BROADCOM®

Data Sheet

HLMP-EGxx, HLMP-EHxx, HLMP-ELxx

T-1¾ (5-mm) Extra High Brightness AlInGaP LED Lamps

Description

These precision optical performance AlInGaP LEDs provide superior light output for excellent readability in sunlight, and are extremely reliable. AlInGaP LED technology provides extremely stable light output over long periods of time. These precision optical performance lamps use aluminum indium gallium phosphide (AlInGaP) technology.

These LED lamps are untinted, T-1¾ packages incorporating second-generation optics, producing well-defined spatial radiation patterns at specific viewing cone angles.

These lamps are made with an advanced optical grade epoxy, offering superior high temperature and high moisture resistance performance in outdoor signal and sign applications. The maximum LED junction temperature limit of +130°C enables high-temperature operation in bright sunlight conditions. The epoxy contains both UVA and UVB inhibitors to reduce the effects of long-term exposure to direct sunlight.

Benefits

- Superior performance for outdoor environments
- Suitable for auto-insertion onto PC board

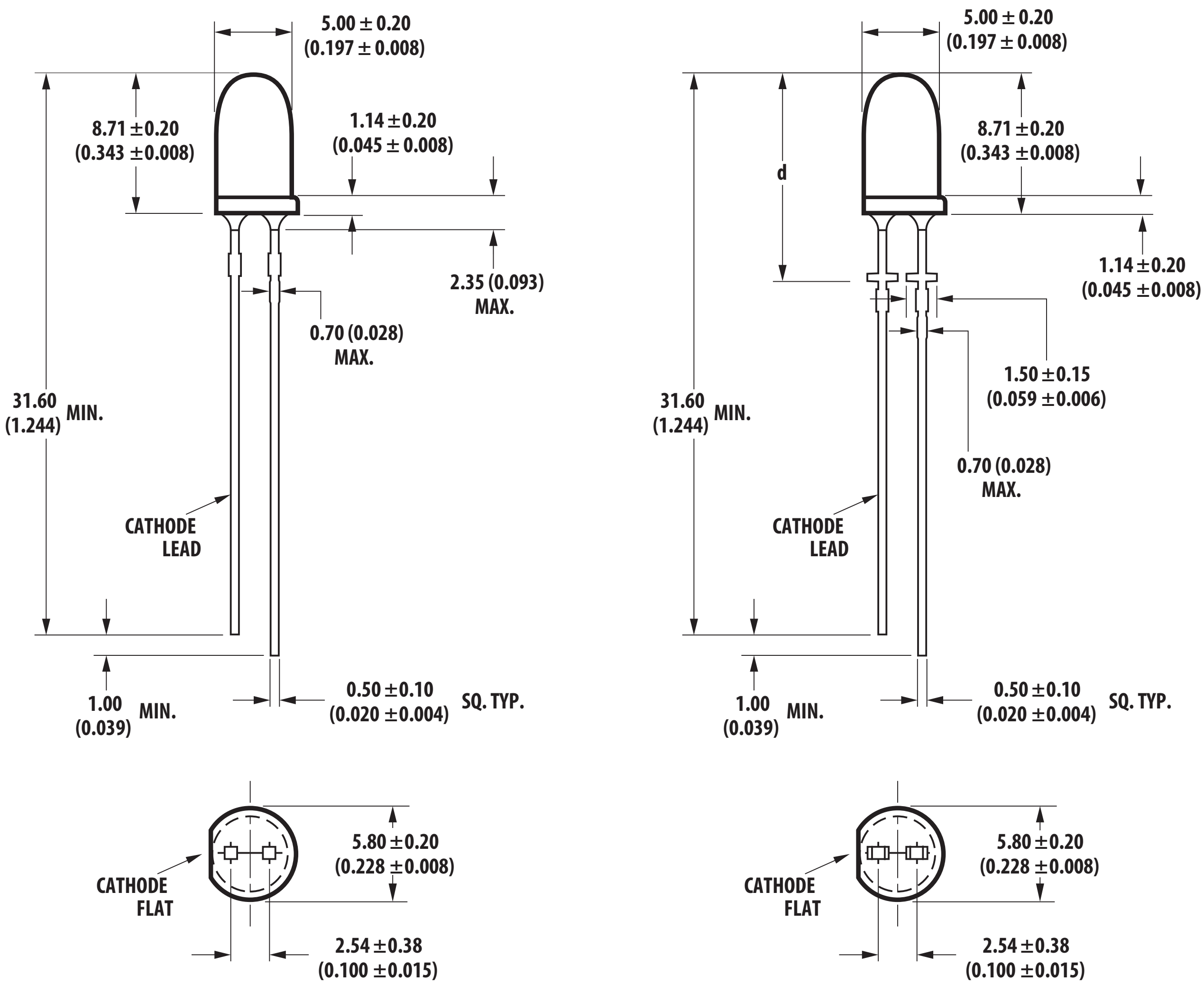
Features

- Viewing angle: 15°, 23°, 30°
- High luminous output
- Colors:
  - 590-nm Amber
  - 615-nm Red Orange
  - 626-nm Red
- Package options:
  - With or without lead standoff
- Superior resistance to moisture
- Untinted for 15°, 23°, and 30° lamps

Applications

- Traffic management:
  - Traffic signals
  - Pedestrian signals
  - Work zone warning lights
  - Variable message signs
- Solar power signs
- Commercial outdoor advertising
  - Signs
  - Marquees

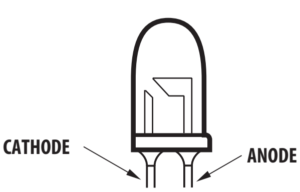
Figure 1: Package Dimensions (Package Drawing A on the Left and Package Drawing B on the Right)



Viewing Angle	d
15°	12.39 mm ± 0.25 mm (0.476 in. ± 0.010 in.)
23° and 30°	11.96 mm ± 0.25 mm (0.459 in. ± 0.010 in.)

NOTE:

1. All dimensions are in millimeters (inches).
2. Leads are mild steel with tin plating.
3. The epoxy meniscus is 1.21 mm, maximum.
4. For identification of polarity after the leads are trimmed off, see the following figure.



Device Selection Guide

Typical Viewing Angle $2\theta_{1/2}$ (Deg)[a]	Color and Dominant Wavelength (nm), Typ.[b]	Lamps without Standoff on Leads (Package Drawing A)	Lamps with Standoff on Leads (Package Drawing B)	Luminous Intensity Iv (mcd)[c, d, e] at 20 mA	
				Min.	Max.
15°	Amber 590	HLMP-EL1A-Z1Kxx	HLMP-EL1B-Z1Kxx	12000	21000
		HLMP-EL1A-Z1LDD	HLMP-EL1B-Z1LDD	12000	21000
	Red 626	HLMP-EG1A-Z10xx	HLMP-EG1B-Z10DD	12000	21000
	Red Orange 615	HLMP-EH1A-Z10DD	—	12000	21000
		—	HLMP-EH1B-120DD	16000	27000
23°	Amber 590	—	HLMP-EL2B-XYKDD	7200	12000
		HLMP-EL2A-YZKxx	HLMP-EL2B-YZKDD	9300	16000
		HLMP-EL2A-YZLDD	HLMP-EL2B-YZLDD	9300	16000
	Red 626	HLMP-EG2A-XY0xx	HLMP-EG2B-XY0xx	7200	12000
	Red Orange 615	HLMP-EH2A-Y10DD	HLMP-EH2B-Y10DD	9300	21000
		—	HLMP-EH2B-YZ0DD	9300	16000
30°	Amber 590	HLMP-EL3A-WXKxx	HLMP-EL3B-WXKxx	5500	9300
		HLMP-EL3A-WXLDD	HLMP-EL3B-WXLDD	5500	9300
	Red 626	HLMP-EG3A-WX0xx	HLMP-EG3B-WX0xx	5500	9300
	Red Orange 615	HLMP-EH3A-WX0xx	HLMP-EH3B-WX0DD	5500	9300

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

b. Dominant wavelength, λ_d, is derived from the CIE Chromaticity Diagram and represents the color of the lamp.

c. The luminous intensity is measured on the mechanical axis of the lamp package and it is tested with pulsing condition.

d. The optical axis is closely aligned with the package mechanical axis.

e. Tolerance for each bin limit is ±15%.

Absolute Maximum Ratings, T_J = 25°C

Parameter	Red, Amber, Red Orange	Units
DC Forward Current[a]	50	mA
Peak Forward Current	100[b]	mA
Average Forward Current	30	mA
Power Dissipation	120	mW
Reverse Voltage	5	V
Operating Temperature Range	–40 to +100	°C
Storage Temperature Range	–40 to +100	°C

a. Derate linearly as shown in Figure 6.

b. Duty factor 30%, frequency 1 KHz.

Electrical/Optical Characteristics, T_J = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Forward Voltage Amber, Red, Red Orange	V_F	1.8	2.1	2.4	V	I_F = 20 mA
Reverse Voltage	V_R	5	—	—	V	I_R = 100 µA
Dominant Wavelength[a] Amber Red Red Orange	λ_d	 584.5 618.0 612.0	 590.0 626.0 615.0	 594.5 630.0 619.0	nm	I_F = 20 mA
Peak Wavelength Amber Red Red Orange	λ_{PEAK}	 — — —	 594 634 621	 — — —	nm	Peak of Wavelength of Spectral Distribution at I_F = 20 mA
Spectral Halfwidth Amber Red Red Orange	$\Delta\lambda_{1/2}$	 — — —	 13 14 14	 — — —	nm	
Thermal Resistance	$R\theta_{J-PIN}$	—	240	—	°C/W	LED junction to anode lead
Luminous Efficacy[b] Amber Red Red Orange	η_v	 — — —	 500 200 265	 — — —	lm/W	Emitted Luminous Flux/Emitted Radiant Flux
Luminous Flux Amber Red Red Orange	ϕv	 — — —	 2100 2300 2300	 — — —	mlm	I_F = 20 mA
Luminous Efficiency[c] Amber Red Red Orange	η_e	 — — —	 50 55 55	 — — —	lm/W	Emitted Luminous Flux/Electrical Power
Thermal Coefficient of λ_d Amber Red Red Orange		 — — —	 0.08 0.05 0.07	 — — —	nm/°C	I_F = 20 mA, +25°C ≤ T_J ≤ +100°C

a. The dominant wavelength, λ_d is derived from the CIE Chromaticity Diagram referenced to Illuminant E. Tolerance for each color of dominant wavelength is ±0.5 nm.

b. The radiant intensity, I_e in watts per steradian, maybe found from the equation $I_e = I_v / \eta_V$ where I_v is the luminous intensity in candela and η_V is the luminous efficacy in lumens/watt.

c. $\eta_e = \phi_v / I_F \times V_F$ where ϕ_v is the emitted luminous flux, I_F is electrical forward current, and V_F is the forward voltage.

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	E	5-mm Standard Round AlInGaP
x_2	Color	G	Red
		L	Amber
		H	Red Orange
x_3 x_4	Viewing angle and lead standoffs	1A	15° without lead standoffs
		1B	15° with lead standoffs
		2A	23° without lead standoffs
		2B	23° with lead standoffs
		3A	30° without lead standoffs
		3B	30° with lead standoffs
x_5	Minimum intensity bin	Refer to Device Selection Guide	
x_6	Maximum intensity bin		
x_7	Color bin selection	0	Full range
		K	Color bin 2 and 4
		L	Color bin 4 and 6
x_8 x_9	Packaging option	00	Bulk packaging
		DD	Ammopack

Bin Information

Intensity Bin Limit Table (1.3:1 Iv Bin Ratio)

Bin	Intensity (mcd) at 20 mA	
	Min.	Max.
V	4200	5500
W	5500	7200
X	7200	9300
Y	9300	12000
Z	12000	16000
1	16000	21000
2	21000	27000

Tolerance for each bin limit is ±15%

V_F Bin Table (V at 20 mA)

Bin ID	Min.	Max.
VD	1.8	2.0
VA	2.0	2.2
VB	2.2	2.4

Tolerance for each bin limit is ±0.05V.

Red Color Range

Min. Dom.	Max. Dom.	X Min.	Y Min.	X Max.	Y Max.
618	630	0.6872	0.3126	0.6890	0.2943
		0.6690	0.3149	0.7080	0.2920

Tolerance for each bin limit is ±0.5 nm.

Red Orange Color Range

Min.Dom	Max. Dom	X Min.	Y Min.	X Max.	Y Max.
612	619	0.6712	0.6887	0.6716	0.6549
		0.3280	0.3109	0.3116	0.3282

Tolerance for each bin limit is ±0.5 nm.

Amber Color Range

Bin	Min. Dom.	Max. Dom.	X Min.	Y Min.	X Max.	Y Max.
2	587	589.5	0.5570	0.4420	0.5670	0.4250
			0.5530	0.4400	0.5720	0.4270
4	589.5	592	0.5720	0.4270	0.5820	0.4110
			0.5670	0.4250	0.5870	0.4130
6	592	594.5	0.5870	0.4130	0.5950	0.3980
			0.5820	0.4110	0.6000	0.3990

Tolerance for each bin limit is ±0.5 nm.

NOTE: All bin categories are established for classification of products. Products may not be available in all bin categories. Contact a Broadcom representative for further information.

Figure 2: Broadcom Color Bin on CIE 1931 Chromaticity Diagram

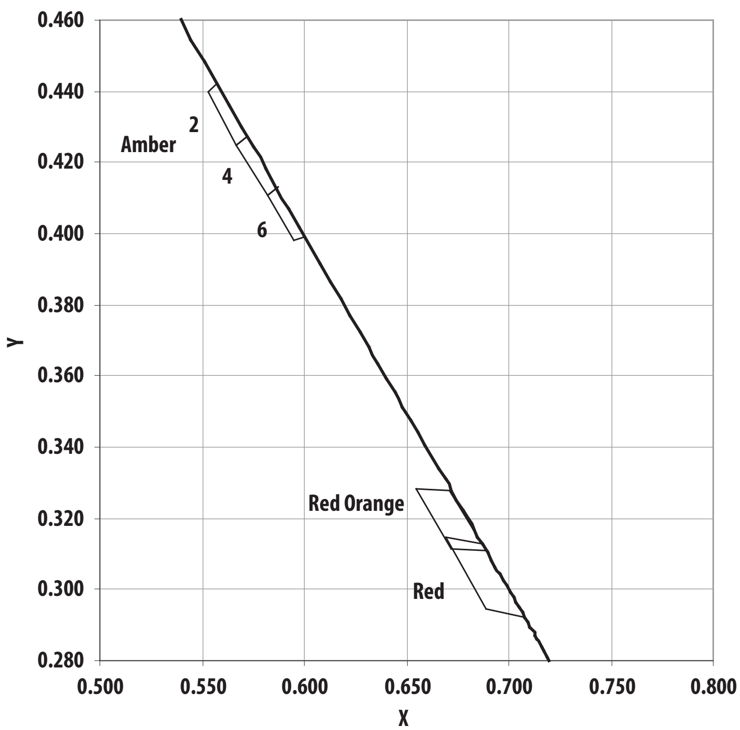


Figure 3: Relative Intensity vs. Peak Wavelength

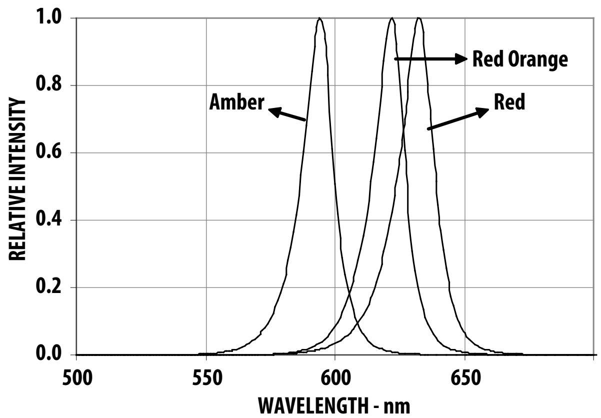


Figure 4: Forward Current vs. Forward Voltage

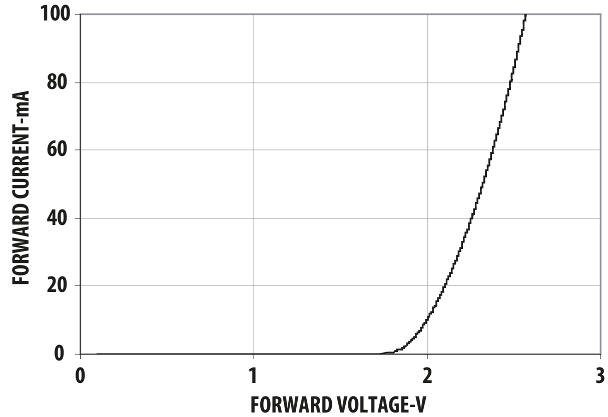


Figure 5: Relative Luminous Intensity vs. Forward Current

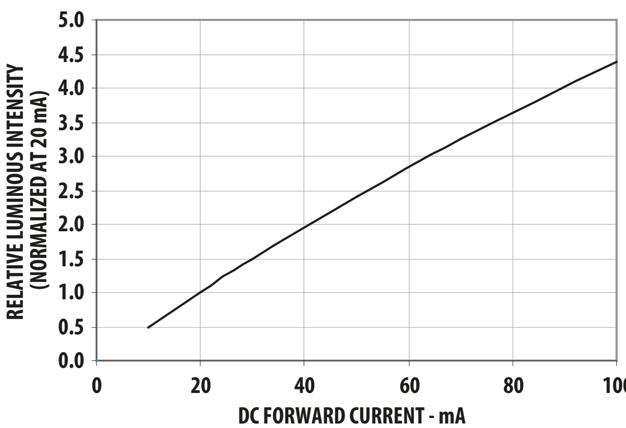


Figure 6: Maximum Forward Current vs. Ambient Temperature

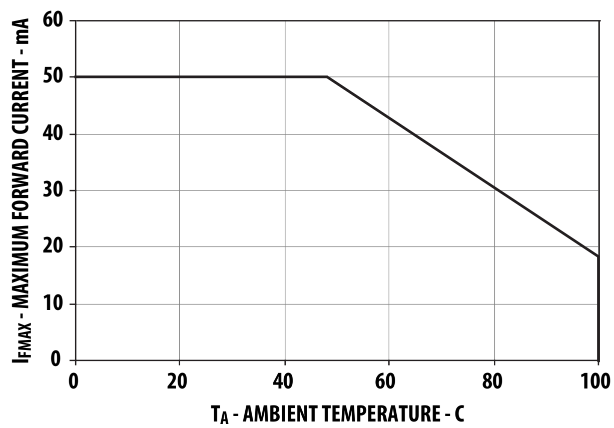


Figure 7: Radiation Pattern for 15° Viewing Angle Lamp

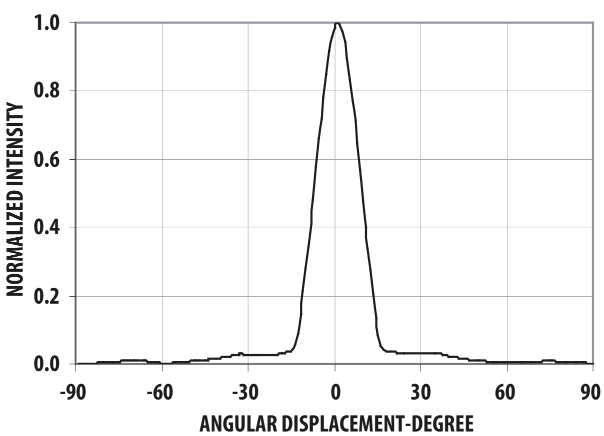


Figure 8: Radiation Pattern for 23° Viewing Angle Lamp

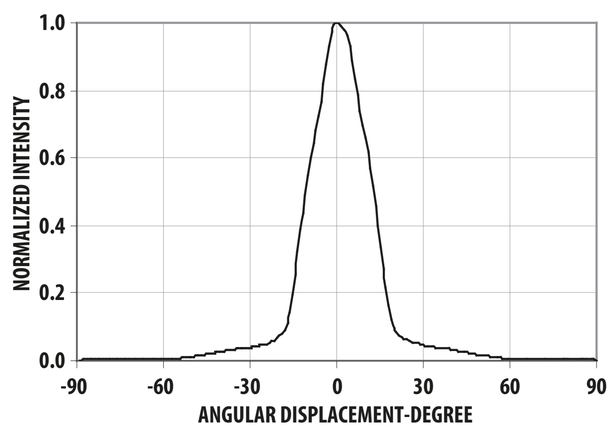


Figure 9: Radiation Pattern for 30° Viewing Angle Lamp

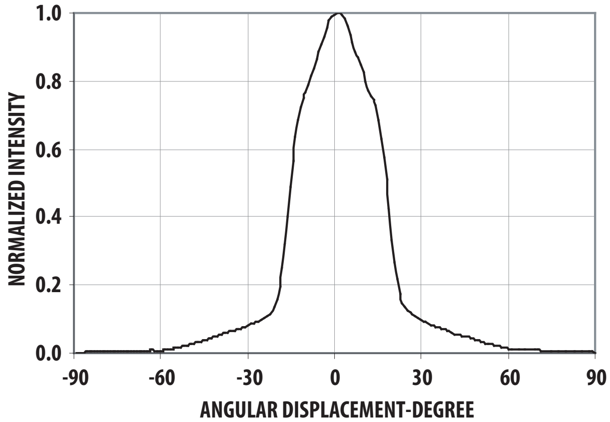


Figure 10: Relative Light Output vs. Junction Temperature

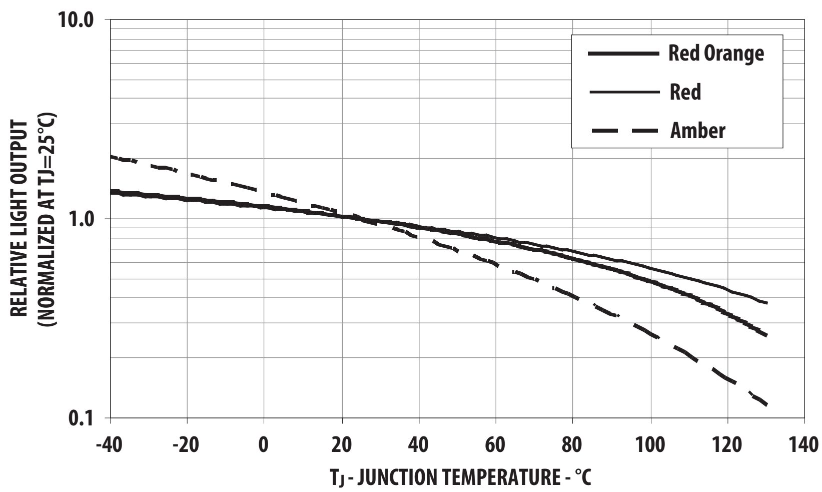
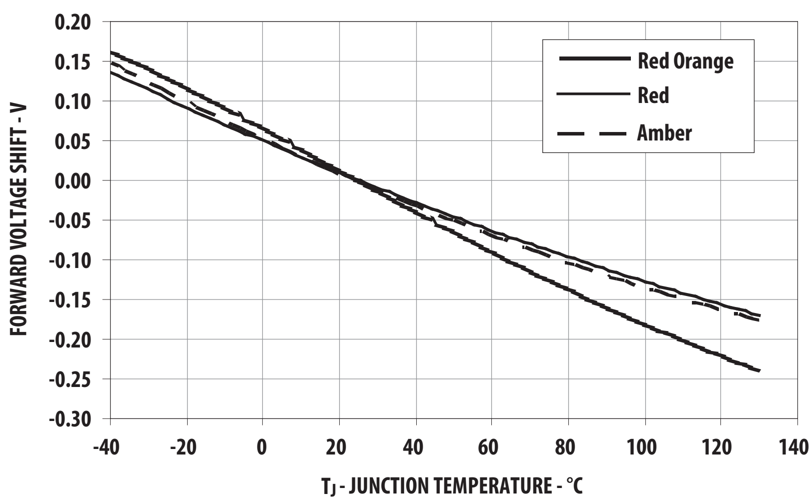


Figure 11: Relative Forward Voltage vs. Junction Temperature



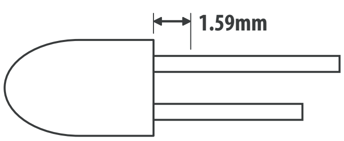
Precautions

Lead Forming

- The leads of an LED lamp may be preformed or cut to length prior to insertion and soldering on the PC board.
- For better control, use the proper tool to precisely form and cut the leads to the 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 hand soldering operations, because the excess lead length also acts as a small heat sink.

Soldering and Handling

- Take care during PCB assembly and soldering process to prevent damage to the LED component.
- The LED component may be effectively hand soldered to the PCB; however, use this method only under unavoidable circumstances, such as rework. The closest manual soldering distance of the soldering heat source (the soldering iron's tip) to the body is 1.59 mm. Soldering the LED using the 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, which is ESD sensitive. Refer to Broadcom Application Note AN-1142 for details. Use a soldering iron with a grounded tip to ensure that the electrostatic charge is properly grounded.
- The recommended soldering conditions follow.

	Wave Soldering[a, b]	Manual Solder Dipping
Preheat Temperature	105°C max.	—
Preheat Time	60 seconds max.	—
Peak Temperature	260°C max.	260°C max.
Dwell Time	5 seconds max.	5 seconds max

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

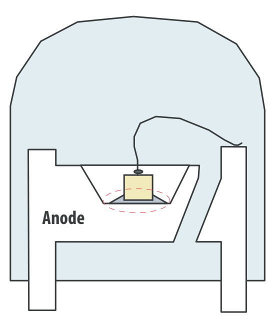
b. Use only bottom preheaters to reduce thermal stress experienced by the LED.

- 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 conforms to the recommended soldering conditions.

NOTE:

- PCBs with different sizes and designs (component density) have different heat masses (heat capacity). This might cause a change in the temperature experienced by the board if the same wave soldering setting is used. Therefore, you must recalibrate the soldering profile again before loading a new type of PCB.
- Broadcom high brightness LEDs use high-efficiency LED dies with a single wire bond as shown in Figure 12. Take extra precautions during wave soldering to ensure that the maximum wave temperature does not exceed 260°C and the solder contact time does not exceed 5 seconds. Over-stressing the LED during soldering process might cause premature failure to the LED due to delamination.

Figure 12: Broadcom LED Configuration



NOTE: The electrical connection between the bottom surface of the LED die and the lead frame is achieved through conductive paste.

- Any alignment fixture that is being applied during wave soldering should be loosely fitted and should not apply weight or force on the LED. Use non-metal material because it will absorb less heat during the wave soldering process.

NOTE: To help you design an accurate jig that fits the Broadcom product, a three-dimensional model of the product is available upon request.

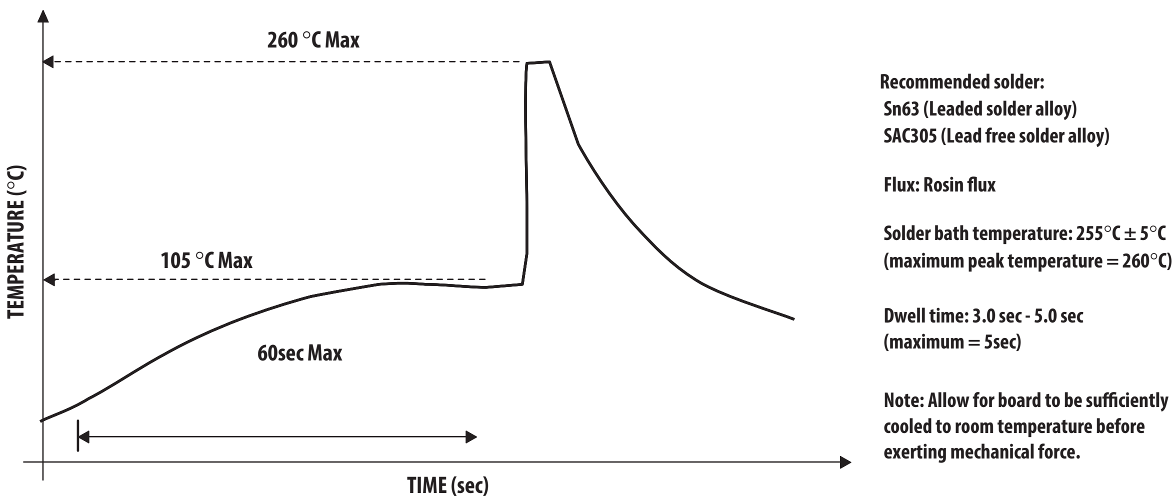
- At elevated temperatures, the LED is more susceptible to mechanical stress. Therefore, allow the PCB to cool down to room temperature prior to handling, which includes removal of the alignment fixture or pallet.
- If the PCB board contains both through-hole (TH) LEDs and other surface mount components, solder surface mount components on the top side of the PCB. If surface-mount LEDs must be soldered on the bottom side, solder these components using reflow soldering prior to insertion the TH LED.
- Recommended PC board plated through-holes (PTHs) size for LED component leads follows.

LED Component Lead Size	Diagonal	Plated Through-Hole Diameter
0.45 mm × 0.45 mm (0.018 in. × 0.018 in.)	0.636 mm (0.025 in.)	0.98 mm to 1.08 mm (0.039 in. to 0.043 in.)
0.50 mm × 0.50 mm (0.020 in. × 0.020 in.)	0.707 mm (0.028 in.)	1.05 mm to 1.15 mm (0.041 in. to 0.045 in.)

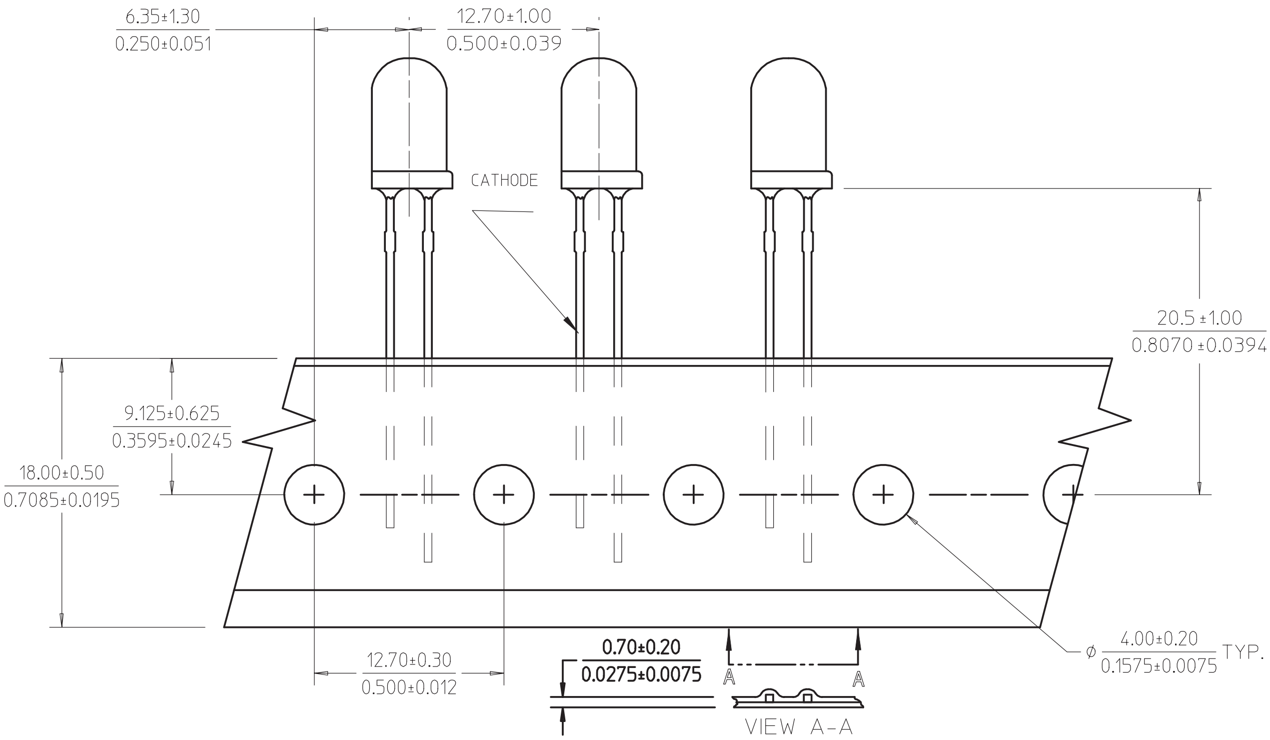
- Over-sizing the PTH can lead to a twisted LED after clinching. On the other hand, under-sizing the PTH can cause difficulty inserting the TH LED.

Refer to Application Note AN5334 for more information about soldering and handling of high-brightness TH LED lamps.

Figure 13: Example of Wave Soldering Temperature Profile for TH LED

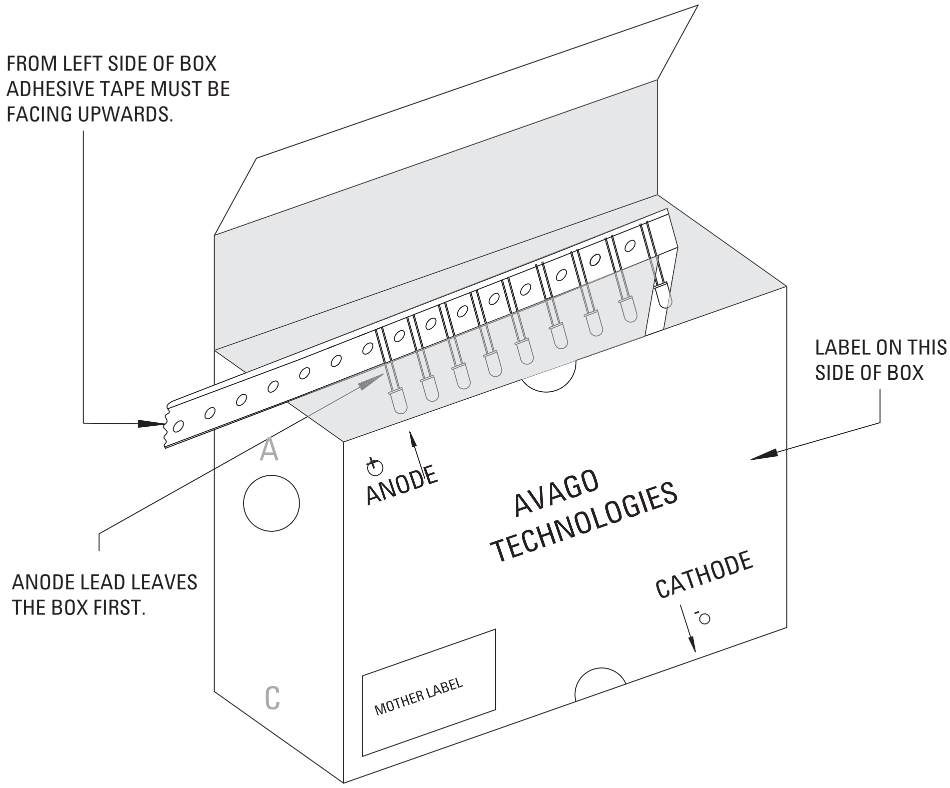


Ammo Packs Drawing



NOTE: The ammo pack drawing is applicable for packaging option -DD and -ZZ, for LEDs both with and without standoffs.

Packaging Box for Ammo Packs



NOTE: The dimensions for the ammo pack are applicable for LEDs both with and without standoffs.

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