

MSA-H1/2-1.5 Series Data Sheet

## Accelerometers and Inclometers

### Analog Output

MSA-H1-1.5 — **Single Axis X**

MSA-H2-1.5 — **Dual Axis XY**



## APPLICATIONS

***Inclination and Tilt Sensing***

***Vibration Analysis***

***Static or Dynamic Acceleration***

***Inertial Navigation and Ded(uctive) Reckoning***

***Vehicle Stability Control***

***Vehicle Roll Detection***

***Vehicle Hill Hold***

***Vehicle Suspension Systems***

***Theft and Accident Alarms***

***GPS Recognition Assist***

***Platform Stabilization***

***Guidance Systems***

## FEATURES

Lead-free Solderability

High Shock Survivability

Excellent Temperature Performance

Very Low Noise Density

Low Power Consumption

User Definable Bandwidth

Factory Programmable Offset  
and Sensitivity

Self-test Function

## PROPRIETARY TECHNOLOGY

These high-performance silicon micromachined linear accelerometers and inclinometers consists of a sensor element and an ASIC packaged in a standard 16-pin SOIC wide-body package. The sensor element is fabricated from single-crystal silicon with proprietary Deep Reactive Ion Etching (DRIE) processes, and is protected from the environment by a hermetically-sealed silicon cap wafer at the wafer level.

The MSA-H series is designed to provide a high signal-to-noise ratio with excellent performance over temperature. These sensors can accept supply voltages between 2.7V and 5.25V. Sensitivity is factory programmable allowing customization for applications requiring  $\pm 1$  to  $\pm 6g$  ranges. Sensor bandwidth is user-definable.

The sensor element functions on the principle of differential capacitance. Acceleration causes displacement of a silicon structure resulting in a change in capacitance. An ASIC, using a standard CMOS manufacturing process, detects and transforms changes in capacitance into an analog output voltage, which is proportional to acceleration. The sense element design utilizes common mode cancellation to decrease errors from process variation and environmental stress.

上海麦游电子科技有限公司

上海市普陀区府村路255号2号楼2层 200333

Tel:(86)-21-32030015 28816246 Fax:32030015

www.my-sensor.com

E-mail:lee@my-sensor.com

sales@my-sensor.com

## PRODUCT SPECIFICATIONS

PERFORMANCE SPECIFICATIONS <sup>1</sup>			
PARAMETERS	UNITS	MSA-H1-1.5 (x) MSA-H2-1.5 (xy)	CONDITION
Range <sup>2</sup>	g	±1.5	Factory programmable
Sensitivity	mV/g	1333	@5V
0g Offset vs. Temp.	mV	±133	Over temp range
	°C	-40 to 125 <sup>3</sup>	
Sensitivity vs. Temp	%	±2.0 typical (±3.0 max)	Over temp range
Span	mV	±2000	@ 5 V
Noise Density	$\mu\text{g} / \sqrt{\text{Hz}}$	40 typical (60 max)	
Bandwidth <sup>4</sup>	Hz	3000	-3dB
Non-Linearity	%	±0.1 typical (±0.5 max)	
Offset Ratiometric Error	% of FS	±0.4 typical (±1.5 max)	
Sensitivity Ratiometric Error	% of FS	±1.4 typical (±2.0 max)	
Cross-axis Sensitivity	%	±2.0 typical (±3.0 max)	
Power Supply	V	2.7 to 5.25	
	V	-0.3 (min) 7.0 (max)	Absolute min/max
	mA	3.9 typical (5.0 max)	Current draw @ 5V

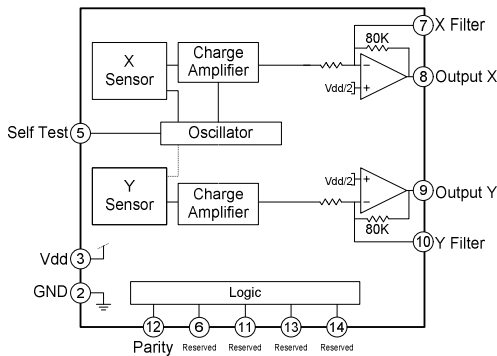
  

ENVIRONMENTAL SPECIFICATIONS			
PARAMETERS	UNITS	MSA-H1-1.5 (x) MSA-H2-1.5 (xy)	CONDITION
Operating Temperature	°C	-40 to 125	Powered
Storage Temperature	°C	-55 to 150	Unpowered
Mechanical Shock	g	4600	Powered or unpowered, 0.5 msec halversine
ESD	V	3000	Human body model

**Notes**

- <sup>1</sup> The performance parameters are programmed and tested at 5 volts. However, the device can be powered from 2.7 V to 5.25 V. Performance parameters will change with supply voltage variations.
- <sup>2</sup> Custom ranges from 1g to 6g available.
- <sup>3</sup> Temperature range for specified offset.
- <sup>4</sup> Lower bandwidth can be achieved by using the external C<sub>2</sub> and C<sub>3</sub>. See application note on page 3.

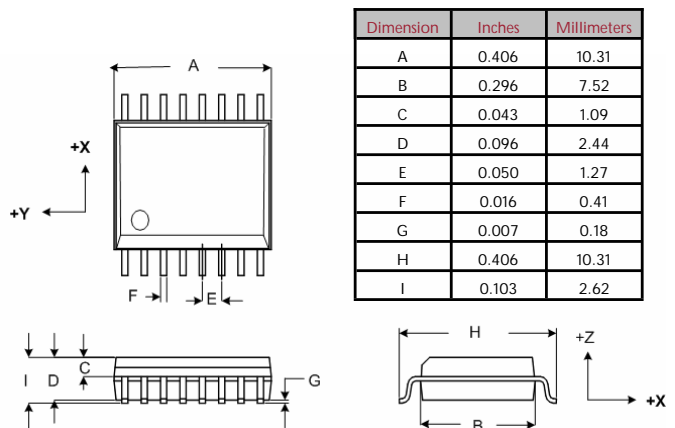
## FUNCTIONAL DIAGRAM



**Notes**

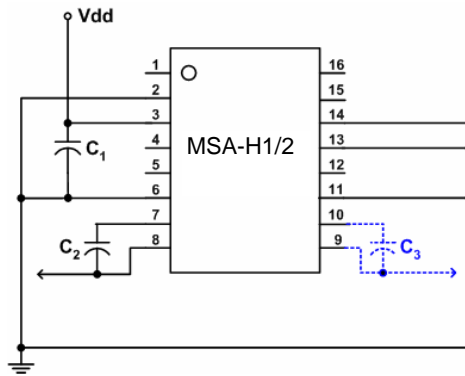
1. Acceleration in the sensitive axis(es) will cause a corresponding increase in output.
2. The packaged device weighs less than .44g gram.

## 16-PIN SOIC OVERMOLDED PACKAGE



## APPLICATION SCHEMATIC &amp; PIN FUNCTION TABLES

Pin	Single-Axis Function
1	DNC
2	GND
3	Vdd (+5V)
4	DNC
5	Self Test
6	Reserved
7	X Filter
8	Output X
9	DNC
10	DNC
11	Reserved
12	Parity
13	Reserved
14	Reserved
15	DNC
16	DNC



Pin	Dual-Axis Function
1	DNC
2	GND
3	Vdd (+5V)
4	DNC
5	Self Test
6	Reserved
7	X Filter
8	Output X
9	Output Y
10	Y Filter
11	Reserved
12	Parity
13	Reserved
14	Reserved
15	DNC
16	DNC

**Definitions**

- C<sub>2</sub>, C<sub>3</sub>** An external capacitor is used to set the -3dB filter point for each sensor output.
- DNC** Do not connect.
- f<sub>BW</sub>** Sensor bandwidth frequency needed in application (typ. 10Hz to 1500Hz).
- Parity** Checks EEPROM for parity error.
- Reserved** For factory use; recommend grounding.
- Self Test** The output of a properly functioning part will increase when 5V is applied to the self-test pin (#5).

**Application Design Equations**

The bandwidth can be adjusted with appropriate capacitors (C<sub>2</sub> and/or C<sub>3</sub>) across pins 7 and 8 and across pins 9 and 10 respectively. The response is single pole. Given a desired bandwidth, f<sub>BW</sub> (in Hertz), the filter capacitor, C<sub>BW</sub> (in Farads), is determined by:

$$C_2 = C_3 = C_{BW} = \frac{1.99 \times 10^{-6}}{f_{BW}}$$

**Notes**

1. Recommend using 0.1 μF for decoupling capacitor C<sub>1</sub>.
2. Do not connect pins #9 and #10 on the single-axis device.
3. An evaluation board is available upon request.

## ORDERING GUIDE

Product	Axis(es) of Sensitivity	Range	Sensitivity (mV/g)	Offset (V)	Operating Voltage (V)	Temperature	Package
MSA-H1-1.5	X	1.5g	1333	2.5	5	-40 to +125 °C	16-pin SOIC Overmolded
MSA-H2-1.5	XY	1.5g	1333	2.5	5	-40 to +125 °C	16-pin SOIC Overmolded