

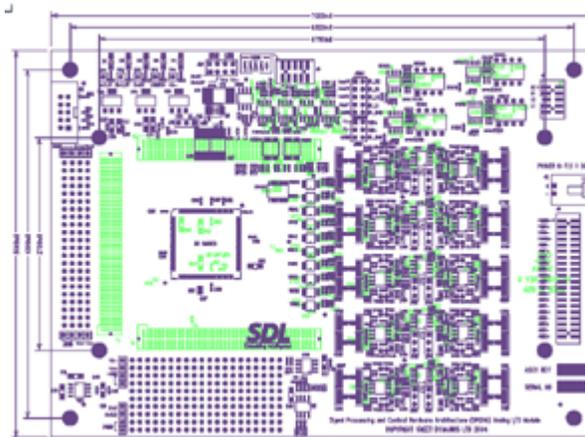
Development of Custom Board for Active Noise Cancellation Application

FAST A/D GIVES 10 μ s TURNAROUND TIME

Problem: The implementation of active noise cancellation into deep-insertion earpieces required DSP hardware with a very low turnaround time. Physical constraints in the problem force the total turnaround time for input, processing, and output to be less than 30 microseconds. An off-the-shelf solution that satisfied all of the requirements for this effort could not be found.



Signal Processing and Control Hardware - Front Side



SPCHA Hardware Component Layout

SDL was recently awarded a Phase II SBIR contract by the AFRL to develop improved hearing protection equipment with integral communication for high-noise military environments such as flight lines and aircraft carrier flight decks. In these environments, the passive hearing protection provided by muffs and plugs is inadequate to protect the wearer from hearing damage due to long-term exposure, so active noise cancellation is required. Because the distance between the microphone where the sound field is measured, and the speaker where the anti-noise is generated, is so small, total turnaround time of less than 30 microseconds was required. Unfortunately, there were no commercial solutions available that had the acquisition speed, processing power, sampling rate, resolution, and the number of channels needed, so SDL designed a custom board to satisfy these requirements.

The SPCHa (Signal Processing and Control Hardware) was designed by SDL to address this application. It functions as an input/output board, and can serve as a daughter board for the family of Analog Devices Blackfin processor boards through their standard input connection as

found on their EZ-Kits. A Complex Programmable Logic Device (CPLD) provides a flexible interface between the function of the two boards. The SPCHa contains 8 channels of analog input, which can be sampled at 16 bits at up to 200 kHz. There are also 4 output channels that can be driven by a current or voltage source. To satisfy the requirements of our application, the A/D and D/A components were specially chosen so that the total turnaround time would be under 10 microseconds. The performance of active noise cancellation algorithms can be sensitive to extraneous noise, so care was taken in laying out the hardware and in choosing filter components to minimize electrical noise on the data lines. Finally, the SPCHa was designed flexibly to accommodate future applications, and includes jumperable anti-aliasing as well as breadboarding space.

Solution: SDL designed custom hardware to provide fast input and output for a Blackfin DSP, yielding a total turnaround time of 10 microseconds. This board can be used in many applications, such as active noise control, where fast A/D is necessary to achieve the required performance.

SDL

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Contact us at:
Phone: 513-631-0579
Fax: 513-631-0582
info@sd ltd.com
www.sd ltd.com