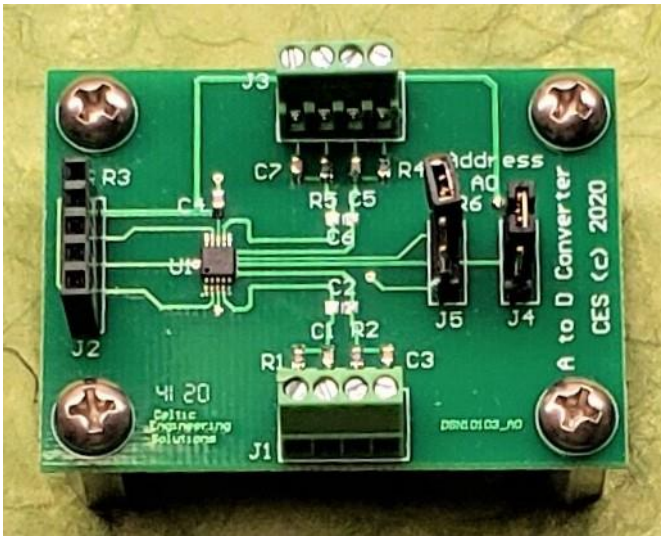
Solstice Family: Analog to Digital Converter

I^2C A to D

General Description



The SF-4 is a serial interfaced analog to digital converter board. The board is based Texas Instruments ADS1015 Ultra-Small, Low-Power, I2C-Compatible, 3.3-kSPS, 12-Bit ADCs. The board can be powered with between 2.0Vdc and 5.5Vdc. The communication to the board is through a two-wire interface and will require pullups on the SDA, SCL lines; 4.99K recommended to start. Actual resistance will depend on the length of the serial cable and the number of devices on the bus.

The ADS1015 has a 12 bit resolution and a data rate up to 3300 samples per second. There is a programable gate array that allows the maximum input voltage range to be set to between ±256 mV and ±6.144 V, however the analog input voltage should never exceed VDD + 0.3V regardless of the maximum input voltage range.

The MUX can be configured to allow two differential or four single ended input measurements. There is also a comparitor that that can be used for under voltage or over voltage detection. It can be configured to run in single shot mode or in continuous mode. This is useful when conserving power.

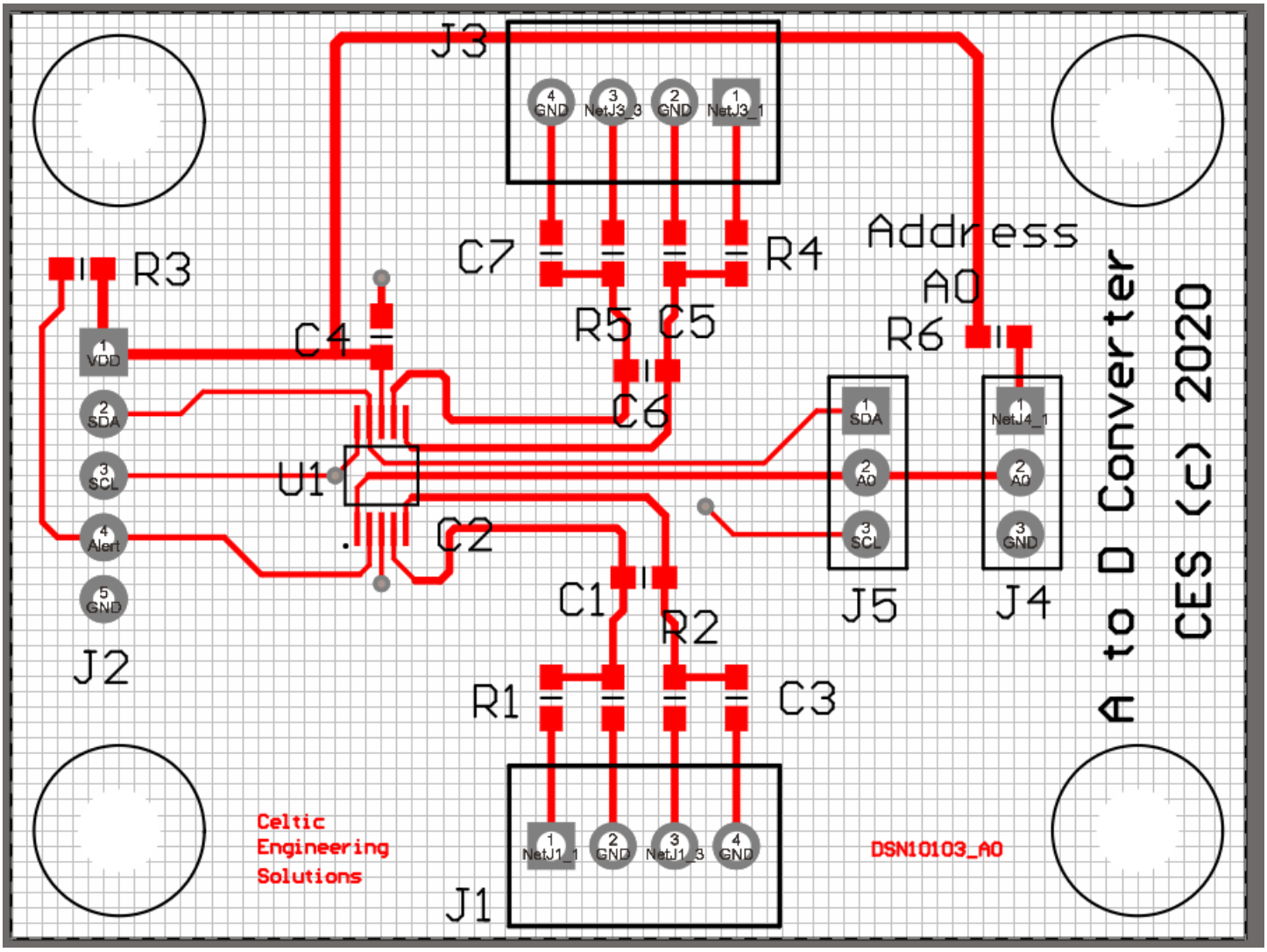
Applications

- Portable Instrumentation
- Battery Voltage and Current Monitoring
- Temperature Measurement Systems
- Consumer Electronics
- Factory Automation and Process Control

Benefits and Features

- Ultra-Small X2QFN Package:
- 2 mm × 1.5 mm × 0.4 mm
- 12-Bit Noise-Free Resolution
- Wide Supply Range: 2.0 V to 5.5 V
- Low Current Consumption: 150 µA (Continuous-Conversion Mode)
- Programmable Data Rate: 128 SPS to 3.3 kSPS
- Single-Cycle Settling
- Internal Low-Drift Voltage Reference
- Internal Oscillator
- I2C Interface: Four Pin-Selectable Addresses
- Four Single-Ended or Two Differential Inputs
- Programmable Comparator

- Operating Temperature Range: –40°C to +125°C
- Board Size: 2.000” x 1.500”



Pin Configuration (J2)

Pin	Name	Function
1	VDD	Power Supply Input
2	SDA	Bidirectional Serial Data
3	SCL	Serial Clock Input
4	Alert/Rdy	Comparator output or conversion ready
5	GND	Ground

Pin Configuration (J1)

Pin	Name	Function
1	Ain0	Analog Input
2	GND	Ground
3	Ain1	Analog Input
4	GND	Ground

Pin Configuration (J3)

Pin	Name	Function
1	Ain2	Analog Input
2	GND	Ground
3	Ain3	Analog Input
4	GND	Ground

Absolute Maximum Ratings

VDD, SDA, SCL, Alert/RDY, A0…… -0.3 to 5.5V
Storage temperature……. -60°C to +150°C

Pin Description

Serial Data Pin (SDA)

SDA is a bidirectional input/output pin, used to serially transmit data to and from the host controller. This pin requires a pull-up resistor to output data.

Serial Clock Pin (SCL)

SCL is a clock input pin. All communications and timing are relative to the signal on this pin. The clock is generated by the host controller on the bus.

Alert/RDY

Indicates when data is ready to be read, or when voltage is out of range. This is set using the registers.

Power supply Input (VDD)

VDD is the power pin. The operating voltage is between 2.0Vdc and 5.5Vdc.

Ground (GND)

This is the system ground pin.

Address Pins

The address pin selects the address of the chip. There are four possible addresses. The address is selected by setting the jumper in one of 4 positions using J4 and J5. These are VDD, GND, SDA or SCL. It is important to only select one. Placing muliple jumpers can damage the chip or the board.

The function of each pin is shown on the accompanying drawing of the board. Upper left is SDA, Lower Left is SCL, Upper Right is VDD and Lower Right is GND.

The board is shipped with A0 pulled high. This makes the address 0b1001001.

INPUTS

There are 4 inputs which can be set up as single ended, meaning that each pin is referenced to ground. For convenience there is a ground connection next to each of the inputs. Additionally, A0-A2 can be differential inputs referenced to Ain3. The final, and default, configuration is for Ain0 to be positive and Ain1 to be negative, set up as a differential input. This is selected in the Config register.

Serial Interface

There are 4 registers in the ADS1015. Before each read or write the Address Pointer Register must be set, unless it was previously set, by writing to the device address followed by the data to be placed in the Address Pointer Register. There are only 4 values that can be written and they are found in Table 4 of the chip datasheet.

The Conversion Register holds the results of a data conversion and is read as 2 8-bit bytes. See Table 5 of the chip datasheet.

The Configuration Register allows the device to be set up with great flexibility. Table 6 of the chip datasheet indicates the fields available in this register.

Finally, there are two registers Lo_thresh and Hi_thresh that set the lower and upper threshold levels when using the comparator. See Table 7 of the chip datasheet.

Filtering

When sampling an input signal, it is imperative to have the appropriate filtering based on your sample rate. Filtering not only reduces unwanted noise but reduces aliasing. The filter cutoff frequency should be at most ½ the sampling frequency to meet Nyquist requirements for aliasing. The board has been set up with 4 low pass filters set at 5.3khz. You will have to adjust these values to suit your application. An excellent design guide exists in the chip datasheet. Additionally, pads are placed so that a capacitor can be placed between differential inputs. These are not populated and will need to be placed by the user when using differential input setups.

For additional information about the performance of the analog to digital converter and the registers please see Texas Instruments datasheet.

Revision History

NR	New Release
01	Updated address to make it clearer.