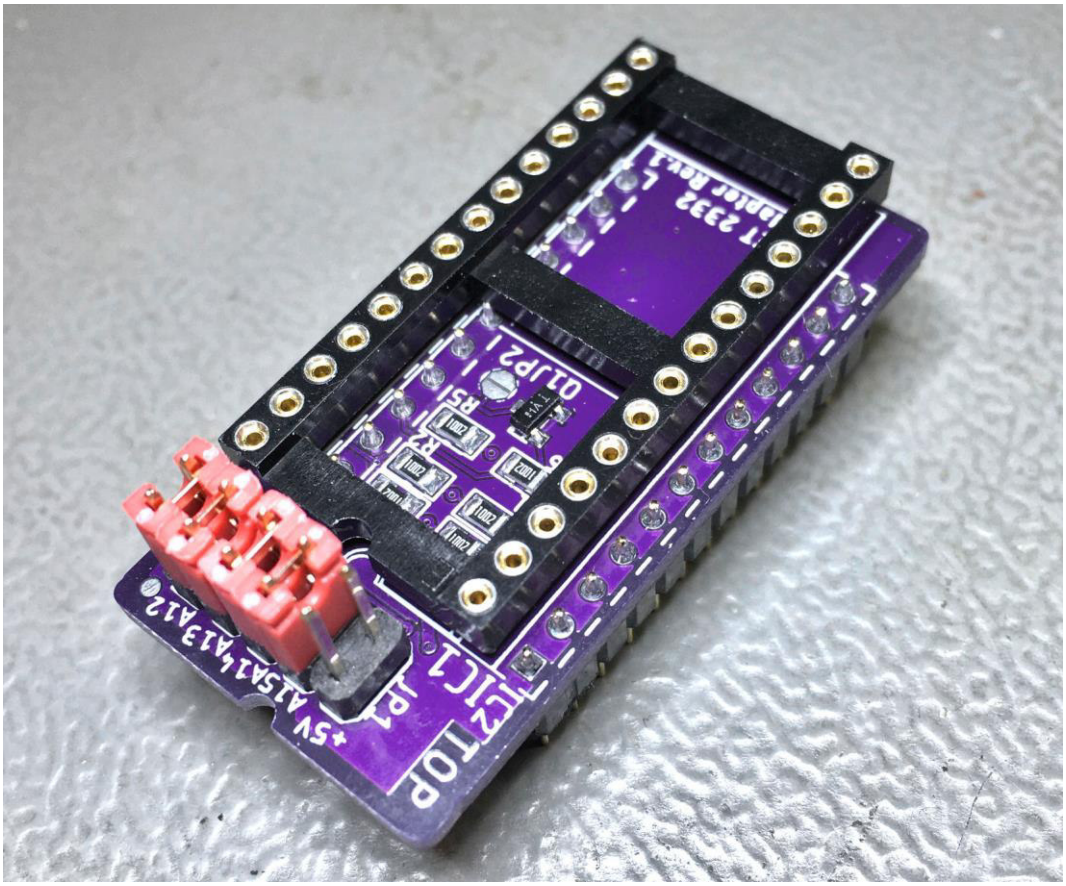
Project Documentation

Commodore PET 2332 Adapter

Project number: 158

Revision: 1

Date: 06.03.2022



PET 2332 Adapter Rev. 1

Module Description

This is an adapter board for 27C64 to 27C512 EPROMs for 2332 sockets in PET/CBM machines, that make use of two chip select signals.

2332 Pin	Name
20	$\overline{CS1}$
21	CS2

Table 1: Chip selects

Pin 20 is an active low chip select, while Pin 21 is active high. In the CBM8032, $\overline{CS1}$ is the "normal" chip select, while CS2 is connected to the $\overline{NOROM}$ signal, which switches off all ROMs (except the character ROM) while LOW. Hardware debugging with the diagnostic clip makes use of this feature. In the (dynamic) PET2001N boards, Pin 21 is permanently connected to +5V.

To implement this second chip select, the $\overline{E}$ (active low enable) Pin 20 of the EPROM is utilized as a second chip select. A transistor and a pull-up resistor are used as an inverter for active high CS2 signal.

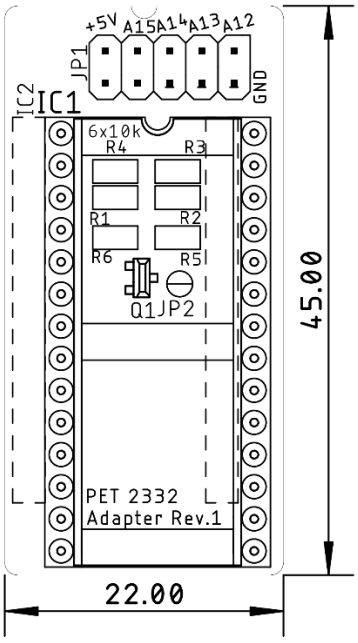


Figure 1: Dimensions of the PET 2332 Adapter

For a 27C512, up to 16 4k-memory banks can be selected. This is done at the pin header. For a fix setting, the pin header can stay not assembled, since the footprint is suitable for solder bridge configuration.

Signal	Pin	Pin	Signal
A12	1	2	GND
A13	3	4	GND
A14	5	6	GND
A15	7	8	GND
+5V	9	10	n.c.

Table 2: Jumper (JP1) for Bank Selection

The +5V pins are to provide supply voltage to a microcontroller, like the Arduino, in case it is desired to do an automatic bank switching in some way.

Compatibility

CBM80xx: The adapter is compatible with all ROM sockets (UD6-UD12), except the Character ROM (UA3).

CBM40xx: The adapter is compatible with all ROM sockets (UD6-UD12), except the Character ROM (UA3).

The **CBM30xx** are PET2001N-16 or -32 (label in the back).

PET2001N: The adapter is compatible with all 4k ROM sockets (UD3-UD7 & UD9), except the Edit ROM (UD8) and the Character ROM (UF10).

Bank Selection

The desired 4k memory bank is selected at JP1. For the pinout refer to Table 2. The jumper is installed (vertically) in a way, that it connects the address line with the GND potential.

A15	A14	A13	A12	4k Block	Addr. Offset
set	set	set	set	#0	0x0000
set	set	set	open	#1	0x1000
set	set	open	set	#2	0x2000
set	set	open	open	#3	0x3000
set	open	set	set	#4	0x4000
set	open	set	open	#5	0x5000
set	open	open	set	#6	0x6000
set	open	open	open	#7	0x7000
open	set	set	set	#8	0x8000
open	set	set	open	#9	0x9000
open	set	open	set	#10	0xA000
open	set	open	open	#11	0xB000
open	open	set	set	#12	0xC000
open	open	set	open	#13	0xD000
open	open	open	set	#14	0xE000
open	open	open	open	#15	0xF000

Table 3: Selection of EPROM memory blocks

A set jumper corresponds to a LOW level (binary 0), an open jumper to a HIGH level. Do not confuse the PET memory address and the EPROM memory address. They have the address Bit A0 to A11 in common, but the rest is different. The selected memory bank appears in the address of the used socket.

Compatibility of EPROMs

Although a 27C512 type EPROM is recommended, other types of EPROMs can be installed:

EPROM	Size	Capacity
27C64	8k	2x 4k option ROM
27C128	16k	4x 4k option ROM
27C256	32k	8x 4k option ROM
27C512	64k	16x 4k option ROM

Table 4: Capacity of EPROM types

Those EPROMs are pin compatible, the jumpers, that have no function, due to the size, have to stay open.

EPROM	Size	A15	A14	A13	A12
27C512	64kx8	☑	☑	☑	☑
27C256	32kx8	open	☑	☑	☑
27C128	16kx8	open	open	☑	☑
27C64	8kx8	open	open	open	☑

Table 5: Settings per EPROM type

☑: The jumper can be open or closed, depending on the desired selection.

In case Vpp is located at a dedicated pin (pin 1), A15 has no effect anymore. A HIGH level is recommended, the corresponding jumper is open. The /PGM Pin should be set HIGH, this is accomplished by an open jumper for A14.

						27C64					
						27C128					
						27C256					
						27C512					
						SOCKET					
Vpp	Vpp	Vpp	A15	1	A15	VCC	28	VCC	VCC	VCC	VCC
A12	A12	A12	A12	2	A12	A14	27	A14	A14	/PGM	/PGM
A7	A7	A7	A7	3	A7	A13	26	A13	A13	A13	n.c.
A6	A6	A6	A6	4	A6	A8	25	A8	A8	A8	A8
A5	A5	A5	A5	5	A5	A9	24	A9	A9	A9	A9
A4	A4	A4	A4	6	A4	A11	23	A11	A11	A11	A11
A3	A3	A3	A3	7	A3	/OE	22	/G/Vpp	/G	/G	/G
A2	A2	A2	A2	8	A2	A10	21	A10	A10	A10	A10
A1	A1	A1	A1	9	A1	GND	20	/E	/E	/E	/E
A0	A0	A0	A0	10	A0	D7	19	D7	D7	D7	D7
D0	D0	D0	D0	11	D0	D6	18	D6	D6	D6	D6
D1	D1	D1	D1	12	D1	D5	17	D5	D5	D5	D5
D2	D2	D2	D2	13	D2	D4	16	D4	D4	D4	D4
GND	GND	GND	GND	14	GND	D3	15	D3	D3	D3	D3

Table 6: EPROM pin compatibility

Using parallel EEPROMs

There are ***parallel*** EPROMs, which fit into the EPROM sockets. They do not require erasing with a UV eraser, like EPROMs, but the price is higher.

Since they can be written, which is controlled by the $\overline{WE}$ signal, but the Super Expander II cartridge is lacking of this functionality, this signal has to be HIGH (inactive). The 28C256 has the A14 signal connected to Pin 1, which is A15 of the EEPROM socket. This is no problem, but it has to be kept in mind, that the jumper for A15 has effect on the bank select A14 of the EPROM.

28C64							
	28C256						
		SOCKET					
n.c.	A14	1	A15	VCC	28	VCC	VCC
A12	A12	2	A12	A14	27	/WE	/WE
A7	A7	3	A7	A13	26	A13	n.c
A6	A6	4	A6	A8	25	A8	A8
A5	A5	5	A5	A9	24	A9	A9
A4	A4	6	A4	A11	23	A11	A11
A3	A3	7	A3	/OE	22	/G/Vpp	/OE
A2	A2	8	A2	A10	21	A10	A10
A1	A1	9	A1	GND	20	/E	/CE
A0	A0	10	A0	D7	19	D7	D7
D0	D0	11	D0	D6	18	D6	D6
D1	D1	12	D1	D5	17	D5	D5
D2	D2	13	D2	D4	16	D4	D4
GND	GND	14	GND	D3	15	D3	D3

Table 7: EEPROM pin compatibility

EEPROM	Size	A15	A14	A13	A12
28C256	32kx8	=A14	OPEN	yes	yes
28C64	8kx8	OPEN	OPEN	OPEN	yes

Table 8: Settings per EEPROM type

Programming instructions

For instructions on setting up a complete multiple character ROM image, please refer to

https://github.com/svenpetersen1965/C64-Kernal-Adapter-Switch-Long-Board/blob/master/Rev.%200/pdf/C64_KernalSw_8k_v0.pdf

The description is about how to create a multiple Kernal ROM image, a multiple 2332 ROM image works pretty similar, except the size is only 4kB.

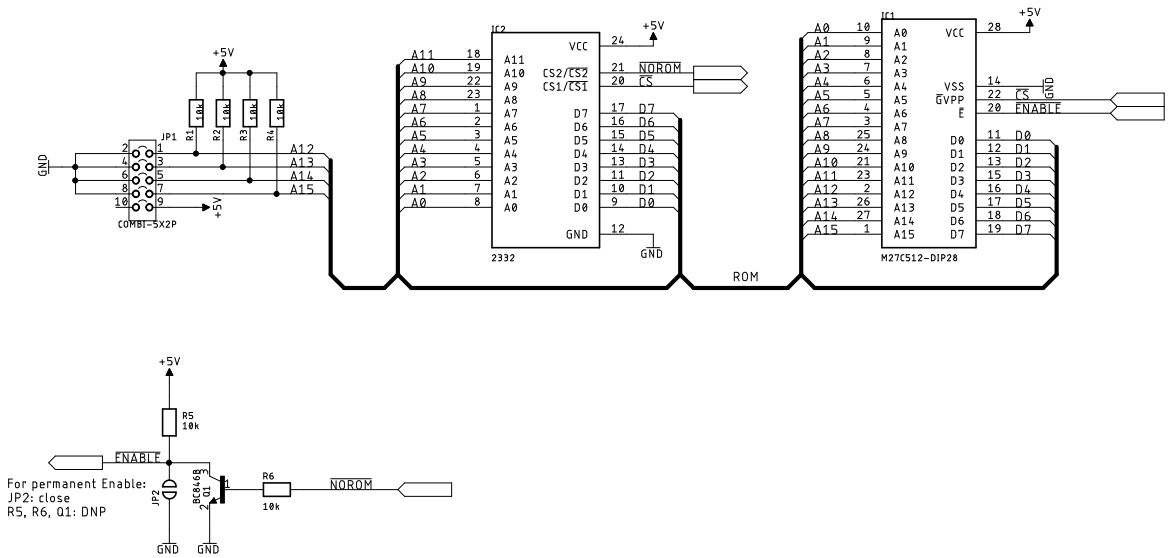
Revision History

Rev. 0

- Prototype, fully functional.

Rev. 1

- Some experimental features removed.
- Rounded corners and a notch added to identify the orientation
- Fully functional



open source hardware

Title:	2332 ROM/EPROM Adapter for Commodore PET	Doc.-No.:	158-1-001-01
		Draft.:	Sven Petersen
Date:	10.02.2022 20:02	Rev.: 1	Page 1/1
File:	2332_adapter_PET		
	http://github.com/svenpetersen1965		A3

Sven Petersen 2022	Doc.-No.: 158-2-01-01	
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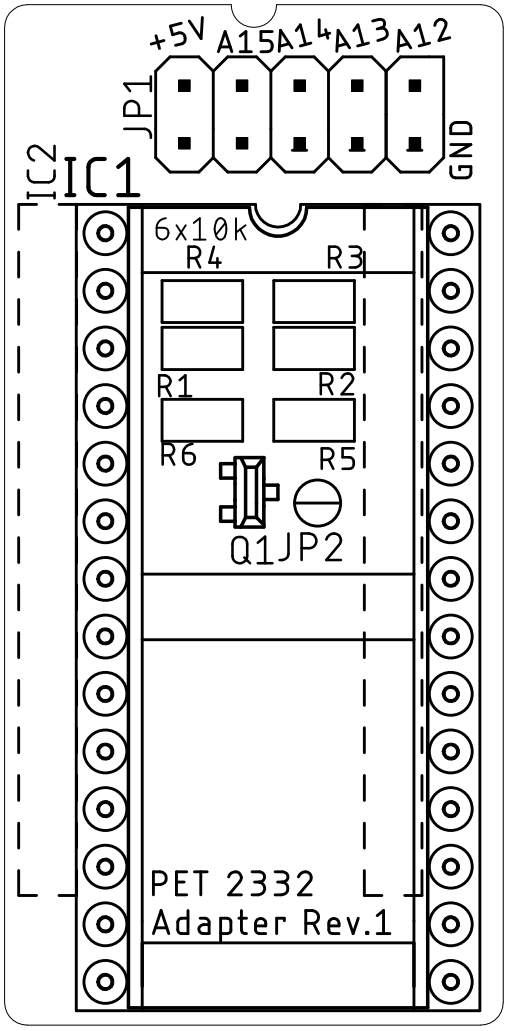
2332_adapter_PET		
nicht gespeichert!		Rev.: 1
placement component side		



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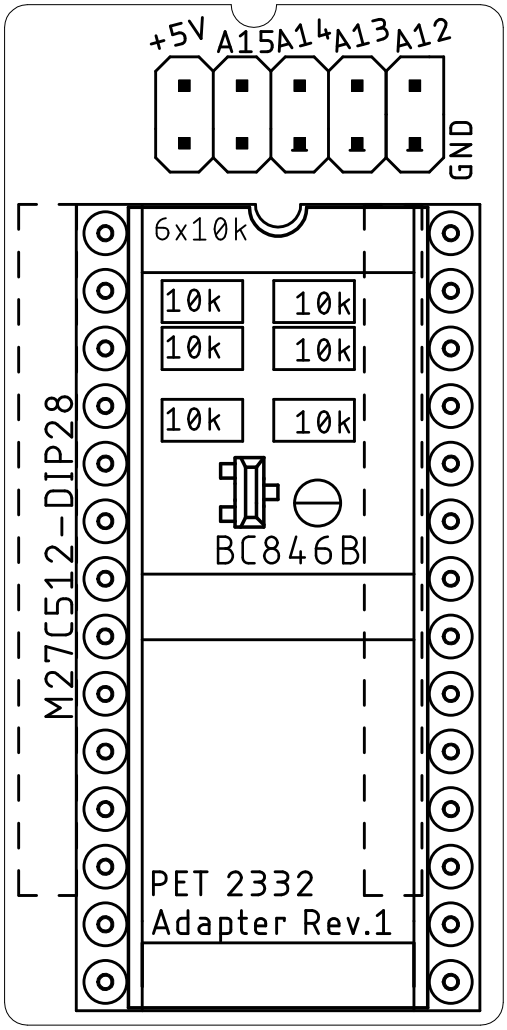
placement component side		



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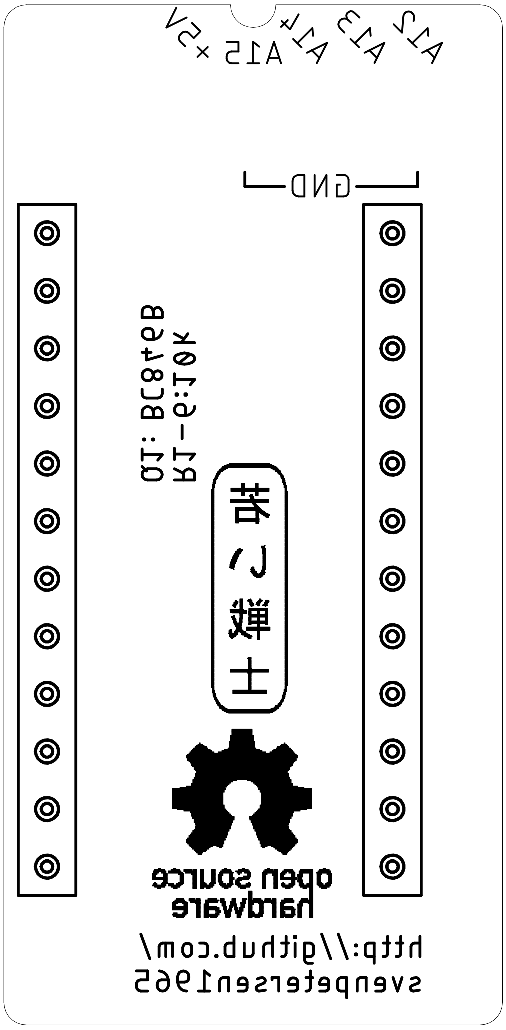

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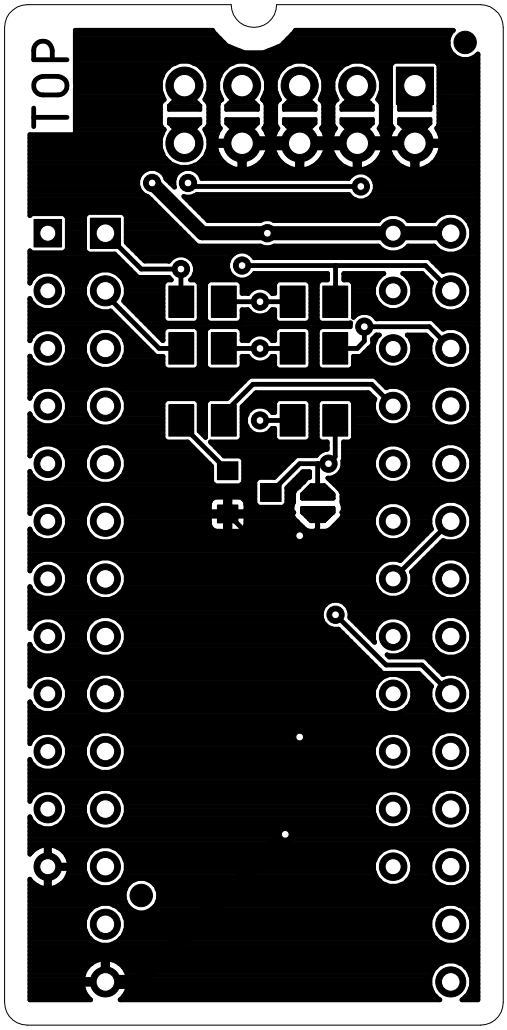

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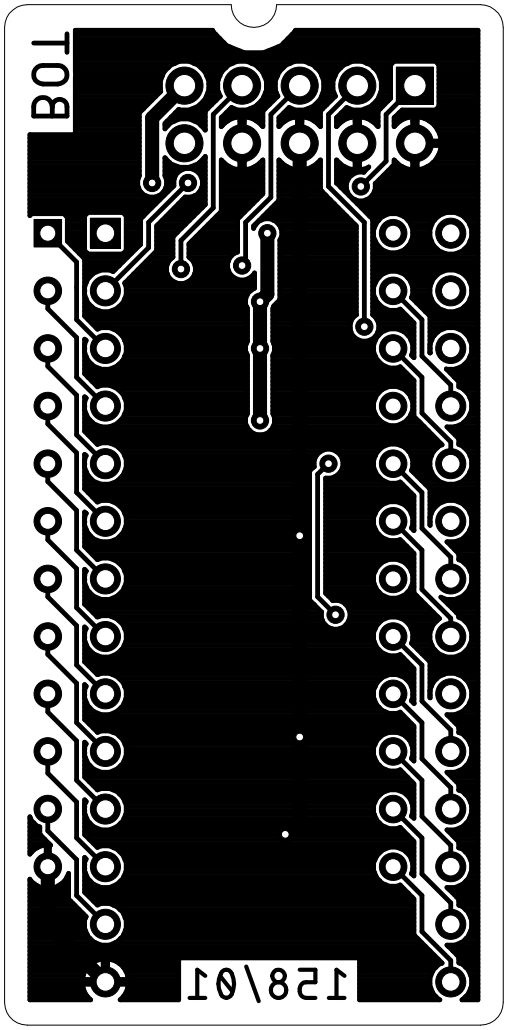

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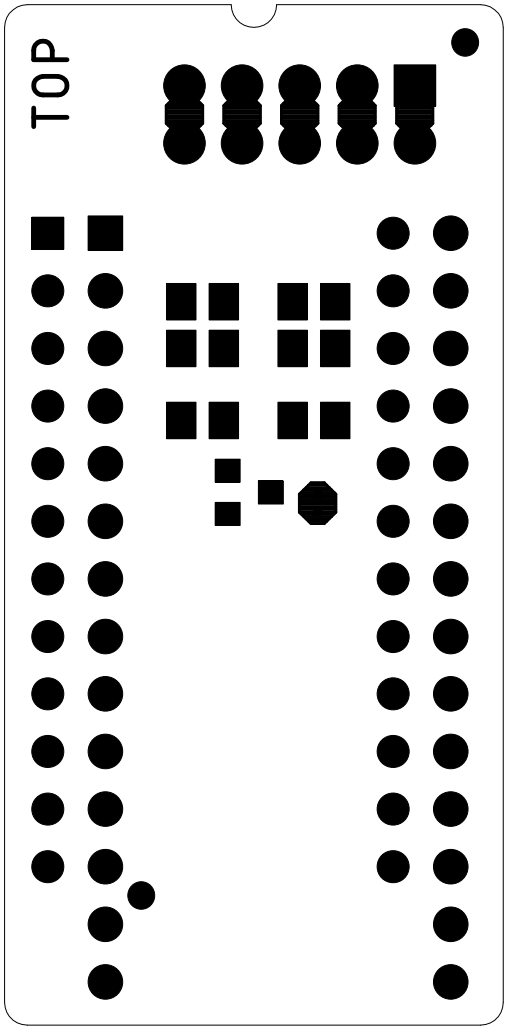
stopmask component side		



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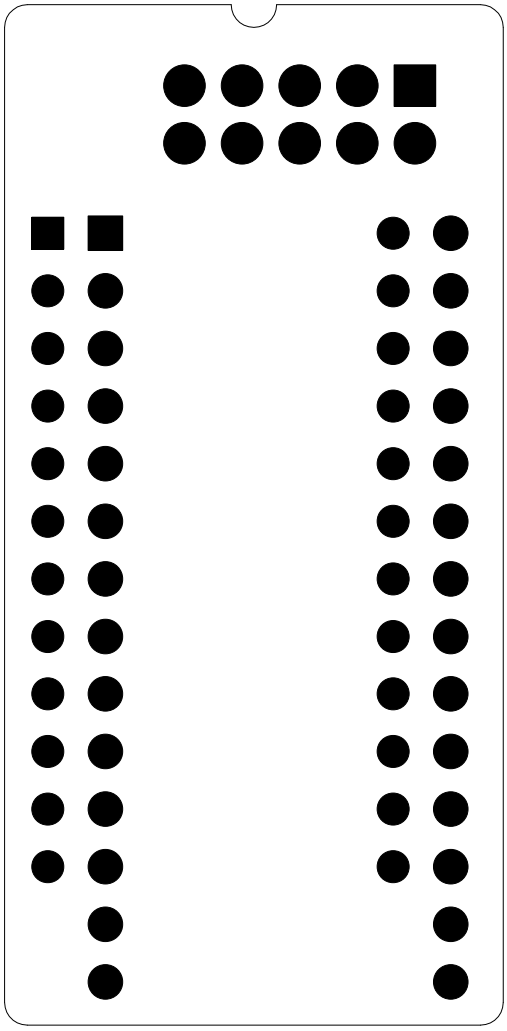
stopmask solder side		



Sven Petersen 2022	Doc.-No.: 158-2-01-01	
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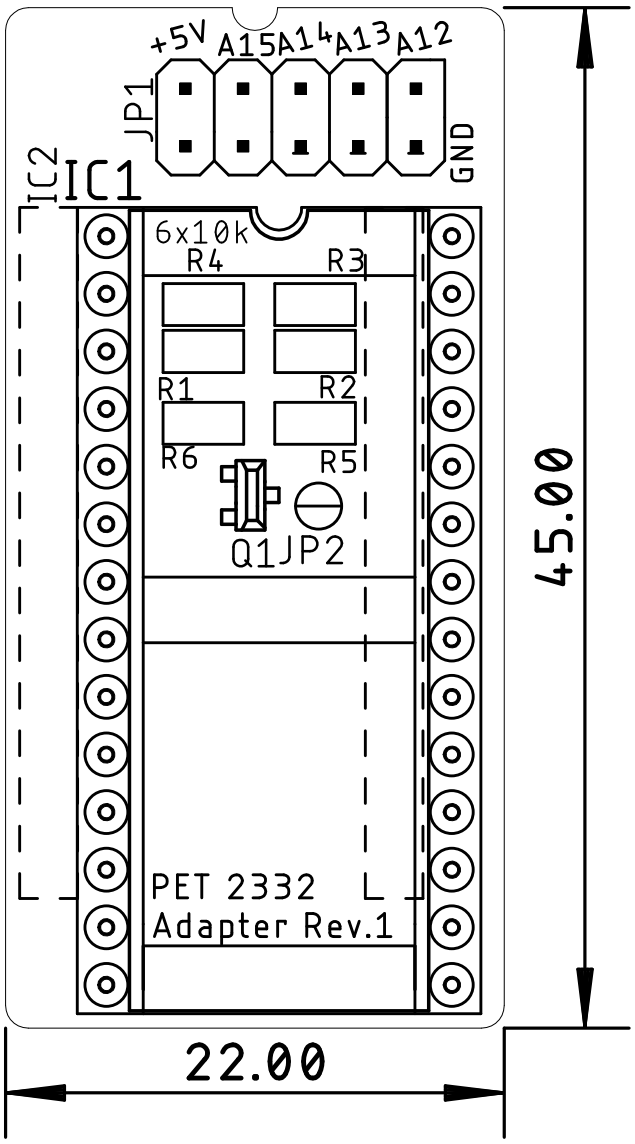
nicht gespeichert!		Rev.: 1
placement component side measures		



PET 2332 Adapter Rev. 1

Testing

1. Test Setup

1. PET 2332 Adapter Rev. 0
2. PET 2332 Adapter Rev. 1
3. CBM8032 (Mainboard ASSY8032030, with CRTC)
4. CBM3016 (Mainboard ASSY320351 Rev. E, without CRTC)
5. A variety of 27C512 EPROMs (120ns)
6. Diagnostic Clip (for CBM80xx)

2. Test Execution

2.1. Option ROM in the CBM8032

The Adapter was used for UD11 and UD12 in the CBM8032. The used software was

- VC1541DOS/80 (UD11)
- SM-Kit-B 2.3 (UD12)
- SM-Kit-M 2.3 (UD11)
- EXBASIC V8.1 (UD12/UD11)

The software was installed in different ROM banks on the 27C512. Both Revision Rev. 0 and Rev. 1 were tested.

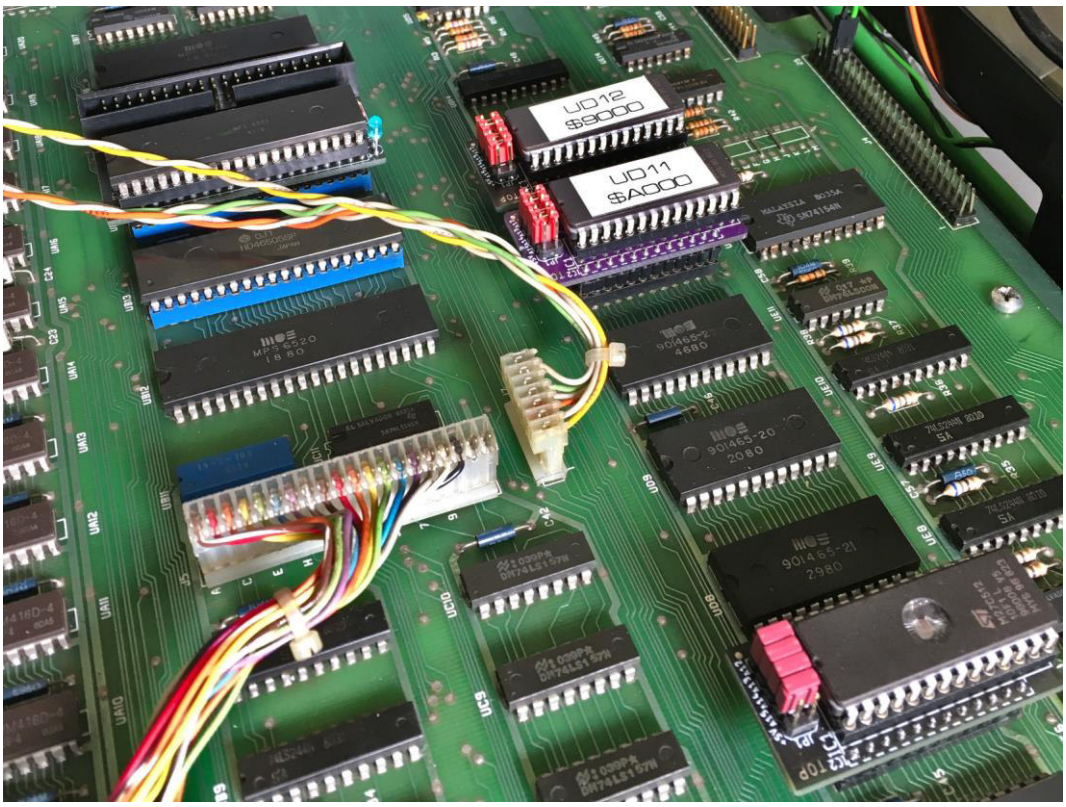


Figure 1: The 2332 adapter in UD11 (v1), UD12 and UD7 (both v0)

Also, the **diagnostic clip**, which males use of the active HIGH chip select pin CS2 (with the /NOROM signal) is working in conjunction with the adapters.

The adapter and EPROMs worked flawless.

2.2. Edit ROM in the CBM8032

The software found in the CBM8032, which was used for the test was programmed into a 27C512 and used in the Edit ROM socket UD7.

The computer worked flawless with this configuration.

2.3. Kernal ROM in the CBM3016/Dynamic PET2001N-16

The Kernal 901465-03 (BASIC 2) was programmed into a 27C512, inserted into the 2332 adapter Rev. 1 and installed in the socket UD9 for the Kernal.

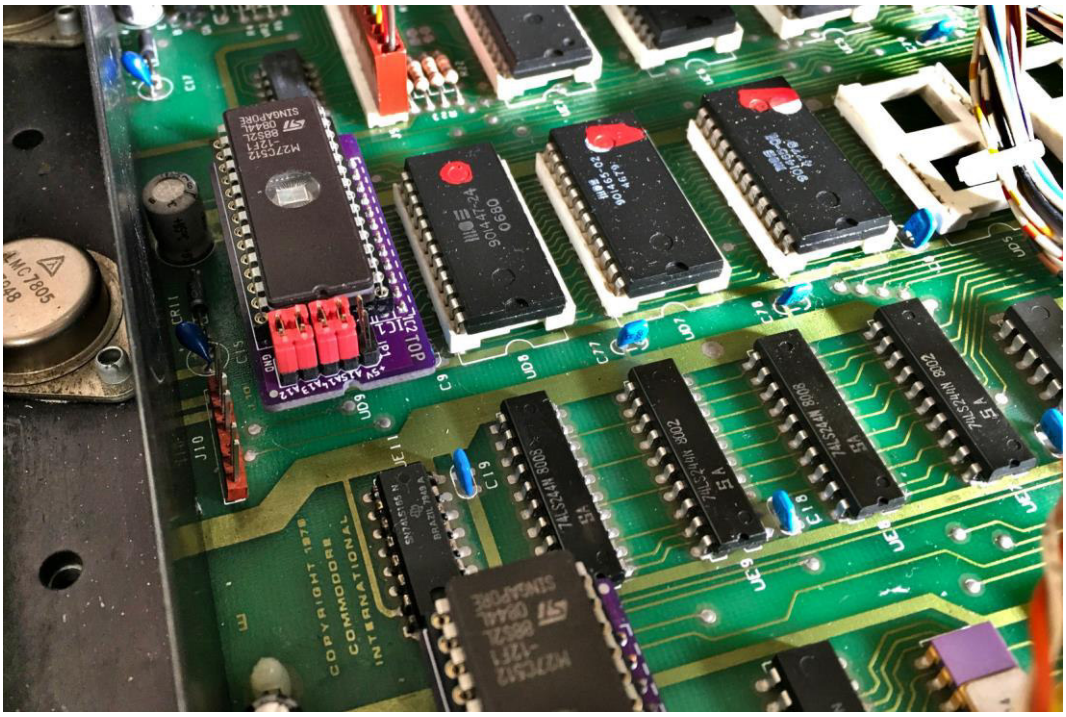


Figure 2: The 2332 adapter v1 in UD9 (Kernal)

The computer worked flawless with this configuration.

3. Conclusion

The 2332 adapters (Rev. 0 and Rev. 1) are fully functional.

PET/CBM 2332 Adapter Rev. 1
Bill of Material Rev. 1.0

Pos.	Qty	Value	Footprint	Ref.-No.	Comment
1	1	158-2-01-01	2 Layer	PCB Rev. 2	2 layer, Cu 35μ, HASL, 45mm x 22mm, 1.6mm FR4
2	1	2x05pin, 2.54mm	2X05	JP1	Standard pin header, 2.54mm pitch. E.g. Reichelt MPE 087-2-010
3	4	Jumper	2.54mm	(JP1)	Jumpers for address selection (in case it is intended to jumper the kenal selection)
4	6	10k	0805	R1, R2, R3, R4, R5, R6	SMD resistor
5	1	two Pinstrip, precision round pins, cut to 12 pins length	DIL24_SOCKET	IC2	Precision Round pins **mandatory**! E.g. Reichelt BKL 10120540 or
					10PCS Single Row 40Pin 2.54mm Round Male Pin Header machined
6	1	M27C512	DIL28-6	IC1	EPROM 200ns or faster recommended, alternative sizes: 27C64, 27C128, 27C256 possible
7	1	DIP28 socket	DIL28-6	(IC1)	Precision round pin is recommended