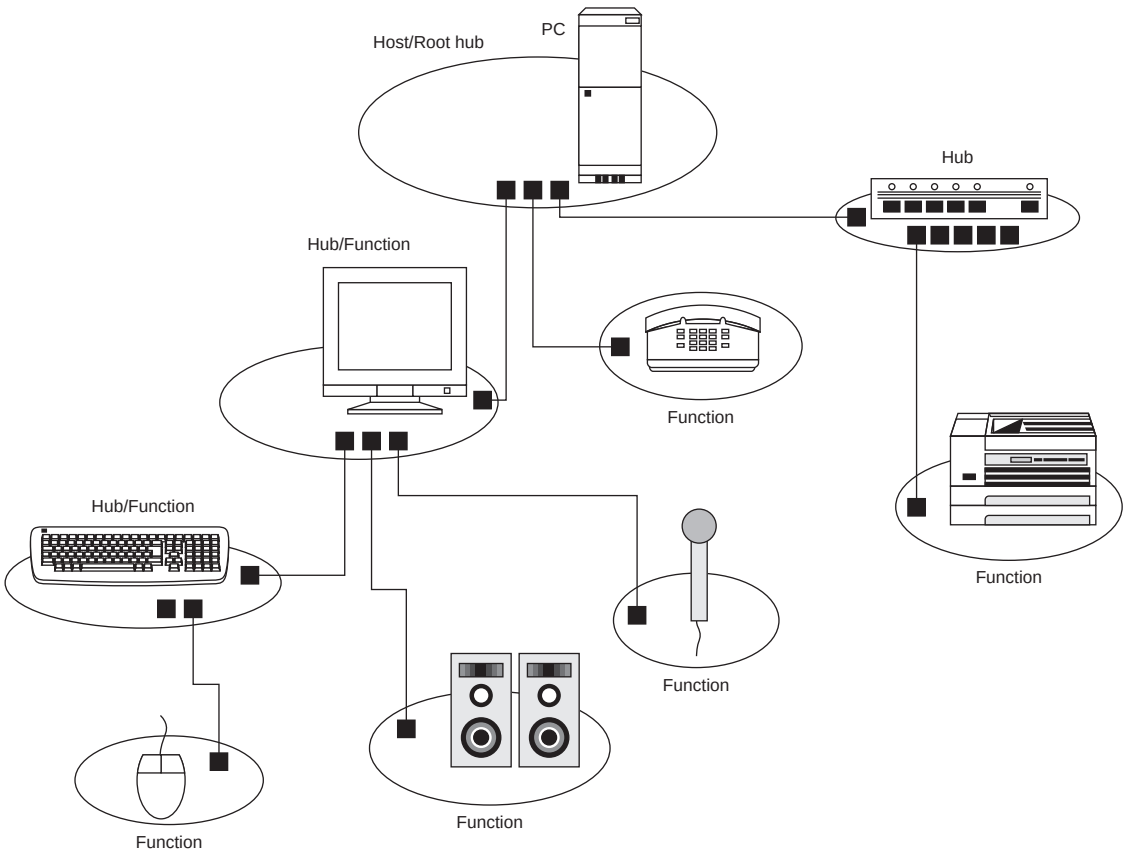
3 Example of Noise Suppression for USB's

The USB (Universal Serial Bus) was devised as an external bus to connect a PC (host) and its peripherals (functions).
Because of easiness to use, the USB is expected to rapidly become widespread in the future.

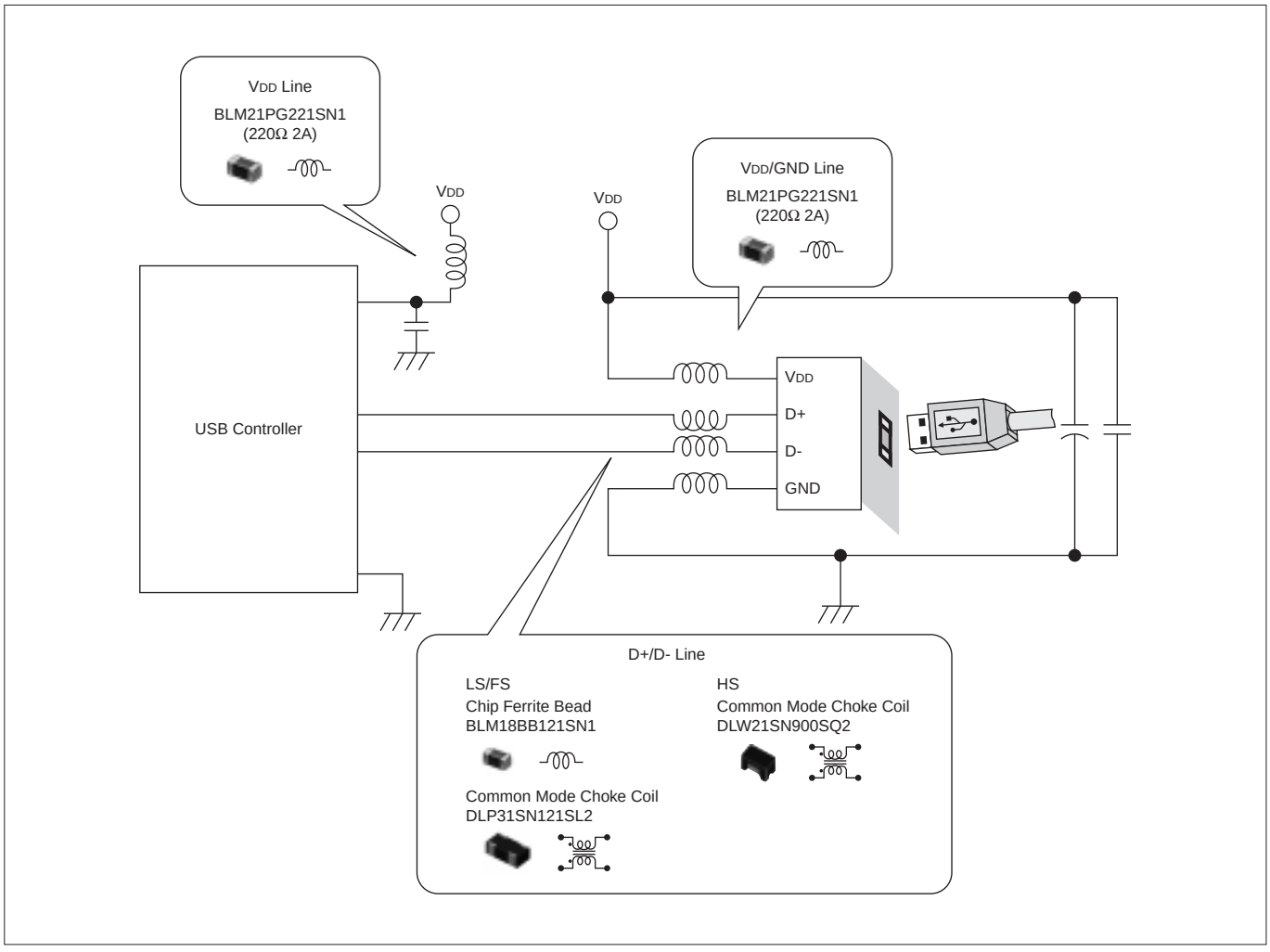
The major noise problem with USB's is noise radiation from the cables. However, common mode noise from other circuits does tend to be stronger than generated by USB signal because USB used differential data transmission.



3 Example of Noise Suppression for USB's

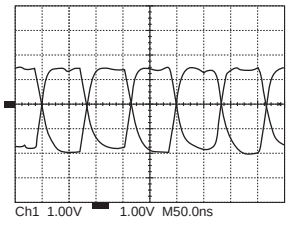
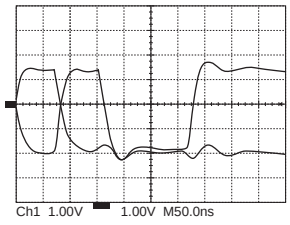
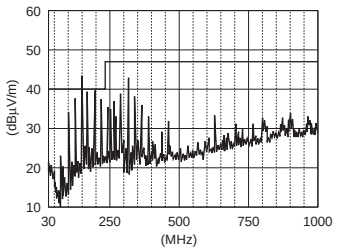
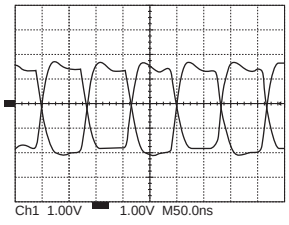
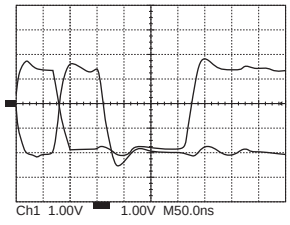
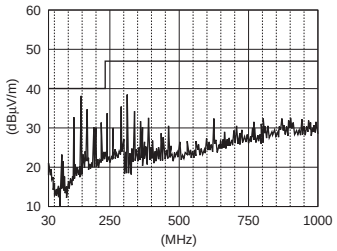
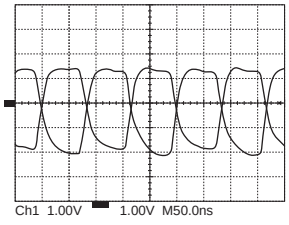
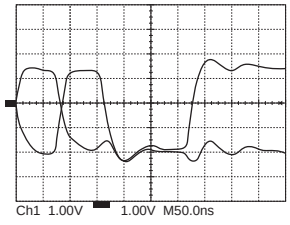
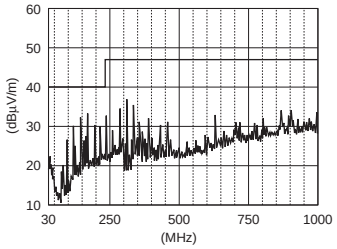
Noise Suppression Content for USB

USB's support three types of transmission modes, depending on the function of the connected device: LS (Low Speed: 1.5Mbps), FS (Full Speed: 12Mbps) and HS (High Speed: 480Mbps). In order to suppress noise emission without deforming the signal waveform, it is necessary to take noise suppressing measures suitable for individual transmission modes.
For noise suppression in the LS/FS mode, chip ferrite bead BLM18BB121SN1 or common mode choke coil DLP31SN121SL2 should be mounted on the signal line, and the BLM□□PG series chip ferrite bead should be mounted on the power supply and GND lines.
In the LS/FS mode, using the EMI filters raises the problem of signal waveform deformation. In this case, influence of the EMI filters on EOP (End of Packet) signal must also be watched.
In the high speed transmission mode such as the HS mode, using the ferrite bead results in signal waveform deformation. To prevent this problem, common mode choke coil DLW21SN900SQ2 should be used, instead of the ferrite bead to suppress noise emission.



Examples of transmission signal waveforms and noise suppressing effects in LS/FS mode

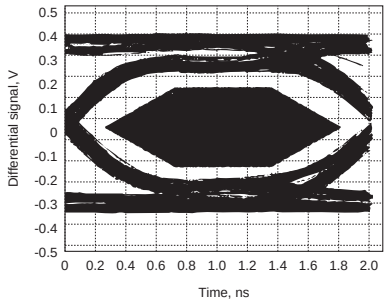
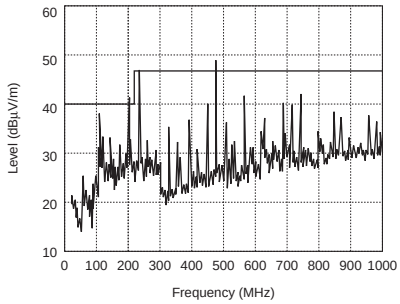
Currently, USB's support two types of combination modes: LS/FS, and LS/FS/HS, but do not support the LS mode alone. Therefore, the influence of the EMI filter on signal waveform should be managed in the FS or HS mode.
An example of noise suppressing measures for the LS/FS mode is described here.
Because USB's are based on the differential transmission method, a differential probe is used to measure the signal waveform.
For the LS/FS mode, the quality of the signal waveform and EOP are checked.
When chip ferrite bead BLM18BB121SNl is used, it slightly affects the signal waveform, but has little influence on EOP, raising no problem on operation. With the ferrite bead, noise emission can be reduced by approx. 5dB max.
Common mode choke coil DLP31SN121SL2 hardly affects both the signal waveform and EOP. With the choke coil, noise emission can be reduced by approx. 10dB max.

	Signal Waveform	EOP	Level Noise
No Filter			
Chip Ferrite Bead BLM18BB121SN1			
Common Mode Choke Coil DLP31SN121SL2			

3 Example of Noise Suppression for USB's

Examples of transmission signal waveforms and noise suppressing effects in HS mode

An example of noise suppressing measures for the HS mode is described here.
For the HS mode, quality of the signal waveform is checked with eye patterns.
Common mode choke coil DLW21SN900SQ2 has little influence on the eye patterns. With the choke coil, noise emission can be reduced by approx. 5dB max.

	Eye pattern	Level Noise
No Filter		
Common Mode Choke Coil DLW21SN900SQ2