

VIT-AP
UNIVERSITY

MODULE-I : LECTURE-3

Introduction to Microprocessors and Microcontrollers

Dr. Subhasish Mahapatra

Sr. Assistant Professor

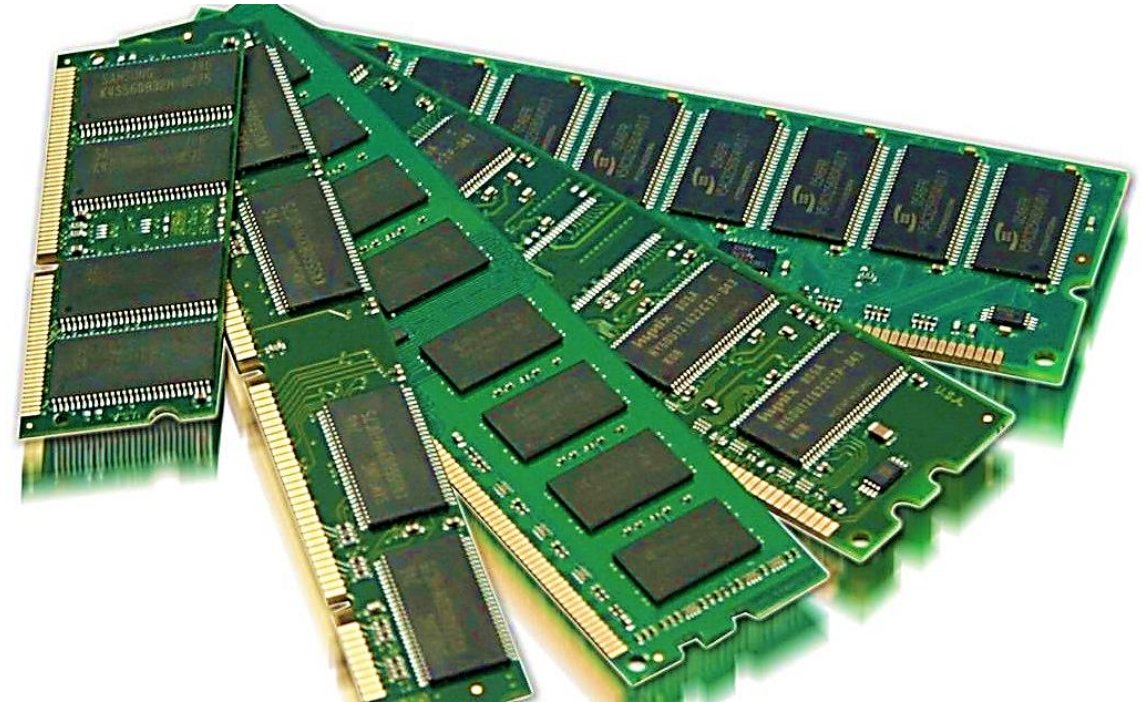
School of Electronics Engineering (SENSE)

VIT-AP University

E-Mail: subhasish.m@vitap.ac.in

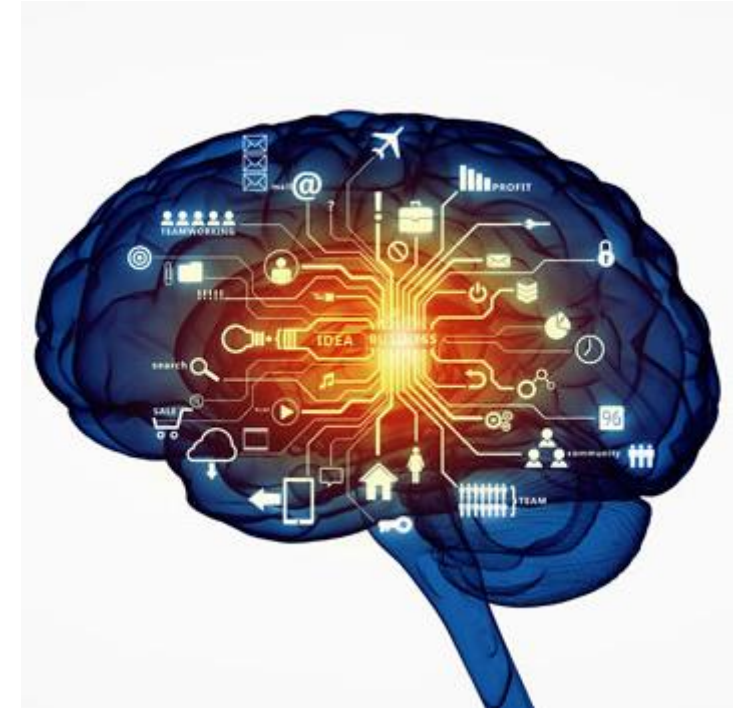
CONTENT

- ✓ **Memory**
- ✓ **Types of Memory**
 - RAM
 - ROM



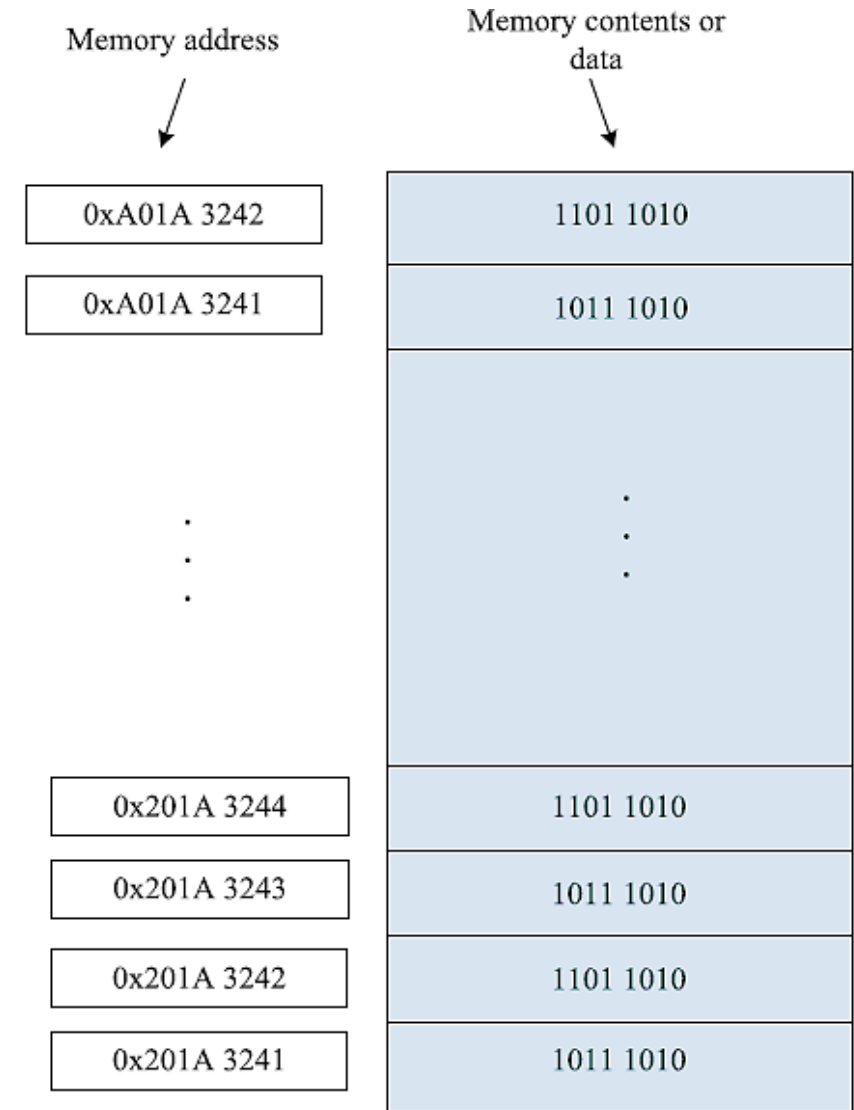
MEMORY

- ✓ Memory stores the information like a human being stores information in brain.
- ✓ To store binary information, digital electronic circuits such as complementary metal oxide semiconductor (CMOS) can be built and a collection of a large number of such circuits is named memory.
- ✓ Memory is the portion of a computer or other system that stores binary data either in the form of 0 or 1 which will be accessed millions of times per second.
- ✓ A memory unit is a device to which binary information is transferred for storage and from which information is retrieved when needed.



MEMORY

- ✓ Binary information received from an input device is stored in memory, and information transferred to an output device is taken from memory.
- ✓ A memory unit is a collection of cells capable of storing a large quantity of binary information.
- ✓ Figure shows in the right where each byte is uniquely addressable, such memories are called byte addressable memories.
- ✓ Other possibilities are bit addressable as well as word (32-bit) and half word (16-bit) addressable memories.

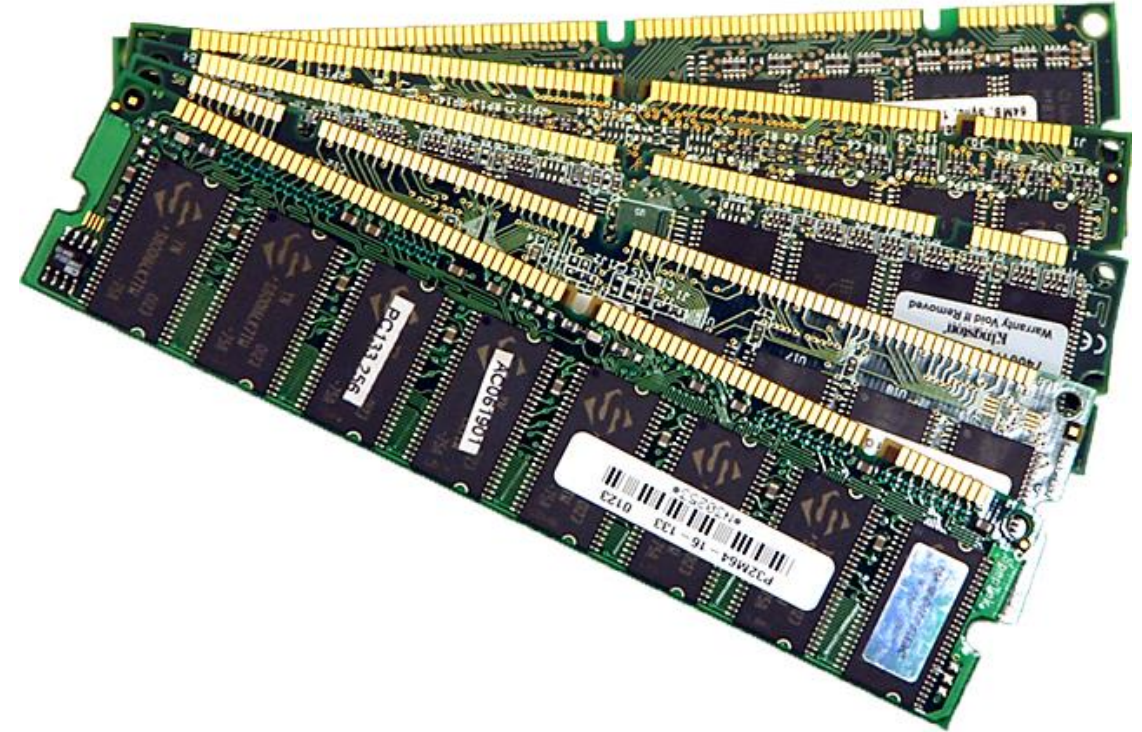


TYPES OF MEMORY

- ✓ There are two types of memories
 - Random Access Memory (RAM)
 - Read Only Memory (ROM)
- ✓ RAM can perform both write and read operations.
- ✓ ROM can perform only the read operation.
- ✓ In general, two operations can be performed by memory
 - **Memory Write:** The process of storing new information into memory.
 - **Memory Read:** The process of transferring the stored information out of memory.

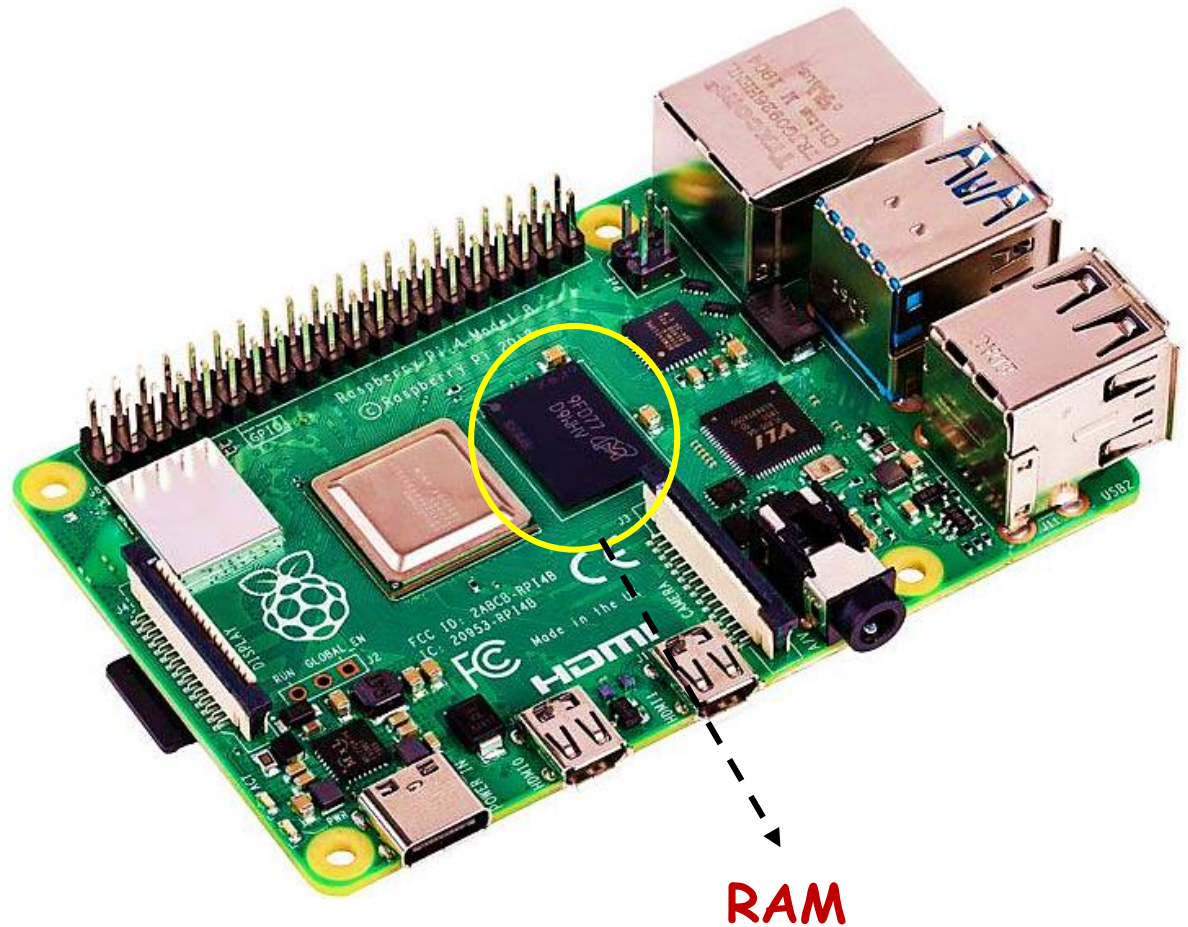
RANDOM ACCESS MEMORY (RAM)

- ✓ A **memory unit** that consists of a collection of storage cells used for **both transfer of information into and out of a device** is called a **RAM**.
- ✓ The architecture of memory is such that information can be **randomly retrieved from any of its internal locations**.
- ✓ The **time required** to **retrieve and store** a binary information **from and to a particular location** respectively, **is always same**.
- ✓ A memory unit stores binary information in **groups of bits** called **words** (may be 8, 16, 32 or 64 bits).



RANDOM ACCESS MEMORY (RAM)

- ✓ It is customary to refer to the number of words (or bytes) in memory with one of the letters **K** (kilo), **M** (mega), and **G** (giga). **K** is equal to 2^{10} , **M** is equal to 2^{20} , and **G** is equal to 2^{30} .
- ✓ A **memory word** is a group of 1's and 0's and may represent a number, an instruction, one or more alphanumeric characters, or any other binary-coded information.
- ✓ One limitation of RAM is that **information** stored in it **is lost** as soon as the **power applied to it is removed**. Hence volatile in nature.



RANDOM ACCESS MEMORY (RAM)

Static RAM:

- Uses **flip-flops** to store the binary information and require 4 to 6 transistors to design the memory cell
- Stored information remains valid as long as power is on. So, **does not require refreshing circuit**
- Shorter read and write cycles, hence **faster**. Hence used in cache memory.
- **Larger** cell area and **more** power consumption

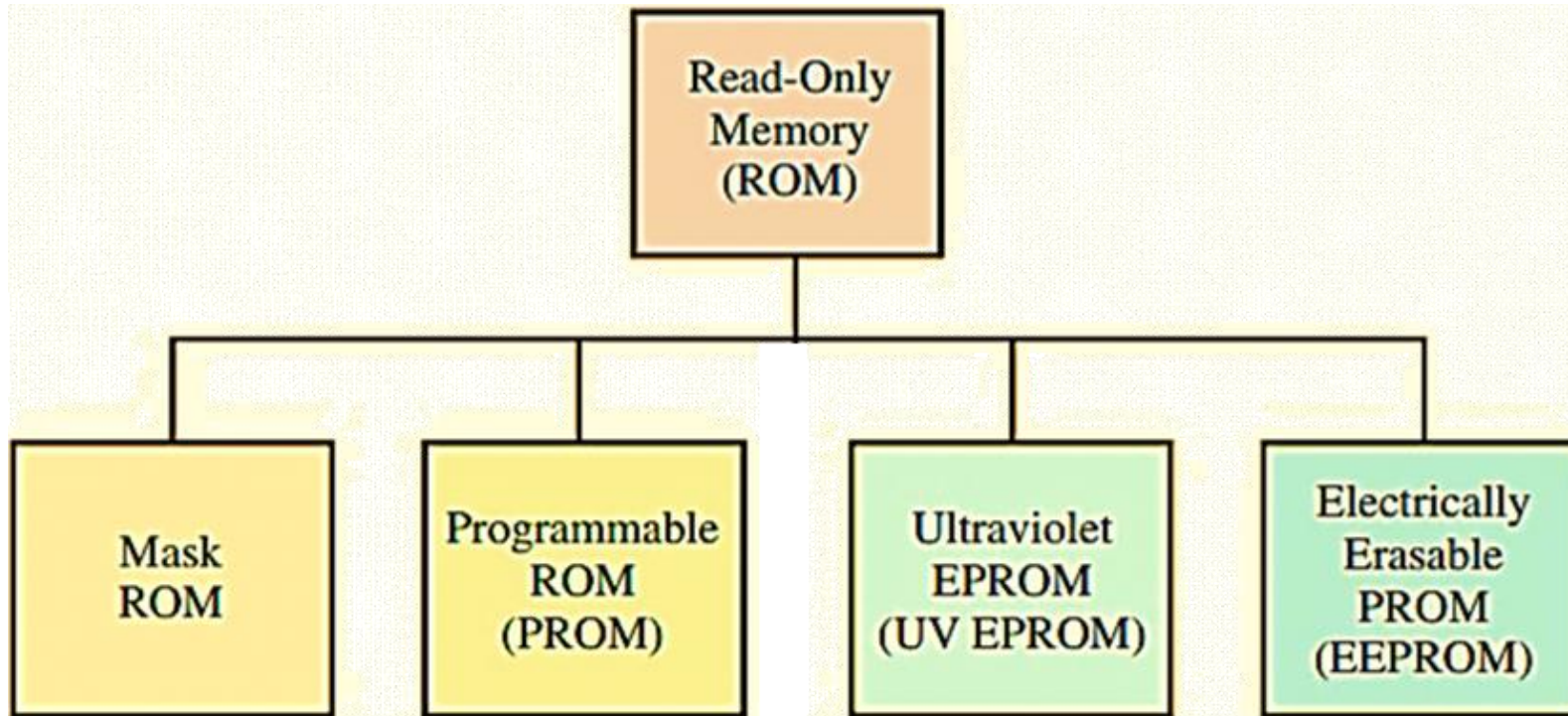
Dynamic RAM:

- Uses a **capacitor and 2 transistors** to design the memory cell for storing the binary information
- **Needs refreshing circuit** for periodically refreshment to hold the stored info
- Longer read and write cycles, hence **less speed than SRAM**. Used in main memory.
- **Smaller** cell area and **less** power consumption

READ ONLY MEMORY (ROM)

- ✓ A **memory device** that can **permanently keep binary data** even when **power is turned off or on**. Hence nonvolatile in nature.
- ✓ ROM does not have data inputs, because it does not have a write operation.
- ✓ **Instructions or a program code** are the information that is normally **stored in a ROM**.
- ✓ Based on how a ROM is programmed, ROMs can be of different types.
- ✓ Example: used in Desktops and laptops for running the operating system.

TYPES OF ROM



TYPES OF ROM

Mask programming ROM:

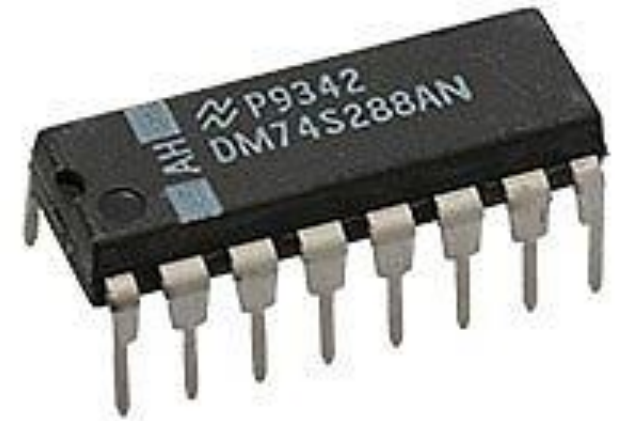
- ✓ In this type of ROM, the specification of the ROM (its contents and their location), is **taken by the manufacturer from the customer in tabular form** in a specified format and then makes corresponding masks for the paths to produce the desired output.
- ✓ Economic for large quantity of the same ROM.
- ✓ They are used in **network operating systems, server operating systems, storing of fonts for laser printers, sound data in electronic musical instruments.**



TYPES OF ROM

Programmable ROM (PROM)

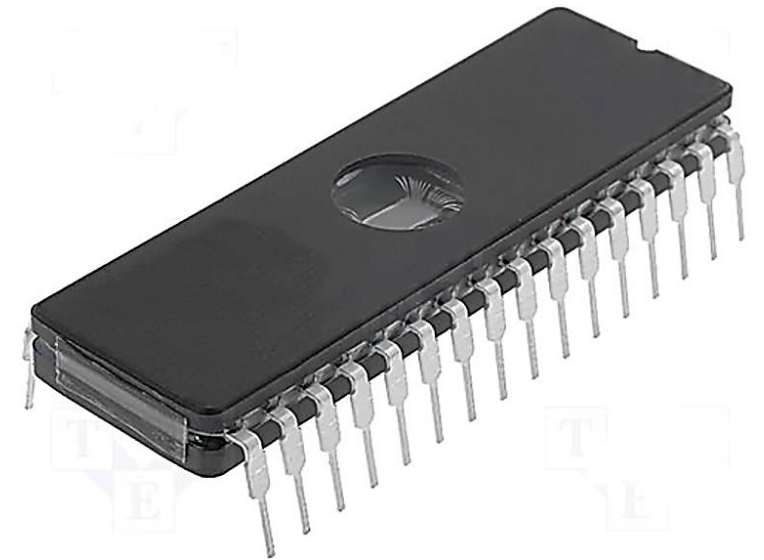
- ✓ It is first prepared as blank memory, and then it is programmed to store the information.
- ✓ **PROM** is **manufactured as blank memory** and programmed after manufacturing, whereas a Mask ROM is programmed during the manufacturing process. Also, the data stored in it cannot be modified, so it is called as **one – time programmable device**.
- ✓ They have several different applications, including **cell phones, video game consoles, RFID tags, medical devices**.



TYPES OF ROM

Erased PROM (EPROM)

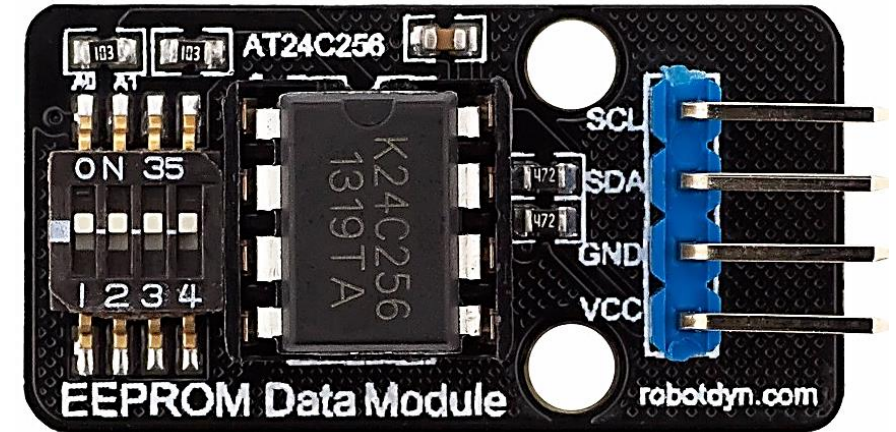
- ✓ It **overcomes** the disadvantage of **PROM** that once programmed, the fixed pattern is permanent and cannot be altered.
- ✓ Unlike an ordinary PROM, an **EPROM** can be **reprogrammed** if an existing program in the memory array is erased first.
- ✓ The EPROM **can be reprogrammed** to the initial state under a special **ultraviolet light (UV)** for a given **period of time**.
- ✓ Used in **compact flash, microcontrollers**, etc.



TYPES OF ROM

Electrically Erasable PROM (EEPROM or E²PROM)

- ✓ The **EEPROM** is returned to its initial state by application of an electrical signal, in place of ultraviolet light.
- ✓ Only allow single byte read and write operations that makes them slow speed device.



Flash Memory

- ✓ **Flash memory** is a type of **EEPROM** that allows read and write operations to be carried out in large multi-byte blocks.
- ✓ In addition, the **cost** of flash memory is also **low** compared to byte-programmable EEPROM.
- ✓ Many modern PCs have their **BIOS stored on a flash memory chip**, called as flash BIOS and they are also used in **modems** as well.

Thank You

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