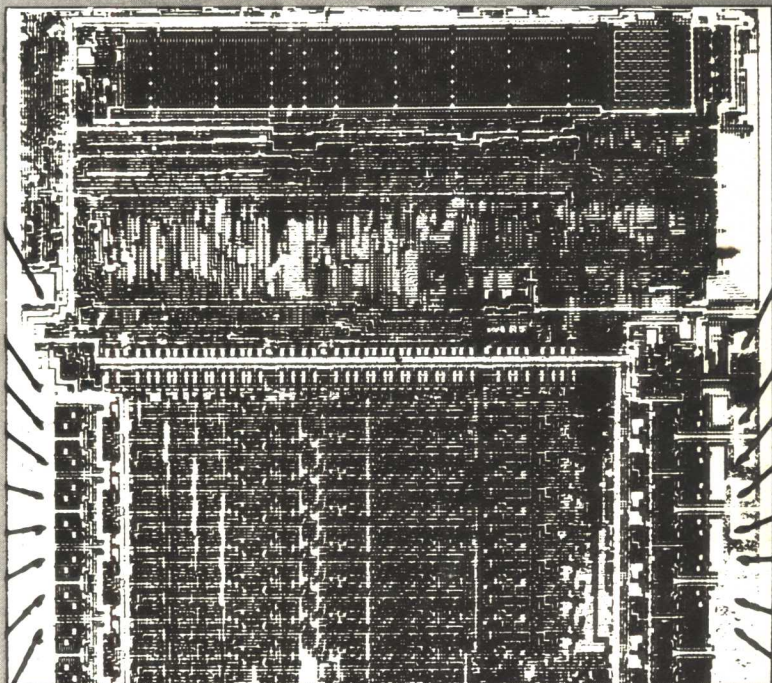


MICROPROCESSORS

THEORY & Applications



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MICROPROCESSORS

Theory and Applications

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PREFACE

Advances in the area of large-scale integration have brought about the development of a solid state device called a microprocessor. Because microprocessors represent a considerable advance in the area of integrated circuit technology and promise to be the nucleus of electronics of the future, this book provides the required reorientation from traditional techniques used in controls and data processing to a versatile programmable controller. An introductory middle-ground approach between hardware and software is taken, which combines software and hardware applications without concentrating exclusively on one or the other.

Universal concepts applicable to all models of microprocessors are presented in Chapters 1 through 9. The book is organized in a linear progression from fundamental principles to complete systems covering both the Motorola MC6800 and Intel 8080 microprocessors in Chapters 10 through 14. The Intel 8080 and Motorola MC6800 have been used throughout the text since their software and hardware serve as typical examples of today's microprocessors.

Starting in Chapter 1 with a general overview of microprocessors which establishes a working language and basic understanding of some of the fundamental concepts, each chapter builds on the previous ones. For example, Chapter 5, "Introduction to Software," presents the basic skills and procedures of programming. In Chapter 9, "Advanced Software," these basic concepts can be discussed in more detail since the intervening chapters on bus control, input/output and memory have provided the necessary background for mastering more specific information.

The final chapters, 10 through 14, contain specific details and applications of the Intel 8080 and Motorola MC6800 which bring together all the fundamental concepts learned in the earlier chapters.

This text contains over one hundred illustrations of circuits, programs, charts, subsystems and systems and photographs of micro dies, which directly reinforce the textual information.

A glossary of new terms is provided at the beginning of each chapter. A general glossary containing all these terms as well as additional ones is located at the back of the book.

The appendixes contain extensive reference information including instruction sets for the Motorola MC6800 and the Intel 8080 and supplemental technical data such as numbering systems, conversion tables, integrated circuit listings, standard logic symbols and a coding system.

Upon completing this book, the reader should have gained the fundamental insights necessary to understanding and learning micro-processors which will serve as the framework for continued study in this exciting, state-of-the-art technology.

ACKNOWLEDGMENTS

The authors acknowledge with appreciation the permission granted by Motorola Inc. and Intel Corporation to reprint their copyrighted instruction set material, which appears in Appendix 5. Furthermore, various diagrams, photos, tables and figures that are noted as courtesy of Hewlett-Packard, Intel Corporation and Motorola Inc. have been reprinted from copyrighted material with the manufacturers' permission from the following manuals:

Hewlett-Packard 59309A HP-IB Digital Clock Operating and Service Manual, 1976. (Fig. 13-3, 13-4, 13-5)

Intel 8080 Microcomputer Systems User's Manual, 1975. (Fig. 7-7, 7-9; 10-1, 10-2, 10-3, 10-4, 10-5, 10-6, 10-7, 10-8; 11-4, 11-5, 11-6; Table 7-1)

Intel Memory Design Handbook, 1977. (Fig. 8-5, 8-6, 8-7, 8-8, 8-9, 8-10, 8-11, 8-12)

Intel MCS85 Training Course, 1977. [Some diagrams have been modified] (Fig. 10-9, 10-10, 10-11, 10-12)

Intel SDK-85 User's Manual, 1977. (Table 9-2)

Motorola TTL Integrated Circuits Data Book, 1971. (Fig. 3-13)

Motorola M6800 Programming Reference Manual, first ed., 1976. (Fig. 4-4)

Motorola M6800 Microcomputer System Design Data, 1976. (Fig. 7-11; 12-1, 12-2, 12-3, 12-4, 12-5, 12-6; Tables 12-1, 12-2, 12-3, 12-4, 12-5, 12-6, 12-7, 12-8)

Motorola M6800 Microprocessor Course, 1977. (Fig. 8-1, 8-2, 8-3, 8-4)

Motorola MEK6800D2 Manual, second ed., 1977. (Fig. 14-12, 14-14; Table 4-2, 9-1)

Motorola M68ADS1A Development System User's Manual,
1978. (Fig. 14-16, 14-17)

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INTRODUCTION TO THE MICROPROCESSOR

- Address** A character or group of characters that identifies a register, a particular part of storage or some other data source or destination. *Glossary*
- Arithmetic logic unit (ALU)** The central processing unit chip logic which actually executes the operations requested by an input command.
- Assembly language** In microprocessor programs, a series of source statements using mnemonic symbols that assist in the definition of the instruction and are then translated into machine understandable object code such as binary 0s and 1s.
- Boolean algebra** A mathematical system of logic which deals with classes, proposition, on-off circuit elements; associated by operators as AND, OR, NOT, EXCEPT, IF. . . . THEN—which permits computations and demonstrations in any other mathematical system.
- Bus** One or more conductors used as a path over which information is transmitted.
- Central processing unit (CPU)** Performs control, input/output, arithmetic and logical operations by executing instructions obtained from memory sources.
- Chip** A single device composed of transistors, diodes and other components interconnected by various chemical processes and usually cut from a silicon wafer.
- Control unit** That section which directs the sequence of operations, interrupts coded instructions and sends the proper signals to other circuits to carry out instructions.
- Development system** A system provided by most manufacturers which allows the designer to accomplish prototype operations utilizing both hardware and software techniques.