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CAMERA INTEGRATE IN LCD PANEL

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Camera integrate in LCD panel

Abstract

This invention discloses a new design that integrates both display and camera, thus largely reduce the bottom border of the hinge up. The display panel was designed and fabricated with bottom glass of the LCD panel. The bottom area can bond CCD and lens for camera to fit in. Camera FPC is integrate to panel PCB. The camera control circuitry is also fabricated on panel glass. And eventually camera cable and panel eDP cable are combined as one, output from panel PCB, thus only one cable go through the hinge. Some of the pins such as the power/GND pins are shared between camera and panel so the total pin number is also reduced.

Background

In the conventional hinge up design, the top border and bottom border are both large. That's the reason we need to fit in the camera in bottom border.

In the conventional laptop hinge up design, the panel signal lines are connected through 2 FPC to a flat type PCB in bottom side. There are Tcon IC and LED drivers and others circuitry on that PCB. Eventually there is an eDP cable connected through the hinge to the system. On the other side, there is camera on top side, a control circuitry near camera, and a cable for camera, which go through the back side of the panel and panel PCB and the hinge, to the system.

There were some trial that moves the camera to bottom side of the hinge up, or the C-deck (with keyboard), to save the top border of the hinge up, and improve the screen to body ratio. But those trial all result in terrible camera experience. Our invention here is a new proposal that move camera to the bottom glass of LCD and integrates with the panel, thus reduce the bottom border and improve the screen to body ratio.

Invention Description

In this invention, the proposal is to have the bent type panel PCB designed and CCD fabricated on the bottom side of the panel glass. Camera signals are connected through FPC to the panel PCB. The camera control circuitry can also be pre-fabricated on panel glass to save camera PCB design. And eventually merge with display panel eDP as one cable, so only one cable needs to go through the hinge.

Power and ground for camera can be supplied from panel PCB. As such the final cable pin number is reduced, e.g. 30 pins for panel +10 pins for camera --> 35 pins combined (the number here is just for example). This is because some of the pins can be shared. Overall cable size is reduced.

And note the design is not just placing the panel with PCB reversely, as that will makes the image reverse too. For example, the conventional PCB connect to panel with few FPC, line 1 in left side and line 1920 in right side (assume FHD). If we just place the panel with PCB reversely, line 1 will be in right side and line 1920 will be in left side, then that's wrong because the image would be reverse. So the new design is place the PCB at top side of the panel, yet still connect to line 1 in left and line

1920 in right. That means the line connection layout on PCB needs to be reverse from the conventional PCB.

Overall speaking, with the design revealed by this invention, the bottom border of hinge up can be largely reduced while keeping top border of hinge up as conventional design. And the cable is combined as one, as such the cable complexity is reduced. And the cable pin number is reduced.

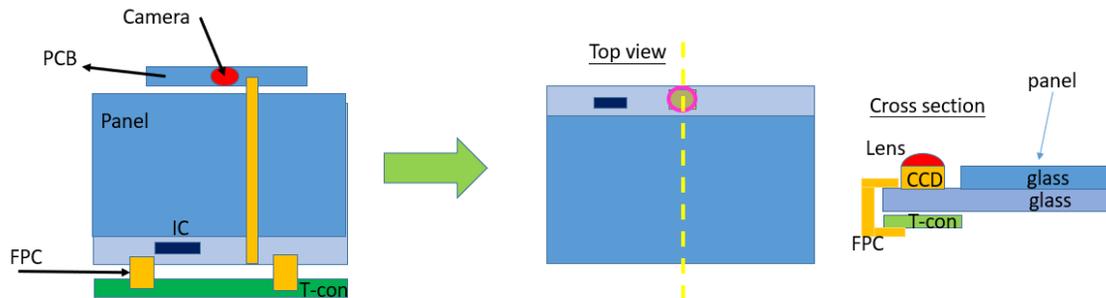


Figure 1. Drawing of new hinge up design with special display design to reach high screen to body ratio.

Advantages

- CCD direct bonding on glass and circuit layout on the panel glass. Lens molding on CCD and the camera circuit can layout on glass to reduce pcb cost.
- When we integrate camera module on panel we can reduce total border and get higher STB ratio.
- Higher screen to body ratio can be achieved by reducing the bottom border in hinge up.
- Camera remains in top side of hinge up, keeping good user experience.
- Camera cable is connected to panel PCB, and merge with panel eDP cable. It could save cable numbers (e.g. 2-->1) and space and even cost. Particularly, the total pin number is also reduced because some of them can be shared, such as power/GND pins.

Disclosed by Super Liao, Hsing-Hung Hsieh and KT Wu, HP Inc.