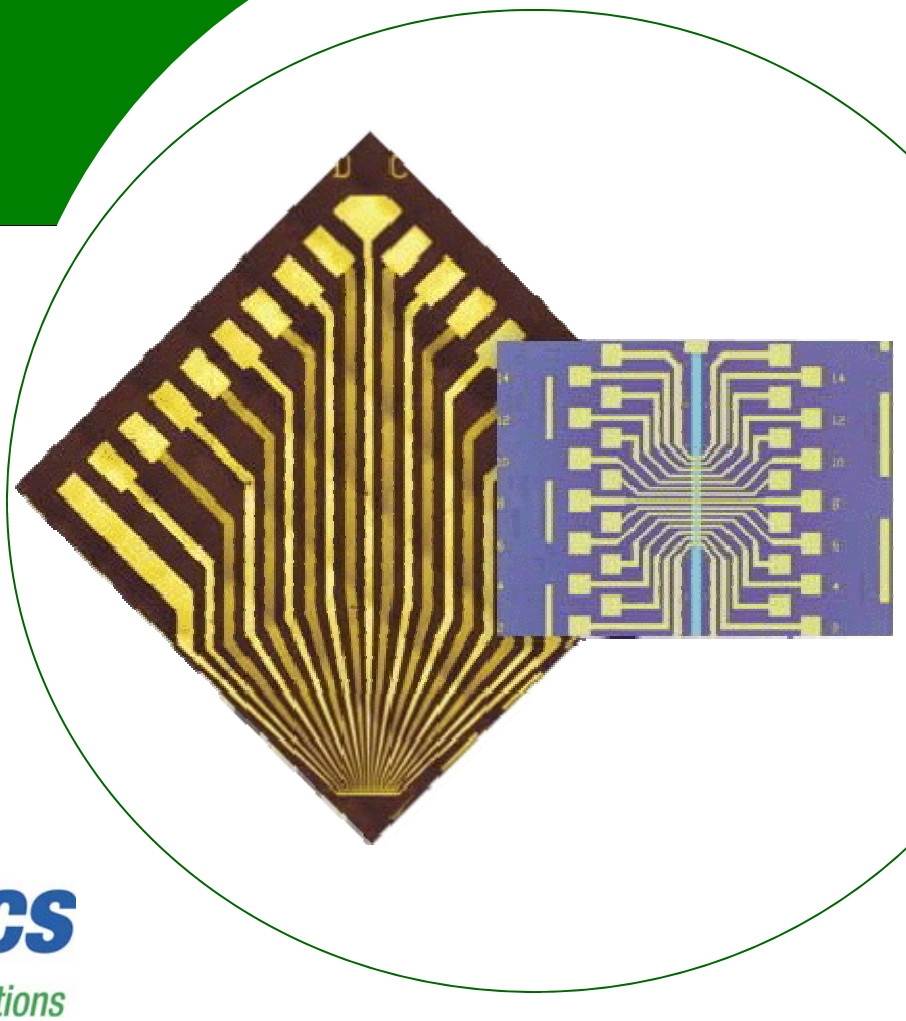
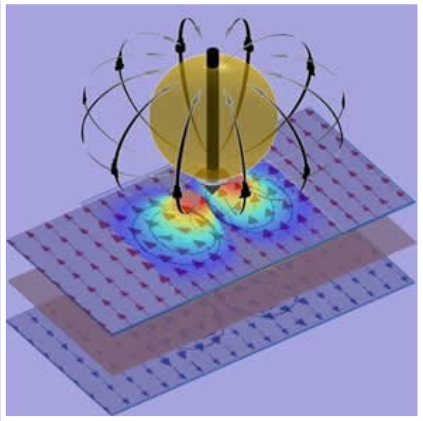
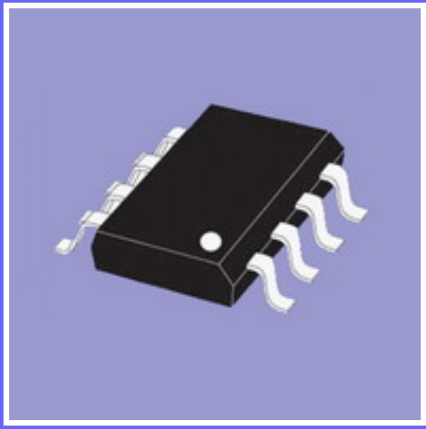
SpinTJ™

Magnetic Field Sensors



Micro Magnetics
Sensible Solutions





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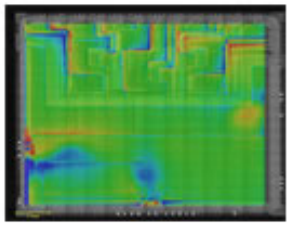
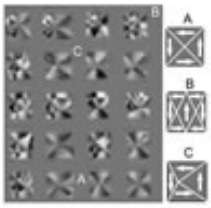
Introduction

Micro Magnetics' SpinTJ Series magnetic field sensors are based on next-generation magnetic tunnel junction technology. They offer unparalleled magnetic sensing capabilities, representing the most sensitive and reliable low-field sensors in the industry. The SpinTJ sensors feature linear and bipolar response, high spatial resolution, superior field sensitivity, low noise, low power consumption, and small physical size. They can also withstand extreme environmental conditions. These sensors have been used in a number of cutting-edge industrial and research applications, including semiconductor failure analysis, compassing and navigation applications, biomagnetic sensing, basic and applied research in magnetism and currency validation.

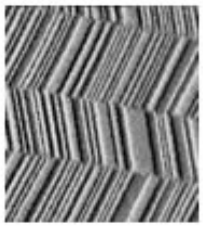
The SpinTJ sensor products are available in a number of packages and electrical configurations, such as probe, SMA, DIP-8, SOIC-8, and bare die form. We also design and manufacture custom magnetic sensors according to your specifications, in large or small quantities. Please contact us for your magnetic sensing requirements.



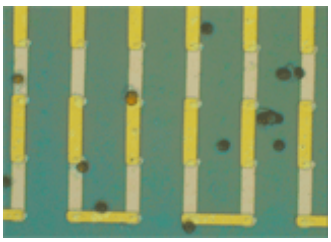
Magnetic field map of a semi-conductor chip measured by a SpinTJ micro-sensor



Magnetic domain patterns imaged using SpinTJ micro-sensors.



Magnetic field image of a 20x20 micron segment of digital video tape.



Detection of DNA labeled with magnetic nanoparticles using SpinTJ sensors.

Optical and magnetic images of a $20 bill, as seen by SpinTJ micro-sensors.

Sensor Selection Guide

The standard SpinTJ Series single magnetic sensors are divided into four categories: 1) micro-sensors; 2) general purpose low-noise sensors; 3) full bridge sensors; and 4) half bridge sensors. They share the same basic features unavailable to other magnetic sensing technologies: linear and bipolar response, high sensitivity, low noise, low power consumption and small size. They differentiate from one another mainly in spatial resolution, dynamic range, measurement (4-point, 2-point) configuration, etc. Our sensors function up to a high frequency of 10 MHz. Custom sensors can extend the frequency limit to a few GHz. Please refer to the following table to select the type of sensor that meets your needs:

Type	Spatial Resolution	Sensing Range	Sensitivity	Detectability	Standard Package
Micro Sensor	~ 2 µm	± 50 Oe	0.5-1.5%/Oe	50 nT/$Hz^{1/2}$@ 100 Hz; 5 nT/$Hz^{1/2}$ @ 10 kHz	Bare die, Probe, SMA, DIP-8
General Purpose Low Noise Sensor	~ 0.9 mm	± 50 Oe	0.7-2.0%/Oe	2 nT/$Hz^{1/2}$ @ 100 Hz; 200 pT/$Hz^{1/2}$ @ 10 kHz	Bare die, Probe, SMA, DIP-8, SOIC-8
Full Bridge Sensor	~ 0.9 mm	± 20 Oe	2-5 mV/V/Oe	3 nT/$Hz^{1/2}$ @ 10 Hz; 100 pT/$Hz^{1/2}$ @ 1 kHz	Bare die, DIP-8, SOIC-8
Half Bridge Sensor	~ 1.8 mm	± 20 Oe	2-4 mV/V/Oe	3 nT/$Hz^{1/2}$ @ 10 Hz; 100 pT/$Hz^{1/2}$ @ 1 kHz	Bare die, DIP-8, SOIC-8

We also offer two standard preamplifiers for signal amplification and conditioning, AL-05 and D-801. The AL-05 is for sensors in probe package; and D-801 is for sensors in DIP-8 package. They amplify and filter the voltage across the sensor and output an analog voltage proportional to magnetic field. They offer good protection to the sensors against electrostatic discharge and electromagnetic interference.

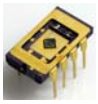
The SpinTJ Series also includes two sensor array products, STJ-A and STJ-B. The STJ-A consists of linear arrays of micro-sensors. They feature up to 16 sensors, each of which has nanotesla field sensitivity and micron - scale spatial resolution. The STJ-A is ideal for scanning and imaging applications, for reading magnetic media or currency, or for basic and applied R & D purposes. The STJ-B is our standard biomagnetic sensing solution package. It consists of four components, a SpinTJ sensor array, a sensor package, a compatible sensor electronics, and a microfluidics circuit.

SpinTJ Micro Sensors

Key Features:

- Linear and bipolar response
- Wide sensing range of ± 50 Oe
- Superior field sensitivity of 0.5-1.5%/Oe
- High detectability of 50 nT/$Hz^{1/2}$@ 100 Hz and 5 nT/$Hz^{1/2}$@ 10 kHz
- Active areas as small as 1 x 2 microns
- On-board ESD protection for packaged sensors
- Small silicon die size of 1.9mmx1.9mmx0.3mm
- Compact packaging and electrical configurations
- Optional sensor polishing allows an approach distance of < 5 microns (0.002")

Standard Products:

Part Number	Type of Sensor	Package Form	Picture
STJ-001	Micro Sensor	Bare Die	
STJ-010	Micro Sensor	Short Probe	
STJ-020	Micro Sensor	Long Probe	
STJ-030	Micro Sensor	SMA Probe	
STJ-100	Micro Sensor	DIP-8	

Applications: scanning magnetic microscopy, detection of magnetic nanoparticles, counterfeit detection, smart dusts, magnetic encoders, spintronics immunoassay, security and military applications, medical devices, high precision position and angular sensors, current sensors, nanotechnology research.

SpinTJ General Purpose Low-Noise Sensors

Key Features:

- Linear and bipolar response
- Superior field sensitivity of 0.7-2.0%/Oe
- Wide sensing range of ± 50 Oe
- High detectability of 2 nT/$Hz^{1/2}$ @ 100 Hz and 200 pT/$Hz^{1/2}$ @ 10 kHz
- Small silicon die size of 0.9x0.9x0.3mm
- Compact packaging and electrical configurations

Standard Products:

Part Number	Type of Sensor	Package Form	Picture
STJ-201	General Purpose Low-Noise Sensor	Bare Die	
STJ-210	General Purpose Low-Noise Sensor	Short Probe	
STJ-220	General Purpose Low-Noise Sensor	Long Probe	
STJ-230	General Purpose Low-Noise Sensor	SMA Probe	
STJ-240	General Purpose Low-Noise Sensor	SOIC-8	
STJ-300	General Purpose Low-Noise Sensor	DIP-8	

Applications: ultralow field sensing (nT), magnetic imaging, detection of magnetic particles, magnetic spectrum analyzer, NMR, compass and navigation, spintronics immunoassay, smart dusts, security and military applications, magnetic encoders, position and angular sensors, current sensors, counterfeit detection, medical devices (hearing aids, microsurgery, drug delivery, etc.), nanotechnology research.

SpinTJ Full Bridge Sensors

Key Features:

- Linear and bipolar response
- Superior field sensitivity of 2-5 mV/V/Oe
- Wide sensing range of ± 20 Oe
- High detectability of 3 nT/$Hz^{1/2}$@ 10 Hz and 100 pT/$Hz^{1/2}$@ 1 kHz
- Compact packaging and electrical configurations

Standard Products:

Part Number	Type of Sensor	Package Form	Picture
STJ-301	Full Bridge Sensor	Bare Die	
STJ-340	Full Bridge Sensor	SOIC-8	
STJ-400	Full Bridge Sensor	DIP-8	

Applications: ultralow field sensing (nT), magnetic imaging, detection of magnetic particles, magnetic spectrum analyzer, NMR, electronic compass and navigation, spintronics immunoassay, smart dusts, security and military applications, magnetic encoders, position and angular sensors, current sensors, counterfeit detection, medical devices (hearing aids, microsurgery, drug delivery, etc.), nanotechnology research.

SpinTJ Half Bridge Sensors

Key Features:

- Linear and bipolar response
- Superior field sensitivity of 2-4 mV/V/Oe
- Wide sensing range of ± 20 Oe
- High detectability of 3 nT/$Hz^{1/2}$@ 10 Hz and 100 nT/$Hz^{1/2}$@ 1 kHz
- Compact packaging and electrical configurations

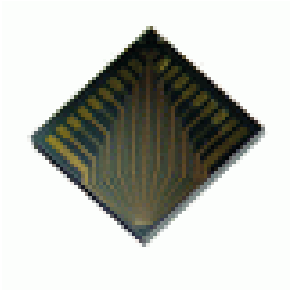
Standard Products:

Part Number	Type of Sensor	Package Form	Picture
STJ-401	Half Bridge Sensor	Bare Die	
STJ-440	Half Bridge Sensor	SOIC-8	
STJ-500	Half Bridge Sensor	DIP-8	

Applications: ultralow field sensing (nT), magnetic imaging, detection of magnetic particles, magnetic spectrum analyzer, NMR, electronic compass and navigation, spintronics immunoassay, smart dusts, security and military applications, magnetic encoders, position and angular sensors, current sensors, counterfeit detection, medical devices (hearing aids, microsurgery, drug delivery, etc.), nanotechnology research.

Magnetic Sensor Arrays and Custom Sensors

STJ-A Series Magnetic Field Micro Sensor Arrays:

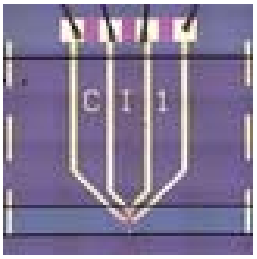


Key Features:

- Linear and bipolar response
- Active areas as small as 2 x 4 microns
- Sensor-to-sensor spacing of 20 microns (standard)
- Linear arrays of 4, 8, or 16 sensors (standard)
- Custom solutions available

The STJ-A Series of products consists of linear arrays of SpinTJ low-field micro sensors. These arrays feature up to 16 sensors, each of which has nT field detectability and micron scale spatial resolution. The sensor arrays feature excellent (<10%) uniformity of sensor impedance and device voltage sensitivity. STJ-A array products come mounted onto an ESD-protected single or dual-row 0.1"-pitch female connector. Custom packages are also available. The STJ-A Series is ideal for scanning and imaging applications, for reading of magnetic currency or media, or for basic and applied R&D purposes.

STJ-B Series Biomagnetic Sensing Solutions:



Key Features:

- Linear and bipolar response
- Superior field sensitivity of 5 nanotesla
- Active areas as small as 2 x 4 microns
- Fully compatible with microfluidics
- Sensor-to-sensor spacing of 20 microns (standard)
- Custom solutions available

The STJ-B Series biomagnetic sensing solutions consists of four components: a linear array of SpinTJ sensors, a package on which the sensor is mounted, a sensor electronics, and a microfluidics circuit. The sensors used in STJ-B Series can be either micro-sensors or low-noise sensors, depending on customers' applications; Standard packages for STJ-B are DIP or SOIC-to-DIP; The D-801 signal conditioning electronics is ideal for use with STJ-B Series; Microfluidic circuits are coupled to the SpinTJ sensing elements based on customer's specifications.

SpinTJ Powering and Preamplification Electronics

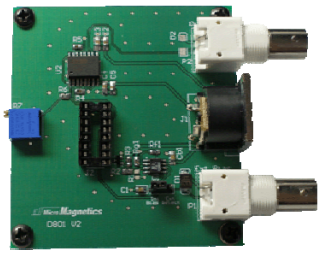
We offer two standard preamplifiers for signal amplification and conditioning, AL-05 and D-801. The preamplification circuitry amplifies and filters the voltage across the sensor and outputs an analog voltage proportional to the magnetic field. The design of the preamplifiers allow power supply noise and other common-mode noise across the sensor to be attenuated by over 100 dB.

The switch on the AL-05 and D-801 is used to switch the powering of the sensor from the internal voltage supply to the external supply, which can be introduced through a coaxial connector. The user can tune the DC offset voltage from –10V to +10V by tuning an adjustment dial. Overvoltage protection on the board prevents the sensor from being subjected to voltage levels above its rated voltage. The gain of the preamplification circuitry is adjustable from 10 to 2000 based on each customer's specifications.

Key Features of AL-05 and D-801:

- Ultra-low-noise preamplification circuitry with adjustable gain
- Use built-in sensor biasing or input from an external power source
- Overvoltage protection circuitry
- Adjustable DC offset voltage
- DC to 1 MHz standard frequency bandwidth
- Allows 100+ dB of power supply and other common-mode noise
- Includes power supply, no other inputs required
- AL-05 is for sensors in probe package, such as STJ-020 and STJ-220
- D-801 is for sensors in DIP-8 package, such as STJ-100 and STJ-300

AL-05



D-801