Notes on using Analog Devices' DSP, audio, & video components from the Computer Products Division
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AD184x Sigma Delta Converters: How well do they work with DC inputs?

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Overview

This Engineer's Note will provide some insight into the AD18xx Sigma Delta Converters and Codecs to be used for DC inputs. The AD184x parts are normally AC-coupled, since they were designed specifically for audio applications which sample sinusoidal signals and reject DC signals.

1. What do you mean by AC-coupling?

The AD1849, AD1847 and AD1843 all are accept Industry-Standard compact disk "line-level" inputs. Line-level inputs are 2 V RMS centered around analog ground.. (For other audio equipment, "line-level" is more loosely defined.) The AD184x codecs are +5 V analog supply powered devices. Line level voltage swings for these parts are defined to be 1 V rms for and ADC input and 0.707 V rms for the DAC output. Thus, 2 V RMS input analog signals must be attenuated and either centered around the reference voltage intermediate between 0 V and +5 V or AC-coupled. The AD1847's VREF pin (or CMOUT for the 1843 and 1849K) will be at this intermediate voltage, nominally 2.25 volts. It has limited drive but can be used as a voltage datum to an op amp input. Note, however, that DC-coupled input are not recommended, as they provide no performance benefits with the AD184x architecture. Furthermore, DC offset differences between multiple DC-coupled inputs create the potential for "clicks" when changing the input mux selection.

2. Crystal data for the CS4215 says that the line inputs should be DC coupled for minimum output offset. The AD datasheets says there is no advantage to DC coupling. Will DC coupling to the AD1849k generate loud pops when switching between the AC coupled mic input and the DC coupled line input as the data sheet suggests? I would have expected no noise as the inputs in both cases would be at the same DC potential. I intend biasing the driving op-amp with the AD1849k CMOUT, so that the only difference in DC levels will be that caused by the op-amp's output offset.

Regarding AC vs. DC input signal coupling. Yes, if you switch between different DC bias voltage levels, you will generate switching noise. The input to the CODEC internal Op-Amps, is biased to the CMOUT voltage, +/- the input offset of the Op-Amps. This input offset is typically less than 5mV and will not cause serious problems, i.e. 'pops & clicks' unless gained-up in subsequent signal processing. If you think your system may generate total input offsets in excess of 10 to 20 mV you may want to determine, by experiment, the maximum tolerable level of switched noise you can tolerate. Wider bandwidth applications where high S/N ratios are expected will be subjectively worse, especially if augmented by ringing in any filters.

3. We want to work to below 1Hz (say 3 dB at 0.5 Hz) implies need 33uF or greater I/P coupling caps, and our present AD1847 circuit could give +ve or -ve bias across caps (i.e. dc offset into I/P).

Is there a problem with dc coupling other than that any offset would get amplified by the gain block of the AD1847? We could have up to 100mV offset (so couldn't use much gain).

This part was designed for audio applications and a small DC offset introduces 'pops-n-clicks' as the different inputs are selected. Also the DC offset generates 'zipper' noise when the gains are changed hence the reason for discouraging DC input signals. We do have a suggested circuit for use in DC applications you might want to see. Email a request with your FAX number and we'll send you the schematic.