

# A 0.5-V Sigma-Delta Modulator Using Analog T-Switch Scheme for the Subthreshold Leakage Suppression

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Digital circuits have been greatly improved.

However, analog circuits such as amplifier, ADC, and filter are still essential.

## Requirements for Analog Circuits in Ubiquitous Electronics

- Small and Low Cost

SOC(System-On-a-Chip)

**Compatibility with Logic Process**

- Battery-Less or Driven by Solar Cells

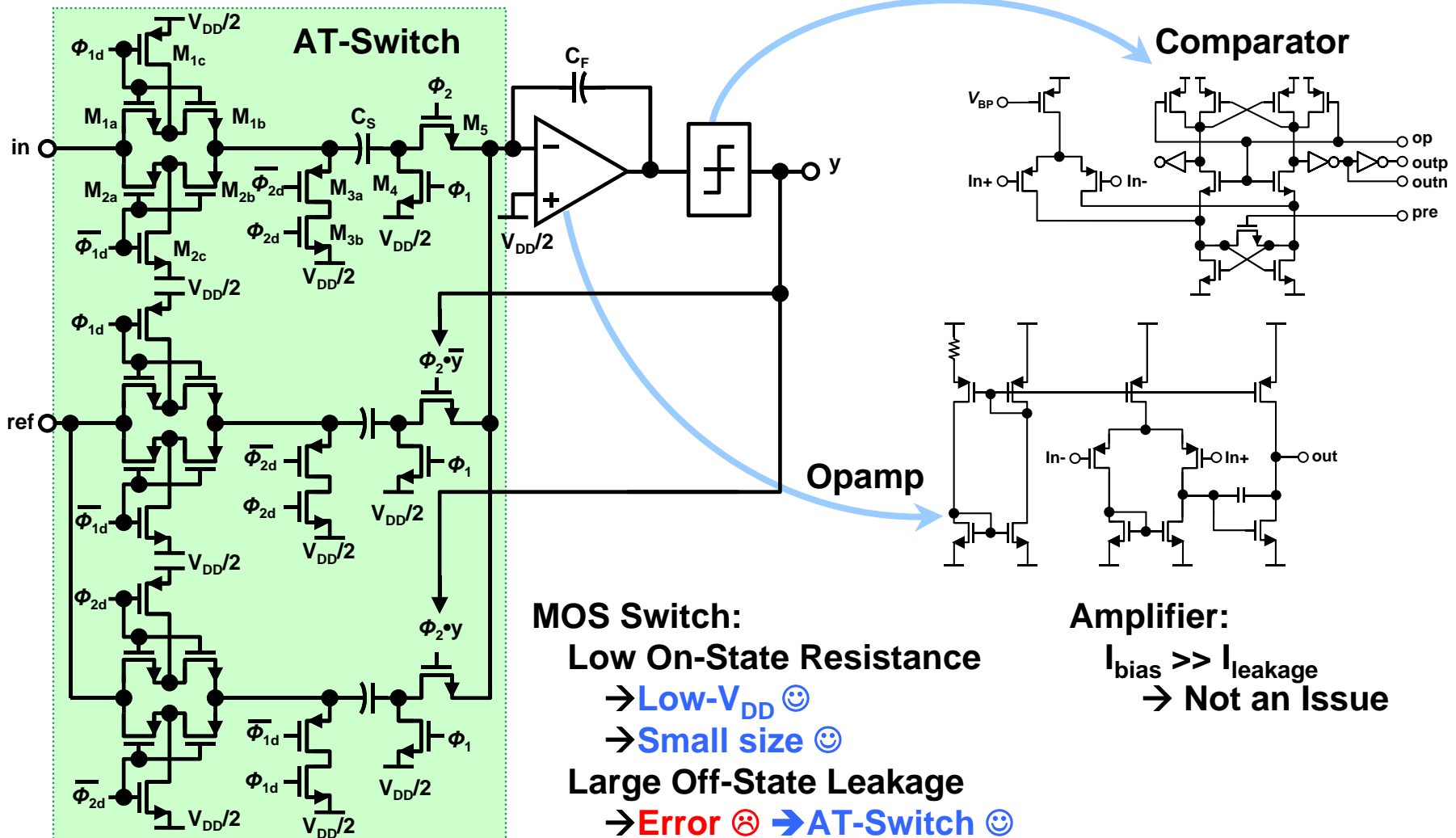
**Low-Voltage, Low-Power**

→ Use Scaled Devices (Small size, Low- $V_{DD}$ , Low- $V_{TH}$ )

→ Realize Low- $V_{DD}$  ADC

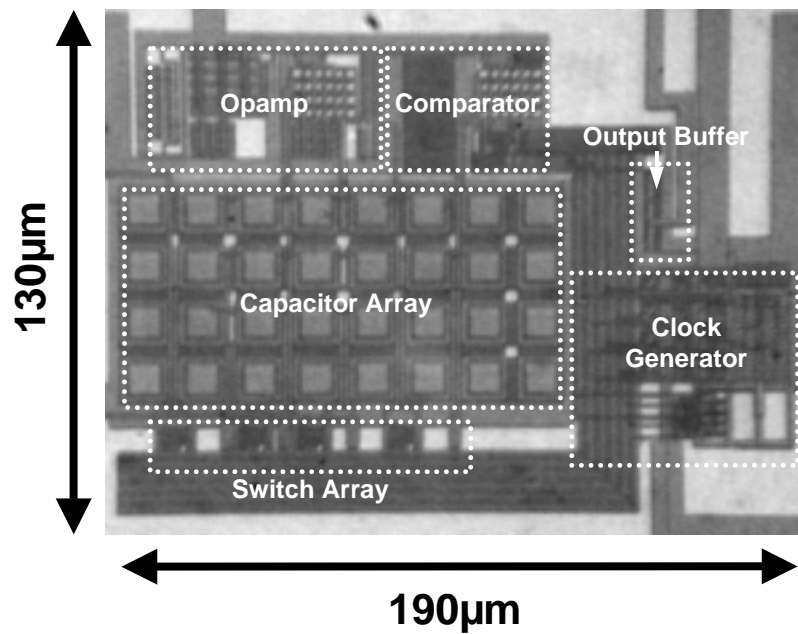


# 0.5-V Sigma-Delta ADC Utilizing AT-Switch



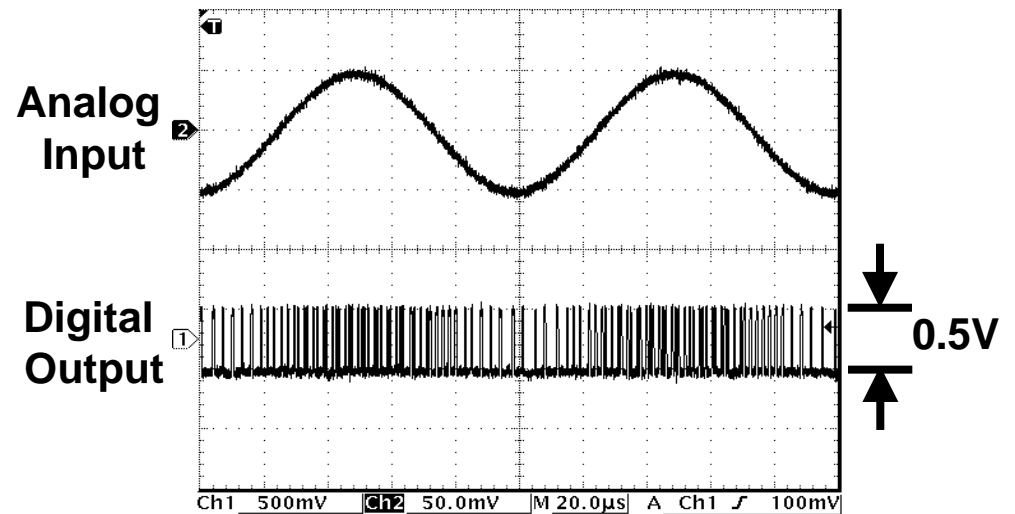
# Chip Photo and Measured Waveform

## Chip Microphotograph



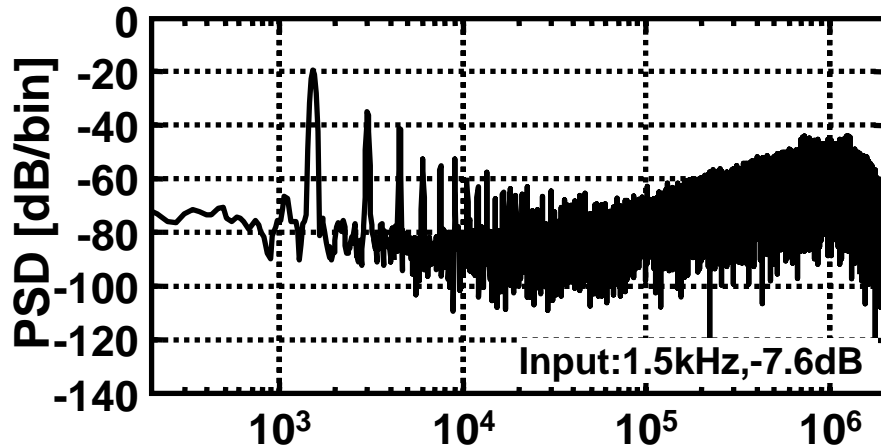
0.15-μm FD-SOI

## Output Waveform

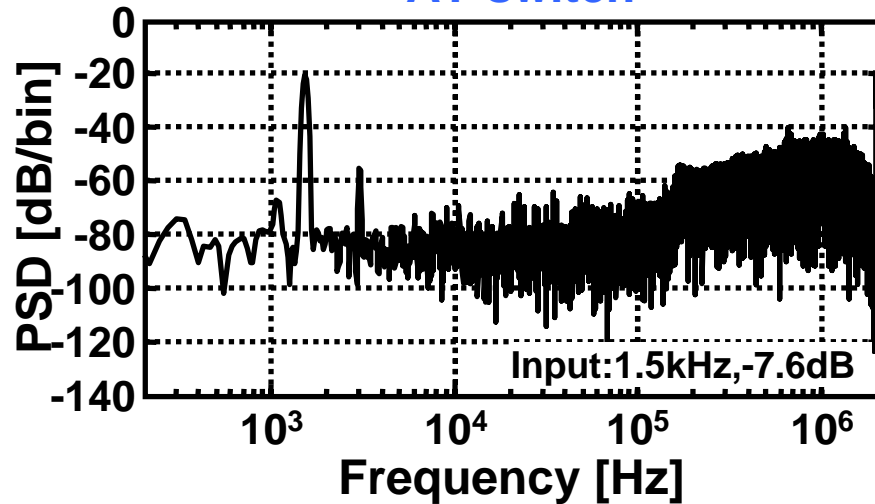


# Measured PSD and SNDR

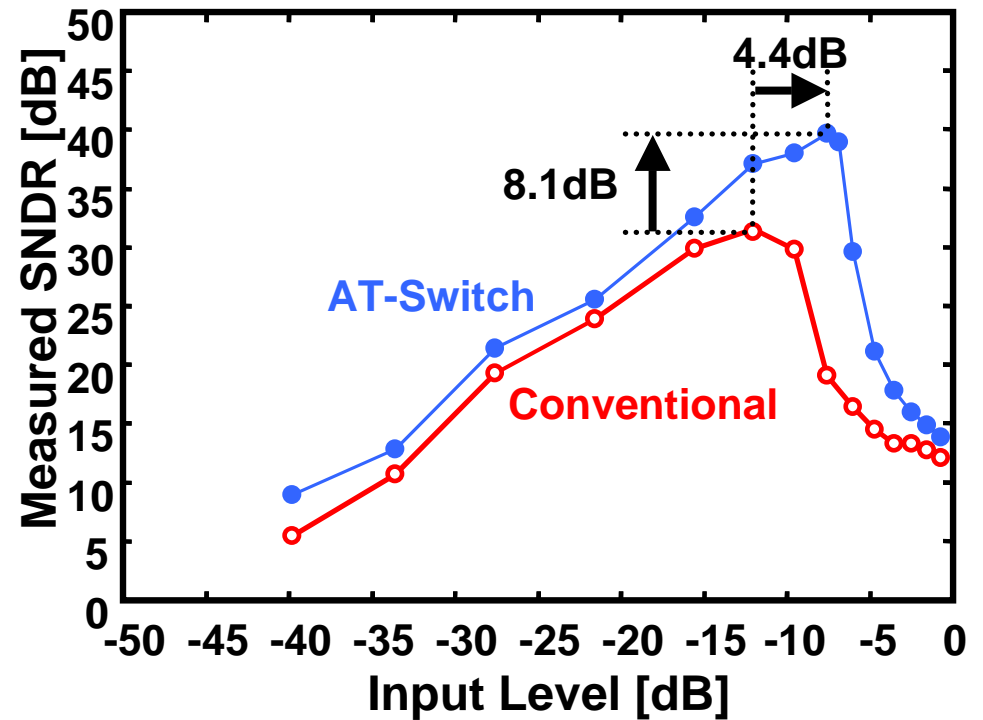
Conventional



AT-switch



$V_{DD}$ :0.5V,  $F_S$ :2MHz, BW:8kHz, Input:1.5kHz



# Conclusion

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**A 0.5-V sigma-delta analog-to-digital converter utilizing AT-Switch is experimentally verified with 0.15- $\mu\text{m}$  FD-SOI and the chip area is 130 $\mu\text{m}$   $\times$  190 $\mu\text{m}$ .**

- **Using Low  $V_{\text{TH}}$  MOS and AT-Switch Scheme**
- **High Conductivity yet Small Leakage Current**
- **Suitable for Low  $V_{\text{DD}}$  Operation**

