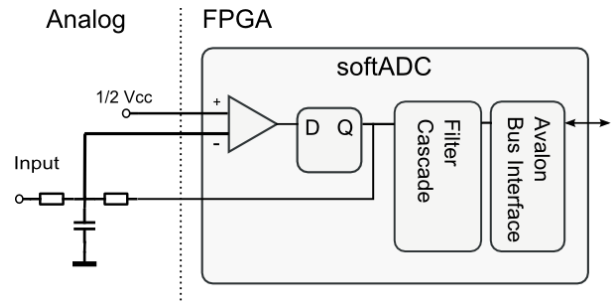


MLE's patent pending technology allows to utilize standard FPGA I/O pins for analog inputs and outputs.

MLE provides the softADC and the softDAC:
www.missinglinkelectronics.com/softanalog

The softADC is a direct integration of an AD-Converter into modern FPGA devices.



Benefits and Use Cases

- PCB footprint and BOM reduction
- No active peripheral ADCs required
- Design flexibility:
 - many ADCs without multiplexing
 - flexible analog setup: „one more I/O“
 - adaptive ADC parameter setting
- Simultaneous and time-synchronous multi-channel sampling
- Move signal processing power close to acquisition

Applications

- Flexible data acquisition and monitoring systems
- Embedded systems with many sensor inputs, sensor networks
- Voltage-based actuator control, DC motor control (with softDAC)
- Audio applications for FPGA
- Integrated microcontrollers with reduced risk of parts obsolescence

Key Features

AC Performance

- Up to 200 kSPS sample rate
- 64 dB SNR at 96 kSPS
- 69 dB SNR at 1 kSPS
- ~ 60dB SINAD
- 11 bit ENOB
- 0.002% THD

Configurability

- Sample rate
- Cut-off frequency
- Gain / Offset compensation

Avalon bus register interface

- Input: Channel configuration
- Output: 16-bit sample data

Resources per channel

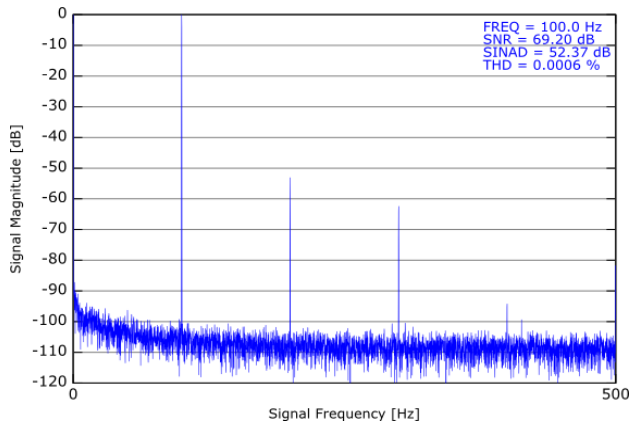
- LE: 100-200, depending on filter
- Pins: 1 LVDS receiver pair, 1 LVTTTL
- Analog: 2 resistors, 1 capacitor

Typical Characteristics: Output Spectrum

The figures below illustrate the output frequency spectrum of the softADC when measuring an input sine wave at a given frequency. The output frequency spectrum comprises of three spectral components: The amplitude peak of the input sine wave, harmonic peaks at multitude of the input sine wave and a continuous noise floor.

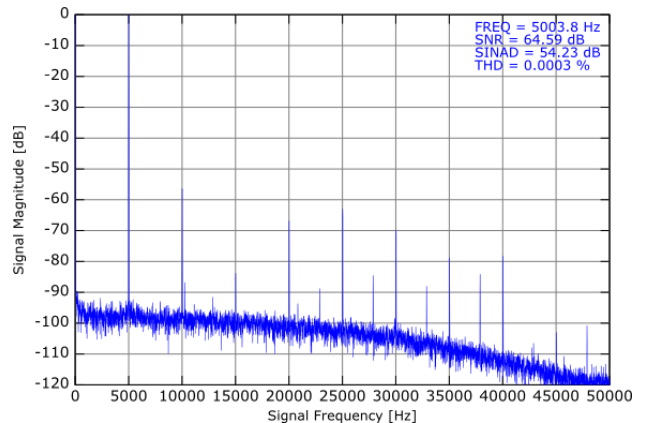
1 kHz Sample rate

Spectrum at 100 Hz

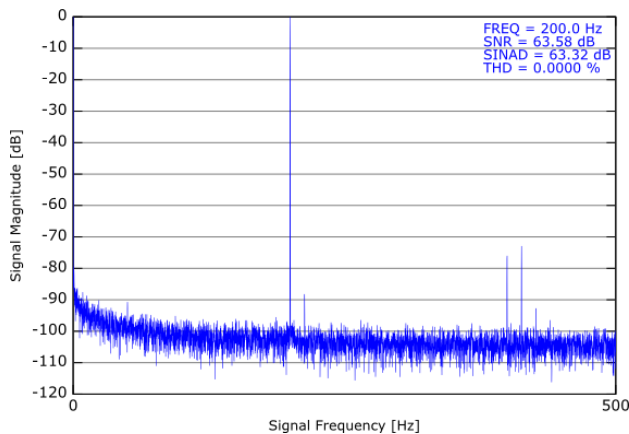


96 kHz Sample rate

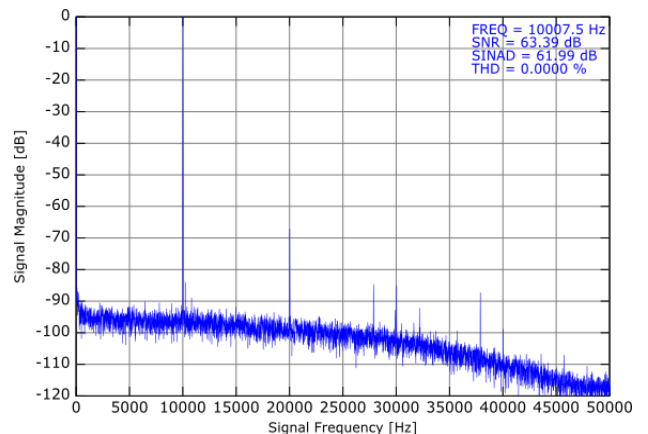
Spectrum at 5 kHz



Spectrum at 200 Hz



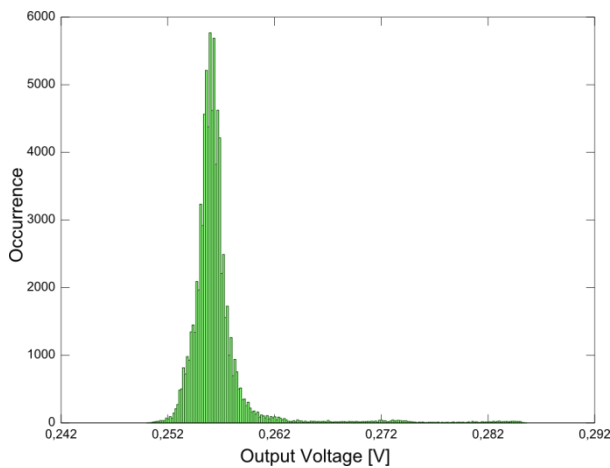
Spectrum at 10 kHz



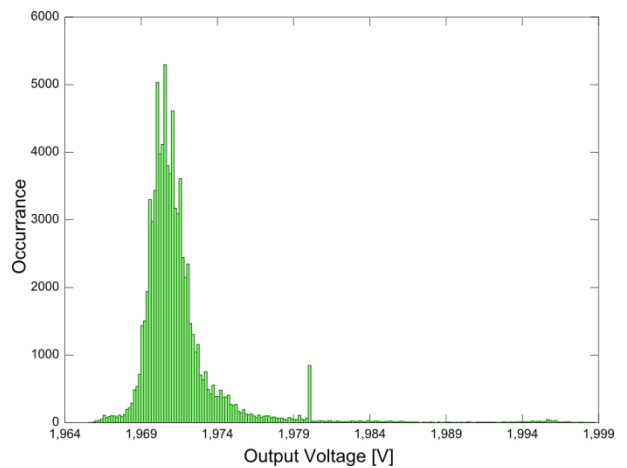
Typical Characteristics: Histogram

The figures below illustrate the distribution of output voltages of the softADC when measuring a given DC input voltage. Each histogram comprises of 81920 single measurements. As expected, the distributions conform to the Gaussian bell curve, whereas a thinner curve stands for higher DC precision.

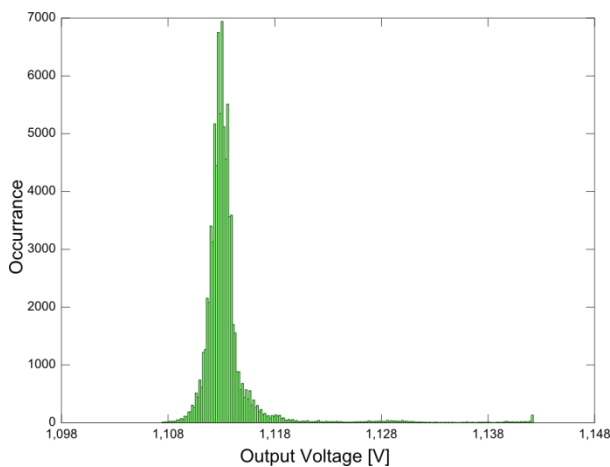
0.255 V DC input



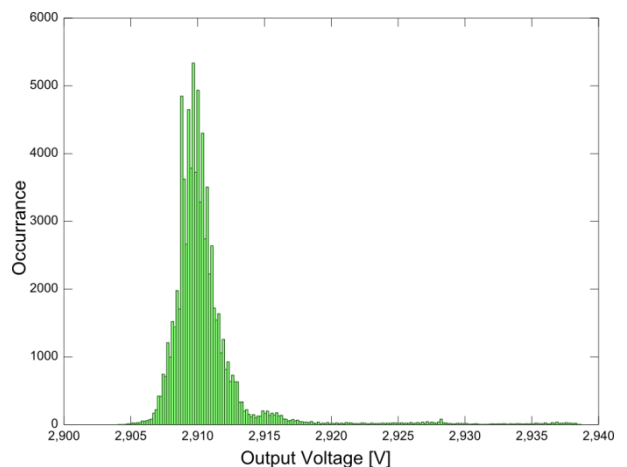
1.972 V DC input



1.113 V DC input



2.909 V DC input



Availability and Contact

Evaluation Kit

Allows evaluation of MLE's softADC and softDAC technology and comes pre-configured.

Included materials:

- Terasic DE0-Nano FPGA Development board
- MLE passive-only ADC connector board

Included software:

- MLE Evaluation FPGA reference design



Product Integration Roadmap

1. Evaluation Kit
To evaluate technology and principles of operation
2. Requirements & Feasibility Service
To optimize configuration for given applications
3. Production License

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