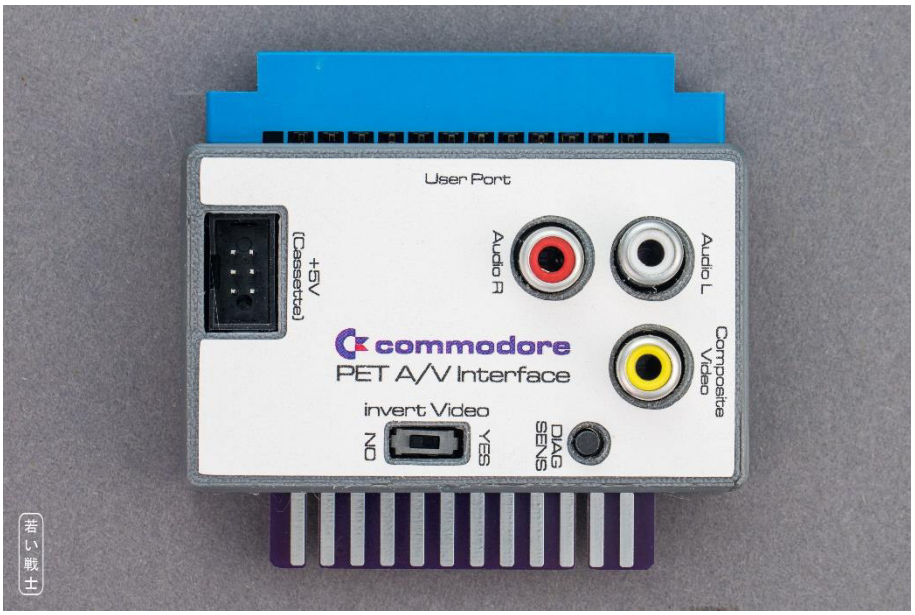
Project Documentation

Commodore PET/CBM80xx/40xx A/V-Interface

Project number: 167

Revision: 2

Date: 01.01.2023



Commodore PET/CBM80xx/40xx A/V-Interface **Rev. 2**

Module Description

The PET A/V-Interface allows to output composite video and audio signals from the user port of the PET. Non-CRTC machines, like the PET 20xx or CBM30xx are outputting video information, which can be mixed to an **NTSC** video signal (Figure 5).

CRTC machines, like most CBM40xx and CBM80xx do not follow any video standard, they generate 50 FPS, but the horizontal rates do not fit any video standard. They require a different edit ROM to meet either PAL or NTSC. With this new edit ROM, the built in monitor will not synchronize. It is recommended to switch off the supply voltage of the monitor, while the PAL or NTSC edit ROM is active.

The **audio signal** is derived from the **CB2** output of the User Port, which is widely used to produce audio with PET or CBM machines. The amplitude of the audio signal is approximately 0.6V. The signal is not suitable to directly drive a speaker, an amplifier is required. It is recommended to try out low volume setting first and adjust the volume to taste. Both J7/white and J6/red are identical, since there is no stereo output. It is desirable to connect the audio signal to both stereo channels of the audio/video equipment.

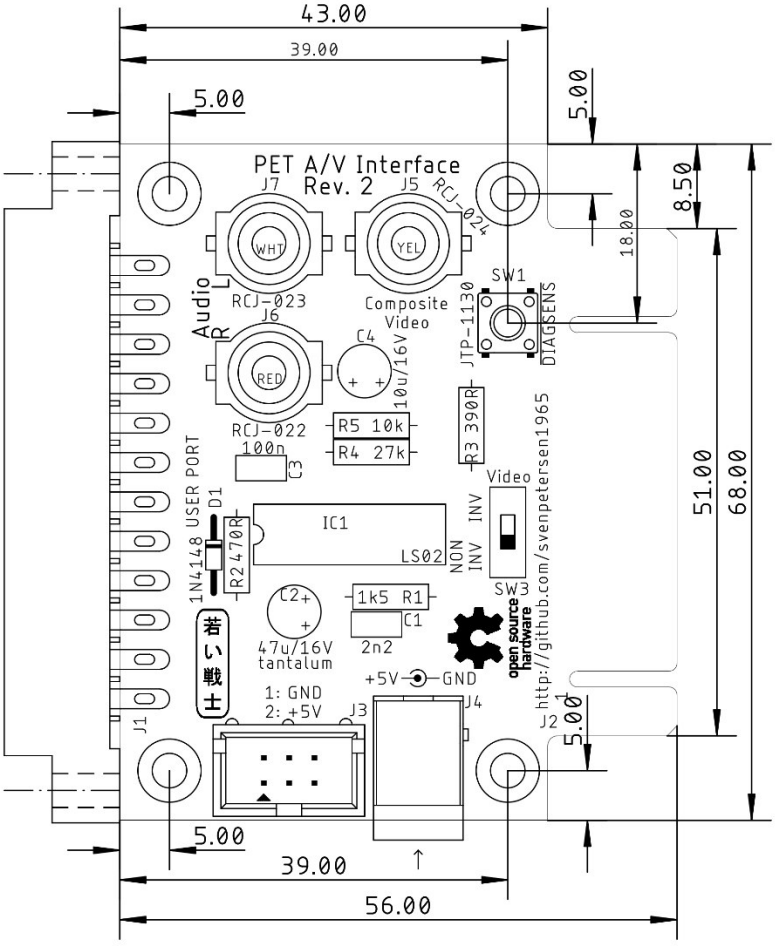


Figure 1: Dimensions of the PET A/V Interface

The A/V Interface requires a supply voltage of 5V, since the PET user port does not have a +5V pin (like the C64 user port). There are two ways to get 5V to the circuit:

1. Tap the Cassette Port with the Cassette Port dongle of the C64 Diagnostic Harness (which is pass through), a Datassette can still be used.
2. A 5V power supply with a 5.5mm/2.5mm barrel jack (inner lead is +5V).

The User Port of the PET is passed through and can be fully used on the edge connector of the board.

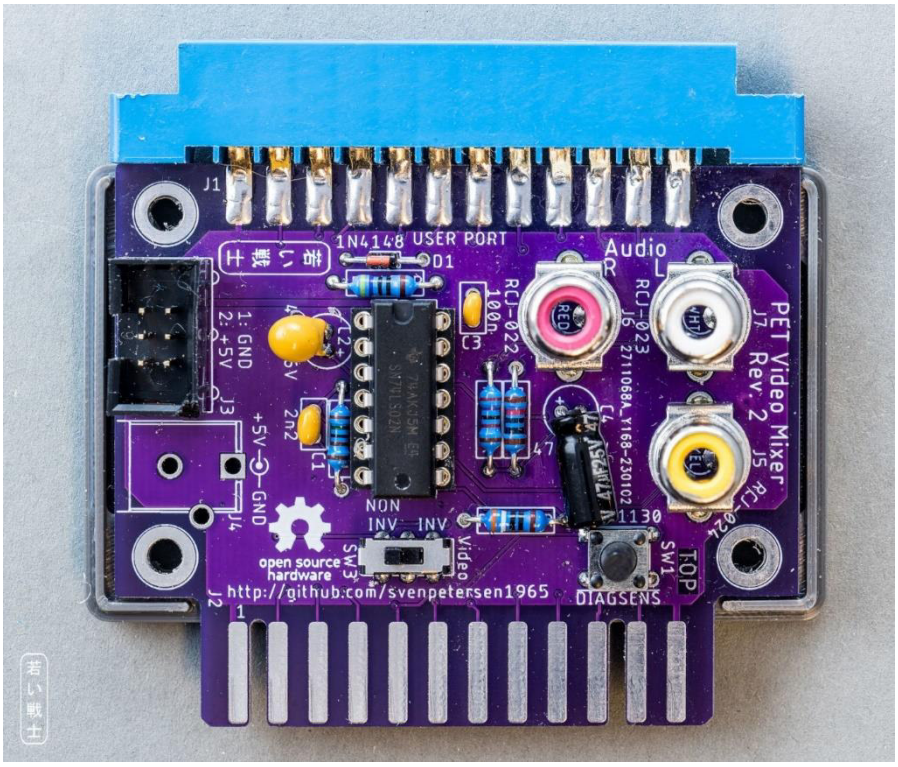


Figure 2: PET A/V Interface Rev. 2 with power via cassette port/box connector (J3)

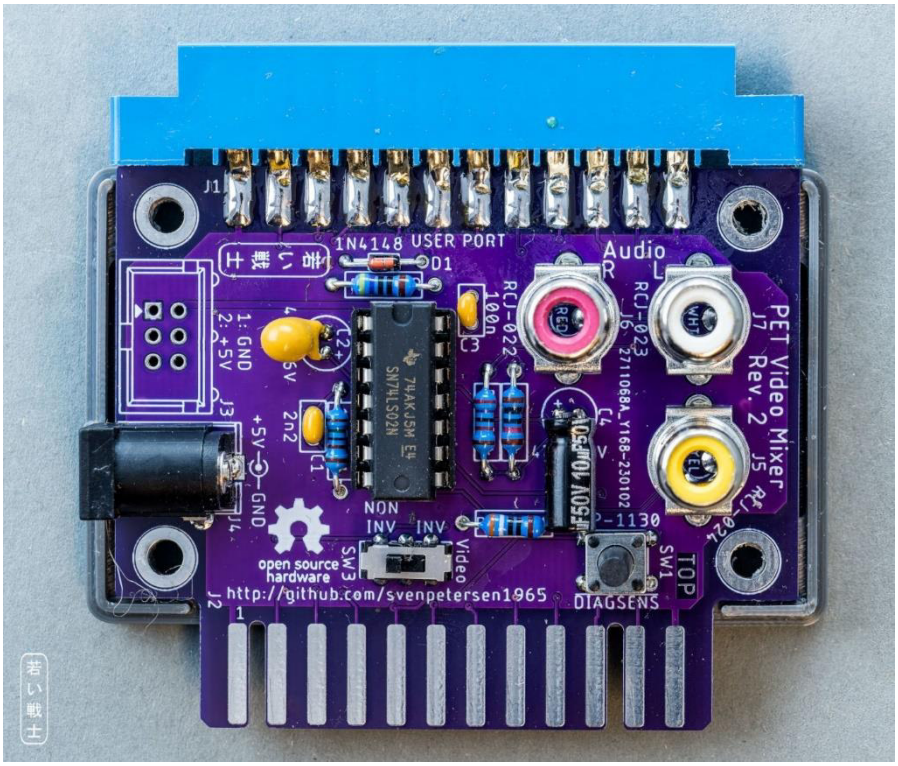


Figure 3: PET A/V Interface Rev. 2 with barrel connector (J4)

Note: C2 has to be a tantalum capacitor

Note: C4 has to be put flat to fit into the 3D printed case (Figure 2, Figure 3)

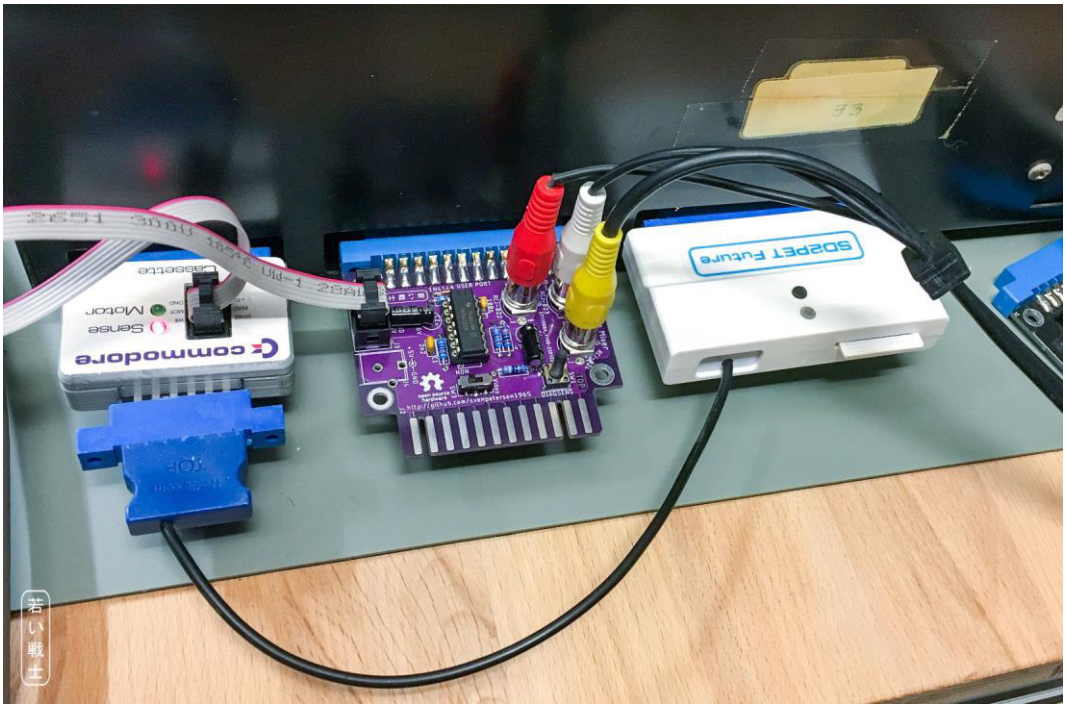


Figure 4: PET A/V Interface on CBM3016, powered from Cassette port (and SD2PET Future Floppy Disk emulator)

Figure 5: CBM3016 monitor and video output on a Framemeister HDMI adapter

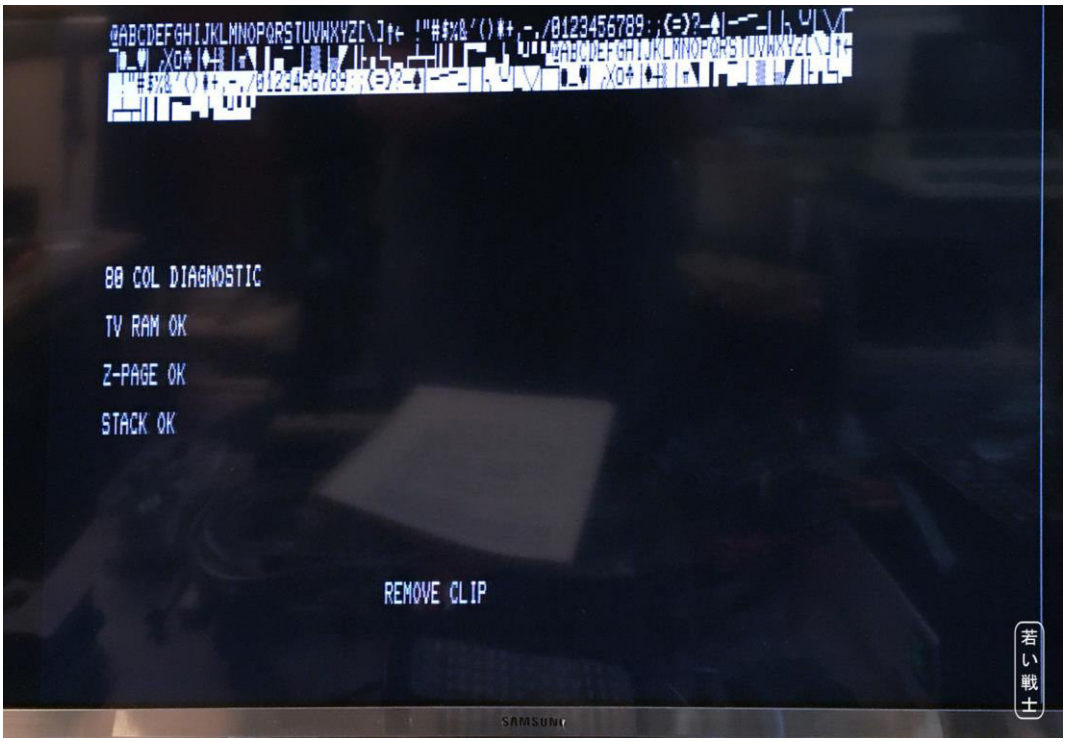


Figure 6: Output of a CRTC machine with edited parameters for NTSC output (the diagnostic clip software)

The CRTC parameters for an NTSC (60Hz) output were derived from Steve Gray's Edit ROM project: https://github.com/sjgray/cbm-edit-rom/blob/master/crtc-reg-normal.asm

Note: It is advised to disconnect and switch off the supply voltage of the CBM 40xx/80xx monitor while operating the mainboard with these modified parameters, since the monitor cannot sync on NTSC. It makes a strange noise instead.

Connectors

J1 – PET User Port

2x12 Pin edge connector, 3.96mm pitch

Signal	Pin (top)	Pin (bottom)	Signal
GND	1	A	GND
TVVIDEO	2	B	CA1
IEEESRQ	3	C	PA0
IEEEEOI	4	D	PA1
$\overline{\text{DIAGSENSE}}$	5	E	PA2
TPREAD2	6	F	PA3
TPWRITE	7	H	PA4
TPREAD1	8	J	PA5
TVVERT	9	K	PA6
TVHOR	10	L	PA7
$\overline{\text{GRAPHIC}}$	11	M	CB2
GND	12	N	GND

J2 – PET User Port (through)

2x12 Pin board connector, 3.96mm pitch

Signal	Pin (top)	Pin (bottom)	Signal
GND	1	A	GND
TVVIDEO	2	B	CA1
IEEESRQ	3	C	PA0
IEEEEOI	4	D	PA1
$\overline{\text{DIAGSENSE}}$	5	E	PA2
TPREAD2	6	F	PA3
TPWRITE	7	H	PA4
TPREAD1	8	J	PA5
TVVERT	9	K	PA6
TVHOR	10	L	PA7
$\overline{\text{GRAPHIC}}$	11	M	CB2
GND	12	N	GND

J3 – Power connector (from cassette port)

2x3 pin box connector

Signal	Pin	Pin	Signal
GND	1	2	+5V
-	3	4	-
-	5	6	-

This connector is optional. It is not required, if the barrel connector J4 is installed.

Powering from cassette port is the preferred way, since it switches off together with the PET. This requires a Cassette Port Dongle (see C64 Diagnostic harness).

J4 - +5VDC Power

5,5mm/2,5mm barrel connector (Cliff FCR681465P)

Pin	Signal
Center	+5VDC
Shaft	GND

This is an alternative power connector, which can be used with an external +5V power supply. It is **not the preferred** way of powering the module.

J5, J6, J7 – Audio and Video RCA jacks

3 RCA jacks

Connector	Color	Center	Ring	Type
J5	Yellow	Composite video	GND	CUI Inc. RCJ-024
J6	Red	Audio	GND	CUI Inc. RCJ-022
J7	White	Audio	GND	CUI Inc. RCJ-023

Note: The CUI Inc connectors are pretty wide spread and available from Mouser and Digikey etc. There are acceptable and cheaper connectors from **AliExpress**, which perfectly fit into the footprint. Click URL

Switches

SW1: DIAGSENS

In case SW1 is pushed while power up or reset, the PET boots into the TIM monitor. This might be useful for debugging. The switch is a 6x6mm TACT switch. The appropriate stem height is 13mm, for the 3D printed case.

SW3: Video non-inverted/inverted

The non CRTC PET models (CBM20xx/30xsx) provide a non-inverted video output on the user port, while the CRTC PET models (like the CBM 40xx or 80xx) provide an inverted signal, which requires to be inverted once more. This can be accomplished with setting SW3.

Model	SW3
PET 20xx	non inverted
CBM 30xx	non inverted
CBM 40xx	inverted
CBM 80xx	inverted

The micro slide switch is a MSS22D18 (through hole, vertical) type, which is widely available from Ali Express. Click URL

3D Printed Case

There are two versions:

- Power supply via box connector J3/cassette port
- Power supply via 5.5mm/2.5mm barrel connector J4/external PSU

The **recommended screws** are (four) C 2.9x9.5H, DIN 7981 self-tapping screws.

Figure 7: The two different case types: Barrel connector (left), box connector (right)

Sources

The basic circuit was derived from the PET Video Mixer by **Commodore Pet Users Club of England** (Newsletter issues 1 & 2, page 9).

Revision history

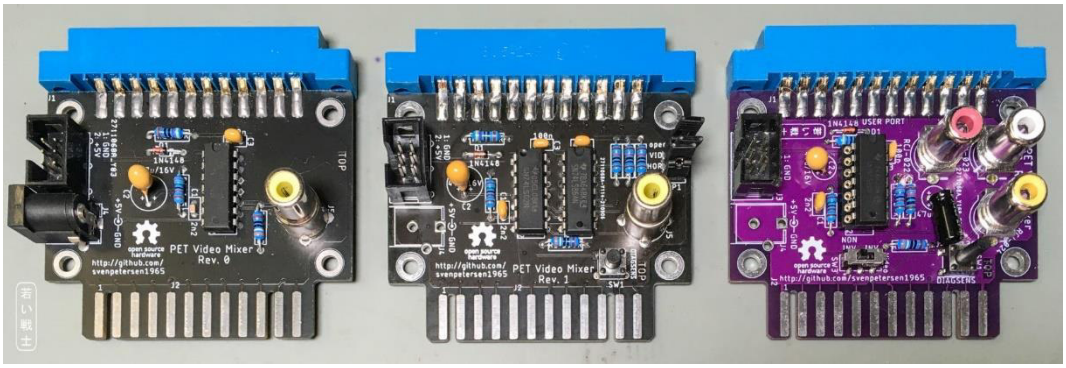


Figure 8: Rev. 0 (left), Rev. 1 and Rev. 2 (right)

Rev. 0

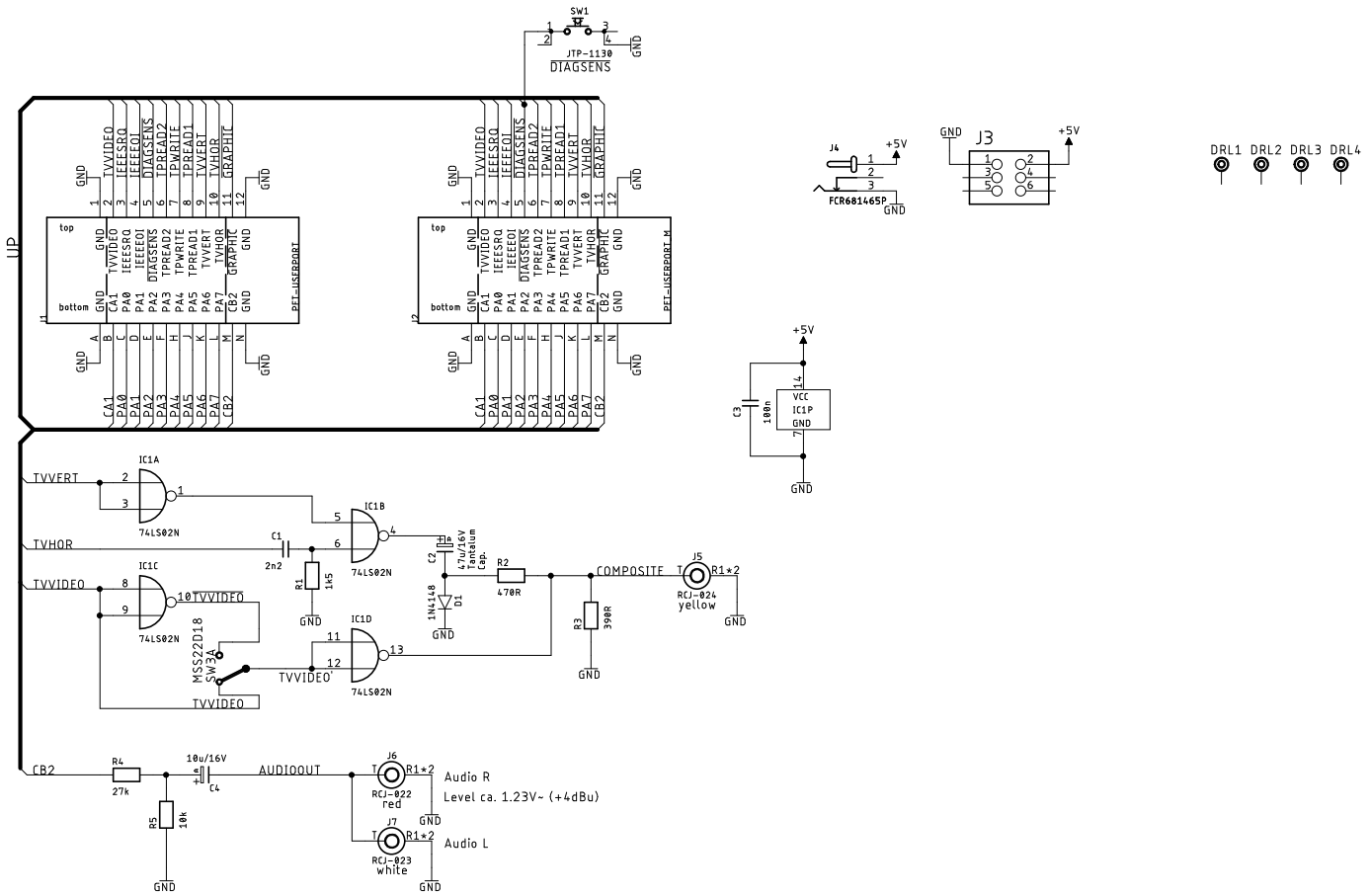
- Prototype, original PET Video Mixer circuit with pass through user port and power supply connectors. Working with CBM3016 (and other non CRTC models)

Rev. 1

- Experimental version: Inverted and non-inverted TVVIDEO, TVVERT and TVHOR signals selectable via jumpers

Rev. 2

- Renamed to PET-A/V Interface
- Audio outputs added
- TVVIDEO switchable between inverted and non-inverted
- 3D printed case available



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		Draft.:	Sven Petersen
Date:	27.02.2023 12:43	Rev.: 2	Page 1/1
File:	PET_AV_Interface		
	http://github.com/svenpetersen1965		A3

Sven Petersen 2023	Doc.-No.: 167-2-01-02	
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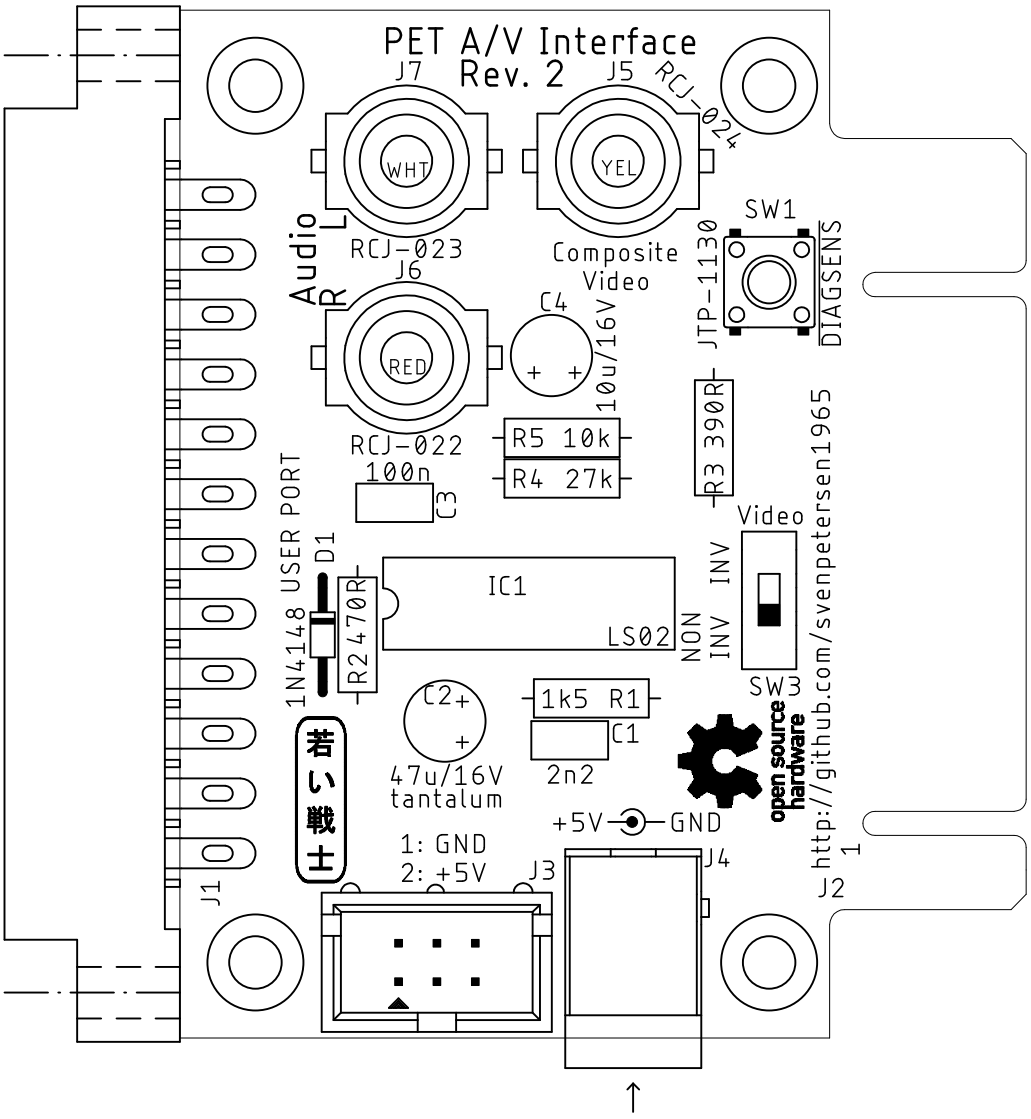
PET_AV_Interface		
nicht gespeichert!		Rev.: 2
placement component side		



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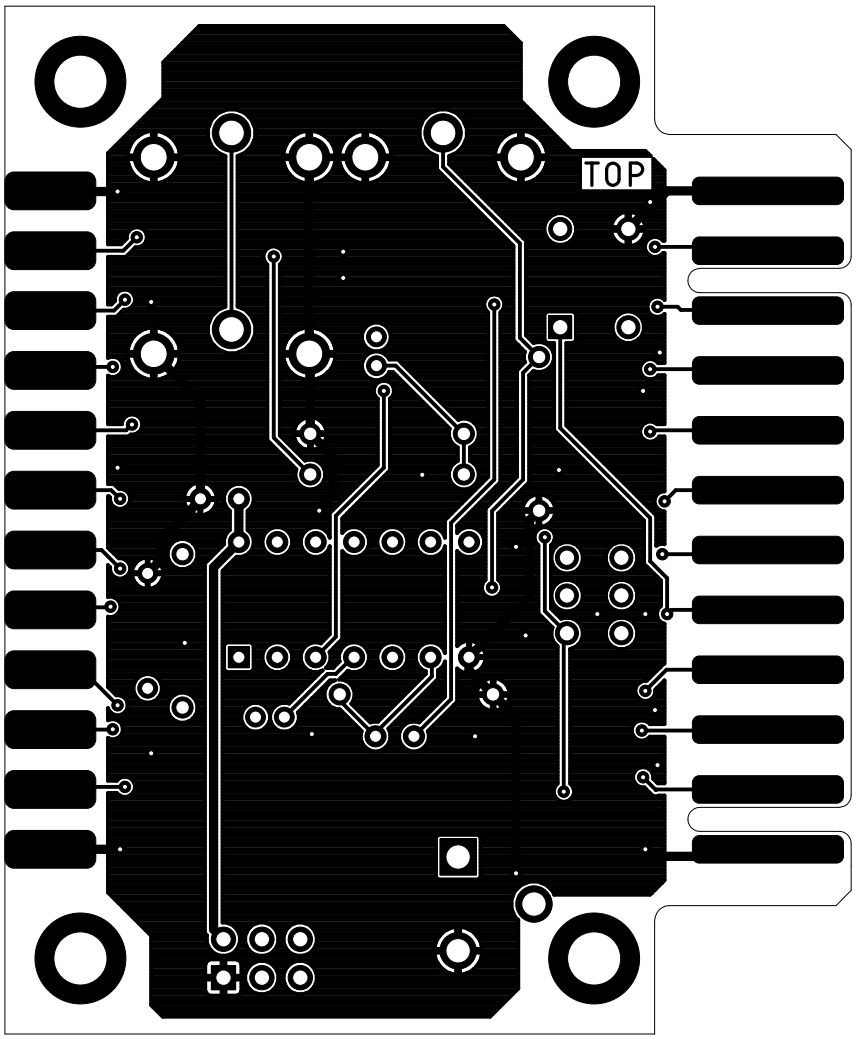

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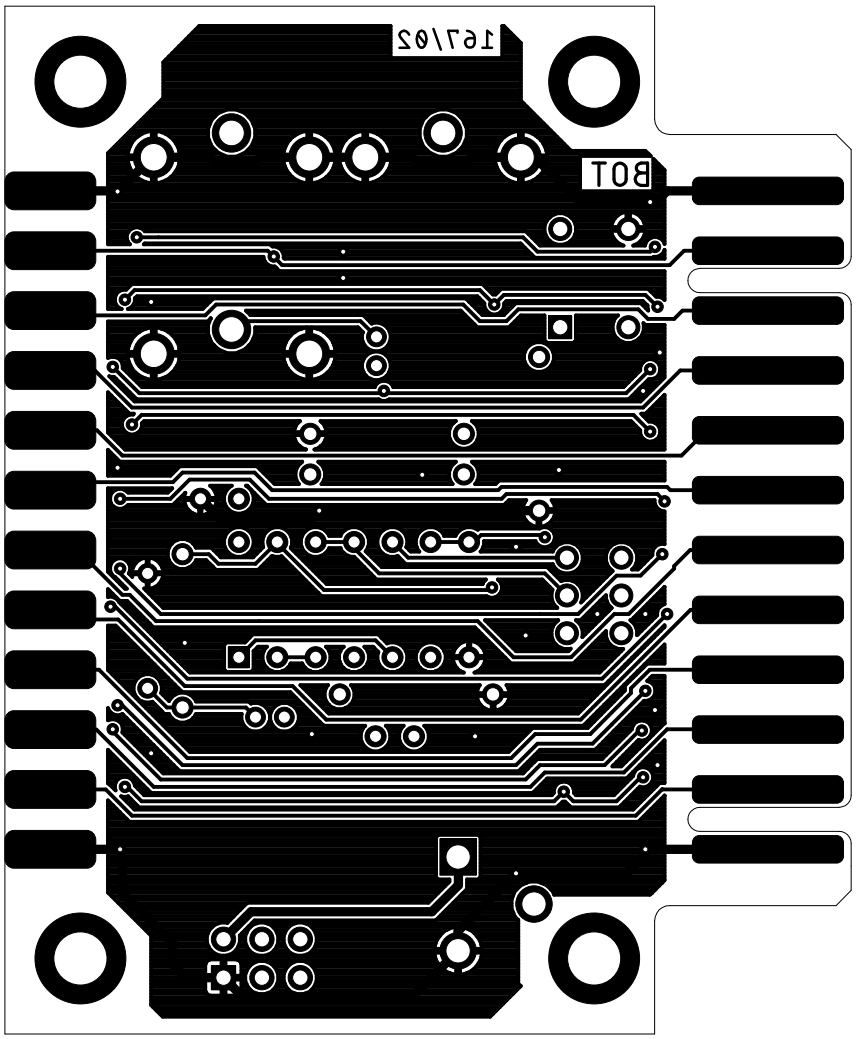

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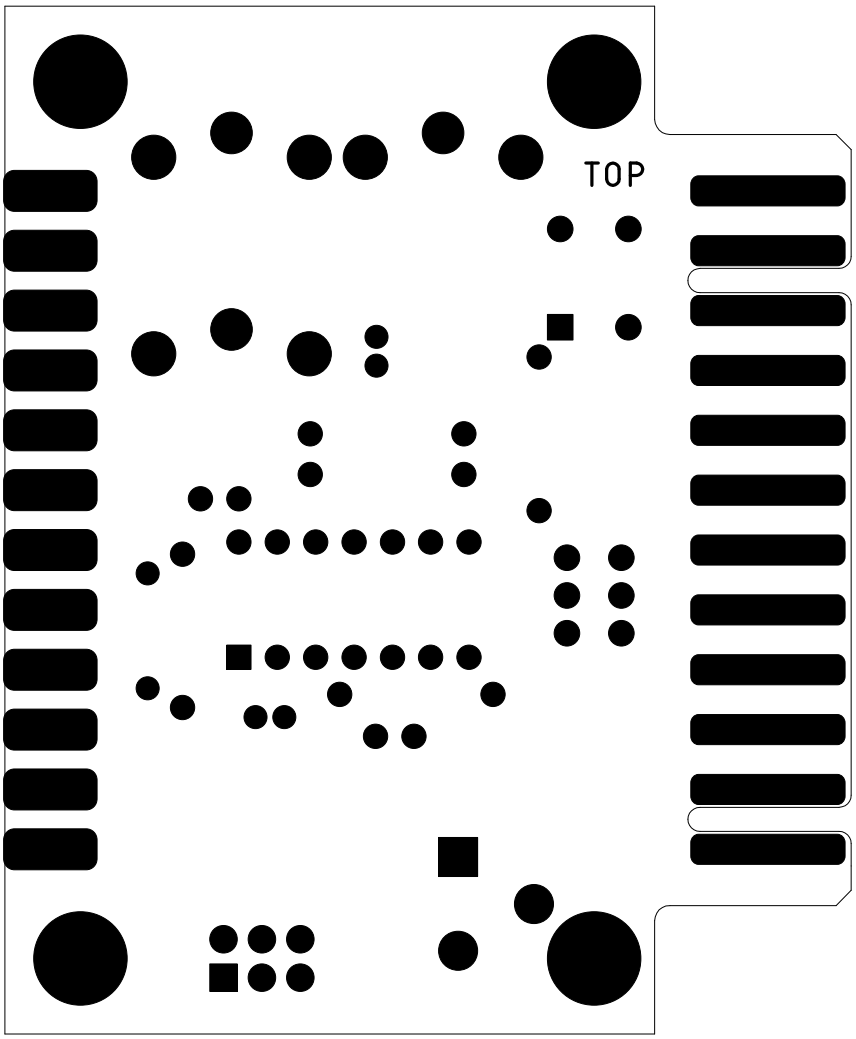
stopmask component side		



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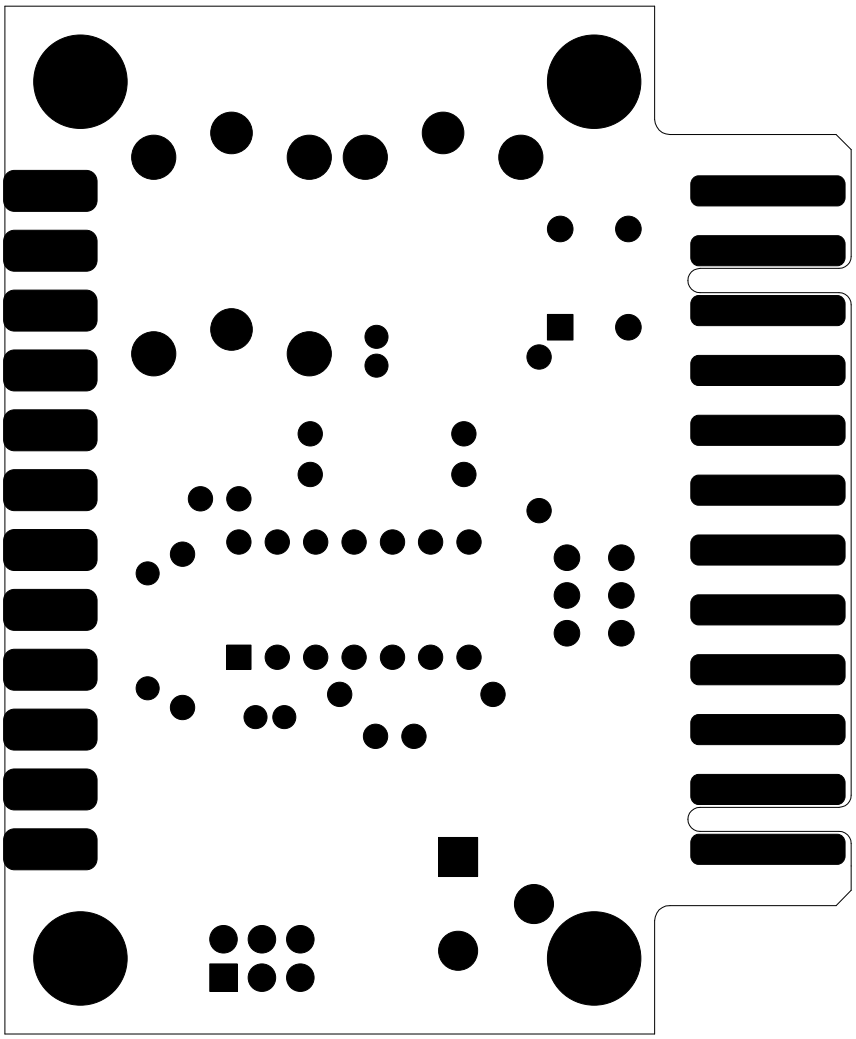
stopmask solder side		



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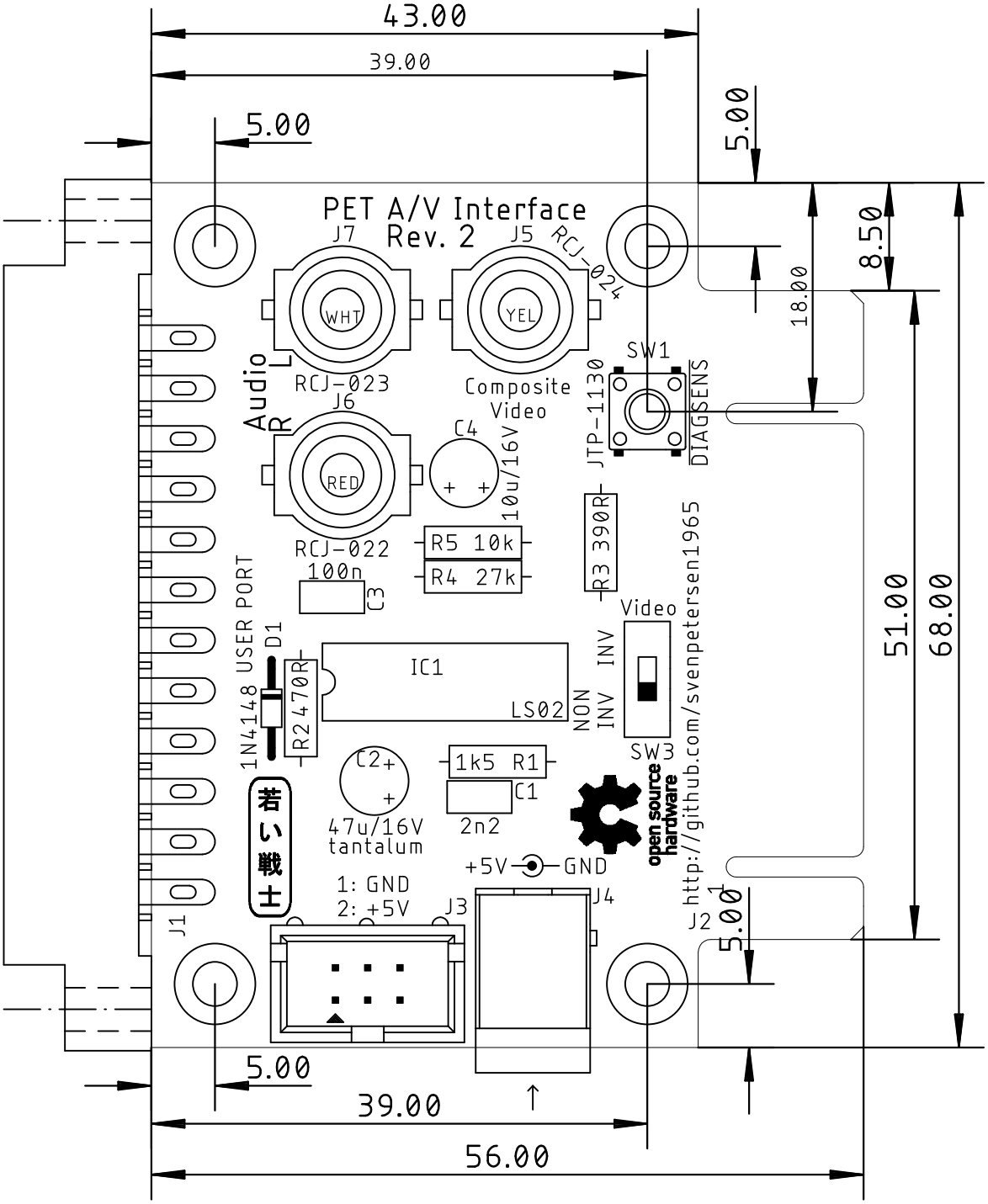
27.02.2023 12:43		Rev.: 2
placement component side measures		



Commodore PET/CBM80xx/40xx A/V-Interface Rev. 2

Testing

Test Setup

Computers

- Commodore CBM3016
- Commodore CBM8032

Video Equipment

- Monitor/Samsung smart TV
- Micomsoft Framemeister XRGB-mini (Video to HDMI converter)
- RetroTINK x2
- TFT display and converter board

Device Under Test

- PET A/V-Interface Rev. 2, power option: box connector
- Cassette Port Dongle (from C64 Diagnostic Harness) and ribbon cable.

Other

- PET Diagnostic Clip
- TFW8bit SD2PET Future (Floppy disk emulator)
- 5m audio/video cable for composite video

Test Execution

CBM3016

The PET A/V-Interface was connected to the CBM3016. The Cassette Dongle was and the ribbon cable for providing +5V to the interface was installed. The switch SW3 on the interface is set to "NON INV" (non-inverted).

An A/V cable was used to connect the interface to the Framemeister. The CBM3016 was powered up and the screen content appeared on the monitor.

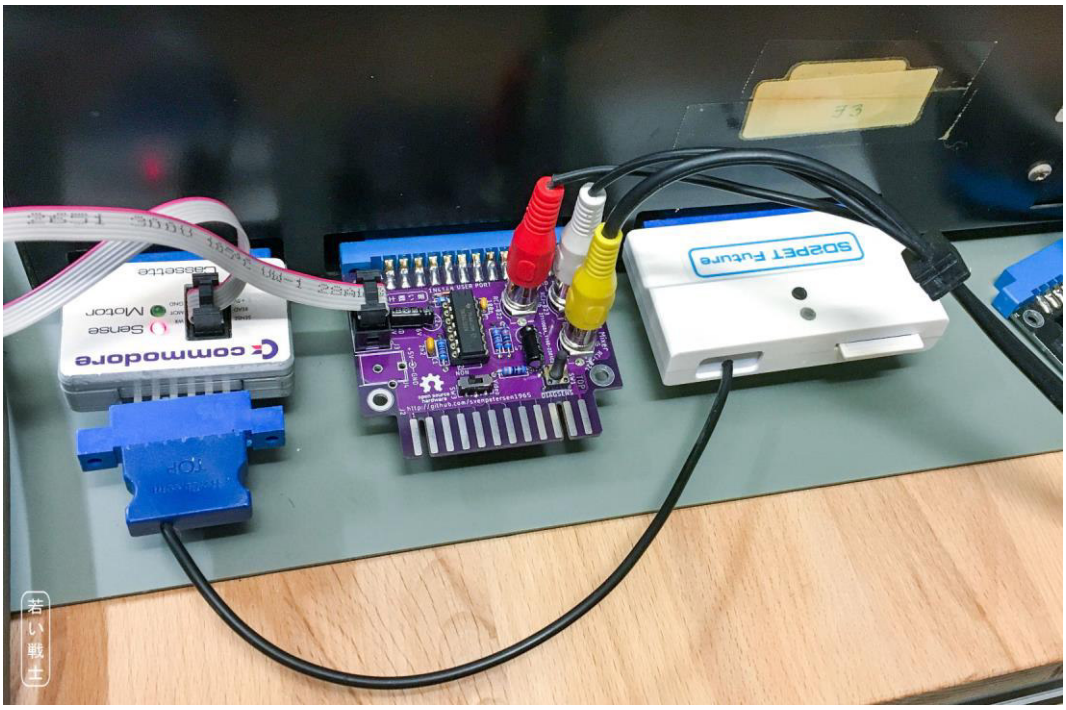


Figure 1: PET A/V Interface on CBM3016, powered from Cassette port (and SD2PET Future Floppy Disk emulator)

Figure 2: CBM3016 monitor and video output on a Framemeister HDMI adapter

A game software was loaded from the SD2PET Future and run. The sounds of the game became audible.

CBM8032

The switch SW3 was set to "INV" (inverted). To prevent modifying the Edit ROM of the 8032, the 80 col diagnostic software of the Diagnostic Clip was modified. That means, the parameters for an NTSC output of the CRTC were replaced in that software.

```
$025B $3F $28 $32 $12 $1E $06 $19 $1C $00 $07 $00 $00 $10 $00 $00 $00 $00 $00
```

At the offset address of $025B, the data shown above is replacing the original data. This if the data set labeled “40/80x25, 60 Hz, 15.748 kHz (NTSC) for External Monitor (inverted video)” from Steve Gray’s file “cbm-edit-rom/crtc-reg-normal.asm”

The BIN-file was burned into an EPROM, which was then installed in the PET Diagnostic Clip. The clip was then installed in the CBM8032. This was then switched on and the Diagnostic Start screen was displayed (Figure 3).

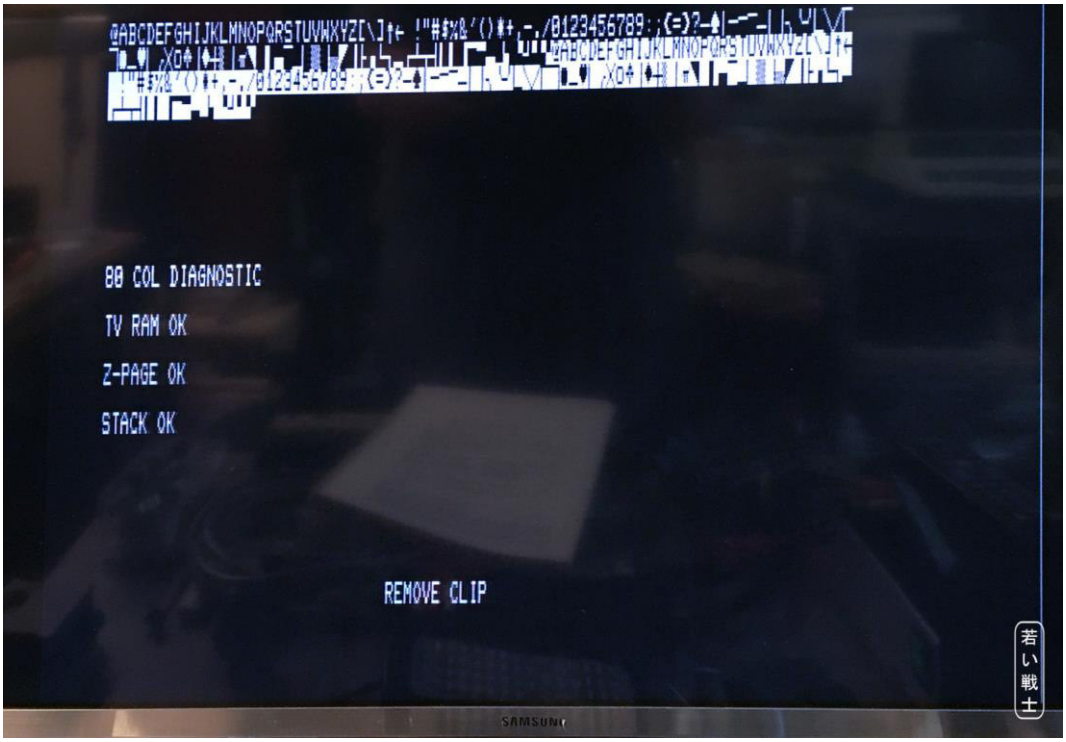


Figure 3: Output of a CRTC machine with edited parameters for NTSC output (the diagnostic clip software)

Note: for completing the Diagnostic Test, the new timing parameters would require to be modified in the test software as well. Without this, the diagnostic test will wail with a horizontal timing error (Figure 4).

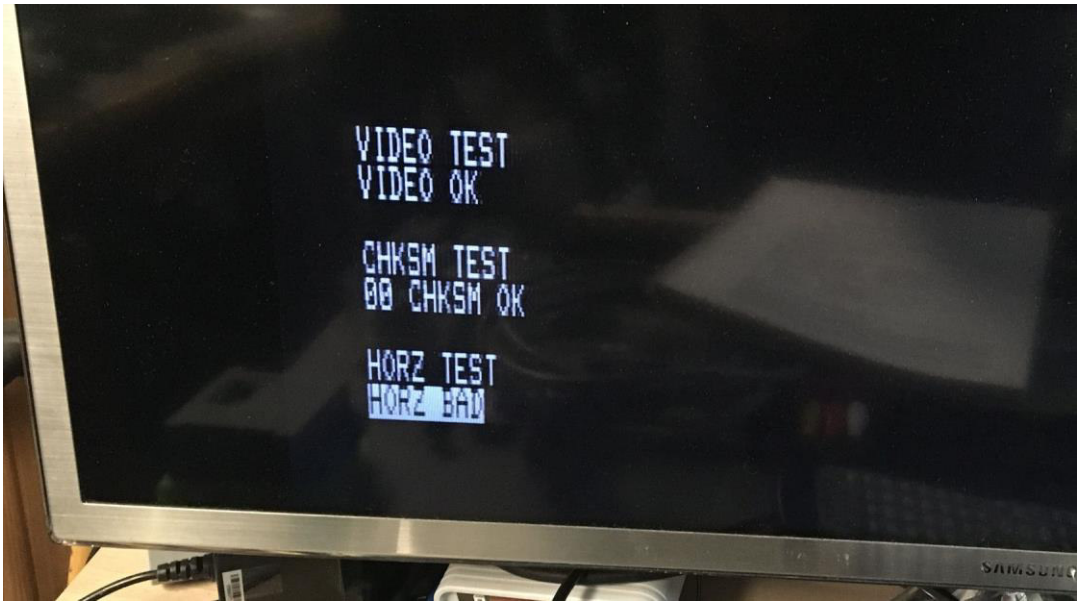


Figure 4: Error message of the modified 80col diagnostic software

Further, the internal monitor produced an unusual sound and did not sync. It is not recommended to drive the complete with this set of parameters.

Conclusion

The PET A/V interface works with non CRTC and with CRTC machines.

The required parameter-change for the CRTC machines and the fact, that the internal monitor does not synchronize with the said settings reduces the usability of the A/V interface for this kind of computers to probably only repair purposes.

The PET A/V-Adapter Rev. 2 is fully functional.

PET A/V Interface Rev. 2
Bill of Material Rev. 2.0

Pos.	Qty	Value	Footprint	Ref.-No.	Comment
1	1	167-2-01-02	2 Layer	PCB Rev. 2	2 layer, Cu 35µ, HASL, 43.0mm x 68.0mm, 1.6mm FR4
2	1	2x3 box header, 2.54mm	2X03WV	J3	e.g. Reichelt WSL 6G. **Option: Power from tape**
3	1	100n/50V	C-2,5	C3	ceramic capacitor, pitch: 2.5mm
4	1	10k	R-10	R5	1/4W, 1% or better
5	1	10u/16V	C5,0/2,0	C4	aluminum electrolytic, ∅5.0mm/pitch 2.0mm 105°C, l=11mm, e.G. Reichelt RD1C106M05011180
6	1	1N4148	DO-35	D1	standard silicon diode
7	1	1k5	R-10	R1	1/4W, 1% or better
8	1	27k	R-10	R4	1/4W, 1% or better
9	1	2n2	C-2,5	C1	ceramic capacitor, pitch: 2.5mm
10	1	390R	R-10	R3	1/4W, 1% or better
11	1	470R	R-10	R2	1/4W, 1% or better
12	1	47u/16V (Tantalum!)	C5,0/2,0	C2	tantalum cap!!! E.g. Reichelt TANTAL 47/16
13	1	74LS02N	DIL-14	IC1	TI or other
14	1	FCR681465P	FCR681465P	J4	Cliff. 2,5mm/5.5mm barrel connector. E.g. Reichelt CLIFF FCR681465P **Option: external Power**
15	1	JTP-1130	JTP-1130	SW1	standard TACT switch 6mm x 6mm, height = 13mm, e.g. Reichelt JTP-1130
16	1	MSS22D18	DPDT_9MM	SW3	mini slide switch, AliExpress or Amazon. , search term "MSS22D18"
17	1	Edge connector, 2x12, 3.96mm	USERPORT	J1	edge connector, C64 user port, Ali Express, "series 805" or other
18	1	RCJ-022	RCJ-02X	J6	CUI Inc., RCA jack, vertical, red. Mouser: 490-RCJ-022, Digikey: CP-1407-ND. Alternative part: Keystone 577
19	1	RCJ-023	RCJ-02X	J7	CUI Inc., RCA jack, vertical, white. Mouser: 490-RCJ-023, Digikey: CP-1408-ND. Alternative part: Keystone 584
20	1	RCJ-024	RCJ-02X	J5	CUI Inc., RCA jack, vertical, yellow. Mouser: 490-RCJ-024, Digikey: CP-1409-ND. Alternative part: Keystone 586

PET A/V Interface Rev. 2
Bill of Material Rev. 2.0

Pos.	Qty	Value	Footprint	Ref.-No.	Comment