

HLMP-1301

T-1 (3 mm) Diffused LED Lamps



Data Sheet

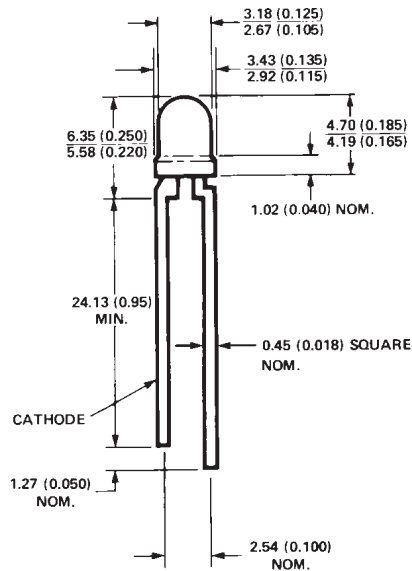


**HLMP-1301, HLMP-1401, HLMP-1503,
HLMP-K401, HLMP-K600**

Description

This family of T-1 lamps is widely used in general purpose indicator applications. Diffusants, tints, and optical design are balanced to yield superior light output and wide viewing angles. Several intensity choices are available in each color for increased design flexibility.

Package Dimensions



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES (INCHES).
2. AN EPOXY MENISCUS MAY EXTEND ABOUT 1mm (0.040") DOWN THE LEADS.

Features

- **High intensity**
- **Choice of 4 bright colors**
 - High Efficiency Red
 - Orange
 - Yellow
 - High Performance Green
- **Popular T-1 diameter package**
- **Selected minimum intensities**
- **Wide viewing angle**
- **General purpose leads**
- **Reliable and rugged**
- **Available on tape and reel**

Selection Guide

| Material | Color | Part Number | Luminous Intensity I _v (mcd) at 10 mA | |
|------------------------------|--------|-----------------|--|------|
| | | | Min. | Max. |
| GaAsP on GaP | Red | HLMP-1301 | 3.4 | – |
| | | HLMP-1301-E00xx | 3.4 | – |
| | | HLMP-1301-FG0xx | 5.4 | 17.2 |
| | | HLMP-1301-G00xx | 8.6 | – |
| | | HLMP-1301-GH0xx | 8.6 | 27.6 |
| | Yellow | HLMP-1401 | 2.2 | – |
| | | HLMP-1401-D00xx | 3.6 | – |
| | | HLMP-1401-E00xx | 5.7 | – |
| | | HLMP-1401-EF0xx | 5.7 | 18.4 |
| | | HLMP-1401-EFBxx | 5.7 | 18.4 |
| | Orange | HLMP-K401 | 2.1 | – |
| | | HLMP-K401-E00xx | 3.4 | – |
| | | HLMP-K401-EF0xx | 3.4 | 10.8 |
| | | HLMP-K401-FGDxx | 5.4 | 17.2 |
| | GaP | Green | HLMP-1503 | 1.0 |
| HLMP-1503-C00xx | | | 2.6 | – |
| HLMP-1503-D00xx | | | 4.2 | – |
| HLMP-1503-DE0xx | | | 4.2 | 13.4 |
| HLMP-1503-DEDxx | | | 4.2 | 13.4 |
| Emerald Green ^[1] | | HLMP-K600 | 1.0 | – |

Note:

1. Please refer to Application Note 1061 for information comparing standard green and emerald green light output degradation.

Part Numbering System

HLMP - x x xx - x x x xx

Mechanical Option

00: Bulk
01: Tape & Reel, Crimped Leads
02, Bx: Tape & Reel, Straight Leads
A1: Right Angle Housing, Uneven Leads
A2: Right Angle Housing, Even Leads
Dx, EE: Ammo Pack, Straight Leads
R4: Tape & Reel, Counter Clockwise
Vx: Ammo Pack, Horizontal Leads
FG: Products need inventory control for Customer IDI

Color Bin Options

0: Full Color Bin Distribution
B: Color Bins 2 & 3 only
D: Color Bins 4 & 5 only

Maximum Iv Bin Options

0: Open (no max. limit)
Others: Please refer to the Iv Bin Table

Minimum Iv Bin Options

Please refer to the Iv Bin Table

Color Options

3: GaP HER
4: GaP Yellow (except K4xx Series)
5: GaP Green
6: GaP Emerald Green

Package Options

1: T-1 (3 mm)
K: T-1 (3 mm) Orange (K4xx) or Emerald Green (K6xx)

Absolute Maximum Ratings at $T_A = 25^\circ\text{C}$

| Parameter | HER/Orange | Yellow | Green | Units |
|--|-------------|-------------|-------------|------------------|
| Peak Forward Current | 90 | 60 | 90 | mA |
| Average Forward Current ^[1] | 25 | 20 | 25 | mA |
| DC Current ^[2] | 30 | 20 | 30 | mA |
| Reverse Voltage ($I_R = 100\ \mu\text{A}$) | 5 | 5 | 5 | V |
| Transient Forward Current ^[4] (10 μsec Pulse) | 500 | 500 | 500 | mA |
| LED Junction Temperature | 110 | 110 | 110 | $^\circ\text{C}$ |
| Operating Temperature Range | -55 to +100 | -55 to +100 | -20 to +100 | $^\circ\text{C}$ |
| Storage Temperature Range | | | -55 to +100 | |

Notes:

1. See Figure 5 (HER/Orange), 10 (Yellow), or 15 (Green/Emerald Green) to establish pulsed operating conditions.
2. For Red, Orange, and Green series derate linearly from 50°C at $0.5\ \text{mA}/^\circ\text{C}$. For Yellow series derate linearly from 50°C at $0.2\ \text{mA}/^\circ\text{C}$.
3. For Red, Orange, and Green series derate power linearly from 25°C at $1.8\ \text{mW}/^\circ\text{C}$. For Yellow series derate power linearly from 50°C at $1.6\ \text{mW}/^\circ\text{C}$.
4. The transient peak current is the maximum non-recurring peak current that can be applied to the device without damaging the LED die and wirebond. It is not recommended that the device be operated at peak currents beyond the peak forward current listed in the Absolute Maximum Ratings.

Electrical Characteristics at $T_A = 25^\circ\text{C}$

| Symbol | Description | Device HLMP- | Min. | Typ. | Max. | Units | Test Conditions |
|--------------------------|--|---|-------------------|---------------------------------|--------------------------|-----------------------|------------------------------------|
| $2\theta^{1/2}$ | Included Angle Between Half Luminous Intensity Points | All | | 60 | | Deg. | $I_F = 10\text{ mA}$ See Note 1 |
| λ_{PEAK} | Peak Wavelength | High Efficiency Red Orange Yellow Green Emerald Green | | 635 600 583 565 558 | | nm | Measurement at Peak |
| λ_d | Dominant Wavelength | High Efficiency Red Orange Yellow Green Emerald Green | | 626 602 585 569 560 | | nm | See Note 2 |
| $\Delta\lambda_{1/2}$ | Spectral Line Halfwidth | High Efficiency Red Yellow Green Emerald Green | | 40 36 28 24 | | nm | |
| τ_s | Speed of Response | High Efficiency Red Orange Yellow Green Emerald Green | | 90 280 90 500 3100 | | ns | |
| C | Capacitance | High Efficiency Red Orange Yellow Green Emerald Green | | 11 4 15 18 35 | | pF | $V_F = 0;$ $f = 1\text{ MHz}$ |
| $R_{\theta\text{J-PIN}}$ | Thermal Resistance | All | | 290 | | $^\circ\text{C/W}$ | Junction to Cathode Lead |
| V_F | Forward Voltage | HER/Orange Yellow Green Emerald Green | 1.5 1.5 1.5 | 1.9 2.0 2.1 2.1 | 2.4 2.4 2.7 2.7 | V | $I_F = 10\text{ mA}$ |
| V_R | Reverse Breakdown Voltage | All | 5.0 | | | V | $I_R = 100\ \mu\text{A}$ |
| η_V | Luminous Efficacy | High Efficiency Red Orange Yellow Green Emerald Green | | 145 380 500 595 655 | | <u>lumens</u> watt | See Note 3 |

Notes:

- $\theta^{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
- The dominant wavelength, λ_d , is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
- Radiant intensity, I_e , in watts/steradian, may be found from the equation $I_e = I_v/\eta_V$, where I_v is the luminous intensity in candelas and η_V is the luminous efficacy in lumens/watt.

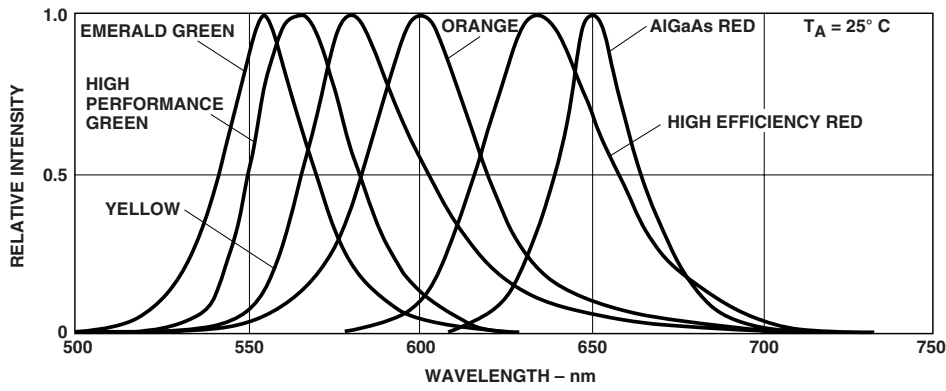


Figure 1. Relative intensity vs. wavelength.

T-1 High Efficiency Red, Orange Diffused Lamps

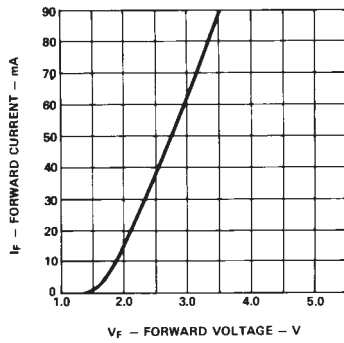


Figure 2. Forward current vs. forward voltage characteristics.

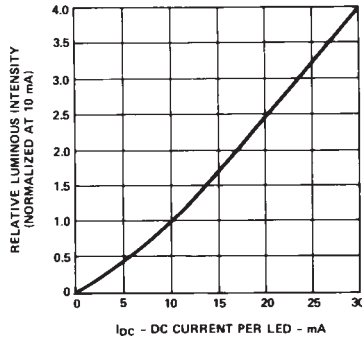


Figure 3. Relative luminous intensity vs. DC forward current.

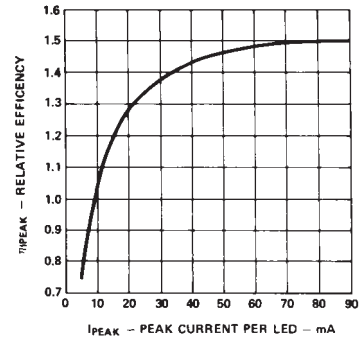


Figure 4. Relative efficiency (luminous intensity per unit current) vs. peak LED current.

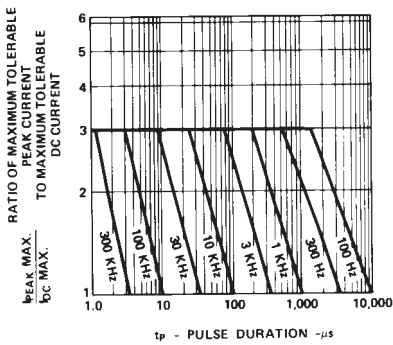


Figure 5. Maximum tolerable peak current vs. pulse duration. (I_{DC} MAX as per MAX ratings).

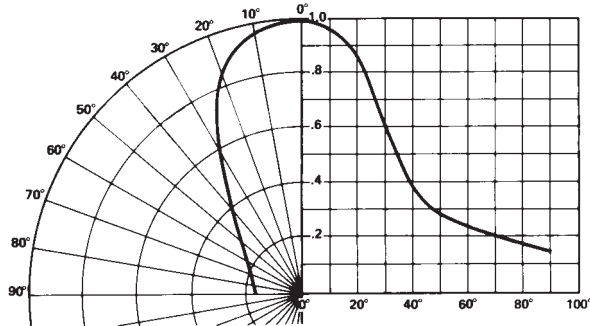


Figure 6. Relative luminous intensity vs. angular displacement.

T-1 Yellow Diffused Lamps

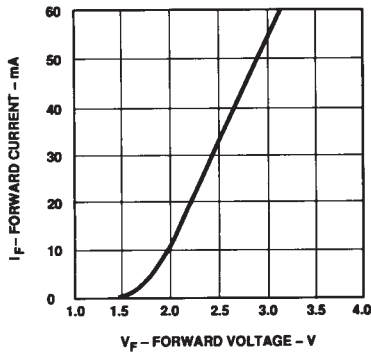


Figure 7. Forward current vs. forward voltage characteristics.

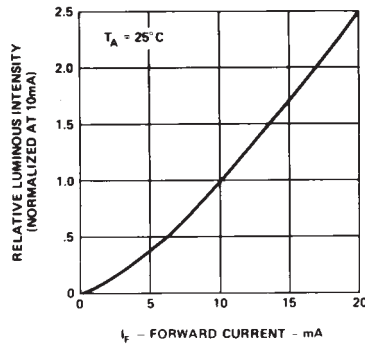


Figure 8. Relative luminous intensity vs. forward current.

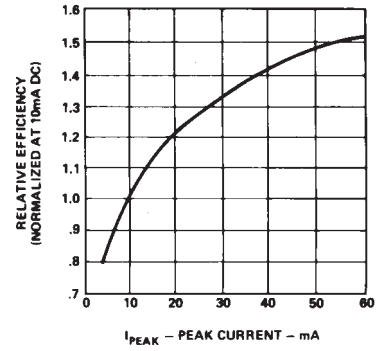


Figure 9. Relative efficiency (luminous intensity per unit current) vs. peak current.

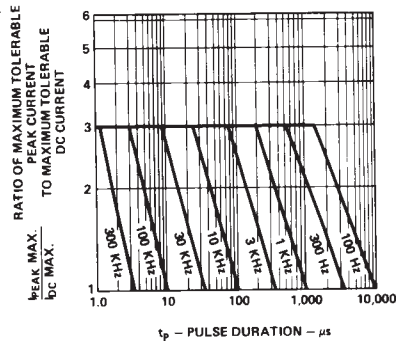


Figure 10. Maximum tolerable peak current vs. pulse duration. (I_{DC} MAX as per MAX ratings).

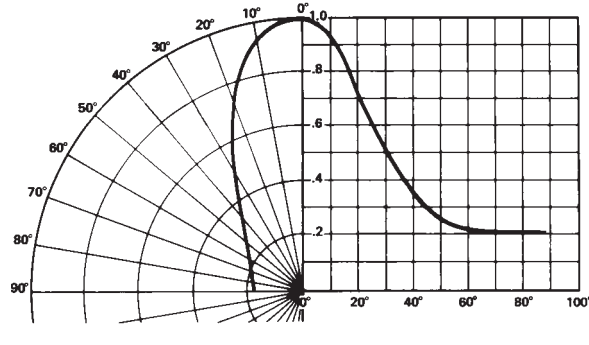


Figure 11. Relative luminous intensity vs. angular displacement.

T-1 Green/Emerald Green Diffused Lamps

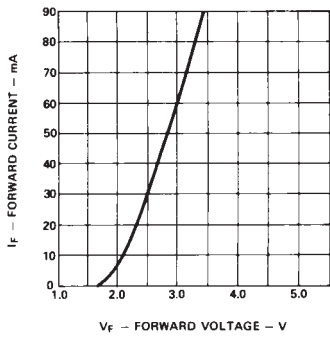


Figure 12. Forward current vs. forward voltage characteristics.

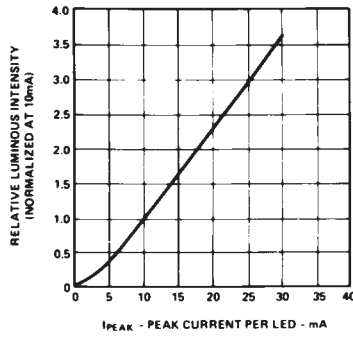


Figure 13. Relative luminous intensity vs. forward current.

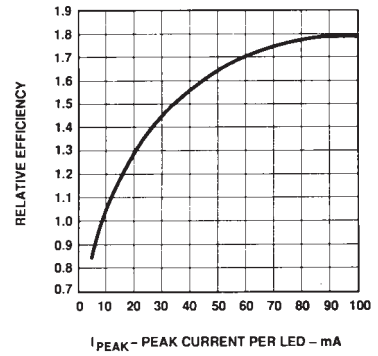


Figure 14. Relative efficiency (luminous intensity per unit current) vs. peak LED current.

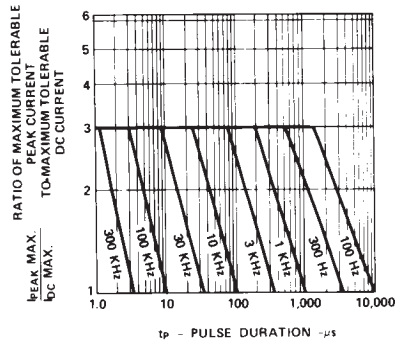


Figure 15. Maximum tolerable peak current vs. pulse duration. (I_{DC} MAX as per MAX ratings).

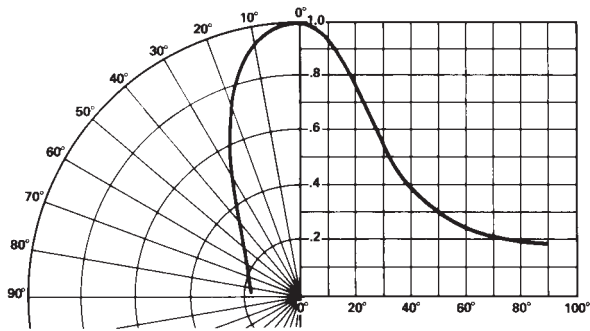


Figure 16. Relative luminous intensity vs. angular displacement.

Intensity Bin Limits

| Color | Bin | Intensity Range (mcd) | |
|------------|---------|-----------------------|---------|
| | | Min. | Max. |
| Red/Orange | D | 2.4 | 3.8 |
| | E | 3.8 | 6.1 |
| | F | 6.1 | 9.7 |
| | G | 9.7 | 15.5 |
| | H | 15.5 | 24.8 |
| | I | 24.8 | 39.6 |
| | J | 39.6 | 63.4 |
| | K | 63.4 | 101.5 |
| | 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 | C | 2.5 | 4.0 |
| | D | 4.0 | 6.5 |
| | E | 6.5 | 10.3 |
| | F | 10.3 | 16.6 |
| | G | 16.6 | 26.5 |
| | H | 26.5 | 42.3 |
| | I | 42.3 | 67.7 |
| | J | 67.7 | 108.2 |
| | K | 108.2 | 173.2 |
| | 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 | |

Intensity Bin Limits, continued

| Color | Bin | Intensity Range (mcd) | |
|-------------------------|---------|-----------------------|--------|
| | | Min. | Max. |
| Green/ Emerald Green | A | 1.1 | 1.8 |
| | B | 1.8 | 2.9 |
| | C | 2.9 | 4.7 |
| | D | 4.7 | 7.6 |
| | 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 $\pm 18\%$.

Color Categories

| Color | Category # | Lambda (nm) | |
|---------------|------------|-------------|-------|
| | | Min. | Max. |
| Emerald Green | 9 | 522.5 | 555.5 |
| | 8 | 555.5 | 558.5 |
| | 7 | 558.5 | 561.5 |
| | 6 | 561.5 | 564.5 |
| 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 |
| | 1 | 582.0 | 584.5 |
| Yellow | 3 | 584.5 | 587.0 |
| | 2 | 587.0 | 589.5 |
| | 4 | 589.5 | 592.0 |
| | 5 | 592.0 | 593.0 |
| | 1 | 597.0 | 599.5 |
| Orange | 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 1800 pcs/bag |
| 02 | Tape & Reel, straight leads, minimum increment 1800 pcs/bag |
| A1 | Right Angle Housing, uneven leads, minimum increment 500 pcs/bag |
| A2 | Right Angle Housing, even leads, minimum increment 500 pcs/bag |
| BG | Tape & Reel, straight leads in 2K increment |
| BJ | Tape & Reel, straight leads in 2K increment |
| DD | Ammo Pack, straight leads in 2K increment |
| DJ | Ammo Pack, straight leads in 2K increment |
| EE | Ammo Pack, straight leads in 5K increment |
| R4 | Tape & Reel, straight leads, counter clockwise, anode lead leaving the reel first |
| VA | Ammo Pack, horizontal leads in 2K increment |
| VB | Ammo Pack, horizontal leads in 2K increment |
| FG | Inventory Control for Customer IDI |

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.

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.

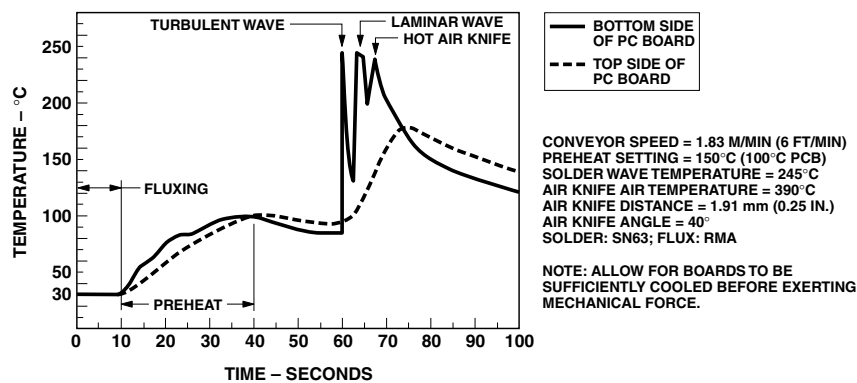


Figure 17. Recommended wave soldering profile.

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

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