Batman BM501 mmWave EVM Kit

mmWAVE SENSOR EVALUATION SOLUTION

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Joybien Batman BM501 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 BM501 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.
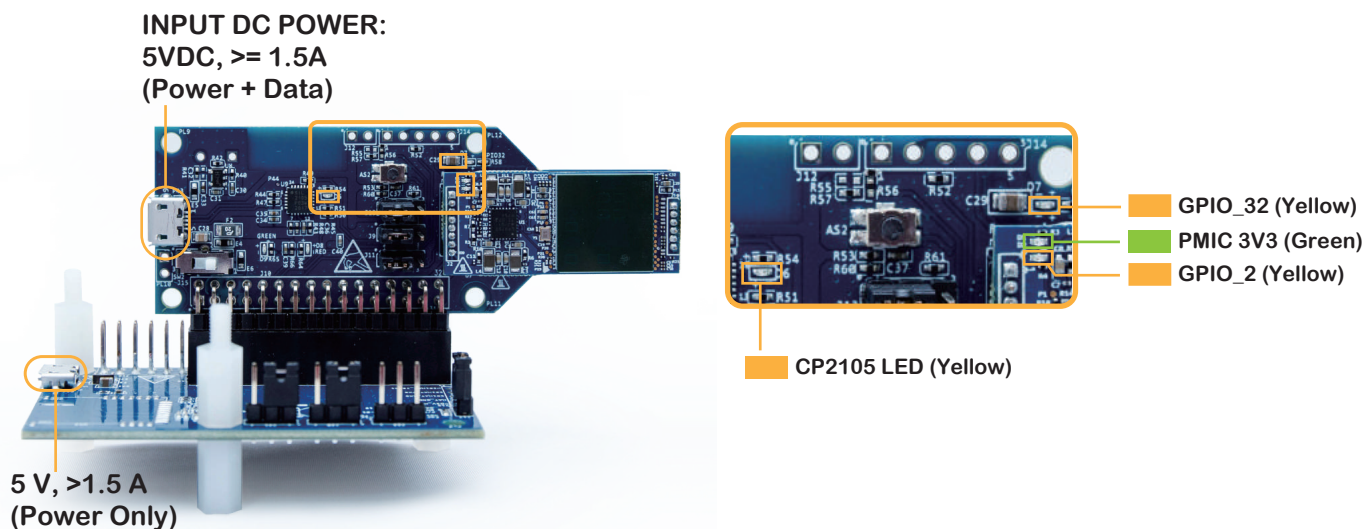- Supplied Voltage: 5VDC & 1.5A

Batman BM501 mmWave EVM Kit
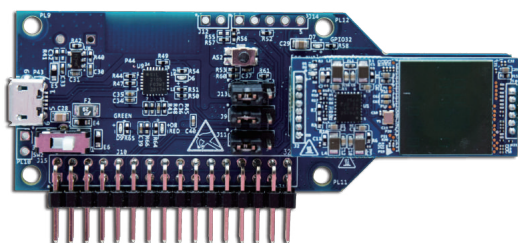
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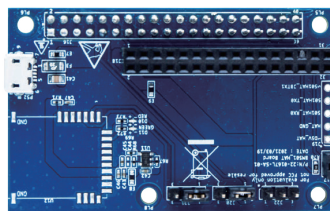### Packing List: mmWave Module, Raspberry Pi-Hat Board, Python SDK

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

INPUT DC POWER:
5VDC, >= 1.5A
(Power + Data)

5 V, >1.5 A
(Power Only)

GPIO_32 (Yellow)
PMIC 3V3 (Green)
GPIO_2 (Yellow)

CP2105 LED (Yellow)

Batman BM501 EVM Kit includes

mmWave + Raspberry Pi / Jetson Nano Hat Board + Python SDK (Python SDK upon request)

Python SDK

Python SDK upon purchasing BM501 EVM Kit via email

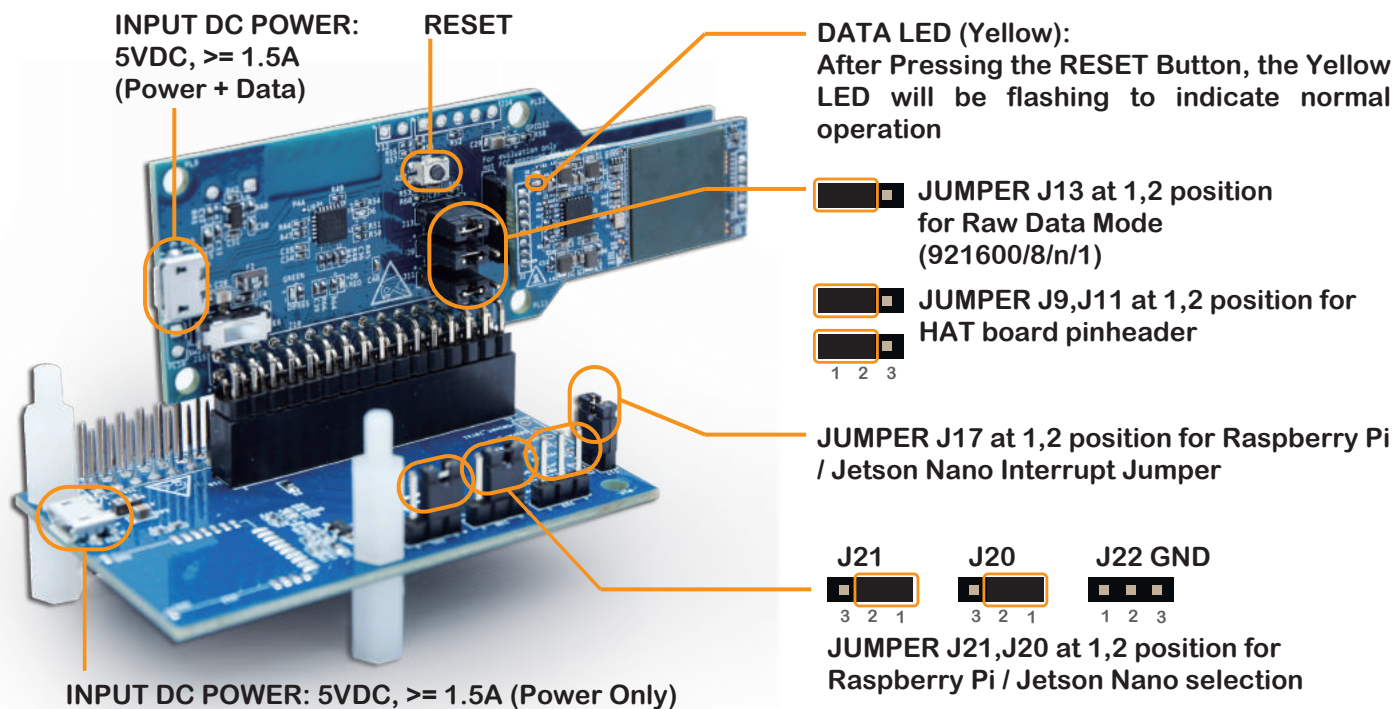**https://github.com/bigheadG/mmWave**

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Selection：Key Data Mode or Raw Data Mode Application

(A) Raw Data Mode(921600/8/n/1)

INPUT DC POWER:
5VDC, >= 1.5A
(Power + Data)

RESET

DATA LED (Yellow):
After Pressing the RESET Button, the Yellow LED will be flashing to indicate normal operation

JUMPER J13 at 1,2 position for Raw Data Mode (921600/8/n/1)

JUMPER J9,J11 at 1,2 position for HAT board pinheader

1 2 3

JUMPER J17 at 1,2 position for Raspberry Pi / Jetson Nano Interrupt Jumper

J21　　**J20**　　**J22 GND**

3 2 1　　3 2 1　　1 2 3

JUMPER J21,J20 at 1,2 position for Raspberry Pi / Jetson Nano selection

INPUT DC POWER: 5VDC, >= 1.5A (Power Only)

(B) Key Data Mode(921600/8/n/1)

INPUT DC POWER:
5VDC, >= 1.5A
(Power + Data)

RESET

DATA LED (Yellow):
After Pressing the RESET Button, the Yellow LED will be flashing to indicate normal operation

JUMPER J13 selection for Key Data Mode (921600/8/n/1)

JUMPER J9,J11 at 1,2 position for HAT board pinheader

1 2 3

JUMPER J17 at 1,2 position for Raspberry Pi / Jetson Nano Interrupt Jumper

J21　　**J20**　　**J22 GND**

3 2 1　　3 2 1　　3 2 1

JUMPER J21,J20 at 1,2 position for Raspberry Pi / Jetson Nano selection

INPUT DC POWER: 5VDC, >= 1.5A (Power Only)

Batman BM501 mmWave EVM Kit

mmWAVE SENSOR EVALUATION SOLUTION

Batman BM501 Module Pin Assignment Note

J2 — J2 Pin Assignment

Pin#	Name
J2.1	5VDC_IN
J2.2	RS232_RX0
J2.3	RS232_TX0
J2.4	nRST
J2.5	SOP2
J2.6	MSS_Logger_JB_TX1
J2.7	GPIO_0
J2.8	
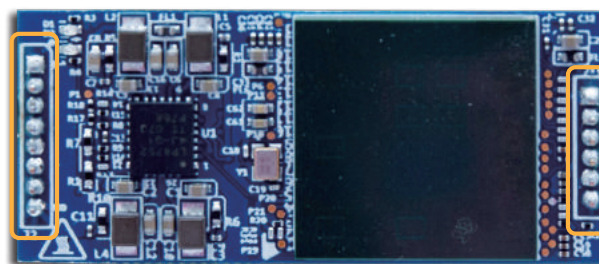
J1 — J1 Pin Assignment

Name	Pin#
TBD,3V3DC_OUT	J1.1
GPIO_31	J1.2
GPIO_32	J1.3
GPIO_2	J1.4
GPIO_1	J1.5
GND	J1.6

Batman BM501 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
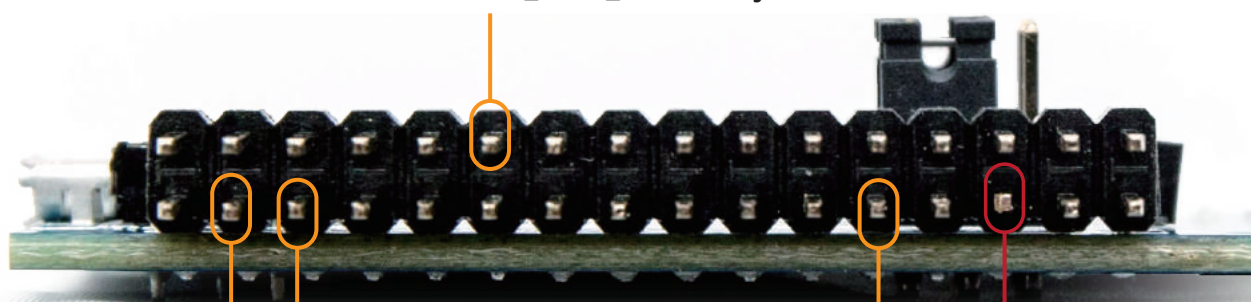
PINHEADER J10 PIN5_GND: Ground Pin

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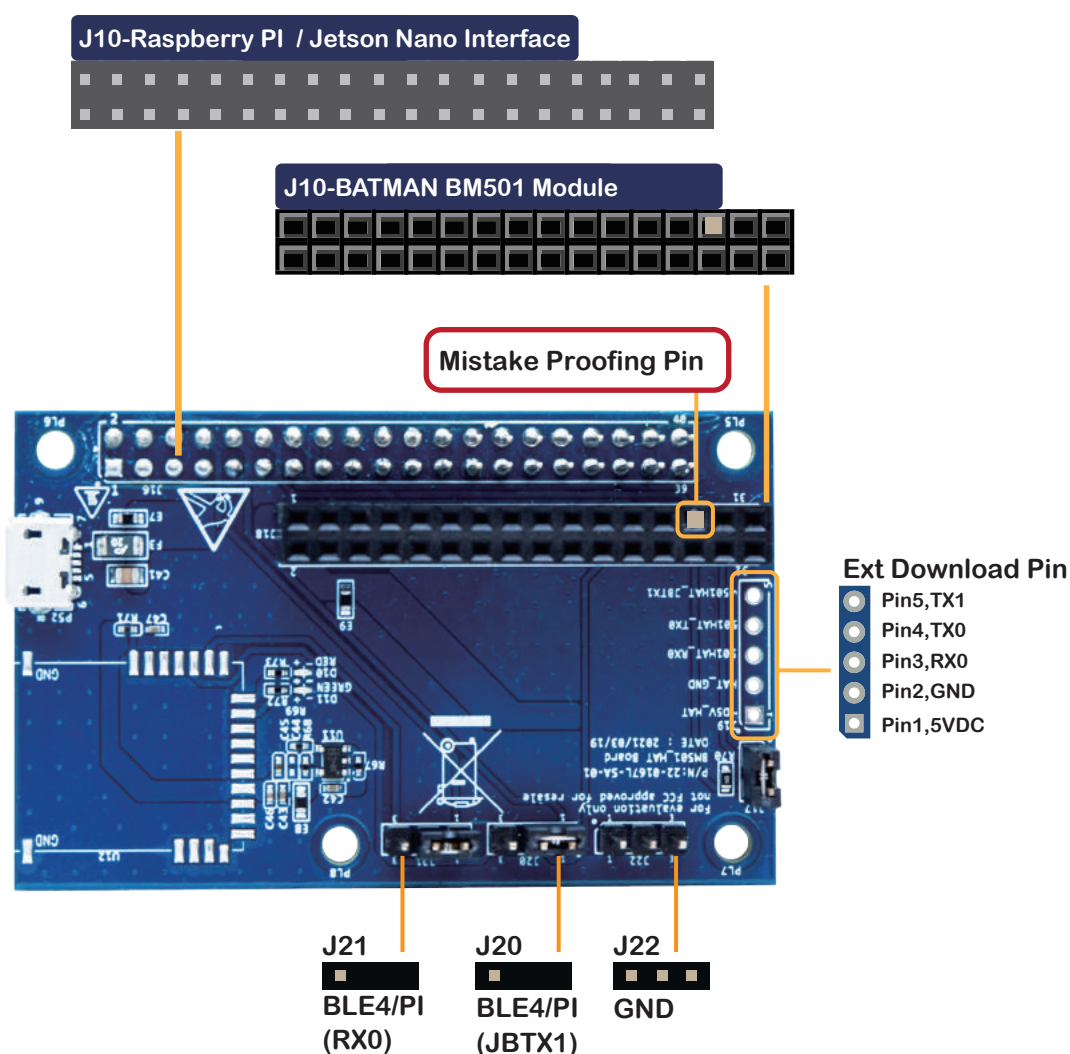
Alert：All GPIO Pins base on 5V System. Pin23_TX1 is DC 5V system.

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mmWAVE SENSOR EVALUATION SOLUTION

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mmWave Raspberry Pi Hat Pin Assignment

J10-Raspberry PI / Jetson Nano Interface

J10-BATMAN BM501 Module

Mistake Proofing Pin

Ext Download Pin

Pin5,TX1
Pin4,TX0
Pin3,RX0
Pin2,GND
Pin1,5VDC

J21

**BLE4/PI
(RX0)**

J20

**BLE4/PI
(JBTX1)**

J22

GND

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mmWAVE SENSOR EVALUATION SOLUTION

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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

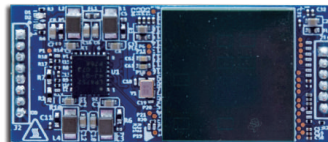## Batman BM501 EVM Kit + Jetson Nano
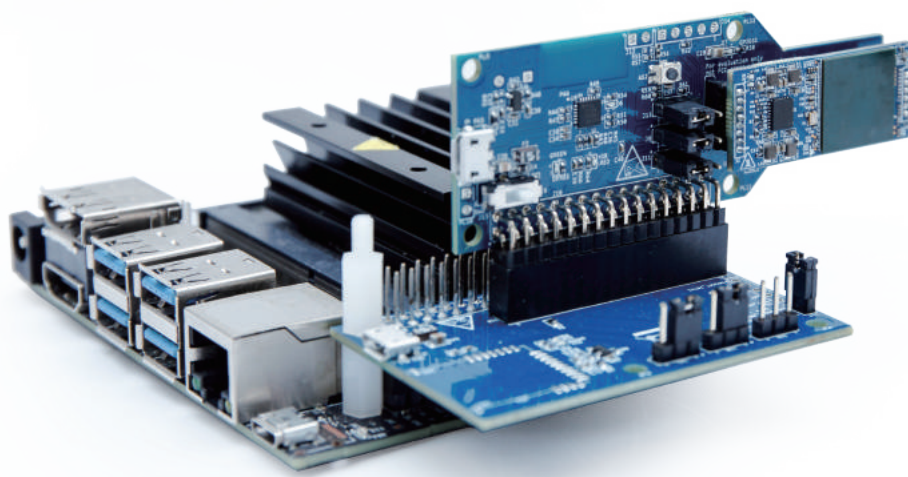
Batman BM501 EVM Kit + Raspberry Pi
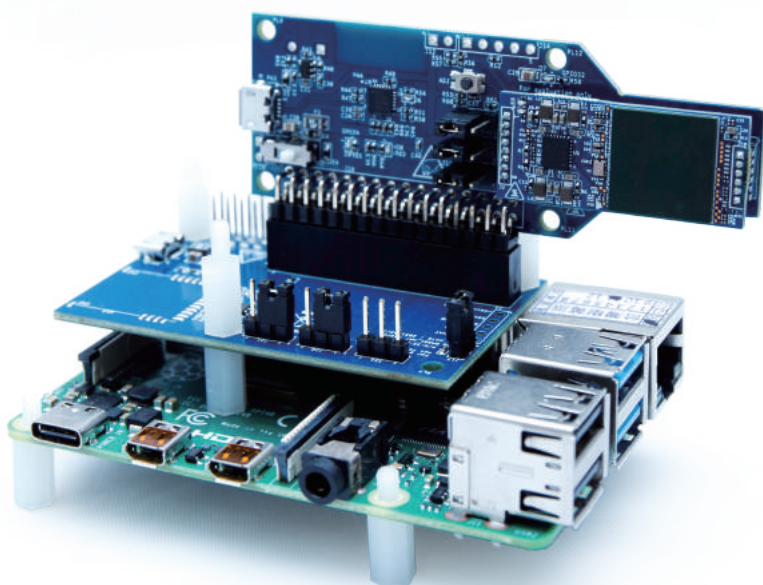
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Specifications

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)
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 ● Micro USB Power Connector (Power only) ● Jumpers for Bluetooth Tx/Rx or Raspberry Pi Tx/Rx Selection
Bluetooth (optional)	● Joybien JBT24M Bluetooth Low Energy Module
Micro USB Input Power	● 5VDC, 1.5Amp. (Note: Power Adapter and Micro USB Cable NOT included)
Operating Temperature Operating Humidity	● 0° to 40° degree Celsius ● 10 ~ 85% Non-Condensing
Dimensions & Weight	● 60mm x 39mm 21 grams

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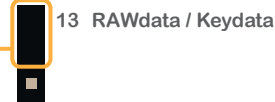
mmWave Pin Assignment

J3   J3 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
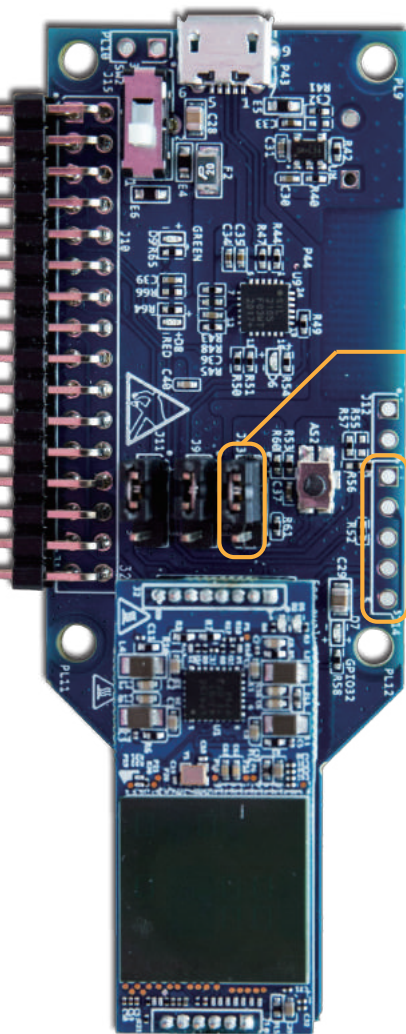
J13   J13 Pin Assignment

13   RAWdata / Keydata

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

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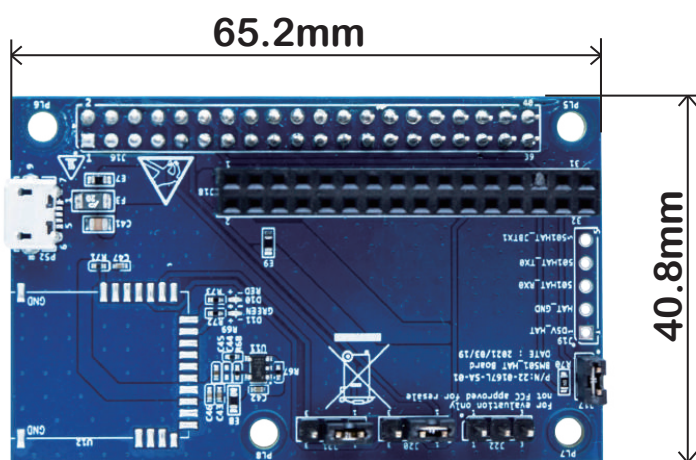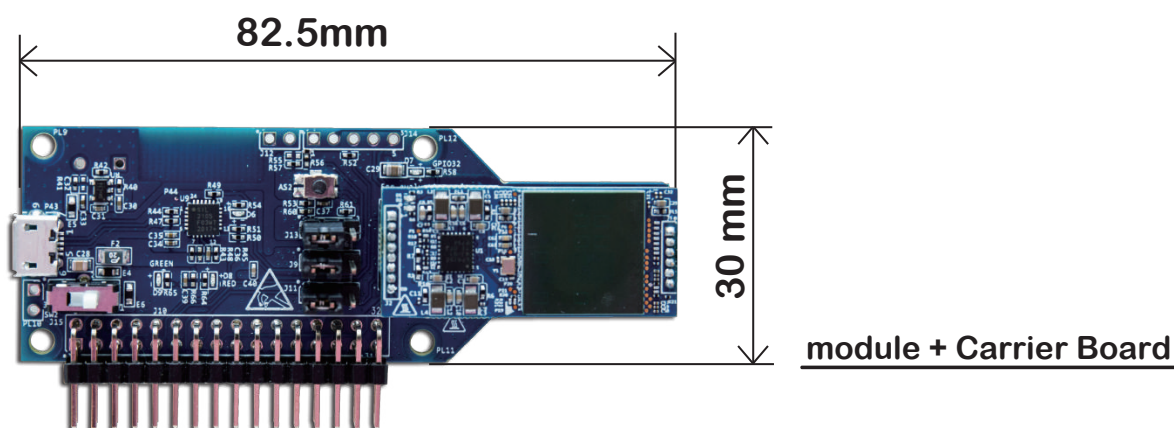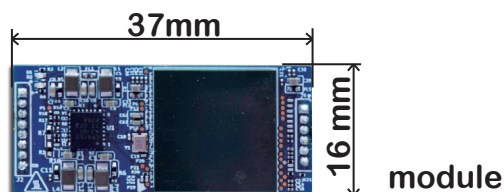
mmWAVE SENSOR EVALUATION SOLUTION

J10 Pin Assignment

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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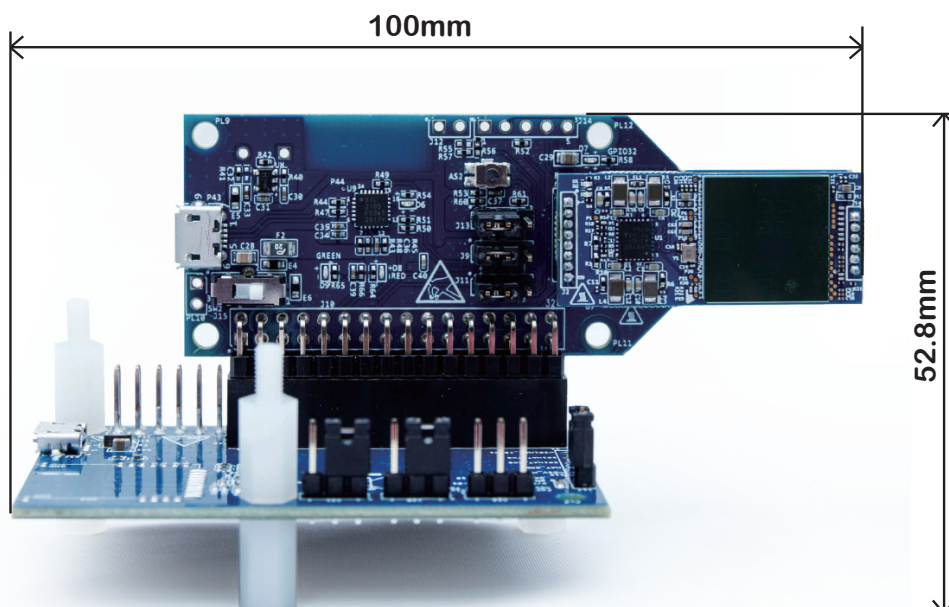
Product Dimensions

37mm

16 mm

module

82.5mm

30 mm

module + Carrier Board

65.2mm

40.8mm

Hat board

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Product Dimensions

100mm

52.8mm

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www.joybien.com

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Raspberry Pi logo and Raspberry Pi 4 are trademarks and/or registered trademarks of Raspberry Pi Foundation.
"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 BM501 commercial application for mass production.