

Chapter 1

Types, Selection, and Applications of Microcontrollers

Lesson 3

Microcontrollers- Types and Examples

CPU

**Micro-
computer**

Ports

Memory

Serial Devices

Interrupt Handler unit

Watchdog Timer

Timing Devices

ADC

Application specific Devices

PWM

Microcontroller Chip or VLSI Core

Processor in Microcontroller

- **8-bit** Microcontroller- 8051 Series, Motorola 68HC11
 - **16-bit** Microcontroller- Extended 8051 XA, Intel 80x96, MC68HC12
- **32-bit** Microcontroller- Cortex M3, ARM7/ARM9/ARM 11 based Microcontroller, PIC 32

Microcontroller Form

- **Microcontroller chip**
- **Microcontroller VLSI Core**
- **VHDL/Verilog File**

Microcontroller Instruction Set

- **CISC Microcontroller - Complicated Instruction Set and Multiple addressing modes**
- **RISC Microcontroller-Reduced Instruction Set, Fewer Addressing modes, Single cycle execution and same instruction length**

Microcontroller Memory Architecture

- **Princeton Memory Architecture**—
Common address spaces for program and data memory

- **Harvard Memory Architecture**—
Separate address spaces for program and data memory

Microcontroller Family

- 8051Series
- AVR
- Atmel
- PIC
- Hitachi
- Texas
- ARM
- Motorola
- Others

8051 Family Microcontroller

- Intel
- Philips
- Atmel
- Siemens
- Dallas

ARM Microcontrollers

- ST Microelectronics
- Philips
- Atmel
- Samsung
- Texas

**64 kB
Data
RAM**

**64 kB
Program
Memory**

**4 kB ROM,
128 B RAM
Internal**

**Philips
8051 MX**

**8051
Classic**

**8051
Extended**

8051 Series Family Members

**No ROM,
512 B RAM
Internal**

**8 kB ROM,
512 B RAM
Internal**

**8 kB
EPROM,
512 B RAM
Internal**

80C51RA/RB

83C51RA/RB

87C51RA/RB

80C51 RA/RB/RC Series

Special Features 8051 MCUs

No ROM,
256 B RAM
Internal

80C552

8 kB ROM,
256 B RAM
Internal

83C552

8 kB
EPROM,
256 B RAM
Internal

87C552

5 Ports

ADC

In-
capture

2 PWMs

Out-
compare

Special Features

Philips

80C552 Series

No ROM,
512 B RAM
Internal

32 kB ROM,
512 B RAM
Internal

32 kB
EPROM,
512 B RAM
Internal

80C528

83C528

87C528

5 Ports

I²C Bus

In-
capture

2
PWMs

Out-
compare

Special Features

Philips

80C528 Series

**No ROM,
256 B RAM
Internal**

**8 kB ROM,
256 B RAM
Internal**

**8 kB
EPROM,
256 B RAM
Internal**

80515-N

80C535-N

87C515-N

6 Ports

2

PWMs

**16-bit
WDT**

**In-capture
and out-
compare**

**40 B
standby
powered**

Special Features

Siemens 80515/535-N Series

**No ROM,
256 B RAM
Internal**

**4 kB ROM,
256 B RAM
Internal**

**4 kB Flash,
256 B RAM
Internal**

Atmel 80C51

Atmel 83C51

AT89C51-12PC

**20 pin
special
package**

**40 Pin
package**

Special Features

Atmel 8051
Series

**No ROM,
256 B RAM
Internal**

**4 kB ROM,
256 B RAM
Internal**

**4 kB Flash,
256 B RAM
Internal**

80C51

83C51

89C51

24 MHz

**up to 3 times
fast code
execution**

Special Features

Dallas 8051 Series

8051 Series Family Members

**4 kB ROM,
256 B RAM**

Internal

**Extended 16
MB Data
RAM**

**Unified
64 MB
Program
Memory**

**8051
Classic**

**8051
Extended**

**Philips
8051 MX**

8051 Series

**External/
Internal
unified**

**8 MB ROM
+ 8MB
Constants
ROM**

**Unified 64 MB
Program/Data
Memory**

**8051
Classic**

**8051
Extended**

**Philips
8051 MX**

**16-bit Stack
Pointer,**

**768 B
Internal
RAM**

8051 Series Family Members

8051 Series

**Internal/External Unified 64 kB
Data RAM/ Program
memory/EEPROM**

8-bit MCU

68HC11

68HC12

68HC16

4 Ports

**1 Analog
Inputs Port**

68HC11/12/16 Series
Family Members

**8-kB ROM, 256 B
RAM, 512 B
EEPROM Internal**

68HC11A8

**12-kB ROM, 512 B
RAM, 512 B
EEPROM Internal**

68HC11E9

Special Features

MC68HC11A8/E9

**16 kB
EPROM, 512
B RAM
Internal**

**84 pins, 1 MB Extended
Addresses, 640 B EEPROM,
768 B RAM, 24kB EPROM,
PWM, Internal**

68HC711L6

68HC711K4

68HC711E9

**512 B
EEPROM
Internal**

**Four input
captures**

Special Features

MC68HC711
Series

**12 kB
EPROM, 512
B RAM, 512
B EEPROM
Internal**

**4 kB EEROM
or EPROM
Internal**

**+ 128kB data
memory**

**24 External
Interrupts**

1 kB RAM

**4MB
Addresses**

**16-bit Stack
Pointer**

ADC

12 Ports

**22-bit
Program
Counter**

Special Features

30% short code

8 Ch.-Timers

16-bit
68HC12A4

**8MHz E-
Clock
0.125 μ s**

Summary

We learnt

- Microcontrollers Types - 8/16/32 bit
- RISC/CISC
- IC/Core
- Many Sources and Many variants
- 8051 Family Examples
- 68HC11/12Series Examples