ASMB-TTB2-0C3A2

Tall Black Surface PLCC6 Tricolor LED

Data Sheet

Description

This family of SMT LEDs are in a PLCC-6 package with a separate heat path for each LED device, enabling it to be driven at a higher current. The full black plastic housing with white inner reflector provides good contrast without compromising brightness.

A typical viewing angle of 115°, together with a closely matched radiation pattern along the package's X-axis, make these LEDs suitable for full color display application.

These LEDs are compatible with the reflow soldering process. For easy pick and place, the LEDs are shipped in tape and reel. Every reel is shipped from a single intensity and color bin except for the red color for better uniformity.

CAUTION These LEDs are ESD-sensitive. Please observe appropriate precautions during handling and processing. Refer to Avago Application Note AN-1142 for additional details.

CAUTION Customers are advised to keep the LED in the MBB when not in use, because prolonged exposure to the environment might cause the silver-plated leads to tarnish, which might cause difficulties in soldering.

Features

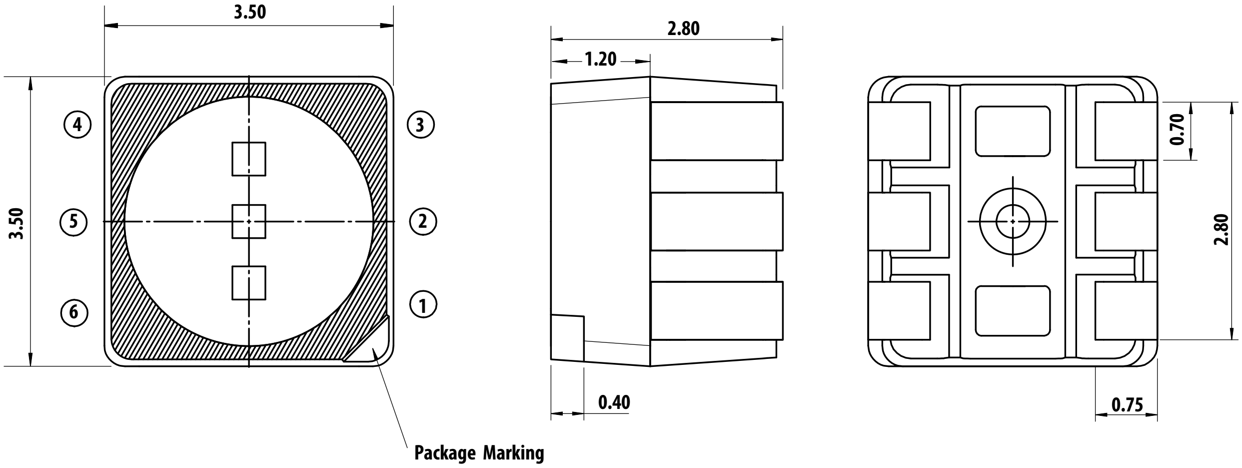
- Standard PLCC-6 package (Plastic Leaded Chip Carrier)
- LED package with diffused encapsulation
- Tall package (enable LED lead potting)
- AlInGaP and InGaN dice technologies
- Typical viewing angle at 115°
- Compatible with the reflow soldering process
- JEDEC MSL 4
- Enhanced corrosion resistance
- Water resistance (IPx6* and IPx8) per IEC 60529:2001

  * The test is conducted on the component level by mounting the components on PCB with potting to protect the leads. Customers should perform the necessary tests on the components for their final applications.

Applications

- Full color display

Package Dimensions



NOTE

1. All dimensions in millimeters (mm).
2. Unless otherwise specified, tolerance is ± 0.20 mm.
3. Terminal finish = silver plating.

Lead Configuration

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

Absolute Maximum Ratings, T_J = 25 °C

Parameter	Red	Green and Blue	Unit
DC Forward Current [a]	50	30	mA
Peak Forward Current[b]	100	100	mA
Power Dissipation	130	105	mW
Maximum Junction Temperature T_{jmax}	110		°C
Operating Temperature Range	–40 to +100		°C
Storage Temperature Range	–40 to +100		°C

a. Derate linearly as shown in Figure 7 to Figure 10.

b. Duty Factor 10%, frequency = 1 kHz.

Optical Characteristics (T_J = 25 °C)

Color	Luminous Intensity, I_V (mcd) @I_F = 20 mA[a]			Dominant Wavelength, λd (nm) @I_F = 20 mA[b]			Peak Wavelength, λP (nm) @I_F = 20 mA	Viewing Angle, 2θ½ (°)[c]
	Min	Typ	Max.	Min	Typ	Max	Typ.	Typ
Red	560	790	1125	618	621	628	635	115
Green	1400	2000	2850	523	529	535	521	115
Blue	285	380	560	465	470	473	464	115

a. The luminous intensity Iv is measured at the mechanical axis of LED package and it is tested in pulsing condition. The actual peak of the spatial radiation pattern may not be aligned with the axis.

b. The dominant wavelength is derived from the CIE Chromaticity Diagram and represents the perceived color of the device.

c. θ½ is the off axis angle where the luminous intensity is ½ the peak intensity.

Electrical Characteristics (T_J = 25 °C)

Color	Forward Voltage, V_F (V) @I_F = 20 mA[a]			Reverse Voltage, V_R (V) @I_R = 100 µA[b]		Reverse Voltage, V_R (V) @I_R = 10 µA[b]	Thermal Resistance $R_{θJ-S}$ (°C/W)
				1 chip on	3 chips on		
	Min	Typ	Max.	Min.	Min.	Typ.	Typ
Red	1.8	2.1	2.5	4	—	320	320
Green	2.7	3.0	3.4	—	4	320	320
Blue	2.7	3.0	3.4	—	4	320	320

a. Tolerance ± 0.1 V.

b. Indicates product final testing condition. Long terns reverse bias is not recommended.

Part Numbering System

A	S	M	B	-	T	T	B	2	-	0	C	3	A	2
							x1				x2	x3	x4	x5

Code	Description	Option		
x1	Package type	B	Black surface	
x2	Minimum intensity bin	C	Red: bin U2 Green: bin W2 Blue: bin T1	Red: bin U2,V1,V2 Green: bin W2,X1,X2 Blue: bin T1,T2,U1
x3	Number of intensity bins	3	3 intensity bins from minimum	
x4	Color bin combination	A	Red: full distribution Green: bin E,A,B Blue: bin A,B,C	
x5	Test option	2	Test current = 20 mA	

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
X2	2240	2850

Tolerance ± 12%.

Color Bins (BIN) – Green

Bin ID	Dominant Wavelength (nm)		Chromaticity Coordinate (for Reference)	
	Min.	Max.	Cx	Cy
E	523.0	529.0	0.0979	0.8316
			0.1685	0.6821
			0.2027	0.6673
			0.1468	0.8104
A	526.0	532.0	0.1223	0.8228
			0.1856	0.6759
			0.2192	0.6576
			0.1701	0.7965
B	529.0	535.0	0.1468	0.8104
			0.2027	0.6673
			0.2350	0.6471
			0.1929	0.7816

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

Tolerance ± 1 nm.

Figure 1 Relative Intensity vs. Wavelength

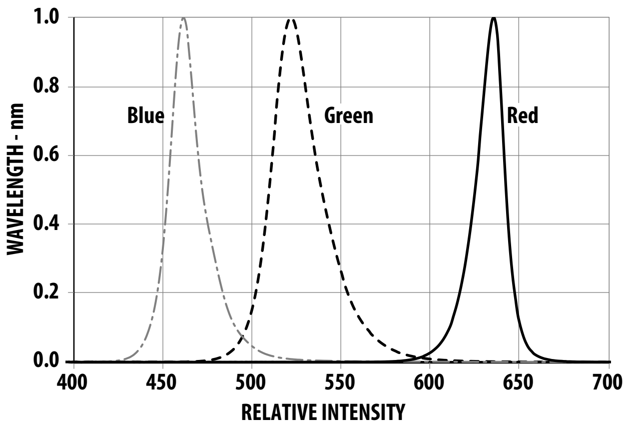


Figure 2 Forward Current vs. Forward Voltage

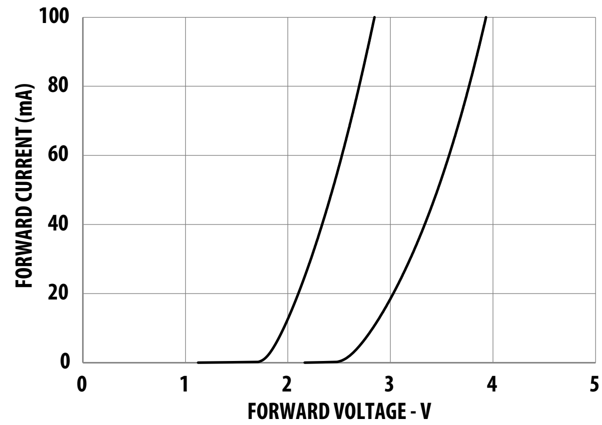


Figure 3 Relative Intensity vs. Forward Current

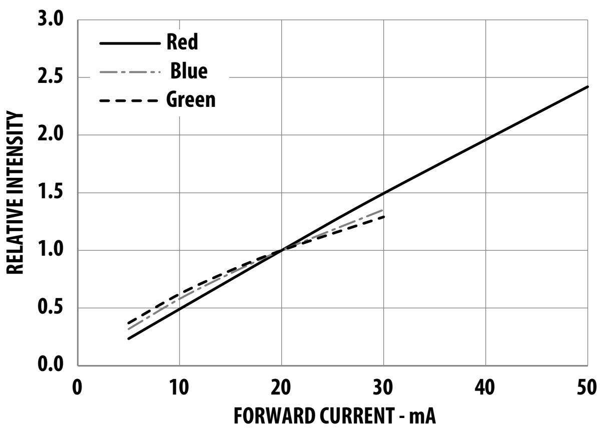


Figure 4 Dominant Wavelength Shift vs. Forward Current

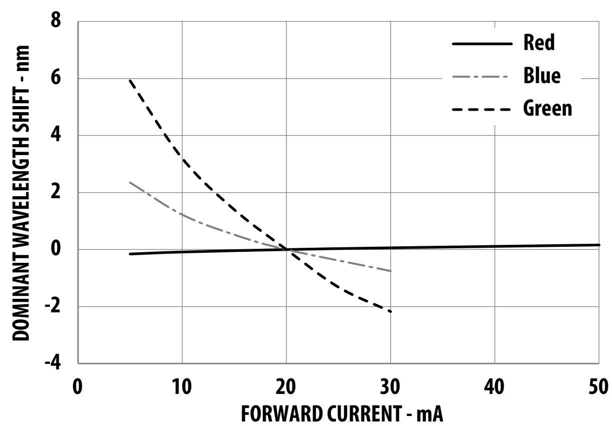


Figure 5 Relative Intensity vs. Junction Temperature

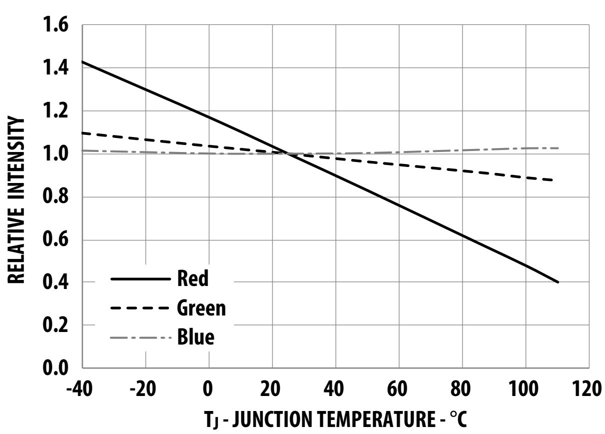


Figure 6 Forward Voltage vs. Junction Temperature

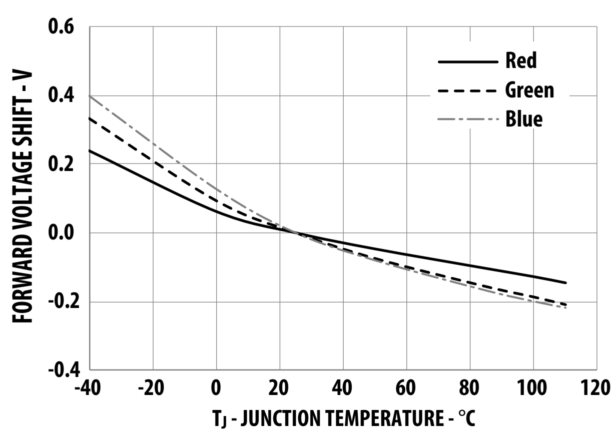


Figure 7 Maximum Forward Current vs. Temperature for Red (1 Chip On)

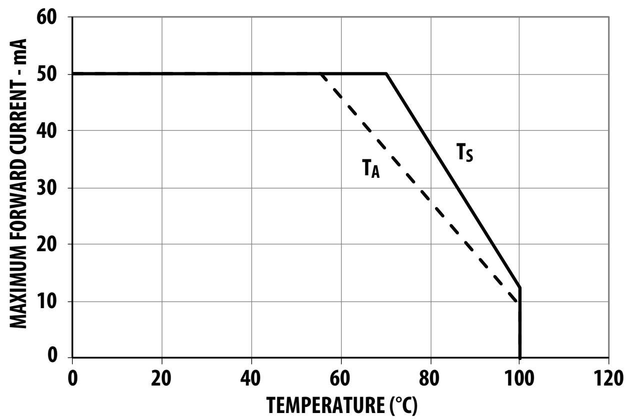


Figure 8 Maximum Forward Current vs. Temperature for Red (3 Chips On)

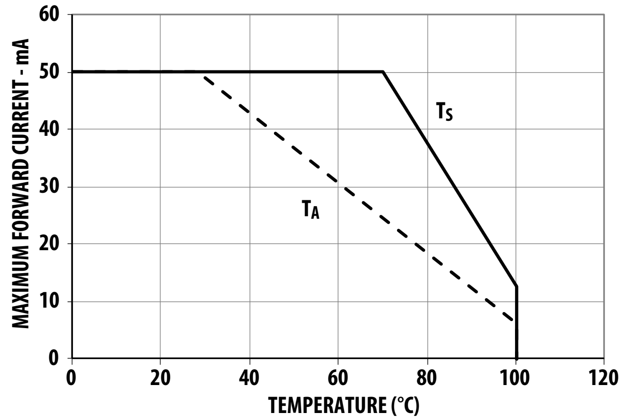


Figure 9 Maximum Forward Current vs. Temperature for Green and Blue (1 Chip On)

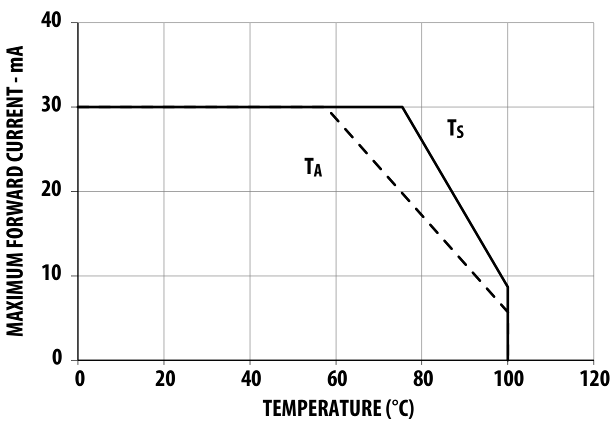
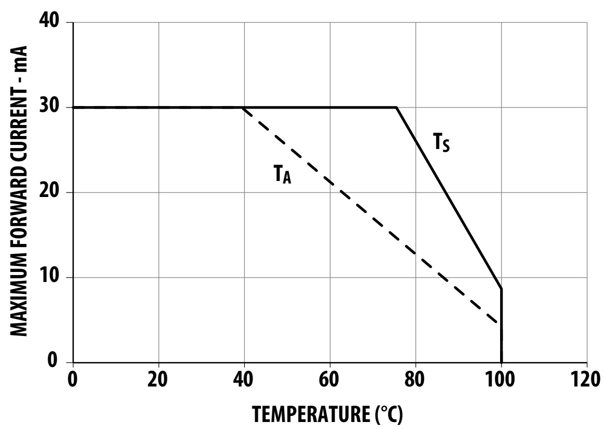


Figure 10 Maximum Forward Current vs. Temperature for Green and Blue (3 Chips On)



NOTE Maximum forward current graphs based on the ambient temperature, T_A are with reference to the thermal resistance $R_{\theta J\text{-}A}$ as follows. For more details, see Precautionary Notes (4).

Condition	Thermal Resistance from LED Junction to Ambient, $R_{\theta J\text{-}A}$ (°C/W)	
	Red	Green & Blue
1 chip on	437	485
3 chips on	654	654

Figure 11 Radiation Pattern for along X-Axis of the Package

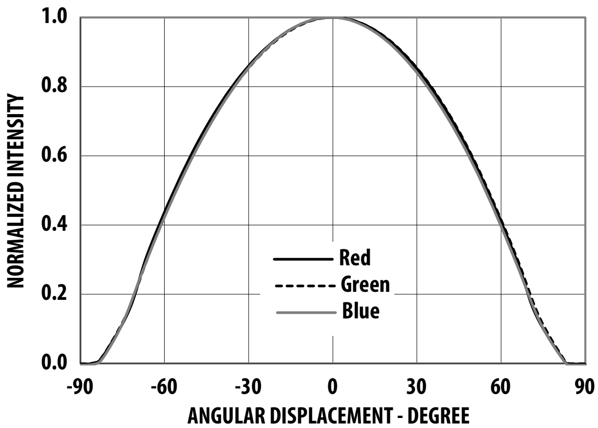


Figure 12 Radiation Pattern along Y-Axis of the Package

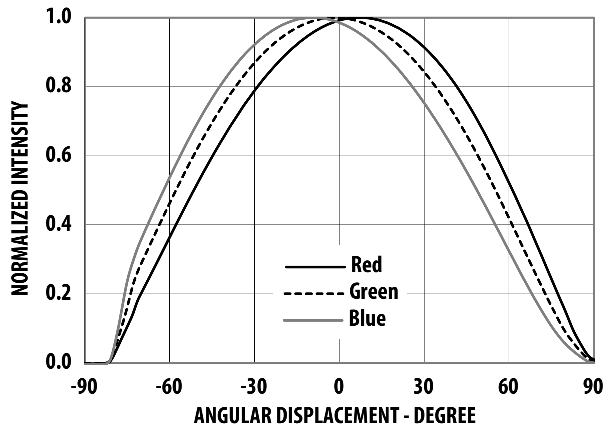


Figure 13 Illustration of Package Axis for Radiation Pattern

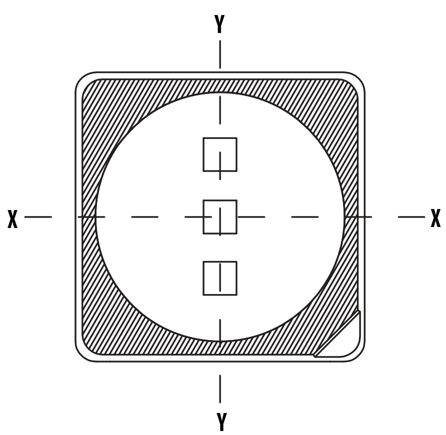


Figure 14 Recommended Soldering Land Pattern

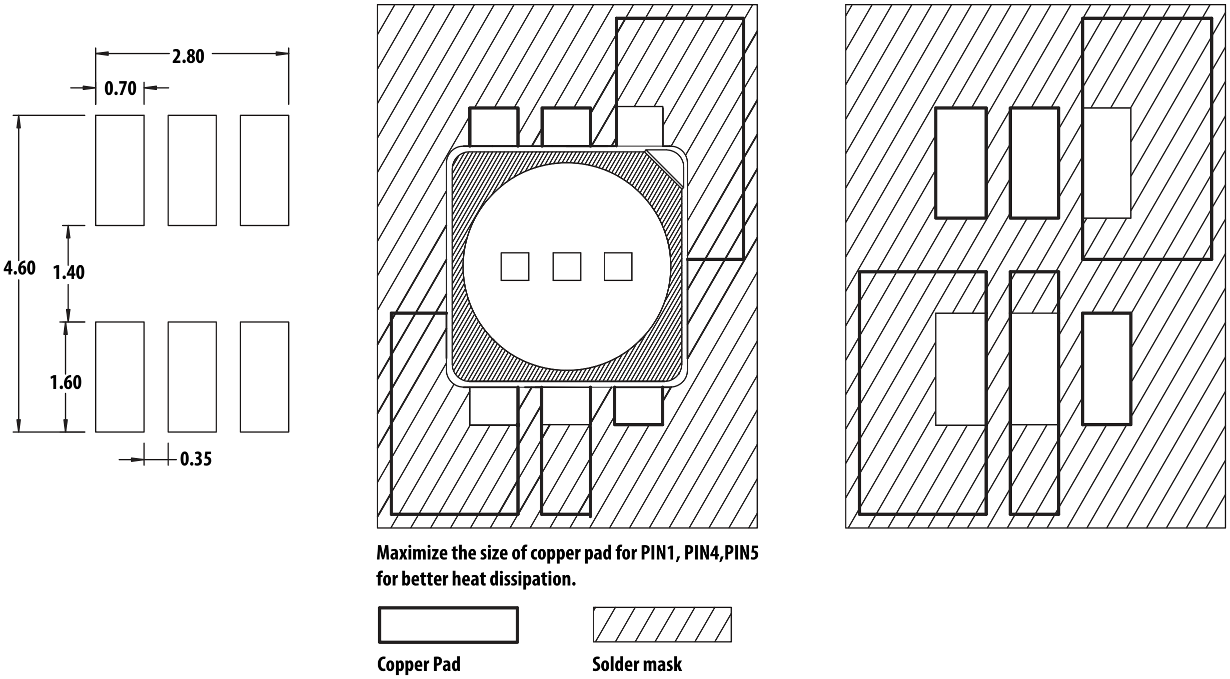


Figure 15 Carrier Tape Dimension

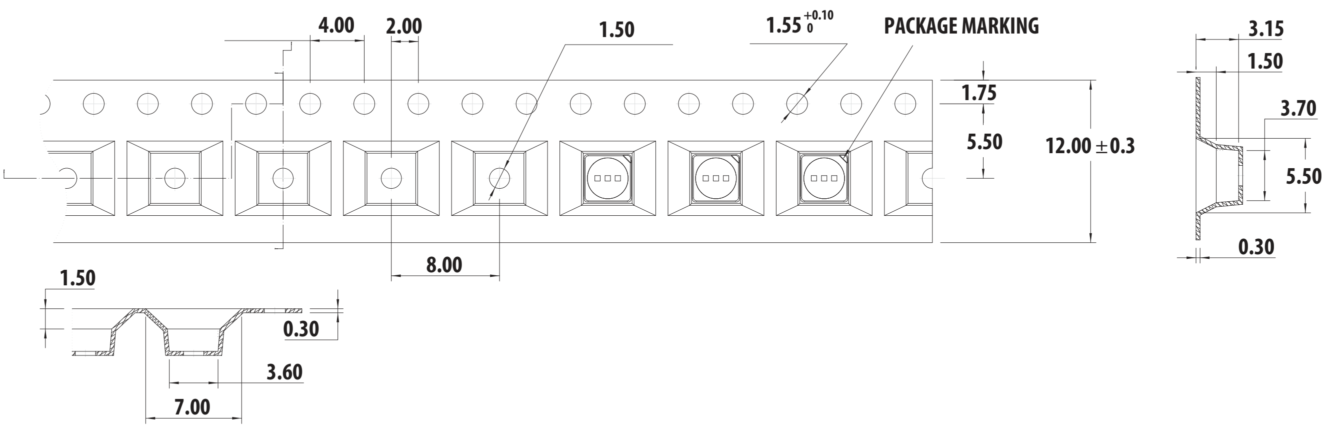


Figure 16 Reeling Orientation

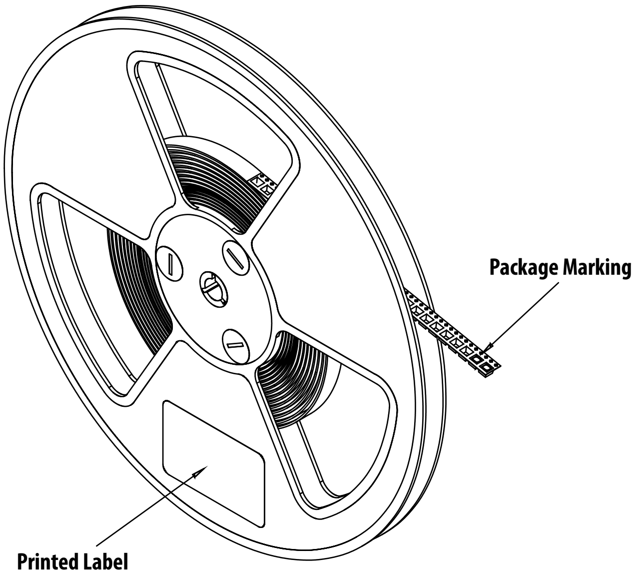
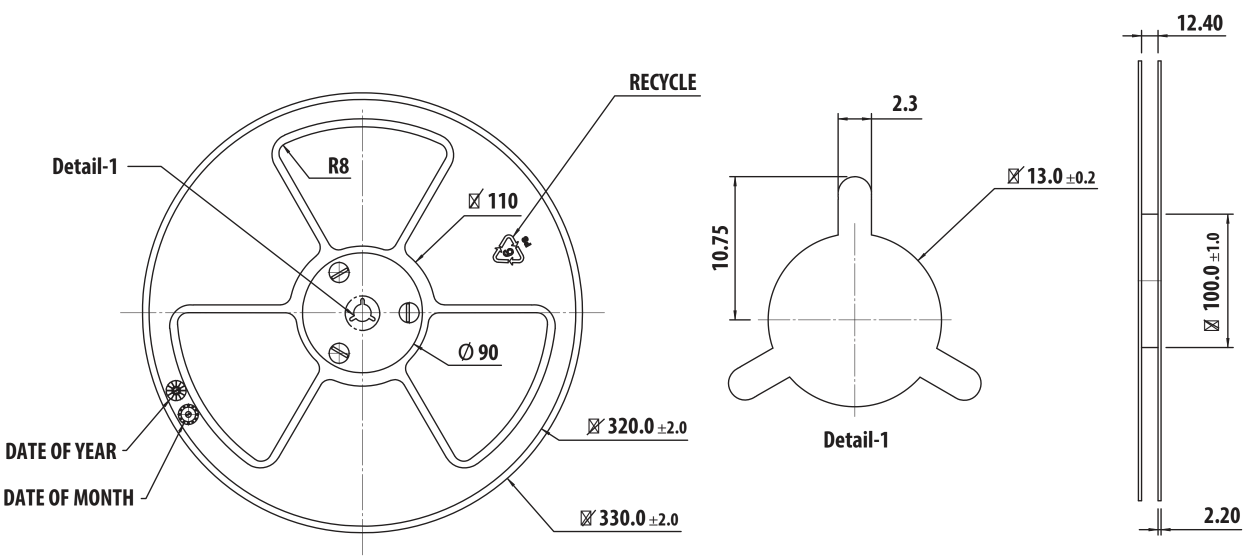


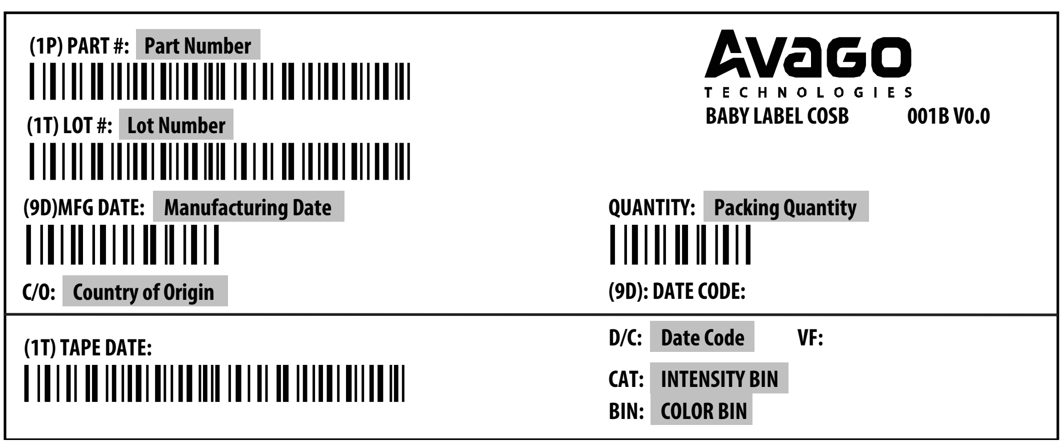
Figure 17 Reel Dimension



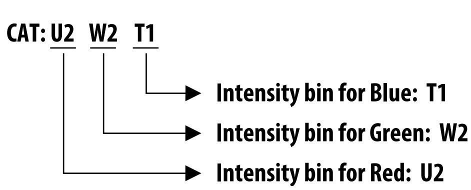
Packing Label

(i) Standard Label (Attached on Moisture Barrier Bag)

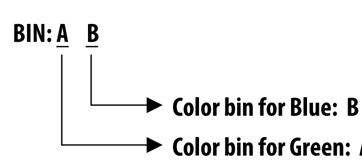
(ii) Baby Label (Attached on Plastic Reel)



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



Example of color bin information on label:

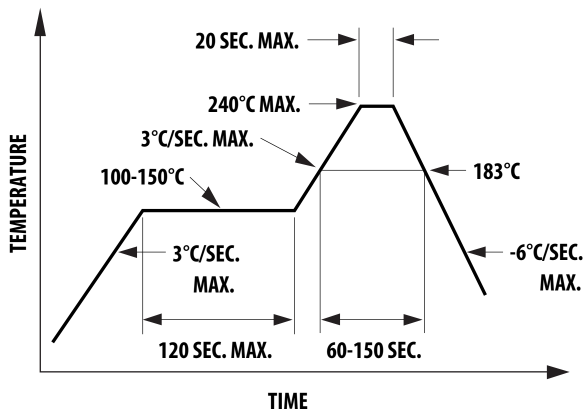


NOTE There is no color bin ID for Red color because there is only 1 range as stated in Table 4.

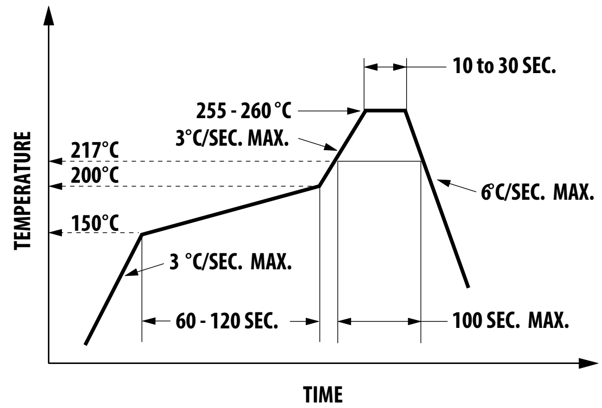
Soldering

Recommended reflow soldering condition:

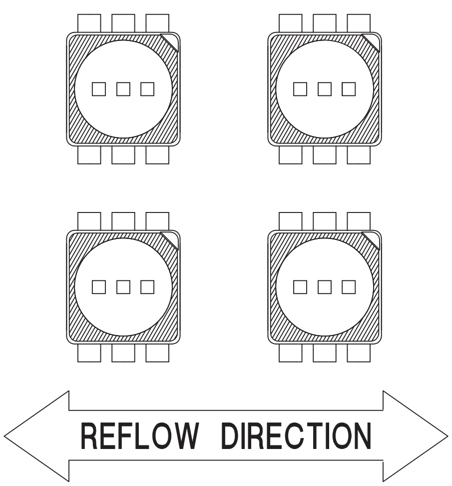
(i) Leaded reflow soldering



(ii) Lead-free reflow soldering



1. Do not perform reflow soldering more than two times. Make sure you take the necessary precautions for handling a moisture-sensitive device, as stated in the following section.
2. The recommended board reflow direction follows.



3. Do not apply any pressure or force on the LED during reflow and after reflow when the LED is still hot.
4. You should 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 = 3 sec maximum.
   - Number of cycles = 1 only
   - Power of soldering iron = 50 W maximum.
5. Do not touch the LED body with a hot soldering iron except the soldering terminals because it might cause damage to the LED.
6. For de-soldering, you should use a double flat tip.
7. Confirm beforehand whether the functionality and performance of the LED is affected by hand soldering.

Precautionary Notes

1. Handling precautions

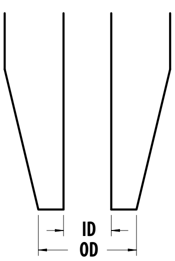
a. Do not poke sharp objects into the encapsulant. Sharp objects, such as tweezers or syringes, might apply excessive force or even pierce through the encapsulant and induce failures to the LED die or wire bond.

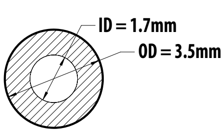
b. Do not touch the encapsulant. Uncontrolled force acting on the encapsulant might result in excessive stress on the wire bond. Hold the LED only by the body.

c. Do not stack assembled PCBs together. Use an appropriate rack to hold the PCBs.

d. To remove foreign particles on the surface of the encapsulant, use a cotton bud with isopropyl alcohol (IPA). During cleaning, rub the surface gently without applying too much pressure. Ultrasonic cleaning is not recommended.

e. For automated pick and place, Avago has tested the following nozzle size 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, customers should verify that the selected nozzle will not damage the LED.





2. Handling of moisture-sensitive device

This product has a Moisture Sensitive Level 4 rating per JEDEC J-STD-020. Refer to Avago Application Note AN5305, *Handling of Moisture Sensitive Surface Mount Devices*, for additional details and a review of proper handling procedures.

a. 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.
- The MBB should not be opened prior to assembly (e.g., for IQC).

b. Control after opening the MBB:
- Read the humidity indicator card (HIC) immediately upon opening the MBB.
- Keep the LEDs at < 30 °C / 60% RH at all times. All high-temperature-related processes, including soldering, curing, or rework, must be completed within 72 hours.

c. Control for unfinished reel:
- Unused LEDs must be stored in a sealed MBB with desiccant or desiccator at < 5% RH.

d. 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 72 hours.

e. 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 72 hrs.

The recommended baking condition is: 60 °C ±5 °C for 24 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, keep unused LEDs in a sealed MBB with desiccant or in desiccator at <5% RH.

3. Application precautions

a. 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.

b. LEDs exhibit slightly different characteristics at different drive currents, which might result in larger performance variations (i.e., intensity, wavelength, and forward voltage). You should set the application current as close as possible to the test current to minimize these variations.

c. The LED is not intended for reverse bias. Use other appropriate components for such purposes. When driving the LED in matrix form, you must ensure that the reverse bias voltage does not exceed the allowable limits of the LED.

d. This LED is designed to have enhanced gas corrosion resistance. Its performance has been tested according to the following specific conditions:

- IEC 60068-2-43: 25 °C / 75% RH, H_2S 15 ppm, 21 days
- IEC 60068-2-42: 25 °C / 75% RH, SO_2 25 ppm, 21 days
- IEC 60068-2-60: 25 °C / 75% RH, SO_2 200 ppb, NO_2 200 ppb, Cl_2 10 ppb, 21 days

As actual application conditions might not be exactly similar to the test conditions, you should verify that the LED will not be damaged by prolonged exposure in the intended environment.

e. Avoid rapid change in ambient temperature, especially in high humidity environments, because this will cause condensation on the LED.

f. Although the LED is rated as IPx6 and IPx8 according to IEC60529: the degree of protection provided by enclosure, the test condition might not represent actual exposure during application. If the LED is intended to be used in an outdoor or a harsh environment, protect the LED against damage 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 the allowable limit at all times. T_J can be calculated as follows.

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

where:

T_A = ambient temperature (°C)

$R_{\theta J\text{-}A}$ = 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 $R_{\theta J\text{-}A}$. Actual T_A is sometimes subjective and hard to determine. $R_{\theta J\text{-}A}$ varies from system to system depending on design and is usually not known.

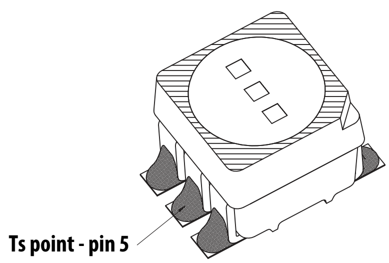
Another way of calculating T_J is by using the solder point temperature T_S as follows.

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

where:

T_S = LED solder point temperature as shown in the following illustration (°C)

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



Measure T_S by mounting a thermocouple on the soldering joint as shown in the preceding illustration, while $R_{\theta J\text{-}S}$ is provided in the data sheet. You should 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 data sheet.

5. Eye safety precautions

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

For product information and a complete list of distributors, please go to our web site: www.avagotech.com

AV02-4698EN – April 19, 2016

Lead (Pb) Free
RoHS 6 fully compliant