Data Sheet

HLMP-EGxx, HLMP-ELxx

T-1¾ (5 mm) High Brightness AlInGaP Red and Amber LEDs

Description

These Broadcom® high brightness 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. Precision optical performance lamps use the aluminum indium gallium phosphide (AlInGaP) technology.

These LED lamps are untinted. T-1¾ packages, which incorporate second-generation optics, produce 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 epoxy contains a UV inhibitor to reduce the effects of long-term exposure to direct sunlight.

Benefits

- Superior performance for outdoor environment

Features

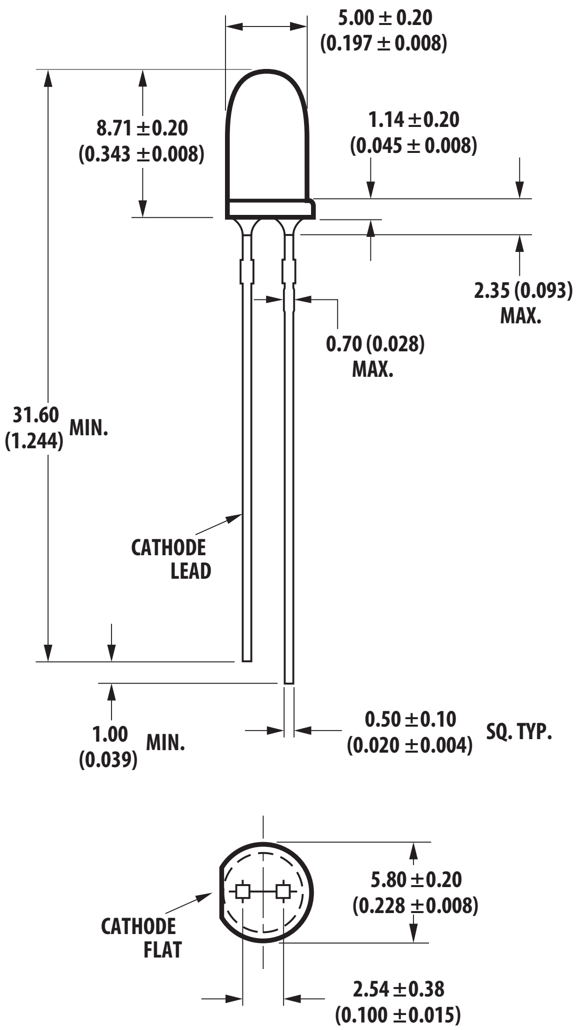
- Viewing angle: 15°, 23° and 30°
- Well-defined spatial radiation pattern
- High brightness material
- Available in Red and Amber
  - Red AlInGaP 621 nm
  - Amber AlInGaP 590 nm
- Superior resistance to moisture
- Package options:
  - With and without standoff

Applications

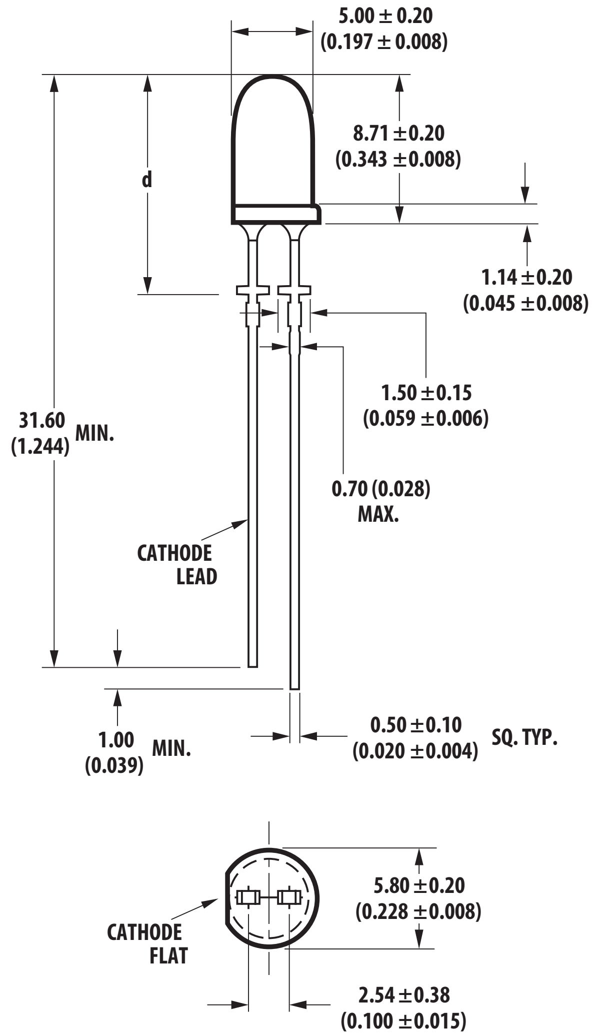
- Traffic management:
  - Traffic signals
  - Pedestrian signals
  - Work zone warning lights
  - Variable message signs
- Solar power signs
- Commercial outdoor advertising
  - Signs
  - Marquee

Figure 1: Package Drawing

A: Non-standoff



B: Standoff

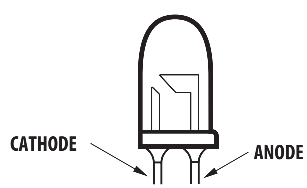


Part Number	Dimension 'd'
HLMP-Ex1T	13.03 ± 0.25
HLMP-Ex2T	12.73 ± 0.25
HLMP-Ex3T	12.26 ± 0.25

NOTE:

1. All dimensions in millimeters (inches).
2. Tolerance is ± 0.20 mm unless other specified.
3. Leads are mild steel with tin plating.
4. The epoxy meniscus is 1.21 mm max.
5. For identification of polarity after the leads are trimmed off, see Figure 2.

Figure 2: Polarity Identification



Device Selection Guide (T_J = 25°C, I_F = 20 mA)

Part Number	Color and Dominant Wavelength λ_d (nm) Type[e]	Luminous Intensity Iv (mcd) at 20 mA[a, b, c] Min	Max	Standoff	Typical Viewing angle (°)[d]
HLMP-EG1S-Z20DD	Red 621	12000	27000	No	15
HLMP-EG1T-Z20DD	Red 621	12000	27000	Yes	
HLMP-EL1S-Z20DD	Amber 590	12000	27000	No	
HLMP-EL1S-Z2KDD	Amber 590	12000	27000	No	
HLMP-EL1S-Z2LDD	Amber 590	12000	27000	No	
HLMP-EL1T-Z20DD	Amber 590	12000	27000	Yes	
HLMP-EL1T-Z2KDD	Amber 590	12000	27000	Yes	
HLMP-EL1T-Z2LDD	Amber 590	12000	27000	Yes	
HLMP-EG2S-XZ0DD	Red 621	7200	16000	No	23
HLMP-EG2T-XZ0DD	Red 621	7200	16000	Yes	
HLMP-EL2S-XZ0DD	Amber 590	7200	16000	No	
HLMP-EL2S-XZKDD	Amber 590	7200	16000	No	
HLMP-EL2S-XZLDD	Amber 590	7200	16000	No	
HLMP-EL2T-XZ0DD	Amber 590	7200	16000	Yes	
HLMP-EL2T-XZKDD	Amber 590	7200	16000	Yes	
HLMP-EL2T-XZLDD	Amber 590	7200	16000	Yes	
HLMP-EG3S-VX0DD	Red 621	4200	9300	No	30
HLMP-EG3T-VX0DD	Red 621	4200	9300	Yes	
HLMP-EL3S-VX0DD	Amber 590	4200	9300	No	
HLMP-EL3S-VXKDD	Amber 590	4200	9300	No	
HLMP-EL3S-VXLDD	Amber 590	4200	9300	No	
HLMP-EL3T-VX0DD	Amber 590	4200	9300	Yes	
HLMP-EL3T-VXKDD	Amber 590	4200	9300	Yes	
HLMP-EL3T-VXLDD	Amber 590	4200	9300	Yes	

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

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

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

d. $\theta_{1/2}$ is the off-axis angle where the luminous intensity is half the on-axis intensity.

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

Absolute Maximum Ratings T_J = 25°C

Parameter	Red/Amber	Units
DC Forward Current[a]	50	mA
Peak Forward Current	100[b]	mA
Power Dissipation	120	mW
LED Junction Temperature	130	°C
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	V_F					
Amber/Red		1.8	2.1	2.4	V	I_F = 20 mA
Reverse Voltage[a]	V_R	5	—	—	V	I_R = 100 µA
Dominant Wavelength[b]	λ_d					
Amber		587.0	590.0	594.5	nm	I_F = 20 mA
Red		618.0	621.0	630.0	nm	
Peak Wavelength	λ_{PEAK}					
Amber		—	594	—	nm	Peak of Wavelength of Spectral Distribution at I_F = 20 mA
Red		—	629	—	nm	
Thermal resistance	$R\theta_{J\text{-}PIN}$	—	240	—	°C/W	LED junction to pin
Luminous Efficacy[c]	η_V					
Amber		—	500	—	lm/W	Emitted Luminous Flux/ Emitted Radiant Flux
Red		—	205	—	lm/W	

a. Indicates product final testing condition, long term reverse bias is not recommended.

b. The dominant wavelength is derived from the Chromaticity Diagram and represents the color of the lamp.

c. The radiant intensity, Ie in watts per steradian, maybe found from the equation Ie = Iv / η_V where Iv is the luminous intensity in candela and η_V is the 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	E	5-mm AlInGaP Round
x_2	Color	G	Red 621 nm
		L	Amber 590 nm
x_3x_4	Viewing Angle and Lead Stand-off	1S	15° without lead stand-off
		1T	15° with lead stand-off
		2S	23° without lead stand-off
		2T	23° with lead stand-off
		3S	30° without lead stand-off
		3T	30° with lead stand-off
x_5	Minimum Intensity Bin	See Intensity Bin Limit Table (1.3:1 Iv Bin Ratio)	
x_6	Maximum Intensity Bin		
x_7	Color Bin Option	0	Full distribution
		K	Color bins 2 and 4
		L	Color bins 4 and 6
x_8x_9	Packing Option	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.
618.0	630.0	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.

Amber Color Range

Bin	Min. Dom	Max. Dom	X Min.	Y Min.	X Max.	Y Max.
2	587.0	589.5	0.5570	0.4420	0.5670	0.4250
			0.5530	0.4400	0.5720	0.4270
4	589.5	592.0	0.5720	0.4270	0.5820	0.4110
			0.5670	0.4250	0.5870	0.4130
6	592.0	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 your Broadcom representative for further information.

Broadcom Color Bin on CIE 1931 Chromaticity Diagram

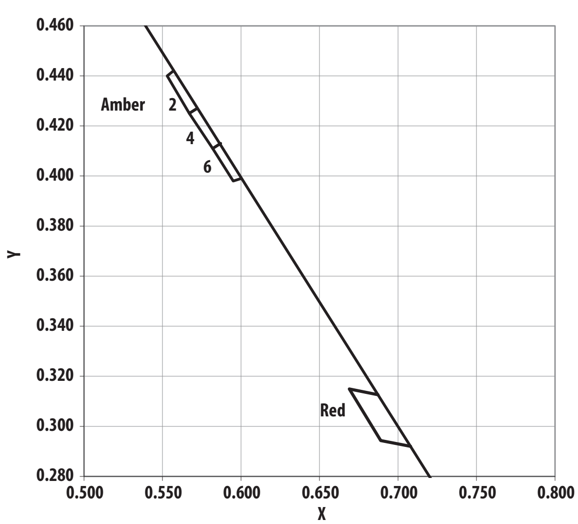


Figure 3: Relative Intensity vs. Wavelength

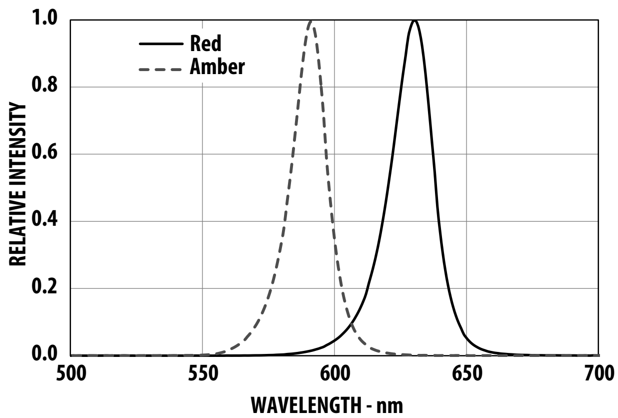


Figure 4: Forward Current vs. Forward Voltage

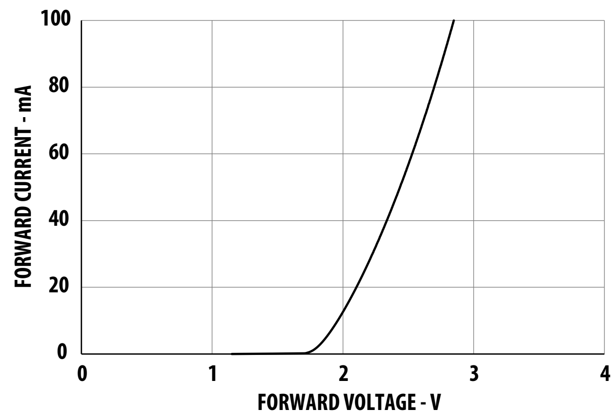


Figure 5: Relative Intensity vs. Forward Current

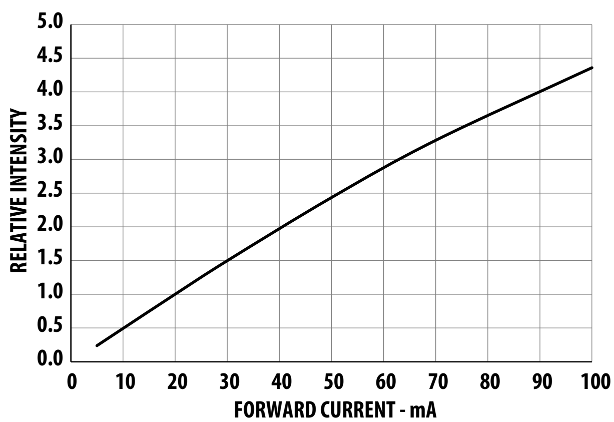


Figure 6: Maximum Forward Current vs. Ambient Temperature

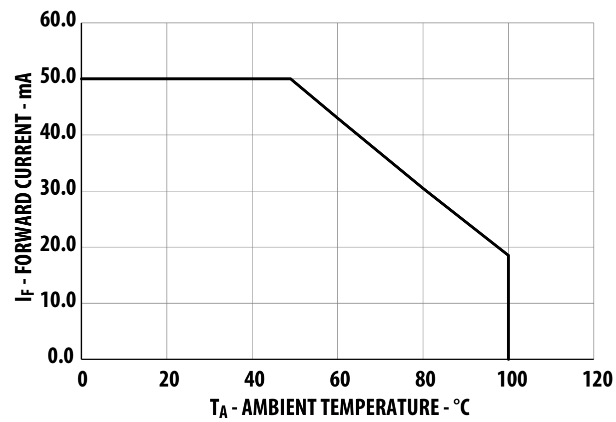


Figure 7: Dominant Wavelength Shift vs. Forward Current

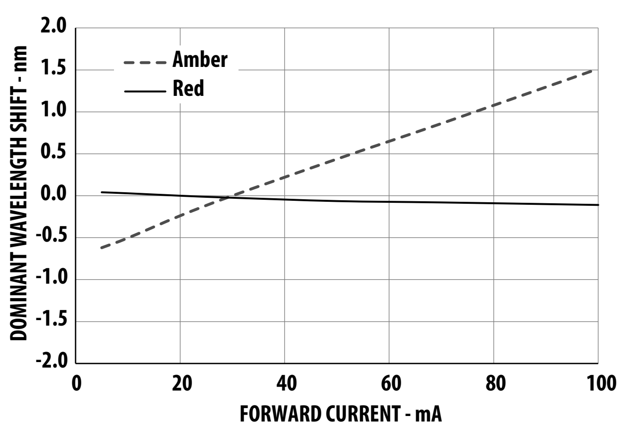


Figure 8: Representative Radiation Pattern for 15° Lamp

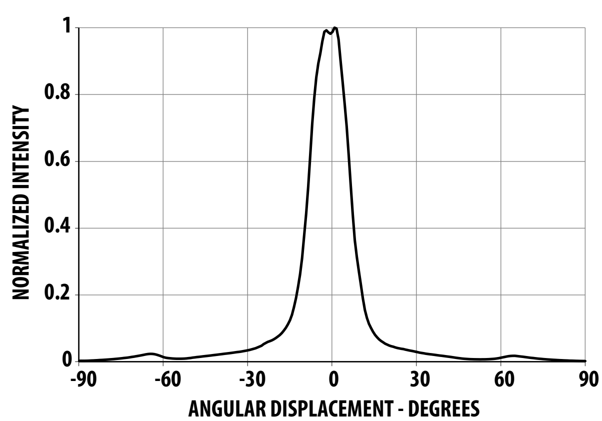


Figure 9: Representative Radiation Pattern for 23° Lamp

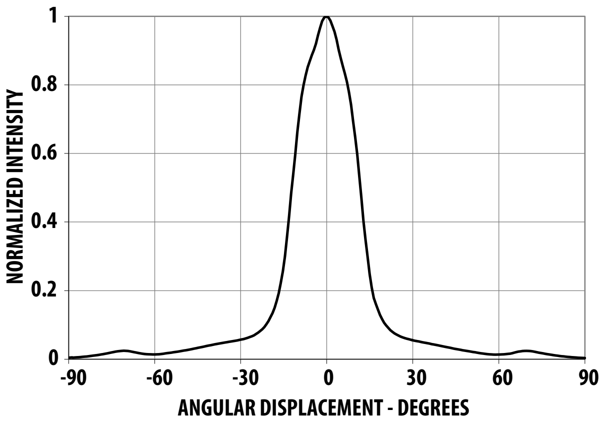


Figure 10: Representative Radiation Pattern for 30° Lamp

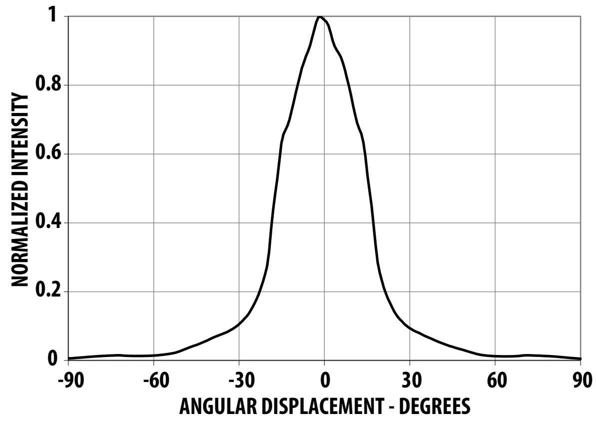


Figure 11: Relative Light Output vs. Junction Temperature

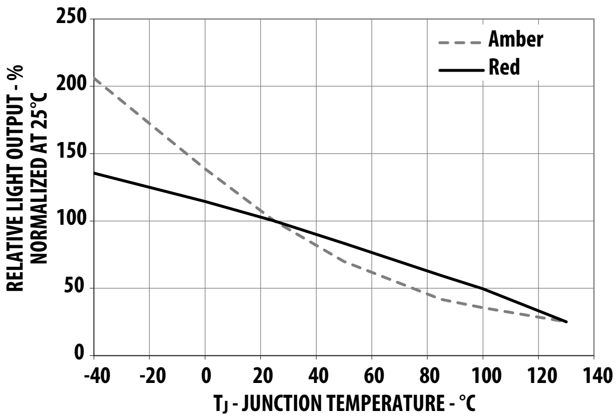


Figure 12: Forward Voltage Shift vs. Junction Temperature

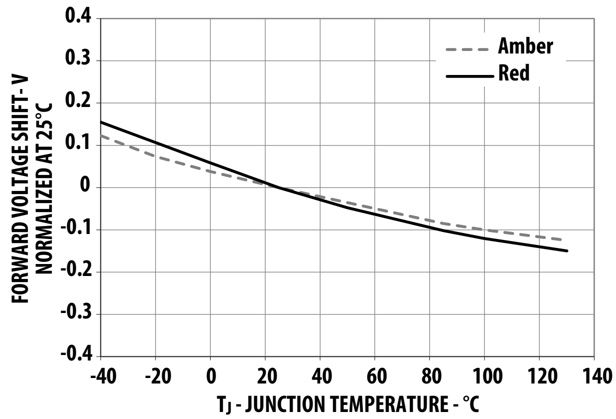
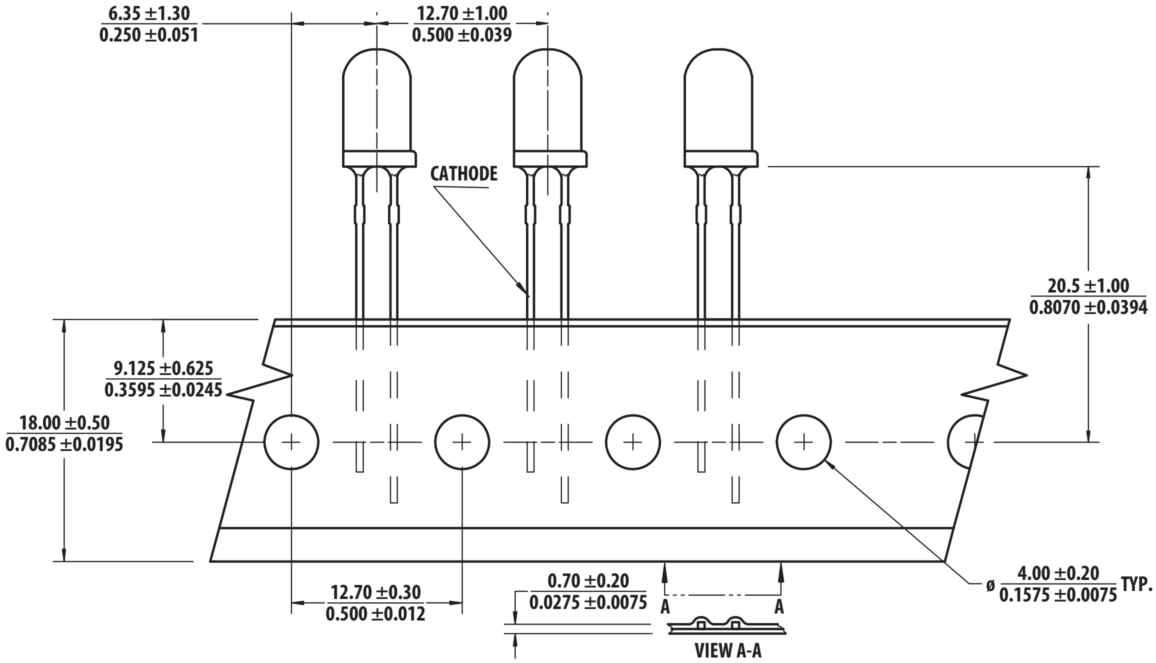
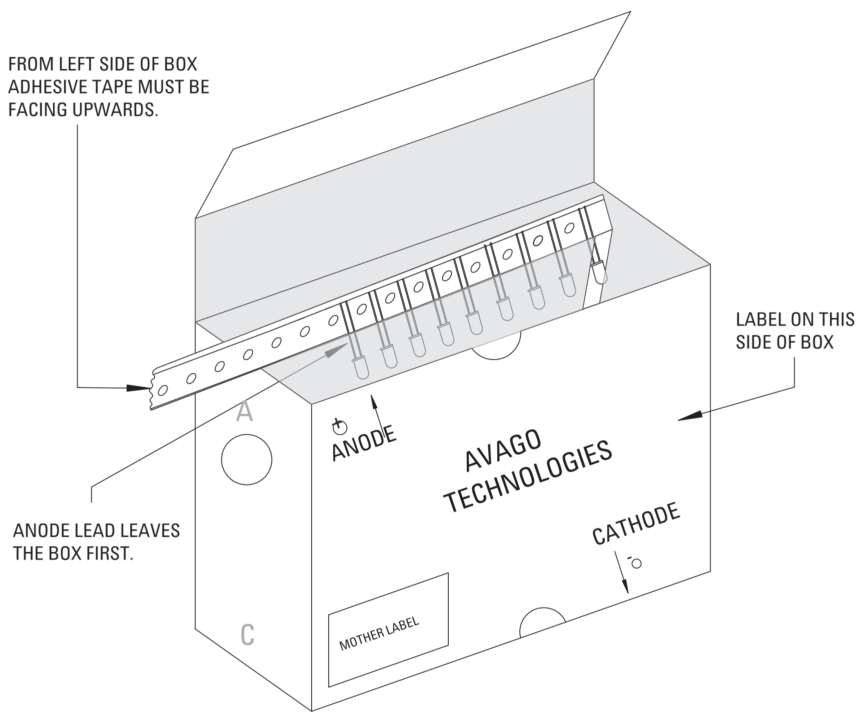


Figure 13: Tape Outline Drawing for Packaging Option DD



NOTE: The ammo-packs drawing is applicable for packaging option -DD and -ZZ and regardless standoff or non-standoff.

Figure 14: Packaging Box for Ammo Packs

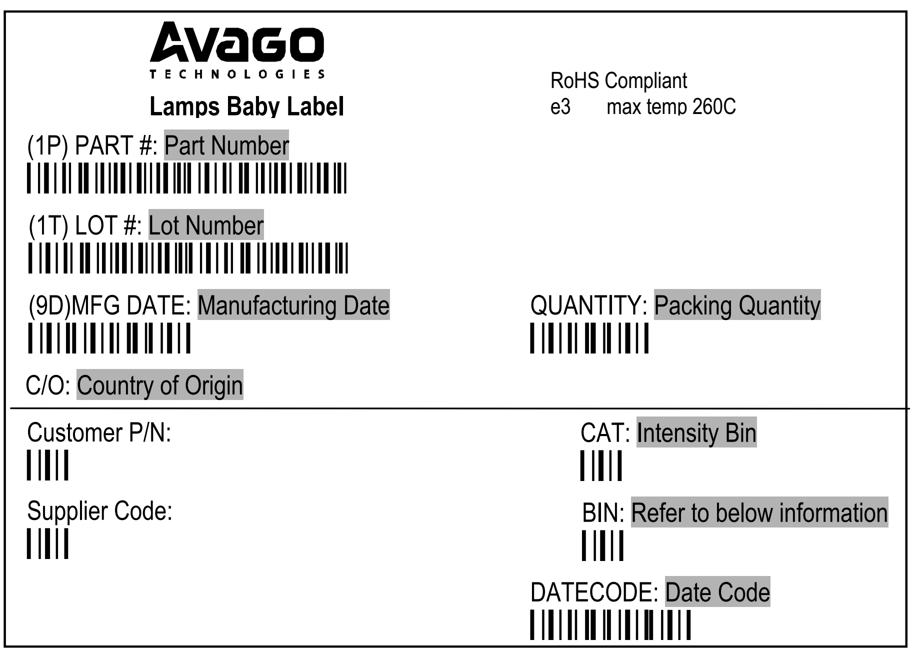


NOTE: The dimension for ammo pack is applicable for the device with standoff and without standoff.

Figure 15: Packaging Label

(i) Mother Label: (Available on packaging box of ammo pack and shipping box)

(ii) Baby Label (Only available on bulk packaging)



Acronyms and Definitions

BIN:

(i) Color bin only or VF bin only

(Applicable for part number with color bins but without VF bin OR part number with VF bins and no color bin)

OR

(ii) Color bin incorporated with VF Bin

(Applicable for part number that have both color bin and VF bin)

Example:

(i) Color bin only or VF bin only

BIN: 2 (represent color bin 2 only)

BIN: VB (represent VF bin “VB” only)

(ii) Color bin incorporate with VF Bin

BIN: 2 VB

2: Color bin 2 only

VB: VF bin “VB”

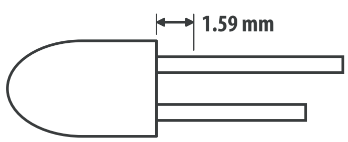
Precautions

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 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 hand solder operation, because the excess lead length also acts as 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 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 precaution 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 should have grounded tip to ensure that the electrostatic charge is properly grounded.
- Recommended soldering condition:

	Wave Soldering[a, b]	Manual Solder Dipping
Pre-heat temperature	105°C max.	—
Preheat time	60s max	—
Peak temperature	260°C max.	260°C max.
Dwell time	5s max.	5s max.

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

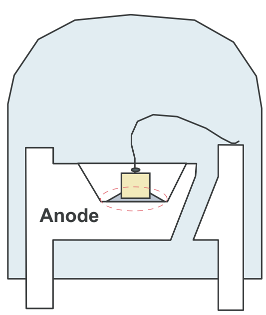
b. Use only bottom preheaters to reduce thermal stress experienced by LED.

- Wave soldering parameters must be set and maintained according to the recommended temperature and dwell time. Customer is advised to perform daily check on the soldering profile to ensure that it is always conforming to recommended soldering conditions.

NOTE:

1. PCB with different size and design (component density) will have different heat mass (heat capacity). This might cause a change in temperature experienced by the board if same wave soldering setting is used. So, it is recommended to re-calibrate the soldering profile again before loading a new type of PCB.
2. Broadcom high brightness LEDs use a high-efficiency LED die with single wire bond as shown below. Customer is advised to take extra precaution during wave soldering to ensure that the maximum wave temperature does not exceed 260°C and the solder contact time does not exceeding 5sec. Over-stressing the LED during soldering process might cause premature failure to the LED due to delamination.

Broadcom LED Configuration



InGaN Device

NOTE: 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 LED. Use non-metal material because it will absorb less heat during the wave soldering process.

NOTE: To further assist customer in designing a jig that accurately fits the Broadcom product, a 3D model of the product is available upon request.

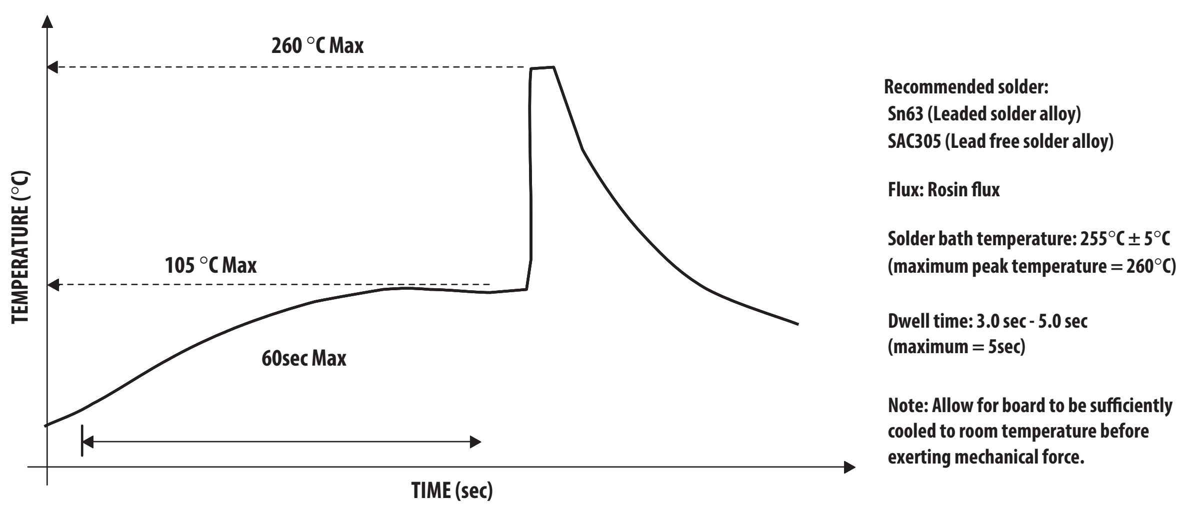
- At elevated temperatures, the LED is more susceptible to mechanical stress. Therefore, allow the PCB to cool down to room temperature prior to handling, which includes removal of the alignment fixture or pallet.
- If the PCB board contains both a through-hole (TH) LED and other surface-mount components, solder the surface mount components on the top side of the PCB. If the surface mount needs to be on the bottom side, solder these components using reflow soldering prior to inserting the TH LED.
- The following table shows the recommended PC board plated through-hole (PTH) size for LED component leads.

LED Component Lead Size	Diagonal	Plated Through-Hole Diameter
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.)
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.)

- Over-sizing the PTH can lead to a twisted LED after clinching. 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 16: Example of Wave Soldering Temperature Profile for TH LED



NOTE: Allow the board to be sufficiently cooled to room temperature before exerting mechanical force.

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