

Introduction

The silicon-controlled rectifier(SCR) which is a power electronic device is unquestionable of the greatest interest today. It was first introduced in 1956 by Bell Telephone Laboratories. It can convert alternating current into direct current and at the same time can control the amount of power fed to the load. Thus it combines the features of a rectifier and a transistor.

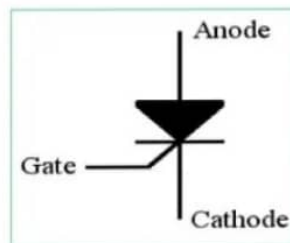
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What is a silicon control rectifier?

- ❑ A Silicon Controlled Rectifier (SCR) is a four layer solid state device that controls current flow. SCR is a three terminal device.

The terminals are:

- Gate (G)
- Anode (A)
- Cathode (K)



- ❑ Two main uses of SCR are:
 - Switching
 - Amplification

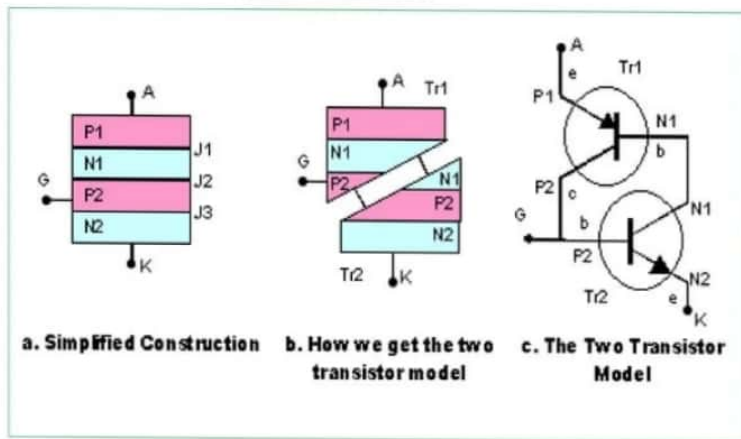
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Basic SCR structure

- ❑ The SCR consists of a four layer p-n-p-n structure with the outer layers are referred to as the anode (p-type) and cathode (n-type). The control terminal of the SCR is named the gate and it is connected to the p-type layer located next to the cathode.
- ❑ The three junctions are normally denoted as J_1 , J_2 , and J_3 . They are numbered serially with J_1 being nearest to the anode.

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Basic SCR



Basic SCR connection

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How does SCR work?

- ❑ Load is connected in series with anode.
- ❑ The anode is always kept at a higher potential than the cathode.

The working of SCR is to be studied under two different conditions:

1. When Gate (G) is open
2. When Gate (G) is positive with respect to Cathode (K)

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-When Gate is Open

no voltage to the gate. J_2 is reverse biased while J_1 & J_3 are forward biased. reverse bias, no current will flow through the device \Rightarrow SCR is cut-off.

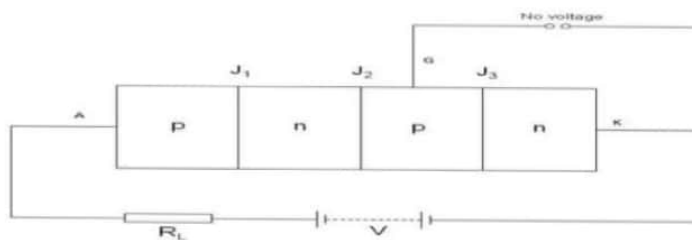


Fig: SCR with gate open

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When Gate is positive with respect to cathode

- J3 is forward biased, J2 is reverse biased.
- Electrons from n-type material start moving across J3 towards left
- Similarly, holes move from p-type material towards the right.
- Eventually, the electrons that moved across J3 are now attracted across J2. This initiates the Gate current and the J2 is now conducting.

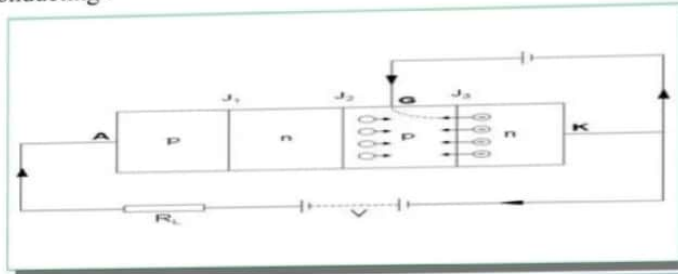
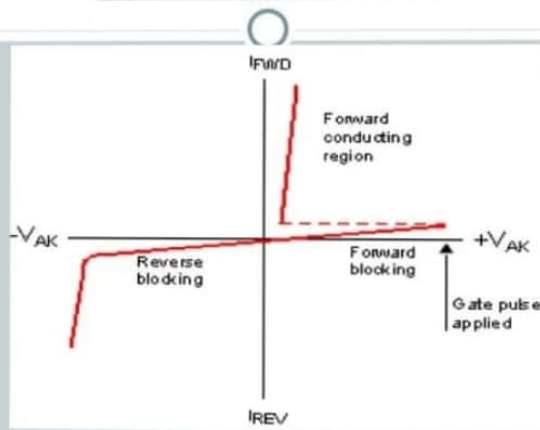


Fig: applying gate voltage

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Characteristics curve



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The SCR has three basic states:

1. Forward blocking mode or off state: In this mode or state the SCR operation is such that it blocks forward current conduction that would normally be carried by a forward biased diode.

2. Forward conduction mode or on state: In this mode the SCR has reached into conduction.

3. Reverse blocking mode or off state: In this mode or state the SCR blocks the current in the same way as that of a reverse biased diode.

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Importance of SCR

- ❑ It has small size and gives trouble free service
- ❑ Reliable fast action and light weight
- ❑ no mechanical part , noiseless operation

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Application for SCRs:

1. Rectification ,
2. Regulated power suppliers,
3. Static switches ,
4. Motor speed controls and,
5. Battery charger and heater controls, etc.

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Conclusion

Finally , Silicon control rectifier (SCR) are widely used in many areas of electronics. SCR circuits can be used for many power applications as these electronics components are able to switch high currents very easily. In addition, these electronics components are very cheap and they are widely available.

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