Data Sheet

ASCB-WTF0-0A30A

2727 RGB Tricolor PLCC-6 Lens

Overview

The Broadcom® ASCB-WTF0 series offers RGB tricolor LEDs in a compact form factor that is specifically designed for outdoor full-color signs. The LED is available in a 2.8 mm × 2.7 mm × 3.0 mm PLCC-6 package, featuring a single lens for closer-pitch signs. The diffused epoxy with a black outer appearance improves display contrast while maintaining high brightness.

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

Features

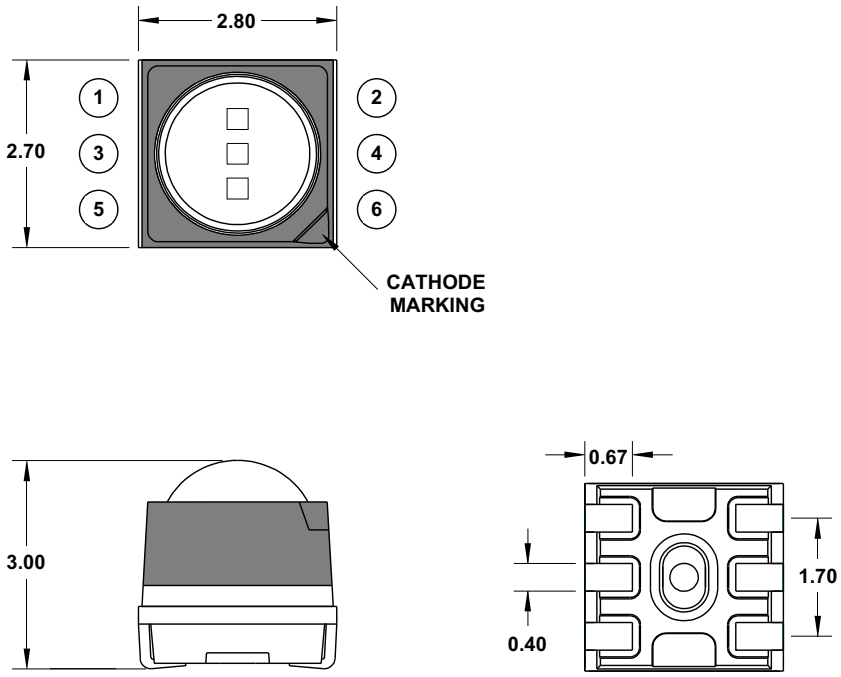
- Compact tricolor PLCC-6 LED with single lens
- Package with black outer appearance

Applications

- Outdoor full-color signs
- Retail shop logo signs

CAUTION! This LED is ESD sensitive. Observe appropriate precautions during handling and processing. Refer to Application Note 1142 for additional details.

Figure 1: Package Drawing



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

NOTE:

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

Absolute Maximum Ratings

Parameters	Red	Green	Blue	Unit
DC Forward Current[a]	25	25	20	mA
Peak Forward Current[b]	100	100	100	mA
Power Dissipation	60	80	64	mW
Reverse Voltage	Not recommended for reverse bias operation			
LED Junction Temperature	105			°C
Operating Temperature Range	–40 to +85			°C
Storage Temperature Range	–40 to +100			°C

a. Derate linearly as shown in Figure 11 and Figure 12.

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, λp (nm)	Viewing Angle, $2\theta_{½}$ (°)[c]	Test Current (mA)
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Typ.	
Red	650	950	1430	617	620	628	626	75	15
Green	1150	1500	2535	523	527	533	519	75	8
Blue	120	150	265	465	470	476	465	75	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 might 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 if 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 mA[b]	Thermal Resistance, $R_{\theta J\text{-}S}$ (°C/W) – Three Chips ON[c]
	Min.	Typ.	Max.	Min.	Typ.
Red	1.7	2.1	2.4	4.0	520
Green	2.4	2.6	3.2	4.0	520
Blue	2.4	2.7	3.2	4.0	730

a. The forward voltage tolerance is ±0.1V. V_F is tested at a test current similar to the optical characteristics test current.

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

c. Thermal resistance from the LED junction to the solder point.

Part Numbering System

A	S	C	B	–	W	T	x_1	0	–	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	A	Test current: Red = 15 mA, Green = 8 mA, Blue = 5 mA	

Bin Information

Intensity Bin Limits (CAT)

Bin ID	Luminous Intensity, I_V (mcd)	
	Min.	Max.
Red		
R1	650	850
R2	850	1100
R3	1100	1430
Green		
G1	1150	1500
G2	1500	1950
G3	1950	2535
Blue		
B1	120	155
B2	155	205
B3	205	265

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		
—	617	628
Green		
A	523	526
B	524	527
C	525	528
D	526	529
E	527	530
F	528	531
G	529	532
H	530	533
Blue		
J	465	468
K	466	469
L	467	470
M	468	471
N	469	472
P	470	473
Q	471	474
R	472	475
S	473	476

Tolerance = ±1.0 nm

Figure 2: Spectral Power Distribution

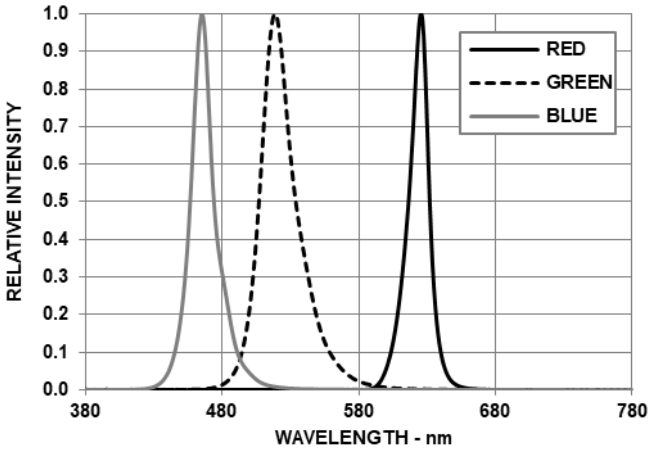


Figure 3: Forward Current vs. Forward Voltage

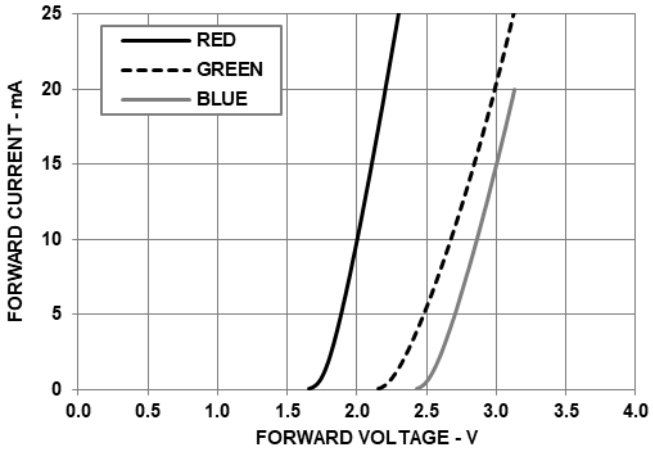


Figure 4: Relative Luminous Intensity vs. Mono Pulse Current

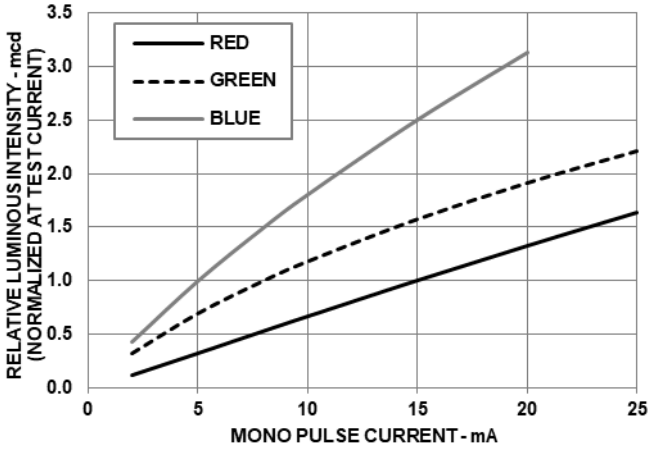


Figure 5: Dominant Wavelength Shift vs. Mono Pulse Current

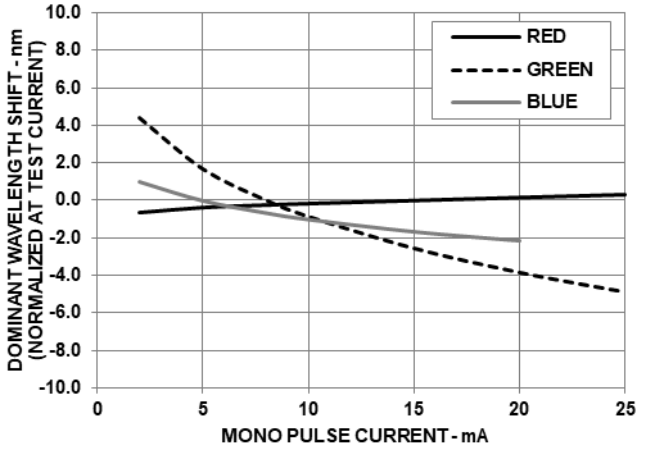


Figure 6: Radiation Pattern for X-Axis

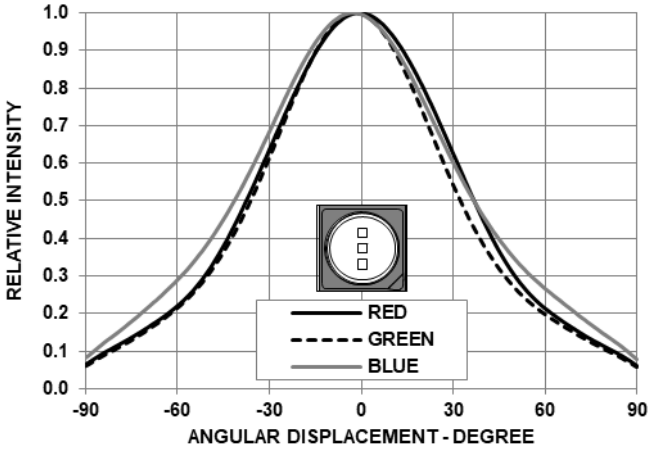


Figure 7: Radiation Pattern for Y-Axis

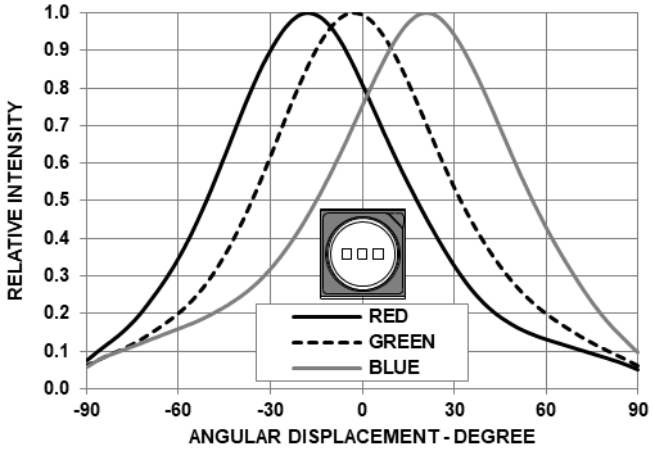


Figure 8: Relative Light Output vs. Junction Temperature

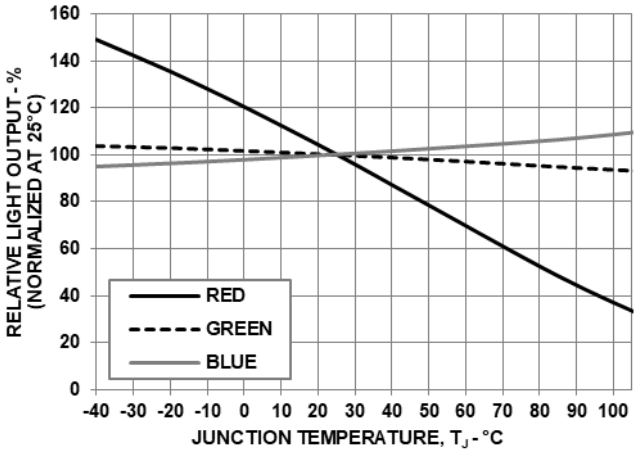


Figure 9: Forward Voltage Shift vs. Junction Temperature

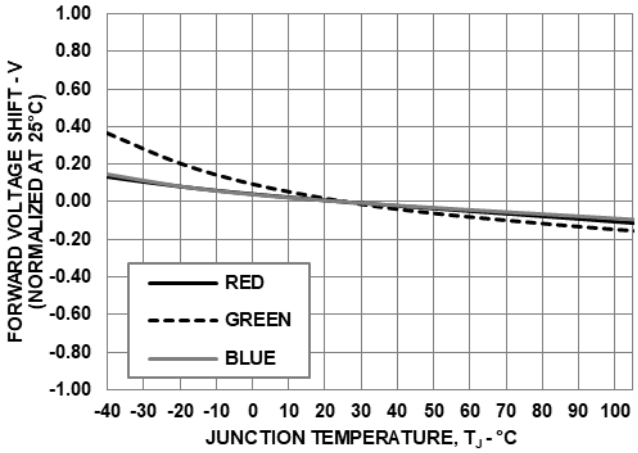


Figure 10: Maximum Forward Current vs. Ambient Temperature for Red, Green, and Blue: Three Chips ON

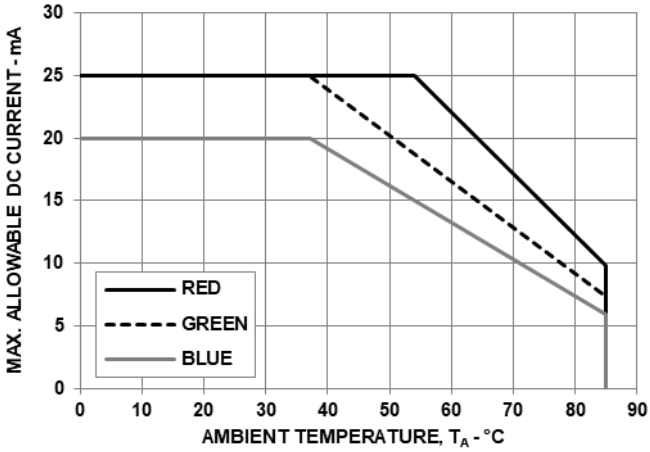


Figure 11: Maximum Forward Current vs. Solder Temperature for Red, Green, and Blue: Three Chips ON

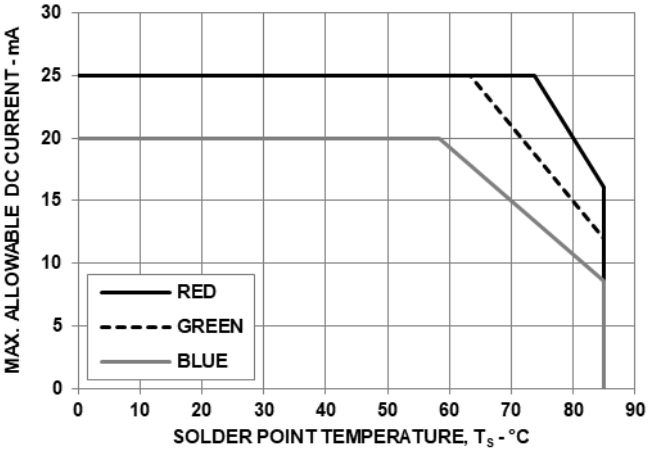
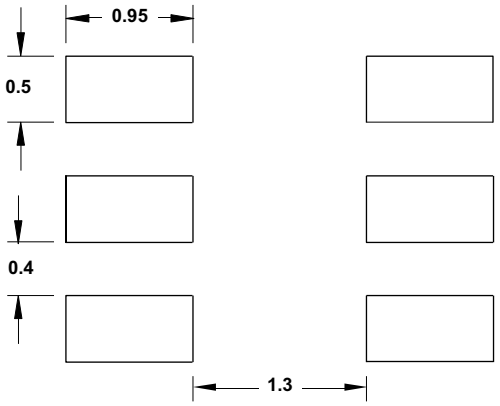
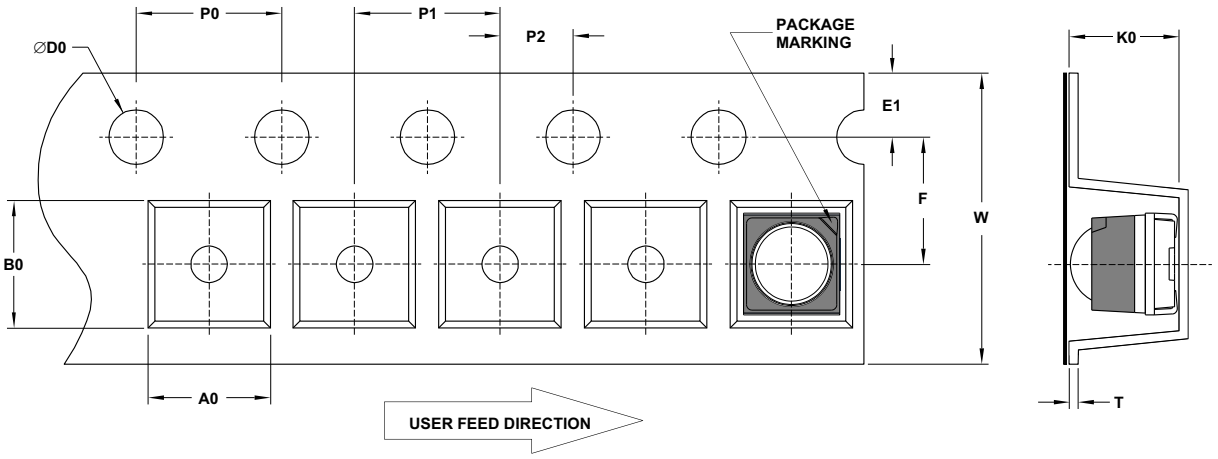


Figure 12: Recommended Soldering Pad Pattern



NOTE: All dimensions are in millimeters (mm).

Figure 13: Carrier Tape Drawing



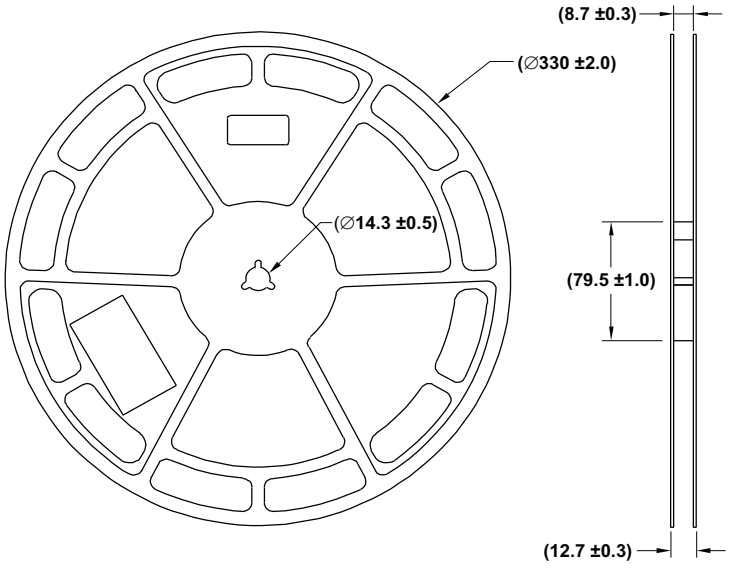
F	E1	P0	P1	P2	D0	W
3.5 ± 0.1	1.75 ± 0.1	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.1	1.6 ± 0.1	8.1 ± 0.1

A0	B0	K0	T
2.9 ± 0.2	3.05 ± 0.2	3.3 ± 0.2	0.4 ± 0.05

NOTE:

1. All dimensions are in millimeters (mm).
2. Quantity per reel is 5000 pieces.

Figure 14: Reel Drawing



NOTE:

1. All dimensions are in millimeters (mm).
2. Dimensions in parentheses are for reference only.

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 the following conditions:
  - Soldering iron tip temperature = 315°C maximum
  - Soldering duration = 3 seconds maximum
  - Number of cycles = 1 only
  - Power of soldering iron = 50W maximum
- Do not touch the LED package body with the soldering iron except for the soldering terminals, because it can cause damage to the LED.
- Confirm beforehand whether the functionality and performance of the LED are affected by soldering with hand soldering.

Figure 15: Recommended Lead-Free Reflow Soldering Profile

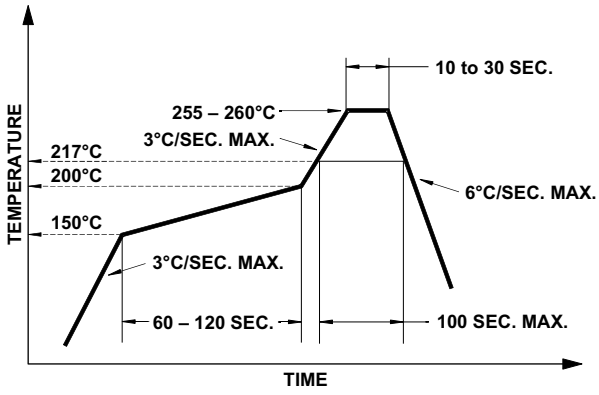
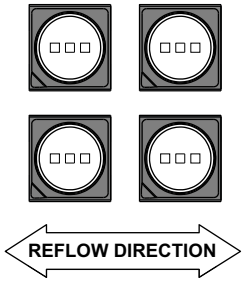


Figure 16: Recommended Board Reflow Direction



Handling Precautions

Observe special handling precautions 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 an OD of 3.5 mm and an ID of 1.7 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 Moisture-Sensitive Devices

This product has a Moisture Sensitive Level 5a rating per JEDEC J-STD-020. For additional details and a review of proper handling procedures, refer to Broadcom Application Note 5305, *Handling Moisture-Sensitive Surface-Mount LEDs.*

- 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, 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 the MBB.
  - Keep the LEDs at <30°C/60% RH at all times, and complete all high-temperature-related processes, including soldering, curing, or rework, within 24 hours.
- Control for unfinished reels:

  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 any of these conditions exist:
  - The HIC 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 ± 5°C for 24 hours.

  Baking can be done 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 become 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 this data sheet. Constant current driving is recommended to ensure consistent performance.
- The circuit design must cater to the whole range of forward voltage (V_F) of the LEDs to ensure that the intended drive current can always be achieved.
- The LED exhibits slightly different characteristics at different drive currents, which can result in a larger variation in 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.
- Because 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 changes 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 environments, protect the LED against damages caused by rainwater, 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. And $R_{\theta J\text{-}A}$ 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:

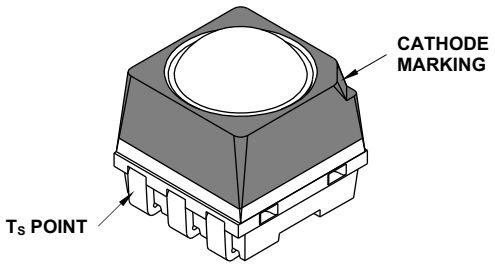
T_S = LED solder point temperature as shown in the following figure (°C)

$R_{\theta J\text{-}S}$ = 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 preceding figure, while $R_{\theta J\text{-}S}$ is provided in this 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 this data sheet.

Eye Safety Precautions

LEDs can 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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