# HLMP-LD63, HLMP-LM63, HLMP-LB63

Precision Optical Performance Red, Green and Blue
New 4mm Standard Oval LEDs

## 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 and high luminous intensity ensure that these devices are excellent for wide field of view outdoor applications where a wide viewing angle and readability in sunlight are essential.

### Features

- Well defined spatial radiation pattern
- High brightness material
- Available in red, green and blue color.

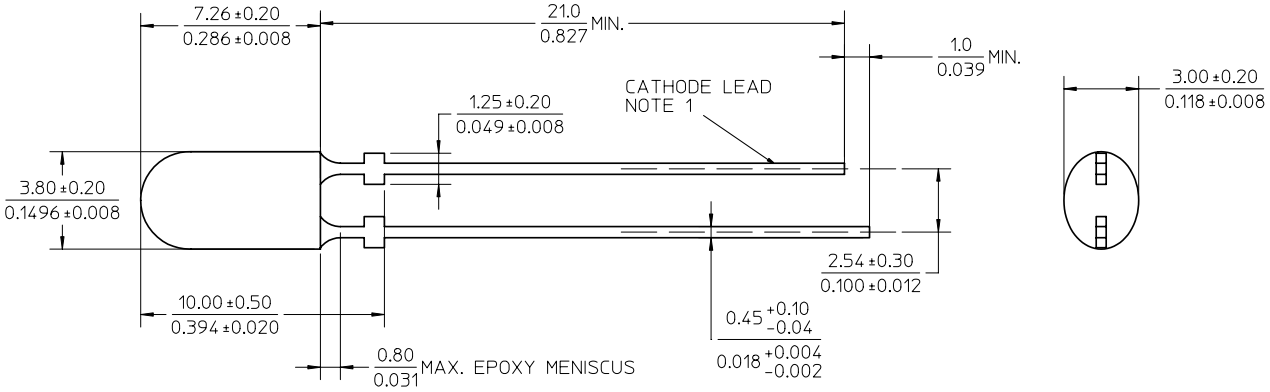
| | | |
|---|---|---|
| Red | AlInGaP | 630nm |
| Green | InGaN | 525nm |
| Blue | InGaN | 470nm |

- Superior resistance to moisture
- Standoff Package
- Typical viewing angle 50° x100°

### Applications

- Full color signs

### Package Dimensions




Notes:
All dimensions in millimeters (inches).
Tolerance is ± 0.20mm unless other specified
For Blue and Green if heat sinking application is required, the terminal for heat sink is anode.

*Caution: InGaN devices are Class 1C HBM ESD sensitive per JEDEC Standard. Please observe appropriate precautions during handling and processing. Refer to Application Note AN-1142 for additional details.*

## Device Selection Guide

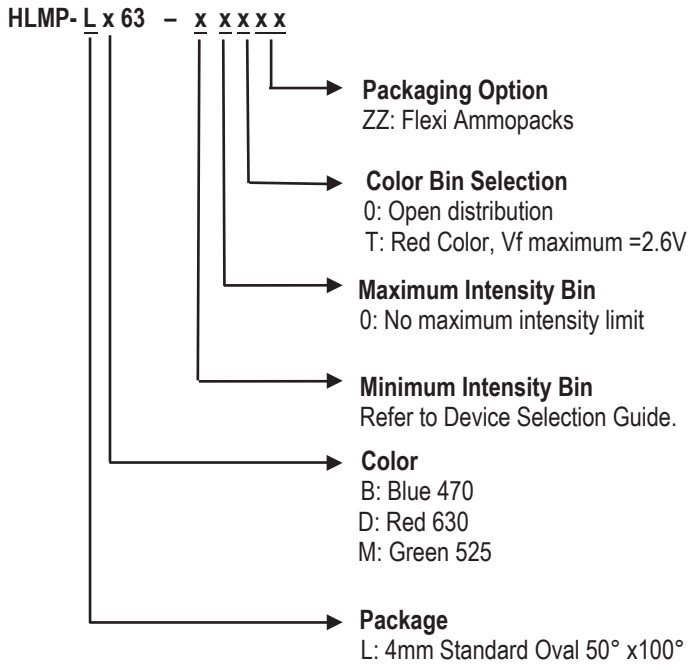
| Part Number | Color and Dominant Wavelength λd (nm) Typ | Luminous Intensity Iv (mcd) at 20 mA-Min | Luminous Intensity Iv (mcd) at 20 mA-Max |
|---|---|---|---|
| HLMP-LD63-SWTZZ | Red 630 | 660 | 1660 |
| HLMP-LM63-X20ZZ | Green 525 | 1660 | 4200 |
| HLMP-LB63-PT0ZZ | Blue 470 | 380 | 960 |

Tolerance for each intensity limit is ± 15%.

Notes:

1. The luminous intensity is measured on the mechanical axis of the lamp package.

## Part Numbering System




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

| Parameter | Red | Blue and Green | Unit |
|---|---|---|---|
| DC Forward Current [1] | 50 | 30 | mA |
| Peak Forward Current | 100 [2] | 100 [3, 4] | mA |
| Power Dissipation | 130 | 111 | mW |
| Reverse Voltage | 5 ($I_R = 100$ µA) | 5 ($I_R = 10$ µA) | V |
| LED Junction Temperature | 130 | 110 | °C |
| Operating Temperature Range | -40 to +100 | -40 to +85 | °C |
| Storage Temperature Range | -40 to +120 | -40 to +100 | °C |

Notes:

1. Derate linearly as shown in Figure 2 and Figure 8.
2. Duty Factor 30%, frequency 1kHz.
3. Duty Factor 10%, frequency 1KHz.
4. For long term performance with minimal light output degradation, drive current below 15mA is recommended for Blue LED.

## Electrical / Optical Characteristics, $T_A = 25°C$

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Forward Voltage | | | | | | |
| Red | | 2.0 | 2.3 | 2.6{1] | | |
| Green | $V_F$ | 2.7 | 3.2 | 3.7 | V | $I_F = 20$ mA |
| Blue | | 2.7 | 3.2 | 3.7 | | |
| Reverse Voltage | | | | | | |
| Red | $V_R$ | 5 | | | V | $I_R = 100$ μA |
| Green & blue | | 5 | | | | $I_R = 10$ μA |
| Dominant Wavelength [2] | | | | | | |
| Red | | 622 | 630 | 634 | | |
| Green | | 520 | 525 | 540 | | $I_F = 20$ mA |
| Blue | | 460 | 470 | 480 | | |
| Peak Wavelength | | | | | | |
| Red | | | 639 | | | Peak of Wavelength of Spectral |
| Green | $\lambda_{PEAK}$ | | 516 | | nm | Distribution at $I_F = 20$ mA |
| Blue | | | 464 | | | |
| Thermal Resistance | $R\theta_{J\text{-}PIN}$ | | 240 | | °C/W | LED Junction-to pin |
| Luminous Efficacy [3] | | | | | | |
| Red | | | 155 | | | Emitted Luminous Power/Emitted |
| Green | $\eta_V$ | | 530 | | lm/W | Radiant Power |
| Blue | | | 65 | | | |

Notes:

1. For option –xxTxx, The $V_F$ maximum is 2.6V, refer to VF bin table.
2. The dominant wavelength is derived from the chromaticity Diagram and represents the color of the lamp
3. The radiant intensity, Ie in watts per steradian, may be found from the equation Ie = $I_V/\eta_V$ where IV is the luminous intensity in candelas and $\eta_V$ is the luminous efficacy in lumens/watt.
4. For AlInGaP Red, thermal resistance applied to LED junction to cathode lead. For InGaN blue and green, thermal resistance applied to LED junction to anode lead.

## AlInGaP Red

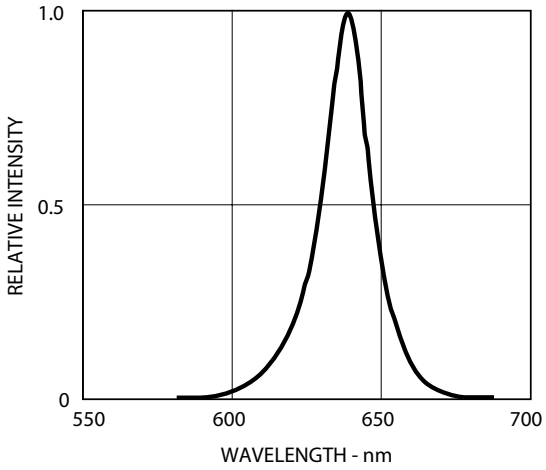



**Figure 1. Relative Intensity vs Wavelength**

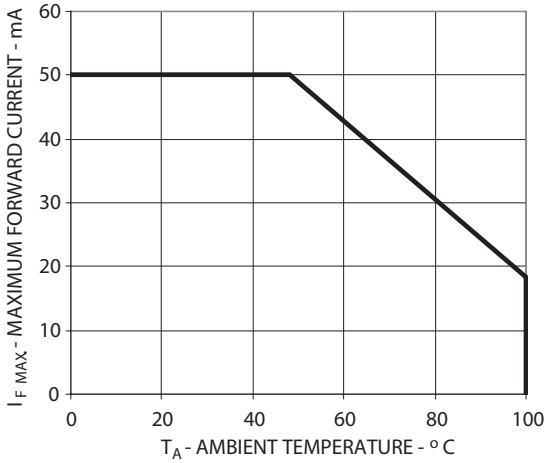



**Figure 2. Maximum Forward Current vs Ambient Temperature**

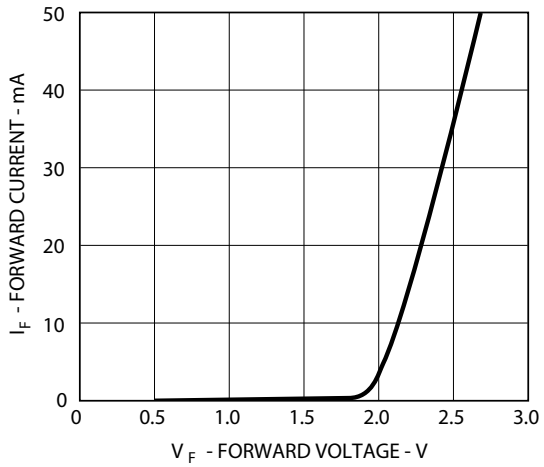



**Figure 3. Forward Current vs Forward Voltage**

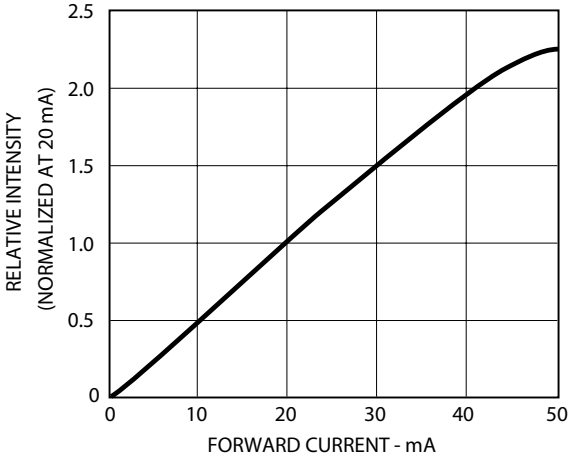



**Figure 4. Relative Intensity vs Forward Current**

## InGaN Blue and Green

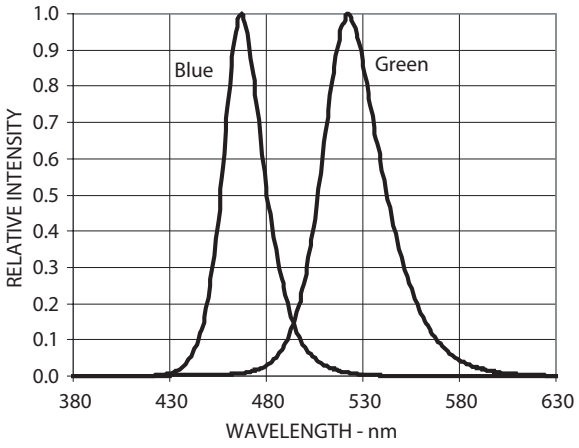



**Figure 5. Relative Intensity vs Wavelength**

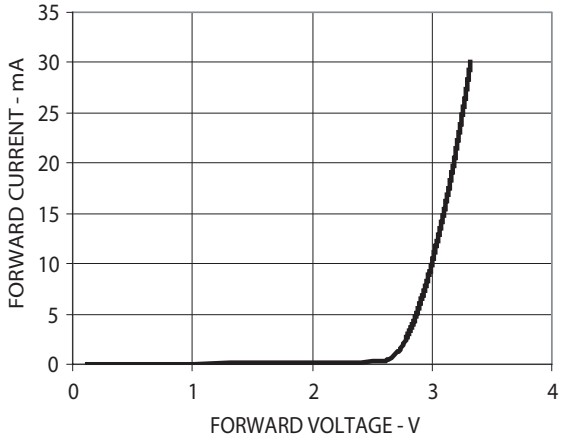



**Figure 6. Forward Current vs Forward Voltage**

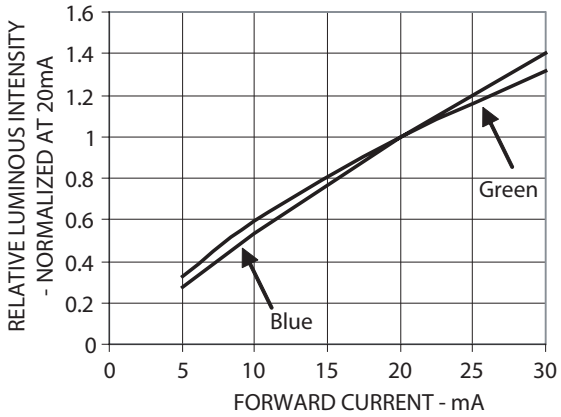



**Figure 7. Relative Intensity vs Forward Current**

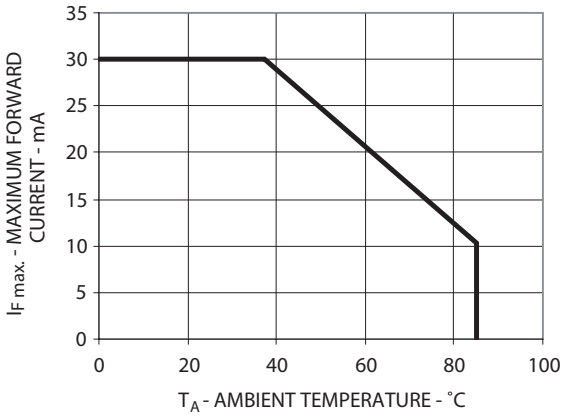



**Figure 8. Maximum Forward Current vs Ambient Temperature**

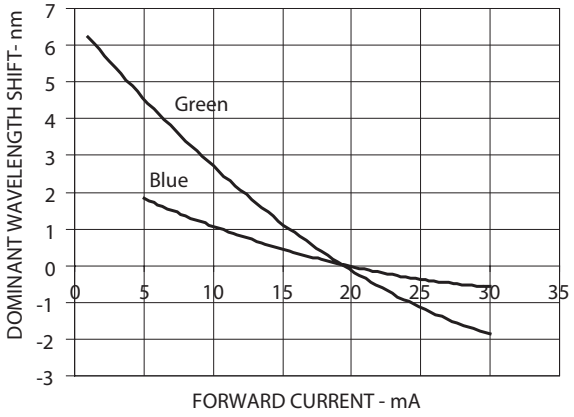



**Figure 9. Relative dominant wavelength vs Forward Current**

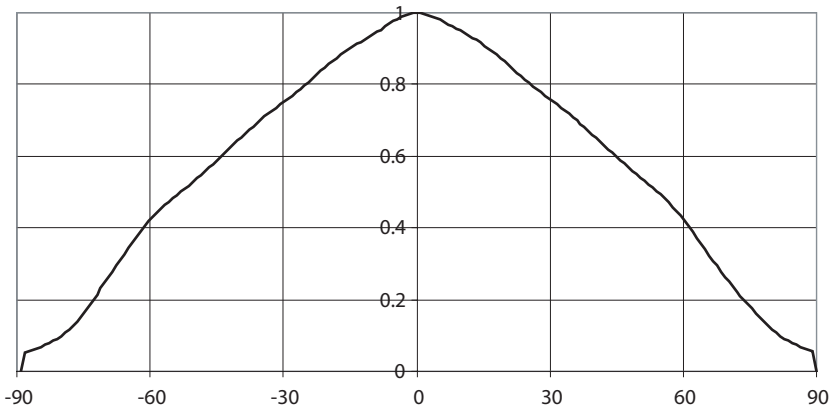



**Figure 10. Radiation pattern-Major Axis**

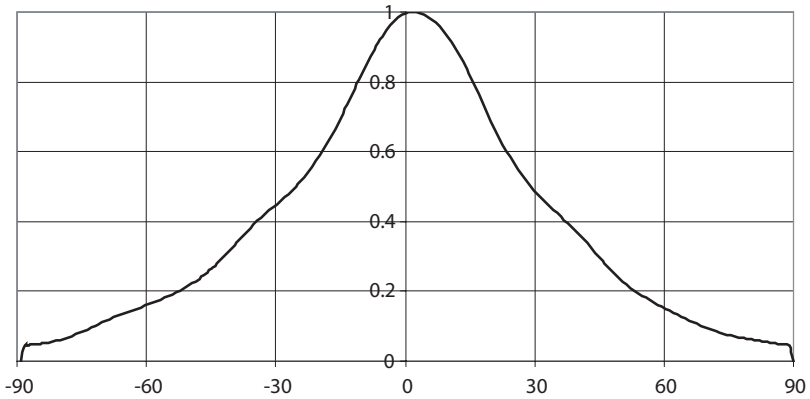



**Figure 11. Radiation pattern-Minor Axis**

## Intensity Bin Limit Table (1.2: 1 Iv Bin Ratio)

| | Intensity (mcd) at 20 mA | |
|---|---|---|
| **Bin** | **Min** | **Max** |
| P | 380 | 460 |
| Q | 460 | 550 |
| R | 550 | 660 |
| S | 660 | 800 |
| T | 800 | 960 |
| U | 960 | 1150 |
| V | 1150 | 1380 |
| W | 1380 | 1660 |
| X | 1660 | 1990 |
| Y | 1990 | 2400 |
| Z | 2400 | 2900 |
| 1 | 2900 | 3500 |
| 2 | 3500 | 4200 |

Tolerance for each bin limit is ± 15%

## VF Bin Table (V at 20mA)

| Bin ID | 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

## Red Color Range

| Min Dom | Max Dom | Xmin | Ymin | Xmax | Ymax |
|---|---|---|---|---|---|
| 622 | 634 | 0.6904 | 0.3094 | 0.6945 | 0.2888 |
| | | 0.6726 | 0.3106 | 0.7135 | 0.2865 |

Tolerance for each bin limit is ± 0.5nm.

## Green Color Bin Table

| Bin | Min Dom | Max Dom | Xmin | Ymin | Xmax | Ymax |
|---|---|---|---|---|---|---|
| 1 | 520.0 | 524.0 | 0.0743 | 0.8338 | 0.1856 | 0.6556 |
| | | | 0.1650 | 0.6586 | 0.1060 | 0.8292 |
| 2 | 524.0 | 528.0 | 0.1060 | 0.8292 | 0.2068 | 0.6463 |
| | | | 0.1856 | 0.6556 | 0.1387 | 0.8148 |
| 3 | 528.0 | 532.0 | 0.1387 | 0.8148 | 0.2273 | 0.6344 |
| | | | 0.2068 | 0.6463 | 0.1702 | 0.7965 |
| 4 | 532.0 | 536.0 | 0.1702 | 0.7965 | 0.2469 | 0.6213 |
| | | | 0.2273 | 0.6344 | 0.2003 | 0.7764 |
| 5 | 536.0 | 540.0 | 0.2003 | 0.7764 | 0.2659 | 0.6070 |
| | | | 0.2469 | 0.6213 | 0.2296 | 0.7543 |

Tolerance for each bin limit is ± 0.5nm

## Blue Color Bin Table

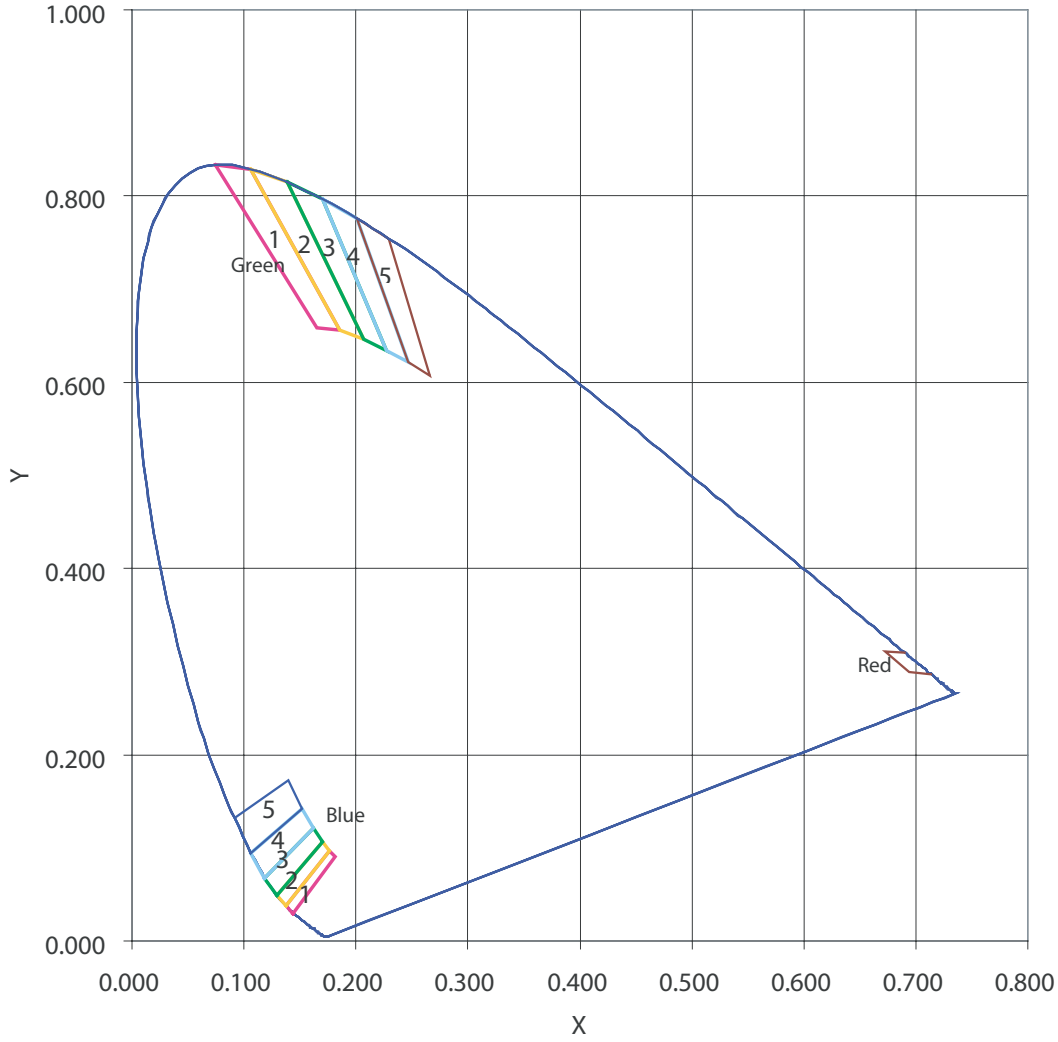
| Bin | Min Dom | Max Dom | Xmin | Ymin | Xmax | Ymax |
|---|---|---|---|---|---|---|
| 1 | 460.0 | 464.0 | 0.1440 | 0.0297 | 0.1766 | 0.0966 |
| | | | 0.1818 | 0.0904 | 0.1374 | 0.0374 |
| 2 | 464.0 | 468.0 | 0.1374 | 0.0374 | 0.1699 | 0.1062 |
| | | | 0.1766 | 0.0966 | 0.1291 | 0.0495 |
| 3 | 468.0 | 472.0 | 0.1291 | 0.0495 | 0.1616 | 0.1209 |
| | | | 0.1699 | 0.1062 | 0.1187 | 0.0671 |
| 4 | 472.0 | 476.0 | 0.1187 | 0.0671 | 0.1517 | 0.1423 |
| | | | 0.1616 | 0.1209 | 0.1063 | 0.0945 |
| 5 | 476.0 | 480.0 | 0.1063 | 0.0945 | 0.1397 | 0.1728 |
| | | | 0.1517 | 0.1423 | 0.0913 | 0.1327 |

Tolerance for each bin limit is ± 0.5nm

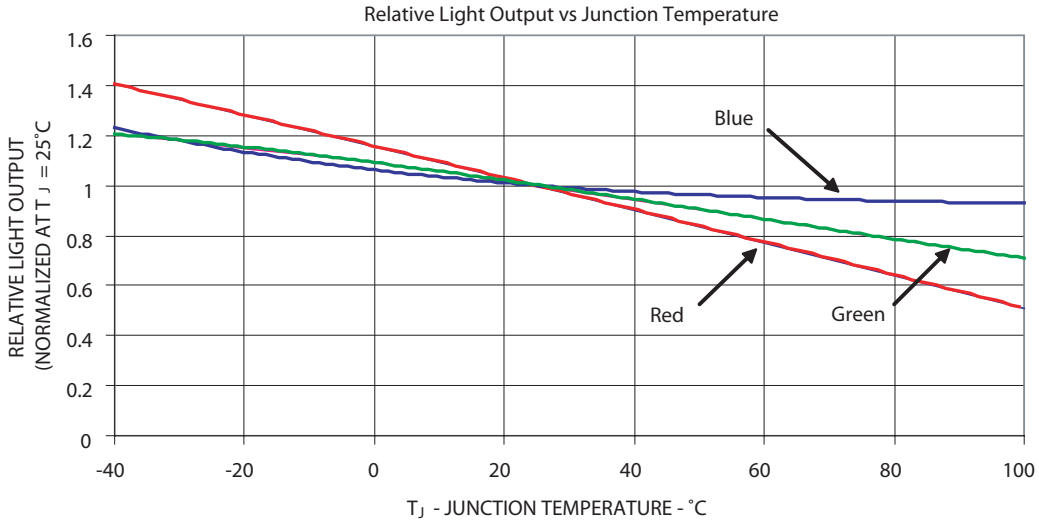
Note:

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

## Avago Color Bin on CIE 1931 Chromaticity Diagram




## Relative Light Output vs Junction Temperature



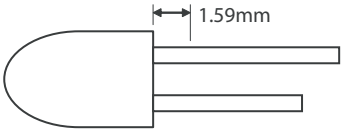
## Precautions:

### Lead Forming:

- The leads of an LED lamp may be performed or cut to 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 induced into the LED package. Otherwise, cut the leads to applicable length after soldering process at room temperature. The solder joint formed will absorb the mechanical stress, due to the lead cutting, from traveling to the LED chip die attach and wirebond.
- 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:

- Care must be taken during PCB assembly and soldering process to prevent damage to the LED component.
- The closest manual soldering distance of the soldering heat source (soldering iron's tip) to the body is 1.59mm. Soldering the LED closer than 1.59mm might damage the LED.




- Recommended soldering condition:

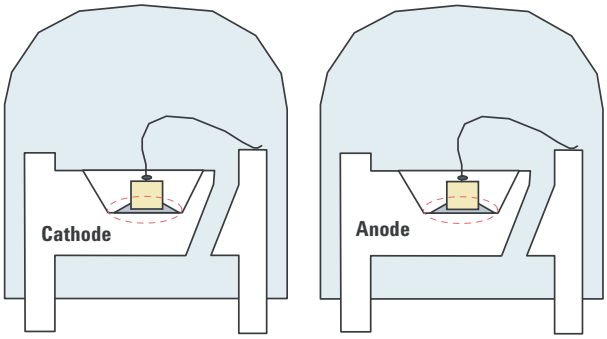
| | Wave Soldering | Manual Solder Dipping |
|---|---|---|
| Pre-heat temperature | 105 °C Max. | - |
| Preheat time | 30 sec Max | - |
| Peak temperature | 250 °C Max. | 260 °C Max. |
| Dwell time | 3 sec Max. | 5 sec Max |

- Wave soldering parameter must be set and maintain according to the recommended temperature and dwell time. Customer is advised to daily check on the soldering profile to ensure that the soldering profile is always conforming to recommended soldering condition.

Note:

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 re-calibrate the soldering profile again before loading a new type of PCB.
2. Avago Technologies' high brightness LED are using 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 is not exceeding 250°C. Over-stressing the LED during soldering process might cause premature failure to the LED due to delamination.

## Avago Technologies LED configuration




**AlInGaP Device** **InGaN Device**

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

- If necessary, use fixture to hold the LED component in proper orientation with respect to the PCB during soldering process.

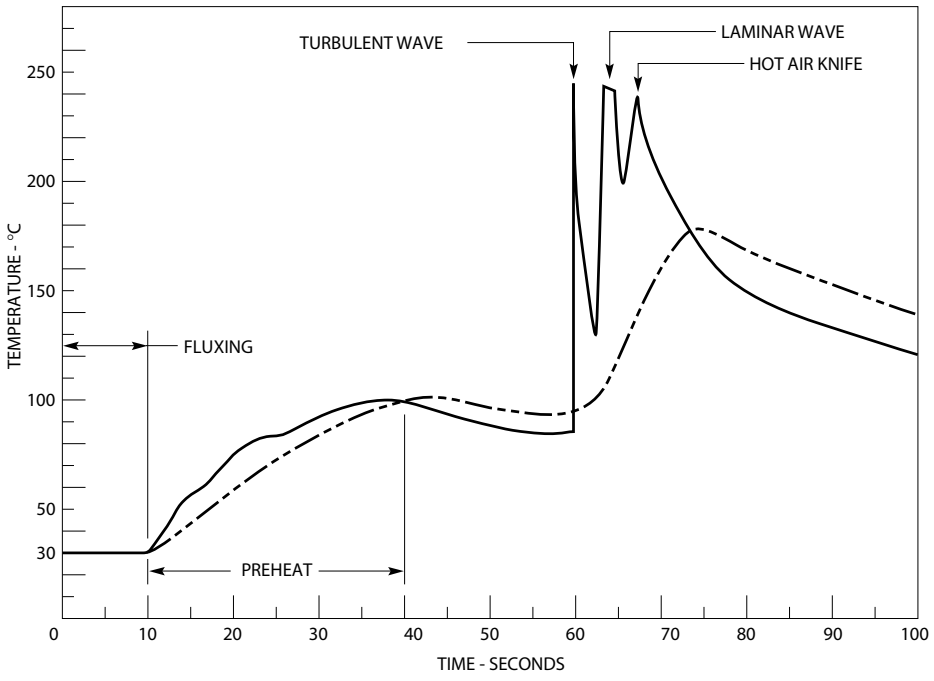
  Note: In order to further assist customer in designing jig accurately that fit Avago Technologies' product, 3D model of the product is available upon request.
- At elevated temperature, the LED is more susceptible to mechanical stress. Therefore, PCB must allowed to cool down to room temperature prior to handling, which includes removal of jigs, fixtures or pallet.
- 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) |

- Under sizing of plated through hole can lead to twisting or improper LED placement during auto insertion. Over sizing plated through hole can lead to mechanical stress on the epoxy lens during clinching.

Note: Refer to application note AN1027 for more information on soldering LED components.

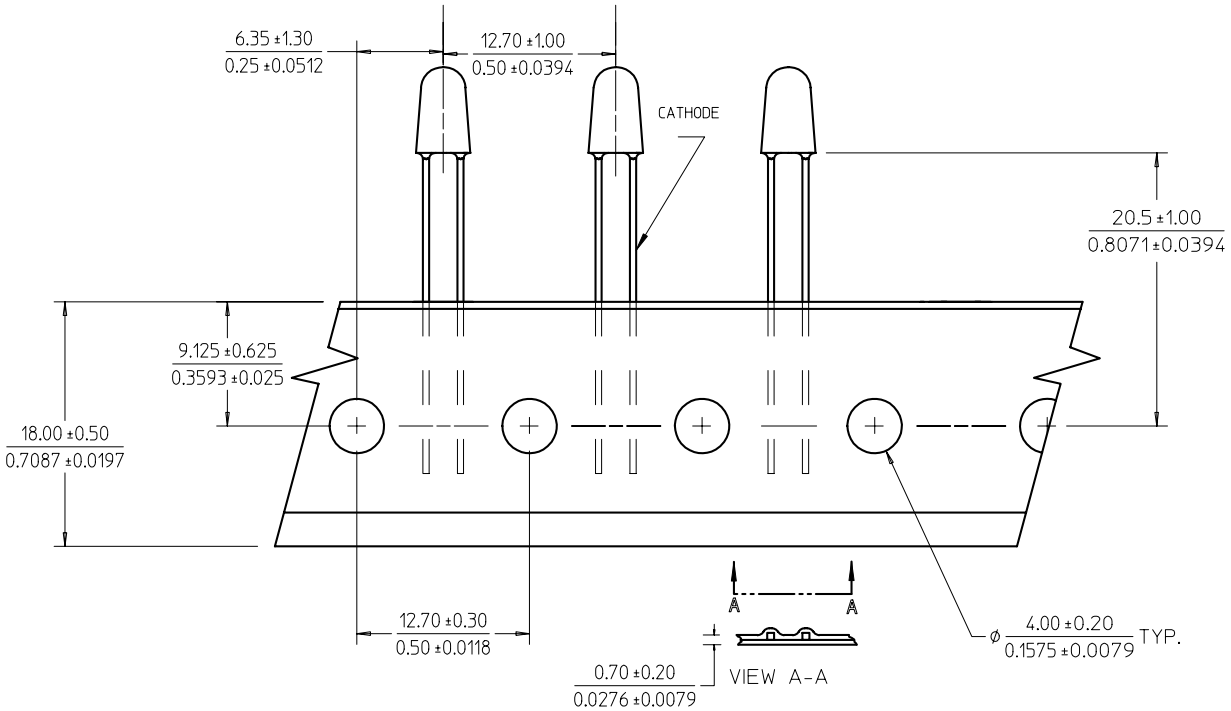
## Recommended Wave Soldering Profile




CONVEYOR SPEED = 1.83 M/MIN (6 FT/MIN)
PREHEAT SETTING = 150°C (100°C PCB)
SOLDER WAVE TEMPERATURE = 245°C ± 5°C
AIR KNIFE AIR TEMPERATURE = 390°C
AIR KNIFE DISTANCE = 1.91 mm (0.25 IN.)
AIR KNIFE ANGLE = 40
SOLDER: SN63; FLUX: RMA
LEAD FREE SOLDER
96.5%Sn; 3.0%Ag; 0.5% Cu

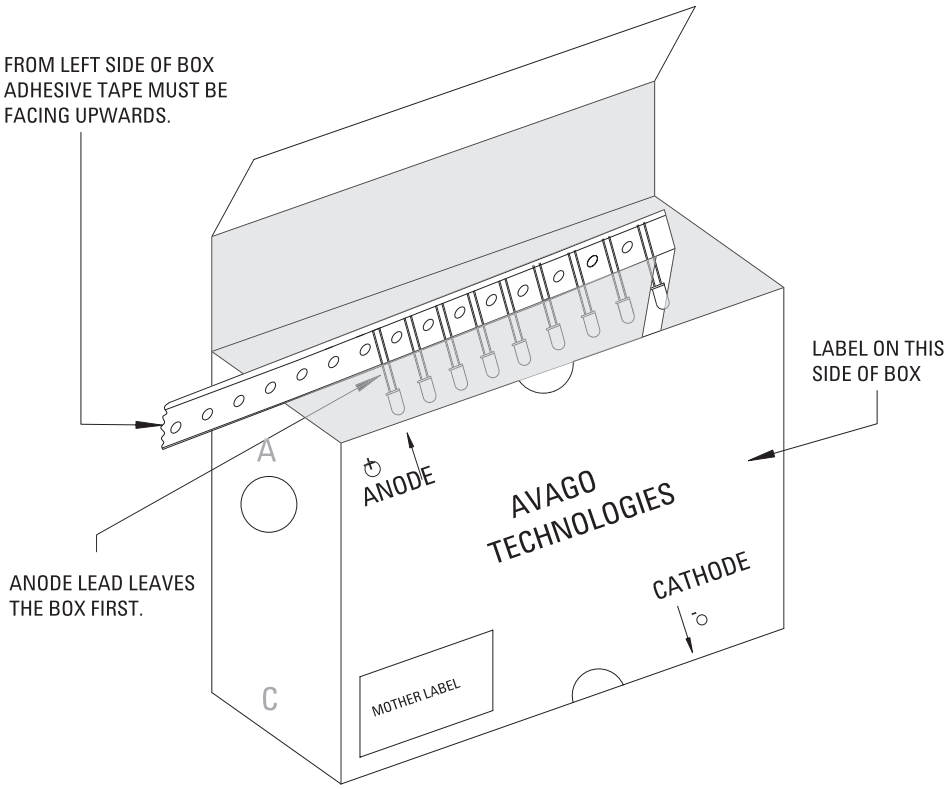
NOTE: ALLOW FOR BOARDS TO BE SUFFICIENTLY COOLED BEFORE EXERTING MECHANICAL FORCE.

## Ammo Packs Drawing




Note: The ammo-packs drawing is applicable for packaging option –DD & -ZZ and regardless standoff or non-standoff

## Packaging Box for Ammo Packs




Note: For InGaN device, the ammo pack packaging box contain ESD logo

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