

COMPUTER ARCHITECTURE

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LIFE CYCLE OF ANY EMBEDDED PROJECT

1 - Coding



we write the project code on our machine which we call it host machine.

2 - Compiling



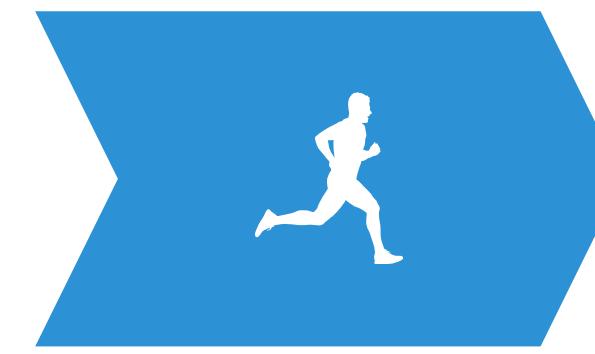
Then we start compiling the project by cross-compiler, since we this project wouldn't run on our host machine.

3 - Delivring



Programmer would Deliver Binary File to Microcontroller

4 - Project On



Project is going to be run on Microcontroller

WHAT IS EVEN A COMPUTER ?

A machine that can help you do a lot of things ex. Play games readings , it has screen, keyboard, and mouse.



MAIN STRUCTURAL COMPONENT OF ANY COMPUTER

I/O Units

Equipment used to move data between computer and its external environment like (screens, usbs, keyboard, mouse) (how a computer talks to outside world)

Memory Unit

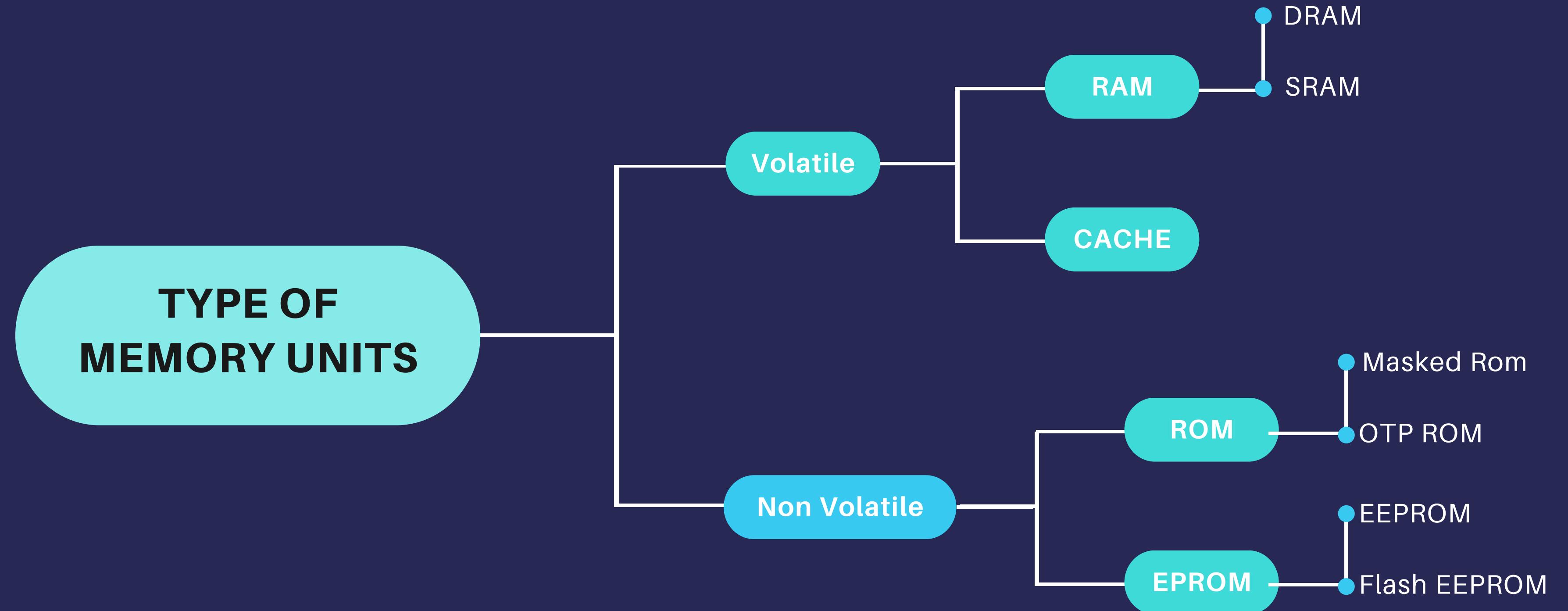
stores data and instructions

CPU

controls the operation of the computers and performs data processing functions.

System Bus

Provide communication among computer components (cpu, I/O, Memory Unit)



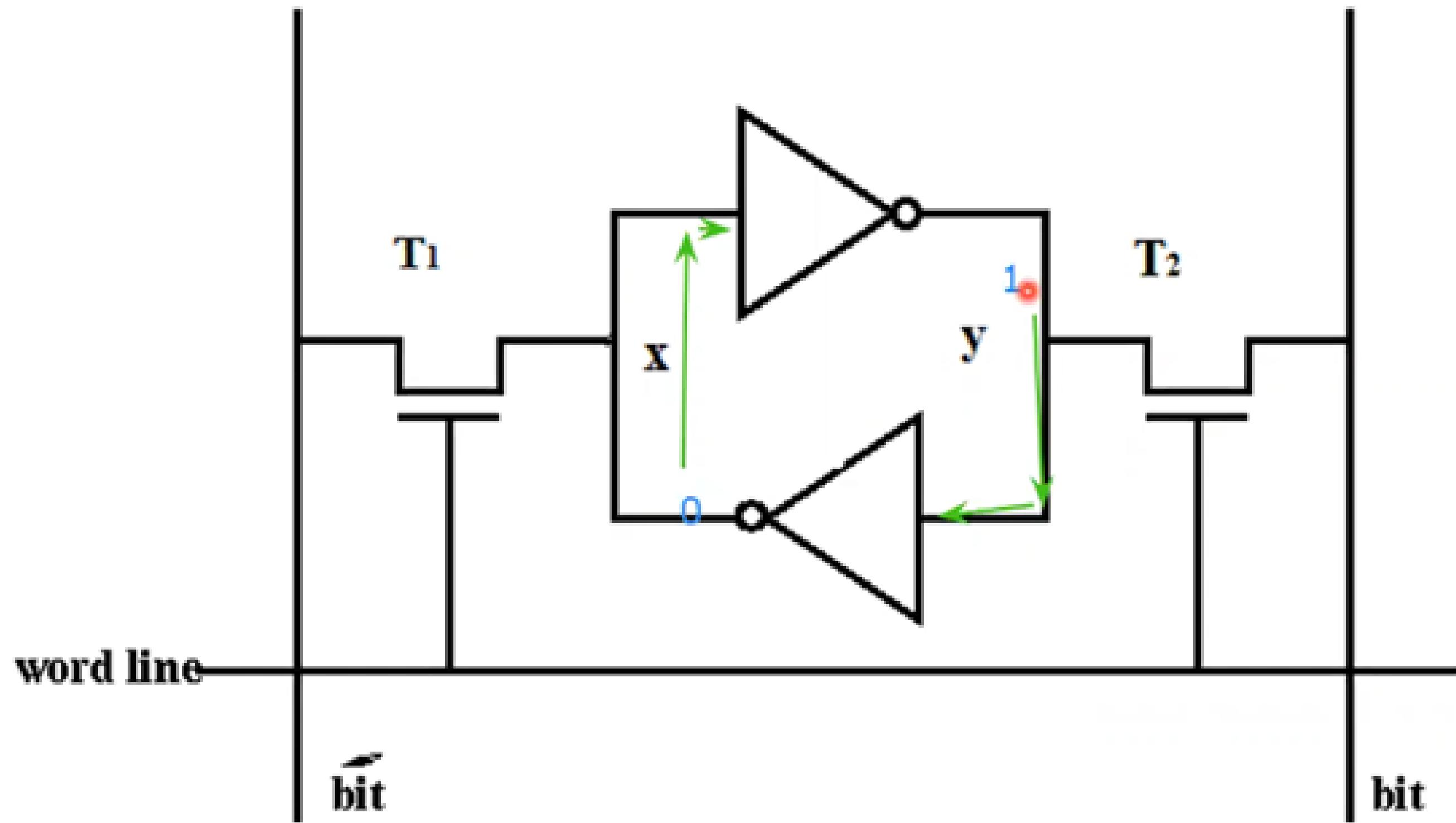
ROM

Rom ‘Read only memory’: type of memory that can only be read, not written to. ‘Data stored in ROM cannot be changed used to store instructions that computer needs to start up. ‘these instructions tell the computer how to load the operating system

RAM

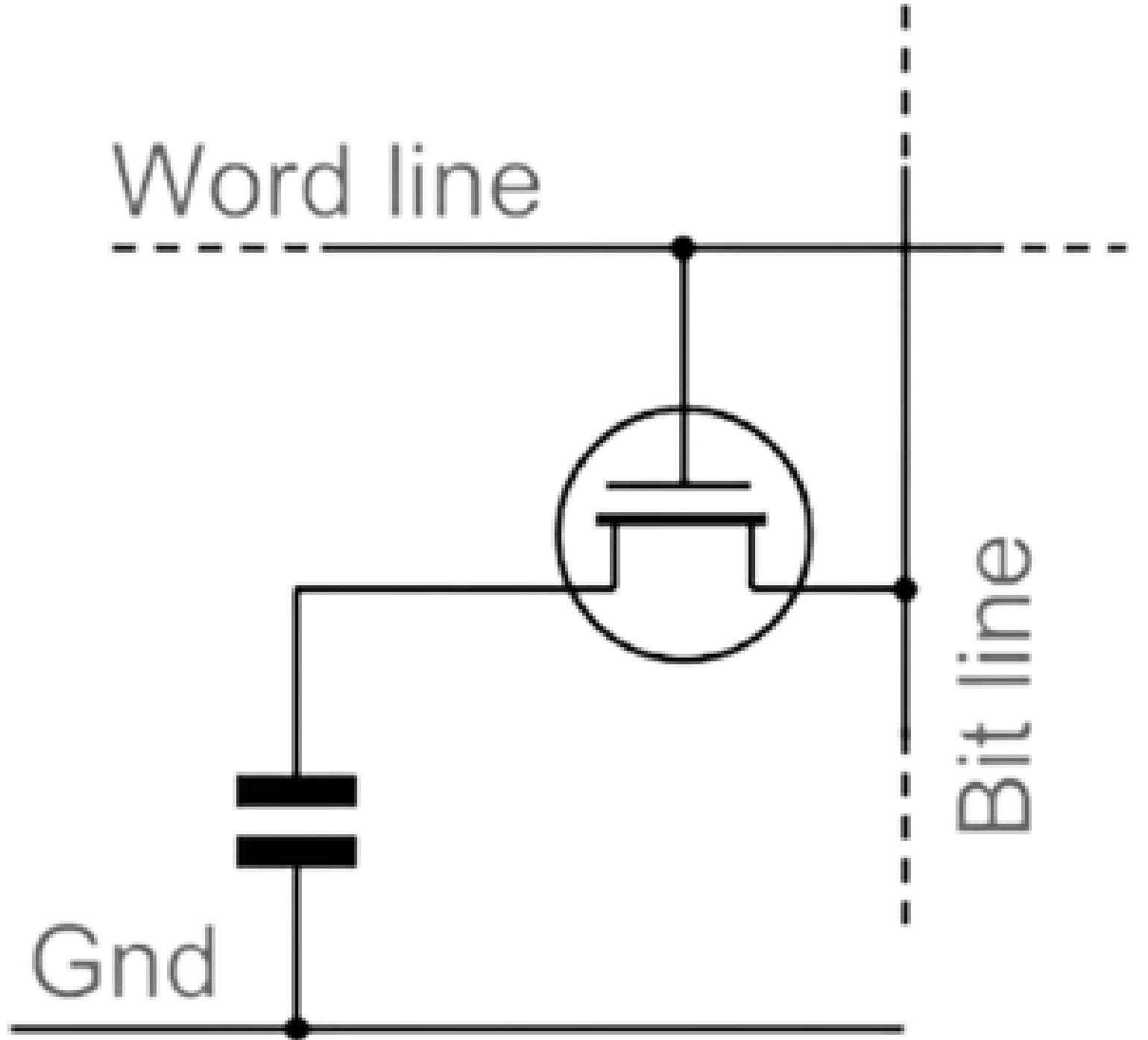
Ram ‘Random access Memory’: type of memory can be read and written to used to store data,used to store data that the computer is currently using (ex. Service of your operating system)

SRAM - STATIC RAM



DRAM

- DRAM - Dynamic Random Access Memory
- Was created as alternative to SRAM to offer higher storage capacity with lower price point, but compare to SRAM it offers lower speed.
- You have to keep feeding it energy every seconds to retain information, if there is no energy data is lost
- Applications: Can be seen in computers memory



READING DRAM CELLS

Dynamic Random Access Memory (DRAM). Part 1: Memory Cell Arrays

Dynamic Random Access Memory

Share

The diagram illustrates a portion of a DRAM chip. It features four vertical columns of memory cells, each consisting of a capacitor connected to a bit line and a transistor controlled by a word line. The cells store binary values '0' or '1'. A red play button icon is positioned in the center of the array. At the bottom, four blue boxes labeled 'Sense Amplifier' are connected to the bit lines. Each sense amplifier receives a 1.5V supply voltage and a 1.5V - 6V control signal, with its output also being 1.5V.

bit line

word line

word line

word line

bit line

word line

word line

word line

bit line

1.5V - 6V

Sense Amplifier

1.5V

1.5V + 6V

Sense Amplifier

1.5V

Sense Amplifier

1.5V

Sense Amplifier

1.5V

Watch on YouTube

Memory Segments

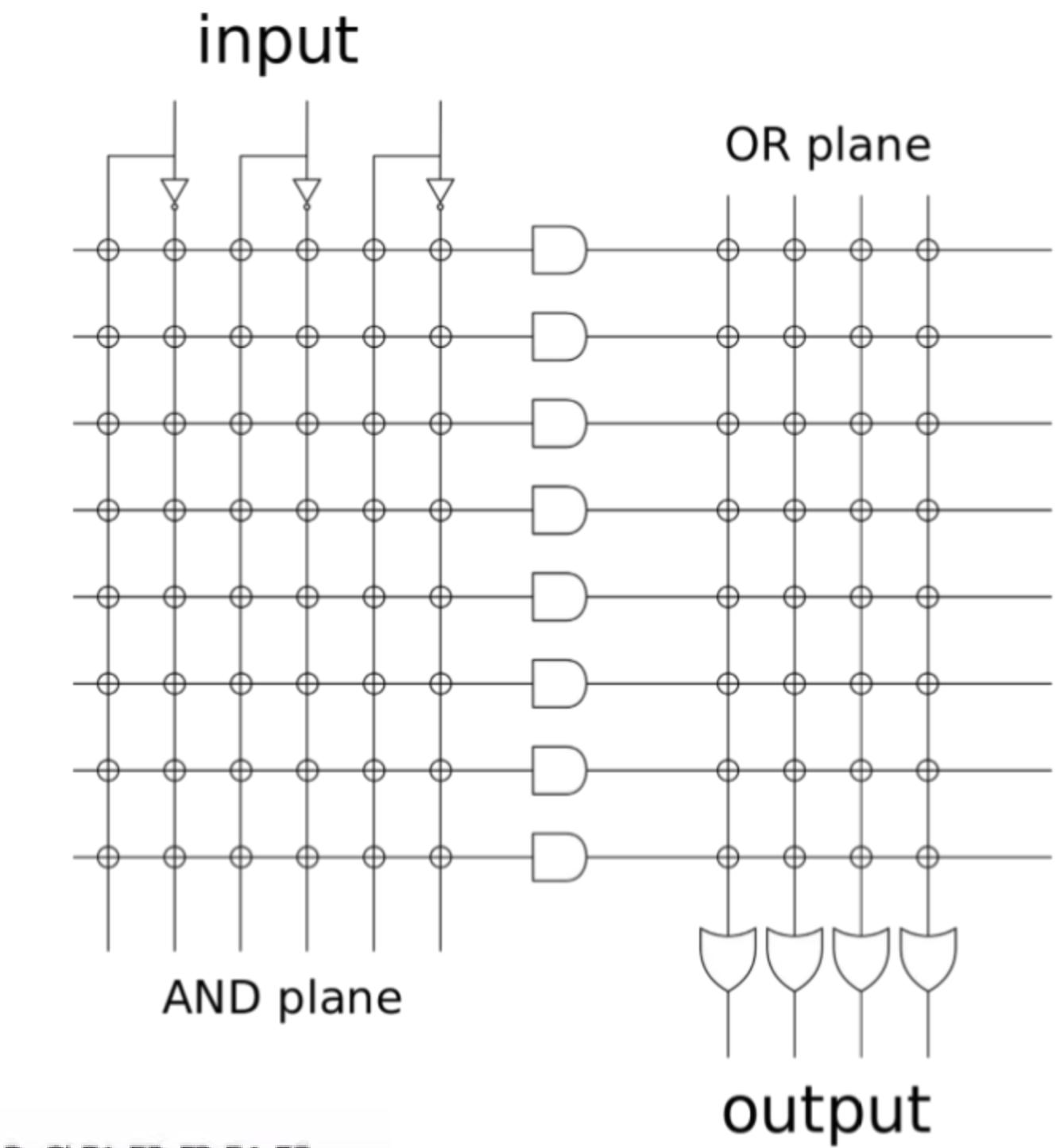
- **Text Segment:** Contains the actual machine instructions of the program.
- **Data Segment:** Storing Global and static variables that do not need an initial value set Program.
- **BSS Segment:** Storing global and static variables that do onto need an initial value set by the program.

Memory Segments

- **Stack:** managing function calls and keeping track of local variables and function parameters.
- **Heap:** Memory where Dynamic Memory allocation occurs. in other word used when allocating memory at run-time.
- **Interrupt Vector Table:** special segment contains memory addresses pointing to starting position of steeped Action to do when that interrupt occurs.

Masked Rom

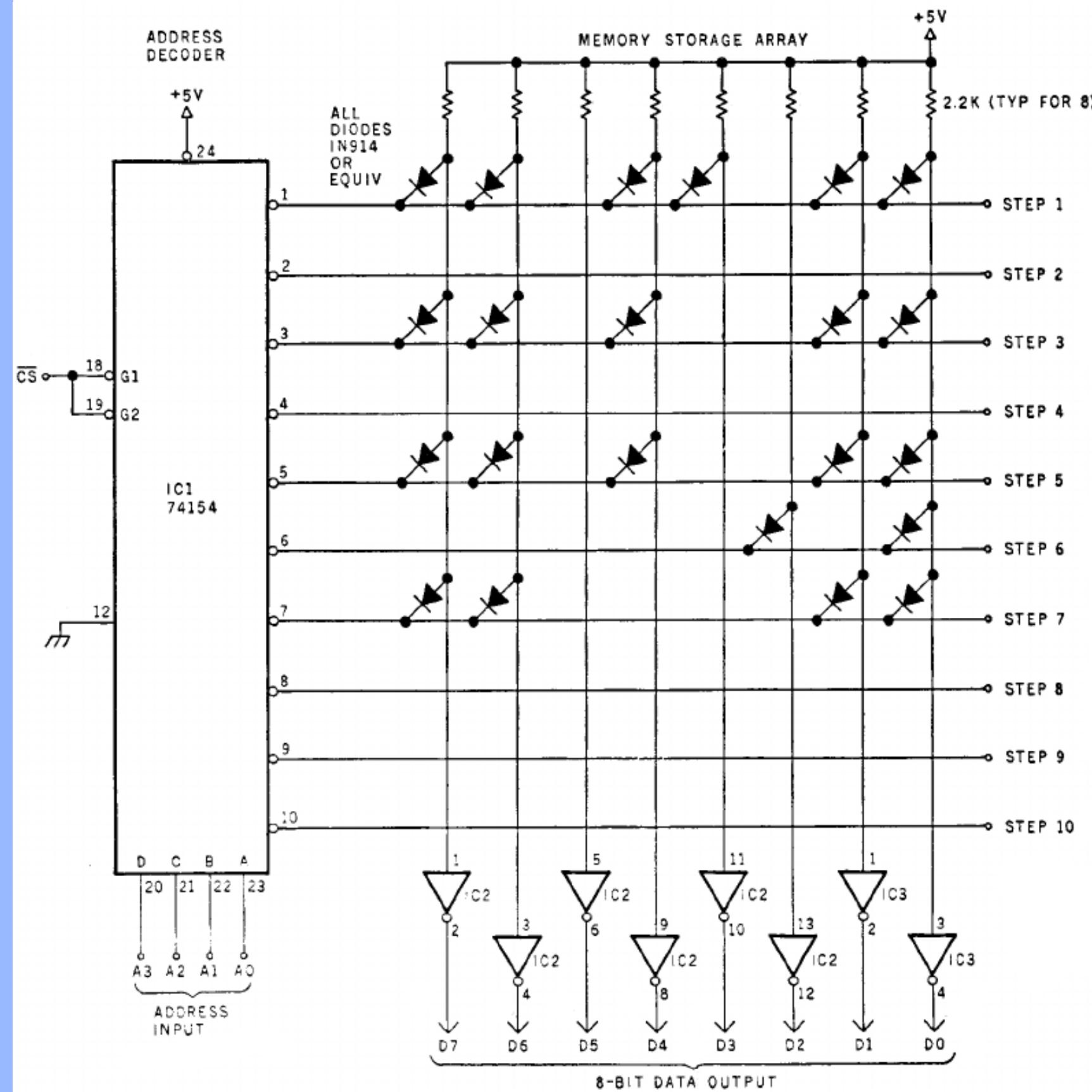
- Is type of Rom considered as PLD
“Programmable Logic Device” Masked ROM is type of PLD that is programmed at factory with pre-sited instructions.
- PLD: Type of IC ‘Integrated circuit’ can be programmed to perform a specific function



A	B	C	F1	F2	F3	F4	F5
0	0	0	0	0	1	1	0
0	0	1	0	1	0	1	1
0	1	0	0	1	0	1	1
0	1	1	0	1	0	1	0
1	0	0	0	1	0	1	1
1	0	1	0	1	0	1	0
1	1	0	0	1	0	1	0
1	1	1	1	1	0	0	1

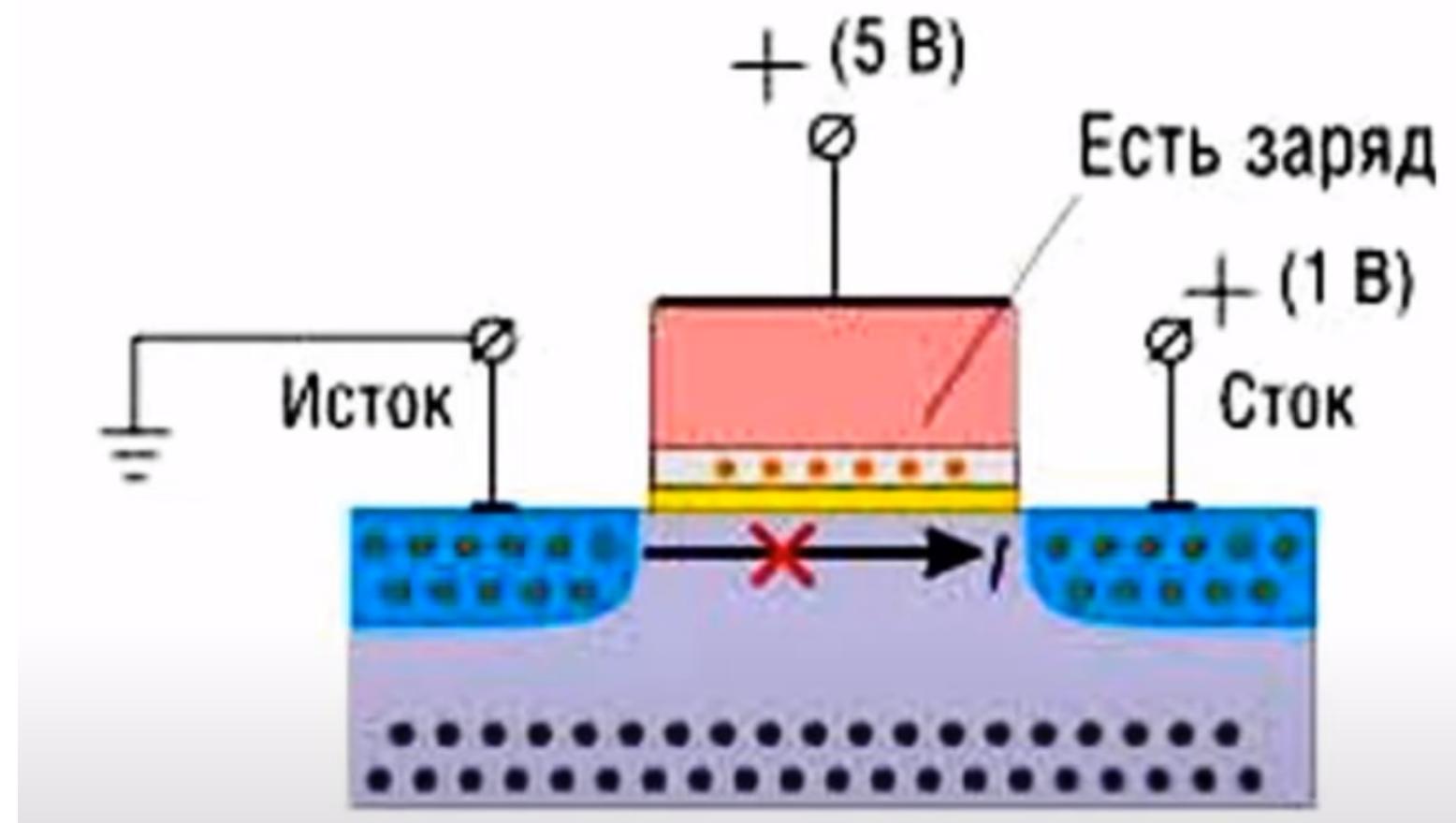
OTP Rom

- Stands for ‘One-Time Programmable ROM’ allows for data programming after manufacturing processing, while masked Rom is permanently programmed during the manufacturing process. But it comes with higher cost compared with masked Rom. This is because the programming capability adds extra step and complexity to the manufacturing process.

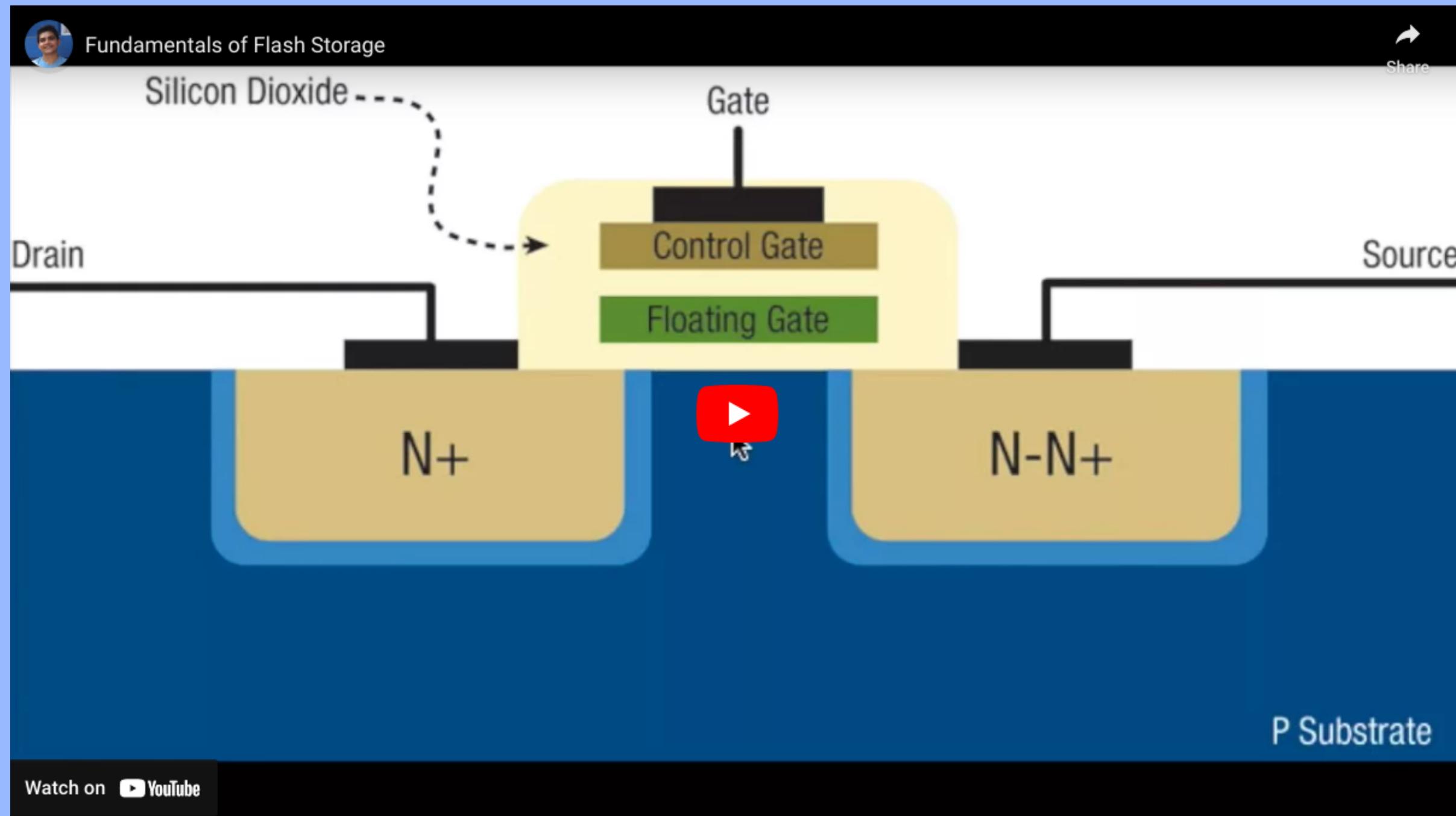


EPROM

- stands for Erasable Programmable Rom
- To erase EPROM memory, we apply UV light in order for trapped electrons to get enough energy to escape floating gate.
- Main component of EPROM cells is Floating Gate transistor
- when there is no electrons between isolated layers: Represents one 'Default state of EPROM'
- when there are electrons between the isolation layer: Represent zero

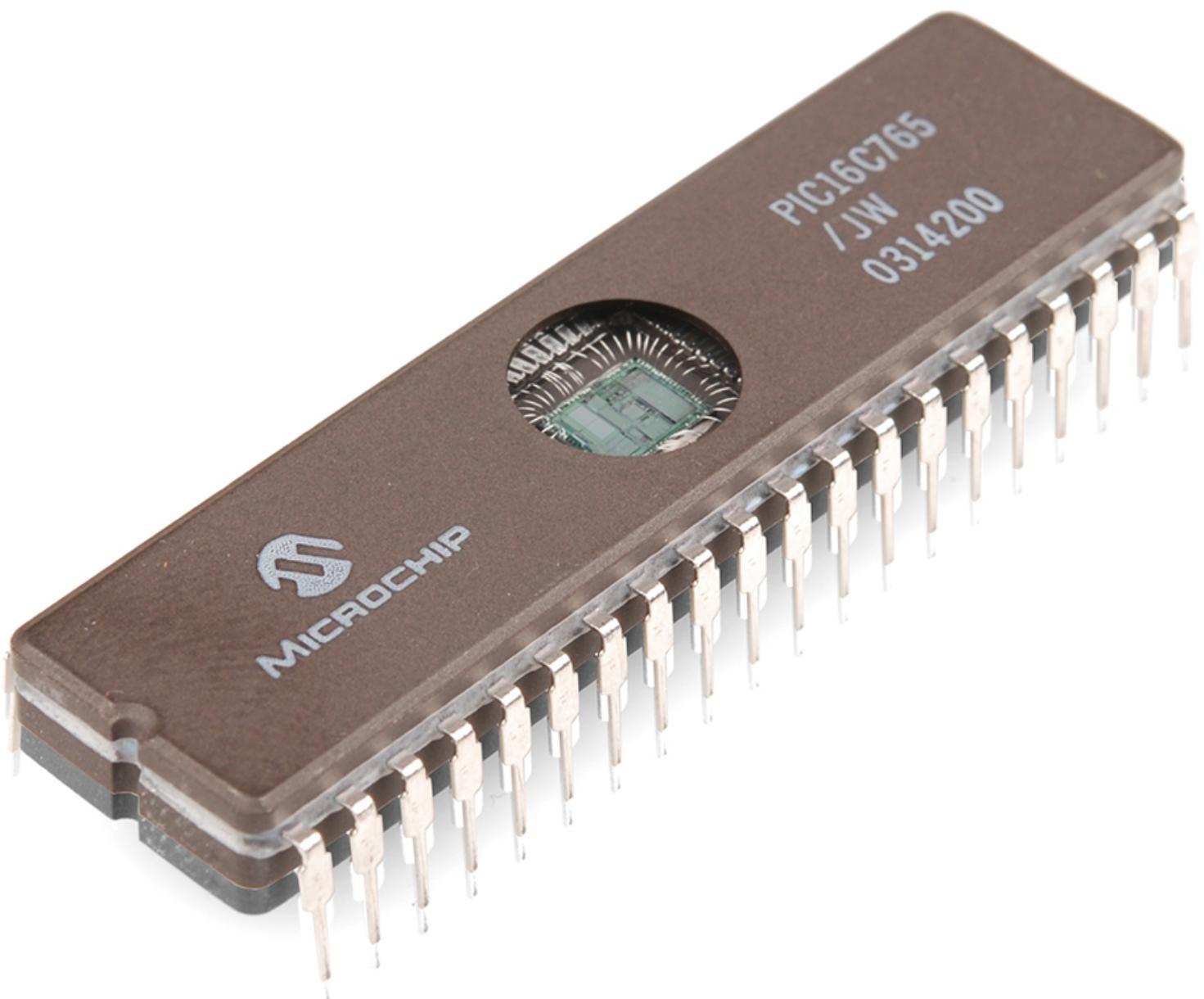


In Depth Look into EPROM



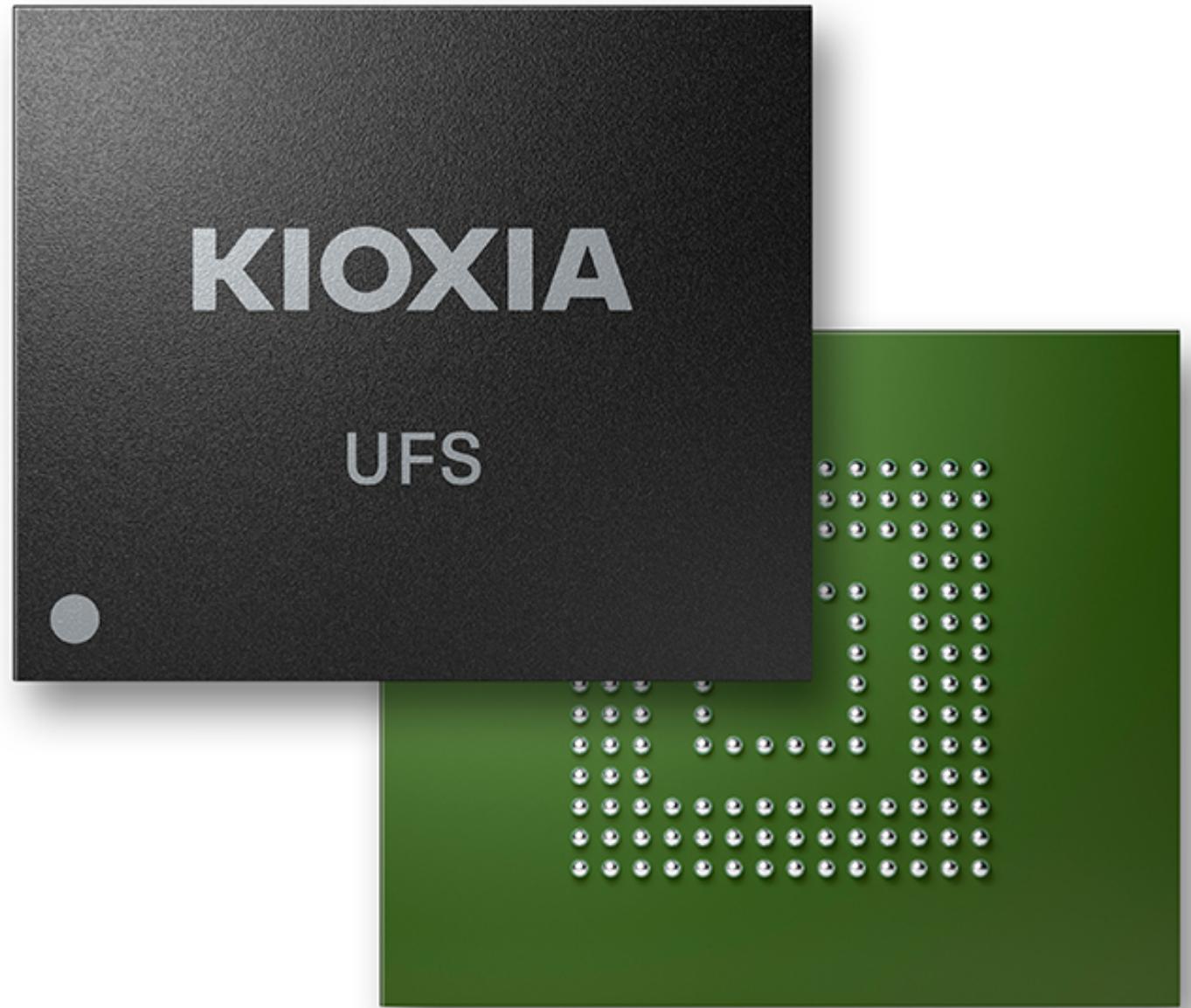
EEPROM

- stands for Electrically Erasable Programmable Rom
- Offers Multiple Read/Write cycles depending on specific type, Note: there is a finite number of write/erase cycles before performance begin to degrade.
- Writing is slower than reading.
- In embedded systems, it's used for storing vital data, such as system configurations and settings, which act as backup in the even of power loss.



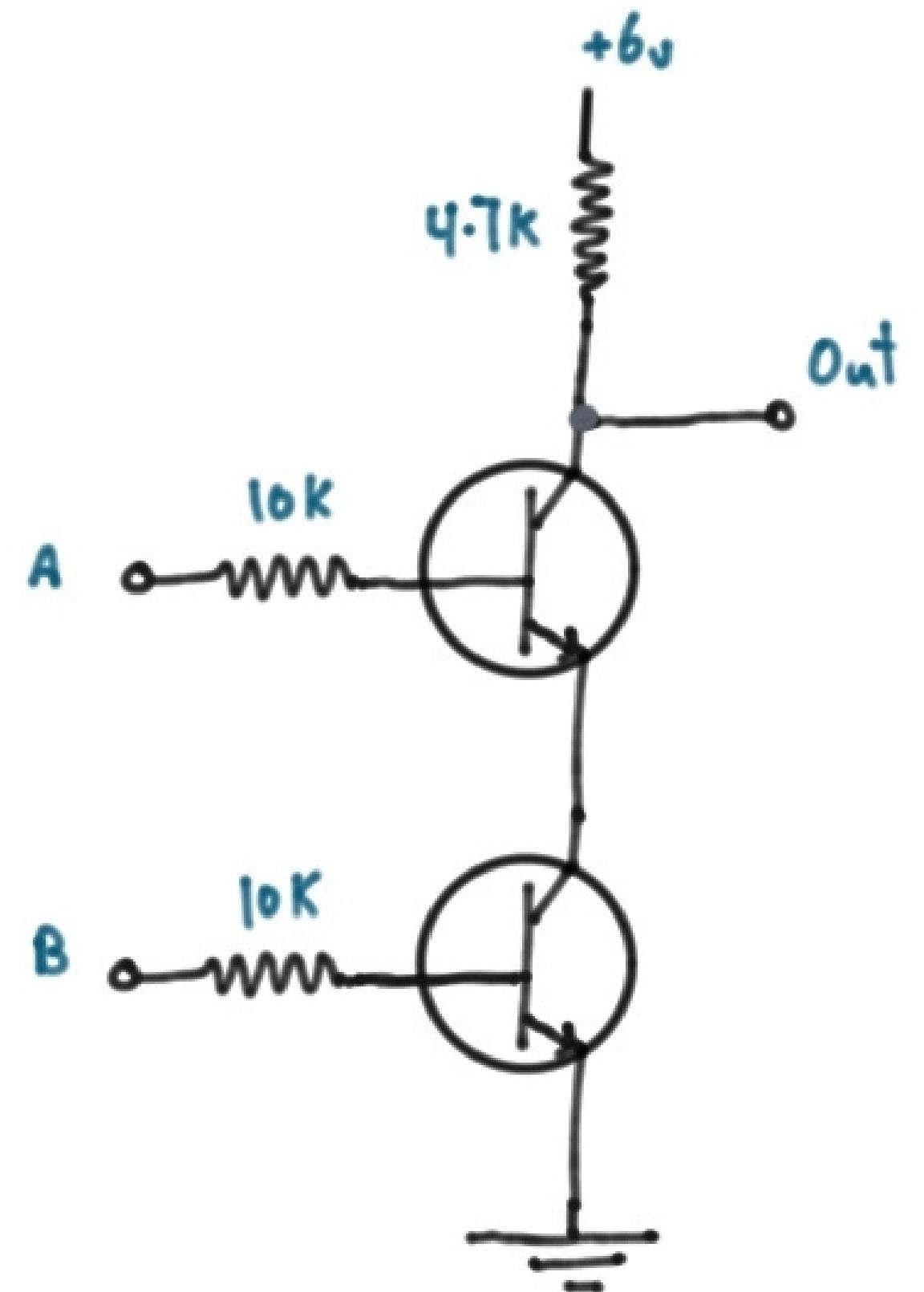
Flash EEPROM

- Provide More speed with smaller size and faster access time compare to EEPROM and EPROM has two types.
- Used for storing Project We wrote.
- There are Two Types of NAND EEPROM and And NOR.



Flash EEPROM

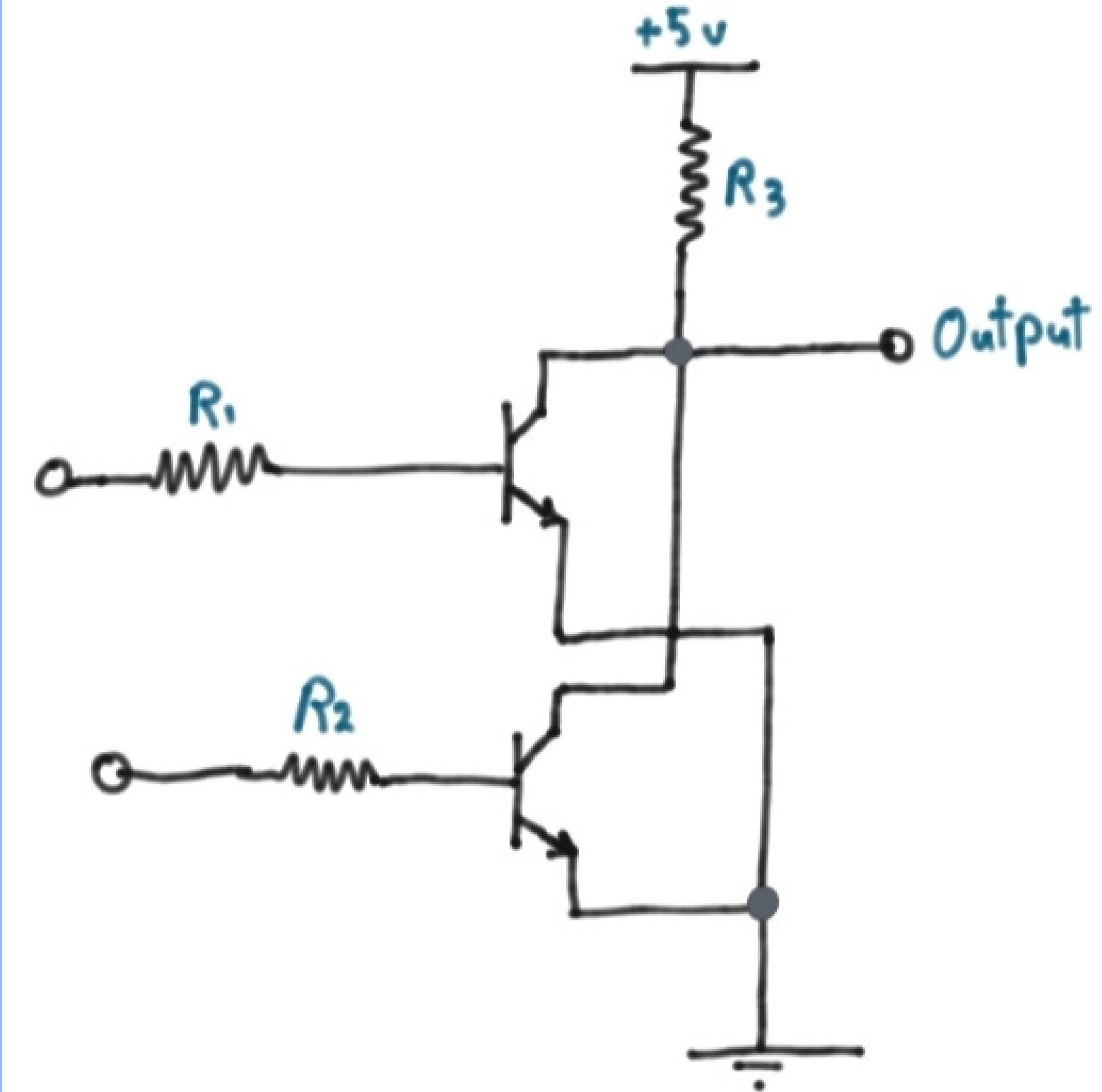
- Used In (USB Drivers - Memory Cards - solid state Drivers).
- Sector addressable.



NAND Flash

Flash EEPROM

- Used In embedded system to store binary of code we wrote.
- Byte addressable.



NOR Flash

Non-Volatile RAM

- NVRAM is a special type of SRAM that has backup battery power so it can retain its content after the main system is shut off. Another variation of NVRAM combines SRAM and EEPROM so that its content is written into the EEPROM so that its content is written into the EEPROM when power is shut off and is read back from the EEPROM when power is restored.