# HLMP-ELxx
# HLMP-EHxx
# HLMP-EDxx

Precision Optical Performance AlInGaP II LED Lamps

## Data Sheet

### Description

Precision Optical Performance AlInGaP II (aluminum indium gallium phosphide) LEDs offer superior light output for excellent readability in sunlight and dependable performance. The AlInGaP II technology provides extremely stable light output over long periods of time.

These LED lamps are untinted, nondiffused, T-1$^3/_4$ packages incorporating second generation optics which produce well defined radiation patterns at specific viewing cone angles.

These lamps are made with an advanced optical grade epoxy offering superior high temperature and high moisture resistance performance in outdoor signal and sign applications. The maximum LED junction temperature limit of +130° C enables high temperature operation in bright sunlight conditions. The epoxy contains both uv-a and uv-b inhibitors to reduce the effects of long term exposure to direct sunlight.

### Features

- **Well defined spatial radiation patterns**
- **Viewing angles: 15°, 23°, 30°**
- **High luminous output**
- **Colors:**
  - 592 nm Amber
  - 617 nm Reddish-Orange
  - 630 nm Red
- **High operating temperature:**
  **$T_{JLED}$ = +130°C**
- **Superior resistance to moisture**

### Benefits

- **Viewing angles match traffic management requirements**
- **Colors meet automotive and traffic signal specifications**
- **Superior light output performance in outdoor environments**
- **Suitable for autoinsertion into PC boards**

### Applications

- **Traffic management:**
  - Traffic signals
  - Work zone warning lights
  - Variable message signs
- **Commercial outdoor advertising:**
  - Signs
  - Marquees
- **Automotive:**
  - Exterior and interior lights

**T-1 3/4 (5 mm) Precision Optical Performance AlInGaP II LED Lamps**
**Selection Guide**

| Typical Viewing Angle $2\theta_{1/2}$ (Deg.)[2] | Color and Dominant Wavelength (nm), Typ.[1] | Lamps Without Standoffs (Outline Drawing A) | Lamps With Standoffs (Outline Drawing B) | Luminous Intensity Iv (mcd)[3,4,5] @ I(f) = 20 mA Min. | Max. |
|---|---|---|---|---|---|
| 15° | Amber 592 | HLMP-EL16-TW000 | HLMP-EL18-TW000 | 2500 | 7200 |
| | | HLMP-EL16-TWR00 | HLMP-EL18-TWR00 | 2500 | 7200 |
| | | HLMP-EL16-TWK00* | | 2500 | 7200 |
| | | HLMP-EL16-TWS00 | | 2500 | 7200 |
| | | HLMP-EL16-TUS00 | | 2500 | 4200 |
| | | HLMP-EL16-TV400** | | 2500 | 5500 |
| | | HLMP-EL16-TVU00 | | 2500 | 5500 |
| | | HLMP-EL16-UX000 | HLMP-EL18-UX000 | 3200 | 9300 |
| | | HLMP-EL16-UXR00 | HLMP-EL18-UXR00 | 3200 | 9300 |
| | | HLMP-EL16-VW000 | | 4200 | 7200 |
| | | HLMP-EL16-VWR000 | | 4200 | 7200 |
| | | HLMP-EL16-VWK00* | | 4200 | 7200 |
| | | HLMP-EL16-VWS00 | | 4200 | 7200 |
| | | HLMP-EL16-VX000 | | 4200 | 9300 |
| | | HLMP-EL16-VXR00 | | 4200 | 9300 |
| | | HLMP-EL16-VX400** | | 4200 | 9300 |
| | | HLMP-EL16-VXK00* | | 4200 | 9300 |
| | | HLMP-EL16-VXS00 | | 4200 | 9300 |
| | | HLMP-EL16-VY000 | HLMP-EL18-VY000 | 4200 | 12000 |
| | | HLMP-EL16-VYR00 | HLMP-EL18-VYR00 | 4200 | 12000 |
| | | HLMP-EL16-VYK00* | | 4200 | 12000 |
| | | HLMP-EL16-VYS00 | | 4200 | 12000 |
| | Red-Orange 615 | | HLMP-EH18-TW000 | 2500 | 7200 |
| | | HLMP-EH16-UX000 | HLMP-EH18-UX000 | 3200 | 9300 |
| | Red 630 | HLMP-ED16-TW000 | HLMP-ED18-TW000 | 2500 | 7200 |
| | | HLMP-ED16-TWT00 | HLMP-ED18-TWT00 | 2500 | 7200 |
| | | HLMP-ED16-UX000 | HLMP-ED18-UX000 | 3200 | 9300 |
| | | HLMP-ED16-UXT00 | HLMP-ED18-UXT00 | 3200 | 9300 |

**T-1 3/4 (5 mm) Precision Optical Performance AlInGaP II Led Lamps (Continued)**
**Selection Guide**

| Typical Viewing Angle $2\theta_{1/2}$ (Deg.)[2] | Color and Dominant Wavelength (nm), Typ.[1] | Lamps Without Standoffs (Outline Drawing A) | Lamps With Standoffs (Outline Drawing B) | Luminous Intensity Iv (mcd)[3,4] @ I(f) = 20 mA Min. | Max. |
|---|---|---|---|---|---|
| 23° | Amber 592 | HLMP-EL25-QS400** | | 1150 | 2500 |
| | | HLMP-EL25-QSU00 | | 1150 | 2500 |
| | | HLMP-EL25-QSK00* | | 1150 | 2500 |
| | | HLMP-EL25-QSS00 | | 1150 | 2500 |
| | | HLMP-EL25-QT000 | | 1150 | 3200 |
| | | HLMP-EL25-QTR00 | HLMP-EL27-QTR00 | 1150 | 3200 |
| | | HLMP-EL25-RU000 | HLMP-EL27-RU000 | 1500 | 4200 |
| | | HLMP-EL25-RUR00 | HLMP-EL27-RUR00 | 1500 | 4200 |
| | | HLMP-EL25-RUK00* | | 1500 | 4200 |
| | | HLMP-EL25-RUS00 | | 1500 | 4200 |
| | | HLMP-EL25-ST000 | | 1900 | 3200 |
| | | HLMP-EL25-STR00 | | 1900 | 3200 |
| | | HLMP-EL25-STK00* | | 1900 | 3200 |
| | | HLMP-EL25-STS00 | | 1900 | 3200 |
| | | HLMP-EL25-SU000 | | 1900 | 4200 |
| | | HLMP-EL25-SUR00 | | 1900 | 4200 |
| | | HLMP-EL25-SU400** | | 1900 | 4200 |
| | | HLMP-EL25-SUU00 | | 1900 | 4200 |
| | | HLMP-EL25-SUK00* | | 1900 | 4200 |
| | | HLMP-EL25-SUS00 | | 1900 | 4200 |
| | | HLMP-EL25-SVK00* | | 1900 | 5500 |
| | | HLMP-EL25-SVS00 | | 1900 | 5500 |
| | | HLMP-EL25-SV000 | HLMP-EL27-SV000 | 1900 | 5500 |
| | | HLMP-EL25-SVR00 | HLMP-EL27-SVR00 | 1900 | 5500 |
| | | HLMP-EL25-TW000 | HLMP-EL27-TW000 | 2500 | 7200 |
| | | HLMP-EL25-TWR00 | HLMP-EL27-TWR00 | 2500 | 7200 |
| | | HLMP-EL25-TWK00* | | 2500 | 7200 |
| | | HLMP-EL25-TWS00 | | 2500 | 7200 |

**Notes:**
1. Dominant Wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the lamp.
2. $\theta_{1/2}$ is the off-axis angle where the luminous intensity is one half the on-axis intensity.
3. The luminous intensity is measured on the mechanical axis of the lamp package.
4. The optical axis is closely aligned with the package mechanical axis.
5. Tolerance for each intensity bin limit is ± 15%.

Part numbers in **bold** are recommended for new designs.
*HLMP-xLxx-xxK00 are selected to amber color bins 2 and 4 only.
**HLMP-xLxx-xx400 are selected to amber color bin 4 only.

**T-1 3/4 (5 mm) Precision Optical Performance AlInGaP II Led Lamps (Continued)**
**Selection Guide**

| Typical Viewing Angle $2\theta_{1/2}$ (Deg.)[2] | Color and Dominant Wavelength (nm), Typ.[1] | Lamps Without Standoffs (Outline Drawing A) | Lamps With Standoffs (Outline Drawing B) | Luminous Intensity Iv (mcd)[3,4] @ I(f) = 20 mA Min. | Max. |
|---|---|---|---|---|---|
| 23° | Red-Orange 615 | HLMP-EH25-QT000 | | 1150 | 3200 |
| | | HLMP-EH25-RU000 | | 1500 | 4200 |
| | | | HLMP-EH27-SV000 | 1900 | 5500 |
| | | HLMP-EH25-TW000 | HLMP-EH27-TW000 | 2500 | 7200 |
| | Red 630 | HLMP-ED25-QT000 | | 1150 | 3200 |
| | | HLMP-ED25-QTT00 | | 1150 | 3200 |
| | | HLMP-ED25-RU000 | HLMP-ED27-RU000 | 1500 | 4200 |
| | | HLMP-ED25-RUT00 | HLMP-ED27-RUT00 | 1500 | 4200 |
| | | HLMP-ED25-SV000 | HLMP-ED27-SV000 | 1900 | 5500 |
| | | HLMP-ED25-SVT00 | HLMP-ED27-SVT00 | 1900 | 5500 |
| | | HLMP-ED25-TW000 | HLMP-ED27-TW000 | 2500 | 7200 |
| | | HLMP-ED25-TWT00 | HLMP-ED27-TWT00 | 2500 | 7200 |
| 30° | Amber 592 | HLMP-EL31-QRS00 | | 1150 | 1900 |
| | | HLMP-EL31-QS000 | | 1150 | 2500 |
| | | HLMP-EL31-QSR00 | | 1150 | 2500 |
| | | HLMP-EL31-QS400** | | 1150 | 2500 |
| | | HLMP-EL31-QSU00 | | 1150 | 2500 |
| | | HLMP-EL31-QT000 | HLMP-EL33-QT000 | 1150 | 3200 |
| | | HLMP-EL31-QTR00 | HLMP-EL33-QTR00 | 1150 | 3200 |
| | | HLMP-EL31-QTK00* | | 1150 | 3200 |
| | | HLMP-EL31-QTS00 | | 1150 | 3200 |
| | | HLMP-EL31-SV000 | HLMP-EL33-SV000 | 1900 | 5500 |
| | | HLMP-EL31-SVR00 | HLMP-EL33-SVR00 | 1900 | 5500 |
| | | HLMP-EL31-ST000 | | 1900 | 3200 |
| | | HLMP-EL31-STR00 | | 1900 | 3200 |
| | | HLMP-EL31-STK00* | | 1900 | 3200 |
| | | HLMP-EL31-STS00 | | 1900 | 3200 |
| | | HLMP-EL31-SUK00* | | 1900 | 4200 |

**Notes:**
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2. $\theta_{1/2}$ is the off-axis angle where the luminous intensity is one half the on-axis intensity.
3. The luminous intensity is measured on the mechanical axis of the lamp package.
4. The optical axis is closely aligned with the package mechanical axis.
5. Tolerance for each intensity bin limit is ± 15%.

Part numbers in **bold** are recommended for new designs.
*HLMP-xLxx-xxK00 are selected to amber color bins 2 and 4 only.
**HLMP-xLxx-xx400 are selected to amber color bin 4 only.

**T-1 3/4 (5 mm) Precision Optical Performance AlInGaP II Led Lamps (Continued)**
**Selection Guide**

| Typical Viewing Angle $2\theta_{1/2}$ (Deg.)[2] | Color and Dominant Wavelength (nm), Typ.[1] | Lamps Without Standoffs (Outline Drawing A) | Lamps With Standoffs (Outline Drawing B) | Luminous Intensity Iv (mcd)[3,4] @ I(f) = 20 mA Min. | Max. |
|---|---|---|---|---|---|
| 30° | Amber 592 | HLMP-EL31-SUS00 | | 1900 | 4200 |
| | | HLMP-EL31-SU400** | | 1900 | 4200 |
| | | HLMP-EL31-SUU00 | | 1900 | 4200 |
| | | HLMP-EL31-SU000 | | 1900 | 4200 |
| | | HLMP-EL31-SUR00 | | 1900 | 4200 |
| | | HLMP-EL31-SVK00* | | 1900 | 5500 |
| | | HLMP-EL31-SVS00 | | 1900 | 5500 |
| | Red-Orange 615 | HLMP-EH31-PS000 | | 880 | 2500 |
| | | HLMP-EH31-QT000 | HLMP-EH33-QT000 | 1150 | 3200 |
| | | HLMP-EH31-RU000 | HLMP-EH33-RU000 | 1500 | 4200 |
| | | HLMP-EH31-SV000 | HLMP-EH33-SV000 | 1900 | 5500 |
| | | HLMP-EH31-SU000 | | 1900 | 4200 |
| | Red 630 | | HLMP-ED33-QT000 | 1150 | 3200 |
| | | HLMP-ED31-QTT00 | HLMP-ED33-QTT00 | 1150 | 3200 |
| | | HLMP-ED31-ST000 | | 1900 | 3200 |
| | | HLMP-ED31-STT00 | | 1900 | 3200 |
| | | HLMP-ED31-SU000 | | 1900 | 4200 |
| | | HLMP-ED31-SUT00 | | 1900 | 4200 |
| | | HLMP-ED31-RU000 | HLMP-ED33-RU000 | 1500 | 4200 |
| | | HLMP-ED31-RUT00 | HLMP-ED33-RUT00 | 1500 | 4200 |
| | | HLMP-ED31-SV000 | HLMP-ED33-SV000 | 1900 | 5500 |
| | | HLMP-ED31-SVT00 | HLMP-ED33-SVT00 | 1900 | 5500 |

**Notes:**
1. Dominant Wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the lamp.
2. $\theta_{1/2}$ is the off-axis angle where the luminous intensity is one half the on-axis intensity.
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Part numbers in **bold** are recommended for new designs.
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### Part Numbering System

HLMP- x x xx - x x x xx

**Mechanical Options**
00: Bulk Packaging
DD: Ammo Pack
YY: Flexi-Bin, Bulk Packaging
ZZ: Flexi-Bin; Ammo Pack

**Color Bin & $V_F$ Selections**
0: No color bin limitation
4: Amber color bin 4 only
K: Amber color bins 2 and 4 only
L: Color bins 4 and 6
R: Amber color bins 1, 2, 4, and 6 with $V_F$ max of 2.6 V
S: Amber color bins 2 and 4 with $V_F$ max of 2.6 V
T: Red color with $V_F$ max of 2.6 V
U: Amber color bin 4 with $V_F$ max of 2.6 V
W: Color bins 2, 4 and 6 with $V_F$ max of 2.6 V
Y: Color bins 4 and 6 with $V_F$ max of 2.6 V

**Maximum Intensity Bin**
0: No Iv bin limitation

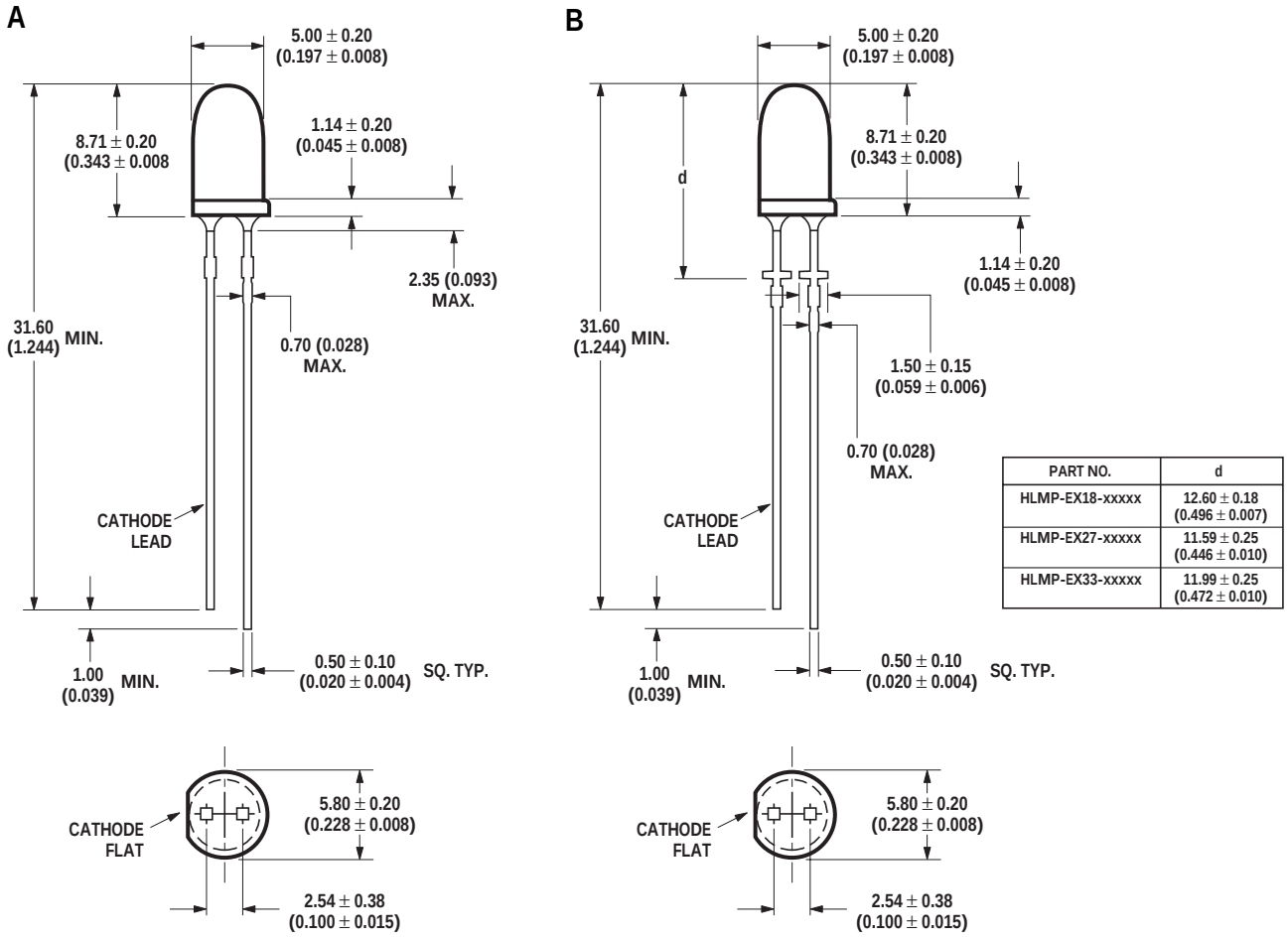
**Minimum Intensity Bin**

**Viewing Angle and Lead Standoffs**
16: 15 degree without lead standoffs
18: 15 degree with lead standoffs
25: 23 degree without lead standoffs
27: 23 degree with lead standoffs
31: 30 degree without lead standoffs
33: 30 degree with lead standoffs

**Color**
D: 630 nm Red
H: 615 nm Red-Orange
L: 592 nm Amber

**Package**
E: 5 mm Round

## Package Dimensions




| PART NO. | d |
|---|---|
| HLMP-EX18-xxxxx | 12.60 ± 0.18 (0.496 ± 0.007) |
| HLMP-EX27-xxxxx | 11.59 ± 0.25 (0.446 ± 0.010) |
| HLMP-EX33-xxxxx | 11.99 ± 0.25 (0.472 ± 0.010) |

### Absolute Maximum Ratings at $T_A$ = 25°C

DC Forward Current[1,2,3] ..... 50 mA
Peak Pulsed Forward Current[2,3] ..... 100 mA
Average Forward Current ..... 30 mA
Reverse Voltage ($I_R$ = 100 μA) ..... 5 V
LED Junction Temperature ..... 130°C
Operating Temperature ..... -40°C to +100°C
Storage Temperature ..... -40°C to +120°C
Wave Solder Temperature ..... 250°C for 3 seconds
Solder Dipping Temperature ..... 260°C for 5 seconds
[1.59 mm (0.060 in.) below body]

**Notes:**

1. Derate linearly as shown in Figure 4.
2. For long term performance with minimal light output degradation, drive currents between 10 mA and 30 mA are recommended. For more information on recommended drive conditions, please refer to Application Brief I-024 (5966-3087E).
3. Please contact your sales representative about operating currents below 10 mA.

**Electrical / Optical Characteristics at $T_A$ = 25°C**

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Forward Voltage | | | | | | $I_F$ = 20 mA |
| Amber ($\lambda_d$ = 592 nm) | | | 2.15 | | | |
| Red-Orange ($\lambda_d$ = 617 nm) | $V_F$ | | 2.08 | 2.4[1] | V | |
| Red ($\lambda_d$ = 630 nm) | | | 2.00 | | | |
| Reverse Voltage | $V_R$ | 5 | 20 | | V | $I_R$ = 100 µA |
| Peak Wavelength | | | | | | Peak of Wavelength of |
| Amber | | | 594 | | | Spectral Distribution |
| Red-Orange | $\lambda_{PEAK}$ | | 623 | | nm | at $I_F$ = 20 mA |
| Red | | | 639 | | | |
| Spectral Halfwidth Distribution | $\Delta\lambda_{1/2}$ | | 17 | | nm | Wavelength Width at Spectral $^1/_2$ Power Point at $I_F$ = 20 mA |
| Speed of Response | $\tau_S$ | | 20 | | ns | Exponential Time Constant, $e^{-t/t_S}$ |
| Capacitance | C | | 40 | | pF | $V_F$ = 0, f = 1 MHz |
| Thermal Resistance | $R\Theta_{J\text{-}PIN}$ | | 240 | | °C/W | LED Junction-to-Cathode Lead |
| Luminous Efficacy[2] | | | | | | Emitted Luminous |
| Amber | | | 500 | | | Power / Emitted Radiant Power |
| Red-Orange | $\eta_v$ | | 235 | | lm/W | at $I_f$ = 20 mA |
| Red | | | 155 | | | |

**Notes:**

1. For options -xxRxx, -xxSxx, -xxTxx, -xxUxx, -xxWxx, -xxYxx, max forward voltage (Vf) is 2.6 V. Refer to Vf bin table.
2. The radiant intensity, $I_e$, in watts per steradian, may be found from the equation $I_e = I_v / \eta_v$, where $I_v$ is the luminous intensity in candelas and $\eta_v$ is the luminous efficacy in lumens / watt.

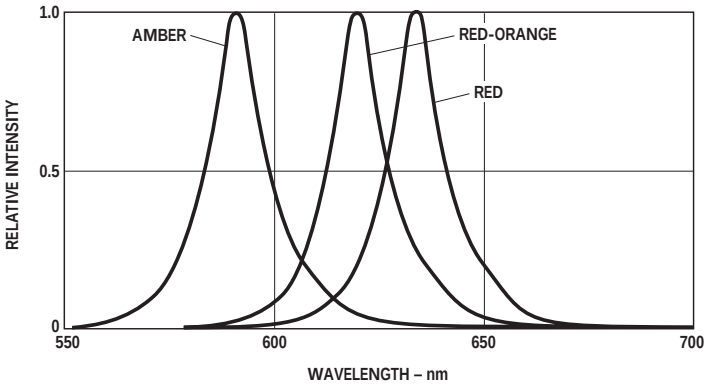



**Figure 1. Relative Intensity vs. Peak Wavelength.**

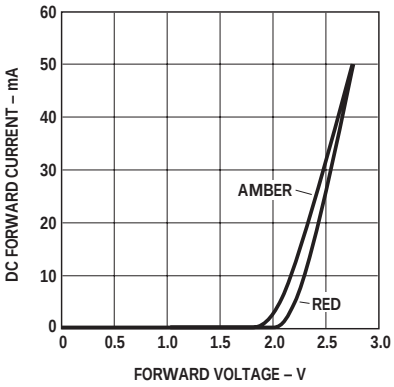



**Figure 2a. Forward Current vs. Forward Voltage for Option -xxRxx, -xxSxx, -xxTxx, -xxUxx, -xxWxx and -xxYxx.**

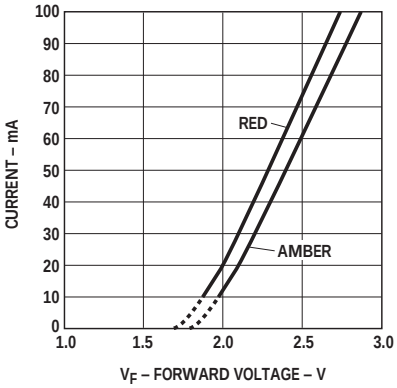



**Figure 2b. Forward Current vs. Forward Voltage.**

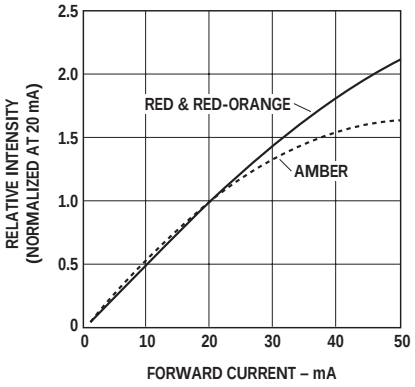



**Figure 3. Relative Luminous Intensity vs. Forward Current.**

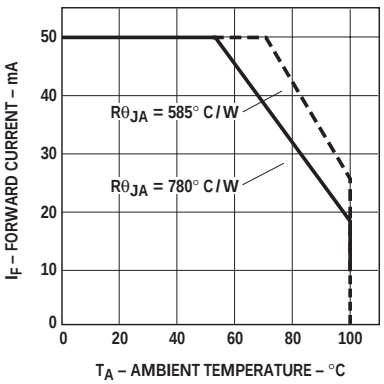



**Figure 4. Maximum Forward Current vs. Ambient Temperature. Derating Based on $T_{JMAX}$ = 130°C.**

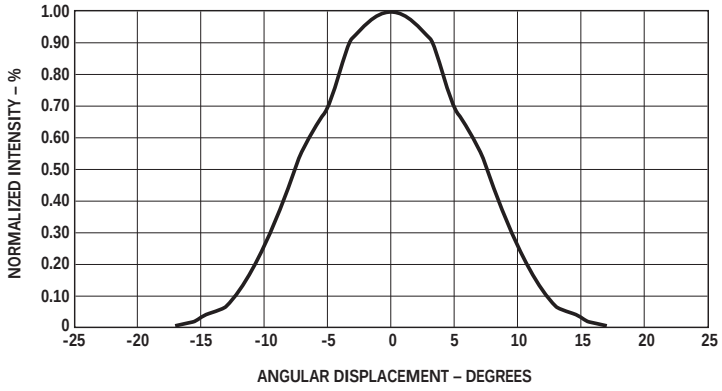



**Figure 5. Representative Spatial Radiation Pattern for 15° Viewing Angle Lamps.**

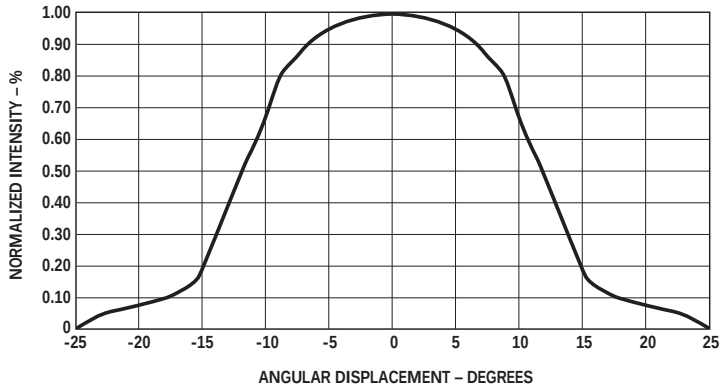



**Figure 6. Representative Spatial Radiation Pattern for 23° Viewing Angle Lamps.**

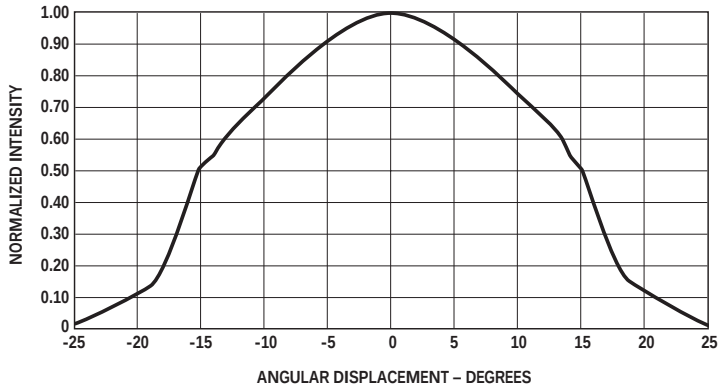



**Figure 7. Representative Spatial Radiation Pattern for 30° Viewing Angle Lamps.**

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

| Bin Name | Min. | Max. |
|---|---|---|
| P | 880 | 1150 |
| Q | 1150 | 1500 |
| R | 1500 | 1900 |
| S | 1900 | 2500 |
| T | 2500 | 3200 |
| U | 3200 | 4200 |
| V | 4200 | 5500 |
| W | 5500 | 7200 |
| X | 7200 | 9300 |
| Y | 9300 | 12000 |
| Z | 12000 | 16000 |

Tolerance for each bin limit is ±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 ±0.5 nm.

**Notes:**
1. Bin categories are established for classification of products. Products may not be available in all bin categories.
2. Vf Bin table only available for those part number with options -xxRxx, -xxSxx, -xxTxx, -xxUxx, -xxWxx, -xxYxx.

**Vf Bin Table[2]**

| Bin Name | Min. | Max. |
|---|---|---|
| VA | 2.0 | 2.2 |
| VB | 2.2 | 2.4 |
| VC | 2.4 | 2.6 |

Tolerance for each bin limit is ±0.05 V.

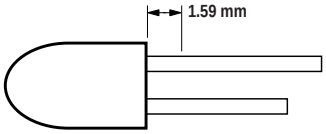
## Precautions

### Lead Forming

- The leads of an LED lamp may be preformed or trimmed to applicable length prior to insertion and soldering on PC board.
- If lead forming is required before soldering, care must be taken to avoid any excessive mechanical stress that is induced into the LED package. Otherwise, trim the leads to applicable length at room temperature after soldering process. The solder joint formed will absorb the mechanical stress, due to the lead cutting, from flowing to the wire bonding area and LED chip die attach.
- For better control, it is recommended to use proper tool to precisely form and cut the leads to applicable length rather than doing it manually.

### Soldering Condition

- Extra care must be taken during PCB assembly and soldering process to prevent damage to the LED component.
- The closest distance of manual soldering from the soldering heat source (soldering iron's tip) to the body is 1.59 mm. Damage might occur if the LED soldering distance is less than 1.59 mm. Please refer to the illustration below.



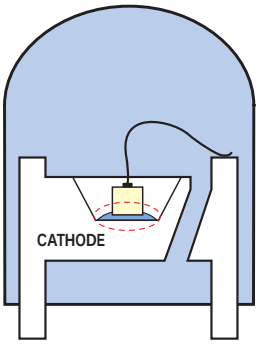

### Recommended Soldering Condition

| | Wave Soldering | Manual Solder Dipping |
|---|---|---|
| Pre-Heat Temperature | 105°C max. | – |
| Pre-Heat Time | 30 sec max. | – |
| Peak Temperature | 250°C max. | 260°C max. |
| Dwell Time | 3 sec max. | 5 sec max. |

- Wave soldering parameter must be set and maintained according to the recommended soldering condition. Customer is advised to daily check on the soldering profile to ensure that the soldering profile is always corresponding to Avago recommended soldering condition.

**Notes:**

1. PCB with different size and design (component density) will have different heat mass (heat capacity). This might cause a change in temperature experienced by the board if same wave soldering setting is used. So, it is recommended to recalibrate the soldering profile again before loading a new type of PCB.
2. Avago Technologies' high brightness LEDs use a high efficiency LED die with single wire bond, as shown below. Customer is advised to take extra precaution during wave soldering to ensure that the maximum wave temperature does not exceed 250°C. Over-stressing the LED during soldering process might cause premature failure to the LED due to delamination.



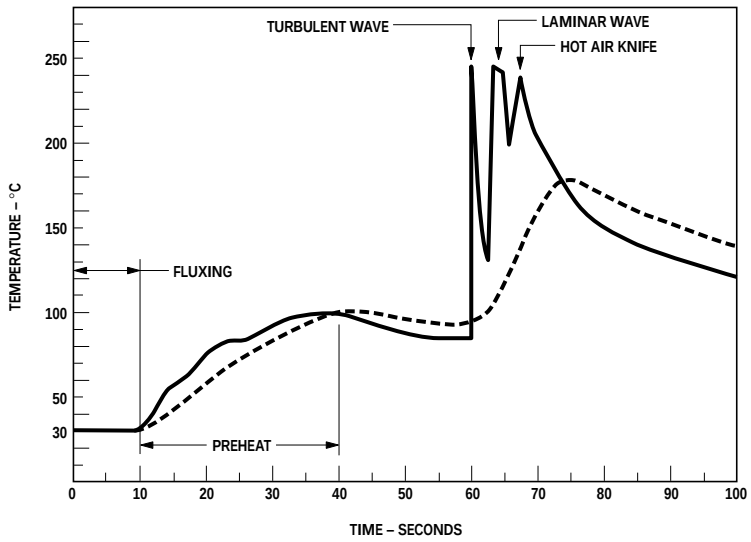

**Note:** Electrical connection between bottom surface of LED die and the lead frame material through conductive paste of solder.

- Special attention must be given to board fabrication, solder masking, surface platting and lead holes size and component orientation to assure the solderability.

### Recommended PC Board Plated Through Holes Size for LED Component Leads

| LED Component Lead Size | Diagonal | Plated Through Hole Diameter |
|---|---|---|
| 0.457 x 0.457 mm (0.018 x 0.018 inch) | 0.646 mm (0.025 inch) | 0.976 to 1.078 mm (0.038 to 0.042 inch) |
| 0.508 x 0.508 mm (0.020 x 0.020 inch) | 0.718 mm (0.028 inch) | 1.049 to 1.150 mm (0.041 to 0.045 inch) |

**Note:** Refer to Application Note AN1027 for more information on soldering LED components.




CONVEYOR SPEED = 1.83 M / MIN (6 FT / MIN)
PREHEAT SETTING = 150°C (100°C PCB)
SOLDER WAVE TEMPERATURE = 245°C
AIR KNIFE AIR TEMPERATURE = 390°C
AIR KNIFE DISTANCE = 1.91 mm (0.25 IN.)
AIR KNIFE ANGLE = 40
LEAD SOLDER: SN63; FLUX: RMA
LEAD FREE SOLDER: 96.5 wt% Sn, 3.0 wt% Ag, 0.5 wt% Cu

NOTE: ALLOW FOR BOARDS TO BE SUFFICIENTLY COOLED BEFORE EXERTING MECHANICAL FORCE.

For product information and a complete list of distributors, please go to our website: **www.avagotech.com**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