HSFE
Hard Sector Floppy Emulator
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HSFE is a small circuit using an ATMEL micro-controller that sits between a
vintage computer's hard sector floppy controller and one or two 3.5" 1.44MB floppy
drives. The circuit then emulates hard sectored floppy media such that the host
controller thinks it is talking to legacy hard sectored 5.25" floppies.

HSFE has the following specifications and limitations:

- emulates 10-hole hard sectored floppies only

- emulates one or two drives simultaneously

- uses a standard PC floppy cable with "twist" between
  HSFE and 3.5" drives

- uses 1.44MB 3.5" media with the high-density hole covered
  with black tape

- tested with Heath H89 H-88-1 controller

- tested with HDOS 2

- tested with CP/M 2.2.X03

- tested with BIOS-80 extension for CP/M resulting in 100K, 200K
  and 400K storage on 3.5" media with H-88-1 controller.

- Each emulated drive can be connected to any of the four
  drive selects SY0, SY1, DRIVE1 or DS0 (DS0 unsupported on H-88-1).

Operation

You must use a 3.5" floppy drive that is capable of 720K low-density format on a
PC. Some cheap 3.5" drives today omit the density sensor and force the drive into
1.44MB mode all the time. The Samsung SFD-321B is an example of one of these
drives. These will not work with the HSFE and your H8 or H89 hard sector
controller because they are unable to operate at the 250Kbps data rate that those
controllers require.

A Sony MPF920 and NEC FD1231H-302 are examples of drives that will work.

You can use older 720K 3.5" floppies if you have them or if you use 1.44MB
floppies, you must cover the density select hole with a piece of black tape. This
forces the 3.5" drive to run in 720K mode (250Kbps data rate) even with the high
density capable media.

You use the 3.5" drives the same way you would in a PC-- namely, one or both
drives are hard wired to the DRIVE 1 select (pin 12) and a floppy cable with a
twist in it is used to connect the HSFE to the drives. The drive before the twist
will respond as Drive A (DSA) and the drive after the twist will respond as Drive
B (DSB).

DIP switches on the HSFE map the DSA and DSB selects to the specific drive select from the controller according to the following table,

DIP SWITCH #	CONTROLLER PIN	H-88-1 / H-17	FLOPPY SELECT
1	6		A
2	10	SY2	A
3	12	SY1	A
4	14	SY0	A
5	6		B
6	10	SY2	B
7	12	SY1	B
8	14	SY0	B

Close just one switch from the set [1,2,3,4] and one from the set [5,6,7,8]. Each floppy can have just one select from the controller routed to it.

3.5" floppy drives require only +5 volt and no +12. HSFE requires only +5 also so the HSFE will have only +5 and ground connections via the power connector to the host. The power cables going to the drives may also have +12 (yellow wires) but they are unused.

CP/M SYSGEN may occasionally have an issue with the first select after a motor off. So the technique I use to work around this is to first format the disk you wish to SYSGEN and then exit back to CP/M. Select the newly formatted drive (eg, if you formatted drive B, do B:<return>). The first select may fail. If it does, hit ^C and you'll return to A:. Select B: again. This time it should work. Now, return to A: and invoke SYSGEN. You should now be able to read from A: and SYSGEN to B: without error.

With the BIOS-80 extension to CP/M 2.2.X03, you can boot from 40 track, 1 sided (100K disks) and you can boot from 80 track, 1 sided (200K disks) because they are both single sided and that is the only format that the MTR proms can boot from. You can SYSGEN an 80 track, 2 sided disk (400K) and then put that in drive A: and warm boot from it as expected. You will just not be able to cold boot from that disk.

One configuration I use has an original 40T, 1S, 5.25" drive internal to the H-89 and then I have the HSFE and two 3.5" drives connected to the external drive connector at the back of the H-89. Another configuration has two 3.5" drives mounted in 3.5" to 5.25" adapters and these are the mounted in place of the original 5.25" drive in the front panel of the H-89.

In both configurations I have DIP SW #3 and #6 closed. This puts drive A on SY1 and drive B on SY2.

Issuing <BOOT 1> to the MTR prom, will boot from the first 3.5" drive and it will become A: under CP/M. The second 3.5" drive will become B: and the internal 5.25" will become C:. This is a very useable configuration and quite suitable for copying old 5.25" media to new 3.5".

"HSFE DUAL" schematic is included here and thanks go to Les Bird for doing the PCB layout, kiting, extensive testing and sales.

Chris Elmquist
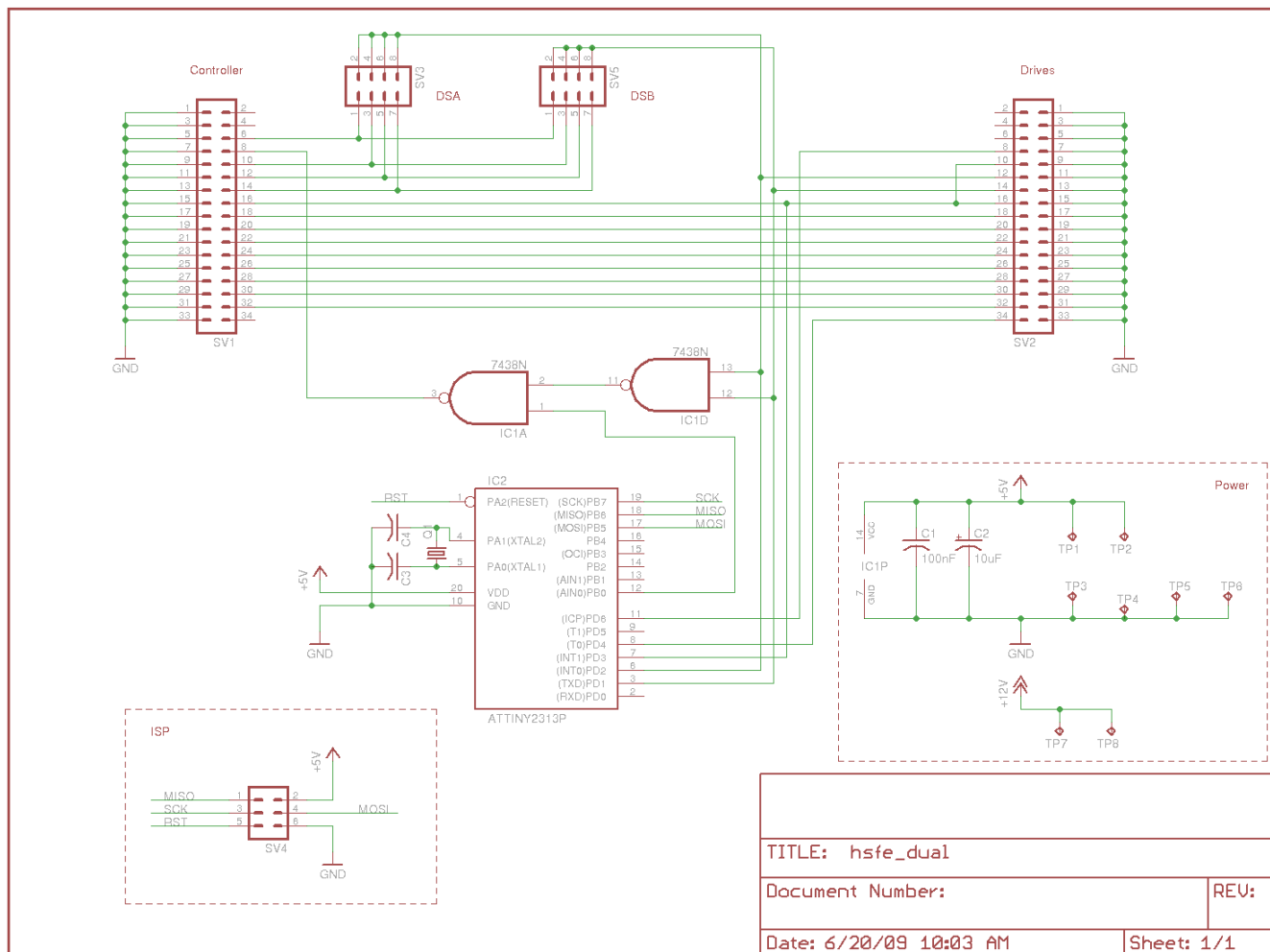
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