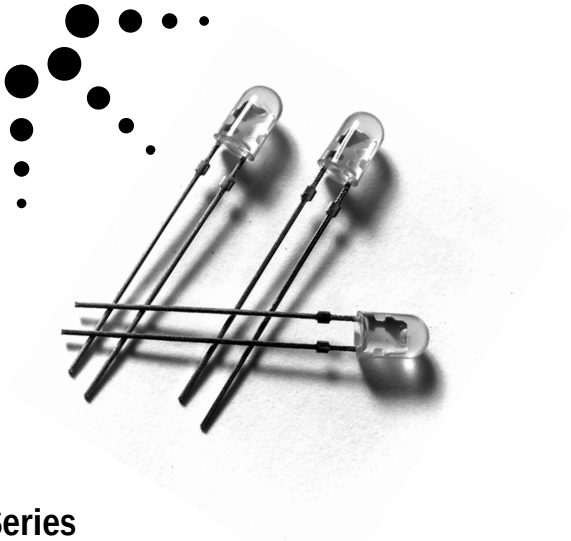
# Agilent 4 mm Super Oval Precision Optical Performance AlInGaP and InGaN LEDs

Data Sheet



## SunPower Series

## Agilent HLMP-RG10, HLMP-SG10, HLMP-RL10, HLMP-SL10, HLMP-RD11, HLMP-SD11, HLMP-RL11, HLMP-SL11, HLMP-RM11, HLMP-SM11, HLMP-RB11, HLMP-SB11

### Description

These Precision Optical Performance Oval LEDs are specifically designed for Full Color/Video and Passenger Information signs. The oval shaped radiation pattern (60° x 120°) 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. 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 materials are used in these lamps: Aluminum Indium Gallium Phosphide (AlInGaP) for Red and Amber color and Indium Gallium Nitride (InGaN) for Blue and Green. There are two families of red and amber lamps, AlInGaP and the higher performance AlInGaP II. Each lamp is made with an advanced 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 (where the axis of the leads is parallel to the wide axis of the oval radiation pattern) or perpendicular orientation. Both lamps are available in tinted version.

### Features

- **Well defined spatial radiation pattern**
- **Viewing angle: major axis 120° minor axis 60°**
- **High luminous output**
- **Two red and amber intensity levels AlInGaP (bright) and AlInGaP II (brightest)**
- **Colors 626 / 630 nm red 590 / 592 nm amber 526 nm green 470 nm blue**
- **Superior resistance to moisture**
- **UV resistant epoxy**

### Benefits

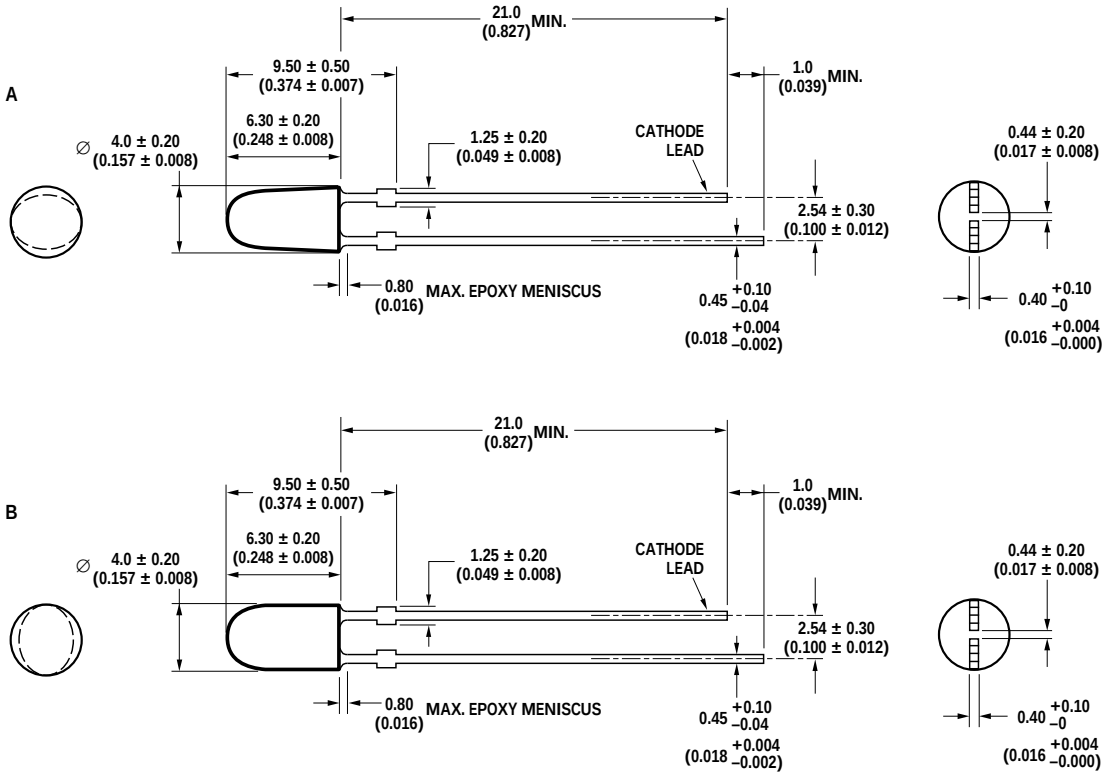
- **Viewing angle designed for wide field of view applications**
- **Superior performance for outdoor environments**
- **Radiation pattern matched for red, green, and blue for full color sign**

### Applications

- **Full color signs**

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

## Package Dimensions




DIMENSIONS ARE IN MILLIMETERS (INCHES).

## Device Selection Guide for AlInGaP

| Part Number | Color and Dominant Wavelength $\lambda_d$ (nm) Typ. | Luminous Intensity $I_V$ (mcd) at 20 mA Min. | Max. | Leads with Stand-Offs | Leadframe Orientation | Package Drawing |
|---|---|---|---|---|---|---|
| HLMP-SG10-JM000 | Red 626 | 240 | 680 | Yes | Perpendicular | A |
| HLMP-RG10-JM000 | Red 626 | 240 | 680 | Yes | Parallel | B |
| HLMP-SL10-LP0xx | Amber 590 | 400 | 1150 | Yes | Perpendicular | A |
| HLMP-RL10-LP0xx | Amber 590 | 400 | 1150 | Yes | Parallel | B |

**Notes:**

1. The luminous intensity is measured on the mechanical axis of the lamp package.
2. The optical axis is closely aligned with the package mechanical axis.
3. The dominant wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the lamp.

**Device Selection Guide for AlInGaP II**

| Part Number | Color and Dominant Wavelength $\lambda_d$ (nm) Typ. | Luminous Intensity $I_V$ (mcd) at 20 mA Min. | Max. | Leads with Stand-Offs | Leadframe Orientation | Package Drawing |
|---|---|---|---|---|---|---|
| HLMP-RD11-J0000 | Red 630 | 240 | - | Yes | Parallel | B |
| HLMP-RD11-LP000 | Red 630 | 400 | 1150 | Yes | Parallel | B |
| HLMP-RD11-LPT00 | Red 630 | 400 | 1150 | Yes | Parallel | B |
| HLMP-RL11-H0000 | Amber 592 | 180 | - | Yes | Parallel | B |
| HLMP-RL11-LP000 | Amber 592 | 400 | 1150 | Yes | Parallel | B |
| HLMP-RL11-LPRxx | Amber 592 | 400 | 1150 | Yes | Parallel | B |
| HLMP-SD11-J0000 | Red 630 | 240 | - | Yes | Perpendicular | A |
| HLMP-SD11-LP000 | Red 630 | 400 | 1150 | Yes | Perpendicular | A |
| HLMP-SD11-LPT00 | Red 630 | 400 | 1150 | Yes | Perpendicular | A |
| HLMP-SD11-MN0xx | Red 630 | 520 | 880 | Yes | Perpendicular | A |
| HLMP-SD11-MNTxx | Red 630 | 520 | 880 | Yes | Perpendicular | A |
| HLMP-SL11-H0000 | Amber 592 | 180 | - | Yes | Perpendicular | A |
| HLMP-SL11-HL0xx | Amber 592 | 180 | 520 | Yes | Perpendicular | A |
| HLMP-SL11-KN0xx | Amber 592 | 310 | 880 | Yes | Perpendicular | A |
| HLMP-SL11-LP0xx | Amber 592 | 400 | 1150 | Yes | Perpendicular | A |
| HLMP-SL11-LPRxx | Amber 592 | 400 | 1150 | Yes | Perpendicular | A |

**Notes:**

1. The luminous intensity is measured on the mechanical axis of the lamp package.
2. The optical axis is closely aligned with the package mechanical axis.
3. The dominant wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the lamp.

**Device Selection Guide for InGaN**

| Part Number | Color and Dominant Wavelength $\lambda_d$ (nm) Typ. | Luminous Intensity $I_V$ (mcd) at 20 mA Min. | Max. | Leads with Stand-Offs | Leadframe Orientation | Package Drawing |
|---|---|---|---|---|---|---|
| HLMP-SM11-LP0xx | Green 526 | 400 | 1150 | Yes | Perpendicular | A |
| HLMP-RM11-H00xx | Green 526 | 180 | - | Yes | Parallel | B |
| HLMP-RM11-M00xx | Green 526 | 520 | - | Yes | Parallel | B |
| HLMP-SB11-H00xx | Blue 470 | 180 | - | Yes | Perpendicular | A |
| HLMP-RB11-D00xx | Blue 470 | 65 | - | Yes | Parallel | B |
| HLMP-RB11-H00xx | Blue 470 | 180 | - | Yes | Parallel | B |

**Notes:**

4. The luminous intensity is measured on the mechanical axis of the lamp package.
5. The optical axis is closely aligned with the package mechanical axis.
6. The dominant wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the lamp.

**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
R: Amber Color Bins 1, 2, 4, and 6 with $V_F$ Maximum of 2.6 V
T: Red Color with $V_F$ Maximum of 2.6 V

**Maximum Intensity Bin**
0: No Iv Bin Limitation

**Minimum Intensity Bin**

**Refer to Device Selection Guide**

**Color**
B: 470 nm Blue
D: 630 nm Red
G: 626 nm Red
L: 590/592 nm Amber
M: 526 nm Green

**Package**
R: 4 mm 60º x 120º Oval, Parallel
S: 4 mm 60º x 120º Oval, Perpendicular

**Absolute Maximum Ratings**
$T_A$ = 25°C

| Parameter | Blue and Green | Amber and Red |
|---|---|---|
| DC Forward Current[1] | 30 mA | 50 mA |
| Peak Pulsed Forward Current | 100 mA | 100 mA |
| Average Forward Current | 30 mA | 30 mA |
| Reverse Voltage ($I_R$ = 100 μA) | 5 V | 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 |

**Note:**
1. Derate linearly as shown in Figures 6 and 7.

**Electrical / Optical Characteristics**

$T_A = 25°C$

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Typical Viewing Angle[1] | $2\theta_{1/2}$ | | | | deg | |
| Major | | | 120 | | | |
| Minor | | | 60 | | | |
| Forward Voltage | $V_F$ | | | | V | $I_F = 20$ mA |
| Red ($\lambda_d = 626$ nm) | | | 1.9 | 2.4 | | |
| Red ($\lambda_d = 630$ nm) | | | 2.0 | 2.4[2] | | |
| Amber ($\lambda_d = 590$ nm) | | | 2.02 | 2.4 | | |
| Amber ($\lambda_d = 592$ nm) | | | 2.15 | 2.4[2] | | |
| Blue ($\lambda_d = 470$ nm) | | | 3.5 | 4.0 | | |
| Green ($\lambda_d = 526$ nm) | | | 3.5 | 4.0 | | |
| Reverse Voltage | $V_R$ | | | | V | $I_R = 100\ \mu A$ |
| Amber and Red | | 5 | 20 | | | |
| Blue and Green | | 5 | – | | | |
| Peak Wavelength | $\lambda_{PEAK}$ | | | | nm | Peak of Wavelength of |
| Red ($\lambda_d = 626$ nm) | | | 635 | | | Spectral Distribution |
| Red ($\lambda_d = 630$ nm) | | | 639 | | | at $I_F = 20$ mA |
| Amber ($\lambda_d = 590$ nm) | | | 592 | | | |
| Amber ($\lambda_d = 592$ nm) | | | 594 | | | |

**LED Indicators**

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Blue ($\lambda_d = 470$ nm) | | | 467 | | | |
| Green ($\lambda_d = 526$ nm) | | | 524 | | | |
| Spectral Halfwidth | $\Delta\lambda_{1/2}$ | | | | nm | Wavelength Width at |
| Red ($\lambda_d = 626/630$ nm) | | | 17 | | | Spectral Distribution |
| Amber ($\lambda_d = 590/592$ nm) | | | 17 | | | $^1/_2$ Power Point at $I_F = 20$ mA |
| Blue ($\lambda_d = 470$ nm) | | | 20 | | | |
| Green ($\lambda_d = 526$ nm) | | | 35 | | | |
| Capacitance | C | | | | pF | $V_F = 0$, F = 1 MHz |
| All Colors | | | 40 | | | |
| Thermal Resistance | $R\theta_{J\text{-}PIN}$ | | | | °C/W | LED Junction-to-Cathode |
| All Colors | | | 240 | | | Lead |
| Luminous Efficacy[3] | $\eta_v$ | | | | lm/W | Emitted Luminous Power / |
| Red ($\lambda_d = 626$ nm) | | | 150 | | | Emitted Radiant Power |
| Red ($\lambda_d = 630$ nm) | | | 155 | | | |
| Amber ($\lambda_d = 590$ nm) | | | 480 | | | |
| Amber ($\lambda_d = 592$ nm) | | | 500 | | | |
| Blue ($\lambda_d = 470$ nm) | | | 70 | | | |
| Green ($\lambda_d = 526$ nm) | | | 540 | | | |

**Notes:**

1. $2\theta_{1/2}$ is the off-axis angle where the luminous intensity is the on-axis intensity.
2. For options -xxRxx, -xxTxx, and -xxVxx, maximum forward voltage, $V_F$, is 2.6 V. Please refer to $V_F$ Bin Table below.
3. 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.

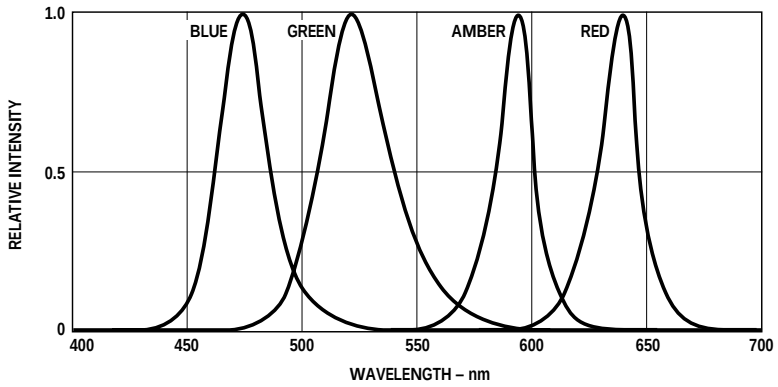



Figure 1. Relative intensity vs. wavelength.

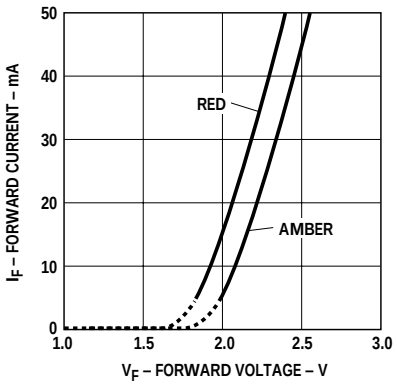



Figure 2. Amber, Red forward current vs. forward voltage.

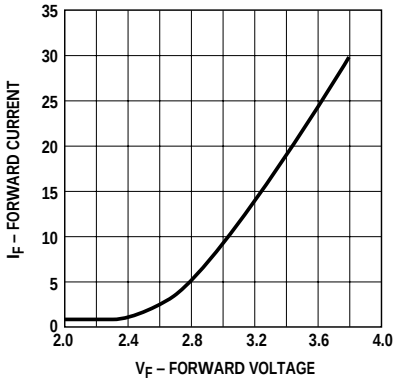



Figure 3. Blue, Green forward current vs. forward voltage.

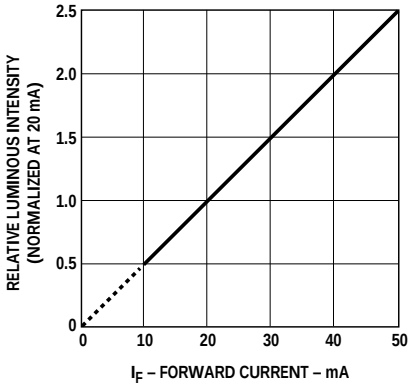



Figure 4. Amber, Red relative luminous intensity vs. forward current.

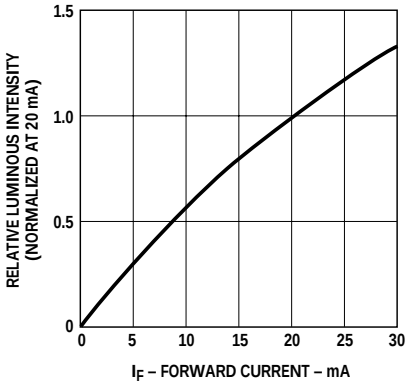



Figure 5. Blue, Green relative luminous intensity vs. forward current.

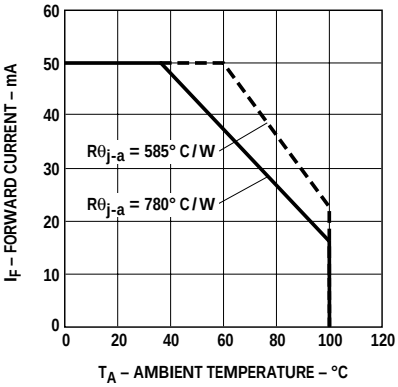



Figure 6. Amber, Red maximum forward current vs. ambient temperature.

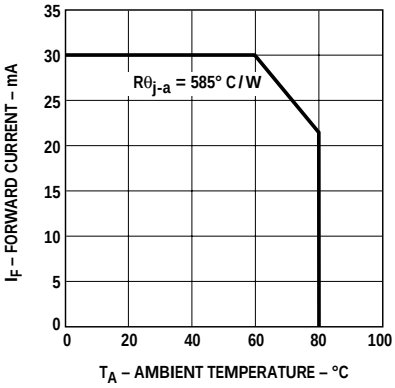



Figure 7. Blue, Green maximum forward current vs. ambient temperature.

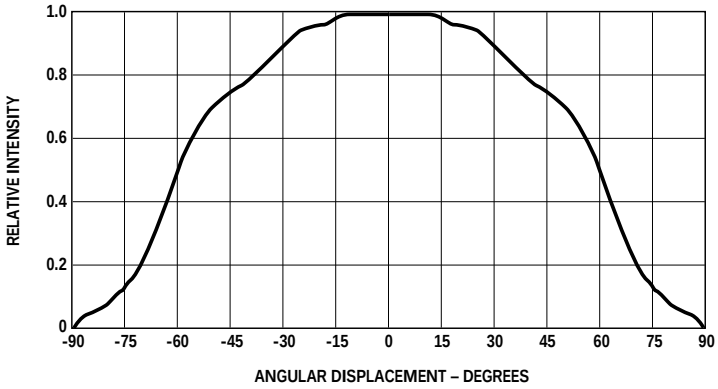



**Figure 8a. Representative spatial radiation pattern for major axis.**

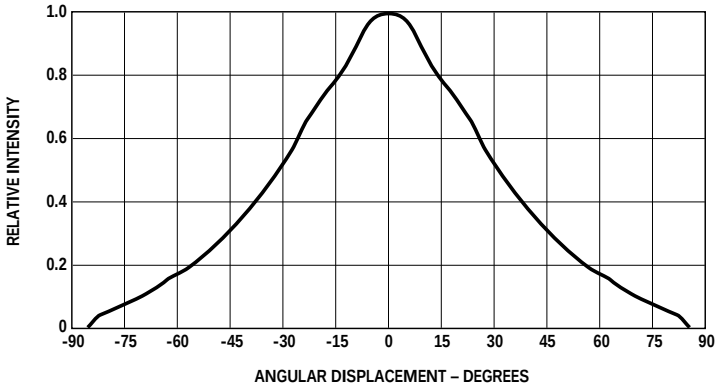



**Figure 8b. Representative spatial radiation pattern for minor axis.**

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

| Bin Name | Min. | Max. |
|---|---|---|
| D | 65 | 85 |
| E | 85 | 110 |
| F | 110 | 140 |
| G | 140 | 180 |
| H | 180 | 240 |
| J | 240 | 310 |
| K | 310 | 400 |
| L | 400 | 520 |
| M | 520 | 680 |
| N | 680 | 880 |
| P | 880 | 1150 |

Tolerance for each bin limit is ± 15%.

**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 is ± 0.05 V.

**Note:**
1. Bin categories are established for classification of products. Products may not be available in all bin categories.

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

| Blue | Color Range (nm) | |
|---|---|---|
| Bin | 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 ± 0.5 nm.

| Green | Color Range (nm) | |
|---|---|---|
| Bin ID | 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 ± 0.5 nm.

| Amber | Color Range (nm) | |
|---|---|---|
| Bin ID | 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.

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

## Precautions

### Lead Forming

- The leads of an LED lamp may be preformed or cut to length prior to insertion and soldering into PC board.
- If lead forming is required before soldering, care must be taken to avoid any excessive mechanical stress induced to LED package. Otherwise, cut the leads of LED to length after soldering process at room temperature. The solder joint formed will absorb the mechanical stress of the lead cutting from traveling to the LED chip die attach and wirebond.
- It is recommended that tooling made to precisely form and cut the leads to length rather than rely upon hand operation.

### Soldering Conditions

- Care must be taken during PCB assembly and soldering process to prevent damage to LED component.
- The closest LED is allowed to solder on board is 1.59 mm below the body (encapsulant epoxy) for those parts without standoff.
- Recommended soldering conditions:

| | 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 recommended temperature and dwell time in the solder wave. Customer is advised to periodically check on the soldering profile to ensure the soldering profile used is always conforming to recommended soldering condition.
- If necessary, use fixture to hold the LED component in proper orientation with respect to the PCB during soldering process.
- Proper handling is imperative to avoid excessive thermal stresses to LED components when heated. Therefore, the soldered PCB must be allowed to cool to room temperature, 25° C, before handling.
- Special attention must be given to board fabrication, solder masking, surface plating and lead holes size and component orientation to assure solderability.
- Recommended PC board plated through hole sizes 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.

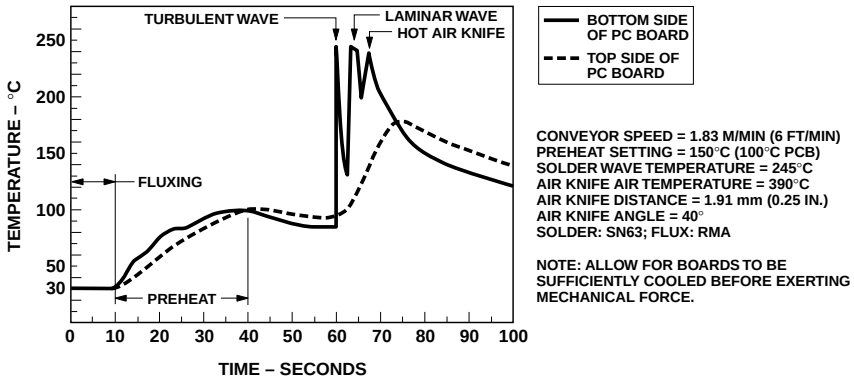



**Figure 9. Recommended wave soldering profile.**

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Data subject to change.



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