UNIT6 :MicroControler&MicroProcessor



What is a microcontroller?

- A microcontroller is an integrated circuit that is programmed to do a specific task.

- Microcontrollers are really just "mini-computers".

History of Microcontrollers



Vacuum Tube
1939



Transistor
1947

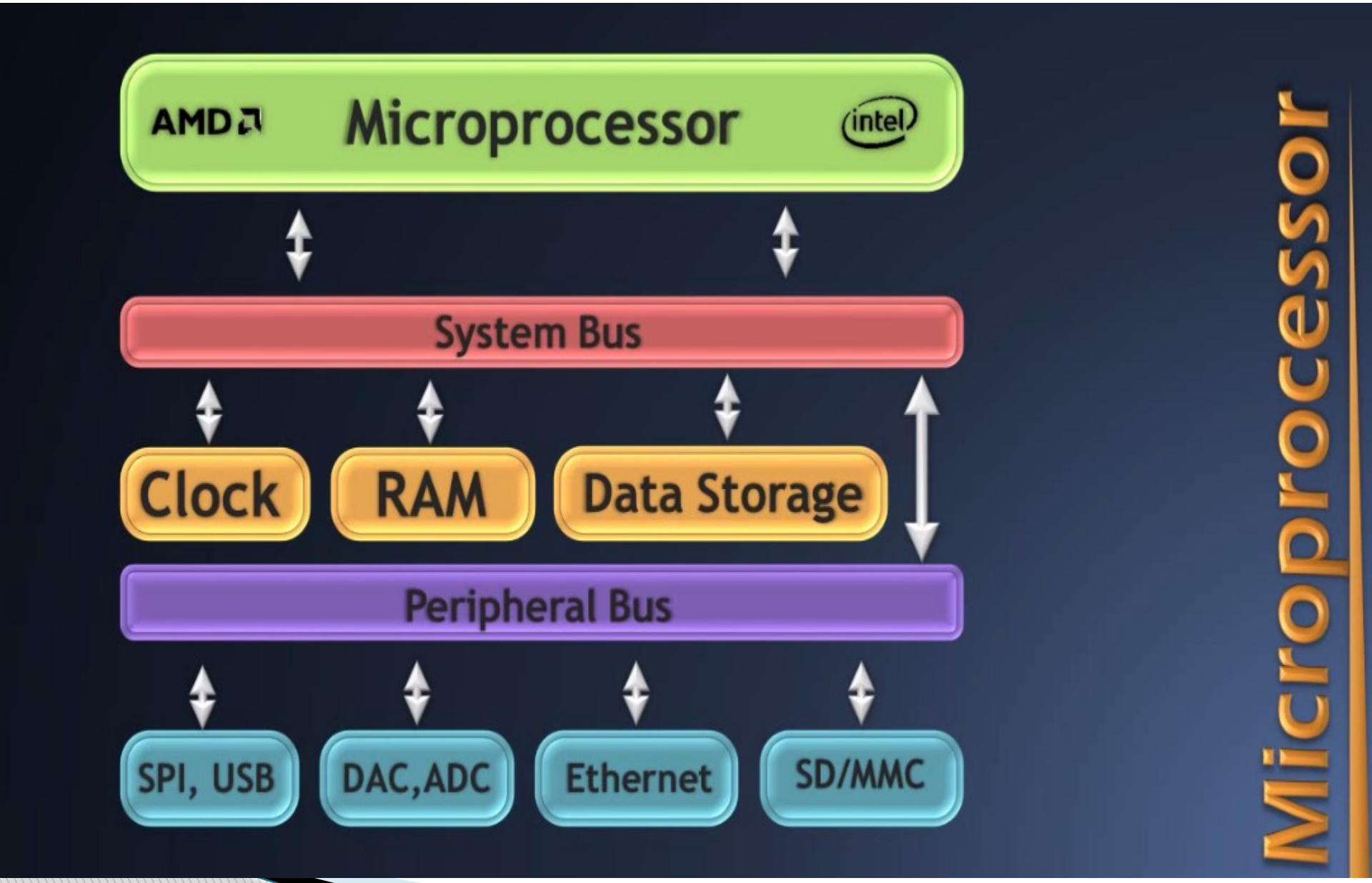


Logic Gate
1960

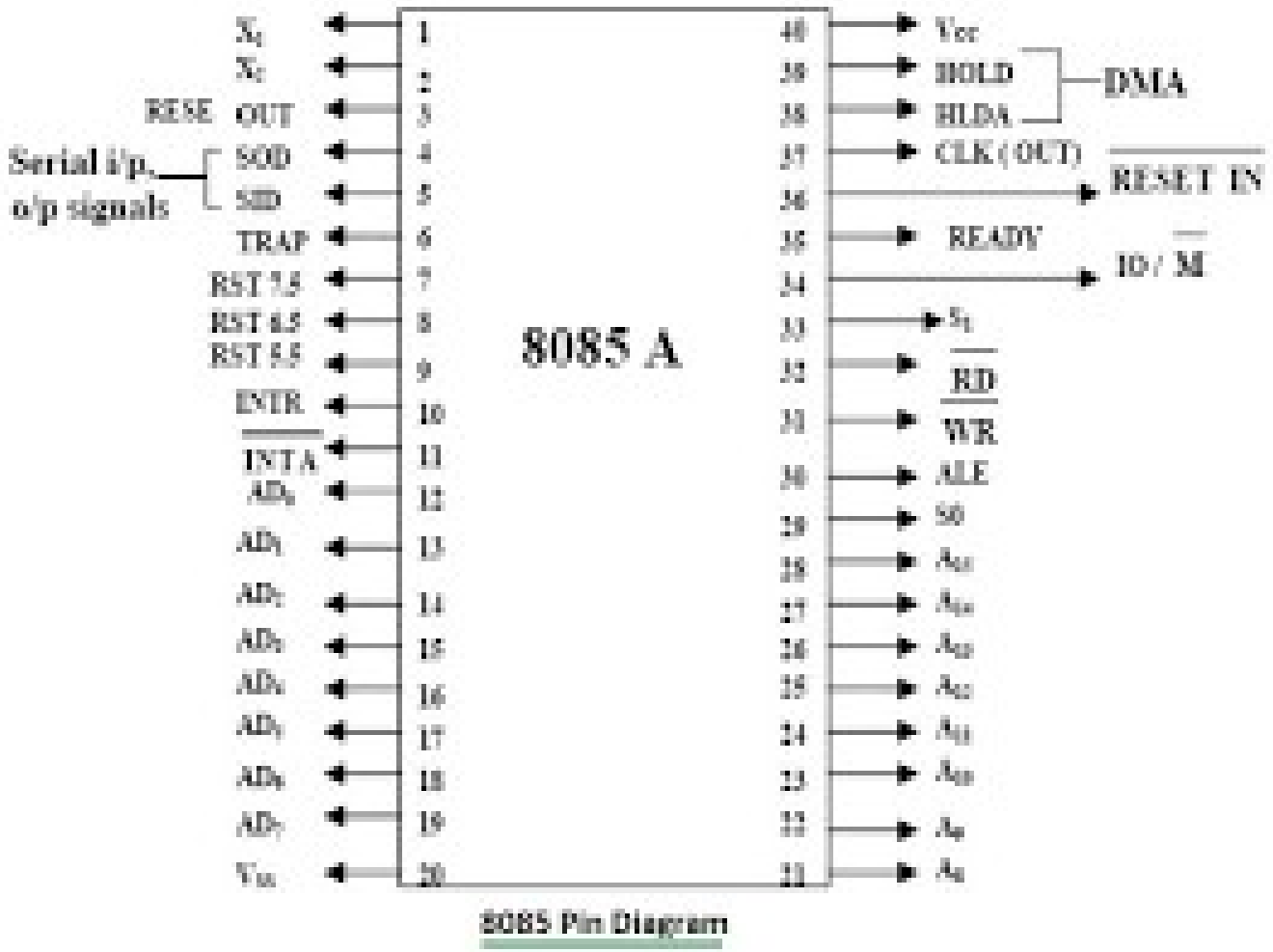


Microcontroller
1971

	Microprocessor	Microcontroller
Applications	General computing (i.e. Laptops, tablets)	Appliances, specialized devices
Speed	Very fast	Relatively slow
External Parts	Many	Few
Cost	High	Low
Energy Use	Medium to high	Very low to low
Vendors	  	   

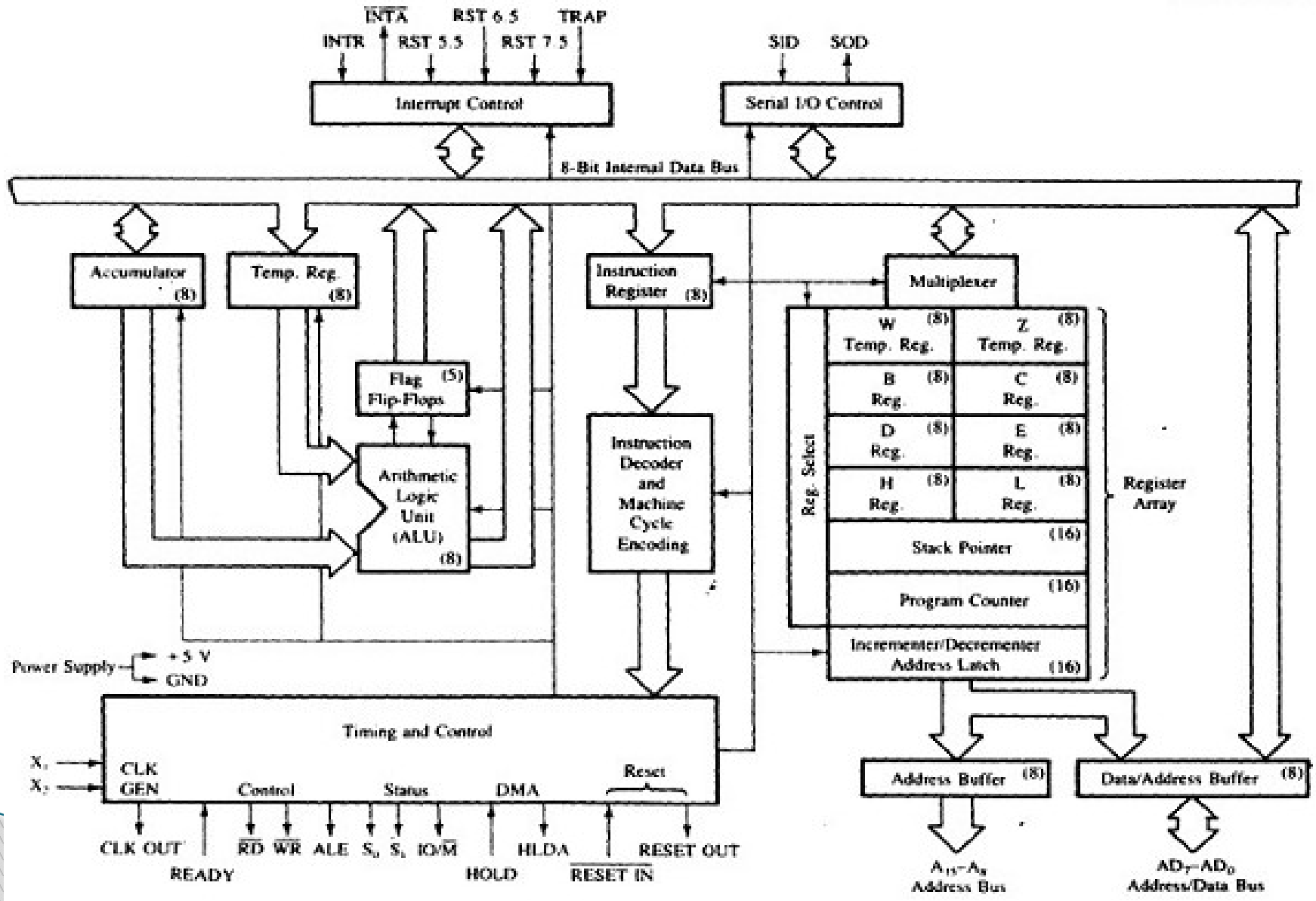

AMD
Microprocessor
intel
System Bus
Clock
RAM
Data Storage
Peripheral Bus
SPI, USB
DAC,ADC
Ethernet
SD/MMC
Microprocessor

EXAMPLE:PIN DIAGRAM 8085



8085 Pin Diagram

8085 micro processor architecture



Instruction register and decoder

It is an 8-bit register. When an instruction is fetched from memory then it is stored in the Instruction register. Instruction decoder decodes the information present in the Instruction register.

Timing and control unit

It provides timing and control signal to the microprocessor to perform operations. Following are the timing and control signals, which control external and internal circuits –

- Control Signals: READY, RD', WR', ALE
- Status Signals: S0, S1, IO/M'
- DMA Signals: HOLD, HLDA
- RESET Signals: RESET IN, RESET OUT

Interrupt control

As the name suggests it controls the interrupts during a process. When a microprocessor is executing a main program and whenever an interrupt occurs, the microprocessor shifts the control from the main program to process the incoming request. After the request is completed, the control goes back to the main program.

There are 5 interrupt signals in 8085 microprocessor: INTR, RST 7.5, RST 6.5, RST 5.5, TRAP.

Serial Input/output control

It controls the serial data communication by using these two instructions: SID (Serial input data) and SOD (Serial output data).

Address buffer and address-data buffer

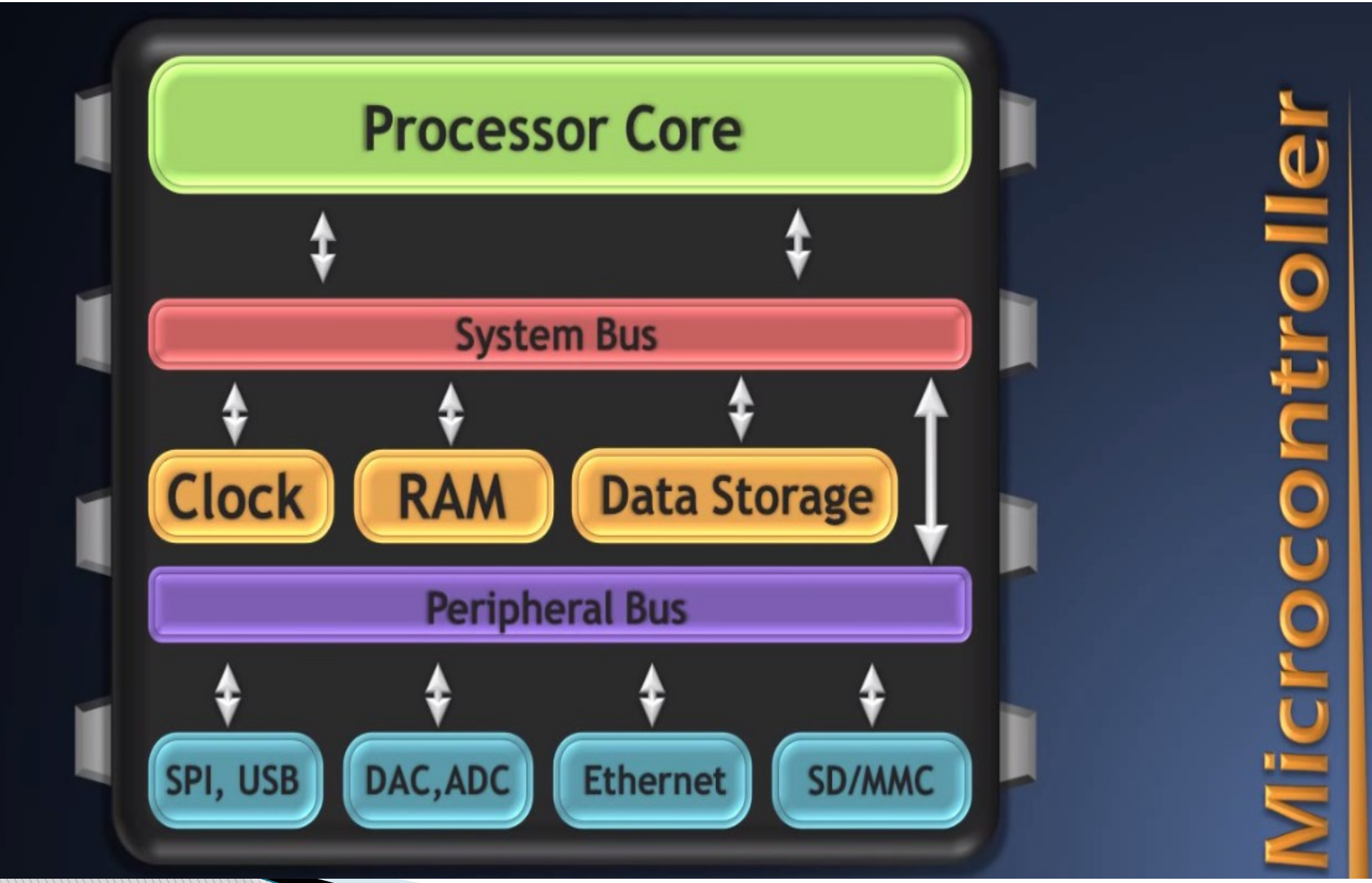
The content stored in the stack pointer and program counter is loaded into the address buffer and address-data buffer to communicate with the CPU. The memory and I/O chips are connected to these buses; the CPU can exchange the desired data with the memory and I/O chips.

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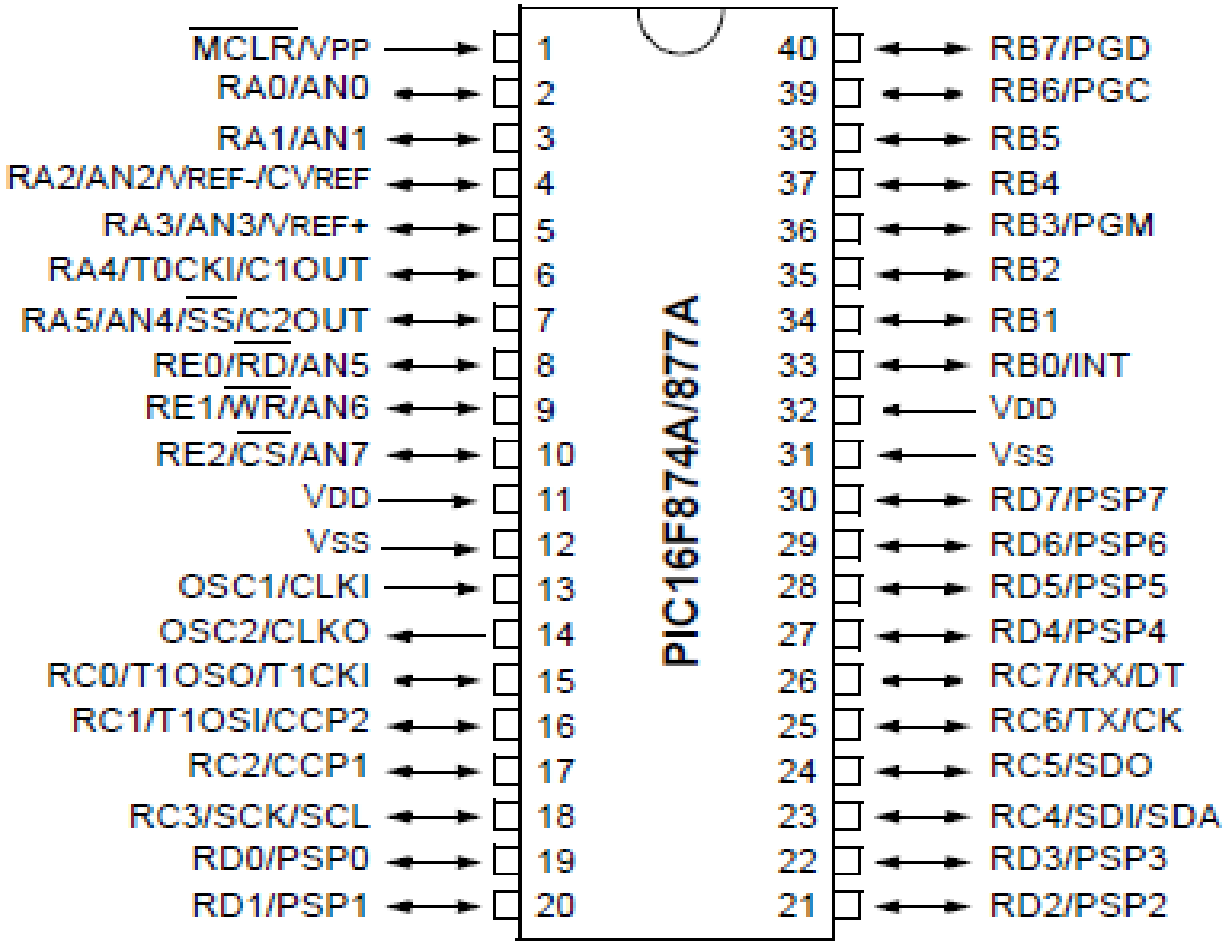
Address bus and data bus

Data bus carries the data to be stored. It is bidirectional, whereas address bus carries the location to where it should be stored and it is unidirectional. It is used to transfer the data & Address I/O devices.

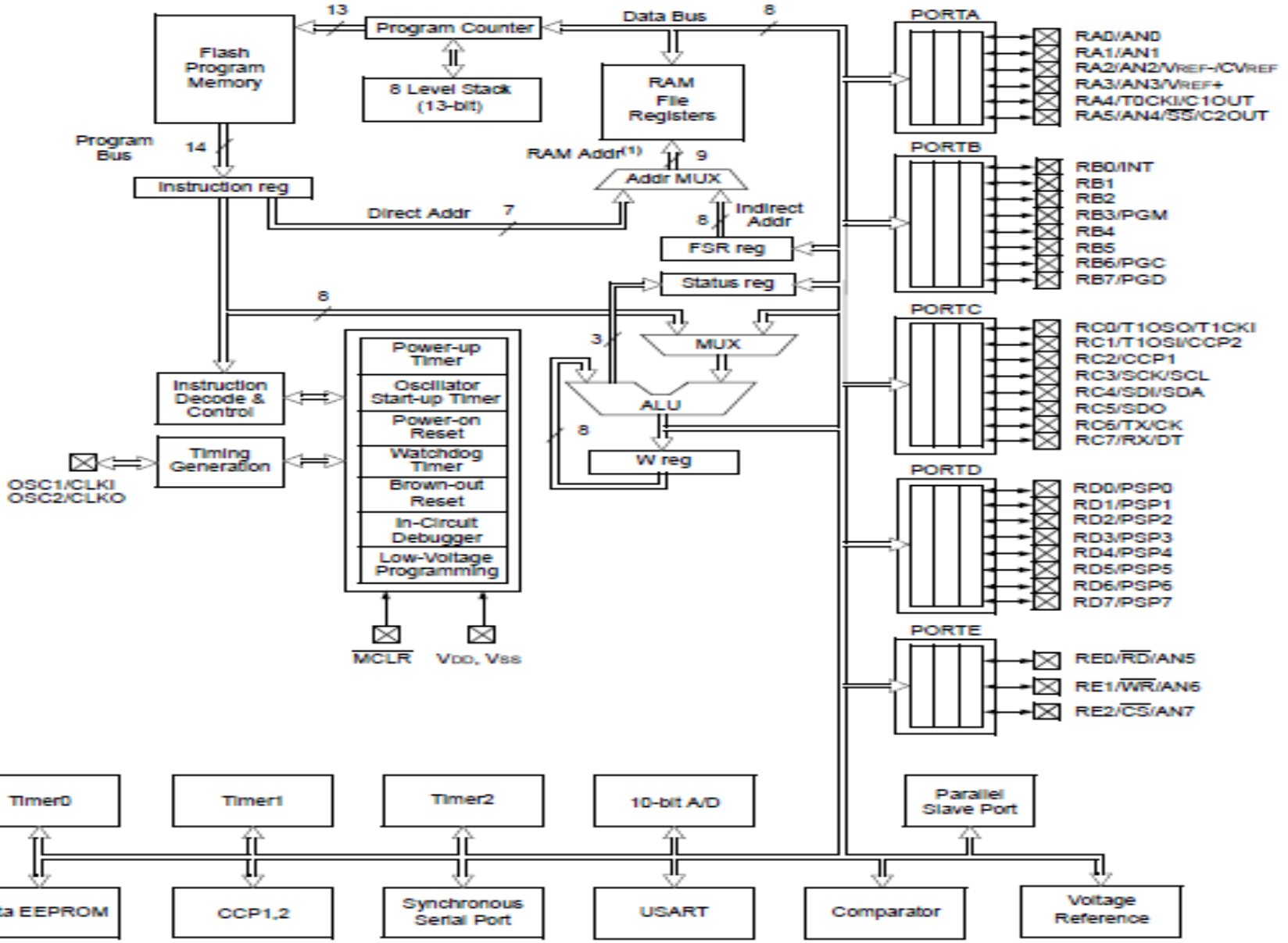

Processor Core
System Bus
Clock
RAM
Data Storage
Peripheral Bus
SPI, USB
DAC,ADC
Ethernet
SD/MMC
Microcontroller

EXAMPLE: PIN DIAGRAM OF PIC16F877A

40-Pin PDIP



EXAMPLE:BLOCK DIAGRAM OF PIC16F877A



Device	Program Flash	Data Memory	Data EEPROM
PIC16F874A	4K words	192 Bytes	128 Bytes
PIC16F877A	8K words	368 Bytes	256 Bytes

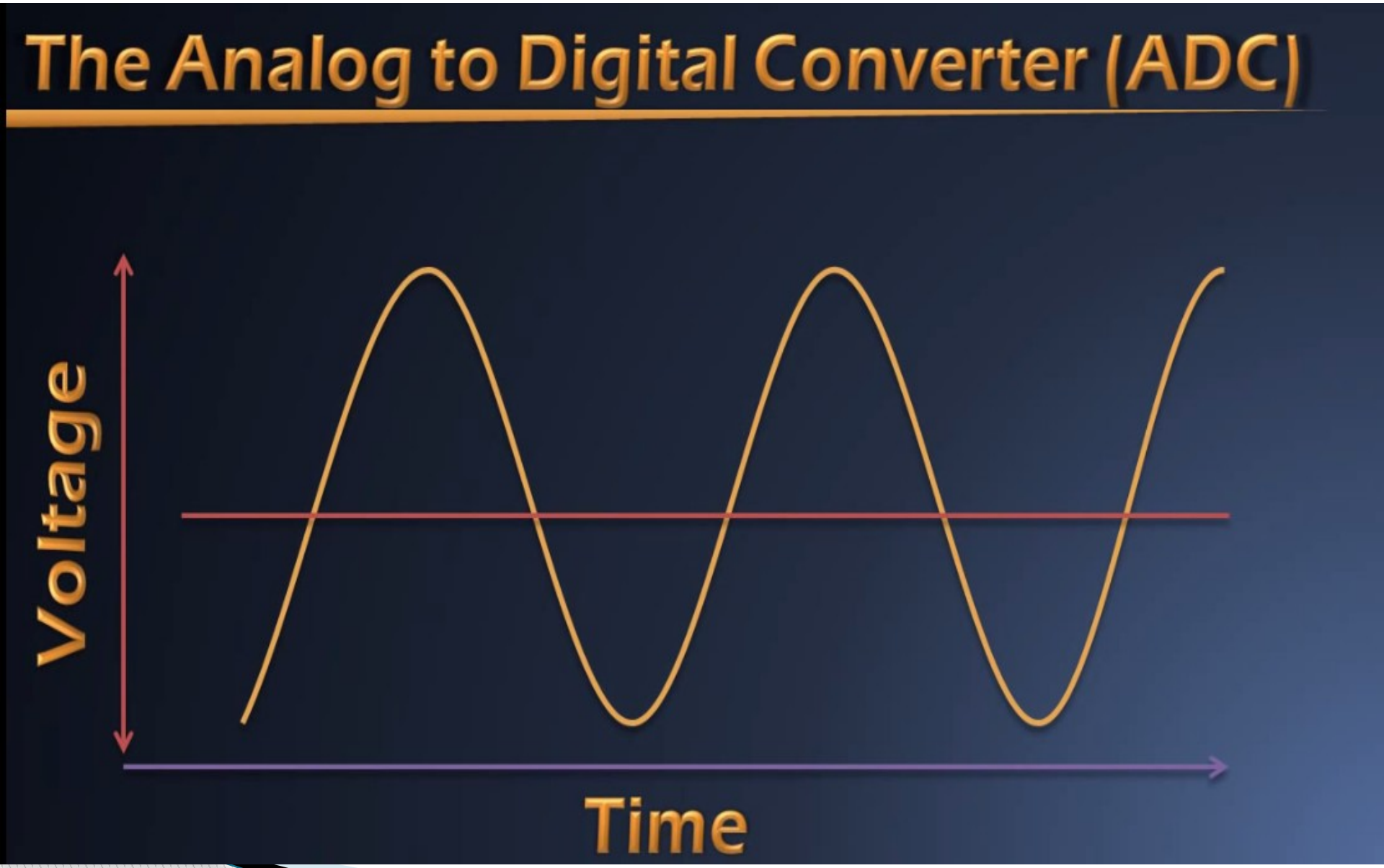
The Analog to Digital Converter (ADC)

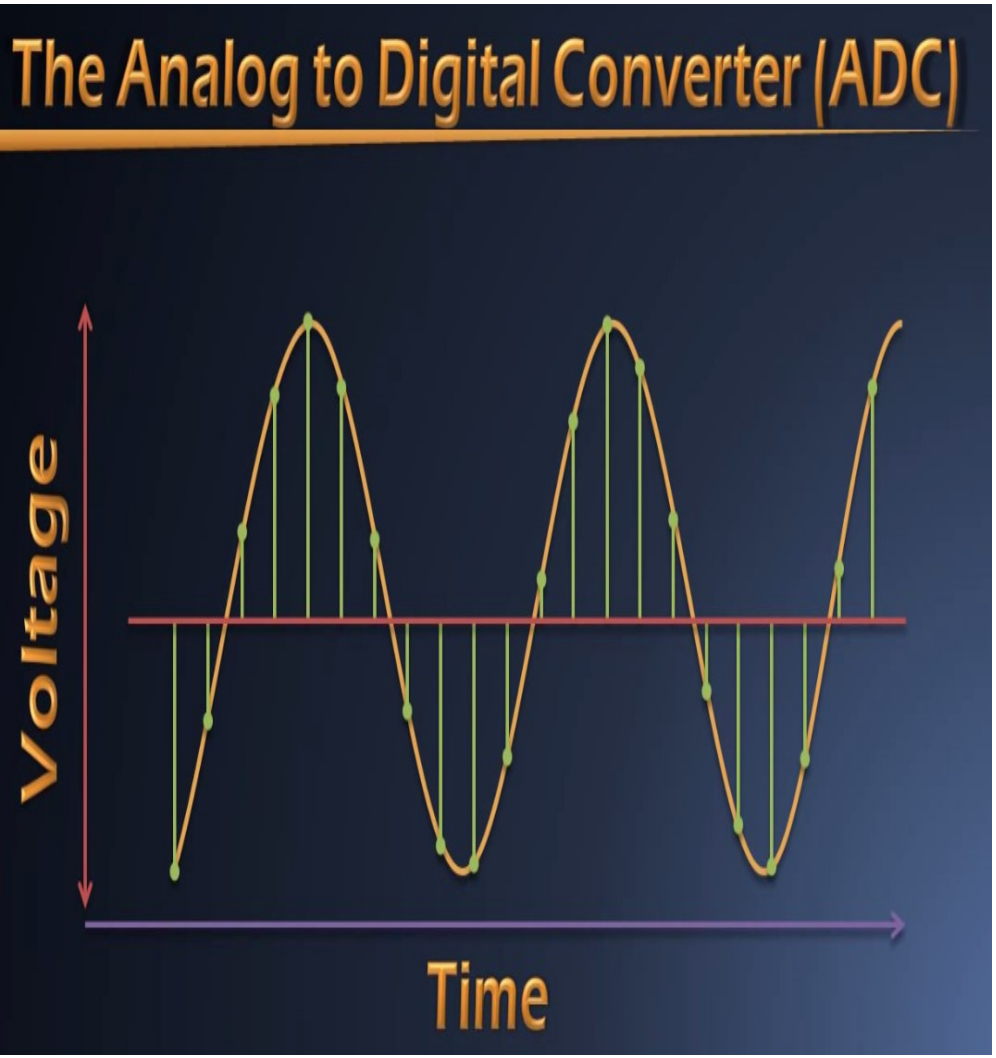
- Just about every modern microcontroller contains an ADC(s).
- It converts analog voltages into digital values.
- These digital representations of the signal at hand can be analyzed in code, logged in memory, or used in practically any other way possible.

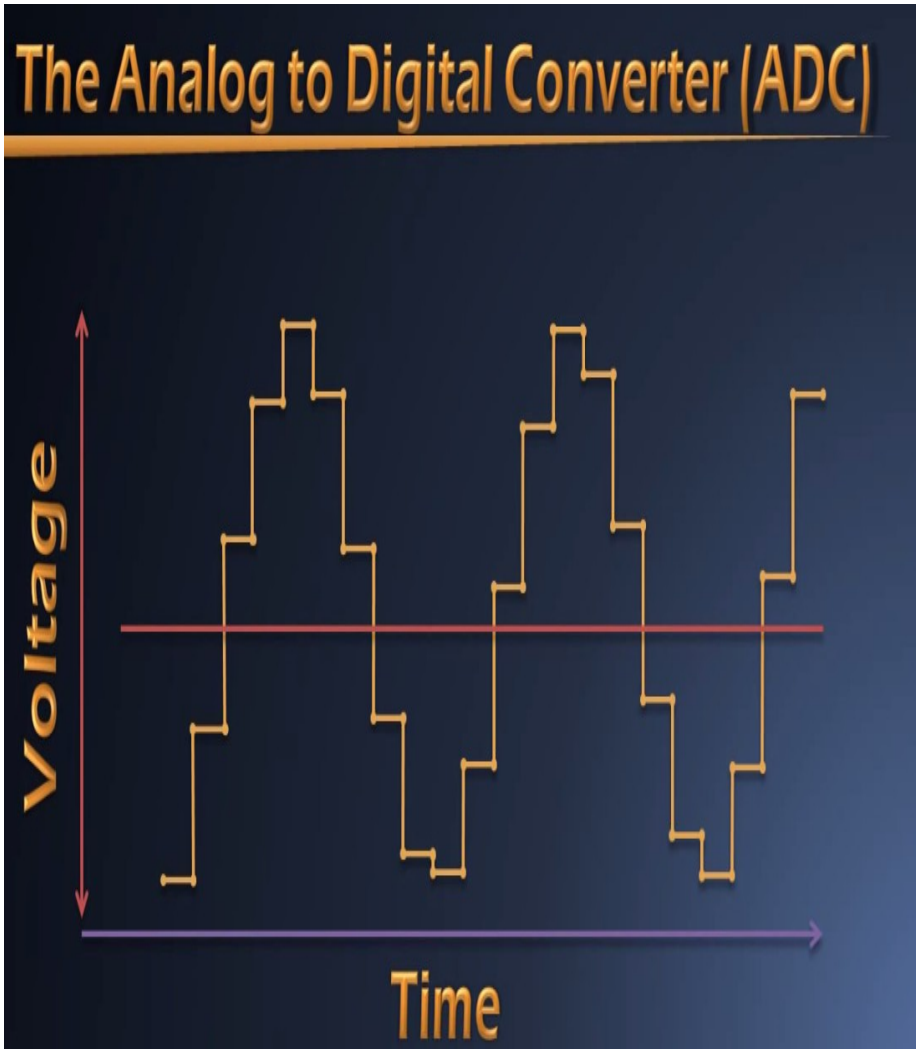
The Digital to Analog Converter (DAC)

- You guessed it! Microcontrollers have accompanying DACs.
- It does exactly the opposite function of an ADC. It takes a digital value and converts it into an pseudo-analog voltage.
- It can be used to do an enormous amount of things. One example is to synthesize a waveform. We can create an audio signal from a microcontroller. Imagine that!

The Analog to Digital Converter (ADC)




The Analog to Digital Converter (ADC)
Voltage
Time


The Analog to Digital Converter (ADC)
Voltage
Time

Basic Principles of Operation

- Microcontrollers are used for specific applications.
- They do not need to be powerful because most applications only require a clock of a few MHz and small amount of storage.
- A microcontroller needs to be programmed to be useful.
- A microcontroller is only as useful as the code written for it. If you wanted to turn on a red light when a temperature reached a certain point, the programmer would have to explicitly specify how that will happen through his code.

Microcontroller Programming

1.) Code is written for the microcontroller in an integrated development environment, a PC program. The code is written in a programming language. (e.g. C, BASIC or Assembly).

2.) The IDE debugs the code for errors, and then compiles it into binary code which the microcontroller can execute.

3.) A programmer (a piece of hardware, not a person) is used to transfer the code from the PC to the microcontroller. The most common type of programmer is an ICSP (In-circuit serial programmer).

Microcontroller Applications

- Many robots use microcontrollers to allow robots to interact with the real world.

- Ex. If a proximity sensor senses an object near by, the microcontroller will know to stop its motors and then find an unobstructed path.

