EV_MOD_CH101-01-02
Evaluation Module User Guide

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1 SCOPE AND PURPOSE

This document details the specification, programming, and operation of an EV_MOD_CH101-01-02 (also referred to as the EV_MOD_CH101 in the remainder of this document) ultrasonic sensor evaluation module. The module board incorporates a CH101 Ultrasonic Sensor device with an 45° field-of-view acoustic housing assembly, a capacitor and an FPC/FFC connector. This evaluation module can perform pitch-catch and pulse-echo range-finding at distances from 4 cm to 1.2m. Several programming options are available for medium and short-range applications.

Figure 1-1. View of EV_MOD_CH101-01-02 evaluation module with a particle ingress filter and 45° field-of-view acoustic housing
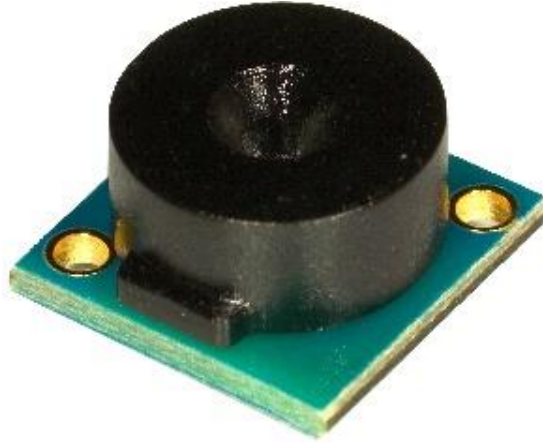
2 EV_MOD_CH101 EVALUATION MODULE BOARD

2.1 PIN ASSIGNMENTS

Table 1. EV_MOD_CH101 ZIF Connector Pin-Out

| PIN	NAME	DESCRIPTION
1	INT	Interrupt output. Can be switched to input for triggering and calibration functions
2	SCL	SCL Input. I²C clock input. This pin must be pulled up to VDD externally.
3	SDA	SDA Input/Output. I²C data I/O. This pin must be pulled up to VDD externally.
4	PROG	Program Enable. This pin must be pulled down to ground externally.
5	RESET_N	Active-low reset. This pin must be pulled up to VDD externally.
6	VSS	Power return.
7	VSS	Power return.
8	VDD	Power supply input. Connect to externally regulated 1.8V supply

2.2 ELECTRICAL SPECIFICATIONS

Please refer to DS-000331 CH101 Datasheet for information on the device's electrical characteristics. Please note that the datasheet covers CH101 part numbers with different suffixes. Regardless, the electrical specifications in the datasheet still apply.

2.3 SCHEMATIC

Electrical connection to the EV_MOD_CH101 module is via an 8-pin 0.5 mm pitch flat flex cable (FFC) connector. Part numbers of the FFC connectors on the module PCB and the recommended FFC cables are shown in Table 2. The electrical schematic of the module, including the connector pinout and the connections to the EV_MOD_CH101 module, are shown in Figure 2-1. Note that the 0.1 µF decoupling capacitor, as recommended in the CH101 datasheet, is included in the module. Consult the CH101 datasheet and application notes for additional information on the electrical connections and operation.

Figure 2-1. EV_MOD_CH101 Schematic
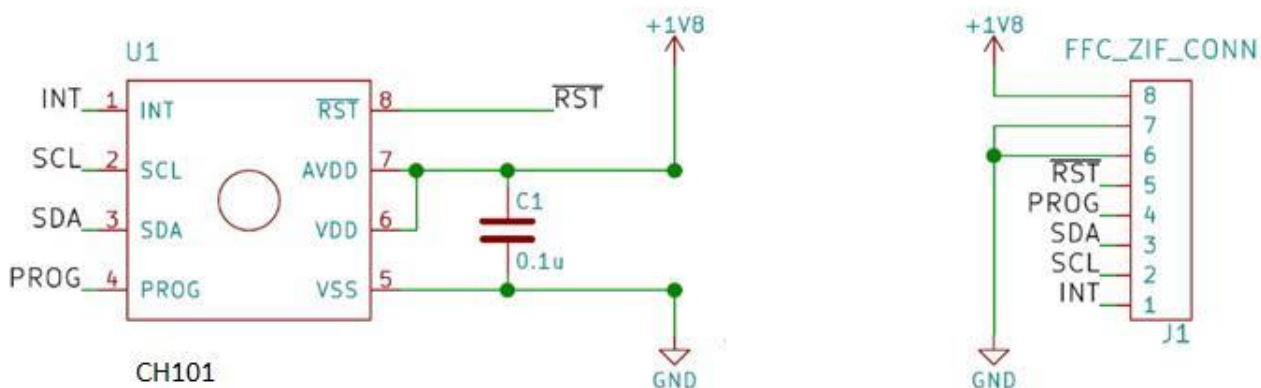
Each EV_MOD_CH101 requires its own PROG and INT lines, the remaining connections can be shared. Refer to the CH101 datasheet for additional information.

Module connections using a flat flex cable (FFC) are shown in Figure 2-2.

Figure 2-2. EV_MOD_CH101 Module Connection (EV_MOD_CH101 acoustic port is facing down)

TABLE 2. RECOMMENDED FLAT FLEX CABLE AND CONNECTOR

FLAT CABLE CONNECTOR TYPE	Molex 503480-0800
RECOMMENDED FLAT CABLE	Molex 151660073…151660094

2.4   BILL OF MATERIALS

TABLE 3. BILL OF MATERIAL

QUANTITY	REFERENCE	PART	PCB FOOTPRINT	MANUFACTURER	MANUFACTURER PART NUMBER
1	PCB	PCB	NA		
1	U1	CH101-01	Custom – 8 Pin	TDK	CH101-01
1	C1	100n 6.3V 20% X7R 0402	0402	TDK	CGA2B1X7R1C104K050BC
1	J1	Connector, FPC-FFC, 8-Pin	8Pin, 0.5 mm Pitch	Molex	503480-0800

3   CONFIGURATION, PROGRAMMING, AND OPERATION

Please refer to DS-000331 CH101 Datasheet for information on the device's electrical characteristics.

3.1   CONFIGURATION AND PROGRAMMING

Please refer to the following documents for configuration and programming information:

- AN-000154 SmartSonic Hello Chirp Hands-On Document
- AN-000175 SonicLib Programmers Guide

3.2   OPERATION

Please refer to the following documents for operating information:

- AN-000155 CHx01 SonicLink Software Quick Start Guide
- AN-000180 CH101 and CH201 SmartSonic Evaluation Kit Users Guide

4 MECHANICAL SPECIFICATIONS

TABLE 4. GEOMETRIC DIMENSIONS FOR EV_MOD_CH101-01-02

DIMENSION	EV_MOD_CH101-01-02	UNIT
Acoustic port hole	0.75	mm
Maximum width	8.15	mm
Module height	5.05	mm

The outer dimensions of the EV_MOD_CH101-01-02 assembly are shown in Figure 4-1. The acoustic port hole has a diameter of 0.75 mm and is in the center of the front face. During transducer operation, the port cannot be occluded or covered.

Figure 4-1. Dimensions of the EV_MOD_CH101-01-02 assembly
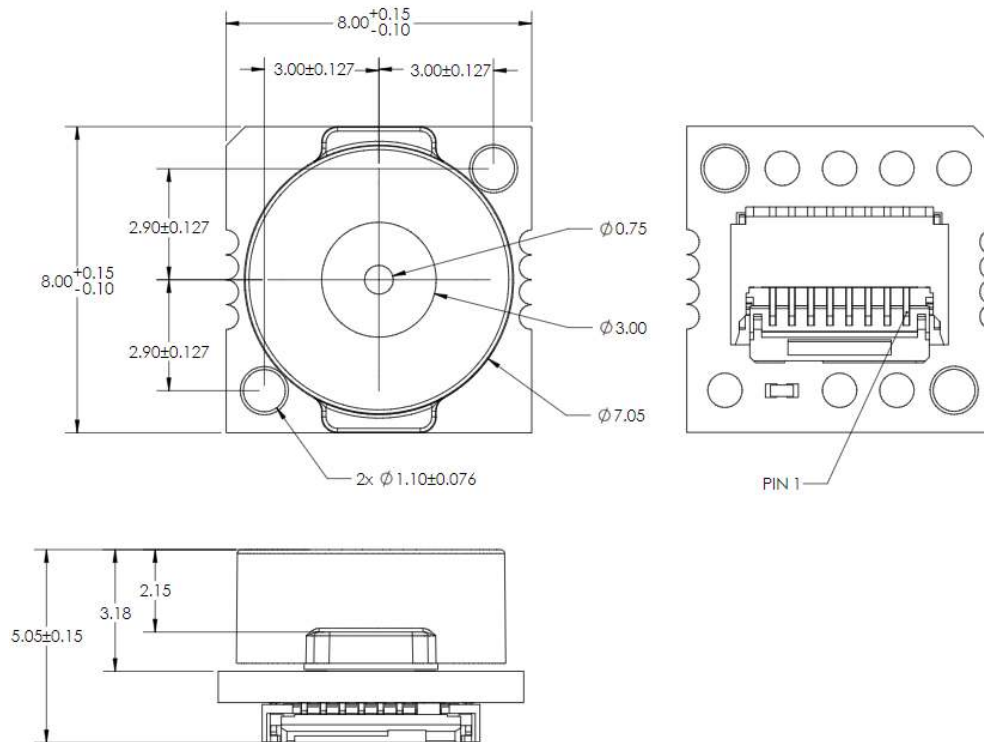
5 APPLICATIONS

5.1 OBJECT DETECTION

Detecting the presence of objects or people can be optimized via software by setting the sensor's full-scale range (FSR). The user may set the maximum distance at which the sensor will detect an object. FSR values refer to the one-way distance to a detected object.

In practice, the FSR setting controls the amount of time that the sensor spends in the listening (receiving) period during a measurement cycle. Therefore, the FSR setting affects the time required to complete a measurement. Longer full-scale range values will require more time for a measurement to complete.

Ultrasonic signal processing using the CH101's General Purpose Rangefinder (GPR) Firmware will detect echoes that bounce off the first target in the Field-of-View. The size, position, and material composition of the target will affect the maximum range at which the sensor can detect the target. Large targets, such as walls, are much easier to detect than smaller targets. Thus, the associated operating range for smaller targets will be shorter. The range to detect people will be affected by a variety of factors such as a person's size, clothing, orientation to the sensor, and the sensor's field-of-view. In general, given these factors, people can be detected at a maximum distance of 1.1m away from the EV_MOD_CH101-01-02 sensor.

5.2 BEAM PATTERNS

5.2.1 Sensor Mounting

To achieve the best acoustic performance, users are recommended to mount the EV_MOD_CH101 module in a flat mounting plate. An example mounting plate is shown in Figure 5-1, where the sensor has been inserted flush into a drilled hole of a 150mm square plastic sheet. In Figure 5-2, the allowable mount gap tolerance between the acoustic interface and device enclosure's hole is shown.

Please refer to AN-000158 CH101 Mechanical Integration Guide for detailed module and module integration information.
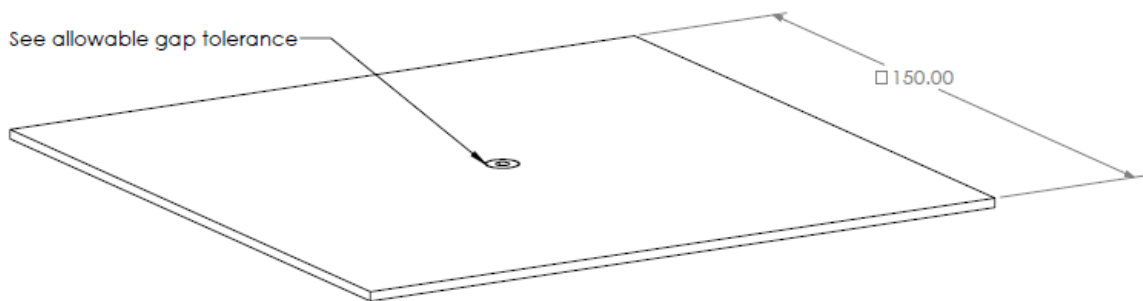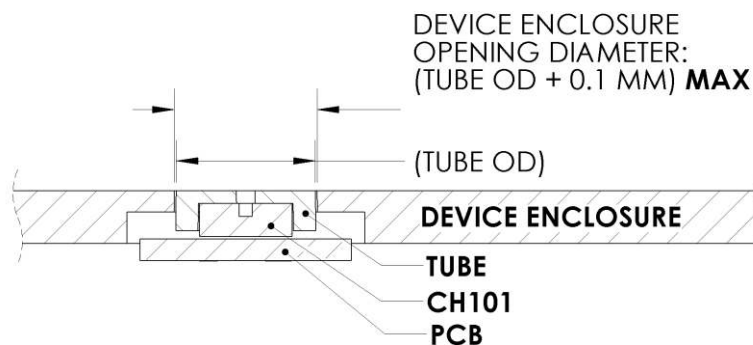
Figure 5-1. Recommended EV_MOD_CH101 module mounting

Figure 5-2. Mount Gap Tolerance

5.2.2   Beam Pattern

Beam-pattern plots of the EV_MOD_CH101-01-02 with a 45° FoV acoustic housing module are shown in Figure 5-3. This beam-pattern was measured by placing a 1m^2 flat target at a 30 cm distance from the EV_MOD_CH101 module and recording the ToF amplitude as the sensor is rotated 180°. The plots are shown in both raw LSB units and normalized dB units, where 0 dB corresponds to the peak amplitude recorded on-axis. Chirp defines the field-of-view (FoV) as the full-width at half-maximum (FWHM) of the beam pattern; in other words, the FoV is the range of angles over which the amplitude remains above half the peak amplitude (or -6 dB). When mounted in the recommended plate, the sensor's FoV is approximately 45°.

Figure 5-3. EV_MOD_CH101-01-02 Beam pattern
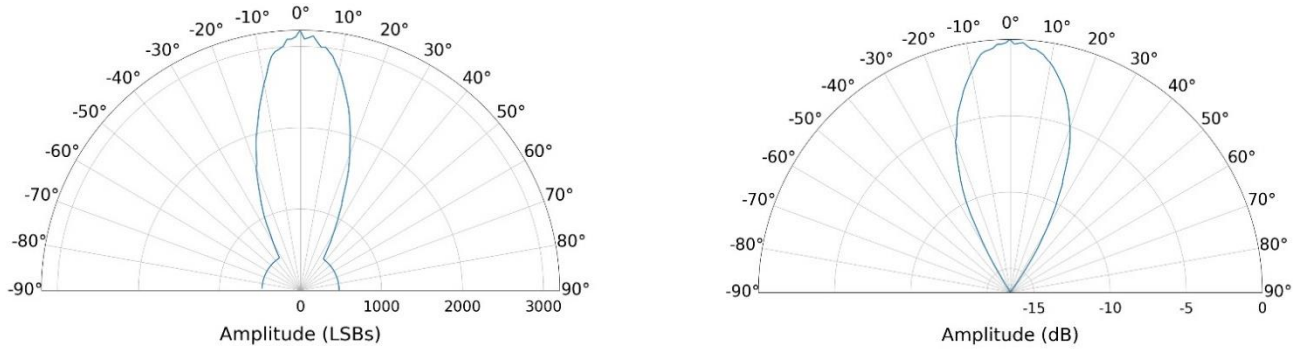
6 REVISION HISTORY

Revision Date	Revision	Description
01/27/2021	1.0	Initial Release