به نام خدا

میکروپروسسور و میکروکنترلر

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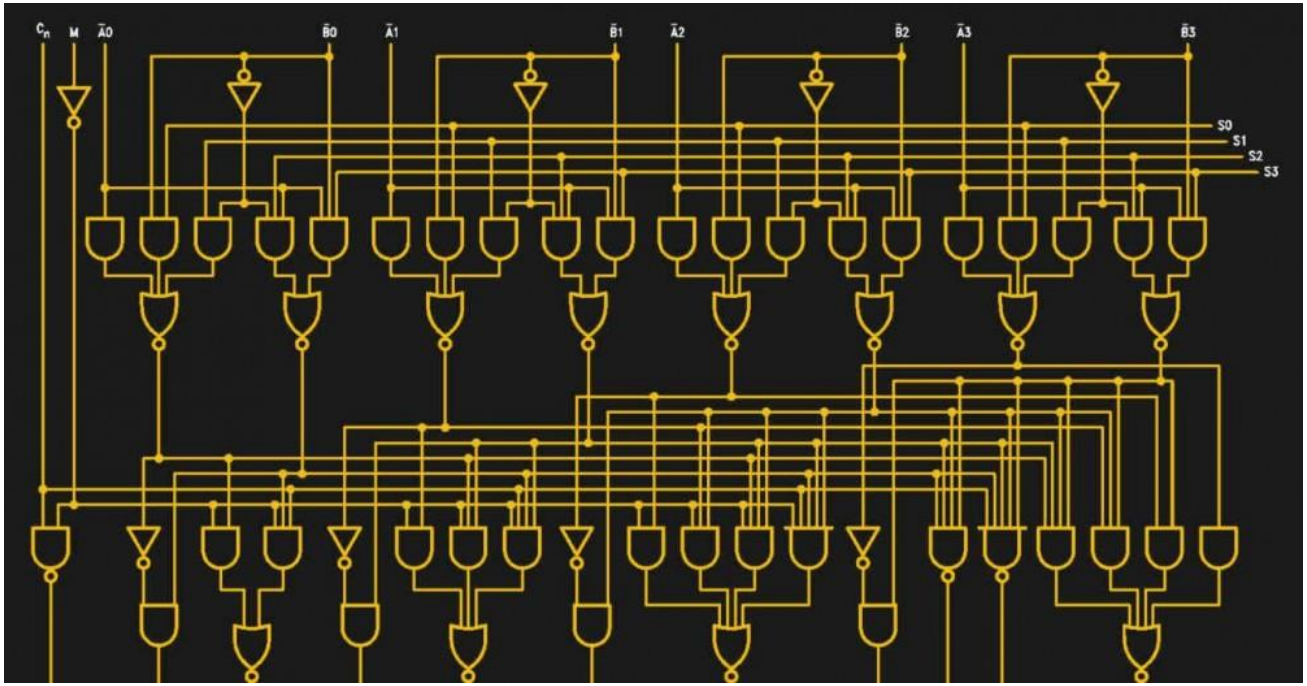
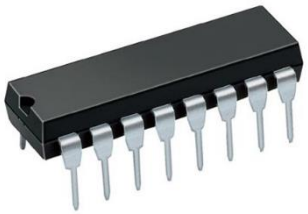
گیت‌های منطقی





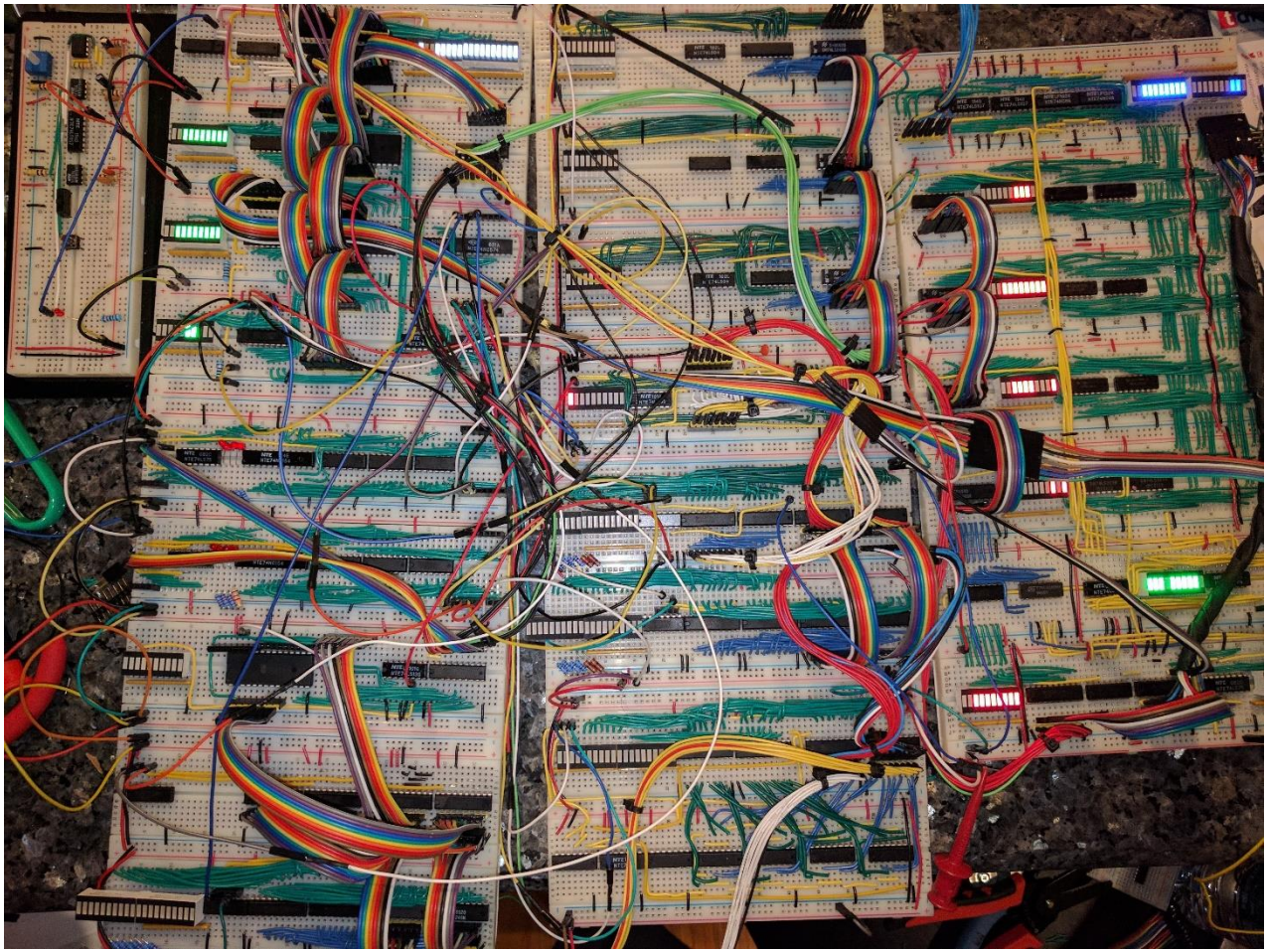
CD4553

3-Digit BCD Counter

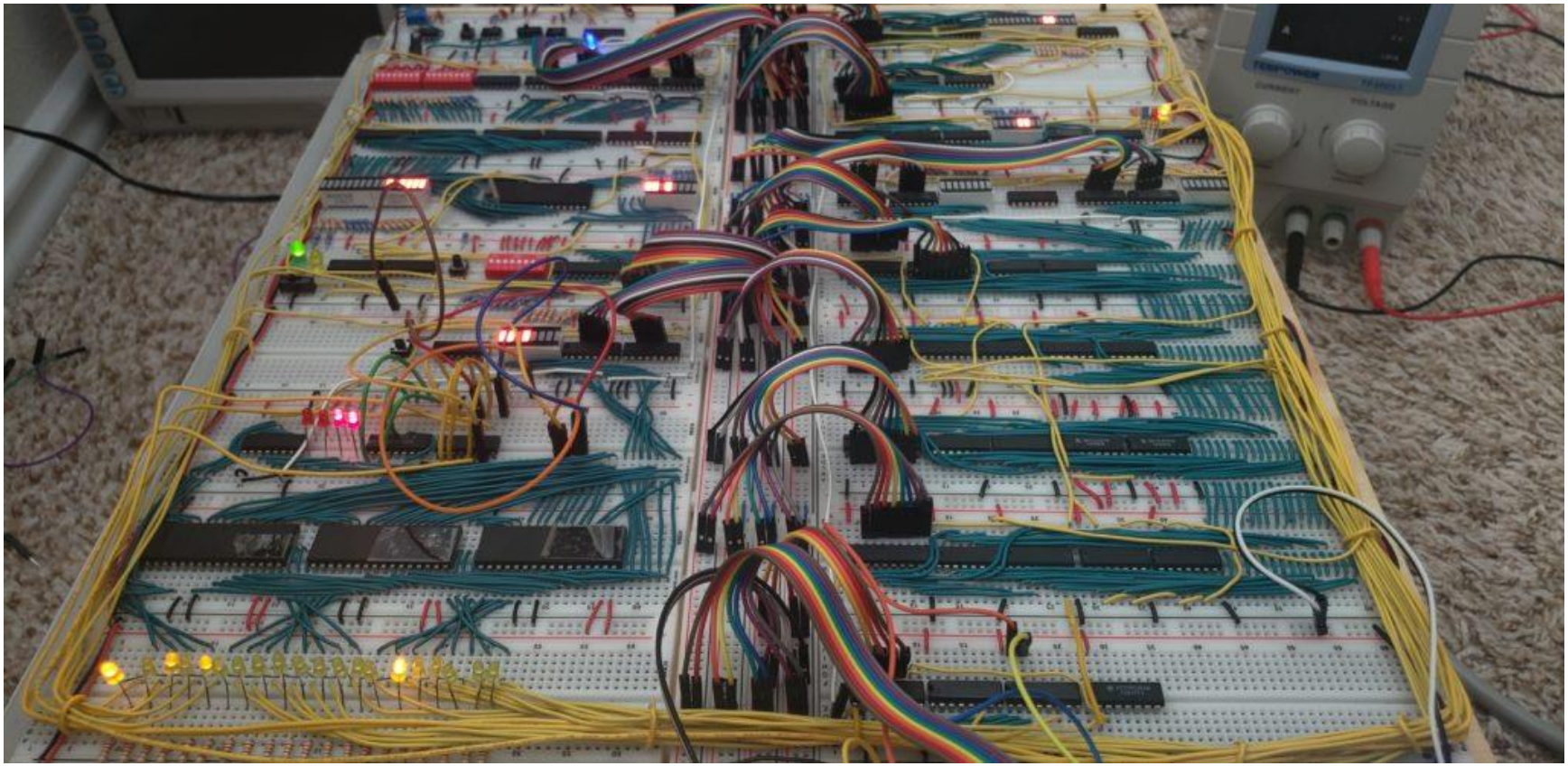
74LS83

4-Bit Binary Full Adder

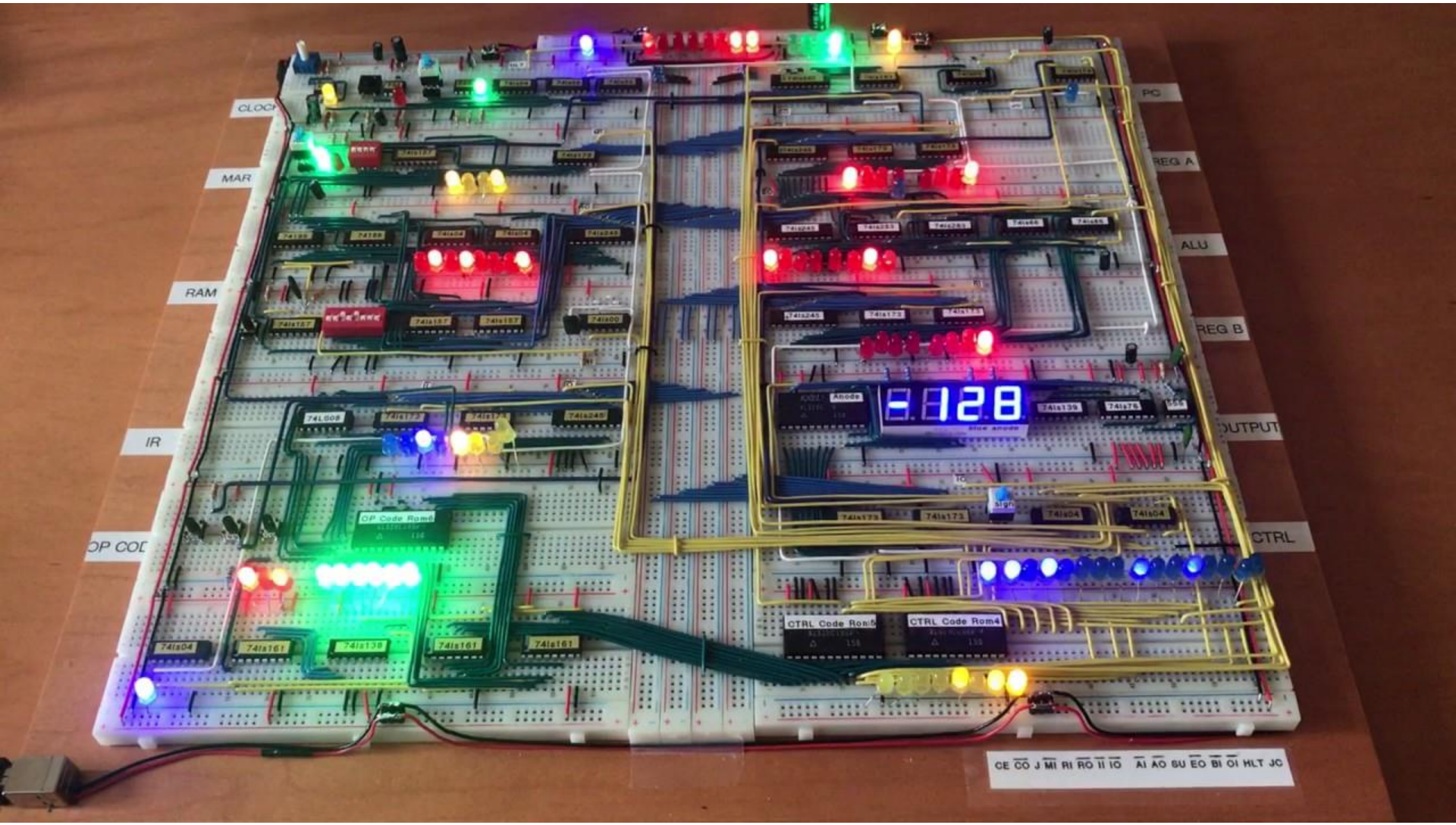
پردازشگر



طراحی حرفه‌ای!(با سلیقه)

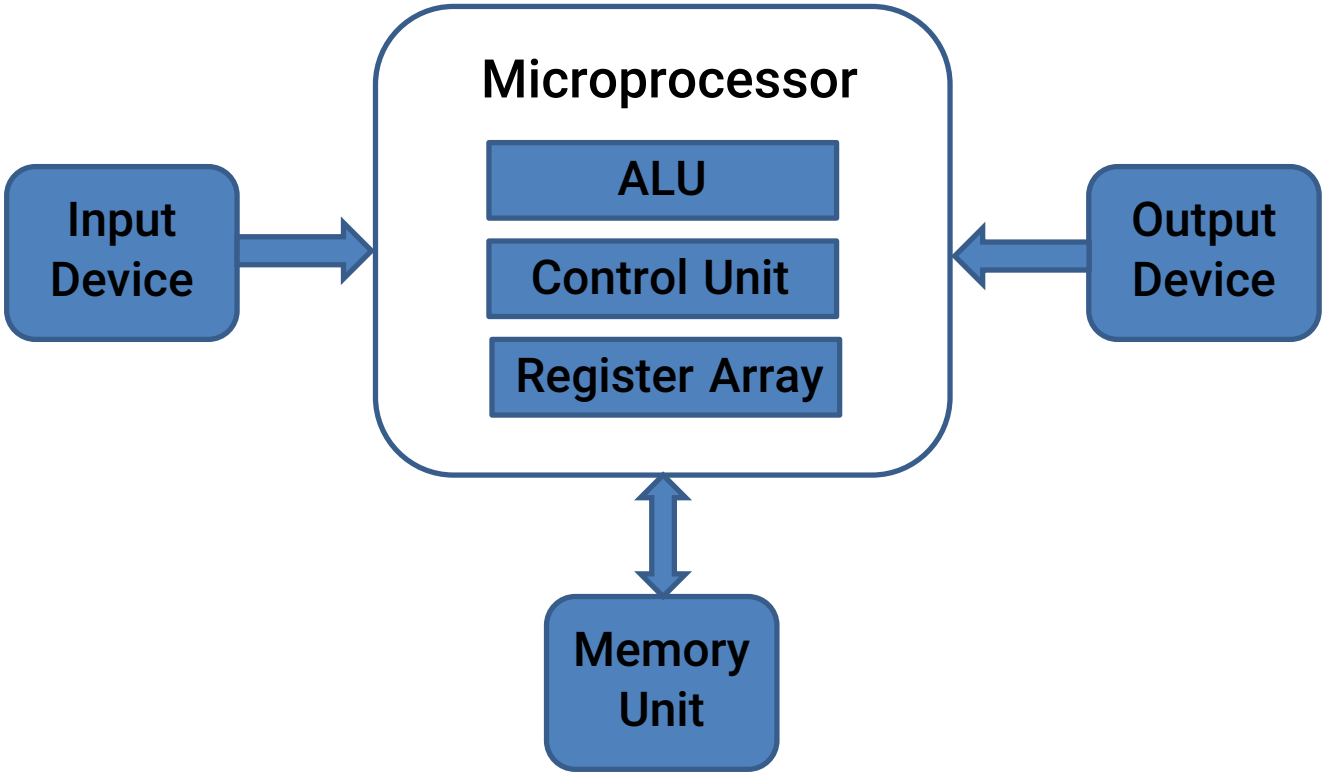


8 bit breadboard computer



CPU Board

میکروپروسسور



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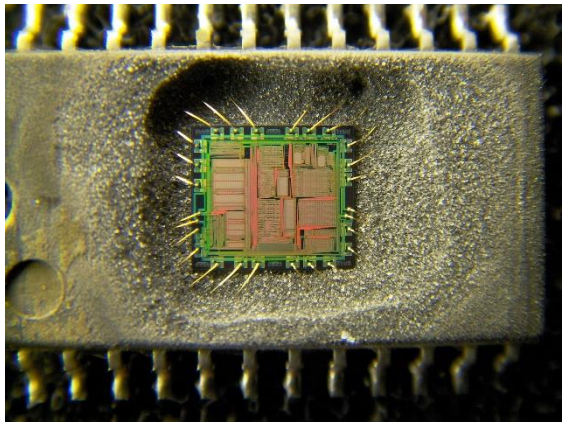

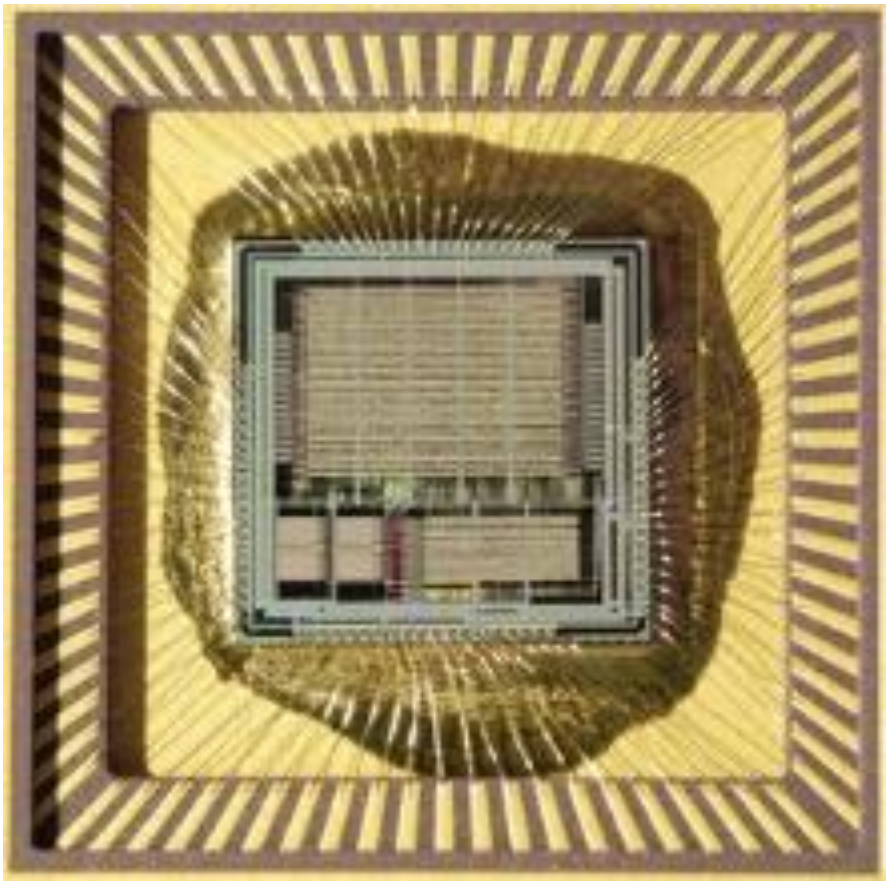

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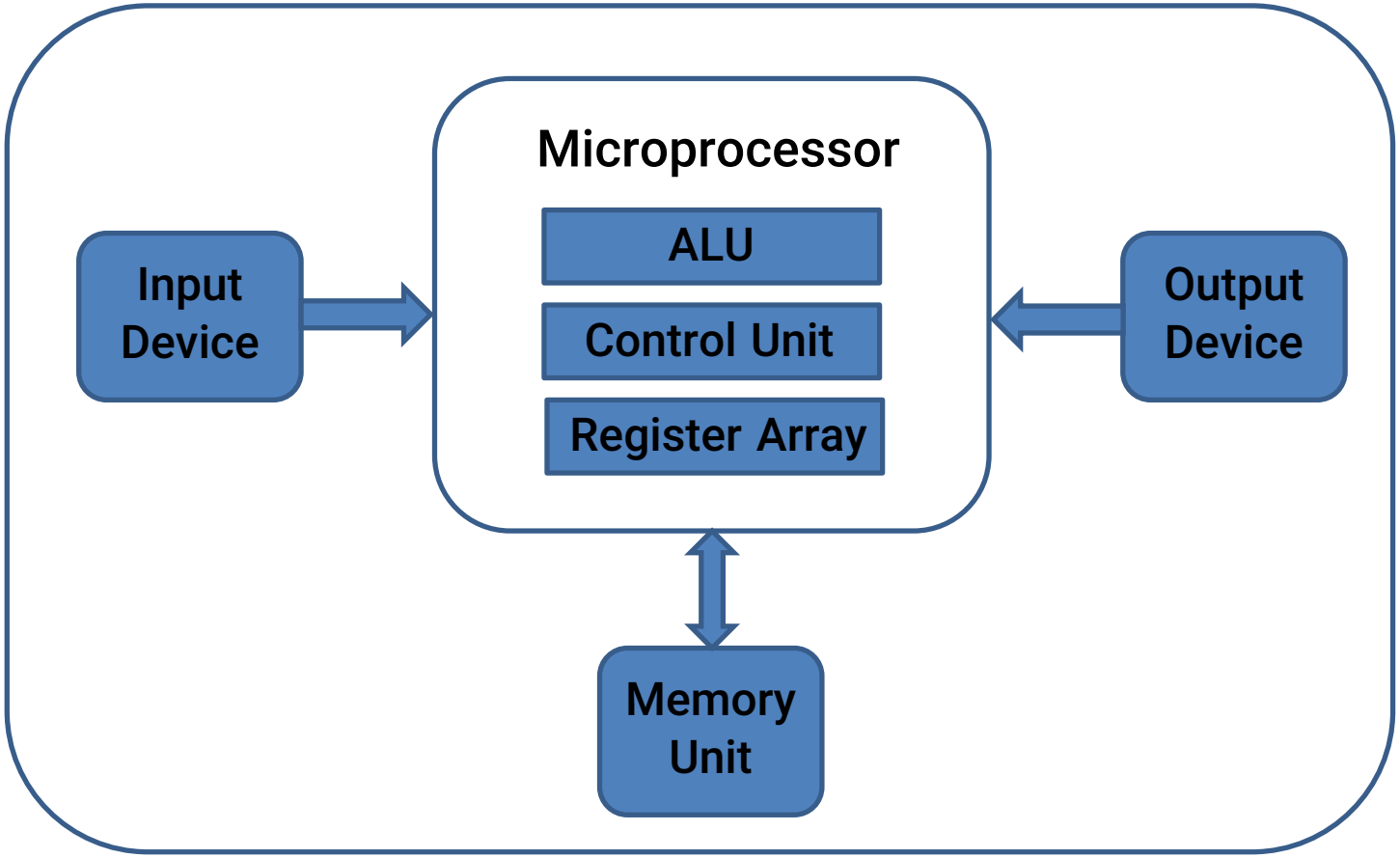

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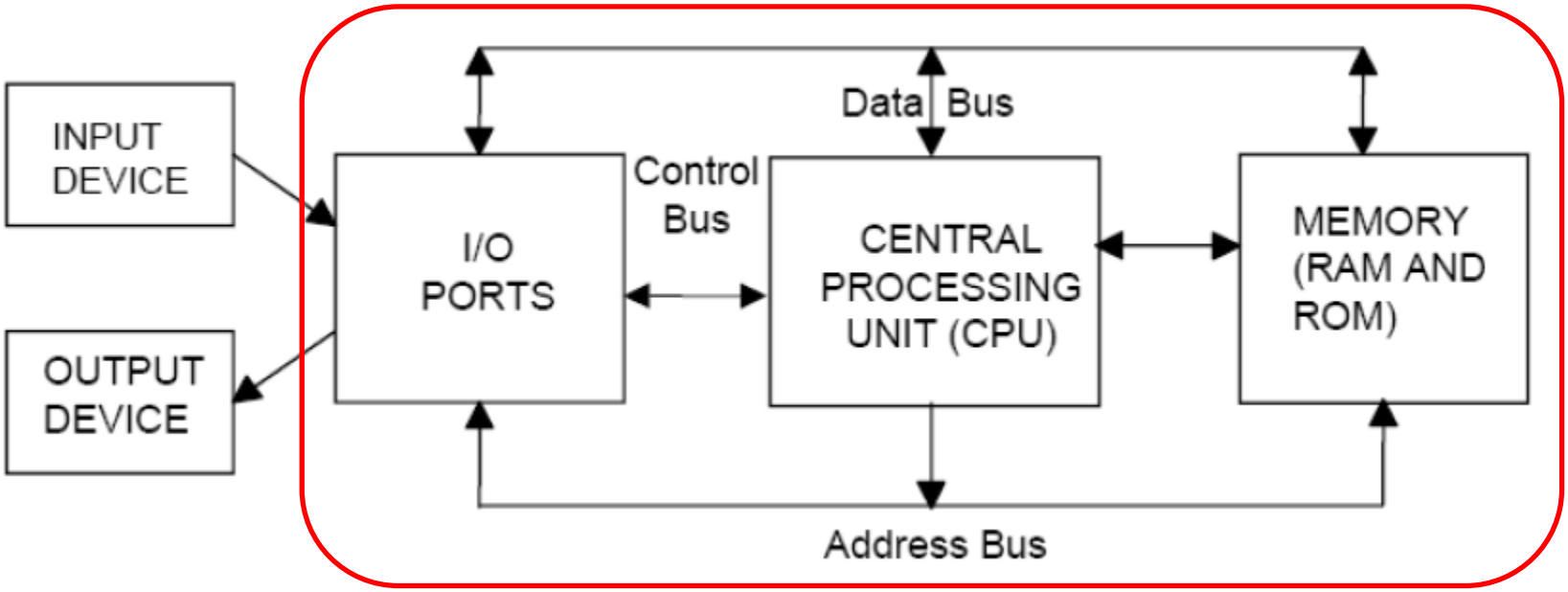
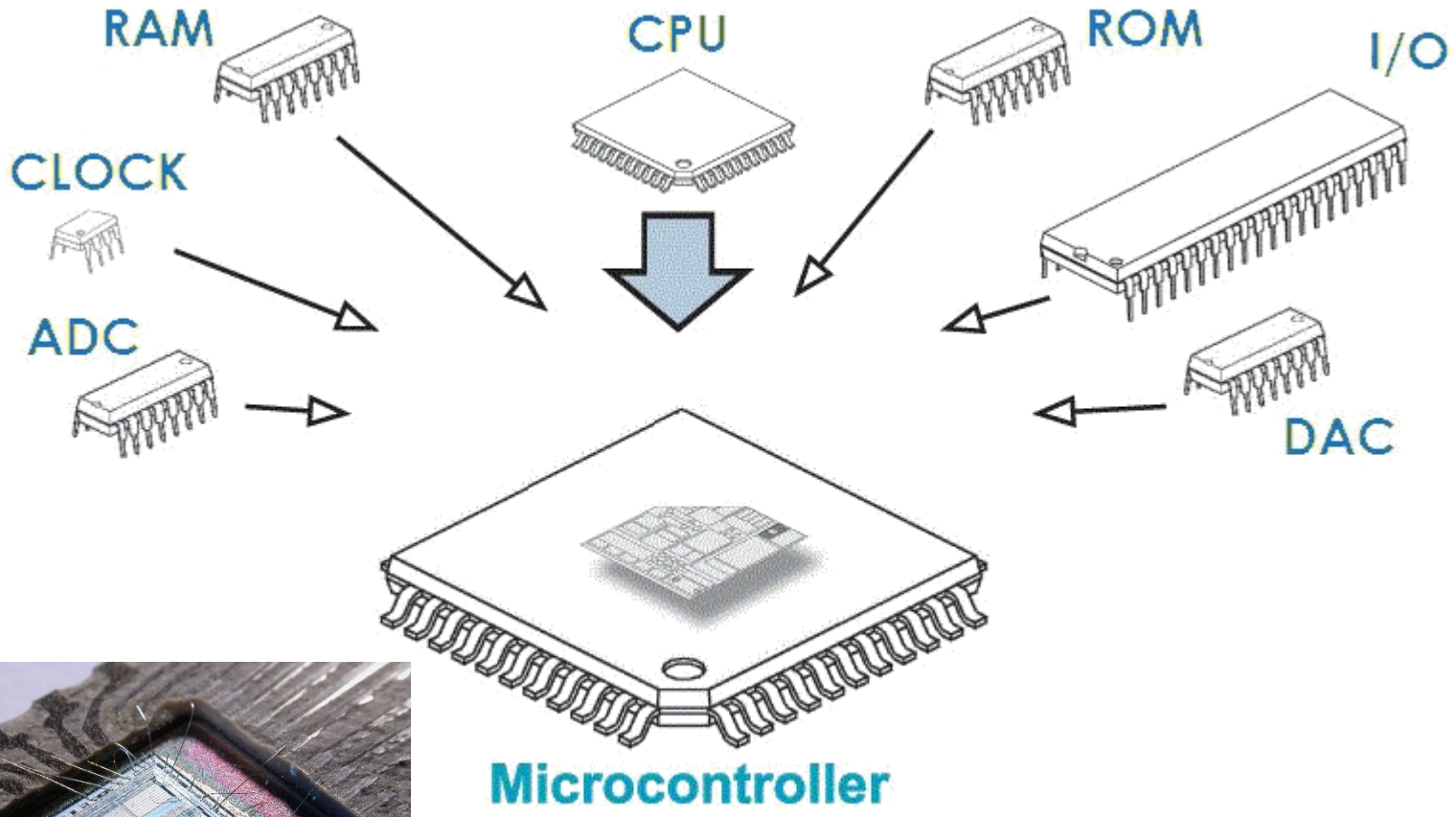
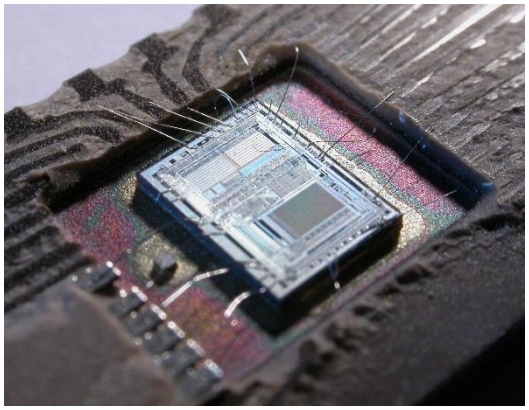


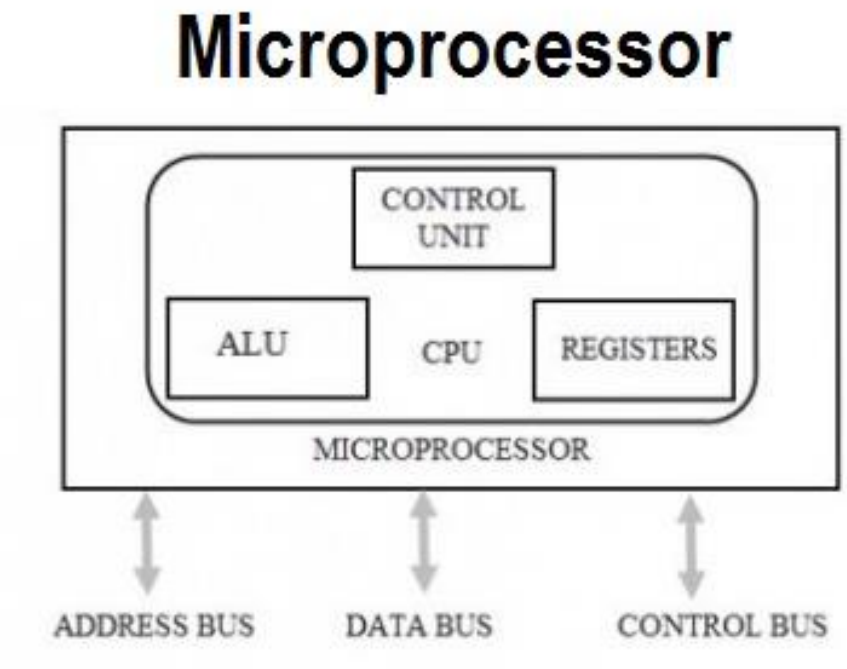
microcontroller

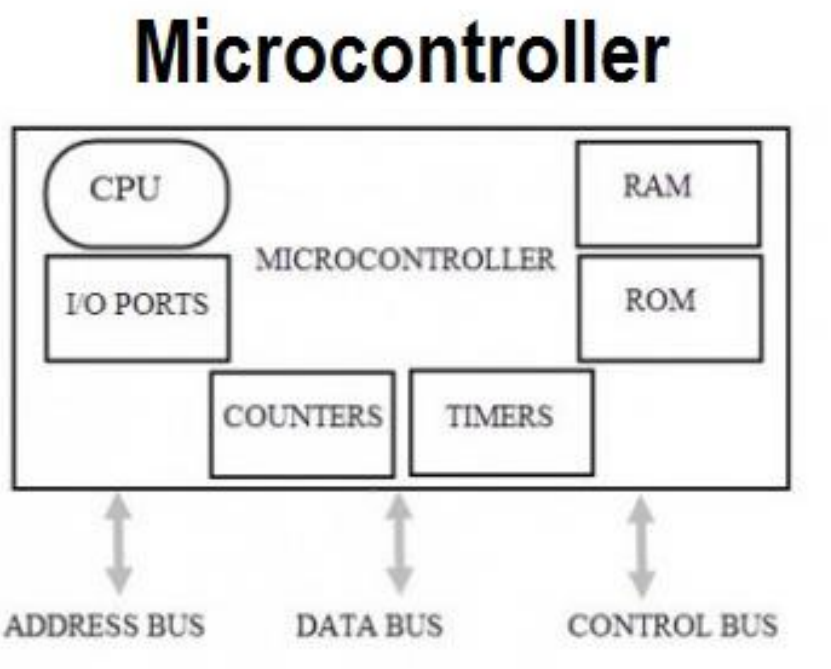
میکروکنترلر





میکروپروسسور و میکروکنترلر





A central processing unit on a single integrated circuit chip containing millions of very small components including transistors, resistors, and diodes that work together.

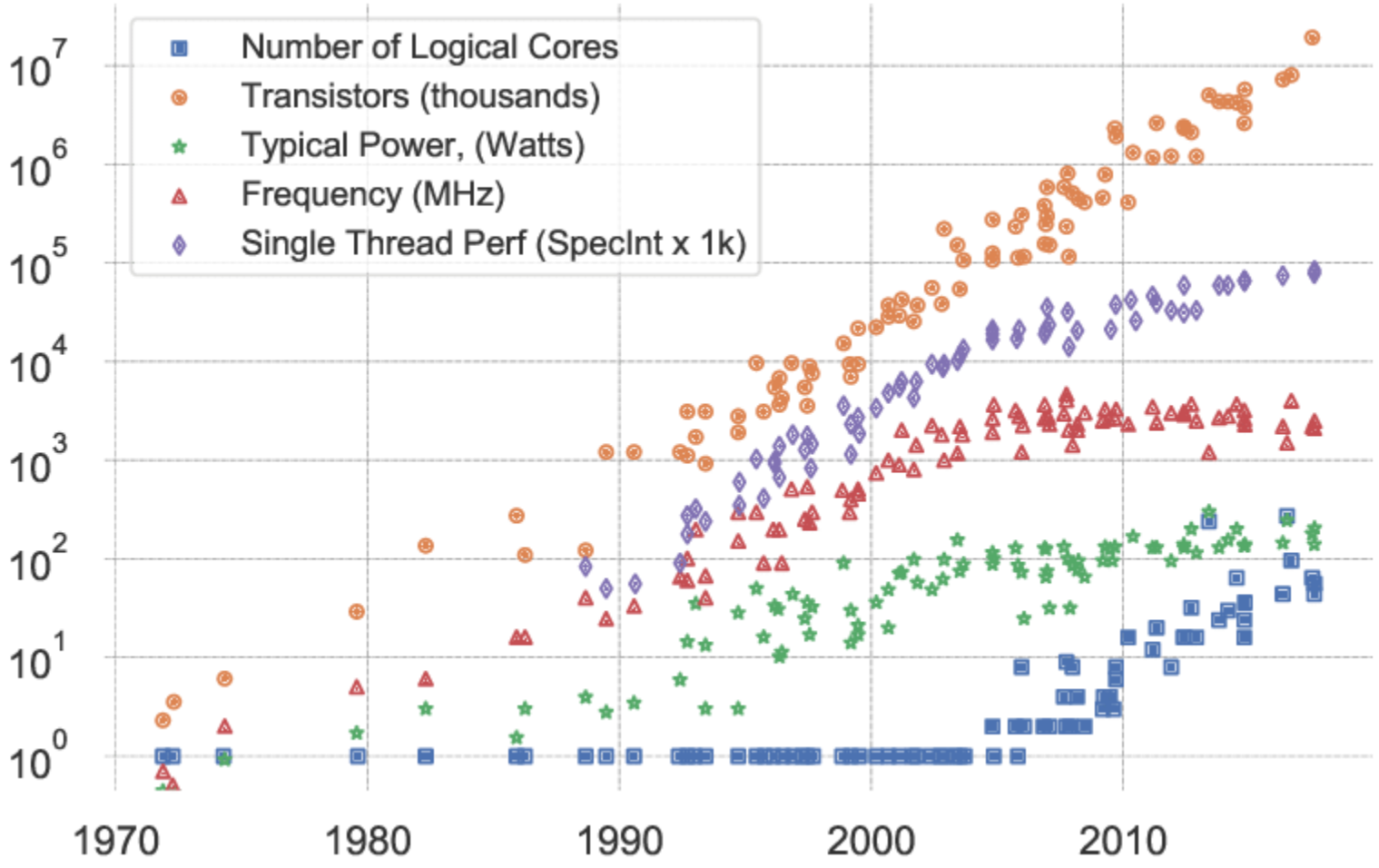
A small computer on a single chip. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals.

Summary	Microprocessor	Microcontroller
Applications	Advanced data processing, video, computer vision, personal computers, fast communications, multi-core computation.	Embedded devices, control systems, smartphones, consumer electronics.
Processing Power	Higher	Lower
Memory	External - Flexible	Internal – Limited Size
Power Consumption	Higher	Lower
Size	Larger	Smaller
Price	Expensive	Cheaper
I/O	Need external peripherals with I/O pins	Programmable digital and analog I/O pins

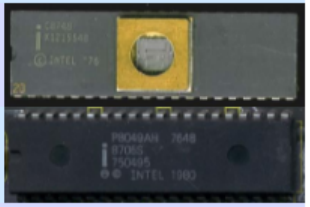
Microcontroller vs Microprocessor

Manufacturer	Processor	Date of introduction	Number of transistors	Process	Area [mm^2]
Intel	Intel4004	1971	2,300	10 µm	12
	Intel8008	1972	3,500	10 µm	14
	Intel8080	1974	4,400	6 µm	20
	Intel8085	1976	6,500	3 µm	20
	Intel8086	1978	29,000	3 µm	33
	Intel80286	1982	134,000	1.5 µm	44
	Intel80386	1985	275,000	1.5 µm	104
	Intel80486	1989	1,180,235	1 µm	173
	Pentium	1993	3,100,000	0.8 µm	294
	Pentium Pro	1995	5,500,000	0.5 µm	307
	Pentium II	1997	7,500,000	0.35 µm	195
	Pentium III	1999	9,500,000	0.25 µm	128
	Pentium 4	2000	42,00,000	180 nm	217
	Itanium 2 McKinely	2002	220,000,000	180 nm	421
	Core 2 Duo	2006	291,000,000	65 nm	143
	Core i7 (Quad)	2008	731,000,000	45 nm	263
	Six-Core Core i7	2010	1,170,000,000	32 nm	240
	Six-Core Core i7/8-Core Xeon E5	2011	2,270,000,000	32 nm	434
	8-Core Itanium Poulson	2012	3.100,000,000	32 nm	544
	R2000	1986	110,000	2.0 µm	80
	R3000	1988	150,000	1.2 µm	56

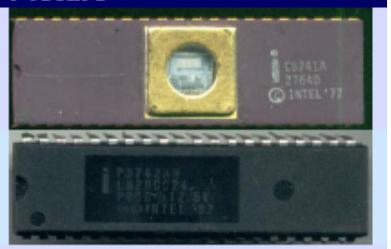
Trend


Number of Logical Cores
Transistors (thousands)
Typical Power, (Watts)
Frequency (MHz)
Single Thread Perf (SpecInt x 1k)
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0
1970
1980
1990
2000
2010

Introduced 1976

Device	RAM (bytes)	ROM	Speed	Timers	Ports	Picture
8021 8021H**	64	1024	100-400KHz	2	2x8, 1x4	
8022 8022H**	128	2048	100-400KHz	2	3x8	Has an ADC
8035	64	-	11MHz			
8038	64	-			3x8	
8039	128	-	11MHz		3x8	
8040	256	-	11MHz			
8048	64	1024	11MHz	2	3x8	
8049	128	2048	11MHz	2	3x8	
8050	256	4096	11MHz			

Introduced 1979

Device	RAM (bytes)	ROM	Speed	ADCs	Timers	Ports	Picture
8041	128	1024	6MHz		2	3x8	
8042	256	2048	12.5MHz		2		

Introduced 1980

Device	RAM (bytes)	ROM	Speed	Timers	Ports	Picture
8031	128	-	12MHz	2	4x8	
8032	256	-	12MHz	2	4x8	
8044*	192	4096	12MHz	2	4x8	
8051	128	4096	12MHz	2	4x8	
8052	256	8192	24MHz	2	4x8	
8054	256	16K	24MHz	3	4x8	
8058	256	32K	33MHz	3	4x8	
MCS-251						
8x251SA	1k	8k	16MHz	3	32	
8x251SB	1k	16k	16MHz	3	32	
8x251SP	512	8k	16MHz	3	32	
8x251SQ	512	16k	16MHz	3	32	
8x251TB	1K	16k	24MHz	3	32	
8251TQ	512	-	24MHz	3	32	

Introduced 1982

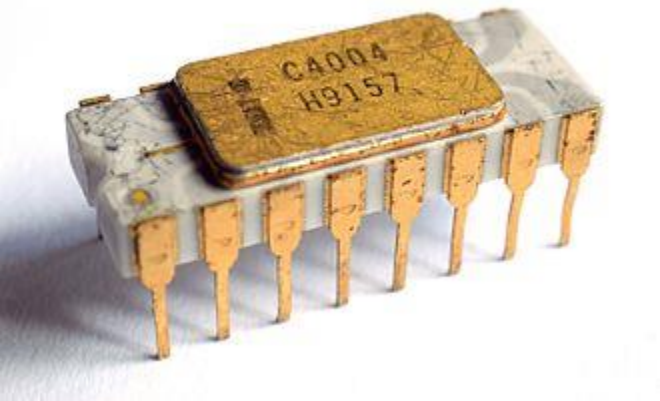
Device	RAM (bytes)	ROM	Speed	ADCs	Timers	I/O Lines	Picture
8395	232	8192	12MHz	4	2	5x8	
8096	232	-	12MHz	-	2	5x8	
8396	232	8192	12MHz	-	2	5x8	
8097	232	-	12MHz	8	2	5x8	
8397	232	8192		8	2	5x8	
Next Generation							
87C196KR	488/256	16K	16MHz	8	2	56	
87C196KQ	360/128	12K	16MHz	8	2	56	
87C196JV	1.5K/512	48K	16MHz	6	2	41	
87C196JT	1K/512	32K	16MHz	6	2	41	
87C196JR	488/256	16K	16MHz	6	2	41	
87C196JQ	360/128	12K	16MHz	6	2	41	
87C196LA	768	24K	20MHz	6	2		
87C196LB	768	24k	20MHz	6	2		
83C196LC	1K/512	32K	22MHz	6	2		
83C196LD	384	16K	22MHz	6	2		
High Speed I/O Family							
8x196KB	232	8k	16MHz	8	2	48	
8x196KC	488	16k	20MHz	8	2	48	
8x196KD	1000	32k	20MHz	8	2	48	

میکروکنترلرهای جدید

Microcontroller	Package	Program Memory	SRAM	EEPROM	I/O Pins	Timers	A/D	SPI	I²C	PWM	USART
28 Pin PDIP											
ATMEGA48V-10PI	PDIP28	4k	512	256	23	2x8,1x16	6x10-bit	Yes	Yes	6	Yes
ATMEGA8A-PU	PDIP28	8k	1024	512	23	2x8,1x16	6x10-bit	Yes	Yes	3	Yes
ATMEGA8L-8PU	PDIP28	8k	1024	512	23	2x8,1x16	6x10-bit	Yes	Yes	3	Yes
ATMEGA88-20PU	PDIP28	8k	1024	512	23	2x8,1x16	6x10-bit	Yes	Yes	6	Yes
ATMEGA88PA-PU	PDIP28	8k	1024	512	23	2x8,1x16	6x10-bit	Yes	Yes	6	Yes
ATMEGA88V-10PU	PDIP28	8k	1024	512	23	2x8,1x16	6x10-bit	Yes	Yes	6	Yes
ATMEGA168-20PU	PDIP28	16k	1024	512	23	2x8,1x16	6x10-bit	Yes	Yes	6	Yes
ATMEGA168V-10PU	PDIP28	16k	1024	512	23	2x8,1x16	6x10-bit	Yes	Yes	6	Yes
ATMEGA328-PU	PDIP28	32k	2048	1024	23	2x8,1x16	6x10-bit	Yes	Yes	6	Yes
ATMEGA328P-PU	PDIP28	32k	2048	1024	23	2x8,1x16	6x10-bit	Yes	Yes	6	Yes

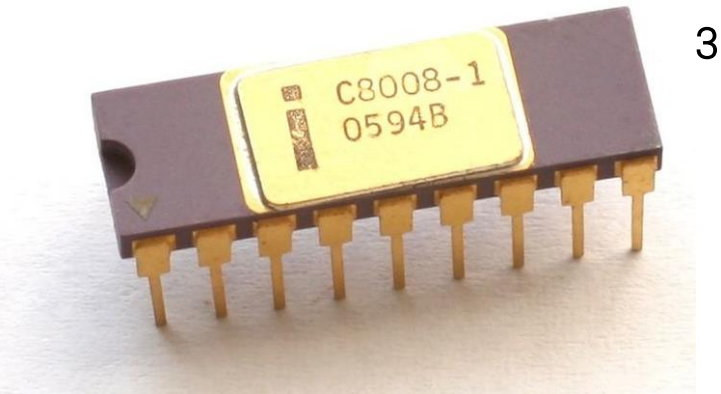
اولین میکروپروسسورها

- Intel 4004 (اولین µp تجاری)
  - 1971 –
  - 4-bit central processing unit –
  - استفاده در یک ماشین حساب –
  - مشخصات –
    - 740-750 kHz
    - 46250 to 92500 instructions per second –



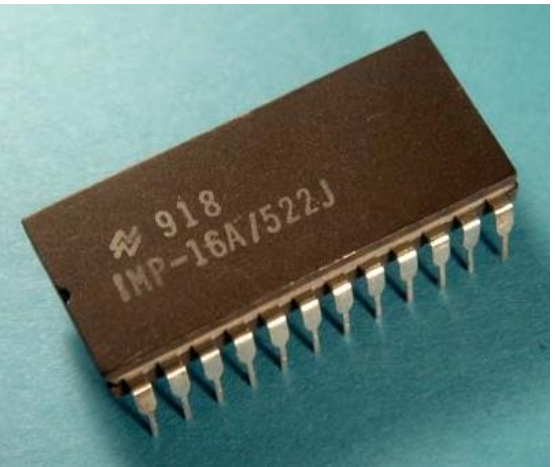
اولین میکروپروسسورها

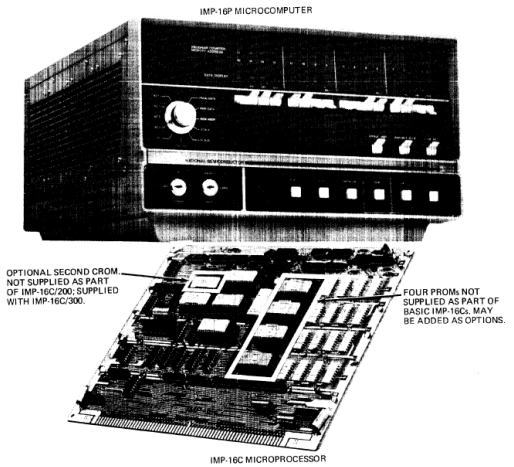
- Intel 8008
  - 1972 –
  - 8-bit central processing unit –
  - first commercial non-calculator personal computers –
  - مشخصات –
    - 200 kHz to 800 kHz
    - 36,000 to 80,000 instructions per second –



اولین میکروپروسسورها

- IMP-16 (by National Semiconductor)
  - 1973 –
  - 16-bit central processing unit –
  - microcomputers –
  - مشخصات –
    - 715 kHz





اولین میکروپروسسورها

- **Motorola 68000**

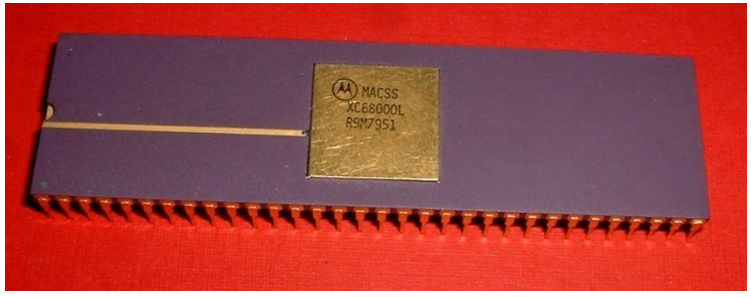
1979 –

32-bit central processing unit –

new generation of personal computers –

مشخصات –

- 8–20 MHz



اولین میکروپروسسورها

- **R4000**
  - 1991 –
  - 64-bit central processing unit –
  - new generation of personal computers –
  - مشخصات –
    - 100, 133, 150, 200, and 250 MHz

اولین میکروپروسسورها

- 16-bit Microprocessor
  - 8086: 4.7MHz, 8MHz, 10MHz
  - 8088: more than 5MHz
  - 80186/80188: 6MHz
  - 80286: 8MHz
- 32-bit Microprocessor
  - INTEL 80386: 16MHz to 33MHz
  - INTEL 80486: 16MHz to 100MHz
  - PENTIUM: 66MHz

اولین میکروپروسسورها

- 64-bit Microprocessor
  - INTEL CORE-2: 1.2GHz to 3GHz
  - INTEL i7: 2.66GHz to 3.33GHz
  - INTEL i5: 2.4GHz to 3.6GHz
  - INTEL i3: 2.93GHz to 3.33GHz

- We do not have any 128-bit Microprocessor at work at present
  - we are a long way from exhausting the 64-bit address
    - we use it at a constant rate of roughly 2 bits every 3 years
    - we have only used 48 bits of 64 bits
  - 128-bit Microprocessor would be much slower than the 64 bit Microprocessor

انواع میکروپروسسورها

- **Reduced Instruction Set Computer (RISC)**
  - Instruction is simple and designed to get executed quickly
  - Instructions get completed in one clock cycle
  - Example:
    - 1. IBM RS6000
    - 2. MC88100
    - 3. DEC Alpha 21064
    - 4. DEC Alpha 21164
    - 5. DEC Alpha 21264

انواع میکروپروسسورها

- **Complex Instruction Set Computer (CISC)**
  - Single instruction can execute multiple low-level operations
  - Example:
    - 1. Intel 386
    - 2. Intel 486
    - 3. Pentium
    - 4. Pentium Pro
    - 5. Pentium II
    - 6. Pentium III
    - 7. Motorola 68000
    - 8. Motorola 68020
    - 9. Motorola 68040

پایان

موفق و پیروز باشید