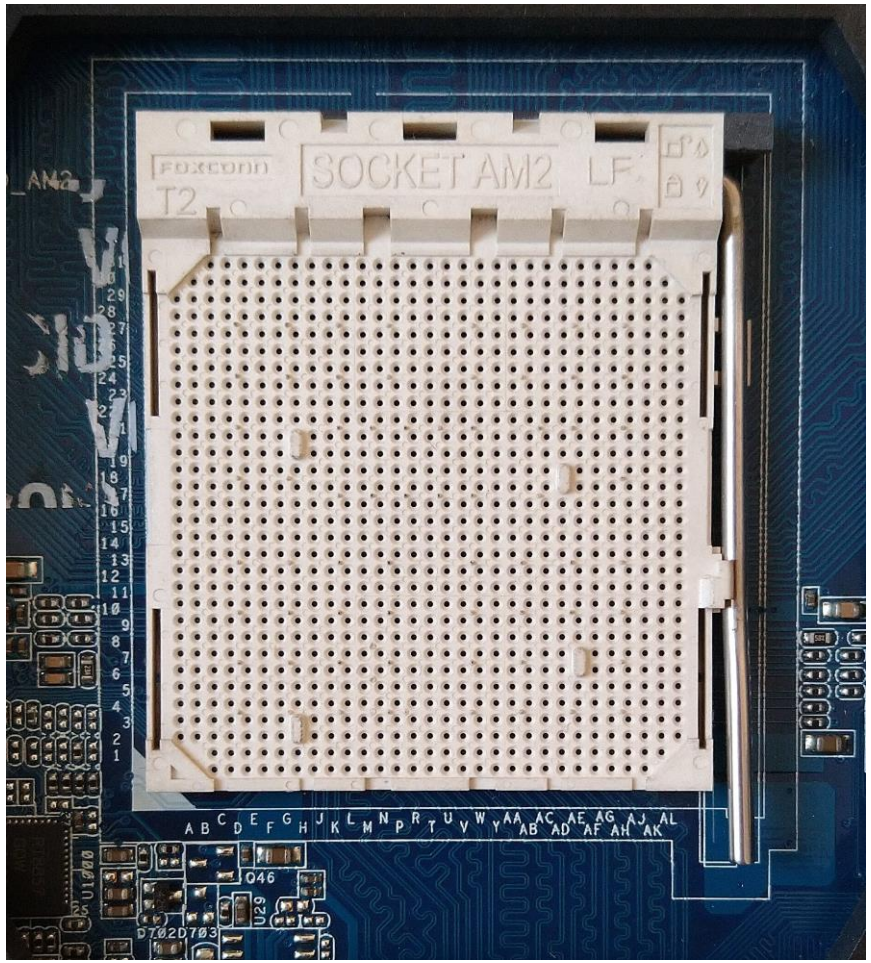
Processor location

- The motherboard has a location to accommodate the processor, called a processor support.
- There are two categories of supports:
  - **Slot:** rectangular connector into which the processor is inserted vertically
  - **Socket:** square connector with a large number of small connectors (pins) onto which the processor plugs directly

Processor location

Slot

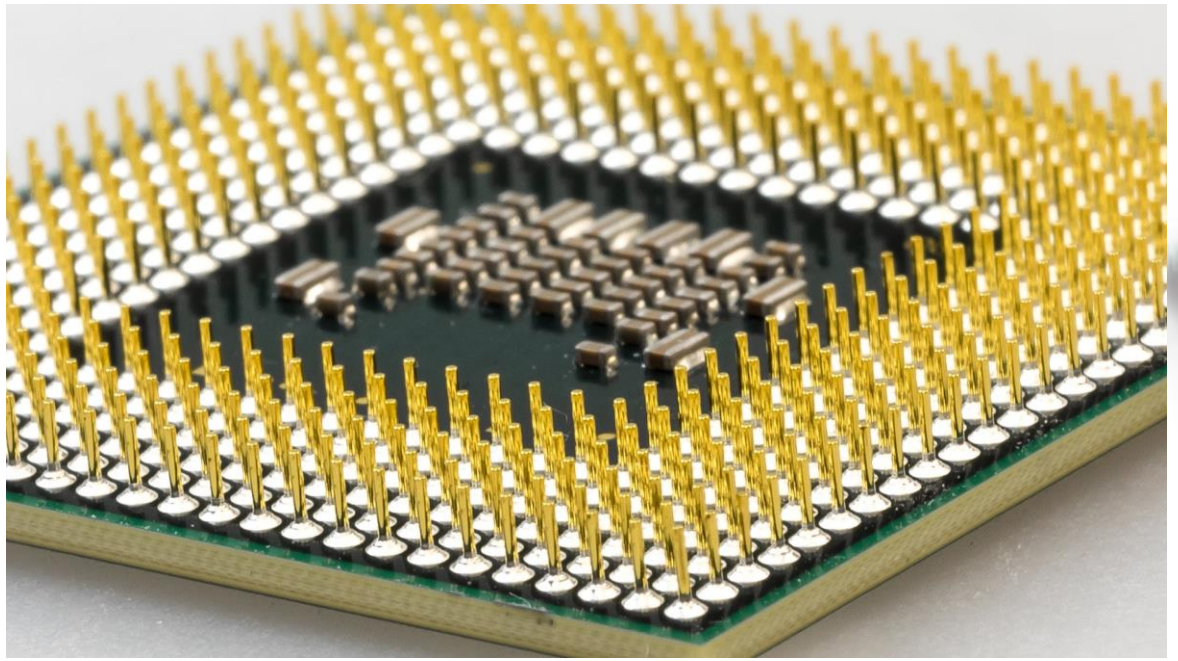


Socket

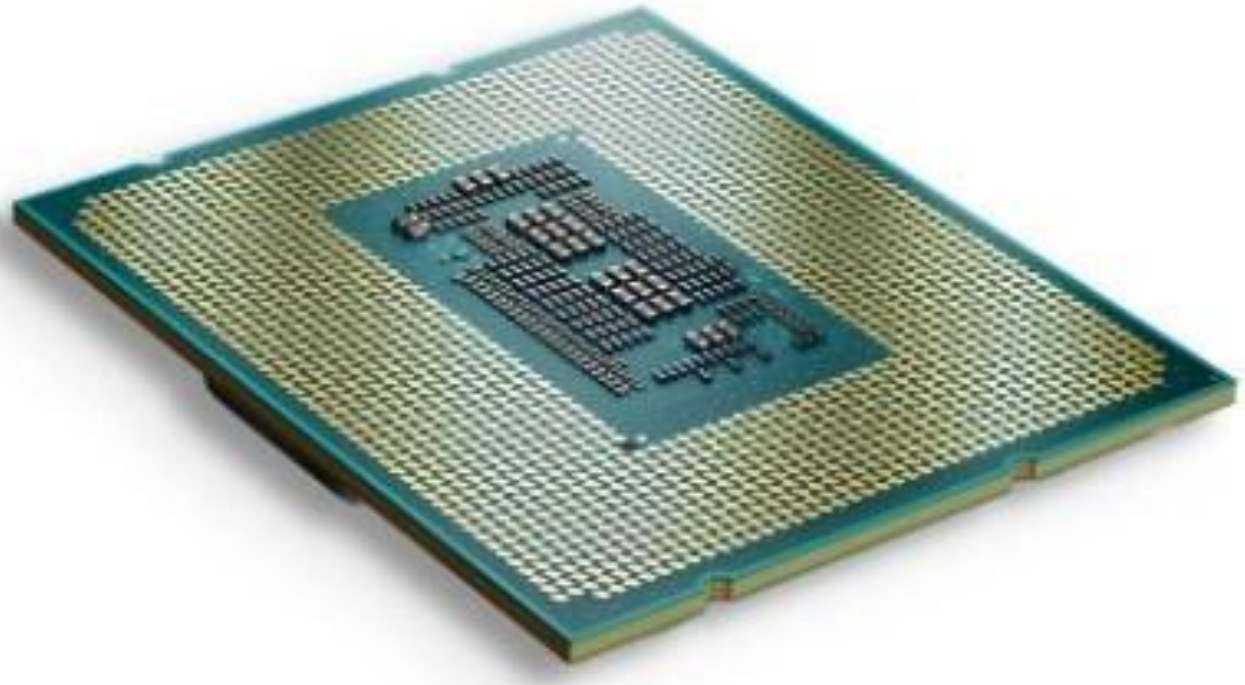
Processor location

- Within these two large families, there are two different versions of support, depending on the type of processor.
  - **PIN**: Pins are found in the processor.
  - **LGA**: The pins are located in the motherboard socket.
- It is essential to plug in the processor carefully so as not to bend any of its pins.

Processor location



PIN

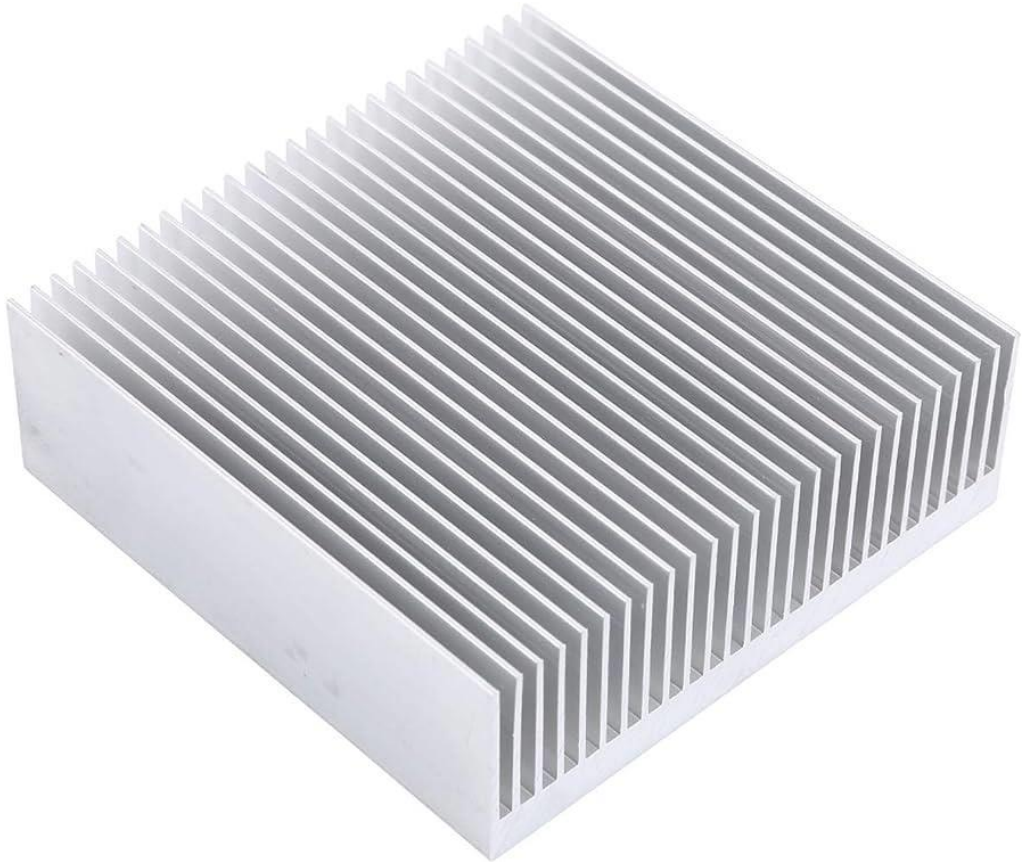


LGA

Dealing with heat

- Insofar as the processor thermally radiates, it is necessary to dissipate the heat to prevent its circuits from melting.

- That's why it is usually topped with a heatsink made of a metal with good thermal conductivity.



Dealing with heat

- A fan usually accompanies the heatsink to improve air circulation around the heatsink and improve heat exchange.

- The term “cooler” is therefore sometimes used to designate the Fan + heatsink assembly.

Integrated circuit

- To carry out information processing, the microprocessor has a set of instructions, called an “instruction set”, carried out using electronic circuits.

- The instruction set is made using semiconductors, “little switches” using the transistor effect, discovered in 1947 by John Barden, Walter H. Brattain and William Shockley.

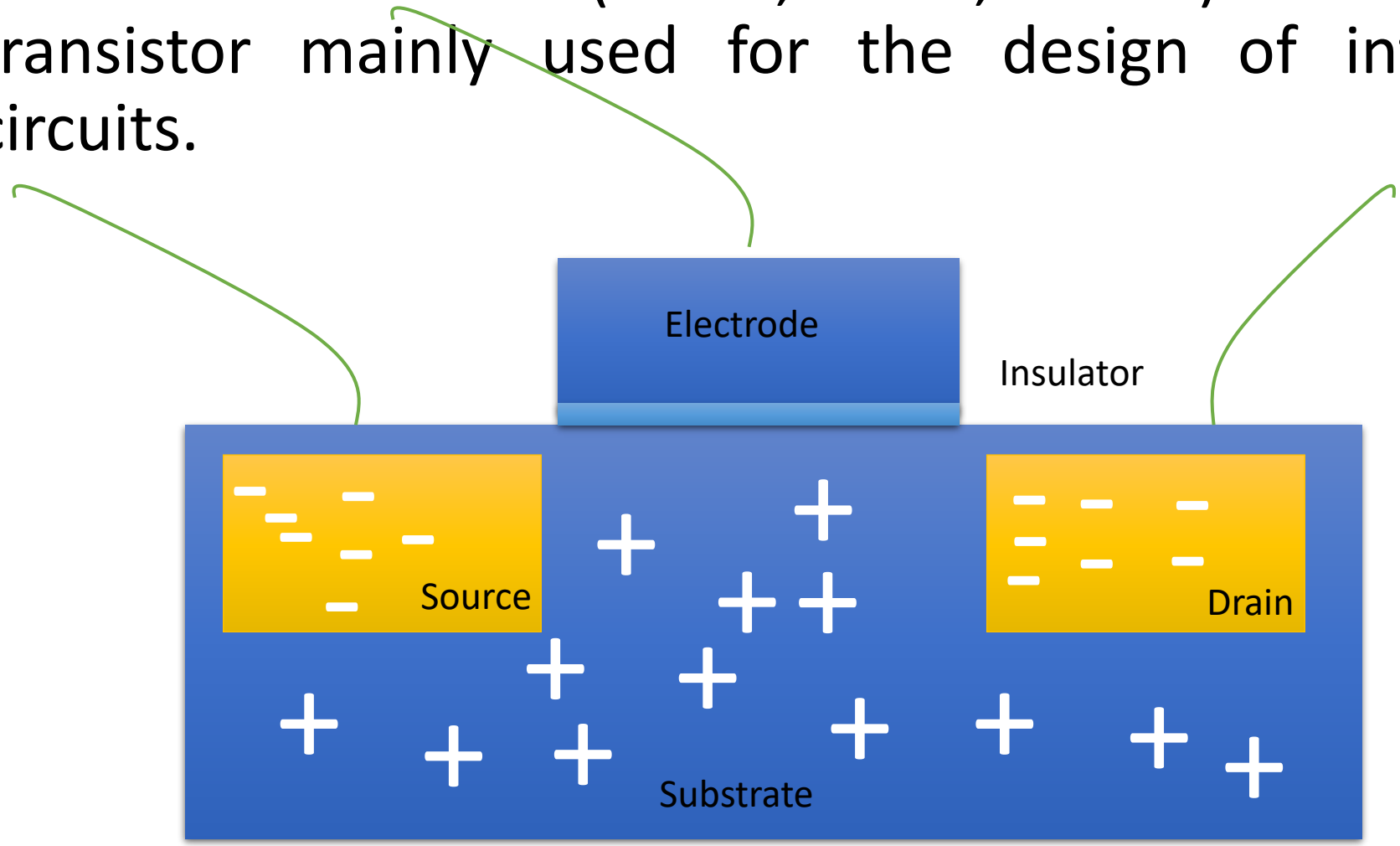
Integrated circuit

- A transistor is a semiconductor electronic component, having three electrodes, capable of modifying the current flowing through it using one of its electrodes (called the control electrode).

- We thus speak of an “active component”, as opposed to “passive components”, such as the resistor or the capacitor, having only two electrodes (we speak of “bipolar”).

Integrated circuit

- The MOS transistor (metal, oxide, silicon) is the type of transistor mainly used for the design of integrated circuits.



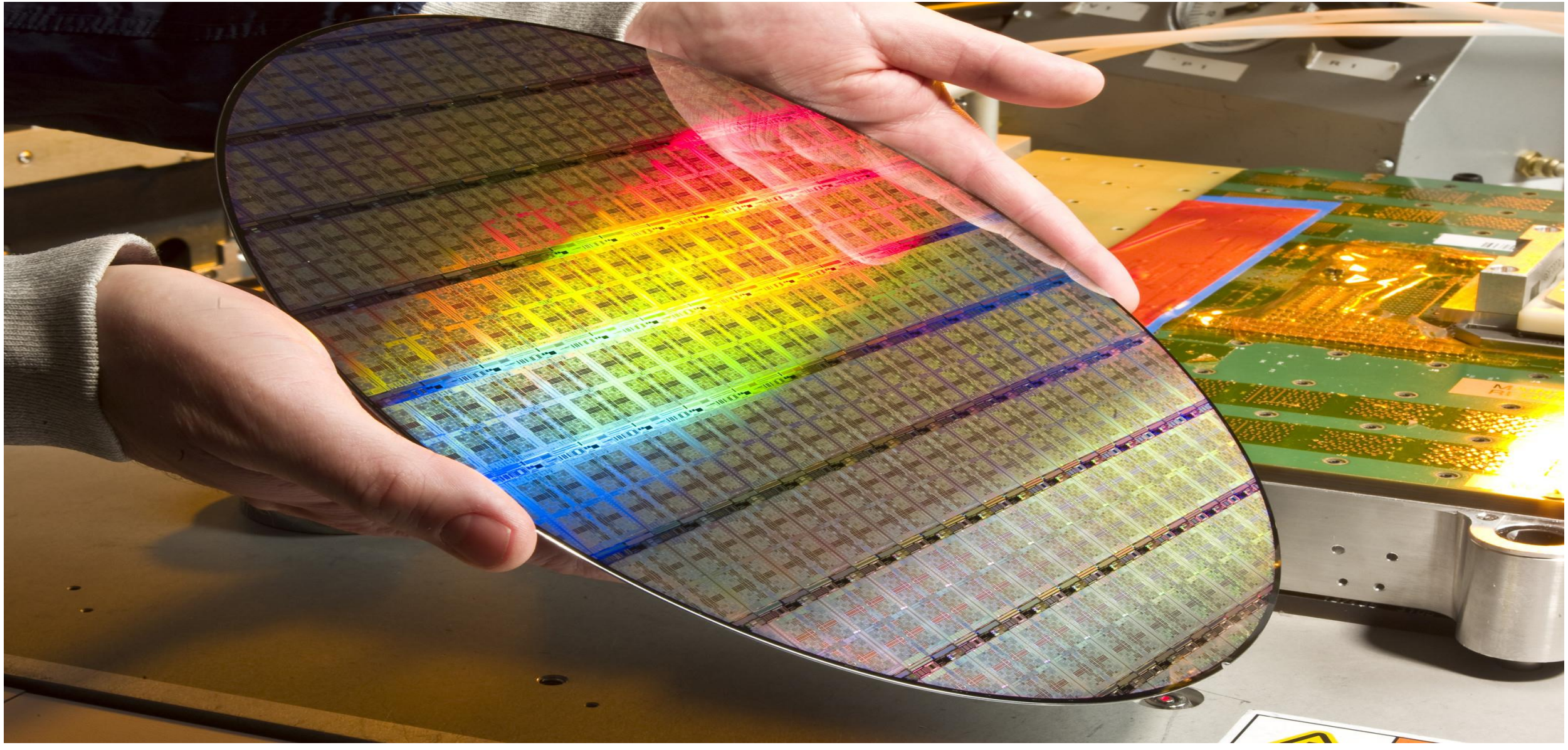
Integrated circuit

- Assembled, transistors can constitute logic circuits, which, assembled in turn, constitute processors.

- The first integrated circuit dates from 1958 developed by the company Texas Instruments.

- MOS transistors are thus made in silicon wafers.

Integrated circuit (silicon wafers)



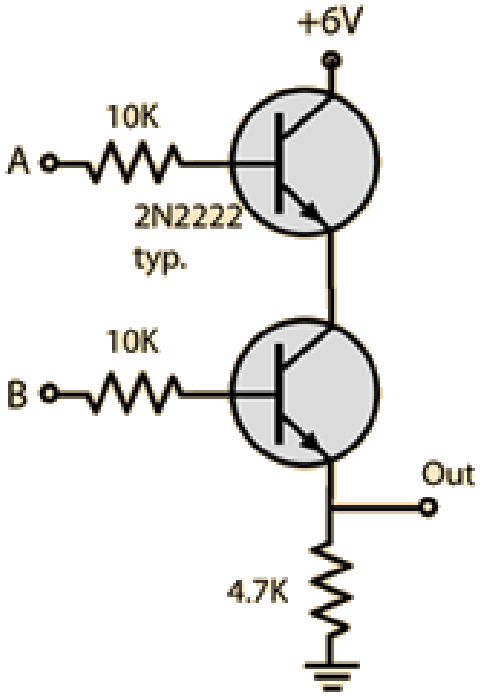
Integrated circuit

- These silicon wafers are then cut into rectangular elements, constituting what we call a “circuit”.

- The circuits are then placed in boxes with input-output connectors, the whole constituting an “integrated circuit”.

- The node size defines the number of transistors per unit area.

Integrated circuit



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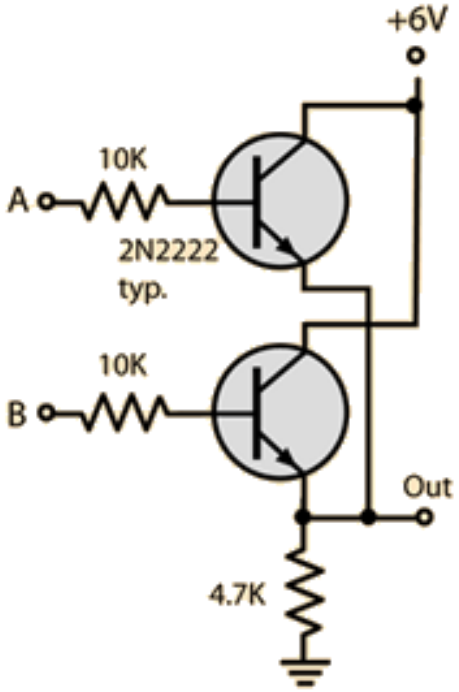

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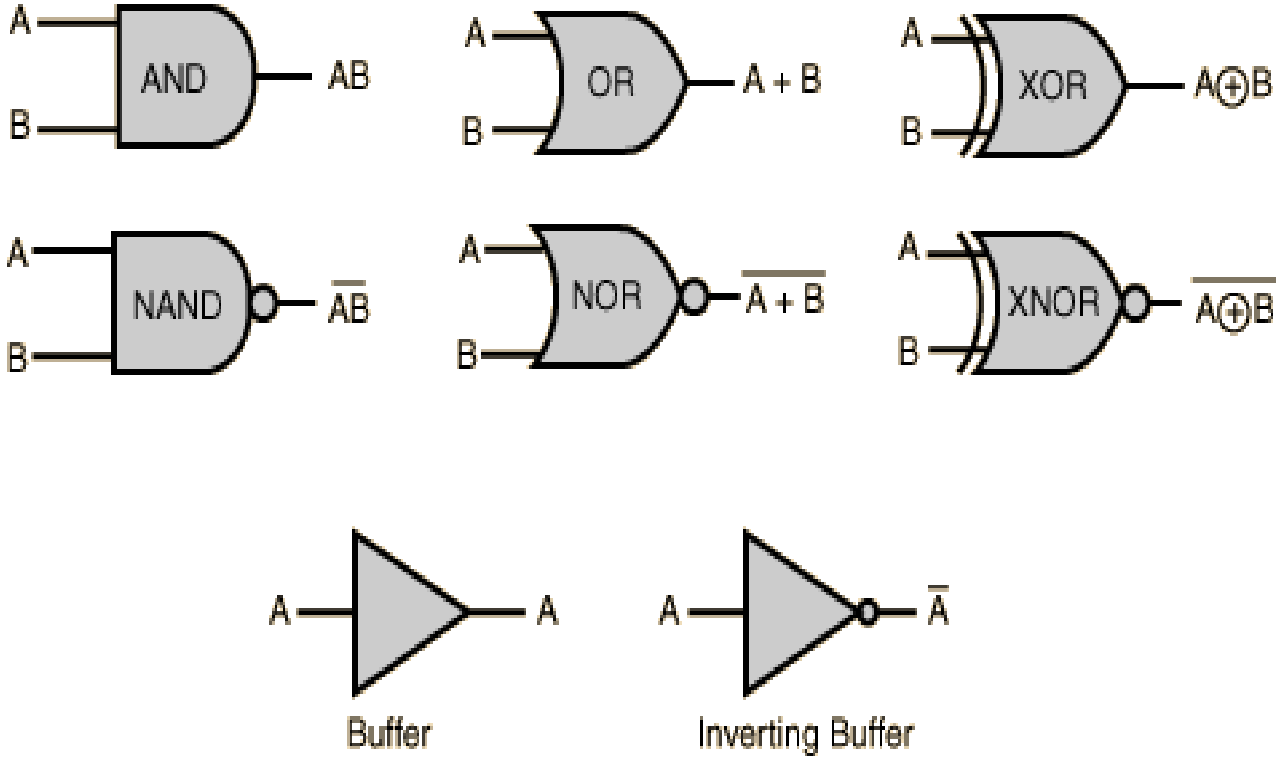

Basic Architecture of a CPU

The control unit

- It allows sequencing the execution of instructions.
- It performs the memory search for the instruction.
- It ensures its decoding to finally carry out its execution and then prepares for the next instruction.

The control unit

- The program counter (PC)
  - It keeps track of the memory address of the next instruction to be executed.
- The instruction register (IR)
  - It holds the current instruction that is being executed or decoded.
- The instruction decoder (ID)
  - It decodes the binary representation of the instruction into a set of signals that control various operations within the CPU.
- The sequencer
  - The sequencer is a component that manages the order of execution of instructions.

The processing unit

- It is the heart of the microprocessor.
- It encompasses the circuits that handle the processes necessary for executing instructions.
- The processing unit is composed of:
  - Arithmetic and Logic Unit (ALU)
  - Floating-Point Calculation Unit
  - Multimedia Unit

Other processor units

Cache memory unit:

- Cache memory (buffer memory) is a fast memory used to reduce waiting times for MC information.
  - First level cache memory (L1 or Level 1)
  - Second level cache memory (L2 or Level 2)
  - Third level cache memory (L3 or Level 3)

Other processor units

Cache memory unit:

Index	Tag	Dirty	Data
0	3F4D	0	
1	0023	0	
2	AAFF	1	
…..	…….	…..	
n	E5FA	1	

Other processor units

Cache memory unit:

- When the processor needs to access memory, it compares the address with the cache line labels.
- If the address is found among the labels, the processor directly utilizes the cached data (success/cache hit).
- Otherwise, it is considered a cache miss.

Other processor units

Cache memory unit:

- The response to a cache miss depends on the nature of the data access.
- In the case of a read operation, the data is loaded from main memory into the cache.
- The loading process requires freeing up a cache line to accommodate the new data.
- The selection of the line to be freed is controlled by the replacement policy.

Other processor units

Cache memory unit:

In the case of a cache miss during a write operation, two techniques are employed:

- The first technique is to proceed similarly to a read operation by loading the data into the cache and allowing the processor to write to the cache.

- The second technique is to write the data directly to memory.

Other processor units

Cache memory unit:

- The “write-through” policy involves reflecting each write in the cache back to main memory.

- The “write-back” policy delays writing to main memory as much as possible. Data written to the cache is transferred to main memory when the line containing that data is released.