

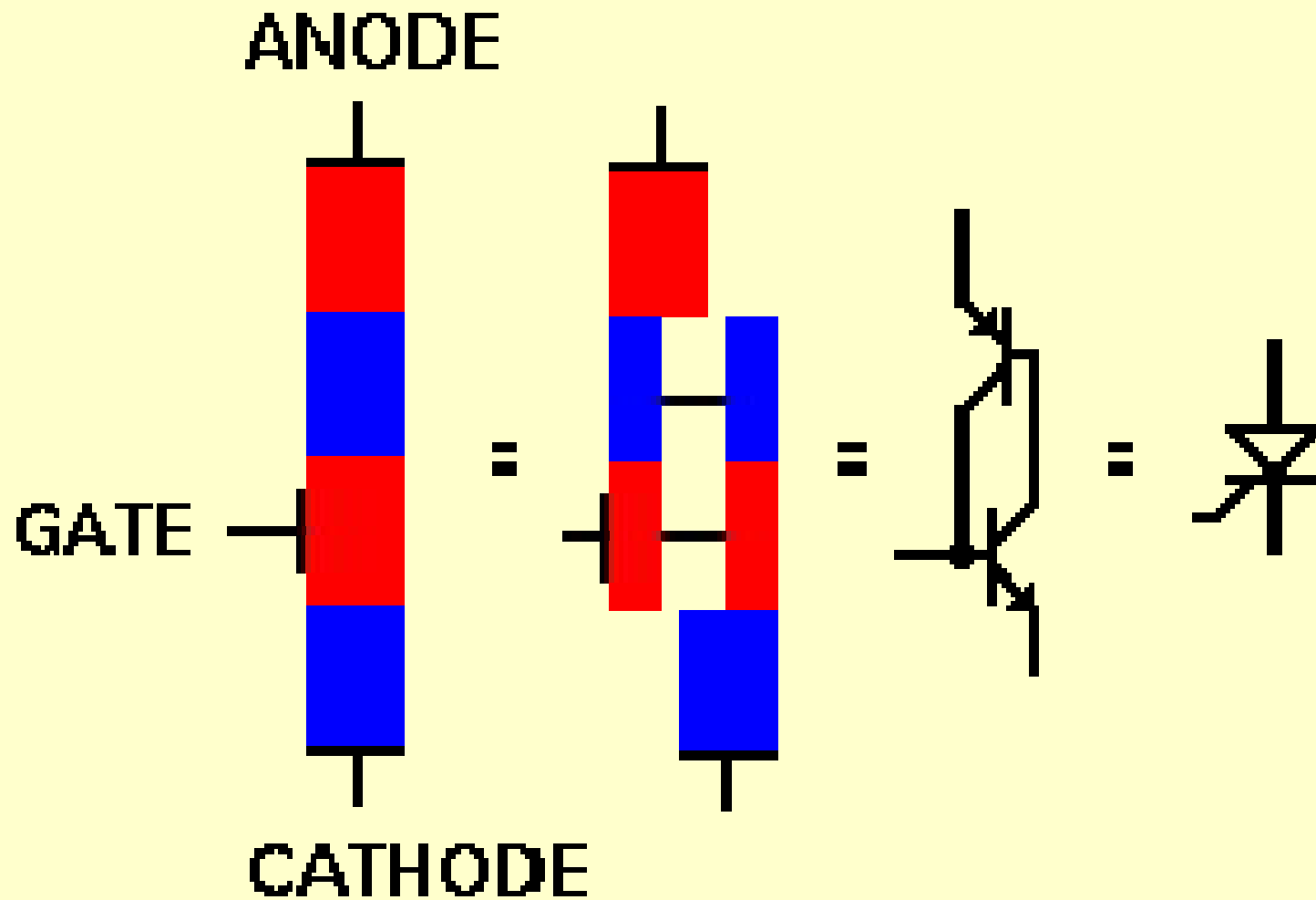
EDC UNIT IV- Transistor and FET Characteristics

Lesson-21: Silicon controlled rectifier

Silicon Controlled Rectifier (SCR)

- The four-layer construction in *Silicon Controlled Rectifier*, or SCR
- We ground both the cathode and the gate, and apply a positive voltage to the anode, no current will flow through this device
- This device acts as a switch that is cheaper than a relay and is able to handle the large power dissipation that we are expecting

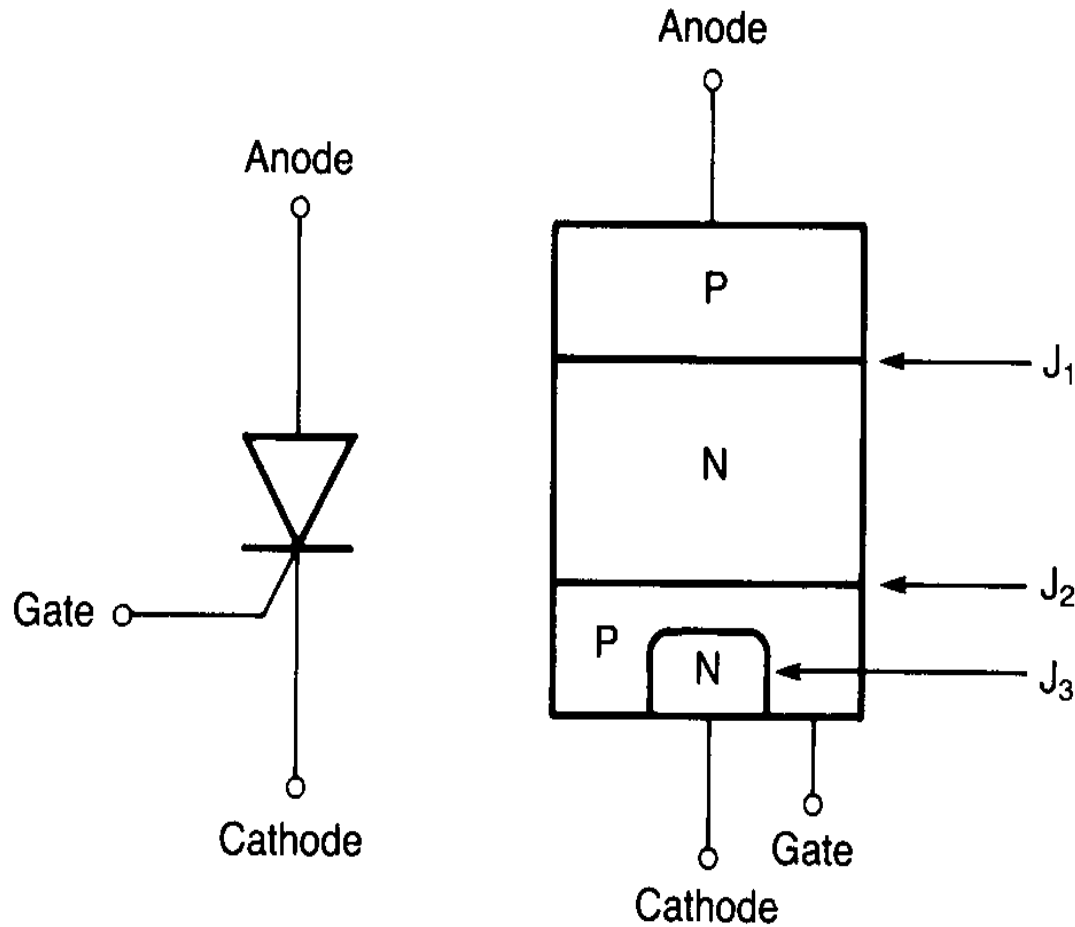
SCR



The Silicon Controlled Rectifier (SCR)

- Simply a conventional rectifier controlled by a gate signal.
- The main circuit is a rectifier, however the application of a forward voltage is not enough for conduction.
- A gate signal controls the rectifier conduction.

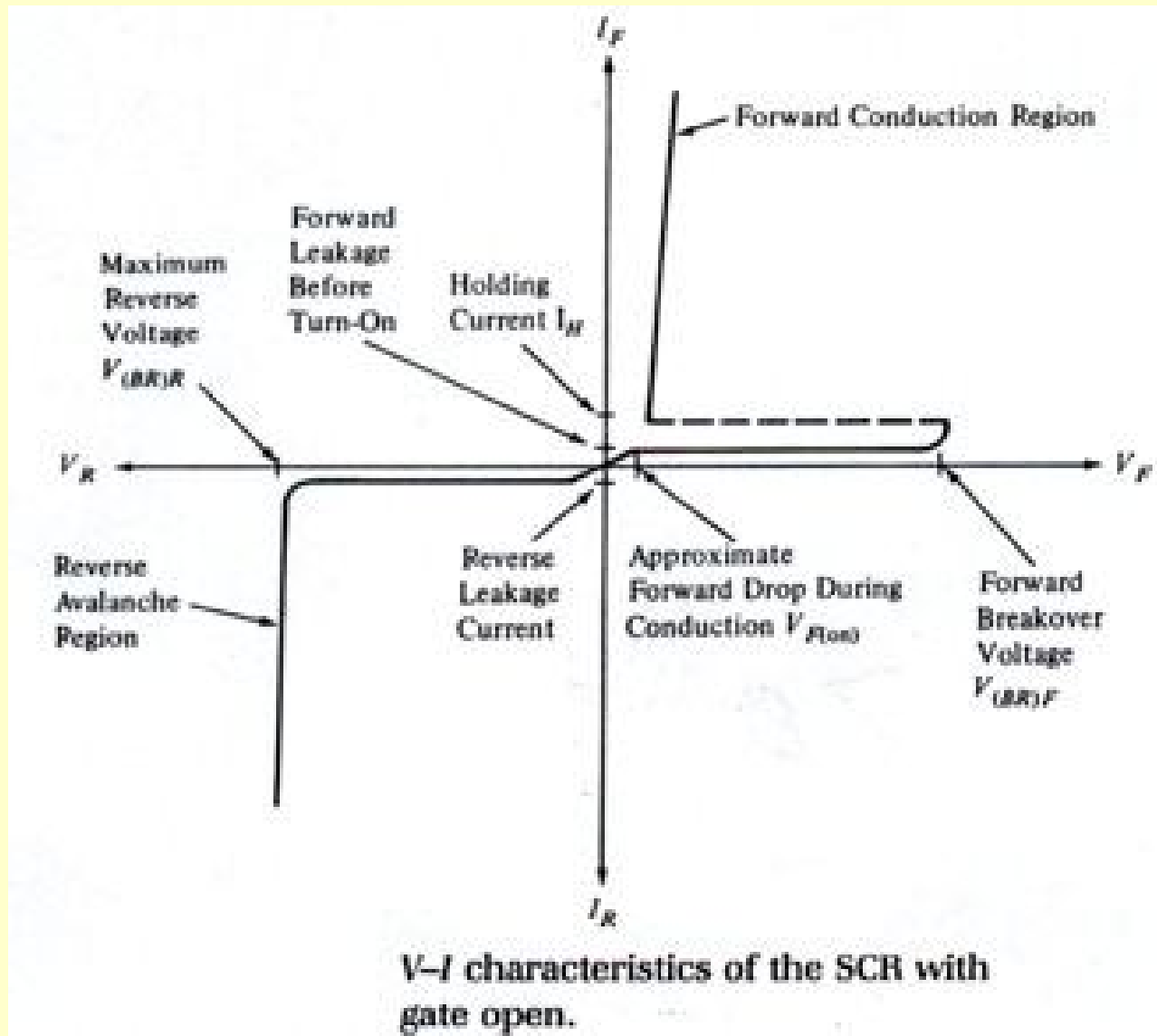
Silicon Controlled Rectifier (SCR)



SCR

- The rectifier circuit (anode-cathode) a low forward resistance and a high reverse resistance.
- Controlled from an off state (high resistance) to the on state (low resistance) by a signal applied to the third terminal, the gate. Once it is turned on it remains on even after removal of the gate signal, as long as a minimum current, the holding current, I_h , is maintained in the main or rectifier circuit. To turn off an SCR the anode-cathode current must be reduced to less than the holding current, I_h .

I-V Characteristics



SCR Parameters

- - (a) Peak forward and reverse breakdown voltages
 - (b) Maximum forward current
 - (c) Gate trigger voltage and current
 - (d) Minimum holding current, I_h
 - (e) Power dissipation
 - (f) Maximum dV/dt

SCR - Continued

- **Three terminals**
 - anode - P-layer
 - cathode - N-layer (opposite end)
 - gate - P-layer near the cathode
- **Three junctions - four layers**

Connect power such that the anode is positive with respect to the cathode - no current will flow

NOTE: Blocked by the reverse bias of junction 2

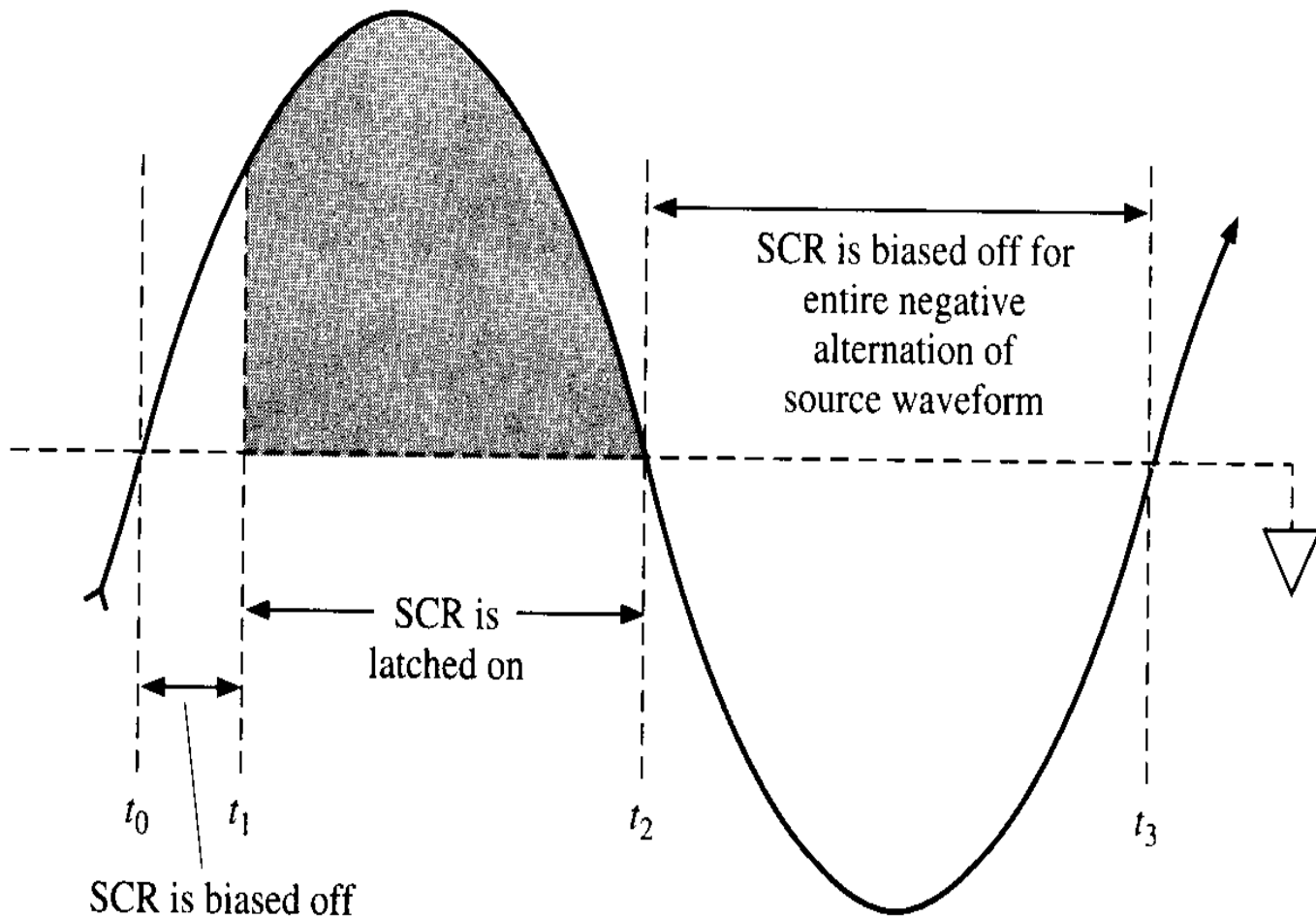
SCR - Continued

- **Positive potential applied to the gate**
 - **Current will flow - TURNED-ON**
 - **Once turned on, gate potential can be removed and the SCR still conducts**

CALLED LATCHING

- **Holding current maintains latch**

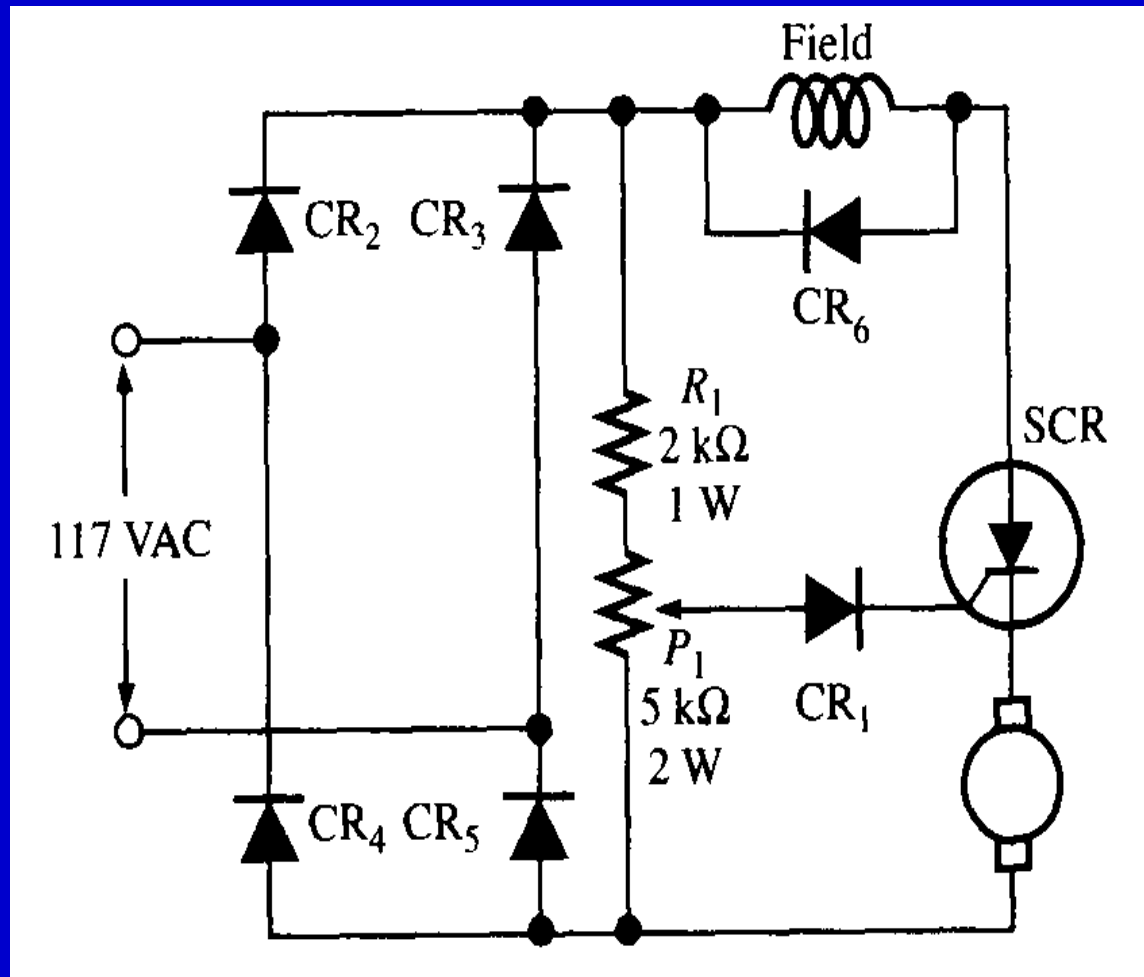
Silicon Controlled Rectifier



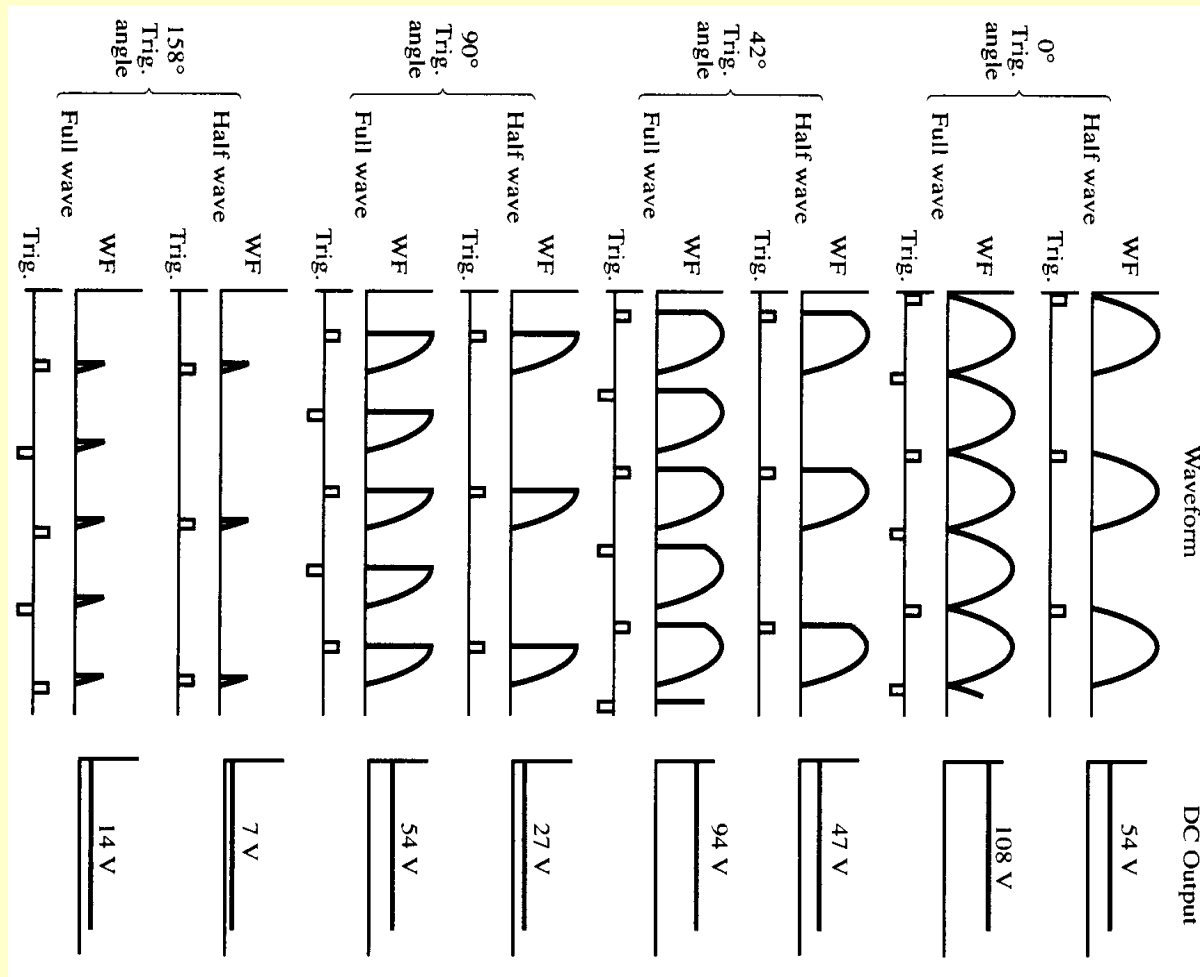
SCR - Continued

- Phase controller produces a trigger pulse to permit on a portion of the positive half cycle to get through
- Average power delivered is thereby controlled

Silicon Controlled Rectifier

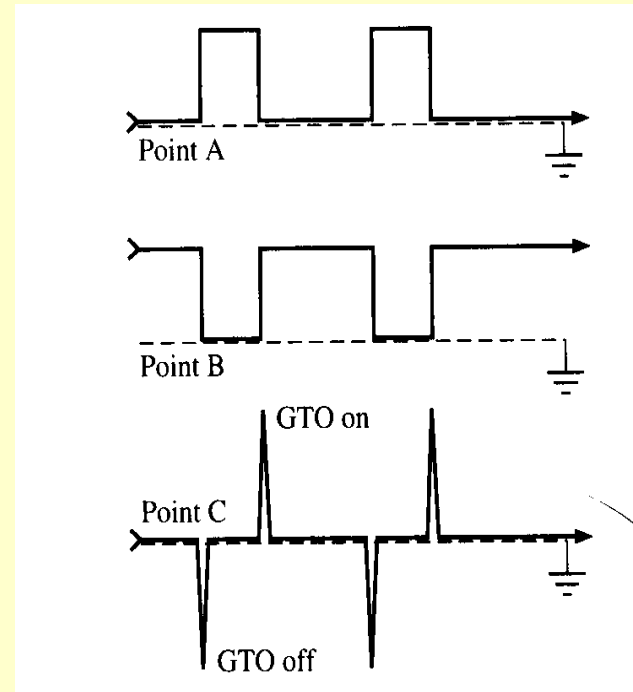
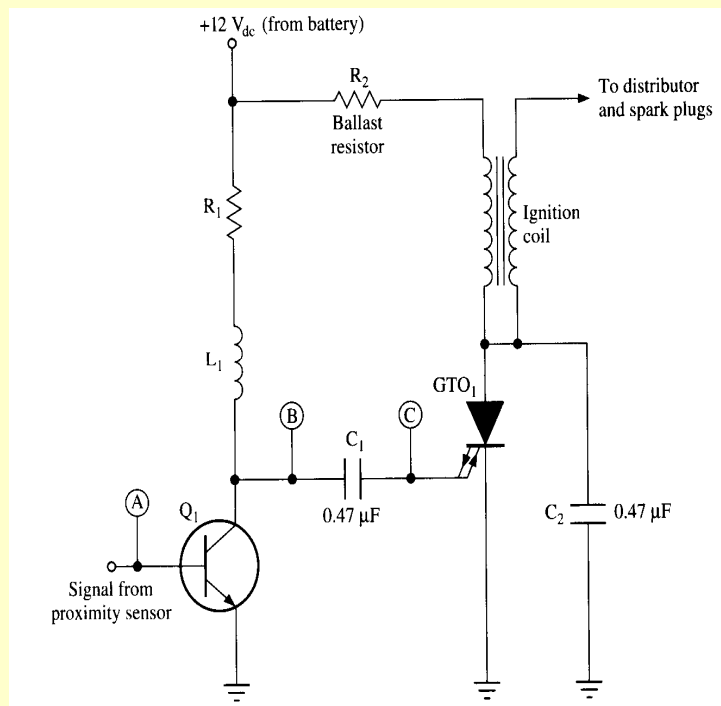


Silicon Controlled Rectifier



SCR Application

- Gate Turn Off switch (GTO)
- Electronic (pointless) automotive ignition



Summary

We learnt

- **Three terminals**
 - anode - P-layer
 - cathode - N-layer (opposite end)
 - gate - P-layer near the cathode
- **Three junctions - four layers**

We learnt

- A gate signal controls the rectifier conduction
- **We connect power such that the anode is positive with respect to the cathode - no current will flow**
- Once it is turned on it remains on even after removal of the gate signal, as long as a minimum current, the holding current, I_h , is maintained in the main or rectifier circuit. To turn off an SCR the anode-cathode current must be reduced to less than the holding current, I_h .

End of Lesson 21