BROADCOM®

Data Sheet

HSMW-C410

Mono-Color Side-View JLED

Description

The Broadcom® HSMW-C410 is a high-brightness white LED in a side-emitting package. This LED uses InGaN chip technology with high-light output performance. This part uses silicone encapsulation to improve product robustness and reliability, thus enabling this LED to operate under a wide range of conditions. This LED has a thin profile and wide viewing angle. The thin profile feature makes this LED suitable for applications that require low package height, whereas the wide viewing angle delivers good uniformity for applications, such as display backlighting. This package is compatible with reflow soldering and binned by both color and intensity.

Features

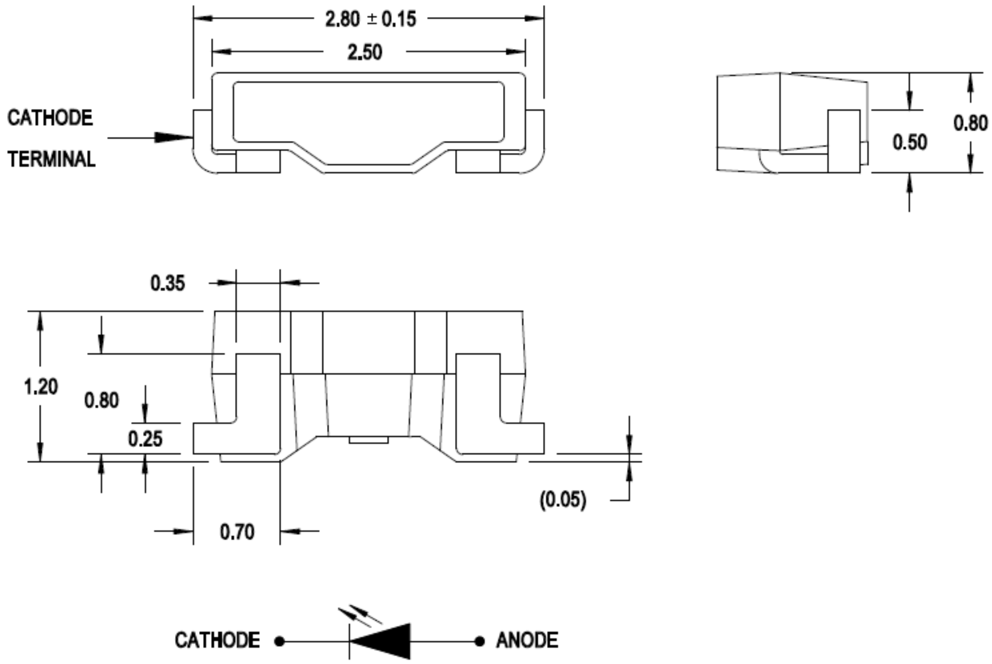
- LED with InGaN die
- White emitting color
- Compatible with reflow soldering
- Available in 8-mm tape on 7-in. diameter reels

Applications

- Indicator
- Backlighting

CAUTION! LEDs are class 1A ESD sensitive per ANSI/ESDA/JEDEC JS-001. Please observe appropriate precautions during handling and processing. Refer to Application Note AN-1142 for additional details.

Figure 1: Package Dimensions



NOTE:

1. All dimensions are in millimeters.
2. Tolerance ±0.10 mm unless otherwise specified.
3. Encapsulation: silicone.
4. Terminal finish: silver plating.
5. Dimensions in brackets are for reference only.

Absolute Maximum Ratings

Parameter	Rating	Units
DC Forward Current[a]	30	mA
Peak Forward Current[b]	100	mA
Power Dissipation	93	mW
LED Junction Temperature	110	°C
Operating Temperature Range	–40 to +85	°C
Storage Temperature Range	–40 to +100	°C

a. Derate as shown in Figure 5.

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

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

Parameters	Min.	Typ.	Max.	Unit
Luminous Intensity, I_V[a]	2800	—	3200	mcd
Viewing Angle, $2\theta_{1/2}$[b]	—	118	—	degree
Forward Voltage, V_F[c]	2.7	—	3.1	V
Reverse Current, I_R at V_R = 5V[d]	—	—	10	µA
Thermal Resistance, $R_{\theta J\text{-}S}$[e]	—	100	—	°C/W

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

b. Viewing angle is the off axis angle where the luminous intensity is ½ the peak intensity.

c. Forward voltage tolerance = ±0.1V.

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

e. Thermal resistance from LED junction to solder point.

Bin Information

Intensity Bin Limits (CAT)

Bin ID	Luminous Intensity, I_V (mcd)	
	Min.	Max.
W9A	2800	2850
W9B	2850	2900
W10A	2900	2950
W10B	2950	3000
Y1A	3000	3050
Y1B	3050	3100
Y2A	3100	3150
Y2B	3150	3200

Tolerance ±15%.

Forward Voltage Bin Limits (VF)

Bin ID	Forward Voltage, V_F (V)	
	Min.	Max.
B	2.7	2.8
A	2.8	2.9
0	2.9	3.0
1	3.0	3.1

Tolerance ± 0.1V.

Example of bin information on reel and packaging label:

CAT: x — Intensity bin
BIN: x — Color bin
VF: x — Forward voltage bin

Color Bin Limits (BIN)

Bin ID	Chromaticity Coordinates	
	x	y
CD1	0.280	0.262
	0.280	0.268
	0.285	0.276
	0.285	0.270
CD2	0.285	0.270
	0.285	0.276
	0.290	0.284
	0.290	0.278
CD3	0.280	0.256
	0.280	0.262
	0.285	0.270
	0.285	0.264
CD4	0.285	0.264
	0.285	0.270
	0.290	0.278
	0.290	0.272
CE1	0.290	0.278
	0.290	0.284
	0.295	0.293
	0.295	0.287
CE2	0.295	0.287
	0.295	0.293
	0.300	0.301
	0.300	0.295
CE3	0.290	0.272
	0.290	0.278
	0.295	0.287
	0.295	0.281
CE4	0.295	0.281
	0.295	0.287
	0.300	0.295
	0.300	0.289

Tolerance ±0.01.

Figure 2: Chromaticity Diagram

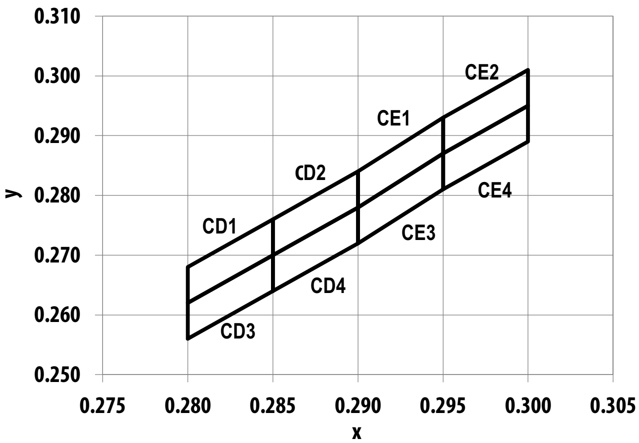


Figure 3: Forward Current vs. Forward Voltage

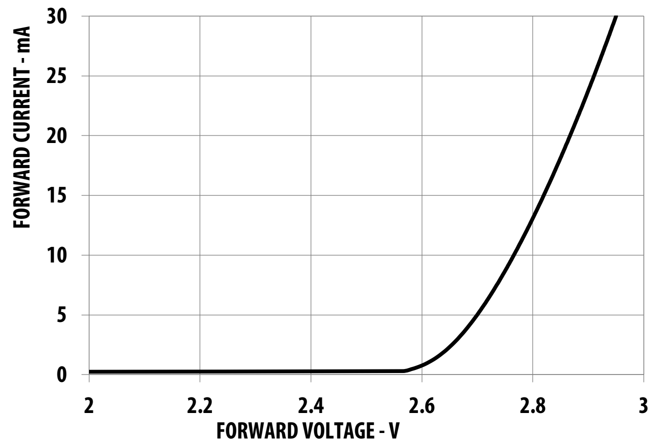


Figure 4: Relative Luminous Intensity vs. Forward Current

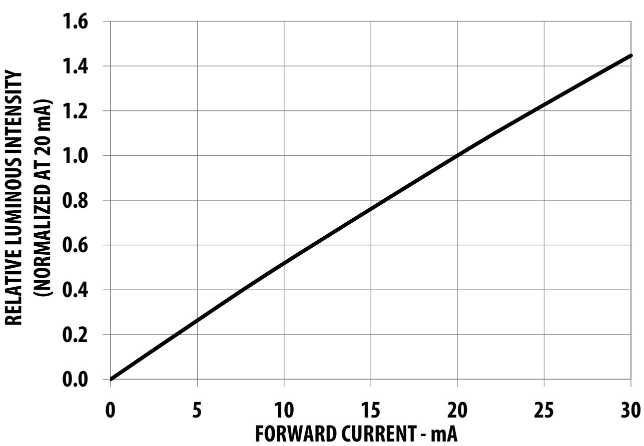


Figure 5: Derating Curve

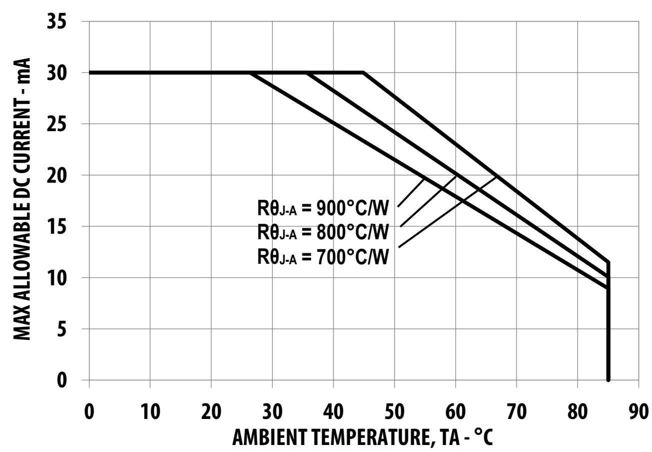


Figure 6: Spectrum

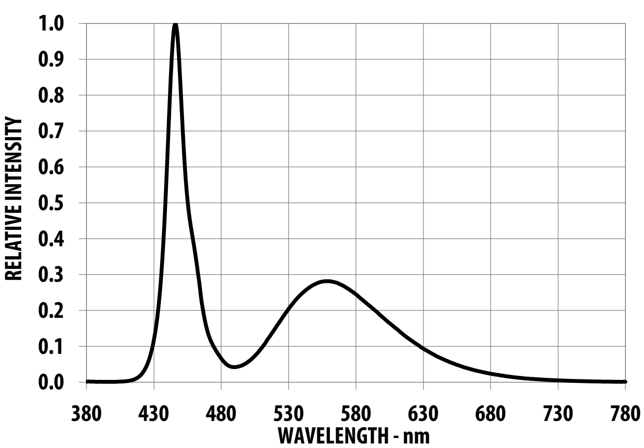


Figure 7: Radiation Pattern

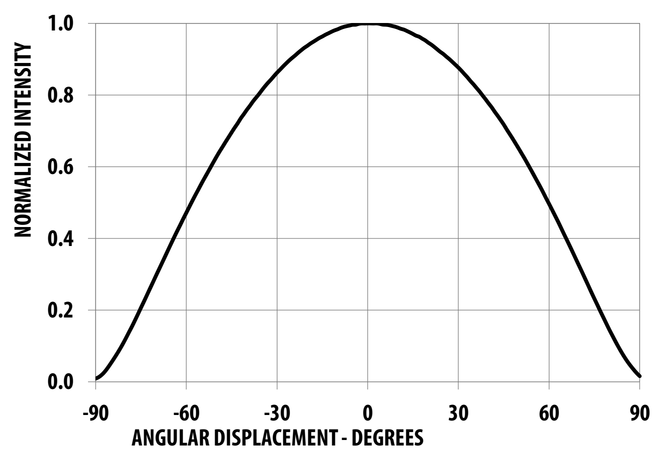


Figure 8: Chromaticity Coordinates Shift vs. Forward Current

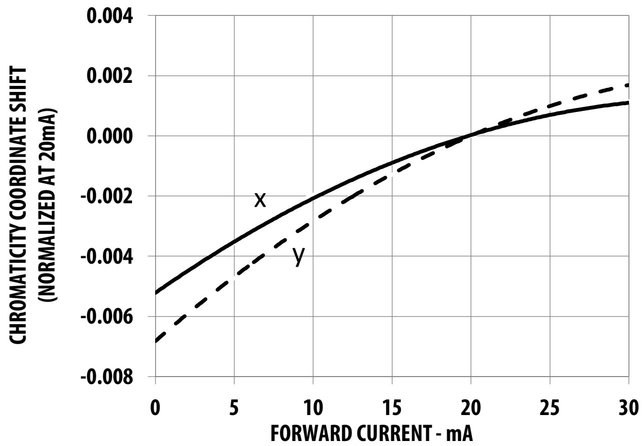


Figure 9: Relative Intensity vs. Temperature

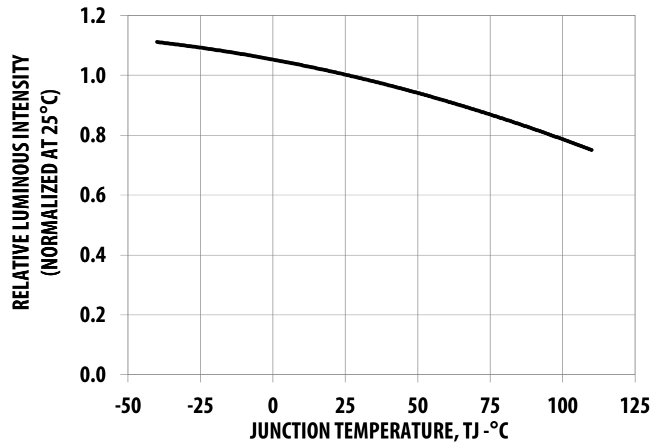


Figure 10: Forward Voltage Shift vs. Temperature

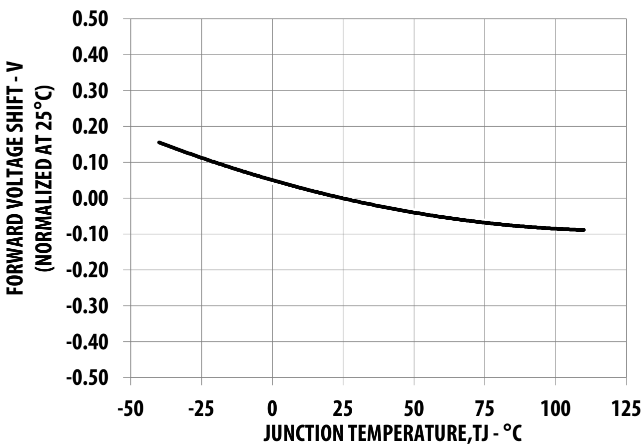
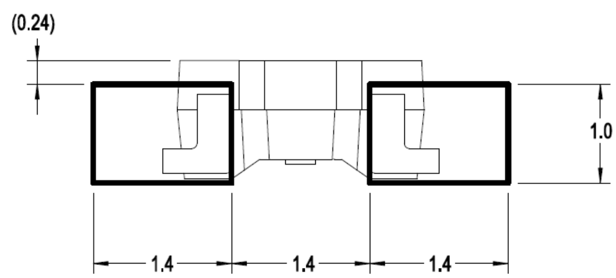


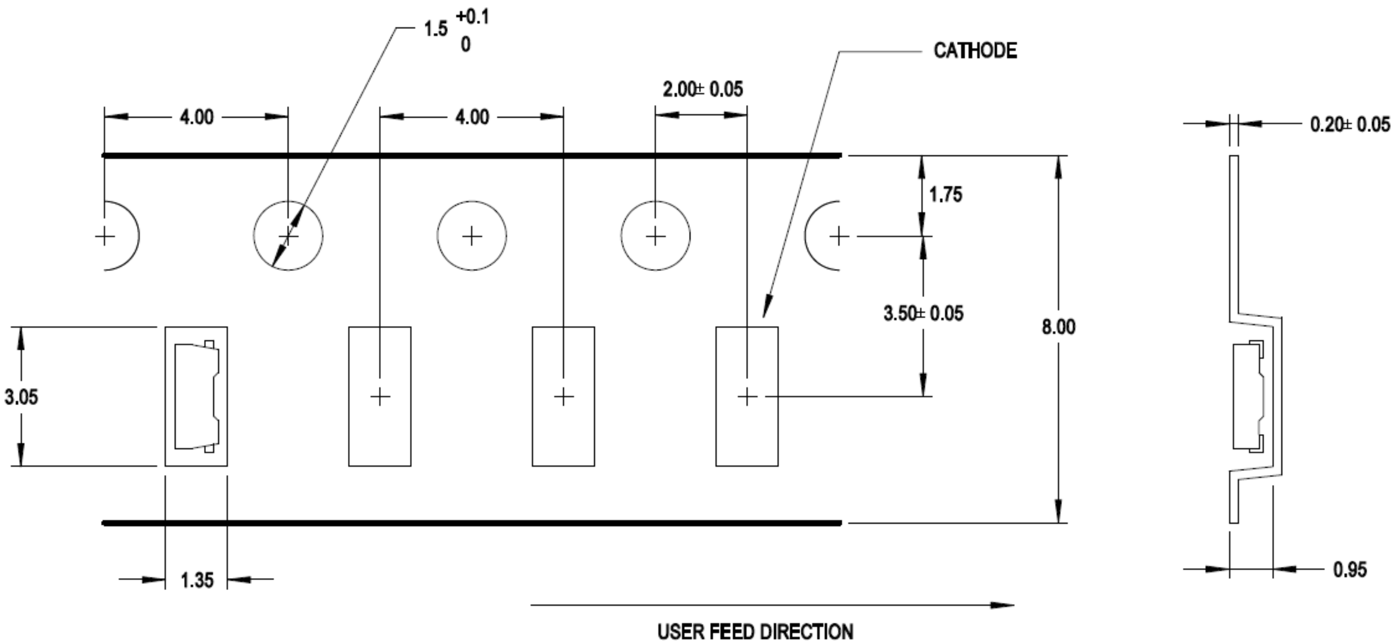
Figure 11: Recommended Soldering Land Pattern



NOTE:

1. All dimensions in millimeters.
2. Tolerance is ±0.10 mm unless otherwise specified.
3. Dimensions in bracket for reference only.

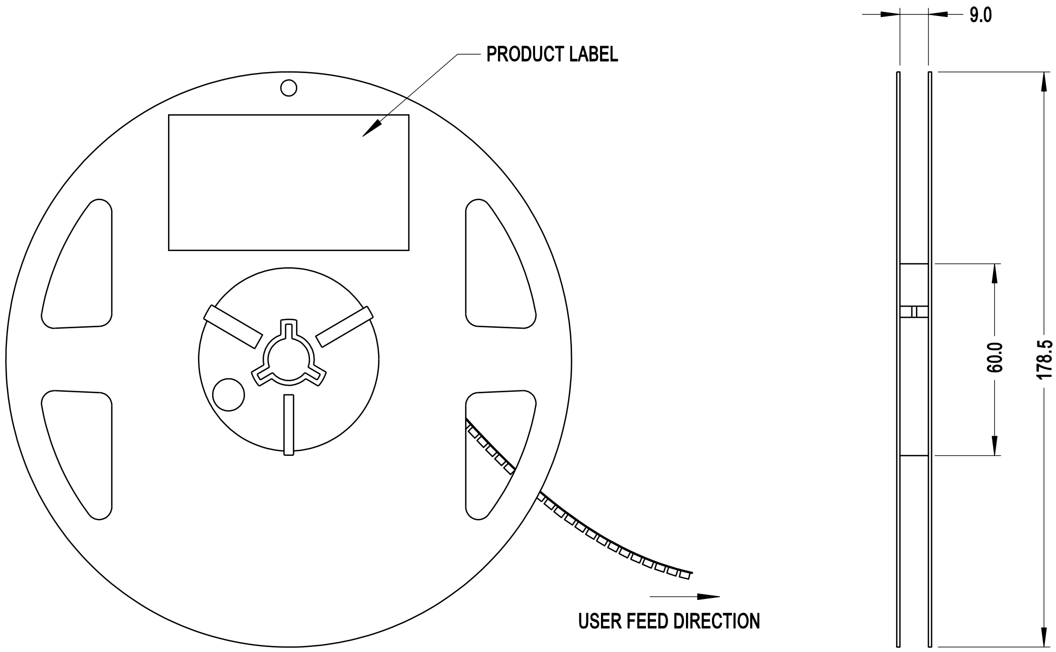
Figure 12: Carrier Tape Dimensions



NOTE:

1. All dimensions are in millimeters.
2. Tolerance is ±0.10mm unless otherwise specified.

Figure 13: Reel Dimensions



NOTE:

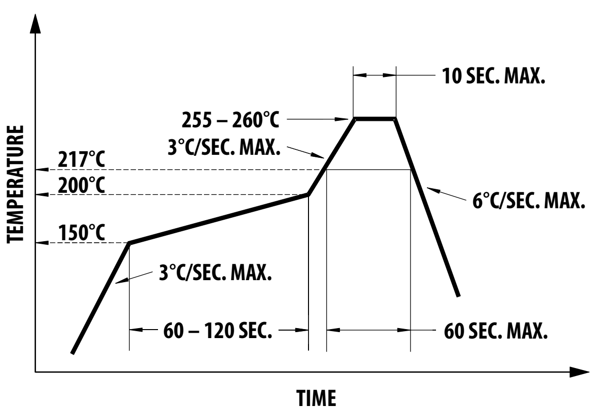
1. All dimensions are in millimeters.
2. Tolerance is ±0.10mm unless otherwise specified.

Precautionary Notes

Soldering

- Reflow soldering must not be done 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. If unavoidable (such as rework), use manual hand soldering strictly controlled to the following conditions:
  – Soldering iron tip temperature = 310°C maximum
  – Soldering duration = 2 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 might cause damage to the LED.
- Confirm beforehand whether the functionality and performance of the LED is affected by hand soldering.

Figure 14: Recommended Lead-Free Reflow Soldering Profile



Handling Precautions

The encapsulation material of the LED is made of silicone for better product reliability. Compared to epoxy encapsulant that 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 Application Note AN5288, *Silicone Encapsulation for LED: Advantages and Handling Precautions,* for more 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.
- Surface of silicone material attracts dusk 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 much pressure on the silicone. Ultrasonic cleaning is not recommended.
- For automated pick-and-place, Broadcom has tested nozzle size with O/D 1 mm to work well 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 damage the LED.

Handling of a Moisture-Sensitive Device

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 < 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).
- **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 all high-temperature-related processes, including soldering, curing, or rework, must be completed within 168 hours.
- **Control for unfinished reel:**

  Store unused LEDs in a sealed MBB with desiccant or 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 LEDs' floor life exceeded 168 hours.

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

  Baking should 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, unused LEDs must be kept in sealed a MBB with desiccant or in 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.
- The circuit design must cater to the entire range of forward voltage (V_F) of the LEDs to ensure that the intended drive current can always be achieved.
- LEDs exhibit slightly different characteristics at different drive currents that might result in larger performance variations (that is, intensity, wavelength, and forward voltage). Set the application current as close as possible to the test current to minimize these variations.
- If the LED is intended to be used along with LEDs of another color to achieve color mixing, Broadcom does not guarantee the consistency of the resultant color. Contact a Broadcom Sale Representative for such applications.
- 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 temperature, especially in high-humidity environments, because this will 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 stress, and so on.

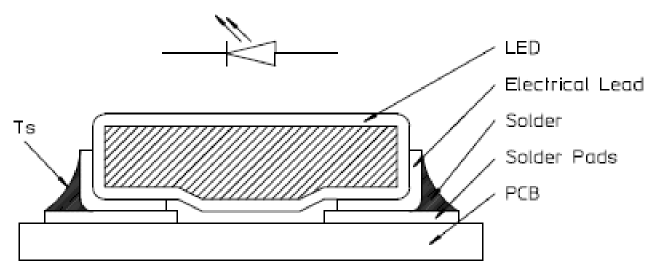
Thermal Management

Optical, electrical, and reliability characteristics of LED are affected by temperature. The junction temperature (T_J) of the LED must be kept below allowable limit at all time. T_J can be calculated as follows:

$$T_J = T_S + R_{\theta JS} \times I_F \times V_{Fmax}$$

where

T_S	=	LED solder point temperature as shown in the following figure (°C)
$R_{\theta JS}$	=	Thermal resistance from junction to solder point (°C/W)
I_F	=	Forward current (A)
V_{Fmax}	=	Maximum forward voltage (V)



To measure the soldering point temperature T_S, mount a thermocouple on the extended soldering pad as shown in preceding figure. Verify the T_S of the LED in the final product to ensure that the LEDs are operated within all maximum ratings stated in the data sheet.

Eye Safety and Precautions

LEDs may pose optical hazards when in operation. Do not look directly at operating LEDs as it may be harmful to the eyes. For safety reasons, use appropriate shielding or personnel protection equipment.

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