Data Sheet

ASMB-6WN2-0C108

RGB Thin DFN6 LED

Description

The Broadcom® ASMB-6WN2 is a tricolor LED in thin DFN6 packaging. It is designed with six separate leads, which enables higher flexibility in circuit 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 lighting applications.

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 the reflow soldering process.

Features

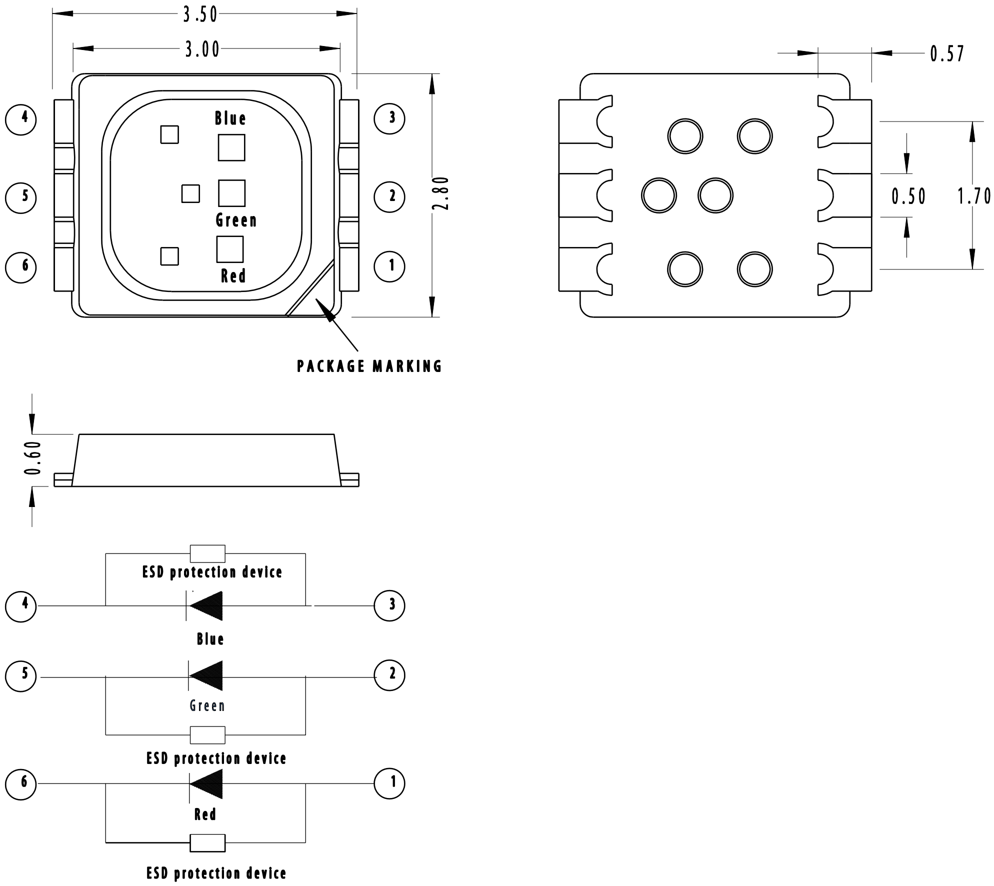
- Diffused encapsulation for uniform light up appearance
- Wide viewing angle
- Binned in white
- Built-in ESD protection device

Applications

- Gaming machines
- Consumer electronics
- White goods

CAUTION! Keep the LED in the moisture barrier bag (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.

Figure 1: Package Drawing



Pin	Configuration
1	Anode Red
2	Anode Green
3	Anode Blue
4	Cathode Blue
5	Cathode Green
6	Cathode Red

NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ±0.20 mm unless otherwise specified.
3. Encapsulation = silicone
4. Terminal finish = silver plating.

Absolute Maximum Ratings

Parameters	Red	Green	Blue	Units
DC Forward Current[a]	30	30	30	mA
Peak Forward Current[b]	100	100	100	mA
Power Dissipation	78	108	108	mW
Reverse Voltage	Not recommended for reverse bias operation			
LED Junction Temperature	100			°C
Operating Temperature Range	–40 to +85			°C
Storage Temperature Range	–40 to +100			°C

a. Derate linearly as shown in Figure 8 and Figure 9.

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

Optical Characteristics

RGB Mix White

Color	Luminous Intensity, I_V (mcd)[a]			Chromaticity Coordinate	Test Current, I_F (mA)
	Min.	Typ.	Max.	Typ.	
Red	1900	2600	3700	0.30, 0.30	19
Green					20
Blue					10

a. The luminous intensity, I_V is measured at the mechanical axis of the package and it is tested with a single current pulse condition. 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 (V) at I_R = 10 µA[b]	Thermal Resistance, $R_{\theta J\text{-}S}$ (°C/W)[c]	
					1 Chip On	3 Chips On
	Min.	Typ.	Max.	Max.	Typ.	Typ.
Red	1.80	2.20	2.60	N/A	300	300
Green	2.60	3.10	3.60	N/A	320	320
Blue	2.60	3.10	3.60	N/A	380	380

a. Forward voltage tolerance is ±0.1V.

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

c. Thermal resistance from LED junction to solder point.

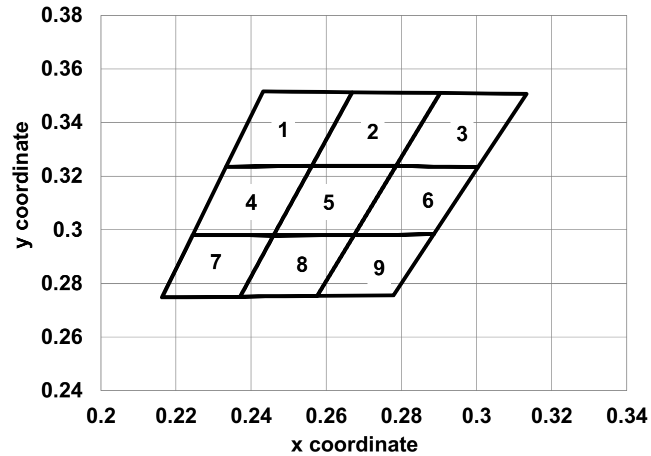
Bin Information

Intensity Bin Limits (CAT)

Bin ID	Luminous Intensity, I_V (mcd)	
	Min.	Max.
C	1900	3700

Tolerance = ±12%.

Chromaticity Diagram



White Color Bins (BIN)

Bin ID	Chromaticity Coordinates	
	x	y
1	0.2333	0.3236
	0.2432	0.3516
	0.2669	0.3513
	0.2561	0.3238
2	0.2561	0.3238
	0.2669	0.3513
	0.2903	0.3511
	0.2786	0.3238
3	0.2786	0.3238
	0.2903	0.3511
	0.3133	0.3508
	0.3004	0.3233
4	0.2245	0.2981
	0.2333	0.3236
	0.2561	0.3238
	0.2460	0.2978
5	0.2460	0.2978
	0.2561	0.3238
	0.2786	0.3238
	0.2674	0.2980

Bin ID	Chromaticity Coordinates	
	x	y
6	0.2674	0.2980
	0.2786	0.3238
	0.3004	0.3233
	0.2887	0.2984
7	0.2163	0.2748
	0.2245	0.2981
	0.2460	0.2978
	0.2371	0.2750
8	0.2371	0.2750
	0.2460	0.2978
	0.2674	0.2980
	0.2576	0.2754
9	0.2576	0.2754
	0.2674	0.2980
	0.2887	0.2984
	0.2779	0.2756

Tolerance = ± 0.01.

Figure 2: Spectral Power Distribution

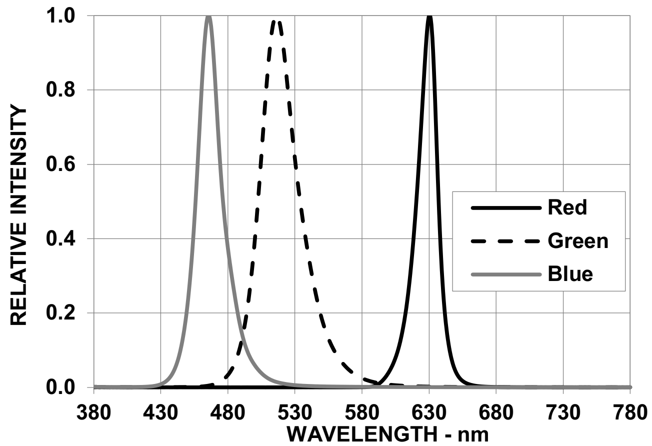


Figure 3: Forward Current vs. Forward Voltage

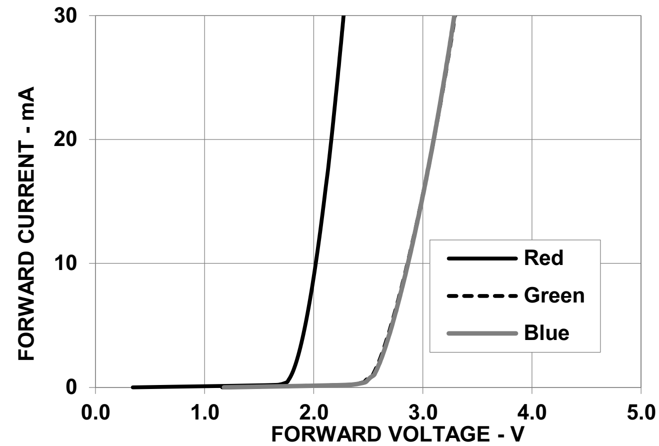


Figure 4: Relative Luminous Intensity vs. Mono Pulse Current

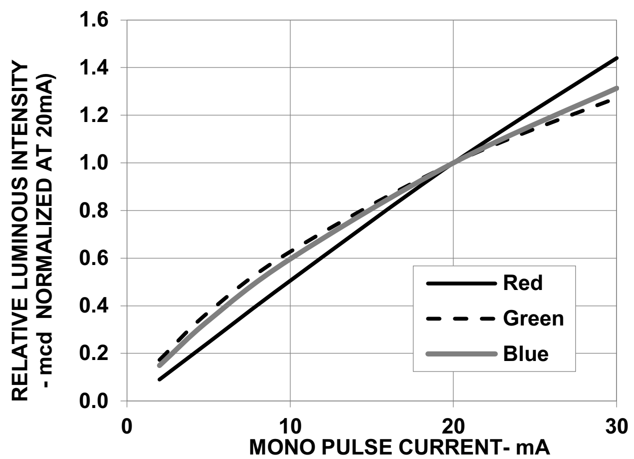


Figure 5: Dominant Wavelength Shift vs. Mono Pulse Current

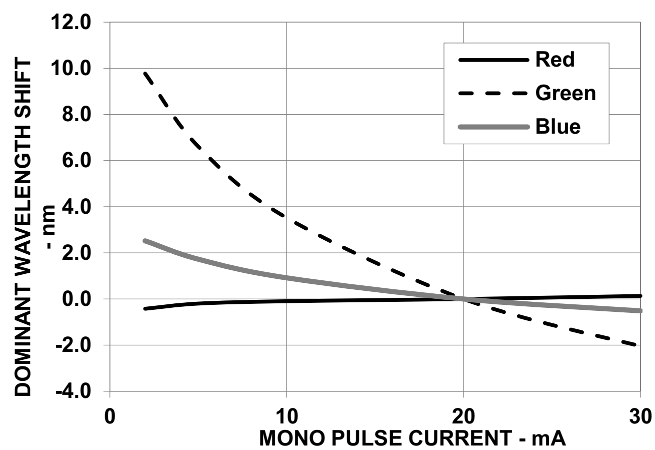


Figure 6: Relative Light Output vs. Junction Temperature

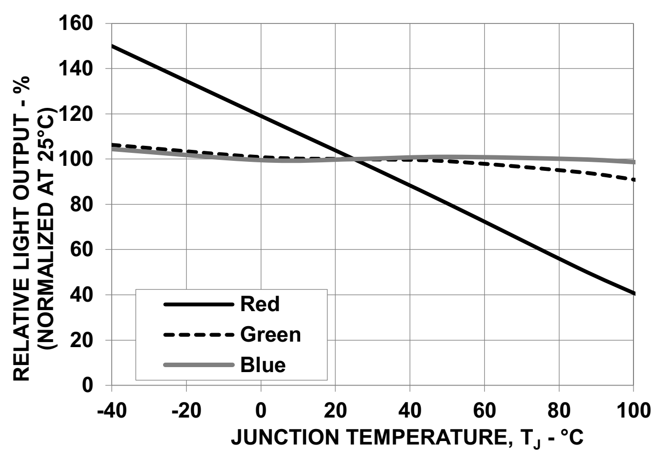


Figure 7: Forward Voltage Shift vs. Junction Temperature

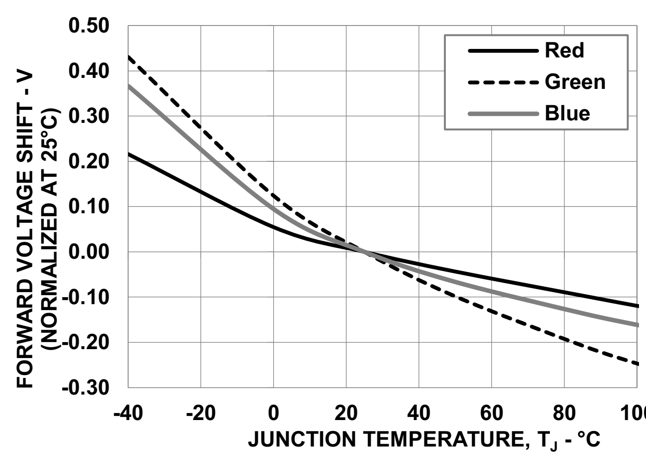


Figure 8: Maximum Forward Current vs. Temperature (3 chips on)

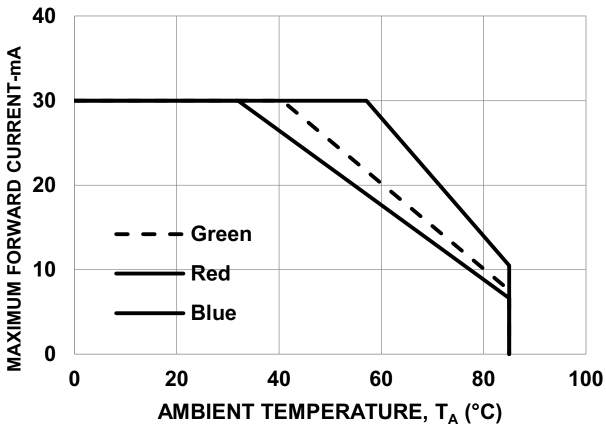
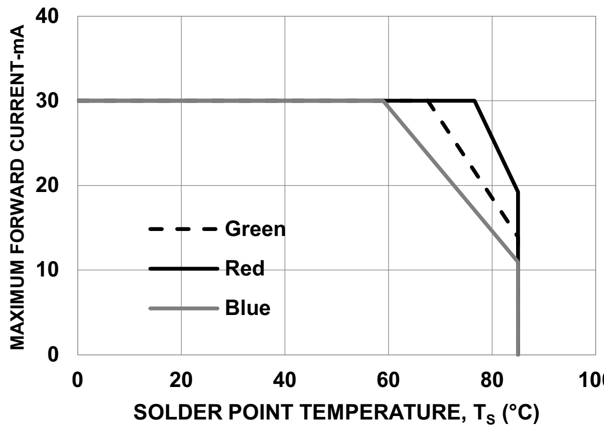


Figure 9: Maximum Forward Current vs. Solder Temperature (3 chips on)



NOTE: Maximum forward current graphs based on ambient temperature (T_A) above are with reference to the thermal resistance $R_{\theta J-A}$ in the following table. See Precautionary Notes for more details.

Condition	Thermal Resistance from LED Junction to Ambient, $R_{\theta J-A}$ (°C/W)		
	Red	Green	Blue
3 chips on	550	550	630

Figure 10: Radiation Pattern for X-axis

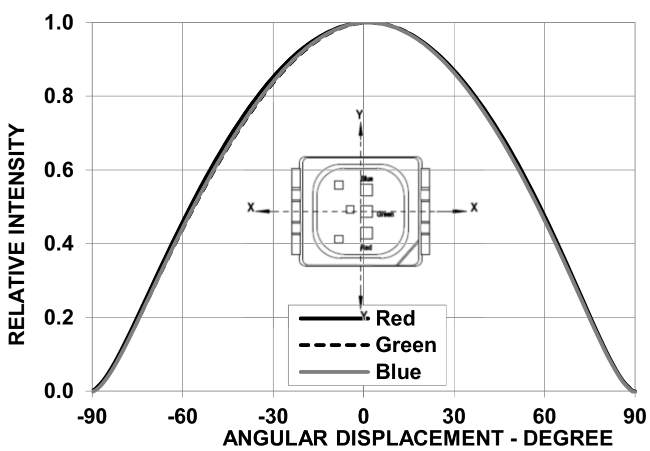


Figure 11: Radiation Pattern for Y-axis

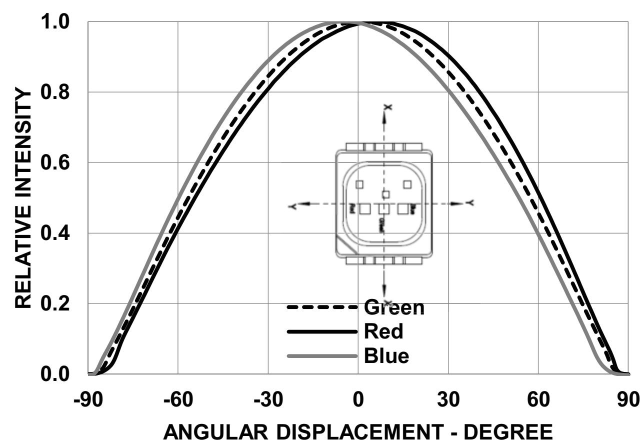
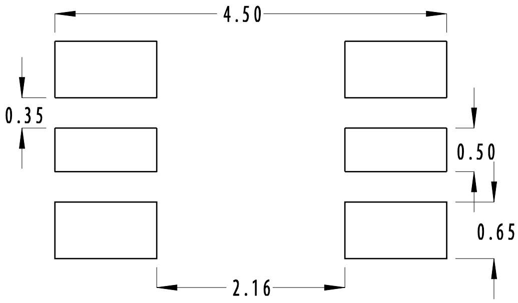
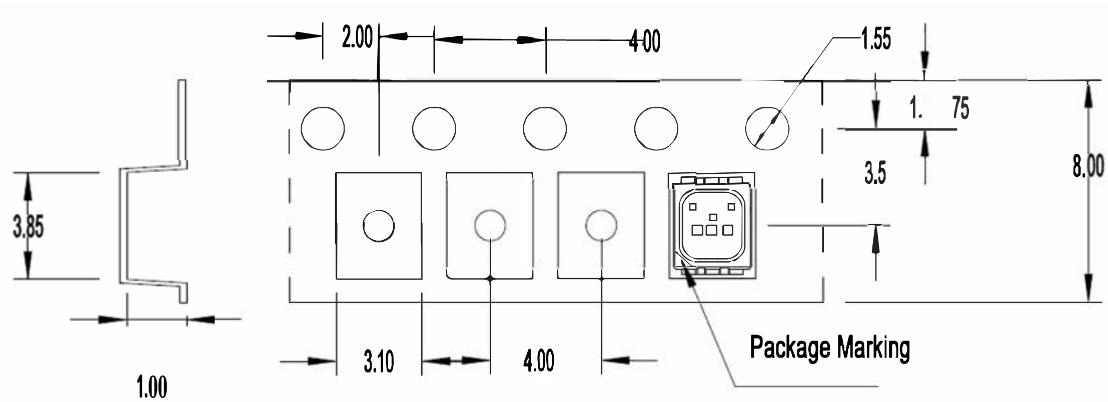


Figure 12: Recommended Land Pattern



NOTE: All dimensions are in millimeters (mm).

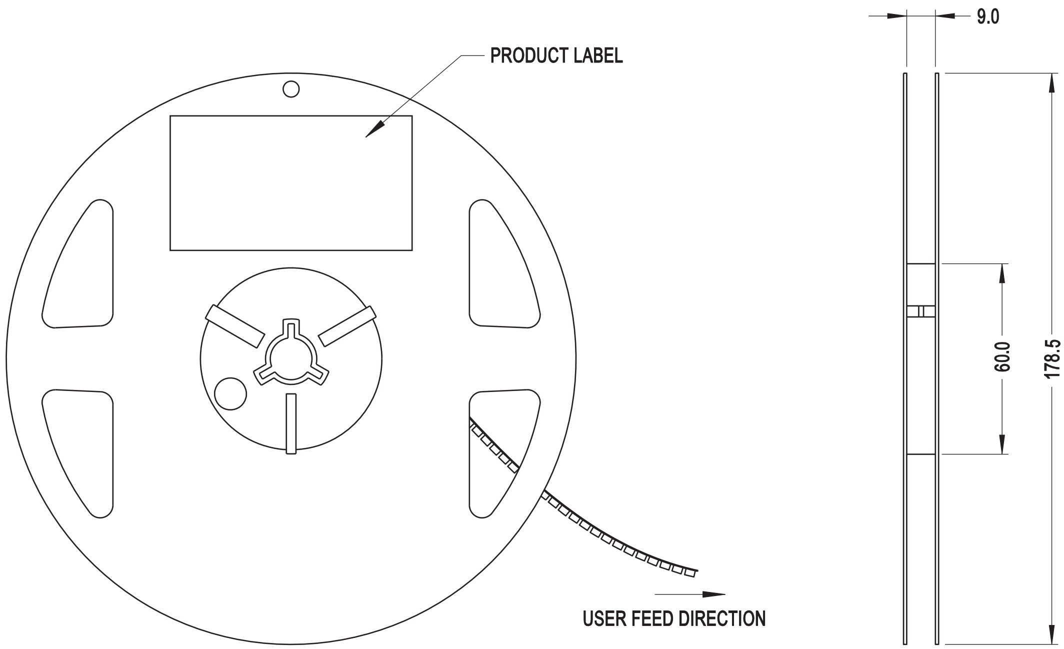
Figure 13: Carrier Tape Dimensions



NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ±0.20 mm unless otherwise specified.

Figure 14: Reel Dimensions



Precautionary Notes

Soldering

- Do not perform reflow soldering more than twice. Observe necessary precautions of handling moisture-sensitive devices as stated in the following section.
- 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 it must be strictly controlled to following conditions:
  - Soldering iron tip temperature = 315°C maximum.
  - Soldering duration = 3 seconds maximum.
  - Number of cycles = 1 only.
  - Power of the soldering iron = 50W maximum.
- Do not touch the LED package body with the soldering iron except for the soldering terminals, because it may cause damage to the LED.
- Confirm beforehand whether the functionality and performance of the LED is affected by soldering with hand soldering.

Figure 15: Recommended Lead-Free Reflow Soldering Profile

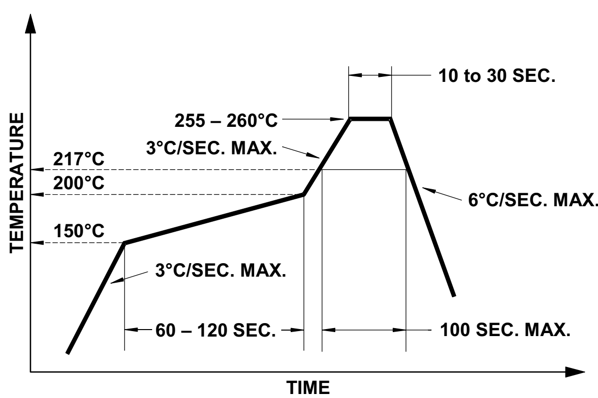
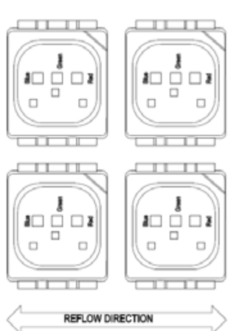


Figure 16: Recommended Board Reflow Direction



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. Observe special handling precautions during assembly of silicone encapsulated LED products. Failure to comply might lead to damage and premature failure of the LED. Refer to Broadcom Application Note AN5288, *Silicone Encapsulation for LED: Advantages and Handling Precautions*, for additional information.

- Do not poke sharp objects into the silicone encapsulant. Sharp objects, such as tweezers or syringes, might apply excessive force or even pierce through the silicone and induce failures to the LED die or wire bond.
- 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 the body.
- Do not stack assembled PCBs together. Use an appropriate rack to hold the PCBs.
- The surface of silicone material attracts dust and dirt easier than epoxy due to its surface tackiness. To remove foreign particles on the surface of silicone, use a cotton bud with isopropyl alcohol (IPA). During cleaning, rub the surface gently without putting too much pressure on the silicone. Ultrasonic cleaning is not recommended.
- For automated pick-and-place, Broadcom has tested a nozzle size with OD 3.5 mm to work 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 selected nozzle 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). If unavoidable, the MBB must be properly resealed with fresh desiccant and HIC. The exposed duration must be taken in as floor life.

Control after opening the MBB:

- Read the HIC immediately upon opening of the MBB.
- Keep the LEDs at <30°/60% RH at all times, and complete all high temperature-related processes, including soldering, curing, or rework within 72 hours.

Control for unfinished reel:

Store unused LEDs in a sealed MBB with desiccant or a 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 72 hours.

Baking is required if the following conditions exist:

- The HIC indicator indicates a change in color for 10% and 5%, as stated on the HIC.
- The LEDs are exposed to conditions of >30°C/60% RH at any time.
- The LED's floor life exceeded 72 hours.

The recommended baking condition is: 60°C ±5ºC for 20 hours.

Baking can only be done once.

Storage:

The soldering terminals of these Broadcom LEDs are silver plated. If the LEDs are exposed in ambient environments 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 a 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.
- Circuit design must cater to the whole range of forward voltage (V_F) of the LEDs to ensure the intended drive current can always be achieved.
- The LED exhibits slightly different characteristics at different drive currents, which may result in a larger variation of performance (such as 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.
- Avoid rapid change in ambient temperatures, especially in high-humidity environments, because they cause condensation on the LED.

Thermal Management

The optical, electrical, and reliability characteristics of the LED are affected by temperature. Keep the junction temperature (T_J) of the LED 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:

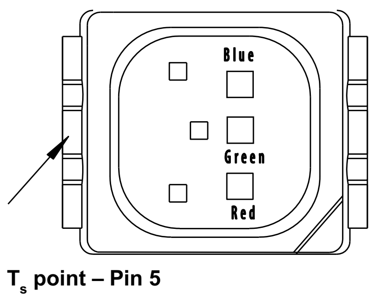
T_S = LED solder point temperature as shown in the following figure (°C)

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

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

Figure 17: Solder Point Temperature on PCB



T_S can be easily measured by mounting a thermocouple on the soldering joint as shown in Figure 17, 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 operating 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 might be harmful to the eyes. For safety reasons, use appropriate shielding or personal protective equipment.

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