

## High-Brightness SMT Round Green and Blue LED Lamps

### Data Sheet

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#### Description

The new Broadcom<sup>®</sup> ALMD-xx3F LED series has the same or just slightly less luminous intensity than conventional high brightness, through-hole LEDs.

The new LED lamps can be assembled using common SMT assembly processes and are 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

- Compact form factor
- High brightness material
- Available in green and blue colors
  - Green InGaN 525 nm
  - Blue InGaN 470 nm
- JEDEC MSL 2A
- Compatible with the reflow soldering process
- Tinted lens
- Typical viewing angle: 30°

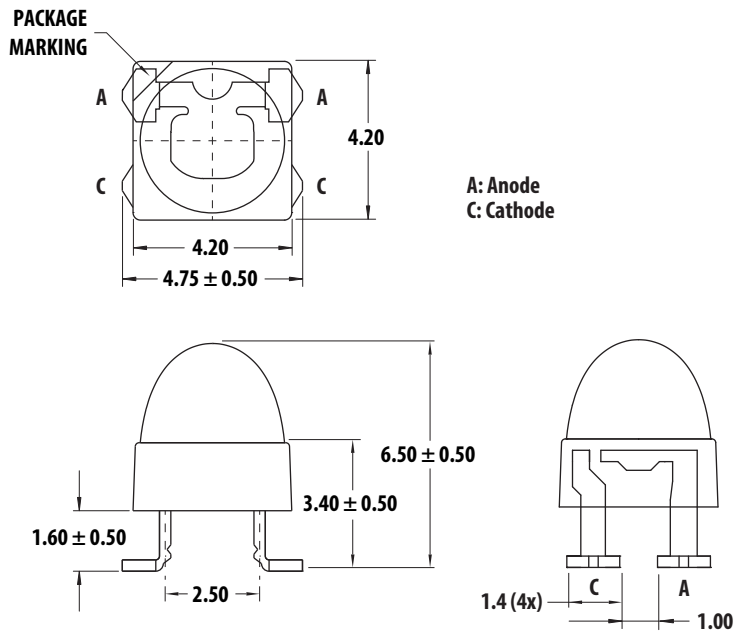
#### Applications

Mono color signs

**CAUTION:** InGaN devices are Class 1C HBM ESD sensitive, AlInGaP devices are Class 1B ESD sensitive per JEDEC Standard. 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



## NOTE

1. All dimensions in millimeters (mm).
2. Tolerance is  $\pm 0.20$  mm, unless other specified.
3. Midsteel lead frame.

## Device Selection Guide

Part Number	Color	Dominant Wavelength, $\lambda_d$	Luminous Intensity, $I_v$ (mcd) <sup>b,c,d</sup>		Viewing Angle, $2\theta_{1/2}$
		(nm) <sup>a</sup>	Min.	Max.	(°) <sup>e</sup>
		Typ.			Typ.
ALMD-CM3F-Y1002	Green	525	9300	21000	30
ALMD-CB3F-TV002	Blue	470	2500	5500	30

- 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, $T_J = 25\text{ }^\circ\text{C}$

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	70	mW
LED Junction Temperature	110	105	$^\circ\text{C}$
Operating Temperature Range	-40 to +85		$^\circ\text{C}$
Storage Temperature Range	-40 to +100		$^\circ\text{C}$

a. Derate linearly as shown in [Figure 5](#).

b. Duty Factor = 30%, frequency = 1 kHz.

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

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Forward Voltage	$V_F$				V	$I_F = 20\text{ mA}$
Green		2.5	2.8	3.8		
Blue		2.5	2.8	3.5		
Reverse Voltage <sup>a</sup>	$V_R$				V	$I_R = 10\text{ }\mu\text{A}$
Green		5	—	—		
Blue		5	—	—		
Dominant Wavelength <sup>b</sup>	$\lambda_d$				nm	$I_F = 20\text{ mA}$
Green		519	525	539		
Blue		460	470	480		
Peak Wavelength	$\lambda_{PEAK}$				nm	Peak of Wavelength of Spectral Distribution at $I_F = 20\text{ mA}$
Green		—	522	—		
Blue		—	464	—		
Thermal Resistance	$R_{\theta J-PIN}$				$^\circ\text{C/W}$	LED Junction-to-Pin
Green		—	270	—		
Blue		—	480	—		
Luminous Efficacy <sup>c</sup>	$\eta_V$				lm/W	Emitted Luminous Power/Emitted Radiant Power
Green		—	500	—		
Blue		—	85	—		
Thermal coefficient of $\lambda_d$					nm/ $^\circ\text{C}$	$I_F = 20\text{ mA}; +25^\circ\text{C} \leq T_J \leq +100^\circ\text{C}$
Green		—	0.033	—		
Blue		—	0.033	—		

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  $\eta_V$  is the luminous efficacy in lumens/watt.

## Part Numbering System

A L M D - 

x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>
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x <sub>5</sub>	x <sub>6</sub>	x <sub>7</sub>	x <sub>8</sub>	x <sub>9</sub>
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Code	Description	Option	
x <sub>1</sub>	Package type	C	Round InGaN
x <sub>2</sub>	Color	B	Blue
		M	Green
x <sub>3</sub>	Viewing angle	3	30°
x <sub>4</sub>	Product specific designation	F	
x <sub>5</sub>	Minimum intensity bin	Refer to the Intensity Bin Limit Table	
x <sub>6</sub>	Maximum intensity bin		
x <sub>7</sub>	Color bin selection	0	Full distribution
x <sub>8</sub> x <sub>9</sub>	Packaging option	02	Tested 20 mA, 13-in. carrier tape

## Bin Information

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

Bin	Luminous Intensity, I <sub>v</sub> (mcd) at 20 mA	
	Min.	Max.
T	2500	3200
U	3200	4200
V	4200	5500
W	5500	7200
X	7200	9300
Y	9300	12000
Z	12000	16000
1	16000	21000

Tolerance for each bin limit is ± 15%.

**Blue Color Range**

Bin	Min. Dom.	Max. Dom.	X Min.	Y Min.	X Max.	Y Max.
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  $\pm 0.5$  nm.

**Green Color Range**

Bin	Min. Dom.	Max. Dom.	X Min.	Y Min.	X Max.	Y Max.
1	519.0	523.0	0.0667	0.8323	0.1450	0.7319
			0.1200	0.7375	0.0979	0.8316
2	523.0	527.0	0.0979	0.8316	0.1711	0.7218
			0.1450	0.7319	0.1305	0.8189
3	527.0	531.0	0.1305	0.8189	0.1967	0.7077
			0.1711	0.7218	0.1625	0.8012
4	531.0	535.0	0.1625	0.8012	0.2210	0.6920
			0.1967	0.7077	0.1929	0.7816
5	535.0	539.0	0.1929	0.7816	0.2445	0.6747
			0.2210	0.6920	0.2233	0.7600

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

# InGaN

Figure 2 Relative Intensity vs. Wavelength

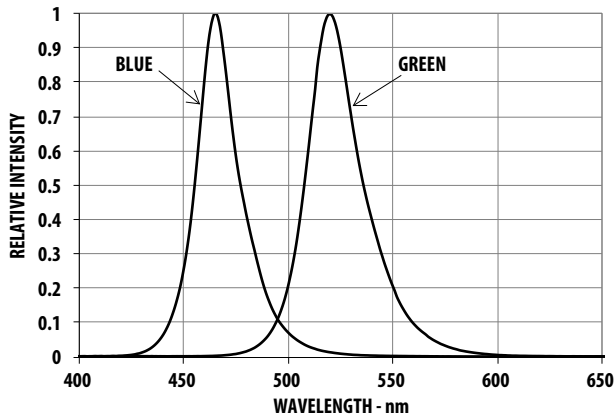


Figure 3 Forward Current vs. Forward Voltage

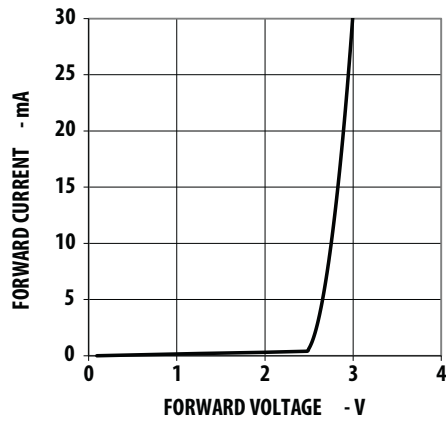


Figure 4 Relative Intensity vs. Forward Current

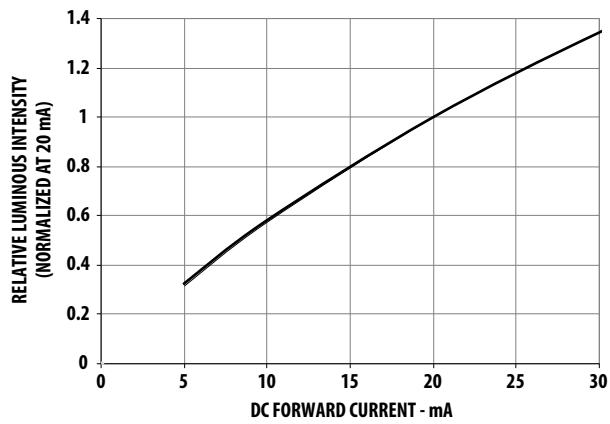


Figure 5 Maximum Forward Current vs. Ambient Temperature

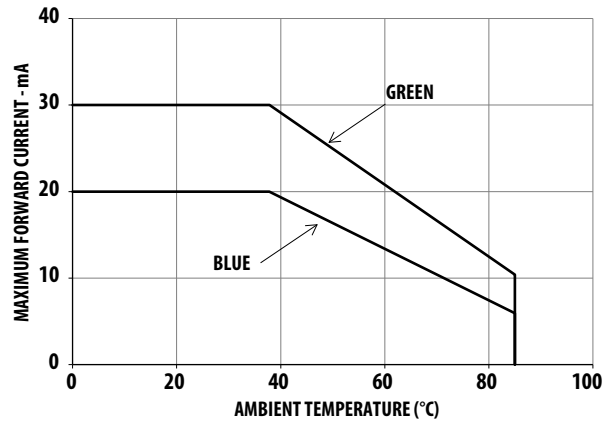
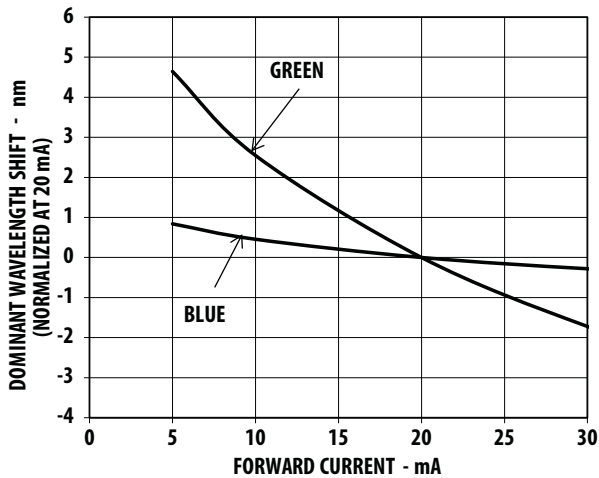
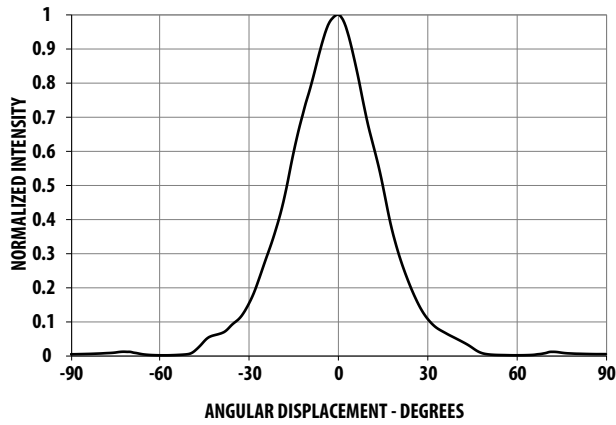


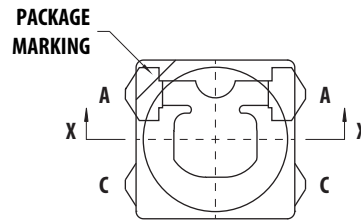
Figure 6 Dominant Wavelength Shift vs. Forward Current



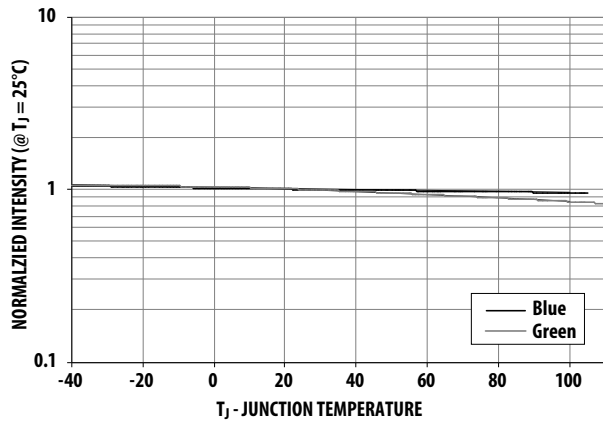
**Figure 7 Radiation Pattern for X Axis**



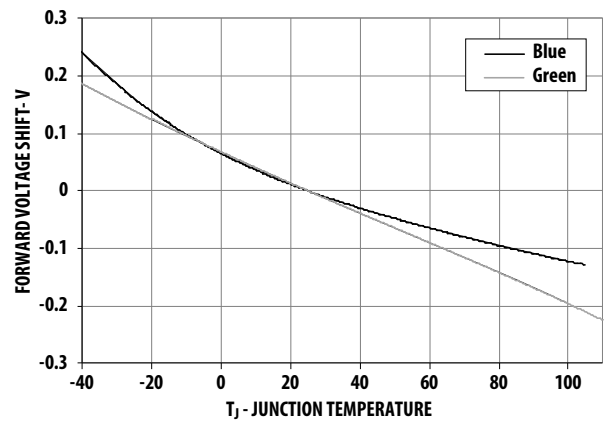
**Figure 8 Component Axis for Radiation Pattern**



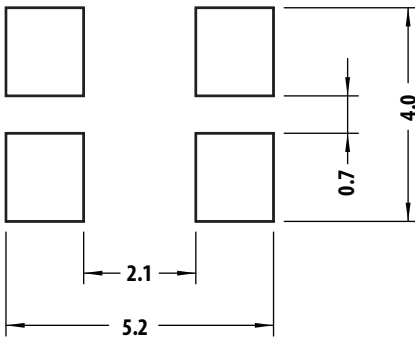
**Figure 9 Relative Intensity Shift vs. Junction Temperature**



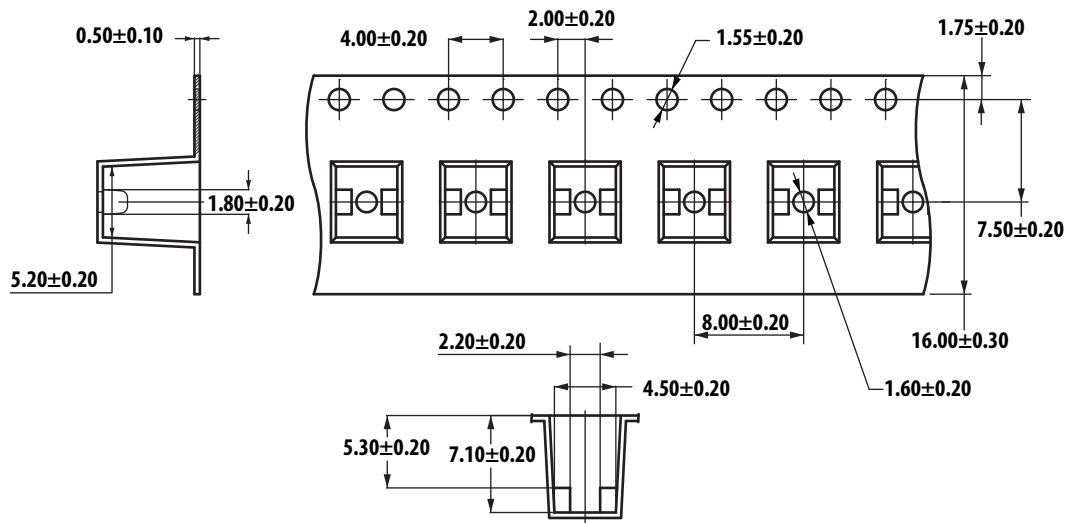
**Figure 10 Forward Voltage Shift vs. Junction Temperature**



**Figure 11 Recommended Soldering Land Pattern**

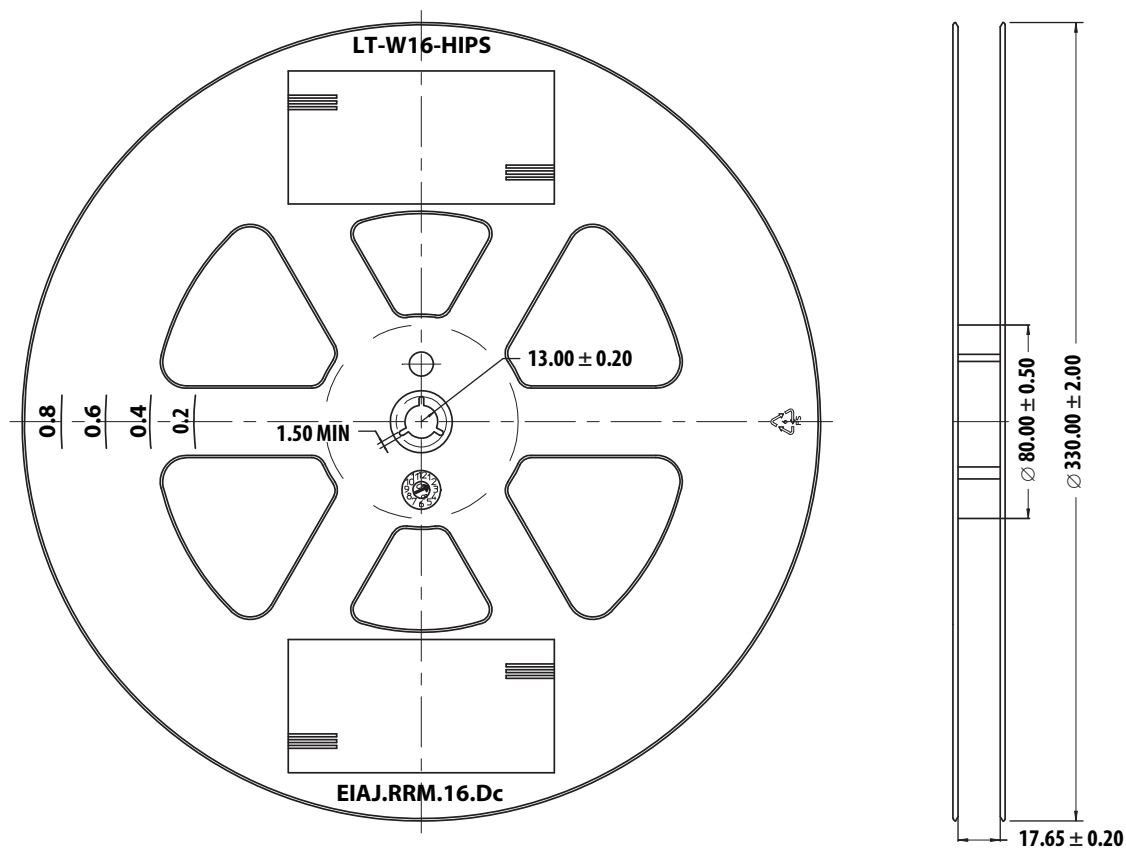


**Figure 12 Carrier Tape Dimension**



**NOTE** All dimensions are in millimeters.

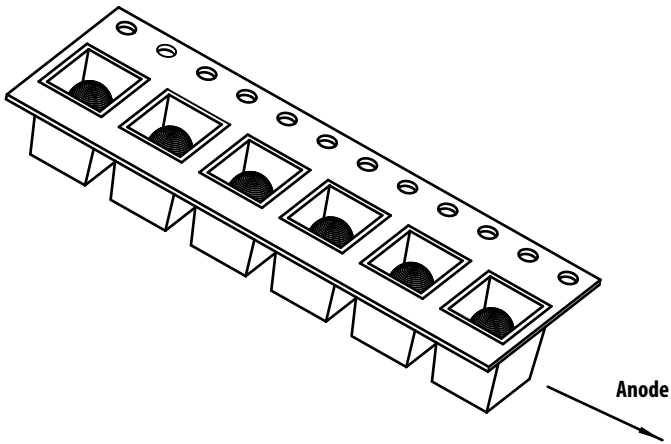
**Figure 13 Reel Dimension**



**NOTE** All dimensions are in millimeters.



**Figure 14 Unit Orientation from Reel**









## Packing Label

### (i) Mother Label (Available on the MBB Bag)

<p>(1P) Item: Part Number  </p> <p>(1T) Lot: Lot Number  </p> <p>LPN:  </p> <p>(9D)MFG Date: Manufacturing Date  </p>		<p><b>AVAGO</b>          TECHNOLOGIES</p> <p>STANDARD LABEL LS0002          RoHS Compliant          e4 Max Temp 260C MSL 2a</p> <p>(Q) QTY: Quantity  </p> <p>CAT: Intensity Bin  </p> <p>BIN: Refer to below information  </p>	
<p>(P) Customer Item:  </p> <p>(V) Vendor ID:  </p> <p>DeptID: OEAT01  </p>		<p>(9D) Date Code: Date Code  </p> <p>Made In: Country of Origin  </p>	

### (ii) Baby Label (Available on the Plastic Reel)

<p>(1P) PART #: Part Number  </p> <p>(1T) Lot #: Lot Number  </p> <p>(9D)MFG Date: Manufacturing Date  </p> <p>C/O: Country of Origin</p> <p>(1T) TAPE DATE: Taping Date  </p>		<p><b>AVAGO</b>          TECHNOLOGIES</p> <p>BABY LABEL COSBOO1B V0.0</p> <p>(Q) QTY: Quantity  </p> <p>(9D) Date Code: Date Code  </p> <p>CAT Intensity Bin</p> <p>BIN Refer to Below information</p>	
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For acronyms and definitions, see the next page.

## Acronyms and Definitions

BIN:

### (i) Color bin only or V<sub>F</sub> bin only

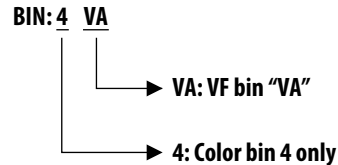
(Applicable for part numbers with color bins but without a V<sub>F</sub> bin or part numbers with V<sub>F</sub> bins and no color bin)

### (ii) Color bin incorporated with V<sub>F</sub> bin

Applicable for part numbers that have both the color bin and the V<sub>F</sub> bin

Example:

- Color bin only or V<sub>F</sub> bin only  
BIN: 4 (represent color bin 4 only)  
BIN: VA (represent V<sub>F</sub> bin "VA" only)
- Color bin incorporates with the V<sub>F</sub> bin



## 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 15 Leaded Reflow Soldering

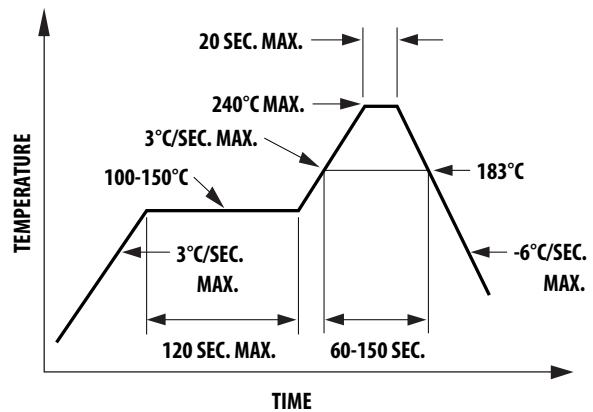
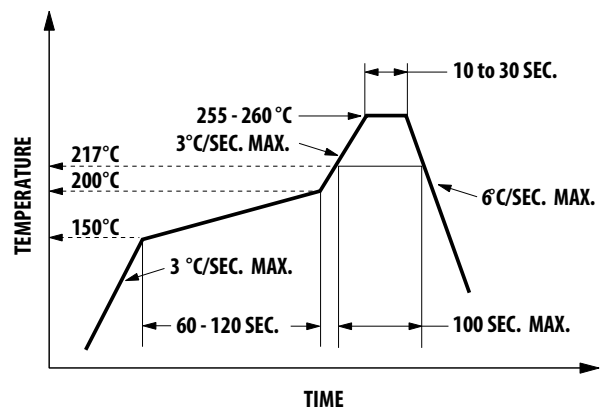
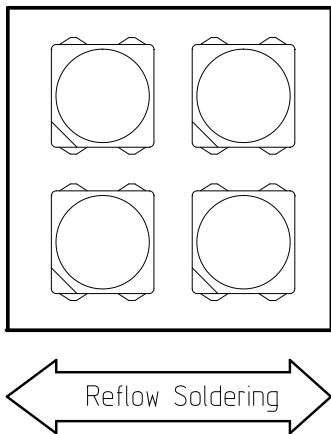


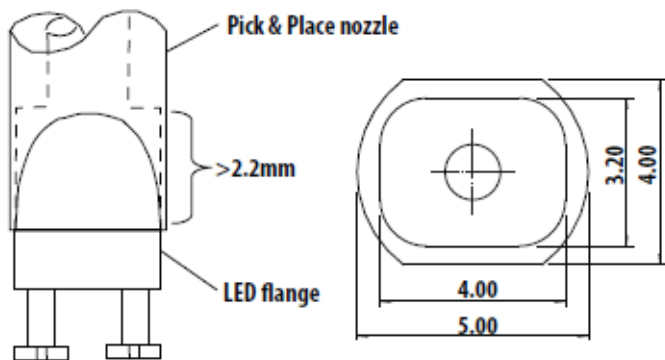
Figure 16 Lead-Free Reflow Soldering



**Figure 17 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.



#### NOTE

- The nozzle tip should touch the LED flange during pick and place.
- 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  $< 40^{\circ}\text{C} / 90\% \text{RH}$  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  $< 30^{\circ}\text{C} / 60\% \text{RH}$  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  $< 5\% \text{RH}$ .
- 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  $< 5\% \text{RH}$  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  $>30^{\circ}\text{C} / 60\% \text{RH}$  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  $< 5\% \text{RH}$ .

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## 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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