Build Your Own Mini-ITX Laptop

A do it yourself guide to getting the parts needed to build your DIY laptop

MENU

Home
What To Get
What I Used
How To
Specs
Pictures
FAQ

What is this site?

This site is dedicated to the living-room-floor construction of a DIY (Do It Yourself) Mini-ITX based Laptop Computer. In case you are wondering "living-room-floor-construction" means you can build one of these nearly anywhere and Mini-ITX is described in the FAQ. This site lays out a detailed description of the parts that are needed for such a project, what I personally recommend, and a specific How-to on its' construction. This site is far from a comprehensive guide but gets pretty close.

First Things First

Building your own laptop from scratch can be one of the most rewarding experiences any person who modifies or builds anything can have. Imagine the pride from building something that until now has been a propriatary buy-only device. Having something that only a couple people out of more than 6 billion have and having done it yourself is a bragging right in many areas, geeks and laymen alike. There are many things to consider when building your own laptop. Read the pages listed at left including the FAQ and see if this is something that you might like to do. For those of you who have built their own arcade machines, go carts, computers, robot, and/or other electronic device, this is the kind of project that you probably would have fun with.

If you are not sure you want to build yourself a homemade laptop then take a short look around and see if this is a doable project for you. The process of building one takes a lot of trial and error and can take a long time. Also the needed parts can be expensive and hard to find, but having one built exactly the way you want and built from standard parts can be worth the cost.

Check out the FAQ page at left or Click here to see the pros about building your own Laptop. Still curious? Good. Why are you still here and not looking through the instructions? Well if you are lost or don't know where to go there are links at the bottom these pages directing you to the next step.

How Do I get Started?

The Navigation Bar at left provides pages of what kinds of parts to get and what you will need to build your very own personal laptop or Click here to see what to get.

Questions & Comments

If you have any questions or comments please email me at diylaptop@yahoo.com

Site last updated January 19, 2005.

What will I have to get?

The MB should be a Mini-ITX form factor, one should probably use the new VIA EPIA MS series motherboard-- low profile, standard, very low power, everything on board including CPU. With the CPU onboard it cannot get knocked loose and saves cost on the board. These can be had between 800MHz and 1.2GHz. This may be slow for some of you but the CPU is designed for power and stability, not performance. You can get a socket 370 Mini-ITX board and put a celeron in it but the power needs are higher than most of these mini power boards can handle. This board also uses SODIMM DDR SDRAM mounted underneath the motherboard. The ITX boards are easy to find, the MS series is finally out. The MS Series have no back panel save VGA, eth0, and CF but there are pinouts for all the ITX goodies, that's what makes it thin. With this board there is no floppy channel so an external usb floppy will have to be mounted inside the case if you want one; the same for a PCMCIA card slot (If thickness isn't an issue than the VIA MII 12000 is a good choice because it has the PCMCIA built in and the CF). Low profile passive heatsinks can reduce the overall height to less than an inch.

Use an external universal battery mounted inside, and not the square foot things with fans because it is already going to be thick and there is space inside for a standard sized battery. Make sure to get a Lithium battery because otherwise you will have to let it completely discharge before you plug it back in. The power brick that comes with this will be the external power pack. If you are exceptionally talented and can make a DIY battery then this can help your construction. The battery will plug into a PSU daughter board that can plug directly into the MB and not add much height but make sure you get a battery with a voltage compatable with the PSU. You can use a more powerful power supply but then you have to find a battery with matching voltages or as aforesaid make your own. These PSU daughter boards can be hard to find but are out there. I suggest setting the PSU next to the MB to save height.

Laptop drives are easy to find as well as the RAM. The slim drives do need the adapter, these are not too hard to find either. For the KB and mouse there is a "Slim-Mini" keyboard out by Zippy that is thin, narrow, and should work well and just buy a touchpad to mount below it. Gateway occasionally sells a laptop style KB-MS combo for a tablet of theirs that looks a lot better.

The screen should be an LCD "kit" that comes with inverter, controller, PSU, and cables. When you get one make sure that it has the controller as a part of the screen and that it connects via a VGA connector. There isn't room for a PCI controller in here if you are worried about it being a slim machine. Some of these kits don't have the PSU but the one on the the What I Used page can be rigged to connect directly to the psu daughter board.

The lights and button(s) can be bought at any electronic store or just rob them from an old case. There are places on the net where the pinout headers can be bought if they don't come with MB. Check out the What I Used page for a good site to buy these from. Of course since this is your build you can add LEDs, light wire, or anything else to personalize it. Most laptops have built-in fan controllers so one will have to be added to keep the machine quiet and cool at the same time.

The hard part will be custom building the case and figuring out where to run all the cables. The cables from the KB and Mouse are about a meter long so the have to be tucked somewhere or cut and spliced to fit, same with the video cable. Check out Step Four on the How To page for a good suggestion.

If you want a port replicator/docking station there is a good one here.

The overall power of this system while playing a DVD is around 45-50 watts and less than 30 when at idle. It will be about the same dimentions as an industrially built laptop but be about twice as thick. This one measures about 30cm x 30cm x 7cm (12"x12"x3"), I know it is a little thick but it is not too bad. The parts weighs about 11-12 pounds or a little over 5 kilos plus the custom case.

What Did I Use?

Well for the MB use one of VIAs MS 12000 boards for $210 from http://www.shentech.com/viaep12apcl1.html

You can buy the DDR266 SODIMM RAM almost anywhere. At http://www.ewiz.com/detail.php?name=D266SC256 256 MB is less than $40.

As for a Hard Drive I used a 20GB 9.5mm 4200rpm Notebook Hard Drive with IDE adapter. You can use any brand or storage but they will all be about $60, $10 more for the adapter. http://www.ewiz.com/detail.php?name=DMFU20GBT

For the Optical Drive I used the Panasonic Slim Slot Load DVD/CD-RW Combo Drive found at: http://www.pcalchemy.com/product_info.php/products_id/39{7}17 for $80, $10 more for the adapter.

The LCD Screen Kit is a raw gathering of parts that I have to make my own bezel for. Find it here: http://store.earthlcd.com/s.nl/c.318770/sc.7/category.44/it.A/id.659/.f. This is about $300.

For the PSU I got the $60 PW-80 from http://www.mini-box.com/pw-80.htm. I used this one because of it's wide voltage input, I could use nearly any battery.

The fan controller is a Pyramid V from http://www.crazypc.com/Merchant2/merchant.mv?Screen=PROD&Product_Code=82813 for $25.

The mouse is a Fellows brand touch pad with assignable buttons, scrolling and zoom, and a 'TouchGesture' feature. The place I bought this is no longer selling them but you can find one here: http://www.amazon.com/exec/obidos/ASIN/B00004Z6M0/crisscross-20/ref=nosim/102-2818337-6052109 Mine cost me $15 from Wal-Mart by the way.

The keyboard has hot keys, 88 keys and can be found at: http://www.jr.com/JRProductPage.process?Product=3981225 for $25.

The battery has it own battery charger which is the power brick for the whole machine. It has an output voltage of 14V~17V it's capacity is 118Wh(Watt-hour). Find it here: http://www.bixnet.com/exnobapo80.html for $170.

A good site to find the connectors for the pinout headers is http://www.frontx.com/. Make sure you get the internal parts. Prices vary by what you want to add.

The PCMCIA slot is an internally mounted external USB-to-PCMCIA adapter. I don't know if this is linux compatable yet but you can find it here: http://www.evalueadded.com/datasheet.asp?mid=15543 for $50.

And the floppy drive is also an internally mounted external. $25 at http://www.ewiz.com/detail.php?name=FD-MPF82E

Prices are USD without shipping because shipping is very dependant on location.

How Did I Do It?

Go to my How To page to see one way of doing it.

How Do I Build It?

While there are as many ways to build one of these as there are imaginations, I will discuss how I did it. One suggestion: put the parts together on a static pad (or something that will prevent a static buildup) and test the system. Make sure it works the way you want it to before you put it together because you will get pretty aggrevated if you get it all together and it doesn't work.

For the screen hinges: I suggest robbing some stiff hinges from an attache case, suitcase, etc.. If you know where to find good ones email me and I will post it. Or you can type it or any suggestion in this box and click Submit

Submit Suggestion

IE 6 users: the browser does not support this form so use the email link.

Step One -Layout-

I figured the best way to design my own laptop was to base it on the general layout of all laptops. The viewpoint of this description is from the top with the screen pointing toward the builder.

-- TEST FIT ALL PARTS BEFORE YOU ATTACH ANYTHING --

The measurement of the base of this machine will be about 12 square inches (30 square cm). Since the MB is the largest part at about 7"x 7" I put it in the top left corner. That leaves about 5" space on each side.

Since the battery is 7.8"x 4.4" I put it in front of the MB. This will stick out to the right of the MB about 1" so to the right of this I put the shortest device: the PCMCIA USB-to-PCMCIA adapter. It is pretty thick so it is by itself. One could remove the casing to shorten it if it was wanted.

Above the PCMCIA slot are the usb floppy and the 9.5mm hard drive. Stacked together they are less than 1" thick and are 2.5" wide. Above these is the DVD/CD combo. It is 5" square so it fits nicely next to the MB. Test fit the adapters, there are several kinds out there and some are bigger than others. I suggest special cables that do the adapting like what can be found at Mini-ITX.com.

If you want you can put the HDD and FDD under or over the DVD/CD and put the PSU in place of the aforementioned parts instead of being plugged directly into the MB. I recomend this setup because then the fan controller can be placed near the PSU, battery, and motherboard where the heat comes from.

I have made a primitive outline drawing of this step here.

Step Two -Layout-

Now that you have the system part laid out you will need to layout the peripherals. On top of the system you can lay the keyboard at the top of this second level with the touchpad below it. We will talk about the bezel in Step Four. (As for speakers I haven't found a way to amplify or find room for them so if you have any ideas please e-mail me.) The LCD monitor is a rough screen but it can me mounted as a third level over the keyboard and mouse just like any other laptop.

Step Three -Case-

Here is the tricky part. If you are not handy with building models and soldering then you might want a little help. Here you will need a modeling kit with puddy, cement, exacto knife or razor, file, and sand paper.

For another perspective on a custom case check out the Bantam PC. The easiest way to build a case is to use plastic sheets (like the sides of an old AT case) and cut them with a jig or recipricating saw. Make sure to keep the edges straight so you dont have to use the putty. Make an open top box. Once you set the system parts inside you can measure exactly how tall the sides need to be because this isn't going to be the same from system to system. I recomend making the side a little higher just in case (it is easier to remove some than add some). On the bottom make sure you have a plastic insulator between the motherboard and the case. The standoffs can be standard or custom, however you like. Don't forget to cut out a section for the ram and fassion a removable door; I like the idea of pilfering an old toy's battery door for this. Screw in the boards and make mountings for the drives (this varies quite a bit so use that wonderful imagination of yours). Once the drives are in and you have made the holes for the pinout header connectors (if you have any) you can make the lid. Do not seal the lid but fashion a clasp or non-magnetic latch (magnets can corrupt data on the HDD). Although mini hinges aren't pretty they are effective and can be had for not much. The lid is where you will mount the keyboard and mouse. On top of this will be the bezel where you can hide the meter long cables of the keyboard and mouse. You can glue the parts on but then they are not easily replacable that way. I suggest just using 4 small drops of glue, one on each corner to hold them in in case of replacement that way there is minimal damage to the case. (If you come up with a better way e-mail me and I will post it here.)

Step Four -Bezel-

The bezels, those things that make laptops look nice and sleek. Building these is not a necessity but they do make the look of your DIY machine a little easier on the eyes. To make the bevels you can use a miter saw or a table saw. You might want to try this on a scrap piece to make sure that it doesn't melt the plastic. If that doesn't work use the file.

You will need to build two or three of these bezels. The screen will be the easiest. Just make a surrounding box with the front bezel. This bezel can be made in pieces like a picture frame and assembled together. Use the sandpaper and exacto knife to make the edges smooth. Since the screen won't take the full breadth of the lid you can strip a mic and mount it next to the screen if you want.

The bezel on the keyboard and mouse can be easy or hard to make. The hard way is to make it a single piece. The easy way is to make a bezel for each part. Make sure the underside of the mouse bezels is hollow so that you have room to hide the cables from the keyboard and mouse (assuming you haven't cut and spliced them). Again the exacto knife and sandpaper will be helpful here.

Does this part get easier?

Well now that you have read the how-to-build-your-own-case section check out the Attache Server to see a much easier way to make your laptop case. Beware: this voids the idea of having a thin laptop but this server looks mighty cool.

Odds 'N' Ends

You can check out the Specs of this system, Pictures of these parts, or some of the Frequently Asked Questions about doing this project. Questions or comments? E-mail me at diylaptop@yahoo.com

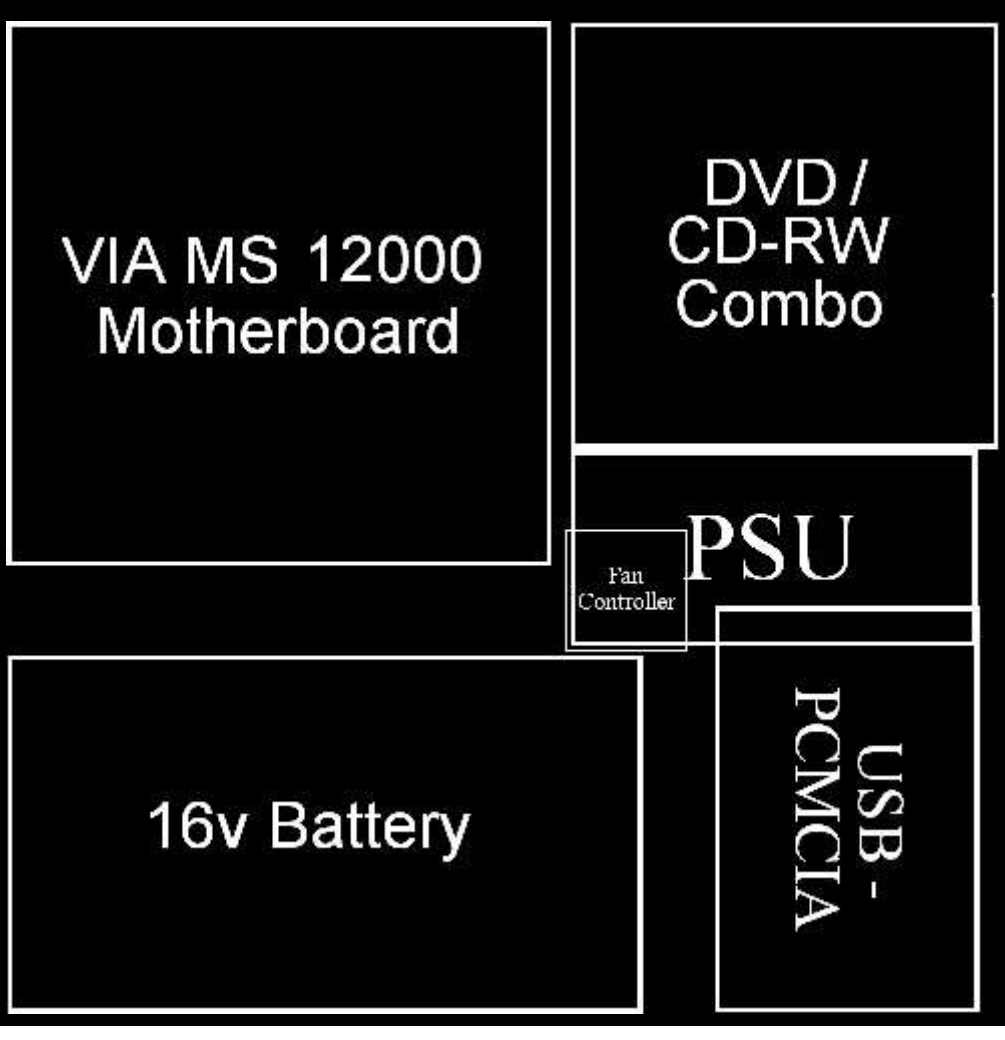
Laptop Specifications	
Processor	- VIA C3™ 1.2 GHz / VIA Eden™ ESP 800 MHz or 1.0 GHz processor
Chipset	- VIA CLE266 North Bridge - VIA VT8237 South Bridge
System Memory	- 1 DDR266 SODIMM socket - Up to 1GB memory size
VGA	- Integrated VIA UniChrome™ AGP graphics w/ MPEG-2 Accelerator
Expansion Slots	- 1 PCI (Not used)
Onboard IDE	- 2 X UltraDMA 133/100/66 Connector
Onboard LAN	- VIA VT6103 10/100 Base-T Ethernet PHY
Onboard Audio	- VIA VT1616 6channel AC' 97 codec
Onboard TV Out	- VIA VT1622A TV Encoder - VFocus FS453 TV Encoder (Manufacturer Optional)
Onboard CF	- VIA VT6207 USB2.0 CF Bridge
Back Panel I/O	- 1 VGA port - 1RJ-45 LAN port - 1CF Slot - 3 USB Connectors for 6 USB 2.0 Ports (2 ports for Floppy & PCMCIA) - Front-Panel Audio Connectors (Mic-in and Line-Out) - CD Audio-in Connector - 1 Buzzer - 1 SM Bus Connector - VIP Port Connector (VIP0) - FIR Connector - CIR Connector (Switchable for KB/MS) - Wake-on-LAN Connector - CPU FAN/SYS FAN/FAN3 Connectors - 1 Connector for LVDS/TTL/DVI Panel and VIP1 (Manufacturer Optional) - 2 Serial Port Connector for 1/2 Com Port - 1 PS2 Mouse Connector - 1 PS2 Keyboard Connector - 1 SPDIF Connector - 1 Connector for S-Video/Composite/SCART/Component (YPbPr) - 1 Audio Pin Header; Line-out, Line-in and Mic-in (Smart 5.1 Support) - ATX Power Connector
Onboard I/O Connectors	
BIOS	- Award BIOS - 2/4Mbit flash memory
System Monitoring & Management	- CPU voltage monitoring - Wake-on-LAN, Keyboard Power-on, Timer Power-on - System power management - AC power failure recovery
Form Factor	- Mini-ITX (6 layer) - 17 cm x 17 cm
Hard Drive	- 20GB 9.5mm 4200rpm Notebook Hard Drive
Optical Drive	- Panasonic 8x 16x 24x Slim Slot Load DVD/CD-RW Combo Drive
Display	- 12.1" Active Matrix TFT 1024x768 Resolution
Power	- 80 Watt 11v-30v MINI-ITX dc to dc converter
Battery	- Lithium, 16v, 111 Wh, 7 hour charge
Keyboard & Mouse	- Internet Multimedia 88 Key & TouchPad w/ Scroll, Zoom, Gesture
Floppy Drive	- Slim USB 1.44MB, 2.88MB
PCMCIA	- 1 Type I / II PC Card Slot

Parts Pictures

Click on these pictures and you can visit the site where I got the part. These links are also written out on the What I Used page in case your browser cannot view these links.

These pictures belong to the sites where these parts come from. The sites can be found on the "What Did I Use" page.

A Basic Picture of Step 1



FAQ - Frequently Asked Questions

1. Has this actually been built, or is it all theory?

Partially. Some of it is completed while the rest is still being built.

2. Sounds like a lot of bother.

Well, yes it is. But the fact that you built it with your own hands to exactly your specs and wants more than makes up for it.

3. Is it expensive?

Yes. The cost of building the one in progress is about $1000 USD. Don't leave yet, read #4.

4. For a $1000 you can get a nice new laptop.

True but here is where the investment meets savings. If something fries or you want an upgrade than you are only out $200 max, you don't have to buy a new propriatary part from one place, these are universal parts that can be had from many different stores across the world.

5. Is there a way to build it cheaper?

Yes but not without sacrificing something. You could save $200 by not using a battery, making it a desknote. By using lesser parts like 24x CD, 10GB HDD, no floppy, no PCMCIA slot, lesser processor, and a smaller LCD you could cut that $1000 cost in half.

6. This is a very low powered machine. Why would I want to build one?

The fact that it is low powered means much longer battery life. Imagine sitting on a six hour plane ride and not have to charge your laptop. Low power also means less heat is created, making it less buggy and the components will last longer.

7. Is this a low spec machine?

Not really. Check the spec page and see what wonderful things come with Mini-ITX boards.

8. Are you a qualified tech or just a guy in his garage?

Both. I am a technician for a small computer store and build and modify computers myself. Many people who build and modify, like me, use Mini-ITX boards. Check out some other projects at:

mini-itx.com
THE NEXT SMALL THING

9. Can I have you build me one and send you the money?

No. What would be the point if you didn't Do It Yourself.

10. What if I have questions?

That's why your here isn't it? Well if none of this FAQ answers your questions then e-mail me. I will help however I can. My address is diylaptop@yahoo.com

11. What Operating System can this run?

Windows and Linux Distros work well and immediately. Mac OS can be used with a Mac OS emulator for linux. (Since Mac and Linux share ancestors this *is* possible) It can be downloaded from:
http://www.sourceforge.net/projects/basilisk/

12. What is that annoying stuff flying around the screen and at the mouse?

~~It is an html effect that I thought would be interesting. If enough people e-mail me that want it gone I will turn it off.~~ This featue has been removed because of comments and the consumption of resources it takes on older machines (like mine).

13. Are these real questions or did you make these up?

These are real questions, including this one.

14. You mention Mini-ITX a lot. What is it? Are you affiliated with them?

Mini-ITX is a PC form-factor like AT, ATX, and FlexATX. Mini-ITX is also a revolution in computing making PCs smaller and more stable while using less electricity. Check out Mini-ITX.com for a better description. As for affiliated, no, just a fan. This site and this laptop would not be possible without inspiration from these guys.

15. How is the PSU so small and how does it work since computers are DC powered?

The PSU is DC. The power brick outside the computer like on any laptop does most of the work so it needs less stuff to do what it does as long as the brick is there.

16. How do the floppy drive and PC Card slot plug inside if they are USB?

The front USB header on the motherboard doesn't have to go to the outside of the PC.

17. Why not close the gaps in between the parts for a smaller sized machine?

There are going to be a lot of cables inside here.

18. In step one, why is the fan controller on top of the PSU?

The fan controller is a pyramid shape and is mounted upside down over the PSU *board.*

19. Can I download your site?

Yes, I have uploaded a PDF document of this site here.

20. Why are there adds at the top of your site?

Because I haven't gotten around to getting a dot com address yet.

21. How do you power the LCD screen?

It has a barrel connector for the power, just snip this off and add a 4-pin molex connector.

Where did you hear about this site?

I like to here where my work is popular so please let me know who you are and where you heard about this site:

E-mail:

Where you found this site:

Let me know.