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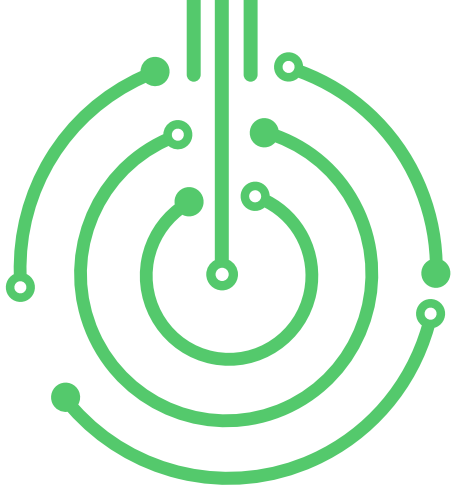


Signal Conditioner for Piezoelectric Sensors

SKU: EL145286

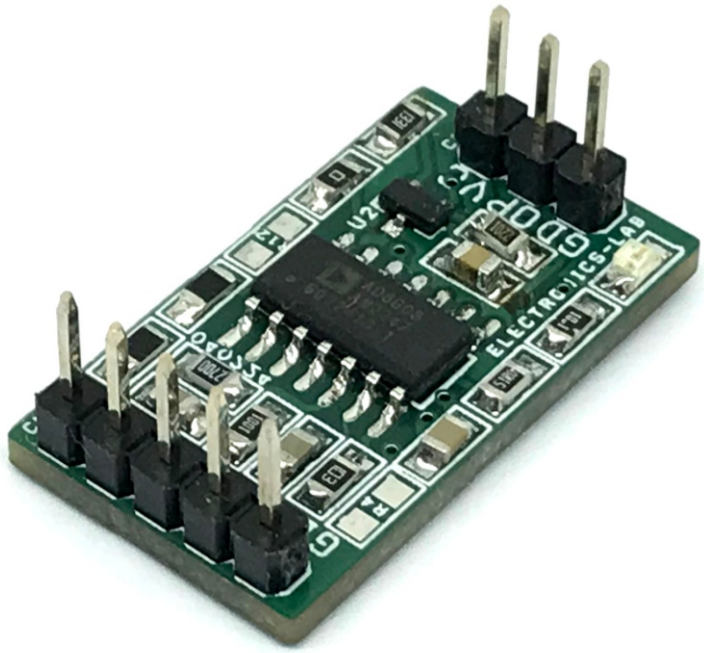
Signal Conditioner for Piezoelectric Sensors

This is a simple signal conditioner circuit for Piezoelectric sensors. The circuit converts the input charge to voltage and the level shifts to the ADC input range of 0.1 V to 2.4 V. The circuit is built using AD8608 OPAMP from Analog devices. Piezoelectric elements are used to construct transducers for a vast number of different applications. Piezoelectric materials generate an electrical charge in response to mechanical movement, or vice versa, produce mechanical movement in response to electrical input. The board shown here is suitable for the Kistler type 8002K sensor. The K8002K is a high-precision accelerometer for shock and vibration measurements.

Piezoelectric elements are commonly used for the measurement of acceleration and vibration. Here, the piezoelectric crystal is used in conjunction with a seismic mass m. If the mass is subjected to acceleration a, then there is a resulting inertial force F = m × a acting on the seismic mass and the piezoelectric crystal. This results in the crystal acquiring a charge q = d × F, where d (measured in Coulombs/Newton, C/N) is the crystal charge sensitivity to force.

FEATURES

- Supply 3.3V DC
- Output 100mV to 2.4V
- On Board Optional Reference Chip
- On Board Power LED
- PCB Dimensions 26.35X14.92MM



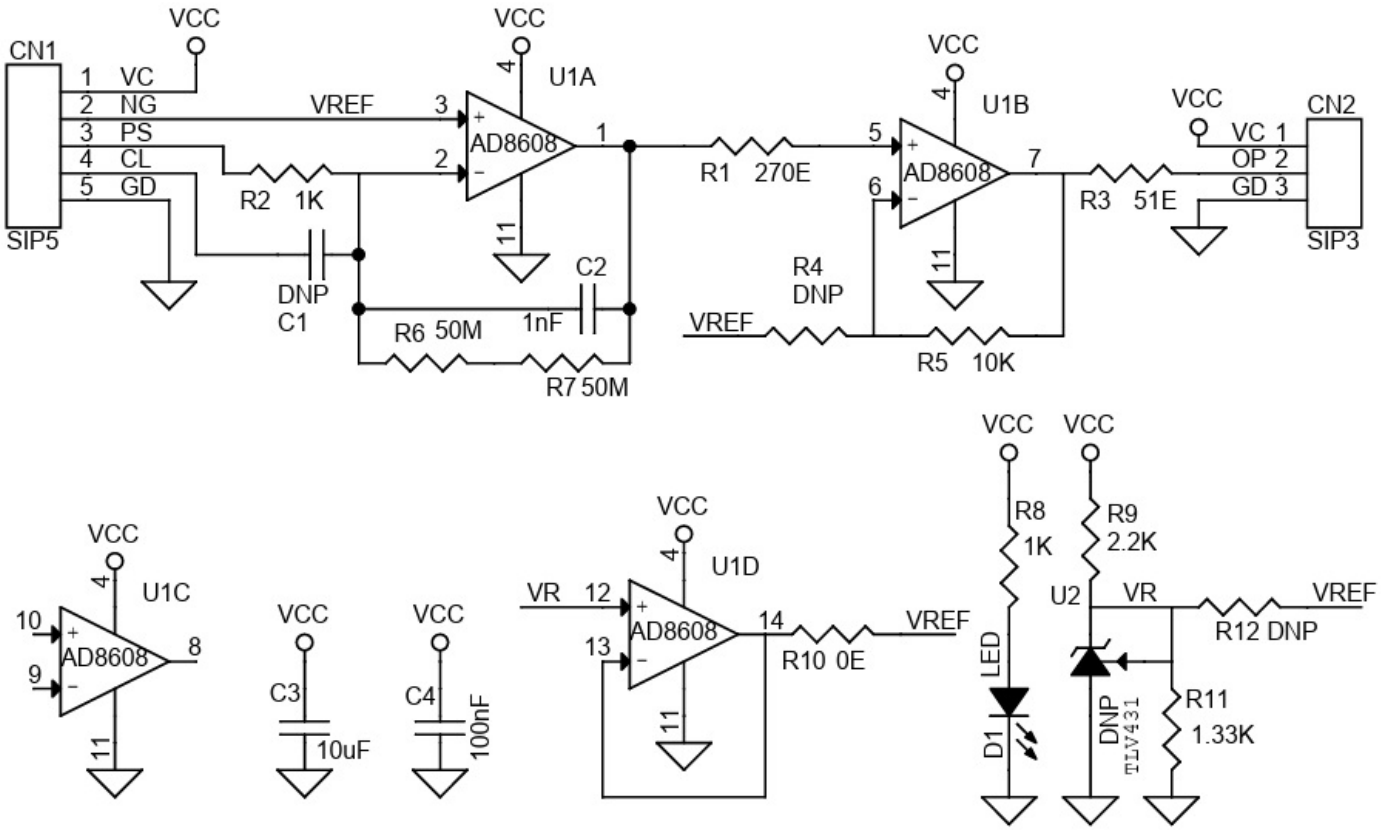
The first stage of the signal conditioning circuit is a charge amplifier (U1A and capacitor C2), The output of the circuit is shifted to handle bipolar input signals (for example, vibration measurements). The zero of the circuit is shifted to the middle of the input range of the ADC, using a reference of 1.25 V. The second stage of the signal conditioning circuit is a non-inverting amplifier which provides the output.

Reference Voltage approx. 1.25V is generated through resistor dividers R9 and R11. An optional chip U2 TLV431 SOT23-3 can be used for accurate reference voltage. The circuit is from the Analog Device's Application Note. Considering the tolerances of the parts, the minimum output voltage (low limit of the range) is set to 100 mV to allow for a safety margin. The upper limit of the output range is set to 2.4 V to give 100 mV headroom for the positive swing at the ADC input. Therefore, the nominal output voltage range of the input op amp is 0.1 V to 2.4 V.

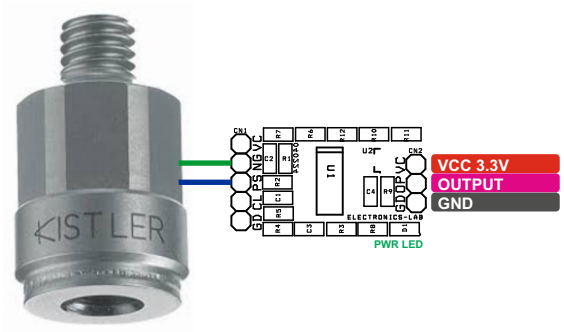
Sensor (Kistler type 8002K quartz accelerometer)

Type 8002K is a high-precision accelerometer for shock and vibration measurements in laboratory applications. Its excellent performance is derived from an ultra-stable crystalline quartz sensing element. Contained within the housing is a piezoelectric assembly consisting of a seismic mass preloaded to a quartz element stack. The force acting on the quartz measuring element is proportional to the acceleration following Newton's Law: F=ma. This element, in turn, gives an electrical charge signal proportional to the force, and therefore, to the acceleration. The charge signal is conducted through a low-noise coaxial cable, such as the 1631 series, and then converted and amplified to a proportional output voltage in a charge amplifier (such as Type 5010). The 8002K accelerometer is a special version with an emphasis on transverse sensitivity and amplitude non-linearity. The 8002K along with a 5022 Charge Amplifier form.

Schematic


CN1
1 VC
2 NG
3 PS
4 CL
5 GD
SIP5
VCC
VREF
R2 1K
DNP
C1
U1A
AD8608
R6 50M
1nF
C2
R7 50M
R1 270E
U1B
R4
DNP
VREF
R5 10K
R3 51E
CN2
VC 1
OP 2
GD 3
SIP3
U1C
C3
10uF
C4
100nF
U1D
VR
R10 0E
R8
1K
R9
2.2K
U2
R12 DNP
LED
D1
DNP
TLV431
R11
1.33K

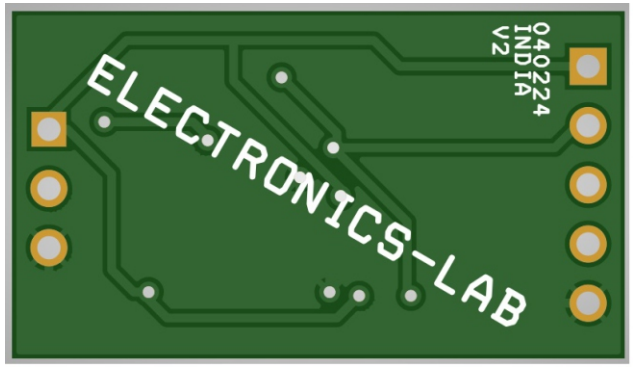
Connections

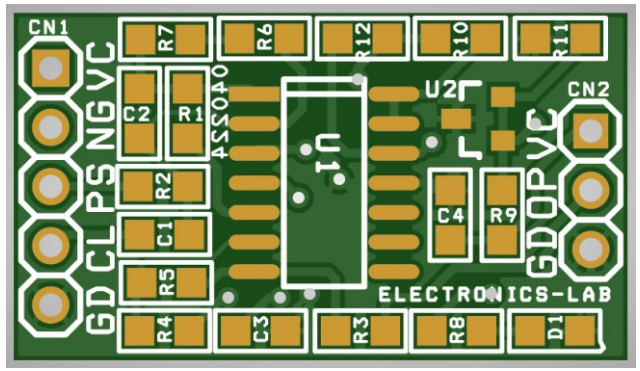


Connections

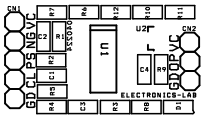
- CN1: Pin 1 = VCC, Pin 2 = Negative, Pin 3 = Positive, Pin 4 = NC, Pin 5 = GND
- CN2: Pin 1 = VCC, Pin 2 = Output, Pin 3 = GND
- D1: Power LED

PCB

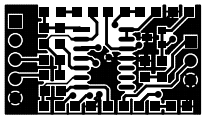




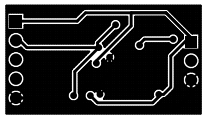
PCB GERBER FILES AVAILABLE



SILK SCREEN TOP



BOTTOM LAYER



TOP LAYER

PCB DIMENSIONS 26.35X14.92MM

Parts List

BOM						
NO	QNTY.	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	5 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5318-ND
2	1	CN2	3 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5316-ND
3	4	C1,U2,R4,R12	DNP		DIGIKEY	
4	1	C2	1nF/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
5	1	C3	10uF/10V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
6	1	C4	100nF/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
7	1	D1	LED SIZE 0805	OSRAM	DIGIKEY	475-1278-1-ND
8	1	R1	270E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
9	2	R2,R8	1K 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
10	1	R3	51E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
11	1	R5	10K 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
12	2	R6,R7	50M 1% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
13	1	R9	2.2K 1% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
14	1	R10	0E SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
15	1	R11	1.33K 1% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
16	1	U1	AD8608 SOIC14	ANALOG DEVICE	DIGIKEY	505-AD8608ARZ-ND

Notes

APP

Android App

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