Along the lines of the various "Tiny" (credit to Plasmo) boards, I've designed and tested a small Z180 board which runs CP/M. Basic details are:

- **Z8S180 at 33MHz**
- 512KB SRAM for code + 440KB RAMdisk (zero wait states)
- 512KB Flash for code + 496KB "disk" (one wait state)
- Two TTL, RS-232 or USB serial ports
- A daughter I/O board with hex LEDs, DIP switch, RTC, 8MB flash and SD card is in the works

There are more details <here> as I haven't gotten around to developing a Wiki page. Schematics are <here> for the TTL/RS-232 version, <here> for the USB version and <here> for the I/O board.

The V1.0 processor boards work okay as-is with either DIP RAM or without I/O expansion headers. I made a mistake (I'll admit it) and used the smaller machine-pin holes for the I/O expansion headers rather than the more common square post headers. However, modified headers (square edges rounded) will work and V1.1 boards will have the larger square post holes.

There is a limitation to the CTS/RTS flow control on ASCI 1 when using a Z8S180 or Z8L180 processor due to a Zilog errata. When using flow control, CTS from a host works as expected but RTS to the host must always be enabled which can be accomplished via a simple board modification. V1.1 boards will properly support CTS/RTS flow control on ASCI 1 regardless of processor. RTS/CTS on ASCI 0 works properly and is not affected by the Zilog errata.

Full kits will be $45US including Canada/US shipping but excluding a +5V power supply for non-USB boards. Full M80 source for the BIOS and CP/M is available.

I currently have some extra V1.0 bare boards available for $10US including shipping. A pre-programmed 45ns flash chip is an extra $5.

Let me know if anyone is interested in one of these boards or kits. I'll need to know:

- TTL/RS-232 or USB-only board and bare board versus full kit?
- Is a V1.0 board or kit (with modified headers) acceptable?
- For the TTL/RS-232 board kit, do you want the four SMD devices pre-soldered at no cost?
- For the USB board kit, do you want the 13 SMD devices pre-soldered ($20 extra)?
- Would you prefer a fully assembled and tested board?

At this time I'm primarily wanting to know if there's any interest in these boards or kits. I'm waiting for a shipment of additional processors (only one extra on hand) so full kits won't be available for a couple of weeks. Only three TTL/RS232 and four USB-only full kits (V1.0) will be available initially and V1.1 board/kit availability will depend upon demand.

For those that may want a much more flexible Z180 development system, I do have some pre-assembled and tested NYOZ base modules. There's some verbose documentation <here>
that definitely needs paring down.

Bill

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Mon, 03 Sep 2018 21:36:03 GMT
View Forum Message <> Reply to Message

First up I need to learn how to type and read ... I think we'd all love to have a processor at 33MHz

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by pbirkel on Tue, 04 Sep 2018 08:13:34 GMT
View Forum Message <> Reply to Message

Bill;

I'm interested in the TTL/RS-232 full kit, four SMD devices pre-soldered, modified-headers acceptable. What is your plan for availability of the I/O Demo Board?

paul

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by b1ackmai1er on Tue, 04 Sep 2018 08:50:46 GMT
View Forum Message <> Reply to Message

So many new projects!

Such slow shipping from China

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by just4fun on Tue, 04 Sep 2018 12:54:31 GMT
View Forum Message <> Reply to Message

Hi,
do you know if HD64180RCP6X have the same ASCI 1 bug of the Z8S180 or Z8L180 (I haven't found any info on the HD64180 datasheet...)?
Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Tue, 04 Sep 2018 13:34:34 GMT
View Forum Message <> Reply to Message

pbirkel wrote on Tue, 04 September 2018 01:13:Bill;
I'm interested in the TTL/RS-232 full kit, four SMD devices pre-soldered, modified-headers acceptable. What is your plan for availability of the I/O Demo Board?
Paul: Your name is now on one of the TTL/RS232 full kits.

I have the I/O Demo PCBs inhand but delayed the prototype testing until after I tested the base boards and BIOS. Additional BIOS development for the I/O board is still required. Realistically, it will probably be the end of the month before I'm ready to ship them and I'm mostly concerned with getting the CPLD FULLY tested since most builders probably don't have the tools to reprogram them.

re: Slow China shipping. I've had mixed results from 2 weeks to 2+ months. UTSource has been 2-3 weeks on previous orders and a lot of the delay has often been Customs. I normally use Digi-Key, Mouser etc. for low quantity testing and only use select Chinese suppliers due to availability or pricing on more expensive ICs.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Tue, 04 Sep 2018 13:56:15 GMT
View Forum Message <> Reply to Message

Quote:do you know if HD64180RCP6X have the same ASCI 1 bug of the Z8S180 or Z8L180
So far as I've read and tested, the significant errata are only on the Z8S* and Z8L* devices and are not on the Z80180 which was derived from the HD64180. Although it was a long time ago, I did build a few systems with the HD64180 and didn't run into any undocumented issues.

The significant Z8S and Z8L errata from a programmer perspective:
- CSI/O timing change and TXS reverting to high after the last bit
- CNTLB1 does not reflect the state of the CTS1 pin
- ASCI overruns stop all receives until the ERF bit is reset, regardless of data reads

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by just4fun on Tue, 04 Sep 2018 20:33:29 GMT
View Forum Message <> Reply to Message

Thanks for the info!

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by gkaufman on Sat, 22 Sep 2018 16:18:09 GMT
View Forum Message <> Reply to Message
Bill -

Kit arrived quickly and went together easily - thanks for the very well written construction notes! This is super-slick and tiny. Anyone looking for a small and fast CP/M system should build one up.

Looking forward to the IO Demo board as well.

- Gary

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Sat, 22 Sep 2018 17:41:02 GMT
View Forum Message <> Reply to Message

Gary,

Glad to hear that the kit arrived safely and went together without problems. I appreciate the followup and compliment.

The I/O demo board is progressing ... CPLD code has been written as has the BIOS disk support for the 8MB flash TSOP . Clock code from an existing similar project needs to be integrated. Initial BIOS release will probably only have drivers for the optional SD card and serial memory chip. I'll keep you informed.

I'm still waiting for my order with additional processors. It's now about four weeks and I expect them at any time.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Sat, 27 Oct 2018 16:44:35 GMT
View Forum Message <> Reply to Message

My order of parts from UTSource finally arrived after 9 weeks rather than my previous experience of 2-3 weeks. I have all the parts for another RS232/TTL board and several USB boards per the first post in this thread.

The prototype I/O board has been assembled but testing has been delayed. I chose to try fight City Hall and the results were as expected I'm ready to get back to testing the I/O board in the next few days.

The V1.1 upgrade has been layed out but I don't plan to order the boards and build/test a prototype unless I receive multiple requests for them. The V1.0 boards work fine for me.

Let me know if anyone wants one of these kits.
Status update:

V1.1 of the RS232/TTL and USB boards have been received and tested. There are two main changes:
1) The header holes were increased in size for typical headers.
2) A flip-flop was added to latch the TXS (RTS1) signal due to Zilog's CSI/O change (i.e. errata) in the Z8S180 and Z8L180 chips.

The I/O demo board was changed to IO2 and appears to be working okay. The main changes are:
1) The serial memory device was removed due to space constraints.
2) A Schmitt buffer was added on the slow-rising open drain clock interrupt signal.
3) Discrete pullups were added on the SD signal lines since the CPLD pullups can't be used.
4) An oscillator was added so the CPLD can clock the bits within an SD data byte from a single I/O operation rather than the CPU having to do multiple I/O operations per bit (i.e. bit-banging the data and clock). This results in a significant performance improvement and with a 33MHz processor the transfer rate is about 1.85MB/sec.

No BIOS changes are required for the upgraded base boards, however the BIOS has been upgraded to V2.0 and tested for use with the additional I/O board devices. The I/O demo board incorporates an 8MB flash disk and the SD card supports an 8MB disk with the rest of the card still useable as FAT32.

Send me a PM if you're interested in a full kit or just a PCB for any of these boards. Per the first post, base module boards are $10US and full kits are $45US including shipping. I also have one assembled and tested board of each type that I'll sell at the same price.

The IO2 boards are $15 which includes an installed voltage regulator and programmed CPLD. A full kit (excluding [H]TIL-311 displays) is $35US but will require fine-pitch SMD soldering. As time permits, I'll be fully assembling and testing a few of these I/O boards and making them available for a minimal surcharge.
IO2 board received and hooked up, works very nicely and really slick!

Subject: Re: A New Small Z180 Board at 33MMHz  
Posted by **wsm** on Mon, 18 Feb 2019 17:09:32 GMT  
View Forum Message <> Reply to Message

Gary: Glad to hear it's up and running! I agree that these are neat little CP/M systems and quite speedy. Program loads are essentially instantaneous to the user and ASCIIART runs in just under 30 seconds.

My latest brain teaser is to see if I can make this a truly "TINY" encased system. The goal is to try make a single two-layer PCB inside a case that's 50x50x15mm or roughly 2"x2"x0.6". Mostly SMD components with similar basic specs: USB for power and serial I/O, 33MHz (I may try overclocking to 36.864), 512KB SRAM (optional piggy-back to 1MB), 512KB flash boot/disk, SD card and RTC. PCB layout is about 3/4 done.

The 8MB TSOP flash on the IO2 board is nice to have for resident bulk storage and reads via DMA are very fast. However, slow writes show the shortcomings of parallel NOR flash and why I'm not including it in a TINY system. If I were re-working the IO2 board, I'd probably substitute two serial quad I/O NOR flash chips making a byte-wide interface. Reads would add a BIT of overhead for setup but write programming would be in 256-byte pages rather than word-wide i.e. the programming delay reduced by a factor of 128.

The things some of us do when weathering a deep freeze ... :) CP/M-3 and FAT32 support are on the possible "to-do" list as is banking more of the BIOS to go back to a 64K system instead of 63K.

Subject: Re: A New Small Z180 Board at 33MMHz  
Posted by **wsm** on Sat, 21 Sep 2019 18:40:52 GMT  
View Forum Message <> Reply to Message

Following along on the "Tiny" MinZ series, I developed a cased version of it. This version is small enough that it can be hung off a PC's front USB connector using an integrated USB-A to male Mini-B adapter.

Size: 50mm x 50mm x 15mm or roughly 2" x 2" x 0.6" (Hammond 1551S case)

Features:
- USB powered
- Z8S180 at 33.333MHz or over-clocked at 36.864MHz
- 512KB Flash - 1 wait state : Boot code + 496KB flash disk
- 512KB or 1MB SRAM - 0 waits : 436KB or 948KB RAMdisk
- 256 Bytes of EEPROM
- 64 Bytes of battery backed SRAM
- Two USB serial ports with RTS/CTS handshaking at 115,200 baud
- Micro SD card with 25 MHz SPI interface
- Real Time Clock with rechargeable battery backup (~4+ months)
- A RUN (green) / HALT (red) indicator LED
- One user programmable LED
- A RESET pushbutton

The current BIOS and software is for CP/M 2.2, all of which is embedded in flash. The SD card currently supports a single 8MB CP/M partition while also retaining a FAT32 partition. Further BIOS development could include multiple CP/M partitions (i.e. "disks"), seamless FAT32 support and/or CP/M 3. In the meantime, testing on the base BIOS and utility programs (i.e. clock routines etc) continues.

The 36.864MHz over-clocked version is being tested for reliability and so far there are no issues. It's about 10% faster than the 33MHz version and will also allow for serial communication at 230,400 baud. Using ASCIART.BAS as a benchmark, it takes just under 30 seconds at 33MHz and about 27 seconds at 36.864MHz using MBASIC 5.21.

This is probably as small as I'm going to go due to physical component sizes and my desire for two layer boards that I can hand solder with an iron. Further hardware development will probably concentrate on my more general NYOZ system and possibly an eZ80 system.

This board is *NOT* for the soldering novice: all components other than the switch are SMD, there are QFN's (one with 0.5mm pitch) and QFP's with 0.8mm pitch. Although the discrete components are 0603's, several of them are very close together. Since the original boards perform exactly as expected, no rework is planned at this time.

If there is enough interest, I might consider making a small batch of these systems.

---

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by etchedpixels on Wed, 25 Sep 2019 14:05:29 GMT

Very sweet - but definitely beyond my soldering skills!

Alan

---

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Tue, 01 Oct 2019 18:20:16 GMT

View Forum Message <> Reply to Message
Alan - Thanks for the compliment. I agree it's a neat little system that is definitely worthy of a banked CP/M-3 upgrade. If I get commitments for three of these, I'll build them up and test them for basically my cost: $50US for a 512KB system including source code, an 8GB SD card and shipping. I'd need to know 33 vs 36MHz and 512KB vs 1MB (+$5). I have other projects on the go but they would be in time for a Christmas present.

re: SMD soldering

I used to shy away from SMD as being too difficult and/or requiring new tools until I finally committed to giving it a serious try. I'm simply using a 40+ year-old Weller WTCPN iron with PTS7 fine tips, .015” Multicore solder and liquid flux pens. I also use an old X-ACTO X-TRA Hands magnifier, an X-ACTO knife with #11 blades and a pair of fine tweezers from an old biology kit ... that's it other than .050” solder wick for the occassional oopsie.

For me, the trick to SMD soldering is "CAREFUL" positioning, LOTS of flux and minimal solder. I use the tweezers to position the part and my other hand to hold the part in position using the flat edge/point of the X-ACTO blade. The tweezer hand is then free to add flux followed by the iron with just the smallest amount of solder on the tip.

QFN's can be done by dragging a SMALL ball of solder along the edges / pads. For QFP's, I tack opposite corners then use a "tap" technique on the pads / ends of each of the pins. The SM PLCC socket on this board is a bit of a challenge but the contacts are accessible and hand solderable.

Once a board is complete, one side at a time I flood it with flux remover then let it sit for a few seconds and finally blast it off with canned air. Isopropyl alcohol also works but not as well.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Fri, 31 Jan 2020 20:34:14 GMT
I've built a small batch of the encased systems with V1.1 boards and am offering them to forum members pre-built and tested for $55US each. That includes:

- The pre-built and encased Z180 system with CP/M 2.2 embedded
- 33.333MHz or overclocked at 36.864MHZ (buyer's choice)
- 512KB of ECC SRAM or 1MB for $7.50 more ($62.50US total)
- Shipping within North America
- A 16GB micro SD card with full BIOS source plus documentation and over 7GB of CP/M related "stuff", including packages, CPMUG, SIGM, DR. Dobbs and The Computer Journal

More information on this system is located <here>. I do have a few spare boards but pretty well all components are surface mounted and aren't suitable for those with just basic soldering skills.

The majority of my testing has been done with the overclocked 36.864MHz systems and I haven't detected any issues at that speed. MBASIC 5.21 runs ASCIIART in about 27 seconds. At this time there are no known hardware or software issues.
The unlabelled systems in this picture are V1.1 and built but are awaiting crystal selection.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by plasmo on Sat, 01 Feb 2020 00:16:22 GMT

Bill,
Very impressive work. I just sent you a PM to buy one at 36.8MHz
Bill

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Sat, 01 Feb 2020 00:48:07 GMT

Bill ... Thanks for the compliment. Hopefully you'll feel the same after you've had a chance to "play" with it.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by djmartins on Sat, 01 Feb 2020 17:04:44 GMT

wsm wrote on Tue, 01 October 2019 14:20
For me, the trick to SMD soldering is *CAREFUL* positioning, LOTS of flux and minimal solder. I use the tweezers to position the part and my other hand to hold the part in position using the flat edge/point of the X-ACTO blade. The tweezer hand is then free to add flux followed by the iron with just the smallest amount of solder on the tip.

I use Loctite Blu-Tak to hold the part in place and tack a pin or two then solder the rest of the part.
A 7x or 10x eye loupe is what I use to solder with now, even through hole parts.
Solder is 0.015" diameter for surface mount stuff.
I read and see people do other things to position a SMD part but haven't seen anyone use tacky putty like I do.
It's easy and works great.
I used it to hold through holes parts in place then flip the board over to solder them in.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Sat, 01 Feb 2020 19:02:15 GMT
I can certainly see how Blu Tack would work with larger components including through hole. I've found that larger SMD's like TQFPs are just as easily positioned with my fingers during tacking so long as I'm electrically grounded. It's the small components like 0603 or smaller that give more trouble and I question whether I could place a small enough dot of Blu Tack. This latest board uses a 2.0x2.5 oscillator which only has 0.6x0.9mm (.024”x.035”) free space in the center and I know I couldn't place a small enough dot of adhesive in there and position it without "smudging" the pads.

There are specialty fine tipped syringe applicators with adhesive to hold SMD components in place. With ever smaller devices, I think they're now primarily used to hold large SMD components during reflow.

In the end, it's all about finding a technique that works consistently and reliably for the individual and I've chosen to just use my basic tools. I know there are better tools and it would be nice to work with reflow etc. but since this is primarily a retirement hobby, I'm very cost conscious.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by djmartins on Sat, 01 Feb 2020 19:21:24 GMT

wsm wrote on Sat, 01 February 2020 14:02It's the small components like 0603 or smaller that give more trouble and I question whether I could place a small enough dot of Blu Tack. You misunderstand how I use it and I do use it on all my SMD caps and resistors. You hold the part in place and put the blu-tak on the other side to hold it and don't put it on the bottom of the part to hold it in place. The blu-tak is removed when one end is soldered in place and no blu-tak is left on the board when finished.
Does that make more sense?

That makes a LOT more sense and I appreciate the clarification. My mind was too focused on the syringe adhesives I'd seen used in the early days of SMD ... must be time for a second cup of coffee :)

It's fine, I totally understand the confusion if you hadn't seen how I do it.
I bring it up because I find it very easy to do and often tack down a bunch of resistors or caps at a time, solder one end, remove the putty then solder the other end. I have looked at putting together a toaster oven deal for years and even have a Cricut cutter I could cut the paste stencils for but I do boards for myself, not production and it would take longer than hand soldering. I use a flux pen to add the extra flux before placing the components. Surface mount stuff scared me off for years until I had a project I really wanted that required it so I used what I had around and now find it about the same as through hole stuff. Hope this helps someone else.

Here is a link to the cheap Harbor Freight eye loupe set that use for this and all sorts of stuff: https://www.harborfreight.com/5-piece-loupe-set-98722.html

Oh, and this is a cool little project!

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by lowen on Mon, 10 Feb 2020 21:02:18 GMT
View Forum Message <> Reply to Message

Received mine today; man, that is some nice packaging!

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Tue, 11 Feb 2020 00:15:39 GMT
View Forum Message <> Reply to Message

Thanks for the compliment ... there was definitely some head scratching involved but I still have hair :). I used PCBway for the boards and there were no problems with the various contours. Hopefully it fully meets or exceeds your expectations when you start "playing" with it.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by scruss on Wed, 12 Feb 2020 03:29:24 GMT
View Forum Message <> Reply to Message

Got mine today, too: it is a glorious thing!

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by gkaufman on Wed, 12 Feb 2020 15:01:27 GMT
View Forum Message <> Reply to Message
Mine arrived also.

This is super slick - about as tiny as a Z80 with 1mb ram and SD storage (and running at 36+ mhz) could be.

Bill - you've outdone yourself!

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Tue, 18 Feb 2020 18:23:46 GMT

I still have one of the encased V1.1 systems available which is awaiting crystal selection (33.333 or 36.864 MHz). Per my previous post, $55US including postage or $62.50 with a 1MB upgrade.

Likewise, I have one of the encased V1.0 systems available, (33.333MHz/1MB or 36.864MHz/512KB) which I'll sell for slightly less ($50US & $45US). These don’t have the dedicated heartbeat LED and since the CPLD can't issue SPI waits, the BIOS compensates with code delays.

These systems took a LOT of time to assemble / test which was done as a holidays project and have been offered at my cost for parts and shipping. I highly doubt I'll be assembling any more of them for sale and if I do, the price will be considerably higher. I have a few extra unpopulated boards with which I'd include a pre-programmed CPLD & flash chip, but they would require various SMD components and good soldering skills.

There are still a few of the original MinZ kits with V1.1 boards which I'll sell for $40US including shipping. Besides the obvious case and size difference, there is an option for RS232 vs USB and they have an I/O bus on headers.

PM me if interested in any of these.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Mon, 09 Mar 2020 15:08:47 GMT

Update: I no longer have any of the V1.1 cased systems available and only one of the V1.0 cased systems is available.

I may make a FEW more of the V1.1 cased systems but the cost will be somewhat higher due to my cost of parts and it will probably be awhile until I have the time to do so. I'll keep a list of anyone who PM's me requesting one of them.
All of the cased systems have now been spoken for.

Subject: Re: A New Small Z180 Board at 33MMHz
Posted by wsm on Wed, 14 Oct 2020 17:51:13 GMT

Fall cleanup is underway and I have several of these systems I'd like to sell. All prices are in US$ and include shipping in North America. Per prior posts, these are Z180 systems at 33 or 36.864MHz with zero wait RAM and running CP/M 2.2 Full BIOS source is included along with LOTS of extra CP/M stuff when an SD card is included.

MinZ V1.1 base modules - Choice of RS232 or USB: Complete kit at $45 or $60 for pre-assembled and tested. Kits have the SMD parts pre-soldered and only require through-hole soldering.

IO2 Modules: $45 fully assembled and tested but require a CR1220/1225 battery due to issues shipping lithium. Includes a 16GB uSD card but TIL311 LEDs are not included and are an extra $15.

MinZ Cased system fully assembled and tested: $90 for 512KB or $100 for 1MB (includes 16GB uSD card + USB-A to Mini-B adapter). I've sold several of these on eBay and they've been going for ~$100+ plus shipping.

PM me with any requests or questions. Unfortunately I haven't created a Wiki page for the documentation but there are links in the previous posts or I can email it if PM'd with an email address.