

# ASMT-YTD2-0BB02

High Brightness Tricolor PLCC6 White Surface LED



## Data Sheet



Lead (Pb) Free  
RoHS 6 fully  
compliant



### Description

This family of SMT LEDs is packaged in the form of PLCC-6 with a separate heat path for each LED die, enabling it to be driven at higher current.

Individually addressable pin-outs give higher flexibility in circuitry design. With closely matched radiation pattern along the package's x-axis, these LEDs are suitable for indoor full color display application.

For easy pick and place, the LEDs are shipped in tape and reel. Every reel is shipped from a single intensity and color bin for better uniformity.

These LEDs are compatible with reflow soldering process.

### Features

- Standard PLCC-6 package (Plastic Leaded Chip Carrier) with individual addressable pin-out for higher flexibility of driving configuration
- High reliability LED package with silicone encapsulation
- High brightness using AlInGaP and InGaN dice technologies
- Typical viewing angle 120°
- Compatible with reflow soldering process
- JEDEC MSL 2a
- Water-Resistance (IPX6\*) per IEC 60529:2001

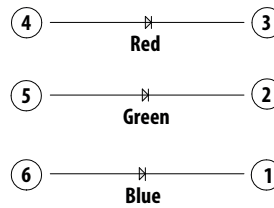
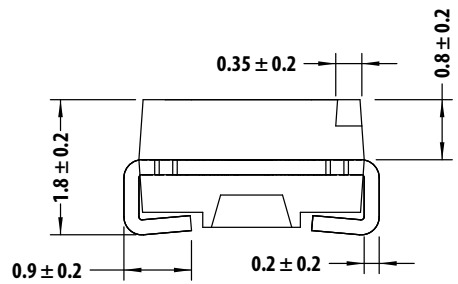
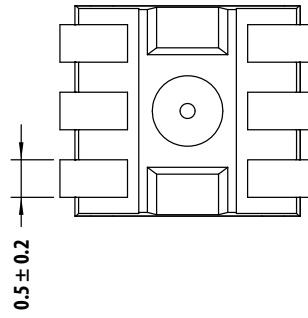
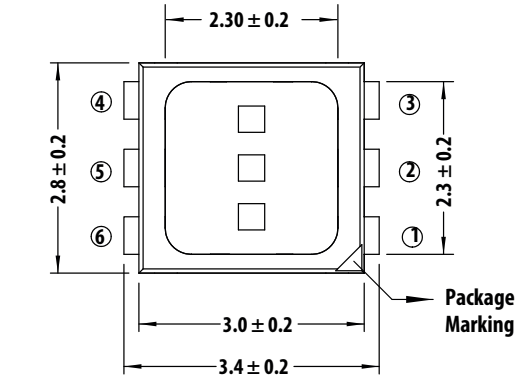
\* The test is conducted on component level by mounting the components on PCB with proper potting to protect the leads. It is strongly recommended that customers perform necessary tests on the components for their final application.

### Applications

- Full color sign display
- Gaming machine

**CAUTION:** LEDs are Class 1C ESD sensitive. Please observe appropriate precautions during handling and processing. Please refer to Avago Application Note AN-1142 for additional details.

## Package Dimensions



## Lead Configuration

1	Cathode (Blue)
2	Cathode (Green)
3	Cathode (Red)
4	Anode (Red)
5	Anode (Green)
6	Anode (Blue)

### Notes:

1. All dimensions are in millimeter (mm).
2. Unless otherwise specified, tolerance is  $\pm 0.20$  mm.
3. Encapsulation = silicone
4. Terminal finish = silver plating

**Table 1. Absolute Maximum Ratings (T<sub>J</sub> = 25 °C)**

Parameter	Red	Green & Blue	Unit
DC forward current <sup>[1]</sup>	50	30	mA
Peak forward current <sup>[2]</sup>	100	100	mA
Power dissipation	125	114	V
Reverse voltage <sup>[3]</sup>		4	V
Junction temperature		125	°C
Operating temperature range	-40 to + 110		°C
Storage temperature range	-40 to + 120		°C

Notes:

1. Derate linearly as shown in Figure 7 to Figure 10.
2. Duty Factor = 10% Frequency = 1 kHz
3. Driving the LED in reverse bias condition is suitable for the short term only

**Table 2. Optical Characteristics (T<sub>J</sub> = 25 °C)**

Color	Luminous Intensity, I <sub>v</sub> (mcd) @ I <sub>F</sub> = 20 mA <sup>[1]</sup>			Dominant Wavelength, λ <sub>d</sub> (nm) @ I <sub>F</sub> = 20 mA <sup>[2]</sup>			Peak Wavelength, λ <sub>p</sub> (nm) @ I <sub>F</sub> = 20 mA	Viewing Angle, 2θ <sub>½</sub> (°) <sup>[3]</sup>	Luminous Efficacy, η <sub>v</sub> (lm/W)	Luminous Efficiency, η <sub>e</sub> (lm/W)
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Typ.	Typ.	Typ.
Red	560	745	1125	618	622	628	629	120	210	43
Green	1125	1600	2240	525	530	537	521	120	535	75
Blue	285	380	560	465	470	477	464	120	84	15

Notes:

1. Luminous intensity, I<sub>v</sub> is measured at the mechanical axis of the LED package at a single current pulse condition. The actual peak of the spatial radiation pattern may not be aligned with the axis.
2. Dominant wavelength is derived from the CIE Chromaticity Diagram and represents the perceived color of the device.
3. θ<sub>½</sub> is the off-axis angle where the luminous intensity is ½ of the peak intensity.
4. Φ<sub>v</sub> is the total luminous flux output as measured with an integrating sphere at mono pulse condition.

**Table 3. Electrical Characteristics (T<sub>J</sub> = 25 °C)**

Color	Forward Voltage, V <sub>F</sub> (V) @ I <sub>F</sub> = 20 mA <sup>[1]</sup>			Reverse Voltage, V <sub>R</sub> (V) @ I <sub>R</sub> = 100 μA <sup>[2]</sup>	Reverse Voltage, V <sub>R</sub> (V) @ I <sub>R</sub> = 10 μA <sup>[2]</sup>	Thermal Resistance, Rθ <sub>J-S</sub> (°C/W)	
	Min.	Typ.	Max.	Min.	Min.	1 chip on	3 chips on
Red	1.8	2.1	2.5	4.0	--	280	280
Green	2.8	3.2	3.8	--	4.0	180	230
Blue	2.8	3.2	3.8	--	4.0	180	230

Notes:

1. Tolerance ± 0.1 V.
2. Indicates product final testing condition. Long-term reverse bias is not recommended.

## Part Numbering System

A S M T - Y T D 2 - 0 B B 0 2

x1	x2	x3	x4	x5
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Code	Description	Option	
x1	Package type	D	White surface
x2	Minimum intensity bin	B	Red: bin U2
			Green: bin W1
			Blue: bin T1
			Red: bin U2, V1, V2 Green: bin W1, W2, X1 Blue: bin T1, T2, U1
x3	Number of intensity bins	B	3 intensity bins from minimum
x4	Color bin combination	0	Red: full distribution
			Green: bin A, B, C
			Blue: bin A, B, C, D, E
x5	Test option	2	Test current = 20 mA

**Table 4. Bin Information**

### Intensity Bins (CAT)

Bin ID	Luminous intensity (mcd)	
	Min.	Max.
T1	285	355
T2	355	450
U1	450	560
U2	560	715
V1	715	900
V2	900	1125
W1	1125	1400
W2	1400	1800
X1	1800	2240

Tolerance: ±12%

### Color Bins (BIN) – Green

Bin ID	Dominant Wavelength (nm)		Chromaticity Coordinate (for reference)	
	Min.	Max.	Cx	Cy
A	525.0	531.0	0.1142	0.8262
			0.1799	0.6783
			0.2138	0.6609
			0.1625	0.8012
B	528.0	534.0	0.1387	0.8148
			0.1971	0.6703
			0.2298	0.6507
			0.1854	0.7867
C	531.0	537.0	0.1625	0.8012
			0.2138	0.6609
			0.2454	0.6397
			0.2077	0.7711

Tolerance: ±1 nm

### Color Bins (BIN) – Red

Bin ID	Dominant Wavelength (nm)		Chromaticity coordinate (for reference)	
	Min.	Max.	Cx	Cy
--	618.0	628.0	0.6873	0.3126
			0.6696	0.3136
			0.6866	0.2967
			0.7052	0.2948

Tolerance: ±1 nm

### Color Bins (BIN) – Blue

Bin ID	Dominant Wavelength (nm)		Chromaticity coordinate (for reference)	
	Min.	Max.	Cx	Cy
A	465.0	469.0	0.1355	0.0399
			0.1751	0.0986
			0.1680	0.1094
			0.1267	0.0534
B	467.0	471.0	0.1314	0.0459
			0.1718	0.1034
			0.1638	0.1167
			0.1215	0.0626
C	469.0	473.0	0.1267	0.0534
			0.1680	0.1094
			0.1593	0.1255
			0.1158	0.0736
D	471.0	475.0	0.1215	0.0626
			0.1638	0.1167
			0.1543	0.1361
			0.1096	0.0868
E	473.0	477.0	0.1158	0.0736
			0.1593	0.1255
			0.1489	0.1490
			0.1028	0.1029

Tolerance: ±1 nm

# Characteristics

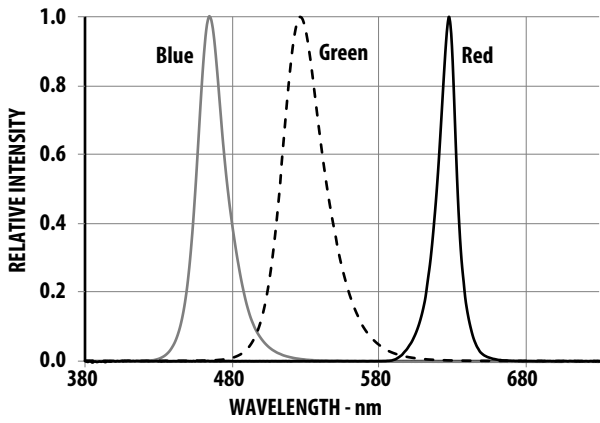


Figure 1. Relative Spectral Emission

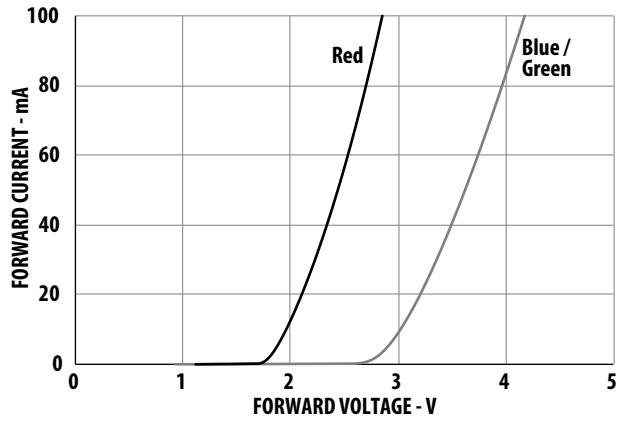


Figure 2. Forward Current vs. Forward Voltage

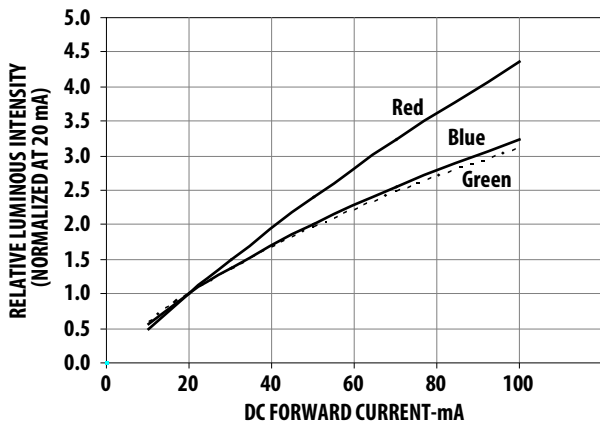


Figure 3. Relative Luminous Intensity vs. Forward Current

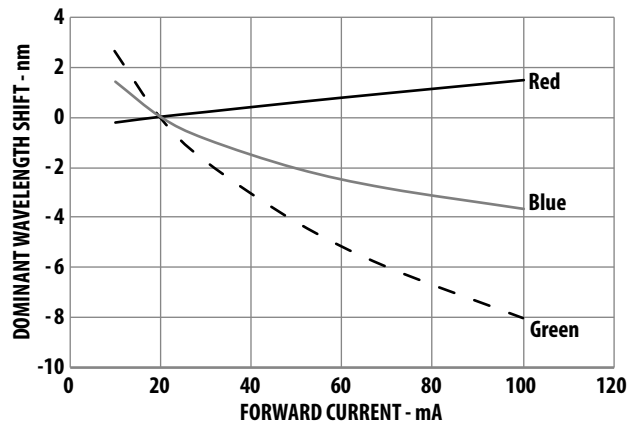


Figure 4. Dominant Wavelength Shift vs. Forward Current

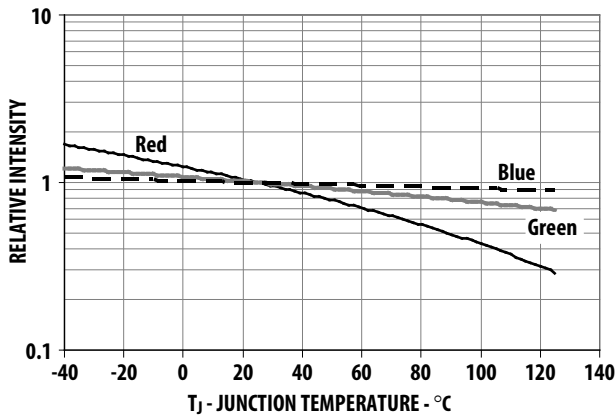


Figure 5. Relative Luminous Intensity vs. Junction Temperature

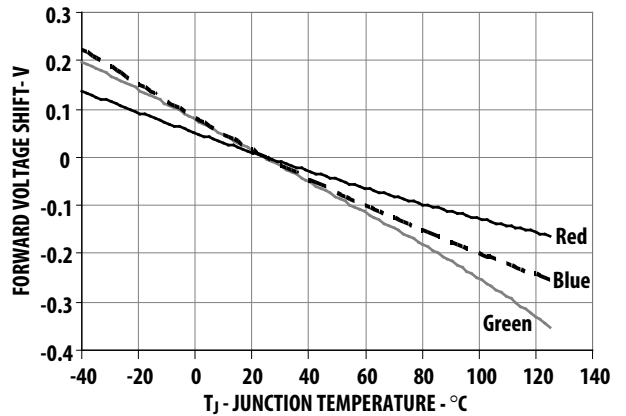


Figure 6. Forward Voltage Shift vs. Junction Temperature

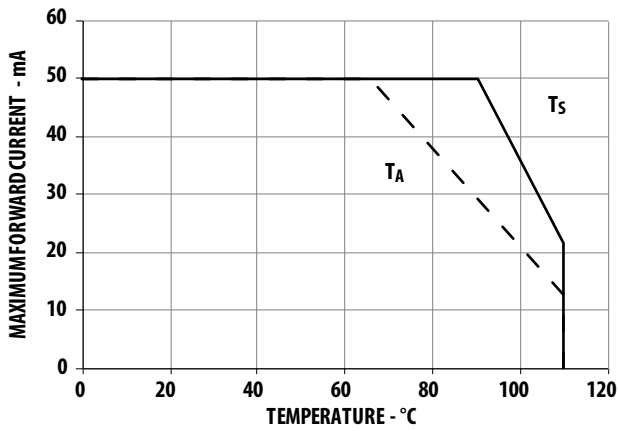


Figure 7. Maximum Forward Current vs. Temperature for Red (1 chip on)

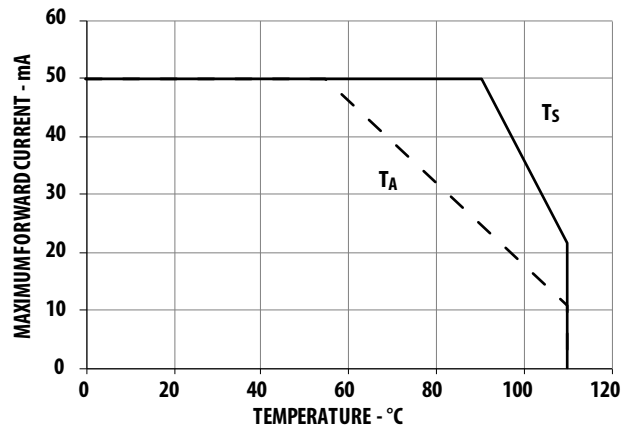


Figure 8. Maximum Forward Current vs. Temperature for Red (3 chips on)

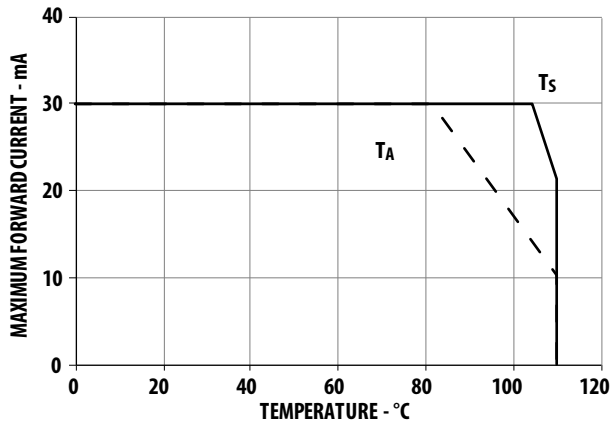


Figure 9. Maximum Forward Current vs. Temperature for Green & Blue (1 chip on)

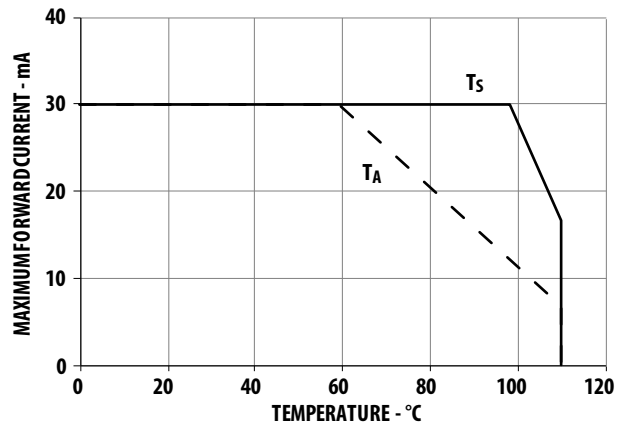


Figure 10. Maximum Forward Current vs. Temperature for Green & Blue (3 chips on)

Note:

Maximum forward current graphs based on ambient temperature,  $T_A$  are with reference to thermal resistance  $R\theta_{J-A}$  below. For more details, see Precautionary Notes (4).

Condition	Thermal resistance from LED junction to ambient, $R\theta_{J-A}$ ( $^{\circ}\text{C}/\text{W}$ )	
	Red	Green & Blue
1 chip on	473	373
3 chips on	563	563

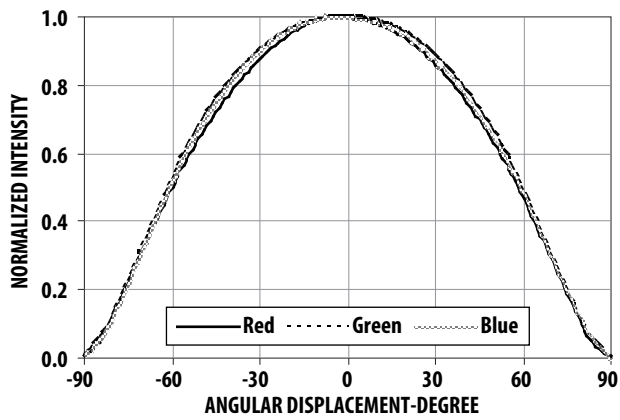


Figure 11a. Radiation pattern along x-axis of the package

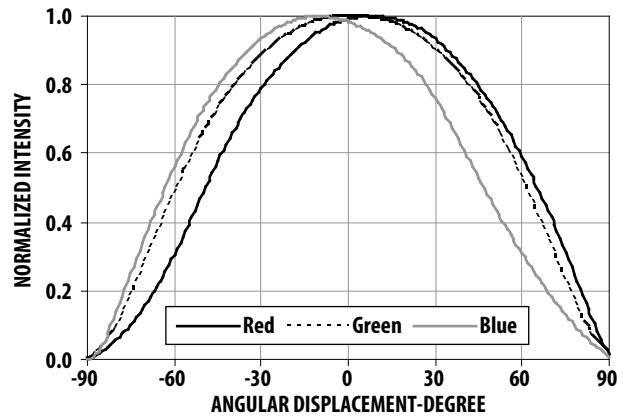


Figure 11b. Radiation pattern along y-axis of the package

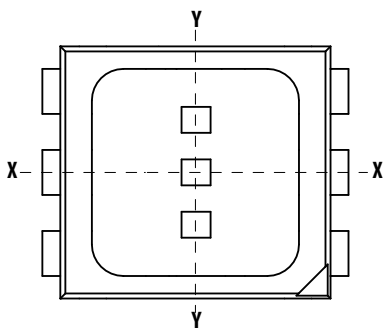


Figure 11c. Illustration of package axis for radiation pattern

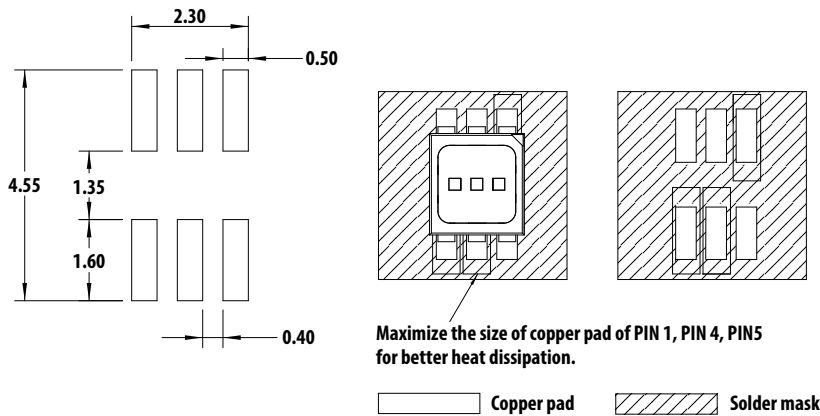


Figure 12. Recommended soldering land pattern

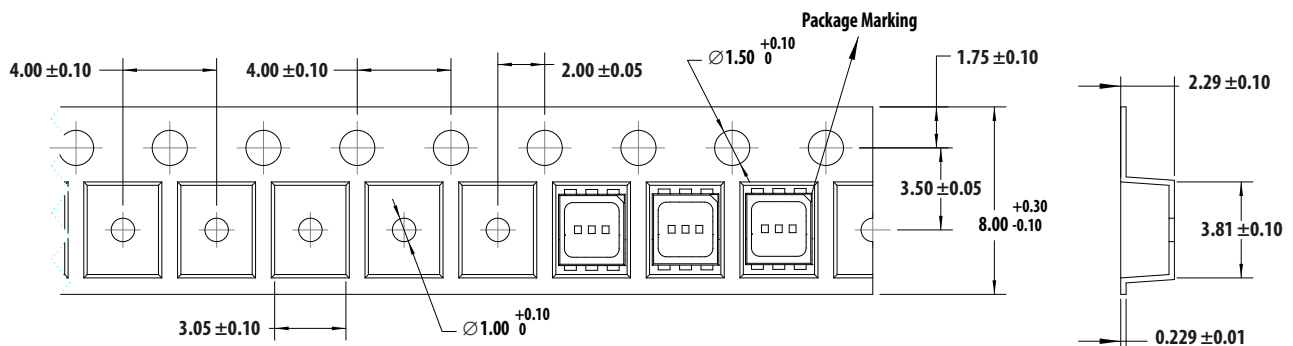


Figure 13. Carrier tape dimensions

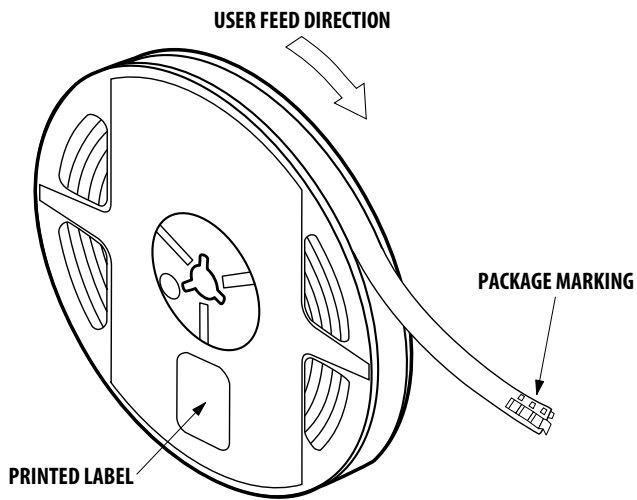


Figure 14. Reeling Orientation

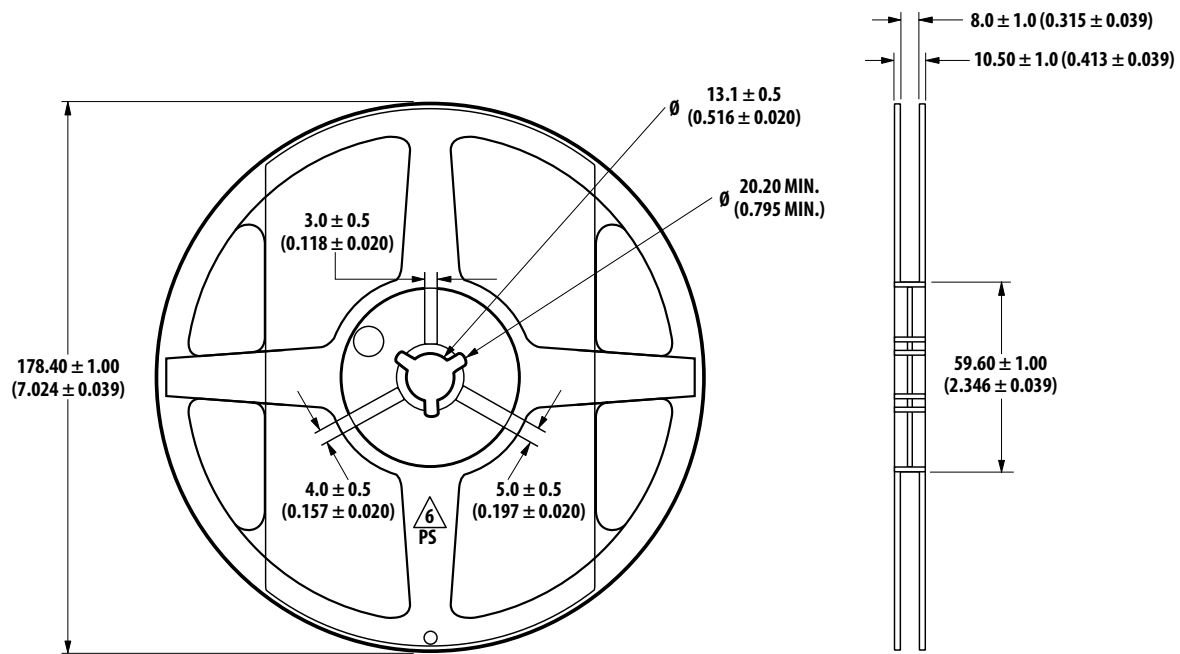


Figure 15. Reel dimensions








## Packing Label

(i) Standard label (attached on moisture barrier bag)

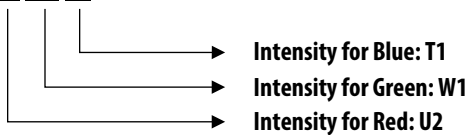
<p>(1P) Item: <b>Part Number</b></p> 		<p><b>AvAGO</b> TECHNOLOGIES STANDARD LABEL LS0002 RoHS Compliant Halogen Free e4 Max Temp 260C MSL2a</p>	
<p>(1T) Lot: <b>Lot Number</b></p> 		<p>(Q) QTY: <b>Quantity</b></p> 	
<p>LPN:</p> 		<p>CAT: <b>Intensity Bin</b></p> 	
<p>(9D)MFG Date: <b>Manufacturing Date</b></p> 		<p>BIN: <b>Color Bin</b></p> 	
<p>(P) Customer Item:</p> 			
<p>(V) Vendor ID:</p> 		<p>(9D) Date Code: <b>Date Code</b></p> 	
<p>DeptID:</p> 		<p>Made In: <b>Country of Origin</b></p> 	

(ii) Baby label (attached on plastic reel)

<p>(1P) PART #: <b>Part Number</b></p> 		<p><b>AvAGO</b> TECHNOLOGIES BABY LABEL COSB001B V0.0</p>	
<p>(1T) LOT #: <b>Lot Number</b></p> 			
<p>(9D)MFG DATE: <b>Manufacturing Date</b></p> 		<p>QUANTITY: <b>Packing Quantity</b></p> 	
<p>C/O: <b>Country of Origin</b></p>		<p>(9D): DATE CODE:</p>	
<p>(1T) TAPE DATE:</p> 		<p>D/C: Date Code    VF:</p>	
		<p>CAT: <b>INTENSITY BIN</b></p>	
		<p>BIN: <b>COLOR BIN</b></p>	

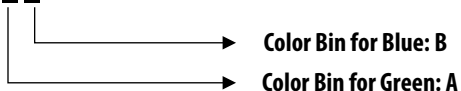
Example of luminous intensity (lv) bin information on label:

**CAT: U2 W1 T1**



Example of color bin information on label:

**BIN: A B**

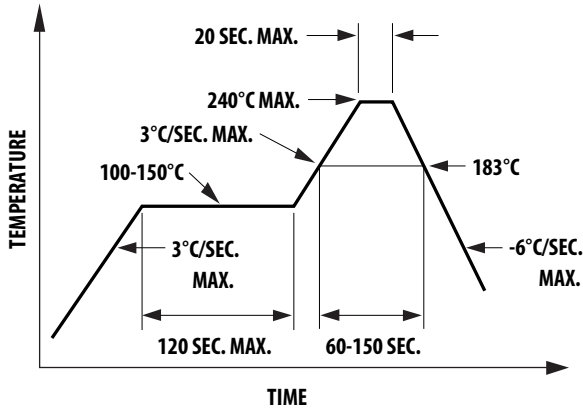


Note: There is no color bin ID for Red color as there is only 1 range ,as stated in Table 4.

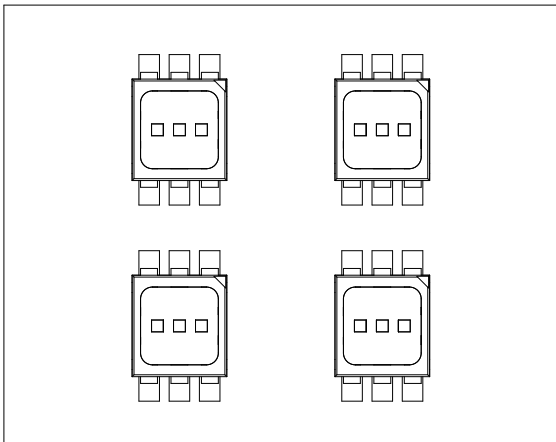
## Soldering

Recommended reflow soldering condition:

### (i) Leaded reflow soldering:

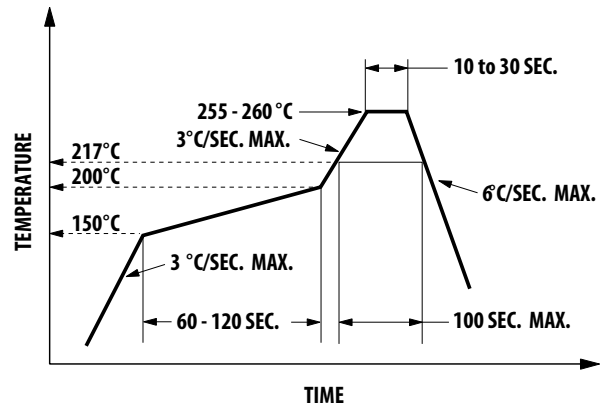


- a. Reflow soldering must not be done more than 2 times. Make sure the necessary precautions are observed for handling moisture-sensitive device as stated in the following section.
- b. Recommended board reflow direction:



**REFLOW DIRECTION**

### (ii) Lead-free reflow soldering:



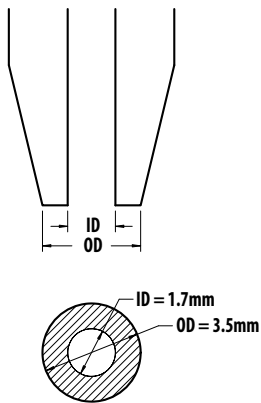
- c. Do not apply any pressure or force on the LED during reflow and after reflow when the LED is still hot.
- d. It is preferred to use reflow soldering to solder the LED. Use hand soldering for rework if this is unavoidable, but it must be strictly controlled to the following conditions:
  - Soldering iron tip temperature = 320 °C max
  - Soldering duration = 3 sec max
  - Number of cycles = 1 only
  - Power of soldering iron = 50 W max
- e. Do not touch the LED body with hot soldering iron except the soldering terminals as it may cause damage to the LED.
- f. For de-soldering, it is recommended that you use a double flat tip.
- g. You are advised to confirm beforehand whether hand soldering will affect the functionality and performance of the LED.

## PRECAUTIONARY NOTES

### 1. Handling precautions

The encapsulation material of the LED is made of silicone for better product reliability. Compared to epoxy encapsulant, which is hard and brittle, silicone is softer and flexible. Special handling precautions must be taken during assembly of silicone encapsulated LED products. Failure to comply might lead to damage and premature failure of the LED. For more information, refer to Application Note AN5288, *Silicone Encapsulation for LED: Advantages and Handling Precautions*.

- a. Do not poke sharp objects into the silicone encapsulant. Sharp objects such as tweezers or syringes might exert excessive force or even pierce through the silicone and induce failures in the LED die or wire bond.
- b. Do not touch the silicone encapsulant. Uncontrolled force acting on the silicone encapsulant might result in excessive stress on the wire bond. Hold the LED only by its body.
- c. Do not stack assembled PCBs together. Use an appropriate rack to hold the PCBs.
- d. The surface of silicone materials attracts more dust and dirt than to epoxy, due to its surface tackiness. To remove foreign particles on the surface of silicone, a cotton bud can be used with isopropyl alcohol (IPA). During cleaning, rub the surface gently without putting much pressure on the silicone. Ultrasonic cleaning is *not* recommended.
- e. For automated pick and place, Avago has tested that the following nozzle size works fine with this LED. However, due to possible variations in other parameters such as pick and place machine maker/model and other settings of the machine, it is recommended that you verify that the nozzle selected will not cause damage to the LED.



### 2. Handling of moisture-sensitive device

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

- a. 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.
  - It is recommended that the MBB not be opened before assembly (e.g., for IQC).
- b. Control after opening the MBB
  - The HIC shall be read immediately upon opening of the MBB.
  - The LEDs must be kept at  $< 30^{\circ}\text{C}/60\% \text{RH}$  at all times and all high temperature related processes including soldering, curing or rework need to be completed within 672 hours.
- c. Control for unfinished reel
  - Unused LEDs must be stored in a sealed MBB with desiccant or desiccator at  $< 5\% \text{RH}$ .
- d. Control of assembled boards
  - If the PCB soldered with the LEDs is to be subjected to other high temperature processes, the PCB must be stored 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.
- e. Baking is required if:
  - The HIC indicator is not BROWN at 10% and is AZURE at 5%.
  - The LEDs are exposed to a condition of  $>30^{\circ}\text{C} / 60\% \text{RH}$  at any time.
  - The LED floor life exceeded 672 hrs.

The recommended baking condition is:  $60 \pm 5^{\circ}\text{C}$  for 20 hrs. Baking should only be done once.
- f. Storage
  - The soldering terminals of these Avago LEDs are silver plated. If the LEDs are exposed in an ambient environment for too long, the silver plating might be oxidized and thus affect its solderability performance. As such, unused LEDs must be kept in a sealed MBB with desiccant or in desiccator at  $< 5\% \text{RH}$ .

### 3. Application precautions

- Drive current of the LED must not exceed the maximum allowable limit across temperature as stated in the datasheet. Constant current driving is recommended to ensure consistent performance.
- LED is not intended for reverse bias. Do use other appropriate components for such purpose. When driving the LED in matrix form, it is crucial to ensure that the reverse bias voltage is not exceeding the allowable limit of the LED.
- Do not use the LED in the vicinity of material with sulfur content, in environment of high gaseous sulfur compound and corrosive elements. Examples of material that may contain sulfur are rubber gasket, RTV (room temperature vulcanizing) silicone rubber, rubber gloves etc. Prolonged exposure to such environment may affect the optical characteristics and product life.
- Avoid rapid change in ambient temperature especially in high humidity environment as this will cause condensation on the LED.
- Although the LED is rated as IPx6 according to IEC60529: Degree of protection provided by enclosure, the test condition may not represent actual exposure during application. If the LED is intended to be used in outdoor or harsh environment, the LED must be protected against damages caused by rain water, dust, oil, corrosive gases, external mechanical stress, and so on.

### 4. Thermal management

Optical, electrical and reliability characteristics of LED are affected by temperature. The junction temperature ( $T_J$ ) of the LED must be kept below allowable limit at all times.  $T_J$  can be calculated as follows:

$$T_J = T_A + R_{\theta J-A} \times I_F \times V_{Fmax}$$

where;

$T_A$  = ambient temperature [°C]

$R_{\theta J-A}$  = thermal resistance from LED junction to ambient [°C/W]

$I_F$  = forward current [A]

$V_{Fmax}$  = maximum forward voltage [V]

The complication of using this formula lies in  $T_A$  and  $R_{\theta J-A}$ . Actual  $T_A$  is sometimes subjective and hard to determine.  $R_{\theta J-A}$  varies from system to system depending on design and is usually not known.

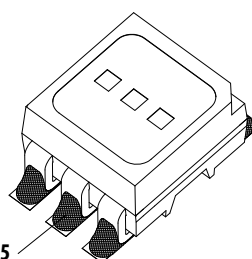
Another way of calculating  $T_J$  is by using solder point temperature  $T_S$  as shown as follows:

$$T_J = T_S + R_{\theta J-S} \times I_F \times V_{Fmax}$$

where;

$T_S$  = LED solder point temperature as shown in the following illustration [°C]

$R_{\theta J-S}$  = thermal resistance from junction to solder point [°C/W]



$T_S$  point - pin 5

$T_S$  can be measured easily by mounting a thermocouple on the soldering joint as shown in illustration above, while  $R_{\theta J-S}$  is provided in the datasheet. User is advised to verify the  $T_S$  of the LED in the final product to ensure that the LEDs are operated within all maximum ratings stated in the datasheet.

### 5. Eye safety precautions

LEDs may pose optical hazards when in operation. It is not advisable to view directly at operating LEDs as it may be harmful to the eyes. For safety reasons, use appropriate shielding or personal protective equipments.

### 6. Disclaimer

Avago's products are not specifically designed, manufactured or authorized for sale as parts, components or assemblies for the planning, construction, maintenance or direct operation of a nuclear facility or for use in medical devices or applications. Customer is solely responsible, and waives all rights to make claims against Avago or its suppliers, for all loss, damage, expense or liability in connection with such use.

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