Ultimate GPS Breakout Board

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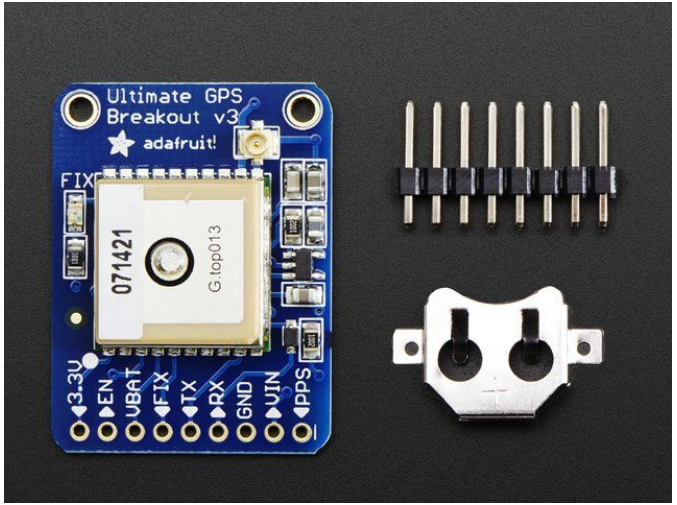
What is it made out of?

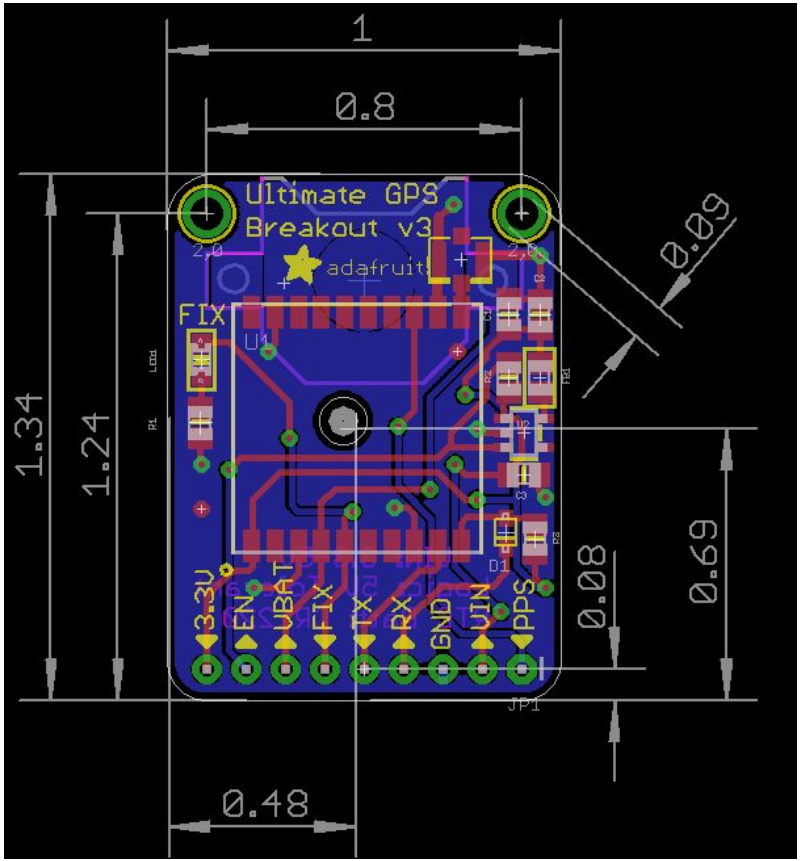


- -165 dBm sensitivity, 10 Hz updates, 66 channels
- 5V, 20mA current draw
- Breadboard friendly + two mounting holes
- RTC battery-compatible
- Built-in datalogging
- PPS output on fix
- Internal patch antenna + u.FL connector for external active antenna
- Fix status LED
- Weight (not including coin cell or holder): 8.5g
- Dimensions (not including coin cell or holder): 25.5mm x 35mm x 6.5mm / 1.0" x 1.35" x 0.25"

Technical Details

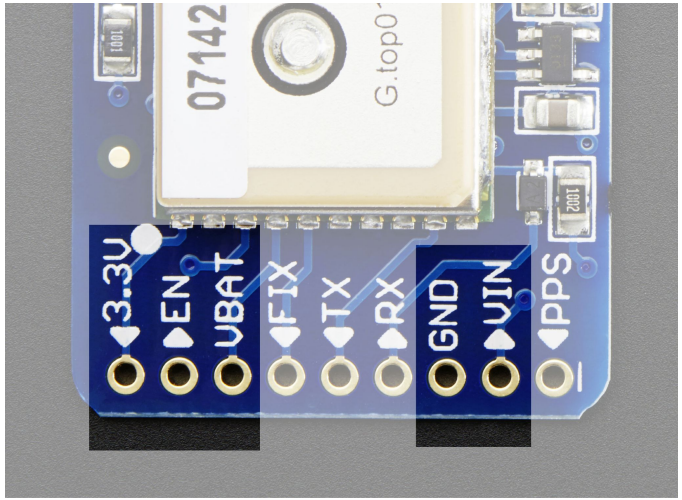
- Satellites: 22 tracking, 66 searching
- Patch Antenna Size: 15mm x 15mm x 4mm
- Update rate: 1 to 10 Hz
- Warm/cold start: 34 seconds
- Acquisition sensitivity: -145 dBm(good phone connection is -85dBm)
- Tracking sensitivity: -165 dBm
- Maximum Velocity: 515m/s
- Vin range: 3.0-5.5VDC
- MTK3339 Operating current: 25mA tracking, 20 mA current draw during navigation
- Output: NMEA 0183, 9600 baud default, 3V logic level out, 5V-safe input
- 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

Schematic


1
0.8
0.09
1.34
1.24
0.69
0.08
0.48
Ultimate GPS
Breakout v3
adafruit
FIX
U1
JP1
3.3V
EN
VBAT
FIX
TX
RX
GND
VIN
PPS

PPS

- **VIN** - power input, connect to 3-5VDC. It's important to connect to a *clean and quiet* power supply. GPS's are very sensitive, so you want a nice and quiet power supply. Don't connect to a switching supply if you can avoid it, an LDO will be less noisy!
- **GND** - power and signal ground. Connect to your power supply and microcontroller ground.

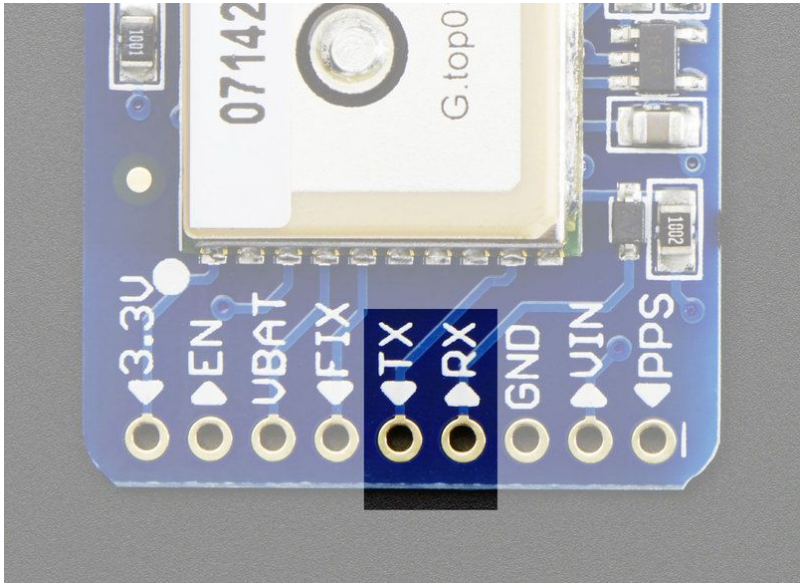


PPS Cont.

- **VBAT** is an input pin - it is connected to the GPS real time clock battery backup. We suggest using the battery spot on the back but if you have a project with a coin cell or other kind of battery that you want to use (and its under 3.3V) you can connect it to the VBAT pin. **For V1 and V2 modules:** If you do this, be sure to cut the trace on the back between the RTC solder pads
- **EN** is the Enable pin, it is pulled high with a 10K resistor. When this pin is pulled to ground, it will turn off the GPS module. This can be handy for very low power projects where you want to easily turn the module off for long periods. You will lose your fix if you disable the GPS and it will also take a long time to get fix back if you dont have the backup battery installed.
- **3.3V** is the output from the onboard 3.3V regulator. If you have a need for a clean 3.3V output, you can use this! It can provide at least 100mA output.

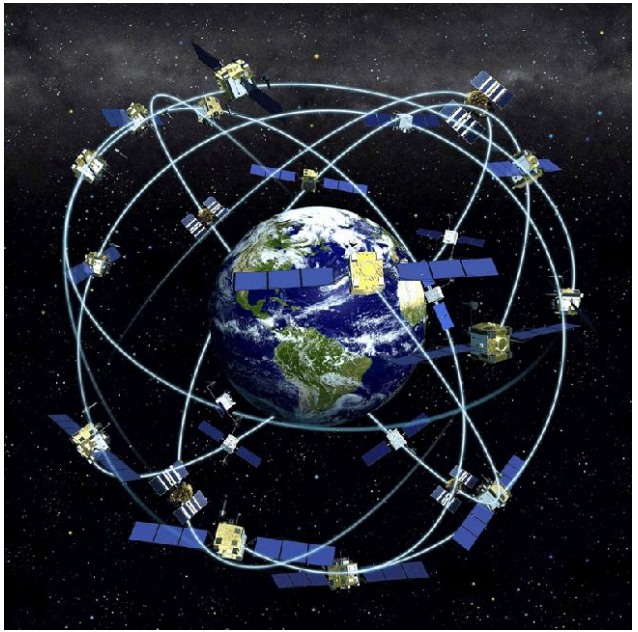
PPS. Cont.

- **TX** - the pin that transmits data *from* the GPS module to your microcontroller or computer. It is 3.3V logic level. Data comes out at 9600 baud by default
- **RX** - the pin that you can use to send data *to* the GPS. You can use use 3.3V or 5V logic, there is a logic level shifter. By default it expects 9600 baud data, and remember you need to send it checksum'med NMEA sentences



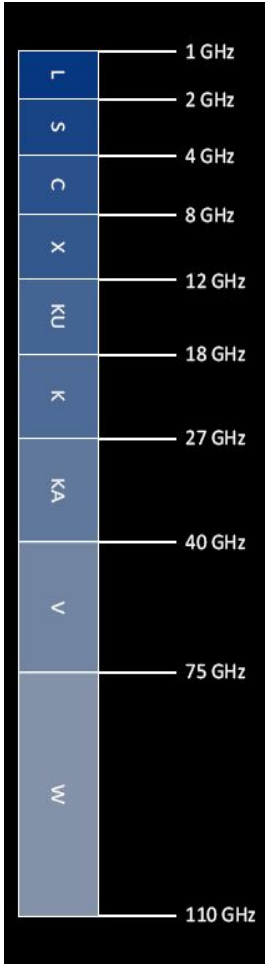
Global Positioning System

- Started as US Military program during Cold War
- Segmented for civilian and military use
- 32 satellites circling Earth every 12 hours
- 31 satellites currently in operation
- Continually broadcasts identifier, orbital position, and time over many signals
- Only one civilian signal (L1 C/A) is in service on all satellites
- GPS receiver locates spacetime location with data from four satellites
- Greatest source of error is the ionosphere (varying electron density)



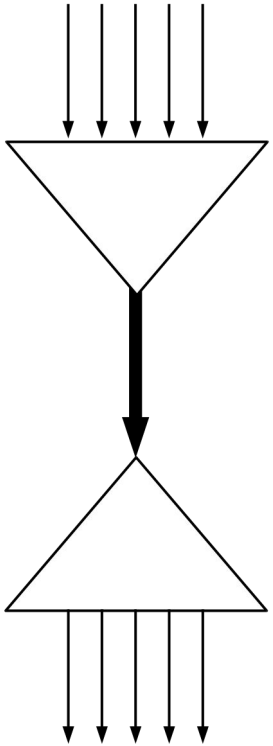
L Band

- Contains all broadcasted GPS signals
- Microwaves from 1 - 2 GHz
- Similar frequencies to those used by mobile carriers and air traffic
- Signals penetrate storms and moderate vegetation
- L1 (1575.42 MHz) for the main consumer GPS signal (L1 C/A)
- L2 (1227.60 MHz) for a modernized GPS signal (L2C)
- L3 (1381.05 MHz) for communication of detected nuclear detonations
- L4 (1379.913 MHz) for a signal to study the ionosphere
- L5 (1176.45 MHz) for a redundant modernized GPS signal (L5 CNAV)



Interfacing with GPS

- Antenna frequency of 1575.42 MHz to receive L1 C/A signals.
- Individual signals discriminated by chip using CDMA (Code-division multiple access)
- Signal is periodically unmodulated according to known list of pseudo-random binary sequences (Gold Codes of period 1023)
- Signals are continually monitored once found, occupying three channels of the chip
- After finding at least four signals, the chip can then calculate spacetime position from the data.



Uses

- Velocity detection (+- 0.1 m/s, max ~500 m/s)
- Determine position (+- 3 m)
- Tracking GPS synchronized real time
- Simple datalogging with internal memory

References

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- https://learn.adafruit.com/adafruit-ultimate-gps/pinouts
- https://en.wikipedia.org/wiki/Global_Positioning_System
- https://en.wikipedia.org/wiki/Code-division_multiple_access
- https://en.wikipedia.org/wiki/GPS_signals
- https://en.wikipedia.org/wiki/L_band
- https://en.wikipedia.org/wiki/Gold_code
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