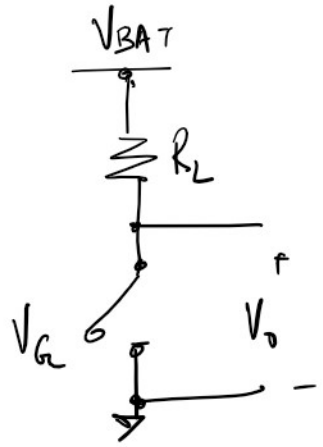
Lecture 10

15 August 2024 21:32



V_G	V_0
0	V_{BAT}
V_{BAT}	0

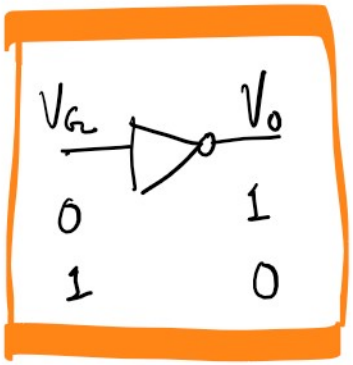
All entries are voltages.

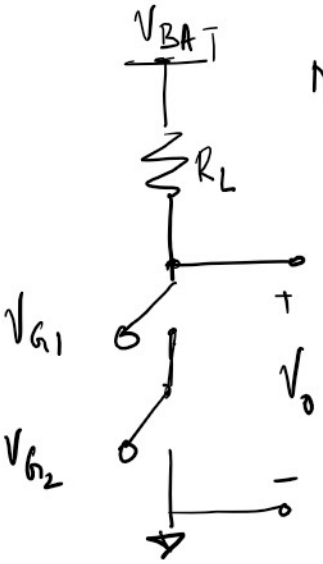
V_{BAT} > THRESHOLD VOLTAGE

Switch activated when $V_G \geq$ some THRESHOLD LEVEL

logically:

V_G	V_0
0	1
1	0

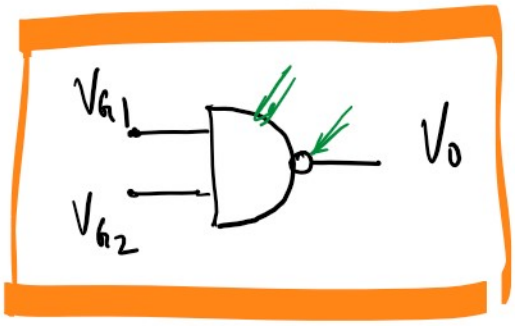


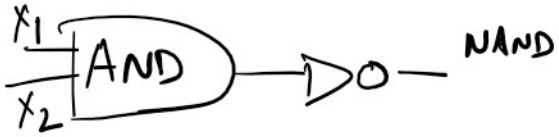


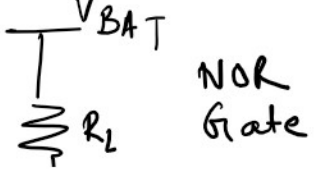
NAND Gate

V_{G_1}	V_{G_2}	V_0
0	0	1
0	1	1
1	0	1
1	1	0

Logical

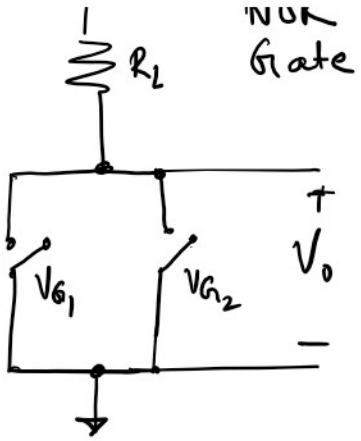






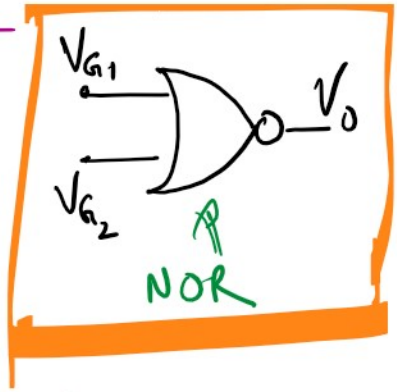
NOR Gate

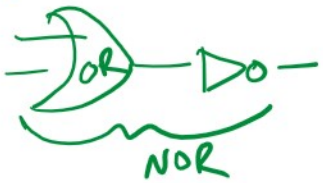
V_{G_1}	V_{G_2}	V_0
0	0	1



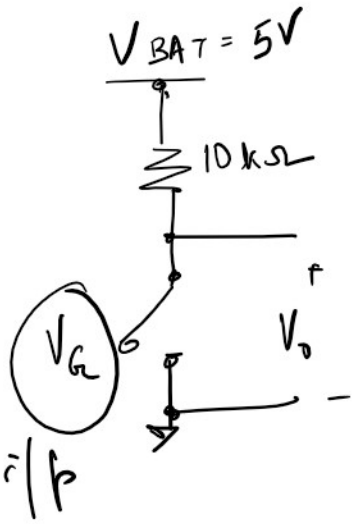
V_{G_1}	V_{G_2}	V_0
0	0	1
0	1	0
1	0	0
1	1	0

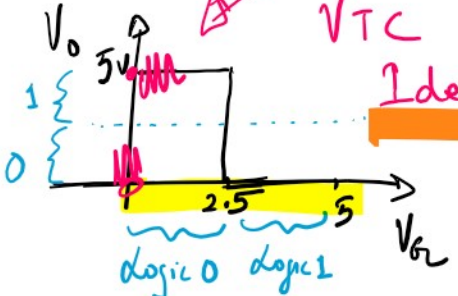
Logical





NO TIME INFORMATION!!



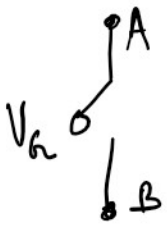


VTC of Ideal Inverter

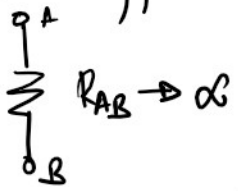
Assume switch turns on if $V_G \geq 2.5V$

Effect of NOISE ?

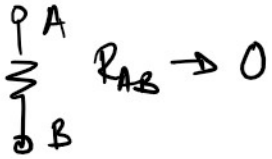
Output I - V char. of a Switch



Switch off

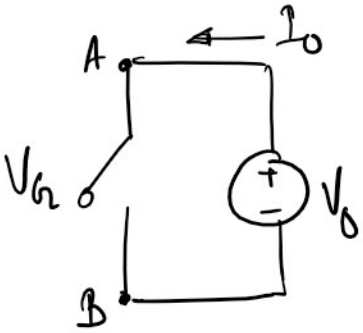


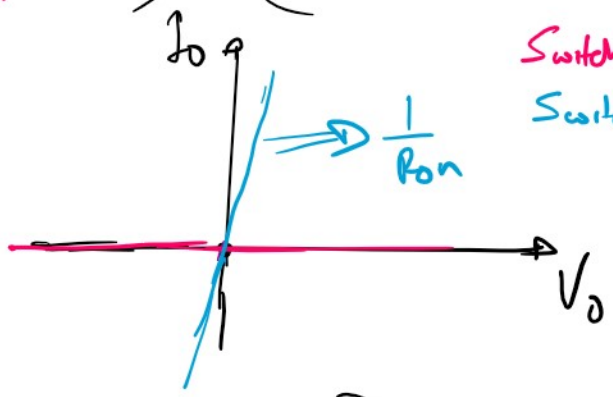
Switch on



(Assume $R_{AB} = \infty$ even in practice)

(Assume some "On - Resistance")

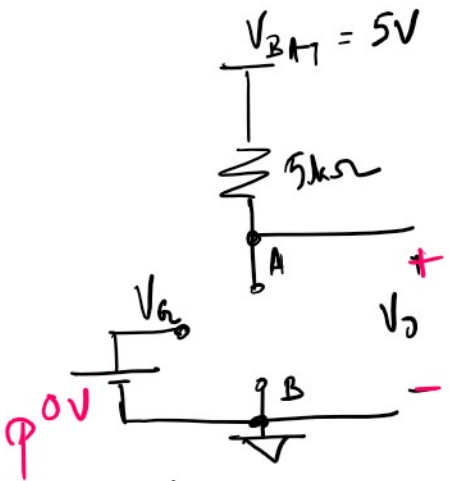




Switch is off
Switch is on

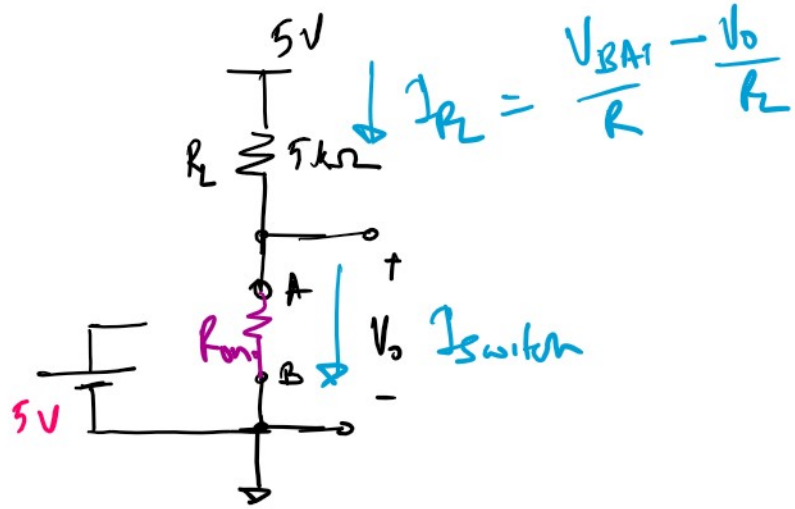
$R_{AB} = \infty$ ($V_G <$ Switch on voltage)

$R_{AB} = R_{on}$ ($V_G >$ " " ")



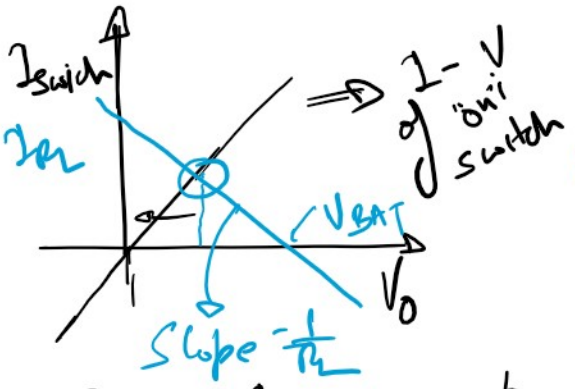
$V_G = 0 < 2.5V$

Switch is off

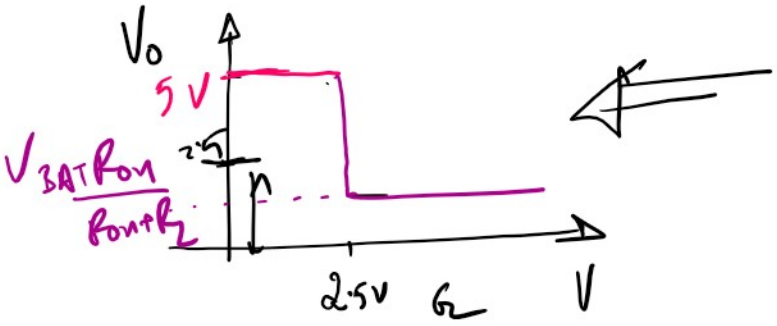


$V_G = 5V > 2.5V$

Switch is o/f



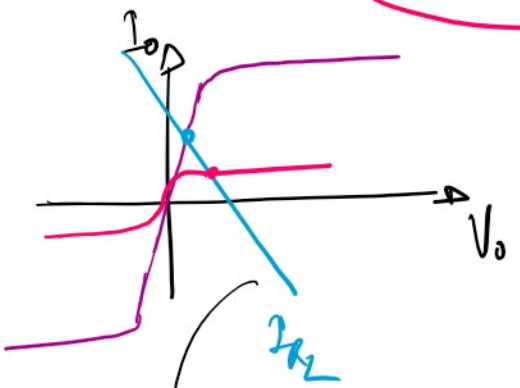
$\Rightarrow$ I-V of "on" switch

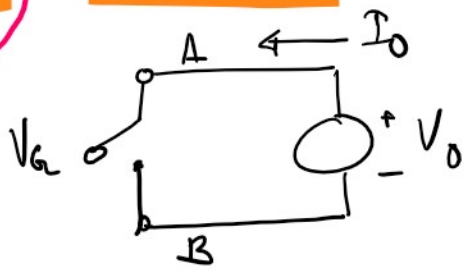


Find I_{switch} by sweeping V_o

" I_{R_L} " " V_o

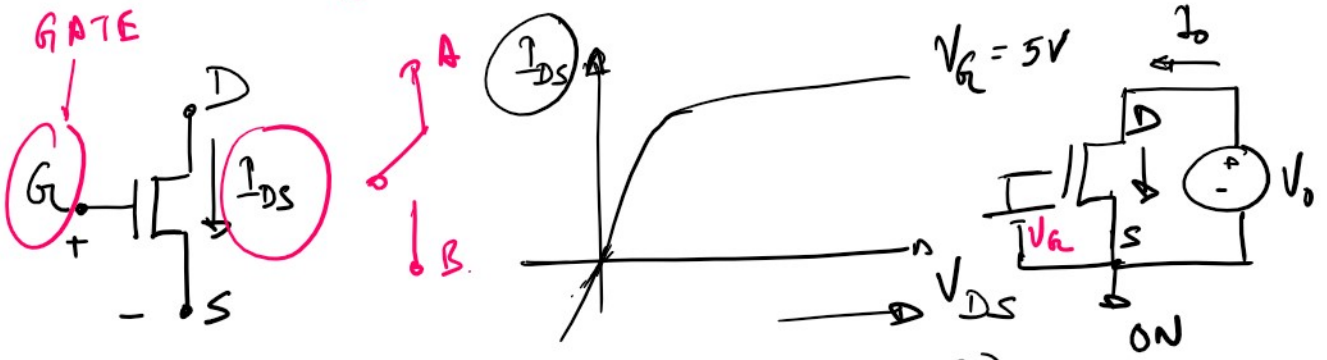
PRACTICAL 3-TERMINAL SWITCHES





CRT / BJT / MOSFET and many more

CRT / BJT / MOSFET and ...

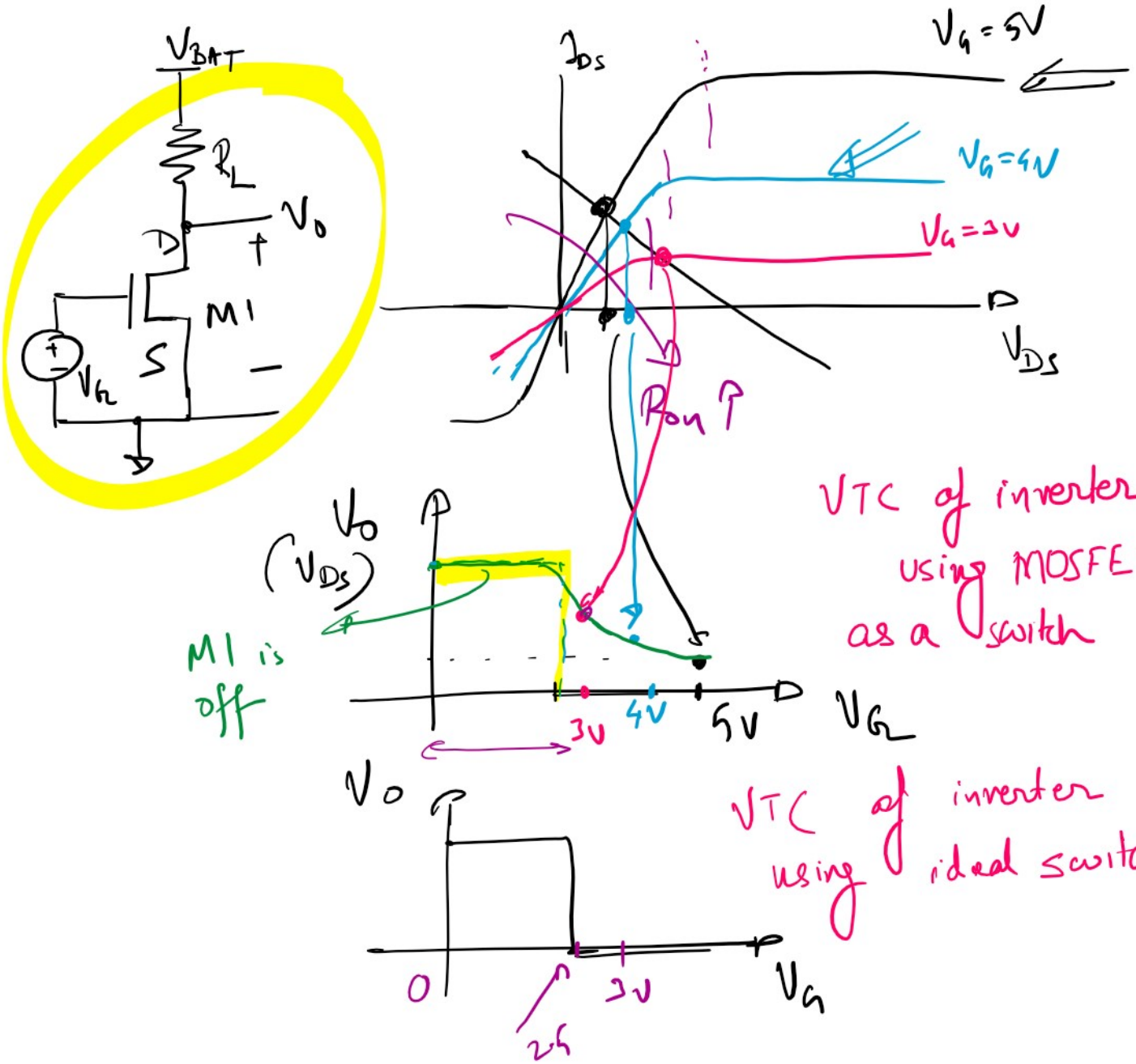


Higher voltage terminal is called DRAIN (D)

Lower " " " " SOURCE (S)

MOSFET acts as a switch for a limited voltage range across it. Current saturates beyond certain o/p voltage, V_{DS}.

The I-V is also dependent on the "analog" value of the gate voltage (V_G).


V_{BAT}
R_L
V_o
D
M1
S
V_G
I_{DS}
$V_G = 5V$
$V_G = 4V$
$V_G = 3V$
V_{DS}
R_{on} ↑
V_o
(V_{DS})
M1 is off
3V
4V
5V
V_G
VTC of inverter using MOSFET as a switch
V_o
0
3V
V_G
2.5
VTC of inverter using ideal switch.