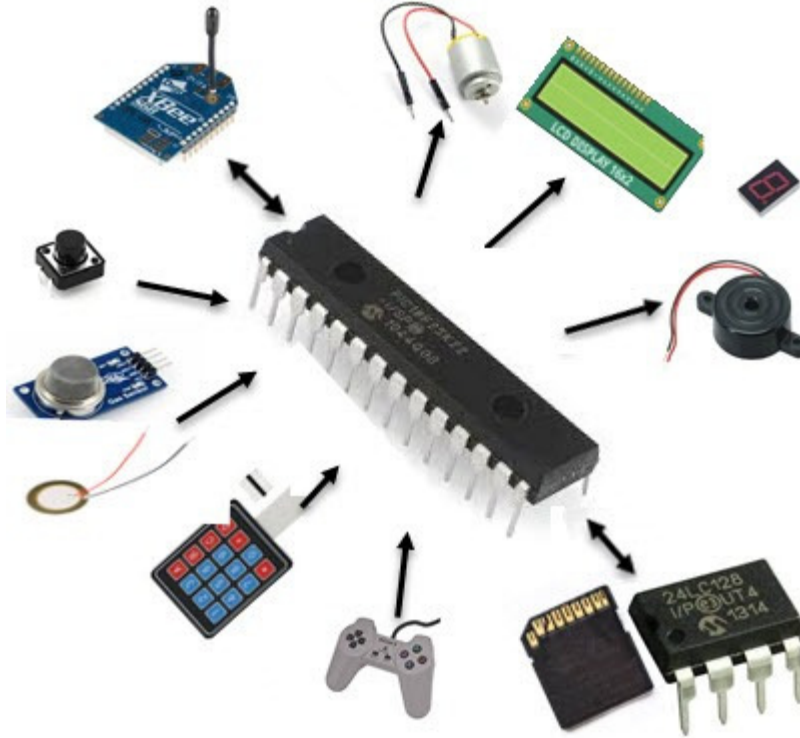


8051 Microcontroller – Architecture and Block diagram explained

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A brief theory of 8051 Microcontroller –

Embedded systems have revolutionized the Electronics industry. From our day to day electronic gadgets to industrial equipment, embedded systems are ubiquitous in our world. They are computing systems which are designed to perform a dedicated task. Embedded systems are **an integration of Hardware and Software**, where the software is generally “embedded” into the hardware part. However, they are nothing without a Microcontroller or a Microprocessor. **Microcontrollers are the soul of an Embedded System.** They are the component of an embedded system which fetch the instructions and execute them. Microcontrollers take the inputs for a system, and process the outputs. Hence this article is designed to make you aware of the 8051 Microcontroller.



Let us look at the attributes of the 8051 Microcontroller.

Features of the 8051 Microcontroller –

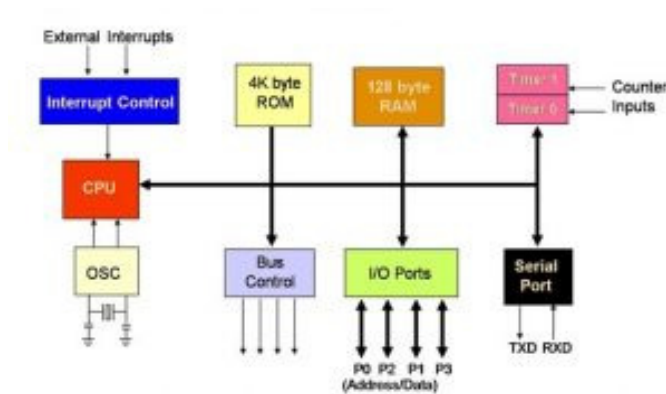
The 8051 Microcontroller is a general purpose Microcontroller. Though it is more than 50 years old, the 8051 microcontroller is still heavily used in a number of electronic and electrical devices. Moreover various industries such as automobile, mobile communications, defense, aeronautics, and even healthcare, would be inefficient without this small but powerful component. So now you must be wondering, what are the qualities of the 8051 Microcontroller that makes it so irresistible to these gadgets and industries.

The reasons for the popularity of 8051 Microcontroller are –

- **Simple to integrate in any electronic device.**
- **Affordable.**
- **Simple architecture.**
- **Easy instruction set.**
- **Low computing power.**

Specifications of 8051 Microcontroller –

So now let us take a look at the important features of 8051 Microcontroller. The block diagram of 8051 is as follows –



- **8-bit Microcontroller –**

The 8051 Microcontroller is an 8-bit Microcontroller. what does this imply? This signifies that the width of the data bus is 8-bits. The data bus is utilized to carry data from specific operations. Consequently, the CPU can process 8 bits of data at one time.

- **Memory –**

A Microcontroller needs program memory to store program/instructions to perform defined tasks. This memory is termed as ROM. Furthermore the Microcontroller also requires data memory to store the operands/data on a temporary basis. This memory is known as RAM. The 8051 Microcontroller is built with 4 Kb on-chip Read Only Memory (ROM) and 128 bytes Random Access Memory (RAM).

- **Address Bus –**

A bus of the Microcontroller can be defined as a group of wire which can act as a medium for the transfer of data. There are two buses present in the 8051 Microcontroller. While we are already aware of the Data Bus, let us know about the Address Bus of the 8051 Microcontroller. The address bus, which is used to address memory locations, is 16-bit wide. Furthermore, the address bus can also be used to transfer data from the CPU (Central Processing Unit) to the memory. Hence, for obvious reasons the address bus is unidirectional.

- **Interrupts –**

The most powerful attribute of the 8051 Microcontroller is the concept of Interrupts. The interrupt is a mechanism to –

- **Temporarily suspend the ongoing program,**

- **Pass the control to a subroutine,**
- **Execute the subroutine,**
- **Resume the ongoing/main program.**

Interrupts can be of various types, such as, Software and Hardware interrupts, Non-maskable and maskable interrupts, etc. Now the 8051 Microcontroller incorporates five interrupts. These are :

1. **INT0** – External Hardware Interrupt.
2. **TF0** – Timer 0 Overflow Interrupt.
3. **INT1** – External Hardware Interrupt.
4. **TF1** – Timer 1 Overflow Interrupt.
5. **R1/T1** – Serial communication Interrupt.

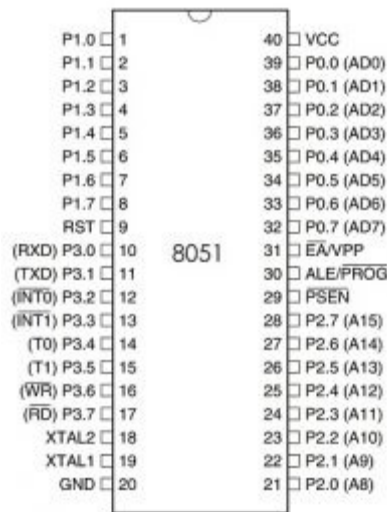
- **Input/Output Ports –**

The 8051 Microcontroller needs to be connected to the peripheral devices in order to control their operations. The I/O Ports are responsible for the connection of the Microcontroller to its peripheral devices. There are total Four 8-bit Input/Output Ports present in this Microcontroller.

Additionally, these are some important features of 8051 microcontroller given as follows :

1. **Two 16-bit Timers and Counters.**
2. **A Data Pointer and a Program Counter of 16-bit each.**
3. **128 User defined Flags.**
4. **Four Register banks.**
5. **31 General Purpose Registers which are of 8-bit each.**

Pin diagram of 8051 Microcontroller –



40 - PIN DIP

The 8051 Microcontroller is a 40-pin Plastic Dual Inline Package (PDIP). The functions of the pins of this Microcontroller are as follows :

• Ports of 8051 Microcontroller –

Port 0 –

The Port 0 or P0 is a General Purpose I/O Port. Consequently, it consists of 8 pins starting from pin 32 to pin 39. However, this port can also be utilized as a multiplexed Address and Data bus (from AD0 to AD7).

Port 1 –

The Port 1 or P1, is also an 8-bit port starting from pin 1 to pin 8. Although similar to the P0, the P1 is also a General Purpose I/O Port, however, unlike the other three ports, P1 does not serve any dual purpose. Hence the sole purpose of P1 is for interfacing.

Port 2 –

The pins from 21 to 28 belong to the Port 2, or P2. Now when there is no presence of an external memory, the P2 act as a General Purpose I/O Port. However, in the presence of external memory, P2 acts as an Address Bus, starting from A8 to A15.

Port 3 –

Though the Port 3 or P3 usually acts as a normal I/O Port, it can provide some other functions as well. The pin numbers are from 10 to 17. The other functions are below.

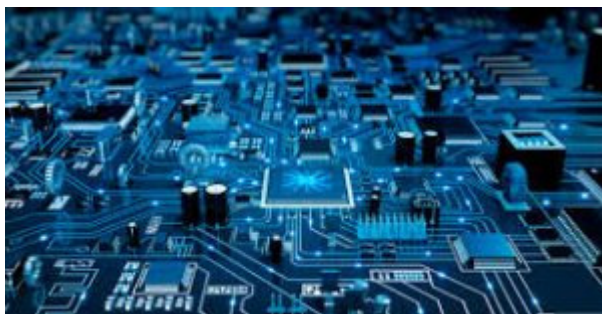
- **Pin10 – RXD**
- **Pin11 – TXD**
- **Pin12 – INT0 complement**
- **Pin13 – INT1**
- **Pin14 – T0**
- **Pin15 – T1**
- **Pin16 – WR**
- **Pin17 – RD complement**

Additionally, the other pins are as follows –

- **Pin20 – GND (Ground)**
- **Pin40 – VCC (Supply)**
- **Pin9 – RST (Reset)**
- **Pin18 – XTAL1 (Oscillator)**
- **Pin19 – XTAL2 (Oscillator)**
- **Pin29 – PSEN (Program Store Enable)**
- **Pin30 – ALE (Address Latch Enable)**
- **Pin31 – EA (External Access)**

Hence, this was the Pin Diagram of the 8051 Microcontroller. Finally, moving on to the applications of the 8051, which are as follows.

The Applications of 8051 Microcontroller



Thanks to the rapid growth in the Science and Technology sector, the 8051 Microcontroller have wide uses in a variety of applications. Thus from our daily

lives, to industrial applications, it is no doubt that Microcontroller is omnipresent. So here is a list of some of the major applications incorporating the 8051 Microcontroller –

1. **Robotics** – Robotics is a technology that is on the exponential increase. This industry relies heavily on the Microcontrollers for their development. Hence, the 8051 is used widely in the Robotics industry.
2. **IoT** – The Internet of Things technology is a booming industry of 2018. Furthermore this new technology has been creeping into almost all of the industries in the world. Thus, the use of Microcontroller has increased as this is a vital component for any smart device.
3. **Temperature and Light sensing devices.**
4. **Process Control Devices.**

So these were some of the major applications of the 8051 Microcontroller.

Although if you need some extra information on the 8051

Microcontroller, [Eckovation](#) would be glad to help you! So just click on the link below for some extra dose on the 8051 Microcontroller.

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In conclusion, learning about the 8051 Microcontroller will be a huge career step for you as the Microcontroller has a wide usage in almost every industry these days. So we hope you learned something new about the Microcontroller. Please drop your comments in the comment section below. Because, we at Eckovation value your feedback.