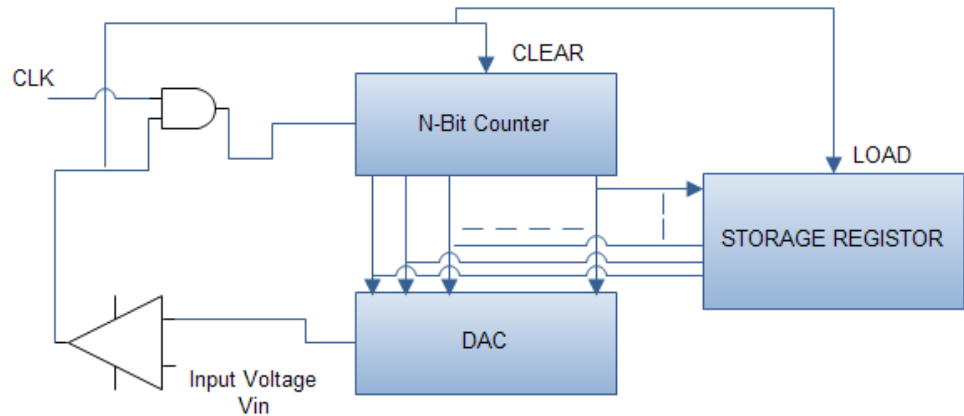


A/D Converter (Counter Type)

The Counter type ADC is the basic type of ADC which is also called as digital ramp type ADC or stair case approximation ADC. This circuit consists of N bit counter, DAC and Op-amp comparator as shown in below figure.

Operation of counter type ADC

The N bit counter generates an n bit digital output which is applied as an input to the DAC. The analog output corresponding to the digital input from DAC is compared with the input analog voltage using an op-amp comparator. The op-amp compares the two voltages and if the generated DAC voltage is less, it generates a high pulse to the N bit counter as a clock pulse to increment the counter. The same process will be repeated until the DAC output equals to the input analog voltage.



If the DAC output voltage is equal to the input analog voltage, then it generates low clock pulse and it also generates a clear signal to the counter and load signal to the storage resistor to store the corresponding digital bits. These digital values are closely matched with the input analog values with small quantization error.

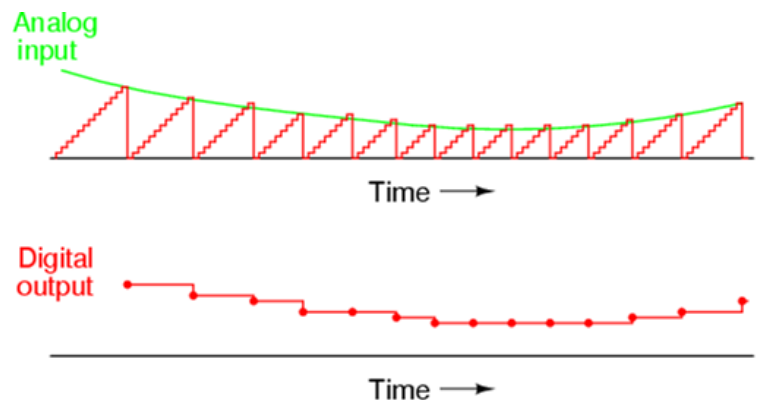
For every sampling interval the DAC output follows a ramp fashion so that it is called as Digital ramp type ADC. And this ramp looks like stair cases for every sampling time so that it is also called as staircase approximation type ADC.

Conversion time of Counter type ADC

Conversion time of ADC is the time taken by the ADC to convert the input sampled analog value to digital value. Here the maximum conversion of high input voltage for a N bit ADC is the clock pulses required to the counter to count its maximum count value. So the maximum conversion of Counter type ADC is $= (2N-1) T$, where, T is the time period of clock pulse.

If N=2 bit then the $T_{max} = 3T$.

By observing the above conversion time of Counter type ADC it is illustrated that the sampling period of Counter type ADC should be $T_s \geq (2N-1) T$



Advantages of Counter type ADC

- Simple to understand and operate.
- Cost is less because of less complexity in design.

Disadvantages or limitations of Counter type of ADC

- Speed is less because every time the counter has to start from ZERO.
- There may be clash or aliasing effect if the next input is sampled before completion of one operation.