ALPS TMDG2 TUNER MODIFICATION WITH STEREO SOUND OPTION

Darren King 7th April 2004

Introduction

USA TiVo's come fitted with a tuner that is not compatible with the analogue (or digital for that matter) TV transmission standards here in Australia. Therefore most people resort to tying up the A/V input of the TiVo with either a VCR to act as a tuner or buy a cheap digital TV set top box. In mid 2003 Peter Vogel and Robert Lowery put forward a document which explained how to remove the original tuner module from a Series 1 TiVo and replace it with a Samsung tuner module which is almost pin-for-pin compatible however it lacked stereo sound. In November 2003 I wrote a how-to document for the Samsung tuner with a stereo sound option.

This document you are reading now is based on my Samsung tuner how-to because the ALPS TMDG2 tuner is almost identical. The APLS TMDG2 tuner is the same tuner as used in the UK Thompson TiVo's, and like the Samsung tuner it is almost pin compatible and dimension wise it is perfect so the overall job needs no major modification to the TiVo case.

I will explain how to fully install the tuner and what is required to get it up and running with either stereo or mono sound. I am assuming that you have opened up your TiVo before and that also you have some basic electronics skills and are comfortable working with miniature components. There is a fair bit of work involved but the results are well worth the effort. If however you are not confident then don't risk destroying your TiVo as there are people in the OzTiVo community who can assist you (myself included) in making a successful job of it.

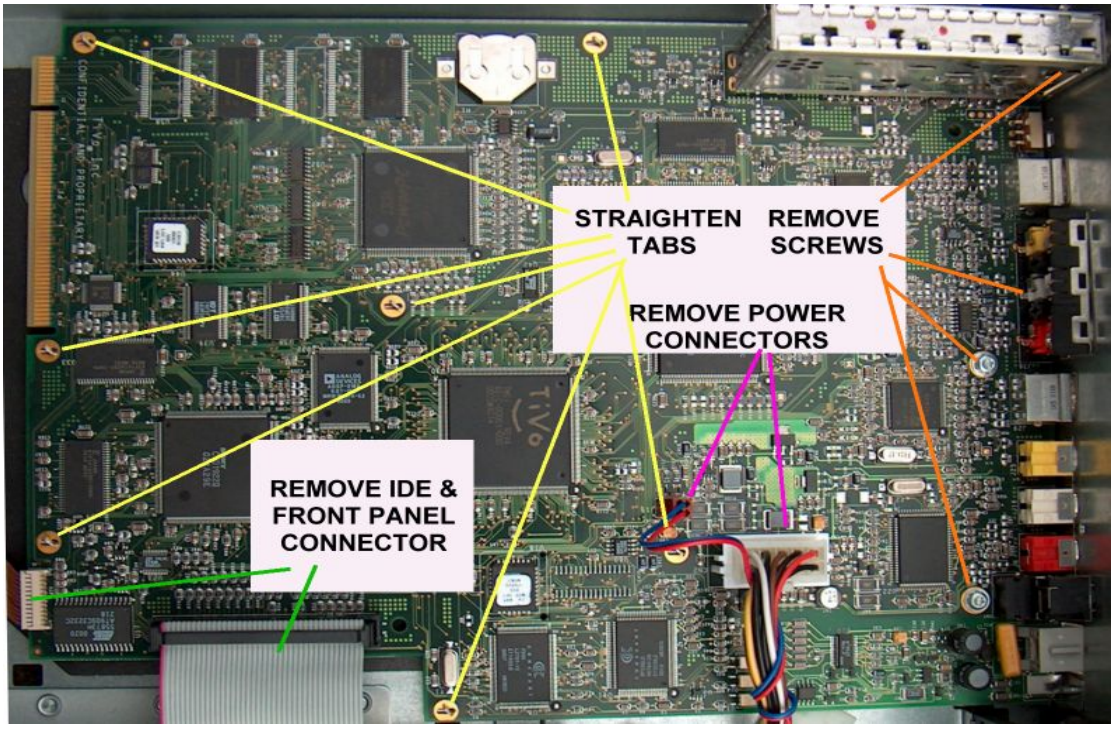
I will point out two small caveats however:

1. If the program material is only broadcast in mono (eg like community channel 31 in Melbourne and Sydney and Channel 10 in Canberra) you only get left channel audio output or even static out of the right channel in some circumstances depending on your proximity to the transmitter. Unfortunately the stereo decoder chip does not common both left and right with mono material. This does not include old mono movies and programs transmitted on normal commercial TV stations because they still output both a left and right (stereo) channels which is made common at the transmitter. The left channel only sound condition also applies if you live in a very flakey (lots of picture noise) reception area as the decoder will not pick up the stereo transmission reliably. Given time and more parts this can be eliminated but it would require more design work and make the circuit more complex. I hope to someday get the time to fix it but for now this is as good as it gets, sorry.

2. At present there is no RF output even though the ALPS tuner supports it. There has been no success with getting the TiVo to output on the RF OUT jack of the tuner yet but on the last page of this How-To you will find the option to wire the appropriate pins of the tuner for future use.

Initial steps: circuit board removal

The first thing is to remove four connectors from the board: Two power connectors, the front panel IR/LED connector and the hard drive IDE connector. There are also two Torx-10 type screws on the circuit board and three Torx Screws on the rear panel. Two of the screws on the rear panel are Torx-10 size but the one on the output A/V connector is a Torx-8 and if you don't have a suitable bit it can be removed destructively with a small flat screwdriver and replace it with a standard phillips head screw. There are also several tabs which need straightening too. Use the following picture as a guide.



With the screws removed and the tabs straightened you can now carefully work from the front of the circuit board lifting it upwards GENTLY so it clears all the tabs. Gently is the key here as we do not want to flex the board too much which may break something. This can be a tough job as the tabs are hard to make perfectly straight. You can assist things here by using a set of pliers and wiggle the tabs left and right while applying upwards pressure to help lift up the circuit board.

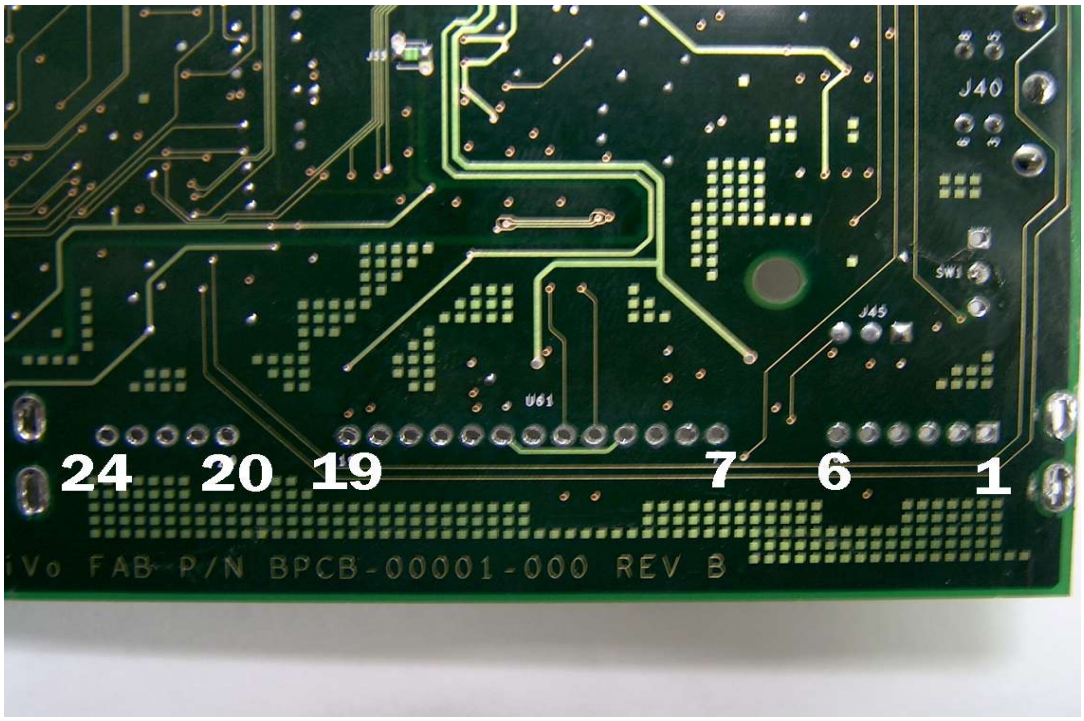
When all the tabs are cleared, slide the circuit board towards the front of the TiVo so the RCA connectors and the RF connectors clear the rear panel and then lift the circuit board up and clear of the TiVo chassis. I find grasping the tuner module with one hand helps. Put the chassis aside and make sure you have a nice clean workspace for you to work on the mainboard with.

OLD TUNER REMOVAL

This is a tricky operation and one of the two hardest parts of the procedure (the other one involves the Micronas chip but that is later on). Do not rush it as there are a lot of small parts around the tuner and a slip with a screwdriver will destroy them.

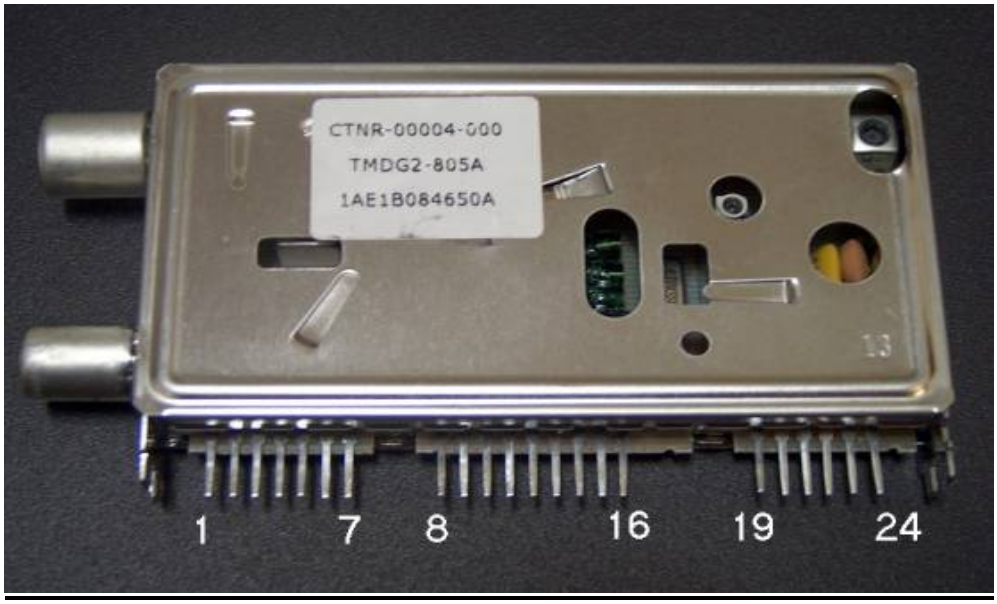
My method of removal is using a proper de-soldering gun, however Peter and Robert chose to do it destructively by carefully snipping off the pins to the tuner and then plucking out the old bits of pins with a soldering iron and some tweezers and then clean up the holes with some de-solder wick. Either way is OK depending on what tools you have available, but again I stress to be very careful that you do not destroy any parts around the tuner or lift any circuit board traces which can happen if you apply too much heat from the soldering iron.

Whichever way you chose to do the operation the end result should be like this:



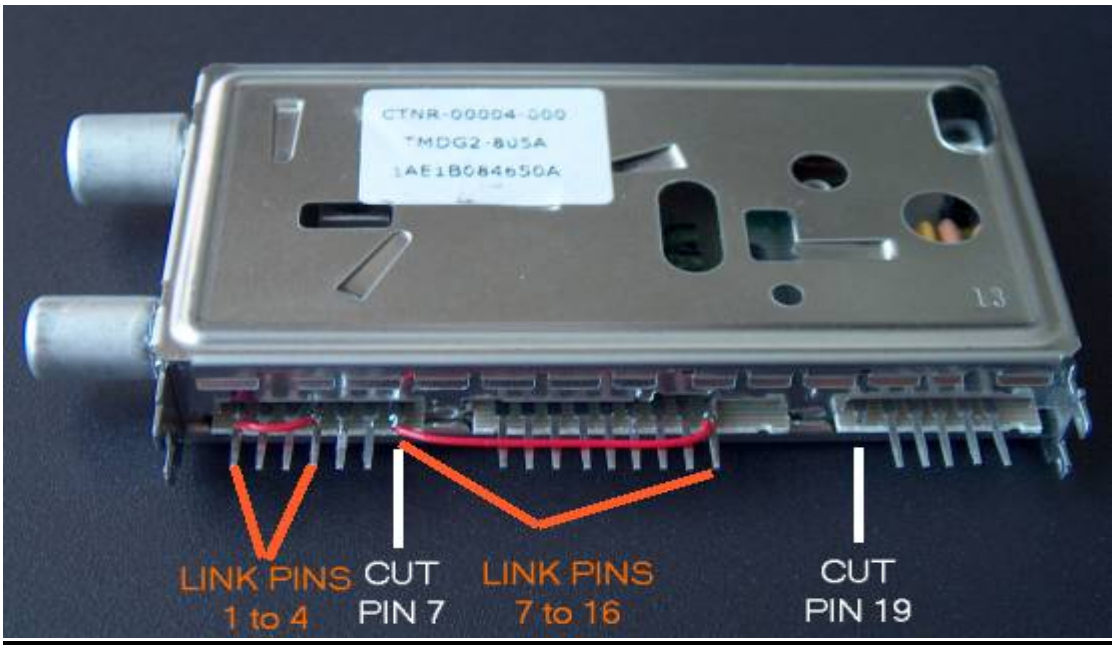
I have made the numbers larger for clarity.

THE ALPS TUNER – INITIAL PREPARATION



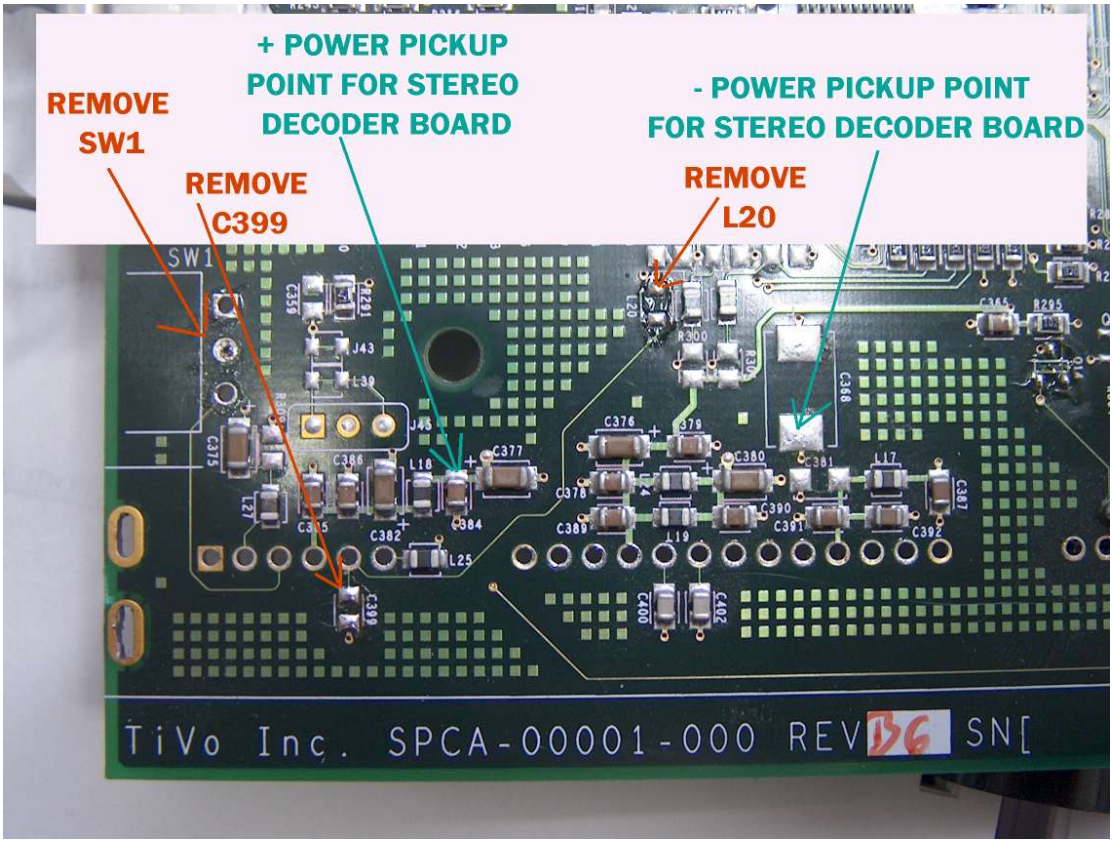
The ALPS tuner is a self contained package that can tune VHF and UHF TV signals and output them in a video and (mono) audio output, along with sound intermediate frequency (SIF) which is used for stereo sound and will be described further on in this article. The tuner uses the I^2C bus protocol to be able to tune to the required frequency easily via commands from a host computer (in this case the TiVo processor). I have included a basic PDF datasheet on the ALPS tuner in the archive this document came in for anyone interested.

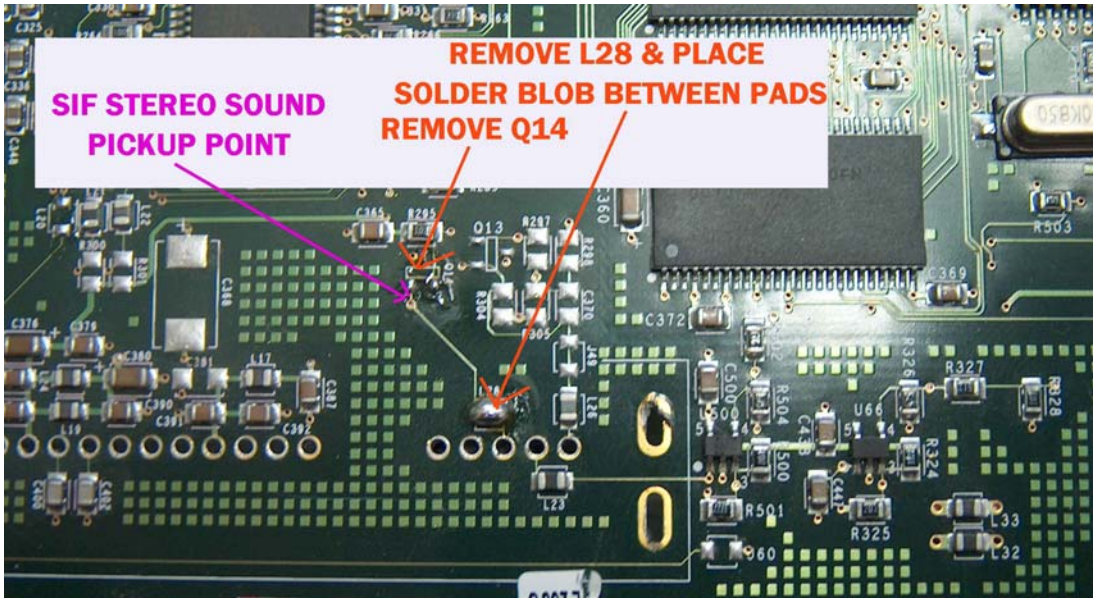
Before it is installed onto the circuit board there are a few modifications required to make it compatible electrically and mechanically, namely cutting some pins (7 and 19) and linking others with some wire (link 1 and 4, 7 and 16) as per this picture:



CIRCUIT BOARD PREPARATION

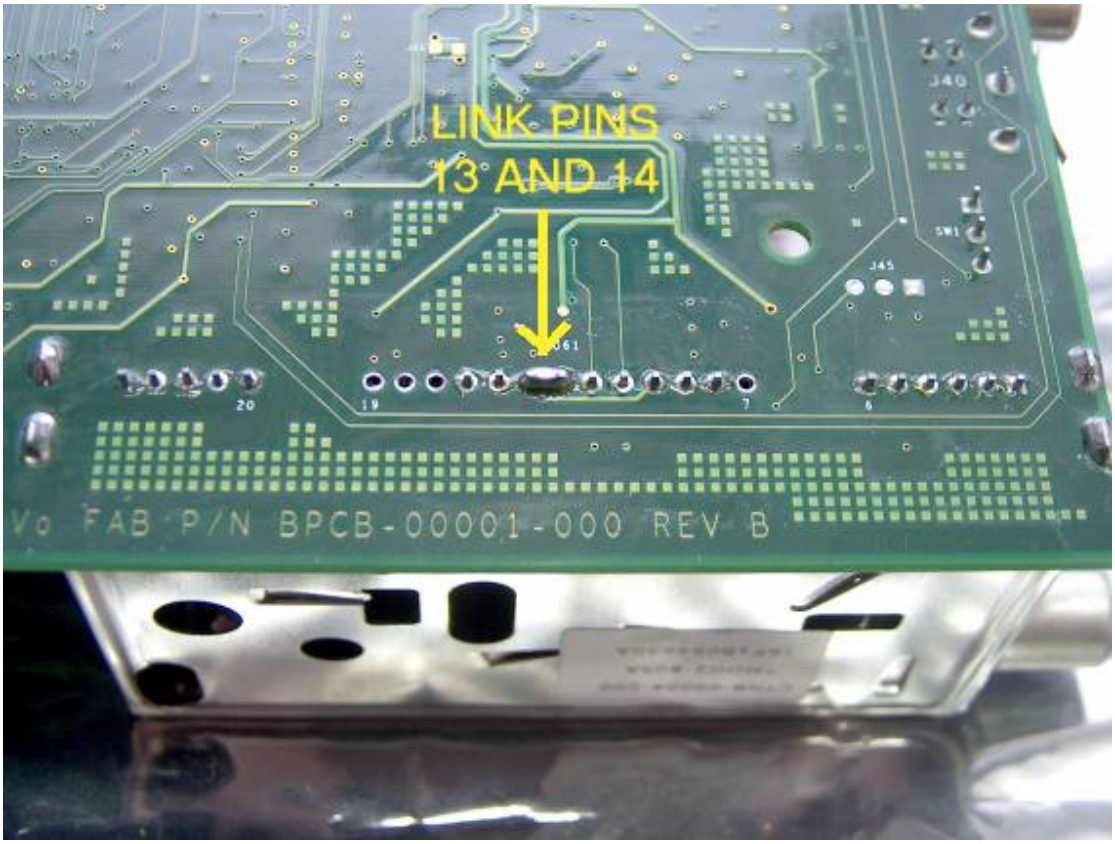
Further to the removal of the old tuner and cleaning out the solder holes there are several other modifications that are needed to make the circuit board compatible with the ALPS tuner. This is explained in these two photos of the top side of the board. At this stage of modification there are no changes to the bottom side.
Note: this procedure is required for both mono and stereo options.





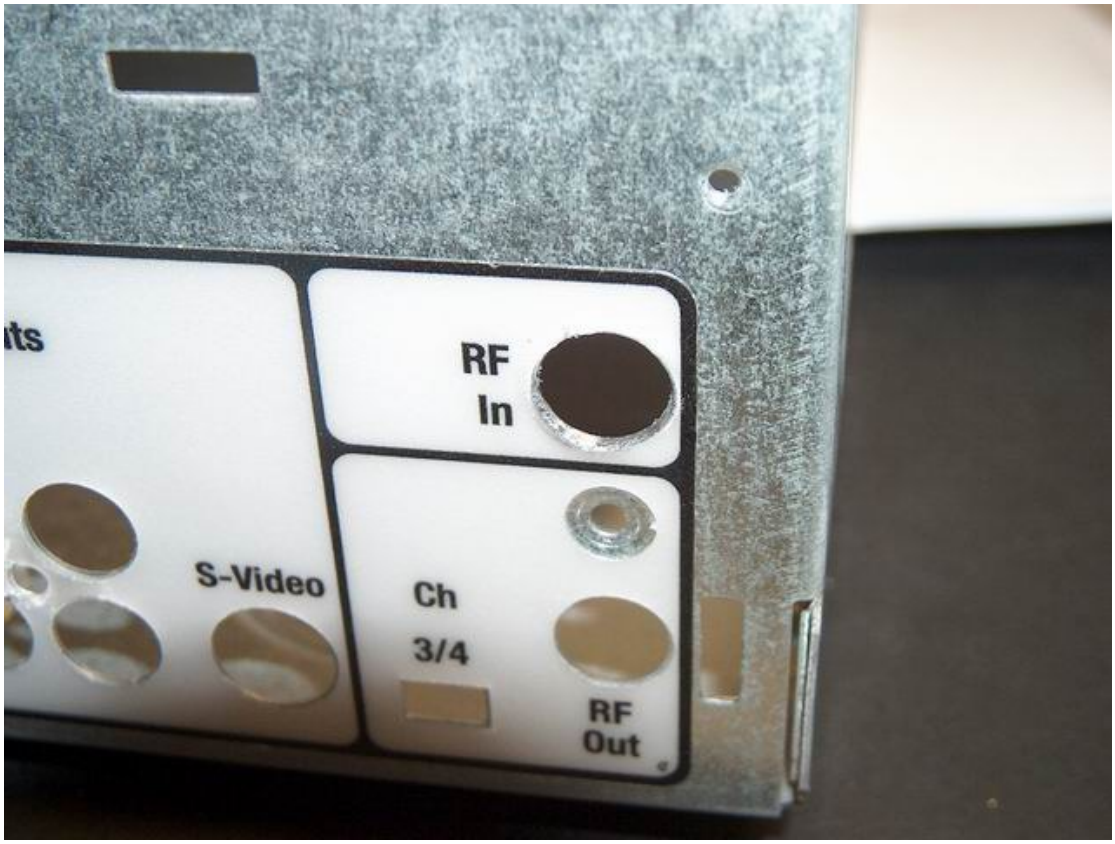
You will notice in the photos I suggest removal of the channel selector switch. This is for two reasons. Firstly it is because the circuit board trace from this switch location now connects to the SDA (Serial Data) pin of the RF modulator section of the tuner therefore we need this trace isolated. Secondly it will prevent confusion that the RF output can be selected via this switch. Removal of the other parts isolates the SCL (Serial Clock) pin of the RF modulator section of the tuner and the SIF (Sound IF) output pin.

With all these modifications done you can now carefully mount the ALPS tuner onto the circuit board and solder all the pins and the mounting tabs at each end of the tuner. You will also have to place a link on the under side of the circuit board between pin 13 and 14. You can simply put a solder blob as this picture shows:



MAKING IT FIT

The next thing to do is enlarge the “RF In” hole a little bigger. Unfortunately the old tuner “F” connector sized hole is not big enough to accommodate the connector on the ALPS tuner. While the case has no mainboard in it grab a reaming tool or a round file and make the hole a little bigger. Be careful that any particles of metal are swept out of the case so they do not short circuit anything.



STEREO SOUND OPTION

If you do not want to build the stereo sound decoder for your ALPS tuner skip his section and move onto the “mono sound option” part of this document.

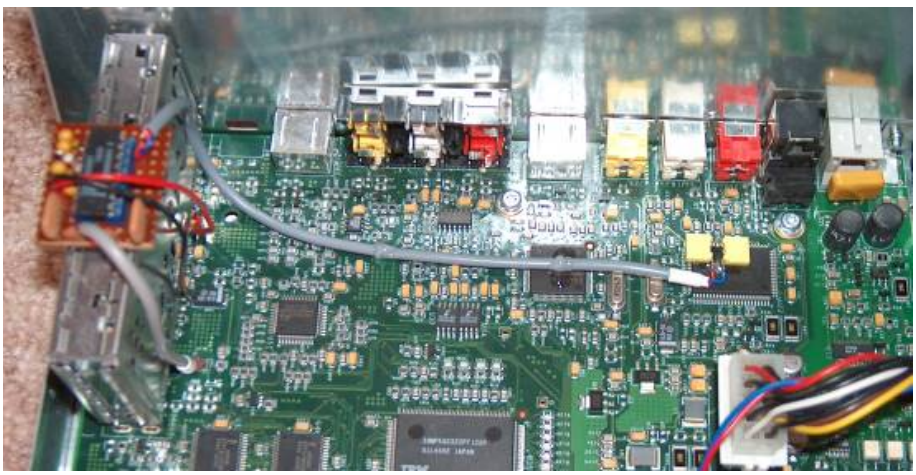
The stereo sound option is a simple addition placed in line from the SIF (Sound IF) output pin of the ALPS tuner to the left and right input pins of the Micronas audio chip. It consists of a Philips TDA 9821 decoder chip and a handful of parts and can be built simply on a small piece of prototyping board and then mounted on top of the ALPS tuner.

To build the decoder you will need the following parts:

1	TDA 9821 from WES Components – part no: TDA9821
1	5.5MHz ceramic filter from WES Components – part no: SFT5.5MA
1	5.74MHz ceramic filter from WES Components – part no: SFT5.74MA
1	10uF/25V tantalum capacitor
1	27Kohm 1/4Watt resistor
1	0.1uF ceramic capacitor
2	0.01uF ceramic capacitors
2	0.22uF polyester capacitors
3	2.2uF 16V tantalum capacitors
	Some “veroboard” prototyping board
	Some light duty solid wire for making wire links (or use the offcuts from the resistor and capacitor leads)
	Some light duty flexible hookup wire

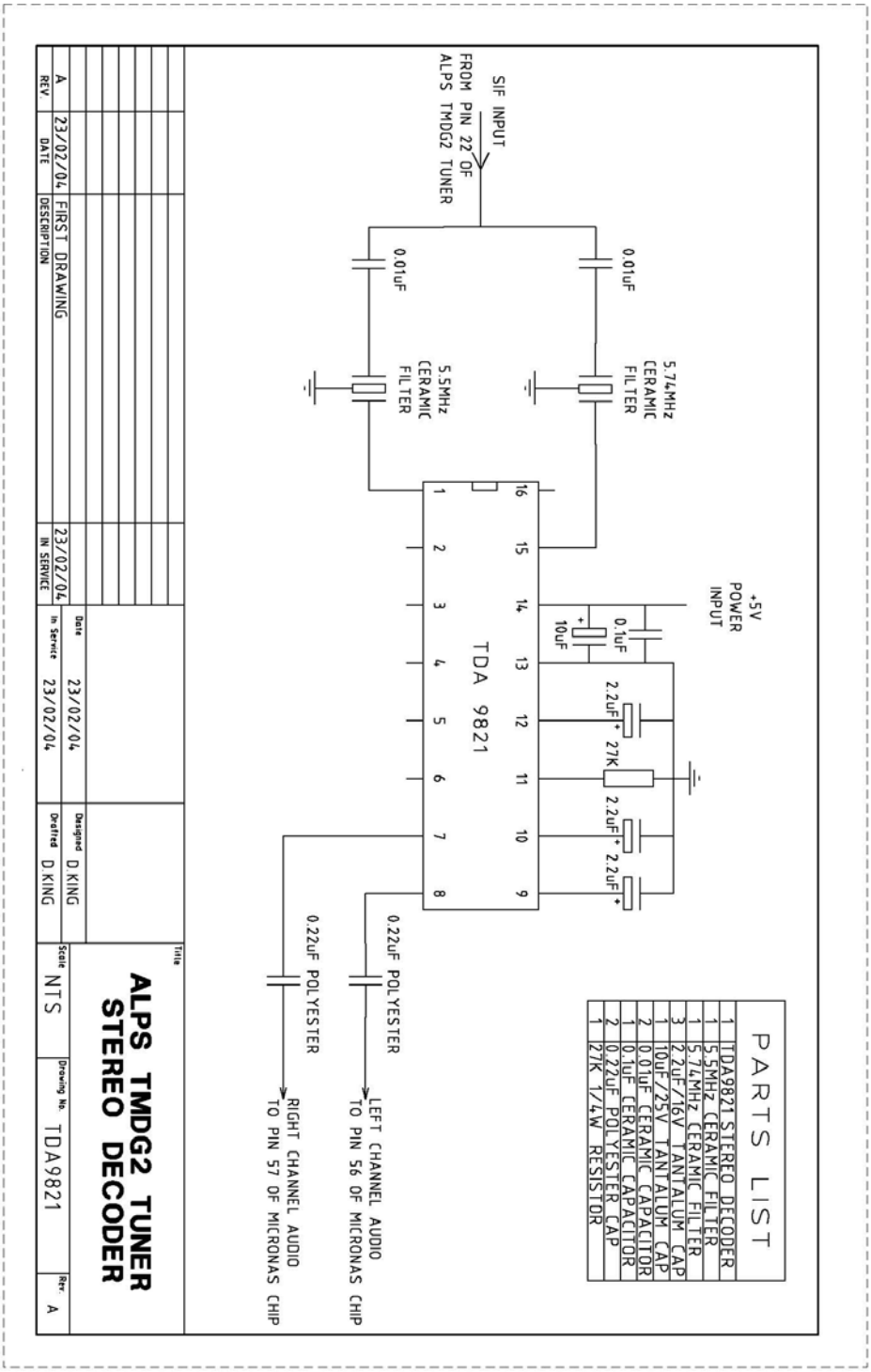
You can get all the parts from WES Components if you like, or it might be easier to go to a local Jaycar, Dick Smith, etc to get the more common items. I actually raided a dead TV for all the parts except the TDA9821. Apart from the specialised parts like the ceramic filters and the TDA9821 nothing else is super critical and you can compromise. It’s up to you. This is a fairly forgiving circuit. One small note is that depending on where you get the 5.5MHz and 5.74MHz filters from they may be 3 pin or 4 pin design. If they are 3 pin the center pin is negative (ground) and if they are 4 pin the two center pins are negative (ground) so just connect both center pins together.

Below you can see a picture of the stereo decoder mounted on top of the tuner.



SCHEMATIC DIAGRAM

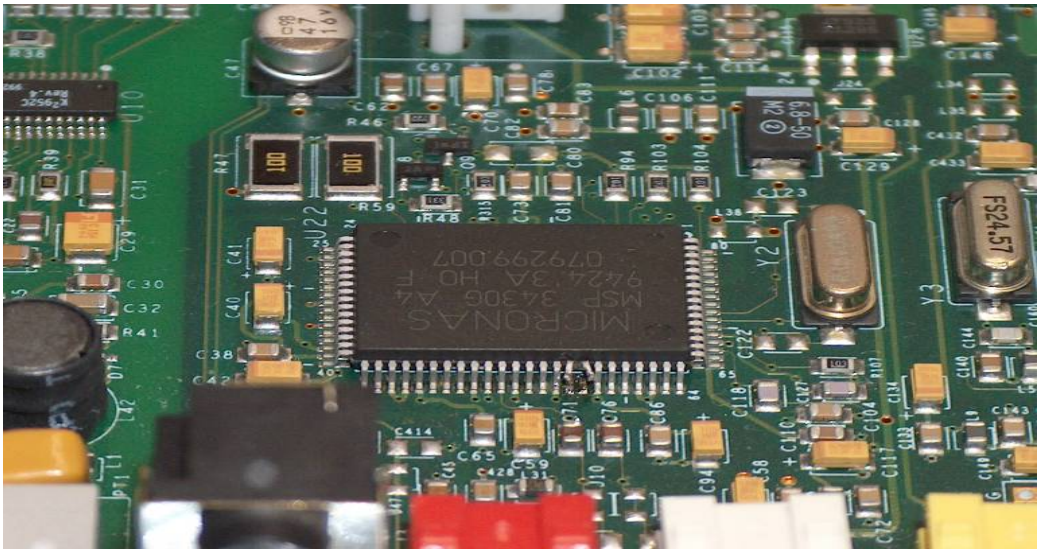
Here is the circuit for the stereo decoder I adapted from the Philips datasheet for use in a TiVo. I have included this schematic and the Philips datasheet in the archive which came with this "how-to" document.



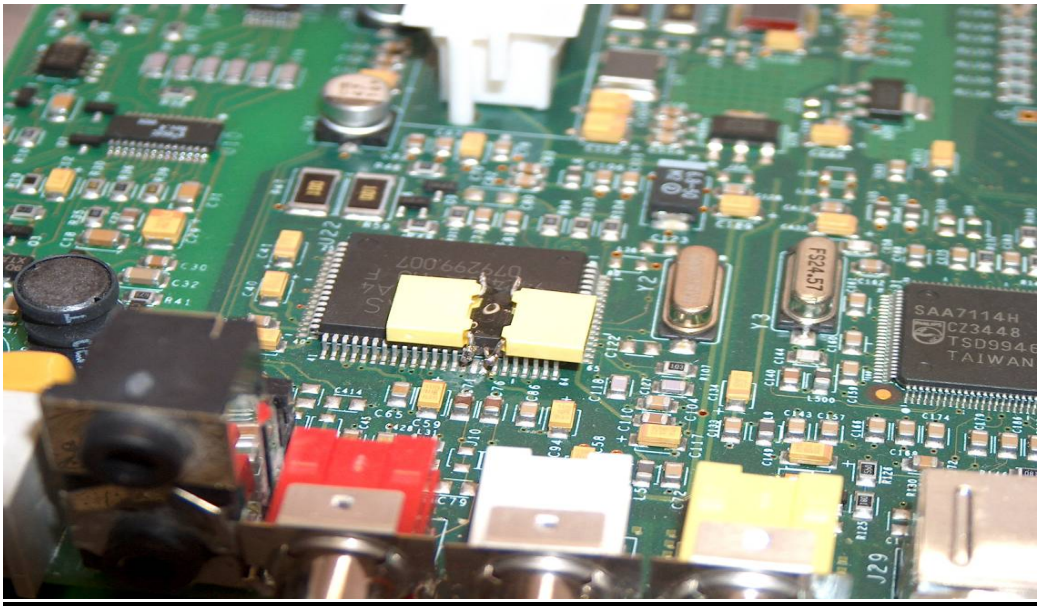
MODIFYING THE MICRONAS CHIP

Modification to the Micronas chip is necessary for both the mono and stereo sound option to allow for sound to be heard. This modification can be a little tricky and a slow and steady approach is the key to a successful modification.

The first step is to apply a little heat with a fine tip soldering iron while levering up pins 56 and 57 of the chip clear from the board. Bend up the pins so they are well clear of the board but not too far that they break off . **Be warned they are brittle so be careful and do not bend the pins too much or they will break off!**



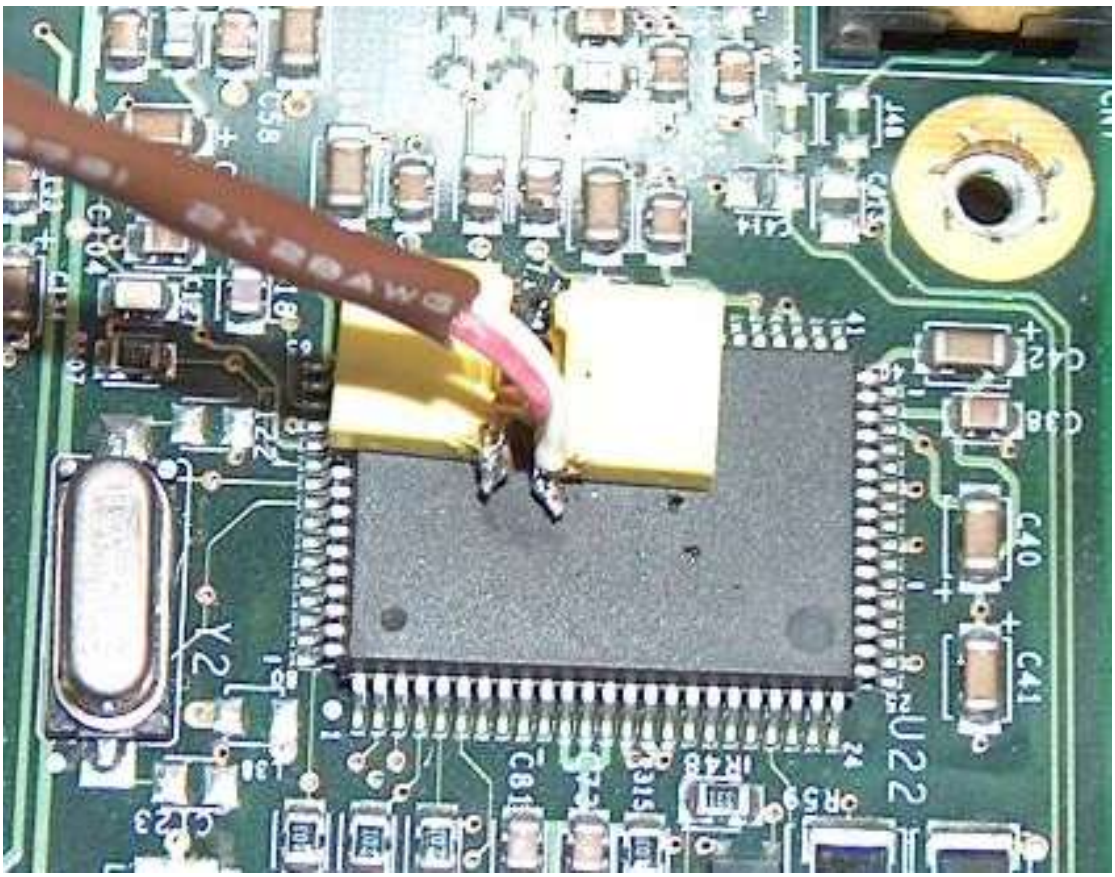
After the pins have been lifted carefully solder on the two capacitors as shown being careful not to bridge pins 56 and 57 with excess solder:



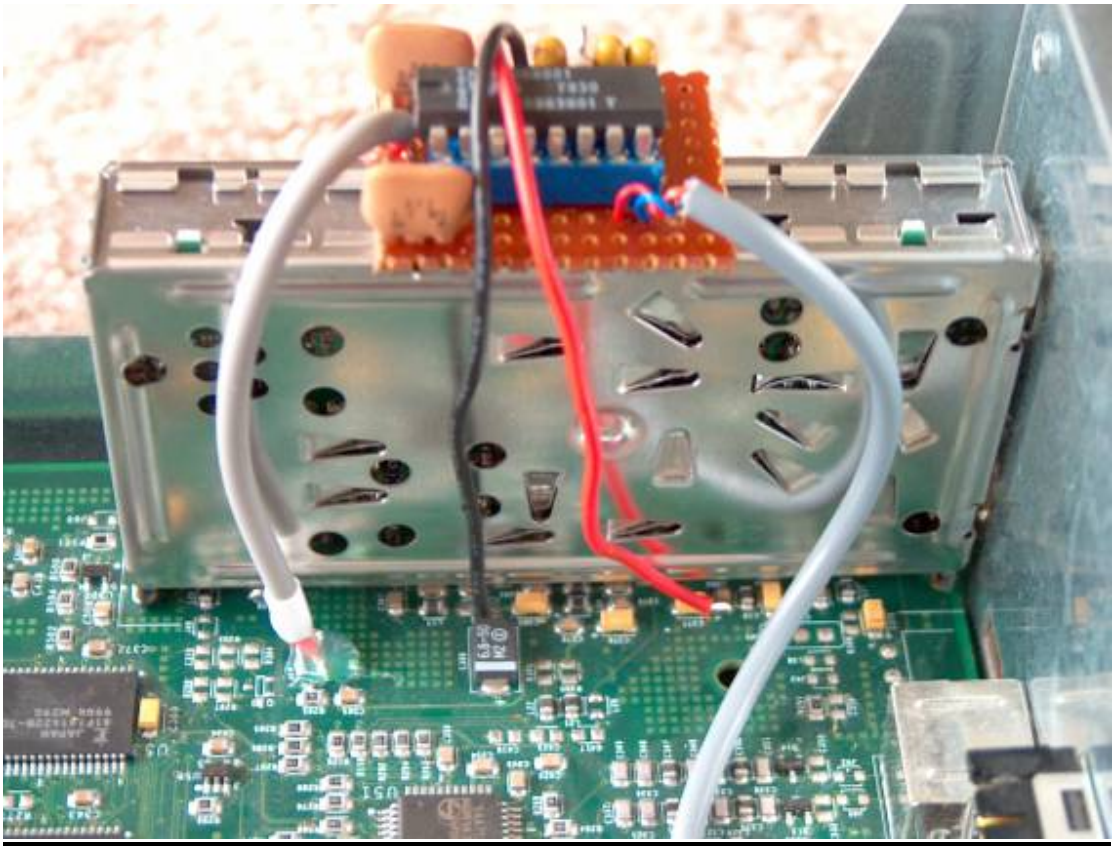
CONNECTING THE DECODER

There are five connections that need to be made: SIF input, +5V power, 0V power, left and right audio output. To connect the SIF input and the +5V and 0(-)V power please refer to the pictures in the “circuit board preparation” section of this document.

For the left and right audio output to the Micronas chip I recommend following a similar procedure to the original mono audio connection in that the 0.22uF capacitors are mounted on the Micronas chip with one side of the capacitors CAREFULLY soldered to pins 56 and 57 of the Micronas respectively. For added mechanical strength I also recommend a dab of araldite on the capacitors to hold them in place on top of the Micronas chip. The other side of the capacitors are connected to the decoder board via a flying lead. I used twin shielded cable to prevent any electrical noise however you may wish to just use standard hookup wire and this is perfectly OK too.



MOUNTING THE DECODER



As can be seen in the above photo the decoder board sits happily on top of the tuner module and I affixed it with a generous blob of hot melt glue but you can use silastic too so long as it is neutral cure and not acidic (vinegar smelling). I do not recommend using double sided adhesive because it tends to come unstuck after a while and the last thing you want is a loose decoder board shorting out on something!

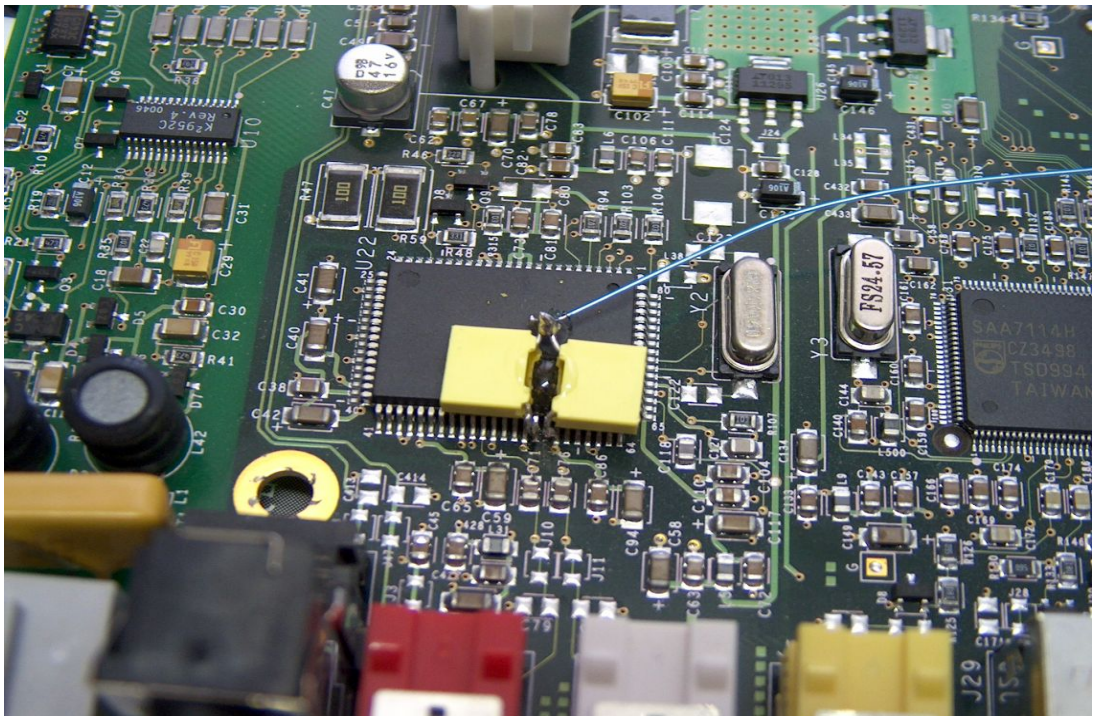
One word of caution is to remember that the tuner module has a metal shell so ensure you DO use a generous blob so that the decoder board is sitting on a layer of silastic or hot melt glue and not touching the metal can.

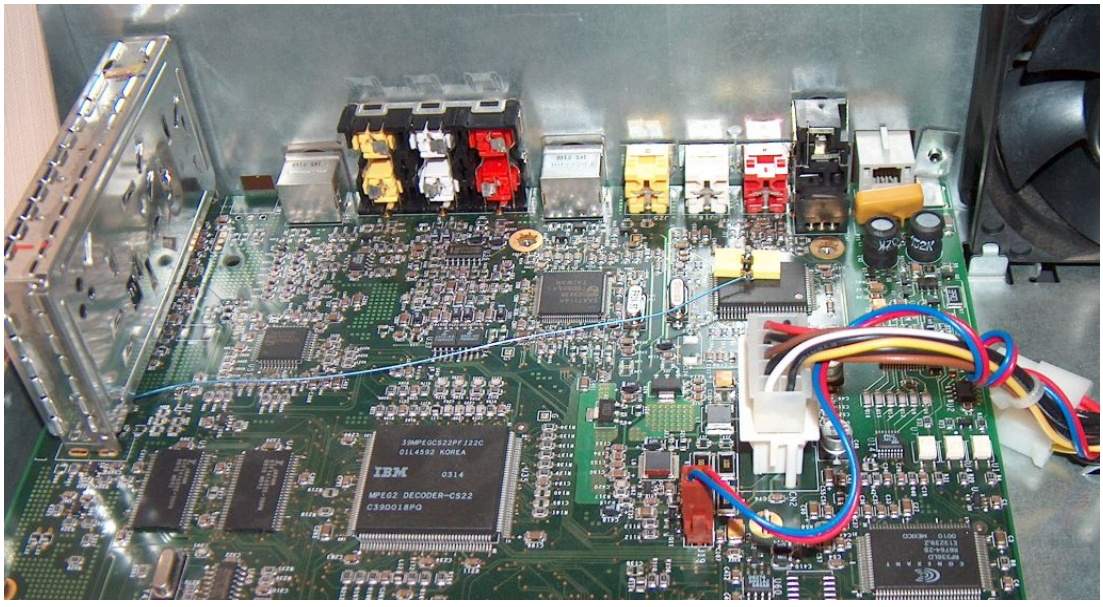
MONO SOUND OPTION

If you do not wish to tackle the stereo decoder then the ALPS tuner does offer the ability to output a mono audio signal direct to the Micronas chip.

To hook up mono audio only simply do the following:

Attach a wire from pin 21 of the ALPS tuner to the two 0.22uF capacitors on top of the Micronas chip (refer to the stereo documentation for how to attach the capacitors onto the Micronas chip). This wire attaches to both the left and right capacitors as shown in this photo.





LOADING THE NEW PALMOD.O FILE*

NOTE: This procedure is only required for the non-emulator TiVo software pre 2004. If you are using the newer TiVo software disregard the following as it is set via a configuarion which is explained on the next page.

The last step is to load on a new palmod.o file so that the TiVo sends the correct commands to the ALPS tuner. The palmod.o file is included in this archive. Without loading on the correct palmod.o file you will get no sound or vision via the RF input with the same behaviour like when the original USA tuner was installed.

With your TiVo booted and a PC running a terminal program that can handle Z-Modem data transfer do the following:
Firstly access the correct folder on the TiVo with the command

```
cd /lib/modules
```

Make the /lib/modules folder read-write active (it is currently read only)

```
rw
```

Check that palmod.o is there by doing an `ls` command
Now delete the existing palmod.o

```
rm palmod.o
```

Check that the existing palmod.o has been deleted with another `ls` command
Now initiate upload of the new palmod.o

```
rz
```

Once you see the TiVo send back “waiting to receive” and strings of strange looking numbers on your terminal program, select the new palmod.o file and upload it.
After the upload has finished check the new palmod.o is there with `ls` again

Now make the folder read only

```
ro
```

Now reboot the TiVo

```
reboot
```

Let the TiVo boot and if you can now see your FTA channels congratulations the modification was successful. If not re-check both your wiring and your original channel programming settings for errors.

CONFIGURING THE TUNER WITH THE NEWER SOFTWARE*

NOTE: This procedure is only required for the newer TiVo software post 2003. If you are using the older non-emulator TiVo software disregard the following and do the procedure on the proceeding page of replacing the palmod.o file.

To configure the ALPS tuner to work in your TiVo do the following from a bash prompt either via a serial cable or Telnet:

At the bash prompt,

[TiVo [p0] ~]# palmod_config
Palmod Configuration Tool

1. Tuner Picture Settings
2. A/V Picture Settings
3. Audio Settings
4. Tuner Settings
5. Save settings and exit
6. Exit without saving

Choice: 4

Tuner Settings

1. Australia - Philips Tuner
2. Australia - Samsung Tuner
3. New Zealand
4. Europe - CCIR
5. Europe - CATV
6. Return to Main Menu

Choice:2

Then return to the main menu and “Save settings and exit”. Job done.

NOTE: You are selecting “Samsung Tuner” even though this is an ALPS tuner. This is correct because the commands that work the Samsung tuner are identical to the commands that make the ALPS tuner work as well.

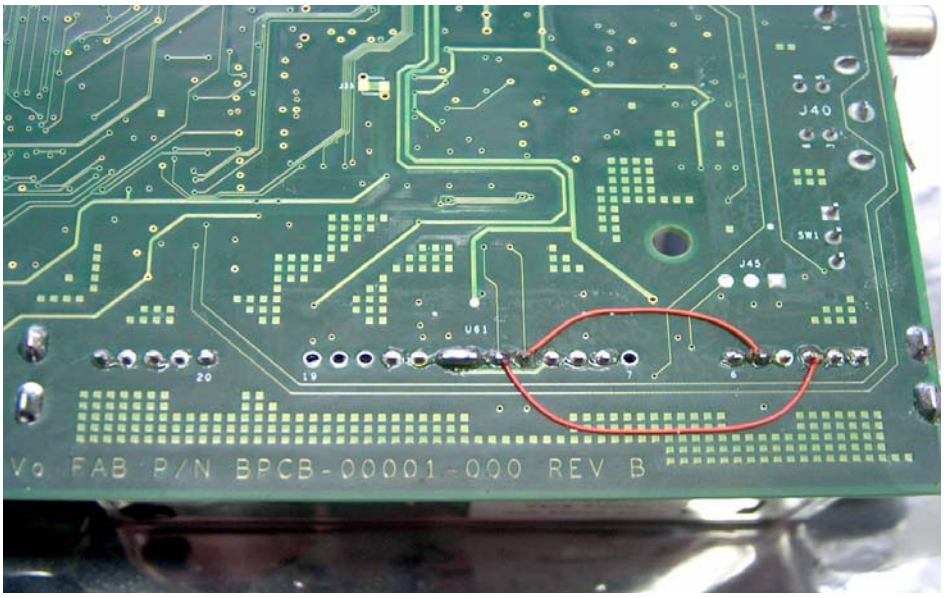
OPTIONAL: RF MOD OUTPUT

As mentioned at the start of this document the ALPS tuner has the ability to output the audio/video from the TiVo via the RF OUT jack on the tuner, however at present it does not work because nobody has implemented it in the TiVo software.

At present the RF OUT terminal will pass through the RF signal from the input jack (ie your antenna) but will not add the TiVo signal to it therefore you still have to use the A/V output jacks to see the TiVo. This is no big deal as most people wire the TiVo into the A/V input of their TV or VCR but it would be nice if hopefully someday someone figures out how to make the TiVo output via the RF OUT jack.

As said above this modification is optional and for future use if someone happens to figure out how to program the RF MOD section of the ALPS tuner. Adding this modification does not affect normal operation of the tuner to receive FTA signals so it is up to you whether you add it or not at this stage.

To do the modification, wire in two wires: one from pin 3 to pin 12 of the tuner and the other from pin 5 to pin 11 of the tuner as per this picture:



What you are doing here is wiring in the SCL (serial clock) and SDA (serial data) I^2C data bus lines of the tuner section (pins 11 and 12) to the RF MOD section of the tuner (pins 3 and 5).