Design of Resource Sharing Reconfigurable ΔΣ SAR-ADC

Motomi Ishizuka, Kohei Yamada,
Yosuke Toyama and Hiroki Ishikuro

Keio University

Background

- **Need of ADC for wireless sensor network**
  - **Vast variety of sensing signal**

Solar cell(<mW)
Sensor
ADC
Logic cell
RF

Sensor node

- **ΔΣ SAR ADC**

ex.) Air conditioning control system

  - **Fully Passive integrator**

    Low power, Small area Incomplete integrate

    →High resolution is challenging

  - **Active integrator**

    High resolution Large area

    →Small area is challenging

Block Diagram

- **Almost capacitor are Time-sharing**
  - **Three benefits**
    - **Reduce the capacitor area($4C_{DAC}$ with differential)**
    - **<u>Use Charge shuttling Technique</u>**
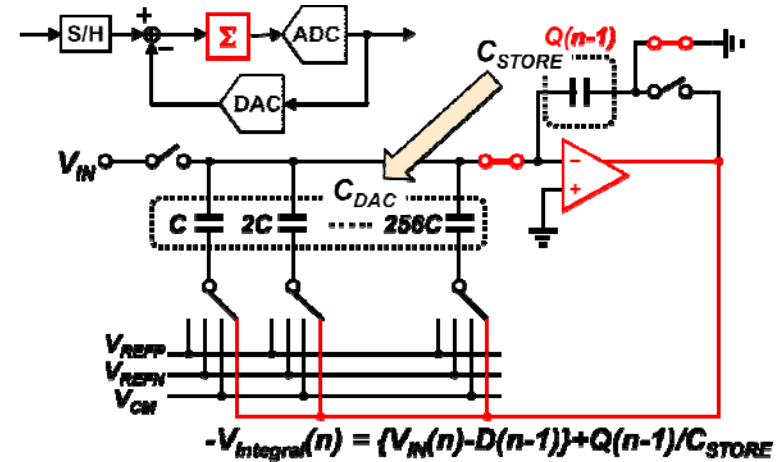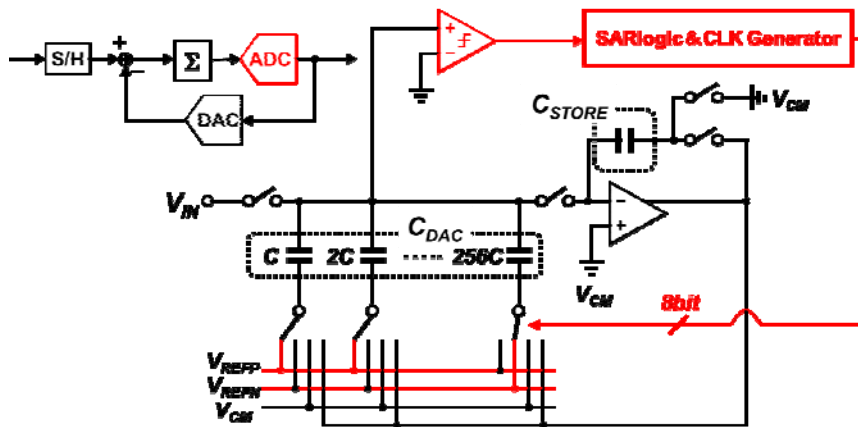   - **Ease the reduction of nonlinearity**
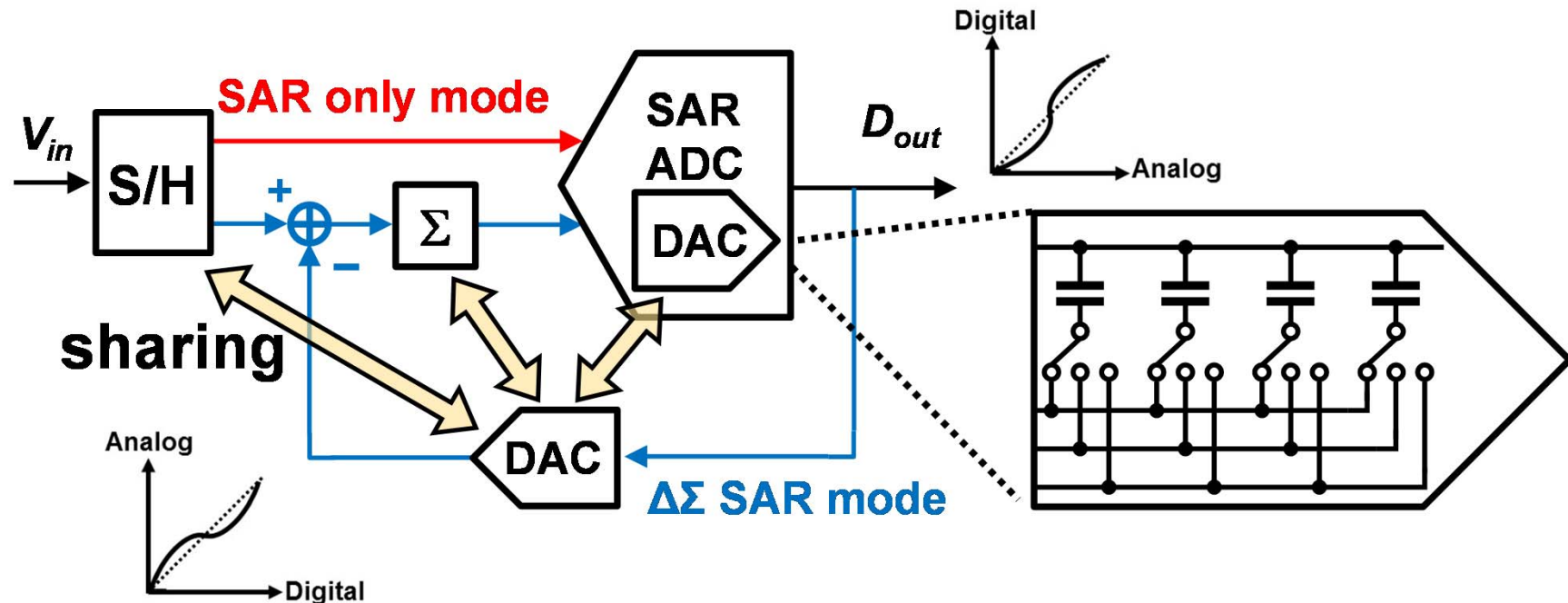
Resource Sharing Technique
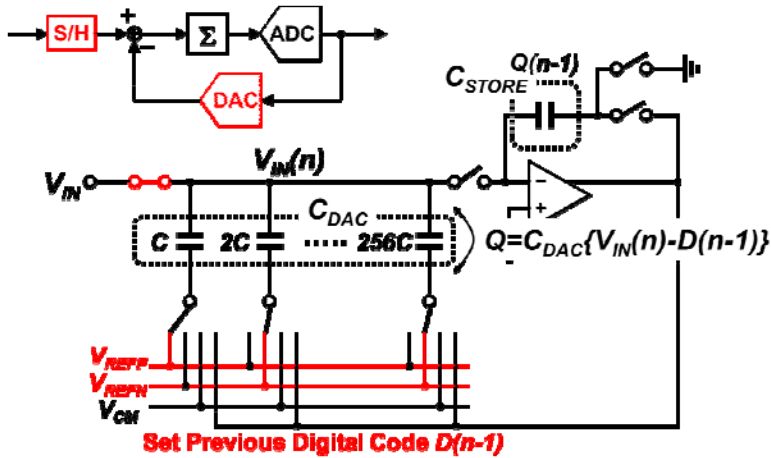
1. Δ phase

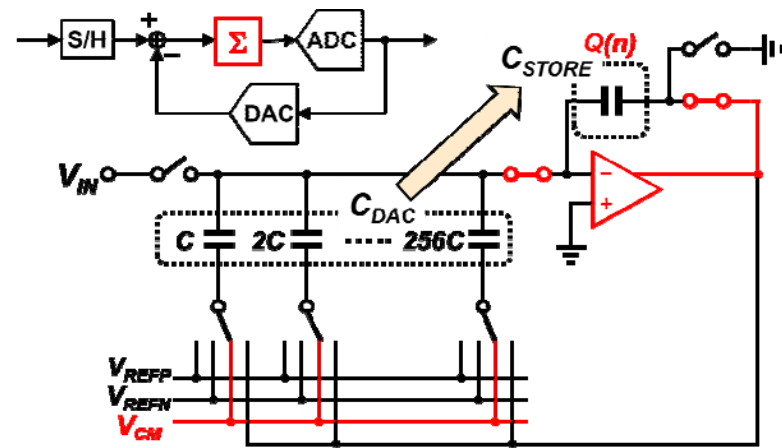- C_{DAC} set the difference voltage

2. Σ phase

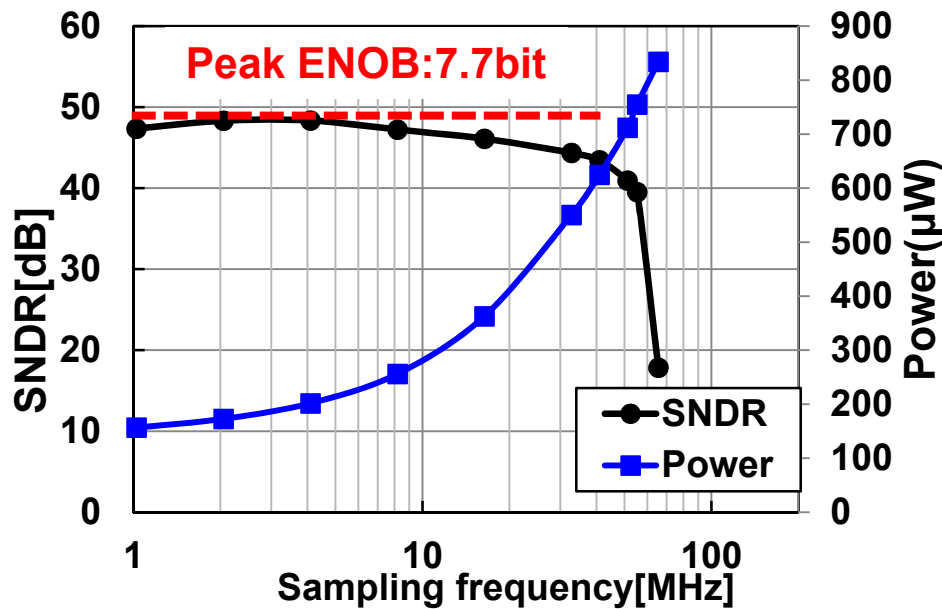- The charge is transferred C_{STORE} to C_{DAC}
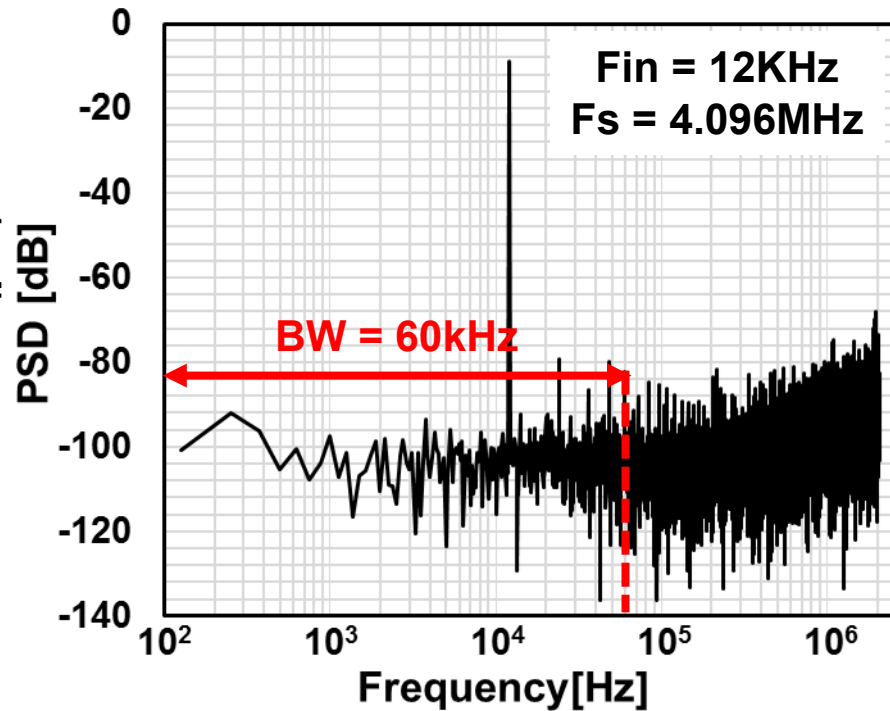
3. Quantization Phase

4. Store phase

- the integrated signal returns to C_{STORE}

Measurement Results

- ## SAR only mode
  ### Sampling freq. vs SNDR, Power

- ## ΔΣ assisted mode
  ### FFT spectrum

w/ digital processing
SNDR=62.9dB