

## UNIPOLAR AND BIPOLAR TRANSISTORS

There are two kinds of transistors: unipolar and bipolar transistors.

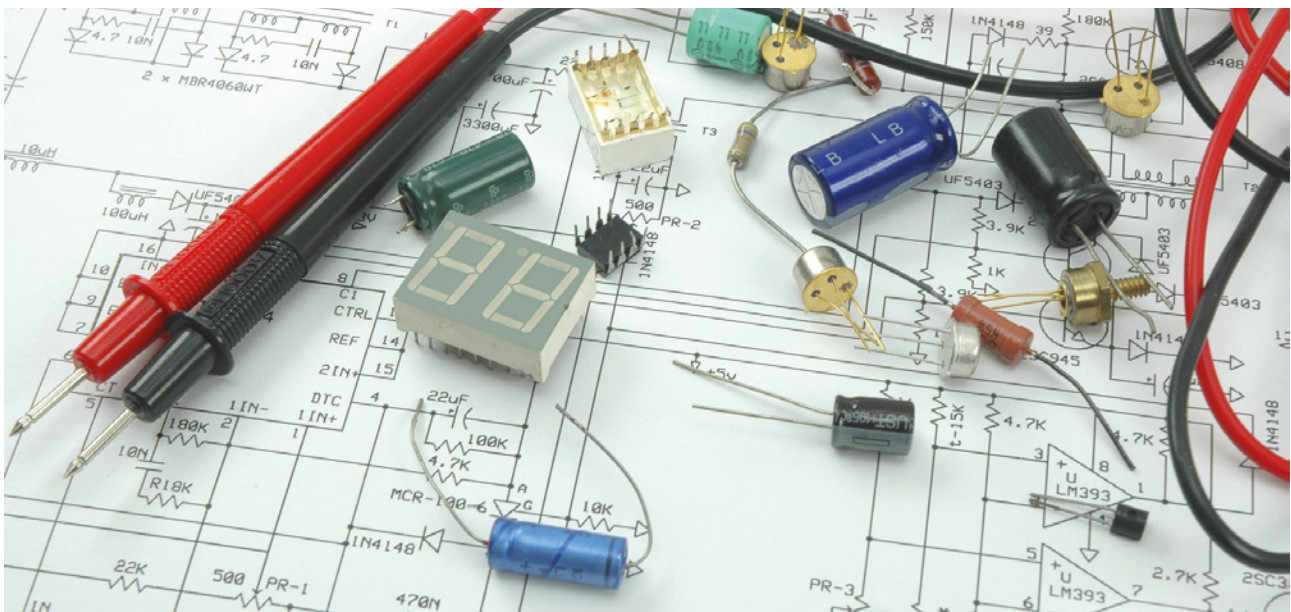
In **unipolar transistors** the three terminals are called gate (G), source (S) and drain (D). They work in a slightly different way, since the voltage applied to the gate terminal controls the current flowing between source and drain. A FET (Field Effect transistor) is simply a semiconducting (one-way) resistor whose value is controlled by the voltage applied to its gate. The drain is in electrical contact with the source only when the gate allows it. The field effect is what actually turns the transistor on and off. When a charge is placed onto the gate, it produces an electric field all around itself. Since the silicon dioxide layer is very thin, the electric field goes down into the silicon. Being a semiconductor, the silicon does not have enough charge on the metal gate of the transistor to attract the opposite charge. When the gate gets positive charge, these positive charges are driven away, and negative charges come in under the gate to form a conductive bridge.

In order to understand how a **bipolar junction transistor** (BJT) works we will imagine that it runs on water current. There are three openings that correspond to the base (B), the collector (C) and the emitter (E). We provide a reservoir of water for C, the power supply voltage. If we pour water current into B this current flows along the base pipe. A tiny amount of current flowing into B allows a large amount to flow from C to E so as to have an amplification effect.

In this way, the transistor can work as an electronic amplifier. We can control a large flow of current with a small flow of current. If we continually change the small amount of water flowing into B, then we cause corresponding changes in the large amount of water flowing from C to E. The transistor can be used to switch the current flow on and off.

If we put sufficient current into B the transistor will allow the maximum amount of current to flow from C to E. In this case the transistor is fully on.

To turn it fully off, we must stop all current flowing into B.



### SPEAKING

- Explain how unipolar and bipolar transistors work.

### ACTIVITIES

