18 Bit, 8 Channel Differential Analogue to Digital Converter with I²C Interface

Introduction

The Delta-Sigma Pi is an 8 channel analogue to digital converter designed for use on the Raspberry Pi computer platform. The board is based around the MCP3424 low noise and high accuracy 18 bit delta-sigma analogue to digital converter from Microchip Technology Inc. A pair of MCP3424 converters are included on the board along with an I2C buffer interface allowing you to connect additional 5V I²C devices to the same bus.

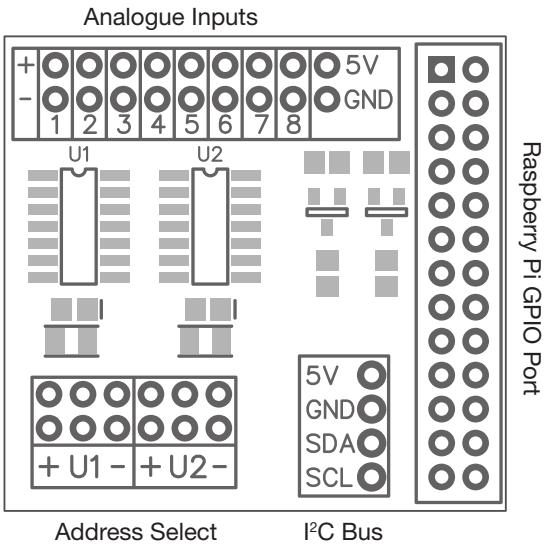
The I²C address bits are selectable using the on-board jumpers. The MCP3424 supports up to 8 different I²C addresses so with two A/D converters on each Delta-Sigma Pi you can stack up to 4 Delta-Sigma Pi boards on a single Raspberry Pi.

The MCP3424 contains an on-board 2.048V reference voltage with an input range of ±2.048V differentially (full scale range of 4.096V/PGA). A programmable Gain Amplifier gives the user a selectable gain of x1, x2, x4 or x8 before the analogue to digital conversion takes place.

The data rate for analogue to digital conversions is 3.75 (18 bit), 15 (16 bit), 60 (14 bit) or 240 (12 bit) samples per second. Data rate and resolution can be configured within software using the I²C interface.

For more information on the MCP3424 visit Microchips website at http://www.microchip.com/wwwproducts/Devices.aspx?dDocName=en536354

Board Layout



Features

- 8 x 18-bit ΔΣ ADC with Differential Inputs
- Control via the Raspberry Pi I²C port
- Stack up to 4 Delta-Sigma Pi boards on a single Raspberry Pi
- Jumper selectable I²C addresses
- Buffered 5V I²C port
- Based on the MCP3424 from Microchip Technologies Inc
- Differential full-scale range of 4.096V
- On-board 2.048V reference voltage (Accuracy ± 0.05%, Drift: 15 ppm/°C)
- On-Board Programmable Gain Amplifier (PGA):
  - Gains of 1, 2, 4 or 8
- Programmable Data Rate Options:
  - 3.75 SPS (18 bits)
  - 15 SPS (16 bits)
  - 60 SPS (14 bits)
  - 240 SPS (12 bits)
- One-Shot or Continuous Conversion Options

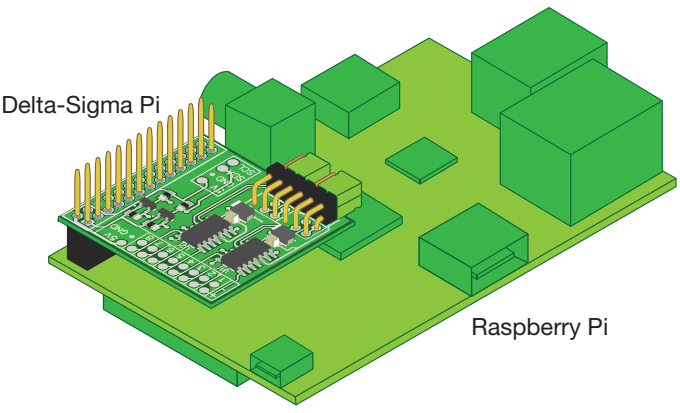
Electrical Characteristics

Vdd (5V pin on I²C bus)	5.0V
All AD inputs and outputs	VSS–0.4V to VDD+0.4 V
Current at Input Pins	±2 mA
I²C SDA/SCL voltage	5.0 V
I²C port current	100 mA

Installation

To install the Delta-Sigma Pi simply press the 26 pin connector down onto the Raspberry Pi GPIO pins with the board sat over the top of the Raspberry Pi as shown in the illustration below.

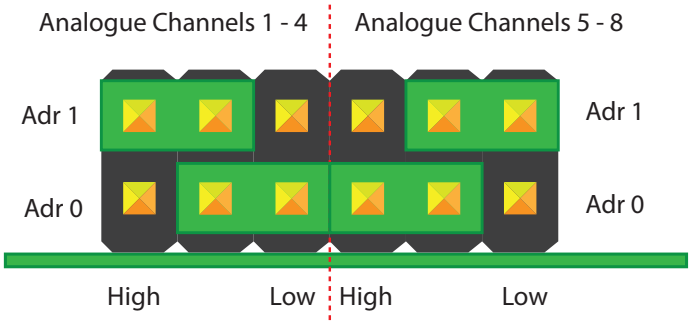
If you are installing more than one Delta-Sigma Pi on a single Raspberry Pi board then you will need to configure the address select jumpers for each Delta-Sigma Pi as shown on page 2 of this datasheet.



I²C Address Selection

The MCP3424 analogue to digital converter contains two address select pins which can be tied to Vss, Vdd or left floating. This gives 8 possible I²C addresses for each chip. The Delta-Sigma Pi contains two MCP3424 chips so you can stack up to 4 Delta-Sigma Pi boards on a single Raspberry Pi. To simplify address selection on the Delta-Sigma Pi we have included a set of address selection pins which can be configured using the included jumpers. The illustrations below show the four recommended configurations for your Delta-Sigma Pi and the associated I²C addresses.

Note:
Disconnect the Delta-Sigma Pi from the Raspberry Pi before changing the address pins. You may need to short the 5V and ground with a resistor to discharge the capacitors in order for the new addresses to be recognised.

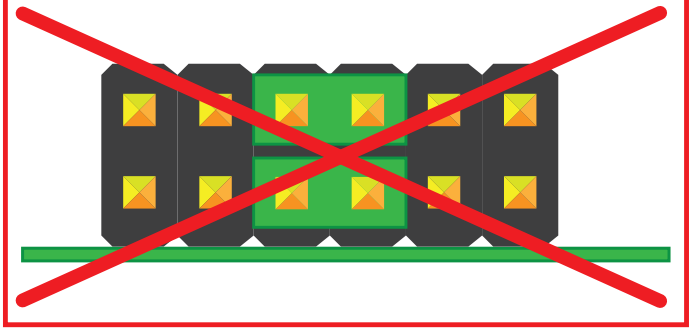


I²C Address Table

Adr 0	Adr 1	I²C Address
Low or Float	Low or Float	0x68
Low	Float	0x69
Low	High	0x6A
Float	Low	0x6B
High	Low	0x6C
High	Float	0x6D
High	High	0x6E
Float	High	0x6F

Warning

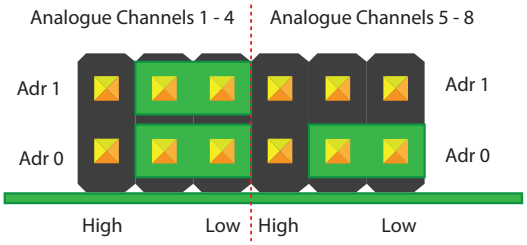
Do not under any circumstanced connect the two centre pins together. This will create a direct short between the 5V and ground pins and will damage or destroy your Raspberry Pi and Delta-Sigma board.



Recommended Address Configurations

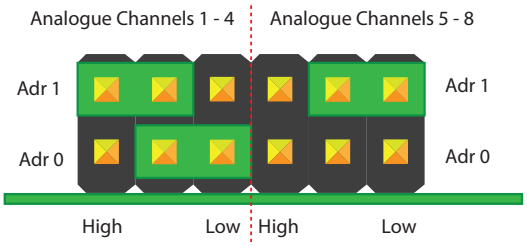
Configuration 1:

Analogue Channels 1-4 = I²C Address: 0x68
Analogue Channels 5-8 = I²C Address: 0x69



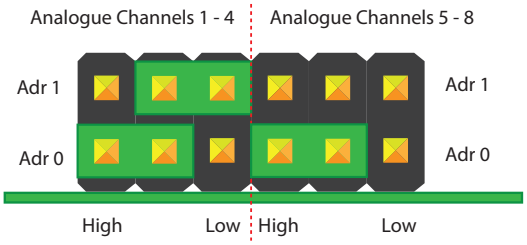
Configuration 2:

Analogue Channels 1-4 = I²C Address: 0x6A
Analogue Channels 5-8 = I²C Address: 0x6B



Configuration 3:

Analogue Channels 1-4 = I²C Address: 0x6C
Analogue Channels 5-8 = I²C Address: 0x6D



Configuration 4:

Analogue Channels 1-4 = I²C Address: 0x6E
Analogue Channels 5-8 = I²C Address: 0x6F