DIODES

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This article explains how diodes work and some of their applications

If you have any suggestions for improving this application note, please drop us a line at: enquiries@electronworks.co.uk

A diode is the simplest of all semiconductor devices. Its function in life is to conduct electricity one way and not the other. So how is this useful?

Consider the design of a power supply. AC mains is applied at 240V. This is reduced down in size to something a bit more sensible (eg 12V) using a transformer, but this waveform is still ac. Placing a diode in the path of the ac waveform causes only the positive half cycles to conduct, thus creating a dc voltage. See our article on Designing a Linear Power Supply to see diodes in action inside a power supply.

How do diodes work?

The symbol for a diode is shown in FIG 1. The anode and cathode are labelled. If the voltage on the anode is greater than the cathode by more than 0.6V then the diode switches on and current flows from the anode to the cathode. If the voltage is less than 0.6V or indeed if the anode is negative with respect to the cathode then the diode does not conduct.

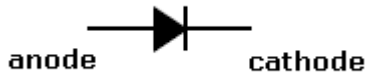

FIG 1

So where can we use a diode? Imagine a system that has a main 5V battery and a 3V backup battery. The main battery supplies power to the circuit (connected to 'Output'), but when the main battery is being changed you still need some power to keep the circuit alive. The circuit in FIG 2 will do this.

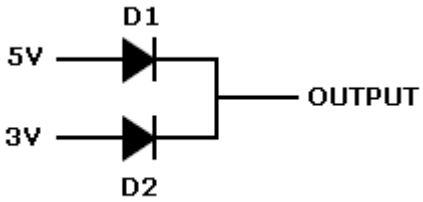

FIG 2

If there is 0.6V across diode D1 its cathode will be at 4.4V. Since the cathode of D1 is at the same voltage as the cathode of D2, diode D2 will be switched off since its anode is at 3V (lower than its cathode). This means that all of the current required by the circuit will be provide by the 5V supply

When the main supply is removed, the reverse bias across D2 is also removed. The cathodes of both diodes now drop to 2.4V which is 0.6V below the voltage on the anode of D2 (3V) and the load connected to the output is now powered from the 3V supply. Once the main supply is reconnected, the voltage at 'output' raises to 4.4V, D2 is reverse biased and the current is supplied via D1 again.

In many electronic circuits we need to keep a record to time - a PC is such an application. There is normally a silicon chip in the design that keeps a record of the time. This chip must always have a power supply connected to it (or the clock gets reset). The circuit above is used in many such applications.