8051 Architecture

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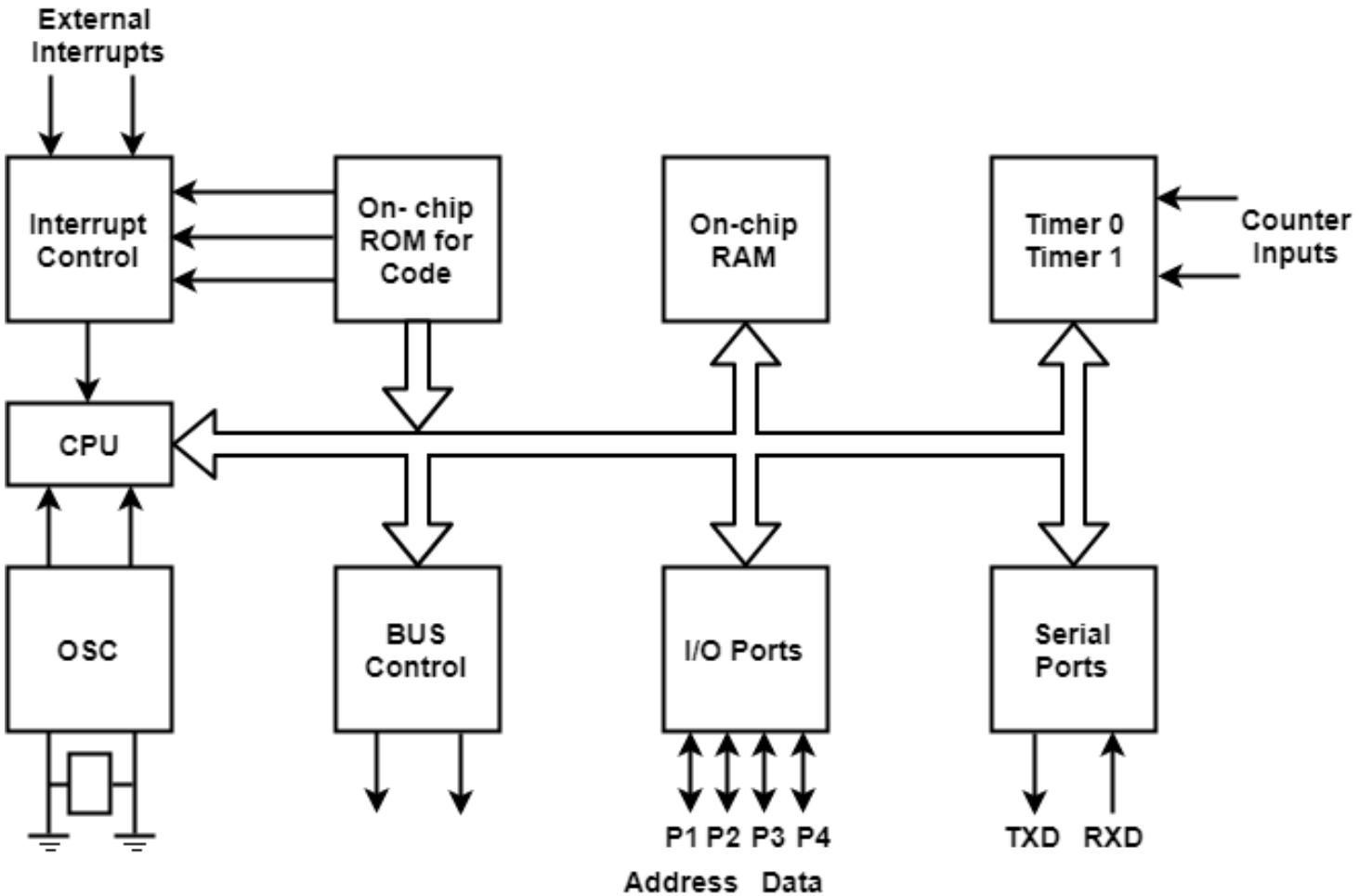
Introduction

- Developed by Intel in the mid 80's
- Also known as Intel MCS-51
- Instruction set Architect was John Wharton
- Developed using N-type metal-oxide-semiconductor
- Later versions used Complementary Metal Oxide Semiconductor (CMOS)

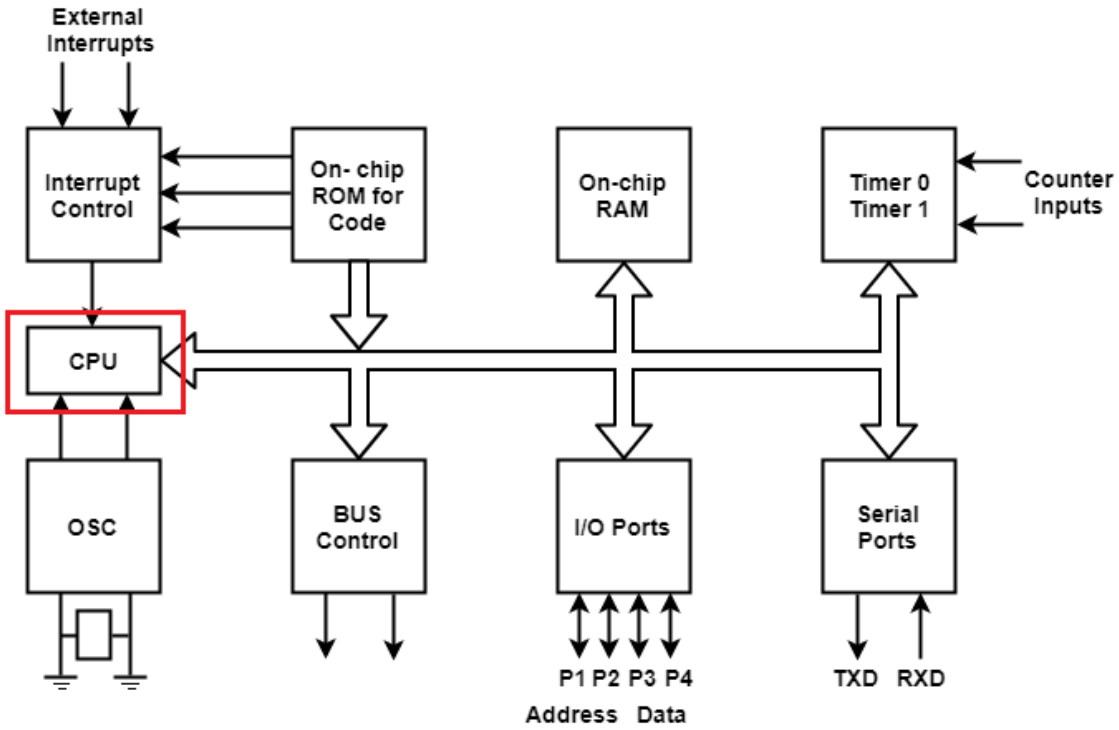
Specifications

RAM	128 bytes
ROM	4K bytes
Timer	2 - 16bit timer
Serial	1 Serial port
I/O	4 I/O Port each 8 bit wide
Bus	8-bit Data Bus, 16-bit Address

Block Diagram

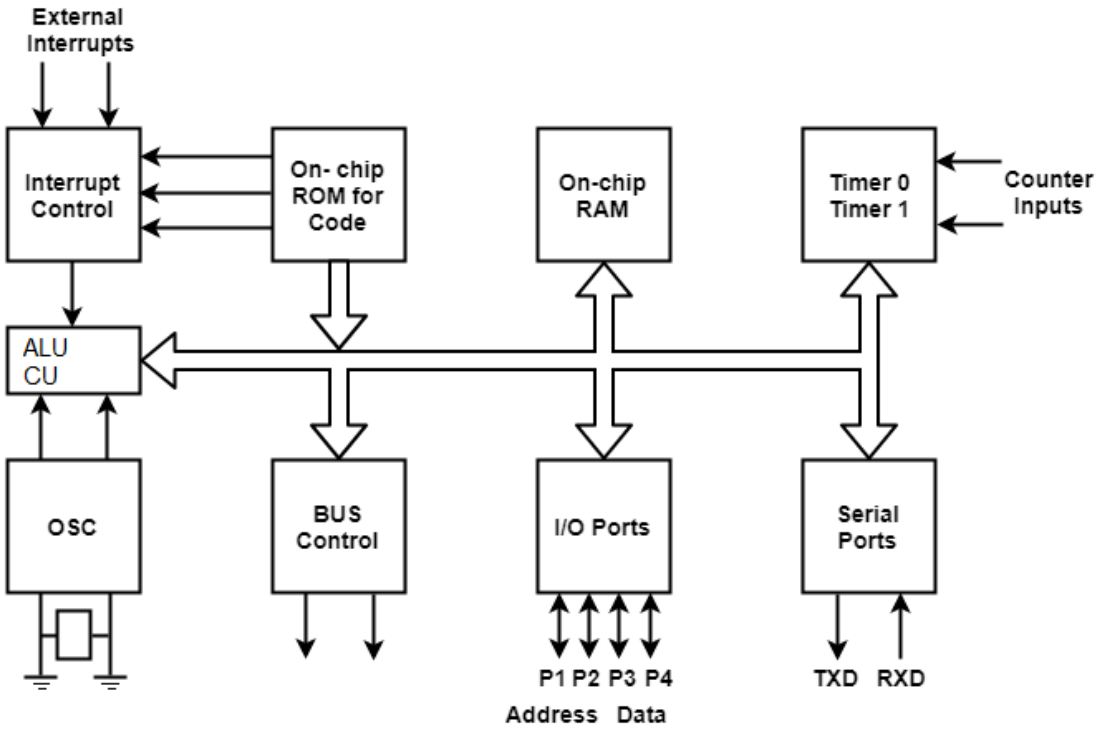


Central Processing Unit (CPU)



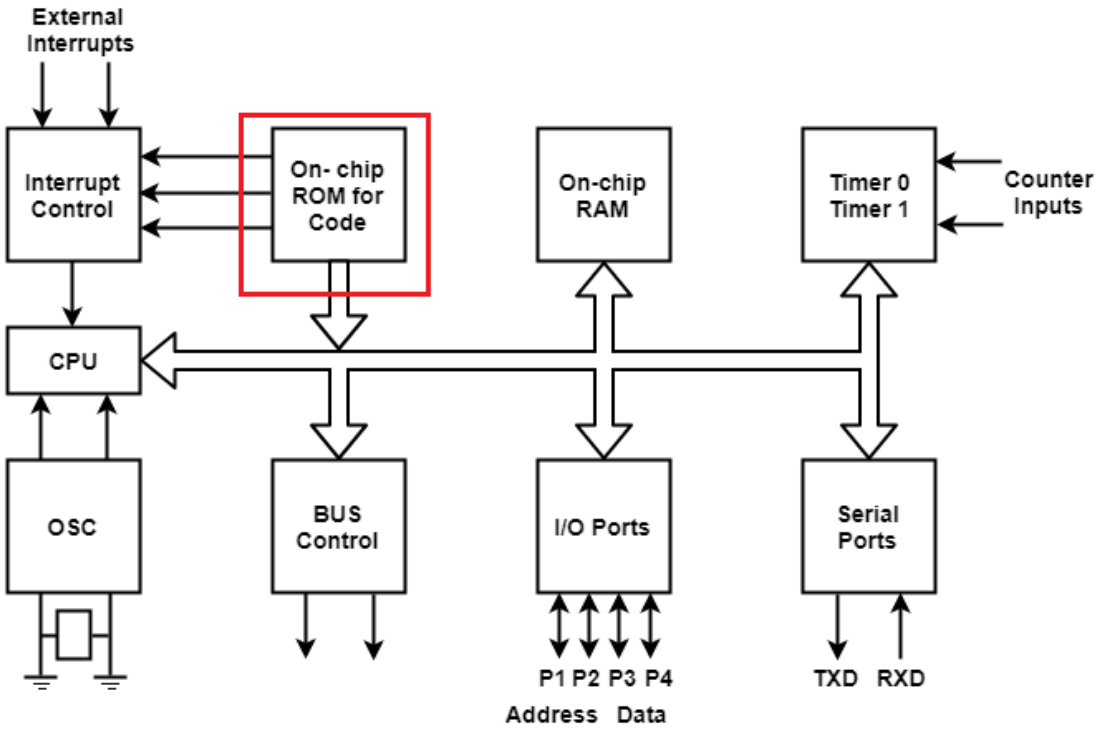
- Heart of the System
- Mainly contains ALU and CU

ALU and CU



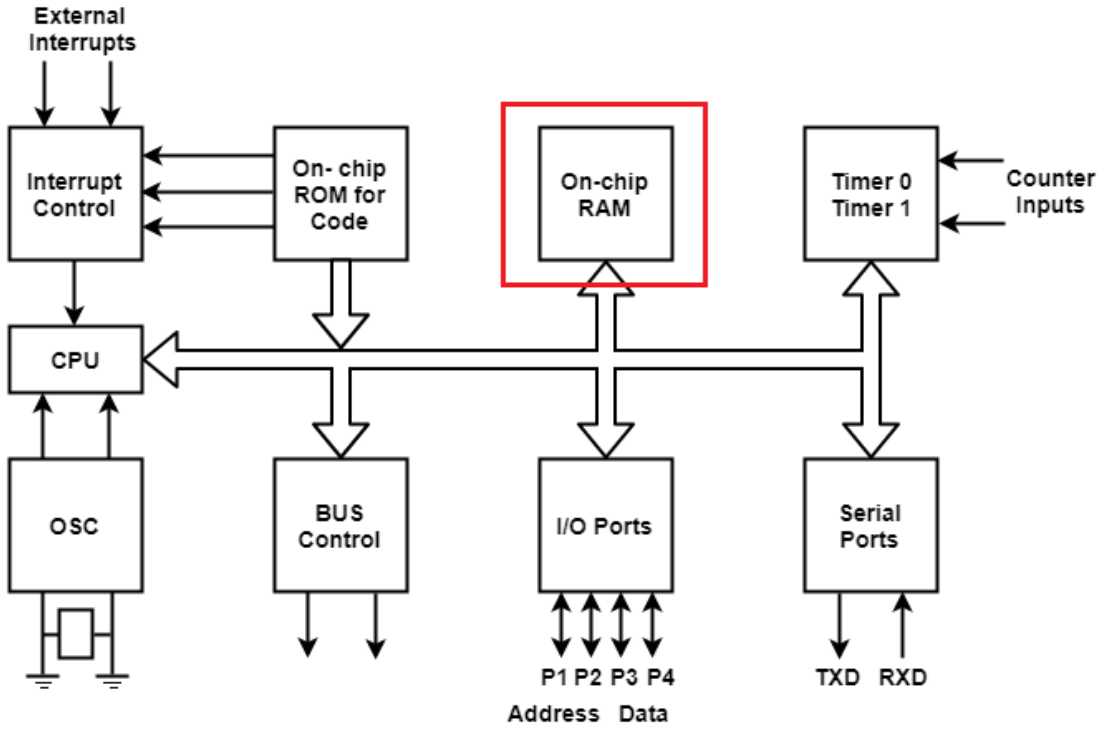
- Arithmetic Logic Unit(ALU) - Responsible in Arithmetic and Logic Operations
- Control Unit (CU) - Responsible for all the timing of communications between CPU and peripherals

Program Memory



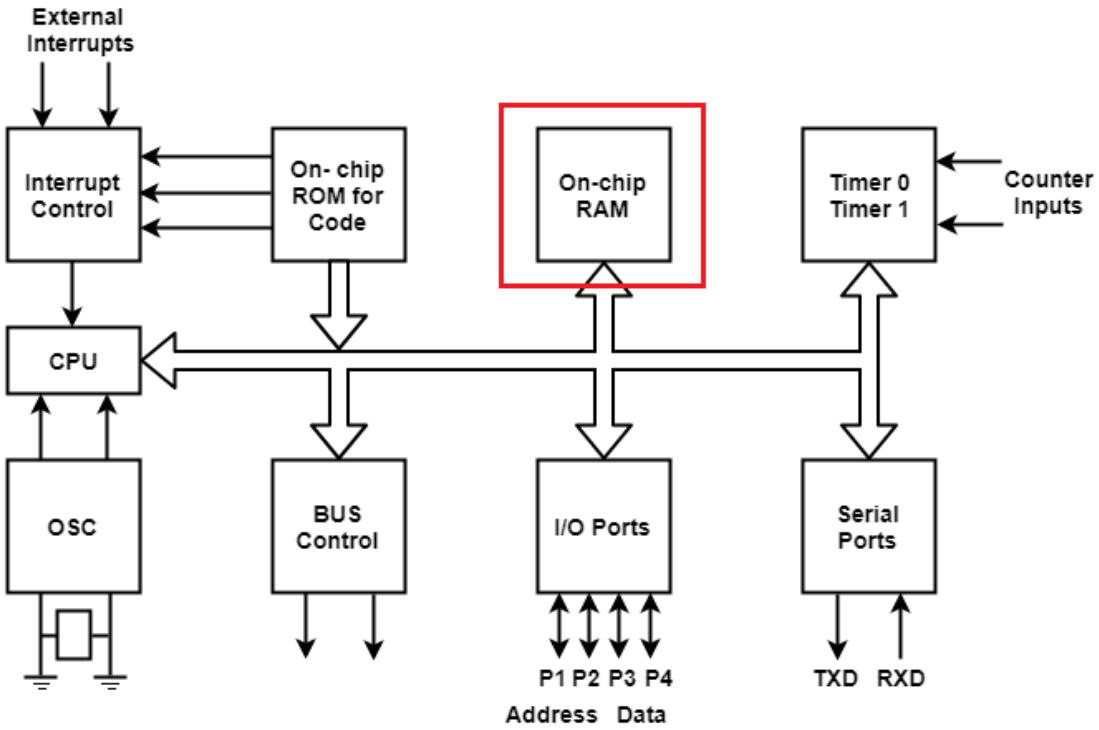
- Also known as code memory
- Retains data even if power is removed

Data Memory



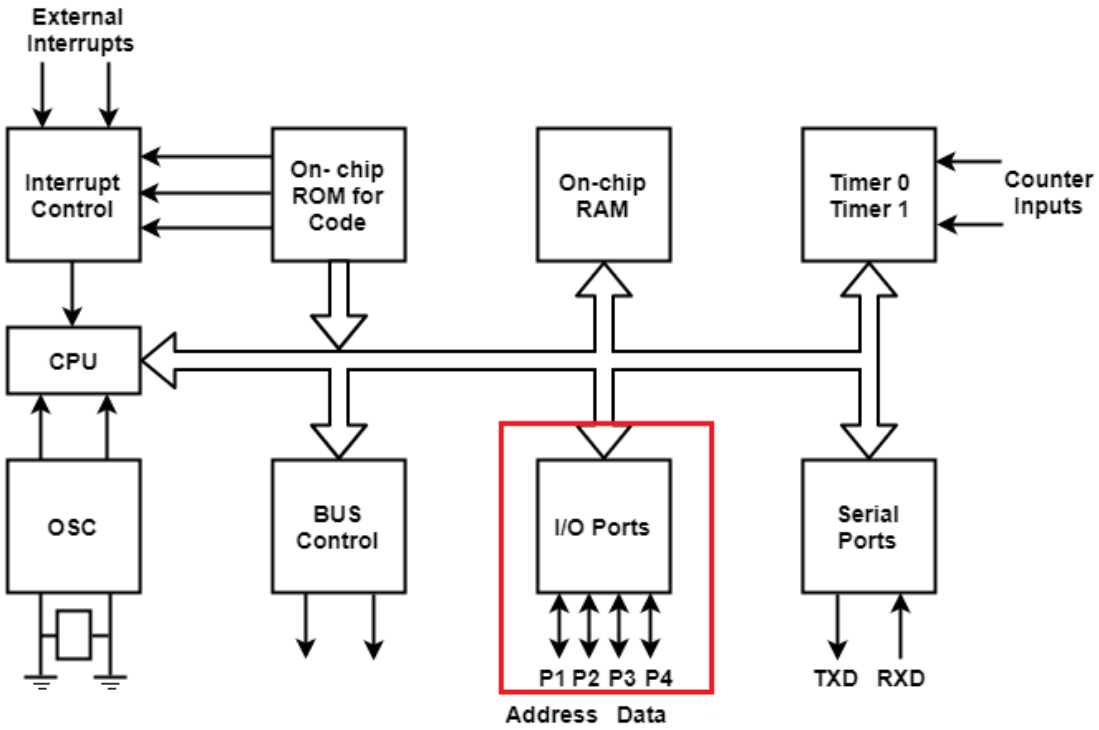
- Also known as Random Access Memory
- Responsible in storing values of variable temporary data and immediate result for the proper operation of the MCU.

Data Memory



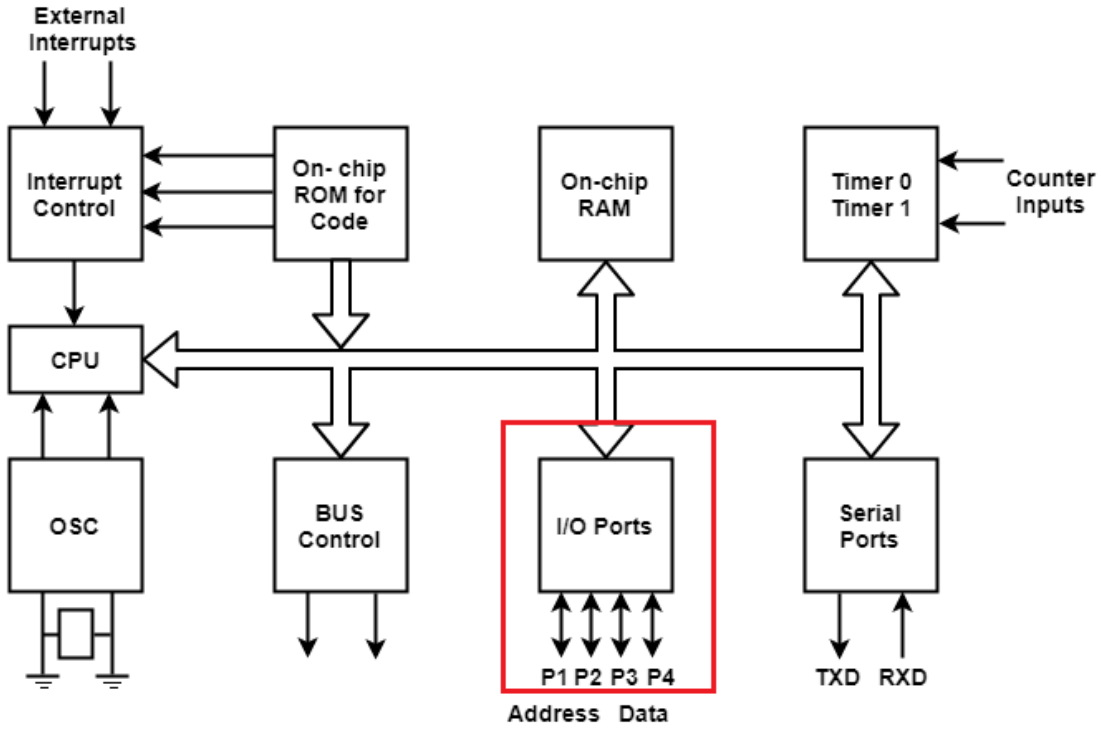
- Generally volatile, data is loss when power is loss
- Arranged as a Register and User accessible locations.

Input/Output (I/O) Ports



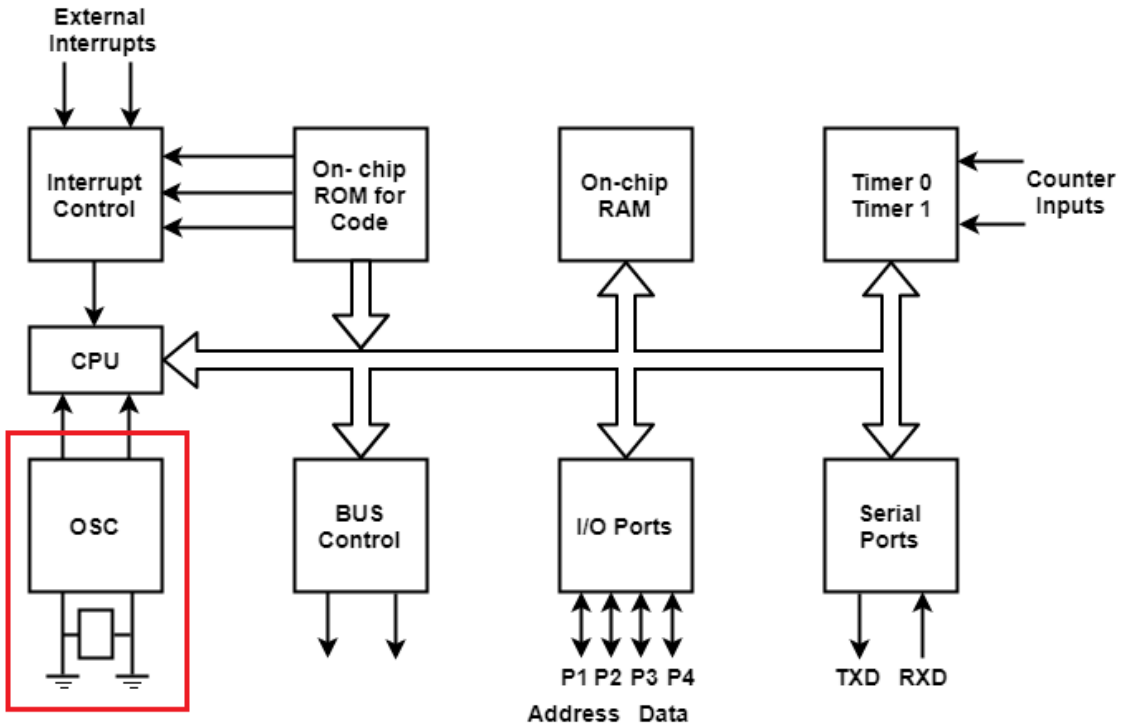
- Provide connection to the outside world.
- Can be configured as an input port or output port.

Input/Output (I/O) Ports



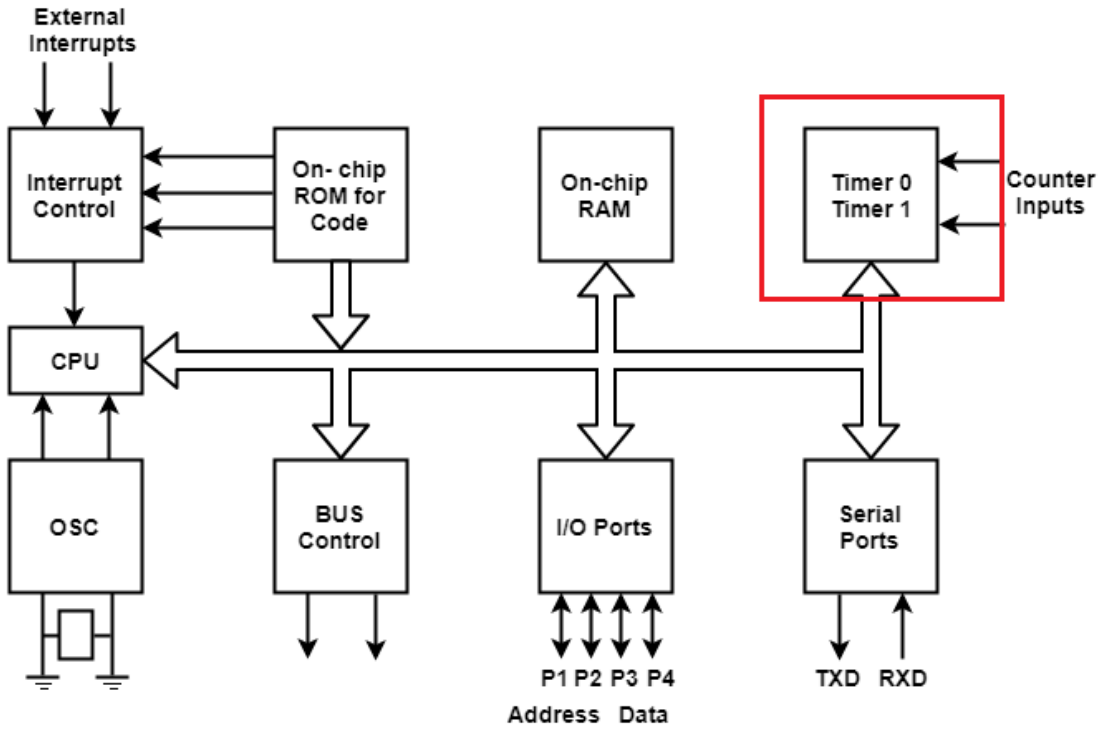
- Provide gateway for passing data from the outside world using sensors.
- Output Ports allow the microcontroller to control external devices such as motor, LED and other actuators.

Oscillator



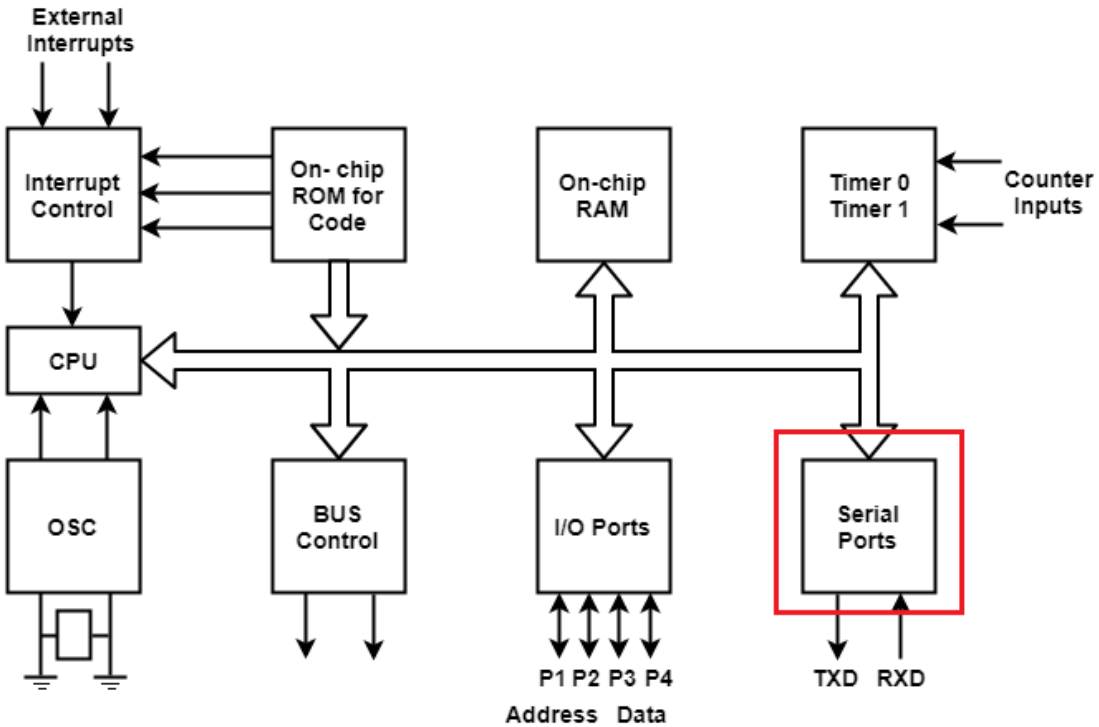
- Used to generate clock signal
- Clock allows the operation of the MCU in synchronous manner.
- Usually in the form of Crystal Oscillator

Timer Peripheral



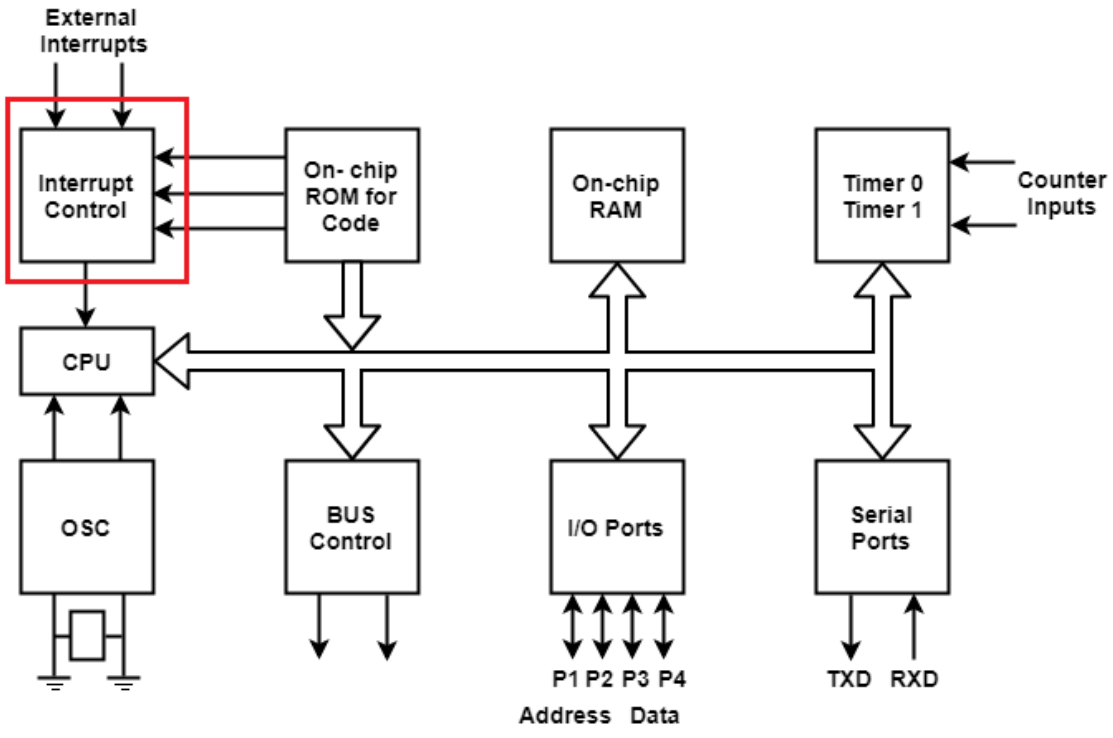
- Used to generate delay
- Can count external event thru T0 and T1 pin

Serial Port



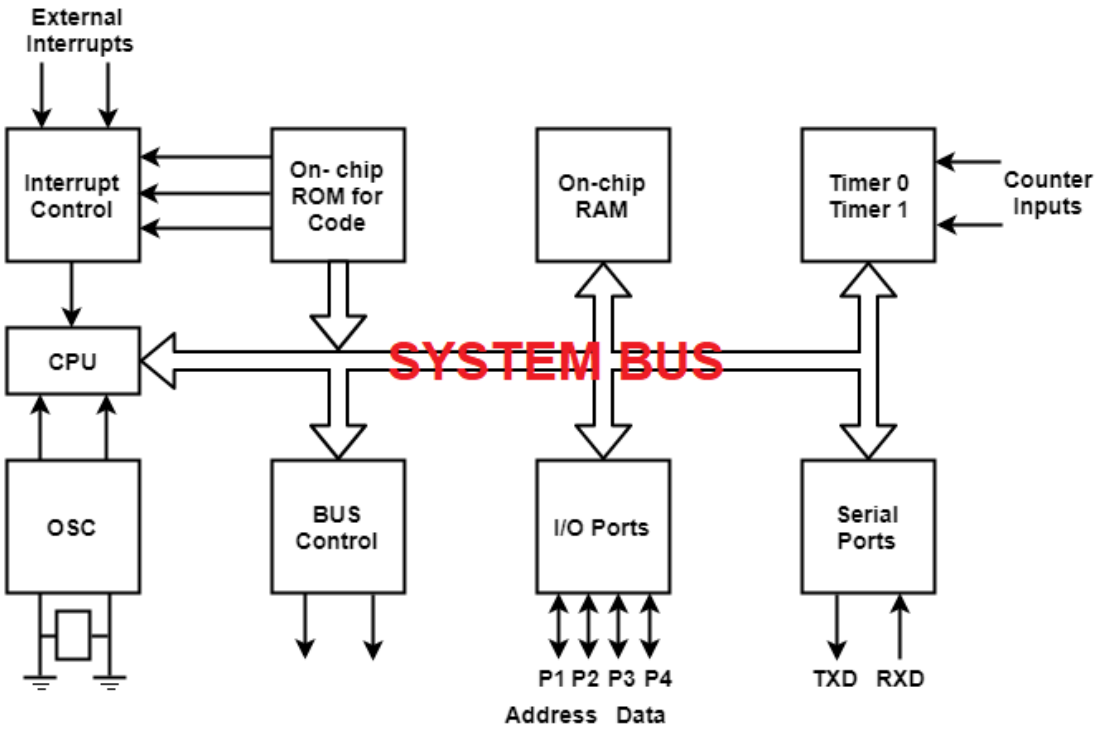
- Used to communicate to other serial devices such as a PC
- can be used to communicate wirelessly thru another wireless serial device thru bluetooth,Zigbee and other wireless communication protocol/devices.

Interrupt Control



- Used to control internal and external interrupt event of the 8051.

System Bus



- Data Memory, Program Memory, I/O Ports, Timers, Interrupt Controller and CPU are interfaced together thru the System Bus.

New and advance 8051 Devices

Newer 8051 devices may contain

- Larger memory
- USB
- AES and DES Encryption
- Analog to Digital Converter
- Analog Comparator
- Op-amps
- RF module and others