

# SEMI-CONDUCTOR is PLATFORM of FLIP-FLOP

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## ABSTRACT:

The flip flop are fundamentally semiconductor based, edge-trigger memory element the store a single bit of digital data, acting as essential component in sequential logic circuit. they are widely used in digital electronics for memory, counter, and shift register application. the performance of flip-flop is evaluated by power consumption, propagation delay and area, advanced design such as sense amplifier based flip-flop (SAFF) or dual charge sensing flip-flop aim for higher speed and lower power consumption and all optical flip-flop for high speed optical work application. they design of dual – sensing 2T flip-flop in 65 nm CMOS (complimentary -metal- oxide – semiconductor). Focus on reducing short circuit current and dynamic power, low voltage and low power time single-phase. 16 transistor flip-flop design. explorer reducing the number of transistor and clock driving local of IoT application. All optical D-flip-flop based on all optical gates present high -speed optical memory using SOA based gate. these platform are essential for high performance VLSI application providing stable state retention capability.

**KEY WORDS: SAFF, CMOS, SOA**

## INTRODUCTION:

A flip-flop is fundamental semi conductor based circuit that serve as a Bi stable multivariate, capable of storing one bit of binary data (0 or 1) identifiably until detected by an input signal to change these circuit are the building block of sequential logic system including computer memory device and counters. This circuit has two stable states high (logic 1) and low (logic 0) and remain in the current state until the trigger pulse are applied, now we have implementation of semi conductor modern flip-flop using semi conductor technology. specifically transistor configured in to a cross-coupled NAND or NOR gates often packed as integrated circuit ICs in like latches which are high-level triggered, flip-flop and typically edge triggered. They only change the state in response to a specific transistor (rising or falling edge) of a clock signals they are essential computer memory (RAM) register, data storage, frequency division and state mechanism. the flip-flop are crucial for synchronization data flow in synchronous circuit and for maintaining state in digital system.

## SEMI-CONDUCTOR MEANS:

A semiconductor is a material typically silicon with electrical conductivity between on conductor and insulator capable acting as both by adding impurity through a process called doping. their

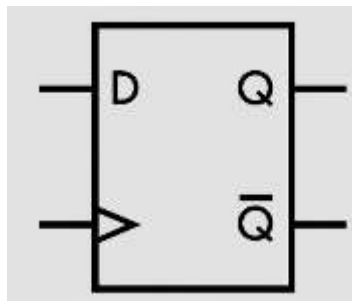
conductivity and can be controlled to power electronics devices they are essential building block of modern technology , enabling component like transistor and integrated circuit ICs used in computing communication and AI .semi conductor posses property that allow the to control electrical current acting as insulator in serve circumstances and conductor in others.

Silicon is the most common material while other included germanium and gallium arsenide . they act as a amplifier , switches and energy converter with in circuit , it essential for smart phone, computer solar call, LEDs and medical devices . the semi conductor industries is vital of advancement and artificial intelligences consumer electronics and automatic safety according to the semiconductor industries association.

**FLIP-FLOP means:**

A flip -flop means in fundamental bi stable multivariate circuit in digital electronics used to store a single bit ( 0 or 1) of binary data it has two stable state (low – high ) and act as a basic memory element by holding its state until triggered by input signals flip-flop are clock depends (sequential)circuit can stay in one of two state (0 or1) identifying typically operate on the rising or falling edge of a clock signals those memory storage is used in register , RAM and cache memory to store data the digital circuit used to count pulse (eg Binary counter) this are during input clock frequency used to shift register for several data transfer , While both are memory element flip-flop and edge trigger (changing the state only clock transmission ) where as lathes and levei0trigger (changing the state continuously while enable signal is active).

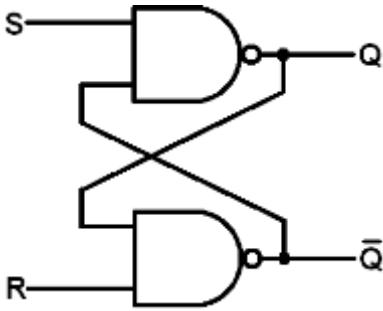
**FLIP-FLOP**



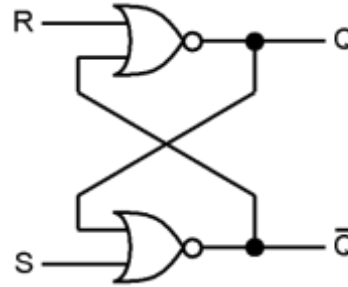
**LATCHES means:**

A latches in electronics is a bi stable digital circuit that store are bit of data (0 or 1) and hold its output state until changed by input signals as a level-sensitive as devices a latches changes it output immediately when they enable signal is active commonly used in memory unit . the circuit continuously check input when they enable circuit is high (active ) allowing the output a clock signal making it immediately but sensitive to input change during the enable phase it user cross-coupled logic gate (NAND-NOR) to feed output back to input and hold the state , it reduce the BUS count , allowing address/data line top be used efficiently (eg 8085 process).

### NAND Latches ( NOT +AND )



### NOR Latches ( NOT + OR )



### DIFFERENT between LATCHES and FLIP-FLOP:

The latches are level- sensitive storage element that react to input continuously while enabled . where as flip-flop are edge-trigger devices that only updates output on a specific clock signals. The latches are synchronous faster and smaller used for temporary storage . while flip-flop are asynchronous , ideal for register and complex circuit.

The latches are “ TRANSPARENT” meaning if enable is active , changes in input instantly reflect at the output flip-flop are not transparent updating the output only during the clock edges .the latches are generally asynchronous . while flip-flop are synchronous . the latches useless power and area but one harder to analysis timing flip-flop are easier to use the synchronous design (eg register) and often better reliability . the flip-flop is essential a clocked latches often created using two latches in MASTER-SLAVE configuration.

The main difference between latches and flip-flop is low they are triggered to change their state . a latches is a level-triggered meaning its continuously response to input change as long as the “ enable” signals is at a specific logic level ( high or low) it construct flip-flop is edge – trigger meaning it only capture the input and update its output at exact moment a clock signals transistor from low to high (rising edge) or high to low (falling edge). The latches ae “ open-doors” when they enabled signals is high anything at the input immediately “flow though “to the output it act as a transparent windows during that period. The flip-flop are like “cameras” they take a quick “snapshot” of the input only at the moment the clock “click” the edge any changes to the input before or after that split the seconds are ignored until the next clock pulse.

### THE SEMI CONDUCTOR IN SYSTEM:

The semi conductor is the primary technology used to stored digital data in modern computer system. Unlike older magnetic-core memory semi conductor memory uses electrical charges stored in silicon – based integrated circuit to represent binary data (0S and 1s).

### 1. VOLATILE MEMORY( temporary workspace)

This type of memories required constant power to maintain data and is used as the systems “scratchpad” for active task.

## 2. DYNAMIC RAM(DRAM)

This is used for maintain system memory . it stores data using a single transistor and capacitor per cell making it use and cost -effective for large capabilities.

## 3. STATIC RAM(SRAM):

This is used for “CPU CACHE “ it is much more faster then DRAM and does not required “REFRESHING” but it is complex structure (6 transistor per cell) make it more expensive and lower is capacity.

## 4. NON-VOLATILE memories (PERMANENT STROGE)

This they retain data use after power is disconnected servicing as long-term storage or firmware housing.

## 5. FLASH MEMORY (NAND/NOR)

Used SSD s USB drives and SD cards NAND -Flash is the backbone of high- capacity storage , while NOR flash is often used for fast reading takes like storing firmware.

## 6. READ-ONLY MEMORY:

Used to store BIOS and FIRMWARE the essential instruction needed to boot the system before the operating system takeover.

### ACCESS SPEED:

Semi conductor memory operate in NANO SECONDS where as mechanical hard drive HDD operate in milli second .

### MINIATURIZATION:

It is solid state nature allowed extremely small , light-weight design suitable for smart phone and laptop.

### DURABLITY:

Because it has no moving parts , it is highly resistant to physical shocks and vibration compared to rotating magnetic disk.

### NEED FOR SEMI-CONDUCTOR:

The semi conductor as essential in today electronic device to support party multi tasking , gaming and 5G/AI data- intensive tasks. Semi conductor memory selected for system memory because it provide to necessary combination of high-speed access – random access capability , comp[at size and reliability , it serves an the primary storage (RAM) that hold data and instruction the process is currently working on , offering access speed (nano second for superior to mechanical storage like hard disk (milli second).

## **FLIP-FLOP:**

It is not only use the semi conductor because it used non-semi conductor also .the flip-flop are not only used in semi conductor devices although that is their most common application today. When modern electronics pre dominantly use semi conductor based flip-flop( such as those in transistor , integrated circuit and FPGAs) they can be constructed using various technology . semi conductor based flip-flop(most common) . transistor/ICs flip-flop are fundamental building block of digital electronics system. Implemented using technology like (CMOS)complimentary-metal-oxide- semi conductor and TTL (transistor-transistor logic)in memory unit they are used in SRAM (static RAM) to store binary data (0s and 1s) in computer and processor they are essential in FOAGs- micro controller and register to store the data information.

## **NON-SEMI CONDUCTOR BASED FLIP-FLOP:**

All optical flip-flop these used optical biostable devices to switch between two state using light-pulses rather than electrical signal for data storage and switching.

## **VACUUM TUBE:**

In the early day of electronics flip-flop were constructed using vacuum tube

## **RELAY/ MECHANICAL:**

Though rare in modern application flip-flop logic can technically be achieved with electro mechanical computer regardless of material a flip-flop is defined as a circuit with two stable state that store are bit of data , used for memory , counting and synchronization

## **CONCLUSION:**

based on the provide search result . the conclusion is that semi conductor technology serves as the fundamental , physics platform for constructing flip-flop which in turn are the building blocks of digital memory and sequential logic circuit the flip-flop biostable multi vibrator that store one bit of binary data (0 or 1) .they are implemented on semi- conductor platform using transistor arranged with logic gates (typically NEND or NOR) these are frequently packaged as ICs (integrated circuit ).the flip-flop are essential in counter , register ( like shift register , data storage and frequency division , making them crucial for processor as the hearty of sequential digital electronics they allow for synchronization operation with edge trigger types (like D type or JK type) being performed for analysis in modern chip design while traditional flip-flop have limitation like propagation delay and constant power usage they continues to be optimized for better energy efficiency and smaller foot print in modern nano technology flip-flop are they storage elements in digital electronics and they are realized physically an SEMI-CONDUCTOR material.

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