



PART 1

Automotive Circuits Bases

Chapter 1

Automotive Electrical Circuits and Symbols

1.1 Electrical Circuit

Electrical devices are used in numerous areas of an automobile, and provide various functions. As electricity passes through a resistor, it affects the resistor and can provide a number of functions.

Electrical devices utilize those functions according to purpose by converting electricity into work.

(1) Heat-generation function

Heat is generated as electricity passes through a resistor, such as a cigarette lighter, fuse.

(2) Light-emitting function

Light is emitted as electricity passes through a resistor, such as a light bulb.

(3) Magnetic function

A magnetic force is generated as electricity passes through a conductor or coil, such as an ignition coil, alternator, or injector.

See Figure 1-1, the diagram on the left describes the mechanism of a relay. When the switch closes, the current flows between points 1 and 2, thus magnetizing the coil. The magnetic force of the coil attracts the moving contact between points 3 and 4. As a result, points 3 and 4 close and allow the current to flow to the light bulb. Thus, through the use of a relay, the switch and the wiring harness to the switch can be of a low capacity.

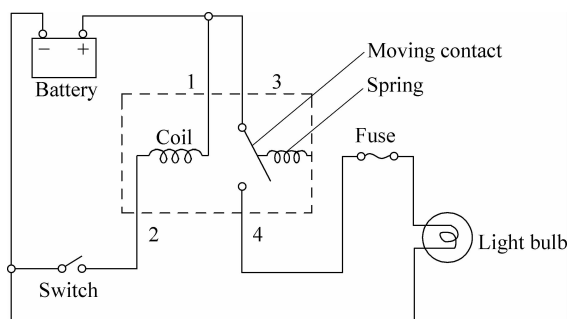


Figure 1-1 Electrical circuit

1.2 Automotive Electrical and Electronic Components and Symbols

Symbols are used on automotive circuit diagrams rather than drawings of actual components and connections. Their use tends to make diagrams less complicated. Identifying symbol is an important part of reading electrical diagrams. Unfortunately, not all automobile symbols are standardized. You will find slightly different symbols used by different manufacturers.

1. Fuses

Fuses are the most common form of circuit protection devices used in automobiles. Fuses consist of a fuse element or strip of low-melting-point metal enclosed in a glass tube or plug-in plastic cartridge, see Figure 1-2.



Figure 1-2 Fuses

2. Resistors

Resistors are used to limit current flow and provide fixed voltage drops, see Figure 1-3.



Figure 1-3 Resistors

3. Capacitors

See Figure 1-4, a capacitor, is a device for storing an electric charge. A capacitor blocks direct current (DC) but passes, alternating current (AC). A capacitor makes a very good noise suppressor because most of the interference is AC and the capacitor will conduct this AC to ground before it can reach the radio or amplifier.

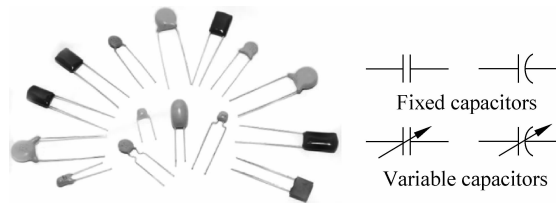


Figure 1-4 Capacitors

4. Diodes

See Figure 1-5, an ordinary diode, allows a current to flow only in one direction; from the P-side to the N-side. A minimum voltage is required for a current to flow from the P-side to the N-side.



Figure 1-5 Ordinary diode

The current will not flow if a voltage is applied in the opposite direction (from the N-side to the P-side).

5. Transistors

See Figure 1-6, a transistor, contains three layers consisting of a P-type semiconductor sandwiched between two N-type semiconductors, or an N-type semiconductor sandwiched between two P-type semiconductors. An electrode is attached to each substrate layer: B (base), E (emitter), and C (collector).

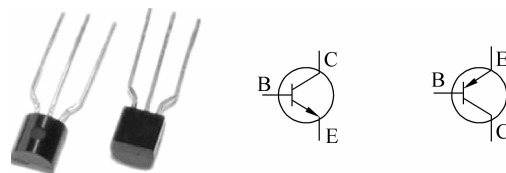


Figure 1-6 Transistors

Ordinary transistors come in two varieties, N-P-N and P-N-P, depending on how the semiconductors are arranged.

A transistor performs the following functions: Amplification; Switching.

New Words & Phrases

circuit ['sə:kit] *n.* 电路

resistor ['ri:zistə] *n.* 电阻(器)

utilize ['ju:tilaiz] *vt.* 利用, 使用

fuse [fju:z] *n.* 熔断器, 保险丝

relay ['ri:lei] *n.* 继电器

coil [kɔil] *n.* 线圈

harness ['hɑ:nis] *n.* 线束

cartridge ['kɑ:tridʒ] *n.* 盒

capacitor [kə'pæsɪtə] *n.* 电容(器)

DC (direct current) 直流电

AC (alternating current) 交流电

noise suppressor 噪声抑制器

interference [ˌɪntə'fɪərəns] *n.* 干扰, 干涉

diode ['daɪəʊd] *n.* 二极管

alternator ['ɔ:lte(:)neɪtə] *n.* 交流发电机

light-emitting diode 发光二极管

semiconductor ['semɪkən'dʌktə] *n.* 半导体

substrate ['sʌbstreɪt] *n.* 基片, 衬底

transistor ['trænzɪstə] *n.* 晶体管

Notes to the Text

1. Symbols are used on automotive circuit diagrams rather than drawings of actual components and connections.

在汽车电路图中, 用各种符号来表示实际的元器件和电气连接。

2. Fuses consist of a fuse element or strip of low-melting-point metal enclosed in a glass tube or plug-in plastic cartridge, see Figure 1-2.

如图 1-2 所示, 保险丝就是封装在玻璃管或插入式塑料盒里的一条低熔点的金属熔断器。

Exercises

1. How does a relay work?
2. How to check the quality of the resistor or the capacitor?
3. Try to use the transistor to control a buzzer.