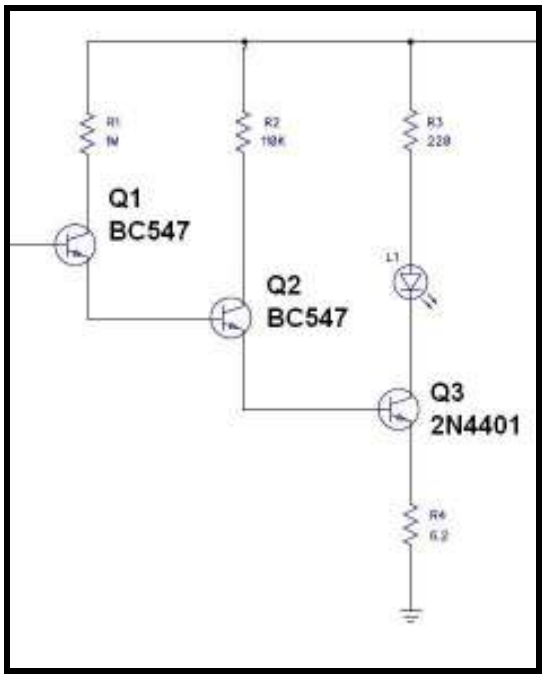
NightFire Electronics

Component Identification and General Assembly Notes

The following are general guidelines in identifying electronic components and some application hints used in the assembly of NightFire Electronics kits.

Transistors:

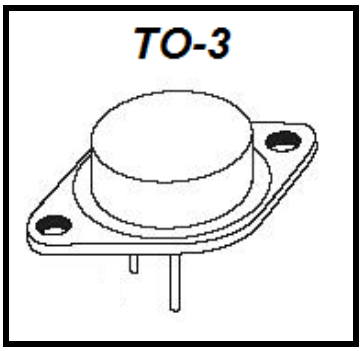
The schematic Circuit Reference for all transistors will be: Q1, Q2, Q3, etc.

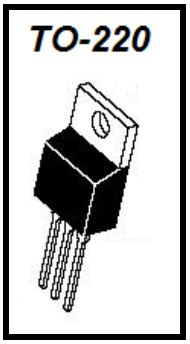


Transistors come in many different sizes and shapes. There are numerous types of Transistors and many other components that have the same body styles or looks.

The two main Transistor types are **Bipolar** with NPN & PNP types and **FET** with N-Channel & P-Channel types. They come in the same body styles and sizes. Do not replace a Bipolar with a FET in our kits.

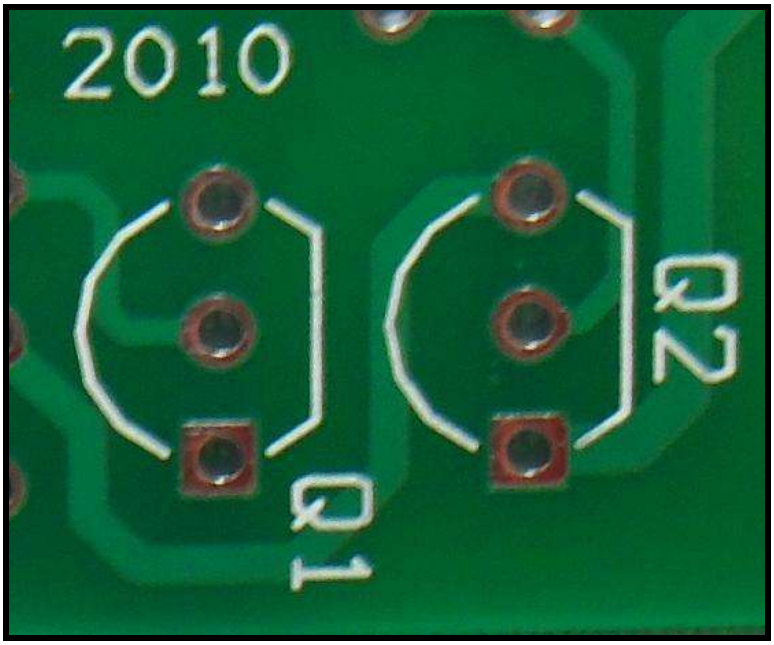
Our Thru-Hole kits mainly use the TO-3, TO-66, TO-92, TO-126, TO-220, TO-226, and the TO-247 sizes. There are other sizes, but these are the most popular sizes we use.





The pinouts vary per transistor. Each NightFire Electronics PCB is laid out such that the transistor will drop right in and you do not need to be concerned with the pin orientation.

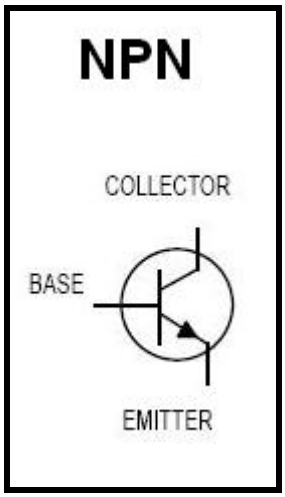
It is permissible to use Transistors with different pinouts as long as the leads are connected to the right place; the replacement Transistor has its Emitter go to the Emitter on the PCB and so forth.

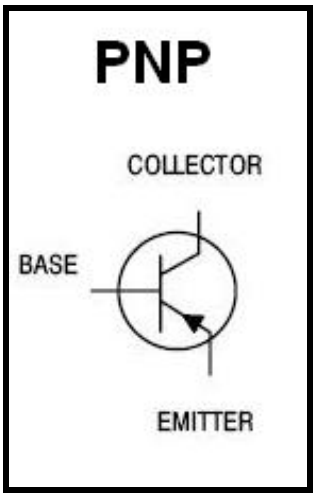


Notice a flat spot on the PCB Silkscreen. This will match the flat spot on the Transistor. Place the Transistor so that the flat spots match. The Transistor can be placed flush with the PCB or a little bit above the PCB, it does not matter.

However, the circuit will look better if the transistor is slightly above the PCB. This will allow you to also make measurements when needed.

Always make sure that you use the correct polarity, do NOT use a PNP in place of an NPN or vice versa.

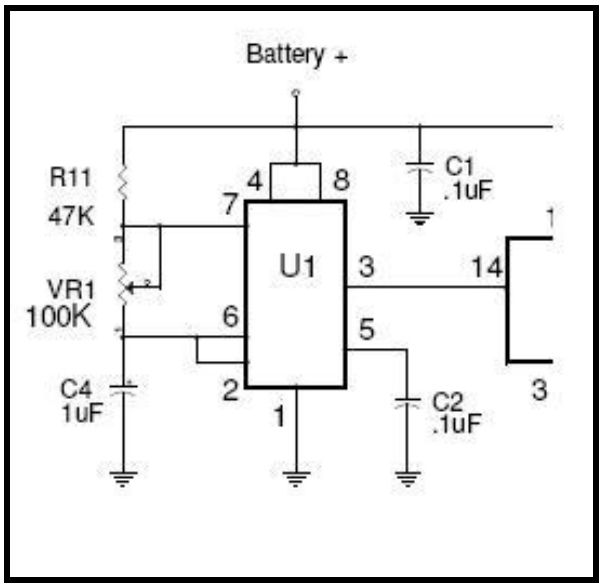




If there are any questions about a specific semiconductor, please refer to the manufacturer's Data Sheets. These are the specifications and many Data Sheets include sample circuits that you can build.

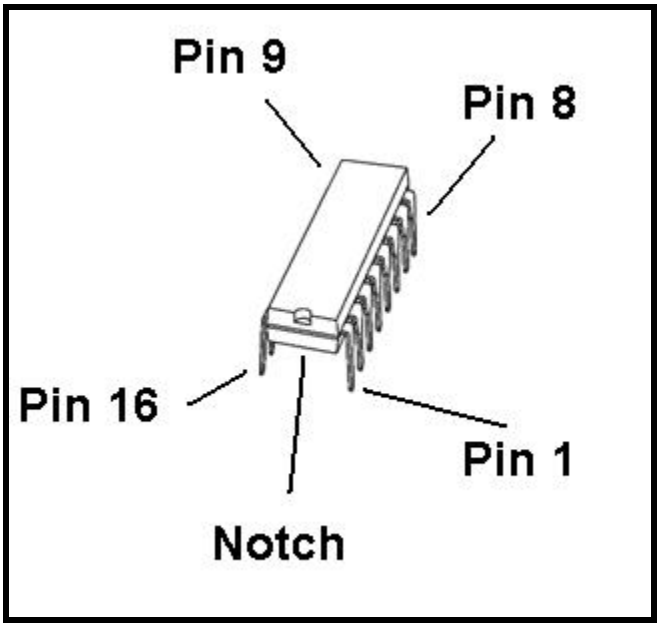
ICs:

The schematic Circuit Reference for all ICs will be: U1, U2, or IC1, IC2, etc.

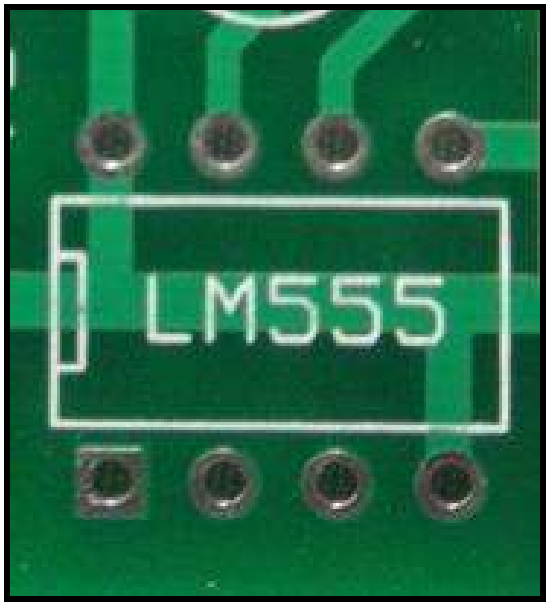


These come in various sizes with 8-pin, 14-pin, 16-pin, 18-pin, 24-pin, 28-pin and 40-pin being the sizes we mainly use in our kits.

The IC will usually be marked by a dot or indentation on one end for pin identification. Pin 1 is always in the top left corner.



A number of ICs, such as Op Amps and Timers, have the same function but different part numbers. For example, the LM555 Timer by National Semiconductor is the same as the NE555 Timer by Signetics and the MC1455 by Motorola.

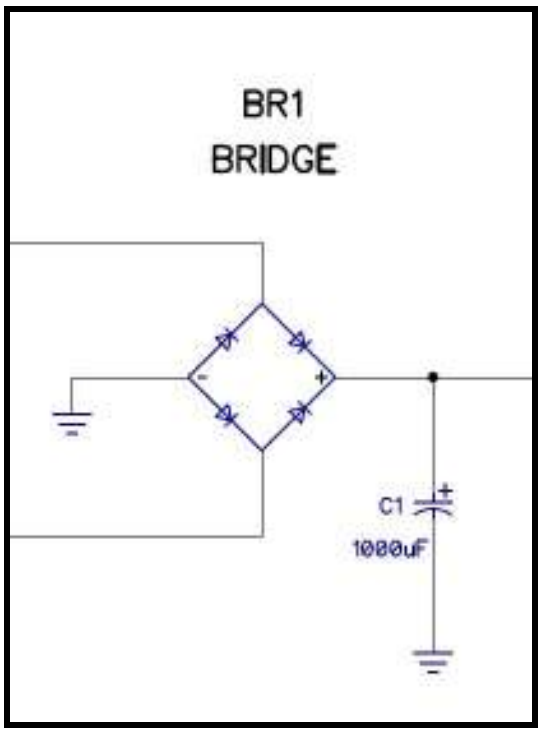


Each different manufacturer will usually have a different prefix and a different suffix, but the central number may be the same or similar.

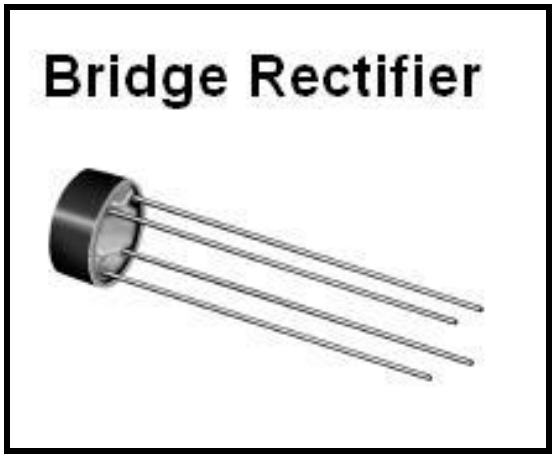
When in doubt, always refer to the manufacturer's datasheets.

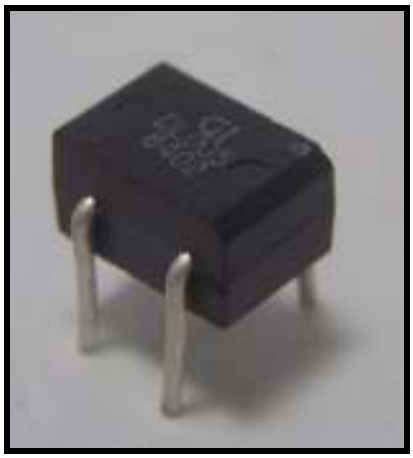
Bridge Rectifiers:

The schematic Circuit Reference for all Bridge Rectifiers will be: BR1, BR2, etc.

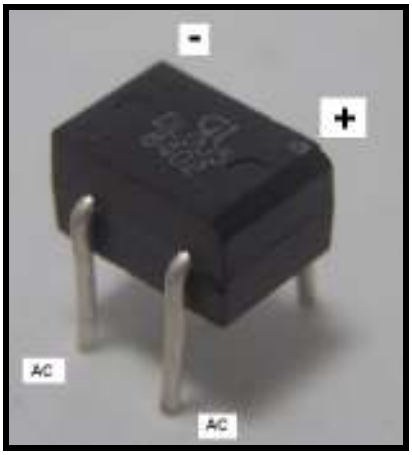


These are usually 4-pin devices; however, Bridge Rectifiers may also be made out of individual Diodes.



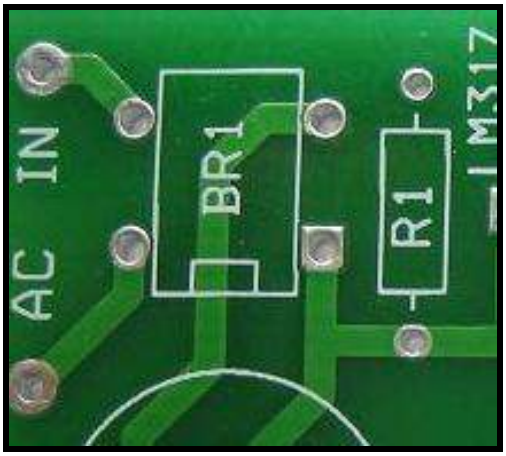


The leads are marked with “~” for the AC input and “+” and “-“ for the positive and negative outputs. This is a very critical part that must NOT be installed incorrectly.



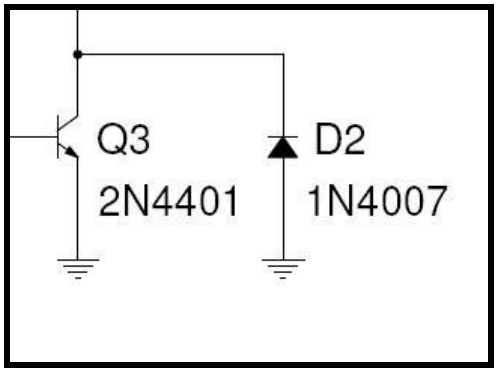
Bridge Rectifiers may also be made out of 4 individual Diodes. In the case where a substitution must be made, you can replace a Bridge Rectifier with 4 Diodes as long as they are installed correctly. The working parameters of the replacement Diodes should meet or exceed the Bridge Rectifier parameters.

Whenever possible, solder the Bridge Rectifier just a little bit above the PCB so that there can be some air flow underneath it. This will aid in keeping it cool.



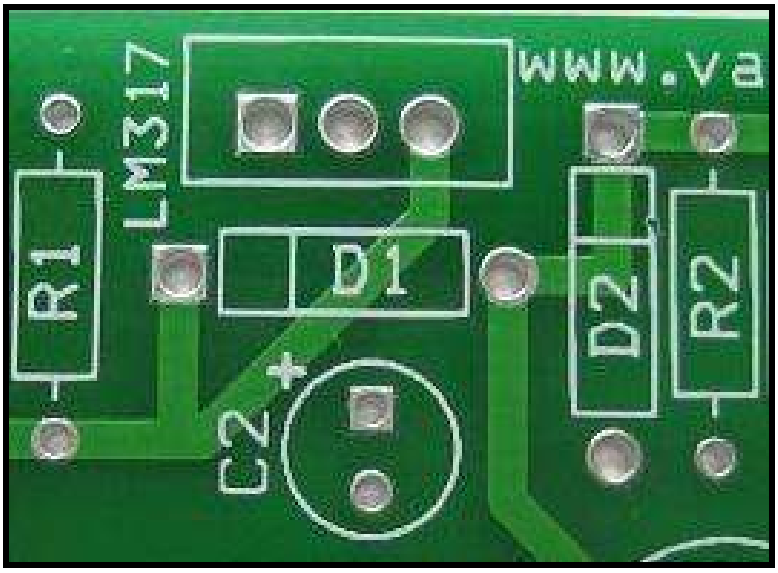
Diodes:

The schematic Circuit Reference for all Diodes will be: D1, D2, etc.

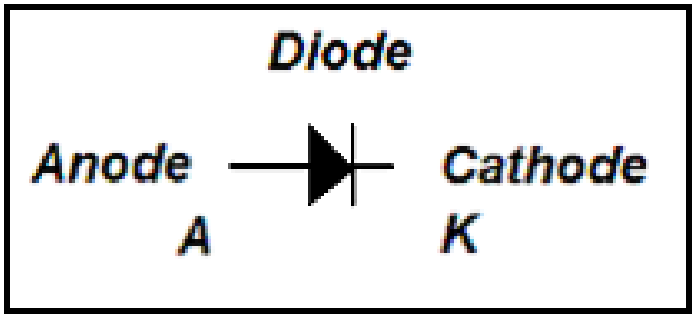


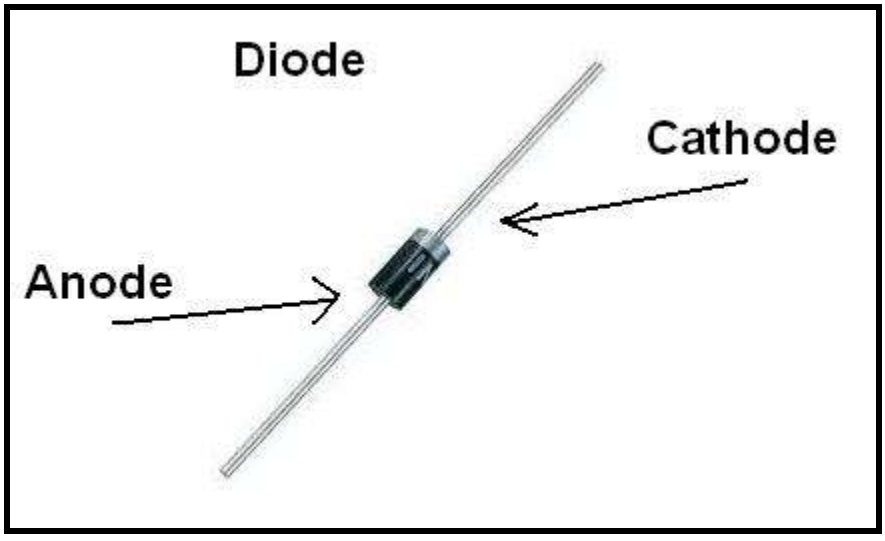
These are two leaded devices and they come in several different packages. We usually use the DO-41 or DO-35 packages. These come in Glass or Plastic bodies.

The manufacturer will typically put a band on the Cathode end. The NightFire Electronics PCB Silkscreen will have a thin line towards one end where the Cathode goes.



Often the PCB will also have a square pad for the Cathode or negative lead.

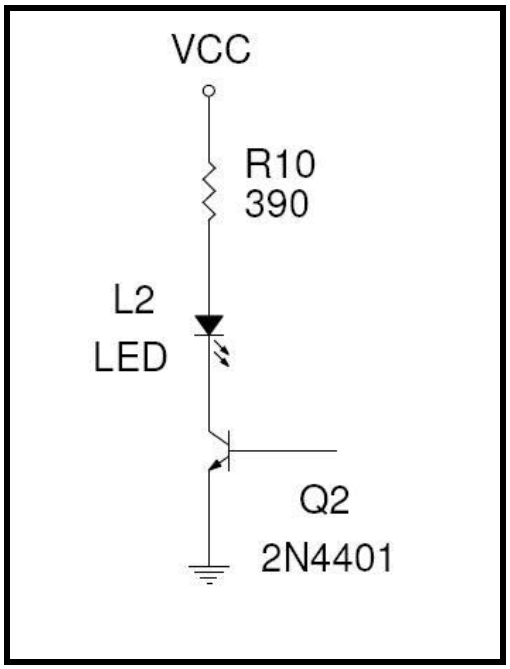




NOTE: The 1N4000 series Diodes we use can be anywhere from 1N4001 to 1N4007. Our circuits are designed such that a 1N4001 Diode will work in a 1N4007 circuit and vice versa. If the schematic states a 1N4001 and you got a 1N4005, then use the 1N4005. This is true for all of our kits unless specifically noted otherwise.

LEDs:

The schematic Circuit Reference for all LEDs will be: L1, L2 or D1, D2, etc.

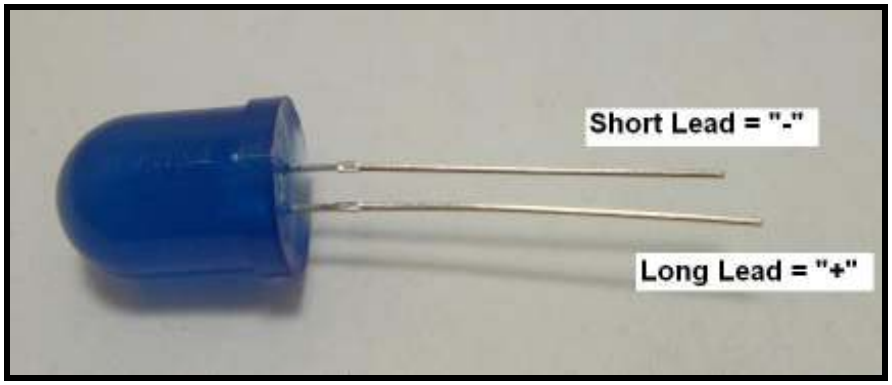


These are typically two leaded devices; however, multi-color LEDs may have more than two leads.

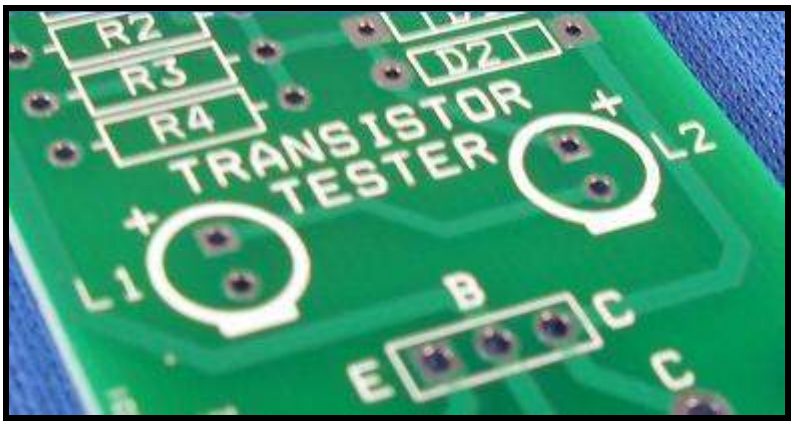
LEDs come in numerous sizes and packages; we will usually use the T1 ¾ (5mm) or the T1 (3mm) sizes. The other common sizes are the Jumbo LEDs in 8mm, 10mm, and 20mm sizes.

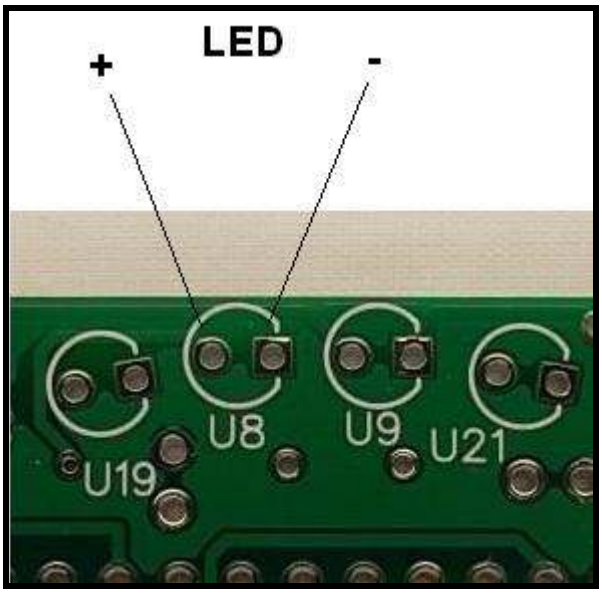
LEDs also come in arrays. Our future kits will use them.

Typically, the long lead is the Anode or positive lead. The manufacture may also have a flat side on the Cathode end of the LED. The PCB trace will have a "**+**" near the positive lead. It may also have a flat line where the negative side goes.



The LED also has the same Anode and Cathode that a regular Diode does.





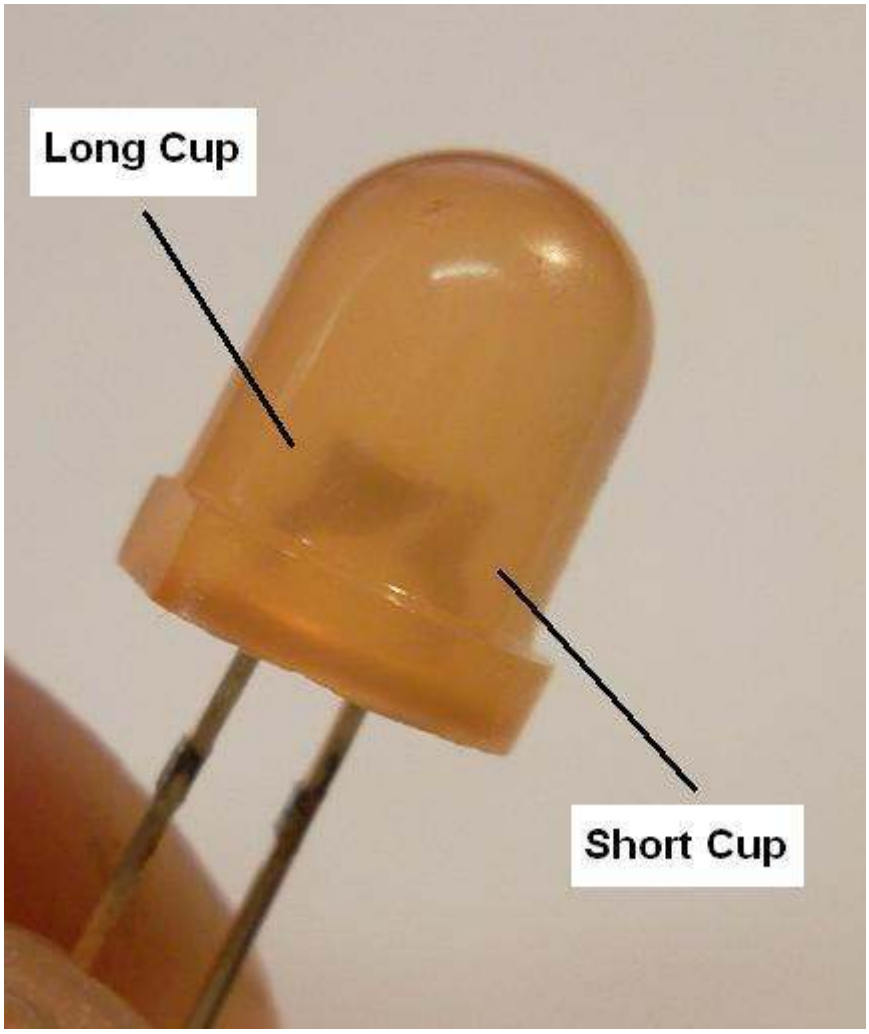
Notice the shape of the LED silkscreen has a flat side. It is important to note that there is also a “+” on the silkscreen. The “+” is where the Anode goes.

NOTE: The flat spot on the LED silkscreen is NOT to be matched with the flat side of the LED. This is because all LEDs are not the same when it comes to this. Some have the Anode on the flat side and some have the Cathode on the flat side. Use the “+” symbol on the PCB silkscreen to determine where the long lead of the LED goes.

Notice the picture below. Inside of the LED are two “cups”. One is obviously larger than the other. Hold the LED up to a light so you can see this. The shorter cup is usually the positive lead.

Typically, the longer lead of the LED is the positive (Anode) end. However, if you get LEDs that have had the leads cut so that they are both the same length, then the way to tell the positive lead is to identify which is the “short cup”. This will be the positive side.

Another sure way to identify the LED leads is to put a 1K Ohm resistor (any wattage will do) in series with the positive end of a 9v battery. Touch the LED to this resistor and to the negative end of the battery. Flip the LED around if it does not light up the first time.



On most of our kits, the LEDs may be soldered on either side of the PCB, depending on your desired effect.

The LEDs may be placed flush with the PCB or they may be placed raised above the PCB by their lead lengths. They may also be bent to any angle.

The LED may also be remoted away from the PCB with a wire connection. The distance may vary per PCB, but should be at least several feet.

When you are in doubt as to which way to put in an LED in one of our kits, build the entire kit and leave the LEDs out. Place a LED in but do not solder it. Turn the power on and observe the LED. You should hold it in place with your hand to ensure a good connection. If it does not light up as part of its normal turn in the circuit, turn the LED around.

Capacitors

There are several different types of Capacitors used in NightFire Electronics kits. We use Aluminum Electrolytic, Tantalum, Ceramic, Metalized Polyester Film, and others.

There are quite a few more but we mainly use the first 4 types. We also use Thru-Hole (with wire leads) and Surface Mount Technology (SMT) capacitors.

The schematic symbol is the same for all of them. The only way to tell what type of capacitor to use is in the circuit description.

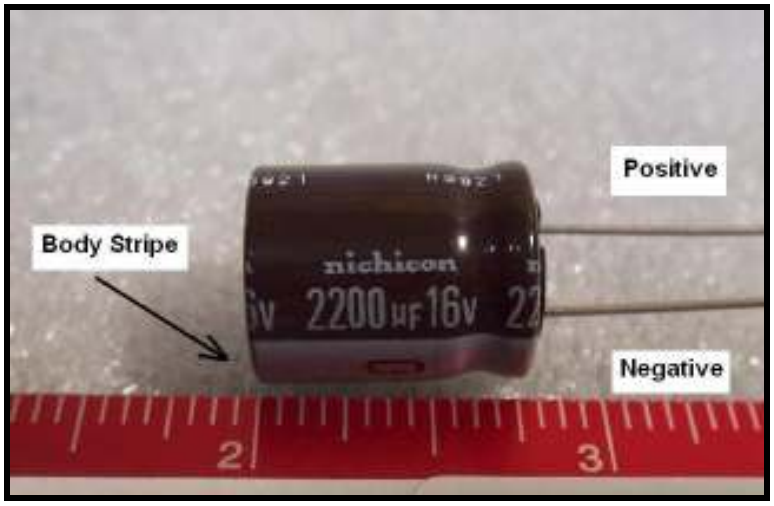
There are two primary parameters that we are concerned with:

1. The value in microfarads (uF) or picofarads (pF).
2. The working voltage.

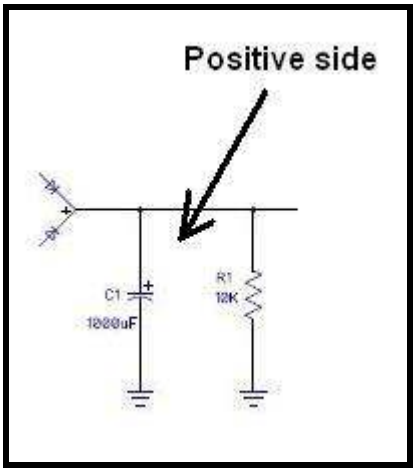
There are a few more parameters such as Dielectric Material, Temperature Coefficient, physical size, lead orientation, etc., but they are to be largely ignored for our kits.

> **NOTE:** A 1uF capacitor is a 1uF capacitor. This means that a 1uF Ceramic capacitor is electrically the same as a 1uF Tantalum or a 1uF Aluminum Electrolytic capacitor. In most circuits, they are interchangeable. If you don't have one of one kind, you can use one of the others. This is a general guideline. Yes, they do have different properties and are best suited for specific applications, but in a pinch, any one of them will work. Watch for the working voltage and polarity.

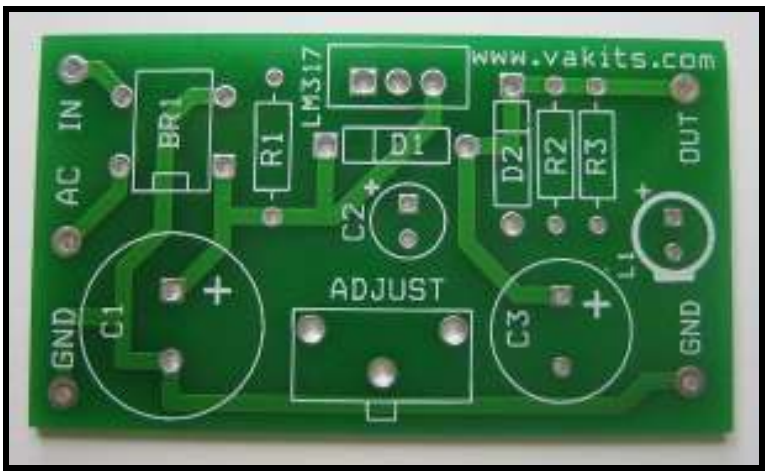
Aluminum and Tantalum capacitors are polarized components: There is a positive and a negative side to them. Aluminum caps will typically have a very obvious stripe labeled with a "-" alongside of it.



A Tantalum will have a marking on its body for the positive side. Do NOT connect them backwards. The schematic will have a “+” where the positive side of the capacitor goes.



The PCB will have a square solder pad for the positive side of the capacitor. If the capacitor is non-polarized, such as a Ceramic, both solder pads will be round. The silkscreen around the capacitor



Aluminum Electrolytic Capacitors:

The schematic Circuit Reference for all Capacitors will be: C1, C2, etc.

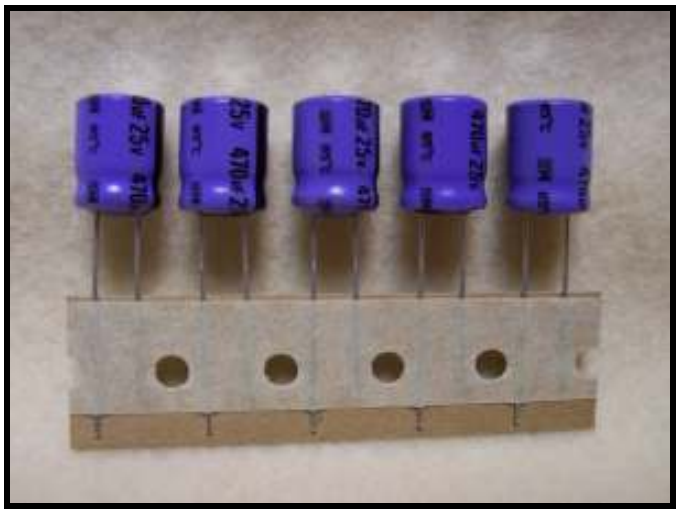
These are two-leaded devices.

The manufacturer will typically have the negative lead marked with a band or stripe along the body of the capacitor. It is usually pretty obvious. The PCB will have a **"+"** marked near the positive lead. Often the positive lead will have a square pad on the PCB. Aluminum Capacitors have a voltage rating and, as a rule, it is ok to use higher voltage rated caps than what the schematic calls for. For example, if the circuit calls for a 16v, it is acceptable to use a 25v or 63v or even a 100v. The same is true for Tantalums and Ceramics.

There are two main types of Aluminum caps: Axials and Radials.

Axial caps have one lead coming out of each end.

Radials have both leads coming out of the same end. If you bend one lead of an Axial capacitor so that it is now next to the other lead, you have just made a Radial capacitor. They are interchangeable, if you can physically fit it in the PCB.

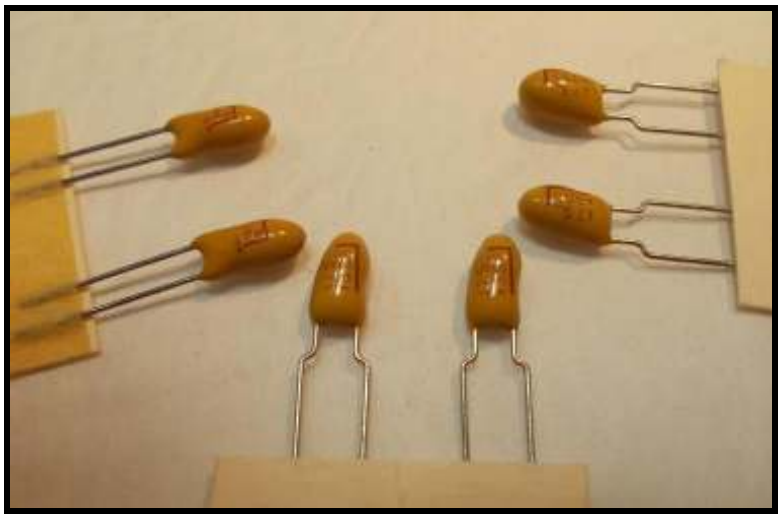


Tantalum Capacitors:

The schematic Circuit Reference for all Capacitors will be: C1, C2, etc.

These are very similar to Aluminum Electrolytics. The PCB will be marked the same way as the Aluminums. The manufacturers typically mark the positive side.

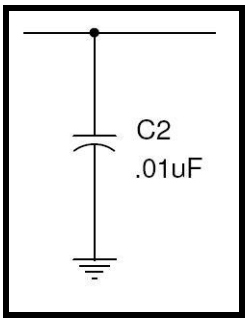
Tantalums also come in Axial or Radial body styles.

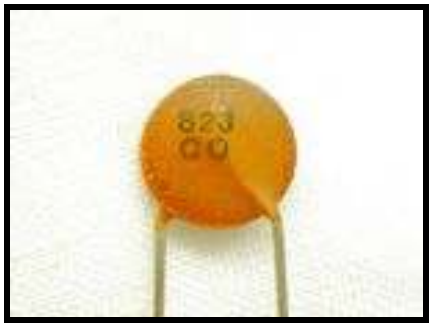


Ceramic Capacitors:

The schematic Circuit Reference for all Capacitors will be: C1, C2, etc.

These are two-leaded devices that are NOT polarized. You can put them in either way. The circuit symbol does NOT have a "**+**" like the Aluminums or Tantalums do.



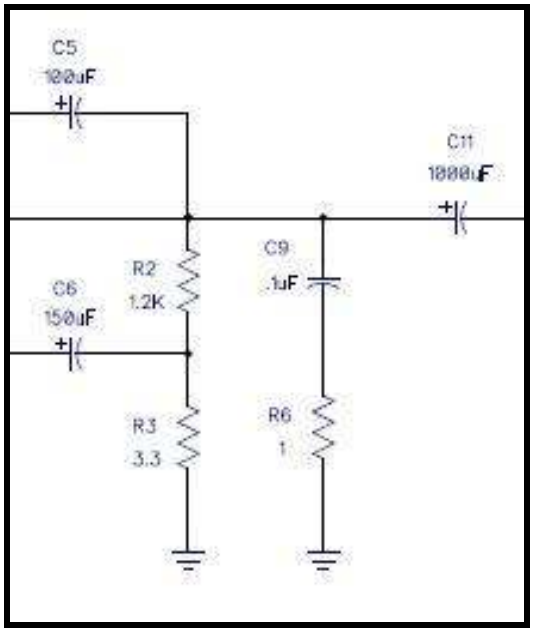


The values are typically written on the body but in different ways. There is no standard way. For example, a 1000pF cap may be stamped as “102” with other letters. Or it may be marked as “1K” or it may be marked as “1000” or “.001”.

Since most of the kits only use a few Ceramics, it should be easy to tell which is the .1uF and which is the 100pF.

Resistors

The schematic Circuit Reference for all Resistors will be: R1, R2, etc.



Resistors come in different sizes and shapes also, but we mainly use Axial resistors. Resistors are rated by their Resistance value and their power handling capabilities, Watts.

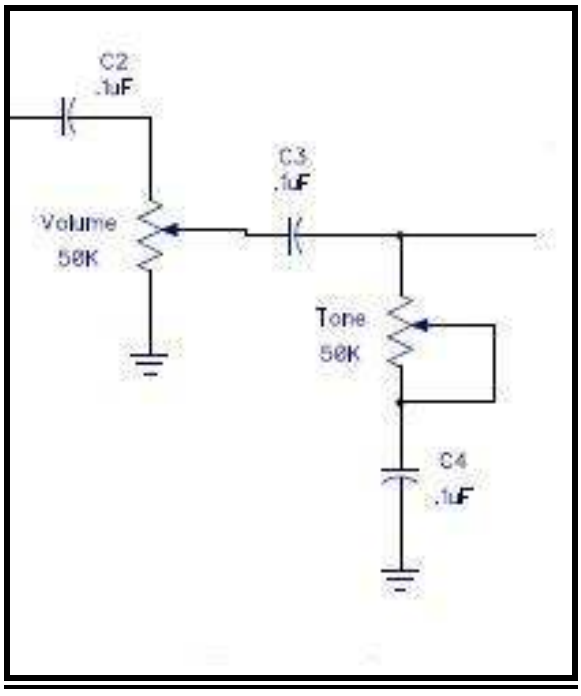
NightFire kits primarily use 1/4 Watt resistors, but we also use 1/8 Watt (very small) and ½ Watt resistors.

Resistors are non-polarized which means you can put them in either way.

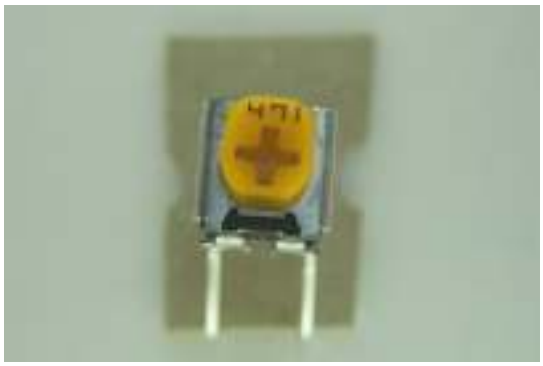
> **NOTE:** If a circuit calls for a ¼ Watt Resistor, it is ok to use a ½ Watt in its place. However, do not use a 1/8 watt in its place unless you know for sure that it will not overheat.

Potentiometers

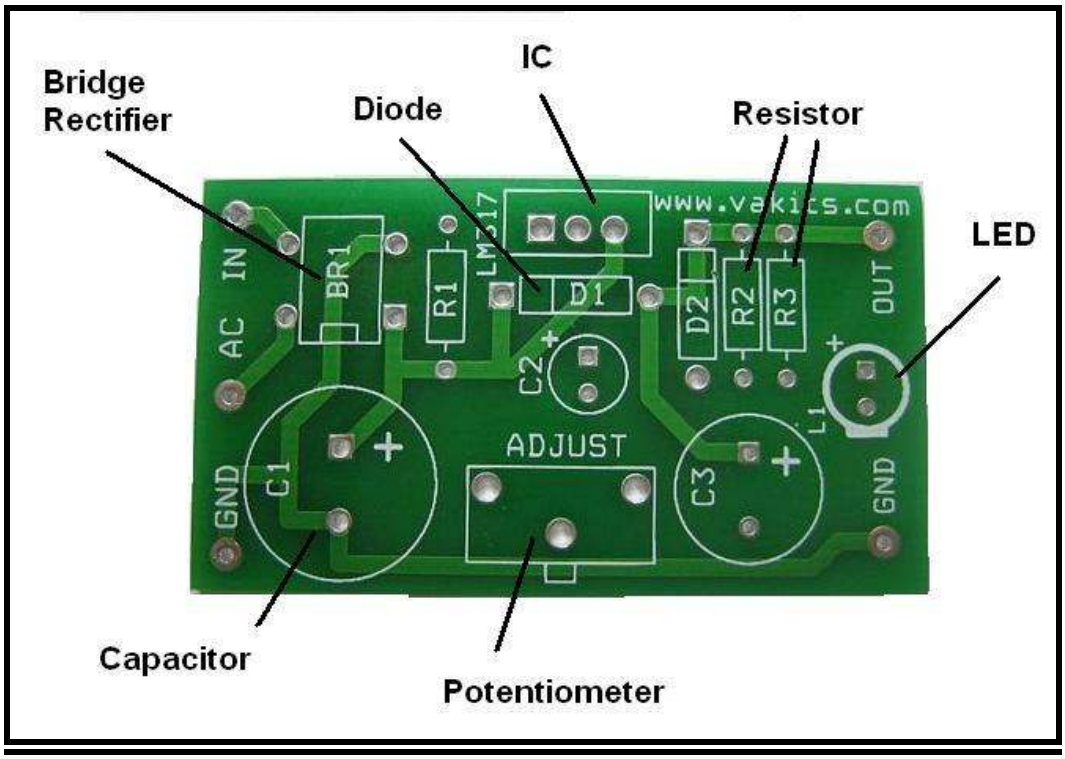
The schematic Circuit Reference for all Potentiometers will vary. This is because sometimes, it is better to label the Potentiometer (Pot) with its function, such as, “Volume”, rather than its reference designator, VR.



Pots come in all sizes and shapes.



Basically, if it fits, you can use just about any type, as long as the resistance is the same. If the leads do not match the PCB footprint, you can add wires to the Pot or you can remote the Pot with wires.

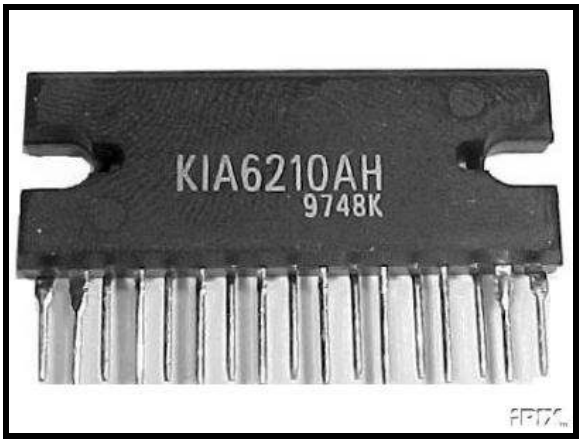


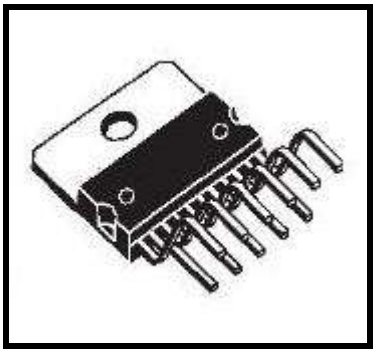
Multiwatt Packages:

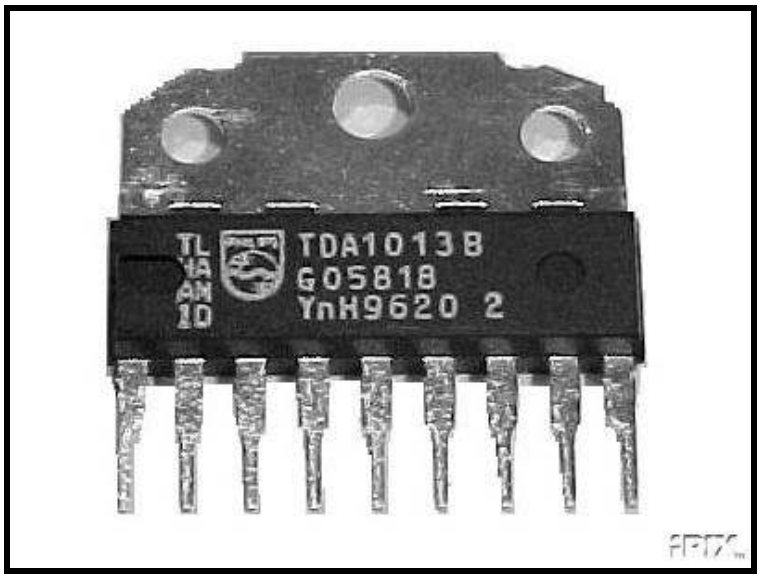
These are components that come in different sizes and shapes.

The Circuit Reference for them will vary, depending on its function.

They can have any number of leads and the leads can be arranged in more than one row.







PIC Development Kits:

We offer a number of kits that use the Microchip PIC series of micro-controllers.

There will generally be a pre-programmed PIC with the kit so that you can see it work. You are encouraged to develop your own program for the PCB.

All of our programs were developed using Microchip's MPLAB IDE platform. The assembly text for each of our programs is freely available, simply contact us and ask for it.

Some of the PIC kits include switches for extra inputs for your program. The sample programs may or may not include a switch function, they are there for you to experiment with.

Spare Parts / Replacement Parts:

You can get any part of any of our kits from us. Each part is available on our website. Simply call us or check out our website, www.vakits.com.

Pre-Built & Tested Kits:

All of our kits are available as a "Built & Tested" version for those that do not want to build the kits themselves. Call us or check our website for details.

Audio Kits with Speakers:

Some of our kits are supplied with miniature speakers. The output drivers for these are such that they cannot drive low impedance (8 Ohms) speakers and so our miniature speakers are 32 to 45 Ohms.

Applying a lower impedance speaker may cause the output Transistor to overheat. This should be avoided.

You may also apply a set of high-impedance headphones to the outputs with no problems in most cases.

To get much more sound power out of them, connect them to a more powerful Audio Amplifier.

LED Kits:

All of our LED kits may have their LEDs swapped out for other colors that you may have on hand. However, you must be aware that the forward voltage drop of each LED color varies and the circuit may work better with one color than another color.

You should still be able to intermix the colors on most of our circuits. Many different color schemes may be made.

The LED size may be interchanged also. Circuits with 3mm (T1) LEDs may drive 5mm (T 1 ¾) LEDs or even 8mm or 10mm LEDs, your choice.

The LEDs may be mounted on the top-side or the bottom-side of the PCBs. You get to decide.

SMT Kits:

Since SMT components are very small, we give some extra parts in all of our SMT kits for “just in case”.

SMT Resistors are labeled with the standard 3 digit codes by the manufacturer. We do not re-label them. A magnifying lens or eye loupe is extremely helpful in reading SMT components.

SMT Ceramic Capacitors are not labeled at all. We apply an ink dot or two to the SMT Ceramic Capacitor and explain the code in the schematic. The parts are too small to write the value and they all look the same, so a simple dot system was developed. This is just for the SMT Ceramic parts, all others are marked and so are not re-marked by us.

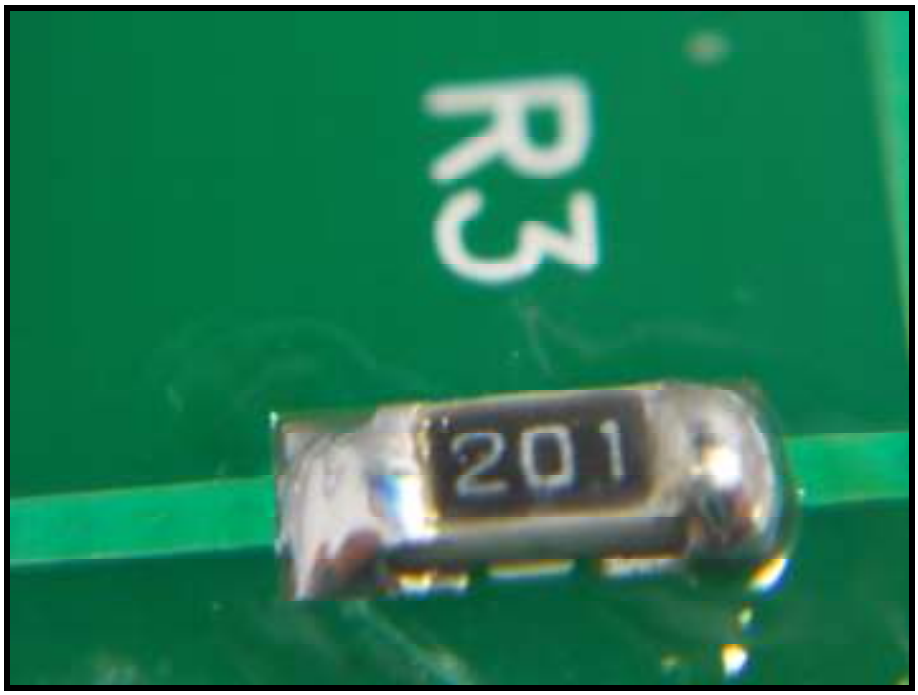
When assembling a SMT PCB, it is good to apply a thin layer of flux to the SMT PCB solder pads before soldering. This will help tremendously in soldering in SMT parts.

Try these easy steps when soldering SMT parts:

1. Add a solder bump to one pad of each part before soldering.

2. Solder one end of the component first.

3. Next, solder the other end.



Do this for all of your parts. The SMT kits include a series of pictures of a SMT PCB being assembled.

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