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THE ERA OF MICROPROCESSOR

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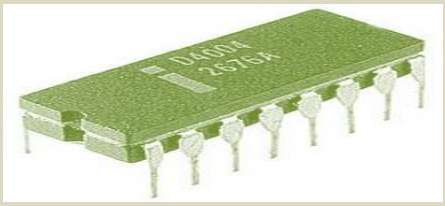


WHAT IS A MICROPROCESSOR?

A microprocessor incorporates the functions of a computer's central processing unit (CPU) on a single integrated circuit(IC),or at most a few integrated circuits. It is a multipurpose, programmable device that accepts digital data as input , processes it according to instructions stored in its memory , and provides results as output . It is an example of sequential digital logic as it has internal memory. Microprocessors operate on numbers and symbols represented in the binary numeral system. The advent of low cost computers on integrated circuit has transformed modern society. General purpose microprocessor in personal computers are used for computation ,text editing multimedia display and communication over the internet .Many more microprocessor are part of embedded systems, providing digital control of a myriad of objects from appliances to automobiles to cellular phones and industrial process control.

INTRODUCTION

Intel introduced its 4 bit microprocessor 4004 in 1971 and its 8 bit microprocessor 8008 in 1972. This microprocessor could not survive as general purpose microprocessor due to their design and performance limitation. The launch of first general purpose 8 bit microprocessor 8080 in 1974 by Intel is considered to be the first major stepping stone towards development of advanced microprocessor. The microprocessor 8085 followed 8080, with few more added feature to its architecture which resulted in the functionally complete microprocessor.

LIMITATIONS OF MICROPROCESSOR

1) Low speed.
2) Low memory addressing capability.
3) Limited number of general purpose register.
4) Less powerful instruction set.

All these resulted of the 8 bit microprocessor pushed the design to build more powerful processor in terms of advanced architecture which had following feature

1) More processing capability
2) Larger memory addressing capabilities
3) More powerful instruction set resulted in designing effort of 8086.

In the family of 16 bit microprocessor, Intel 8086 was the first one to be launched in 1978. The 8086 microprocessor has much more powerful instruction set along with architectural development with imparts substantial flexibility and improvement in speed over the 8 bit microprocessor. The peripheral chips designed earlier for 8085 were compatible with microprocessor 8086 with slight or no modification. Their is considerable difference between the

memory addressing technique of 8085 and 8086,the memory interfacing technique is similar but include the use of few additional signals. The clock requirement is also different as compared to 8085 but the overall minimal system organization of 8086 is similar to that of general 8 bit microprocessor.

REGISTER ORGANIZATION OF 8086:

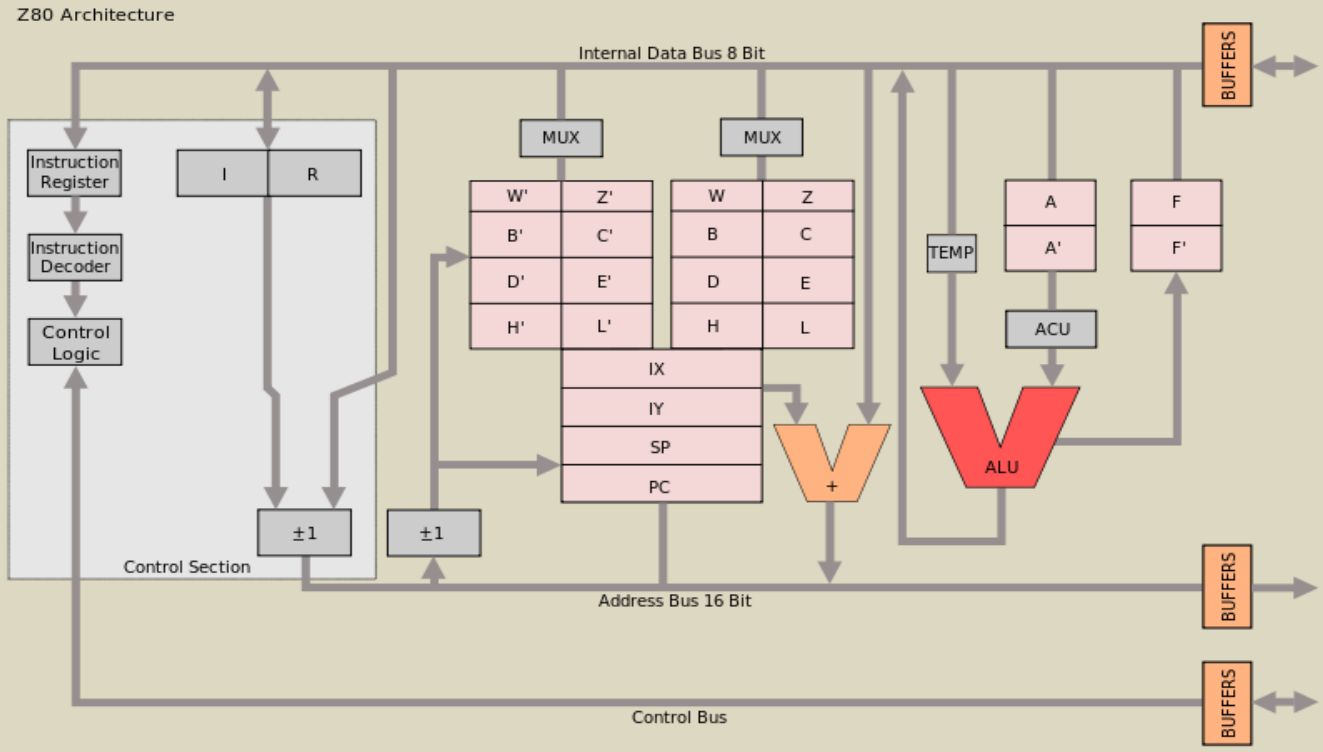
The 8086 has a powerful set of registers known as as general purpose and special purpose register. All of them are 16 bit register .The general purpose register can be used as either 8 bit register or 16 bit register.

FUNCTION

They may be either for holding data variable and intermediate result temporarily or for other purposes like a counter or for storing offset address for some particular addressing modes etc. Special purpose register are used as segment register, pointer, index register or an offset storage for a particular addressing mode.

General data register

Fig. Block diagram of internal architecture



The above is a Register organization. The register AX,BX,CX and DX are the general purpose register .AX is 16 bit accumulator , with lower 8 bit of AX designated as AL and higher 8 bit as AH.AL can be used as an 8 bit accumulator for 8 bit operation usually letter L and H specify the lower and higher bytes of a particular register. ***For example*** CH means the higher 8 bit of the CX register. The letter X is used to specify the complete 16 bit register.

Where CX ⟶ Default Counter.

STRUCTURE

The internal arrangement of a microprocessor varies depending on the age of the design and the intended purposes of the processor .The complexity of an integrated circuit is bounded by physical limitation on the number of transistors that can be put onto one chip, the number of package termination that can connect the processor to other parts of the system, the number of interconnections it is possible to make on the chip., and the heat that the chip can dissipate. Advance technology makes more complex and powerful chip to manufacture. A minimal hypothetical microprocessor might only include an arithmetic logic unit (ALU) and control logic section. The ALU performs operation such as addition, subtraction, and operation such as AND or OR. Each operation of the ALU sets one or more flags in status register, which indicates the result of last operation. A single operation code might affect many individual data paths, registers, and other elements of the processor. As integrated circuit technology advanced, it is feasible to manufacture more and more complex processor on a single chip. The size of data object became larger, allowing more transistor on a chip allowed word size to increase from 4 and 8 bit words up to today's 64 bit words .Additional features were added to processor architecture more on chip registered speeded up program and complex instruction could be used to make more compact program. With the ability to put large number of transistor on one chip, it becomes feasible to integrate memory on the same die as the processor. Generally processor speed has increased more rapidly than external memory speed, so cache memory is necessary if the process is not delayed by slower external memory.

GARY BOONE

TI Engineer Gary Boone and Micheal Cochran succeeded in creating the first microcomputer in 1971the first lone chipped CPU in 1971.The TI filled for a patent on the microprocessor. Gary Boone was awarded U.S .Patent.

8 Bit Design

The Intel 4004 was followed in 1972 by the Intel 8008, the world's first 8 bit microprocessor. The 8008 was not however, an extension of the 4004 design , but instead the culmination of a separate design project at Intel, arising from a contract with computer terminal corporation.

12 BIT DESIGN

The Intersil 6100 family consisted of a12 bit microprocessor and range of peripheral support the memory IC's. The microprocessor recognized the DEC PDP8 microcomputer instruction set. As such it was sometimes referred to as the **CMOS PDP8.** Since it was produced by Harris Corporation, it was known as the **Harris HM-6100.**

16 BIT DESIGN

The first multi-chip 16 bit microprocessor was the national semiconductor IMP-16, introduced in early 1973.An 8bit version of the chipset was introduced in 1974 as the IMP-8. Early multi-chip 16 bit microprocessor include one that Digital Equipment Corporation(DEC) used in the LSI-11OEM board set the packaged PDP 11/03 mini computer and the fair child Semiconductor Micro Flame 9440 both introduced in 1975-1976.National introduced the first 16bit single- chip microprocessor, the National Semiconductor PACE.

32 BIT DESIGN

16-bit design had only been on the market briefly when 32 bit implementations started to appear. The most significant of the 32- bit design s is the Motorola MC68000, introduce in 1979.The world's first single –chip fully 32 bit microprocessor with 32 bit data paths 32 bit buses 32 bit addresses was the AT&T Bell Labs BELLMAC-32A,with first sample in 1980.

64 BIT DESIGN IN PERSONAL COMPUTERS

While 64 bit microprocessor designs have been used in several markets since early 1990s, the early 2000 saw the introduction of 64-bit microprocessor targeted at the PC market...With AMD'S introduction of 64 bit architecture backwards compatible with x86,x86-64from Sep 2003 64 –bit desktop era began with operating system Windows XP x64,Windows Vista x64, Windows7x64 etc.

MULTICORE DESIGN

A different approach to improving a computer performance is to add extra processors, as in symmetric multiprocessing designs, which have been popular in servers and workstations since the early 1990s.Keeping up with Moore's law is becoming increasingly challenging as chip making technologies approach their physical limits. In response, manufacturers look for other way to improve performance so they can maintain the momentum of constant upgrades.

RISC:

In the mid 1980 to early 1990, a crop of new high performance Reduced Instruction Set Computer (RISC) microprocessor appeared, influence by discrete RISC-like CPU design such as IBM 801and others. RISC microprocessor were initially used in special purpose machine and UNIX workstations, but then gained wide acceptance in other roles.

CONCLUSION

Today the fastest microprocessor chips that are commercially available to normal people are the six core hyper threaded chips from Intel these chips run at approximately 3.3GHZand each can execute two threads, That chip is built using 32 nanometer technology. Within 5 to 10 years, silicon chip will reach theoretical minimum feature size at approx 11 nanometer.

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