Low tech graphite based sensor

1, Feature

- Passive sensor
- Low cost
- Low energy consumption
- Small size

2, Description

The graphite sensor is a strain sensor based on the materials graphite who is deposed on a paper as a film. This graphite on a paper is from the pencil 2H.

The sensor uses the electrical properties of graphite whose conductivity depend the deformation. At the microscopic scale, the tunnel effect sensitive to the average distance of the nanoparticles in the graphite. In the graphite, it's tunnel effect who dominate the conductivity. So, the resistance depend directly on the deformation that we apply to the sensor. Otherwise, the conductivity depends on the thickness, the length and particularly the material of graphite.
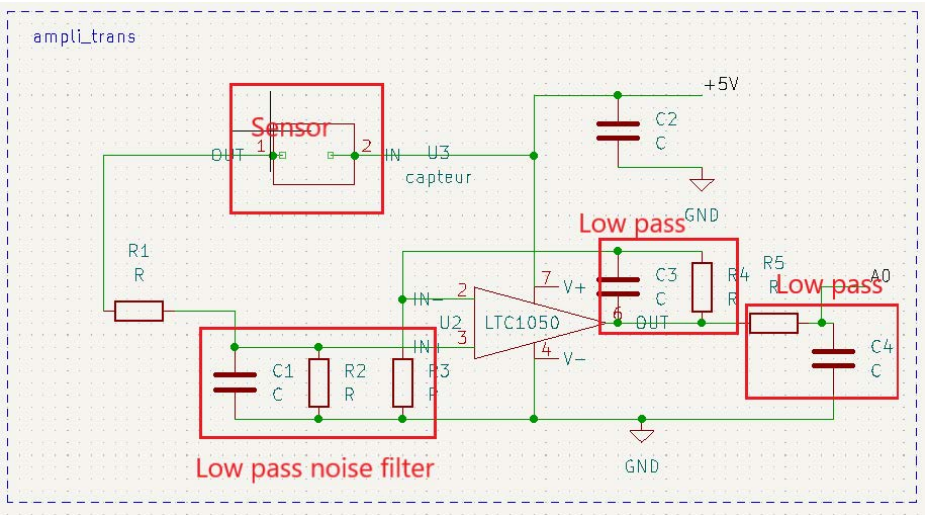
	L1	L2	L3	L4	L5
Length(mm)	1	10	23	6	2

Standard use condition

	Unit	Typical value
Temperature	°C	20±5
Humidity	%	60±10

Specification

SUPPLY VOLTAGE	5V
MESURAND	Voltage
SENSOR TYPE	Passive
Output signal	Analog
Response time	<100ms

Warning: the usage of the sensor is delicate, user was not recommanded to touch the surface of the graphite or compress the sensor.

Above we have the transimpedance circuit used to filter the bruit and increase the signal at output A0. This circuit is developed on Ki-cad and built on a PCB shield. The software is code in Arduino to record the result and do the calculation.

3, Electric characterization

In the figure below we plotted the variation relative of sensor's resistance($\Delta R/R0$). The horizontal coordinate is the deformation expressed on ($\varepsilon = D/(2*R)$, D the thickness of paper, R is the rayon of the radius of curvature of paper).

Resistance	Unit	Value		
		Min	Type	Max
2H	MΩ	153	269	385
HB	MΩ	539	660	781

Electric caraterisation of graphite sensor in extension