BASIC ELECTRONICS(3320701)

OSCILLATOR

Need of an Oscillator

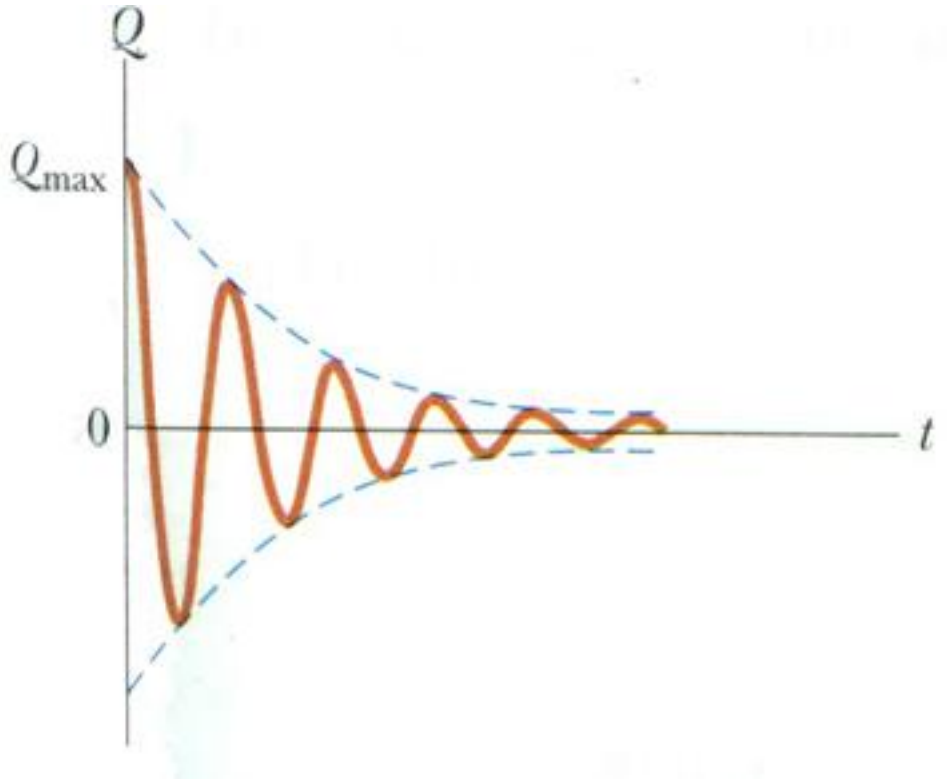
- An oscillator circuit is capable of producing ac voltage of desired frequency and waveshape.
- To test performance of electronic circuits, it is called signal generator.
- It can produce square, pulse, triangular, or sawtooth waveshape.
- High frequency oscillator are used in broadcasting.
- Microwave oven uses an oscillator.
- Used for induction heating and dielectric heating.

Types of Oscillators

- Sinusoidal or non-sinusoidal.
- An oscillator generating square wave or a pulse train is called multivibrator :
  1. Bistable multivibrator (Flip-Flop Circuit).
  2. Monostable multivibrator.
  3. Astable multivibrator (Free-running).
- Depending upon type of feedback, we have
  1. Tuned Circuit (*LC*) oscillators.
  2. *RC* oscillators, and
  3. Crystal oscillators.

Damped oscillation

- WHEN THE MAGNITUDE OF VOLTAGE IS DECREASING & AFTER SOME TIME, IT BECOMES 0(ZERO) OSCILLIATION STOPPED.



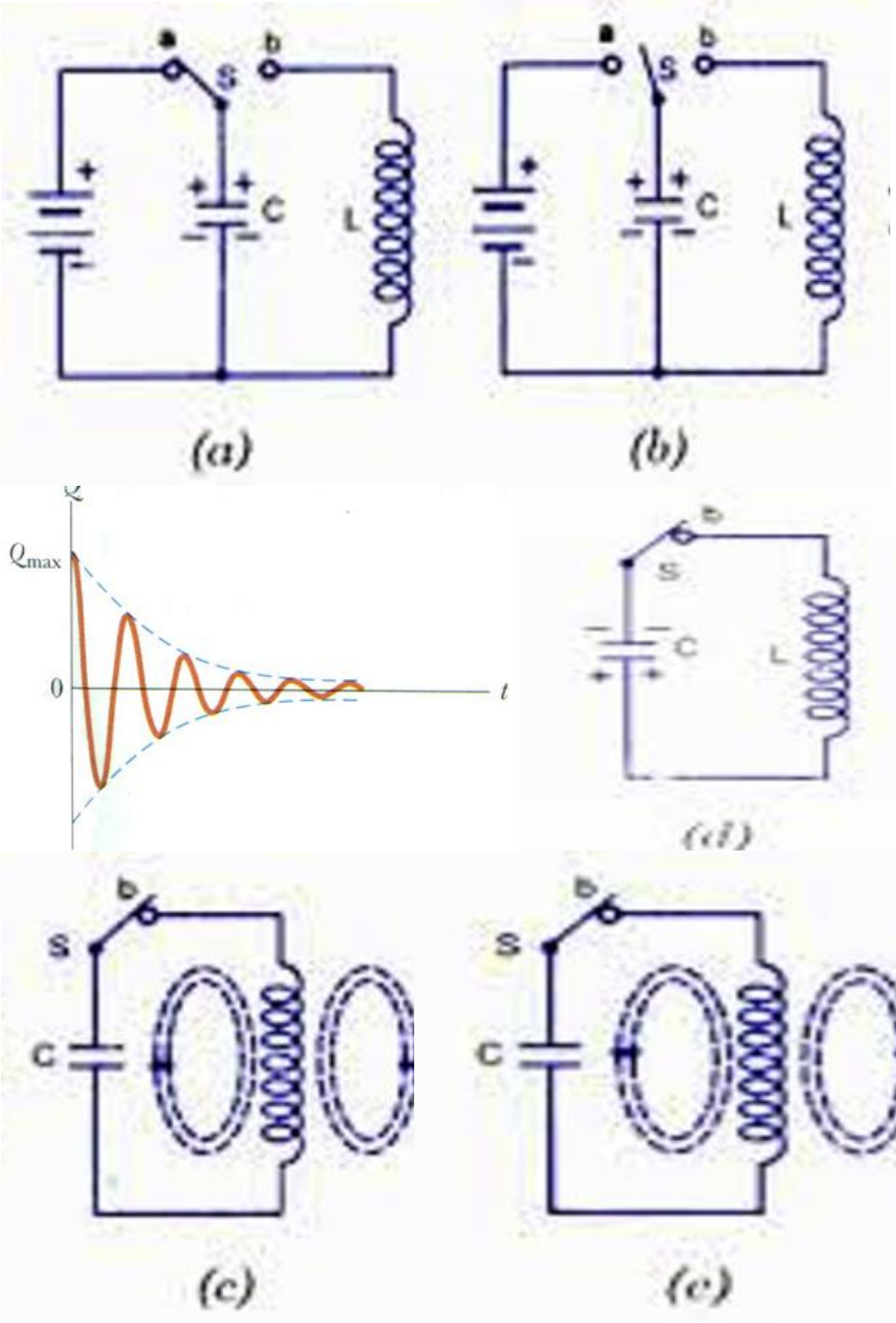
DAMPED OSCILLIATION IN LC TUNED CIRCUIT

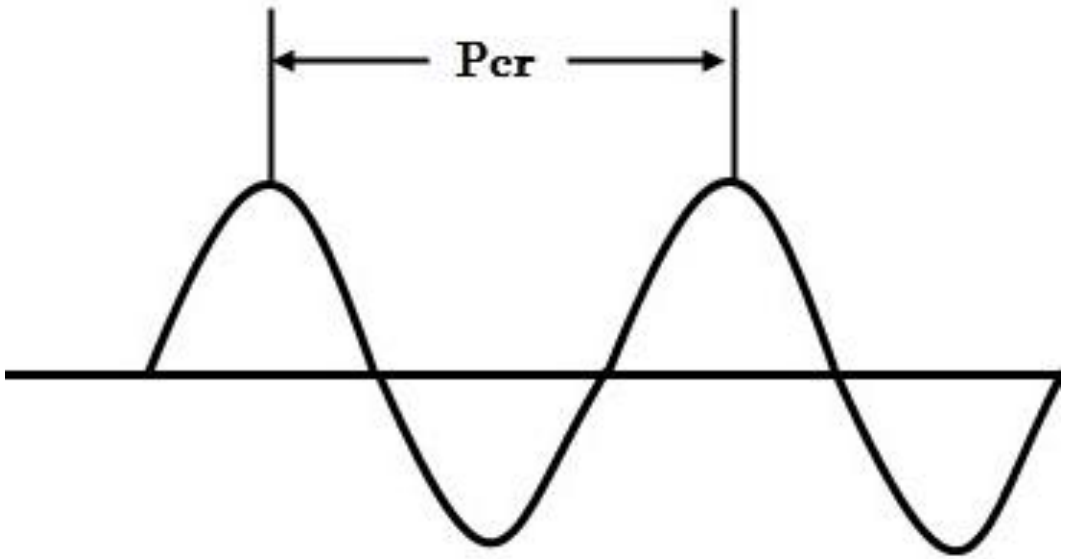
- IN FIG A SHOWN THAT KEY S IS BROUGHT TO POSITION A.

THE CAPASITOR C CHARGES. SO POSITIVE CHARGE IS TO UPPER PLATE W.R.T BOTTOM PLATE. SO VOLTAGE INCREASES & ENERGY STORED.

- NOW WHEN KEY S IS CONNECTED TO POSITION C CAPACITOR CONNECTED TO L. SO VOLTAGE DECRESES.

SO DAMPED OSCILLIATION IS DONE.



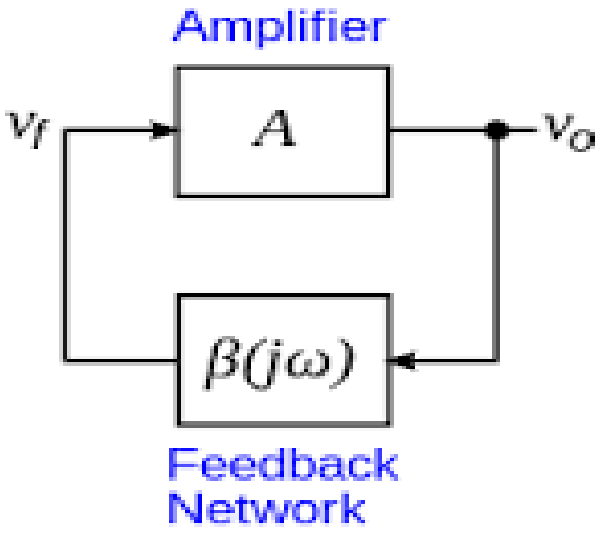


Sustained Oscillations
with period Pcr

SUSTAINED OSCILLATION

WHEN PRODUCED ENERGY IS EQUL TO WASTE ENERGY IN CAPACITOR & INDUCTOR.

AMPLIFIER WITH POSITIVE FEEDBACK AS OSCILLIATOR



IN FIGURE POSITIVE FEEDBACK SHOWN .A IS GAIN . POSITIVE FEEDBACK IS GIVEN TO B.

TOTAL GAIN :- Af=A/1-AB

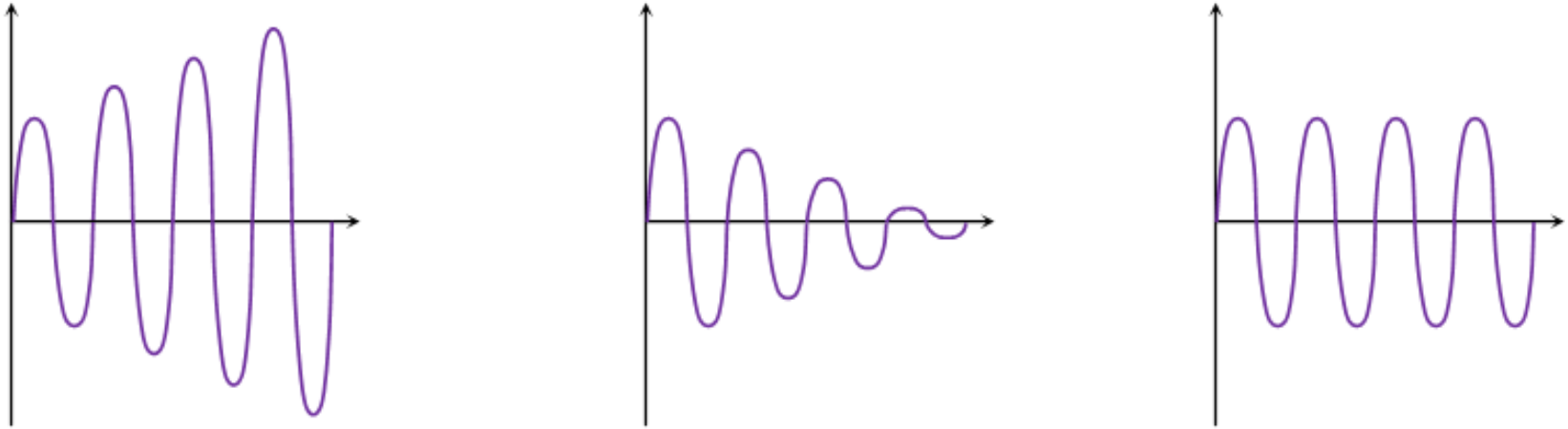


Figure 2 (a) Increasing Oscillations (b) Decaying Oscillations (c) Constant-Amplitude Oscillations

- IF AB < 1 SO Vf DECREASES (fig.b)
- IF AB > 1 SO Vf INCREASES (fig.a)
- IF AB = 1 (fig.c)

Af=A/1-AB =1/0=Infinite.

REQUIRMENT OF AN OSCILLIATOR

- ACTIVE DEVICE:-It works as amplifier. For this value/FET/transistor are used.
- POWER SUPPLY:-It is necessary for biasing the active device & to compensate for the energy loss.
- FREQUENCY DETERMINING NETWORK:-In LC oscilliation frequency of oscilliator depends upon the tuned circuit.

REQUIRMENT OF OSCILLIATOR

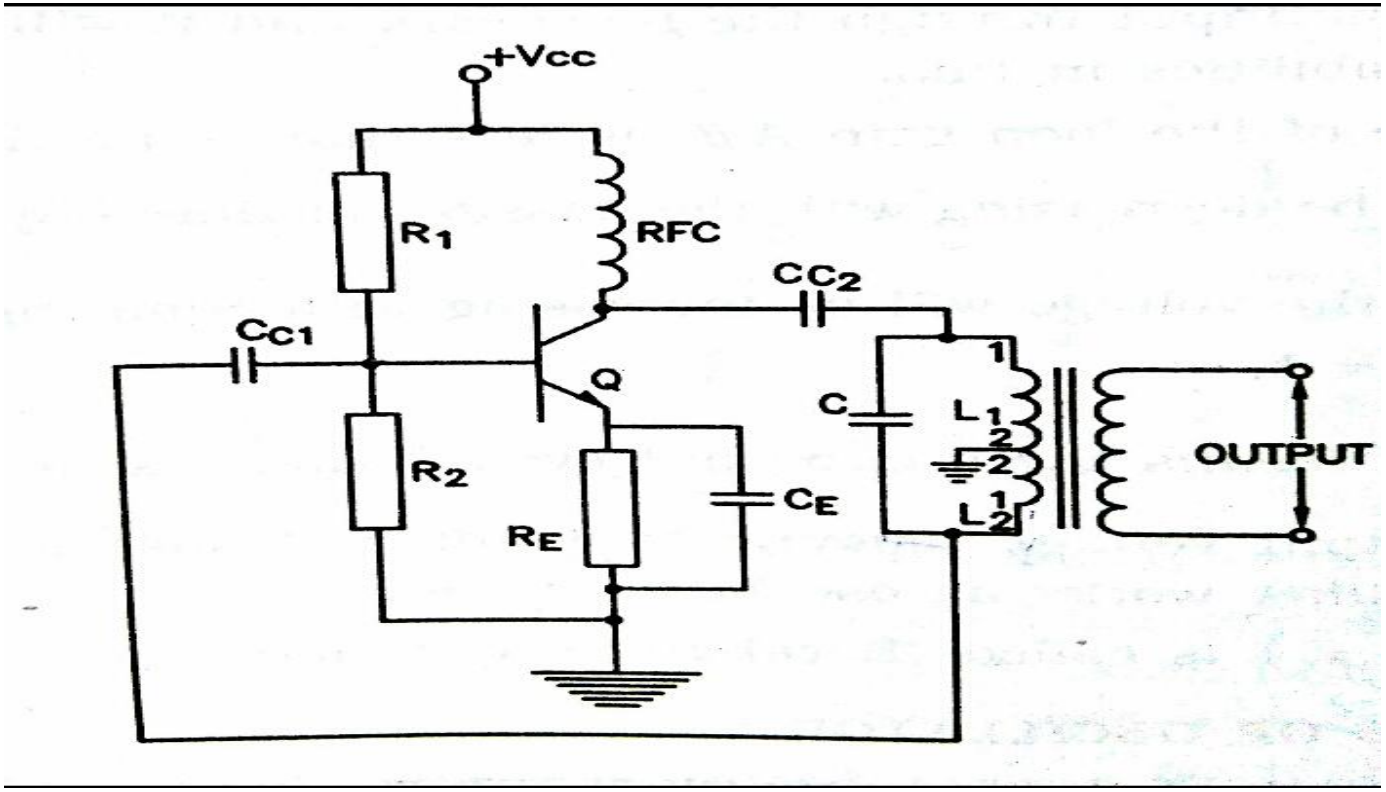
- POSITIVE FEEDBACK:- It is essential.
- Initially value of AB should be more than 1.
- Value of loop gain AB should be equal to 1 after the oscillations are started.

Hartley Oscillator

- The **Hartley oscillator** is an electronic oscillator circuit in which the oscillation determined by a tuned circuit consisting of **capacitors & inductors** , that is , an **LC oscillator**. The circuit was invented in 1915 by **American** engineer Ralph **Hartley.**

- The distinguishing feature of the Hartley oscillator is that the tuned circuit consist of a **single capacitor** in **parallel with two inductors in series**, and the **feedback signal** needed for oscillation is **taken** from the **center connection of two inductors.**

The diagram of Hartley oscillator



Hartley Oscillator

- Some important formulae from Hartley oscillator:

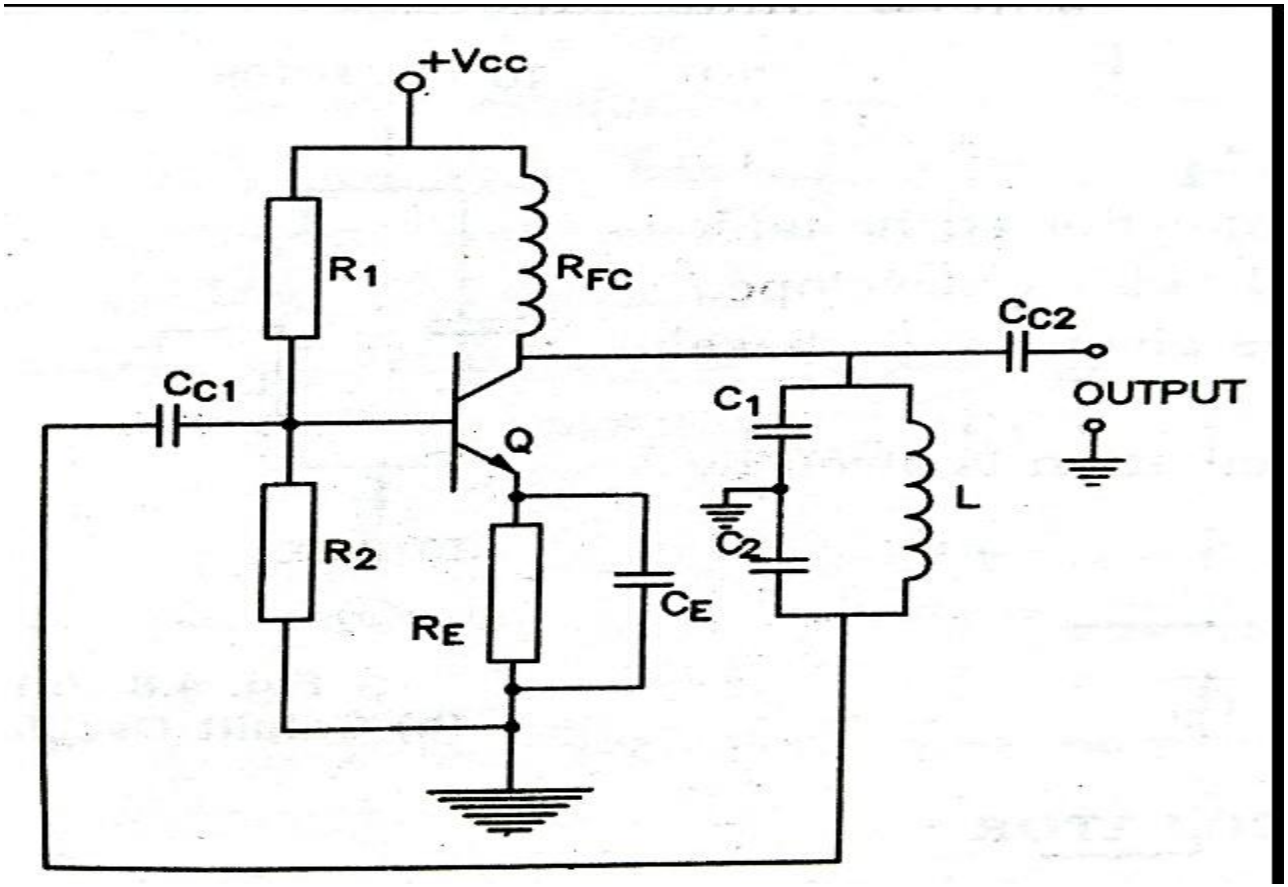
$$f = \frac{1}{2\pi\sqrt{LC}}$$

L=L1 + L2

Colpitt Oscillator

- A Colpitt oscillator, invented in 1918 by American engineer Edwin H. Colpitts, is one of a number of designs for LC oscillators, electronic oscillator that use a combination of inductors and capacitors to produce an oscillation at a certain frequency.
- The distinguishing feature of the colpitts oscillator is that the feedback for the active device is taken from a voltage divider made of two capacitors in series across the inductor.

The diagram of Colpitt oscillator



Colpitt Oscillator

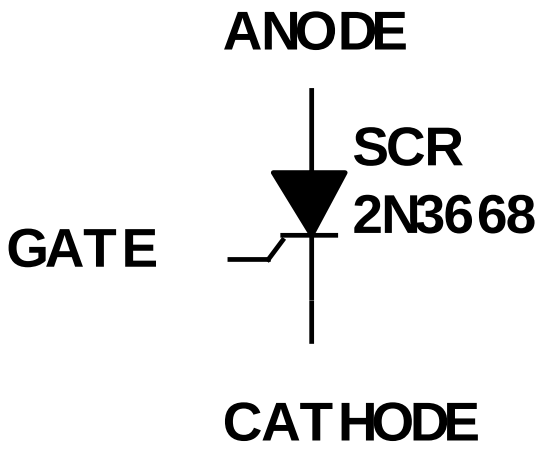
- Some important formulae from colpitt oscillator:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

$$C = \frac{C1\ C2}{C1 + C2}$$

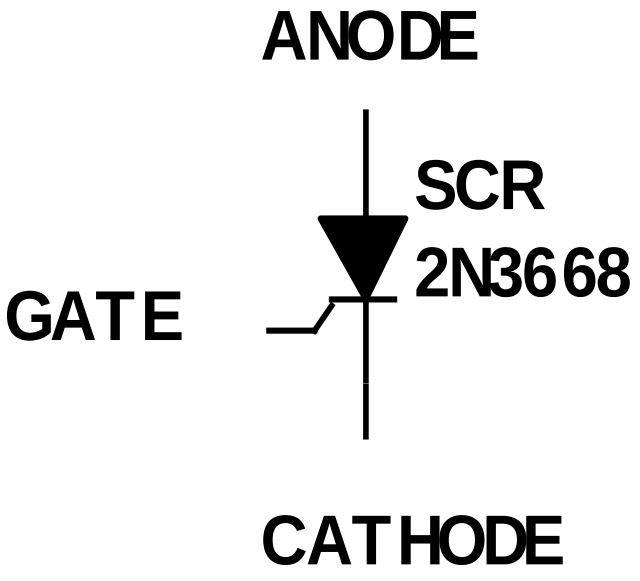
Silicon Controlled Rectifier-SCR

- Circuit Symbol and Terminal Identification



SCR / Thyristor

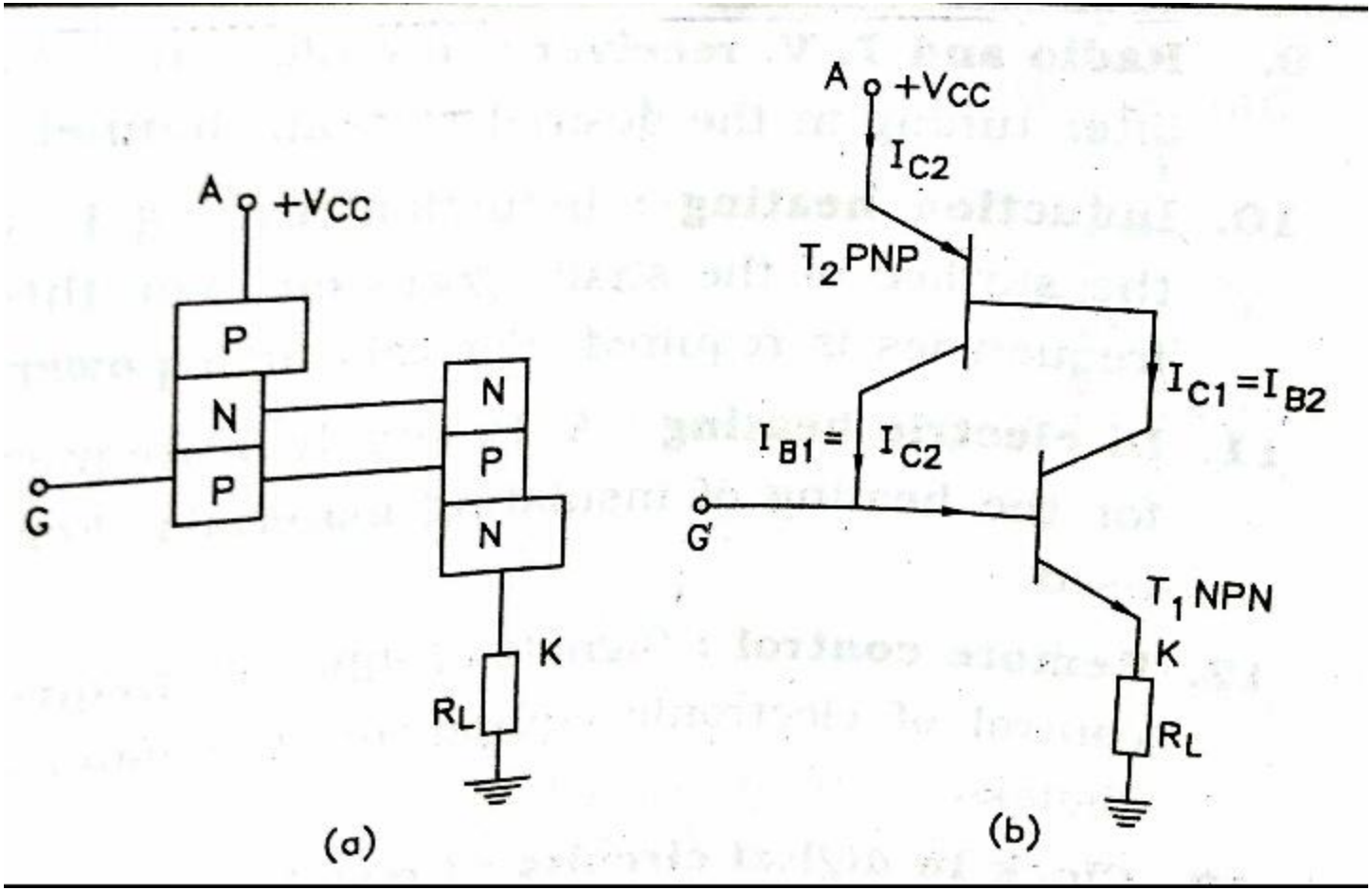
- Anode and Cathode terminals as conventional pn junction diode
- Gate terminal for a controlling input signal



SCR/ Thyristor

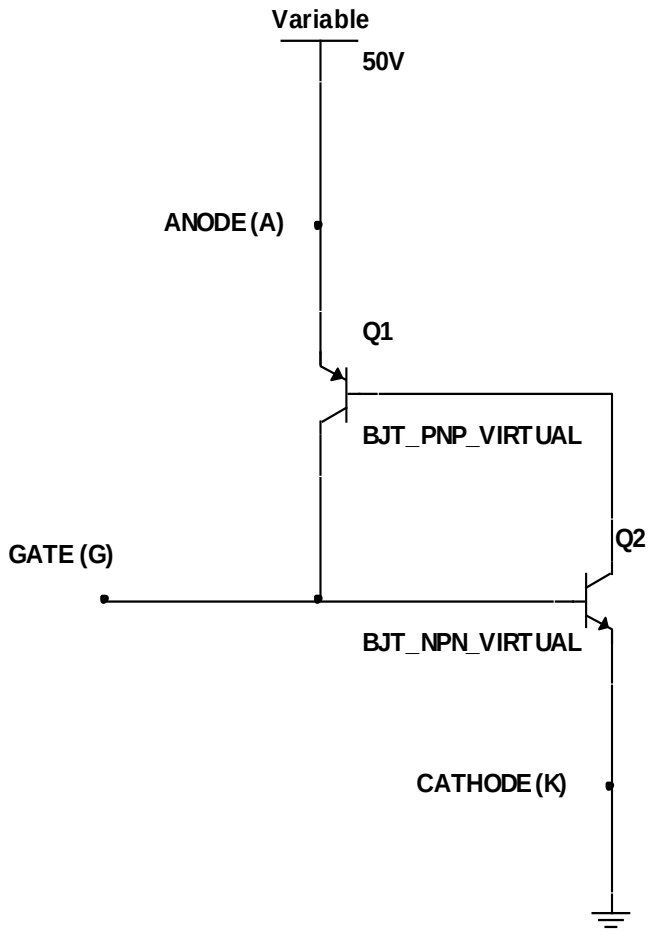
- An SCR (Thyristor) is a “controlled” rectifier (diode) Control the conduction under forward bias by applying a current into the Gate terminal Under reverse bias, looks like conventional pn junction diode.
- 4-layer (pnpn) device.
- Anode, Cathode as for a conventional pn junction diode.
- Cathode Gate brought out for controlling input.

Equivalent Circuit



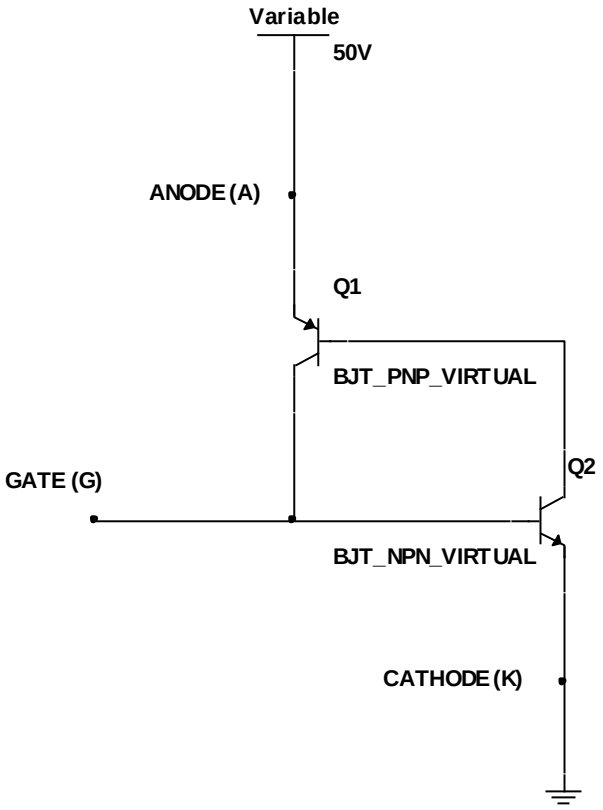
Apply Biasing

- With the Gate terminal OPEN, both transistors are OFF. As the applied voltage increases, there will be a "breakdown" that causes both transistors to conduct (saturate) making $I_F > 0$ and $V_{AK} = 0$.
- $V_{Breakdown} = V_{BR(F)}$



Apply a Gate Current

- For $0 < V_{AK} < V_{BR(F)}$,
- Turn Q_2 ON by applying a current into the Gate
- This causes Q_1 to turn ON, and eventually both transistors SATURATE
- $V_{AK} = V_{CEsat} + V_{BEsat}$
- If the Gate pulse is removed, Q_1 and Q_2 still stay ON!



How do you turn it OFF?

- Cause the forward current to fall below the value if the “holding” current, I_H

- Reverse bias the device.

Application Of SCR

- It is used for the speed control of the D . C motors.
- It used for the temperature control of the furnace,
- It is used in electronic ignition of automobiles.
- It is used in poly phase rectifiers and inverter.

THANK YOU