Data Sheet

HLMP-LG71, HLMP-LM71, HLMP-LB71

Red, Green, and Blue 4-mm Standard Oval LEDs

Description

These Broadcom® 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.

CAUTION! InGaN devices are Class 1C HBM ESD sensitive per the JEDEC Standard. Please observe appropriate precautions during handling and processing. Refer to Application Note AN-1142 for additional details.

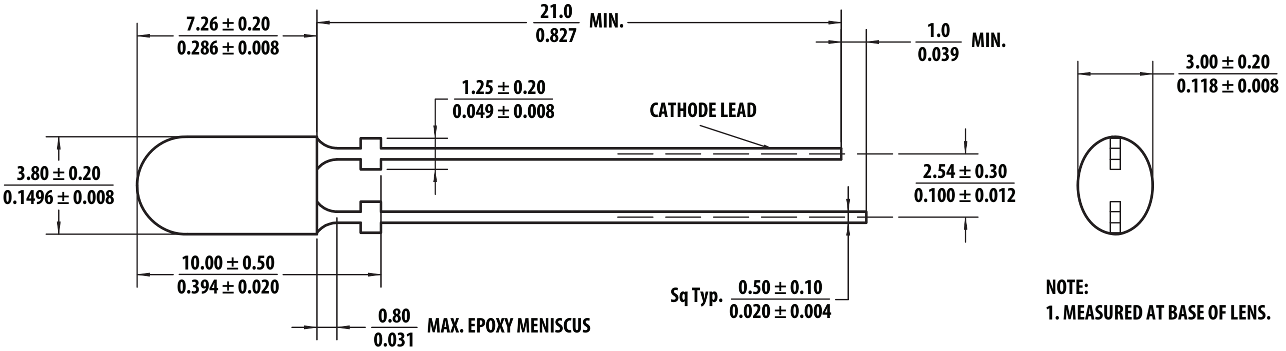
Features

- Well-defined spatial radiation pattern
- High brightness material
- Available in red, green, and blue colors
  - Red AlInGaP 626 nm
  - Green InGaN 525 nm
  - Blue InGaN 470 nm
- Superior resistance to moisture
- Standoff package
- Tinted and diffused
- Typical viewing angle 40° × 100°

Applications

- Billboard signs
- Full color signs

Figure 1: Package Dimensions



NOTE:

- All dimensions in millimeters (inches).
- 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-Min[b, c, d]	Luminous Intensity I_V (mcd) at 20 mA-Max[b, c, d]
HLMP-LG71-VY0DD	Red 626	1150	2400
HLMP-LG71-WX000	Red 626	1380	1990
HLMP-LG71-XZ0DD	Red 626	1660	2900
HLMP-LM71-Z3000	Green 525	2400	5040
HLMP-LM71-Z30DD	Green 525	2400	5040
HLMP-LM71-Z3C00	Green 525	2400	5040
HLMP-LM71-Z3CDD	Green 525	2400	5040
HLMP-LB71-TUBDD	Blue 470	800	1150
HLMP-LB71-TUCDD	Blue 470	800	1150

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

b. The luminous intensity 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. Tolerance for each bin limit is ± 15%.

NOTE: Refer to AB 5337 for complete information about the part numbering system.

Absolute Maximum Rating, T_A = 25°C

Parameter	Red	Green/Blue	Units
DC Forward Current [a]	50	30	mA
Peak Forward Current	100[b]	100[c]	mA
Power Dissipation	120	110	mW
LED Junction Temperature	130	110	°C
Operating Temperature Range	–40 to +100	–40 to +85	°C
Storage Temperature Range	–40 to +100		°C

a. Derate linearly as shown in Figure 5 and Figure 9.

b. Duty Factor 30%, frequency 1 kHz.

c. 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				V	I_F = 20 mA
Red		1.8	2.1	2.4		
Green		2.8	3.1	3.6		
Blue		2.8	3.1	3.6		
Reverse Voltage[a]	V_R				V	
Red		5				I_R = 100 µA
Green and Blue		5				I_R = 10 µA
Dominant Wavelength[b]					nm	I_F = 20 mA
Red		618	626	630		
Green		520	525	540		
Blue		460	470	480		
Peak Wavelength	λ_{PEAK}				nm	Peak of Wavelength of Spectral Distribution at I_F = 20 mA
Red			634			
Green			517			
Blue			461			
Thermal Resistance	$R\theta_{J-PIN}$		240		°C/W	LED Junction-to-Pin
Luminous Efficacy[c]	η_v				lm/W	Emitted Luminous Power/Emitted Radiant Power
Red			190			
Green			475			
Blue			68			
Luminous Efficiency[d]	η_e				lm/W	Luminous Flux/Electrical Power
Red			50			
Green			60			
Blue			13			

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, 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 the luminous efficacy in lumens/watt.

d. $\eta_e = \varphi_V / I_F \times V_F$, 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	L	4-mm Standard Oval 40° × 100°
x_2	Color	B G M	Blue Red Green
x_3 x_4	Lead Standoffs	71	With lead standoffs
x_5	Minimum intensity bin		See the Device Selection Guide
x_6	Maximum intensity bin		See the Device Selection Guide
x_7	Color bin selection	0 B C	Full range Color bins 2 and 3 Color bins 3 and 4
x_8x_9	Packaging option	DD	Ammopack

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

Bin	Intensity (mcd) at 20 mA	
	Min.	Max.
T	800	960
U	960	1150
V	1150	1380
W	1380	1660
X	1660	1990
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

NOTE:

1. Tolerance for each bin limit is ± 0.05 V.
2. V_F binning only applicable to Red color.

Red Color Range

Min. Dom	Max. Dom	Chromaticity Coordinate				
618.0	630.0	x	0.6872	0.3126	0.6890	0.2943
		y	0.6690	0.3149	0.7080	0.2920

Tolerance for each bin limit is ± 0.5 nm.

Green Color Bin Table

Bin	Min. Dom	Max. Dom	Xmin	Ymin	Xmax	Ymax
1	520.0	524.0	0.0743	0.8338	0.1856	0.6556
			0.1650	0.6586	0.1060	0.8292
2	524.0	528.0	0.1060	0.8292	0.2068	0.6463
			0.1856	0.6556	0.1387	0.8148
3	528.0	532.0	0.1387	0.8148	0.2273	0.6344
			0.2068	0.6463	0.1702	0.7965
4	532.0	536.0	0.1702	0.7965	0.2469	0.6213
			0.2273	0.6344	0.2003	0.7764
5	536.0	540.0	0.2003	0.7764	0.2659	0.6070
			0.2469	0.6213	0.2296	0.7543

Tolerance for each bin limit is ± 0.5 nm.

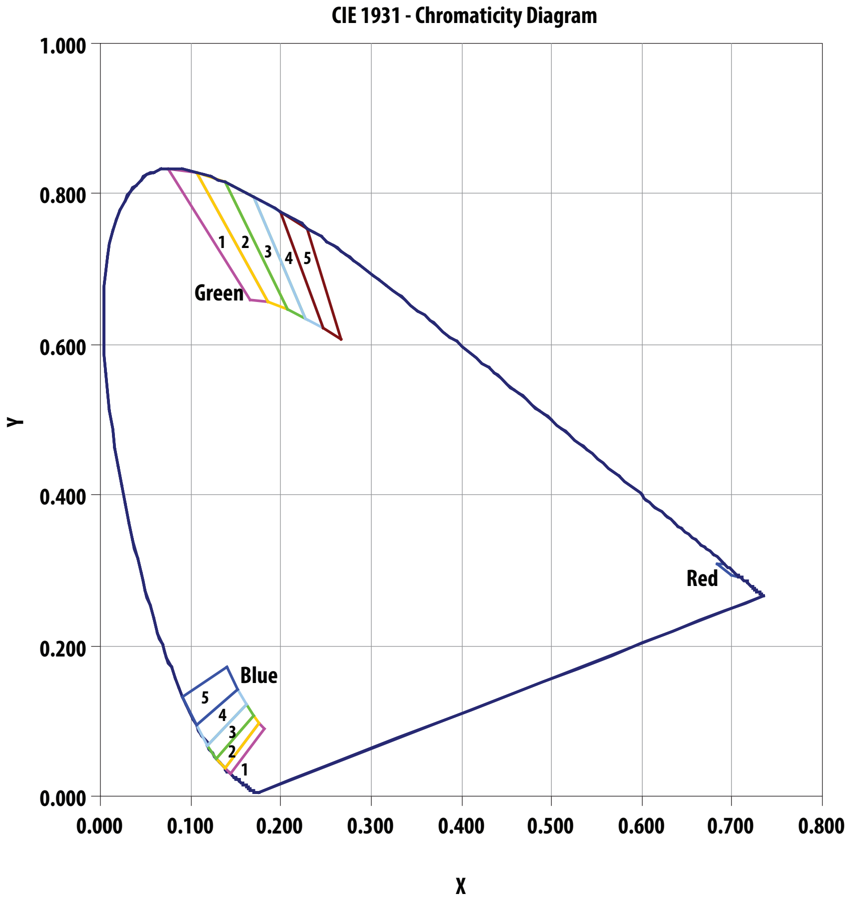
Blue Color Bin Table

Bin	Min. Dom	Max. Dom	Xmin	Ymin	Xmax	Ymax
1	460.0	464.0	0.1440	0.0297	0.1766	0.0966
			0.1818	0.0904	0.1374	0.0374
2	464.0	468.0	0.1374	0.0374	0.1699	0.1062
			0.1766	0.0966	0.1291	0.0495
3	468.0	472.0	0.1291	0.0495	0.1616	0.1209
			0.1699	0.1062	0.1187	0.0671
4	472.0	476.0	0.1187	0.0671	0.1517	0.1423
			0.1616	0.1209	0.1063	0.0945
5	476.0	480.0	0.1063	0.0945	0.1397	0.1728
			0.1517	0.1423	0.0913	0.1327

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



AlInGaP Red

Figure 2: Relative Intensity vs. Wavelength

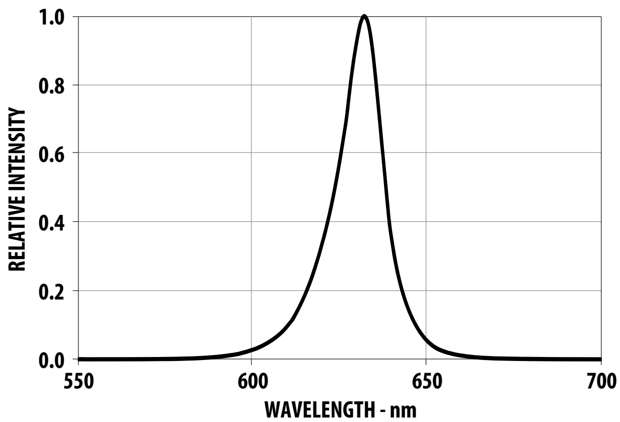


Figure 3: Forward Current vs. Forward Voltage

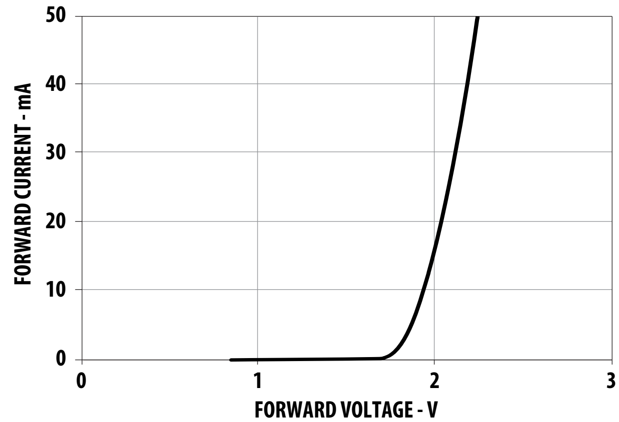


Figure 4: Relative Intensity vs. Forward Current

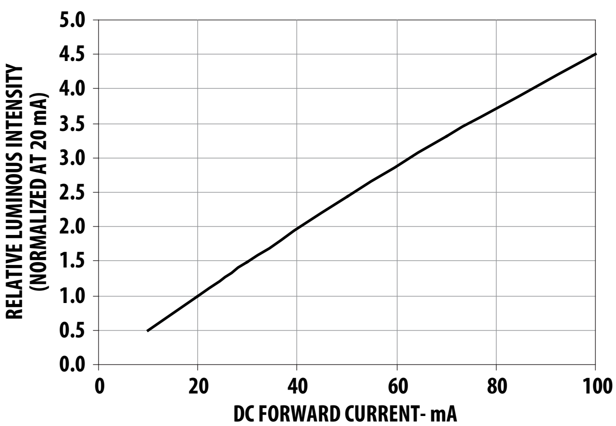


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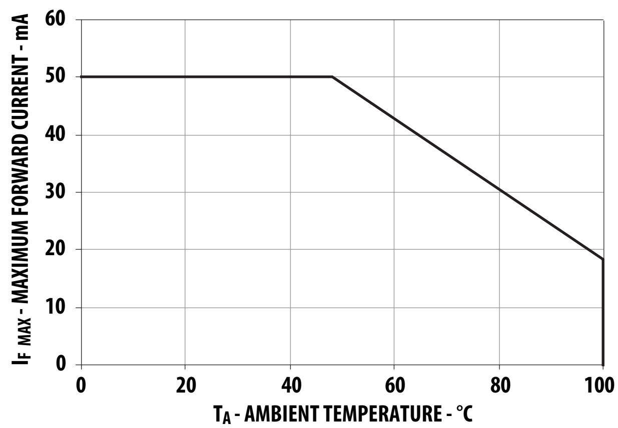
Figure 5: Maximum Forward Current vs. Ambient Temperature



InGaN Green and Blue

Figure 6: Relative Intensity vs. Wavelength

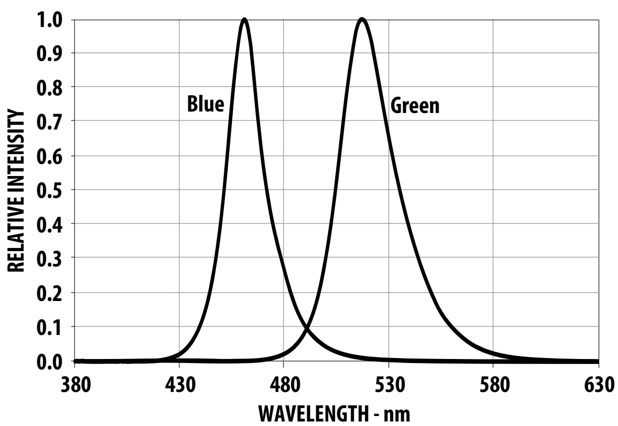


Figure 7: Forward Current vs. Forward Voltage

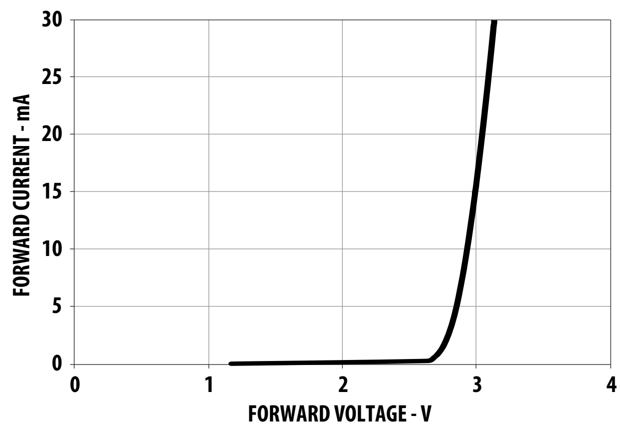


Figure 8: Relative Intensity vs. Forward Current

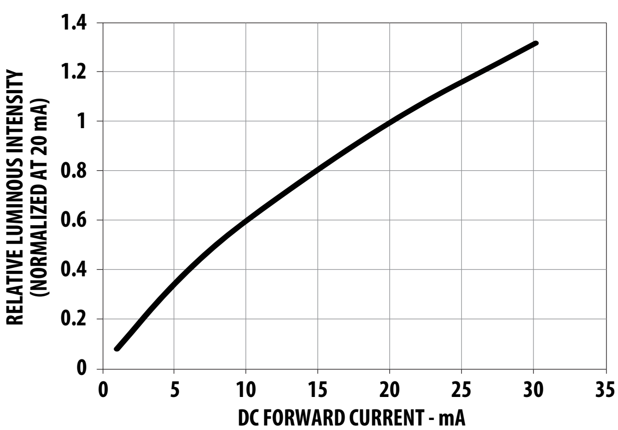


Figure 9: Maximum Forward Current vs. Ambient Temperature

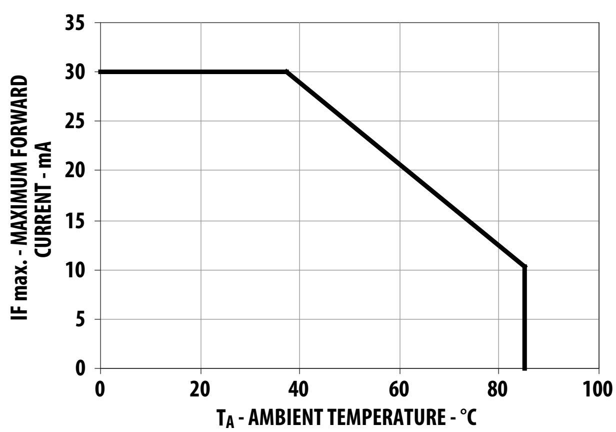


Figure 10: Relative Dominant Wavelength vs. Forward Current

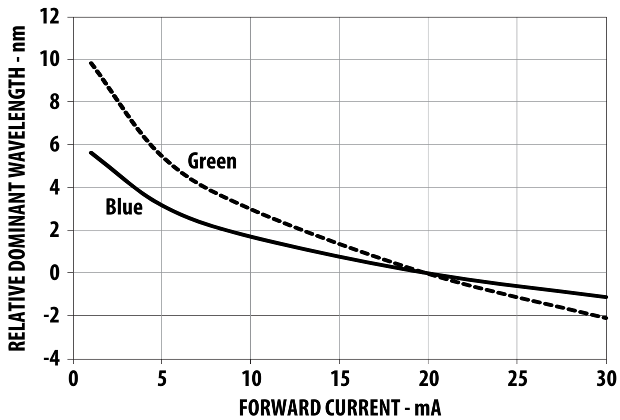


Figure 11: Radiation Pattern – Major Axis

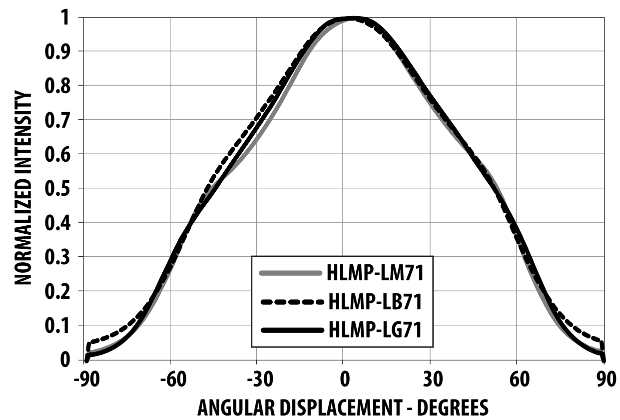


Figure 12: Radiation Pattern – Minor Axis

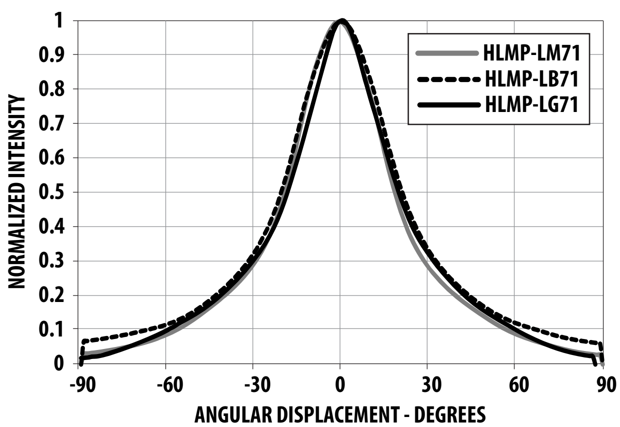


Figure 13: Relative Light Output vs. Junction Temperature

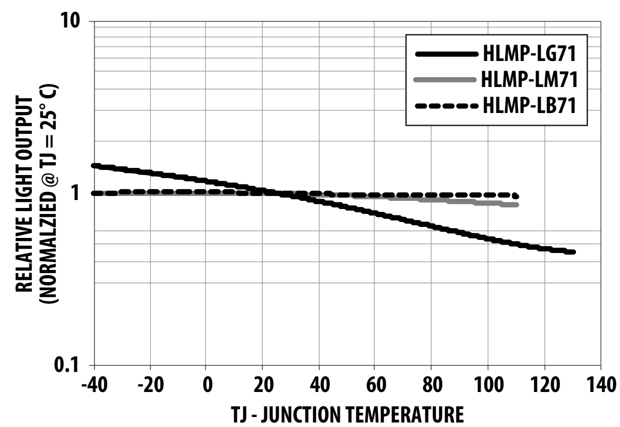
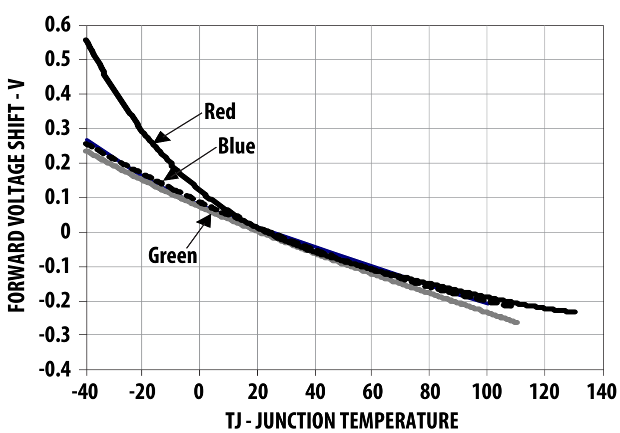


Figure 14: Forward Voltage Shift vs. Junction Temperature



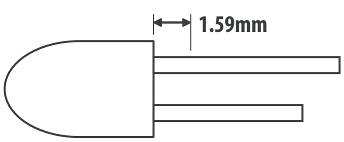
Precautions

Lead Forming

- Preform or cut to length the leads of the LED lamp prior to insertion and soldering on the PC board.
- For better control, use the proper tool to precisely form and cut the leads to an 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. Cutting the leads after hand soldering is recommended 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 PCB. However, do it 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 soldering iron tip closer than 1.59 mm might damage the LED.



- Apply ESD precautions properly 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.
- 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. The above conditions refer to measurements with a thermocouple mounted at the bottom of PCB.

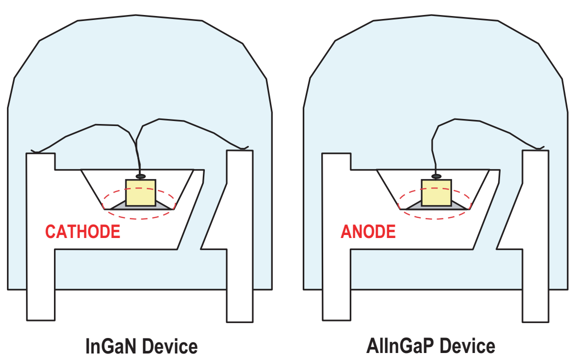
b. Use only bottom preheaters to reduce thermal stress experienced by the LED.

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

NOTE:

1. PCBs with different size and design (component density) 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, recalibrate the soldering profile again before loading a new type of PCB.
2. Broadcom's AllnGaP high brightness LEDs use high-efficiency LED dies with a single wire bond as shown in Figure 15. 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 5s. Over-stressing the LED during the soldering process might cause premature failure to the LED due to delamination.

Figure 15: Broadcom's LED Configuration



- Any alignment fixture that is applied during wave soldering should be loosely fitted and should not apply weight or force on LED. Non-metallic material is recommended as it absorbs less heat during the wave soldering process.
- At elevated temperatures, the LED is more susceptible to mechanical stress. Therefore, the PCB must be cooled down to room temperature prior to handling, which includes the removal of the alignment fixture or pallet.
- If the PCB 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 must be on the bottom side, solder these components using reflow soldering prior to inserting 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
0.45 x 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 x 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.)

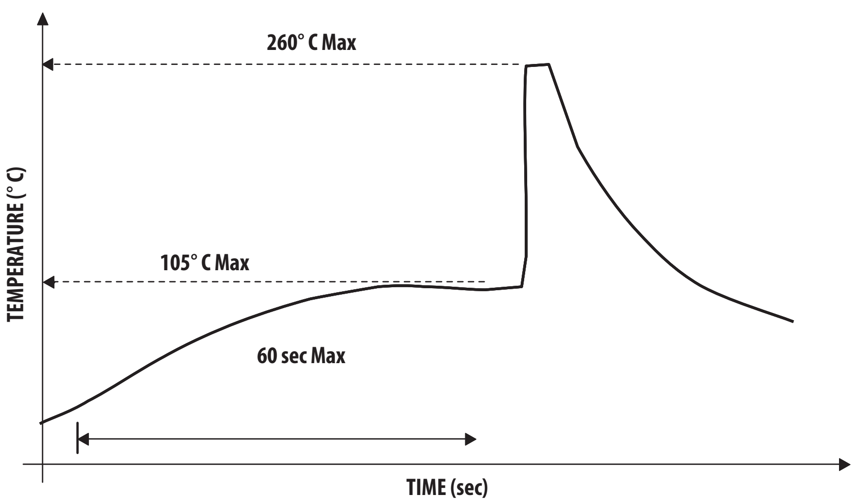
- Over-sizing the PTH can lead to a twisted LED after clinching. In addition, undersizing the PTH can make it difficult to insert the TH LED.

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

Application Precautions

- The drive current of the LED must not exceed the maximum allowable limit across temperature as stated in the data sheet. Constant current driving is recommended to ensure consistent performance.
- LEDs exhibit slightly different characteristics at different drive currents that might result in larger performance variations (this is, intensity, wavelength, and forward voltage). Set the application current as close as possible to the test current to minimize these variations.
- The LED is not intended for reverse bias. Use other appropriate components for such purposes. When driving the LED in matrix form, ensure that the reverse bias voltage does not exceed the allowable limit of the LED.

Figure 16: 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: 3.0 sec - 5.0 sec
(maximum = 5 sec)

Note: Allow for board to be sufficiently cooled to room temperature before exerting mechanical force.

Figure 17: Ammo Packs Drawing

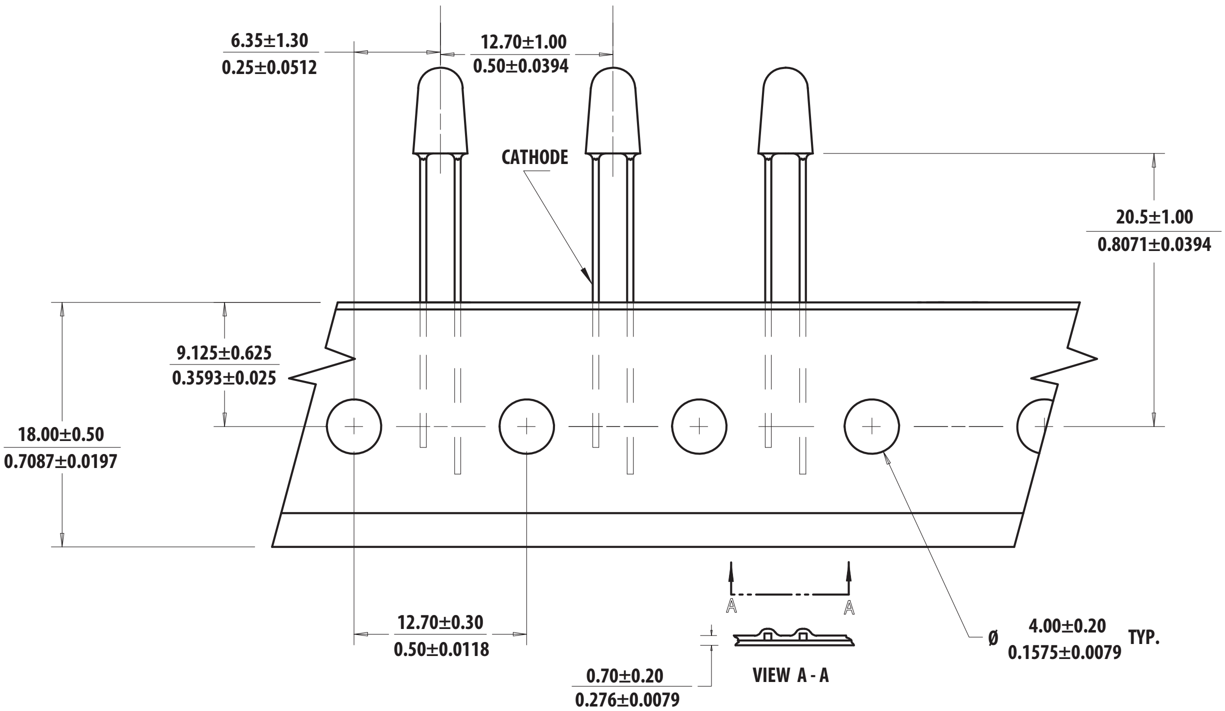
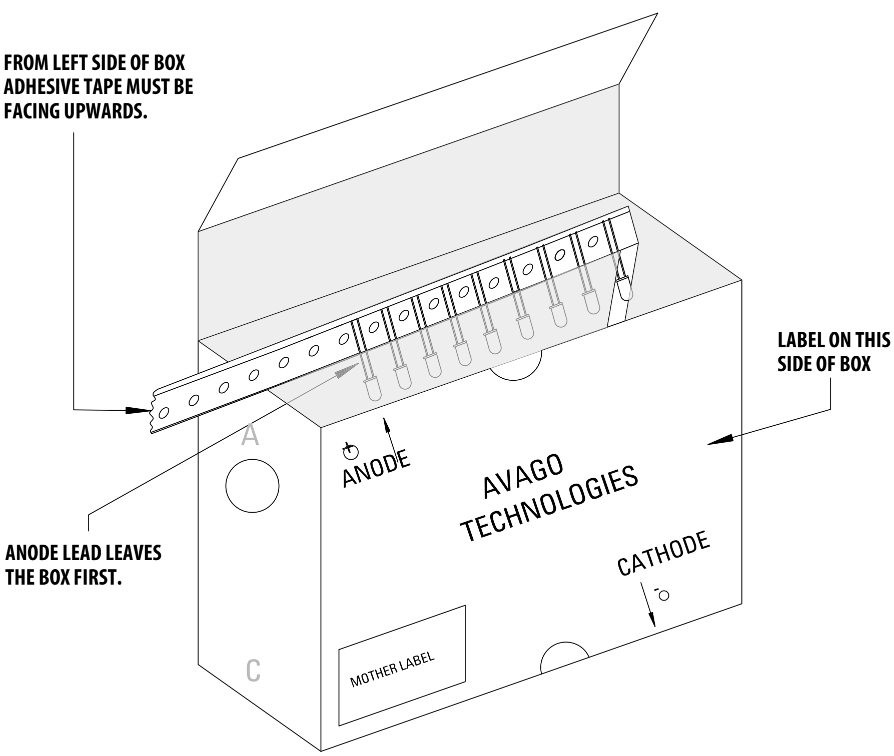


Figure 18: Packaging Box for Ammo Packs

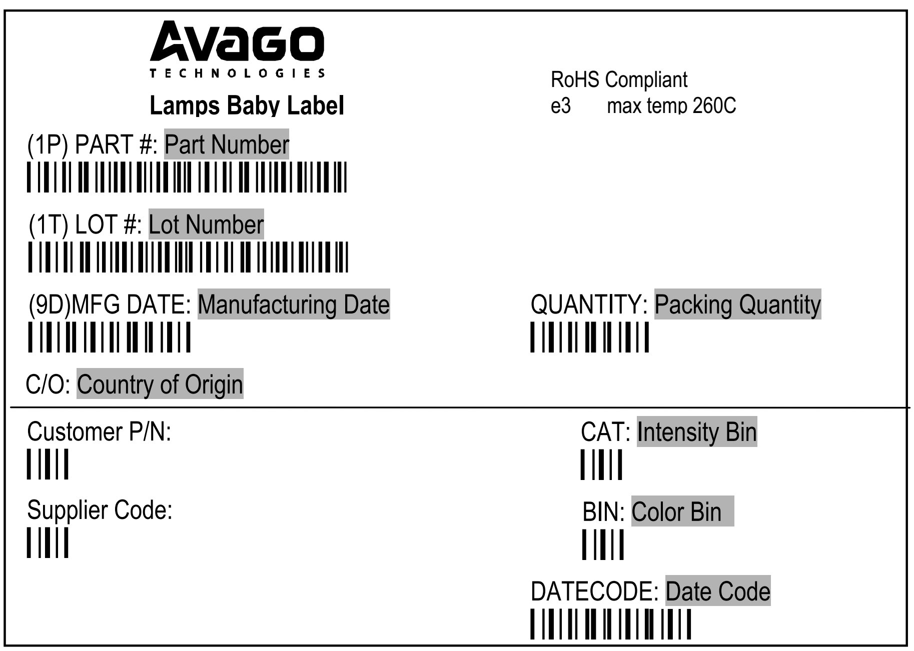


NOTE: For InGaN device, the ammo pack packaging box contains the ESD logo.

Packaging Label

Figure 19: Avago Mother Label (available on packaging box of ammo pack and shipping box)

Figure 20: Avago 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: 2VB

2 →	Color bin 2 only
VB →	VF bin “VB”

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