BROADCOM®

Data Sheet

ASMM-CA03-Cxxx2

Amber PLCC-2 Surface Mount LED

Description

The Broadcom® ASMM-CA03 Surface Mount LED is packaged in the industry-standard PLCC-2 package. It has a high reliability performance designed to work under a wide range of environmental conditions, which makes it ideally suited for use in various signage applications.

The wide viewing angle at 120° makes these LEDs ideally suited for panel, push button, or general backlighting in office equipment, industrial equipment, and home appliances. The flat-top emitting surface makes it easy for these LEDs to integrate with light pipes. With the built-in reflector enhancing the light output intensity, these LEDs are also suitable to be used as LED pixels in indoor electronic signs.

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

Features

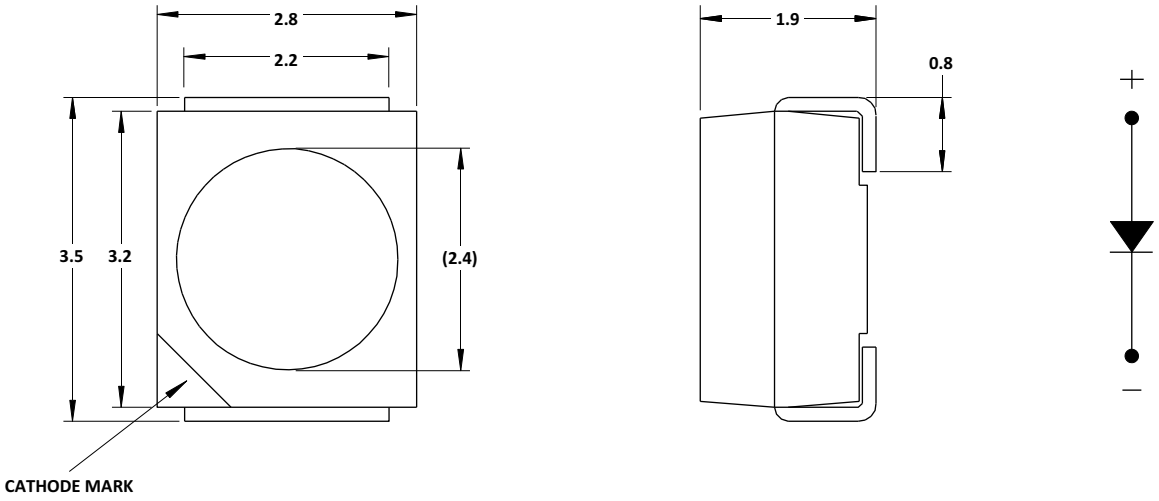
- Industry standard PLCC-2 package
- High reliability package with enhanced silicone resin encapsulation
- High brightness using AlInGaP dice technology
- Available in Amber color only
- Wide viewing angle at 120°
- JEDEC MSL 3

Applications

- Electronic signs and signals
- Office automations, home appliances, industrial equipment
  - Front panel backlighting
  - Push button backlighting
  - Display backlighting
- Scanner lighting

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

Figure 1: Package Drawing



NOTE:

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

Absolute Maximum Ratings

Parameters	ASMM-CA03-Cxxx2	Units
DC Forward Current[a]	30	mA
Peak Forward Current[b]	50	mA
Power Dissipation	78	mW
LED Junction Temperature	110	°C
Operating Temperature Range	-40 to +100	°C
Storage Temperature Range	-40 to +100	°C

a. Derate linearly as shown in Figure 10 and Figure 11.

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

Optical Characteristics (T_J = 25°C, I_F = 20 mA)

Part Number	Color	Package	Luminous Intensity, I_v (mcd)[a, b]			Peak Wavelength, λ_p (nm)	Dominant Wavelength, λ_d (nm)[c]	Viewing Angle, $2\theta_{½}$ (°)[d]
			Min.	Typ.	Max.	Typ.	Typ.	Typ.
ASMM-CA03-CV2C2	Amber	Non-diffused	715	—	1125	592	590	120
ASMM-CA03-CV6C2	Amber	Diffused	900	—	1400	592	590	120

a. The luminous intensity, I_v, is measured at the mechanical axis of the LED package at a single current pulse condition. The actual peak of the spatial radiation pattern may not be aligned with the axis.

b. Luminous intensity tolerance = ± 12%.

c. The dominant wavelength, λd, is derived from the CIE Chromaticity Diagram and represents the color of the device.

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

Electrical Characteristics (T_J = 25°C, I_F = 20 mA)

Part Number	Color	Package	Forward Voltage, V_F (V)[a]			Reverse Voltage, V_R (V) at I_R = 100µA[b]	Thermal Resistance, $R_{\theta J-S}$ (°C/W)[c]
			Min.	Typ.	Max.	Min.	Typ.
ASMM-CA03-CV2C2	Amber	Non-diffused	1.7	2.4	2.6	5	250
ASMM-CA03-CV6C2	Amber	Diffused	1.7	2.4	2.6	5	250

a. Forward voltage tolerance is ± 0.1V.

b. Indicates 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	M	M	-	C	x_1	0	3	-	C	x_2	x_3	x_4	x_5

Code	Description	Option	
x_1	Color	A	Amber
x_2	Minimum Intensity Bin	See Intensity Bin Limits (CAT)	
x_3	Number of Half Bins	2	2 half bins starting from (x2)1
		6	2 half bins starting from (x2)2
x_4	Color Bin Option	C	3 and 4 only
x_5	Test Option	2	Test Current = 20 mA

Part Number Example

ASMM-CA03-CV6C2

x_1: A – Amber color

x_2 x_3: V 2 – 2 half bins from intensity bin V2 (V2 and W1)

x_4: C – Color bin 3 and 4 only

x_5: 2 – Test current = 20 mA

Bin Information

Intensity Bin Limits (CAT)

Bin ID	Luminous Intensity, I_V (mcd)	
	Min.	Max.
V1	715	900
V2	900	1125
W1	1125	1400

Tolerance = ± 12%.

Color Bin Limits (BIN)

Bin ID	Dominant Wavelength, λ_d (nm)	
	Min.	Max.
3	586.0	589.0
4	589.0	592.0

Tolerance = ± 1.0 nm.

Example of bin information on reel and packaging label:

CAT: V2 – Intensity bin V2

BIN: 4 – Color bin 4

Figure 2: Spectral Power Distribution

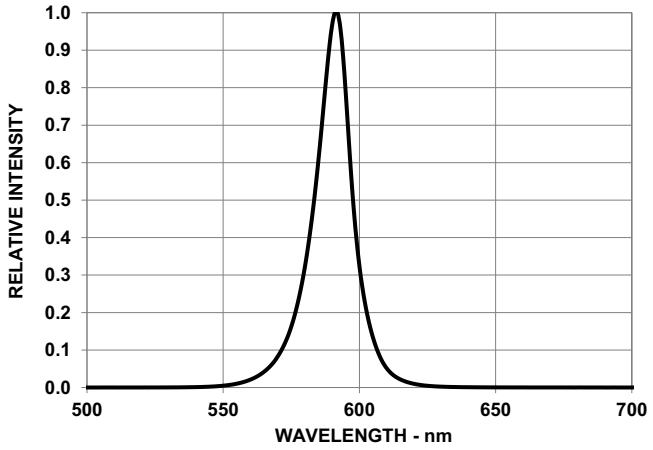


Figure 3: Forward Current vs. Forward Voltage

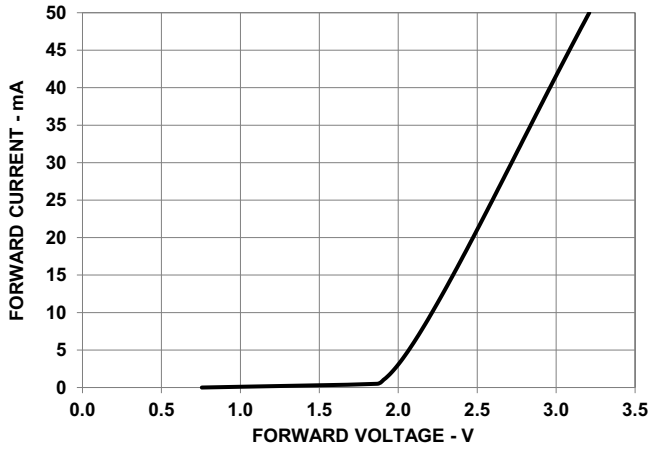


Figure 4: Relative Luminous Intensity vs. Mono Pulse Current

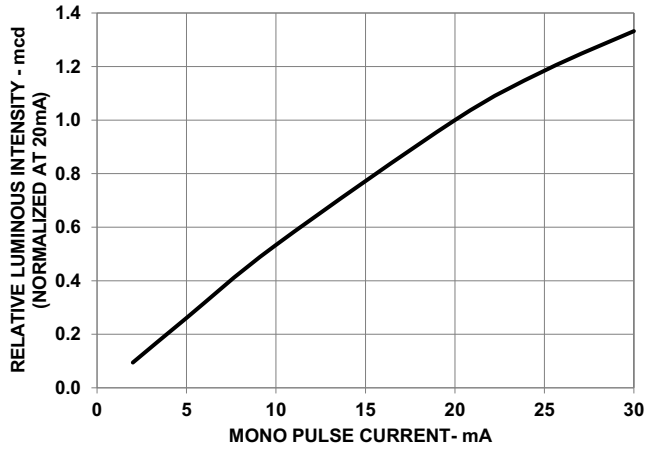


Figure 5: Radiation Pattern

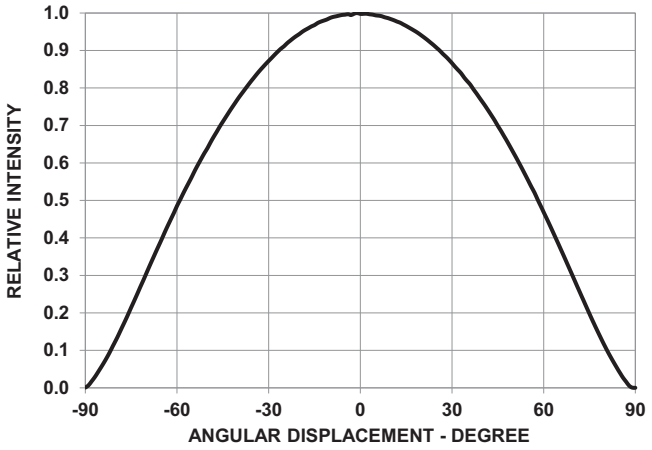


Figure 6: Dominant Wavelength Shift vs. Mono Pulse Current

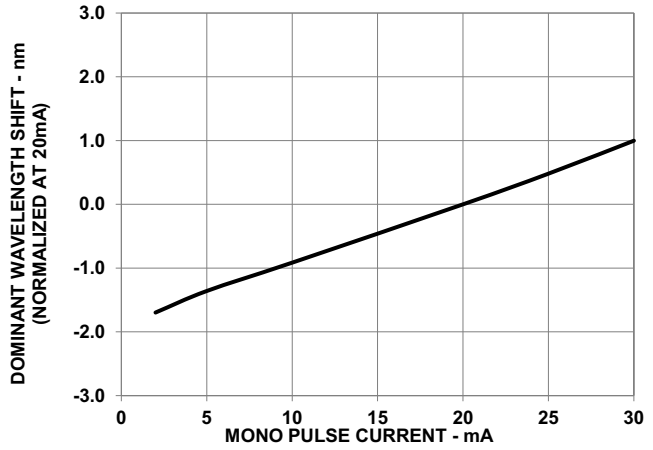


Figure 7: Relative Light Output vs. Junction Temperature

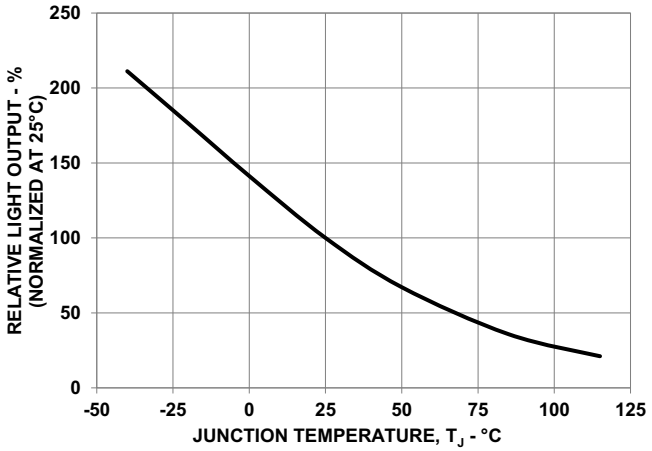


Figure 8: Forward Voltage Shift vs. Junction Temperature

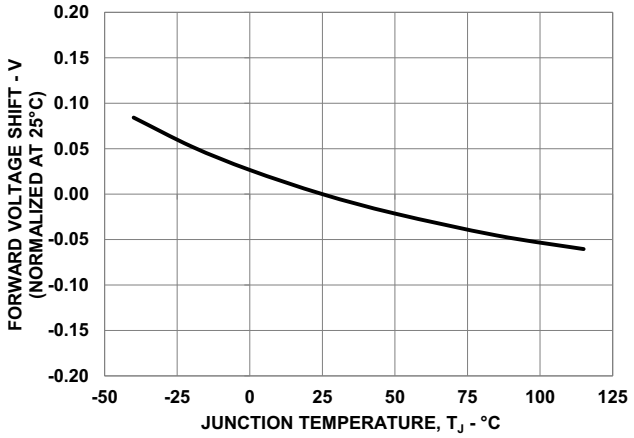


Figure 9: Dominant Wavelength Shift vs. Junction Temperature

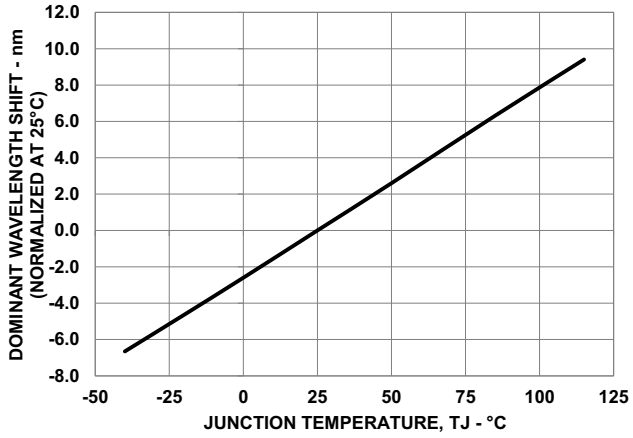


Figure 10: Maximum Forward Current vs. Ambient Temperature

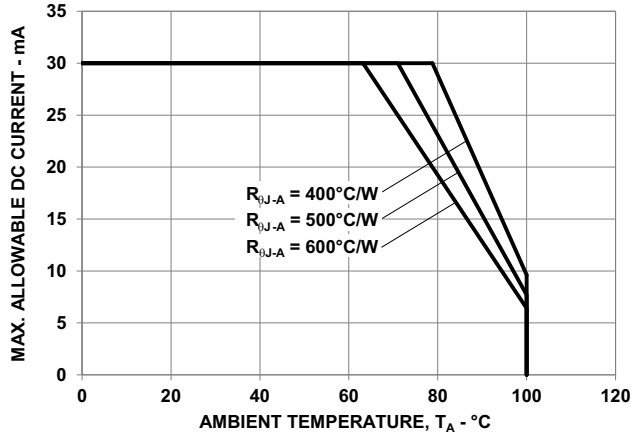


Figure 11: Maximum Forward Current vs. Solder Point Temperature

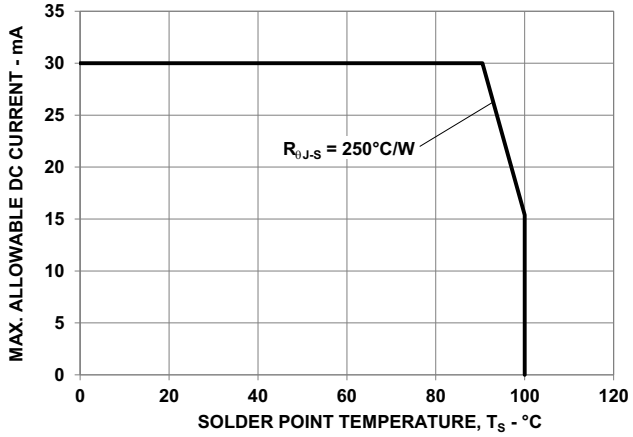
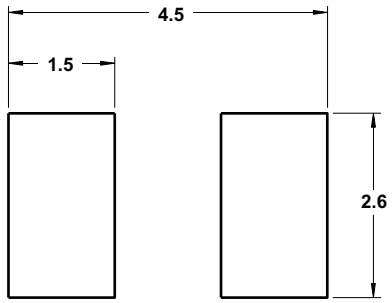
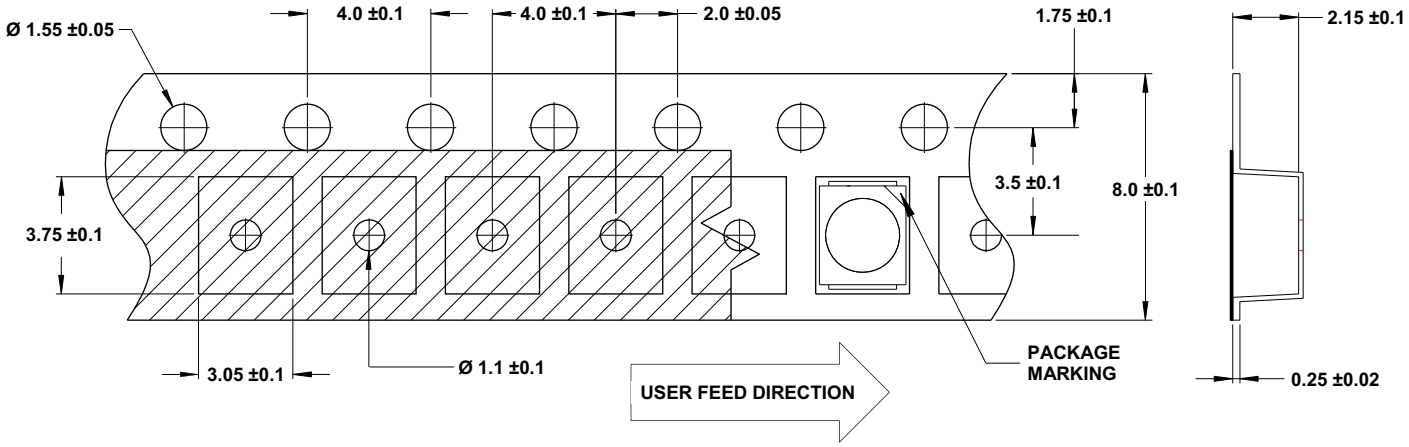


Figure 12: Recommended Soldering Land Pattern



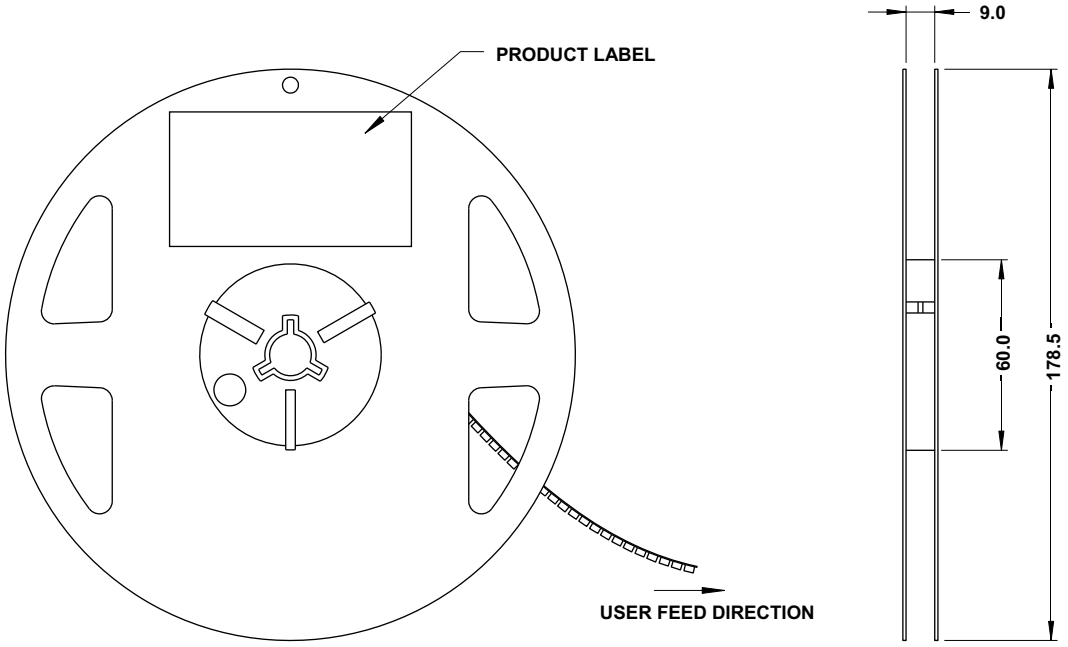
NOTE: All dimensions are in millimeters (mm).

Figure 13: Carrier Tape Dimensions



NOTE: All dimensions are in millimeters (mm).

Figure 14: 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 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 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

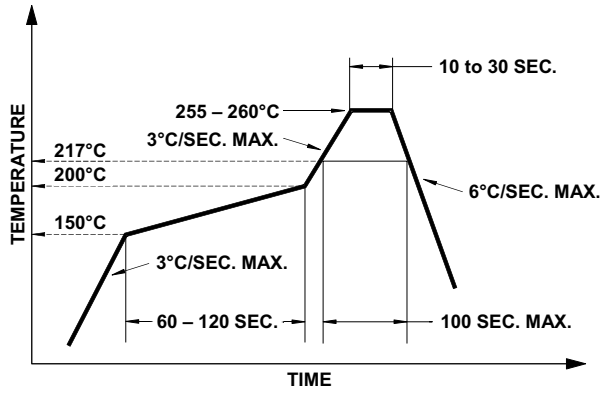
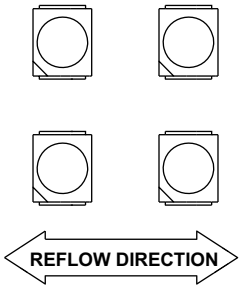


Figure 16: Recommended Board Reflow Direction



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 an OD of 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 3 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:

- Store an unopened moisture barrier bag (MBB) 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, properly seal the MBB 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 168 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 168 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 168 hours.

The recommended baking condition is: 60°C ± 5°C 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 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 the data sheet. Use constant current driving to ensure consistent performance.
- The circuit design must cater to the entire 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.
- 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 might contain sulfur are rubber gaskets, room-temperature vulcanizing (RTV) 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 they cause condensation on the LED.
- If the LED is intended to be used in a harsh or an 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_{Fma}x = 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:

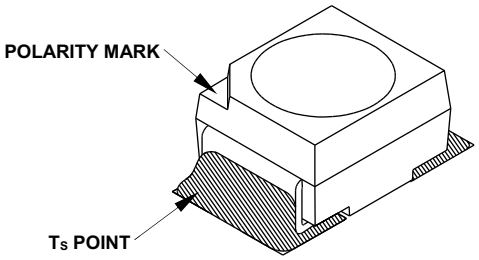
T_S = LED solder point temperature as shown in the following figure (°C)

$R_{\theta J\text{-}S}$ = 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 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 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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