Diodes and Rectifiers

Now we come to the most popular application of the diode: ***rectification*.**

Simply defined, rectification is the conversion of alternating current (AC) to direct current (DC). This involves a device that only allows one-way flow of electrons. As we have seen, this is exactly what a semiconductor diode does. The simplest kind of rectifier circuit is the *half-wave* rectifier. It only allows one half of an AC waveform to pass through to the load. (Figure 1)

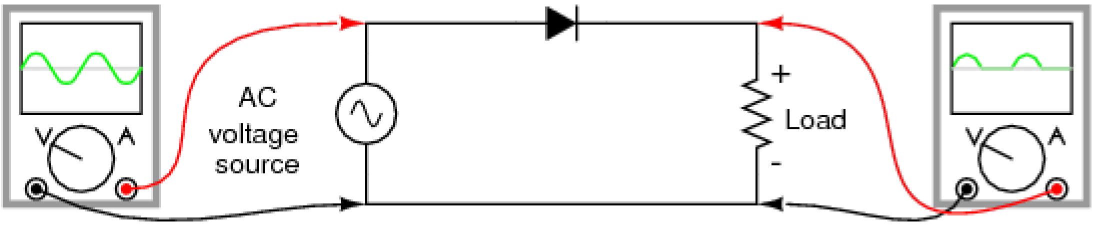

Fig.1 Half-wave rectifier circuit.

For most power applications, half-wave rectification is insufficient for the task. The AC power source only supplies power to the load one half every full cycle, meaning that half of its capacity is unused.

If we need to rectify AC power to obtain the full use of *both* half-cycles of the sine wave, a different rectifier circuit configuration must be used.

Another, more popular full-wave rectifier design exists, and it is built around a four-diode bridge configuration. For obvious reasons, this design is called a *full-wave bridge*. (Figure 2)

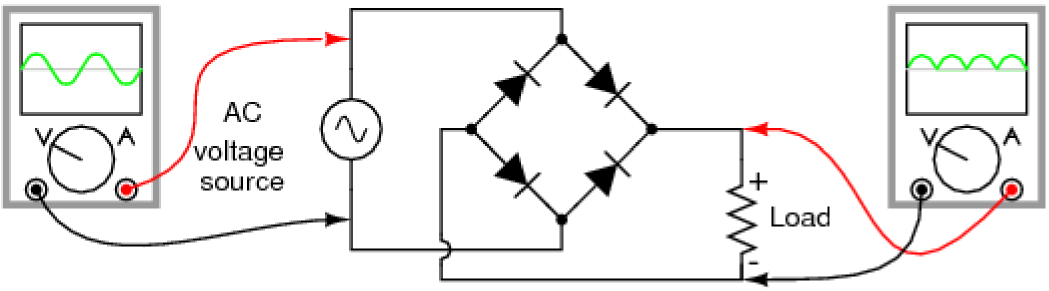

Fig.2 Full-wave bridge rectifier.

Current directions for the full-wave bridge rectifier circuit are as shown in Figure 3 for positive half-cycle and Figure 4 for negative half-cycles of the AC source waveform. Note that regardless of the polarity of the input, the current flows in the same direction through the load. That is, the negative half-cycle of source is a positive half-cycle at the load. The current flow is through two diodes in series for both polarities. Thus, two diode drops of the source voltage are lost ($0.7 \cdot 2=1.4$ V for Si) in the diodes. This is a disadvantage compared with a full-wave center-tap design. This disadvantage is only a problem in very low voltage power supplies.

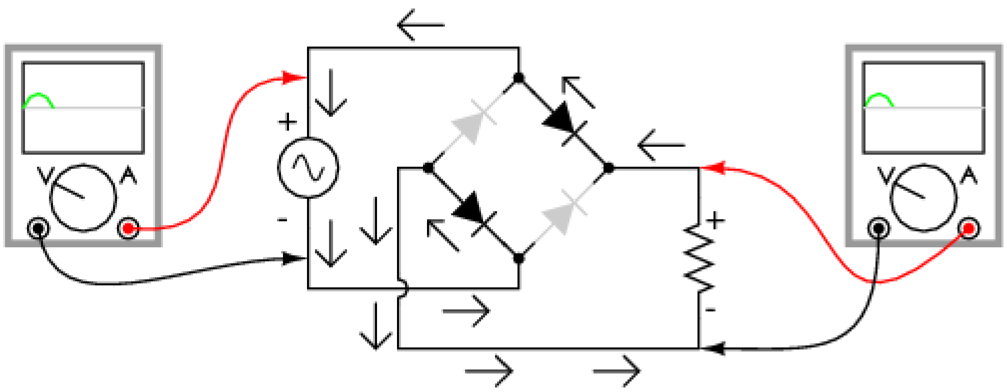

Fig.3 Full-wave bridge rectifier: Electron flow for positive half-cycles.

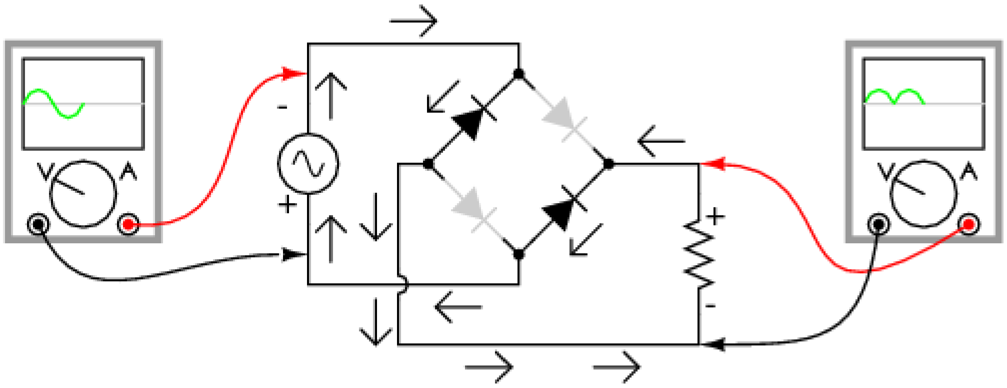

Fig.4 Full-wave bridge rectifier: Electron flow for negative half=cycles.

Remembering the proper layout of diodes in a full-wave bridge rectifier circuit can often be frustrating to the new student of electronics.

An alternative representation of this circuit is easier both to remember and to comprehend. It's the exact same circuit, except all diodes are drawn in a horizontal attitude, all "pointing" the same direction. (Figure 5)

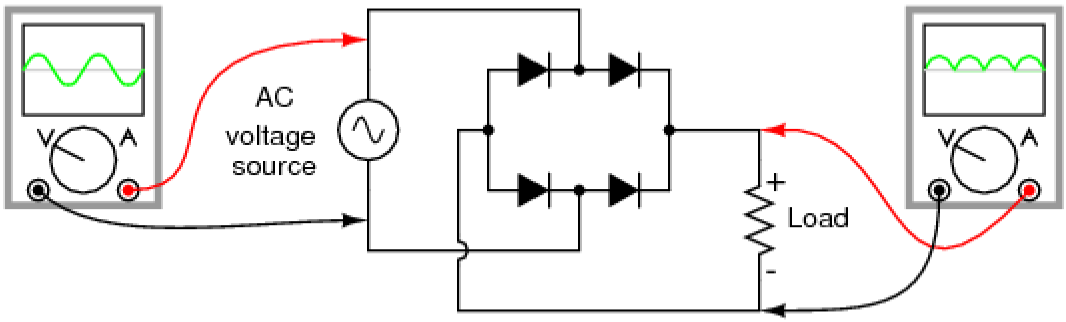

Fig.5 Alternative layout style for Full-wave bridge rectifier.