INVARM User Guide

PURPOSE

This document describes the hardware, connectivity and circuitry for revision G of the InvenSense ARM Controller Board (INVARM).

USAGE

The INVARM board allows developers to interface a host PC with most of InvenSense's sensor products (mounted to a Universal Evaluation Board [UEVB] or Small Form Factor [SFF] board), and transfer serial data using the I2C and SPI protocols via USB interface. Additionally, there are some GPIO pins which may be used for general purpose signaling.

RELATED DOCUMENTS

The product specification for the AT91SAM7SE512 MCU used on this board can be downloaded from the following website: http://www.atmel.com/devices/SAM7SE512.aspx. The MCU supports both I2C and SPI protocols. Also see InvenSense's Motion Sensor Universal Evaluation Board: http://invensense.com/search.html?cx=005393117892451572175%3Aey19ruasuq4&cof=FORID%3A11&ie=UTF-8&q=uevb&sa=

InvenSense Inc.
1745 Technology Drive, San Jose, CA 95110 U.S.A
+1(408) 988–7339
www.invensense.com

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INVARM BOARD MAIN FEATURES

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  - I2C – Master with On-Board Pullup Resistors
  - SPI – Master with Two /CS Signal Lines
  - On-Board Programming and Debugging of ARM7 through JTAG Interface
  - UART Interface for Firmware Debug
- Digital I/O
  - One Mechanical Button
  - One User LED (LED2, Green)
  - GPIO – Four General-Purpose I/O Control Signal Lines
- Power Output
  - Provides two optional voltage levels for flexible operation at 1.8V and 3V; VDD and VDDIO can be independently set
  - Provides required 5V power supply to InvenSense UEVBs

INVARM BOARD OVERVIEW

The INVARM board is designed to be the host controller board for all of InvenSense's sensor products. Any UEVB can be connected to the JP6 user interface, and any SFF board can be connected to CN13. The INVARM board will communicate to the host PC through its USB interface.

All interface connectors are shown in

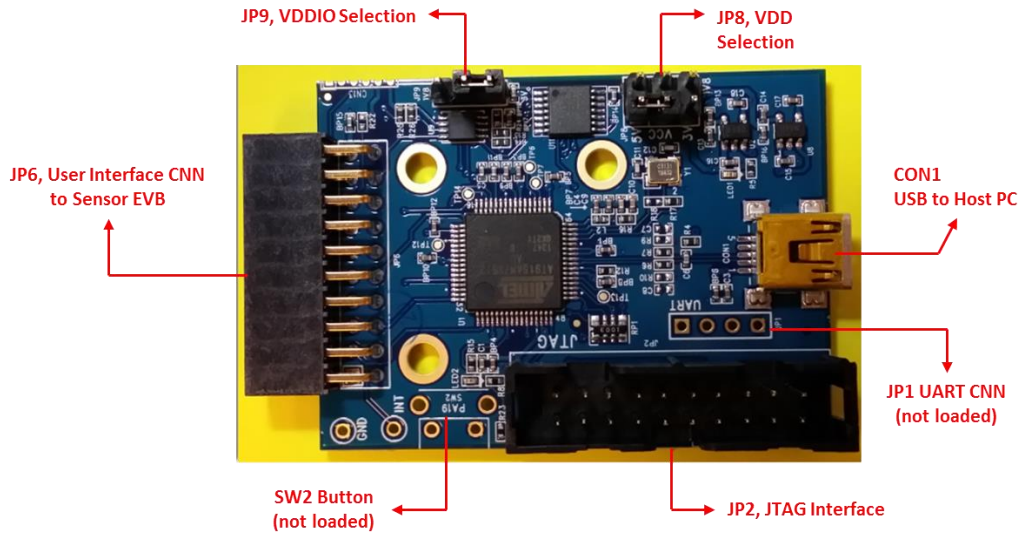


Figure 1. Figure 2 depicts the bottom side of the PCB. Signal names are labeled accordingly for user convenience.

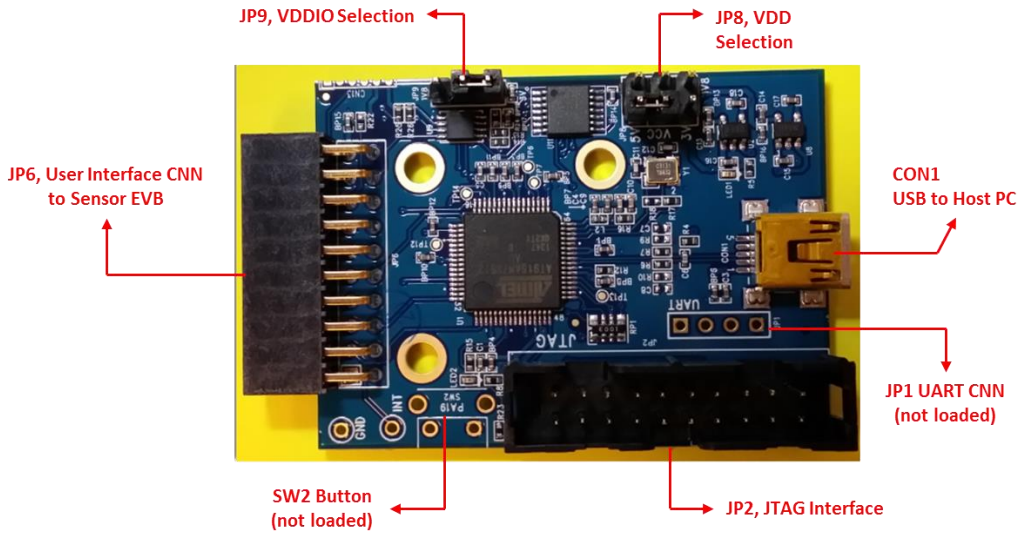


Figure 1: INVARM Board Interfaces—Top View

Figure 2: INVARM Board—Bottom View

INVARM BOARD CONNECTORS

The INVARM boards communicate with a host PC through the USB interface. The CON1 USB connector is a standard USB mini connector. The signals on CON1 follow the standard USB pin assignment.

JP6 is a user interface connector used to connect the INVARM board to a UEVB. Signal descriptions are shown in Table 1.

Table 1: User Interface Connector

JP6 PIN NUMBER	SIGNAL NAME	SIGNAL DESCRIPTION
1	1V8	1.8V Power-Supply Connection. Power supply to UEVB with at least 100mA capacity 1.8V.
2	/CS0	Chip Select 0. Low-active SPI interface chip select.
3	INT	Interrupt. Interrupt input from the UEVB to the INVARM board.
4	/CS2	Chip Select 2. Low-active SPI interface chip select.
5, 7, 9, 10, 12, 15, 17	NC	No Connect. Do not connect.
6	PA7	GPIO. General purpose I/O signal line.
8	PA20	GPIO. General purpose I/O signal line.
11, 13	GND	Ground. Ground connection between UEVB and INVARM board.
16	SCLK_SCL	Serial Clock Line. SPI: SCLK, I2C: SCL
18	MOSI_SDA	Serial Data Line. SPI: MOSI, I2C: SDA
19	VCC	Main Power Supply. Power supply for the UEVB. Three option voltage levels can be selected by jumper setting (see Tables 5 and 6 for details on how to select the desired voltage levels for VDD and VDDIO.)
20	MISO_AD0	Address Bit/Serial Data Line. SPI: MISO, I2C: save device address Bit 0

JP2 is the JTAG interface connector. Its signal description is shown in Table 2.

Table 2: JTAG Connector

JP2 PIN NUMBER	SIGNAL NAME	SIGNAL DESCRIPTION
1	3V0	3V Power Supply
2	3V0	3V Power Supply
3	Pullup	100kΩ Pullup Resistor
4, 6, 8, 10, 12, 14, 16, 18, 20	GND	Ground Connection
5	TDI	JTAG TDI. JTAG Test Data In.
7	TMS	JTAG TMS. JTAG Test Mode Select.
9, 11	TCK	JTAG TCK. JTAG Test Clock.
13	TDO	JTAG TDO. JTAG Test Data Out.
15	NRST	JTAG NRST. JTAG Low-Active Test Reset.
17, 19	NC	No Connect. Do not connect.
20	GND	Ground Connection

JP1 is the UART debug connector. Its signal description is shown in Table 3.

Table 3: UART Interface Connector

JP1 PIN NUMBER	SIGNAL NAME	SIGNAL DESCRIPTION
1	3V0	3V Power Supply
2	TXD	UART TXD. Connect it to target RXD.
3	RXD	UART RXD. Connect it to target TXD.
4	GND	Ground Connection

CN13 is designed to connect directly with the SFF board (soldering required). Its signal description is shown in Table 4.

Table 4: Sensor SFF Board Connector

CN13 PIN NUMBER	SIGNAL NAME	SIGNAL DESCRIPTION
1	SCL	I2C clock. Serial clock line.
2	SDA	I2C data. Serial data line.
3	INT	Interrupt from SFF to INVARM board.
4	GND	Ground Connection.
5	VDD	VDD power supply to SFF board.
6	VDDIO	VDDIO power supply to SFF board.

The digital interface voltage level can be selected through JP9. Jumper settings description is shown in Table 5.

Table 5: VDDIO Selection Jumper

VDDIO	JP9 JUMPER POSITION
1.8V	For a 1.8V supply setting, place a shunt across pins 1 and 2 of JP9.
3.0V	For a 3V supply setting, place a shunt across pins 2 and 3 of JP9.

Power-supply selections for the UEVB (VCC). Voltage levels can be selected by placing shunts accordingly across the various pins of JP8. Jumper settings are shown in Table 6.

Table 6: VDD Selection Jumper

VCC	JP8 JUMPER POSITION
1.8V	For a 1.8V supply setting, place a shunt across pins 3 and 4 of JP8.
3.0V	For a 3V supply setting, place a shunt across pins 3 and 5 of JP8.
5.0V	For a 5V supply setting, place a shunt across pins 1 and 3 of JP8.

INVARM BOARD LAYOUT

The INVARM board is a 4-layer FR-4 PCB measuring 38mm x 52mm x 1.6mm. Figure 3 shows the PCB's layout top and bottom side (silkscreen view).

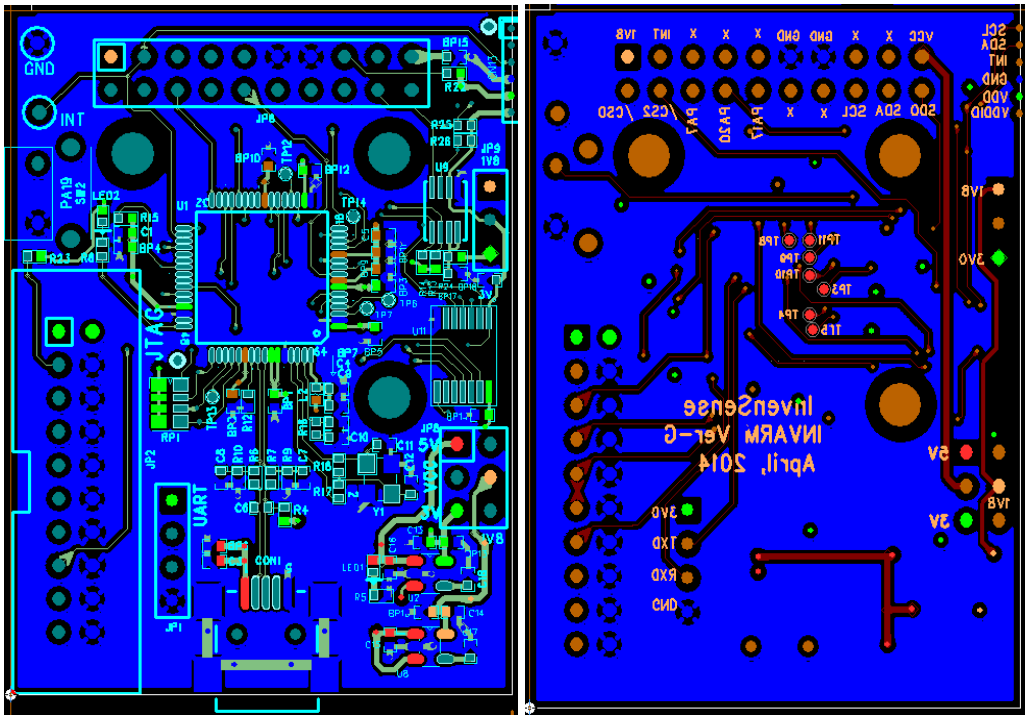
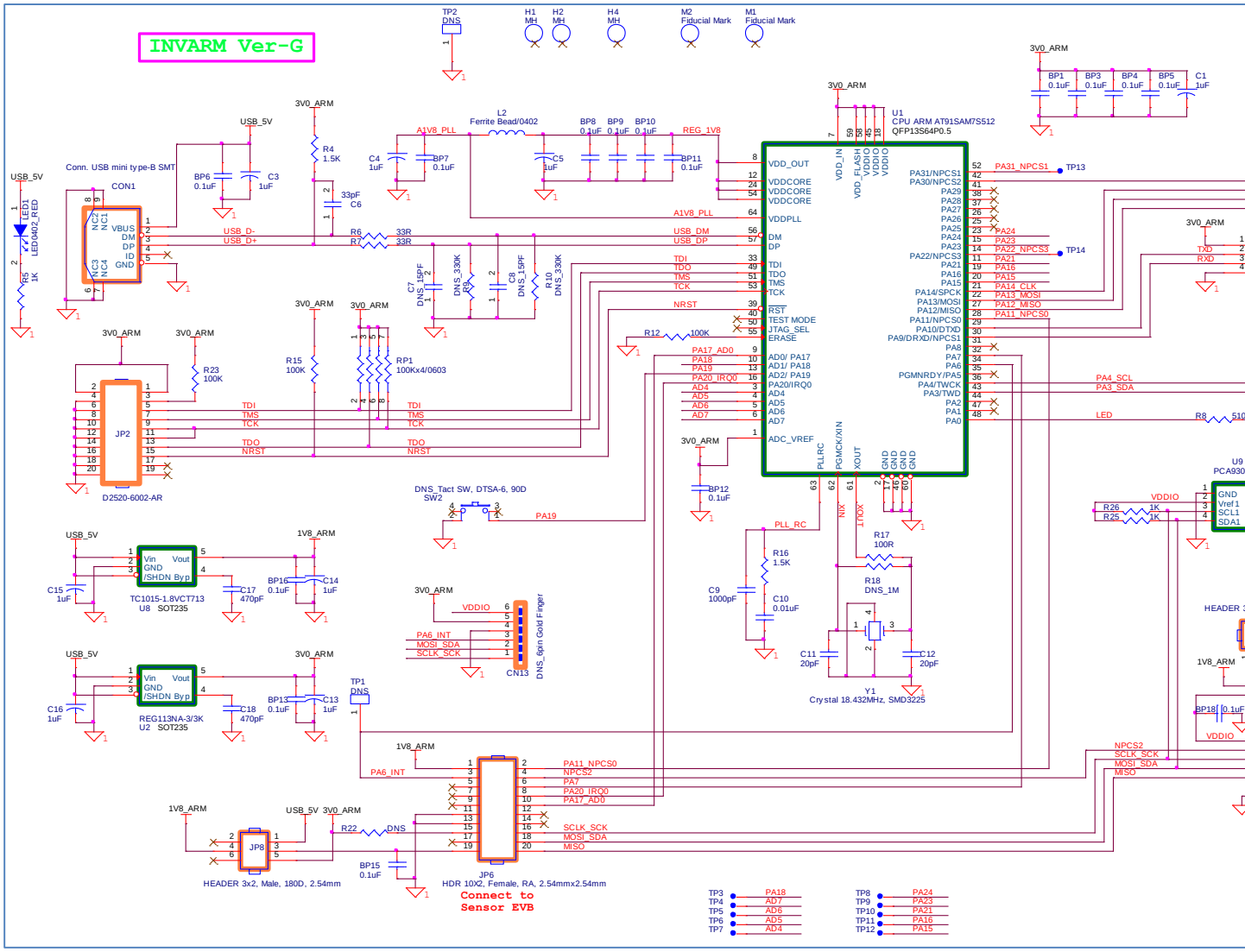


Figure 3: INVARM Board Top & Bottom Silkscreen

CIRCUIT SCHEMATIC



BILL OF MATERIAL (BOM)

Table 7: Bill of Materials

Item	Quantity	Reference	Part	Manufacturer	Man
1	17	BP1,BP3,BP4,BP5,BP6,BP7,BP8,BP9,BP10, BP11,BP12,BP13,BP14,BP15,BP16,BP17,BP18	0.1µF	Kemet	C040
2	8	C1,C3,C4,C5,C13,C14,C15,C16	1µF	TDK	C1
3	1	C6	33pF	TDK	C1
4	1	C9	1000pF	TDK	C1005
5	1	C10	0.01µF	TDK	C1
6	2	C11,C12	20pF	Yageo	CC04
7	2	C17,C18	470pF	TDK	C1005
8	1	CON1	Conn. USB mini type-B SMT	On Shore Tech	U
9	1	JP2	D2520-6002-AR	3M	D2
10	1	JP6	HDR 10X2, Female, RA, 2.54mmx2.54mm	Samtec	SSW
11	1	JP8	HEADER 3x2, Male, 180D, 2.54mm	TE	
12	1	JP9	HEADER 3x1, Male, 180D, 2.54mm	TE	
13	1	LED1	LED0402_RED	Kingbright Corp	APH
14	1	LED2	LED0402_GRN	Kingbright Corp	AP
15	1	L2	Ferrite Bead/0402	TDK	MI
16	1	RP1	100kΩx4/0603	Vishay/Dale	CRA
17	2	R4,R16	1.5kΩ	Yageo	RC0

Item	Quantity	Reference	Part	Manufacturer	Man
18	5	R5,R13,R14,R25,R26	1kΩ	Yageo	RC
19	2	R6,R7	33kΩ	Panasonic	EF
20	1	R8	510kΩ	Vishay/Dale	CRCV
21	3	R12,R15,R23	100kΩ	Yageo	RC0
22	1	R17	100kΩ	TE Connectivity	2
23	1	R24	200kΩ	Panasonic	E
24	1	U1	CPU ARM AT91SAM7S512	Atmel	AT91
25	1	U2	REG113NA-3/3K	TI	RE
26	1	U8	TC1015-1.8VCT713	Microchip	TC1
27	1	U9	PCA9306DCTR	TI	P
28	1	U11	MAX3378EEUD	Maxim	MA
29	1	Y1	Crystal 18.432MHz, SMD3225	Citizen	CS32

CONNECTION TO INVENSENSE'S UEVB & SFF

For InvenSense's UEVB (Universal Evaluation Board) and SFF (Small Form Factor) board, communication with a host PC occurs via a USB port. Simply connect the INVARM to either a UEVB (JP6) or a SFF (CN13), and utilize the Universal Data Logger (UDL) to set up your sensor board registers and collect data.

Please refer to the *Readme InvenSense Universal Data Logger* document for detailed instructions on how to use the data logger to obtain the sensor data. This information can be provided by your local field team/applications engineer on an as-needed basis.

Figure depicts the connection of the INVARM board to a UEVB (MPU-6050 UEVB pictured). The connection between the two boards is made via header JP6 on the INVARM board.

Figure 4: INVARM Board Connected to InvenSense's UEVB

Figure shows the INVARM board in connection with a SFF board. Connection between the two boards is made via connector CN13 on the INVARM board. Soldering is needed to establish connection between the two boards.

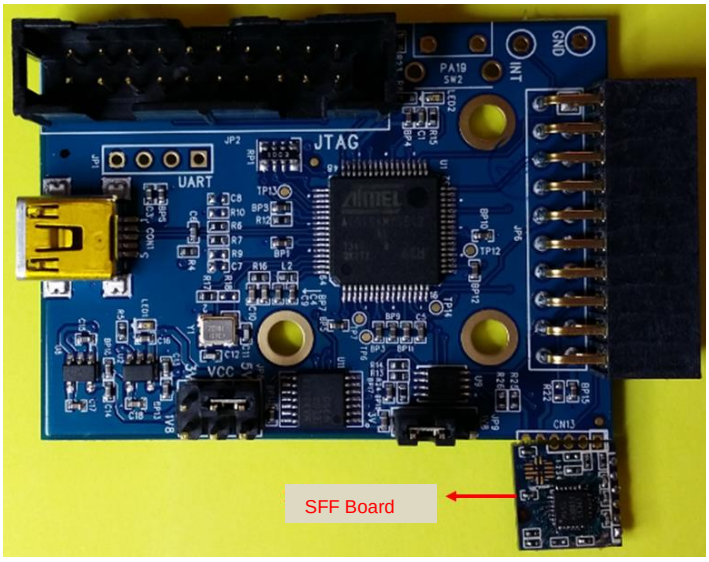


Figure 5: INVARM Board Connected to InvenSense's SFF Board

SPECIAL INSTRUCTIONS

The electronic components on these boards can be permanently damaged by electrostatic discharge (ESD). ESD precautions for handling and storage must be taken to avoid damage.

REVISION HISTORY

DATE	REVISION	DESCRIPTION
01/26/16	1.0	Initial Release Revision-G Arm Board

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