MOD_CH101 Datasheet

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GENERAL INFORMATION

The MOD_CH101 sensor module is designed for rapid integration of Chirp's CH-101 ultrasonic Time-of-Flight (ToF) range sensor into customer enclosures. It is especially useful for prototyping and small-scale production in applications that are not extremely space constrained. The module's electronic interface is via a standard 8-pin flat flex cable (FFC) connector. The module includes an acoustic housing that determines the CH-101 sensor's field-of-view. The MOD_CH101-03-01 sensor module includes an omnidirectional acoustic housing with a 0.7 mm diameter acoustic port and a 5.3 mm outer diameter.

DEVICE INFORMATION

PART NUMBER	PACKAGE	LID OPENING
MOD_CH101-03-01	8x8x3.57 PCBA	1-Hole

RoHS and Green-Compliant Package

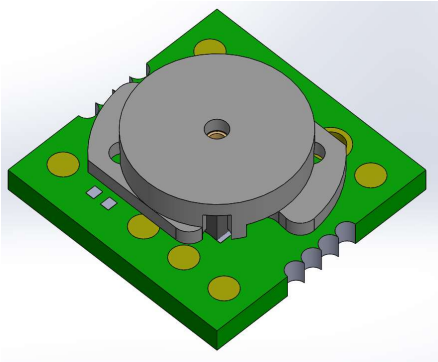

Figure 1. Front view of CH-101 sensor module with omnidirectional housing (P/N MOD_CH101-03-01)

APPLICATIONS

- Augmented and Virtual Reality
- Drones and Robotics
- Mobile and Computing Devices
- Obstacle avoidance
- Printers and Scanners
- Proximity sensing
- Presence detection: always-on sensing to lock/unlock and power on/off notebooks, tablets, white goods, etc.
- Smart Home

FEATURES

- Fast, accurate range-finding
  - Operating range from 4 cm to 1.2 m
  - Sample rate up to 100 samples/sec
  - 1.0 mm RMS range noise at 30 cm range
  - Programmable modes optimized for medium and short-range sensing applications
  - Customizable Field-of-View (FoV) up to 180°
  - Multi-object detection
  - Works in sunlight and any other lighting
  - Insensitive to object color, detects optically transparent surfaces like glass windows
- Easy to integrate
  - Single sensor for receive and transmit
  - Single 1.8V supply
  - I^2C Fast-Mode compatible interface, data rates up to 400 kbps
  - Dedicated programmable range interrupt pin
  - Platform-independent software driver enables turnkey range-finding
- Miniature integrated module
  - Low-power micro-controller running advanced ultrasound firmware
  - Operating temperature range: -40° to 85°C
- Ultra-low supply current
  - 1 sample/s:
    - 13 µA (10 cm max range)
    - 15 µA (1.0 m max range)
  - 30 samples/s:
    - 33 µA (10 cm max range)
    - 130 µA (1.0 m max range)
  - Host Interface: I^2C at up to 400 kbps
  - Single Supply voltage: 1.8V ±5%
  - RoHS and Green compliant

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1 INTRODUCTION

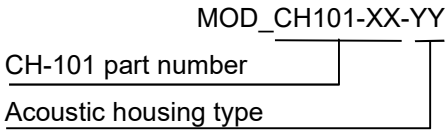
1.1 PURPOSE AND SCOPE

This document is a preliminary product specification, providing a description, specifications, and design related information for the MOD_CH101 ultrasonic time-of-flight sensor module. Specifications are subject to change without notice.

1.2 PRODUCT OVERVIEW

The MOD_CH101 sensor module is designed for rapid integration of Chirp's CH-101 ultrasonic sensor into customer enclosures. It is especially useful for prototyping and small-scale production in applications that are not extremely space constrained. It also provides a flexible flat cable connector to connect the CH-101 sensor.

1.3 PART NUMBERING



This datasheet specifies the following part numbers

Part Number	Description
MOD_CH101-03-01	Ultrasonic sensor module with CH-101-03 sensor and omnidirectional acoustic housing

The MOD_CH101-03 is an omnidirectional sensor module designed to fit a 5.4 mm diameter hole in the application enclosure and enclosure wall thickness up to 1 mm.

2 DIMENSIONS AND PROPERTIES

The outer dimensions of the MOD_CH101-03-01 assembly are shown in Figure 2. The acoustic port has a diameter of 0.7 mm and is in the center of the front face. During transducer operation, the port cannot be occluded or covered.

The MOD_CH101 is designed to attach to the application enclosure using adhesive. The module should be installed such that the front face is flush with the outside of the application enclosure. If the application enclosure's wall thickness is smaller than the maximum allowable wall thickness, as specified in Table 1, it is recommended that a spacer be used at the backside of the application enclosure to ensure that the module surface is flush with the surface of the enclosure.

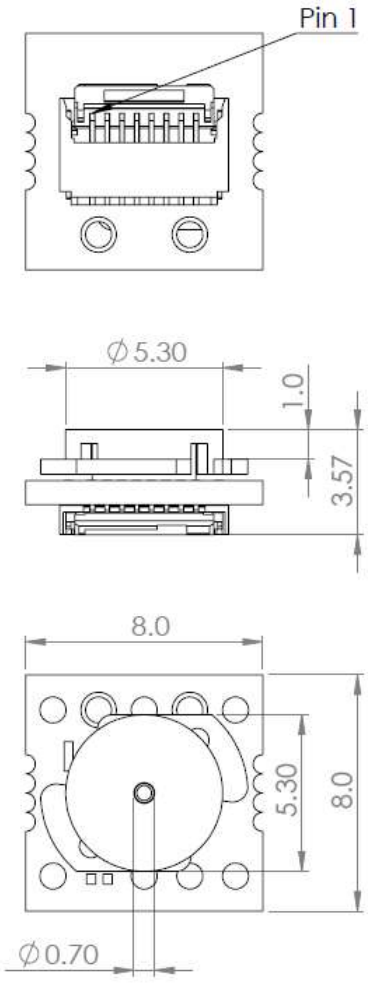


Figure 2. Main dimensions of the MOD_CH101-03-01 assembly

3 INTEGRATION INTO MOTHERBOARD

Electrical connection to the CH-101 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 CH-101 sensor, is shown in Figure 3. Note that the 0.1 uF decoupling capacitor, as recommended in the CH-101 datasheet, is included in the module. Consult the CH-101 datasheet and application notes for additional information on electrical connection and operation of the CH-101 sensor.

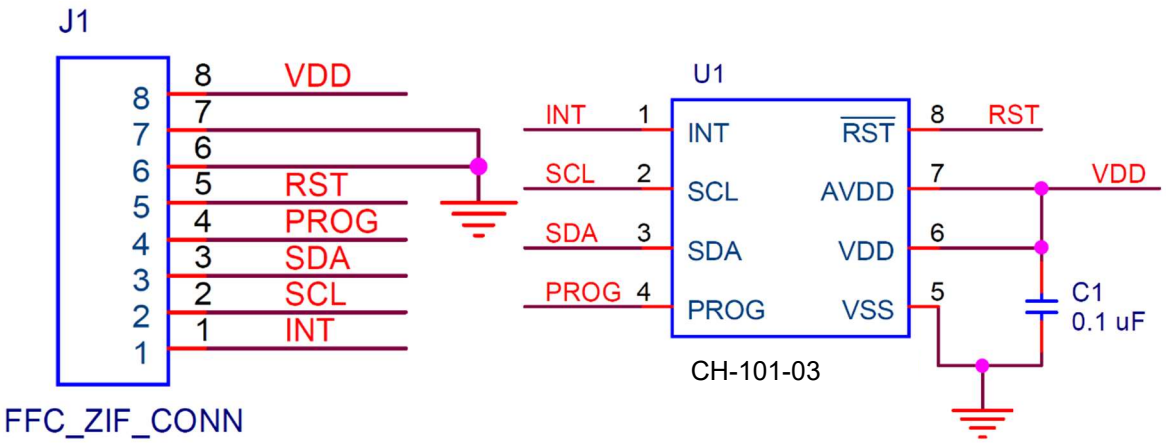


Figure 3. Flat cable connector pin layout (left) and CH-101 board layout (right)

In Figure 5, the motherboard side connections are shown for connecting MOD_CH101 through a flat flex cable to an identical FFC connector on the motherboard. Note that the pin numbering is reversed between the two schematics (Figure 3 and Figure 4).

Each CH-101 requires its own PROG line and each CH-101 has its own INT line, the remaining connections can be shared. (Refer to the CH-101 datasheet for additional information.)

In Figure 5, the resulting orientation of the MOD_CH101 is shown when using the specified motherboard pinout. The acoustic port of the CH-101 is facing downward, allowing the FFC to be curled upward and have the CH-101 facing away from the board. If the preferred orientation is for the MOD_CH101 to be facing upward or towards the board, the connections on the motherboard should be mirrored, such that the motherboard pinout matches Figure 3.

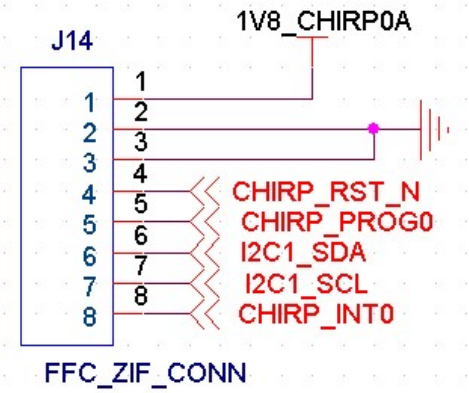


Figure 4. Flat flex cable connector motherboard side pin layout

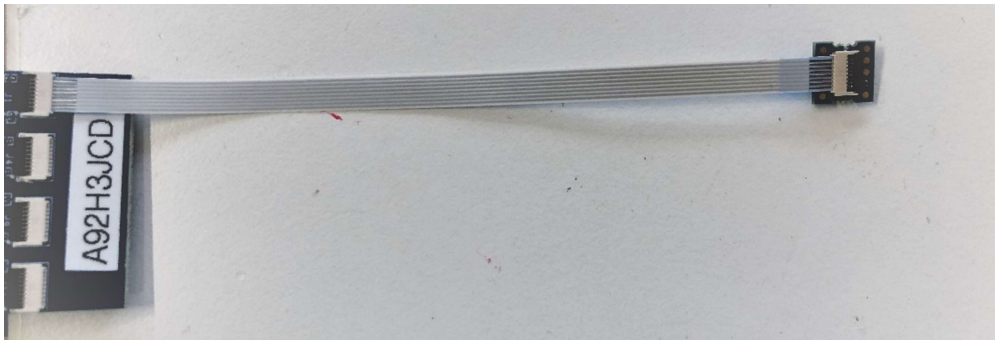


Figure 5. Default orientation of sensor on motherboard (CH-101 acoustic port is facing down)

4 MECHANICAL

Dimension	MOD_CH101-03-01	Unit
Acoustic port hole	0.7	mm
Front plate diameter	5.3	mm
Recommended application enclosure opening diameter	5.4	mm
Maximum application enclosure wall thickness	1	mm
Maximum width	8	mm
Maximum height	8	mm

Table 1. Geometric Dimensions for MOD_CH101-03-01

Flat cable connector type	Molex 503480-0800
Recommended flat cable	Molex 151660073...151660094

Table 2. Recommended Flat Flex Cable and Connector

5 SENSOR MOUNTING AND INGRESS PROTECTION

5.1 SENSOR MOUNTING

The MOD_CH101-03-01 is omnidirectional, allowing the sensor to detect objects over a very wide field-of-view (FoV). However, omnidirectional response is only achieved when the sensor is mounted in a flat surface, free from reflecting edges. To achieve the best acoustic performance, users are recommended to mount the MOD_CH101-03-01 module in a flat plate measuring at least 100 cm in diameter. An example mounting plate is shown in Figure 6, where the sensor has been inserted into a 5.3 mm diameter hole has been drilled in a 1 mm thick plastic plate measuring 135 mm x 175 mm.

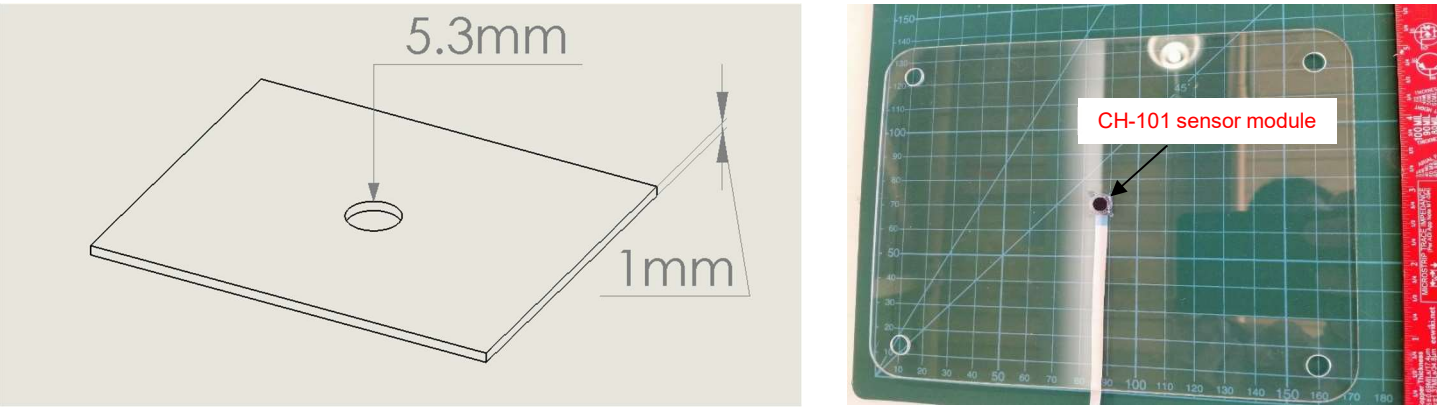


Figure 6. Recommended MOD_CH101-03-01 module mounting

Pulse-echo beam-pattern plots of the MOD_CH101-03-01 module mounted in the recommended plate are shown in Figure 7. This beam-pattern was measured by placing a 1 m^2 target at a 30 cm distance from the CH-101 module and recording the CH-101 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 (5000 LSB) 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 in dB units). When mounted in the recommended plate, the sensor's FoV is approximately 160° and the pulse-echo amplitude diminishes relatively smoothly from 0° to ±80°.

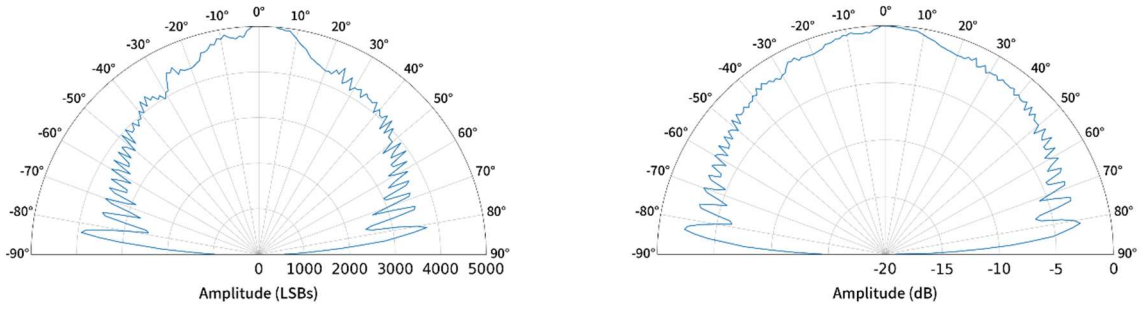


Figure 7. Beam pattern measurements of module in 100 mm plate (raw linear LSB units left, normalized dB right)

For comparison, the pulse-echo beam-pattern plot measured for a bare MOD_CH101-03-01 module is shown in Figure 8. The beam pattern shows three lobes: a main lobe and two side-lobes that are centered at ±45°. The bare module will work well for detecting on-axis targets but targets located at ±25° will have approximately 70% lower (-10 dB) amplitude, possibly resulting in poor range-finding performance.

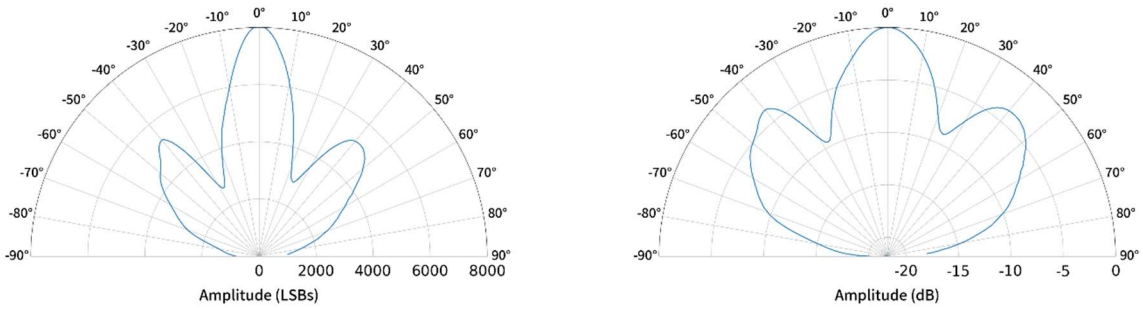


Figure 8. Beam pattern measurements of bare module (raw linear LSB units left, normalized dB right)

5.2 INGRESS PROTECTION

Users should take care to avoid exposing the CH-101 module's acoustic port to water or fine particles. For applications requiring dust ingress protection, Chirp recommends using Acoustex 042 acoustic fabric (Saati S.p.A.). The Acoustex 042 fabric can be cut to size and placed over the top of the sensor module when it is inserted into an application enclosure, as shown in Figure 9. Covering the sensor module with Acoustex 042 will result in somewhat lower pulse-echo amplitude and reduced maximum range but does not otherwise impact CH-101 sensor performance.

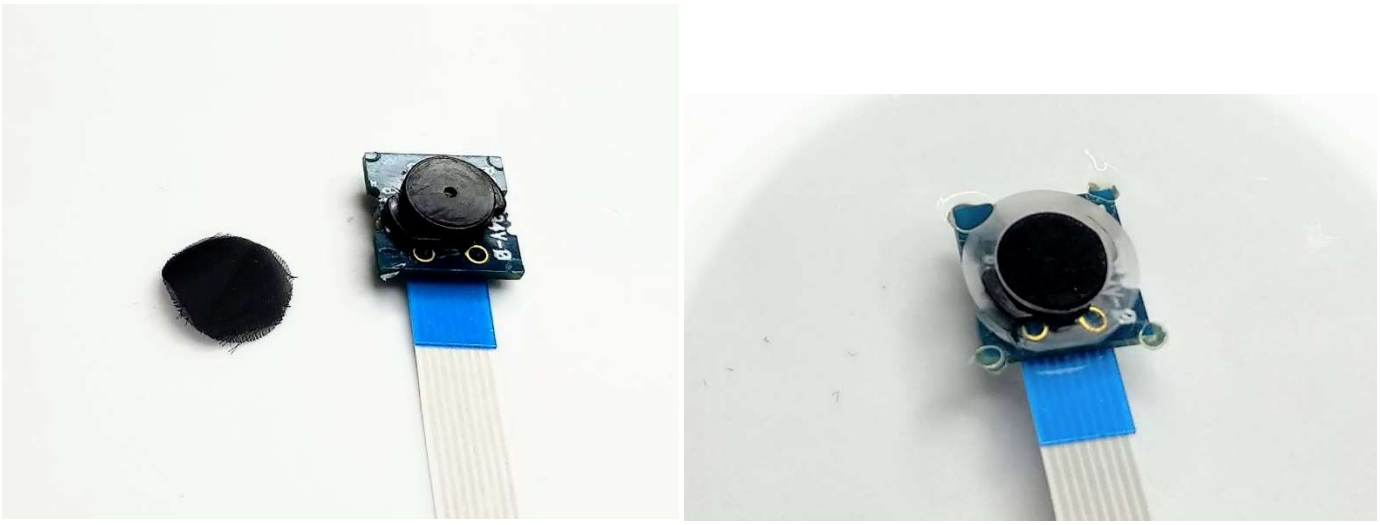


Figure 9. CH-101 sensor module alongside Acoustex 042 acoustic fabric (left); fabric-covered sensor module inserted into a clear plastic application enclosure (right).

6 REVISION HISTORY

Revision Date	Revision	Description
9/30/2019	1.0	Initial Release

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