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 ~500mV and the IC process limit
- Throughput: ~1MSPS 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 µs @1MHz clock
- Easily implemented as Pipeline Converters for faster conversion rates
- Amplifier SNR: -150 dB
- Harmonic distortion: -150dB
- Temperature Range: -55 °C to 125 °C with extended linear range of –150 °C to 250 °C
- Differential DAC
  - Power consumption: ~10 µW
  - Energy consumption: ~170 pico-Joules/conversion
- Single ended ADC
  - Power consumption: ~24 µw
  - 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
Differential DAC

Successive Approximation DAC

Successive Approximation Differential DAC

Differential DAC

Offset=0

Next Offset=0
Single-Ended ADC 1.0V_{DD} \textbf{MSB}_0110 1011 0010 1110 \textbf{LSB} 334.942mV_{in} \text{ Unipolar} 400mV_{ref} 1MHz