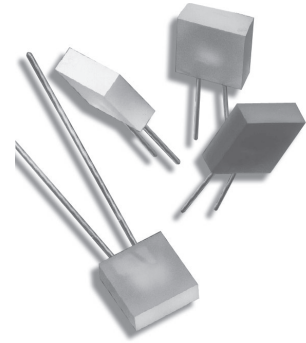


HLMP-R100, HLMP-0301, HLMP-0401, HLMP-0504

2.5 mm × 7.6 mm Rectangular LED Lamps



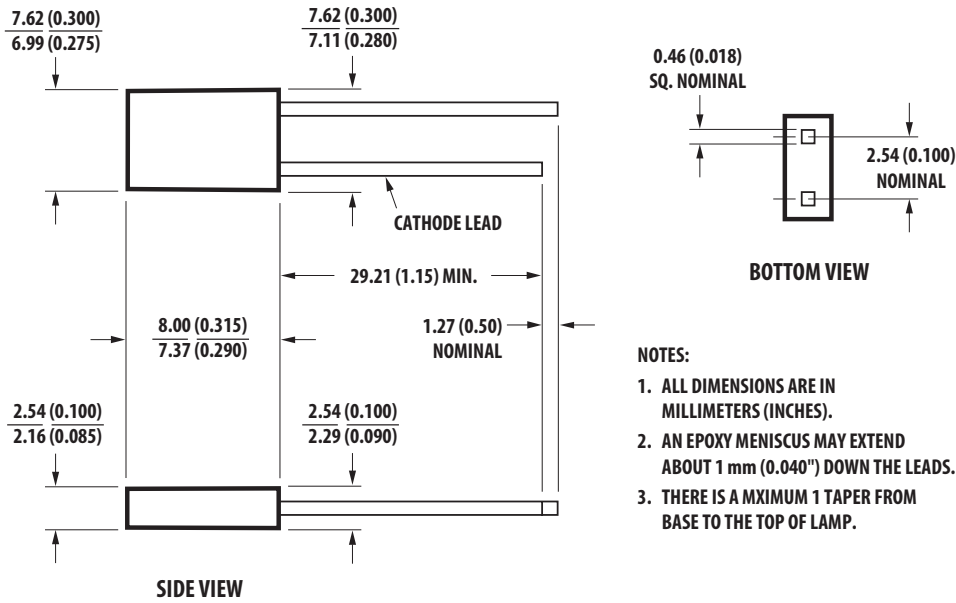
Description

The HLMP-R100, -0301, -0401, -0504 are solid state lamps encapsulated in a radial lead rectangular epoxy package. They utilize a tinted, diffused epoxy to provide high on-off contrast and a flat high intensity emitting surface. Borderless package design allows creation of uninterrupted light emitting areas.

Features

- Rectangular light emitting surface
- Flat high sterance emitting surface
- Stackable on 2.54-mm (0.100-in.) centers
- Ideal as flush mounted panel indicators
- Ideal for backlighting legends
- Long life: solid state reliability
- AllnGaP LED technology
- Choice of four bright colors
 - Deep Red
 - Red
 - Yellow
 - Green
- IC compatible/low current requirements

Package Dimensions



- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETERS (INCHES).
 2. AN EPOXY MENISCUS MAY EXTEND ABOUT 1 mm (0.040") DOWN THE LEADS.
 3. THERE IS A MXIMUM 1 TAPER FROM BASE TO THE TOP OF LAMP.

Device Selection Guide

| Color | Part Number | Luminous Intensity I _v (mcd) at 20 mA | |
|----------|-----------------|--|------|
| | | Min. | Typ. |
| Deep Red | HLMP-R100 | 2.1 | — |
| Red | HLMP-0301 | 2.1 | — |
| | HLMP-0301-C00xx | 1.3 | — |
| Yellow | HLMP-0401 | 3.6 | — |
| | HLMP-0401-B00xx | 1.4 | — |
| | HLMP-0401-D00xx | 3.6 | — |
| Green | HLMP-0504 | 2.6 | — |
| | HLMP-0504-B00xx | 1.6 | — |
| | HLMP-0504-C00xx | 2.6 | — |

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

| Parameter | HLMP-R100 | HLMP-0301 | HLMP-0401 | HLMP-0504 | Units |
|---|-------------|-------------|-------------|-------------|------------------|
| Peak Forward Current | 300 | 90 | 60 | 90 | mA |
| Average Forward Current ^a | 20 | 25 | 20 | 25 | mA |
| DC Current ^b | 30 | 30 | 20 | 30 | mA |
| Power Dissipation | 87 | 135 | 85 | 135 | mW |
| Reverse Voltage (IR = 100 μA) | 5 | 5 | 5 | 5 | V |
| Operating Temperature Range | -20 to +100 | -40 to +100 | -40 to +100 | -20 to +100 | $^\circ\text{C}$ |
| Storage Temperature Range | -40 to +100 | -40 to +100 | -40 to +100 | -40 to +100 | $^\circ\text{C}$ |

a. See [Figure 4](#) to establish pulsed operating conditions.

b. For Deep Red, Red, and Green Series derate linearly from 50 $^\circ\text{C}$ at 0.5 mA/ $^\circ\text{C}$. For Yellow Series, derate linearly from 50 $^\circ\text{C}$ at 0.2 mA/ $^\circ\text{C}$.

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

| Sym. | Description | HLMP-R100 | | | HLMP-0301 | | | HLMP-0401 | | | HLMP-0504 | | | Units | Test Conditions |
|-----------------------|---|-----------|------|------|-----------|------|------|-----------|------|------|-----------|------|------|--------------------|---|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | | |
| $2\theta_{1/2}$ | Included Angle Between Half Luminous Intensity Points | — | 100 | — | — | 100 | — | — | 100 | — | — | 100 | — | Deg. | Note ^a , Figure 5 |
| λ_P | Peak Wavelength | — | 660 | — | — | 632 | — | — | 590 | — | — | 570 | — | nm | Measurement at Peak |
| λ_d | Dominant Wavelength | — | 640 | — | — | 626 | — | — | 589 | — | — | 569 | — | nm | Note ^b |
| $\Delta\lambda_{1/2}$ | Spectral Line Halfwidth | — | 20 | — | — | 14 | — | — | 12 | — | — | 13 | — | nm | |
| τ_s | Speed of Response | — | 30 | — | — | 90 | — | — | 90 | — | — | 500 | — | ns | |
| C | Capacitance | — | 30 | — | — | 16 | — | — | 18 | — | — | 18 | — | pF | $V_F = 0$; $f = 1 \text{ MHz}$ |
| $R\theta_{J-PIN}$ | Thermal Resistance | — | 260 | — | — | 260 | — | — | 260 | — | — | 260 | — | $^\circ\text{C/W}$ | Junction to Cathode Lead |
| V_F | Forward Voltage | — | 2.0 | 2.4 | — | 2.0 | 2.6 | — | 2.0 | 2.6 | — | 2.1 | 3.0 | V | $I_F = 20 \text{ mA}$, Figure 2 |
| V_R | Reverse Breakdown Voltage | 5.0 | — | — | 5.0 | — | — | 5.0 | — | — | 5.0 | — | — | V | $I_R = 100 \mu\text{A}$ |
| η_V | Luminous Efficacy | — | 65 | — | — | 180 | — | — | 500 | — | — | 640 | — | lm/W | Note ^c |

a. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

b. The dominant wavelength, λ_d , is derived from the CIE chromaticity diagram and represents the single wavelength that defines the color of the device.

c. 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.

Part Numbering System

H L M P - x₁ x₂ x₃ x₄ - x₅ x₆ x₇ x₈ x₉

| Code | Description | Option | |
|-------------------------------|------------------------------|------------------------------|--|
| x ₁ | Package Type | R | Rectangular 2.5 mm x 7.6 mm |
| | | 0 | |
| x ₂ | Color | 1 | Deep Red |
| | | 3 | Red |
| | | 4 | Yellow |
| | | 5 | Green |
| x ₃ x ₄ | Product Specific Designation | | |
| x ₅ | Minimum Intensity Bin | Refer to Intensity Bin Table | |
| x ₆ | Maximum Intensity Bin | 0 | Open binning (No maximum IV bin limit) |
| x ₇ | Color Bin Selection | 0 | Full color bin range |
| x ₈ x ₉ | Packaging Option | 00 | Bulk |
| | | 02 | Tape and Reel, Straight Leads |

Bin Information

Intensity Bin Limits

| Color | Bin | Intensity Range (mcd) | |
|--------------|---------|-----------------------|--------|
| | | Min. | Max. |
| Deep Red/Red | C | 1.5 | 2.4 |
| | 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 | |

Maximum tolerance for each bin limit is ±18%.

| Color | Bin | Intensity Range (mcd) | |
|--------|---------|-----------------------|---------|
| | | Min. | Max. |
| Yellow | B | 1.6 | 2.5 |
| | 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 | |

Maximum tolerance for each bin limit is ±18%.

| Color | Bin | Intensity Range (mcd) | |
|-------|---------|-----------------------|---------|
| | | Min. | Max. |
| Green | 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 | |

Color Categories

| Color | Category Number | 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 |
| | 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 |

Tolerance for each bin limit is ± 0.5 nm.

Maximum tolerance for each bin limit is $\pm 18\%$.

Packaging Option Matrix

| Packaging Option Code | Definition |
|-----------------------|---|
| 00 | Bulk Packaging, minimum increment 500 pieces/bag |
| 02 | Tape and Reel, straight leads, minimum increment 1300 pieces/reel |

NOTE: All categories are established for classification of products. Products may not be available in all categories. Contact your local Broadcom representative for further clarification/information.

Figure 1: Relative Intensity vs. Wavelength

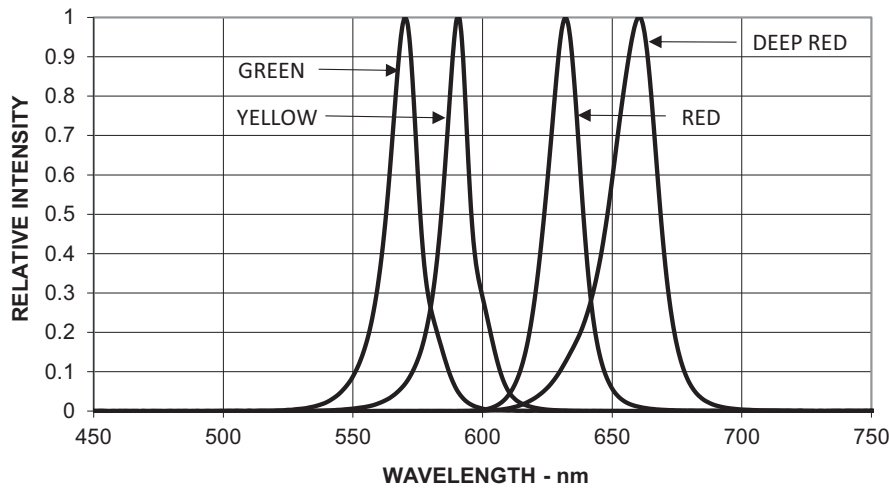


Figure 2: Forward Current vs. Forward Voltage

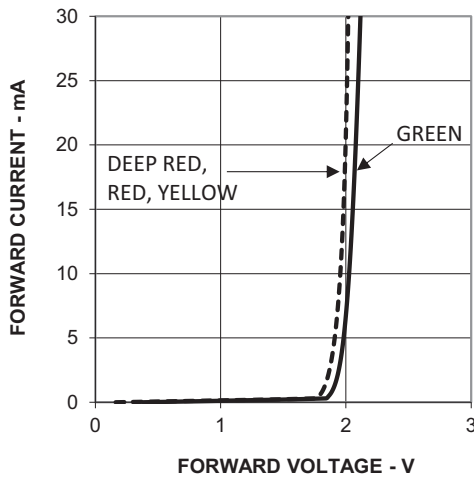


Figure 3: Relative Luminous Intensity vs. Forward Current

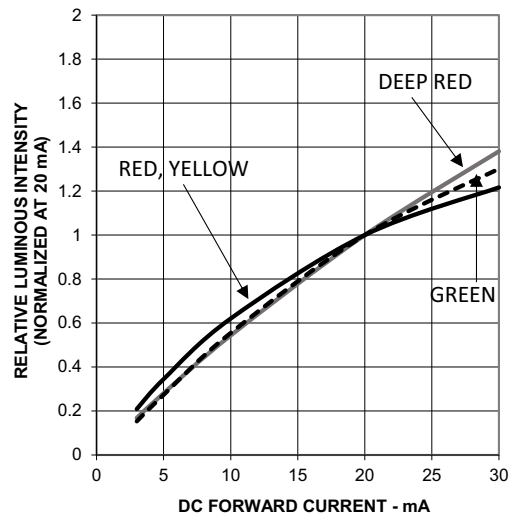


Figure 4: Maximum Tolerable Peak Current vs. Peak Duration ($I_{PEAK\ MAX}$ determined from temperature derated $I_{DC\ MAX}$).

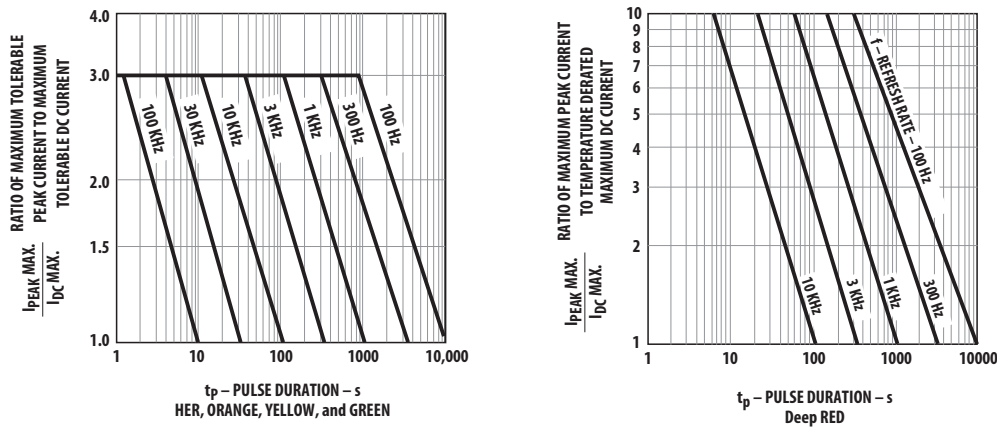
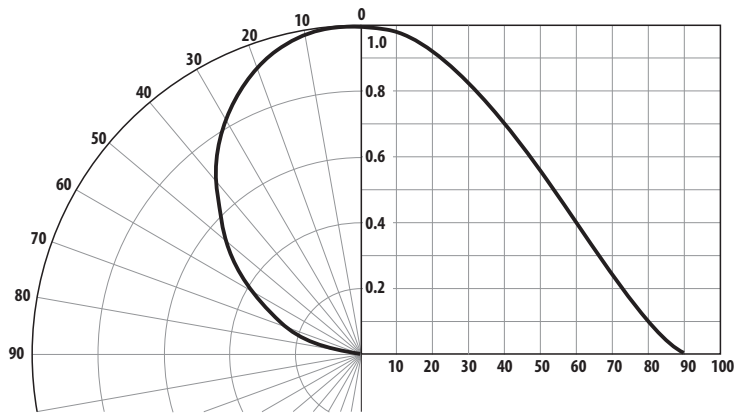


Figure 5: Relative Luminous Intensity vs. Angular Displacement



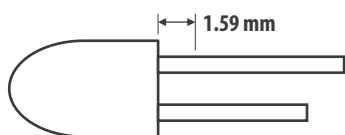
Precautions

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, use the 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 that prevents mechanical stress due to lead cutting from traveling into LED package. Use this method for the hand soldering operation, because the excess lead length also acts as small heat sink.

Soldering and Handling

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



- Apply ESD precautions on the soldering station and personnel to prevent ESD damage to the LED component that is ESD sensitive. Refer to Broadcom application note AN 1142 for details. The soldering iron used must have a grounded tip to ensure electrostatic charge is properly grounded.
- Recommended soldering condition.

| | Wave Soldering ^{a, b} | Manual Solder Dipping |
|----------------------|--------------------------------|-----------------------|
| Pre-heat Temperature | 105°C max. | — |
| Pre-heat Time | 60s max. | — |
| Peak Temperature | 250°C max. | 260°C max. |
| Dwell Time | 3s max. | 5s max. |

- The preceding conditions refer to measurement with a thermocouple mounted at the bottom of the PCB.
- Use only bottom pre-heaters to reduce thermal stress experienced by LED.

- Set and maintain wave soldering parameters according to the recommended temperature and dwell time. Perform daily checks on the soldering profile to ensure that it always conforms to the recommended soldering conditions.

NOTE:

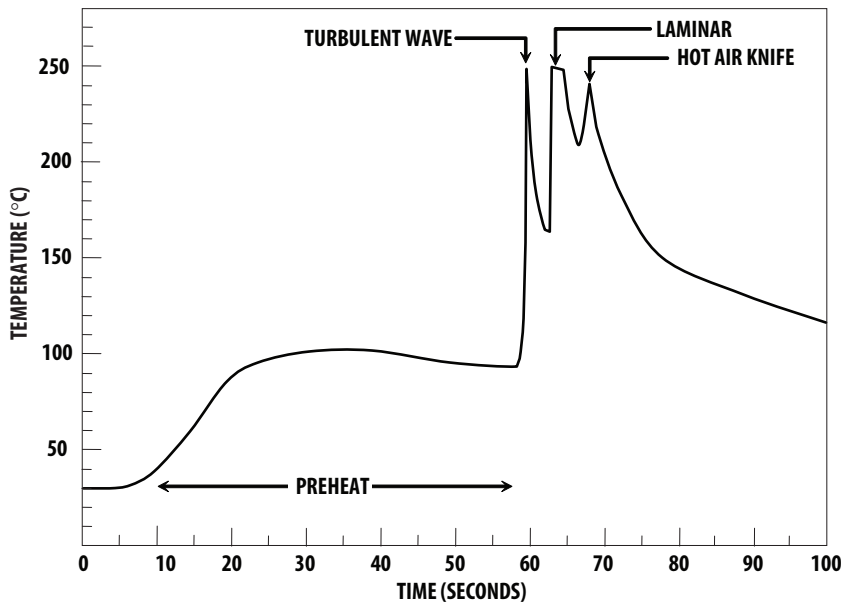
- PCBs with different size and design (component density) will have a different heat mass (heat capacity). This might cause a change in temperature experienced by the board if the same wave soldering setting is used. Therefore, recalibrate the soldering profile again before loading a new type of PCB.
 - Take extra precautions during wave soldering to ensure that the maximum wave temperature does not exceed 250°C and the solder contact time does not exceed 3s. Over-stressing the LED during the soldering process might cause premature failure to the LED due to delamination.
- Loosely fit any alignment fixture that is being applied during wave soldering and do not apply weight or force on the LED. Use nonmetal material because it absorbs less heat during the wave soldering process.
 - At elevated temperature, LED is more susceptible to mechanical stress. Therefore, allow the PCB 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, solder surface-mount components on the top side of the PCB. If the surface mount must be on the bottom side, solder these components using reflow soldering prior to the insertion of the TH LED.
 - The recommended PC board plated through holes (PTH) size for LED component leads follows.

| | LED Component Lead Size | Diagonal | Plated Through-Hole Diameter |
|------------------------------|---------------------------------------|-------------------------|---|
| Lead size (typ.) | 0.45 x 0.45 mm (0.018 x 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 x 0.50 mm (0.020 x 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.) | |

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

- Over-sizing the PTH can lead to twisted LED after clinching. On the other hand under sizing the PTH can cause difficulty inserting the TH LED.

Figure 6: 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: 1.5s – 3.0s (maximum = 3 seconds)

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

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