## ALMD-CM1F/2F, ALMD-CB1E/2E



High-Brightness SMT Round Green and Blue LED Lamps

### **Data Sheet**

### **Description**

The Broadcom ALMD-Cx1x/Cx2x series is like a conventional high brightness through-hole LED in the form of surface mount device. It can be assembled using common SMT assembly processes and is compatible with industrial reflow soldering processes.

The LEDs are made with an advanced optical grade epoxy for superior performance in outdoor sign applications. For easy pick-and-place assembly, the LEDs are shipped in tape and reel. Every reel is shipped from a single intensity and color bin for better uniformity.

#### **Features**

- Using high brightness InGaN
- Available green and blue
  - Green InGaN 525 nm
  - Blue InGaN 470 nm
- Typical viewing angle: 15° and 23°
- JEDEC MSL 2A
- Compatible with a reflow soldering process
- Tinted

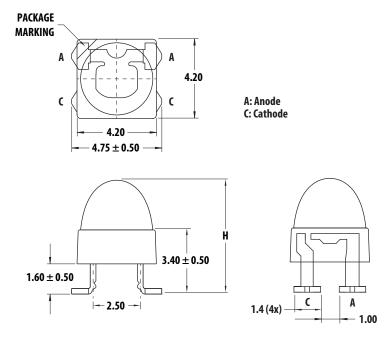
### **Applications**

Variable message signs

**CAUTION:** The LEDs are ESD sensitive per ANSI/ESDA/JEDEC JS-001. Please observe appropriate precautions during handling and processing. Refer to Application Note AN-1142 for additional details.

**CAUTION:** Customers should always keep the LED in the moisture barrier bag (MBB) with < 5% RH when not in use because prolonged exposure to the environment might cause the silver-plated leads to tarnish or rust, which might cause difficulties in soldering.

**Figure 1 Package Dimensions** 



Part Number	Dimension H
ALMD-Cx1x	$6.80 \pm 0.50$
ALMD-Cx2x	6.50± 0.50

### NOTE

- 1. All dimensions are in millimeters (mm).
- 2. Tolerance is ±0.20 mm unless otherwise specified.
- 3. Midsteel lead frame.

## **Device Selection Guide**

Part Number	Color	Dominant Wavelength, $\lambda_{f d}$ (nm) $^{f a}$	Luminous Inten	Viewing Angle, 2θ <sub>1/2</sub> (°) <sup>e</sup>		
		Тур.	Min.	Max.	Тур.	
ALMD-CM1F-34002	Green	525	27000	45000	15	
ALMD-CM1F-34B02						
ALMD-CM1F-34C02						
ALMD-CB1E-VW002	Blue	470	4200	7200		
ALMD-CB1E-VWB02						
ALMD-CB1E-VWC02						
ALMD-CM2F-12002	Green	525	16000	27000	23	
ALMD-CM2F-12B02						
ALMD-CM2F-12C02						
ALMD-CB2E-UV002	Blue	470	3200	5500		
ALMD-CB2E-UVB02						
ALMD-CB2E-UVC02	1					

- a. Dominant wavelength,  $\lambda_d$ , 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  $\pm$  15%.
- e.  $\theta_{1/2}$  is the off-axis angle where the luminous intensity is half of the peak intensity.

## Absolute Maximum Rating, $T_J = 25$ °C

Parameter	Green	Blue	Unit		
DC Forward Current <sup>a</sup>	30	20	mA		
Peak Forward Current <sup>b</sup>	100	100	mA		
Power Dissipation	114	76	mW		
Reverse Voltage	Not recommended for reverse bias				
LED Junction Temperature	110	105	°C		
Operating Temperature Range	-40 to +85		°C		
Storage Temperature Range	-40 to	°C			

- a. Derate linearly as shown in Figure 5.
- b. Duty factor = 10%, frequency = 1 kHz.

# Electrical/Optical Characteristics, $T_J = 25^{\circ}C$

Parameter	Symbol	Min.	Тур.	Max.	Units	Test Conditions
Forward Voltage	V <sub>F</sub>				V	I <sub>F</sub> = 20 mA
Green		2.5	2.8	3.8		
Blue		2.8	3.2	3.8		
Reverse Voltage <sup>a</sup>	V <sub>R</sub>				V	$I_R = 10 \mu A$
Green		5	_	_		
Blue		5	_	_		
Dominant Wavelength <sup>b</sup>	$\lambda_{d}$				nm	I <sub>F</sub> = 20 mA
Green		519.0	525.0	539.0		
Blue		460.0	470.0	480.0		
Peak Wavelength	$\lambda_{PEAK}$				nm	Peak of Wavelength of Spectral
Green		_	516.0	_		Distribution at I <sub>F</sub> = 20 mA
Blue		_	464.0	_		
Thermal Resistance	R <sub>0J-PIN</sub>				°C/W	LED Junction-to-Pin
Green		_	270	_		
Blue		_	480	_		

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

## **Part Numbering System**

A L M D -  $x_1 x_2 x_3 x_4$  -  $x_5 x_6 x_7 x_8 x_9$ 

Code	Description	Option	Option				
x <sub>1</sub>	Package type	С	Round InGaN				
x <sub>2</sub>	Color	В	Blue				
		М	Green				
x <sub>3</sub>	Viewing angle	1	15°				
		2	23°				
x <sub>4</sub>	Product specific designation		_				
			F —				
x <sub>5</sub>	Minimum intensity bin	See Inte	nsity Bin Limit Table				
x <sub>6</sub>	Maximum intensity bin						
x <sub>7</sub>	Color bin	0	Full distribution				
		В	Color bin 2 and bin 3				
		С	Color bin 3 and bin 4				
x <sub>8</sub> x <sub>9</sub>	Packaging option	02	Tested 20 mA, 13-in. carrier tape				

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

## **Bin Information**

# Intensity Bin Limit Table (1:3:1 I<sub>v</sub> Bin Ratio)

Bin	Luminous Intensity, I <sub>v</sub> (mcd) at 20 mA				
5	Min.	Max.			
U	3200	4200			
V	4200	5500			
W	5500	7200			
X	7200	9300			
Y	9300	12000			
Z	12000	16000			
1	16000	21000			
2	21000	27000			
3	27000	35000			
4	35000	45000			

Tolerance for each bin limit is  $\pm$  15%.

## **Green Color Range**

Bin	Min. Dom.	Max. Dom.	Chromaticity Coordinate				
1	1 519.0	523.0	х	0.0667	0.1200	0.1450	0.0979
'	319.0	323.0	У	0.8323	0.7375	0.7319	0.8316
2	2 523.0 527.0	х	0.0979	0.1450	0.1711	0.1305	
		327.0	у	0.8316	0.7319	0.7218	0.8189
3	3 527.0 531.0	531.0	х	0.1305	0.1711	0.1967	0.1625
		331.0	у	0.8189	0.7218	0.7077	0.8012
1	4 531.0 535.0	х	0.1625	0.1967	0.2210	0.1929	
		333.0	у	0.8012	0.7077	0.6920	0.7816
5	5 535.0	539.0	х	0.1929	0.2210	0.2445	0.2233
		339.0	у	0.7816	0.6920	0.6747	0.7600

Tolerance for each bin limit is  $\pm$  0.5 nm.

## **Blue Color Range**

Bin	Min. Dom.	Max. Dom.	Chromaticity Coordinate				
1	1 460.0	464.0	х	0.1440	0.1818	0.1766	0.1374
'	400.0	404.0	у	0.0297	0.0904	0.0966	0.0374
2	2 464.0 468.0	х	0.1374	0.1766	0.1699	0.1291	
		400.0	у	0.0374	0.0966	0.1062	0.0495
3	3 468.0 472.0	472 N	х	0.1291	0.1699	0.1616	0.1187
		у	0.0495	0.1062	0.1209	0.0671	
4	4 472.0 476.0	х	0.1187	0.1616	0.1517	0.1063	
		47 0.0	у	0.0671	0.1209	0.1423	0.0945
5	5 476.0 480.0	480.0	х	0.1063	0.1517	0.1397	0.0913
		<del>-100.0</del>	у	0.0945	0.1423	0.1728	0.1327

Tolerance for each bin limit is  $\pm$  0.5nm.

Example of bin information on reel and packaging label:

CAT: X - Intensity bin X

BIN: 2 - Color bin 2

Figure 2 Relative Intensity vs. Wavelength

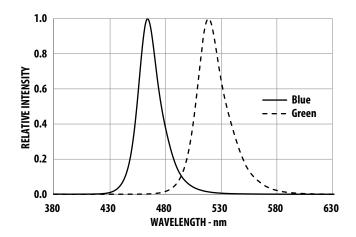


Figure 3 Forward Current vs. Forward Voltage

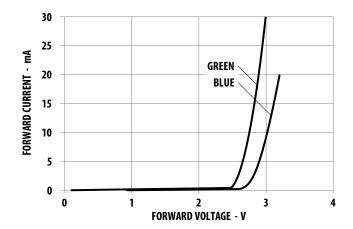


Figure 4 Relative Intensity vs. Forward Current

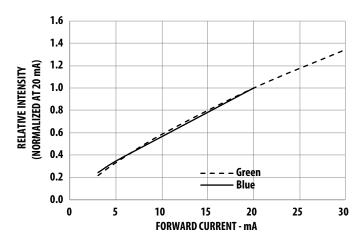


Figure 5 Maximum Forward Current vs. Ambient Temperature

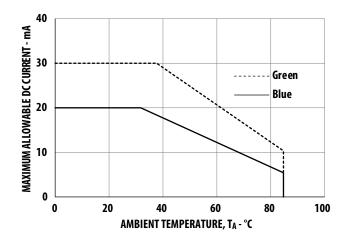


Figure 6 Relative Dominant Wavelength Shift vs. Forward Current

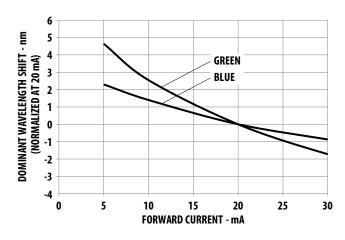


Figure 7 Radiation Pattern for X Axis -15°

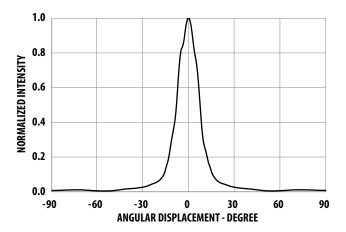
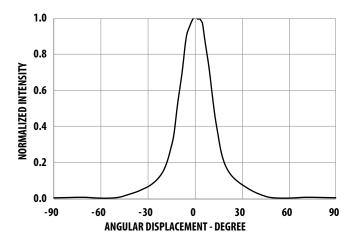


Figure 8 Radiation Pattern for X Axis -23°



**Figure 9 Component Axis for Radiation Pattern** 

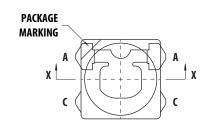


Figure 10 Relative Light Output vs. Junction Temperature

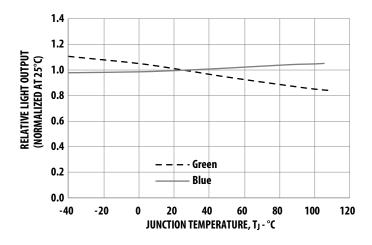
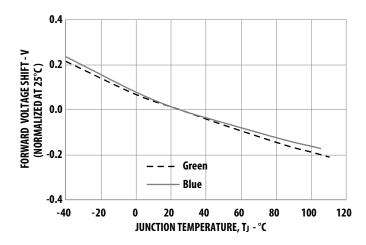
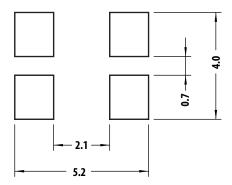


Figure 11 Forward Voltage Shift vs. Junction Temperature



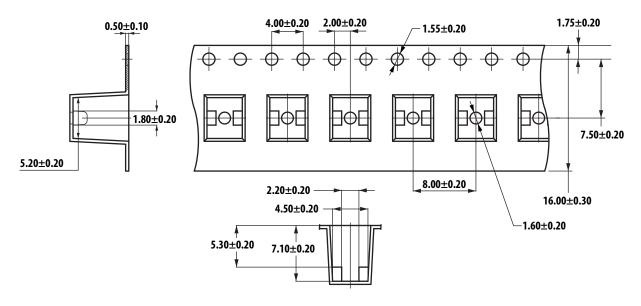
**Figure 12 Recommended Soldering Land Pattern** 



#### NOTE

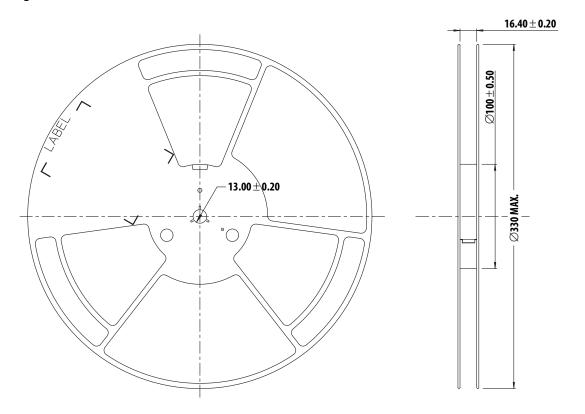
- 1. All dimensions are in millimeters (mm).
- 2. Recommended stencil thickness is 0.1524 mm (6 mils) minimum and above.

**Figure 13 Carrier Tape Dimension** 



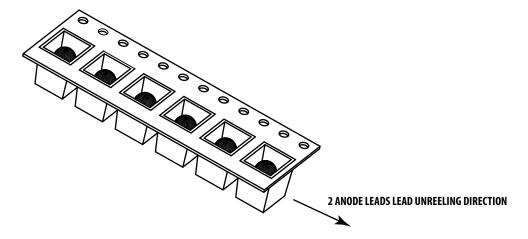
**NOTE** All dimensions are in millimeters (mm).

Figure 14 Reel Dimension



**NOTE** All dimensions are in millimeters (mm).

Figure 15 Unit Orientation from Reel



### **Precautionary Notes**

#### **Soldering**

- Reflow soldering must not be done more than two times.
  Take the necessary precautions for handling a moisture-sensitive device, as stated in Handling Precautions.
- Do not apply any pressure or force on the LED during reflow and after reflow when the LED is still hot.
- Use reflow soldering to solder the LED. Use hand soldering only for rework if unavoidable, but hand soldering must be strictly controlled to the following conditions:
  - Soldering iron tip temperature = 320°C maximum.
  - Soldering duration = 3s maximum.
  - Number of cycles = 1 only
  - Power of soldering iron = 50W maximum.
- Do not touch the LED body with a hot soldering iron except the soldering terminals because this might damage the LED.
- For de-soldering, use a double head soldering iron.
- Confirm beforehand whether the functionality and performance of the LED is affected by hand soldering.

Figure 16 Leaded Reflow Soldering

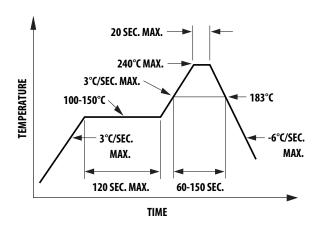


Figure 17 Lead-Free Reflow Soldering

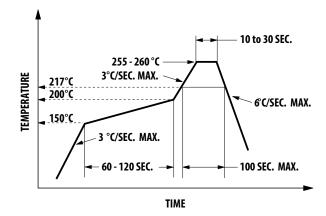
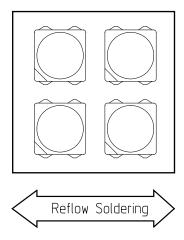


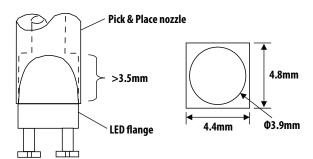
Figure 18 Recommended Board Reflow Direction



#### **Handling Precautions**

For automated pick and place, Broadcom has tested the following nozzle size made with urethane material to work well with this LED. However, due to the possibility of variations in other parameters, such as pick and place, machine maker/model, and other settings of the machine, verify the selected nozzle.

Figure 19 Nozzle Size



#### NOTE

- 1. The nozzle tip should touch the LED flange during pick and place.
- 2. The outer dimensions of the nozzle should fit into the carrier tape pocket.

### **Handling of Moisture-Sensitive Devices**

This product has a Moisture Sensitive Level 2a rating per JEDEC J-STD-020. Refer to Broadcom Application Note AN5305, *Handling of Moisture Sensitive Surface Mount Devices*, for additional details and a review of proper handling procedures.

#### Before use:

- An unopened moisture barrier bag (MBB) can be stored at < 40°C / 90% RH for 12 months. If the actual shelf life has exceeded 12 months and the humidity indicator card (HIC) indicates that baking is not required, then it is safe to reflow the LEDs per the original MSL rating.
- Do not open the MBB prior to assembly (for example, for IQC).
- Control after opening the MBB:
  - Read the HIC immediately upon opening of the MBB.
  - Keep the LEDs < 30°C / 60% RH at all times; all high-temperature-related processes, including soldering, curing, or rework, must be completed within 672 hours.
- Control for unfinished reel:

Store unused LEDs in a sealed MBB with desiccant or desiccator at < 5% RH.

Control of assembled boards:

If the PCB soldered with the LEDs is to be subjected to other high-temperature processes, store the PCB in a sealed MBB with desiccant or desiccator at < 5% RH to ensure that all LEDs have not exceeded their floor life of 672 hours.

- Baking is required if:
  - The HIC indicator is not BROWN at 10% and is AZURE at 5%.
  - The LEDs are exposed to conditions of >30°C / 60% RH at any time.
  - The LED floor life exceeded 672 hours.

The recommended baking condition is:  $60^{\circ}\text{C} \pm 5^{\circ}\text{C}$  for 20 hours. Baking should only be done once.

Storage

The soldering terminals of these Broadcom LEDs are silver plated. If the LEDs are exposed for too long in an ambient environment, the silver plating might become oxidized, thus affecting its solderability performance. As such, keep unused LEDs in a sealed MBB with desiccant or in desiccator at < 5% RH.

#### **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, which might result in larger performance variations (that 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, make sure that the reverse bias voltage does not exceed the allowable limit of the LED.
- Avoid rapid changes in ambient temperature, especially in high-humidity environments, because this will cause condensation on the LED.
- If the LED is intended to be used in outdoor or harsh environments, protect the LED leads with suitable potting material against damages caused by rain water, oil, corrosive gases, and so on. Use a louver or shade to reduce direct sunlight on the LEDs.

#### **Eye Safety Precautions**

LEDs might pose optical hazards when in operation. Do not look directly at operating LEDs because it might be harmful to the eyes. For safety reasons, use appropriate shielding or personal protective equipment.

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