

## **HSMF-C112**

### **Tri-Color Top-Mount ChipLED**

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#### **Description**

The Broadcom® HSMF-C112 is a 4-pin tri-color RGB surface-mount chipLED. This chipLED is available in a very small package footprint of 0.69 mm × 0.69 mm. The small package footprint and low package height of 0.5 mm make this chipLED an ideal solution for application that has constraint in space and head room, such as wearables and handheld portable devices.

Its small form factor enables flexible board design and allows the chipLED to be assembled in a closer pitch. This chipLED offers industry-leading light output performance by using efficient and high-brightness AlInGaP and InGaN LED materials.

This chipLED is compatible with reflow soldering process. For easy pick-and-place, the parts are packed in tape and reel. Every reel is shipped from a single intensity and color bin for better uniformity control.

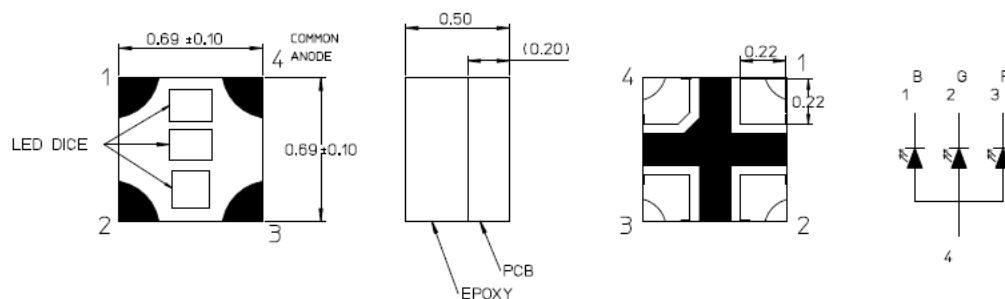
#### **Features**

- LED with AlInGaP Red, InGaN Green and Blue
- Compatible with reflow soldering
- Available in 8-mm tape on 7-in. diameter reels

#### **Applications**

- Backlighting
- Indicator

**CAUTION!** This LED is 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. Dimensions in brackets are for reference only.
3. Tolerance  $\pm 0.10$  mm unless otherwise specified.

**Absolute Maximum Value at  $T_J = 25^\circ\text{C}$** 

Parameter	Red	Green	Blue	Units
DC Forward Current <sup>a</sup>	10	10	5	mA
Power Dissipation	24	34	17	mW
LED Junction Temperature	95			$^\circ\text{C}$
Operating Temperature Range	-40 to +85			$^\circ\text{C}$
Storage Temperature Range	-40 to +85			$^\circ\text{C}$

a. Derate as shown in [Figure 6](#).

**Optical Characteristics ( $T_J = 25^\circ\text{C}$ , Red = 10 mA, Green/Blue = 5 mA)**

Color	Luminous Intensity $I_v^a$ (mcd)		Dominant Wavelength $\lambda_d^b$ (nm)	Peak Wavelength $\lambda_{\text{peak}}$ (nm)	Viewing Angle $2\theta_{1/2}^c$ (Degrees)
	Min.	Max.	Typ.	Typ.	Typ.
Red	36.0	79.0	622	629	130
Green	71.0	155.0	527	519	150
Blue	14.0	31.5	468	464	150

- 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.
- The dominant wavelength,  $\lambda_d$ , is derived from the CIE Chromaticity Diagram and represents the perceived color of the device.
- $\theta_{1/2}$  is the off-axis angle where the luminous intensity is  $\frac{1}{2}$  the peak intensity.

## Electrical Characteristics at $T_J = 25^\circ\text{C}$ , Red = 10 mA, Green/Blue = 5 mA)

Color	Forward Voltage $V_F$ (Volts) <sup>a</sup>		Reverse Current $I_R$ ( $\mu\text{A}$ ) at $V_R = 5\text{V}^b$
	Min.	Max.	Max.
Red	1.6	2.4	100
Green	2.4	3.4	100
Blue	2.4	3.4	100

a.  $V_F$  tolerance:  $\pm 0.1\text{V}$ .

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

## Bin Information

### Intensity Bin Limits (CAT)

Bin ID	Luminous Intensity, $I_v$ (mcd)	
	Min.	Max.
<b>Red</b>		
N7	36.0	56.0
N9	40.0	63.0
P	45.0	71.0
P5	50.0	79.0
<b>Green</b>		
Q	71.0	112.0
Q5	80.0	125.0
Q7	90.0	140.0
Q9	95.0	155.0
<b>Blue</b>		
L7	14.0	22.0
L9	16.0	25.0
M	18.0	28.5
M5	20.0	31.5

Tolerance  $\pm 15\%$ .

### Color Bin Limits (BIN)

Bin ID	Dominant Wavelength, $\lambda_d$ (nm)	
	Min.	Max.
<b>Red</b>		
1	615	627
<b>Green</b>		
2	523	529
3	525	531
4	528	534
5	530	536
6	533	539
<b>Blue</b>		
5	464	469
6	466	471
7	468	473
8	470	475

Tolerance  $\pm 1.0$  nm.

Indication of bin information on reel and packaging label:

CAT:    xxx —>    Red/Green/Blue Intensity bin  
 BIN:    xxx —>    Red/Green/Blue Color bin

### CAUTION!

1. The above optical specifications are valid in the case where a single LED is illuminated.
2. The above product specifications *do not* provide any guarantee on color mixing, color consistency over time, or uniformity in luminous intensity when more than one LED is illuminated.

Figure 2: Spectral Power Distribution

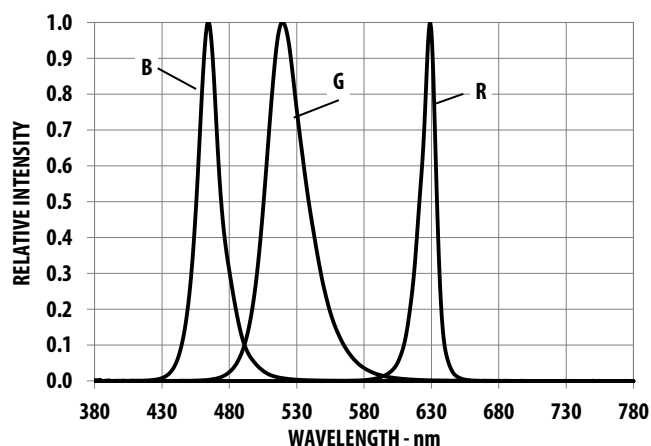


Figure 3: Forward Current vs. Forward Voltage

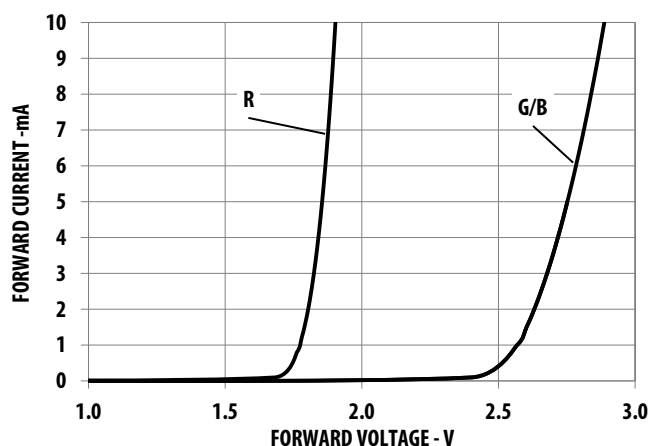


Figure 4: Relative Luminous Intensity vs. Forward Current

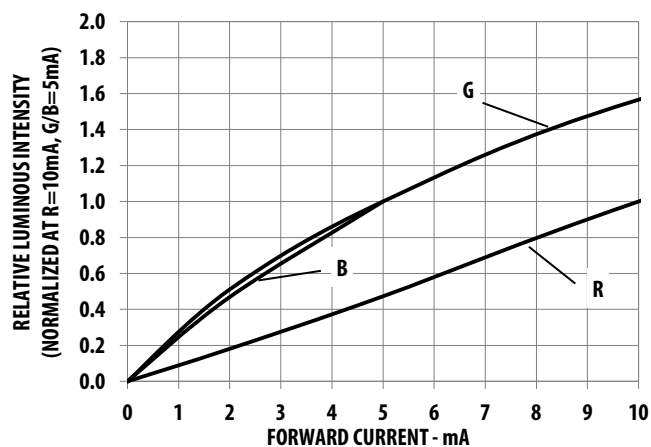


Figure 5: Radiation Pattern

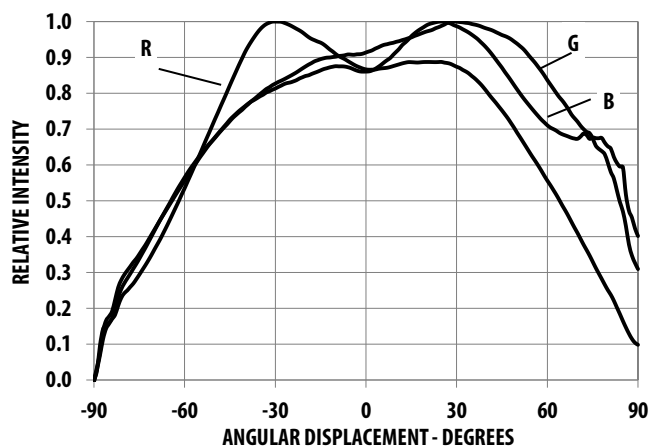


Figure 6: Derating Curve

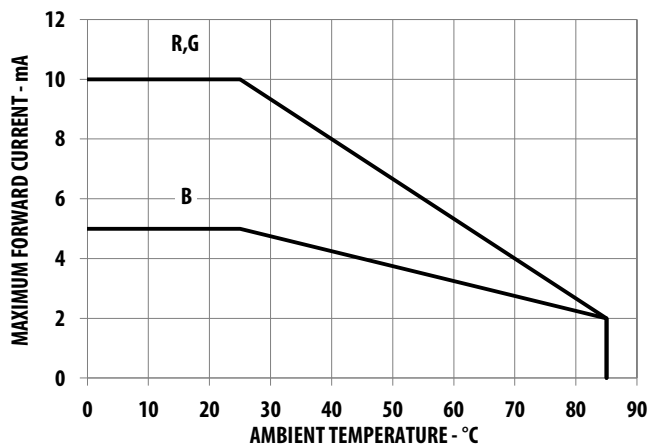
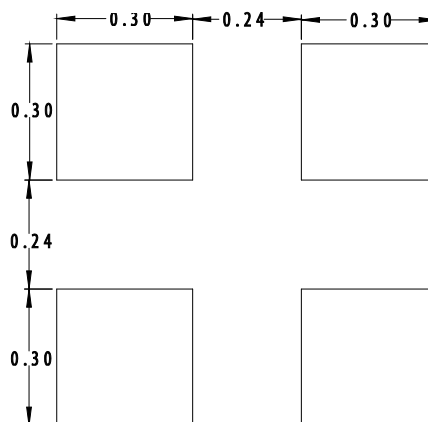
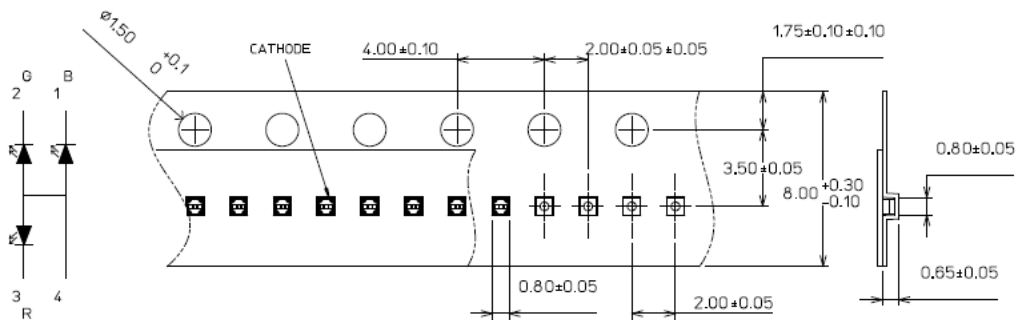


Figure 7: Recommended Soldering Land Pattern



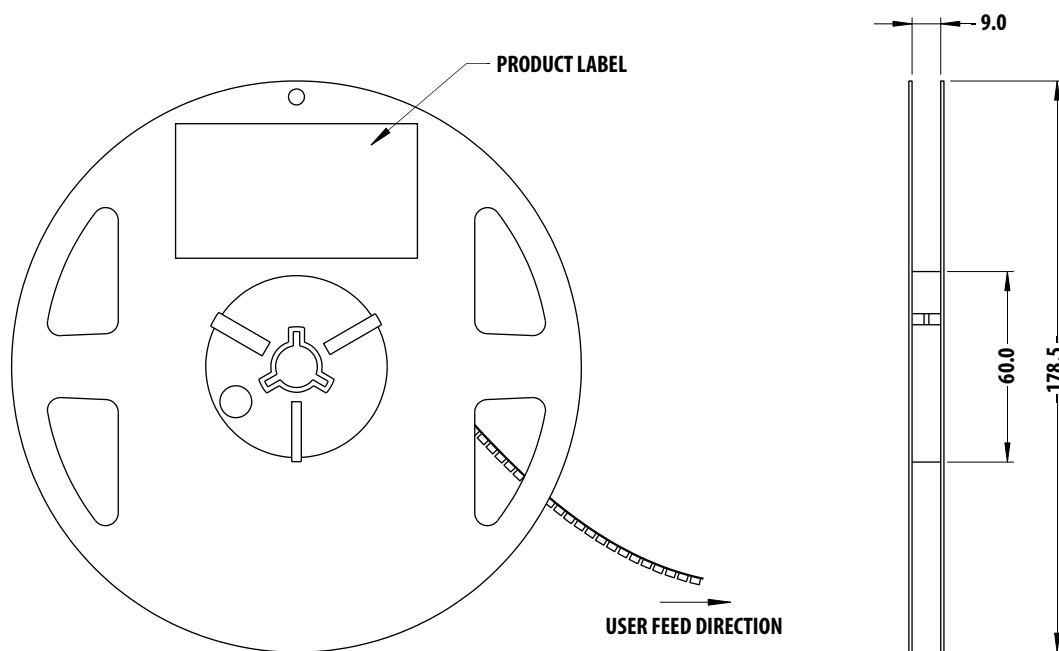
**NOTE:** All dimensions are in millimeters.

### Figure 8: Carrier Tape Dimensions



**NOTE:** All dimensions are in millimeters.

### Figure 9: Reel Dimensions

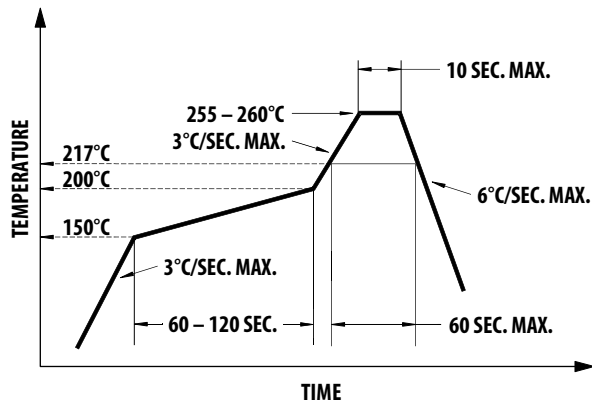


**NOTE:** All dimensions are in millimeters.

## Precautionary Notes

### Soldering

Figure 10: Recommended Lead-Free Reflow Soldering Profile



- 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. If unavoidable (such as rework), use 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.

### Handling of Moisture-Sensitive Devices

This product has a Moisture Sensitive Level 2a 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). If unavoidable, properly reseal 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 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 672 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 672 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 672 hours.

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

Baking should only be done once.

### 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.

- 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.
- 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.

## 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 personal protection equipment.

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