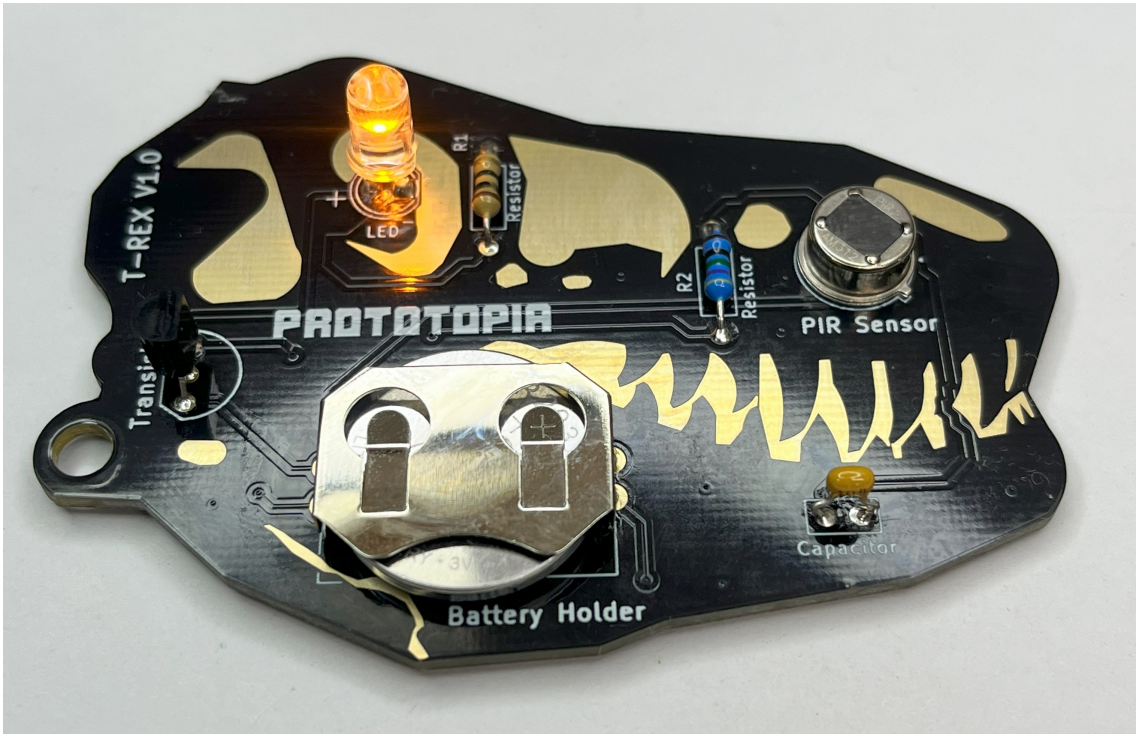
T-Rex Solder Manual

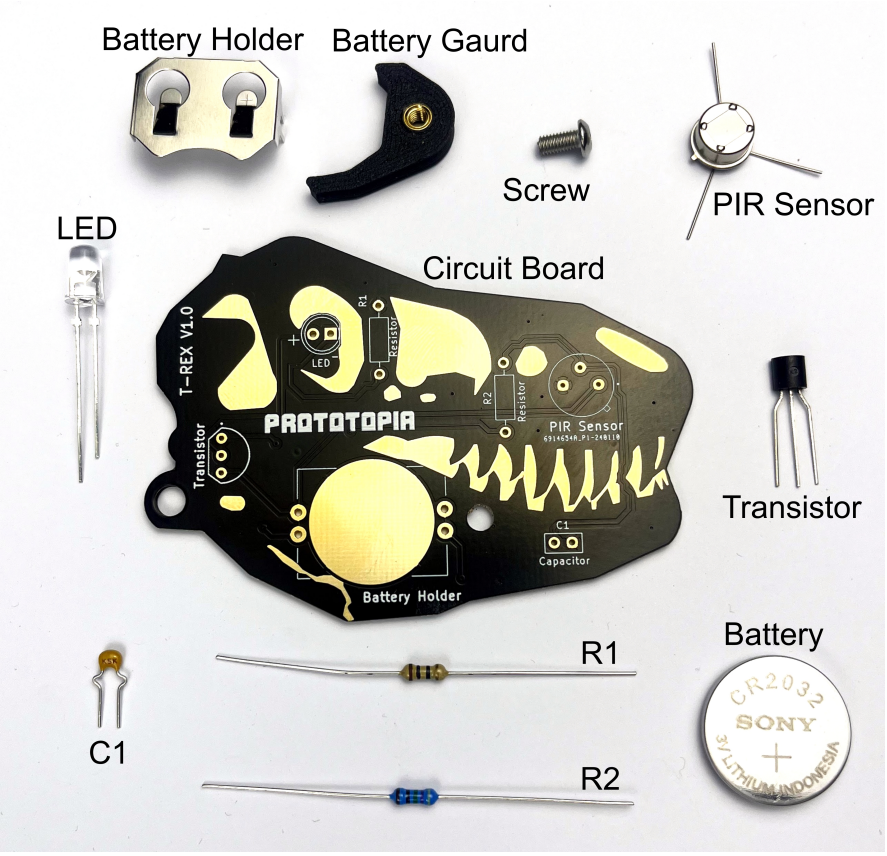


Description

The T-Rex completed circuit utilizes infrared detection science to only turn on the LED when a change in infrared light is observed, such as a moving person or pet.

The T-Rex soldering kit is engineered as an educational and fun way to learn how to solder. The following step-by-step directions provide information on how each component affects the final circuit, giving the builder a better understanding of exactly what they are building.

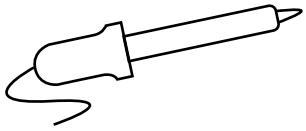
Materials



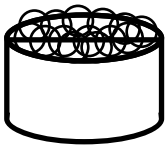
Included

1 × 100 Ohm Resistor (R1)
1 × 475 Ohm Resistor (R2)
1 × 0.1 uF Capacitor (C1)
1 x Battery Holder
1 x NPN Transistor
1 x Light Emitting Diode (LED)
1 x Passive Infared Sensor (PIR)
1 x Coincell battery
1 x T-Rex Circuit Board (PCB)
1 x M3 6mm Screw
1 x Battery Guard

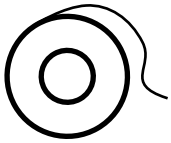
Tools Needed (Not Included)



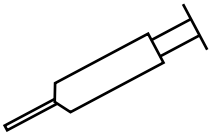
Soldering Iron



Brass wool



Lead-Free Solder

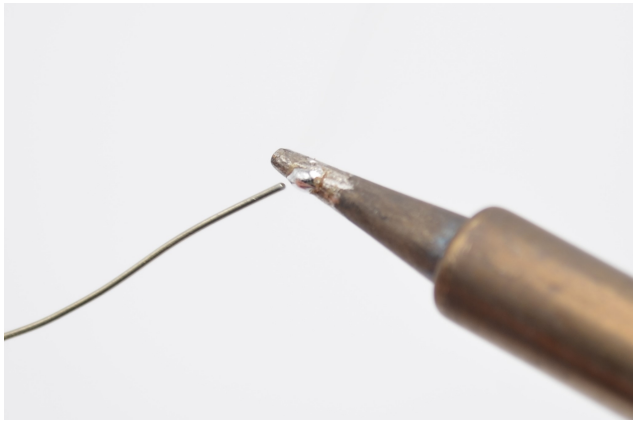


Soldering Flux

Soldering invloves very hot temperature materials and tools. Follow eqiupment safety instructions for all items used and wear appropriate personal protection equipment.

INGESTION HAZARD: This product contains a button cell or coin battery.

Soldering For Beginners

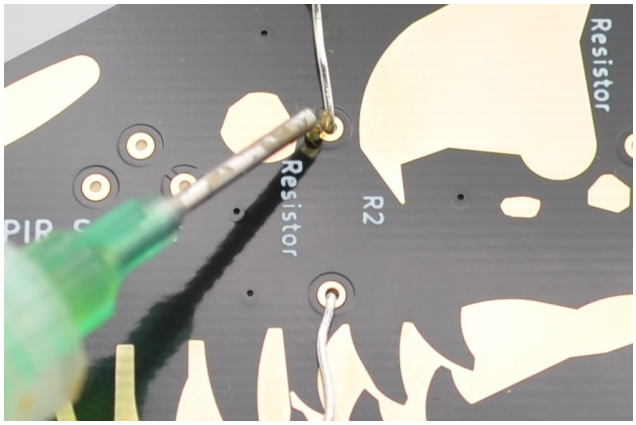


Tin The Tip

It is very important to solder with a clean, oxide free soldering tip. Heat the soldering iron to 390°C (734°F). Holding the solder wire a few inches from the end, melt a small amount onto the iron tip.

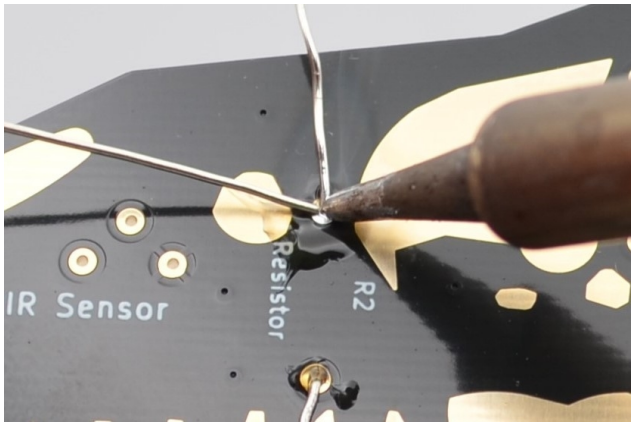
Clean

To remove unwanted material and old oxides, quickly press the tip into some brass wool several times. This will help coat the solder you melted uniformly and wipe off any unwanted residue. This step should be performed often throughout the soldering process.



Apply Flux

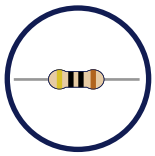
Probably the most important aspect of soldering is to use flux. Flux removes unwanted oxides that insulate the metals we are trying to bond. Apply a small amount of flux to the area to be soldered.



Solder

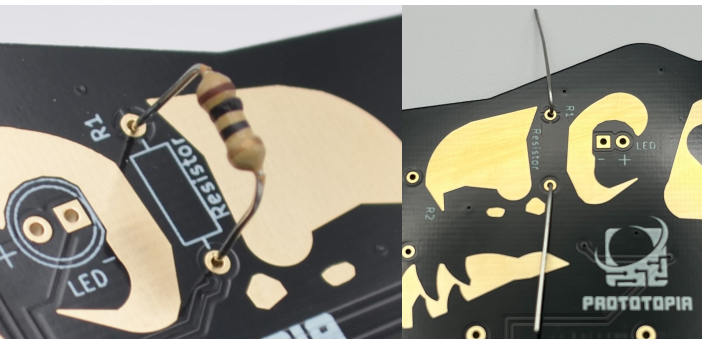
Using a tinned and cleaned soldering tip, press the tip against both metal parts needing to be soldered. Touch the solder wire to the PCB pad until it melts and flows onto both metals. This should be a quick operation, taking only a few seconds to perform.

Resistor R1



Part

Symbol

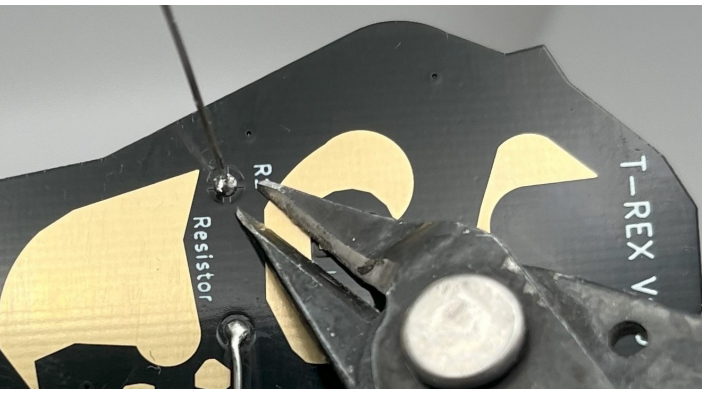


Position R1 Resistor

Bend both legs of the resistor to form a 'U' shape and insert into the R1 marked location on the top side of the board. On the backside, bend the legs away from eachother to snuggly hold the part in place.

Apply Flux & Solder

Place a small amount of flux on both pads located on the backside of the PCB. Follow soldering steps to securely fuse each leg to the respective pad. It is good if some solder flows through the hole to the other side.

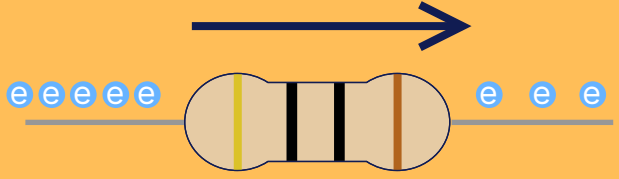


Remove Excess

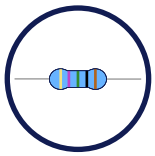
Carefully snip the excess R1 leg just above the solder ball.

What Does It Do?

The resistor inibits the flow of electrons by forcing them to pass through a less conductive material. In this circuit R1 has a value of 100 Ohms and allows us to reduce the current passing through the LED so we can control the brightness and extend battery life.

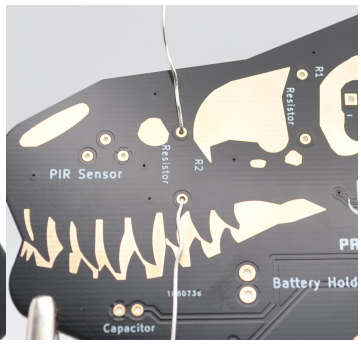


Resistor R2



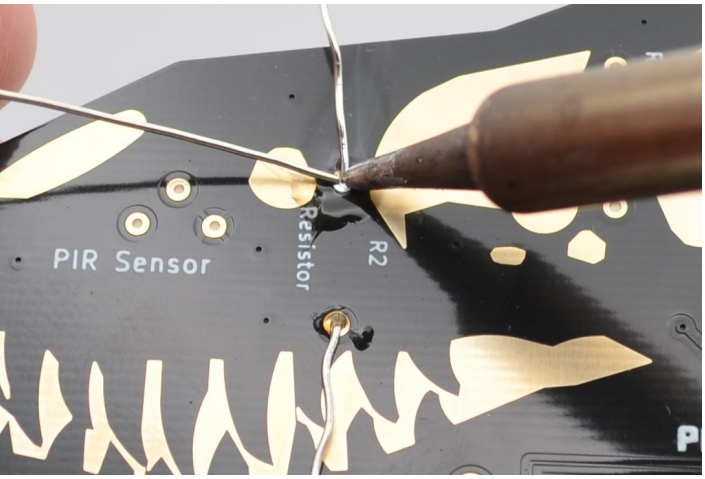
Part

Symbol



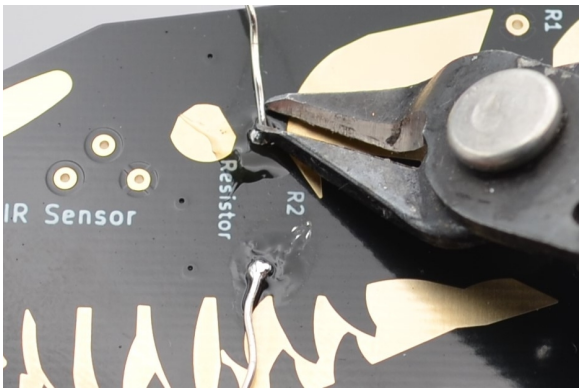
Position R2 Resistor

Bend both legs of the resistor to form a 'U' shape and insert into the R2 marked location on the top side of the board. On the backside, bend the legs away from eachother to snuggly hold the part in place.



Apply Flux & Solder

Place a small amount of flux on both pads located on the backside of the PCB. Follow soldering steps to securely fuse each leg to the respective pad. It is good if some solder flows through the hole to the other side.

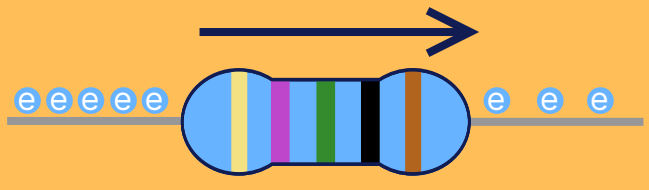


Remove Excess

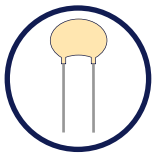
Carefully snip the excess R2 legs just above the solder ball.

What Does It Do?

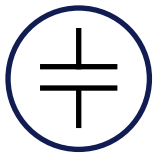
The resistor inibits the flow of electrons by forcing them to pass through a less conductive material. In this circuit R2 has a value of 475 Ohms and allows us to limit the current flowing between the transistors base and emitter, effectivly protecting it and the PIR sensor.



Capacitor C1



Part



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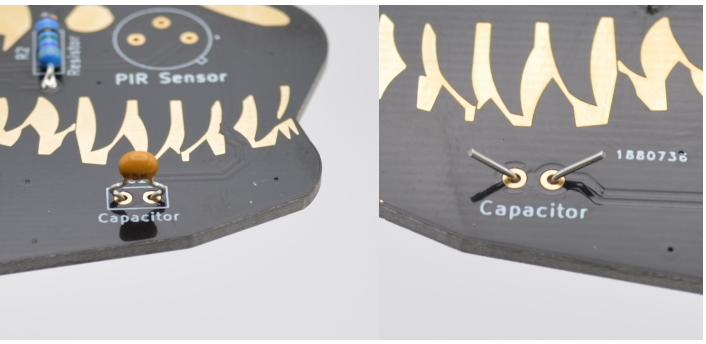
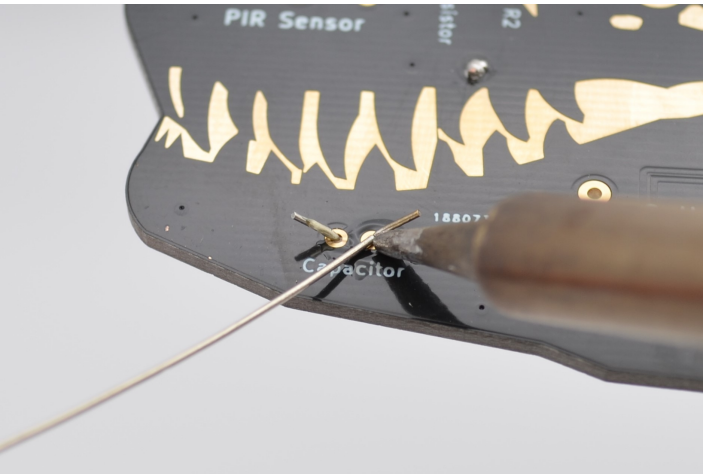


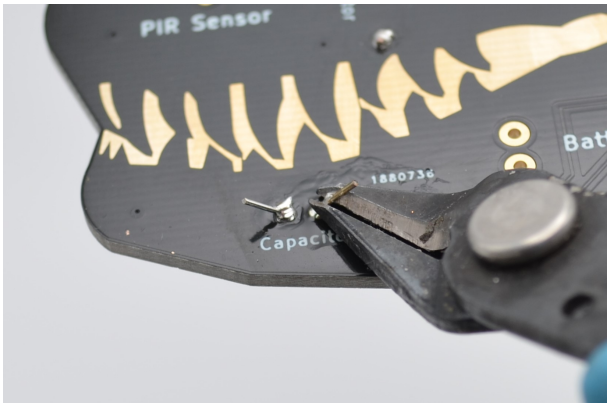
Position C1 Capacitor

Insert the capacitor into the C1 marked location on the top side of the board. On the backside, bend the legs away from eachother to snuggly hold the part in place.



Apply Flux & Solder

Place a small amount of flux on both pads located on the backside of the PCB. Follow soldering steps to securely fuse each leg to the respective pad. It is good if some solder flows through the hole to the other side.

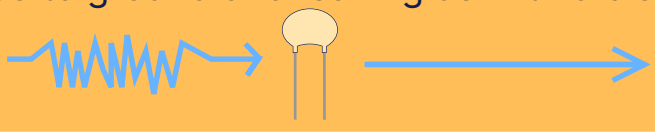


Remove Excess

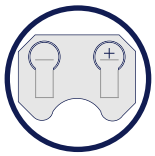
Carefully snip the excess C1 legs just above the solder ball.

What Does It Do?

A capacitor is composed of two conductive plates a short distance apart. When a DC voltage is applied across the capacitor it becomes charged and blocks the current. However when an AC (alternating current) voltage is applied, it seems to allow the current through even though no current is flowing through the gap between the plates. In reality it is charging and discharging the plates back and forth. In this circuit, C1 acts as filter, shunting AC noise to ground and leaving us with a cleaner DC signal.



Battery Holder



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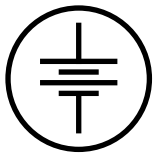

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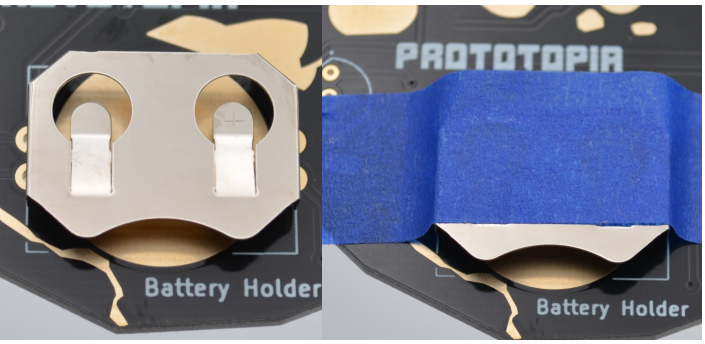
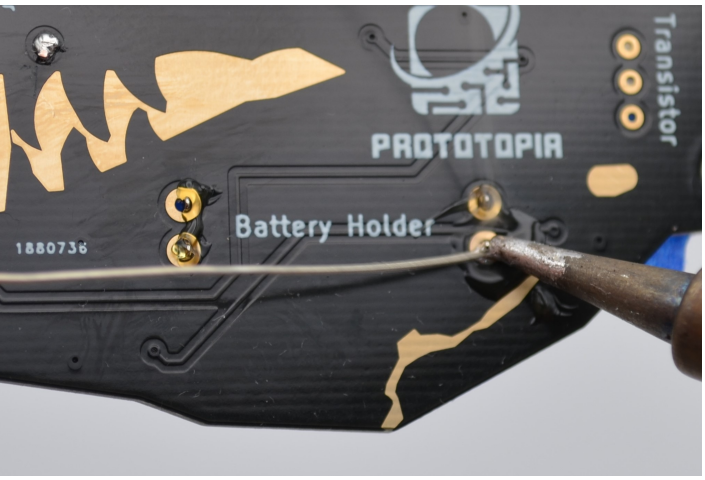


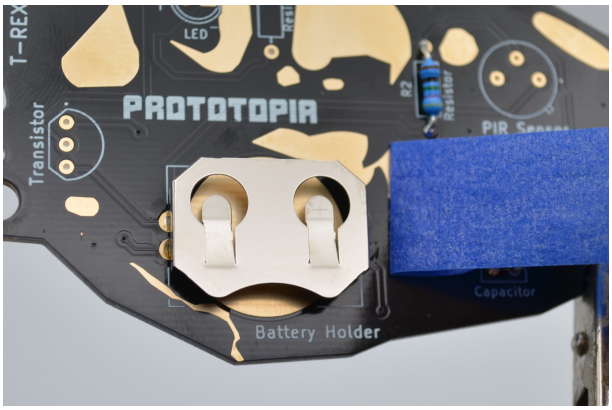
Position Battery Holder

Insert the battery holder with the curved opening facing the edge of the pcb. Use a small piece of tape to hold the part in place for soldering.



Apply Flux & Solder

Place a small amount of flux on all four pads located on the backside of the PCB. Follow soldering steps to securely fuse each leg to the respective pad. It is good if some solder flows through the hole to the other side.



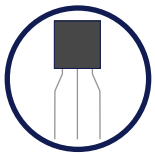
Remove Tape

Make sure to remove any tape after soldering is complete and cooled.

What Does It Do?

The battery holders job is to provide good conection to the circuit for the battery to power it. It requires a firm connection with enough strength to withstand changing the battery occasionally.

Transistor (NPN)



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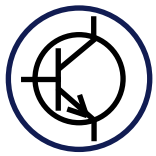

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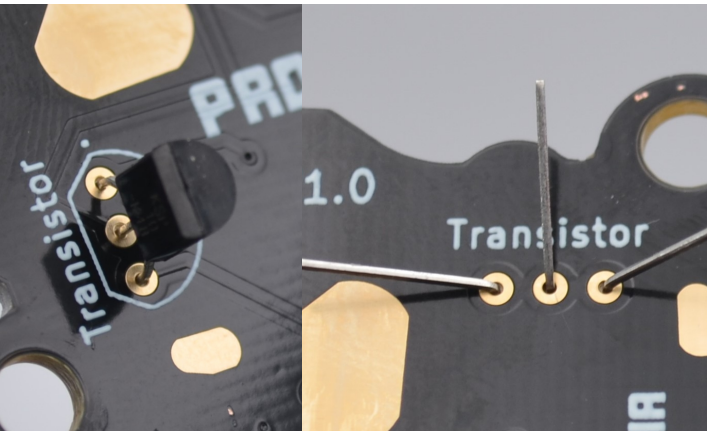
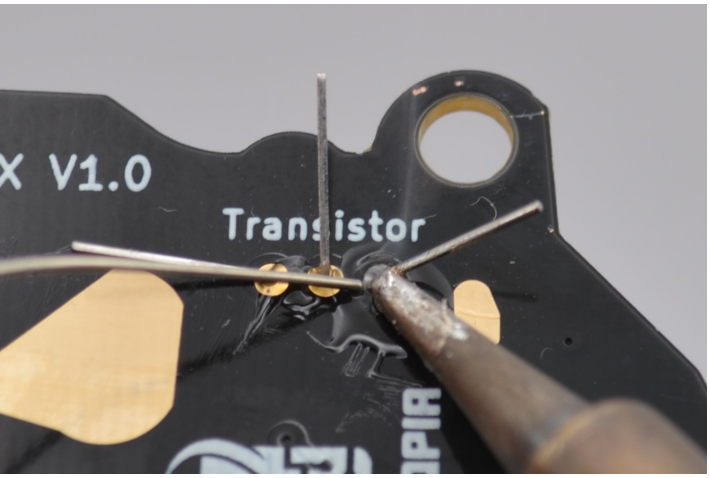
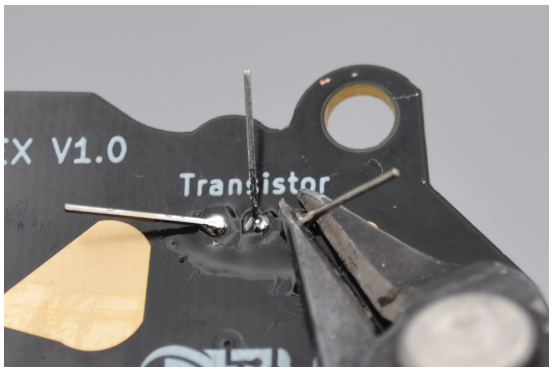






Position Transistor

Insert the transistor into the marked location on the top side of the board with the flat side facing the outer edge. On the backside, bend the legs away from eachother to snuggly hold the part in place.

Apply Flux & Solder

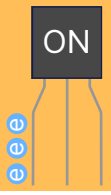
Place a small amount of flux on all three pads located on the backside of the PCB. Follow soldering steps to securely fuse each leg to the respective pad. It is good if some solder flows through the hole to the other side.

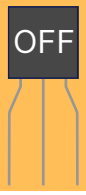
Remove Excess

Carefully snip the excess transistor legs just above the solder balls.

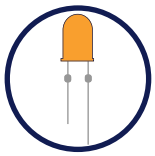
What Does It Do?

Transistors are made from semiconductor material in three layers that allow it to act as a switch. When a small voltage is applied to the base pin of an npn transistor it turns on the collector to emitter pathway allowing a larger current and voltage to flow. In this circuit, our PIR sensor provides the base voltage and turns on the LED.





LED Light



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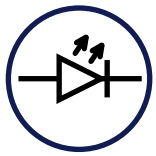
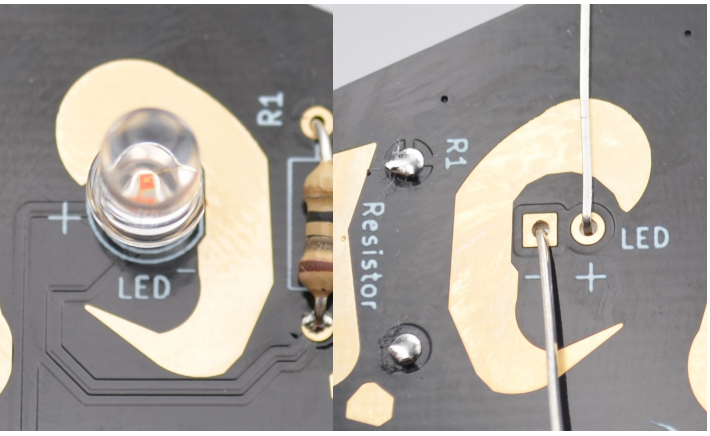
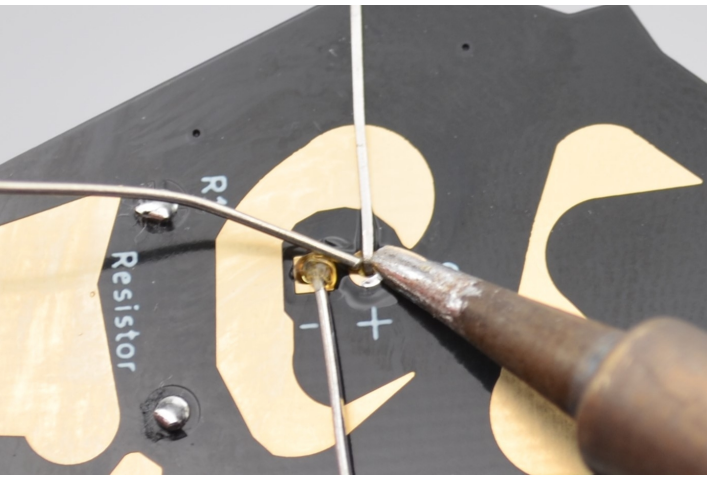
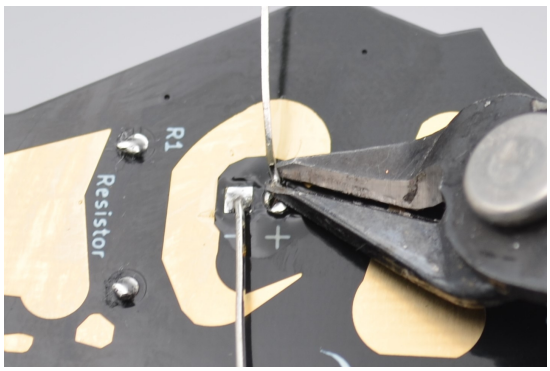


Symbol







Position LED

Insert the LED into the marked location on the top side of the board with the positive leg (longer leg) in the circular pad. On the backside, bend the legs away from eachother to snuggly hold the part in place.

Apply Flux & Solder

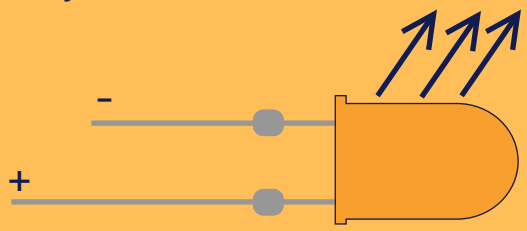
Place a small amount of flux on both pads located on the backside of the PCB. Follow soldering steps to securely fuse each leg to the respective pad. It is good if some solder flows through the hole to the other side.

Remove Excess

Carefully snip the excess LED legs just above the solder balls.

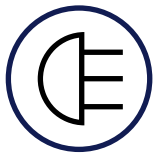
What Does It Do?

Light Emitting Diodes (LED for short) are composed of layered semiconductors that produce photons (light) when a voltage is applied. LED's are also inherintly a diode, which means a current will only flow in one direction under normal operating conditions.



Passive Infared (PIR)

Part



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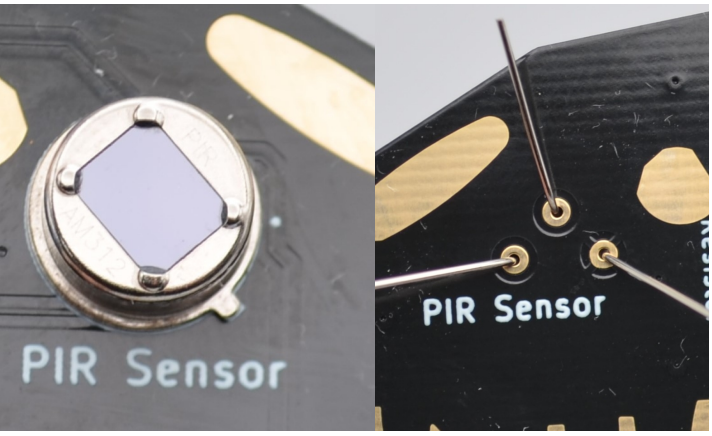
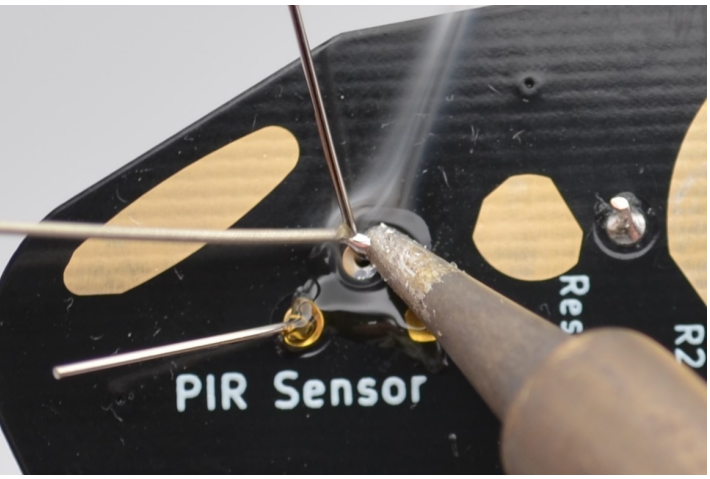


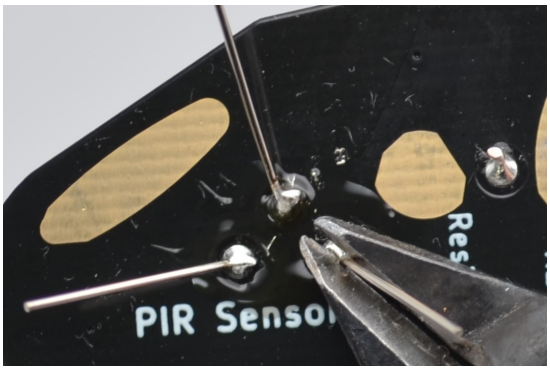
Position PIR Sensor

Insert the PIR sensor into the marked location on the top side of the board with the metal tab matching the white outline notch. On the backside, bend the legs away from eachother to snuggly hold the part in place.



Apply Flux & Solder

Place a small amount of flux on all three pads located on the backside of the PCB. Follow soldering steps to securely fuse each leg to the respective pad. It is good if some solder flows through the hole to the other side.

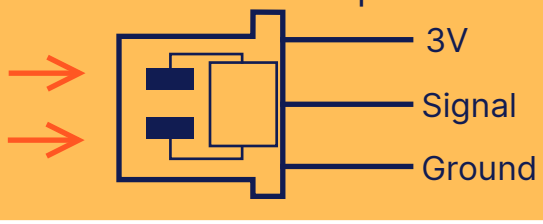


Remove Excess

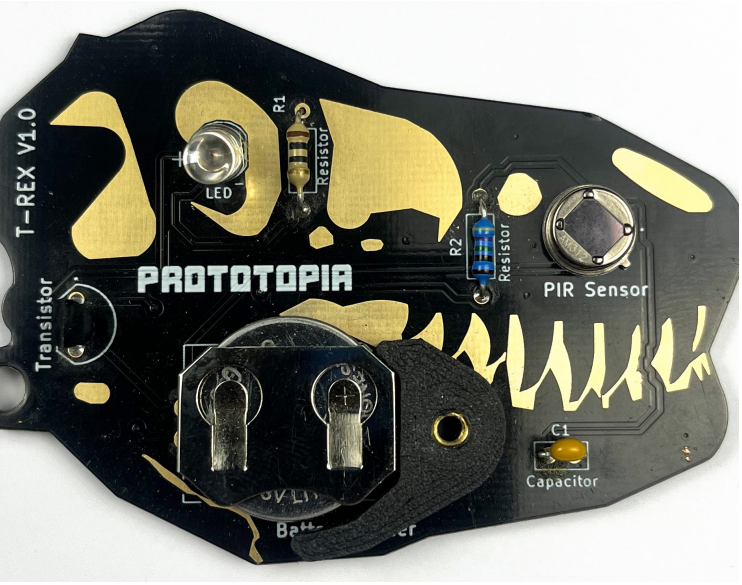
Carefully snip the excess PIR legs just above the solder balls.

What Does It Do?

The PIR or Passive Infared sensor consists of two pyroelectric crystals which produce a voltage difference when a infared light enters the lens and warms them. This particular sensor has a small circuit that holds the output signal high for a set amount of time, allowing the transistor to turn on the LED for multiple seconds.

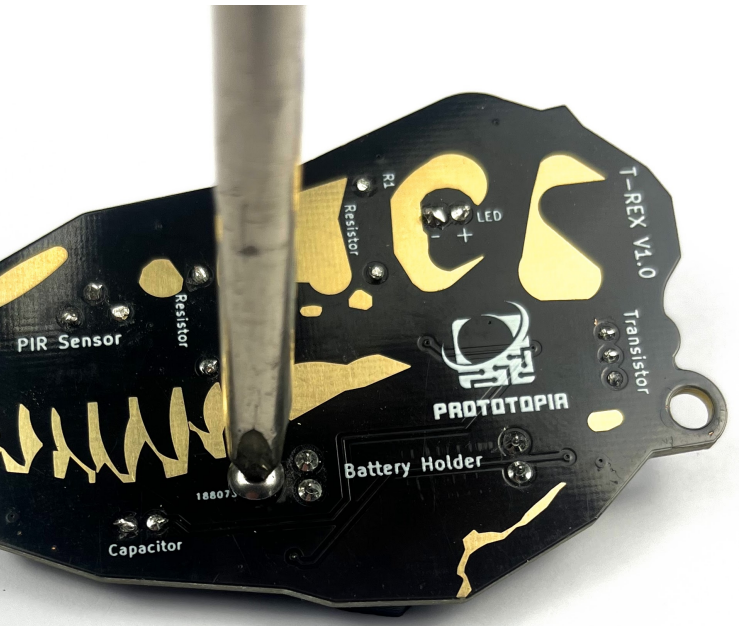


T-Rex Battery Guard



Position Battery Guard

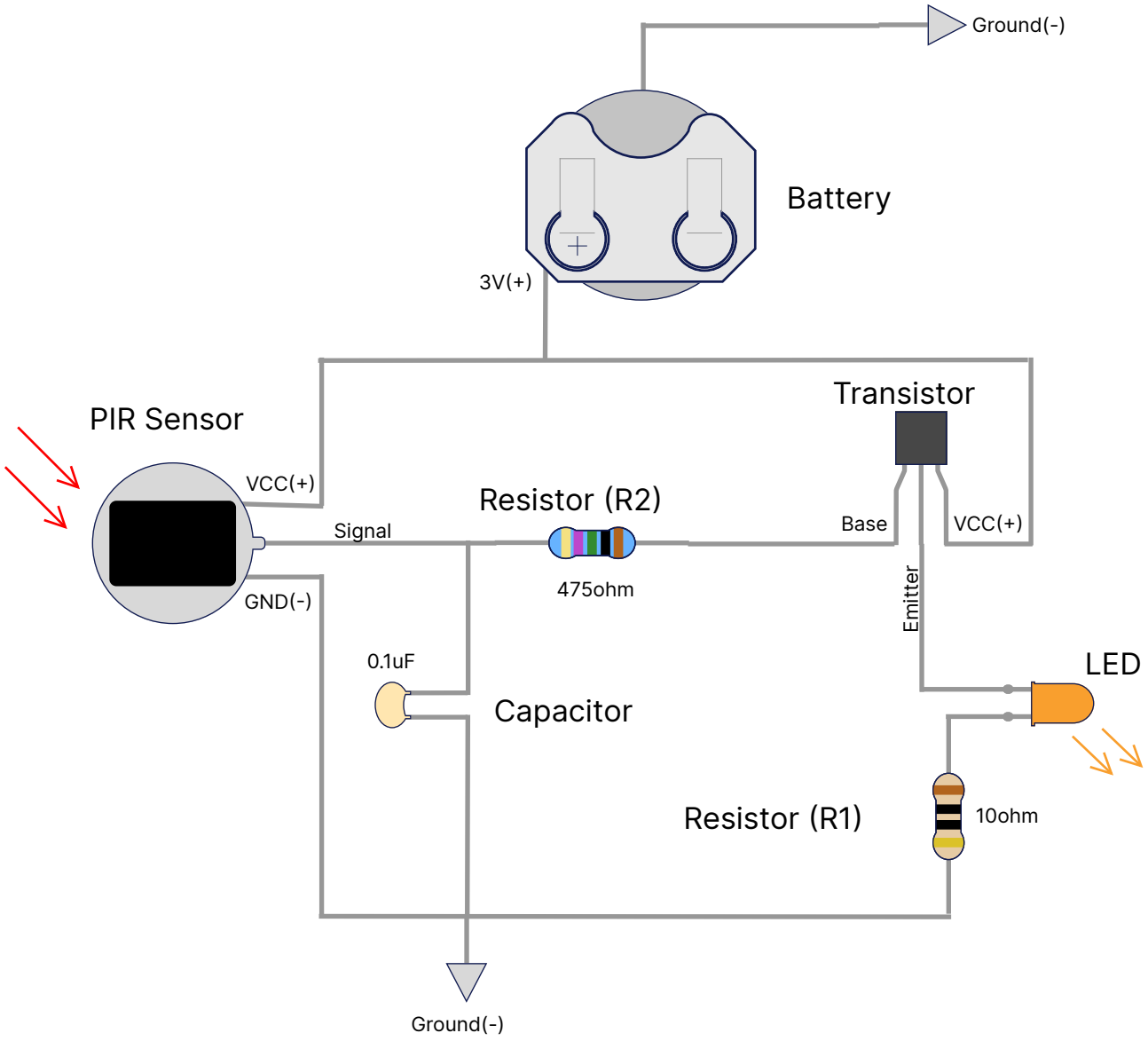
With the battery inserted. Place the plastic battery guard with the long side along the bottom of the pcb.



Insert Screw to Secure Guard

Insert the provided screw with a philips tool until the guard is held tightly to safe guard the battery.

T-Rex Schematic



How it works

Each component you solder onto this PCB plays an important role in the overall function. The PIR sensor detects changes in infrared light and sends a signal to the transistor causing it to turn on and allow the current to flow through the LED, emmitting an amber light. This PIR signal only stays on for a handful of seconds and will turn off the circuit if no furhter chagnes in inrared light are detected. This circuit makes a great night light or bag light, only turning on when a person is near enough. Try playing with different materials covering the PIR sensor such as translusent plastic or solid paper and observe the results.