



THINKPAD X220/X230 FHD MOD

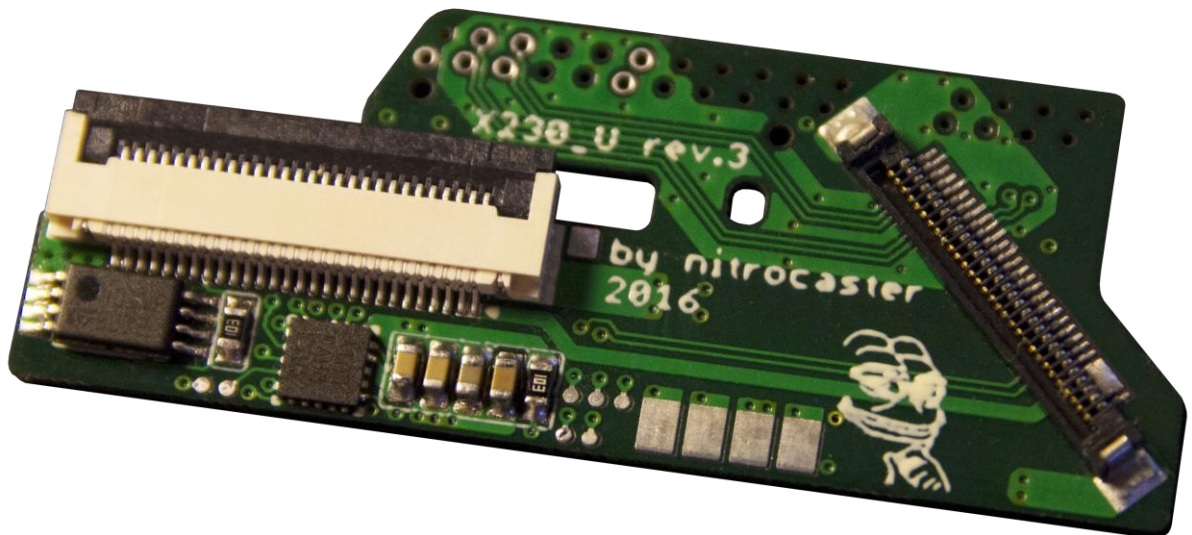
Overview and installation guide

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Hardware revision: 3



RECORD OF REVISIONS

| Revision No | Revision Date | Page | Description |
|-------------|---------------|------|---|
| 0.1 | Oct. 9, 2016 | - | First draft |
| 0.2 | Oct 25, 2016 | 1 | Add adapter image |
| | | 2 | Rename chapter 'Installation' -> 'Installation notes' |
| | | 3 | Update fig. 3 |
| | | 3 | Add R318 image |
| | | 4 | Add auxiliary power wire image |
| | | 4 | Update fig. 5 |
| | | 4 | Add bottom isolation image |
| | | 4 | Update fig. 6 |
| | | 5 | Update fig. 7 |
| | | 8 | Rename section 'Modification' -> 'Installation' |
| | | 8 | Add 'Application notes' chapter |

OVERVIEW

The kit contains 5 items as shown on the figure 1:

1. Adapter board
2. Sense wire
3. LVDS cable
4. Auxiliary power wire
5. eDP cable

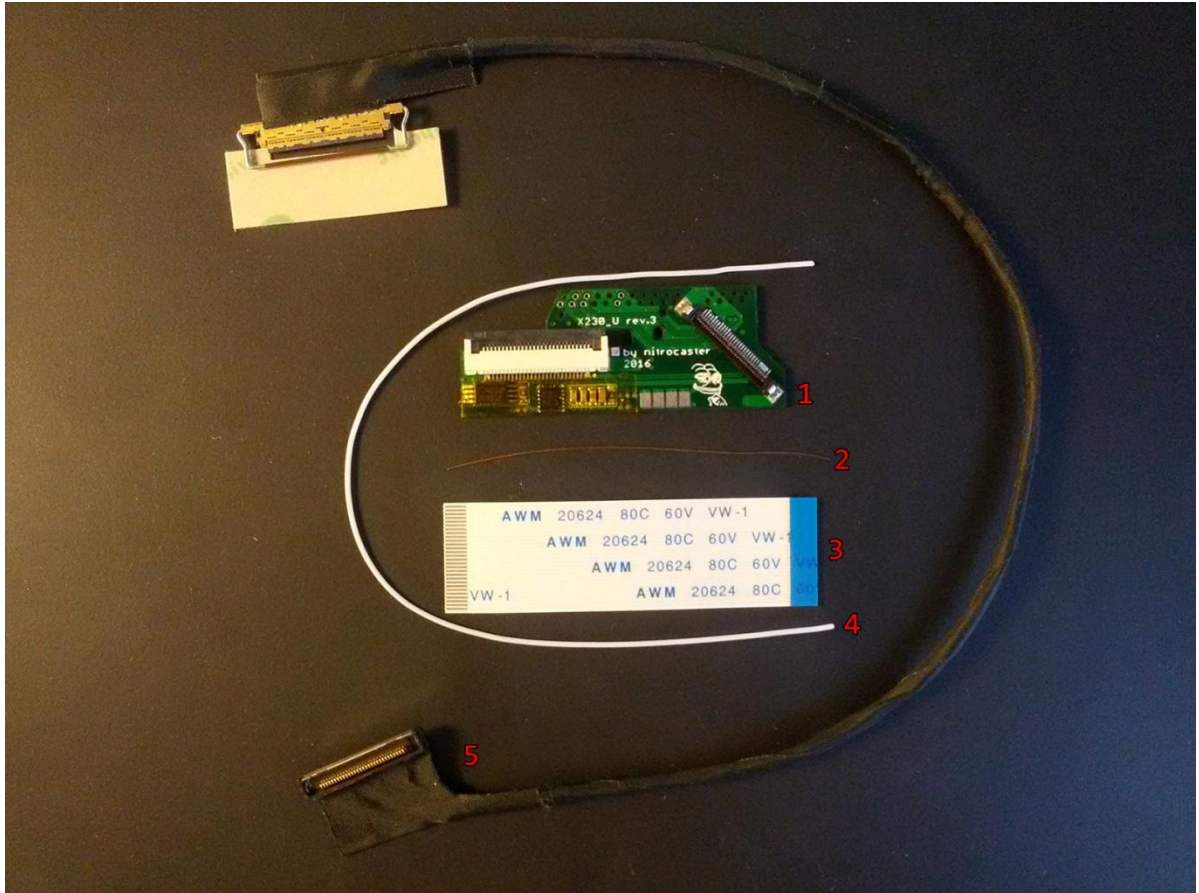


Figure 1. The kit

The adapter board uses 2 DisplayPort lanes from the docking connector, providing enough bandwidth for Full HD displays.

INSTALLATION NOTES



DANGER

Turn off the computer, disconnect the power cord and remove the battery pack before proceeding with the installation. To prevent permanent hardware damage, do not plug or unplug any internal cables unless the power cord is disconnected and battery pack is removed.



Note:

All HMM references contained herein apply to *ThinkPad X230 and X230i Hardware Maintenance Manual*, which is available on Lenovo website: <https://support.lenovo.com/docs/um014928>

1. ADAPTER BOARD

The adapter board has to be installed on the back side of the docking connector. For access, do the following:

1. Power off the computer, and unplug the AC power adapter from it.
2. Remove the battery pack ("1010 Battery pack", HMM page 56).
3. Remove the keyboard ("1040 Keyboard", HMM page 60).
4. Remove the palm rest ("1050 Palm rest", HMM page 63).
5. Remove the keyboard bezel ("1110 Keyboard bezel", HMM page 75).

The motherboard is covered with black protective film, which should be removed in the areas around solder points. Figure 2 shows these areas for X220 and X230 motherboards.

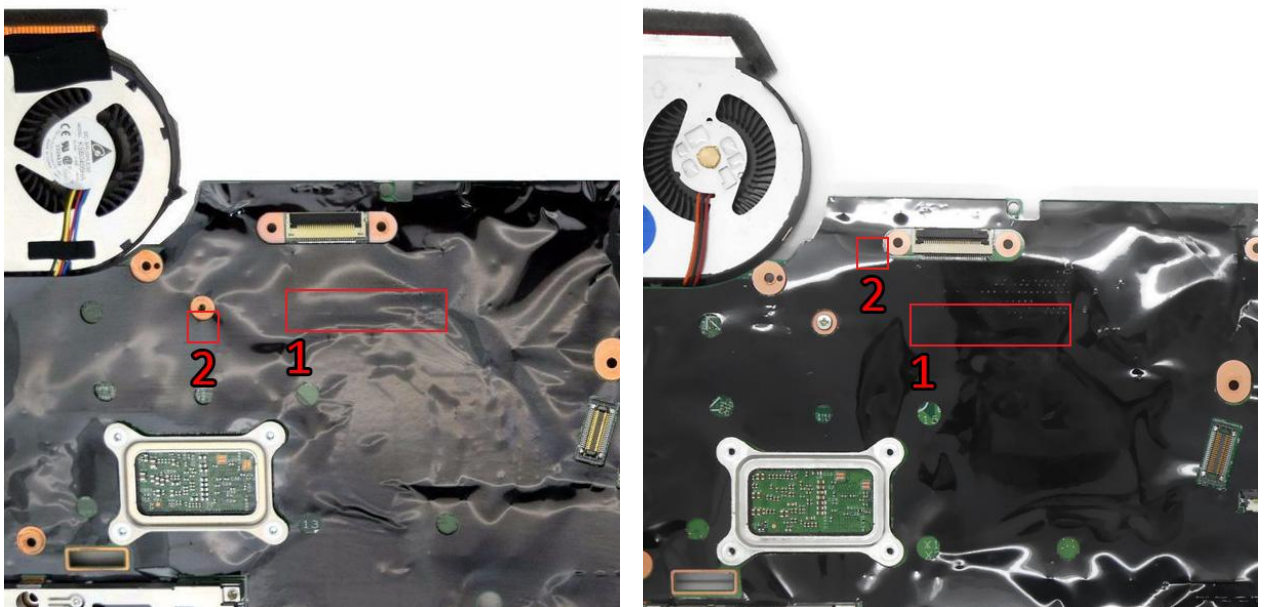


Figure 2. Solder points for X220 (on the left) and for X230 (on the right)

Area 1 covers docking connector pins with nearby components which look similar for both models (see figure 3).

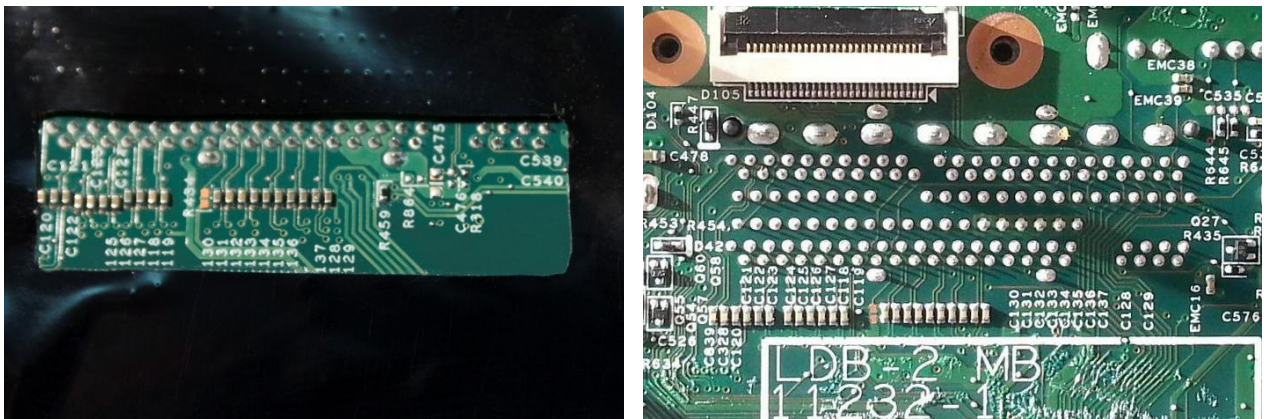


Figure 3. Docking connector pins of X220 (on the left) and X230 (on the right)

R318 resistor is not installed on all X220 motherboards except for X220 with Core i7 (see figure 4), where it prevents adapter board installation. Fortunately, it does not provide any critical functionality and can be safely removed.

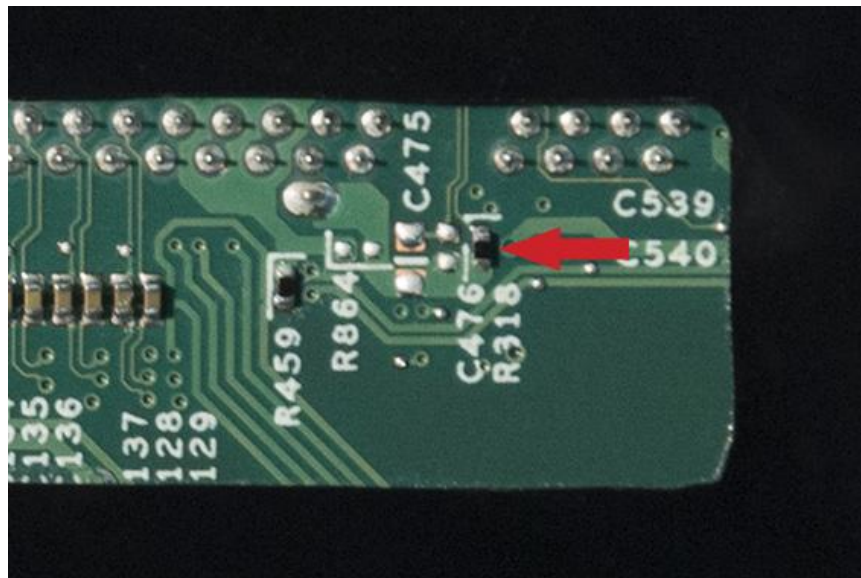


Figure 4. R318 resistor on X220 i7 motherboard

Area 2 covers pads for auxiliary power wire. These pads are located in different places on X220 and X230 motherboards (see figures 5 and 6).

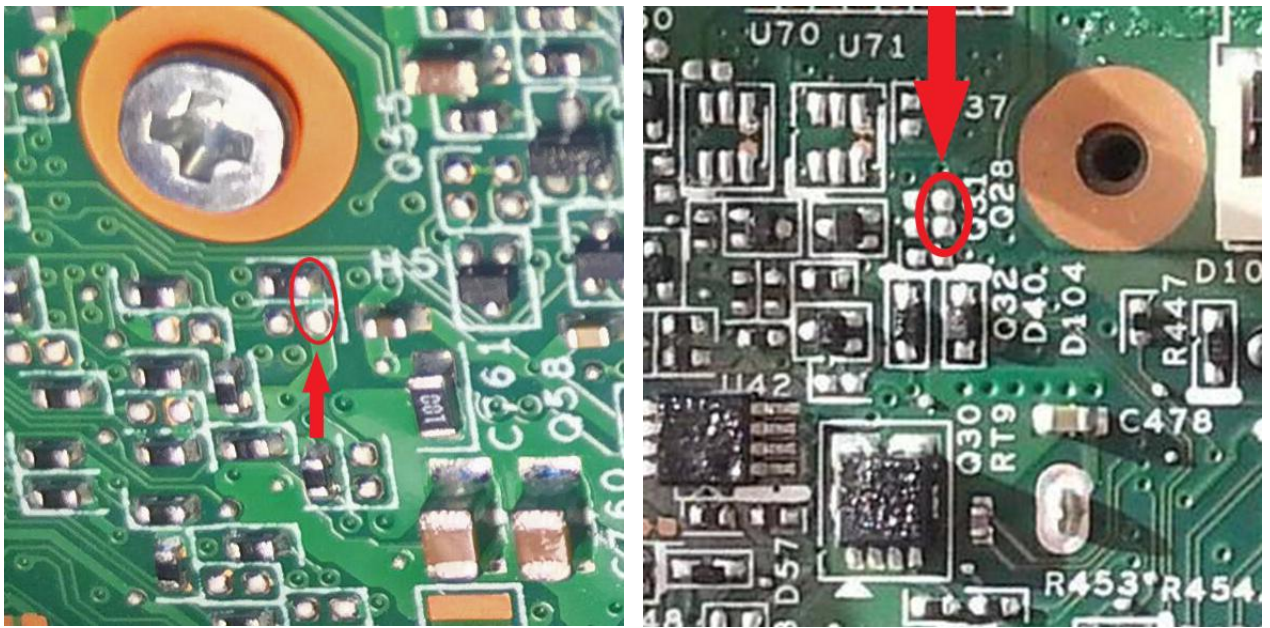


Figure 5. Auxiliary power pads of X220 (on the left) and X230 (on the right)

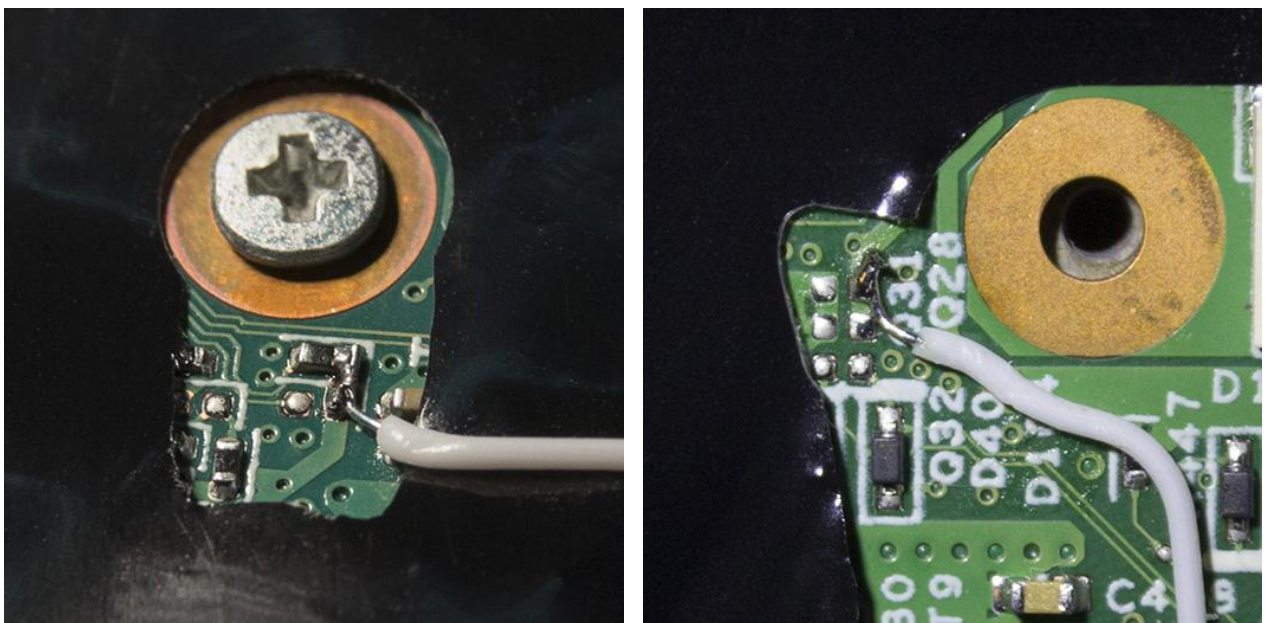


Figure 6. Auxiliary power wire soldered to X220 (on the left) and X230 motherboard (on the right)

It's recommended to apply kapton tape to the bottom side of the adapter board to provide solid isolation layer between the motherboard and the adapter board (see figure 7). Scotch tape can also be used, but kapton should be preferred due to its high durability.

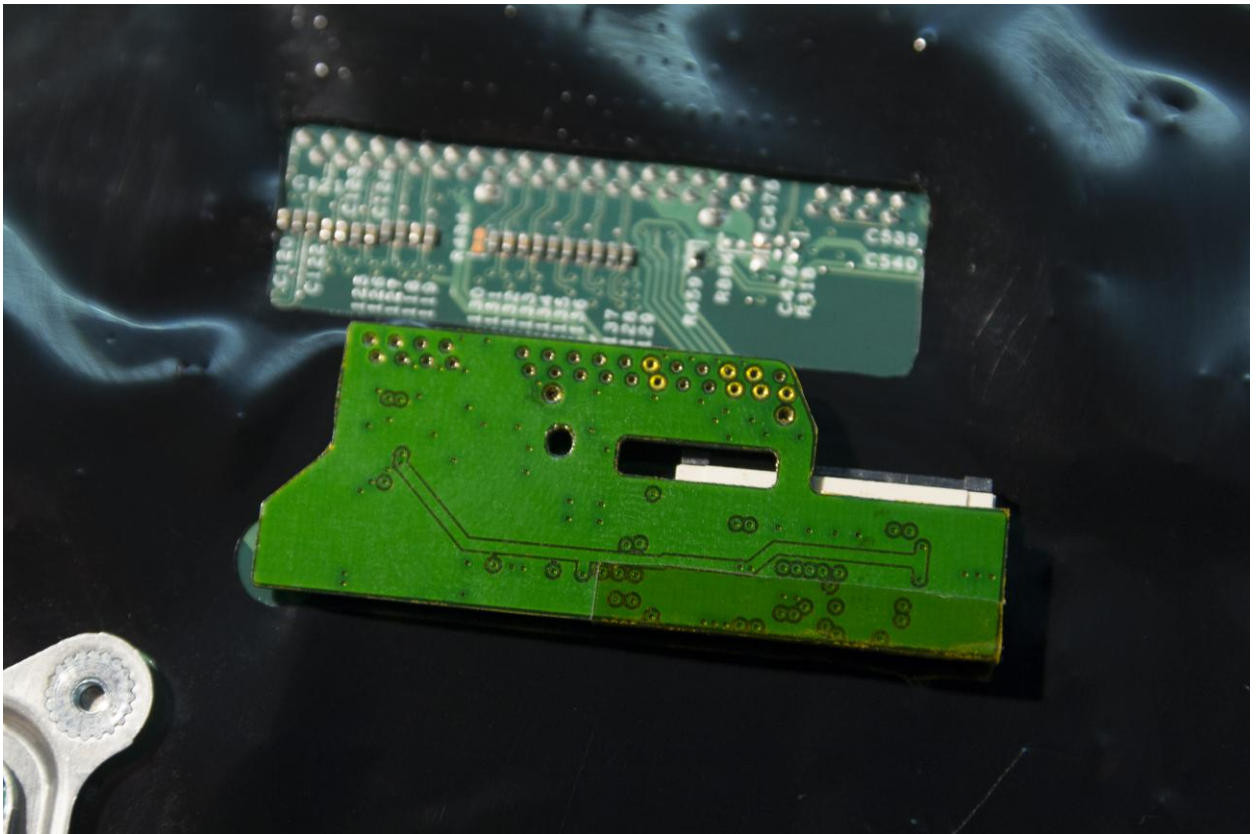


Figure 7. Bottom side of the adapter board covered with kapton tape

The sense wire is soldered to the bottom pad of the third capacitor from the right side of the row of capacitors under the docking connector, as shown on figures 8 and 9.

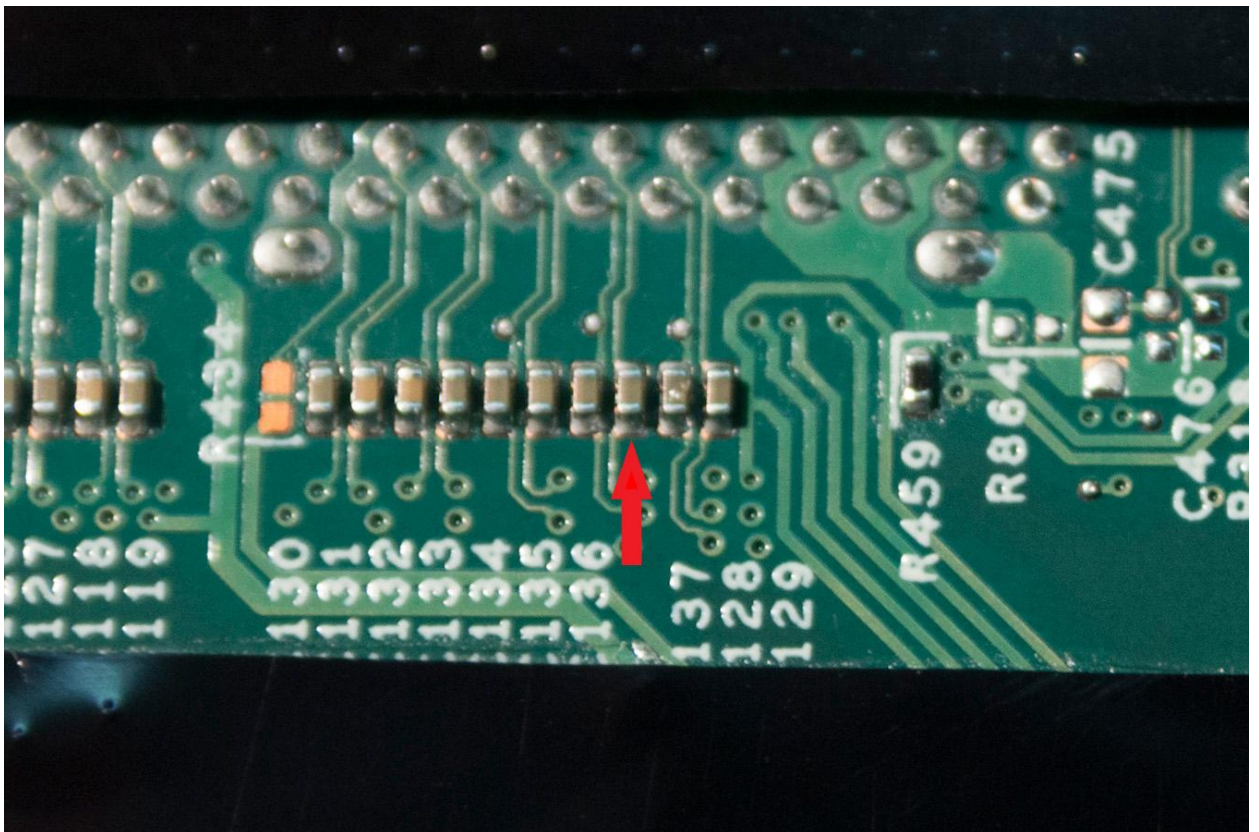


Figure 8. The pad for the sense wire

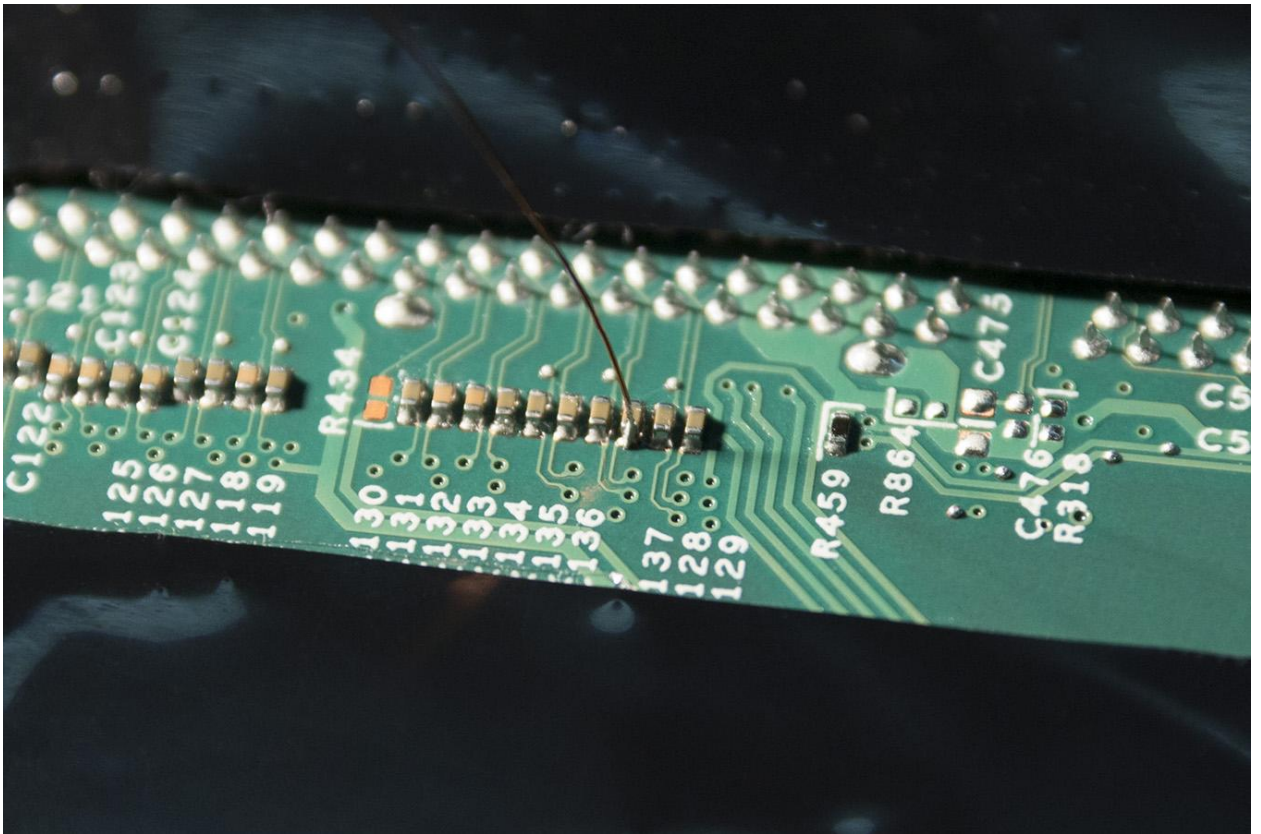


Figure 9. The sense wire soldered to the capacitor's pad

The sense wire and the auxiliary power wire are soldered to pads 1 and 2 respectively on the adapter board (see figure 10).

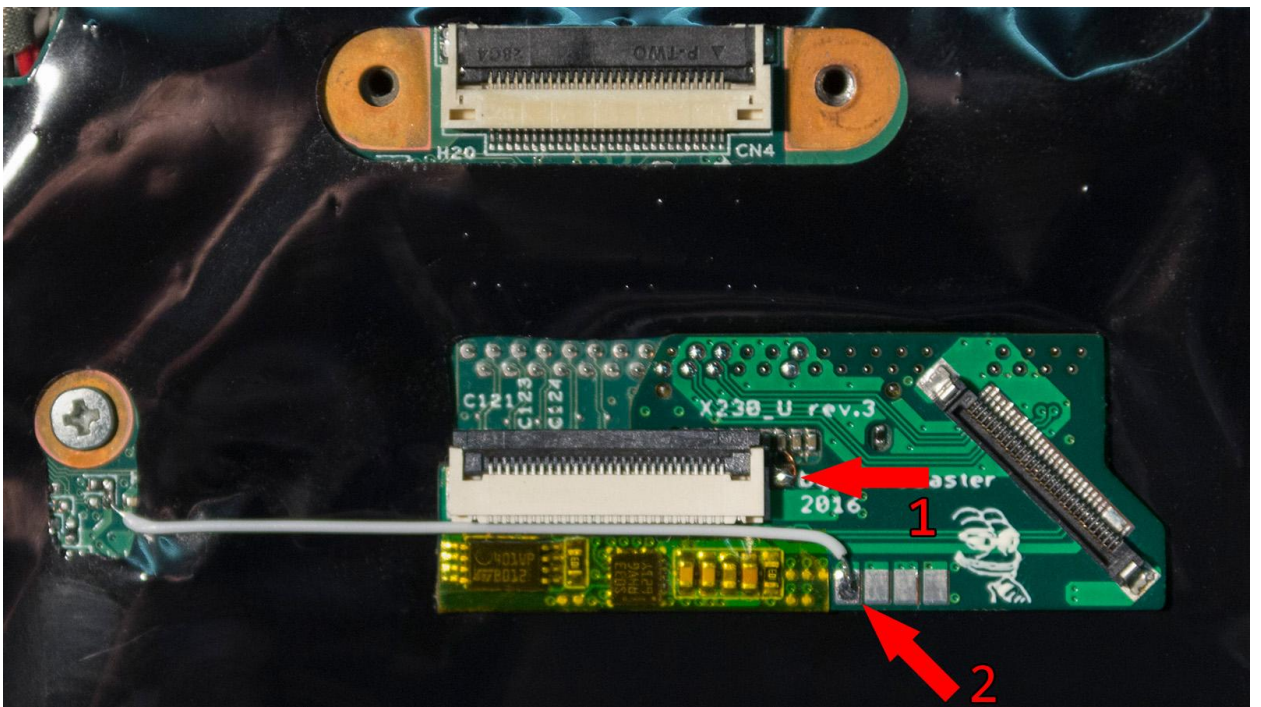


Figure 10. The sense wire pad (1) and the auxiliary power pad (2)

2. LCD PANEL

The default LCD panel has to be replaced with Full HD LCD panel. However, because logic boards of Full HD LCD panels are bigger and the lid is designed to fit the default LCD panel, some material has to be removed from the inside of the lid (see figure 11). The exact amount depends on the particular LCD panel. For access to the LCD panel, refer to page 87 of the HMM ("2030 LCD panel").

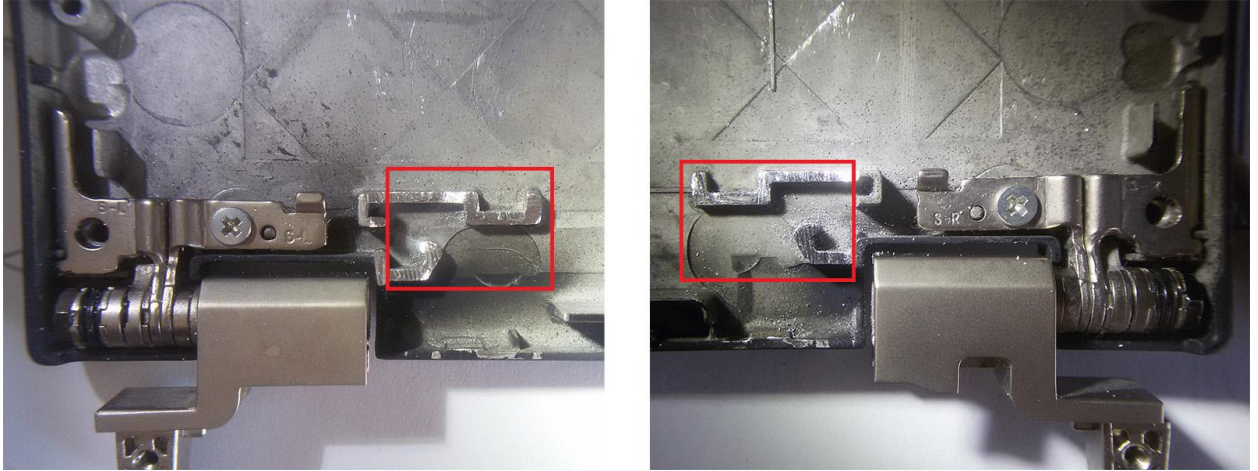


Figure 11. Protrusions in the lid were removed to fit Full HD LCD panel

Two inner latches on the LCD bezel have to also be removed to fit new LCD panel (see figure 12).

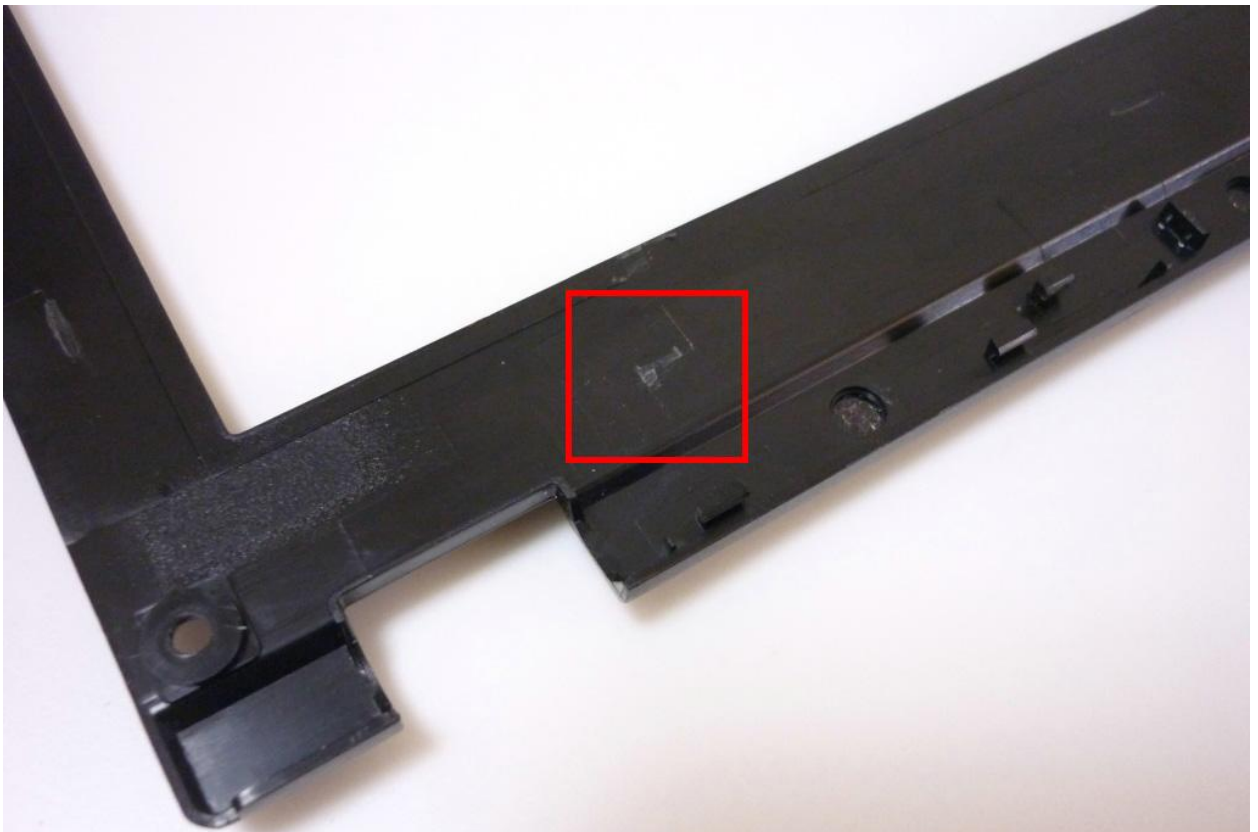


Figure 12. Right inner LCD bezel latch was removed to fit Full HD LCD panel (the left one looks similar)

3. LVDS AND EDP CABLES

The LVDS cable connects the adapter board to the motherboard and the eDP cable connects the LCD panel to the adapter board. These cables are connected and routed as shown on figure 13.

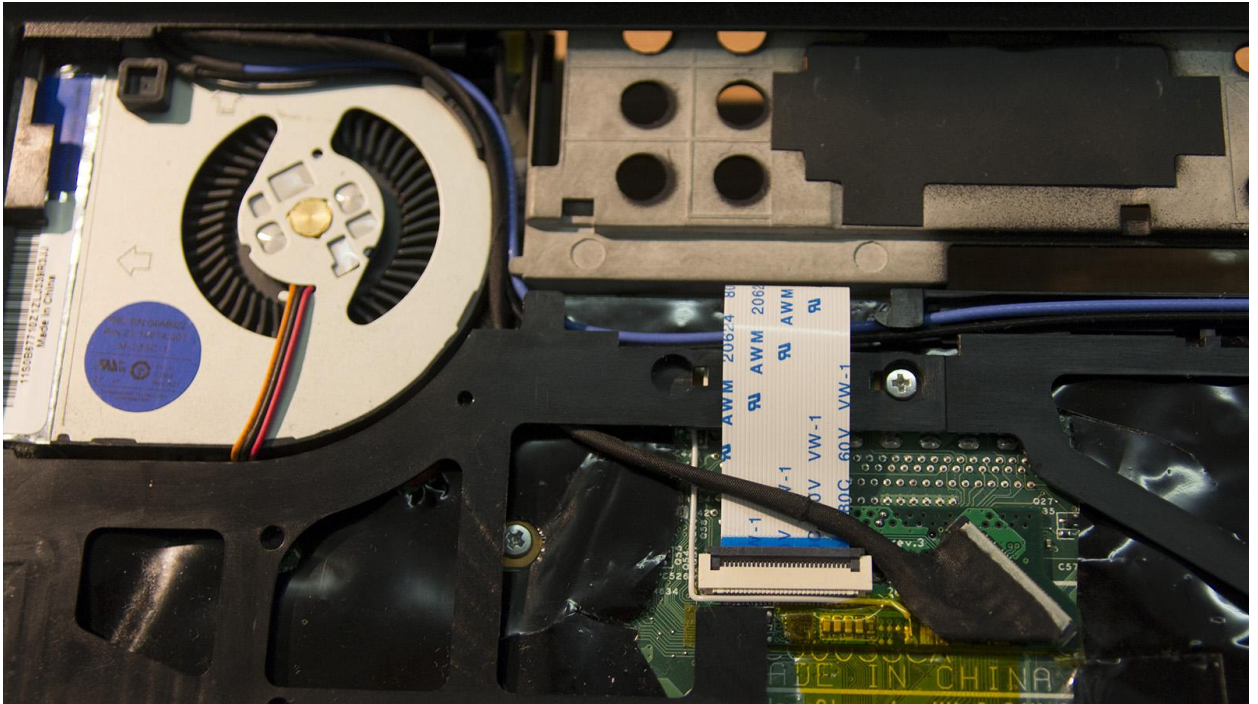


Figure 13. LVDS and eDP cable routing

To allow the eDP cable to pass under the keyboard bezel, a small piece of plastic has to be removed (see figure 14).

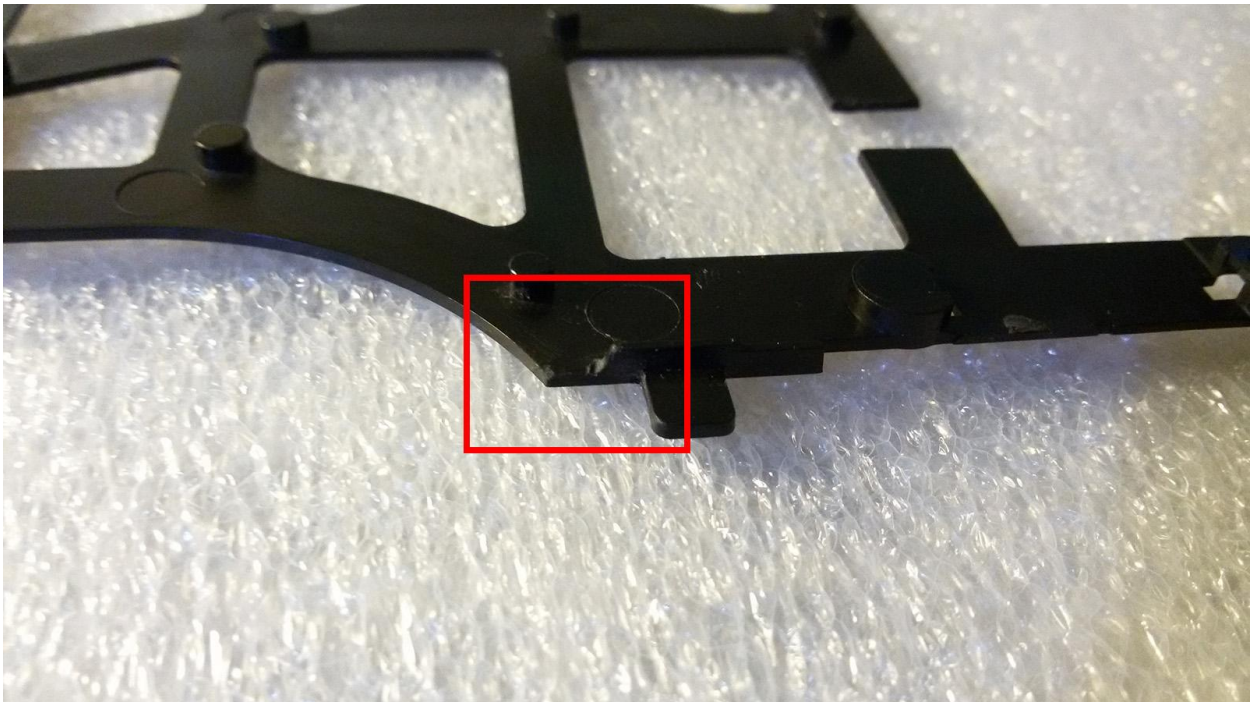


Figure 14. The cutout in the keyboard bezel

The last cutout is required for X230 bezel only (see figure 15).

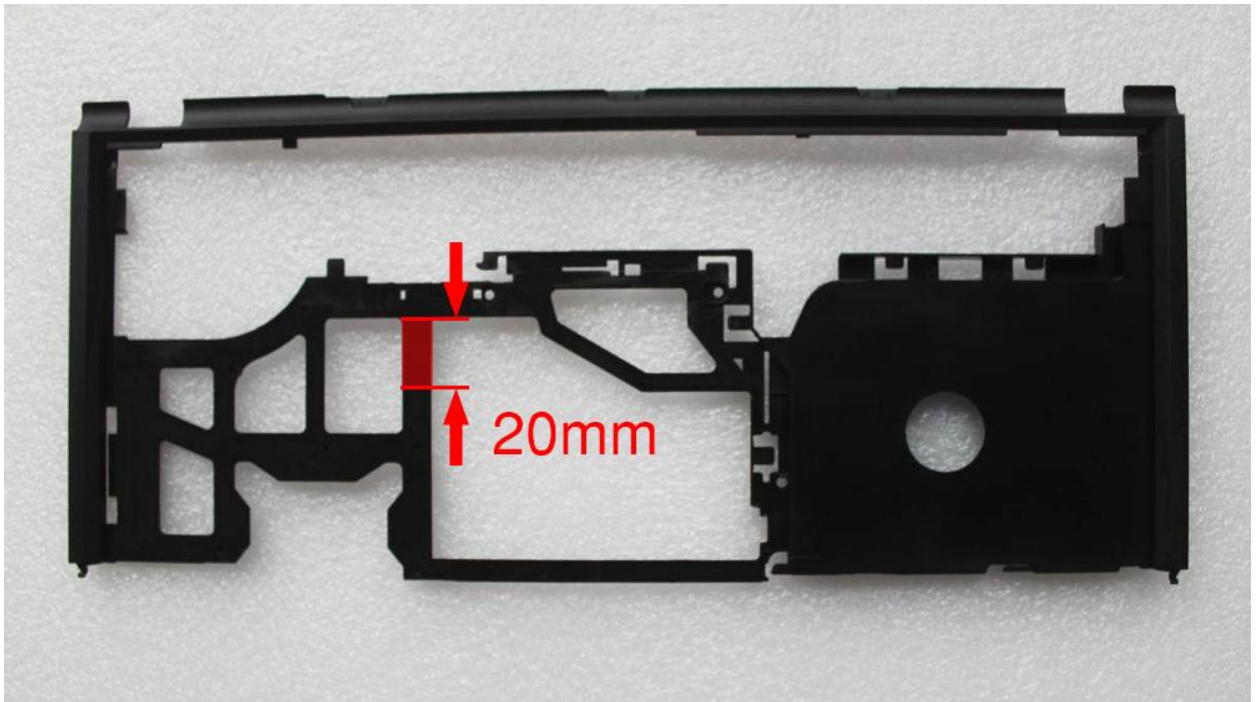


Figure 15. 20mm cutout in the keyboard bezel of X230

4. INSTALLATION

Do the following:

1. Remove the protective film in the areas of solder points.
2. Solder the sense wire to the motherboard.
3. Apply insulation tape to the back side of the adapter board. Make sure to make holes for docking connector pins and the nearby components.
4. Install and solder the adapter board to the motherboard.
5. Solder the sense wire to the adapter board.
6. Solder the auxiliary power wire to the motherboard and to the adapter board.
7. Make the required cutouts in the lid to fit the new LCD panel.
8. Remove two inner latches from the LCD bezel.
9. Make the required cutouts in the keyboard bezel.
10. Cover the bottom part of the adapter board with insulation tape to prevent electrical contact with the inner side of the keyboard.
11. Install all removed parts according to the HMM.

APPLICATION NOTES

1. COMPATIBLE LCD PANELS

Although any LCD panel with 30-pin eDP interface is electrically compatible and would work with this kit, there are some additional requirements. The panel must have screw holes so that it can be firmly installed in the lid and offset eDP connector, because the eDP cable is not long enough for panels with centered eDP connector (see figure 16).

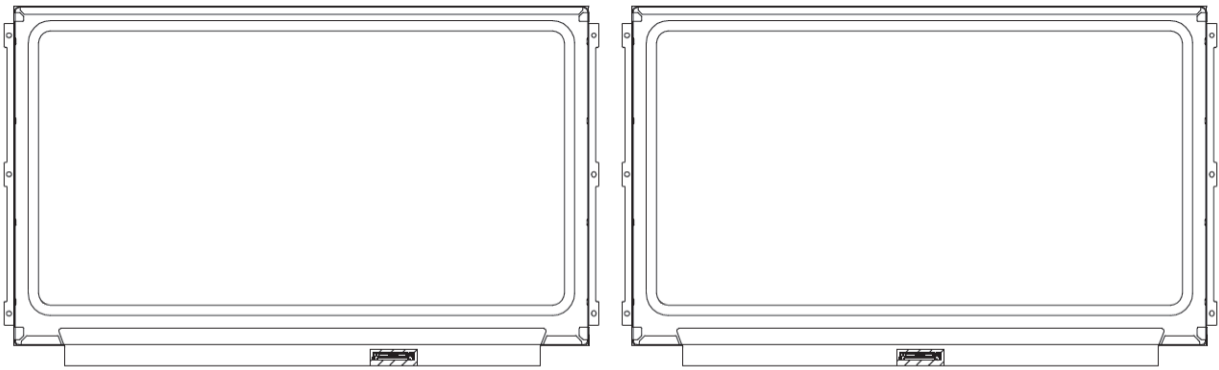


Figure 16. Offset (on the left) and centered (on the right) eDP connector

2. BANDING ARTIFACTS

Due to a bug in Intel graphics driver, dithering is not enabled for DisplayPort displays of 6 bpc and lower, which results in banding artifacts (see figure 17).

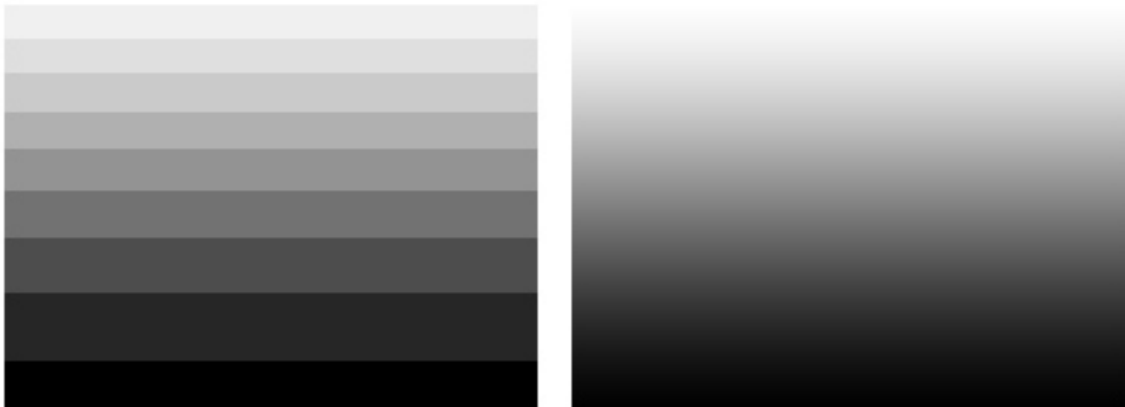


Figure 17. Banded gradient (on the left) and dithered gradient (on the right)

Linux users are not affected. Windows users should use *Dithering Settings for Intel Graphics* utility: http://kawamoto.no-ip.org/henteko/myapp_en.html#ditherig

This utility can work on ThinkPad X230 out of the box, but additional setup has to be done to make it run on X220:

1. In the utility directory, navigate to `ditherig\x86\` (if using 32-bit Windows) or `ditherig\amd64\` (if using 64-bit Windows);
2. Open `database.csv`, find the device list and insert new row in the beginning (see figure 18);

| | Vendor ID | Device ID | Type | |
|----|-----------|-----------|--|--|
| 43 | | | | |
| 44 | 2 0x8086 | 0x0126 | 1 Intel(R) HD Graphics (Sandy Bridge) | |
| 45 | 2 0x8086 | 0x0152 | 1 Intel(R) HD Graphics (Ivy Bridge) | |
| 46 | 2 0x8086 | 0x0156 | 1 Intel(R) HD Graphics (Ivy Bridge) | |
| 47 | 2 0x8086 | 0x015a | 1 Intel(R) HD Graphics (Ivy Bridge) | |
| 48 | 2 0x8086 | 0x0162 | 1 Intel(R) HD Graphics 4000 (Ivy Bridge) | |
| 49 | 2 0x8086 | 0x0166 | 1 Intel(R) HD Graphics (Ivy Bridge) | |
| 50 | 2 0x8086 | 0x016a | 1 Intel(R) HD Graphics (Ivy Bridge) | |

Figure 18. New entry in the device list

3. Save and close `database.csv`.