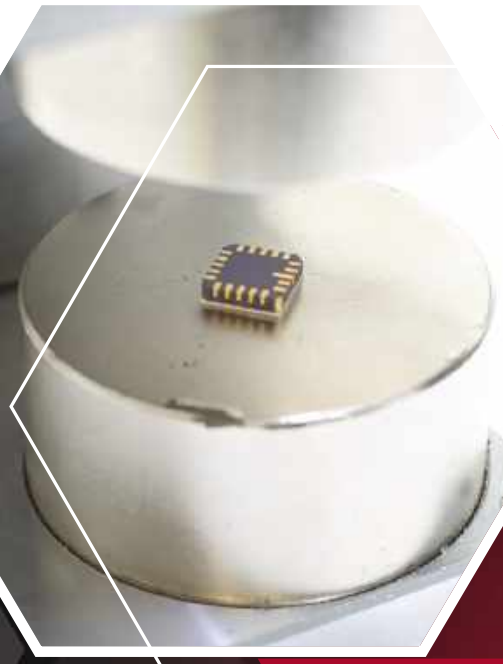


GHS01AT Graphene Hall Effect Sensor Kit

Summary

Paragraf's Graphene Hall Sensors (the GHS series) are optimised for measuring small fields with high resolution (<20 ppm) and are therefore suited to provide high performance analogue magnetic field measurements for battery & electric technologies, scientific research, healthcare, aerospace and industrial applications.

The standard GHS01AT Kit includes a GHS01AT sensor and a small interface PCB for ease and convenience of implementation (see Figure 1).

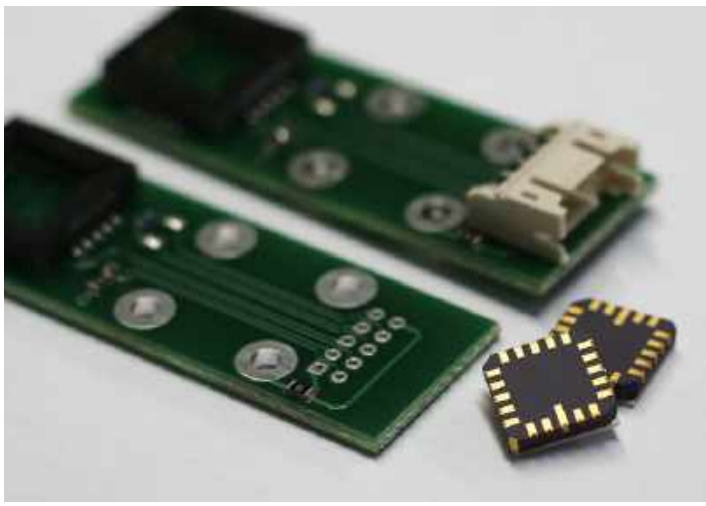


Figure 1. Paragraf GHS01AT sensors with PCB accessory (front board)

Features

- Exceptionally high resolution
- Ultra-low noise performance
- High linearity
- Low power operation & small footprint
- Immunity to in-plane stray fields

Description

Bringing the magnetic field measurement resolution towards that of more complex magnetic sensors, yet with the small size and ease of use of a Hall sensor. The GHS01AT can address magnetic measurement tasks which conventional technologies simply cannot provide an effective solution for.

By utilising a graphene monolayer (just 0.34nm thick) the GHS01AT is not affected by the presence of in-plane stray electromagnetic fields that would severely impact on the accuracy of alternative sensing mechanisms. The small footprint allows good spatial resolution and magnetic measurement in small spaces.

High resolution magnetic field strength measurements and precise position, rotation and speed sensing can all be realised with the GHS01AT.

Example Applications

Battery testing

The GHS01AT Hall Effect sensors are ideally suited to battery testing applications. They can measure the magnetic fields produced within battery cells, at the cathode/anode tabs and at the busbars feeding the cells. Local current density/resistivity trends can therefore be analysed during battery testing and comparisons across the cell can be performed.

This is an indirect and non-destructive method which is isolated from the cells and test setup, so can be added onto existing battery test rigs without interfering with existing equipment. It represents a more direct means for the assessment of changes in cell internal resistance than conventional local temperature measurement techniques and provides a faster response time allowing better data capture of local transient effects.

Using the GHS01AT, it is possible to get a more detailed and localised understanding of battery behaviour; within individual cells (see e.g. Figure 2) and cell-to-cell at the pack and module level.

Battery applications include:

- Direct current measurement on the cathode/anode tabs – absolute current, current fluctuations, changes in total cell internal resistance
- Real time current density mapping in active material – variations across cell and over time
- Direction of current flow – map current flow path through cylindrical / pouch cells
- Failure mode analysis – mapping hot spots to changes in current density and therefore local resistance
- Quality control – check for cell defects and leakage currents
- Monitor current flowing into individual cells within a multi-cell pack

Such measurements are facilitated by the GHS Array Starter Kit (see below)

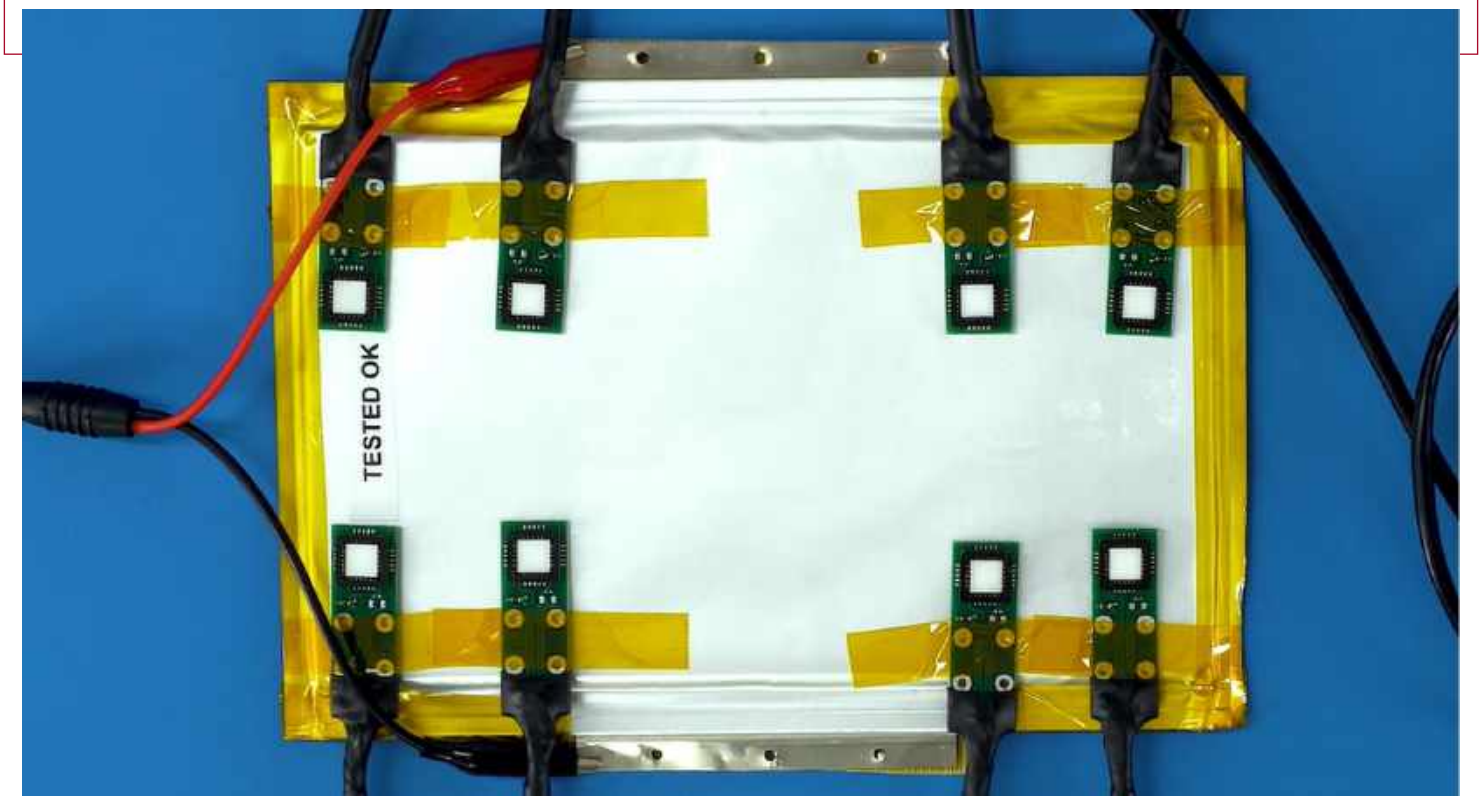


Figure 2 Example of the local current density mapping application for the GHS01AT sensors and GHS Array Starter Kit

Other example applications for the GHS01AT sensor and GHS Array Starter Kit

- Electromagnet mapping – real time field imaging and field gradient mapping of electromagnets
- Electric motors/bearings – map and monitor rotor and stator fields, check for defects e.g. pinholes in winding insulation and monitor how they develop
- Robotics – e.g. high precision positioning of robotic arms
- Magnetic materials research – e.g. multi-axis magnetic materials characterisation during stress testing
- Magnet sorting – quick multi-axis characterisation and sorting of different magnet grades

Performance Characteristics

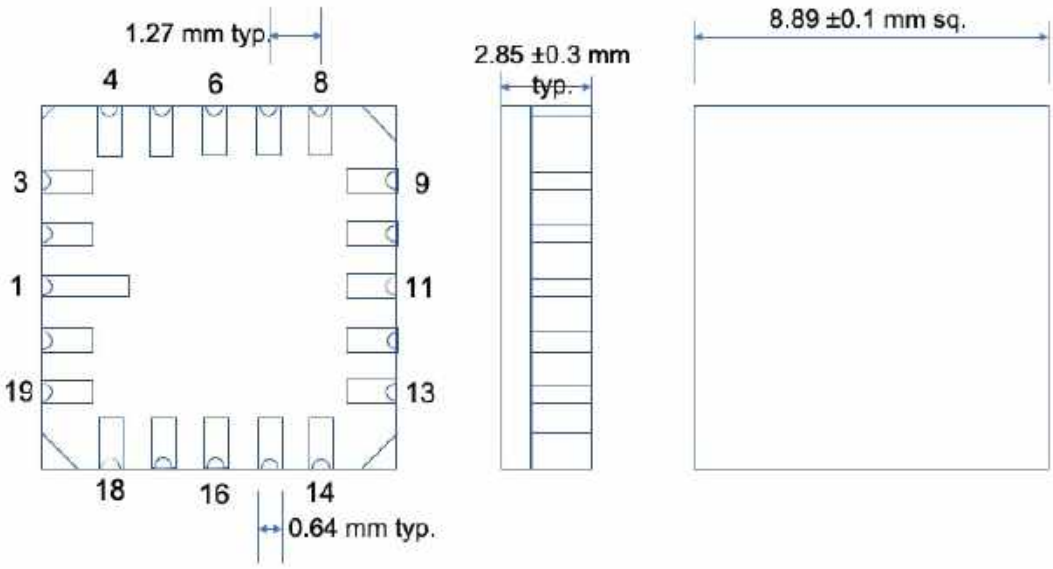
Parameter	Symbol	Value (Typical unless otherwise stated)	Unit	Notes
Resolution, based on SDt on a 1 T field		20	ppm	1 Hz, 2 V_{RMS} (equivalent to I=I_N)
Measurable field range	B	2	T	
Maximum operating temperature range	T	50	°C	
Linearity of Hall Voltage % of full scale		<0.5	%	Typical linearity over +/- 1T. I-I_N.
Nominal Supply Current	I_N	0.2	mA	
Maximum Supply Current	I_{max}	1	mA	
Supply Side Internal Resistance	R_{IN}	12.5	kΩ	B=0 T
Hall Side Internal Resistance	R_{OUT}	12.5	kΩ	B=0 T
Offset Voltage	Ω_{R0}	450	Ω	Typical offset voltage at B=0 T

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 VIN polarity and field polarity
V_H^-	16 or 6	



Package type: 20-pin LCC Ni-free package

Figure 3 The GHS Array Starter Kit, facilitating simultaneous data collection from up to 8 GHS sensors

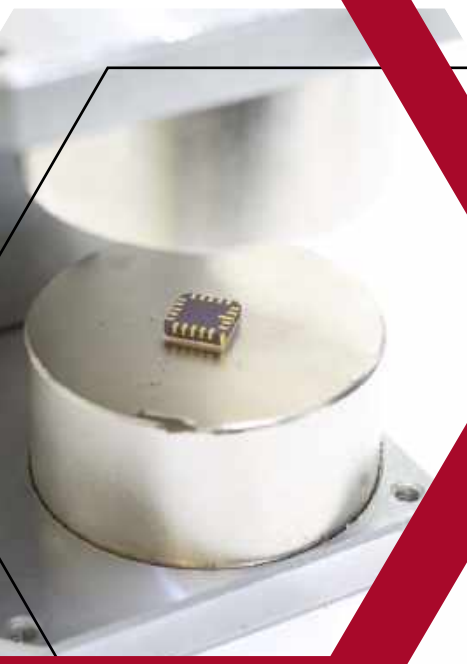
Accessories

Interface PCB

The standard GHS01AT Kit includes a GHS01AT sensor and a small (50 x 17 x 4.6 mm) interface PCB for ease and convenience of implementation. The PCB incorporates a temperature sensor close to the GHS to facilitate accurate temperature correction of the Hall voltage measurements. See Figure 1.

The GHS Array Starter Kit

Paragraf also offer the GHS Array Starter Kit, a plug-and-play kit facilitating simultaneous data collection from up to 8 GHS probes, see Figure 3. The probes include a temperature sensor to facilitate temperature correction of the GHS data. The kit interfaces with the users own power supply and data acquisition.



For more information, please visit our website at
www.paragraf.com/graphene-hall-effect-sensors

To discuss specific requirements, contact
hallsensors@paragraf.com

www.paragraf.com

All enquires:
Email: hallsensors@paragraf.com
Tel: +44 (0)1223 739782