POLOLU

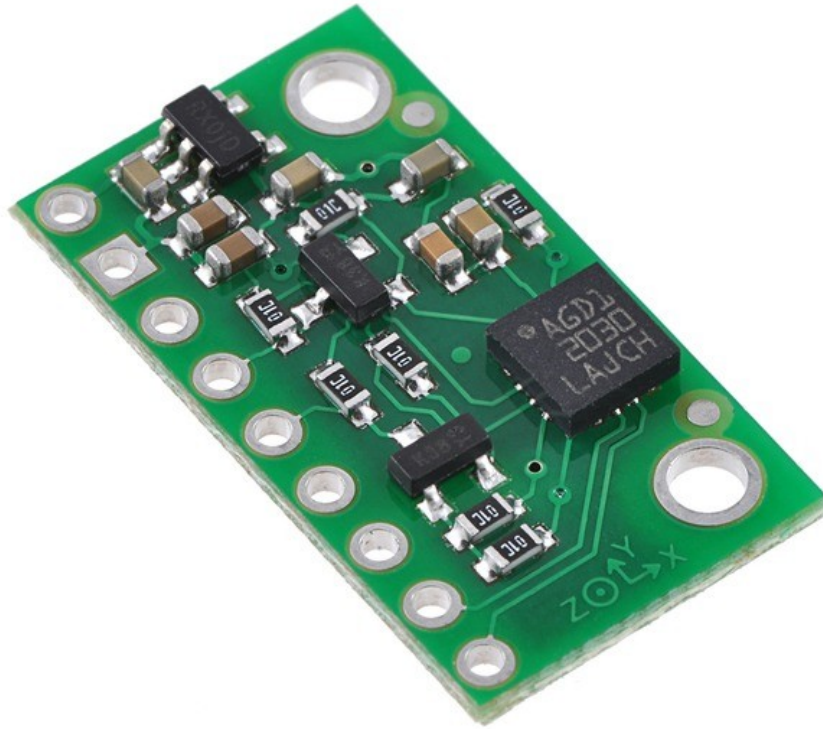## L3G4200D 3-Axis Gyro Carrier with Voltage Regulator

Pololu item #: 1272

This sensor is a carrier/breakout board for the ST L3G4200D three-axis gyroscope, which measures the angular rates of rotation about the pitch (x), roll (y), and yaw (z) axes. Angular velocity measurements with a configurable range of ±250°/s, ±500°/s, or ±2000°/s can be read through a digital I²C or SPI interface. The board has a 3.3 V linear regulator and integrated level-shifters that allow it to work over an input voltage range of 2.5–5.5 V, and the 0.1″ pin spacing making it easy to use with standard solderless breadboards and 0.1″ perfboards.

Overview

This board is a compact (0.5″ × 0.9″) breakout board for ST's L3G4200D ultra-stable three-axis digital-output gyroscope; we therefore recommend careful reading of the L3G4200D datasheet (1MB pdf) before using this product. The L3G4200D is a great IC, but its small, leadless, LGA package makes it difficult for the typical student or hobbyist to use. It also operates at voltages below 3.6 V, which can make interfacing difficult for microcontrollers operating at 5 V. This carrier board addresses these issues by incorporating additional electronics, including a 3.3 V voltage regulator and level-shifting circuits, while keeping the overall size as compact as

possible. The board ships fully populated with its SMD components, including the L3G4200D, as shown in the product picture.

The L3G4200D has many configurable options, including three selectable angular rate sensitivities, a choice of output data rates, an embedded FIFO for buffering output data, and a programmable external interrupt signal. The three angular velocity readings are available through a digital interface, which can be configured to operate in either I²C or SPI mode.

The carrier board includes a low-dropout linear voltage regulator that provides the 3.3 V required by the L3G4200D, which allows the sensor to be powered from a 2.5-5.5 V supply. The regulator output is available on the VDD pin and can supply almost 150 mA to external devices. The breakout board also includes a circuit that shifts the I²C/SPI clock and data in lines to the same logic voltage level as the supplied VIN, making it simple to interface the board with 5 V systems, and the board's 0.1″ pin spacing makes it easy to use with standard solderless breadboards and 0.1″ perfboards.

Specifications

- Dimensions: 0.5″ × 0.9″ × 0.1″ (13 × 23 × 3 mm)

- Weight without header pins: 0.7 g (0.03 oz)

- Operating voltage: 2.5 to 5.5 V

- Supply current: 7 mA

- Output format (I²C/SPI): one 16-bit reading per axis

- Sensitivity range (configurable): ±250°/s, ±500°/s, or ±2000°/s

Included components

A 9×1 strip of 0.1″ header pins and a 9×1 strip of 0.1″ right-angle header pins are included, as shown in the picture below. You can solder the header strip of your choice to the board for use with custom cables or solderless breadboards, or you can solder wires directly to the board itself for more compact installations.
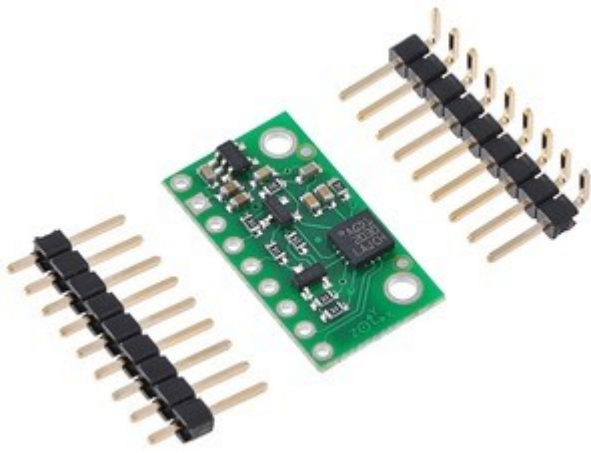
Using the L3G4200D

Connections

Regardless of the interface being used to communicate with the L3G4200D, its VIN pin should be connected to a 2.5-5.5 V source, and GND should be connected to 0 volts. (Alternatively, if you are using the gyro with a 3.3 V system, you can leave VIN disconnected and bypass the built-in regulator by connecting 3.3 V directly to VDD.)

A minimum of two logic connections are necessary to use the L3G4200D in I²C mode (this is the default mode): SCL and SDA. These should be connected to an I²C bus operating at the same logic level as VIN.

To use the L3G4200D in SPI mode, four logic connections are required: SPC, SDI, SDO, and CS. These should be connected to an SPI bus operating at the same logic level as VIN. The SPI interface operates in 4-wire mode by default, with SDI and SDO on separate pins, but it can be configured to use 3-wire mode so that SDO shares a pin with SDI.
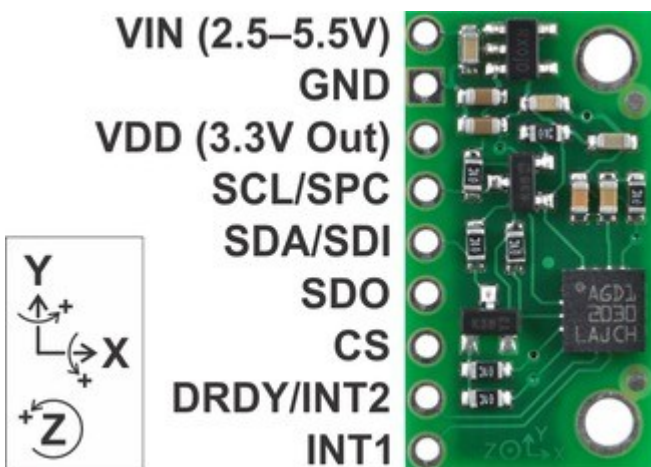
L3G4200D 3-axis gyro carrier with voltage regulator, labeled top view.
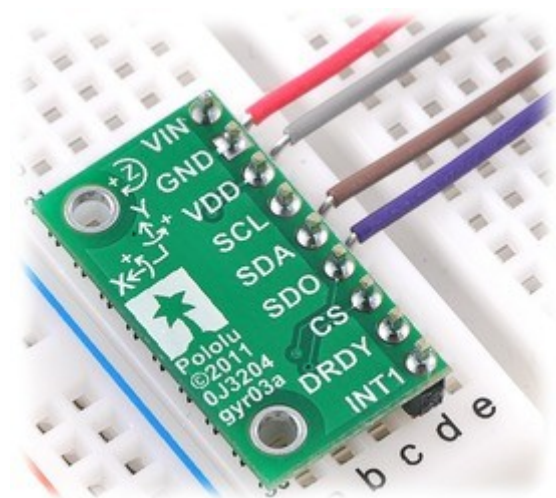
L3G4200D 3-axis gyro carrier with voltage regulator in a breadboard.

Pinout

PIN	Description
VIN	This is the main 2.5-5.5 V power supply connection. The SCL/SPC and SDA/SDI level shifters pull the I²C and SPI bus high bits up to this level.
GND	The ground (0 V) connection for your power supply. Your I²C or SPI control source must also share a common ground with this board.
VDD	Regulated 3.3 V **output**. Almost 150 mA is available to power external components. (If you want to bypass the internal regulator, you can instead use this pin as a 3.3 V input with VIN disconnected.)
SCL/SPC	Level-shifted I²C/SPI clock line: HIGH is VIN, LOW is 0 V
SDA/SDI	Level-shifted I²C data line and SPI data in line (also doubles as SDO in 3-wire mode): HIGH is VIN, LOW is 0 V
SDO	SPI data out line in 4-wire mode: HIGH is VDD, LOW is 0 V. *This output is not level-shifted.* Also used as an input to determine I²C slave address (see below).
CS	SPI enable (chip select). Pulled up to VDD to enable I²C communication by default; drive low to begin SPI communication.
DRDY/INT2	Data ready indicator, a 3.3-V-logic-level output. HIGH (3.3 V) indicates angular rate data can be read. Can also be configured as a FIFO interrupt. *This output is not level-shifted.*
INT1	Programmable interrupt, a 3.3-V-logic-level output. *This output is not level-shifted.*

Schematic Diagram
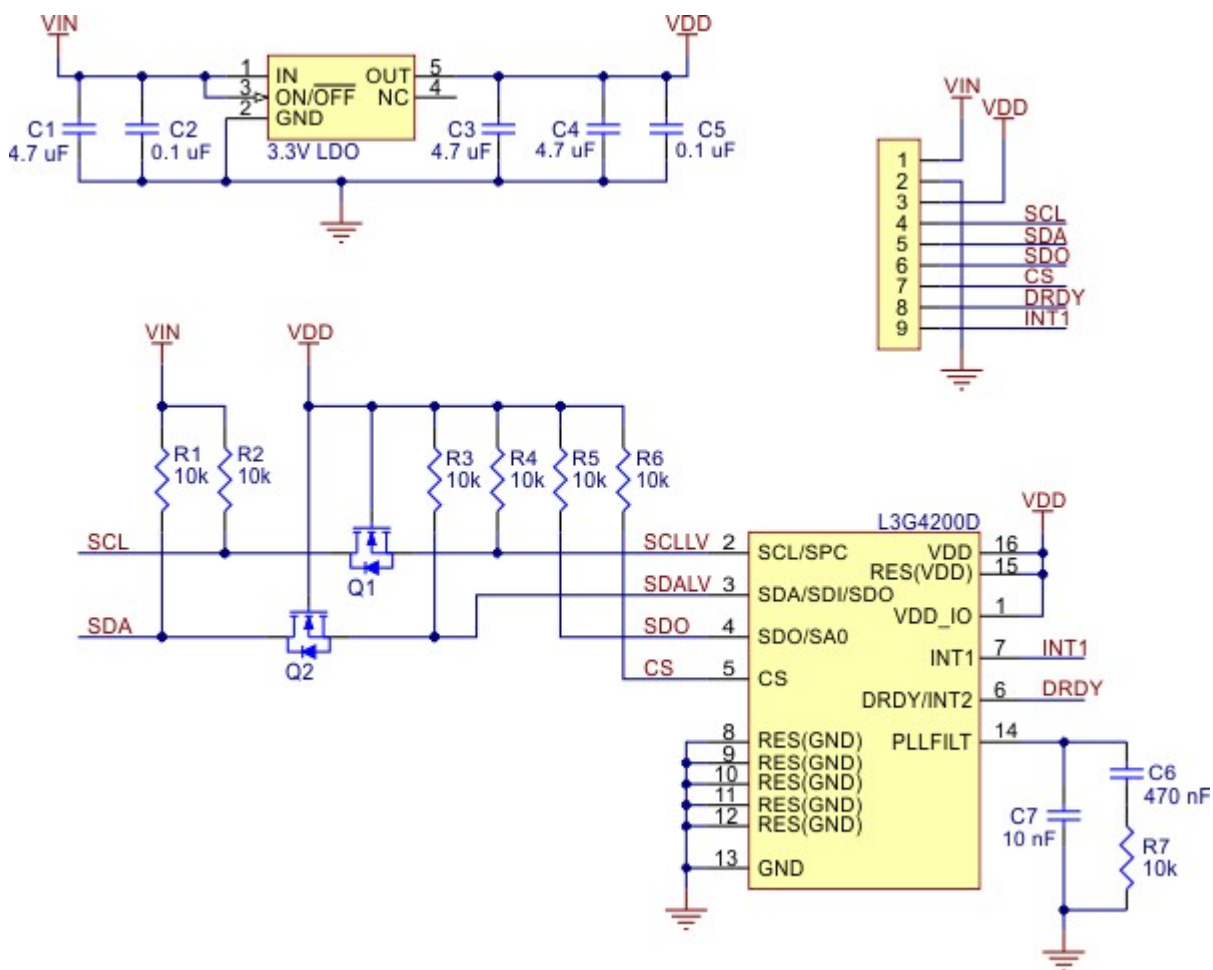
The above schematic shows the additional components the carrier board incorporates to make the L3G4200D easier to use, including the voltage regulator that allow the board to be powered from a 2.5-5.5 V supply and the level-shifter circuit that allows for I²C and SPI communication at the same logic voltage level as VIN.

I²C Communication

With the CS pin in its default state (pulled up to VDD), the L3G4200D can be configured and its angular velocity readings can be queried through the I²C bus. Level shifters on the I²C clock (SCL) and data (SDA) lines enable I²C communication with microcontrollers operating at the same voltage as VIN (2.5-5.5 V). A detailed explanation of the I²C interface on the L3G4200D can be found in its [datasheet](#) (1MB pdf), and more detailed information about I²C in general can be found in [NXP's I²C-bus specification](#) (371k pdf).

In I²C mode, the gyro's 7-bit slave address has its least significant bit (LSb) determined by the voltage on the SDO pin. The carrier board pulls SDO to VDD through a 10 kΩ resistor, making the LSb 1. If the gyro's selected slave address happens to conflict with some other device on your I²C bus, you can drive SDO low to set the LSb to 0.

In our tests of the board, we were able to communicate with the chip at a clock frequencies up to 400 kHz; higher frequencies might work but were not tested. The chip itself and carrier board do not meet of some requirements to make the device compliant with I²C fast-mode. It is missing 50 ns spike suppression on the clock and data lines, and additional pull-ups on the clock and data lines might also be necessary to achieve compliant signal timing characteristics.

SPI Communication

To communicate with the L3G4200D in SPI mode, the CS pin (which the board pulls to VDD through a 10 kΩ resistor) must be driven low before the start of an SPI command and allowed to return high after the end of the command. Level shifters on the SPI clock (SPC) and data in (SDI) lines enable SPI communication with microcontrollers operating at the same voltage as VIN (2.5-5.5 V).

In the default 4-wire mode, the gyro transmits data to the SPI master on a dedicated data out (SDO) line. If the SPI interface is configured to use 3-wire mode instead, the SDI line doubles as SDO and is driven by the L3G4200D when it transmits data to the master. A detailed explanation of the SPI interface on the L3G4200D can be found in its [datasheet](#) (1MB pdf).

Protocol Hints

The datasheet provides all the information you need to use this sensor, but picking out the important details can take some time. Here are some pointers for communicating with and configuring the L3G4200D that we hope will get you up and running a little bit faster:

- The gyro is in power down mode by default. You have to turn it on by writing the appropriate value to the CTRL_REG1 register.

- You can read or write multiple registers in a single I²C command by asserting the most significant bit of the register address to enable address auto-increment.

- You can enable the same auto-increment feature in SPI mode by asserting the second bit (bit 1, called the MS bit in the datasheet) of an SPI command.