Data Sheet

ASMB-6WD0/ASMB-6WZ0

RGBW Thin DFN6 LED

Description

The Broadcom® ASMB-6WD0/6WZ0 is a tricolor LED in thin DFN6 packaging. It is designed with six separate leads enabling higher flexibility in circuitry design for the control of individual color. This LED offers high reliability, high intensity light output and a wide viewing angle making it ideally suited for amusement and pachinko machine application.

For easy pick and place, the LEDs are shipped in tape and reel form. Each reel is shipped from a single intensity and color bin to provide better intensity and color uniformity. These tricolor LEDs are compatible with reflow soldering process.

Features

- Diffused encapsulation for uniform light up appearance
- High brightness using AlInGaP and InGaN die technology
- Wide viewing angle
- Compatible with reflow soldering process
- Binned in White color for superior color uniformity
- With or without ESD protection

Applications

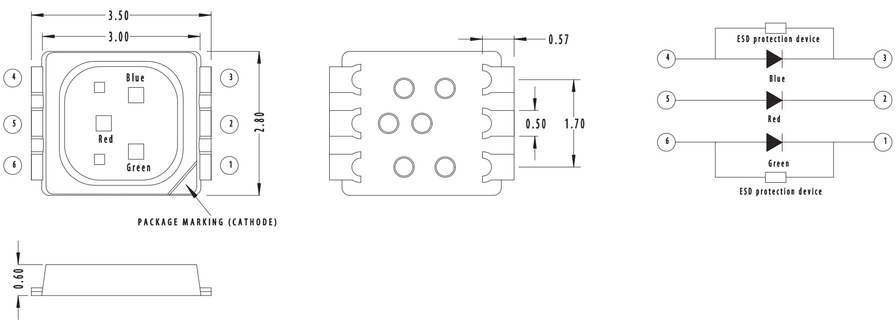
- Amusement lighting
- Decorative lighting
- Audio system illumination
- Gaming machine

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

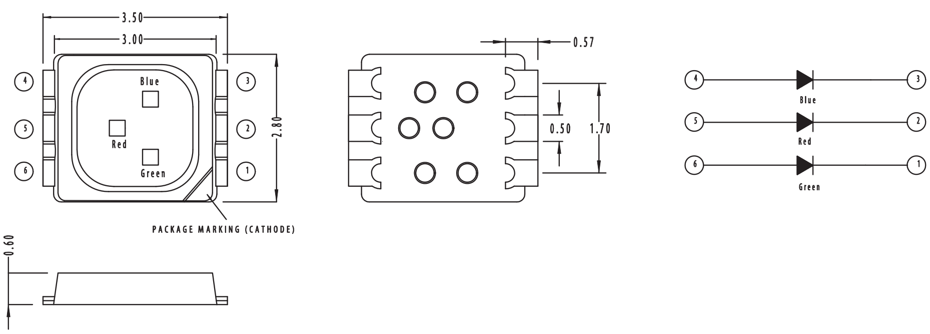
CAUTION! It is advised that LEDs are kept in the moisture barrier bag (MBB) when not in use, as prolonged exposure to the environment might cause the silver-plated leads to tarnish, which might cause difficulties in soldering.

Package Dimensions

With ESD Protection



Without ESD Protection



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

NOTE:

1. All dimensions are in millimeter (mm).
2. Unless otherwise specified, tolerance is ±0.2 mm.
3. Encapsulation = silicone.
4. Terminal finish = silver plating.

Device Selection Guide

Part Number	ESD Protection
ASMB-6WD0-0A101	Without ESD protection
ASMB-6WZ0-0A101	With ESD protection

Absolute Maximum Ratings

Parameter	Red	Green and Blue	Units
DC forward current	50	30	mA
Peak forward current[a]	100	100	mA
Power dissipation	130	111	mW
Reverse voltage	Not recommended for reverse bias		
Junction temperature	100		°C
Operating temperature range	–40 to +85		°C
Storage temperature range	–40 to +100		°C

a. Duty factor = 10%, frequency = 1 kHz.

Optical Characteristics (T_J = 25°C)

Individual Color Light Up

Color	Luminous Intensity, I_V (mcd)[a]			Dominant Wavelength, λd (nm)[b]			Test Current, I_F (mA)
	Min.	Typ.	Max.	Min.	Typ.	Max.	
Red	500	750	1150	618	624	628	20
Green	1000	1800	2400	520	524	530	
Blue	220	340	500	462	466	472	

a. The luminous intensity I_V is measured at the mechanical axis of LED package and it is tested with single current pulse. 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.

RGB Mix White

Color	Luminous Intensity, I_V (mcd)[a]			Chromaticity Coordinate	Test Current, I_F (mA)
	Min.	Typ.	Max.	Typ.	
Red	1600	1900	2600	0.30, 0.30	14
Green					11
Blue					9

a. The luminous intensity I_V is measured at the mechanical axis of LED package and it is tested with single current pulse. The actual peak of the spatial radiation pattern may not be aligned with the axis.

Electrical Characteristics (T_J = 25°C)

Color	Forward Voltage, V_F (V) at I_F = 20 mA[a]			Reverse Voltage, V_R at 10 µA[b]	Reverse Voltage, V_R at 10 µA[b, c]	Thermal Resistance, $R_{\theta J\text{-}S}$ (°C/W) 1 Chip On	Thermal Resistance, $R_{\theta J\text{-}S}$ (°C/W) 3 Chips On
	Min.	Typ.	Max.	Min.	Min.	Typ.	Typ.
Red	1.8	2.1	2.6	4	4	240	240
Green	2.7	3.0	3.7	4	NA	320	320
Blue	2.7	3.0	3.7	4	NA	320	320

a. Tolerance ± 0.1V.

b. Indicates product final test condition. Long terms reverse bias is not recommended.

c. For part number with ESD protection.

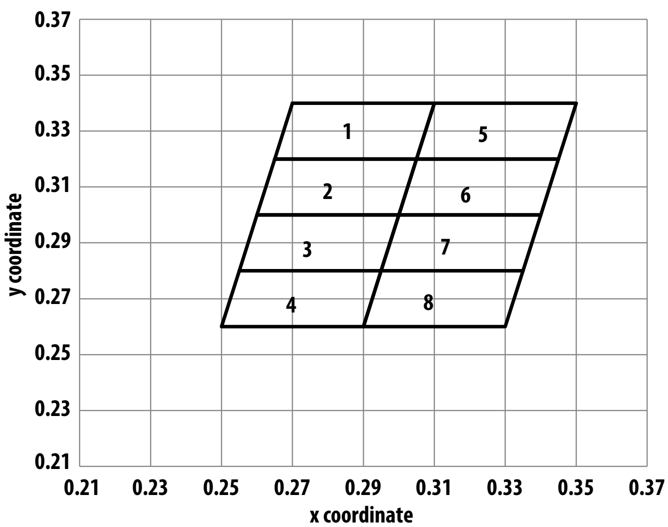
Bin Information

Intensity Bins (CAT)

Bin ID	Luminous Intensity (mcd)	
	Min.	Max.
A	1600	2600

Tolerance: ±12%

Chromaticity Diagram



White Color Bins (BIN)

Bin ID	Chromaticity Coordinate	
	Cx	Cy
1	0.270	0.340
	0.265	0.320
	0.305	0.320
	0.310	0.340
2	0.265	0.320
	0.260	0.300
	0.300	0.300
	0.305	0.320
3	0.260	0.300
	0.255	0.280
	0.295	0.280
	0.300	0.300
4	0.255	0.280
	0.250	0.260
	0.290	0.260
	0.295	0.280
5	0.310	0.340
	0.305	0.320
	0.345	0.320
	0.350	0.340
6	0.305	0.320
	0.300	0.300
	0.340	0.300
	0.345	0.320
7	0.300	0.300
	0.295	0.280
	0.335	0.280
	0.340	0.300
8	0.295	0.280
	0.290	0.260
	0.330	0.260
	0.335	0.280

Performance

Figure 1: Relative Intensity vs Wavelength

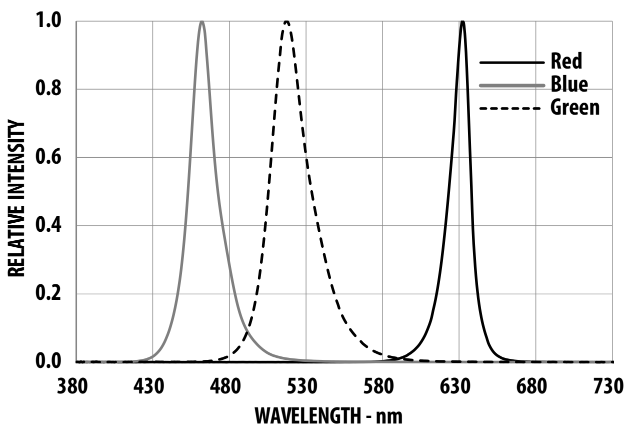


Figure 2: Forward Current vs Forward Voltage

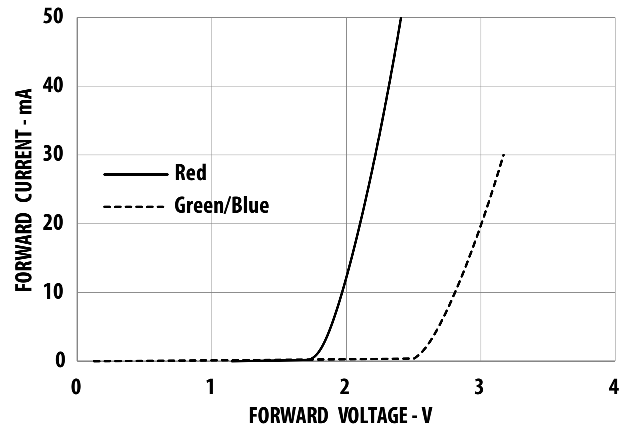


Figure 3: Relative Intensity vs Forward Current

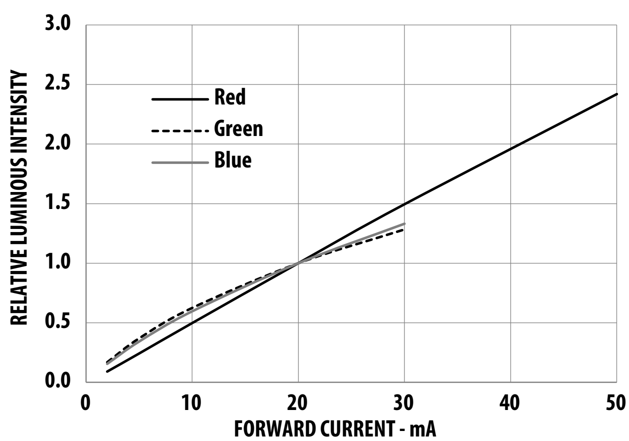


Figure 4: Dominant Wavelength Shift vs Forward Current

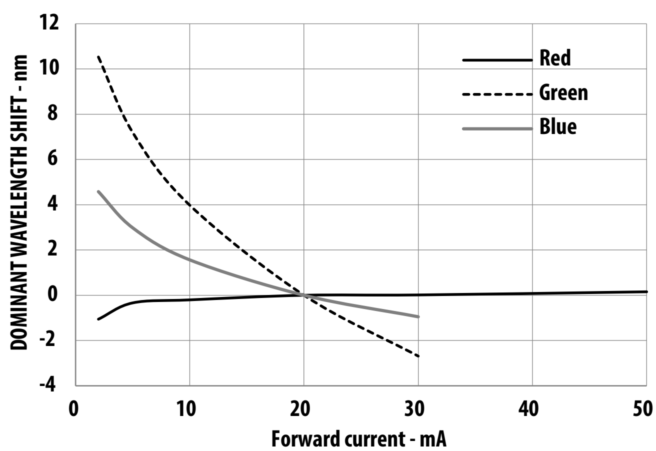


Figure 5: Relative Intensity vs Junction Temperature

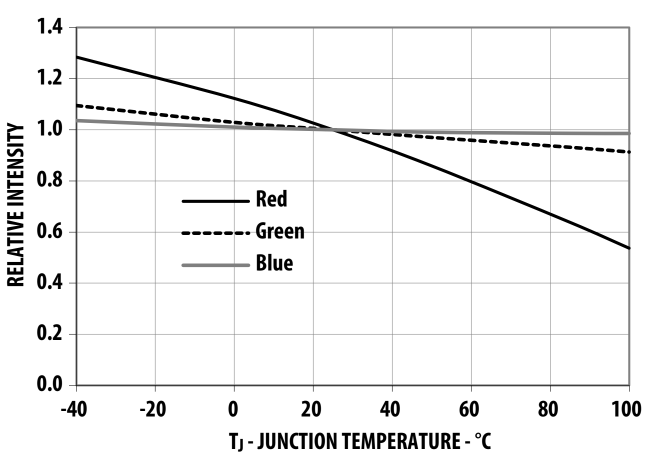


Figure 6: Forward Voltage vs Junction Temperature

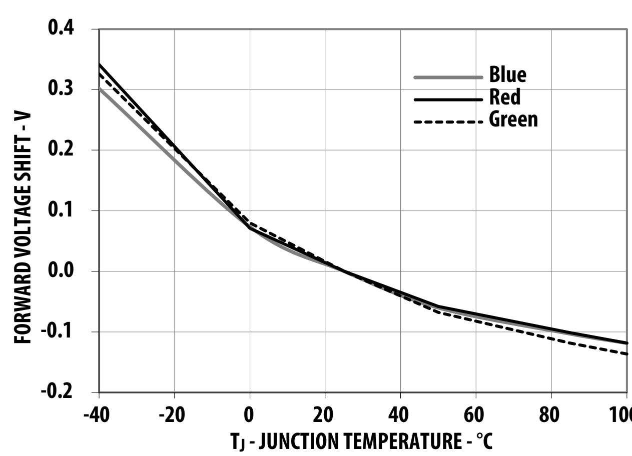


Figure 7: Maximum Forward Current vs Temperature for Red (1 Chip On)

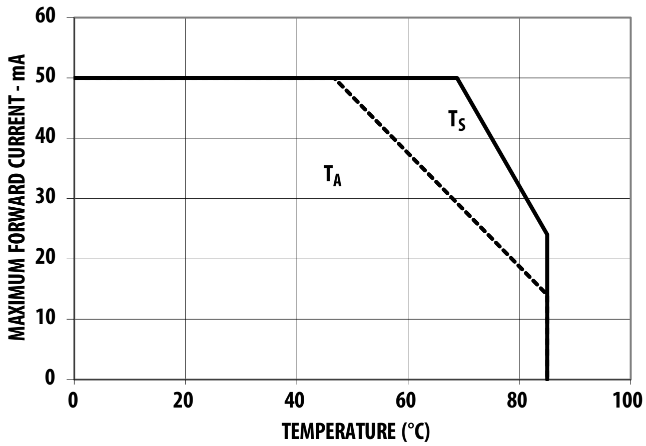


Figure 8: Maximum Forward Current vs Temperature for Red (3 Chips On)

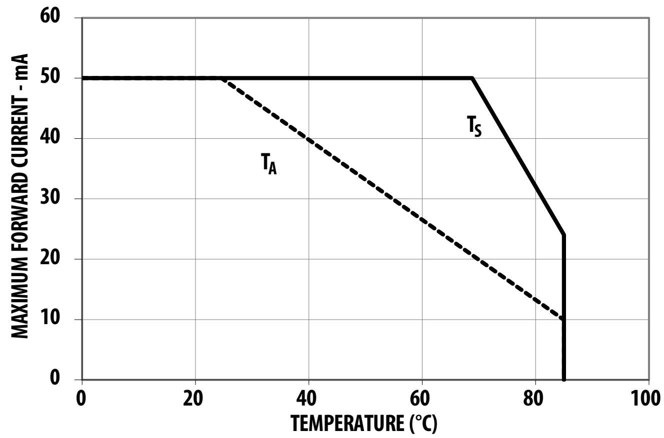


Figure 9: Maximum Forward Current vs Temperature for Green and Blue (1 Chip On)

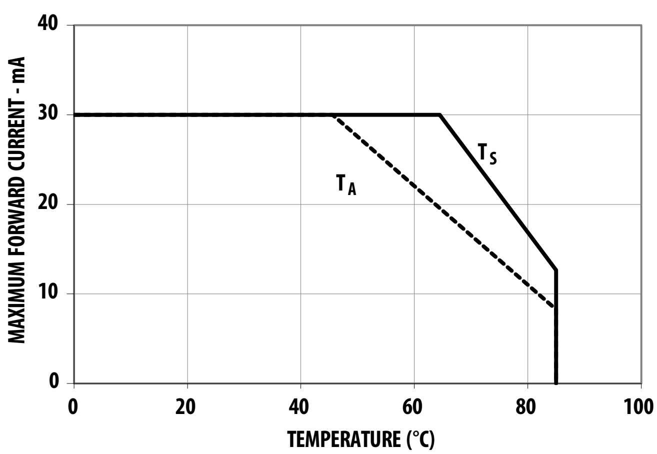
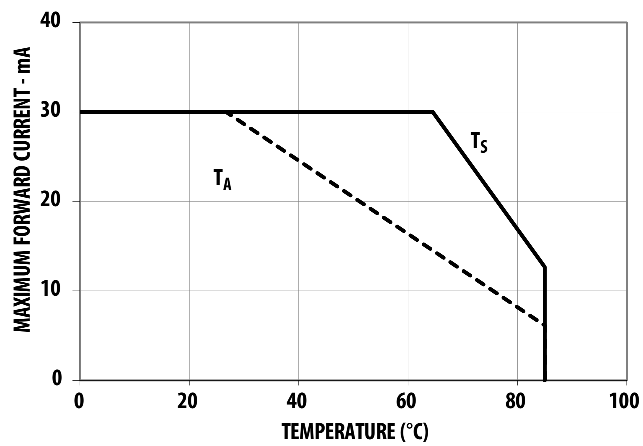


Figure 10: Maximum Forward Current vs Temperature for Green and Blue (3 Chips On)



NOTE: Maximum forward current graphs based on ambient temperature, T_A, are with reference to thermal resistance, $R_{\theta J\text{-}A}$, below.

Condition	Thermal Resistance from LED Junction to Ambient, $R_{\theta J\text{-}A}$ (°C/W)	
	Red	Green / Blue
1 chip on	410	490
3 chips on	580	660

Figure 11: Radiation Pattern along X-axis of the Package

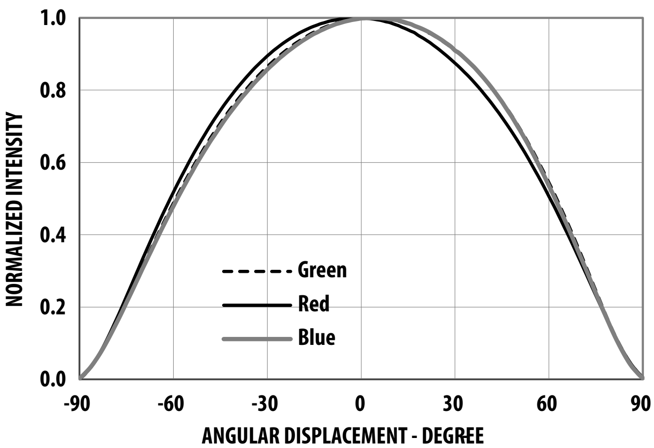


Figure 12: Radiation Pattern along Y-axis of the Package

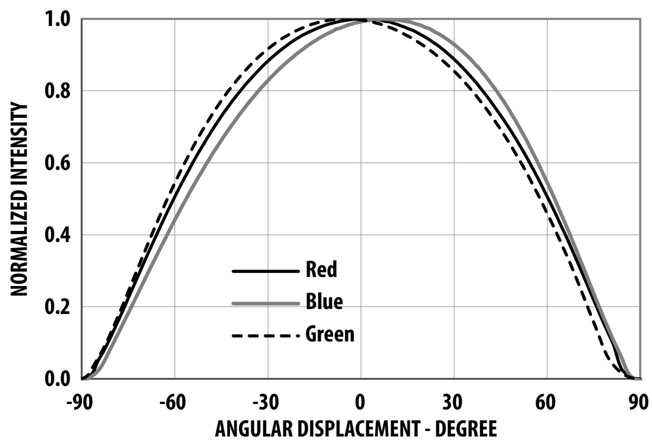


Figure 13: Illustration of Package Axis for Radiation Pattern

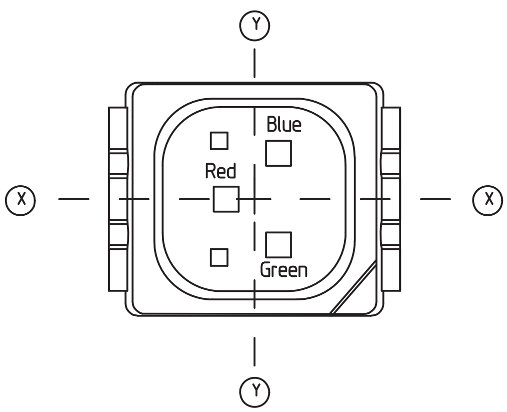
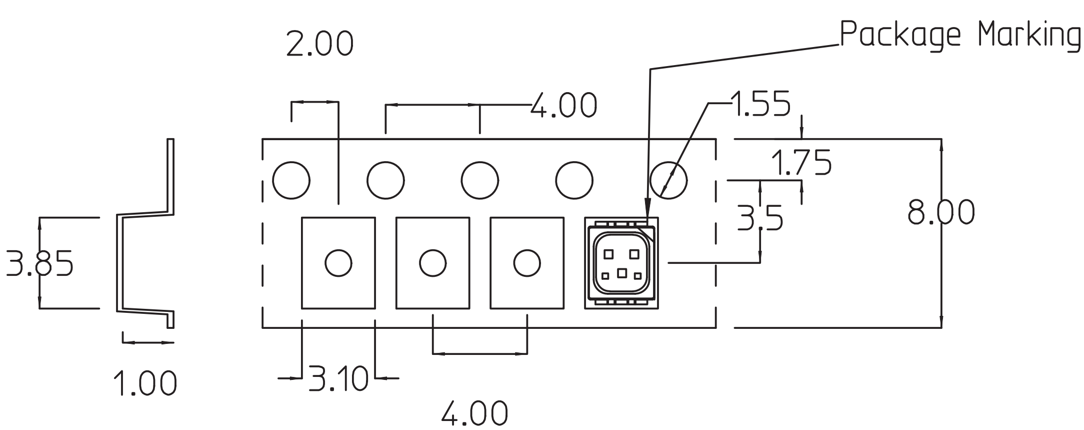


Figure 14: Carrier Tape



NOTE: All dimensions are in mm, tolerance is ±0.20 unless otherwise specified.

Reel Dimensions and Orientation

Figure 15: Reel Dimensions

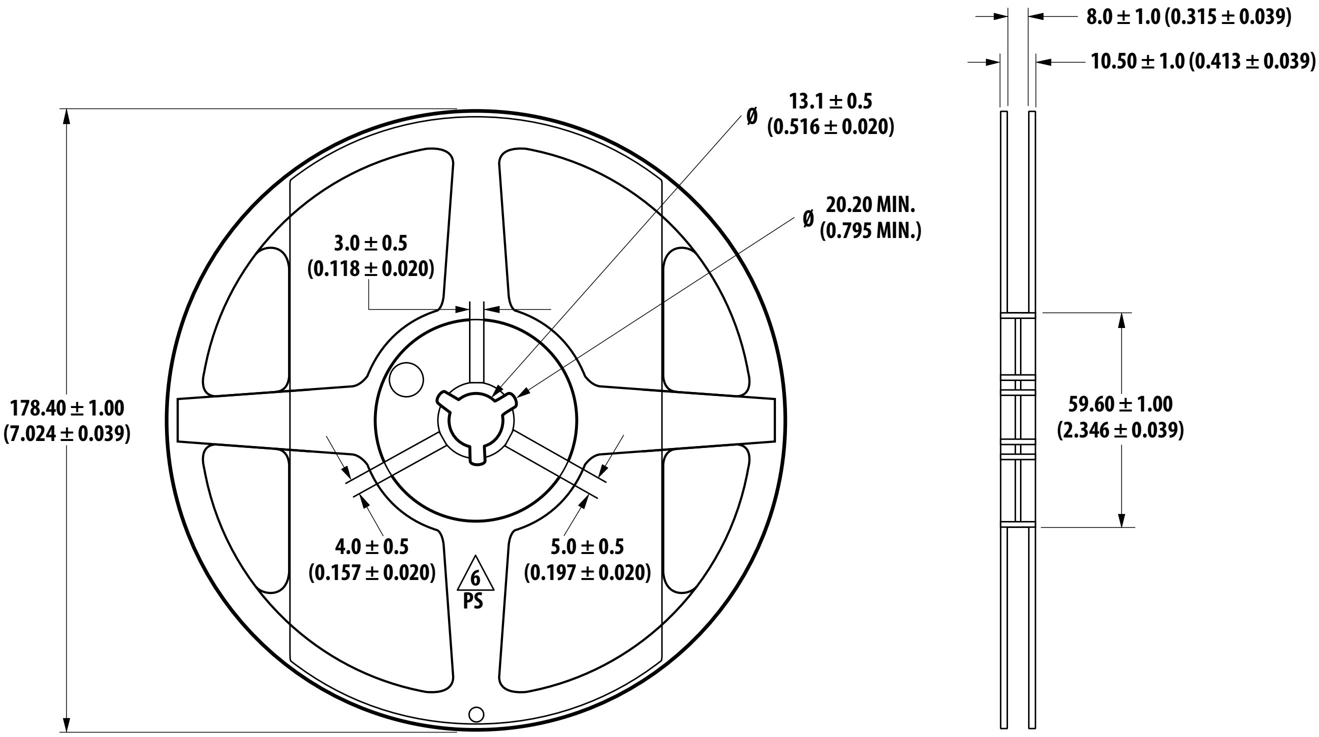
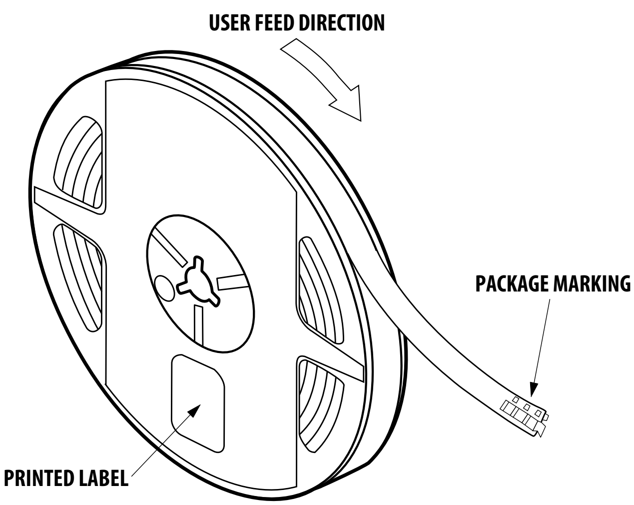


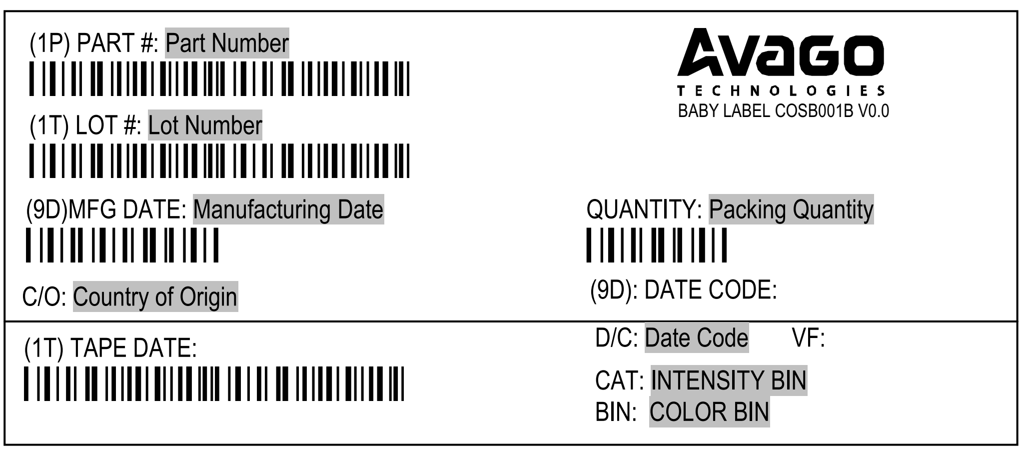
Figure 16: Reeling Orientation



Packing Label

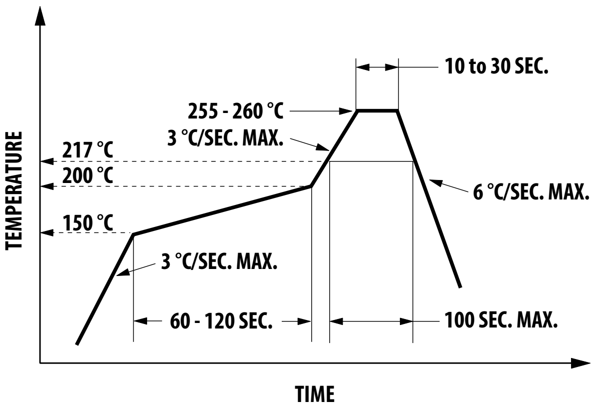
Standard Label (Attached on Moisture Barrier Bag)

Baby Label (Attached on Plastic Reel)

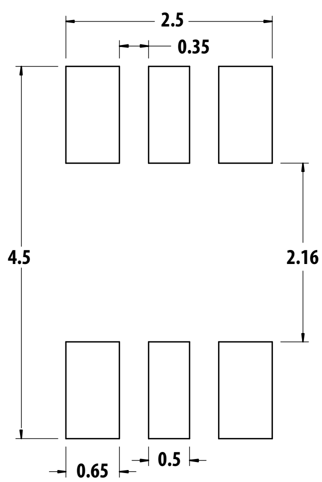


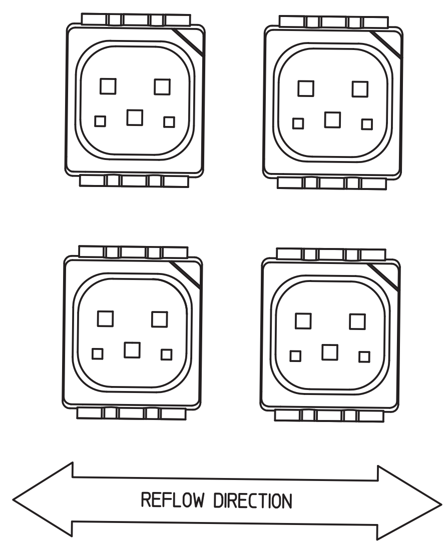
Soldering

Recommended lead free reflow soldering condition.



- Reflow soldering must not be done more than twice. Observe necessary precautions of handling moisturesensitive devices as stated in the following section.
- The recommended land pattern and the recommended board reflow direction are shown in the following figures.



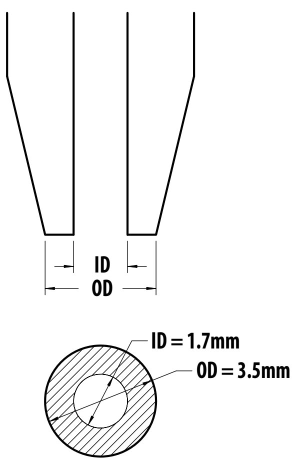


- Do not apply any pressure or force on the LED during reflow and after reflow when the LED is still hot.
- Do not touch the LED body with the hot soldering iron except the soldering terminals because it may cause damage to the LED.
- For de-soldering, use a suitable soldering iron tip.
- Confirm beforehand whether the functionality and performance of the LED is affected by hand soldering.

Precautionary Notes

Handling Precautions

- 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.
- 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.
- Do not stack assembled PCBs together. Use an appropriate rack to hold the PCBs.
- To remove foreign particles on the surface of encapsulant, use a cotton bud with isopropyl alcohol (IPA). During cleaning, rub the surface gently without putting too much pressure. Ultrasonic cleaning is not recommended.
- For automated pick and place, Broadcom has tested he 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, verify that the nozzle selected will not cause damage to the LED.



Handling of Moisture-Sensitive Devices

This product has a Moisture Sensitive Level 4 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, 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 the MBB.
  - Keep the LEDs at <30°C/60% RH at all times and all high-temperature-related processes, including soldering, curing, or rework, must be completed within 72 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, the PCB must be stored 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.
- **Baking is required if:**
  - The HIC indicator is not BLUE at 10% and is PINK at 5%.
  - The LEDs are exposed to conditions of > 30°C/60% RH at any time.
  - The LED floor life exceeded 72 hours.
  - The recommended baking condition is: 60°C ± 5ºC for 24 hours.
  - Perform baking only once.
- **Storage**

  The soldering terminals of these Broadcom LEDs are silver plated. If the LEDs are exposed in an ambient environment for too long, the silver plating might be 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 that 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, ensure that the reverse bias voltage does not exceed the allowable limit of the LED.
- Do not use the LED in the vicinity of material with sulfur content or in environments of high gaseous sulfur compounds and corrosive elements. Examples of material that may contain sulfur are rubber gaskets, RTV (room temperature vulcanizing) silicone rubber, rubber gloves, and so on. Prolonged exposure to such environments may affect the optical characteristics and product life.
- Avoid rapid changes in ambient temperature, especially in high-humidity environments, because this will cause condensation on the LED.
- The number of reflow cycles and reflow temperature conditions used may affect optical characteristics of the LED. Use LEDs with the same number of reflow cycles and same reflow temperature conditions within the same finished good.

Thermal Management

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

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

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]

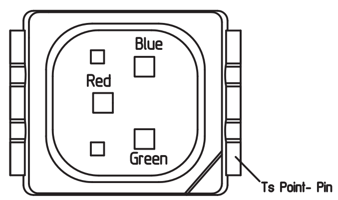
The complication of using this formula lies in T_A and $R_{\theta J\text{-}A}$. Actual T_A is sometimes subjective and hard to determine. $R_{\theta J\text{-}A}$ varies from system to system depending on design and is usually not known.

Another way of calculating T_J is by using 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 illustration below [°C]
$R_{\theta J\text{-}S}$	= Thermal resistance from junction to solder point [°C/W]



T_S can be measured easily by mounting a thermocouple on the soldering joint as shown in the preceding figure, while $R_{\theta J\text{-}S}$ is provided in the data sheet. 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.

Eye Safety Precautions

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