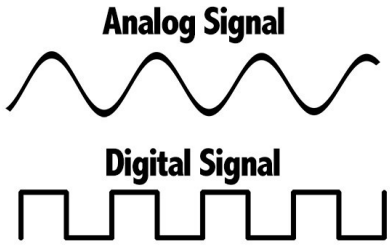
Chapter 1: Digital Electronics

Analogue Versus Digital:

There are two basic ways of representing the numerical values of the various physical quantities with which we constantly deal in our day-to-day lives. One of the ways**, referred to as analogue, is to express the numerical value of the quantity as a continuous range of values between the two expected extreme values**.



For example, **the temperature** of an oven settable anywhere from 0 to 100°C may be measured to be 65°C or 64.96°C or 64.958°C or even 64.9579°C and so on, depending upon the accuracy of the measuring instrument.

The underlying concept in this mode of representation is that variation in the numerical value of **the quantity is continuous** and could have any of the infinite theoretically possible values between the two extremes.

The **other possible way, referred to as digital**, represents the numerical value of the quantity **in steps of discrete values. The numerical values are mostly represented using binary numbers**. For example, the temperature of the oven may be represented in steps of 1°C as 64°C, 65°C, 66°C and so on.

To summarize, while an analogue representation gives a continuous output, a digital representation produces a discrete output.

Analogue systems contain devices that process or work on various physical quantities represented in analogue form.

Digital systems contain devices that process the physical quantities represented in digital form.

Digital techniques and systems have the advantages of being relatively much easier to design and having higher accuracy, programmability, noise immunity, easier storage of data and ease of fabrication in integrated circuit form, leading to availability of more complex functions in a smaller size. The real world, however, is analogue. **Most physical quantities – position, velocity, acceleration, force, pressure, temperature and flowrate, for example – are analogue in nature**.

Types of Multi-Vibrators

a. **Monostable Multi-vibrator**: **(one Shot**) A monostable multivibrator is the type of multivibrator circuit whose output is in only one stable state. It is also known as one-shot multivibrator. In a monostable multivibrator, the output pulse duration is determined by the RC time constant.

b. **A Stable Multi-vibrator**: **(Clock**) A stable vibrator is a circuit with an oscillating output. It doesn't need any external triggering, and it has got no stable state. It is a type of regenerative oscillator.

c. **Bistable Multi-vibrator**:(**Latch**) A bistable vibrator is a circuit with two stable states: high and low. Generally a switch is

required for toggling between the high and low state of the output (Flip-Flop)

What are the Important Multivibrator Circuits for Pulse Generation?

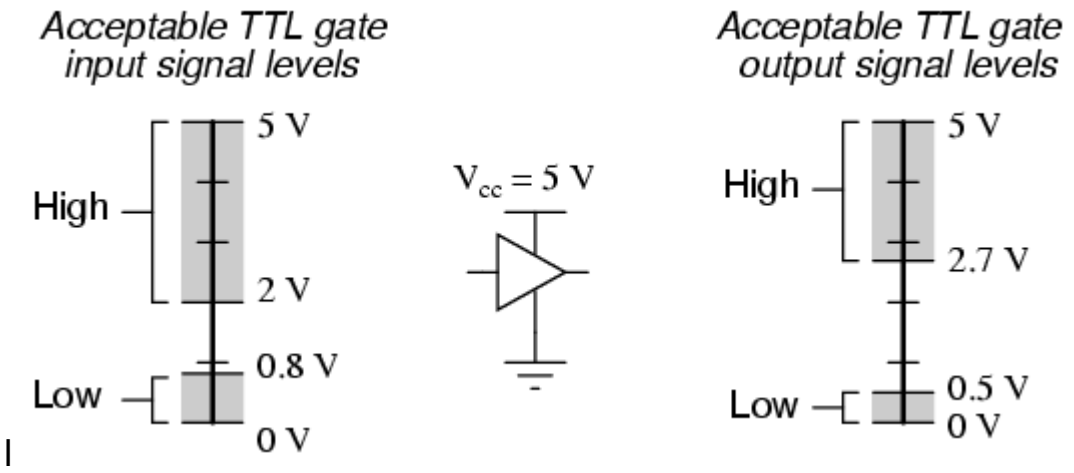
Multi-vibrator circuits refer to the special **type of electronic circuits** used for generating pulse signals. These pulse signals can be rectangular or square wave signals. They generally produce output in two states: high or low. **A specific characteristic of multi-vibrators is the use of passive elements like resistor and capacitor to determine the output state.**

Logic Level

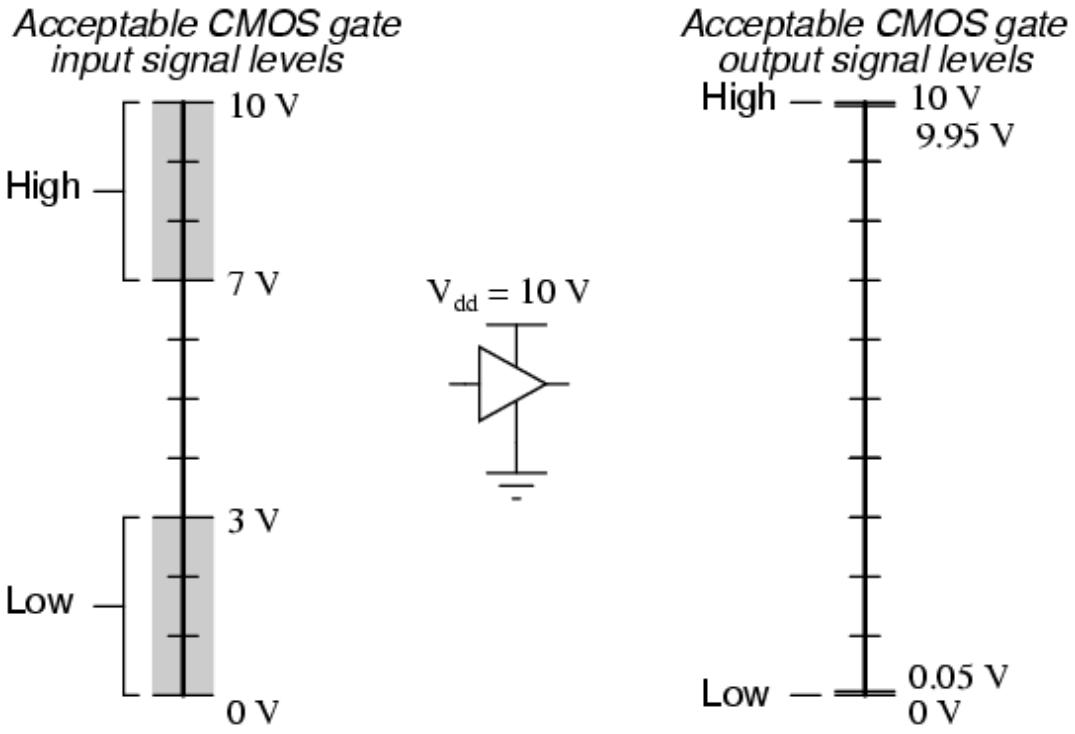
___In digital circuits, a logic level is one of a finite number of states that a digital signal can inhabit. **Logic levels are usually represented by the voltage difference between the signal and ground**, although other standards exist. The range of voltage levels that represents each state depends on the logic family being used._

Two logic level.

In binary logic the two levels are **logical high and logical low**, which generally correspond to binary numbers 1 and 0 respectively. Signals with one of these two levels can be used in boolean algebra for digital circuit design or analysis.
The use of either the higher or the lower voltage level to represent either state is arbitrary. The two options are active high and active low.

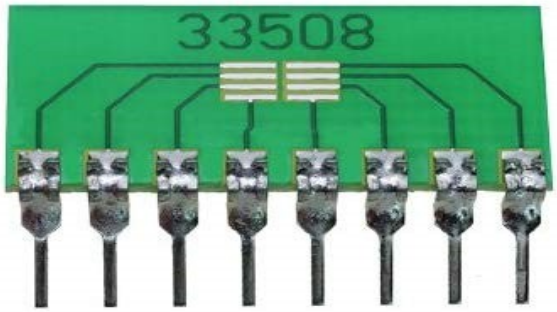


It was 1958 when Jack Kilby from Texas Instruments, introduced the world's first **Integrated Circuit (IC)** Chip to the electronics industry. This invention spread like wild fire since ICs were more reliable, compact and could also save power compared to the conventional circuits used then. Soon this spread like wild fire and every company started fabricating and adapting Integrated circuits which lead to the modern electronics as we know today. There are many fabrication techniques used in IC manufacturing **the two most popular** types are the **Transistor Transistor Logic (TTL)** which got introduced in 1963 and the **Complementry Metal Oxide Semiconductor (CMOS)**which introduced in 1968



The logic levels between the low and high levels are undefined region with unpredictable results.

Surface-mount Technology



Surface-mount technology (SMT) is a method for producing electronic circuits in which the components are mounted or placed directly onto the surface of printed circuit boards (PCBs). An electronic device so made is called a surface-mount device (SMD). In industry, it has largely replaced the through-hole technology construction method of fitting components with wire leads into holes in the circuit board. Both technologies can be used on the same board, with the through-hole technology used for components not suitable for surface mounting such as large transformers and heat-sinked power semiconductors.