Batman BM601 mmWave EVM Kit

mmWAVE SENSOR EVALUATION SOLUTION

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Joybien Batman BM601 mmWave EVM Kit is a Texas Instruments (TI) IWR1843 ASIC based millimeter-wave (mmWave) Kit with Frequency-Modulated Continuous Wave (FMCW) radar technology capable of operation in the 76GHz to 81GHz 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 BM601 mmWave EVM Kit is an extremely light and compact mmWave Module with low-power, self-monitored, ultra-accurate, and lighting condition independent versatilities 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, Parking Space occupancy and Proximity Advertisement
- Consumer's Gesture Recognition, Obstacle Avoidance, etc.

Features

- Operating Frequency: 76GHz ~ 81GHz coverage
  with 4GHz continuous bandwidth
- Antenna: 3 Tx and 4 Rx with:
  TX Power: 12 dBm
  RX Noise Figure: 14 dB(76GHz ~ 77GHz) / 15 dB(77GHz ~ 81GHz)
  Phase noise at 1MHz:–95 (76GHz ~ 77GHz) / –93 (77GHz ~ 81GHz)
- 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 & 2.1A

Joybien Technologies Co., Ltd. TEL:02-8227-3098 http://www.joybien.com
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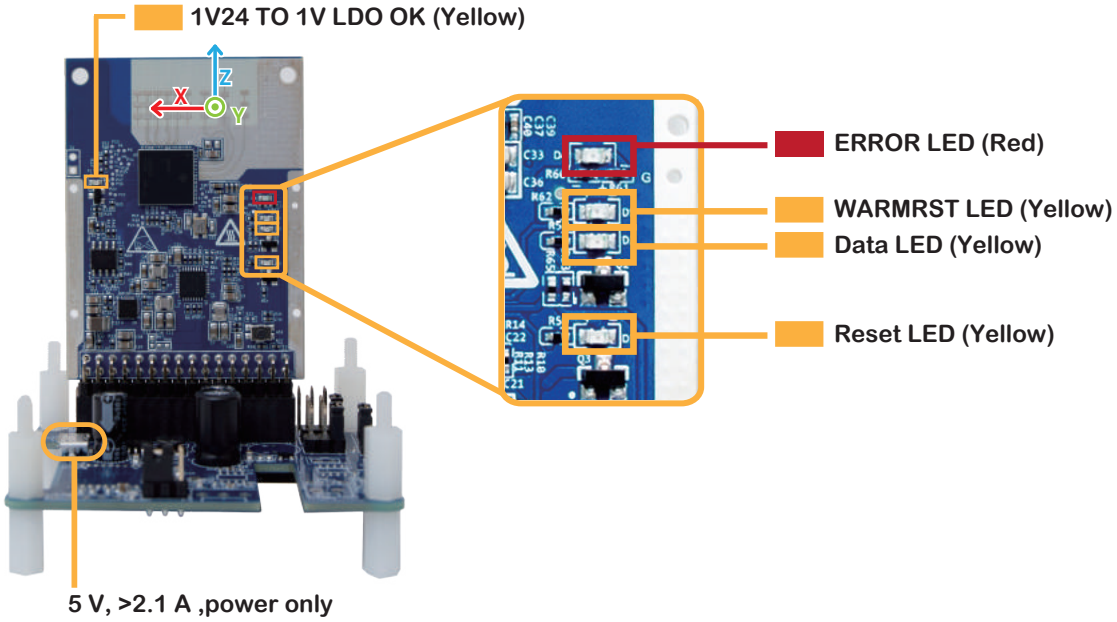
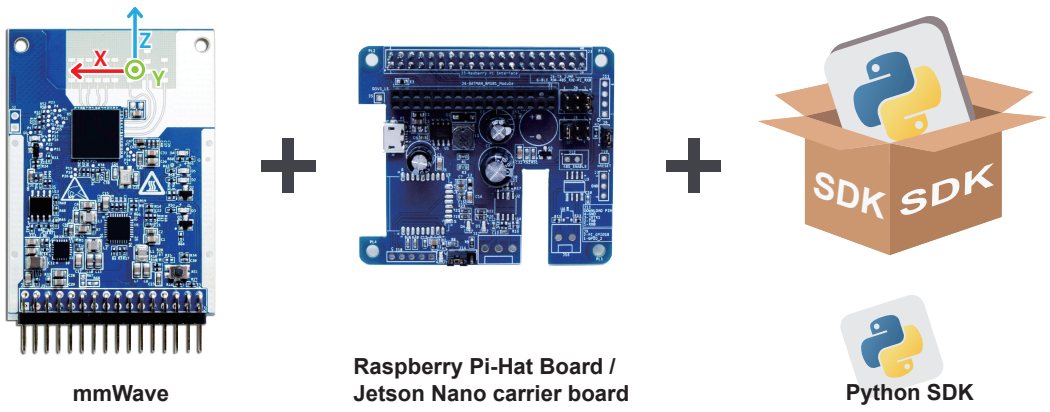
Packing List: mmWave Module, Raspberry Pi-Hat Board, Python SDK

- Make sure you are using the correct power supply of 5 V, >2.1 A with a Micro USB connection



Note: Raspberry Pi, Jetson Nano, or Linux/Mac/Windows computer not included.

Batman BM601 EVM Kit includes



mmWave

Raspberry Pi-Hat Board /
Jetson Nano carrier board

Python SDK

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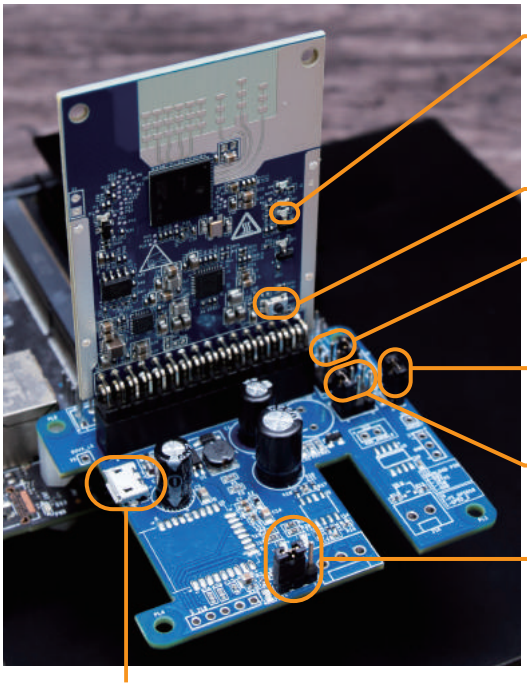
Selection：Key Data Mode or Raw Data Mode Application

(A) Raw Data Mode



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

RESET

JUMPER J6 at 1,2 position for Raspberry Pi / Jetson Nano selection

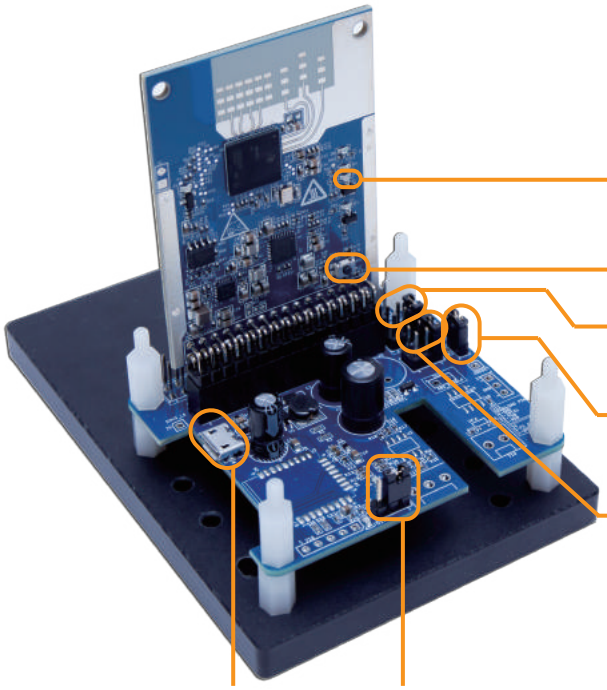
JUMPER J9 at 1,2 position for Raspberry Pi / Jetson Nano Interrupt Jumper

JUMPER J8 at 5,6 position for RX0

JUMPER J14 at 1,2 position for Raw Data Mode

INPUT DC POWER: 5VDC, >= 2.1A (only power)

(B) Key Data Mode



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RESET

JUMPER J6 at 1,2 position for Raspberry Pi / Jetson Nano selection

JUMPER J9 at 1,2 position for Raspberry Pi / Jetson Nano Interrupt Jumper

JUMPER J8 at 5,6 position for RX0

INPUT DC POWER: 5VDC, >= 2.1A (only power)

JUMPER J14 selection for Key Data Mode

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Batman BM601 Module J3 Pin Assignment Note

PINHEADER J3 PIN12_GPIO_0 High: Raw Data Baud Rate 921600/8/n/1 selection for PIN23_TX1
PINHEADER J3 PIN12_GPIO_0 Low : Key Data Baud Rate 115200/8/n/1 selection for PIN23_TX1

PINHEADER J3
PIN5_GND: Ground Pin

PINHEADER J3
PIN3_3V: 3VDC, 2.1A

PINHEADER J3
PIN23_TX1:
The UART TX1 Voltage Level is 3.3VDC (NOT 5VDC).
Please handle with care

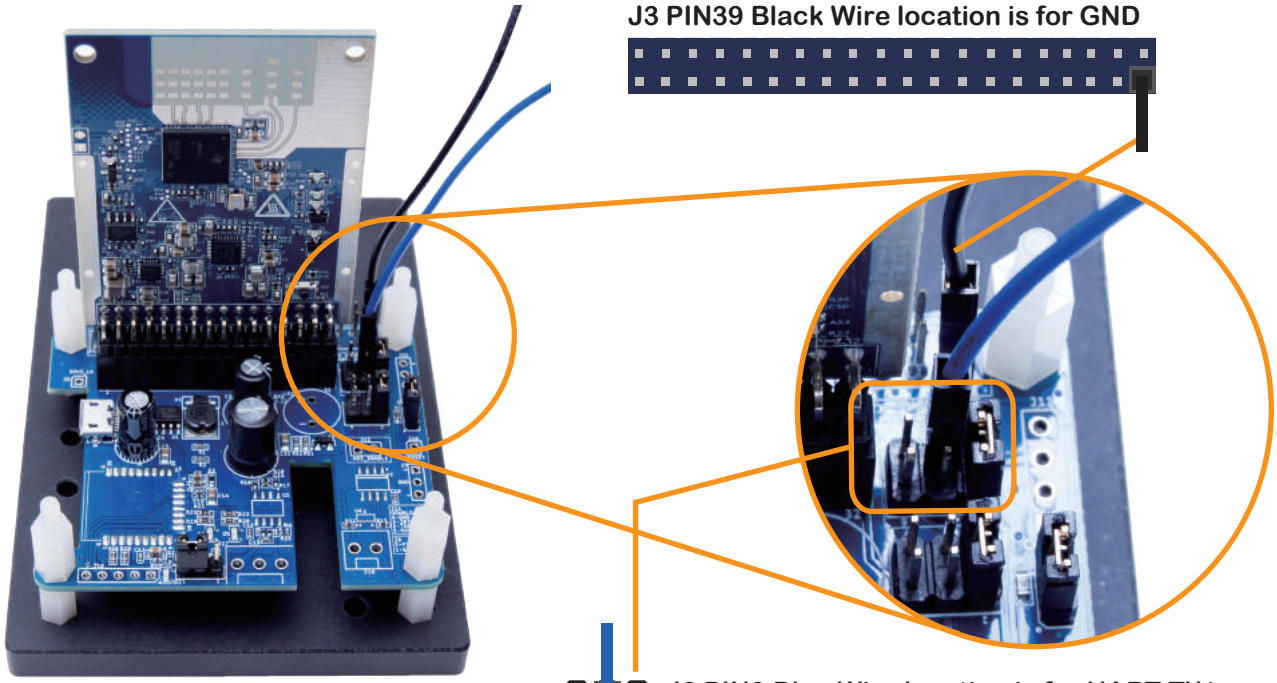
Mistake Proofing Pin

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 3.3V System. Pin23_TX1 is DC 3.3V system.

Batman BM601 EVM Kit + External Microprocessor

Wire connections for external microprocessor access on the HAT-Board



J3 PIN39 Black Wire location is for GND

J6 PIN3 Blue Wire location is for UART TX1
Note: The UART Voltage Level is 3.3VDC (NOT 5VDC).
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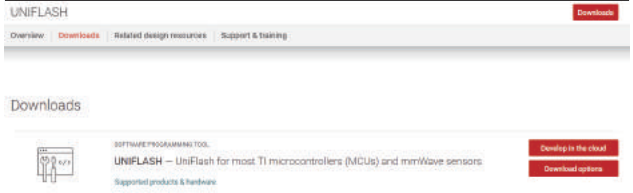
Batman Kit + EM110 Emulator for PC Computer Connection

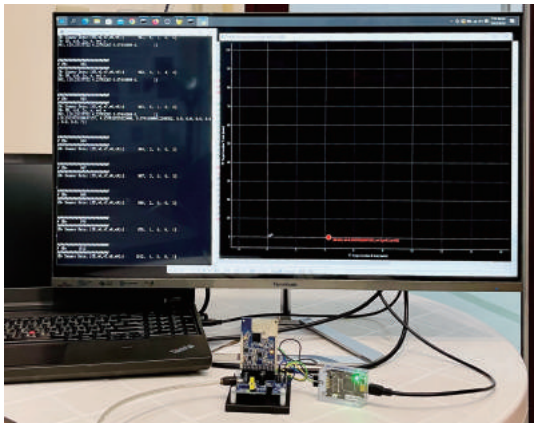
Batman BM601 EVM Kit + EM110 Emulator+PC

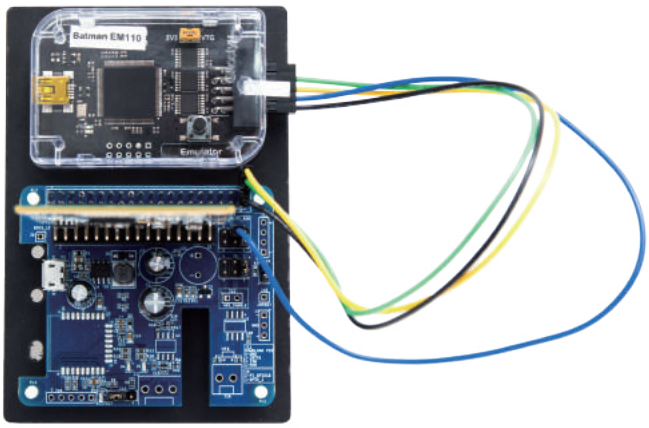
Wire connections for external EM110 Emulator on the HAT-Board

Please visit TI website for UNIFLASH Driver download.

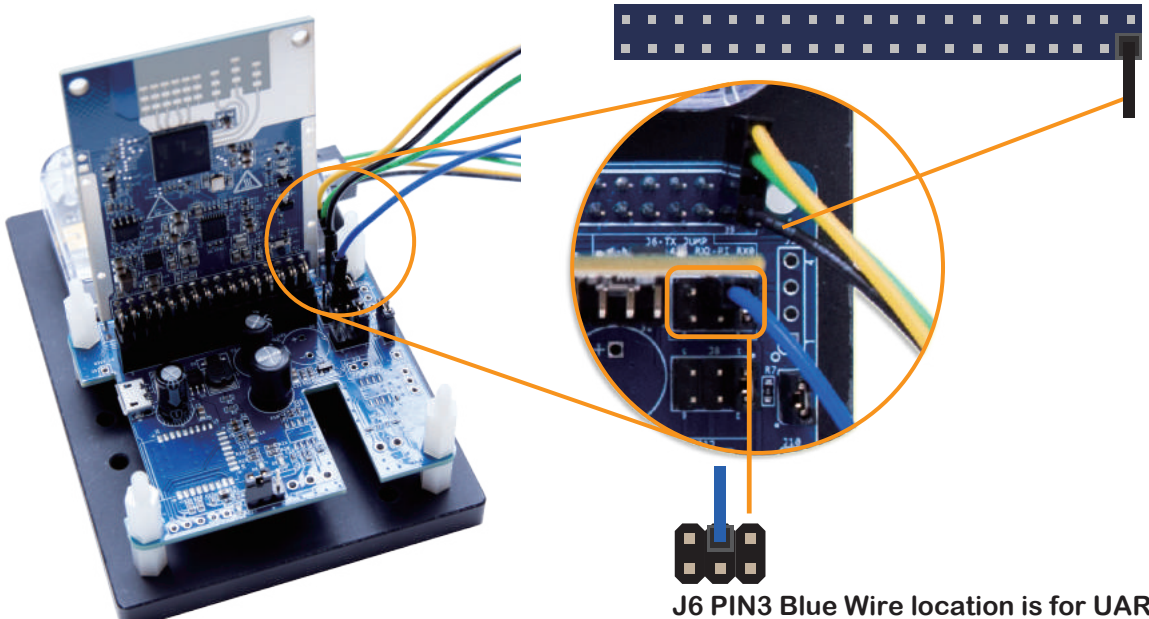
Install UNIFLASH Driver for EM110 Emulator







J3 PIN39 Black Wire location is for GND



J6 PIN3 Blue Wire location is for UART TX1
Note: The UART Voltage Level is 3.3VDC (NOT 5VDC).
Please handle with care.

Note: EM110 Emulator not included within this EVM Kit.
Please contact Joybien for purchasing info.

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BM601 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 BM601 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/

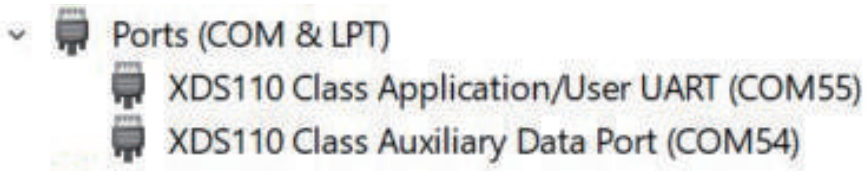
At this point, you may download and execute the corresponding BM601 EVM Kit’s Python SDK examples at:
https://github.com/bigheadG/mmWave
Note: Please follow the Python example to install relevant Libraries for proper execution.

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 XDS110 Class Auxiliary Data 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 EM110’s XDS110 Class Auxiliary Data Port assigned, and in this case, it is COM54; so you will need to enable your Python Code to include:

```
port = serial.Serial("COM54",baudrate = 921600, timeout = 0.5)
```



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

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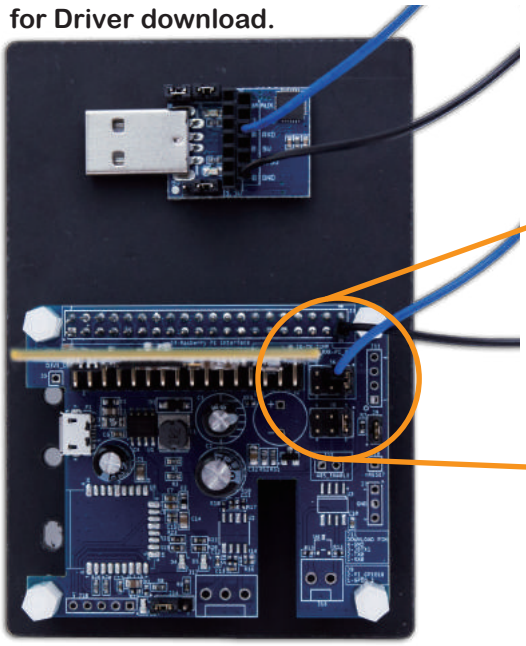
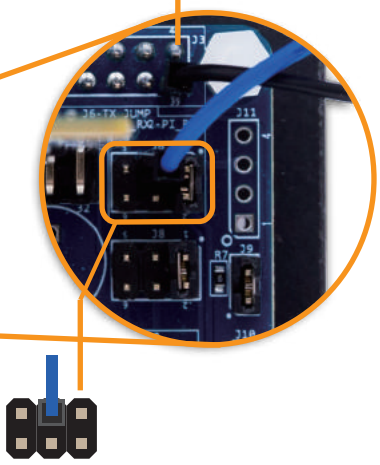
Batman BM601 EVM Kit + UART USB for PC Computer Connection

Batman BM601 EVM Kit + UART

For Silicon Labs CP210X UART-to-USB Dongle, please visit Silicon Labs website for Driver download.

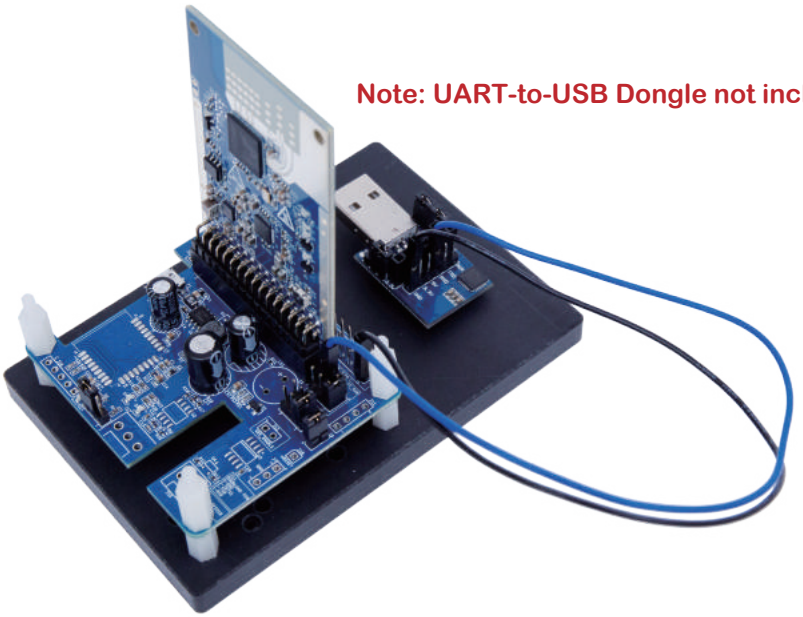


J3 PIN39 Black Wire location is for GND



J6 PIN3 Blue Wire location is for UART TX1

Note: The UART Voltage Level is 3.3VDC (NOT 5VDC). Please handle with care.



Note: UART-to-USB Dongle not included within this EVM Kit.

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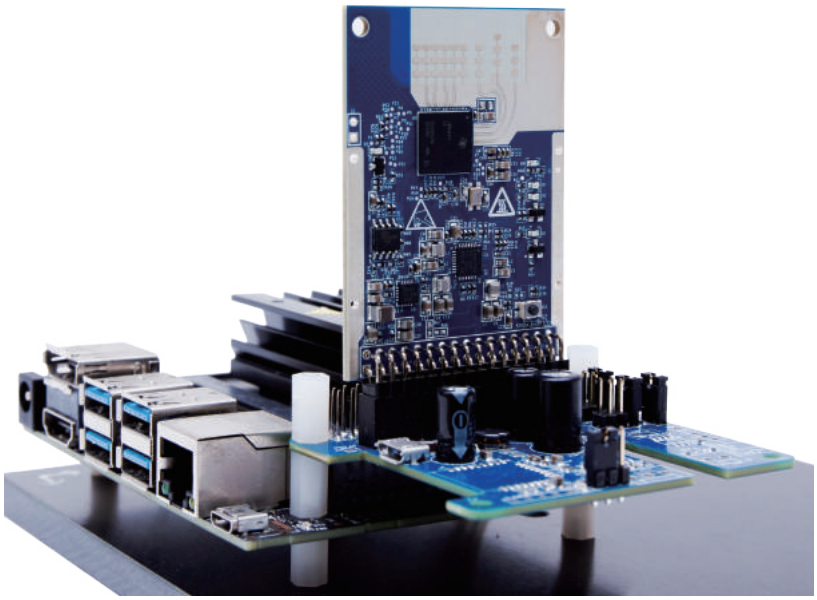
Batman Kit + NVIDIA Jetson Nano / Batman Kit + Raspberry Pi

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

Batman BM601 EVM Kit + Jetson Nano



Batman BM601 EVM Kit + Raspberry Pi

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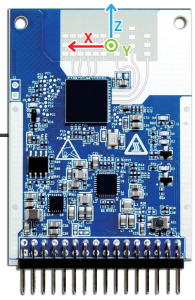

Specifications

mmWave Sensor Evaluation Module

mmWave ASIC	TI IWR1843 Single Chip mmWave Sensor
FMCW Transceiver	● Integrated PLL, Transmitter, Receiver, Baseband, and A2D ● 76GHz to 81GHz Coverage With 4GHz Continuous Bandwidth ● Four Receive Channels ● Three Transmit Channels ● Ultra-Accurate Chirp Engine Based on Fractional-N PLL ● TX Power: 12 dBm ● RX Noise Figure: 14 dB(76GHz ~ 77GHz) / 15 dB(77GHz ~ 81GHz) ● Phase Noise at 1 MHz: –95 (76GHz ~ 77GHz) / –93 (77GHz ~ 81GHz) ● Antenna Type : ISK Antenna ● Max real sampling rate: 25 Msps ● Max complex sampling rate :12.5 Msps
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	● 2MB
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 40° elevation FoV
Input Power	3.3VDC, 2.1A source
Operating Temperature & Humidity	0°C ~ 40°C 10% ~ 85% Non-Condensing
Dimensions & Weight	70.2mm x 45.9mm x 9mm ; 16 grams net

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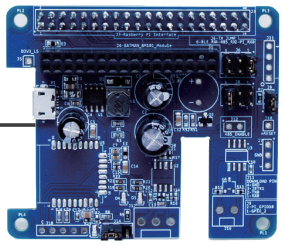
Raspberry Pi-Hat Board / Jetson Nano carrier board



Connector	● Matching mmWave Module Female Connector ● Matching Raspberry Pi GPIO Female Connector ● Micro USB Power Connector ● Jumpers for Bluetooth Tx/Rx or Raspberry Pi Tx/Rx Selection ● Jumper for mmWave Raw Data or Key Data Selection
Bluetooth (optional)	● Joybien JBT24M Bluetooth Low Energy Module
Micro USB Input Power	● 5VDC, 2.1Amp. (Note: Power Adapter and Micro USB Cable NOT included)
Operating Temperature Operating Humidity	● 0° to 40° degree Celsius ● 10 ~ 85% Non-Condensing
Dimensions & Weight	● 65.3mm x 56.3mm 23 grams

Python SDK

Python SDK	● Available on GitHub Note: Please refer to README.md file first for proper configuration GitHub https://github.com/bigheadG/mmWave

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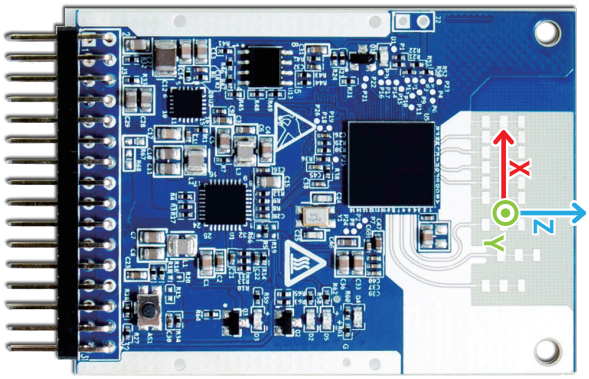
mmWave Pin Assignment

J3 J3 Pin Assignment

Pin#	Name	Name	Pin#
01	D3V3	D3V3	02
03	D3V3	PI SDA	04
05	GND	PI SCL	06
07	RS232 RX	SYNC IN JBRX1	08
09	RS232 TX	GND	10
11	nRST	GPIO 0	12
13	GND	GPIO 1	14
15	DP0	CS1	16
17	DP1	SOP0	18
19	GND	MOSI 1	20
21	BSS LOGGER	MISO 1	22
23	MSS LOGGER JBTX1	SPICLK 1	24
25	PMIC CLKOUT SOP2	GND	26
27	SYNC OUT SOP1	nERRIN	28
29	GND(Mistake Proofing Pin)	nERROUT	30
31	WARMRST	GPIO 2	32



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BATMAN BM601 mmWAVE SENSOR MODULE

J3 Pin Assignment

Pin No	Name	Pin Type	Function Description
01	D3V3	I	POWER DC 3V3 Input
02	D3V3	I	POWER DC 3V3 Input
03	D3V3	I	POWER DC 3V3 Input
04	SDA	IO	I2C Pin
05	GND	GROUND	Digital ground
06	SCL	IO	I2C Pin
07	RS232 RX0	I	UART A Receive
08	SYNC IN JBRX1	I	Low frequency Synchronization signal input, UART B Receive
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	GPIO 1	I	Reserved
15	DP0	IO	GPIO Pin
16	CS1	IO	SPI Channel A - chip Select
17	DP1	IO	GPIO Pin
18	SOP0	O	SOP0
19	GND	GROUND	Digital ground
20	MOSI 1	IO	SPI Channel A - Master Out Slave In
21	BSS LOGGER	IO	BSS LOGGER
22	MISO 1	IO	SPI Channel A - Master In Slave Out
23	MSS LOGGER JBTX1	O	UART B Transmit
24	SPICLK 1	IO	SPI Channel A - Clock
25	SOP2	I	SOP2
26	GND	GROUND	Digital ground
27	SOP1	I	SOP1
28	nERRIN	I	Failsafe input to the device. Nerror output from any other device can be concentrated in the error signaling monitor module inside the device and appropriate action can be taken by Firmware.
29	GND	GROUND	Mistake Proofing Pin
30	nERROUT	O	Open drain fail safe output signal. Connected to PMIC/Processor/MCU to indicate that some severe criticatlity fault has happened. Recovery would be through reset.
31	WARMRST	IO	Open drain fail safe warm reset signal. Can be driven from PMIC for diagnostic or can be used as status signal that the device is going through reset.
32	GPIO2	O	LED Indicator

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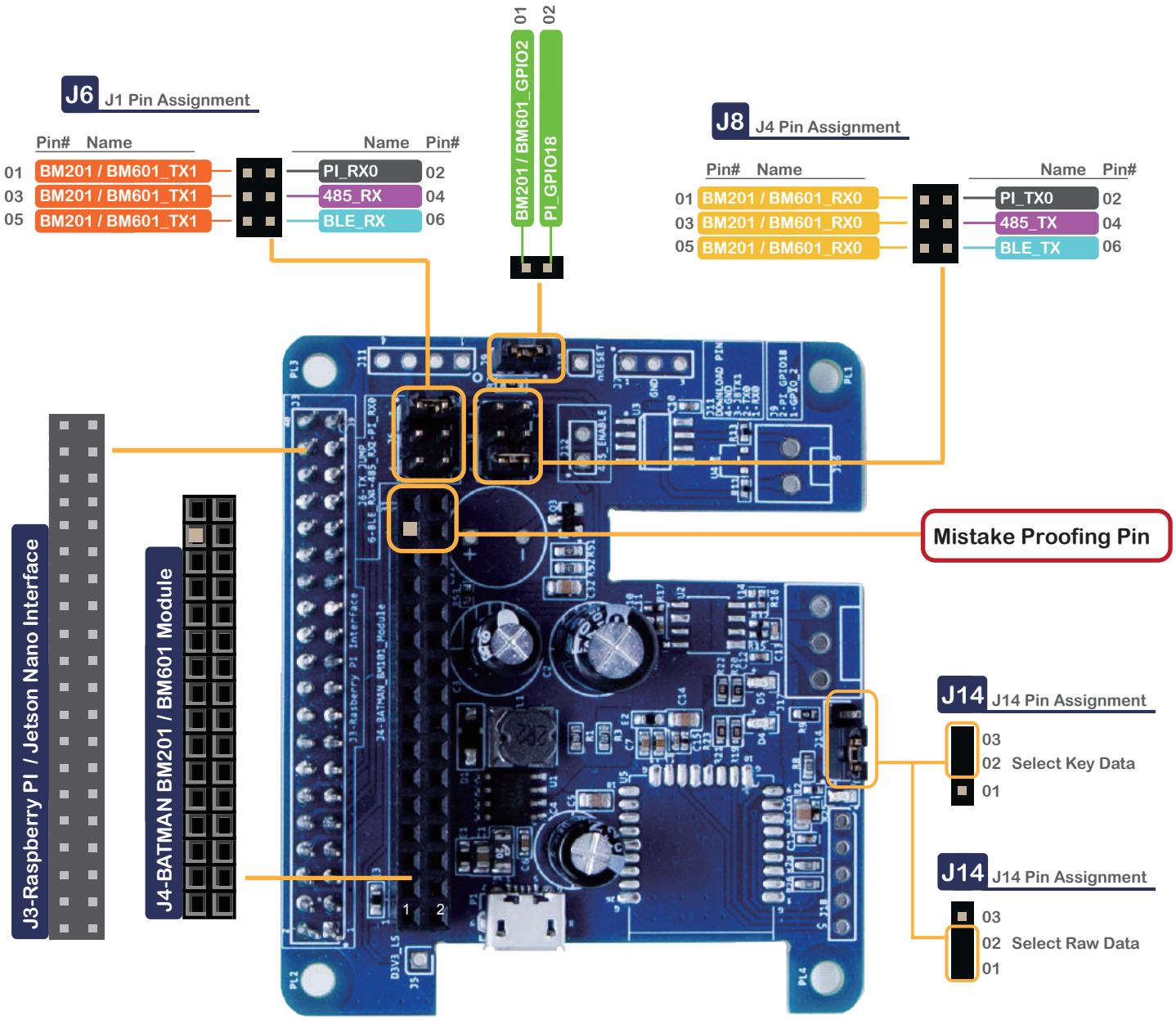
mmWave Raspberry Pi Hat Pin Assignment



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Product Dimensions

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NVIDIA logo, and Jetson Nano are trademarks and/or registered trademarks of NVIDIA Corporation.
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.