Four Layer P-N-P-N Switching Devices
(Shockley Diode)
Lecture – 10

TDC PART – II
Paper - III (Group - A)
Chapter - 4

by:

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- **P-N-P-N Diode or Shockley Diode**
- **Lecture Content :-**

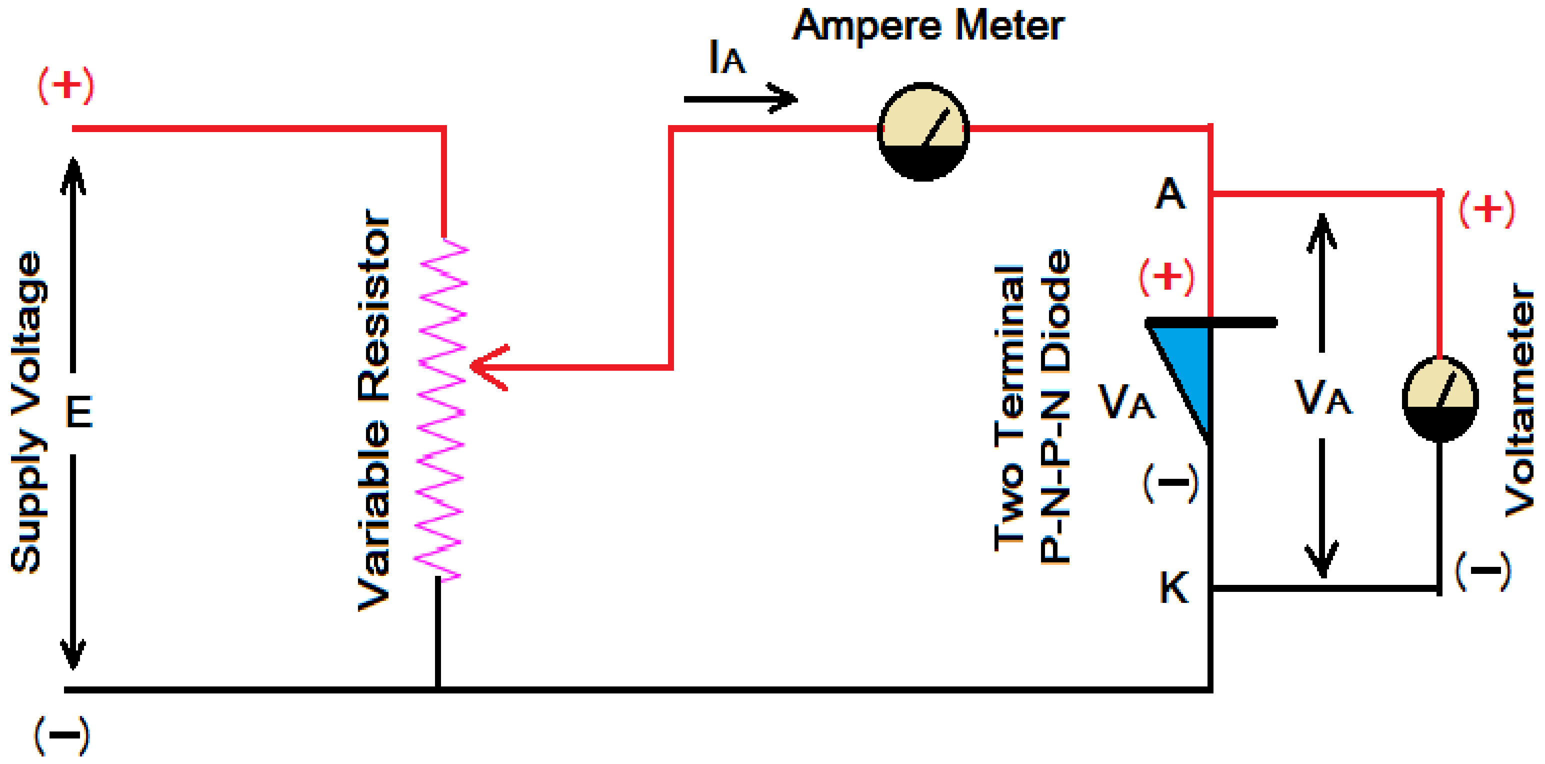
➢ **(7) V-I Characteristics of P-N-P-N Diode or Shockley Diode**

➢ **(II) Forward Blocking Mode (OFF-State)**

P-N-P-N Diode or Shockley Diode

- **(7) V-I Characteristics of P-N-P-N Diode or Shockley Diode**

- **An Elementary Circuit Diagram** for obtaining **V-I Characteristics** of a **P-N-P-N Diode or Shockley Diode** is shown in **Figure (18)** below. The **Anode (A) and Cathode (K)** are connected to **Main Source (Supply Voltage E)** through an **"Ampere Meter" and a Voltage finding meter "Voltmeter"** connected in **Parallel in device.**



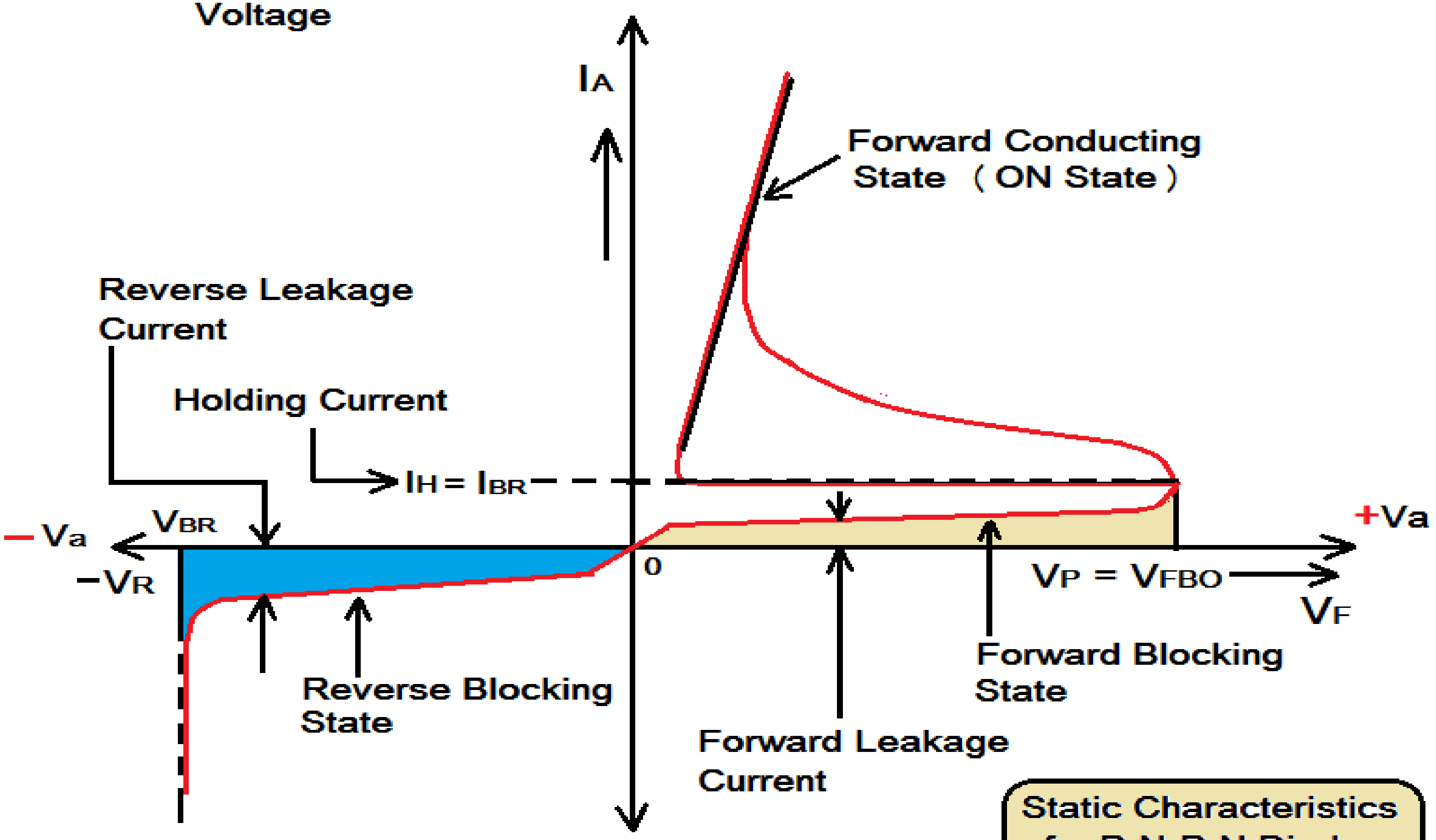
Elementary Circuit for
Obtaining P-N-P-N Diode
V-I Characteristics

- **Fig. (18)** Shown an elementary circuit diagram for obtaining V-I Characteristics of a P-N-P-N Diode or Shockley Diode.

- **Figure (19)** shown below a **Static V-I Characteristics of a P-N-P-N Diode.** Here **VA** is the **Anode (A) Voltage** across **P-N-P-N Diode** terminals **Anode (A), Cathode (K)** and **IA** is the **Anode (A) Current.**

V_{FBO} = Forward Breakover Voltage or Forward Peak Voltage

V_{BR} = Reverse Breakover Voltage



Static Characteristics of a P-N-P-N Diode or Shockley Diode

- Fig. (19) Shown Static V-I Characteristics of a P-N-P-N Diode or Shockley Diode.

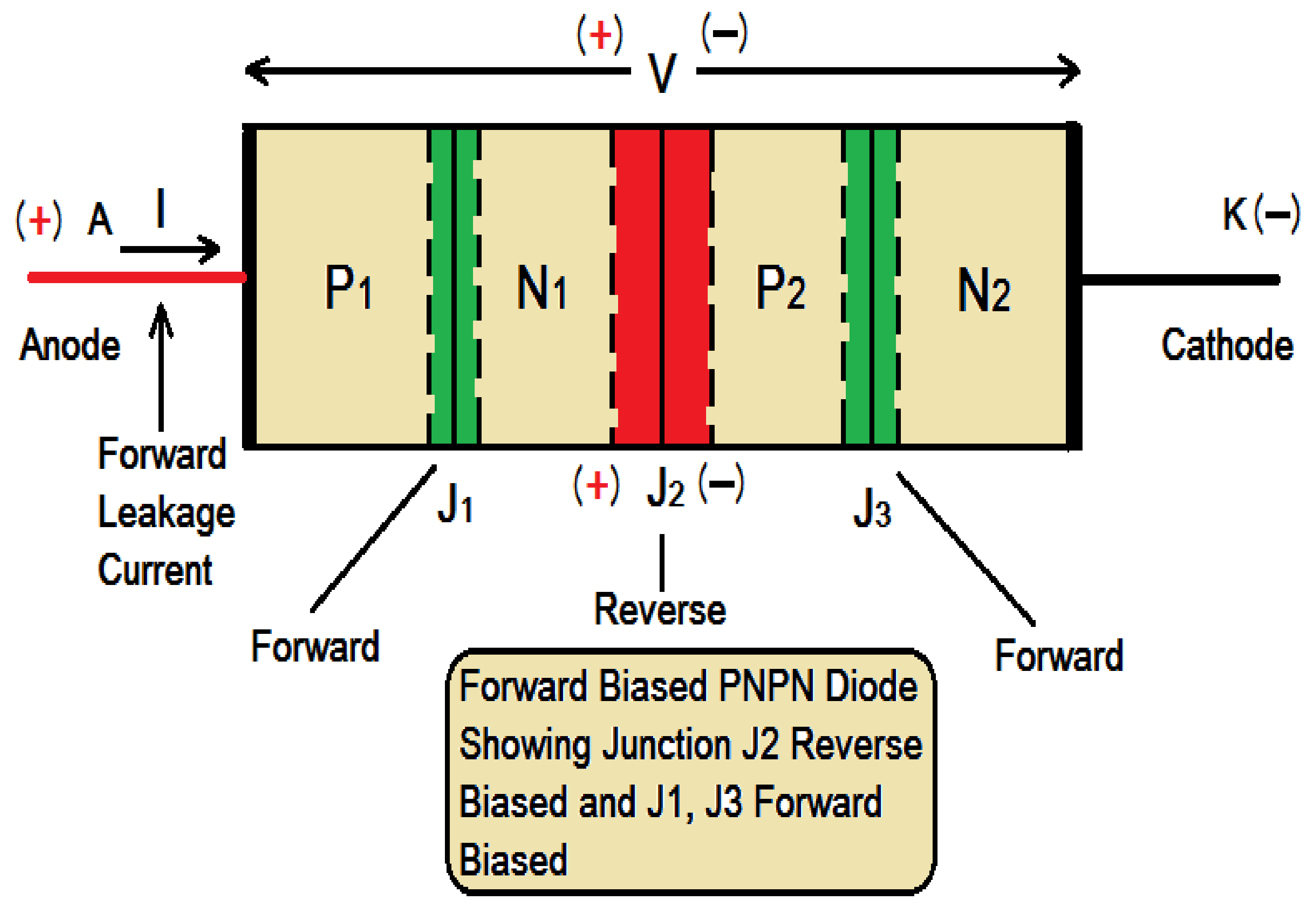
- Typical **P-N-P-N Diode V-I Characteristics** shown above in **Figure (19)** reveals that a **P-N-P-N Diode** has **Three Basic Mode of Operation**; namely,

- **(I) Reverse Blocking Mode (OFF-State)**
- **(II) Forward Blocking Mode (OFF-State)**
- **(III) Forward Conducting Mode (ON-State)**

- These **three modes of operation** are now discussed below one by one;

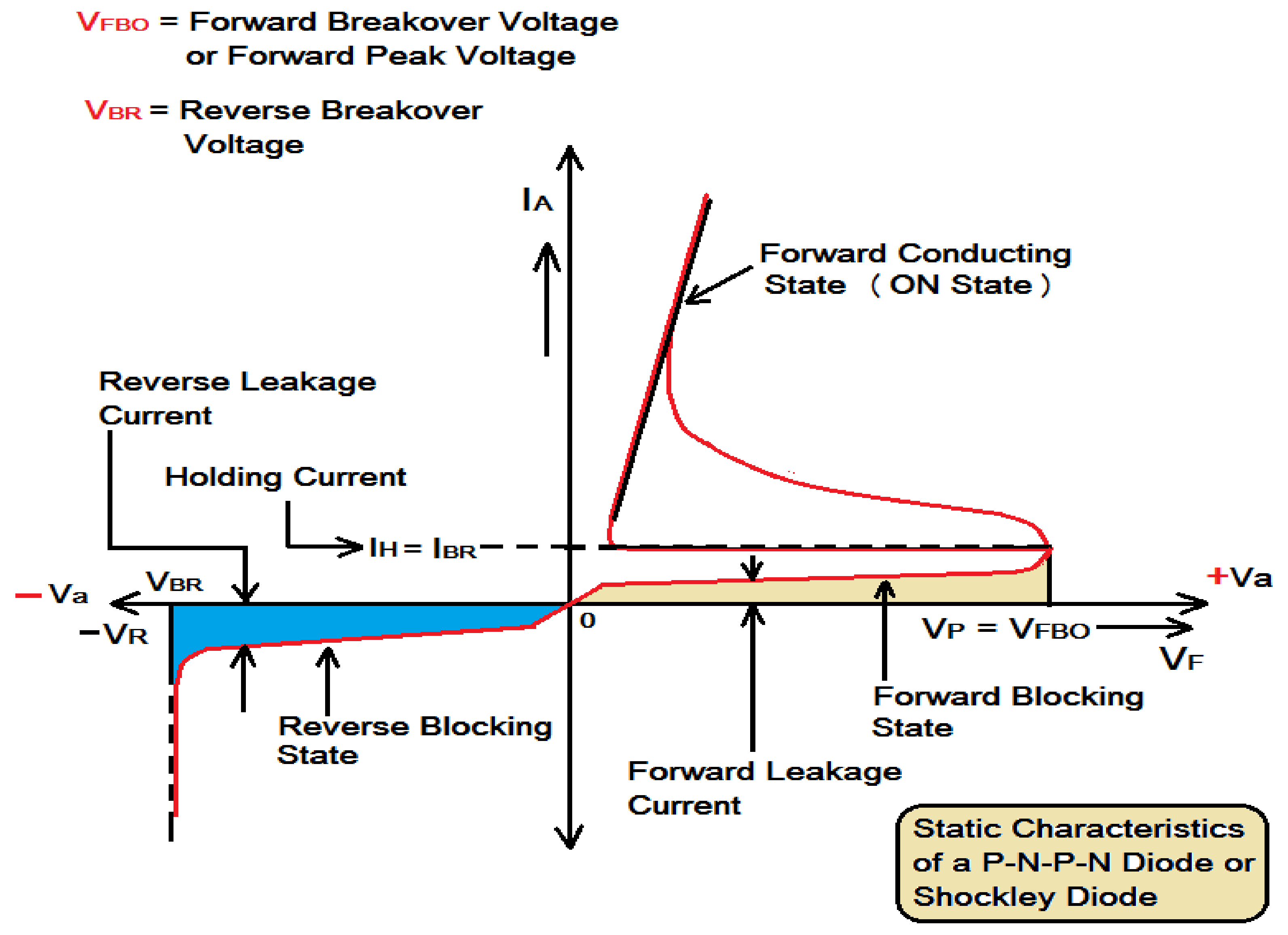
(II) Forward Blocking Mode (OFF-State)

- When **Anode (A) terminal is Positive** with respect to the **Cathode (K) terminal, P-N-P-N Diode** is said to be **Forward Biased** as shown in **Figure (22)** below. It is seen also from this **Figure (22)** that **Junctions J1 and J3 is Forward Biased** but **Junction J2 is Reverse Biased.**



- **Fig. (22)** Shown Forward Biased P-N-P-N Diode with Junctions J1, and J3 are Forward Biased but Junction J2 is Reverse Biased.

- In this **Forward Blocking Mode, a Small Current, called Forward Leakage Current,** flows as Shown above in **Figure (22).** It may be also seen from **Static V-I Characteristics of a P-N-P-N Diode or Shockley Diode** shown in **Figure (23) below.**



- **Fig. (23)** Shown Static V-I Characteristics of a P-N-P-N Diode or Shockley Diode.

- In case the **Forward Voltage is Increased,** then the **Reverse Biased Junction J2** will have an **Avalanche Breakdown** at a **Voltage called Forward Breakdown or Brakover Voltage VFBO** or **Forward-Peak Voltage VP.**

- When **Forward Voltage is** **Less** **than Forward Breakdown or Breakover Voltage V_{FBO}, P-N-P-N Diode** offers a **High Impedance.** Therefore, a **P-N-P-N Diode** can be treated as an **Open-Switch** even in the **Forward Blocking Mode.**

to be continued ....