

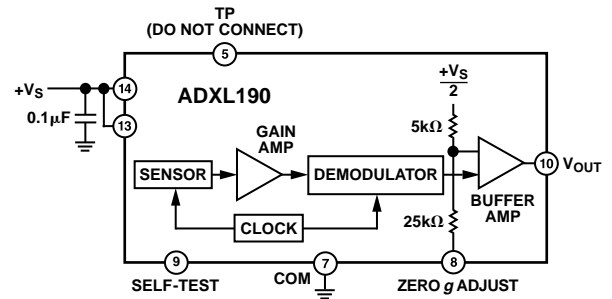
FEATURES

iMEMS® Single Chip IC Accelerometer
 40 Milli-*g* Resolution
 Low Power 2 mA
 400 Hz Bandwidth
 +5.0 V Single Supply Operation
 2000 *g* Shock Survival

APPLICATIONS

Shock and Vibration Measurement
 Machine Health
 Shipping Recorders
 Military Fuze, Safe and Arm

FUNCTIONAL BLOCK DIAGRAM



GENERAL DESCRIPTION

The ADXL190 is a complete acceleration measurement system on a single monolithic IC. It contains a polysilicon surface-micromachined sensor and signal conditioning circuitry to implement an open-loop acceleration measurement architecture. The ADXL190 is capable of measuring both positive and negative accelerations up to $\pm 100 g$, making it suitable for shock and vibration measurement.

Typical noise floor is $4 \text{ mg}/\sqrt{\text{Hz}}$ allowing signals below 40 milli-*g* to be resolved. The ADXL190 can measure both dynamic accelerations, (typical of vibration) or static accelerations, (such as inertial force or gravity).

The ADXL190 has a two-pole Bessel switched-capacitor filter. Bessel filters, sometimes called linear phase filters, have a step response with minimal overshoot and a maximally flat group

delay. The -3 dB frequency of the poles is preset at the factory to 400 Hz. These filters are also completely self-contained and buffered, requiring no external components.

The product features a built-in self-test feature that exercises both the mechanical structure and electrical circuitry. When triggered by a logic high on the self-test pin, an electrostatic force acts on the beam equivalent to approximately 20% of full-scale acceleration input, and thus a proportional voltage change appears on the output pin. No external components other than a decoupling capacitor are required.

The ADXL190 is available in a hermetic 14-lead surface mount cerpak, specified over the -40°C to $+105^\circ\text{C}$ temperature range.

*Patent Pending.

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ADXL190—SPECIFICATIONS ($T_A = T_{MIN}$ to T_{MAX} , $V_S = +5$ V, Acceleration = 0 g unless otherwise noted)

| Parameter | Conditions | ADXL190WQC | | | Units | |
|---|---------------------------------|------------|------|--------------|----------------------------|--------------------------------------|
| | | Min | Typ | Max | | |
| SENSOR INPUT | | | | | | |
| Dynamic Range ^{1, 2, 3} | Without Zero-g Adjust | ±105 | | | g | |
| Alignment Error | | | ±1 | | Degrees | |
| Nonlinearity | | | 0.2 | | % | |
| Cross Axis Sensitivity | | | ±2 | | % | |
| SENSITIVITY | | | | | | |
| Initial ⁴ | Ratiometric Δ from +25°C | 16.5 | 18.0 | 19.5 | mV/g | |
| Temperature Drift ⁵ | | | ±0.5 | | % | |
| ZERO g BIAS LEVEL | | | | | | |
| Initial ^{2, 3} | Ratiometric Δ from +25°C | 2.3 | 2.5 | 2.7 | V | |
| 0 g Offset vs. Temperature ⁵ | | | 1.0 | | g | |
| Zero g Adjustment Gain | | | 0.45 | 0.50 | 0.55 | $\Delta V_{OUT}/\Delta V$ 0 g Adjust |
| Zero g Adjust Pin Input Impedance | | | 20 | 30 | 40 | kΩ |
| NOISE PERFORMANCE | | | | | | |
| Noise Density | | | 4 | 12 | mg/ $\sqrt{\text{Hz}}$ rms | |
| FREQUENCY RESPONSE | | | | | | |
| 3 dB Bandwidth | | 360 | 400 | | Hz | |
| Sensor Resonant Frequency | | | 24 | | kHz | |
| SELF-TEST | | | | | | |
| Output Change ⁶ | | 450 | | 990 | mV | |
| Logic “1” Voltage | | 3.5 | | | V | |
| Logic “0” Voltage | | | | 1.0 | V | |
| Input Impedance | | | 50 | | kΩ | |
| ANALOG OUTPUT | | | | | | |
| Output Voltage Range | $I_{OUT} = \pm 100 \mu\text{A}$ | 0.25 | | $V_S - 0.25$ | V | |
| Capacitive Load Drive | | 1000 | | | pF | |
| POWER SUPPLY | | | | | | |
| Specified Performance | | 4.75 | | 5.25 | V | |
| Quiescent Supply Current | | | 2.0 | 5.0 | mA | |
| TEMPERATURE RANGE | | | | | | |
| Specified Performance | | -40 | | +105 | °C | |

NOTES

¹Product is tested at ±50 g, and the combination of 0-g error, sensitivity error, and output voltage swing measurements provide the calculations for dynamic range.

²0-g is nominally $V_S/2$. Use of the 0-g adjustment pin is used to null the 0-g error, resulting in increased dynamic range. It can also be used to create an asymmetrical dynamic range if so desired.

³The output response is ratiometric and is described by the following equation. $V_{OUT}(\text{accel}, V_S) = [V_S/2 \pm (a V_S/5 V)] + [(\text{accel}) (b V_S + c V_S^2)(1 \pm 0.08)]$

Where $a = 0.2$ V, $b = 2.712 \times 10^{-3}$ 1/g, $c = 0.178 \times 10^{-3}$ 1/g/V.

⁴Measured at 100 Hz, ±50 g.

⁵Specification refers to the maximum change in parameter from its initial value at +25°C to its worst case value at T_{MIN} or T_{MAX} .

⁶ST pin Logic “0” to “1”; $\Delta V_{OUT} = (\Delta V_{OUT} @ 5 V) \times (V_S/5 V)$.

All min and max specifications are guaranteed. Typical specifications are not tested or guaranteed.

Specifications subject to change without notice.

