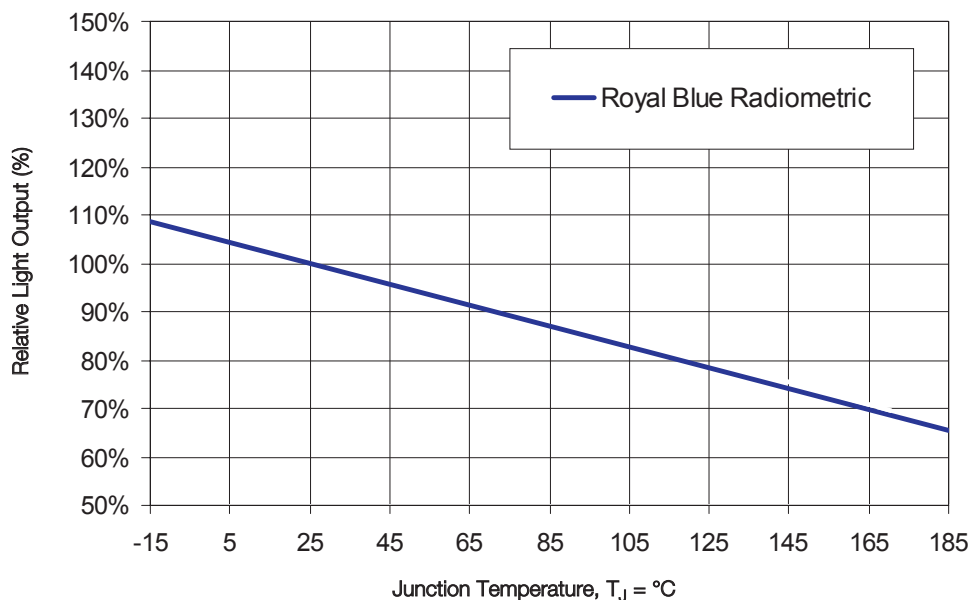


Figure 12e. Relative light output vs. junction temperature for royal blue.

Red, Red-Orange and Amber at Test Current

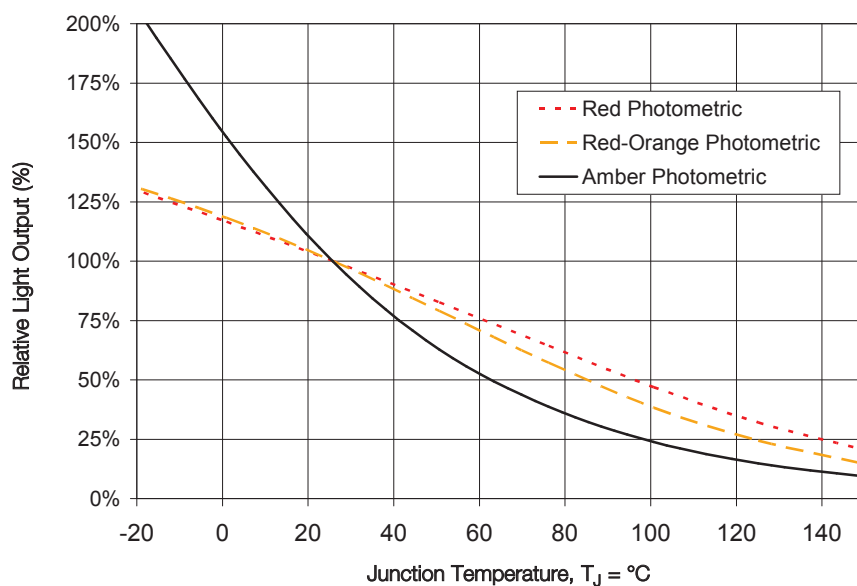


Figure 13. Relative light output vs. junction temperature for red, red-orange and amber.

Typical Forward Current Characteristics

Cool-White, Neutral-White, Warm-White, Green, Cyan, Blue
and Royal Blue, Junction Temperature, $T_J = 25^\circ\text{C}$

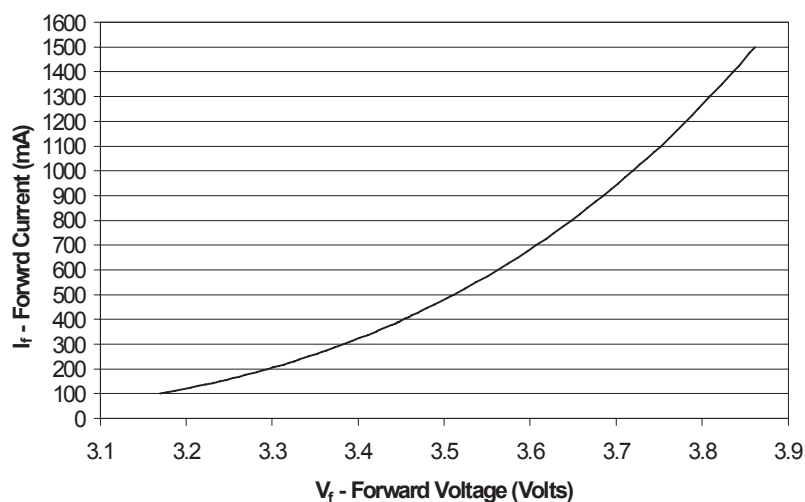


Figure 14. Forward current vs. forward voltage for white, green, cyan, blue and royal blue.

Red, Red-Orange and Amber, Junction Temperature, $T_J = 25^\circ\text{C}$

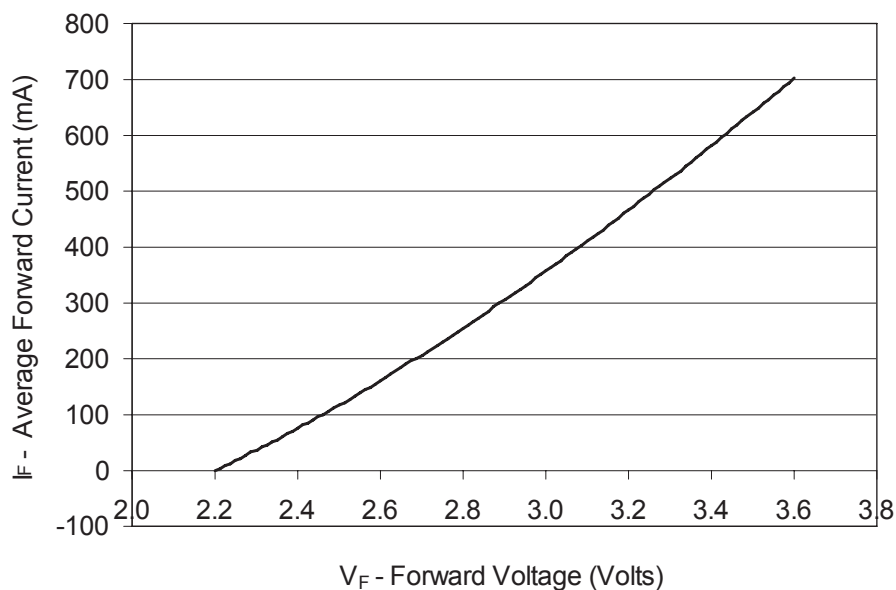


Figure 15. Forward current vs. forward voltage for red, red-orange and amber.

Notes for Figures 14 & 15:

Driving these high power devices at currents less than the test conditions (350 mA or 1000 mA) may produce unpredictable results and may be subject to variation in performance. Pulse width modulation (PWM) is recommended for dimming effects.

Typical Relative Luminous Flux

Relative Luminous Flux vs. Forward Current for Cool-White, Neutral-White, Warm-White, Green, Cyan, Blue and Royal Blue Junction Temperature, $T_J = 25^\circ\text{C}$

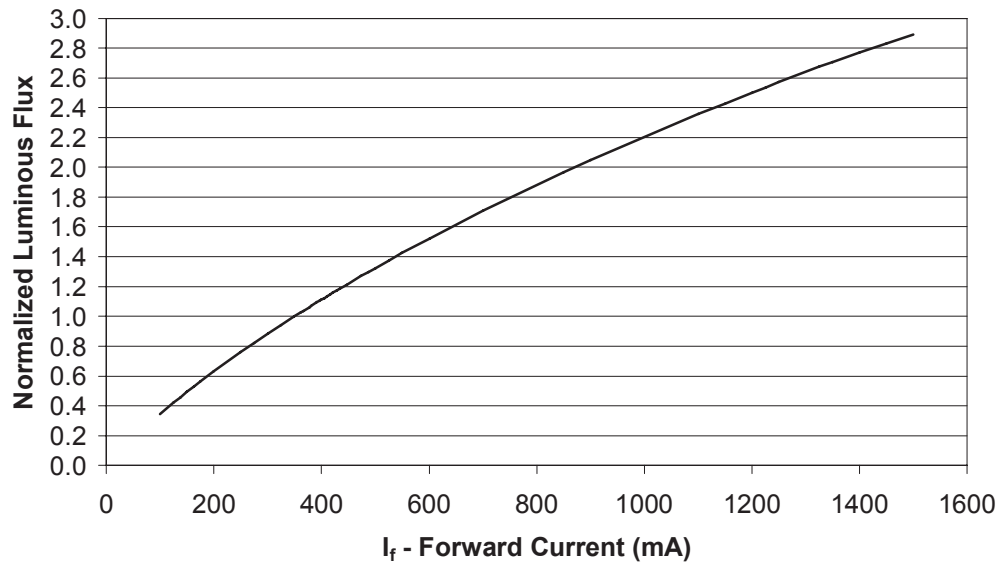


Figure 16. Relative luminous flux or radiometric power vs. forward current for white, green, cyan, blue and royal blue at $T_J = 25^\circ\text{C}$ maintained, test current 350 mA.

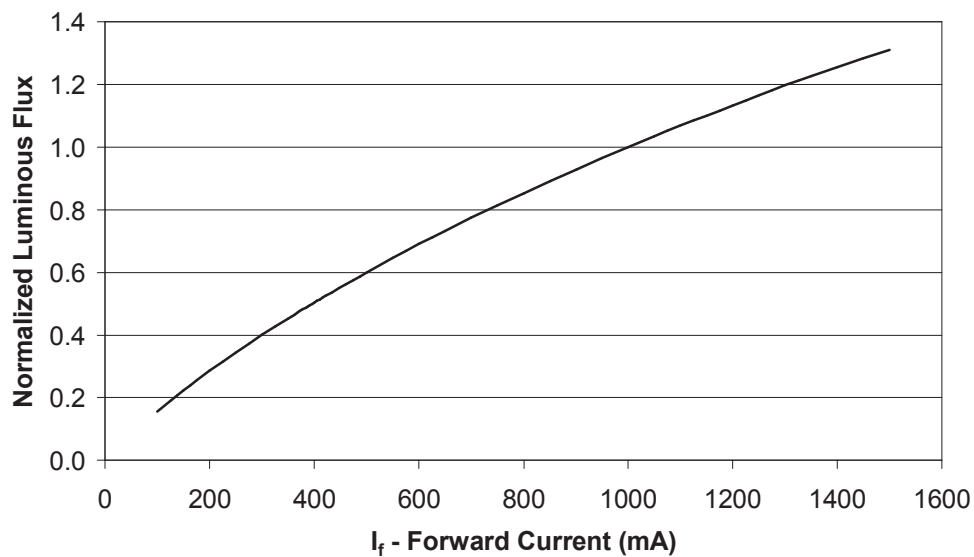


Figure 17. Relative luminous flux or radiometric power vs. forward current for white, green, cyan, blue and royal blue at $T_J = 25^\circ\text{C}$ maintained, test current 1000 mA.

Notes for Figures 16 & 17:

Driving these high power devices at currents less than the test conditions (350 mA or 1000 mA) may produce unpredictable results and may be subject to variation in performance. Pulse width modulation (PWM) is recommended for dimming effects.

Relative Luminous Flux vs. Forward Current for Red, Red-Orange and Amber, Junction Temperature, $T_J = 25^\circ\text{C}$

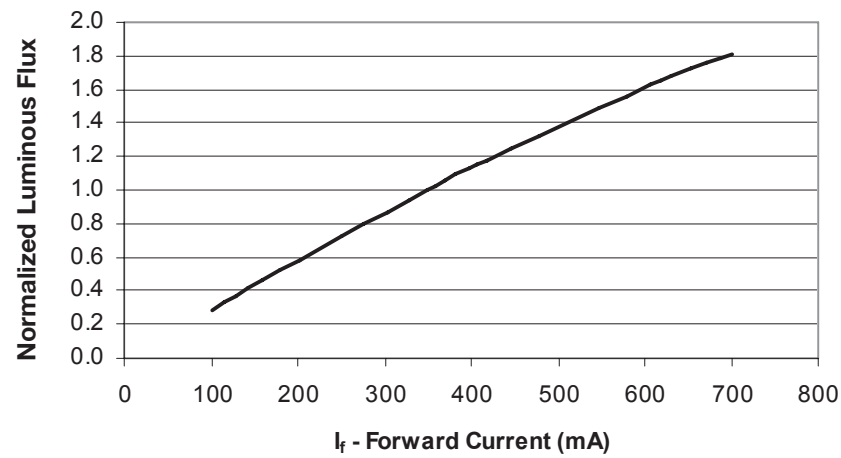


Figure 18: Relative luminous flux or radiometric power vs. forward current for red, red-orange and amber at $T_J = 25^\circ\text{C}$ maintained, test current 350 mA.

Note for Figure 18:

Driving these high power devices at currents less than the test conditions (350 mA or 1000 mA) may produce unpredictable results and may be subject to variation in performance. Pulse width modulation (PWM) is recommended for dimming effects.

Current Derating Curves

Current Derating Curve for 350 mA Drive Current Cool-White, Neutral-White, Warm-White

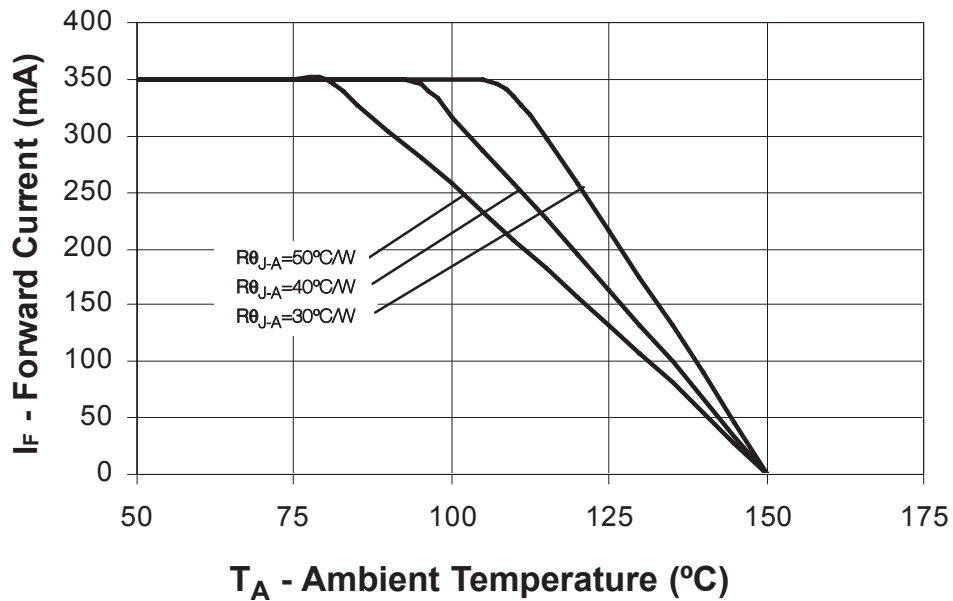


Figure 19: Maximum forward current vs. ambient temperature, based on $T_{JMAX} = 150^\circ\text{C}$.

Current Derating Curve for 350 mA Drive Current Green, Cyan, Blue and Royal Blue

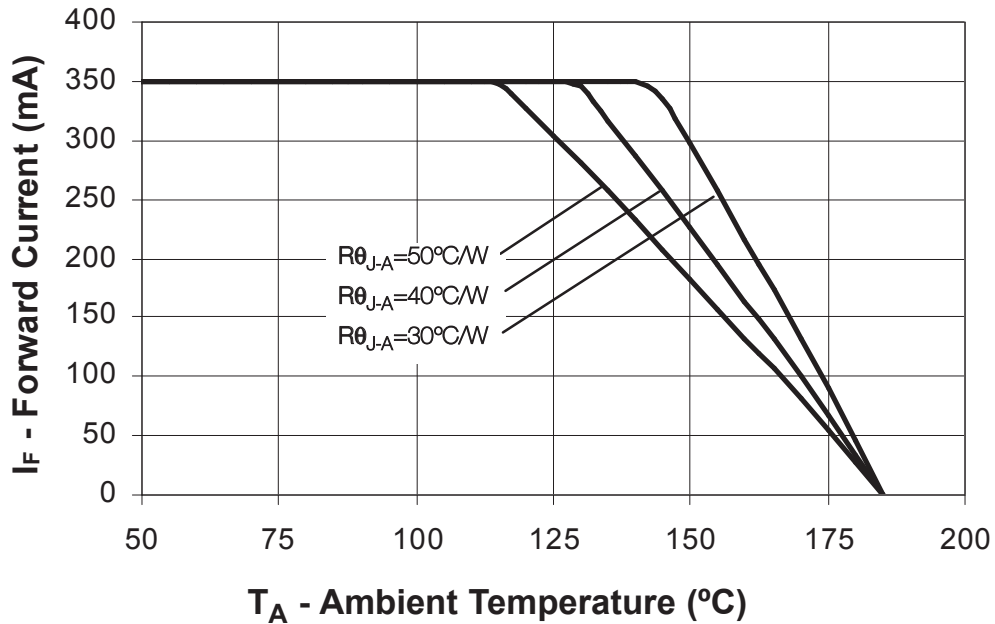


Figure 20: Maximum forward current vs. ambient temperature, based on $T_{JMAX} = 185^\circ\text{C}$.

Current Derating Curve for 350 mA Drive Current Red, Red-Orange and Amber

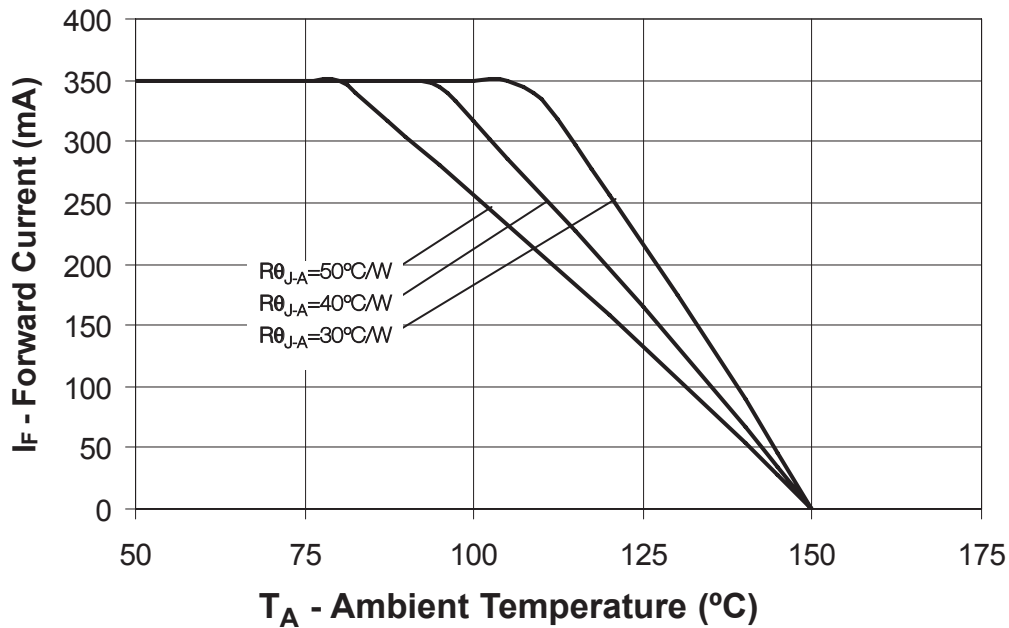


Figure 21: Maximum forward current vs. ambient temperature, based on $T_{JMAX} = 150^\circ\text{C}$.

Current Derating Curve for 700 mA Drive Current Cool-White, Neutral-White, Warm-White

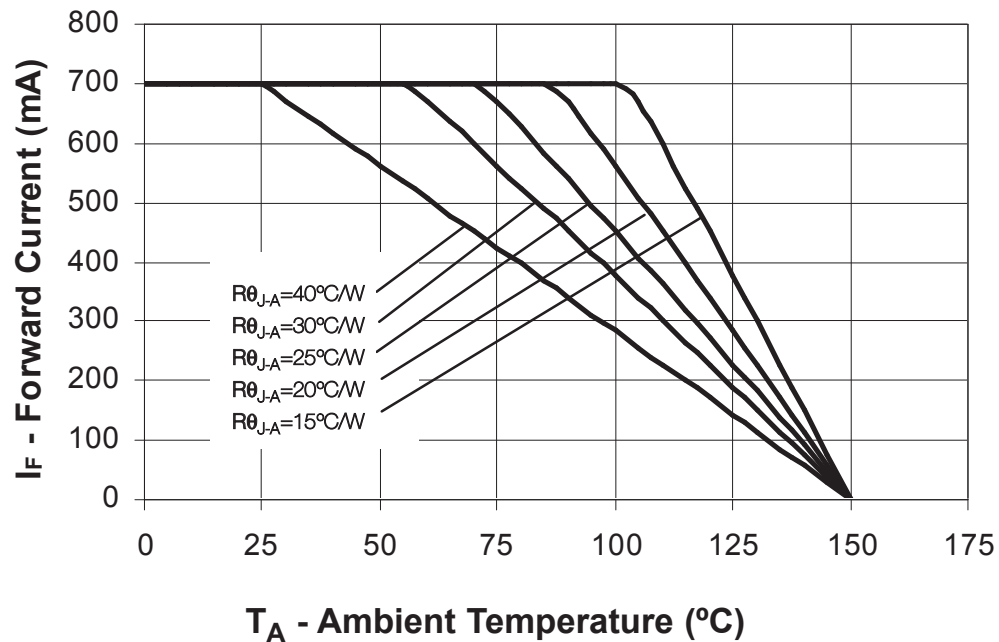


Figure 22: Maximum forward current vs. ambient temperature, based on $T_{JMAX} = 150^\circ\text{C}$.

Current Derating Curve for 700 mA Drive Current Green, Cyan, Blue and Royal Blue

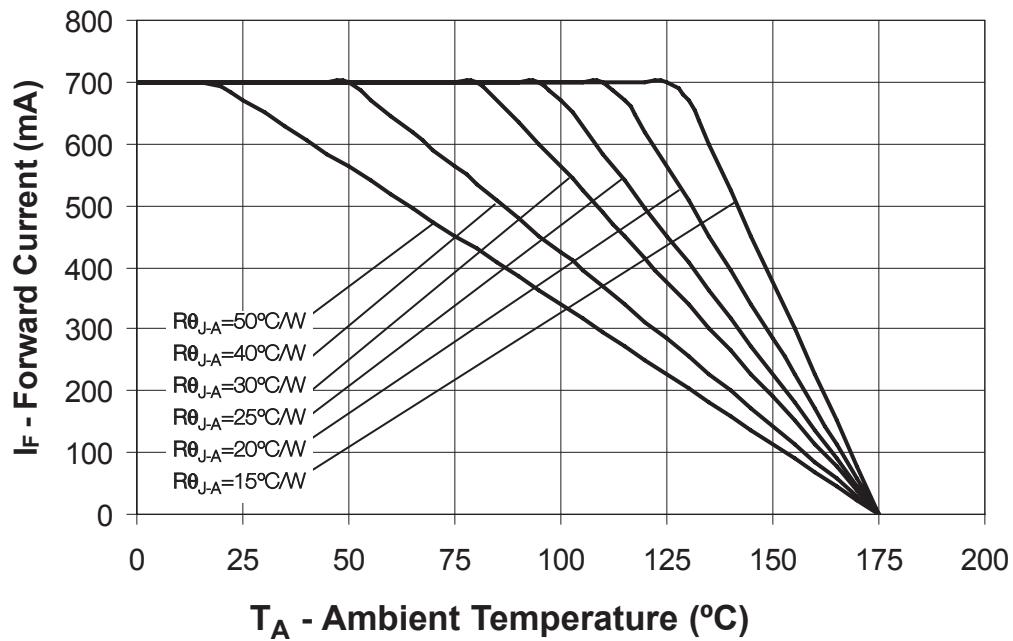


Figure 23: Maximum forward current vs. ambient temperature, based on $T_{JMAX} = 175^{\circ}\text{C}$.

Current Derating Curve for 700 mA Drive Current Red, Red-Orange and Amber

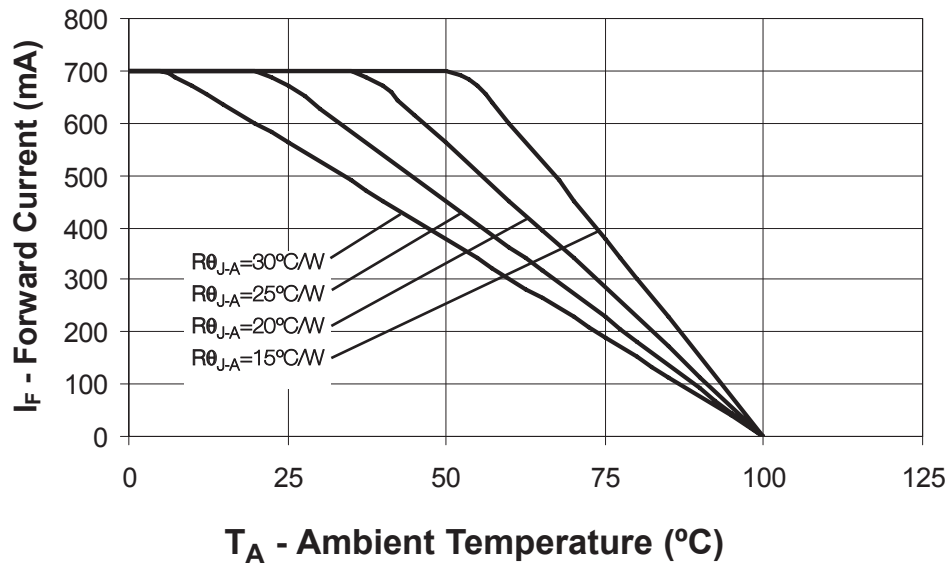


Figure 24: Maximum forward current vs. ambient temperature, based on $T_{JMAX} = 100^{\circ}\text{C}$.

Current Derating Curve for 1000 mA Drive Current Cool-White, Neutral-White, Warm-White, Green, Cyan, Blue and Royal Blue

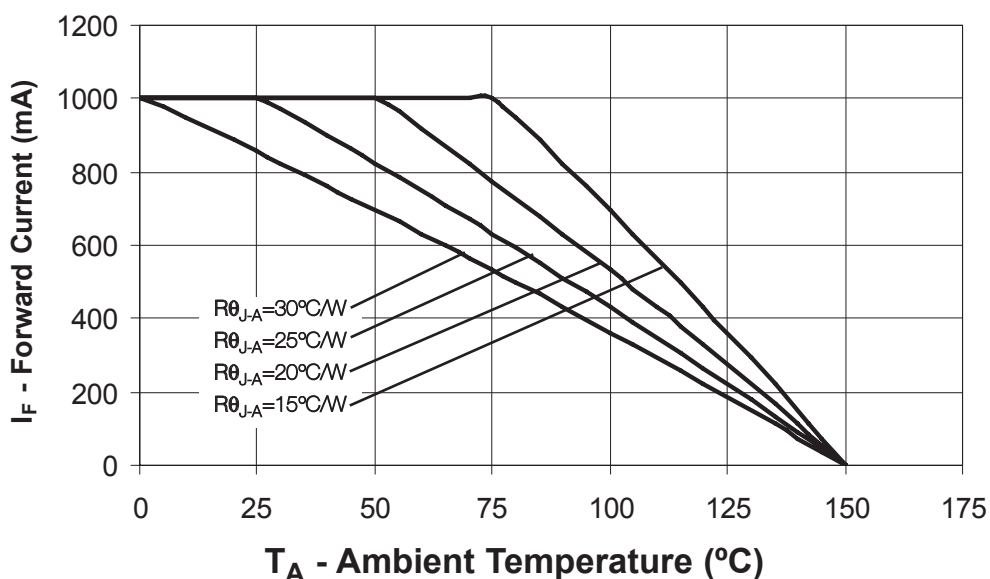


Figure 25: Maximum forward current vs. ambient temperature, based on T_{JMAX} = 150°C.

Current Derating Curve for 1500 mA Drive Current Cool-White, Neutral-White, Warm-White, Green, Cyan, Blue and Royal Blue

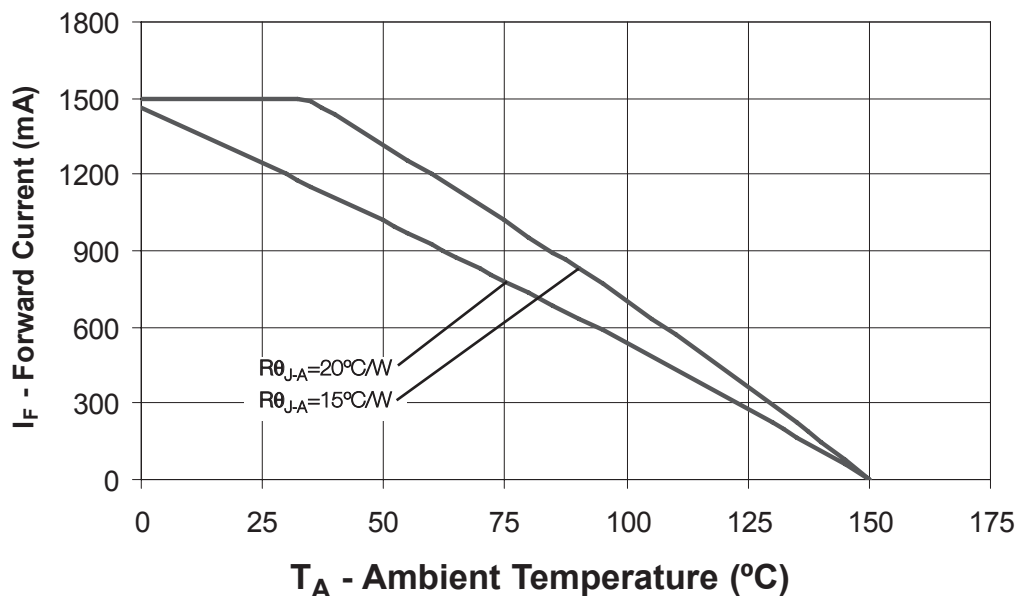


Figure 26: Maximum forward current vs. ambient temperature, based on T_{JMAX} = 150°C.

Typical Radiation Patterns

Typical Representative Spatial Radiation Pattern for White Lambertian

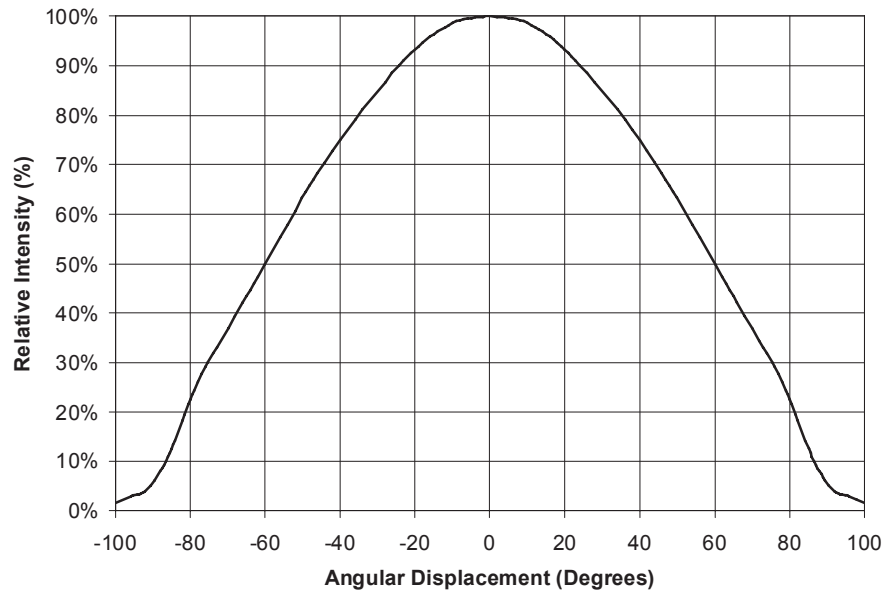


Figure 27: Typical Representative Spatial Radiation Pattern for White Lambertian.

Typical Polar Radiation Pattern for White Lambertian

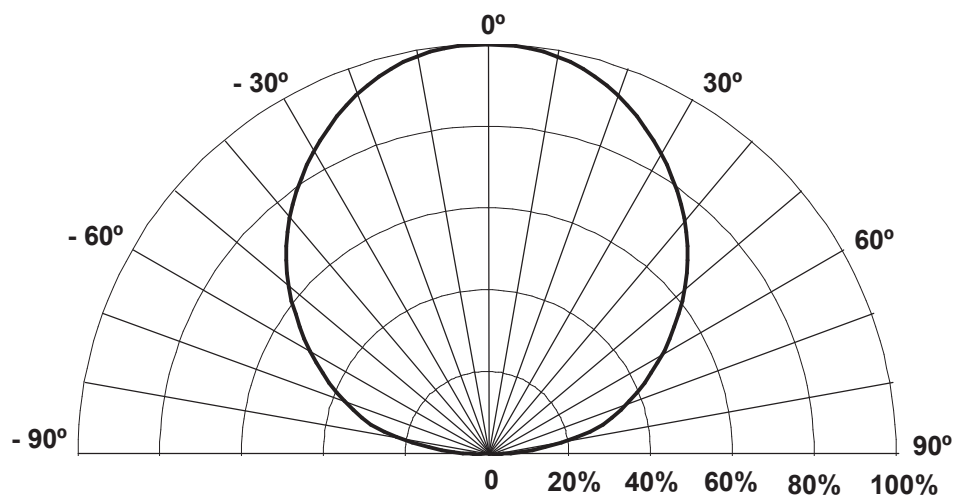


Figure 28: Typical Polar Radiation Pattern for White Lambertian.

Typical Representative Spatial Radiation Pattern for Green, Cyan, Blue and Royal Blue Lambertian

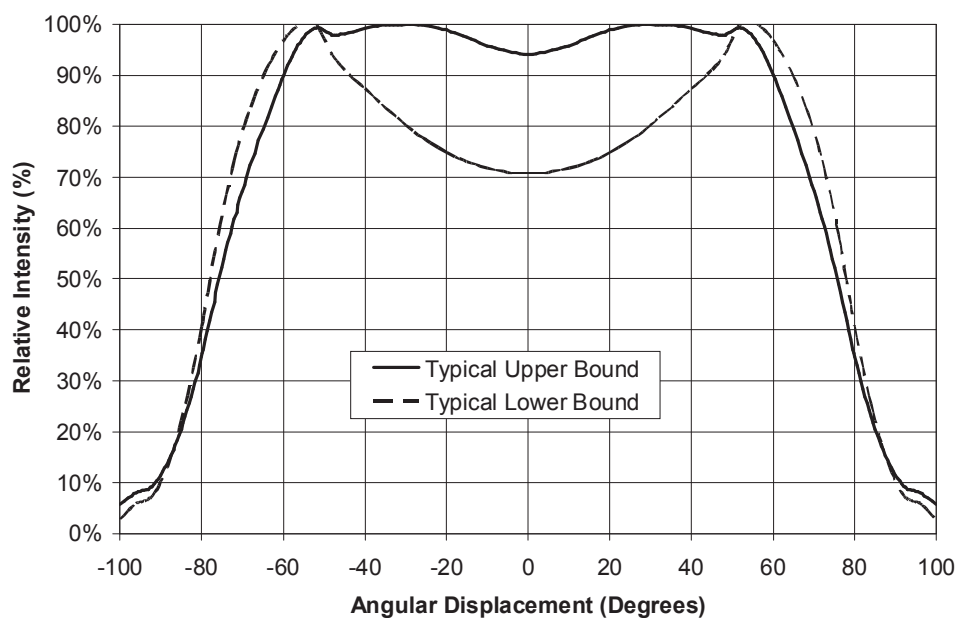


Figure 29: Typical Representative Spatial Radiation Pattern for Green, Cyan, Blue and Royal Blue Lambertian.

Typical Polar Radiation Pattern for Green, Cyan, Blue and Royal Blue Lambertian

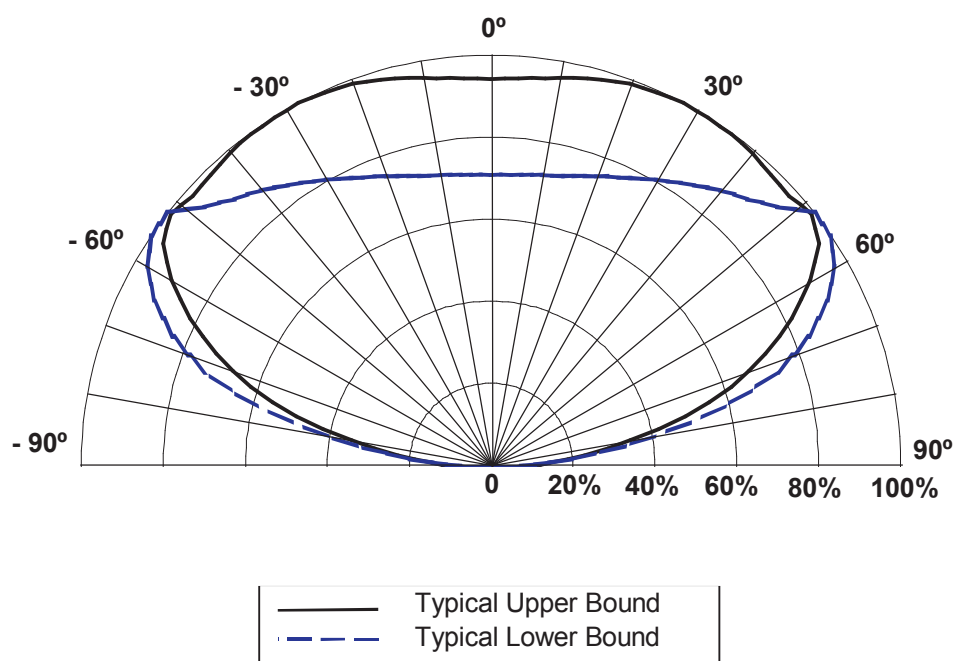


Figure 30: Typical Polar Radiation Pattern for Green, Cyan, Blue and Royal Blue Lambertian.

Typical Representative Spatial Radiation Pattern for Red, Red-Orange and Amber Lambertian

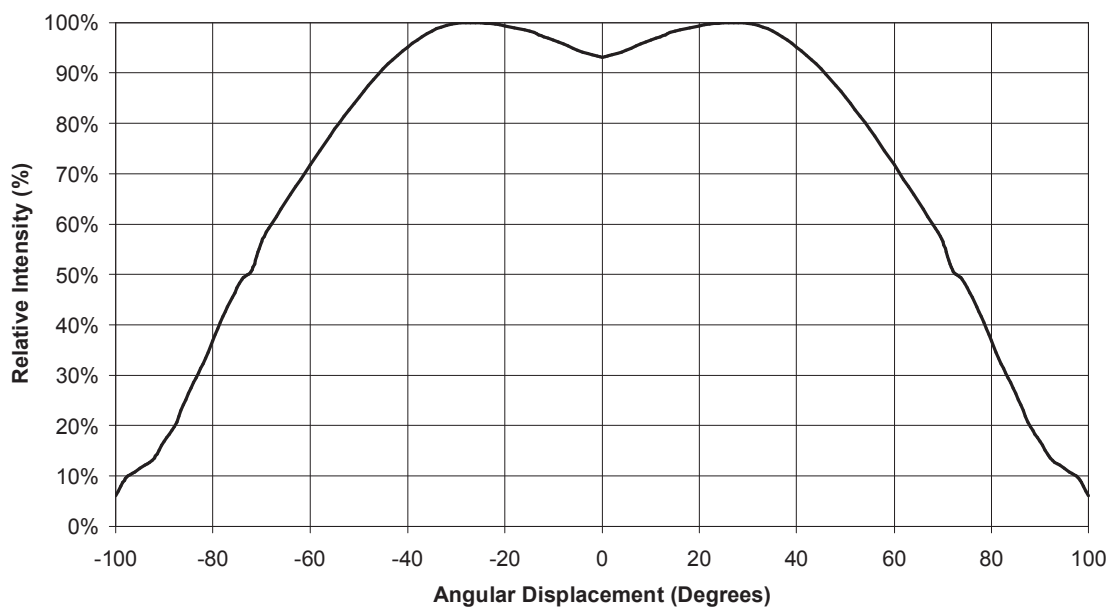


Figure 31: Typical Representative Spatial Radiation Pattern for Red, Red_Orange and Amber Lambertian.

Typical Polar Radiation Pattern for Red, Red-Orange and Amber Lambertian

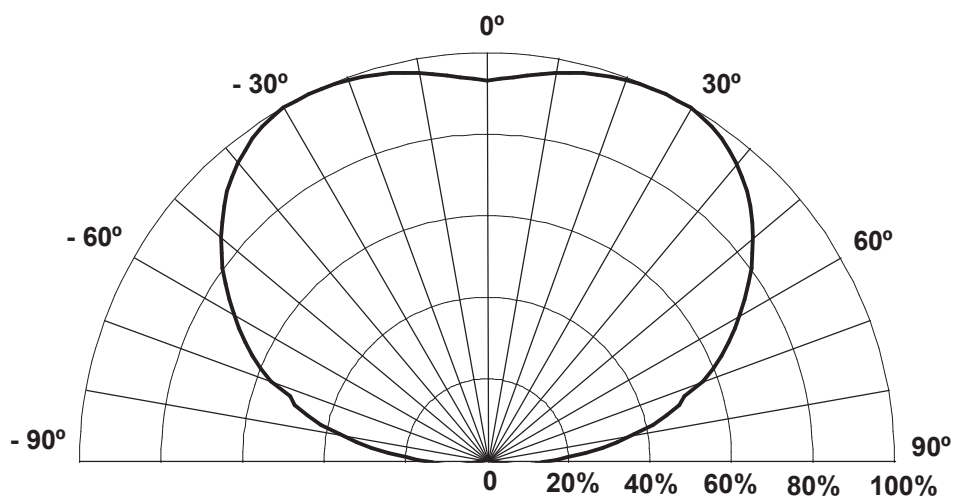
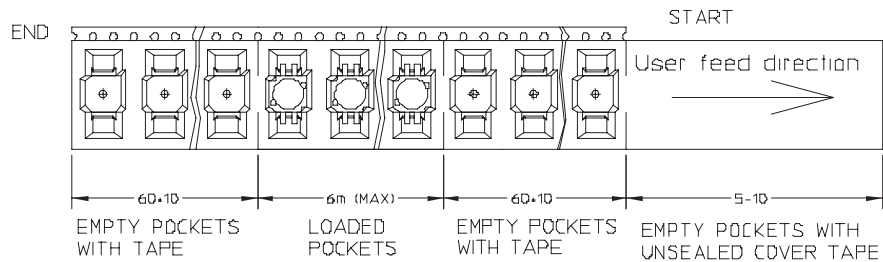


Figure 32: Typical Polar Radiation Pattern for Red, Red-Orange and Amber Lambertian.



White Binning Information

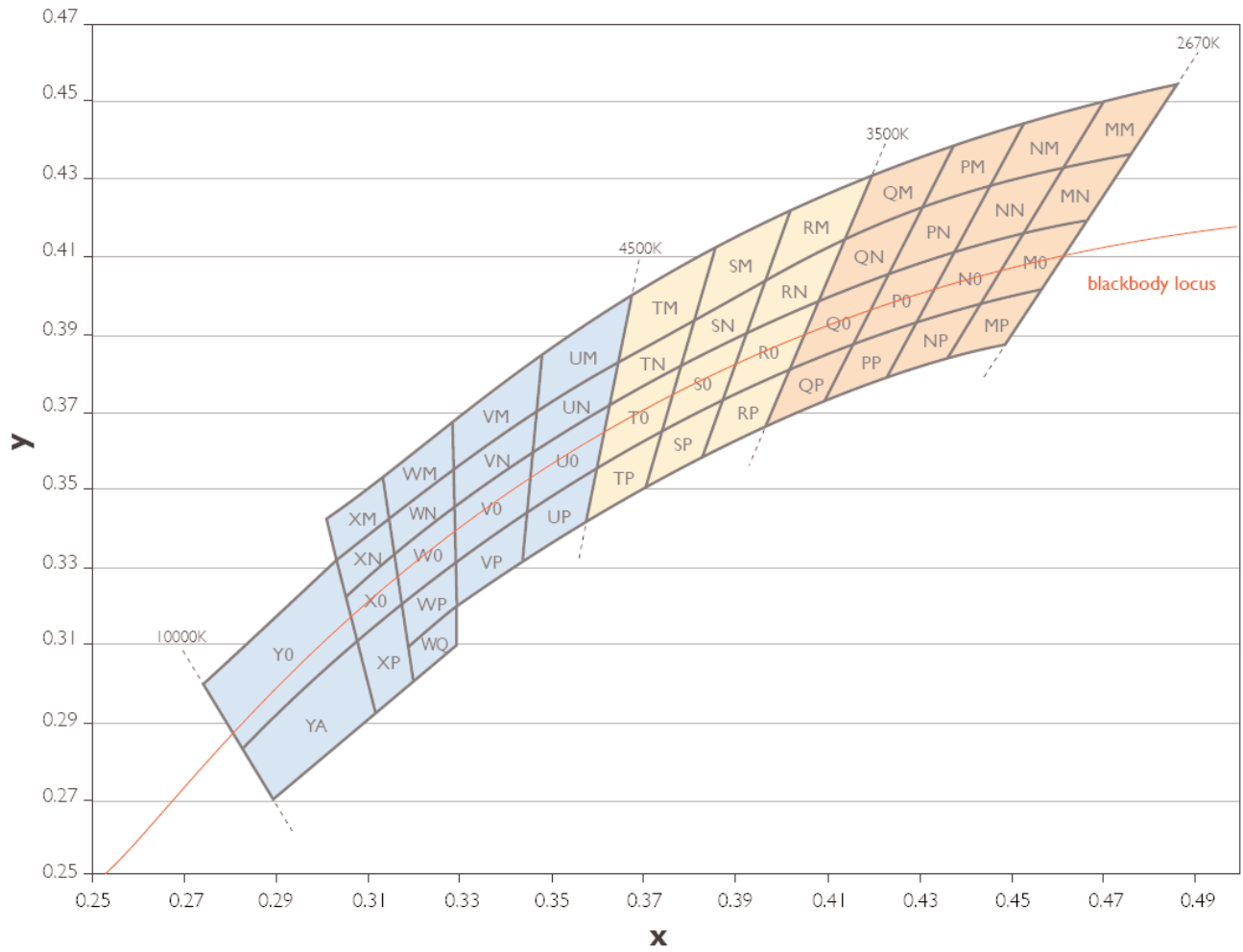


Figure 33: White Binning Structure

LUXEON K2 Cool-White Bin Structure

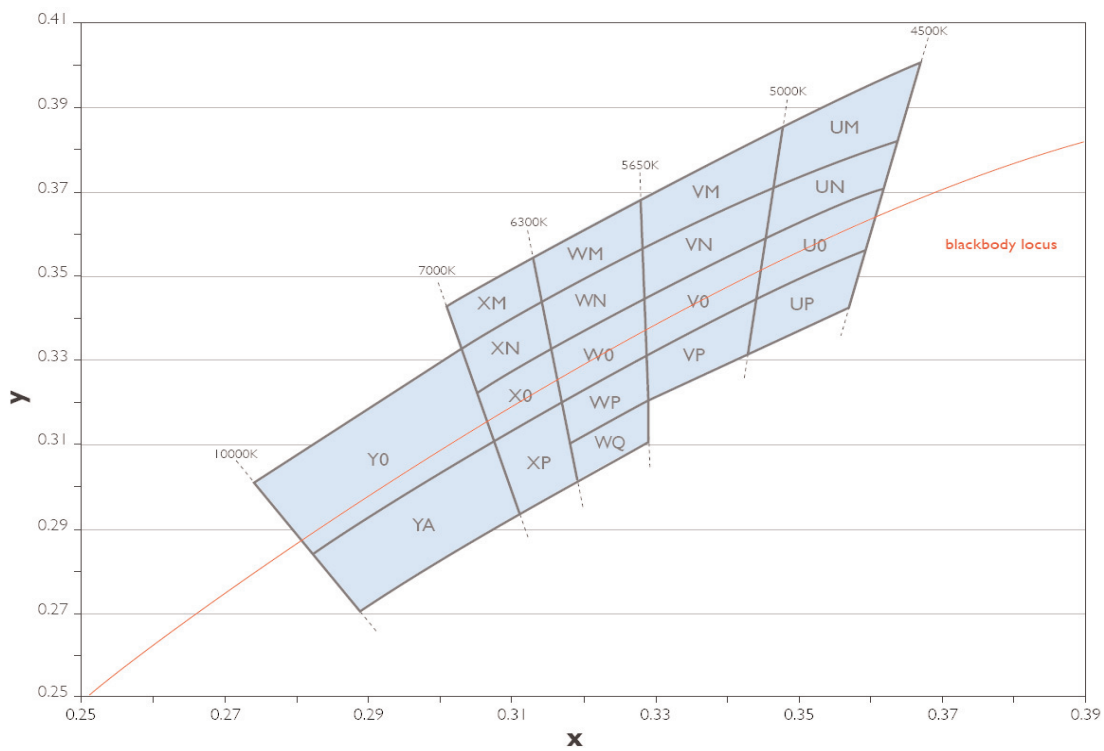


Figure 34: Cool-White Bin Structure

LUXEON K2 Cool-White Bin Structure, Continued

Cool-White LUXEON K2 Emitters are tested and binned by x,y coordinates.

19 Color Bins, CCT Range 10,000K to 4,500K

Table 11.

| Cool White Bin Structure | | | | | | | |
|--------------------------|----------|----------|-----------------|----------|----------|----------|-----------------|
| Bin Code | X | Y | Typical CCT (K) | Bin Code | X | Y | Typical CCT (K) |
| Y0 | 0.274238 | 0.300667 | 8000 | WQ | 0.318606 | 0.310201 | 6000 |
| | 0.303051 | 0.332708 | | | 0.329393 | 0.320211 | |
| | 0.307553 | 0.310778 | | | 0.329544 | 0.310495 | |
| | 0.282968 | 0.283772 | | | 0.319597 | 0.301303 | |
| YA | 0.282968 | 0.283772 | 8000 | VM | 0.328636 | 0.368952 | 5300 |
| | 0.307553 | 0.310778 | | | 0.348147 | 0.385629 | |
| | 0.311163 | 0.293192 | | | 0.346904 | 0.371742 | |
| | 0.289922 | 0.270316 | | | 0.328823 | 0.356917 | |
| XM | 0.301093 | 0.342244 | 6700 | VN | 0.328823 | 0.356917 | 5300 |
| | 0.313617 | 0.354992 | | | 0.346904 | 0.371742 | |
| | 0.314792 | 0.344438 | | | 0.345781 | 0.359190 | |
| | 0.303051 | 0.332708 | | | 0.329006 | 0.345092 | |
| XN | 0.303051 | 0.332708 | 6700 | V0 | 0.329006 | 0.345092 | 5300 |
| | 0.314792 | 0.344438 | | | 0.345781 | 0.359190 | |
| | 0.316042 | 0.333222 | | | 0.344443 | 0.344232 | |
| | 0.305170 | 0.322386 | | | 0.329220 | 0.331331 | |
| X0 | 0.305170 | 0.322386 | 6700 | VP | 0.329220 | 0.331331 | 5300 |
| | 0.316042 | 0.333222 | | | 0.344443 | 0.344232 | |
| | 0.317466 | 0.320438 | | | 0.343352 | 0.332034 | |
| | 0.307553 | 0.310778 | | | 0.329393 | 0.320211 | |
| XP | 0.307553 | 0.310778 | 6700 | UM | 0.348147 | 0.385629 | 4750 |
| | 0.317466 | 0.320438 | | | 0.367294 | 0.400290 | |
| | 0.319597 | 0.301303 | | | 0.364212 | 0.382878 | |
| | 0.311163 | 0.293192 | | | 0.346904 | 0.371742 | |
| WM | 0.313617 | 0.354992 | 6000 | UN | 0.346904 | 0.371742 | 4750 |
| | 0.328636 | 0.368952 | | | 0.364212 | 0.382878 | |
| | 0.328823 | 0.356917 | | | 0.362219 | 0.371616 | |
| | 0.314792 | 0.344438 | | | 0.345781 | 0.359190 | |
| WN | 0.314792 | 0.344438 | 6000 | U0 | 0.345781 | 0.359190 | 4750 |
| | 0.328823 | 0.356917 | | | 0.362219 | 0.371616 | |
| | 0.329006 | 0.345092 | | | 0.359401 | 0.355699 | |
| | 0.316042 | 0.333222 | | | 0.344443 | 0.344232 | |
| W0 | 0.316042 | 0.333222 | 6000 | UP | 0.344443 | 0.344232 | 4750 |
| | 0.329006 | 0.345092 | | | 0.359401 | 0.355699 | |
| | 0.329220 | 0.331331 | | | 0.357079 | 0.342581 | |
| | 0.317466 | 0.320438 | | | 0.343352 | 0.332034 | |
| WP | 0.317466 | 0.320438 | 6000 | | | | |
| | 0.329220 | 0.331331 | | | | | |
| | 0.329393 | 0.320211 | | | | | |
| | 0.318606 | 0.310201 | | | | | |

Note for Table 11:

1. Philips Lumileds maintains a tester tolerance of ± 0.005 on x, y color coordinates.

LUXEON K2 Neutral-White Bin Structure

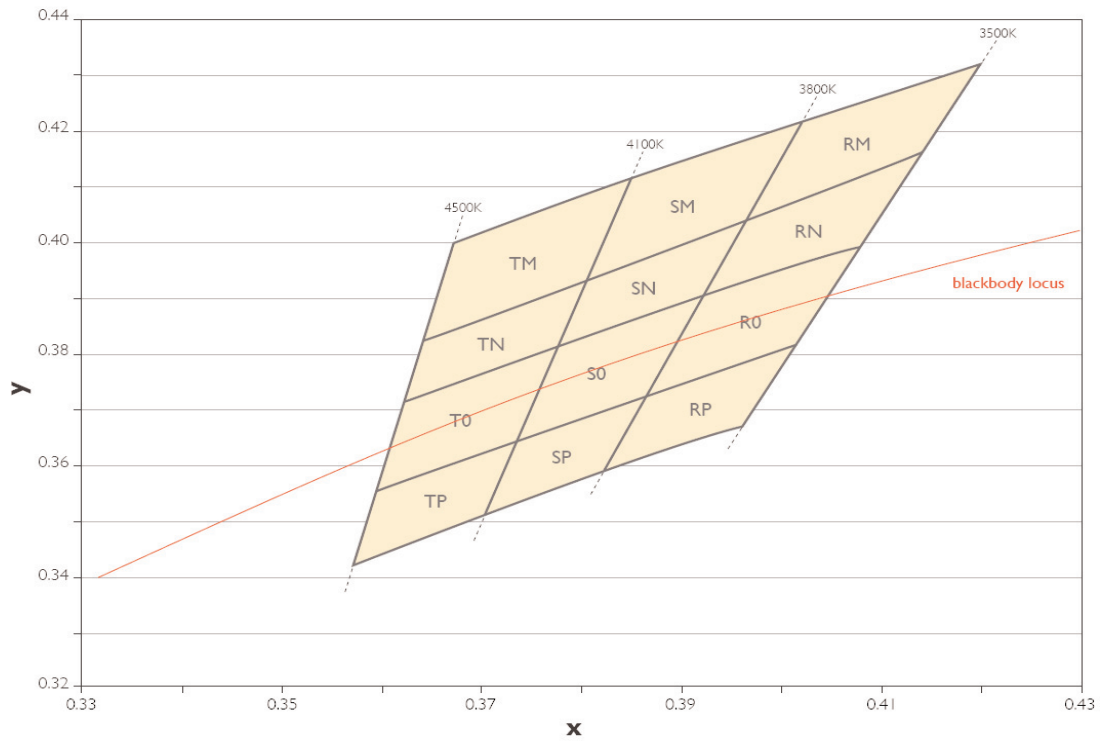


Figure 35: Neutral-White Bin Structure.

LUXEON K2 Neutral-White Bin Structure, Continued

Neutral-White LUXEON K2 Emitters are tested and binned by x,y coordinates.
12 Color Bins, CCT Range 4,500K to 3,500K

Table 12.

| Neutral-White Bin Structure | | | | | | | |
|-----------------------------|----------|----------|-----------------|----------|----------|----------|-----------------|
| Bin Code | X | Y | Typical CCT (K) | Bin Code | X | Y | Typical CCT (K) |
| TM | 0.367294 | 0.400290 | 4300 | S0 | 0.378264 | 0.382458 | 3950 |
| | 0.385953 | 0.412995 | | | 0.392368 | 0.390932 | |
| | 0.381106 | 0.393747 | | | 0.387071 | 0.373899 | |
| | 0.364212 | 0.382878 | | | 0.374075 | 0.365822 | |
| TN | 0.364212 | 0.382878 | 4300 | SP | 0.374075 | 0.365822 | 3950 |
| | 0.381106 | 0.393747 | | | 0.387071 | 0.373899 | |
| | 0.378264 | 0.382458 | | | 0.382598 | 0.359515 | |
| | 0.362219 | 0.371616 | | | 0.370582 | 0.351953 | |
| T0 | 0.362219 | 0.371616 | 4300 | RM | 0.402270 | 0.422776 | 3650 |
| | 0.378264 | 0.382458 | | | 0.420940 | 0.432618 | |
| | 0.374075 | 0.365822 | | | 0.414776 | 0.416097 | |
| | 0.359401 | 0.355699 | | | 0.396279 | 0.403508 | |
| TP | 0.359401 | 0.355699 | 4300 | RN | 0.396279 | 0.403508 | 3650 |
| | 0.374075 | 0.365822 | | | 0.414776 | 0.416097 | |
| | 0.370582 | 0.351953 | | | 0.408593 | 0.399525 | |
| | 0.357079 | 0.342581 | | | 0.392368 | 0.390932 | |
| SM | 0.385953 | 0.412995 | 3950 | R0 | 0.392368 | 0.390932 | 3650 |
| | 0.402270 | 0.422776 | | | 0.408593 | 0.399525 | |
| | 0.396279 | 0.403508 | | | 0.402113 | 0.382156 | |
| | 0.381106 | 0.393747 | | | 0.387071 | 0.373899 | |
| SN | 0.381106 | 0.393747 | 3950 | RP | 0.387071 | 0.373899 | 3650 |
| | 0.396279 | 0.403508 | | | 0.402113 | 0.382156 | |
| | 0.392368 | 0.390932 | | | 0.396564 | 0.367284 | |
| | 0.378264 | 0.382458 | | | 0.382598 | 0.359515 | |

Note for Table 12:

1. Philips Lumileds maintains a tester tolerance of ± 0.005 on x, y color coordinates.

LUXEON K2 Warm-White Bin Structure

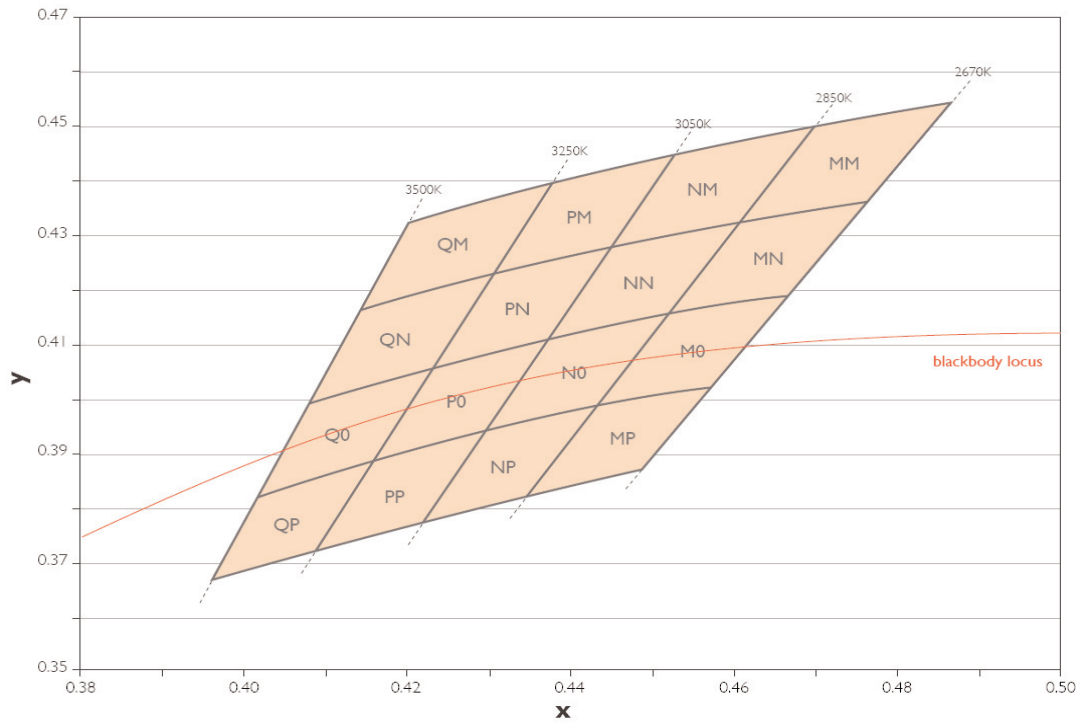


Figure 36: Warm-White Bin Structure.

LUXEON K2 Warm-White Bin Structure, Continued

Warm-White LUXEON K2 Emitters are tested and binned by x,y coordinates.
16 Color Bins, CCT Range 3,500K to 2,670K

Table 13.

| Warm-White Bin Structure | | | | | | | |
|--------------------------|----------|----------|-----------------|----------|----------|----------|-----------------|
| Bin Code | X | Y | Typical CCT (K) | Bin Code | X | Y | Typical CCT (K) |
| QM | 0.420940 | 0.432618 | 3375 | NM | 0.453820 | 0.445980 | 2950 |
| | 0.438458 | 0.440399 | | | 0.470507 | 0.450832 | |
| | 0.431186 | 0.423386 | | | 0.461404 | 0.433334 | |
| | 0.414776 | 0.416097 | | | 0.445639 | 0.428680 | |
| QN | 0.414776 | 0.416097 | 3375 | NN | 0.445639 | 0.428680 | 2950 |
| | 0.431186 | 0.423386 | | | 0.461404 | 0.433334 | |
| | 0.423956 | 0.406472 | | | 0.452512 | 0.416241 | |
| | 0.408593 | 0.399525 | | | 0.437578 | 0.411632 | |
| QO | 0.408593 | 0.399525 | 3375 | NO | 0.437578 | 0.411632 | 2950 |
| | 0.423956 | 0.406472 | | | 0.452512 | 0.416241 | |
| | 0.416487 | 0.389001 | | | 0.443600 | 0.399111 | |
| | 0.402113 | 0.382156 | | | 0.429373 | 0.394281 | |
| QP | 0.402113 | 0.382156 | 3375 | NP | 0.429373 | 0.394281 | 2950 |
| | 0.416487 | 0.389001 | | | 0.443600 | 0.399111 | |
| | 0.409996 | 0.373814 | | | 0.435591 | 0.383714 | |
| | 0.396564 | 0.367284 | | | 0.422124 | 0.378952 | |
| PM | 0.438458 | 0.440399 | 3150 | MM | 0.470507 | 0.450832 | 2760 |
| | 0.453820 | 0.445980 | | | 0.486648 | 0.454191 | |
| | 0.445639 | 0.428680 | | | 0.476733 | 0.436634 | |
| | 0.431186 | 0.423386 | | | 0.461404 | 0.433334 | |
| PN | 0.431186 | 0.423386 | 3150 | MN | 0.461404 | 0.433334 | 2760 |
| | 0.445639 | 0.428680 | | | 0.476733 | 0.436634 | |
| | 0.437578 | 0.411632 | | | 0.467132 | 0.419632 | |
| | 0.423956 | 0.406472 | | | 0.452512 | 0.416241 | |
| PO | 0.423956 | 0.406472 | 3150 | MO | 0.452512 | 0.416241 | 2760 |
| | 0.437578 | 0.411632 | | | 0.467132 | 0.419632 | |
| | 0.429373 | 0.394281 | | | 0.457663 | 0.402866 | |
| | 0.416487 | 0.389001 | | | 0.443600 | 0.399111 | |
| PP | 0.416487 | 0.389001 | 3150 | MP | 0.443600 | 0.399111 | 2760 |
| | 0.429373 | 0.394281 | | | 0.457663 | 0.402866 | |
| | 0.422124 | 0.378952 | | | 0.448994 | 0.387515 | |
| | 0.409996 | 0.373814 | | | 0.435591 | 0.383714 | |

Note for Table 13:

1. Philips Lumileds maintains a tester tolerance of ± 0.005 on x, y color coordinates.



Company Information

Philips Lumileds Lighting Company is a world class supplier of Light Emitting Diodes (LEDs) and produces billions of LEDs annually. 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 as well as production capabilities in San Jose, Penang Malaysia and Singapore. Founded in 1999, Philips Lumileds is the high-flux LED technology leader and is dedicated to bridging the gap between solid-state LED technology and the lighting world. Philips Lumileds technologies, LEDs and systems are enabling new applications and markets in the lighting world.

Philips Lumileds may make process or materials changes affecting the performance or other characteristics of our products. These products supplied after such changes will continue to meet published specifications, but may not be identical to products supplied as samples or under prior orders.



WWW.LUXEON.COM
WWW.LUMILEDSFUTURE.COM

FOR TECHNICAL ASSISTANCE OR THE
LOCATION OF YOUR NEAREST SALES
OFFICE CONTACT ANY OF THE
FOLLOWING:

NORTH AMERICA:
1 888 589 3662
AMERICAS@FUTURELIGHTINGSOLUTIONS.COM

EUROPE:
00 800 443 88 873
EUROPE@FUTURELIGHTINGSOLUTIONS.COM

ASIA PACIFIC:
800 5864 5337
ASIA@FUTURELIGHTINGSOLUTIONS.COM

JAPAN:
800 5864 5337
JAPAN@FUTURELIGHTINGSOLUTIONS.COM