Waveform Generation

Lecture - 13

(26/04/2021)

B.Sc (Electronics)

TDC PART - III

Paper – 6

Unit – 8

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➢ Transistor Mono-Stable Multivibrator Circuit Operation (PART – 3)

⇨ **The operation of the Mono-Stable Multivibrator (MMV) circuit illustrated in Fig (5), (6) and (7) is as follows:-**

⇨ When the **Mono-Stable Multivibrator (MMV) Power supply +V_{CC}** is **switched ON** by closing the **Switch S**, both **Transistors Q1** and **Q2** start conducting. Then one transistor starts conducting slightly more then the other due to small differences in their **operating characteristics of the transistors**. This starts a series of events.

(1) MMV Initial Condition (STABLE STATE)

⇨ In the absence of a **Triggering Pulse** at **Capacitor C_2** and with **Switch S** closed,

(1) **Positive Power Supply +V_{CC}** provides **Reverse Bias** for **C/B junctions of Transistors Q1 and Q2** but **Forward-Bias** for **E/B junction of Transistor Q2 only.** Hence, **Transistor Q2 gets into Saturation** and **Conducts (ON-State).**

(2) **Negative Power Supply –V_{BB} supply** and **Resistor R3 Reverse Bias Transistor Q1** and **keep it Cut-OFF** and **Non-conducts (OFF-State).**

(3) **Capacitor C1 charges to nearly Positive +V_{CC}** through **Load Resistor R_{L1}** to **ground** by the **Low-Resistance path** provided by **Saturated Transistor Q2.**

⇨ As seen, the **Initial Stable State** is represented by

(i) **Transistor Q2 Conducting (ON State)** at **Saturation** and

(ii) **Transistor Q1 Cut-OFF (OFF State).**

⇨ **Figure (5)** Shown below **Mono-Stable Multivibrator Initial Stable State Condition**,

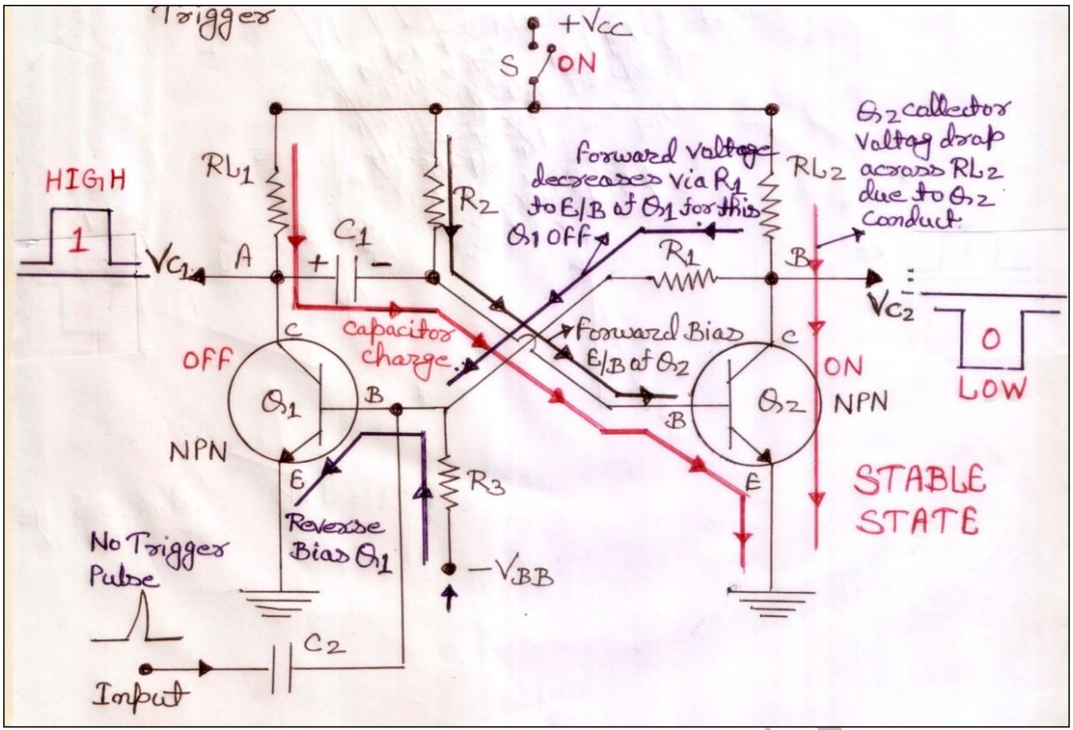

Fig (5) Shown MMV Initial Condition when No Trigger Pulse applied (STABLE STATE)

(2) When Trigger Pulse is Applied (UNSTABLE STATE)

➩ When a External **Positive Trigger Pulse** is applied to **NPN Transistor Q1** through **Capacitor C_2, Mono-Stable Multivibrator** will **switch** to its **Opposite Unstable State** where **Transistor Q2** is **Cut-OFF (OFF-State)** and **Transistor Q1 Conducts (ON-State)** at **Saturation.** The chain of circuit actions is as under:-

(1) If **Positive Trigger Pulse** is of **sufficient amplitude**, it will over-ride the **Reverse Bias of the E/B junction** of **Transistor Q1** and give it a **Forward Bias**. Hence, **Transistor Q1 will start Conducting (ON-State).**

(2) As **Transistor Q1 Conducts (ON-State)**, its **Collector Voltage** falls due to voltage drop across **Load Resistor R_{L1}**. It means that potential of **Point A falls (negative-going signal).** This **Negative-going voltage** is fed to **Transistor Q2 via Capacitor C_1 where it decreases its Forward Bias.**

(3) As **Collector Current of Transistor Q1 starts decreasing,** potential of **Point B increases (Positive-going Signal) due to lesser drop over Load Resistor R_{L2}.** Soon, **Transistor Q2 comes out of Conduction State (ON-State).**

(4) The **Positive-going Signal** at **Point B** is **fed via Resistor R1** to the **Base of Transistor Q1** where it **increases its Forward Bias further.** As **Transistor Q1 Conducts** more, potential of **Point A approaches 0 V (volt).**

(5) This action is **Cumulative and ends with Transistor Q1 Conducting (ON-State) at Saturation and Transistor Q2 Cut-OFF (OFF-State).**

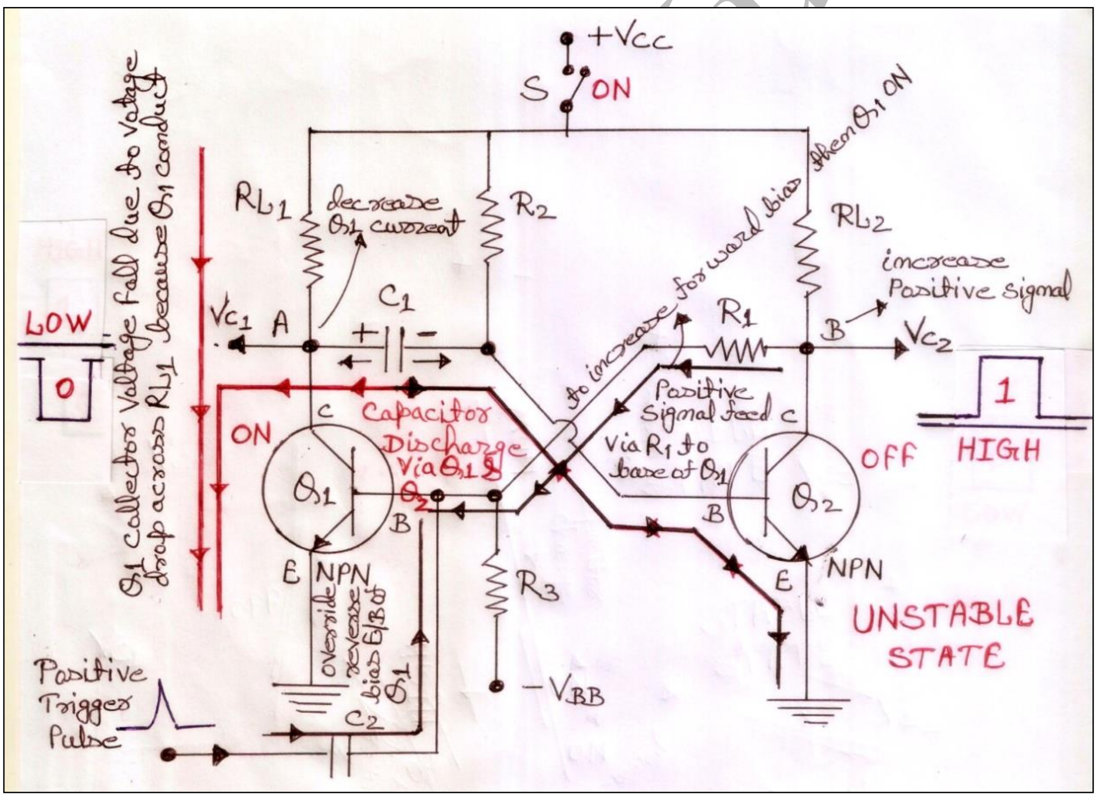

Fig (6) Shown MMV Circuit Diagram when Positive Trigger Pulse is applied (UNSTABLE STATE)

(3) Return to Initial Stable State (BACK TO STABLE STATE)

(1) As **Point A** is at **almost 0 V (volt), Capacitor C_1 Starts to Discharge** through **Saturated (ON) Transistor Q1 to ground.**

(2) As **Capacitor C_1 Discharges**, the **Negative Potential** at the **Base of Transistor Q2** is **decreased**. As **Capacitor C_1 Discharges further, Transistor Q2 is pulled out of Cut-OFF (OFF-State).**

(3) As **Transistor Q2 Conducts further**, a **Negative-going Signal** from **Point B** via **Resistor R_1** drives **Transistor Q1** into **Cut-OFF (OFF-State)**.

⇨ Hence, the circuit reverts to its **Original Initial Stable State** with **Transistor Q2 Conducting (ON-State)** at **Saturation** and **Transistor Q1 Cut-OFF (OFF-State)**. **It remains in this Original Initial Stable State till another Trigger Pulse comes along when the entire cycle repeats itself.** It is shown below in **Figure (7),** when **Mono-Stable Multivibrator (MMV)** back to **Original Initial Stable State**.

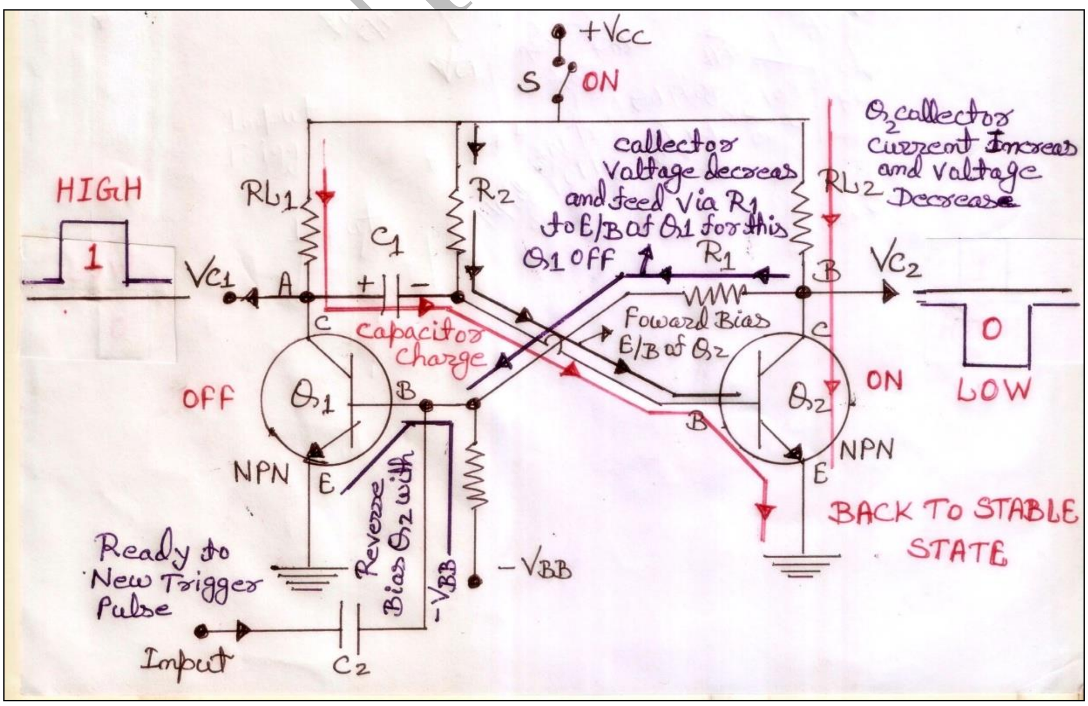

Fig (7) Shown MMV Circuit Diagram when MMV return to Initial Stable State (BACK TO STABLE STATE)

- ⇨ The **output** is taken from the **Point A of Collector terminal of Transistor Q2** though it can also be taken from **Point A of Transistor Q1** as shown in above **Figure (5), (6) and (7).** The **Width of this Pulse is determined by the Time Constant of R_2C_1.** Since this **Mono-Stable Multivibrator produces One Output Pulse for every Input Trigger Pulse it receives, it is called Mono or One-Shot Multivibrator.**

- ⇨ Detailed **of the Transistor Mono-Stable Multivibrator Output Waveforms, Its Advantage, Disadvantage and Applications** are discussed in next **Lecture – 14.**

to be continued ....

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