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In the ever-evolving world of electronics, surface-mount devices (SMDs) have become an integral part of modern circuit boards and electronic devices. These diminutive yet powerful components offer numerous advantages, including space-saving designs, improved performance, and enhanced reliability. Whether you're a hobbyist, an engineer, or a technician, understanding the different types of SMD components and how to identify them is crucial. In this comprehensive guide, we'll delve into the fascinating realm of SMDs, exploring their classifications, characteristics, and identification techniques. Request PCB Assembly Quote Now Passive SMD components are the workhorses of electronic circuits, performing their duties without the need for external power or signal input. These unassuming yet essential components play a vital role in a wide range of applications, from wireless communications to automotive electronics, where reliability is of utmost importance. Surface Mount Resistors Thin Film Surface Mount Resistors Thin film surface mount resistors are flat-shaped components that can be mounted directly on circuit boards. These compact resistors are designed to provide resistance values ranging from 0Ω to 5Ω, often used in series with other components or circuits. Their low resistance and compact size make them ideal for various applications. Thick Film Surface Mount Resistors Thick film surface mount resistors share a similar form factor to their thin film counterparts but offer higher resistance values. These resistors are commonly used when greater resistance is required, making them versatile components in electronic design. Surface Mount Resistor Networks Surface mount resistor networks comprise a chip with multiple resistors connected in series. These networks are employed when higher resistance values are needed than what a single resistor can provide. By combining multiple resistors into a single package, resistor networks offer a space-saving solution while delivering the desired resistance. Surface Mount Capacitors Capacitors are essential components in electronic circuits, responsible for storing and releasing electrical energy. SMD capacitors come in various forms, including ceramic and electrolytic varieties, each with its unique properties and applications. Ceramic SMD Capacitors Ceramic SMD capacitors are widely used for their stability, reliability, and compact size. These capacitors utilize ceramic materials as their dielectric, making them suitable for high-frequency applications and harsh environmental conditions. Electrolytic SMD Capacitors Electrolytic SMD capacitors are known for their ability to store large amounts of electrical charge, making them ideal for applications requiring high capacitance values. These capacitors typically feature an electrolytic dielectric material, offering superior energy storage capabilities compared to their ceramic counterparts. SMT Tubular Passive Components Metal Electrode Leadless Faces (MELFs) are cylindrical-shaped passive SMD components used for capacitors, diodes, jumpers, tantalum, and resistors. Their unique shape allows for efficient space utilization on circuit boards, while their inexpensive nature and color-coding make them easy to identify and work with. Active SMD components are the dynamic workhorses of electronic circuits, acting as switches that respond to input signals by turning on or off. These components play a crucial role in controlling the flow of current and enabling various functionalities in electronic devices. Ceramic Leaded Chip Carriers Ceramic Leaded Chip Carriers (CLCCs) are specialized SMD components designed for high-frequency applications. Featuring a ceramic dielectric material and gold-plated copper leads, CLCCs offer superior performance and reliability in demanding environments. Leadless Ceramic Chip Carriers Leadless ceramic chip carriers are a type of SMD component that can be mounted directly onto printed circuit boards (PCBs) using solder paste. These compact components are often utilized in high-speed integrated circuits (ICs) and other electronics where small size and high reliability are paramount. Instead of traditional leads or pins, they feature integral metal pads on their surface, serving as contact points for electrical connections. While ceramic packages are commonly used in military applications, plastic packages for active SMD components have found their way into non-military applications where a hermetic seal is not required. These plastic packages offer a cost-effective alternative while still delivering reliable performance. Small Outline Transistors Small Outline Transistors (SOTs) are surface mount devices available in both four-lead and three-lead configurations. These versatile packages are suitable for housing both transistors and diodes, making them a universal solution for smaller surface-mount devices. Plastic Leaded Chip Carriers Plastic Leaded Chip Carriers (PLCCs) are a more economical alternative to their ceramic counterparts. While they may not offer the same level of durability as ceramic packages, PLCCs provide a cost-effective solution for applications where a hermetic seal is not a necessity. Their leads help distribute stress away from the solder joint, preventing cracks and ensuring reliable performance. Small Outline Packages ce is at a premium. These packages feature pins on only two sides, making them thin and space-efficient. SOPs combine the handling benefits of PLCCs or SOICs with the high density of DRAMs, offering a versatile solution for a wide range of applications. Small Outline Integrated Circuits Small Outline Integrated Circuits (SOICs) are shrink packages with leads spaced 0.050 inches apart. These compact packages are capable of housing larger integrated circuits than their SOT counterparts, making them a versatile choice for various electronic designs. In some cases, SOICs are even used to house multiple SOTs within a single package. Circuit Ball Grid Arrays Ball Grid Arrays (BGAs) are a type of packaging commonly referred to as pin grid arrays. Unlike traditional packages with leads or pins, BGAs feature an array of solder balls on the bottom of the package, enabling high-density interconnects. BGAs come in various sizes and pin counts, catering to diverse applications and complexity levels. Fine Pitch SMD Packages Fine pitch SMD packages, such as Thin Quad Flat Packs (TQFPs), Plastic Quad Flat Packs (PQFPs), and Ceramic Quad Flat Packs (CQFPs), feature thinner leads and require a thinner pattern land design. These packages are designed for applications where miniaturization and precision are critical, making them ideal for high-density electronic designs. With the vast array of SMD components available, the ability to identify them accurately is an invaluable skill. Whether you're troubleshooting a circuit, ordering replacement parts, or designing a new electronic system, proper component identification is crucial. Decoding SMD Resistors SMD resistors are often denoted by the letter "R," followed by a numerical value indicating the resistance in ohms. For example, "10R" represents a 10Ω resistor, while "0.1R" signifies a 0.1Ω resistor. By understanding this simple naming convention, you can quickly determine the resistance value of an SMD resistor. Recognizing SMD Capacitors SMD capacitors are typically marked with the letter "C," representing their capacitance value. The unit of measurement for capacitance is the farad (F), but for SMD capacitors, smaller units such as picofarads (pF), nanofarads (nF), and microfarads (µF) are more commonly used. For instance, "1µF" indicates a capacitance of 1 microfarad, or 1,000 nanofarads. Identifying SMD Inductors SMD inductors are characterized by the letter "L," which denotes the inductance value measured in henries (H). However, due to the small size of SMD inductors, smaller units such as millihenries (mH) and microhenries (µH) are more commonly used. For example, "1mH" represents an inductance of 1 millihenry, or 1,000 microhenries. Recognizing SMD Diodes and Triodes SMD diodes are typically marked with the letter "D" or "CR," indicating their function as a diode. These components allow current to flow in one direction while blocking it in the reverse direction. Additionally, metal SMD diodes often have a terminal with lines or metal backing, indicating the negative electrode side. SMD triodes, used for amplifying and controlling electronic signals, are typically designated with the capital letter "Q." These components play a crucial role in regulating the flow of current and enabling various functionalities in electronic circuits. Deciphering SMD Integrated Circuits (ICs) Integrated circuits (ICs) are complex components that integrate multiple electronic components onto a single semiconductor chip. SMD ICs come in various packaging types, such as Small Slim Outline Packages (SSOPs), Chip Scale Packages (CSPs), Ball Grid Arrays (BGAs), Quad Flat Packages (QFPs), Plastic Quad Flat Packages (PQFPs), Plastic Pin Grid Arrays (PPGAs), and Plastic Leaded Chip Carriers (PLCCs). Identifying the specific package type can provide valuable insights into the IC's functionality and application. Identifying SMD Crystal Oscillators SMD crystal oscillators are easily recognizable by the presence of a quartz crystal and two polished terminals. These components are designated with the letter "Y" or a combination of numbers and "Z/HZ," indicating their role as crystal oscillators. SMD crystal oscillators are responsible for providing the main clock signal in electronic systems, making them essential components in timekeeping and synchronization applications. Recognizing SMD Connectors and Switches SMD connectors facilitate temporary or permanent electrical connections within a circuit. These components are often used in pairs and can be identified by their distinct connector shapes and pin configurations. SMD button switches, on the other hand, are used to open or close electrical connections on a circuit board. These compact switches are typically surface-mounted and can be easily identified by their small, button-like appearance. SMD components are crucial in modern electronics, offering a range of applications across various industries. Their small size, lightweight, and compatibility with automated assembly techniques make them ideal for numerous electronic devices. Here are some common applications of PCB SMD components: Consumer Electronics: SMD components are widely used in smartphones, tablets, laptops, TVs, and digital cameras. They help in miniaturizing devices and enhancing their functionality. Automotive Electronics: SMD components are used in vehicle control systems, entertainment systems, navigation systems, and lighting. They offer reliability and durability, essential for automotive applications. Industrial Equipment: SMD components are found in industrial control systems, robotics, machinery, and sensors. Their small size and high performance make them suitable for various industrial applications. Medical Devices: SMD components are used in medical equipment such as monitors, imaging devices, and diagnostic equipment. They provide precision and reliability in critical medical applications. Telecommunications: SMD components play a vital role in telecommunications equipment, including routers, modems, switches, and base stations. They help in ensuring efficient communication networks. Aerospace and Defense: SMD components are used in avionics, satellites, radar systems, and military equipment. They offer high reliability and performance in demanding environments. LED Lighting: SMD components are used in LED lighting systems for power management, control, and lighting effects. They contribute to the efficiency and durability of LED lights. Renewable Energy: SMD components are used in solar inverters, wind turbines, and energy storage systems. They help in efficient power conversion and management in renewable energy applications. Security Systems: SMD components are used in security cameras, alarms, and access control systems. They provide reliable performance for security applications. Wearable Technology: SMD components are used in wearable devices such as smartwatches, fitness trackers, and health monitors. They enable compact and lightweight designs for wearable technology. These applications highlight the versatility and importance of SMD components in modern electronics, driving innovation and advancement in various industries. In the ever-evolving world of PCB manufacturing and assembly, choosing a reliable and experienced partner is crucial. Highleap Electronic, with over 15 years of industry experience, stands as a trusted manufacturer of PCB and PCB assembly products. Our success is driven by the success of our clients, and our reputation is built on delivering high-quality, accurate, and durable solutions. At Highleap Electronic, we understand the demands of the PCB industry and strive to exceed expectations. Our clients' reviews reflect our commitment to excellence, and we have proudly served businesses of all sizes, from small startups to large multinational corporations. SMD components have revolutionized the electronics industry, enabling compact, high-performance, and reliable devices. Understanding the different types of SMD components and their identification techniques is essential for anyone working in the field of electronics, from hobbyists to professional engineers. In this comprehensive guide, we have explored the various categories of SMD components, including passive components like resistors, capacitors, and inductors, as well as active components such as transistors, integrated circuits, and oscillators. We have also delved into the art of identifying these components through their markings, shapes, and package types. Request PCB Assembly Quote Now Discover how our expertise can help with PCBA project. SMD components, or surface mount components, are electronic components to be mounted on printed circuit boards to function. How to identify SMD components from their appearances? This article will guide you to identify surface mount components fast and easily. Part 1: Identify SMD Resistors SMD resistors are basic surface mount components that limit the current passing through them. "R" stands for resistance, and the unit of resistance is Ohm (Ω). 1KΩ equals to 1000Ω, 1MΩ equals to 100000Ω. There are two methods to indicate the resistance value on the SMD resistors' appearance. In Arabic numbers: the first two numbers indicate the absolute numbers of the resistance value, and the last number means the power of 10. For example, 103 means 10000Ω, 391 means 390Ω, and 473 means 47000Ω. In a combination of Arabic numbers and R: the Arabic numbers before the R stand for the whole part of the resistance value, and those after the R stand for the fractional part of the resistance value. For example, R100 means 0.100Ω, 5R60 means 5.60Ω, 30R9 means 30.9Ω. Classification of SMD resistors: according to the use differences, there are normal resistors, precision resistors, power resistors, high voltage resistors, high-resistance resistors, high-frequency resistors. Of course, you could find other ways to identify SMT resistor. Part 2: Identify SMD Capacitors SMD capacitors are PCB parts consisting of two metal pieces separated by an insulator and mainly used to store energy. "C" stands for capacitance, and the unit of capacitance is Farad (F). The unit F is too big for SMDs' capacitance, and we usually use the smaller unit µF, nF, pF. 1µF equals to 1000nF, 1nF equals to 1000pF. There are two methods to indicate the capacitance value on the SMD capacitors' appearance. Directly denote the capacitance and working voltage on the capacitors, for example, 10µF/16V. In a combination of Arabic numbers and working voltage: the first two numbers indicate the absolute numbers of the capacitance value, and the last number means the power of 10. For example, 107 means 10 × 107pF (= 100µF), 225 means 22 × 105pF (=2.2µF) Besides, on SMD capacitors, the capacitance is denoted by a combination of numbers and a letter. The letter stands for capacitance tolerance. Here is a chart: For example, 104J means 10 × 104pF (= 0.1µF), and the capacitance tolerance is ±5%.Classification of SMD Capacitors. Ceramic capacitors: made up of a ceramic insulator with two terminals sprayed with silver then sintered. On SMD capacitors, C.CAP stands for ceramic capacitors. Aluminum electrolytic capacitors: made up of an aluminum cylinder filled with liquid electrolyte (together as the negative electrode) and a curly aluminum strip (as the positive electrode) covered with an oxide film (as the insulator) plugged in it. Tantalum electrolytic capacitors: made up of tantalum or niobium (as the positive electrode) and dilute sulfuric acid (as the negative electrode), the oxide film covered on tantalum or niobium as the insulator. TAN.CAP or TC stands for tantalum capacitors. Part 3: Identify SMD Inductors SMD inductors are basic electronic components that convert electrical energy into magnetic energy and store it. Inductors are made up of an enameled wire winding around an insulator. "L" stands for inductance, and the unit of inductance is Henry (H). 1H equals to 1000mH, and 1mH equals to 1000µH. The method to indicate the inductance value on the SMD inductors' appearance is below. In Arabic numbers: the first two numbers indicate the absolute numbers of the inductance value, and the last number means the power of 10. For example, 470 means 47H, 101 means 100H, and 100 means 10H. Part 4: Identify SMD Diodes and SMD Triodes SMD diodes are unidirectional conductive electronic components. Diodes are also polar components, and the positive and negative electrodes can't be reversed. When currents flow from the positive electrode, the diode's resistance is extremely small. Vice versa, the resistance is extremely large. CR or D stands for diodes. On SMD diodes, the terminal printed with lines is the negative electrode. SMD triodes are control components that amplify currents. Q stands for triodes. Part 5: Identify SMD ICs SMD ICs are surface-mounted integrated circuits that integrate components such as diodes, resistors, capacitors, and inductors on an extremely small semiconductor and then package them. According to the packaging differences, the integrated circuits include PLCC, PPGA, PQFP, QFP, BGA, CSP, SSOP, etc. Part 6: Identify SMD Crystal Oscillators An SMD crystal is a quartz piece with two terminals polished and sprayed with a silver film. When an IC is packaged with the quartz piece to form the oscillation circuit, it is an SMD oscillator. Y stands for crystal oscillators. SMD crystal oscillators provide basic clock signals for the system. On a component, if you see a combination of numbers and HZ or Z, that is a crystal oscillator. You can see crystal oscillators from the below image. DIP crystal oscillators have two long pins, and the rest are SMD crystal oscillators. SMD crystal oscillators have two or four pins. Part 7: Identify SMD Connectors SMD connectors provide temporary or permanent electrical connections for circuits, and they are usually used in pairs. Part 8: Identify SMD Button Switches SMD button switches are surface mount switches that use a button to connect or separate the two contacts to realize the circuit switch. SMD Components Sourcing and PCB Assembly One-Stop Solutions PCBONLINE provides one-stop-shop solutions for SMD electronic components sourcing, PCB Assembly, and advanced PCB manufacturing. PCBONLINE is an ISO-certified electronics manufacturing services provider founded in 1999. Relying on our EMS factory for manufacturing, PCBONLINE takes part in joint components procurement with other large EMS and enjoys bargaining power. From PCBONLINE, you can enjoy these benefits in SMD components sourcing: High-quality SMD components directly sourced from original factories. SMD components at possibly the lowest prices because we pick up the best prices from hundreds of distribution points around the globe. Quality refund guarantee. You can buy one tray of SMD components to try before bulky purchase. Strict quality control of SMD components and free IC counterfeit detection. You can let PCBONLINE mount SMD components on printed circuit boards, complete all PCBA tests, and do the end-product assembly. Please feel free to send your BOM to PCBONLINE by email at info@pcbonline.com to get a quote for your electronic components. Conclusion This article gives a brief introduction to common SMD components, displays their images, and provides tips to identify components from their appearances. If you have any concerns or needs for SMD components or PCBs, welcome to contact PCBONLINE by email or from the online chat window on the right of our website pages. SMD components come in a variety of package types, each with its own unique characteristics. Understanding these package types is crucial for identifying SMD components. Here are some of the most common SMD package types: Chip Components Chip components are the simplest and most common type of SMD components. They are rectangular in shape and have two terminals, one on each end. Examples of chip components include resistors, capacitors, and inductors. SOT (Small Outline Transistor) Packages SOT packages are used for transistors and diodes. They have a small, rectangular body with three or more leads. The most common SOT packages are SOT-23 and SOT-223. SOIC (Small Outline Integrated Circuit) Packages SOIC packages are used for integrated circuits (ICs) and have a rectangular body with leads on two sides. The number of leads can vary, but common SOIC packages include SOIC-8, SOIC-14, and SOIC-16. QFP (Quad Flat Pack) Packages QFP packages are used for ICs with a large number of pins. They have a square or rectangular body with leads on all four sides. Common QFP packages include TQFP (Thin Quad Flat Pack) and LQFP (Low-profile Quad Flat Pack). BGA (Ball Grid Array) Packages BGA packages are used for high-density ICs and have a grid of solder balls on the bottom of the package. These packages are more difficult to identify visually due to the lack of visible leads. Identifying SMD Components by Marking Many SMD components have markings on their surface that can help with identification. These markings can include: Numerical Codes Resistors and capacitors often have numerical codes printed on their surface that indicate their value. For example, a resistor with the code "103" has a value of 10 kΩ (10,000 ohms). Alphabetical Codes Some SMD components, such as diodes and transistors, may have alphabetical codes that indicate their type and specifications. For example, a diode with the marking "1N4148" is a small-signal diode with specific characteristics. Manufacturer Logos Many SMD components have manufacturer logos or branding on their surface. Familiarizing yourself with common manufacturer logos can help in identifying the component's origin and potential specifications. Using SMD Code Books and Online Resources There are various code books and online resources available that can assist in identifying SMD components based on their markings and appearance. Some popular resources include: SMD Codebook by Elektor The SMD Codebook by Turuta Electronics SMALLParts.net SMD Component Identification Alldatasheet.com These resources provide comprehensive lists of SMD codes and their corresponding component values or types. Visual Inspection Techniques In some cases, SMD components may not have clear markings, or the markings may be obscured. In these situations, visual inspection techniques can be helpful for identification. Comparing with Known Components If you have a known SMD component that closely resembles the unknown component, you can compare their physical characteristics, such as size, shape, and lead configuration, to make an educated guess about the unknown component's identity. Using Magnification Employing magnification tools, such as a magnifying glass or a microscope, can help in examining the details of SMD components more closely. This can be particularly useful for identifying small components or those with tiny markings. Consulting Datasheets and Application Notes If you have a general idea of what the SMD component might be, consulting datasheets and application notes from manufacturers can provide valuable information about the component's appearance, dimensions, and pinout, which can aid in identification. FAQs Q1: What should I do if I cannot find any markings on an SMD component? A1: If there are no visible markings on the SMD component, try using visual inspection techniques such as comparing it with known components, using magnification, or consulting datasheets and application notes for components with similar appearances. Q2: Are all SMD components marked with codes? A2: No, not all SMD components have markings or codes. Some components, particularly smaller ones like chip resistors and capacitors, may not have any markings due to their size limitations. Q3: Can I use a multimeter to identify SMD components? A3: In some cases, a multimeter can be used to measure the electrical properties of SMD components, such as resistance or capacitance, which can help in identification. However, this method may not be applicable for all types of SMD components, and it requires some knowledge of the expected values for the component in question. Q4: Are there any mobile apps that can help identify SMD components? A4: Yes, there are several mobile apps available for both Android and iOS devices that can assist in SMD component identification. Some popular apps include "SMD Components Identifier" and "SMD Identifier – Electronic Toolbox." Q5: What should I do if I'm still unsure about the identity of an SMD component? A5: If you have exhausted all available resources and techniques for identifying an SMD component, it may be best to consult with an experienced electronics professional or a dedicated electronics forum where you can seek advice from knowledgeable individuals in the field. Conclusion Identifying SMD components from their appearance can be a challenging task, but with the right knowledge and tools, it becomes more manageable. Understanding SMD package types, knowing how to interpret component markings, and using visual inspection techniques are all key skills in SMD component identification. Additionally, making use of code books, online resources, and mobile apps can greatly assist in the process. With practice and experience, identifying SMD components will become easier, enabling you to work more efficiently on your electronic projects. Surface mount devices (SMD components) are the main electronic function parts that are soldered onto the circuit board using the surface mount technology. They are not that different from the through-hole electronic components so far we are talking about the electrical function.However, due to the smaller size, the surface mount components offer a much better electrical performance. Note that, not all of the smd components present in the surface mount is for the PCB assembly process of electronics.This is why the benefits of PCB surface mounting aren't available. Also, we are limited to the mix and match surface mount type of assemblies. Using the through hole components like pin grid array (PGA) and ball grid array (BGA) for large connectors and high end processors help in keeping the industry in the mixed assembly mode for the future.Request Electronic Components Bom List Quote NowWhile there are just a few DIP packages, which meet the packaging requirements, the surface mount packages world is widely more complex.Note that the types of packages, as well as the lead and package configurations are numerous. Furthermore, the requirements of the SMD components and electronic components are much more demanding. The SMCs or SMD components have to withstand the higher temperatures for soldering. Also, selecting, placing, and soldering them have to be done very carefully so as to achieve an acceptable yield in manufacturing.Also available are scores of different electronic components present for electrical requirements. This causes a major issue or problem, when it comes to component proliferation. Also, some smd components have good standards, whereas others are nonexistent or inadequate.Though the SMT (surface mount technology) has matured, it evolves constantly coupled with introducing new packages. Every day, the electronics industry keeps making progress in resolving the standardization, technical, and economic problems with the SMD components. The surface mount components and SMD components come in both passive and active electronic components.SMD ComponentsThick film resistors, tantalum capacitors, monolithic ceramic capacitors form the main group of the passive smd components. Generally, the shapes are cylindrical and rectangular. The mass of the electronic components' mass is usually 10 times lower when compared than the through hole.Furthermore, the surface mount capacitors and resistors are in different case sizes. This is to meet the requirements and needs of the different applications used in the electronics industry. Though a trend falls towards the shrinking sizes of the case, there are larger case sizes as well if there are large capacitance requirements. These electronic components and surface mount devices are also available in both tubular and rectangular shapes.These come in two types, namely thin film and thick film. The thick film type is constructed using a screening resistive film on a high purity flat alumina substrate surface. You can get the resistance value by varying the resistive paste's composition before the laser trimming after screening and before screening.The resistor networks of the surface mounts, also known as R-packs, are usually used in replacing discrete resistors. This helps in saving placement time and real estate. The styles currently available are usually based on the well-known Small Outline Integrated Circuits (SOIC). However there may be variations in the dimensions of the body. Generally, they come in about 16 – 20 pins having a power of 0.5 – 2 watts for each package.Request Electronic Components Bom List Quote NowThe surface mount capacitors are great for circuit applications of high-frequency due to the fact that it doesn't have any leads. Also, you can place it under the package, which is the PCB Assembly's opposite side. The reel and 8 mm tape is the most used when packaging the ceramic capacitors.Also, the SMT ceramic capacitors are useful for frequency control and decoupling applications. There have been improvements in the volumetric capacity of the monolithic multilayer ceramic capacitors. This is one of the smd components that are very reliable and are useful in very high volumes in under the hood aerospace applications, military equipment, and automotive applications.This is another of the smd components that provide a very high reliability, capacitance-voltage product for each unit volume. Furthermore, the lead capacitors have leads rather than terminations as well as a beveled top as its polarity indicator.Also, there are no placement or soldering issues when making use of the plastic molded tantalum capacitors. You will find them in two sizes – the extended and the standard range.These cylindrical devices, which are also called MELFs, are useful for resistors, diodes, tantalum and ceramic capacitors, and jumpers. In addition, they have metal and cylindrical end caps that are useful for soldering.Surface mounting provides more types of passive and active passages compared to the through hole technology. Below are the different categories of the active smd components.From the name, these carriers feature no leads. Rather they feature groove-shaped, gold plated terminations referred to as castellations, which offer signal paths that are shorter, thereby permitting higher frequencies for operation. Also, we can divide these LCCCs in different families. This depends on the package's pitch. Of all, the most common is the 50 mil family. The other families available include 20, 25, and 40 mil families.Request Electronic Components Bom List Quote NowYou can find these in the postleaded and preleaded formats. For the preleaded carriers, they have Kovar or copper alloy leads, which the manufacturer attaches to it. Also, for the postleaded type, the leads are attached by the user to the ceramic leadless chip carriers' castellation.The ceramic packages are costly and are mainly for the military applications. Also, the plastic packages for the smd components are frequently used for the nonmilitary applications, whereby there is no need for hermeticity. Below are the plastic packages for the active smd components.A small outline transistor is widely regarded as one of the important and active devices when dealing with surface mounting. These surface mount devices are both four-lead and three-lead devices. Generally, these packages are useful for transistors and diodes. Also, these packages have now become universal for the surface mounting small transistors.This is basically called a shrink package having leads on centers of 0.050 inch. Also, it is useful in the housing of integrated circuits that are larger than possible in the SOT packages. There are cases whereby they are useful in housing multiple SOTs.Furthermore, this has leads on both sides which are usually formed outward where it is referred to as the gull wing lead. It is necessary to handle the small outline integrated circuits with care to avoid any lead damage. They come in two body widths, which are 300 mil and 150 mil. Packages that have body width less than 16 leads will have a value of 150 mil. However for cases over 16 leads, then you should use the width of 300 mil.The plastic leaded chip carrier is a less expensive option or version of the ceramic chipcarrier. Its leads offer the necessary compliance in taking up the stress of the solder joint as well as preventing cracks coming to the solder joint. They require proper handling.The small outline package features J-bend leads. However they only feature pins on just two of its sides. Furthermore, the thin small outline package is a PLCC and SOIC hybrid. It also combines the space efficiency of the SOIC and PLCC's handling benefits. The shrink small outline package is usually useful for very high density DRAMSs.Ball grid array is referred to as a type of array package such as the pin grid array, however with the exception of the leads. The BGA package comes in different types, however the major categories are plastic and ceramic BGA.The ball pitches of the different types are standardized at 1.5, 1.27, and 1.0 mm pitch, which is equal to 60, 50, and 40 mil pitch. Also, the BGAs body sizes usually vary from about 7 – 50 mm, with their pin counts also varying from 16 -2400.These smd components feature fine pitch, as well as higher number of leads. Examples of this pitch package include thin quad flat pack, plastic quad flat pack, and ceramic quad flat pack. The fine pitch package feature thinner leads and they also require a thinner pattern land design.Request Electronic Components Bom List Quote NowThe SMD components, which are also known as surface mount components can be described as electronic components which are mounted on the PCB (printed circuit board) to work and function. Now, we will be talking about ways of identifying the surface mount device components easily and quickly.The SMD resistors can be described as the main surface mount components limiting the amount of current that passes through them. The R denotes resistance and the unit of measurement of resistance is called ohm. Here, there are two main methods for indicating the resistance value present on the appearance of the SMD resistors.Here, the first two of the Arabic numbers tell us the resistance value's absolute numbers. Also, the last number indicates a power of 10. Explaining this, it means that 103 is 10000Ω, then 391 indicates 390Ω. While 470 indicates 47000Ω.Arabic numbers standing before the R indicate the value of resistance for the entire part. Also those coming after the R indicate the resistance value's fractional part. Explaining this, it means that R100 indicates 0.100Ω, while 5R60 indicates 5.60Ω. Also, 30R9 indicates 30.9Ω.Furthermore, the classification of the SMD resistors according to use differences includes normal resistors, power resistors, precision resistors, high-frequency resistors, high-resistance resistors, high-voltage resistors.The SMD capacitors can be described as parts of the printed circuit board (PCB) made up of two pieces of metal which an insulator separates and majorly used in storing energy. The C denotes capacitance, while the unit of measuring it is in Farad (F).This F unit is somehow too large or big for the capacitance of SMDs, and we always make use of the smaller unit, which is pF, nF, µF. Note that 1µF is the same as 1000nF, while 1nF is the same as 1000pF.Two main methods are available for indicating the value of the capacitance on the appearance of the SMD capacitors. The first method is to denote the working voltage and capacitance on the capacitors directly.The second method is by combining the working voltage and the Arabic numbers. The first two of the Arabic numbers help to indicate the capacitance value's absolute numbers. Also, the final number indicates a power of 10.To explain further, 107 indicates 10 x 10^7 pF which equals 100µF. Also, 225 indicates 22 x 10^5 pF which equals 2.2µF. Furthermore, on the SMD capacitors, a letter and a combination of some numbers denote the capacitance. These letters indicate the capacitance tolerance.Request Electronic Components Bom List Quote NowCeramic capacitors are composed of ceramic insulators having two terminals that are sprayed using solver and then sintered. On the SMD capacitors, the C.CAP indicates ceramic capacitors.Aluminum electrolytic capacitors are composed of aluminum cylinders that are filled with a liquid electrolyte (altogether as a negative electrode) as well as an aluminum strip (denoting the positive electrode) which is covered using an oxide film which serves as the insulator and plugged into it.The Tantalum electrolytic capacitors are composed of niobium or tantalum (serving as the positive electrode, while dilute sulfuric acid serves as the negative electrode. Also, it includes the oxide film, which is covered on niobium or tantalum, which serves as the insulator. TC or TAN.CAP denotes the tantalum capacitors.The SMD inductors are one of the major electronic components, which help in the conversion of electrical energy to magnetic energy. It also stores it. Also, inductors are composed of a specific enameled wire that winds around the insulator. The L indicates the inductance, and it is measured in Henry (H).1H means 1000mH, while 1mH means 1000µH. This is the method useful in indicating the value of inductance on the appearance of the SMD inductors.The first and initial two numbers in the Arabic numbers, tells us the inductance value's absolute numbers. While the final or last number indicates the power of 10. This means that 470 indicates 47H, while 101 indicates 100H, and 100 indicates 10H.The SMD diodes are the conductive and unidirectional electronic components. The Diodes are polar components, and it is impossible to reverse their negative and positive electrodes. Also, when there is a flow of current from its positive electrode, the resistance of the diode becomes extremely small. Also, vice versa, there is an extremely large value for the resistance. D or CR indicates the diodes.On the SMD diodes, that terminal that is printed with lines can be denoted as the negative side of the electrode. The SMD triodes help in controlling the components, which amplifies the current. The Q stands or denotes the triodes.The SMD ICs are also called surface-mount integrated circuits. This helps in the integration of components like inductors, capacitors, resistors, and diodes, on a very small semiconductor. After this, it is then packaged. With respect to the differences in packaging, the ICs, integrated circuits include SSOP, CSP, BGA, QFP, PQFP, PPGA, PLCC, etc.Request Electronic Components Bom List Quote NowThe SMD crystal can be described as the quartz piece having two terminals that are sprayed and polished with the help of a silver film. When you package the IC using a quartz piece in forming an oscillation circuit, then it becomes an SMD oscillator. The Y denotes crystal oscillators.The SMD crystal oscillators offer the main clock signals that serve the system. Also, on any components, if there's a number combination and Z or HZ, then it is known as a crystal oscillator. Furthermore, you will be able to see the crystal oscillators from that image below. The DIP crystal oscillators feature two long pins. Also, the rest will be the SMD crystal oscillators. In addition, there are four or tins pins.The SMD connectors offer permanent and temporary electrical connections for the circuits. Also, there are normally used in the pairs.The switches of the SMD button are the surface mount switches, which make use of a button in separating or connecting the two contacts on realizing the switch of the circuit.This article has given full details regarding the entire well-known surface mount device – SMD components. We have explained how to identify these electronic components just from their appearance. However, if you have needs or concerns regarding the SMD components or printed circuit board, you can contact RayMing PCB using any of our channels. Types of SMD Components, their functions and identification. SMD Components or Surface Mount Electronic Components for SMT are no different from through-hole components as far as the electrical function is concerned. Because they are smaller, however, the SMCs (surface mount components) provide better electrical performance. Not all components are available in surface mount for electronics PCB Assembly at this time; hence the full benefits of surface mounting on PCB are not available, and we are essentially limited to mix-and-match surface mount assemblies. The use of through-hole components for high end processors and large connectors will keep the industry in mixed assembly mode for the foreseeable future. Availability of Different Types of SMD Components While only a few types of conventional DIP packages meet all the packaging requirements, the world of surface mount packages is vastly more complex. The package types and package and lead configurations available are numerous. In addition, the requirements of surface mount components are far more demanding. SMD or SMCs must withstand the higher soldering temperatures and must be selected, placed, and soldered more carefully to achieve acceptable manufacturing yield. There are scores of components available for some electrical requirements, causing a serious problem of component proliferation. There are good standards for some components, whereas for others standards are inadequate or nonexistent. Some electronic components are available at a discount, and others carry a premium. While surface mount technology has matured, it is constantly evolving as well with the introduction of new packages. The electronics industry is making progress every day in resolving the economic, technical, and standardization issues with surface mount components. SMD are available as both active and passive electronic components. Passive SMD Components Name List and Identification The world of passive surface mounting is somewhat simpler. Monolithic ceramic capacitors, tantalum capacitors, and thick film resistors form the core group of passive SMD. The shapes are generally rectangular and cylindrical. The mass of the components is about 10 times lower than their through-hole counterparts. The surface mount resistors and capacitors come in various case sizes to meet the needs of various applications in the electronics industry. While there is a trend toward shrinking case sizes, larger case sizes are also available if capacitance requirements are large. These devices/components come in both rectangular and tubular (MELF: metal electrode leadless face) shapes. Passive Surface Mount Electronic Components Surface Mount Discrete Resistors (SMD Resistor) There are two main types of surface mount resistors: Thick film: Thick film surface mount resistors are constructed by screening resistive film (ruthenium dioxide based paste or similar material) on a flat, high purity alumina substrate surface as opposed to depositing resistive film on a round core as in axial resistors. The resistance value is obtained by varying the composition of resistive paste before screening and laser trimming the film after screening. Thin film: In thin film resistors the resistive element on a ceramic substrate with protective coating (glass passivation) on top and solderable terminations (tin-lead) on the sides. The terminations have an adhesion layer (silver deposited as thick film paste) on the ceramic substrate, and nickel barrier underplating followed by either dipped or plated solder coating. The nickel barrier is very important in preserving the solderability of terminations because it prevents leaching (dissolution) of the silver or gold electrode during SMD soldering. Resistors come in 1/16, 1/10, 1/8 and ¼ watt ratings in 1 ohm to 100 megaohm resistance in various sizes and various tolerance. Commonly used sizes are: 0402, 0603, 0805, 1206, and 1210. A surface mount resistor has some form of colored resistive layer with protective coating on one side and generally a white base material on the other side. Thus the outer appearance offers a simple way to distinguish between resistors and capacitors. Surface Mount Resistor Surface Mount Resistor Networks The surface mount resistor networks or R-packs are commonly used as replacement for series of discrete resistors. This saves real estate and placement time. The currently available styles are based on the popular STOIC (Small Outline Integrated Circuits), but the body dimensions vary. They generally come in 16 to 20 pins with ½ to 2 watts power per package. Surface Mount Resistor Networks Ceramic Capacitors for SMT Surface mount capacitors are ideal for high frequency circuit applications because it does not have any leads and can be placed underneath the package on the opposite side of the PCB Assembly. The most widely used packaging for ceramic capacitors is 8 mm tape and reel. Surface mount capacitors are used for both decoupling applications and for frequency control. Multilayer monolithic ceramic capacitors have improved volumetric efficiency. They are available in different dielectric types per EIA RS-198n, namely COG or NPO, X7R, Z5U, and Y5V. Surface mount capacitors are highly reliable and has been used in high volumes in under-the-hood automotive applications, military equipment and aerospace applications. Surface Mount Ceramic Capacitor Surface Mount Tantalum Capacitors For Surface Mount capacitors, the dielectric can either be ceramic or tantalum. Surface mount tantalum capacitors offer very high volumetric efficiency or a high capacitance-voltage product per unit volume and high reliability. The wrap-under lead capacitors, commonly called plastic molded tantalum capacitors, have leads instead of terminations and a beveled top as a polarity indicator. There are no soldering or placement concerns when using the molded plastic tantalum capacitors. They are available in two case sizes – standard and extended range. The capacitance value for tantalum capacitors vary from 0.1 to 100 µF and from 4 to 50 V dc in different case sizes. They can also be custom made as per the requirement of the application. Tantalum capacitors are available with or without marked capacitance values in bulk, in waffle packs, and on tape and reel. Surface Mount Tantalum Capacitors Tubular Passive SMD Components for SMT The cylindrical devices known as metal electrode leadless faces (MELFs) are used for resistors, jumpers, ceramic and tantalum capacitors, and diodes. They are cylindrical and have metal ends caps for soldering. Since MELFs are cylindrical, the resistors do not have to be placed with resistive elements away from the board surface as is the case with the rectangular resistors. MELFs are less expensive. Like the conventional axial devices, MELFs are color coded for values. MELF diodes are identified as MLL 41 and MLL 34. MELF resistors are identified as 0805, 1206, 1406 and 2309. SMD Tubular Passive Components Active SMD Components List and Identification Surface mounting offers more types of active and passive packages than through-hole technology. Here are all the various categories of active surface mount component packages: Leadless Ceramic Chip Carriers (LCCC) As the name indicates, leadless chip carriers have no leads. Instead they have gold plated, groove-shaped terminations known as castellations that provide shorter signal paths allowing higher operating frequencies. The LCCCs can be divided into different families depending on the pitch of the package. The most common is 50 mil (1.27 mm) family. Others are 40, 25 and 20 mil families. Leadless Ceramic Chip Carrier (LCCC) Ceramic Leaded Chip Carriers (CLCC) (Preleaded and Postleaded) Leaded ceramic carriers are available in both

preleaded and postleaded formats. The preleaded chip carriers have copper alloy or Kovar leads that are attached by the manufacturer. In postleaded chip carriers, the user attaches the leads to the castellations of the leadless ceramic chip carriers. When leaded ceramic packages are used, their dimensions are generally the same as in plastic leaded chip carriers. Ceramic Leaded Chip Carrier (CLCC) Active SMT Components (Plastic Packages) As discussed above, ceramic packages are expensive and are used primarily for military applications. Plastic SMD packages, on the other hand, are most widely used packages for nonmilitary applications, where hermiticity is not required. The ceramic packages have solder joint cracking due to CTE mismatch between the package and the substrate, but the plastic packages are also not trouble free. Here are all the Active SMD Components (Plastic Packages): Small Outline Transistors (SOT) Small Outline Transistors are one of the forerunners of active devices in surface mounting. They are three- and four-lead devices. The three-lead SOTs are identified as SOT 23 (EIA TO 236) and SOT 89 (EIA TO 243). The four-lead device is known as SOT 143 (EIA TO 253). These packages are generally used for diodes and transistors. The SOT 23 and SOT 89 packages have become almost universal for surface mounting small transistors. Even as the use of high pin count complex integrated circuits is becoming widespread, the demand for various types of SOTs and SODs continue to grow. Small Outline Transistors (SOT) Small Outline Integrated Circuit (SOIC and SOP) The small outline integrated circuit (SOIC or SO) is basically a shrink package with leads on 0.050 inch centers. It is used to house larger integrated circuits than is possible in SOT packages. In some cases, SOICs are used to house multiple SOTs. SOIC contains leads on two sides that are formed outward in what is generally called gull wing lead. SOICs need to be handled carefully to prevent lead damage. SOICs come in mainly two different body widths: 150 mil 300 mils. The body width of packages having fewer than 16 leads is 150 mil; for more than 16 leads, 300 mil widths is used. The 16 lead packages come in both body widths. Small Outline Integrated Circuit (SOIC and SOP) Plastic Leaded Chip Carriers (PLCC) The plastic leaded chip carrier (PLCC) is a cheaper version of ceramic chipcarrier. The leads in PLCC provide the compliance needed to take up the solder joint stress and thus prevent solder joint cracking. PLCCs with large die-to-package ratios may be susceptible to package cracking due to moisture absorption. They need proper handling. Plastic Leaded Chip Carriers (PLCC) Small Outline J Packages (SOJ) The SOJ packages have J-bend leads like PLCC, but they have pins on only two sides. This package is a hybrid of SOIC and PLCC and combines the handling benefits of PLCC and space efficiency of SOIC. SOJs are commonly used for high density (1, 4, and 16 MB) DRAMSs. Small Outline J Packages (SOJ) Fine Pitch SMD Packages (QFP, SQFP) SMD packages with very fine pitch and larger number of leads are called fine pitch package. Quad flat pack (QFP) and shrink quad flat pack (SQFP) are examples of fine pitch package. Fine pitch packages have thinner leads and require a thinner land pattern design. Fine Pitch SMD Packages (QFP, SQFP) Ball Grid Array (BGA) SMD Components BGA or Ball Grid Array is an array package like PGA (pin grid array) but without the leads. There are various types of BGAs, but the main categories are ceramic and plastic BGA. The ceramic BGAs are called CBGA (Ceramic Ball Grid Array) and CCGA (Ceramic Column Grid Array), and the plastic BGAs are referred to as PBGA. There is another category of BGA known as tape BGA (TBGA). The ball pitches have been standardized at 1.0, 1.27, and 1.5 mm pitch. (40,50, and 60 mil pitch). The body sizes of BGAs vary from 7 to 50 mm and their pin counts vary from 16 to 2400. Most common BGA pin counts range between 200 and 500 pins. BGAs are very good for self alignment during reflow even if they are misplaced by 50% (CCGA and TBGA do not self align as well as PBGAs and CBGAs do). This is one reason for the higher yield with BGAs. Ball Grid Array (BGA) How to Identify SMD Components SMDs don’t have any visible leads like their through-hole counterparts. They are rather marked with with cryptic codes. You can adopt different methodology to identify these small SMD components – Physical appearance (Shape, Size), SMD code, use SMD Tester or a Multimeter or Refer to Online Database. Let us learn in some detail as to how to identify SMD components efficiently. 1. Identify SMD Components from Appearances Observe the Package Type. Different SMD components have unique package shapes and sizes. Common types include: Resistors: Rectangular in shape with three or four-digit codes. Example – 0402, 0603, 0805. Capacitors: Similar in shape to resistors but may not have any markings. Example – 0603, 0805, 1206 Diodes: Marked with polarity bands. Example – SOD-123, SOT-23 Transistors and ICs: Feature multiple pins and sometimes have identification codes. Transistors Example – SOT-23, SOT-223. ICs Example – QFP, BGA, SOIC 2. Identify by Component Code SMD components are generally marked with alphanumeric codes. You can refer to the datasheet or SMD code book to identity and determine the type and value of the component. 3. Use a SMD Component Tester or a Multimeter You can use Smart SMD Tester that can easily help you to accurately identify component types and characteristics (capacitance, resistance, and diodes). Alternatively, you can also use a digital multimeter to test and verify values of resistors, capacitors, diodes, and transistors. 4. Refer to Datasheet and Online Database Most major electronic components manufacturers in the world provide detailed specifications for all the SMD components they manufacture or supply. You can refer to their official website or third party websites that host Datasheet Archive of most SMD Components. Common SMD Components and Identification Methods Component Package Example Identification Method Resistor 0402, 0603, 0805 Printed value code (e.g., 103 = 10kΩ) Capacitor 0603, 0805, 1206 No marking, use Smart Tweezers Diode SOD-123, SOT-23 Polarity band, part number Transistor SOT-23, SOT-223 Manufacturer marking, pin count IC QFP, BGA, SOIC P/N on top Video: Types of SMD Components List and Identification Conclusion We hope this comprehensive guide with pictures and videos helped you to understand different types of SMD components and how to identify SMD components from appearance, by reading SMD codes, component markings, and by using testing tools like a smart SMD tester or a digital multimeter. Please do share your thoughts and ideas in comment below. Thanks! FAQs: SMD (Surface Mounted Devices) SMD components (Surface Mount Device Components) are electronic parts used in PCB circuit assembly. Unlike traditional through-hole components, SMD components are soldered directly onto the surface of a circuit board. They are smaller, more compact, and allow for automated assembly processes. SMD components offer several advantages: They save space on circuit boards, enabling higher component density. They also facilitate automated assembly, reducing production costs. SMD components have better high-frequency performance due to shorter lead lengths and less parasitic effects. Additionally, their smaller size supports miniaturization in electronic devices. SMD components are soldered using reflow soldering. The process involves applying solder paste to the pads on the circuit board, placing the SMD components on top of the paste, and then heating the board in a reflow oven. The solder paste melts, creating a secure electrical and mechanical connection between the components and the board. There are various types of SMD components, including: Resistors: Passive components that limit current flow. Capacitors: Store and release electrical energy. Diodes: Allow current to flow in one direction only. Transistors: Control current or amplify signals. Integrated Circuits (ICs): Complex electronic functions in a single package. While SMD components offer numerous benefits, there are challenges to consider. Their small size makes manual soldering difficult without specialized tools. SMD components can also be more sensitive to heat during soldering, potentially leading to thermal damage. Additionally, troubleshooting and repair can be more complex due to the densely packed nature of SMD PCB assemblies. Related Articles: