ATARI INSIDER... REPORTED BY JEFF MORIN

This file was found on the Cleveland Freenet a few months back, without author information. If you're out there, thanks! BY HARRY DODGSON

Specifications for the Atari 2600/7800

	2600	7800
CPU:	6507	6502C (custom, NOT 65C02)
RAM:	128 Bytes, in VLSI	4K, high speed
ROM:	6K max	52K max
Cpu Clock:	1.19 MHz	1.79 MHz
Graphics Clock:	3.58 MHz	7.16 MHz
Slot Config:	Rom access only	Most CPU lines + video/audio
CPU Avail:	less than 50%	over 90%

Notes:
1. ROM specs are based on a non-bank select scheme.
2. Graphics Clock is the master clock used to drive the video chips.

Programming the 2600 in a nutshell.
The Atari 2600 consists of 3 important ICs: the CPU (6507), the Television Interface Adapter (TIA or Stella), and the RIOT (6532). The 7800 has a CPU (6502C or Sally) instead of the 6507 and a GCC1702 (Maria) chip in addition to the Stella chip.

The CPU:
The 6507 CPU is a 6502 with 2 important exceptions: it only has external address lines for 8K of memory and there are NO interrupt lines connected. This is not as limiting as it seems if you examine some of the games for the machine.

The Stella chip:
This chip makes all the video displays and sounds for the 2600 VCS. It also has 6 registers which are used as A/D converters and for the trigger buttons on the joysticks. The chip also controls the RDY line of the CPU to initiate horizontal syncronization control. The chip is NOT a DMA chip. The CPU must write each line of data into the chip registers AS it draws the screen. This accounts for the low CPU availability. The Chip is addresed through 44 write only registers, and 13 read only registers mapped to the low end of page 0. For those familiar with the Atari 800, this chip is about 1/2 of a TIA/Pokey in all respects. But, there is no ANTIC chip to drive it; the CPU must do all the work that the ANTIC does in the 800.

The RIOT
This chip reads all the console switches (excluding power), the joysticks, and other controllers. It also contains the only RAM in the system and a general purpose timer. The RAM is mapped to the high end of both page 0 and page 1. This means that it acts as both page 0 fast access memory and the 6502 stack. The timer and I/O ports are mapped to Page 2 and 3.

In order to produce a video display, a program must do the following:
1. Start the vertical blanking interval
2. Start the vertical sync interval immediately. There is time for about 80 instructions after this.
3. End vertical sync. The game computations must be done now as there won't be time later.
4. End vertical blanking
5. Set up each line of the video display as it is drawn. There is time for about 6 instructions to the video chip before the current line starts being displayed. Atari recommends changing the display every other line to gain processing time.
6. Loop back to step 1

Continued...

ATARI INSIDER... PAGE TWO...

The Cartridge:
A standard cartridge contains the equivalent of a 2716 or 2732/2532 with one notable exception: the chip select line is active high, not low. The high order address line of the 6507 (A12) is used as the chip enable. There was at least one company that used EPROMs with a 74LS04 inverter to compensate for this.

Major differences between 2600 and 7800 mode:
2600 mode is default in the 7800. If it finds 128 bytes at the high end of memory to match its encryption scheme, it will enable 7800 mode. There is a small ROM inside the unit which displays the Atari pattern on screen as it does this. The 7800 mode is DMA driven, so the processor is free most of the time to do other things, as the graphics chip runs 4 times faster than the CPU. The 7800 cartridge slot includes 8 more lines: A13, A14, A15, R/W, phase 2 clock, audio, video, and HALT (unique to Atari 6502). The 2600 video has foreground/background, 2 player/missiles, and one ball. The 7800 can display as many objects as the DMA can read in one line. The sound is exactly the same as it still uses the Stella chip (except Ballblazer which has its own sound chip in the cartridge).

CLANCY 2

Thomas DON'T WORK ON JR W/O AMP CIRCUIT

----------NEW TEXTFILE BELOW----------

COMPOSITE/AUDIO/CHROMA/LUMA OUTPUT FOR ATARI 2600 by THOMAS CLANCY

File revision 1.1

After finding my entertainment budget disappear (poor university student) I was forced to economize--I dusted off the Ole'2600. I figured I would hook it up to my computer monitor, but to my dismay there was no composite output on the beast (Atari). Determined to overcome, I quickly disassembled it. After some poking and prodding around I managed to locate the required signals.

Benefits: No longer require a TV. You no longer require those god-awful switch boxes. No more interference patterns on the screen (from the RF cable being used as a bloody antenna). No longer requires the 100' hookup RF cable. Crisp clear Audio etc;

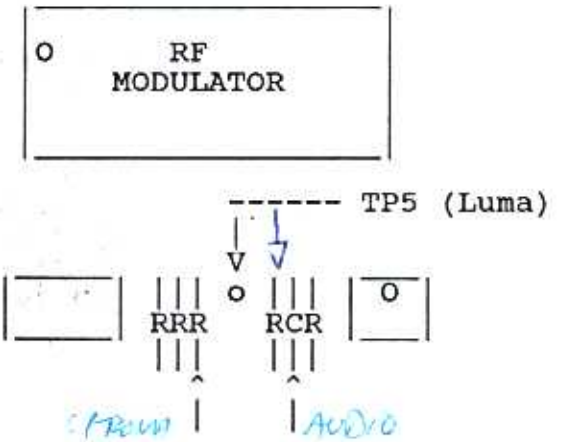
Drawbacks: No longer get to see sister trip in 100' RF cable. No longer get to fall asleep with psychedelic interference patterns on screen.

Materials Required:
Phillips screwdriver, a soldering iron, solder, a small piece of wire, 2 or 3 patch cables and a small pair of needle-nose pliers.

* The following schematic is for the NEWER model which is sometimes referred to as the "Atari Junior". The older model is much the same.

1-Simply unplug everything from your console, turn it over and remove the 5 screws.
2-Remove the top and bottom plastic case pieces. When removing the TOP piece carefully pull out the ribbon cable that connects it to the main board.
3-You should now have the board (covered by a metal shield) in your hands. Turn it over, you will see little clasps on the edge of the shield that hold it in place. Straighten these with your pliers and you can then remove 2 LARGE shields (One on Bottom of unit, one on Top). The small shield remaining (On Top) covers the RF modulator.
4-Orient the exposed board into the position that it would normally be in. ie: The way it is when you play (On/Off switch near Top Left).
5-Look in the LOWER RIGHTHAND AREA of the TOPSIDE (front) of the board. You will see a setup that resembles the schematic below.

TOPSIDE OF THE BOARD,
LOWER RIGHTHAND CORNER



-130Ω

```
                    R41 (Chroma) ---     --- C19 (Audio)
                    Gold/Red/Grey/Blue       Usually turquoise Colored
                    Color-banded
```

NOTE: You can connect the Audio to EITHER side of the Capacitor, the best results are obtained by placing it on the BOTTOM of the Capacitor (as shown).

The Chroma *MUST* be hooked up to the BOTTOM of the resistor (as shown). It will NOT work if you hook it to the top of the resistor.

To gain Chroma/Luma/Audio output you will need 3 RCA patch cables [the kind commonly used with Stereos]. Simply solder the cables at the required points (Chroma/Luma/Audio) as shown. Remember to GROUND ALL cables! ie: solder the GROUND wire [the wire that wraps around the inner wire] to any point that the board shield connects to.

To gain Composite/Audio output you need 2 RCA patch cables [the kind commonly used with Stereos]. Here it gets a little different than above. Simply solder a "jumper" [a piece of wire] from R41 (Chroma) to TP5 (Luma), then connect a patch cord to TP5 [Presto! you now have composite]. Solder the remaining cable to C19 (Audio). Again, remember to GROUND all cables. Do *NOT* GROUND the jumper!

Simply re-assemble the unit and you are done. You will find that it is easier to have the newly installed cables exit through the joystick port. Alternatively, you could cut a notch in the case for a separate exit. Having the cables exit through the RF output is not recommended. There will not be enough room (without pinching the cables) to hook up the RF cable. Adjust your brightness/contrast. Enjoy!

If you ever wish to adjust your color (chroma) there is a "POT" that you can tweek. It can be found near the OFF/ON switch. It is the only pot on the left side of the board.

DISCLAIMER:

I can not, and will not, be held responsible for any damages that you or your system incur. This document is provided for informational purposes only.

Send all Questions/Comments/Cartridges you are no longer using to:

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Later.....

-----=======((((((((((((((Ryan 'Gozar' Collins))))))))))))))=======-------
(On whether abstinance is a Religious term, and should or should not be in the schools:)
"What if you're an Atheist who hates sex?"
                    - Andy from my EDL 304 class

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-----=======((((((((((((((()))))))))))))))=======----- 23-AUG-

How to make a video driver suitable for a 2600 or 7800

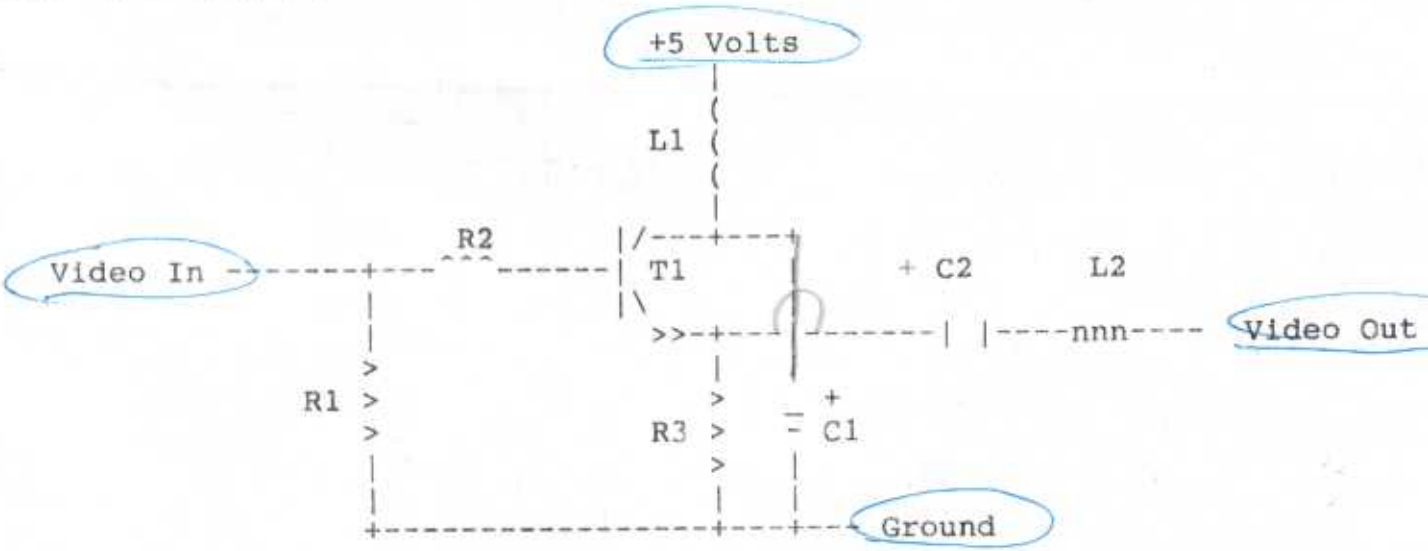
HARRY DODGSON

Parts list:

T1	2SC1815	
R1	2.7K	
R2	150	271-013
R3	68	271-010
~~L1~~	~~180 uH~~	
~~L2~~	~~2.7 uH~~	
C1, C2	100 uF 6.3 V	

wire list:

R1:1 to Ground
R1:2 to Video In
R2:1 to Video In
R2:2 to T1 base
R3:1 to Ground
R3:2 to T1 emitter
L1:1 to +5V
L1:2 to T1 collector
C1:1 to Ground
C1:2 to T1 collector (positive lead of C1)
C2:1 to L2:1
C2:2 to T1 emitter (positive lead of C2)
L2:1 to C1:1
L2:2 to Video Out



This is a simple common emitter amplifier. It is a non-inverting current amplifier and serves here to allow the video signal from the game to drive a standard composite monitor with 75 ohm impedance.

In order to prevent the audio from interfering with the video signal, the mixing oscillator must be disabled on the main circuit board.
disconnect the base lead of Q1 (a 2N3563 located near the RF modulator)

The audio doesn't need any extra buffering.

Places to get signals:

1. from RF modulator
   Video: Pin 3
   Ground: Pin 1

   do not use pin 2 for the +5 volts

2. from Expansion Interface on 7800
   Audio: Pin 17
   Video: Pin 3
   +5: Pin 2
   Ground: Pin 1, 9, 18

3. from video mixer on main circuit board
   Video: point where R10 thru R15, R3, C7, and C8 meet
   Audio: point where R4 thru R6, C4, C5, and C9 meet
   Ground: other end of R4, C7, or R14
   +5: other end of C4

This is required for the 7800 and the Sears Video Arcade II.

Atari 2600 Audio/Video Outputs by Sean Kelly

When I mentioned the possibility of doing this hack I was surprised at the amount of interest in it. As you all are well aware, the graphics capability of the 2600 is what you might call less than impressive, and having separate A/V outputs does not help this much. However, since so many people asked me about it I went ahead with it.

Those of you that read the article I wrote in Digital Press on ColecoVision will notice that I have written this one very differently. The reason for this is that there so many variations on the 2600 internals that a universal set of instructions would be impossible. In ColecoVision's case, even though there are nearly as many revisions to the motherboard (MB), the basic design always stayed the same. On the 2600, you have three DRASTIC design changes and several more that are not quite as drastic, but do affect the layout of the MB somewhat. The hardware needed is essentially the same though, so wherever you got the parts for the ColecoVision hack you will probably find what you need for this one.

Basically, this article is designed to give you a good idea where to start and how to locate the raw audio and video signals. It should work with all revisions of the 2600 MB, but is not guaranteed to. Consider this the disclaimer paragraph! Neither the author nor the publisher or anyone affiliated with either of the aforesaid can be held responsible for any damages caused either directly or indirectly by performing this modification. It is intended to be done completely at your own risk. I did fry one of my 2600's by accidentally connecting a wire to something I shouldn't have connected it to so please be careful when wiring.

The following is a list of the parts you will need:

Transistor - Radio Shack Part #276-1617

Capacitor - Radio Shack Part #272-1028 (Electrolytic Type)

Capacitor - Radio Shack Part #272-121 (Ceramic Disc Type)

Resistor - 330 OHMS (Stripes - Orange, Orange, Brown, Gold)

5 Lug Tie Points - Radio Shack Part #274-688. (referred to as "terminal")

Dual Phone Jacks - Radio Shack Part #274-332

You will also need about 7 short pieces of 22-24 guage wire

Open up your Atari 2600's case. The number of screws to be removed can vary from revision to revision. Once you have the top off the case, you will need to remove the shielding. On older models it's a large thick metal box that is held on by six screws on the bottom. On newer models, Atari used a thin silver metal box that's held in place by four tabs that are twisted. Untwist them and remove the metal shielding.

The first thing you need to do is locate the RF Modulator on the MB. It's a silver box about two inches long and one inch high and on all revisions of the MB I have checked, it's located on the right side of the MB. You will notice a small section of circuit board sticking out of the left side of this box. Towards the bottom of this section of circuit board are five pins that are soldered to the MB - these are the input/output lines to the RF modulator. Only the video signal can be drawn from this location though. If you look at the MB at the point where these pins go into it, you will see either a single number "1" or a "1" and a "5" which are the numbers of the pins. In case your version of the MB does not have these numbers, they are numbered from one of five from left to right. The pin that has the raw video signal is pin four. As you can now see, there isn't much room between each of these pins and you are going to need to attach a wire to pin four somehow. What I did was to turn the MB over and "follow" the trace on the MB to find a better place to attach a wire. This is one of those places where the differences in MB revisions keep me from writing a universal article because there are many different places this trace goes depending on the revision you are working with. A rule of thumb though; attach the wire anywhere before it gets to another component. Meaning if the trace "ends" at a resistor or capacitor or something, attach the wire someplace between pin four and the component that is feeding it. You CAN attach the wire directly to pin four, but be careful not to solder any of the pins together or it's fry time!!

Next we need to locate the raw audio signal. There are three chips on the 2600 MB; two 40 pin chips and one 28 pin chip. The chip you will be using is the 40-pin chip that is furthest from the cartridge slot. In this chip (and all others for that matter) there is a small notch on one end of it. Counting from the end that the notch is on, you need to locate the 12th or 13th pin - both output the raw audio. Follow the same procedure as mentioned with the video source by tracing pin 12 or 13 to a more suitable location for attaching a wire.

The next thing you need to locate is a power source. There are a number of components on the MB that you can draw power from, but the easiest to find is a large blue 2200 uF capacitor. On all the MB revisions I checked, the positive side is clearly labeled by a "+" on etched on the MB. In case it's not labeled on yours, simply look at the capacitor itself and you will see that the negative side is labeled. Connect a wire to the positive side of the capacitor. You can also use the point the power switch itself is connected to. There are six connection points on the switch and the top left point is where you can draw power from. This should not vary from MB to MB, but it might. I suggest using a volt meter if you have one handy to make sure this is the correct point. If you don't have a volt meter it would probably be a good idea to use the capacitor lead.

This wire will be referred to as your power supply.

Lastly, you need to locate a grounding source. On older MB revisions that giant metal box that the MB is inside is a ground source so you can attach a wire to one of the two screws that hold the circuit board with all the switches on it. On newer revisions, the silver cover that covers the chips can be used as your ground source.

You can now begin to wire your terminal. There aren't any numbers printed on the terminal itself, but I will be referring to each lug by number. I have them numbered from left to right, one to five, looking at the terminal from the side that the center lug bends towards you. I will also refer to the transistors' pins by number. They are numbered from one to three, left to right also, looking at if from the curved side. The following is a list of what gets connected to each lug on the terminal:

Lug #1 - Lead #1 of the transistor.

Your power supply wire.

Lug #2 - Lead #2 of the transistor.

One lead from the Disc capacitor. (Doesn't matter which).

Lug #3 - This is the GROUND lug. One side of the resistor is connected here.

Connect your ground wire here.

Connect two pieces of wire here. These will be used as the grounds for the audio & video jacks.

Lug #4 - The negative lead of the Electrolytic capacitor. The negative lead is identified by the arrow which is pointing to the negative lead or simply by a "-" sign.

Connect one piece of wire here which will be your positive VIDEO output.

Lug #5 - Connect your audio source wire here.

Connect once piece of wire here which will be your positive AUDIO output.

You now have one lead of the transistor, one lead of the resistor, and one lead of each capacitor just hanging there right? Connect all of these together, but do not connect them to any of the lugs. Just sort of let them hang there, but make sure not to touch them to any other component on the MB OR what you have just built. It would probably be a good idea to tape this "junction" up once you have soldered it together so it doesn't touch something when you put the system back toghether.

You now need to find a suitable location to mount this contraption. Luckily, the 2600's case is much larger than it needed to be so there is plenty of room in there. I suggest drilling a hole somewhere and using a small nut & bolt to securely fasten it. One thing to consider when picking a location is that your audio and video output wires do not like to be placed near each other or any other wires or components as they will accept alot of interference from anything near them. Try routing them to your A/V jacks so that they are as isolated as possible.

The Dual Phono Jacks are now ready to be mounted. Again, because there is plenty of space inside the 2600's case you have a number of choices. You will have to cut out a small square out of the case roughly one inch by one half inch. Once you have your square cut out place the phono jack on the case from the outside and using four small screws securely fasten it to the 2600's case. Now you can connect all your wires to the phono jacks. Each of the outside posts on the phono jack gets a ground wire, and the two inside posts will get an audio or video wire.

That's basically all there is to it. A couple of minor problems that I have noticed though. First, the regular output wire that you would normally connect to your TV/Game switch seems to be slightly upset that you have added the A/V outputs and some interference is noticeable. If you plan on using your A/V outputs exclusively you can just remove this wire before you put the system back together. But if you would like the ability to use the old output wire and the interference bothers you, you can install a toggle switch between the power supply wire and the terminal. The second problem I had was getting color output through the video jack. This seems to be a problem with the ground. If you find you are only getting black and white output find another place to connect your ground wire and make sure it's making a good connection.