



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35**  
**An Autonomous Institution**



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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **19ECB204 – LINEAR AND DIGITAL CIRCUITS**

II YEAR/ III SEMESTER

#### **UNIT 2 – COMPARATORS AND SPECIAL FUNCTION IC's**

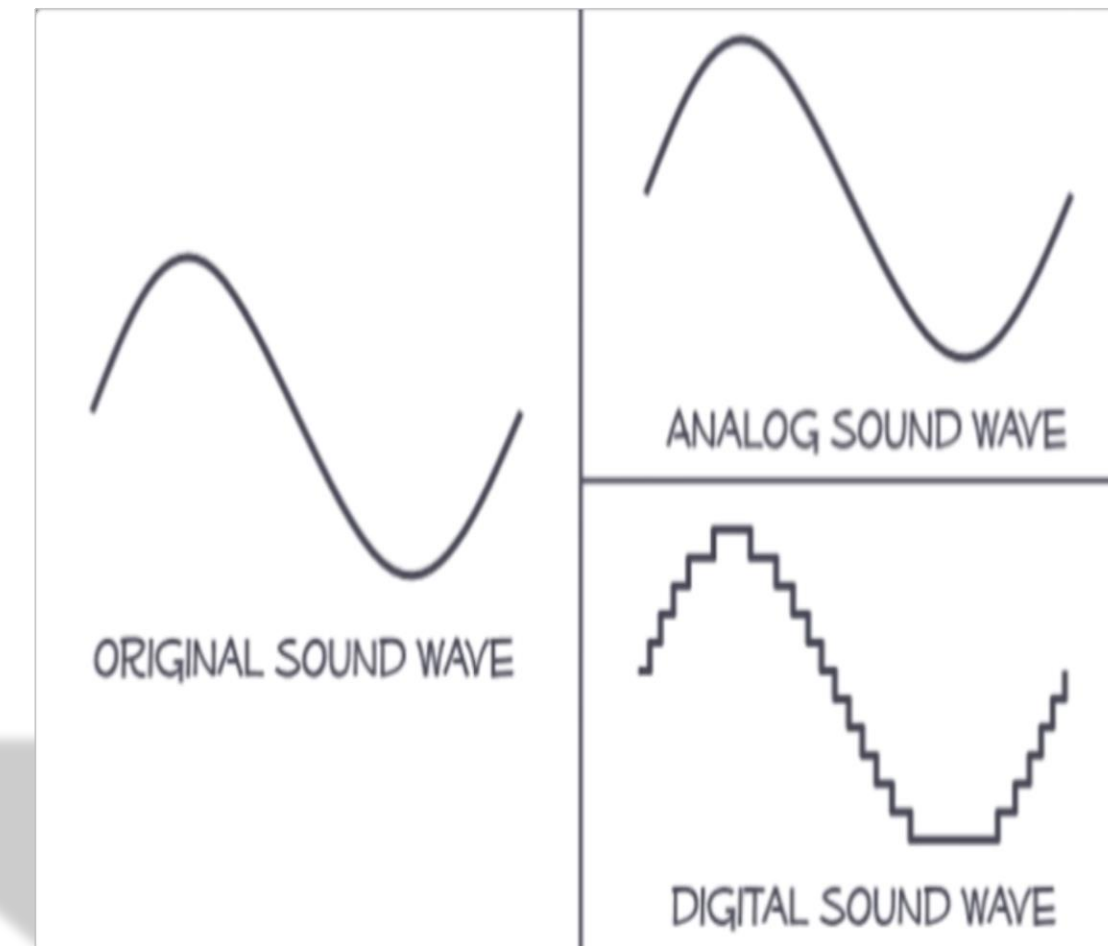
#### **TOPIC 8 - Analog to Digital Converter**



# Types of ADC



- 1) Direct type
  - i) Flash type
  - ii) Successive Approximation
  
- 2) Integrating type of ADC
  - i) Dual slope ADC
  - ii) Ramp type





## Flash Type



- It is one of the simplest types of ADC. In the above diagram resistors are connected in network and it acts as a voltage divider.
- The resistive network is connected with the comparator.
- The comparator itself can resolve the problem while it is given with the same level of voltage.
- Generally the comparator compares the 2 levels of voltages given to its 2 input terminal.
- If the analog input voltage  $V_a$  is connected with the non inverting terminal and the reference voltage  $V_r$  is given to its inverting terminal.



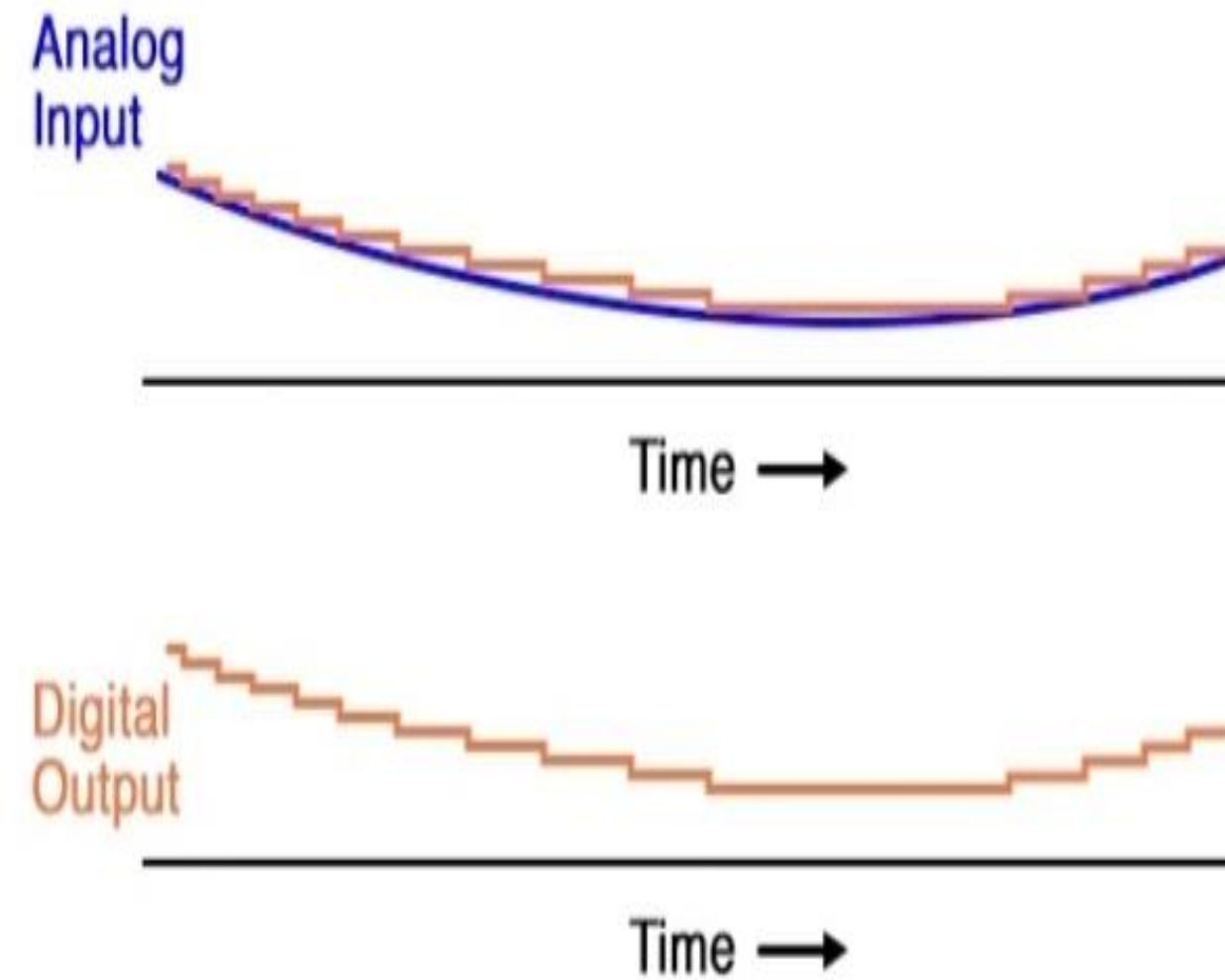
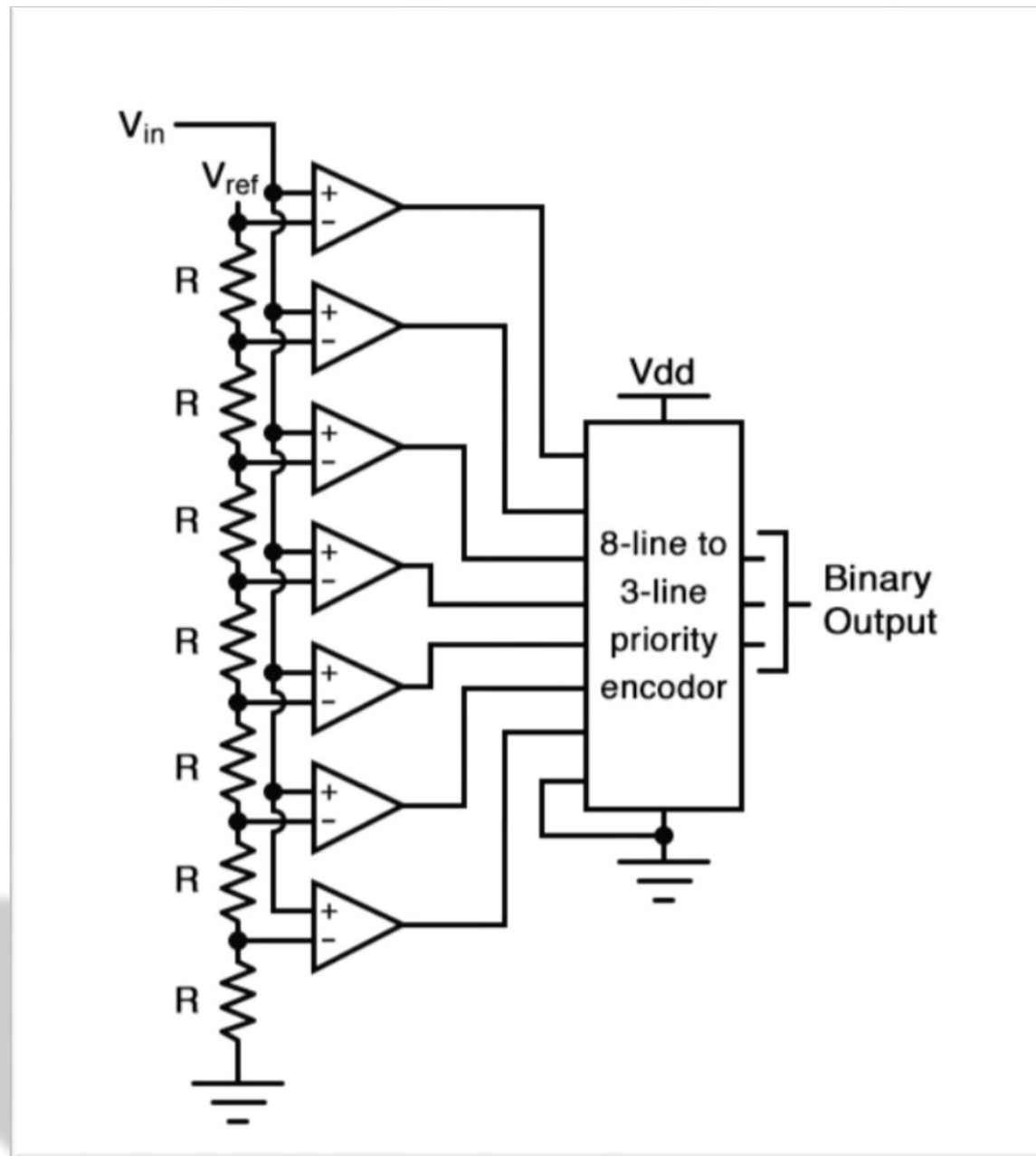
## Flash Type



- The comparator compares these 2 voltages ( $V_a$  &  $V_r$ ) and produces its output as:
  - i) If  $V_a$  greater than  $V_d$  output will be 1.
  - ii) If  $V_a$  greater than  $V_r$  output will be 0.
  - iii) If  $V_a = V_d$  the previous value will be maintained.
- This comparison takes place simultaneously at all the nodes within 100ns. The conversion speed is depends upon the comparator speed and the priority encoder.
- The main drawback of this convertor is that it requires more number of comparator for minimum number of bit operations.
- That is for „n“ number of bits conversion it needs  $2^n - 1$  number of comparator. It will increase the cost of the system.



# Flash Type





# Advantages and Disadvantages



ADVANTAGES	DISADVANTAGES
Very fast	Expensive
Very simple operator theory.	Each addition bit of resolution requires twice the comparator.
Speed is only limited by gate and comparator propagation delay.	Prone to produce glitches in the output.



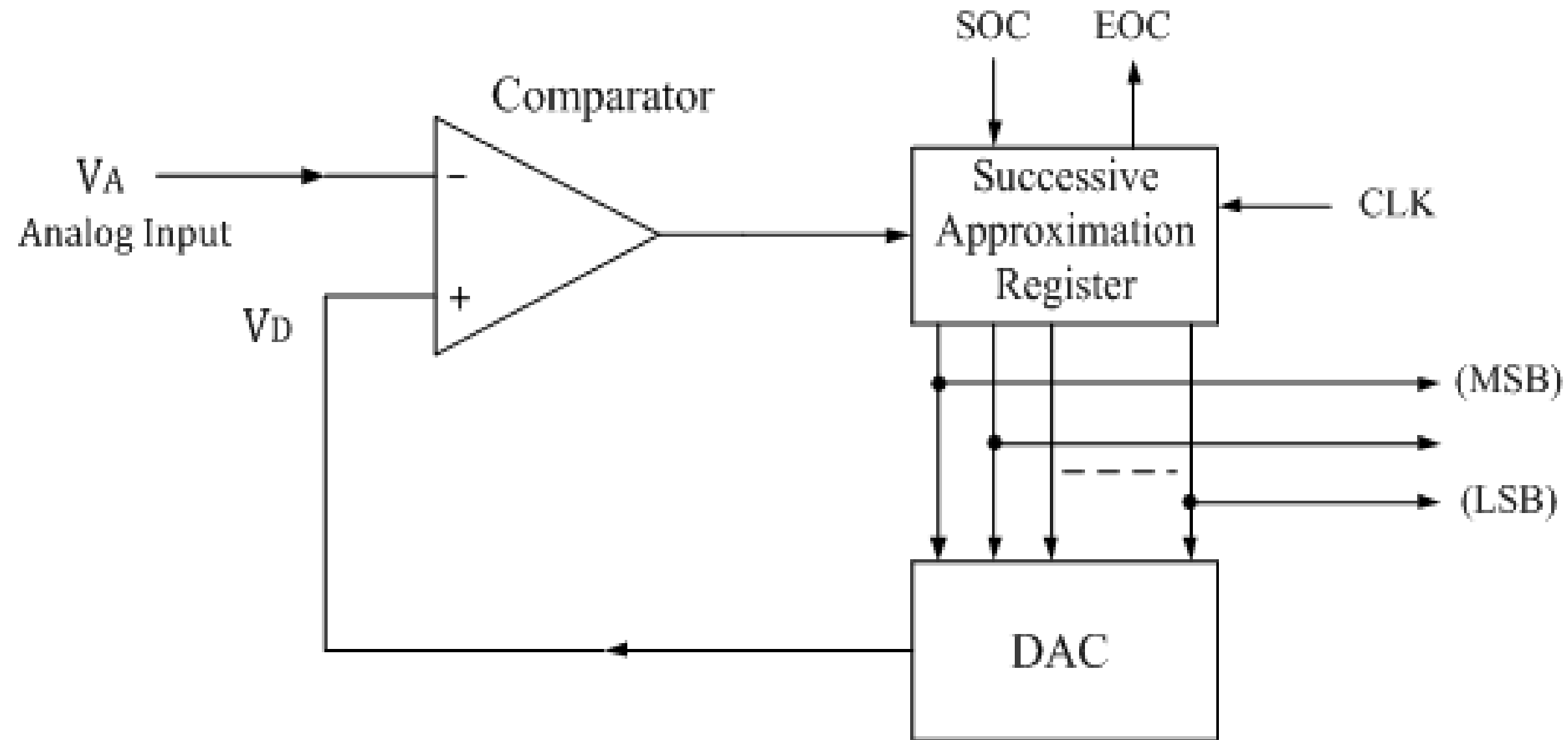
# Successive Approximation



- A **successive-approximation ADC** is a type of analog-to-digital **converter** that converts a continuous analog waveform into a discrete digital representation using a binary search through all possible quantization levels before finally converging upon a digital output for each **conversion**.
- **SOC** [Start of conversion]: When High to low signal is appears to this pin of ADC, ADC then starts conversion. **EOC** [End of conversion]: ADC sends this high **EOC** signal to Micro-Controller to indicate completion of conversion.



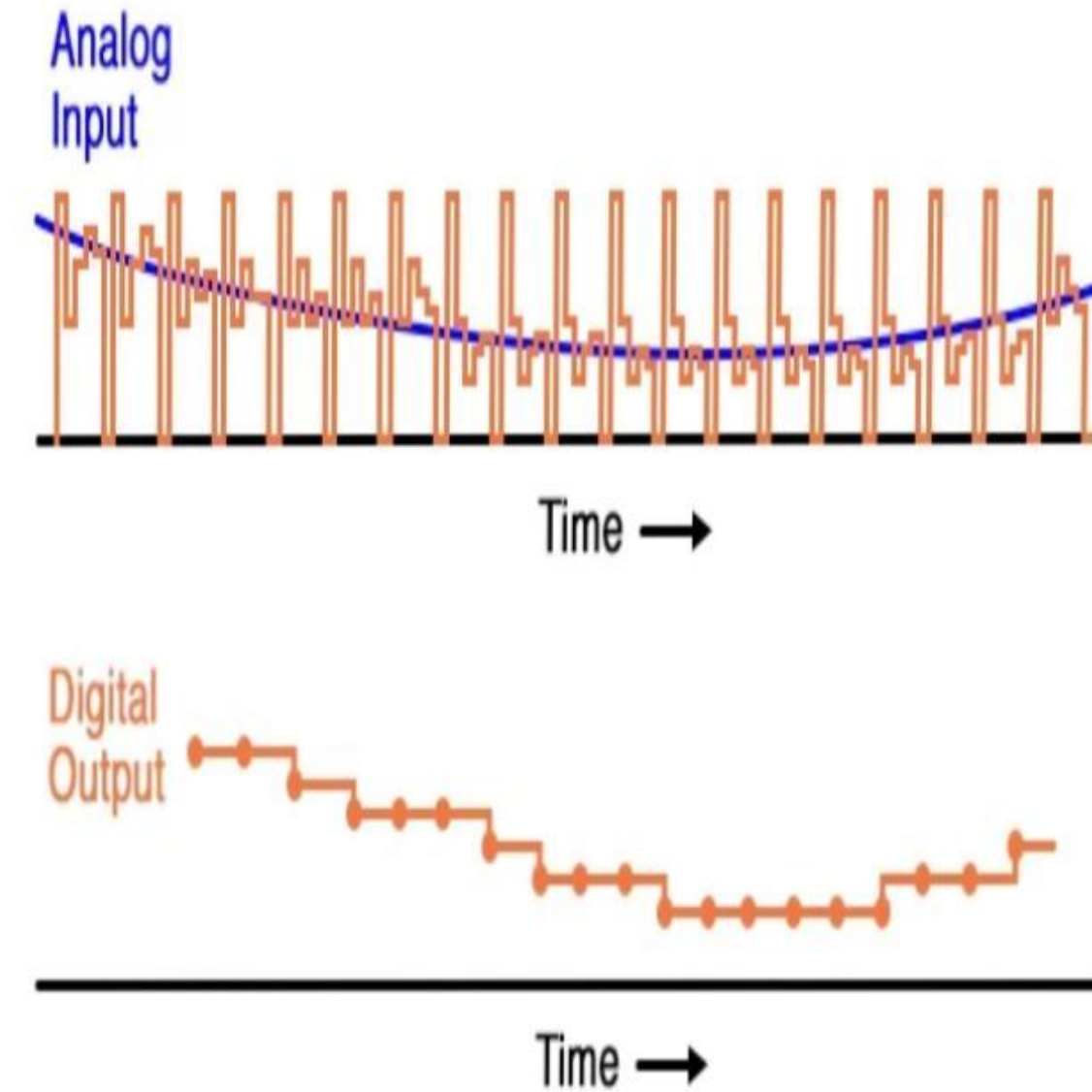
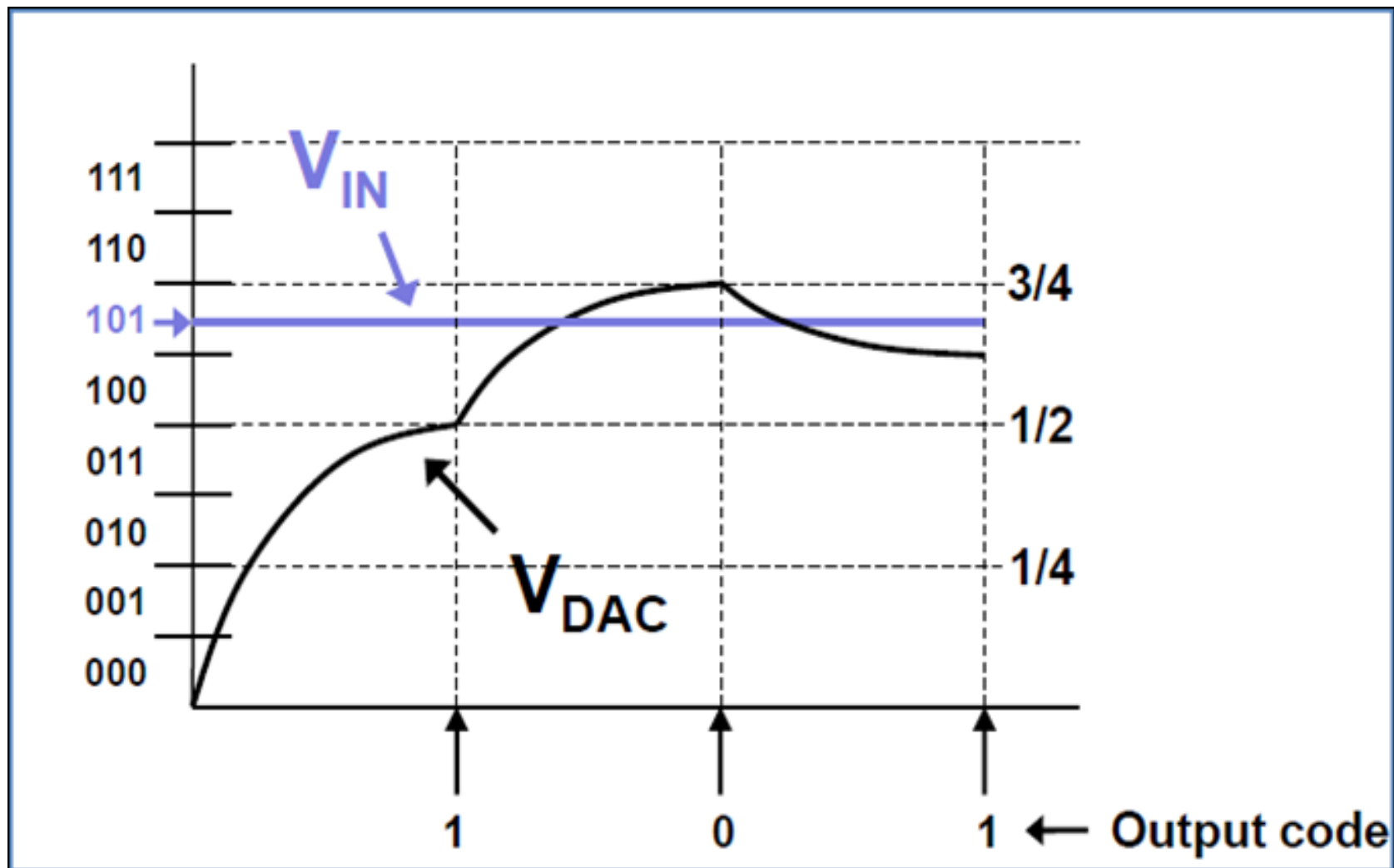
# Successive Approximation







# Successive Approximation





# Successive Approximation



- It is one of the efficient methods of ADC. It needs „n“ number of clock periods for „n“ number of bits conversion.
- Consists 3 main parts
  - i) Comparator
  - ii) Successive Approximation registers
  - iii) DAC
- The analog input voltage  $V_a$  is given to the inverting terminal of comparator and the output of DAC is given to the non inverting terminal of the comparator.
- If the start pulse is given to SAR, the SAR makes  $d_1$  become one state and makes all other bits are to be zero, so that the code of SAR is 100000000.



# Successive Approximation



- The output of DAC called  $V_d$  is compared with  $V_a$  is greater than  $V_d$  then the code generated is less than the digital representation.
- Then consider the next MSB bit & make it to „1“. So the data bit becomes 01000000 & it is also tested further and so on.
- However if  $V_a < V_d$  then the data bit is greater than the correct digital representation.
- At the time the SAR reset the MSB to zero & make the next lower MSB to be „1“ and it will be continuous process until all the bits are tested correctly.
- After finishing the conversion is given to SAR to reset the SAR to start the next code word operations.



# Advantages and Disadvantages



ADVANTAGES	DISADVANTAGES
Conversion time is very small	Circuit is complex.
Conversion time is constant and independent of the analog of the input signal.	The conversion time is more compared to flash type ADC



**THANK YOU**