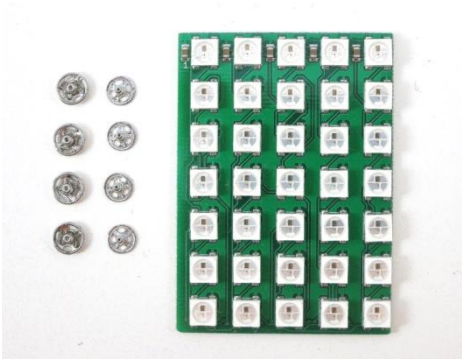
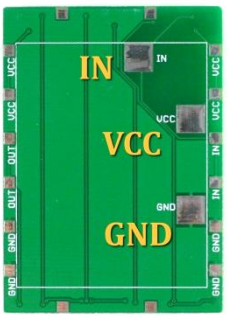
SquareWear Chainable Color LED Matrix

This document contains instructions to use the SquareWear chainable color LED matrix.

- **Specifications**

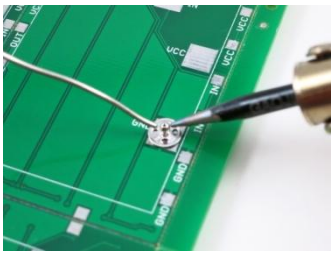




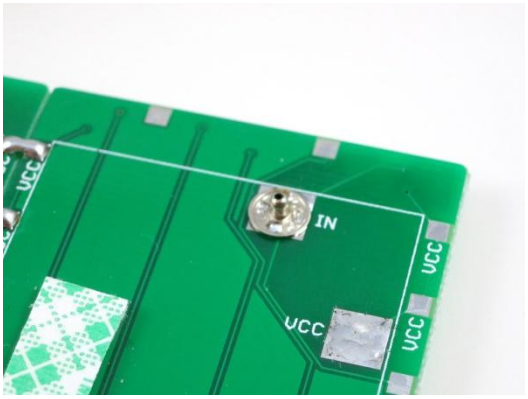
  - The LED matrix contains 35 WS2812B color LEDs arranged on a 5x7 grid with 8mm spacing.
  - The LED's operating voltage **3.3V – 5V**; operating current up to 25mA per LED (under 3.3V).
  - The packet also includes four 6mm sew-on snaps.
  - The matrix can be extended horizontally and vertically.

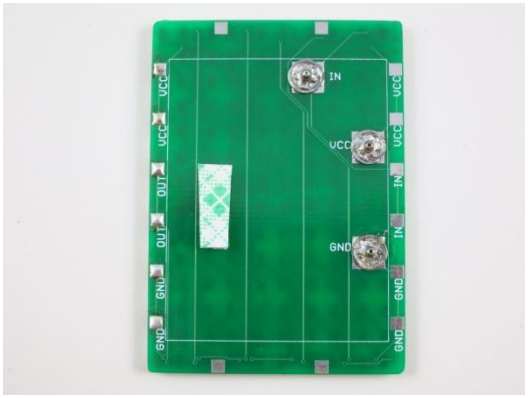
- **Power Options (IMPORTANT!!! Please READ!!!)**
  - The LED matrix can be powered by SquareWear or any Arduino compatible board.
  - If using standard SquareWear 2.0, solder three wires to connect SquareWear's **VCC**, **GND**, and any digital pin (we recommend **D10**) to the **VCC**, **GND**, and **DATA_IN** pins on the LED matrix.
  - If using SquareWear Mini, we recommend soldering sew-on snaps to directly attach SquareWear Mini to the matrix. See instructions below.
  - SquareWear provides 3.3V and up to 250mA current, which is fine to drive up to 4 matrices. **If chaining more than 4 LED matrices, please power the matrices directly from the LiPo battery** (otherwise the voltage drop along the chain can cause reliability issues). See instructions later.
  - **The LEDs can be extremely bright** and consume a lot of current! We recommend setting the brightness value (in software) to **no more than 0.25**, and suitably reduce it further when chaining multiple matrices. If the total current draw exceeds 250mA, SquareWear's voltage regulator may shut down due to thermo protection. In this case, reduce the brightness value and try again.

- **Connecting LED Matrix to SquareWear Mini using Sew-on Snaps.**
  - The VCC, GND, and DATA_IN pins on the LED matrix are designed to exactly match the VCC, GND, and D10 pins on SquareWear Mini. You can solder sew-on snaps to easily attach the two together, or directly solder these pins together for a more permanent connection.
  - To solder the snaps, first **tin the pads** at the back of the matrix with some solder, then place the male snap at the center of the pad, and apply some more solder.

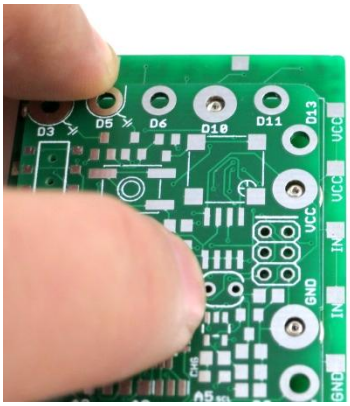


- Keep the snap at the center of the pad as much as possible, and use a tweezer to help move it around if necessary. Cut a small piece of double-sided tape form and stick it close to the left edge of the matrix. This will help support SquareWear mini when it's snapped on.

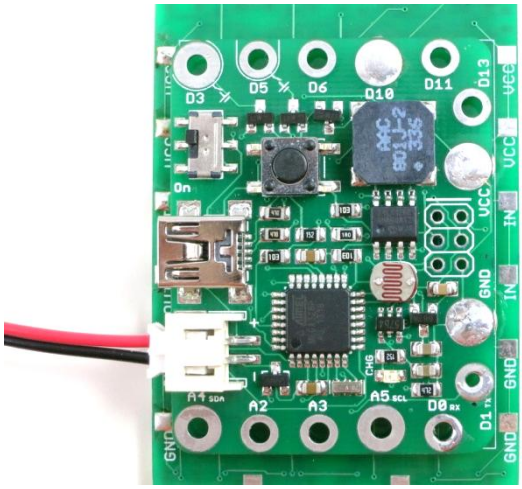


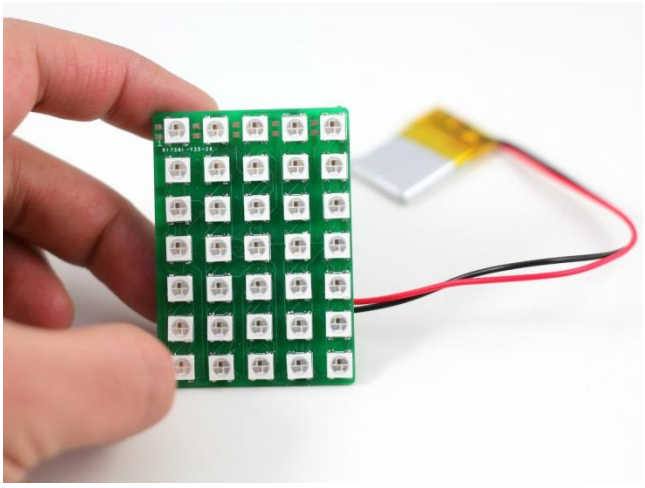


- Now snap on the female pieces and place the SqureWear Mini board on top of the snaps. Align the board so that you can see the snaps through the holes of pin D10, VCC, and GND.



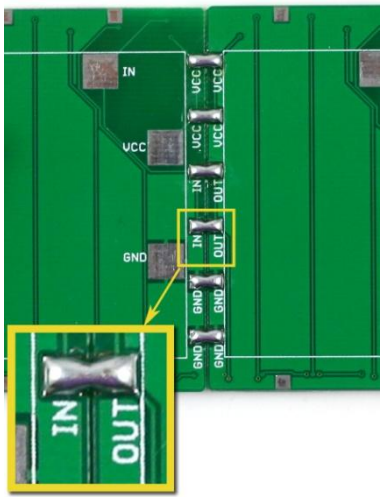
- Proceed to solder the snaps with the pin holes. Use sufficient solder to allow reliable connection. Wait till the solder has completely cooled down before attempting to detach the SquareWear Mini. Now you are all set!

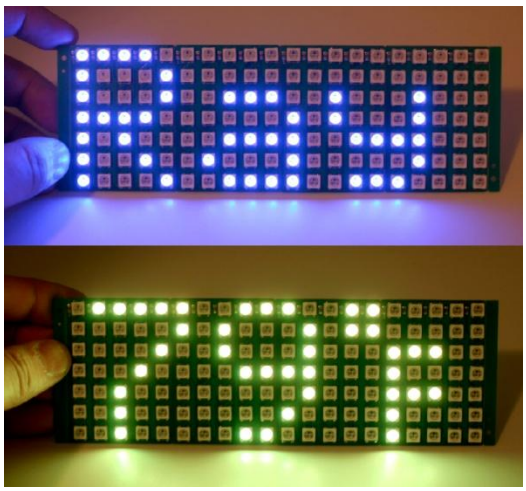




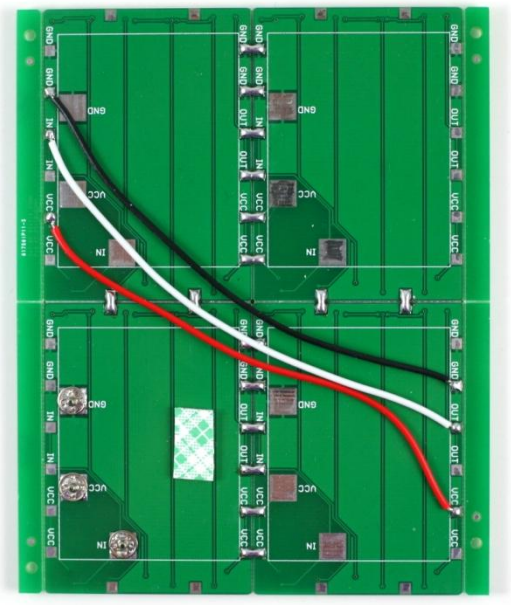
- **Chaining LED Matrices**

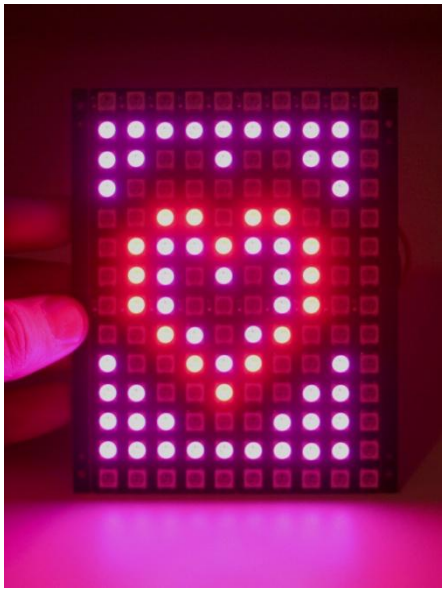
  The LED matrix is designed to be chainable. Each board has DATA_IN pins on one side, and DATA_OUT on the other side. To extend the number of boards in the **X direction**, just place two matrices side by side and solder across the 6 pins on the boundary. The solder will get the two boards firmly attached to each other. Chain several boards together to make a large display panel – it's great for showing text and messages.





  You can also extend the panel in the **Y direction**. To do so, use three wires to connect the VCC, GND, and DATA_OUT pins of the previous row to the VCC, GND, DATA_IN pins of the next row. Also solder across the pins on the vertical direction to firmly attach the two rows of boards together. There you go, a bigger panel to display more detailed graphics!



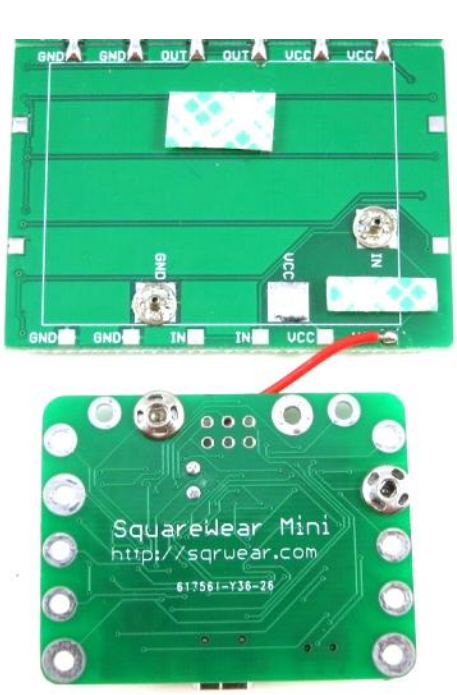


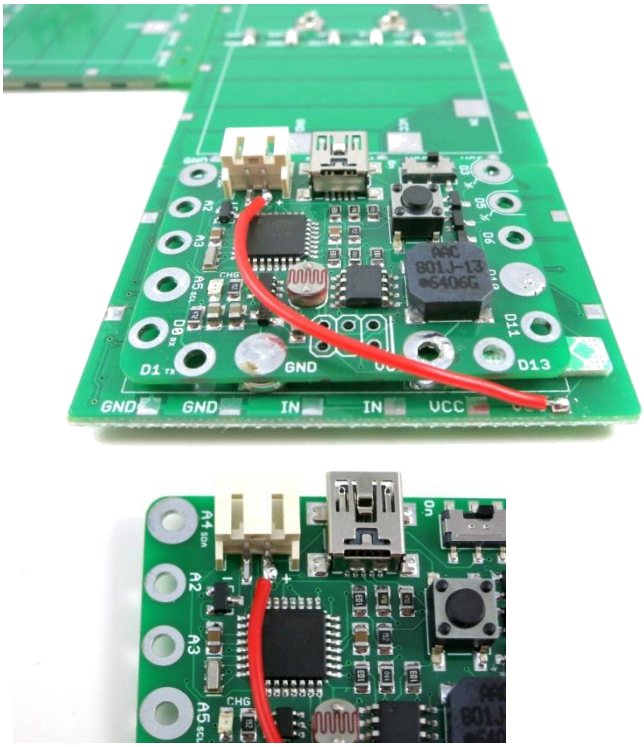
- **Powering Multiple Matrices**

  Powering multiple matrices can be an issue due to the large amount of current draw. Each LED can draw up to 25mA at full brightness (under 3.3V), and the total current draw can quickly scale up to several amps! Fortunately, you seldom need to turn on all LEDs at full brightness at the same time (unless if you are using

it as a light source!), so the average current draw is typically low. Still, it's a good idea to limit the brightness in software to avoid reliability issues. Here are some rules of thumb:

1. In software, set the brightness value to **no more than 0.25**, and **suitably reduce it** further when chaining multiple boards (ideally it should be inversely proportional to the number of boards).
2. If the total current draw exceeds 250mA, it may cause SquareWear's voltage regulator to shut down due to thermo protection. In this case, reduce the brightness value and try again, or use the method below to power the LED matrices directly from the battery.
3. If chaining more than 4 boards, you should power the matrices directly from the LiPo battery (instead of SquareWear's VCC pin). Otherwise the voltage drop along the chain can cause problems for LEDs towards the end of the chain. To do so, first remove the snaps (or the wire) connecting the VCC pin on SquareWear to the LED matrix's VCC pin. Then solder a wire from the matrix's VCC pin to the LiPo battery jack's + lead. See the pictures below for illustration.





This way the matrices are directly powered from the battery instead of going through the voltage regulator on SquareWear. This allows you to turn up the brightness of the LEDs, and also will reduce the voltage drop issues along the chain.