

# **DK-45605 & DK-45686**

## **SmartMotion Development Platform (Ver. I)**

### **Hardware User Guide**

## TABLE OF CONTENTS

1	Overview .....	3
2	Introduction .....	4
2.1.	Features Overview .....	4
2.2.	Platform Overview .....	4
2.3.	Hardware User Guide .....	4
3	Sensors and Development Kits .....	4
3.1.	DK-45605 .....	5
3.2.	DK-45686 .....	5
4	The Smartmotion System Design.....	6
4.1.	System Block Diagram .....	6
4.2.	Main MCU SAMG55 Resource Allocation .....	6
4.3.	Connectors .....	7
4.4.	Jumper Settings .....	7
5	Schematics and Board PCB .....	8
5.1.	Schematics.....	8
5.2.	Board PCB .....	11
6	Revision History .....	12
7	Declaration Disclaimer .....	13

## 1 OVERVIEW

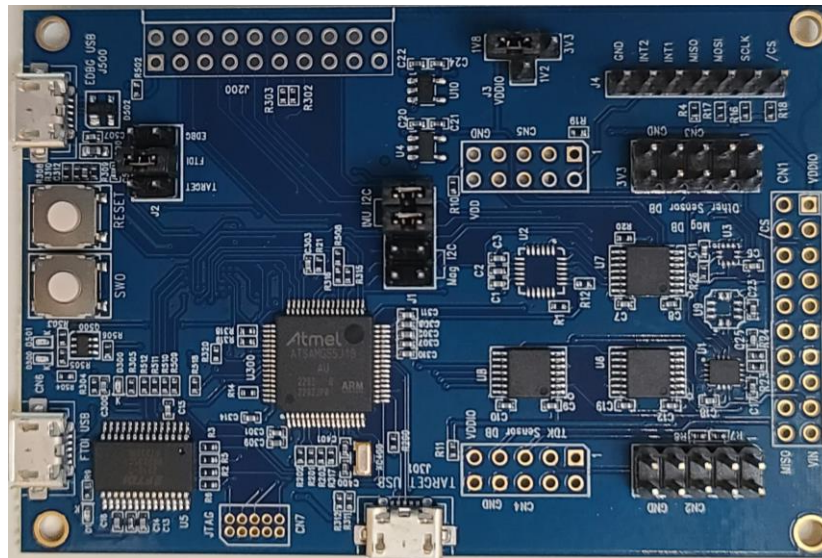
The TDK SmartMotion Platform Ver. I is a comprehensive development system for TDK InvenSense Motion Sensor devices. The platform designed around the Microchip SAMG55 MCU can be used by customers for rapid evaluation and development of InvenSense sensor-based solutions. The platform integrates an on-board Embedded Debugger so external tools are not required to program or debug with the SAMG55 MCU. Each InvenSense motion sensor has its own unique development kit. Their DK numbers are listed in this document.

The SmartMotion platform comes with the necessary software including InvenSense MotionLink, a GUI based development tool and embedded Motion Drivers (eMD) for InvenSense motion sensors.

Embedded Motion Drivers (eMD) consist of a set of APIs to configure various aspects of the platform including motion sensor parameters such as full-scale range (FSR), output data rate (ODR) signal redirection to dedicated pin, sensors low pass filter cutoff or alarm bits check.

MotionLink is a GUI based development tool included with the platform. It can be used to capture and visualize the sensor data from the motion sensor.

The platform supports Atmel Studio and is compatible with Microchip Xplained Pro Extension boards. Xplained Pro extension series evaluation kits offer additional peripherals to extend the features of the board and ease the development of customer designs.



**Figure 1. SmartMotion Platform (Ver. I) Development Kit**

## 2 INTRODUCTION

### 2.1. FEATURES OVERVIEW

- Integrated TDK InvenSense motion sensor
- Support for a magnetic sensor with plug in daughter boards (DB)
- Microchip SAMG55 microcontroller with 512 KB Flash
- On-board Embedded debugger (EDBG) for Programming and debugging
- Built in FTDI USB to UART interface for fast motion sensor data transfer
- USB Connectors for host interface to software debug and data logging
- Board Power Supply through USB

### 2.2. PLATFORM OVERVIEW

The TDK SmartMotion Platform Ver. I is a hardware unit for TDK sensor product evaluation and algorithm software development. The platform offers support for many different application developments.

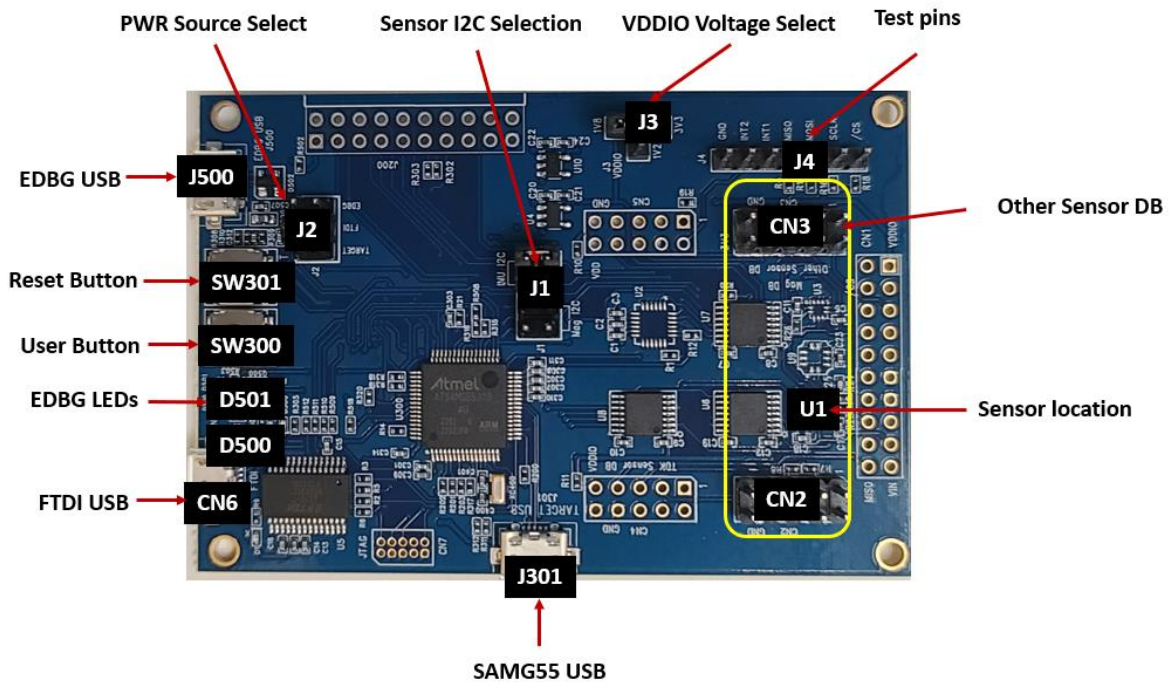


Figure 2. The SmartMotion Platform Overview

### 2.3. HARDWARE USER GUIDE

The TDK SmartMotion Platform Ver. I is compatible with Microchip’s SAM G55 Xplained Pro. The link to the Atmel Xplained Pro user guide is here:

[http://www.atmel.com/Images/Atmel-42389-SAM-G55-Xplained-Pro\\_User-Guide.pdf](http://www.atmel.com/Images/Atmel-42389-SAM-G55-Xplained-Pro_User-Guide.pdf)

## 3 SENSORS AND DEVELOPMENT KITS

The TDK SmartMotion Platform Ver. I support multiple types of TDK IMUs and pressure sensors. The Development

Kits (DKs) based on this SmartMotion Platform Ver. I are listed in Table 1 below.

**Important Note:**

The DK boards are intended for basic sensor product evaluation and software development at Room Temperature. These boards are NOT designed to be used at any other temperature. For sensor evaluation or characterization at temperature range specified in the product datasheet, please obtain an Evaluation Board (EVB) from your TDK FAE or sales contact.

#	DK PART NUMBER	SUPPORTED SENSOR	SMT IN
1	DK-45605	ICM-45605	U1
2	DK-45686	ICM-45686	U1

**Table 1. Sensors and DKs**

### 3.1. DK-45605

The DK-45605 is the development kit (DK) for TDK IMU ICM-45605.

The ICM-45605 is a high performance 6-axis MEMS MotionTracking device. It has a configurable host interface that supports I3C<sup>SM</sup>, I<sup>2</sup>C and SPI serial communication, and an I<sup>2</sup>C master mode interface for connection to external sensors. The device features up to 8Kbytes FIFO and 2 programmable interrupts.

Please refer to the ICM-45605 datasheet for the sensor details.

### 3.2. DK-45686

The DK-45686 is the development kit (DK) for TDK IMU ICM-45686.

The ICM-45686 is a high-performance dual interface (UI + AUX) 6-axis MEMS MotionTracking device. It has a configurable host interface that supports I3C<sup>SM</sup>, I<sup>2</sup>C and SPI serial communication, and an AUX interface that supports SPI slave mode for connection to OIS controllers or I<sup>2</sup>C master mode for connection to external sensors. The device features up to 8Kbytes FIFO and 2 programmable interrupts.

Please refer to the ICM-45686 datasheet for the sensor details.

## 4 THE SMARTMOTION SYSTEM DESIGN

This section is a system design overview and addresses MCU SAMG55 resource allocation.

### 4.1. SYSTEM BLOCK DIAGRAM

On board EDBG MCU AT32UC3A4256HHB-C1UR allows user to do main MCU SAMG55 debug, trace, and programming without using external tools. Figure 3 shows the system block diagram.

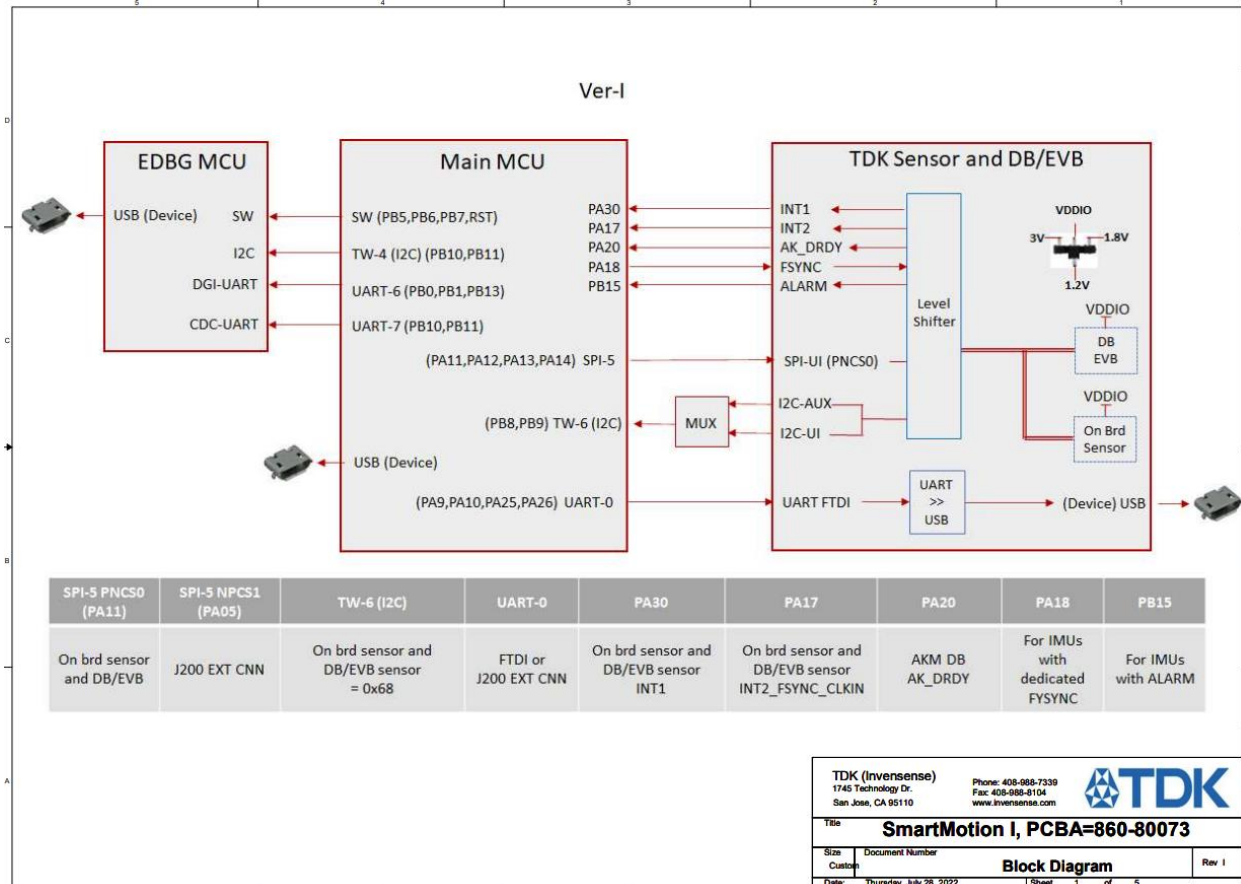


Figure 3. System Block Diagram

### 4.2. MAIN MCU SAMG55 RESOURCE ALLOCATION

SAMG55 RESOURCE	USAGE
UART 0 (PA9/10/25/26)	The UART0 is connected to FTDI input by default. In the use case of Extension-1 on J200, the UART0 to FTDI connection can be disconnected through jumper J3.
TW6 (I2C) (PB8/9)	Master I <sup>2</sup> C lines for external sensor connected through CN2.
SPI5 (PA11/12/13/14)	The SPI5 master is connected to TDK IMU sensor. On board IMU sensor /CS = PNC50
GPIO (INTs) PA17/18/20/30 and PB15	The GPIOs are used for sensor interrupt inputs and other intelligent functions. Refer to the table in Figure 3.
TW4 (I2C)	The master I <sup>2</sup> C communicates with EDBG MCU slave I <sup>2</sup> C.
UART6	The UART6 is used for EDBG DGI-UART interface.
UART7	The UART7 is used for EDBG CDC-UART interface.

Table 2. SAMG55 Resource Allocation

### 4.3. CONNECTORS

TDK SmartMotion Platform Ver. I connector and header reference names and descriptions.

CONNECTOR NAME	CONNECTOR REF #	CONNECTOR FUNCTION DESCRIPTIONS
Other Sensor DB	CN2/CN3	Daughter board connector for Mag sensor. I <sup>2</sup> C interface only
FTDI USB	CN6	USB connector for FTDI USB to serial UART interface
EDBG LEDs	D500/D501	EDBG LEDs. D500 is green and D501 is yellow
Sensor I <sup>2</sup> C Selection	J1	Select host I <sup>2</sup> C connections, for IMU sensor and other sensors
PWR Source Select	J2	Board power source selection
VDDIO Voltage Select	J3	Selects voltage level between 3.3V, 1.8V and 1.2V for VDDIO
Test pins	J4	Digital signal test pins
SAMG55 USB	J301	MCU SAM G55 USB connector
EDBG USB	J500	EDBG MCU USB connector
User Button	SW300	User Button is connected to MCU GPIO, function is defined by the user
Reset Button	SW301	RESET Button: Hardware Reset for the Target MCU and EDDBG MCU

**Table 3. Connectors**

### 4.4. JUMPER SETTINGS

JUMPER	DESCRIPTION
J1	The J1 is used to select which sensor will be connected to the SAMG55 master I <sup>2</sup> C. Only two jumper shunts are allowed. Jumper shunts on pin 1/2 and 3/4: IMU Sensor primary I <sup>2</sup> C is connected to SAMG55 I <sup>2</sup> C master Jumper shunts on pin 5/6 and 7/8: Other Sensor I <sup>2</sup> C is connected to SAMG55 I <sup>2</sup> C master. In this configuration TDK IMU Sensor is connected to SAMG55 SPI master.
J2	The J2 is for board power source selection. Only one jumper shunt is allowed. Jumper shunt on pin 1/2: board power is from EDDBG USB on J500 Jumper shunt on pin 3/4: board power is from FTDI USB on CN6 Jumper shunt on pin 5/6: board power is from SAMG55 USB on J30
J3	J3 is for system VDDIO level selection. Jumper shunts on pin-1/2: VDDIO=3V3 Jumper shunts on pin-3/2: VDDIO=1V8 Jumper shunts on pin-4/2: VDDIO=1V2
J4	J4 have digital signals as test points. Pin-1: SPI /CS Pin-2: SPI SCLK, I <sup>2</sup> C SCL Pin-3: SPI MOSI, I <sup>2</sup> C SDA Pin-4: SPI MISO, I <sup>2</sup> C AD0 Pin-5: INT1 Pin-6: INT2 Pin-7: GND

**Table 4. Jumper Setting**

## 5 SCHEMATICS AND BOARD PCB

### 5.1. SCHEMATICS

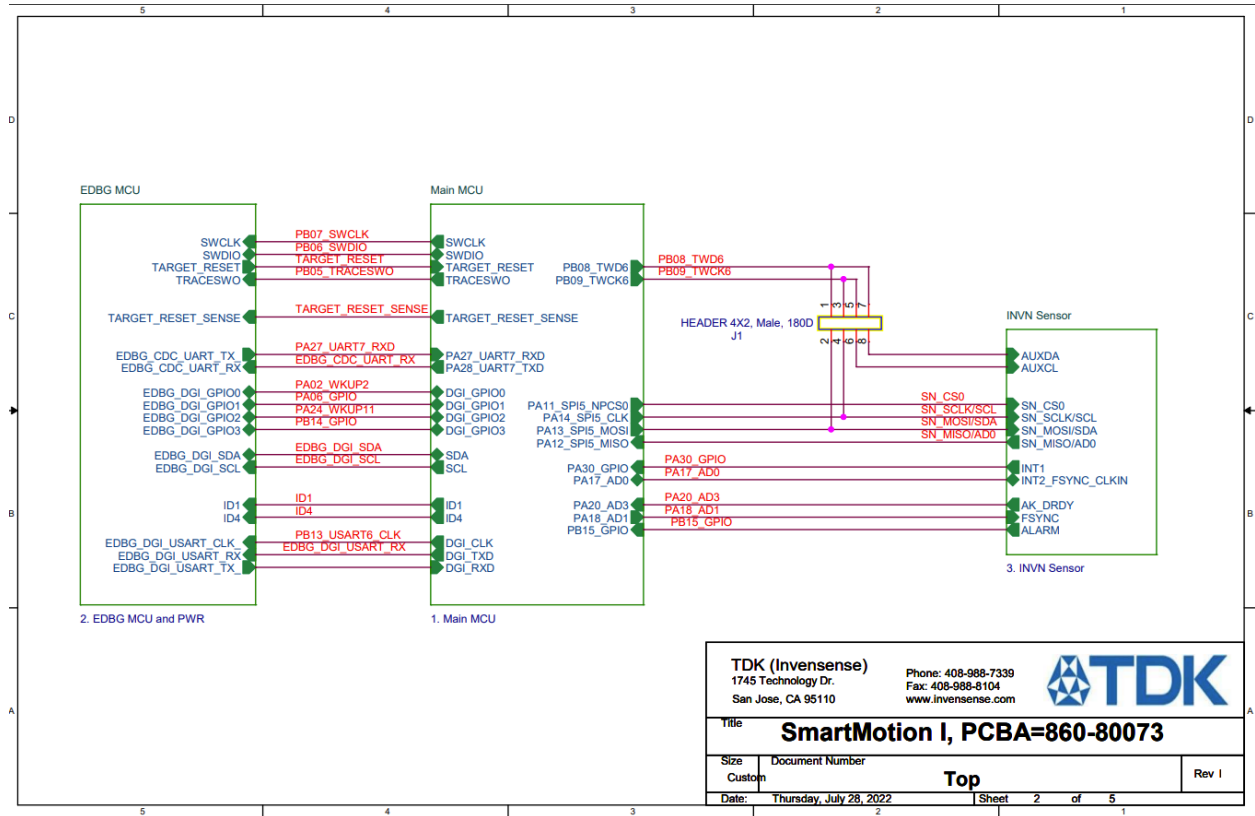


Figure 4. Block Diagram



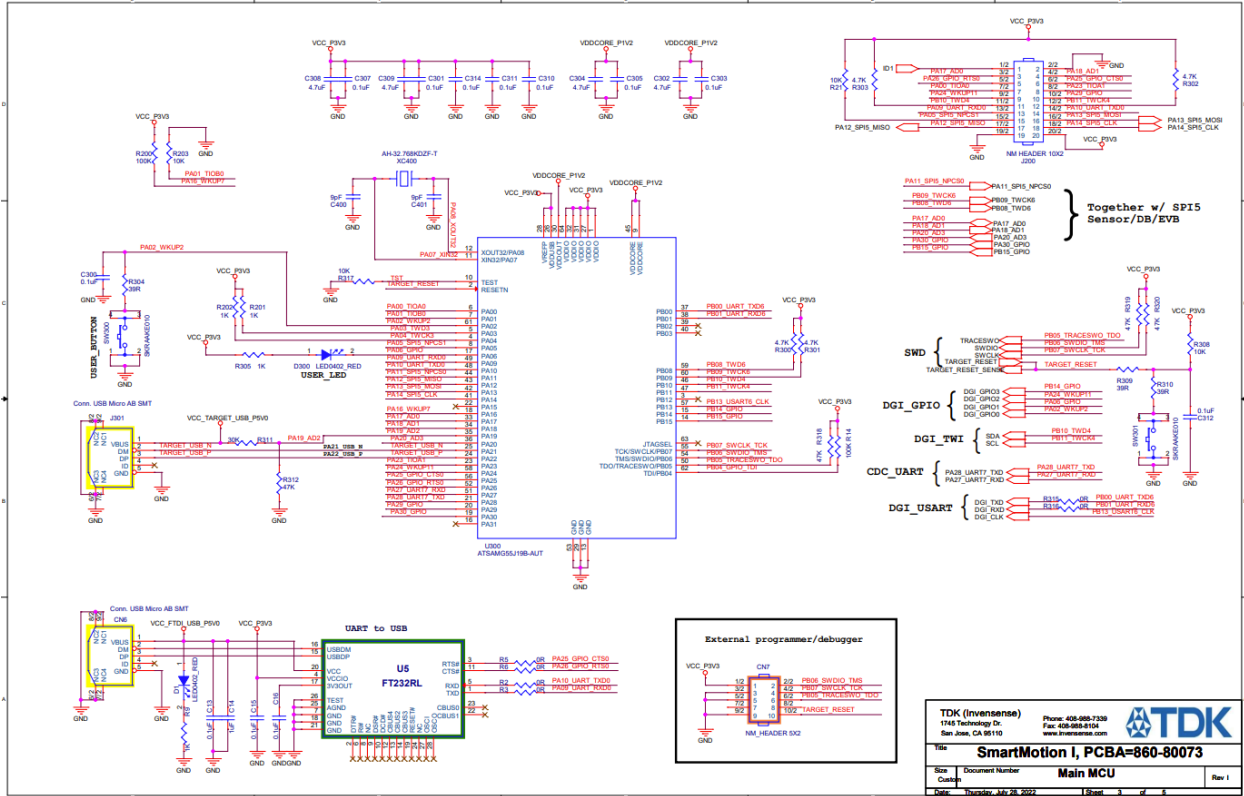


Figure 5. Main MCU

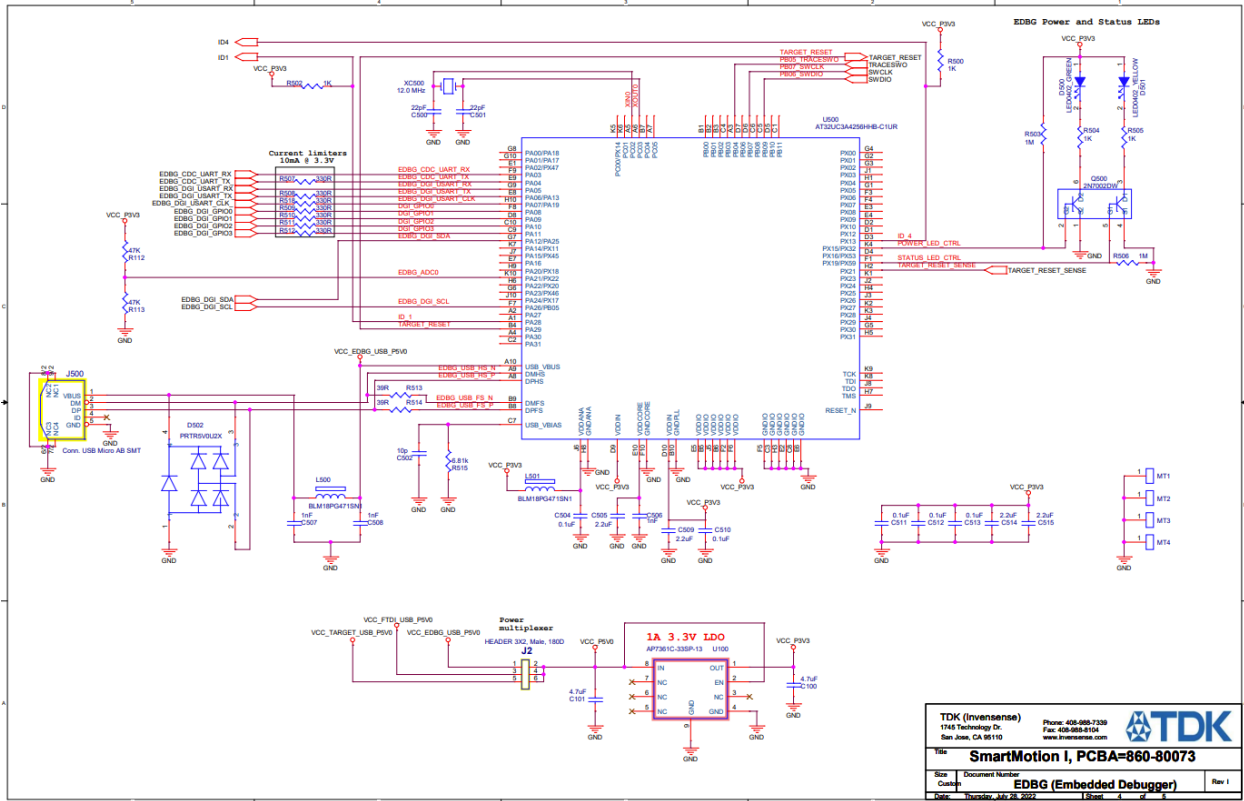


Figure 6. Embedded Debugger

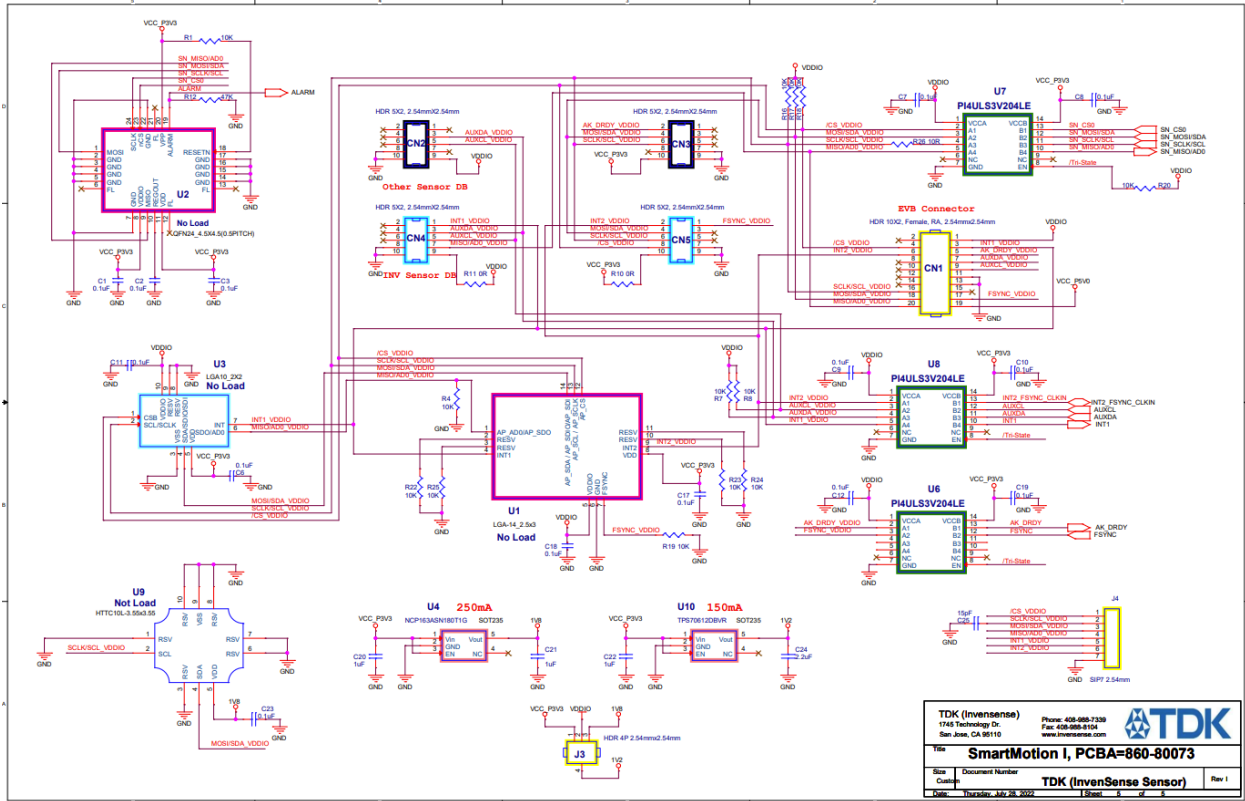
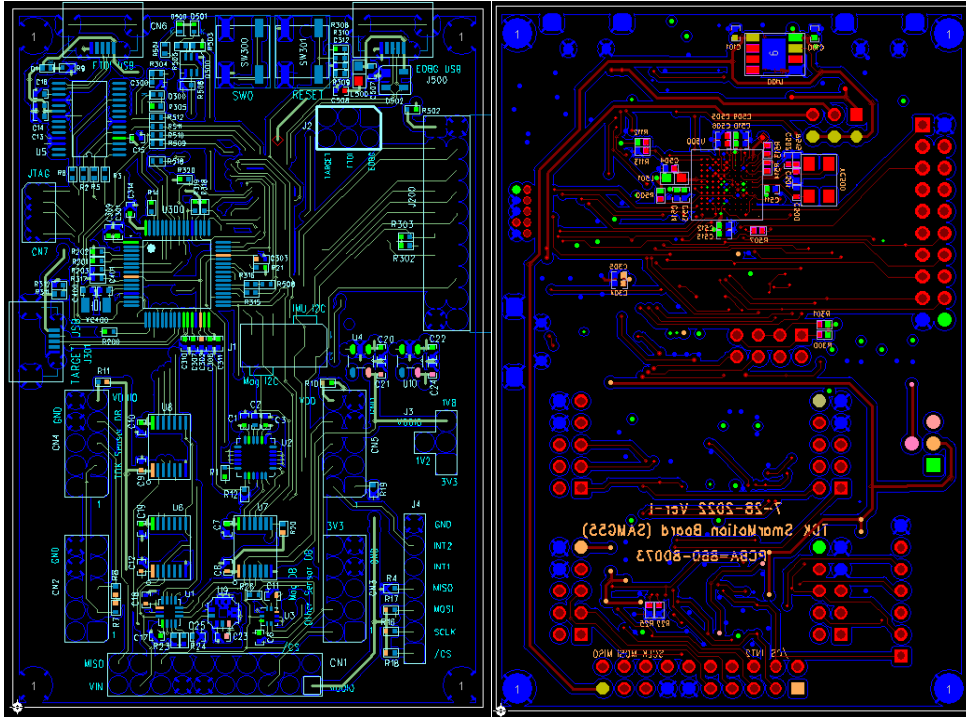


Figure 7. Sensors, DB and EVB connectors

<b>TDK (InvenSense)</b> 1745 Technology Dr. San Jose, CA 95110 Phone: 408-988-2730 Fax: 408-988-8104 www.invensense.com		
<b>SmartMotion I, PCB A=860-80073</b>		
Doc. No.	Document Number	Rev. 1
Date:	Thursday, July 28, 2012	1 of 2

**5.2. BOARD PCB**



**Figure 8. Ver. I PCB Top view (left) and Bottom view (right)**

## 6 REVISION HISTORY

REVISION DATE	REVISION	DESCRIPTION
7/26/2024	1.0	Initial Release

---

## **7 DECLARATION DISCLAIMER**

InvenSense believes the environmental and other compliance information given in this document to be correct but cannot guarantee accuracy or completeness. Conformity documents substantiating the specifications and component characteristics are on file. InvenSense subcontracts manufacturing, and the information contained herein is based on data received from vendors and suppliers, which has not been validated by InvenSense.

This information furnished by InvenSense or its affiliates (“TDK InvenSense”) is believed to be accurate and reliable. However, no responsibility is assumed by TDK InvenSense for its use, or for any infringements of patents or other rights of third parties that may result from its use. Specifications are subject to change without notice. TDK InvenSense reserves the right to make changes to this product, including its circuits and software, in order to improve its design and/or performance, without prior notice. TDK InvenSense makes no warranties, neither expressed nor implied, regarding the information and specifications contained in this document. TDK InvenSense assumes no responsibility for any claims or damages arising from information contained in this document, or from the use of products and services detailed therein. This includes, but is not limited to, claims or damages based on the infringement of patents, copyrights, mask work and/or other intellectual property rights.

Certain intellectual property owned by InvenSense and described in this document is patent protected. No license is granted by implication or otherwise under any patent or patent rights of InvenSense. This publication supersedes and replaces all information previously supplied. Trademarks that are registered trademarks are the property of their respective companies. TDK InvenSense sensors should not be used or sold in the development, storage, production, or utilization of any conventional or mass-destructive weapons or for any other weapons or life-threatening applications, as well as in any other life critical applications such as medical equipment, transportation, aerospace and nuclear instruments, undersea equipment, power plant equipment, disaster prevention and crime prevention equipment.

©2024 InvenSense. All rights reserved. InvenSense, SmartMotion, SmartIndustrial, SmartSonic, SmartAutomotive, SmartRobotics, SmartSound, SmartPressure, MotionProcessing, MotionProcessor, UltraPrint, MotionTracking, CHIRP Microsystems, SmartBug, SonicLink, Digital Motion Processor, AAR, and the InvenSense logo are registered trademarks of InvenSense, Inc. The TDK logo is a trademark of TDK Corporation. Other company and product names may be trademarks of the respective companies with which they are associated.



©2024 InvenSense. All rights reserved.

## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

*Click to view similar products for [Multiple Function Sensor Development Tools](#) category:*

*Click to view products by [TDK](#) manufacturer:*

Other Similar products are found below :

[AS7022-EVALKIT](#) [P-NUCLEO-53L5A1](#) [X-NUCLEO-6283A1](#) [DK-45686](#) [DK-40609-D](#) [MIKROE-5448](#) [GX-F12A](#) [GX-F12A-P](#) [GX-F15A](#)  
[GX-F6A](#) [GX-F6A-P](#) [GX-H12A](#) [GX-H12A-P](#) [1093](#) [MIKROE-2455](#) [MIKROE-2458](#) [MIKROE-2507](#) [MIKROE-2508](#) [MIKROE-2516](#)  
[MIKROE-2529](#) [1458](#) [DK-20789](#) [176](#) [189](#) [1893](#) [ATQT4-XPRO](#) [910-28015A](#) [GX-F12AI-P](#) [GX-F15A-P](#) [GX-F8A](#) [GX-F8A-P](#) [GX-H15A-P](#)  
[GX-H8A](#) [GX-H8A-P](#) [GX-FL15A-P](#) [SDAWIR01](#) [AAS-AQS-UNO](#) [SDAWIR02](#) [SDAF01](#) [IQS620AEV04-S](#) [SMOD701KITV1](#) [DFR0131](#)  
[DFR0165](#) [DFR0280](#) [SEN0213](#) [SEN0217](#) [SEN0219](#) [SEN0220](#) [SEN0231](#) [SEK002](#)