BlackburnTechno

PCI2CH24BIT High Speed Acoustic data acquisition card

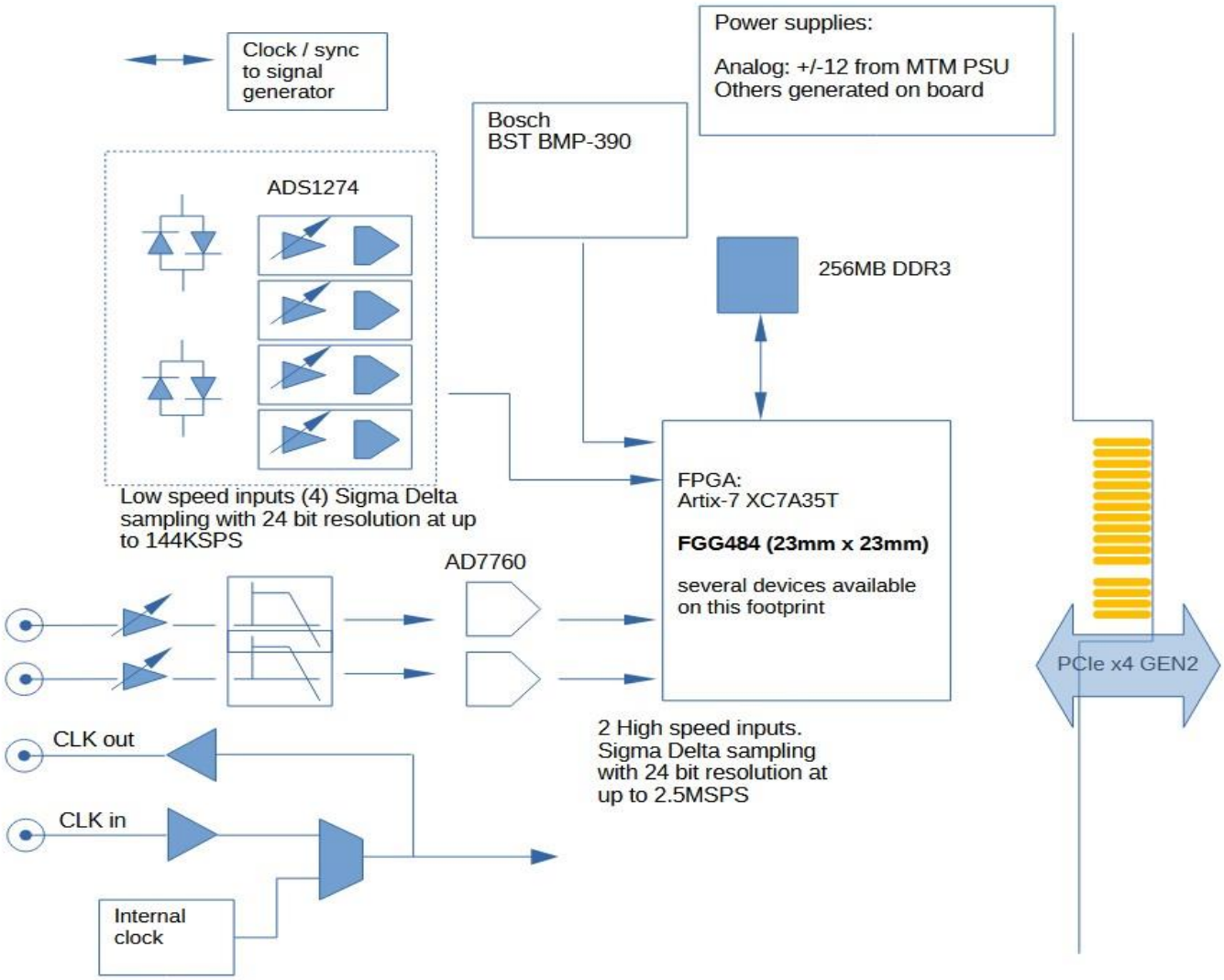
About the PCI2CH24BIT

The PCI2CH24BIT is a high-resolution wide band acoustic data acquisition card in PCIe form factor which enables a variety of acoustic and ultrasound signal processing functions, including active or passive sonar, vibration analysis, geophysics, and other test and measurement applications. The card provides two “high speed” (2.5MSPS) analog input channels, and four “low speed” (144kSPS) channels, which it converts to digital data with 24-bit resolution. Anti-aliasing inherent in the Sigma-Delta converters simplifies analog signal conditioning elsewhere in the signal path. The analog front end includes adjustable gain and two pole anti-alias filtering. All other processing is performed using the on-board FPGA resources.

The PCI2CH24BIT includes a high precision frequency synthesizer which allows the user to generate a sample clock of virtually any frequency, with high precision. It can also accept an external clock for frequency coherent synchronization to peripheral equipment. When using the PCI2CH24BIT, data acquisition may be performed in either capture or continuous mode. In capture mode a specific number of samples are acquired following a trigger event, while in continuous mode the amount data acquired is virtually unlimited. In this mode acquisition is initiated and terminated by software commands.

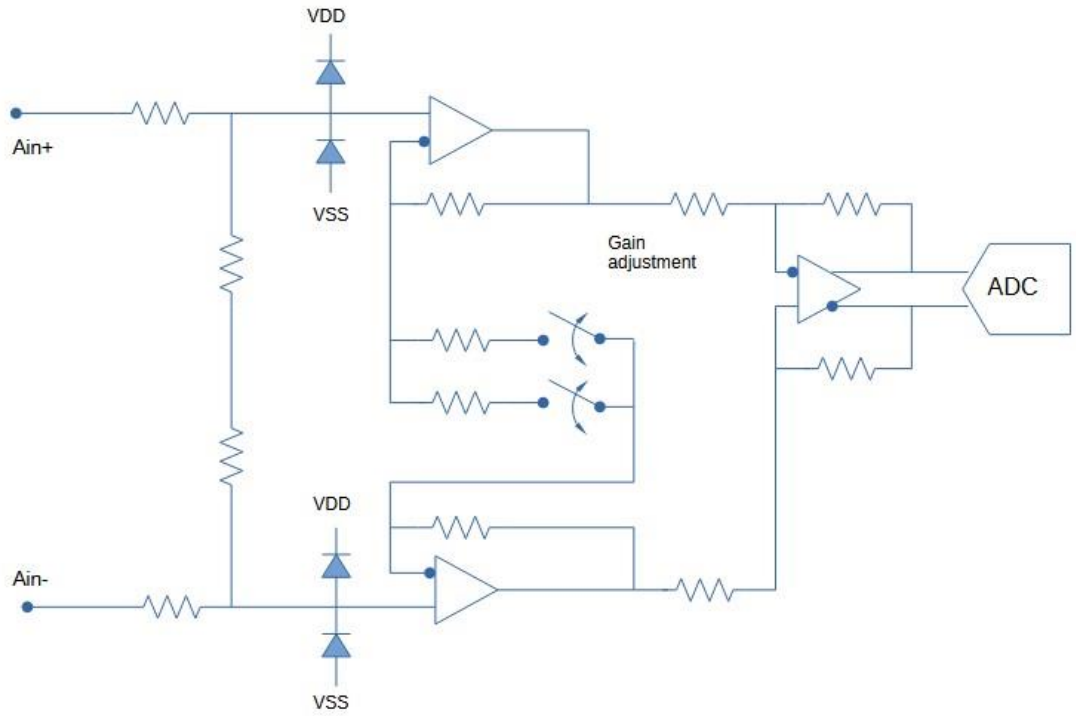
256MB of DDR3 DRAM (configured as a ring buffer) is included for on board data storage, and the card includes a DMA engine for efficient data transfer to host memory.

Architecture



“High speed” analog input circuits

The “high speed” analog inputs are arranged as shown above. Use of differential inputs is recommended whenever possible, but this circuit may be ordered in a configuration to allow the card to accept single ended signals. Note that there will be a slight reduction some aspects of performance when operating with single ended inputs. The sensitivity of the input can be adjusted at run time, selecting from one of four ranges. Input impedance is frequency dependent, and is can be approximately characterized as 1MOhm || 10pF.



“Low speed” analog inputs

The low-speed analog inputs are received by Linear Technologies LTC6373 instrumentation amplifiers. The devices offer extremely high input resistance (>1.0E12), and provide programmable gains from 0.25 to 16.

Target Specifications:

Architecture and Functionality

- Sigma-delta data acquisition card in PCI Express form factor, half-length half-height
- 256MB DDR3 DRAM memory configured as a ring buffer.
- Xilinx Artix 7 FPGA
- QSPI Flash memory for FPGA configuration, calibration data, etc.
- Supports continuous and capture modes of operation.
- x4 PCI Express (Gen 2). Includes demand mode DMA engine with 64 bit addressing capability.
- Total power dissipation approximately 9W. (estimated)

“High Speed” (2.5MSPS) Analog Inputs

- 2 differential analog input channels. 1Mhom input impedance. Two pole low pass anti-alias filter. Fc 1.1MHz.
- Programmable voltage range, up to 20Vp-p differential, can be driven single ended up to 10Vp-p.
- Other values can be supported as build options (minimum order quantities may be required).
- 24-bit Sigma Delta ADCs, Analog Devices AD7760. Sample rate programmable up to 4MSPS.
- Low latency and wideband digital filtering modes.
- >95dB SNR @ 2.5MSPS (Target specifications)
- >93dB SINAD (THD >99dB)
- >110dB SFDR @ 2.5MSPS (excluding harmonics)
- 15 pin high density D-SUB connector.

“Low Speed” Analog Inputs (up to 144kSPS)

- 4 differential analog input channels. Very high input resistance. (>10MOhm).
- Supports up to 20Vp-p differential input voltage. Programmable gain from 0.25 to 16.
- 24-bit Sigma Delta ADCs, Texas Instruments ADs1274. Sample rate programmable up to 144kSPS.
- Low latency and wideband digital filtering modes.
- >105dB SNR @ 125kSPS (Target specifications)
- >93dB SINAD (THD >99dB)
- >110dB SFDR @ 144kSPS (excluding harmonics)
- Molex Mini-grid connector.

Clock generation and synchronization

- On board clock synthesizer programmable with approximately 1Hz resolution.
- The clock synthesizer may be synchronized to an external reference clock (typically 10MHz).
- Molex 2mm pitch connector for multi-card synchronization

Integration Support

- Software Development Kit for 64-bit Linux.
- Application examples written in ‘C’.

Environmental

- Specifications guaranteed for operation from 0 to 50 °C.
- Storage temperature -40 to +85 °C.
- Approximately 500LFM airflow required for cooling.