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Identification and characterization of components

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ABSTRACT

In the information age, components in all kinds of electronic products occupy an important position, in particular, some common electronic components, electronic products is essential to the basic material. The performance of various types of components, features, the use of the scope of the function of the electronic product design and manufacturing has a very important role especially in the past period. Along with the rapid development of the electronics industry, new requirements and components industry is also constantly using new materials. New technology has introduced new products for the development of electronic products to open up new ways. This chapter will be a number of commonly used electronic components according to its type, performance characteristics and testing. As a brief introduction and strive to have a wide range of components have a general understanding in order to facilitate product design and expand the range of components used.

Introduction

With the rapid development of global information technology, electronic components become increasingly important, whether it is electronic information industry or other industries are occupying a very important position, and China's electronics industry is also growing, China's electronic components accounted for nearly 39% of the world. Production of the world's first products are: capacitors, resistors, electro-acoustic devices, magnetic materials, piezoelectric quartz crystal, micro motor, electronic transformers, print circuit boards. With the expansion of China's electronic information industry, the Pearl River Delta, Yangtze River Delta, Bohai Bay area, part of the central and western regions of the four major electronic information industry base. These areas of electronic information companies focus on the industry chain is more complete with considerable size and supporting capacity. China's electronic materials and components industry there are some major problems: middle and low product surplus, high-end products mainly rely on imports, lack of core technology, product profit is low, small-scale enterprises and lack of investment in technology development.

1. Status of Electronic Components Industry

The electronic components industry is mainly composed of electronic components industry, semiconductor sub-device and integrated circuit industry and other components.

Electronic components include: Resistors, capacitors, potentiometers, tubes, radiators, electromechanical components, connectors, semiconductor discrete devices, electro-acoustic devices, laser devices, electronic display devices, optoelectronic devices, sensors, power supplies, switches, micro motor , electronic transformers, relays, printed circuit boards, integrated circuits, various types of circuits, piezoelectric, crystal, quartz, ceramic magnetic materials, printed circuit substrate, electronic function process materials, electronic glue (tape) Chemical materials and parts.

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China's electronic materials and components industry there are some major problems: middle and low product surplus, high-end products mainly rely on imports; lack of core technology, product profit is low; small-scale enterprises,

lack of investment in technology development. The production of electronic components are mainly distributed in Guangdong, Zhejiang, Jiangsu, Shanghai, Fujian, Shandong and other cities.

2. Identification and Detection of Resistors

Resistance according to the material are generally: carbon film resistors, metal film resistors, cement resistance, line Rao resistance. General household appliances use more carbon film resistors because of its low cost. Metal film resistance to be higher and the use of higher requirements in the equipment. Cement resistance and line Rao resistance are able to withstand more high-power while line Rao resistance is also relatively high accuracy and is commonly used in demanding measuring instruments.

2.1. The identification of resistors

Low-power carbon film and metal film resistors, generally with the color ring that resistance size which is our learning resistor is a very important step. The unit of resistance is ohm. Color ring resistance, which black 0 brown 1 red 2 orange 3 yellow 4 green 5 blue 6 purple 7 gray 8 white 9 gold, silver that error, and color ring order different meaning is not the same, the color ring meaning as follows:

The first color ring: the first digit of the resistance;

The second color ring: the second digit of the resistance;

The third is the power of 10:

The fourth color ring: the error that.

For example: resistance color ring: brown green red gold

First place: 1;

Second place: 5;

10 is a power of 2 (ie 100);

Error of 5%

The resistance is: 15X100 = 1500 ohms = 1.5 kohms = 1.5K

2.2. Resistance device detection method

Fixed resistor detection

A, two table pen (regardless of positive and negative), respectively, and the resistance of the two ends of the pin can be measured to determine the actual resistance value. In order to improve the measurement accuracy, should be measured according to the size of the nominal resistance to select the range. Due to the non-linearity of the ohmic scale, it is finer in the middle, so the pointer should be as low as possible in the middle of the scale in the range of 20% to 80% of the full scale which was measured more accurately. According to the different levels of resistance error. ± 5%, ± 10%, or ± 20% error between reading and nominal resistance, respectively. If it does not match, beyond the error range, then the resistance value of the variable.

B, Note: test, especially in the measured resistance of dozens of kΩ or more resistance, the hand does not touch the pen and the conductive part of the resistance; the resistance from the circuit to detect the welding down, at least to open a head to avoid the circuit In the other components of the test have an impact, resulting in measurement error color ring resistance. The best use of a multimeter to test its actual resistance.

The detection of cement resistance

The detection of cement resistance methods and precautions and detection of ordinary fixed resistance are exactly the same.

The detection of fuse resistance

In the circuit, when the fuse resistor blows open, you can judge according to experience: If the fuse resistor surface is black or charred, it can be concluded that if the load is too heavy, the current exceeds the rated value of many times. If its surface without any trace and open, then the flow of current just equal to or slightly larger than its rated fuse value. For the surface without any trace of the fuse resistor good or bad judgment, it can be measured with a multimeter R × 1

block in order to ensure accurate measurement, the fuse should be welded from one end of the circuit. If the measured resistance is infinite, then the fuse resistor has failed to open the road and if the measured resistance and the nominal value of a far cry, indicating that the resistance variable, it is not appropriate to use. In the maintenance practice found that there are a small number of fuse resistors in the circuit was short-circuit phenomenon, the detection should also be noted.

The potentiometer detection

Check the potentiometer, first turn the handle to see whether the rotation of the handle is smooth, the switch is flexible, switch off, when the 'click' sound is crisp and listen to a potential. The internal contact point and the resistance of the friction body of the sound such as 'rustling' sound, indicating that the quality is not good. When testing with a multimeter, first select the appropriate resistance range of the multimeter according to the size of the measured potentiometer and then check it according to the following method. With a multimeter ohm block test '1', '2' at both ends of the reading should be the nominal resistance of the potentiometer such as multimeter pointer fixed or a lot of resistance difference, then the potentiometer has been damage. B, Detect the potentiometer active arm and the resistance of the contact is good. (1), '2' (or '2', '3') at both ends of the multimeter, the counter shaft of the potentiometer is rotated counterclockwise to the position close to 'OFF', and the smaller the resistance value the better. Then clockwise slowly rotating shaft handle, the resistance value should be gradually increased, the head of the pointer should be a smooth move. When the shaft is rotated to the extreme position '3', the resistance should be close to the nominal value of the potentiometer. For instance, the multimeter pointer in the potentiometer handle during the rotation of the phenomenon of beating, indicating that the active contact with poor contact failure.

The detection of photosensitive resistance

A: Photoresistor transparent window cover with a black paper, then the multimeter pointer remained intact, the resistance close to infinity. The greater the value, the better the photoresistor performance. If this value is small or close to zero, indicating that the photosensitive resistor has burned damaged, can no longer continue to use. B: □It will be a light source aligned light through the window, then the multimeter pointer should have a more substantial swing, the resistance was significantly less than the smaller value of the photosensitive resistor performance better. If this value is large or even infinite, indicating that the internal resistance of the photosensitive resistor is broken, can no longer continue to use. C: It will be photosensitive light transmission window at the incident light with a small black paper in the shade of the shade of the photosensitive shadows, so that intermittent by light, then the multimeter pointer should swing with the black paper and swing around. If the multimeter pointer is always stopped in a position does not sway with the paper and swing, indicating that the photoresist photosensitive material has been damaged.

3. Identification and Detection of Capacitors

Capacitors are an essential element in electronic instruments. Its basic structure is in the two adjacent to the conductor between layers of non-conductive insulating material - the media, constitute a capacitor. It is an energy storage element that can store a certain amount of charge on both sides of the medium. The ability to store charge is expressed in terms of capacitance. The basic potential is Farah, denoted by F. As the unit of Farah is too large, the common units of capacitance are microfarads (μF) and (pF).

3.1. The identification of capacitors:

Capacitors in the circuit generally use 'C' plus digital (such as C13 said the number 13 of the capacitor). Capacitance is composed of two pieces of metal film close to the middle of the insulating material separated by the composition of the components. The characteristics of the capacitor are mainly DC-AC. Capacitive capacity is the size that can store the size of the energy, the capacitance of the AC signal is called the capacitive reactance, which is the frequency of AC signals and capacitance.

Common capacitors according to the different materials can be divided into: porcelain prices capacitors, polyester capacitors, electrolytic capacitors, Tam capacitors, as well as advanced polypropylene capacitors whereby they all have different uses. For example, porcelain prices are often used for high frequency and electrolysis for power supply filtering.

Some examples are given above. Among them, the electrolytic capacitor is positive and negative points, the other is not. Capacitance capacity units are: method (F), micro-law (uf), leather method (pf). Generally we do not have to do it because it is too big. The conversion between the units is: 1F = 1000000uf 1uf = 1000000pf

3.2. The detection of capacitors

Fixed capacitor detection

A, 10pF below the detection of small capacitors, 10pF below the fixed capacitor capacity is too small, with a multimeter to measure, only qualitative check whether there is leakage, internal short circuit or breakdown phenomenon. Measurement, the optional multimeter R × 10k block, with two test leads were any two capacitors connected, the resistance should be infinite. If the measured resistance (pointer to the right swing) is zero, then the capacitor leakage damage or internal breakdown. B, test 10PF - 0.01μF fixed capacitor is charging phenomenon, and then determine good or bad. Multimeter selection R × 1k block. Two triodes of the β value is more than 100, and the penetration of the current to some can choose 3DG6 and other types of silicon transistors composed of composite pipe. The multimeter's red and black test leads are connected to the emitter e and collector c of the composite tube, respectively. Due to the amplification of the composite transistor, the measured capacitance of the charge and discharge process to be amplified, so that the multimeter pointer increase the amplitude, so easy to observe. It should be noted that: in the test operation, especially in the measurement of a small capacity of the capacitor, it is necessary to repeatedly change the measured capacitance of the pin contact A, B two points, in order to clearly see the multimeter pointer swing. C, 0.01μF or more for the fixed capacitor, you can use the multimeter R × 10k block directly test whether the charging process of the capacitor and whether the internal short circuit or leakage, and according to the size of the pointer to the right of the size of the capacitor to estimate the capacity.

Electrolytic capacitor detection

A, The measurement should be used for different capacity selection of the appropriate range because the electrolytic capacitor capacity is much larger than the general fixed capacitor. According to experience, under normal circumstances, 1 - 47μF capacitance between the R × 1k block can be measured, more than 47μF capacitor can be measured with R × 100 block. B, The multimeter red pen then negative, black pen then positive, in the moment of contact, multimeter pointer that is deflected to the right skew (for the same block, the larger the capacity, the greater the swing), then gradually left Rotate until it stops at a certain location. The resistance at this time is the positive leakage resistance of the electrolytic capacitor, which is slightly larger than the reverse leakage resistance. Practical experience shows that the leakage resistance of electrolytic capacitors should generally be more than a few hundred kΩ, otherwise, will not work properly. In the test, if the forward and reverse are no charge of the phenomenon, that is, the needle does not move, then the capacity disappeared or internal circuit; if the measured resistance is small or zero, indicating that the capacitor leakage or breakdown has been damaged, Can no longer be used. C, For the positive and negative signs of unknown electrolytic capacitors, can be used to measure the leakage resistance of the method to be identified. That is, first to measure the leakage resistance, remember its size, and then exchange the pen and then measured a resistance. Two measurements in the resistance of the big one is the positive connection, that is, the black pen is a positive pole, red pen is connected to the negative pole. D, use multimeter block, the use of electrolytic capacitors for positive and reverse charging method, according to the size of the pointer to the right swing amplitude, can estimate the capacity of electrolytic capacitors.

Variable capacitor detection

A, Gently rotating the shaft by hand, should feel very smooth, should not feel sometimes loose and even stuck phenomenon. Will be loaded forward, rear, up, down, left, right and other directions to push, the shaft should not be loose phenomenon. B, With one hand to rotate the shaft, the other hand light touch the outer edge of the film group, should not feel any loose phenomenon. Shaft and moving between the poor contacts with the variable capacitor, can no longer continue to use. C, The multimeter placed in the R × 10k block, one hand will be two table pen then connect the variable capacitor moving film and set the leading end, the other hand will slowly rotate the shaft several back and forth, multimeter pointer should be in infinity position does not move. In the process of rotating the shaft, if the pointer sometimes pointed to zero, indicating the existence of short pieces between the moving film and the fixed point; if you encounter a certain angle, the multimeter reading is not infinite but a certain resistance, indicating that the variable capacitor. There is a leakage between the film and the chip.

4. Inductor, transformer identification and detection

4.1. Inductor, transformer identification

Inductors are used in a wide range of applications, such as tuning, oscillation, coupling, matching, filtering, notch, delay, compensation and deflection focusing and other circuits are essential. Because of its use, operating frequency, power, different working conditions, the basic parameters of the inductor and the structure of the different requirements,

resulting in the type of inductor and structure diversification. Inductors (also known as inductive coils) are divided into fixed and variable according to the working characteristics. According to the nature of magnetic conductor into a single layer, multi-layer, honeycomb type, a skeleton or no skeleton.

The main functions of the transformer are: voltage conversion. Current conversion, impedance conversion; isolation. Voltage regulator (magnetic saturation transformer); autotransformer. High voltage transformer (dry and oil type), transformer commonly used core shape generally E Type and C type core, XED type, ED type CD type. Transformers can be divided into: distribution transformers, power transformers, sealed transformers, modular transformers, dry transformers, oil-immersed transformers, single-phase transformers, electric furnace transformers, rectifier transformers, reactors, anti-interference transformers, transformers, box transformer, test transformers, corner transformers, high current transformers, excitation transformers.

4.2. Inductor, transformer detection:

Color code sensor detection:

The multimeter placed in the R × 1 block, red and black pen each color code inductor any of the lead-out, then the pointer should swing to the right. According to the measured resistance value, can be divided into the following three cases to identify: A, measured color code inductor resistance is zero, the internal short-circuit fault. B, the measured color code inductor DC resistance value and the size of the wound coil used in winding the enamel wire diameter, the number of turns around the circle has a direct relationship, as long as the resistance can be measured, you can think that the measured color sensor is normal of.

The middle of the transformer detection

A, will dial to R × 1 block, in accordance with the transformer in the winding of the winding rules, one by one check the winding off the situation, and then determine whether it is normal. (1) The resistance between the primary winding and the secondary winding; (2) the resistance between the primary winding and the shell; (2) the resistance between the primary winding and the secondary winding. (2) The resistance between the primary winding and the shell. (3) The resistance between the secondary winding and the housing. The above test results are divided into three cases: (1) resistance is infinite: normal. (2) Resistance is zero: a short circuit fault. (3) Resistance is less than infinity, but is greater than zero: a leakage fault.

The power transformer detection

A, by observing the appearance of the transformer to check whether there are obvious abnormalities. Such as whether the coil wire break, desoldering, insulation materials are scorched traces, the core fastening screw is loose, silicon steel sheet with or without corrosion, and winding coil is exposed. B, insulation test. With a multimeter R × 10k block were measured core and primary, primary and secondary, core and the secondary, electrostatic shielding and pantal secondary, secondary resistance between the windings, multimeter pointer should be in the infinity position is not move. Otherwise, the transformer insulation performance is bad. C, coil on and off detection. The multimeter placed in the R × 1 block, the test, if a winding resistance is infinite, then this winding has a circuit fault. D, identify the primary and secondary coils. Power transformer primary and secondary pins are generally derived from both sides, and the primary winding with more than 220V words, the secondary winding is marked with rated voltage, such as 15V, 24V and 35V. And then according to these markers to identify. E, no-load current detection. (A) direct measurement method. (500mA, string into the primary winding. When the primary winding plug into the 220V AC mains, the multimeter is indicated by the no-load current value. This value should not be More than 10% to 20% of the full load current of the transformer. General common electronic equipment Power transformer normal no-load current should be about 100mA. If too much, then the transformer has a short circuit fault. (B) Indirect measurement method. Of the primary winding in series with a 10 acmite / 5W resistance, the secondary still all the no-load. The multimeter dial to the AC voltage block. After power, with two test pen resistance R across the voltage drop U, and then calculated by Ohm's law No load current I empty, that is, I = U / R.F, no-load voltage detection. The power transformer primary 220V mains, with a multimeter AC voltage followed by measuring the winding no-load voltage (U21, U22, U23, U24) should meet the requirements, the allowable error range is generally: high voltage winding ≤ ± 10%, low voltage winding ≤ ± 5%, with the center of the two groups of symmetrical winding voltage difference ≤ ± 2% General merit Power transformer to allow the temperature rise of 40 ℃ - 50 ℃, if the quality of the insulating material used to allow the temperature rise can also be increased. H, detection and identification of the same side of the winding in the use of power transformers, sometimes in order to get the required times Voltage, two or more secondary windings can be used in series. Using the series method to use the power transformer, the series of the same winding must be properly connected, cannot make mistakes. Otherwise, the transformer cannot work. Power transformer short-circuit fault of the comprehensive detection and identification of power transformer short-circuit fault after the main symptoms are serious heat and secondary

winding output voltage anomalies. Often, the coil turns between the internal short-circuit point, the greater the short-circuit current, and transformer The more serious the heat to detect the power transformer to determine whether there is a short circuit fault is a simple way to measure the no-load current (test method has been described earlier.) There is a short circuit fault of the transformer, the no-load current value will be much greater than 10% of full load current. When the short circuit is serious, the transformer in the no-load power within tens of seconds will quickly heat, hand Touch the core will have a hot feeling at this time without measuring the no-load current can be determined there is a short circuit point of the transformer.

5. Identification and Detection of Diodes and Transistors

5.1. Diode, transistor identification:

Diode, also known as crystal diode, referred to as diode (diode); it only in one direction to send current electronic components. It is a device with two terminals with one part number and has the property of flowing or not flowing in the direction of the applied voltage. The crystal diode is a p-n junction formed by a p-type semiconductor and an n-type semiconductor, forming a space charge layer on both sides at its interface and constructing a self-built electric field. When there is no applied voltage, the diffusion current due to the difference in carrier concentration between the two sides of the p-n junction is equal to the drift current caused by the built-in electric field and is in an electrical equilibrium state.

Semiconductor transistor, also known as 'crystal transistor' or 'transistor'. Crystal transistor in the circuit commonly used 'Q' plus the number that the semiconductor germanium or silicon single crystal on the preparation of two can affect each other PN junction, constitute a PNP (or NPN) structure. The middle of the N area (or N area) called the base area, both sides of the area called the launch area and the collector area, the three parts each have an electrode lead, respectively, called the base B, emitter E and collector C, Amplification, oscillation or switching of the role of semiconductor electronic devices. Transistor has an important parameter is the current amplification factor β. When a small current is applied to the base of the transistor, a current that is about 2.5 times the injection current, the collector current, can be obtained at the collector. The collector current varies with the base current, and a small change in the base current can cause a large change in the collector current, which is the amplification of the transistor. Transistor can also be used for electronic switches, with other components can also constitute the oscillator.

5.2. Diode, transistor detection:

Multimeter to detect the polarity and good quality of ordinary diodes:

Detection principle: According to the diode of the one-way conductivity of this feature good performance of the diode, the forward resistance is small, reverse resistance. The bigger difference between the two values the better. If the difference is that the performance of the diode is not good or has been damaged.

Measurement, the choice of multimeter 'ohm' block. Generally with R x100 or R xlk block, without Rx1 or R x10k block. Because Rxl block the current is too large, easy to burn the diode, R xlok block the internal power supply voltage is too large, easy to breakdown diode. Measuring method: the two table bars were connected to the two electrodes of the diode, read the measured resistance Value; then the table bar and then re-measured once, write down the second resistance. If the difference between the two resistance is very large, indicating that the diode performance is good; and according to the measurement of the resistance of the small rod that method (called the forward connection), to determine the black rod is connected with the diode cathode, The red pole is connected to the negative pole of the diode. Due to the multimeter's internal power supply is connected to the multimeter's '-' jack, the negative of the internal power supply is connected to the '+' jack of the multimeter.

If the resistance of the two measurements are very small, indicating that the diode has been punctured; if the resistance measured twice are large, indicating that the diode has been broken inside: the difference between the two measured resistance is not that the diode performance is poor. In these cases, the diode cannot be used.

It must be pointed out that since the volt-ampere characteristics of the diode are non-linear, different resistance values are obtained when measuring the resistance of the diode with different resistors of the multimeter. When actually used, the current flowing through the diode will be larger and the diode. The resistance value will be smaller.

The detection of special types of diodes:

Zener diode, Zener diode is a work in the reverse breakdown area, with a stable voltage of the diode. The measurement of the polarity and performance of the diode is similar to that of a conventional diode, except that when the diode is measured using the Rxlk block of the multimeter, the reverse resistance is measured. In this case, the multimeter is switched to Rx10k file, if the multimeter pointer to the right deflection of the larger angle, that is, the reverse resistance decreases a lot of the case, the diode for the Zener diode; if the reverse resistance is basically unchanged, indicating that the diode is a common diode, rather than Zener diode.

Zener diode measurement principle is: Multimeter Rxlk block internal battery voltage is small, usually does not make ordinary diode and Zener diode breakdown, so the measured reverse resistance is great. When the multimeter switch to Rx10k block, the multimeter battery voltage becomes very large, so that the regulator diode reverse breakdown phenomenon, so its reverse resistance drops a lot, because the ordinary diode reverse breakdown voltage than the regulator diode high Much more, so ordinary diode does not breakdown, the reverse resistance is still great.

The transistor detection:

In order to quickly grasp the measurement method, in the measurement of the transistor summed up the four formulas: 'three reverse, find the base. PN junction, tube type. Along the arrow, deflection large, uncertainty, moving mouth. 'Let us explain the sentence below it.

One, three upside down, looking for base. We all know that the transistor is a semiconductor device with two PN junctions. According to the two PN junction connection, can be divided into NPN type and PNP type two different types of conductivity of the transistor, test transistor to use the omnidirectional meter block, and select R × 100 or R × 1k gear. Suppose we do not know whether the measured transistor is NPN or PNP type, but also cannot tell what the pin is the electrode. The first step in the test is to determine which pin is the base. At this time, we take two electrodes (such as the two electrodes for the 1,2), with a universal meter two table pen reverse measurement of its positive and reverse resistance, observe the deflection angle of the needle. 3 electrodes and two electrodes, respectively, reverse the measurement of their positive and negative resistance, observe the deflection angle of the needle. In this three reversal measurements, there must be two measurements similar to the results: that is reversed in the measurement of a needle deflection, a slight deflection. The rest must be reversed before and after the pointer deflection angle is very small, this time not measured that only. The pin is the base we're looking for. Second, PN junction, tube type, find the base of the transistor, we can base and the other two electrodes between the PN junction to determine the direction of the conductivity of the tube. Will be the multimeter of the black pen touch base, red pen touch the other two electrodes in the electrode, if the head pointer deflection angle is large, then the measured transistor for the NPN tube; if the head pointer deflection angle is very small, The measured tube is PNP type. Three, along the arrow, deflection, find the base b, the other two electrodes which is the collector c, which is the emitter. At this time we can use the measured

current ICEO method to determine the collector c and launch Pole e (1) For the NPN type transistor, the penetration current measurement circuit shown in Figure 3. According to this principle, with a million meter black and red pen pen reverse measurement between the positive and negative resistance Rce and Rec, although the two measurements in the multimeter pointer deflection angle is very small, but careful observation, there will always be a deflection. The current flow direction is exactly the same as the direction of the arrow in the transistor symbol ('arrow') so the black table pen at this time, the current flow direction must be: black table pen → c pole → b pole → e pole → red pen, Then must be connected to the collector c, red table pen must be connected to the emitter e. (2) For the PNP type transistor, the reason is similar to the NPN type, the current flow must be: black table pen → e pole → b pole → c pole → red pen, the current flow direction also with the arrow in the direction of the arrow, so at this time the black table pen must be connected to the emitter e, red table pen connected to the collection must be C. Fourth, cannot be measured, moving mouth If the 'arrow, deflection large' in the measurement process, if the reversal before and after the two measurement pointer deflection are too small to distinguish, it is necessary to 'move the mouth'. The specific method is: in the 'arrows, deflection large' in the two measurements, with two hands were pinching the combination of two pen and pin, with the mouth (or tongue against) base electrode b, still The open collector c and emitter e can be distinguished by the discriminant method of 'shaking arrows and deflecting large'.

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