LinearDimensions SEMICONDUCTOR

PHYSIOsensiics™ with nanoPower Technology

LNDAQ2

Complete Signal Acquisition, Extraction & Fusion Analysis SoC

GENERAL DESCRIPTION

The LNDAQ2 is a complete signal interface, acquisition, extraction and interrogation IC using the latest low power sub-threshold instrumentation amplifiers, automatic gain control systems, high order switched capacitor filters, and low OSR data converters.

The primary feature of the LNDAQ2 is that it represents the lowest power solution on the market today integrating terminator, AGC, INA, high order high and low pass filters, and precision data converters. In fact the LNDAQ2 draws one quarter (1/4) of the current of its nearest competitor dramatically extending battery life. It does this by utilizing the latest technologies in subthreshold and low power design, making obsolete many of the conventional solutions used in competitive devices.

The LNDAQ2 includes a >90dB CMRR terminator, and a precision INA with offsets in the uVs. The INA includes an SPI controlled AGC capability which can gain up signals <50uV. The LNDAQ2 can be configured in DC or AC configuration. In AC configuration it includes a time constant accelerator to quickly recapture the baseline if there is a saturation event.

Following the INA are a pair of switch capacitor filters. These filters allow coefficients to be programmed through the SPI interface and can implement a variety of filters including Bessel filters up to 8th order for the high pass filter (which can achieve 0.05Hz corner frequencies) to 6th order low pass.

Following the filters are an analog buffer (which can be turned off) as well as three ADCs. The first ADC is an 18 bit **ΔΣ** converter, the second a 14 bit pipeline converter, and the final ADC is a 6 bit flash converter. These three converters combined represent the **ΔΣ**, however, the pipeline and flash may be used independently to save power or increase the bandwidth of sampling.

The **ΔΣ**, is a low OSR type using a cascade architecture and 5 bit quantizer to minimize power consumption. OSR may be increased to improve resolution or reduced to minimize power consumption.

The flash converter is a modern delay line design optimizing silicon area & power consumption. The filters and dataconverters work from 1.8V while the input stage allows signals up to 3.6V to be measured.

EXAMPLE APPLICATION



Figure 1 – Example application requiring nanoPOWER technology.

FEATURES

- Complete signal acquisition, extraction, interrogation and analysis system
- Includes:
  - Common mode terminator (>90 dB)
  - LNDINA333A/B/C
  - LNDFILT8
  - LNDADC18
- Interfaces (including probes) for all of:
  - Galvanic skin response
  - Skin impedance
  - Heart waveform extraction
  - Temperature sensing
  - Optional right led drive (two or three electrode interface for heart rate extraction)
- Operates from as little as 2.7V to 3.6V, 1.8V Vout
- AC or DC mode instrumentation amplifier (INA)
- 6 & 8th order (LP/HP) programmable filters
- **<35uA average current**
- Signal Acquisition:
  - Automatic or Programmed Gain Control (AGC) allows acquisition from multiple sites
  - Time Constant Accelerator for Quick Baseline Recapture
- Capable of Measuring signals <50uV even in a noisy environment with noise in the same spectrum
- Penetrates real world noise such as muscle noise, lighting, electrode connect & disconnect, 60Hz
- AGC allows multiple inputs from anywhere on the body for physiological fusion applications
- Three analog to digital converters (ADCs)
  - 6 bit delay line flash ADC (<1uA typ)
  - Up to 14 bit pipeline ADC (<4uA typ)
  - Up to 18 bit low OSR ΔΣ ADC (<10uA typ – ΔΣ includes the 6 bit and 14 bit ADCs)
- Each ADC may be put to sleep to save power
- Power optimization subsystem
- SPI Interface (with independent enable)

APPLICATIONS

- Portable heart rate equipment
- Wellness patch products
- Paper battery powered products (<40mAH)
- Portable fitness & wellness products
- Physiological fusion analysis consumer devices
- Non-critical diagnostics
- Low bandwidth portable electronics
- Vibration sensors