BROADCOM®

Data Sheet

HLMP-CE17/CE18/CE20/CE21/CE32/CE33

T-1¾ (5-mm) Extra Bright Cyan LEDs

Description

The Broadcom® high-intensity Cyan LEDs are based on the most efficient and cost-effective InGaN material technology. The 505-nm typical dominant wavelength is most suitable for traffic signal applications. These LED lamps are untinted, nondiffused, T-1¾ packages that incorporate second-generation optics and produce well defined spatial radiation patterns at specific viewing cone angles.

These lamps are made with an advanced optical grade epoxy, offering superior temperature and moisture resistance in outdoor sign and signals applications.

Features

- Viewing angle: 15°, 23°, and 30°
- Well defined spatial radiation pattern
- High-brightness material
- Superior resistance to moisture
- Package options:
  - Standoff and non-standoff leads
- Untinted and nondiffused

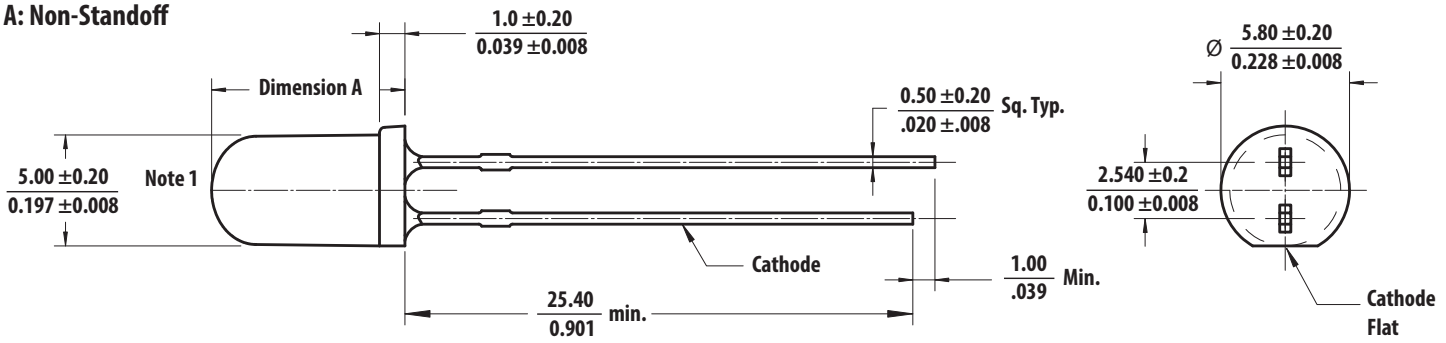
Applications

- Traffic signals

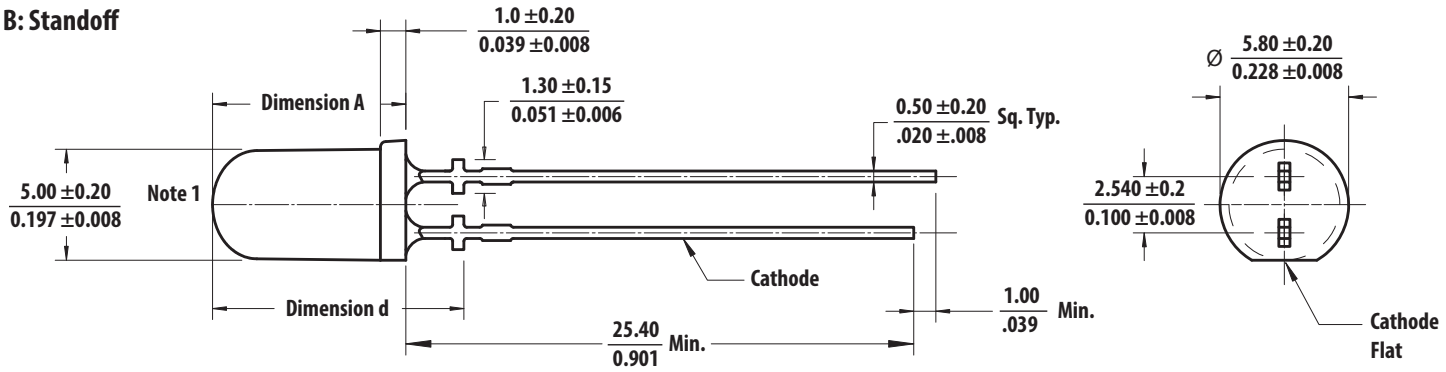
CAUTION! InGaN devices are Class 1C HBM ESD sensitive per the JEDEC standard. Observe appropriate precautions during handling and processing. Refer to Broadcom Application Note 1142 for additional details.

Package Dimensions

A: Non-Standoff



B: Standoff



Package	Dimension A	Dimension d
15°	8.70 mm ± 0.20 mm	12.40 mm ± 0.20 mm
23°	8.65 mm ± 0.20 mm	12.25 mm ± 0.20 mm
30°	8.65 mm ± 0.20 mm	12.05 mm ± 0.20 mm

NOTE:

1. Measured above the flange.
2. All dimensions are in millimeters (inches).

Device Selection Guide

Part Number	Luminous Intensity Iv (mcd) at 20 mA Min.	Luminous Intensity Iv (mcd) at 20 mA Max.	Standoff
HLMP-CE17-34BDD	27000	45000	No
HLMP-CE17-350DD	27000	59000	No
HLMP-CE17-35CDD	27000	59000	No
HLMP-CE20-Z20DD	12000	27000	No
HLMP-CE20-Z2CDD	12000	27000	No
HLMP-CE20-Z2QDD	12000	27000	No
HLMP-CE32-Y10DD	9300	21000	No
HLMP-CE32-Y1CDD	9300	21000	No
HLMP-CE32-Y1C00	9300	21000	No
HLMP-CE32-Y1QDD	9300	21000	No
HLMP-CE18-350DD	27000	59000	Yes
HLMP-CE18-35CDD	27000	59000	Yes
HLMP-CE18-35QDD	27000	59000	Yes
HLMP-CE21-Z20DD	12000	27000	Yes
HLMP-CE21-Z2CDD	12000	27000	Yes
HLMP-CE21-Z2QDD	12000	27000	Yes
HLMP-CE33-Y10DD	9300	21000	Yes
HLMP-CE33-Y1CDD	9300	21000	Yes
HLMP-CE33-Y1QDD	9300	21000	Yes

NOTE:

1. The luminous intensity is measured on the mechanical axis of the lamp package.
2. The tolerance for each intensity limit is ± 15%.
3. Refer to Broadcom Application Note 5352 for detailed information on the features of standoff and non-standoff LEDs.

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	C	5 mm InGaN round
x_2	Color	E	Cyan 505 nm
x_3 x_4	Viewing Angle and Lead Standoff	17	15° without lead standoff
		18	15° with lead standoff
		20	23° without lead standoff
		21	23° with lead standoff
		32	30° without lead standoff
		33	30° with lead standoff
x_5	Minimum Intensity Bin	See the Intensity Bin Limit Table (1.3: 1 Iv Bin Ratio).	
x_6	Maximum Intensity Bin		
x_7	Color Bin Option	0	Full distribution
		B	Color bins 2 and 3
		C	Color bins 3 and 4
		Q	Color bins 7 and 8
x_8 x_9	Packing Option	DD	Ammo pack
		00	Bulk packaging

Absolute Maximum Ratings (T_J = 25°C)

Parameter	Value	Units
DC Forward Current[a]	30	mA
Peak Forward Current	100[b]	mA
Power Dissipation	107	mW
Reverse Voltage	Not recommended for reverse bias	
Operating Temperature Range	–40 to +85	°C
Storage Temperature Range	–40 to +85	°C

a. Derate linearly as shown in Figure 5.

b. Duty factor 10%, frequency 1 kHz.

Electrical/Optical Characteristics (T_A = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Forward Voltage	V_F	2.8	3.0	3.5	V	I_F = 20 mA
Reverse Voltage[a]	V_R	5	—	—	V	I_R = 10 µA
Dominant Wavelength[b]	λ_d	—	505	—	nm	I_F = 20 mA
Peak Wavelength	λ_{PEAK}	—	501	—	nm	Peak of wavelength of spectral distribution at I_F = 20 mA
Spectral Halfwidth	$\Delta\lambda_{1/2}$	—	25	—	—	Wavelength width at spectral distribution ½ power point at I_F = 20 mA
Thermal Resistance	$R\theta_{J\text{-}PIN}$	—	240	—	°C/W	LED junction-to-cathode lead
Luminous Efficacy[c]	η_V	—	283	—	lm/W	Emitted luminous power/emitted radiant power

a. Indicates the 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. Tolerance for each color of dominant wavelength is ± 0.5 nm.

c. The radiant intensity, I_e, in watts per steradian can be found from the equation $I_e = I_V/\eta_V$ where I_V is the luminous intensity in candelas and η_V is the luminous efficacy in lumens/watt.

Figure 1: Relative Intensity vs. Wavelength

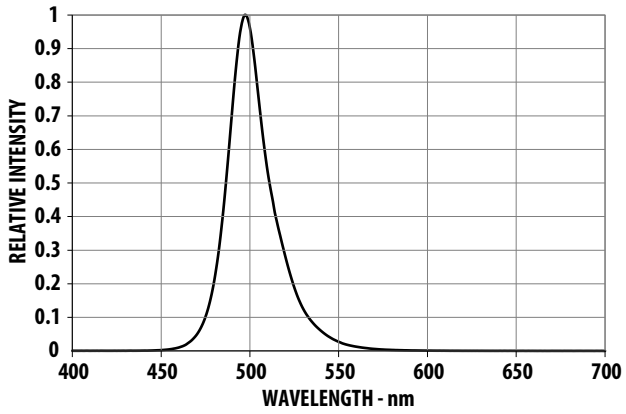


Figure 2: Forward Current vs. Forward Voltage

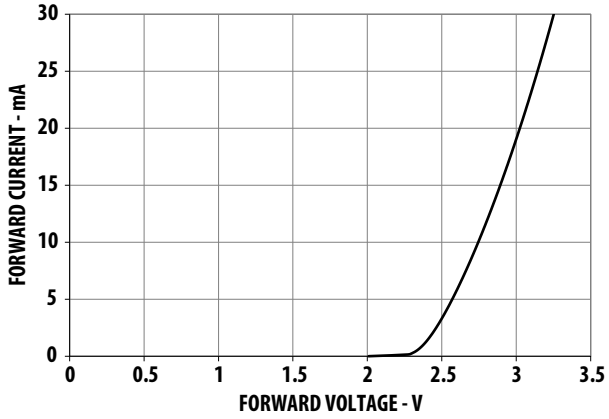


Figure 3: Relative Intensity vs. Forward Current

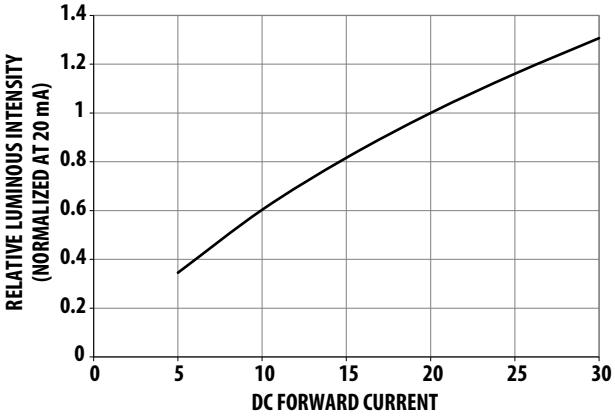


Figure 4: Relative Dominant Wavelength vs. Forward Current

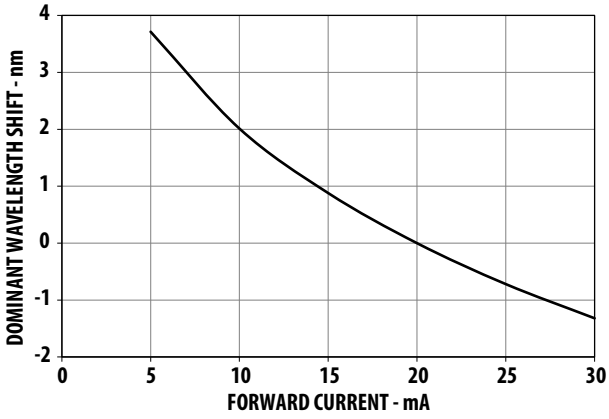


Figure 5: Maximum Forward Current vs. Ambient Temperature

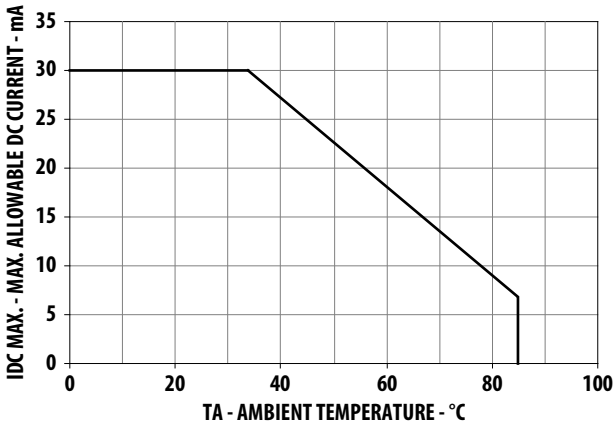


Figure 6: Representative Spatial Radiation Pattern – 15° Lamps

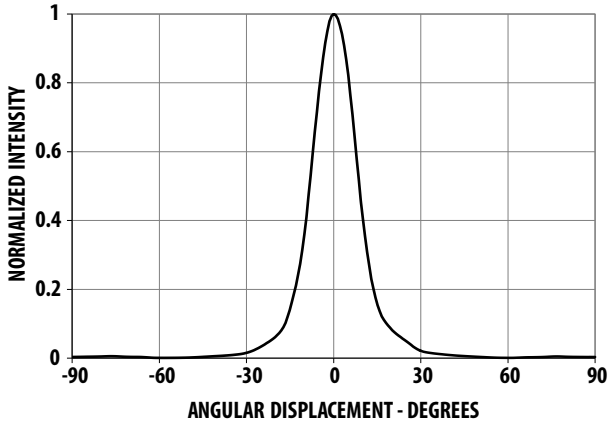


Figure 7: Representative Spatial Radiation Pattern – 23° Lamps

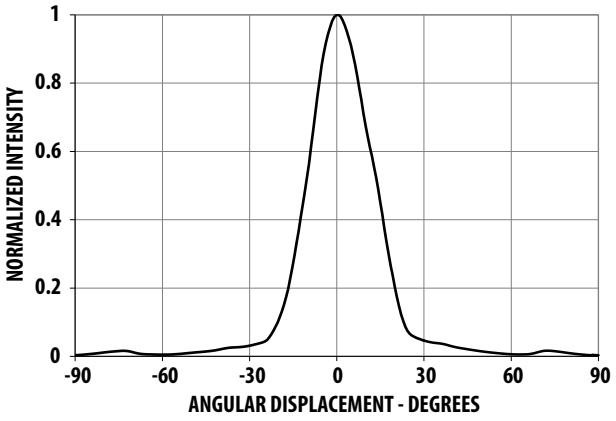


Figure 8: Representative Spatial Radiation Pattern – 30° Lamps

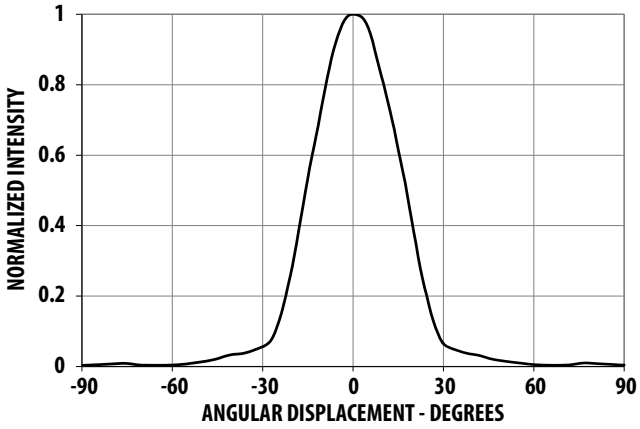


Figure 9: Relative Light Output vs. Junction Temperature

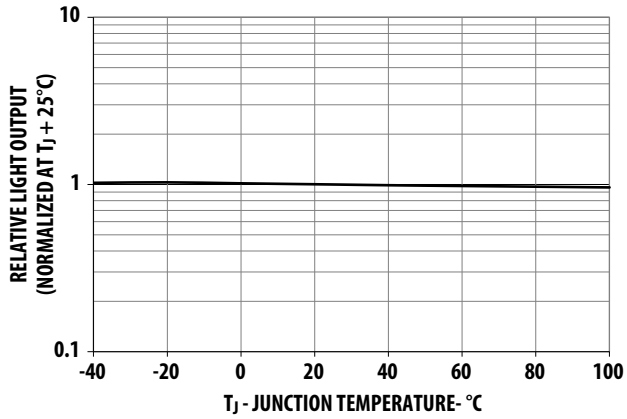
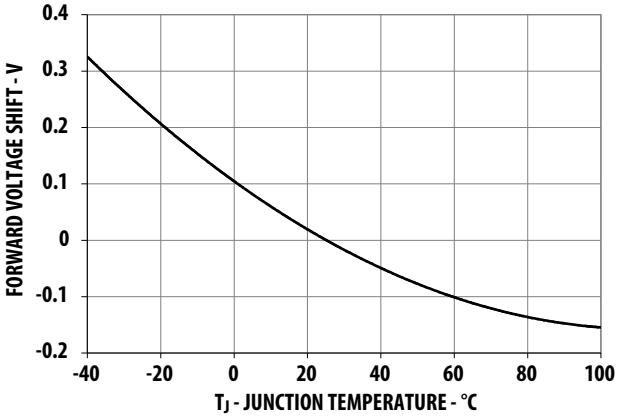


Figure 10: Forward Voltage Shift vs. Junction Temperature



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

Bin	Intensity (mcd) at 20 mA	
	Min.	Max.
Y	9300	12000
Z	12000	16000
1	16000	21000
2	21000	27000
3	27000	35000
4	35000	45000
5	45000	59000

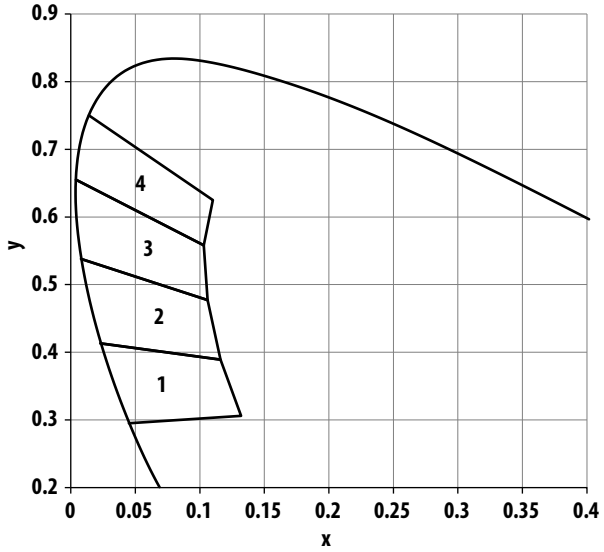
Tolerance for each bin limit is ± 15%.

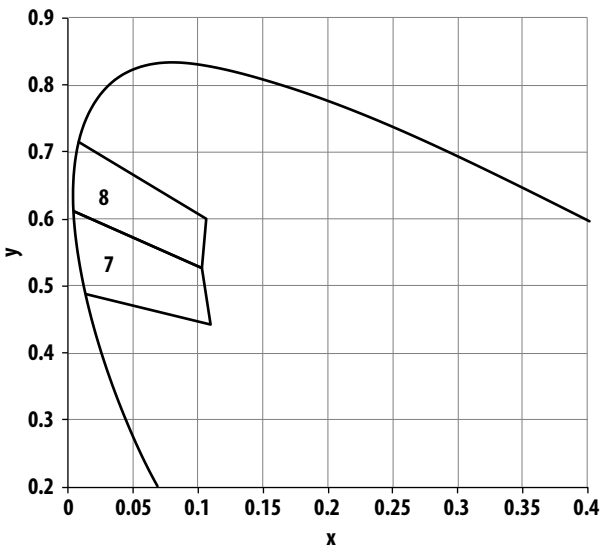
Cyan Color Bin Range

Bin	Min. Dom	Max. Dom	Chromaticity Coordinates				
1	490	495	x	0.045	0.132	0.116	0.023
			y	0.295	0.306	0.389	0.413
2	495	500	x	0.023	0.116	0.106	0.008
			y	0.413	0.389	0.477	0.538
3	500	505	x	0.008	0.106	0.103	0.004
			y	0.538	0.477	0.558	0.655
4	505	510	x	0.004	0.103	0.11	0.014
			y	0.655	0.558	0.625	0.75
7	498	503	x	0.013	0.109	0.103	0.004
			y	0.488	0.442	0.527	0.61
8	503	508	x	0.004	0.103	0.106	0.008
			y	0.61	0.527	0.601	0.715

Tolerance for each bin limit is ± 0.5 nm.

Broadcom Cyan Color Bin on CIE Chromaticity Diagram





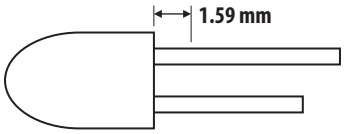
Precautions

Lead Forming

- The leads of an LED lamp can be preformed or cut to length before 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 process for hand-soldering operation, because the excess lead length also acts as a 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 can be effectively hand-soldered to the PCB; however, do so 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, which is ESD sensitive. Refer to Broadcom Application Note 1142 for details. Use a soldering iron with a grounded tip to ensure that electrostatic charge is properly grounded.
- Recommended soldering condition:

Condition	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 preceding conditions refer to measurements with the thermocouple mounted at the bottom of the PCB.

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

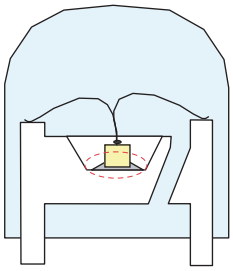
- Set and maintain wave soldering parameters according to the recommended temperature and dwell time. Perform daily checks on the soldering profile to ensure that it always conforms to recommended soldering conditions.

NOTE:

1. PCBs with a different size and design (component density) will have a different heat mass (heat capacity). This might cause a change in the temperature experienced by the board if the same wave soldering setting is used. So recalibrate 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 260°C and that the solder contact time does not exceed 5 seconds. Overstressing the LED during the soldering process might cause premature failure of the LED due to delamination.

Broadcom LED Configuration

Figure 11: LED Configuration



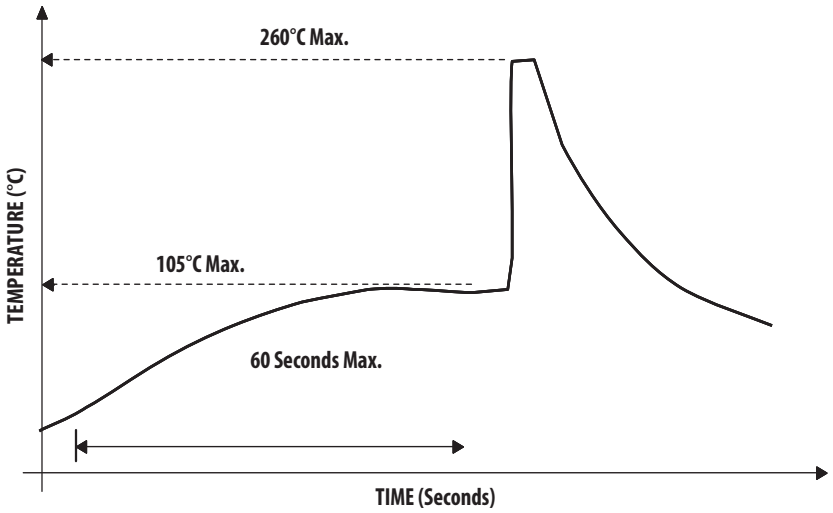
- Any alignment fixture that is being applied during wave soldering should be loosely fitted and should not apply weight or force on the LED. Use a nonmetal material because it will absorb less heat during the wave soldering process.
- At elevated temperatures, the LED is more susceptible to mechanical 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 must be on the bottom side, solder these components using reflow soldering before inserting the TH LED.
- The following table shows the recommended PC board plated through-hole (PTH) size for the 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.h)

- 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 Broadcom Application Note 5334 for more information about soldering and handling of high-brightness TH LED lamps.

Figure 12: Example of Wave Soldering Temperature Profile for TH LED



Recommended solder:
Sn63 (leaded solder alloy)
SAC305 (lead-free solder alloy)

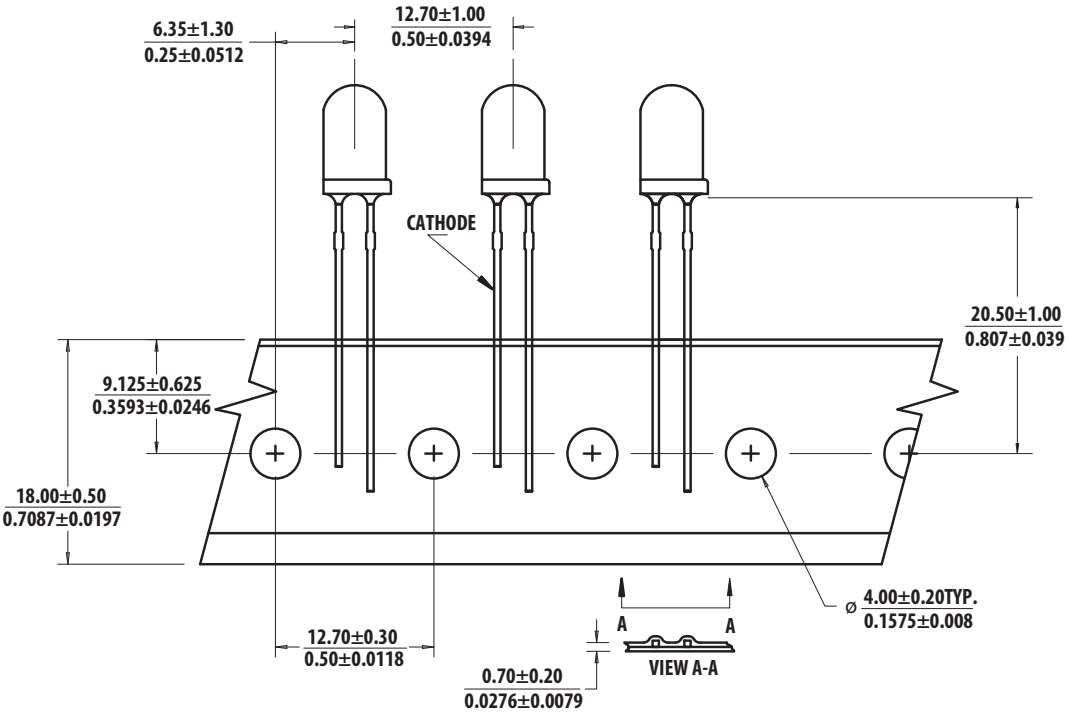
Flux: Rosin flux

Solder bath temperature: 255°C ± 5°C
(maximum peak temperature = 260°C)

Dwell time: 3 sec. - 5 sec.
(maximum = 5 sec.)

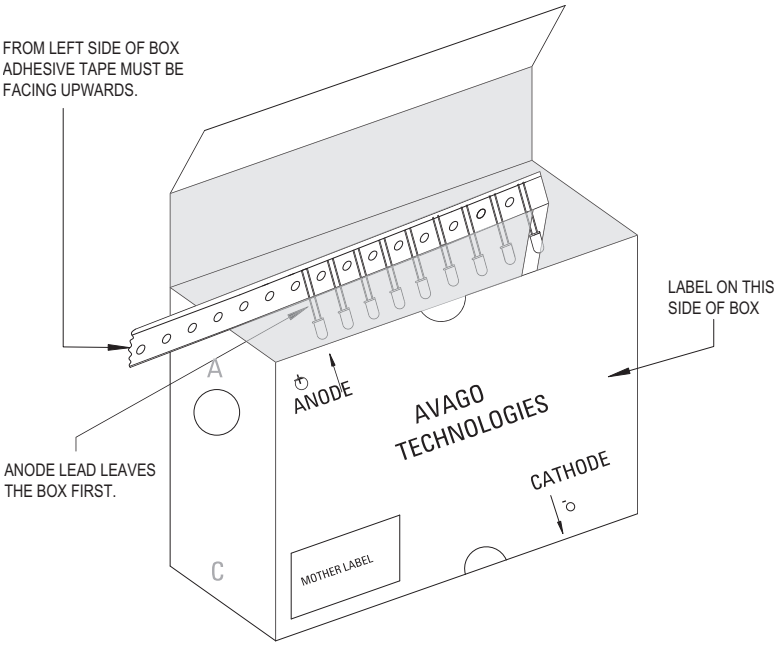
Note: Allow the board to sufficiently cool to room temperature before exerting mechanical force.

Ammo Packs Drawing



NOTE: All dimensions are in millimeters (inches).

Packaging Box for Ammo Packs



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

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