

2 Example of Noise Suppression in Notebook PCs

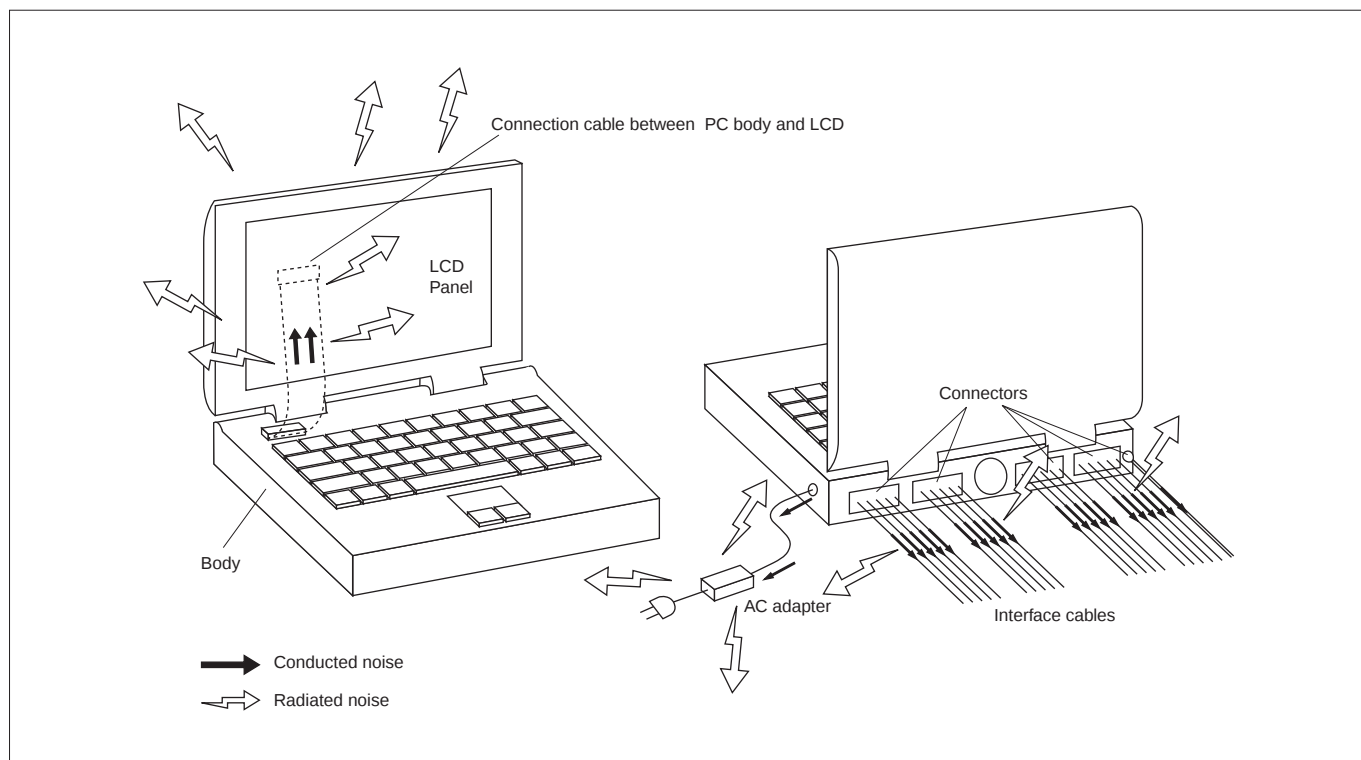
Noise Emission Status :

Noise emission from PC body, LCD, connection cables, and connection cable between PC body and LCD.

In notebook PCs, PCBs incorporate many signal lines with high-level noise. Generally, notebook PCs use a resin case with conductive plating, which provides a lower shielding effect than the metal case of desktop PCs, causing high level noise to be emitted from the PC body. Furthermore, they use many connection cables,

which also emit noise.

In most cases, transmission signals to the LCD are LVDSs (Low Voltage Differential Signals). Since the LVDSs are high-speed signals containing high level noise, the connection cable between the PC body and LCD also emits high level noise.



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Noise Suppression Content in Notebook Personal Computers

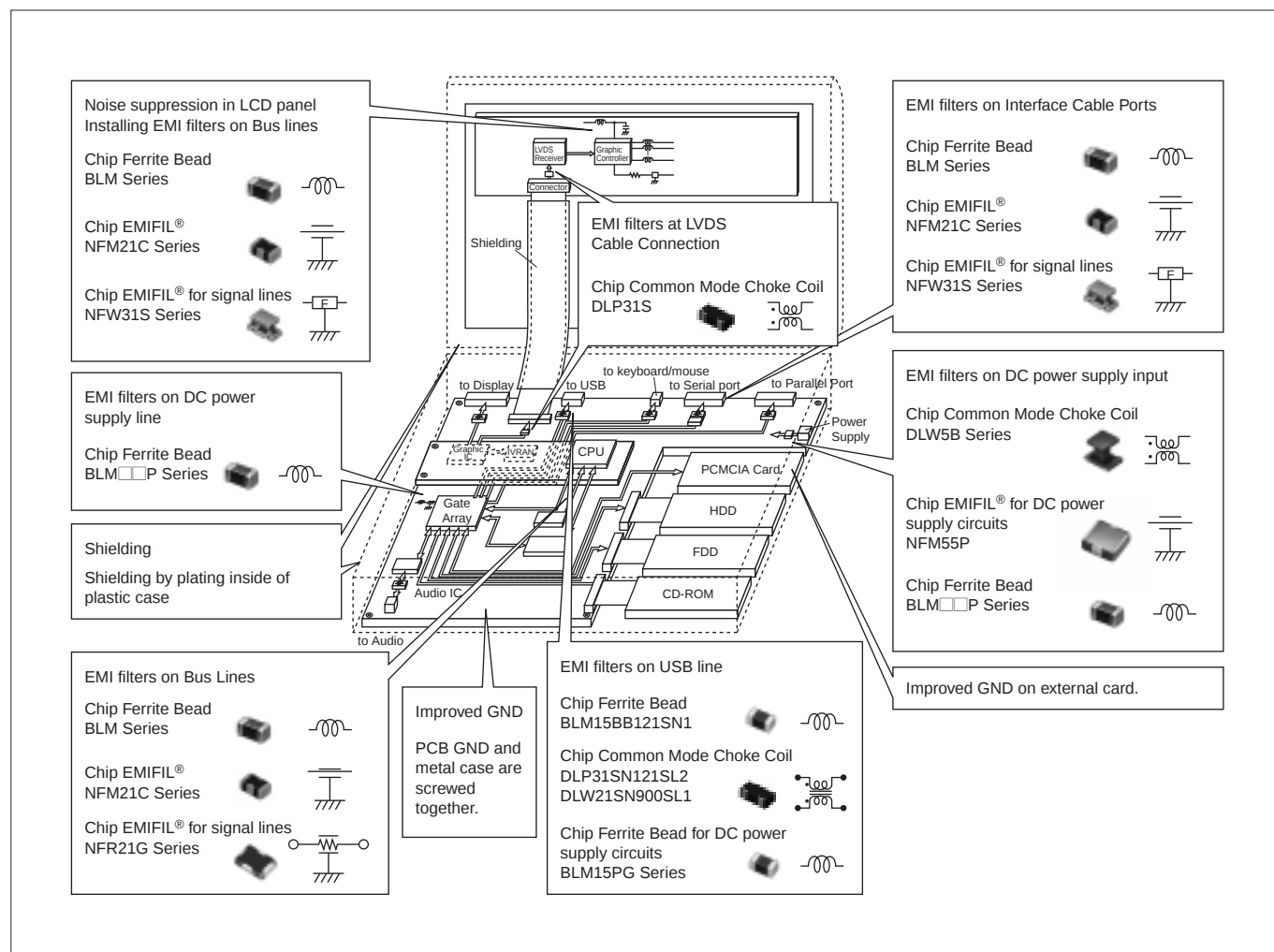
Notebook PC components are mounted in a limited space. Therefore, it is important to intensify the shielding condition as much as possible to suppress noise emission, before mounting noise-suppressing components. As shielding measures, the resin case is provided with conductive plating, and metal plates are provided above and below the PCB to intensify the shielding condition. For cable connectors, the PCB GND is connected with the metal plates to intensify the GND condition, and additionally, noise suppressing components are mounted.

Transmission signals to the LCD are mainly LVDSs (Low Voltage Differential Signals), which also emit high-

level noise.

Therefore, the DLP series common mode choke coils should be mounted to the signal lines. In some cases, it is also necessary to shield the cables. The LCD incorporates many signal lines that are connected from the graphic control IC to the LCD driver. Because these signal lines may emit noise, chip ferrite beads (e.g. BLM series) should be mounted to the signal lines to suppress noise emission.

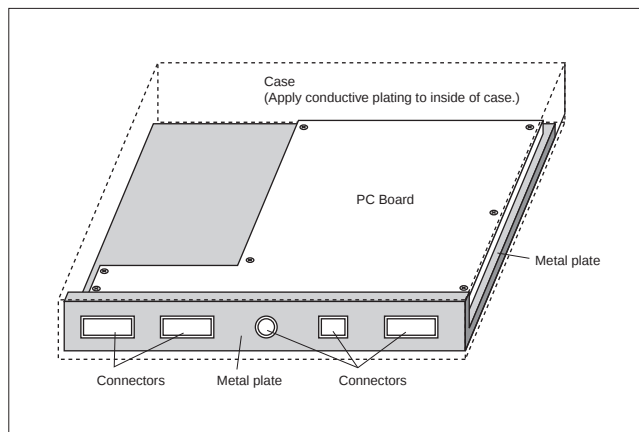
The card slot for connecting an external card, such as PCMCIA card, must be designed to reduce the high frequency impedance between the PCB GND and the card. Also, the card slot must be shielded.



Example of Noise Suppression in Notebook PCs 2

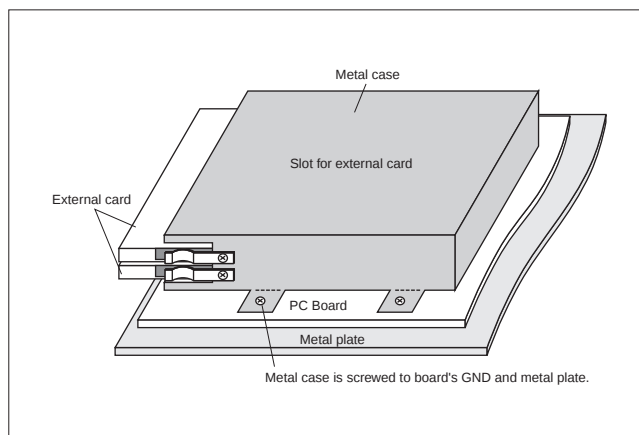
Improving the Case Shielding and GND Connection

Since plastic is usually used to encase a notebook PC, conductive plating is applied to the inside of the case. However, conductive plating alone is not sufficient for shielding. Therefore, to improve the GND, metal plates are also installed above and below the PCB. These plates are screwed together so they maintain contact with the PCB's GND and the conductive plating.



Improving the External Card GND

When an external card with a cable is connected, noise is emitted not only from the card itself but also from the notebook PC, conducted through the cable. When the high frequency impedance between the card's GND and PC's GND is high, the card's GND becomes unstable. This makes noise suppression difficult. Therefore, the slot fingers in contact with the card's GND are screwed to the PCB's GND and metal plate, minimizing the high frequency impedance between them. If the PC's noise affects the card, radiated noise cannot be suppressed, even if the card contains a noise suppressor. In this case, the slot is shielded with a metal plate.

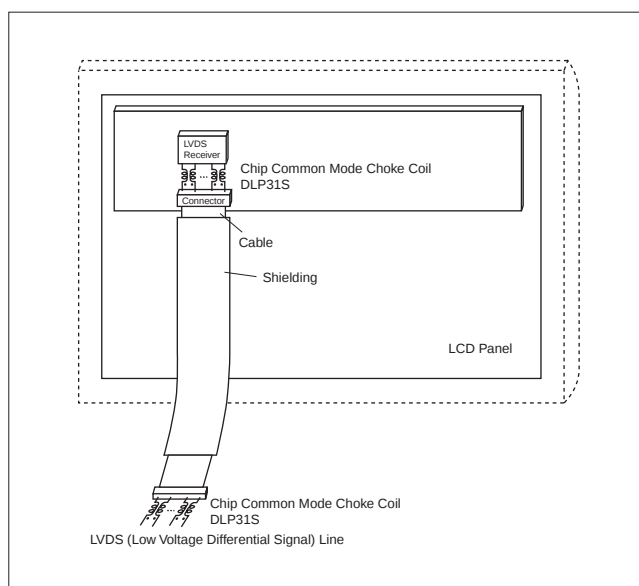


When the ground connection relies on physical contact, such as when an external card makes contact with the slot, the level of radiated noise varies widely depending on the status of the contact. When taking measures to suppress noise or measure the noise level, care must be taken.

EMI Filter at LVDS Cable Connection

The connection cable between the PC body and LCD raises problems on noise emission due to signal harmonics to the LCD, and from the surrounding circuits other than the signal line.

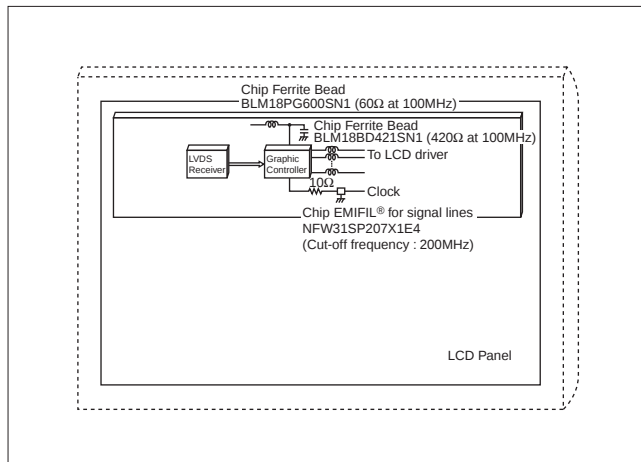
Because LVDSs (Low Voltage Differential Signals) are transmitted at a high-speed of several hundred MHz, common mode choke coils should be used to prevent rounding of the signal waveform. LVDSs are based on the differential transmission method, which cancels magnetic flux generated by a current, resulting in noise suppression. However, the current may be unbalanced by signal reflection. In this case, the common mode choke coil serves as a transformer to balance the current, thus enabling the noise caused by the unbalanced current to be suppressed.



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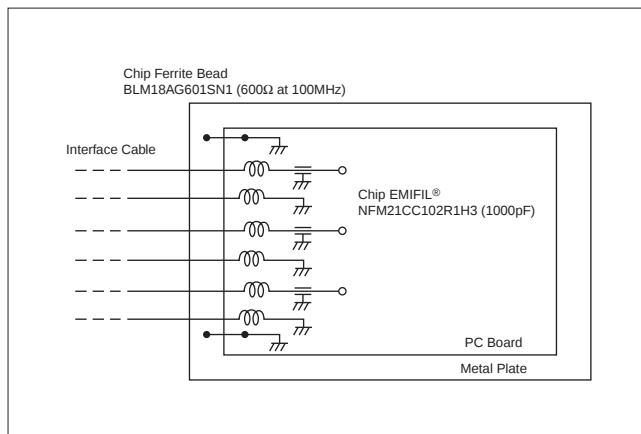
Noise Suppression in LCD

The connection between the graphic controller and LCD driver contains many lines that switch on and off simultaneously. This switching creates instantaneous large current flows into the GND and power supply line. Therefore, it is necessary to suppress the current flow from the signal lines. The BLM series (Chip Ferrite Bead) is typically used for this purpose. On the clock line, especially at high operating speeds and high noise levels, a filter with high and steep attenuation is used, such as the NFW31S series (Chip EMIFIL® for signal lines).



Installing EMI filters on Interface Cable Ports

On the lines to the interface cable, three terminal capacitor the NFM21C series and Chip Ferrite Bead BLM series are generally installed in combination. In some cases, the EMIFIL® for signal lines is used. It is important to design the circuitry to minimize the high frequency impedance between the EMI filter's GND and the metal plate.



Installing EMI Filters on the DC Power Supply Input

Since noise is radiated from the DC power supply cable of the AC adapter, some noise suppression is necessary at input to DC power supply of personal computer. The DC power supply line contains both differential mode noise and common mode noise. Both mode noises need to be suppressed.

The GND and metal plate are first connected together. The NFM55P series (Chip EMIFIL®) and the BLM□□P series (Chip Ferrite Bead) are used for differential mode noise suppression. The DLW5BS/AH series (Chip Common Mode Choke Coil) is used for common mode noise suppression.

