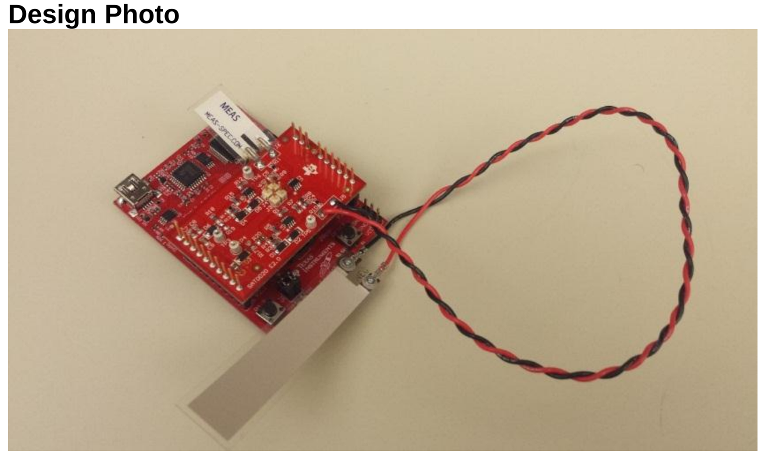
TI Designs

Piezoelectric Airflow Sensor

System Description

This Piezoelectric Airflow Sensor is intended for use in systems that require fan airflow detection. This can include server intake/exhaust airflow detection, as well as desktop computer airflow. The Piezoelectric Airflow Sensor design is a simple, low cost solution which would help designers who are looking for a means to detect the presence or absence of fan airflow in existing systems.

Design Photo



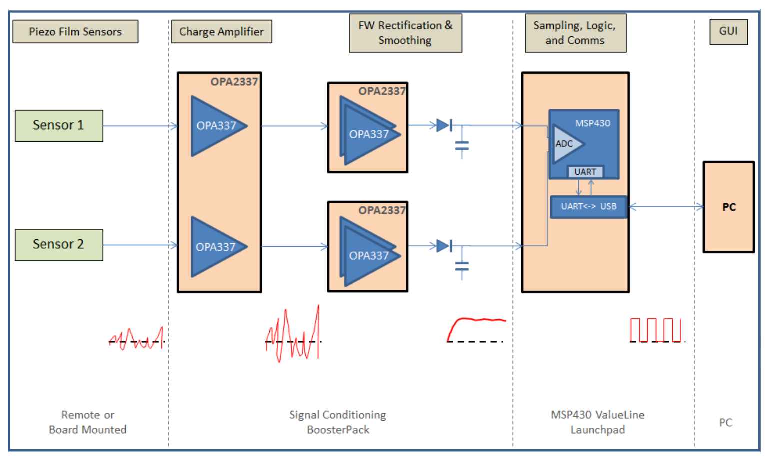
Featured Applications

- Server Intake/Exhaust Airflow Detection
- Desktop Airflow Detection
- HVAC Airflow detection

Design Resources

- Block Diagram and Schematic
- Test Data
- Gerber Files
- Design Files
- Bill of Materials
- Wiki Page

Block Diagram



Design Features

- Piezoelectric film sensor can be used in conjunction with an MSP430 microcontroller to provide a low-cost solution to detecting the presence or absence of fan airflow
- Small solution size with efficient layout considerations
- MSP430 LaunchPad BoosterPack form factor
- Easy to read GUI for interpreting airflow sensor results

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TEXAS INSTRUMENTS

Associated Part Numbers

Part Number	Part Description
OPA2337	Single-Supply CMOS Operational Amplifier
MSP-EXP430G2	MSP430 LaunchPad Value Line Development kit

Design Considerations:

1. **Alternate Part**
   a. IVC102 - Precision Switched Integrator Transimpedance Amplifier. IVC102 has integrated feedback capacitors which eliminate the need for external passives. It also eliminates the need for the large value feedback resistor used in the current design and reduces the number of components needed.
2. **Output Configurations**
   There are three ways in which the output of the first amplifier stage can be monitored, each offering its own set of advantages
   a. **Full rectification and filtering using precision Absolute Value circuit**
      i. This configuration uses dual OPA337s to translate the output of the charge amplifier to a DC value which corresponds to the peak amplitude of the input signal.
      ii. The absolute value circuit has the highest component count of all three options, however it has the most precise output. Selectable via a 0Ω resistor on the board.
   b. **Half-wave rectification and filtering**
      i. This configuration uses only a diode and an output capacitor to rectify and smooth the output of the charge amplifier. Like the absolute-value circuit, it will be read by the MSP430 as a DC value with some averaging.This option requires very few components, only one rectifying diode and an output filter
      ii. The output of the sensor can be sporadic and not guaranteed to be symmetric between its positive and negative outputs (this depends on the way in which the sensor is deflected spacially). Since the half-wave rectification will essentially block the negative half of the signal, the final output may not be completely representative of the original sensor input. Selectable via a 0Ω resistor on the board.
   c. **Direct output from the charge amplifier**
      i. This configuration requires no additional components past the charge amplifier (first stage). The MSP430 will need to do "peak detection" and some averaging to get use out of this signal. However, since this configuration can feed the "raw" data to the PC, there is the opportunity to have access to the frequency content of the incoming signal, which is more or less lost in the other two configurations.
      ii. Due to the overhead of the signal processing, this configuration does not scale as well to multiple sensors as the other two configurations. This signal is available via headers on the board and the user has the option to feed this to open analog channels on the MSP430 via jumper wire.

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