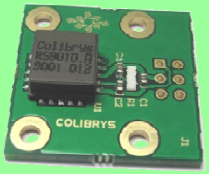

MEMS Capacitive Accelerometers

Application Notes

VAGND Reference on RS9000

30N.VAGND RS9X.B.06.09

Features of RS9000	Applications
Tactical grade performance	**Inertial sensing**
Excellent vibration rectification coefficient	**Tilt sensing**
Very low intrinsic temperature sensitivity	
Extra small packaging (LCC20, 8.9mm x 8.9mm)	
Harsh environment (shock, vibration, temperature)	

Introduction

RS9000 MEMS accelerometer is the latest Colibrys product from the IRIS™ family. This product is a major breakthrough toward advanced inertia and high stability tilt measurements.
The RS9000.A is an accelerometer based on a new MEMS element, realized with the latest Colibrys technology and designed exclusively for high bias stability, scale factor stability and axis alignment stability, improved vibration rectification performance and enhanced temperature behaviour.

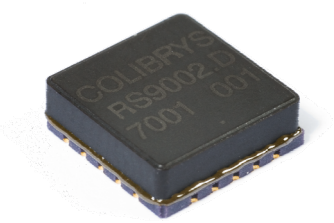

Fig. 1 : RS9000 in a LCC20 packaging

It is interfaced with open loop electronics, specifically designed for long term stability. This integrated electronics provide an acceleration-proportional output voltage as well as a temperature-proportional output voltage for further temperature compensations. It is operating from a single power supply voltage (between 2.5V and 5.5V) with a low current consumption (< 0.7mA at 5V). The output is a ratiometric analog voltage that varies between 0.5V and 4.5V for the full-scale acceleration range at a voltage supply of 5V.

The sensor is self-contained and packaged in a LCC20 ceramic housing, thus insuring full hermeticity. It operates over a temperature range of –55°C to 95°C and can withstand shocks up to 1000g, half sine, 0.15ms without performance degradation. Shock survivability goes up to 4000g (single shock mode). For further technical information please refer to the related data sheet and product description.

Reference voltage (VAGND)

To ensure the best possible stability of the product, the reference voltage of the sensor (VAGND) is generated outside of the LCC package on the RS9000. Therefore, extreme care should be taken when designing this node. This node represents the internal reference voltage used in the circuit and any drift of this node will result in a drift multiplied by a factor of about 12 on the output signal (Vout). Therefore the stability of this node should be controlled as precisely as possible and typically within <5µV over the life of the product.
One possible solution proposed by Colibrys and implemented on our evaluation board is to mount an ultra-high precision resistive divider to generate this external VAGND. This voltage divider is by nature ratiometric and the ratio stability is typically within 2ppm.

Precision resistor divider

To get the required VAGND performance, two precisely matched resistors of 10 KΩ each is needed to be connected in parallel with the two C2 capacitors as shown in figure 2. We have chosen a single component which includes these two precise resistors in one package. This component need to have the following characteristics:

Resistor divider specifications	Value
Absolute resistive value	10KΩ / 10KΩ
Resistor matching	100ppm
TCR tracking	0.5ppm/°C
Load life stability ratio	2ppm

The resistor selected by Colibrys for all qualification and mounted on the RS9000 EVBA is a resistor from Vishay: *VFCD 1505, Integrated Construction (Z-Foil), 10KΩ / 10KΩ, Abs. 0.01%, Ratio 0.01%*.

Electrical connection of the RS9000

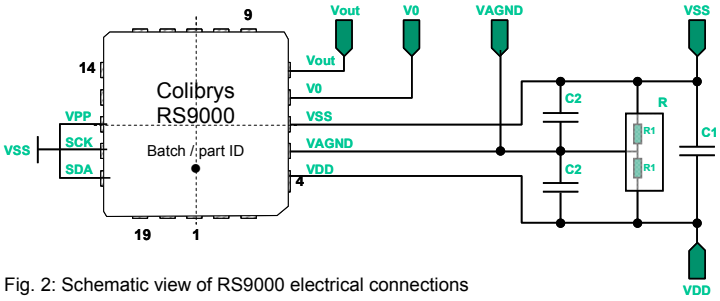

Fig. 2: Schematic view of RS9000 electrical connections

When the output of the sensor is measured differentially (Vout-VAGND), it is necessary to take care of the current drawn on the node VAGND. This should be lower than 0.1nA to avoid instability on the node VAGND and therefore on the output signal (Vout). Therefore, we recommend connecting a buffer to this node with a bias current lower than this value. If the current is larger than 0.1nA, it could detrimentally affect the bias value and bias stability.
Note: If using an A/D converter, use either a ratiometric ADC or a very stable power supply.

Evaluation board layout and components

A small Evaluation Board circuit is available and intended to help the system designer or qualification engineer to speed-up the evaluation and integration of the RS9000 accelerometer series to any new or upgraded system. It is simple to use and no additional components are required. It can easily be connected to a power supply and a voltmeter to read the accelerometer output and temperature signal through the 6-pin connector.

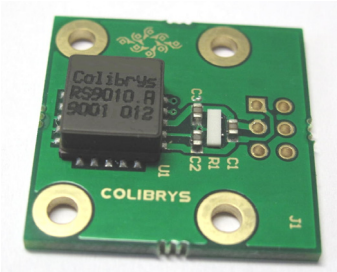

Fig. 3 : EVBA RS9000

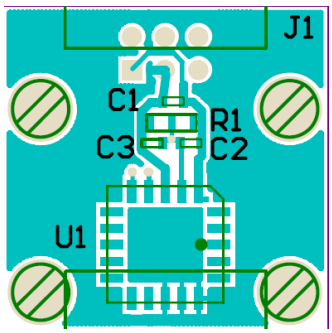

Fig. 4 : Layout of the EVBA RS9000

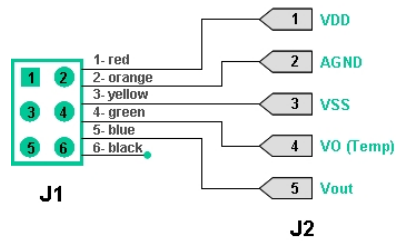

Fig. 6 : Connector

The EVBA (Fig. 2) is very simple and mainly comprises of three decoupling capacitors and one double resistor.

The EVBA is designed to be mounted easily in various evaluation environments; the shaker (for dynamic measurements), the tumble table (for static measurement) and the temperature chamber (for temperature measurement).
The sensitive axis (Z-axis) is perpendicular to the plan of EVBA. The mounting of the EVBA is critical to insure best possible measurements. Therefore it is important to mount the EVBA as tightly as possible to obtain accurate performance.

A schematic of the EVBA is presented in Fig. 3 as the layout and the outline dimensions are presented in Fig. 4 and Fig. 5, both presented hereafter. The schematic of the connector in presented in Fig. 6.

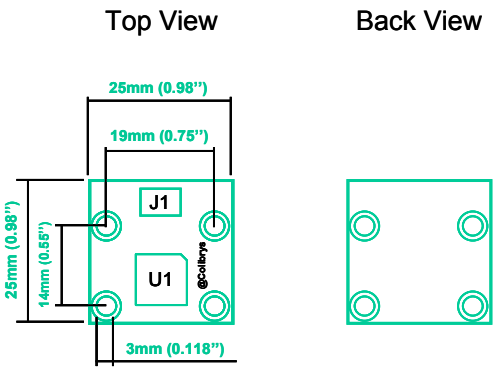

Fig. 5 : EVBA RS9000 outline dimensions

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