

**FEATURES**
**3-axis sensing**
**Small, low-profile package**
**4 mm × 4 mm × 1.45 mm LFCSP**
**Low power**
**200  $\mu A$  at  $V_s = 2.0 V$  (typ)**
**Single-supply operation**
**2.0 V to 3.6 V**
**10,000 g shock survival**
**Good zero g bias stability**
**Good sensitivity accuracy**
**BW adjustment with a single capacitor**
**RoHS/WEEE lead-free compliant**
**APPLICATIONS**
**Cost-sensitive motion- and tilt-sensing applications**
**Cellular handsets**
**Gaming devices**
**Disk drive protection**
**Image stabilization**
**Sports and health devices**
**GENERAL DESCRIPTION**

The ADXL330 is a small, low power complete three axis accelerometer with signal conditioned voltage outputs, all on a single monolithic IC. The product measures acceleration with a minimum full-scale range of  $\pm 2 g$ . It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

The user selects the bandwidth of the accelerometer using capacitors  $C_x$ ,  $C_y$ ,  $C_z$  and at the  $X_{OUT}$ ,  $Y_{OUT}$ , and  $Z_{OUT}$  pins. Bandwidths may be selected to suit the application, with a range of 0.5 Hz to 1,600 Hz for X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

The ADXL330 is available in a small, low-profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP).

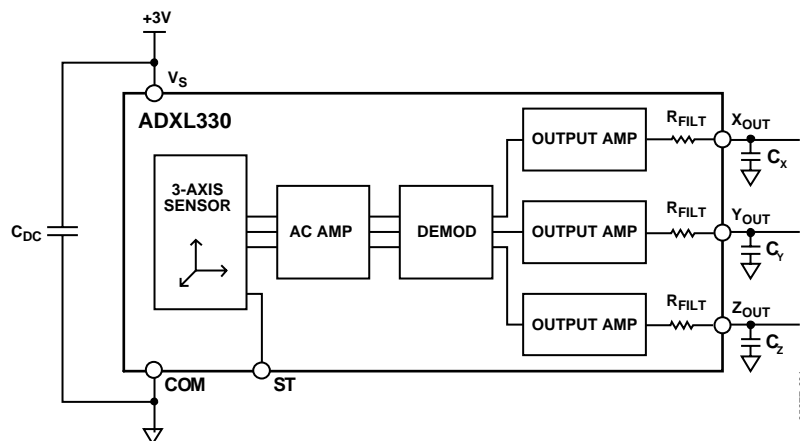
**FUNCTIONAL BLOCK DIAGRAM**


Figure 1.

**Rev. PrA**

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**REVISION HISTORY**

10/05—Revision PrA: Preliminary Version

## SPECIFICATIONS

T<sub>A</sub> = 25°C, V<sub>S</sub> = 3 V, C<sub>X</sub> = C<sub>Y</sub> = C<sub>Z</sub> = 0.1 μF, acceleration = 0 g, unless otherwise noted. All minimum and maximum specifications are guaranteed. Typical specifications are not guaranteed.

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
<b>SENSOR INPUT</b>					
Measurement Range	Each axis	±2	±4		g
Nonlinearity	% of full scale		±0.3		%
Inter-Axis Alignment Error			±0.1		Degrees
Cross Axis Sensitivity <sup>1</sup>			±1		%
<b>SENSITIVITY (RATIOMETRIC)<sup>2</sup></b>					
Sensitivity at X <sub>OUT</sub> , Y <sub>OUT</sub> , Z <sub>OUT</sub>	V <sub>S</sub> = 3 V	270	300	330	mV/g
Sensitivity Change Due to Temperature <sup>3</sup>	V <sub>S</sub> = 3 V		±0.01		%/°C
<b>ZERO g BIAS LEVEL (RATIOMETRIC)</b>					
0 g Voltage at X <sub>OUT</sub> , Y <sub>OUT</sub> , Z <sub>OUT</sub>	V <sub>S</sub> = 3 V	1.2	1.5	1.8	V
0 g Offset vs. Temperature			±1		mg/°C
<b>NOISE PERFORMANCE</b>					
Noise Density X <sub>OUT</sub> , Y <sub>OUT</sub>			170		μg/√Hz rms
Noise Density Z <sub>OUT</sub>			350		μg/√Hz rms
<b>FREQUENCY RESPONSE<sup>4</sup></b>					
Bandwidth X <sub>OUT</sub> , Y <sub>OUT</sub> <sup>5</sup>	No external filter		1600		Hz
Bandwidth Z <sub>OUT</sub>	No external filter		550		Hz
R <sub>FILT</sub> Tolerance			32 ± 15%		kΩ
Sensor Resonant Frequency			5.5		kHz
<b>SELF-TEST<sup>6</sup></b>					
Logic Input Low			+0.6		V
Logic Input High			+2.4		V
Output Change at X <sub>OUT</sub>	Self-test 0 to 1		-130		mV
Output Change at Y <sub>OUT</sub>	Self-test 0 to 1		+130		mV
Output Change at Z <sub>OUT</sub>	Self-test 0 to 1		-70		mV
<b>OUTPUT AMPLIFIER</b>					
Output Swing Low	No load		0.1		V
Output Swing High	No load		2.8		V
<b>POWER SUPPLY</b>					
Operating Voltage Range		2.0		3.6	V
Quiescent Supply Current			320		μA
Turn-On Time <sup>7</sup>	No external filter		1		ms
<b>TEMPERATURE</b>					
Operating Temperature Range		-25		70	°C

<sup>1</sup> Defined as coupling between any two axes.

<sup>2</sup> Sensitivity is essentially ratiometric to V<sub>S</sub>. For V<sub>S</sub> = 2.7 V to 3.3 V, sensitivity is TBD mV/V/g to TBD mV/V/g typical.

<sup>3</sup> Defined as the output change from ambient-to-maximum temperature or ambient-to-minimum temperature.

<sup>4</sup> Actual frequency response controlled by user-supplied external filter capacitors (C<sub>X</sub>, C<sub>Y</sub>, C<sub>Z</sub>).

<sup>5</sup> Bandwidth with external capacitors = 1/(2 × π × 32 kΩ × C). For C<sub>X</sub>, C<sub>Y</sub>, C<sub>Z</sub> = 0.003 μF, bandwidth = 1.6 kHz. For C<sub>X</sub>, C<sub>Y</sub>, C<sub>Z</sub> = 10 μF, bandwidth = 0.5 Hz.

<sup>6</sup> Self-test response changes cubically with V<sub>S</sub>.

<sup>7</sup> Turn-on time is dependent on C<sub>X</sub>, C<sub>Y</sub>, C<sub>Z</sub> and is approximately 160 × C<sub>X</sub> or C<sub>Y</sub> or C<sub>Z</sub> + 1 ms, where C<sub>X</sub>, C<sub>Y</sub>, C<sub>Z</sub> are in μF.

## ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Acceleration (Any Axis, Unpowered)	10,000 <i>g</i>
Acceleration (Any Axis, Powered)	10,000 <i>g</i>
$V_s$	-0.3 V to +7.0 V
All Other Pins	(COM - 0.3 V) to ( $V_s$ + 0.3 V)
Output Short-Circuit Duration (Any Pin to Common)	Indefinite
Temperature Range (Powered)	-55°C to +125°C
Temperature Range (Storage)	-65°C to +150°C

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



### PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

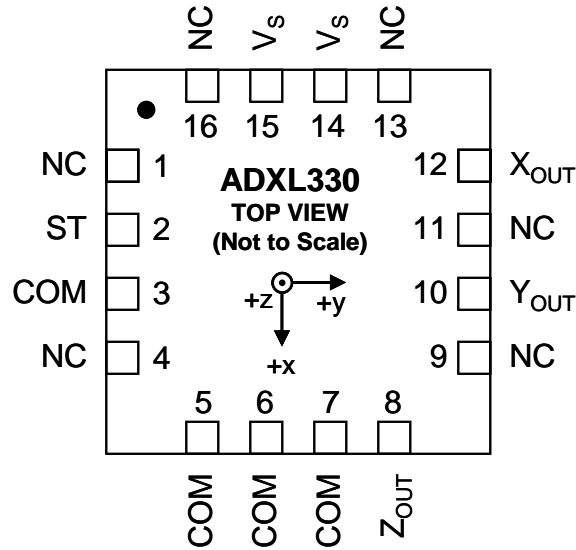


Figure 2. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	NC	No Connect
2	ST	Self-Test
3	COM	Common
4	NC	No Connect
5	COM	Common
6	COM	Common
7	COM	Common
8	Z <sub>OUT</sub>	Z Channel Output
9	NC	No Connect
10	Y <sub>OUT</sub>	Y Channel Output
11	NC	No Connect
12	X <sub>OUT</sub>	X Channel Output
13	NC	No Connect
14	V <sub>S</sub>	Supply Voltage (2.0 V to 3.6 V)
15	V <sub>S</sub>	Supply Voltage (2.0 V to 3.6 V)
16	NC	No Connect

**AXES OF ACCELERATION SENSITIVITY**

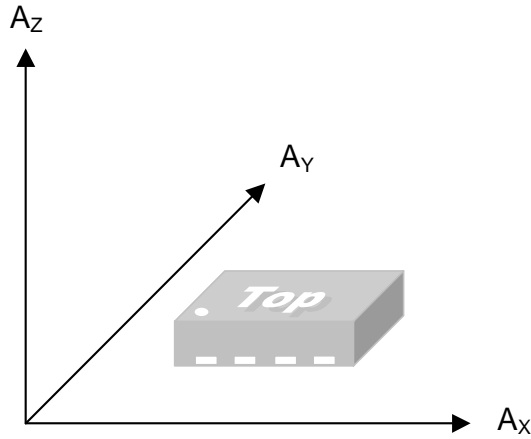


Figure 3. Axes of Acceleration Sensitivity  
(Corresponding Output Voltage Increases When Accelerated Along the Sensitive Axis)

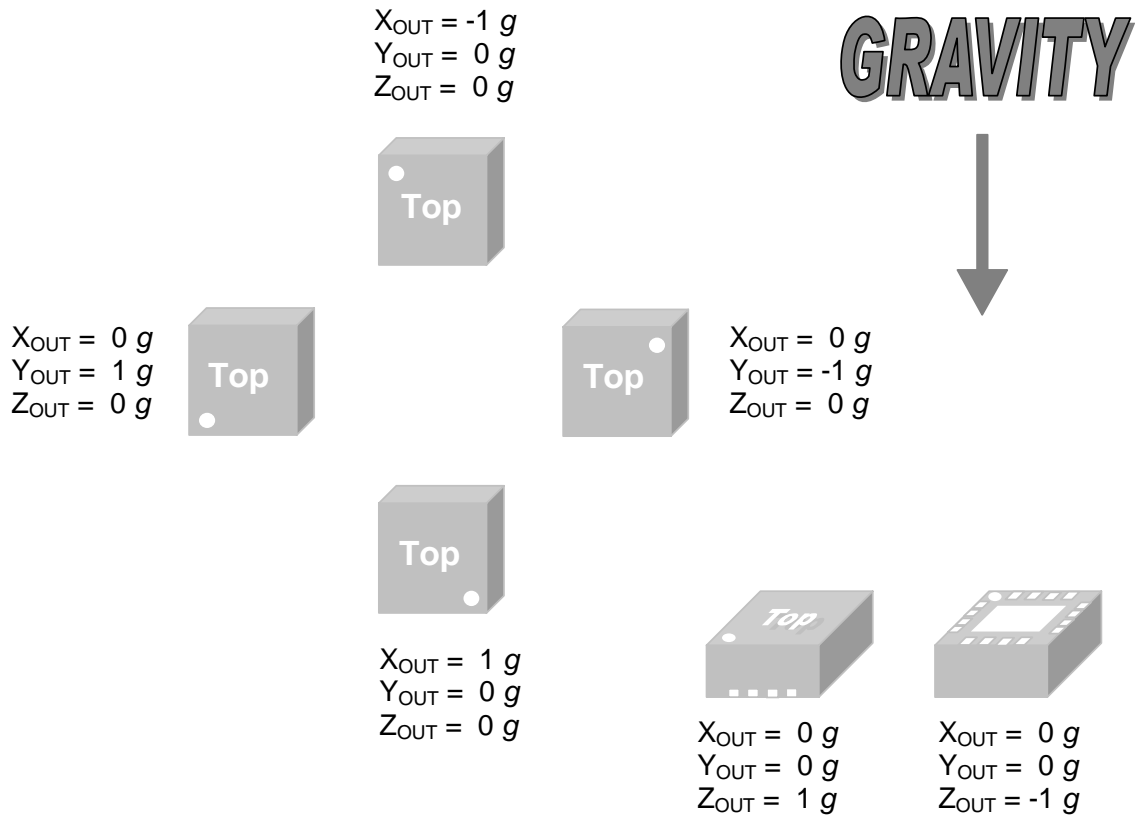


Figure 4. Output Response vs. Orientation to Gravity

### OUTLINE DIMENSIONS

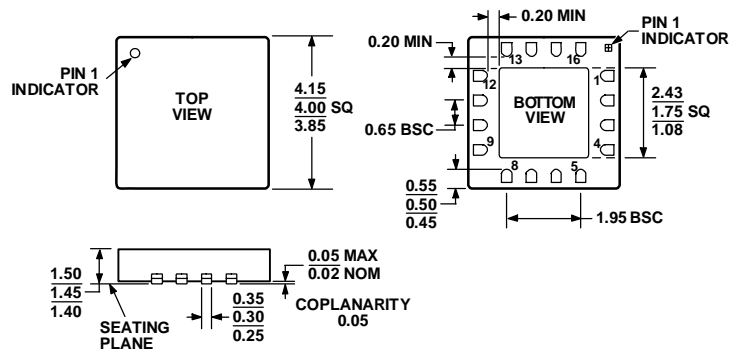


Figure 5. 16-Lead Lead Frame Chip Scale Package [LFCSP]  
 4 mm × 4 mm Body  
 (CP-16-5)  
 Dimensions shown in millimeters  
 (Drawing Not to Scale)

### ORDERING GUIDE

Model	Measurement Range	Specified Voltage (V)	Temperature Range	Package Description	Package Option
ADXL330KCPZ <sup>1</sup>	±2 g	3	-25°C to +70°C	16-Lead LFCSP	CP-16-5
ADXL330KCPZ-RL	±2 g	3	-25°C to +70°C	16-Lead LFCSP	CP-16-5
EVAL-ADXL330				Evaluation Board	

<sup>1</sup> Lead finish—matte tin.

**NOTES**