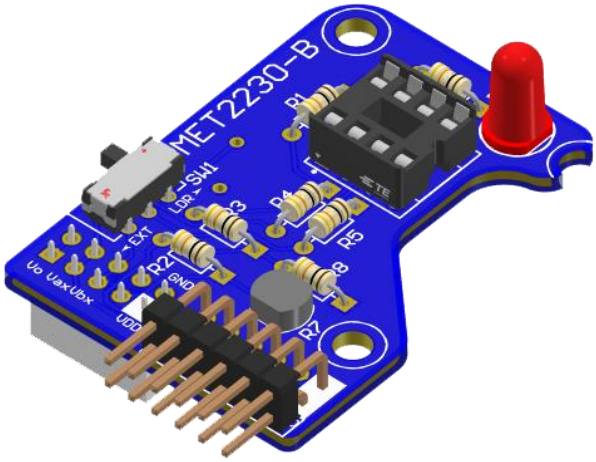
Atlantic Electro Education

MET2230 Op-Amp Light Tracker Module



- Sensitive LDR for light tracking
- Op-Amp is user replaceable
- On board switch for external connection to other signals
- Male and female headers for connecting to various development kits and other devices.

APPLICATIONS

Can be used for many applications requiring light detection, such as solar tracking, motion detection, and room light detection.

OPERATION MODES

Switch between an included LDR circuit and an external circuit by toggling the on board switch. Connect to headers for microcontroller operation. Connect to other development boards such as the EasyMx PRO, ARTY, or Arduino.

RESOURCES

Included with the board is access to datasheets, sample code, schematic, and sample projects for easy integration into the classroom.

The MET2230 circuit board is an educational tool for learning about operational amplifiers, wheatstone bridge circuits, and light dependent resistors. MET2230 utilizes resistors and an LDR configured as a wheatstone bridge, wired to a 741 Operational Amplifier from Texas Instruments. The op-amp acts as a differential amplifier, amplifying the difference between the points of the bridge. The circuit gain is dictacted by the R1 resistor mounted above the op-amp. The circuit output is wired to a light emitting diode which will change brightness depending on the level of light applied to the LDR. Typical applications for this type of circuit would be solar tracking, motion detection, and room light detection in a smart home appliance.

The board features male and female headers for connection to various embedded development boards such as the Easy Mx Pro V7 for STM32 or the Diligent Arty S7 for FPGA. There are three methods of control, labeled on the board as SW1, P1, and J1. SW1 is a switch to bypass the LDR circuit and connect to a different differential signal external to the PCB. P1 utilizes a 12-position right angled 2.54mm pitch male pin header which is capable of connecting to various development kits or a breadboard. J1 utilizes a 10-position 2.54mm pitch female pass-through socket which is capable of connecting ot various development kits. Both headers connect to MET1SHD for easy integration to an Arduino Uno, and MET2SHD for easy integration with a breadboard.

Schematic 1.0

The circuit consists of a IC operational amplifier (TI 741) with a connected light dependent resistor (LDR) in a wheatstone bridge configuration. The PCB also features a selection switch to allow connection to any other differential circuit for amplification.

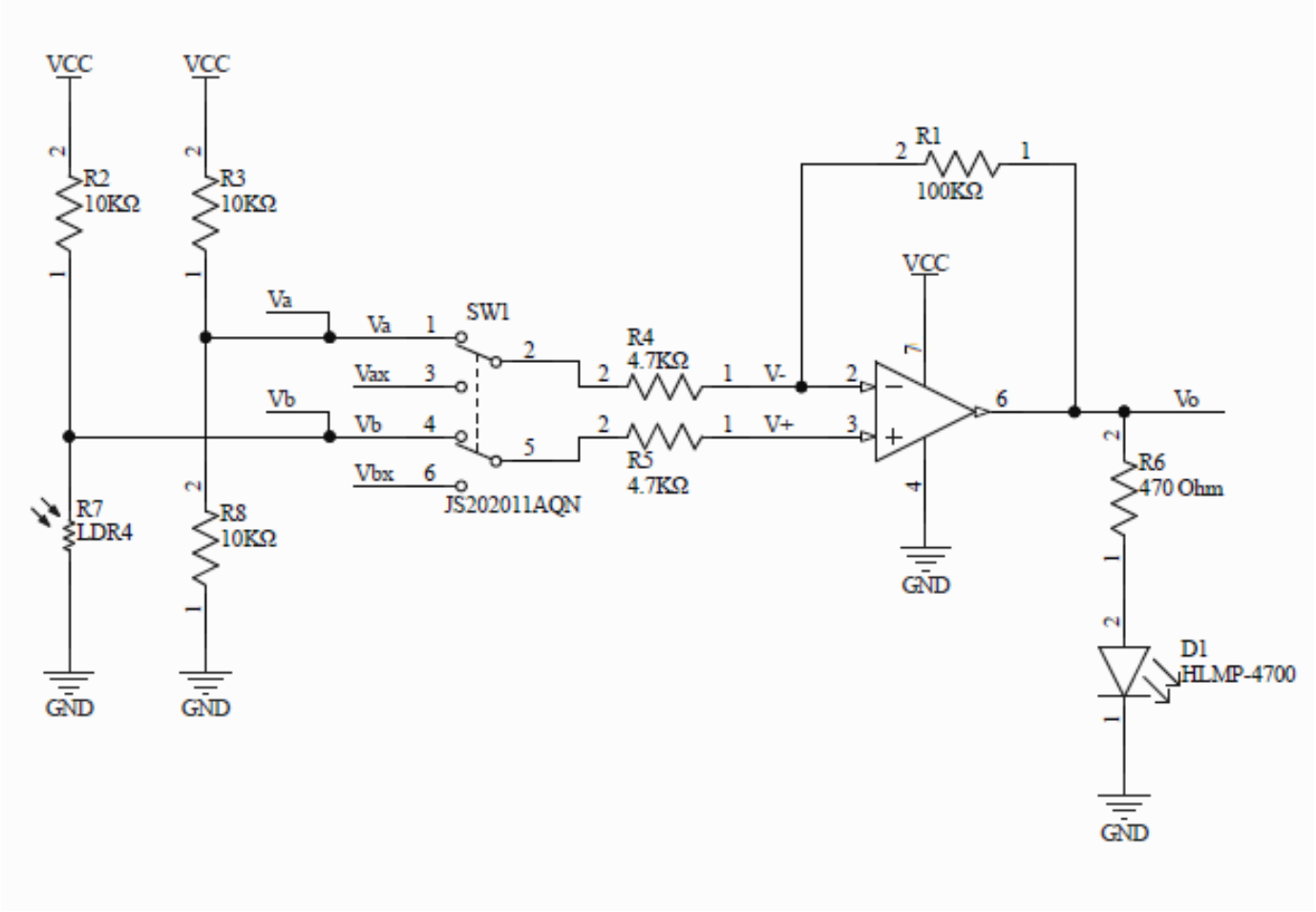
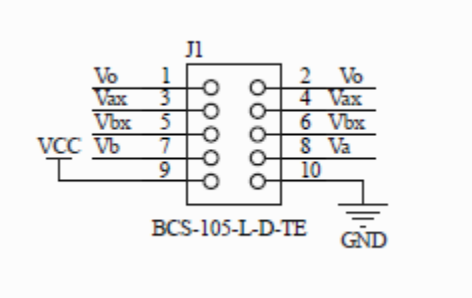


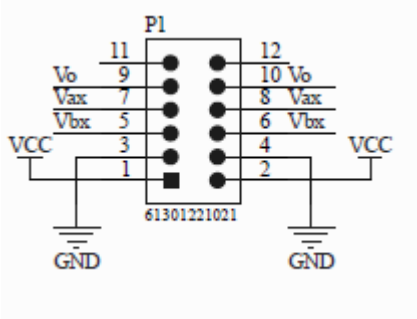
Table 2.1: Switch Functions.

Pin Name	Description
EXT	Utilize the op-amp with an externally connected circuit.
LDR	Connect the internal LDR circuit to the op-amp.

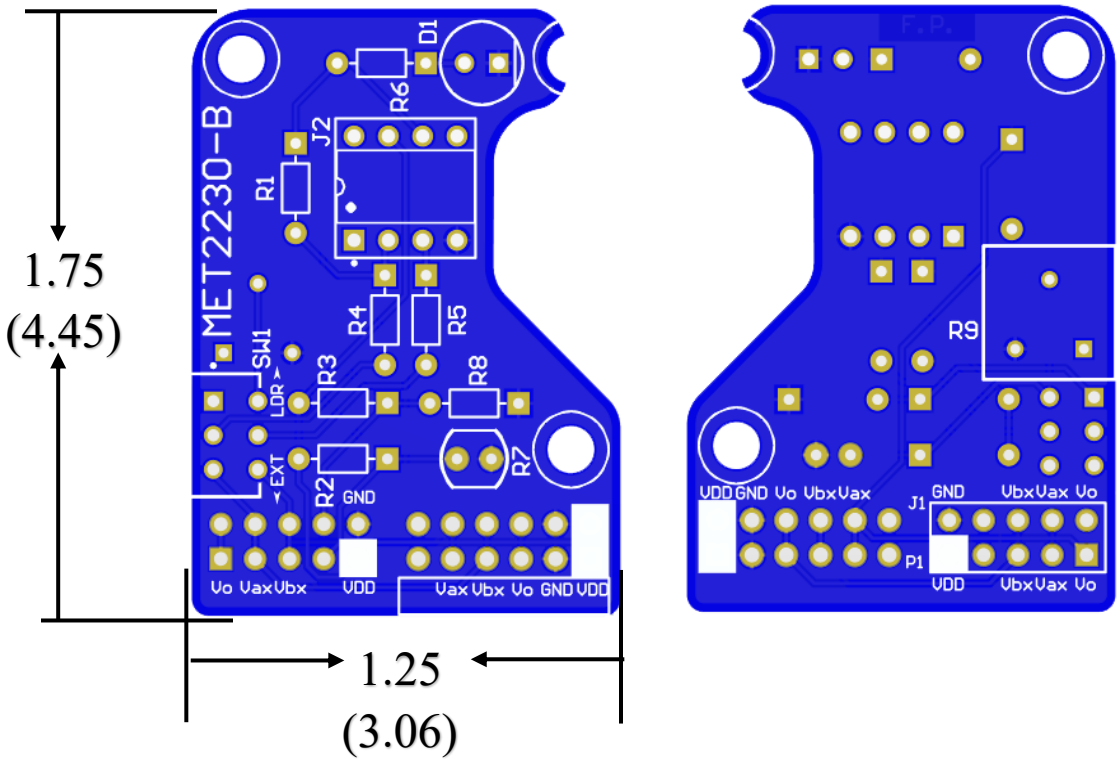
Setting the switch to LDR connects the on board wheatstone bridge circuit with LDR for light tracking. Setting the switch to EXT allows for external connection of a circuit to the Vax and Vbx pins.

Power is sent to the board through the VCC pin, and must be below 36 volts. The VCC pin is highlighted in white on the PCB, as well as labeled in Figure 3 and Figure 4. The switch functions for external or LDR mode operation are outlined in Table 1. The male header is fully compatible with breadboard connections without the need for an external adapter.

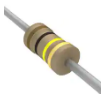
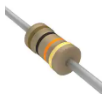
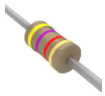
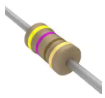




Mechanical Drawing 3.0



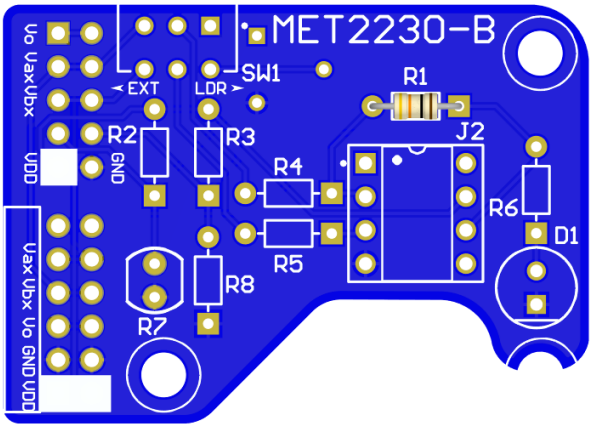
Materials List 4.0

Part Index	Designators	Manufacturer Number	Description	Image
001		MET2230	MET2230 Bare PCB	
002	R1	CF18JT100K	RES 100K OHM 5% 1/8W AXIAL	
003	R2, R3, R8	CF18JT10K0	RES 10K OHM 5% 1/8W AXIAL	
004	R4, R5	CF18JT4K70	RES 4.7K OHM 5% 1/8W AXIAL	
005	R6	CF18JT470R	RES 470 OHM 5% 1/8W AXIAL	
0006	R7	NSL-5112	PHOTORESISTOR 550NM 6-14K OHM	
007	J2	A 08-LC-TT	CONN IC DIP SOCKET 8POS TIN	
008	SW1	JS202011AQN	SWITCH SLIDE DPDT 300MA 6V	
009	D1	LTL-4223	LED RED DIFFUSED	
010	J1	RS2-10-G	RECEPTACLE STRIP 10P 2.54MM PITC	
011	P1	PH2RA-12-UA	CONN HEADER R/A 12POS 2.54MM	
012	U1	UA741CP	IC OPAMP GP 1 CIRCUIT 8DIP	

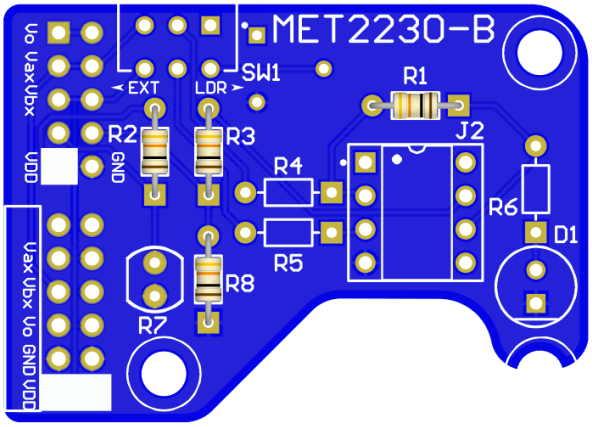
Assembly Instructions 5.0

5.1 Gather all components and lay them out in the order listed on the Kit Materials List. It is recommended to install parts in the order they are listed in.

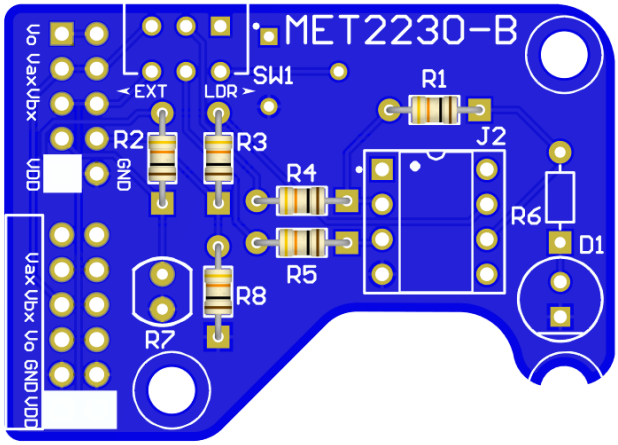
5.2 Identify the part designator R1 on the PCB. Bend the leads of the resistor so they align with the holes and mount the component so it is sitting flat on the top of the PCB. Solder per Appendix 1.



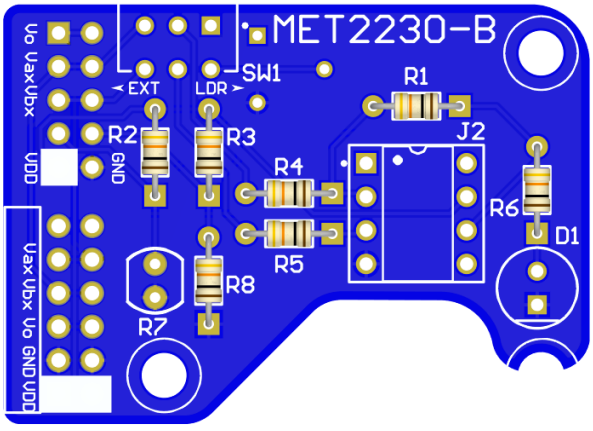
5.3 Identify the part designator R2, R3, and R8 on the PCB. Bend the leads of the resistors so they align with the holes and mount the components so they are sitting flat on the top of the PCB. Solder per Appendix 1.



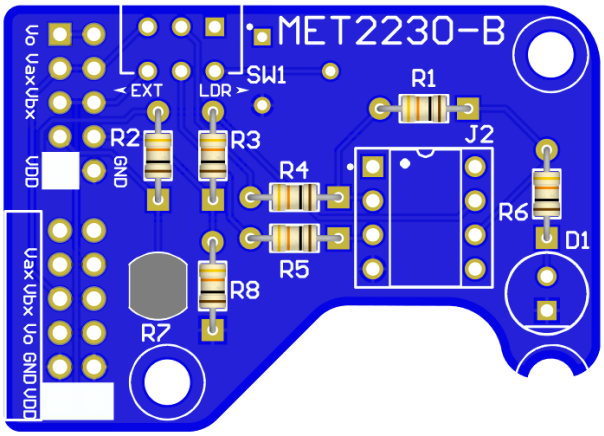
5.4 Identify the part designator R4 and R5 on the PCB. Bend the leads of the resistors so they align with the holes and mount the components so they are sitting flat on the top of the PCB.



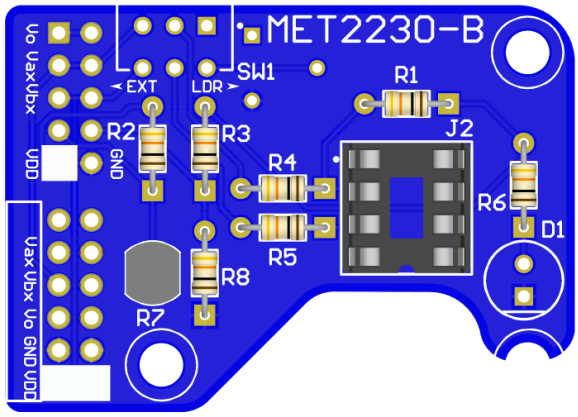
5.5 Identify the part designator R6 on the PCB. Bend the leads of the resistor so they align with the holes and mount the component so it is sitting flat on the top of the PCB. Solder per Appendix 1.



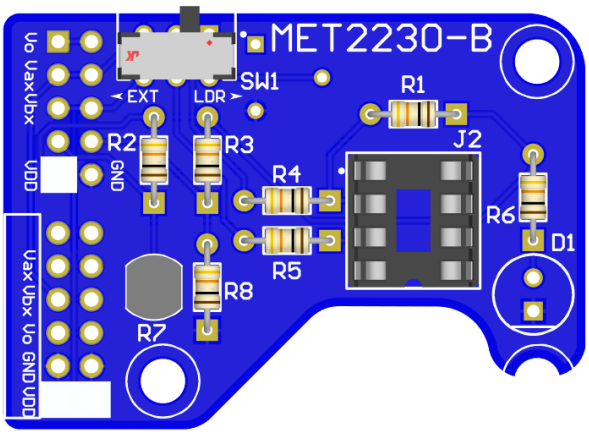
5.6 Identify the part designator for R7 and mount the LDR to the PCB. Solder per Appendix 1.



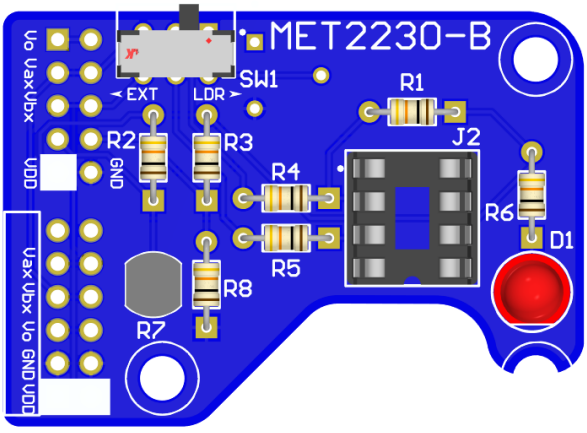
5.7 Identify the part designator for J2 and mount the connector to the PCB. Solder per Appendix 1.



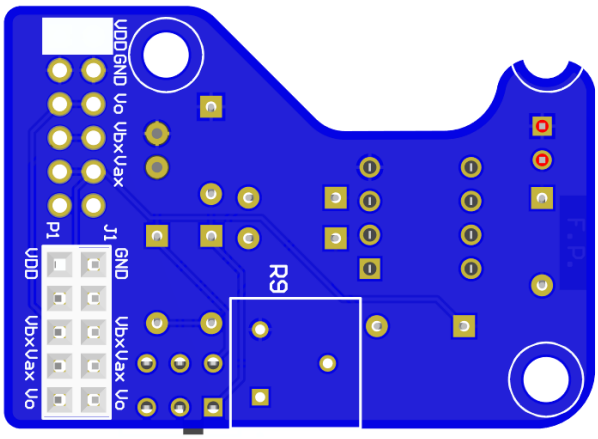
5.8 Identify the part designator for SW1 and mount the switch to the PCB. Solder per Appendix 1.



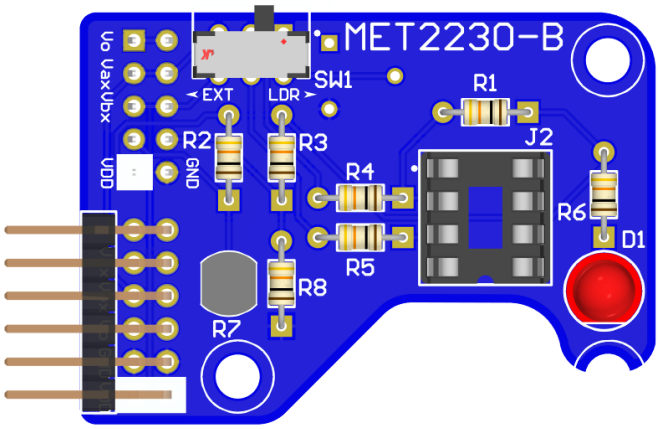
5.9 Identify the part designator for D1 and mount the LED to the PCB. Solder per Appendix 1.



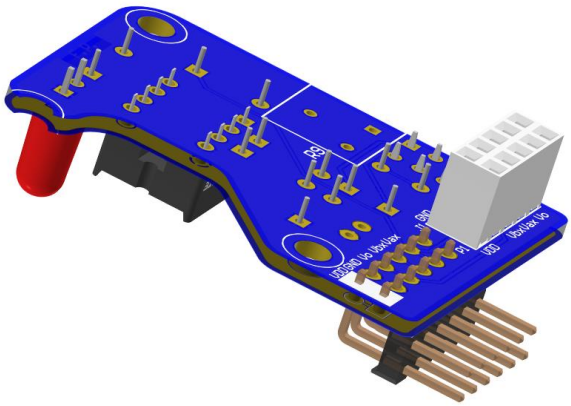
5.10 Identify the part designator for J1 and mount the connector to the PCB. Note that the designator is on the bottom of the PCB. Solder per Appendix 1.



5.11 Identify the part designator for P1 and mount the connector to the PCB. Note that the designator is on the bottom of the PCB. Solder per Appendix 1.



5.12 Trim excess leads from all components such that they do not protrude more than 1/8” from the bottom of the PCB.



5.13 Brush or wipe away any residual flux or solder using a brush or q tip and IPA alcohol. Trim the lead to the height of the mound. Inspect for incomplete solder.

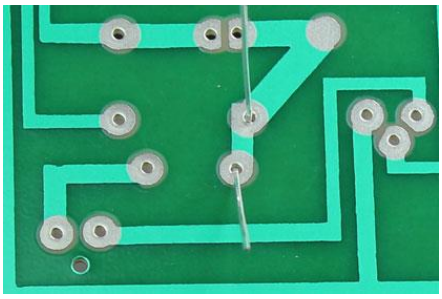
Solder can be removed by using a desoldering braid to remove the bonding solder. Place the braid on top of the joint to be removed. Head the soldering iron and touch the tip to the top of the braid. After waiting a sufficient amount of time, the solder will be removed.

Congratulations! You have completely assembled the MET2230 PCB.

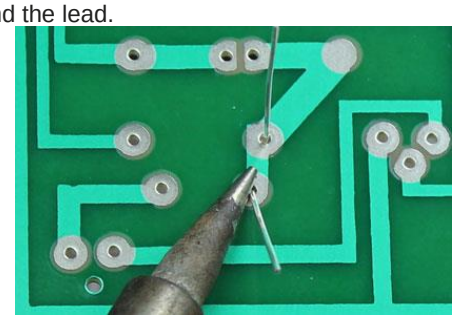
6.1 Soldering

Soldering is the process of joining two or more electronic parts together by melting solder around the connection. Solder is a metal alloy and when it cools it creates a strong electrical bond between the parts. Soldering can be completed by following these four steps.

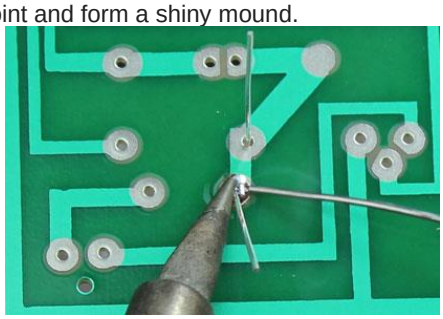
STEP 1: Mount the Component.
Insert the leads of the component into the holes of the circuit board. Flip the board over to expose the soldering pad.



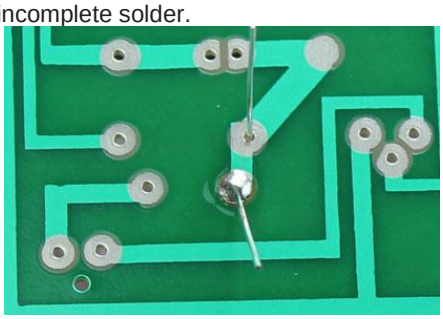
STEP 2: Heat the Joint.
Touch the tip of the iron to the pad and the component lead at the same time. Hold the iron in place for 3 – 4 seconds to heat the pad and the lead.



STEP 3: Apply Solder to the Joint.
Continue holding the soldering iron on the pad and the lead, then touch solder to the joint. Apply enough solder to completely cover the joint and form a shiny mound.



STEP 4: Clean the Joint.
Brush or wipe away any residual flux or solder using a brush or q tip and IPA alcohol. Trim the lead to the height of the mound. Inspect for incomplete solder.



Solder can be removed by using a desoldering braid to remove the bonding solder. Place the braid on top of the joint to be removed. Head the soldering iron and touch the tip to the top of the braid. After waiting a sufficient amount of time, the solder will be removed.