



# **Piezo Film Sensors**

# **Technical Manual**

## **Internet Version**

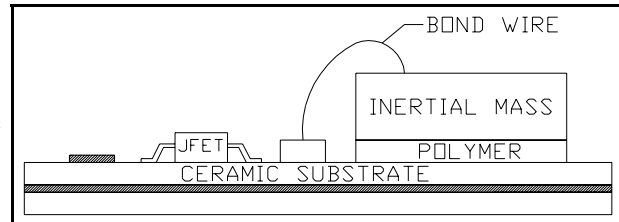
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## ACCELEROMETERS

A logical outgrowth of the many vibration sensor applications of MSI's piezoelectric technology are accelerometers. These accelerometer designs are based on more traditional piezoelectric ceramic, as well as piezoelectric polymer materials. The choice of base materials allows the product to be tailored for specific applications. Table 6 lists the key specifications for the MSI Accelerometer product family.

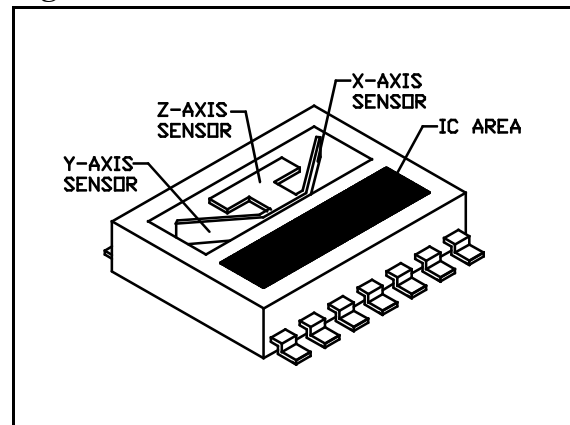
Figure 59. ACH-01-XX internal view



Like more conventional sensors, these accelerometers are configured as either compression-design type or beam-design type. Compression-design accelerometers typically have higher resonant frequencies providing wide useful frequency ranges. An internal view of MSI's ACH-01-XX compression-design accelerometer is shown in Figure 59.

Beam-design accelerometers tend to have lower resonant frequencies and useful frequency ranges. Beam-design accelerometers also have another very interesting feature: they can be oriented to sense acceleration in multiple-axes with one monolithic sensing element using MSI's patented "Origami" beam technology ("Origami" is the Japanese word for the art of paper folding). An internal view of the ACH-04-08-05 beam-design accelerometer, with its origami sensing element, is shown in Figure 60.

Figure 60. ACH-04-08-05 internal view



To reduce system costs as well as simplify use, all of MSI's accelerometers include buffers. JFET biasing and signal processing is implemented external to the device.

The ACH-01 family of products is typically used in applications which require broad frequency capability, high sensitivity, low noise, and low cost. Such applications include: speaker feedback and control systems, automotive anti-theft systems, acoustic pick-ups, machine-health and pump monitoring systems, and medical body motion monitoring.

The ACH-04-08 product family is used in a very broad range of applications such as speaker feedback and control systems, appliance fault monitoring, virtual reality systems, automotive systems, medical body motion monitoring, shipment damage and material-handling monitoring systems, vibration switches and earthquake shut-off switches. OEM applications that require acceleration or vibration measurements in more than one axis are perfect for the ACH-04-08-05.

MSI is constantly developing and upgrading its accelerometer product line. Please contact MSI for further details on these products or on customizing one of our other products.

**Table 6. Accelerometer Family**

<b>Production Qualified Accelerometers</b>				
		<b>ACH-01-XX</b>	<b>ACH-04-08-05</b>	<b>ACH-04-08-09</b>
Key Features		-Wide Frequency Range -Wide Dynamic Range -High Sensitivity -Low Noise -JFET Buffer	-Low Frequency Operation -3 Simultaneous Analog Outputs -Low current generation - JFET Buffer	-Low Frequency Operation -Low Current Operation - JFET Buffer
Sensitive Axes	X-Axis	---	X	--
	Y-Axis	---	X	X
	Z-Axis	X	X	--
Sensitivity (Nominal)		10 mV/g	1.8 mV/g	6mV/g
Frequency Range ( $\pm 3$ dB)		1.0 Hz-20 kHz	0.5 Hz to 4 kHz	0.2 to 1500 Hz
Dynamic Range		$\pm 250$ g	$\pm 250$ g	$\pm 40$ g
Resolution (@ 100 Hz)		$40\mu\text{g}/\sqrt{\text{Hz}}$	$200\mu\text{g}/\sqrt{\text{Hz}}$	$40\mu\text{g}/\sqrt{\text{Hz}}$
Resonant Frequency		>35 kHz	9.2 kHz	3.4 kHz
Resonant Q (Hz/Hz)		30	10	10
Transverse Sensitivity		5%	15%	<20%
Linearity		0.1%	0.1%	0.1%
Operating Temperature		-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
Storage Temperature		-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
Maximum Shock		1000 g	1000 g	1000 g
Supply Voltage		3 V to 40 V	3 V to 40 V	3 V to 28 V
Supply Current		2 $\mu$ A Typical	6 $\mu$ A Typical	2 $\mu$ A Typical
Weight		3 grams	0.35 grams	0.35 grams
Size (mm)		13 x 19 x 6	11 x 10 x 1.8	11 x 10 x 1.8
Mounting Method		Adhesive	Hand Solder to PCB	Hand Solder to PCB

**Table 7. Accelerometer Applications**

		<b>ACCELEROMETER PRODUCTS</b>		
<b>Industry</b>	<b>Application</b>	<b>ACH-01-XX</b>	<b>ACH-04-08-05</b>	<b>ACH-04-08-09</b>
<i>Aerospace &amp; Defense Electronics</i>	Anti-Tamper Sensors	X	X	X
	Surveillance	X		
	Modal Analysis	X	X	
<i>Automotive</i>	Antitheft	X	X	X
	Skid/Rain Sensing	X		
<i>Computers &amp; Peripherals</i>	Computer Mouse Sensor		X	
	Virtual Reality Sensor		X	
<i>Household Appliances</i>	Out-of-Balance Sensor	X	X	X
	Spray Arm Jam Sensor		X	X
	$\mu$ wave Acoustic Sensor	X		
<i>Consumer Electronics</i>	Speaker Feedback	X		
	Acoustic Pick-ups	X		
	Security		X	X
<i>Industrial</i>	Machine Health Monitor	X	X	
	Bearing Monitor	X	X	
<i>Instruments &amp; Measuring Equipment</i>	Active Vibration Damping	X	X	X
	Predictive Maintenance	X	X	X
<i>Medical</i>	Motion Sensor	X	X	
	Pacemaker	Consult Factory for further Information		
<i>Power &amp; Utilities</i>	Earthquake Shut-Off		X	X
	Machine Monitoring	X	X	
<i>Transport &amp; Material Handling</i>	Shipment Monitoring	X	X	
	Railroad Systems	X	X	X