Recap.

Sampled data Control Loop ⇒ Periodically sampled output $y(t)$ is digitized and the discrete signal is sent to a discrete controller. The output of the controller $u(kT)$ is passed through a sample and hold circuit and the output of the Z_{OH} $u^*(t)$ is fed to continuous time actuator and plant.

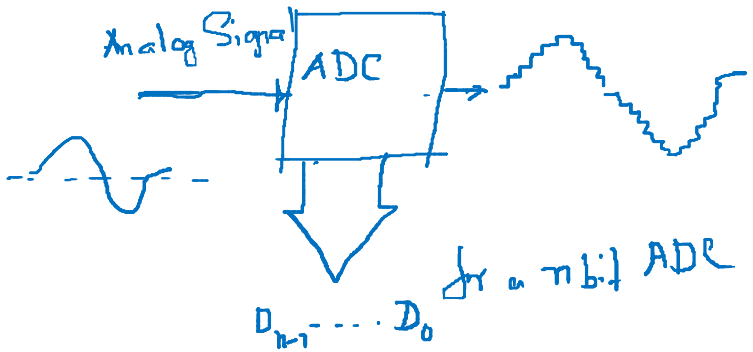
↳ Specification of an ADC.

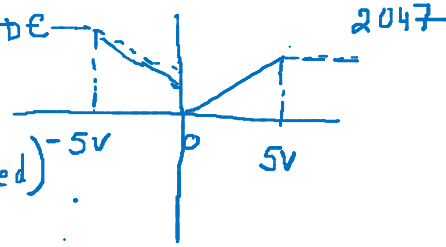
(i) No of bits. (8 bit, 12 bit, Signed or unsigned)

(ii) Input voltage range.

(iii) Conversion time (Depends on Type of ADC).

(iv) Error bound.



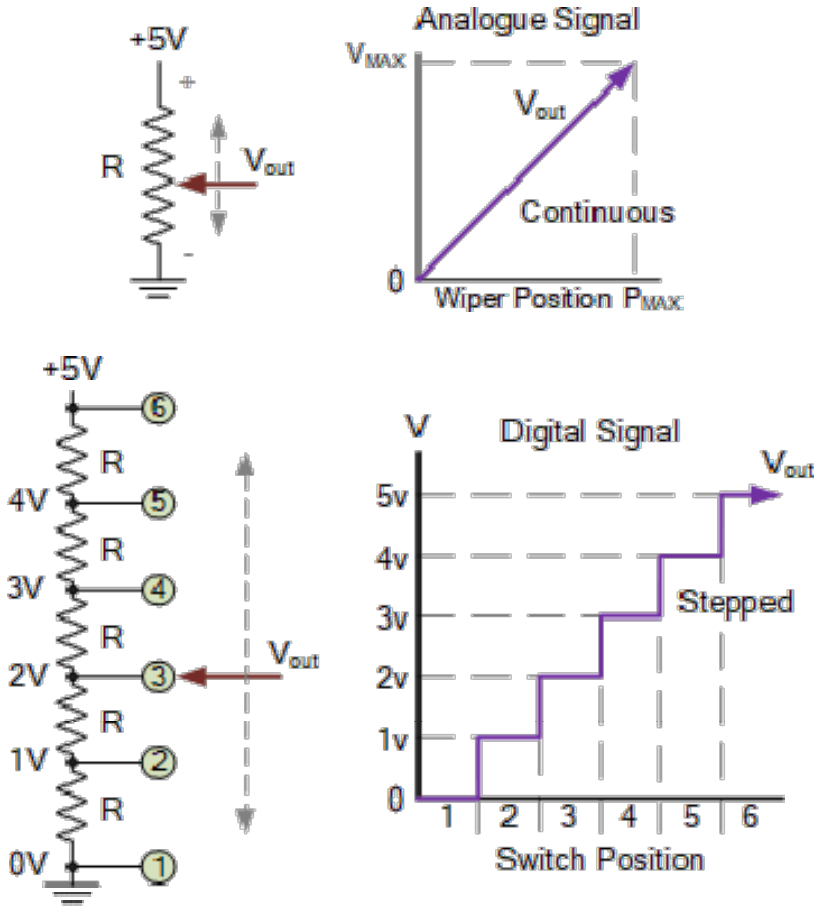


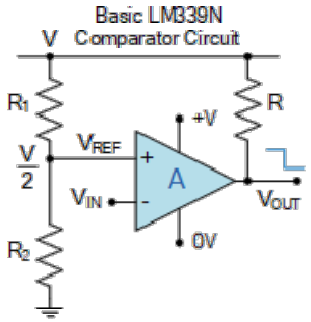
$\pm 5V$ $\varepsilon = \pm LSB * 0.5$

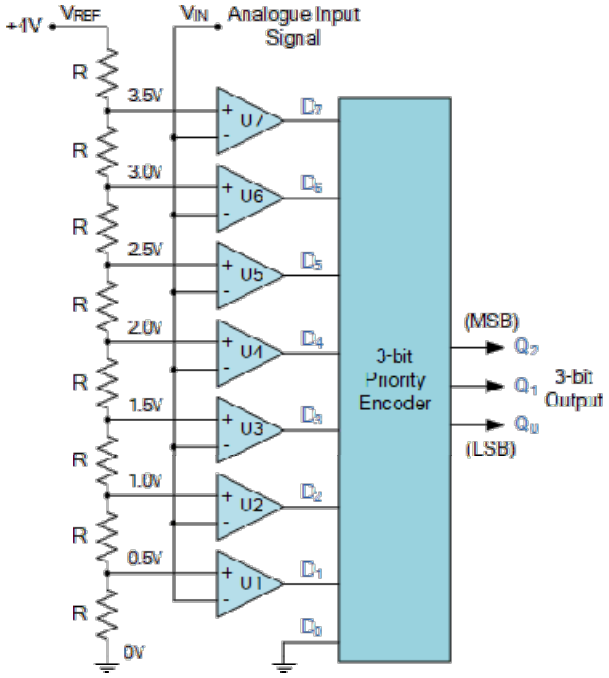
$-5V$ to $+5V$ for a 'n' bit ADC

$$\frac{|V|}{2^{n-1}}$$

Analog and Digital Signals

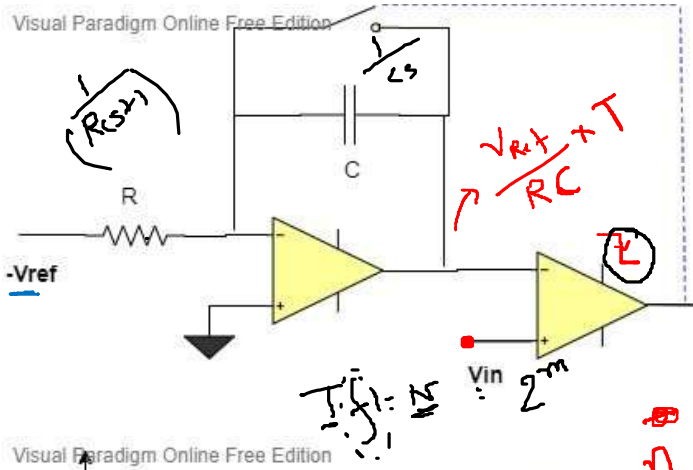




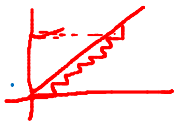


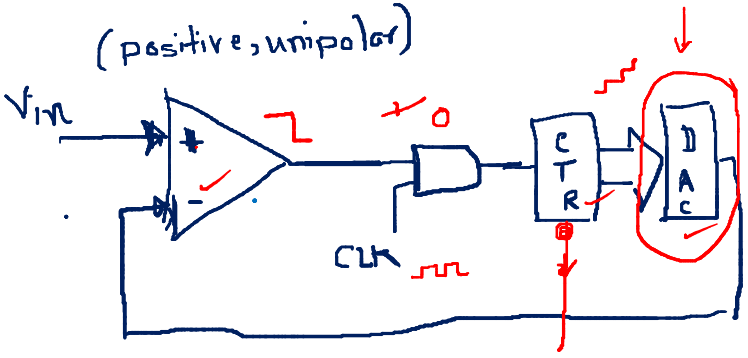
Analogue Input Voltage (V_{IN})	Comparator Outputs								Digital Outputs		
	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	Q_2	Q_1	Q_0
0 to 0.5 V	0	0	0	0	0	0	0	**0**	0	0	0
0.5 to 1.0 V	0	0	0	0	0	0	**1**	X	0	0	1
1.0 to 1.5 V	0	0	0	0	0	**1**	X	X	0	1	0
1.5 to 2.0 V	0	0	0	0	**1**	X	X	X	0	1	1
2.0 to 2.5 V	0	0	0	**1**	X	X	X	X	1	0	0
2.5 to 3.0 V	0	0	**1**	X	X	X	X	X	1	0	1
3.0 to 3.5 V	0	**1**	X	X	X	X	X	X	1	1	0
3.5 to 4.0 V	**1**	X	X	X	X	X	X	X	1	1	1

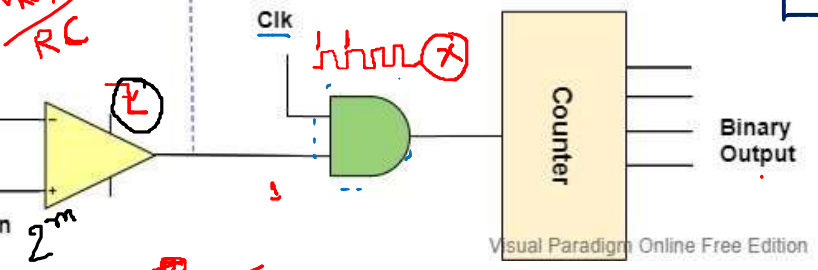
Single slope type AD Converter



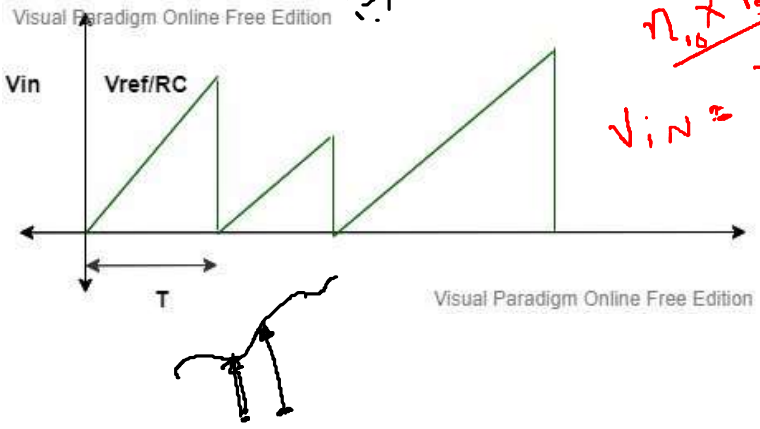
Wilkinson Type Integrating ADC



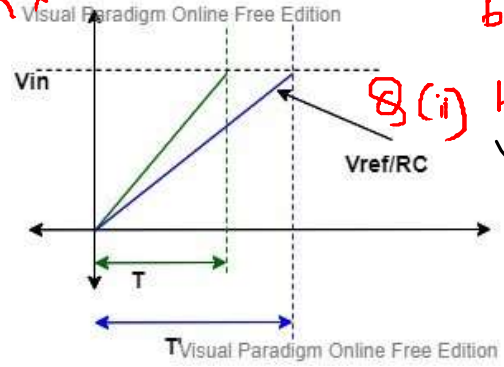




Conversion time Reset. depends on the input voltage. for the setup above.

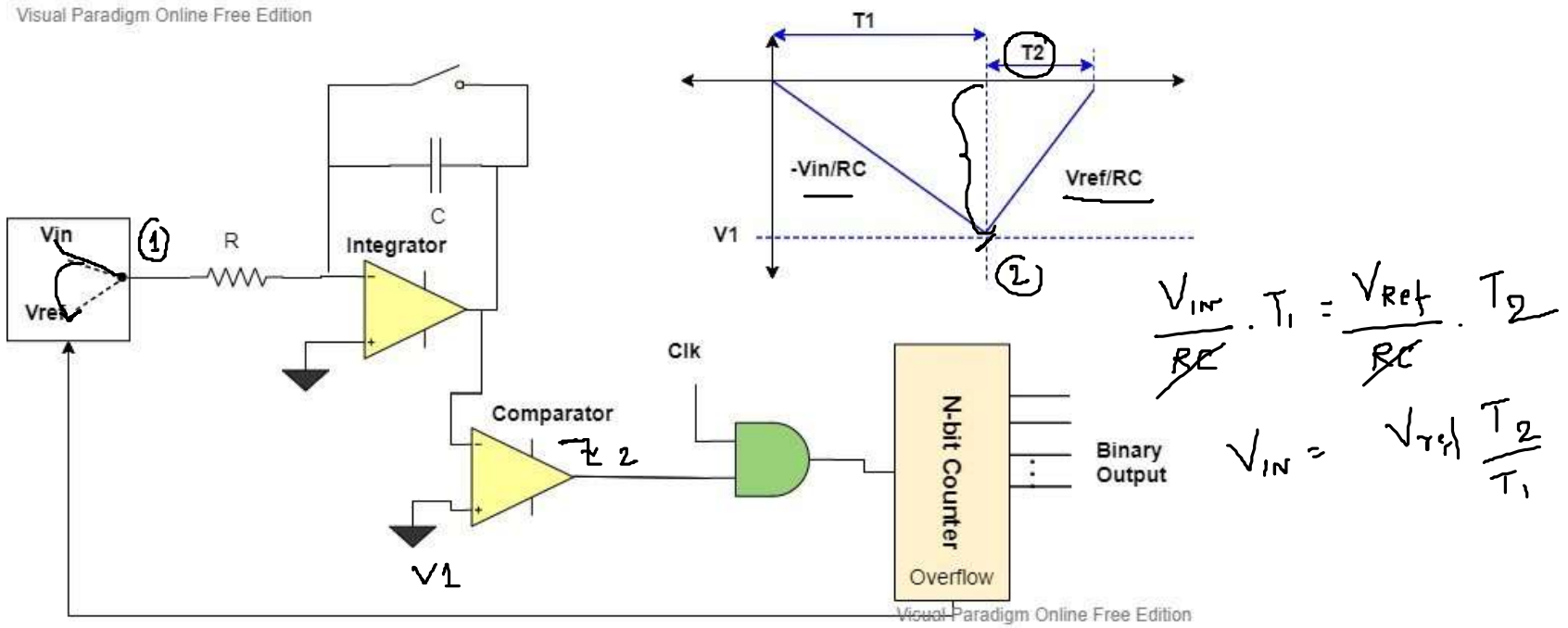


$V_{in} = \frac{V_{ref}}{RC} \times n \times T_s$



8 (i) Can this be converted to a bipolar ADC?

8 (ii) How can I avoid starting from zero every time.



$$\frac{V_{IN}}{RC} \cdot T_1 = \frac{V_{Ref}}{RC} \cdot T_2$$

$$V_{IN} = V_{Ref} \frac{T_2}{T_1}$$

(1) Initially in the conversion, the switch is connected to the input voltage and the integrator integrates the input voltage until its output equals the applied voltage.

After T1 time, the switch gets connected to the reference voltage and the respective voltage is integrated.

As negative reference is applied, the integrator integrates in a positive direction and keeps on integrating until the output is equal to the zero voltage. The time taken is represented by T2.

Successive Approximation A/D conversion