

## HSMQ-C400

### Side-Fire Mono-Color Surface-Mount ChipLED

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#### Description

The Broadcom<sup>®</sup> HSMQ-C400 is a side-emitting surface-mount chipLED. This chipLED is available in industrial popular package footprint of 3.2 mm × 2.55 mm. This product comes with integrated optical lens that narrows the viewing angle of the light beam, thereby increasing the on-axis intensity. This allows effective light coupling into secondary optics, such as a light guide and a light pipe.

It offers industry-leading performance by using efficient and high-brightness InGaN LED materials.

This chipLED is ideal for applications that require narrow beam angle or high on-axis intensity. Examples include industrial equipment, consumer electronics, and black-and-white home appliances. It is compatible with industry-standard automatic machine placement and reflow soldering.

#### Features

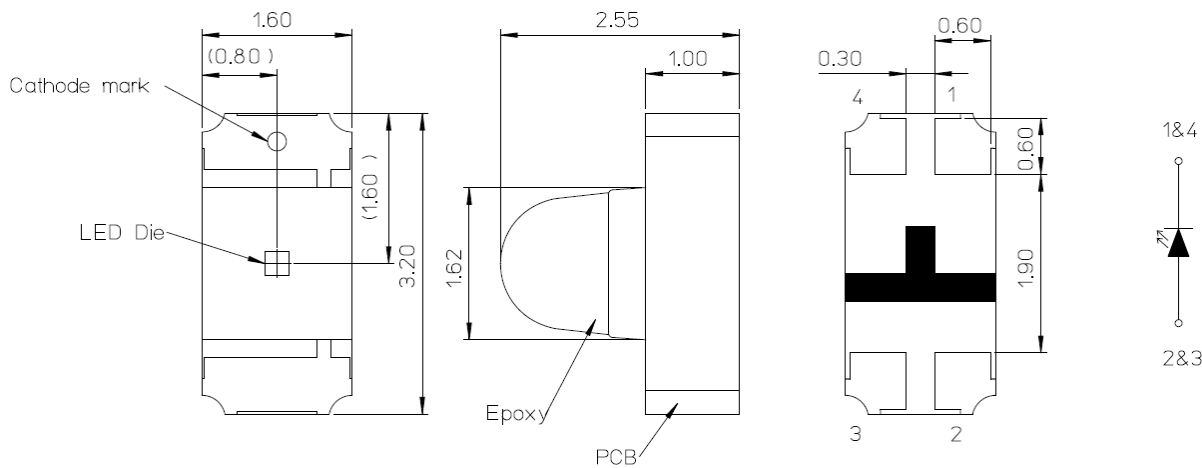
- LED with InGaN Green
- Compatible with reflow soldering
- Available in 8-mm tape on 7-in. diameter reels

#### Applications

- Backlighting
- Status indicator

**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  $\pm 0.1$  mm unless otherwise specified.
3. Dimensions in brackets are for reference only.

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

Parameter	Rating	Units
DC Forward Current <sup>a</sup>	20	mA
Power Dissipation	78	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 5.

**Electrical Characteristics at  $T_J = 25^\circ\text{C}$** 

Color	Forward Voltage $V_F$ (Volts) <sup>a</sup> @ $I_F = 20$ mA		Reverse Current $I_R$ ( $\mu\text{A}$ ) <sup>b</sup> @ $V_R = 5$ V	Thermal Resistance, $R_{\theta J-S}$ ( $^\circ\text{C}/\text{W}$ ) <sup>c</sup>
	Min.	Max.	Max.	Typ.
Green	2.9	3.9	100	500

a.  $V_F$  tolerance:  $\pm 0.1$  V.

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

c. Thermal resistance from LED junction to solder point.

## Optical Characteristics at $T_J = 25^\circ\text{C}$

Color	Luminous Intensity $I_V^a$ (mcd) @ 20mA		Peak Wavelength $\lambda_{\text{peak}}$ (nm)	Dominant Wavelength $\lambda_d^b$ (nm)	Viewing Angle $2\theta_{1/2}^c$ (Degrees)
	Min.	Max.	Typ.	Typ.	Typ.
Green	285.0	4500.0	515	522	130

- The luminous intensity 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.

## Bin Information

### Intensity Bins (CAT)

Bin ID	Luminous Intensity (mcd)	
	Min.	Max.
T	285.0	450.0
U	450.0	715.0
V	715.0	1125.0
W	1125.0	1800.0
X	1800.0	2850.0
Y	2850.0	4500.0

Tolerance  $\pm 15\%$ .

### Color Bins (BIN)

Bin ID	Dominant Wavelength (nm)	
	Min.	Max.
A	515	520
B	520	525
C	525	530
D	530	535

Tolerance  $\pm 1$  nm.

### Forward Voltage (VF)

Bin ID	Forward Voltage (V)	
	Min.	Max.
1	2.9	3.1
2	3.1	3.3
3	3.3	3.5
4	3.5	3.7
5	3.7	3.9

Tolerance  $\pm 0.1\text{V}$ .

Example of bin information on reel and packaging label:

CAT: x  $\rightarrow$  Green Iv bin  
 BIN: x  $\rightarrow$  Green color bin  
 VF: x  $\rightarrow$  Forward voltage bin

Figure 2: Relative Intensity vs. Wavelength

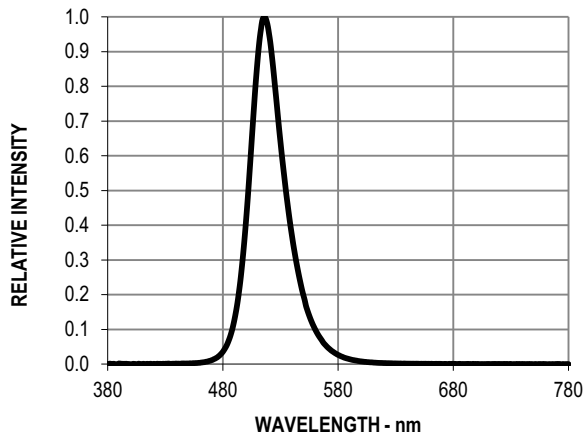


Figure 3: Forward Current vs. Forward Voltage

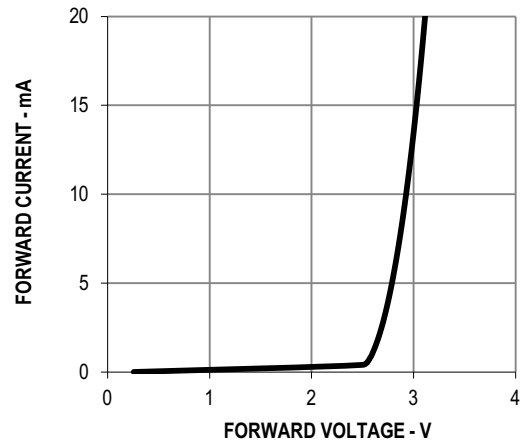


Figure 4: Luminous Intensity vs. Forward Current

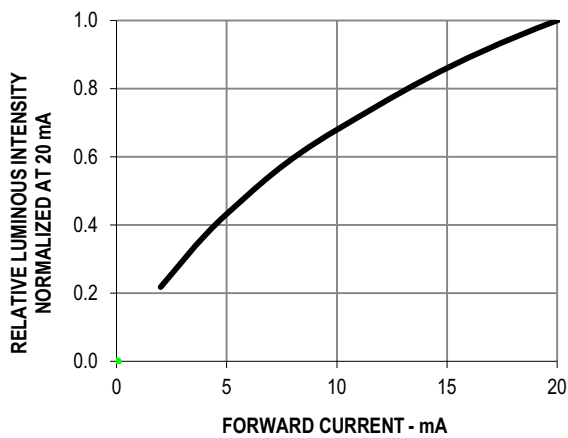


Figure 5: Maximum Forward Current vs. Ambient Temperature

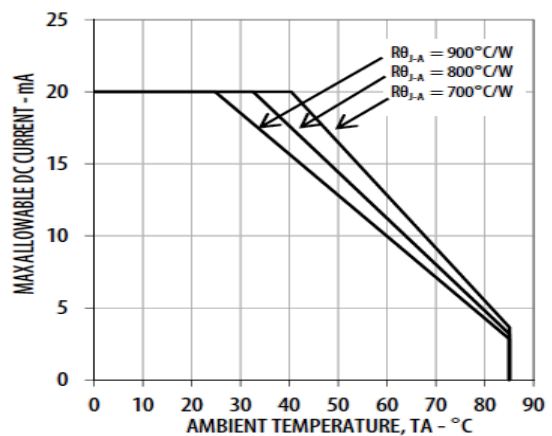


Figure 6: Relative Intensity vs. Angle

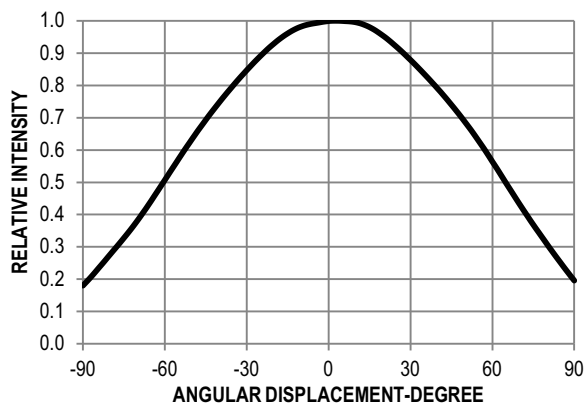


Figure 7: Recommended Soldering Land Pattern (Units: mm)

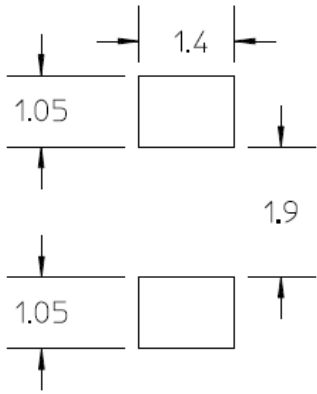


Figure 8: Reel Dimensions

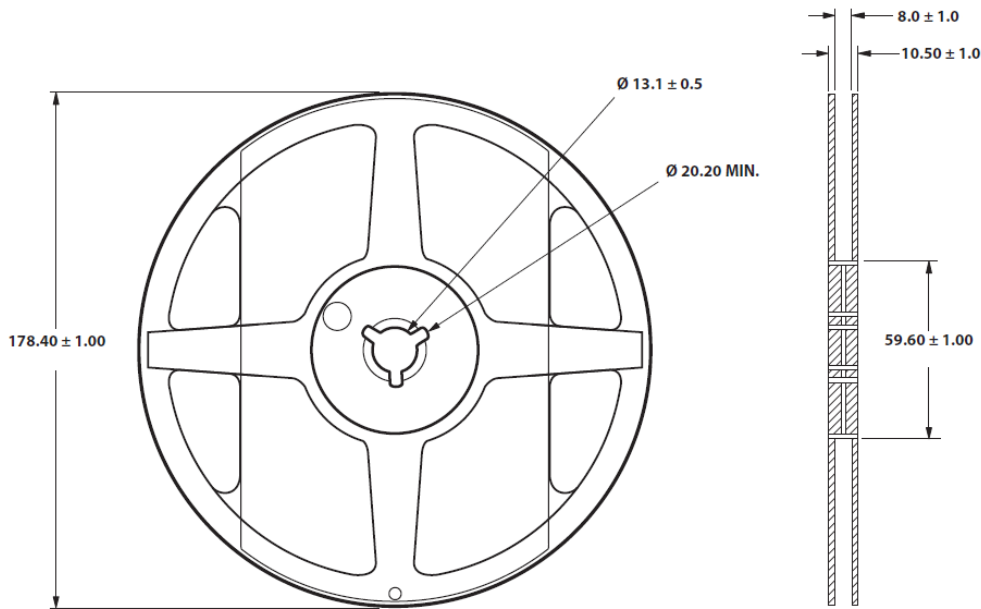
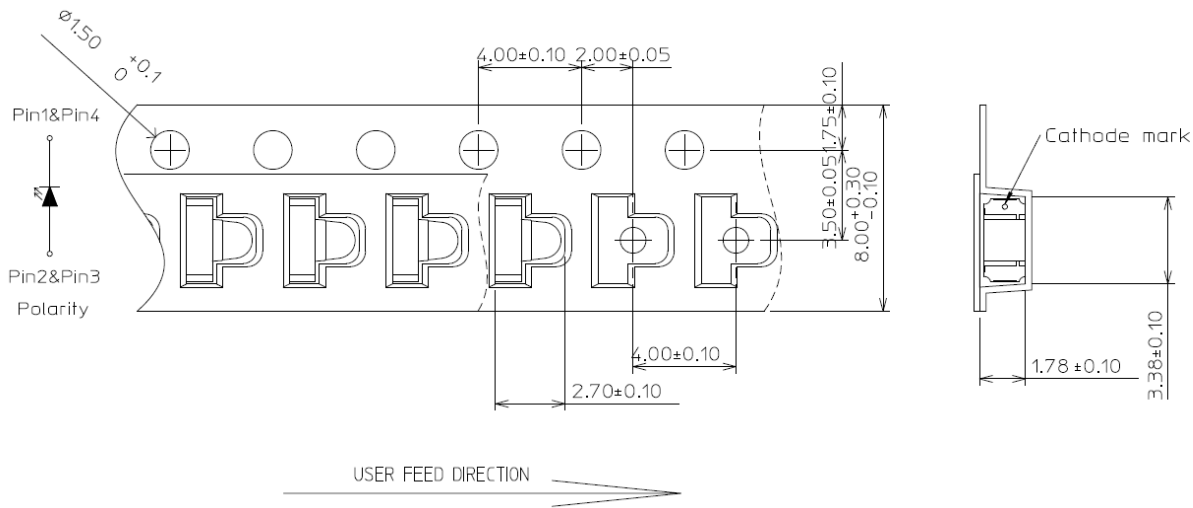
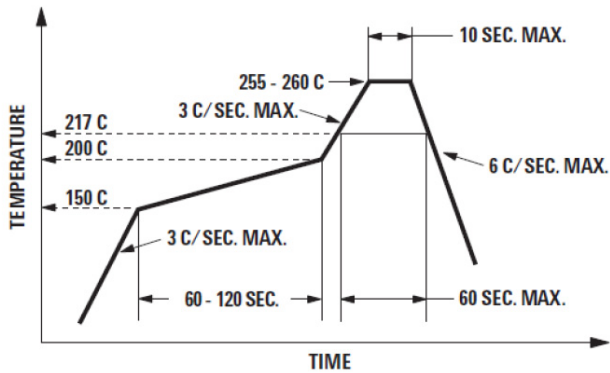


Figure 9: Tape Dimensions (Units: mm)



## Soldering

Figure 10: Recommended Reflow Soldering Conditions



- 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.

## Precautionary Notes

### Handling of a Moisture-Sensitive Device

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 <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).
- **Control after opening the MBB:**
  - Read the HIC immediately upon opening the MBB.
  - Keep the LEDs at <math>< 30^{\circ}\text{C}/60\% \text{RH}</math> at all times, and all high-temperature-related processes, including soldering, curing, or rework, must be completed 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.

## 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.

## 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.
- 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 environments, protect the LED against damages caused by rain water, dust, oil, corrosive gases, external mechanical stress, and so on.

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