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Upgrades And Mods on Thinkpad X230/t

MARCH 14, 2017MARCH 20, 2017 ~ SVO

Today I'm going to follow up my software/setup guide for the X230/t (https://codeablereason.wordpress.com/2017/03/14/set-up-x230-tablet/) with guidance on the upgrade options for the Thinkpad X230 and X230 tablet (X230t).

In the community of Thinkpad fans, it's common to do after-market upgrades and mods, often using components from earlier or later model lines. For example, people will swap in more comfortable touchpads or keyboards, or use a better quality screen. If you are inclined to do this, here's a breakdown of what you can and cannot do on this model.

Batteries:

- The X230 has a 9 cell battery that can give more than 8 hours of web browsing or light use.
- The X230 **tablet** is not compatible with this battery and uses a different and incompatible 6-cell battery (64 Wh). This is the largest normal battery it can mount, and it has a handle shape that can be used to pick up the laptop. It is also notched back in one corner — this is intended to let you convert to table mode and nestle it in the crook of your left arm
- There are some unofficial batteries on Amazon that claim to be X220t/X230t compatible 9-cells but they do not appear to deliver on expected capacity.
- For the maximum capacity, you can use the 6-cell slice battery (Thinkpad 19+), which clamps over the bottom of an X220, X220t, X230, or X230t and attaches to the docking port. It will add about 1.6 pounds of weight and quite a bit of thickness, but basically doubles battery life on the tablets.

CPU: soldered, and not upgradeable without replacing the motherboard.

- The most common models for the X230/X230t are the i5-3210M (weaker), i5-3320M (standard), and i7-3520M. All are dual-core CPUs with 35W TDP.
- The faster i7-3520M is about 20% faster than the slowest i5, the i5-3210M. By modern standards the i7 is still quite fast, competitive with a Skylake i7-6500U and barely slower than the Kaby Lake i5-7200U featured in many of this year's midrange laptops (although quite a bit less power efficient).
- There exist a few other rare CPU options on systems customized for businesses, but the i7-3520M appears to be the fastest.

Memory: socketed, 2 slots for a DDR3/LPDDR3 SODIMM, officially can mount up to 16 GB (2×8 GB SODIMMs) at 1600 MHz speeds (PC3-12800)

- Although the platform specification does not advertise it, I have heard that the X230/X230t can run up to 2133 MHz DDR3L and still get full speed (the CPU and

motherboard support it). The performance benefit should be very small in most cases though.
- These will also work fine with DDR3L aka LPDDR3 memory at 1.35V versus normal DDR3 at 1.5V
- There is a known issue when using 16 GB of RAM in combination with an ExpressCard external GPU rig that causes 100% CPU use, so be aware.

Wireless Card (mini-PCI): the main option is the Intel Centrino Advanced-N 6205, and it's probably the best option.   A BIOS whitelist prevents upgrading to any card with 802.11ac support.

- Apparently the whitelist *can* be bypassed with a custom BIOS, but this requires desoldering the BIOS chip and reprogramming, and not all capabilities are guaranteed to work.
- With a solid router and appropriate driver configuration, I have measured download and upload speeds on a Intel 6205 of ~200 MBit using 5 GHz 802.11n with an X230t (next to the router).
- The Intel Ultimate-N 6300 works with the X230 and is *supposed* to be superior to the 6205 due to a 3×3 antenna vs. 2×2. However I have it on a T530 laptop and it appears to underperform the 6205, even using the iwlwifi parameter tweaks from my previous post (https://codeablereason.wordpress.com/2017/03/14/set-up-x230-tablet/). Also, if you have a webcam then there will not be a 3rd antenna available, so the 6300 will become basically a 6205.

Wired Networking: it delivers full gigabit speeds (I've measured 800-900 MBit in the real world). If you need 10 GBit then you probably shouldn't be using a laptop, neh?

BIOS: I've heard that you can flash a custom BIOS by desoldering the chip and reprogramming it, but not tried it. This is supposed to work for the X230 but reports are mixed for the X230t.

- The X220 had a much simpler process for flashing the BIOS, so if you're looking to do heavy customization that requires working around the whitelist, that's probably the superior base platform.

Storage:

- The main drive bay will accept a 2.5″ SATA 3 SSD. This is the fastest and best option for most people, since you can get the full SSD speeds (generally ~500-550 MB/s max).
- The mSATA slot under the keyboard will also accept a smaller mSATA SSD, but only has a SATA 2 connection. This limits peak disk throughput to ~200-275 MB/s in practice, but does not impact the far-more-crucial random I/O performance. Still, I'd suggest a 2.5″ drive unless you are using an existing mSATA drive or need the additional storage from an internal HDD.
- The Samsung 850 EVO 250 GB SATA/mSATA models offers a good combination of price/performance/capacity for most people.
- Be aware that migrating a bootable Windows install from the 2.5″ bay to a mSATA SSD can prove extremely difficult or impossible.

ExpressCard (/34 and /54 support, PCIe 3.0 x 1) :

- The most interesting use of this port is to connect an external GPU (eGPU), although performance is somewhat limited by the single PCIe 3 lane. Link: Reddit Thread about one setup (https://www.reddit.com/r/thinkpad/comments/5kustd/x230_gtx1050_egpu_guide_and_info_should_also_work/?st=j0b6cga7&sh=e3aa5716).
- I have read (although not tested) that NVIDIA cards perform better in an eGPU setup on this model due to the use of PCI link compression to make better use of interface bandwidth
- As with most eGPU configurations, the best performance comes from connecting the GPU to an external monitor, so you are not using interface bandwidth to return the display data to the laptop's internal monitor
- There are also small ExpressCard adapters to add additional ports that may not be present — but unless you need something special and can't use a normal adapter dongle, that's probably pointless. For the X220 it was useful as a way to add USB 3.0 though.

Graphics: you're on HD Graphics 4000, unless you go the eGPU route (see immediately above). This is adequate for some older and less demanding games on low settings (including Skyrim), but be aware that it does heat up the laptop rather rapidly.

Display (12.5″, 40-pin LVDS connector – confirm this)

- The best issued display is an IPS 1366×768 – you really want the IPS display because the TN model is rather awful.
- There exists a mod from the Chinese 51nb forum to internally convert the DisplayPort to an eDP connector (https://www.reddit.com/r/thinkpad/comments/3f2ht0/ive_got_the_51nb_fhd_x230/?st=j0i6c8mt&sh=17ca2545) (link goes to Reddit post with that mod), allowing the X220 and X230 to mount the 1920×1080 (FHD) IPS monitors from later X-series laptops.
- Nitrocaster is also selling modkits (http://forum.thinkpads.com/viewtopic.php?f=43&t=122640) to members of the Thinkpad Forums for a FHD mod using that board. At time of writing he is investigating a modded version for the X220t and X230t with digitizer
- Note that there is a moderate battery penalty (https://www.reddit.com/r/thinkpadsforsale/comments/5xj87g/usmd_h_x230_fhd_modded_w_paypal/deik0w7/?utm_content=permalink&utm_medium=front&utm_source=reddit&utm_name=thinkpadsforsale) (1-2 hours or so, call it 20%?) for the higher resolution display and the additional graphics/processing to display it.

Keyboard: with a patched BIOS, it is possible to use the X220 keyboard, which some people prefer. ThinkWiki has instructions. (http://www.thinkwiki.org/wiki/Install_Classic_Keyboard_on_xx30_Series_ThinkPads#A_compatible_ThinkPad)

Trackpad & Trackpoint: how would you improve on a classic?

It is worth consulting the X230t Platform Specification (http://www.lenovo.com/psref/pdf/withdraw/ThinkPad_X230_Tablet.pdf) and X230 Platform Specification (https://www.lenovo.com/psref/pdf/withdraw/ThinkPad_X230.pdf) for details

on the hardware and capabilities.

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3. **The Flash**
   SAYS:
   JANUARY 10, 2018 AT 10:53 PM
   Desoldering is overkill; you can connect a hardware flasher to the x230 BIOS chips in-place.

   (The safest way to power the chip while doing this is to enable Wake-on-LAN in the BIOS, shut down the PC, connect something via Ethernet, and wait for the Ethernet port LED to light up. Now you're ready to connect a Raspberry Pi, Beaglebone Black etc. to either of the two chips with an SOIC-8 clip.)

   Reply
4. **Dan**
   SAYS:
   FEBRUARY 1, 2018 AT 8:23 PM
   3rd party batteries sometimes are not so bad. Almost a year now I'm using a 94Wh 9-cell battery which I bought on AliExpress, produced by KingSener. Lenovo Power Manager shows 104.06Wh, it was a bit higher (112?) when I got it 10 months and 140 cycles back. I did calibrate it (also used thresholds of 80/85), so these numbers are correct. And I'm SO pleased with it! I easily get 10hrs with light load like browser, office, wifi.

   Reply
   1. **Ari**
      SAYS:

JANUARY 11, 2021 AT 12:53 PM
does the battery slice work for extending

Reply

5. **Mark Nixon**
SAYS:
MARCH 24, 2018 AT 1:18 AM
You can upgrade the terrible tn panel with a cheap replacement from a lenovo twist tablet..same great ips panel about 20-30 on ebay

Reply

   1. **Rusty Shackleford (@D3FSE)**
      SAYS:
      JUNE 2, 2018 AT 9:00 PM
      Can the glass display from the Lenovo twist be also used?

      Reply

6. **clay vaulin**
SAYS:
JANUARY 20, 2021 AT 3:22 AM
1vyrain allows you to access more bios settings where you can remove some hardware whitelists, overclock and disable the me and can be done without directly flashing the rom chip

Reply

7. **jojo**
SAYS:
JUNE 12, 2021 AT 6:35 PM
no mention of a possible fan upgrade or fan mod ?

what about improving the speakers which are lacking ? I heard some people have had success with replacing them with a nexus 6p speakers

Reply

CREATE A FREE WEBSITE OR BLOG AT WORDPRESS.COM.