

# HST9-B400

## Side-View Surface-Mount Phototransistor

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### Description

The Broadcom<sup>®</sup> HST9-B400 is a side-view phototransistor that is available in the industry-popular package size of 3.20 mm (L) × 2.55 mm (W) × 1.60 mm (H).

It comes with black epoxy that cuts off visible light and thus reduces unwanted noise from the visible light range. The superior package design makes this product ideal for a wide variety of applications in consumer and industrial segments.

This product is built with an integrated optical lens that makes it capable of supporting the very narrow angle of half sensitivity of  $\pm 20$  degrees. The narrow angle optic focuses light into the phototransistor die, resulting in higher light sensitivity and cutting off stray light from the side.

It has a wide spectral range of sensitivity of 700 nm to 1100 nm with peak sensitivity at 920 nm.

To facilitate easy pick-and-place assembly, the phototransistor is packed in tape and reel. It is compatible with industry-standard automatic machine placement and IR reflow soldering.

### Features

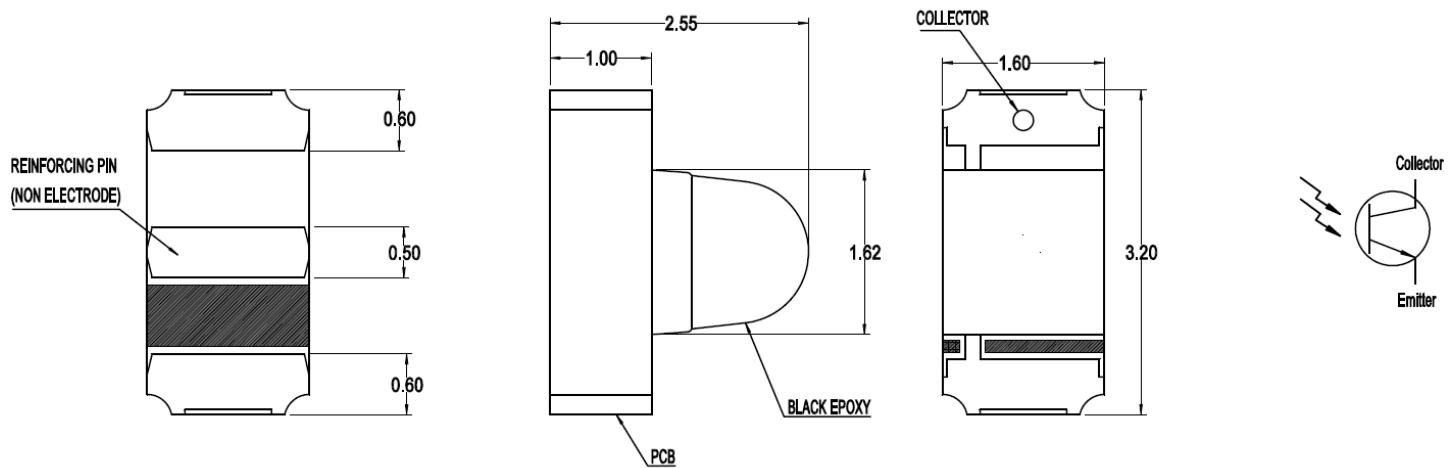
- Silicon NPN phototransistor
- Right angle
- Black epoxy
- Wide spectral range of sensitivity from 700 nm to 1100 nm
- Peak sensitivity at 920 nm
- Angle of half sensitivity of  $\pm 20$  degrees

### Applications

- Office and factory automation
- Home appliances

**CAUTION!** This package is ESD sensitive per ANSI/ESDA/JEDEC JS-001. Observe appropriate precautions during handling and processing. Refer to [Application Note 1142](#) for additional details.

Figure 1: Package Drawing

**NOTE:**

- All dimensions are in millimeters (mm).
- The tolerance is  $\pm 0.10$  mm unless otherwise specified.

**Absolute Maximum Ratings**

Parameter	Value	Unit
Collector-Emitter Voltage, $V_{CE}$	30	V
Emitter-Collector Voltage, $V_{EC}$	5	V
Collector Current, $I_{CA}$	20	mA
Power Dissipation, $P_d$	100	mW
Operating Temperature Range	-40 to +85	$^{\circ}\text{C}$
Storage Temperature Range	-40 to +85	$^{\circ}\text{C}$

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

Parameter	Value			Unit	Test Condition
	Min.	Typ.	Max.		
Collector Light Current, $I_{CA}$	4.0	6.0	—	mA	$E_e = 1 \text{ mW/cm}^2$ , $\lambda = 940 \text{ nm}$ , $V_{CE} = 5\text{V}$
Wavelength of Peak Sensitivity, $\lambda_{smax}$	—	920	—	nm	—
Spectral Range of Sensitivity, $\lambda_{0.1}$	700	—	1100	nm	—
Angle of Half Sensitivity, $\phi$	—	$\pm 20$	—	$^{\circ}$	—
Dark Current, $I_{CEO}$	—	—	100	nA	$E_e = 0 \text{ mW/cm}^2$ , $V_{CE} = 10\text{V}$
Collector-Emitter Saturation Voltage, $V_{CEsat}$	—	—	0.4	V	$E_e = 1 \text{ mW/cm}^2$ , $\lambda = 940 \text{ nm}$ , $I_{CA} = 100 \mu\text{A}$

Figure 2: Relative Sensitivity vs. Wavelength

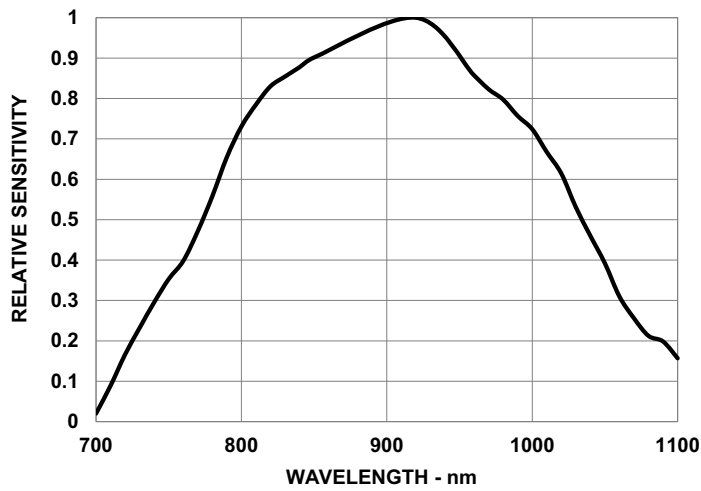


Figure 3: Relative Sensitivity vs. Angular Displacement

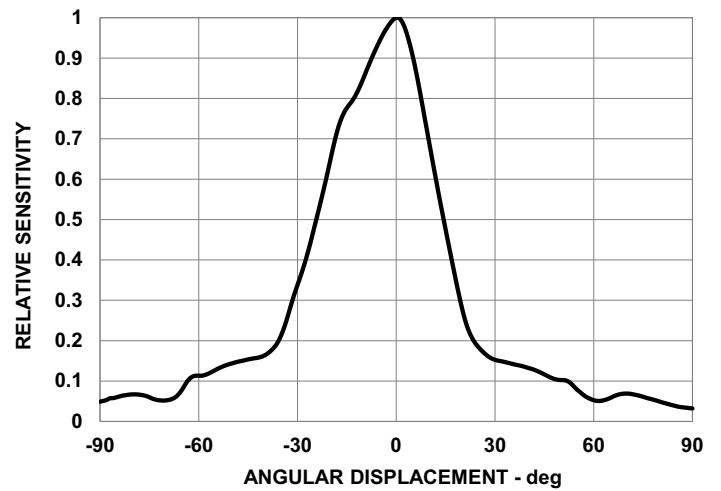


Figure 4: Collector Current vs. Collector Emitter Voltage

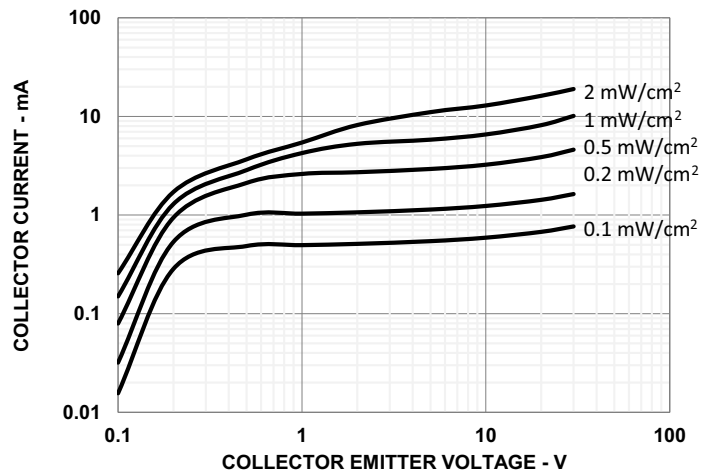


Figure 5: Collector Current vs. Irradiance ( $V_{ce} = 5V, \lambda = 940\text{ nm}$ )

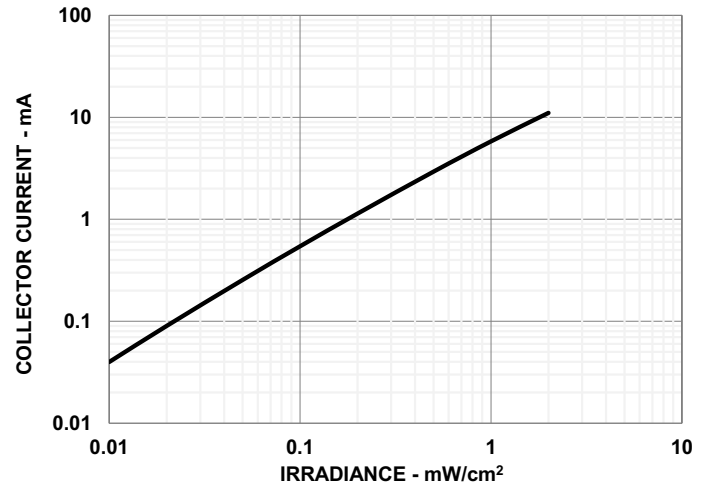


Figure 6: Dark Current vs. Ambient Temperature

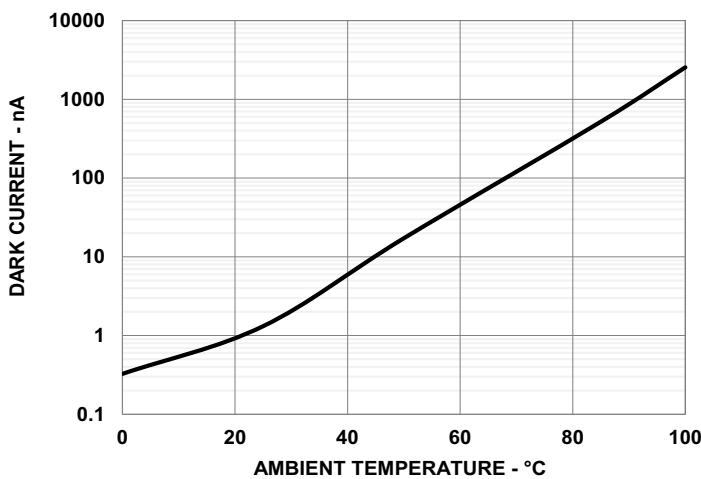


Figure 7: Relative Light Current vs. Ambient Temperature ( $V_{ce} = 5V, E_e = 1\text{ mW/cm}^2, \lambda = 940\text{ nm}$ )

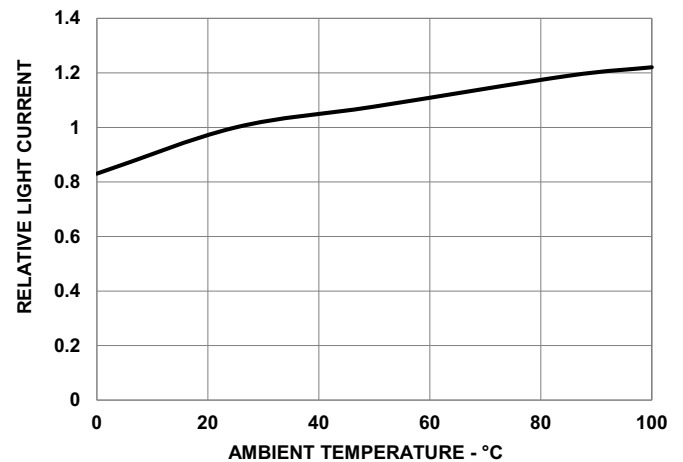


Figure 8: Recommended Soldering Land Pattern

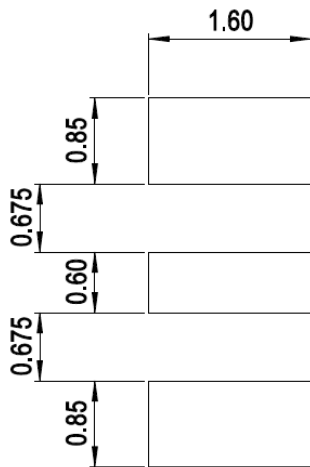
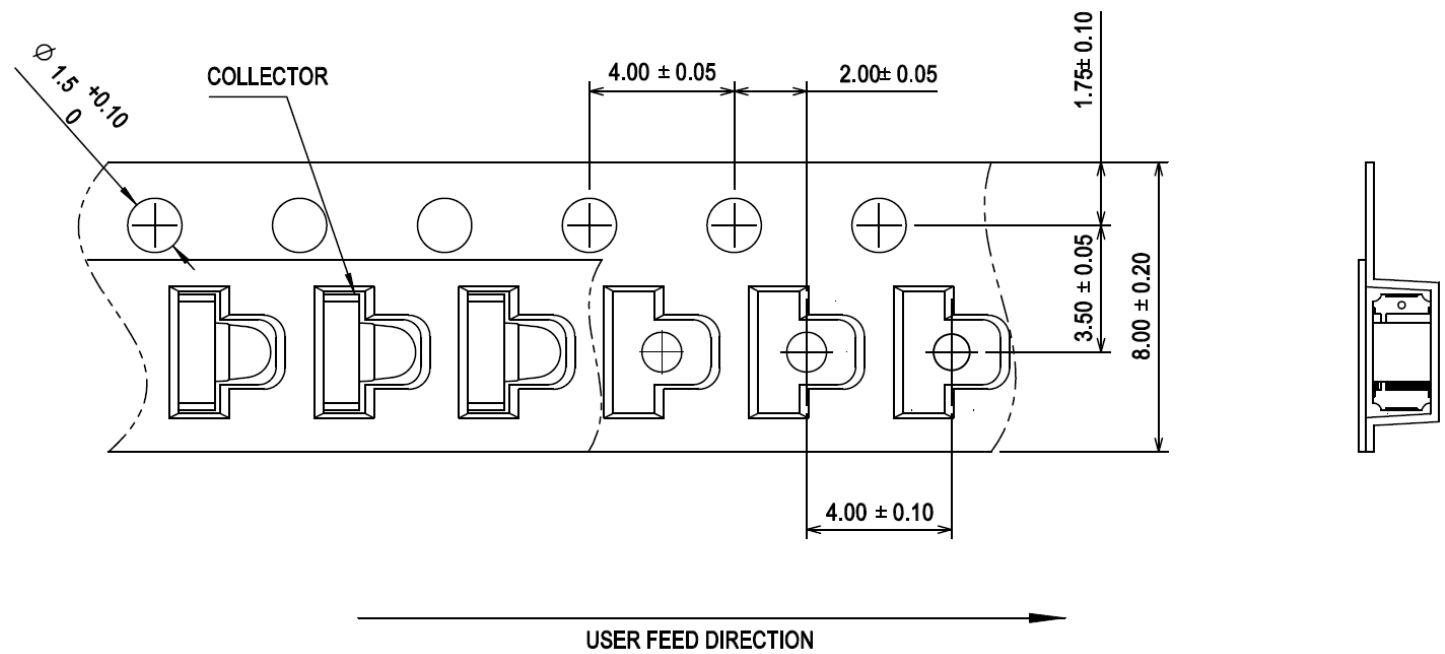
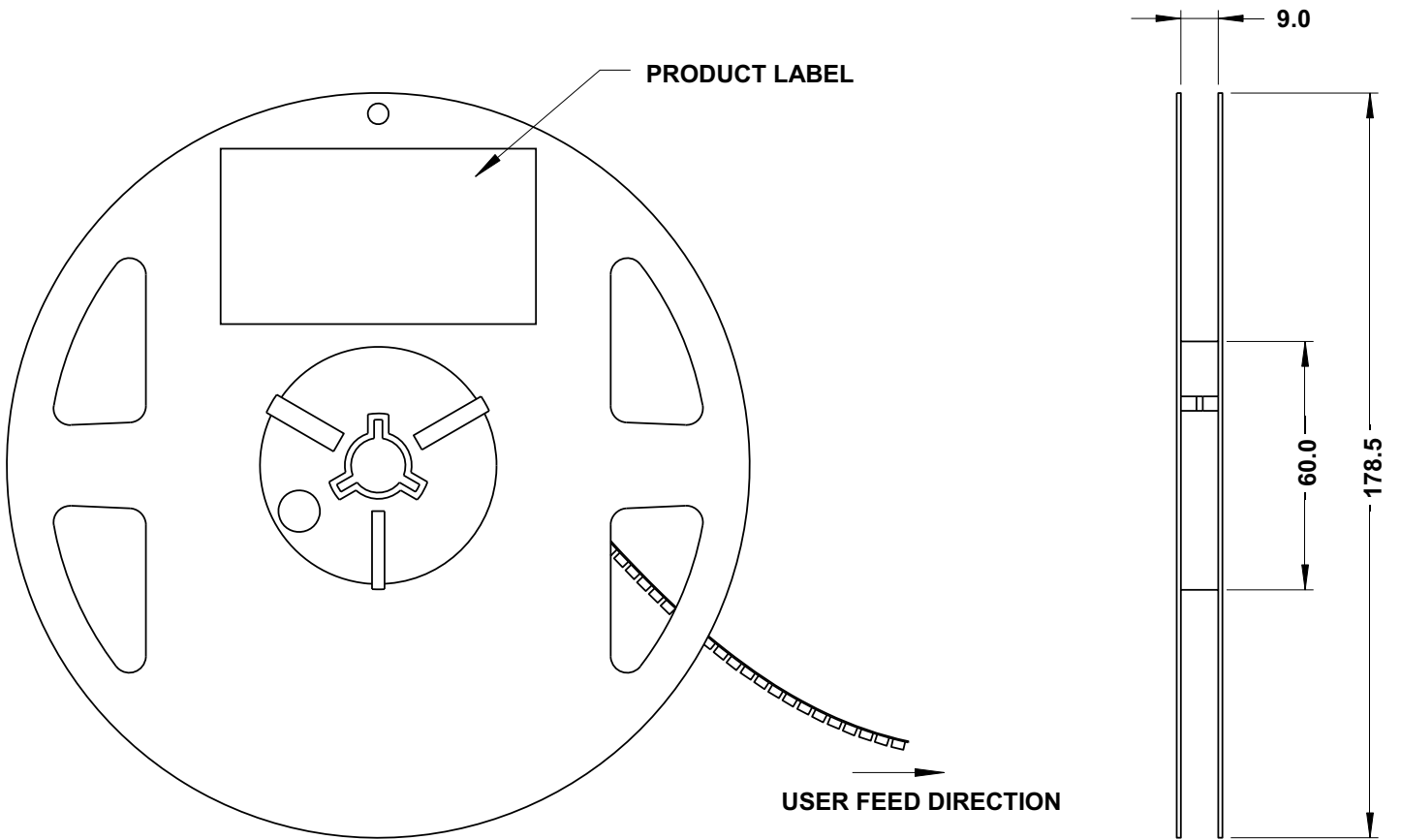


Figure 9: Carrier Tape Dimensions



NOTE: All dimensions are in millimeters (mm).

Figure 10: Reel Dimensions



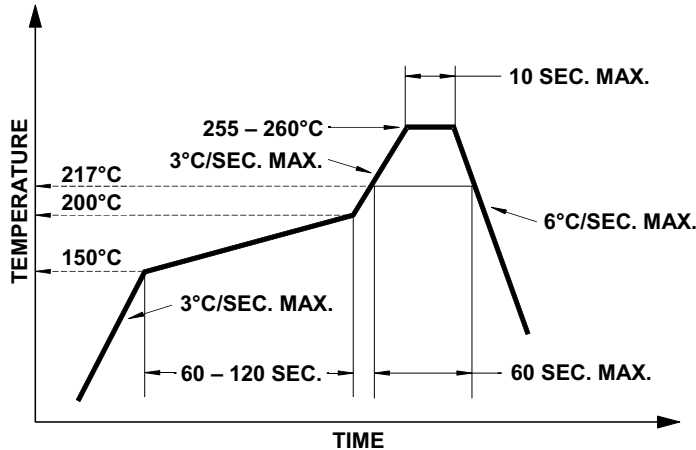
**NOTE:** All dimensions are in millimeters (mm).

## Precautionary Notes

### Soldering

- Do not perform reflow soldering more than twice. Observe necessary precautions for handling moisture-sensitive devices as stated in the following section.
- Do not apply any pressure or force on the package during reflow and after reflow when the package is still hot.
- Use reflow soldering to solder the package. Use hand soldering only for rework if unavoidable, but it must be strictly controlled to following conditions:
  - Soldering iron tip temperature = 310°C max.
  - Soldering duration = 2 seconds max.
  - Number of cycles = 1 only
  - Power of soldering iron = 50W max.
- Do not touch the package body with the soldering iron except for the soldering terminals, as it may cause damage to the package.
- Confirm beforehand whether the functionality and performance of the package are affected by hand soldering.

Figure 11: 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 <math><40^{\circ}\text{C}/90\% \text{ RH}</math> for 12 months. If the actual shelf life exceeds 12 months and the humidity indicator card (HIC) indicates that baking is not required, then it is safe to reflow the packages 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 packages at <math><30^{\circ}/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 reels:
  - Store unused packages 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 packages is to be subjected to other high-temperature processes, store the PCB in a sealed MBB with desiccant or a desiccator at <math><5\% \text{ RH}</math> to ensure that all packages 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 <math>>30^{\circ}\text{C}/60\% \text{ RH}</math> at any time.
  - The LED's floor life exceeds 168 hours.

The recommended baking condition is  $60\pm 5^{\circ}\text{C}$  for 20 hours.

Baking can be done only once.

## Application Precautions

- If the package is intended to be used in a harsh or outdoor environment, protect it against damages caused by rain water, water, dust, oil, corrosive gases, external mechanical stresses, and so on.

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