

# Unit → 10

8/8/25

Friday

## 1) Memory Types...

### Introduction...

### Memory (Embedded)

- There are two types of memory via internal & external.
- Internal memory is limited.
- For small applications, the internal memory is sufficient.
- Internal memory is present inside the chip.
- Processor can access this memory at CPU speeds.
- External I/O pins are not used & access internal memory, hence I/O pins can be used for I/O operations.
- External memory cycle is not executed for internal memory.
- Cost of microcontroller depends upon the size of internal memory. Internal memory can be used for RAM, ROM, PROM, EPROM, or flash or EEPROM.
- Internal ROM, RAM, PROM, EPROM, flash/EEPROM are treated as program memory.
- Size of internal program memory is greater than internal data memory.
- Some microprocessors provides internal caches.

## # Types of Memories

They are classified into three categories:-

- (i) RAM
- (ii) ROM
- (iii) Hybrid memory

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RAM :-

- Memory location can be accessed randomly.
- Read & write memory.
- Two types :- Static RAM (SRAM)  
Dynamic RAM (DRAM)
- SRAM does not requires refreshing.
- DRAM requires refreshing (done by DRAM controller).
- SRAM is faster but expensive.
- DRAM is cheap but slow.

Advanced RAMs :-

The advanced RAMs are NVRAM, EDORAM, SDRAM, RDRAM, parameterized distributed & parameterized block RAM. RAMs are made from MOS cells.

\*NVRAM:-

Non-volatile RAM. It is basically backed RAM. It is expensive.

- But Data Access is very fast.
- RAM can be written infinite number of time.
- DRAM is used by so sophisticated system.
- Most of the embedded system use SRAM.

\*ERDRAM :-

Extended data out RAM.

- zero wait state RAM used with high speed processors.

\*DRAM:-

- After receiving first byte of the processor, the EDORAM supplies next byte immediately.

The next successive location it selected immediately (bit wise).

- CPU frequency  $\leq 100$  MHz.
- CPU can read one byte within one clock cycle.
- The selection of next byte is none on its logics, selects only one cells.

## # Program memory or Data memory

Program memory or data memory are storage area in a computer system. Program memory usually ROM or flash memory stores instruction that make up the software, while data memory typically RAM holds the information that the program is operating on.

Essential program is for code data memory is for variables and other information the code uses.

## # Program memory

Program memory (code memory) stores the instruction that the CPU execute to perform task this the software or code of application. Typically Read only non-volatile meaning its contained are even when the power is off, example including ROM and flash memory.

## # Data memory

Data memory (RAM) stores the data that the program uses, variables, input value and intermediate results. Typically Read write. Volatile meaning its contained are lost when the power is off, example:- include RAM.

In integrated system enter are crucial for directly interacting with memory, including accessing hardware register, managing dynamic memory and working with data structure.

## # Flash memory

Flash memory is higher speed memory that data and instruction enable faster by the CPU and improving overall system performance it act as a buffer b/w the C.P.U and main memory.

NON - Volatile memory that can be erase and reprogram, often used for firmware configuration data.

## \* Pointer...

A pointer is variable that stores the memory address of another variable. Pointer enable direct memory enable direct memory manipulating which is virtual interacting with hardware and optimizing resource uses in embedded system. Pointer are uses to access memory map register, manage dynamic memory a location, work with data structure like linked list it more.

⇒ Different types of pointer such as:-

- (i) Basic pointer
- (ii) Function pointer
- (iii) Smart pointer

(i) Basic pointer :- This are the fundamental pointer that uses to store the address of variable of various datatype. example :- integer, float, character, double float.

(ii) Function pointer :- It stores the address of a function, allowing for dynamic function call. This is useful for implementing callback and for creating flexible control structure.

(iii) Smart pointer :- In C++, smart pointer automated memory management helping prevent memory leak a & pointer.