RASPERRY PI HARWARE ATTACHED ON TOP (HAT)

HAT Technical Specifications & User Manual

Purpose of the Document

The purpose of this document is to explain the technical specifications and manual for using the Raspberry PI HAT module.

Document History

Version	Author	Date	Description
A	5G HUB	05.25.2020	Initial Document

Table of Contents

1 Package Content

Package:

- Raspberry PI HAT for miniPCIe.

Download software:

Software can be downloaded from the following website:

https://www.5ghub.us/download

Software to download:

- QNavigatorV1.6 (in the folder \Tools).
- Quectel driver (in the folder \Driver).

Documentation:

- Quectel AT commands and GNSS commands manual (in the folder \Doc).

2 General Description

2.1 Overview

The Raspberry Pi (RP) model B+ can be used with add-on boards called HAT (Hardware Attached on Top). A HAT is an add-on board for RP model B+ that conforms to a specific set of rules that will make life easier for users and enable use of different hardware wireless chipsets (BG95, BG96, EG95) with raspberry PI.

The RP HAT is a rectangular board (65x56mm) that has four mounting holes in the (nicely rounded) corners that align with the mounting holes on the RP B+, has a 40W GPIO header and supports the special autoconfiguration system that allows automatic GPIO setup and driver setup. The automatic configuration is achieved using 2 dedicated pins (ID_SD and ID_SC) on the 40W B+ GPIO header that are reserved for an I2C EEPROM. The EEPROM holds the board manufacturer information, GPIO setup and a thing called a "device tree" fragment – basically a description of the attached hardware that allows Linux to automatically load the required drivers.

1) via the GPIO connector the HAT can supply a minimum of 1.3A continuously to the Pi.

2.2 Key Features

The HAT has following features:

- Has miniPCIe interface can be used with BG95/BG96/EG95 wireless IoT chipsets
- Fully compatible with Raspberry Pi models that have the 40-pin GPIO header (4, 3, 2, B+, A+, Zero)
- Easy-to-use, simple setup, plug-and-play
- QMI and PPP are supported
- Clip-in Mini PCIe socket compatible with worldwide LTE/UMTS/HSPA+ and GSM/GPRS/EDGE coverage with regional or global modules which work with different frequencies & carriers
- With the 4G/LTE module (e.g Quectel EC25 and EG95) you can reach 150Mbps downlink and 50Mbps uplink data rates
- Nano USIM card socket can easily reachable on the upside of the HAT
- Can be used standalone with PC/Laptop over micro USB, without stacking with Raspberry Pi
- The HAT can be powered from an external 5V source by exposed power pins, directly from Raspberry Pi 5V GPIO headers, via micro USB, or optional JST connector on the bottom of the board
- Taking the module into the Airplane Mode, resetting module or RI and DTR functions can be accessible over GPIO pins
- The power of the whole board electronics can be disabled for low-power consumption use cases
- The modules (BG95, BG96, EC25, EG95) have built-in GNSS(GPS/GLONASS) receiver for geo-location applications
- Uses a GPIO connector that spaces the HAT at least 8mm from the Pi (i.e. uses spacers 8mm or larger)
- Conforms to the RP HAT requirements
- Conforms to the HAT mechanical specification

2.3 Interfaces

- miniPCIe interface

- USB 2.0 with High Speed up to 480Mbps
- Nano USIM card slot
- 40W GPIO to the raspberry PI

2.4 Software Features

The HAT does not need or has a driver. Rather The host computer (such as RPi) needs the driver of the compatible module that will be used with the HAT. For example, if you are using Quectel BG95/BG96/EC25/EG95 with the HAT, then your host device should have the driver for Quectel modules. Nowadays, most of the Linux kernel comes with the required drivers installed as a result the modules are recognized.

The HAT is compatible with the following boards. Note that the HAT can be connected to these board via the USB. UART communication can be work with every device in the list easily which have 3.3V level UART port.

- Raspberry Pi 4, 3, 2, B+, A+, Zero
- Asus Tinker Board
- Rock 64
- Orange Pi
- Samsung ARTIK's Eagleye board
- Latte Panda

2.5 General Features

- Temperature Range: -40°C ~ +80°C
- Dimensions: 65 mm x 56 mm x 9 mm
- Weight: Approx. 12g
- Supply Voltage: 3.3V - 5V.

2.6 Key Applications

1. Environmental sensing and monitoring
2. Traffic monitoring
3. Video/Music Streaming
4. Large Data Downloads and Uploads
5. LTE Dongle/Router
6. Mobile Internet Hotspot
7. GPS Tracking
8. Security & Asset tracking
9. Smart city, smart building, smart transportation, and smart agriculture.
10. Smart Parking

2.7 Overview Diagrams

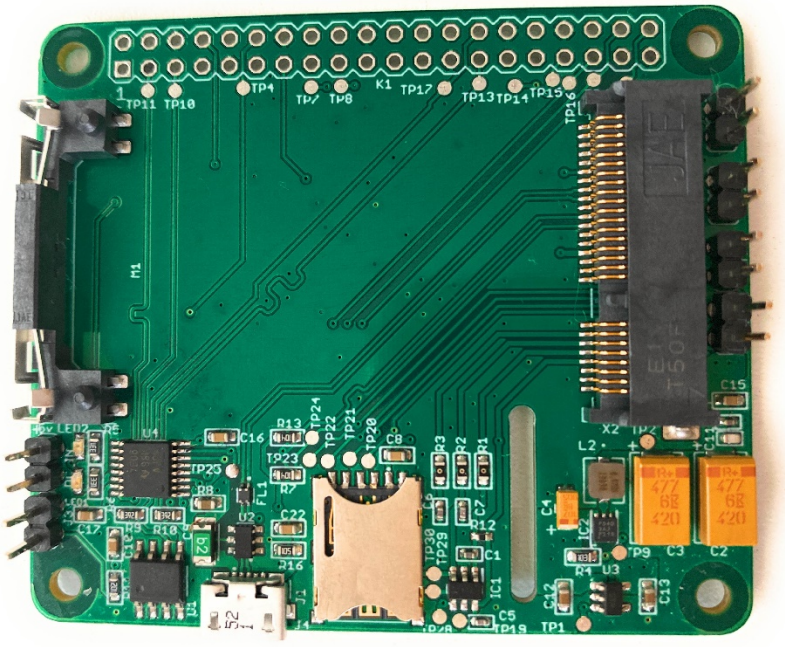


Figure 1. HAT Top View.

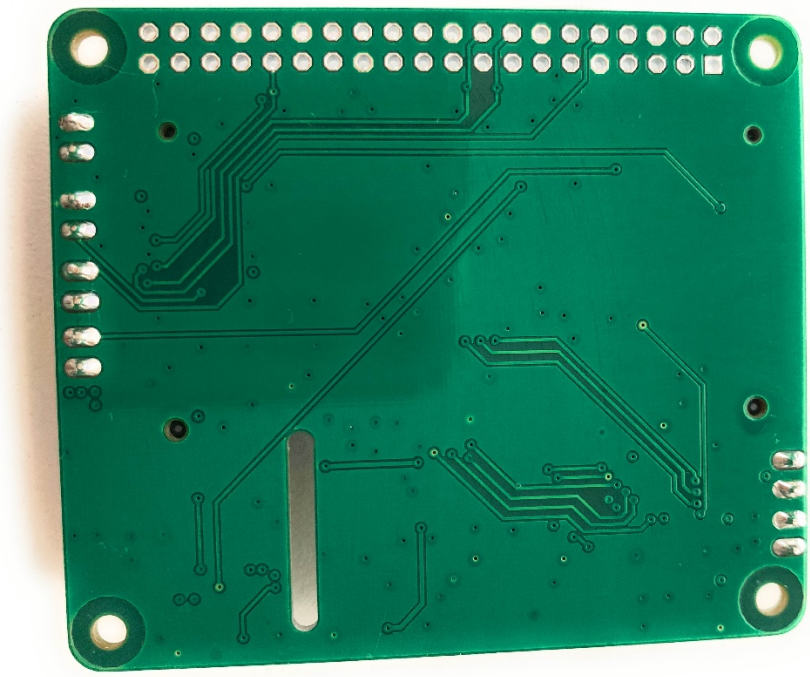
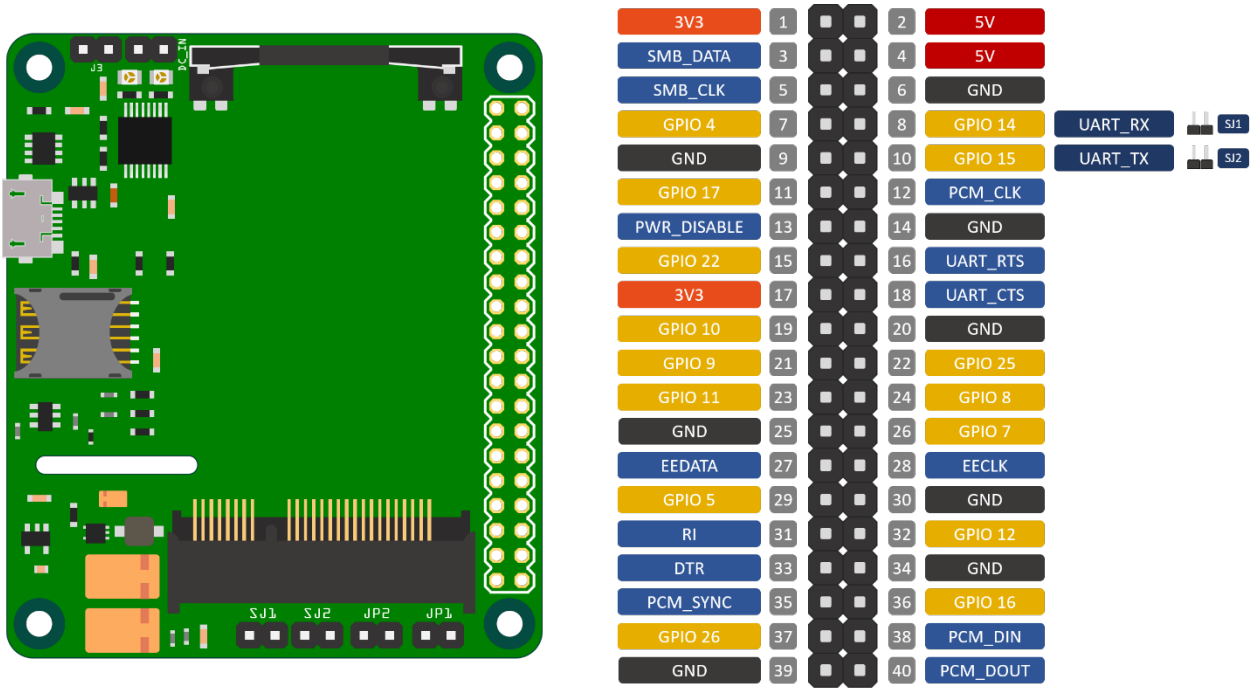


Figure 2. HAT Bottom View.

2.8 40W GPIO Interface to RASPBERRY PI



2.9 miniPCIe PIN Diagram and Assignment

The HAT has miniPCIe socket. The physical connections and signal levels of the miniPCIe socket complies with PCI Express Mini Card Electromechanical Specification and has the following interfaces:

- Power supply
- (U)SIM interface
- USB interface
- UART interfaces
- PCM and I2C interfaces
- Control and indication pins

The miniPCIe socket acceptS miniPCIe cards and has the following signals:

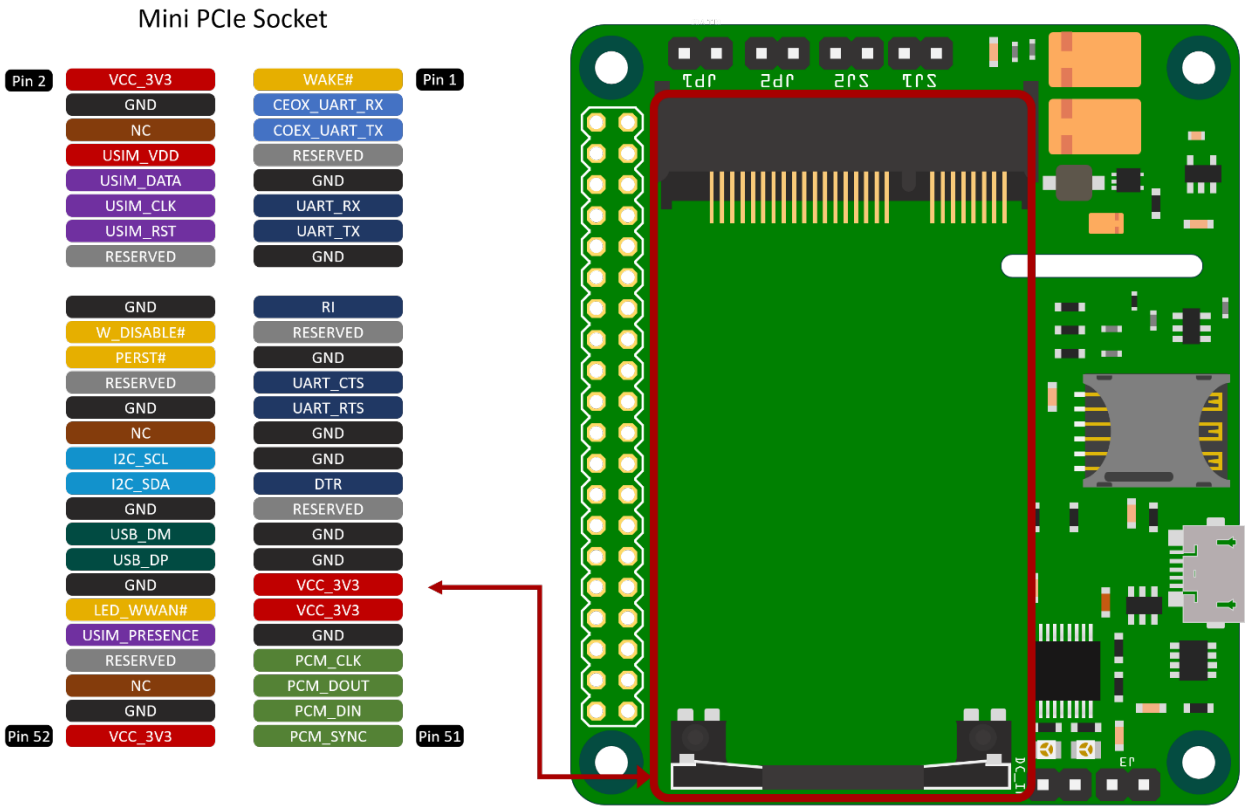


Figure 3. miniPCIe Pin Assignment

2.10 Pin Description

Pin #	Pin Name	Pin Direction	Pin Functionality
1	NC		
2	VCC_3V3	I	3.0V~3.6V, typically 3.3V DC supply
3	NC		
4	GND		Mini card ground
5	NC		
6	NC		Not connected
7	RESERVED		Reserved
8	USIM_VDD	O	Power supply for the (U)SIM card
9	GND		
10	USIM_DATA	I	Data signal of (U)SIM card
11	UART_RX	I	UART receive data
12	USIM_CLK	O	Clock signal of (U)SIM card
13	UART_TX	O	UART transmit data
14	USIM_RST	O	Reset signal of (U)SIM

			card
15	GND		
16	RESERVED		
17	RI	O	Ring indication
18	GND		
19	RESERVED		
20	W_DISABLE#	I	Airplane mode control
21	GND		
22	PERST#	I	Fundamental reset signal
23	UART_CTS	I	UART clear to send
24	RESERVED		
25	UART_RTS	O	UART request to send
26	GND		
27	GND		
28	NC		
29	GND		
30	I2C_SCL	OD	I2C serial clock
31	DTR	DI	Sleep mode control
32	I2C_SDA	OD	OD I2C serial data
33	RESERVED		
34	GND		
35	GND		
36	USB_DM	IO	USB differential data (-)
37	GND		
38	USB_DP	IO	USB differential data (+)
39	VCC_3V3	I	3.0V~3.6V, typically 3.3V DC supply
40	GND		
41	VCC_3V3	I	3.0V~3.6V, typically 3.3V DC supply
42	LED_WWAN#	OC	LED signal for indicating the network status of the module
43	GND		
44	NC		(U)SIM card insertion detection
45	PCM_CLK	IO	PCM clock signal
46	RESERVED		
47	PCM_DOUT	O	PCM data output
48	NC		
49	PCM_DIN	I	PCM data input
50	GND		
51	PCM_SYNC	IO	PCM frame synchronization
52	VCC_3V3	PI	3.0V~3.6V, typically 3.3V DC supply