HLMP-AG70/71, HLMP-AL70/71

5-mm Mini Oval Red and Amber LEDs

Description

These precision optical performance oval LEDs are specifically designed for full color/video and passenger information signs. The oval shaped radiation pattern and high luminous intensity ensure that these devices are excellent for wide field-of-view outdoor applications where a wide viewing angle and readability in sunlight are essential. The package epoxy contains UV inhibitors to reduce the effects of long-term exposure to direct sunlight.

Applications

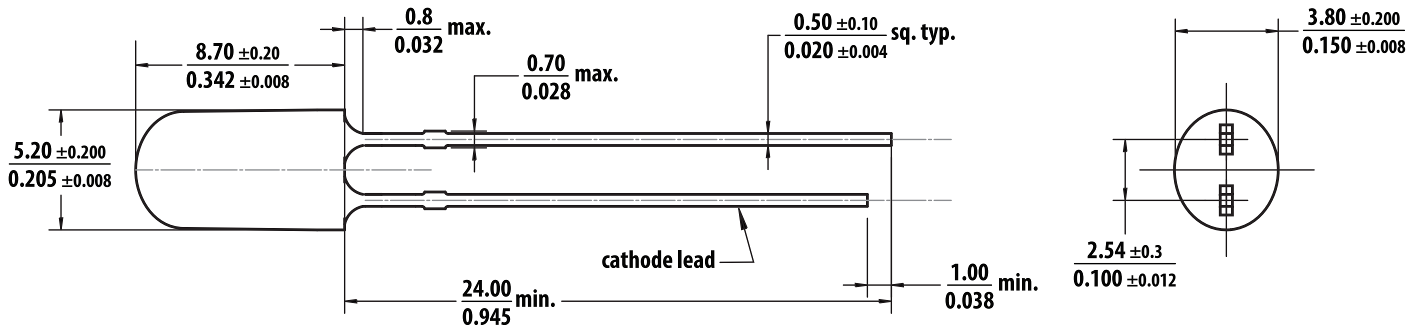
- Gas price signs
- Mono-color signs – marquee

Features

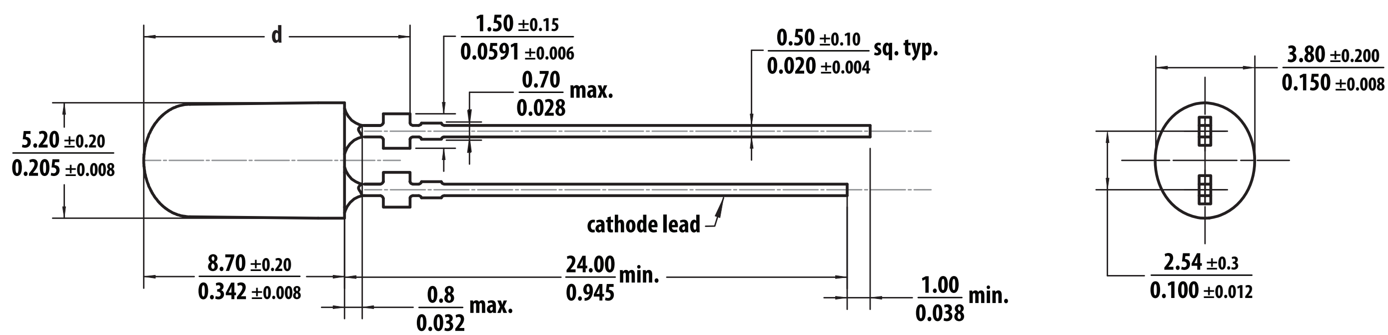
- Well-defined spatial radiation pattern
- High-brightness material
- Available in red and amber:
  - Red AlInGaP 626 nm
  - Amber AlInGaP 590 nm
- Superior resistance to moisture
- Standoff and nonstandoff packages
- Tinted and diffused
- Typical viewing angle: 30° × 70°

Package Dimensions

A: No Standoff



B: Standoff



Part Number	Dimension "d"
HLMP-AG71-xxxxx	12.30 mm ± 0.25 mm
HLMP-AL71-xxxxx	12.64 mm ± 0.25 mm

NOTE:

1. All dimensions are in millimeters (inches).
2. Tolerance is ± 0.20 mm unless otherwise specified.

Device Selection Guide

Part Number	Color and Dominant Wavelength λ_d (nm) Typ.[a]	Luminous Intensity I_V (mcd) at 20 mA[b, c, d, e]		Standoff	Package Drawing
		Min.	Max.		
HLMP-AG70-Z20DD	Red 626	2400	4200	No	A
HLMP-AG71-Z20DD	Red 626	2400	4200	Yes	B
HLMP-AL70-13KDD	Amber 590	2900	5040	No	A
HLMP-AL70-13LDD	Amber 590	2900	5040	No	A
HLMP-AL71-130DD	Amber 590	2900	5040	Yes	B
HLMP-AL71-13KDD	Amber 590	2900	5040	Yes	B
HLMP-AL71-13LDD	Amber 590	2900	5040	Yes	B

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

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

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

d. The tolerance for each bin limit is ± 15%.

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

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 4.

b. Duty factor 30%, frequency 1 kHz.

Electrical/Optical Characteristics (T_J = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Forward Voltage Red and Amber	V_F	1.8	2.1	2.4	V	I_F = 20 mA
Reverse Voltage[a] Red and Amber	V_R	5	—	—	V	I_R = 100 µA
Dominant Wavelength[b] Red Amber	λ_d	 618.0 584.5	 626.0 590.0	 630.0 594.5	nm	I_F = 20 mA
Peak Wavelength Red Amber	λ_{PEAK}	 — —	 634 594	 — —	nm	Peak of wavelength of spectral distribution at I_F = 20 mA
Thermal Resistance	$R\theta_{J\text{-}PIN}$	—	240	—	°C/W	LED junction-to pin
Luminous Efficacy[c] Red Amber	η_V	 — —	 190 490	 — —	lm/W	Emitted luminous power/emitted radiant power
Thermal Coefficient of λ_d Red Amber	—	 — —	 0.05 0.09	 — —	nm/°C	I_F = 20 mA; +25°C ≤ T_J ≤ +100°C

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

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

c. 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 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	A	5-mm mini oval 30° x 70°
x_2	Color	G	Red
		L	Amber
x_3 x_4	Lead Standoff	70	Without a lead standoff
		71	With a lead standoff
x_5	Minimum Intensity Bin	See Intensity Bin Limit Table (1.2 : 1 I_V Bin Ratio)	
x_6	Maximum Intensity Bin		
x_7	Color Bin Option	0	Full distribution
		K	Color bin 2 and 4
		L	Color bin 4 and 6
x_8 x_9	Packing Option	DD	Ammo pack

Bin Information

Intensity Bin Limit Table (1.2 : 1 I_V Bin Ratio)

Bin	Intensity (mcd) at 20 mA	
	Min.	Max.
Y	1990	2400
Z	2400	2900
1	2900	3500
2	3500	4200
3	4200	5040

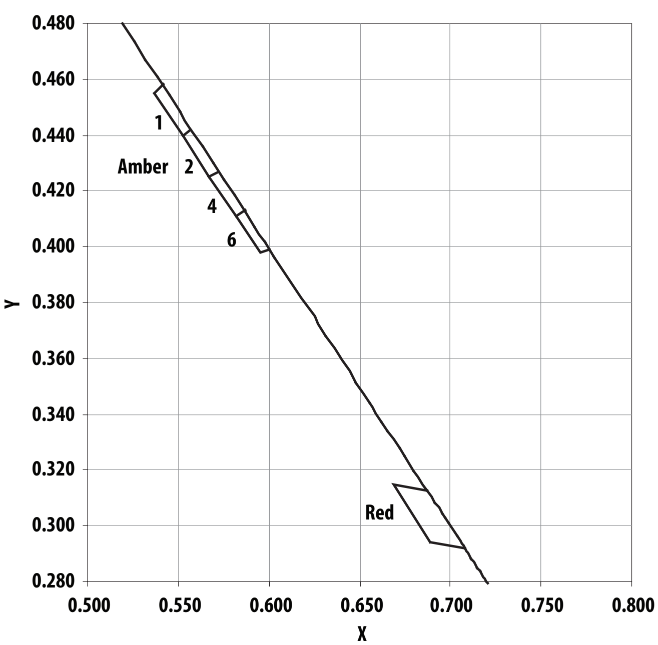
Tolerance for each bin limit is ± 15%.

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.

Color Bin on CIE 1931 Chromaticity Diagram



Red Color Range

Min. Dominant Wavelength	Max. Dominant Wavelength	Chromaticity Coordinates				
618.0	630.0	x	0.6872	0.6690	0.6890	0.7080
		y	0.3126	0.3149	0.2943	0.2920

Tolerance for each bin limit is ± 0.5 nm.

Amber Color Range

Bin	Min. Dominant Wavelength	Max. Dominant Wavelength	Chromaticity Coordinates				
1	584.5	587.0	x	0.5420	0.5370	0.5530	0.5570
			y	0.4580	0.4550	0.4400	0.4420
2	587.0	589.5	x	0.5570	0.5530	0.5670	0.5720
			y	0.4420	0.4400	0.4250	0.4270
4	589.5	592.0	x	0.5720	0.5670	0.5820	0.5870
			y	0.4270	0.4250	0.4110	0.4130
6	592.0	594.5	x	0.5870	0.5820	0.5950	0.6000
			y	0.4130	0.4110	0.3980	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.

Figure 1: Relative Intensity vs. Wavelength

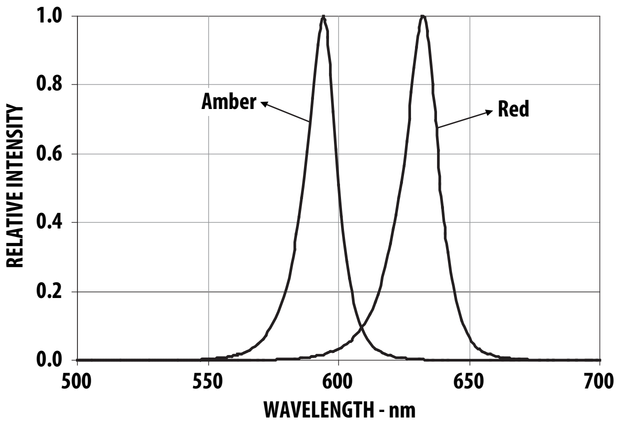


Figure 2: Forward Current vs. Forward Voltage

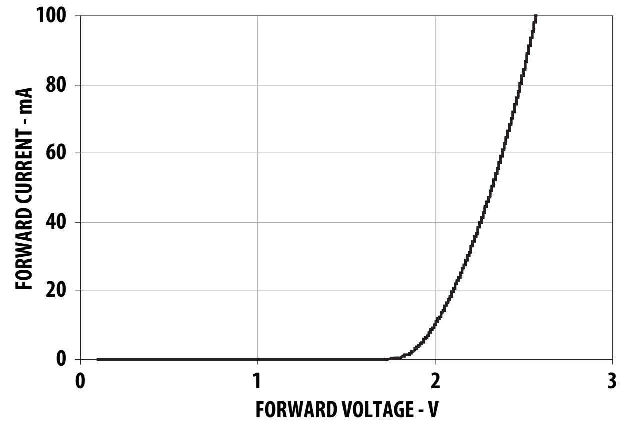


Figure 3: Relative Intensity vs. Forward Current

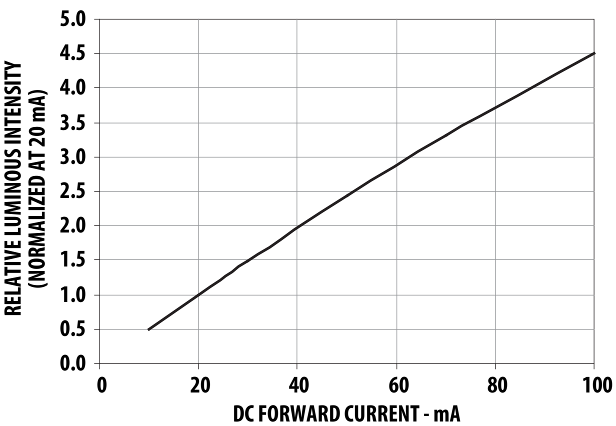


Figure 4: Maximum Forward Current vs. Ambient Temperature

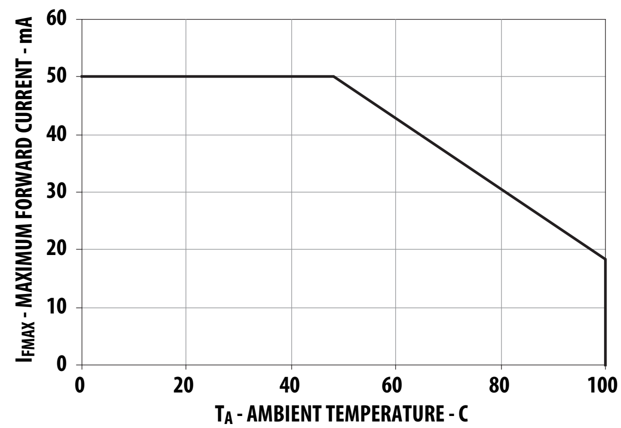


Figure 5: Radiation Pattern for Red – Major Axis

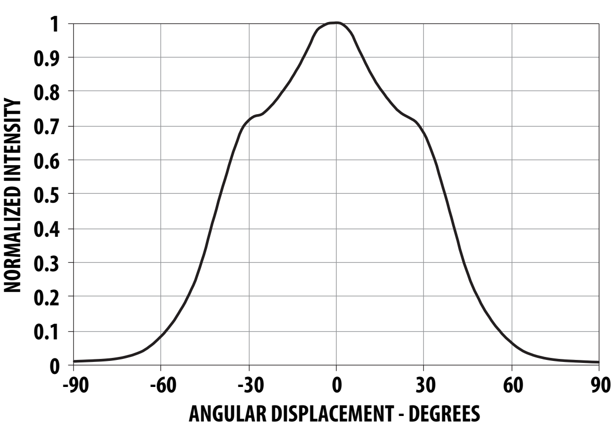


Figure 6: Radiation Pattern for Red – Minor Axis

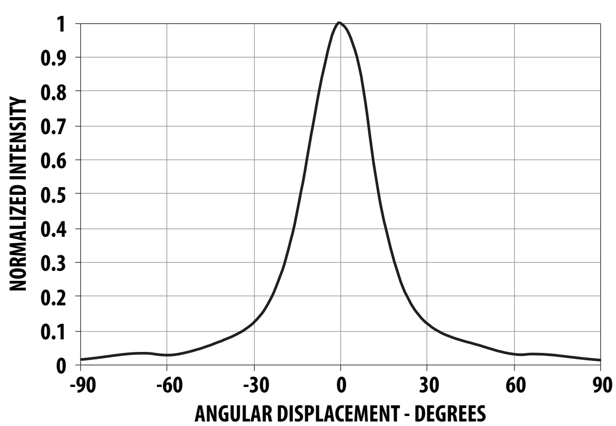


Figure 7: Radiation Pattern for Amber – Major Axis

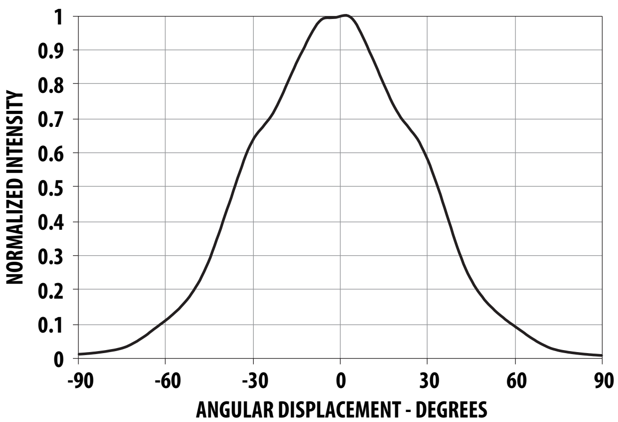


Figure 8: Radiation Pattern for Amber – Minor Axis

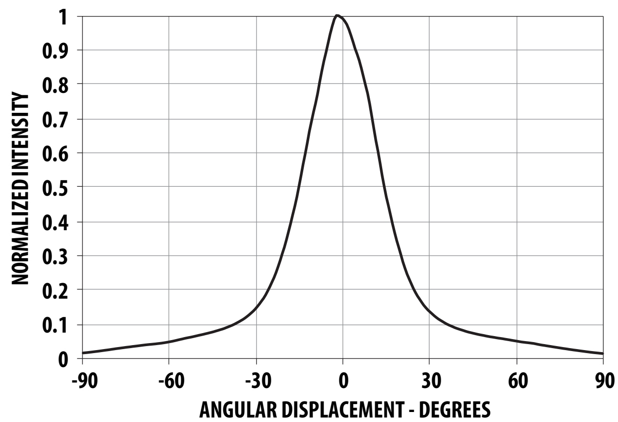


Figure 9: Relative Light Output vs. Junction Temperature

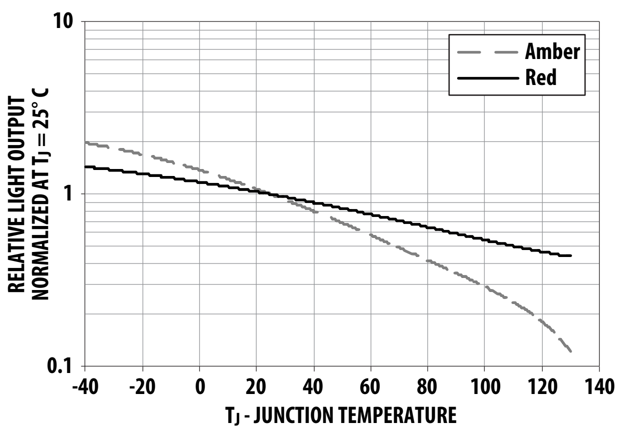
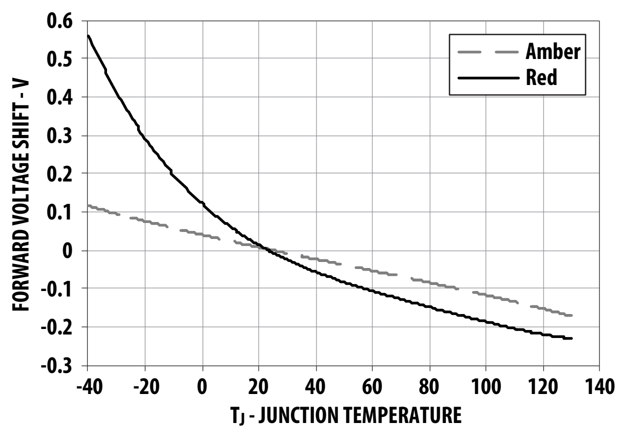


Figure 10: Forward Voltage Shift vs. Junction Temperature



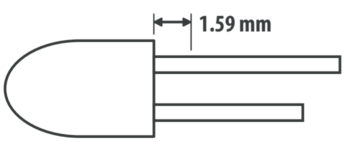
Precautions

Lead Forming

- Preform the leads of an LED lamp or cut them to length prior to insertion and soldering on the PC board.
- For better control, use a proper tool to precisely form and cut the leads to applicable lengths rather than cutting them 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 technique for hand solder operations, 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, perform hand soldering 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 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 that is ESD sensitive. Refer to Broadcom application note AN 1142 for details. The soldering iron should have a grounded tip to ensure that electrostatic charge is properly grounded.
- The recommended soldering conditions follow.

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

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

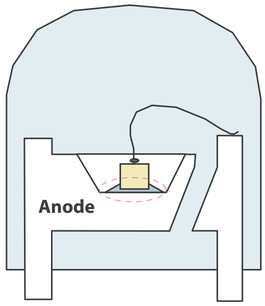
b. Use only bottom preheaters to reduce the thermal stress experienced by the LED.

- 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 sizes and designs (component density) have a different heat mass (heat capacity). This difference 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. The Broadcom® high-brightness LEDs use a high-efficiency LED die with a single wire bond as follows. 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. Overstressing the LED during the soldering process might cause a premature failure to the LED due to delamination.

LED Configuration



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

- Loosely fit any alignment fixture that is being applied during wave soldering, and ensure that it does not apply weight or force on the LED. Use nonmetal material because it absorbs less heat during the wave soldering process.

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

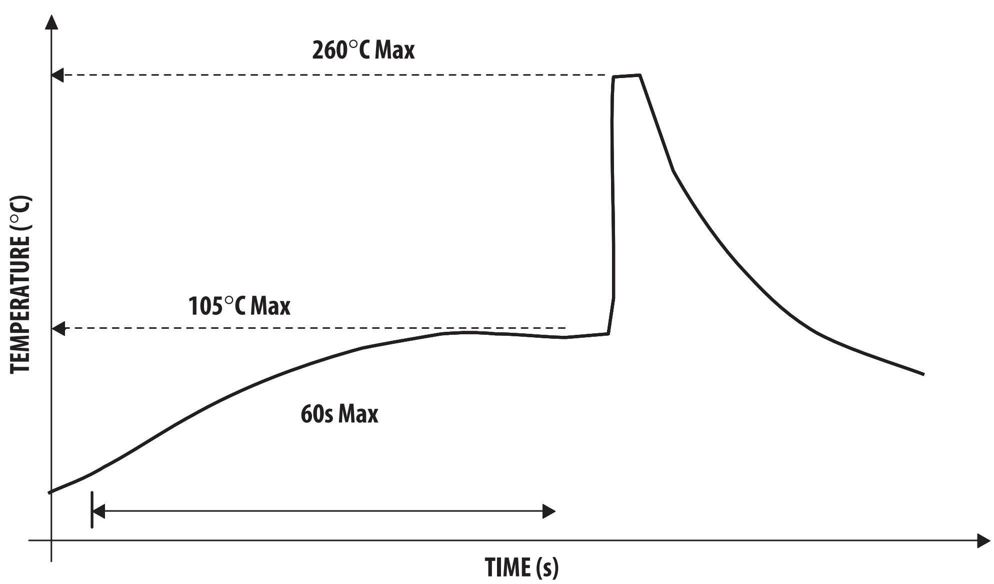
- At elevated temperatures, the LED is more susceptible to mechanical stress. Therefore, allow the PCB to cool down to room temperature prior to handling, which includes the removal of the alignment fixture or pallet.
- If the PC board contains both through-hole (TH) LEDs and other surface-mount components,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

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.)

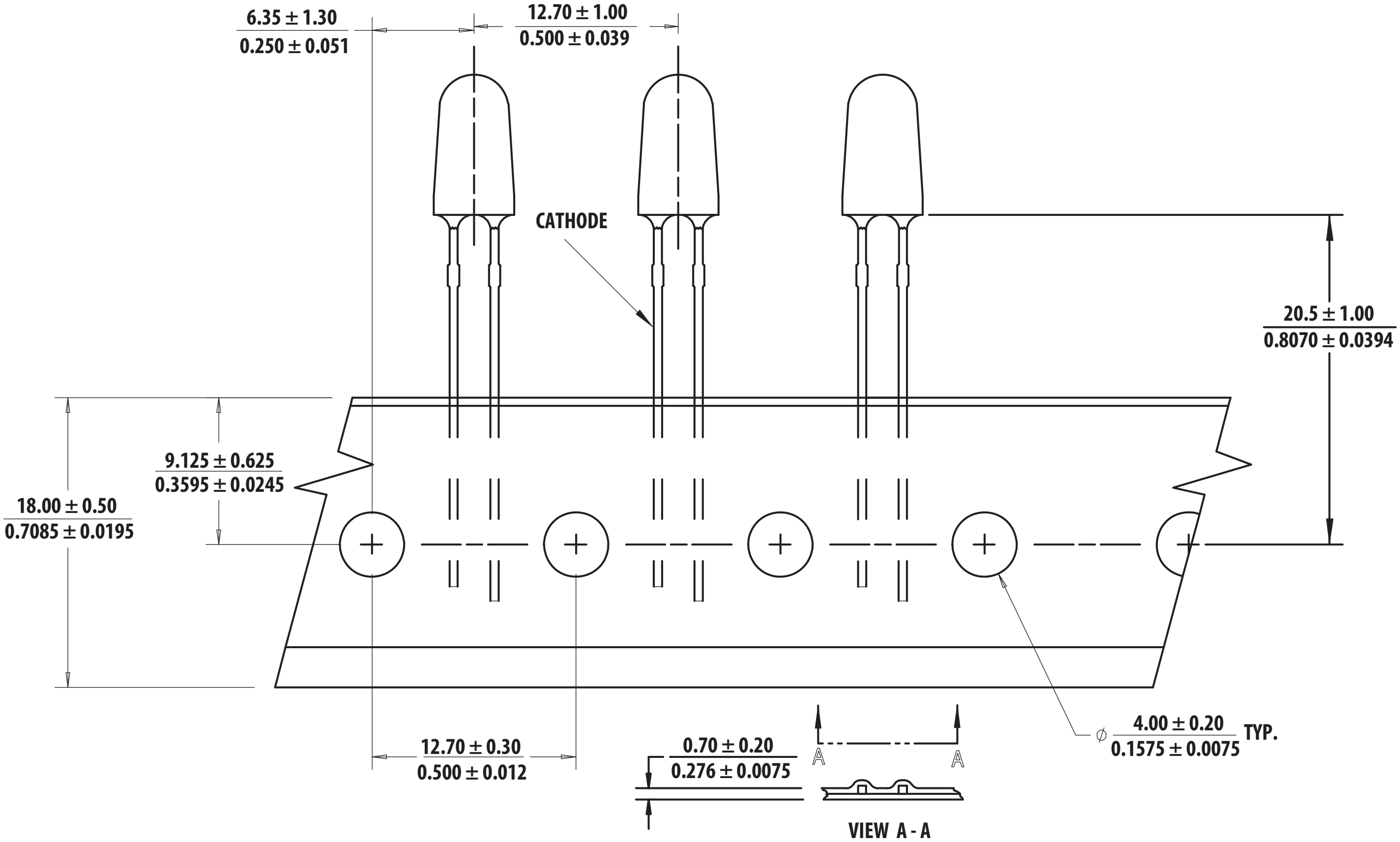
- Oversizing the PTH can lead to a twisted LED after clinching. On the other hand, undersizing the PTH can cause difficulty inserting the TH LED.

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

Example of Wave Soldering Temperature Profile for TH LED

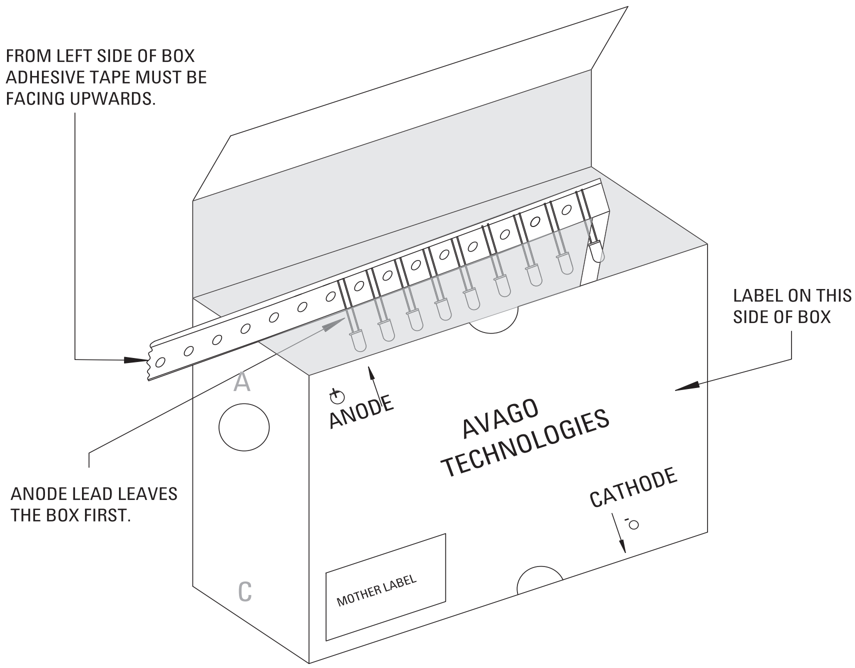


Ammo Packs Drawing



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

Packaging Box for Ammo Packs



NOTE: The ammo-pack dimensions are applicable for the device with a standoff and without a standoff.

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