Georgia Institute of Technology

Introduction to Electronics

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An introduction to electronic components and a study of circuits containing such devices.

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CMOS Logic Gates

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Introduction to logic gates made from CMOS transistors

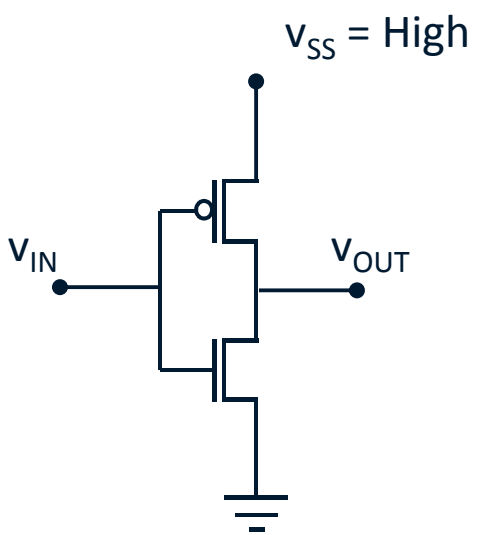
Previous Lesson

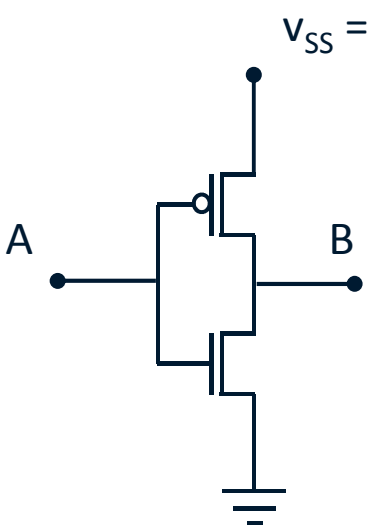
- MOSFET Switches

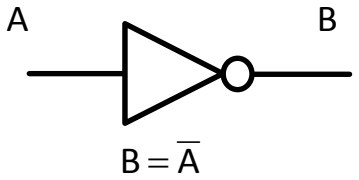
Lesson Objectives

- Introduce logic gates and their transistor circuits
  - NOT, NAND, NOR, AND, OR

CMOS NOT Gate (Inverter Circuit)







V_{IN}	V_{OUT}
High	Low
Low	High

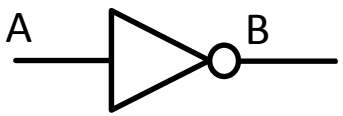
Truth Table

A	B
0	1
1	0

Logic Gates

NOT

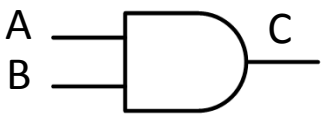
A	B
0	1
1	0



$B = \overline{A}$

AND

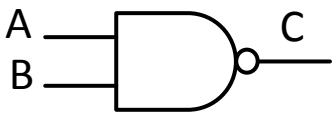
A B	C
0 0	0
0 1	0
1 0	0
1 1	1



$C = A \bullet B$

NAND

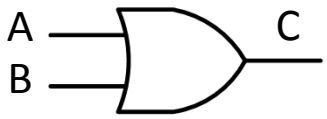
A B	C
0 0	1
0 1	1
1 0	1
1 1	0



$C = \overline{A \bullet B}$

OR

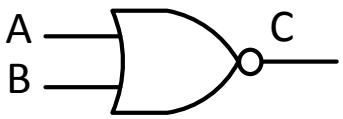
A B	C
0 0	0
0 1	1
1 0	1
1 1	1



$C = A + B$

NOR

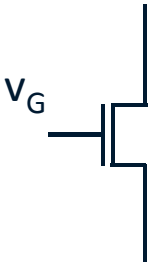
A B	C
0 0	1
0 1	0
1 0	0
1 1	0



$C = \overline{A + B}$

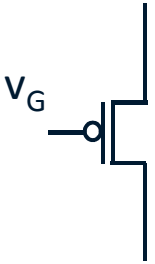
PMOS Switch Behavior

NMOS



V_G	Switch
High	ON
Low	OFF

PMOS

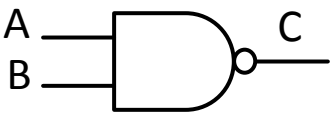


V_G	Switch
High	OFF
Low	ON

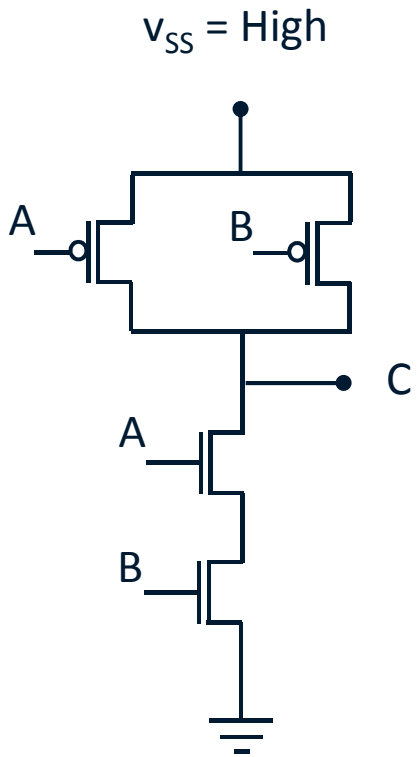
NAND Gate

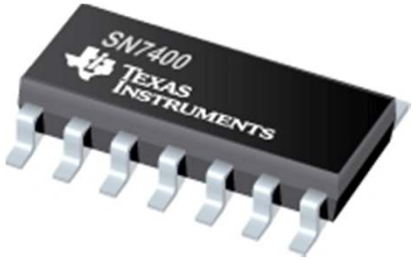
NAND

A B	C
0 0	1
0 1	1
1 0	1
1 1	0



$C = \overline{A \bullet B}$

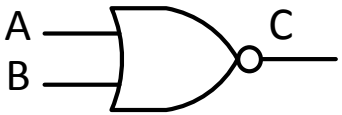




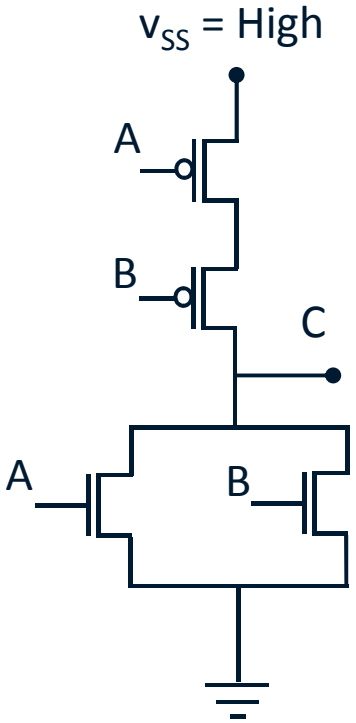
NOR Gate

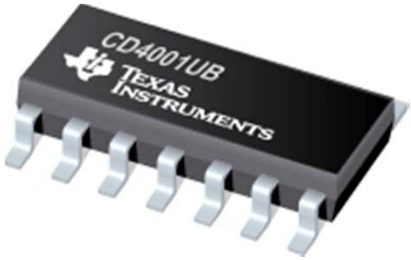
NOR

A B	C
0 0	1
0 1	0
1 0	0
1 1	0



$C = \overline{A+B}$





Summary

- Logic gate circuits are made from CMOS n-type and p-type transistors

Next Lesson