Pico Load

Assembly and User Guide

2 Amp Adjustable Electronic Load
30V and 20 Watts Max

Powered by:
9V Battery

Pico Load is a convenient constant current load for testing batteries and power supplies. The digital readout makes setup simple.

ubld.it

Support: http://ubld.it/pload

Manual: v2.0

Kit Version: v2.0

Tool Checklist

1. Soldering Iron

We recommend the Hakko FX888 or similar iron with a chisel tip.

2. Wire Cutters

Small cutters for clipping excess wire leads after soldering.

3. Solder

Electronic solder is used for soldering parts to the PCB.

4. Multimeter

Multimeter for verifying component values and adjusting the circuit.

5. Wire Strippers

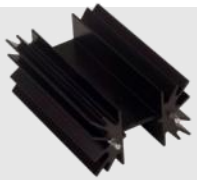
18 AWG Wire Strippers for removing insulation from wires.

CAUTION

EYE PROTECTION REQUIRED BEYOND THIS POINT

STEP 1: Check the BOM

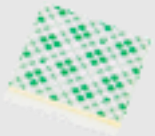
BOM is short for Bill of Materials. Check each line item as you verify the required quantity of components.

✓	Line	Designator	Description		Required	Kit Qty
☐	1	B1	9V Battery Holder		1	1
☐	2	C1, C3, C4	.1uF 50V Capacitor		3	3
☐	3	C2	100pF 50V Disc Capacitor		1	1
☐	4	D1	0 Ohm ¼ Watt Resistor		1	1
☐	5	HS1	Black Anodized Heat Sink		1	1
☐	6	J1, J2	Banana Jack		2	2

STEP 1: Check the BOM (continued)

✓	Line	Designator	Description		Required	Kit Qty
☐	7	LED1	3 Wire 10V Digital Meter		1	1
☐	8	Q1	IRF520		1	1
☐	9	R1	1 Ohm 5 W 1% Resistor		1	1
☐	10	R2	100 Ohm 1/4W Resistor		1	1
☐	11	R3, R4	1K 1/4W Resistor		2	2
☐	12	R5	2K Ohm Potentiometer		1	1
☐	13	R6	2.2K Ohm 1/4W Resistor		1	1

STEP 1: Check the BOM (continued)

✓	Line	Designator	Description		Required	Kit Qty
☐	14	S1	Slide Switch		1	1
☐	15	U1	LM358N		1	1
☐	16	U2	L78L05ACZ		1	1
☐	17	M1	TO-220 Heat Sink Assembly		1	1
☐	18	Tape	Double Sided Tap		1	4

Warning:

When in operation this device can exceed temperatures of 200°F (93°C) which can cause sever burns and even start fires. Make sure to mount your finished Pico Load to a stable non- flammable base. Use standoffs to prevent solder joints from shorting to a conductive base.

STEP 2: Inserting the first component

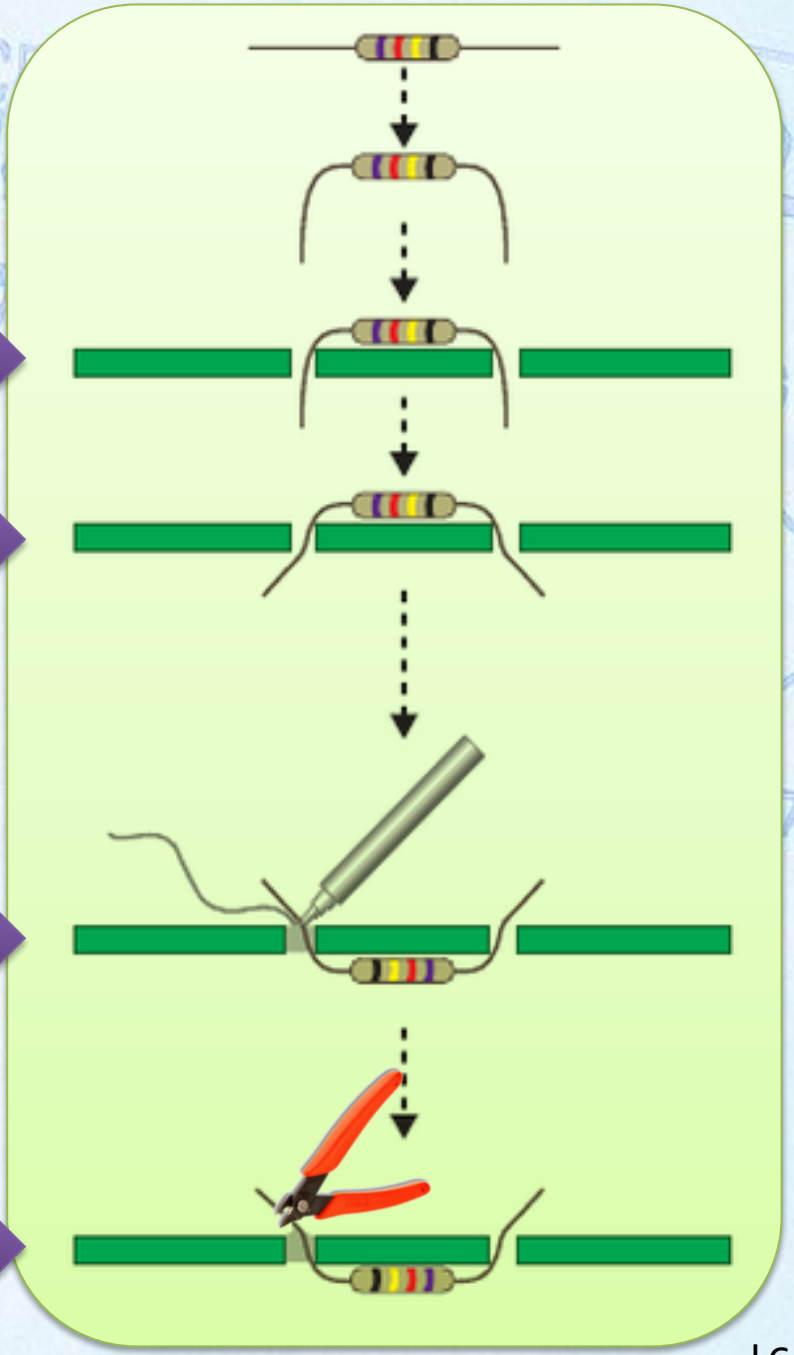
Before we locate the first component let's take a minute to review the proper way to insert and solder the components to your circuit board.

Insert the components into the circuit board.

Bend the component leads to hold the component in place while soldering.

Flip the board and solder the component leads .

Trim the component leads at the top of the solder joint.



STEP 2b: Inserting the first component

Solder the 1 Ohm 5 Watt Resistor into R1.

The first component to locate is a one 1 Ohm 5 Watt Resistor (line #9).

Warning:

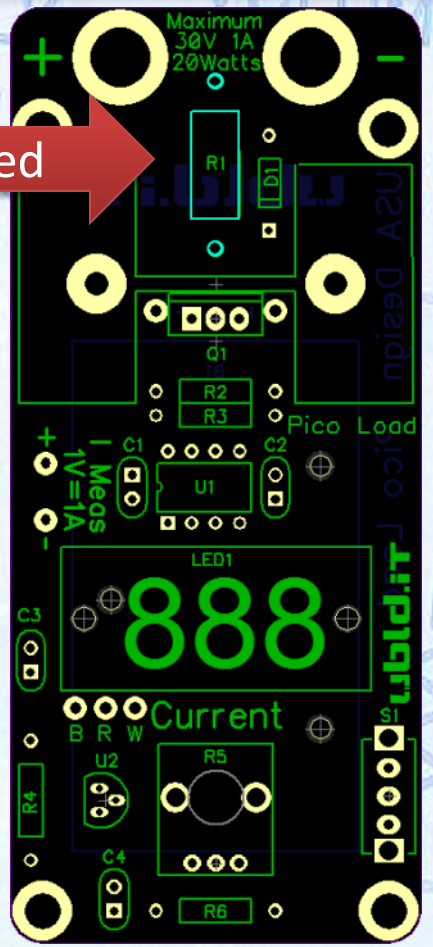
This resistor is rated for 5 Watts and temperatures as high as 250°C.

With a 2 Amps going through a 1 Ohm resistor, Ohm's Law ($P = R \times I^2$) tells us we are operating at 4 Watts. Also, we have measure the external temperature to be about 140°C

Under this condition we have observed it smoking. This smoke eventually stops and the device continues to operate as normal.

Avoid adjusting the current setting above 2 Amps.

Highlighted

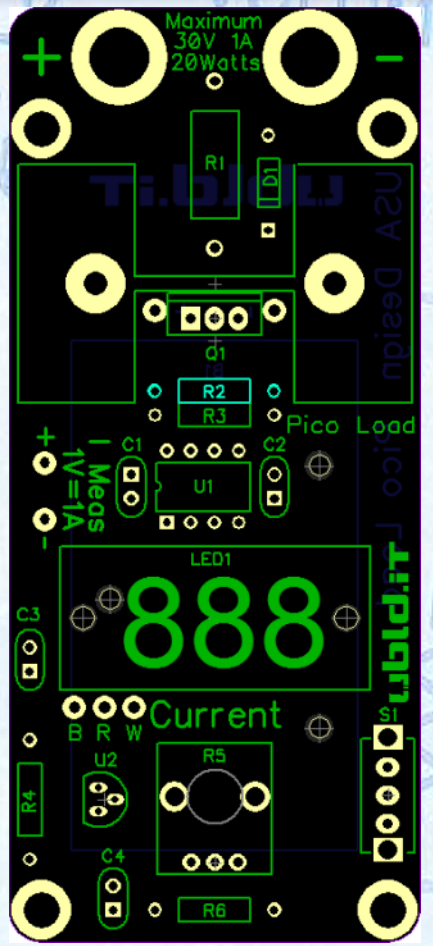


Axial Lead Resistors such as the ones used in this kit are color coded. Compare the resistor you are installing to the images shown in each step. Also double check the values with a multimeter on the ohm setting.

STEP 3: Insert the 100 Ohm Resistors

Solder the 100 Ohm ¼ Watt Resistor into R2.

Locate one 100 Ohm ¼ Watt Resistor (line #10).

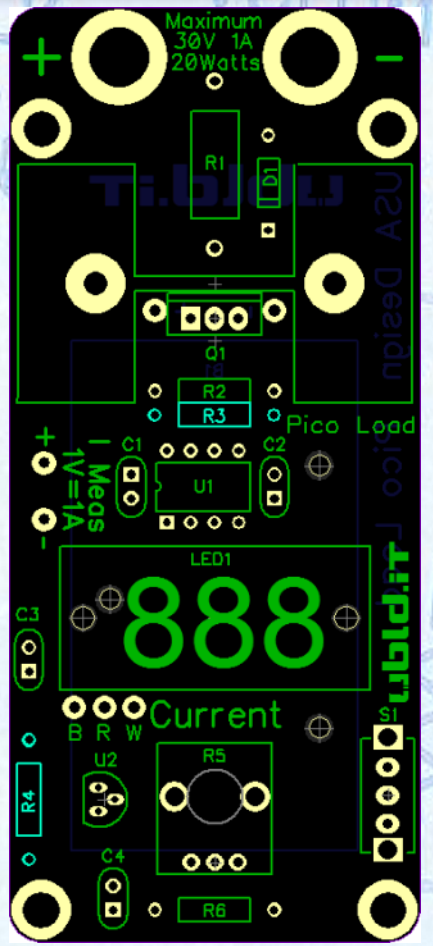


Take pride in your work. Take your time to bend all the components leads to 90 degree angles using needle nose pliers.

STEP 4: Insert the 1K Ohm Resistor

Solder the 1K Ohm ¼ Watt Resistors into R3, R4.

Locate two 1K Ohm ¼ Watt Resistors (line #11).

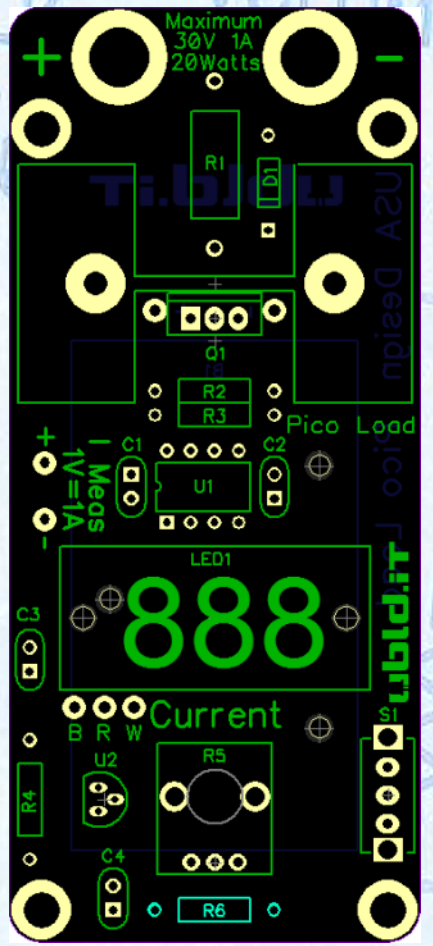


It's not necessary for resistors, but inserting them all in the same direction will make your board look that much better. Use the last band (tolerance band) as a reference for the orientation.

STEP 5: Insert the 6.8K Ohm Resistors

Solder the 2.2k Ohm ¼ Watt Resistor into R6.

Locate one 2.2k Ohm ¼ Watt Resistors (line #13).

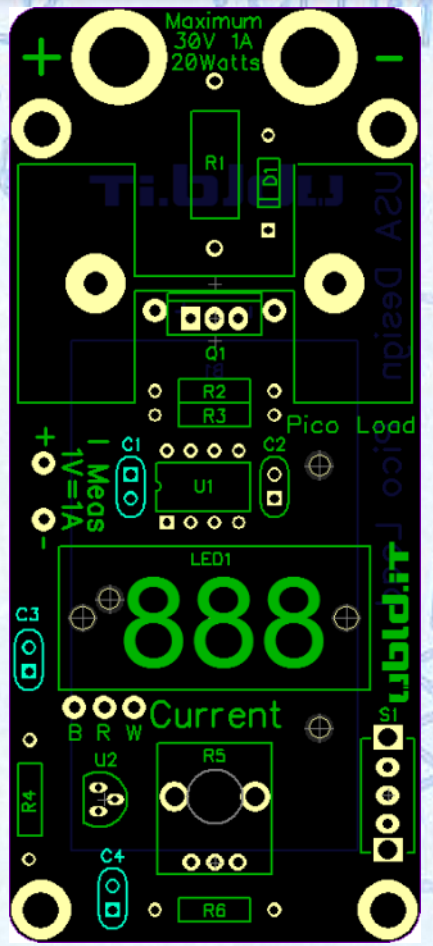


For better looking solder joints use Kester #2331-ZX water soluble flux pen on every pad before applying solder. Flux removes oxidation and allows heat to transfer from your iron to the pad.

STEP 6: .1uF 50V Disc Capacitors

Solder the .1uF 50V Capacitors into C1, C3, and C4

Locate three .1uF 50V Capacitors (line #2).

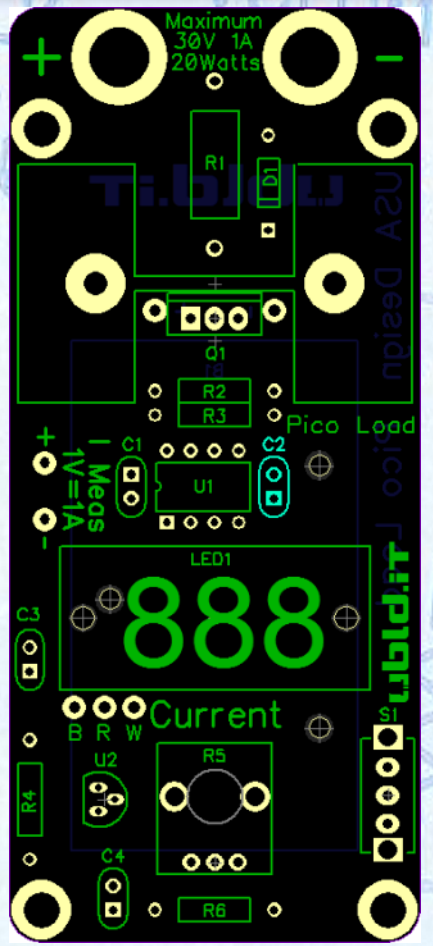


Ceramic capacitors are not polarized so orientation doesn't matter.

STEP 7: Insert the 100pF 50V Capacitor

Solder the 100pF 50V Disc Capacitor into C2.

Locate one 100pF 50V Disc Capacitor (line #3).

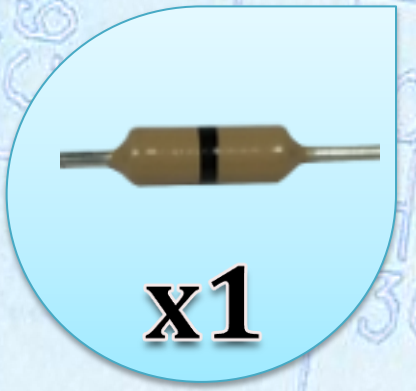


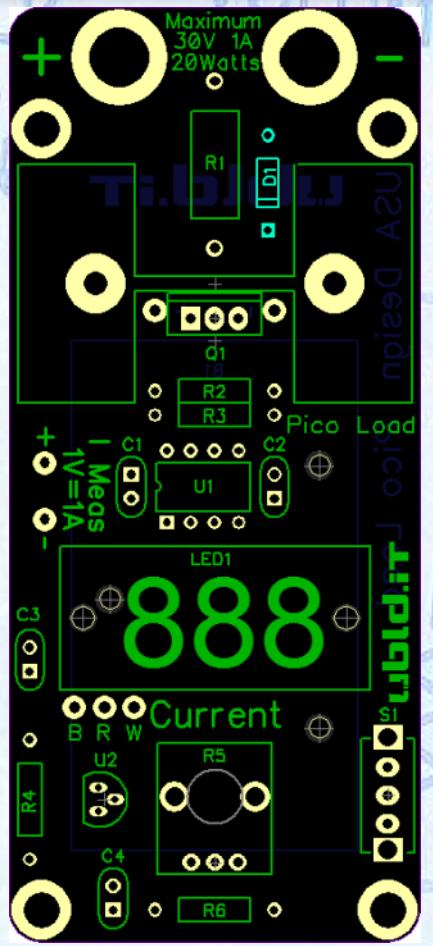
Capacitors store an electrical charge much like your body builds and stores static. It's also good to know that since a capacitor takes time to charge and discharge it's said that it opposes changes in voltage.

STEP 8: Insert the 1N914

Solder the 0 Ohm ¼ Watt Resistor into D1.

Locate one 0 Ohm ¼ Watt Resistor (line #4).



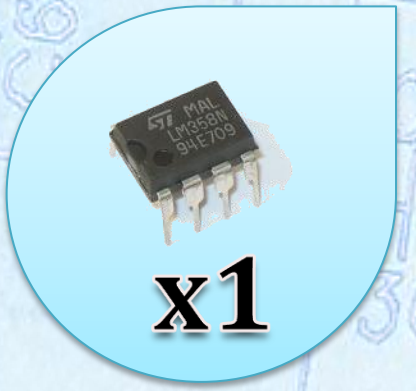


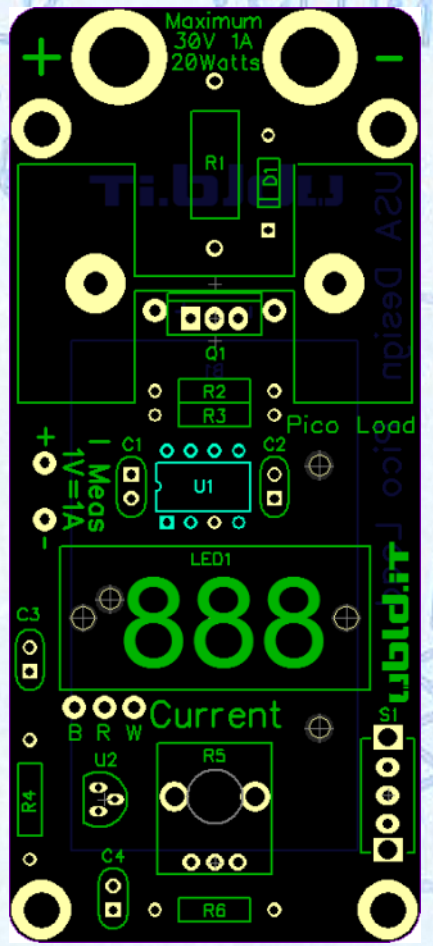
Resistors are typically marked with the designator R. However, in this case the original diode was replaced with a 0 Ohm Resistor. This part substitution is just one of a few which has allowed us to increase current rating on the Pico Load.

STEP 9: Insert the LM358N

Solder the LM358N into U1.

Locate one LM358N (line #15).



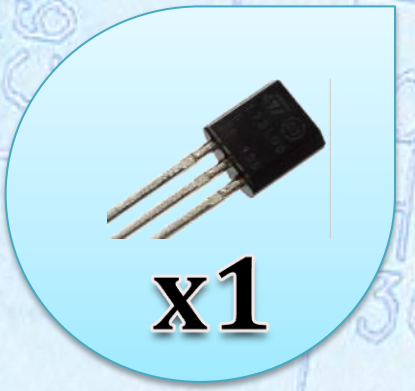


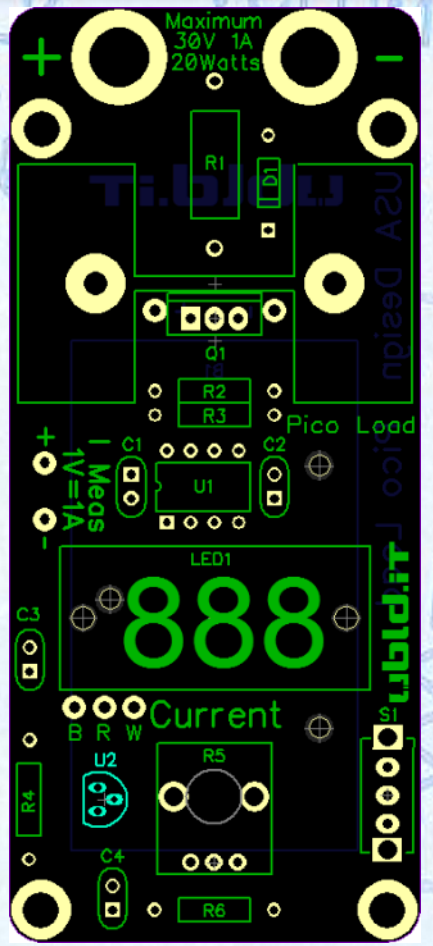
Pin one of the IC is marked with a small indentation in the package. Orient the package indentation with the silkscreen indentation.

STEP 11: Insert the L78Lo5ACZ

Solder the L78L05ACZ U2

Locate one L78L05ACZ (line #16).





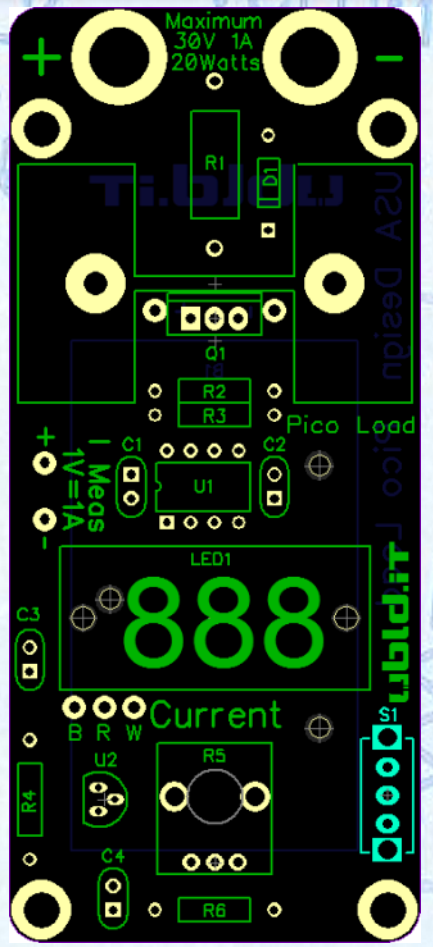
U2 is a 5V Regulator in a TO-92 package. This small package also has current limiting and thermal protection making virtually indestructible.

STEP 12: Insert the Slide Switch

Solder the Slide Switch into S1

Locate one Slide Switch (line #14).

x1

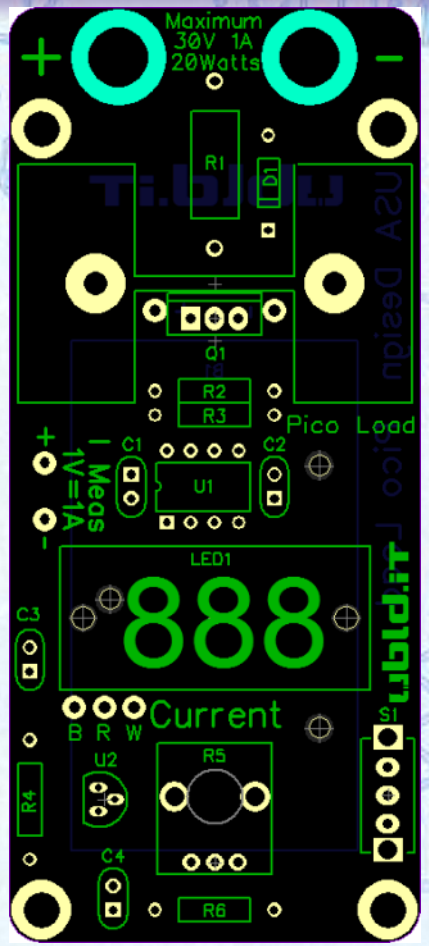


SW is used to turn the circuit on and off. It's a good idea to turn R5 full counter clockwise (down) before turning power on.

STEP 14: Insert the Banana Jacks

Insert the Red Banana Jack in the hole marked with a + and the Black Banana Jack in the hole marked with a -. Secure with the nuts supplied.

Locate two Banana Jacks
(line #6).

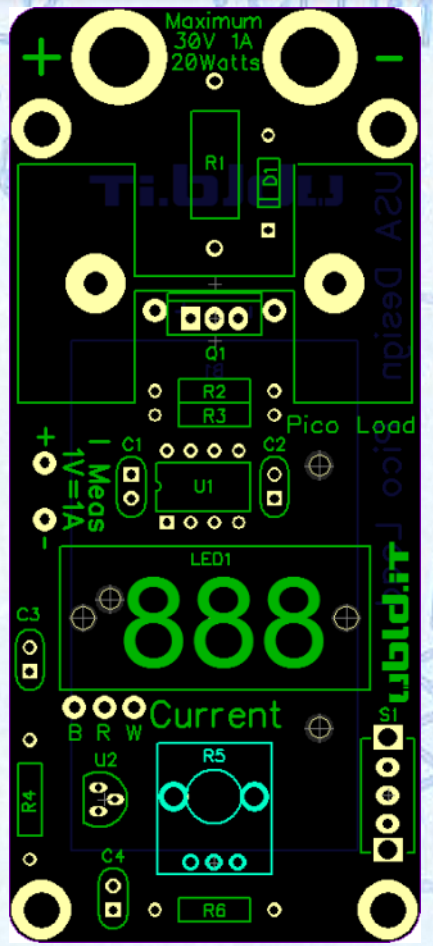


The banana jacks are where you will attach your power source to be tested.

STEP 15: Insert the 2k Ohm Potentiometer

Solder the 2k Ohm Potentiometer into R5

Locate one 2k Ohm Potentiometer (line #12).

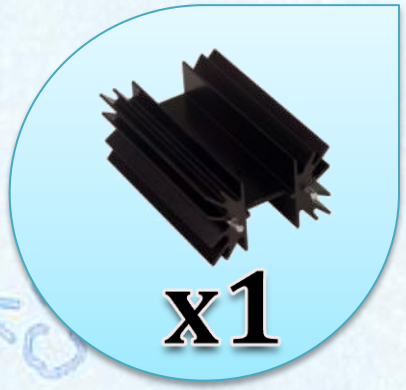


R5 is used to set the desired current draw.

STEP 16: Insert the 4.7uF Capacitor

Attach Q1 (IRF520) to HS1 (Heat Sink) using M1 (TO-220 Mounting Hardware). First place the thermal pad between Q1 and the Heat Sink. Then insert the 3mm screw through the white plastic insulating bushing and insert that into Q1. Attach Q1 to the Heat Sink with the leads towards the mounting pins of the Heat Sink. Secure the assembly with the 3mm Hex Nut leaving it a little loose until everything has been soldered into the PCB.

Q1



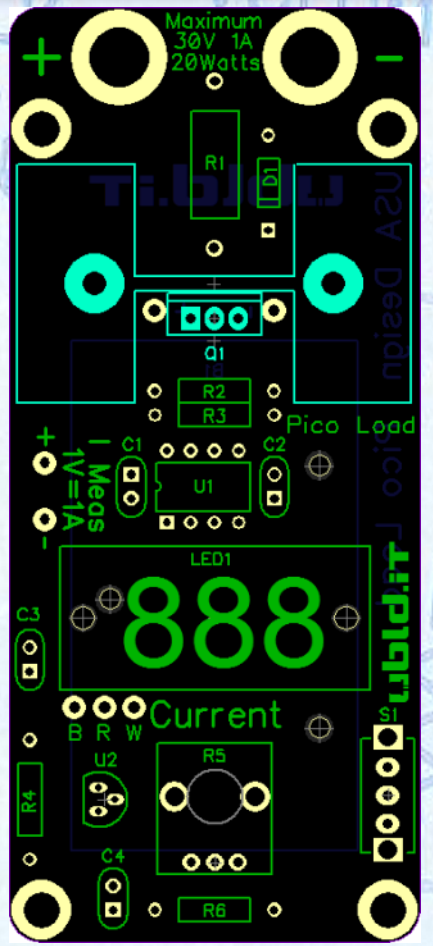
HS1

M1

Finish tightening the screw and nut after your solder the assembly to the PCB. This will make for easier alignment.

STEP 17: Insert the Q1 and HS1 Assembly

Solder the Q1 and HS1 Assembly into the respective holes.

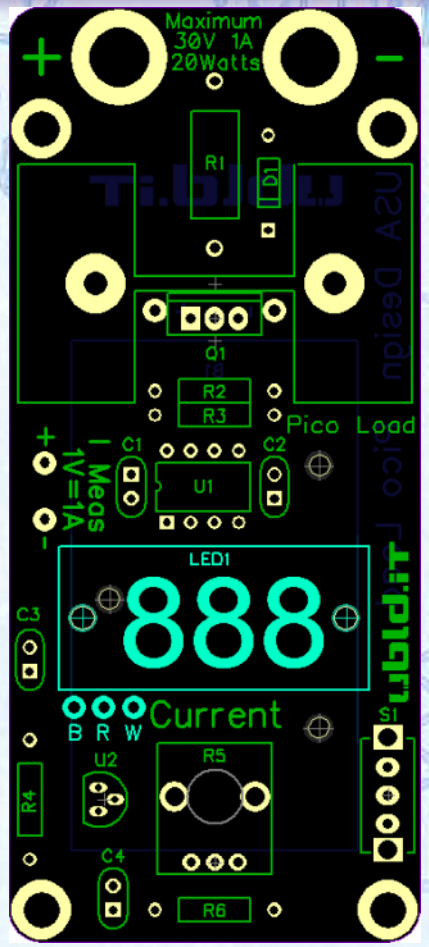


The best way to clean your assembled board is to use an Ultrasonic Cleaner with De-ionized water heated to 60c.

STEP 18: Install 3 Wire Digital Meter

Solder LED1 (Digital Meter) to B (Black), R (Red), and W (White) and adhere it to the circuit board with the provided double sided tape.

Locate one 3 Wire Digital Meter and Double Sided Tape (line #3).



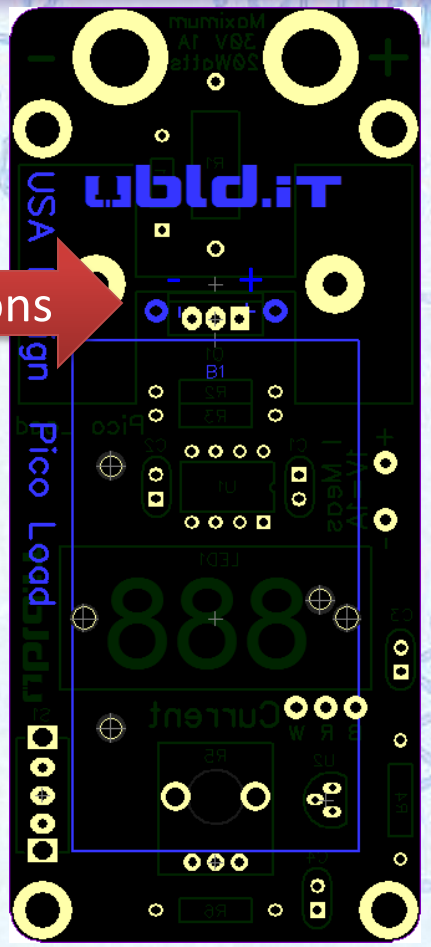
Cut the wires short enough but not too short. A little slack is better than having your display off center.

STEP 19: Insert the 9V Battery Holder

Install the Battery Holder into B1. You will probably want to cut the wires very short . Attach the battery holder with double sided tape.

Locate one 9V Battery Holder

Battery Connections



Warning: Make sure your battery is good. The digital meter is powered directly from the 9V battery and low voltage will throw off the readings.

Final Assembly

Visit the Community Support Forums:
http://ubld.it/pload

Warning:

When in operation this device can exceed temperatures of 200°F (93°C) which can cause sever burns and even start fires. Make sure to mount your finished Pico Load to a stable non-flammable base. Use standoffs to prevent solder joints from shorting to a conductive base.

Your final assembly should look like this. Double check all polarized components such as D1.