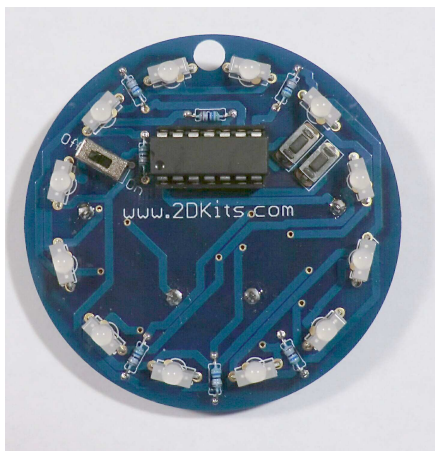


When done, please return these instructions for the next person to use. Thank you.

Kit 42 – 12 RGB Circle (Using LED Jigs)

The 12 RGB Circle is both one of the most beautiful blinkie kits, and also surprisingly straightforward to build considering its intermediate level parts count.

The heart of this blinkie is a 12F1824 PIC made by a company called Microchip. A PIC is a tiny, yet surprisingly powerful little computer.



By itself, the PIC can't do much – it needs some way to interact with the world – we are going to do this by giving it input and output:

- Input: two push buttons
- Output: 12 RGB (Red, Green, Blue) light emitting diodes (LEDs) – a total of 36!



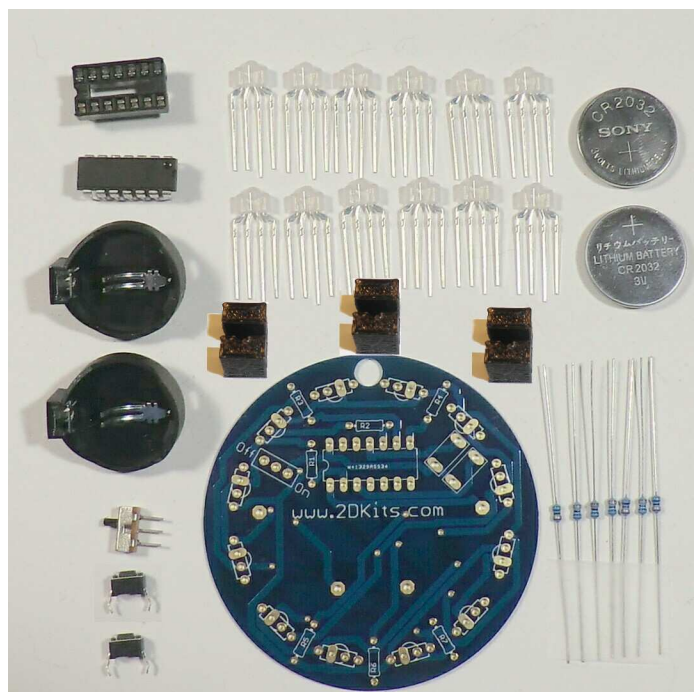
By building this blinkie, we hope you have a lot of fun, and learn how easy it is to assemble and solder a circuit, and gain a desire to learn more!

Let's Build-a-Blinkie!!!

First, open up the kit and review the contents.

Looking from top to bottom, and left to right there should be the following parts:

- 14 pin socket for the PIC
- 14 pin MicroChip 12F1824 PIC “computer”
- Two CR2032 battery holders
- Power switch
- Two push button switches
- Twelve RGB LEDs, each with 4 wires or “leads” (rhymes with “seeds”)
- Three plastic 3D printed “Jigs” to make LEDs easy to align
- RGB Circle printed circuit board
- Two CR2032 3 Volt batteries – If not with the kit, ask for them.
- Seven 56 ohm resistors (green, blue, black). Since they are all the same, “Don't worry about the colors”.



Got everything to start? If not, give us a shout.

Assembly

Any Questions? Contact us – dwayne@2dkits.com or drsulak@2dkits.com

TIP: There is an **outline** of the part (battery holder, switch, LED, resistor, etc.) showing from which side you push its leads through the board. You will be soldering on the **OTHER** side of the board.

The **front** of the board has the outlines for the 12 LEDs around the outer part of it, for the 14-pin PIC socket, the power switch, and the two push button switches. The **back** of the board has **ONLY** the outlines for the battery holders.

Orient the board front side up, with the lanyard hole at the top. You'll see the small resistor outlines – as highlighted in yellow in the picture below.

1. If your resistors are on tapes, snip the leads off the tape near the end as shown in the top-left inset picture.
2. Bend the leads as shown. Then insert one into each location, marked R1 through R7, highlighted in yellow in picture.
3. As each is inserted on the front side, make the 2 leads into a “V” on the back side to hold the resistor in place for soldering.

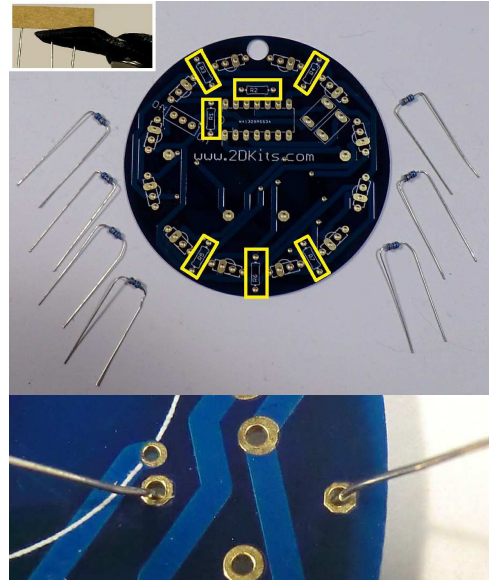
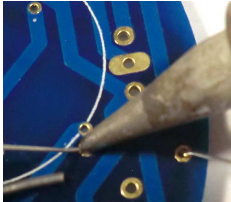
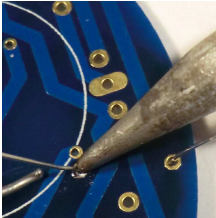
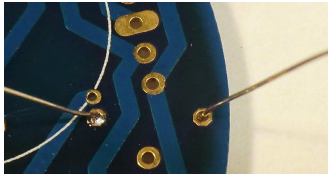


Photo of leads formed into a “V”:
Do NOT flatten to the board, just a “V”.

4. When all the resistors are inserted, flip the board over to the back and solder all the leads to the pads around the holes they come up through.
Be careful when soldering the left lead shown in the bottom picture – you don't want to have the solder flow into the tiny hole NEXT to the pad being soldered to. It connects a circuit from the top to the bottom, and is technically called a “via”.
5. After soldering, trim the leads, being sure to hold them so they don't fly off.

HOW TO SOLDER: (More tips on page 6 of this document)

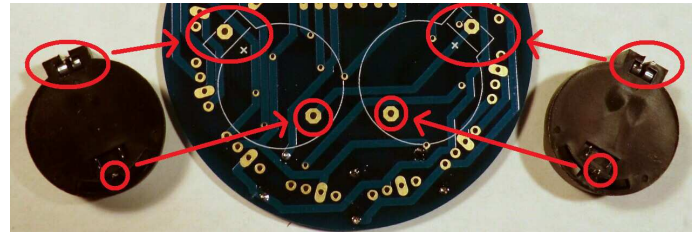
			
1. Heat pad and lead for about 2 seconds	2. Feed in a bit of solder	3. Remove the solder, keep heating until flows	4. Remove iron, let cool.

- Note in picture 4 above how little solder was used – just a small mound, covering the pad on the board, and coming up the lead just a tiny bit. Note **ESPECIALLY** how that prevents the solder overflowing into a nearby hole in the board, i.e. the one just above the left lead in picture 4.
- If a connection is moved before it cools, it will take on a dull, grainy 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.

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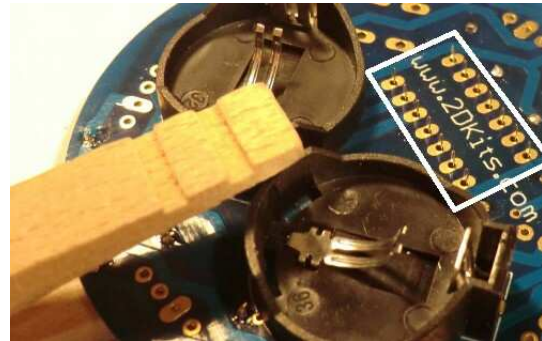
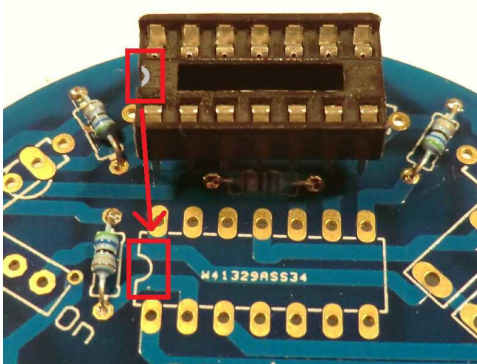
- Keep the tip of the soldering iron clean. Do the “plunge into stainless steel wool” cleaning now and then, especially when having not soldering for a while.

6. Flip the board to the back – where the battery holder outlines are, see photo at right:
7. Insert the battery holders, square end with square outline on the board .
8. Hold them in place and turn over to the front.
9. Solder the two pins on each battery holder,



10. With the board front-side up, notice the notch at the left end of the PIC Socket outline, then insert the 14-pin socket where the outline shows, lining up the notches as below.

Flip the board to its back, holding the socket in place. To make the socket level for soldering, slide the back of the clothespin in as shown.

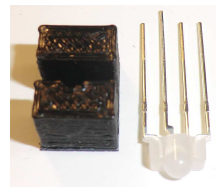


11. Solder just TWO pins of the socket – on opposite corners
 - Verify the socket is flat against the board, remelting a connection if you need to push it tight
 - Then solder the rest of the socket pins.

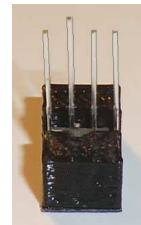
INSTALLING THE LEDs:

12. To make the LEDs easy to install, we've included 3 “jigs”: plastic holders for the LEDs while you solder. Put 3 LEDs in jigs:

- Notice the jig has a slot, and the LED will go in only one way, as shown:
- Push it all the way down, make sure the leads are straight up and down.

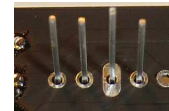
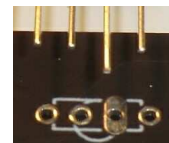


Jig and LED



LED in Jig

13. Insert the LED-in-JIG on the FRONT of the board, **long lead in larger oval pad.**
 - Skip 3 LEDs, put a 2nd LED-in-JIG there.
 - Repeat above. You should have 3 equally space LEDs in jigs.
 - Flip the board over and stand them on the jigs – The LED leads should look as shown in the bottom-right picture for soldering:



14. Solder **ONE** lead of one of the LEDs. If the board is not flat on the jig, melt that solder connection and press down on the board, then remove the iron and wait a few seconds for it to cool down. Double check the leads are perfectly vertical, and the jig is tight, and solder the remaining leads.
 - Repeat for the LED in the 2nd, then 3rd jig.

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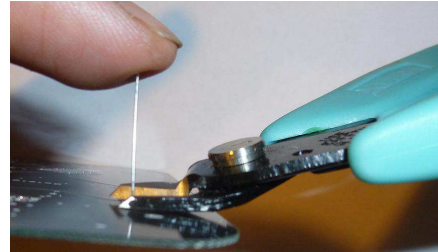
- 15.** Continue putting 3 LEDs in jigs, inserting them from the front, and flipping the board over and standing it on the jigs, and solder as in step 3.

- Repeat this until you have all twelve LEDs each with one pin soldered, and ensure they're nicely lined up.

Then solder all the LED leads.

TRIMMING THE LEADS:

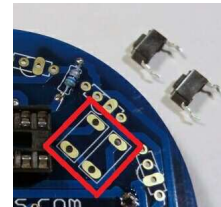
- When trimming the leads, be sure to catch them as shown in the picture to keep them from flying off



Installing the pushbuttons:

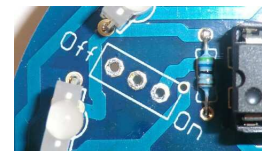
- 16.** From the front, as shown, insert the two push buttons. They will snap into the holes, top-right in the picture.

It is a tight fit, so some wiggling to get it to snap in properly may be necessary. They will stay in place.

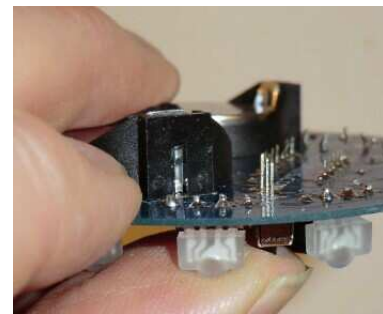


Installing the power switch:

- 17.** Insert the power switch in its three holes on the front:

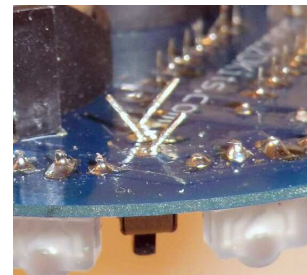


- 18.** Hold the switch in tightly with your thumb as shown, with your third finger under the board – on the same side as the switch – so you can hold it in one hand.



- 19.** Holding the switch tightly against the board, use your thumbnail or a pliers to bend the middle lead of the switch one way, the other two the other way, so the switch will stay in the board when you let go.

- 20.** Solder ONE switch lead, then make sure the switch is not crooked, remelting and moving if need be.



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21. Then solder the other two switch pins.

22. Verify the power switch is off, then insert the two batteries.

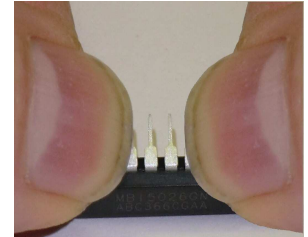
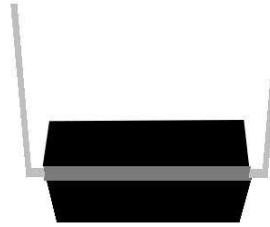
- “+” side up
- Angle each battery down and in against the metal tab at the square end.
- Then push the battery in and down from the side opposite the square end. Squeeze hard!



Inserting the PIC chip

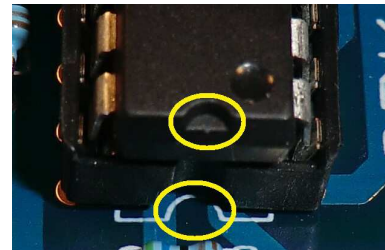
23. The PIC may come with the leads spread -- not parallel – (left drawing), making it hard to plug in. Fix this by placing the chip on the table as shown (right drawing), and push down and away from you **a little** to make the leads perpendicular.

- Then do this with the other side's leads.



24. The PIC chip is inserted so the **notch** on the end **lines up with the outline notch on the circuit board**.

- If you put the SOCKET in backwards, you are OK! Just make sure the PIC chip notch lines up with the outline notch on the board.
- If you can't SEE the notch on the PIC chip, you can feel it with a fingernail.



25. Turn the power on and enjoy.

Using your blinkie:

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

As of this writing, this blinkie has 16 patterns stored in the PIC.

To change patterns, press and hold a push button for more than one second. One button counts to a higher numbered pattern, the other to a lower numbered pattern. The pattern number is shown in binary using the top right LED as 1, and the next one to the right as 2, on through 4, 8, and 16. So first and third LEDs on = $1 + (not\ 2) + 4 =$ pattern 5.

Some Blinkie Pattern Examples:

- Pattern 6 is a “police colors” sort of pattern – repeating circling red followed by circling blue.
- Patterns 2-4 and several others are multi-colored sweeping fades. I call them “Chroma Therapy”

The blinkie has two display modes, demo and normal:

- Demo mode, where it will automatically switch to the next stored pattern now and then. When it hits the highest pattern, it will start again with the first.

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- Normal mode, where will continue to display the current pattern until a new pattern is selected via the push buttons.
- Changing modes: Hold both buttons down while it is powered on, to switch into and out of demo mode. If it is in demo mode, a blue LED will be lit when one or both push buttons are held down.
 - Release the button with the blue light on to go into demo mode.
 - Release the button with the blue light off to go into normal mode.

Soldering Hints

Soldering is not like gluing. The parts being soldered, such as an LED's wire or lead (rhymes with “seed”) and the circuit board's metallic pad, must get hot enough for the solder to melt and **wet** them. It creates an electrical and mechanical connection. The solder has a core of rosin or flux to help “wet” the connection when soldering. The rosin is what “smokes” when you melt the solder. Try not to inhale this smoke.

Here's how to make a good solder connection between the hole in the board with it's electrical circuit pad, and the lead or pin sticking through it:

- Preparing the soldering iron:
 - Clean the tip by plunging it into the jar of stainless steel wool several times, or wiping on a damp sponge or thickly folded wet paper towel.
 - Check that the tip is clean and up to temperature by melting a little solder (a 2mm length) onto the tip. This is called “tinning” the iron, and will make soldering much easier.
 - If the solder doesn't melt, the iron may not be up to temperature – about 300°C.
 - If the solder doesn't stick, repeat the cleaning process. If it **STILL** doesn't, contact a blinkie tech for some soldering iron tip cleaner – sort of a “detergent” for the tip.

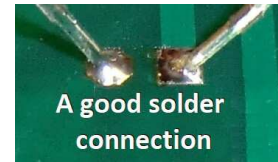
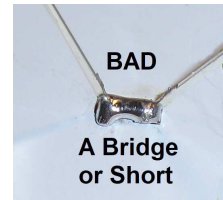
Troubleshooting

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.

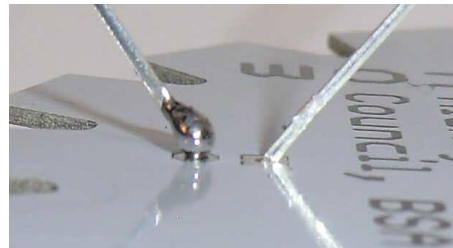
If your LEDs blinked in testing, but not after soldering, you may have a solder bridge, as shown in the picture. Power flows through the **bridge**, instead of the LED. (Turn the power switch off!!!)

A bridge is easy to fix. You can often just remelt it and pull the tip of the soldering iron through the bridge, breaking it, then shake any captured solder off the iron. Or, remelt all the solder and tap the edge of the board on the table to shake off the excess while it is still melted. ...Or ask for help.

A **good** solder connection is shown for comparison.



- A **common soldering problem** is to have solder on the lead but NOT connecting it to the pad. Notice the pad UNDER the solder in the picture:
- Remelt the connection, being sure to press DOWN on the pad with the soldering iron tip and wait for the solder to “puddle” around the pad and lead.



- 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 that every connection is **soldered!** We occasionally see missed pins on a socket, etc.
- Check for bits of solder, lead 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 thousands of kits built, we’ve seen only a handful of 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.

Instructions by Ward Christensen, WardC@2dkits.com
Feedback encouraged.