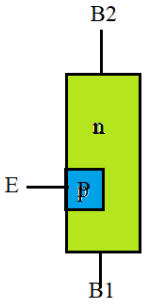
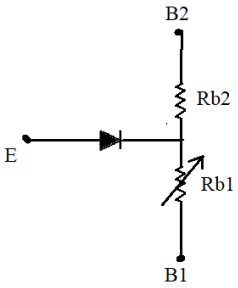
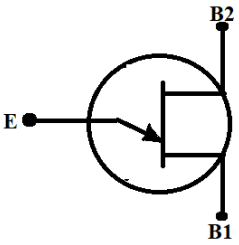
Unit 2: **Silicon Controlled Rectifier (SCR)**

Module 7: UJT firing circuit and Synchronized UJT firing circuit **Unit 2**

Unijunction transistor (UJT)

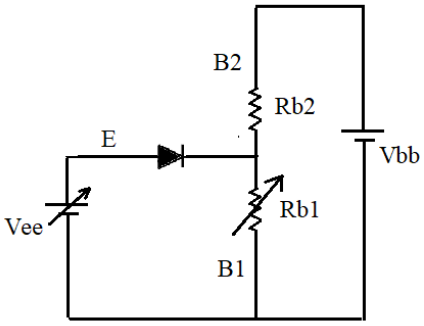


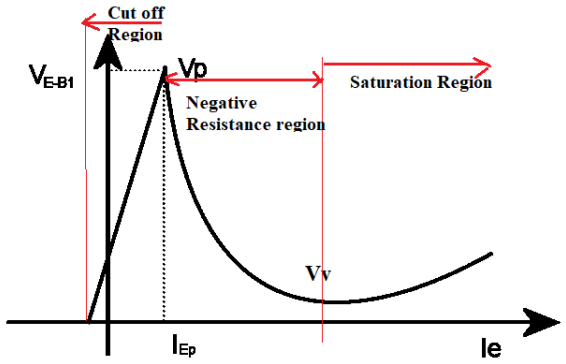




A unijunction transistor (UJT) is an electronic semiconductor device that has only one junction. The UJT has three terminals: an emitter (E) and two bases (B1 and B2). The base is formed by lightly doped n-type bar of silicon. Two ohmic contacts B1 and B2 are attached at its ends. The emitter is of p-type and it is heavily doped. The resistance between B1 and B2, when the emitter is open-circuit is called inter-base resistance.

$$V_{R_{B1}} = \frac{R_{B1}V_{BB}}{(R_{B1}+R_{B2})}\Big|_{I_E=0} = \eta V_{BB}$$

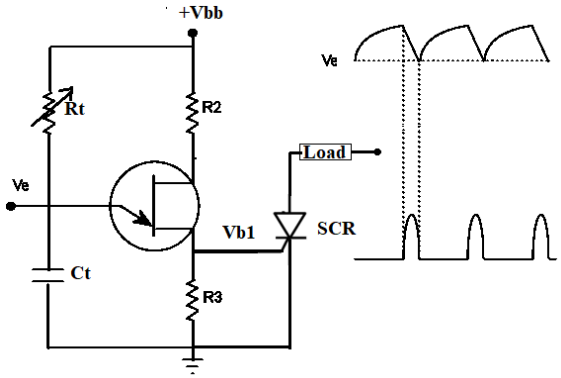




I-V(Emitter) Characteristics of UJT

$$V_p = \eta V_{BB} + V_D$$

UJT Firing Circuit



$$T = RC \ln(1/(1-\eta))$$

$$F = \frac{1}{RC \ln(1/(1-\eta))}$$

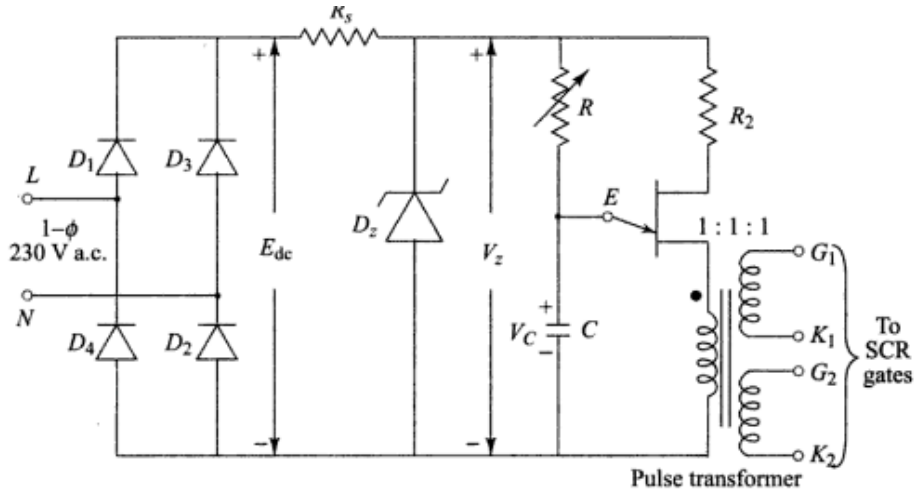
It is the most common method of triggering the SCR because the prolonged pulses at the gate using R and RC triggering methods cause more power dissipation at the gate so by using UJT (Uni Junction Transistor) as triggering device the power loss is limited as it produces a train of pulses.

The RC network is connected to the emitter terminal of the UJT which forms the timing circuit. The capacitor is fixed while the resistance is variable and hence the charging rate of the capacitor depends on the variable resistance means that the controlling of the RC time constant.

When the voltage is applied, the capacitor starts charging through the variable resistance. By varying the resistance value voltage across the capacitor get varied. Once the capacitor voltage is equal to the peak value of the UJT, it starts conducting and hence produce a pulse output till the voltage across the capacitor equal to the valley voltage Vv of the UJT. This process repeats and produces a train of pulses at base terminal 1.

The pulse output at the base terminal 1 is used to turn ON the SCR at predetermined time intervals.

Synchronized UJT firing circuit



Synchronized UJT trigger-circuit

Synchronized UJT triggering circuit is shown in Fig. The diode bridge D1−D4 rectifies a.c. to d.c. Resistor Rs lowers Vdc to a suitable value for the zener diode and UJT. The zener diode Dz is used to clip the rectified-voltage to a fixed voltage Vz. This voltage Vz is applied to the charging circuit RC.

Capacitor C Charges through R until it reaches the UJT trigger voltage Vp. The UJT then turns "on" and capacitor C discharges through the UJT emitter and primary of the pulse-transformer. The windings of the pulse transformer have pulse voltages at their secondary terminals. Pulses at the two secondary windings feed the same in phase pulse to two SCRs of a full wave circuit. SCR with positive anode voltage would turn ON. Rate of rise of capacitor voltage can be controlled by varying R. The firing angle can be controlled up to about 150◦. This method of controlling the output power by varying charging resistor R is called as ramp control, open loop control or manual control.