

MEMS Capacitive Accelerometers

# Preliminary Data sheet

## MS9001.D

30S.MS9001.B.04.10

### Features

**Extra small LCC20 packaging (8.9mm x 8.9mm)**  
**±1g Full Scale Range**  
**Excellent Bias stability**  
**Harsh Environment (shock, vibration, temperature)**  
**MIL-STD-833-G qualified**  
**Low power analogue voltage output**  
**Brown out protected**

### Applications

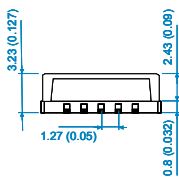
**Inertial sensing**  
 Platform stabilization  
 - Camera  
 - Turret  
 - Antenna  
 Tilt measurements

### Description

Colibrys MS9001 inertial and tilt accelerometer is a new extra small product designed for harsh environment and safety critical applications. This generation of products comes in a LCC20 (8.9mm x 8.9mm) ceramic package and in a variety of g ranges from ±1g to ±200g. These sensors can operate over extended temperature ranges with just a few mili g bias stability guaranteed over extended lifetime.

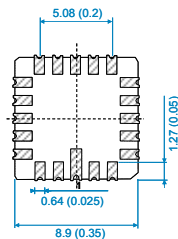
The Colibrys MS9001 accelerometer is a MEMS capacitive sensor, based upon a bulk micro-machined silicon element, a low power ASIC for signal conditioning, a micro-controller for storage of compensation values and a temperature sensor. The product is low power, calibrated, robust and stable and the electronic configuration provides a solid power on reset and ensures a full protection against brown-out.

MS9000 side view

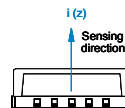


Typ. values mm (inch)

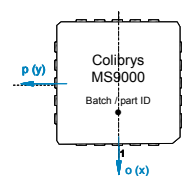
MS9000 bottom view



MS9000 side view



MS9000 top view



### Preliminary specifications

All values are specified at +20°C (+68°F) and 5.0 VDC supply voltage, unless otherwise stated

|   | Units           | MS9001.D  |
|---|-----------------|---|
| Full scale range                          | g               | ± 1g  |
| Packaging                                 |                 | LCC20 (non magnetic, 8.9mm x 8.9mm / 0.35inch x 0.35inch) |
| Bias calibration                          | mg              | < 5   |
| One year bias stability @ 6000g [1]       | mg typ. (max.)  | 0.75 (<2.5)   |
| One year bias stability @ 1000g [2]       | mg typ. (max.)  | 0.15 (<0.75)  |
| Switch on/off repeatability               | mg max.         | < 0.1   |
| Bias temp. coefficient [3]                | mg/°C typ.      | <0.05   |
|   | mg/°C max.      | ± 0.2   |
| Scale factor sensitivity (K1)             | mV/g            | 2000 ± 8  |
| One year scale factor stability [2]       | ppm typ. (max.) | 300 (< 1000)  |
| Scale factor temp. coefficient [3]        | ppm / °C typ.   | 100   |
|   | min. / max.     | -50 / 250   |
| Input axis misalignment (Kp, Ko)          | mrad max.       | < 10  |
|   | % max           | 1   |
| Resolution / Threshold (@ 1Hz)            | mg max.         | < 0.05  |
| Non linearity                             | % of FS max.    | < 0.5   |
|   | g max.          | < 0.01  |
| Bandwidth [4]                             | Hz              | 0 to ≥ 100  |
| Noise spectral density in band [0 ; 9kHz) | µV/√Hz typ.     | 18  |
|   | max.            | 24  |

[1]: One year stability defined according to IEEE 528-2001: turn on / on, storage at -55°C and 85°C, -40°C to 125°C T cycling, -55°C to 85°C unpowered harass, vibration, shock (6000g, single shock).

[2]: One year stability defined according to IEEE 528-2001: turn on / on, storage at -55°C and 85°C, -40°C to 125°C T cycling, -55°C to 85°C unpowered harass, vibration, shock (1000g, single shock).

[3]: Temperature coefficients are specified for a range of -40°C to 20°C, where temperature behavior is typically linear.

[4]: The bandwidth is defined as the frequency band for which the sensitivity has decreased by less than 3dB.

## Environmental

### MS9001.D

|                             |  |
|-----------------------------|--|
| Operating temperature range | -55°C to +125°C (-67°F to 255°F)   |
| Reliability                 | Results based on MIL-HDBK-217, notice 2, are available on request.   |
| Shock resistance            | Up to 6'000 g (0.15ms half-sine, single shock, not repetitive, in one direction o, p or l)   |
| Recovery time               | < 1ms (1000g, half-sine period 1ms, shocks in direction i)   |
| Vibration                   | 20 g rms, 20-2000 Hz (random noise, 30 minutes in each direction o, p, i)  |
| LCC packaging               | The product has been qualified according to MIL-STD-833-G Hermetic sealing is qualified at 5·10 <sup>-8</sup> atm·cm <sup>3</sup> /s   |
| ESD sensitivity             | Class 2 (requirements MIL-STD-883-G, 1 Method 3015.7), HBM 2kV   |
| Proximity effect            | The sensor is sensitive to external parasitic capacitance. Proximity of large metallic mass (typ accelerometer size in mm ranges) must be avoided to insure best performances. |

Note: LCC must be tightly fixed to the PCB, using the bottom of the housing as reference plan for axis alignment.

## Electrical

### MS9001.D

|  |   |
|--|---|
| Input voltage (VDD – VSS)                  | 2.5 to 5.5 VDC. The standard voltage for calibration is 5.0 VDC.  |
| Output voltage range                       | From 0.5 to 4.5 VDC @ 5.0 VDC input voltage (2.5 V ± 10mV at 0g)  |
| Operating current consumption              | < 400 µA @ 5.0 VDC  |
| Initialization & reset current consumption | Typ. 1500 µA @ 5.0 VDC during the initialization phase (less than 35 ms at room temperature)  |
| Reset                                      | The sensor is Brown out protected. A reset occurs when the power supply jumps more than +0.46 V with a slope >380V/s or if the power supply drops below 2.2V. The recovery time is typ. 25 ms (max 35 ms) |
| Output impedance / load                    | Min. 50 kΩ at Vout (pin 5) and VAGND (pin 2)<br>Max. 50 pF at Vout (pin 5) and Max. 100 µF at VAGND (pin 2)   |

## Physical

|        |  |                              |
|--------|--|------------------------------|
|        | Hermetically sealed LCC, 20 pins housing |                              |
| Weight | < 1.5 grams                              |                              |
| Size   | Typ. 8.9 x 8.9 x 3.23 mm                 | (0.35 x 0.35 x 0.127 inch)   |
|        | Max. 9.2 x 9.2 x 3.5 mm                  | (0.354 x 0.354 x 0.138 inch) |

## Temperature sensor:

|                        |  |
|------------------------|--|
| Output Voltage at 20°C | Typ: 1.632 V                           |
| Sensitivity            | Typ: -11.77 mV/°C                      |
| Long term stability    | Max -0.03°C to +0.09°C (1000h @ 150°C) |
| Accuracy               | ± 5°C (From -40°C to 125°C)            |

## Block diagram and electrical connections

It is necessary to use decoupling capacitors [C] of 1µF each between VDD and VAGND and between VAGND and VSS,

placed as close as possible from the accelerometer. COG or X7R @ 5% capacitor types are recommended.

| Pin | Description                             | Remarks                                       |
|-----|---|---|
| 4   | VDD                                     | Power supply                                  |
| 5   | VAGND                                   | Accelerometer output reference voltage(VDD/2) |
| 6   | VSS                                     | Ground  |
| 7   | V0                                      | Temperature sensor output                     |
| 8   | Vout                                    | Accelerometer output signal                   |
| 16  | VPP (Colibrys internal calibration pin) | <b>Must</b> be connected to VSS               |
| 17  | SCK (Colibrys internal calibration pin) | <b>Must</b> be connected to VSS               |
| 18  | SDA (Colibrys internal calibration pin) | <b>Must</b> be connected to VSS               |

A detailed MS9000 Product Description (30D.MS9X.x.xx.xx) and further Application Notes are available on demand or on our web site.

In order to provide an ideal support to our customers, our

standard MS9001 product is available worldwide through a wide network of distributors and agents or directly at Colibrys.