



MEGGITT

smart engineering for
extreme environments

Variable Capacitance (VC) Accelerometers

Why VC accelerometers

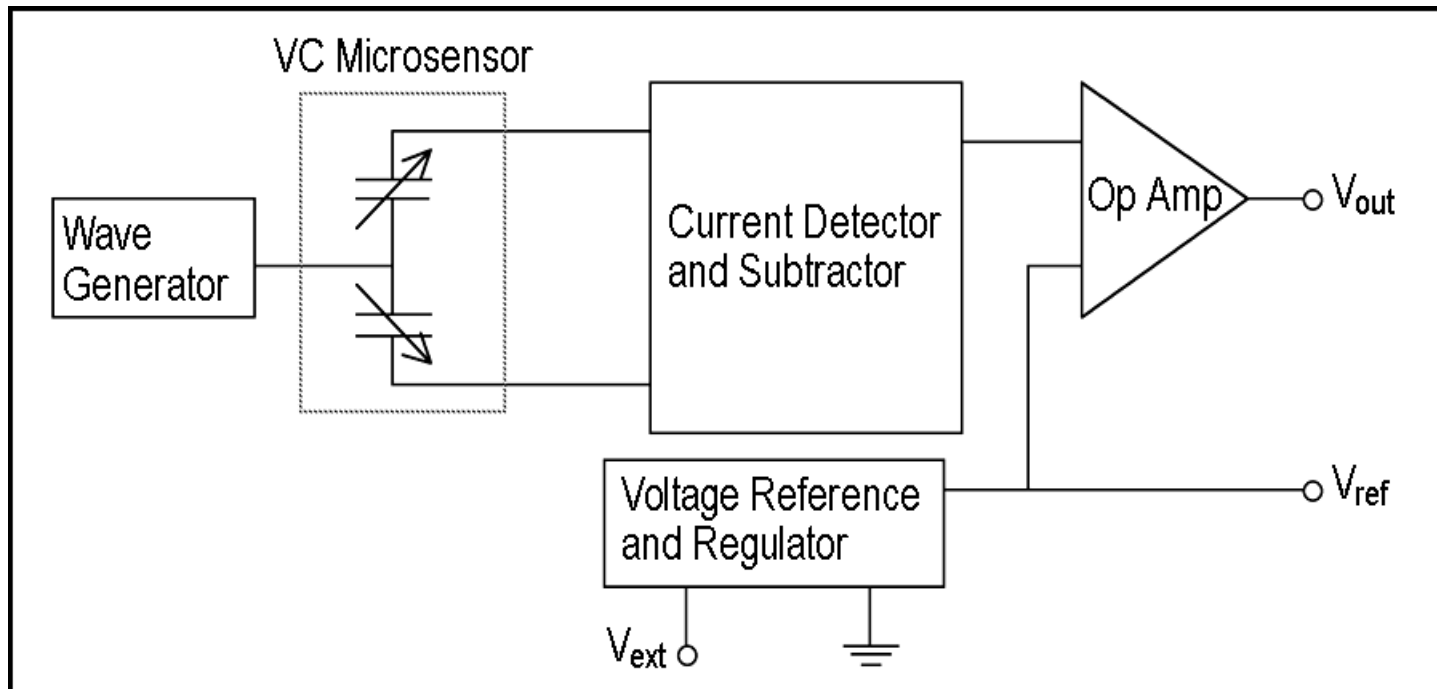
How they differ from piezoelectric and
piezoresistive accelerometers

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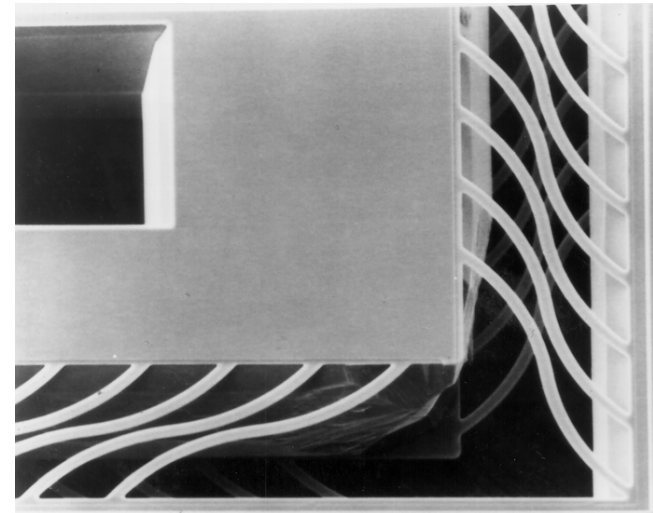
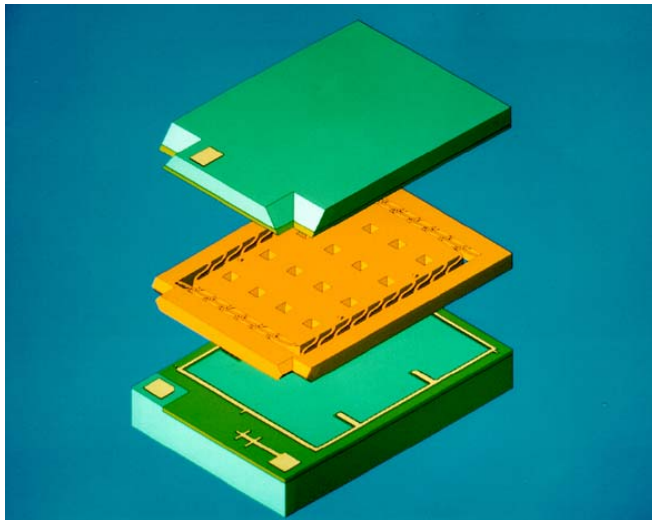
Variable Capacitance (VC) Effect

Theory of operation:

Changes in capacitance due to capacitive plate movements are proportional to acceleration



Variable Capacitance Sensor



Three Layers Wafer Anodically Bonded Together
Inertial Mass in Center Layer
Microsensor Size, 2 mm x 2.8 mm x 0.9 mm

Variable Capacitance Accelerometers

7290A



7293A



7296A



7292



Actual size

- Low-g
- EMI protection
- Electronic Temp. Compensation
- Hermetic Sealing

VC Characteristics

- ▶ Frequency response is down to DC
- ▶ DC Power is required (Typically 10.0 Vdc)
- ▶ Greater output at low g levels than a PR Device
- ▶ Limited high frequency response compared to PR Device
- ▶ Same signal conditioning as a full, four wire Wheatstone Bridge sensor
- ▶ Frequently used in “Flight Test” applications for high output voltage at low level g applications

Some VC Specifications

- Thermal Sensitivity Shift: +/- 1.5% from -67°F to 257°F (-55°C to 125°C)
- Thermal Zero Shift: +/- 1.5% Full Scale Output from -67°F to 257°F (-55°C to 125°C)
- Wide excitation voltage range 8.0 to 30.0 Vdc
- Gas Damping – ratio change 0.04%/°F (0.08%/°C)
- Ranges from +/- 2g to +/- 150g full scale
- High shock survivability
- Micro g resolution; nano g resolution available with large IEPE

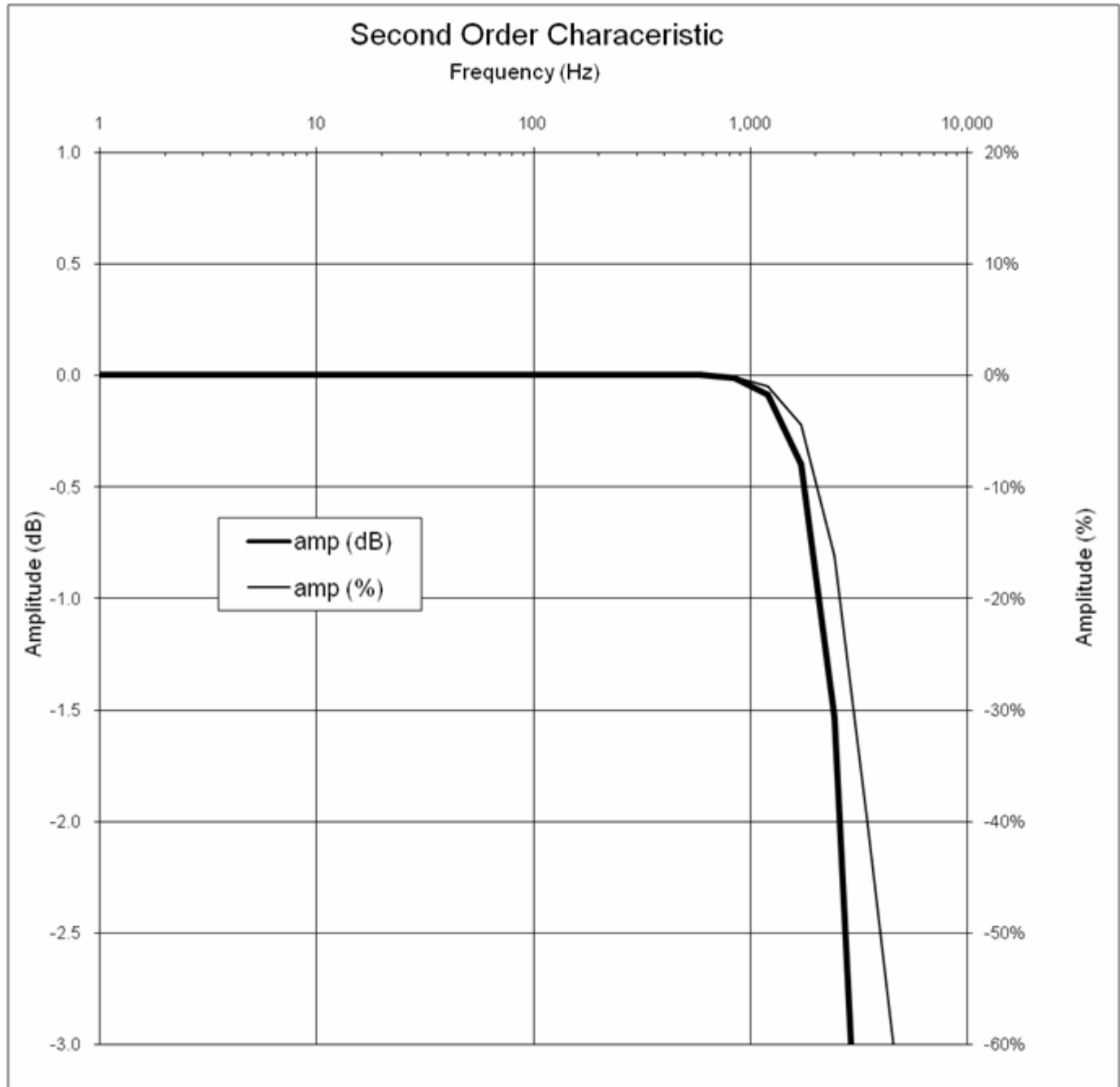
second order
characteristic

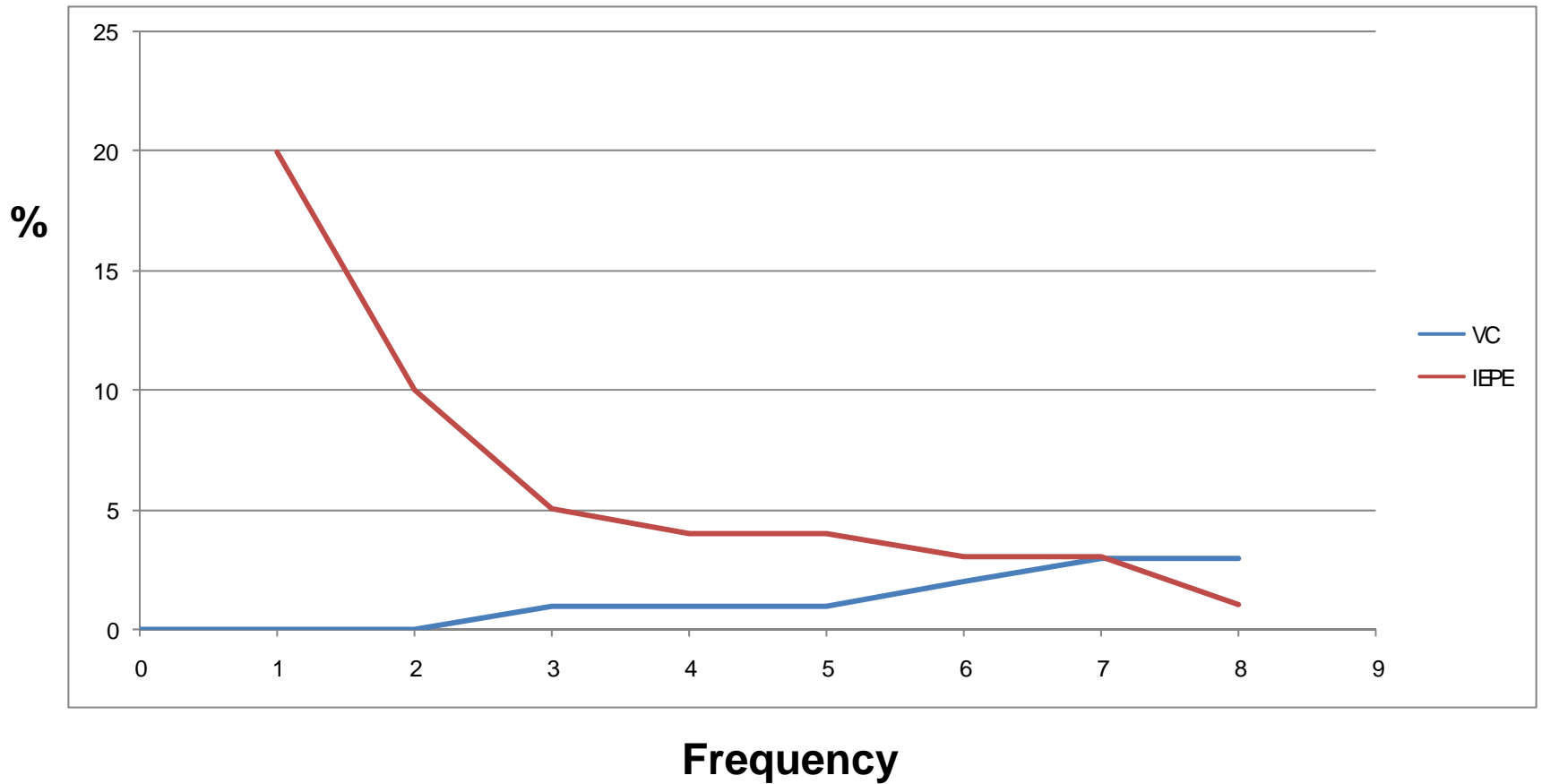
Second Order Characteristic

Frequency (Hz)

natural frequency 3000 Hz
damping 0.70 ratio
scale freq 1.426 multiplier

freq (Hz)	amp (dB)	amp (%)	phase (deg)
1	0.0	0%	0
1	0.0	0%	0
2	0.0	0%	0
3	0.0	0%	0
4	0.0	0%	0
6	0.0	0%	0
8	0.0	0%	0
12	0.0	0%	0
17	0.0	0%	0
24	0.0	0%	1
35	0.0	0%	1
50	0.0	0%	1
71	0.0	0%	2
101	0.0	0%	3
144	0.0	0%	4
205	0.0	0%	5
292	0.0	0%	8
417	0.0	0%	11
594	0.0	0%	16
848	0.0	0%	23
1,209	-0.1	-1%	34
1,724	-0.4	-4%	50
2,458	-1.5	-16%	74
3,505	-4.5	-40%	-77
4,999	-9.3	-66%	-53
7,128	-15.1	-82%	-36
10,165	-21.2	-91%	-24





Phase Comparison VC vs. IEPE Accelerometer

Where are they used?

- ▶ Vehicle ride studies
- ▶ Elevators and amusement park rides
- ▶ Flutter testing
- ▶ Railroad testing and control
- ▶ Robotics
- ▶ Tilt measurement
- ▶ Low frequency vibration and modal analysis

Some Important Terms (VC)

- ▶ ZMO: “Zero measurand output” DC bias voltage present with no input signal
- ▶ TZS: “Thermal zero shift” . The amount of zero drift, in mV, over a specified temperature range
- ▶ TSS: “Thermal sensitivity shift” The % change in sensitivity over a specified temperature range
- ▶ Excitation Voltage: The supply voltage applied to the sensor



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