

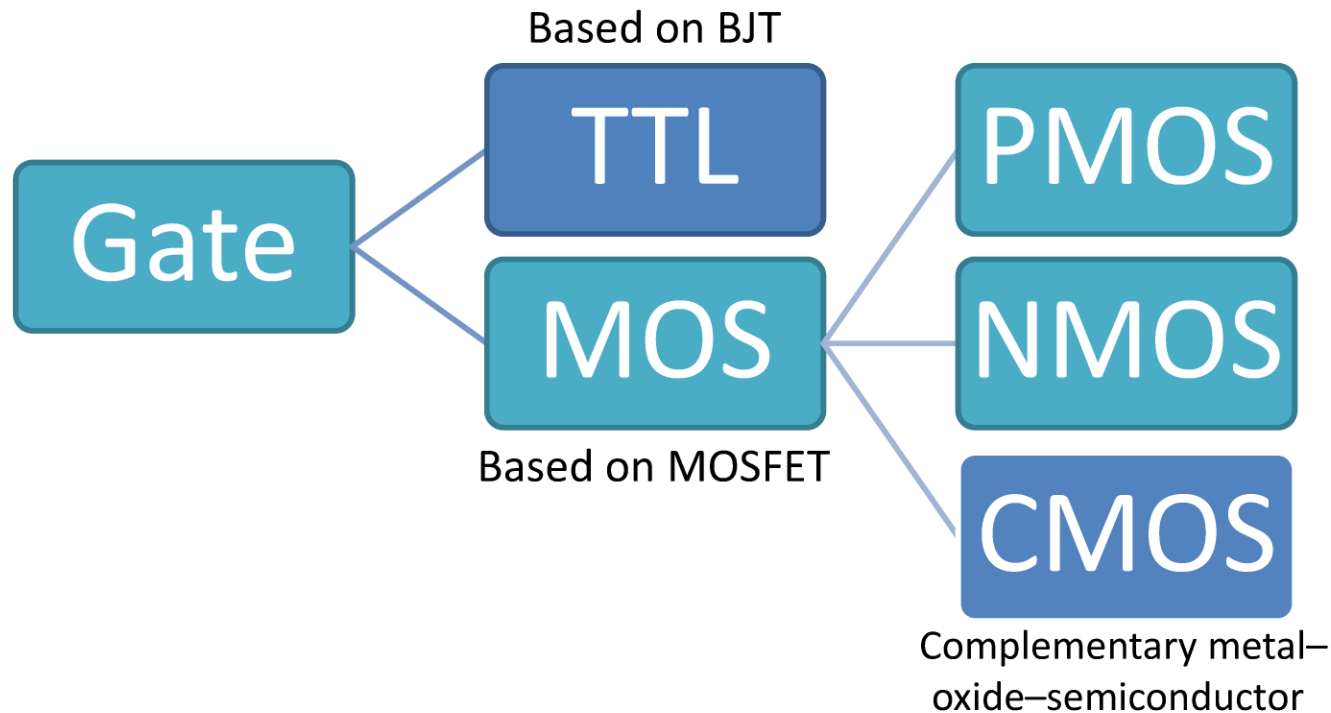
# Logic Gates

Digital Electronics

Wolfgang Neff

# Logic Gates (1)

- Families of Logic Gates



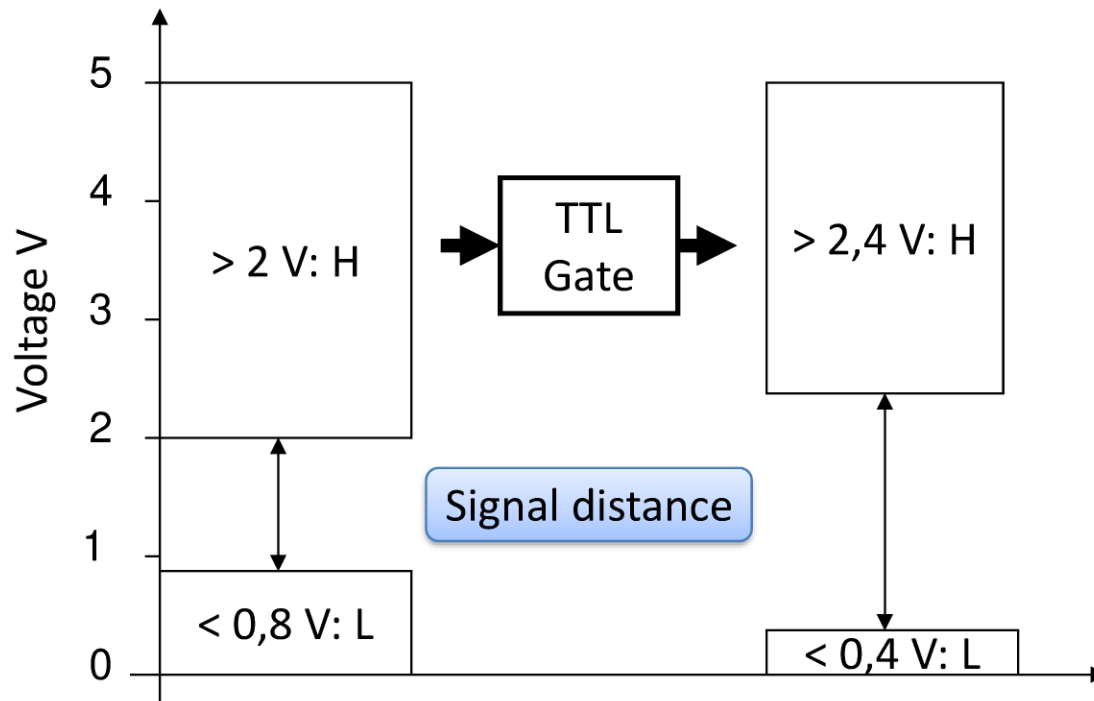
# Logic Gates (2)

- Transistor-Transistor-Logic
  - TTL circuits operate with 5 V supply power
  - H and L are defined as voltage ranges
  - 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 |

# Logic Gates (3)

- Transistor-Transistor-Logic (continued)
  - Signal levels



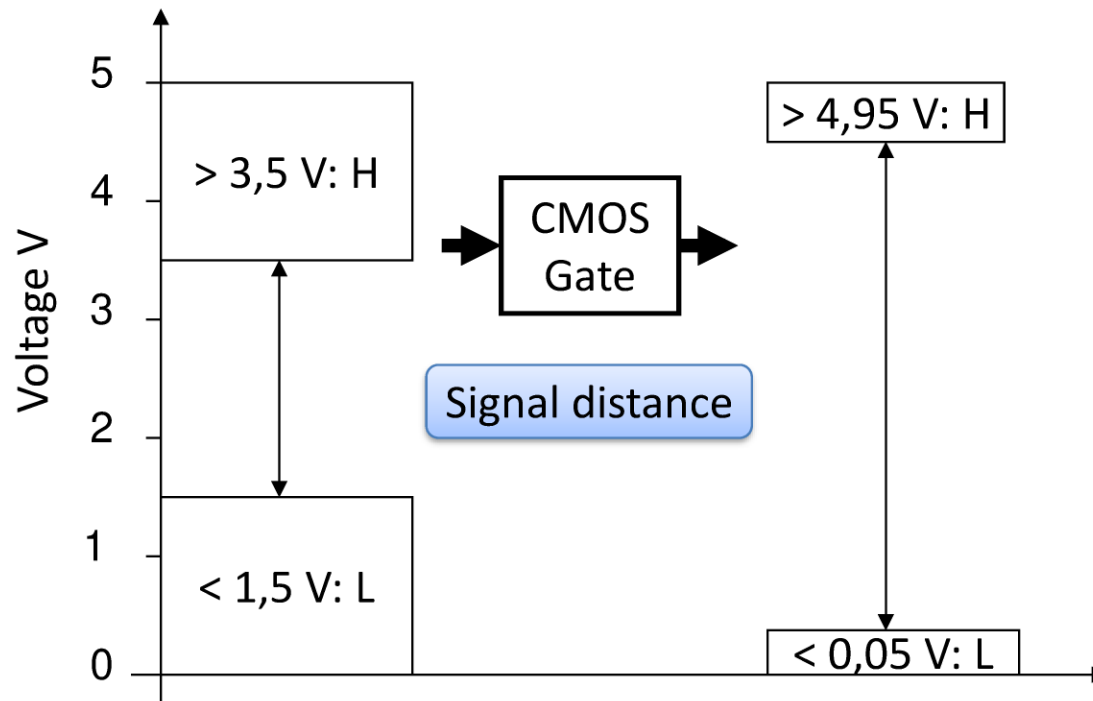
# Logic Gates (4)

- Transistor-Transistor-Logic (*finished*)
  - TTL gates are found in the 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     |

# Logic Gates (5)

- CMOS Logic Gates
  - Signal levels



# Logic Gates (6)

- CMOS Logic Gates (continued)

- CMOS gates are found in the 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     |

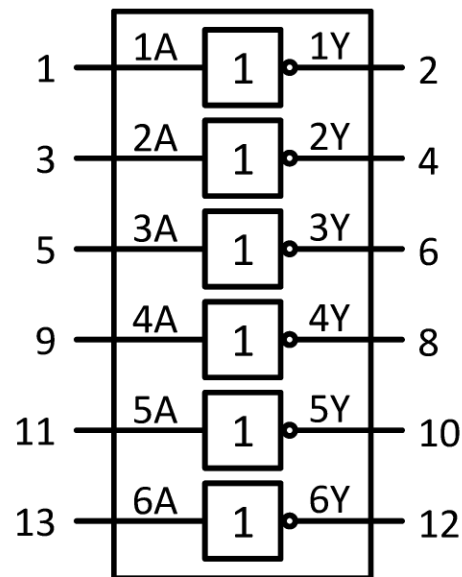
- There are also CMOS version of the TTL gates

- 74HC00: CMOS compatible voltage levels
- 74HCT00: TTL compatible voltage levels

# Logic Gates (7)

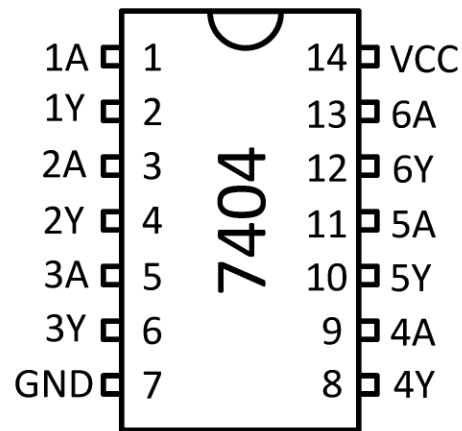
- 7404: Hex inverter

Functional Diagram

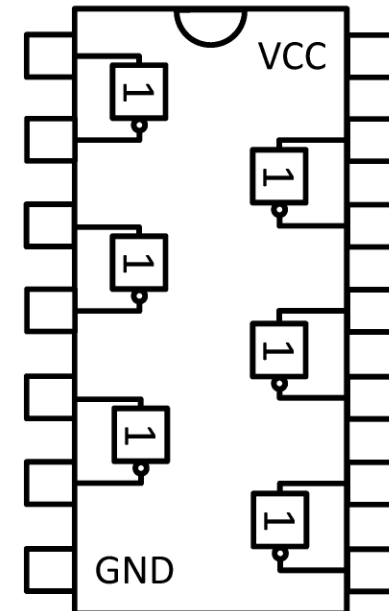


Logical View

Pin Configuration



Physical View



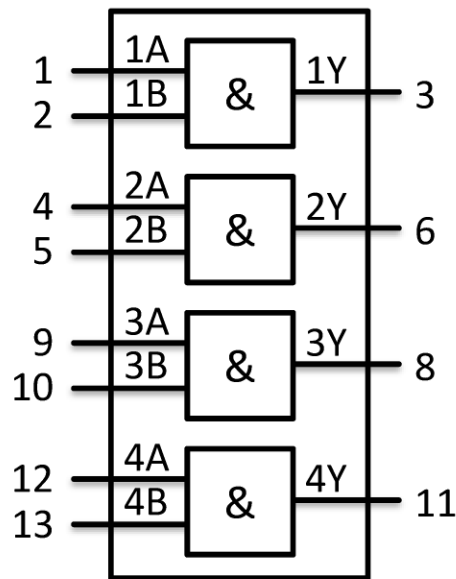
Internal View



# Logic Gates (8)

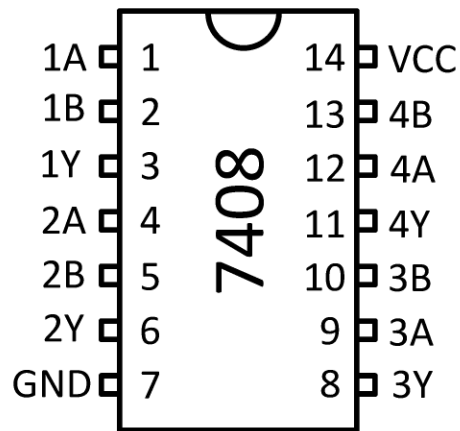
- 7408: Quad 2-input AND gate

Functional Diagram

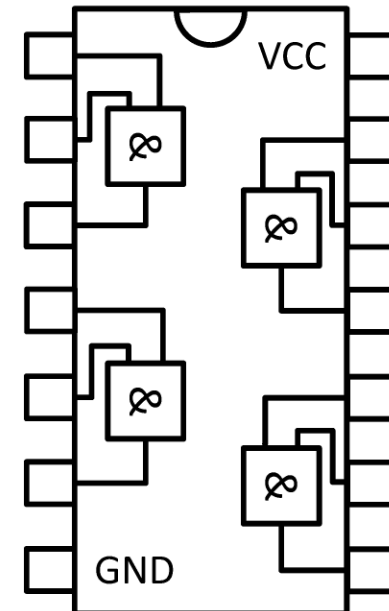


Logical View

Pin Configuration



Physical View

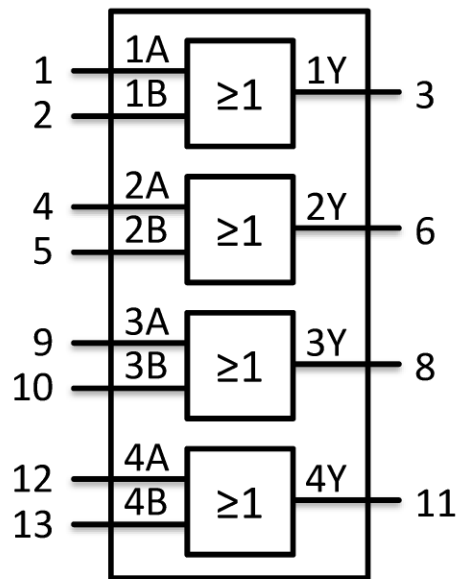


Internal View

# Logic Gates (9)

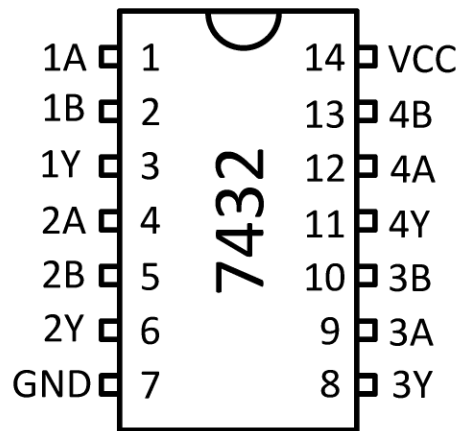
- 7432: Quad 2-input OR gate

Functional Diagram

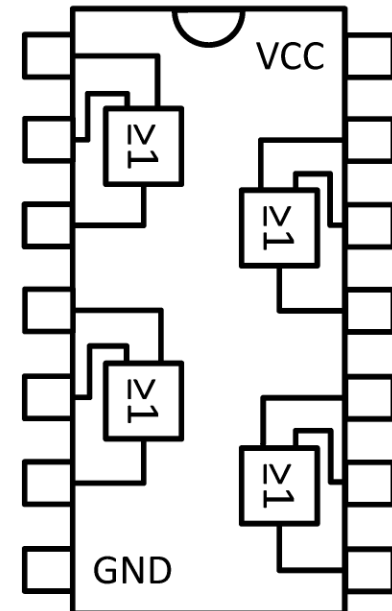


Logical View

Pin Configuration



Physical View

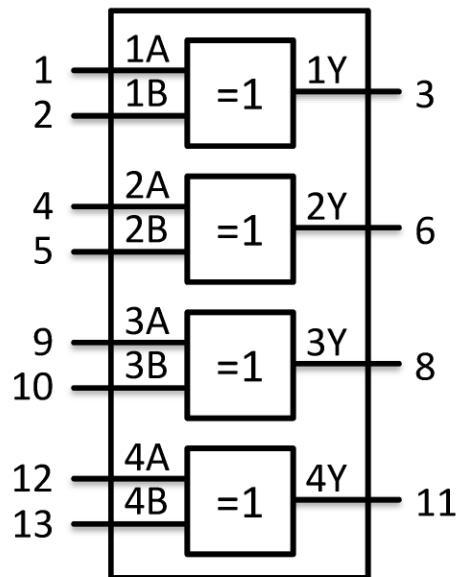


Internal View

# Logic Gates (10)

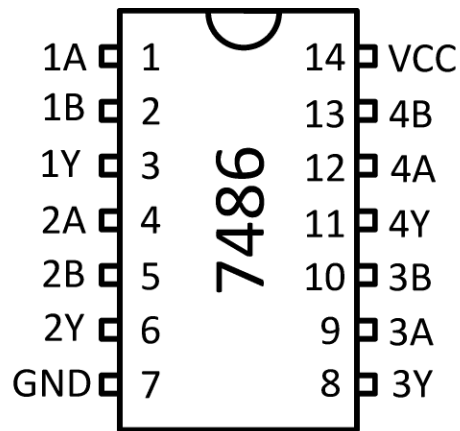
- 7486: Quad 2-input XOR gate

Functional Diagram

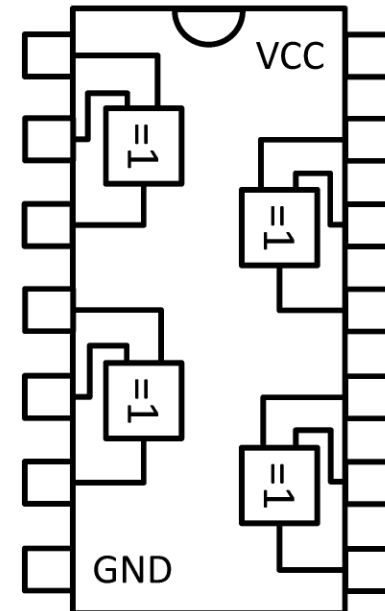


Logical View

Pin Configuration



Physical View



Internal View