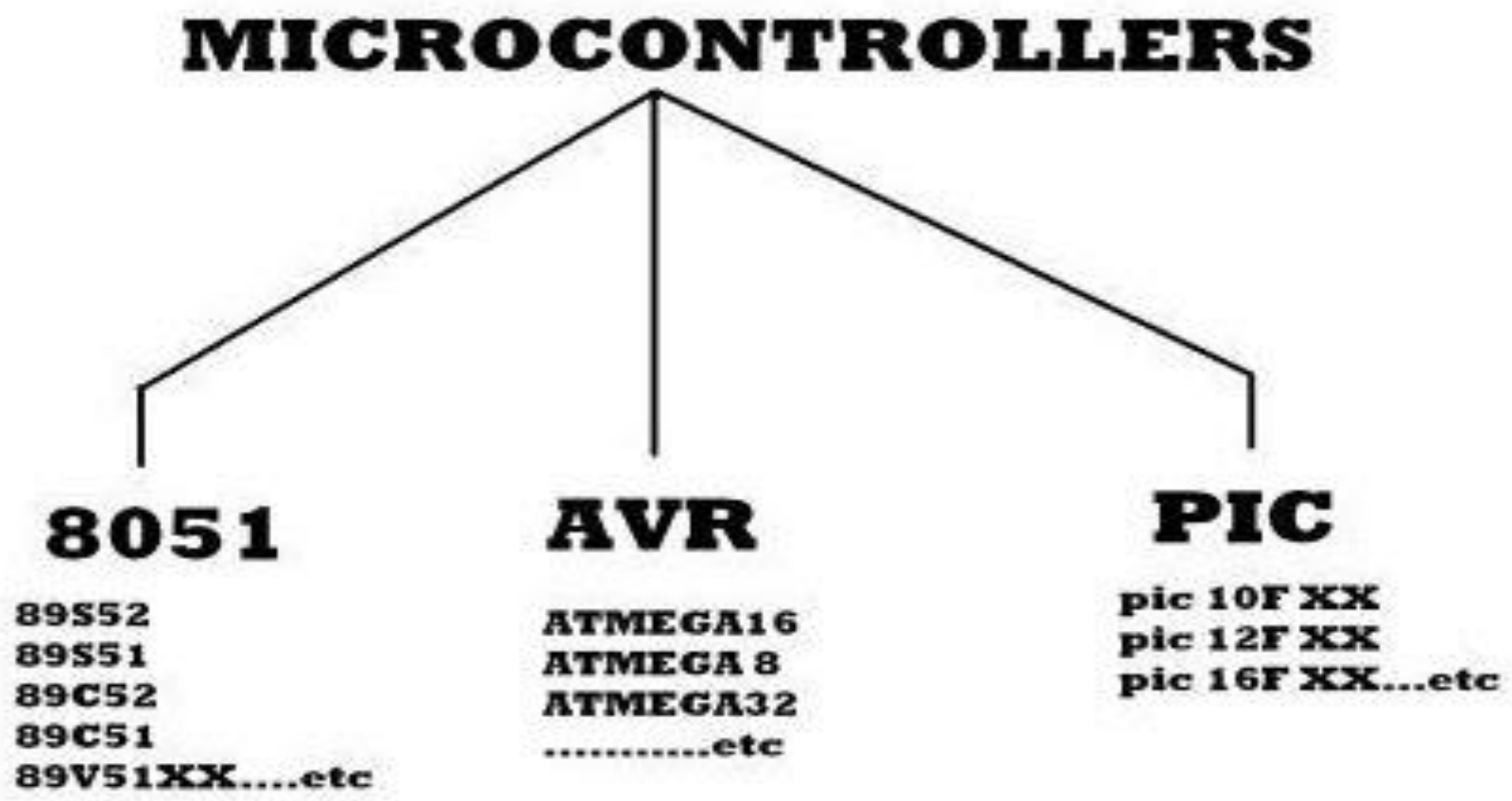
Overview OF Microcontroller
ATmega32 Microcontroller

What is a Microcontroller?

- A Microcontroller is a programmable digital processor with necessary peripherals.
- Microcontrollers are complex sequential digital circuits meant to carry out job according to the program / instructions.
- A microcontroller can be compared to a Swiss knife with multiple functions incorporated in the same IC.

Types Of Micro-Controller



8Bit
Microcontroller

16Bit
Microcontroller

32Bit
Microcontroller

64Bit
Microcontroller

What is ATmega32 micro-controller?

- ATmega32 micro-controller is based on the advanced Reduced Instruction Set Computer (RISC) architecture.
- It is a low power CMOS technology based controller.
- Due to RISC architecture, ATmega32 microcontroller can execute 1 million of instructions per second if cycle frequency is 1 MHz provided by crystal oscillator.

Features of Atmega32 Micro-Controller.

ATMEGA32 – Simplified Features	
ADC Module	8 channels , 10-bit resolution ADC
Number of Pins	40
CPU	8-bit AVR
Operating Voltage (V)	+4.5 to +5.5 V (+5.5V being absolute maximum)
Timer Module	Two 8-bit counters, One 16-bit counter [Total three]
Analog Comparators	1
Number of I/O pins	32

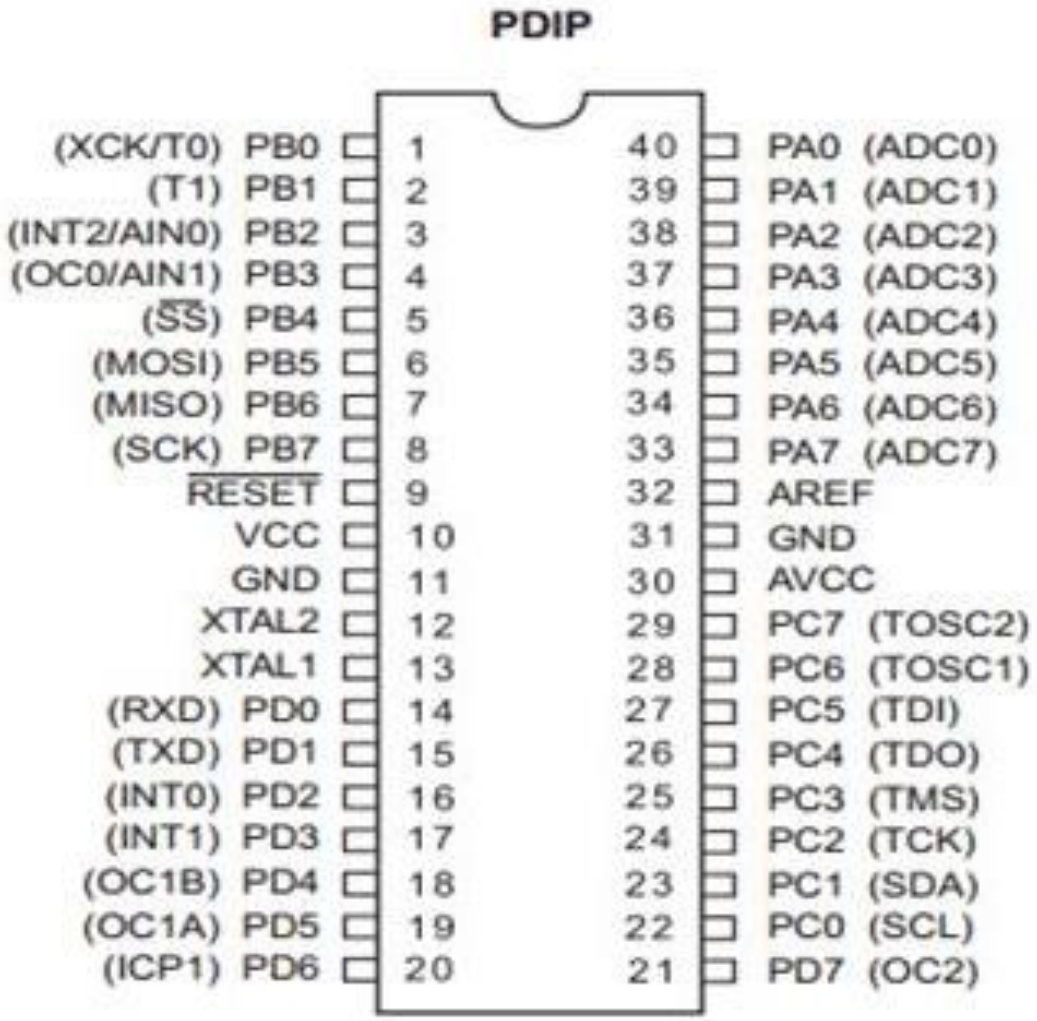
Features of Atmega32 Micro-Controller.(CONT)

DAC Module	Nil
PWM channels	4
Program Memory Type	Flash
Program Memory (KB)	32Kbytes[10000 write/erase cycles]
CPU Speed (MIPS)	16 MIPS
RAM Bytes	2KBytes
Data EEPROM	1024 Bytes
Watchdog Timer	Programmable Watchdog Timer with Separate On-chip Oscillator
Power Save Modes	Six Modes[Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby]
Internal Oscillator	0-8MHz Calibrated Internal Oscillator

Advantages of ATmega32 Micro-Controller

- ATmega32 micro-controller has a GCC based IDE that is free for the whole range of their processors.
- ATmega32 micro-controller is an 8-bit CPU and on the same clock it is 4 times faster than 8-bit PIC and 12 times faster than 8051.
- ATmega32 micro-controller is popular for low price and widely used.

Pin Diagram of ATmega32 microcontroller



Pin Description:

- **Port A (PA7-PA0):** Port A serves as analog inputs for A/D converter. It also acts as an 8-bit bidirectional I/O port if the A/D converter is not used internally.

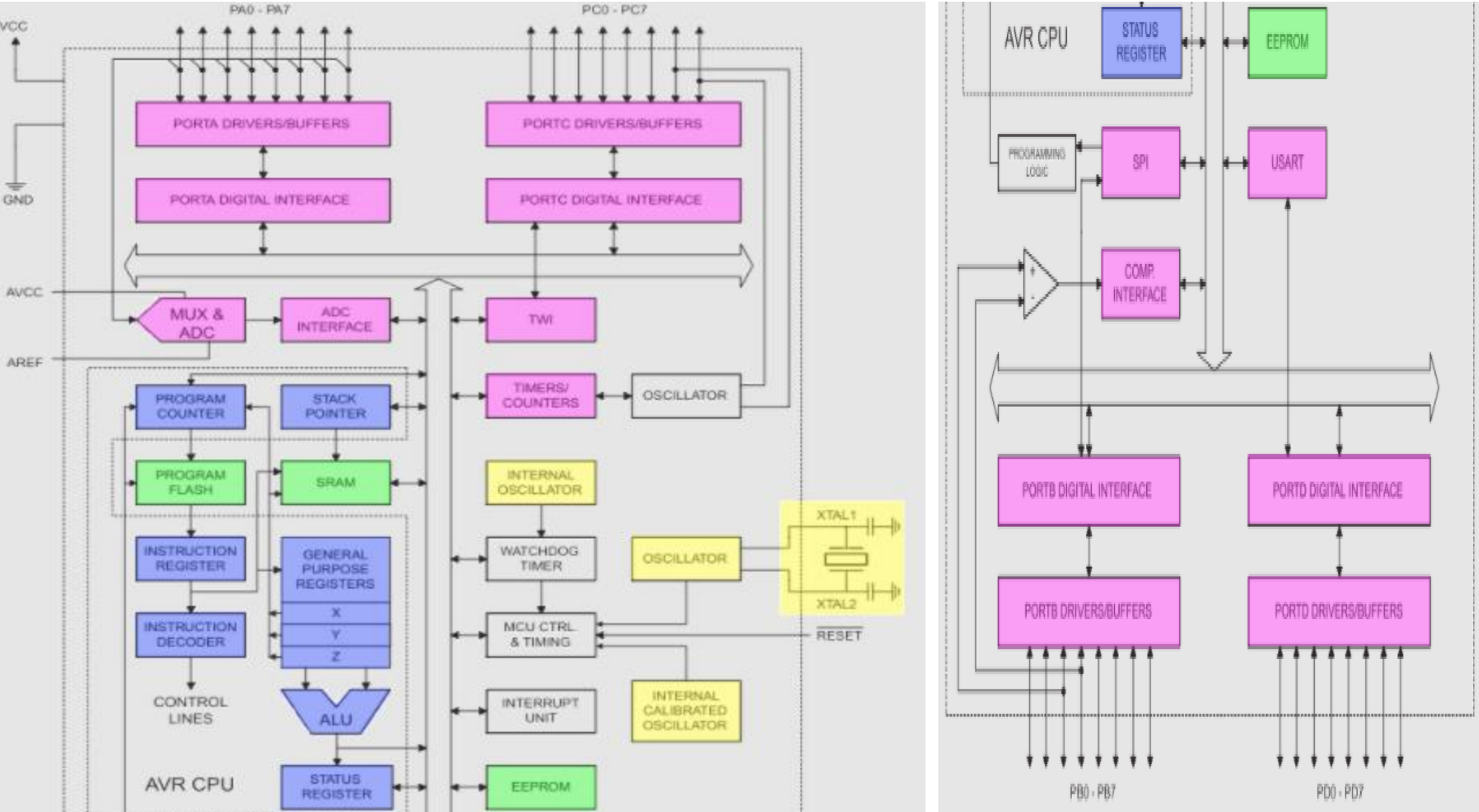
- **Port B (PB7-PB0) and Port D (PD7-PD0):** These ports are 8-bit bidirectional I/O ports. Their output buffers have symmetrical drive characteristics with high source and sink capability. As inputs, these are pulled low if the pull-up resistors are used. It also provides various special functional features of the ATmega32.

Pin Description(CONT):

- **Port C (PC7-PC0):** Port C is an 8-bit bidirectional I/O port. If the Joint Test Action Group (JTAG) interface is enabled, the pull-up resistors on pins PC2 (TCK), PC3 (TMS), and PC5 (TDI) will be activated.
- **VCC:** Digital voltage supply
- **GND:** Ground
- **RESET:** It is a RESET pin which is utilized to set the microcontroller ATmega32 to its primary value. During the beginning of an application the RESET pin is to be set elevated for two machine rotations.
- **XTAL1:** It is an input for the inverting oscillator amplifier and input to an internal clock operating circuit.
- **XTAL2:** It is an output from an inverting oscillator amplifier.
- **AVCC:** It is a supply voltage pin for A/D converter and Port A. It must be connected with VCC.
- **AREF:** AREF is an analog signal reference pin for the analog to digital converter.

Architecture of ATmega32 Microprocessor

The ATmega32 micro-controller has the following architecture:


PA0 - PA7
PC0 - PC7
VCC
GND
PORTA DRIVERS/BUFFERS
PORTC DRIVERS/BUFFERS
PORTA DIGITAL INTERFACE
PORTC DIGITAL INTERFACE
AVCC
AREF
MUX & ADC
ADC INTERFACE
TWI
TIMERS/ COUNTERS
OSCILLATOR
PROGRAM COUNTER
STACK POINTER
PROGRAM FLASH
SRAM
INTERNAL OSCILLATOR
INSTRUCTION REGISTER
GENERAL PURPOSE REGISTERS
X
Y
Z
WATCHDOG TIMER
OSCILLATOR
XTAL1
XTAL2
INSTRUCTION DECODER
MCU CTRL & TIMING
RESET
CONTROL LINES
ALU
INTERRUPT UNIT
INTERNAL CALIBRATED OSCILLATOR
AVR CPU
STATUS REGISTER
EEPROM
AVR CPU
STATUS REGISTER
EEPROM
PROGRAMMING LOGIC
SPI
USART
COMP. INTERFACE
PORTB DIGITAL INTERFACE
PORTD DIGITAL INTERFACE
PORTB DRIVERS/BUFFERS
PORTD DRIVERS/BUFFERS
PB0 - PB7
PD0 - PD7

- The CPU components are shaded blue.
- The memory components are shaded green.
- The clock components are shaded in orange.
- The I/O components are shaded in purple.

Application of ATmega32 Micro-Controller

- Temperature control systems
- Analog signal measuring and manipulations.
- Embedded systems like coffee machine, vending machine.
- Motor control systems.
- Digital signal processing.
- Peripheral Interface system.