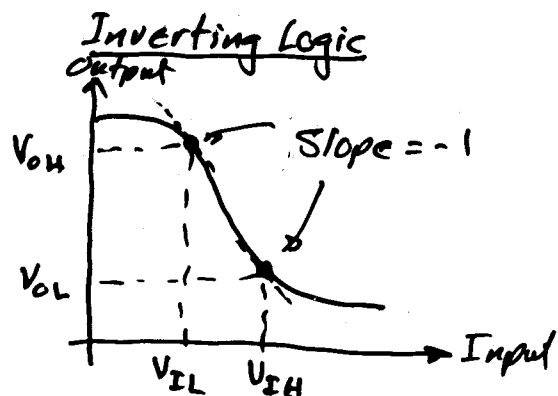
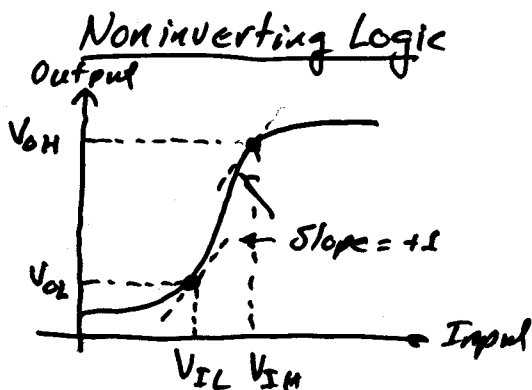
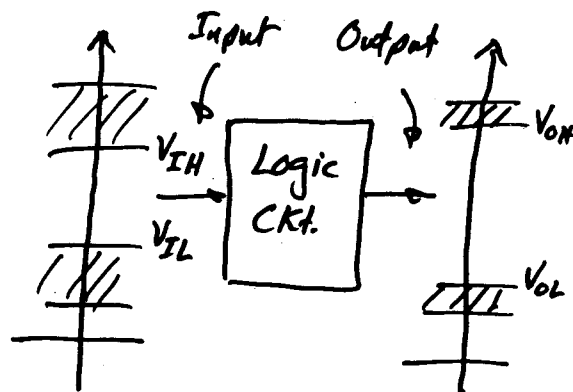
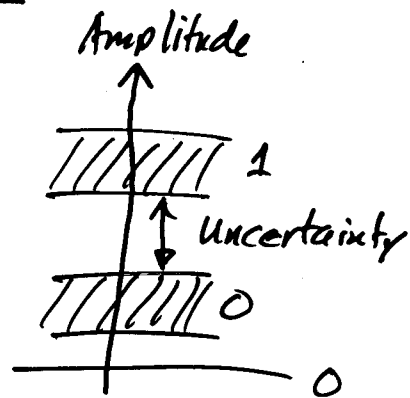


Implementation of Logic Circuits

Characteristics -

- 1.) Binary output must be a function of the binary inputs.
- 2.) Amplitudes should be quantizable
- 3.) Amplitude levels should be regenerated. Requires the voltage transfer characteristic (VTC) to have a $gain > 1$.

Comment:

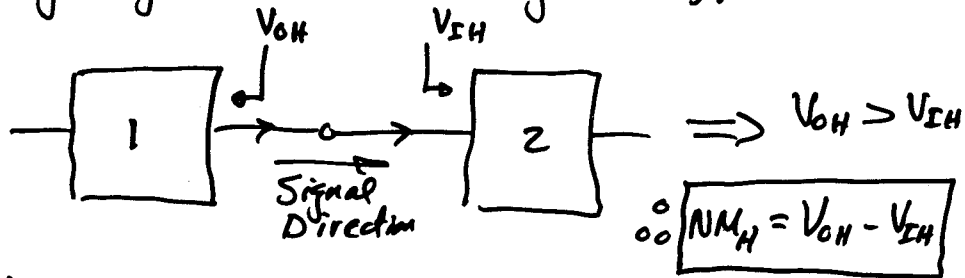


- 4.) Output should not influence the inputs (directivity)
- 5.) Fanout - the output of one logic ckt. must be capable of driving more than one input of a similar logic ckt.
Fanin - number of independent inputs.

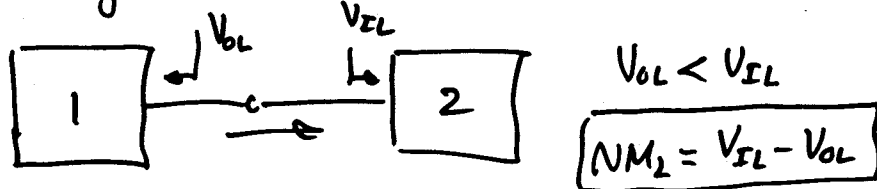
Noise Margin

Noise is an unwanted signal. If the noise is too large, it may cause logic error.

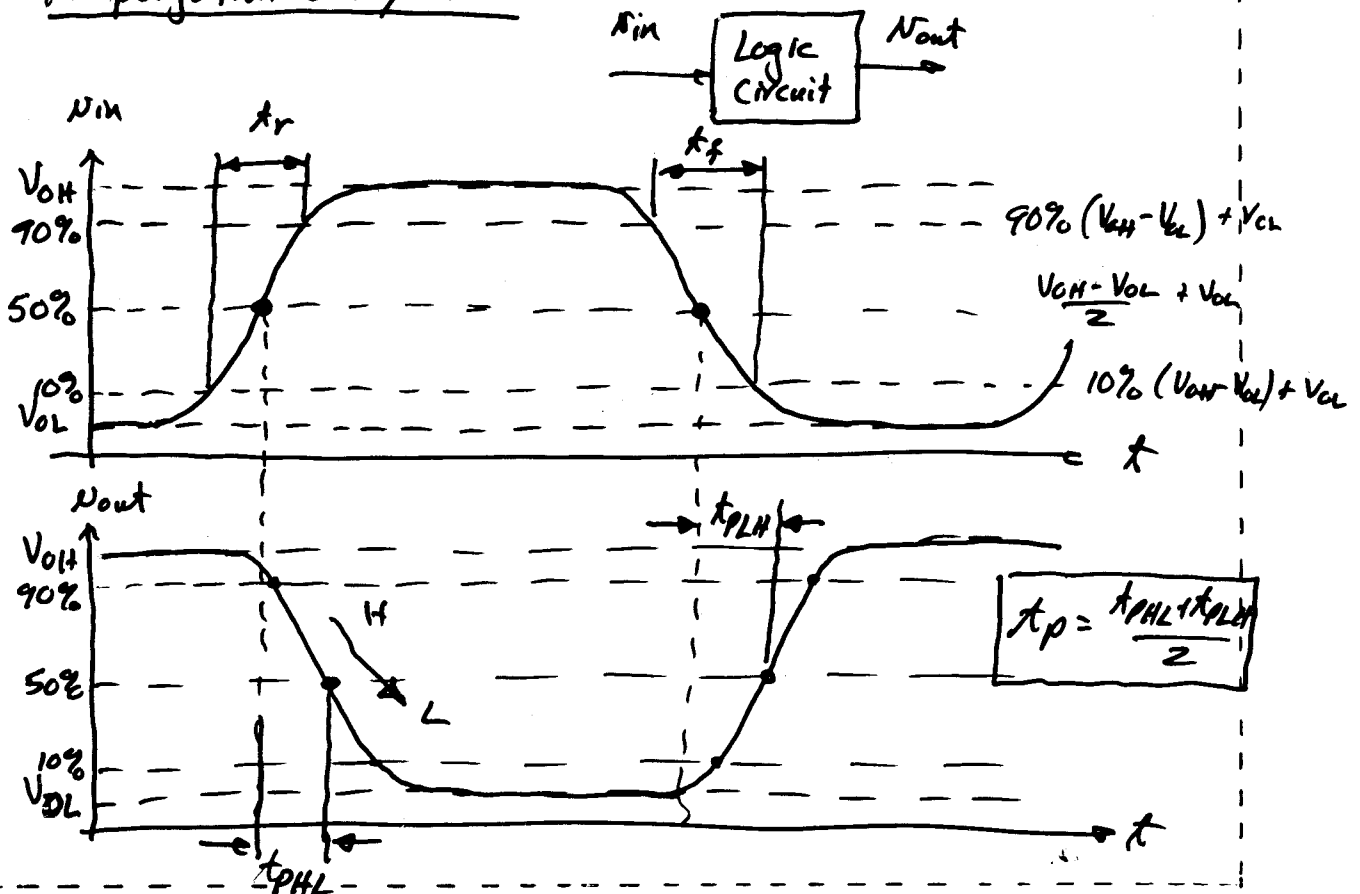
1.) High logic state noise margin (NM_H):



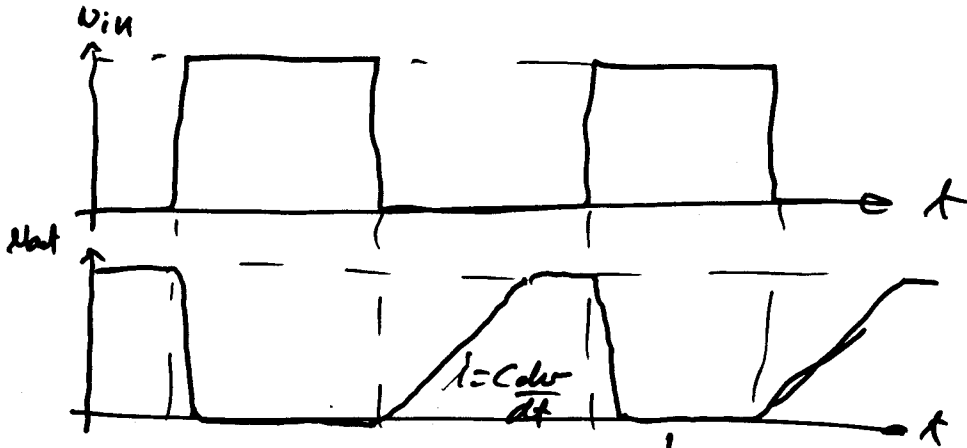
2.) Low logic state NM:



Propagation Delay Time



A poor Logic (the motivation for defining propagation delay time.)



Rise and fall times \propto Current \propto Capacitance

Power



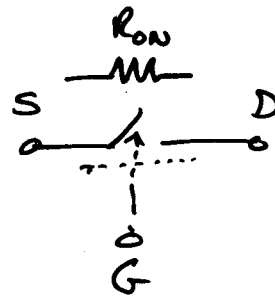
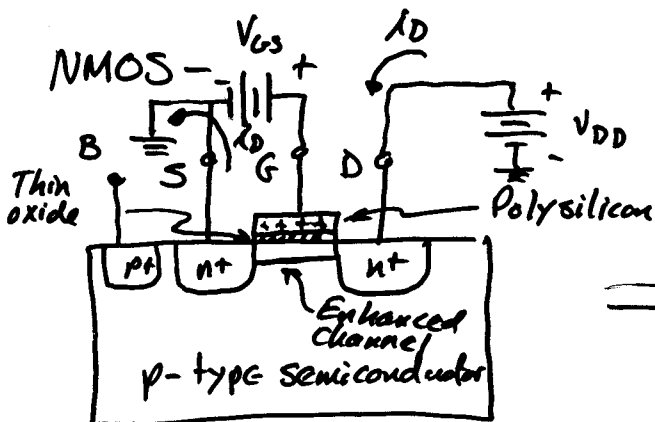
$$P_{total} = P_{static} + P_{dynamic} = (I_{DC} + I_{leakage})V_{DD} + CV_{DD}^2 f_{clk}$$

$I_{leakage}$ = current flowing when the logic off

C = output capacitance

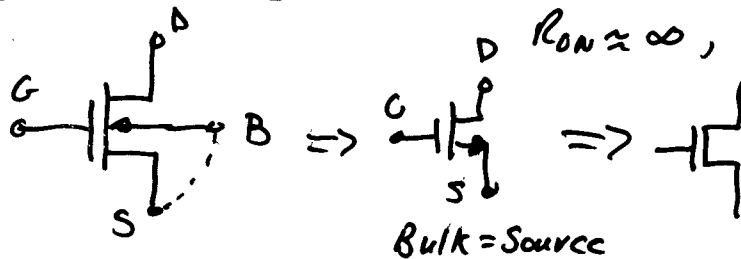
f_{clk} = clock frequency

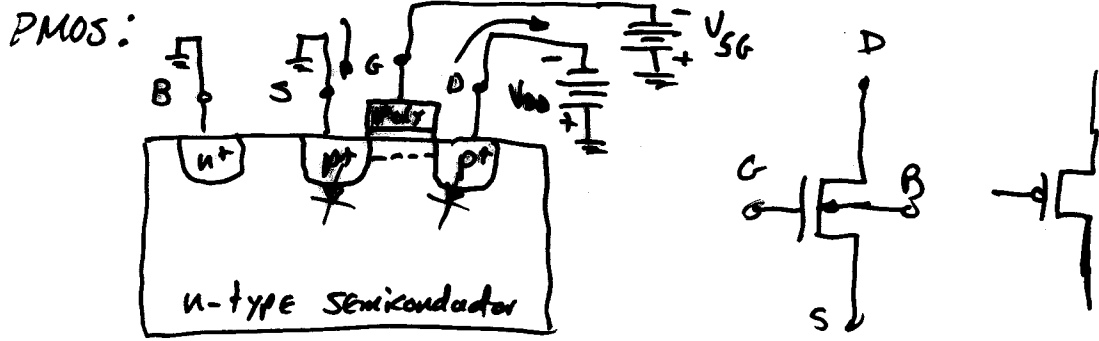
MOS Transistor - Structure and Operation



$$R_{on} \approx 100 - 1000 \Omega, V_{GS} > V_T$$

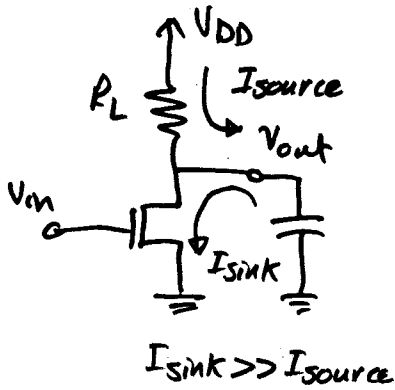
$$R_{on} \approx \infty, V_{GS} = 0$$





CMOS VERSUS NMOS or PMOS Logic

NMOS Inverter:



CMOS Inverter:

