Four Layer P-N-P-N Switching Devices
(Shockley Diode)
Lecture – 5

TDC PART – II

Paper - III (Group - A)

Chapter - 4

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

➢ **(5) Variation of α with Injection**

P-N-P-N Diode or Shockley Diode

- **(5) Variation of α with Injection**

- Since the **Two-Transistor Analogy** implies that **switching involves an increase in the Alphas (α) to the point that α1 + α2 approaches Unity,** it may be helpful to review **how Alpha (α) varies with injection for a transistor.** The **Emitter-to-Collector Current Transfer Ratio α** is given as the **Product of the Emitter Injection Efficiency** γ and the **Base (transfer) Transport Factor B.**

- An <u>**Increase**</u> **in α** with **injection** can be caused by <u>**Increases**</u> **in either of these factors, or both.** At **Very Low Current** (such as in the **Forward-Blocking State of the P-N-P-N diodes**), γ is usually **dominated by recombination** in the **transition region** γ <u>**Increases**</u>.

- There are **several mechanisms** by which the **Base Transport Factor B** **Increases** **with injection,** including the **Saturation of Recombination Centres** as the **Excess Carrier Concentration becomes Large.** Which ever **mechanism dominates,** the increase in $\alpha 1 + \alpha 2$ required for **Switching of the P-N-P-N Diode** is **automatically accomplished.**

- In general, **no special design** is required to maintain **$\alpha 1 + \alpha 2$ Smaller than Unity** during the **Forward-Blocking State;** this requirement is usually met at **Low Current** by the **Dominance of Recombination** within the **Transition Region of Junction J1 and J3.**

to be continued ....