AIRduino Guitar Datasheet

Ultrasonic Distance Sensor (HC-SR04):

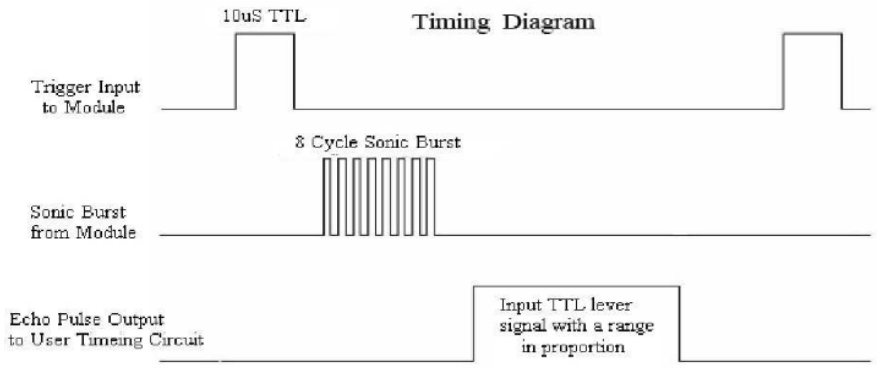
Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

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 × 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 × 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:

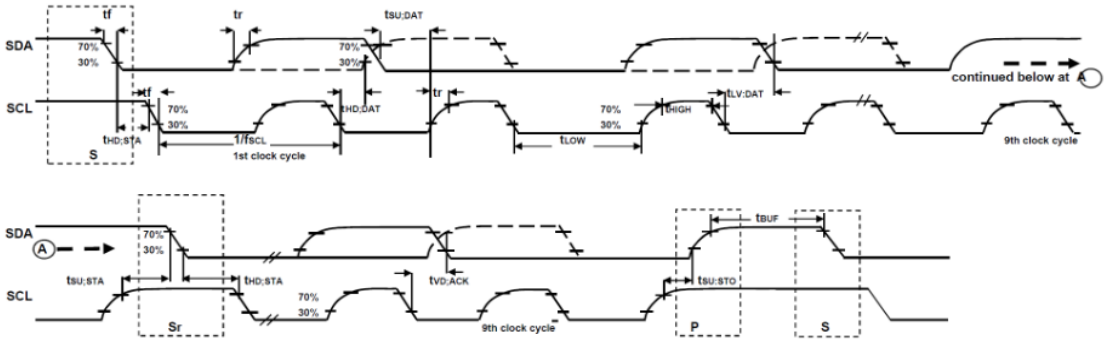
- Digital-output triple-axis accelerometer with a programmable full-scale range of ±2g, ±4g, ±8g and±16g.

- Integrated 16-bit ADCs enable simultaneous sampling of accelerometers while requiring no external multiplexer.
- Accelerometer normal operating current: 500µA.
- Low power accelerometer mode current: 10µA at 1.25Hz, 20µA at 5Hz, 60µA at 20Hz, 110µA 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
ACCELEROMETER SENSITIVITY						
Full-Scale Range	AFS_SEL=0		±2		*g*	
	AFS_SEL=1		±4		*g*	
	AFS_SEL=2		±8		*g*	
	AFS_SEL=3		±16		*g*	
ADC Word Length	Output in two's complement format		16		bits	
Sensitivity Scale Factor	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*	
Initial Calibration Tolerance			±3		%	
Sensitivity Change vs. Temperature	AFS_SEL=0, -40°C to +85°C		±0.02		%/°C	
Nonlinearity	Best Fit Straight Line		0.5		%	
Cross-Axis Sensitivity			±2		%	
ZERO-G OUTPUT						
Initial Calibration Tolerance	X and Y axes		±50		mg	1
	Z axis		±80		mg	
Zero-G Level Change vs. Temperature	X and Y axes, 0°C to +70°C		±35			
	Z axis, 0°C to +70°C		±60		mg	
SELF TEST RESPONSE						
Relative	Change from factory trim	-14		14	%	2
NOISE PERFORMANCE						
Power Spectral Density	@10Hz, AFS_SEL=0 & ODR=1kHz		400		µg/ √ Hz	
LOW PASS FILTER RESPONSE						
	Programmable Range	5		260	Hz	
OUTPUT DATA RATE						
	Programmable Range	4		1,000	Hz	
INTELLIGENCE FUNCTION INCREMENT			32		mg/LSB	

I^2C Timing Characteristics:



I^2C Bus Timing Diagram

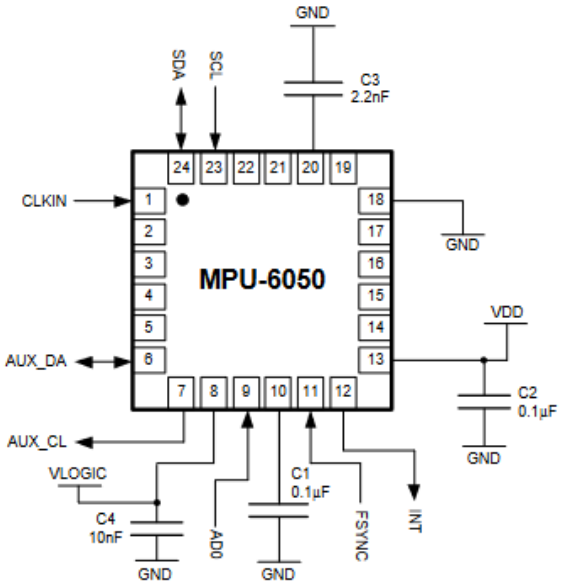
Parameters	Conditions	Min	Typical	Max	Units	Notes
I^2C TIMING	I^2C FAST-MODE					
f_{SCL}, SCL Clock Frequency				400	kHz	
$t_{HD.STA}$, (Repeated) START Condition Hold Time		0.6			µs	
t_{LOW}, SCL Low Period		1.3			µs	
t_{HIGH}, SCL High Period		0.6			µs	
$t_{SU.STA}$, Repeated START Condition Setup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

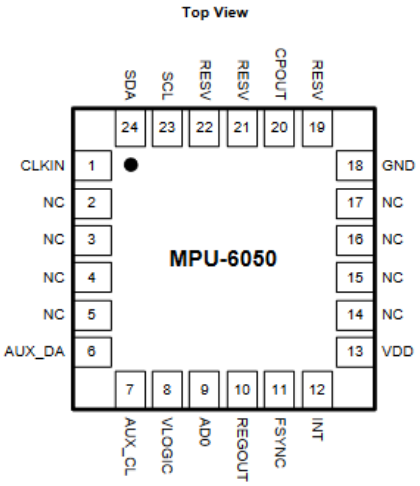
Absolute Maximum Ratings

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

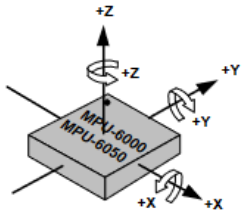
Parameter	Rating
Supply Voltage, VDD	-0.5V to +6V
VLOGIC Input Voltage Level (MPU-6050)	-0.5V to VDD + 0.5V
REGOUT	-0.5V to 2V
Input Voltage Level (CLKIN, AUX_DA, AD0, FSYNC, INT, SCL, SDA)	-0.5V to VDD + 0.5V
CPOUT (2.5V ≤ VDD ≤ 3.6V)	-0.5V to 30V
Acceleration (Any Axis, unpowered)	10,000g for 0.2ms
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:





QFN Package
24-pin, 4mm x 4mm x 0.9mm



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^2C master serial data, for connecting to external sensors
AUX_CL	I^2C Master serial clock, for connecting to external sensors
/CS	SPI chip select (0=SPI mode)
VLOGIC	Digital I/O supply voltage
AD0 / SDO	I^2C Slave Address LSB (AD0); SPI serial data output (SDO)
AD0	I^2C 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^2C serial clock (SCL); SPI serial clock (SCLK)
SCL	I^2C serial clock (SCL)
SDA / SDI	I^2C serial data (SDA); SPI serial data input (SDI)
SDA	I^2C serial data (SDA)
NC	Not internally connected. May be used for PCB trace routing.

Overall System:

Accuracy	5.47%