IDG-2020 & IXZ-2020
Evaluation Board User Guide
Revision 1.0

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1. Revision History

Date	Revision	Description
12/20/2011	1.0	Initial release

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2. Purpose

This document describes the hardware and circuitry on the IDG-2020™ and IXZ-2020™ Evaluation (EV) Boards. It covers applying the EV board to a larger system, understanding key signals and circuit functions, hardware jumper settings, and port connectors.

Sensor Axes for each device

Device	IDG-2020	IXZ-2020
Gyro Axes	X, Y	X, Z

For the remainder of the document, the IDG-2020 and IXZ-2020 will be known as Ixx-2020.

2.1 Usage

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

- X&Y or X&Z Axis gyros with ±250°/sec, ±500°/sec, ±1000°/sec, ±2000°/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 SPI or I²C serial communications interfaces. Alternatively, it may be connected to InvenSense's ARM Evaluation Board (INVARMEVB) for connectivity to a host computer using USB interface.

2.2 Related Documents

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

- Ixx-2020 Product Specification
- Ixx-2020 Register Map and Register Descriptions

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3. Ixx-2020 2-Axis EV Board Overview

The Ixx-2020 2-Axis EV Board contains the Ixx-2020 2-Axis gyroscope. 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 ease of measurement access. The 10x2 user header connector is designed to connect with the InvenSense ARM Evaluation Board (INVARMEVB), which is a host microcontroller board useful for adapting the Ixx-2020 2-Axis EV Board to a personal computer via its USB port.

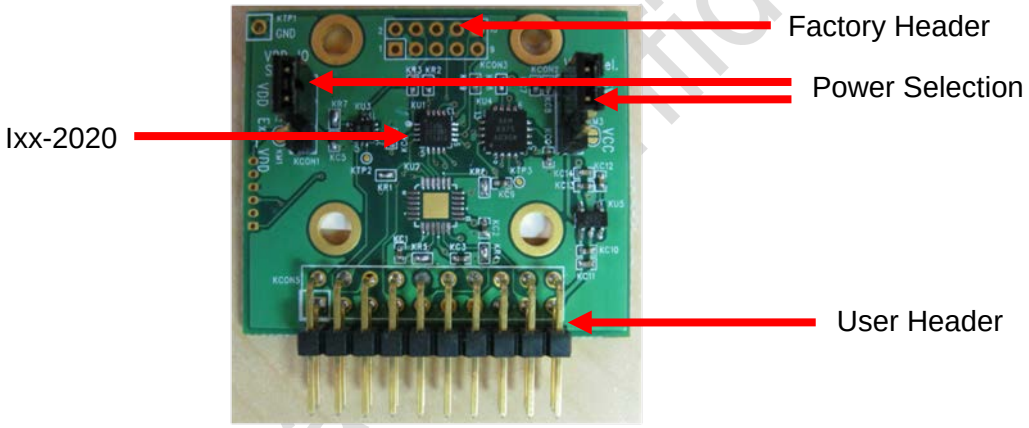

Figure 1. Top side of the Ixx-2020 2-Axis EV Board

The 5x2 extension factory header is intended for connecting additional devices to the EV Board, such as a camera image stabilization processor, or a digital-output compass, among others. The 3-pin power selection headers are used to select which voltage supply is fed to the Ixx-2020.

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3.1 Ixx-2020 Key Function and Pin-outs

The Ixx-2020 EVB is a fully-tested evaluation board, providing a means for quick evaluation of the Ixx-2020's X&Y or X&Z-axis angular rate gyroscope. The Ixx-2020 uses InvenSense's proprietary MEMS technology with monolithic angular rate sensors (gyros) to produce a functionally complete motion sensor. All required conditioning electronics are integrated into a single chip measuring 3mm x 3mm x 0.9mm. It incorporates X&Y or X&Z-axis low-pass filters and an EEPROM for on-chip 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.

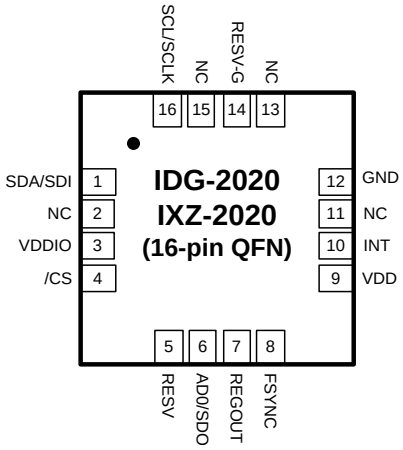

Figure 2: QFN Package (Top View)
16-pin, 3mm x 3mm x 0.90mm

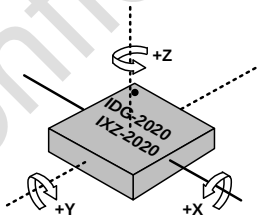

Figure 3: Orientation of Axes of Sensitivity and Polarity of Rotation

3.2 Ixx-2020 Bus Connection

The Ixx-2020 communicates to a system processor using SPI or I^2C serial interfaces. The device always acts as a slave when communicating to the system processor.

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4. Ixx-2020 2-Axis EVB Schematics

The schematic diagram below shows the Ixx-2020 EVB. For the Ixx-2020 EVB, U3 and U4 are not populated.

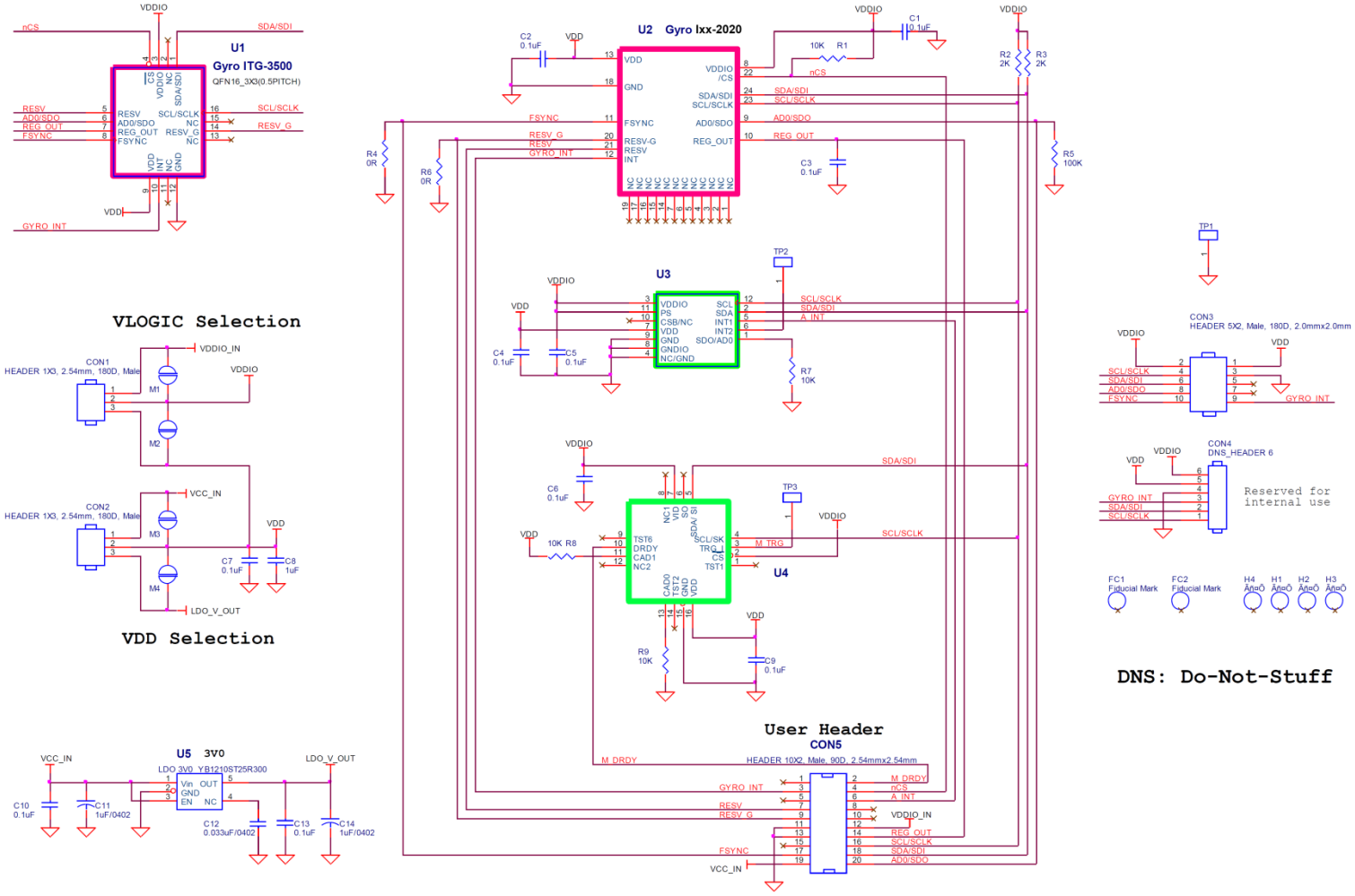

Figure 2 Schematics

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5. Bill of Materials

Table 1. Bill of Materials

Item	Quantity	Reference	Part	PCB Footprint
1	2	CON2,CON1	HEADER 1X3, 2.54mm, 180D, Male	SIP-3P
2	1	CON3	HEADER 5X2, Male, 180D, 2.0mmx2.0mm	SIP2X5N2
4	1	CON5	HEADER 10X2, Male, 90D, 2.54mmx2.54mm	J100\20DF-VR
5	10	C1,C2,C3,C4,C5,C6,C7,C9, C10,C13	0.1uF	C0402
6	3	C8,C11,C14	1uF/0402	C0402
7	1	C12	0.033uF/0402	C0402
11	4	R1,R7,R8,R9	10K/0402	R0402
12	2	R3,R2	2K/0402	R0402
13	2	R4,R6	0R/0402	R0402
14	1	R5	100K/0402	R0402
18	1	U1	Gyro Ixx-2020	QFN16_3X3(0.5PITCH)
22	1	U5	LDO 3V0 YB1210ST25R300	SOT235

6. Power Supply Connections

CON1 and CON2 are 3 header-pin plug-in jumpers which allow users to select between on-board LDO and external DC supply to the Ixx-2020. For details, please refer 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 LDO_V_OUT on the schematic, and using it will assure that the gyroscope will meet intended specifications.

Selecting the raw VCC_IN 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 user intends to use on board LDO 3V0 power, external VCC_IN must be provided with higher than 3.7V to ensure that the LDO works properly.

If user provides VCC_IN with 5V, CON1 and CON2 must be set as "2-3 short". Ixx-2020 VDD and VDDIO operation range is 1.71V to 3.6V.

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7. Ixx-2020 EVB connector signals description

Table 2 Power Selection Jumpers

CON1 Pin Number	Signal description
1-2 short	VDDIO = VDDIO_IN (from external)
2-3 short	VDDIO = VDD
CON2 Pin Number	Signal description
1-2 short	VDD = Vcc_IN (from external)
2-3 short	VDD = 3V (from on board 3V0 LDO)

Table 3. User Interface Connector Signals

CON5 Pin Number	Signal description
1	NC
3	Ixx-2020 Gyro INT output to controller
5	NC
7	Reserved
9	Reserved
11	GND
13	GND
15	NC
17	FSYNC
19	VCC_IN
4	Ixx-2020 SPI /CS
8	NC
10	NC
12	VDDIO_IN
14	Reserved
16	Ixx-2020 I²C mode: SCL; SPI mode: SCLK
18	Ixx-2020 I²C mode: SDA; SPI mode: MOSI
20	Ixx-2020 I²C mode: AD0; SPI mode: MISO

Table 4. Extended Factory Connector

CON3 Pin Number	Signal description
1	VCC, power from ARM-7 controller board or external power. It should be 5V, with >200mA
3	GND

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5	NC
7	NC
9	NC
2	3V
4	Ixx-2020 I²C mode: SCL
6	Ixx-2020 I²C mode: SDA
8	Ixx-2020 I²C mode: AD0
10	Ixx-2020 FSYNC

7.1 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 Ixx-2020's serial bus transfer with the master timing set by the camera system. FSYNC can originate from the host processor via CON5 pin-17, or from CON3 pin-10. There is no external pull-up termination for the FSYNC line.

8. Serial bus Levels, Speeds and Terminations

The Ixx-2020 supports I²C up to 400 kHz and SPI up to 1MHz serial clock rates. The I²C bus open drain pull up resisters are connected to either 3.0V or external provided VCC_IN. The pull up level is selected by CON1. Please refer to Table 2 Power Selection Jumpers.

8.1 Data Gathering Options

The Ixx-2020's Digital Sensor Data is available at the User Header. Alternatively, for connectivity with a host PC, an InvenSense ARM Processor Board may be used.

8.2 Connection to ARM EVB

For communications via USB to a host computer, the Ixx-2020 EVB can be connected to InvenSense's ARM processor board, the INV-ARMEVB.

The photo below shows the connection of Ixx-2020 to INV-ARMEVB. Connection between the two boards is made via the user header.

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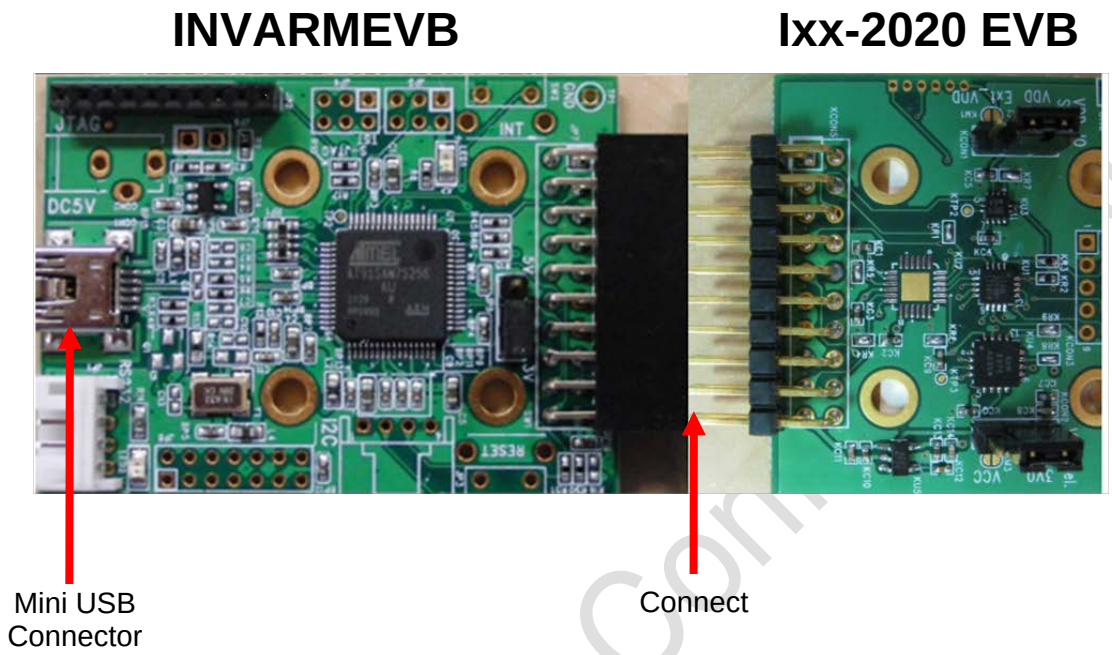

Figure 3 Connect Ixx-2020 EVB to ARM Board

8.3 Use of Ixx-2020 without ARM EVB board

I²C and SPI signals are available on CON3 and CON5. User can develop tools to communicate with the Ixx-2020. There is no bus mode selection setting needed.

9. Special Instructions

9.1 Electrostatic Discharge Sensitivity

The Ixx-2020 gyro can be permanently damaged by an electrostatic discharge. ESD precautions for handling and storage are recommended.

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10. Dimension Drawing

The Ixx-2020 EV board is a 4 layer PCB with 32mm x 38mm dimension.

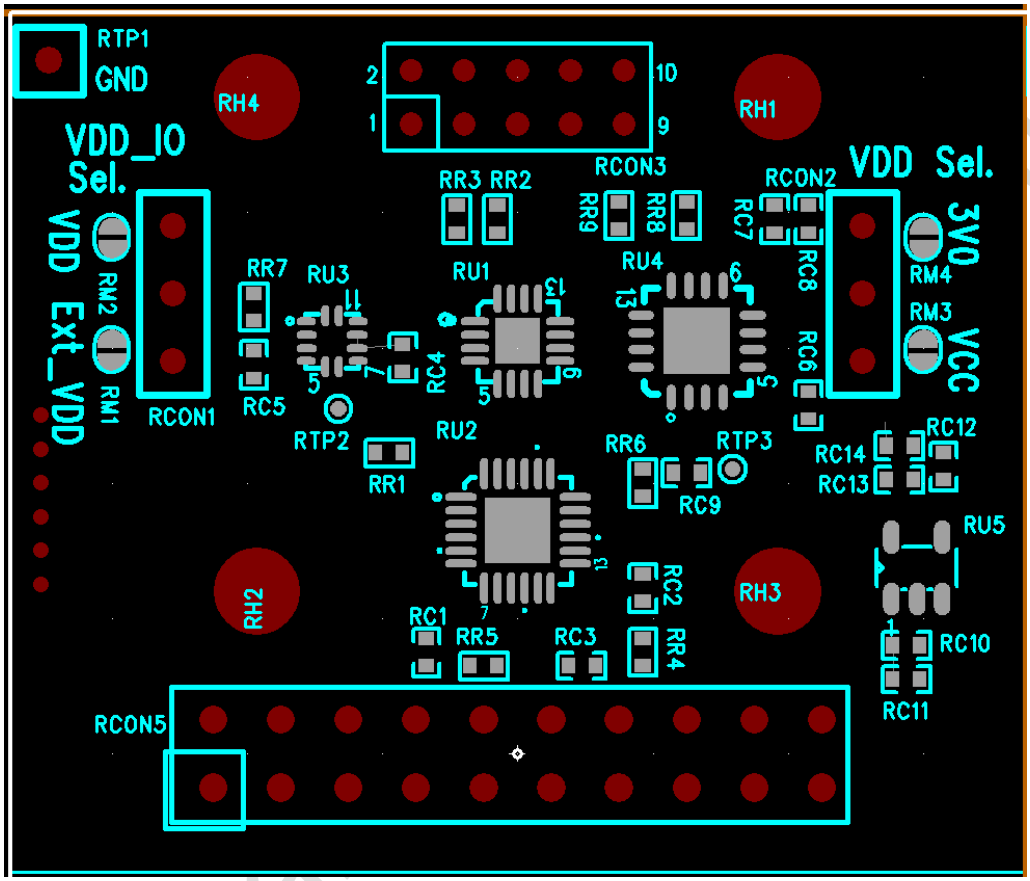

Figure 4 Ixx-2020 EVB

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