

# Agilent HLMP-ALxx, HLMP-BLxx, HLMP-ADxx, HLMP-BDxx, HLMP-BB11, HLMP-BM11 T-1<sup>3</sup>/<sub>4</sub> (5 mm) Oval Precision Optical Performance AlInGaP and InGaN Lamps Data Sheet



## Description

These Precision Optical Performance Oval LEDs are specifically designed for full color/video and passenger information signs. The oval shaped radiation pattern (35° x 70°) and high luminous intensity ensure that these devices are excellent for wide field of view outdoor application where a wide viewing angle and readability in sunlight are essential. These lamps have very smooth, matched radiation patterns ensuring consistent color mixing in full color applications, message uniformity across the viewing angle of the sign.

High efficiency LED material is used in these lamps: Aluminum Indium Gallium Phosphide (AlInGaP) for amber and red, and Indium Gallium Nitride (InGaN) for blue and green. Each lamp is made with an advance optical grade epoxy offering superior high temperature and high moisture resistance in outdoor applications. The package epoxy contains both UV-A and UV-B inhibitors to reduce the effects of long term exposure to direct sunlight.

Designers can select parallel or perpendicular orientation. Both lamps are available in tinted version.

## Features

- Well defined spatial radiation pattern
- Viewing angles:  
Major axis 70°  
Minor axis 35°
- High luminous output
- AllInGaP II (brightest) intensity level
- Colors:  
472 nm blue  
526 nm green  
626 nm red  
630 nm red  
590 nm amber  
592 nm amber
- Superior resistance to moisture
- UV resistant epoxy

## Benefits

- Viewing angle designed for wide field of view application
- Red, green, and blue radiation patterns matched for full color sign
- Superior performance in outdoor environments

## Applications

- Full color/video signs

**CAUTION:** The blue and green LEDs are Class 1 ESD sensitive. Please observe appropriate precautions during handling and processing. Refer to Agilent Application Note AN-1142 for additional details.



**Table 1. Device Selection Guide for AlInGaP II**

| <b>Part Number</b> | <b>Color and Dominant Wavelength <math>\lambda_d</math> (nm) Typ.</b> | <b>Luminous Intensity, <math>I_v</math> (mcd) Min.</b> | <b>Luminous Intensity, <math>I_v</math> (mcd) Max.</b> | <b>Forward Voltage, <math>V_f</math> (V) Max.</b> | <b>Leads with Stand-offs</b> | <b>Leadframe Orientation</b> | <b>Package Drawing</b> |
|--------------------|---|--|--|---|------------------------------|------------------------------|------------------------|
| HLMP-AD06-P00xx    | Red 630   | 765  |  | 2.4   | No                           | Parallel                     | A                      |
| HLMP-AD06-P0Txx    | Red 630   | 765  |  | 2.4   | No                           | Parallel                     | A                      |
| HLMP-AD16-P00xx    | Red 630   | 765  |  | 2.4   | Yes                          | Parallel                     | B                      |
| HLMP-AD16-P0Txx    | Red 630   | 765  |  | 2.4   | Yes                          | Parallel                     | B                      |
| HLMP-AD16-RS0xx    | Red 630   | 1300   | 2900   | 2.6   | Yes                          | Parallel                     | B                      |
| HLMP-AD16-RSTxx    | Red 630   | 1300   | 2900   | 2.6   | Yes                          | Parallel                     | B                      |
| HLMP-AD16-RU0xx    | Red 630   | 1300   | 4800   | 2.4   | Yes                          | Parallel                     | B                      |
| HLMP-AD16-RUTxx    | Red 630   | 1300   | 4800   | 2.6   | Yes                          | Parallel                     | B                      |
| HLMP-AD16-ST0xx    | Red 630   | 1650   | 3700   | 2.4   | Yes                          | Parallel                     | B                      |
| HLMP-AD16-STTxx    | Red 630   | 1650   | 3700   | 2.6   | Yes                          | Parallel                     | B                      |
| HLMP-AL06-L00xx    | Amber 592   | 345  |  | 2.4   | No                           | Parallel                     | A                      |
| HLMP-AL06-L0Rxx    | Amber 592   | 345  |  | 2.6   | No                           | Parallel                     | A                      |
| HLMP-AL06-N00xx    | Amber 592   | 590  |  | 2.4   | No                           | Parallel                     | A                      |
| HLMP-AL06-N0Rxx    | Amber 592   | 590  |  | 2.6   | No                           | Parallel                     | A                      |
| HLMP-AL16-N00xx    | Amber 592   | 590  |  | 2.4   | Yes                          | Parallel                     | B                      |
| HLMP-AL16-N0Rxx    | Amber 592   | 590  |  | 2.6   | Yes                          | Parallel                     | B                      |
| HLMP-AL16-PSRxx    | Amber 592   | 765  | 2900   | 2.6   | Yes                          | Parallel                     | B                      |
| HLMP-AL16-QR0xx    | Amber 592   | 1000   | 2200   | 2.4   | Yes                          | Parallel                     | B                      |
| HLMP-AL16-QRRxx    | Amber 592   | 1000   | 2200   | 2.6   | Yes                          | Parallel                     | B                      |
| HLMP-BD06-P00xx    | Red 630   | 765  |  | 2.4   | No                           | Perpendicular                | C                      |
| HLMP-BD06-P0Txx    | Red 630   | 765  |  | 2.6   | No                           | Perpendicular                | C                      |
| HLMP-BD06-RS0xx    | Red 630   | 1300   | 2900   | 2.4   | No                           | Perpendicular                | C                      |
| HLMP-BD06-RSTxx    | Red 630   | 1300   | 2900   | 2.6   | No                           | Perpendicular                | C                      |
| HLMP-BD16-P00xx    | Red 630   | 765  |  | 2.4   | Yes                          | Perpendicular                | D                      |
| HLMP-BD16-P0Txx    | Red 630   | 765  |  | 2.6   | Yes                          | Perpendicular                | D                      |
| HLMP-BD16-RU0xx    | Red 630   | 1300   | 4800   | 2.4   | Yes                          | Perpendicular                | D                      |
| HLMP-BD16-RUTxx    | Red 630   | 1300   | 4800   | 2.6   | Yes                          | Perpendicular                | D                      |
| HLMP-BD16-ST0xx    | Red 630   | 1650   | 3700   | 2.4   | Yes                          | Perpendicular                | D                      |
| HLMP-BD16-STTxx    | Red 630   | 1650   | 3700   | 2.6   | Yes                          | Perpendicular                | D                      |
| HLMP-BL06-N00xx    | Amber 592   | 590  |  | 2.4   | No                           | Perpendicular                | C                      |
| HLMP-BL06-N0Rxx    | Amber 592   | 590  |  | 2.6   | No                           | Perpendicular                | C                      |
| HLMP-BL06-QRKxx    | Amber 592   | 1000   | 2200   | 2.4   | No                           | Perpendicular                | C                      |
| HLMP-BL06-QRSxx    | Amber 592   | 1000   | 2200   | 2.6   | No                           | Perpendicular                | C                      |
| HLMP-BL16-N00xx    | Amber 592   | 590  |  | 2.4   | Yes                          | Perpendicular                | D                      |
| HLMP-BL16-N0Rxx    | Amber 592   | 590  |  | 2.6   | Yes                          | Perpendicular                | D                      |
| HLMP-BL16-PS0xx    | Amber 592   | 765  | 2900   | 2.4   | Yes                          | Perpendicular                | D                      |
| HLMP-BL16-PSRxx    | Amber 592   | 765  | 2900   | 2.6   | Yes                          | Perpendicular                | D                      |

**Table 2. LED Indicators  
Device Selection Guide for AlInGaP**

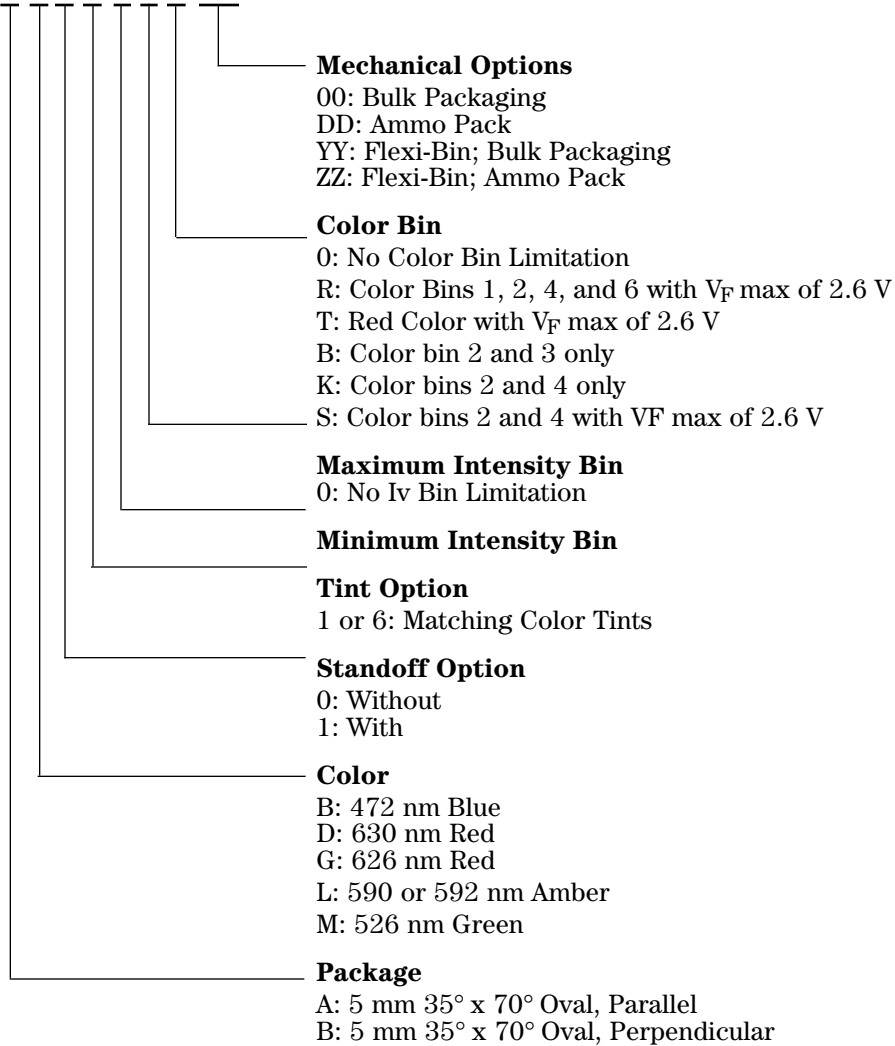
| <b>Part Number</b> | <b>Color and Dominant Wavelength <math>\lambda_d</math> (nm) Typ.</b> | <b>Luminous Intensity, <math>I_v</math> (mcd) Min.</b> | <b>Luminous Intensity, <math>I_v</math> (mcd) Max.</b> | <b>Leads with Stand-offs</b> | <b>Leadframe Orientation</b> | <b>Package Drawing</b> |
|--------------------|---|--|--|------------------------------|------------------------------|------------------------|
| HLMP-AG01-K00xx    | Red 626   | 270  |  | No                           | Parallel                     | A                      |
| HLMP-AG11-KN0xx    | Red 626   | 270  | 1010   | Yes                          | Parallel                     | B                      |
| HLMP-AL01-K00xx    | Amber 590   | 270  |  | No                           | Parallel                     | A                      |
| HLMP-AL01-LP0xx    | Amber 590   | 345  | 1330   | No                           | Parallel                     | A                      |
| HLMP-AL01-NR0xx    | Amber 590   | 590  | 2200   | No                           | Parallel                     | A                      |
| HLMP-AL11-KN0xx    | Amber 590   | 270  | 1010   | Yes                          | Parallel                     | B                      |
| HLMP-AL11-NR0xx    | Amber 590   | 590  | 2200   | Yes                          | Parallel                     | B                      |
| HLMP-BG01-MN0xx    | Red 626   | 450  | 1010   | No                           | Perpendicular                | C                      |
| HLMP-BG11-KN0xx    | Red 626   | 270  | 1010   | Yes                          | Perpendicular                | D                      |
| HLMP-BL01-NR0xx    | Amber 590   | 590  | 2200   | No                           | Perpendicular                | C                      |
| HLMP-BL11-KN0xx    | Amber 590   | 270  | 1010   | Yes                          | Perpendicular                | D                      |
| HLMP-BL11-NR0xx    | Amber 590   | 590  | 2200   | Yes                          | Perpendicular                | D                      |

**Table 3. Device Selection Guide for InGaN**

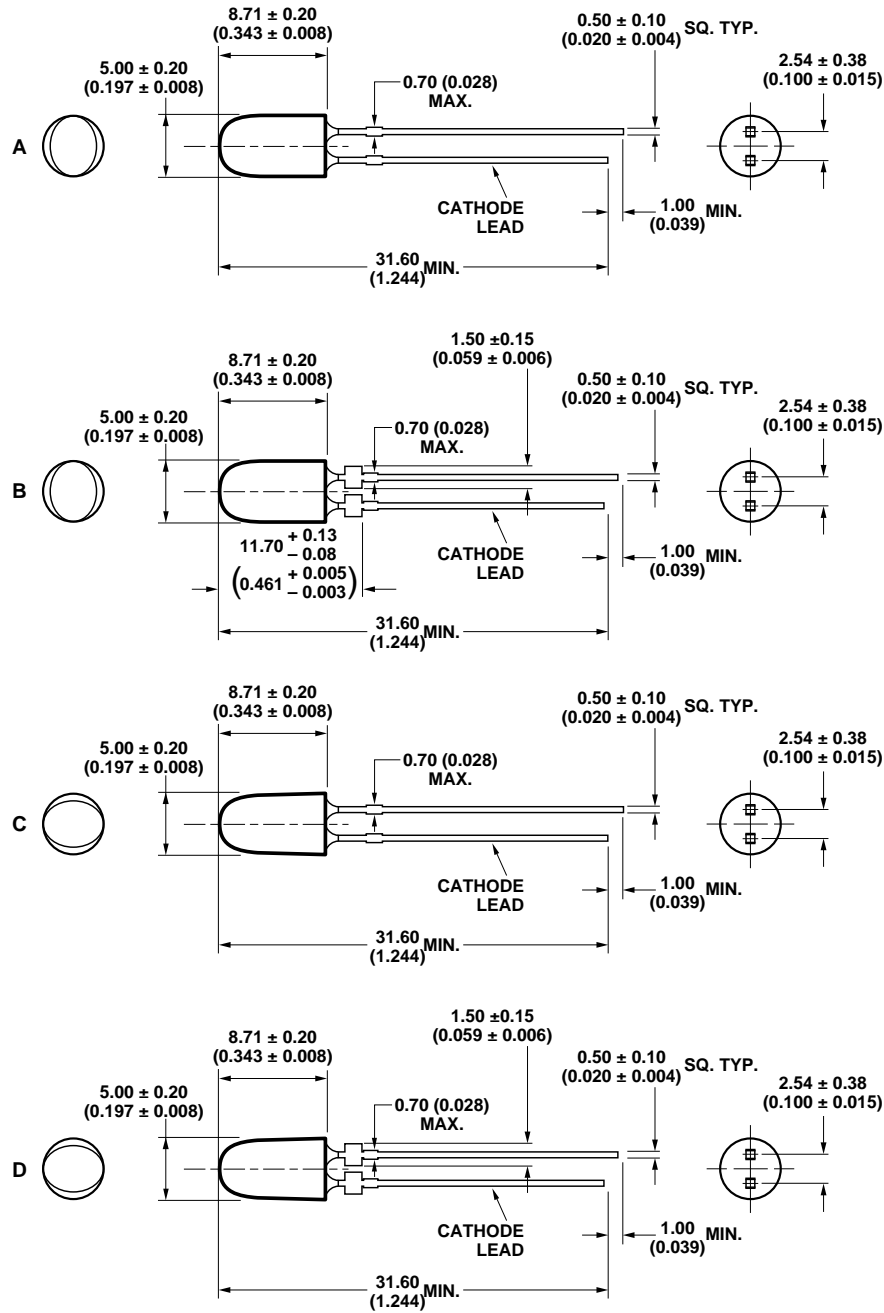
| <b>Part Number</b> | <b>Color and Dominant Wavelength <math>\lambda_d</math> (nm) Typ.</b> | <b>Luminous Intensity, <math>I_v</math> (mcd) Min.</b> | <b>Leads with Stand-offs</b> | <b>Leadframe Orientation</b> | <b>Package Drawing</b> |
|--------------------|---|--|------------------------------|------------------------------|------------------------|
| HLMP-AB01-J00xx    | Blue 472  | 205  | No                           | Parallel                     | A                      |
| HLMP-BB11-J00xx    | Blue 472  | 205  | Yes                          | Perpendicular                | D                      |
| HLMP-BB11-K00xx    | Blue 472  | 270  | Yes                          | Perpendicular                | D                      |
| HLMP-BM11-L00xx    | Green 526   | 345  | Yes                          | Perpendicular                | D                      |
| HLMP-BM11-Q00xx    | Green 526   | 1000   | Yes                          | Perpendicular                | D                      |

## Part Numbering System

HLMP-X X X X-X X X X X



## Package Dimensions



### NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS (INCHES).
- LEADS ARE MILD STEEL, SOLDER DIPPED.
- TAPERS SHOWN AT TOP OF LEADS (BOTTOM OF LAMP PACKAGE) INDICATE AN EPOXY MENISCUS THAT MAY EXTEND ABOUT 1 mm (0.040 IN.) DOWN THE LEADS.
- RECOMMENDED PC BOARD HOLE DIAMETERS:
  - LAMP PACKAGES A AND C WITHOUT STAND-OFFS: FLUSH MOUNTING AT BASE OF LAMP PACKAGE = 1.143/1.067 mm (0.044/0.042 IN.).
  - LAMP PACKAGES B AND D WITH STAND-OFFS: MOUNTING AT LEAD STAND-OFFS.

**Absolute Maximum Ratings at T<sub>A</sub> = 25°C**

| Parameter                                 | Blue and Green      | Red and Amber       |
|---|---------------------|---------------------|
| DC Forward Current <sup>[1]</sup>         | 30 mA               | 50 mA               |
| Peak Pulsed Forward Current               | 100 mA              | 100 mA              |
| Average Forward Current                   | 30 mA               | 30 mA               |
| Reverse Voltage (I <sub>R</sub> = 100 μA) |                     | 5 V                 |
| Reverse Voltage (I <sub>R</sub> = 10 μA)  | 5 V                 |                     |
| Power Dissipation                         | 120 mW              | 120 mW              |
| LED Junction Temperature                  | 130°C               | 130°C               |
| Operating Temperature Range               | -40°C to +80°C      | -40°C to +100°C     |
| Storage Temperature Range                 | -40°C to +100°C     | -40°C to +120°C     |
| Soldering Temperature                     | 260°C for 5 seconds | 260°C for 5 seconds |

**Electrical/Optical Characteristics at T<sub>A</sub> = 25°C**

| Parameter                       | Symbol              | Min. | Typ. | Max. | Units | Test Conditions   |
|---------------------------------|---------------------|------|------|------|-------|---|
| Typical Viewing Angle           |                     |      |      |      |       |   |
| Major                           | 2θ <sub>1/2</sub>   |      | 70   |      | deg   |   |
| Minor                           |                     |      | 35   |      |       |   |
| Forward Voltage                 | V <sub>F</sub>      |      |      |      |       | I <sub>F</sub> = 20 mA  |
| Amber (λ <sub>d</sub> = 592 nm) |                     |      | 2.15 | 2.60 | V     |   |
| Red (λ <sub>d</sub> = 630 nm)   |                     |      | 2.00 | 2.60 |       |   |
| Blue (λ <sub>d</sub> = 472 nm)  |                     |      | 3.5  | 4.0  |       |   |
| Green (λ <sub>d</sub> = 526 nm) |                     |      | 3.5  | 4.0  |       |   |
| Reverse Voltage                 |                     |      |      |      |       |   |
| Amber, Red                      | V <sub>R</sub>      | 5    | 20   |      | V     | I <sub>R</sub> = 100 μA   |
| Blue, Green                     |                     | 5    | –    |      |       | I <sub>R</sub> = 10 μA  |
| Peak Wavelength                 |                     |      |      |      |       |   |
| Amber (λ <sub>d</sub> = 592 nm) | λ <sub>peak</sub>   |      | 594  |      | nm    | Peak of Wavelength of Spectral Distribution at I <sub>F</sub> = 20 mA               |
| Red (λ <sub>d</sub> = 630 nm)   |                     |      | 639  |      |       |   |
| Blue (λ <sub>d</sub> = 472 nm)  |                     |      | 470  |      |       |   |
| Green (λ <sub>d</sub> = 526 nm) |                     |      | 524  |      |       |   |
| Spectral Halfwidth              |                     |      |      |      |       |   |
| Amber (λ <sub>d</sub> = 592 nm) | Δλ <sub>1/2</sub>   |      | 17   |      | nm    | Wavelength Width at Spectral Distribution 1/2 Power Point at I <sub>F</sub> = 20 mA |
| Red (λ <sub>d</sub> = 630 nm)   |                     |      | 17   |      |       |   |
| Blue (λ <sub>d</sub> = 472 nm)  |                     |      | 35   |      |       |   |
| Green (λ <sub>d</sub> = 526 nm) |                     |      | 47   |      |       |   |
| Capacitance                     |                     |      |      |      |       | V <sub>F</sub> = 0, F = 1 MHz   |
| Amber, Red                      | C                   |      | 40   |      | pF    |   |
| Blue, Green                     |                     |      | 43   |      |       |   |
| Luminous Efficacy               |                     |      |      |      |       |   |
| Amber (λ <sub>d</sub> = 592 nm) | η <sub>v</sub>      |      | 500  |      | lm/W  | Emitted Luminous Power/Emitted Radiant Power at I <sub>F</sub> = 20 mA              |
| Red (λ <sub>d</sub> = 630 nm)   |                     |      | 155  |      |       |   |
| Blue (λ <sub>d</sub> = 472 nm)  |                     |      | 75   |      |       |   |
| Green (λ <sub>d</sub> = 526 nm) |                     |      | 520  |      |       |   |
| Thermal Resistance              | R <sub>ΘJ-PIN</sub> |      | 240  |      | °C/W  | LED Junction-to-Cathode Lead  |

**Notes:**

- 2θ<sub>1/2</sub> is the off-axis angle where the luminous intensity is 1/2 the on-axis intensity.
- The radiant intensity, I<sub>e</sub> in watts per steradian, may be found from the equation I<sub>e</sub> = I<sub>v</sub>/η<sub>v</sub>, where I<sub>v</sub> is the luminous intensity in candelas and η<sub>v</sub> is the luminous efficacy in lumens/watt.
- The luminous intensity is measured on the mechanical axis of the lamp package.
- The optical axis is closely aligned with the package mechanical axis.
- The dominant wavelength λ<sub>d</sub> is derived from the CIE Chromaticity Diagram and represents the color of the lamp.

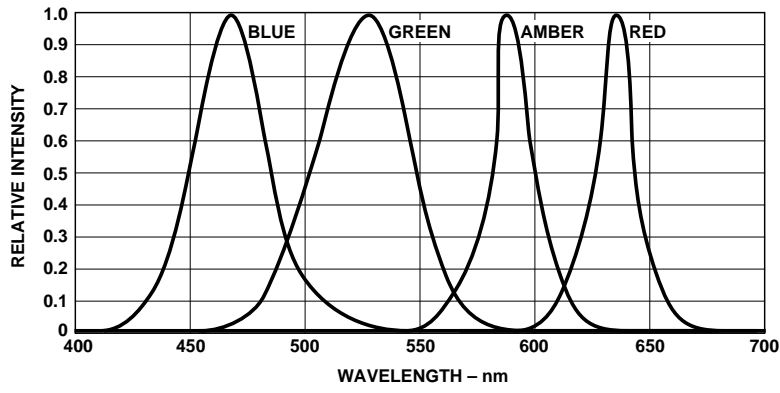


Figure 1. Relative intensity vs. wavelength.

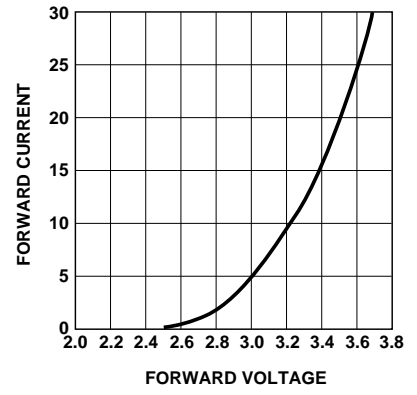


Figure 2. Blue, green forward current vs. forward voltage.

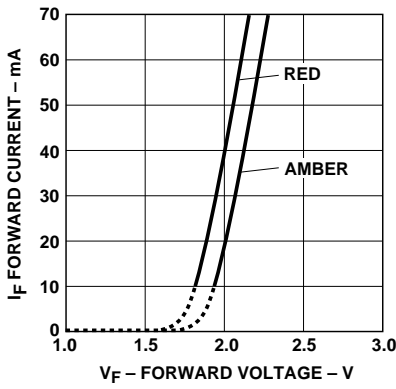


Figure 3. Amber, red forward current vs. forward voltage.

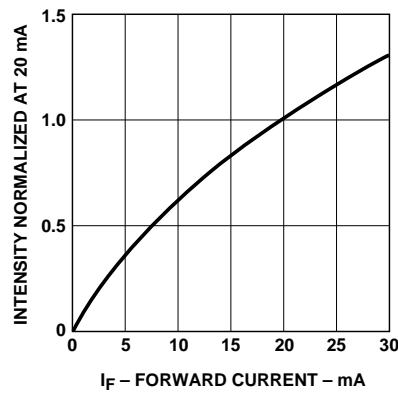


Figure 4. Blue, green relative luminous intensity vs. forward current.

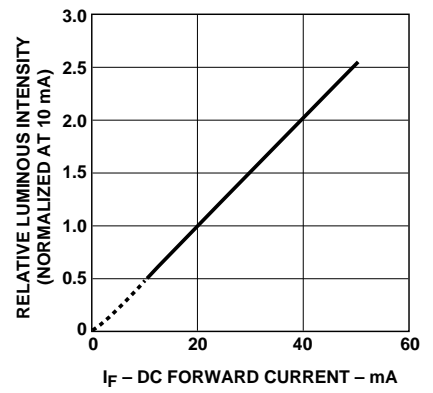


Figure 5. Amber, red relative luminous intensity vs. forward current.

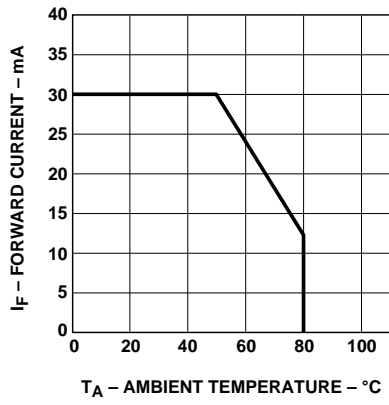


Figure 6. Blue, green maximum forward current vs. ambient temperature.

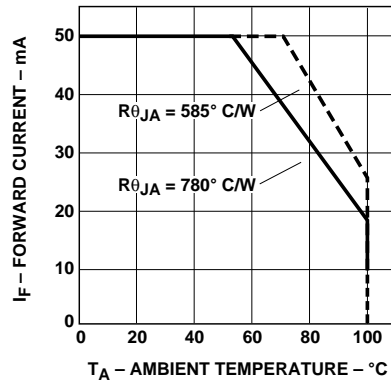


Figure 7. Amber, red maximum forward current vs. ambient temperature.

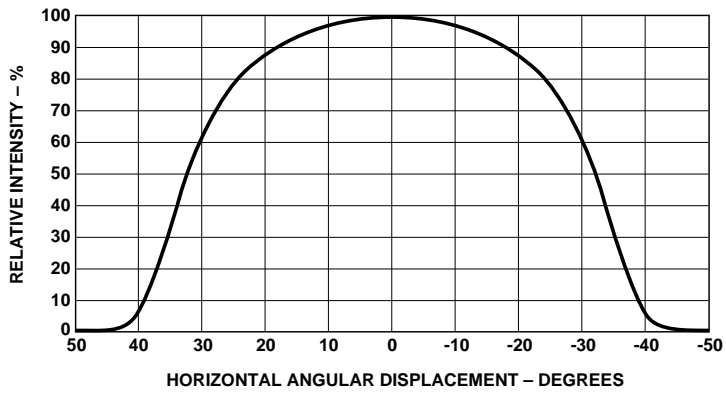
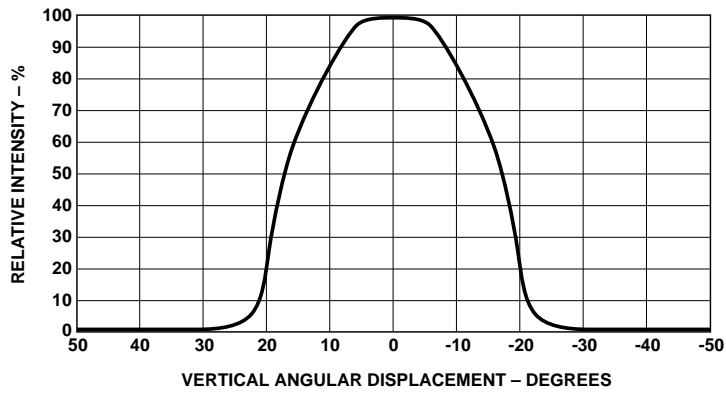


Figure 8. Spatial radiation pattern – 35 x 70 degree lamps.



**Intensity Bin Limits  
(mcd at 20 mA)**

| Bin Name | Min. | Max. |
|----------|------|------|
| G        | 140  | 180  |
| H        | 180  | 240  |
| J        | 240  | 310  |
| K        | 310  | 400  |
| L        | 400  | 520  |
| M        | 520  | 680  |
| N        | 680  | 880  |
| P        | 880  | 1150 |
| Q        | 1150 | 1500 |
| R        | 1500 | 1900 |
| S        | 1900 | 2500 |

Tolerance for each bin limit is  $\pm 15\%$ .

**Amber Color Bin Limits  
(nm at 20 mA)**

| Bin Name | Min.  | Max.  |
|----------|-------|-------|
| 1        | 584.5 | 587.0 |
| 2        | 587.0 | 589.5 |
| 4        | 589.5 | 592.0 |
| 6        | 592.0 | 594.5 |

Tolerance for each bin limit is  $\pm 0.5$  nm.

**Blue Color Bin Limits  
(nm at 20 mA)**

| Bin Name | Min.  | Max.  |
|----------|-------|-------|
| 1        | 460.0 | 464.0 |
| 2        | 464.0 | 468.0 |
| 3        | 468.0 | 472.0 |
| 4        | 472.0 | 476.0 |
| 5        | 476.0 | 480.0 |

Tolerance for each bin limit is  $\pm 2$  nm.

**Green Color Bin Limits  
(nm at 20 mA)**

| Bin Name | Min.  | Max.  |
|----------|-------|-------|
| 1        | 520.0 | 524.0 |
| 2        | 524.0 | 528.0 |
| 3        | 528.0 | 532.0 |
| 4        | 532.0 | 536.0 |
| 5        | 536.0 | 540.0 |

Tolerance for each bin limit is  $\pm 0.5$  nm.

**Note:**

1. All bin categories are established for classification of products. Products may not be available in all bin categories. Please contact your Agilent representative for further information.

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