

Other more specialized FETs exist. Some of their unique characteristics are owed to design alterations and others to material variations. The transistor devices discussed above use silicon-based semiconductors. But the use of other semiconductor materials can yield variations in performance. Metal semiconductor FETs (MESFETs) for example, are often used in microwave applications. They have a combined metal and semiconductor material at the gate and are typically made from gallium arsenide or indium phosphide. MESFETs are used for their quickness when starting and stopping current flows especially in opposite directions. High electron mobility transistors (HEMT) and pseudomorphic high electron mobility transistors (PHEMT) are also constructed from gallium arsenide semiconductor material and are used for high-frequency applications.

Photodiodes and Phototransistors

Light contains electromagnetic energy that is carried by photons. The amount of energy depends on the frequency of light of the photon. This energy can be very useful in the operation of electronic devices since all semiconductors are affected by light energy. When a photon strikes a semiconductor atom, it raises the energy level above what is needed to hold its electrons in orbit. The extra energy frees an electron enabling it to flow as current. The vacated position of the electron becomes a hole. In photodiodes, this occurs in the depletion area of the reversed biased PN junction turning on the device and allowing current to flow.

Figure 11-38 illustrates a photodiode in a coil circuit. In this case, the light striking the photodiode causes current to flow in the circuit whereas the diode would have otherwise blocked it. The result is the coil energizes and closes another circuit enabling its operation.

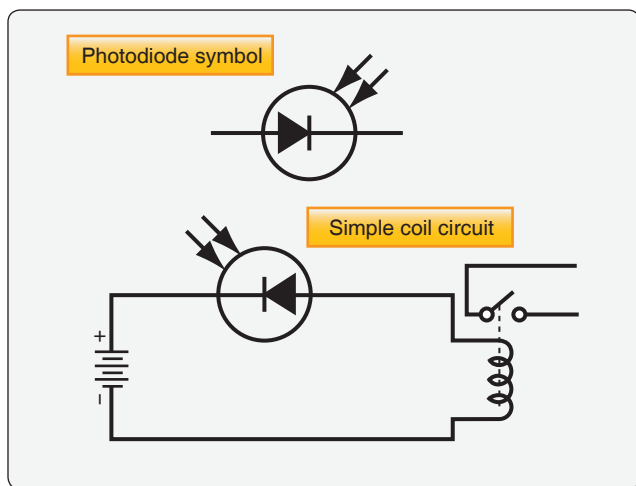


Figure 11-38. The symbol for a photodiode and a photodiode in a simple coil circuit.

A photon activated transistor could be used to carry even more current than a photodiode. In this case, the light energy is focused on a collector-base junction. This frees electrons in the depletion area and starts a flow of electrons from the base that turns on the transistor. Once on, heavier current flows from the emitter to the collector. [Figure 11-39] In practice, engineers have developed numerous ways to use the energy in light photons to trigger semiconductor devices in electronic circuits. [Figure 11-40]

Light Emitting Diodes

Light emitting diodes (LEDs) have become so commonly used in electronics that their importance may tend to be overlooked. Numerous avionics displays and indicators use LEDs for indicator lights, digital readouts, and backlighting of liquid crystal display (LCD) screens.

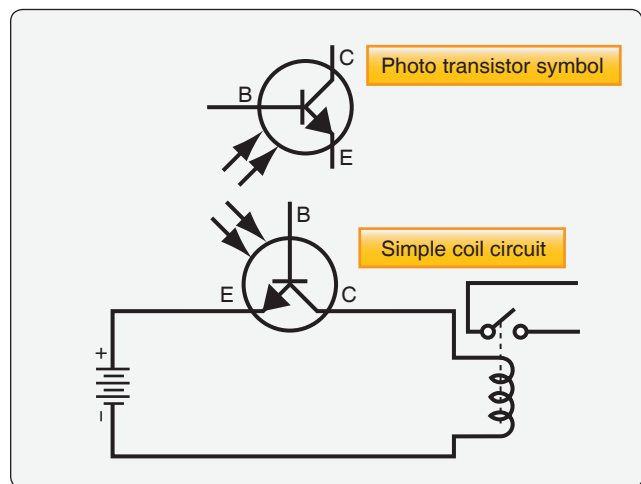


Figure 11-39. A photo transistor in a simple coil circuit (bottom) and the symbol for a phototransistor (top).



Figure 11-40. Phototransistors.