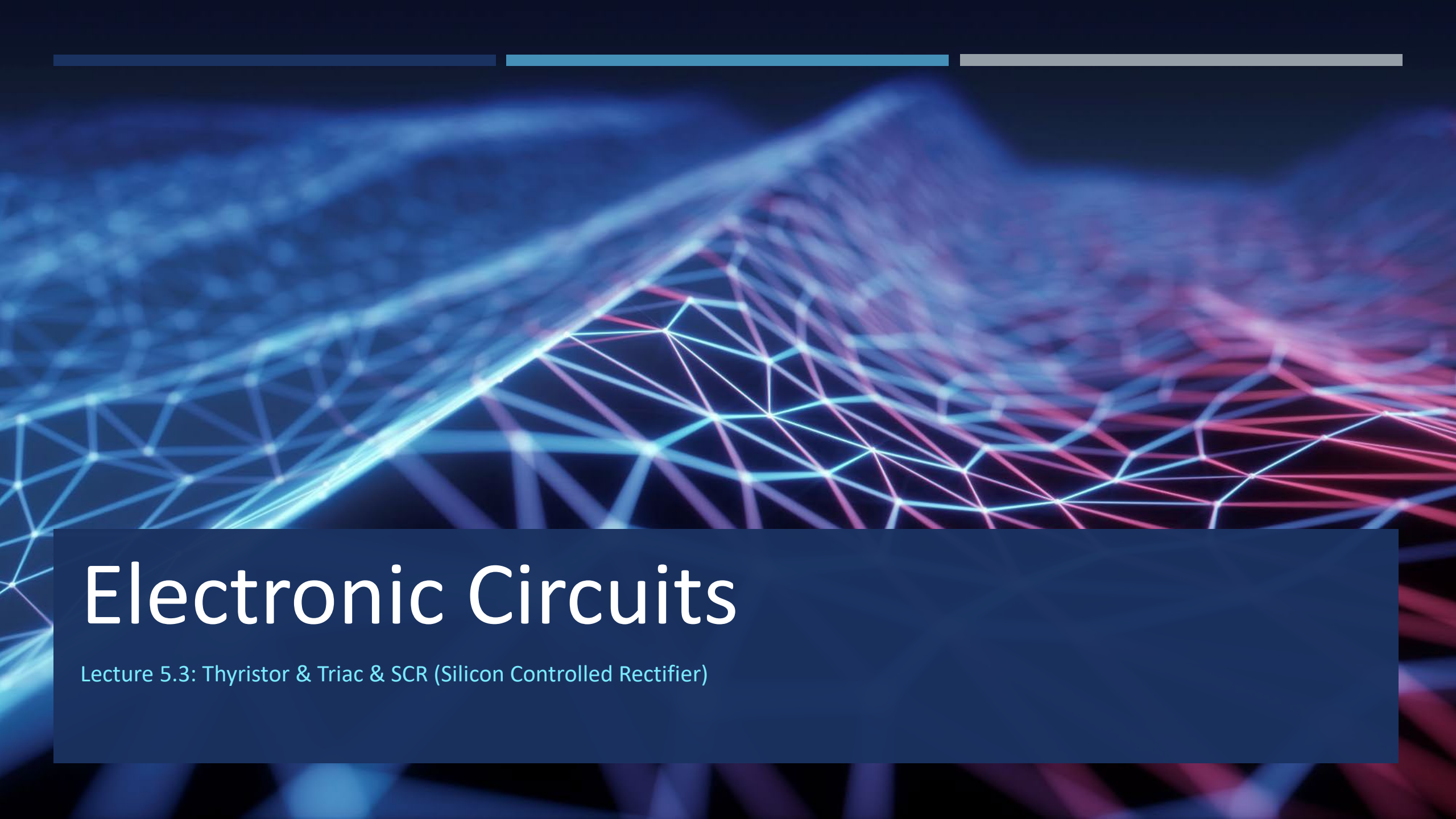


Electronic Circuits

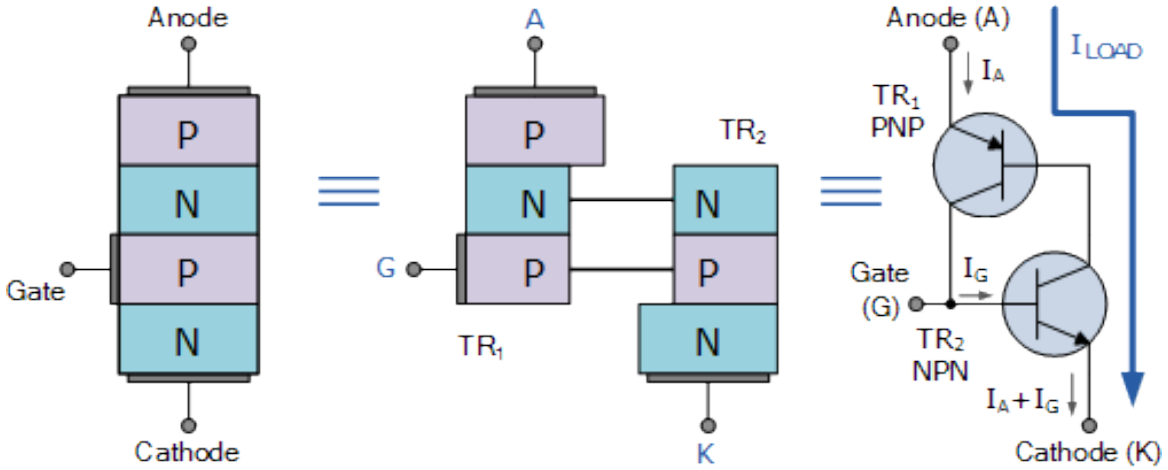
Lecture 5.3: Thyristor & Triac & SCR (Silicon Controlled Rectifier)

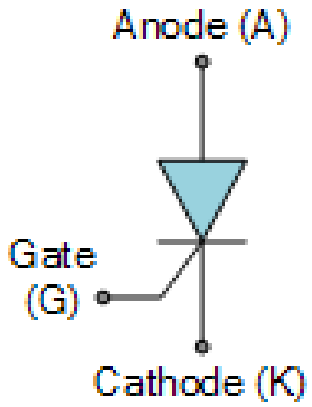
New Terms

- **Thyristor - a bistable semiconductor device made of 3 or more junctions that can be switched from the off state to the on state or vice versa.**
- **Silicon controlled rectifier (SCR) - a gate triggered 3-terminal thyristor that has positive anode to cathode voltages and exhibits a reverse blocking state for negative anode to cathode voltages.**
- **Triac - a gate triggered, 3-terminal thyristor that switches for either positive anode to cathode voltages or negative anode to cathode voltages.**

- **After activating a device by applying triggering signal to the gate, to deactivate the device**
  - **Force I = 0 through the device (guarantee method),**
  - **Force V = 0 over the device (simply phase changing) but this method is useless if the current doesn't cross the zero level.**

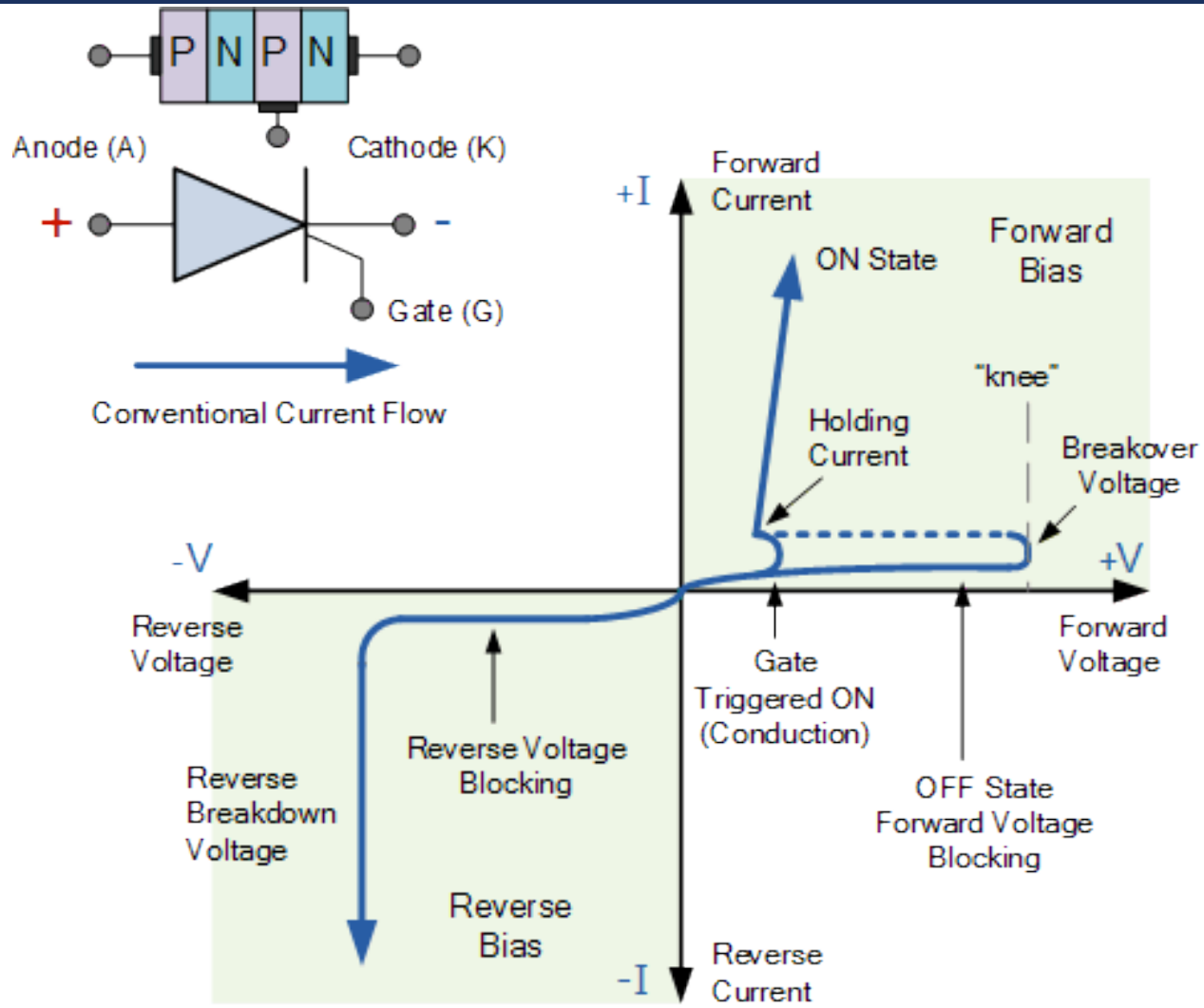
Thyristors



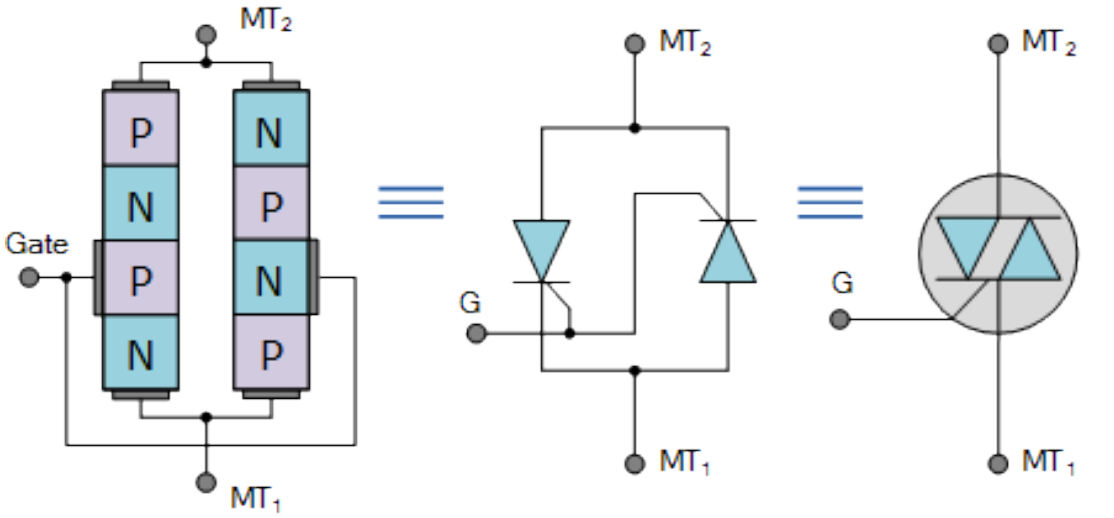


- Thyristors support high voltages and possess a simplified approach to switching on and off states. As a result, they are used for the following applications:
  - speed controls;
  - light dimmers;
  - camera flashes; and
  - various types of circuits, such as inverter, logic and timer circuits.
- Once a signal enters the thyristor gate and activates the device, it remains open until a current reverse occurs or the voltage drops below a specific level.

Thyristor: I-V Characteristics



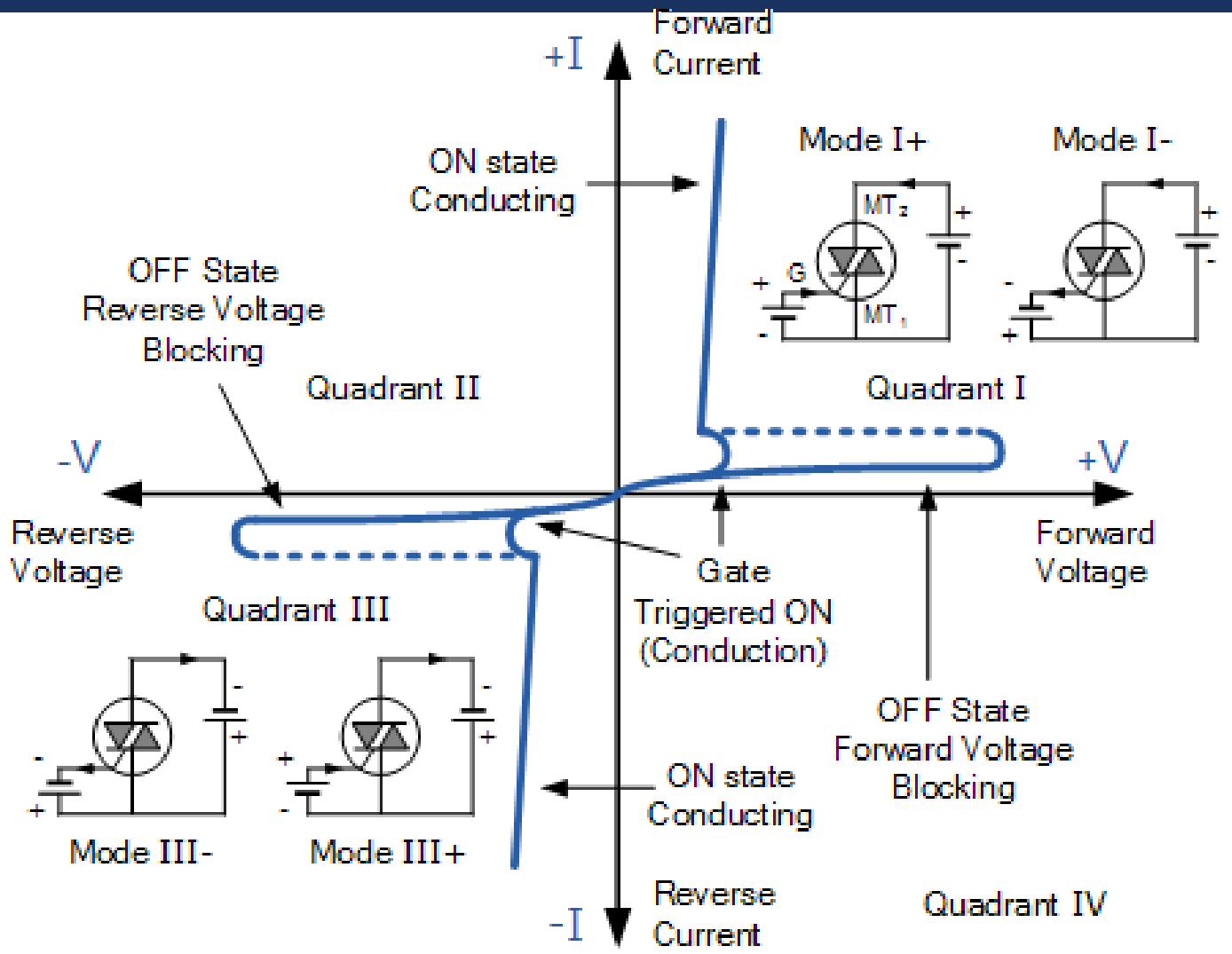
Triacs



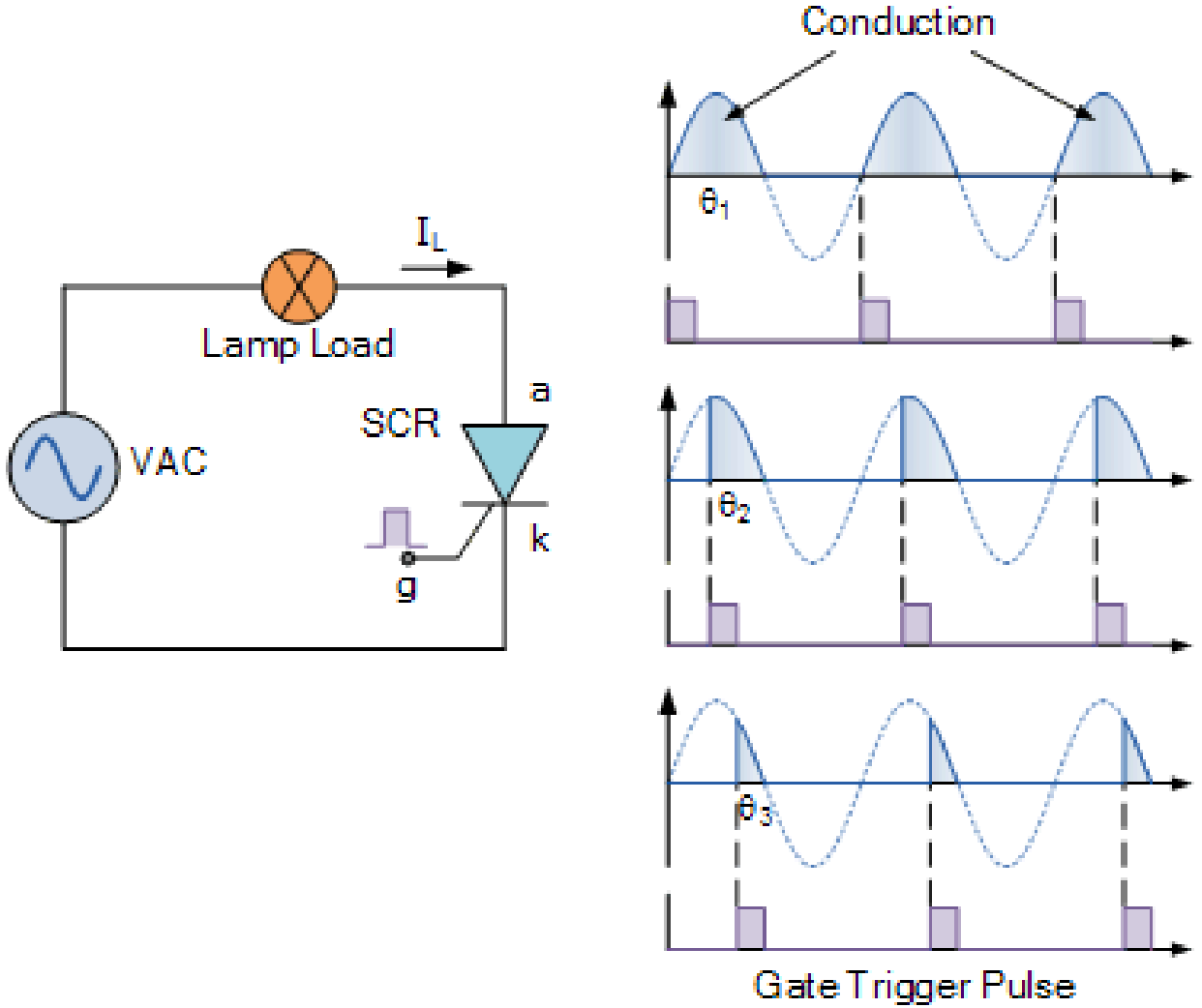
Physical Construction Two-Thyristor Analogy Circuit Symbol

- Both the thyristor and triac can be used to control lamps, motors, or heaters etc. However, one of the problems of using a thyristor for controlling such circuits is that like a diode, the “thyristor” is a unidirectional device, meaning that it passes current in one direction only, from *Anode* to *Cathode*.
- In other words, a *Triac* can be triggered into conduction by both positive and negative voltages applied to its Anode and with both positive and negative trigger pulses applied to its Gate terminal making it a two-quadrant switching Gate controlled device.

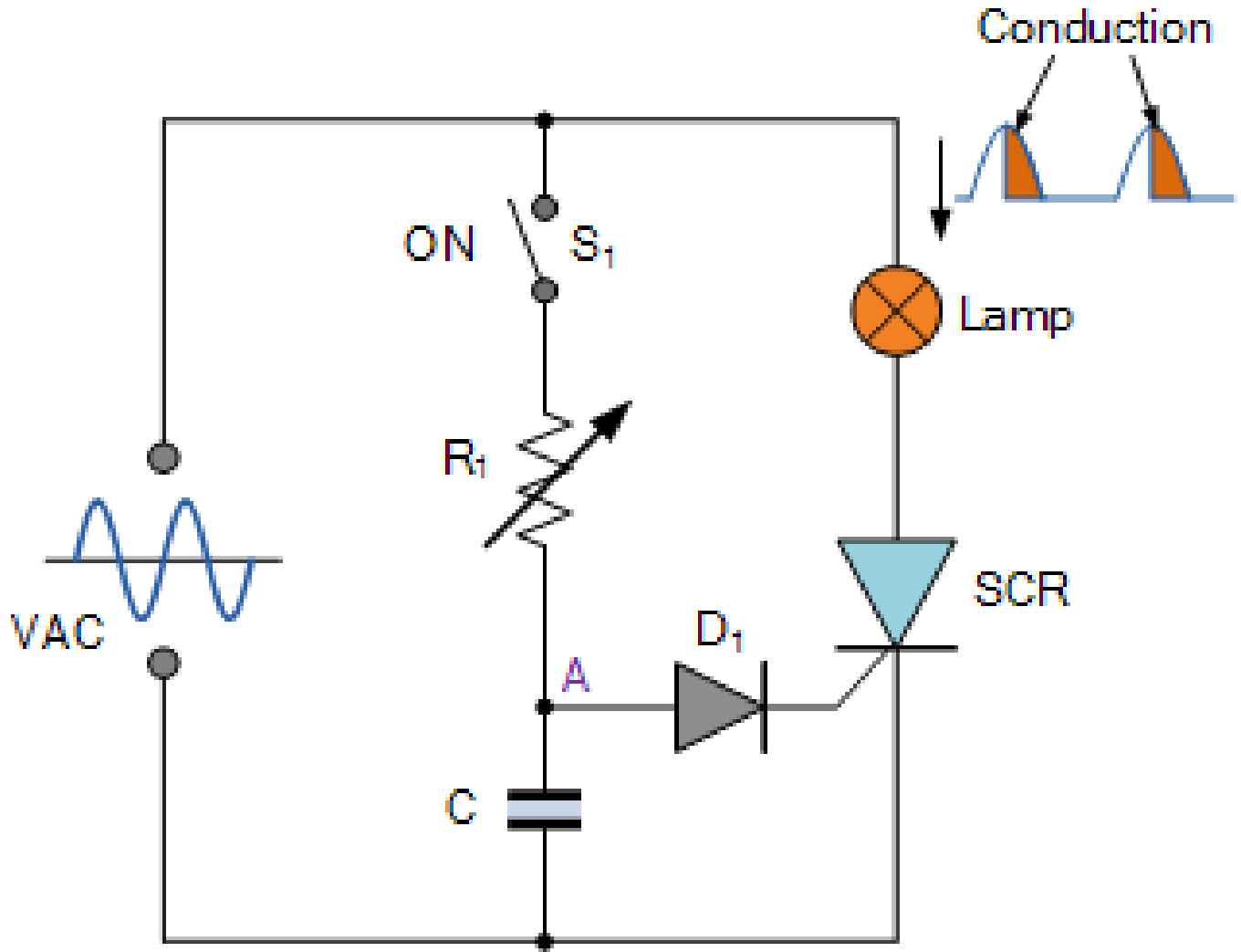
Triac: I-V Characteristics



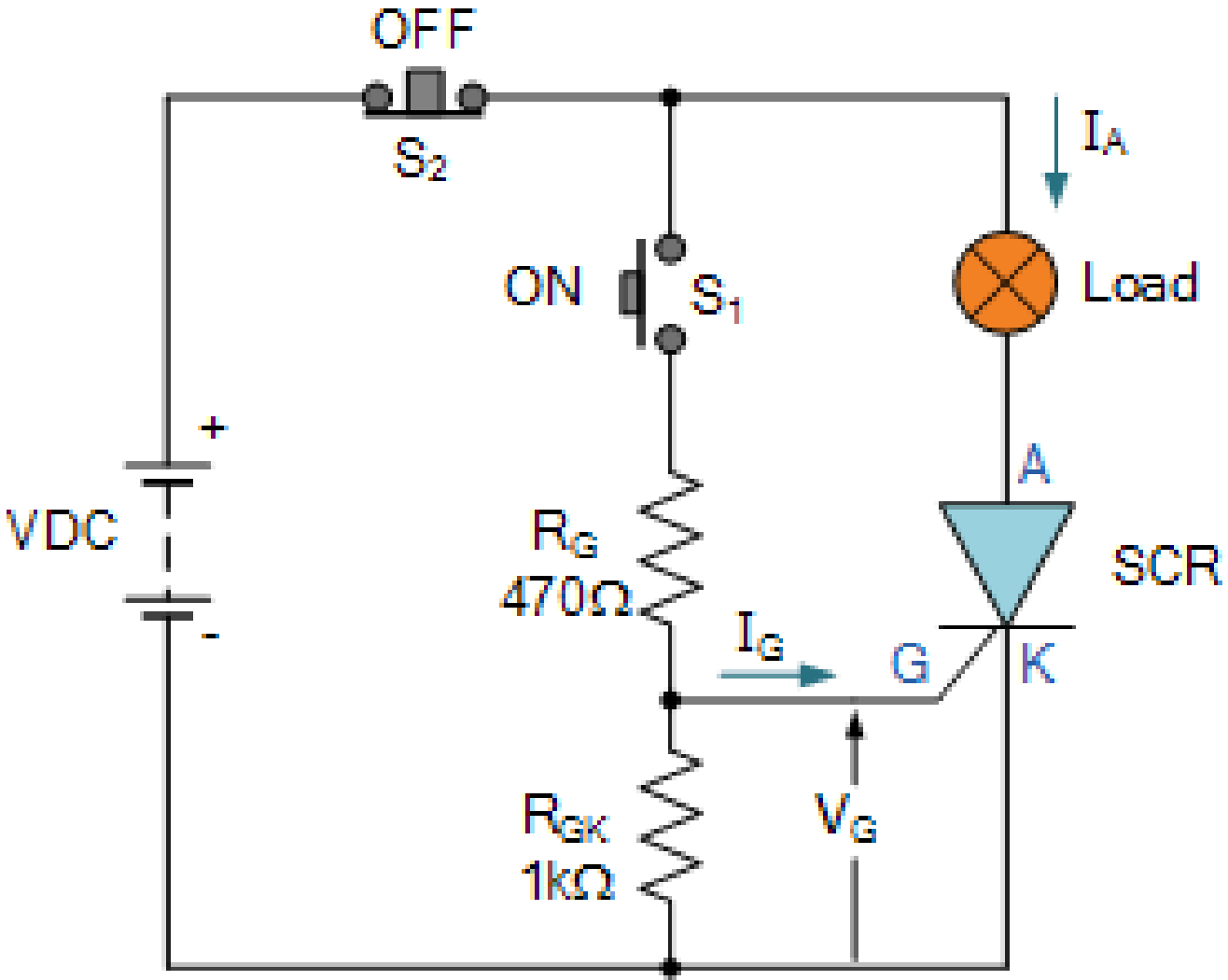
Thyristor: Half-Wave Phase Control



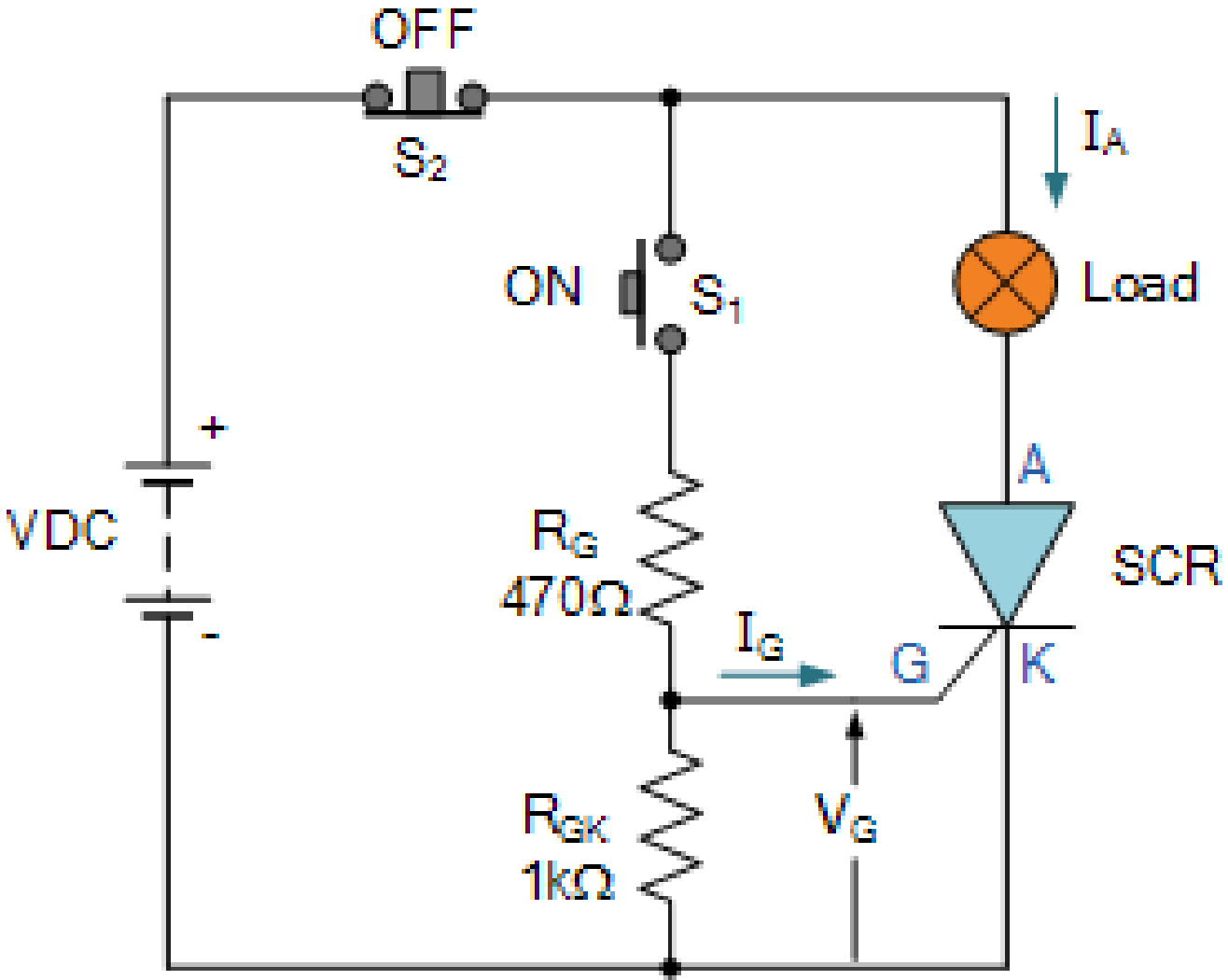
Thyristor: Half-Wave Phase Control Alternative



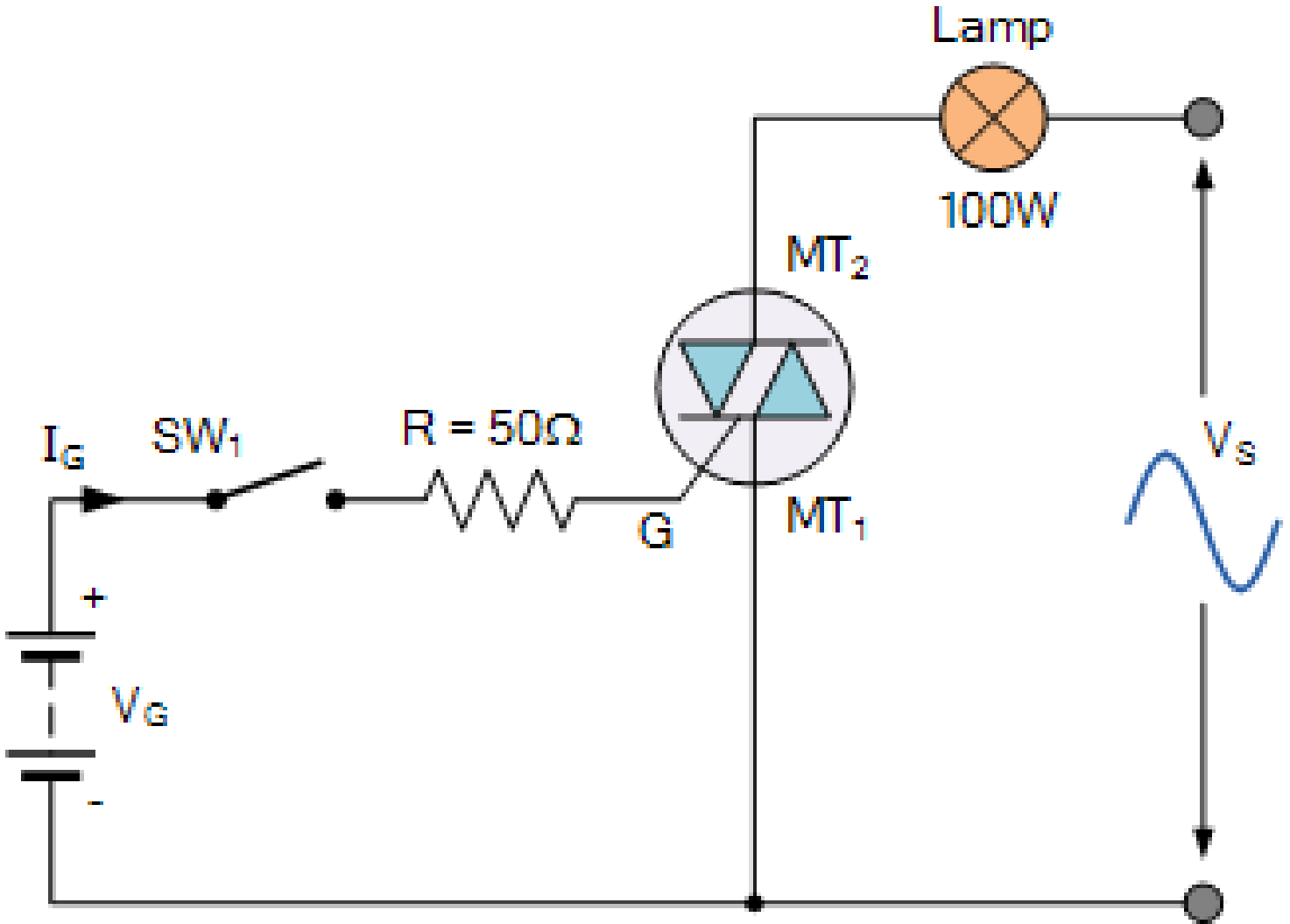
Thyristor: DC Switching



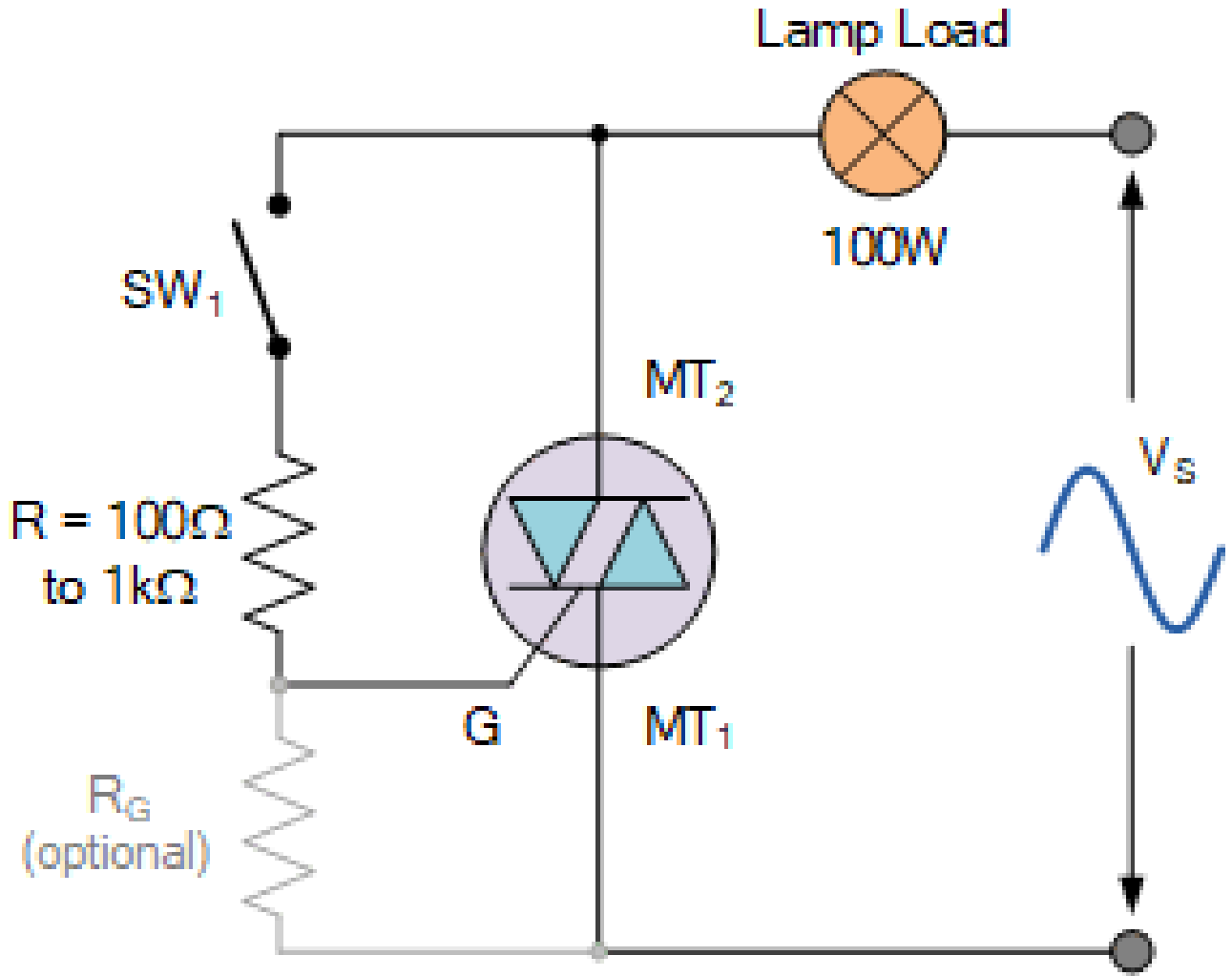
Thyristor: DC Switching



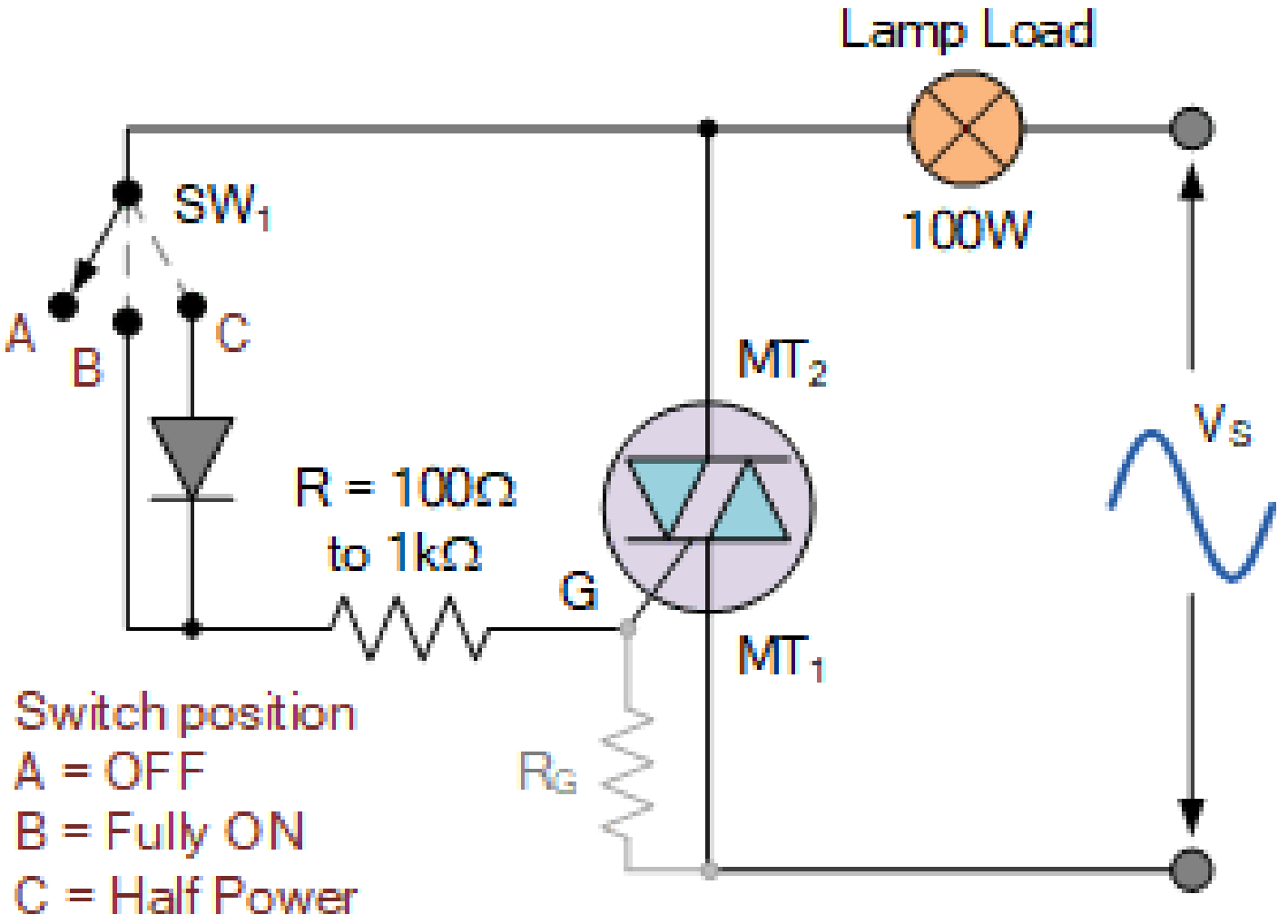
Triac: Basic Switching



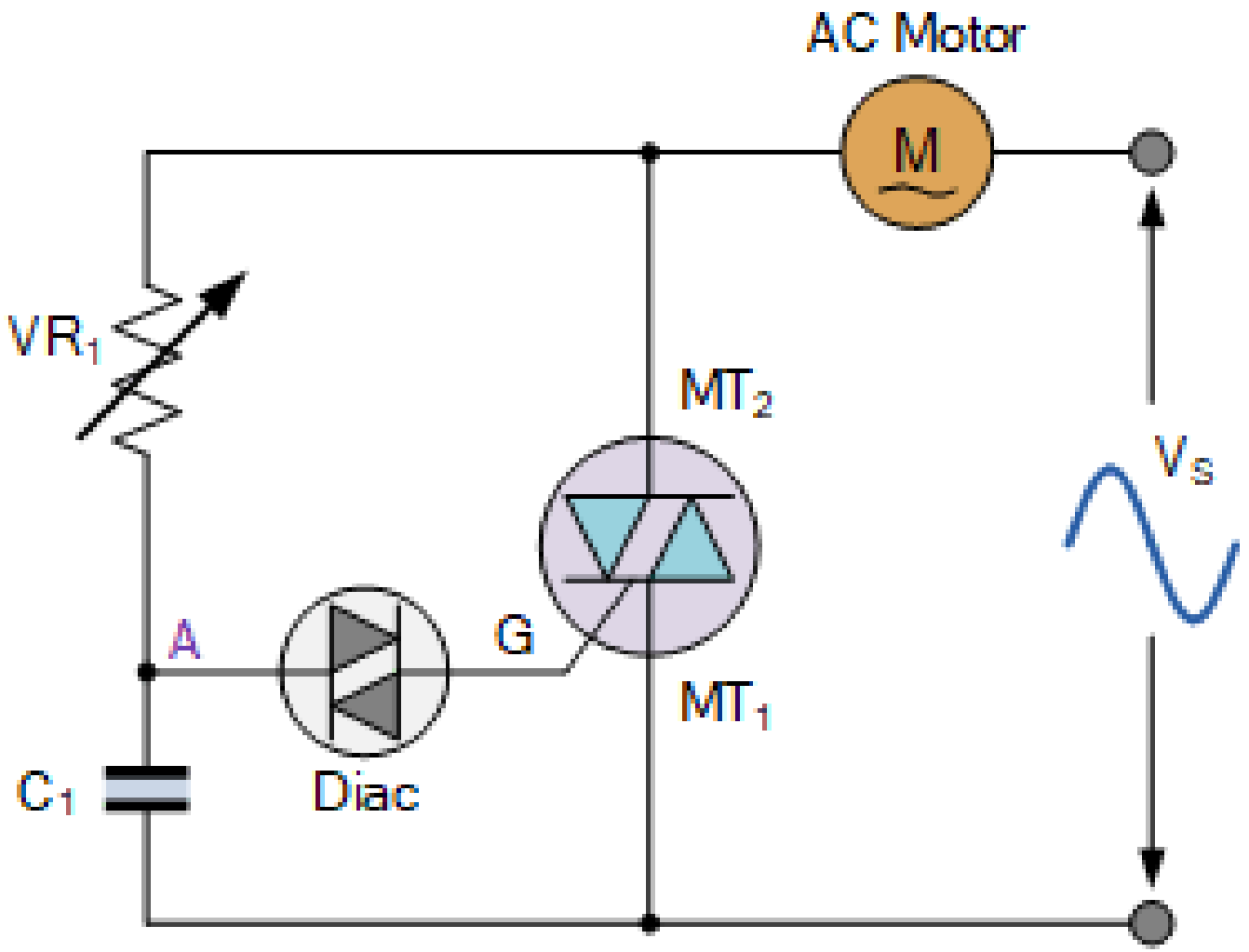
Triac: Basic Switching Alternative



Triac: Modified Switching Alternative



Triac: Phase Control



Thanks for listening ☺

YALÇIN İŞLER

Assoc. Prof.