

Research on the Application of Universal Circuit Board to Build Circuits in Electronic Practice Courses

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Abstract

In the course of electronic practice, building circuits through universal circuit boards can combine theoretical knowledge with practice, so that students can better verify and understand theoretical knowledge while mastering skills. For normal undergraduate students who are not electronics majors, building circuits with universal circuit boards should adopt a step-by-step method, especially the installation of circuits, which should not be too difficult. In the specific teaching work, learning the skill of universal circuit board building circuit will be more practical in students' future work, and will be of great help to students' employment in the future.

Keywords

Electronic Practice; Universal Circuit Board; Building.

1. Introduction

Practice teaching is an important part of practical teaching in universities, which is completely different from theoretical courses in teaching objectives, teaching contents, teaching resources and teaching methods. The basic condition of doing well in the teaching of electronic practice course is to stimulate students' interest in learning. The establishment of students' interest is the guarantee for them to take active actions and overcome difficulties. In order to attract students, the circuits we built should be practical, interesting and moderately difficult to make, so that students can often enjoy the pleasure of making success through certain efforts.

2. Universal Circuit Board

Universal circuit board (PCB) is a printed circuit board with many pads or copper wires evenly distributed according to the requirements of standard IC spacing (2.5mm). It is a circuit board that can be inserted with components and wires according to one's own wishes, also known as hole board, universal board, experimental board, learning board, dot matrix board, etc. Through the steps of design, manual assembly, welding and debugging, small and medium-sized circuits with good reliability and certain strength can be built on the universal circuit board. According to the form of pads, it can be divided into single-hole board (pads on the whole circuit board are independent) and perforated board (multiple pads are connected together according to certain rules, with 2 holes, 3 holes and 4 holes, etc.). According to the material selection, it is divided into copper plate and tin plate. The pad of copper plate is copper, and the surface is usually brushed with a thin layer of flux, showing golden copper color. The substrate of such boards is generally FR1. Advantages are simple processing and low price. Disadvantages are that because the surface flux is easy to erase, it should be wrapped in newspapers or plastic bags during storage to prevent pad oxidation. In case of pad oxidation (the pad loses luster and is difficult to tin), you can dip a cotton swab in alcohol or wipe it with a rubber to remove the oxide layer. A layer of tin is plated on the surface of the copper pad through the tin spraying process, which is called a tin spraying board, and the pad is silvery white. Tin plates are usually coated with solder resist, and the substrate is mostly FR4. The advantages are not easy

oxidation and welding, but the processing technology is relatively complex and the price is relatively high [1].

Compared with professional PCB boards, universal circuit boards have the advantages of low cost, convenient use, convenient and flexible expansion, etc. In the teaching of electronic practice course, electronic circuits are built by universal circuit boards, which combines theoretical knowledge with practice, so that students can better verify and understand theoretical knowledge while mastering skills. The installation method of universal circuit board is relatively simple and the installation method is relatively safe. Its technical content is relatively low, the line installation process is relatively simple, its application area is wide, and its performance is relatively perfect. Compared with installing PCB electronic kit, students can also train circuit wiring design and complicated manual welding skills, to cultivate students' observation ability, logic ability, practical operation ability, innovation ability, anti-frustration ability and team cooperation spirit. Through the students' continuous combing of circuit connections, they can further promote the students' memory and understanding of circuit principles. Building a circuit on a universal circuit board can train students to be rigorous, dedicated and patient.

3. Application of Universal Circuit Board in Electronic Practice Course

In the process of guiding students to know the universal circuit board, we should first clarify the structure of the single-hole universal circuit board (the pads on the welding surface are all independent). For example, the universal circuit board is used to install various components, and one side of the universal circuit board is soldered with copper while the other side is the opposite side. The other side is the side where components are installed, which is the front side of the universal circuit board. When installing components, attention should be paid to inserting them from the front side, and welding should be carried out from the welding surface after inserting them.

3.1. Solder Joint Exercise

In the course of electronic practice, mastering the basic welding technology is an essential basic skill for students, so a very important content in the early stage of learning is welding spot practice and strengthening basic skill training to meet the requirements of welding technology. In the guidance process, use the universal circuit board (with components) used by students who failed to install Works before, and let students observe the installation process, welding quality and wiring of the circuit.

First, use an electric soldering iron to remove the components on the universal circuit board that failed to install the work, and then conduct wire welding practice. Directly bend the bare copper wire into a U shape and weld it on two welding holes to train students to improve the quality of welding points and welding speed, to prepare for circuit welding in the future. Finally, resistance welding training, which trains students to improve the quality and speed of resistance pin forming while improving the quality of welding points, can also be used to train the reading speed and welding speed of color ring resistance.

3.2. Construction of Multivibrator Circuit

It is very flexible to build circuits with universal circuit boards. Different building methods will have different layouts, and different building methods have their own advantages and disadvantages. Students may be afraid of difficulties when they first come into contact with the construction of circuit boards. In practical teaching, students should be guided not to retreat from difficulties. Many seemingly complex circuits can realize circuit functions if they are correctly inserted and welded in place according to the schematic diagram. To guide students to choose a suitable universal circuit board, after the universal circuit board is selected, the next

step is to assemble the circuit. When inserting, the components of the whole circuit should be laid out on the universal board first. After the students have mastered the component knowledge, welding skills and basic circuit assembly and testing skills, they can use the universal board to build the circuit. The first built circuit should be as simple as possible, with fewer components and simple connection relationship between components, so that students can get started easily.

The teacher will show the sample circuit to the students to stimulate the students' thirst for knowledge. Guide students to learn to look at the circuit diagram of multivibrator circuit, as shown in Figure 1. And master the basic concepts such as current and voltage, master the characteristics and basic applications of common components such as resistance, capacitance and transistor, and be able to skillfully use welding technology and common instruments [2]. Introduce students to circuit structure, component function, working principle and other theoretical knowledge. The mastery of these knowledge is of great help to students in maintenance and test operation.

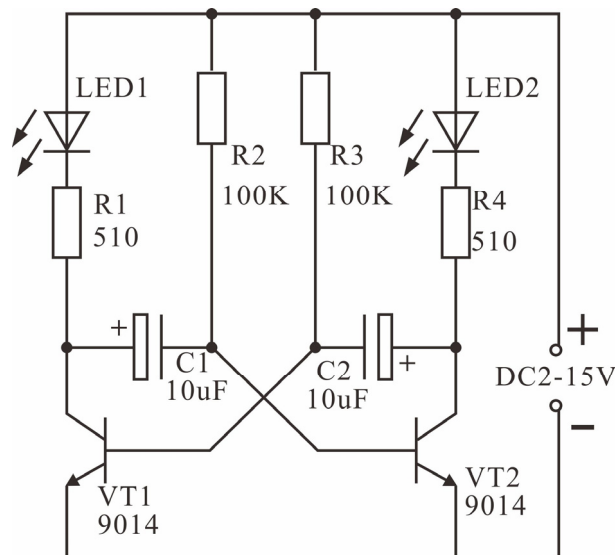


Figure 1. Schematic diagram of multiple resonant circuit

Turning the circuit diagram into an actual electronic product is inseparable from the layout and routing design of circuit components. In order to train students' ability, manual layout and routing design are generally adopted. Manual layout Students first draw the positions of components on the draft paper and design the wire connection. This skill requires repeated training. While strengthening guidance and inspection, we should guide students to design rational layout drawings on the premise of being correct, tidy, beautiful and economical. Design the layout, and after passing the inspection by the teacher, ask the students to insert the physical components into the universal circuit board, and then draw the connection lines between the components with a pen, to solidify the connection relationship between the components and facilitate the students' subsequent welding operation. In the process of this experiment, we need to use universal circuit board, resistance, capacitance, led, triode, solder and wire. After the materials such as universal circuit board were ready, we began to build a multivibrator circuit. In the process of installing various components, students can improve their communication ability and problem-solving ability through their own personal practice.

The specific experimental steps are as follows: we first weld the circuit according to the circuit diagram, pay attention to safe operation during welding, and ensure the connection quality of solder joints and wires, and then weld the power input line. The sequence is as follows: assemble the battery, lead out two wires from the positive and negative poles of the power

supply, which are red and black wires respectively, and distinguish them; Next, assemble the button switch and weld two white wires to the switch; Then, the power supply, loudspeaker, switch and universal circuit board are composed into a circuit in turn; Finally, the triode needs to be installed on the circuit, as shown in Figure 2.

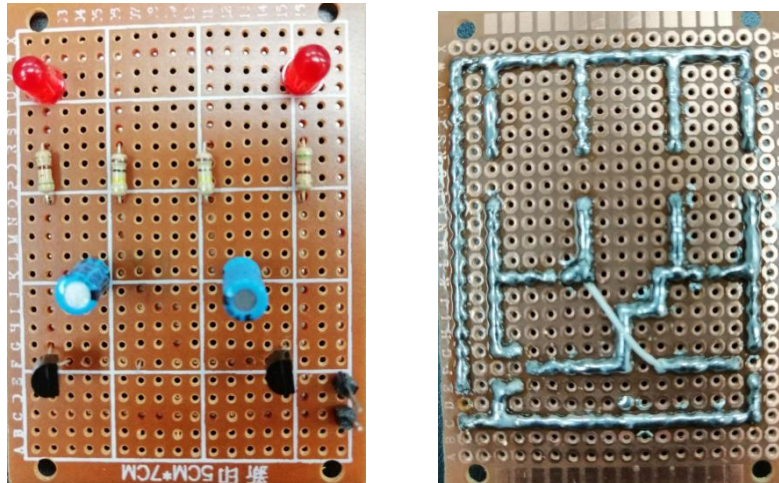


Figure 2. Multi-resonant circuit installation diagram

3.3. Test of Multivibrator Circuit

After the above steps are completed, test the circuit. Students can connect the circuit with 5V DC power supply, and when the switch is pressed, D1 and D2 will illuminate alternately. If D1 or D2 fails to emit light, or if it does not emit light normally, which link has problems, such as the wires may be reversed or the positive and negative poles of the voltage may be misplaced. Are pins B, C and E of transistors VT1 and VT2 installed upside down? The anode and cathode of capacitors C1 and C2 are wrong? Are the 50 Ω resistors and 100K Ω resistors installed upside down? After welding the circuit, students should also conduct self-inspection and mutual inspection to check whether the circuit is installed completely, whether the circuit wiring is correct, and repair if there are problems. After the assembly is normal, students can carry out data testing, fault simulation and other training according to the project assignment. Through testing and fault simulation, students can also have a deeper understanding of circuit principle.

4. Guide the Construction Experience of Universal Circuit Board

The layout of components should be reasonable. In the early stage of welding practice, students can draw the layout and routing of components on the simulation paper of universal board in advance, and then carry out circuit welding. This can not only prevent students from wiring impassability caused by improper layout during welding, which will affect the overall beauty and even the signal integrity, but also reduce the error probability. Reasonable power supply layout is very important, it can make the circuit look simple and clear, and reduce the occurrence of danger. Copper foil is arranged on some universal boards, which can be used as ground wire. If there is no copper foil, practical problems need to be treated practically, that is, the experimenter needs to arrange the power lines and ground wires reasonably [3].

Components shall be molded and placed as required. Components shall be molded according to the requirements of radio assembly and debugging, and the same components shall have the same height. Color ring resistors are placed from left to right and from top to bottom in order to facilitate reading. Other components are placed mainly for easy reading and identification.

Lead-out wires are made of different colors. In order to distinguish various signal lines, it is best to use different colors for the outgoing lines in the circuit. Usually, the positive power supply of

the power cord is red, the ground wire is black, the negative power supply is blue, and the other signal lines are different in color from the power cord.

Keep your lines in order. The wiring of circuit welding with universal board should be mainly on the welding surface, and the wiring should be straight and close to the board surface. Considering the reliability and mechanical strength, the wiring should be welded with every pad under it. If the wiring on the welding surface is blocked, the jumper shall be placed on the same side of the components, and the length of the jumper shall be as short as possible, preferably no more than 6 welding holes. At the same time, pay attention to the horizontal and vertical direction. Large-current traces should be thickened to increase current carrying capacity. In case of high voltage, sufficient safe distance between traces should be considered.

According to the circuit principle, make and debug step by step. Complex circuits can be partially completed, including measurement and debugging, and then welding and debugging of subsequent circuits step by step. This is not only beneficial to circuit debugging, but also can be locked in a small scope to solve problems, which accelerates the debugging speed of students.

Pay attention to welding process. When using universal board to weld circuits, not only the layout of components and the routing of circuits should be considered, but also the quality and appearance of solder joints should be required. Therefore, the welding process requirements of universal board welding circuit are relatively high, and there are certain difficulties and skills in welding.

5. Conclusion

After the universal circuit board has been widely used in the teaching of electronic practice course, not only can students master the welding skills, but more importantly, through the welding of electronic circuits, students can better understand the principles and functions of electronic circuits and master the measurement and analysis methods of electronic circuits. It cultivates students' rigorous learning attitude, improves their ability to analyze and solve problems alone, and enhances their ability to work independently. When they encounter a problem, they can calmly analyze the cause of the problem until they can solve the problem independently. Therefore, it can mobilize students' interest in professional learning, improve students' quality in all aspects and improve teaching effect.

Acknowledgments

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