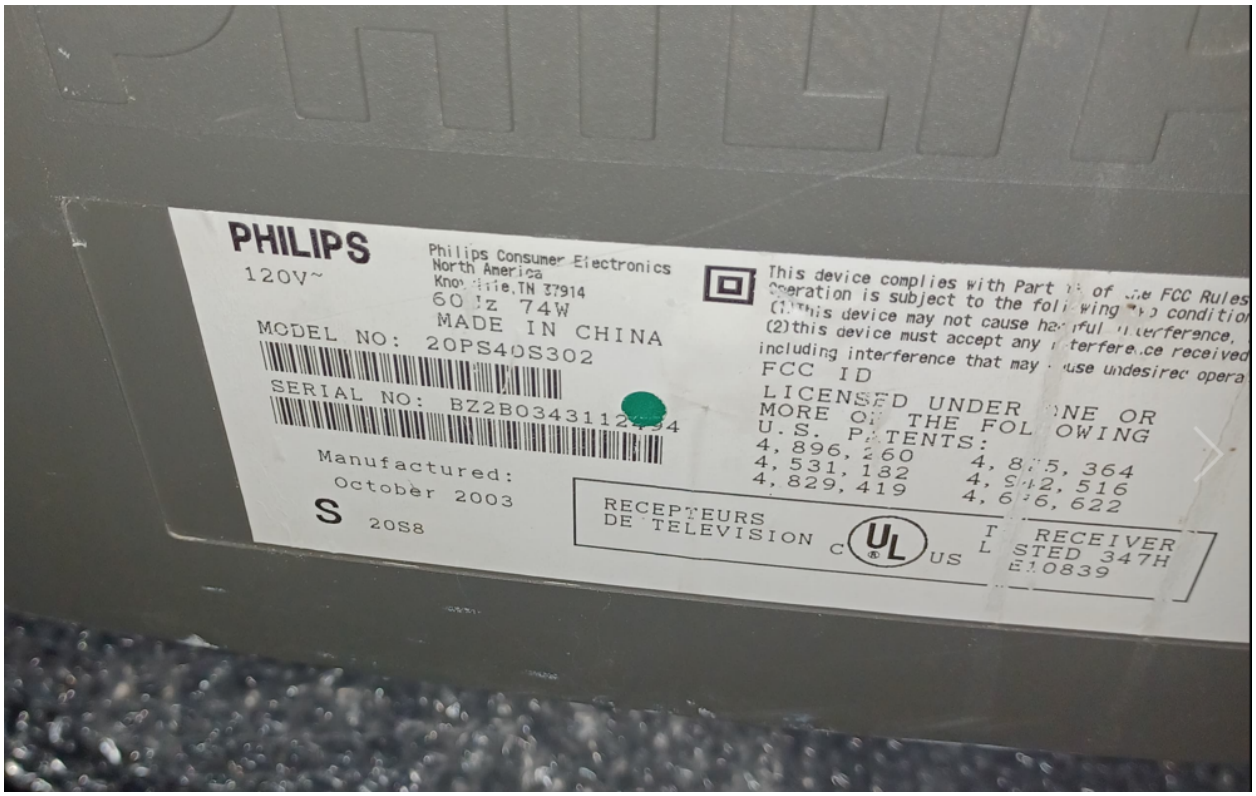
Component Modding a CRT: Philips 20PS40S302

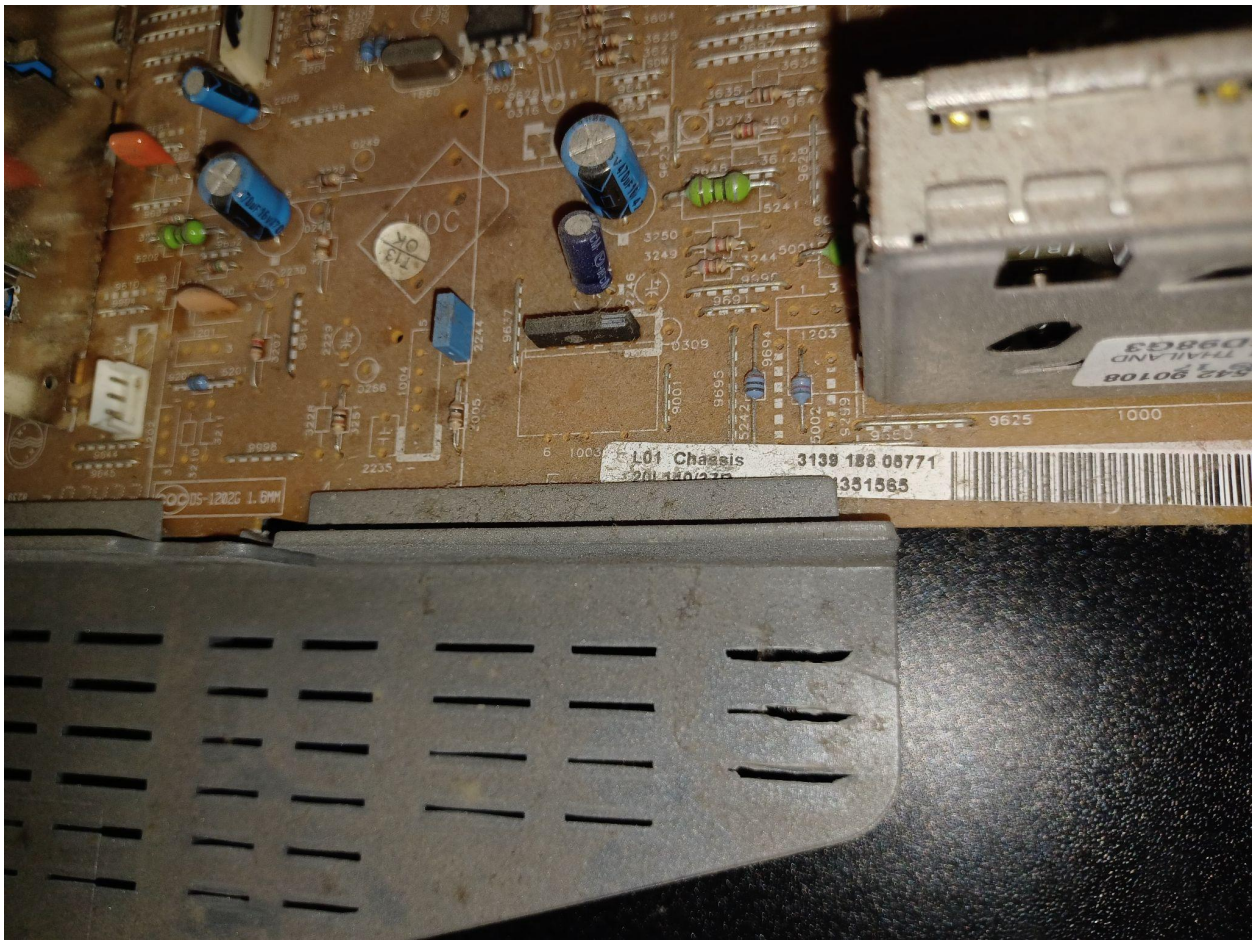
Materials Needed: one 1k resistor, three RCA jacks, kapton tape (optional), three 75 ohm resistors, three 0.1 uF capacitors, heat shrink tubing (optional but highly recommended), dupont connectors (optional but highly recommended)

Huge thanks to Matt Ross for designing this mod and helping walk me through the process!

1. **Compatibility Verification and CRT Disassembly**

This mod will work on a number of Philips CRTs, but not all. Before starting the mod process, please verify that your set has the appropriate chassis to take the mod. This set has the L01 chassis, which worked fine with this particular component modification. As noted by 6tanks (Matt) of CRTDatabase.com, the L03.2U chassis will also work.





To check if CVI (component video) is available for your set, open the service menu on your TV (press 0 6 2 5 9 6 + MENU) and adjust Option 5. I highly suggest noting ALL option numbers before making any changes. On my set, Option 5 was set at 180. In order to access CVI and keep the functionality of s-video and composite on the back, as well as composite on the front, I entered “254” as the new option number. You must press those three numbers when Option 5 is selected to change it. Turn the TV off and unplug it for 10 seconds for the changes to take hold. If you are able to see CVI as an input when you turn the TV back on and flip through the inputs, your set is compatible with the mod.

How to Calculate the Value of an Option Byte

Calculate an Option Byte value (OP 1 .. OP 7) in the following way:

1. Check the status of the single option bits (OB): are they enabled (1) or disabled (0).
2. When an option bit is enabled (1), it represents a certain value (see first column "value between brackets" in table below). When an option bit is disabled, its value is 0.
3. The total value of an Option Byte is formed by the sum of its eight option bits. See second table below for the correct Option Bytes per type number.

Bit (value)	OP1	OP2	OP3	OP4	OP5	OP6	OP7
0 (1)	OB10	OB20	OB30	OB40	OB50	OB60	OB70
1 (2)	OB11	OB21	OB31	OB41	OB51	OB61	OB71
2 (4)	OB12	OB22	OB32	OB42	OB52	OB62	OB72
3 (8)	OB13	OB23	OB33	OB43	OB53	OB63	OB73
4 (16)	OB14	OB24	OB34	OB44	OB54	OB64	OB74
5 (32)	OB15	OB25	OB35	OB45	OB55	OB65	OB75
6 (64)	OB16	OB26	OB36	OB46	OB56	OB66	OB76
7 (128)	OB17	OB27	OB37	OB47	OB57	OB67	OB77
Total:	**Sum**	**Sum**	**Sum**	**Sum**	**Sum**	**Sum**	**Sum**

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Figure 8-3 Option Byte calculation

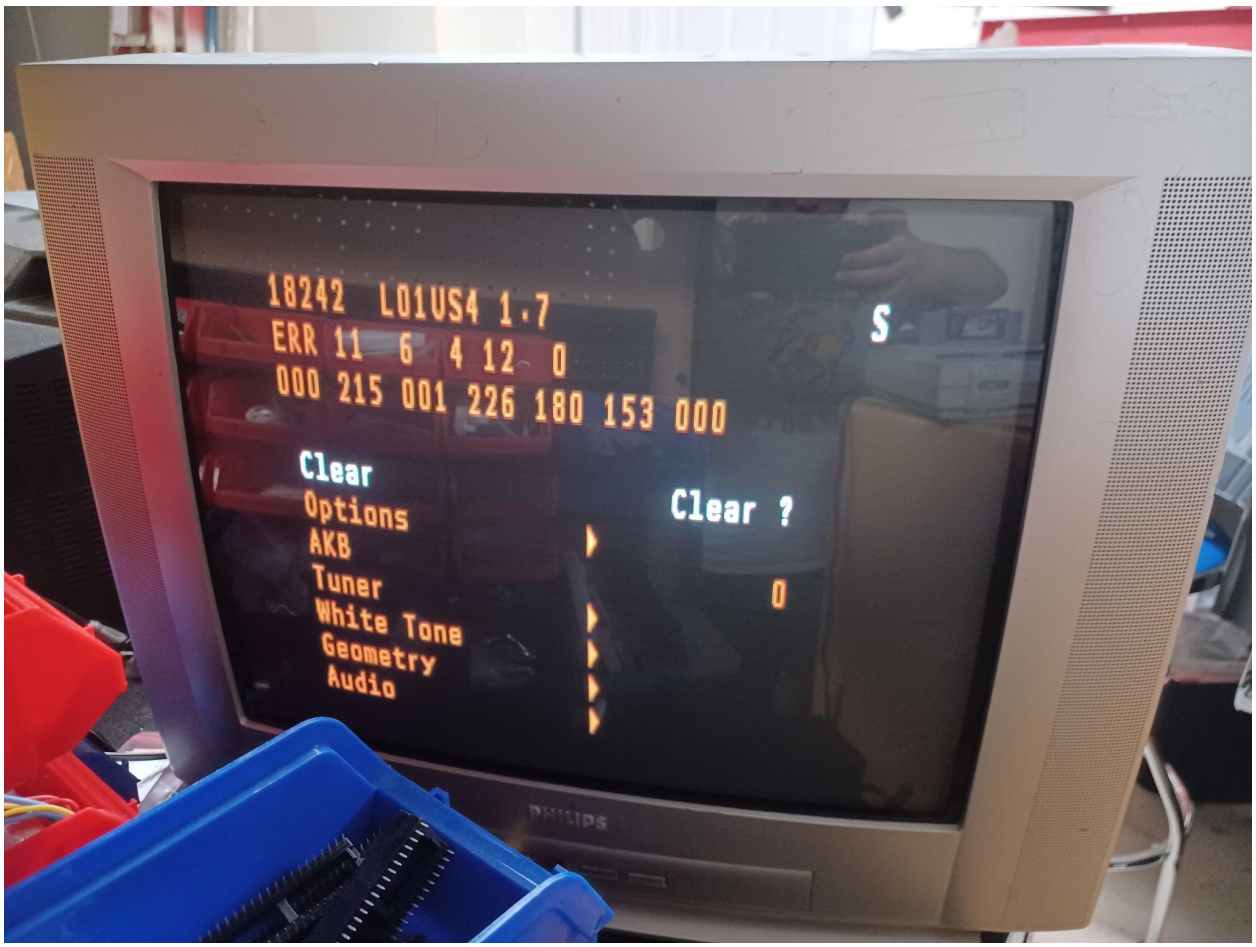
Table 8-2 Options settings

Type number	OP1	OP2	OP3	OP4	OP5	OP6	OP7
13MT1431/17	01	215	67	160	192	201	64
13MT1532/17	01	215	67	160	192	201	64
13MT1533/17	01	215	67	160	192	201	64
14MS2331/17	01	215	67	161	192	201	64
20MS2331/17	01	215	67	161	192	201	64
20MT1331/17	01	215	67	160	192	201	64
20MS1336/37	65	215	67	160	192	201	64

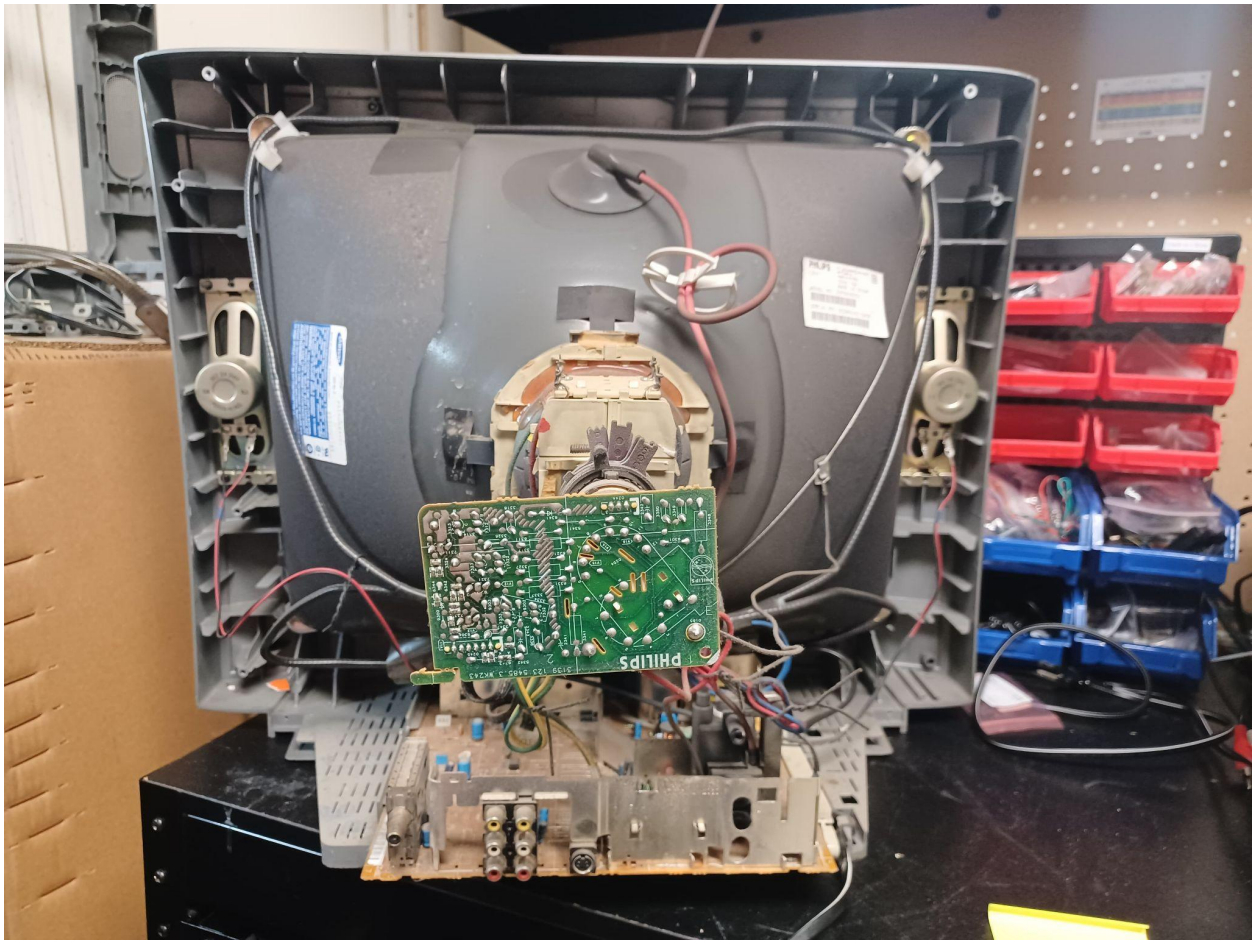
Option Bit Assignment

Following are the option bit assignments for all L03 software clusters.

Option Byte			Option Bit Definition		
OP #		Assignment	Bit = [0]	Bit = [1]	Default setting
5	OBx0	PIP or CLOCK	Feature is disabled or not applicable	Feature is enabled	LATAM & NAFTA: 0
	OBx1	HOTEL_MODE	Hotel mode is disabled or not applicable	Hotel mode is enabled	LATAM & NAFTA: 0 for stereo sets, 1 for mono sets.
	OBx2	SVHS	SVHS source is not available	SVHS source is available	LATAM & NAFTA: 0. (Note: This option bit is not applicable for EU)
	OBx3	CVI	CVI source is not available	CVI source is available	
	OBx4	AV3	Side/Front AV3 source is not present	Side/Front AV3 source is present	LATAM & NAFTA: 0.
	OBx5	AV2	AV2 source is not present	AV2 source is present	LATAM & NAFTA: 0. (Note: For EU, when AV2=1, both EXT2 and SVHS2 should be included in the OSD loop)
	OBx6	AV1	AV1 source is not present	AV1 source is present	LATAM & NAFTA: 0
	OBx7	NTSC_PLAYBACK	NTSC playback feature is not available	NTSC playback feature is available	LATAM & NAFTA: 0

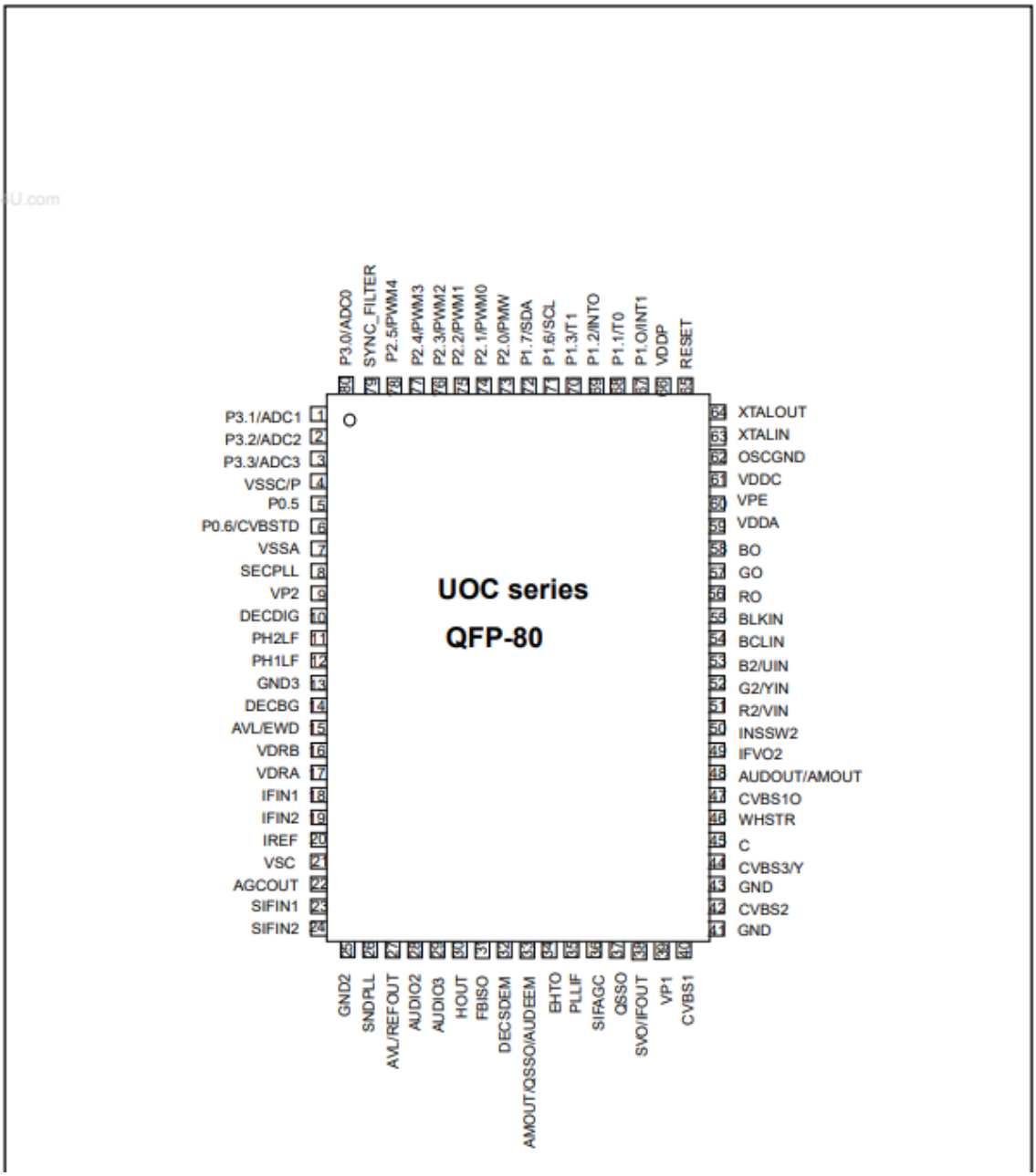


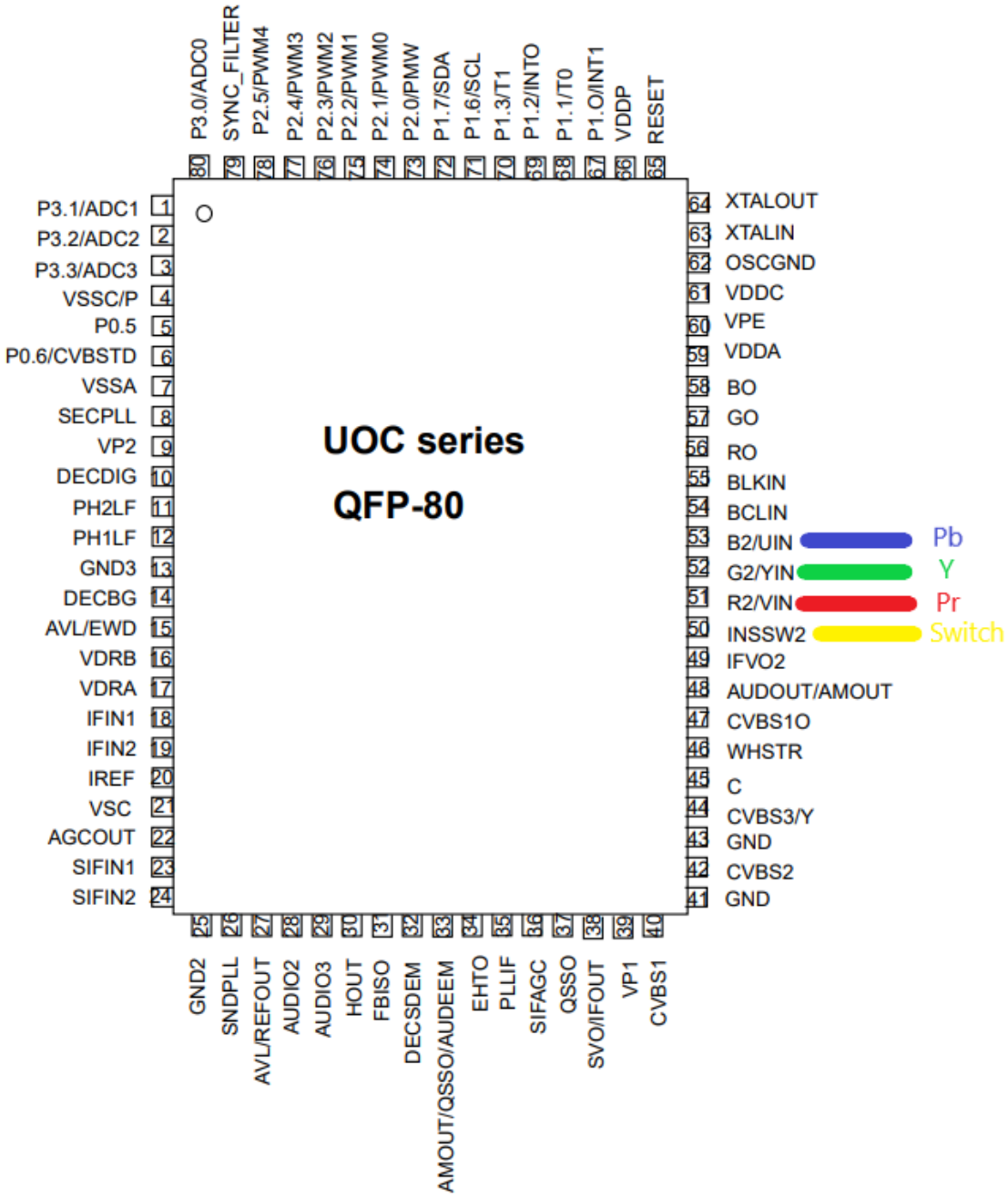
Now that you have verified that CVI is available, remove the chassis from the tube. This includes disconnecting the anode cap from the tube, removing the neckboard from the yoke, and unplugging various cables on the main PCB. Take pictures or otherwise document the position of the cables so that you do not plug them in incorrectly upon reassembly.



2. **Main PCB Inspection and Plan of Attack**

With the main PCB removed, look at the underside of the board and search for a small surface mount IC. You should see a TDA chip (in my case, TDA 9587H). This is where we will want to grab our YUV signals, as well as add a resistor to make the CVI functional.


UOC series
QFP-80
P3.1/ADC1 1
P3.2/ADC2 2
P3.3/ADC3 3
VSSC/P 4
P0.5 5
P0.6/CVBSTD 6
VSSA 7
SECPLL 8
VP2 9
DECDIG 10
PH2LF 11
PH1LF 12
GND3 13
DECBG 14
AVL/EWD 15
VDRB 16
VDRA 17
IFIN1 18
IFIN2 19
IREF 20
VSC 21
AGCOUT 22
SIFIN1 23
SIFIN2 24
GND2 25
SNDPLL 26
AVL/REFOUT 27
AUDIO2 28
AUDIO3 29
HOUT 30
FBISO 31
DEC/SDEM 32
AMOUT/QSSO/AUDEEM 33
EHTO 34
PLLIF 35
SIFAGC 36
QSSO 37
SVO/IFOUT 38
VP1 39
CVBS1 40
P3.0/ADC0 80
SYNC_FILTER 79
P2.5/PWM4 78
P2.4/PWM3 77
P2.3/PWM2 76
P2.2/PWM1 75
P2.1/PWM0 74
P2.0/PMW 73
P1.7/SDA 72
P1.6/SCL 71
P1.3/T1 70
P1.2/INTO 69
P1.1/T0 68
P1.0/INT1 67
VDDP 66
RESET 65
XTALOUT 64
XTALIN 63
OSCGND 62
VDDC 61
VPE 60
VDDA 59
BO 58
GO 57
RO 56
BLKIN 55
BCLIN 54
B2/UIN 53
G2/YIN 52
R2/VIN 51
INSSW2 50
IFVO2 49
AUDOUT/AMOUT 48
CVBS1O 47
WHSTR 46
C 45
CVBS3/Y 44
GND 43
CVBS2 42
GND 41


UOC series
QFP-80
1 P3.1/ADC1
2 P3.2/ADC2
3 P3.3/ADC3
4 VSSC/P
5 P0.5
6 P0.6/CVBSTD
7 VSSA
8 SECPLL
9 VP2
10 DECDIG
11 PH2LF
12 PH1LF
13 GND3
14 DECBG
15 AVL/EWD
16 VDRB
17 VDRA
18 IFIN1
19 IFIN2
20 IREF
21 VSC
22 AGCOUT
23 SIFIN1
24 SIFIN2
25 GND2
26 SNDPLL
27 AVL/REFOUT
28 AUDIO2
29 AUDIO3
30 HOUT
31 FBISO
32 DECSDEM
33 AMOUT/QSSO/AUDEEM
34 EHTO
35 PLLIF
36 SIFAGC
37 QSSO
38 SVO/IFOUT
39 VP1
40 CVBS1
41 GND
42 CVBS2
43 GND
44 CVBS3/Y
45 C
46 WHSTR
47 CVBS1O
48 AUDOUT/AMOUT
49 IFVO2
50 INSSW2
51 R2/VIN
52 G2/YIN
53 B2/UIN
54 BCLIN
55 BLKIN
56 RO
57 GO
58 BO
59 VDDA
60 VPE
61 VDDC
62 OSCGND
63 XTALIN
64 XTALOUT
65 RESET
66 VDDP
67 P1.O/INT1
68 P1.1/T0
69 P1.2/INTO
70 P1.3/T1
71 P1.6/SCL
72 P1.7/SDA
73 P2.0/PMW
74 P2.1/PWM0
75 P2.2/PWM1
76 P2.3/PWM2
77 P2.4/PWM3
78 P2.5/PWM4
79 SYNC_FILTER
80 P3.0/ADC0
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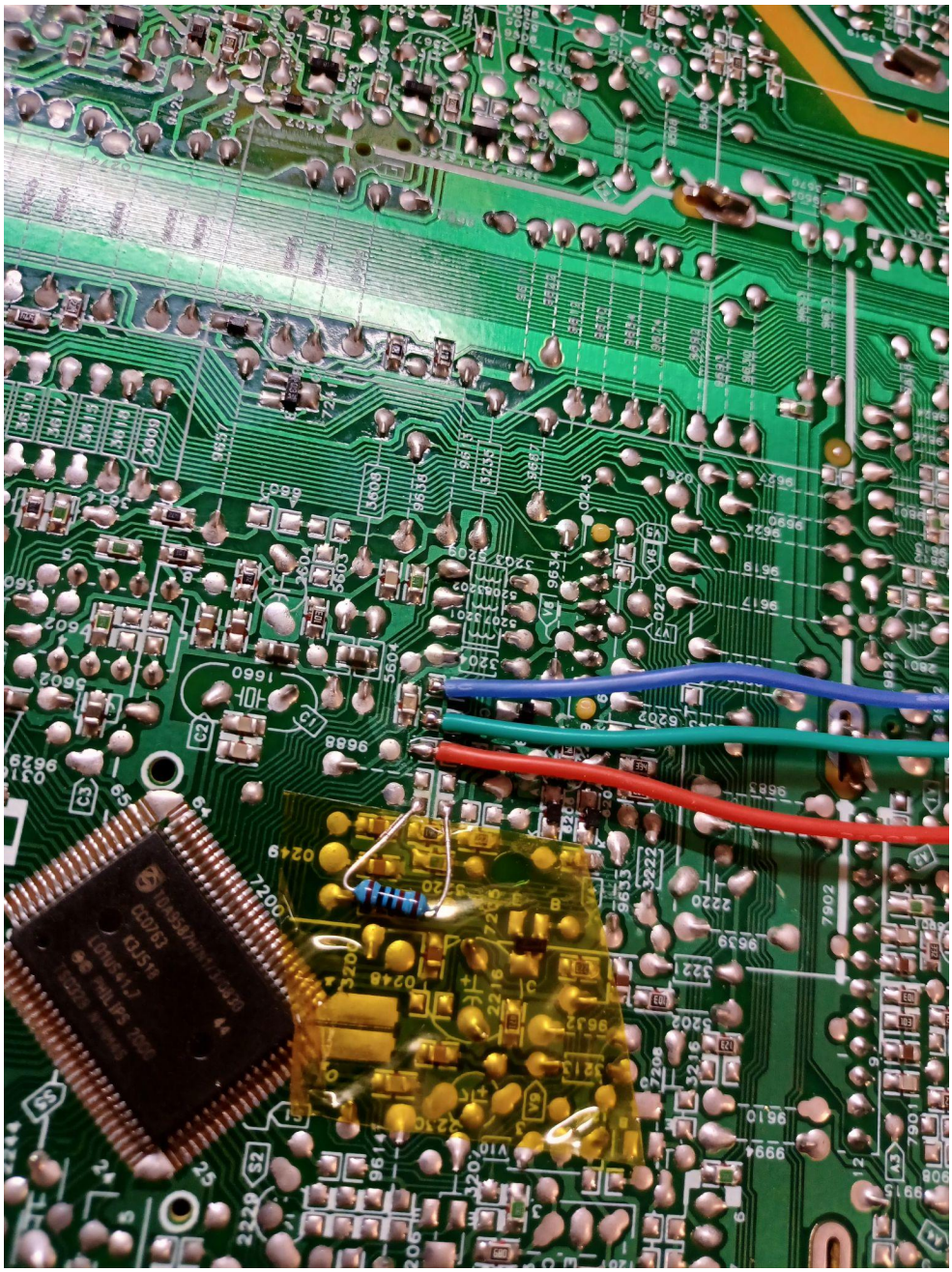
Use a multimeter and trace pin 50 to an unpopulated pad for a resistor. Here, we want to add a 1k resistor. I used a through hole resistor, but a surface mount one might be a bit more elegant. The YUV (YPbPr) lines may be attached at the left side of the unpopulated pads up above, skipping one pad in the row. Again, use a multimeter to link pins 51-53 to these pads and then add the necessary wires. I strongly suggest using wires with dupont connectors to make future servicing much easier. Use about a foot and a half of wire per connection, cut it in half, and turn one end on each into a female and male end dupont connector, with the others ends tinned for soldering to the RCA jacks and main PCB. Kapton tape is also recommended to prevent any shorts if using through hole components.



3. RCA Jack Installation and TV Shell Modification

With our wires soldered on and dupont connectors installed, it is now time to work on the RCA jacks and TV shell. There are a couple spots you could install these jacks, but I opted to put them between the AV in and the s-video jack. Just make sure you are aware of the clearance of the shielding around the AV inputs. I used a pencil to trace a rectangle on the shell plastic while the PCB was sitting inside. Then, I dotted three holes that would allow for the new jacks to be decently centered with the original holes. Drill out the plastic as needed.

Next step is to add a common ground wire for all jacks, a 75 ohm resistor for each jack (ground to signal line of each jack), and a 0.1 uF capacitor on each signal line. I strongly recommend using heat shrink tubing to prevent any shorts, unlikely as they may be.


75 Ω
out
in
VIDEO
L
AUDIO
R
S-VIDEO
CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN
ATTENTION


out
in
VIDEO
L
AUDIO
R
CAUTION

4. **Reassemble and Test**

Now you can reassemble the TV and test it out. Hopefully, your hard work will reward you with an awesome component capable CRT!

Credit: Guide by Ian Ramsey, Design by 6tanks (Matt Ross), Additional Help by Andy King