

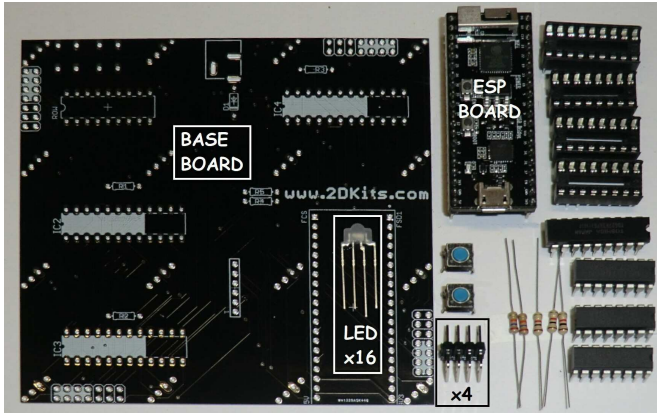
When done, please return these instructions for the next person to use. Thank you.

Kit 13B - 4 x 4 x 4 RGB Cube Blinkie Instructions

These instructions will guide you in building your cube blinkie.

As an advanced kit we're going to assume you are an experienced solderer and blinkie builder, and not bore you with lots of details.

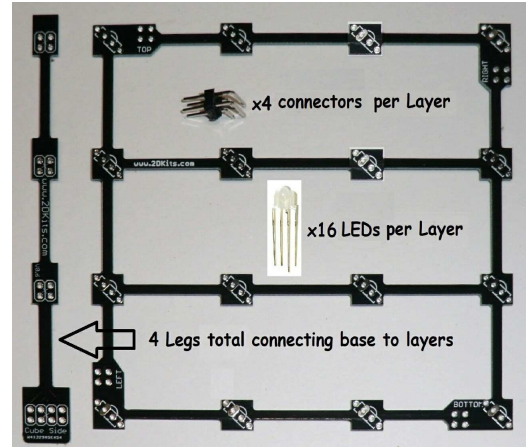
Inventory for the Cube Base



Not Shown: Micro USB cable

- 1 base circuit board
- 1 USB+WiFi Board ("ESP" in top center of photo)
- 64 LEDs: 16 on the base, 16 on each layer above
- 2 pushbuttons
- 3 16-pin sockets + 3 16-pin RGB driver chips
- 1 18-pin socket + 1 18-pin driver chip

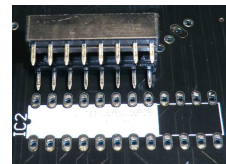
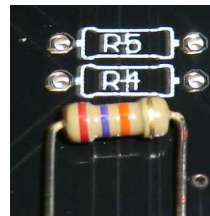
Inventory for the 3 upper layers



- 3 1K ohm resistors (brown black red)
- 2 27K ohm resistors (red violet orange)
- 3 "Waffle" or "upper Layer" circuit boards
- 12 4-pin connectors for the Waffle Boards
- 4 8-pin connectors for the base circuit board
- 4 legs to go from base to upper 3 layers

NOTE: Parts are always inserted from the side of the board that has the white outline. Examples:

- Resistor next to its white outline
- Socket next to white outline – **and** – for the CUBE, it goes over the white rectangle.
 - The TOWER chip has more pins
- LED and its outline on the board



Base Circuit Board Assembly:

1. Installing the Resistors:

- Find the 2, 27K resistors that are banded red, violet, orange
Insert them over their outlines near the center of the board, marked R4 and R5
- Find the 3, 1K resistors that are banded brown, black red
Insert them over their outlines, marked R1, R2 and R3, each next to one of the 24-pin sockets
- You can spread the resistor leads a bit on the back to keep them from falling out.
- Solder and trim, catching the trimmings.

2. Installing the Sockets: (3, 16-pin, 1, 18 pin) (See photo 4. at the bottom of page 4)

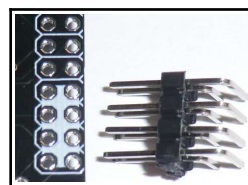
- Line up each socket's end notch with the notch printed on the circuit board, and insert it
- **NOTE the 3 16-pin sockets are short – insert over the "white" rectangle.** See picture
- As you insert each one, you can bend opposite corner pins on the other side enough to hold the socket in place
- After all four are inserted, set the board on the sockets and solder all the pins.

3. Installing the LEDS:

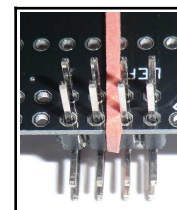
- Everything you have installed so far is on the **bottom** of the base circuit board.
- The LEDS will all be installed on the **top**.
- Method 1, used if you do **not** have the little plastic LED “jigs”
 - Insert all 16 base board LEDS. They go over their outline.
 - The **long** lead goes in the solder pad that is **the biggest one** – a flattened oval
 - **Double check** that the bulge on the side of the LED matches the bulge printed on the board.
 - To keep the LEDS from falling out before soldering, place a **waffle board** on top of all the LEDS, and use two rubber bands to hold them together.
 - For **each** LED, move the leads to be vertical, then solder **one** pin
 - When you have finished soldering **one** pin, if any leads aren't lined up, re-melt the solder and position the LED's leads to be vertical.
 - Then solder the remaining LED leads
 - Then trim all the LED leads, being careful to catch them so they don't fly off
- Method 2:, used if you **DO** have the little plastic LED “jigs”
 - Insert 4 LEDS into 4 jigs. Make sure the leads are vertical. Push them in tightly.
 - Insert one LED+jig over its white outline, in **any corner** of the base board.
 - Then insert another LED+jig two away along one edge, I.E. one open LED position
 - Repeat above along the other edge.
 - Insert the 4th LED+jig so as to make a square. Every LED is two away from the others
 - Flip the board over, setting it on the jigs as “legs”.
 - Make sure each LED's leads are vertical, and solder **one** lead per LED
 - If any is a bit crooked, re-melt the solder and straighten it.
 - -or- if any LED is not pretty tight against the base board, re-melt and fix it too.
 - Now solder all the rest of the four LEDS leads
 - Remove the jigs, and trim the LEDS leads, being sure to catch them. Make a pile for easy cleanup.
 - Repeat all the above Method 2 steps, for the next 4 LEDS. By always doing a 2x2 square of LEDS, you will be able to stand the base on the jigs to solder.
 - Do this twice more, and all LEDS will be installed in the base board.

4. Installing the Connectors: (4, 14-pin)

- The connectors are the right-angle pins held together by a plastic block.
- The straight pins are inserted over the white outline, the bent pins sticking out from the base circuit board.
- Hold the connector in place with a rubber band as shown, repeat for each of the other 3 connectors



Bottom view



Top View

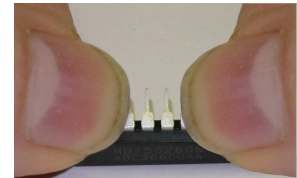
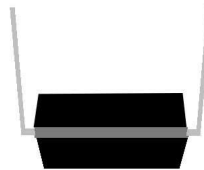
- Flip the circuit board over so it sits on the bent pins of the connectors: above right picture.
- **TIP:** The plastic block is easily softened, moving the pins out of place, so try not to hold the iron on any pin more than two seconds. *(See photo (1.) of problem on the bottom of page 4)*
- On **each** connector, make sure the pins are **vertical**, not **bent**, and solder **one** pin. Another way to check is that the right-angle pins under the board, are **horizontal**.
 - Having soldered just one pin, check that the plastic block is tight against the circuit board on the other side. If necessary, re-melt the solder on the pin to straighten it out.
- Solder the rest of the pins, and to avoid possibly melting the plastic, do not solder adjacent pins.

5. Installing the ESP board: (See photo (2.) at the bottom of page 4)

- Insert the ESP board over its white outline as follows:
 - **The USB connector must be even with the edge of the base circuit board**
 - There are 3 per side, 6 total, pins toward the middle of the board that will be left open
 - Double check: The 6 pins nearest “www.2dkits.com” are open in ESP and on base board.
 - Flip the board to the back and solder **one** of the corner pins.
 - If the ESP board is not tight against the other side of the base board, re-melt the solder while pushing it tighter to the bottom of the board.
 - Now solder the **one** opposite corner pin, and repeat checking that the board is tight.
 - Now solder all the rest of the ESP pins

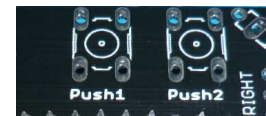
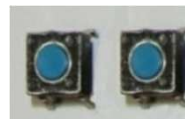
6. Installing the chips:

- The chips come with the leads spread a bit as in the left diagram. This makes them a bit hard to insert in the sockets.
- Place a chip on its side, and roll it a bit toward the pins to make them perpendicular.
- Repeat for the other side, then for all chips
- Insert each chip in its socket, **making sure to line up the notch in the end of the chip with the notch printed on the circuit board.** The sockets should also match, but a backwards installed socket will not matter as long as you match the notch printed on the circuit board when you insert the chip!



7. Installing the pushbuttons

- Insert the 2 pushbuttons over their outlines, they will snap in.
- Flip to bottom and solder the 8 pins.

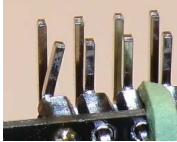


CONGRATULATIONS, you have finished the base – and can **test it!!!**

8. Testing your base circuit board:

- Check for any MISSED solder connections. (See photo (5.) at the top of the next page)
 - If you haven't done so, check all your solder connections. You can hold the board at an angle and reflect light off the little “mound” or “Hershey's Kiss” of solder on each lead or pin.
 - A further test is to hold the board so the light reflects off the board itself – and look for any silver solder pads that aren't covered. (See photo (3.) at the top of the next page)
 - Check also that all four 14-pin connectors' pins are evenly spaced – they line up, like : : : : : :
 - If any are not in line, use a needle nose pliers to bend the out of place pin back in place. (See photo (1.) at the top of next page)
 - Plug your base board into USB power – or PC or laptop – using the supplied cable
 - There is no power switch, so the board should begin showing a test pattern.
 - After an initial red flash, the 16 LEDs should light up all green, then go dark (as it tries to light the additional 7 layers that aren't installed) then all red, and finally all blue.
 - The base board **must be working before continuing**, because it is hard to check and fix soldering problems after other boards are stacked on top via the legs!
- Problems? See **Troubleshooting** further on in these instructions.

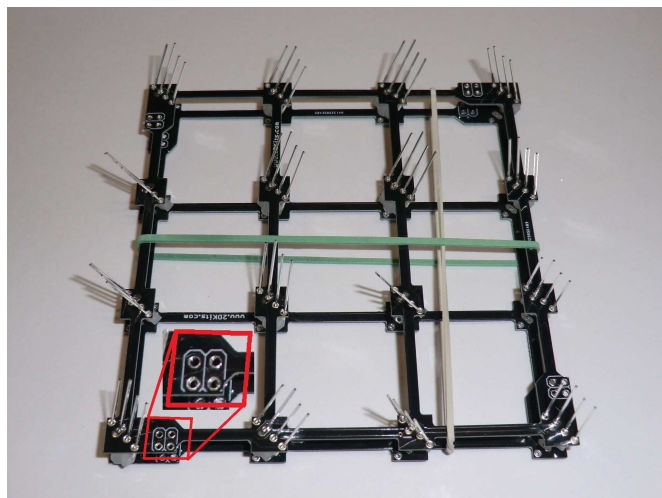
Collection of images

1. Overheated Pin:	2. ESP open pins	3. Pin: Good solder	4. Socket Notch...	5. Check for...
 This needs to be straightened!	 Above is CORRECT	 “Hershey's Kiss”	 ...matches the white outline notch	 ...missed soldering, and fix them.

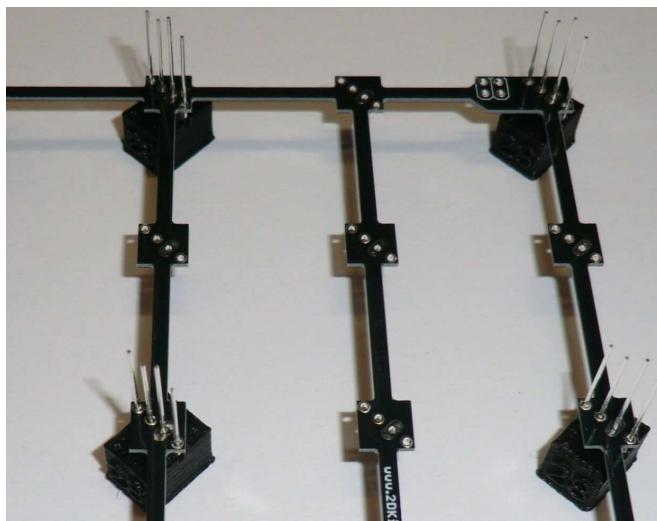
Assembly of each of 3 upper layers (“Waffle Boards”) of the cube:

9. Insert, solder, and trim 16 LEDs in the waffle board, **repeating the steps above on pages 2 and 3** labeled “Method 1” (no jigs) or “Method 2” (using jigs)

Method 1: Using a waffle board to hold the LEDs

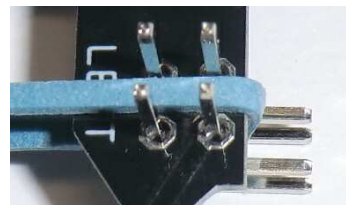
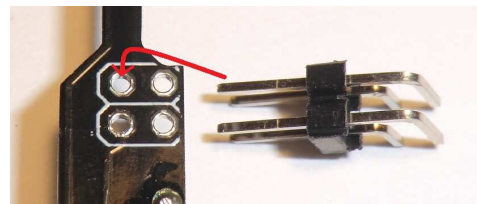


Method 2: 4 JIGS at a time to hold 4 LEDs



10. Install the 4-pin connectors:

- Locate four of the 4-pin angle connectors.
- With the LED side facing down, insert the STRAIGHT pins of the connectors over their white outline, (see above left picture) with the bent pins facing away from the Waffle board as shown on the **top picture** to the right:
- Hold the connector in place with a rubber band – **bottom picture.**
- **Important tip** (again) The plastic block is easily softened, moving the pins out of place, so try not to hold the iron on any pin more than two seconds.
- Solder ONE pin, remove the rubber band, check it, then solder a diagonally-opposite pin – not two adjacent ones.

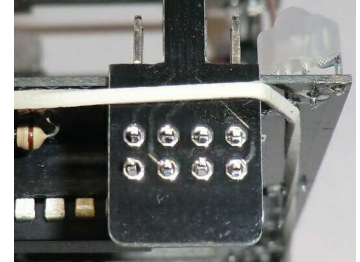


- Now repeat the above steps for each of the other three connectors – 1) hold in place with rubber band; 2) solder one pin; 3) check, fix if crooked; 4) remove rubber band; 5) solder diagonally opposite pin.
- Now go back and solder the rest of the connector pins.
- **Double check** each and every solder connection on the layer board – LEDs and connectors.

At this point you can build more layer boards – I.E. starting at step 8, or you can solder each one into the cube as you complete it.

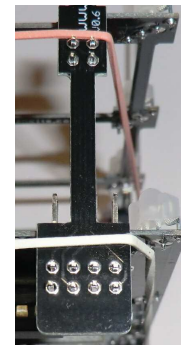
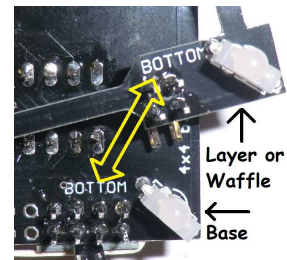
11. Add the legs, but don't solder until the first upper layer board is in.

- Install each leg onto the base board and run a rubber band around them as shown.
 - Be **SURE** the side labeled “Cube Side” is facing the base board, so the other side – as shown in the picture – has no printing.
- Add a second rubber band around the legs just above the base board



12. Install and solder the first Layer/Waffle board onto the base:

- **VERY VERY** very important: the words **BOTTOM**, top, left, and right, on the **base** and on **EVERY Waffle board** MUST be lined up vertically, IE. above the identical one below.
- Insert a Waffle board in the lowest open position in each leg
- It should look like the bottom picture to the right
- Ensuring that the legs are perfectly vertical, solder one pin on each of the 4-pin connectors
 - The upper rubber band tends to pull the legs a bit left – off of vertical, so you may have to push them a bit to vertical as the solder hardens, or re-melt the solder and do it.
 - Solder one pin on the base board at the bottom of each leg, again making sure each leg is vertical
- Remove the bottom rubber band, and move the upper one above the board you just soldered in
- Finish soldering the 4-pin connectors on the new Waffle board
- Then solder the remaining pins on each leg on the base board.



If available, power up your cube with this first Waffle board, and resolve any issues of dark LEDs, columns, or rows.

13. Soldering the remaining Waffle boards

- Repeat the above steps, which in summary are:
 - Line up the **BOTTOM** above the **BOTTOM** of the next lower board
 - Insert all the 4-pin connectors in the legs
 - Solder the 4-pin connectors
- Move the rubber band up above the last-done layer
- Plug in - see if the last-added Waffle board works well, resolve issues before continuing
 - If you see a little flicker during the patterns, it is just taking time to do WiFi things.

You are DONE with the hardware build of your beautiful cube blinkie

14. Now it is time for software setup

- There are 3 ways to connect to your cube
 - When plugged into your computer
 - 1) Via a serial terminal program such as “Putty” on Windows, “screen” on a MAC
 - 2) By connecting your PC or MAC to the WiFi address the cube creates.
 - After being set up by one of the above two methods:
 - 3) By using your browser to the address your network assigned to the cube

15. Connect to the cube via WiFi – this can be done via just about any device with WiFi

- Go to your pc/mac/tablet/phone settings for Wifi, and connect to an SSID called “blinkie-xxxx” such as “blinkie-6821”. There is no SSID password, though you could add one later.
- Once your device is connected, browse to 192.168.4.1
- It may take a little time – this IS a tiny “server” you're browsing into – in your cube!
- You'll see a left-column menu entitled “cube”
 - You'll see an option “Patterns” and you can choose them to see what they do
 - To set up the cube to connect to YOUR WiFi, click Settings
 - Under “**WiFi network**” enter your SSID and password, and click [save settings]
 - When the cube is in range of that network, it will DHCP (be assigned) an address.
 - If you are in range of your network, you will see an additional line under “**Home-Status**” such as “ap ip = 192.168.0.51” with the address your network assigned.
 - You can now reconnect your pc/mac/tablet/phone to your regular network, and access the cube from the address assigned. May I say “Whee!”?
- You are now set up to choose patterns, download new patterns offered by 2dkits.com which the menu calls “**Cloud Pattern Library**”, add new SSIDs – such as when taking your cube to an event or friend's house.
- You can also add a password on the “**Settings**” screen for 192.168.4.1 in case you are concerned about the security hole it creates, namely that someone with a WiFi scanner could discover it and browse into it and see YOUR NETWORK'S SSID and password. At some point new software will change that to “assigned” vs the actual password

16. Connect to the cube via serial-USB

- Windows:
 - When you first plug your cube in, you might “luck out” and notice the COMx: number as Windows discovers a new device. If not follow these steps:
 - Open the Windows device manager, and expand “**Ports (COM & LPT)**”



Read the number after COM on the “Silicon Labs” line, in this case: 7

- This means COM7: is your serial port
- Connect a serial program such as PUTTY, to COM7: at 115,200 baud
- Skip to the section commands in serial mode
- Apple MAC: Special thanks to Brian Sebby for documenting this
 - 1. Plug in the blinkie, and it should create a new device as /dev/tty.usbserial-<number>:

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

```
$ ls /dev/tty.usb*  
ls: /dev/tty.usb*: No such file or directory  
<plug in>
```

```
$ ls /dev/tty.usb*  
/dev/tty.usbserial-0001
```

- 2. Connect to the blinkie using screen:

```
$ screen /dev/tty.usbserial-0001 115200  
... a bunch of text ...
```

```
2DKits blinkie console ready  
2DKITS>
```

- Commands in serial mode:
 - `help` shows the available commands
 - Do the following to add YOUR network SSID and password
 - `addssid ssid -p passcode`
 - Do `winfo` to show the WiFi info – WiFi AP is the address YOUR network assigned
 - It may take a bit of time for your router to assign an IP, so run `winfo` until it does.

TBD:

- Troubleshooting
- Adding a “completed and running” picture
- Perhaps detailed docs on all the commands in the WiFi interface?

FYI:

Please return empty solder spools (bobbins) for refills;

If you don't want any of the plastic bags, please leave them, we will collect them and re-use them.

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

Instructions by Ward Christensen, WardC@2dkits.com