EC Buying BNO080/BNO085

EC Buying BNO080/BNO085 Nine-Axis Sensor Module User Manual

1. Introduction

This manual provides essential information for the proper setup, operation, and maintenance of the EC Buying BNO080/BNO085 Nine-Axis Sensor Module. This module is designed for applications requiring precise motion tracking and orientation data, such as augmented reality (AR), virtual reality (VR), robotics, and various Internet of Things (IoT) devices.

2. Product Overview

The BNO080/BNO085 is a sophisticated 9-axis System-in-Package (SiP) that integrates high-performance accelerometers, magnetometers, and gyroscopes. It is powered by a low-power 32-bit ARM Cortex M0+ microcontroller, enabling efficient processing of sensor data within a compact form factor.
Key features include:

- Integrated 3-axis accelerometer, gyroscope, and magnetometer.
- Utilizes ARM Cortex M0+ with advanced algorithms for precise data processing.
- Generates accurate rotation vector outputs, suitable for VR and heading applications, with a static rotation error of 2 degrees or less.
- Provides an I2C-based library for accessing rotation vectors, acceleration, gyroscope, magnetometer readings, step detection, activity classification, and calibration functions.

3. Specifications

Specification	Value
Package Dimensions	5.75 x 4.29 x 0.28 inches
Item Weight	0.634 ounces
ASIN	B0CDGZMLPP
Manufacturer	EC Buying

Specification	Value
Date First Available	August 2, 2023

4. Setup

4.1 Pinout Diagram

Refer to the image below for the pinout of the BNO080/BNO085 module. Understanding each pin's function is crucial for correct integration.

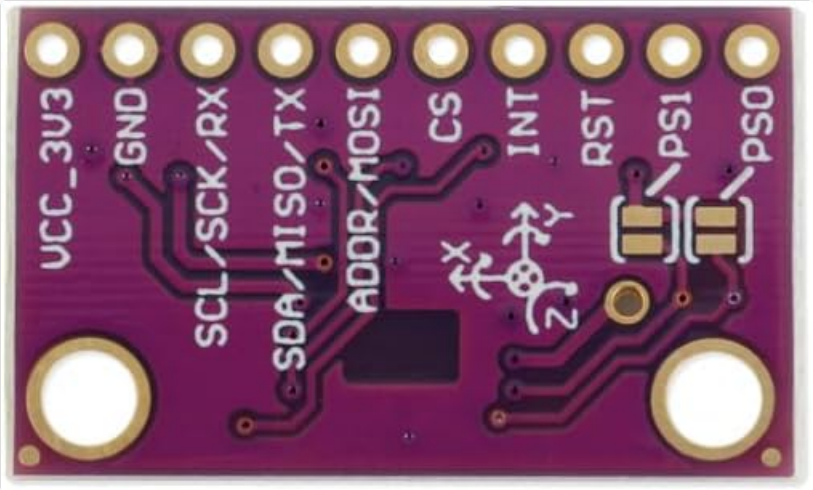

Figure 1: Bottom view of the BNO080/BNO085 module with pin labels. This view is essential for identifying connection points.

4.2 Pin Descriptions

- **VCC:** Power supply input (typically 3.3V).
- **GND:** Ground connection.
- **SCL:** I2C Serial Clock Line.
- **SDA:** I2C Serial Data Line.
- **ADO/MOSI:** I2C Address Select (or SPI MOSI). For I2C, this pin can be used to select the I2C address.
- **CS:** Chip Select (for SPI communication, typically pulled high for I2C).
- **INT:** Interrupt pin.
- **RST:** Reset pin.
- **PS1, PS0:** Power Select pins (for configuring power modes or boot modes).
- **BOOT:** Boot mode select pin.

4.3 Basic Wiring (I2C)

To connect the BNO080/BNO085 module to a microcontroller using I2C:

1. Connect the **VCC** pin to your microcontroller's 3.3V power supply output.
2. Connect the **GND** pin to the common ground of your system.
3. Connect the **SCL** pin to your microcontroller's I2C clock line.
4. Connect the **SDA** pin to your microcontroller's I2C data line.
5. Ensure appropriate pull-up resistors are used on SCL and SDA lines if not already present on your microcontroller board or the sensor module.

The default I2C address for the BNO080/BNO085 module is typically 0x4B. Some modules might default to 0x4A depending on the ADDR pin configuration. Consult the module's specific documentation or experiment with I2C scanning if communication issues arise.

4.4 Power Requirements

The module operates on a 3.3V power supply. Ensure your power source can provide stable 3.3V to prevent erratic behavior or damage to the sensor.

5. Operating Instructions

The BNO080/BNO085 module communicates primarily via the I2C protocol. To begin acquiring data, you will typically use a software library compatible with your chosen microcontroller platform (e.g., Arduino, Raspberry Pi).

5.1 Software Library Integration

Search for and install a BNO080/BNO085 specific library for your development environment. These libraries handle the complex I2C communication and data parsing, providing easy access to the sensor's outputs.

5.2 Data Acquisition

Once the library is integrated, you can access various data reports from the sensor, including:

- **Rotation Vectors:** Provides orientation data (quaternions or Euler angles) for precise heading and motion tracking.
- **Acceleration:** Linear acceleration along X, Y, and Z axes.
- **Gyroscope:** Angular velocity along X, Y, and Z axes.
- **Magnetometer:** Magnetic field strength along X, Y, and Z axes.
- **Step Counter:** Detects and counts steps.
- **Activity Classifier:** Identifies different physical activities.

5.3 Calibration

For optimal accuracy, especially for magnetometer readings, the sensor requires calibration. Most libraries include functions or examples for performing sensor calibration. Follow the library's instructions for best results. Calibration helps compensate for magnetic distortions in the environment and sensor biases.

6. Maintenance

The BNO080/BNO085 sensor module is a sensitive electronic component. Proper handling and environmental conditions are essential for its longevity and performance.

- **Handling:** Always handle the module by its edges to avoid touching the sensitive components. Use anti-static precautions (e.g., ESD wrist strap) when working with the module to prevent damage from electrostatic discharge.
- **Environment:** Store and operate the module in a dry environment, away from extreme temperatures, high humidity, and corrosive substances. Avoid strong magnetic fields, which can interfere with the magnetometer readings.
- **Cleaning:** If necessary, gently clean the module with a soft, dry brush or compressed air. Do not use liquids or solvents.

7. Troubleshooting

If you encounter issues with your BNO080/BNO085 module, consider the following troubleshooting steps:

7.1 No Communication / No Acknowledge

- **Check Wiring:** Verify all connections (VCC, GND, SCL, SDA) are secure and correctly wired to your microcontroller.
- **Power Supply:** Ensure the module is receiving a stable 3.3V power supply.
- **I2C Address:** Confirm the I2C address used in your code matches the module's address (typically 0x4B, but can be 0x4A). Use an I2C scanner sketch to detect active devices on the bus.
- **Pull-up Resistors:** Ensure SCL and SDA lines have appropriate pull-up resistors (e.g., 4.7kΩ) if your microcontroller or development board does not provide them internally.

7.2 No Measurement Data / Chip Stuck in Bootloader

- **Firmware:** In rare cases, the chip might not have firmware flashed or may be stuck in bootloader mode. This is uncommon for new modules but can occur. If you suspect this, consult the manufacturer's support or community forums for firmware flashing procedures.
- **Library Initialization:** Ensure your software library is correctly initializing the sensor. Check for any error messages during initialization.

7.3 Inaccurate Readings

- **Calibration:** Perform a full sensor calibration, especially for the magnetometer, to compensate for environmental magnetic interference and sensor biases.
- **Environmental Interference:** Keep the module away from strong magnetic fields (e.g., motors, power cables, magnets) and sources of vibration or rapid temperature changes.
- **Mounting:** Ensure the module is securely mounted to prevent unwanted vibrations or movement that could affect readings.

8. Safety Information

- Do not expose the module to water or excessive moisture.
- Avoid applying excessive force or bending the module, as this can damage the PCB or components.
- Ensure proper ventilation if integrating into an enclosed system to prevent overheating.
- Always disconnect power before making or changing connections to the module.

9. Warranty and Support

For specific warranty information and technical support, please refer to the EC Buying product page or contact EC Buying customer service directly. Keep your purchase receipt for warranty claims.