# ADC Successive Approximation

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**Step Size:** the smallest change that can be discerned by an ADC.

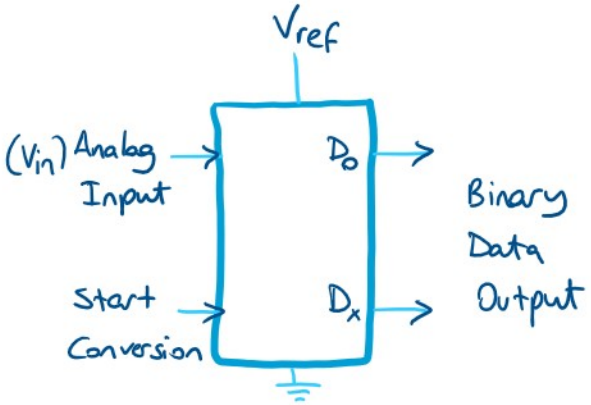
**Resolution:** defines the number of possible unique digital output values the ADC can produce

**Reference Voltage:** determines the highest signal level that the ADC can convert.

**Conversion Time:** required for converting an analog input into a digital number.

- MOS: Metal Oxide Semiconductor
- TTL: Transistor - Transistor Logic

## ADC Block Diagram




$$V_{ref} = V_{ref}(max) - V_{ref}(min)$$

## Digital Data Output

$$D_{out} = \frac{V_{in}}{\text{step size}} = \frac{V_{in}}{V_{ref}/2^n}$$

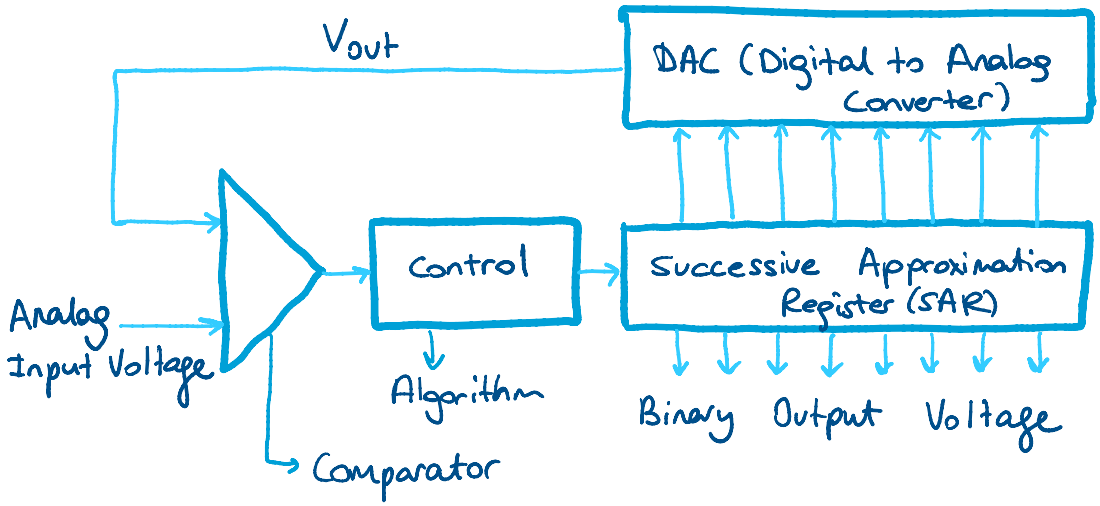
$2^n$ → Resolution ($n$ = bit size)

## Calculating $V_{DAC}$

$$V_{DAC} = (SAR) \times \text{Stepsize}$$

SAR = Successive Approximation Register

# ✱ SUCCESSIVE APPROXIMATION ILLUSTRATION




# ✱ SUCCESSIVE APPRX. ALGORITHM

for n bit ADC

1. Set the index to n-1 (most significant bit).
2. Start with SAR set to highest possible value (1000 for 4-bit).
3. read an input Voltage (Vin)
4. if index > 0 set SAR[index-1] = 1
5. Compare Vin with $V_{DAC}$

   if Vin > $V_{DAC}$

   SAR[index] = 1

   else

   SAR[index] = 0

6. Index--; 7.