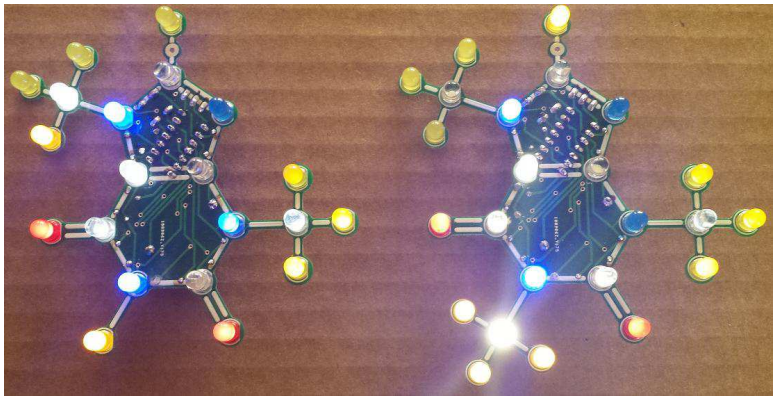
When done, please return these instructions for the next person to use. Thank you.

Kit 27 - Caffeine Blinkie
Kit 28 - Chocolate (Theobromine) Blinkie

The heart of this blinkie is a 16F1824 PIC produced by a company called Microchip. A PIC is a tiny, yet surprisingly powerful little computer. By itself, it can't do much – it needs someway to interact with the world – we are going to do this by giving it senses:



Theobromine/Chocolate Caffeine

- From us – two push buttons
- To us – 24 (if caffeine) or 21 (if theobromine/chocolate) light emitting diodes (LEDs).

By building this blinkie, we hope you have a lot of fun, as well as learn how easy it is to assemble and solder a circuit, as well as gain a desire to learn more!

Use

Once built, the use of this blinkie is fairly straightforward. Don't get it wet. Don't stick it in a pocket with a bunch of car or house keys where it might short out.

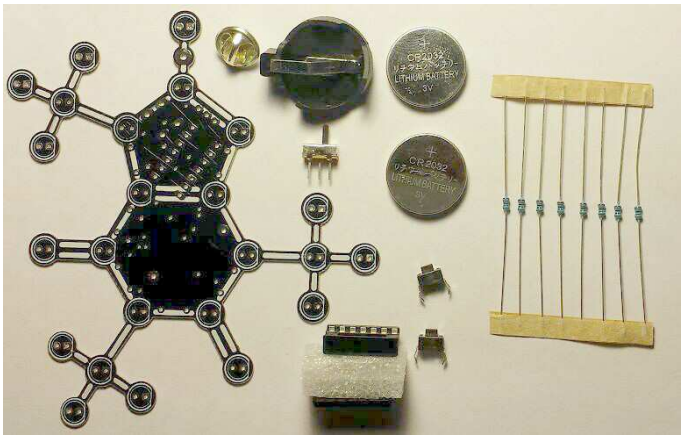
This blinkie has additional patterns stored in the PIC. To change patterns or messages, press the push button and hold. The bottom LED on the shield will light, and then the LEDs will count up in a binary sequence. Each sequence represents a stored pattern. If the push button is released, the pattern associated with that particular binary number will then be displayed on your blinkie.

The blinkie has two display modes. Demo mode, where it will switch to a different stored pattern every minute, as it cycles through all the stored patterns. If it is in demo mode, when the push button is held down, the very top most LED will be lit. Normal mode, where will continue to display the current pattern until a new pattern is selected via the push buttons. To toggle between the modes, hold down the push button while turning on the power.

Term	Meaning
Solder	A metal alloy that melts easily and conducts electricity. You will have a "coil" of it.
(Solder) Joint	An electrical and mechanical connection between a component and the circuit board, done by heating both and adding solder
Component	Any of the parts in the kit that will be soldered – LEDs, battery holders, switch, etc.
LED	Light Emitting Diode – the "light bulb" of the blinkie
Lead	Rhymes with "seed". The wire that comes out of an LED or resistor that you solder to the circuit board
Pad	Small shiny areas on the circuit board, usually circles or squares, that you'll be soldering LED and other component leads to
Pin	Like a lead, but comes out of the battery holders, tie tack pin, socket, switch, and push button
Chip	A small electronic circuit package, with leads in rows on both sides.
Silkscreen	The white printing on the circuit board – both decorative, and outlining where, and on which side, the various parts go

Now, on to the assembly…First, open up the kit and review the contents. Looking from top to bottom, and left to right there should be the following parts:

- Circuit board – Showing FRONT as will be referred to in these build instructions
- Pin Back
- Dual CR2032 battery holder
- Power switch
- Two CR2032 3V batteries (you may have to ask for them)
- 14 pin socket
- 14 pin 16F1824 PIC chip
- Eight 56 ohm resistors (**green**, **blue**, **black**)
- Two push buttons
- 24 for caffeine, or 21 for theobromine / chocolate) light emitting diodes (LEDs) (not shown in picture)



Got everything to start? If not, give us a shout. Next, a few words on soldering…

Soldering Hints

Soldering is not like gluing; the solder forms an alloy with the metals to be connected that creates a stable electrical path and a certain amount of mechanical attachment. For the small connections on this project, a 25 or 30 watt soldering iron works well. Rosin core solder is used – the acid core solder sold for plumbing would eat your components in a short time.

Here's how to make a good joint:

- Prepare the joint. Bend the component lead slightly after it passes through the printed circuit board (this helps hold it in place while soldering).
- Prepare the tool. The soldering iron should be up to temperature. Clean the tip by quickly brushing it against a dry wire pad, or damp sponge, or damp cloth. Melt a little solder (a 2mm length) onto the tip so it's shiny. This is called "tinning". The solder coating helps conduct heat from the tip to the joint.
- Place the tip in contact with the component lead and the printed circuit board pad.
- Place the solder against the joint directly opposite the tool. It should melt within 2 seconds, and flow around the joint. If it takes longer than that, you're not getting enough heat into the joint.
- Keep the soldering iron in place until the solder flows freely and completely covers the joint. If the heat is removed too soon, the solder will tend to "ball up" and not stick well to the conductors. The solder joint should look "wetted", with concave shapes.
- Let the joint cool without movement at room temperature. This usually takes only a few seconds.
- If a joint is moved before it cools, it will take on a dull, satin look that is characteristic of a cold solder joint. A cold solder joint is fragile and conducts poorly – reheat the joint until the solder flows freely, and hold it still until it cools.

- Keep the tip of the soldering iron clean. Wipe off flux and excess solder regularly in a damp sponge or cloth, or plunging it into a holder of stainless steel wool. Be sure solder melts to the tip.

Assembly

Take care when soldering the headers and sockets to the circuit board and make sure you are soldering them from the correct side!

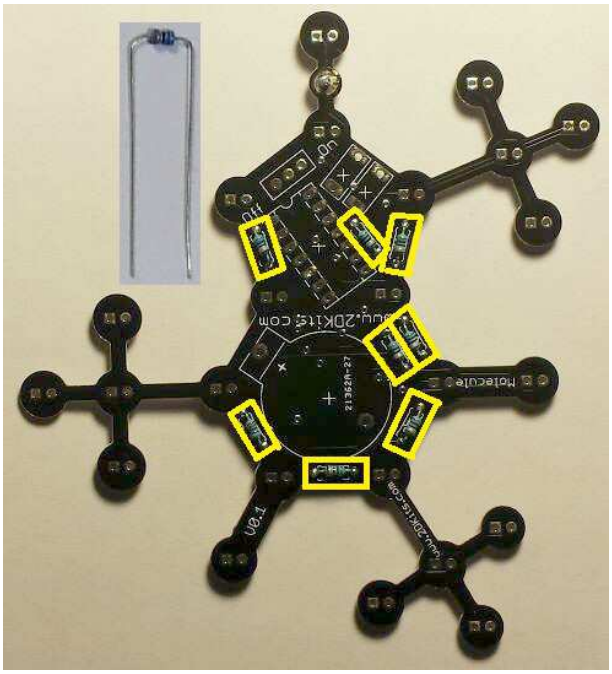
Ready to start? First, flip the circuit board over. Orient the board so the hole for the pin is at the top. You will see the silk screening for the power switch (Off On), the battery holder (round with square).

1. Insert the resistors. To make inserting easier, pre-bend the leads as shown in the inset.

They should be inserted into the locations marked (R0, R1, R2, R3, etc).

Once inserted, it may help to form the leads into a vertical "V" on the back to hold them in.

Flip the board to the back and solder. Trim the leads. Remember to trim the leads only after soldering them.



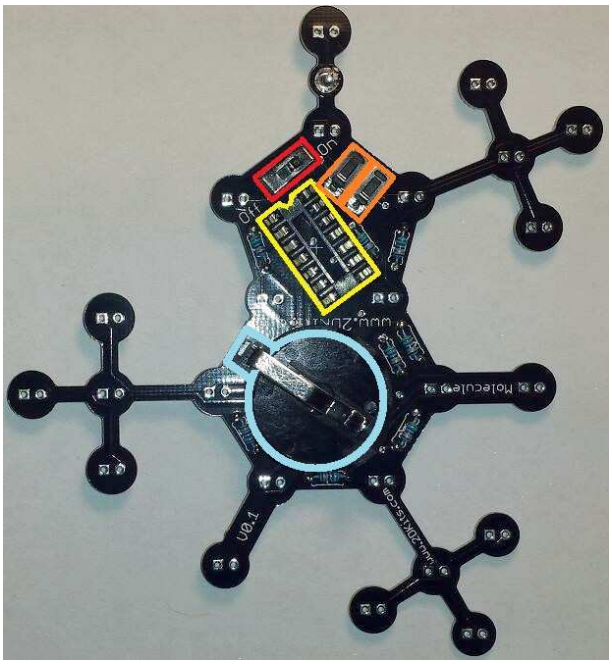
2. Flip the board back to the front.

3. Separate the pin from the clasp of the tie tack (pin and clasp). There is a small secondary post. Use the cutters to remove the smaller post as close as possible to the head of the pin.

4. Insert the pin through the hole. It should go through the front of the board.

5. Hold the pin, and flip the board on its back as shown in the picture, and solder the pin – as shown in the picture of the **back** of the board after soldering.

6. Insert the 14 pin socket. The socket will be inserted from the side that has the rectangular silk screen (printed) outline (yellow in picture). Make sure the notch on the socket matches the silk screen outline; the notch will be to the top. Flip the board over and solder the leads. Flip the board back over.



7. Insert the push buttons (Orange in picture). They will snap into the pins. It is a tight fit, so some wiggling to get it to snap in properly may be necessary. Flip the board over and solder the leads. Flip the board back over.

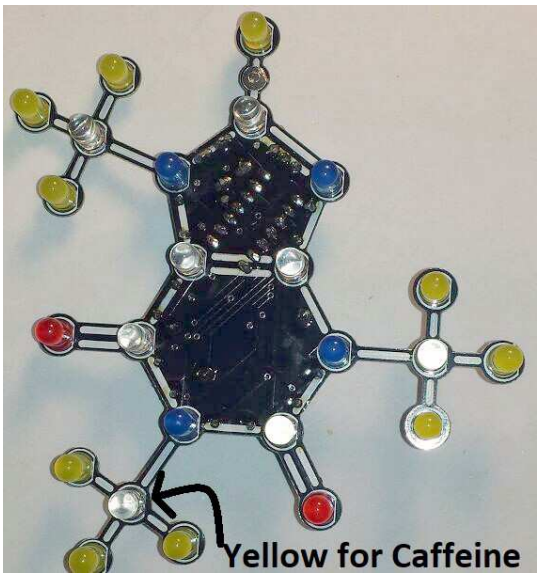
8. Insert the power switch (red in picture). Flip the board over and solder the leads. Flip the board back over.

9. Insert the dual battery holder (light blue in picture). Orientation (the direction the battery holder is turned) is important. Match the square bump on the holder to the square bump printed in the silkscreening. Flip the board over and solder the leads.

10. Insert each LED into the board from the front side. "Front": Where the single and double lines are, representing the bonds between the various atoms.
- Use the picture for which color goes where.

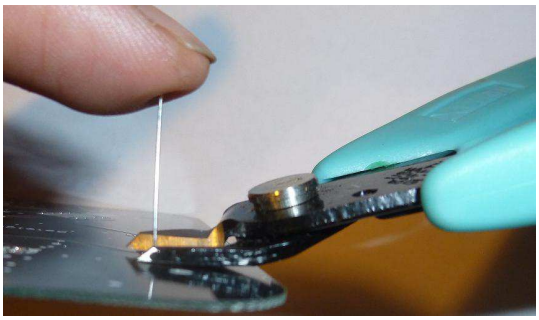
Orientation (how the LED is inserted into the two holes) **is important** for LEDs. Remember: **Long lead, round pad**. Then **Short lead, square pad.** Remember to trim the leads only after soldering them. Flip the board over and solder the leads. Flip the board back over.

Note: A method to ensure the LEDs are straight and flat against the circuit board once soldered, is to solder only one leg of each LED. Then align the LEDs by using the soldering iron to reheat and reposition the LED if necessary. Once aligned, solder the remaining legs.



The LED colors represent elements: Yellow for Hydrogen, White for Carbon, Red for Oxygen, and Blue for Nitrogen.

11. Trim the excess leads with the cutters. Hold your finger over the ends of each lead to keep it from flying off when cut.



12. Although the leads are short on the socket, push button, power switch, and dual battery holder, you may want to trim them down to the solder.

13. Verify the power switch is in the off position. Insert the batteries. The plus "+" faces up. The batteries need to be slid under the top spring. Don't bend the spring up too much when adding the second battery, or it might not make a good contact with the "stack of 2 batteries".

14. The PIC chip is inserted in the socket, so the **notch lines up with the notch printed in the silkscreening of the board.**

15. Turn the power on and enjoy.

Troubleshooting

If one or more of the LEDs don't flash, then you'll need to do a little troubleshooting to finish your project. The following steps should isolate most problems.

- Recheck your solder connections. 80% of all problems are traced to this. Cold solder joints and broken joints will cause erratic performance or failure. Reheat any questionable solder connections until they flow and look shiny and secure.
- Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.
- LEDs were reversed.
- Batteries incorrectly inserted. The "+" side of the battery should always be inserted facing up.
- Bad part – it does happen. In the hundreds of boards assembled, we've seen two or three parts fail. Send us email, and we will send a replacement part.
- A part got lost/melted/damaged/destroyed while building the kit. It happens – you're not the first (or second, or fiftieth). Let us know, and we'll see what we can do.