

**Sensolute GmbH**

Hermann-von-Helmholtz-Platz 1  
D-76344 Eggenstein-Leopoldshafen

+49 (0) 7247 82 5623  
+49 (0) 7247 82 9016

info@sensolute.com  
www.sensolute.com

## **APPLICATION NOTE**

**Micro Vibration Sensor**  
MVS1006.01 / MVS0608.02  
MVS0409.01 / MVS0409.02

Revision 1.5  
Supersedes data of 2010 Oct. 04

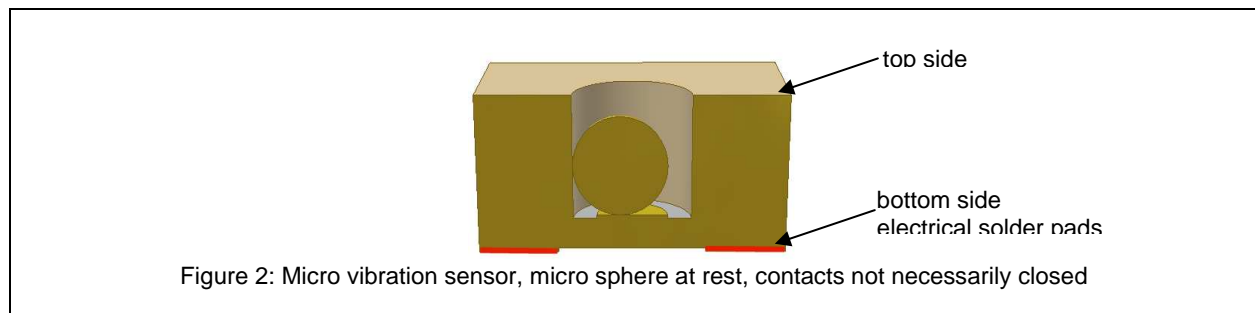
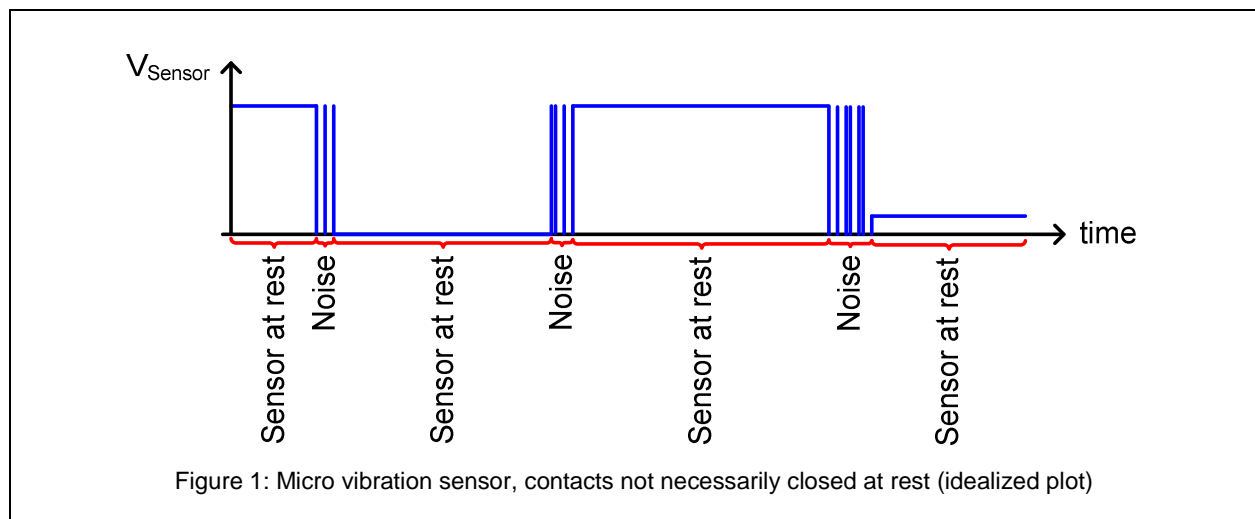
2010 Nov. 04

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## 1. Sensor evaluation

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 as shown in Figure 1. If the Sensor is at one DC-level (e.g. high), a slight vibration may cause the sensor signal to toggle. This fake motion cannot be filtered out by the "Small filter circuit" and has to be handled by the  $\mu\text{C}$  software. If a hardware solution is needed for this situation the DC part of the signal has to be filtered out first by a high pass filter to get a defined rest state output.



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

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 is edge sensitivity rather than level sensitivity.

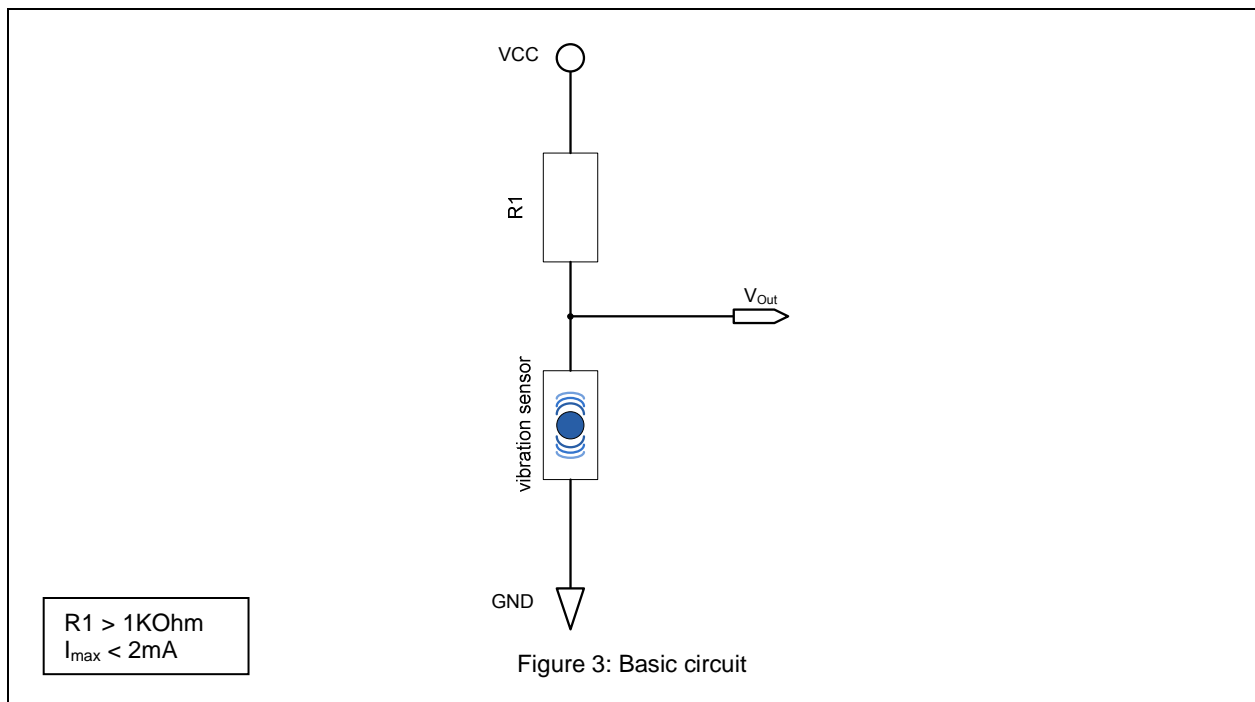
## 2. Application Note 1: Basic circuit

### 2.1 General description

The most simple circuit with a minimum of component requirement.

R1 should be chosen to limit the maximum current through the sensor to a maximum value of 2mA.

### 2.2 Circuit



### 3. Application Note 2: Filter Circuit

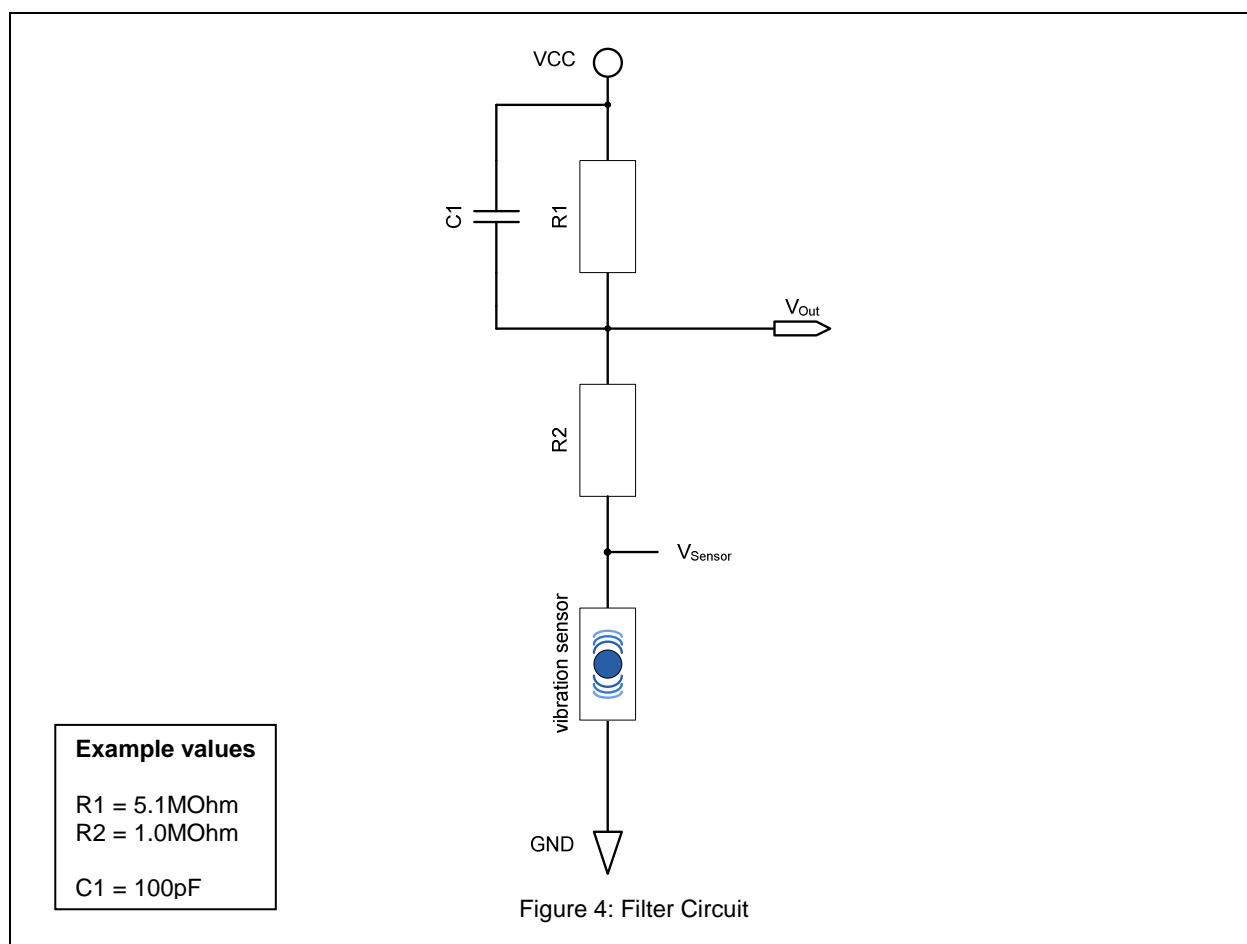
#### 3.1 General description

In order to reduce the sensitivity of the sensor, a small capacitor can be added to the evaluation circuit presented in Figure 4. 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 5.

#### 3.2 Circuit



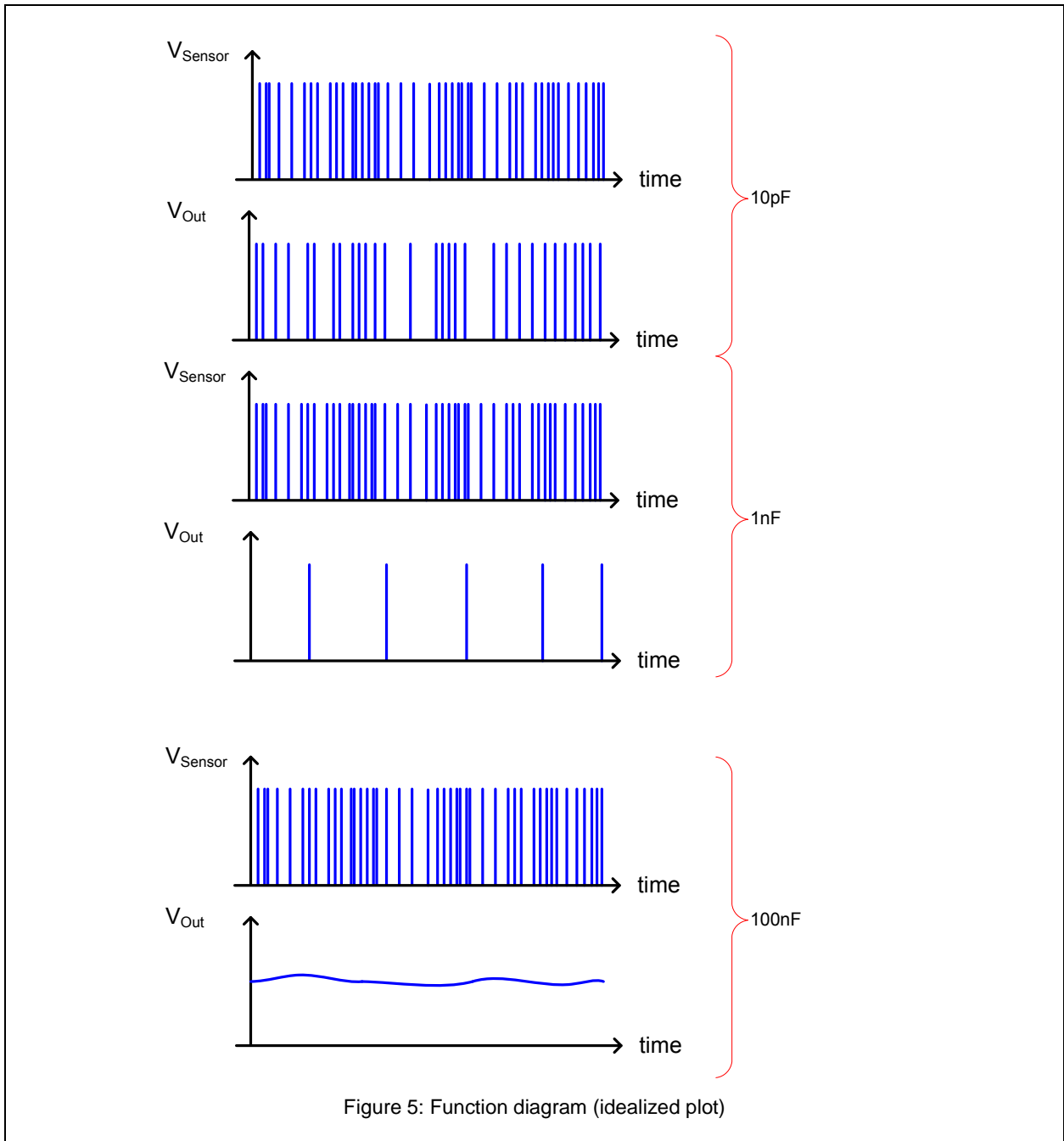


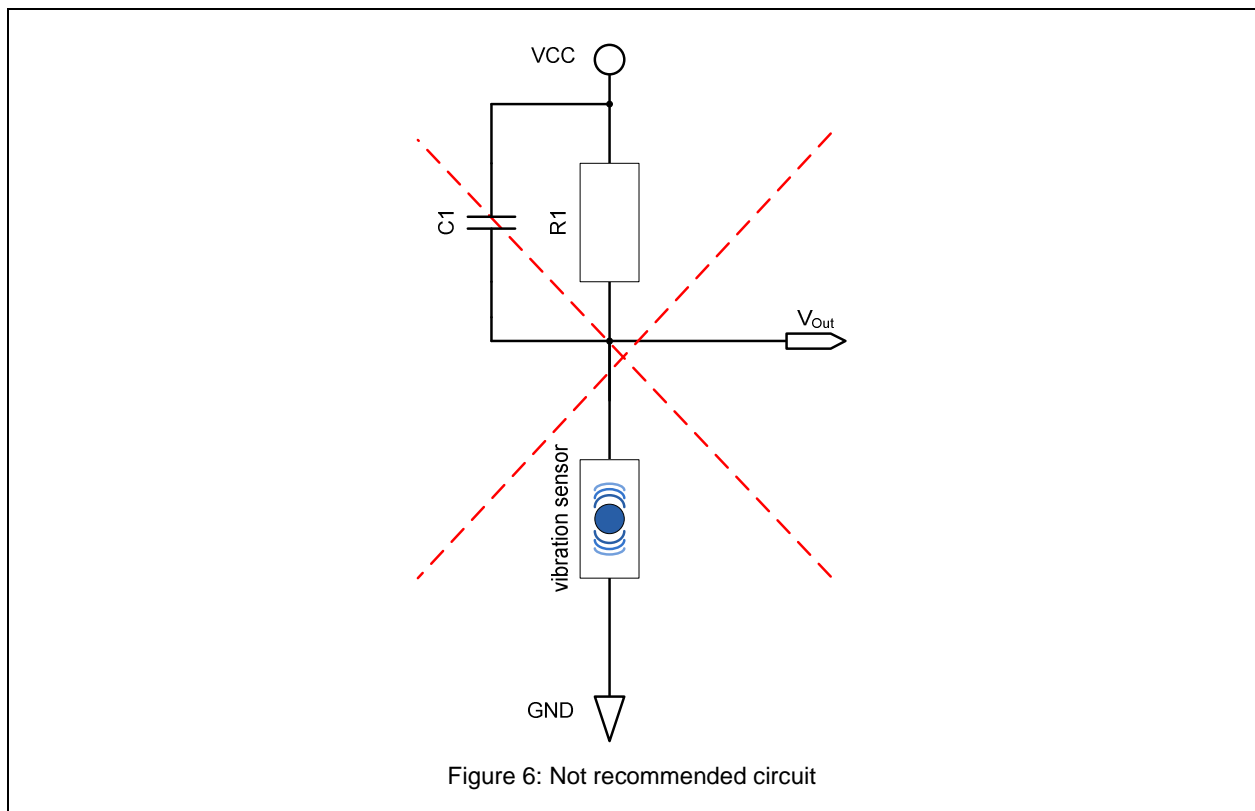
Figure 5: Function diagram (idealized plot)

## 4. Application Note 3: Not recommended circuit

### 4.1 General description

It's not recommended to connect a capacity 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 life of the Sensor.

### 4.2 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

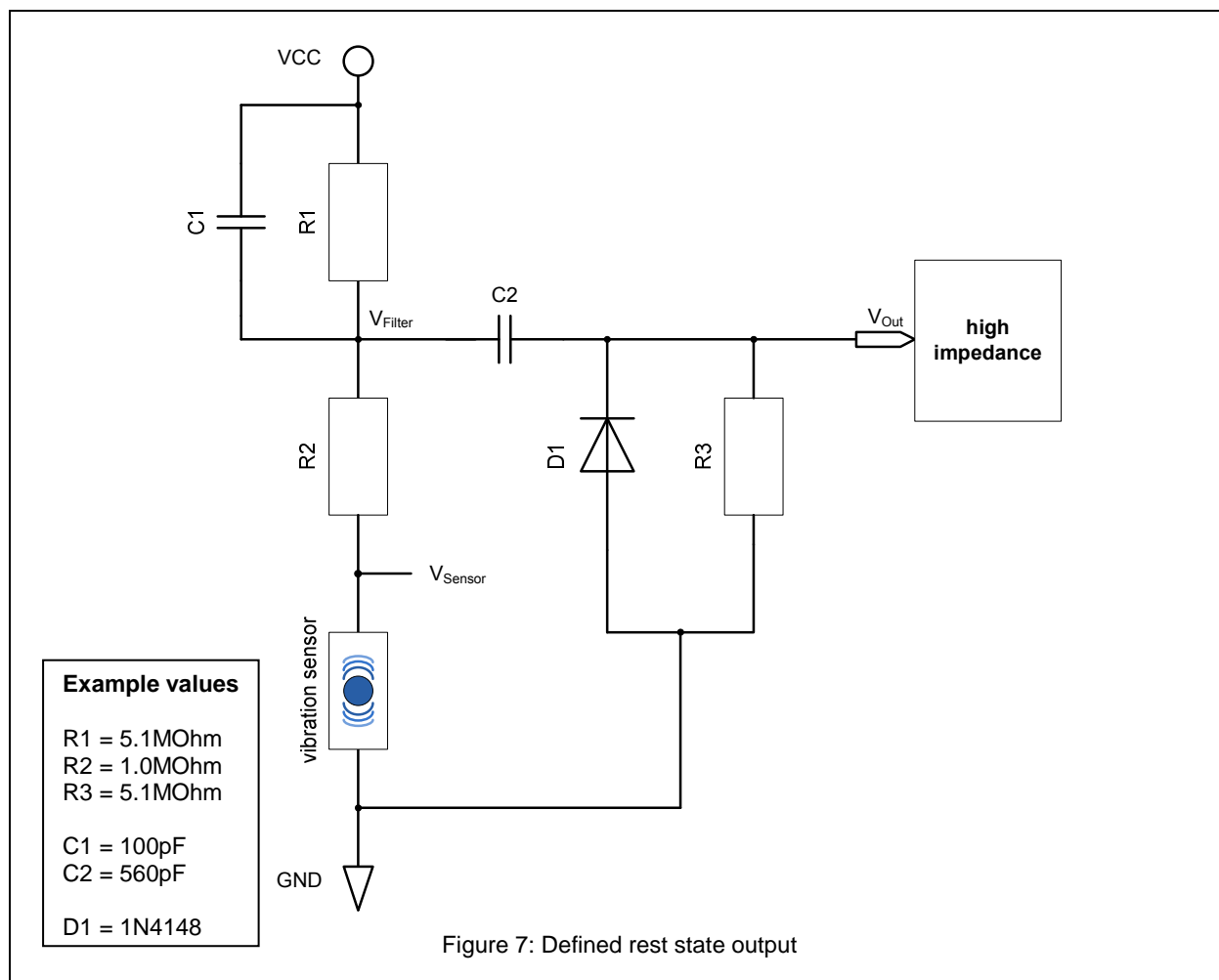
Both versions of the micro vibration sensor (unidirectional MVS1006.01 and omnidirectional MVS0608.02) are not necessarily closed when at rest. Only in 70% - 99% of time they will be closed when at rest.

This Circuit can be used, if the output signal needs to be **low** when the Sensor at rest. (See Figure 8)

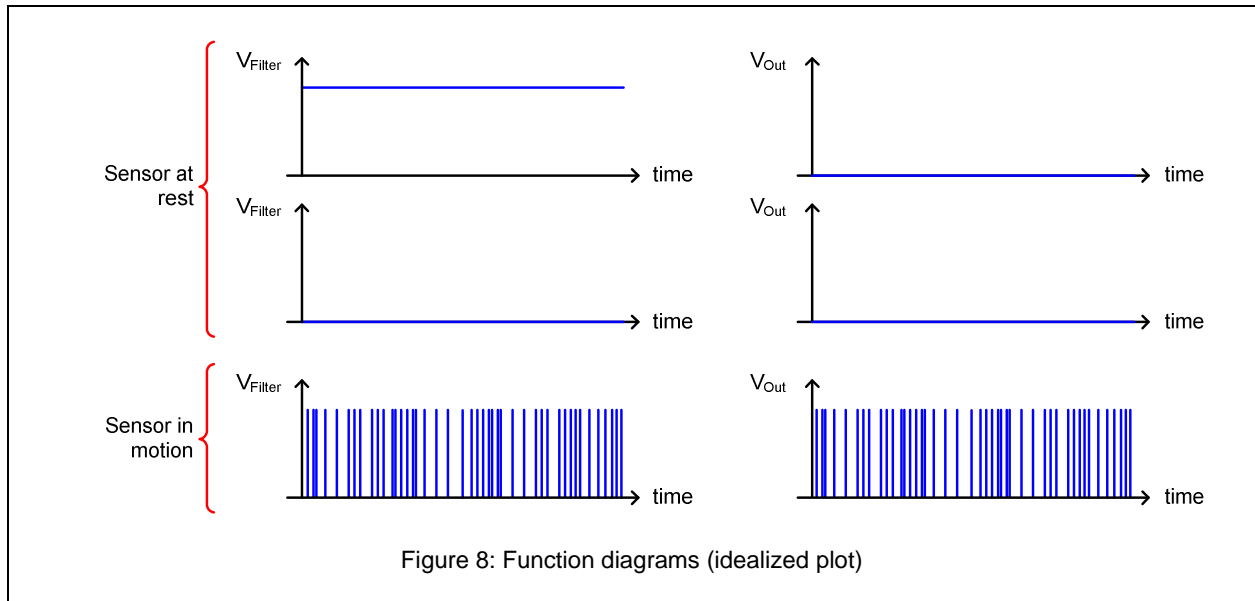
For low power applications high values of R1 and R2 can be used to further limit the current, however the circuit impedance must be considered. Depending on the desired output voltage swing resistor values of 5.1M R1 and 1.0M R2 can be used.

The capacitive voltage divider determines the filter characteristics. C2 should be  $\geq 5C1$ . 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







## 7. Application Note 5: Delay circuit

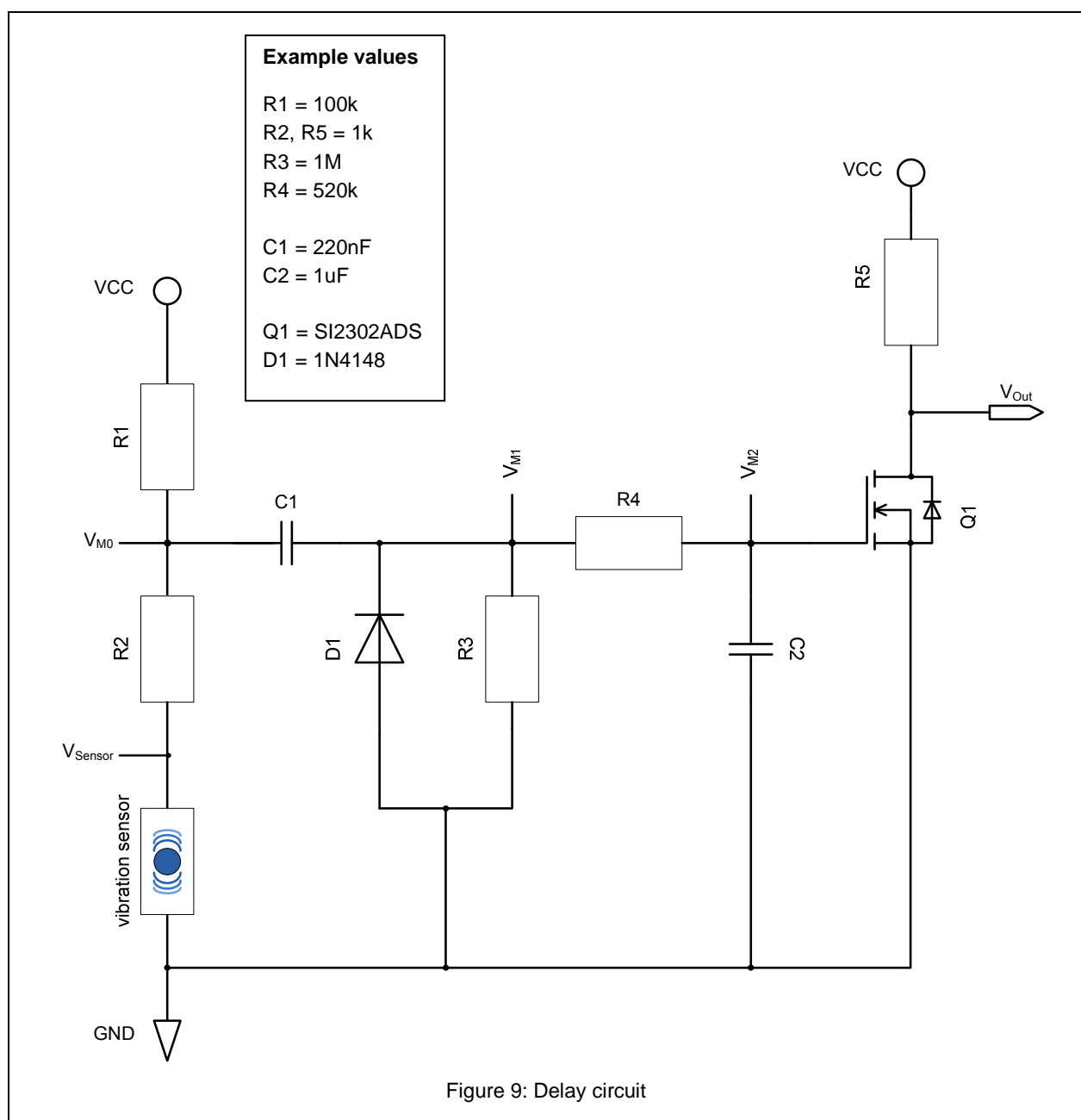
### 7.1 General description

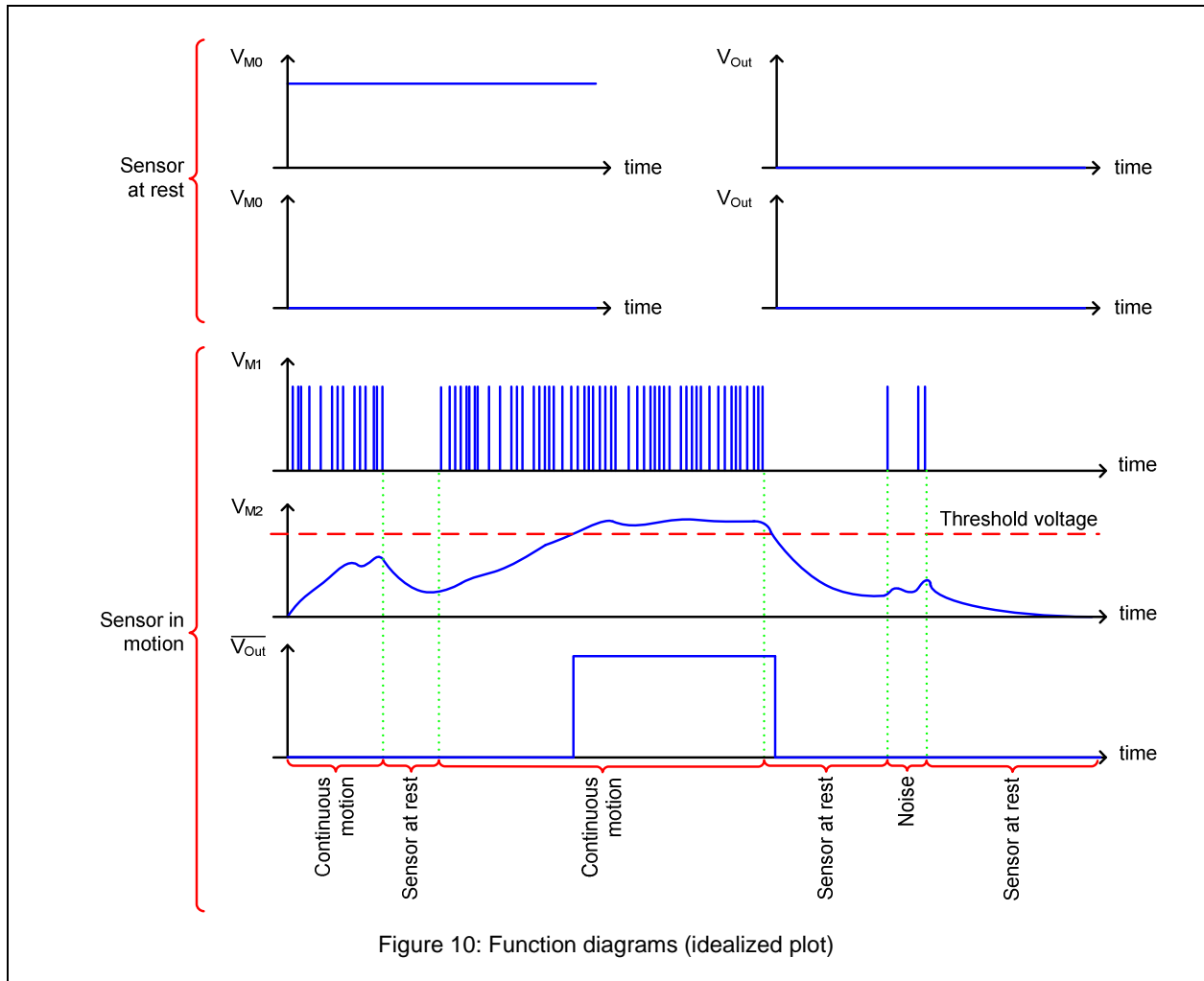
This Circuit can be used, if the output signal needs to be **noise insensitive**, and **high** when the Sensor at rest. (See Figure 10)

To increase the noise insensitivity, change the value of C2 in a range of 220nF – 4.7µF (for values  $\geq 1\mu\text{F}$  use tantalum capacitors).

An increase of C2 increases the inactivity of the circuit. From this it follows, that a longer excitation is required to reach the threshold voltages!

### 7.2 Circuit





## 8. Application Note 6: Digital analysis

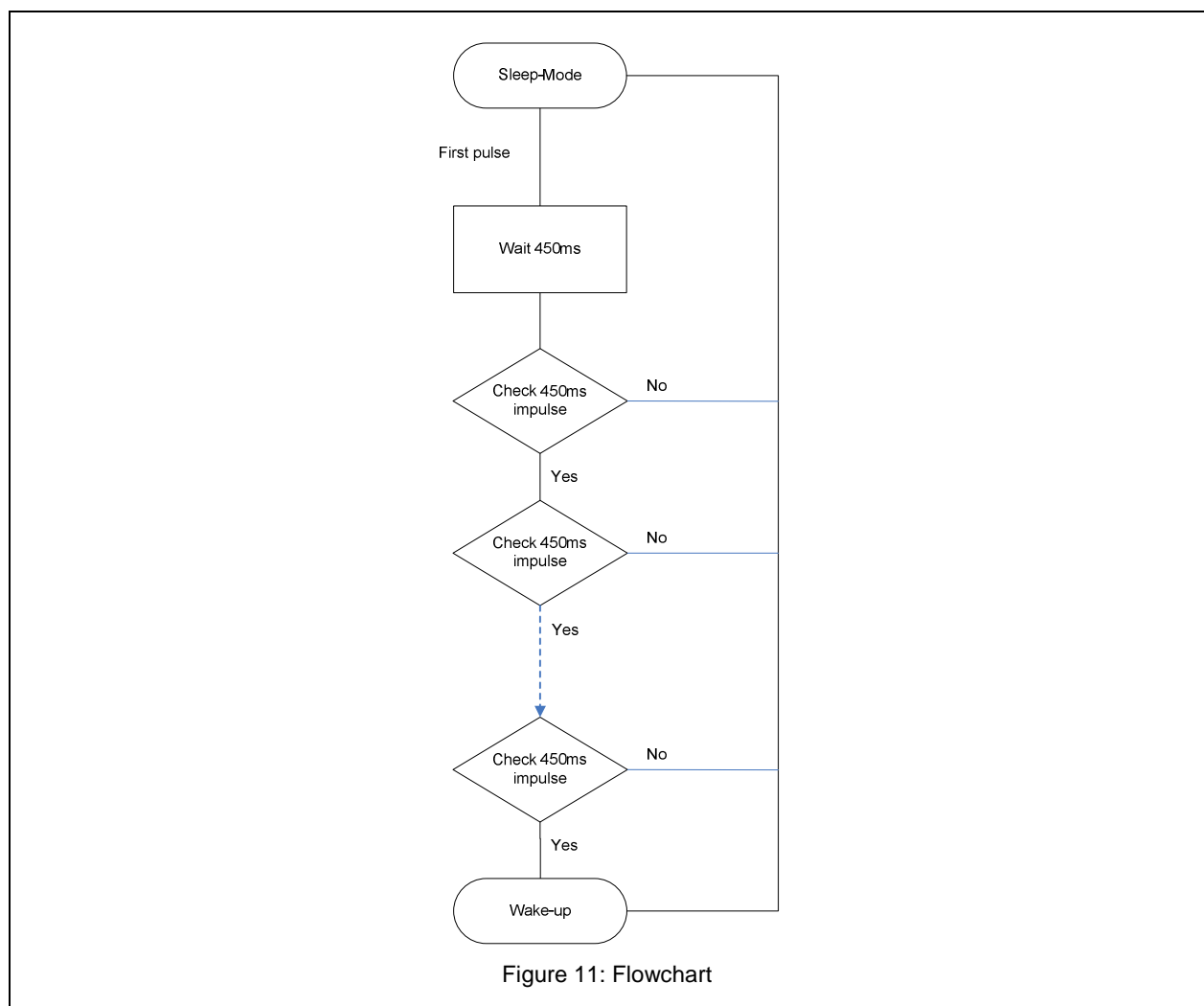
### 8.1 General description

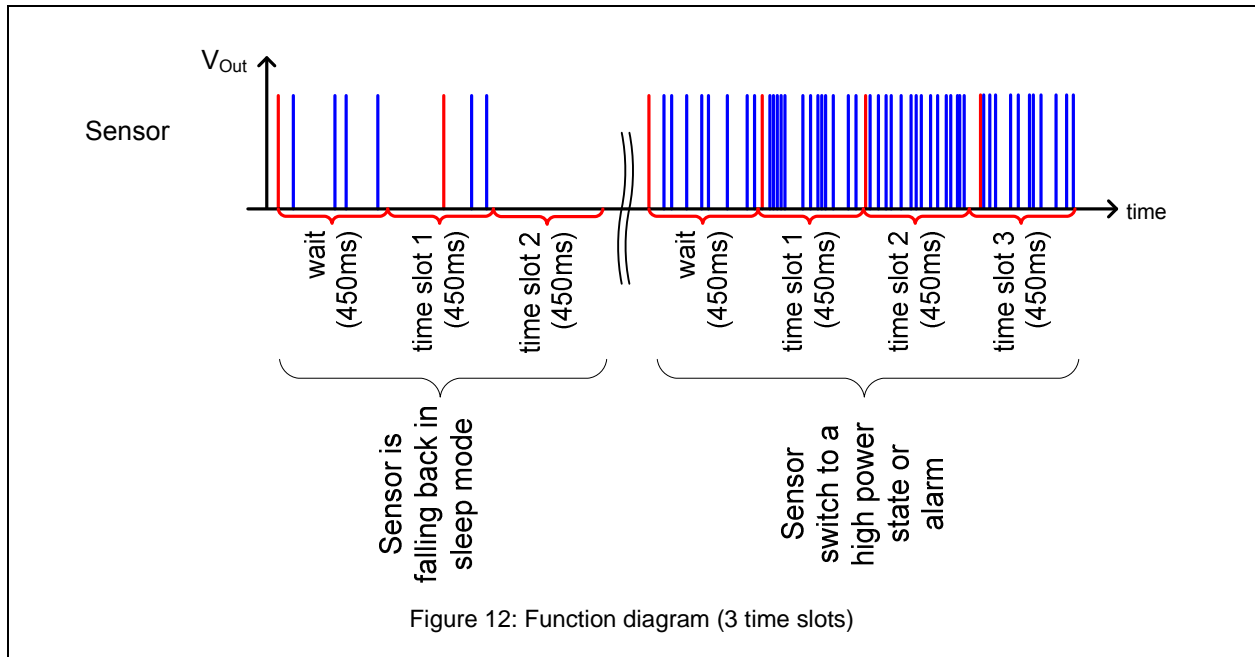
The micro vibration sensor is connected to a low power micro controller to activate consumer electronics systems while in motion. When the device comes to rest, it is powered down (or up) by the microcontroller after a short delay time. The whole system is able to enter an idle mode with a current consumption of less than  $0.6\mu\text{A}$ , depending on the micro controller used.

The micro controller allows implementing an application specific algorithm to digitally filter the sensor signals and adopt the sensitivity of the sensor to the applications requirement.

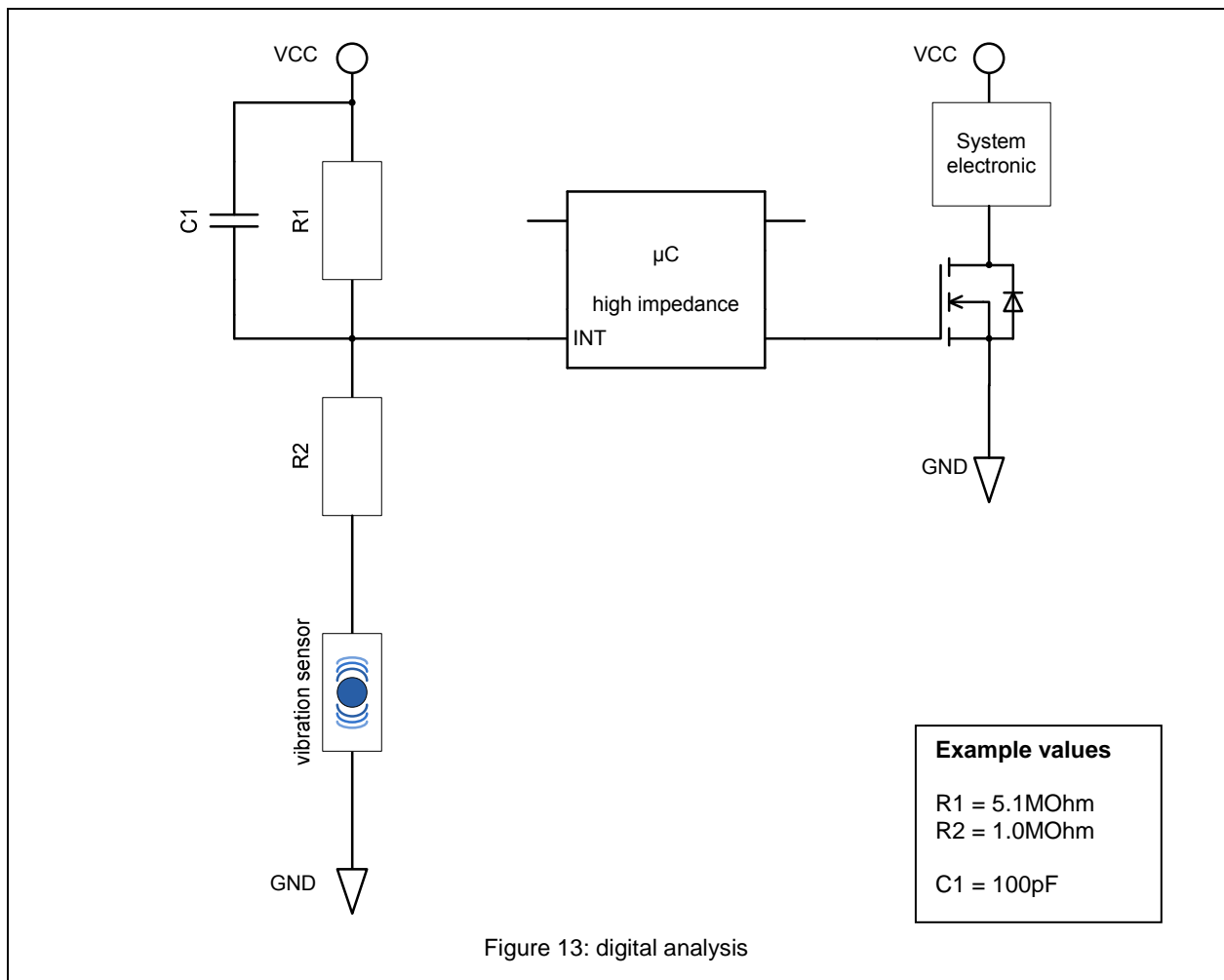
### 8.2 Schematic

The micro vibration sensor is connected in series with a  $5.1\text{M}\Omega$  series resistor, limiting 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 into 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. Vary the time and the amount of the time slots for different applications.





### 8.3 Circuit



**NOTES:**

## 9. Important Notice

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**Mailing Address:**

Sensolute GmbH  
Hermann-von-Helmholtz-Platz 1  
76344 Eggenstein-Leopoldshafen, Germany