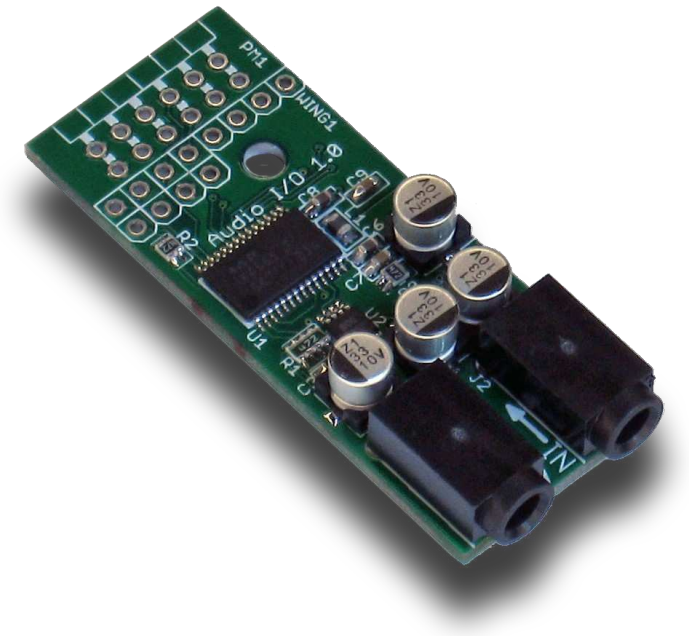
XESS Corporation

StickIt! Audio I/O Manual

How to install and use your new StickIt! Audio I/O Module



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StickIt! Audio I/O Manual
MAN009 (V1.0) October 14, 2013

The following table shows the revision history for this document.

Date	Version	Revision
10/14/13	1.0	Initial release for StickIt! Audio I/O module V1.0.

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C.1 Preliminaries

Here's some helpful information before getting started.

Getting Help!

Here are some places to get help if you encounter problems:

- If you can't get the StickIt! Audio I/O module to work, send an e-mail message describing your problem to help@xess.com or submit a problem report at http://www.xess.com/help.php.
- Our web site also has
  - answers to frequently-asked-questions,
  - example designs, application notes and tutorials,
  - a forum where you can post questions.

Take Notice!

It's pretty hard to get in trouble with this module.

Packing List

Here is what you should have received in your package:

- a StickIt! Audio I/O module.
- PMOD™ male header.
- Wing male headers (8-pin & 4-pin).

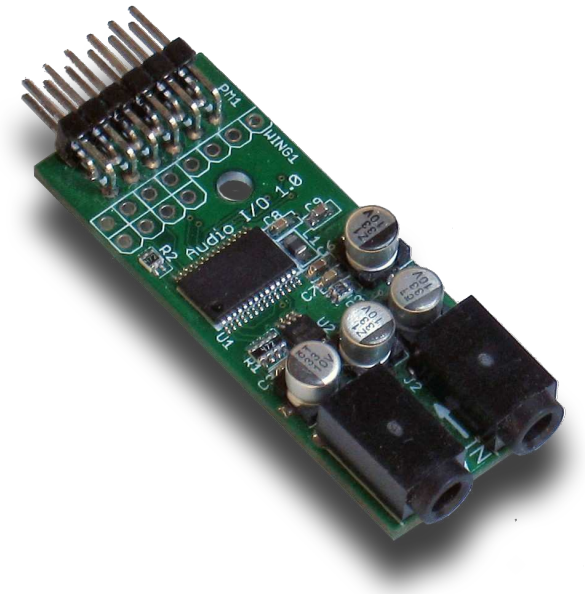
C.2 Setup

The StickIt! Audio I/O module can both sample and output stereo audio inputs with 20-bits of resolution at 44.1 Khz using a single eight-bit PMOD or a Wing socket on your StickIt! board.

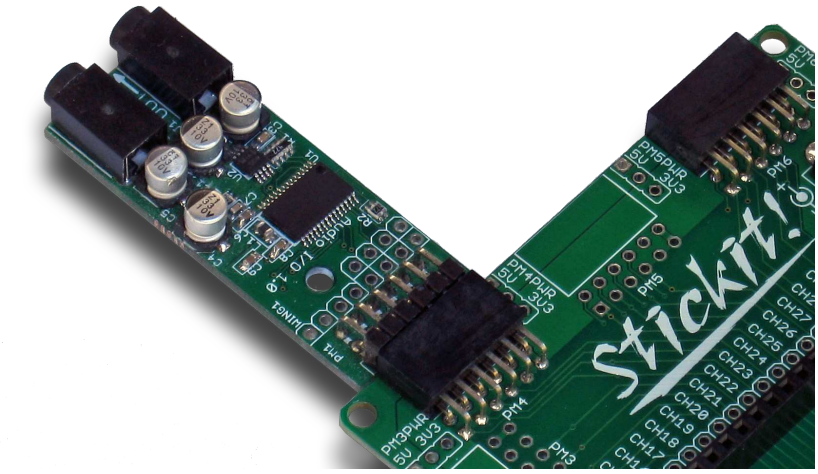
Inserting Your StickIt! Audio I/O Module Into Your StickIt! Board

Inserting Into a PMOD Socket

To use the StickIt! Audio I/O module with a PMOD socket, first solder the included male PMOD header to the module as shown. (**To insure a stable connection, only use a header with 0.025" square pins.**)

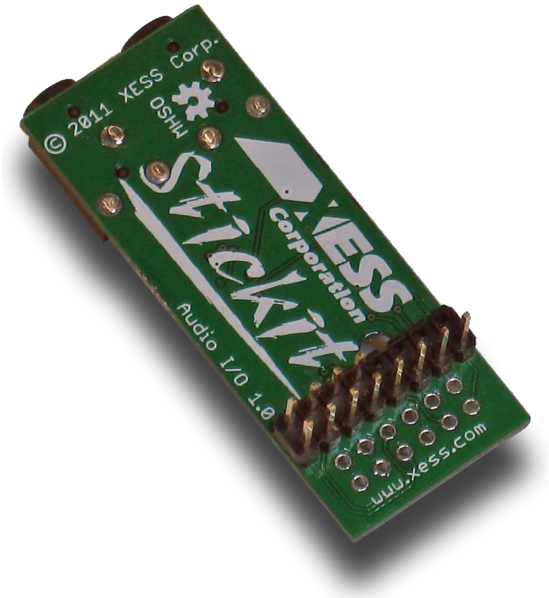


Then insert the module into one of the PMOD sockets on the StickIt! Board.

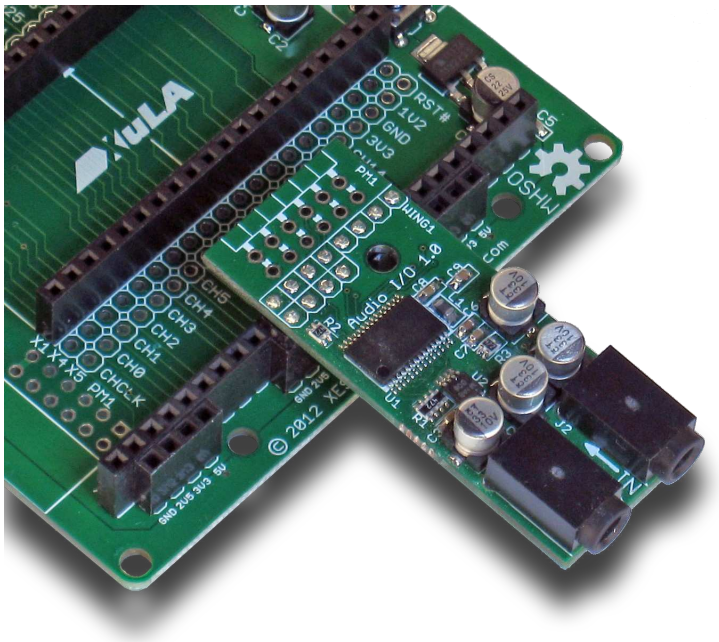


Inserting Into a Wing Socket

To use the StickIt! Audio I/O module with a Wing socket, first solder the included male Wing headers to the module as shown. (**To insure a stable connection, only use a header with 0.025" square pins.**)

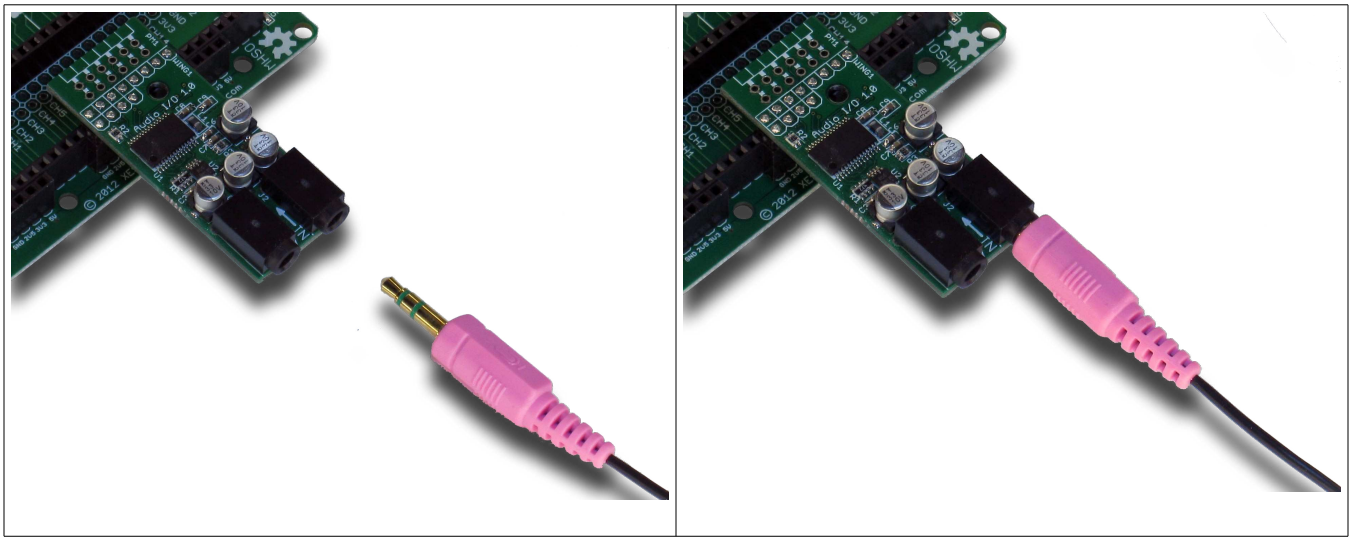


Then insert the module into one of the eight-bit Wing sockets on the StickIt! board.

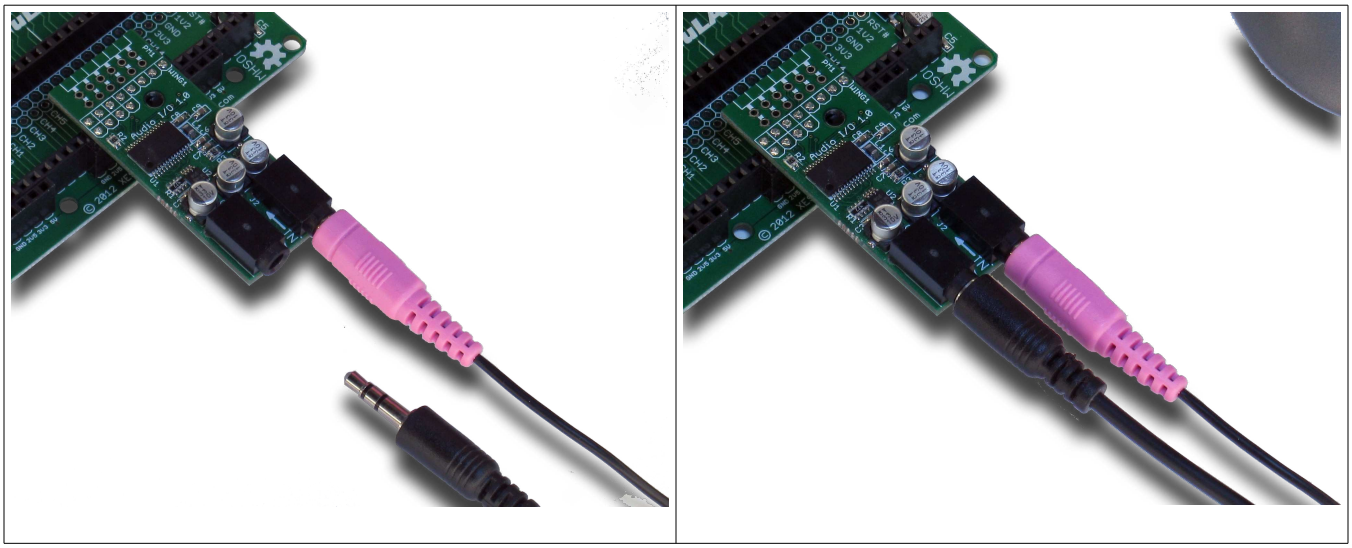


Connecting Audio Cables to Your StickIt! Audio I/O Module

The StickIt! Audio I/O module accepts mono or stereo audio signals from powered sources (such as the audio line-out port of a computer) or from passive sources (such as a microphone). The input connector accepts a 1/8” (3.5mm) jack as shown below.

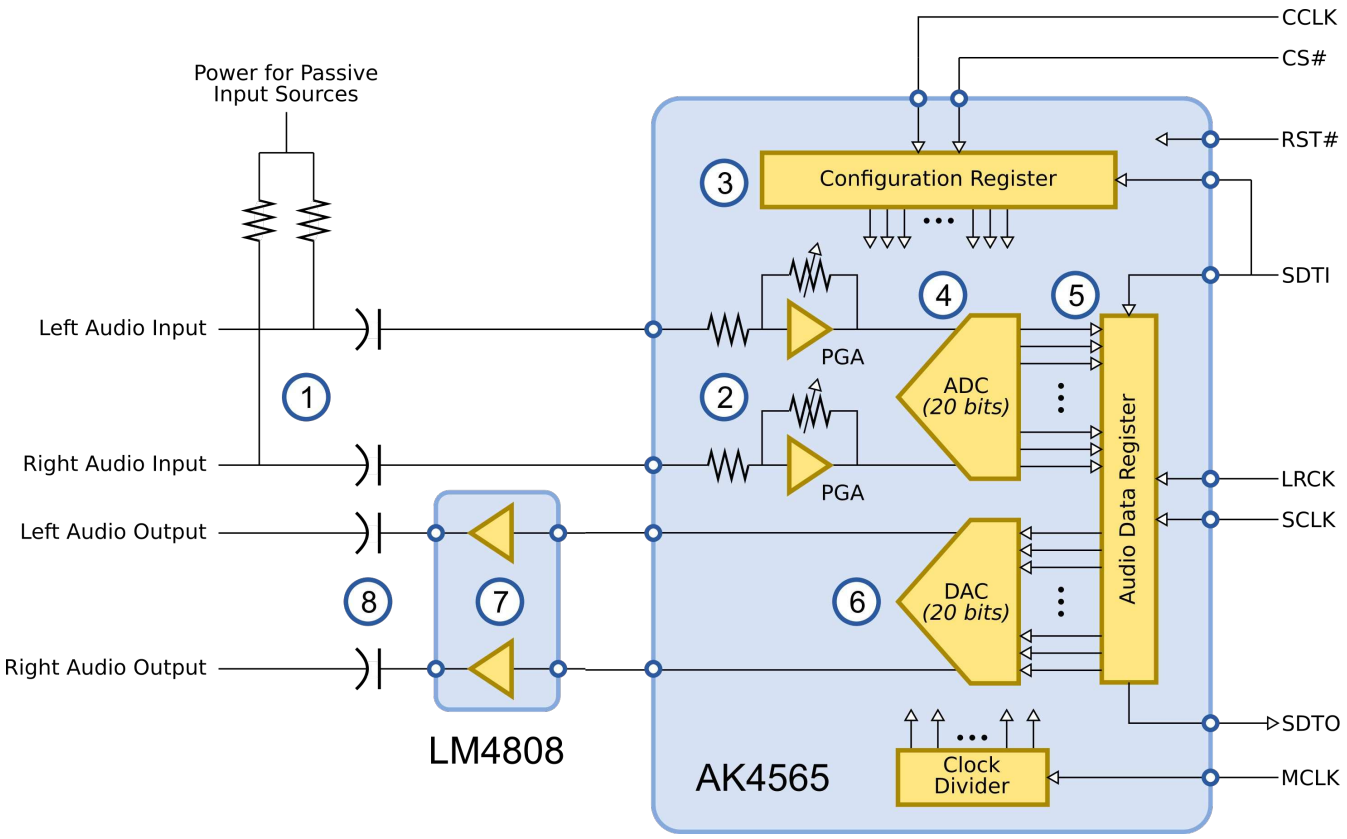


The StickIt! Audio I/O module outputs stereo audio signals that can drive a 16Ω load such as is found in headphones or powered speakers. The output connector accepts a 1/8” (3.5mm) jack as shown below.



C.3 Operation

This chapter describes the operation of the StickIt! Audio I/O module using a simplified schematic. You can find a complete schematic at the end of this manual.



Left and right channels of a stereo audio source enter the StickIt! Audio I/O module at ①. Two pull-up resistors on the stereo inputs provide power if a passive microphone is used for the audio source. Blocking capacitors prevent any DC offset in the audio signal from reaching the input terminals of the AK4565 codec.

Upon entering the codec, the audio inputs are amplified by programmable gain amplifiers (PGAs) at ②. The gain of the PGAs can be set (along with other things) by shifting bits

into the configuration register at ③ using the CS# (chip-select), SDTI (serial data input), and CCLK (configuration clock input). The PGAs allow the codec to work with either small-amplitude signals from microphones or larger signals from powered sources.

The amplified left and right audio signals are digitized into twenty-bit values by the analog-to-digital converter (ADC) at ④. These values are loaded into the audio data register at ⑤ and shifted out of the SDTO (serial data output) pin of the codec using the SCLK (bit-shift clock) and LRCK (left-right channel clock) inputs.

While the digitized input bits are shifted out of the codec, twenty-bit values for the left and right stereo output channels are shifted in through the SDTI input. These bit strings are turned into analog values by the digital-to-analog converter (DAC) at ⑥ and exit the codec.

The two analog output signals are amplified by an LM4808 at ⑦. Any DC offsets in the amplified outputs are removed by the blocking capacitors at ⑧ before exiting the StickIt! Audio I/O module on their way to a powered speaker or headphones.

C.4 Using the Module

To use the StickIt! Audio I/O module, you will need to do the following:

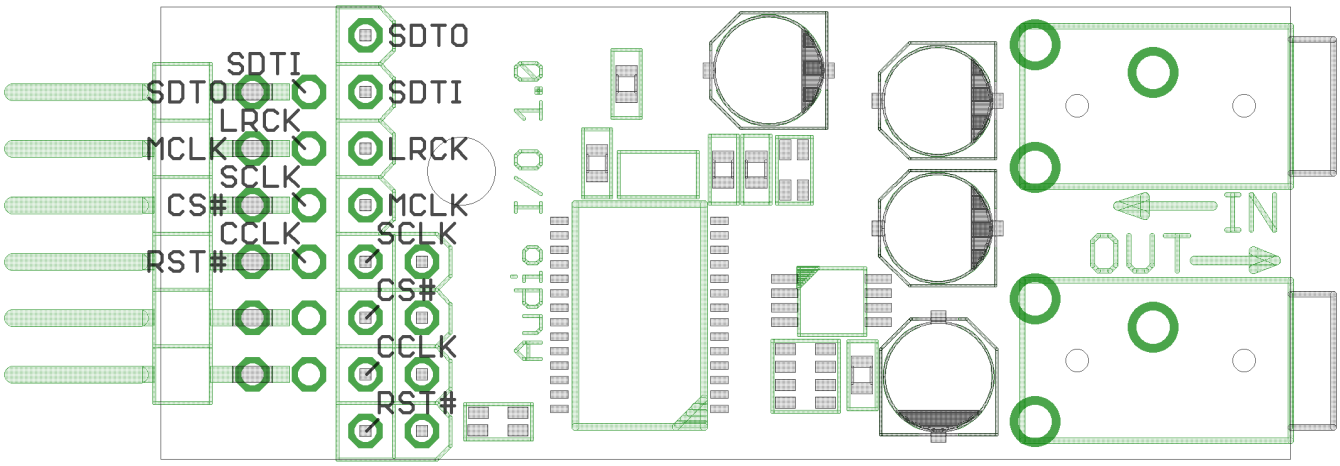
- Create a Xilinx ISE project and allocate seven FPGA outputs to drive the CS#, CCLK, SDTI, RST#, LRCK, SCLK and MCLK inputs and one FPGA input to accept the SDTO output.
- Create an FPGA design that sends serialized configuration bits to initialize the audio codec. Then the design must transfer and receive serialized audio data to/from the codec while keeping up with the 48 Khz sampling rate and maintaining the left/right-channel synchronization. (You'll probably find the datasheet for the AK4565 handy for doing this: http://www.xess.com/manuals/AK4565.pdf)
- Attach the module to either a PMOD or Wing socket on the StickIt! board.
- Determine the channel signals on the PMOD or Wing socket that connect to each I/O pin of the module.
- Find which FPGA pin of the XuLA board connects to each channel signal. (You can find this information in the StickIt! Board manual.)
- Make a UCF file associating each FPGA pin with an I/O pin of the module.
- Include the UCF file in your ISE project.

That's a lot of work just to sample and output audio signals, so we've done most of it for you. Just go to http://github.com/xesscorp/StickIt. There, you will find a subdirectory with a Xilinx ISE project that includes:

- a VHDL module that initializes the audio codec and provides an interface that accepts and delivers audio data as 20-bit words with a signal to synchronize the data transfers.
- a simple example design that digitizes a stereo audio source and then re-digitizes it and sends it back to a speaker or headphones.

A.1 I/O Locations

The connections of the PMOD and Wing header I/O signals to the switches (S1 through S8) of the StickIt! Audio I/O module are shown below.



A.2 Schematic