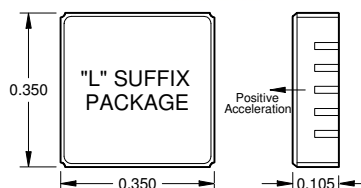


- Excellent long term stability
- Responds to DC and AC Acceleration
- Differential or Single Ended Output
- $\pm 4V$ Differential
- 0.5V to 4.5V Single Ended
- +5 VDC, 6 mA power (typical)
- -40 to +85°C operation
- Integrated sensor & amplifier
- Nitrogen damped & hermetically sealed
- Serialized


AVAILABLE G-RANGES

| FULL SCALE ACCELERATION | 20 PIN LCC |
|-------------------------|------------|
| $\pm 5\text{ g}$ | 1510L-005 |
| $\pm 10\text{ g}$ | 1510L-010 |
| $\pm 25\text{ g}$ | 1510L-025 |
| $\pm 50\text{ g}$ | 1510L-050 |
| $\pm 100\text{ g}$ | 1510L-100 |

DESCRIPTION

The low cost 1510 is ideally suited for vibration applications. Each miniature, hermetically sealed package combines a micro-machined capacitive sense element and a custom ASIC that includes an amplifier and differential output stage. It is relatively insensitive to temperature changes and gradients. The 1510 is RoHS compliant.

ZERO (DC) TO MEDIUM FREQUENCY APPLICATIONS

PERFORMANCE

| INPUT RANGE | FREQUENCY RESPONSE (MINIMUM, 3 DB) | SENSITIVITY, DIFFERENTIAL | OUTPUT NOISE, DIFFERENTIAL (RMS, TYPICAL) | MAX. MECHANICAL SHOCK (0.1 MS) |
|-------------|------------------------------------|---------------------------|---|--------------------------------|
| g | Hz | mV/g | $\mu\text{g}/(\text{root Hz})$ | g (peak) |
| ± 5 | 0 – 600 | 800 | 32 | 2000 |
| ± 10 | 0 – 900 | 400 | 63 | 5000 |
| ± 25 | 0 – 1500 | 160 | 158 | |
| ± 50 | 0 – 2000 | 80 | 316 | |
| ± 100 | 0 – 2500 | 40 | 632 | |

By Model: $V_{DD}=V_R=5.0\text{ VDC}$, $T_C=25^\circ\text{C}$.

PERFORMANCE - ALL VERSIONS

All Models: Unless otherwise specified $V_{DD}=V_R=5.0\text{ VDC}$, $T_C=25^\circ\text{C}$, Differential. Span = $\pm\text{g}$ range = 8000 mV

| PARAMETER | MIN | TYP | MAX | UNITS |
|---|------|------|------|---------------------------------|
| Cross Axis Sensitivity | | | 3 | $\pm\%$ |
| Bias Calibration Error, differential | | | 1 | $\pm\%$ of span |
| Bias Calibration Error, single ended ³ | | | 0.15 | $\pm\text{V}$ |
| Bias Temperature Shift ($T_C = -40$ to $+85^\circ\text{C}$) | -200 | | 200 | (ppm of span)/ $^\circ\text{C}$ |
| Scale Factor Calibration Error ¹ | | | 1.5 | $\pm\%$ |
| Scale Factor Temperature Shift ($T_C = -40$ to $+85^\circ\text{C}$) | -300 | | 300 | PPM/ $^\circ\text{C}$ |
| Long Term Bias Stability | | 1000 | 2000 | $\pm\text{PPM}$ of span |
| Non-Linearity (-90 to +90% of Full Scale) ² | | | 1.0 | $\pm\%$ of span |
| Output Impedance | | 90 | | Ohms |
| Operating Voltage | 4.75 | 5.0 | 5.25 | volts |
| Operating Current ($I_{DD}+I_{VR}$) | | 6 | 8 | mA |
| Mass: 'L' package | | 0.62 | | grams |

Note 1: Single ended sensitivity is half of values shown. Note 2: 100g version is tested and specified from -65g to +65g.

Note 3: Voltage difference from +2.5V reference voltage supplied to pin 17

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 www.silicondesigns.com [page 1] 29-April-2015

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Model 1510 Analog Surface Mount Accelerometer for Vibration

MAXIMUM RATINGS *

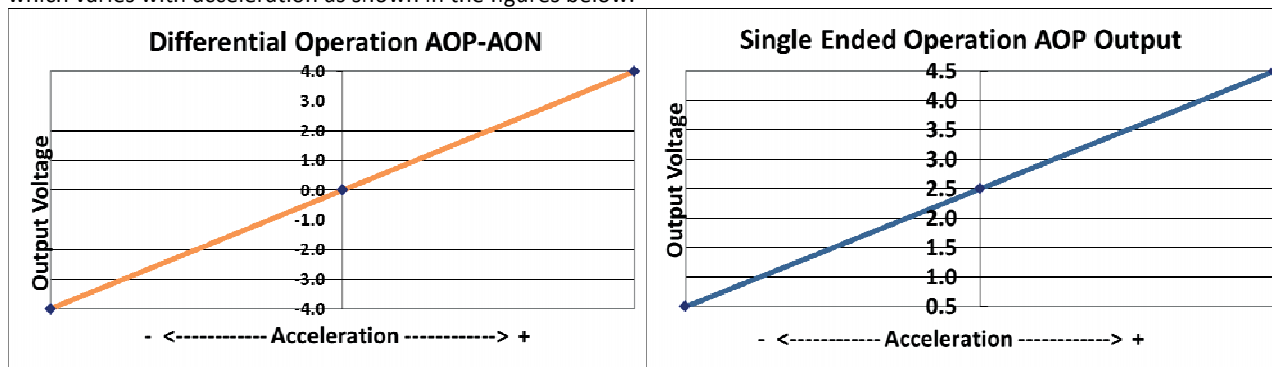
| | |
|--|--------------------------------|
| Case Operating Temperature | -40 to +85°C |
| Storage Temperature | -40 to +120°C |
| Voltage on V _{DD} to GND | -0.5V to 6.5V |
| Voltage on Any Pin (except DV) to GND ¹ | -0.5V to V _{DD} +0.5V |
| Voltage on DV to GND (Self-Test) | ±15V |
| Power Dissipation, max | 50 mW |

* NOTICE: Stresses greater than those listed above may cause permanent damage to the device. These are maximum stress ratings only. Functional operation of the device at or above these conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability and lifespan.

OPERATION

The model 1510 sensitive axis is perpendicular to the bottom of the package, with positive acceleration resulting from a positive force pushing on the bottom of the package. The seismic center is located on a centerline through the dual sense elements and halfway between them. The internal electronics effectively cancel any errors due to rotation. Two reference voltages, +5.0 and +2.5 volts (nominal), are required; scale factor is ratiometric to the +5.0 volt reference voltage relative to GND, and both outputs at zero acceleration are nominally 80 mV below the +2.5 volt input.

The Model 1510 produces a differential +/-4 volts output voltage or single ended mode, 0.5 – 4.5 volts full scale, the value of which varies with acceleration as shown in the figures below.



SIGNAL DESCRIPTIONS

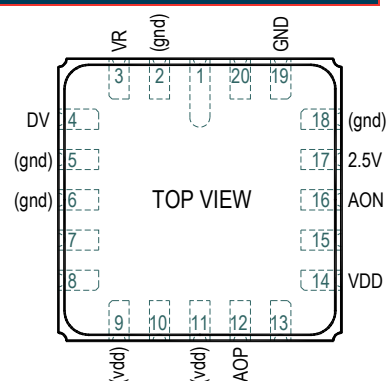
VDD and GND (power): Pins (9,11,14) and (2,5,6,18,19) respectively. Power (+5 Volts DC) and ground.

AOP and AON (output): Pins 12 and 16 respectively. Analog output voltages proportional to acceleration. The AOP voltage increases (AON decreases) with positive acceleration; at zero acceleration both outputs are nominally equal to the +2.5 volt reference. The device experiences positive (+1g) acceleration with its lid facing up in the earth's gravitational field. Either output can be used individually or the two outputs can be used differentially but differential mode is recommended for both lowest noise and highest accuracy operation. Voltages can be measured ratiometrically to VR for good accuracy without requiring a precision reference voltage. In single ended mode the unused -AON signal output PIN 16 must be left unconnected. Connecting this signal output to your shield or to the 0 volt power supply ground plane will potentially cause the sensor to overheat and prematurely fail.

DV (input): Pin 4. Deflection Voltage. Normally left open. A test input that applies an electrostatic force to the sense element, simulating a positive acceleration. The nominal voltage at this pin is ½ VDD. DV voltages higher than required to bring the output to positive full scale may cause device damage.

VR (input): Pin 3. Voltage Reference. Tie directly to VDD for ratiometric measurements or to a +5V reference for better absolute accuracy. A 0.1µF bypass capacitor is recommended at this pin.

2.5 Volt (input): Pin 17. Voltage Reference. Tie to resistive voltage divider from +5 volts or a +2.5 volt reference voltage.



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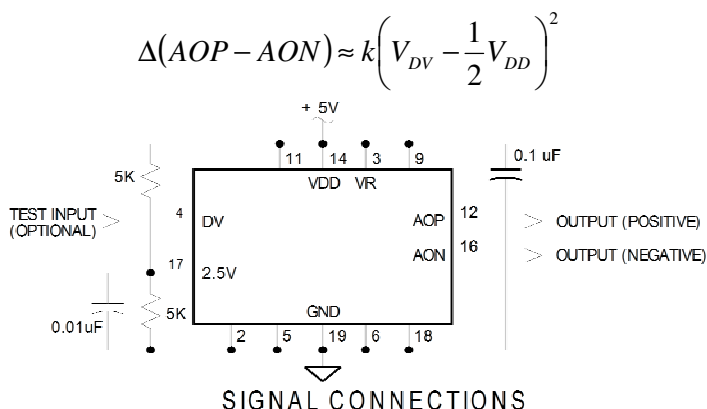


Model 1510 Analog Surface Mount Accelerometer for Vibration

RECOMMENDED CONNECTIONS

DEFLECTION VOLTAGE (DV) TEST INPUT: This test input applies an electrostatic force to the sense element, simulating a positive acceleration. It has a nominal input impedance of 32 k Ω and a nominal open circuit voltage of $\frac{1}{2} V_{DD}$. For best accuracy during normal operation, this input should be left unconnected or connected to a voltage source equal to $\frac{1}{2}$ of the V_{DD} supply. The change in differential output voltage (**AOP – AON**) is proportional to the square of the difference between the voltage applied to the **DV** input (V_{DV}) and $\frac{1}{2} V_{DD}$. Only positive shifts in the output voltage may be generated by applying voltage to the **DV** input. When voltage is applied to the **DV** input, it should be applied gradually. The application of **DV** voltages greater than required to bring the output to positive full scale may cause device damage. The proportionality constant (**k**) varies for each device and is not characterized. The 2.5V input (pin 17) may be driven from a resistive divider.

ESD and LATCH-UP CONSIDERATIONS: The model 1510 accelerometer is a CMOS device subject to damage from large electrostatic discharges. Diode protection is provided on the inputs and outputs, and it is not easily damaged, but care should be exercised during handling. However, individuals and tools should be grounded before coming in contact with the device. Although the 1510 is resistant to latch-up, inserting a 1510 into or removing it from a powered socket may cause damage.



SOLDERING RECOMMENDATIONS

RoHS Compliance: The model 1510 does not contain elemental lead and is RoHS compliant.

Pre-Tinning of Accelerometer Leads is Recommended: To prevent gold migration embrittlement of the solder joints, it is best to pre-tin the accelerometer leads.

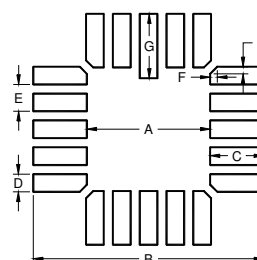
LCC Solder Contact Plating Information: The plating composition and thickness for the solder pads and castellations on the "L" suffix (LCC) package are 60 to 225 micro-inches thick of gold (Au) over 80 to 350 micro-inches thick of nickel (Ni) over a minimum of 5 micro-inches thick of moly-manganese or tungsten refractory material. The J-Lead package top layer is 100 to 225 microinches thick of 99.7% gold (Au) over 80 to 350 microinches thick of electroplated nickel (Ni).

Recommended Solder Pad Pattern: The recommended solder pad size and shape for both the LCC and J LCC packages is shown in the diagram and table below. These dimensions are recommendations only and may or may not be optimum for your particular soldering process.

Do not use ultrasonic cleaners.

Ultrasonic cleaning may break internal wire bonds and will void the warranty.

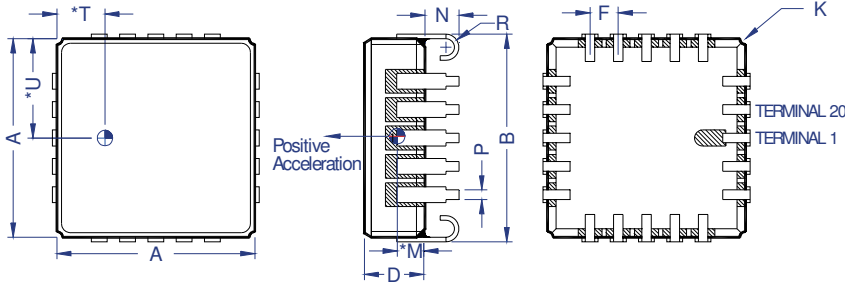
| DIM | Inch | mm |
|-----|------|-------|
| A | .230 | 5.84 |
| B | .430 | 10.92 |
| C | .100 | 2.54 |
| D | .033 | 0.84 |
| E | .050 | 1.27 |
| F | .013 | 0.33 |
| G | .120 | 3.05 |



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PACKAGE DIMENSIONS

1. *Dimensions "M," "T," and "U" locate sensing element's center of mass.
2. Lid is electrically tied to terminal 19 (GND).
3. Controlling dimension: Inch.
4. Terminals are plated with 60 microinches min gold over 80 microinches min nickel. This plating specification does not apply to the Pin-1 identifier mark on the bottom of the J-lead package version.
5. Package: 90% min alumina (black), lid: solder sealed kovar.



| Dim | Inches | | Millimeters | |
|-----|-------------|-------|-------------|------|
| | Min | Max | Min | Max |
| A | 0.342 | 0.358 | 8.69 | 9.09 |
| B | 0.346 | 0.378 | 8.79 | 9.60 |
| D | 0.095 | 0.115 | 2.41 | 2.92 |
| F | 0.050 BSC | | 1.27 BSC | |
| K | 0.010 R TYP | | 0.25 R TYP | |
| * M | 0.048 TYP | | 1.23 TYP | |
| N | 0.050 | 0.070 | 1.27 | 1.78 |
| P | 0.017 TYP | | 0.43 TYP | |
| R | 0.023 R TYP | | 0.58 R TYP | |
| * T | 0.085 TYP | | 2.16 TYP | |
| * U | 0.175 TYP | | 4.45 TYP | |

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