

## HSM9-C400

### Side-View Lens Infrared Emitter



#### Description

The Broadcom® HSM9-C400 is a side-emitting surface-mount IR ChipLED. This IR ChipLED is available in the industry-popular package footprint of 3.20 mm x 2.55 mm. This robust and high-quality infrared emitter is versatile and easy to use.

This product is built with an integrated optical lens that makes it capable of supporting a very narrow viewing angle of  $\pm 18$  degrees. The optical lens focuses the infrared light beam emitted from the LED die, minimizing crosstalk and increasing the on-axis radiant intensity. The narrow viewing angle allows effective light coupling into secondary optics such as light guides and light pipes.

This product is available in a 940-nm peak wavelength. Coupled with its narrow viewing angle, these features make this product suitable for many applications, such as remote control in home appliances, smart utility meters, and light curtains in industrial automation.

The HSM9-C400 comes in tape and reel packing that is compatible with industry-standard automatic machine placement and IR reflow soldering.

#### Features

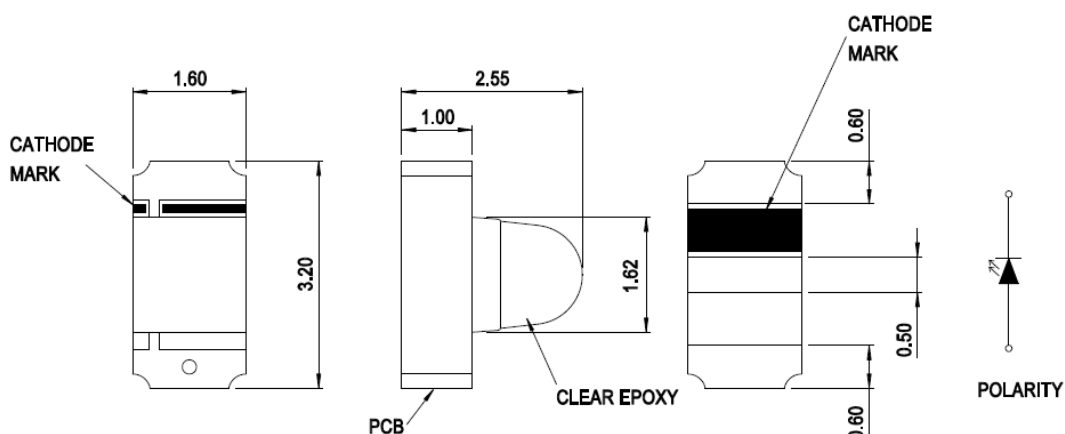
- Infrared emitter in a side-view package
- Narrow viewing angle:  $\pm 18$  degrees
- Available in a 940-nm peak wavelength
- Compatible with IR reflow soldering

#### Applications

- Machine vision
- Smart meters
- Light curtains

**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 1142 for additional details.

Figure 1: Package Drawing

**NOTE:**

1. All dimensions are in millimeters (mm).
2. Tolerance is  $\pm 0.10$  mm unless otherwise specified.

## Absolute Maximum Ratings

Parameter	Value	Unit
DC Forward Current <sup>a</sup>	70	mA
Pulse Forward Current <sup>b</sup>	350	mA
Power Dissipation	126	mW
LED Junction Temperature	100	°C
Operating Temperature Range	-40 to +85	°C
Storage Temperature Range	-40 to +100	°C

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

b. Frequency = 100 Hz, duty factor = 1%,  $T_s = 25^\circ\text{C}$ .

## Optical and Electrical Characteristics ( $T_J = 25^\circ\text{C}$ )

Parameter	Min.	Typ. <sup>a</sup>	Max.	Unit
Radiant Intensity, $I_e^b$ @ $I_F = 20$ mA	20	26	35	mW/sr
Peak Wavelength, $\lambda_p$	920	940	960	nm
Viewing Angle, $2\theta_{1/2}^c$	—	18	—	°
Forward Voltage, $V_F^d$ @ $I_F = 20$ mA	1.2	1.5	1.8	V
Reverse Current, $I_R$ at $V_R = 5V^e$	—	—	10	$\mu\text{A}$

a. The typical value is for reference only.

b.  $t_p = 20$  ms.

c.  $\theta_{1/2}$  is the off-axis angle where the radiant intensity is  $\frac{1}{2}$  the peak intensity.

d. Forward voltage tolerance is  $\pm 0.1V$ .

e. Indicates the product final test condition. Long-term reverse bias is not recommended.

Figure 2: Spectral Power Distribution

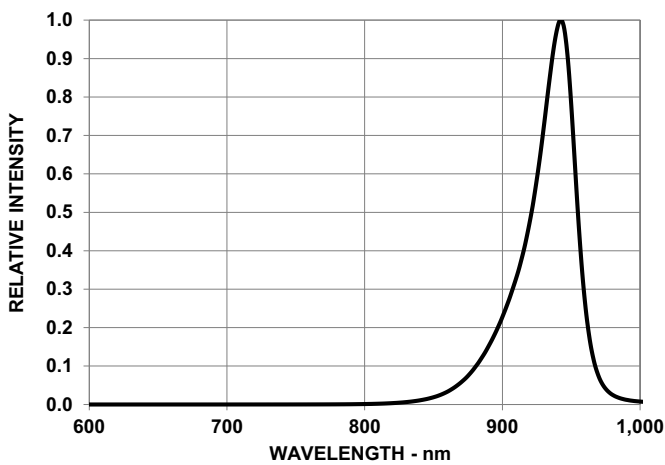


Figure 3: Forward Current vs. Forward Voltage

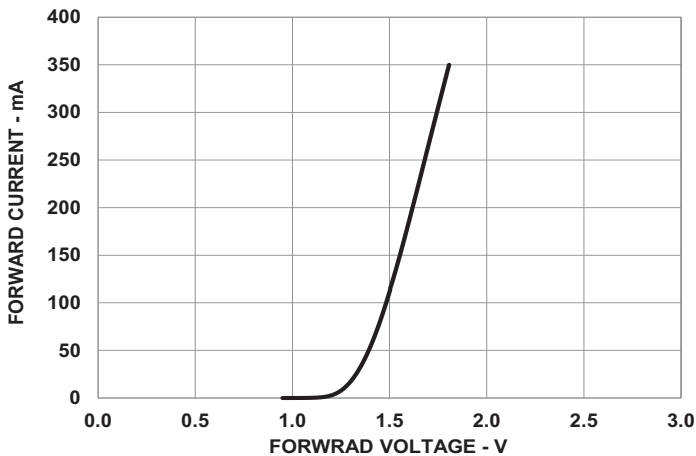


Figure 4: Relative Radiant Intensity vs. Forward Current

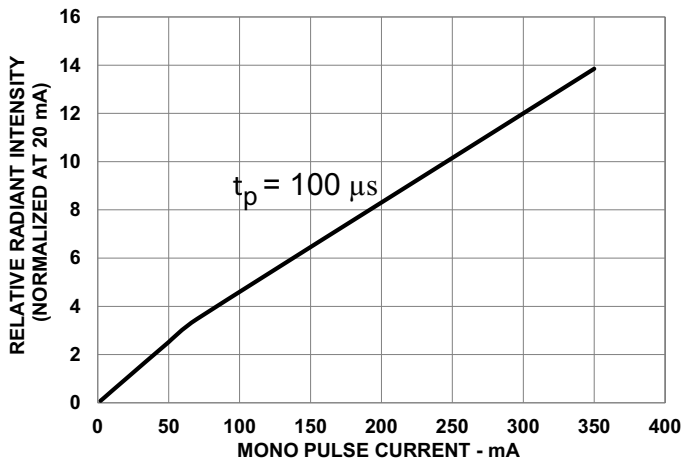


Figure 5: Radiation Pattern

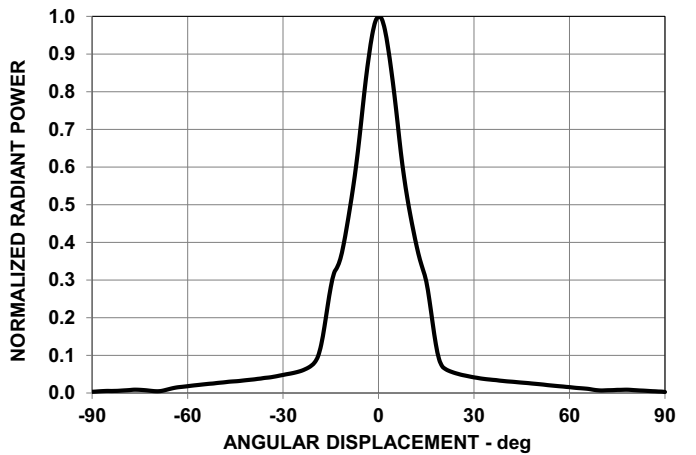


Figure 6: Derating Curve

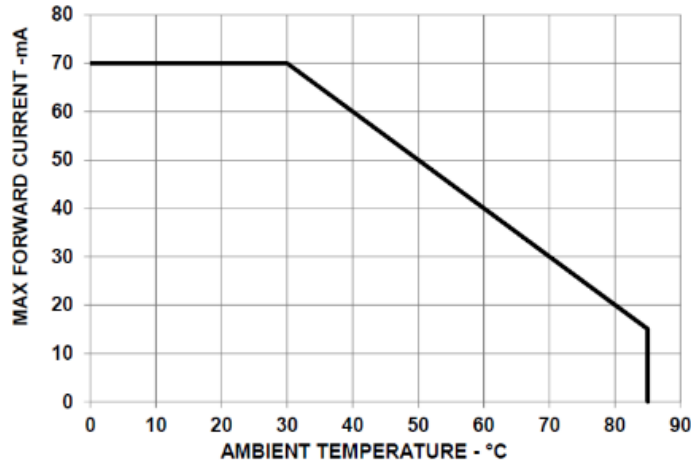


Figure 7: Recommended Soldering Land Pattern

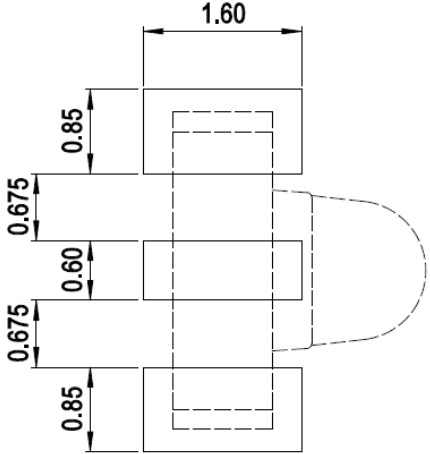
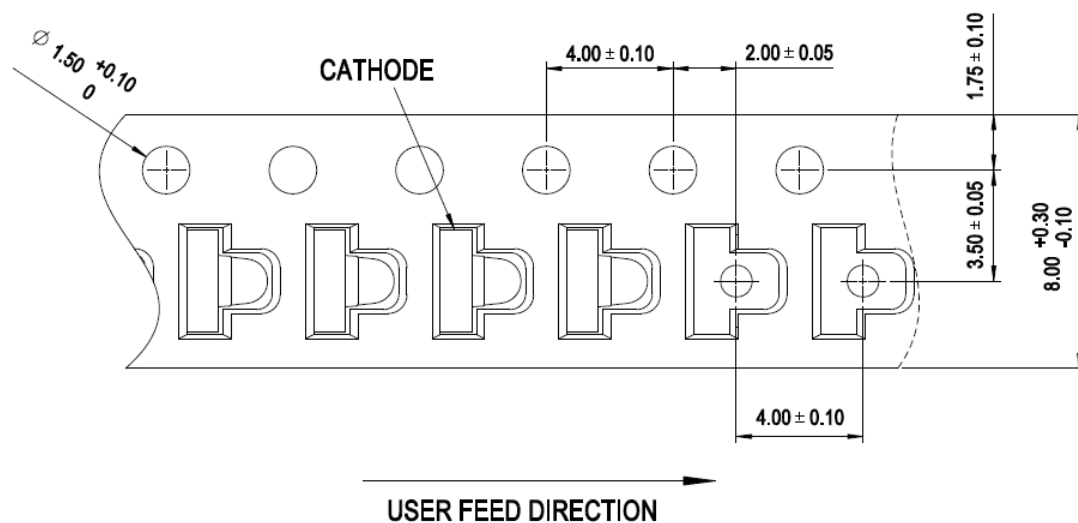
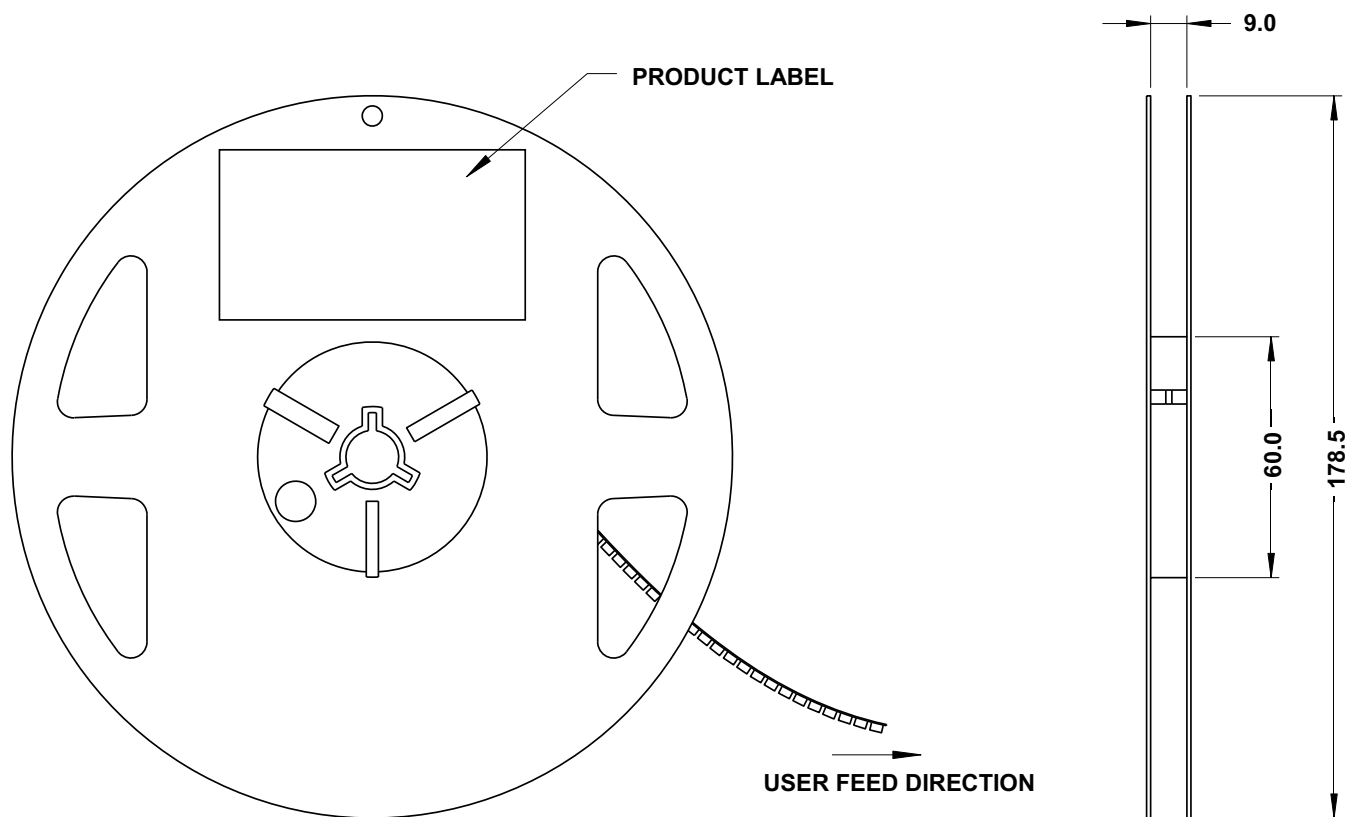


Figure 8: Carrier Tape Dimensions

**NOTE:**

1. All dimensions in are millimeters (mm).
2. Tolerance is  $\pm 0.10$  mm unless otherwise specified.

Figure 9: Reel Dimensions



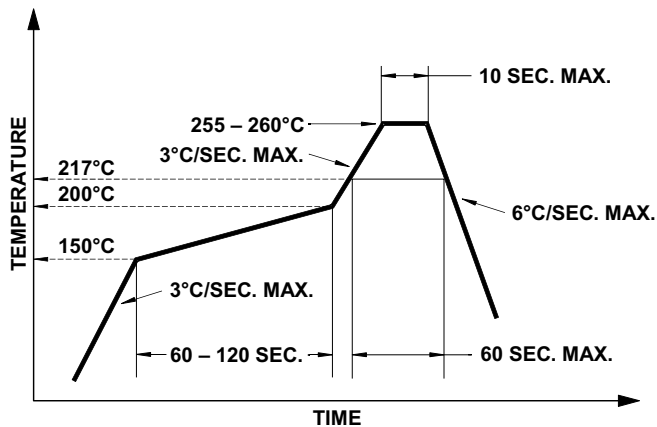
**NOTE:** All dimensions are in millimeters (mm).

## 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 = 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 can cause damage to the LED.
- Confirm beforehand whether the functionality and performance of the LED are affected by soldering with hand soldering.

Figure 10: Recommended Lead-Free Reflow Soldering Profile



### Handling Precautions

This product has a Moisture Sensitive Level 3 rating per JEDEC J-STD-020. Refer to Broadcom Application Note 5305, *Handling Moisture-Sensitive Surface-Mount LEDs*, 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, then 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 the 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 a desiccator at <5% RH to ensure that all LEDs have not exceeded their floor life of 168 hours.
- Baking is required if:
  - The HIC 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 be done only once.

## Application Precautions

- The drive current of the LED must not exceed the maximum allowable limit across temperature as stated in this 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 that the intended drive current can always be achieved.
- The LED exhibits slightly different characteristics at different drive currents, which can result in a larger variation of performance (meaning 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 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 outdoor environment, protect the LED against damages caused by rainwater, water, dust, oil, corrosive gases, external mechanical stresses, and so on.

## Eye Safety Precautions

LEDs can 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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Lead (Pb) Free  
RoHS Compliant