BROADCOM® **Data Sheet**

HLMP-4101

T-1¾ (5-mm) Very High Intensity AlInGaP Deep Red LED Lamps

Description

These Broadcom® solid state LED lamps use AlInGaP material technology. This LED material has outstanding light output efficiency over a wide range of drive currents. The lamp package has a tapered lens designed to concentrate the luminous flux into a narrow radiation pattern to achieve a very high intensity. The LED color is deep red at the dominant wavelength of 640 nm. These lamps may be DC-driven or pulse-driven to achieve the desired light output.

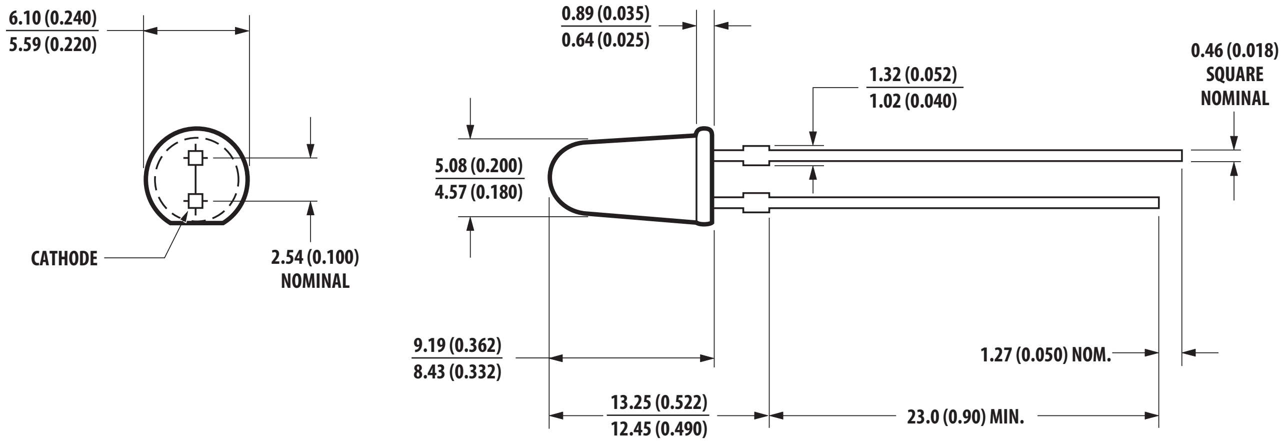
Features

- Very high intensity at low drive currents
- Narrow viewing angle
- Outstanding material efficiency
- CMOS/MOS compatible
- TTL compatible
- Deep red color

Applications

- Bright ambient lighting conditions
- Emitter/detector and signaling applications
- General use

Package Dimensions



NOTE:

1. All dimensions are in mm (inches).
2. An epoxy meniscus may extend about 1 mm (0.40 in.) down the leads.
3. For PCB hole recommendations, see Precautions.

Device Selection Guide

Device	Luminous Intensity Iv (mcd) at 20 mA			$2\theta_{1/2}$[a] Degree
	Min.	Typ.	Max.	
HLMP-4101	700.0	1000.0	—	8

a. $\theta_{1/2}$ is the angle from optical centerline where the luminous intensity is one-half the optical centerline value.

Absolute Maximum Ratings at T_A = 25°C

Parameter	Maximum Rating	Units
Peak Forward Current[a, b]	300	mA
Average Forward Current[b]	20	mA
DC Current[c]	30	mA
Power Dissipation	87	mW
Reverse Voltage (I_R = 100 µA)	5	V
Operating Temperature Range	–20 to +100	°C
Storage Temperature Range	–40 to +100	°C

a. Maximum I_{PEAK} at f = 1 kHz, DF = 6.7%.

b. See Figure 5 to establish pulsed operating conditions.

c. Derate linearly as shown in Figure 4.

Electrical/Optical Characteristics at T_A = 25°C

Symbol	Description	Min.	Typ.	Max.	Units	Test Conditions
V_F	Forward Voltage	—	2.0	2.4	V	I_F = 20 mA
V_R	Reverse Breakdown Voltage	5.0	—	—	V	I_R = 100 µA
λ_{PEAK}	Peak Wavelength	—	660	—	nm	Measurement at Peak
λ_d	Dominant Wavelength	—	640	—	nm	Note [a]
$\Delta\lambda_{1/2}$	Spectral Line Halfwidth	—	20	—	nm	
τS	Speed of Response	—	30	—	ns	Exponential Time Constant, $e^{-t/2}$
C	Capacitance	—	30	—	pF	V_F = 0; f = 1 MHz
θ_{Jc}	Thermal Resistance	—	220	—	°C/W	Junction to Cathode Lead
η_V	Luminous Efficacy	—	65	—	lm/W	Note [b, c]

a. The dominant wavelength, λ_d, is derived from the CIE chromaticity diagram and represents the color of the device.

b. The radiant intensity, I_e, in watts per 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 luminous efficacy in lumens/watt.

c. The approximate total luminous flux output within a cone angle of 2θ about the optical axis, $\phi_V(2\theta)$, may be obtained from the following formula: $\phi_V(2\theta) = [\phi_V(\theta) / I_V(0)]\, I_V$; where: $\phi_V(\theta) / I_V(0)$ is obtained from Figure 6.

Figure 1: Relative Intensity vs. Wavelength

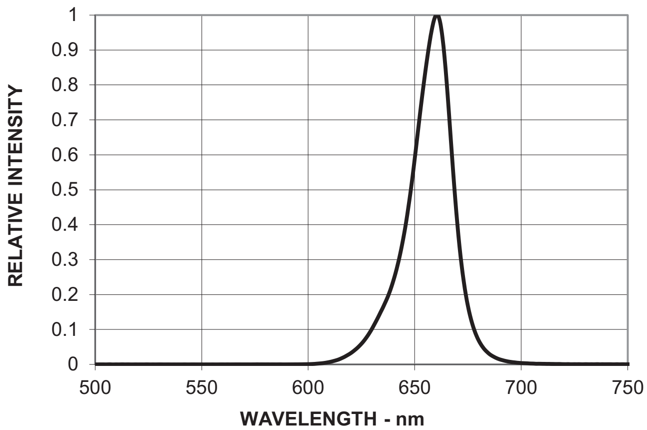


Figure 2: Forward Current vs. Forward Voltage

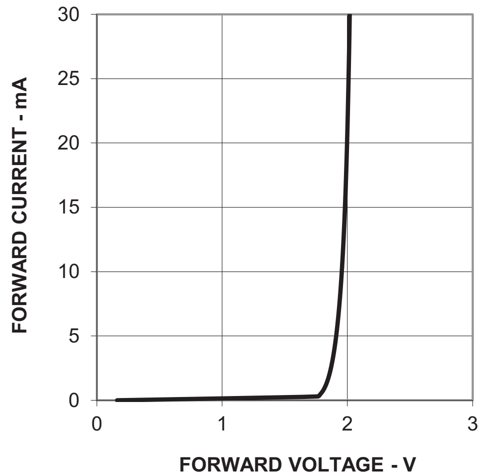


Figure 3: Relative Luminous Intensity vs. DC Forward Current

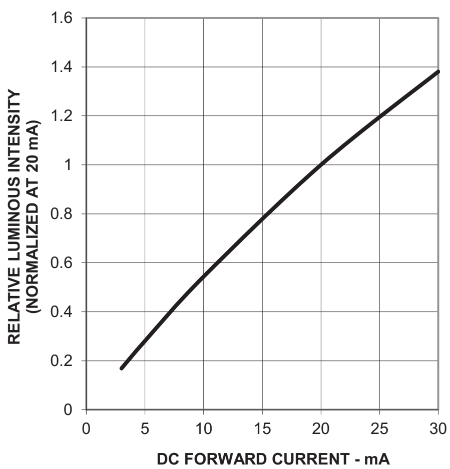


Figure 4: Maximum Forward DC Current vs. Ambient Temperature Derating Based on T_J MAX. = 110°C

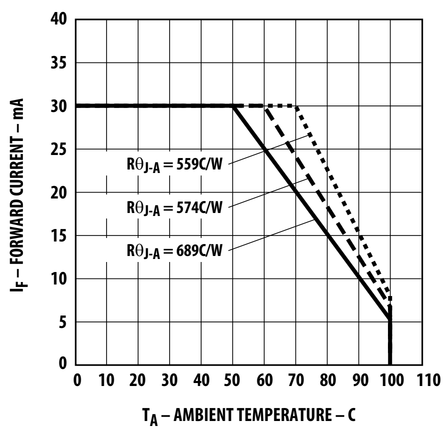


Figure 5: Maximum Tolerable Peak Current vs. Peak Duration (I_{PEAK} MAX. Determined from Temperature-Derated I_{DC} MAX.)

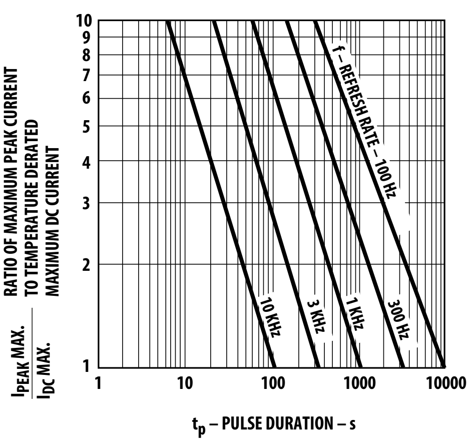
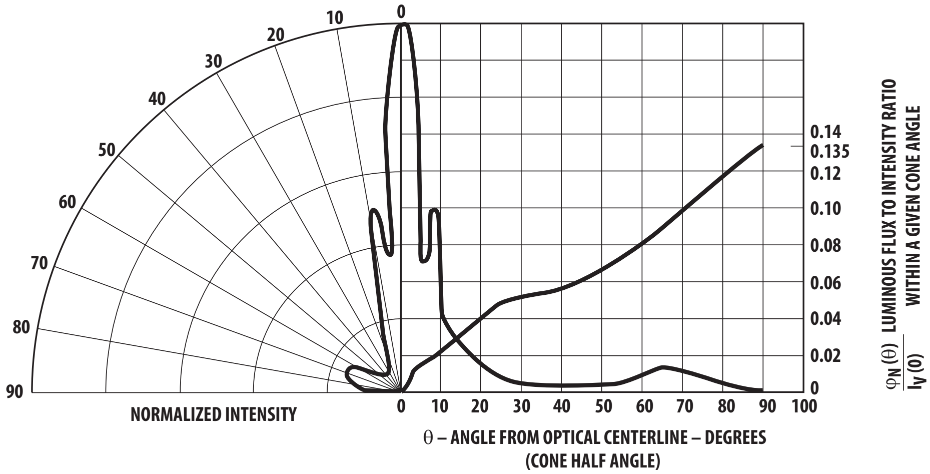


Figure 6: Relative Luminous Intensity vs. Angular Displacement



Intensity Bin Limits

Color	Bin	Intensity Range (mcd)	
		Min.	Max.
Red	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%.

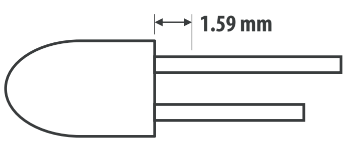
Precautions

Lead Forming

- Preform or cut to length the leads of an LED lamp 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 process for the hand solder 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 only 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 by personnel to prevent ESD damage to the LED component , which is ESD sensitive. For details, refer to Broadcom application note AN 1142. The soldering iron must have a grounded tip to ensure that the electrostatic charge is properly grounded.
- Recommended soldering conditions follow.

	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.

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

b. To reduce thermal stress experienced by the LED, use only the bottom preheaters.

- 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 sizes and designs (component density) have different heat mass (heat capacity). This might cause a change in temperature experienced by the board if the same wave soldering setting is used. So, re-calibrate 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. Over-stressing the LED during soldering process might cause premature failure to the LED due to delamination.

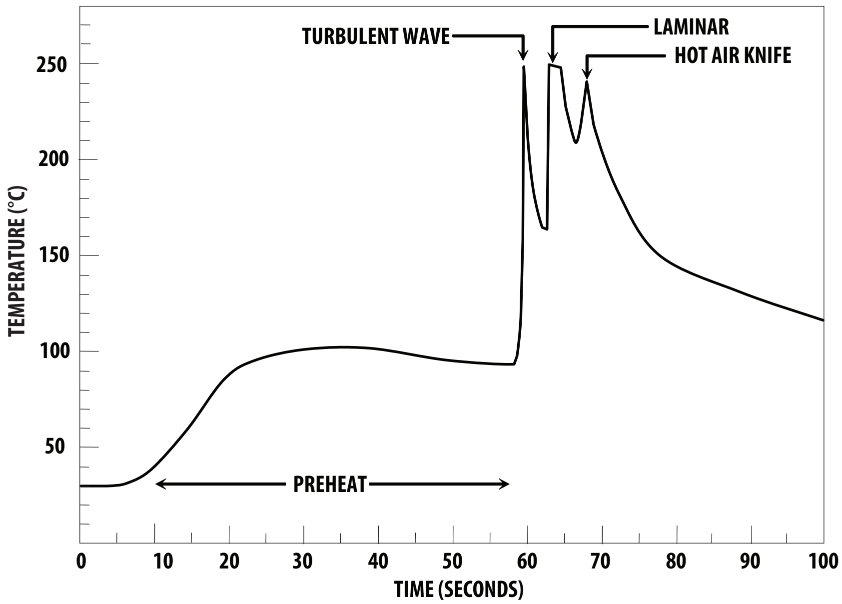
- Loosely fit any alignment fixture that is being applied during wave soldering and it should not apply weight or force on the LED. Use non-metal material because it absorbs less heat during the wave soldering process.
- At elevated temperature, the LED is more susceptible to mechanical stress. Therefore, 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) LEDs and other surface mount components, solder the surface mount components on the top side of the PCB. If surface mount must be on the bottom side, solder these components using reflow soldering prior to inserting 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.)	

- 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.

Figure 7: 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)

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