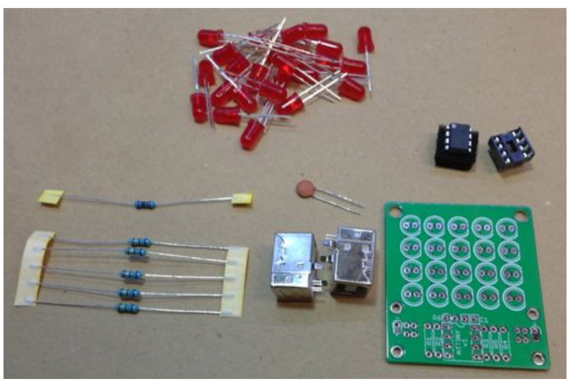
Tiny Life Build Instructions

PARTS LIST:

Quantity	Name	Location	Description
1	Circuit Board	-	
20	5mm Diffused LEDs	-	
5	68 Ω resistors	R1-R5	blue - gray - black - silver - brown
1	10k Ω resistor	R6	brown - black - black - red - brown
1	100 nF capacitor	C1	Labeled “104”
1	8 pin socket	ATTINY	
1	ATtiny85	ATTINY	ATTINY85-20PU
2	USB B Female	-	

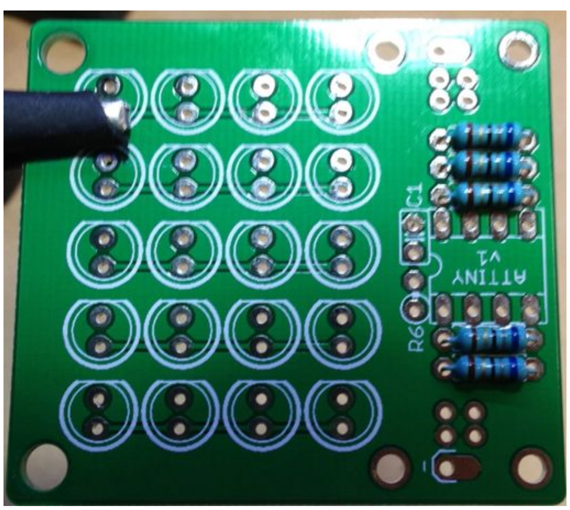
BUILD INSTRUCTIONS:

Please familiarize yourself with all of the instructions before you begin as there are some helpful hints scattered throughout the project that help with later steps.



1. The contents of the kit - 20 LEDs, the ATtiny microcontroller and socket, a solitary 10k Ω resistor and five 68 Ω resistors, the tan capacitor above two USB B Female sockets and the circuit board.

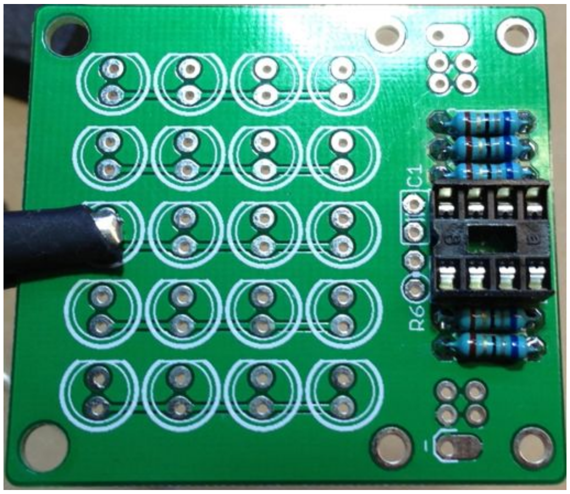
There might be slight cosmetic differences to the board between production runs, but the part locations should stay consistent. The general philosophy of what order the parts are installed generally goes from shortest to tallest. Since the resistors are the shorted items in the kit, let’s start with them!



2. First insert all five 68 Ω resistors in positions R1 through R5 as shown. Flip the circuit board over and solder them and clip the excess leads once they’re soldered. Resistors don’t have any polarity, so you can insert them in either direction. You can solder them one by one if you’re more comfortable soldering them that way.

The 68 Ω resistors look like this:

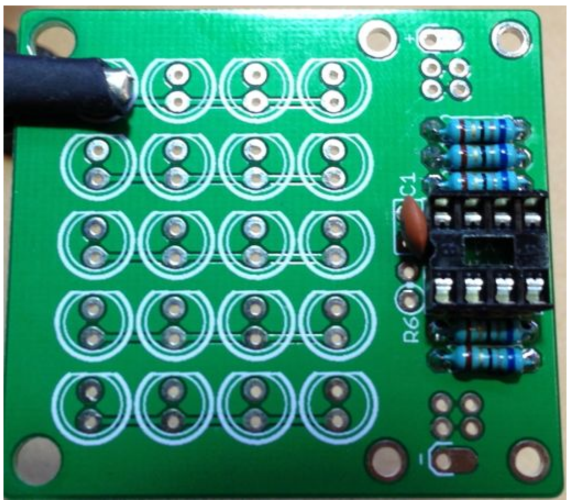
These resistors act as current limiters for the LEDs. If you swap them for ones with smaller values, the first thing that tends to happen is the microcontroller goes into a constant state of reset and nothing happens or the system flickers and restarts continually. If you let it happen for long enough, you could also burn out the microcontroller or possibly damage an LED. This is voltage sensitive: If you intend on using this from a 3v source, you can get away with smaller resistors - 27 Ω is comfortable for 3v for example. 68 Ω is plenty for a USB source and what is included in the kit.



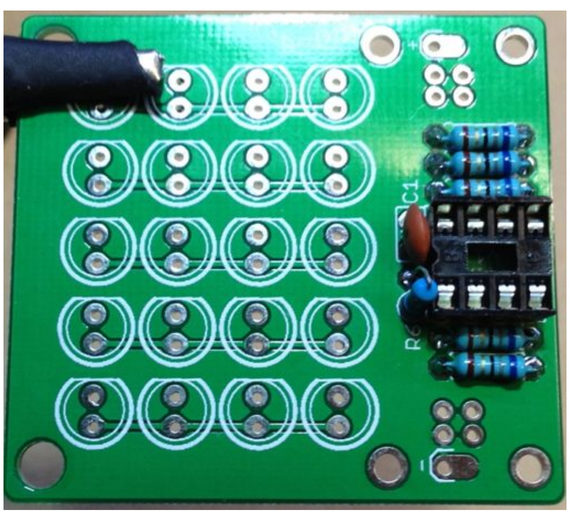
3. Insert the 8 pin socket in the spot labeled ATTINY. Make sure the little cutout in the socket matches the cutout on the silkscreen

Helpful hint: While it isn't strictly necessary, I find that it helps to fold over the socket legs on the other side of the board.

Solder the socket in place. Since the leads are so short, you usually don't need to trim them, and if you fold them over you definitely won't be able to.



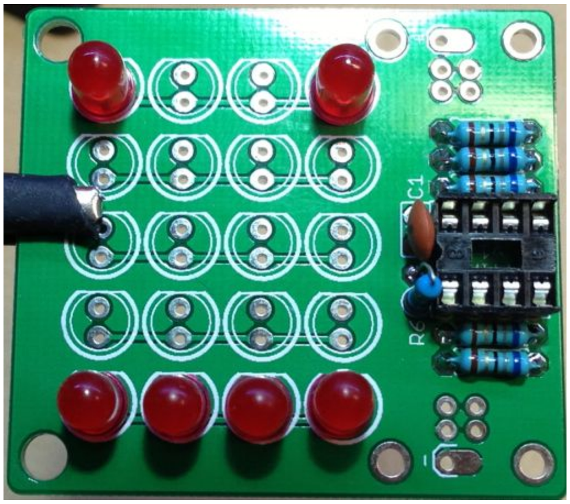
4. Insert the 100 nF capacitor marked "104" in the holes on the opposite side of the socket.   Solder it into place and clip the leads. Ceramic capacitors like this aren't polarized, so it doesn't matter which lead goes into which hole. This capacitor acts as a noise filter from the high frequency noise that the circuit can generate. Each LED will get turned on and off at a high rate, and every time the LED is turned on and off, the current draw from the power source is affected - this capacitor acts as a buffer for those changes.



5. Insert the remaining 10k Ω resistor in the spot marked R6. You'll have to fold the resistor in half like so to get it into the holes.

Once you have it in place, solder it and clip the leads again. It doesn't matter if you fit the resistor body up against the circle on the silkscreen, that's merely an aesthetic choice.

This resistor acts as a pull-up for the reset pin and helps prevent electrical noise from generating an unintended reset.

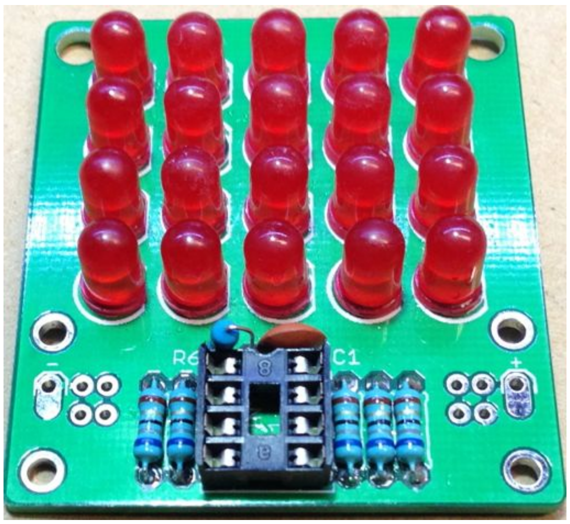


6. Now you will need to insert and solder the LEDs. The LEDs are polarized, which means that it's important you get the right legs into the right holes. There are two things to help you get the LEDs lined up properly:

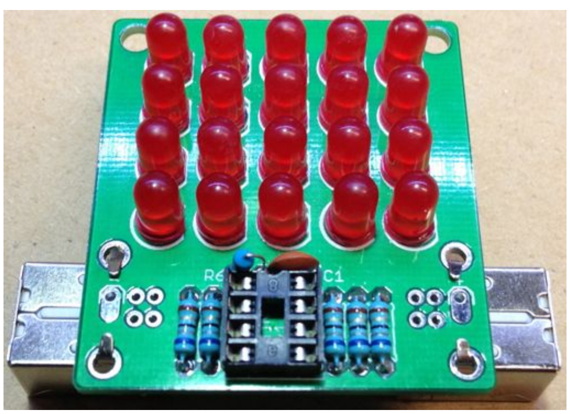
1) Each LED has a flattened face on the shoulder at the base of the LED. Make sure the flat side lines up with the silkscreen on the board.

2) Each LED also has one lead longer than the other. The long lead should go in the side opposite from the flat face.

Start from either end. I usually put outrigger LEDs in the opposite corner to assist making sure everything is level when I start to solder them. Solder one leg of the LED and then inspect the LED alignment from the other side and make any necessary adjustments so the rows and columns are as straight as you can get them.

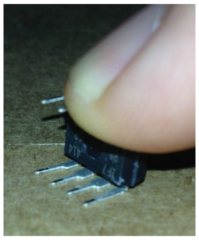


Once you're done soldering all 20 LEDs in place, the board should look something like this. It's possible to get the LEDs aligned pretty well by adjusting them while only one leg is soldered.



7. By this time you should only have 3 parts left: The USB jacks and the microcontroller. Set the microcontroller aside and insert the USB jacks as shown. Bend over the legs in the large holes so they're tight to the board on the front and solder the jacks in place. Make sure to use plenty of solder on the four big holes because those connections are structural. Be careful to not short out any of the pins on the USB jack. You can check for continuity between the big silver pad marked "-" on the left and the big silver pad marked "+" on the right hand side: If there's any continuity between those two points, look carefully at the board and try to spot the electrical short.

8. Now you should insert the ATtiny85 microcontroller in the socket. I've put a little silver paint dot indicating which pin is pin 1 on the microcontroller. This should be on the same side as the cutout in the socket. If you inserted the socket backwards, don't worry, just make sure that the microcontroller is oriented correctly compared to the markings on the board.



When you receive the microcontroller, its legs will be splayed a bit. In order to get the chip in the socket, you will need to bend the legs in so they are parallel. With 8 pin chips such as the ATtiny85, you can usually just gently squeeze them between your fingers, but if you aren't comfortable doing that, you can also use your bench top to flatten them like pictured to the left.

Just be gentle and don't crush the chip - it doesn't take a lot of force to bend the legs.

9. At this point, the board is done. If you want to power it from a USB cable, you should be able to connect it to a USB power supply and it should start to play Conway's Game of Life. Note: I don't recommend and can't take responsibility for plugging it in to a computer's USB jack because the data lines are floating, and any short between Vcc and GND will be powered by the computer, possibly damaging it.

Helpful hint:
There's enough space between the USB jacks for a taped-up stack of pennies, which will help keep the board from flipping over if you use the USB jacks as stands. Otherwise there are a couple of mounting holes at the top that you can use to mount it to an alternate surface.

TROUBLESHOOTING:

The display will flash all on before starting a new game of Life. If any of the LEDs fail to light, make sure you inserted them correctly. If not, use one of the spare LEDs to replace it. Most problems with charlieplex boards will eventually result from either a short across the LED legs or an improperly polarized LEDs.

SOURCE CODE:

The software repository for this project is at https://github.com/pfriedel/TinyLife

Any questions? Mail me - pfriedel@compulsive.net.