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# HLMP-C115, HLMP-C123, HLMP-C215, HLMP-C223, HLMP-C315, HLMP-C323, HLMP-C415, HLMP-C423, HLMP-C515, HLMP-C523, HLMP-C615, HLMP-C623

T-1¾ Super Ultra-Bright LED Lamps

## Data Sheet

### Description

These non-diffused lamps are designed to produce a bright light source and smooth radiation pattern. This lamp has been designed with a 20 mil lead frame, enhanced flange, and tight meniscus controls, making it compatible with radial lead automated insertion equipment.

### Applications

- Ideal for backlighting front panels*
- Used for lighting switches
- Adapted for indoor and outdoor signs

### Features

- Very high intensity
- Exceptional uniformity
- Consistent viewability
  All colors:
  AlGaAs Red
  High Efficiency Red
  Yellow
  Orange
  Green
  Emerald Green
- 15° and 25° family
- Tape and reel options available
- Binned for color and intensity

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## Selection Guide

| Color | $2\theta_{1/2}$[1] | Standoff Leads | Part Number | Luminous Intensity Iv (mcd) Min. | Max. |
|---|---|---|---|---|---|
| DH AS AlGaAs | 15 | No | HLMP-C115 | 290.0 | – |
| | 25 | No | HLMP-C123-L00xx | 90.2 | – |
| Red | 15 | No | HLMP-C215 | 138.0 | – |
| | 25 | No | HLMP-C223 | 90.2 | – |
| Yellow | 15 | No | HLMP-C315 | 147.0 | – |
| | 25 | No | HLMP-C323 | 96.2 | – |
| Orange | 15 | No | HLMP-C415 | 138.0 | – |
| | 25 | No | HLMP-C423 | 90.2 | – |
| | | | HLMP-C423-L00xx | 90.2 | – |
| Green | 15 | No | HLMP-C515 | 170.0 | – |
| | | | HLMP-C515-L00xx | 170.0 | |
| | 25 | No | HLMP-C523 | 69.8 | – |
| | | | HLMP-C523-J00xx | 69.8 | – |
| Emerald Green | 15 | No | HLMP-C615-G00xx | 17.0 | – |

## Part Numbering System

HLMP - C x xx - x x x xx

**Mechanical Options**
00: Bulk
01: Tape & Reel, Crimped Leads
02: Tape & Reel, Straight Leads
B2: Right Angle Housing, Even Leads

**Color Bin Options**
0: Full Color Bin Distribution

**Maximum Iv Bin Options**
0: Open (No Maximum Limit)
Others: Please refer to the Iv Bin Table

**Minimum Iv Bin Options**
Please refer to the Iv Bin Table

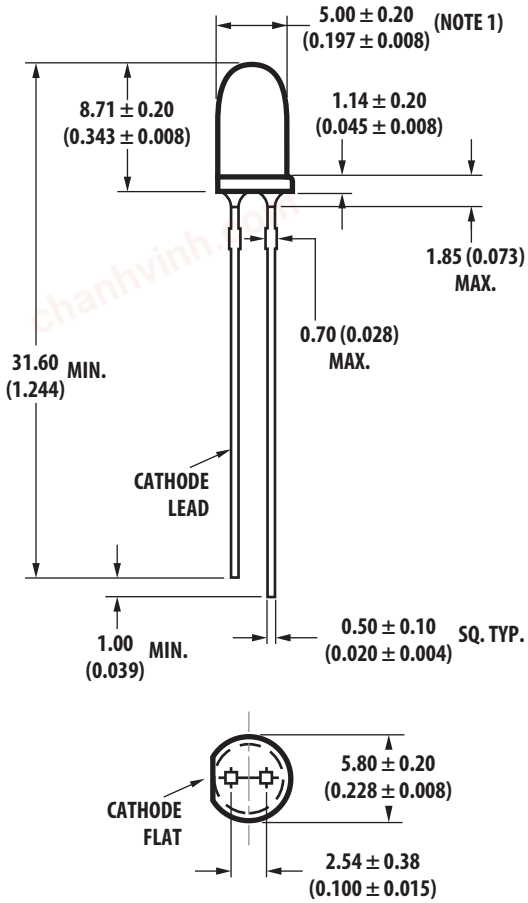
**Viewing Angle & Standoffs Options**
15: 15 Degree, without Standoffs
23: 25 Degree, without Standoffs

**Color Options**
1. AS AlGaAs Red
2. High Efficiency Red
3. Yellow
4. Orange
5. Green
6. Emerald Green

**Package Options**
C: T-1 3/4 (5 mm)

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## Package Dimensions




Notes:
1. All dimensions are in millimeters (inches).
2. An epoxy meniscus may extend about 0.5 mm (0.020 in.) down the leads.
3. For PCB hole recommendations, see the Precautions section.

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

| Parameter | DH AS AlGaAs Red | High Efficiency Red and Orange | Yellow | High Performance Green and Emerald Green | Units |
|---|---|---|---|---|---|
| DC Forward Current[1] | 30 | 30 | 20 | 30 | mA |
| Transient Forward Current[2] (10 µsec Pulse) | 500 | 500 | 500 | 500 | mA |
| Reverse Voltage (Ir = 100 µA) | 5 | 5 | 5 | 5 | V |
| LED Junction Temperature | 110 | 110 | 110 | 110 | °C |
| Operating Temperature Range | –20 to +100 | –40 to +100 | –40 to +100 | –20 to +100 | °C |
| Storage Temperature Range | –40 to +100 | –40 to +100 | –40 to +100 | –40 to +100 | °C |

Notes:
1. See Figure 5 for maximum current derating vs. ambient temperature.
2. The transient current is the maximum nonrecurring peak current the device can withstand without damaging the LED die and wire bond.

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## Electrical Characteristics at $T_A = 25°C$

| | Forward Voltage Vf (Volts) @ If = 20 mA | | Reverse Breakdown Vr (Volts) @ Ir = 100 μA | Capacitance C (pF) Vf = 0 f = 1 MHz | Thermal Resistance $R\theta_{J\text{-}PIN}$ (°C/W) | Speed of Response $\tau_s$ (ns) Time Constant $e^{-t/\tau s}$ |
|---|---|---|---|---|---|---|
| **Part Number** | **Typ.** | **Max.** | **Min.** | **Typ.** | | **Typ.** |
| HLMP-C115 HLMP-C123 | 1.8 | 2.2 | 5 | 30 | 210 | 30 |
| HLMP-C215 HLMP-C223 | 1.9 | 2.6 | 5 | 11 | 210 | 90 |
| HLMP-C315 HLMP-C323 | 2.1 | 2.6 | 5 | 15 | 210 | 90 |
| HLMP-C415 HLMP-C423 | 1.9 | 2.6 | 5 | 4 | 210 | 280 |
| HLMP-C515 HLMP-C523 | 2.2 | 3.0 | 5 | 18 | 210 | 260 |
| HLMP-C615 HLMP-C623 | 2.2 | 3.0 | 5 | 18 | 210 | 260 |

## Optical Characteristics at $T_A = 25°C$

| | Luminous Intensity Iv (mcd) @ 20 mA[1] | | Peak Wavelength $\lambda_{peak}$ (nm) | Color, Dominant Wavelength $\lambda_d$[2] (nm) | Viewing Angle $2\theta_{1/2}$ (Degrees)[3] | Luminous Efficacy $\eta_v$ |
|---|---|---|---|---|---|---|
| **Part Number** | **Min.** | **Typ.** | **Typ.** | **Typ.** | **Typ.** | **(lm/w)** |
| HLMP-C115 | 290 | 600 | 645 | 637 | 11 | 80 |
| HLMP-C123 | 90 | 200 | | | 26 | |
| HLMP-C215 | 138 | 300 | 635 | 626 | 17 | 145 |
| | 90 | 170 | | | 23 | |
| HLMP-C315 | 146 | 300 | 583 | 585 | 17 | 500 |
| | 96 | 170 | | | 25 | |
| HLMP-C415 | 138 | 300 | 600 | 602 | 17 | 380 |
| | 90 | 170 | | | 23 | |
| HLMP-C515 | 170 | 300 | 568 | 570 | 20 | 595 |
| | 69 | 170 | | | 28 | |
| HLMP-C615 | 17 | 45 | 558 | 560 | 20 | 656 |
| | 6 | 27 | | | 28 | |

Notes:
1. The luminous intensity, Iv, is measured at the mechanical axis of the lamp package. The actual peak of the spatial radiation pattern may not be aligned with this axis.
2. The dominant wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the device.
3. $2\theta_{1/2}$ is the off-axis angle where the luminous intensity is ½ the on-axis intensity.

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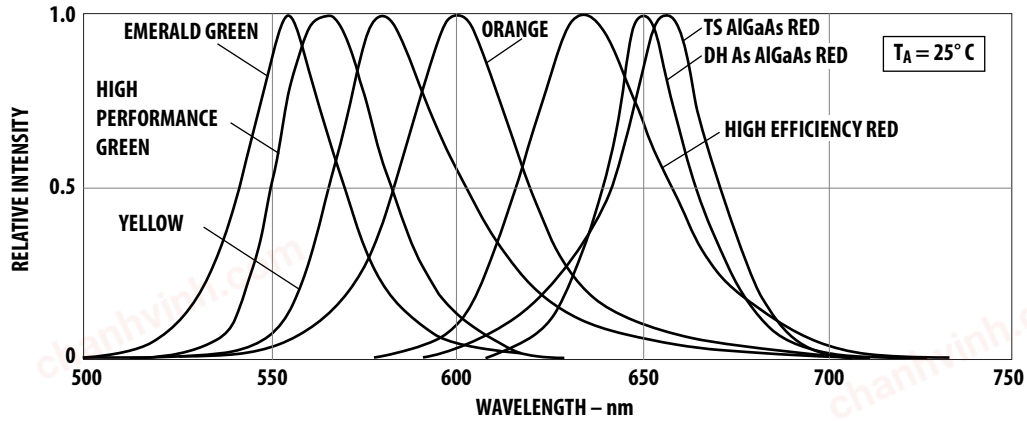
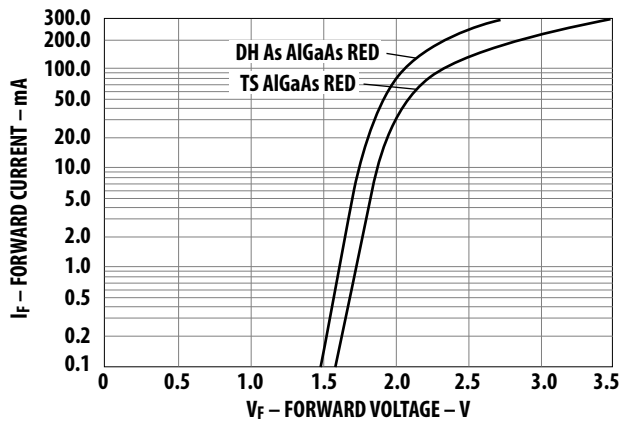



Figure 1. Relative intensity vs. wavelength.



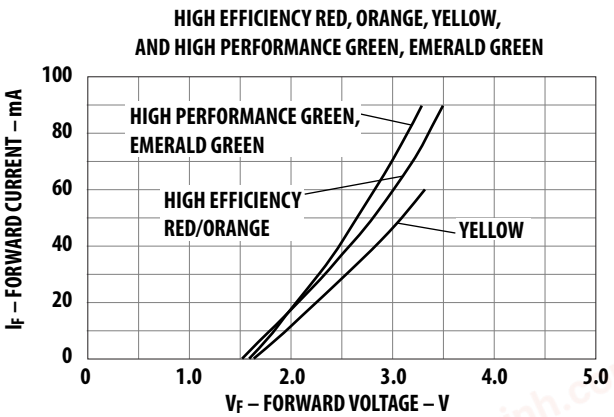
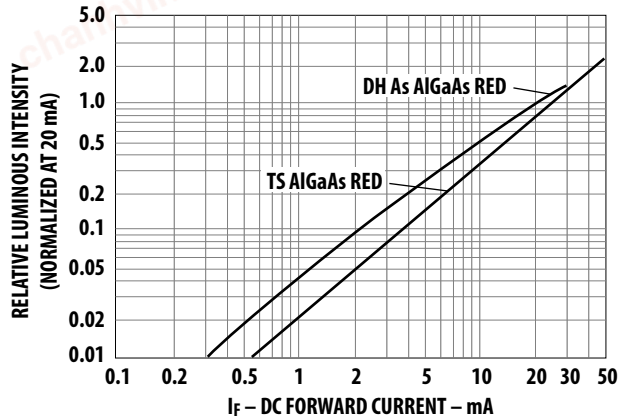




Figure 2. Forward current vs. forward voltage (non-resistor lamp).



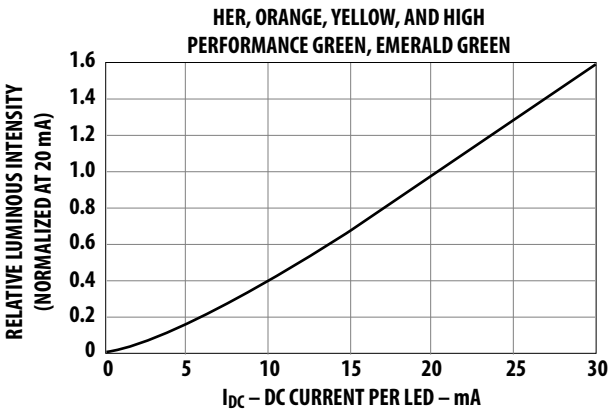
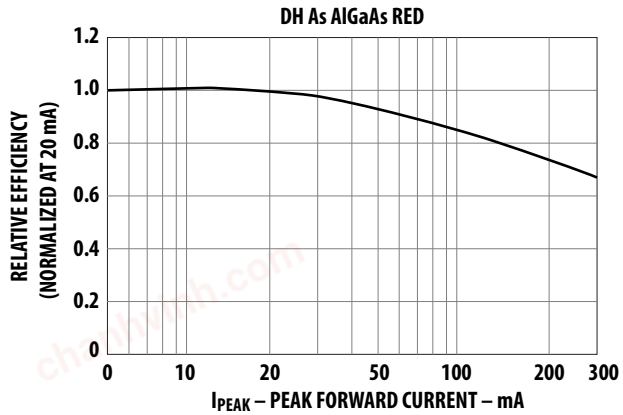




Figure 3. Relative luminous intensity vs. forward current.

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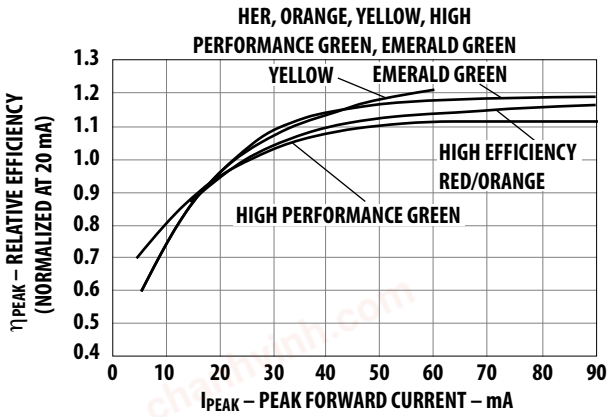
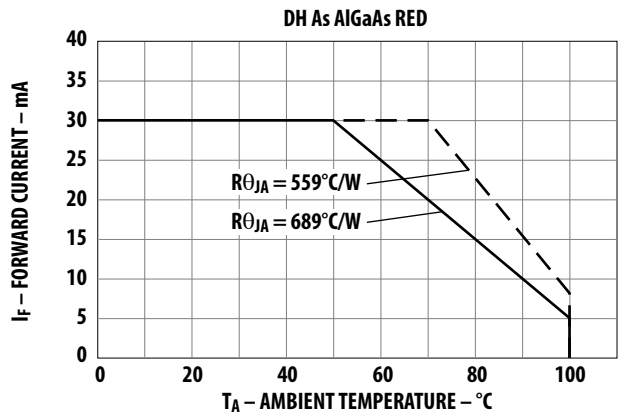




Figure 4. Relative efficiency (luminous intensity per unit current) vs. peak current.



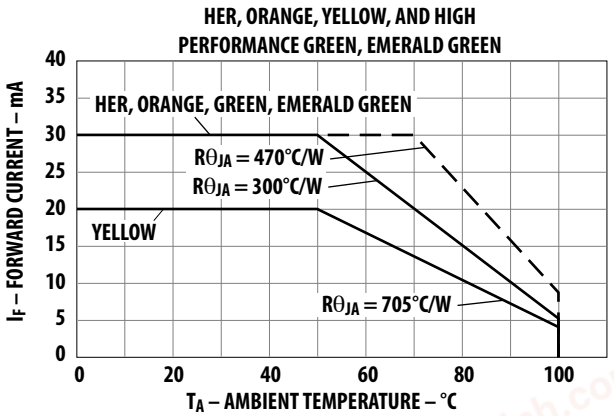




Figure 5. Maximum forward dc current vs. ambient temperature. Derating based on $T_jMAX = 110°C$.

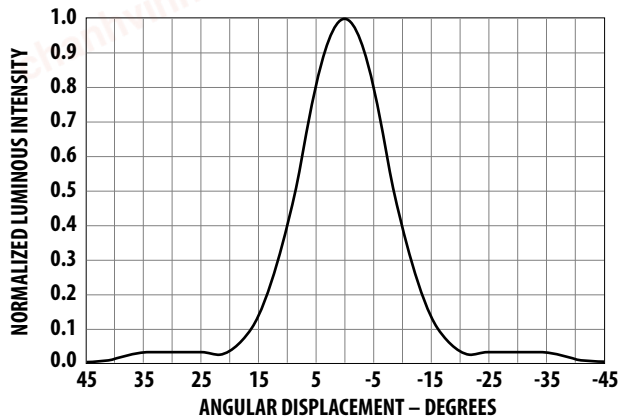



Figure 6. Relative luminous intensity vs. angular displacement. 15 degree family.

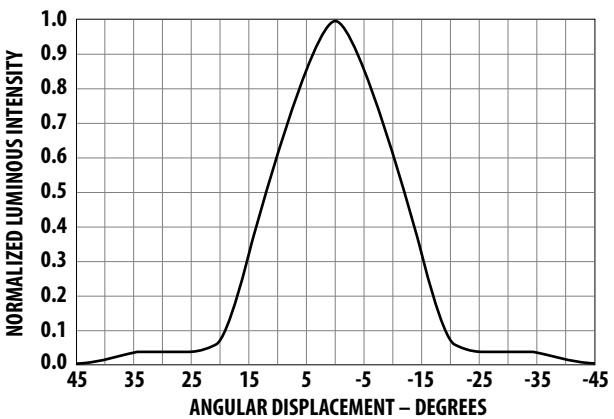



Figure 7. Relative luminous intensity vs. angular displacement. 25 degree family.

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## Intensity Bin Limits

| Color | Bin | Intensity Range (mcd) Min. | Max. |
|---|---|---|---|
| Red/Orange | L | 101.5 | 162.4 |
| | M | 162.4 | 234.6 |
| | N | 234.6 | 340.0 |
| | O | 340.0 | 540.0 |
| | P | 540.0 | 850.0 |
| | Q | 850.0 | 1200.0 |
| | R | 1200.0 | 1700.0 |
| | S | 1700.0 | 2400.0 |
| | T | 2400.0 | 3400.0 |
| | U | 3400.0 | 4900.0 |
| | V | 4900.0 | 7100.0 |
| | W | 7100.0 | 10200.0 |
| | X | 10200.0 | 14800.0 |
| | Y | 14800.0 | 21400.0 |
| | Z | 21400.0 | 30900.0 |
| Yellow | L | 173.2 | 250.0 |
| | M | 250.0 | 360.0 |
| | N | 360.0 | 510.0 |
| | O | 510.0 | 800.0 |
| | P | 800.0 | 1250.0 |
| | Q | 1250.0 | 1800.0 |
| | R | 1800.0 | 2900.0 |
| | S | 2900.0 | 4700.0 |
| | T | 4700.0 | 7200.0 |
| | U | 7200.0 | 11700.0 |
| | V | 11700.0 | 18000.0 |
| | W | 18000.0 | 27000.0 |
| Green/ Emerald Green | E | 7.6 | 12.0 |
| | F | 12.0 | 19.1 |
| | G | 19.1 | 30.7 |
| | H | 30.7 | 49.1 |
| | I | 49.1 | 78.5 |
| | J | 78.5 | 125.7 |
| | K | 125.7 | 201.1 |
| | L | 201.1 | 289.0 |
| | M | 289.0 | 417.0 |
| | N | 417.0 | 680.0 |
| | O | 680.0 | 1100.0 |
| | P | 1100.0 | 1800.0 |
| | Q | 1800.0 | 2700.0 |
| | R | 2700.0 | 4300.0 |
| | S | 4300.0 | 6800.0 |
| | T | 6800.0 | 10800.0 |
| | U | 10800.0 | 16000.0 |
| | V | 16000.0 | 25000.0 |
| | W | 25000.0 | 40000.0 |

Maximum tolerance for each bin limit is ± 18%.

## Color Categories

| Color | Category# | Lambda (nm) Min. | Max. |
|---|---|---|---|
| Green | 6 | 561.5 | 564.5 |
| | 5 | 564.5 | 567.5 |
| | 4 | 567.5 | 570.5 |
| | 3 | 570.5 | 573.5 |
| | 2 | 573.5 | 576.5 |
| Yellow | 1 | 582.0 | 584.5 |
| | 3 | 584.5 | 587.0 |
| | 2 | 587.0 | 589.5 |
| | 4 | 589.5 | 592.0 |
| | 5 | 592.0 | 593.0 |
| Orange | 1 | 597.0 | 599.5 |
| | 2 | 599.5 | 602.0 |
| | 3 | 602.0 | 604.5 |
| | 4 | 604.5 | 607.5 |
| | 5 | 607.5 | 610.5 |
| | 6 | 610.5 | 613.5 |
| | 7 | 613.5 | 616.5 |
| | 8 | 616.5 | 619.5 |

Tolerance for each bin limit is ± 0.5 nm.

## Mechanical Option Matrix

| Mechanical Option Code | Definition |
|---|---|
| 00 | Bulk Packaging, minimum increment 500 pcs/bag |
| 01 | Tape & Reel, crimped leads, minimum increment 1300 pcs/bag |
| 02 | Tape & Reel, straight leads, minimum increment 1300 pcs/bag |
| B2 | Right Angle Housing, even leads, minimum increment 500 pcs/bag |

Note:
All categories are established for classification of products. Products may not be available in all categories. Please contact your local Avago representative for further clarification/information.

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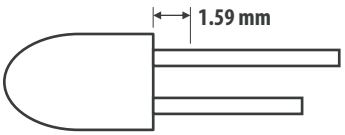
## Precautions:

### Lead Forming:

- The leads of an LED lamp may be preformed or cut to length prior to insertion and soldering on PC board.
- 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.
- If manual lead cutting is necessary, cut the leads after the soldering process. The solder connection forms a mechanical ground which prevents mechanical stress due to lead cutting from traveling into LED package. This is highly recommended for hand solder operation, as the excess lead length also acts as small heat sink.

### Soldering and Handling:

- Care must be taken during PCB assembly and soldering process to prevent damage to the LED component.
- LED component may be effectively hand soldered to PCB. However, it is only recommended under unavoidable circumstances such as rework. The closest manual soldering distance of the soldering heat source (soldering iron's tip) to the body is 1.59mm. Soldering the LED using soldering iron tip closer than 1.59mm might damage the LED.




- ESD precaution must be properly applied on the soldering station and by personnel to prevent ESD damage to the LED component that is ESD sensitive. For details, refer to Avago application note AN 1142. The soldering iron used should have a grounded tip to ensure electrostatic charge is properly grounded.
- Recommended soldering conditions:

| | Wave Soldering[1],[2] | Manual Solder Dipping |
|---|---|---|
| Pre-heat Temperature | 105°C Max. | – |
| Pre-heat Time | 60 sec Max. | – |
| Peak Temperature | 250°C Max. | 260°C Max. |
| Dwell Time | 3 sec Max. | 5 sec Max. |

Notes:
1. These conditions refer to measurement with a thermocouple mounted at the bottom of PCB.
2. To reduce thermal stress experienced by the LED, it is recommended that you use only the bottom preheaters.

- Wave soldering parameters must be set and maintained according to the recommended temperature and dwell time. Customer is advised to perform daily check on the soldering profile to ensure that it is always conforming to recommended soldering conditions.

  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. Customer is advised to take extra precaution during wave soldering to ensure that the maximum wave temperature does not exceed 250°C and the solder contact time does not exceeding 3sec. Over-stressing the LED during soldering process might cause premature failure to the LED due to delamination.
- Any alignment fixture that is being applied during wave soldering should be loosely fitted and should not apply weight or force on LED. Non metal material is recommended as it will absorb less heat during wave soldering process.
- At elevated temperature, LED is more susceptible to mechanical stress. Therefore, PCB must allowed to cool down to room temperature prior to handling, which includes removal of alignment fixture or pallet.
- If PCB board contains both through hole (TH) LED and other surface mount components, it is recommended that surface mount components be soldered on the top side of the PCB. If surface mount need to be on the bottom side, these components should be soldered using reflow soldering prior to insertion the TH LED.
- Recommended PC board plated through holes (PTH) size for LED component leads.

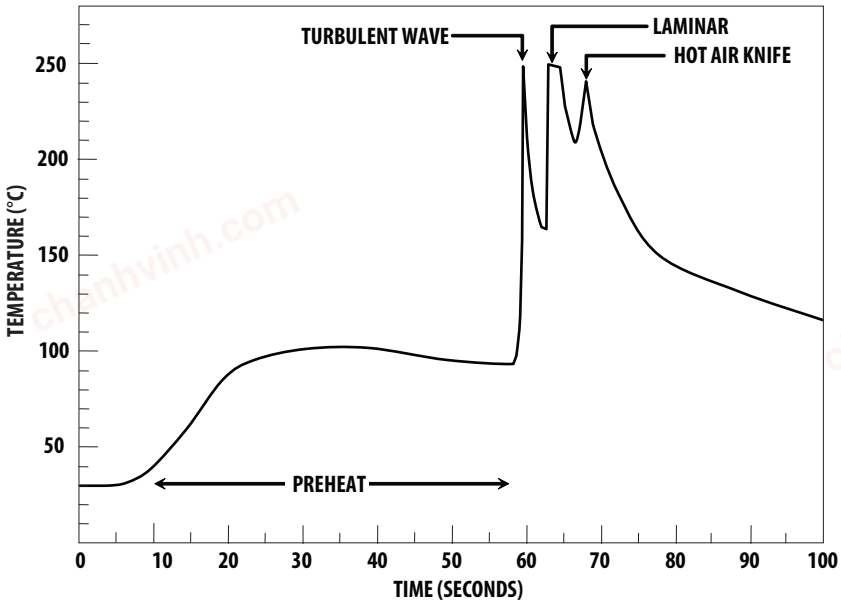
| | LED Component Lead Size | Diagonal | Plated Through-Hole Diameter |
|---|---|---|---|
| Lead size (typ.) | 0.45 × 0.45 mm (0.018 × 0.018 in.) | 0.636 mm (0.025 in) | 0.98 to 1.08 mm (0.039 to 0.043 in) |
| Dambar shear-off area (max.) | 0.65 mm (0.026 in) | 0.919 mm (0.036 in) | |
| Lead size (typ.) | 0.50 × 0.50 mm (0.020 × 0.020 in.) | 0.707 mm (0.028 in) | 1.05 to 1.15 mm (0.041 to 0.045 in) |
| Dambar shear-off area (max.) | 0.70 mm (0.028 in) | 0.99 mm (0.039 in) | |

- Over-sizing the PTH can lead to a twisted LED after it is clinched. On the other hand, undersizing the PTH can make inserting the TH LED difficult.

For more information about soldering and handling of TH LED lamps, refer to application note AN5334.

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Example of Wave Soldering Temperature Profile for TH LED




**Recommended solder:**
**Sn63 (Leaded solder alloy)**
**SAC305 (Lead free solder alloy)**

**Flux: Rosin flux**

**Solder bath temperature:**
**245°C± 5°C (maximum peak temperature = 250°C)**

**Dwell time: 1.5 sec – 3.0 sec (maximum = 3sec)**

**Note: Allow for board to be sufficiently cooled to room temperature before exerting mechanical force.**

**Recommended solder:**
**Sn63 (Leaded solder alloy)**
**SAC305 (Lead free solder alloy)**

**Flux: Rosin flux**

**Solder bath temperature:**
**245°C± 5°C (maximum peak temperature = 250°C)**

**Dwell time: 1.5 sec – 3.0 sec (maximum = 3sec)**

**Note: Allow for board to be sufficiently cooled to room temperature before exerting mechanical force.**

## Packaging Label:

### (i) Avago Mother Label: (Available on packaging box of ammo pack and shipping box)

AVAGO TECHNOLOGIES

(1P) Item: Part Number

STANDARD LABEL LS0002
RoHS Compliant
e3 max temp 250C

(1T) Lot: Lot Number

(Q) QTY: Quantity

LPN:

CAT: Intensity Bin

(9D)MFG Date: Manufacturing Date

BIN: Color Bin

(P) Customer Item:

(V) Vendor ID:

(9D) Date Code: Date Code

DeptID:

Made In: Country of Origin

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**(ii) Avago Baby Label (Only available on bulk packaging)**

AVAGO TECHNOLOGIES

**Lamps Baby Label**

RoHS Compliant
e3 max temp 250C

(1P) PART #: Part Number

(1T) LOT #: Lot Number

(9D)MFG DATE: Manufacturing Date

QUANTITY: Packing Quantity

C/O: Country of Origin

Customer P/N:

CAT: Intensity Bin

Supplier Code:

BIN: Color Bin

DATECODE: Date Code

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