Initial Badge Assembly Instructions

Let me start by welcoming you to the 2025 Orange County Maker Faire. These assembly instructions will guide you through the assembly and customization of your badge for this year's event.

This badge is illuminate by a tricolor LED (Red/Green/Blue). Based on how you assemble your badge printed circuit board assembly (PCBA), the LED will emit one or more of the following colors:

- Red – Red is active while Green and Blue are inactive
- Green – Green is active while Red and Blue are inactive
- Blue – Blue is active while Red and Green are inactive
- Yellow – Blue is inactive while Red and Green are active
- Purple – Green is inactive while Red and Blue are active
- Aqua – Red is inactive while Green and Blue are active
- White – Red, Green and Blue are all active

Like any custom design, we need to answer a few critical questions before we begin assemble on our project. For this project:

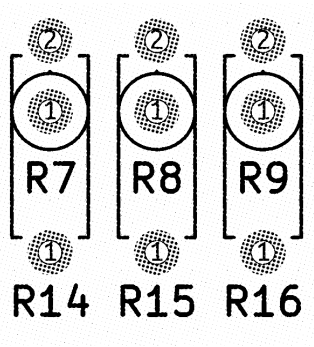
1. Do you want your badge to continually blink one or more of the LED colors?
2. Do you want your badge to be powered from a USB Cable for display purposes at a later time?

If you answered yes to either the above questions, continue assembly using the "**Customized Assembly Instructions**".

If you answered no to both questions, continue assembly using the "**Expedited Assembly Instructions**".

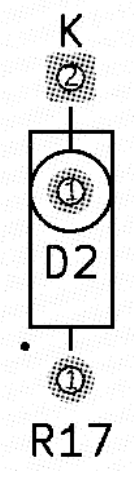
Item to Note on Footprints

To prevent the assembly of incompatible circuits, 4 components have overlapping footprints. For each component, footprints share the same pad 1 and have a unique pad 2.



Proper component assembly requires the correct pads to be used during assembly. The silkscreen and pads for each overlapping component are on this page. The overlapping components are as follows:

- R17 and D2
- R7 and R14
- R8 and R15
- R9 and R16



Note that component outlines are printed on the silkscreen.

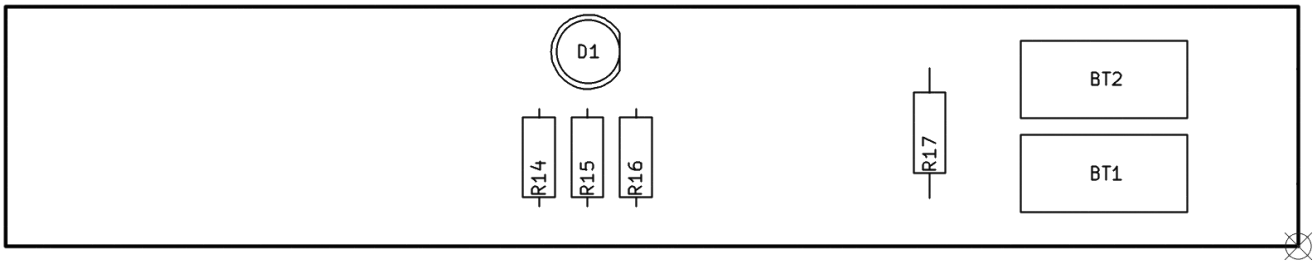
Expedited Assembly Instructions (Page 1 of 1)

Review the Expedited Assembly Instructions on this page before starting assembly. Note that this assembly requires between Five to Seven components based on the desired LED color.

Component List for the Simple Assembly

For the simplest Assembly, the LED stays on whenever both coin cells are installed. The simplest Assembly contains the following components:

- Two Coin Cell Holders BT1 and BT2
- 0 Ohm Resistor R17
- Tri-Color LED (Red, Green and Blue) D1
- If Red is active, 205 Ohm Resistor R15 (If Red is configured to be inactive, do not equip)
- If Green is active, 133 Ohm Resistor R14 (If Green is configured to be inactive, do not equip)
- If Blue is active, 133 Ohm Resistor R16 (If Blue is configured to be inactive, do not equip



Component Placement of Simple Assembly

Soldering the Simple Assembly

Step 1.) Bend Resistors and place flush to PCB. Orientation is not important with Resistors

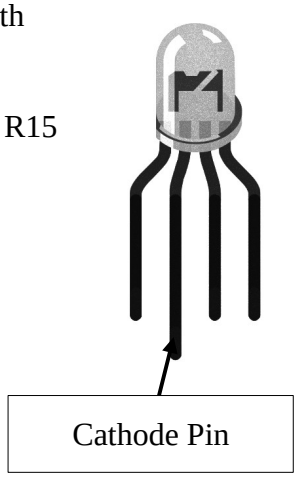
Step 2.) Solder Resistor pads to secure R14, R15, R16 and R17. Note that R14, R15 and/or R16 are not populated dependent on the active LED color.

Step 3.) Place LED to PCB with the longest pin going through pad 2. Pad 2 is marked with a silkscreen “K”. The longest pin is the Cathode Pin.

Step 4.) Solder LED pads to secure D1.

Step 5.) Place BT1 and BT2 flush to the PCB and solder both components

Step 6.) Plug in batteries and confirm LED activates.



Congratulations, you have completed the assembly of the PCA ! ! !

Customized Assembly Instructions (Page 1 of 12)

Review the Customized Assembly Instructions on this page before starting assembly. Note that this assembly requires between Fourteen to Thirty-Two components based on the desired PCBA behaviors.

In order to properly assemble the PCBA the following customization must be determined:

- Power Circuitry configuration
  - Primary Power via Battery with no Secondary Power
    - PCBA is only powered via batteries
  - Primary Power via Battery and Secondary Power via USB Cable
    - When batteries are not installed, the PCBA can be powered via a USB Type-C cable.
    - When batteries are installed, the PCBA will be powered by batteries, not the USB cable.

- The Behavior of each LED color
  - LED Red Color Behavior
    - LED glows Red along with other active colors when power is available
    - LED blinks Red along with other active colors when power is available
    - LED does not glow Red is off when power is available
  - LED Green Color Behavior
    - LED glows Green along with other active colors when power is available
    - LED blinks Green along with other active colors when power is available
    - LED does not glow Green is off when power is available
  - LED Blue Color Behavior
    - LED glows Blue along with other active colors when power is available
    - LED blinks Blue along with other active colors when power is available
    - LED does not glow Blue is off when power is available

The kitting and assembly instructions for the PCBA is to be followed based on the Power Circuitry Configuration and the Behavior of each LED color.

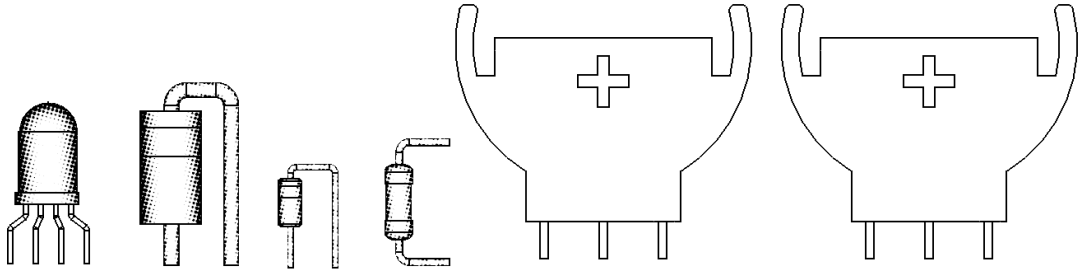
The next four sections will list the components required for each custom behavior. Kit components based on the customization options in each section.

Customized Assembly Instructions (Page 2 of 12)

Components list based on Power Circuitry configuration

The following components are required if the secondary power input is unpopulated:

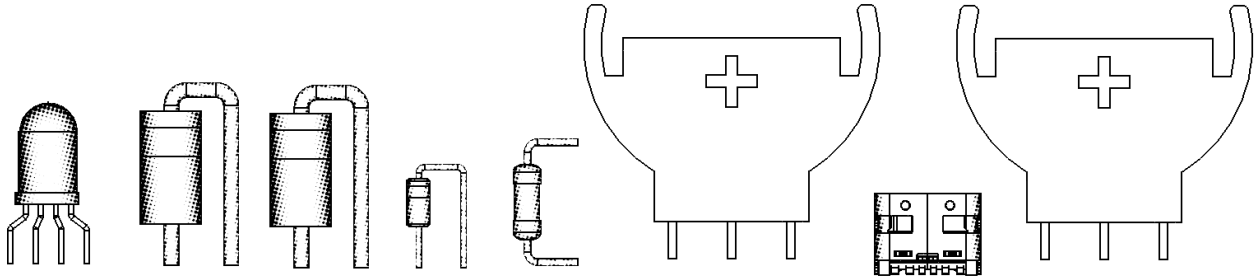
- Two Coin Cell Holders BT1 and BT2
- 1N5822 Diode D3
- 3.9 Volt Zener Diode D2
- 20.5 Ohm Resistor R13
- Tricolor LED D1



Components of Power Circuitry without a secondary power input

The primary power is provided by 2 Coin Cell Batteries in series. When the 2 Coin Cell Batteries are installed, the PCBA will not pull power from the secondary power input via a USB Type-C cable. The following components are required to support a secondary power input:

- USB C Socket J1
- Two Coin Cell Holders BT1 and BT2
- Two 1N5822 Diode D3 and D4
- 3.9 Volt Zener Diode D2
- 20.5 Ohm Resistor R13
- Tricolor LED D1



Components of Power Circuitry with secondary USB Type-C power input

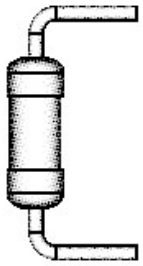
Customized Assembly Instructions (Page 3 of 12)

Component List based on Red LED Behavior

The Red LED will either, actively glow, blink or stay inactive based on the components used. No additional components are required to keep the Red LED from staying inactive.

The following component will cause the Red LED to actively glow:

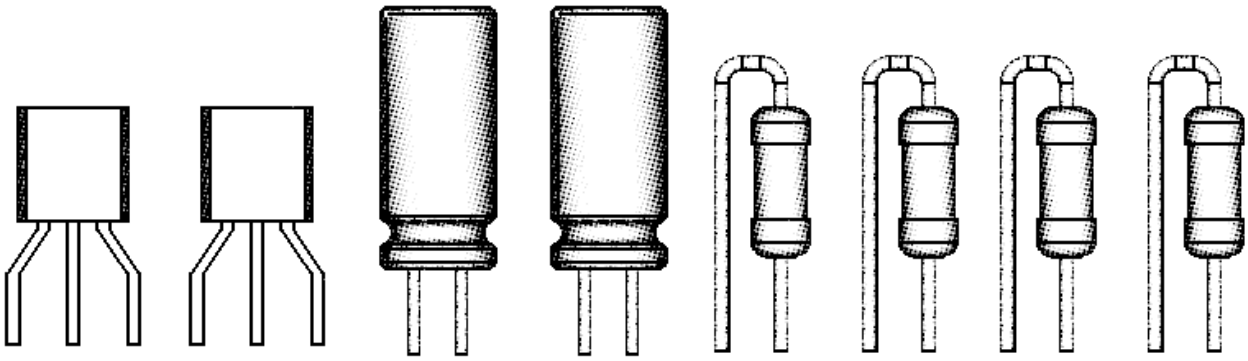
- 95.3 ohm Resistor R15



Component for an active Red LED (No Blinking)

The following components will cause the Red LED to blink:

- Two 2N3906 PNP bipolar junction transistor Q1, Q2
- Two 100 micro-farad electrolytic capacitor C1, C2
- 15.4 kilo-ohm Resistor R1
- 205 ohm Resistor R2
- 56.2 kilo-ohm Resistor R3
- 95.3 ohm Resistor R8



Components for a Blinking Red LED

Customized Assembly Instructions (Page 4 of 12)

Component List based on Green LED Behavior

The Green LED will either, actively glow, blink or stay inactive based on the components used. No additional components are required to keep the Green LED from staying inactive.

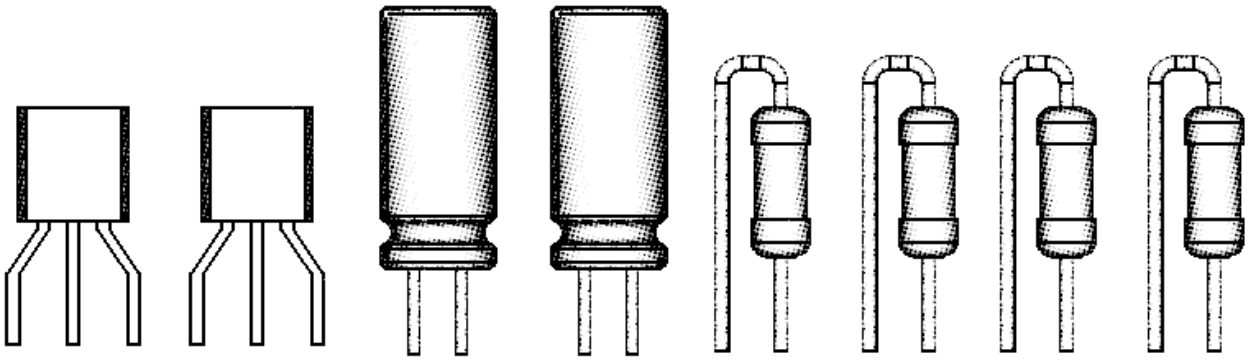
The following component will cause the Green LED to actively glow:

- 24.9 ohm Resistor R14

Component for an active Green LED (No Blinking)

The following components will cause the Green LED to blink:

- Two 2N3906 PNP bipolar junction transistor Q3, Q4
- Two 100 micro-farad electrolytic capacitor C3, C4
- 14.7 kilo-ohm Resistor R4
- 205 ohm Resistor R5
- 48.7 kilo-ohm Resistor R6
- 24.9 ohm Resistor R7



Components for a Blinking Green LED

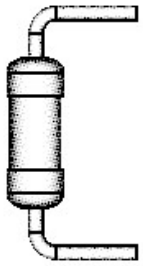
Customized Assembly (Page 5 of 12)

Component List based on Blue LED Behavior

The Blue LED will either, actively glow, blink or stay inactive based on the components used. No additional components are required to keep the Blue LED from staying inactive.

The following component will cause the Blue LED to actively glow:

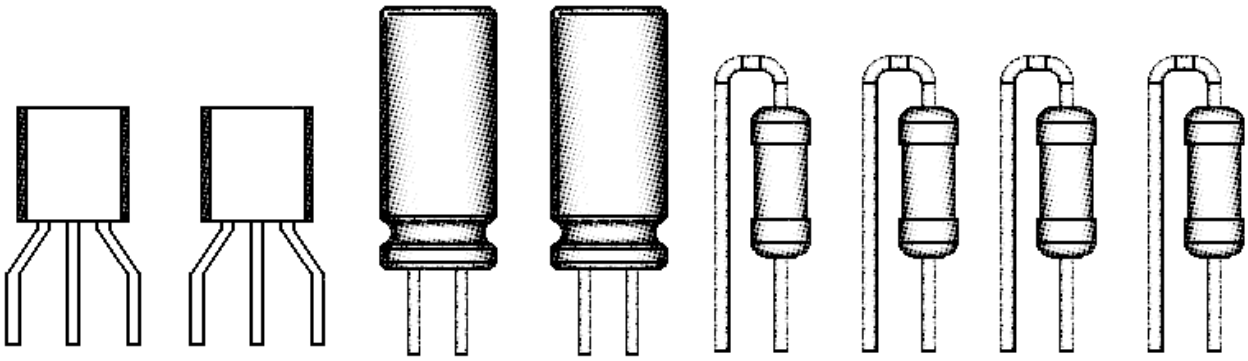
- 24.9 ohm Resistor R16



Component for an active Blue LED (No Blinking)

The following components will cause the Blue LED to blink:

- Two 2N3906 PNP bipolar junction transistor Q5, Q6
- Two 100 micro-farad electrolytic capacitor C5, C6
- 14.0 kilo-ohm Resistor R10
- 205 ohm Resistor R11
- 40.2 kilo-ohm Resistor R12
- 24.9 ohm Resistor R9

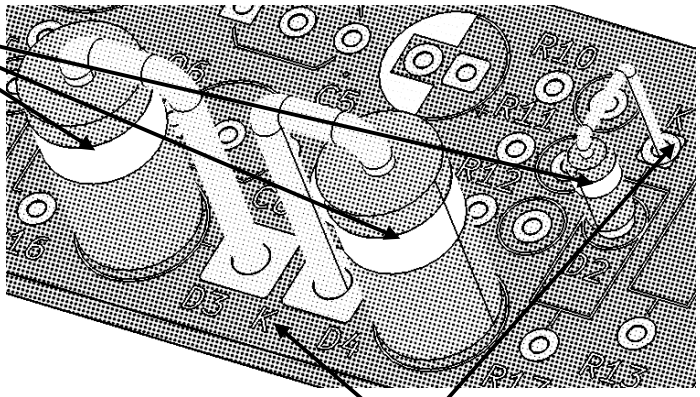


Components for a blinking Blue LED

Customized Assembly (Page 6 of 12)

Item to Note on Diodes prior to Assembly

Diode Cathode Band



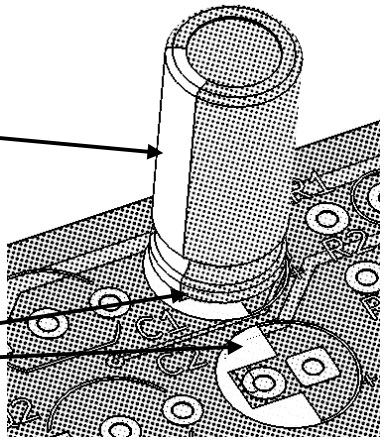
"K" Silkscreen

There are 3 diodes on the PCBA. For all 3 diode footprints, the Cathode pad is labeled with a "K" in silkscreen.

Note: The body of the diode is marked with a band closer to the Cathode pin.

Item to Note on Electrolytic Capacitors prior to Assembly

Capacitor Negative Terminal Band



There are 6 capacitors on the PCBA. For all 6 footprints, the Negative Terminal is marked by silkscreen. Note that the body of each capacitor has a vertical line marking the negative terminal.

Negative Terminal Silkscreen

Customized Assembly (Page 7 of 12)

Soldering for the Customized Assembly (Page 1 of 6)

Step 1.) If a USB Connector will be added as Secondary Power input, continue to Step 2. Otherwise skip to Step 3.

Step 2.) Solder USB C Socket J1.

Location of J1 on PCB

Step 3.) If the Red LED will be blinking continue to Step 4. Otherwise, skip to Step 7.

Step 4.) Place the following components on the PCBA:

- Two 2N3906 PNP bipolar junction transistor Q1, Q2
- Two 100 micro-farad electrolytic capacitor C1, C2
- 15.4 kilo-ohm Resistor R1
- 205 ohm Resistor R2
- 56.2 kilo-ohm Resistor R3

Location of Q1, Q2, C1, C2, R1, R2 and R3 on PCB

Step 5.) Place the blinking jig over all the components.

Step 6.) Solder all the components held by the blinking jig.

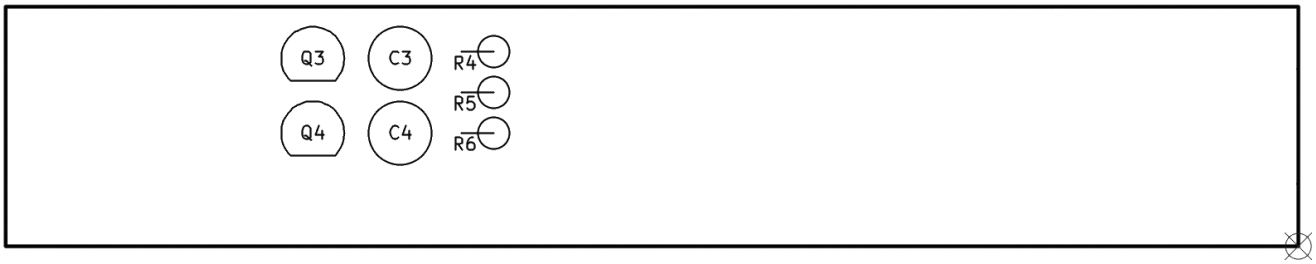
Step 7.) If the Green LED will be blinking continue to Step 8. Otherwise, skip to Step 11.

Customized Assembly (Page 8 of 12)

Soldering for the Customized Assembly (Page 2 of 6)

Step 8.) Place the following components on the PCBA:

- Two 2N3906 PNP bipolar junction transistor Q3, Q4
- Two 100 micro-farad electrolytic capacitor C3, C4
- 14.7 kilo-ohm Resistor R4
- 205 ohm Resistor R5
- 48.7 kilo-ohm Resistor R6



Location of Q3, Q4, C3, C4, R4, R5 and R6 on PCB

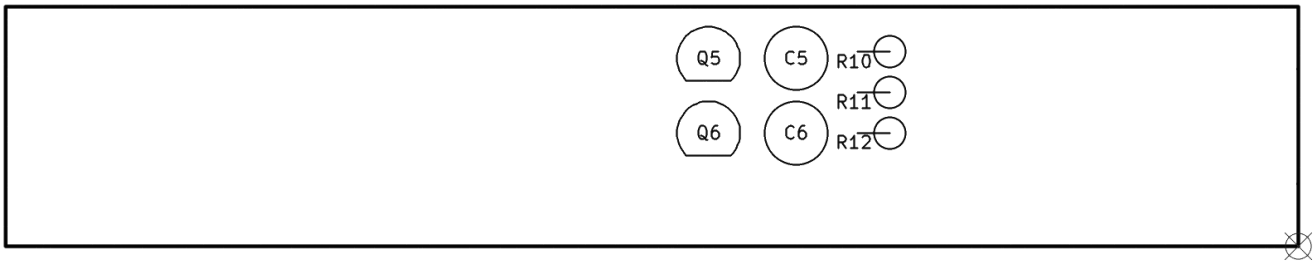
Step 9.) Place the blinking jig over all the components.

Step 10.) Solder all the components held by the blinking jig.

Step 11.) If the Blue LED will be blinking continue to Step 12. Otherwise, skip to Step 15.

Step 12.) Place the following components on the PCBA:

- Two 2N3906 PNP bipolar junction transistor Q5, Q6
- Two 100 micro-farad electrolytic capacitor C5, C6
- 14.0 kilo-ohm Resistor R10
- 205 ohm Resistor R11
- 40.2 kilo-ohm Resistor R12



Location of Q5, Q6, C5, C6, R10, R11 and R12 on PCB

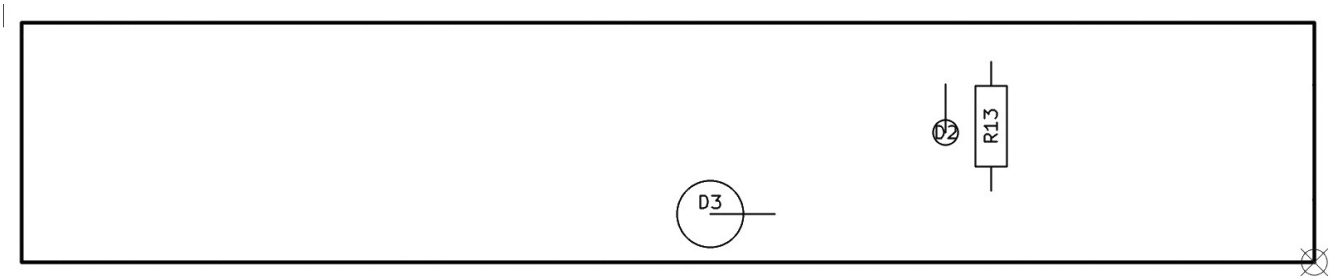
Step 13.) Place the blinking jig over all the components.

Step 14.) Solder all the components held by the blinking jig.

Customized Assembly (Page 9 of 12)

Soldering for the Customized Assembly (Page 3 of 6)

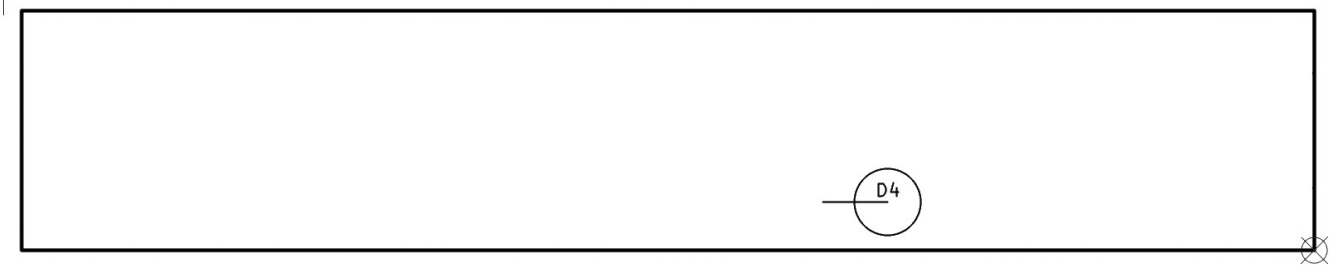
Step 15.) Solder the 3.9 Volt Zener Diode D2, the 20.5 Ohm Resistor R13 and the 1N5822 Diode D3.



Location of D2, D3 and R13 on PCB

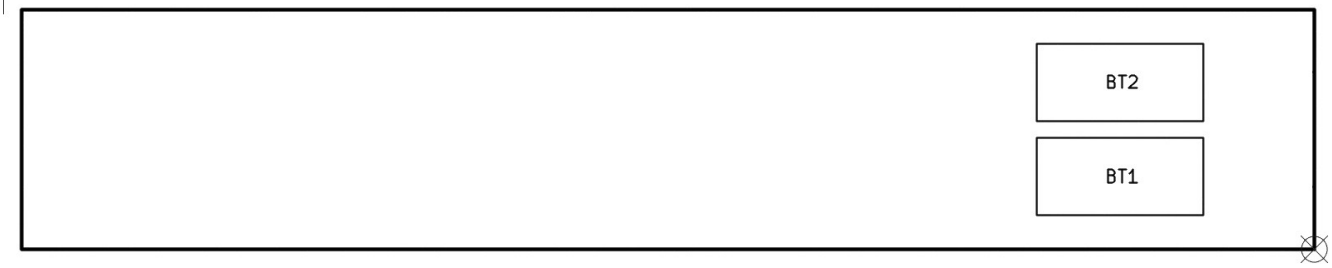
Step 16.) If a USB Connector will be added as Secondary Power input, continue to Step 17. Otherwise skip to Step 18.

Step 17.) Solder the 1N5822 Diode D4.



Location of D4 on PCB

Step 18.) Solder the Two Coin Cell Holders BT1 and BT2.



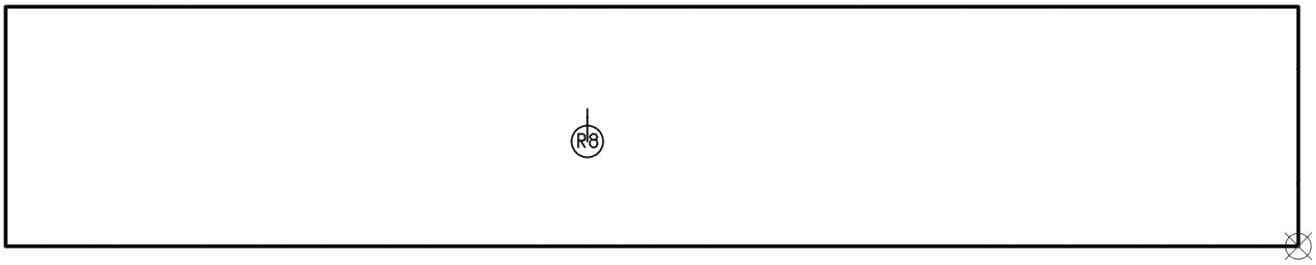
Location of BT1 and BT2 on PCB

Step 19.) If the Red LED will be blinking continue to Step 20. If the Red LED will stay active when power is available, skip to step 21. Otherwise, skip to Step 22.

Customized Assembly (Page 10 of 12)

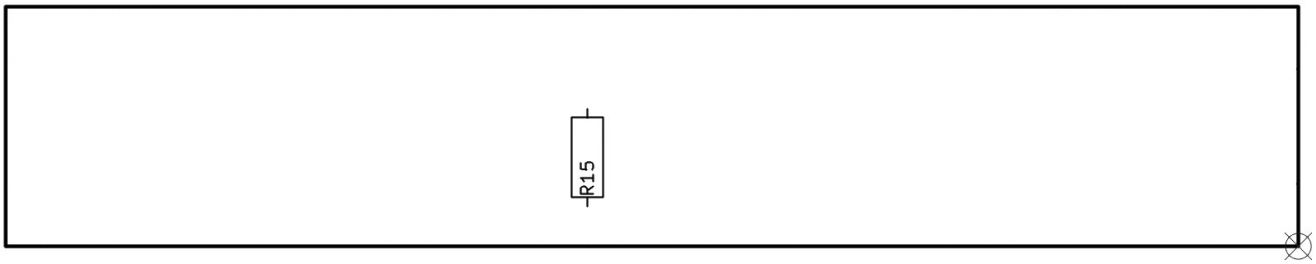
Soldering for the Customized Assembly (Page 4 of 6)

Step 20.) Solder the 95.3 ohm Resistor R8. Skip to Step 22.



Location of R8 on PCB (Blinking Red)

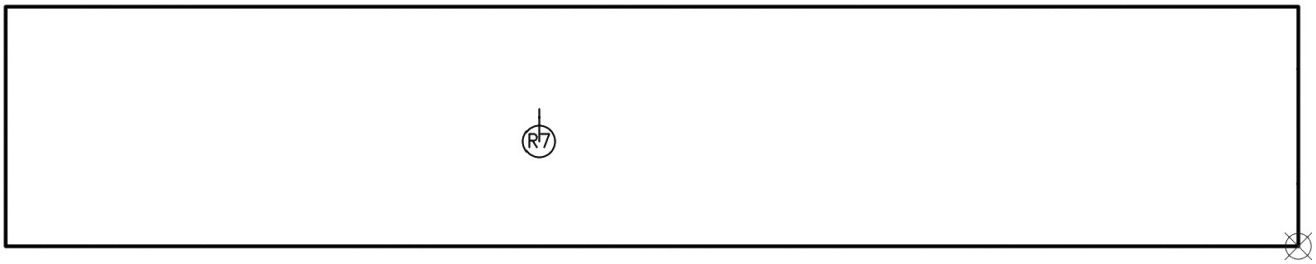
Step 21.) Solder the 95.3 ohm Resistor R15.



Location of R15 on PCB (Solid Red)

Step 22.) If the Green LED will be blinking continue to Step 23. If the Green LED will stay active when power is available, skip to step 24. Otherwise, skip to Step 25.

Step 23.) Solder the 24.9 ohm Resistor R7. Skip to Step 25.

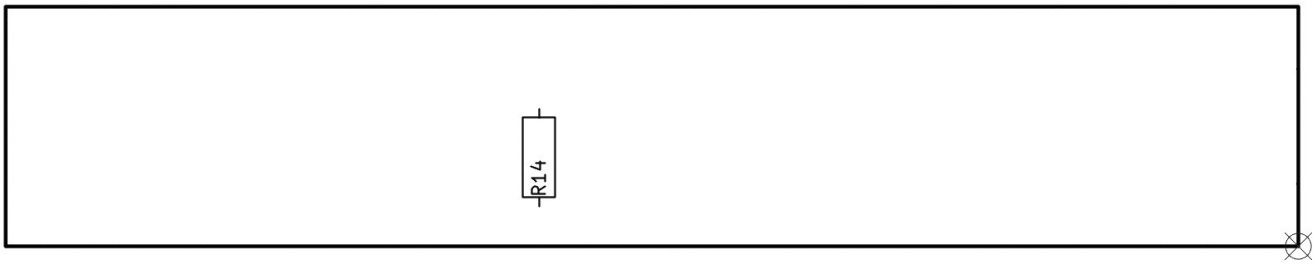


Location of R14 on PCB (Blinking Green)

Customized Assembly (Page 11 of 12)

Soldering for the Customized Assembly (Page 5 of 6)

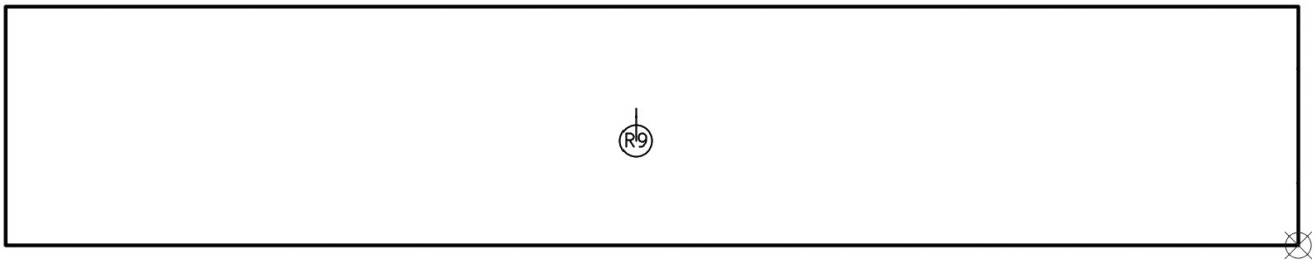
Step 24.) Solder the 24.9 ohm Resistor R14.



Location of R14 on PCB (Solid Green)

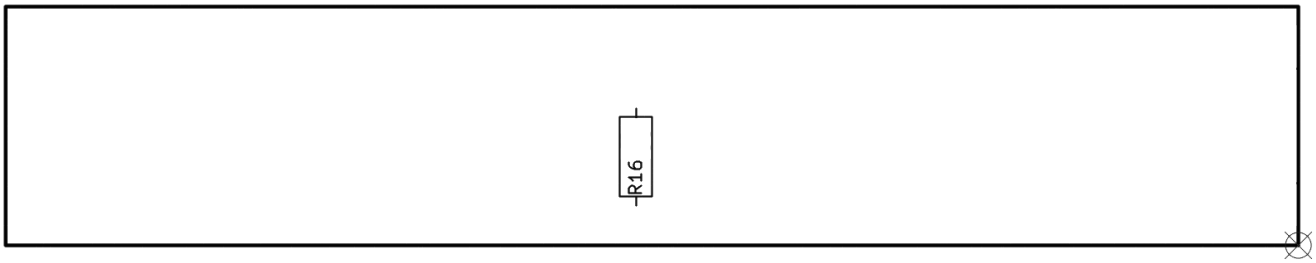
Step 25.) If the Blue LED will be blinking continue to Step 26. If the Blue LED will stay active when power is available, skip to step 27. Otherwise, skip to Step 28.

Step 26.) Solder the 24.9 ohm Resistor R9. Skip to Step 28.



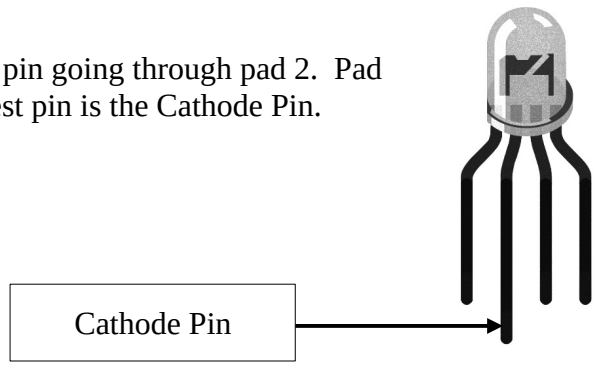
Location of R9 on PCB (Blinking Blue)

Step 27.) Solder the 24.9 ohm Resistor R16.



Location of R16 on PCB (Solid Blue)

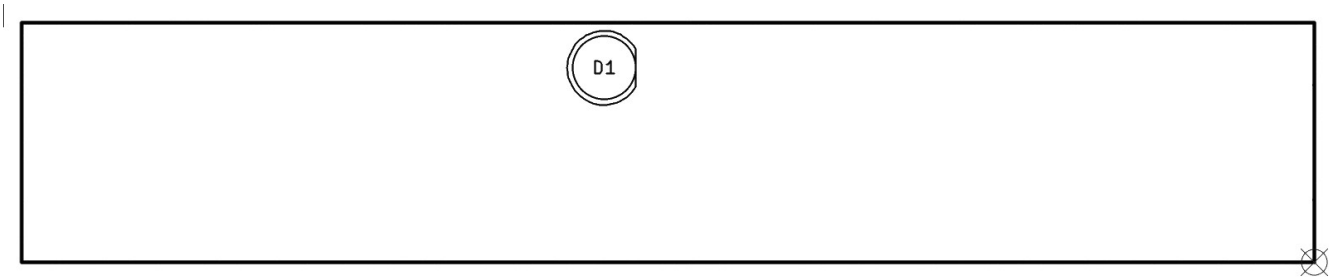
Step 28.) Place LED to PCB with the longest pin going through pad 2. Pad 2 is marked with a silkscreen “K”. The longest pin is the Cathode Pin.



Customized Assembly (Page 12 of 12)

Soldering for the Customized Assembly (Page 6 of 6)

Step 29.) Solder LED pads to secure D1.



Location of D1 on PCB

Step 30.) Plug in batteries and confirm LED activates. Congratulations, you have completed the assembly of the PCA