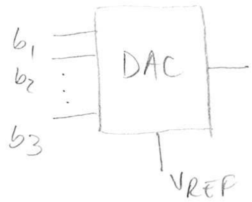
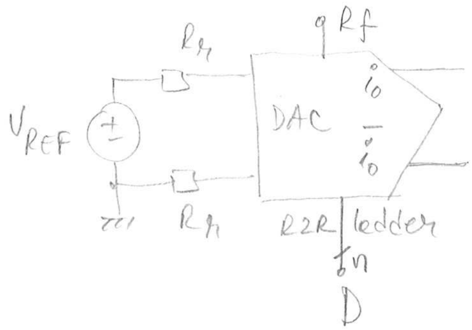
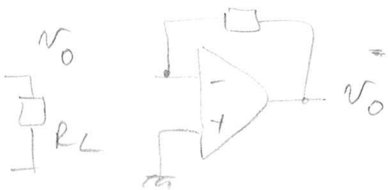
Ch. 12 | Part 2

- We talked about digital to analog converters [DAC]



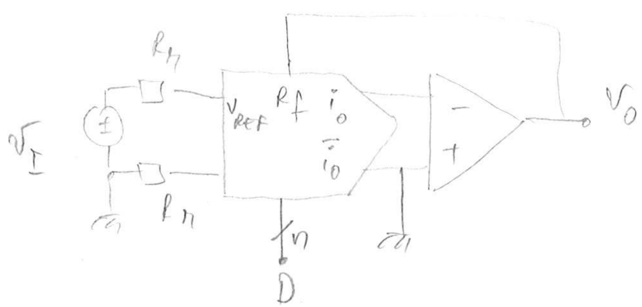
$$v_0 = K \cdot V_{REF}\left(\frac{b_1}{2} + \frac{b_2}{2^2} + \frac{b_3}{2^3} + \dots + \frac{b_n}{2^n}\right) = K V_{REF} \cdot D_I = v_0$$





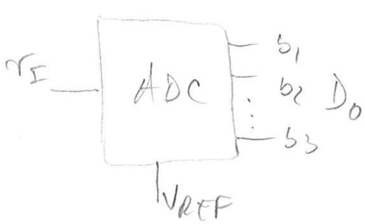
$$i_0 = \frac{V_{REF}}{R_1}\left(\frac{b_1}{2} + \frac{b_2}{2^2} + \dots + \frac{b_n}{2^n}\right)$$

- Digitally programmable attenuators and amplifiers.



$$v_0 = -D \cdot v_I \quad , \quad D = \frac{b_1}{2} + \frac{b_2}{2^2} + \dots + \frac{b_n}{2^n}.$$

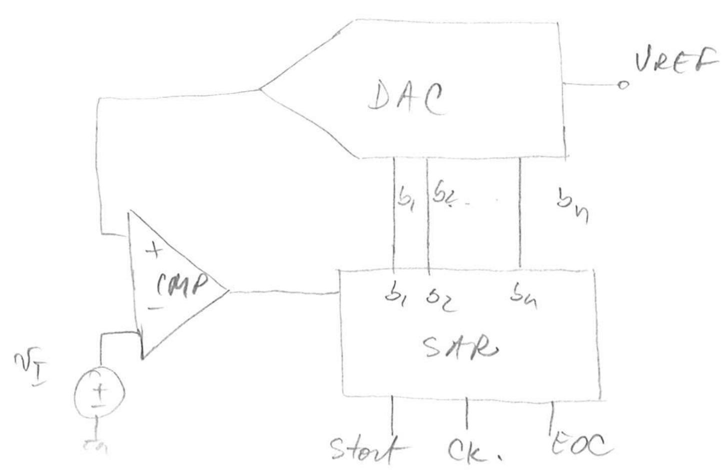
Analog to digital converters



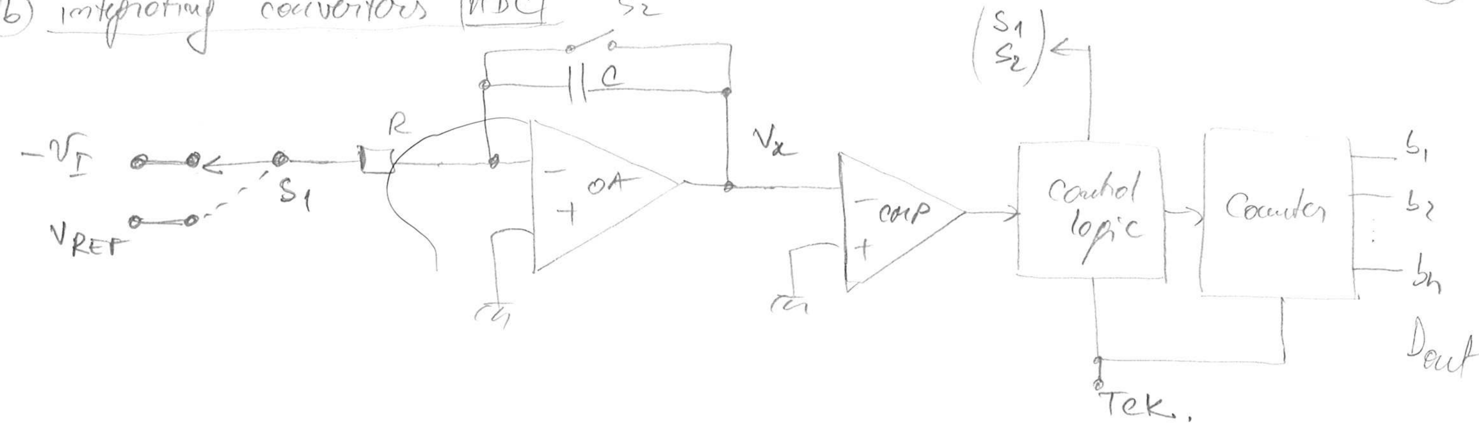
$$v_I = K V_{REF} \cdot D_0$$

$$D_0 = \frac{v_I}{K V_{REF}}$$

(a) Successive Approximation ADC



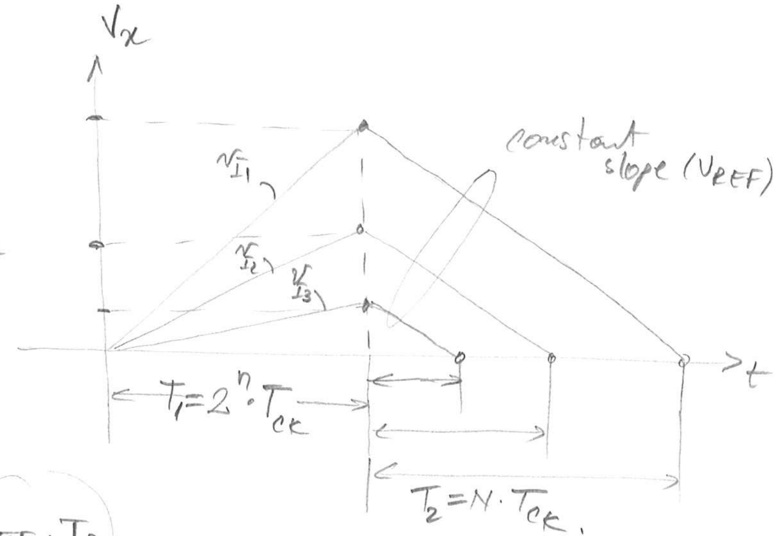
(b) integrating converters [ADC]



Phase 1: $S_1 = -v_I$

C charges thru the integrator, till $\dfrac{V_I \cdot T_1}{RC}$

for 2^n clock cycles: $T_1 = 2^n T_{CK}$



Phase 2: $S_2 = V_{REF}$

C discharges and

$T_2 = N T_{CK}$ so that: $\dfrac{V_{REF} \cdot T_2}{RC}$

$$\frac{V_I T_1}{RC} = \frac{V_{REF} T_2}{RC} \Rightarrow \boxed{T_2 = T_1 \frac{V_I}{V_{REF}}}$$

$$\boxed{N = 2^n \frac{V_I}{V_{REF}}}$$

OSS: – The idea is that N is proportional to v_I
= usefull in slow speed applications!
– for faster operation use flash-converters!