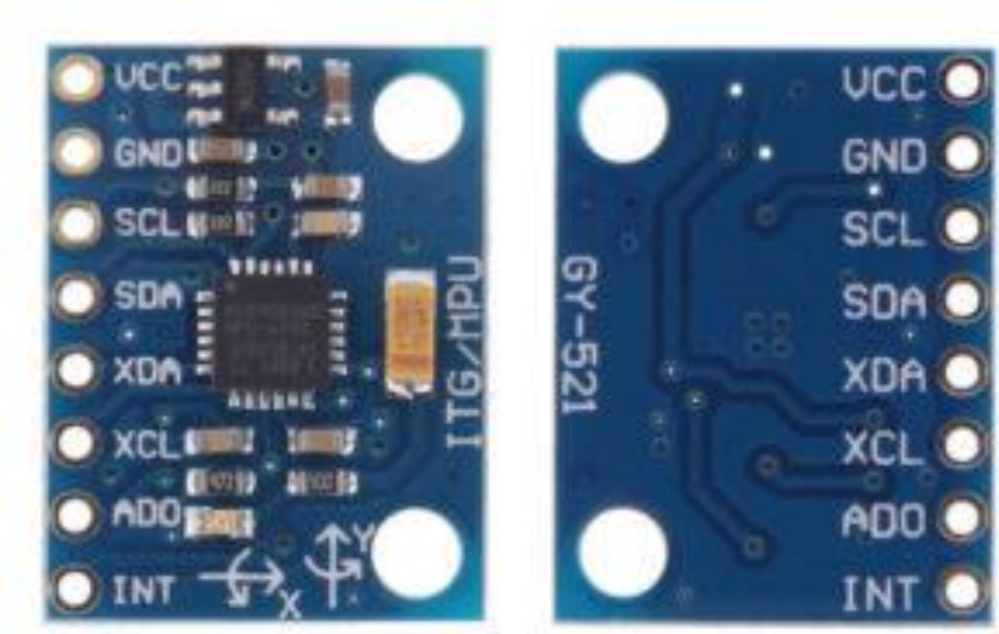
GY-521 MPU6050 3-Axis Accelerometer & Gyroscope Sensor (I2C)

The **GY-521 MPU6050 module** is a highly popular **3-axis accelerometer and gyroscope sensor** used in robotics, drones, motion tracking, and embedded electronics projects. With its **I2C interface**, it integrates seamlessly with microcontrollers such as **Arduino, ESP32, ESP8266, STM32, and Raspberry Pi**, making it an essential choice for hobbyists, students, and engineers.

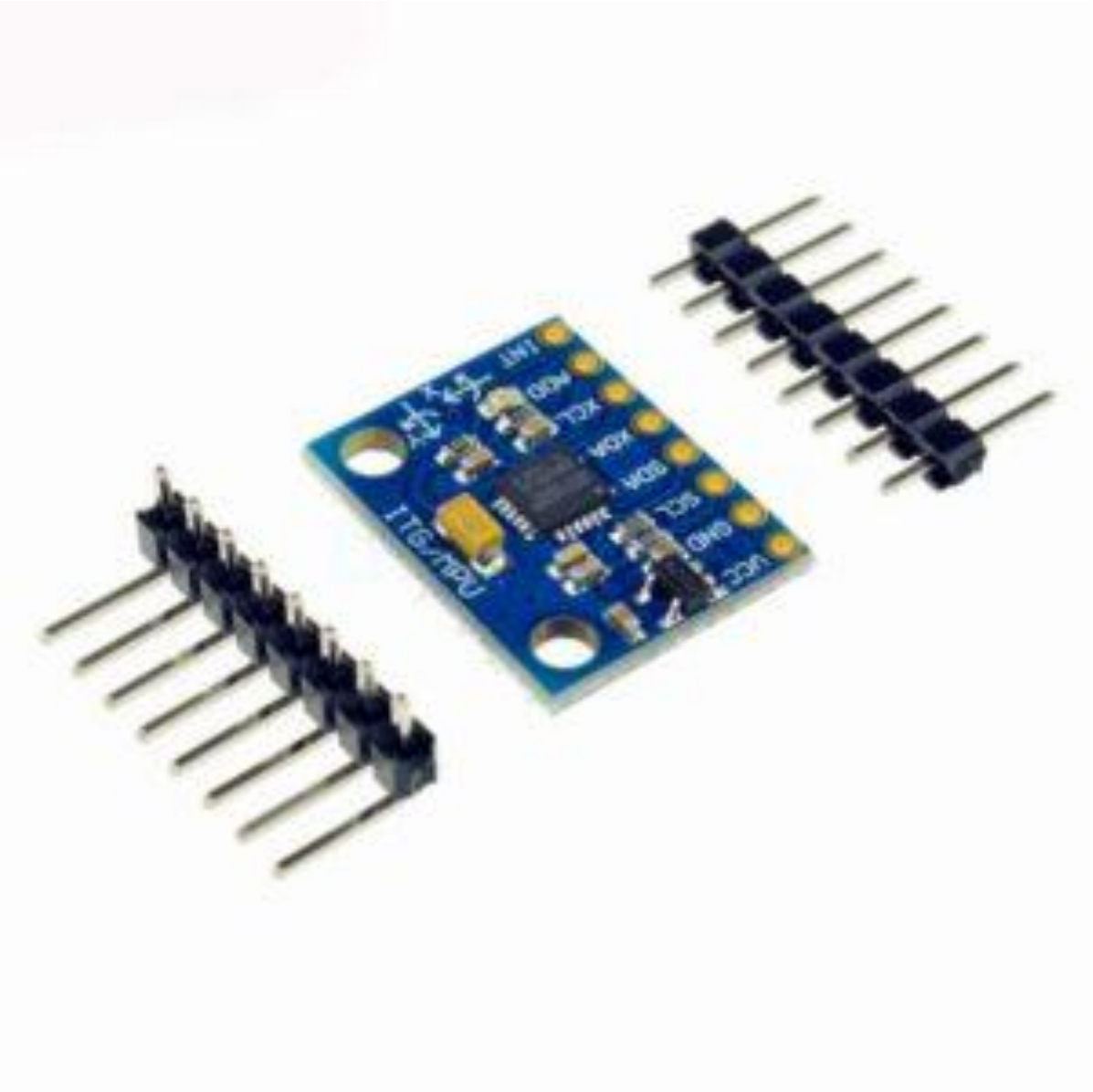
This compact and cost-effective sensor provides real-time motion and orientation data with excellent precision, making it suitable for a wide range of applications including **gesture detection, tilt sensing, balancing robots, UAV navigation, and motion capture systems**.



Key Features of the GY-521 MPU6050

- **3-Axis Accelerometer**: Measures acceleration along the X, Y, and Z axes.
- **3-Axis Gyroscope**: Detects angular velocity and rotation on three axes.
- **Integrated 16-bit ADCs**: High precision for both accelerometer and gyroscope data.
- **I2C Communication Interface**: Easy to connect with Arduino and other microcontrollers using just two pins (SCL and SDA).
- **Onboard 3.3V regulator**: Operates on both 3.3V and 5V systems.

- **Low Power Consumption**: Ideal for portable and battery-operated projects.
- **Digital Motion Processing (DMP)**: Built-in motion fusion algorithms to combine sensor data.
- **Compact Size**: Lightweight and easy to integrate into robotic and wearable projects.



Why Choose the GY-521 MPU6050 Module?

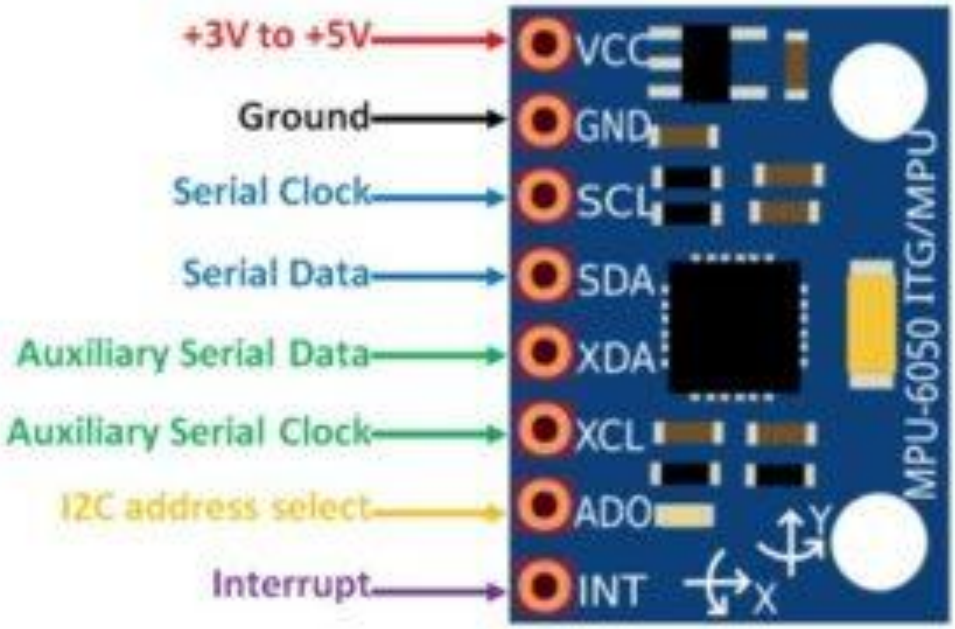
The **MPU6050 sensor** is one of the most reliable and widely used motion sensors in electronics. Unlike basic accelerometers or gyroscopes, this module combines both in a single chip, offering **6 degrees of freedom (DOF)** motion tracking. This makes it far more versatile and powerful.

Some key advantages:

1. **Easy integration** with Arduino libraries such as `Wire.h` and `I2Cdevlib`.
2. **Affordable** while delivering high accuracy.
3. **Robust applications** in robotics, UAVs, and gaming controllers.
4. **Stable and efficient** performance for real-time motion sensing.

Technical Specifications

- **Chipset**: MPU6050
- **Accelerometer Range**: ±2g, ±4g, ±8g, ±16g
- **Gyroscope Range**: ±250, ±500, ±1000, ±2000°/s
- **Resolution**: 16-bit
- **Communication Protocol**: I2C (address 0x68 by default)
- **Operating Voltage**: 3V – 5V (with onboard regulator)
- **Current Consumption**: ~3.9mA (active mode)
- **Temperature Sensor**: Built-in, for compensation
- **Dimensions**: Approx. 20mm × 15mm × 1mm
- **Weight**: Lightweight, under 5g



MPU6050 Pinout

Applications of GY-521 MPU6050 Sensor

The **GY-521 accelerometer and gyroscope module** is used in a variety of fields, including:

- **Robotics**: For motion control, self-balancing robots, and gesture recognition.
- **Drones & Quadcopters**: Stabilization, flight control, and orientation sensing.
- **Wearable Devices**: Motion and activity tracking in smart bands and fitness devices.
- **Gaming & VR Controllers**: Detects tilt, rotation, and movement.
- **Navigation Systems**: Used in IMU (Inertial Measurement Units) for position estimation.
- **DIY Electronics Projects**: Ideal for makers, hobbyists, and students working with Arduino or Raspberry Pi.

How to Use the GY-521 with Arduino

Using the GY-521 with **Arduino** is simple:

1. Connect the module to your Arduino using **I2C pins** (SDA to A4, SCL to A5 on Arduino Uno).
2. Supply power using **3.3V or 5V** pin.
3. Install the **I2Cdev and MPU6050 Arduino libraries**.
4. Upload example codes to start reading accelerometer and gyroscope data.
5. Use the sensor values to control robots, detect tilt, or stabilize drones.

For advanced projects, you can also use the **DMP (Digital Motion Processor)** to obtain **quaternions and motion fusion data**, which greatly simplifies sensor data processing.

Package Includes

- 1 × **GY-521 MPU6050 3-Axis Accelerometer & Gyroscope Sensor Module (I2C)**

Conclusion

The **GY-521 MPU6050 module** is one of the most important sensors for **robotics, drones, and motion tracking applications**. Its combination of a 3-axis accelerometer and 3-axis gyroscope, along with an easy-to-use I2C interface, makes it ideal for both beginners and professionals.

Whether you are working on a **DIY Arduino project, a university robotics assignment, or a professional UAV system**, this sensor delivers **accuracy, reliability, and affordability** in one compact package.

If you need a **cost-effective motion sensing solution**, the **GY-521 MPU6050 Accelerometer & Gyroscope Module** is the perfect choice.