Transistor and gto bride inverters

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What is a thyristor? They are powerful on-off switches for a range of both alternating current (AC) and direct current (DC) equipment, primarily within industry. Rectifiers are electronic components that convert alternating current into direct current when charge flows through them.

These powerful devices are solid-state switches, meaning that they are made from semiconducting components such as transistors and diodes. Semiconductor devices have electrical conduction that is halfway between a full conductor, like copper, and an insulator like glass.

The name thyristor is derived from a combination of transistor and thyratron (an earlier gas-filled tube with a similar function). Originally developed in the 1950s, these devices are also often referred to as silicon-controlled rectifiers (SCR) because they are made from four layers of silicon, which is a widely used semiconducting material.

Thyristors are bistable switches, meaning that they have only two possible states - on or off (0 or 1). These remain stable even when the device is powered down. Current models will activate - i.e. move from the state of being off to on - as soon as current reaches the control gate (entry point). They will continue to allow current to flow through them until it drops to zero or when the current ends or changes direction.

The latter is known as reverse biasing or reverse voltage. Earlier models relied on a reversal in the current to move from the on state to the off state, but it is possible to deactivate newer models via the control gate. These are sometimes called gate turn-off (GTO) thyristors.

Controlled rectifiers are high gain devices, meaning that the current present at the control gate can control a much higher level of current between the anode and cathode. As a result, they are classed as current operated equipment.

Now for the key question - how do thyristors work? They typically have three leads or electrodes (points at which electricity enters or exits). These are called the anode, the cathode and the gate (or control gate). The first is the positive terminal and the second the negative one, while the gate controls the main anode-to-cathode current, triggering this via an external pulse. Some models feature two or four electrodes.

Within a typical SCR, there are two alternating layers of N-type (negative) semiconductor and P-type (positive) semiconductor. This makes four layers altogether, with three junctions between these. The four-layered silicon in each is electrically treated to increase the number of either negative or positive charge-carrying electrons. They are also known as NPN and PNP semiconductors, referring to the pattern of positive and negative electrons in each.

If no current is flowing into the device via the gate, it will rest in an off state, with the central junction (of three) reversed, opposite to the anode and cathode, so current cannot pass through whatever the direction of the device. This is referred to as forward blocking mode or negative blocking mode, depending on the direction.

A transistor is a standard electrical component used to switch electrical signals on or off and to amplify them. Their invention in the early 20th-century enabled the development of radio and long-distance telephony. Despite their versatility, however, they do not work well with high voltage currents and are best suited to low power milliamp currents. To put that into perspective, a milliamp is one-thousandth of an amp. By contrast, thyristors can operate with much higher levels of power, 5-10 amps and hundreds, even thousands, of volts.

Diodes are relatively simple, inexpensive components with only two terminals (one positive and one negative), an anode (also known as a plate), and a cathode. Electricity flows through in one direction only. In electrical terminology, they are forward biased rather than reverse biased.

Diodes are mainly used for switching or converting current. They have only two semiconductor layers - one positive and one negative - with a single electrical junction between these.

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