

| Analog Signals | Digital Signals |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| ✓ Analog signal is continuous and time varying. | ✓ Digital signal have two or more states and in binary form. |
| ✓ Troubleshooting of analog signals are difficult. | ✓ Troubleshooting of digital signals are easy. |
| ✓ An analog signal is usually in the form of sine wave. | ✓ An digital signal is usually in the form of square wave. |
| ✓ Easily affected by the noise. | ✓ These are stable and less prone to noise. |
| ✓ Analog signals use continous values to represent the data. | ✓ Digital signals use discrete values to represent the data. |
| ✓ Accuracy of the analog signals may be affected by noise. | ✓ Accuracy of the digital signals are immune from the noise. |
| ✓ Analog signals may be affected during data transmission. | ✓ Digital signals are not affacted during data transmission. |
| ✓ Analog signal use more power. | ✓ Digital signal use less power. |
| Examples: <u>Temperature</u> , <u>Pressure</u> , <u>Flow measurements</u> , etc. | Examples: <u>Valve Feedback</u> , <u>Motor Start</u> , <u>Trip</u> , etc. |
| Components like <u>resistors</u> , <u>Capacitors</u> , <u>Inductors</u> , <u>Diodes</u> are used in analog circuits. | Components like transistors, <u>logic gates</u> , and <u>microcontrollers</u> are used in Digital circuits. |


```

1  #include <io.h>
2
3
4  void main(void)
5  {
6      char A = 1;
7      char B = 2;
8      char C = A + B;
9      while (1)
10     {
11
12     }
13 }
14

```

a ~ 255

نوع سبزار و کیت

```

_main:
; .FSTART _main
; 0000 0006 char A = 1;
; 0000 0007 char B = 2;
; 0000 0008 char C = A + B;
; 0000 0009 while (1)
; A -> R17
; B -> R16
; C -> R19
LDI R17,1
LDI R16,2
MOV R30,R16
ADD R30,R17
MOV R19,R30

```

A
B
C
↑
↑

AC 1 4 32

RA
R1
231

Bin



Ram

RAM

PRam

Read only memory

Random access memory

10111000
00000001
00000000
10111011
00000010
00000000
00000011
11000011
10001011
11001000

RAM

Definition Random Access Memory or RAM is a form of data storage that can be accessed randomly at any time, in any order and from any physical location., allowing quick access and manipulation.

Stands for Random Access Memory

Use RAM allows the computer to read data quickly to run applications. It allows reading and writing.

Volatility RAM is volatile i.e. its contents are lost when the device is powered off.

Types The two main types of RAM are static RAM and dynamic RAM.

ROM (Flash)

Read-only memory or ROM is also a form of data storage that can not be easily altered or reprogrammed. Stores instructions that are not necessary for re-booting up to make the computer operate when it is switched off. They are hardwired.

Stands for Read-only memory

Use ROM stores the program required to initially boot the computer. It only allows reading.

Volatility It is non-volatile i.e. its contents are retained even when the device is powered off.

Types The types of ROM include PROM, EPROM and EEPROM.

| Static RAM | Dynamic RAM |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------|
| ➤ SRAM uses <u>transistor</u> to store a single bit of data | ➤ DRAM uses a separate <u>capacitor</u> to store each bit of data |
| ➤ SRAM does not need periodic refreshment to maintain data | ➤ DRAM needs periodic refreshment to maintain the charge in the capacitors for data |
| ➤ SRAM's structure is <u>complex</u> than DRAM | ➤ DRAM's structure is <u>simplex</u> than SRAM |
| ➤ SRAM are expensive as compared to DRAM | ➤ DRAM's are less expensive as compared to SRAM |
| ➤ SRAM are faster than DRAM | ➤ DRAM's are slower than SRAM |
| ➤ SRAM are used in Cache memory <i>4mb</i> | ➤ DRAM are used in Main memory <i>RAM DDR4 16g, 8g</i> |

Programmable Read-Only Memory (PROM)

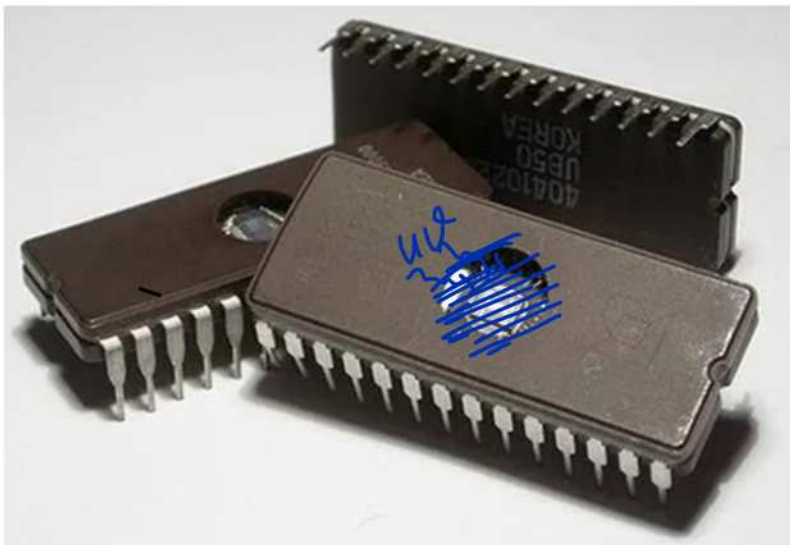
This type of ROM can be re-programmed by using a special device called a PROM programmer. Generally, a PROM can only be changed/updated once.

Erasable Programmable Read-Only Memory (EPROM)

This type of ROM can have its contents erased by ultraviolet light and then reprogrammed by an EPROM programmer. This procedure can be carried out many times; however, the constant erasing and rewriting will eventually render the chip useless.

Electrically Erasable Programmable Read-Only Memory (EEPROM)

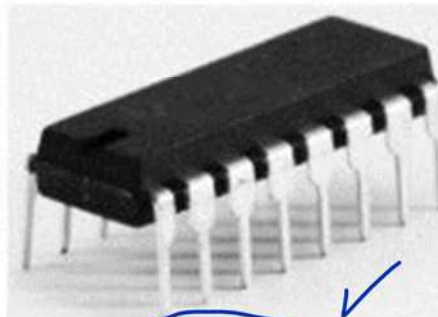
This type of ROM works in a similar way to Flash memory in that its contents can be 'flushed' for erasure and then written to without having to remove the chip from its environment. EEPROMs are used to store a computer system's BIOS, and can be updated without returning the unit to the factory. In many cases, BIOS updates can be carried out by computer users wishing a BIOS update.



EPROM

**Erasable Programmable
Read-Only Memory**

Vs



EEPROM

**Electrically Erasable Programmable
Read-Only Memory**

Figure 7-1. Block Diagram of the AVR Architecture

