GT-LTGSJ24

LOW-TECH GRAPHITE STRAIN JAUGE

MAIN FEATURES

- ✓ Eco-friendly: low power consumption, easily reparable
- ✓ Easy to use
- ✓ Thin and light
- ✓ Flexible and portable

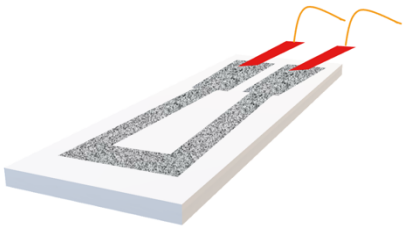

Fig. 1: Sensor illustration

GENERAL DESCRIPTION

The strain sensor was developed in the Engineering Physics Department at INSA Toulouse. It is based on the article "*Pencil Drawn Strain Gauges and Chemiresistors on Paper*" by Cheng-Wei Lin, Zhibo Zhao, Jaemyung Kim, and Jiaxing Huang, published in 2014. This sensor consists of a small piece of paper coated with a graphite layer from a pencil.

When the paper is deformed, the number of connected graphite particles in the thin layer changes. This variation is directly related to the type of deformation, resulting in a change in resistance and conductance. This allows us to measure deformation, like a traditional strain gauge.

The structure of the graphite layer varies depending on the type of pencil used. We conducted tests with two types of pencils: HB (medium hardness) and 2B (softer). To achieve this, our sensors were coupled with a transimpedance amplifier and an Arduino Uno, all mounted on a PCB.

PIN CONFIGURATION

Pin number	Usage
1	V_{in}
2	$+V_{CC}$*

**Typically, a +5 V voltage*

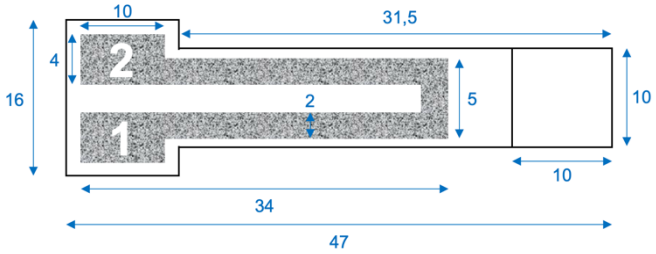

Fig. 2: Top view dimensions (in mm)

STANDARD USE CONDITIONS

Pin number	Unit	Typical value
Temperature	°C	20 ± 10
Humidity	%	45 ± 15
Air quality	$\%N_2/O_2$	80/20

TECHNICAL SPECIFICATIONS

Type	Strain sensor
Materials	Graphite (4B to 2H pencils)
Sensor type	Passive: power supply required
Power supply	+5 V
Nature of output signal	Analog
Nature of measurand	Voltage
Typical response time	Less than 50 ms
Typical use	Evaluation of a compression or a tension deformation

ELECTRICAL CHARACTERISTICS

Pencil type	Unit	Value		
		Minimum	*Typical*	*Maximum*
HB	$M\Omega$	200	220	380
2B	$M\Omega$	2	2,3	3

TYPICAL PERFORMANCE CHARACTERISTICS

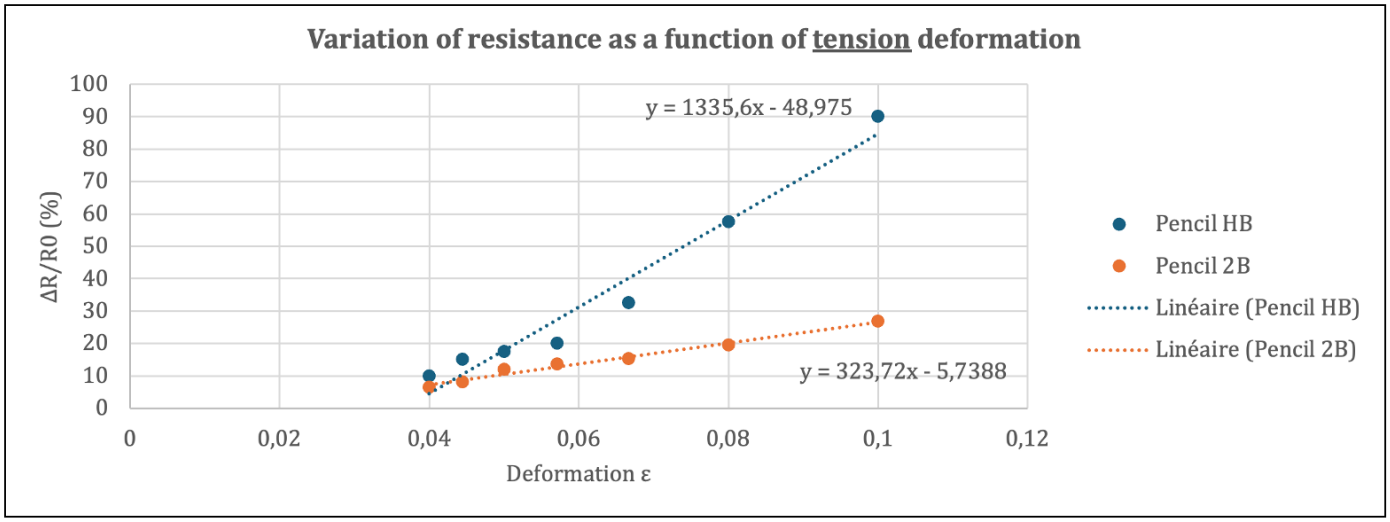

Fig. 3: Characteristics in tension

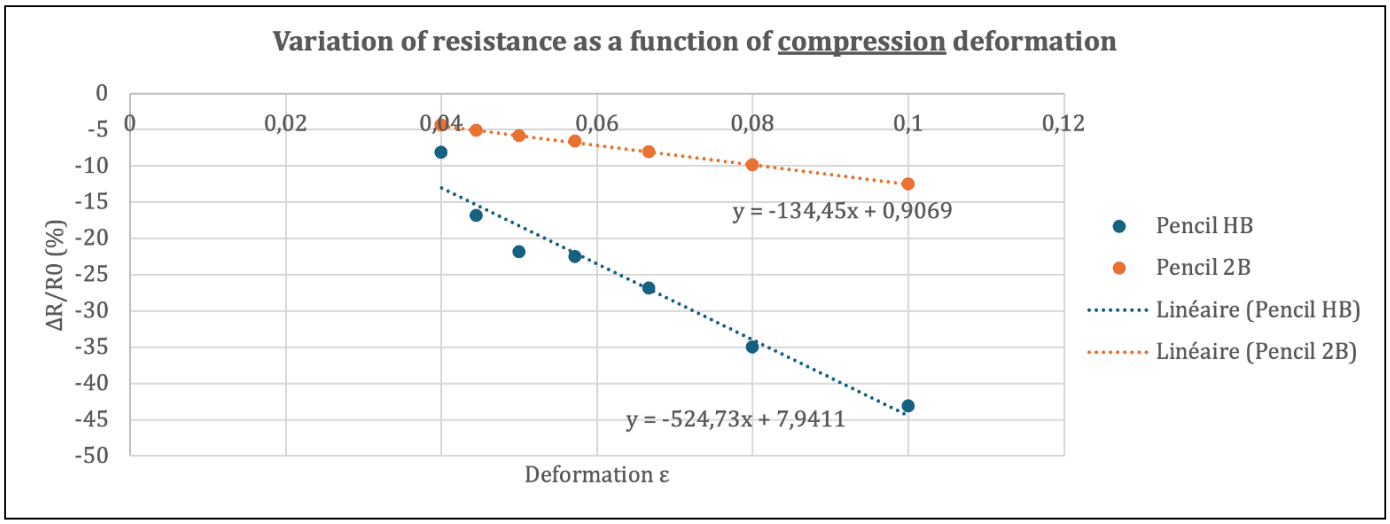

Fig. 4: Characteristics in compression

TYPICAL APPLICATION

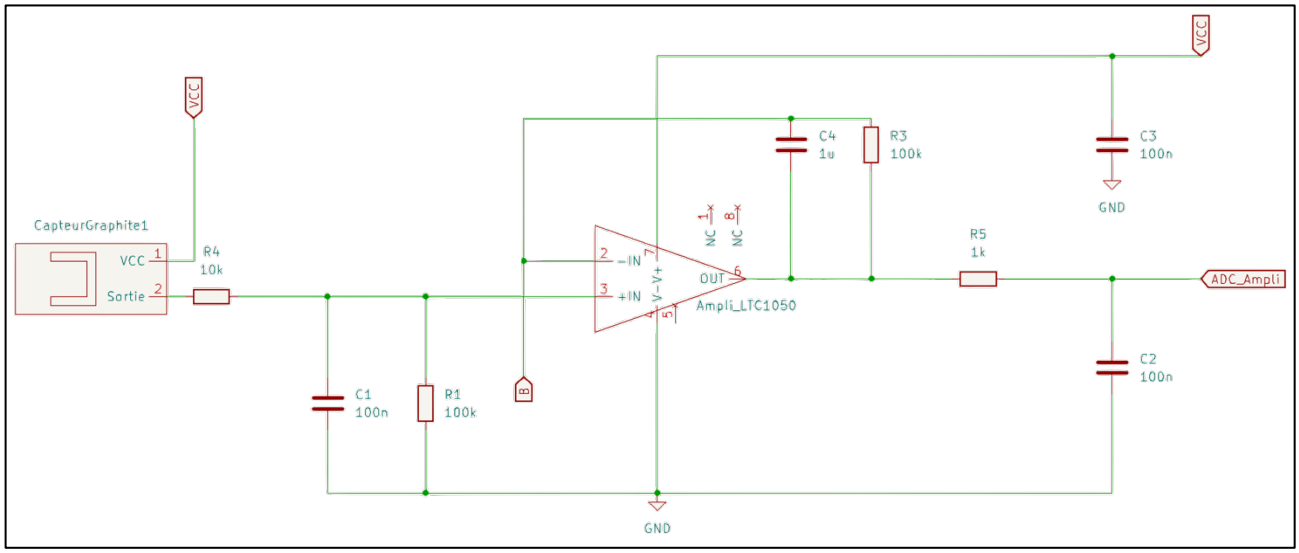

Fig. 5: Transimpedance amplifier circuit in order to use the sensor

The strain sensor is connected to a transimpedance amplifier circuit (in order to collect a readable signal for the Arduino Uno). The latter is composed by low- and high-pass filters to cancel the different noises (amplification, current and the "50 Hz component" due to the electric network).

The component B represents a variable resistor. It is used to match amplification of circuit for each type of pencil.

Finally, it is possible to know the value of the resistance of our *GazouTech™ GT-LTGSJ24* with the following formula:

$$R_{sensor} = R_1 \left(1 + \frac{R_3}{R_{variable}}\right) \frac{V_{cc}}{V_{adc}} - R_1 - R_5$$