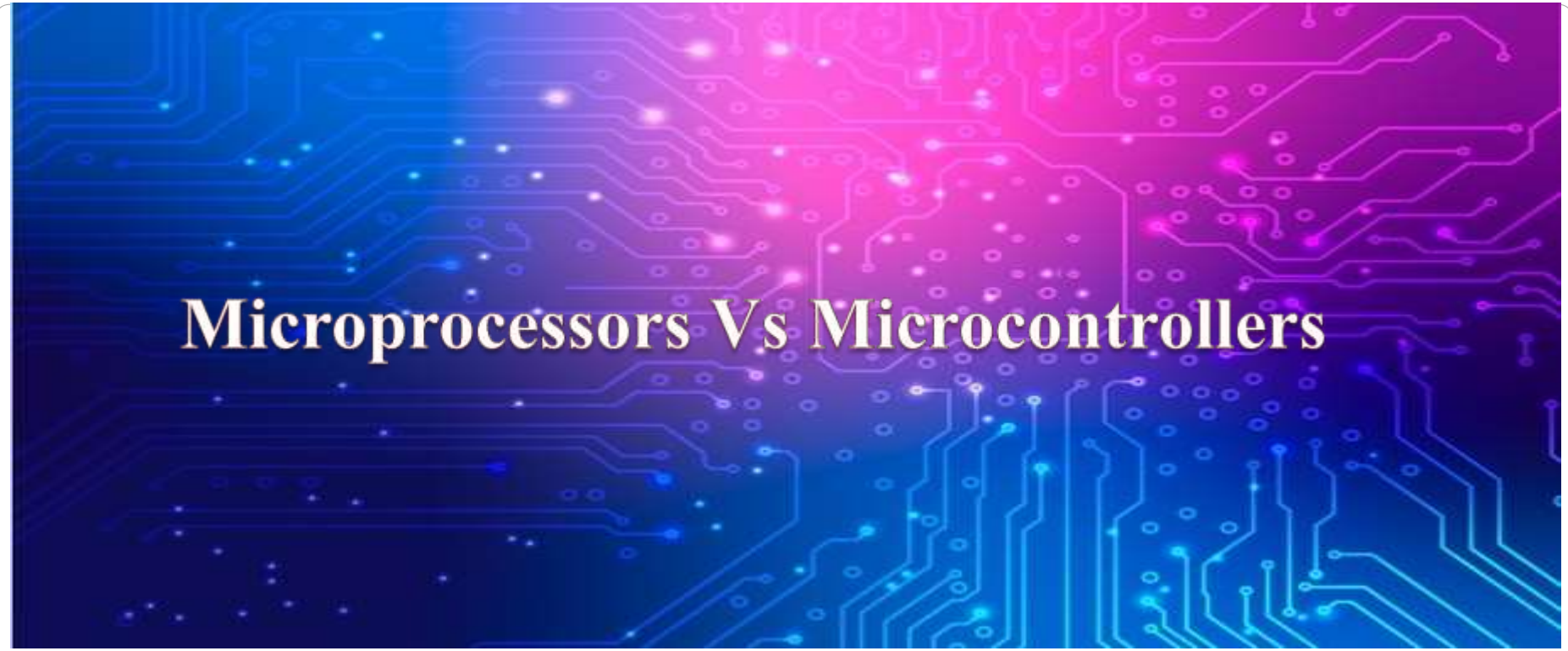
Microprocessors & Microcontrollers
: Arm Cortex M0+
(Using RP2040)

ES7
Microprocessors Vs Microcontrollers

Focus

- Microprocessors Vs Microcontrollers
  - Different Levels of Implementation
  - µP Vs µC
  - Inside a Microcontroller
  - Other Micro Controllers (MCUs)



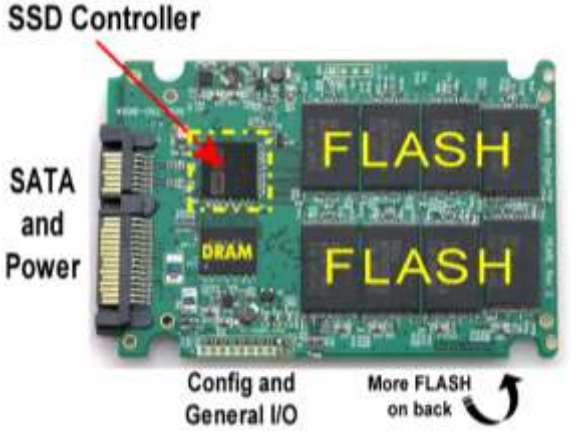
µP Vs µC

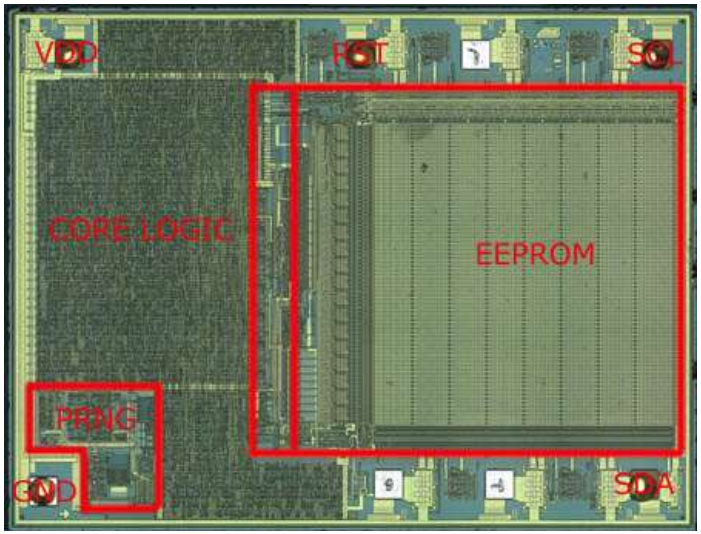
Another name for **Microcontrollers – MCU – Micro Controller Unit**

Different Levels of Implementation

Only CPU core and L1 cache inside the chip.
Outside: L2 caches, RAM memory, peripherals

CPU core and cache inside the chip
Outside: RAM/FLASH memory, peripherals





SSD: Solid State Device (Flash memory)

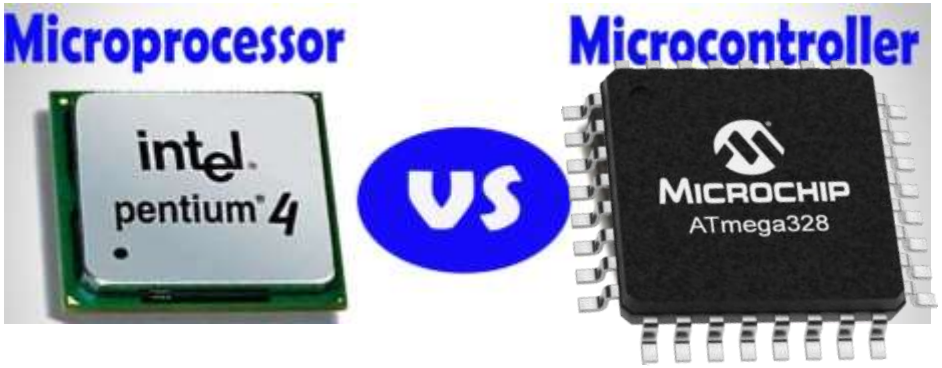
SATA: Hard-disk interface, used early in PCs.

SATA: Serial ATA

ATA: Advanced Technology Interface

Microcontroller:
CPU core, SRAM, EEPROM,
FLASH memory and
Peripherals all inside the chip
Only I/O pins come out of the chip

µP Vs µC



No. of Pins: 423

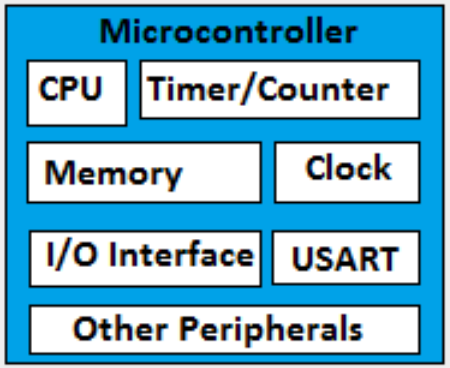
No. of Pins: 32

With **µP**, many chips are required to build a system Memory is outside because µP core is of complex design having no space to accommodate memory inside the chip.

MCUs have a simpler core logic having space to put memory, peripherals inside, resulting in a simpler, low power system, with less number of pins

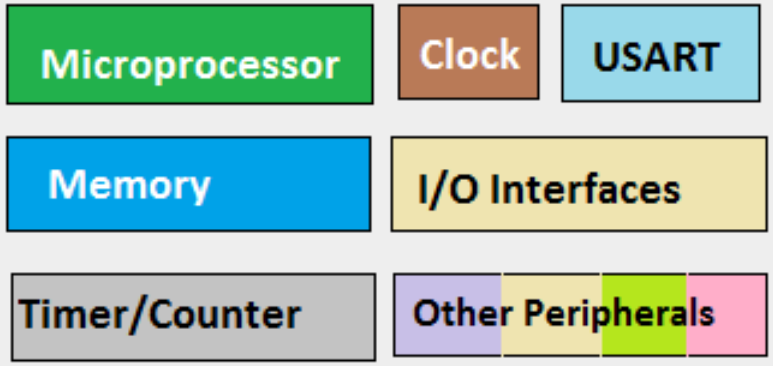
µC

One chip

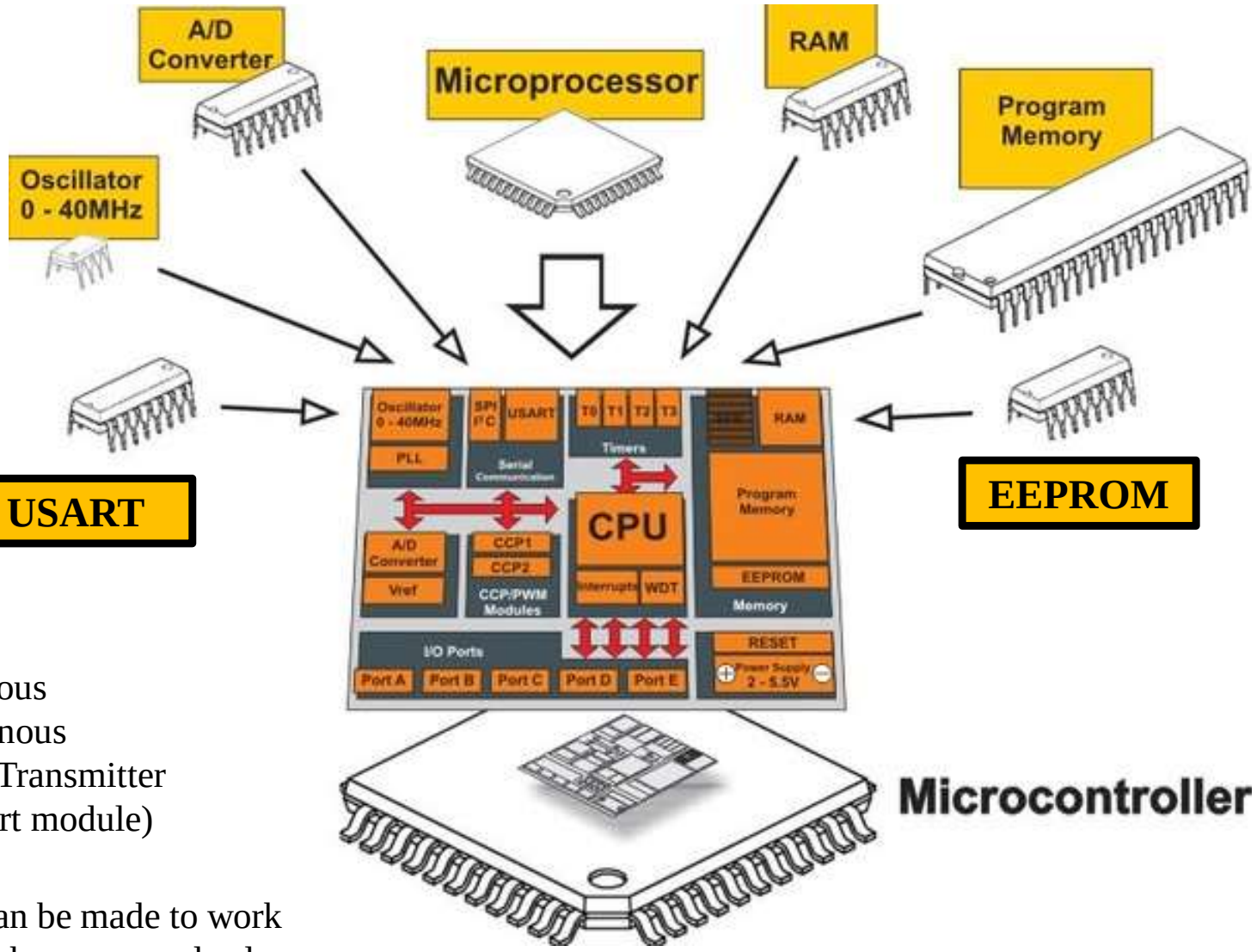


µP

Many different chips



Inside a Microcontroller



USART:
Universal
Synchronous
Asynchronous
Receiver/Transmitter
(Serial port module)

USART can be made to work in the Synchronous mode also

Quiz 1: Why do MCUs consume less power?

- Choose **all the valid reasons** below:
  - A. Simpler processor core design with less number of instructions
  - B. Both code and data memories are built into the chip
  - C. Most of the peripherals are built into the chip
  - D. Most of the time, the processor accesses internal modules than driving signals over the pins to access external modules

Answer: **A, B, C, D**

Note: When the CPU needs to access the external modules, it needs to drive signals over long lines requiring more power. Since MCUs most of the time access internal modules, they consume less power compared to microprocessors, because memory and most of the peripherals are outside the microprocessor chips.

Other Micro Controllers (MCUs)


ARM7


ARM9


TI MSP430

PIC microcont...


STM32

Here are some of popular microcontrollers used for industry needs.

- ARM controllers (ARM 7, ARM 9 ARM 11)
- MSP430 controllers. **16-bit µC from TI**
- PIC **microcontroller**. **8 to 32-bit MCUs from Microchip Technology**
- Renesas family. **Renesas Electronics, Tokyo, Japan**
- STM electronics (STM 32, STR9 series) **STMircroelectronics, Switzerland.**

8051: µC from Intel

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