BROADCOM®

Data Sheet

HLMP-D101/D105, HLMP-K101/K105

T-1¾ (5 mm), T-1 (3 mm), High Intensity, AlInGaP Deep Red LED Lamps

Description

The Broadcom® HLMP-D101/D105, HLMP-K101/K105 solid-state LED lamps use AlInGaP material technology. This LED material has outstanding light output efficiency over a wide range of drive currents. The color is deep red at the dominant wavelength of 640 nm. These lamps may be DC or pulse driven to achieve desired light output.

Features

- Exceptional brightness
- Wide viewing angle
- Outstanding material efficiency
- CMOS/MOS compatible
- TTL compatible
- Deep red color

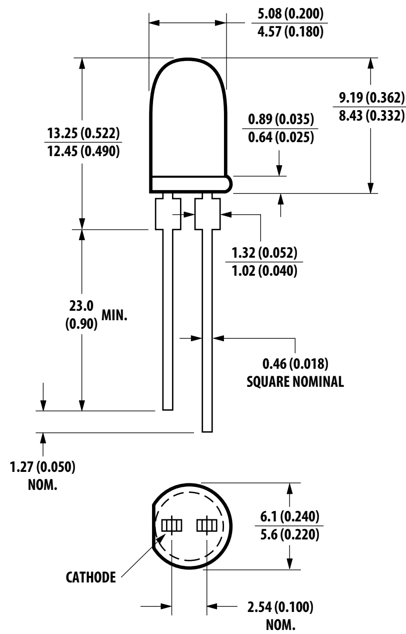
Applications

- Bright ambient lighting conditions
- Moving message panels
- Portable equipment
- General use

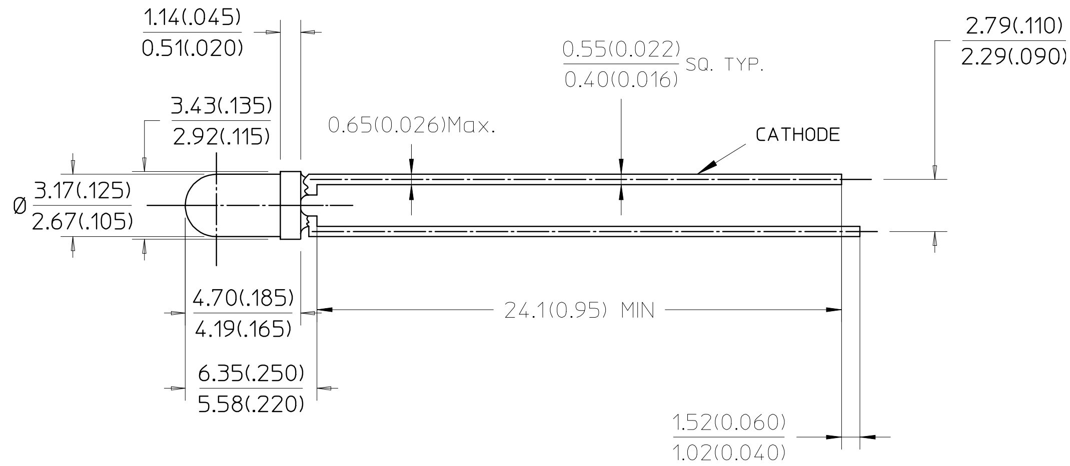
Package Dimensions

Package Outline A

Package Outline B



Package Outline C



NOTE:

1. All dimensions are in mm (in.).
2. An epoxy meniscus may extend about 1 mm (0.040 in.) down the leads.
3. For PCB hole recommendations, see Precautions.

Device Selection Guide

Package Description	Device HLMP-	Luminous Intensity Iv (mcd) at 20 mA			$2\theta_{1/2}$[a] Degree	Package Outline
		Min.	Typ.	Max.		
T-1¾ Red Tinted Diffused	D101	35.2	70.0	—	65	A
	D101-J00xx	35.2	70.0	—	65	A
T-1¾ Red Untinted Non-diffused	D105	138.0	240.0	—	24	B
	D105-M00xx	138.0	240.0	—	24	B
T-1 Red Tinted Diffused	K101	22.0	45.0	—	60	C
	K101-I00xx	22.0	45.0	—	60	C
T-1 Red Untinted Non-diffused	K105	35.2	65.0	—	45	C
	K105-J00xx	35.2	65.0	—	45	C

a. $\theta_{1/2}$ is the off axis angle from lamp centerline where the luminous intensity is ½ the on-axis value.

Absolute Maximum Ratings at T_A = 25°C

Parameter	Value
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)	5V
LED Junction Temperature	110°C
Operating Temperature Range	–20°C to +100°C
Storage Temperature Range	–40°C 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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Forward Voltage	V_F	—	2.0	2.4	V	I_F = 20 mA
Reverse Breakdown Voltage	V_R	5.0	—	—	V	I_R = 100 µA
Peak Wavelength	λ_p	—	660	—	nm	Measurement at Peak
Dominant Wavelength	λ_d	—	640	—	nm	Note [a]
Spectral Line Halfwidth	Δλ½	—	20	—	nm	Wavelength width at spectral distribution ½ power point.
Speed of Response	τ_S	—	30	—	ns	Exponential Time Constant, e^{-t}/T_S
Capacitance	C	—	30	—	pF	V_F = 0, f = 1 MHz
Thermal Resistance	$R\theta_{J\text{-}PIN}$	—	260[b] 210[c] 290[d]	—	°C/W	Junction to Cathode Lead
Luminous Efficacy	η_V	—	65	—	lm/W	Note [e]

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

b. HLMP-D101.

c. HLMP-D105.

d. HLMP-K101/-K105.

e. 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.

Part Numbering System

H L M P - X_1 X_2 X_3 X_4 - X_5 X_6 X_7 X_8 X_9

Code	Description	Option	
X_1	Package type	D	T-1¾ (5 mm)
		K	T-1 (3 mm)
X_2	Color options	1	Deep Red
X_3 X_4	Lens type	01	Tinted, diffused
		05	Untinted, non-diffused
X_5	Minimum intensity bin	See Intensity Bin Limits	
X_6	Maximum intensity bin	0	Open binning (no maximum limit)
X_7	Color bin selection	0	Full range
X_8 X_9	Packaging option	00	Bulk packaging
		02	Tape and reel

Intensity Bin Limits

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

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 (T-1¾)/1800 pieces (T-1)/reel

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

Figure 1: Relative Intensity vs. Wavelength

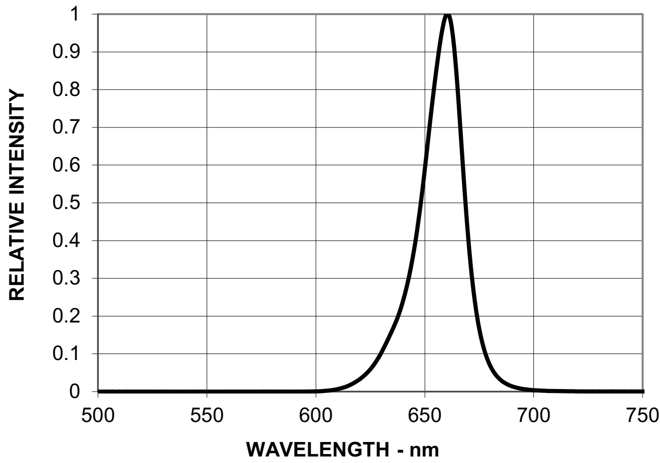


Figure 2: Forward Current vs. Forward Voltage

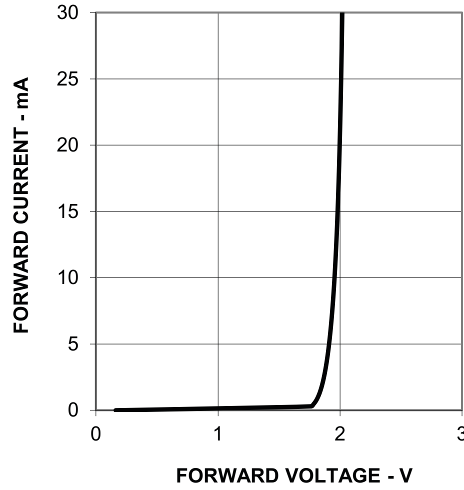


Figure 3: Relative Luminous Intensity vs. DC Forward Current

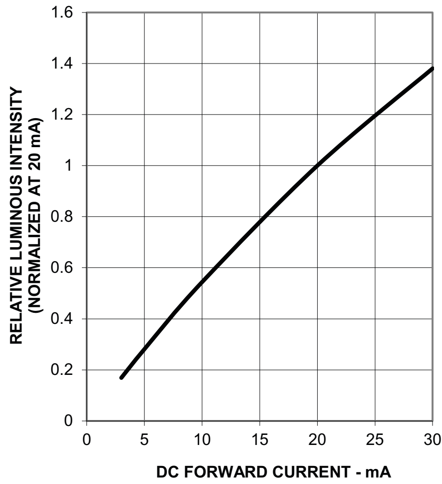


Figure 4: Maximum Forward DC Current vs. Ambient Temperature. Derating based on T_J MAX. = 110°C.

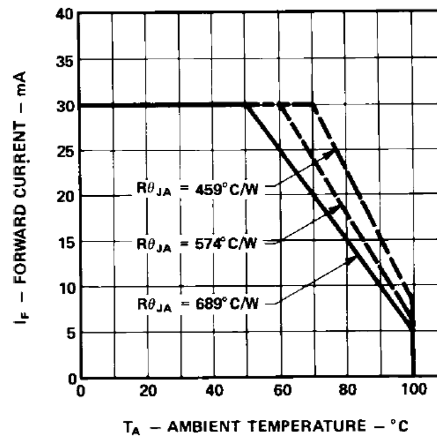


Figure 5: Maximum Tolerable Peak Current vs. Peak Duration. I_{PEAK} MAX. determined from temperature derated I_{DC} MAX.

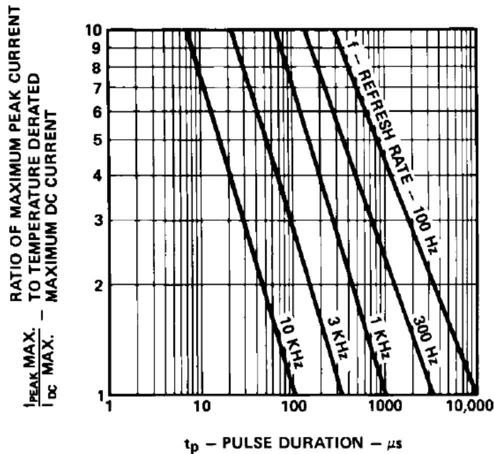


Figure 6: Relative Luminous Intensity vs. Angular Displacement, HLMP-D101

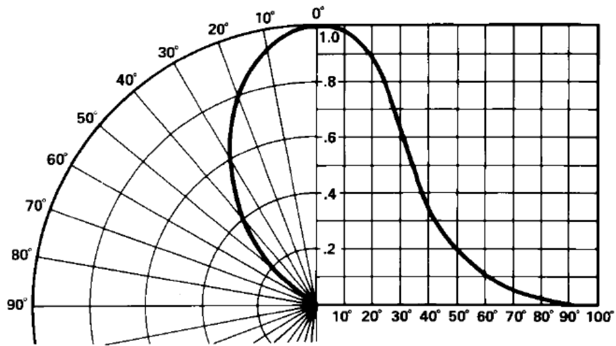


Figure 7: Relative Luminous Intensity vs. Angular Displacement, HLMP-K101

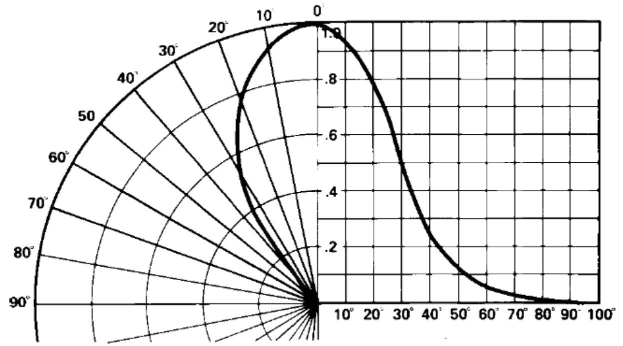


Figure 8: Relative Luminous Intensity vs. Angular Displacement, HLMP-D105

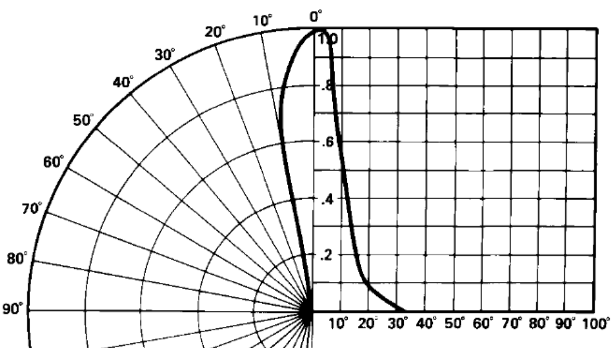
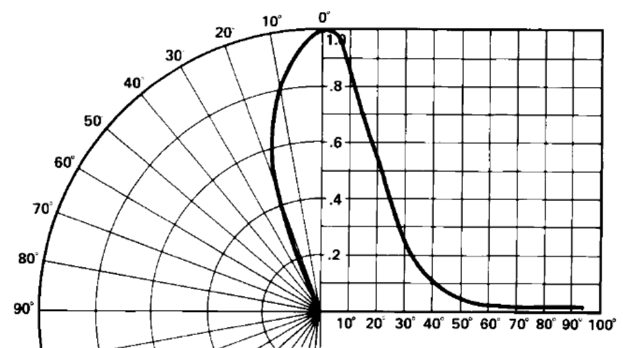


Figure 9: Relative Luminous Intensity vs. Angular Displacement, HLMP-K105



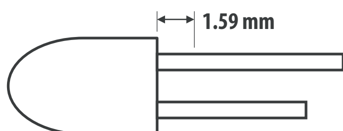
Precautions

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 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.

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 the 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, 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. 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 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 the LED component leads follows.

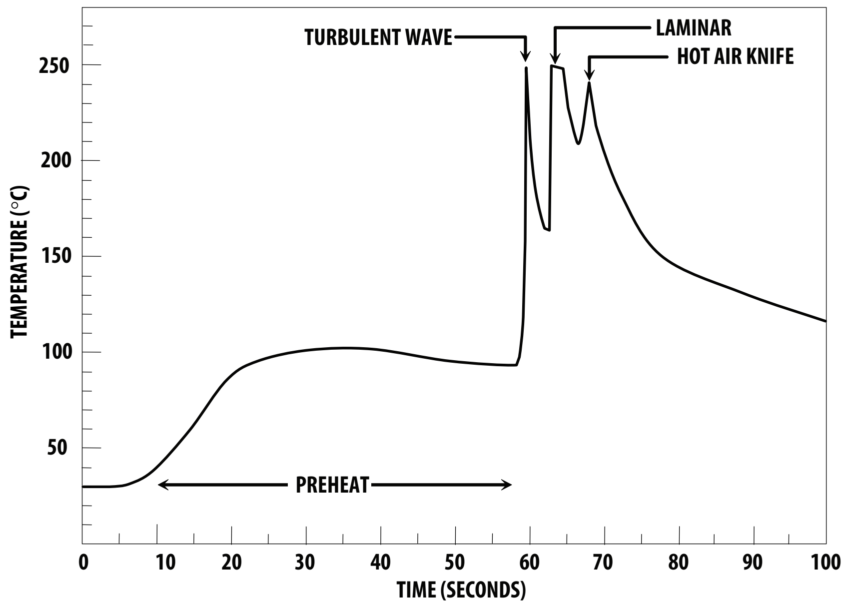
	LED Component Lead Size	Diagonal	Plated Through-Hole Diameter
Lead size (typ.)	0.45 × 0.45 mm (0.018 × 0.018 in.)	0.636 mm (0.025 in.)	0.98 to 1.08 mm (0.039 to 0.043 in.)
Dambar shear-off area (max.)	0.65 mm (0.026 in.)	0.919 mm (0.036 in.)	
Lead size (typ.)	0.50 × 0.50 mm (0.020 × 0.020 in.)	0.707 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.)	

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

- 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 AN5334 for more information about soldering and handling of TH LED lamps.

Figure 10: 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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