

# Memory - ROM

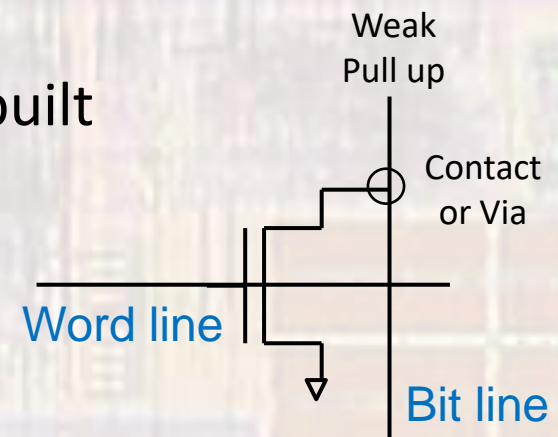
Last updated 1/25/21

# Memory - ROM

- Read Only Memory - ROM
  - Key Attributes
    - Sequential vs. **Random Access**
    - **Read only** vs. Read/Write
    - **Static** vs. Dynamic
    - Volatile vs. **non-Volatile**
  - Key Measures
    - Density +
    - Speed
    - Power
    - Cost / bit +

# Memory - ROM

- ROM – Read Only Memory
  - Memory cell (1 bit) is based on whether a MOSFET is or is not connected between the bit line and word line
  - The MOSFET structure is always part of the bit cell
    - It can be connected to the bit line through a contact or via (via ROM)
    - It can be disabled by removing the S/D diffusion (diffusion ROM)
- Cannot be modified once the part is built
- Typically used as Boot memory or to hold chip configuration data



# Memory - ROM

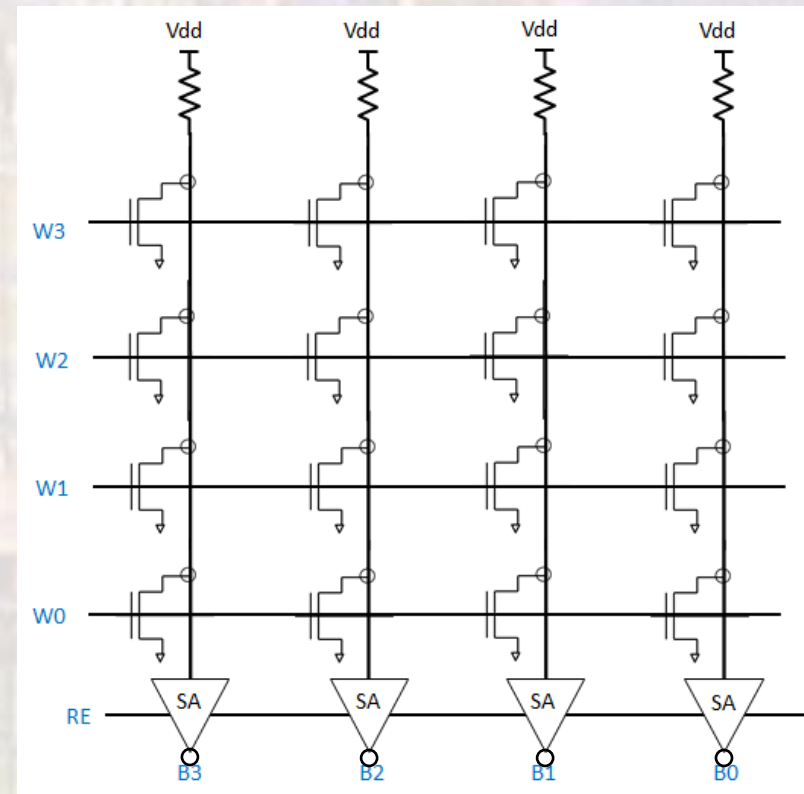
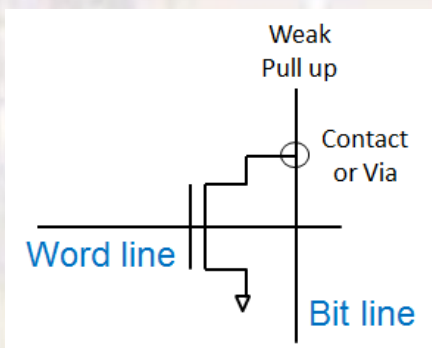
- ROM – Read Only Memory

- Read

- Read Enable (RE) high
    - Sense amplifiers on
    - Apply an address
    - Select the desired word line (high)
    - Sense amplifiers read the value of the bit lines

If connected – will read a “0”

If not connected – will read a “1”



# Memory - ROM

- ROM – Read Only Memory
  - Read – x1 configuration

RE high  
address = 5  
0101

→

data out = 0

RE high  
address = 8  
1000

→

data out = 1

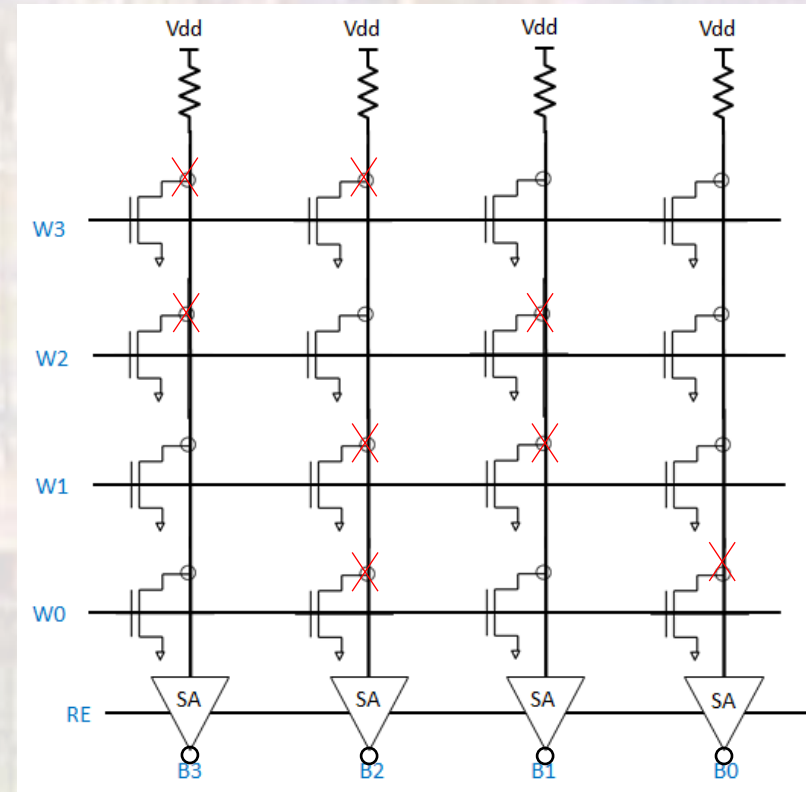
RE high  
address = 10  
1010

→

data out = 1

addr\_high

2



addr\_low

2

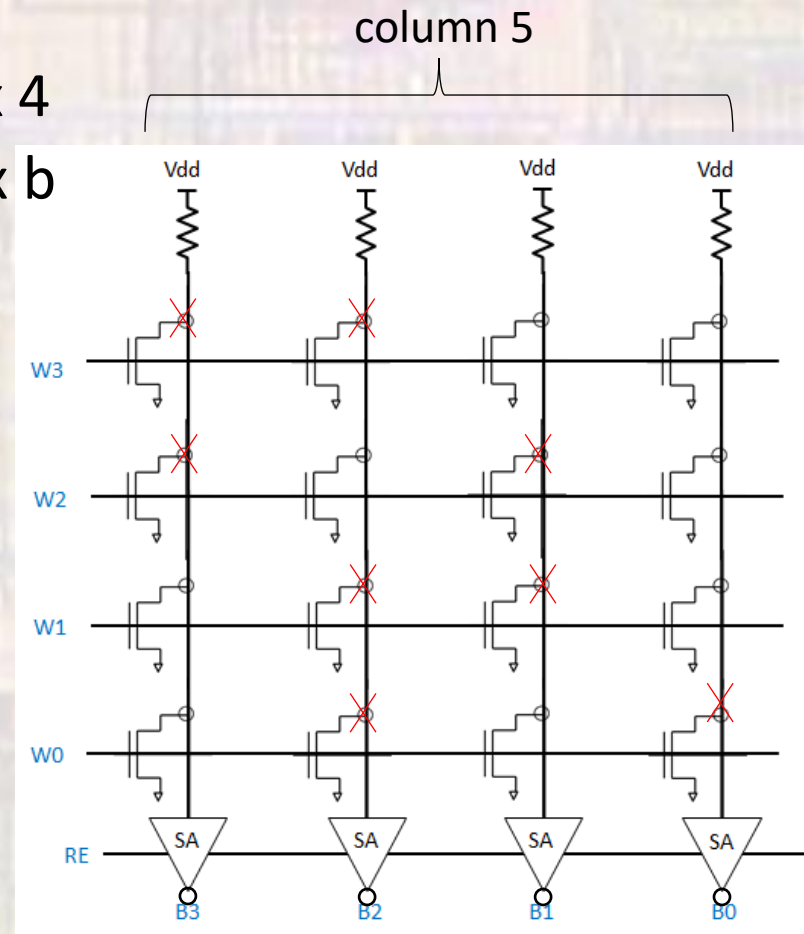
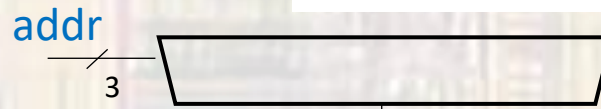
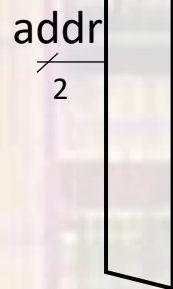
data out

# Memory - ROM

- ROM – Read Only Memory
  - Read – x4 configuration – 4 x 8 x 4

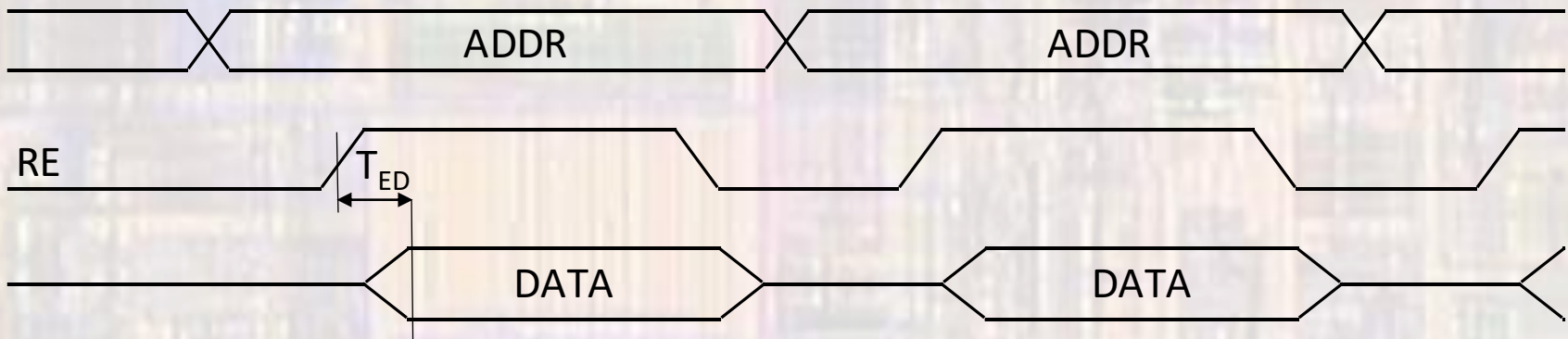
R x C x b

RE high address = 29 11101	RE high address = 21 10101	RE high address = 5 00101
→	→	→
data out = 0011	data out = 0101	data out = 1010

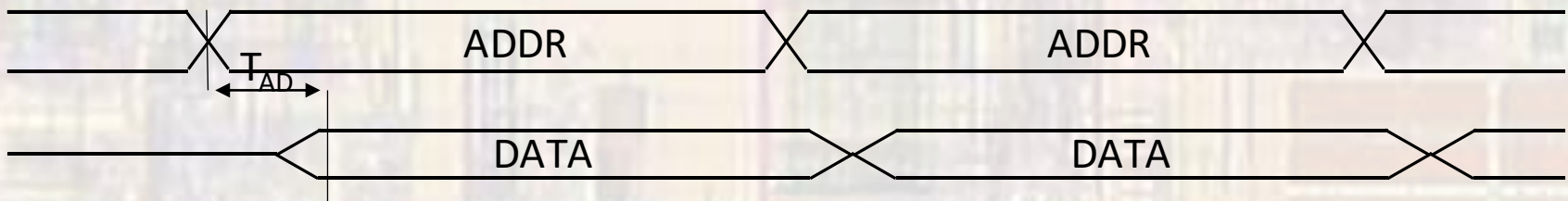


# Memory - ROM

- ROM – Read Only Memory
  - Timing – Read enable

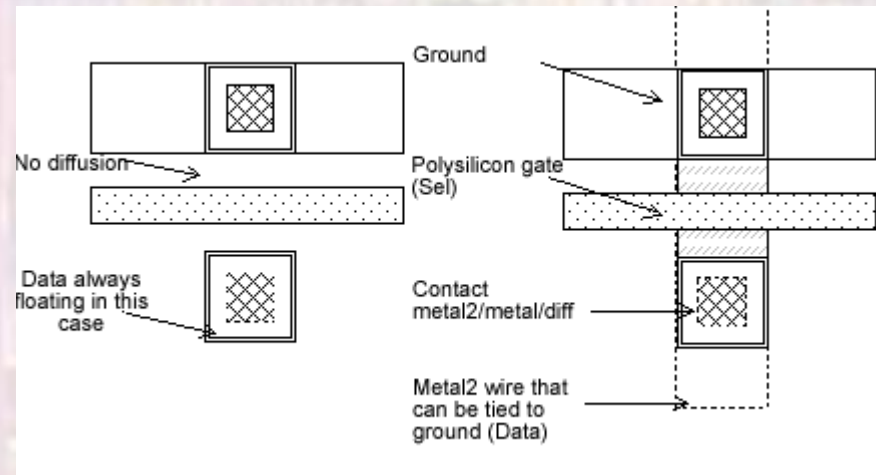
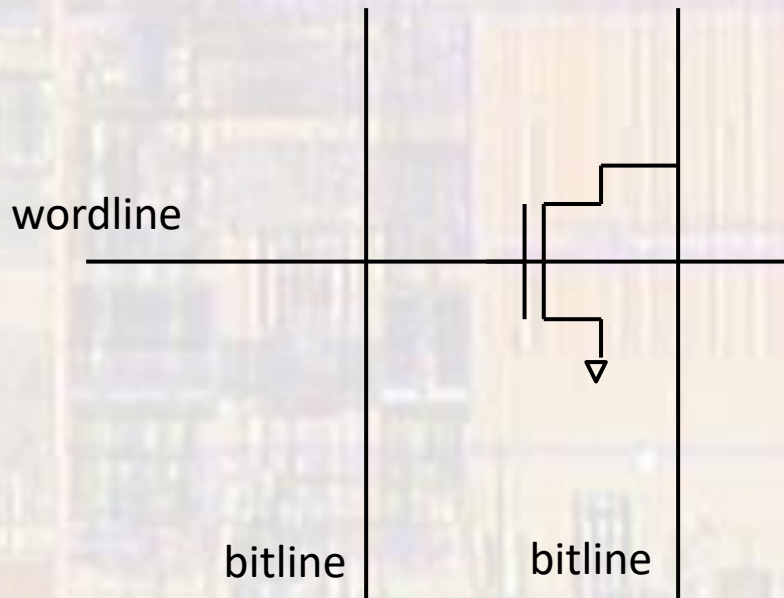


- Timing – no Read enable



# Memory - ROM

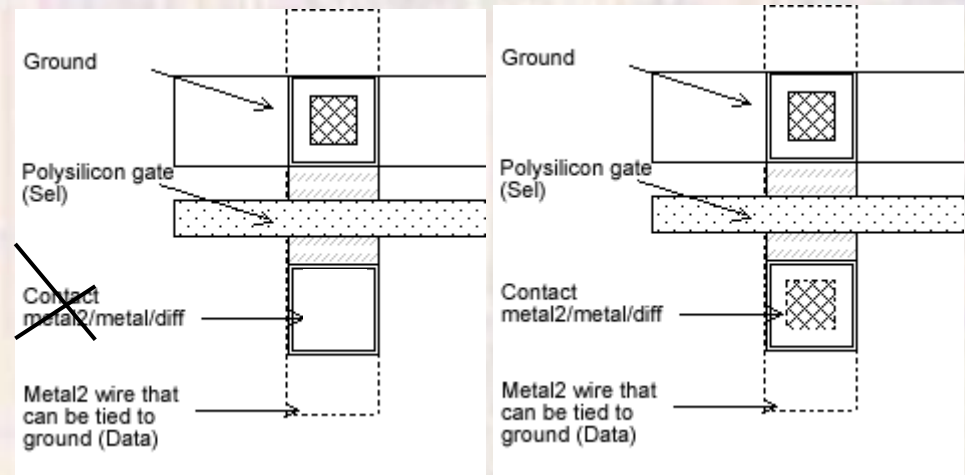
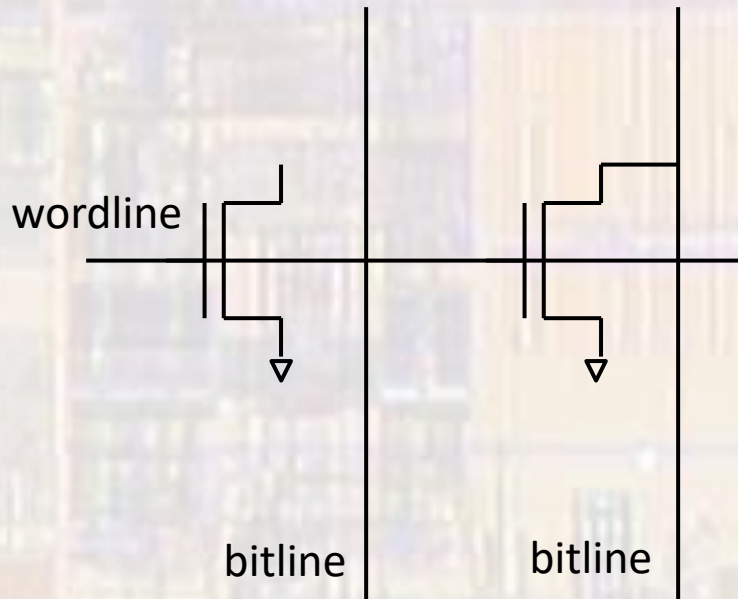
- ROM – Read Only Memory – Diffusion ROM





# Memory - ROM

- ROM – Read Only Memory – Via (contact) ROM



"0"