Graphene magnetic field sensor GHS09CC

The GHS series of graphene sensors provides high performance analogue magnetic field measurement for scientific research, healthcare, aerospace and industrial applications.

Figure 1. Paragraf GHS09CC sensor on test assembly

GHS09CC Features:

- Exceptionally high resolution
- Ultra-low noise performance
- Use at cryogenic extremes
- Large dynamic range
- High linearity
- Extremely low power operation

Description:

Paragraf's GHS09CC utilises the inherently low noise characteristics of graphene to deliver outstanding field resolution without signal conditioning. The two-dimensional nature of graphene minimises the planar Hall effect and graphene's robustness and electron mobility provide unsurpassed temperature and magnetic-field operational ranges.

Applications include:

- Precision magnetic field measurement
- Accurate mapping of field gradients and fringe fields
- High precision position, rotation and speed sensing
- Ultra-low power field measurement at cryogenic temperatures

Benefits:

The GHS09CC delivers to an extraordinary range of application demands. Benefits to be exploited include:

- Operation under extremes of temperature < 1.8 K to 353 K
- Resolution of ppb magnetic field changes over large field ranges (> 9 T)
- Operation down to 10 nA, saving power and representing only 5 pW heat dissipation
- Negligible planar Hall effect, aiding precise instrument positioning w.r.t. field direction

To discuss specific requirements, contact hallsensors@paragraf.com

Performance Characteristics: GHS09CC

Parameter	Symbol	Value (typical)	Unit	Notes
Maximum operating temperature range	T	1.8 to 353	K	Performance guaranteed within this range. Operation <1.8 K is possible
Measurable field range	B	>+/- 9	T	See Fig.2. At 1.8K, 0-9 T is possible with reduced linearity
Open Circuit Sensitivity	S	1100	V/AT	@ room temperature. see Fig 3 for change with temperature
Open Circuit Hall Voltage	V_H	110	mV	$I=I_N$ and B=1 T, increases with reducing temperature
Spectral Noise Density	SD_T	7	$\mu T/\sqrt{Hz}$	10 Hz, 2 V_{RMS} (equivalent to $I=I_N$)
		0.7		1 kHz, 2 V_{RMS} (equivalent to $I=I_N$)
		0.3		10 kHz, 2 V_{RMS} (equivalent to $I=I_N$)
		0.07		100 kHz, 2 V_{RMS} (equivalent to $I=I_N$)
Resolution, based on SD_T on a 1 T field	R_{SND}	7	ppm	10 Hz, 2 V_{RMS} (equivalent to $I=I_N$)
		0.7		1 kHz, 2 V_{RMS} (equivalent to $I=I_N$)
		0.3		10 kHz, 2 V_{RMS} (equivalent to $I=I_N$)
		0.07		100 kHz, 2 V_{RMS} (equivalent to $I=I_N$)
RMS noise	$\sqrt{\langle T^2 \rangle}$	40	μT	0.1 – 10 Hz, 2 V_{RMS} (equivalent to $I=I_N$)
		28		10 – 100 kHz, 2 V_{RMS} (equivalent to $I=I_N$)
Linearity of Hall Voltage % of full scale	F_L	<0.5	%	-1 to 1 T. See Fig 2 for full 0-9 T range
Corrected Linearity		<0.01	%	-1 to 1 T, after 3rd order correction
Planar Hall Effect	H_{PL}	<10	μT	At $I=I_N$, 1 T
Nominal Supply Current	I_N	0.1	mA	Can be operated down to I=10 nA
Maximum Supply Current	I_{max}	1	mA	
Supply Side Internal Resistance	R_{IN}	22	kΩ	B=0 T
Hall Side Internal Resistance	R_{OUT}	22	kΩ	B=0 T
Offset Voltage	V_{R0}	8	mV	Typical offset voltage at $I=I_N$ and B=0 T
		0.6	mV	Min offset voltage at $I=I_N$ and B=0 T
		34	mV	Max offset voltage at $I=I_N$ and B=0 T
Temperature Coefficient of Sensitivity	T_{CS}	-4.7	V/AT/K	@ room temperature, I_N

High field and low temperature performance

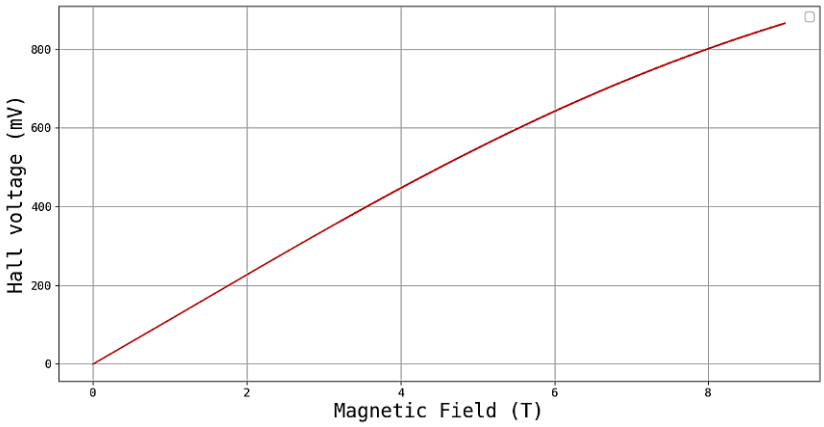


Figure 2. Hall Voltage output of the GHS09CC at 295 K, from 0 to 9 T

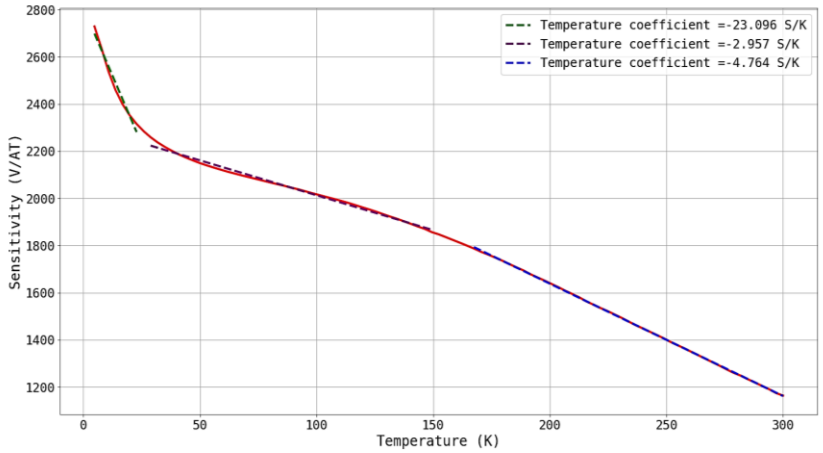
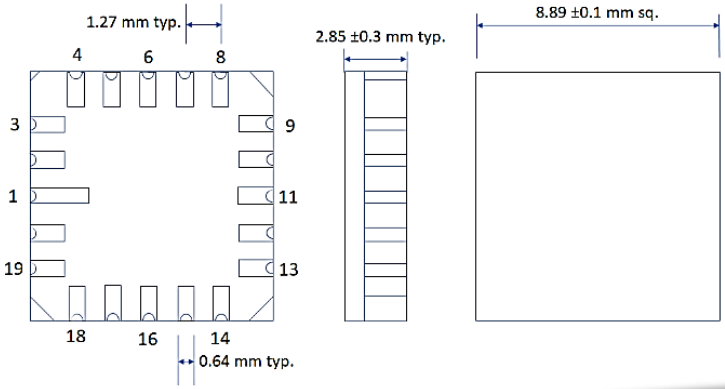


Figure 3. Sensitivity of the GHS09CC as a function of temperature from 1.8 K to 300 K. Measured at 1T.

Packaging Information

Active area: 1.3 x 1.3 mm located at the centre of the package

Package type: 20-pin LCC, ceramic, Ni-free, surface mount



	Pin	Notes
V_{IN}+	1 or 11	Input voltage can be supplied with either polarity
V_{IN}-	11 or 1	
V_H+	6 or 16	Hall voltage polarity will depend on V_{IN} polarity and field polarity
V_H-	16 or 6	