

***A personal note to potential RGB cube builders:***

*The physical construction of an RGB cube is s a lot of work. A single color cube is very easy to build by comparison. My first cube was an 8x8x8 RGB cube. When it was finished, I swore I would never build another one. And I didn't until now – almost 7 years later! The 5x5x5 RGB cube is a much easier build than an 8x8x8, but only because it contains roughly ¼ the number of LEDs.*

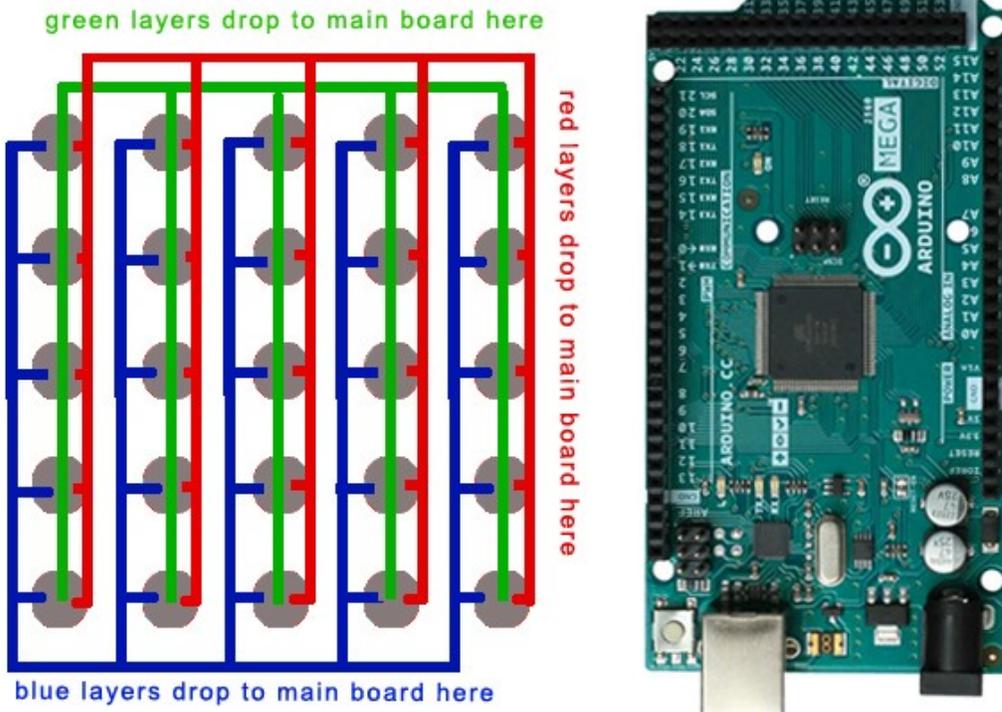
*The lead forming is tedious and time consuming, but doing it right is essential. Take your time and get everything just right before starting to solder LEDs together. Good lead forming really pays off later on.*

*This particular 5x5x5 cube for the Mega has some particular challenges. Lead forming and then soldering the LEDs into columns of 5 is fairly straight forward. So is fitting the main board with resistors, transistors, and wires. But, because we bring 3 sets of cathodes out on 3 different sides of the cube, putting together panels of 25 LEDs is a real challenge. I apologize for designing something so difficult to assemble.*

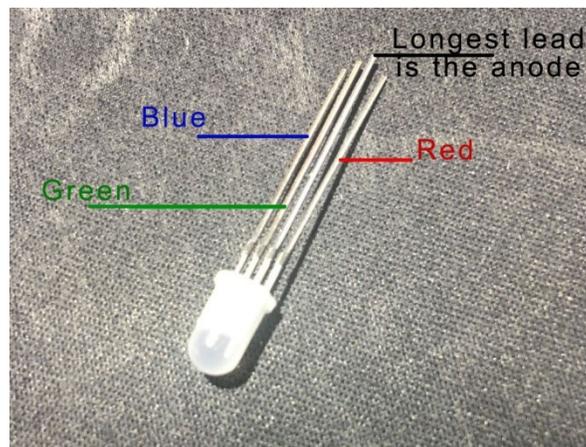
*I learned some tricks along the way, sometimes the hard way. I will explain in detail below how I put mine together. But unless you have some time and a lot of patience, you might want to try building the single color cube instead! I am older than most of you, so I may work slower, but it took me about an hour the lead form 25 LEDs, and another 2 hours to put one panel together. It was such a tedious task that I only did one panel per day, and then final assembled the finished cube on a sixth day.*

*If you are still ready to build an RGB 5x5x5 cube, detailed instructions start on the next page.*

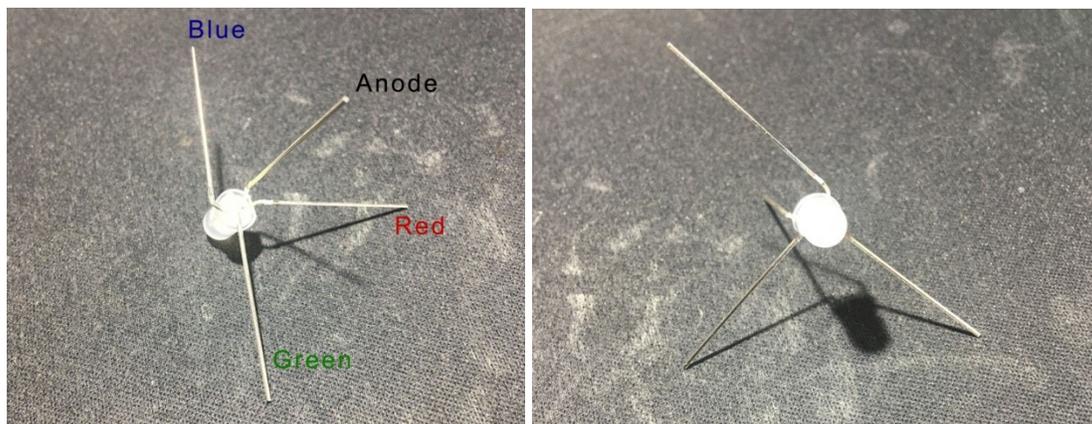
Before we go into detail of constructing the cube, let's give you an idea of where this is all going. We are going to connect anodes together vertically for 5 LEDs and connect them at the bottom to a resistor on the main board. We are connecting the cathodes of each layer together and bringing them out the sides of the cube before bringing them down to the main board. This top-view of the cube illustrates how and where the various cathodes are connected together.



Construction starts with lead forming. Then we solder LEDs together vertically in groups of 5. We then solder 5 of these vertical groups together to form panels. Then we have to solder the panels together to form our cube. Finally, we have to bring the three cathodes for each layer down to the main board and connect them to the collector of a transistor.

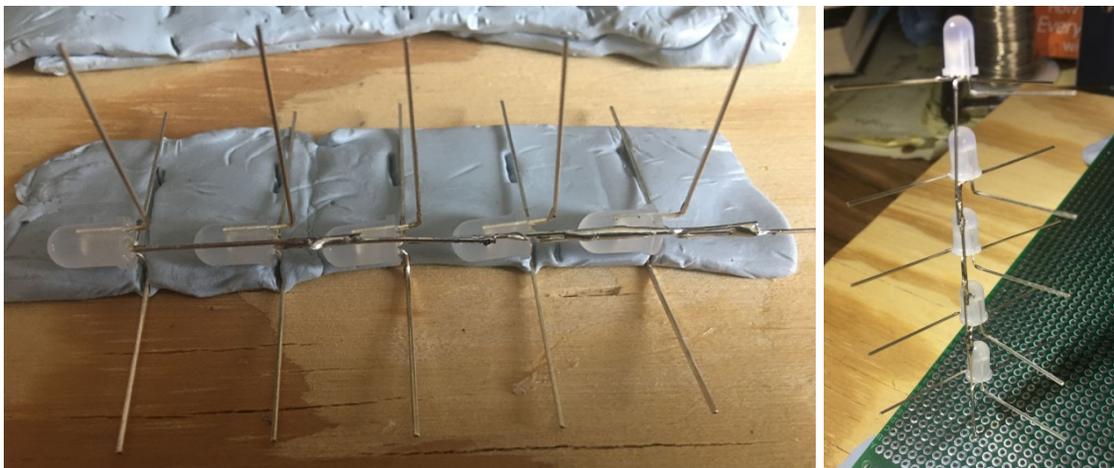


So what does lead forming involve? The anodes come straight out the bottom and will go down into the main board to meet their 180 ohm resistor. But they have to be offset to the edge of the LED so that they can pass between LEDs. That requires two 90 degree bends. I also turned the anode lead so that where it comes out and down, it is roughly half way between the red and blue leads. The three cathode leads come out in 90 degree angles to each other. The red cathode lead comes down out of the LED about 3 mm and then makes a 90 degree turn away from the other leads. The blue lead is bent at 90 degrees away from the other leads in the opposite direction. It goes out about 3 mm and then makes another 90 degree turn. The green lead is bent 90 degrees in the opposite direction that the blue lead goes.

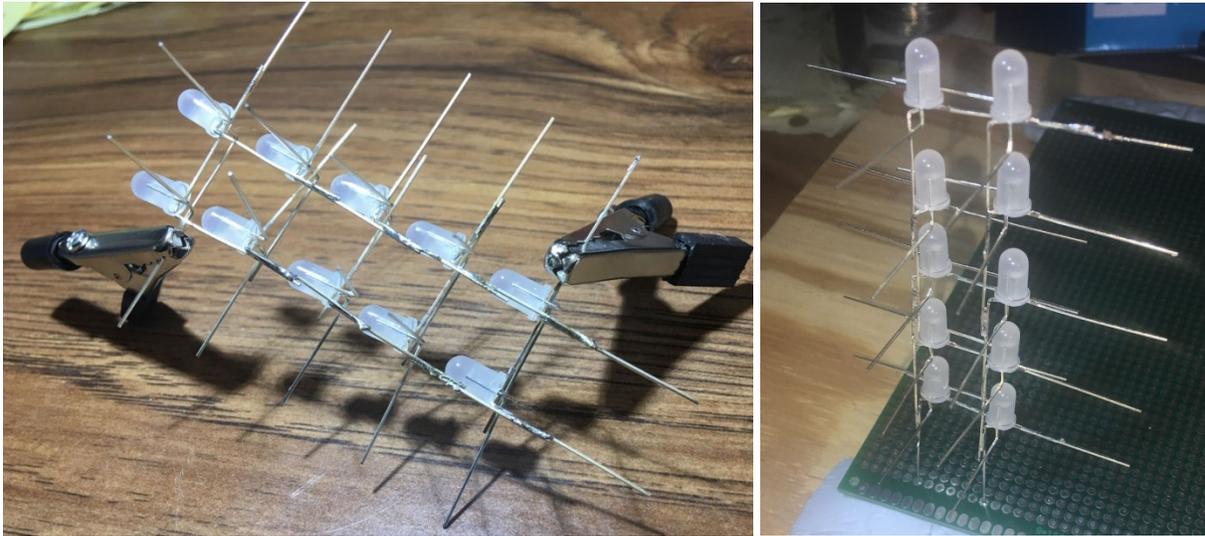


Here are bottom and top views of LEDs after lead forming. The red leads will eventually need one more bend to bring them out to the same side as the green, but this isn't done here. I didn't do that last bend until the panels were assembled and I was ready to connect the red leads in one layer to each other. More on that later.

Next we build columns of 5 LEDs. I used Blue Tack to hold the LEDs in position until they are soldered. Our LEDs are separated by 0.6 inches both vertically and horizontally. So the first thing I do is mark off 0.6 inch spacing in the Blue Tack. This is an important step and you need to keep checking the spacing. Small differences in LED height are very noticeable in the finished cube.



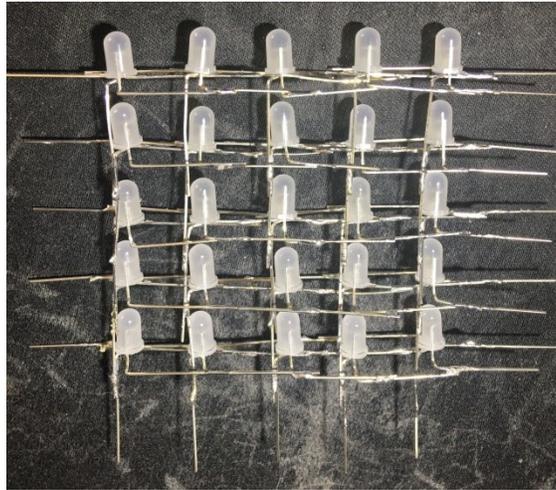
Next comes what is by far the hardest part of building this cube – putting 5 of the columns you just built together to form a panel. Getting just the first two columns together so that the green leads connect and the blue leads connect and they don't touch each other is the trickiest part. Once you get the first two soldered together, it is a little bit easier to add the other 3, soldering each one in place before adding the next.



I tried several different ways to use Blue Tack to hold my column in place while assembling panels. Nothing seemed to work. I finally resorted to alligator clips to get it started. I placed the alligator clips anywhere where two leads came together naturally, then started pushing others into place and soldering them. Eventually you get all 5 blues and all five greens soldered together. Then you can add another column and repeat the process until your panel consists of 5 columns.

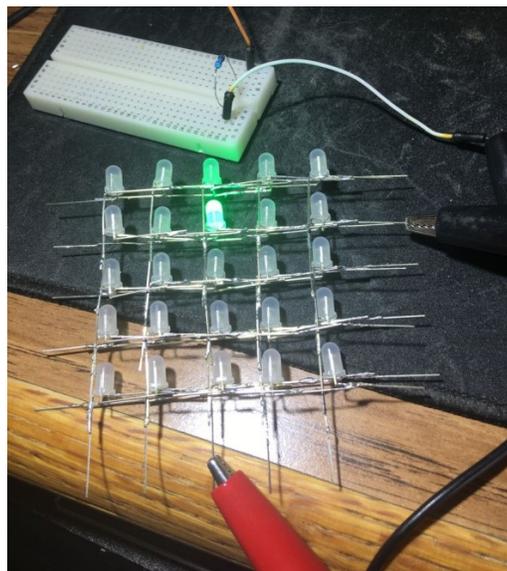


In the last picture, we have the green cathodes coming out on the right, the blue cathodes coming out on the left, but we still have 25 anode leads sticking straight toward the camera. I briefly toyed with the idea of trying to make those 25 connections to the next panel, but it would have made assembly practically impossible. So we will bring them out the same side as the green and make the connections between panels out on the side of the cube.

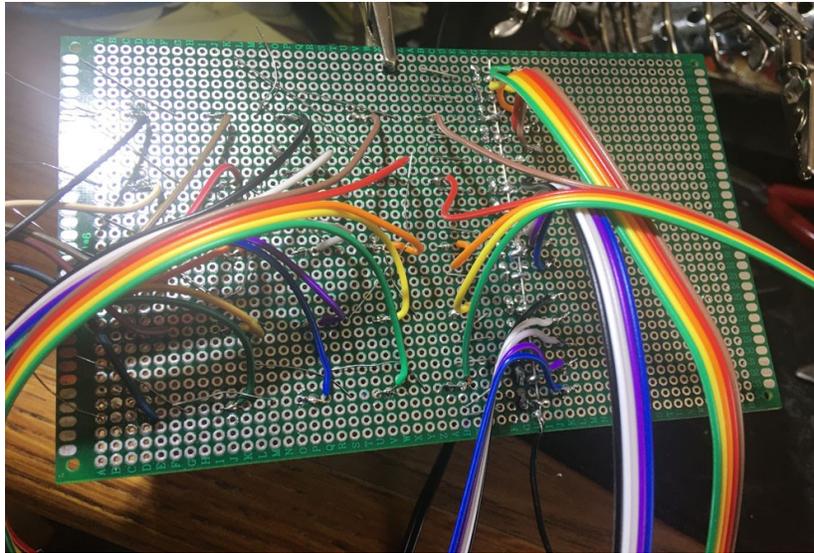


In the picture above, you can see we have bent the red cathodes 90 degrees and soldered them together for each layer. They come out the same side as the green, but are lower and offset toward the camera.

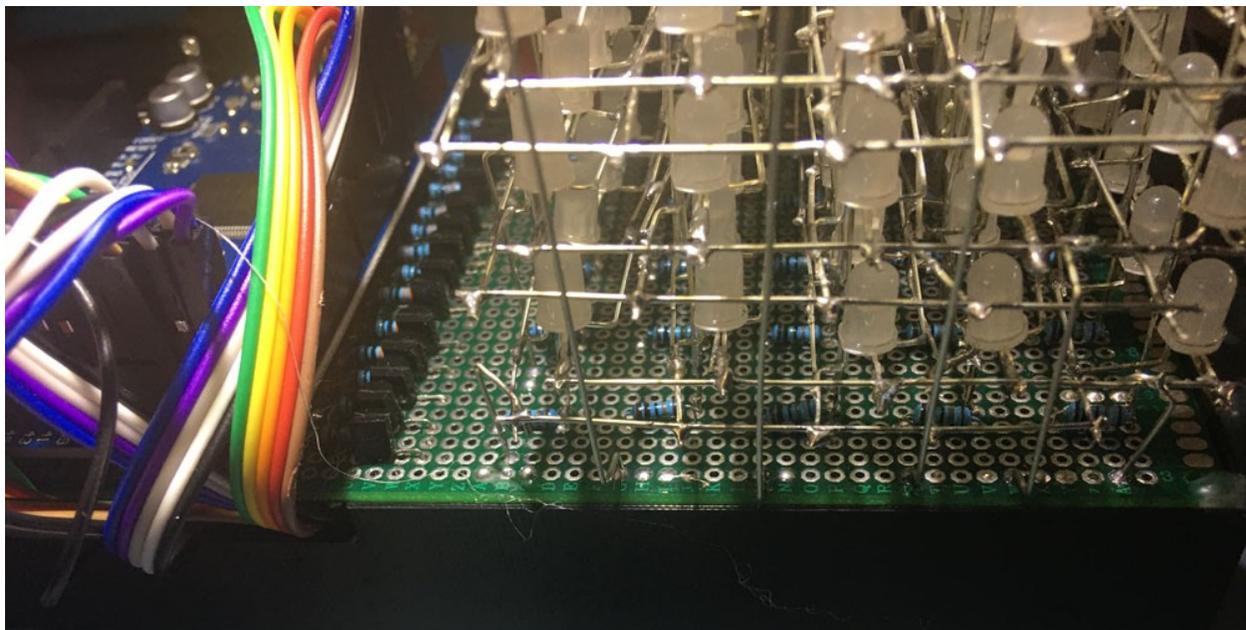
We need to test our panels before starting to assemble the cube. That's because cold solder joints are a cube builder's nightmare, especially if they end up on the inside of a finished cube. I thought about hooking up each panel to the Mega, and running in through its paces, but that's a lot of temporary connections, so I tested it the old fashioned way, with 5 volts, a 330 ohm resistor, and alligator clips. I needed to see each LED light up all three colors – no open connections and no shorts.



Once we have 5 panels made and tested, we are ready to assemble the cube, but first we have to get our board wired up, because we will build the cube from here on out on our board. We have 25 - 180 ohm resistors, 15 - 330 ohm resistors, and 15 NPN transistors which need to be mounted on the board, along with 41 wires going to our Mega. (That's 25 anodes, 15 cathodes, and ground.) Anode resistors will have to be placed 0.6 inches apart on both directions to match our 0.6 inch LED spacing. You can also attach the Mega to the board at this time. Use stand-offs if you have them. I actually used a couple of small plastic pieces as stand-offs and attached the Mega using hot glue. The finished board will look something like this from the bottom:



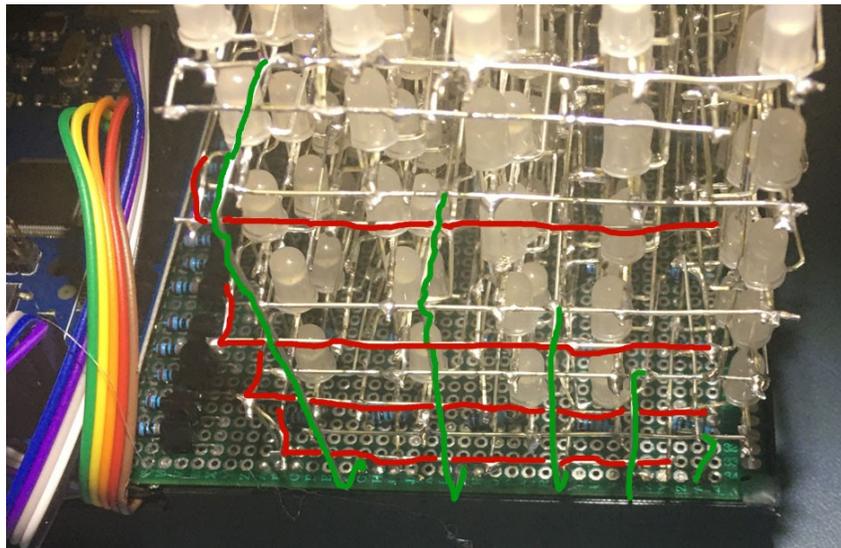
I didn't photograph the top of the board before putting the cube on, but you can see here the placement of resistors and transistors:



Now we are finally ready to do the final assembly of our cube. The panels are installed one at a time, putting them next to their respective resistor and spacing them 0.6 inches apart. That's every 6 holes in the board. When you get a panel in place, check its height to make sure it is not crooked and that it matches the height of other panels. Only solder it in place and connect it to the resistors when you are sure it is in the right place.

Once you get all panels installed, you need to run rails between panels connecting like colored cathodes in that layer. Start with the blue, since they are by themselves on one side of the cube. The key step here is to make sure each panel is straight and 0.6 inches apart from each other at the top of the cube before soldering these rails. You are kind of stuck with the shape of your cube once you connect them. On the other side of the cube, you need to do the same thing, but keeping the red and green cathodes separate from each other. Their offset in height should allow you to connect red to red and green to green without colliding with each other.

The final step is to bring the three cathodes from each layer down to the main board. I use the same tinned wire to do this as I used for the rails between panels. The blue is fairly straight forward since it's by itself. I am including a picture of the green side, where I have made a rather crude attempt to show the green returns to the board. It also shows the red rails which actually go around the corner, where their returns to the board are done on the side facing the Mega.



The red cathode returns come onto the board very close to their transistors and can be connected with bare wire. The green and blue returns are some distance from their respective transistors and will require insulated hook up wire. Now that your cube is mounted on the board, you need to be very careful working on the underside of the board. I would suggest clamping the edge of the board in something to hold it up, rather than trying to place the top of the cube on a hard surface.

At this point, we are done. If you actually read all this, you must be serious about building this cube. Good luck, and feel free to contact me if you have questions.

If you have access to a 3D printer, I have included a .stl file for a base that holds the board and keeps all the back side wiring safe and enclosed. The board can be attached to this case with a little hot glue.