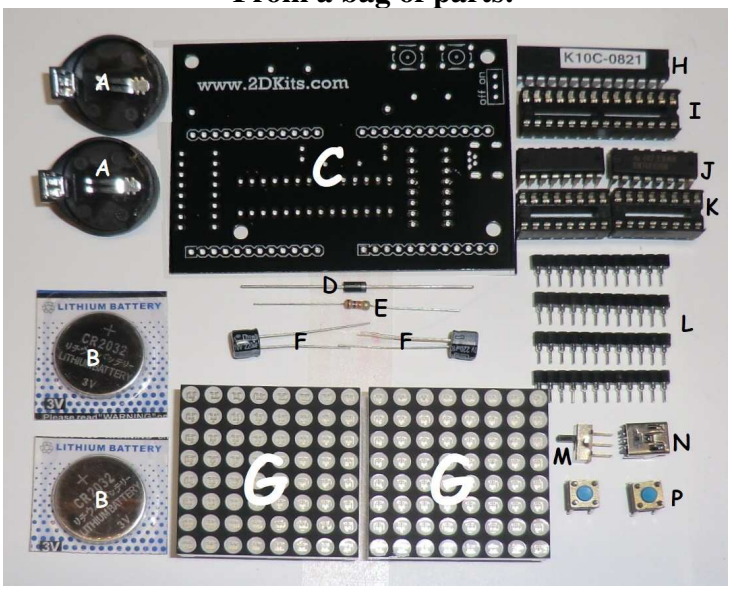
When done, please return these instructions for the next person to use. Thank you.

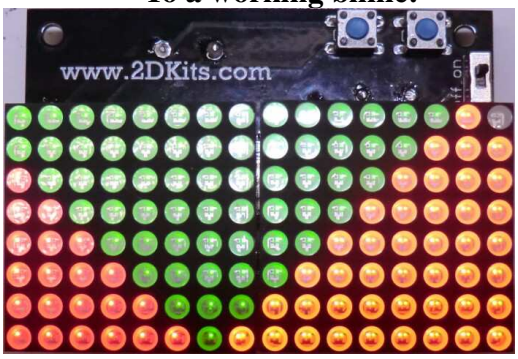
Kit 10C, 8x16 bi-color Matrix Blinkie G3

The heart of this blinkie is a 18F25K50 PIC produced by a company called Microchip. A PIC is a tiny, yet surprisingly powerful little computer.

From a bag of parts:



To a working blinie!



This blinkie has:

- 128 two-color (red/green) light emitting diodes (LEDs)
- 2 push-buttons for changing patterns
- USB power option
- 19 stored patterns / messages

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

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

A) Two CR2032 battery holders	I) 28 pin socket
B) Two CRCR2032 3V batteries	J) Two 74AC138 LED driver chips
C) 8x16 matrix circuit board, green or blue	K) Two 16 pin sockets
D) Diode – with a sliver stripe near one end	L) Four 12 pin single row socket.
E) 27K ohm resistor (**red**, **violet**, **orange**)	M) Power switch
F) Two 220 µF electrolytic capacitors	N) USB socket
G) Two 8x8 bi-color (red/green) LED matrices	O) [none]
H) 28 pin 18F25K50 PIC	P) Two push buttons

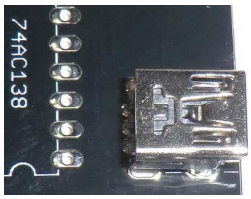
Got everything to start? If not, give us a shout. **Soldering Hints** are at the end of this document.

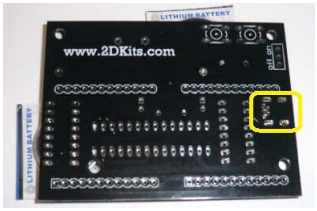
Assembly

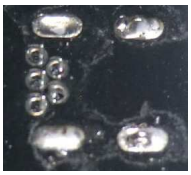
Important tip: All parts are inserted over their white outline printed on the circuit board.
When you are soldering on the other side, there will be no white outlines, just little silver printed circuit pads with the wires or pins coming through them.

1. Insert the USB socket as shown.

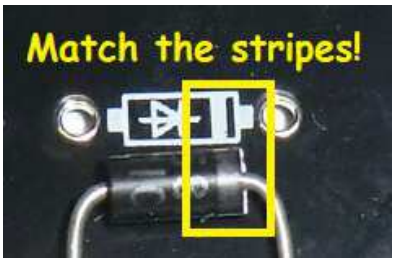
- Holding the USB socket, flip the board over, setting it on the 2 battery cards as shown in the right picture.
- This will keep the USB Socket flat against the circuit board.
- Solder ONLY the 4 large tabs on the USB, making sure the 5 little pins show up through the holes of the USB connector, as shown in the bottom picture. We'll solder the pins later.





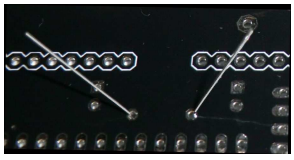


2. Insert the diode. To make inserting easier, bend the leads like this:



Orientation is important for diodes. There is a bar on the diode. Insert it so the bar is on the right, and matches the white printing – see picture. Flip to the back and form the leads into a "V".

3. Insert the resistor. Bend the leads like this:



Insert the resistor over its outline, about in the middle of the board.
Orientation does not matter.
Insert, then **"V" the leads** (Bottom photo)
Solder, and **trim** the **diode** and **resistor** leads. Don't let them "fly".

4. Insert the two push-buttons on the front top right as shown.
The leads are angled and will "snap" into place

5. Installing the switch

- Insert the switch as shown in the photo:

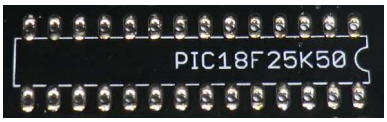
- Reach under the board and hold the switch's 3 pins and flip the board over on its back.

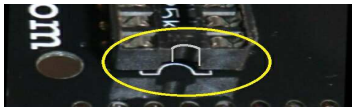
- Make sure the switch pins are vertical as shown in the picture. If not you can slide the board left and right a bit while it is resting on the switch handle – you can "feel" when the switch is square to the board.

- Solder ONE PIN of the switch using just a LITTLE BIT of solder.
- Look to see if the switch is straight – if not, you can re-melt the solder with the soldering iron tip, and straighten up the switch, pull the iron back, and hold a bit for solder to harden,
- Now solder the other two switch pins.
- Then solder the four push-buttons pins.

6. Installing the sockets:

- Flip to the front of the board.
- Locate the outline with PIC18F25K50 text in it.
- Notice the notch at the right (top picture)
- Insert the 28-pin socket, with the notch to the right. (bottom picture, although that's a rotated view to see it better)



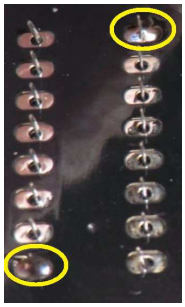


- With the notches facing up, insert each of the two 16-pin sockets over their outlines with text 74AC138 – one to the right of the PIC, one to the left.

- Hold the 2dkits.com business card over the sockets to help hold them in place, and flip the board over to its back and set it on the table for soldering.
- Then slide out the business card

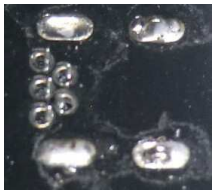
Keeping the sockets tight to the board while soldering is a bit tricky, so read carefully:

- You will first solder "opposite corners" of each of the 3 sockets, making sure the sockets are tight against the circuit board as the solder cools!
- Those corner pins will hold the socket so you can do the rest. (Picture)
- **HOW TO SOLDER THESE CORNER PINS:**
  - Heat the pin and the pad, then add solder.
  - While still pressing down with the iron, set the solder aside, and **hold the board against the socket for 2 seconds while it cools.**



- Repeat the "opposite corner pins" soldering for all 3 sockets.
- Now they will stay in place – so look on the other side to be sure they are tight against the board.
- Then **solder the remaining 54 socket pins**
- **Double check each solder connection carefully –** they will be covered by the displays!

7. Soldering the USB data and power pins



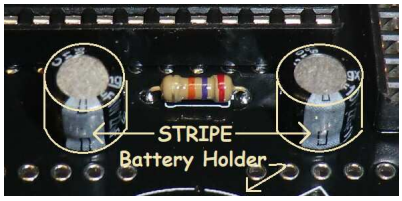
On the **back** of the board, under the USB connector, locate the 5 **tiny** USB data and power pins.

- Clean your soldering iron tip and make sure a little solder will stick to it
- If it doesn't clean it more,
- Then carefully solder the pins, making sure each pin is separate from the rest.
- **IF two are connected,** clean the iron tip, and draw the iron tip between the two you want to separate. Some solder will stick to the iron and clean it up.

8. Flip over to the back, and insert the two electrolytic capacitors at the round printed outline shown, on either side of the resistor.

Orientation is important:
Long lead, round pad. Short lead, square pad. You can double-check: the positive (long lead) will match up with the "+" printed marking.

- Please double-check the capacitors are installed correctly by checking the STRIPE on the side of each – they should be facing the battery holder outlines.
- Flip the board over, pull tight and "V" the leads, then **solder** the 4 leads.
  Trim the leads, catching them.

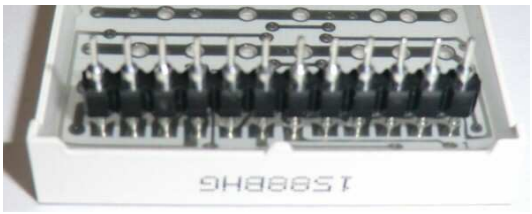


Double check where the **stripe** is

9. Installing the 12-pin sockets on the displays:

- Find the 4, 12-pin sockets, **L** on page 1 (top picture)
- Find the displays, **G** on page 1 (bottom picture, end-on)
- Prepare to plug the display pins into the sockets by making sure the pins are lined up, evenly spaced.
  If necessary, use the pliers to fix any pins that aren't lined up:
  - The pins must be evenly spaced – Note the 2 bent pins in the top picture.
  - Then look down the row of pins from the side – all must be lined up front to back – fix any out of line.

- Plug the display pins into the socket so it looks like the picture.
- Repeat so all 4 sockets are on the two displays.



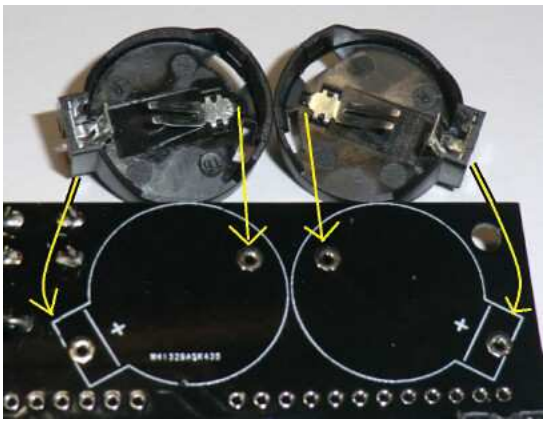
- Insert each display from the front of the board, over the white outline (top picture)
- The center bump goes on the board edge.

Holding the displays in, flip to the back.

- Solder pins 1 and 12 on each socket. Inspect the socket and make sure they are aligned and flush with the board. If they are not, gently press the center of each socket while reheating (and re-melting) the solder. You may feel the socket settling against the board.
- If all looks aligned and flush, solder the rest of the pins. Flip the board over to the front.

10. Soldering the battery holders:

- Line up the squared off end of the battery holder with the squared off outline on the circuit board, and insert them.
- Holding them in place, flip the board over so it sits on the battery holders.
- As with the sockets, you will have to solder the battery pins, then leaving the iron pushing down, set down the solder, hold the board down, remove the iron, let the solder cool for 3 seconds.



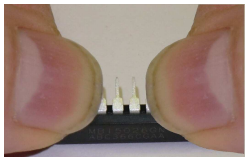
Congratulations – you have completed **140 pin-to-board solder connections**!

11. Verify the power switch is in the off position. Insert the batteries. The plus "+" faces up.

- Angle the battery down against the metal tab inside the squared off end of the holder, then snap down into the opposite black side.
- BE CAREFUL if "squeezing" - the pins are SHARP.

12. Installing the chips

- Look at all 3 chips – References **H** and **J** on page 1.
- Most chips come with the leads spread (left drawing), so place each chip on the table as shown (right drawing), and push down and away from you **a little** to make the leads straight up and down – like this: |__|
  - Then do this with the other side's leads.



- The 16-pin chips are inserted so the n**otch is facing up –** highlighted in yellow in the picture. These are the only components that are unforgiving if you insert them the wrong way. If they are incorrectly inserted, they will short out internally. You won't see any smoke, but they will be **dead**.

- The 28-pin chip is inserted so the **notch is facing right,** as shown.
  - **IGNORE which way the label faces, up/down.**
  - **IF YOU INSTALLED THE SOCKETS BACKWARDS,** just make sure the CHIPS are inserted to match the notch in the printing, not the sockets.

13. Flip the board over, and remove the protective film coating from the 8x8 matrices. Turn the power on and enjoy. This board can also be connected to a USB power supply **OR** to a USB cable connected to a USB port.

REMOVE THE BATTERIES BEFORE CONNECTING THE USB!!!!!!

Testing

When you turn on your blinkie, a test pattern is shown. Every LED in each color, will be shown.

- If there are any that don't light up, you have a bad or missing solder connection, or possibly two pins shorted together – bridged by solder.
- Check every connection you can see, fixing them, and trying the test again.
- If there are still missing LEDs, you will have to carefully unplug the displays and look **again** at all the solder connections for the 3 chips, correct any problems, and plug the displays back in.

Use

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

This blinkie has additional patterns and scrolling text stored in the PIC. To change patterns or messages, press a push button and hold. The display will show the pattern number, then will count up (or down). Each number represents a stored pattern or message. If the push button is released, the pattern associated with that particular number will then be displayed on your blinkie.

The blinkie has two display modes. **Demo**, where it will switch to a different stored pattern every minute, as it cycles through all the stored patterns. **Normal**, 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 both push buttons. The pattern number will start with "D" when in demo mode.

Advanced usage with a PC

A PC program available from 2dkits.com will allow you to replace the the test pattern, with your own message.

Troubleshooting

If the LED matrices 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. 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.
- LED matrices installed upside down.
- 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). Send us email, and we'll see what we can do. We have no problem selling just the parts you need to get it working.

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 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 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 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 a "Hershey's Kiss" shape.
- Let the connection cool without movement at room temperature. This usually takes only a few seconds.
- 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 – reheat 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.