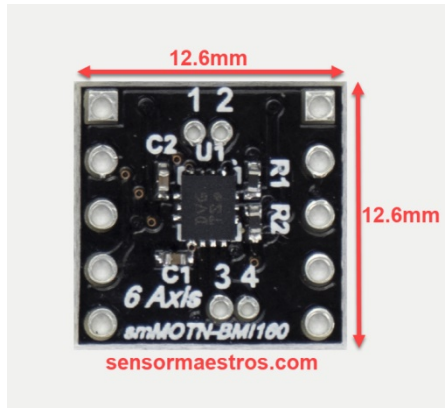![Sensor Maestros logo]

smMOTN-BMI160

12.6x12.6mm *6-Axis* Accel, Gyro Breakout Board

Features

- BMI160: 2.5x3.0x0.83mm 6-Axis IMU
- VDD = 1.71-3.6V, VDDIO = 1.2-3.6V
- 16bit Accelerometer and Gyroscope
- 925uA Full Operation ACCEL & GYRO
- 3uA SLEEP Mode ACCEL & GYRO
- 1024 Byte FIFO / 0.75s of Data Capture
- Gyro: ±125, 250, 500, 1000, 2000°/sec
  - 850/8uA Full Rate/SLEEP
  - 0.1 %FS Nonlinearity
  - ±3 °/s Zero-Rate Offset
  - 25-3000Hz ODR
- Accel: ±2, 4, 8, 16g
  - 180/20uA Normal/Low Power Mode
  - ±40mg Zero-G Offset Soldered
  - 180ug / √Hz Output Noise
  - 12.5-1600Hz ODR
  -

- Timestamped Output with 39us Resolution
- Internal Step, Tap, Orientation, Flat, Low-g/High-g, No/Slow-Motion Algorithms built in
- 2 Configurable GPIO Interrupt lines
- Select between I2C/SPI interfaces
  - Secondary I2C Master or Slave OIS Interface
- Self-Test for Accel, Gyro, Mag
- Internal Temperature Sensor
- *smWSP-ARD, smWSP Compatible*(Wireless Sensor Platform)
- 12.6x12.6mm(0.5x0.5") Breakout board
- 2.54mm(0.1") headers on 10.16mm(0.4") spacing
- 10,000G Max Mechanical Shock
- **COMING SOON!!**
- 6-Axis Sensor Fusion Source Code Example with smWSP-ARD Wireless Sensor Rapid Prototyping Kit.
- SENSR-LOGR Mobile App

Applications

- IoT Sensors
- Sports Equipment
- Vibration Monitoring
- Wearables
- Medical
- RTLS/Beacon Location
- Gaming, Remote Controls

![Sensor Maestros logo]

Contents

SENSOR MAESTROS

Description:

The BMI160 is a very small form factor 6-axis inertial measurement unit(IMU) consisting of 16bit 3-Axis Accelerometer and 3-Axis Gyroscope in a 14LD 2.5x3.0x0.83mm LGA package. It provides ultra-low power operation of 925uA in Full Operation mode along with other high performance features such as a 1024byte FIFO, Timestamped output with 39us resolution, and an on-chip interrupt engine enabling low-power motion-based gesture recognition and context awareness. The BMI160 also features a secondary interface that can be used as an I2C Master to connect to a Magnetometer or as a slave OIS-Interface to a Camera Module.

The **smMOTN-BMI160** provides an easy to use, low-cost, small form factor breakout board for the BMI160. All pins are all mapped to standard 2.54mm/0.1" headers. This allows for use in a standard bread-board or to be 'wired' into an application. The header-header spacing is 10.16mm (400mil). The smMOTN-BMI160 is selectable between SPI and I2C interfaces. The Default is I2C to select the SPI interface a simple modification to remove 2 resistors(R1,R2) is performed. All BMI160 pins are mapped out to headers including VDDIO which selects the I/O interface voltage. Operating features are outlined below.
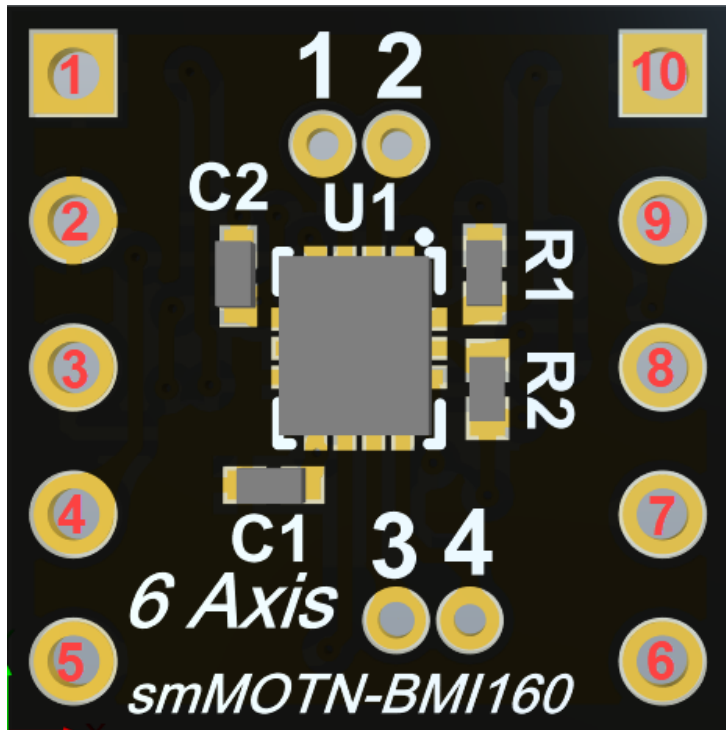
The smMOTN-BMI160 also provides connections to the Secondary I2C Master / Slave OIS-Interface pins via 2 sets of small vias labeled 1, 2 and 3, 4 respectively. These can be used to solder 30 AWG wire into the vias to connect to external devices.

Device Operation:

Feature	
Single Voltage Operation	No Change
Dual Voltage Operation	Cut SBS2 Solder Bridge (Backside of PCBA) Connect Pin 1 VDD = 1.71-3.6V Connect Pin 3 VDDIO = 1.2-3.6V
I2C	Default No Modifications Necessary
SPI	Remove R1 and R2 10K Pull-up resistors Cut SBS1 Solder Bridge (Backside of PCBA)
OIS-Interface (Slave)	Solder 30AWG Wires to Via Locations 3,4. 3 = OCSB 4 = OSDO *See BMI160 Datasheet for OIS-Interface Details*
AUX I2C Lines	Solder 30 AWG wires into Via Locations 1,2. 1 = ASCx 2 = ASDx *See BMI160 Datasheet for OIS-Interface Details*
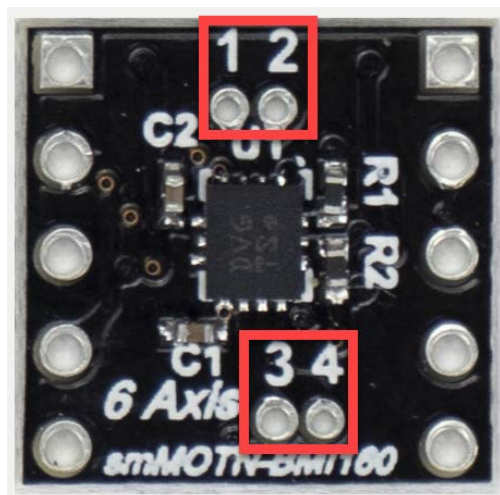
smMOTN-BMI160 Pin Descriptions:

Pin	Name	Type	Function
1	VDD	Power	Power Supply, 1.71-3.6V
2	GND	Power	Ground. Connect to System GND.
3	VDDIO	Power	1.2-3.6V, **NOTE: Cut SBS2 for Dual Supply Operation**
4	INT2	Output	User programmable Interrupt Line
5	INT1	Output	User programmable Interrupt Line
6	N/C	N/C	No Connect
7	$\overline{\text{CSB}}$	Input	SPI Active Low Chip Select. Default is pulled HIGH for I2C Mode **For SPI Mode Cut SBS1**.
8	SA0/SDO	Output	I2C LSB = Address Select, GND for Default Address SPI Slave Output. Connect to SI/SDI/MISO of Master SPI
9	SCL/SCK	Input	I2C SCL by default. Connected via R2/10kΩ to VDDIO. **Remove R2 for SPI.** SPI Serial Clock. Connect to SCK of Master SPI.
10	SDA/SI	Input	I2C SDA by default. Connected via R1/10kΩ to VDDIO. **Remove R1 for SPI.** SPI Serial Input. Connect to SO/SDO/MOSI of Master SPI.
Via 1	ASCx	Output	Secondary Interface: Master I2C Clock
Via 2	ASDx	I/O	Secondary Interface: I2C Serial Data
Via 3	OCSB	I/O	Secondary Interface: OIS Interface
Via 4	OSDO	I/O	Secondary Interface: OIS Interface

All **SMSTRS smMOTN, smMEM, smSENSR, smCOM**, **smBAT**, **smPWR** products are compatible with the Sensor Maestros **Wireless Sensor Platform**s such as the **smWSP** and **smWSP-ARD** that provide Rapid prototyping for Sensor and BTLE applications. The **smMOTN-BMI160** can be plugged into either of the 10pin **smBLOCK** SPI or I2C sockets. More info provided later in document.

BMI160/Sensor Fusion Software:

The BMI160 is being integrated into an Open Source Sensor Fusion Embedded Firmware Suite that will provide the ability to configure and view/log the output the BMI160 raw sensor and Sensor Fusion outputs via USB and BLE interfaces. The BLE Interface will connect to the Sensor Maestros SENSR-LOGR Mobile application.

This is expected to be completed Q2 of 2022. Please inquire at sales@sensormaestros.com

This will require the purchase of smWSP-ARD Wireless Sensor Rapid Prototyping platform.

Custom Embedded PCB/Software, Wireless/Mobile Applications, and general design services can be provided by Sensor Maestros for your own application.

BMI160 Datasheet:

https://www.bosch-sensortec.com/media/boschsensortec/downloads/datasheets/bst-bmi270-ds000.pdf

SENSOR MAESTROS

Wireless Sensor Development Kits

Sensor Maestros is the inventor of the concept of providing a pluggable wireless sensor development kit. The smWSP-ARD(Arduino Rev 3 compatible) and the smWSP provide the capability to plug in any of the Sensor Maestros *smMEM*, *smSENSR*, *smMOTN*, *smCOM*, *smBAT*, and *smPWR* breakout boards directly into the smWSP-ARD or smWSP using smBLOCKs to quickly plug in these pin compatible design components making it simple to swap in/out numerous different wireless, sensor, memory, and power configurations to completely customize your system and then just as easy to completely change it a day later. Gone are the days of having to work with a sensor evaluation board that has several sensors you would love to change but they are soldered directly to the PCB. Now you can pick and choose your RF, sensor, memory, power, and battery configuration.

smWSP-ARD

The *smWSP-ARD* is the second offering for the Sensor Maestros *Wireless Sensor Prototype* platform that is in the form of an Arduino Shield. The *smWSP-ARD* provides the same rapid prototype sensor functionality as the *smWSP* but in an Arduino Shield Compatible format.

Image of smWSP-ARD: Shown with smMOTN-BMI160, smSENSR-si7006, smCOM-FT230, and smRF-LR832.

Features

- Allows use of all Sensor Maestros *smSENSR*, *smMEM*, *smCOM, smBAT, smPWR* Products
    - I2C and SPI *smBLOCKS* available
- Arduino Shield compatible.
- Selectable Power Supply
    - 3.3V from Arduino Base
    - Rechargeable Lithium Polymer with DC/DC, such as *smPWR-MP2148*
    - CR2032 Coin Cell holder on Bottom of PCBA
    - External Power Supply
- Allows configurable SPI and GPIO Interrupt lines from *smRF* compatible plugins such as the *smRF-LR832* to I2C and SPI smBLOCKS for Sensor and Memory products. Selectable with slide switches and DIP switch selectors.
- 4 I2C, 1 SPI, smBLOCKS
- 1 *smBAT*, 1 *smPWR*, 1 *smCOM* BLOCKS
- Can be programmed directly with the Nordic nRF52 DK
- 10pin SWD Connector for use with external SWD Programmer/Debugger

smWSP-ARD Information:

https://sensormaestros.com/products/rapid-development-iot-platforms/arduino-compatible-rapid-development-platform/smwsp-ard/

smWSP

The **smWSP** (Wireless Sensor Prototype) is a board that allows the Sensor Maestros **smSENSR**, **smMEM**, **smCOM**, **smBAT** products to be plugged into the WSP allowing Rapid Prototyping of a Sensor/Wireless Sensor system. On the right hand side it can be directly connected to the **smRF-WB** to add BTLE capability and on the Left-hand side it can directly connect to **ANY** of the Silicon Labs **EFM32/EFR32 Starter kits** to add a high performance/ultra-low power MCU capability to a system. The WSP has been designed with a Slide Switch to accommodate the slight variations of the EFM32 Starter Kits.

The **smWSP** can be used with the Silicon Labs EFM32 and EFR32 Starter Kits.

Features

- Allows use of all Sensor Maestros **smSENSR**, **smMEM**, **smCOM, smBAT** Products
  - I2C and SPI slots available
- Direct Connection to **smRF-WB**, for easy programming/debugging of BTLE plugins.
- Direct Connection with all Silicon Labs EFM/EFR32 Starter Kits
- 2 COM-FT230/USB-UART slots
- Selectable Voltage between: VMCU(EFM32 Starter Kits), 3V3(from EMCOM-FT230), or from Regulated voltage supplied by **smRF-WB** (typically when the **smRF-WB** is powered from a battery and uses the DC/DC converter to provide regulated voltage to the BTLE module.
- Allows for UART, LPUART, and SPI serial communication from the EFM32 Starter kits to the **smRF-WB**. Selectable with Slide Switches and DIP switch selectors.
- Several GPIO can be directly connected between EFM32 STK's and **smRF-WB**
- GPIO pins can individually be connected to Sensor INT lines for individual Interrupt control

SFM2: 9-DOF Wearable IMU

The SFM2 is an example of the engineering expertise Sensor Maestros can provide. The SFM2 is the smallest form-factor and lowest power wireless 9 DOF Sensor Fusion Module with optional Pressure, Temperature and Humidty sensors. The SFM2 offers both a Bluetooth Low Energy and a USB/COM port interface. The SFM2 provides an extremely flexible BLE and USB interfaces and allows complete customization of sensor output streams and sensor configurations. The SFM2 can easily be worn using the Velcro strap ran through slot in the bottom of the enclosure. **OEM CUSTOMIZABLE!!**

- 40.9 x 28.1 x 14.3mm Form Factor
- Wearable: Enclosure has slot for Velcro strap.
- USB and BLE Interfaces
    - Firmware updates via BLE
- 9 DOF: 3-Axis Gyro, Accel, Mag
    - Optional Pressure, Temp, and Humidity
- Up to 833Hz Sensor Fusion Operation. Multiple Streams can be enabled at same time.
    - Tared & Un-Tared Quaternian Output
    - Fusion Compass Heading and Tilt Output
    - Fusion Linear Acceleration Output
    - Fusion Euler Angle Output
- Sensor Fusion Output via BLE or USB Interface
    - 833, 417, 208, 104, 52, 26Hz ODR Rate Selections
- Raw Sensor Output availability for all sensors up to 1667Hz ODR.
- USB(1Mbps) and BLE Interfaces
- iOS and Android App for sensor and data output configuration.
- USB/COM ASCII Command set for SFM2 configuration
    - Python API Library for easy configuration.
    - Binary Output option to maximize throughput
- TARE function to zero orientation for quaternian output.
- GLOBAL REFERENCE enable/disable command
- TIMESTAMP data with 25us resolution and user definable OFFSET for multiple SFM2 synchronization.
- Rechargable Battery (typical 250mAh)
    - ~156hour battery life with Quaternian output @ 26Hz using BLE interface
    - ~100hour battery life with Quaternian output @ 104Hz using BLE interface
    - ~58hour battery life with Quaternian output @417Hz using BLE interface
- Individual Control of BLE Output/Notification for every Sensor Output
    - Every Sensor Output has its own characteristic/Notification
    - Sensors and Sensor Fusion can be completely customized including Sensor Filters.

➢ Custom OEM/Logo Enclosure, customized PCB, Firmware, Mobile App, etc
High Volume Pricing please inquire at sales@sensormaestros.com