

## **Diodes (and Other Specialized Semiconductor Devices)**

Diode symbol triangle pointing to straight line. Line is the cathode, triangle is the anode. To conduct, the anode must be more positive than the cathode by about 0.6 volts.

Has a current limitation going through the device.

Lots of variations on the diode.

### ***SCR – Silicon Controlled Rectifier***

Diagram 1 shows symbol. What does the control line control? When it conducts. Like a switch. Good in some applications. Continues to conduct once the control line has voltage applied to it, even when the control voltage is no longer applied, until the voltage to the entire circuit is no longer there (drops to low enough to stop the SCR from conducting – about 0.3 volt or around there). Conducts assuming anode > cathode of course.

TTL chips will handle up to 7 volts.

Diagram 2. Suppose voltage goes to 6 volts, the SCR diode gets turned on and shorts 6 volts to ground, blowing fuse and protecting a board full of chips. Called a crowbar circuit. Name from putting a crowbar across a battery, which shorts it dead. Something must blow the fuse safely and nondestructively (except the fuse is destroyed), but the SCR isn't destroyed since it is rated for the amount of current expected.

### ***Zener/Avalanche Diode***

Diagram 3 has symbol. Has a fixed voltage drop. Breakdown voltage (also called PIV – peak inverse voltage).

If put 20 volts onto a Zener diode rated at 5 volts, would expect to have 5 volts on the output (see diagram 4).

Most Zeners not capable of handling a lot of power. Zeners not very big. Usually associated with a transistor which amplifies the effect of the Zener.

Diagram 5. How to have a 6 volt battery supply 5 volts as a backup if AC power goes away? This is how clock radios work. Battery uses no current because it is reverse biasing the diode in series, until AC goes away then it is forward biasing the diode.

### ***Triac***

Diagram 6. Meant for AC. Handles as much as 600 watts of AC. Waveform is a little choppy due to the 0.7 V drop. Lighting in this studio runs on triacs. Brightness controlled by gate input. If have a sine wave coming in, and take a portion of the sine wave to turn it on and off (diagram 7), brightness of light controlled by how much of the sine wave passes through.

Looks like a small transistor.

Appearances of semiconductor packages. A particular package can contain one of a number of various

semiconductor devices. For example, a package could be a photo diode, . Could be common cathode or common anode device (the multi-color LEDs).

### ***Photo Transistor***

Three leads. Base to collector junction exposed to clearplastic. When light hits, it changes the conductance.

### ***Shottky Diode***

Very fast. Picoseconds. When you stop the voltage, it stops conducting very fast. Use for RF when you need very fast acting parts. Sometimes called hot carrier (hasn't heard this term in a long time).

### ***Hall Effect Devices***

Distributor pickups in automobiles. Something that moves into a magnetic field will disrupt (Faraday's law) the field, and the device will sense that and change its characteristics. In VTRs, use these to detect every time the reel turns around. Hall effect device is fast enough to work at 3600 rpm.

Diagram 8. If detect light, conducts. In VTRs, can measure tape speed as reel rotates with that slotted/drilled ring spinning around. Vane comes around and cuts through between the LED and the photosensitive diode (often sensitive to IR). Can even tell direction by seeing which one senses light before the other (if have two pairs). Vane cuts through between the LED and the IR-sensing detector.

### ***Optoisolators***

Sealed device with two leads. A four- or six-pin IC chip. Two leads run IR emitter, other two leads are output of detector. All this happens inside the chip. Telephone company insists you isolate completely from the telephone line; this is how. Computers also have these. The server has a GPI (general purpose input) that is protected this way. The output of these are proportional to the input; the IR emitter emits based on current and the detector allows current/voltage proportional to the light it detects.

## **Lab Work**