SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
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
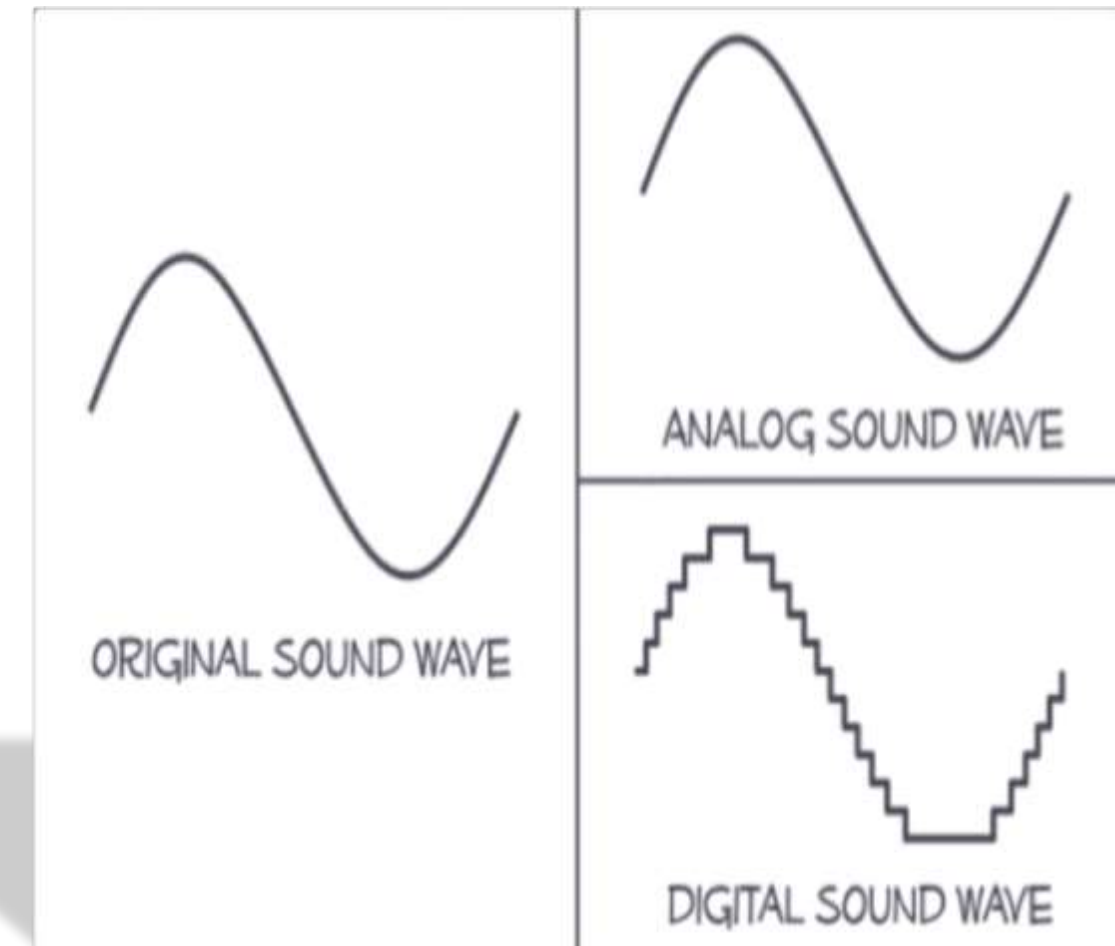
TOPIC 8 - Analog to Digital Converter

Types of ADC

1) Direct type
   i) Flash type
   ii) Successive Approximation

2) Integrating type of ADC
   i) Dual slope ADC
   ii) Ramp type

ANALOG SOUND WAVE

ORIGINAL SOUND WAVE

DIGITAL SOUND WAVE

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 he analog input voltage Va is connected with the non inverting terminal and the reference voltage Vr is given to its inverting terminal.
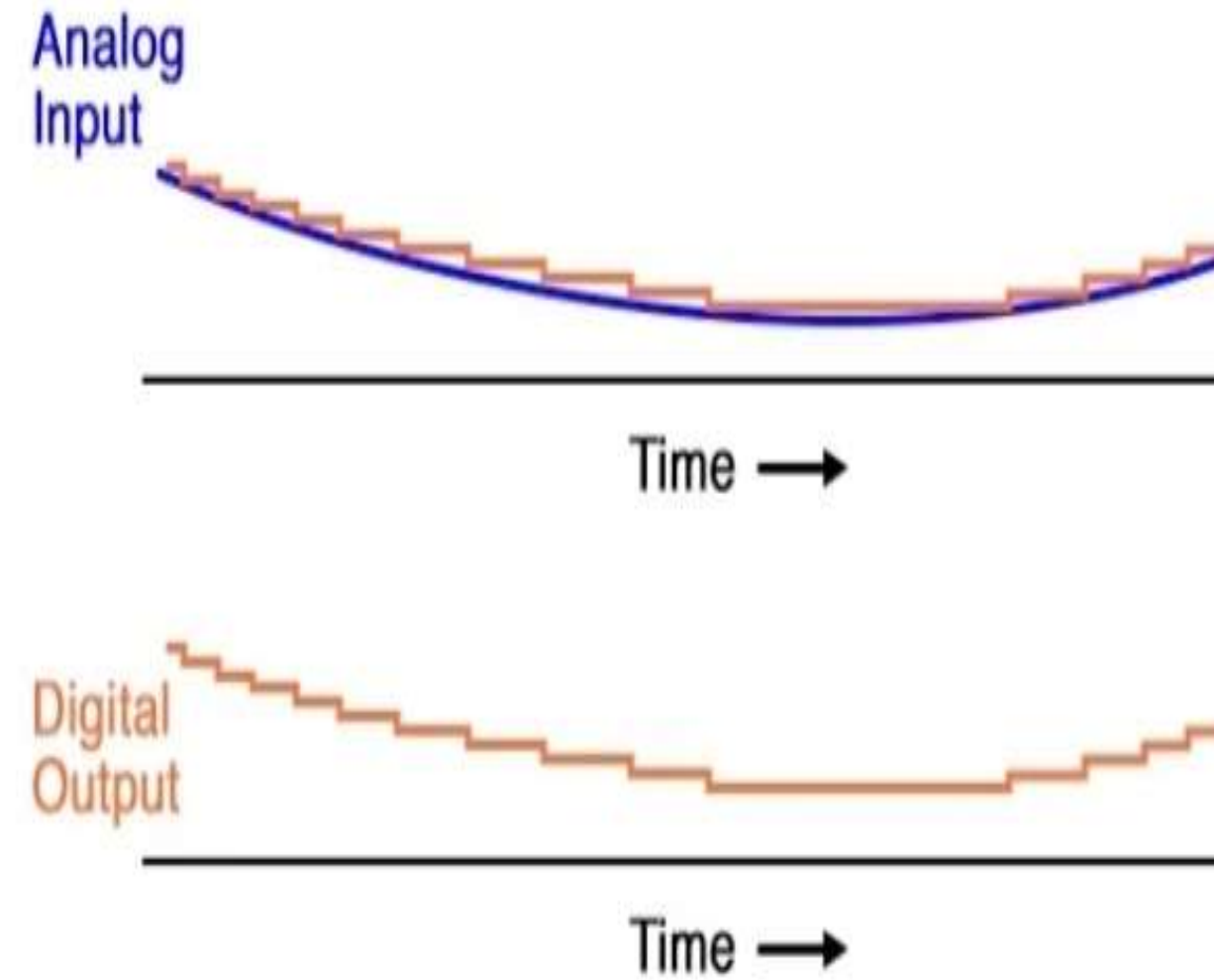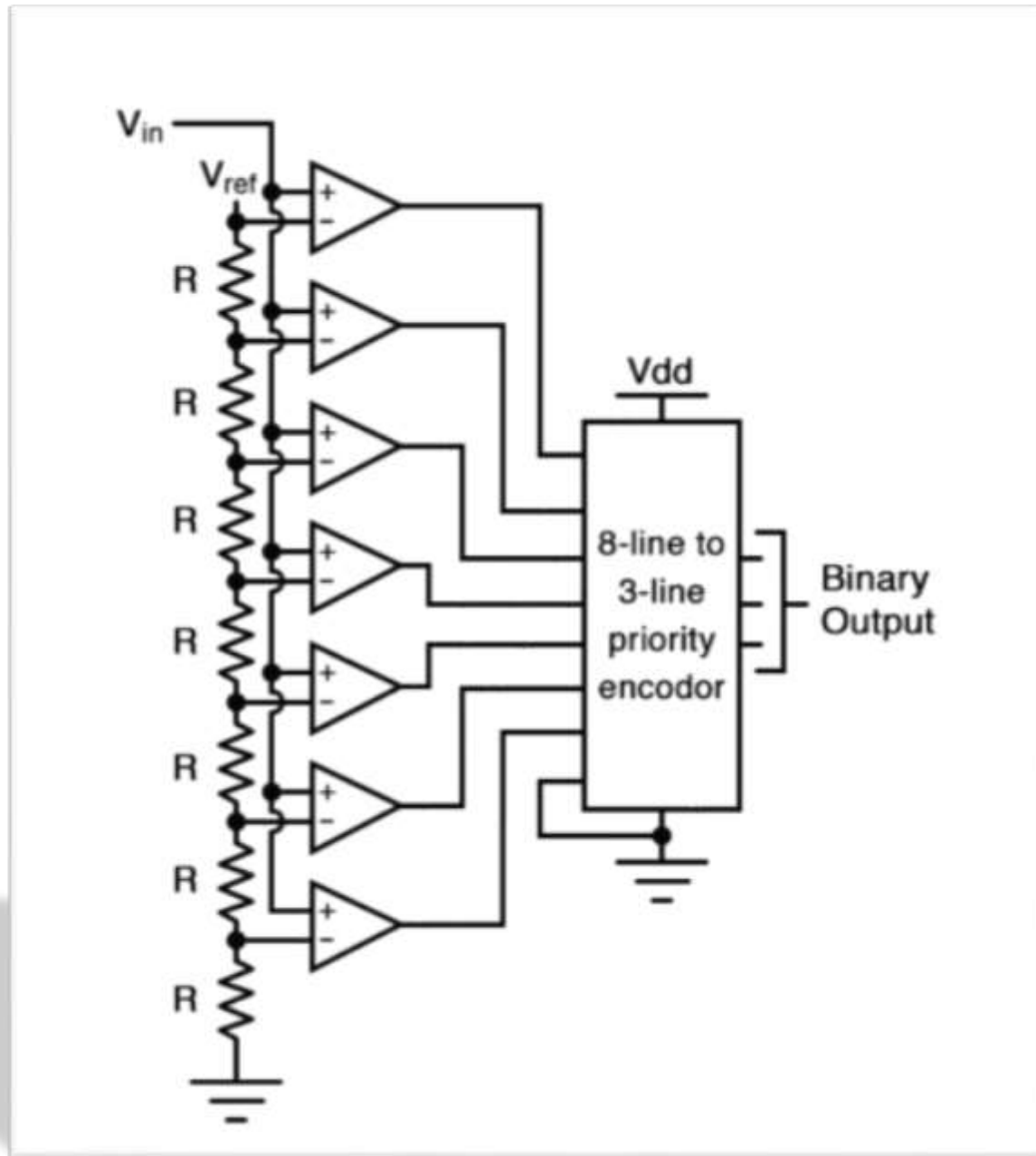
Flash Type

➤ The comparator compares these 2 voltages (Va & Vr) and produces its output as:

➤ i) If Va greater than Vd output will be 1.

➤ ii) If Va greater than Vr output will be 0.

➤ iii) If Va = Vd 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 2n-1 number of comparator. It will increase the cost of the system.

Analog to Digital Converter/19ECB204/Linear and Digital Circuits / Dr.B.Sivasankari,ASP/ECE/SNSCT

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 dely.	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.
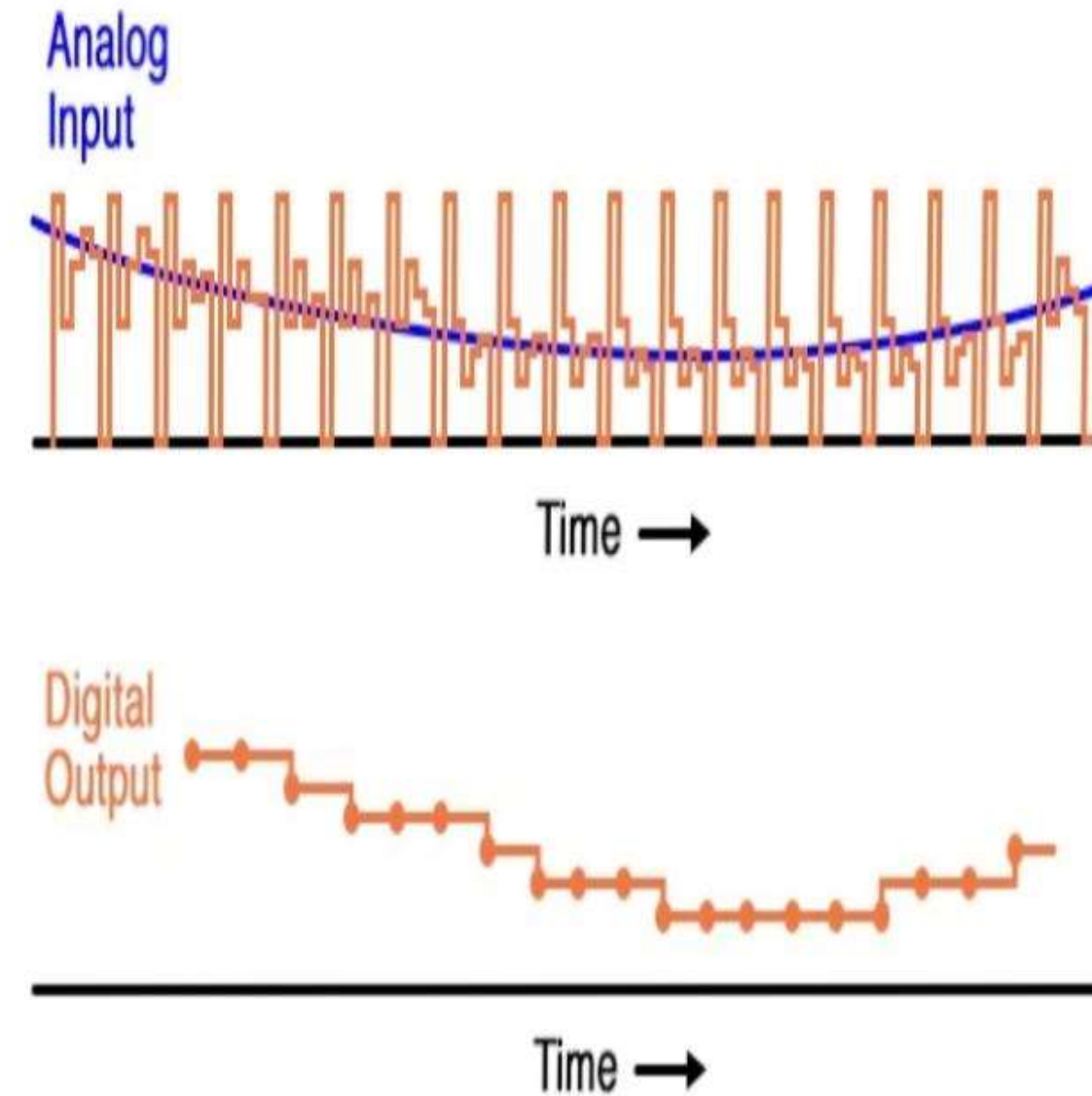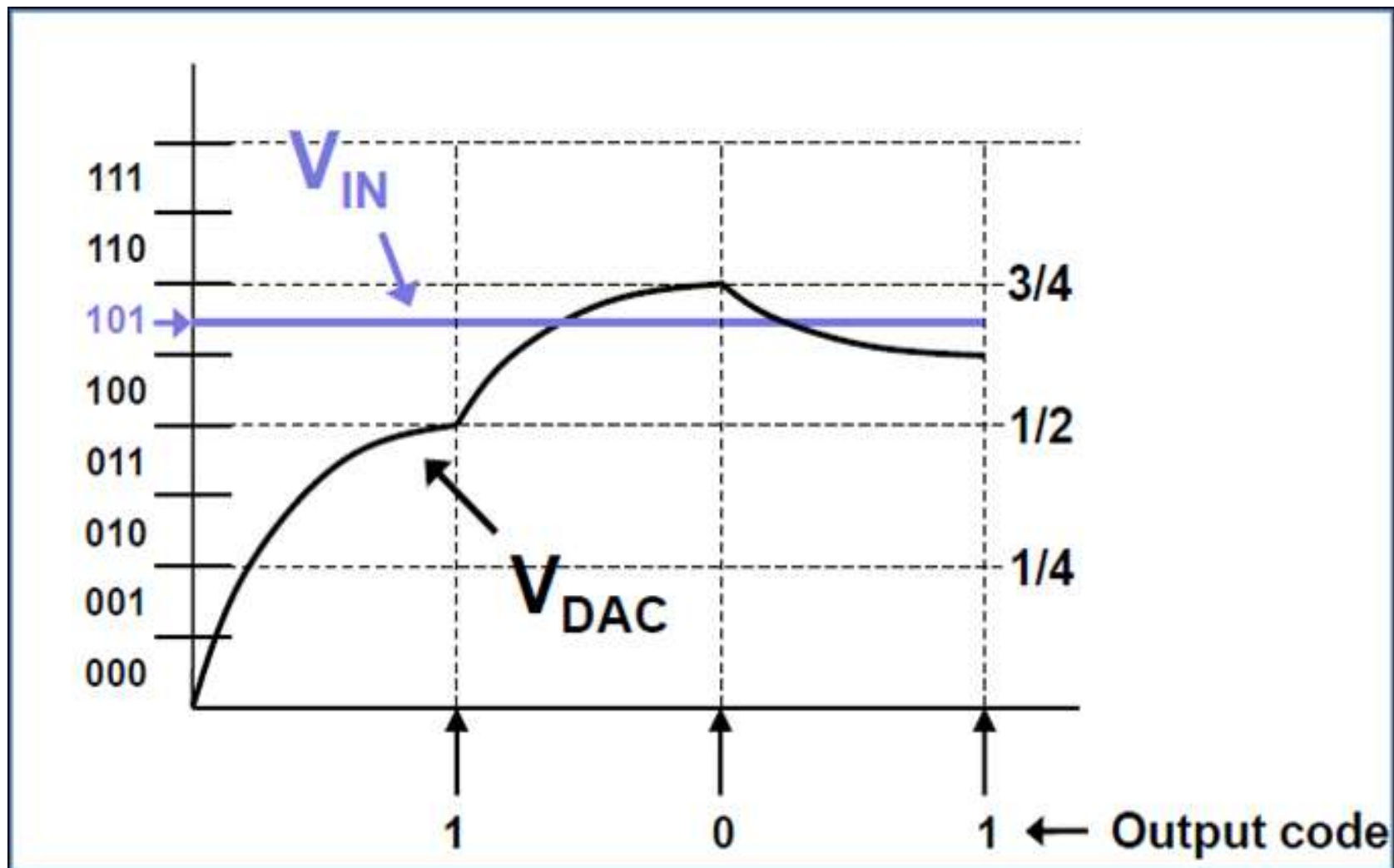
Successive Approximation

Analog to Digital Converter/19ECB204/Linear and Digital Circuits / Dr.B.Sivasankari,ASP/ECE/SNSCT
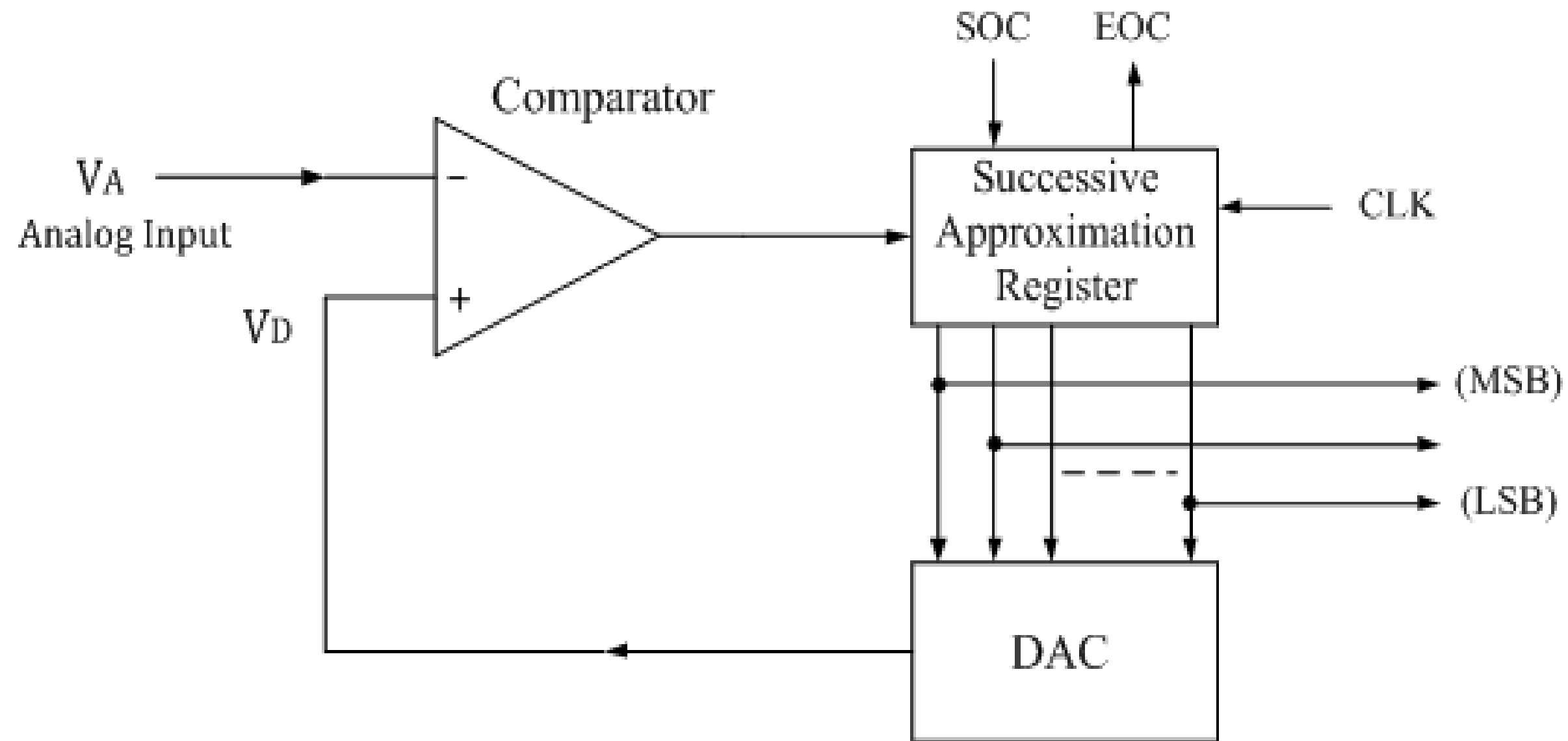
Successive Approximation

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 Va 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 d1 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 Vd is compared with Va is greater than Vd then the code generated is less than the digital representation.

➢ Then consider the next MSB bit & make it to „I". So the data bit becomes 01000000 & it is also tested further and so on.

➢ However if Va < Vd 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 „I" 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.

Analog to Digital Converter/19ECB204/Linear and Digital Circuits / Dr.B.Sivasankari,ASP/ECE/SNSCT

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