BROADCOM®

Data Sheet

ASCB-GTF2-0A307

1212 Tricolor PLCC-4 LED

Overview

The Broadcom® ASCB-GTF2-series are RGB tricolor LEDs targeting small pixel pitch displays. They come in a 1.2 mm x 1.2 mm x 1.1 mm PLCC-4 package with a common anode footprint. The black outer appearance diffused epoxy enhance the display contrast while maintaining high brightness.

To facilitate easy pick-and-place assembly, the LEDs are packed in tape and reel form. Every reel is shipped in single intensity and color bin to ensure uniformity.

Features

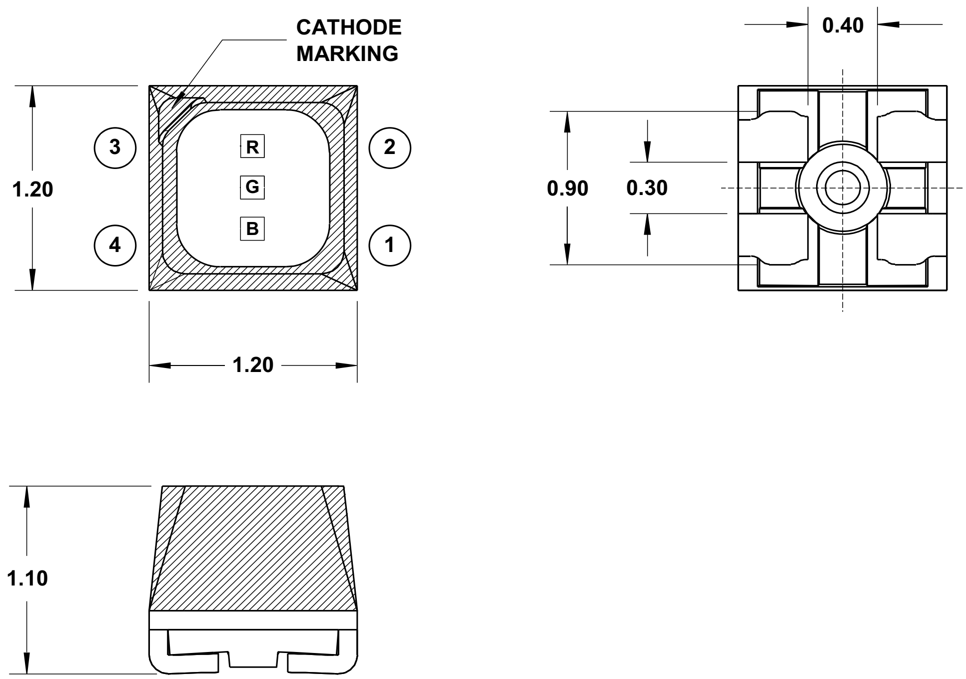
- PLCC-4 package with black outer appearance
- Suitable for small pitch signs

Applications

- Full color displays
- Status indicators

CAUTION! This LED is ESD sensitive. Observe appropriate precautions during handling and processing. Refer to the *Premium InGaN LEDs: Safety Handling Fundamentals ESD*, application note AN-1142 for additional details.

Figure 1: Package Drawing



Pin	Configuration
1	Blue Cathode
2	Green Cathode
3	Red Cathode
4	Common Anode

NOTE:

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

Absolute Maximum Ratings

Parameter	Red	Green	Blue	Unit
DC Forward Current[a]	15	15	10	mA
Peak Forward Current[b]	100	100	100	mA
Power Dissipation	36	49.5	33	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 12 and Figure 13.

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

Optical Characteristics (T_J = 25°C)

Color	Luminous Intensity, I_V (mcd)[a]			Dominant Wavelength, λ_d (nm)[b]			Peak Wavelength, λ_p (nm)	Viewing Angle, $2\theta_{½}$ (°)[c]	Test Current (mA)
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Typ.	
Red	260	310	390	618	620	625	628	100	10
Green	710	840	975	524	529	534	522	100	10
Blue	68	85	101	464	470	475	466	100	5

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.

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

c. $\theta_{½}$ is the off-axis angle where the luminous intensity is half of the peak intensity.

Electrical Characteristics (T_J = 25°C)

Color	Forward Voltage, V_F (V)[a]			Reverse Voltage, V_R (V) at I_R = 10 µA[b]
	Min.	Typ.	Max.	Min.
Red	1.70	2.1	2.40	4.0
Green	2.50	2.8	3.30	4.0
Blue	2.50	2.9	3.30	4.0

a. Forward voltage tolerance is ±0.1V. V_F is tested at test current similar with optical characteristics test current.

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

Part Numbering System

A S C B - G T x_1 2 - 0 x_2 x_3 x_4 x_5

Code	Description	Option		
x_1	Package Type	F	Black outer appearance	
x_2	Minimum Intensity Bin	A	Red = Bin R1	Red: Bin R1, R2, R3 Green: Bin G1, G2, G3 Blue: Bin B1, B2, B3
			Green = Bin G1	
			Blue = Bin B1	
x_3	Number of Intensity Bins	3	3 Intensity Bins from minimum	
x_4	Color Bin Option	0	Red = Full distribution	
			Green = Bin A, B, C, D, E, F, G, H	
			Blue = Bin J, K, L, M, N, P, Q, R, S	
x_5	Test Option	7	Test Current: Red 10 mA, Green 10 mA, Blue 5 mA	

Bin Information

Intensity Bin Limits (CAT)

Bin ID	Luminous Intensity, I_V (mcd)	
	Min.	Max.
Red		
R1	260	340
R2	280	365
R3	300	390
Green		
G1	710	925
G2	730	950
G3	750	975
Blue		
B1	68	88
B2	73	95
B3	78	101

Tolerance = ±12%

Example of bin information on reel and packaging label:

CAT : R2 G2 B2	–	Red intensity bin R2
	–	Green intensity bin G2
	–	Blue intensity bin B2
BIN : BL	–	Green color bin B
	–	Blue color bin L

Color Bin Limits (BIN)

Bin ID	Dominant Wavelength, λ_d (nm)	
	Min.	Max.
Red		
—	618	625
Green		
A	524	527
B	525	528
C	526	529
D	527	530
E	528	531
F	529	532
G	530	533
H	531	534
Blue		
J	464	467
K	465	468
L	466	469
M	467	470
N	468	471
P	469	472
Q	470	473
R	471	474
S	472	475

Tolerance = ±1.0 nm

Figure 2: Spectral Power Distribution

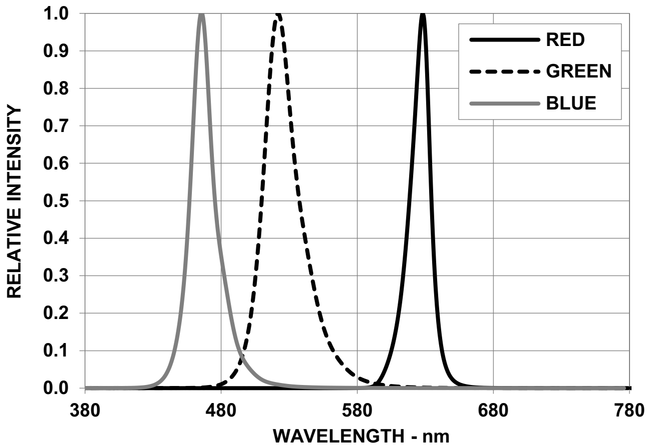


Figure 3: Forward Current vs. Forward Voltage

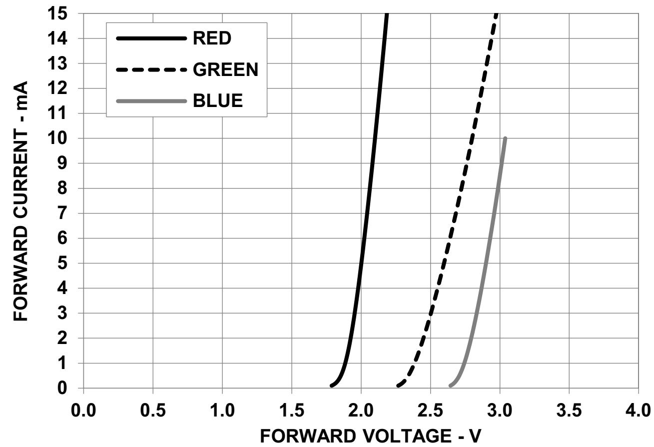


Figure 4: Relative Luminous Intensity vs. Mono Pulse Current - Red and Green

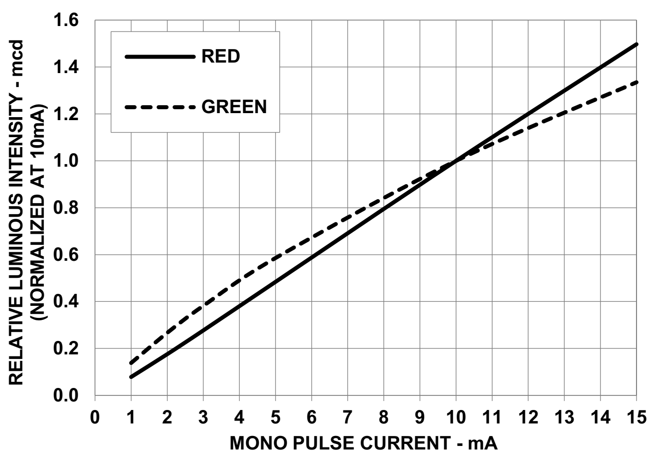


Figure 5: Relative Luminous Intensity vs. Mono Pulse Current - Blue

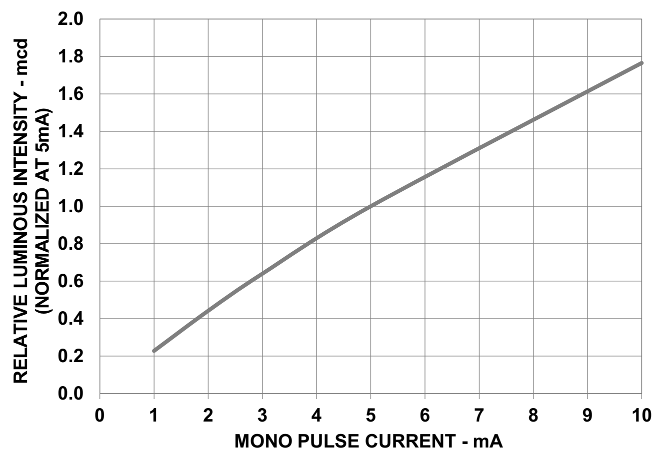


Figure 6: Dominant Wavelength Shift vs. Mono Pulse Current - Red and Green

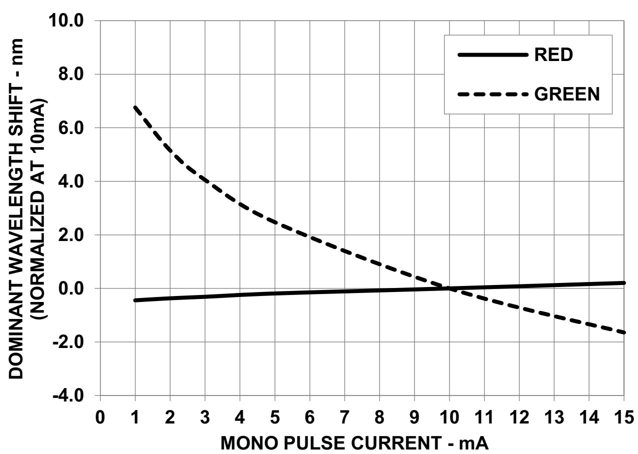


Figure 7: Dominant Wavelength Shift vs. Mono Pulse Current - Blue

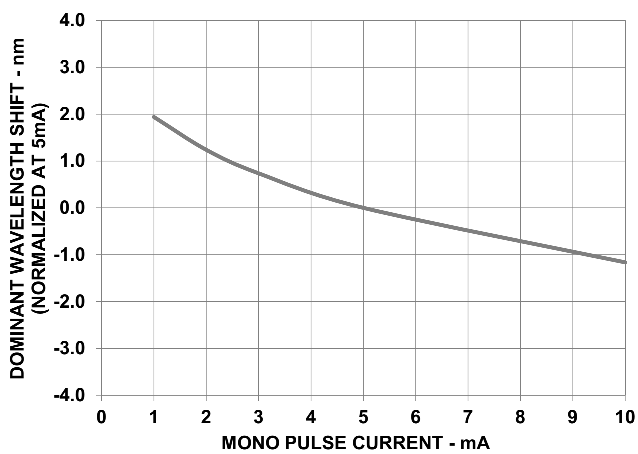


Figure 8: Relative Light Output vs. Junction Temperature

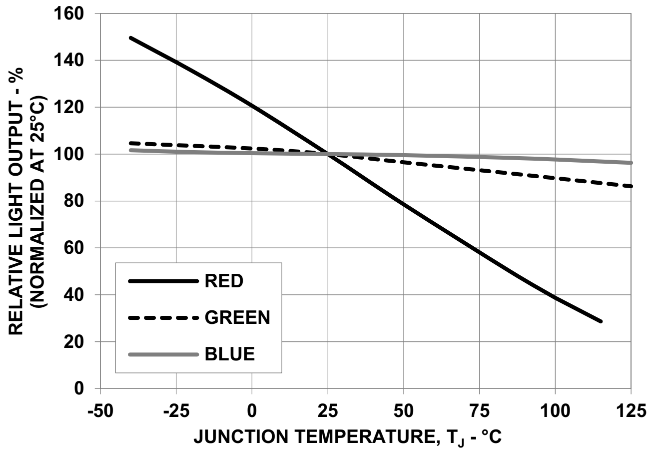


Figure 9: Forward Voltage Shift vs. Junction Temperature

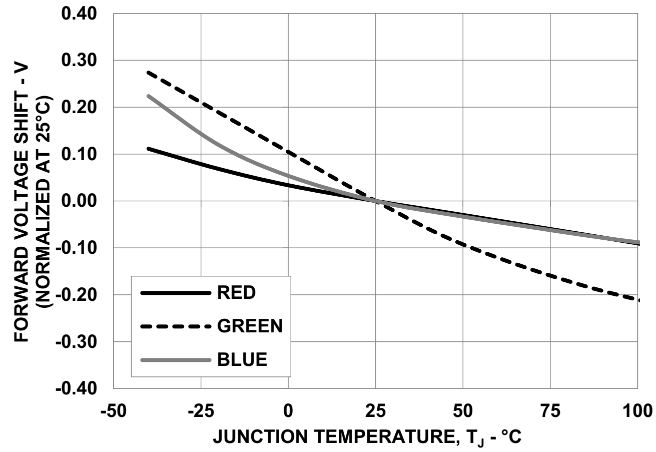


Figure 10: Radiation Pattern for x-axis

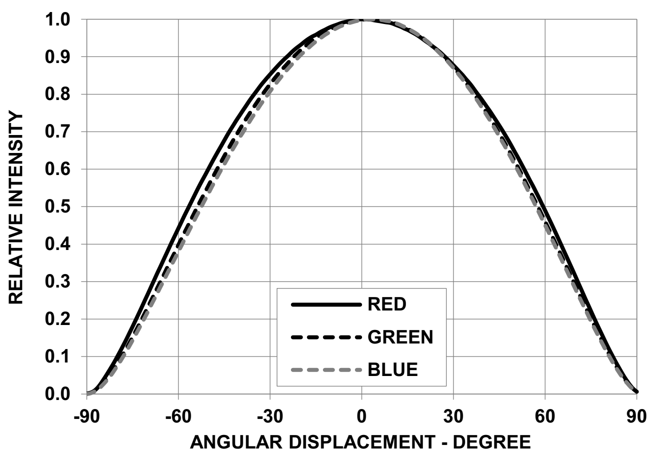


Figure 11: Radiation Pattern for y-axis

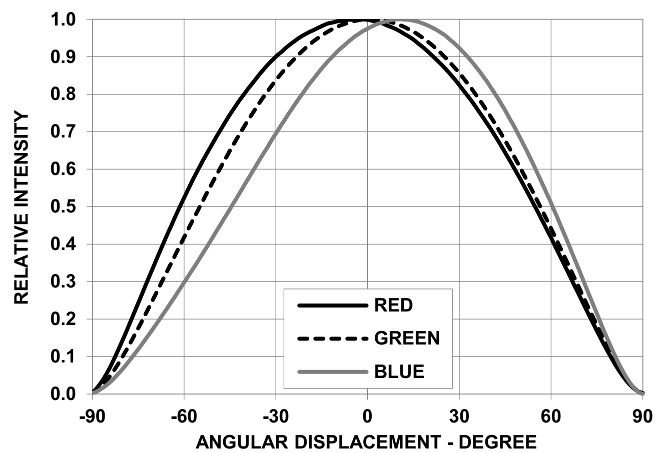


Figure 12: Maximum Forward Current vs. Ambient Temperature for Red, Green, and Blue (3 Chips On)

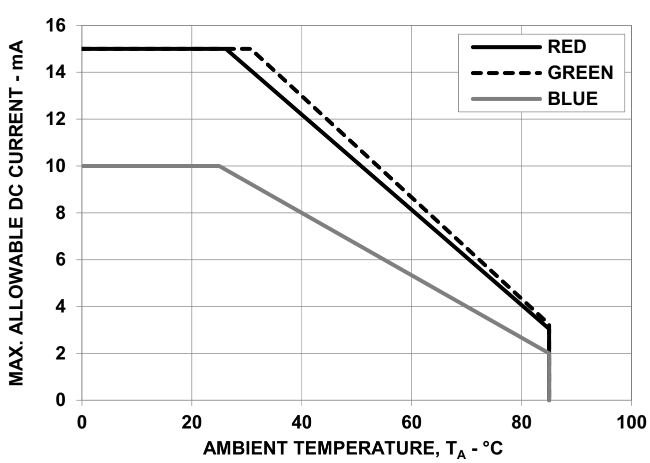


Figure 13: Maximum Forward Current vs. Solder Temperature for Red, Green, and Blue (3 Chips On)

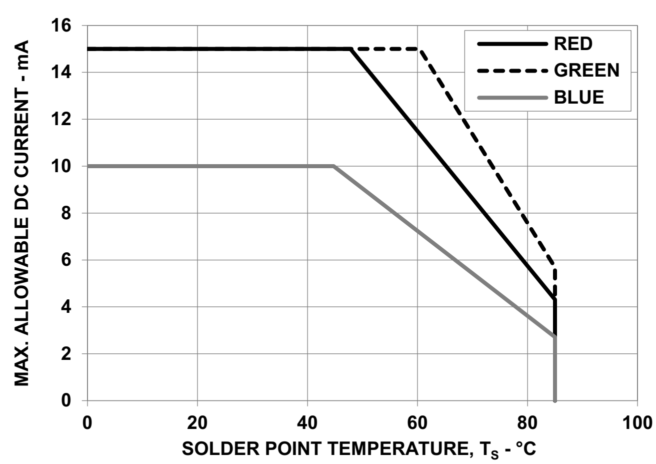
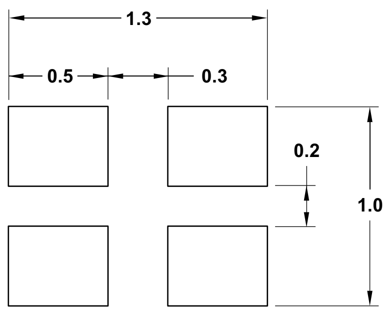
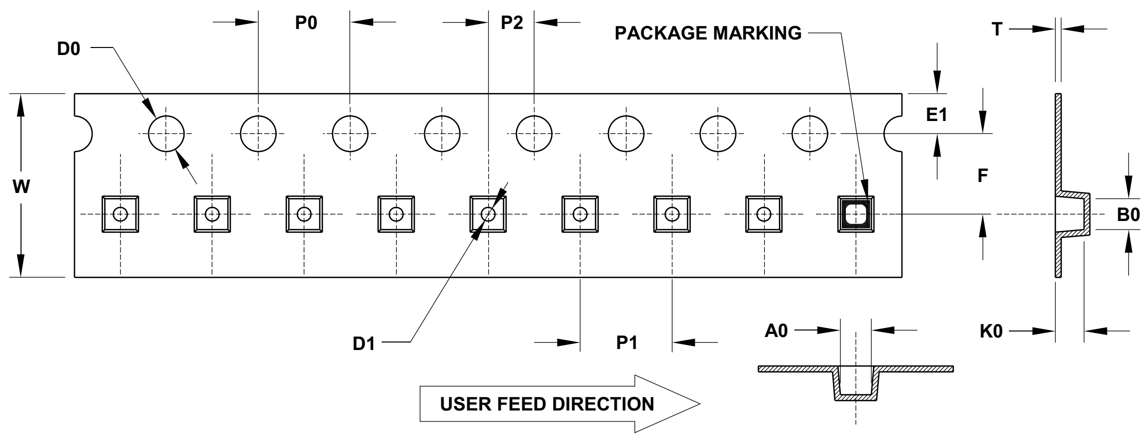


Figure 14: Recommended Soldering Pad Pattern



NOTE: All dimensions are in millimeters (mm).

Figure 15: Carrier Tape Dimensions



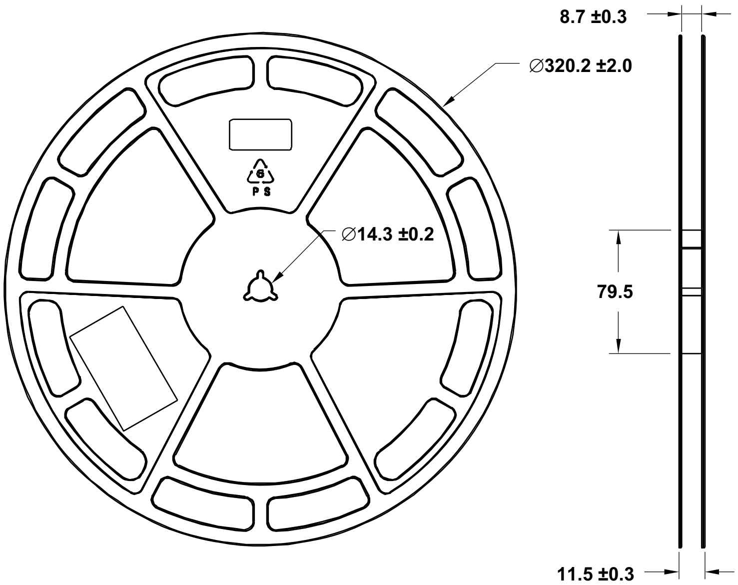
F	E1	P0	P1	P2	D0	D1
3.5 ± 0.10	1.75 ± 0.10	4.00 ± 0.10	4.00 ± 0.05	2.00 ± 0.05	1.55 ± 0.05	0.6 ± 0.10

W	A0	K0	B0	T
8.00 ± 0.10	1.30 ± 0.05	1.25 ± 0.05	1.30 ± 0.05	0.20 ± 0.05

NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ±0.20 mm unless otherwise specified.
3. LED quantity per reel is 13000 pcs.

Figure 16: Reel Dimensions



NOTE: All dimensions are in millimeters (mm).

Precautionary Notes

Soldering

- Do not perform reflow soldering more than twice. Observe necessary precautions of handling moisture-sensitive device 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 max.
  - Soldering duration = 3 seconds max.
  - Number of cycles = 1 only
  - Power of soldering iron = 50W max.
- Do not touch the LED package body with the soldering iron except for the soldering terminals, as 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 17: Recommended Lead-Free Reflow Soldering Profile

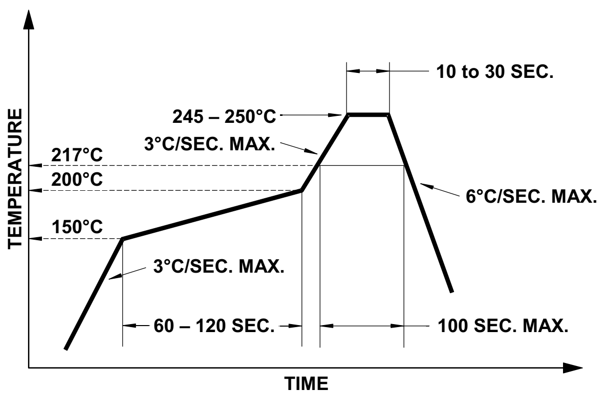
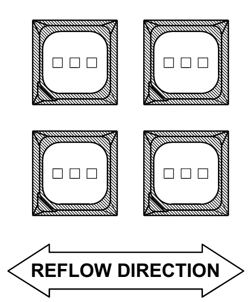


Figure 18: Recommended Board Reflow Direction



Handling Precautions

Special handling precaution need to be observed during assembly of epoxy encapsulated LED products. Failure to comply might lead to damage and premature failure of the LED.

- Do not stack assembled PCBs together. Use an appropriate rack to hold the PCBs.
- For automated pick-and-place, Broadcom has tested a nozzle size with OD 1.0 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 5a 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, 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). If unavoidable, 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 MBB.
  - Keep the LEDs at <30°/60%RH at all times, and complete all high temperature-related processes, including soldering, curing or rework within 24 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 24 hours.
- Baking is required if:
  - 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 24 hours.

  The recommended baking condition is: 65°C ± 5ºC for 24 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 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 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 (meaning: 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.
- As actual application might not be exactly similar to the test conditions, do verify that the LED will not be damaged by prolonged exposure in the intended environment.
- Avoid rapid change in ambient temperature, especially in high-humidity environments, because they cause condensation on the LED.
- If the LED is intended to be used in harsh or outdoor environment, protect the LED against damages caused by rain water, water, dust, oil, corrosive gases, external mechanical stresses, and so on.

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:

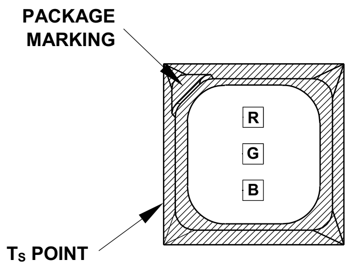
T_S = LED solder point temperature as shown in Figure 19 (°C)

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

I_F = forward current (A)

V_{Fmax} = maximum forward voltage (V)

Figure 19: Solder Point Temperature on PCB



T_S can be easily measured by mounting a thermocouple on the soldering joint as shown in Figure 19, 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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RoHS Compliant