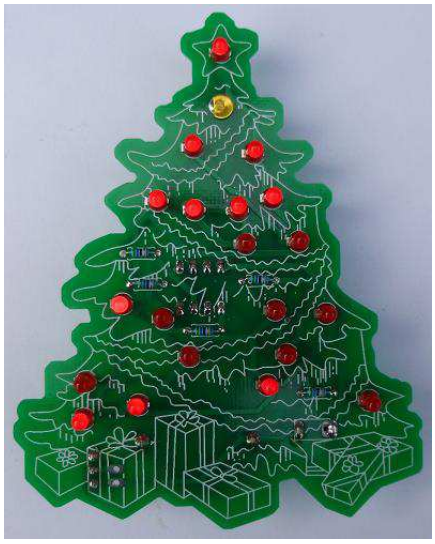
Kit 23b - 20 LED Tree Blinkie G2

The heart of this blinkie is a 12F1822 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 some way to interact with the world – we are going to do this by giving it senses:



Single color option

- From us – a push button
- To us – 20 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!

Multi-color option

Use

Once built, the use of this blinkie is fairly straightforward. Don't get it wet. Don't stick it in a pocket, purse, drawer, etc. with a bunch of change or 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 leftmost LED, about halfway up the tree 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.

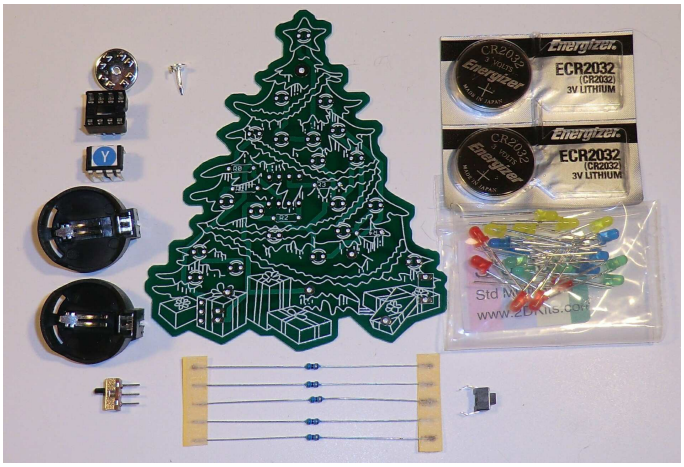
The blinkie has two display modes. In demo mode, it will switch to a different stored pattern every minute, as it cycles through all the stored patterns. If it is in demo mode, when the push button is held down, the very top most LED will be lit. In normal mode, it will continue to display the current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

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

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:

- Tie tack (shown with clasp separated from pin)
- 8 pin socket
- 8 pin 12F1822 PIC
- Two CR2032 battery holders
- Power switch
- Circuit board
- Five 56 ohm resistors (**green**, **blue**, **black**)
- Two CR2032 3V batteries (with the kit, or separately handed out when you ask)
- 20 LEDs
  - These may be all the same color
  - Or multi-colored, as shown
- Push button



Let us know if anything is missing!

Soldering Hints

Soldering is not like gluing. The melted solder forms an electrical and mechanical connection between the board and a part. 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 connection:

- Prepare the connection. Bend the component lead slightly after it passes through the printed circuit board (this helps hold it in place while soldering).
- Prepare the iron. 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 connection.
- Place the tip in contact with the component lead and the printed circuit board pad.
- Place the solder against the connection directly opposite the tool. It should melt within 2 seconds, and flow around the connection. If it takes longer than that, you're not getting enough heat into the connection.
- Keep the soldering iron in place until the solder flows freely and completely covers the connection. If the heat is removed too soon, the solder will tend to "ball up" and not stick well to the conductors. The solder connection should look "wetted", with concave shapes.
- Let the connection cool without movement at room temperature. This usually takes only a few seconds. **See the "A good solder connection" picture on the last page of this document.**
- If a connection is moved before it cools, it will take on a dull, satin look that is characteristic of a cold solder connection. A cold solder connection is fragile and conducts poorly – remelt the connection 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 the damp sponge or cloth, and re-tin if needed.

Assembly

TIP: These instructions tell you which side to put a component (part) on, but you can DOUBLE CHECK by making sure you are putting it on the silk screened white outline (rectangle, circle, etc) printed on the circuit board

1. Insert the 8 pin socket. The socket will be inserted from the side that has the silk screen. Make sure the notch on the socket matches the silk screen outline; the notch will be to the right. Flip the board to the front and solder the leads.

2. Flip the board to the front. Insert the push button. It will snap in. It is a tight fit, so some wiggling to get it to snap in properly may be necessary. Flip the board to the back and solder the leads.
   - The rectangular silk screen left of the switch is not used.

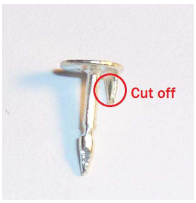
Continue using the above picture for these next 3 steps:

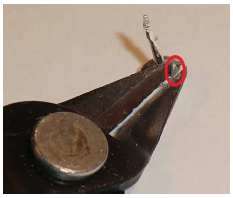
3. Flip the board to the back. Insert the power switch. It doesn't matter which direction. Flip the board to the front. Making sure the pins are straight up, solder ONE pin then check for the pins being crooked. Also check the back that the switch itself isn't crooked. If so, you can melt the solder on that one pin while straightening it. Then solder the other two pins.

4. Insert each battery holder. **Orientation** (the direction the battery holder is turned) **is important**. The battery holders have a square end, and the silk screen printing has a square end to be matched up as in the above picture.

5. Although the leads are short on the socket, push button, power switch, and battery holders, you may want to trim them flush with the board. Be sure to avoid the cut-off ends flying off when cutting.

6. Separate the pin from the clasp of the tie tack (pin and clasp). The pin has a small secondary post. Use the cutters to remove the smaller post as close as possible to the head of the pin. Again, catch it from flying off!

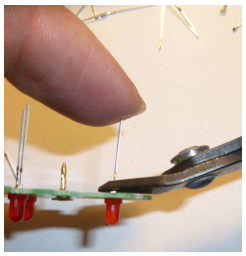


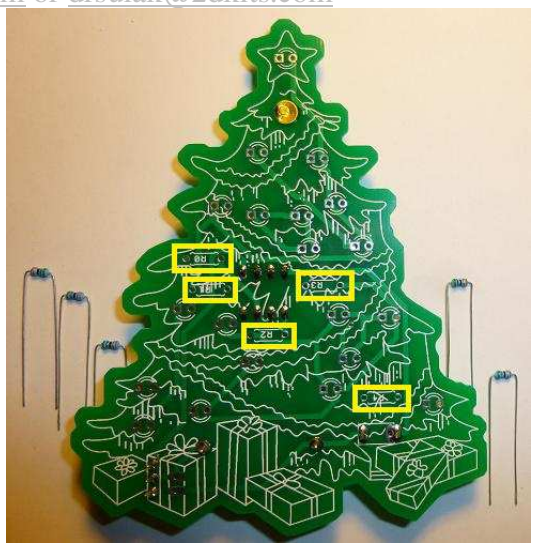


7. Insert the pin through the hole in the front of the board with the tree silk screening and stick through on the 2dkits.com silk screen side.

8. Solder the pin on the back – 2dkits.com silk screen side.
   1. Heat the pin and pad for 5-10 seconds with the soldering iron tip
   2. Add a little solder (1/8" or so)
   3. Remove the solder, keeping the iron in place
   4. Remove the soldering iron

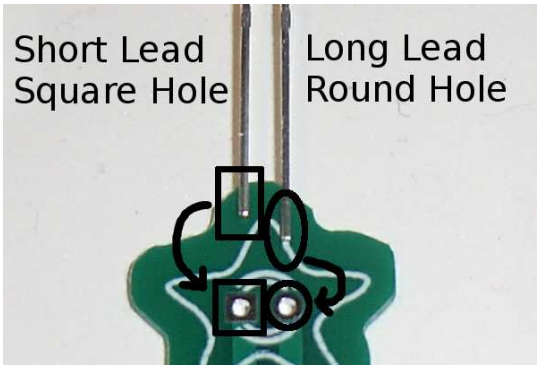
9. Insert the resistors.
   - To make inserting easier, bend the leads as shown.
   - They should inserted into the locations marked (R0, R1, R2, R3, and R4). Orientation/direction doesn't matter with any resistor.
   - On the back, spread the resistor's leads into a "V" to hold it in place and make soldering easier
   - Flip the board over to the back and solder them – one at a time or all at once.
   - Trim the leads, and catch them from flying off as shown below:





TIP: When soldering LEDs, solder just ONE lead, then check that the LED is flat against the circuit board. If not, re-melt the solder on the one pin while pushing the LED from the front toward the circuit board until it is snug against the board. THEN solder the other lead.

10. Flip the board to the front.
    - Insert each LED into the board from the tree side.
    - If you have the multi-color pack, you may place them wherever you wish.
    - **Orientation** (how the LED is inserted into the two holes) **is important** for LEDs.
    - **Short lead, square pad. Long lead, round pad**.
    - There are a total of 20 LEDs to insert and solder. It may be easier to do five at a time and trim the leads, then insert and solder the next set. Remember to trim (and catch!) the leads only after soldering them.



11. Verify the power switch is in the off position.
    - Insert the batteries as follows:
    - The plus "+" faces up.
    - Angle it into the battery holder against the metal tab, and then press in and down over the black rim.

12. The PIC chip is inserted so the **notch is facing right**. Its notch matches the notch on the silk screening. You can feel the notch with a fingernail, if hard to see.

13. The clasp is inserted onto the pin of the tie tack.

14. 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 connections and broken connections will cause erratic performance or failure. Remelt 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.

- Check for, and if found, remove solder bridges (excess solder making an unwanted connection on the board, which "shorts out", for example, the LED.)

- A bridge is easy to fix. You can often just remelt the solder, pulling the tip of the soldering iron through the bridge, breaking it. Or, remelt all the solder and tap the board on edge to shake off the excess while it is still melted.

A GOOD solder connection will have a little mound of solder covering the pad and wire.

- An occasional problem is soldering "up on the lead" but without the soldering iron tip being down on the pad so the solder connects the two.
- See the picture – there's a gap below the solder.
- Fix it by pressing down on the "blob" with the soldering iron tip until it flows down on the pad.