Chapter 2

A Introduction to the 68000 Microprocessor

Objectives

- The register set of the 68000
- The addressing capabilities and data types that may be used
- The different instruction types available
- The signals generated used by the 68000
- Some of the hardware and software advantages of the 68000

Introduction

- Instructions unheard of in 8-bit machines – a very large address space, many different addressing modes, and an architecture that easily lends itself to multiprocessing or multitasking.
- 68000 is a machine with many possibilities

The Software Model of the 68000

- 8 data registers, D0 – D7; 8 address registers, A0 – A7; a program counter (PC); and a status register (SR). All except for the SR are 32 bits in length.
- Data registers store information within 68000 processor
- Address registers store the location where data can be found outside the processor

The Software Model of the 68000

- Only the lower 24 bits of PC are used by the 68000
- Two A7 address registers: user stack pointer (USP) and supervisor stack pointer (SSP)
- Microprocessor’s status is determined by the status register (SR)
A Functional Description of the 68000

- 68000 is referred to as a 16-bit machine
- 16 bidirectional data lines: D0-D15
- 23 address lines: A1-A23, together with UDS and LDS, can address up to 16MB
- Other signals for two types of data transfers: synchronous and asynchronous

A Functional Description of the 68000

- 68000 will respond to seven levels of external hardware interrupts (IPL2 – IPL0)
- All features come in a 64-pin package
- Some expanded 68000 series: MC68HC000, MC68HC001, MC68EC000, and MC68SEC000

68000 Data Organization

- Bit 0 – least significant bit; bit 7, 15, or 31 (for byte, word, or longword) – most significant bit
- 68000: big endian processor – lower 8 bits in higher location
- 80X86: little endian processors

68000 Data Organization

- Word or longword must be stored in an even address; byte may stored in any location
- Trying to write a word to an odd location will result in address error exception
- A diagram called memory map can show groups of locations as a single block
68000 Instruction Types
- Data transfer group
- Arithmetic group
- Logical group
- Shift and rotate group
- Bit manipulation group
- Binary coded decimal group
- Program control group
- System control group

Advantages of the 68000
- 8086 data and address lines multiplexed
- 68000 16MB addressing capability
- Registers: 8086 – 16 bits; 68000 – 32 bits
- External interrupts: 8086 – 2; 68000 – 7
- 8086 runs at a slower clock speed

Advantages of the 68000
- In summary, the 68000's 32-bit arithmetic, 32-bit registers, large addressing space, nonmultiplexed address and data buses, external interrupt features, and faster clock speed make it a better choice than the 8086

Beginning the Calculator Project
- How much memory needed?
- What kind of operations will be available?
- Use binary numbers or BCD numbers?
- Automatic power-down feature?

Troubleshooting Techniques
- Name all registers, bit sizes, and meaning of .B, .W, and .L suffixes
- Familiar with architecture features: addressing space (16MB), interrupt mechanism, and data bus operation
- Explain why 68000 is a big endian processor
Troubleshooting Techniques

- Names and meanings of common flags: such as zero, carry, and sign.
- Difference between the user and supervisor states
- Show how an instruction is composed of an operation, a set of operands, and a particular addressing mode

Summary

- Introduction to a powerful processor – the 68000
- Registers and data and address lines
- Two states of operation – user and supervisor
- Memory map
- Data types and instructions