

Esercitazione 4

ADXL335 (accelerometro triassiale): uscita del sensore per un'accelerazione di (0; -9.8; 1) [m/s²]; fino a quale frequenza di variazione dell'accelerazione può essere utilizzato il sensore (file collegato esercitazione4.m)



Small, Low Power, 3-Axis $\pm 3\text{ g}$ Accelerometer

ADXL335

FEATURES

3-axis sensing

Small, low profile package

4 mm × 4 mm × 1.45 mm LFCSP

Low power : 350 μA (typical)

Single-supply operation: 1.8 V to 3.6 V

10,000 g shock survival

Excellent temperature stability

BW adjustment with a single capacitor per axis

RoHS/WEEE lead-free compliant

APPLICATIONS

Cost sensitive, low power, motion- and tilt-sensing applications

Mobile devices

Gaming systems

Disk drive protection

Image stabilization

Sports and health devices

GENERAL DESCRIPTION

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of $\pm 3\text{ g}$. 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 the C_X , C_Y , and C_Z capacitors at the X_{OUT} , Y_{OUT} , and Z_{OUT} pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

The ADXL335 is available in a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP_LQ).

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		±3	±3.6		g
Nonlinearity	% of full scale		±0.3		%
Package Alignment Error			±1		Degrees
Interaxis 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)					
0 g Voltage at X _{OUT} , Y _{OUT}	V _S = 3 V	1.35	1.5	1.65	V
0 g Voltage at Z _{OUT}	V _S = 3 V	1.2	1.5	1.8	V
0 g Offset vs. Temperature			±1		mg/°C
NOISE PERFORMANCE					
Noise Density X _{OUT} , Y _{OUT}			150		µg/√Hz rms
Noise Density Z _{OUT}			300		µg/√Hz rms
FREQUENCY RESPONSE ⁴					
Bandwidth X _{OUT} , Y _{OUT} ⁵	No external filter		1600		Hz
Bandwidth Z _{OUT} ⁵	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
ST Actuation Current			+60		µA
Output Change at X _{OUT}	Self-Test 0 to Self-Test 1	−150	−325	−600	mV
Output Change at Y _{OUT}	Self-Test 0 to Self-Test 1	+150	+325	+600	mV
Output Change at Z _{OUT}	Self-Test 0 to Self-Test 1	+150	+550	+1000	mV
OUTPUT AMPLIFIER					
Output Swing Low	No load		0.1		V
Output Swing High	No load		2.8		V
POWER SUPPLY					
Operating Voltage Range		1.8		3.6	V
Supply Current	V _S = 3 V		350		µA
Turn-On Time ⁷	No external filter		1		ms
TEMPERATURE					
Operating Temperature Range		−40		+85	°C

ADXL330

- Dal datasheet
 - Sensibilità 300 mV/g
 - Linearità $\pm 0.3\%$
 - Errore di taratura non definito!
 - Offset 1.5V

Funzione di taratura

- Le funzione di taratura è compresa nella fascia a ridosso dell'approssimazione lineare della curva di taratura determinata dall'errore di non linearità (non essendo definita l'incertezza assoluta)
- Approssimazione lineare curva di taratura

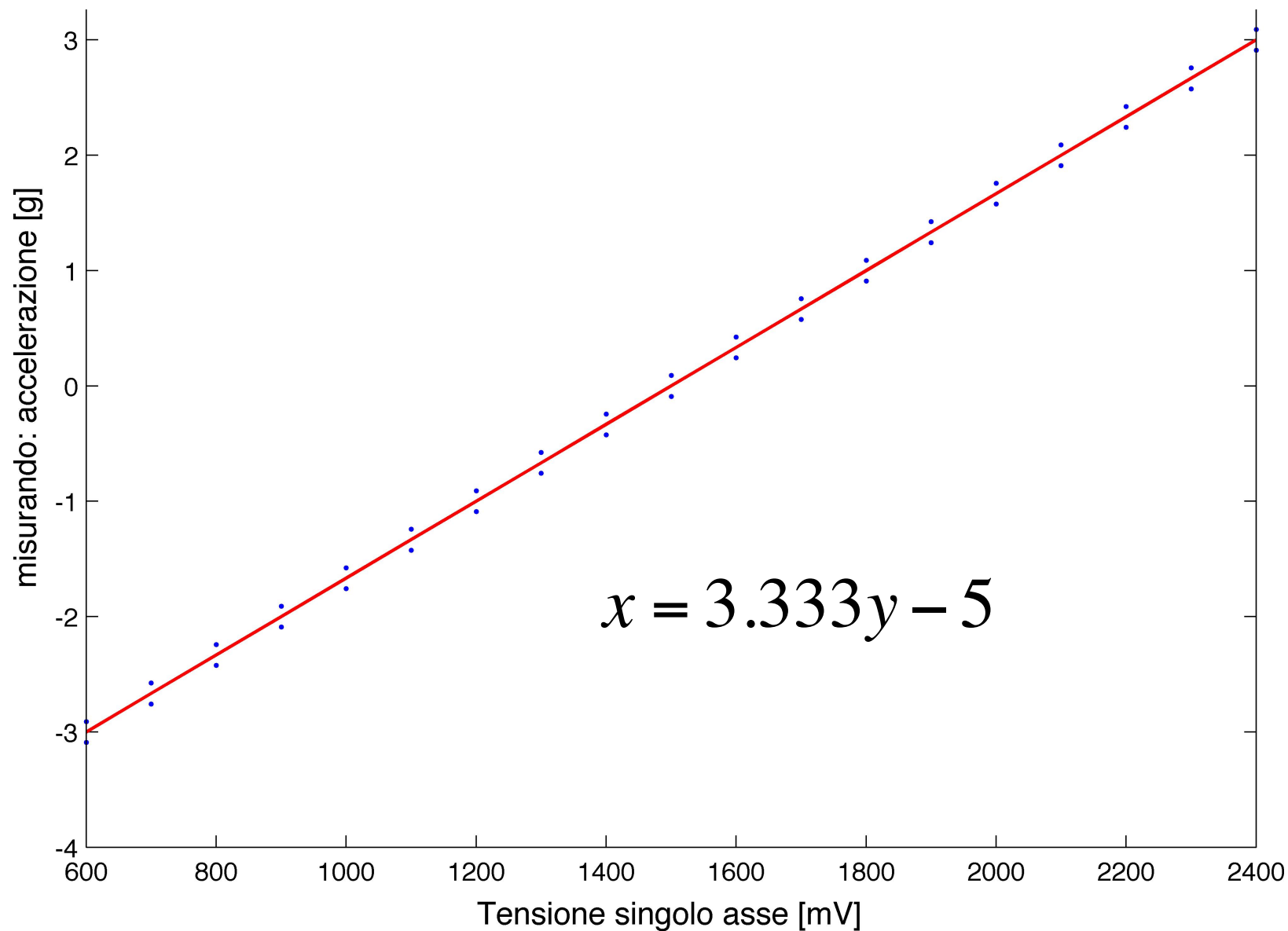
$$x = cy + q$$

$$c = (1 / 300) \quad [\text{g/mV}] \text{ Inverso sensibilità}$$

$$q = -c \cdot \text{offset}$$

- Incertezza totale (supponiamo la non linearità relativa riferita la fondo scala di 3g): $0.003 * 6\text{g} = 0.018 \text{ g}$

Approssimazione Funzione di taratura



Uscita

- Riporto l'accelerazione in unità di g (divido per 9.8m/s^2)
 - (0; -9.8; 1) ->(0; -1;0.1)
 - Considero la relazione tra accelerazione e uscita:
$$Y = s \cdot X + offset$$
$$s = 300 \cdot 10^{-3} \quad offset = 1.5V$$
 - considerando l'uscita soprariportata, utilizzando l'approssimazione lineare ottengo (1.5; 1.2;1.53) V
- Frequenza utile fino a 550 Hz