BROADCOM®

Data Sheet

HLMP-NG0x, HLMP-NL06

T-1 (3-mm) Auto-Insertable LED Lamps

Description

This Broadcom® family of 3-mm LED lamps is capable of withstanding automatic insertion and wave soldering processes.

Designed with a thick epoxy flange and soft lead frame material, it is ideal for clinch and cut operations.

Features

- T-1 (3-mm) auto-insertable package
- High brightness light output
- Tinted non-diffused lens
- Wide viewing angle
- Available colors: Red and Amber

Applications

- General purpose
- High volume manufacturing

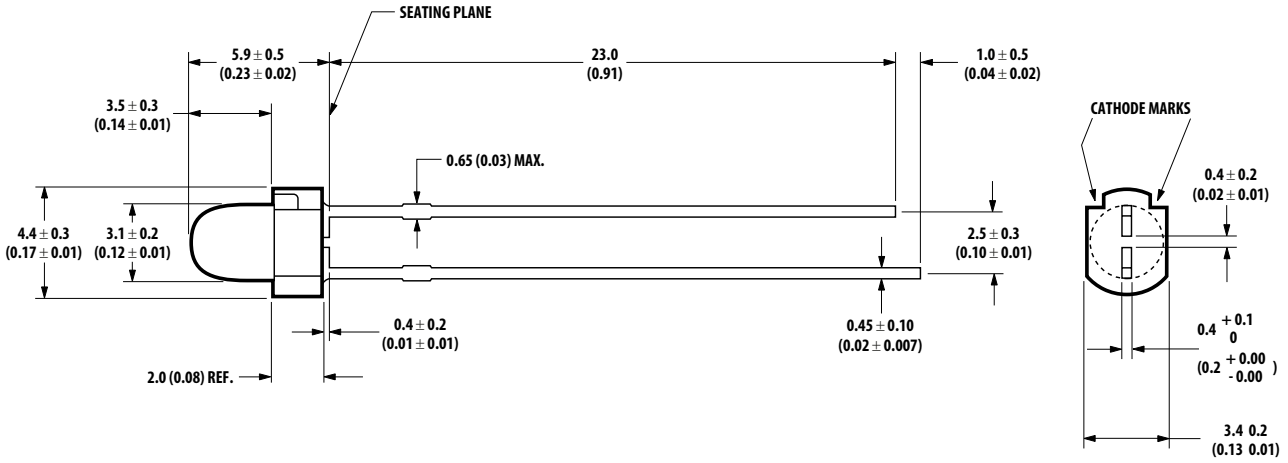
Device Selection Guide

Part Number	Color	Package Lens	Luminous Intensity, Min. Iv at 20 mA	Viewing Angle, $2\theta_{½}$ [a]	Package Drawing
HLMP-NG05	AlInGaP Red	Micro-tinted	90.2	45	A
HLMP-NG07	AlInGaP Red	Micro-tinted	90.2	60	B
HLMP-NL06	AlInGaP Amber	Micro-tinted	96.2	60	B

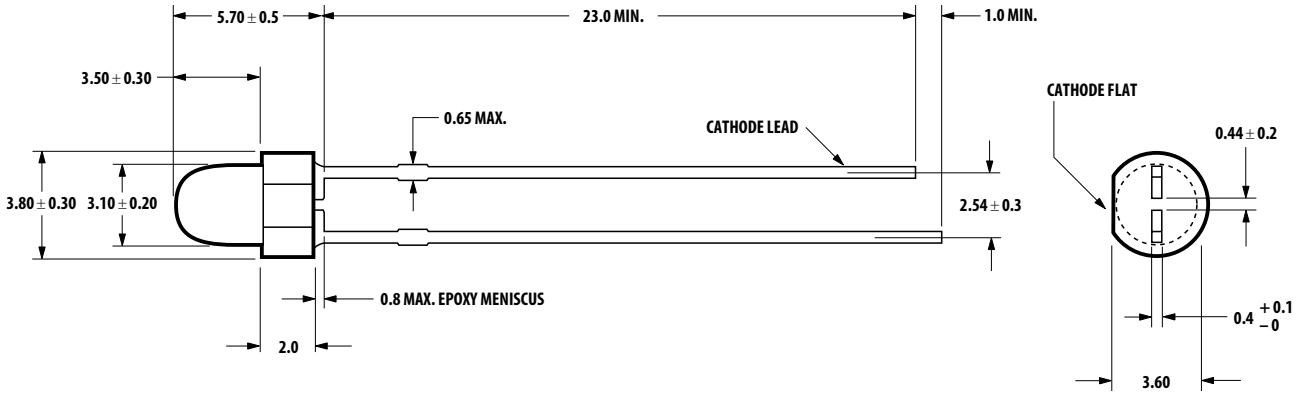
a. $2\theta_{½}$ is the off-axis angle where the luminous intensity is ½ the on-axis intensity.

Package Dimensions

Package Drawing A



Package Drawing B



NOTE:

1. All dimensions are in millimeters (inches).
2. Leads are mild steel with tin plating.
3. Epoxy meniscus of 0.8 mm (0.03 in.) maximum may extend to the leads.
4. For PCB hole recommendations, see the Precautions section.

Absolute Maximum Ratings at T_A = 25°C

Parameter	AlInGaP Amber and Red	Units
DC Forward Current[a]	30[b, c]	mA
Reverse Voltage (I_R = 100 µA)	5	V
Junction Temperature, T_{jmax}	110	°C
Storage Temperature Range	–40 to +85	°C
Operating Temperature Range	–40 to +85	°C

a. See Figure 4 for maximum current derating vs. ambient temperature.

b. Suggested minimum DC current:10 mA.

c. Maximum Peak Pulsed Forward Current: 50 mA, 30 mA average.

Electrical Characteristics at T_A = 25°C

Part Number	Forward Voltage Vf (V)			Capacitance C (pF), Vf = 0, f = 1 MHz	Thermal Resistance $R\theta_{J\text{-}PIN}$ (°C/W)	Speed of Response τ_S (ns) Time Constant $e^{-t/\tau S}$
	Typ.	Max.	If (mA)	Typ.		Typ.
HLMP-NL06[a]	2.02	2.4	20	40	240	20
HLMP-NG0x[a]	1.90	2.4	20	40	240	20

a. Contact your Broadcom Sales Representative about operating currents below 10 mA.

Optical Characteristics at T_A = 25°C

Part Number	Luminous Intensity[a]		Typ. Peak Wavelength (nm)	Typ. Dominant Wavelength[b] (nm)	Typ. Spectral Half Width (nm)	Luminous Efficacy[c] (lm/W)
	Min. (mcd)	If (mA)				
HLMP-NG05	90.2	20	635	626	17	150
HLMP-NG07	90.2	20	635	626	17	150
HLMP-NL06	96.2	20	592	590	17	480

a. 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.

b. The dominant wavelength, λ_d, is derived from the CIE Chromaticity Diagram and represents the color of the device.

c. The radiant intensity, Ie, in watts per steradian, may be found from the equation Ie = Iv/ ηv, where Iv is the luminous intensity in candelas and ηv is the luminous efficacy in lumens/watt.

Figure 1: Relative Intensity vs. Peak Wavelength

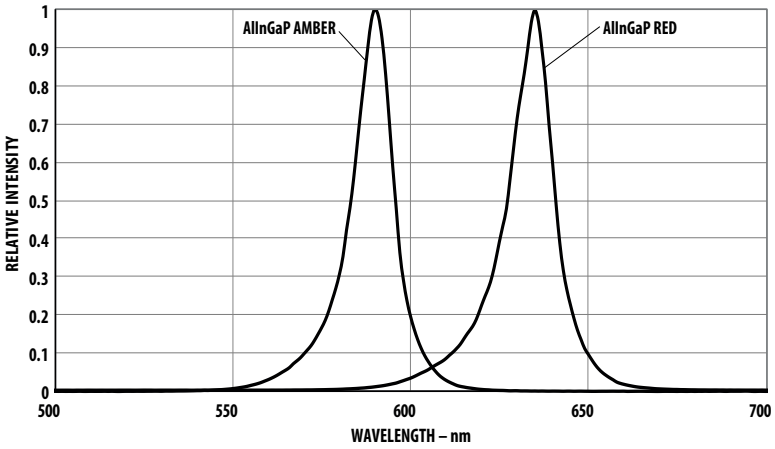


Figure 2: Forward Current vs. Forward Voltage

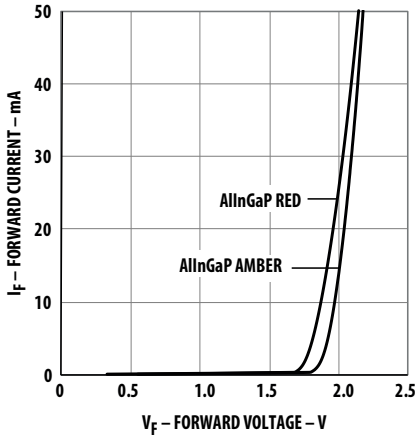


Figure 3: Relative Luminous Intensity vs. Forward Current

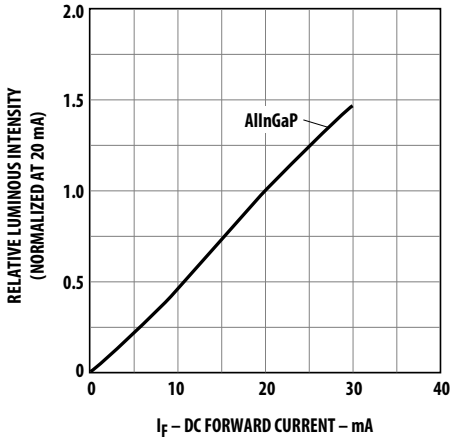


Figure 4: Maximum Forward DC Current vs. Ambient Temperature

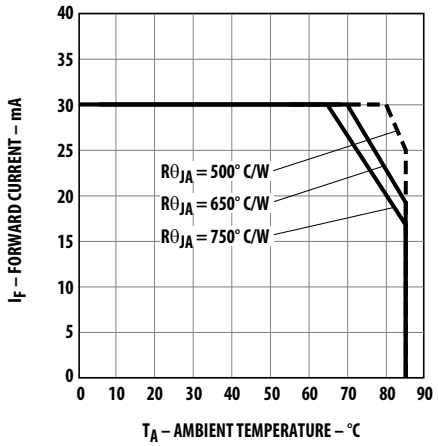


Figure 5: Representative Spatial Radiation Pattern for 45° Viewing Angle

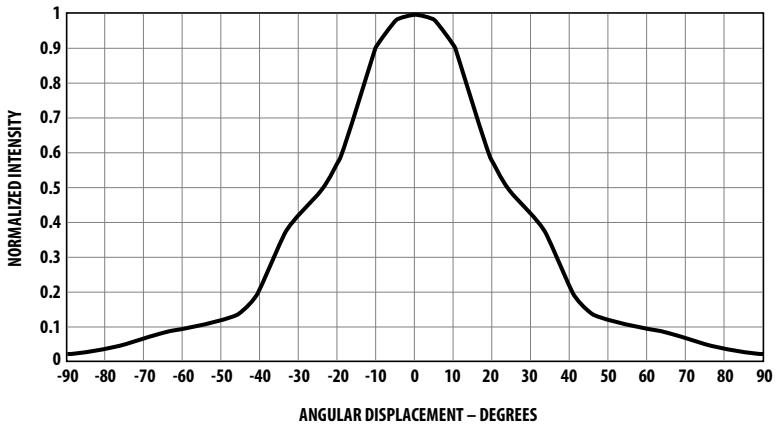
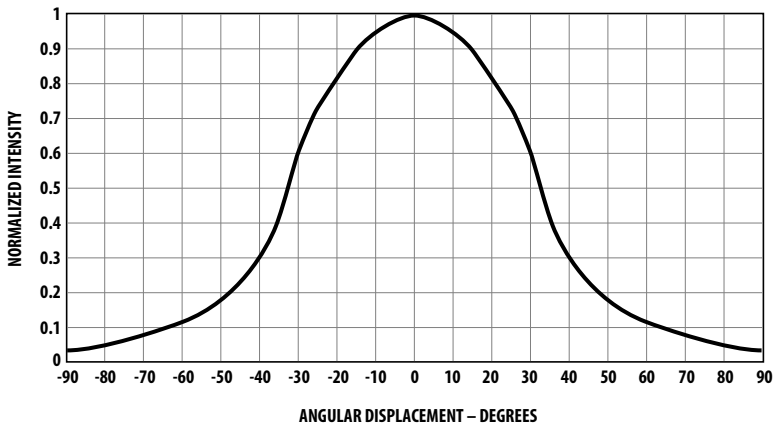


Figure 6: Representative Spatial Radiation Pattern for 60° Viewing Angle



Intensity Bin Limits

Color	Bin	Intensity Range (mcd)	
		Min.	Max.
Red/Orange/ Red-Orange	H	13.8	27.6
	I	22.0	44.0
	J	35.2	70.4
	K	56.4	112.8
	L	90.2	180.4
	M	138.0	276.0
	N	200.0	400.0
	O	290.0	580.0
	P	500.0	1000.0
	Q	700.0	1400.0
	R	1000.0	2000.0
	S	1400.0	2800.0
	T	2000.0	4000.0
	U	2900.0	5800.0
	V	4200.0	8400.0
	W	6000.0	12000.0
	X	8700.0	17400.0
	Y	12600.0	25200.0
	Z	18200.0	36400.0
Yellow/Amber	G	14.7	29.4
	H	23.5	47.0
	I	37.6	75.2
	J	60.1	120.2
	K	96.2	192.4
	L	147.0	294.0
	M	212.0	424.0
	N	300.0	600.0
	O	450.0	900.0
	P	700.0	1400.0
	Q	1000.0	2000.0
	R	1600.0	3200.0
	S	2600.0	5200.0
	T	4000.0	8000.0
	U	6500.0	13000.0
	V	10000.0	20000.0
	W	16000.0	30000.0

Maximum tolerance for each bin limit is ± 18%.

Amber Color Bin Limits

Bin Name	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.

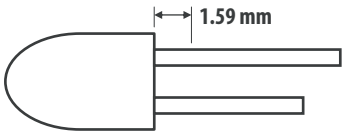
Precautions

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 the 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.
- The LED component may be effectively hand soldered to the 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 conditions:

	Wave Soldering[a, b]	Manual Solder Dipping
Pre-heat Temperature	105°C max.	—
Pre-heat Time	30s max.	—
Peak Temperature	250°C max.	260°C max.
Dwell Time	3s max.	5s max.

a. The preceding conditions refer to measurement with a thermocouple mounted at the bottom of the PCB.

b. 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:

1. 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.
2. 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. Overstressing the LED during the soldering process might cause premature failure to the LED due to delamination.

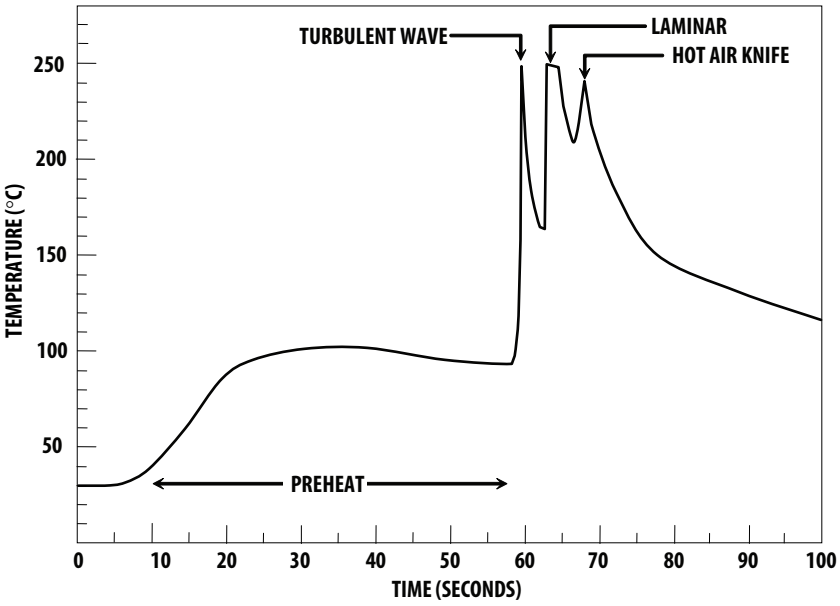
- Loosely fit any alignment fixture that is being applied during wave soldering and do not apply weight or force on the LED. Use non-metal material because it will absorb less heat during the wave soldering process.
- At elevated temperature, the LED is more susceptible to mechanical stress. Therefore, allow the PCB to cool down to room temperature prior to handling, which includes removal of alignment fixture or pallet.
- If the 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 × 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.)	

- Oversizing the PTH can lead to a twisted LED after clinching. On the other hand, undersizing the PTH can cause difficulty inserting the TH LED.

Refer to application note AN1027 for more information about soldering and handling of TH LED lamps.

Figure 7: 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 = 3 seconds)

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

BROADCOM®

Lead (Pb) Free
RoHS Compliant