ZSA: Z80 Standard Architecture

A Proposal for A Z80-based DIY Computer Architecture

Draft Version 0.2

Abstract

This proposal will outline the physical, electrical, and software requirements for a community-owned, open-source hardware, 3.3V logic level DIY computer architecture, built around Z80 and compatible CPUs. Inspired by, and physically similar to, the Industry Standard Architecture, or ISA, bus, this bus will serve the same purpose for new, Z80-based DIY computer systems: provide an open standard to which any and all participants are welcome.

Rationale

The inspiration and motivation behind this proposal is, simply put, the current reality facing computer hobbyists: 5V parts are becoming harder to find, while 3.3V parts are plentiful, inexpensive, and far more broad in their natures and selection. Moving from a 5V standard logic to 3.3V opens up a new world of potential, enabling the use not only of more modern surface-mount logic and memory and processor devices, but CPLDs, FPGAs, microcontrollers, and specialized ASICs which all default to 3.3V logic levels.

A 3.3V standard for DIY computer kits and accessories will enable the use of all these components and many more than can be enumerated here, as well as enable the use of modern, high-quality, economical PCB fabrication and population facilities provided to the modern hobbyist by such services as PCBWAY and JLCPCB, among others.

Bus Signals

The bus of this standard is carried on female edge connectors with a pin pitch of 2.54mm. Through-hole female connectors are recommended for mechanical strength. All signals are specified to use 3.3V logic levels, and are assumed to be 5V-intolerant.

The bus consists of 50 signals, numbered and named as per figure 1, using a 70-pin edge connector. Each signal on the board is adjacent to a ground pin, either on the same side of the connector or directly opposite. The two power rails are separated from other pins by non-connected pins.

The pin and signal descriptions are found in table 1 below. The bus is designed with the expectation that conforming systems will use static RAM and flash ROM, rather than more complicated memory systems.

A conforming backplane MUST provide, for each expansion slot, EITHER a two pin 2.54mm pitch pin header OR a SPST switch, which links the /INT2IN and /INT2OUT pins when connected.

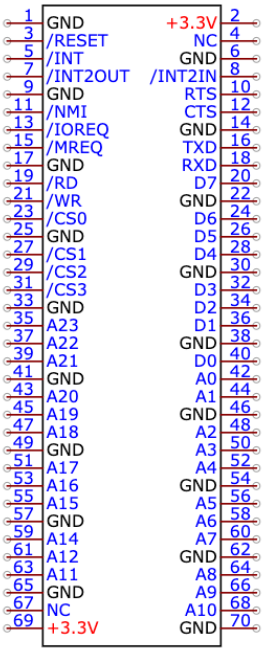

Figure 1: Bus Pinout

A conforming expansion card MUST pass signals from /INT2IN to /INT2OUT, even if it does not use those pins itself.

A conforming expansion card which makes use of the /INT2OUT signal MUST block signals from /INT2IN at any time when it is asserting the /INT2OUT signal.

A conforming backplane MUST provide some means of selecting which of the card slots SPI /SS lines will be asserted, if any. The RECOMMENDED method is the use of a latch wired to an I/O port, with a value of “0” signifying no card selected.

Power

A conforming backplane MUST provide voltage levels of +3.3V at a minimum capacity of 500mA to each expansion slot; this means that a backplane with three card slots must provide a total of at least 1500mA to the +3.3V rails.

A conforming expansion card MUST draw no more than a peak total of 500mA on the +3.3V rail.

A conforming expansion card MAY make use of supplemental power, provided that power source is referenced to the same gound level as the +3.3V rail.

Physical Measurements

A conforming backplane MUST place its expansion slots at a centre-to-centre distance from each other of exactly 20.3mm.

A conforming backplane MAY be physically compatible with any existing case mounting standard. Such a backplane MUST be clearly marked as to

Pin Name	Pin Number	Desciption
+3.3V	2, 69	+3.3 volt power rail
A23..A0	35, 37, 39, 43, 45, 47, 51, 53, 55, 59, 61, 63, 68, 66, 64, 60, 58, 56, 52, 50, 48, 44, 42	24-bit address bus
/MREQ	15	Memory request (active-low)
/IORQ	13	I/O request (active-Llw)
/RD	19	Bus read (active-low)
/WR	21	Bus write (active-low)
/INT	5	Interrupt (active-low)
/NMI	11	Non-maskable interrupt (active-low)
D0..D7	40, 36, 34, 32, 28, 26, 24, 20	8-bit data bus
RXD	18	+3.3V serial recieve
TXD	16	+3.3V serial transmit
CTS	12	+3.3V serial “clear to send” handshake line
RTS	10	+3.3V serial “ready to send” handshake line
/INT2OUT	7	Mode 2 interrupt daisy-chain output (active-low)
/INT2IN	8	Mode 2 interrupt daisy-chain input (active-low)
/CS0../CS3	23, 27, 29, 31	“Chip select” lines (active-low)
NC	4, 69	No connection
GND	1, 9, 17, 25, 33, 41, 49, 57, 65, 70, 62, 54, 46, 38, 30, 22, 14, 6	Ground

Table 1: Pin and Signal Descriptions

which case mounting standard it is compatible, on the side with the conformance mark(s).

A conforming backplane MAY use any power supply design or connector which safely provides at least the minimum required current on the positive voltage rail.

A conforming expansion card MUST have board dimensions and outline matching those in figure 2.

A conforming expansion card MAY have the mating edge of the PCB chamfered.

A conforming expansion card MUST have all the mounting holes in figure 2.

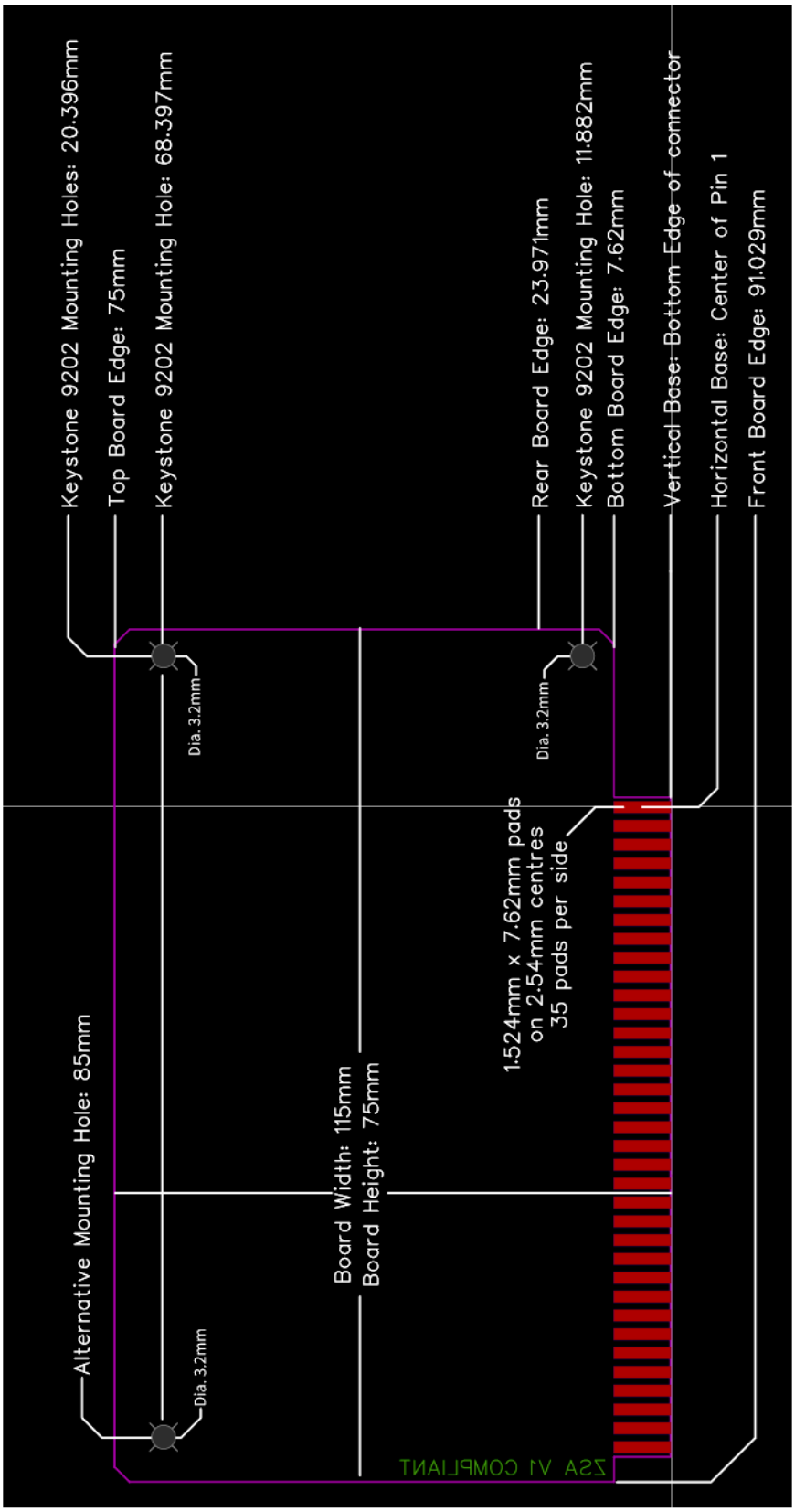

Figure 2: ZSA Expansion Card Specifications

The “Alternative Mounting Hole” in figure 2 is there to be used with 18mm M3 nylon standoffs, to mechanically link cards together when the backplane is not installed into a case which makes use of the Keystone brackets. In such a case, the Keystone bracket MAY be removed, and the top mounting hole used for a second 18mm M3 nylon standoff.

Ports

A conforming expansion card MAY place rear-facing ports, such as (but not limited to) D-subminature connectors, in the area between the two Keystone 9202 mounting holes on the rear-facing edge of the PCB. Those ports, when possible, should be positioned such that existing, off-the-shelf pre-fabricated Keystone-compatible brackets can be affixed to the PCB.

Software

A conforming implementation, which provides a Z80 compatible CPU, MUST provide a bootable operating system which is call-compatible with CP/M version 2.[1] This operating system MAY be located in ROM, OR be loaded at boot from a storage medium such as a floppy disk or SD card.

A conforming implementation of any other expansion card MUST provide either or both of hardware interface documentation or an example implementation of the use of the hardware under CP/M version 2.

Licensing

The license terms under which the design of a conforming implementation are released are not specified by the standard.

Conforming implementations MUST carry the mark [MARK TEXT TBD] on the side facing pin 2 of the expansion connector in the case of an expansion card, or on the top-facing side in the case of a backplane.

Conforming implementations MAY carry the [LOGO NAME TBD] graphic on either or both sides of the PCB.

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[1] This includes CP/M-Plus and/or the different implementations of the "Z-System".