

Bubble Pushing

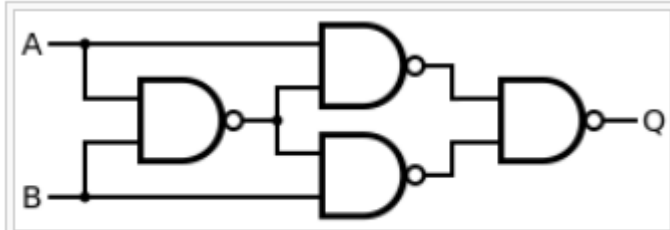
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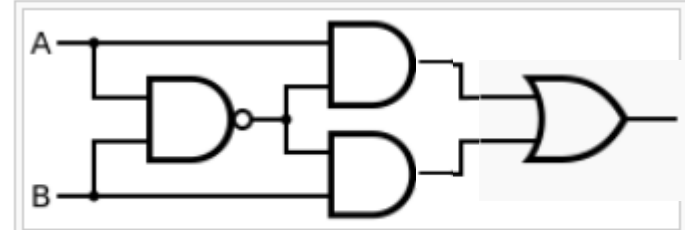
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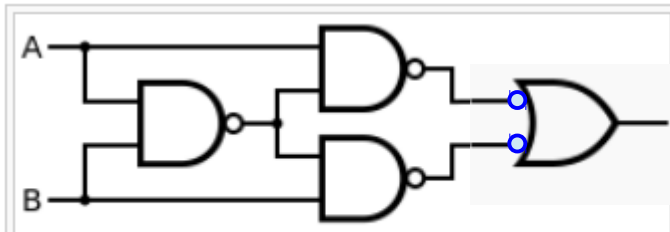
XOR Gate



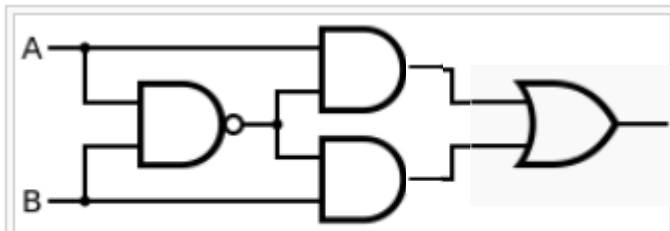
XOR gate circuit constructed using only NAND gates.



XOR gate circuit constructed using only NAND gates.



XOR gate circuit constructed using only NAND gates.



XOR gate circuit constructed using only NAND gates.

$$\overline{A \cdot B} = \bar{A} + \bar{B}$$

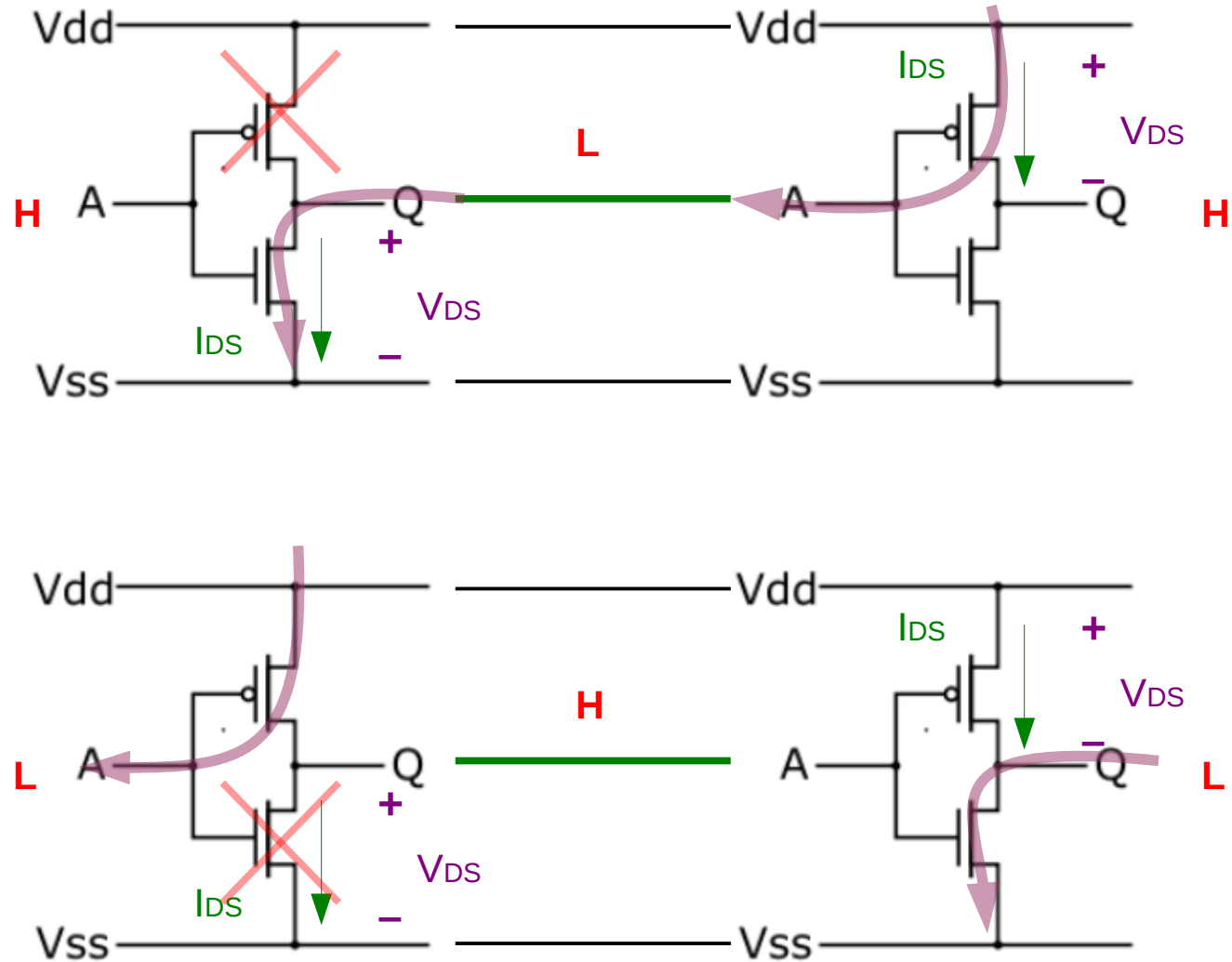
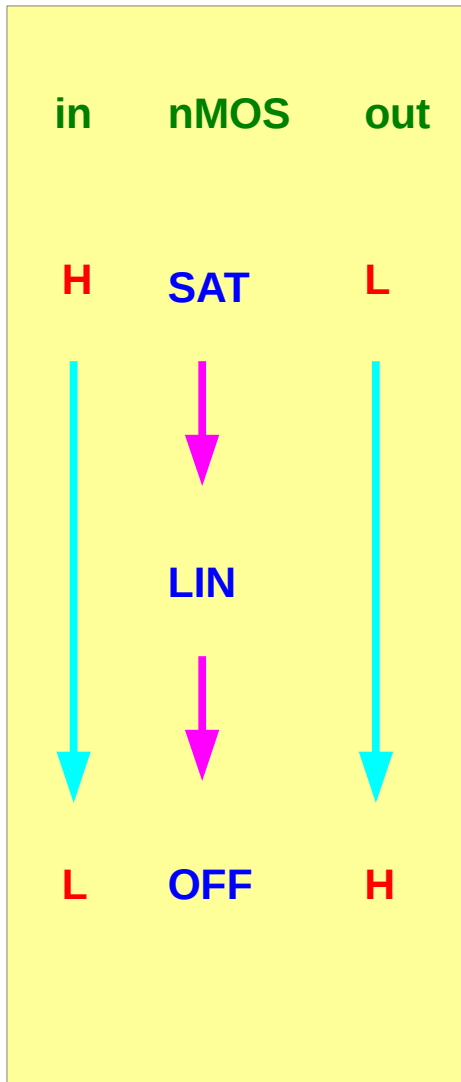
$$A \cdot \overline{A \cdot B} = A \cdot (\bar{A} + \bar{B}) = A \cdot \bar{B}$$

$$B \cdot \overline{A \cdot B} = B \cdot (\bar{A} + \bar{B}) = \bar{A} \cdot B$$

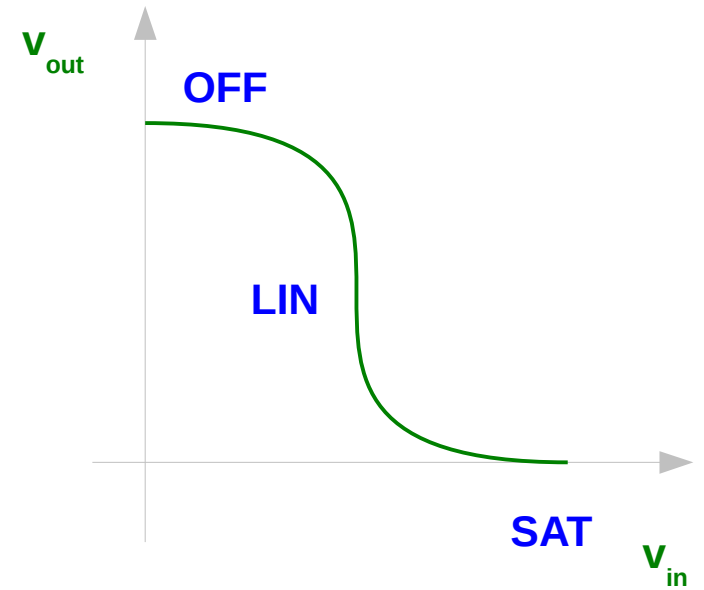
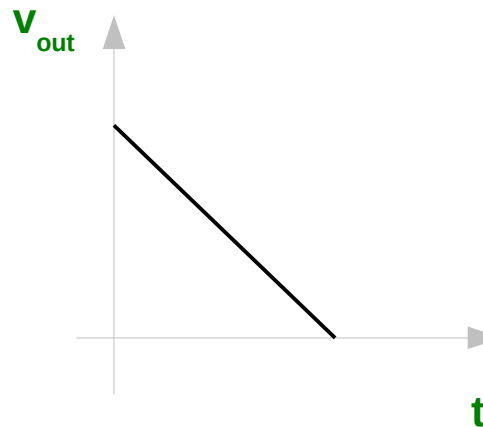
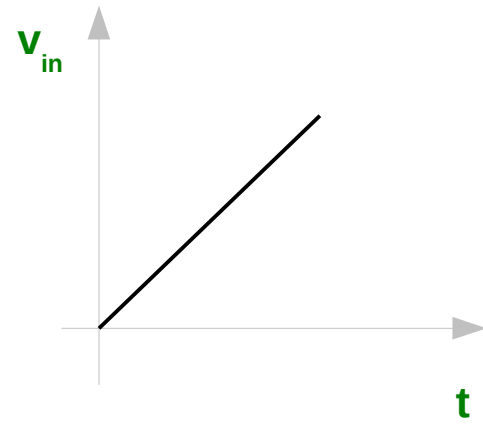
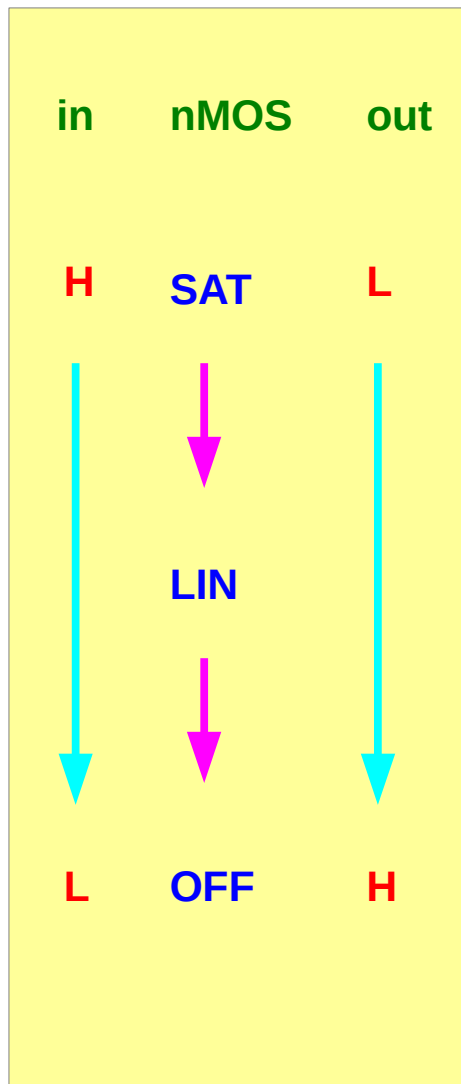
Logic Level

Characteristic Curve

Voltage Transfer Curve (1)



Voltage Transfer Curve (2)



Spice Model

References

- [1] <http://en.wikipedia.org/>
- [2] <http://www.allaboutcircuits.com/>
- [3] W. Wolf, "Modern VLSI Design : Systems on Silicon"
- [4] N. Weste, D. Harris, "CMOS VLSI Design: A Circuits and Systems Perspective"