

EE4390 Microprocessors

Lesson 1

Course Overview, 68HC12 Overview

Revised: Aug 1, 2003

Overview

- Course overview
- Course policies
- Computers and Embedded Controllers
- 68HC12 Overview

Computers and Embedded Controllers

- All computers contain four hardware modules
 - central processing unit (CPU)
 - memory
 - input/output devices
 - buses
- Reference Figure 1.1, pg 5

Central Processing Unit

- Governs order of instruction execution
- Controls access to memory and I/O devices
- Performs arithmetic and logical operations
- Handles interrupt services
- Contains: ALU, control unit, internal registers, timers, buses
- Speed based on clock speed

Memory

- Contains instructions and data
- von Neumann architecture -- instructions and data stored in the same memory
- Memory technologies:
 - RAM
 - ROM

I/O Devices

- Input/Output devices:

Buses

- Pathways connecting computer components
 - address: specify address locations where data and instructions reside in memory
 - data: carries instructions and data to and from memory
 - control: sends and receives control commands among system components

Terminology

- Microprocessor: CPU units packaged in a single chip
- Microcomputer: computer that uses the microprocessor as its CPU (e.g. PC)
- Microcontrollers (a.k.a. embedded controllers): all computer components in a single VLSI (Very Large Scale Integration) chip

Applications

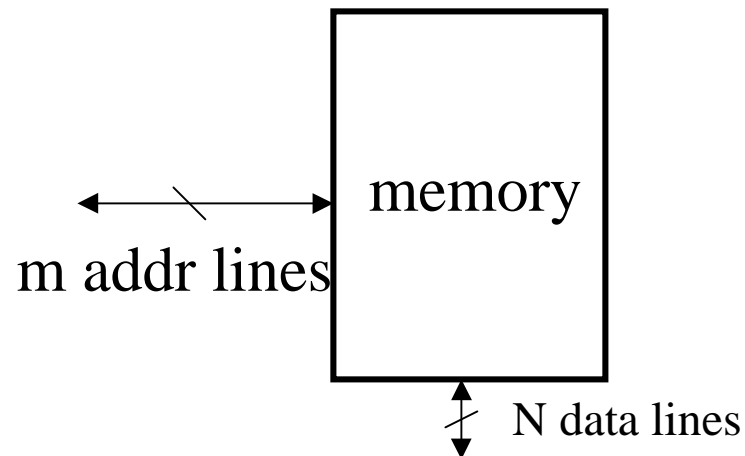
- How many embedded controllers have you used today?

68HC12 Overview

- Introduced by Motorola 1997
- Instruction Set
 - 209 instructions
 - multiple addressing modes (where's the data!)
- CPU12
 - 16 bit processor
 - variants:
 - “A4” : expanded mode, 8 MHz
 - “B32”: single chip mode, 8 MHz
 - HCS12 series: larger onboard memory, 25 MHz
- Clock speed: 16 MHz crystal, divide by 2 for 8 MHz system clock
 - clock generated by crystal or ceramic resonator

Memory Concepts - Review

- Width: M bits, number of data lines, determines size of operand
- Length: number of separately addressable locations, $2^{\#addr\ lines} = \#memory\ locations$



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Memory Concepts - Review

- RAM

- read/write
- volatile
- faster access time
- variants
 - SRAM
 - DRAM
- applications
 - variables
 - dynamic memory allocation
 - heaps, stacks

- ROM

- read only
- non-volatile
- slower
- variants
 - ROM, PROM, EPROM, EEPROM (byte-addressable, FLASH)
- applications
 - programs
 - constants, codes, etc.

Memory Concepts - Review

$2^{10} = 1024$	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
binary	1	0	0	0	0	0	0	0	0	0	0
hex	\$		4				0				0

Other common conversions:

$$2^8 = 256 = \$100$$

$$2^{10} = 1024 = \$400 \text{ approximately } 1\text{K}$$

$$2^{12} = 4096 = \$1000 \text{ approximately } 4\text{K}$$

68HC12 Overview (cont)

- Memory: 1K-byte RAM, 4K-bytes EEPROM, expandable to 5M-bytes
- Serial communications: SCI and SPI
 - asynchronous vs. synchronous communication
 - SCI: communications - asynchronous
 - SPI: extend features of 68HC12 - synchronous
- 8 channel analog-to-digital converter
- 8 channel timer
 - input capture, output compare, pulse accumulation
- Background Debug Mode (BDM) - troubleshooting
- Memory-mapped input/output

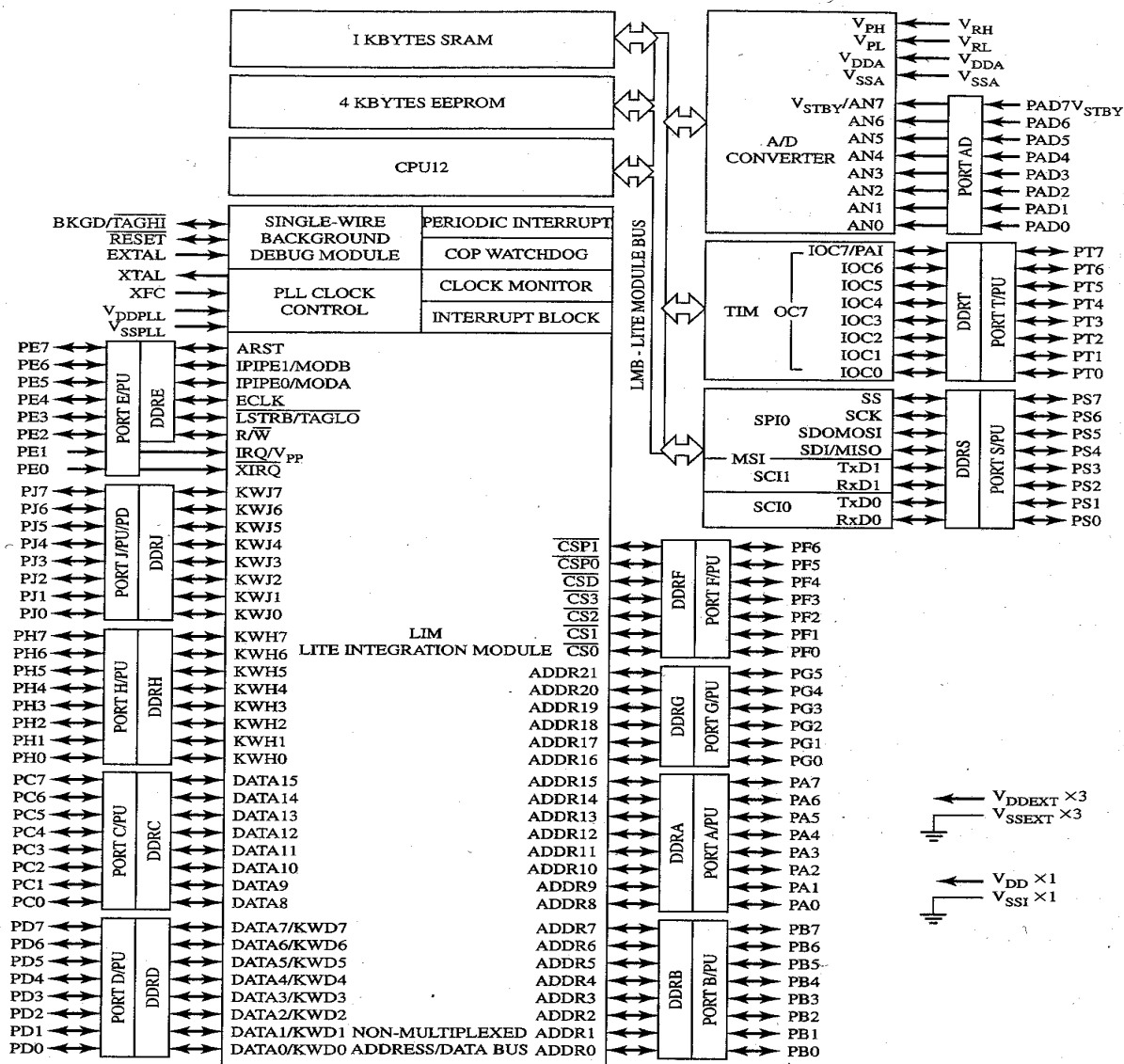


Figure 1.3 The block diagram of the MC68HC812A4 (Motorola).

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1.6 Block Diagrams

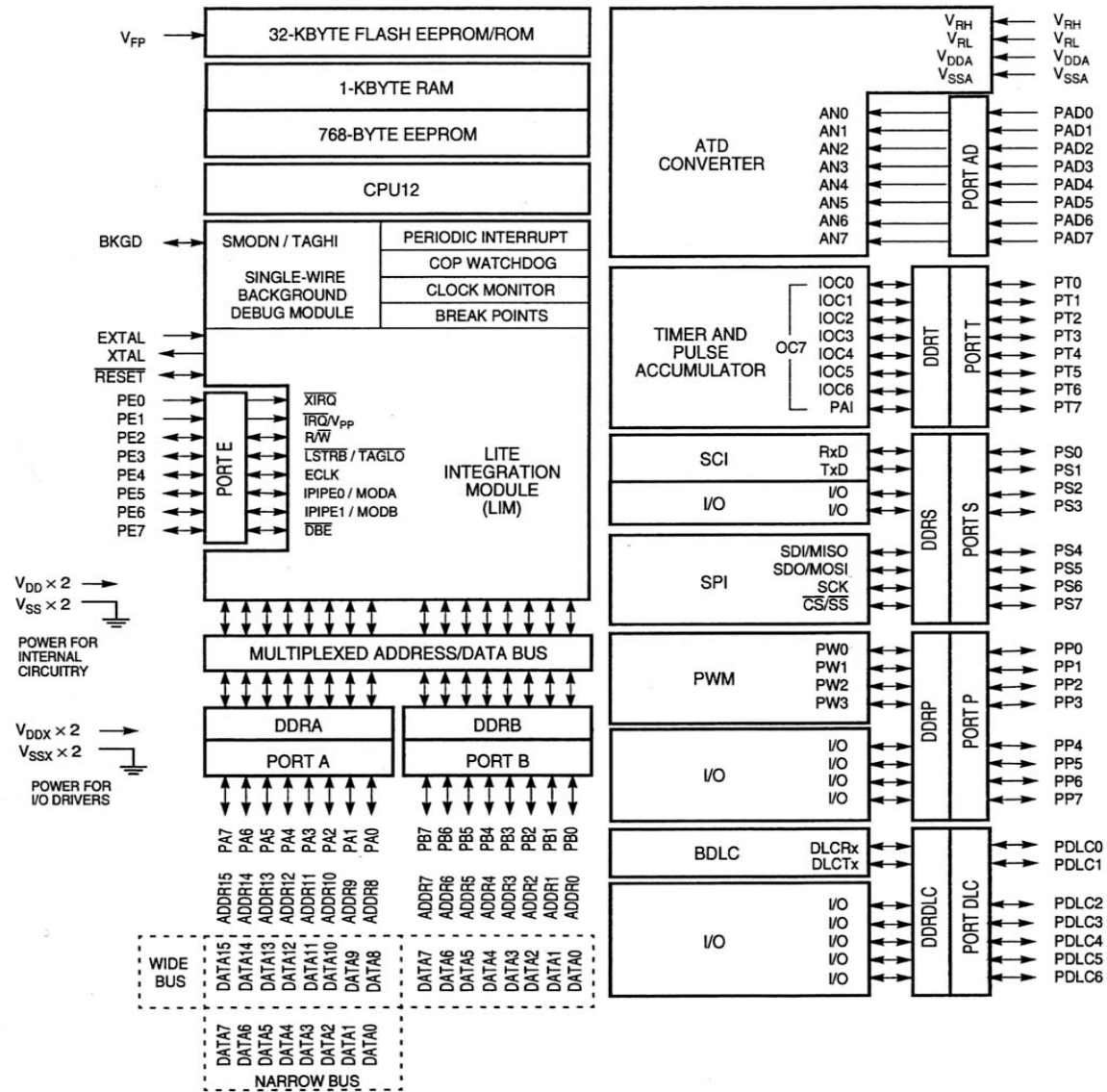


Figure 1-1. Block Diagram for MC68HC912B32 and MC68HC12BE32

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