

## HLMP-Yxxx

### T-1 (3 mm) GaP/GaAsP LED Lamps

#### Description

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

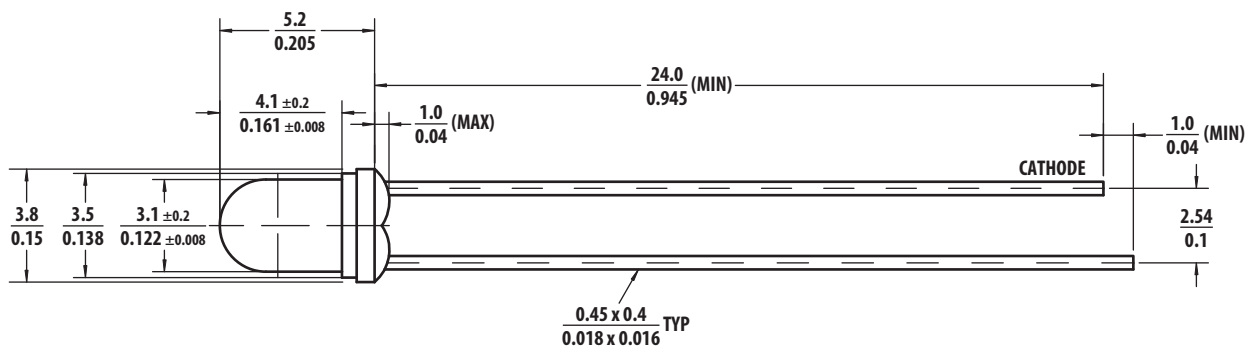
#### Features

- Low power consumption
- High efficiency
- Versatile mounting on PCB or panel
- I.C. compatible/low current requirement
- Popular T-1 package
- RoHS compliant

#### Applications

- Status indicator
- Backlighting front panels
- Light pipe sources
- Lighted switches

**Figure 1: Package Dimension**



#### NOTE:

1. All dimensions are in millimeter (inches).
2. Tolerance is  $\pm 0.25$  mm (.010 in.) unless otherwise stated.
3. Lead spacing is measured where the leads emerge from the package.

## Selection Guide

| Part Number     | Color        | Package Description     | Luminous Intensity, I <sub>v</sub> (mcd) at 10 mA |      |      | Viewing Angle, 2θ <sup>1/2</sup> (°) |
|-----------------|--------------|-------------------------|---|------|------|--------------------------------------|
|                 |              |                         | Min.  | Typ. | Max. |                                      |
| HLMP-Y301-F00xx | GaAsP HER    | Tinted,<br>Non-diffused | 6.1   | 19   | —    | 45                                   |
| HLMP-Y402-G00xx | GaAsP Orange |                         | 9.7   | 29   | —    | 45                                   |
| HLMP-Y502-F00xx | GaP Green    |                         | 12  | 40   | —    | 55                                   |

## Absolute Maximum Ratings at T<sub>A</sub> = 25°C

| Parameter   | HLMP-Y301   | HLMP-Y402 | HLMP-Y502 | Units |
|---|-------------|-----------|-----------|-------|
| DC Forward Current <sup>a</sup>                               | 20          | 20        | 20        | mA    |
| Peak Forward Current<br>(1/10 Duty Cycle, 0.1 ms Pulse Width) | 90          | 60        | 120       | mA    |
| Reverse Voltage (I <sub>R</sub> = 100 μA)                     | 5           | 5         | 5         | V     |
| Junction Temperature  | 110         | 110       | 110       | °C    |
| Power Dissipation   | 52          | 52        | 52        | mW    |
| Storage Temperature Range                                     | -40 to +100 |           |           | °C    |
| Operating Temperature Range                                   | -40 to +100 |           |           | °C    |

a. Derate linearly as shown in [Figure 4](#).

## Electrical/Optical Characteristics at T<sub>A</sub> = 25°C

| Parameter                        | Symbol              | Part Number                         | Min.                  | Typ.              | Max.                  | Units | Test Conditions   |
|----------------------------------|---------------------|-------------------------------------|-----------------------|-------------------|-----------------------|-------|---|
| Peak Wavelength                  | λ <sub>PEAK</sub>   | HLMP-Y301<br>HLMP-Y402<br>HLMP-Y502 | —<br>—<br>—           | 635<br>610<br>565 | —<br>—<br>—           | nm    | Peak of wavelength of spectral distribution at I <sub>F</sub> = 10 mA |
| Dominant Wavelength <sup>a</sup> | λ <sub>d</sub>      | HLMP-Y301<br>HLMP-Y402<br>HLMP-Y502 | 615<br>599.5<br>561.5 | 626<br>605<br>573 | 632<br>613.5<br>576.5 | nm    | I <sub>F</sub> = 10 mA  |
| Spectrum Half Width              | Δλ                  | HLMP-Y301<br>HLMP-Y402<br>HLMP-Y502 | —<br>—<br>—           | 40<br>35<br>30    | —<br>—<br>—           | nm    |   |
| Forward Voltage                  | V <sub>F</sub>      | HLMP-Y301<br>HLMP-Y402<br>HLMP-Y502 | —<br>—<br>—           | 2.1<br>2.1<br>2.2 | 2.6<br>2.6<br>2.6     | V     | I <sub>F</sub> = 10 mA ( <a href="#">Figure 2</a> )                   |
| Reverse Voltage                  | V <sub>R</sub>      | HLMP-Y301<br>HLMP-Y402<br>HLMP-Y502 | 5<br>5<br>5           | —<br>—<br>—       | —<br>—<br>—           | V     | I <sub>R</sub> = 100 μA   |
| Thermal Resistance               | R <sub>θJ-PIN</sub> | HLMP-Y301<br>HLMP-Y402<br>HLMP-Y502 | —<br>—<br>—           | 310<br>310<br>310 | —<br>—<br>—           | °C/W  | Junction to Cathode Lead  |

a. The dominant wavelength, λ<sub>d</sub>, is derived from the Chromaticity Diagram and represents the color of the lamp.

## Part Numbering System

H L M P - 

|                |                |                |                |
|----------------|----------------|----------------|----------------|
| x <sub>1</sub> | x <sub>2</sub> | x <sub>3</sub> | x <sub>4</sub> |
|----------------|----------------|----------------|----------------|

 - 

|                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|
| x <sub>5</sub> | x <sub>6</sub> | x <sub>7</sub> | x <sub>8</sub> | x <sub>9</sub> |
|----------------|----------------|----------------|----------------|----------------|

| Code   | Description           | Option  |                |
|--|-----------------------|---|----------------|
| x <sub>1</sub>                               | Package type          | Y   | T-1 (3mm)      |
| x <sub>2</sub> x <sub>3</sub> x <sub>4</sub> | Color                 | 301   | GaAsP HER      |
|  |                       | 402   | GaAsP Orange   |
|  |                       | 502   | GaP Green      |
| x <sub>5</sub>                               | Minimum intensity bin | Refer to <a href="#">Intensity Bin Limits</a> Table |                |
| x <sub>6</sub>                               | Maximum intensity bin |   |                |
| x <sub>7</sub>                               | Color bin selection   | 0   | Full range     |
| x <sub>8</sub> x <sub>9</sub>                | Packaging option      | 00  | Bulk packaging |

## Bin Information

### Intensity Bin Limits

| Color      | Bin | Intensity Range (mcd) |       |
|------------|-----|-----------------------|-------|
|            |     | Min.                  | Max.  |
| HER/Orange | 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 |
| Green      | 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 |
|            | O   | 289.0                 | 417.0 |

Tolerance for each bin limit is  $\pm 15\%$ .

### Color Bin Limits Table

| Color  | Cat.  | Lambda (nm) |       |
|--------|-------|-------------|-------|
|        |       | Min.        | Max.  |
| 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 |
|        | Green | 6           | 561.5 |
| 5      |       | 564.5       | 567.5 |
| 4      |       | 567.5       | 570.5 |
| 3      |       | 570.5       | 573.5 |
| 2      |       | 573.5       | 576.5 |

Tolerance for each bin limit is  $\pm 1.0$  nm.

Figure 2: Forward Current vs. Forward Voltage

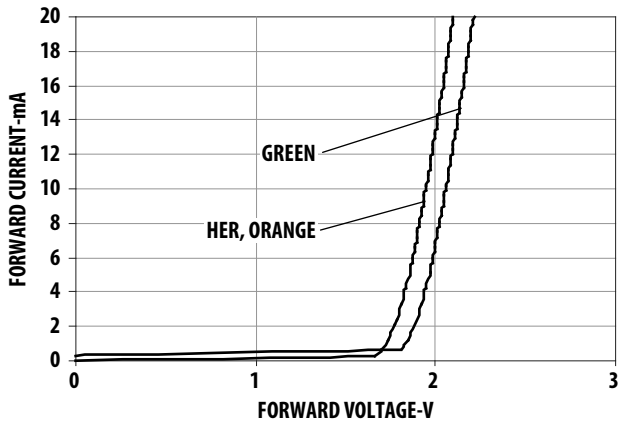


Figure 3: Relative Luminous Intensity vs. Forward Current

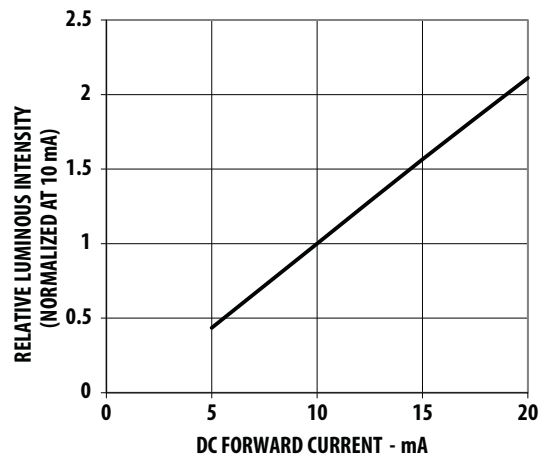


Figure 4: Ambient Temperature vs. Maximum DC Forward Current

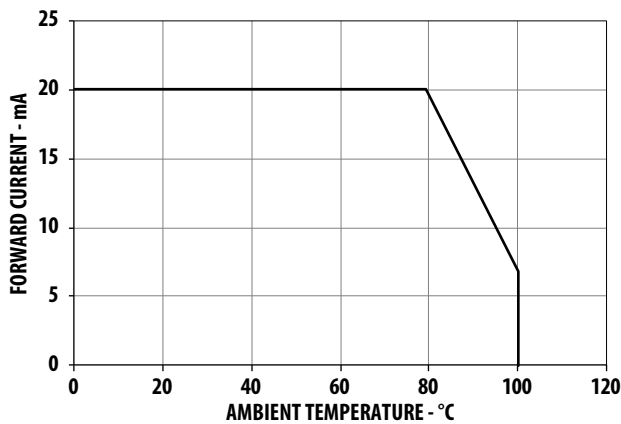


Figure 5: Representative Radiation Pattern for HLMP-Y502

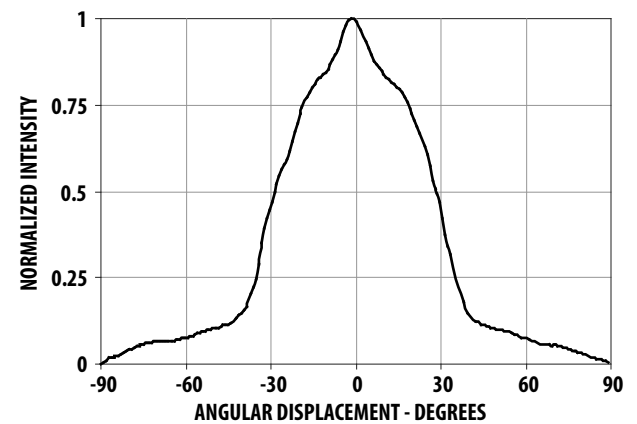


Figure 6: Representative Radiation Pattern for HLMP-Y301 and HLMP-Y402

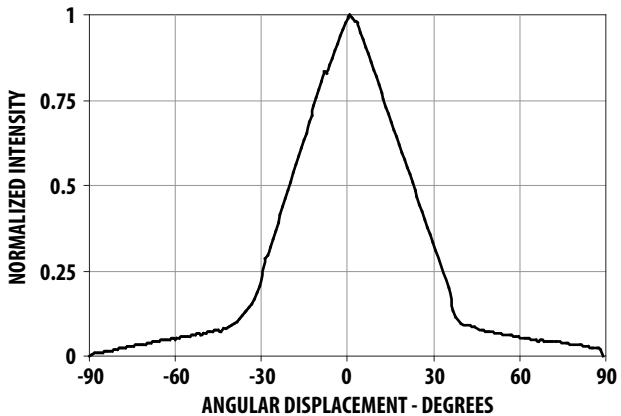
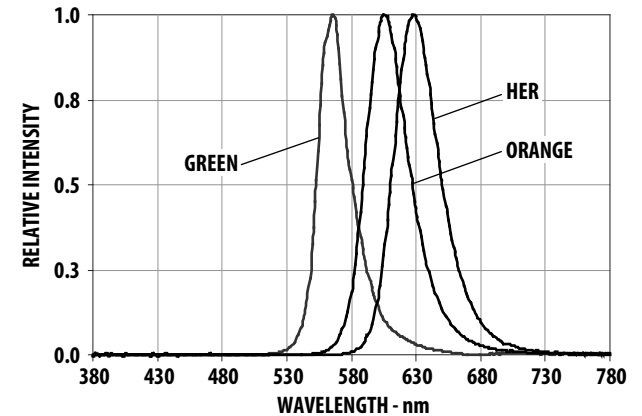


Figure 7: Relative Luminous Intensity vs. Wavelength



## Precautions

### Assembly Method

This product is not meant for auto-insertion.

### 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, take care 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.
- During lead forming, the leads should be bent at a point at least 3 mm from the base of the lens. Do not use the base of the lead frame as a fulcrum during forming. Do lead forming before soldering at normal temperature.
- Make tooling to precisely form and cut the leads to length rather than rely upon hand operation.

### Soldering Conditions

- Take care during the PCB assembly and soldering process to prevent damage to the 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.
- The recommended soldering conditions follow.

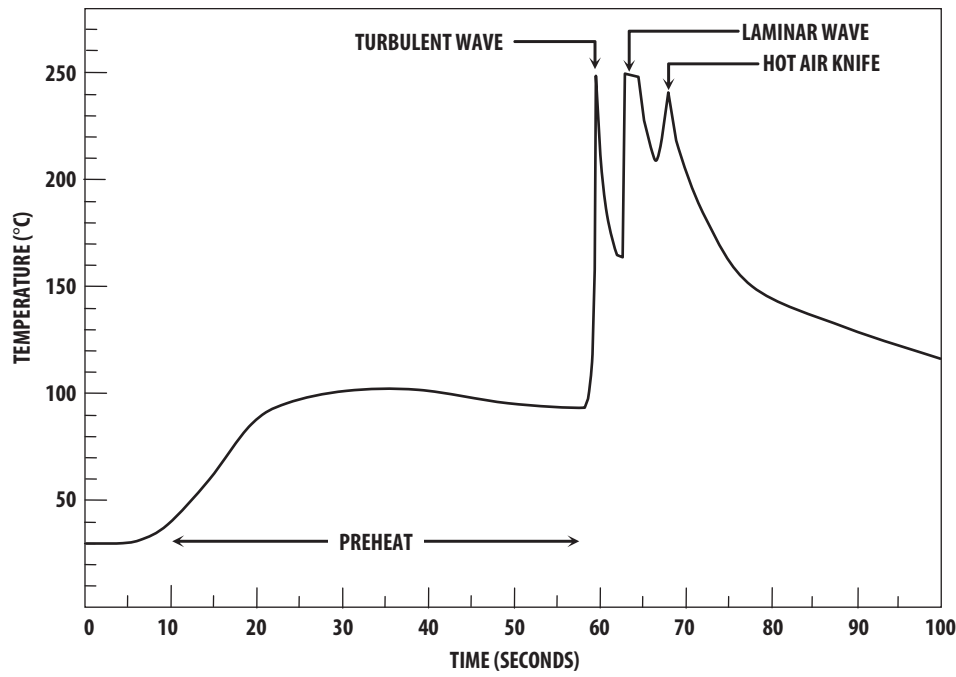
|                      | Wave Soldering | Manual Solder Dipping |
|----------------------|----------------|-----------------------|
| Pre-heat Temperature | 105°C max.     | —                     |
| Preheat Time         | 60s max        | —                     |
| Peak Temperature     | 250°C max.     | 260°C max.            |
| Dwell Time           | 3s max.        | 5s max                |

- Set and maintain the wave soldering parameter according to the recommended temperature and dwell time in the solder wave. Periodically check on the soldering profile to ensure the soldering profile used always conforms to the recommended soldering condition.
- If necessary, use a fixture to hold the LED component in the proper orientation with respect to the PCB during the 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.
- Pay special attention 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 follow.

| Led Component Lead Size                        | Diagonal                | Plated Through Hole Diameter                     |
|--|-------------------------|--|
| 0.457 mm × 0.457 mm<br>(0.018 in. × 0.018 in.) | 0.646 mm<br>(0.025 in.) | 0.976 mm to 1.078 mm<br>(0.038 in. to 0.042 in.) |
| 0.508 mm × 0.508 mm<br>(0.020 in. × 0.020 in.) | 0.718 mm<br>(0.028 in.) | 1.049 mm to 1.150 mm<br>(0.041 in. to 0.045 in.) |

**NOTE:** Refer to application note AN1027 for more information on soldering LED component.

**Figure 8: Recommended Wave Soldering Profile**



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: 1.5s - 3.0s  
 (maximum = 3s)

Note: Allow for board to be  
 sufficiently cooled to room  
 temperature before you exert  
 mechanical force.

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