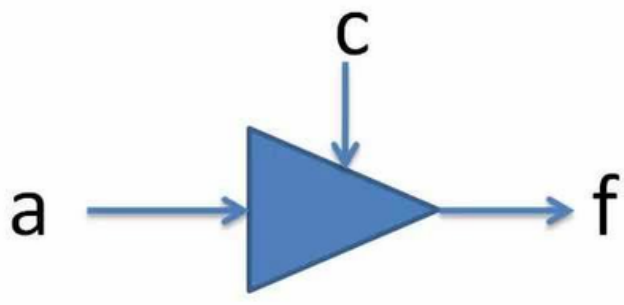
Tristate TTL Devices and TTL characteristics

Roll Numbers: **51-60**

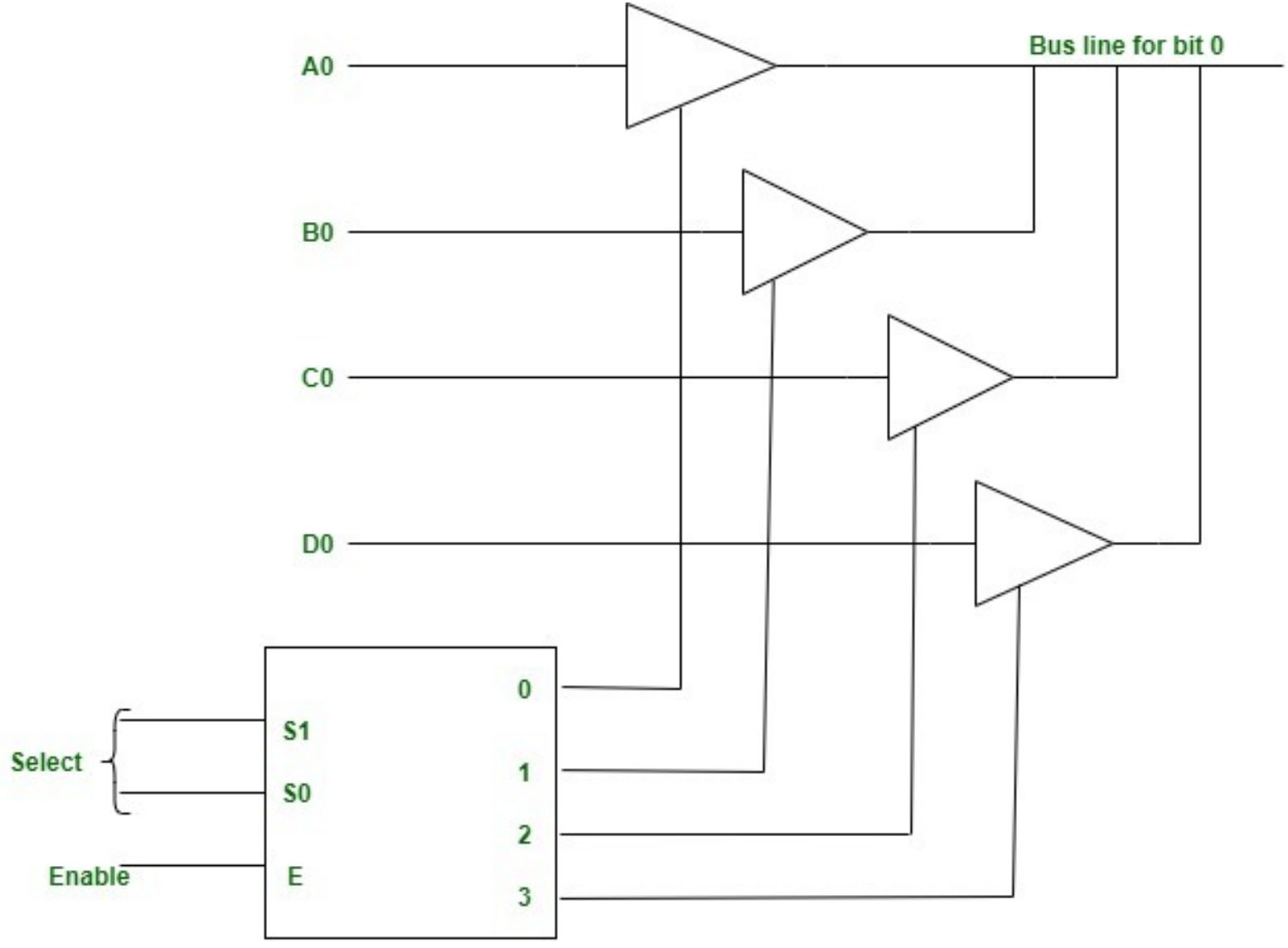
Tristate or Three-state Logic

Tri-State Buffer

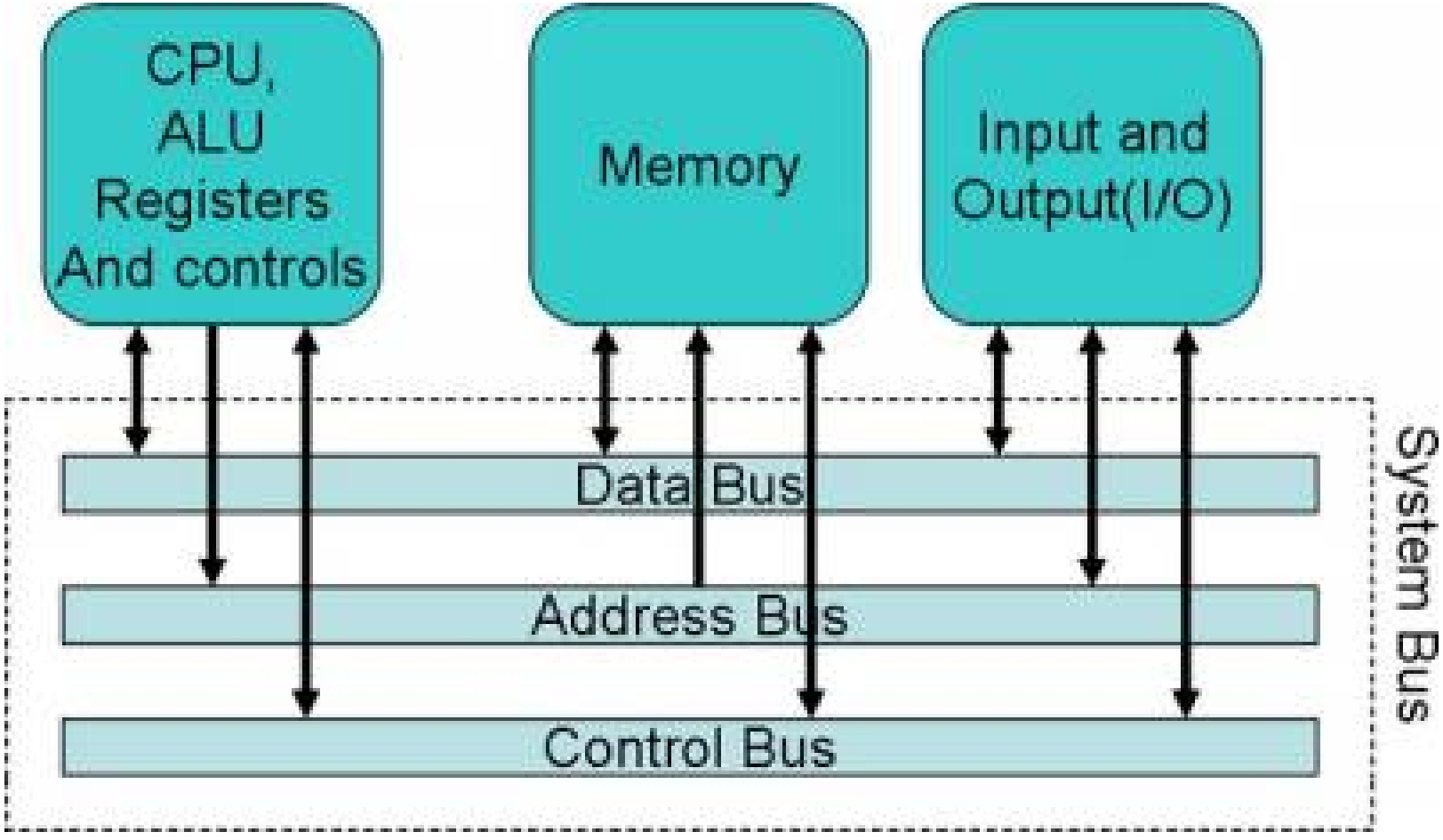


c	a	f
0	0	Z
0	1	Z
1	0	0
1	1	1

Multiplexers with Three-state logic devices



How are tristate devices useful in computers?



TTL Characteristics

TTL is a Logic Family, but what is a logic family?

A logic family of **digital integrated circuit** devices is a **group of electronic logic gates** constructed using one of several different designs, usually with compatible logic levels and power supply characteristics within a family.

What is TTL (Transistor-transistor logic)

Transistor–transistor logic (TTL) is a logic family built from **bipolar junction transistors.** Its name signifies that transistors perform both the **logic function** (the first "transistor") and the **amplifying function** (the second "transistor")

Which logic family is used in modern computers?

Of the millions of transistors in a typical microprocessor, what percentage of them are BJTs and MOFSETS?

In a microprocessor: **ZERO**. All modern processors use CMOS logic.

Reasons why:

- CMOS transistors can be made much-much smaller than BJTs, that means cheaper chips and more functionality per chip
- CMOS logic is much more power efficient than logic made with BJTs
- When CMOS logic is static (no state changes like when in standby) current consumption can be almost **zero**. This is impossible to do with BJT based logic.
- CMOS manufacturing processes are generally **simpler** (less processing steps) than processes with BJTs. This means lower manufacturing costs.
- If your Iphone used BJT based logic for everything then it would need to be **as large as a truck**, half of which would need to be reserved for the battery or generator and fuel.

BJTs **are often used** in **high frequency** circuits like the circuits that connect to the antennas. There is a trend to use CMOS transistors for this as well so what is used depends on price and what performance is needed.

What is used in a particular phone can only be answered by the designers or you'd need to reverse engineer the phone. You would need a well equipped lab to do that and specialists to analyze the chips. Many chips will be unmarked and even if you would know the model number of a chip then it might not be clear if it uses any BJTs inside.

answered Feb 6, 2020 at 7:57

Bimpelrekkie

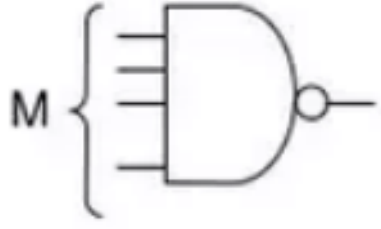
79.4k ● 2 ● 91 ● 181

TTL Characteristics

FANIN

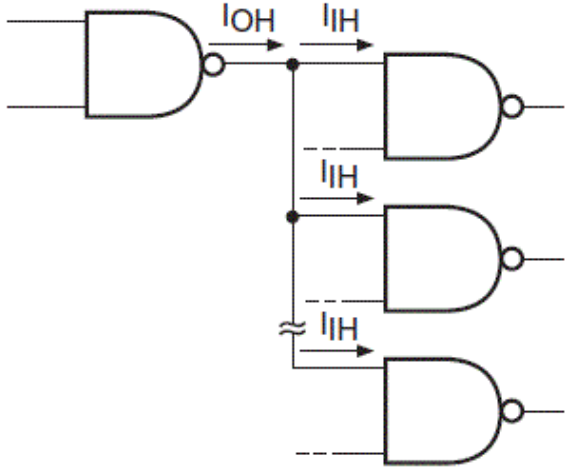
The fan-in defined as the maximum number of inputs that a logic gate can accept. If number of input exceeds, the output will be undefined or incorrect. It is specified by manufacturer and is provided in the data sheet.

- Fan-in – the number of inputs to the gate
  - gates with large fan-in are bigger and slower

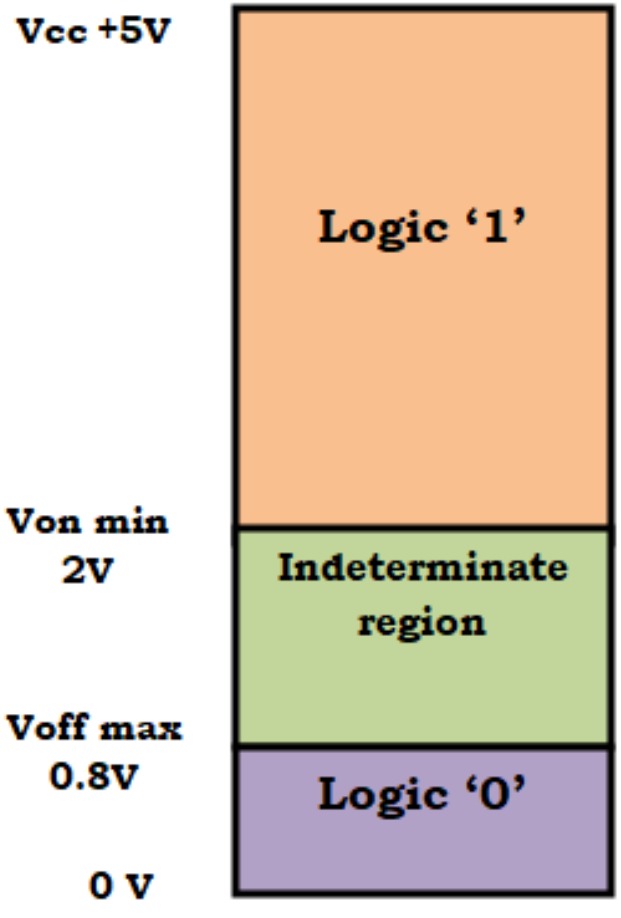


FANOUT

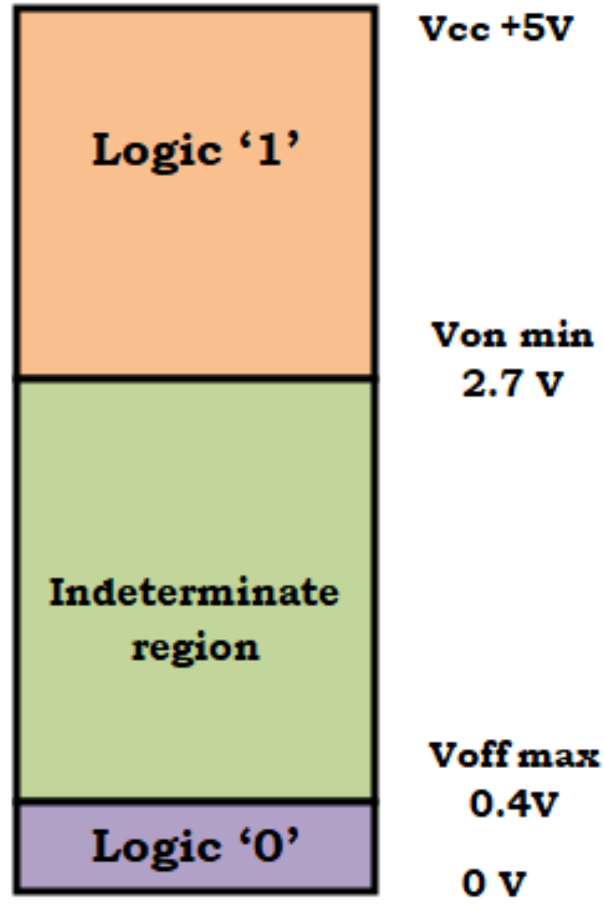
The fan-out is defined as the maximum number of inputs (load) that can be connected to the output of a gate without degrading the normal operation. Fan Out is calculated from the amount of current available in the output of a gate and the amount of current needed in each input of the connecting gate. It is specified by manufacturer and is provided in the data sheet.



Logic Levels

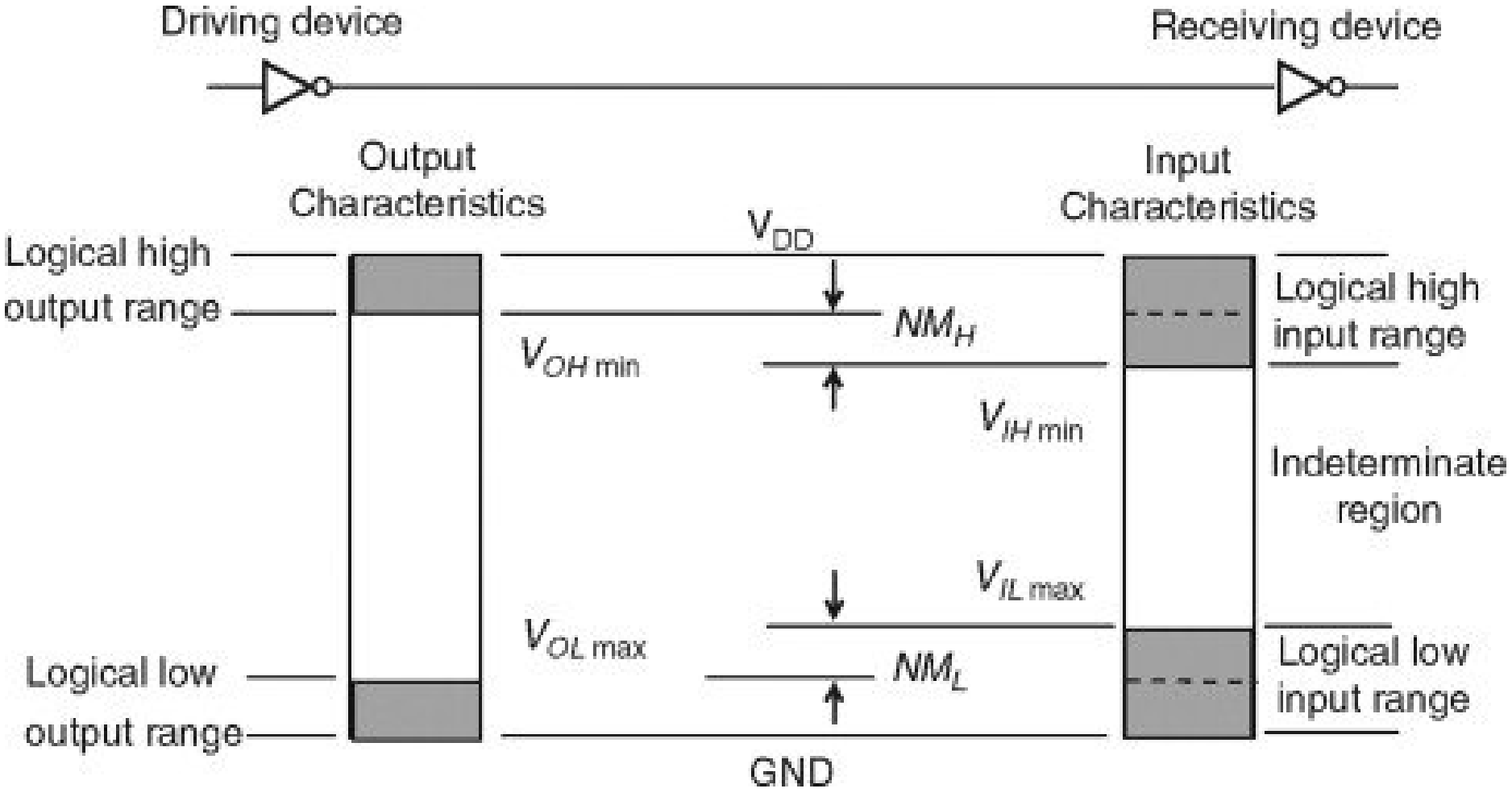


TTL Input Voltage



TTL Output Voltage

Noise-Immunity



Propagation Delay

In logic circuits, propagation delay is less about the amount of time required for a signal to travel from the input to the output. It mainly refers to the switching time and settling time, i.e., the time required for an input signal to force a transition between ON and OFF states, finally causing the output to settle at its final voltage.

The standard TTL series has a typical propagation delay of 10ns

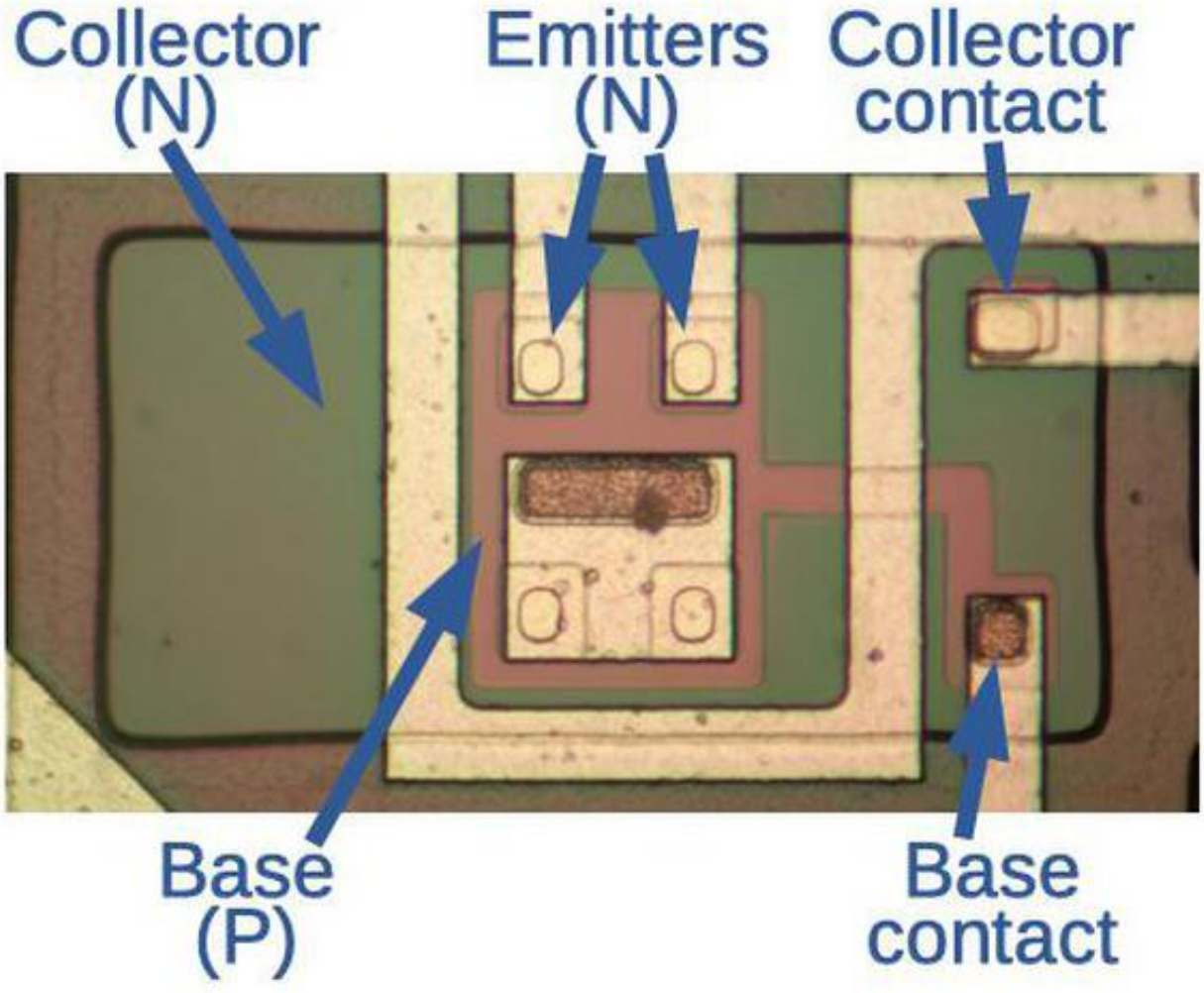
Figure of Merit

It is defined as the product of propagation delay and power dissipation measured in picojoules (pJ). Value of this parameter indicates that, a given propagation delay can be achieved without excessive power dissipation. This product is also referred to as figure of merit for the logic family.

For TTL logic family, the figure of merit is 100 pJ

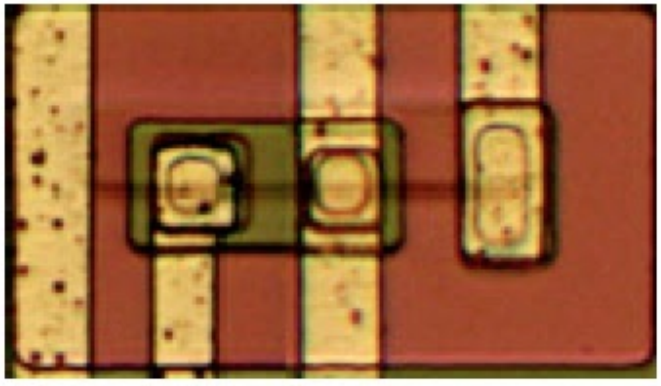
Family	Characteristics	Switching speed	Power consumption	Example
L	Low-power TTL	33ns	1 mW	74L00
H	High-speed TTL	6ns	22 mW	74H00
S	Schottky TTL	3ns	19 mW	74S00
LS	Low-power Schottky TTL	9.5ns	2 mW	74LS00
F	Fast Schottky TTL	>9.5ns	10 pJ	74F00
AS	Advanced-Schottky	>FSTTL	4 pJ	74AS00

Real time clock built with TTL chips in 1979



Microscopic view of a TTL logic gate

NPN transistor



E B C

PNP transistor

C E B

Thank You