Cryogenic Control Systems, Inc.

S950
Silicon Diode Temperature Sensor

General Description

Silicon diodes are the most common temperature sensors used in cryogenic applications. They offer good sensitivity and a wide range of operation compared to other devices. Further, they have excellent interchangeability and stability.

As with all Silicon Diode sensors, they are not recommended for use in high magnetic fields or radiation environments.

Use of a 10μA constant-current excitation will insure against self-heating and current switching errors.

Three packages are offered to fit a wide range of applications:

- The BB package is an industry standard 0.310” (8mm) bobbin with 36” (92cm) leads. It is one of the easiest to use cryogenic sensors available. Cryo-con's BB package features individual serial numbers on the top of the package and strain relief on the lead wires.
- The SM package includes an insulating substrate and is designed for direct surface mounting. It can be easily attached to any flat surface. Features include extremely small size and 3” (7.6cm) copper leads that greatly simplify thermally anchoring.
- The CP package is the smallest cryogenic temperature sensor available. Bonded lead wires extend high temperature operation to 370K.

Features

- Good sensitivity over the temperature range from 1.4K to 370K (370K in the CP package). High sensitivity in the range from 20K to 1.4K.
- Conforms to the standard S950 calibration curve with high accuracy, giving excellent interchangeability.
- Available in two tolerance grades. Accuracy can be further improved using Cryo-con's CalGen™ software.
- Available in a variety of packages.
- High repeatability and stability. Minimum long term drift.
- Fabricated with non-magnetic materials.

Applications

- Wide temperature range measurements outside of a magnetic field.
- Cryocoolers and cryogen free systems.
- Nitrogen and Helium flow cryostats.
- Cryogenic liquifiers, Storage tanks.
- Systems requiring rapid thermal response.

Specifications

Temperature Range: 1.5K to 370K for the BB and SM packages. 1.5K to 370K for the CP package.

Standard Curve: Cryo-con S950.

Excitation Current: 10μA ±0.1%

Repeatability: 10mK @4.2K, 16mK @77K, 75mK @273K.

Magnetic Field Use: Not recommended for fields above 0.1 Tesla or temperature below 40K.

Use in Radiation: Not recommended for high radiation environments.

Maximum Temperature: Do not store above 370K.

Maximum Reverse Voltage: 60V.

Maximum Excitation Current: 2mA.

Power Dissipation: 16μW at 4.2K.

Standard Temperature Response

T(K)	V	S(mV/K)
1.4	1.67	-31.5
4.2	1.55	-38.9
77.35	1.03	-1.7
273	0.62	-2.29
370	0.39	-2.1

Tolerance Bands

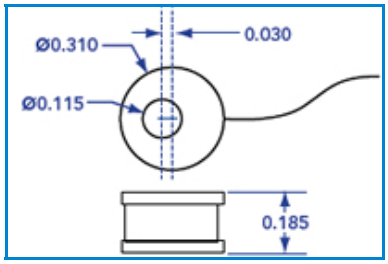
	1.5K to 30K	30K to 100K	100K to 370K
Band A	±0.1K	±0.2K	±1.0K
Uncalibrated	±0.2K	±0.4K	±1.0K

Ordering Information

S950-BB	Bobbin package. Uncalibrated
S950-A-BB	Bobbin package. Tolerance Band A
S950-SM	Surface-mounted package. Uncalibrated
S950-A-SM	Surface-mounted package. Tolerance Band A
S950-CP	CAP package. Uncalibrated
S950-A-CP	CAP package. Tolerance Band A

Packaging

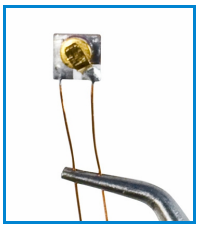
S950-BB

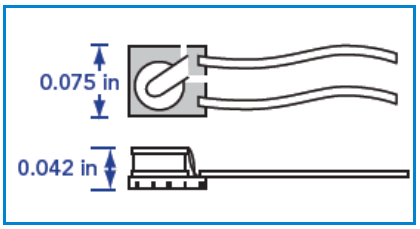


S950 Bobbin Package
Temperature Range: 1.5 to 370K.
Marking: Individual serial number.
Mass: 1.1g excluding leads.
Construction: Bobbin Material is gold plated oxygen free hard copper. Sensor bonding is Stycastσ epoxy.
Leads: 36", 36AWG Phosphor-Bronze. Four-lead color coded cryogenic ribbon cable. Insulation is heavy Formvarσ. Strain relief is Teflonσ.
Mounting: 4-40 brass machine screw. A thin layer of Apiezonσ N grease is recommended.

Color Code	
V+	Clear
V–	Green
I+	Black
I–	Red

S950-SM

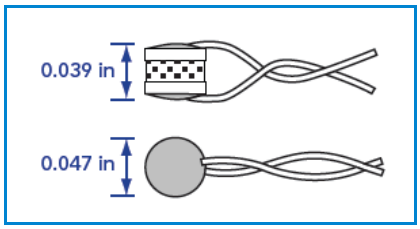




S950 SM Package
Temperature range: 1.5 to 370K.
Mass: 37mg
Thermal response time: <10mS at 4.2K, 100mS at 77K and 200mS at 305K.
Construction: Package material is gold plated OHFC copper on an Alumina substrate.
Leads: 3", 37 AWG copper with Polyimide insulation. Positive connection is red and negative is black. Lead attach is 60/40 solder.
Mounting: Varnish, epoxy or clamp to a clean flat surface. Thermally anchor copper leads.

Color Code	
+	Red
–	Black

S950-CP

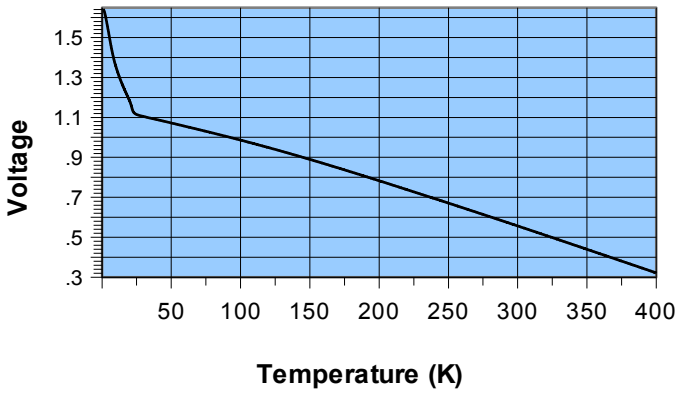


S950 Cap Package:
Temperature Range: 1.4 to 370K
Mass: 32mg
Thermal response time: <10mS at 4.2K, 100mS at 77K and 200mS at 305K.
Construction: Package material is Alumina with gold plated OHFC copper end caps. Leads are 3", 37 AWG copper with Polyimide insulation. Positive connection is red and negative is black. Bonded lead attach.
Mounting: Sensor body must be electrically insulated from mounting surface. Attach using varnish or epoxy. Thermally anchoring the copper leads will ensure proper thermal connection.

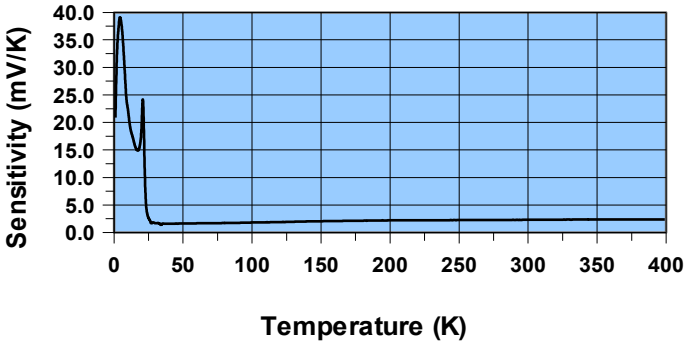
Color Code	
+	Red
–	Black

Typical Performance Characteristics

Temperature Response



Sensitivity (mV/K)



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