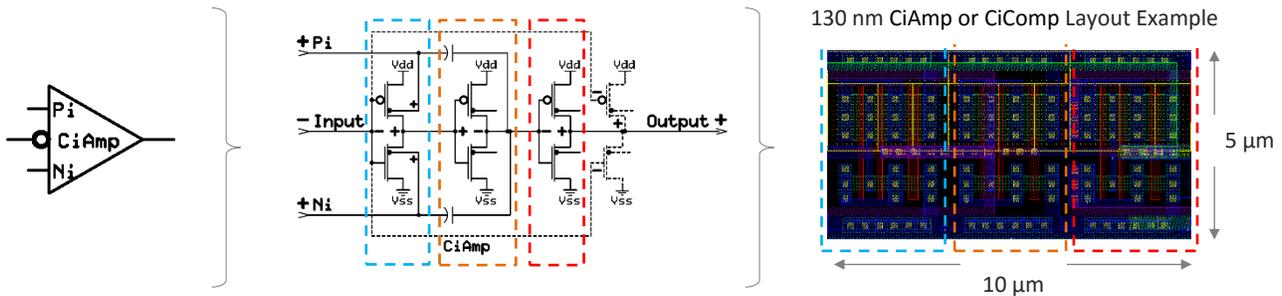


Circuit Seed ADC/DAC Overview

General Description

This is an introduction to a class of CiFET based Data Converter implementations that empower conversion between analog and digital signals within *any* digital or processor based system, thus seamlessly interfacing real-world analog into a single chip systems (SoC). These converters are implemented in *any* all-digital IC processes, including nanoscale and FinFETs, to tightly integrate analog to digital signal processing into larger smart digital systems that are available today. This is accomplished by employing a reliable a high-precision amplifier, CiAmp (Complementary Current Amplifier).



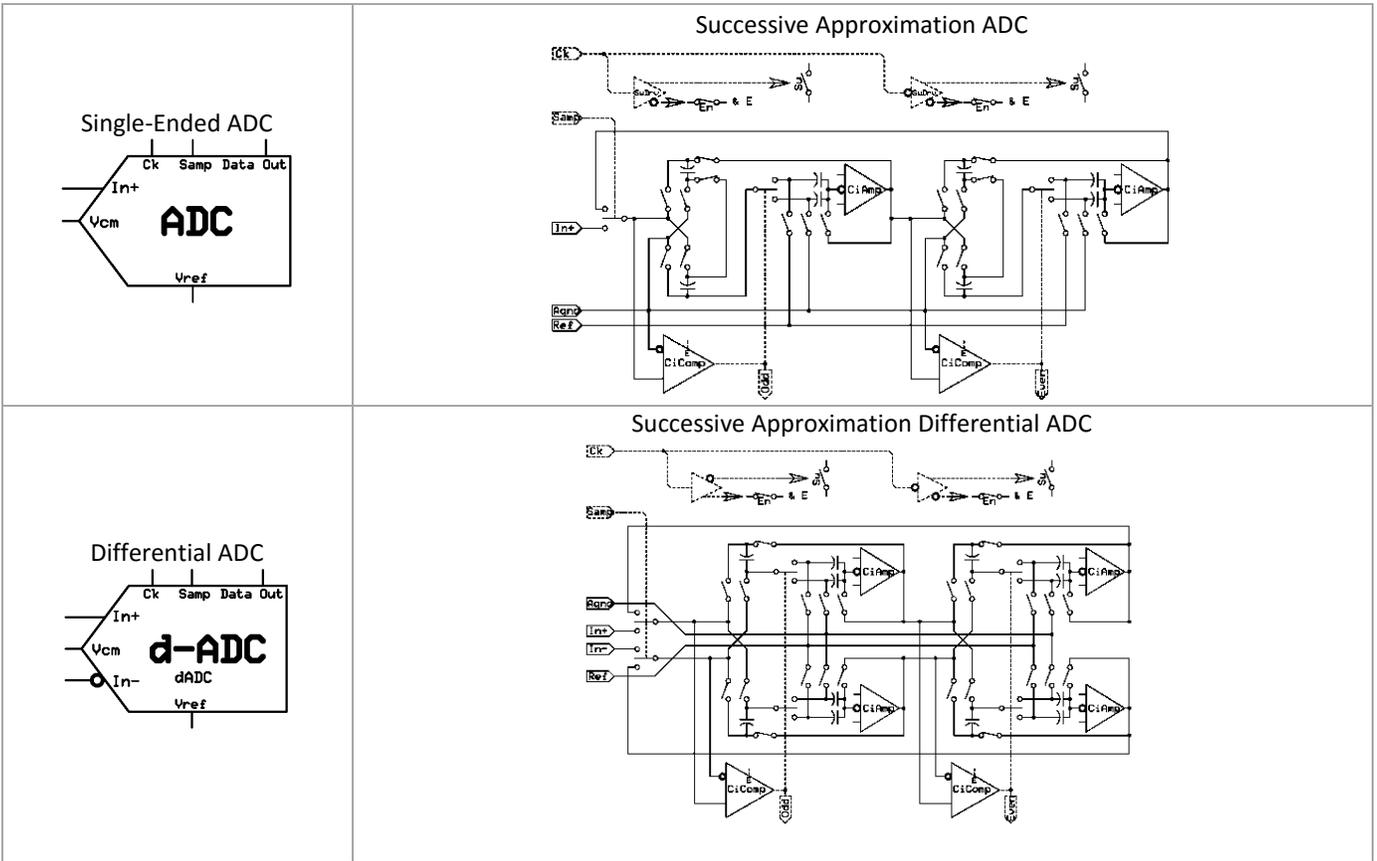
Features

- Supply voltage: 1.0V, which can be operated between $\sim 500\text{mV}$ and the IC process limit
- Throughput: $\sim 1\text{MSPS}$ in this 130nm example which scales to IC process ring oscillator rates
- Resolution: 16-bits in these examples (control logic implements higher or lower resolutions)
- Successive Approximation Conversion period: $16 \mu\text{s}$ @1MHz clock
- Easily implemented as Pipeline Converters for faster conversion rates
- Amplifier SNR: -150 dB
- Harmonic distortion: -150dB
- Temperature Range: $-55 \text{ }^\circ\text{C}$ to $125 \text{ }^\circ\text{C}$ with extended linear range of $-150 \text{ }^\circ\text{C}$ to $250 \text{ }^\circ\text{C}$
- Differential DAC
 - Power consumption: $\sim 10 \mu\text{W}$
 - Energy consumption: ~ 170 pico-Joules/conversion
- Single ended ADC
 - Power consumption: $\sim 24 \mu\text{W}$
 - Energy consumption: ~ 408 pico-Joules/conversion

Advantages

- Works in any IC process including all-digital processes
- No IC process extensions thus enabling portability between IC process including FinFETs
- Operates best at nanoscale reduced power supply voltages around 1V
- Ability to produce analog building blocks constructed entirely from digital parts
- Small area, low power, Fast, stable, portable design between IC process nodes
- Simple and flexible design - easily scalable to various speed-resolution requirements
- Self-biasing without the use of current mirrors or IC process extensions
- Single-ended or differential analog signal path
- Bi-directional positive and negative analog signals over wide dynamic linear range
- High parametric drift and noise tolerance
- Stable operation tolerant to individual 50% parametric deviations for high production yields
- Full-Differential input and output available with input swings beyond rail-to-rail and output swings approaching rail-to-rail
- Power can be interrupted between conversions with instantaneous full-precision start up

ADC



Single-Ended ADC 1.0V_{DD} MSB_0110 1011 0010 1110_LSB 334.942mV_{in} Unipolar 400mV_{ref} 1MHz

