

# Logic Families

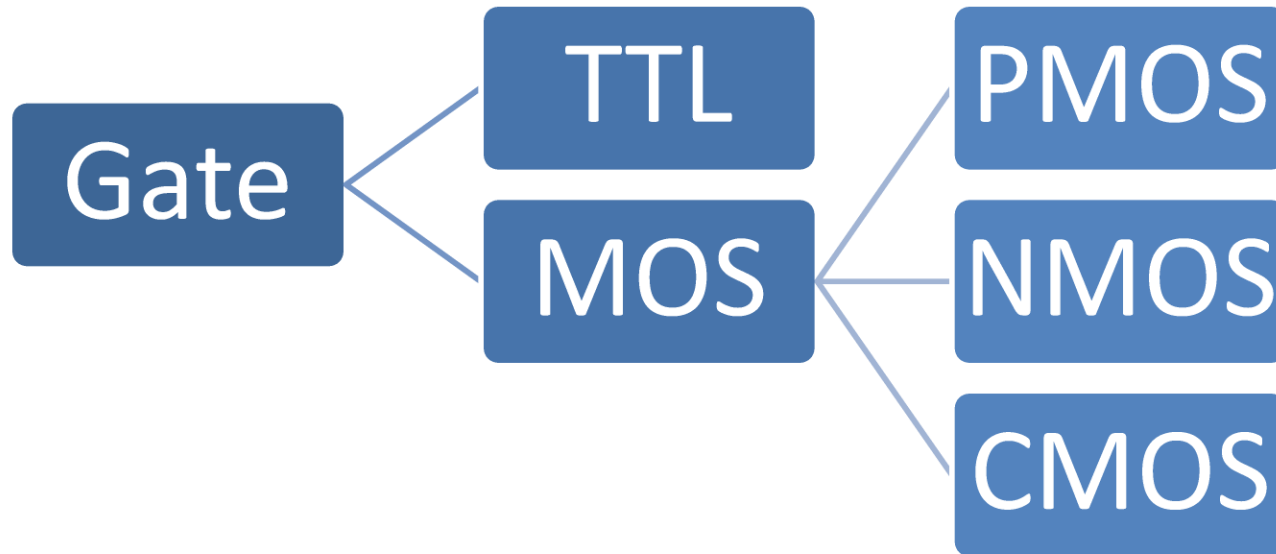
Networks and Embedded Software

Module 3.2.6 (optional)

by Wolfgang Neff

# Logic Gates

- Families of logic gates



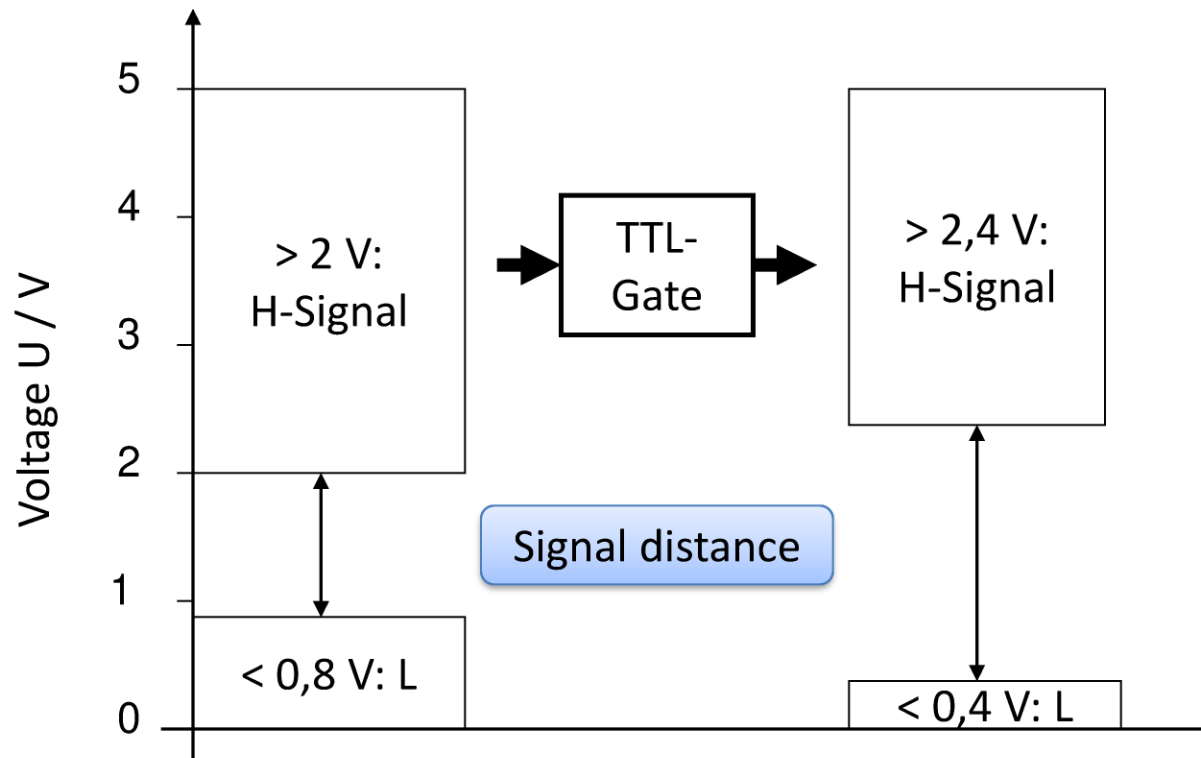
# TTL (1)

- Transistor-Transistor-Logic
  - TTL circuits operate with a 5 V power supply.
  - H and L are defined for voltage regions.
  - Input and output ranges differ.

TTL Signal	Input	Output
L	0 V ... 0,8 V	0 V ... 0,4 V
H	2 V ... 5 V	2,4 V ... 5 V

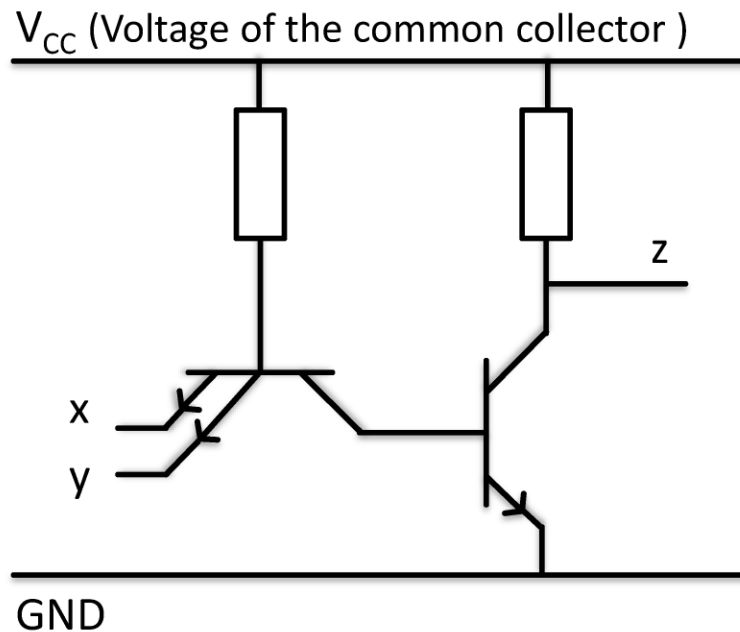
# TTL (2)

- Signal levels



# TTL (3)

- Fundamental TTL NAND gate



A	B	$A\bar{B}$
0	0	1
0	1	1
1	0	1
1	1	0

# TTL (4)

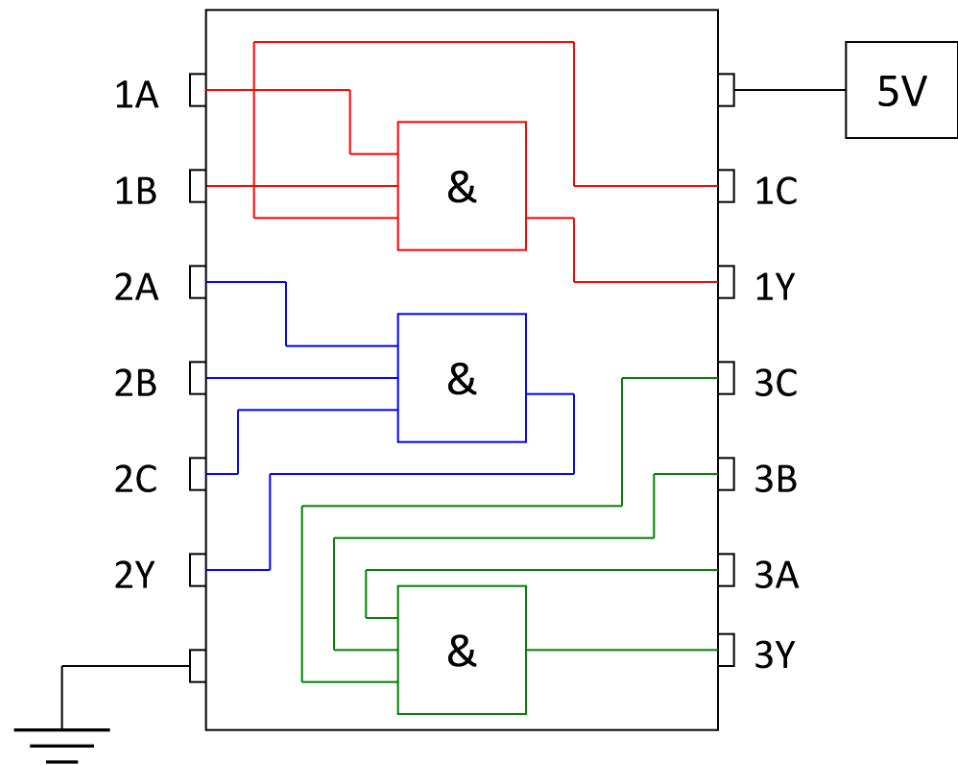
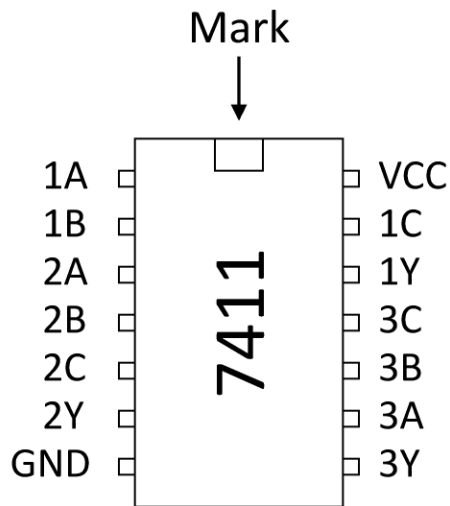
- TTL gates are found in the IC 7400 series.

IC	Gate	Number	Lines	IC	Gate	Number	Lines
7408	AND	4	2	7400	NAND	4	2
7411	AND	3	3	7410	NAND	3	3
7421	AND	2	4	7420	NAND	2	4
7432	OR	4	2	7402	NOR	4	2
7404	NOT	6	1	7427	NOR	3	3

# TTL (5)

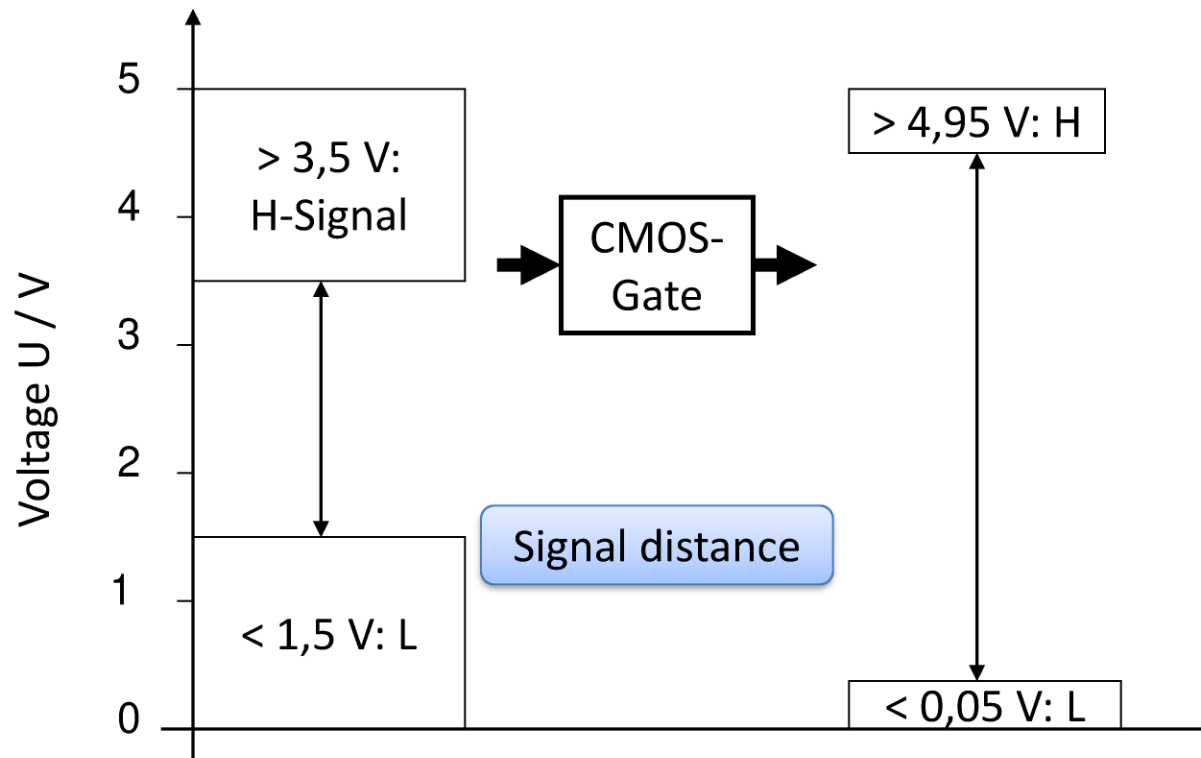
- Device description

- 7411: Triple 3-Input Positive-AND Gates (about 0,30 €)



# CMOS (1)

- Signal levels (4000 series CMOS Logic ICs)



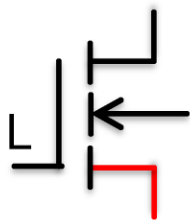


# CMOS (2)

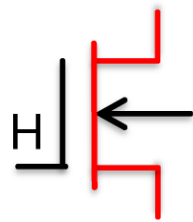
- Switching with MOSFETs

- N-Channel

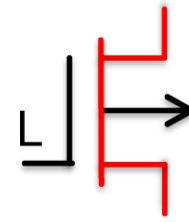
- P-Channel



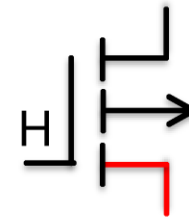
off



on



on

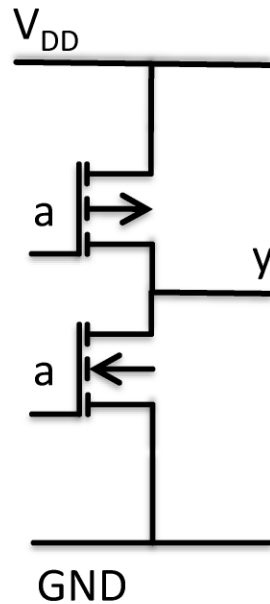


off

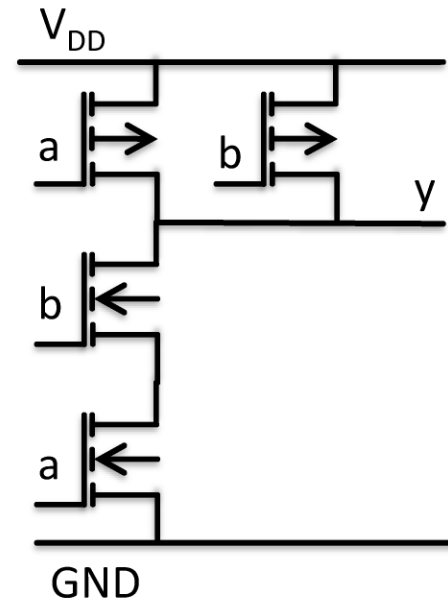
# CMOS (3)

- Fundamental CMOS gates

- NOT-Gate



- NAND-Gate



# CMOS (4)

- CMOS gates are found in the IC 4000 series

IC	Gate	Number	Lines	IC	Gate	Number	Lines
4081	AND	4	2	4011	NAND	4	2
4073	AND	3	3	4023	NAND	3	3
4082	AND	2	4	4012	NAND	2	4
4071	OR	4	2	4001	NOR	4	2
4049	NOT	6	1	4025	NOR	3	3

- There are also CMOS version of the TTL gates
  - 74HC00: CMOS compatible voltage levels
  - 74HCT00: TTL compatible voltage levels