Small, Low Power, 3-Axis ±2 *g* *i*MEMS® Accelerometer

Preliminary Technical Data

ADXL330

FEATURES

3-axis sensing
Small, low-profile package
4 mm × 4 mm × 1.45 mm LFCSP
Low power
200 µA 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 ±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

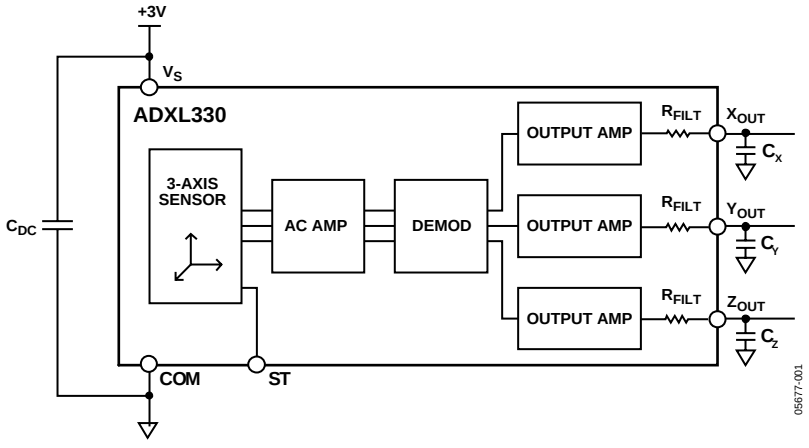

Figure 1.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 www.analog.com
Fax: 781.461.3113

TABLE OF CONTENTS

REVISION HISTORY

10/05—Revision PrA: Preliminary Version

SPECIFICATIONS

T_A = 25°C, V_S = 3 V, C_X = C_Y = C_Z = 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
SENSOR INPUT	Each axis				
Measurement Range		±2	±4		*g*
Nonlinearity	% of full scale		±0.3		%
Inter-Axis Alignment Error			±0.1		Degrees
Cross Axis Sensitivity[1]			±1		%
SENSITIVITY (RATIOMETRIC)[2]	Each axis				
Sensitivity at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 3 V	270	300	330	mV/*g*
Sensitivity Change Due to Temperature[3]	V_S = 3 V		±0.01		%/°C
ZERO *g* BIAS LEVEL (RATIOMETRIC)	Each axis				
0 *g* Voltage at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 3 V	1.2	1.5	1.8	V
0 *g* Offset vs. Temperature			±1		m*g*/°C
NOISE PERFORMANCE					
Noise Density X_{OUT}, Y_{OUT}			170		µ*g*/√Hz rms
Noise Density Z_{OUT}			350		µ*g*/√Hz rms
FREQUENCY RESPONSE[4]					
Bandwidth X_{OUT}, Y_{OUT}[5]	No external filter		1600		Hz
Bandwidth Z_{OUT}	No external filter		550		Hz
R_{FILT} Tolerance			32 ± 15%		kΩ
Sensor Resonant Frequency			5.5		kHz
SELF-TEST[6]					
Logic Input Low			+0.6		V
Logic Input High			+2.4		V
Output Change at X_{OUT}	Self-test 0 to 1		−130		mV
Output Change at Y_{OUT}	Self-test 0 to 1		+130		mV
Output Change at Z_{OUT}	Self-test 0 to 1		−70		mV
OUTPUT AMPLIFIER					
Output Swing Low	No load		0.1		V
Output Swing High	No load		2.8		V
POWER SUPPLY					
Operating Voltage Range		2.0		3.6	V
Quiescent Supply Current			320		µA
Turn-On Time[7]	No external filter		1		ms
TEMPERATURE					
Operating Temperature Range		−25		70	°C

[1] Defined as coupling between any two axes.
[2] Sensitivity is essentially ratiometric to V_S. For V_S = 2.7 V to 3.3 V, sensitivity is TBD mV/V/*g* to TBD mV/V/*g* typical.
[3] Defined as the output change from ambient-to-maximum temperature or ambient-to-minimum temperature.
[4] Actual frequency response controlled by user-supplied external filter capacitors (C_X, C_Y, C_Z).
[5] Bandwidth with external capacitors = $1/(2 \times \pi \times 32\ k\Omega \times C)$. For C_X, C_Y, C_Z = 0.003 µF, bandwidth = 1.6 kHz. For C_X, C_Y, C_Z = 10 µF, bandwidth = 0.5 Hz.
[6] Self-test response changes cubically with V_S.
[7] Turn-on time is dependent on C_X, C_Y, C_Z and is approximately 160 × C_X or C_Y or C_Z + 1 ms, where C_X, C_Y, C_Z are in µF.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Acceleration (Any Axis, Unpowered)	10,000 *g*
Acceleration (Any Axis, Powered)	10,000 *g*
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

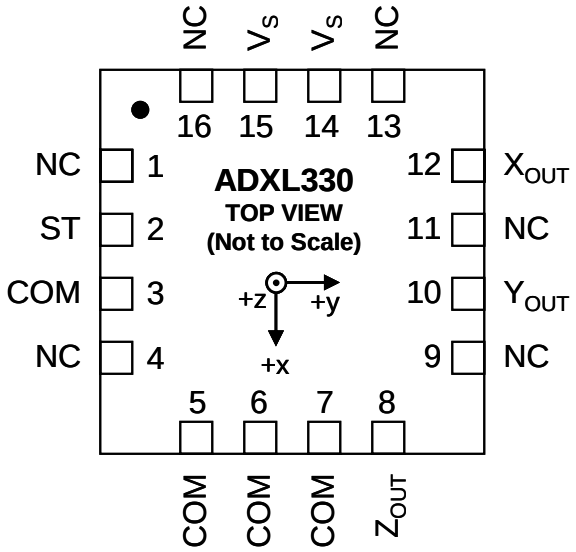

Figure 2. Pin Configuration

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_{OUT}	Z Channel Output
9	NC	No Connect
10	Y_{OUT}	Y Channel Output
11	NC	No Connect
12	X_{OUT}	X Channel Output
13	NC	No Connect
14	V_S	Supply Voltage (2.0 V to 3.6 V)
15	V_S	Supply Voltage (2.0 V to 3.6 V)
16	NC	No Connect

AXES OF ACCELERATION SENSITIVITY

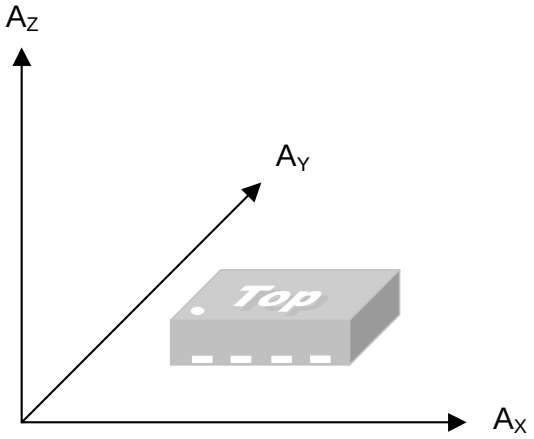

Figure 3. Axes of Acceleration Sensitivity
(Corresponding Output Voltage Increases When Accelerated Along the Sensitive Axis)

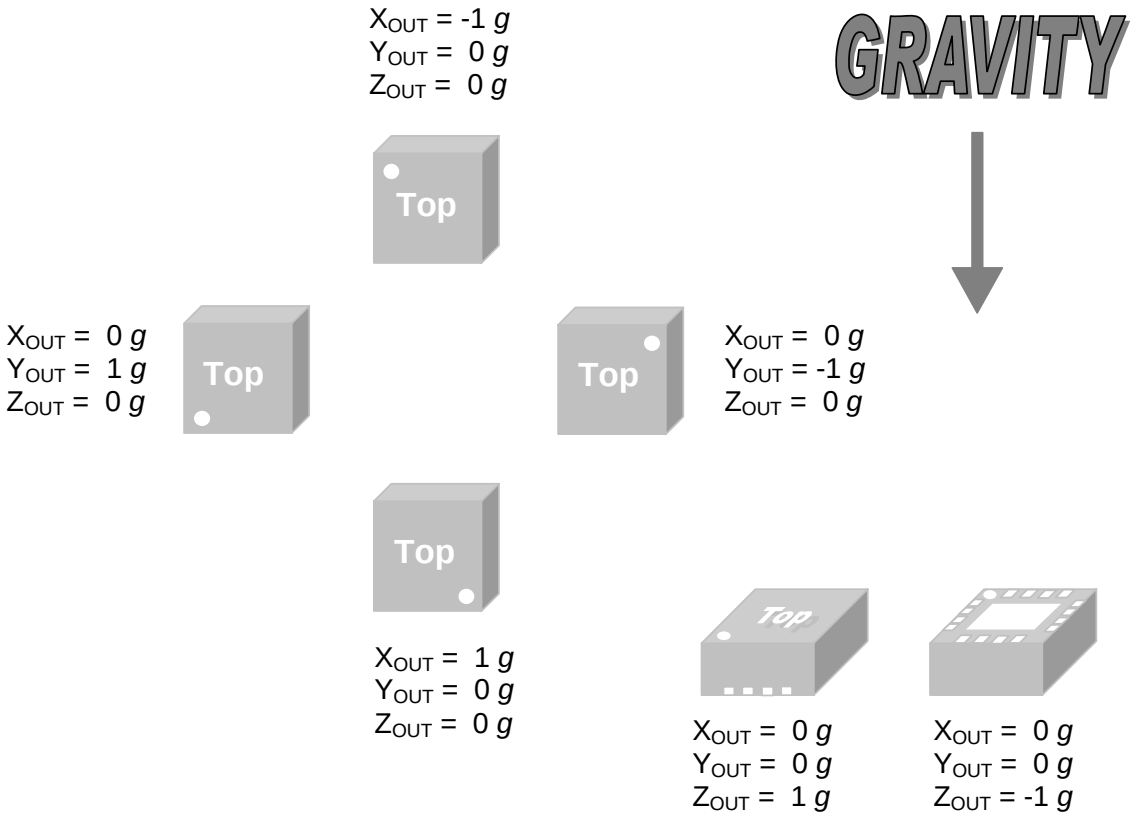

Figure 4. Output Response vs. Orientation to Gravity

OUTLINE DIMENSIONS

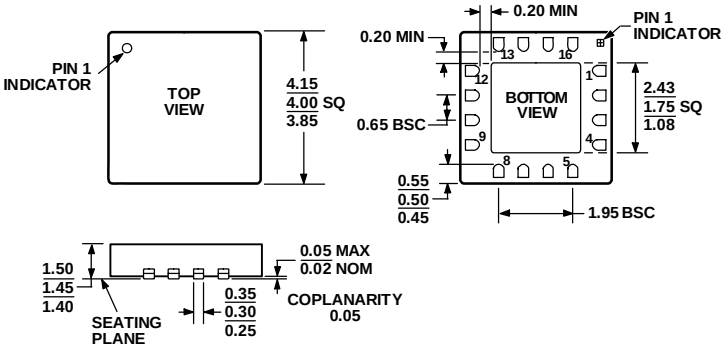

Figure 5. 16-Lead Lead Frame Chip Scale Package [LFCSP]
4 mm × 4 mm Body
(CP-16-5)
Dimensions shown in millimeters
(Drawing Not to Scale)

ORDERING GUIDE

Model	Measurement Range	Specified Voltage (V)	Temperature Range	Package Description	Package Option
ADXL330KCPZ[1]	±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	

[1] Lead finish—matte tin.

NOTES

D05677-0-10/05(PrA)