SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF MECHATRONICS ENGINEERING

19MCT201 - DESIGN OF DIGITAL CIRCUITS

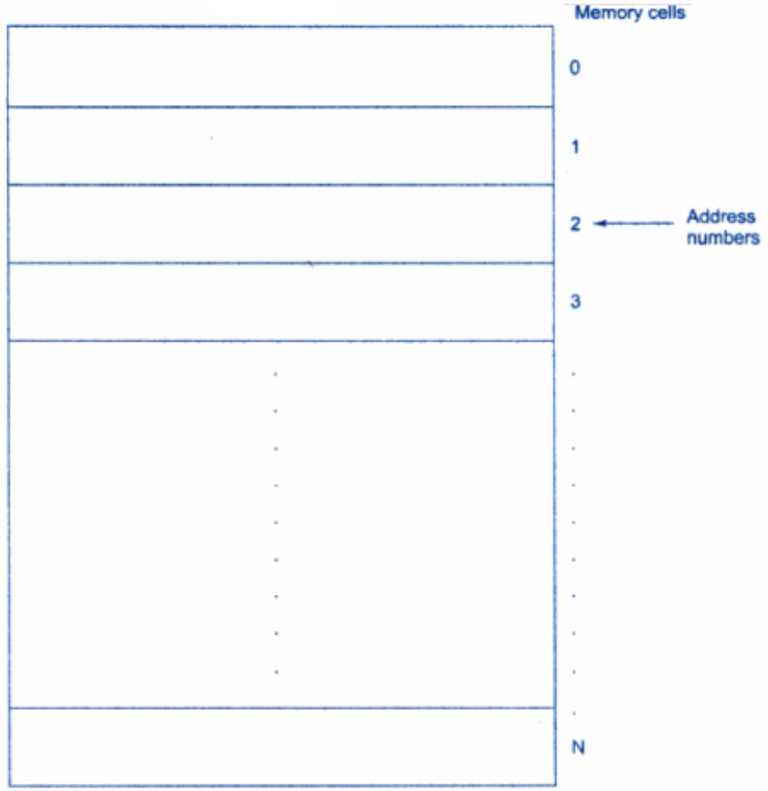
II YEAR - III SEM

UNIT 5 – DIGITAL LOGIC FAMILIES AND PLD

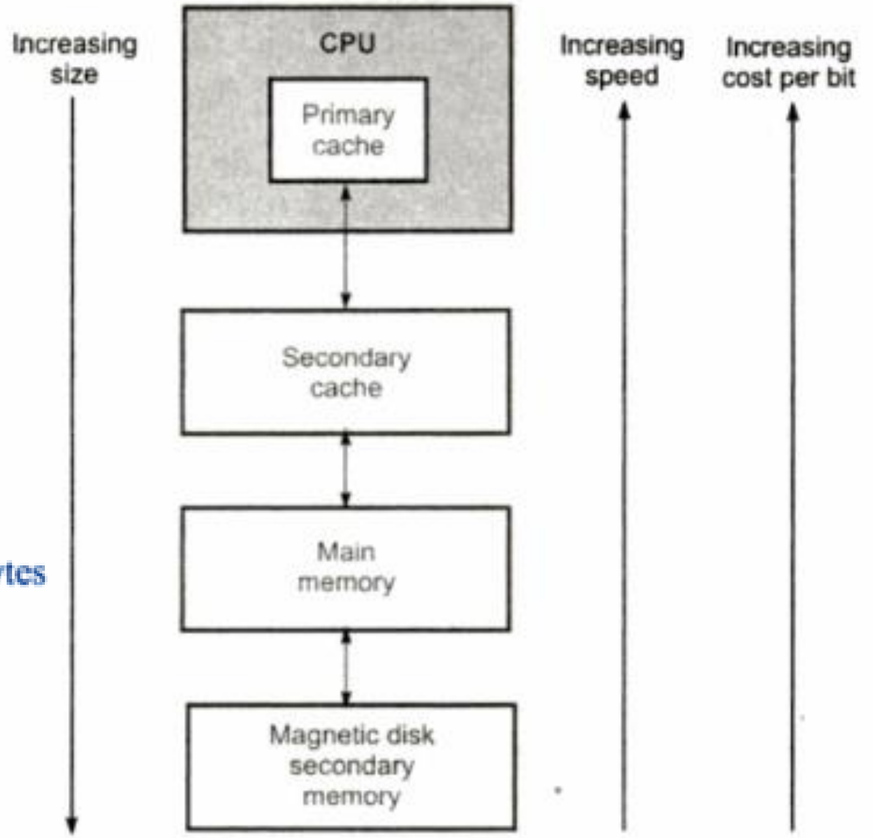
TOPIC 1– Memories

Introduction to Memory

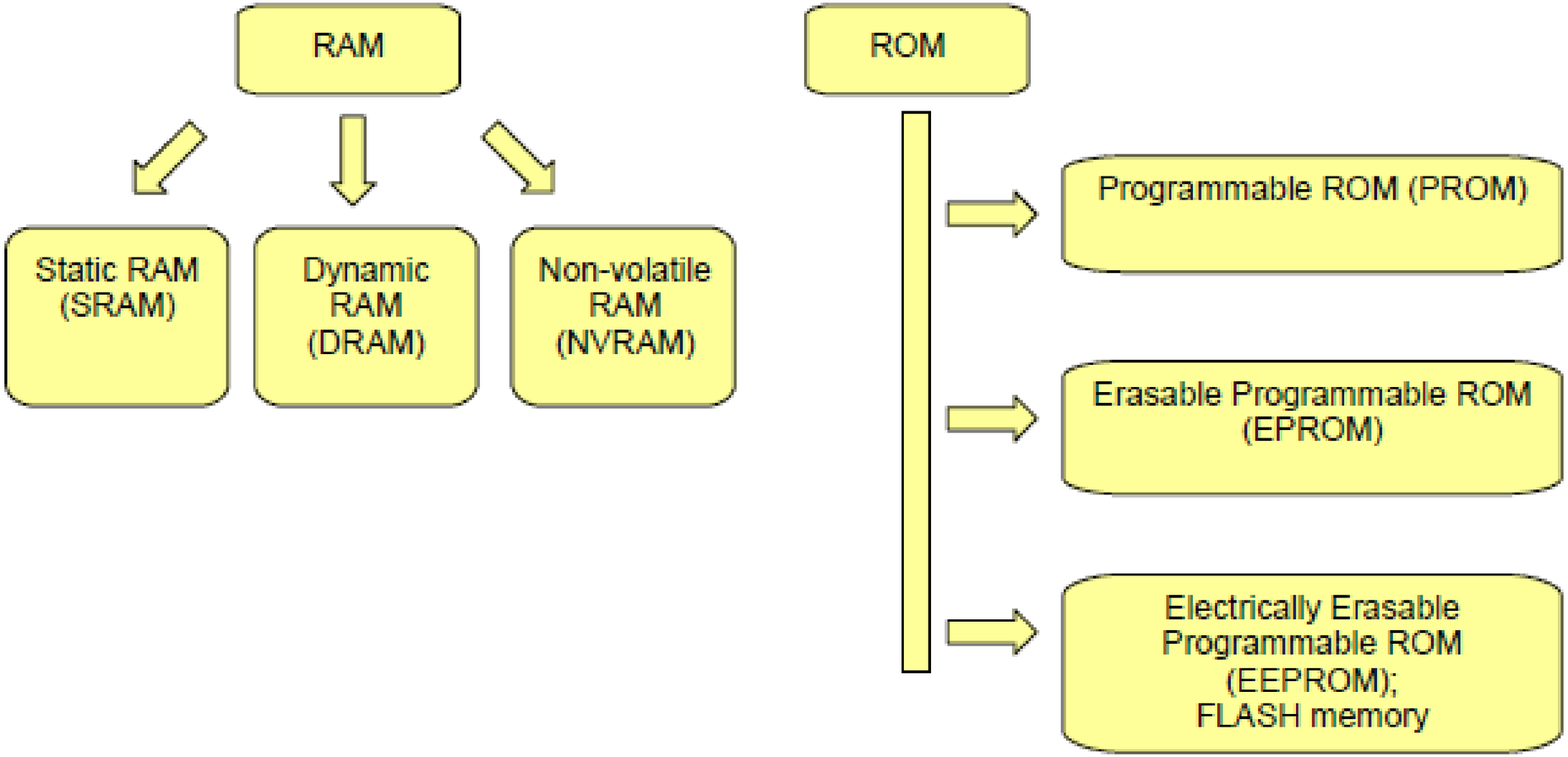
Programs and the data that processor operate are held in the main memory of the computer during execution, and the data with high storage requirement is stored in the secondary memories such as floppy disk, hard disk etc.



1 KB (Kilobyte) = 1,024 bytes
1 MB (Megabyte) = 1,048,576 bytes
1 GB (Gigabyte) = 1,073,741,824 bytes
1 TB (Terabyte) = 1,099,511,627,776 bytes

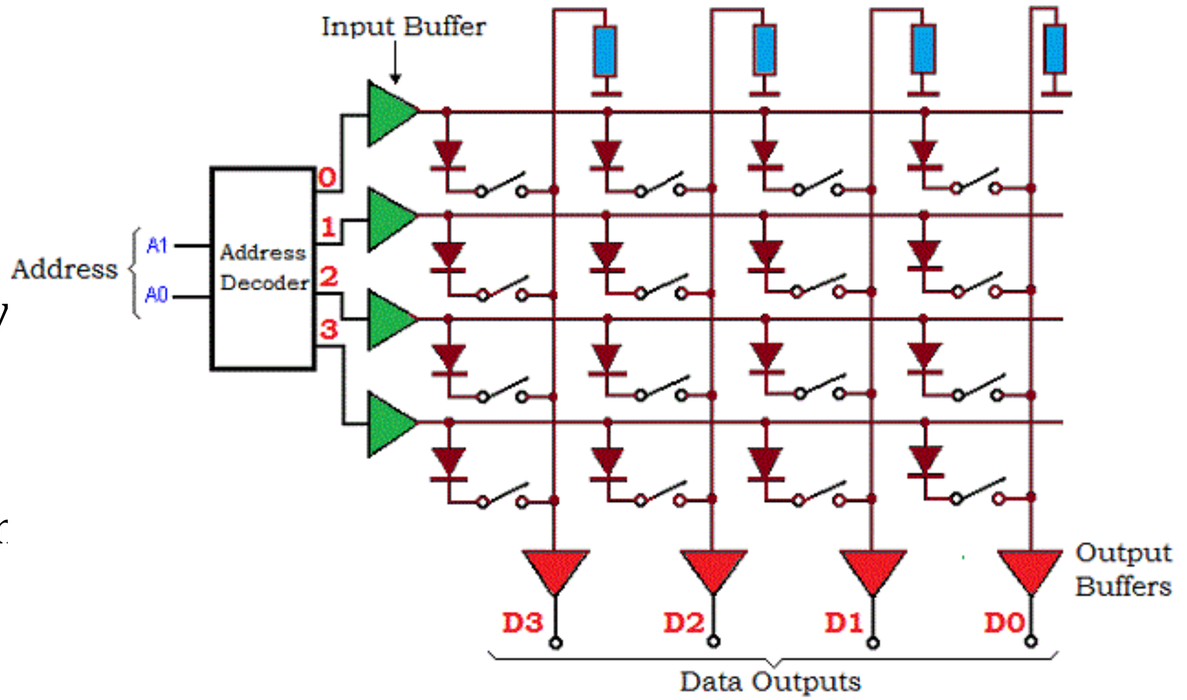


Types of Memories



Read-Only Memory (ROM)

- Written only once during manufacturing
- Can be read, but cannot be written later
- Is nonvolatile, nonerasable
- **Applications:**
  - microprogramming, system programs, library subroutines
- **Advantage**
  - data/programs are permanently in main mem
- **Problems**
  - costly for small runs, but attractive for high-volume runs
  - no room for error



ROM: Read Only Memory

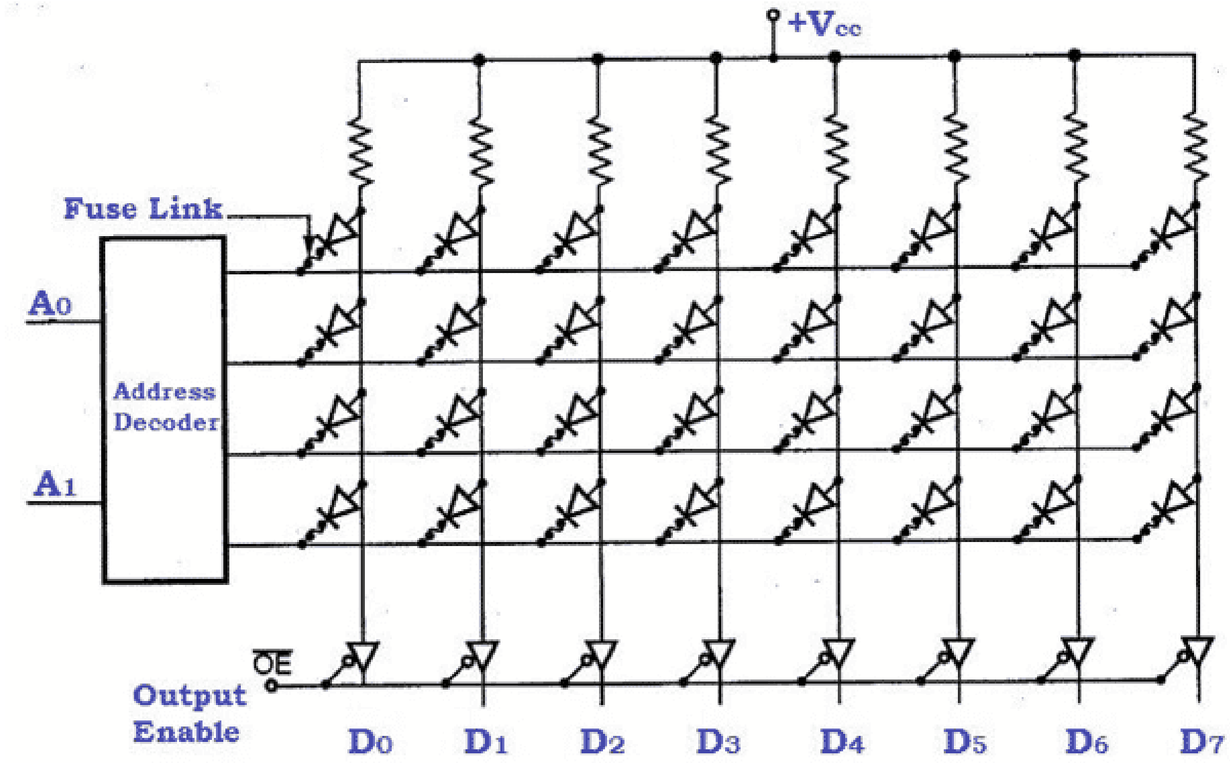
Read only memory devices are a special case of memory where, in normal system operation, the memory is read but not changed. Read only memories are non-volatile, that is, stored information is retained when the power is removed.

It is programmed never. The data is hard-coded into the chip itself. Once the chip wafer is manufactured, that is it, it can never be changed, only tested before it goes out. The ones and zeros are hard-coded connections to +V and ground.“

Programmable ROM (PROM)

- Written only once after manufacturing
- Can be read, but cannot be written later
- Is nonvolatile, non-erasable
- Attractive for small production runs

- **Advantages:**
  - flexible and convenient
  - less expensive



PROM

One step up from the masked ROM is the PROM (programmable ROM), which is purchased in an unprogrammed state.

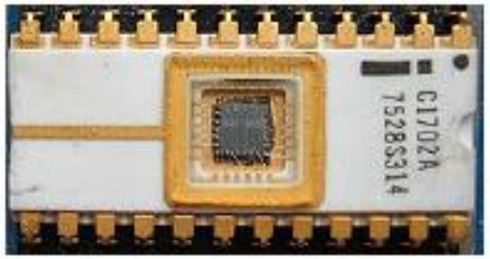
- If you were to look at the contents of an unprogrammed PROM, the data is made up entirely of 1's.
- The process of writing your data to the PROM involves a special piece of equipment called a device programmer. The device programmer writes data to the device one word at a time by applying an electrical charge to the input pins of the chip.
- Once a PROM has been programmed in this way, its contents can never be changed. If the code or data stored in the PROM must be changed, the current device must be discarded. As a result, PROMs are also known as one-time programmable (OTP) devices.

Erasable PROM (EPROM)

- Can be written many times
- Erased by ultraviolet radiation before each write operation at chip level
- Erasure (20 mins) can be performed repeatedly
- Is nonvolatile
- Pros & cons:
  - Capable of multiple update
  - More expensive than PROM

Erasable PROM (EPROM)

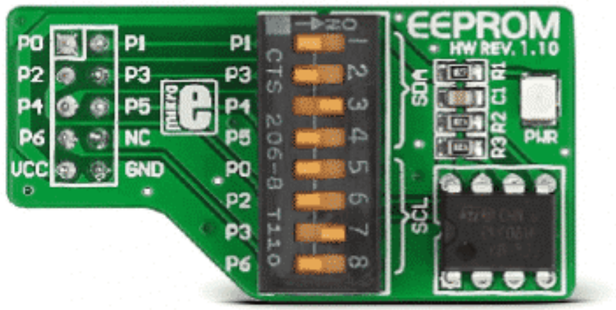
- ✓ An EPROM (erasable-and-programmable ROM) is programmed in exactly the same manner as a PROM.
- ✓ However, EPROMs can be erased and reprogrammed repeatedly.
- ✓ To erase an EPROM, you simply expose the device to a strong source of ultraviolet light. (A window in the top of the device allows the light to reach the silicon.) .
- ✓ Though more expensive than PROMs, their ability to be reprogrammed makes EPROMs an essential part of the software development and testing process.



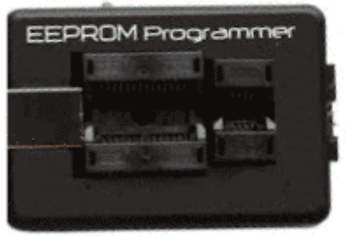
Example of EPROM chip with glass window admitting UV light

Electrically EPROM (EEPROM)

- Erased and updated at the byte level
- Takes much longer to write than read
- Is nonvolatile
- More expensive and less dense than EPROM



EEPROM Chip



EEPROM Programmer

- **EEPROMS** are electrically-erasable-and-programmable.
- Internally, they are similar to EPROMs, but the erase operation is accomplished electrically, rather than by exposure to ultraviolet light.
- Any byte within an EEPROM may be erased and rewritten. Once written, the new data will remain in the device forever-or at least until it is electrically erased.

Comparision

PROM	EPROM	EFPROM
A Read Only Memory (ROM) that can be modified only once by a users	A programmable ROM that can be erased and reused	A user-modifiable ROM that can be erased and reprogrammed repeatedly through a normal electrical voltage
Stands for Programmable Read Only Memory	Stands for Erasable Programmable Read Only Memory	Stands for Electrically Erasable Programmable Read-Only Memory
Developed by Wen Tsing Chow in 1956	Developed by Dov Frohman in 1971	Developed by George Perlegos in 1978
Reprogrammable only once	Can be reprogramed using ultraviolet light	Can be reprogramed using electrical charge

Types of Memories

Introduction to Memory

Types of Memories

ASSESSMENT - 1

Mux relates with us….

Question 1

Which combinational circuit is renowned for selecting a single input from multiple inputs & directing the binary information to output line?

- a) Data Selector
- b) Data distributor
- c) Both data selector and data distributor
- d) DeMultiplexer

Question 2

Which is the major functioning responsibility of the multiplexing combinational circuit?

- a) Decoding the binary information
- b) Generation of all minterms in an output function with OR-gate
- c) Generation of selected path between multiple sources and a single destination
- d) Encoding of binary information

References

- https://brilliant.org/wiki/de-morgans-laws/
- https://circuitglobe.com/demorgans-theorem.html
- https://www.electrical4u.com/