# Linear Potentiometer - KYOCERA AVX 4114902490

## Description

The 4114902490 is a Conductive Polymer **Potentiometer** with 10mm linear effective travel for automotive and industrial applications. Connection via flying leads colour coded as detailed below, 200mm in length. Standard spindle is 3mm diameter with a length of 29mm from fixing face, but other lengths area available upon request.

## Pin Configuration

|  |  |  |
| --- | --- | --- |
| Pin # | Function | Wire Lead Colour |
| 1 | WIPER/ VCC | RED |
| 2 | OUTPUT | GREEN |
| 3 | GND | YELLOW |

## Overview

|  |  |
| --- | --- |
| ±20% Selection tolerance | 10mm ± 0.5mm Effective travel |
| ±2.0% Typical independent linearity | 12.5mm maximum Mechanical travel |
| <25ppm/ºC Maximum output signal temperature coefficient | 3 x 106 cycles Endurance |
| 4 to 96% 0.5% over a 2 deg window Microgradient in output range | Pin Count: 3 |

## Code

As this is simple potentiometer there’s plenty of documentation online on coding, but here’s an example:

A computer screen shot of a program code

Description automatically generated

## Power Considerations

|  |  |
| --- | --- |
| Isolation voltage – 500V AC RMS | Resistance - 10K Ohm |
| Gang(s) – 1 | Tolerance 20% |
| No detent |  |

## Limitations & Constraints

|  |  |
| --- | --- |
| Operating Temperature -40oC +130OC | Shaft Diameter 3mm |
| Shaft Length 12mm |  |

## Datasheet:

<https://www.farnell.com/datasheets/2861069.pdf>

# Several switches with metal levers Description automatically generatedPlunger Limit Switch - Omron Long Straight Lever Subminiature Micro Switch, PCB Terminal, 100 mA, SPST, IP67

## Description

Long stroke seal switch with high reliability and high insulation performance. Sealed Ultra Subminiature Basic Switch.

## Overview

|  |  |
| --- | --- |
| Current Rating 100mA | Terminal Type PCB |
| Voltage Rating 12V | Contact Configuration – SPSY |
| Case Material - Rubber | IP Rating IP67 |
| Contact Material - Silver | Pin Count: 2 |

## Code

As it’s a simple 2 pin switch the code is very simple again, here’s an example:

A computer screen shot of a program code

Description automatically generated

## Power Considerations

|  |  |
| --- | --- |
| Minimum Applicable load 5VDC 1mA | Rated @ 12VDC 0.1A |

## Limitations & Constraints

|  |  |
| --- | --- |
| Ambient Operating Temperature -40OC to 85OC | Ambient Operation Humidity 95%RH Max. (For +5 to +45OC) |
| Operating Speed 30mm to 500mm/s |  |

## A diagram of a machine Description automatically generated with medium confidenceVariations

# 3-Axis Surface Mount Accelerometer & Gyroscope - LGA-14L, SPI, 14-Pin

## Description

## The LSM6DSV16BX is a system-in-package featuring a 3-axis digital accelerometer and a 3-axis digital gyroscope with a triple core for processing acceleration, angular rate, and Qvar sensing data on three separate channels with dedicated configuration, processing, and filtering. The LSM6DSV16BX integrates a UI sensor, audio accelerometer, and Qvar sensor in a compact package (2.5 x 3.0 x 0.71 mm). The UI in high-performance mode runs at 0.6 mA and enables always-on low-power features for an optimal motion experience for wearable and TWS applications.

## Overview

|  |  |
| --- | --- |
| Sensor Type: Accelerometer, Gyroscope | Package Type LGA-14L |
| Number of Axis: 3 | Pin Count: 14 |
| Mounting Type: Surface Mount | Serial Interface: SPI / I²C & MIPI I3C® v1.1 |

### **Digital Output:** This chip provides digital output and supports various communication protocols like I2C (Inter-Integrated Circuit) and SPI (Serial Peripheral Interface).

### **Temperature Sensor:** This chip includes an integrated temperature sensor to measure the temperature of the device.

### **Low Power Consumption:** It can operate on a low power consumption mode, making them suitable for battery-powered applications.

### A diagram of a computer Description automatically generated**Motion Detection and Free-Fall Detection:** This chip often include features motion detection and free-fall detection, enabling applications to respond to specific motion events.

### Pin Connections

A diagram of a computer

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A table with text and images

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## A screen shot of a computer program Description automatically generatedCode

This example assumes we are using an Arduino platform, at least for prototyping. This code **SHOULD** read the accelerometer and gyroscope data from the LSM6DS3 and prints the values to the serial monitor.

* The **setup** function initializes the communication, the Wire library (I2C communication), and the LSM6DS3 sensor.
* The **loop** function continuously reads accelerometer and gyroscope data, prints it to the serial monitor, and then adds a delay.
* The **initLSM6DS3** function configures the LSM6DS3 sensor by allowing the accelerometer and gyroscope, setting their scales, and configuring the data rate.

A computer screen shot of a program

Description automatically generated

* The **readAccelData** and **readGyroData** functions read accelerometer and gyroscopic data from the sensor.
* The **writeRegister** function is a utility function to write a value to a specific register address on the LSM6DS3.

## Features

|  |  |  |
| --- | --- | --- |
| **Power consumption: 0.95 mA in combo high-performance mode** | ±2/±4/±8/±16 g full scale | ±125/±250/±500/±1000/±2000/±4000 dps full scale |
| **Analog supply voltage: 1.71 V to 3.6 V** | **Independent IO supply (extended range: 1.08 V to 3.6 V)** | Compact footprint: 2.5 mm x 3 mm x 0.71 mm |
| **SPI / I²C & MIPI I3C® v1.1 serial interface with main processor data synchronization** | TDM slave interface | Significant motion detection, tilt detection |
| Standard interrupts: free-fall, wakeup, 6D orientation, click and double-click | Programmable finite state machine for accelerometer, gyroscope, and Qvar sensor data processing with high rate @ 960 Hz | Machine learning core with exportable features and filters for AI applications |
| Embedded Qvar: electric charge variation detection | Embedded analog hub for ADC and processing analog input data | Embedded sensor fusion low-power algorithm |
| Embedded temperature sensor | ECOPACK and RoHS compliant |  |

### Digital Interfaces

The registers embedded inside the LSM6DSV16BX may be accessed through both the I²C and SPI serial interfaces. The latter may be software configured to operate either in 3-wire or 4-wire interface mode. The device is compatible with SPI modes 0 and 3. The serial interfaces are mapped to the same pins. To select/exploit the I²C interface, the CS line must be tied high (that is, connected to Vdd\_IO)

A screen shot of a pin description

Description automatically generated

## Datasheet

<https://docs.rs-online.com/b594/A700000009535778.pdf>

# 3-axis accelerometer, surface mount - MC3479

## Description

The MC3479 is a compact 3-axis accelerometer designed for applications in cell phones and consumer motion sensing products. It features a dedicated motion block with algorithms for various motion detection functionalities such as "any motion," shake detection, tilt/flip, and tilt 35 position detection. The device, designed for low power consumption, is monolithically fabricated, integrating the MEMS accelerometer into a single chip with the electronics circuit. The accelerometer offers a range of sample rates from 0.5 to 2000 samples per second and supports reading sample and event status through polling or interrupts. The primary applications include user interface control, gaming motion input, electronic compass tilt compensation, and integration into devices like cell phones, game controllers, remote controls, and portable media products.

## Overview

In the WAKE state, acceleration data for X, Y, and Z axes is sampled at a rate between 0.5 and 2000 samples/second. The detectable acceleration range is variable and is set in the RANGE bits of the range and scale control register. Supports I2C and SPI

### A table with text and symbols Description automatically generated with medium confidenceA diagram of a square with many squares Description automatically generated with medium confidencePin Diagram

Notes:

1. This pin requires a pull-up resistor, typically 4.7kΩ to pin VDD. Higher resistance values can be used (typically done to reduce current leakage).
2. This pin can be configured by software to operate either as an open-drain output or push-pull output. If set to open-drain, then it requires a pull-up resistor, typically 4.7kΩ to VDD.
3. INTN pin polarity is programmable in the GPIO control register, address 0x33.

### Power Considerations

A close-up of a list

Description automatically generated

### Operational States

The device has two states of operation: STANDBY and WAKE. All states are controlled by the software, there is no automatic power control.

The device defaults to the STANDBY state following a power-up and must be in the WAKE state before executing a reset.A white paper with black text

Description automatically generated

|  |  |  |
| --- | --- | --- |
| Axis: X, Y, Z | Output type: IIC & SPI | Operating temp: -40OC to 85OC |
| Surface Mount | 12 Pins | Supply Voltage: -0.3 to +3.6 |
| Input voltage to non-power pin: -0.3/ (VDD + 0.3) or 3.6, whichever is lower |  |  |

## Code

A screenshot of a computer program

Description automatically generatedA computer screen shot of a program code

Description automatically generated

This is come generic code for a 3-axis accelerometer.

This assumes your using the IIC protocol and the address is 0x1D. This example uses the I2Cdev library to communicate with the accelerometer.

## Datasheet

<https://www.memsic.com/Public/Uploads/uploadfile/files/20220522/MC3479Datasheet(APS-048-0072v1.2).pdf>

# Temperature & Humidity Sensor expansion board - SHT35

Grove - I2C High Accuracy Temp&Humi Sensor(SHT35) is based on SHT3x-DIS. The SHT3x-DIS has increased intelligence, reliability and improved accuracy specifications compared to its predecessor. Its functionality includes enhanced signal processing, two distinctive and user selectable I2C addresses and communication speeds of up to 1 MHz.

## Overview

### A blue circuit board with white text and black text Description automatically generatedPin configuration

A screenshot of a computer program

Description automatically generatedA blue circuit board with white text

Description automatically generated

### Power

The input voltage of this chip ranges from 2.15v-5.5v, so you can use both 3.3v and 5v pin of Arduino to supply for this module.

## Code

This code is from the datasheet and can be found on page 7, with a full tutorial starting on page 6.

## Datasheet

https://www.digikey.co.uk/en/htmldatasheets/production/3484094/0/0/1/101020592

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# GPS Module - ADAFRUIT INDUSTRIES 746

## Description

The breakout is built around the MTK3339 chipset, a no-nonsense, high-quality GPS module that can track up to 22 satellites on 66 channels, has an excellent high-sensitivity receiver (-165 dBm tracking!), and a built-in antenna. It can do up to 10 location updates a second for high speed, high sensitivity logging, or tracking. Power usage is incredibly low, only 20 mA during navigation.

It has an ultra-low dropout 3.3V regulator so you can power it with 3.3-5VDC in, 5V level safe inputs, ENABLE pin so you can turn off the module using any microcontroller pin or switch, a footprint for optional CR1220 coin cell to keep the RTC running and allow warm starts and a tiny bright red LED.

## Overview

### Features

|  |  |  |
| --- | --- | --- |
| Satellites: 22 tracking, 66 searching | Patch Antenna Size: 15mm x 15mm x 4mm | Update rate: 1 to 10 Hz |
| Position Accuracy: < 3 meters (all GPS technology has about 3m accuracy) | Velocity Accuracy: 0.1meters/s | Warm/cold start: 34 seconds |
| Acquisition sensitivity: -145 dBm | Tracking sensitivity: -165 dBm | Maximum Velocity: 515m/s |
| Vin range: 3.0-5.5VDC | MTK3339 Operating current: 25mA tracking, 20 mA current draw during navigation | Output: NMEA 0183, 9600 baud default, 3V logic level out, 5V-safeinput |
| DGPS/WAAS/EGNOS supported | FCC E911 compliance and AGPS support (Offline mode : EPO valid up to 14 days ) | Up to 210 PRN channels |
| Jammer detection and reduction | Multi-path detection and compensation |  |

### Pin Diagram

A diagram of a top view

Description automatically generated

A screenshot of a computer

Description automatically generated

### Ratings

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A table with text and numbers

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## Code

<https://cdn-shop.adafruit.com/datasheets/PMTK_A11.pdf> - Command Sheet for changing the fix data rate, baud rate, sentence outputs, etc

A screenshot of a computer program

Description automatically generatedIf you want to write the code in standard C, without using the Arduino framework or libraries, you would typically need to handle the low-level communication with the GPS module and parsing of NMEA sentences yourself. Below is a simple example in standard C using a hypothetical scenario. Please note that in a real-world application, you may need to adapt this code based on the actual communication protocol of your GPS module and handle the NMEA sentences accordingly.

Keep in mind that the **initSerial**, **readChar**, and **writeChar** functions would need to be implemented based on the hardware you are using for serial communication. Additionally, the **parseNMEA** function needs to be customized based on the NMEA sentence structure and the information you want to extract. Always refer to the datasheet or technical documentation of your specific GPS module for accurate details on the communication protocol and NMEA sentence format.

## Datasheet

<https://cdn-shop.adafruit.com/product-files/746/CD+PA1616S+Datasheet.v03.pdf>

# MEMS Module, Gyroscope/Accelerometer - TDK INVENSENSE MPU-6050

## Description

The MPU-6050 device combines a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die together with an onboard Digital Motion Processor (DMP) capable of processing complex 9-axis MotionFusion algorithms. The parts' integrated 9-axis MotionFusion algorithms access external magnetometers or other sensors through an auxiliary master I2C bus, allowing the devices to gather a full set of sensor data without intervention from the system processor.

## Overview

### Features

|  |  |
| --- | --- |
| User-programmable digital filters for gyroscope, accelerometer, and temp sensor | Digital-output temperature sensor |
| 9-Axis MotionFusion by the on-chip digital motion processor (DMP) | Auxiliary master I2C bus for reading data from external sensors |
| Minimal cross-axis sensitivity between the accelerometer and gyroscope axes | MEMS structure hermetically sealed and bonded at wafer level |
| 10,000 g shock tolerant | 400kHz fast mode I2C for communicating with all registers |

* 6 Degrees of Freedom (6-DoF): The MPU-6050 integrates a 3-axis accelerometer and a 3-axis gyroscope in a single chip, providing measurements of linear acceleration and angular velocity along three axes (X, Y, Z).
* Digital Motion Processing (DMP): The MPU-6050 includes a Digital Motion Processor (DMP) that offloads the computation of complex motion processing tasks from the host microcontroller. This feature is beneficial for applications requiring sophisticated motion processing algorithms.
* I2C Communication: The MPU-6050 communicates with the host microcontroller using the I2C (Inter-Integrated Circuit) communication protocol. This is a widely used and standardized serial communication interface.
* Programmable Gyroscope and Accelerometer Full Scale Range: The sensor allows the programmer to configure the full-scale range for both the gyroscope and accelerometer. This allows adaptation to different acceleration and angular velocity levels in the application.
* Temperature Sensor: The MPU-6050 includes an embedded temperature sensor, providing the current temperature of the device.
* Interrupts: The MPU-6050 supports interrupts, allowing the microcontroller to be notified when specific events, such as data ready or motion detection, occur.
* Low Power Consumption: The sensor is designed for low power consumption, making it suitable for battery-powered applications.
* Quaternion Output: The DMP on the MPU-6050 can provide quaternion data, which is useful for orientation estimation in 3D space.
* Motion Detection and Free-Fall Detection: The sensor includes features for motion detection and free-fall detection, enabling the detection of specific motion events.
* Tap Detection: The MPU-6050 can detect taps or impacts, providing information about sudden changes in motion.
* Register Configuration: The sensor's behavior can be configured through various registers. Understanding the register map and configuration settings is crucial for customization.

### Pin Diagram

A diagram of a computer chip

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### Ratings

Absolute Maximum Ratings

**A screenshot of a computer

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**A screenshot of a computer

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## A screen shot of a computer program Description automatically generatedCode

This code reads accelerometer and gyroscope data from the MPU-6050 and prints it to the console. Please note that the code assumes little-endian architecture. The MPU-6050's register addresses and configuration may vary, so you should refer to the MPU-6050 datasheet for the specific register map and configuration details.

A screen shot of a computer program

Description automatically generated

## Datasheet

https://www.farnell.com/datasheets/1788002.pdf

# Barometer/Altimeter - MS561101BA03-50

## Description

The MS5611-01BA03 is a barometric pressure sensor designed for measuring atmospheric pressure and temperature. It provides accurate data for altitude determination and weather monitoring. With high resolution and low power consumption, it communicates via I2C or SPI, making it suitable for applications like altimeters and airspeed indicators in aviation.

## Overview

### Features

|  |  |  |
| --- | --- | --- |
| High resolution module, 10 cm | Fast conversion down to 1 ms | Low power, 1 µA (standby < 0.15 µA) |
| QFN package 5.0 x 3.0 x 1.0 mm3 | Supply voltage 1.8 to 3.6 V | Integrated digital pressure sensor (24 bit ΔΣ ADC) |
| Operating range: 10 to 1200 mbar, -40 to +85 °C | Excellent long-term stability | I2C and SPI interface up to 20 MHz |
| No external components (Internal oscillator) |  |  |

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### Ratings

### Digital Inputs and Pressure Outputs

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## Converting Pressure to Altitude

To convert pressure to altitude using the MS5611-01BA03, you can use the barometric formula, which relates pressure to altitude. The formula is:

Where:

* ℎ*h* is the altitude,
* *R* is the specific gas constant for dry air,
* *T*0​ is the standard temperature at sea level,
* *g* is the acceleration due to gravity,
* *P*0​ is the atmospheric pressure at sea level, and
* A computer screen shot of a program

  Description automatically generated*P* is the current atmospheric pressure.

Some basic code doing that:

In this example, you need to replace the **currentPressure** variable with the actual pressure reading from the MS5611-01BA03 sensor. This is a simplified calculation, and real-world applications might require additional considerations and calibration for accuracy.

## Code

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A computer screen shot of a program code

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I've added the **pressureToAltitude** function to convert pressure to altitude based on the barometric formula. Replace the placeholder temperature values with the actual temperature reading from the sensor for better accuracy. Additionally, consider adjusting the temperature lapse rate (**exponent**) according to the environmental conditions if needed.

## Datasheet

https://www.mouser.co.uk/datasheet/2/418/6/ENG\_DS\_MS5611\_01BA03\_B3-1134567.pdf