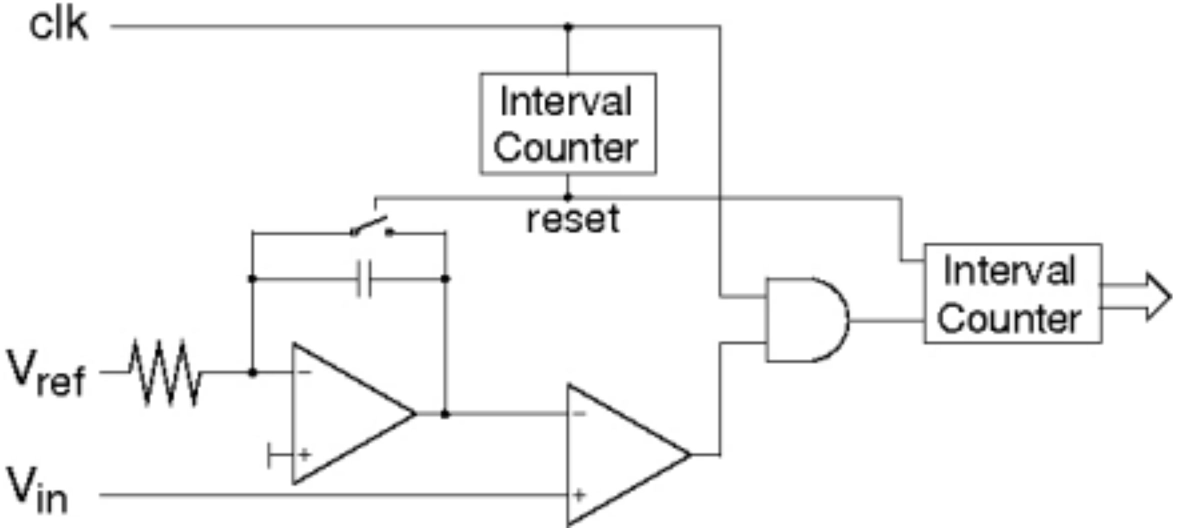
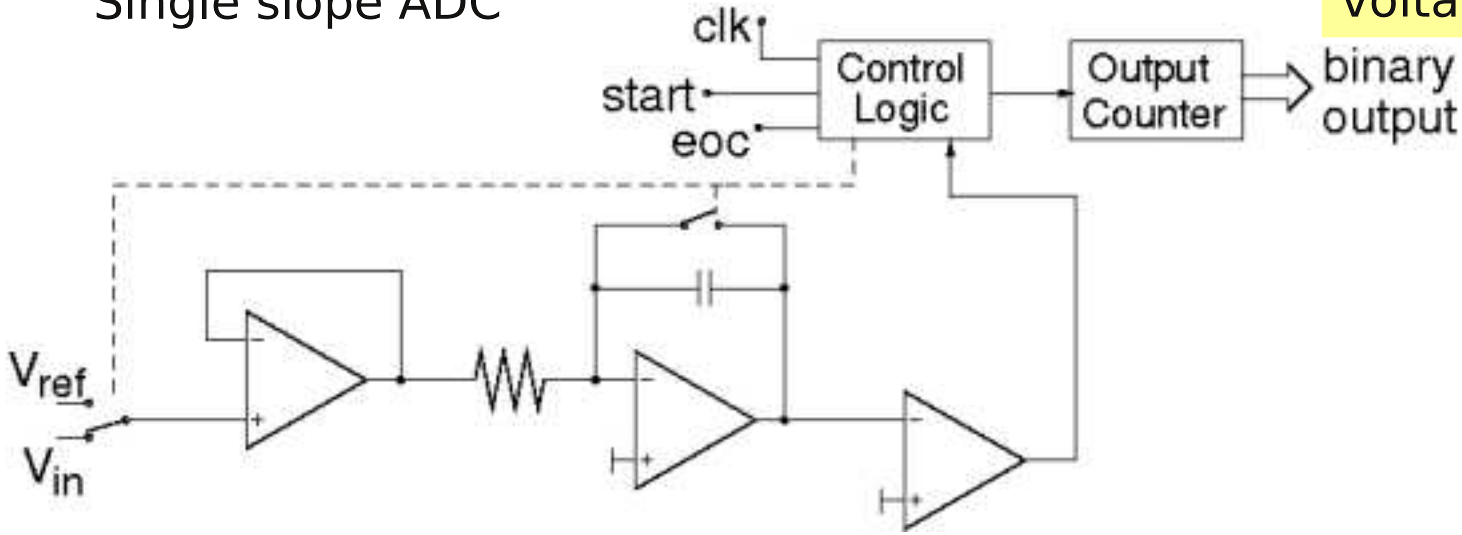
8.2 ADC

Integration A/D converters



Single slope ADC



Dual slope ADC

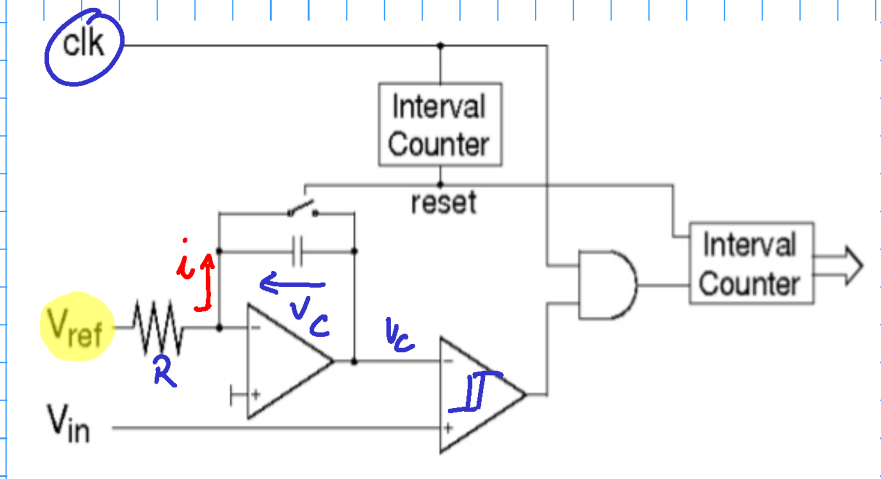
Advantages:

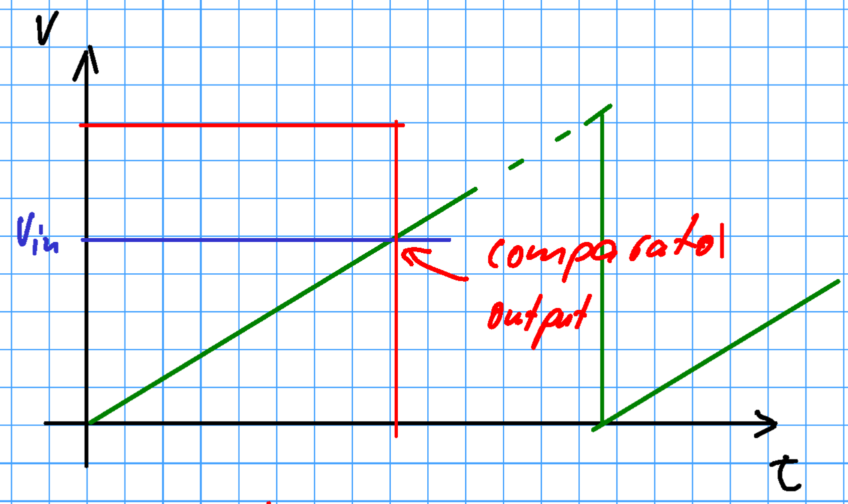
- High resolution
- Small chip area results
- in an inexpensive
- converter type

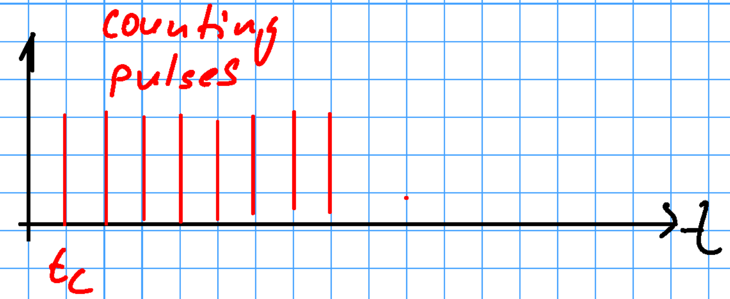
Disadvantages:

- Slow conversion rates

Number of clock cycles is proportional to input voltage.





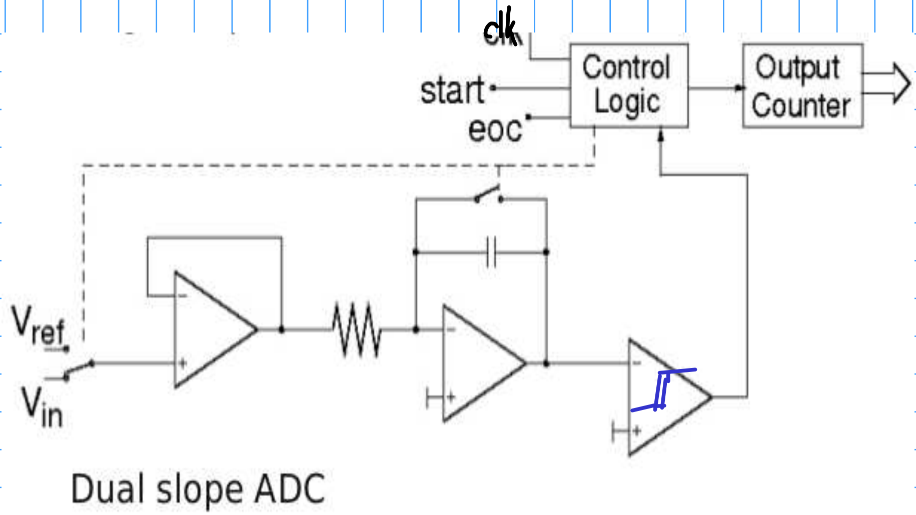


$$V_c = \frac{1}{C}\int_0^{t_c} i\,dt = \frac{1}{C}\int_0^{t_c}\frac{V_{ref}}{R}\cdot dt$$

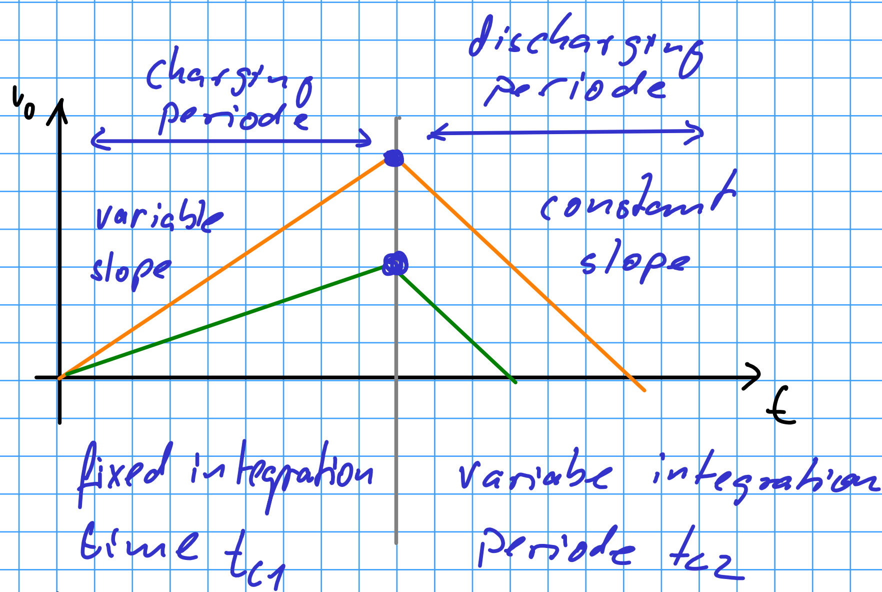
$$t_c = \frac{V_{in}}{V_{ref}}\cdot 2^n\cdot t_{clk} \quad \Rightarrow \quad f_{sample} = f_{clk}\cdot\frac{V_{ref}}{2^n\cdot V_{in}}$$

$$\Rightarrow V_c = \frac{\cancel{V_{ref}}}{RC}\cdot\frac{V_{in}}{\cancel{V_{ref}}}\cdot 2^n\cdot t_{clk} = V_{in}\cdot\frac{2^n}{RC}\cdot t_{clk}$$

⇒ converter accuracy is related to all of the parameters and in addition to offset



Dual slope ADC



Accuracy

$$V_C = -\frac{1}{C}\int_0^{t_{c1}} \frac{V_{in}}{R}\,dt = -\frac{V_{in}}{RC}\cdot t_{c1} = \frac{|V_{in}|}{RC}\cdot t_{c1}$$

Discharging periode begins with an initial condition

$$V_C = \frac{V_{in}}{RC}\cdot t_{c1} - \frac{1}{C}\int_0^{t_{c2}} \frac{V_{ref}}{R}\cdot dt = \frac{|V_{in}|}{RC}\cdot t_{c1} - \frac{V_{ref}}{RC}\cdot t_{c2} = 0$$

$\Rightarrow |V_{in}| \cdot t_{c1} = V_{ref} \cdot t_{c2}$ $\Rightarrow$ for $t_{c1} \rightarrow 2^n$ cycles, $t_{c2} \rightarrow D$ output

$$\frac{|V_{in}|}{V_{ref}} = \frac{D}{2^n}$$