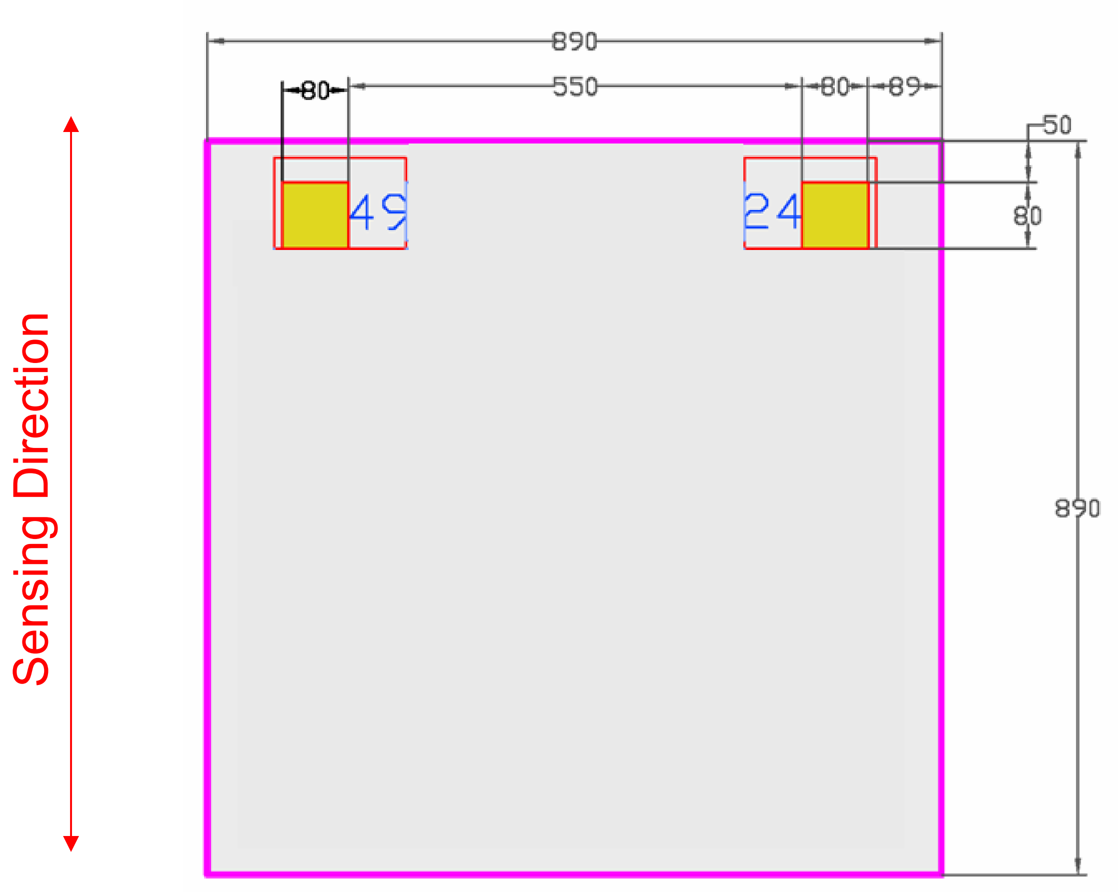
STJ-201 – Physical Dimensions



The active areas are represented by purple ellipses, and the bond pads are shown in gold.

All dimensions in microns.

The thickness of the die is 0.3 mm.

Note: Dimensions are approximate only. Actual dimensions may differ. The schematic above is for illustration only.

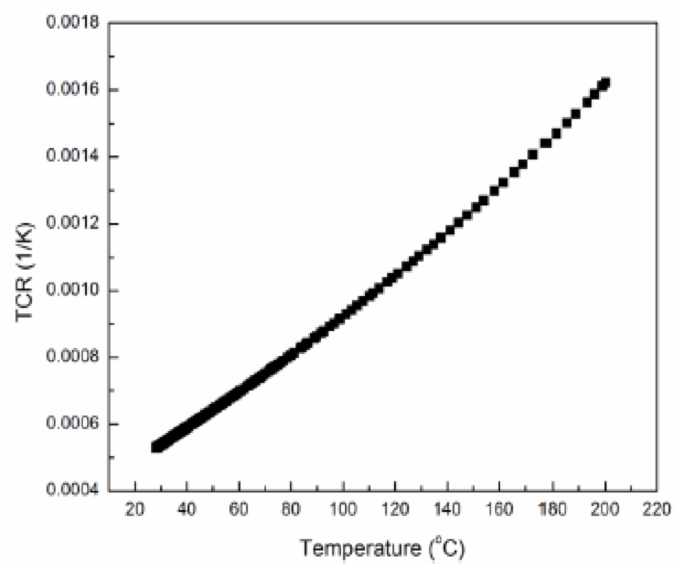
STJ-201 – Specifications

PHYSICAL	Min.	Typical	Max.	Unit
Die Size		0.89 x 0.89		mm
Die Thickness		0.3		mm
Active Area Length		0.79		mm
Active Area Width		0.71		mm
Active Area Thickness	3.0	60.0	100.0	nm
ELECTRICAL				
Sensor Resistance[1]	100	10000	200000	Ω
Recommended Operating Voltage	0.01	5.0	12.0	V
Maximum Operating Frequency[2]	1	5	25	MHz
MAGNETIC				
Total Magnetoresistance[3]	40	80	200	%
Magnetic Field Sensitivity	0.4	1.0	2.0	%/G
Non-linearity[4] (+/- 1 G)		0.25	2.0	%
Hysteresis[5] (field range = +/- 1 G)		0.01	0.05	G
Non-linearity[4] (+/- 10 G)		0.50	5.0	%
Hysteresis[5] (field range = +/- 10 G)		0.5	2.0	G
Voltage sensitivity (V_{IN} = +12 V)	48	120	240	mV/G
Equivalent Field Noise (100 Hz)	2	5	15	$nT/Hz^{0.5}$
Equivalent Field Noise (10 kHz)	0.2	1	5	$nT/Hz^{0.5}$

STJ-201 – Thermal Data (Typical)

Temperature Coefficient of Resistance

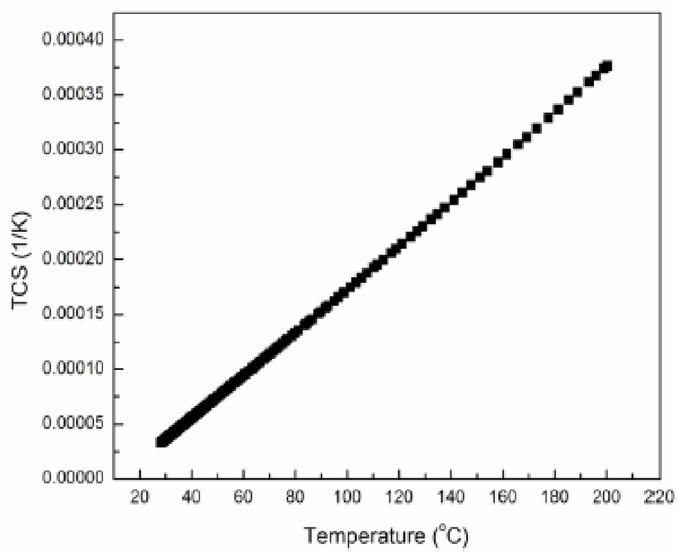
TCR=(1/R)(△R/△T)



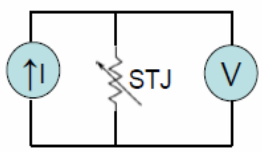
Temperature Coefficient of Sensitivity

TCS=(1/S)(△S/△T)

S=(1/R)(△R/△B) (Units: %/Oe)



STJ-201 – Typical Measurement Circuits

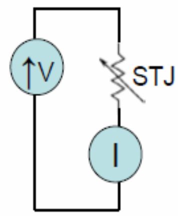


Bias STJ sensor with a constant current supply.

Measure voltage drop V across STJ.

Calculate resistance:

R = V/I

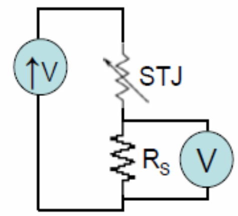


Bias STJ sensor with a constant voltage supply.

Measure current I through the STJ element.

Calculate resistance:

R = V/I



Place sensor in series with a fixed resistor R_S.

Bias the series devices with a constant voltage V_{IN}.

Measure voltage V across the fixed resistor.

Calculate resistance:

$R = R_S(V/V_{IN} - 1)$

STJ-201 – Specifications Notes

1. Sensor resistances can be customized over a wide range of values (10 Ω-1 MΩ) . Please contact Micro Magnetics to discuss your specific needs.

2. The sensor's operating frequency is limited by its RC time constant. The device's capacitance is nearly constant, but resistance values can vary quite a bit. Therefore, the operating frequency can vary a great deal with the sensor resistance (smaller resistance values allow higher operating frequencies).

3. Magnetoresistance is measured over a field sweep range of 100-150 G.

4. Sensor non-linearity is defined as the percentage difference between the measured experimental transfer (resistance versus applied field) curve and the best-fit line to the data. For example, a transfer curve with a linear correlation coefficient of 0.995 would have a non-linearity of 0.5%. Contact Micro Magnetics for more details on how this figure is calculated.

5. Sensor hysteresis is defined as the average (magnetic field) absolute separation between the increasing and decreasing transfer curve data, over the field range of interest. Contact Micro Magnetics for more details on how this figure is calculated.

STJ-201 – Notes and Handling Instructions

1. The active area of the sensor occupies most of the area of the sensor die. **Avoid physical contact with the die.**

2. Please store sensors as they were shipped and in a location which is away from sources of radiated electromagnetic fields (ESD/EMI).

3. Sensors are sensitive to electrostatic discharge (ESD). Be careful to ground tools and your hands when handling the sensors. If possible, be sure to wear grounding straps when handling the sensors.

4. MTJ sensors will fail if subjected to a sufficiently large differential voltage. A good rule-of thumb is to **limit the voltage drop across the sensor element to 12 V** or less at all times.

5. To directly measure MTJ sensor resistance, connect to a constant current source, and measure the voltage drop directly across the two active leads. In order to limit the voltage drop across the MTJ sensor, initial applied current values should NOT exceed 50 µA. If this amount of current is not sufficient to measure the device resistance, the current may be increased gradually until the sensor voltage is sufficient to make an accurate reading.

STJ-201 – Detailed Description and Notes

The STJ-201 is a bipolar, high-sensitivity, linear-output magnetic sensor which works on a magnetoresistive principle. Over the specified range of operation, the resistance of this device is approximated by

$$R(H) = R_0(1 + SH)$$

where R_0 is the sensor resistance at zero field, H is the magnetic field strength in gauss (G) in the sensing direction (indicated on page 1), and S is the sensor's coefficient of sensitivity, expressed in units of 1/G. The value of S is provided in the datasheet which is sent with each sensor. Note that the values of R_0 and S can change by up to 10% if the sensor is exposed to large DC magnetic fields and then re-measured at low field.

The sensor consists of numerous small active regions evenly spaced across the sensor die. This effectively guarantees that the sensor will respond to the average field strength which is experienced by the entirety of the die surface.

Making a measurement of field can be accomplished by any method which allows precise measurement of the STJ-201 sensor's electrical resistance, with the following requirement: The sensor has a safe operating differential voltage of no larger than 12 V. **Under no circumstances the sensor to be subjected to differential voltages of more than 12 V in either direction.**

STJ-201 – Detailed Description and Notes (2)

The simplest way to use the STJ-201 sensor is to apply a constant current across the two terminals of the device (using the two wire bond pads indicated on page 1), and measure the corresponding voltage. Alternatively, a constant voltage can be supplied and the current measured to read the sensor resistance.

Another way to use the STJ-201, if the above methods are not feasible, is to build a simple voltage divider with the STJ-201 and a fixed resistor in series. Applying a known voltage to the two-resistor circuit and measuring the voltage across the STJ-201 (or across the fixed resistor) will allow for calculation of the resistance of the STJ-201, and therefore the magnetic field.

Testing the STJ-201 Sensor:
In general, every sensor which is operating properly should behave in the following ways:

1. The resistance of the STJ-201 in small magnetic fields should be within ~25% of the calibrated resistance (this is available on an included datasheet or by contacting Micro Magnetics). Almost always, a sensor which has been damaged has a zero-field resistance which is either infinite (open circuit) or much smaller than the quoted R_0.

2. A marked change in the resistance of the STJ-201 should be observed when a small magnet (i.e. a refrigerator magnet or even a magnetized tool) is brought to within 1" of the sensor's active area. Even the Earth's magnetic field is strong enough to cause a substantial resistance change (i.e. if the sensor is rotated with respect to this field).

If you are unsure about the condition of an STJ-201 sensor, the above tests are a good first step to take.

Technical Support:
If you require technical support please contact Micro Magnetics at: support@micromagnetics.com or (508) 672-4489.