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APPLICATION NOTE

Micro vibration sensor

MVS1006.01 / MVS0608.02
MVS0409.01 / MVS0409.02

Revision 1.2
Supersedes data of 2009 Oct. 22

2009 Nov. 24

Index

1. Operation Note

Both versions of the micro vibration sensor (unidirectional MVS1006.01 and omnidirectional MVS0608.02) are **not necessarily closed when at rest**. They will be closed in 70-99% of the time when at rest.

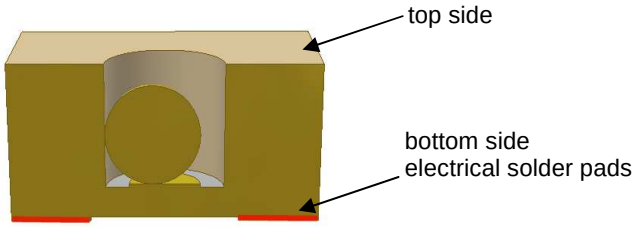


Figure 1: Micro vibration sensor, micro sphere at rest, contacts not necessarily closed

The unidirectional sensor version MVS1006.01 is open at rest, when mounted in upside down position, so that the micro sphere is on the top side of the sensor, which has no contact pad.

The circuit and/or the software of the electronic device should evaluate state changes from open to closed or closed to open instead of steady states open or closed. Therefore the edge sensitivity is more important than the level sensitivity.

2. Application Note 1: Basic circuit

2.1 General description

The most simple circuit with a minimum of component requirement.
R1 should be chosen to limit the current through the sensor to a maximum value of 750µA.

2.2 Circuit

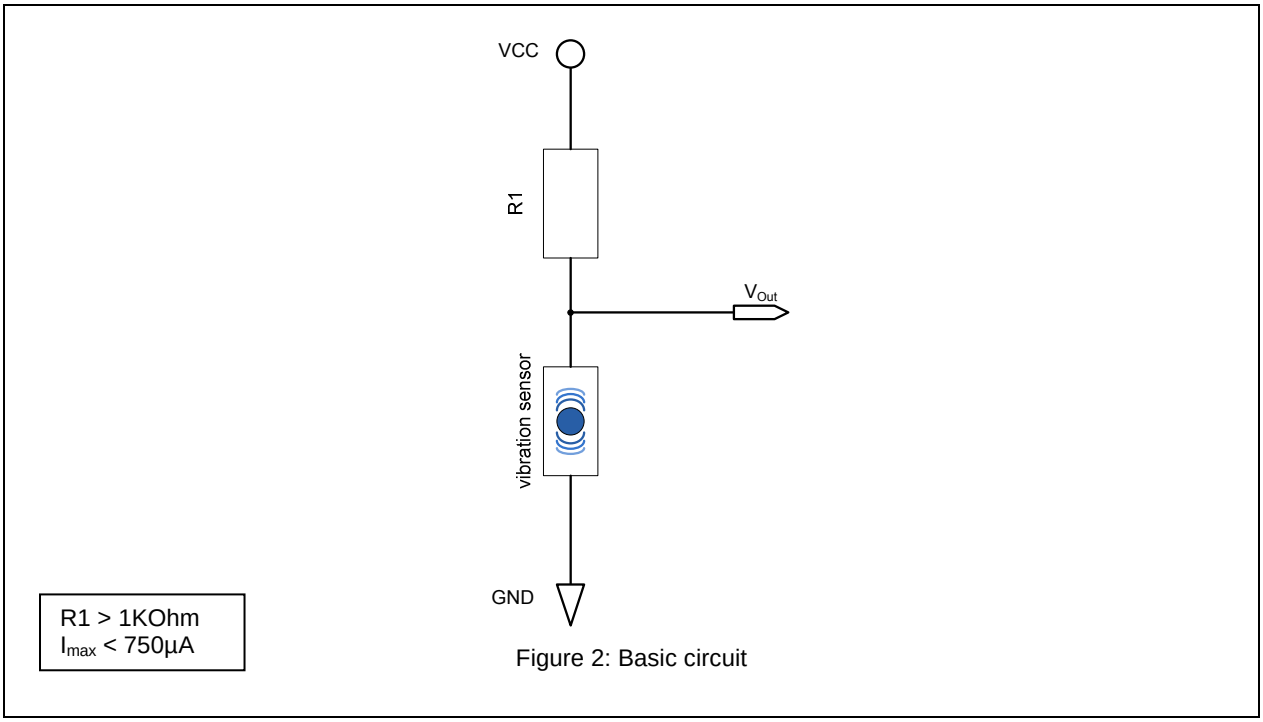


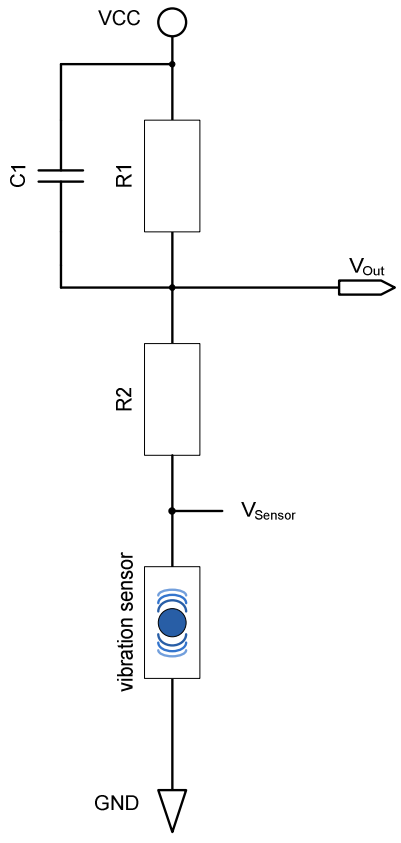
Figure 2: Basic circuit

3. Application Note 2: Filter Circuit

3.1 General description

In order to reduce the sensitivity of the sensor, a small capacitor can be added to the evaluation circuit presented in Figure 3. Additionally to the capacitor C1 a resistor R2 is applied, which limits the current through the sensor when the capacitor impedance is low.
For low power applications high values of R1 and R2 can be used to limit the current. If high resistor values are used, the circuit impedance must be considered. For the resistive voltage divider a good value of R1 is 5.1M and R2 can be between 100k and 1M, depending on the desired output voltage swing.
C1 can be varied on a range of 10pF to 1nF for different filter options. A larger C1 value e.g. 100nF will turn the peaks of the output into an analog average value shown in Figure 4.

3.2 Circuit



Example values

R1 = 5.1MOhm
R2 = 1.0MOhm

C1 = 100pF

Figure 3: Filter Circuit

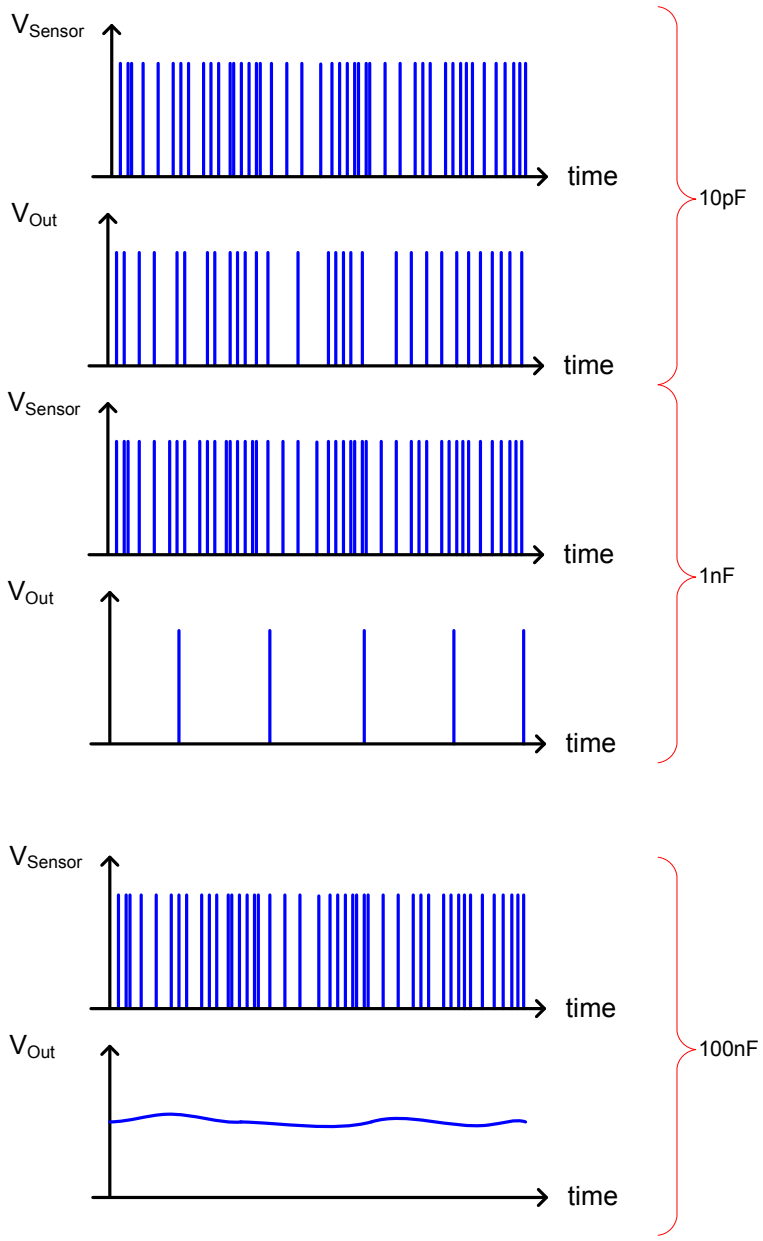


Figure 4: Function diagram (idealized plot)

4. Application Note 3: Not recommended circuit

4.1 General description

It's not recommended to connect a capacitor from any supply directly to the sensor. When the sensing mechanism opens and closes, a large inrush current will occur. It will potentially damage the contacts and reduce the lifetime of the sensor.

4.2 Circuit

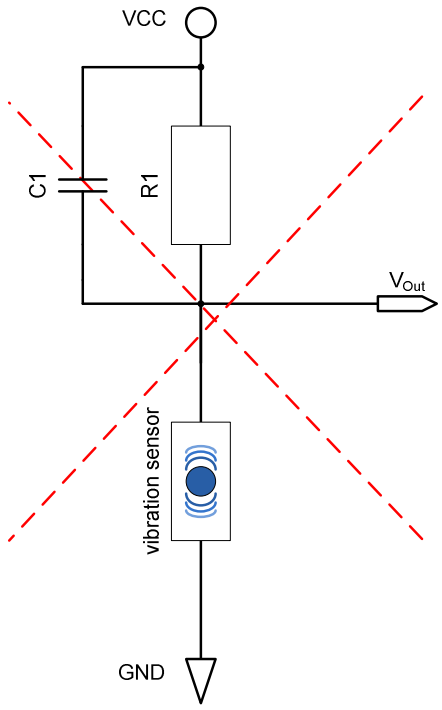


Figure 5: Not recommended circuit

5. Measuring Note

When measuring with an oscilloscope, it is recommended to use the 10x probe for circuit debugging. If 1x probe is used, the series resistance will cause a large voltage drop.

6. Application Note 4: Defined rest state output

6.1 General description

Both versions of the micro vibration sensor (unidirectional MVS1006.01 and omnidirectional MVS0608.02) are not necessarily closed when at rest. Only in 70% - 99% of time they will be closed when at rest.
This circuit can be used, if the output signal needs to be **low** when the sensor is at rest. (See Figure 7)

For low power applications high values of R1 and R2 can be used to limit the current, however the circuit impedance must be considered. Depending on the desired output voltage swing resistor values of 5.1M R1 and 1.0M R2 can be used.
The capacitive voltage divider determines the filter characteristics. C2 should be ≥5C1. A value of 100pF for C1 keeps the high sensitivity of the sensor. A large C1 value e.g. 100nF will turn the peaks of the output into an analog average value.

6.2 Circuit

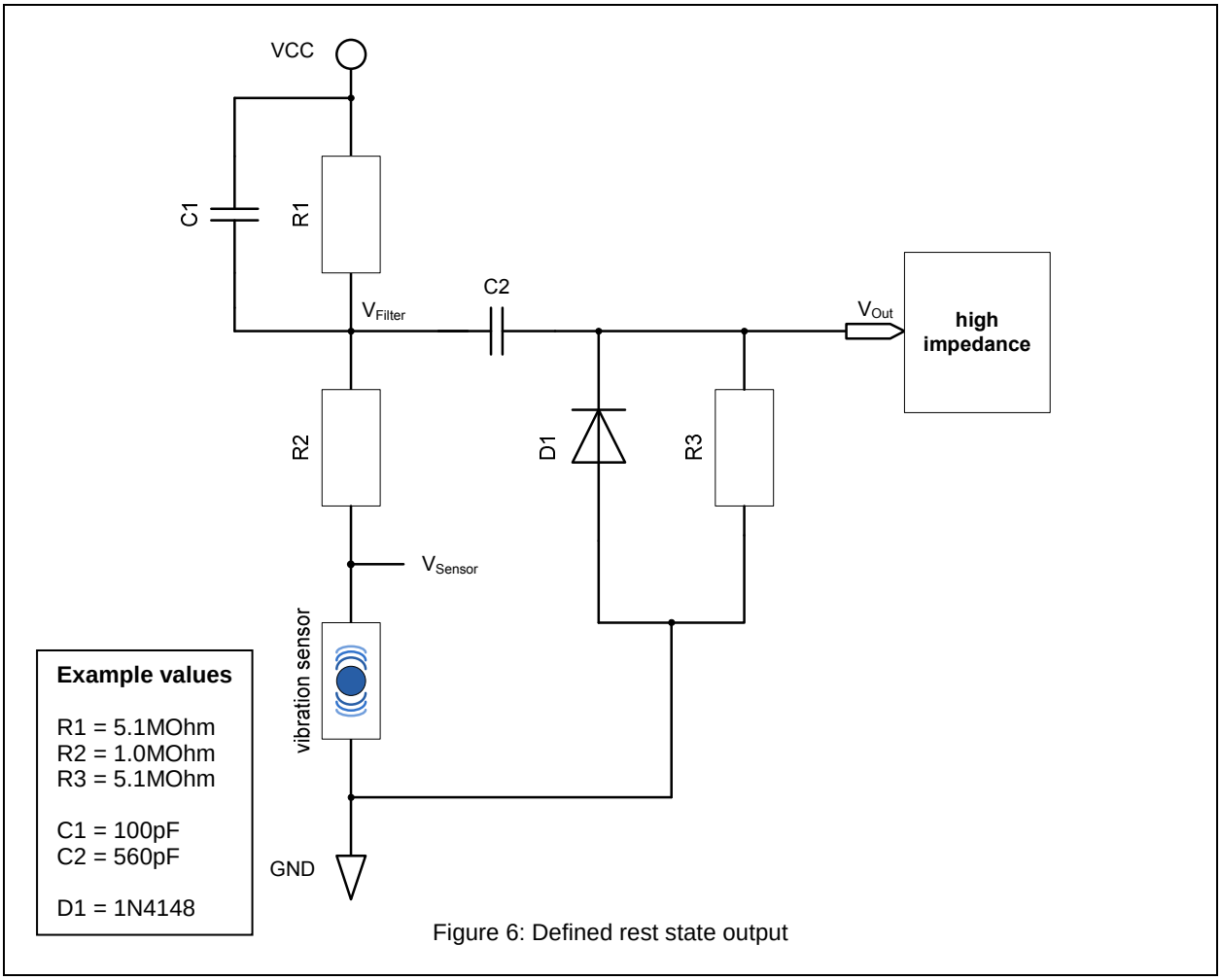


Figure 6: Defined rest state output

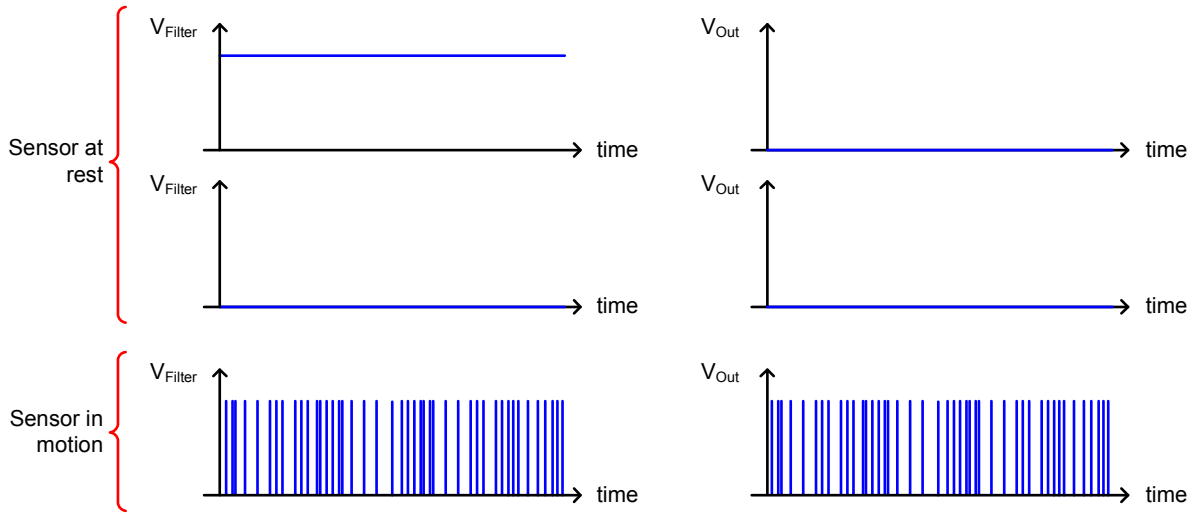


Figure 7: Function diagrams (idealized plot)

7. Application Note 5: Digital analysis

7.1 General description

The micro vibration sensor is connected to a low power micro controller to activate consumer electronics systems while in motion. When the device comes to rest, it is powered down (or waked up) by the microcontroller after a short delay time. The whole system is able to enter an idle mode with a current consumption of less than 0.6µA, depending on the micro controller used.
The micro controller allows implementing an algorithm to digitally filter the sensor signals and adopt the sensivitiy of the sensor to the application's requirement.

7.2 Schematic

The micro vibration sensor is connected in series with a 5.1MOhm series resistor which limits the current running through the sensor. If the vibration sensor detects motion, a trigger signal is sent to the micro-controller and a delay timer will be started. Now it will be checked if there is a pulse in a time slot of e.g. 450ms. If there is no pulse the microcontroller is falling back in sleep mode. If there is a pulse after 450ms, check the following 100ms for a pulse etc., then switch to a high power state or alarm. Variegate the time and the amount of the time slots for different applications.

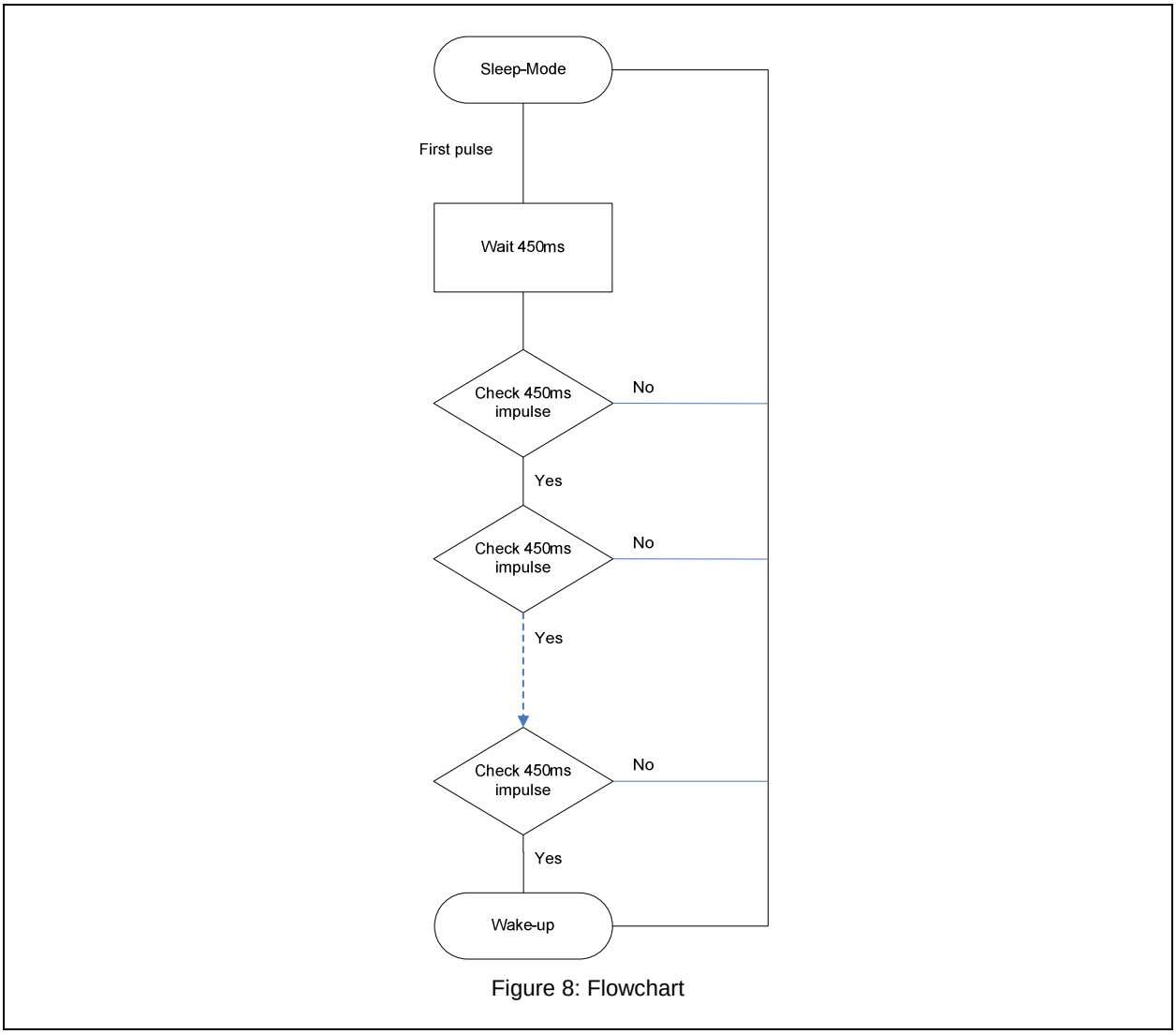


Figure 8: Flowchart

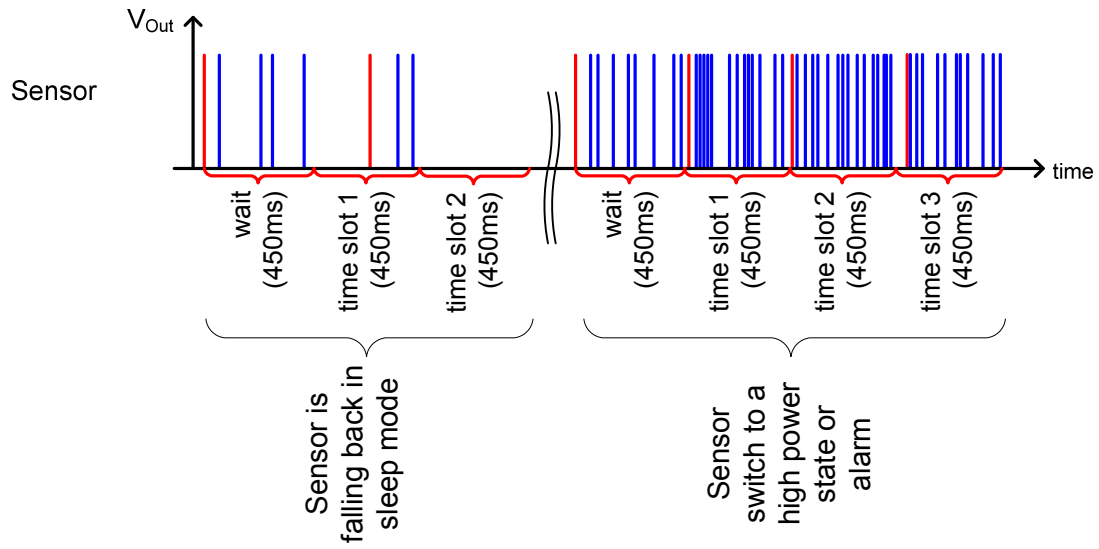


Figure 9: Function diagram (3 time slots)

7.3 Circuit

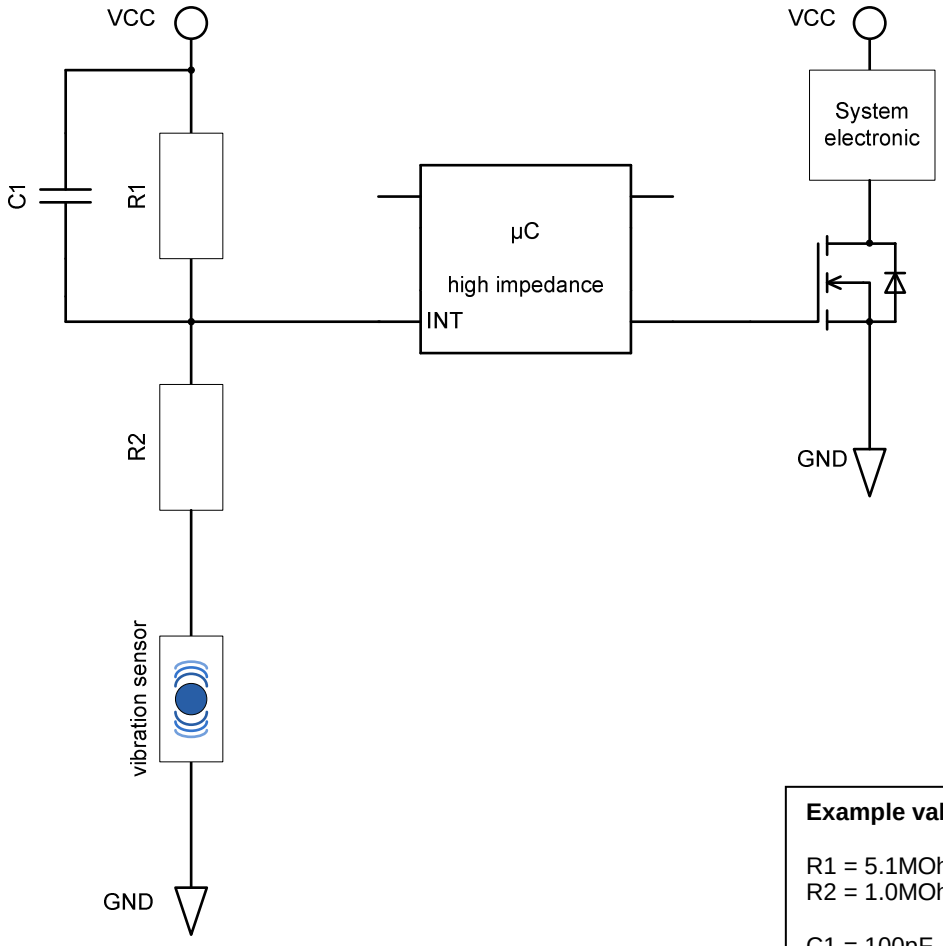


Figure 10: digital analysis