

TEMPERATURE, MAGNETIC FIELD AND MULTIFUNCTIONAL SENSORS FOR CRYOGENIC APPLICATION

Description

Three types of sensors are offered:

- A family of Ge-on-GaAs film resistance thermometers covering the temperature range for operation from 0.03 K to 500 K.
- Dual function sensors (DFSs) for concurrent and coincident measurements of temperature (1.5 K to 400 K and 0.1 K to 400 K) and magnetic field.
- Si diode temperature sensor for measurement of temperature in the 1.5 K to 450 K range.

Ge-on-GaAs film resistance thermometers are based on Ge film resistors deposited onto semi-insulating GaAs substrates using vacuum technology. Ge-on-GaAs film temperature sensing elements are produced using innovative semiconductor processing techniques and provide high device sensitivity within the range 0.03 K to 500 K. The prepared sensing elements are then employed in different packages. Nowadays three types of sensor packages are offered: -cylindrical canister package, made from gold plated copper (3 mm in diameter and 5.0 mm long), micro-package (1.2 mm in diameter and 1.0 mm long) and micro-package with plate (2 mm square by 0.15 mm thick).

Dual function sensor (DFS) is intended for concurrent and coincident measurements of temperature and magnetic fields in cryogenic applications. The DFS approach can also be applied to the problem in cryogenic thermometry of temperature measurements in high magnetic fields, since, by simultaneous, direct measurements of temperature and local magnetic field, it enables computational correction of the field effects on the thermometer. The DFS consists of a Ge-on-GaAs film resistance thermometer and an InSb-on-GaAs film Hall-effect magnetic field sensor, which at constant current provides an output voltage proportional to magnetic field induction. These sensors are incorporated in a parallelepiped package, made from gold plated copper, sealed with epoxy. The dimensions of this package are 3.5 mm wide, 2.2 mm high and 10.1 mm long. The DFS has eight copper contact leads: - four leads for the resistance thermometer and four leads for the Hall-effect magnetic field sensor.

Si diode temperature sensor is silicon p+-n-n+ planar diodes. The size of the diode structure is (0.35×0.35×0.2) mm. This sensitive element is placed in nonmagnetic miniature package. The diode temperature microsensor overall size is 1.2 mm in diameter and 1.0 mm thick. This micro-packaged thermometer can also be soldered to the plate (2 mm square by 0.15 mm thick).

Innovative Aspect and Main Advantages

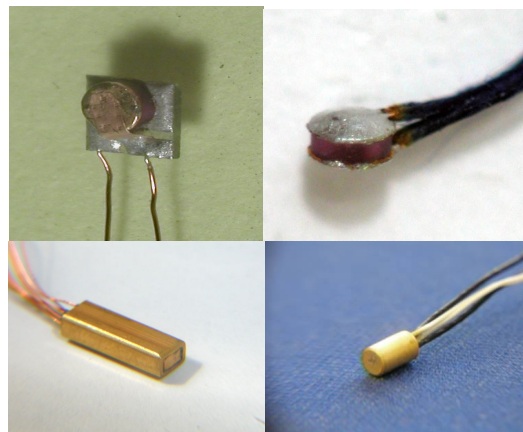
The sensors provide:

- wide temperature and magnetic field range for operation (0.03 K to 500 K and 0÷30 T);
- monotonic response over a wide temperature range;
- small temperature reading errors for operation in magnetic fields;
- small size;
- extremely fast response to temperature and magnetic field changes;
- high radiation tolerance.

Areas of Applications

Sensors for application in extreme electronics (low temperatures, strong magnetic fields and intense ionizing radiations). Static and dynamic temperature and magnetic field measurements in the 0.03 K to 500 K range and fields up to 30 T.

- Devices for diagnostics of large superconducting magnet systems for magnetic resonance imaging or high energy physics applications.
- Devices for application in space and rocket industry.
- A number of industrial plants of cryogenic liquids.
- Research laboratories and universities.
- Cryogenic medicine.



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