High Precision, Impedance Converter

Data Sheet **AD5943W**

FEATURES

- **Analog input**
  - **16-bit precision ADC with 800 kSPS and 1.6 MSPS options**
  - **Ultralow leakage, programmable switch matrix for custom sensor connections**
  - **High precision voltage, current, and impedance measurements**
  - **Impedance measurements up to 200 kHz**
  - **ADC input path**
    - **Input buffers**
    - **Programmable gain amplifier with gain values of 1, 1.5, 2, 4, and 9**
- **1 high speed, 12-bit DAC**
  - **Output voltage range: ±607 mV typical**
  - **Programmable gain amplifier on output with gain settings of 2 and 0.05**
- **Amplifiers, accelerators, and references**
  - **Analog hardware accelerators**
    - **Discrete Fourier transform (DFT) measurement block to calculate complex impedance**
  - **1 high speed TIA to handle wide bandwidth input signals up to 200 kHz**
  - **Digital waveform generator for generation of sinusoid and trapezoid waveforms**
  - **1.82 V internal reference voltage (V_{REF}) sources**
- **System level power savings**
  - **Fast power-up and power-down analog blocks for duty cycling**
  - **Programmable AFE sequencer to minimize workload on host controller**
  - **6 kB SRAM to preprogram AFE sequences**
- **On-chip peripherals**
  - **SPI serial input and output**
  - **Wake-up timer**
  - **Interrupt controller**
- **Power**
  - **2.8 V to 3.6 V supply**
  - **POR**
- **Package and temperature range**
  - **7 mm × 7 mm, 48-lead LFCSP**
  - **Fully specified for an operating temperature range of −40°C to +105°C**
- **AEC-Q100 qualified for automotive applications**

APPLICATIONS

- **Impedance measurement**
- **Automotive hands on detect**

GENERAL DESCRIPTION

The AD5943W is a high precision, impedance converter with a high precision ac excitation and receive channel that can generate and measure signals from dc up to 200 kHz. The excitation loop consists of a 12-bit digital-to-analog converter (DAC) referred to as the high speed DAC (HSDAC). The HSDAC chain consists of a programmable gain stage and programmable instrumentation amplifier. The HSDAC can generate signals of amplitude up to ±607 mV.

The measurement channel consists of a high speed transimpedance amplifier (HSTIA) with programmable load and gain resistors. The HSTIA is designed to measure signals up to 200 kHz. The output of the HSTIA feeds into the ADC multiplexer (mux). The ADC is a 16-bit, 800 kSPS and 1.6 MSPS, multichannel successive approximation register (SAR) analog-to-digital converter (ADC) with input buffers, a built in antialiasing filter (AAF), and a programmable gain amplifier (PGA). An input mux in front of the ADC allows the user to select an input channel for measurement. These input channels include multiple external current inputs, external voltage inputs, and internal channels. The internal channels allow diagnostic measurements of the internal supply voltages, die temperature, and reference voltages.

An ultralow leakage, programmable switch matrix connects the sensor to the internal analog excitation and measurement blocks. This matrix provides an interface for connecting external transimpedance amplifier resistors (R_{TIA}s) and calibration resistors. The matrix facilitates a multielectrode system using the same analog measurement blocks.

The AD5943W measurement blocks can be controlled via direct register writes through the serial peripheral interface (SPI) or by using a preprogrammable sequencer that provides autonomous control of the AFE chip. The 6 kB of static random access memory (SRAM) is partitioned for a deep data first in, first out (FIFO) and command FIFO. The measurement commands are stored in the command FIFO, and the measurement results are stored in the data FIFO. A number of FIFO related interrupts are available to indicate when the FIFO is full.

For more information about the AD5943W, contact impedance@analog.com.

Rev. Sp0 Document Feedback

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