

# AIRduino Guitar Datasheet

## Ultrasonic Distance Sensor (HC-SR04):

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

### Features:

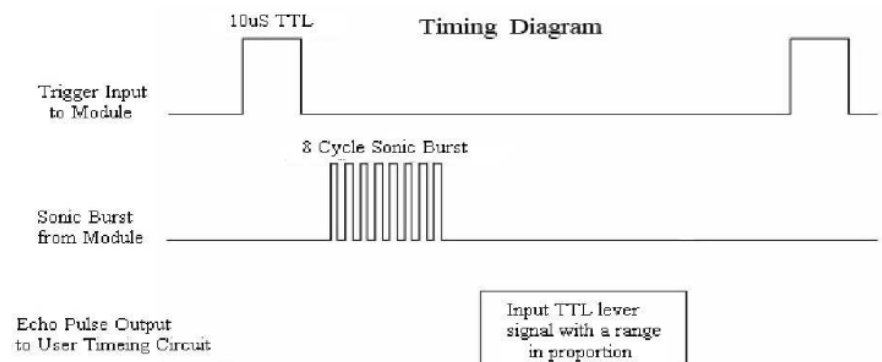
- Using IO trigger for at least 10us high level signal.
- The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.
- Test distance = (high level time  $\times$  velocity of sound (340M/S) / 2

NOTE: In our case we removed the division by 2 as we have modified this sensor. The resulting formula is then:

- Test distance = (high level time  $\times$  velocity of sound (340M/S)

### Electric Parameters:

Operating Voltage	5V DC
Operating Current	15mA
Operating Frequency	40KHz
Min Range	2cm / 1 inch
Max Range	400cm / 13 feet
Accuracy	3mm
Measuring Angle	<15°
Dimension	45 x 20 x 15mm



## MPU-6050 Accelerometer:

The accelerometer we used has multiple features that are out of scope for this project so we will emphasize the ones we used.

### Features:

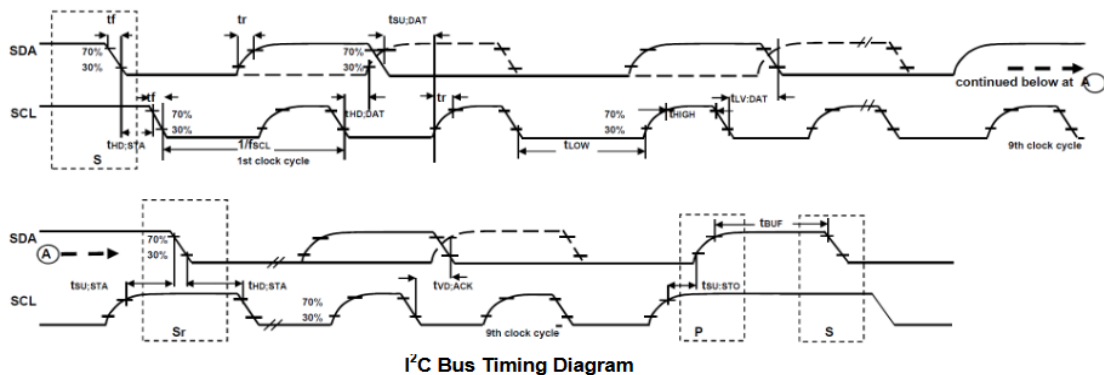
- Digital-output triple-axis accelerometer with a programmable full-scale range of  $\pm 2g$ ,  $\pm 4g$ ,  $\pm 8g$  and  $\pm 16g$ .

- Integrated 16-bit ADCs enable simultaneous sampling of accelerometers while requiring no external multiplexer.
- Accelerometer normal operating current: 500 $\mu$ A.
- Low power accelerometer mode current: 10 $\mu$ A at 1.25Hz, 20 $\mu$ A at 5Hz, 60 $\mu$ A at 20Hz, 110 $\mu$ A at 40Hz.
- Orientation detection and signaling.
- Tap detection.
- User-programmable interrupts.
- High-G interrupt.
- User self-test.

### Specifications:

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
<b>ACCELEROMETER SENSITIVITY</b> Full-Scale Range  ADC Word Length Sensitivity Scale Factor  Initial Calibration Tolerance Sensitivity Change vs. Temperature Nonlinearity Cross-Axis Sensitivity	AFS_SEL=0		$\pm 2$		g	
	AFS_SEL=1		$\pm 4$		g	
	AFS_SEL=2		$\pm 8$		g	
	AFS_SEL=3		$\pm 16$		g	
	Output in two's complement format		16		bits	
	AFS_SEL=0		16,384		LSB/g	
	AFS_SEL=1		8,192		LSB/g	
	AFS_SEL=2		4,096		LSB/g	
	AFS_SEL=3		2,048		LSB/g	
			$\pm 3$		%	
<b>ZERO-G OUTPUT</b> Initial Calibration Tolerance  Zero-G Level Change vs. Temperature	X and Y axes		$\pm 50$		mg	1
	Z axis		$\pm 80$		mg	
	X and Y axes, 0°C to +70°C		$\pm 35$			
	Z axis, 0°C to +70°C		$\pm 60$		mg	
<b>SELF TEST RESPONSE</b> Relative	Change from factory trim	-14		14	%	2
<b>NOISE PERFORMANCE</b> Power Spectral Density	@10Hz, AFS_SEL=0 & ODR=1kHz		400		$\mu$ g/ $\sqrt{\text{Hz}}$	
<b>LOW PASS FILTER RESPONSE</b>	Programmable Range	5		260	Hz	
<b>OUTPUT DATA RATE</b>	Programmable Range	4		1,000	Hz	
<b>INTELLIGENCE FUNCTION INCREMENT</b>			32		mg/LSB	

### I<sup>2</sup>C Timing Characteristics:



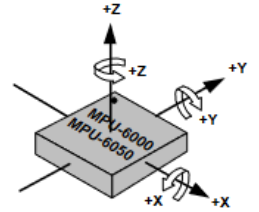
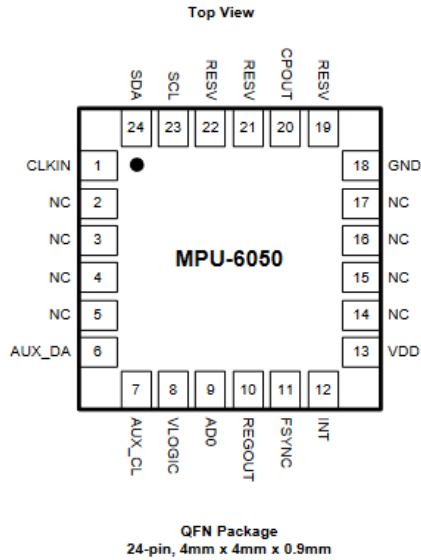
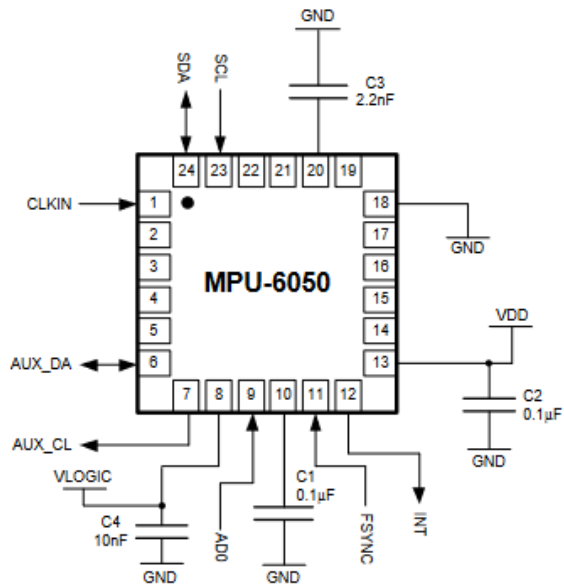
Parameters	Conditions	Min	Typical	Max	Units	Notes
<b>I<sup>2</sup>C TIMING</b>	<b>I<sup>2</sup>C FAST-MODE</b>					
f <sub>SCL</sub> , SCL Clock Frequency				400	kHz	
t <sub>HD,STA</sub> , (Repeated) START Condition Hold Time		0.6			μs	
t <sub>LOW</sub> , SCL Low Period		1.3			μs	
t <sub>HIGH</sub> , SCL High Period		0.6			μs	
t <sub>SU,STA</sub> , Repeated START Condition Setup Time		0.6			μs	
t <sub>HD,DAT</sub> , SDA Data Hold Time		0			μs	
t <sub>SU,DAT</sub> , SDA Data Setup Time		100			ns	
t <sub>r</sub> , SDA and SCL Rise Time	C <sub>b</sub> bus cap. from 10 to 400pF	20+0.1C <sub>b</sub>		300	ns	
t <sub>f</sub> , SDA and SCL Fall Time	C <sub>b</sub> bus cap. from 10 to 400pF	20+0.1C <sub>b</sub>		300	ns	
t <sub>SU,STO</sub> , STOP Condition Setup Time		0.6			μs	
t <sub>BUF</sub> , Bus Free Time Between STOP and START Condition		1.3			μs	
C <sub>b</sub> , Capacitive Load for each Bus Line			< 400		pF	
t <sub>VD,DAT</sub> , Data Valid Time				0.9	μs	
t <sub>VD,ACK</sub> , Data Valid Acknowledge Time				0.9	μs	

### Absolute Maximum Ratings

Stress above those listed as “Absolute Maximum Ratings” may cause permanent damage to the device.

Parameter	Rating
Supply Voltage, VDD	-0.5V to +6V
VLOGIC Input Voltage Level (MPU-6050)	-0.5V to VDD + 0.5V
REGOUT	-0.5V to 2V
Input Voltage Level (CLKIN, AUX_DA, AD0, FSYNC, INT, SCL, SDA)	-0.5V to VDD + 0.5V
CPOUT (2.5V ≤ VDD ≤ 3.6V )	-0.5V to 30V
Acceleration (Any Axis, unpowered)	10,000g for 0.2ms
Operating Temperature Range	-40°C to +105°C
Storage Temperature Range	-40°C to +125°C
Electrostatic Discharge (ESD) Protection	2kV (HBM); 250V (MM)
Latch-up	JEDEC Class II (2), 125°C ±100mA

## Pin out and Signal schematics:



Orientation of Axes of Sensitivity and Polarity of Rotation

Pin Name	Pin Description
CLKIN	Optional external reference clock input. Connect to GND if unused.
AUX_DA	I <sup>2</sup> C master serial data, for connecting to external sensors
AUX_CL	I <sup>2</sup> C Master serial clock, for connecting to external sensors
/CS	SPI chip select (0=SPI mode)
VLOGIC	Digital I/O supply voltage
AD0 / SDO	I <sup>2</sup> C Slave Address LSB (AD0); SPI serial data output (SDO)
AD0	I <sup>2</sup> C Slave Address LSB (AD0)
REGOUT	Regulator filter capacitor connection
FSYNC	Frame synchronization digital input. Connect to GND if unused.
INT	Interrupt digital output (totem pole or open-drain)
VDD	Power supply voltage and Digital I/O supply voltage
GND	Power supply ground
RESV	Reserved. Do not connect.
CPOUT	Charge pump capacitor connection
RESV	Reserved. Do not connect.
SCL / SCLK	I <sup>2</sup> C serial clock (SCL); SPI serial clock (SCLK)
SCL	I <sup>2</sup> C serial clock (SCL)
SDA / SDI	I <sup>2</sup> C serial data (SDA); SPI serial data input (SDI)
SDA	I <sup>2</sup> C serial data (SDA)
NC	Not internally connected. May be used for PCB trace routing.

## Overall System:

Accuracy	5.47%
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