

South Berkeley Electronics -- Hanukiah Kit Instructions

Thank you for ordering a “kit” version of our Hanukkah menorah! I hope you enjoy assembling it.

This is a simple kit and for the most part, it should be obvious where parts go. **However, please read these instructions first before proceeding!**

Of course, if you have any issues at all, please contact me at dave@southberkeleyelectronics.com

Sequence

- You can assemble the parts in any order you find convenient **EXCEPT do the battery holder last.**

Partial Pre-assembly

- You’ll notice that a few parts are already on the board. Unfortunately, I have to attach a few components in order to program the microcontroller and verify that it is working. I do not mean to deprive you of the opportunity to solder those parts!

Removing the panelization frame

- Odd-shaped circuit boards are usually made inside a regular-shaped panel. This makes it easier to handle the board during manufacture and assembly.
- The menorah may arrive with the frame it was manufactured in still attached. The pieces are designed to snap off at the “mouse bite” (series of very small holes) connections, much like the pieces of a model airplane. I recommend you leave the pieces attached until you’re almost done, as the rectangular shape is easier to handle than the menorah shape.
- When you are ready to detach, carefully bend the pieces so that they snap at the mouse bites. After separation, the mouse bites may be a bit rough. I usually smooth these down with a file, or use a pocket knife to scrape them flat.

Attaching the shift register chips

- These are the two chips in 16-pin packages
- In general, for multi-pin devices like the buttons or chips, it is easiest to put some solder on a corner pad of the footprint on the board, then use tweezers to position the part while you keep the solder on that pad molten. Then solder the opposite corner pin, and then do the rest.
- For the 74HC595 chips, you’ll notice they have a beveled edge. On the board, you’ll notice a notch in footprint picture. When chips have a bevel but do not have a notch, the bevel goes to

the left of the notch end. So, in this case, the bevel should face "up" towards the candles. The text on the chip will be upside down when the menorah is upright.

Capacitors and Resistors

- Orientation does not matter
- If the capacitors have not already been soldered onto the board, the baggie will contain two kinds of capacitors, a 100n and 1u. The 100n is a little smaller and usually a slightly different color than the 1u, otherwise they are hard to tell apart. You want one of each next to each chip. Normally, the 100n goes closer to the chip.
- In the baggy with the LEDs, I also included 220 ohm resistors. They should be on a tape. There may be a mix of 5% and 1% tolerance resistors. They will be marked 221 or 2200. Either is fine and they can be mixed. These are the only resistors in the kit, so they are all essentially the same. If this is the Model I menorah, these will be "0805" size resistors, same basic size as the LEDs. However, on the Model II, they are slightly smally "0603" resistors.

LEDs

- **Orientation is critical.** They must be right-side up and have their cathodes and anodes oriented properly.
- Soldering the LEDs can be tricky. The lines on the silkscreen for the LED designators represent the cathode (negative) of the diode. The cathode is marked on the diode, too, often on the bottom. The marking on my diodes is a "T" shape and the vertical line of the "T" points to the cathode. Some diodes have the cathode mark on the top, some green dots on the cathode side. When in doubt test with a multimeter in diode mode!

Buttons

- Nothing special here. It should be obvious which way they go from the footprint. Like a chip, do one pin first, the opposite corner, then the two remaining.

Programming Header (optional)

- Optional. Only necessary if you plan to reprogram the menorah. This is a 2x3 pin header.

Battery Holder

- Attach the battery holder last. **It goes on the rear of the board.**
- The battery holder is also what helps the board stand on its own. Because of this, it's worth taking the time to position it very carefully so that its bottom is square with the bottom of the menorah.
- It may require a bit more heat from your iron, particularly on the negative pin, which is attached to a ground flood on the board. Before soldering the battery holder you may want to **first affix it in place with a dab of hot-melt glue**, so that it will stay close to the board. If you have

double-stick tape, that also works nicely. (check if already present!) If you do not use any glue or tape, the leads will be the only thing holding the battery case in place, and it may not lay flat.

Reference Photos:

Model I:

<https://photos.app.goo.gl/udeTEgBtj12eUKSqZ>

Model II:

<https://photos.app.goo.gl/JmQ5XB8DBqqKe3CD7>

SMT Soldering Tips

There are plenty of tutorials for SMT soldering on Youtube and around the Internet, so I encourage you to explore those if you are just getting started with SMT.

Here are a few quick tips:

You do not need to deal with solder paste, reflow ovens, hot plates, or anything like that to assemble this kit. By the standards of SMT, all the parts here are “pretty big.” :-)

I strongly recommend you have the following items on hand:

- Good, sharp tweezers (a must)
- A quality (temperature-controlled) iron with a reasonably small chisel tip (1-2mm)
- Fine solder. Use leaded, it's just easier in every way than lead-free
- Flux. Use whatever kind you like best. I like a basic rosin flux
- Desoldering braid. This is for the inevitable mistakes. (Remember that desoldering braid works a lot better with a drop of flux on it!)

The technique I use for parts of this size is to:

1. Put some solder onto one pin of the pad on the PCB
2. Use tweezers to slide the part into place while still using the iron to keep the solder wet
3. Remove the heat

At this point, you'll have a chip with one pin soldered, or a passive component with one end soldered. Now go back and do the opposite end/corner. For a many-pin chip, after you have both opposite corners done, just go and solder the rest.

If you bridge two pins of a chip, use the solder braid to remove excess solder. Again, plenty of flux helps a lot.

If you have soldered a multi-pin part incorrectly, for example, backwards, it is very difficult to remove with a soldering iron alone. If it is just a two-pin device like an LED or resistor, you can put a huge blob of solder on the part, then get it all molten and just slide the part away from the pads. Then clean up the pads and start over. (For this kit you should have a few extra resistors and diodes.) But for a chip with many pins, your best bet is to use hot air if you have it. If you don't, you can try to get solder up using braid, but it is difficult to completely free part this way, and very easy to damage pads trying. Take your time.