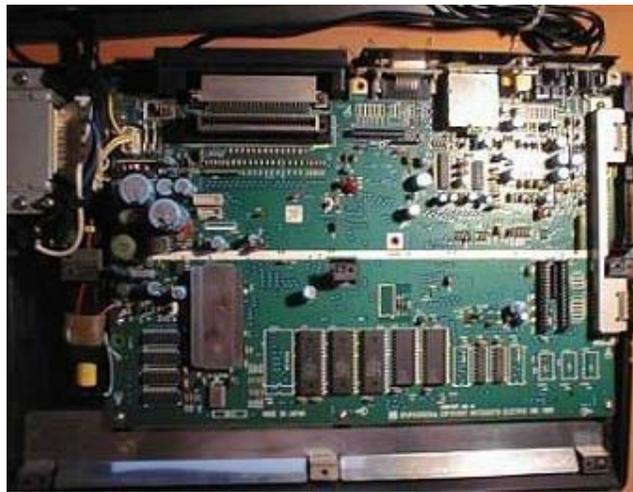# Panasonic MSX2+ computer
256/512KBytes internal memory upgrade

Adrian Oboroc

Desolder 4464 DRAM chips from IC22 and IC23 and capacitors from C89 and C90 (you can use 4164 chips to upgrade your VRAM to 192KBytes or expand SCC+ cartridge from 64 to 128KBytes). Put those capacitors in C88 and C91 and 44256 DRAM chips in IC21 and IC24 positions.

Panasonic FS A1WSX PCB

2 x 4464 DRAM chips before upgrade

2 x 44256 DRAM chips after upgrade

Look for the T9769 chip (MSX engine) of the other side of PCB. Next to it you will find two jumpers: J3 and J2 (R140 and R141 for WSX PCB). Desolder resistor from J2 (R140 on WSX). Short J3 (R141) with a small piece of wire to get +5V on T9769 pin 52.

R140 and R141 on the back side of Panasonic FS A1WSX PCB

This is all you need to do for a 256KByte upgrade!

If you want to get full 512KBytes of memory, follow the rest of the steps.

Solder two more 44256 chips over first two, leave pin 17 unsoldered and bended up.

*** Now comes the toughest part of this upgrade. Be extra careful, since you can damage your MSX2+ computer beyond repair! ***

Desolder T9769 pin 51 and connect it to pin 52 (+5V). Solder a wire from T9769 pin 50 to pin 17 of both "second flour" 44256 chips.

All done! If you did everything correctly, you'll get full 512KBytes of RAM in your MSX2+ computer. This is enough to play english disk version of Metal Gear 2 with SCC sound.

Chip pinouts

DIP-20 44256/44C256/514256 256KWord x 4-bit DRAM chip

```
       +---+  +---+
  D0 |1  +--+ 20| GND

  D1 |2         19| D3

 /WE |3         18| D2

/RAS |4         17| /CAS

     |5 44256 16| /OE

  A0 |6 44258 15| A8

  A1 |7         14| A7

  A2 |8         13| A6

  A3 |9         12| A5

 VCC |10        11| A4

     +----------+
```

Toshiba T9769 "MSX Engine"

```
    108 107        74 73

     |  | .......  |  |

      _____
109--|                |--72

     |                |

110--|                |--71

    :|      TOSHIBA   | :

    :|                | :

    :|       T9769    | :

143--|                |--38

     | o              |

144--|_____|--37

     |  | .......  |  |

     1  2         35 36
```
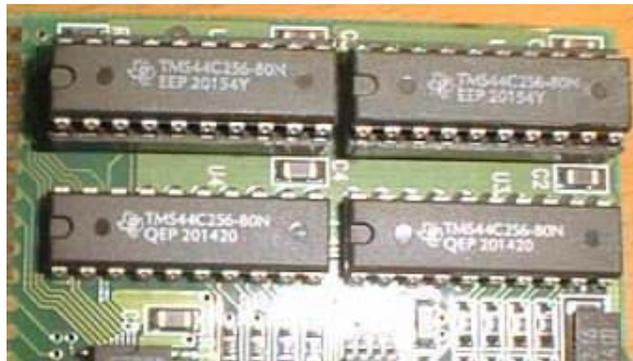
Obtaining 44256 DRAM chips

If you have a choise, try to find 44256 or 514256 DRAM chips. Some people say that CMOS chips (44C256) get less hot.

I got my DRAM chips from an old SVGA board from local electronic junk store. It was 8 CA$, which is about 5.5 US$ or 4 euro.

ATI ISA SVGA board from circa 1991

Another popular source for this chips is old PC motherboards (286 or early 386).

Some fairly generic soldering advices

Use desoldering braid or a special air-sucking tool to desolder components from PCB without damage. Use good flux to cleanly solder components. Try to remove excess of flux from PCB using some alcohol. Use a low-power soldering iron (~20Watt). Try to find a low voltage grounded soldering station, for example Solomon SL-20. Make sure your soldering gun is properly cleaned before you work on T9769. Try to reduce the shaking of your hands by relaxing for a few minutes before you start the work. A nice cup of fresh green tea and few deep breaths will do. Be extra careful then working with high pin density chips like T9769. Use a fine needle and a soldering iron to heat-up and gently pull the pinx from the PCB. Don't touch pin with soldering gun for more then a second.

Credits

Big thanks to Manuel "Guillian" Pazos for the all the great help!
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