

Ver-G SmartMotion Hardware User Guide

INTRODUCTION

The DK-42688-P TDK SmartMotion Platform 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.

The DK-42688-P SmartMotion platform comes with the necessary software including InvenSense Motion Link, a GUI based development tool and embedded Motion Drivers (eMD) for InvenSense motion sensors.

Embedded Motion Drivers (eMD) consists 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), low-power or low-noise mode, and sensor interface to host (I²C, SPI). eMDs will also provide the following enhanced motion functions that run on the MCU:

- Sensor Fusion
- Accelerometer and Gyroscope Calibration
- Android Functions: Game Rotation Vector, Gravity, Linear Acceleration

Motion Link 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.

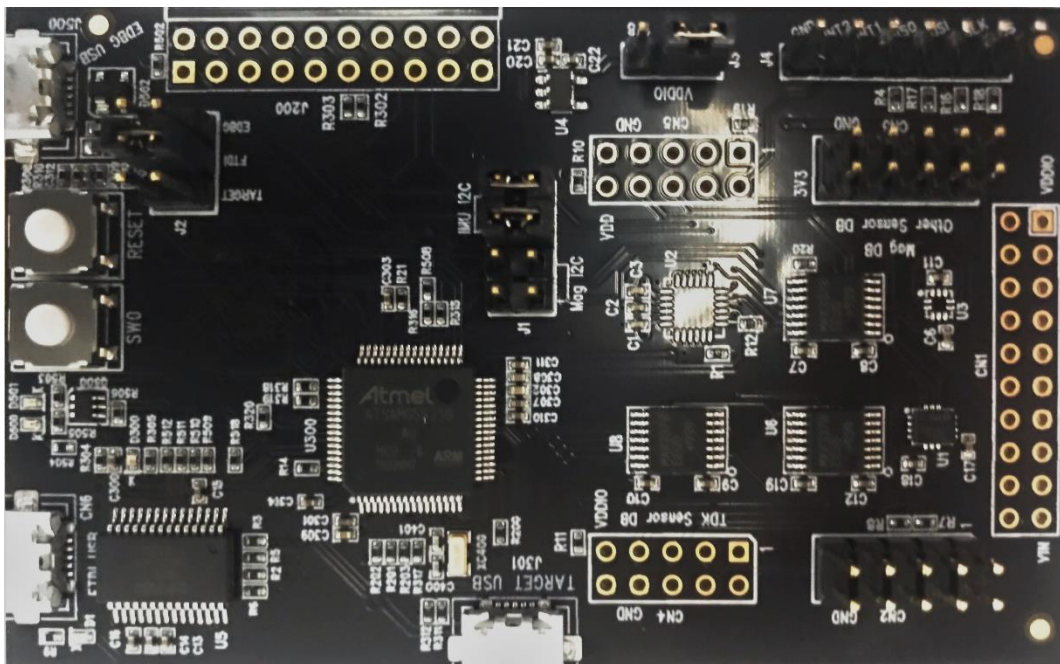


Figure 1. DK-42688-P SmartMotion Development Kit

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OVERVIEW

FEATURES OVERVIEW

- Integrated TDK InvenSense motion sensor
- Support for a magnetic sensor with plug in daughter boards (DB).
- Microchip SAMG55 microcontroller with 512KB 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

PLATFORM OVERVIEW

DK-42688-P SmartMotion Platform is a hardware unit for TDK sensor product evaluation and algorithm software development. The platform offers flexibilities for many different application developments.

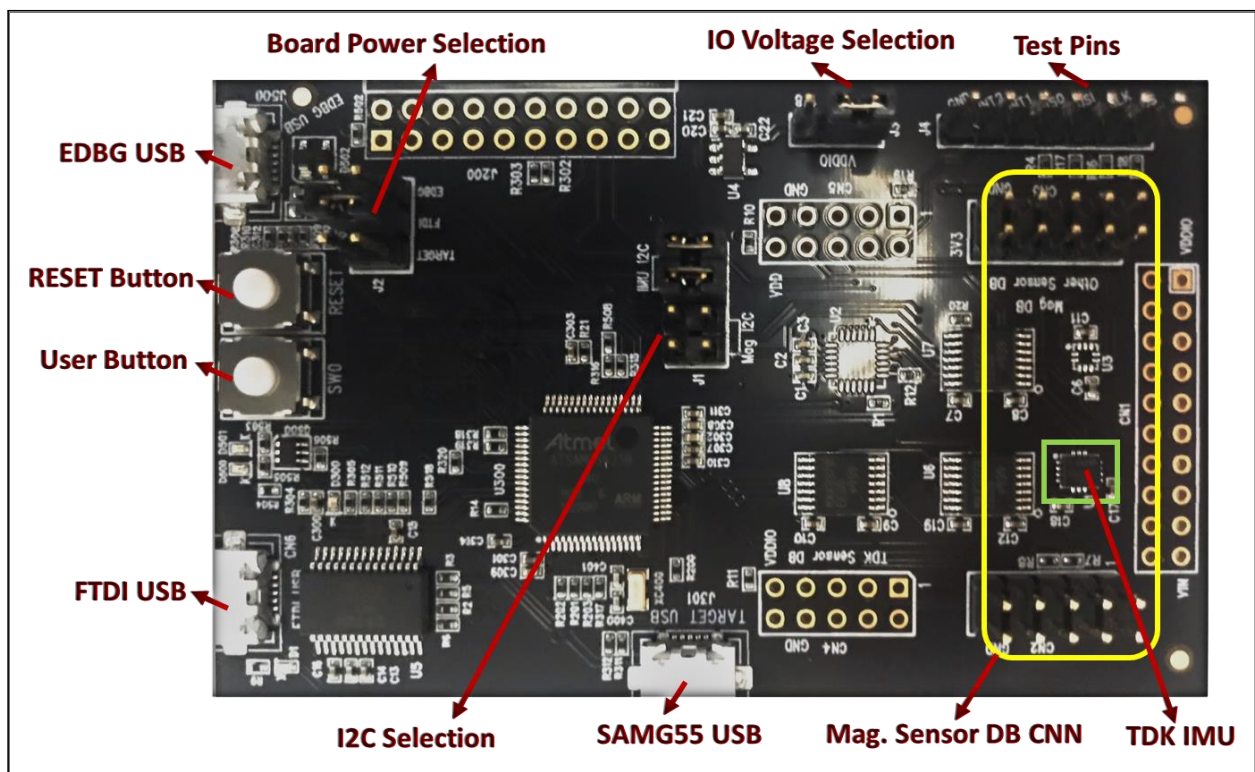


Figure 2. Platform Overview

HARDWARE USER GUIDE

DK-42688-P SmartMotion Platform 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

SYSTEM BLOCK DIAGRAM

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

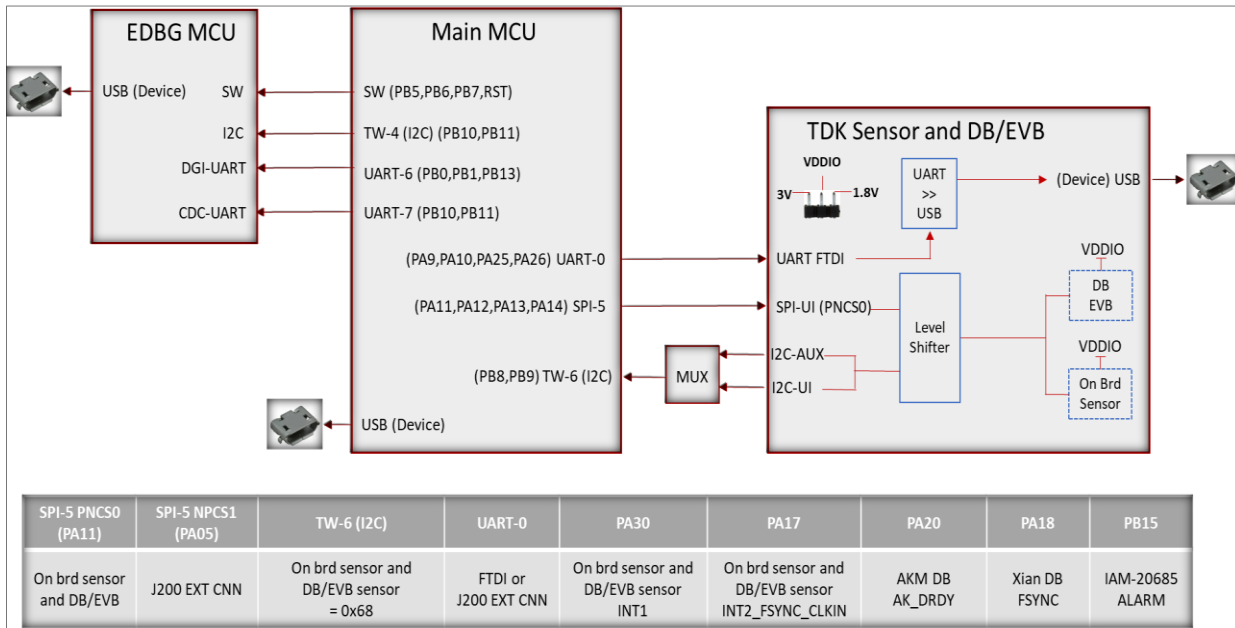


Figure 3. System Block Diagram

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)	TDK sensor is connected to this master I2C. On board sensor slave address = 0x69. Sensors on DB and EVB have slave address = 0x68.
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. Referring to the table in Figure 3.
TW4 (I2C)	The master I2C communicates with EDBG MCU slave I2C.
UART6	The UART6 is used for EDBG DGI-UART interface.
UART7	The UART7 is used for EDBG CDC-UART interface.

Table 1. SAMG55 Resource Allocation

CONNECTORS

Error! Reference source not found. details the DK-42688-P SmartMotion Platform connector and header reference names and descriptions.

Connector Ref Name	Connector Function descriptions
CN1 (Not loaded)	External TDK sensor EVB connector
CN2/CN3	Daughter board connector for Mag. sensor. I2C interface only.
CN4/CN5 (Not loaded)	Daughter board connector for TDK sensor. I2C and SPI interfaces.
CN6	USB connector for FTDI USB to serial UART interface

Connector Ref Name	Connector Function descriptions
J1	Select host I2C connections, for IMU sensor and mag. sensor, or mag. Sensor only.
J2	Board power source selection.
J3	Select VDDIO voltage level, 3V0 or 1V8.
J4	Digital signal test pins
J200 (Not loaded)	Extension header 1. Has same function as J200 on Microchip's Xplained-Pro board.
J301	MCU SAMG55 USB connector
J500	EDBG MCU USB connector
SW300	User button
SW301	RESET button.

Table 2. Connectors

TDK SENSOR TO SAMG55 MCU CONNECTION

TDK ICM-42688-P sensor can be connected to SAMG55 MCU I2C or SPI.

The sensor I²C slave address is 0x68. Its SPI /CS = NPCSO.

MAGNETIC SENSORS CONNECTION

Third party magnetic sensors can be connected to the same SAMG55 MCU I²C bus with TDK sensor through DB, assuming it has a different slave address.

CN2/3 are designed for the magnetic sensor DB plug in. It supports I²C only, not SPI.

JUMPER SETTINGS

Jumper	Description
J1	<p>J1 is used to select input source for SAMG55 master I²C. Only two jumper shunts are allowed.</p> <p>Jumper shunts on pin-1/2 and 3/4: ICM-42688-P IMU Sensor primary I²C is connected to SAMG55 I2C master</p> <p>Jumper shunts on pin-5/6 and 7/8: Magnetic Sensor I²C is connected to SAMG55 I²C master. In this configuration ICM-42688-P IMU Sensor is connected to SAMG55 SPI master.</p>
J2	<p>The J2 is for board power source selection. Only one jumper shunt is allowed.</p> <p>Jumper shunt on pin-1/2: board power is from EDBG USB on J500.</p> <p>Jumper shunt on pin-3/4: board power is from FTDI USB on CN6</p> <p>Jumper shunt on pin-5/6: board power is from SAMG55 USB on J301</p>
J3	<p>J3 is for system VDDIO level selection.</p> <p>Jumper shunts on pin-1/2: VDDIO=3V0</p> <p>Jumper shunts on pin-3/2: VDDIO=1V8</p>
J4	<p>J4 have digital signals as test points.</p> <p>Pin-1: SPI /CS</p> <p>Pin-2: SPI SCLK, I2C SCL</p> <p>Pin-3: SPI MOSI, I2C SDA</p> <p>Pin-4: SPI MISO, I2C AD0</p> <p>Pin-5: INT1 of ICM-42688-P</p> <p>Pin-6: INT2 of ICM-42688-P</p> <p>Pin-7: GND</p>

Table 3. Jumper Setting

SCHEMATICS

The schematics version is Ver-G.

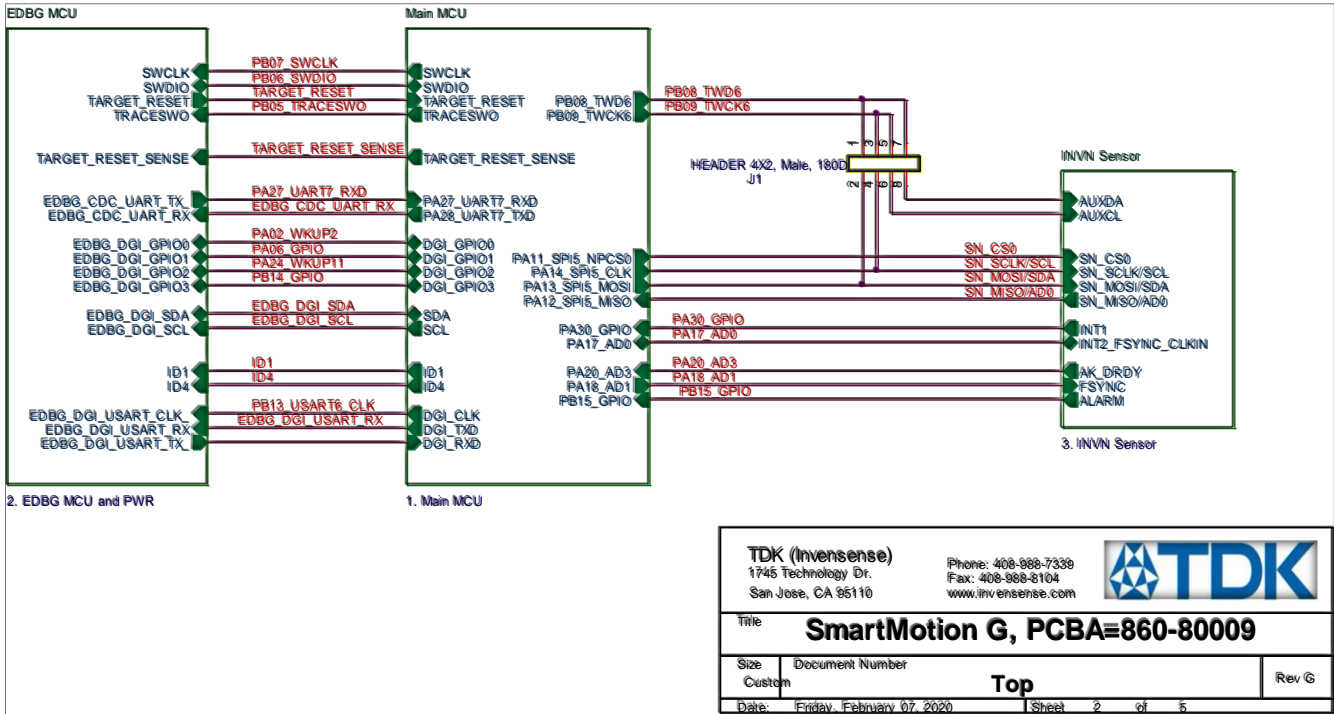


Figure 4. Top View

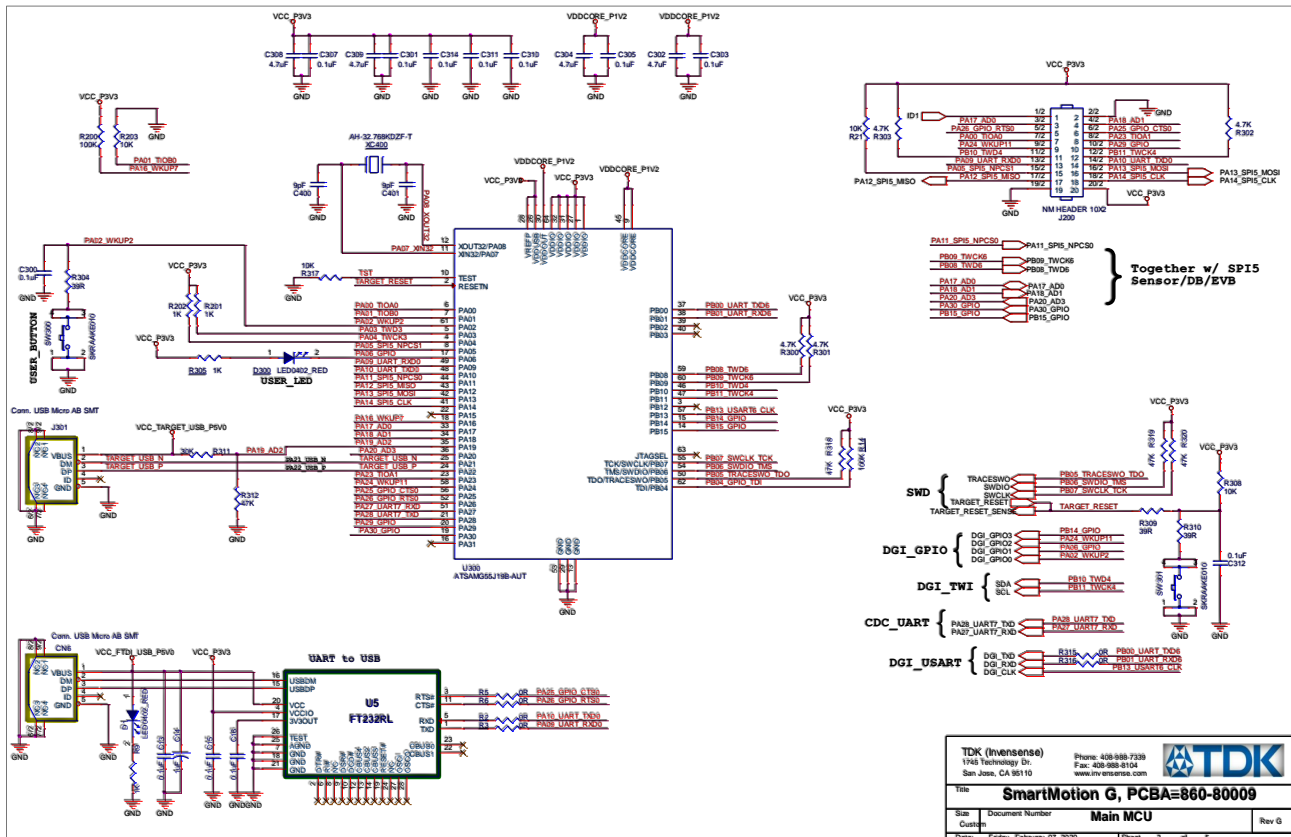


Figure 5. Main MCU

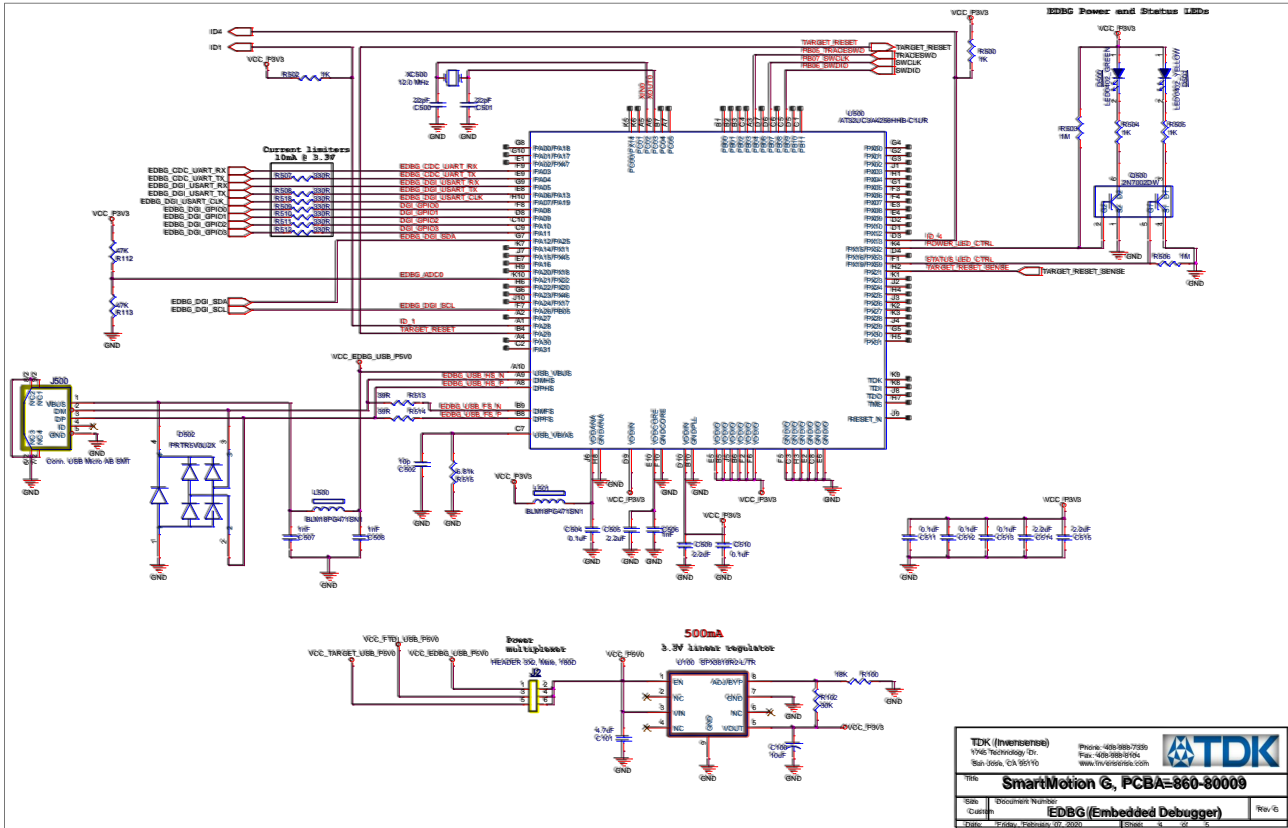


Figure 6. Embedded Debugger

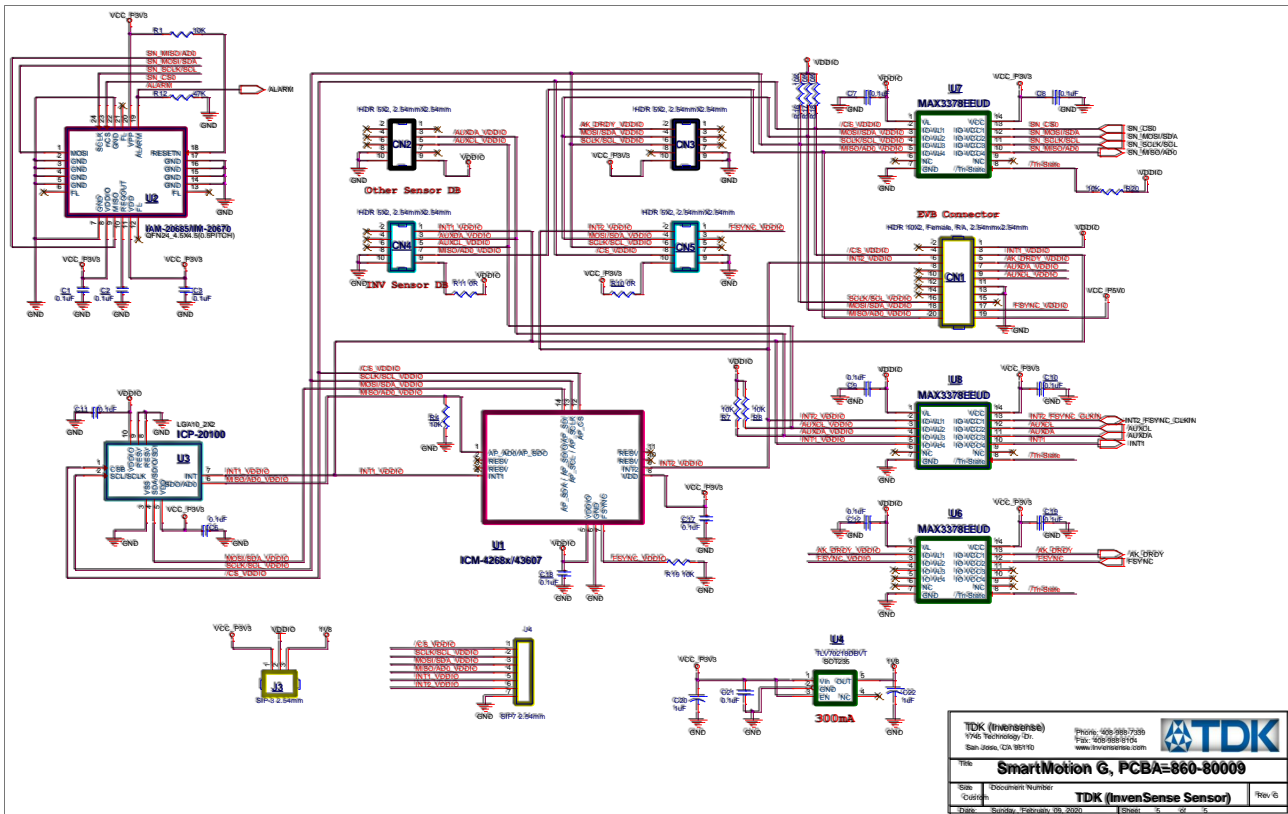


Figure 7. Ver G. Sensor

Board PCB

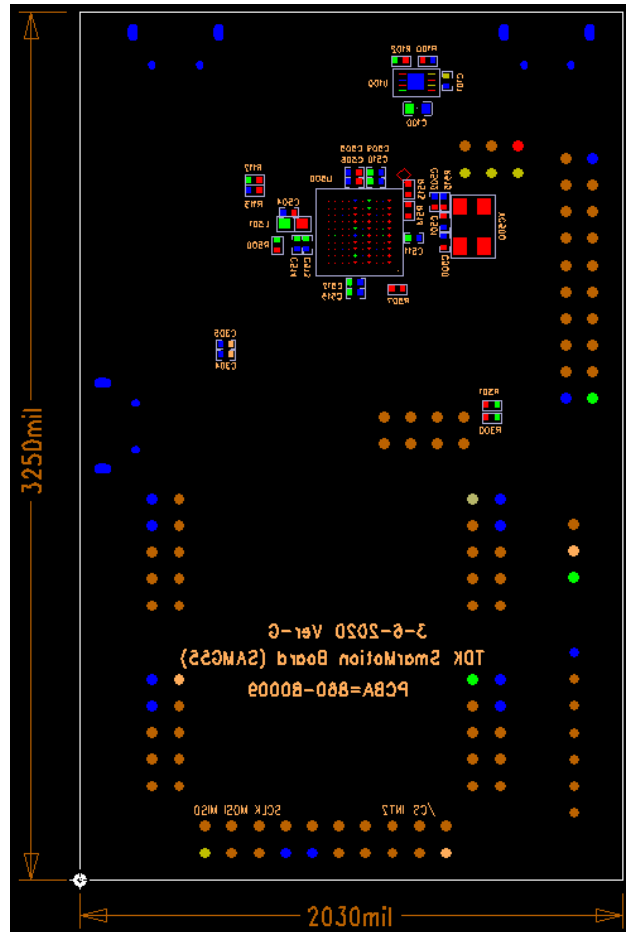
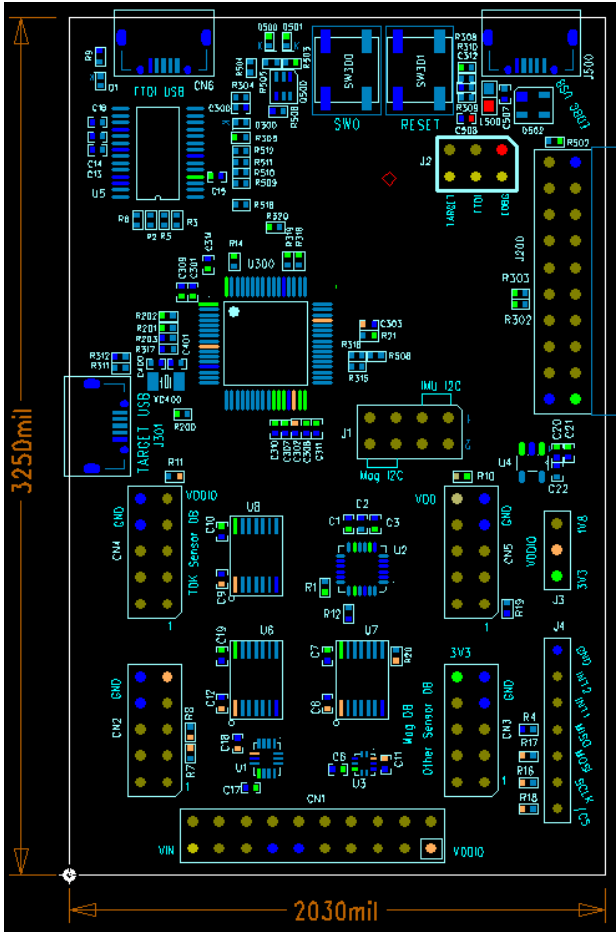


Figure 8. Ver. G PCB

REVISION HISTORY

REVISION DATE	REVISION	DESCRIPTION
04/22/2020	1.0	Initial Release

DECLARATION DISCLAIMER

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