



BCIT
School of Energy

Electronic Fabrication
DC Power Supply



PCB Assembly Guidelines
Prepared by: M. LeNoble

Shop Safety

When working in the shop...

- Safety glasses must be worn at all times. (No exceptions)
- Closed toed shoes are to be worn.
- Wear close fitting clothing that cannot interfere with work.
- Tie back long hair so that it cannot interfere with work.



PCB Assembly

- The PCB assembly begins the DC Power Supply manufacture with the steps needed to attach the electronic components to the printed circuit board.
- The following tools are required for this phase of work:

Student Supplied	Shop Supplied
Safety glasses*	Pb-free solder station
Precision side cutters	Work mat (non-ESD)
Needle-nose pliers	SAC Pb-free flux core solder
	De-soldering kit
	Magnifying lens station

*Must be worn at all times when working in the shop.

- A practice kit containing a PCB and components will be provided for solder training / practice.

Reference the component locator drawing for correct placement of parts on the PCB.

PCB Assembly

- The DC Power Supply PCB assembly requires hand soldering components using Pb-free solder.
- Pb-free solders have higher melting points than traditional Pb solders. Tip temperatures start at about 315°C (600°F) for Pb solders and 350°C (660°F) for Pb-free solders.

Pb-free soldering is more difficult to perform than traditional Pb soldering.



*IPC Training Video: IPC-142C, Introduction to Hand Soldering
(Available in class / lab only)*

- **Preparing the tip - Tinning**
 1. Gently wipe the tip (2 – 3 times) on a **slightly damp** (deionized water) cleaning sponge.
 - A brass soldering tip cleaning pad is preferred as it does not affect tip temperature.
 2. After wiping, tin the tip with flux core solder – the tip should appear shiny.

Tin the tip regularly before it oxidizes (tarnishes) when doing soldering work.

Basic Tip Maintenance...

 - Verify soldering station temperature is correctly set to 350°C (660°F) – reduces oxidation rate.
 - Use the correct tip for the soldering application – larger tips deliver heat faster.
 - Apply minimal pressure to the tip while soldering – more pressure does not improve heat transfer.
 - Avoid continually feeding solder to the tip while soldering – use ‘heat bridge’ method.
 - Avoid mechanical damage by using tools on the tip – tip removal (as needed) is done by instructor.

PCB Assembly

- Obtain the DC Power Supply parts kit* and verify its contents with the Bill of Materials.

ELECTRICAL				REQUIREMENTS	
Item	Description	Manufacturer	Part Number	Qty / Kit	
Capacitor	Capacitor, Al electrolytic, Radial, 3300uF, 20%, 25V	Nichicon	UVR1E332MHD	2	pcs
Capacitor	Capacitor, Al electrolytic, Radial, 1uF, 20%, 50V	Nichicon	UVR1H010MDD	2	pcs
Capacitor	Capacitor, Al electrolytic, Radial, 0.1uF, 20%, 50V	Nichicon	UVR1H0R1MDD	2	pcs
Capacitor	Capacitor, Al electrolytic, Radial, 2.2uF, 20%, 50V	Nichicon	UVR1H2R2MDD	1	pcs
Connector	Connector, Banana, White, Panel Mount, Solder Lug	Johnson	108-0901-001	1	pcs
Connector	Connector, Banana, Red, Panel Mount, Solder Lug	Johnson	108-0902-001	1	pcs
Connector	Connector, Banana, Black, Panel Mount, Solder Lug	Johnson	108-0903-001	1	pcs
Connector	Connector, Banana, Violet, Panel Mount, Solder Lug	Johnson	108-0912-001	1	pcs
Diode	Diode, General purpose, DO41, 600V, 1A	Fairchild Semiconductor	1N4005	4	pcs
Diode	Diode, Light emitting, Red, Panel Mount, 2-pin	Mode Electronics	55-432-0	1	pcs
Fuse	Fuse, Glass, Miniature, Slow Blow, 250V, 0.375A	Bussman / Eaton	MDL-3/8	1	pcs
Potentiometer	Potentiometer, Linear, 5K, 20%, 0.1W, Panel Mount, Solder Lug	Mode Electronics	52-243-0	1	pcs
Regulator	Regulator, Adjustable, TO220-3, LM317, 1.5A	Fairchild Semiconductor	LM317TFS-ND	1	pcs
Regulator	Regulator, Fixed, TO220-3, LM7805, 5V, 1A	Fairchild Semiconductor	LM7805ACT	1	pcs
Regulator	Regulator, Fixed, TO220-3, LM7915, -15V, 1A	Fairchild Semiconductor	LM7915CT	1	pcs
Resistor	Resistor, Axial, 10R, 5%, 10W	Ohmite	20J10RE	1	pcs
Resistor	Resistor, Axial, Carbon Film, 390R, 5%, 0.25W	Stackpole Electronics	CF14JT390R	2	pcs
Switch	Switch, SPST, Round, Rocker, Quick Connect, 250V, 10A	Mode Electronics	46-100I-0	1	pcs
MECHANICAL					
Item	Value	Manufacturer	Part Number	Qty / Kit	
Board	Board, Printed circuit, DC Power Supply, Rev B	Enigma Interconnect	DC Power Supply Rev B	1	pcs
OPTIONAL					
Item	Value	Manufacturer	Part Number	Qty / Kit	
Board	Board, Printed circuit, Solder_Practice	Enigma Interconnect	Solder_Practice	1	pcs
Connector	Connector, Banana Plug, Cable Mount, Black	Mode Electronics	31-461-0	1	pcs
Connector	Connector, Banana Plug, Cable Mount, Red	Mode Electronics	31-462-0	1	pcs

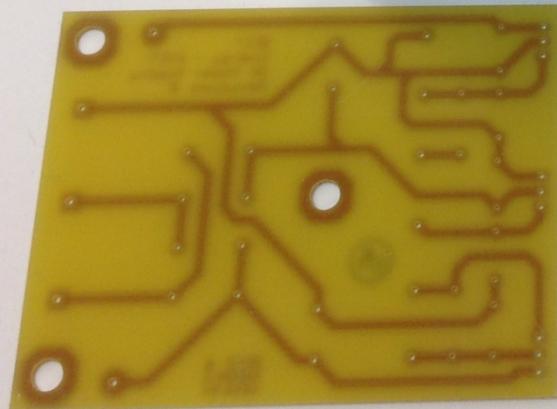
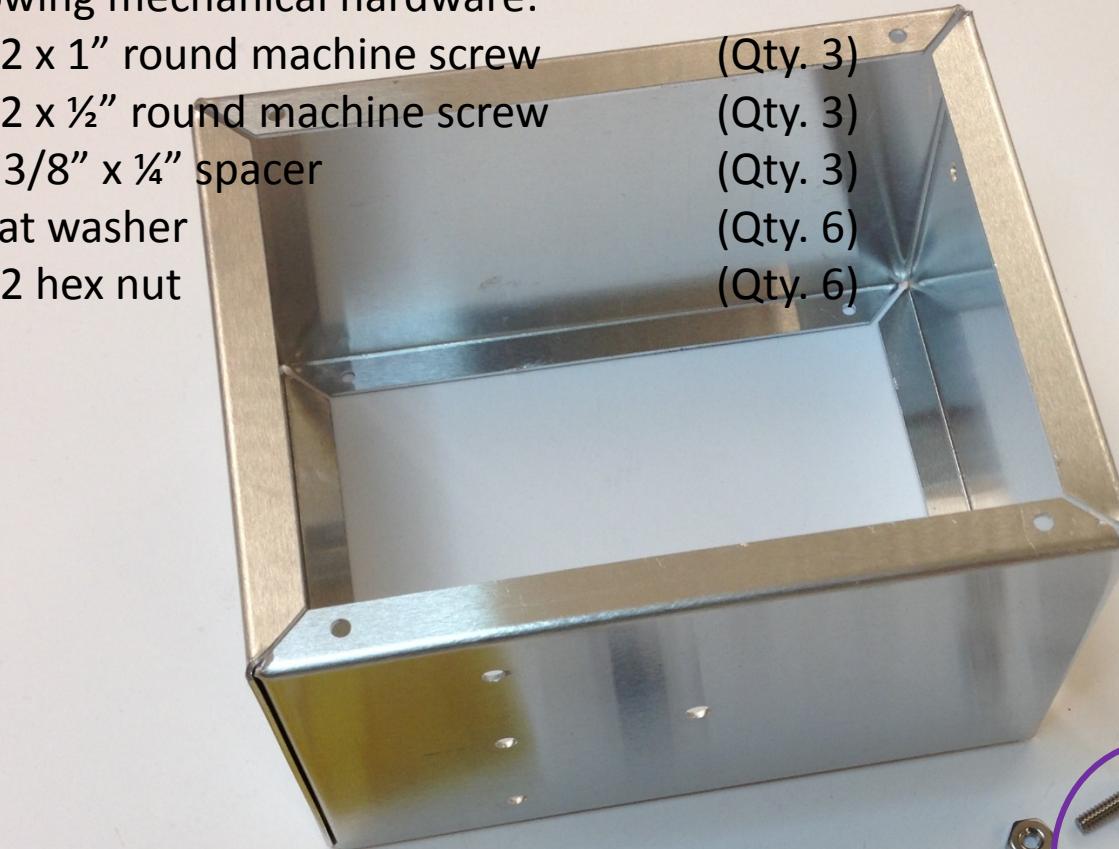
* May be supplied by the BCIT IEEE Student Members. Additional parts may be included.

PCB Assembly

- The leads of the 3 voltage regulators VR1 – VR3 must be preformed prior to soldering to the PCB.
- Obtain the following mechanical hardware.
 1. #6-32 x 1" round machine screw (Qty. 3)
 2. #6-32 x ½" round machine screw (Qty. 3)
 3. #6 x 3/8" x ¼" spacer (Qty. 3)
 4. #6 flat washer (Qty. 6)
 5. #6-32 hex nut (Qty. 6)

Use the following mechanical hardware:

- #6-32 x 1" round machine screw (Qty. 3)
- #6-32 x $\frac{1}{2}$ " round machine screw (Qty. 3)
- #6 x 3/8" x 1/4" spacer (Qty. 3)
- #6 flat washer (Qty. 6)
- #6-32 hex nut (Qty. 6)



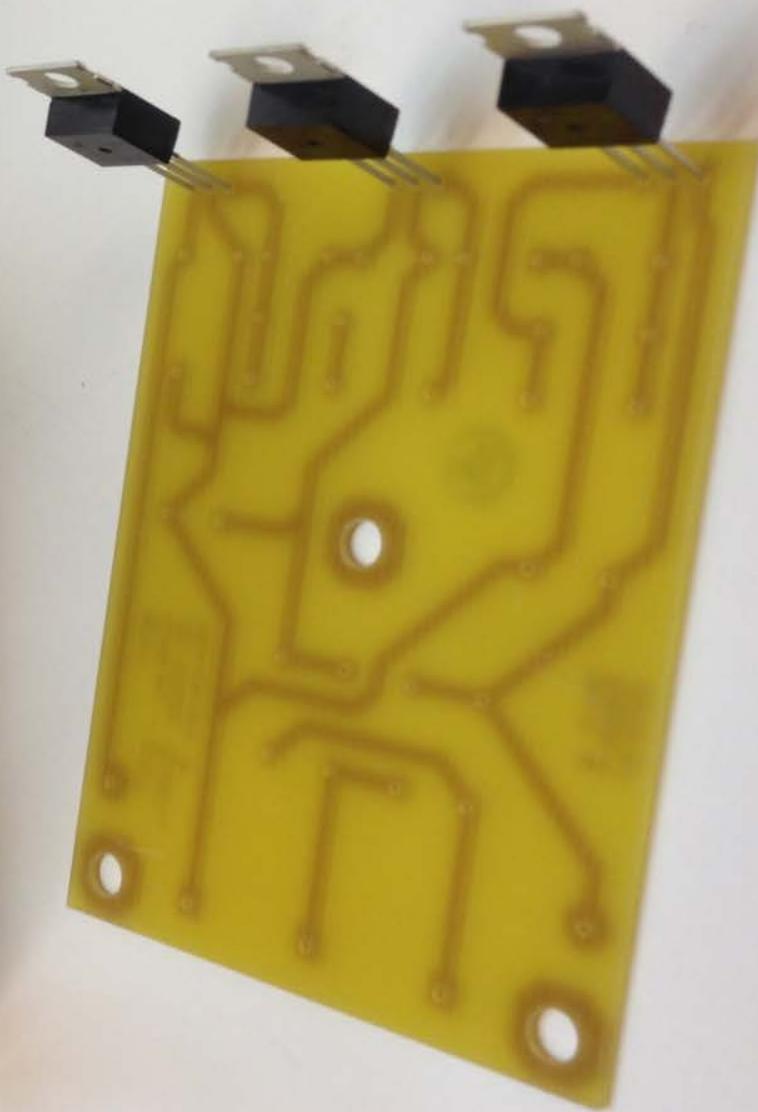
Use the $\frac{1}{2}$ " screws



NOTE:

The kit contains 1 spare #6-32 x $\frac{1}{2}$ " round machine screw and #6-32 hex nut.

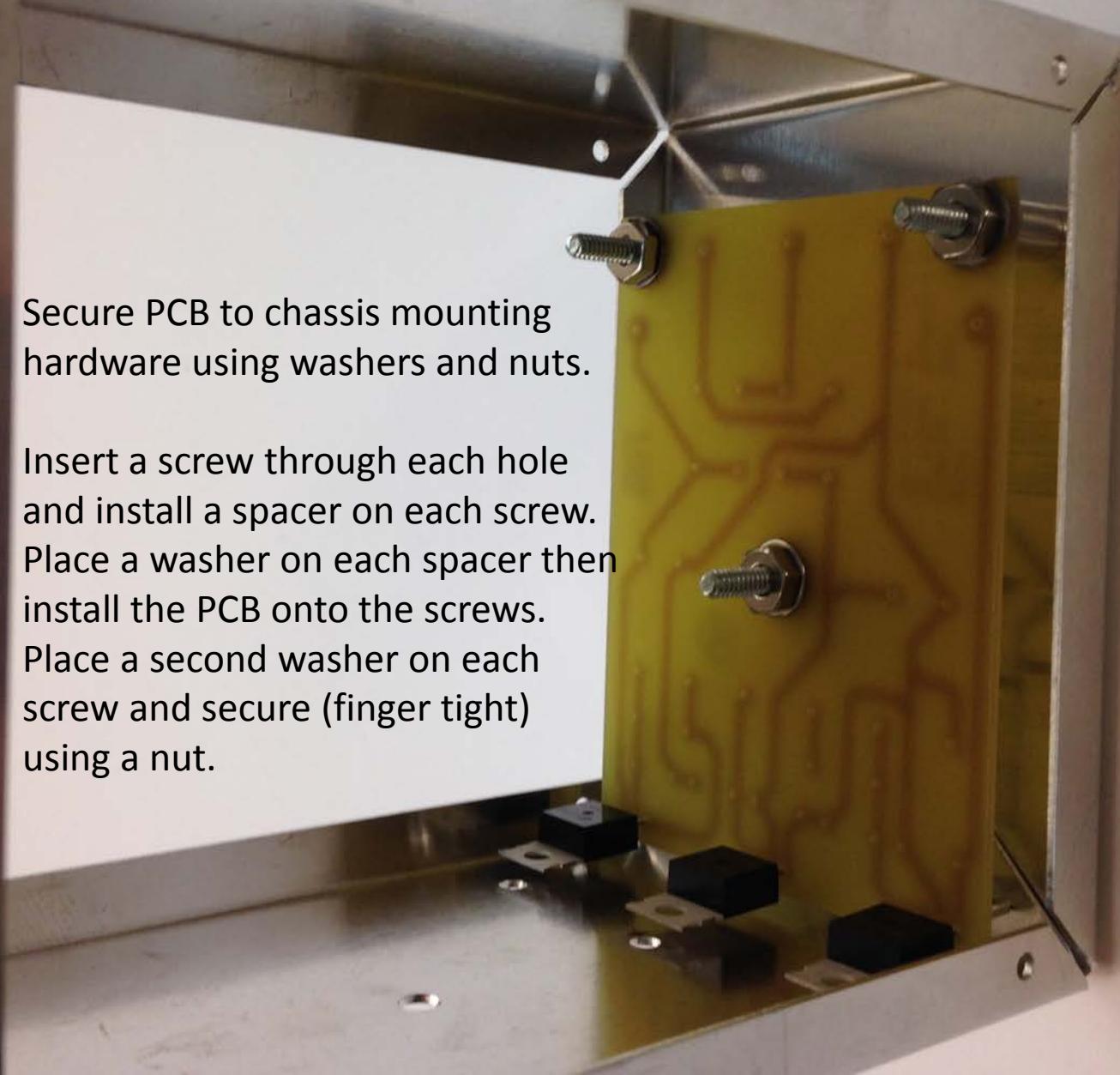
Install three machine screws, spacers and washers
in the PCB mounting holes in the chassis.



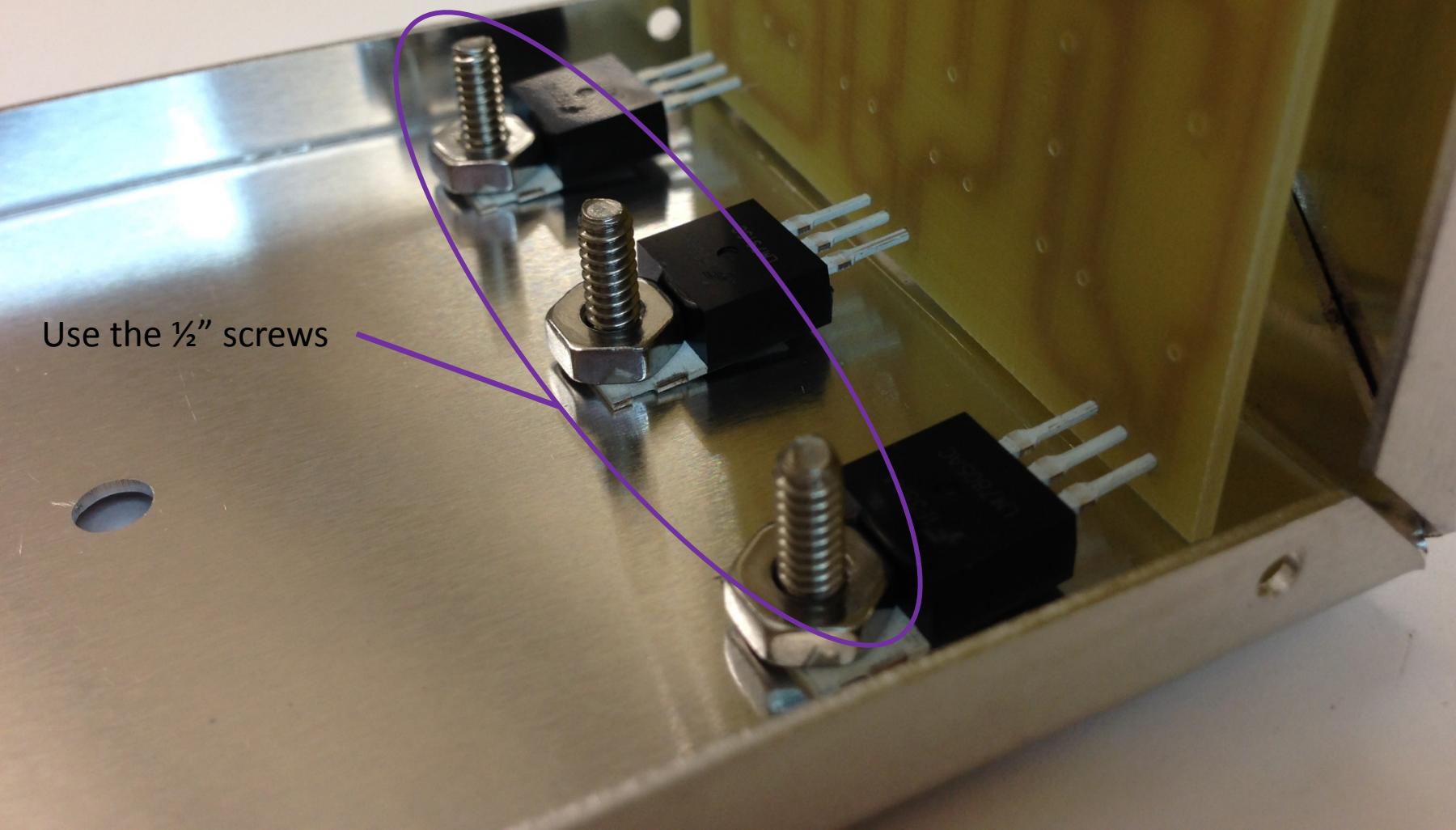
Insert regulator leads through their respective holes on the PCB.

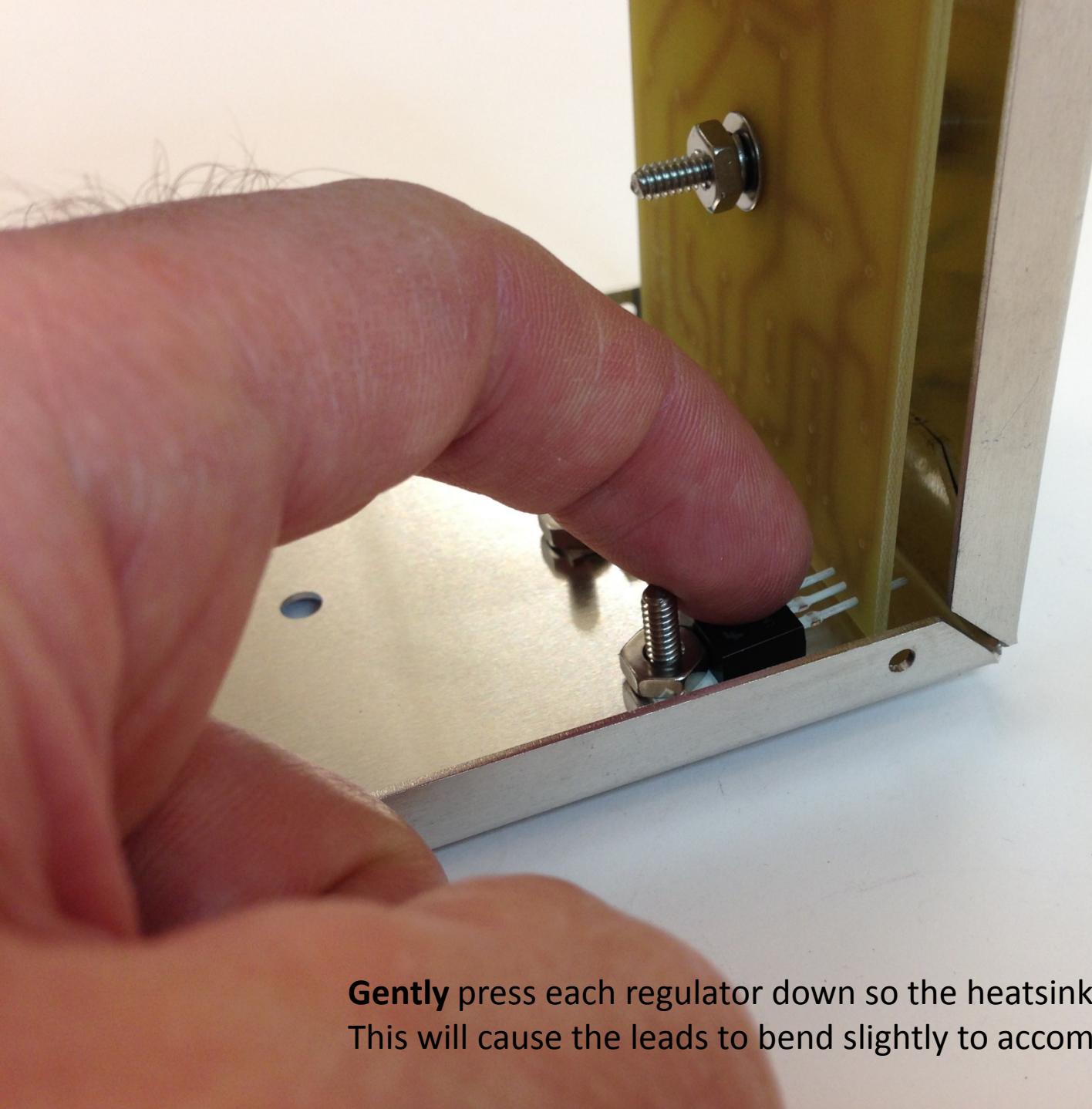
Secure PCB to chassis mounting hardware using washers and nuts.

Insert a screw through each hole and install a spacer on each screw. Place a washer on each spacer then install the PCB onto the screws. Place a second washer on each screw and secure (finger tight) using a nut.

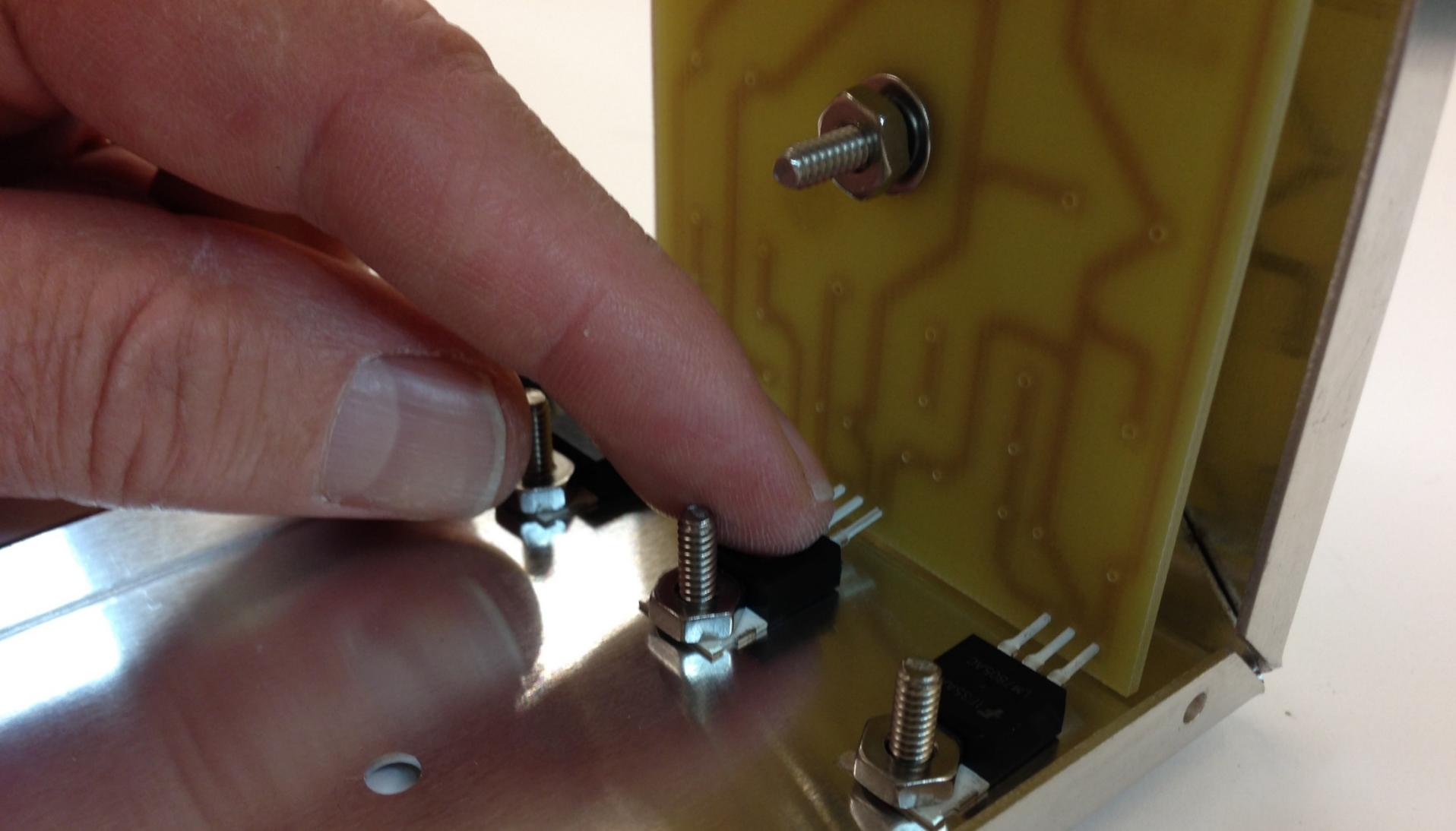


Attach regulator heatsink tabs to their respective chassis mounting locations using screws and nuts (finger tight).
Verify leads are inserted in their respective holes.





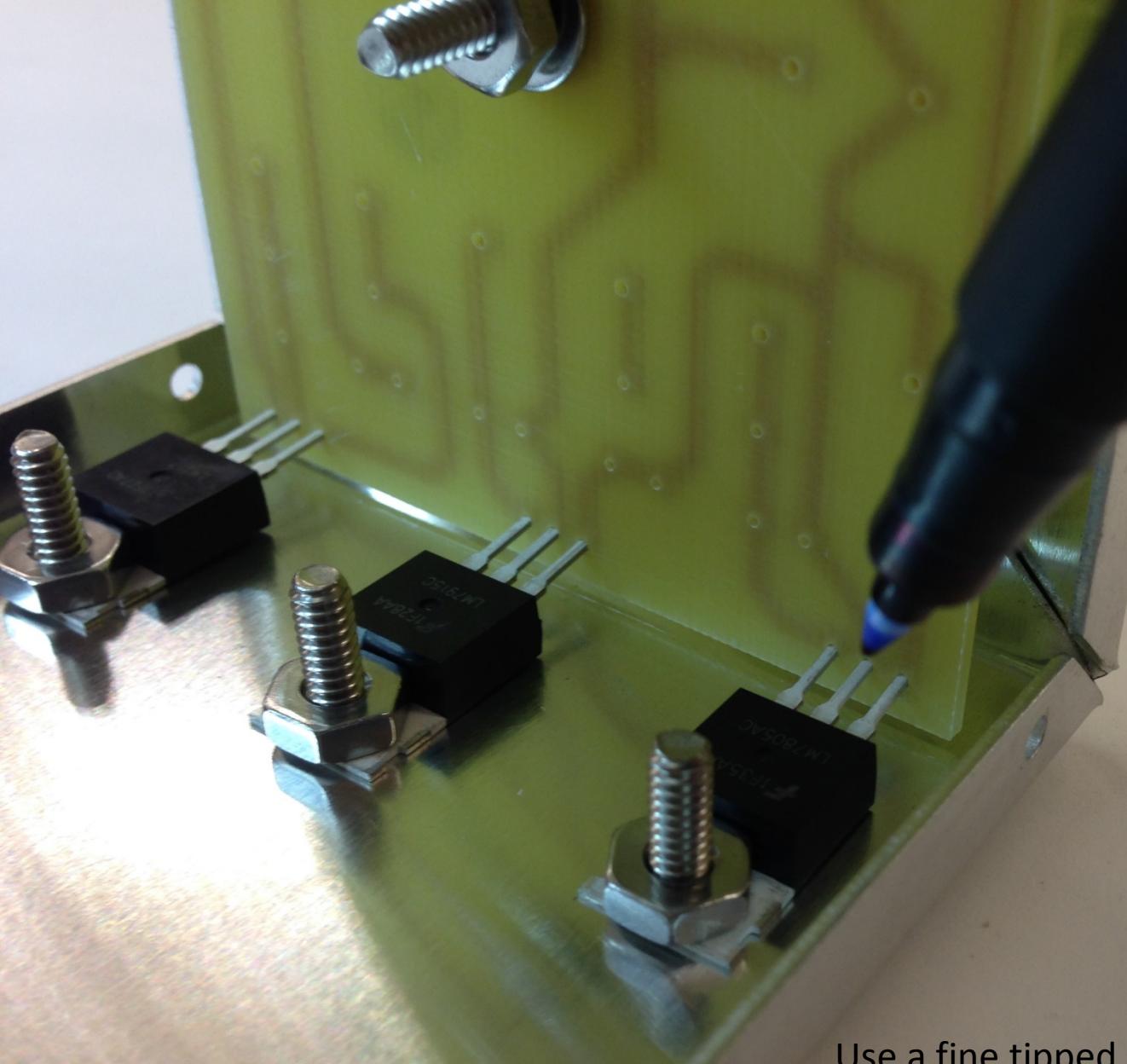
Gently press each regulator down so the heatsink tab is flush to chassis. This will cause the leads to bend slightly to accommodate the alignment.



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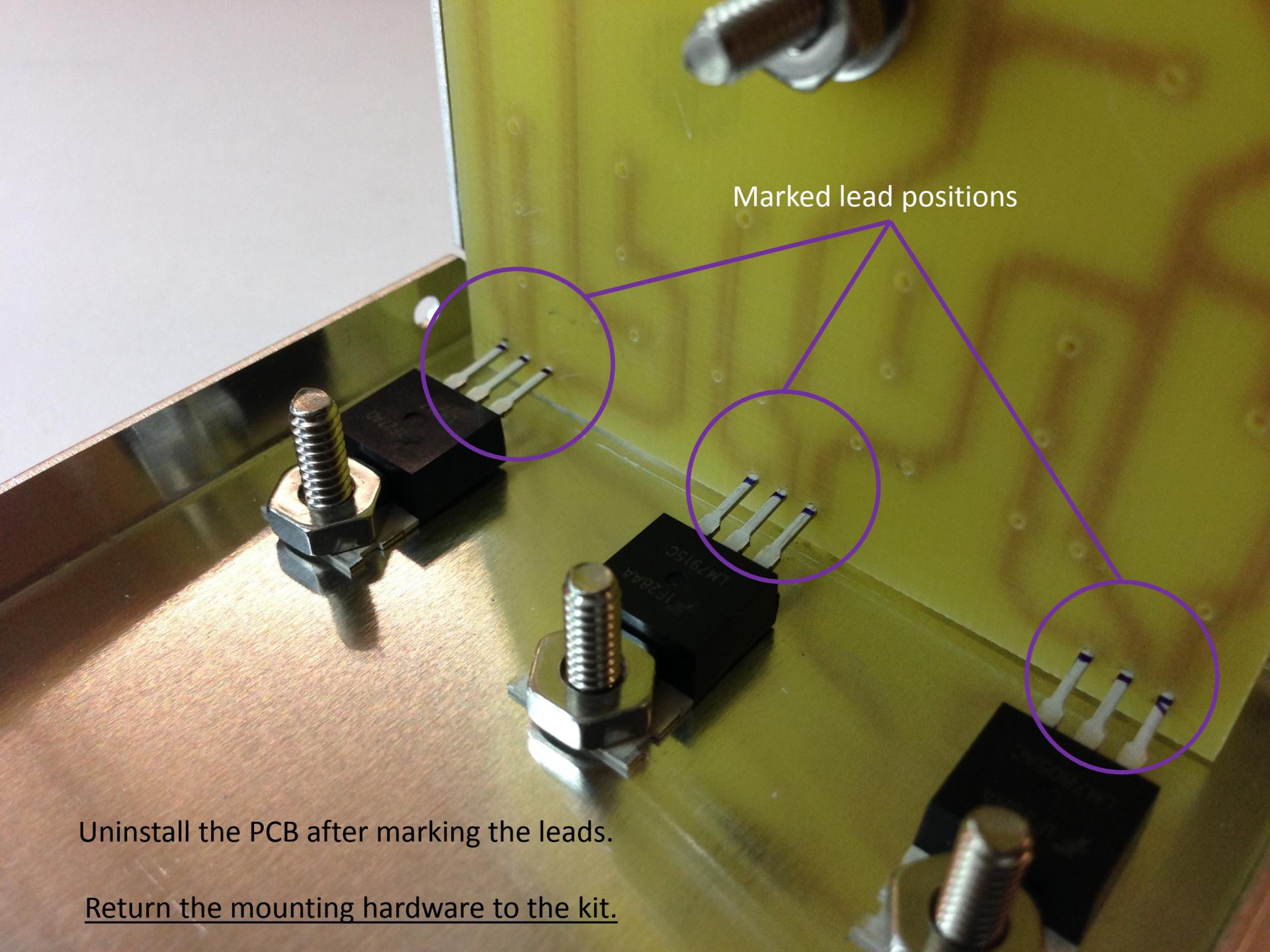


Gently press each regulator down so the heatsink tab is flush to chassis.
This will cause the leads to bend slightly to accommodate the alignment.



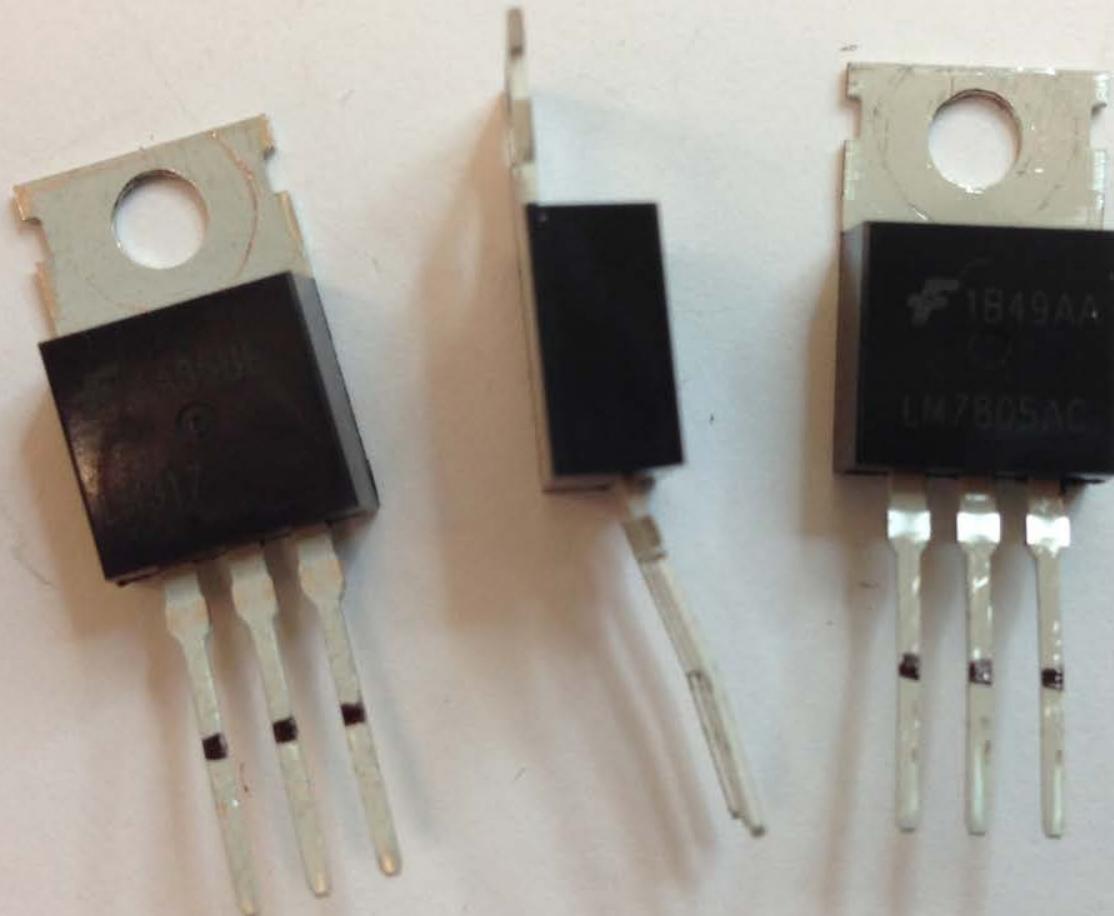
Use a fine tipped marker (or similar) to mark the positions where each lead enters the PCB.

Marked lead positions



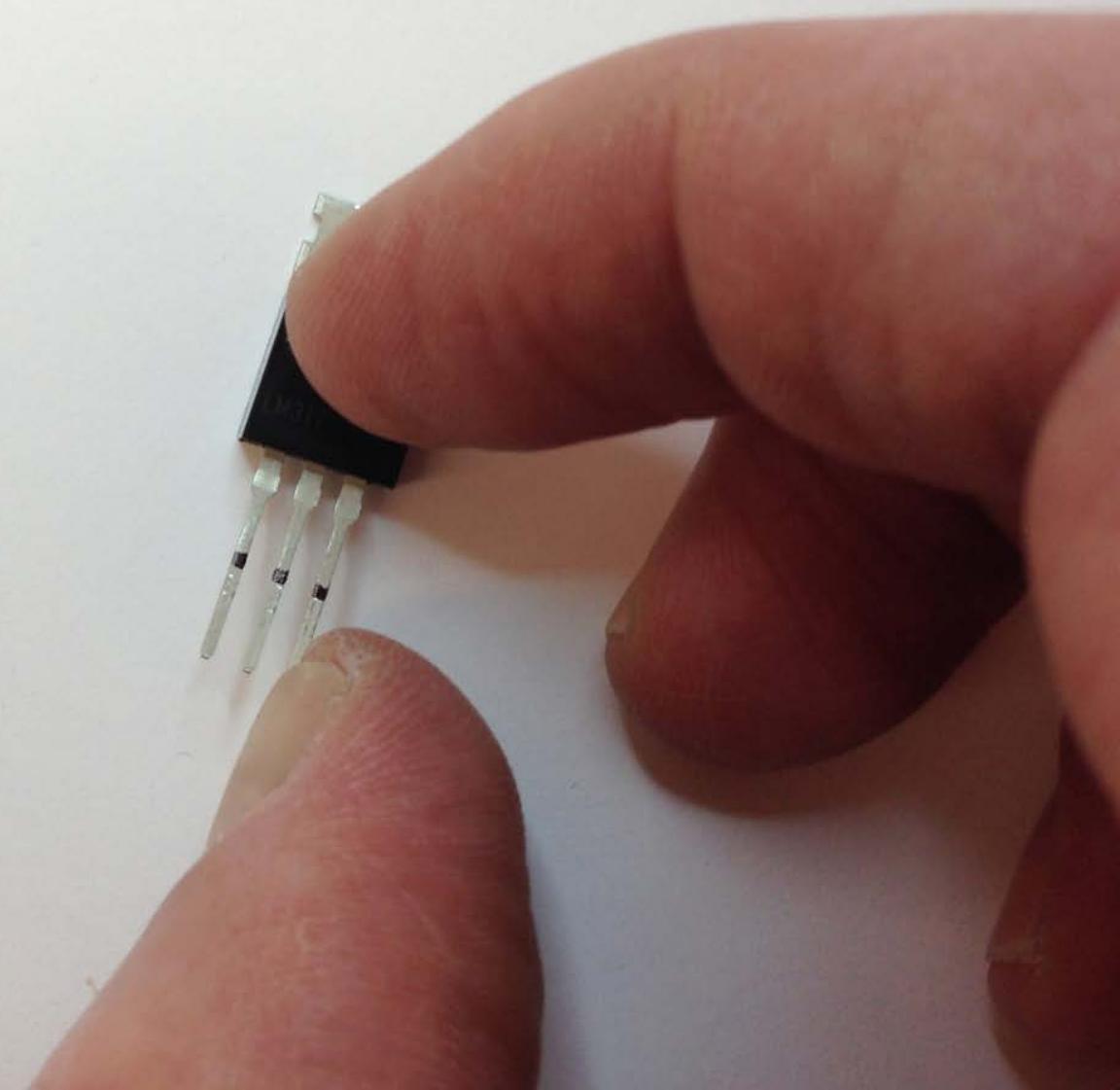
Uninstall the PCB after marking the leads.

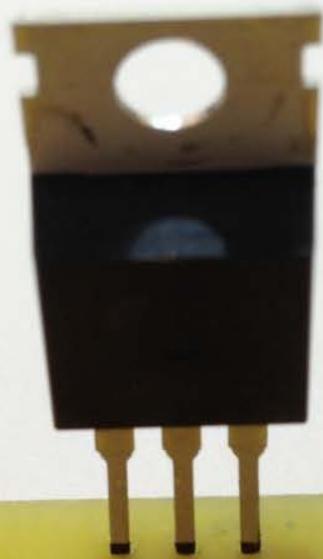
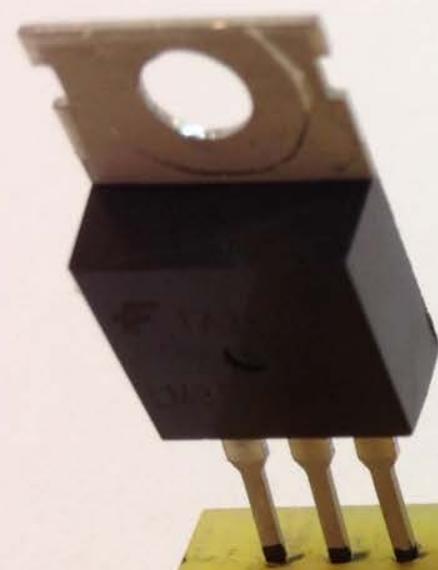
Return the mounting hardware to the kit.



Marked and formed regulator leads

Gently separate the outer leads slightly from the center lead.
This will produce a retaining force that prevents the regulator
from moving (sliding out) when inserted back into the PCB.



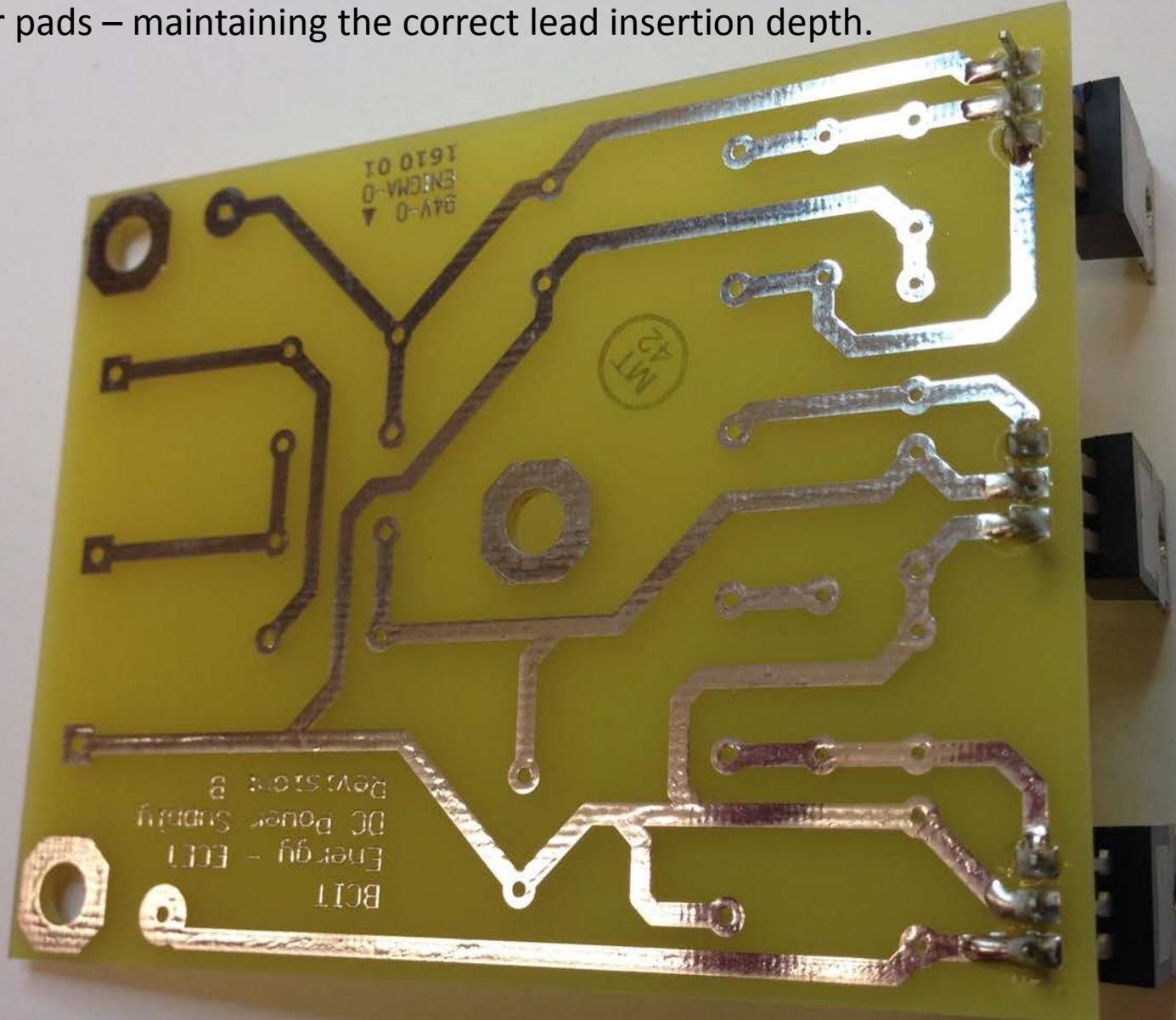


Install the three regulators into their respective locations on the PCB.
Use the lines marked on the regulator leads to set the insertion depth.
Verify the regulators are located in their correct positions.

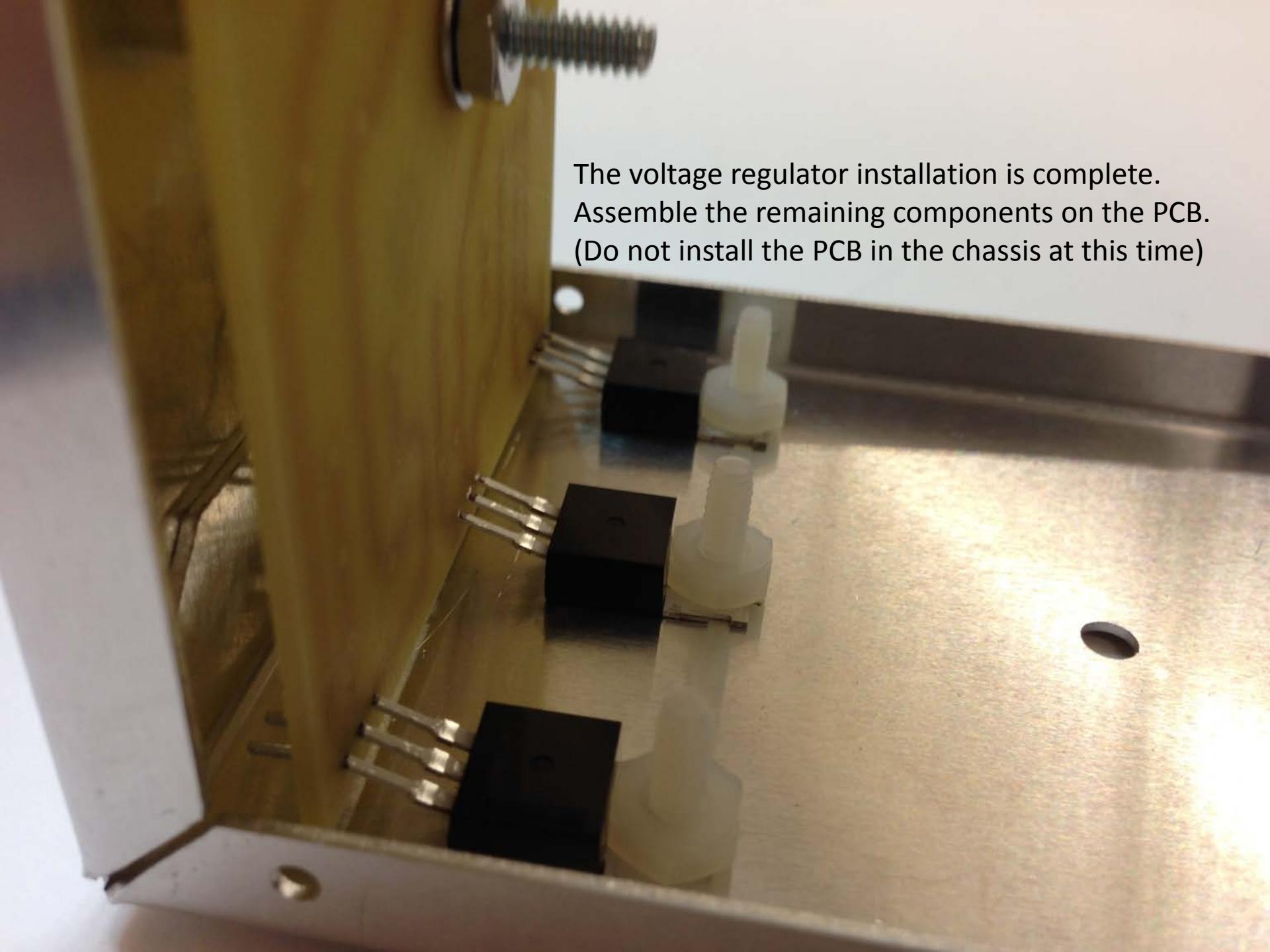
The regulators should be reasonably secure and remain in position.



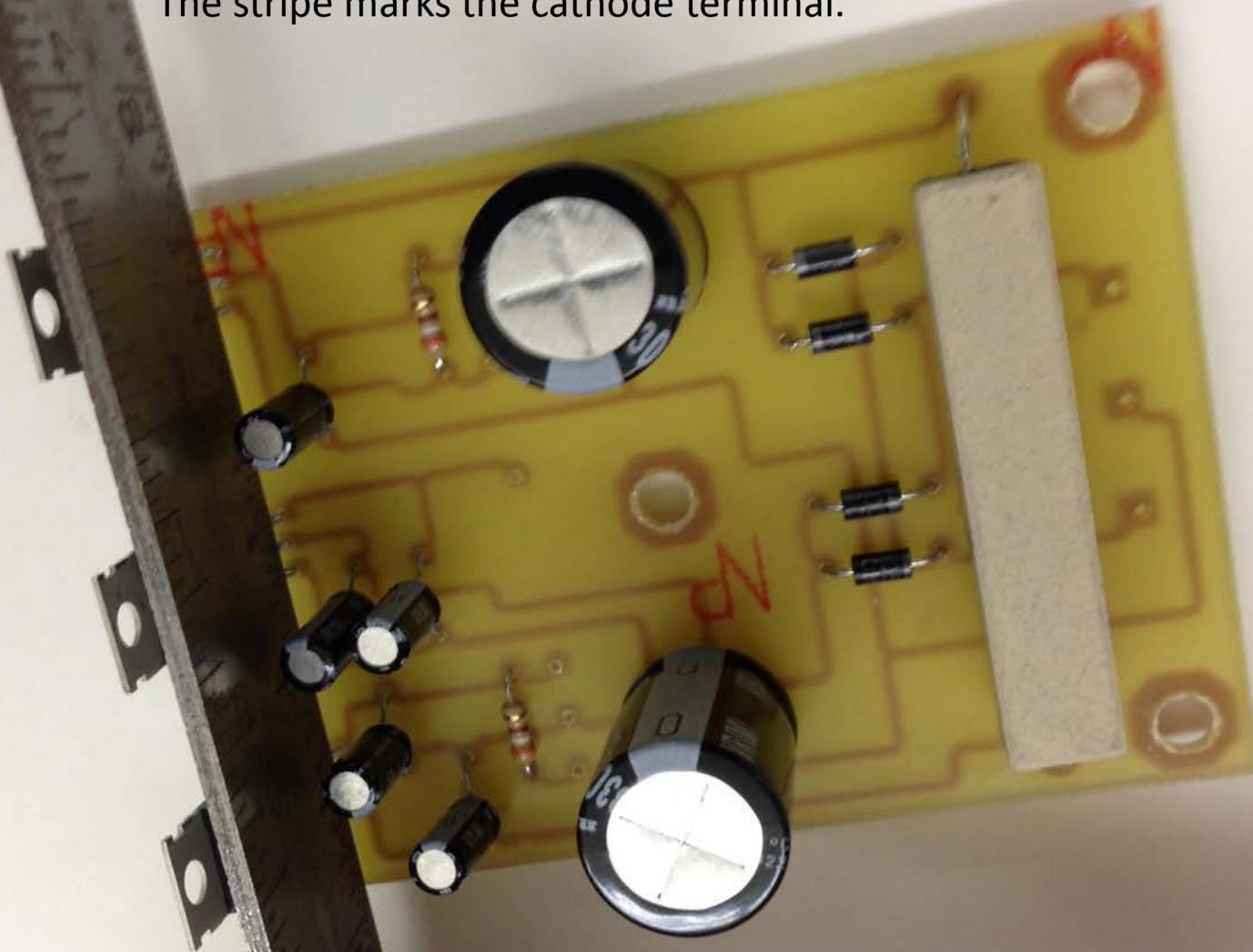
Turn the PCB over and carefully solder all of the regulator leads to their pads – maintaining the correct lead insertion depth.



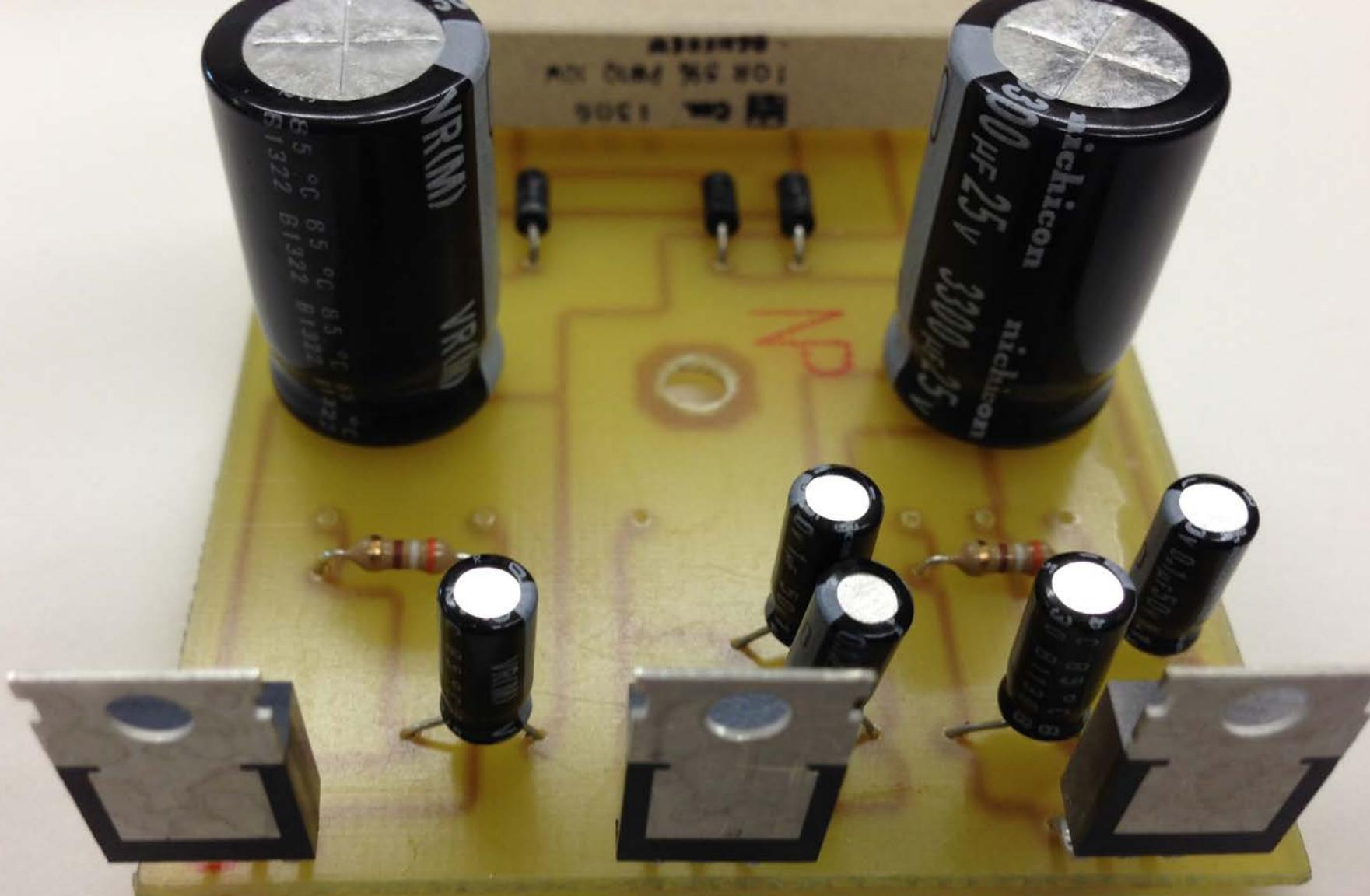
The voltage regulator installation is complete.
Assemble the remaining components on the PCB.
(Do not install the PCB in the chassis at this time)



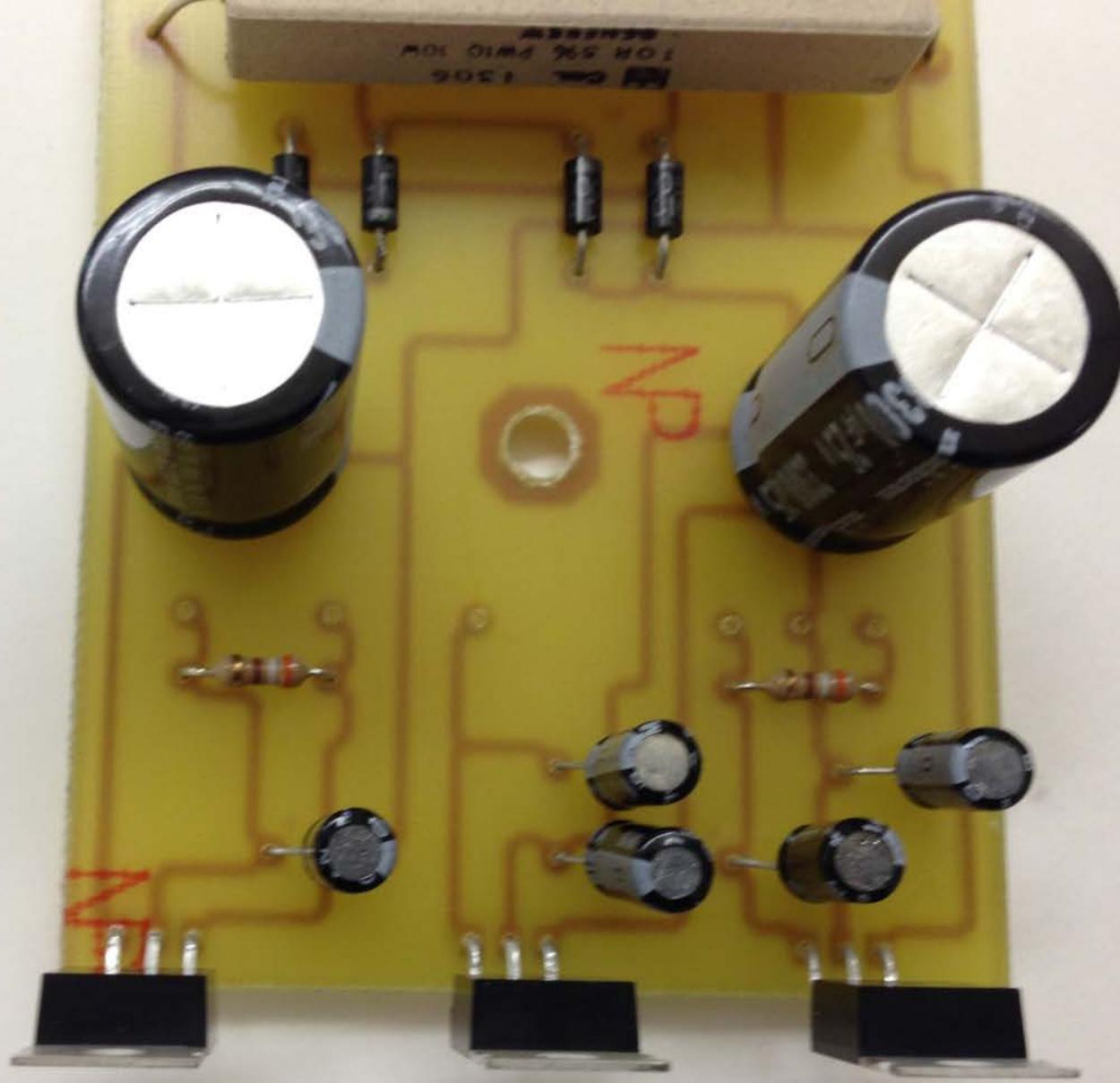
Ensure correct orientation of diodes D1 – D4.
The stripe marks the cathode terminal.



Include a 5 – 10mm gap between the 10Ω , 10W power resistor and the PCB when installing. This will improve heat dissipation by allowing air to circulate around the resistor body when in use.



Ensure capacitors C1 – C7 polarity marks are correctly aligned. The stripe marks the (-) terminal. Gently form leads of capacitors C3 – C7 (minimize stressing the leads), prior to installation.



Verify 390Ω , $\frac{1}{4}W$ resistors (x2) are installed.

Cut lengths of 22AWG stranded DC hookup wire:

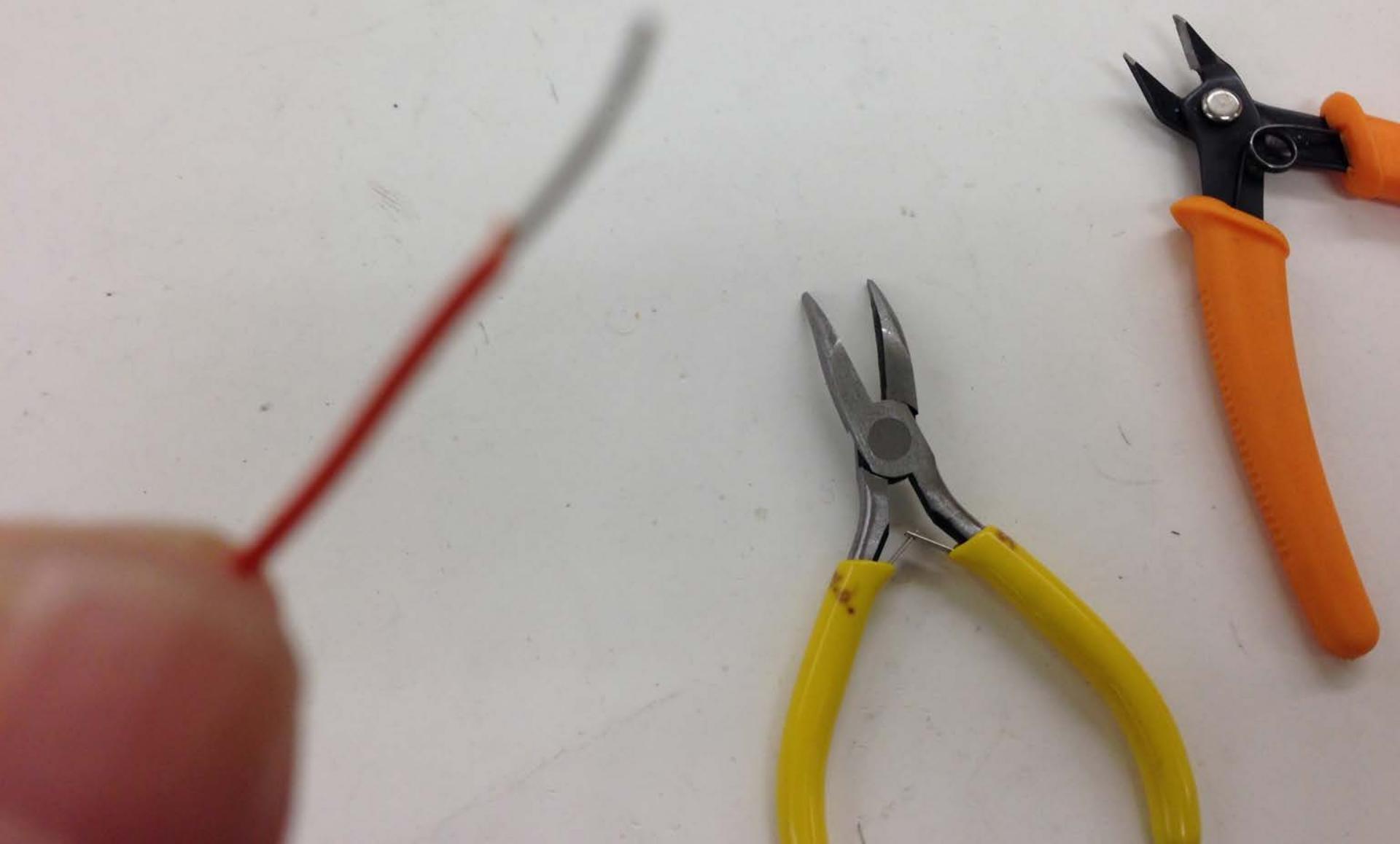
- Black x 1
- Red x 1
- Orange x 1
- Yellow x 1
- Violet x 1
- White x 1

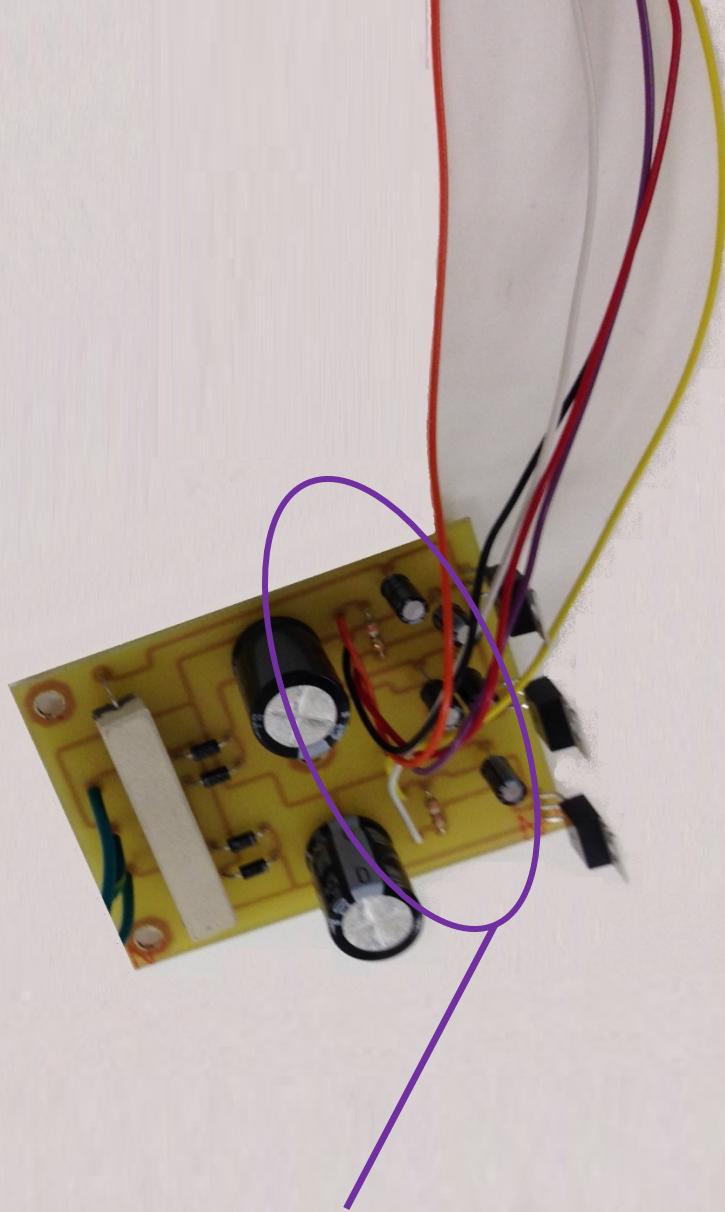


~~← DC WIRE LENGTH →~~

← DC WIRE LENGTH →

Strip both ends of each wire approximately $\frac{1}{4}$ inch.





Solder the 6 colored DC hookup wires to the appropriate jumper locations on the PCB.
(Refer to the Component Locator and Interconnect drawings)

PCB Assembly

When the printed circuit board assembly (PCBA) is complete...

- Obtain 2 lengths of AC hookup wire.
- Solder 1 wire to each of the transformer input terminals J7 – J8 on the PCBA.
- Perform a functional test of the PCBA (with instructor) using the Alignment Test document.
- Repair any circuit deficiencies identified during testing and retest the PCBA, as needed.
- Remove the 2 wires from the transformer input terminals J7 – J8 on the PCBA.
- Carefully remove any excess solder from the PCBA after removing the wires.

The PCBA is ready for assembly into the chassis in Phase 2.