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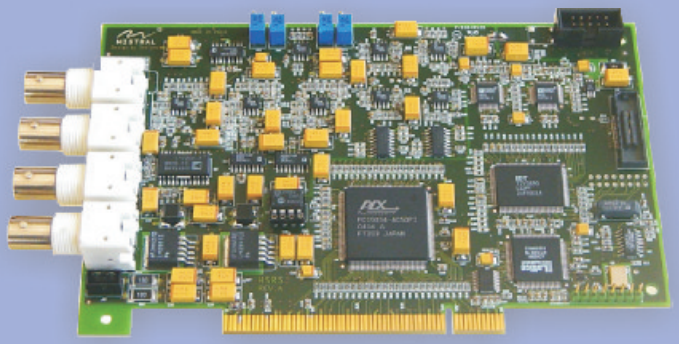
Case Study

High Speed Recording System (HSRS)

Introduction

Audio recording has come a long way since the first known recording of a human voice was carried out in the 1870s, on a tinfoil cylinder phonograph. In the present times, the Audio Recording industry uses high voltage, multi-channel, multiple-speed recording systems with variable gain levels. Designing such a system poses a severe engineering challenge; as does the additional challenge of maintaining high SNR (Signal-to-Noise Ratio) for all recording speeds. This case study showcases Mistral's ability to design and develop such a high-speed recording system.



> "This Case Study showcases a PC based high-speed recording solution designed by Mistral featuring 4-channels 14-bit data conversion resolution, up to 128X speeds with Windows based GUI."

The Customer

A leading high technology company in US, focusing on manufacture and sales of recording, CD-R, cassette duplication, telephony and audio logging equipment, approached Mistral to provide a solution for high-speed audio tape recording.

The Requirement

The customer requirement was to design a PC based 4-channel audio recording system compatible with different slave recorders.

Solution Provided

Audio recording applications require a large amount of memory and low latency data transfers to obtain high quality audio. Mistral came up with a novel solution: a PC-based, high-speed, PCI compatible card featuring 4-channels, 14-bit data conversion resolution, up to 128X speeds, and a Windows-based GUI.

- On-board sharp cut-off low-pass filter banks to keep minimum THD (Total Harmonic Distortion)
- On-board 32K memory for continuous data streaming from system memory
- Auto-filter bank selection, based on the speed
- Multiple recording speeds: 32X, 40X, 64X, 80X, 100X and 128X (where X is the base audio recording speed, viz. 44.1 KHz)
- 4 Audio channels
- Variable gain levels (-3dB to 23dB)
- Compatible with up to 20 slave systems
- 60 dB SNR for all recording speeds
- PC-based hardware with Windows compatible software
- Cue tone generation with software adjustments for level, frequency and duration
- Configurable counter to record number of duplications
- Remote start/stop control for slaves
- A hardware custom logic controlling critical timing parameters.

The Challenges

Continuous data streaming

Achieving continuous streaming of large amounts of audio data from hard disc / CD-R into the HSRS board, through the PCI interface, was a challenge. The team was able to achieve effective low-latency data-streaming by providing sufficient on-board memory and through control logic.

Noise suppression and SNR

With the output voltage level swing being as high as 30V, noise can creep into the system and get amplified. To suppress this noise, special filter circuits were adopted. Furthermore, the following board design steps were undertaken:

- Higher order elliptic filters were implemented to obtain sharp roll-off at the stop band and to minimize the harmonics and aliasing effects
- Proper isolation was provided between the power planes, digital and analog sections to minimize noise
- Clock signals were shielded by digital ground to avoid radiating noise; to ensure high quality clock generation and distribution.

Board Control logic

Building a custom logic to control timing, recording speeds, filter bank selection and gain selection was a challenge. This was achieved by using a reconfigurable PLD.

Key Achievement

- High recording speeds of up to 128X
- Sharp signal roll-off
- High SNR and low THD for all recording speeds

Customer Benefits

- Customized solution to suit its audio recording needs
- Windows-based GUI over PCI interface
- Single card supports multiple speeds and different gain levels, thereby reducing the system cost as well as the recording cost.

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