SDR Cube Transceiver
Online Assembly Guide

Detailed construction notes for building and testing each of the SDR Cube kit modules

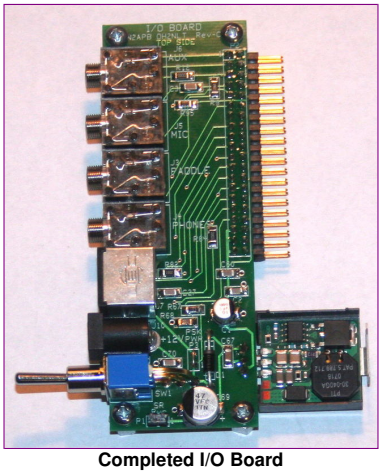
Home Bill of Materials I/O Board Controls Board DSP Board Softrock SR-Base Softrock TX/PA
RXAMP X-LPF Internal Cable Set External Cable Set Main Enclosure Accessory Enclosure
Digital Subassembly Test Final Assembly RF Functional Test

Building the I/O Board

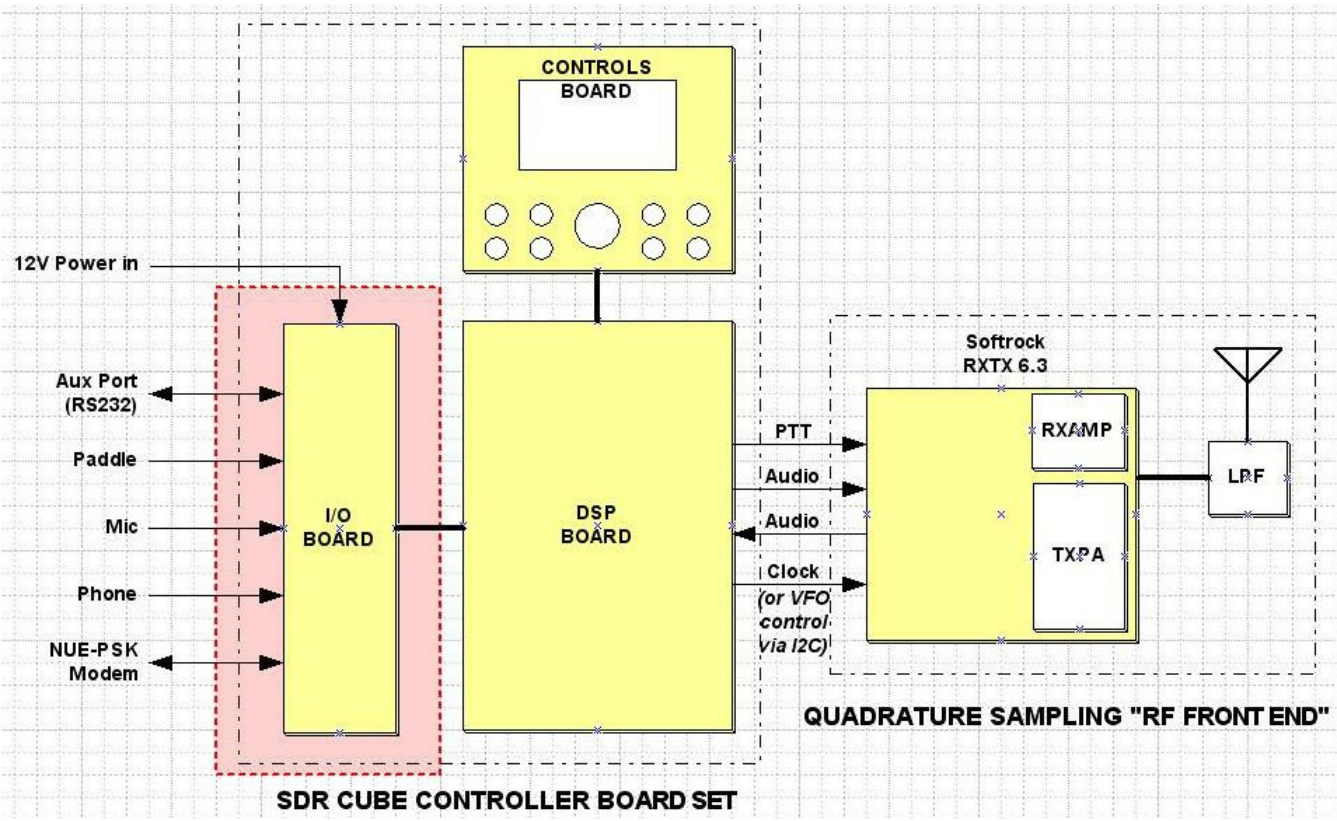
... (Section version 1.0a)

What Is It?

The I/O Board is the main interconnection point between the SDR Cube and the user, with the connection points for power, microphone, paddle headphones and the serial port. It is simplest of the three SDR Cube pc boards to assemble, as there are no surface mount integrated circuits to worry about, and it provides the main regulator for 5V power to the other two boards. The I/O Board will ultimately mount to the internal sub-chassis of the enclosure with the jacks and power switch extending out the back panel.



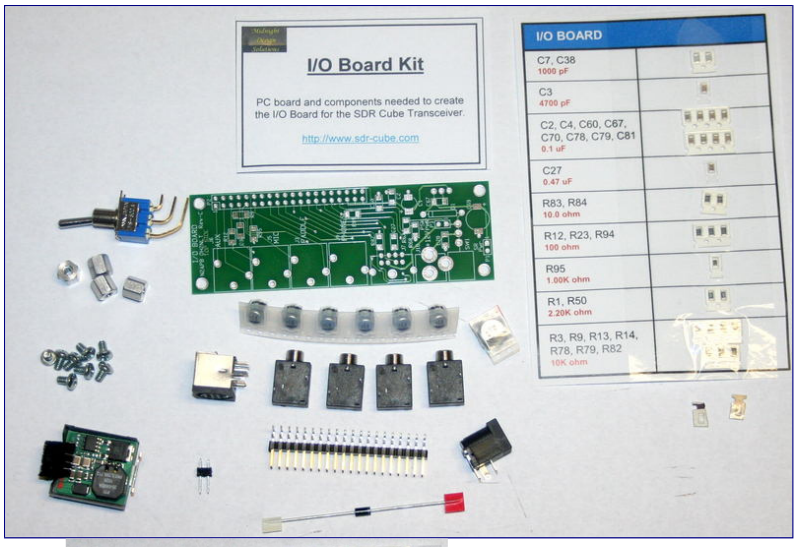
Completed I/O Board

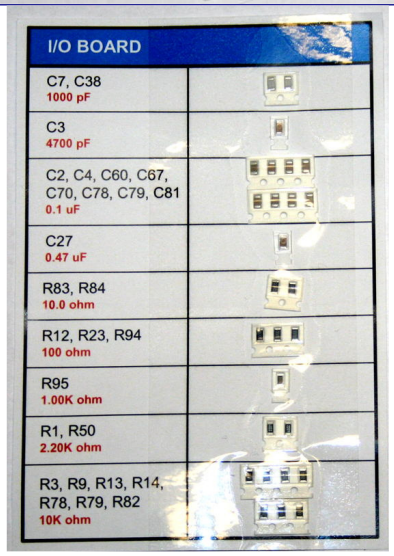


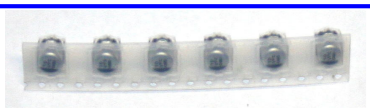
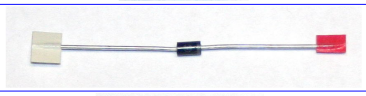
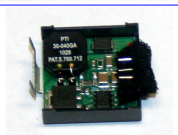
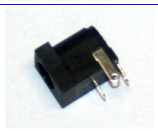
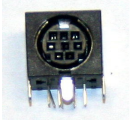
CONSTRUCTION STEPS

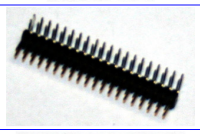
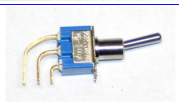
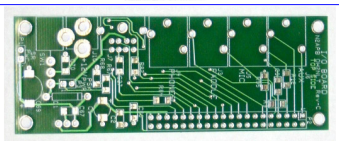
[____] STEP 1: Inventory the supplied parts

Check to make sure you received the I/O Board Kit bag and all the components that are pictured below. (Click on any photo to see a larger image.)

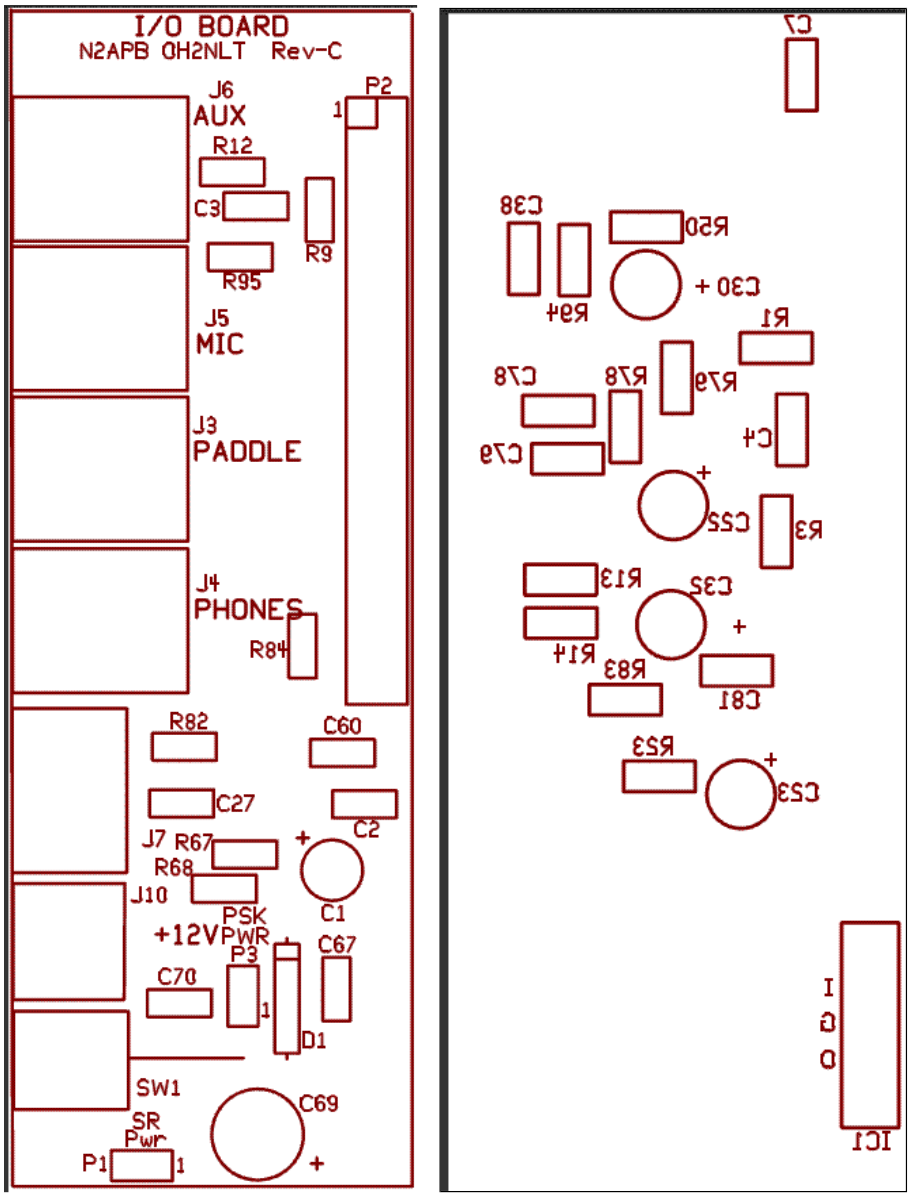




C1, C22, C23, C30, C32	5	CAP 10UF 35V ELECT FC SMD	
C69	1	CAP 47UF 35V ELECT FC SMD	
D1	1	DIODE SCHOTTKY 20V 1A DO-41	
IC1	1	Voltage regulator, 5V Switching, PT78ST105H, 5V	
J10	1	Coaxial DC power connector, 2.1mm	
J7	1	8-pin Mini-DIN	

J3, J4, J5, J6	4	Audio jack, stereo, 3.5mm, pcb mount	
P1	1	Pinheader, 1x2, 0.1"	
P2	1	Pinheader, 80P, 2ROW, (2x40), 0.1", right angle	
SW1	1	Switch, toggle, SPDT, PCB mount	
R68	1	RES 2.00K OHM 1/4W 1% 1206 SMD	
R67	1	RES 1/8W 10K OHM 0.1% 1206	
		HARDWARE	
	8	Machine screw, pan #4-40x3/16", phillips	
	4	Spacer, AL, hex tapped, #4, 1/4" (PCB)	
PCB-I/O	1	PCB, I/O	

PARTS LAYOUT diagrams for the I/O Board (top and bottom side) ...



STEP 2: Install the surface mount capacitors and resistors from the SMT Card.

Using the order of the parts as listed on the SMT card as a guide, and the Parts Layout diagrams above (and on the board's silkscreen) as a guide, first attach the capacitors to their respective pads ...

[____] C7, C38

[____] C3

[____] C2, C4, C60, C67, C70, C78, C79, C81

[____] C27

Next, attach the resistors to the board, in the order they are listed on the SMT parts card ...

[____] R83, R84

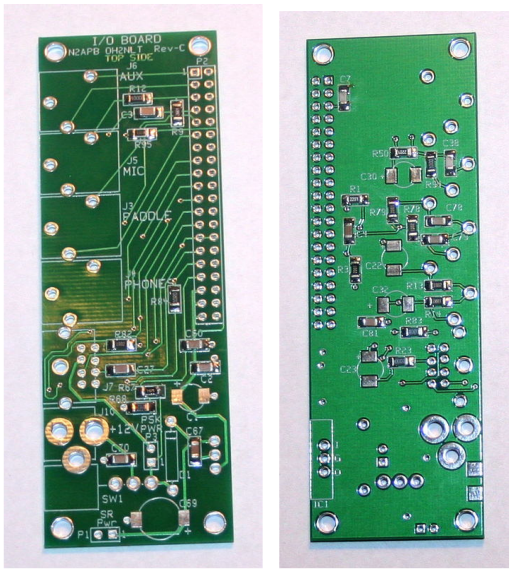
[____] R12, R23, R94

[____] R95

[____] R1, R50

[____] R3, R9, R13, R14, R78, R79, R82

This is how the I/O board will look with all the surface mount components installed ...



STEP 3: Install the Electrolytic capacitors to the I/O board

The electrolytic caps looks like little silver "tin cans" with leads on the bottom that will attach to the pads at their location. It is important to note that these electrolytic capacitors are polarized and must be installed with the proper orientation or things could get messy when powered up. The negative side is indicated with a black half-moon mark, and the positive side is the unmarked side, as shown below ...

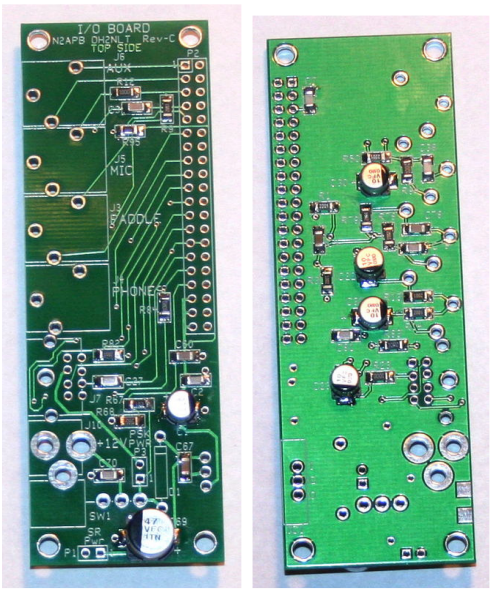
Positive  Negative

In a few cases, for example with this 47 uF component (C69), the pads are somewhat close and you'll need to carefully solder capacitor leads at the outside edge of the pads. The easiest way to do this is to pre-tin the pad (as you should do in all cases of attaching Rs and Cs), and then place the electrolytic cap in place while that one pad is still being heated with your iron. Making sure it is properly aligned so the other lead falls on its pad, and that the capacitor is far enough over (at the edge) so as to allow the other side to be soldered next, remove your iron and let the part cool. Then solder the other side with the capacitor's lead on top its pad.

[____] C1, C22, C23, C30, C32 ... These are the 10 uF capacitors.

[____] C69 .. this is the larger 47 uF capacitor

And this is how the I/O board will look with all the electrolytic capacitors attached ...



STEP 4: Install diode D1 just above the larger 47 uF electrolytic capacitor C69

The diode has polarity, of course, with the cathode being noted by the banded end. This cathode end should be inserted in the upper hole for D1, denoted with the band on the silkscreen.

[____] D1

STEP 5: Install R67 and R68 ... these are the two loose resistors in the bag that missed the train for getting onto the SMT card

These two resistors missed getting onto the SMT card, so we provide them each in their SMT carrier loose in the bag. Don't miss them!

[____] R67 ... This resistor is 10K ("103") and has a black mark on the bottom of its paper carrier.

[____] R68 ... This resistor is 2K ("202") and has no mark on the bottom of its paper carrier.

STEP 6: Install P1, the 2-pin pinheader next to C69

[____] P1

STEP 7: Install the four stereo audio jacks along the edge of the board.

Make sure that the three pins of each jack are properly placed into the respective holes before pushing the jacks snuggly down into place and soldering them.

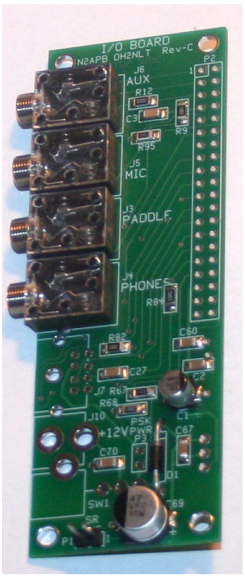
[____] J3 ... This is the Paddle connector

[____] J4 ... This is the Phones connector

[____] J5 ... This is the Mic connector

[____] J6 ... This is the Aux connector

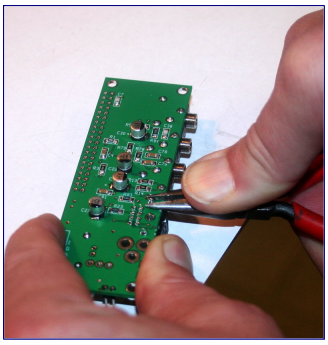
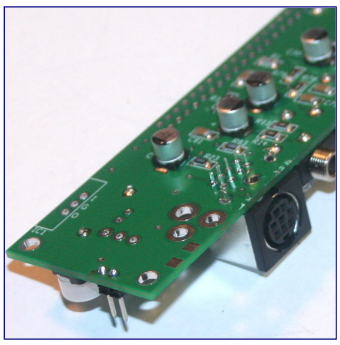
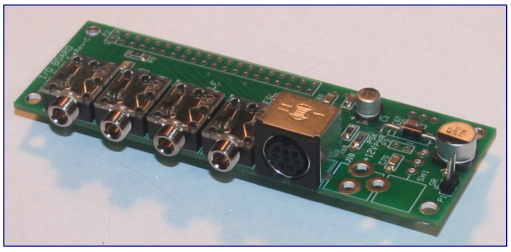
And this is how the I/O board should look after installing D1, P1 and the audio jacks ...



STEP 8: Install the MiniDIN "NUE-PSK" connector

The outside mounting tabs for the miniDIN connector J7 are a bit too large for the corresponding mounting holes. However if you carefully press them (hard) into place, you will indeed push the mounting tabs into the too-small holes. You can do this using the technique shown in the photo below on the left: using a pair of pliers, alternately press each side of the connector down onto the connector as it sits on the table surface. This does work, although you'll invent some new words to help along the way. Alternatively, you could file down the sides of the two mounting tabs to make the fit easier. Once in place, carefully solder all leads and both mounting tabs.

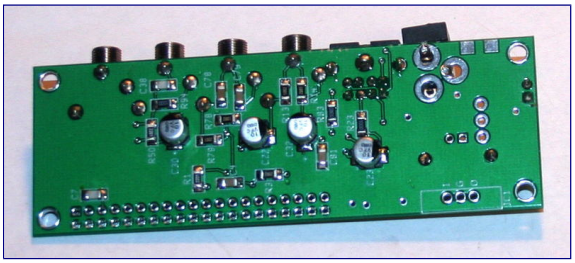
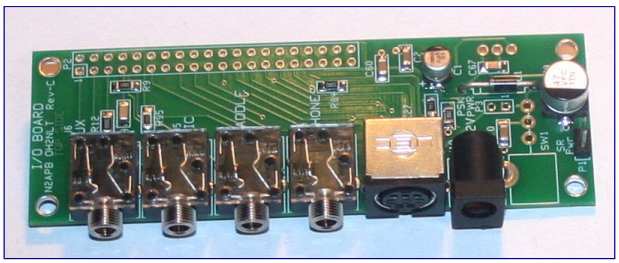
[____] J7 ... This is the 8-pin miniDIN connector

STEP 9: Install the coaxial DC power jack

The coaxial DC power jack J10 fits pretty loosely into its three mounting holes. A good way to attach this connector is to bend the three tabs over against the bottom side of the mounting pads; then first solder one lead, hold in the connector aligned and in place flush against the board surface, and then solder the last lead. See the photos below for the technique. Some builders like to slip a straight piece of component wire through the hole in each lead and then solder the lead and wire to the pad, thus possibly making a stronger connection.

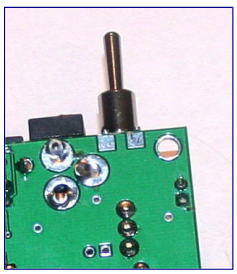
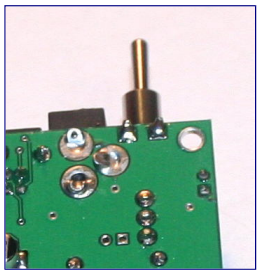
[____] J10 ... This is the coaxial DC power jack

STEP 10: Install the toggle switch

The toggle switch leads may need to be bent such that they "go perpendicular" into the board closer to the body of the switch. When the switch is properly fitted to the board, its mounting tabs will hang over the edge of the board and ultimately get soldered to the two exposed grounding tabs on the bottom of the board. This will give the switch good mechanical strength. Once the three leads are adjusted as described, and the switch is inserted into the board such that the metal tabs on the body are close against the edge of the board, and the switch is being pressed tightly down onto the board, solder the three leads to their respective tabs. (Photo on left, below.) Then, solder the metal tabs to their mounting pads, using a good amount of heat and solder. (Photo on right, below.)

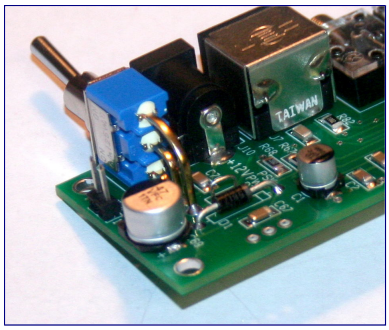
[____] SW1 ... This is the toggle switch for on-off power control

STEP 11: Add wire jumper at P3 (if you will be using a NUE-PSK modem with the Cube)

if you intend to be operating the NUE-PSK Digital Modem with the SDR Cube, you have an option to power the NUE-PSK appliance over the modem cable ... and jumpering the J3 pads will provide power to the miniDIN connector for this purpose.

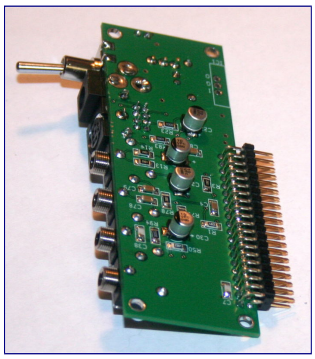
[____] P3 jumper ... This is a wire jumper, next to the D1 diode, to power the NUE-PSK modem via the miniDIN connector



STEP 12: Install the 40-position pinheader

The P2 pinheader is used to connect the I/O board signals and power to the DSP board ... **IMPORTANT** : For everything to match up correctly it must be mounted on the bottom of the board!

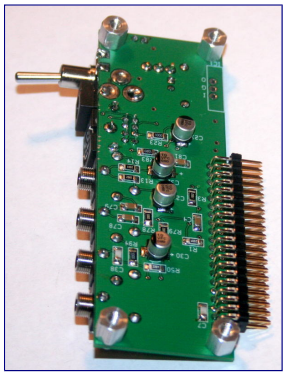
[____] P2 ... This is the 2x20, right-angle pinheader ... mounted on the bottom of the board



STEP 13: Mount the standoffs

Using the #4-40 x 1/4" screws, mount the four aluminum standoffs to the bottom of the board

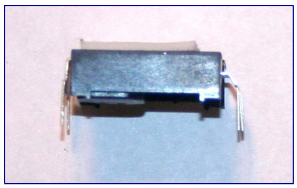
[____] Standoffs & Screws



STEP 14: Mount the 5V regulator

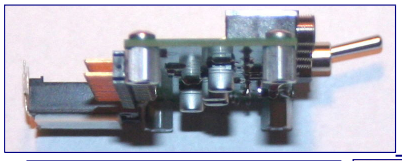
The regulator we are using is a switching type that will actually be mounted such that it extends way off the board. It's leads will be attached on the bottom side of the I/O board and it will appear to be "upside down", with the internal components of the regulator being seen when viewed from the top. The regulator has a double-sticky pad to hold it to the sub-chassis when the I/O board is fully mounted. (Note: The regulator will not be getting hot, so there is no need to heatsink the device.)

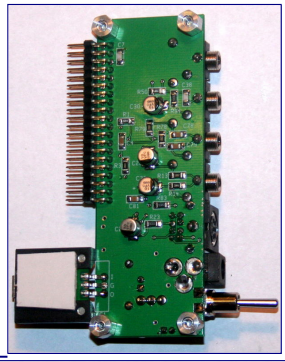
> **STEP 14a:** Carefully adjust the regulator's mounting leads as shown in the photo below. Using pliers, adjust the leads exactly as shown ... for two important reasons: (1) The leads will break off if they are over-flexed or if they are bent beyond the point shown in the photo; and (2) the bends will put the regulator far enough away from the board such that the regulator doesn't get caught beneath the board when later assembled to the sub-chassis.

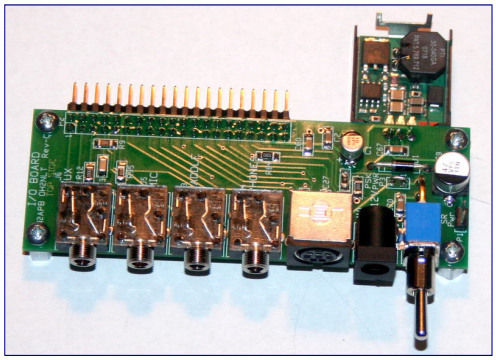


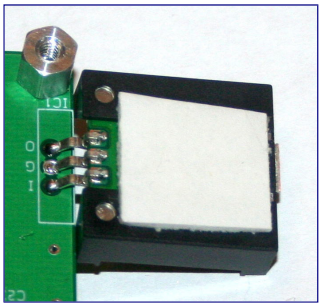
STEP 14b: Carefully insert the regulator into its mounting pads from the bottom side of the board and hold it loosely in place as you place the I/O board on a flat surface. The pc board is elevated by 1/4" standoffs and the regulator (with its still-protected stick pad) will also sit on that flat surface when you release it. With the regulator sitting flush on the flat surface, and with its leads extending up into the I/O board, solder the three leads.

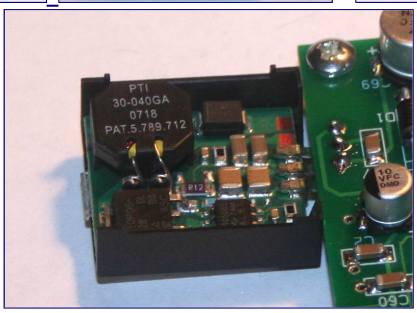
[____] IC1 ... This is the 5V switching regulator

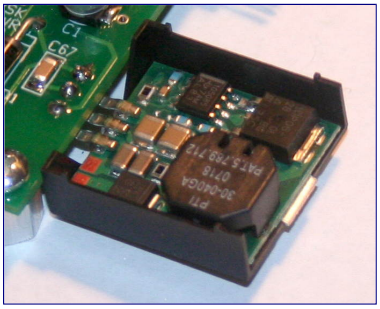


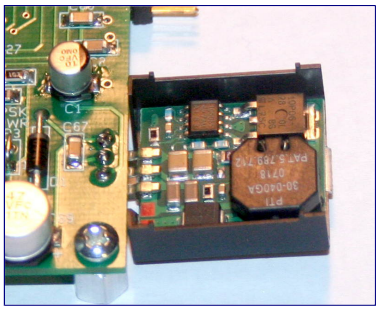


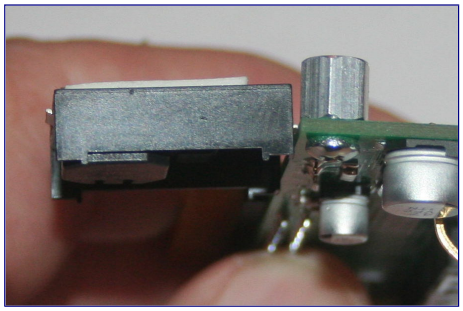












STEP 15: **Quick smoke test**

The I/O board is now complete. carefully check all connections, components polarities where appropriate, and especially look for unintended solder shorts and opens (like a surface mount component raised from the pad, or even mistakenly not yet soldered.)

Apply 12V DC to the connector (2.1mm power plug, center positive), and measure 5V on the regulator output (lowest pin, closest to the board standoff). If you have current monitoring capability on your power supply, you should see no more than 14 ma being drawn.

The I/O Board is complete! Set it aside and next move on to building the Controls Board.

Back to Construction Home

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