MPU-3300 3-Axis Evaluation Board User Guide Revision 1.0

CONTENTS

1. Revision History

Date	Revision	Description
6/13/2012	1.0	Initial release

2. Purpose

This document describes the hardware and circuitry on the MPU-3300™3-Axis Evaluation (EV) Board. It covers applications incorporating the EV board into a larger system, understanding key signals and circuit functions, hardware jumper settings, and port connectors.

2.1 Usage

This evaluation board provides three axes of motion sensing, comprised of:

- X-, Y- and Z-Axis gyros with ±225°/sec and ±450°/sec selectable full-scale range.
- Digital data measured using on-chip ADCs, is transmitted over I²C or SPI interfaces.

The Evaluation board may be used by itself using either SPI or I²C serial communications interfaces. Alternatively, it may be connected to InvenSense's ARM Evaluation Board for connectivity to a host computer using the USB interface.

2.2 Related Documents

The following documents are recommended for additional information regarding the products and systems described in this Application Note.

- MPU-3300 Product Specification
- MPU-3300 Register Map and Register Descriptions
- MPU-3300 EVB schematics

3. MPU-3300 EV Board Overview

The MPU-3300 EV Board contains the MPU-3300. It contains a number of 'solder-across' jumper points that permit several circuit configurations.

Refer to Figure 1. The EV Board is populated on its top side only for easy measurement access. The 10x2 customer header connector is designed to connect with the InvenSense ARM Evaluation Board, which is a host microcontroller board useful for adapting the MPU-3300 EV Board to a personal computer via its USB port.

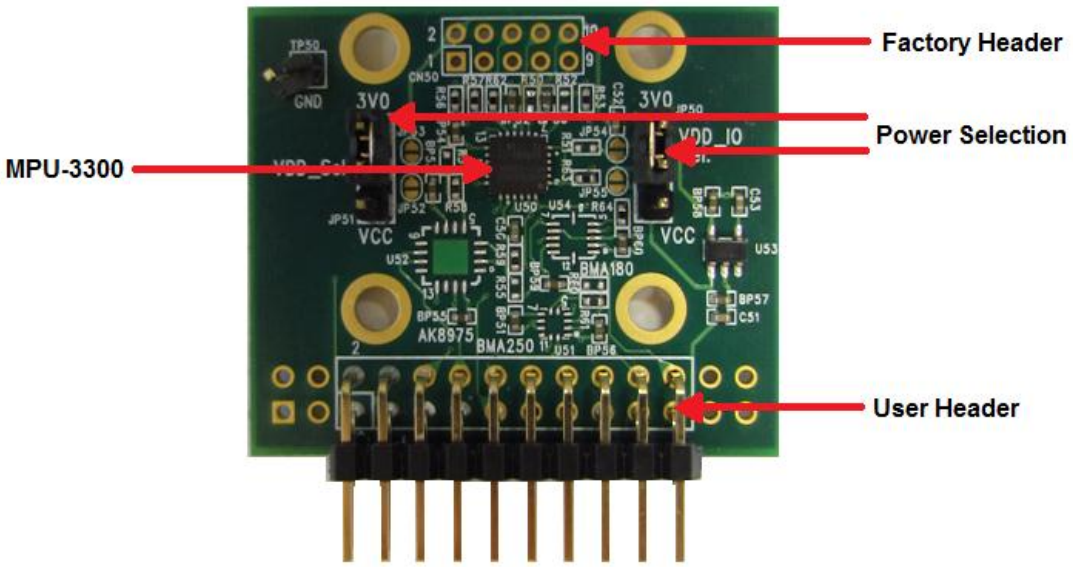
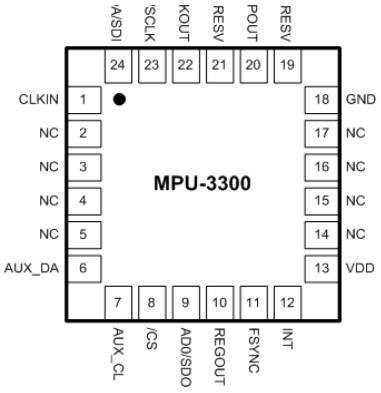


Figure 1: Top side of the MPU-3300 3-Axis EV Board

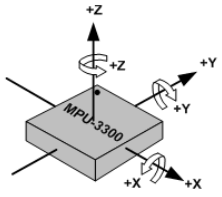
The 5x2 extension factory header is intended for connecting additional devices to the EV Board. The 3-pin power selection headers are used to select which voltage supply is applied to the MPU-3300.

3.1 MPU-3300 Key Function and Pin-outs

The MPU-3300 EVB is a fully-tested evaluation board, providing for quick evaluation of the MPU-3300 X- , Y- , and Z-axis angular rate gyroscope. The MPU-3300 uses InvenSense's proprietary MEMS technology with vertically driven vibrating masses to produce a functionally complete, low-cost motion sensor. All required conditioning electronics are integrated into a single chip measuring 4 x 4 x 0.9mm. It incorporates X- , Y- and Z-axis low-pass filters and an OTP (One Time Programmable) embedded memory used for factory calibration of the sensor. Factory trimmed scale factors eliminate the need for external active components and end-user calibration. A built-in Proportional-To-Absolute-Temperature (PTAT) sensor provides temperature compensation information. The product is lead-free and Green Compliant.



QFN Package
24-pin, 4mm x 4mm x 0.9mm



Orientation of Axes of Sensitivity and Polarity of Rotation

Figure 2: MPU-3300 Package

3.2 MPU-3300 Bus Connection

The MPU-3300 communicates to a system processor using either SPI or an I^2C serial communications interface. The MPU-3300 always acts as a slave when communicating to the system processor.

4. MPU-3300 3-Axis EVB Schematics

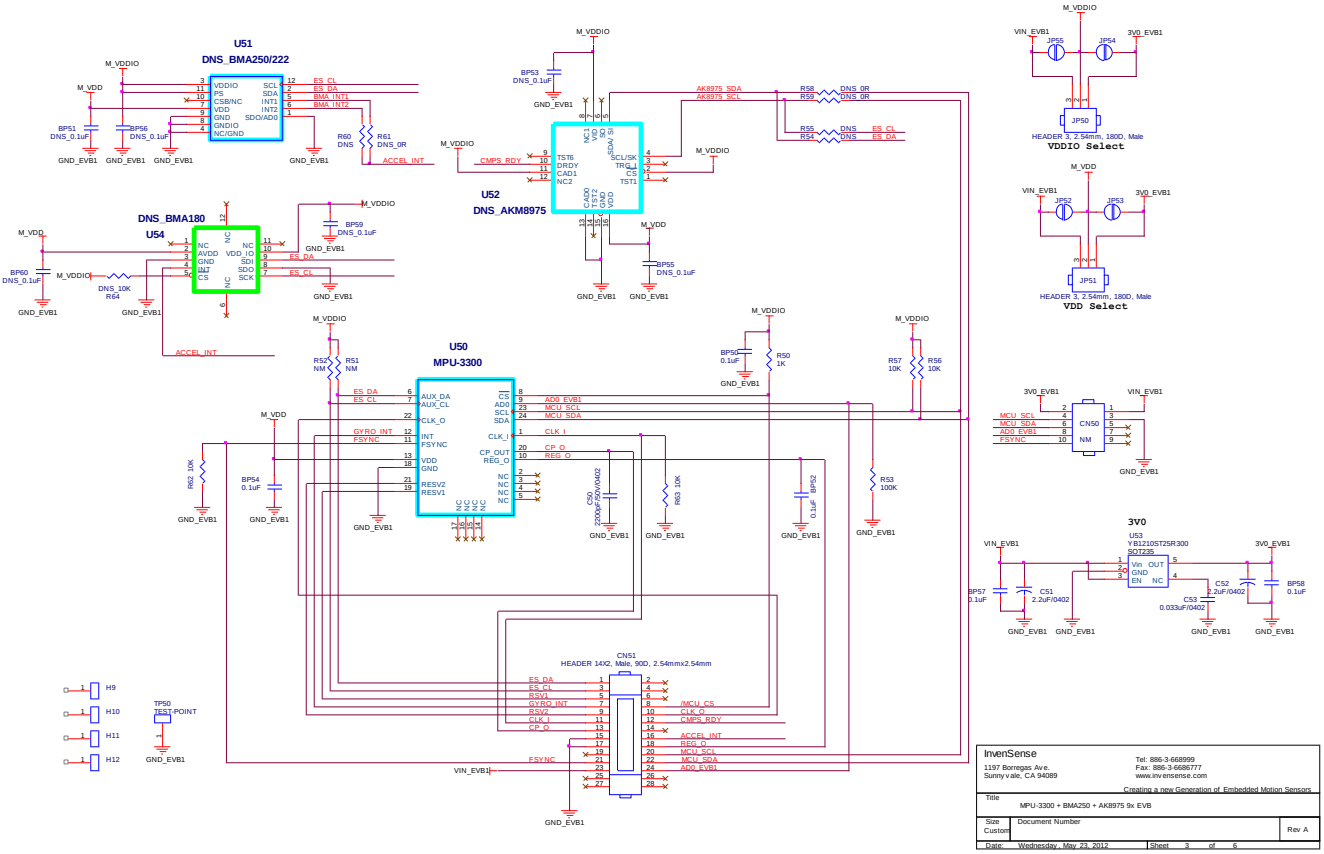


Figure 3: Schematics

4.1 Bill of Materials

Table 1: Bill of Materials

Item	Quantity	Reference	Part	PCB Footprint
1	5	BP50,BP52,BP54,BP57, BP58	0.1uF	C0402
2	1	C50	2200pF/50V	C0402
3	2	C51,C52	2.2uF	C0603
4	1	C53	0.033uF	C0402
5	1	CN51	HEADER 14X2, Male, 90D, 2.54mmx2.54mm	
6	2	JP51,JP50	HEADER 3, 80mil, 180D, Male	JP2P1_8X1_3S
7	1	R50	1K	R0402
8	1	R53	100K	R0402
9	4	R56,R57,R62,R63	10K	R0402
10	1	U50	MPU-3300, 24-Lead QFN (4mm x 4mm x 0.9mm)	QFN24_4X4(0.5PITCH)
11	1	U53	YB1210ST25R300	SOT235

4.2 Power Supply Connections

JP550 and JP51 are 3 header-pin plug-in jumpers which allow users to select between the on-board LDO and an external DC supply for the MPU-3300. For details, please refer to Table 2: Power Selection Jumpers.

The on-board 3.0V LDO (Low-dropout voltage regulator) is a low-noise version with stable enable-disable profile. Its output is called 3V0 on the schematic. Using the LDO will assure that the gyroscope and accelerometer performance will meet published specifications.

Selecting the raw Vcc line to power the chip is generally done while designing and evaluating an embedded platform, where the host processor and related electronics needs full control over the motion processing chipset's power supply.

When selecting the on-board LDO (3V0) power; supply at least 3.7V to the external Vcc to ensure that the LDO works properly.

When selecting to supply 5V Vcc; JP50 and JP51 must be set as "1-2 short" to supply the MPU-3300 VDD and VLOGIC operation range at 2.1V to 3.6V.

4.3 MPU-3300 EVB Connector Signals Description

Table 2: Power Selection Jumpers (JP51, JP50)

JP50 Pin Number	Signal description
1-2 short	VLOGIC = 3V
2-3 short	VLOGIC = Vcc (from external)
JP51 Pin Number	Signal description
1-2 short	VDD = 3V
2-3 short	VDD = Vcc (from external)

Table 3: User Interface Connector Signals (CN51)

CN51 Pin Number	Signal description
1	Reserved
3	Reserved
5	Reserved
7	INT, INT output to controller
9	Reserved
11	CLK_I
13	CPOUT
15	GND
17	GND
19	3V
21	FSYNC
23	Receive power from ARM-7 Controller Board or external. It should be 5V, with >200mA
25	NC
27	NC
2	NC
4	NC
6	NC
8	SPI CS
10	Reserved
12	Reserved
14	NC
16	Reserved
18	REGOUT
20	I^2C SCL or SPI SCLK
22	I^2C SDA or SPI SDI
24	I^2C Addr or SPI SDO
26	NC
28	NC

Table 4: Extended Factory Connector

CN50 Pin Number	Signal description
1	VCC, power from ARM-7 controller board or external power. It should be 5V, with >200mA
3	GND
5	NC
7	NC
9	NC
2	3V
4	I²C SCL or SPI SCLK
6	I²C SDA or SPI SDI
8	I²C Addr or SPI SDO
10	FSYNC

4.4 Connecting the FSYNC Line

The FSYNC line is intended for use in a camera's image-stabilization system. It is an input from the camera platform to the EV Board, and is intended to synchronize the MPU-3300 serial bus transfer with the master timing set by the camera system. FSYNC can originate from the host processor via CN51 pin-21, or from CN50 pin-10. There is no external pull-up termination for the FSYNC line.

4.5 Serial bus Levels, Speeds and Terminations

The MPU-3300 supports I²C communications at up to 400 kHz clock rate, and SPI communications at up to 1 MHz serial clock rate. The I²C bus open-drain pull-up resisters are connected to either 3.0V or an external provided Vcc (3V or 5V depend on user). The pull-up level is selected by JP50. Please refer to Table 2: Power Selection Jumpers.

5. Data Gathering Options

The MPU-3300 Digital Sensor Data is available at the User Interface Header. Alternatively, for connectivity with a host PC, an InvenSense ARM Processor Board may be used.

5.1 Connection to ARM EVB

For communications via USB to a host computer, the MPU-3300 EVB can be connected to InvenSense's ARM processor board.

The photo below shows the connection of MPU-3300 to ARM board. Connection between the two boards is made via the User Interface Header.

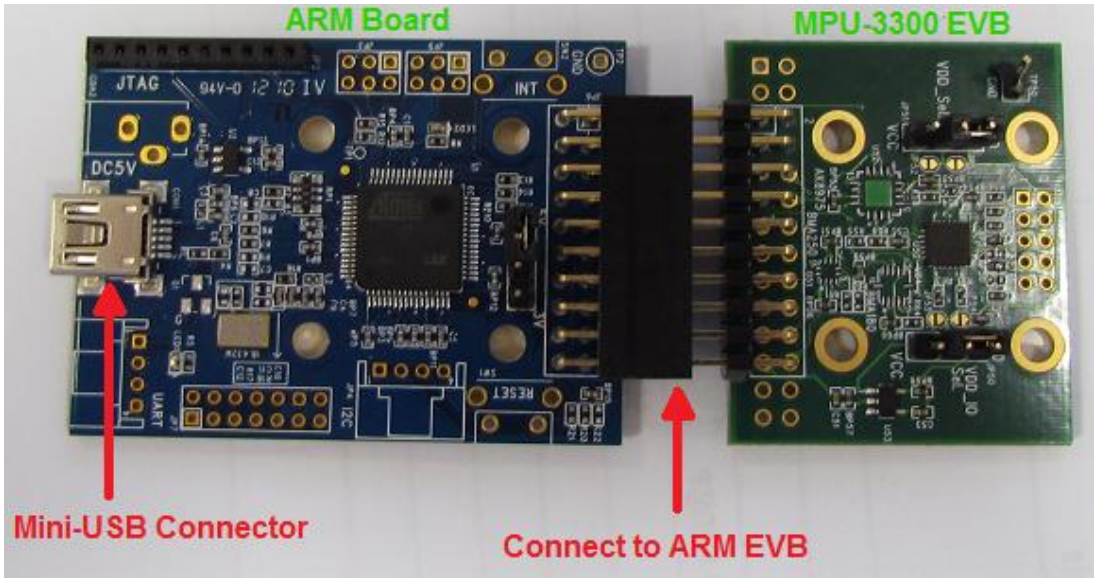


Figure 4: MPU-3300 EVB to ARM Board Connection

5.2 Use of MPU-3300 without ARM EVB board

I²C and SPI signals are available on JP8 and JP6. The user can develop tools to communicate with the MPU-3300. There is no bus mode selection setting needed.

6. Special Instructions

6.1 Electrostatic Discharge Sensitivity

The MPU-3300 gyro can be permanently damaged by an electrostatic discharge. ESD precautions for handling and storage are recommended.

7. Component Placement

The MPU-3300 EV board is a 4 layer PCB with 1500.0 mil x 1270.0 mil dimensions.

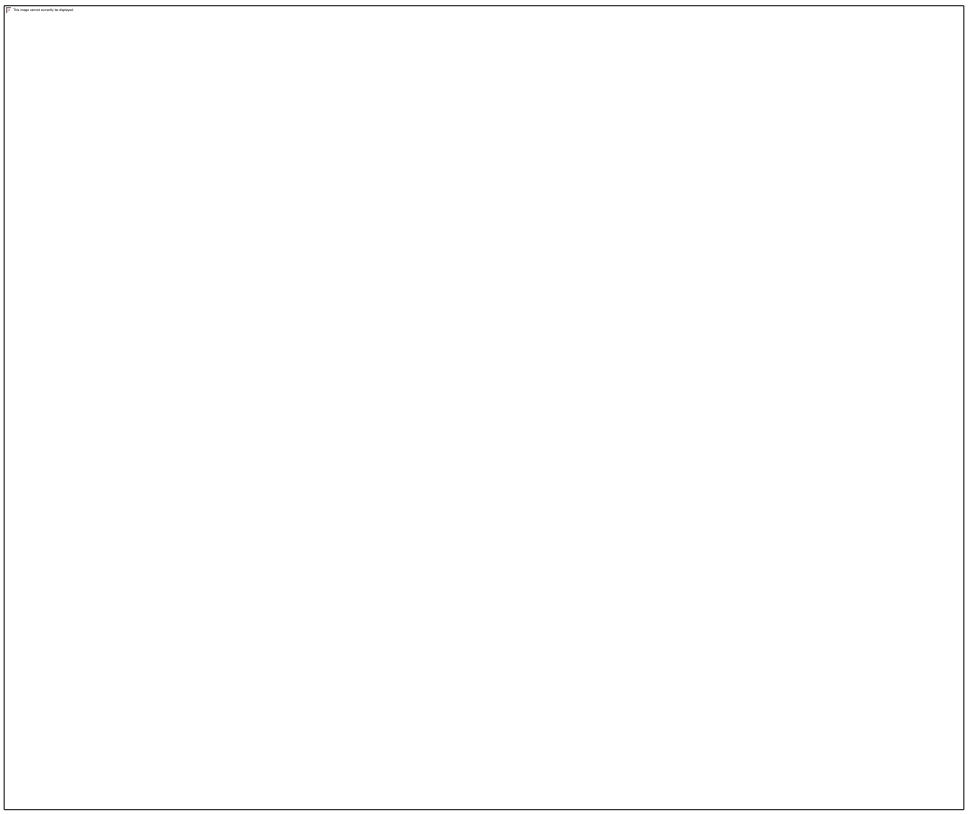


Figure 5: MPU-3300 EVB Dimensions