AnalogMAX-DAQ1: A High-Accuracy Programmable Data Acquisition Development Platform

Based on Analog Devices' AD4003 18-Bit, 2 MSPS, Easy Drive, Differential SAR ADC

AnalogMAX-DAQ1 is a high-performance, high-accuracy data acquisition platform that meets power, footprint, and reliability requirements of measurement instruments in industrial, medical, and scientific applications. This platform is an ideal tool to develop products that enhance the efficiency of field testing and require accurate and reliable operation over long periods of time. The non-volatile low-cost Intel® MAX® 10 FPGA offers 8K Logic Elements (LEs) and a flexible environment to customize designs for a variety of use cases.

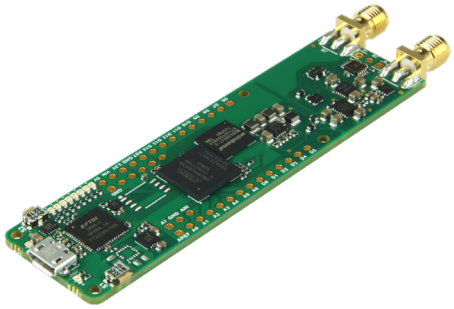
The data acquisition platform is based on the high-impedance, programmable ADC driver stage using AD8251 along with AD8475 driving the Analog Devices' AD4003 Easy Drive, Differential SAR ADC. The high throughput allows accurate capture of both high frequency signals and decimation to achieve higher SNR (Signal-to-Noise-Ratio), while also reducing antialiasing filter challenges. The reduced non-linear input current in high input-impedance mode coupled with a long signal acquisition phase broadens the range of low power precision amplifiers that can drive the AD4003 directly, reducing the signal-chain power demands.

The internal overvoltage protection protects the ADC inputs against overvoltage, minimizes disturbance on the reference pin and removes the need for external protection devices. The span compression enables the ADC driver stage to operate from the same supply rail as the ADC without the need for a negative supply while preserving the full ADC code range, thus, simplifying power management. This combination supports increased channel density while reducing the system-level complexity and power requirements, without compromising performance.

Benefits of the AnalogMAX-DAQ1 Platform

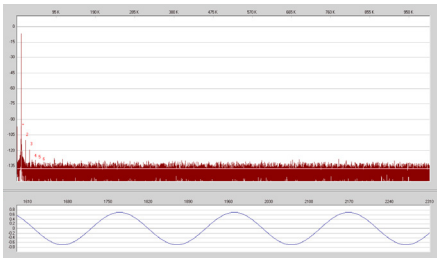
- **High-accuracy analog front-end** – Ideal for applications requiring accurate data capture at high throughputs
- **Flexible platform** – Based on the programmable Intel® MAX® 10 FPGA, easily adjusts to a wide range of use cases and production needs
- **Rapid prototyping and product development** – Rapid development and testing with an out-of-the-box experience that includes a Jupyter notebook demo with Python code
- **Quick customization services** – Add new functionality, lower BOM cost, or have the complete product designed

High-Accuracy Data Acquisition Development Platform Based on Intel® MAX® 10 FPGA

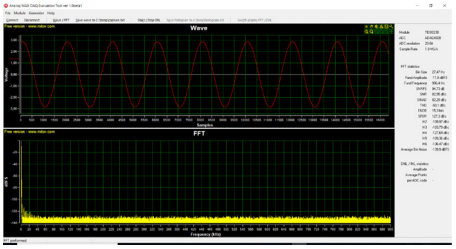


Part #: AnalogMAX-DAQ1

Signal Spectrum

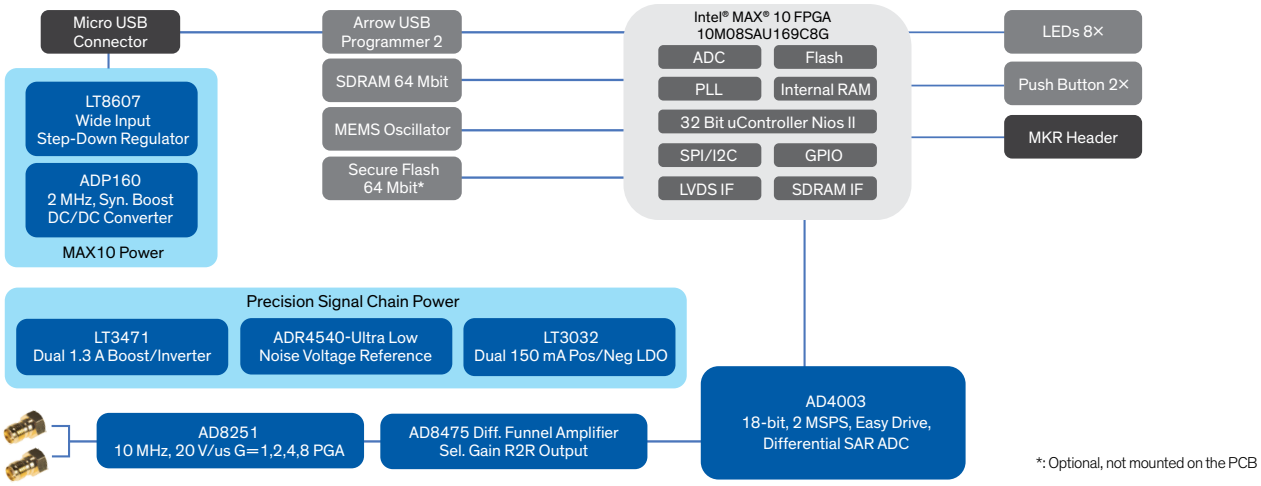


Input signal is a 1 kHz sine wave



DAQCapture Windows Application

AnalogMAX-DAQ1 Block Diagram



*: Optional, not mounted on the PCB

Hardware Features

- High-accuracy, 18-bit 2 MSPS ADC (Analog Devices AD4003)
- Power: Small footprint, low-noise power design
- On-board Intel® MAX® 10 FPGA to combine and process data from multiple sensor inputs
- Memory: SDRAM Memory up to 64 Mb, 166 MHz, 64 Mb Quad SPI Flash and 4 Kb EEPROM Memory
- Dual high-speed USB to multipurpose UART/FIFO IC
- I/O interface: 23 × GPIO

Software and Demo Features

- Works out-of-the-box with the latest code and documentation all available on wiki and GitHub
- User experience includes intuitive demos featuring the Jupyter Notebook software tools or with the standalone Windows application DAQCapture. Jupyter notebook is flexible and extensible. DAQCapture is simple and easy to use. Both can be operated in a loopback mode, and do not require a source waveform.

Key Components

Analog Signal Chain

- AD4003: A 18-bit, 2 MSPS, easy drive, differential SAR ADC
- AD8251: 10 MHz, G = 1, 2, 4, 8 iCMOS® programmable gain instrumentation amplifier
- AD8475: precision, selectable gain, fully differential funnel amplifier

Processor

- Intel® MAX® 10 FPGA: Non-volatile low-cost FPGAs (part #:10M08SAU169C8G)

Power

- LT8607: 42 V, 750 mA synchronous step-down regulator with 2.5 µA quiescent current
- ADR4540: Ultra-low noise, high-accuracy 4.096 V voltage reference
- LT3471: Dual 1.3 A, 1.2 MHz boost/inverter in 3 mm × 3 mm DFN
- ADP160: Ultra-low quiescent current 150 mA, CMOS linear regulator

Features of the AD4003 18-Bit, 2 MSPS, Easy Drive, Differential SAR ADC

- Low-power solution with guaranteed 18-bit no missing codes
- Throughput: 2 MSPS /1 MSPS / 500 kSPS options
- INL: ± 1.0 LSB (± 3.8 ppm)
- SNR: 100.5 dB at f_{IN} = 11 kHz, 99 dB at f_{IN} = 100 kHz
- THD: -123 dB at f_{IN} = 1 kHz

Ordering Information

Part #: AnalogMAX-DAQ1

Documentation and Instructions

github.com/ArrowElectronics/AnalogMAX/wiki

Online

www.arrow.com/analogMAX

Five Years Out