TDK-InvenSense EV_ICM-45686 Evaluation Board (EVB) User Guide

1 PURPOSE

This document describes the hardware and circuitry on the TDK-InvenSense EV_ICM-45686 evaluation board for TDK motion sensor ICM-45686.

This user guide also covers the key signals, circuit functions, hardware jumper settings, and interface connections.

1.1 USAGE

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^{SM}, I^{2}C and SPI serial communication, and an AUX interface that supports SPI slave mode for connection to OIS controllers or I^{2}C master mode for connection to external sensors. The device features up to 8Kbytes FIFO and 2 programmable interrupts.

The ICM-45686 supports the lowest gyro and accel sensor noise in this IMU class, and has the highest stability against temperature, shock (up to 20,000g) or SMT/bend induced offset as well as immunity against out-of-band vibration induced noise. Other industry-leading features include InvenSense on-chip APEX Motion Processing engine for gesture recognition, activity classification, and pedometer, along with programmable digital filters, and an embedded temperature sensor.

The EV_ICM-45686 may be connected to a TDK-InvenSense DK board (development kit MCU host board) for using TDK-InvenSense MotionLink software.

The EV_ICM-45686 evaluation board is lead-free and RoHS compliant.

1.2 RELATED DOCUMENTS

Please refer to the product specification of the ICM-45686 for mechanic, electrical characteristics, pinout, sensor configuration registers, and applications details. The datasheet can be found at invensense.tdk.com.

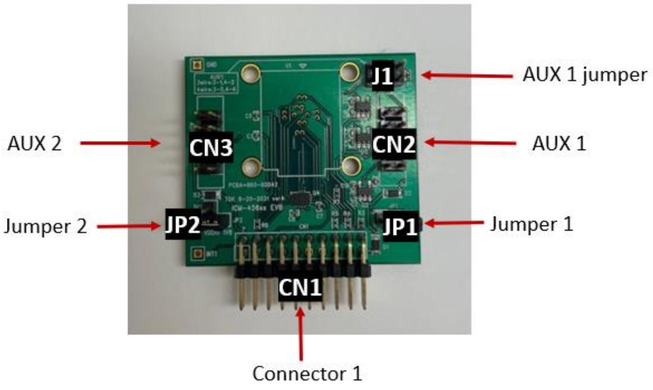

Figure 1. ICM-45686 EVB

TABLE OF CONTENTS

2 EV_ICM-45686 EVALUATION BOARD OVERVIEW

The EV_ICM-45686 evaluation board hosts the ICM-45686 TDK-InvenSense motion sensor which is in a small 2.5 x 3 mm 14-Pin LGA package.

The digital signal IO voltage (VDDIO) can be selected between 1.2V, 1.8V, and 3.0V, and chip operation voltage (VDD) can be selected between 1.8V and 3.0V.

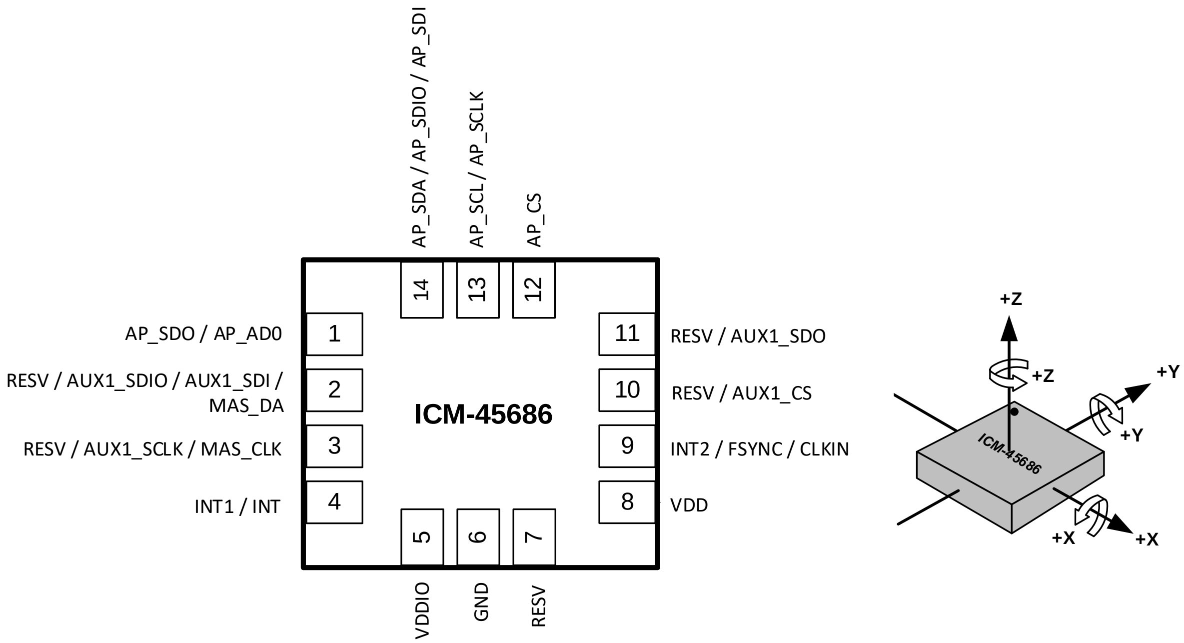

Figure 2. Pin Out Diagram for ICM-45686 2.5x3.0x0.81 mm LGA

The EV_ICM-45686 evaluation board is populated with components only on its top side to achieve ease of jumper setting access. Board name, code, and date are printed on the top side too. There is no component and silkscreen print on the bottom side.

Please note, the same PCB fab may be used for TDK-InvenSense other motion sensors.

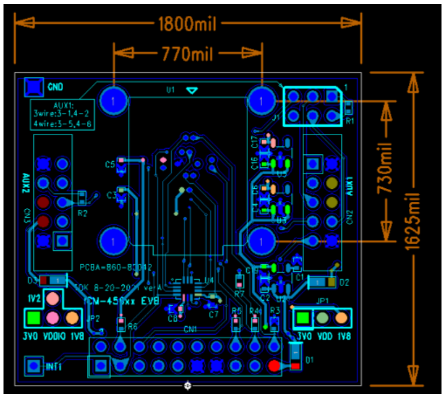

Figure 3. Evaluation board top side

3 EV_ICM-45686 EVALUTION BOARD SCHEMATICS

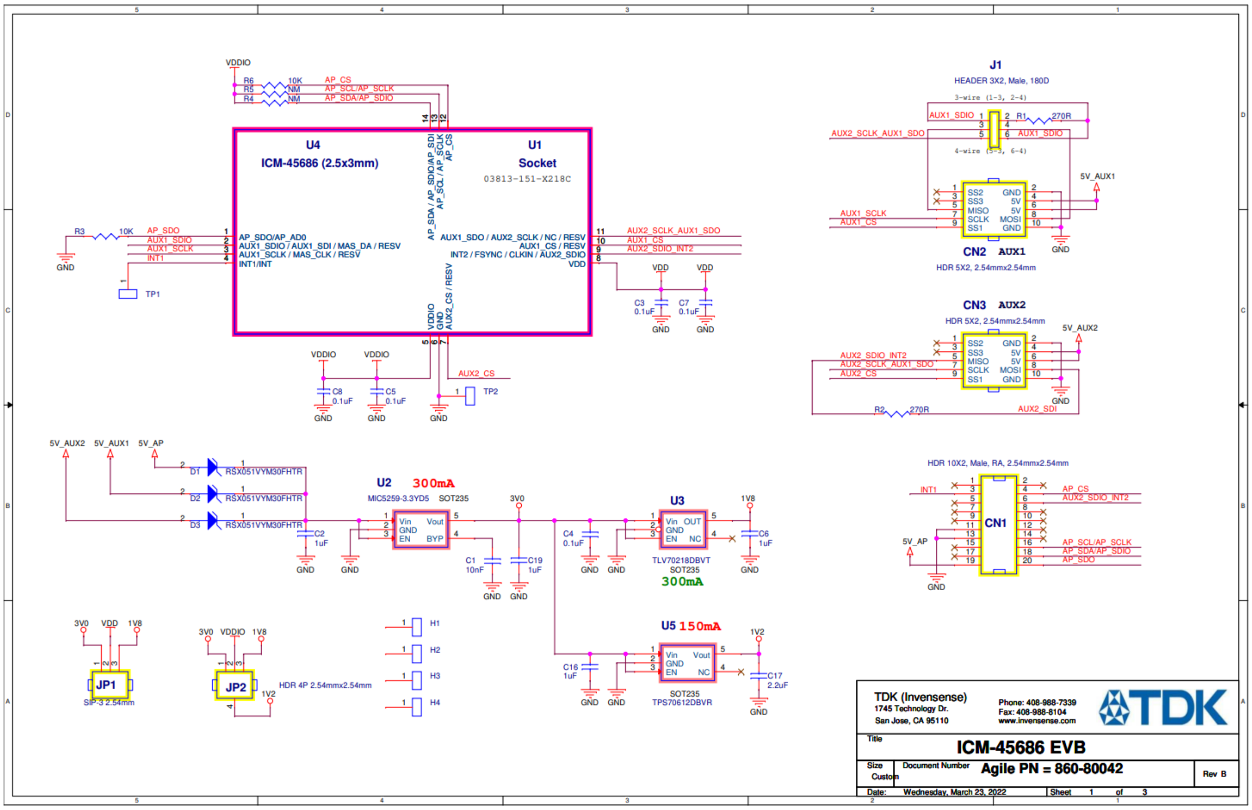

Figure 4. EV_ICM-45686 Evaluation Board Schematics

4 BILL OF MATERIALS (BOM)

The BOM the evaluation board is provided below for reference.

QUANTITY	REFERENCE	PART	MANUFACTURER	MANUFACTURER'S PART NUMBER
1	CN1	HDR 10X2, Male, RA, 2.54mmx2.54mm	Wurth	732-5357-ND
2	CN2,CN3	HDR 5X2, 2.54mmx2.54mm	FCI	609-3236-ND
1	JP1	SIP-3 2.54mm	FCI	609-3461-ND
1	JP2	HDR 4P 2.54mmx2.54mm		
1	J1	HEADER 3X2, Male, 180D	FCI	609-3234-ND
1	C1	10nF	TDK	445-173760-1-ND
4	C2,C6,C16,C19	1uF	TDK	445-12010-1-ND
5	C3,C4,C5,C7,C8	0.1uF	Yageo	311-1336-1-ND
1	C17	2.2uF	TDK	445-13885-1-ND
3	D1,D2,D3	RSX051VYM30FHTR	ROHM	RSX051VYM30FHCT-ND
2	R1,R2	270R	Yageo	311-270LRCT-ND
2	R3,R6	10K	Yageo	311-10KJRCT-ND
1	U2	MIC5259-3.3YD5	Microchip	150-MIC5259-3.3YD5-CT-ND
1	U3	TLV70218DBVT	TI	296-27889-1-ND
1	U4	ICM-45686 (2.5x3mm)	TDK	ICM-45686
1	U5	TPS70612DBVR	TI	296-47895-1-ND
1	U1	Socket – Not Mounted	N/A	N/A
2	JP1 pin 2-3, JP2 pin 2-3	Jumper shunt	Sullins	S9337-ND

Table 1. Bill of Materials

5 CONNECTOR AND JUMPERS

CN1 is used for I^2C/I3C/SPI host communication, IRQ, and power supply connection.

CONNECTOR REF. NAME	PIN #	SIGNALS
CN1	3	INT1
	4	AP_CS
	6	INT2
	11	GND
	13	GND
	16	AP_SCL/AP_SCLK
	17	FSYNC
	18	AP_SDA/AP_SDIO
	19	5V
	20	AP_SDO
	1,2,5,7,8,9,10,12,14,15	NC

Table 2. CN1 Signals

JP1 and JP2 are jumpers to set VDD and VDDIO voltage level.

CONNECTOR REF. NAME	PIN #	SIGNALS	DESCRIPTION
Jumper 1 (JP1)	1	3.0V	Jumper short on pin 1/2: VDD = 3.0V
	2	VDD	
	3	1.8V	Jumper short on pin 2/3: VDD = 1.8V (default)
Jumper 2 (JP2)	1	3.0V	Jumper close on pin 1/2: VDDIO = 3.0V
	2	VDDIO	
	3	1.8V	Jumper close on pin 2/3: VDDIO = 1.8V (default)
	4	1.2V	Jumper close on pin 2/4: VDDIO = 1.2V

Table 3. JP1 and JP2 Signals

CN2 and CN3 is used for multiple interface communication.

CONNECTOR REF. NAME	PIN #	SIGNALS
AUX 1 (CN2) AUX 2 (CN3)	2,10	GND
	4,6	5V
	5	MISO
	7	SCLK
	8	MOSI
	9	CS
	1,3	NC

Table 4. CN2 and CN3 Signals

J1 is used for either 3 wire or 4 wire SPI communications on AUX 1.

CONNECTOR REF. NAME	PIN #	SIGNALS	DESCRIPTION
AUX 1 Jumper (J1)	1	AUX1 SDIO	Short 1-3, 2-4 for 3 wire SPI
	2	AUX1 SDIO	
	3	MISO	
	4	MOSI	
	5	AUX2 SCLK/AUX1 SDO	Short 5-3, 6-4 for 4 wire SPI
	6	AUX1 SDIO	

Table 5. J1 Signals

6 HOST INTERFACE OPTIONS

EV_ICM-45686 sensor data can be read using the jump wires or by soldering the required pins from CN1 to the external host CPU.

The evaluation board can be directly plugged in via CN1 to a TDK InvenSense SmartMotion Host Interface board DK-UNIVERSAL-I, ordered separately.

7 ELECTROSTATIC DISCHARGE SENSITIVITY

The IMU sensor can be permanently damaged by electrostatic discharge (ESD). ESD precautions for handling and storage must be taken to avoid damage to the devices.

8 REVISION HISTORY

DATE	REVISION	DESCRIPTION
08/20/2024	1.0	Initial release
09/25/2024	1.1	Updated Figure2 with correct package height

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.

TDK InvenSense

©2024 InvenSense. All rights reserved.