

# Difference between Microprocessor and Microcontroller

## Microprocessor vs Microcontroller: Key Difference

- Microprocessor consists of only a Central Processing Unit, whereas Micro Controller contains a CPU, Memory, I/O all integrated into one chip.
- Microprocessor is used in Personal Computers whereas Micro Controller is used in an embedded system.
- Microprocessor uses an external bus to interface to RAM, ROM, and other peripherals, on the other hand, Microcontroller uses an internal controlling bus.
- Microprocessors are based on Von Neumann model Micro controllers are based on Harvard architecture
- Microprocessor is complicated and expensive, with a large number of instructions to process but Microcontroller is inexpensive and straightforward with fewer instructions to process.

## What is a Microprocessor?

A **microprocessor** is a controlling unit of a micro-computer wrapped inside a small chip. It performs Arithmetic Logical Unit (ALU) operations and communicates with the other devices connected with it. It is a single Integrated Circuit in which several functions are combined.

## What is Microcontroller?

A **microcontroller** is a chip optimized to control electronic devices. It is stored in a single integrated circuit which is dedicated to performing a particular task and execute one specific application.

It is specially designed circuits for embedded applications and is widely used in automatically controlled electronic devices. It contains memory, processor, and programmable I/O.

## Types of Microprocessor

Important types of Microprocessors are:

- Complex Instruction Set Microprocessors
- The Application Specific Integrated Circuit

- Reduced Instruction Set Microprocessors
- Digital Signal Multiprocessors (DSPs)

## Types of Microcontroller

Here are important types of Microcontroller:

- 8 bit Microcontroller
- 16 bit Microcontroller
- 32 bit Microcontroller
- Embedded Microcontroller
- External memory Microcontroller

## History of Microprocessor

Here, are the important landmark from the history of Microprocessor

- Fairchild Semiconductors invented the first IC (Integrated Circuit) in 1959.
- In 1968, Robert Noyce, Gordon Moore, Andrew Grove found their own company Intel.
- Intel grew from 3 man start-up in 1968 to industrial giant by 1981.
- In 1971, INTEL created the first generation Microprocessor 4004 that would run at a clock speed of 108 kHz
- From 1973 to 1978, second-generation 8-bit microprocessors were fabricated like Motorola 6800 and 6801, INTEL-8085, and Zilog's-Z80.
- In 1978, Intel 8008 third-generation process came into the market.
- In the early 80s, Intel released fourth-generation 32-bit processors.
- In 1995, intel released in fifth-generation 64-bit processors .

## History of Microcontroller

Here, are important landmarks from the history of Microcontroller:

- First used in 1975(Intel 8048)

- The introduction of EEPROM in 1993
- The same year, Atmel introduced the first microcontroller using Flash memory.

## Difference Between Microprocessor and Microcontroller

Here is the difference between Microprocessor vs. Microcontroller



Microprocessor	Microcontroller
Microprocessor is the heart of Computer system.	Micro Controller is the heart of an embedded system.
It is only a processor, so memory and I/O components need to be connected externally	Micro Controller has a processor along with internal memory and I/O components.
Memory and I/O has to be connected externally, so the circuit becomes large.	Memory and I/O are already present, and the internal circuit is small.
You can't use it in compact systems	You can use it in compact systems.
Cost of the entire system is high	Cost of the entire system is low
Due to external components, the total power consumption is high. Therefore, it is not ideal for the devices running on stored power like batteries.	As external components are low, total power consumption is less. So it can be used with devices running on stored power like batteries.
Most of the microprocessors do not have power saving features.	Most of the microcontrollers offer power-saving mode.

Microprocessor	Microcontroller
It is mainly used in personal computers.	It is used mainly in a washing machine, MP3 players, and embedded systems.
Microprocessor has a smaller number of registers, so more operations are memory-based.	Microcontroller has more register. Hence the programs are easier to write.
Microprocessors are based on Von Neumann model	Micro controllers are based on Harvard architecture
It is a central processing unit on a single silicon-based integrated chip.	It is a byproduct of the development of microprocessors with a CPU along with other peripherals.
It has no RAM, ROM, Input-Output units, timers, and other peripherals on the chip.	It has a CPU along with RAM, ROM, and other peripherals embedded on a single chip.
It uses an external bus to interface to RAM, ROM, and other peripherals.	It uses an internal controlling bus.
Microprocessor-based systems can run at a very high speed because of the technology involved.	Microcontroller based systems run up to 200MHz or more depending on the architecture.
It's used for general purpose applications that allow you to handle loads of data.	It's used for application-specific systems.
It's complex and expensive, with a large number of instructions to process.	It's simple and inexpensive with less number of instructions to process.

## Features of Microprocessor

Here are some important features of Microprocessor:

- Offers built-in monitor/debugger program with interrupt capability

- Large amount of instructions each carrying out a different variation of the same operation
- Offers Parallel I/O
- Instruction cycle timer
- External memory interface

## Features of Microcontroller

Here are some important features of Microcontroller:

- Processor reset
- Program and Variable Memory (RAM) I/O pins
- Device clocking central processor
- Instruction cycle timers

## Applications of Microprocessor

Microprocessors are mainly used in devices like:

- Calculators
- Accounting system
- Games machine
- Complex industrial controllers
- Traffic light
- Control data
- Military applications
- Defense systems
- Computation systems

## Applications of Microcontroller

Microcontrollers are mainly used in devices like:

- Mobile phones
- Automobiles
- CD/DVD players
- Washing machines
- Cameras
- Security alarms
- Keyboard controllers
- Microwave oven
- Watches
- Mp3 players

## Summary

### What is the Difference Between a Microcontroller and Microprocessor?

The key difference between a Microprocessor and a Microcontroller is the Microprocessor consists of only a Central Processing Unit, whereas the Microcontroller contains a CPU, Memory, I/O all integrated into one chip. A microcontroller is an inexpensive, straightforward, and small number of instructions to process, whereas a Microprocessor is complex and expensive, with many instructions.

### Which is Better Microcontroller or Microprocessor?

Both of these processes are good. However, which one you should use depends upon your requirements. Microcontrollers are mainly used for small applications like washing machines, Cameras, Security alarms, Keyboard controllers, etc., Whereas Microprocessor is used in Personal Computers, Complex industrial controllers, Traffic light, Defense systems, etc.

### Which is Faster Microprocessor or Microcontroller?

Microprocessors are much faster than microcontrollers. The clock speed of a microprocessor is above 1 GHz. While in the case of the Microcontroller, the clock speed is 200MHz or more, depending on the architecture.