

# ASMT-SWB5-Nxxxx

## Surface Mount LED Indicator

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### Description

The PLCC-4 White SMT LED is an extension of the Broadcom<sup>®</sup> standard PLCC-4 SMT LED family. The package can be driven at higher currents due to its superior package design. The product is able to dissipate heat more efficiently compared to the conventional PLCC-2 SMT LEDs. In proportion to the increase in driving current, this family of LEDs is able to produce higher light output as compared to the conventional PLCC-2 SMT LEDs.

The PLCC-4 White SMT LEDs have higher reliability performance and are designed to work under a wide range of environmental conditions. Superior reliability makes them suitable to be used in office automation, home appliances, and industrial equipment. The wide viewing angle of 120° makes these LEDs ideally suited for panel, push-button, or general backlighting applications.

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

These LEDs are compatible with IR solder reflow process.

### Features

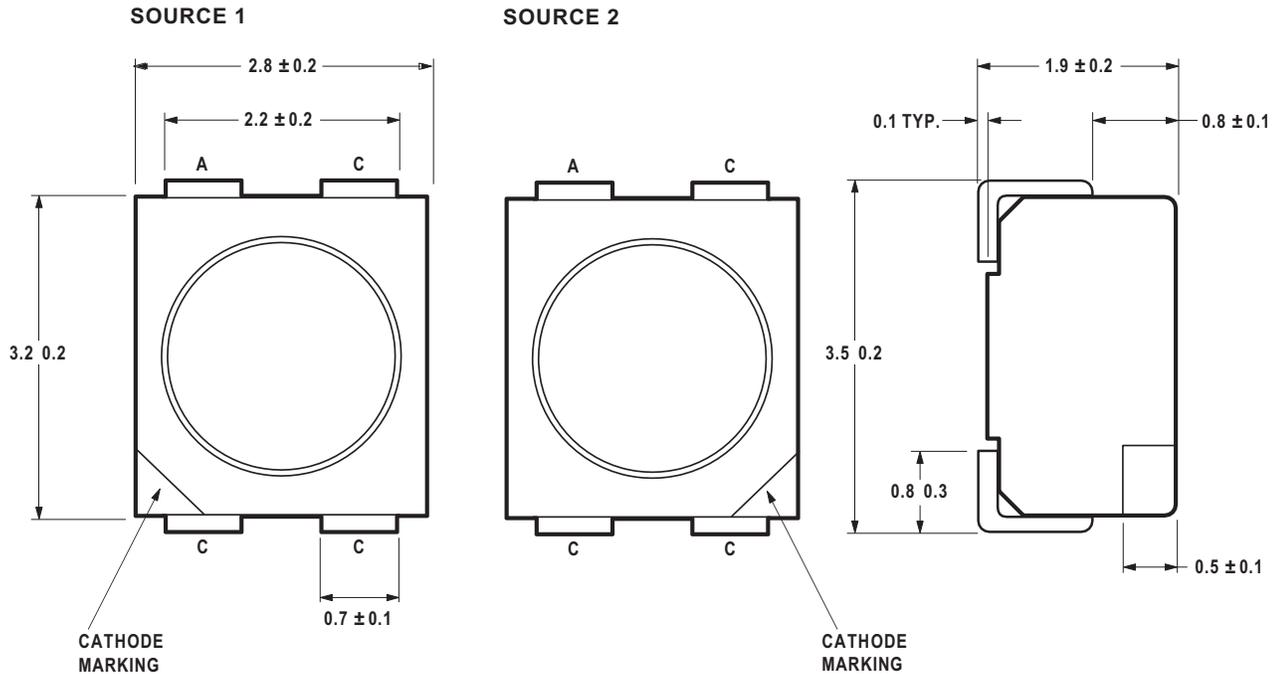
- Industry standard PLCC-4
- High-reliability LED package
- High brightness using InGaN technologies
- High optical efficiency
- Higher ambient temperature at the same current possible compared to PLCC-2
- Super wide viewing angle at 120°
- High reliability LED package due to enhanced silicone resin material
- JEDEC MSL 2a

### Applications

- Office automation, home appliances, industrial equipment
- Front panel backlighting
- Push button backlighting
- Display backlighting

**CAUTION!** This LED is ESD sensitive. Observe appropriate precautions during handling and processing. Refer to application note AN-1142 for additional detail.

Figure 1: Package Drawing

**NOTE:**

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

**Device Selection Guide ( $T_J = 25^\circ\text{C}$ ,  $I_F = 30$  mA)**

Part Number	Luminous Intensity, (mcd) <sup>a, b</sup>			Chip
	Min.	Typ.	Max.	
ASMT-SWB5-NW703	1400.00	—	2850	InGaN

a. The luminous intensity  $I_v$ , is measured at the mechanical axis of the lamp package. The actual peak of the spatial radiation pattern may not be aligned with this axis.

b. Tolerance is  $\pm 12\%$ .

## Absolute Maximum Ratings

Parameters	ASMT-SWB5-NW703	Units
DC Forward Current <sup>a, b</sup>	30	mA
Peak Forward Current <sup>c</sup>	90	mA
Power Dissipation	114	mW
Reverse Voltage	5	V
LED Junction Temperature	110	°C
Operating Temperature Range	-40 to +100	°C
Storage Temperature Range	-40 to +100	°C

- Derate linearly as shown in [Figure 6](#).
- Drive current between 10 mA and 30 mA is recommended for best long term performance.
- Duty factor = 10%, frequency = 1 kHz.

## Optical and Electrical Characteristics (T<sub>J</sub> = 25°C, I<sub>F</sub> = 30 mA)

Parameters	Min.	Typ.	Max.	Units
Viewing Angle, 2θ <sub>1/2</sub> <sup>a</sup>	—	120	—	°
Forward Voltage, V <sub>F</sub> <sup>b</sup>	—	3.20	4.10	V
Reverse Current, I <sub>R</sub> at V <sub>R</sub> = 5V <sup>c</sup>	—	—	10	A
Thermal Resistance R <sub>θJP</sub>	—	280	—	°C/W

- θ<sub>1/2</sub> is the off-axis angle where the luminous intensity is half of the peak intensity.
- Forward voltage tolerance is ±0.1V.
- Indicates product final test condition. Long term reverse bias is not recommended.

## Part Numbering System

A S M T - S x<sub>1</sub> B 5 - N x<sub>2</sub> x<sub>3</sub> x<sub>4</sub> x<sub>5</sub>

Code	Description	Option			
x <sub>1</sub>	LED Chip Color	W	White		
x <sub>2</sub>	Minimum Iv Bin				
x <sub>3</sub>	Intensity Bin Selection	0	Full distribution		
		A	1 half bins starting from X <sub>2</sub> 1		
		2	2 half bins starting from X <sub>2</sub> 1		
		3	3 half bins starting from X <sub>2</sub> 1		
		4	4 half bins starting from X <sub>2</sub> 1		
		5	5 half bins starting from X <sub>2</sub> 1		
		B	1 half bins starting from X <sub>2</sub> 2		
		6	2 half bins starting from X <sub>2</sub> 2		
		7	3 half bins starting from X <sub>2</sub> 2		
		8	4 half bins starting from X <sub>2</sub> 2		
9	5 half bins starting from X <sub>2</sub> 2				
x <sub>4</sub>	Color Bin Selection	0	Full distribution	L	5, 6, and 7 only
		A	1 and 2 only	M	1, 2, 3, and 4 only
		B	2 and 3 only	N	2, 3, 4, and 5 only
		C	3 and 4 only	P	3, 4, 5, and 6 only
		D	4 and 5 only	Q	4, 5, 6, and 7 only
		E	5 and 6 only	R	1, 2, 3, 4, and 5 only
		F	6 and 7 only	S	2, 3, 4, 5, and 6 only
		G	1, 2, and 3 only	T	3, 4, 5, 6, and 7 only
		H	2, 3, and 4 only	U	1, 2, 3, 4, 5 and 6 only
		J	3, 4, and 5 only	V	2, 3, 4, 5, 6 and 7 only
K	4, 5, and 6 only	Z	Special Color Bin		
x <sub>5</sub>	Packaging Option	3	30 mA, top mount, 7 in. reel size		

### Part Number Example

ASMT-SWB5-NW703

- x<sub>1</sub> : W — White
- x<sub>2</sub> : W — Minimum intensity bin W
- x<sub>3</sub> : 7 — 3 half bins starting from X<sub>2</sub>2
- x<sub>4</sub> : 0 — Full distribution
- x<sub>5</sub> : 3 — Test current = 30 mA, top mount, 7-in. reel

## Bin Information

### Intensity Bin Limits (CAT)

Bin ID	Luminous Flux, IV (lm)	
	Min.	Max.
W1	1125	1400
W2	1400	1800
X1	1800	2240
X2	2240	2850
Y1	2850	3550
Y2	3550	4500
Z1	4500	5600
Z2	5600	7150

Tolerance =  $\pm 12\%$ .

### Color Bin Limits (BIN)

Color Bin ID	Chromaticity Coordinates Limits				
1	x	0.296	0.291	0.31	0.313
	y	0.259	0.268	0.297	0.284
2	x	0.291	0.285	0.307	0.31
	y	0.268	0.279	0.312	0.297
3	x	0.313	0.31	0.33	0.33
	y	0.284	0.297	0.33	0.31
4	x	0.31	0.307	0.33	0.33
	y	0.297	0.312	0.347	0.33
5	x	0.33	0.33	0.338	0.352
	y	0.31	0.33	0.342	0.344
6	x	0.33	0.33	0.347	0.345
	y	0.33	0.347	0.371	0.352
7	x	0.352	0.338	0.364	0.36
	y	0.344	0.342	0.38	0.357
8	x	0.345	0.347	0.367	0.364
	y	0.352	0.371	0.401	0.38

Tolerance of each bin limit =  $\pm 0.02$  mm.

Figure 2: Chromaticity Diagram

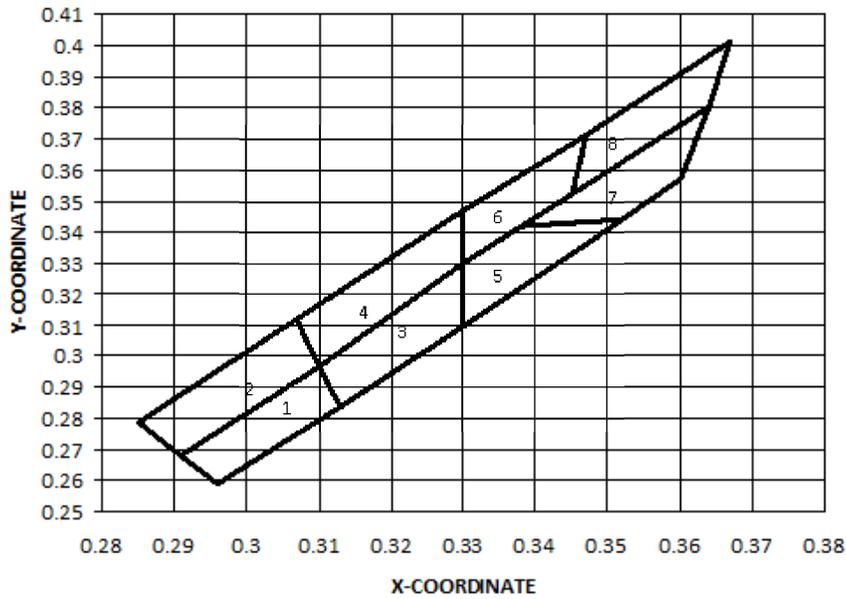


Figure 3: Forward Current vs. Forward Voltage

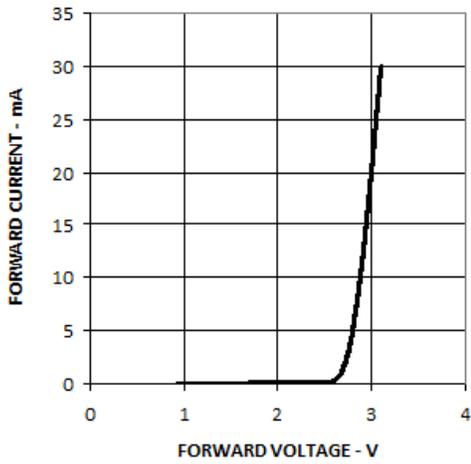


Figure 4: Relative Intensity vs. Mono Pulse Current

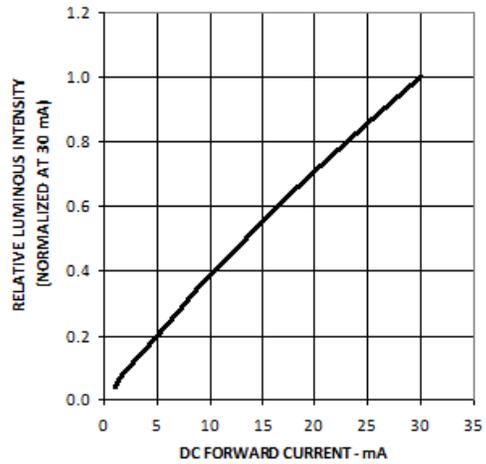


Figure 5: Radiation Pattern

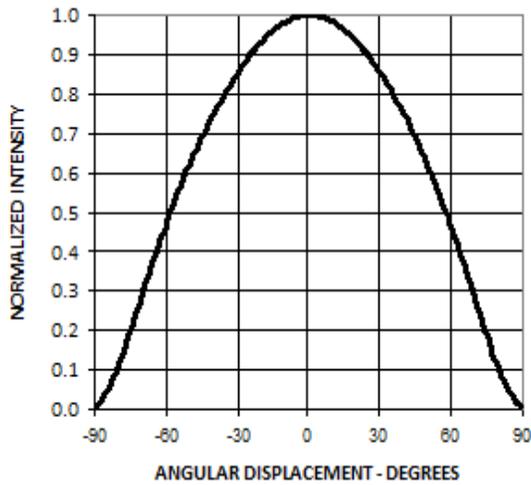


Figure 6: Maximum Forward Current vs. Ambient Temperature. Derated based on  $T_{jmax}$  110° C,  $R_{thja}$  600°C/W.

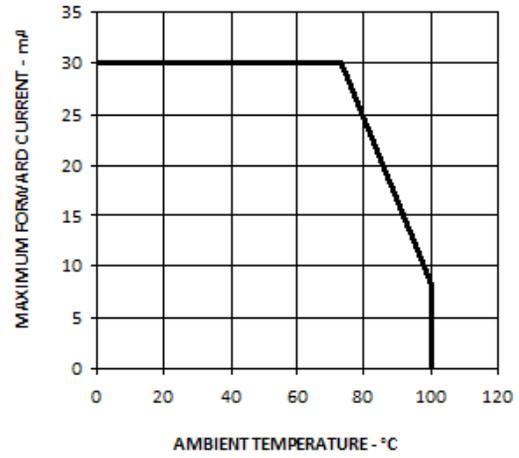
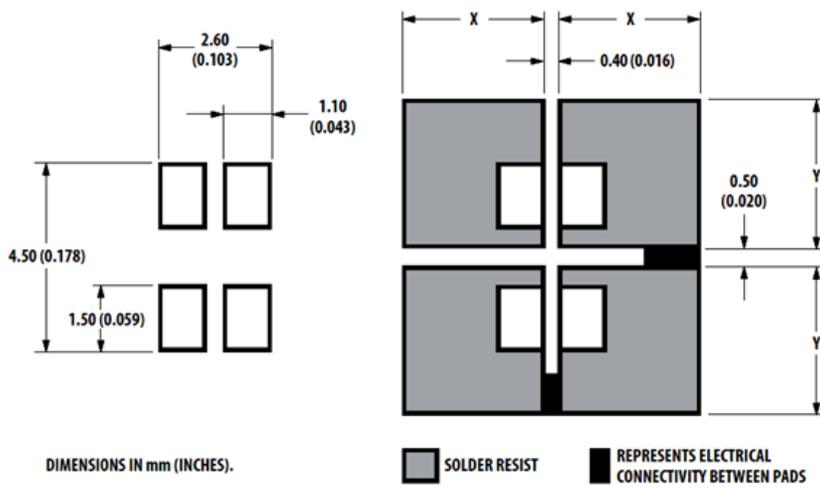
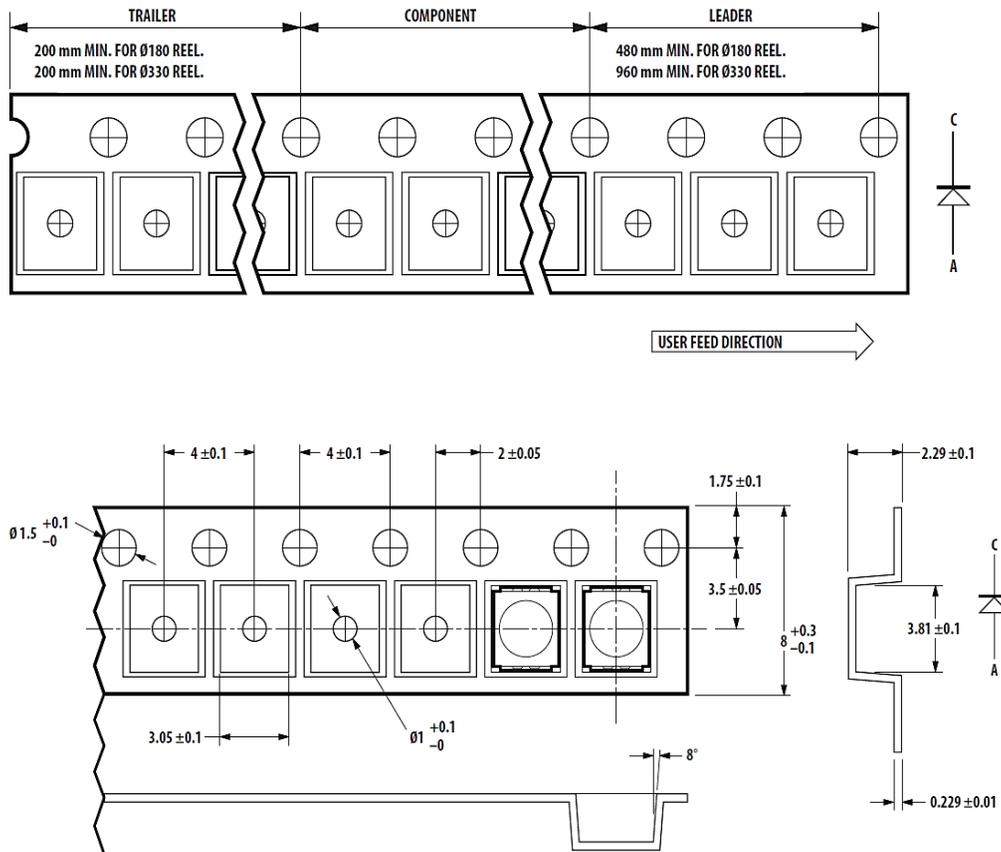


Figure 7: Recommended Soldering Land Pattern



NOTE: All dimensions are in millimeters (mm).

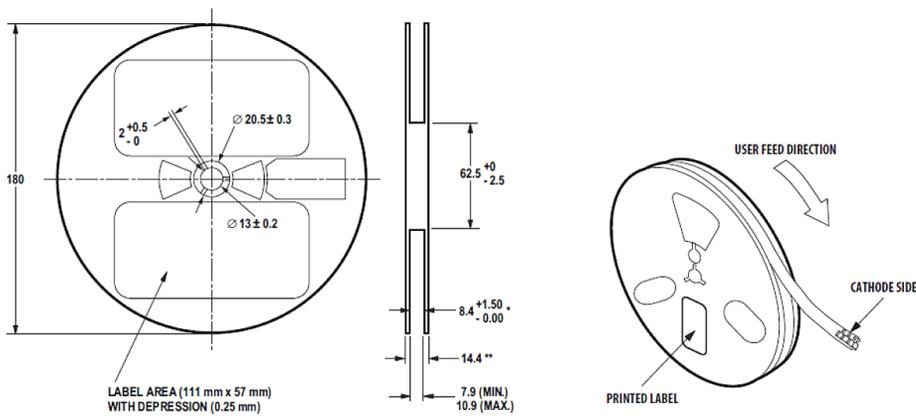
**Figure 8: Carrier Tape Dimensions**



**NOTE:**

1. All dimensions in millimeters (mm).
2. Tolerance is  $\pm 0.20$  mm unless otherwise specified.

**Figure 9: Reel Dimensions**



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 10: Recommended Lead-Free Reflow Soldering Profile

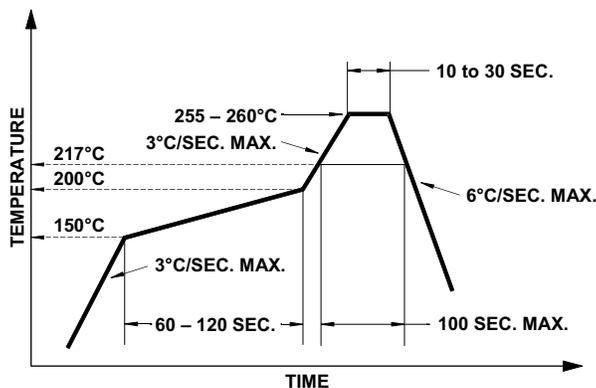
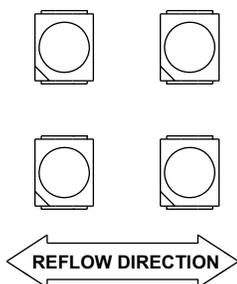


Figure 11: Recommended Board Reflow Direction



### 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 the 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 the 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 1.5 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:

- An unopened moisture barrier bag (MBB) can be stored at <math>40^{\circ}\text{C}/90\% \text{ RH}</math> 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 <math>30^{\circ}\text{C}/60\% \text{ RH}</math> 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 <math>5\% \text{ RH}</math>.

### 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 <math>5\% \text{ RH}</math> 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 <math>30^{\circ}\text{C}/60\% \text{ RH}</math> at any time.
- The LED's floor life exceeded 168 hours.

The recommended baking condition is: <math>60^{\circ}\text{C} \pm 5^{\circ}\text{C}</math> 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 be oxidized, thus affecting its solderability performance. As such, keep unused LEDs in a sealed MBB with desiccant or in a desiccator at <math>5\% \text{ RH}</math>.

## 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.
- 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.
- White LEDs must not be exposed to acidic environments and must not be used in the vicinity of any compound that may have acidic outgas, such as, but not limited to, acrylate adhesive. These environments have an adverse effect on LED performance.
- 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 environments, 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:

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

where:

$T_A$  = Ambient temperature ( $^{\circ}\text{C}$ )

$R_{\theta J-A}$  = Thermal resistance from LED junction to ambient ( $^{\circ}\text{C}/\text{W}$ )

$I_F$  = Forward current (A)

$V_{Fmax}$  = Maximum forward voltage (V)

The complication of using this formula lies in  $T_A$  and  $R_{\theta J-A}$ . Actual  $T_A$  is sometimes subjective and hard to determine.  $R_{\theta J-A}$  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:

$$T_J = T_S + R_{\theta J-S} \times I_F \times V_{Fmax}$$

where:

$T_S$  = LED solder point temperature as shown in the following figure ( $^{\circ}\text{C}$ )

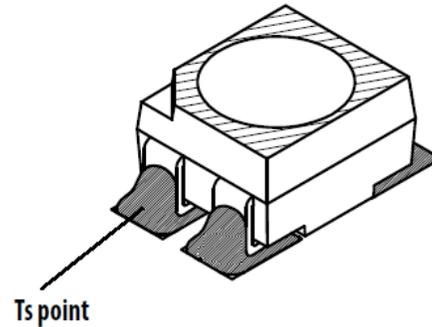
$R_{\theta J-S}$  = Thermal resistance from junction to solder point ( $^{\circ}\text{C}/\text{W}$ )

$I_F$  = Forward current (A)

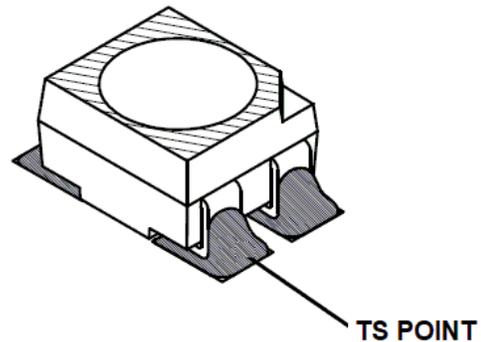
$V_{Fmax}$  = Maximum forward voltage (V)

Figure 12: Solder Point Temperature on PCB

Source 1



Source 2



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

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