

Creating a 32K Atari 7800 Custom Cartridge

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Introduction

With the recent availability of homes brews (Beef Drop, Frogger, and Q-bert) and hacks (Pac-Man, Miss Pac Attack, and Hangly-man) for the Atari 7800 enthusiast are searching for way to enjoy these on a real 7800 console. Sure the Cuttle Cart provides an easy way to enjoy these games but, if you're searching for an alternative or simply enjoy having an individual cartridge to add to your collection there is a less expensive way!

Unfortunately, at the time of writing this, nobody has made a general purpose PCB or cartridge shell available for the home-brewer to create your own cartridges. Then again if there were we wouldn't need this document... Unfortunately this leaves the only option of cannibalizing a common 7800 32K cartridge. Thankfully there is an abundance of these commons that can be picked off, even on eBay, for a relatively low cost.

Requirements

Before beginning make sure you have access to the following:

- (1) 27256 or 27c256 32K EPROM
- (1) 32K Atari 7800 Cartridge*
- (1) 74LS04 (hex inverter)
- EPROM Programmer (I use a Pocket Programmer 2 – <http://www.xtronics.com>)
- Solder Gun – *if you're not proficient, practice a bit before attempting this.*
- Solder
- Wire
- Some double-sided tape (optional)

- (1) 32-pin socket (optional)

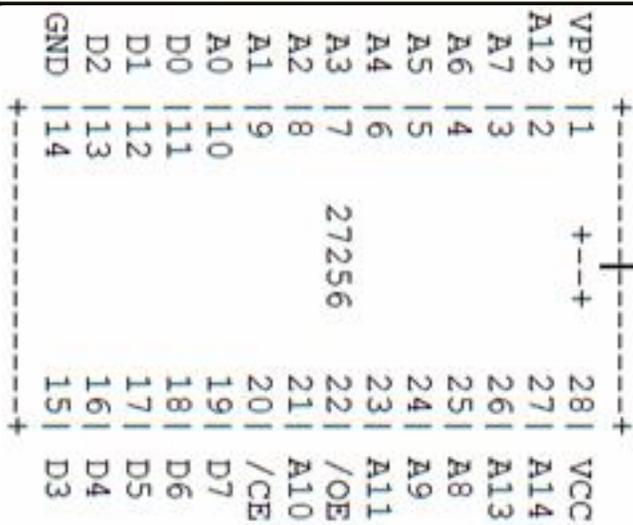
**The type 1 & type 2 cartridges (see appendix for incomplete list) seem to work fine. In this document we'll look using at Food Fight. With minor modifications I've also used this for Pole Position II.*

Component Pin-Outs

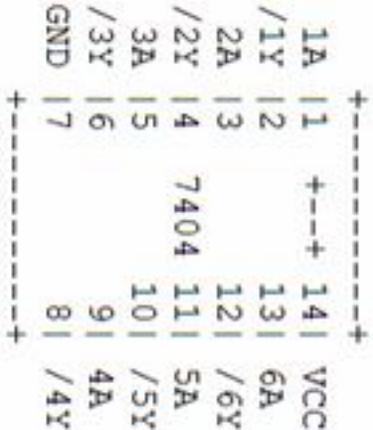
Through the course of this document I'll reference pins on the boards edge connector, the hex inverter, and the ERPOM. Use the following as guides to better understand which locations are being affected.

Top/Component Side			
Atari 7800 Cartridge Pinout, looking at cart edge.			
1	Read/Write from 6502, low = Write	32	Phase 2 clock from 6502
2	Halt to 6502	31	IRQ to 6502
3	D3 to/from 6502	30	Ground
4	D4 to/from 6502	29	D2 from 6502
5	D5 to/from 6502	28	D1 from 6502
6	D6 to/from 6502	27	D0 from 6502
7	D7 to/from 6502	26	A0 from 6502
8	A12 from 6502	25	A1 from 6502
9	A10 from 6502	24	A2 from 6502
10	A11 from 6502	23	A3 from 6502
11	A9 from 6502	22	A4 from 6502
12	A8 from 6502	21	A5 from 6502
13	+5 VDC	20	A6 from 6502
14	Ground	19	A7 from 6502
15	A13 from 6502	18	External Audio to system
16	A14 from 6502	17	A15 from 6502

27256 EPROM Pin-Out



LS7404 Hex Inverter Pin-out



Step-by-Step Instructions

Step 1:

- A. Grab your least favorite 32K cartridge game (or your unwanted duplicate) and donate it to the process. In this example we'll look at using Food fight. A game I have a couple copies of.
- B. Poke a hole in the center of the cartridge most, but not all, will have a screw that needs to be removed to open the cart.
- C. Gently flex and squeeze the cart from the sides to separate the two halves.

Step 2:

- A. Remove the PCB (printed circuit board) from the cartridge.

B. Grab soldering gun and remove solder from each of the legs of the prom.**Note:** If you don't care about the prom you can cut the legs and quickly remove chip. I prefer to keep the chips to validate the board later in the process

C. Gently remove the prom from the board. Do not force it as you may accidentally pull a trace or lift a solder joint. Once removed it should look like the image to the right.

Step 3:

A. Remove any excess solder from any of the holes. Once complete the backside should look like the image to the right.

Step 4: (optional)

I recommend using a socket because it will allow you to easily remove the EPROM if it needs to be reprogrammed with a newer release. 7800 cartridges generally have enough room for the socket and an EPROM (unlike 5200 cartridges) so it does not prevent you from putting it back in the cartridge case it was removed from in Step 1.

A. Take a 32-pin socket and solder it to the **front** of the board. Make sure you orientate the notch on the socket properly. If inserted correctly the notch should be on the right side of the front of the board as in the image to the right.

Step 5: (optional)

At this point we've only modified the board to contain a socket and nothing else. To make sure we haven't lifted a trace you can insert the original PROM and test in your Atari.

A. Re-insert the original prom into the socket on the PCB board. If you forgot which way it goes just follow the notch on the chip. It should be orientated just like your socket as in the image to the right.



Step 6:

This is where we start to make the one major modification to the board.

A. You will need to break the trace running from pin 17 on the edge connector to OE (pin 22 on a 27256 EPROM). See the red line in the image to the right.

B. Use a continuity tester to confirm that you have broken the trace and it is now an open circuit.



Step 7:

A. Using some double-sided tape, apply the tape to the back of your LS7404 (hex inverter) and adhere it to the back of the PCB. The notch should be facing to the left (as seen in the next image).

B. Using a short wire, connect the ground pin on the hex inverter to ground of the board. In the picture this is top right pin of the hex inverter running to trace that connects to pin 30 on the edge connector of the PCB.

C. Bend pin 4Y (this is an output pin) of the hex inverter and connect it to OE going to the EPROM

D. Bend pin VCC of the hex inverter and connect it to VCC of the EPROM

E. Scratch some of the protective film over the trace running to pin 17 of the PCB edge connector. In the image this is the left most trace. We'll need to do this so we can solder a wire to that trace.

F. Solder a wire to trace we just exposed in step 7E. and run it to pin 4A in the hex inverter

If all was done correctly, your board should look similar to the board below:



Step 8:

- A. Finally, insert your programmed 27256 EPROM into the socket. Make sure you insert it with the notch pointing in the correct direction.
- B. Place PCB back in cartridge case and enjoy!

Appendix

Table of Type 1 – Type 9

Type 1: Standard ROM cart. PCB CO24926-xxx	
DigDug	Type 1 - C300048-003A
Ms. Pac Man	Type 1 - C300038-007A
Pole Position II	Type 1 - CO28408-01
Xevious	Type 1 - C028410A-38
FoodFight	Type 1 - C028404-38

Type 2: Standard ROM with resistor in series with +5V. PCB CO24926-xxx

Joust	Type 2 - C300049-006A
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Robotron	Type 2 - C300049-009A-01
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Type 3: POKEY cart. PCB C026461. These carts also have 3 hardwired jumpers

Ballblazer	C300049-015A-01 W1:1-2 W2:1-2 W3:on
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Type 4: Supercart without RAM IC. PCB C100339. These carts have 8 soldered jumpers

Real Sports Baseball	C300514-034A W1:off W2:on W3,W4,W5,W6,W7,W8: off
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Type 5: Supercart PCB board with only a ROM and U2 (74LS02). PCB C100339

Donkey Kong	C300050-048A W1:on W2:off W3:off W4:on W5:off W6:off W7:on W8:on
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Donkey Kong Jr	C300050-049A W1:on W2:off W3:off W4:on W5:off W6:off W7:on W8:on
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Hat Trick	C300050-029A W1:on W2:on W3:off W4:on W5:off W6:off W7:on W8:on
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Mario Bros	C300050-050A W1:on W2:off W3:off W4:on W5:off W6:off W7:on W8:on
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Type 6: Small style Supercart with no RAM. PCB C300595. No jumpers

Mat Mania Challenge	C300051-063A
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Midnight Mutants	C300051-089A
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Ninja Golf	C300051-070A
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Scrapyard Dog	C300051-079A
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Type 7: Supercart without RAM IC. PCB C300565. These carts have 6 soldered jumpers

Barnyard Blaster	C300051-059A W1:off W2:on W3:on W4:off W5:off W6:off
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Crack'ed	C300051-036A W1:off W2:on W3:on W4:off W5:off W6:off
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Dark Chambers	C300051-037B W1:off W2:on W3:on W4:off W5:off W6:off
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Type 8: Supercart with all IC's. PCB C100339. These carts have 8 soldered jumpers

Crossbow	C300048-044A/C300051-044B W1:off W2:on W3:off W4:off W5:on W6:off W7:off W8:off
Type 9: Supercart with all IC's. PCB C300565. These carts have 6 soldered jumpers	
Jinks	C300051-057A W1:off W2:on W3:on W4:off W5:off W6:off
Tower Toppler	C300050-056A W1:off W2:on W3:off W4:on W5:off W6:off
Winter Games	C300051-031A W1:off W2:on W3:on w4:off W5:off W6:off