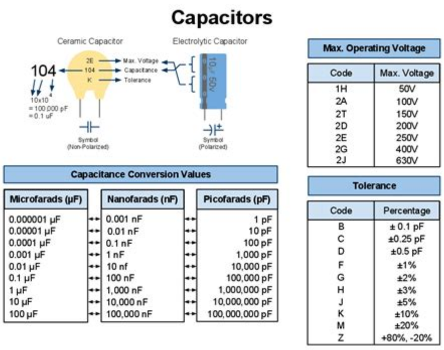

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Book Descriptions:

capacitor marking code manual

These markings and codes indicate various properties for the capacitors and it is essential to understand them in order to select the required type. These capacitor colour codes are less common than in previous years, but some may still be seen. There are a number of basic marking systems that are used and different capacitor types and different manufacturers use these as needed and best fits the particular product. This method works best on larger capacitors where there is sufficient space for the markings.This capacitor marking code uses three characters. It bears many similarities to the numeric code system adopted for some surface mount resistors. The first two figures refer to the significant figures of the capacitor value, and the third one acts as a multiplier. The value of the capacitor is denoted in picofarads for ceramic, film, and tantalum capacitors, but for aluminium electrolytic capacitors the value is denoted in microfarads. Abbreviated capacitor code This type of capacitor marking is used less these days but may be seen on some older capacitors. The code used is actually the same as that used with resistors as it utilises the EIA scheme In many instances where the capacitor is small no voltage coding is provided and care must be taken when using a capacitor without any knowledge of its working voltage. Again the marking code uses the EIA scheme This occupies much less space and bears many similarities to the EIA system. These capacitor codes are standardised by EIA, but also some other generally used industry codes may also be seen in common use. These codes are typically used for ceramic and other film type capacitors. Great care must be taken to ensure the polarity markings are observed when inserting these capacitors into circuits otherwise damage to the component, and more importantly to the remainder of the circuit board can result. Polarised capacitors effectively mean aluminium electrolytic and tantalum types.http://www.flowprofile.it/userfiles/bosch-logixx-8-sensitive-manual-child-lock.xml

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On an electrolytic capacitor the stripe indicates the negative lead. When new, a further polarity making may be used because it may be seen that the positive lead is longer than the negative one. As such it is often possible to provide the complete value and details in a nonabbreviated format. However many smaller electrolytic capacitors need to have coded markings on them as there is insufficient space. The value and working voltage is obvious. The polarity is marked by a bar to indicate the negative terminal. Typically the markings on a capacitor may give the figures like 22 and 6V.A variety of schemes may be used. Often the value may be given in picofarads. Sometimes figures such as 10n will be seen and this indicates a 10nF capacitor. Similarly n51 indicates a 0.51nF, or 510 pF capacitor, etc.. During manufacture the capacitors are loaded into a pick and place machine and there is no need for any markings. This is particularly important because it is necessary to be able to check the polarity and to have a marking to identify the polarity of the capacitor. It is particularly important to have a capacitor polarity marking because reverse biasing tantalum capacitors leads to their destruction.Although there appear to be many different coding schemes, they are normally very obvious, and if not their meaning is soon revealed when referring to a coding guide. Sometimes you need a little more power supply decoupling, an output coupling cap, or careful tuning of a filter circuit all applications where capacitors are critical. The SparkFun Capacitor Kit contains a wide range of capacitor values, so you will always have them on hand when you need them. There are also ten pieces of 22pf, which are frequently used as load capacitors when building crystal oscillators. Capacitor values are usually tiny often in the millionths or billionths of a

Farad. To express those small values succinctly, we use the metric system.At SparkFun, we often use the letter u as a substitute.http://www.cafezipp.at/lehremitholz/img/upload/bosch-logixx-8-sensitive-dryer-user-manual.xml

These are small, nonpolarized caps with yellow blob for their body. This code is similar to the color code on resistors, but uses digits instead of colors. The first two digits are the two most significant digits of the value, and the third digit is the exponent on the 10. The value is expressed in terms of picoFarads. They typically offer higher capacitance than ceramic caps. Unlike ceramics, they are polarized. The positive leg needs to be kept at a higher DC potential than the negative leg. If theyre installed backwards, theyre prone to explode. There are a couple of tricks that can be used to bridge those gaps, by combining caps in series or parallel. You can gang up smaller caps to effectively form a larger cap. Take a look at our beginners guide toClick here for details. Both parts of each calculator work separately you do not have toDetails of capacitor markings can be found in. Now I have a DMM that reads capacitance, which makes identifying capacitors much simpler. BEAM circuits are often bilateral twosided and balanced, and in these cases try to use the same value on both sides. This is the value in pf. Some values are usually given in uF, especially those used in BEAM applications, so I have given these as a separate column where appropriate. They are generally higher values and usually have the value printed right on them. But the fact is, normally there's just not enough space to display this information in plain English. While any engineer knows that the color markings on a resistor signify the resistance, some may not realize that capacitors also have their own set of markings, which vary depending on the size of the device. This article will explore just what these markings mean on a number of different components. They range in size from the head of a pin to somewhere in the vicinity of a soda can, so both the characteristics of capacitors and the ability to print information on them vary greatly.

If so, the polarization marking indicates the negative side, and generally takes the form of a lightly colored stripe It indicates that the capacitor breaks down at 50 volts. Finally, the white stripe indicates the negative leg of this capacitor, which is generally also the shorter leg. The top “683” marking indicates the capacitance value, which is 68,000 picofarads pF. There are three exceptions for the last digit 7 is not used, 8 means to multiply the leading digits by 0.01, and 9 means to multiply the leading digits by 0.1. There is no negative indicator, as this capacitor doesn't have a dedicated polarity and can be installed either way. Therefore, the capacitance of these two capacitors are 10 and 15 picofarads, respectively. As in the previous case, these capacitors also have no polarity to display. Because of their small size, there's no markings for the dielectric breakdown voltage—you'll need to look it up on the capacitor's spec sheet. Capacitors may also indicate their tolerance with a letter placed after the first three numbers. The table below gives more of these tolerance codes. However, with these guidelines, you should be able to identify a capacitor's basic characteristics. Zach, with Arrow Electronics, has a background in consumer product development. Jeremy has worked in manufacturing automation and writes for a variety of technical publications. You can learn more about capacitors here. It consists of a pellet of porous tantalum metal as an anode, covered by an insulating oxide layer that forms the dielectric, surrounded by liquid or solid electrolyte as a cathode. Because of its very thin and relatively high permittivity dielectric layer, the tantalum capacitor distinguishes itself from other conventional and electrolytic capacitors in having high capacitance per volume high volumetric efficiency and lower weight.Tantalum electrolytic capacitors are considerably more expensive than comparable aluminum electrolytic capacitors.

Reverse voltage can destroy the capacitor. Nonpolar or bipolar tantalum capacitors are made by effectively connecting two polarized capacitors in series, with the anodes oriented in opposite directions.Applying a positive voltage to the tantalum anode material in an electrolytic bath forms an oxide barrier layer with a thickness proportional to the applied voltage. This oxide layer serves as the dielectric in an electrolytic capacitor. The properties of this oxide layer compared with tantalum oxide layer are given in the following tableAn electrolyte acts as the cathode of electrolytic capacitors. There are many different electrolytes in use. Generally, the electrolytes will be distinguished into two species, nonsolid and solid electrolytes. Nonsolid electrolytes are a liquid medium whose conductivity is ionic. The oxide layer may be destroyed if the polarity of the applied voltage is reversed.Despite this, the dielectric strengths of these oxide layers are quite high. Thus, tantalum capacitors can achieve a high volumetric capacitance compared to other capacitor types.However, in comparing the permittivities of different oxide materials, it is seen that tantalum pentoxide has an approximately 3 times higher permittivity than aluminum oxide. Tantalum electrolytic capacitors of a given CV value can therefore be smaller than aluminum electrolytic capacitors.During sintering, the powder takes on a spongelike structure, with all the particles interconnected into a monolithic spatial lattice. This structure is of predictable mechanical strength and density, but is also highly porous, producing a large internal surface area see Figure 2. By choosing the correct powder type and sintering temperature, a specific capacitance or voltage rating can be achieved.The total dielectric thickness is determined by the final voltage applied during the forming process. Initially the power supply is kept in a constant current mode until the correct voltage i.e.

dielectric thickness has been reached; it then holds this voltage and the current decays to close to zero to provide a uniform thickness throughout the device and production lot.For each unit thickness of oxide growth, one third grows out and two thirds grows in. Due to the limits of oxide growth, there is a limit on the maximum voltage rating of tantalum oxide for each of the presently available tantalum powders see Figure 3.This is achieved by pyrolysis of manganese nitrate into manganese dioxide.It has contact surfaces on the end faces of the case and is manufactured in different sizes, typically following the EIA 535BAAC standard. The different sizes can also be identified by case code letters. For some case sizes A to E, which have been manufactured for many decades, the dimensions and case coding over all manufactures are still largely the same. These departures from EIA standards mean devices from different manufacturers are no longer always uniform.Due to their selfhealing properties the nonsolid electrolyte can deliver oxygen to form new oxide layer in weak areas of the dielectric, the dielectric thickness can be formed with much lower safety margins and consequently with much thinner dielectric than for solid types, resulting in a higher CV value per volume unit. Additionally, wet tantalum capacitors are able to operate at voltages in excess of 100 V up to 630 V, have a relatively low ESR, and have the lowest leakage current of all electrolytic capacitors.They are used in ruggedized industrial applications, such as in probes for oil exploration. Types with military approvals can provide the extended capacitance and voltage ratings, along with the high quality levels required for avionics, military, and space applications.Aluminum electrolytic capacitors were commercially manufactured in the 1930s.The solution R. L. Taylor and H. E. Haring from the Bell Labs found for the new miniaturized capacitor found in early 1950 was based on experience with ceramics.

This dramatically reduced the leakage current of the finished capacitors.In the style of tantalum pearls, they soon found wide use in radio and new television devices.All properties can be defined and specified by a series equivalent circuit composed of an idealized capacitance and additional electrical components which model all losses and inductive parameters of a capacitor. In this seriesequivalent circuit the electrical characteristics are defined byThis influences the capacitance value of tantalum capacitors, which depend on operating frequency and temperature. The basic unit of electrolytic capacitors capacitance is microfarad F.Standardized measuring condition for electrolytic capacitors is an AC measuring method with a frequency of 100 to 120 Hz. Electrolytic capacitors differ from other capacitor types, whose capacitances are typically measured at 1 kHz or higher.Electrolytic capacitors are available in different tolerance series classifications, whose values are specified in the E series specified in IEC 60063. For abbreviated marking in tight spaces, a letter code for each tolerance is specified in IEC 60062.Electrolytic capacitors, which are often used for filtering and bypassing capacitors dont have the need for narrow tolerances because they are mostly not used for accurate frequency applications like oscillators.For some applications it is important to use a higher temperature range. Lowering the voltage applied at a higher temperature maintains safety margins. The category voltage is the maximum DC voltage or peak pulse voltage that may be applied continuously to a capacitor at any temperature within the category temperature range T C. The relation between both voltages and temperatures is given in the picture right.Although the current may only be a few microamps, it represents a very high localized current density which can cause a tiny hotspot. This can cause some conversion of amorphous tantalum pentoxide to the more conductive crystalline form.

When a high current is available, this effect can avalanche and the capacitor may become a total short.The most common guidelines for tantalum reverse voltage areFor timers or similar applications, capacitors are seen as a storage component to store electrical energy. But for smoothing, bypassing, or decoupling applications like in power supplies, the capacitors work additionally as AC resistors to filter undesired AC components from voltage rails.As higher the capacitance as lower the resonance frequency. In this sense impedance is a measure of the ability of the capacitor to attenuate alternating currents and can be used like Ohms lawIn this case the impedance at the angular frequency.At this point, the capacitor begins to behave primarily as an inductance.This internal heat may influence the reliability of tantalum electrolytic capacitors.The dissipation factor is determined by the tangent of the phase angle between the subtraction of capacitive reactance X C from inductive reactance X L, and the ESR. If the capacitors inductance ESL is small, the dissipation factor can be approximated asIt arises mainly in power supplies including switchedmode power supplies after rectifying an AC voltage and flows as charge and discharge current through the decoupling or smoothing capacitor.This dissipation power loss P L is caused by ESR and is the squared value of the effective RMS ripple current I R.T against the ambient. This heat has to be distributed as thermal losses P th over the capacitors surface A and the thermal resistance.The temperature of the capacitor, which is established on the balance between heat produced and distributed, should not exceed the capacitors maximum specified temperature.This current is represented by the resistor R leak in parallel with the capacitor in the seriesequivalent circuit of electrolytic capacitors.

This statement should not be confused with the selfhealing process during field crystallization, as described in Reliability failure rate.They normally have a very low leakage current, most much lower than the specified worstcase.It is subject to a stochastic process and can be described qualitatively and quantitatively; it is not directly measurable.Failure types included in the total failure rate are short circuit, open circuit, and degradation failures exceeding electrical parameters. Individual components fail at random times but at a predictable rate.For example, higher temperature and applied voltage cause the failure rate to increase.Continuous improvement in tantalum powder and capacitor technologies have resulted in a significant reduction in the amount of impurities present, which formerly have caused most of the field crystallization failures.Application rules for types with an inherent failure mode are specified to ensure high reliability and long life.In this circumstance, the failure can be catastrophic if there is nothing to limit the available current, as the series resistance of the capacitor can become very low.The purity of the tantalum powder is one of the most important parameters for defining its risk of crystallization. Since the mid1980s, manufactured tantalum powders have exhibited an increase in purity. Current flowing through the crystallized area causes heating in the manganese dioxide cathode near the fault.Large sizes capacitors, especially large sizes and high voltage types should be individually protected against sudden discharge of the whole bank due to a failed capacitor.During charging, the voltage across each of the capacitors connected in series is proportional to the inverse of the individual capacitors leakage current. Since every capacitor differs a little bit in individual leakage current the capacitors with a higher leakage current will get less voltage.

The voltage balance over the series connected capacitors is not symmetrically.When subjected to reversed polarity even briefly, the capacitor depolarizes and the dielectric oxide layer breaks down, which can cause it to fail even when later operated with correct polarity. If the failure is a short circuit the most common occurrence, and current is not limited to a safe value, catastrophic thermal runaway may occur. This failure can even result in the capacitor forcefully ejecting its burning core. The polarity better can be identified on the shaped side of the case, which has the positive terminal. The different marking styles can cause dangerous confusion.Whereas on aluminium surface mount capacitors it is the negative terminal that is so marked.But most tantalum capacitors are chip types so the reduced space limits the imprinted signs to capacitance, tolerance, voltage and polarity.Here only the traceability of the manufacturers can ensure the identification of a type.Tantalum ore is one of the conflict minerals. Some nongovernmental organizations are working together to raise awareness of the relationship between consumer electronic devices and conflict minerals.They are also often used for power supply rail decoupling in parallel with film or ceramic capacitors which provide low ESR and low reactance at high frequency. Tantalum capacitors can replace aluminum electrolytic capacitors in situations where the external environment or dense component packing results in a sustained hot internal environment and where high reliability is important. Equipment such as medical electronics and space equipment that require high quality and reliability makes use of tantalum capacitors.Retrieved 20150102. CS1 maint archived copy as title link Retrieved 20100126. CS1 maint archived copy as title link Retrieved 20150102. CS1 maint archived copy as title link By using this site, you agree to the Terms of Use and Privacy Policy.

By using our site, you agree to our cookie policy.Learn why people trust wikiHow Ralph Childers is a master electrician based in the Portland, Oregon area with over 30 years of conducting and teaching electrical work. Ralph received his B.S. in Electrical Engineering from the University of Louisiana at Lafeyette and holds an Oregon Journeyman Electrical License as well as electrician licenses in Louisiana and Texas.This article received 27 testimonials and 91% of readers who voted found it helpful, earning it our readerapproved status.Physically small capacitors are especially difficult to read, due to the limited space available for printing. The information in this article should help you read almost all modern consumer capacitors. Dont be surprised if your information is printed in a different order than the one described here, or if voltage and tolerance info is missing from your capacitor. For many lowvoltage DIY circuits, the only information you need is the capacitance.The base unit of capacitance is the farad F.Most large capacitors have a capacitance value written on the side. Slight variations are common, so look for the value that most closely matches the units above. You may need to adjust for the followingSome capacitors list a tolerance, or the maximum expected range in capacitance compared to its listed value. This isnt important in all circuits, but you may need to pay attention to this if you require a precise capacitor value.This may be code for a tolerance value, described below. If there is no symbol at all, reserve the cap for lowvoltage circuits only. Traditionally, this mark designates the end on an aluminum electrolytic capacitor which are usually shaped like tin cans.Older capacitors are less predictable, but almost all modern examples use the EIA standard code when the capacitor is too small to write out the capacitance in full.Skip down to finding units.

The threedigit capacitance code works as followsThe smallest capacitors made from ceramic, film, or tantalum use units of picofarads pF, equal to 10 12 farads.However, if there is only one letter after the code, this is usually the tolerance code, not the unit. P and N are uncommon tolerance codes, but they do exist. If your code includes a letter as one of the first two characters, there are three possibilitiesReplace this letter with a decimal point.This letter represents the tolerance of the capacitor, meaning how close the actual value of the capacitor can be expected to be to the indicated value of the capacitor.Many types of capacitors represent the tolerance with a more detailed threesymbol system.If multiple values could apply such as 1A or 2A, youll need to work it out from context. Depending on what you are working on, you may need the exact match, but for most electronics such as TVs and monitors, its fine to up the voltage, just make sure the uF is the same.What is it The 5% tolerance can be ignored. Run caps are used to provide phase shift for windings on motors so deviation from the designed value will affect the motors performance. Be sure to choose one rated as a RUN capacitor and not a start capacitor. Run caps have lower internal losses. Electrical supply houses usually stock both these kinds, as they are a frequently replaced item for motors. Dont use anything less than 240 VAC, but higher is okay provided the thing physically fits in the space. It has a 7, followed by a small space and a 3. A second line says 100, and a third line says 25A. What capacitance and voltage is this A capacitor is an electronic component that stores electrical energy in an electrical field.But I suggest the same uf value.If you are suggesting replacing it in an HF circuit, then sure, it can be done physically with some fine gymnastics. Just make the leads as short as you can and bend them so the cap looks like it has feet.

Then, solder the leads to the pads on the board. However, if you are working on a microwave project, I would strongly discourage you from trying this. Leaded parts will start to look like tiny antennas that approach a fraction of the wavelength of the signal its handling, and you can have serious RF loop problems as a result. How can I find the values to replace it Search online. Check the manufacturers website. The service manual is sure to have it; possibly the owners manual. It will be somewhere online.The capacitor should support a higher voltage than the circuit you use it in; otherwise, it may break down possibly explode under operation For example, a 10,000 pF cap is more commonly referred to as 0.01 uF. Always make sure to discharge them first by using an appropriate resistor. Never short circuit them, as this could cause an explosion. Ralph Childers is a master electrician based in the Portland, Oregon area with over 30 years of conducting and teaching electrical work. Ralph received his B.S. in Electrical Engineering from the University of Louisiana at Lafeyette and holds an Oregon Journeyman Electrical License as well as electrician licenses in Louisiana and Texas. This article has been viewed 722,315 times.Next, check the voltage rating, which is usually listed as a number followed by the letters V, VDC, VDCW, or WV. Finally, see if your capacitor is polarized by looking for plus or minus signs next to its terminals, which indicate that it is. For more on reading capacitors, including how to read compact capacitor codes, scroll down! By continuing to use our site, you agree to our cookie policy. Please help us continue to provide you with our trusted howto guides and videos for free by whitelisting wikiHow on your ad blocker. If you really can’t stand to see another ad again, then please consider supporting our work with a contribution to wikiHow.

Read on to learn all about capacitors, including the different types of capacitors, popular capacitor products from Wurth Electronics Midcom, our special ABC of Capacitors design guide, and upcoming webinars on capacitors. Capacitors are indispensable components in today’s electronics industry. Around twothirds of the entire passive component market volume is attributed to capacitors. So what exactly is a capacitor. We cover the basics below. A capacitor describes every arrangement for storing stationary electric charges. The structure of a capacitor always consists of two conducting surfaces the electrodes sometimes referred to as sheets. They are always separated by an insulating material the dielectric. You can see the relationship between the electrodes 1, the dielectric material 2, and the distance between electrodes 3 in the image provided. These are the three key parameters used to distinguish the power and manipulate the performance of a capacitor. The capacitance of a capacitor describes its capacity to store electric charges. It is calculated from the field constant, the relative permittivity of the dielectric used, the effective area the overlapping area of the electrodes, and the thickness of the dielectric or the separation produced between the electrodes. As an electronic component, a capacitor is able to store electrical energy and then release it again. This energy release takes place at a defined rate over a certain period depending on its design characteristics. A capacitor is thus an energy reservoir, which blocks the direct flow of current with DC voltage and allows the flow of current with AC or pulsating voltage depending on its capacitance and the given frequency. That means the capacitor can assume a different role depending on the circuit In a DC circuit, it is a charge storage device.

Here are the essential characteristicsTo get a solid understanding of capacitor characteristics and how they influence different applications, see our ABC of Capacitors design guide. The first is to advance miniaturization in order to keep up with increasing integration density in the electronics industry. The second is, of course, to increase capacitance. Since the capacitor like the classical rechargeable battery is a potential energy storage device, this is becoming increasingly attractive as the technology advances. Capacitors with fixed capacitance are most common in modern electronics, though capacitors with variable capacitance such as rotary or trimmer capacitors do exist. Still, they play a rather subordinate role. Capacitors with fixed capacitance can be distinguished by their polarity. A nonpolar capacitor film and ceramic can be operated with both DC and AC voltage, while a polar capacitor electrolytic and super can be operated with DC voltage only. We will describe each briefly below. For a more thorough overview of the different types of capacitors, check out our ABC of Capacitors design guide. To construct a film capacitor, either 1 two metal films with an intermediate film, or 2 films of dielectric on which a metal layer is vapor deposited, are wound. Because of this, film capacitors are sometime called wound capacitors. Film capacitors use either paper or plastic films for the dielectric material.To construct a ceramic capacitor, either 1 a homogeneous block singlelayer capacitor, or 2 many layers multilayer capacitor, give rise to a monolithic ceramic body. Singlelayer ceramic capacitors are found in highvoltage and AC voltage applications, while multilayer ceramic capacitors MLCCs are mainly configured as SMD components. With quadrillions of units made, MLCCs are the predominating type in the world market. The structure of ceramic capacitors enables very low inductance designs.