

GPS 4G HAT

Extension board for Raspberry Pi and other microcontroller boards

Introduction

The GPS 4G HAT is an extension board for Single-Board Computers (SBCs) like the Raspberry Pi. It can be attached on top using the 40 pin header and therewith provides electrical components that are essential to build a sophisticated GPS tracking device. As the GPS 4G HAT provides multiple connection options, additional sensors can still be connected and used to cover a vast amount of possible use cases.

Typical application(s)

- Building a GPS tracking device
- Enhancing sensor data with location data

Key Features

- GPS positioning
- Mobile data communication
- SIM card slot
- Built-in 3-axis acceleration sensor
- Multiple connection options

GPS Positioning

- Provided via the module: Quectel BG-77
- Supports GPS, GLONASS, Galileo (L1 band)
- Built-in GPS patch antenna
- Possibility to connect an external GPS antenna (Jumper has to be moved)
 - active or passive
 - 1574MHz – 1605MHz
- Position tolerance up to +/- 3m
- Sensitivity

State	Sensitivity
Cold start	-145 dBm
Reacquisition	-158 dBm
Tracking	-158 dBm

- Time to first fix (TTFF)
 - Under open sky

State	Time
Cold start*	31.22 s
Warm start	30.74 s
Hot start	1.43 s

* Switching from data mode to positioning mode is considered a cold start

Communication

- Provided via the module: Quectel BG-77
- Supports 4G for IoT: NB-IoT (Cat NB1 and NB2), LTE Cat-M1
- Built-in PCB-wire antenna
- LTE frequency bands
 - B1/ 2/ 3/ 4/ 5/ 8/ 12/ 13/ 18/ 19/ 20/ 25/ 26/ 27/ 28/ 66/ 71
- Output power
 - Max. 21 dBm
- Possibility to connect an external 4G antenna (Jumper has to be moved)
 - 700MHz – 2100MHz
- Micro SIM card slot with ESD protection on PCB

Accelerometer

- 3-axis accelerometer
- Sensor: MEMSIC MC3479
- 16bit, sample rate up to 1kHz, up to 16g acceleration
- Wake up on motion
- Tilt detection
- Shake detection

Connections

- 4 digital inputs
- 4 digital outputs
- Connectors for signals RxD, TxD, SCL, SDA
- I²C connector

Interaction

- 3 built-in SMT LEDs
 - red: power indicator for communication module
 - blue: network indicator for communication module
 - green: configurable
- 2 built-in buttons
 - Integrated ESD protection
 - 1 Button: reset communication module
 - 1 Button: configurable

Compatibility

- Raspberry Pi models Zero / 2 / 3 / 4
- Raspberry Pi alternatives with the same pinout of the 40 pin header
- Other (microcontroller) boards with individual soldering

Connector Details

I²C connector

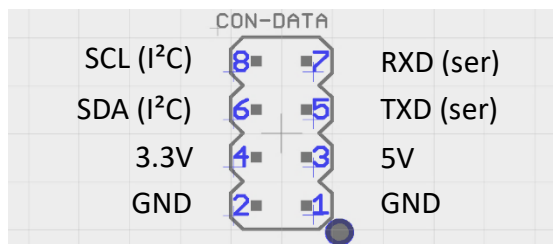
- Module: JST SM04B-SRSS-TB
- Compatible with Sparkfun Quiic, Adafruit STEMMA QT
- Pinout

Pin	Signal
1	GND
2	3.3V
3	SDA
4	SCL

Data Header

Pins

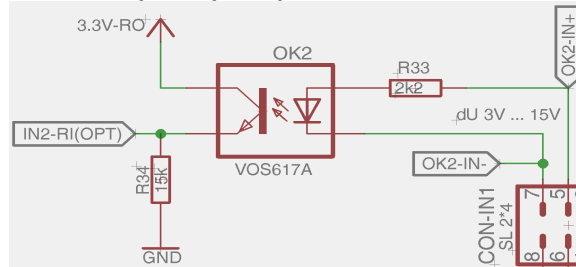
- RxD
- TxD
- SCL
- SDA
- 3.3V
- 5.0V
- GND



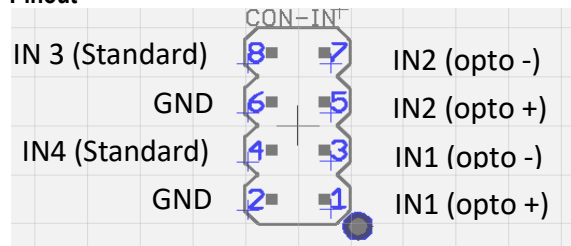
Digital Input Header

- 2 digital inputs
 - 1V ... 15V
 - decoupled by transistor
- 2 galvanic isolated optocoupler inputs
 - detection voltage between 3V and 15V
 - min. 1mA required
 - max. voltage against GND must be less than 60V for safety reasons

Schematic optocoupler input



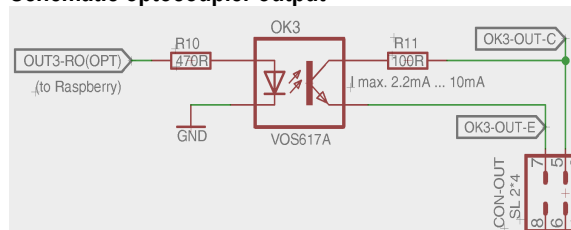
Pinout



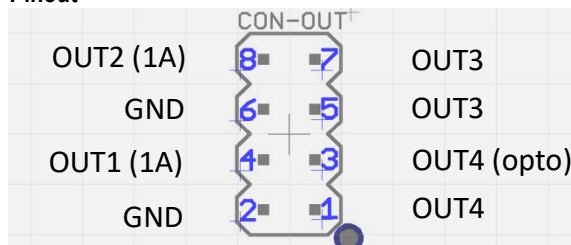
Digital Output Header

- 2 power switches
 - 5.0V
 - max. 1A, if provided by the power supply
- 2 optical outputs
 - for potential-free connection of peripherals
 - output current is limited between 2.2mA and 10mA
 - allowed voltage between 1.2V and 15V

Schematic optocoupler output



Pinout



Power Supply / Level Adjustments

- GPS 4G HAT is supplied with 3.3V and 5V by the Raspberry Pi
- Current consumption is max. 800mA during active 4G data sending
- Average current is less than 100mA
- Quectel module is always supplied with power; using the energy saving sleep mode is possible
- Separate, filtered voltages (3.3V and 3.34V) to supply Quectel module and sensors
- Signal levels are adapted by level translators and transistor circuits

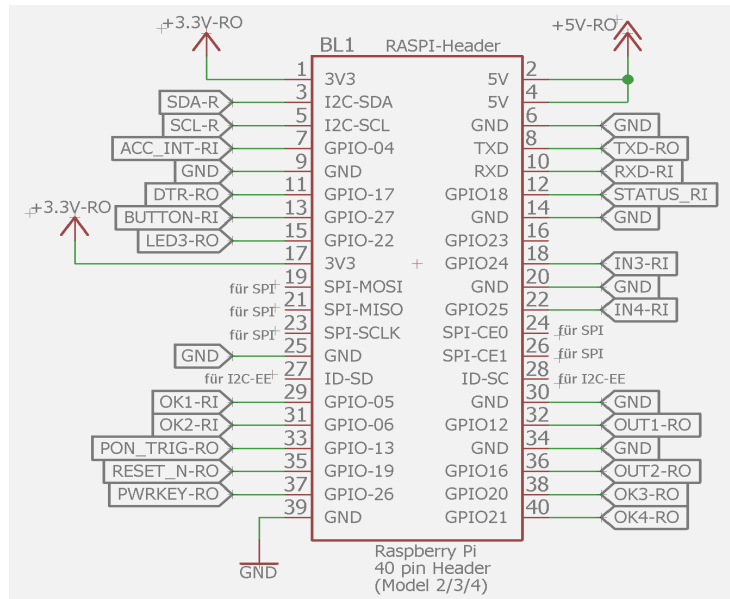
Operating Temperature

- Temperature range (operating): -20°C ... 60°C, non-condensing

Protection Class

- IP class: IP 00
- No protection against humidity and contact

Pinout at Raspberry Pi 40 Pin Header



RI = Raspberry Pi Input
RO = Raspberry Pi Output

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