Four Layer P-N-P-N Switching Devices (Shockley Diode) Lecture – 8

TDC PART – II

Paper - III (Group - A)

Chapter - 4

by:

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Four Layer P-N-P-N Switching Devices (Shockley Diode)

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

➢ **(6) Various States in V-I Characteristics of Two Terminals P-N-P-N Diode or Shockley Diode**

➢ **(III) Reverse Blocking State (OFF-State)**

P-N-P-N Diode or Shockley Diode

- **(6) Various States in V-I Characteristics of Two Terminals P-N-P-N Diode or Shockley Diode**

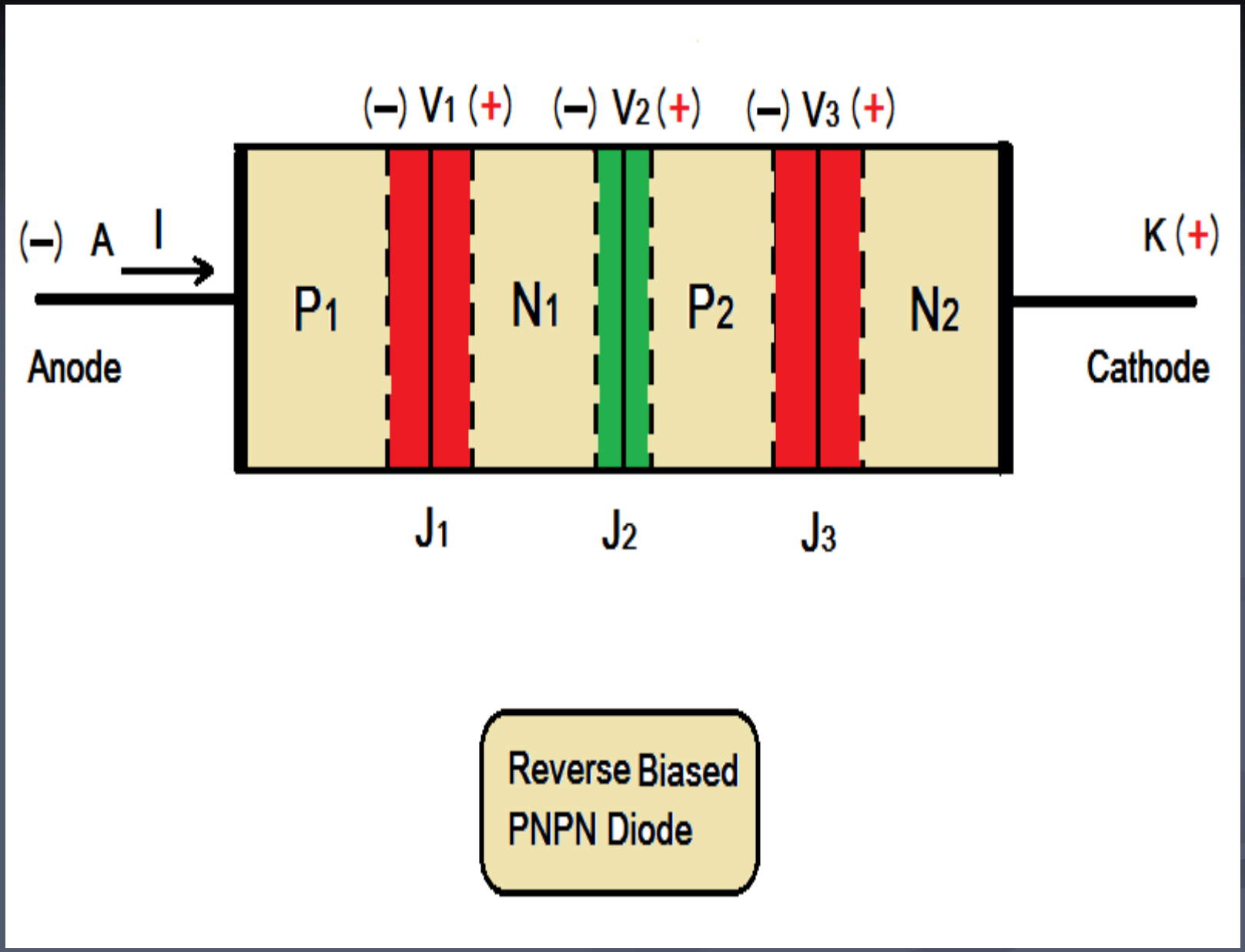
- A careful observation and detailed study of the **V-I characteristics** reveal that the **Two Terminal P-N-P-N Diode or Shockley Diode** has **three basic State of operation** namely the,

- **(I) Forward Blocking State (OFF-State),**
- **(II) Forward Conduction State (ON-State), and**
- **(III) Reverse Blocking State (OFF-State)**

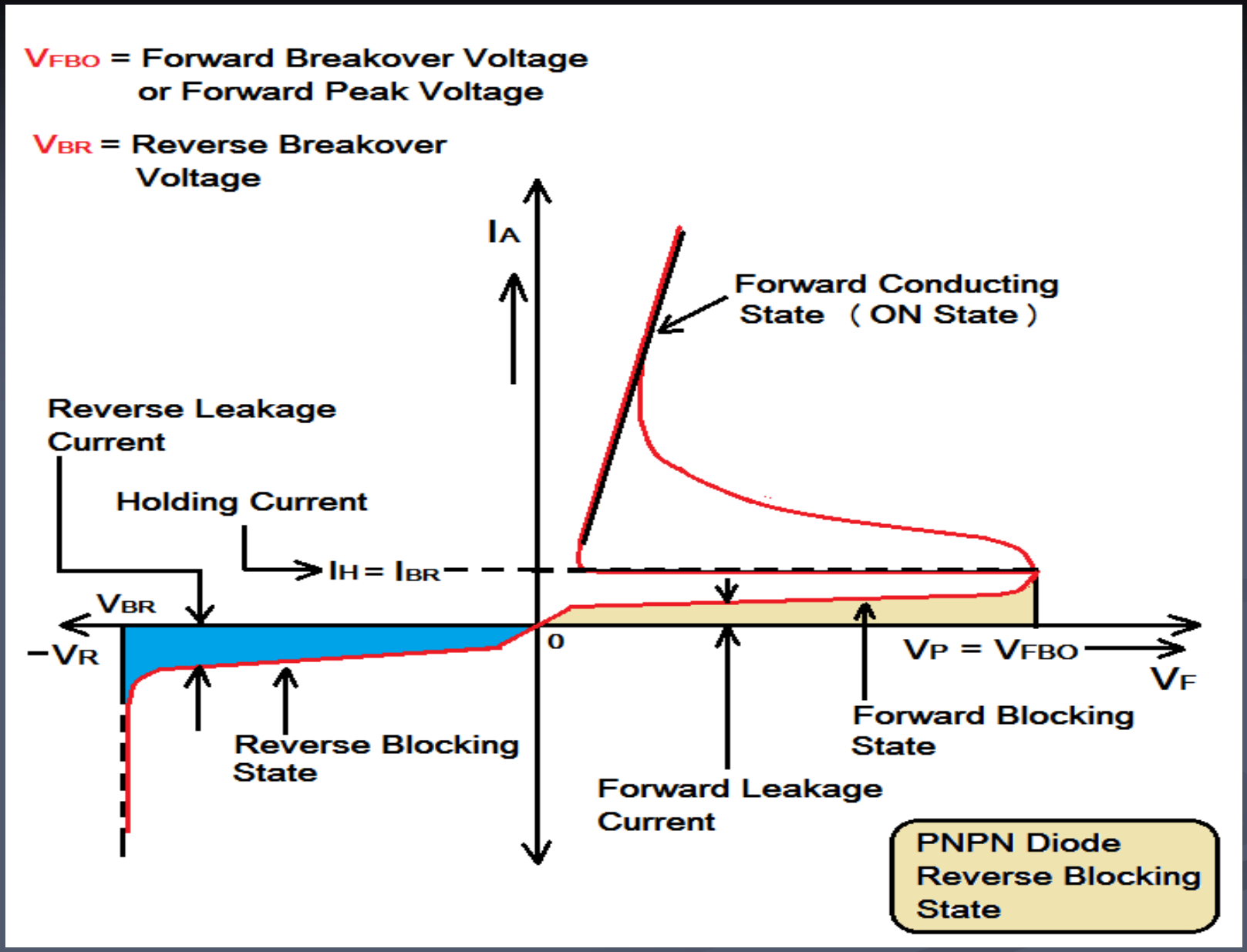
- The above basic State of Operations is discussed in great details below, to **understand the overall characteristics of a Two Terminal P-N-P-N Diode or Shockley Diode**. Let us now discuss each of the **Three State** one by one,

(III) Reverse Blocking State (OFF-State)

- When **Cathode (K)** is made **Positive** with respect to **Anode (A)** with Shown in **Figure (16)** below, **P-N-P-N Diode** is **Reverse Biased** as shown in **Figure (16). Junctions J1, and J3** is seen to be **Reverse Biased** whereas **Junction J2** is **Forward Biased.** The device behaves as if **Two Diodes** are **connected in Series with Reverse Voltage applied across them.**



- **Fig. (16)** Shown Reverse Biased P-N-P-N Diode.



- **Fig. (17)** Shown Reverse Blocking State of a P-N-P-N Diode V-I Characteristics.

- A small **Leakage Current** of the order of a **few mill amperes (mA)** (or a **few micro amperes** depending upon the **Two Terminals P-N-P-N Diode**) flows. This is **Reverse-Blocking Mode, called the OFF-State,** of the **Two Terminals P-N-P-N Diode.**

- If the **Reverse Voltage** is **increased,** then at a **Critical Breakdown Level, called Reverse Breakdown Voltage V_{BR},** an **Avalanche Breakdown occurs at Junction J1 and J3** and the **Reverse Current increases rapidly.** A **Large Current** associated with **Reverse Breakdown Voltage V_{BR}** gives **rise to more losses** in the **P-N-P-N Diode.** This may lead to **P-N-P-N Diode Damage as the junction temperature may exceed its permissible temperature rise.**

- It should, therefore, be ensured that **Maximum Working Reverse Voltage across P-N-P-N Diode does not exceed Reverse Breakdown Voltage V_{BR}.** When **Reverse Voltage** applied across a **P-N-P-N Diode** is **less than Reverse Breakdown Voltage V_{BR},** the **device offers High Impedance** in the **Reverse Direction.** The **Two Terminals P-N-P-N Diode** in the **Reverse Blocking State** may therefore be treated as an **Open Switch (OFF-State).**

to be continued .....