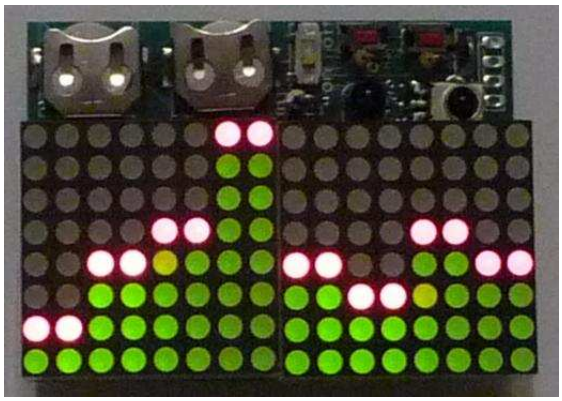
16x8 Matrix Blinkie



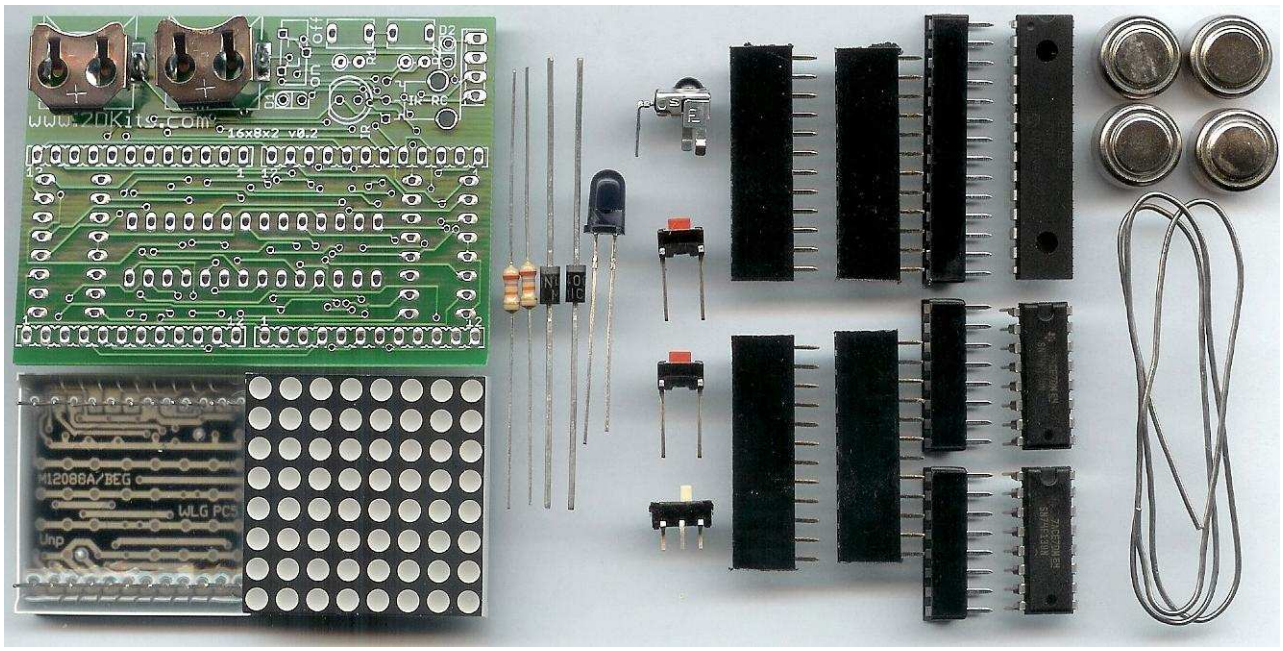
The heart of this blinkie is a 16F886 PIC produced by a company called Microchip. A PIC is a tiny, yet surprisingly powerful little computer. By itself, it can't do much – it needs someway to interact with the world – we are going to do this by giving it senses:

- Sight – an IR receiver
- Touch – push buttons

and ways to communicate:

- To us – 128 light emitting diodes (LEDs)
- To other blinkies – an infrared (IR) LED

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



Circuit board	IR LED	28 pin socket	Length of solder
8x8 LED matrix	IR receiver	Two 16 pin sockets	
8x8 LED matrix	Two push buttons	16F886 PIC	
Two 27K ohm resistors	Power switch	Two LED driver ICs	
Two diodes	Four header sockets	Four LR44 batteries	

The board itself will have the battery clips already soldered. Got everything to start? If not, give us a shout. Also, since we pre-solder the battery clips, sometimes the switch gets hidden under the battery clips. If you're building at a convention, the kit won't initially include batteries, chips, or solder. Get the solder at the work table, and the chip and batteries from the staff after you solder your board.

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 damp sponge or metal fiber pad. 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 the damp sponge or metal fiber pad, and re-tin if needed.

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 change where it might short out.

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

This blinkie will also broadcast its current pattern via the IR LED. If another blinkie with an IR detector sees this, it will change its pattern to match. Of course, this can also happen to this blinkie – another blinkie may "infect" its pattern on this one before it can do the same.

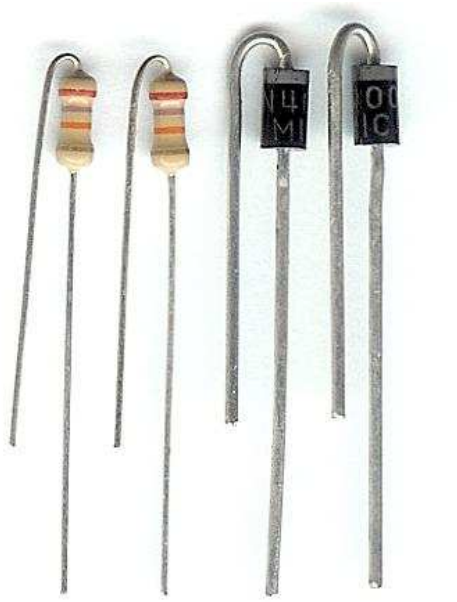
Assembly

You will notice this board has a lot of holes. There is a special type of hole, called a **via**. Very simply, it is a way to connect a trace from one side of the board to the other without the need of a jumper wire. Due to the complexity of the board, there are quite a few. Be careful when placing a part so one end does not accidentally end up in a via. Also be careful not to make a solder bridge to a via. Take your time and you shouldn't have any trouble.

If you accidentally drip solder into a via, as long as it isn't bridged to another pad, it's ok. You can leave it filled. Now, onto the assembly!

First, orient the board so the battery clips are at the upper left of the board. Since both sides are silk screened, it is the side that has the IR-RC labeled.

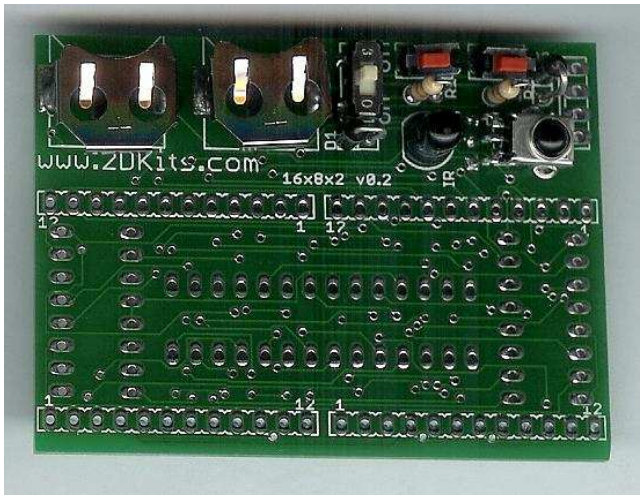
Due to limited space, the diodes and resistors need to be inserted on end.



1. Bend over the leg (lead) of both diodes and both resistors so they look like this picture.

2. **Orientation is important** for diodes. Insert the straight leg of the first diode into hole labeled D1. The white or grey band on the diode will be at the top. Insert the other leg into the hole to the right.

3. **Orientation is important** for diodes. Insert the straight leg of the second diode into hole labeled D2. The white or grey band on the diode will be at the top. Insert the other leg into the hole toward the bottom of the board.



4. Insert the power switch. It is located to the right of the battery clips.

5. Insert the two switches. They are located near the top of the board.

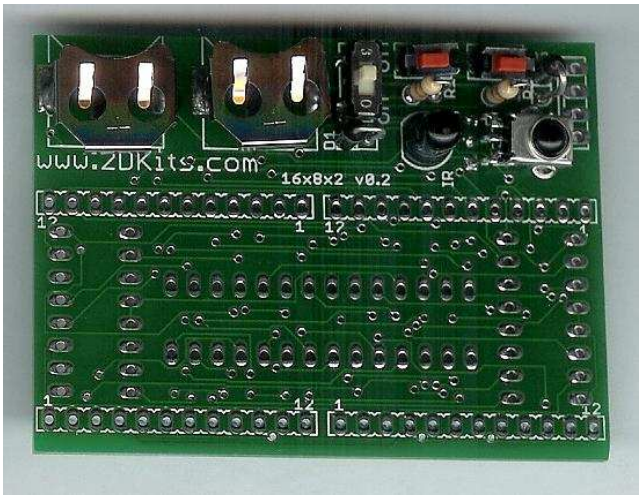
6. Insert the IR detector. On the board it is labeled IR-RC.

7. Insert the two 27K ohm (**red**, **purple**, **orange**) resistors. On the board they are labeled R1 and R2. Insert the other leg into the hole to the left. It doesn't matter which way they are inserted.

8. Once all the above parts have been soldered in, trim off the excess wire (leads).

9. Insert the IR LED into the board – on the board it is labeled IR. **Orientation is important** for LEDs. For some reason, both pads on the board are round, so we need to use another method to orient the LED. The short lead goes in the hole nearest to the battery clips. Also, if you take a very close look at the LED, one side is slightly flat. This flat side also matches the white printing on the board.

10. Once all the parts have been soldered, trim off the excess wire (leads).

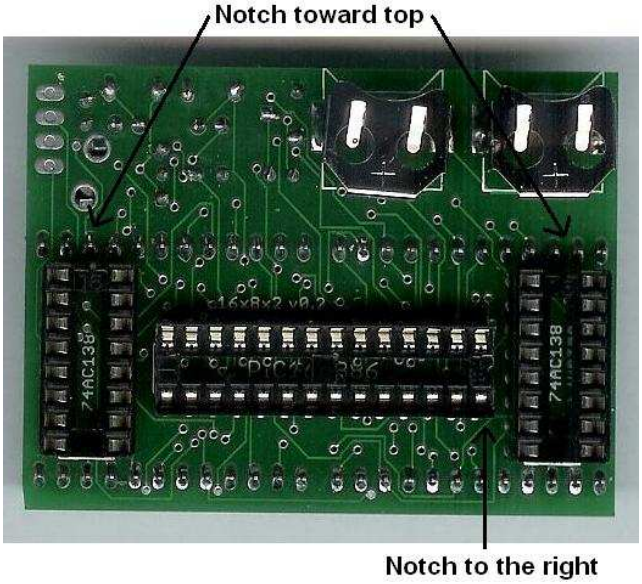


Flip the board over. Orient the board so the battery clips are at the upper right of the board.

11. Solder the 28 pin socket into the board. The socket has a small notch in it. The notch should face the right of the board. On the board it is labeled PIC16F886.

12. Solder a 16 pin socket onto the left-hand side of the board. The socket has a small notch in it. The notch should face the top of the board. On the board it is labeled 74AC138.

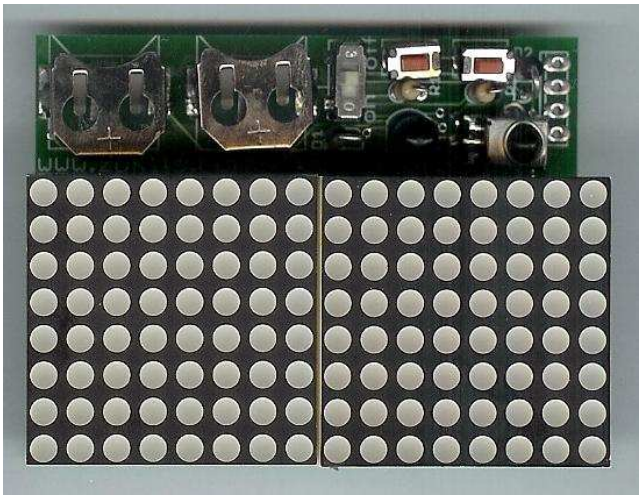
13. Solder a 16 pin socket onto the right-hand side of the board. The socket has a small notch in it. The notch should face the top of the board. On the board it is labeled 74AC138.



Flip the board over. Orient the board so the battery clips are at the upper left of the board.

14. Take the header sockets and slide two of them on each 8x8 LED matrix.

15. Insert each 8x8 LED matrix into the board. There is printing on one side of the 8x8 matrix. This must face the bottom edge of the board. Turn the board over and solder.



16. Before installing the LED driver ICs, PIC, and batteries, check all solder connections and make sure there are no solder bridges. If everything looks good, move onto the next step.

17. The LED driver ICs are inserted so the **dot or notch is facing up**. 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**.

18. The PIC chip is inserted so the **dot or notch is facing right**.

19. The batteries are inserted so **the "+" on the battery is facing up**.

20. Turn on the board! Enjoy.

Troubleshooting

If your 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.
- The 8x8 LED matrix reversed. Verify the printing faces the bottom of the board.
- 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. Let us know.
- A part was missing or wrong. Sorry about that, we sort and bag the parts by hand – no outsourcing here! Let us know.
- A part was lost/melted/damaged/destroyed while building the kit. It happens – you're not the first (or second, or fiftieth). Let us know.