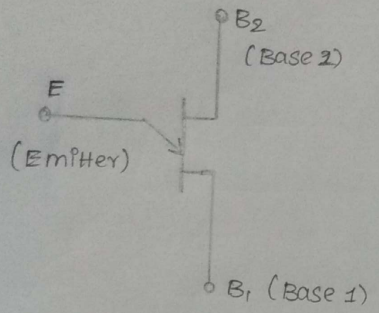
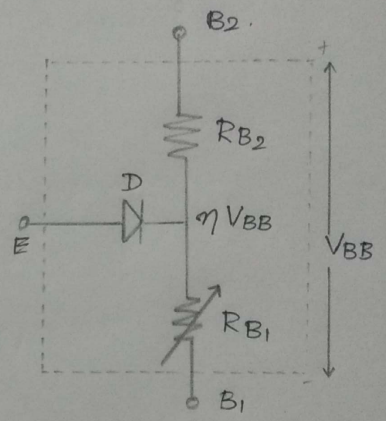
UNI JUNCTION TRANSISTOR

current controlled negative resistance device.

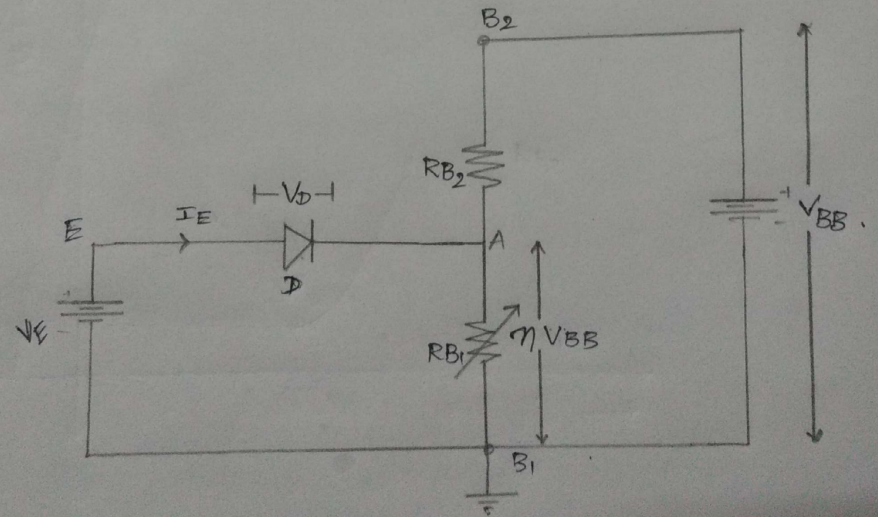
SYMBOL



SIMPLIFIED EQUIVALENT CIRCUIT

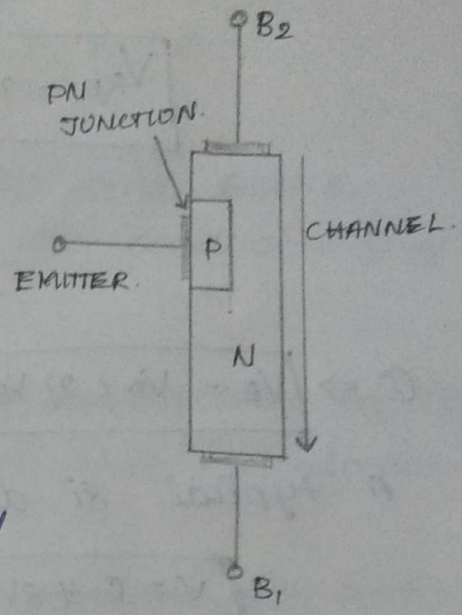


CIRCUIT DIAGRAM:-



Construction:-

- Has 3 terminals ⇒ an emitter, & Bases B_1 and B_2. Since it consists of two Bases, it is also called double base diode.



- Base is formed of lightly doped n-type bar of silicon. & ohmic contacts B_1 and B_2 are attached to its ends.

- Emitter is formed of Heavily doped P-type material.

Emitter is located closer to B_2 than B_1. Resistance between Base 1 and Base 2 when Emitter Junction is open is called Inter base Resistance.

Working:-

- When no potential exists b/w Emitter and Either of its base, extremely small current flows from Base 1 to Base 2.
- UJT works effectively when the Emitter-Base Junction is forward biased.
- The Emitter Base Junction is forward biased only when the applied potential (V_E) is greater than the sum of the Barrier potential of the diode (V_D) and voltage drop across R_{B1}.

i.e $\boxed{V_E = V_D + V_{RB_1}} \rightarrow (1)$.

By Applying voltage division Rule, in the circuit

$$V_{RB_1} = \frac{V_{BB}}{R_{B_2} + R_{B_1}} \cdot R_{B_1}$$

$$\boxed{V_{RB_1} = \eta V_{BB}} \quad \text{where } \eta = \frac{R_{B_1}}{R_{B_2} + R_{B_1}}$$

η - intrinsic stand-off Ratio.

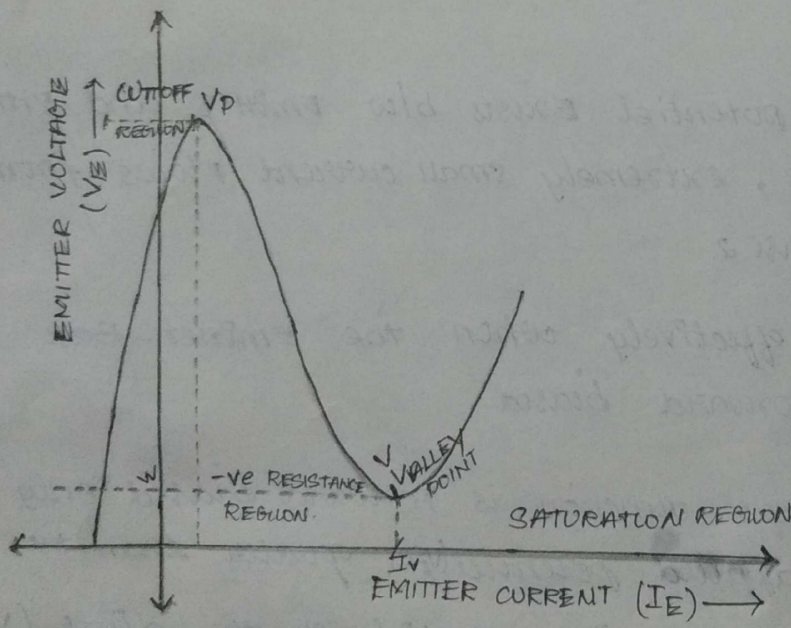
typical Range → (0.4 to 0.8)

① ⇒ $\boxed{V_E = V_D + \eta V_{BB}}$

A typical Si diode has $V_D = 0.7$ eV.

$$\boxed{V = 0.7\text{ eV} + \eta V_{BB}}$$

Thus, the minimum value of emitter voltage V_E for which the emitter starts to flow is called Triguring / Firing voltage of UJT.



- As V_E increases, emitter current (I_E) also will increase and here the Junction behaves like a typical PN Junction.

But V_E can be increased upto particular voltage called peak voltage (V_P).

At this point considerable amount of emitter current flows and significant number of Holes are injected into the junction. These Holes are Repelled by B_2 and attracted by B_1.

- As a Result, Region b/w emitter and Base B_1 starts saturating by holes and the conductivity of this Region starts to increase

This phenomenon of increase in conductivity by the insertion of Holes is called conductivity modulation.

- This increase in conductivity, reduces R_{B_1} and η.

This Results in a condition where I_E increases and V_E decreases. and this situation results in negative - Resistance Region.

- The negative Resistance Region of curve lasts until the valley point V is reached with the valley voltage (V_v) and valley point current I_v.

After the valley point, the device is driven to Saturation.

Applications :-

1) Triggering device for SCR's and TRIAC's.

2) Sawtoothed generators, simple oscillators, Phase control and timing circuits.

3) Simplest of all UJT is Relaxation oscillator producing non-sinusoidal waveforms.