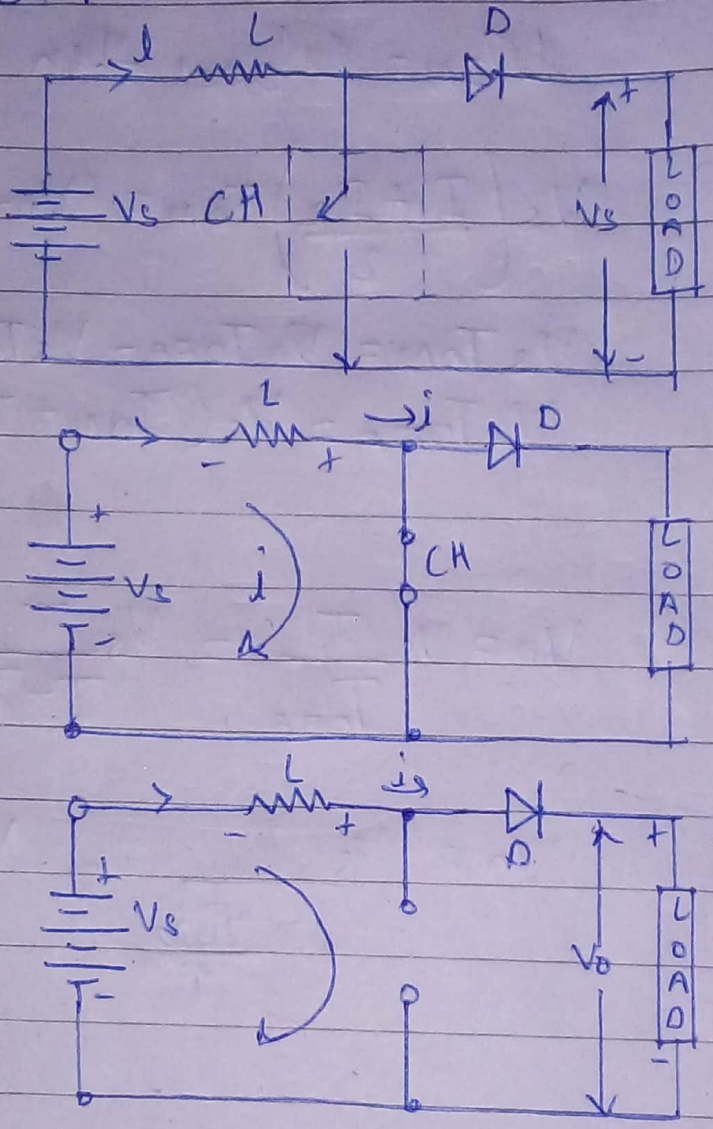
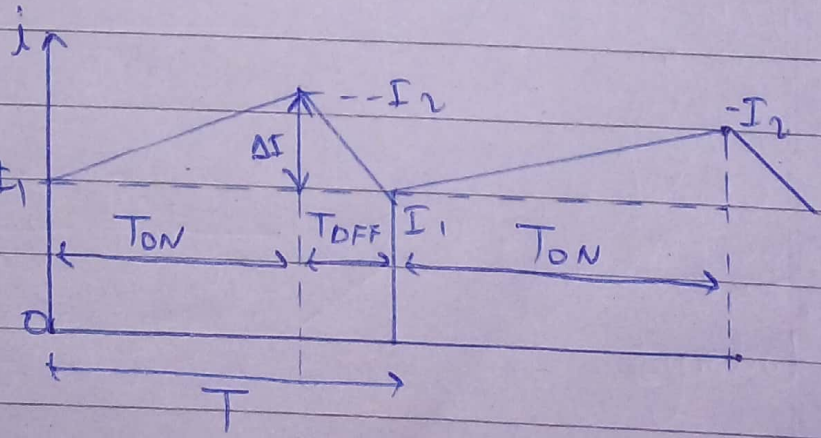
Boost converter - or Step-up chopper

The chopper having average O/P voltage V_o greater than input voltage V_s is called step-up chopper.





$$W_{IN} = V_s\left(\frac{I_1+I_2}{2}\right) T_{ON} \quad \text{---} (1)$$

W_{OFF} = (Voltage across L) x (Average current through L) x T_{OFF}

$$W_{OFF} = (V_o - V_s)\left(\frac{I_1 + I_2}{2}\right) T_{OFF} \quad \text{---(1)}$$

$W_{IN} = W_{OFF}$, then

$$V_s\left(\frac{I_1 + I_2}{2}\right) T_{ON} = (V_o - V_s)\left(\frac{I_1 + I_2}{2}\right) T_{OFF}$$

$$V_s T_{ON} = V_o T_{OFF} - V_s T_{OFF}$$

$$V_o T_{OFF} = V_s (T_{ON} + T_{OFF})$$

$\{ \because T = T_{ON} + T_{OFF}$

$$V_o = V_s \frac{T}{T_{OFF}} = V_s \frac{T}{T - T_{ON}}$$

$$V_o = V_s \frac{1}{1 - \frac{T_{ON}}{T}} = V_s \frac{1}{1-\alpha} \left(\alpha = \frac{T_{ON}}{T}\right.$$

Date / /

→ Power BJT

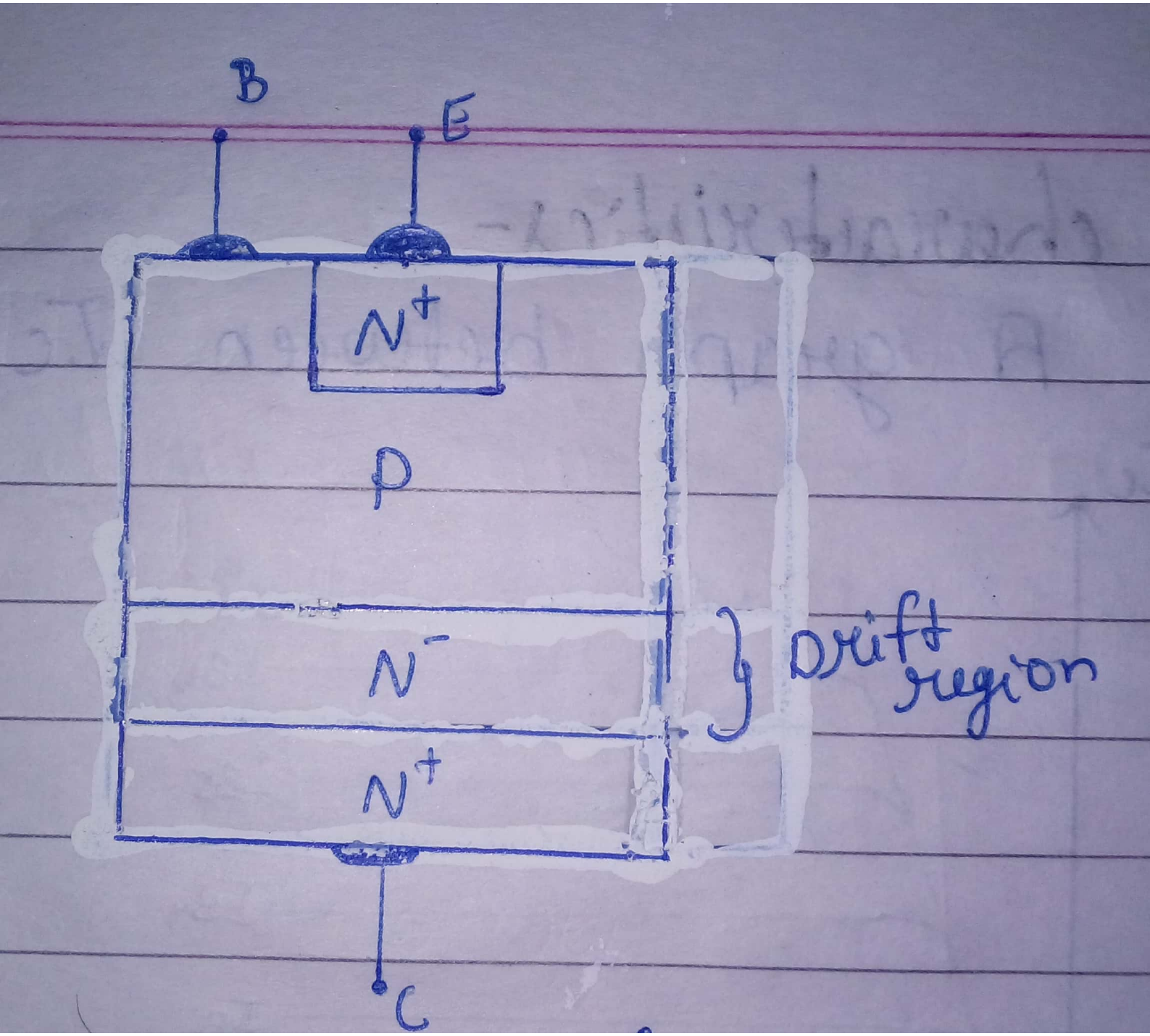
(Power Bipolar Junction Transistor)

A transistor is a device that regulates current or voltage flow & acts as a switch or gate for electronic signals. It consists of three layers of a semiconductor material, each capable of carrying a current.

The BJT blocks a high voltage in OFF-state & high current carrying capacity in the ON-state. The power handling capacity is very high.

← Construction of Power BJT-

It has three terminals Collector (C) Emitter (E) & Base (B). It is vertically oriented four-layers structure. The vertical structure use to increase the cross-sectional area.


B
E
N^+
P
N^-
N^+
C
Drift region

It has four layers. The first layer is heavily doped emitter layer (n^+). The second layer is moderately doped base layer (P). The third region is lightly doped collector drift region (n^-). The last layer is highly doped collector region (n^+).

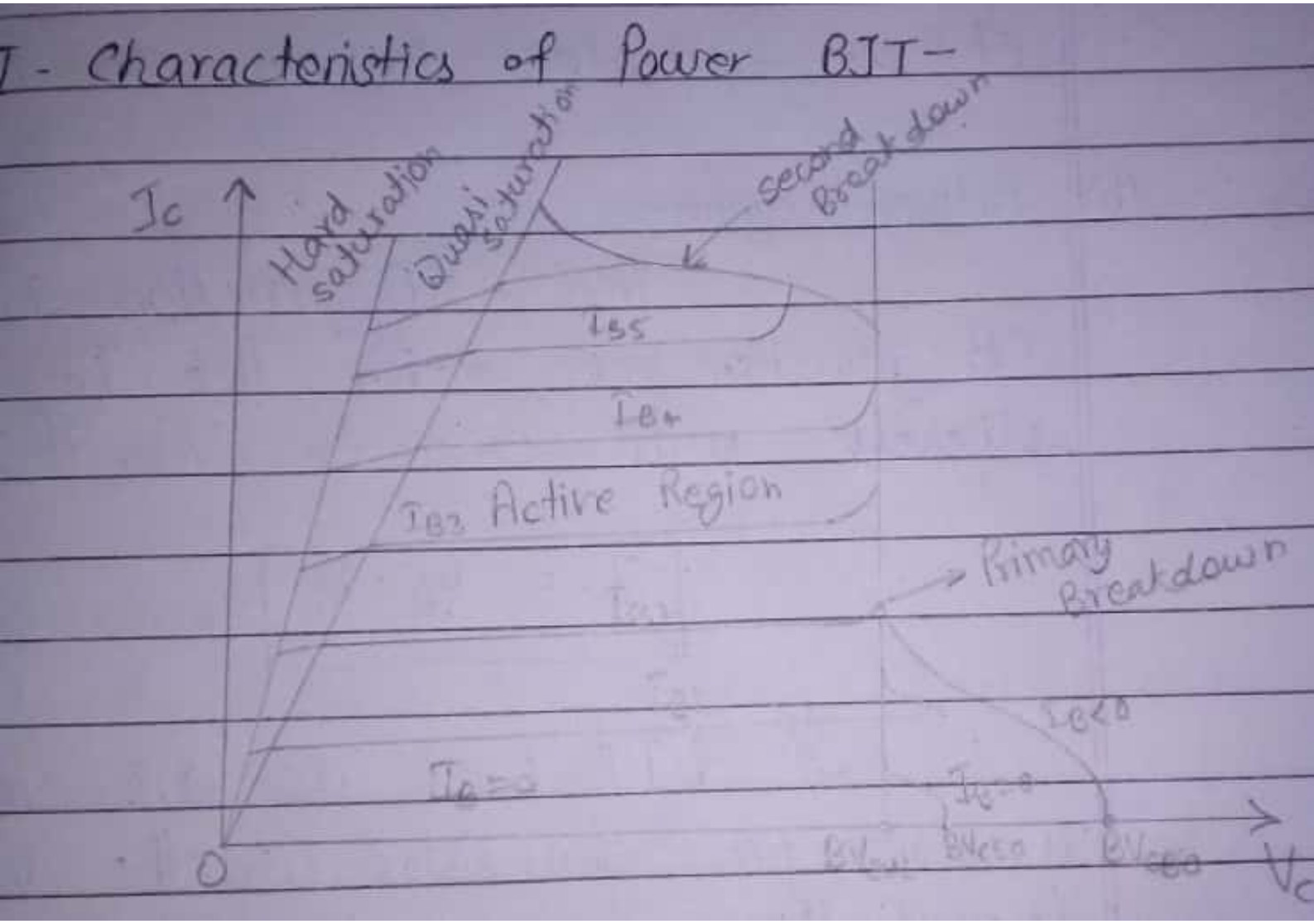
Working of power BJT-

As the Base & emitter junction is in forward bias (F.B.) and C-B junction is in reverse bias (R.B.). Because of F.B. at the B-E, the flow of the majority carriers takes place from the emitter to base.

As the region at the base, is of light doping, not all the majority carriers combine, Some of them tends to flow towards the collector. In this way, the currents at the E, B and C generated.

- $I_E = I_B + I_C$
- $I_B < I_E$ & $I_B < I_C$

I - Characteristics of Power BJT -



Application of boost converter

(i) In regulated DC power supply
(ii) In regenerative braking of DC machine
(iii) As switching regulators
(iv) In portable device applications
(v) In battery power applications

Application of BJT-

(i) Switching
(ii) Amplification.