Batman BM502 mmWave EVM Kit

mmWAVE SENSOR EVALUATION SOLUTION

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Joybien Batman BM502 mmWave EVM Kit is a Texas Instruments (TI) IWR6843AOP ASIC based millimeter-wave (mmWave) Kit with Frequency-Modulated Continuous Wave (FMCW) radar technology capable of operation in the 60GHz to 64GHz band with up to 4 GHz continuous chirp, using 3 Transmission Antennas and 4 Receiving Antennas, for sensing target object's range, velocity, and angle parameters.

Batman BM502 mmWave EVM Kit consists of an extremely light and compact mmWave Module (with approx. 1/3 of the size of the previous Batman series mmWave Module; along with low-power, self-monitored, ultra-accurate, and lighting condition independent versatilities), a Module Carrier Board that brings user experience and hardware integration flexibilities, and a Pi-Hat-Board for simple and direct connectivity to a Raspberry Pi or NVIDIA Jetson Nano computer; suitable for various applications including: Education, Engineering, Science, Industrial, Medical, and Business & Consumer.

Applications

- **Education's Practical Radar Introduction**
- **Engineering & Science's Motion Detection, Displacement, etc.**
- **Industrial sensor for Displacement & Safe Guard, Factory Automation, Robotics, etc.**
- **Building Automation sensor for Occupancy Detection, Proximity & Position sensing, People Counting, People Density, Security and Surveillance,**
- **Healthcare's Vital Signs Detection, People Fall Detection, etc.**
- **Business' Traffic Monitoring, and Proximity Advertisement**
- **Consumer's Gesture Recognition, Obstacle Avoidance, etc.**

Features

- **Operating Frequency: 60GHz ~ 64GHz coverage with 4GHz continuous bandwidth**
- **Antenna: 3 Tx and 4 Rx Antenna on Package (AOP), with:**
  TX Power: 15 dBm
  RX Noise Figure: 14 dB
- **Processors: ARM R4F based MCU, and C674x DSP for FMCW signal processing**
- **On-Chip Memory: 1.75MB**
- **Internal Memories With ECC**
- **Integrated Peripherals**
- **Extremely light and compact Module design.**
- **Supplied Voltage: 5VDC & 1.5A**

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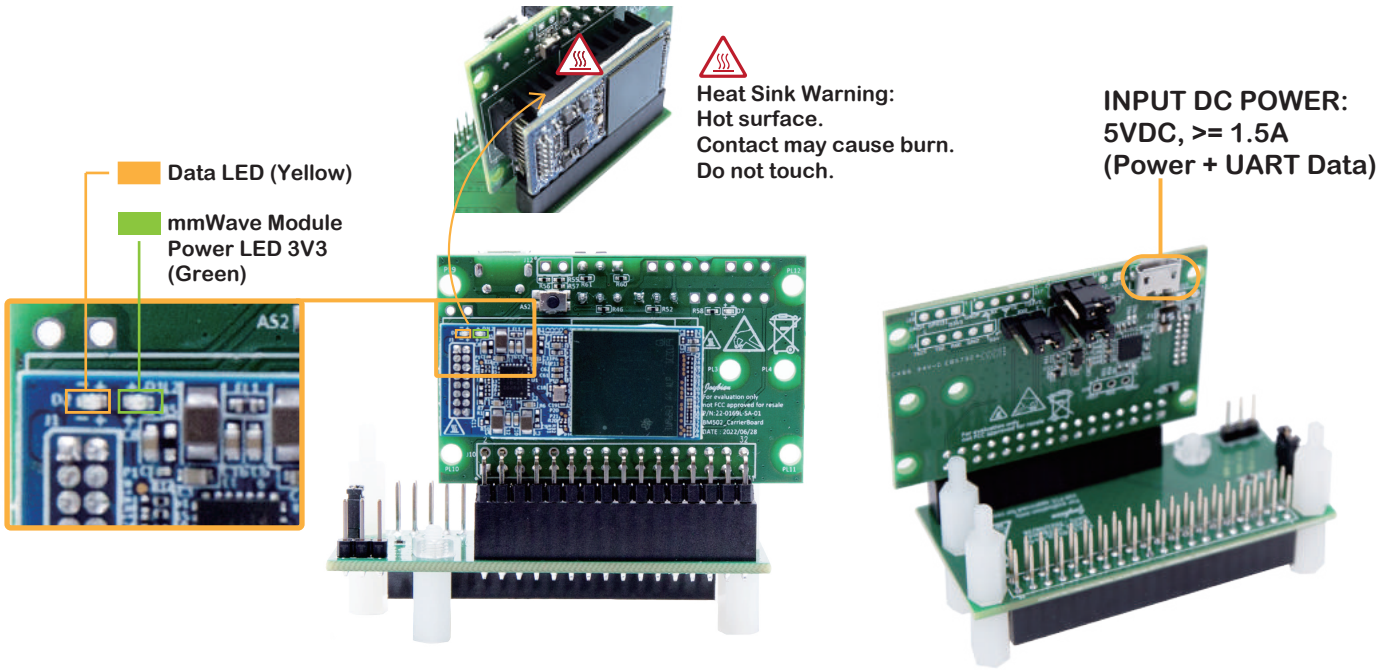
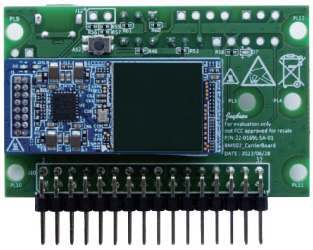
Packing List: mmWave Module on Carrier Board, Raspberry Pi-Hat Board, Python SDK

- Make sure you are using the correct power supply of 5 V, >1.5 A with a Micro USB connection



Batman BM502 EVM Kit includes



mmWave Module on Carrier Board

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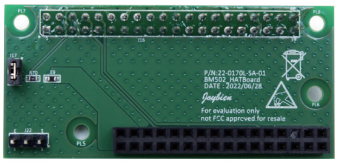

Raspberry Pi / Jetson Nano
Hat Board

+

Python SDK
(Python SDK upon request)

Python SDK

Python SDK upon purchasing BM502 EVM Kit via email or on Github at:

https://github.com/bigheadG/mmWave

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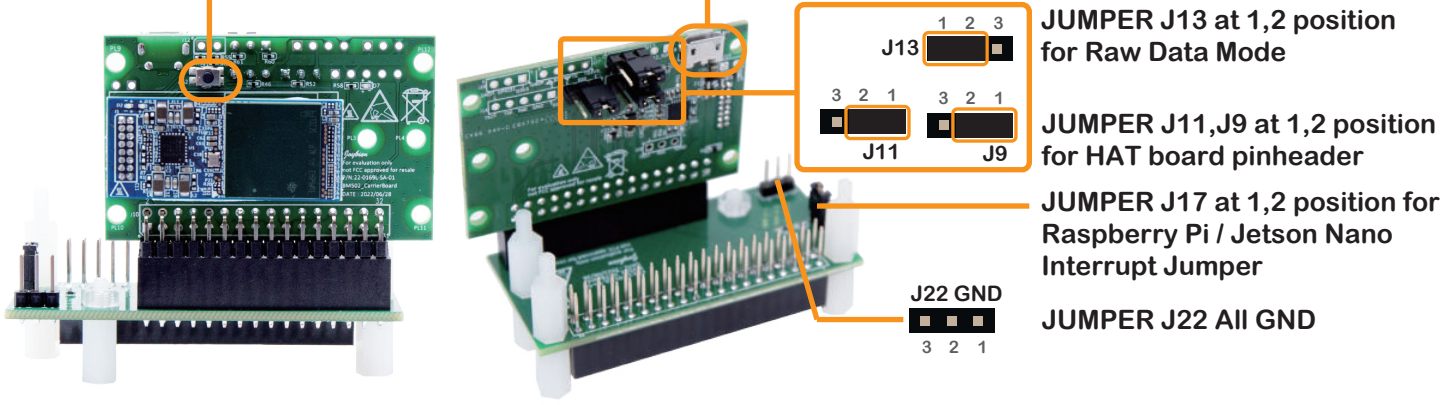
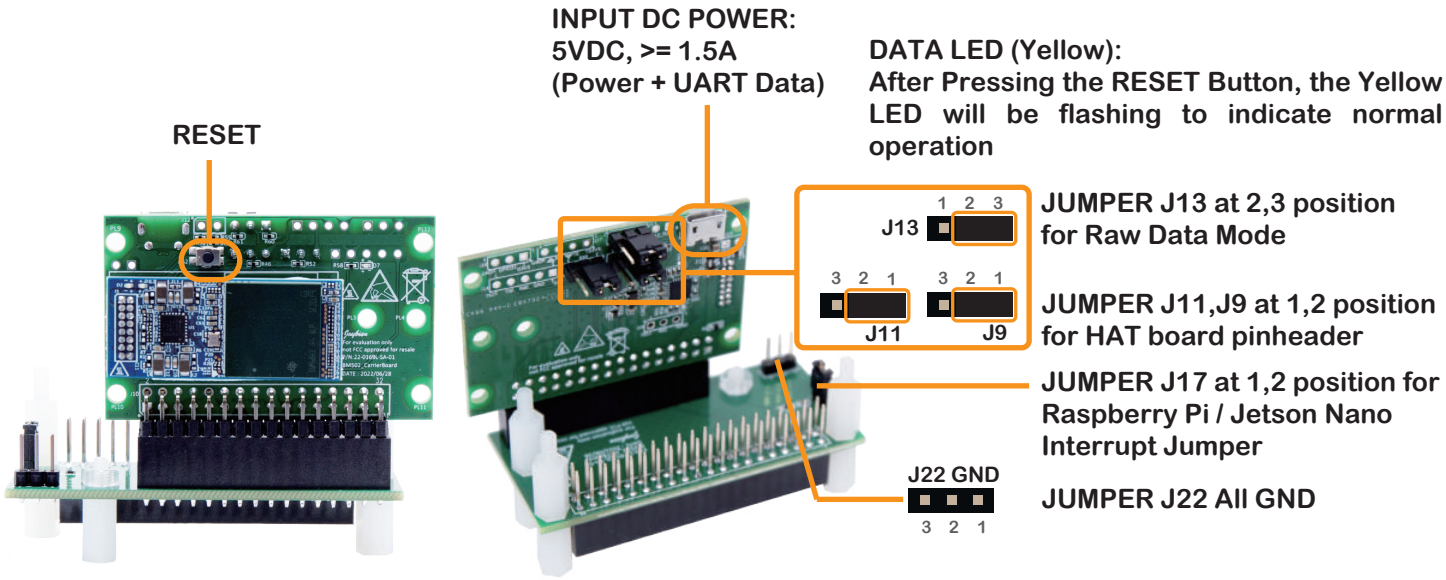
Selection：Key Data Mode or Raw Data Mode Application

(A) Raw Data Mode



(B) Key Data Mode



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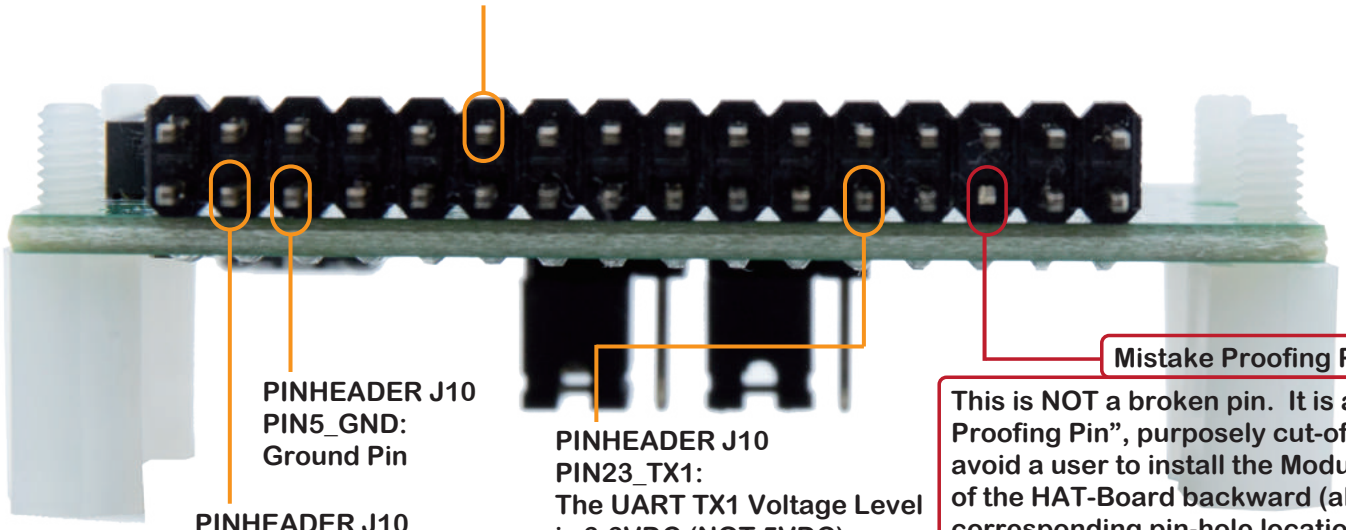
Batman BM502 Module Pin Assignment Note

J1 J1 Pin Assignment

Pin#	Name		Name	Pin#
J1.1	5VDC_IN		5VDC_IN	J1.2
J1.3	RS232_RX0		GPIO_1	J1.4
J1.5	RS232_TX0		GPIO_2	J1.6
J1.7	nRST		GPIO_32	J1.8
J1.9	PMIC_CLKOUT_SOP2		GPIO_31	J1.10
J1.11	MSS_Logger_JB_TX1		SDA	J1.12
J1.13	GPIO_0		SCL	J1.14
J1.15	GND		GND	J1.16

Batman BM502 Carry Board J10 Pin Assignment Note

PINHEADER J10 PIN12_GPIO_0 High: Raw Data Baud Rate 921600/8/n/1 selection for PIN23_TX1
PINHEADER J10 PIN12_GPIO_0 Low : Key Data Baud Rate 921600/8/n/1 selection for PIN23_TX1



PINHEADER J10
PIN5_GND:
Ground Pin

PINHEADER J10
PIN5V: 5VDC, 1.5A

PINHEADER J10
PIN23_TX1:
The UART TX1 Voltage Level is 3.3VDC (NOT 5VDC).
Please handle with care

Mistake Proofing Pin

This is NOT a broken pin. It is a “Mistake Proofing Pin”, purposely cut-off; so to avoid a user to install the Module on top of the HAT-Board backward (also see the corresponding pin-hole location on the Female Connector on the HAT-Board with the pin-hole blocked).

Alert : All GPIO Pins base on 5V System. Pin23_TX1 is DC 5V system.

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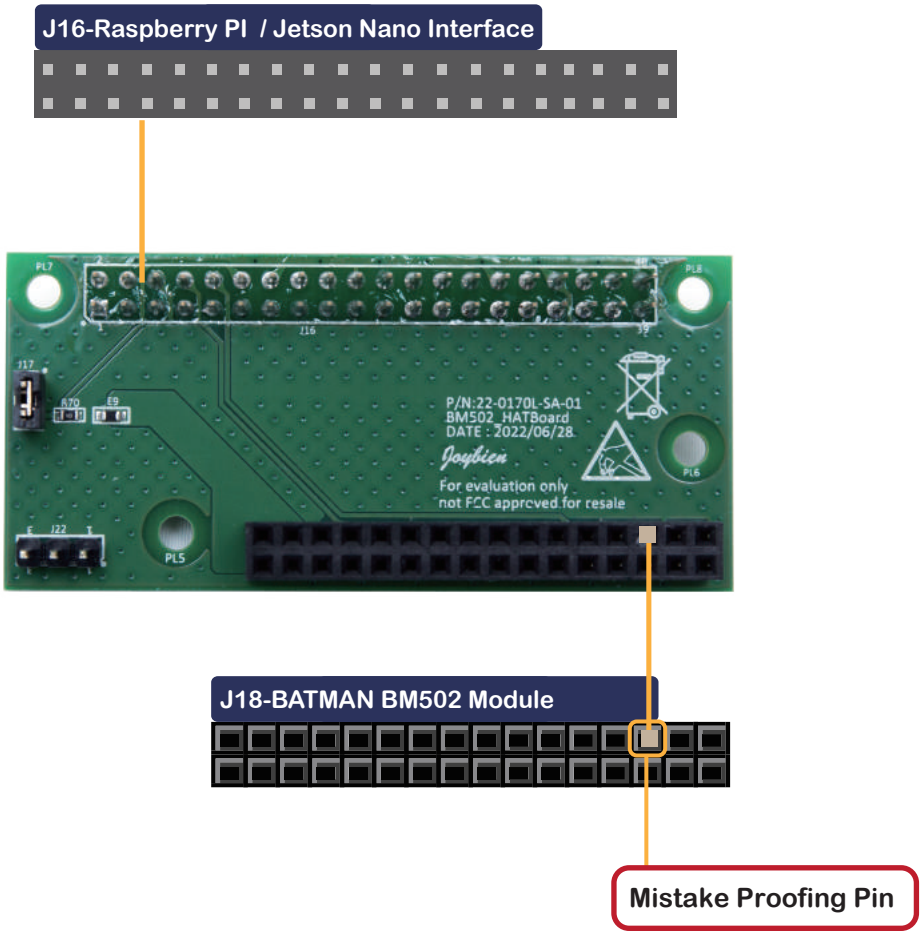
mmWave Raspberry Pi Hat Pin Assignment



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BM502 EVM Kit Installation on Desktop Computer

On Software side, please download & install Silicon Labs CP210x USB to UART Bridge Virtual COM Port (VCP) drivers for your Computer (Windows, Mac, or Linux) at:
https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers
to enable the UART communication between BM502 EVM Kit and Computer.

Please make sure that you have installed Python on your Computer at:
https://www.python.org/downloads/
Note: You must enable “Add Python to PATH” upon installation.

You may download GEANY as your Python code editor at:
https://www.geany.org/download/releases/

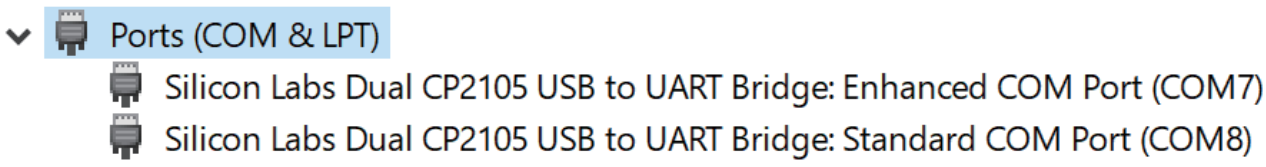
At this point, you may download and execute the corresponding BM502 EVM Kit’s Python SDK examples at:
https://github.com/bigheadG/mmWave
Note: Please follow the Python example to install relevant Libraries for proper execution.

To enable UART port on Computer, you will need to enable proper PORT setting within the Python Code. As an example, for Window PC having UART running at 921600 bps, please enable:

```
port = serial.Serial("COM#",baudrate = 921600, timeout = 0.5)
```

where the “#” of the COM# should correspond to the Enhanced COM Port dynamically assigned by Windows Device Manager’s Ports (COM & LPT) after the USB cable is properly connected on the both ends. As an example, in the picture below, the COM port used is the Silicon Labs CP210x Enhanced COM Port assigned, and in this case, it is COM7; so you will need to enable your Python Code to include:

```
port = serial.Serial("COM7",baudrate = 921600, timeout = 0.5)
```



Please follow similar process for Mac or Linux Computer for the UART communication port used.

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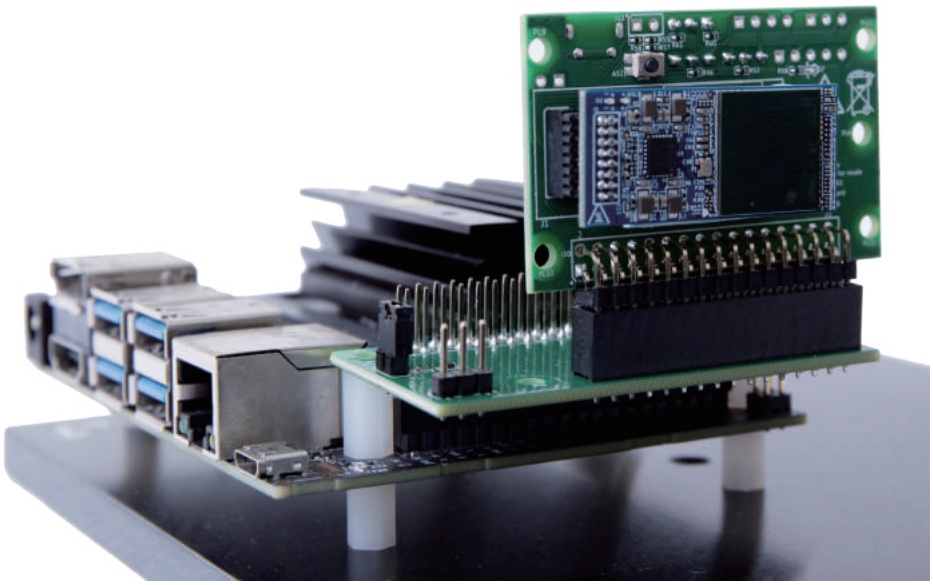
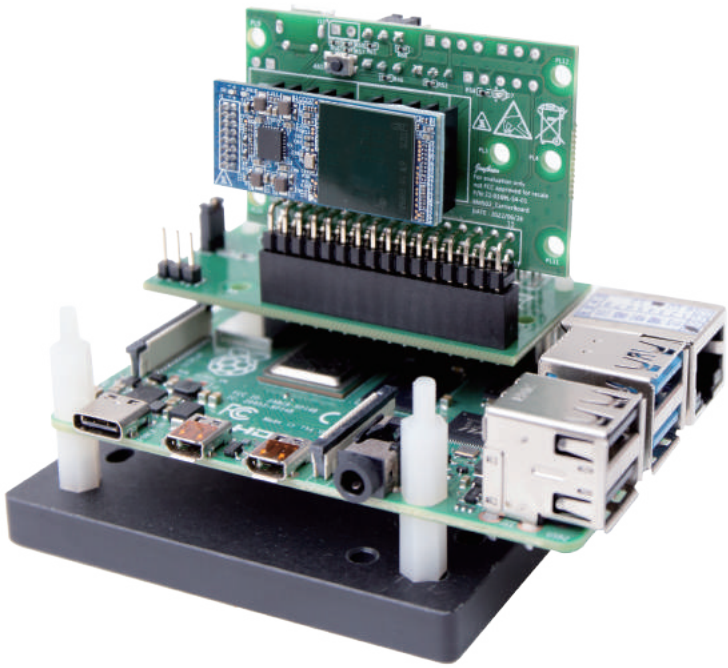
Batman Kit + NVIDIA Jetson Nano / Batman Kit + Raspberry Pi

Please make sure that the JUMPER SETTING is for Raw Data Mode

Batman BM502 EVM Kit + Jetson Nano



Batman BM502 EVM Kit + Raspberry Pi



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Specifications

mmWave Sensor Evaluation Module

mmWave ASIC	TI IWR6843AOP Single Chip mmWave Sensor
FMCW Transceiver	● Integrated PLL, Transmitter, Receiver, Baseband, and A2D ● 60GHz to 64GHz Coverage With 4GHz Continuous Bandwidth ● Four Receive Channels ● Three Transmit Channels ● Ultra-Accurate Chirp Engine Based on Fractional-N PLL ● TX Power: 15 dBm ● RX Noise Figure: 14 dB ● Phase Noise at 1 MHz: –92 dBc/Hz ● Antenna Type : Antenna On Package(AOP)
Built-in Calibration and Self-Test (Monitoring)	● ARM® Cortex® -R4F-Based Radio Control System ● Built-in Firmware (ROM) ● Self-calibrating System Across Frequency and Temperature
DSP	● C674x DSP for Advanced Signal Processing
On-Chip Memory	● 1.75MB
MCU	● ARM R4F Microcontroller for Object Detection, and Interface Control ● Joybien mmWave Protocol (Per configuration)
I/O	● UART x 2 ● GPIO x 2(GPIO_31,GPIO_32) ● I2C x 1
Power Management	● Built-in LDO Network for Enhanced PSRR ● I/Os Support Dual Voltage 3.3 V
Clock Source	40MHz
Antenna Orientation	4 receive(RX) 3 transmit (TX) antenna with 120° azimuth field of view (FoV) and 120° elevation FoV
Input Power	5VDC, 1.5A source
Operating Temperature & Humidity	0°C ~ 40°C 10% ~ 85% Non-Condensing
Dimensions & Weight	37mm x 16mm x 2.4mm ; 3 grams net

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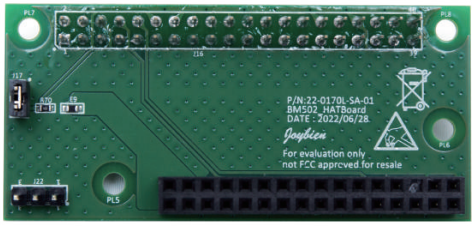
Raspberry Pi / Jetson Nano Hat Board



Connector	● Matching mmWave Module Female Connector ● Matching Raspberry Pi GPIO Female Connector
Operating Temperature Operating Humidity	● 0° to 40° degree Celsius ● 10 ~ 85% Non-Condensing
Dimensions & Weight	● 65mm x 30mm 21 grams

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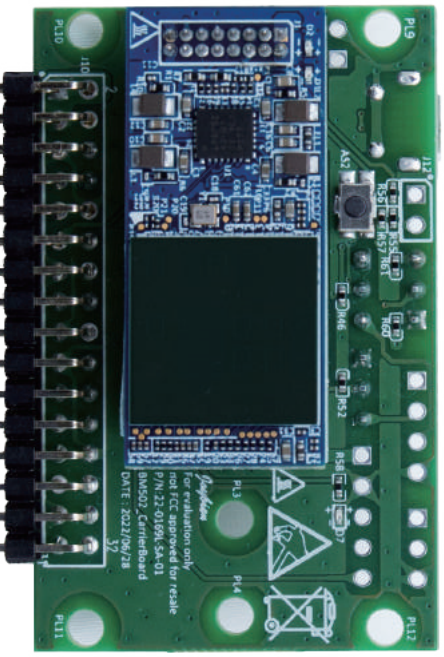
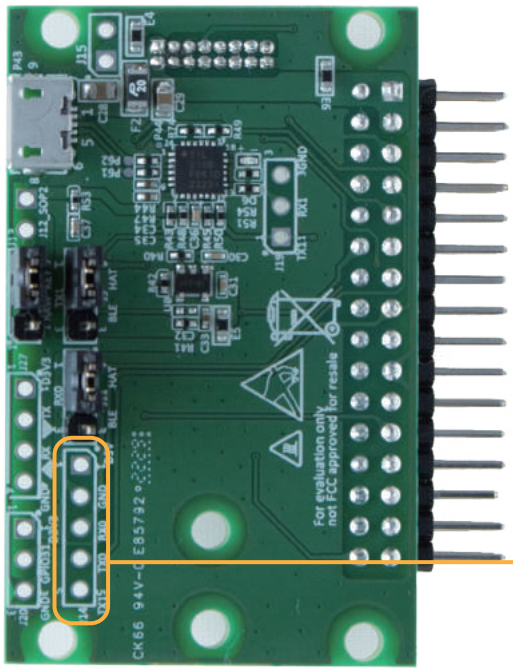
mmWave Carrier Board Pin Assignment

J10 J10 Pin Assignment

Pin#	Name		Name	Pin#
01	5VDC		5VDC	02
03	5VDC		X	04
05	GND		X	06
07	RS232 RX		X	08
09	RS232 TX		GND	10
11	nRST		GPIO 0	12
13	GND		X	14
15	GPIO31		X	16
17	GPIO32		X	18
19	GND		X	20
21	X		X	22
23	MSS LOGGER JBTX1		X	24
25	X		GND	26
27	Mistake Proofing Pin		X	28
29	GND		X	30
31	X		GPIO 32	32





J14	Name	Pin#
	DC 5V	01
	GND	02
	RX0	03
	TX0	04
	TX1	05

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J10 Pin Assignment

"X" = Not applicable

Pin No	Name	Pin Type	Function Description
01	5VDC	I	POWER 5VDC Input
02	5VDC	I	POWER 5VDC Input
03	5VDC	I	POWER 5VDC Input
04	X	X	X
05	GND	GROUND	Digital ground
06	X	X	X
07	RS232 RX0	I	UART A Receive
08	X	X	X
09	RS232 TX0	O	UART A Transmit
10	GND	GROUND	Digital ground
11	nRST	I	Power on reset for chip. Active low
12	GPIO 0	I	Select KeyData or RawData
13	GND	GROUND	Digital ground
14	X	X	X
15	GPIO 31	IO	GPIO Pin
16	X	X	X
17	GPIO 32	IO	GPIO Pin
18	X	X	X
19	GND	GROUND	Digital ground
20	X	X	X
21	X	X	X
22	X	X	X
23	MSS LOGGER JBTX1	O	UART B Transmit
24	X	X	X
25	X	X	X
26	GND	GROUND	Digital ground
27	X	X	Mistake Proofing Pin
28	X	X	X
29	GND	GROUND	Digital ground
30	X	X	X
31	X	X	X
32	GPIO2	O	LED Indicator

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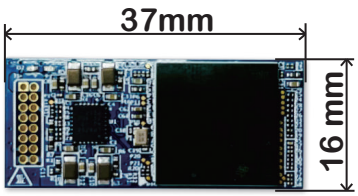
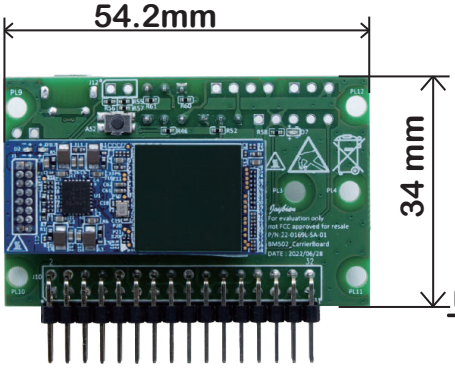
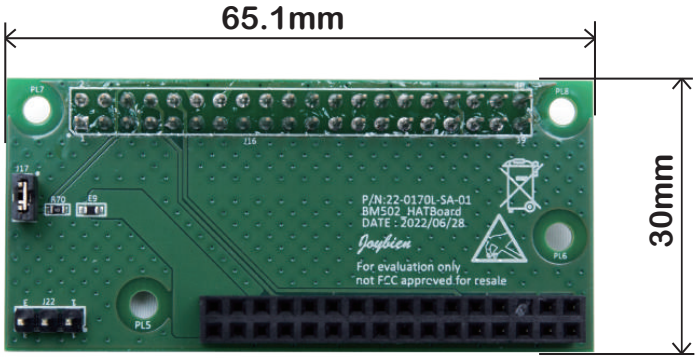
Product Dimensions



module



module + Carrier Board



Hat board

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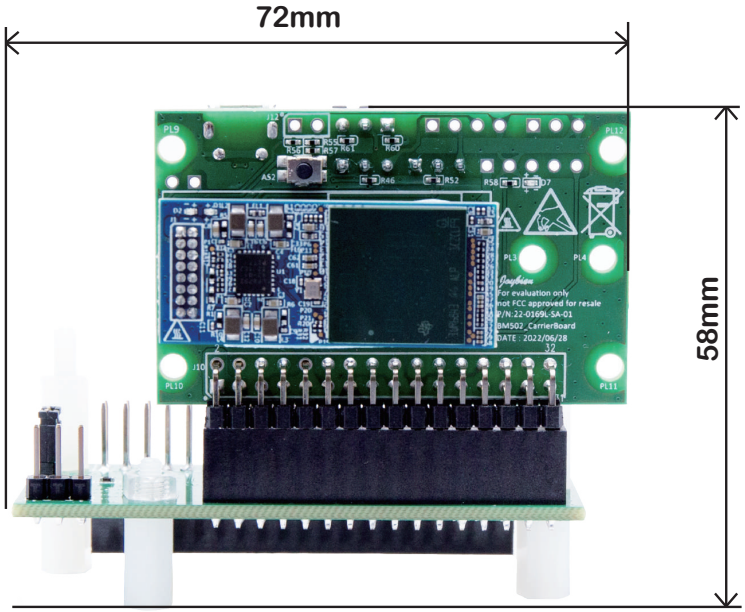

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"Python" is a registered trademark of the PSF.
This EVM Kit does not include Raspberry Pi computer, nor NVIDIA Jetson Nano computer.
Please contact us at Joybien in advance for BM502 commercial application for mass production.