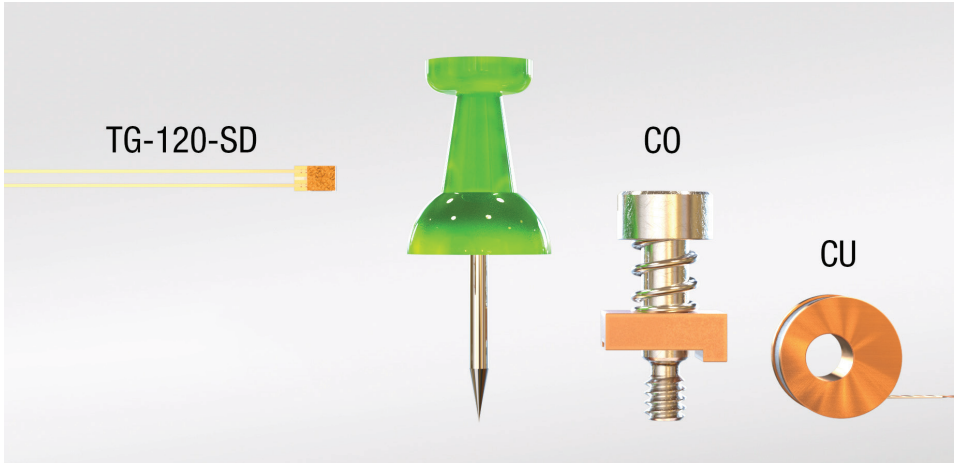
GaAlAs Diodes

TG-120-SD features

- Monotonic temperature response from 1.4 K to 500 K
- Excellent sensitivity (dV/dT) at temperatures below 50 K
- Relatively low magnetic field-induced errors
- Rugged, reliable Lake Shore SD package designed to withstand repeated thermal cycling and minimize sensor self-heating
- Variety of packaging options



The TG-120 gallium-aluminum-arsenide (GaAlAs) diode temperature sensors are particularly well suited for low to moderate magnetic field applications at low temperatures. The GaAlAs sensing element exhibits high sensitivity (dV/dT) at low temperatures. Voltage-temperature characteristics are monotonic over the sensor's useful range from 1.4 K to 500 K (see data plots below).

Gallium-aluminum-arsenide diodes are direct band-gap, single junction devices that produce small output variances in the presence of magnetic fields. Consequently, their low magnetic field dependence makes them ideally suited for applications in moderate magnetic fields up to five tesla.

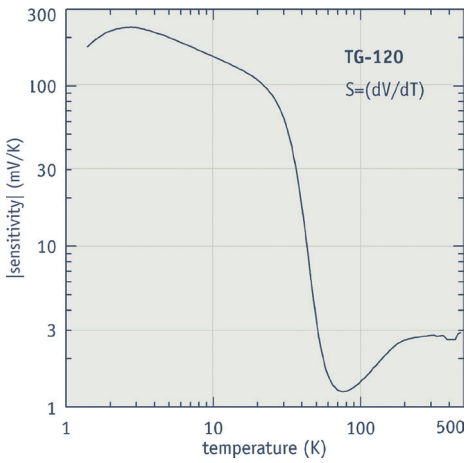
Packaging options

P, PL, SD, CO, CU

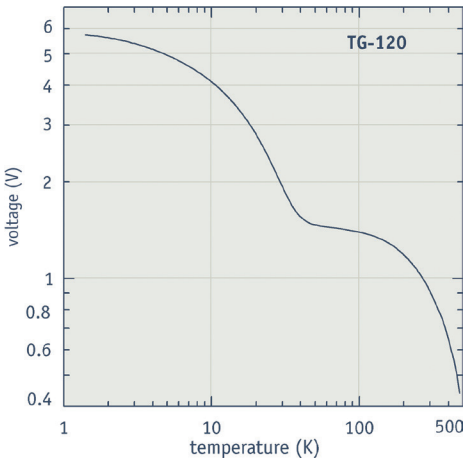
The Lake Shore SD package — the most rugged, versatile package in the industry

The SD package, with direct sensor-to-sapphire base mounting, hermetic seal, and brazed Kovar leads, provides the industry's most rugged, versatile sensors with the best sample to chip connection. Designed so heat coming down the leads bypasses the chip, it can survive several thousand hours at 500 K (depending on model) and is compatible with most ultra high vacuum applications. It can be indium soldered to samples without shift in sensor calibration. If desired, the SD package is also available without Kovar leads.

Typical GaAlAs diode sensitivity



Typical GaAlAs diode voltage



Specifications

Standard curve Not applicable

Recommended excitation 10 µA ±0.1%

Maximum reverse voltage (diode) 2 V

Maximum forward current (diode) 500 mA

Dissipation at recommended excitation Typical 50 µW max at 4.2 K, 14 µW at 77 K, 10 µW at 300 K

Thermal response time (typical) SD: <10 ms at 4.2 K; P and PL: 100 ms at 4.2 K, 250 ms at 77 K, 3 s at 305 K;

Use in radiation Recommended for use only in low level radiation—see Appendix B

Use in magnetic field Low magnetic field dependence when used in fields up to 5 T above 60 K—see Appendix B

Reproducibility[1] ±10 mK at 4.2 K

Soldering standard J-STD-001 Class 2

[1] Short-term reproducibility data is obtained by subjecting sensor to repeated thermal shocks from 305 K to 4.2 K

Range of use

	Minimum limit	Maximum limit
TG-120-SD, CU-HT	1.4 K	500 K
TG-120-P, PL (discontinued)	1.4 K	325 K

Calibrated accuracy

	Typical sensor accuracy[2]	Long-term stability[3]
1.4 K[4]	±12 mK	±25 mK
4.2 K[4]	±12 mK	±15 mK
10 K	±12 mK	±25 mK
77 K	±22 mK	±15 mK
300 K	±32 mK	±50 mK
500 K	±50 mK	—

[2] $[(\text{Calibration uncertainty})^2 + (\text{reproducibility})^2]^{0.5}$ for more information see Appendices B, D, and E

[3] Long-term stability data is obtained by subjecting sensor to 200 thermal shocks from 305 K to 77 K

[4] Under 10 K calibration valid in vacuum only

Temperature response data table (typical)

	TG-120	
	V (volts)	dV/dT (mV/K)
1.4 K	5.3909	-97.5
4.2 K	4.7651	-214
20 K	2.5341	-97.5
77 K	1.4222	-1.24
300 K	0.8978	-2.85
500 K	0.3778	-3.15

See Appendix G for expanded response table

Typical magnetic field-dependent temperature errors[5] ΔT/T (%) at B (magnetic induction)

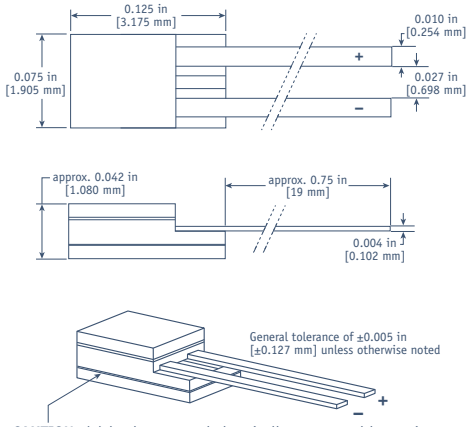
	Package base parallel to field B				
	1 T	2 T	3 T	4 T	5 T
4.2 K	2.9	3.8	3.7	2.8	1
30 K	0.2	0.2	0.3	0.3	0.2
78 K	<0.1	<0.1	0.17	0.16	0.1
300 K	0.1	0.1	0.1	0.1	0.1

[5] To minimize magnetic field-induced temperature errors, the sensor should be oriented so that the package base is perpendicular to the magnetic field flux lines—this results in the diode current being parallel to the magnetic field

Physical specifications

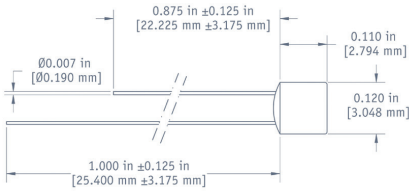
	Mass	Lead type	Internal atmosphere	Lead polarity	Sensor materials
TG-120-SD	38 mg	2 platinum, welded to package; CAUTION: leads are delicate	Hermetically sealed in vacuum	Positive lead on right with package lid up and leads toward user	Chip mounted on sapphirebase with alumina body andlid, Mo/Mn metallization onbase & lid top with nickel and gold plating
TG-120-P (discontinued)	79 mg	2 phosphor bronze, insulated with heavy build Polyimide	Air	Short (+) Long (–)	BeO ceramic header set into a gold plated copper cylinder
TG-120-PL (discontinued)	20 mg	2 platinum	Solid epoxy	Short (+) Long (–)	Constructed with platinum, Stycast® epoxy, and alumina

TG-120-SD



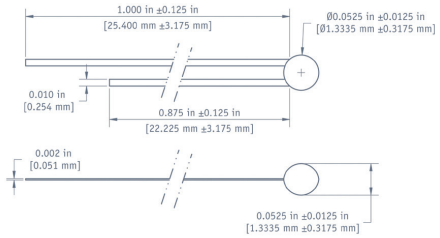
CAUTION: (+) lead connected electrically to external braze ring—take care not to cause a short

TG-120-P



General tolerance of ±0.005 in [±0.127 mm] unless otherwise noted

TG-120-PL



General tolerance of ±0.005 in [±0.127 mm] unless otherwise noted

Ordering information

Uncalibrated sensor
Specify the model number in the left column only, for example TG-120-SD.

Calibrated sensor
Add calibration range suffix code to the end of the model number, for example TG-120-SD-1.4L.

GaAlAs diode	Calibration range suffix codes Numeric figure is the low end of the calibration Letters represent the high end: L=325 K, H=500 K				
Part number	Uncal	1.4L	1.4H	70L	70H
TG-120-SD	■	■	■	■	■
TG-120-CO	■	■	■	■	■
TG-120-CU	■	■		■	
TG-120-CU-HT	■	■	■	■	■

*Below 10 K, calibration is valid in vaccuum only
Other packaging available by special order—please consult Lake Shore

Accessories available for sensors

ECRIT	Expanded interpolation table
8000	Calibration report on CD-ROM
COC-SEN	Certificate of conformance

Accessories suggested for installation—see Accessories section for full descriptions
Stycast® epoxy
Apiezon® grease
90% Pb, 10% Sn solder
Indium solder
VGE-7031 varnish
Phosphor bronze wire
Manganin wire
CryoCable™

Packaging options

For more information on sensor packages and mounting adapters, see page 21.

CO adapter — spring loaded clamp for easy sensor interchangeability

See the appendices for a detailed description of:
Installation
Uncalibrated sensors
SoftCal™
Calibrated sensors
CalCurve™
Sensor packages

To add length to sensor leads, see page 25.