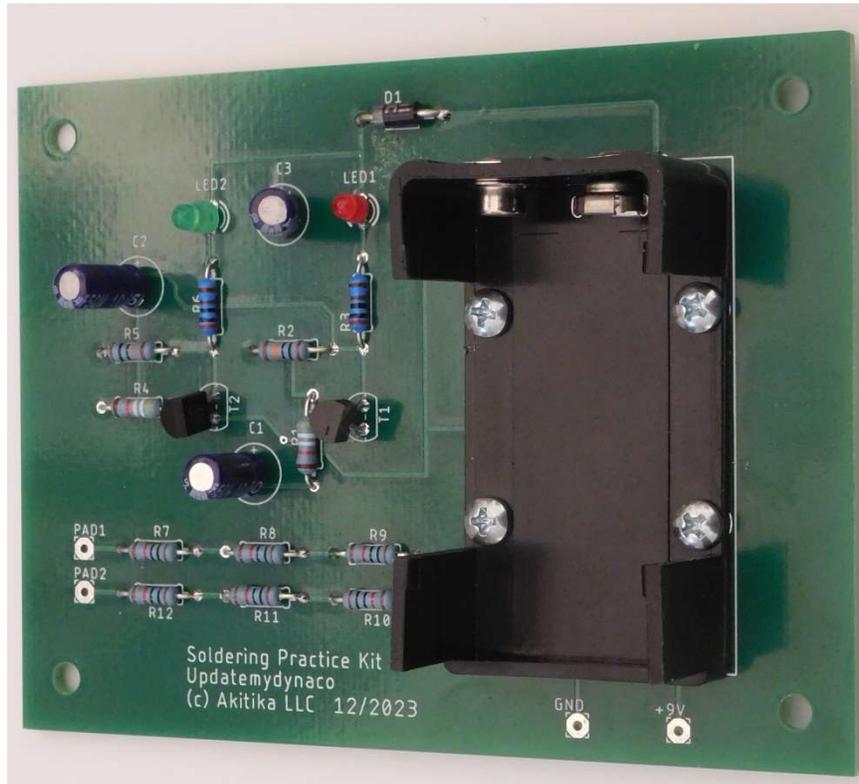


# Akitika



## *Soldering Practice Kit* **ASSEMBLY MANUAL**

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## Project Overview

The project consists of the following steps:

1. Install resistors in a series string.
2. Measure the total resistance of the resistors.
3. Build and test the red/green LED blinker.

## Important Safety Notes

Many of these notes apply to this kit, some do not. Please review all the safety tips that some day may save your life.

By purchasing, using, or assembling this kit, you have agreed to hold Akitika LLC harmless for any injuries you may receive in its assembly and/or use.

### To prevent injuries:

- **Wear safety glasses** when soldering or clipping wires to prevent eye injuries.
- Always **unplug** the power before working on any electronic equipment.
- Large capacitors hold lots of energy for a long time. Before you put your hands into the amplifier:
  - Pull the AC plug!
  - Wait 2 full minutes for the capacitors to discharge!
- Remove jewelry and rings from your hands and wrists, or anything that might dangle into the amplifier.
- If working on the equipment with the power on, keep one hand in your pocket, especially if you are near the power supply or power supply wires. This can prevent serious shocks.
- Build with a buddy nearby. If you have ignored all the previous advice, they can dial 911 or take you to the hospital.
- Read and understand the safety manuals of all the tools you use.

## About Components

We reserve the right to make design/or component changes at any time without prior notification.

## Warranty

*With the exception of fuses, **Akitika** will replace for free any parts of a correctly assembled product that fails within one year of the date of purchase when the equipment has been used in home stereo applications. It is the responsibility of the kit builder to install the replacement part(s). This warranty applies to the original purchaser only. It does not apply to units that have been physically or electrically abused, modified without prior factory authorization, or assembled with other than 60/40 Rosin Core solder. Akitika LLC's liability shall in no event exceed the cost paid to **Akitika LLC** for the kit.*

## Section 1: About This Manual

Follow these directions and you will improve your ability to solder. This improves the chances of kits that you build in the future will work the first time.

- You'll install and measure some resistors.
- You'll go on to build a circuit that alternately blinks a red and a green LED, but only if you get everything in the right place!

## Items NOT included in this kit

- Safety goggles
- 9-volt battery

## Tools you'll need to start building the kit

1. Pencil type soldering iron of 25 to 50 Watts (no huge honking soldering guns or blowtorches)
2. Wire cutters
3. Multi-meter to measure power supply voltages and confirm resistor values (strongly recommended)!
4. Solder. The best solder to use is 63/37, 0.031" diameter, Kester 24-6337-8800 50.

This **kit includes a 5-foot length** of this solder. You'll have to buy your own solder for subsequent kits.

## Helpful Tools (optional)

**These optional tools make building the kit easier.**

1. Magnifying glass, if you're over a 'certain age!'
2. **Lead bending jig** to form axial component leads to the correct span for insertion in the PCB.



**Figure 1** - lead bending jig (optional)

3. **Hakko 599B Water-free Tip Cleaner** – to keep the tip of your soldering iron clean.



Figure 2 - Hakko 599B waterless tip cleaner (optional)

## Section 2: Kit Building Hints

Yes, I know you want to ignore this section and jump right into building the kit. However, please **take a minute and read the advice of this section.**

- Stop any time you are feeling confused, tired, or anxious. Taking breaks at those strategic times will keep the build enjoyable and greatly enhance your chances of first-time success.
- A soup bowl is your friend. Before you build a board, carefully empty the parts into a broad, flat, light colored soup bowl. That makes it easy to find the parts and keeps them from getting lost.



Figure 3-place the contents of the parts envelope in a light-colored soup bowl

- A digital ohm-meter is an easy way to make sure that you've picked the right resistor. It's a great cross-check on the resistor color code. Measure twice and solder once!



Figure 4-Digital Ohmmeter

- Is something in this manual confusing? Does something look wrong? Send your questions to [dan@akitika.com](mailto:dan@akitika.com). You'll help yourself and everyone who builds the kit.
- 

## ***Let's Get Started!***

### **Soldering Tutorials**

The following links may be quite helpful to learn about soldering.

**How to Solder Electronics** <By CuriousInventor>

<https://www.youtube.com/watch?v=lpkkfK937mU>

**General Construction Hints** <By Akitika>

<https://www.akitika.com/ConstructionHints.html>

The section that follows explains about some of the important points to remember, but I think it will make much more sense if you watch the YouTube before continuing.

### **What Does a Good Solder Joint Look Like?**

1. Good solder joints are smooth and shiny.
2. If your joints have a dull or coarse appearance, the soldering iron may be too cold.
3. Increase the temperature of your soldering iron, and re-flow the suspicious solder joints.

### **There are two ways to make a good solder joint.**

#### **Preferred method**

- Make a sandwich of the component wire being soldered, the solder, and the tip of the iron. The tip of the iron should contact both the solder and the pad.
- Apply a little pressure from the iron in the direction of the wire. That pressure makes good contact between the iron and the solder, transferring heat to melt the solder. This releases flux in the solder that cleans the joint. The solder melts, and reforms on the component (e.g. resistor) lead and the pad.

#### **'OK' method**

- Position the tip of the iron to simultaneously contact the lead and the pad.
- Wait for a bit (perhaps two seconds), then feed a bit of solder into the lead near where it meets the PCB.

➤ ***Safety FIRST!***

➤ ***Wear protective glasses.***

➤ ***Please be careful.***

➤ **Only pick up the soldering iron by the handle.**

## Clean and Tin the Soldering Iron Tip

Turn your soldering iron on and let it come up to temperature.

Check the temperature of the soldering iron by melting a bit of solder on the tip. Some smoke will rise from the tip. This is normal. It is the flux in the solder going into a liquid form and then boiling off. The flux acts as a cleaning agent that makes for better joints.

Ideally, the working surface of your soldering iron (the area near the tip) should look silvery and smooth. **If your soldering iron's tip isn't silvery and smooth, then:**

- Drag the tip through the wet sponge on your soldering station, or
- Use a HAKKO 599B-02 wire cleaner
- Melt a little solder on the tip of the iron and clean the tip again with the sponge or the HAKKO wire cleaner.
- Melt a little more solder on the tip. This is called "tinning the tip". It leaves a small, clean film of molten solder on the tip that helps transfer heat from the soldering iron to the components.

## About PCB's (Printed Circuit Boards)

The PCB has two sides.

The **component side**, with silk-screen printing showing component designations like R1.

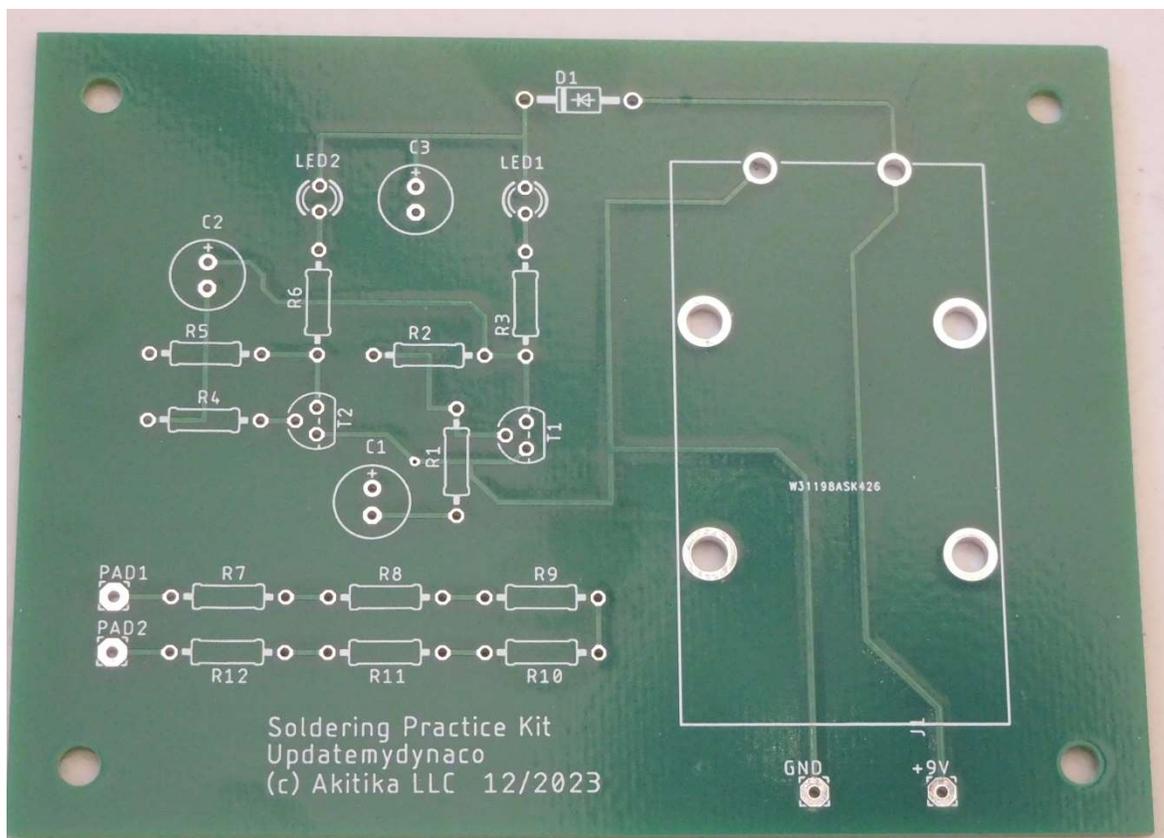
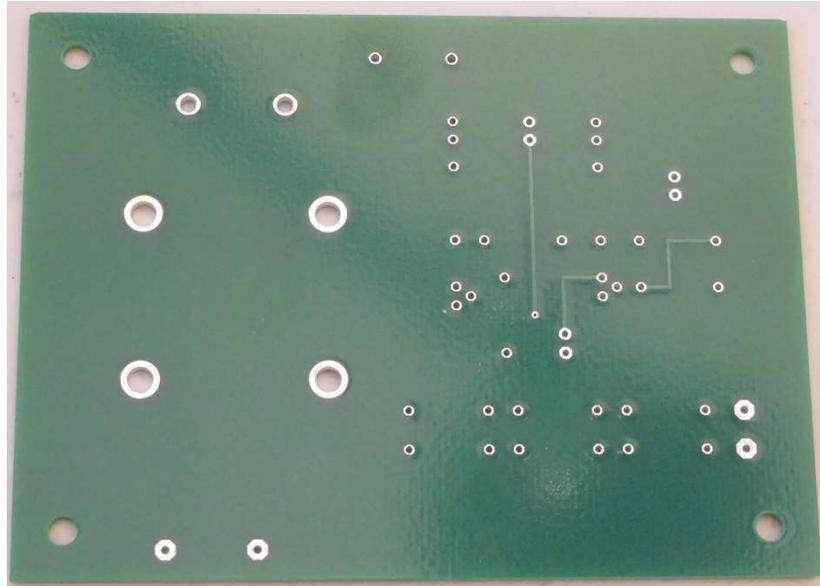


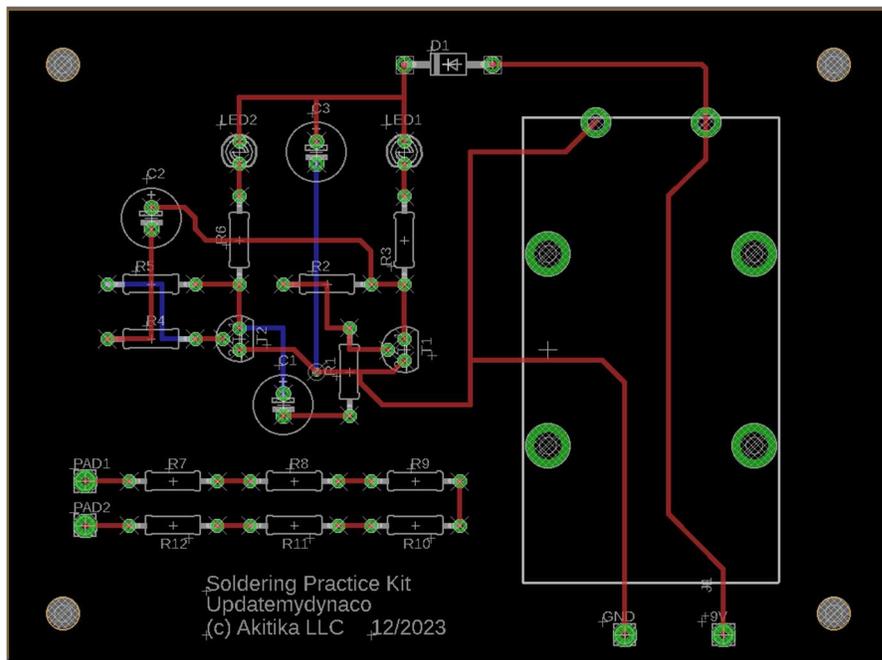
Figure 5-Silk screen on component side shows component locations

The **solder side**, which is unmarked.

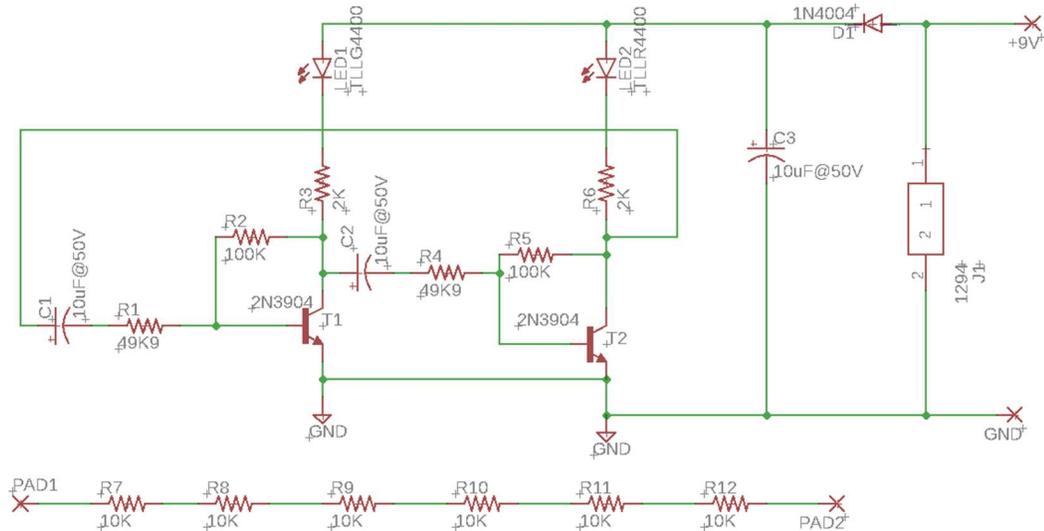


### Section 3: Building the Kit

This section details installing a string of resistors connected in series. We do this because the total resistance looking into the series string is the sum of the value of all the resistors in the string. If one of your solder joints is bad, you may instead see an infinite resistance. If a wrong value is installed, you may see the wrong value when you test the string.



**Figure 6-Component side of printed circuit board**



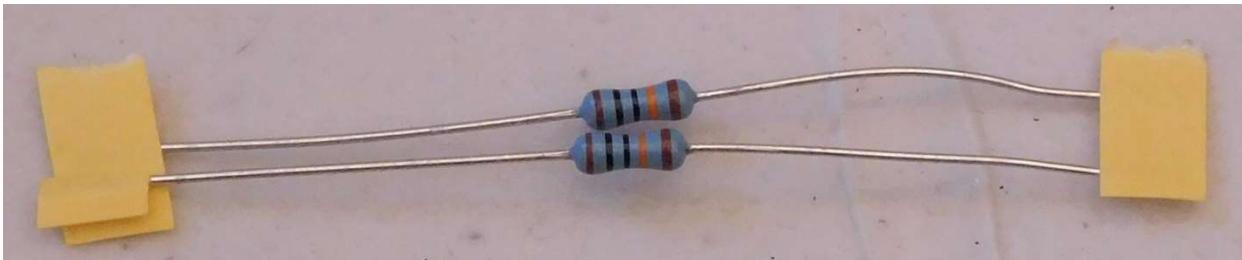
**Figure 7-Soldering practice board schematic**

## About Resistors

Resistors have a value in Ohms. They are also rated for tolerance, which speaks about how much the part will vary from its stated value in Ohms. The resistors in this kit have +/-1% tolerance. That says that a 100 Ohm resistor could range in value from 99 to 101 Ohms.

Resistors are also rated for the power that they can safely dissipate. The resistors in this kit are rated for 1/4 Watt of dissipation.

The value of the resistors is marked by color rings on the resistor. That color code will be listed for every resistor to help you find the correct value. We recommend that you back up the color code by measuring the resistor with an Ohmmeter. Figure 8 shows a pair of 100K resistors.



**Figure 8-these two resistors are 100K Ohms according to their color code, brown, black, black, orange, brown**

## Inserting the Resistor String

Looking at the bottom of the schematic, you'll see 6 10K Ohm resistors in series between PAD1 and PAD2.

If this first bit of work is successful, then your Ohmmeter will measure 60K Ohms between PAD1 and PAD2.

Let's start the assembly. If this all seems like gibberish, don't worry. Carry on, and it won't seem so foreign.

## Install Resistors R7-R12

In general, you install axial leaded components (like the resistors) by placing the body on the silk screen side of the board, and the leads through the indicated holes.

Bend the leads over on the back of the board to keep the resistors from falling out until you solder them in place.

Try to bend the leads in a direction that won't lead to solder bridges between traces that should remain disconnected.

Note: resistors are non-directional, so either orientation of the resistor is just fine.

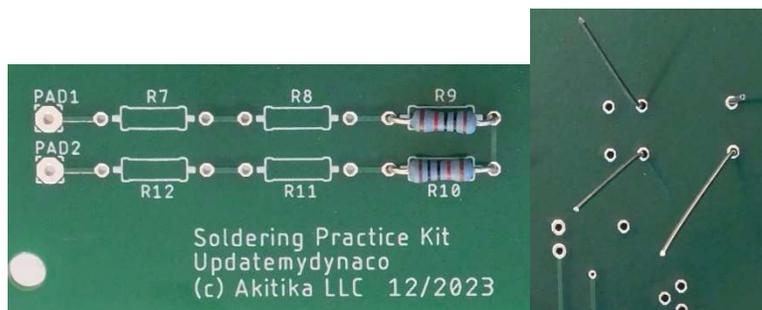


Figure 9-Install R9 and R10 from the component side and bend the leads on the solder side to hold them for soldering

### We recommend the following procedure to install resistors

1. Verify your reading of the color code using an Ohmmeter. Check twice and solder once.
2. You may want to cut off the end  $\frac{1}{4}$ " or so of the leads to keep adhesive from the tape from gumming up the works when you pass the lead through the PCB.
3. Insert all components of the same value or type.
4. Bend the leads as described above.
5. Solder the leads on the back of the board. This is also called the "solder side", and it typically will have no silk screen (white lettering).
6. Clip the leads, leaving them slightly protruding above the solder "volcano".



Figure 10-clipped leads protrude past the solder volcano

Track your progress by placing a checkmark in the done column as you install each component.

Designation	Value	Color Code	Done ✓
R7	10K	Brown, Black, Black, Red, Brown	
R8	10K	Brown, Black, Black, Red, Brown	
R9	10K	Brown, Black, Black, Red, Brown	
R10	10K	Brown, Black, Black, Red, Brown	
R11	10K	Brown, Black, Black, Red, Brown	
R12	10K	Brown, Black, Black, Red, Brown	

### Check Your Work

If all is well, measuring the resistance from PAD1 to PAD2 should show a total of 60000 Ohms. If your meter shows an open circuit, then:

- Verify that your meter and test leads are working correctly. Touch your ohmmeter leads together. The meter should show nearly zero Ohms.
- If your meter does not auto-range, set it on a range that can measure 60K Ohms.
- Put one lead on pad 1. Move the other lead to the pads of R7, R8, and so on up to R12. If the meter shows an open, then one of the intervening solder joints needs to be re-worked.

If your work passes the test outlined above, continue to the next section.

### Install the rest of the resistors

Using the same technique described above, install the rest of the resistors. Make sure that the color code and the ohmmeter readings agree. Double check the R number and the value for that R number. Note the “funny order” in the Designation column. We’ve done that to group like values of resistors.

Also note the shorthand used for resistor values. 49K9 means 49,900 Ohms which is equivalent to saying 49.9K Ohms.

We use the **49K9 style** because decimal points are sometimes easy to miss, whereas the **K stands out boldly**. (**49K9**=49,900 Ohms=49.9K)

Designation	Value	Color Code	Done ✓
R2	100K	Brown, Black, Black, Orange, Brown	
R5	100K	Brown, Black, Black, Orange, Brown	
R3	2K	Red, Black, Black, Brown, Brown	
R6	2K	Red, Black, Black, Brown, Brown	
R1	49K9	Yellow, White, White, Red, Brown	
R4	49K9	Yellow, White, White, Red, Brown	

## Install the Electrolytic (polarized) Capacitors

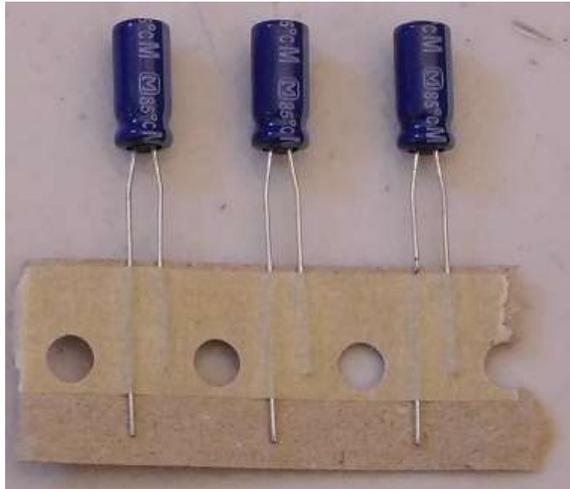


Figure 11- These are 3 10µF 50V capacitors

Electrolytic capacitors **are polarized**. That means that the way you install them matters.

On the capacitors, typically only the negative side is marked. Of course, on the PCB, only the positive side is marked. Thus, when you install the caps on the PCB, **the negative sign on the cap must face AWAY from the positive sign on the PCB!** The bottom of the body of the capacitor should sit on the PCB.

Polarized Capacitors (watch polarity)			
Designation	Value	Rating, Marking, lead type	Done? (✓)
C1	10 µF	Electrolytic capacitor, 10µF 50 V, radial leads	
C2	10 µF	Electrolytic capacitor, 10 µF 50 V, radial leads	
C3	10 µF	Electrolytic capacitor, 10 µF 50 V, radial leads	

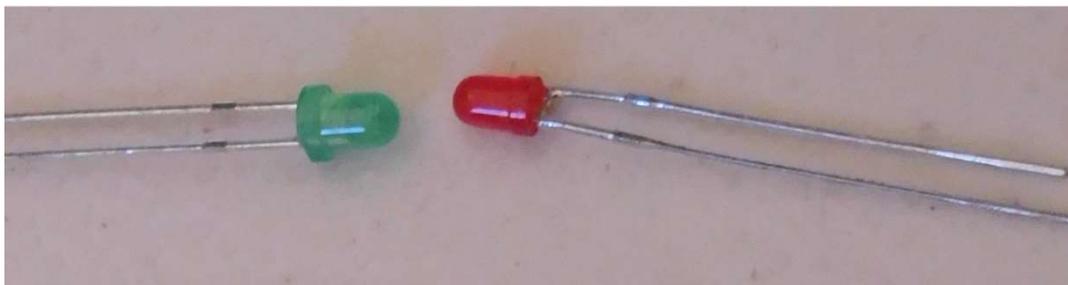


Figure 12-Green and Red LEDs

## Install the LEDs

LEDs are polarized. That means the way you install them matters.

Looking down on the LED package, you will see a basically circular outline with a flat side. The flat side is the cathode, or negative side of the LED.

## Install the LEDs (continued)

Examine the silk screen where LED1 and LED2 are installed, and you will see a similar flat side in the outline for these LEDs. Install the LEDs, being careful to get the correct orientation.

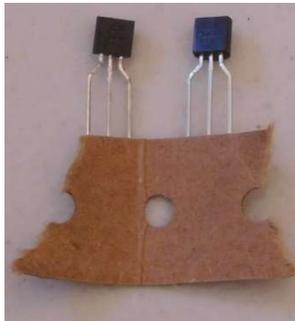
- The Green LED has a nicely visible flat side. That flat side should be positioned closest to R6.
- The RED LED has an almost impossible to see flat side, but, the Cathode is the shorter of the two uncut leads. The Cathode should be positioned closest to R3.

The bottom of the LED package should sit on the board. If you prefer, you could leave it up to 0.1" off the board. Keeping the LEDs close to the board discourages twisting of the leads that might short the LED out.

LEDS (watch polarity)		
Designation	Color	Done? (✓)
LED1	RED	
LED2	GREEN	

## Install the transistors

Transistors have **three leads**. Their names are Emitter, Base, and Collector. (You don't need to worry much about this) You need only to match the body shape to the shape on the silkscreen.



The bottom of the transistor should be within 0.1-0.2" of the surface of the PCB. Closer than 0.1" makes it hard to install and increases the possibility of damage from excess heat. Longer than 0.2" increases the possibility of twisting the transistor and shorting out the leads.

Transistors (watch orientation)		
Designation	Type, Voltage, Polarity	Done? (✓)
T1	2N3904, 40V NPN	
T2	2N3904, 40V NPN	



Figure 13-Diode. Note the band on the left side!

## Install the Battery Holder

The kit uses a 9V battery. Make sure that the battery is not installed for this step. You'll solder the battery holder's power connections into the PCB. The four mounting holes fasten the battery to the PCB using 4.40x5/16" Phillips screws and 4-40 keps nuts. (Keps nuts have a built-in lockwasher).

Install the battery holder and fasten it down with 4 screws and 4 nuts. Solder the two output leads to the PCB, then clip the excess length of those leads, leaving some space between the end of the lead and the solder volcano.

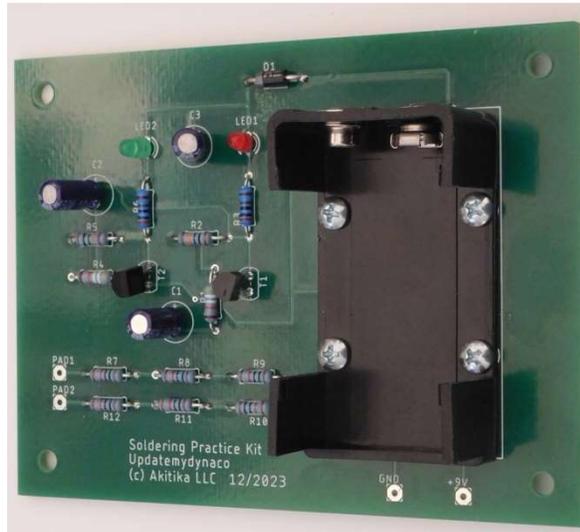


Figure 14-Completed Kit, battery not yet installed

## Pre-power Inspection

- Look at the solder side of the PCB to make sure that all the components have been soldered.
- Look at the solder side to make sure that there are no solder blobs shorting things out.
- Look at the silk-screen (component side) of the PCB to make sure the capacitors, diode, LEDs, and transistors have the correct orientation.

## Power Up

You're now ready for the moment of truth!

Install the battery in the holder. Watch the polarity!

After you have snapped the battery in place, wait a few seconds. At first, both LEDs may illuminate. After a few seconds, if all is well, the red and green LEDs should flash alternately at a rate of about 1 flash per second.

## Troubleshooting

If the flasher doesn't flash, pull the battery and walk away for 10 minutes. Do something else, talk to the kids, pet the cat, feed the dog. That short break will restore your ability to see what's really on the board.

1. Re-check the orientation of the polarized devices.
2. Look at the solder side of the board for either suspicious or missing joints.
3. Check the values of all the resistors.

## Reaching Akitika and Updatemydynaco

You can find more kits to build and more information about those kits here:

[www.updatemydynaco.com](http://www.updatemydynaco.com)

Upgrades for Dynaco and other HiFi Equipment

[www.akitika.com](http://www.akitika.com)

New kits and assembled HiFi, a 2PPM oscillator, and lots more information about building your own HiFi equipment.