

**CS4223/24**

# **24-Bit 105 dB Audio Codec with Volume Control**

The following information is based on the technical datasheet:

*CS4223/4 DS290PP1 OCT '98*

Please contact Cirrus Logic : Crystal Semiconductor Products Division for further information.

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## **CRYSTAL SEMICONDUCTOR PRODUCTS DIVISION PRODUCT INFORMATION**

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PI290PP1 OCT '98



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## ***24-Bit 105 dB Audio Codec with Volume Control***

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### **Features**

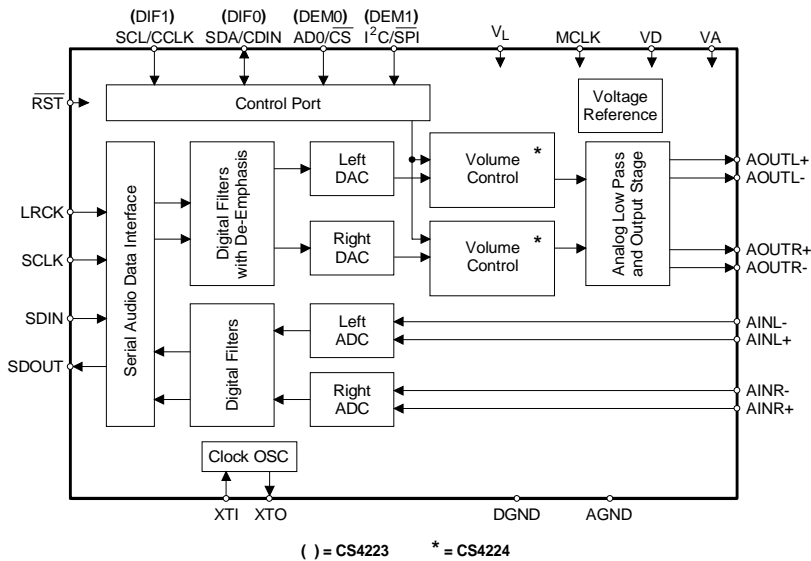
- 105 dB Dynamic Range A/D Converters
- 105 dB Dynamic Range D/A Converters
- 110 dB DAC Signal-to-Noise Ratio (EIAJ)
- Analog Volume Control (CS4224 only)
- Differential Inputs
- Differential Outputs
- On-chip Anti-aliasing and Output Smoothing Filters
- De-emphasis for 32, 44.1 and 48 kHz
- Supports Master and Slave Modes
- Single +5 V power supply
- On-Chip Crystal Oscillator
- 3 - 5 V Digital Interface

### **Description**

The CS4223/4 is a highly integrated, high performance, 24-bit, audio codec providing stereo analog-to-digital and stereo digital-to-analog converters using delta-sigma conversion techniques. The device operates from a single +5 V power supply, and features low power consumption. Selectable de-emphasis filter for 32, 44.1, and 48 kHz sample rates is also included.

The CS4223/4 also includes an analog volume control capable of 113.5 dB attenuation in 0.5 dB steps. The analog volume control architecture preserves dynamic range during attenuation. Volume control changes are implemented using a “soft” ramping or zero crossing technique.

Applications include digital effects processors, DAT, and multitrack recorders.



## Overview

The CS4223/4 has 2 channels of 24-bit analog-to-digital conversion and 2 channels of 24-bit digital-to-analog conversion. All ADCs and DACs are delta-sigma converters. The DAC outputs on the CS4224 have adjustable output attenuation implemented in 0.5 dB step resolution. The device also includes digital de-emphasis for 32, 44.1, and 48 kHz.

Digital audio data for the DACs and from the ADCs is communicated over separate serial ports. This allows concurrent writing to and reading from the device. The CS4223 is a stand-alone device controlled via pins. Control for the functions available on the CS4224 are communicated over a serial microcontroller interface.

The CS4224 supports additional functions through the control port interface as outlined in Table 1.

<b>CS4224</b>	<b>CS4223</b>
Volume control	-
Adjustable Mute ramp rate	-
Enable zero crossing detect	-
Enable/Disable mute on zero input	-
De-emphasis	De-emphasis
Mute DAC outputs	-
ADC Input Peak Level Detect	-
20, 24 bit Interface	20, 24 bit Interface
Codec power down	Codec power down
Cal on command	Cal on power-up
High pass enable/disable	High pass enabled

**Table 1. CS4224 vs. CS4223**

## **FAQs**

- 1) Why does the CS4224 implement analog volume control instead of digital volume control?  
A: Analog volume control allows one to preserve system dynamic range. As the audio signal is attenuated, the noise floor is also attenuated by the same amount. Thus, dynamic range is preserved during attenuation.
  
- 2) What does the term "soft volume control" mean?  
A: When the user writes a new volume control setting, the CS4224 ramps from the old volume setting to the new volume setting in 0.5 dB steps. This approach is audibly superior to a single large volume control change which can result in an audible "click" or "pop". The rate at which this ramp occurs can be set to 4 different settings through a register in the control port. This same approach is used when muting the DAC outputs.
  
- 3) Are these parts backward compatible with the CS4222?  
A: The best choice for backward compatibility is the CS4224. Pin 13 changes from being DEM0 to being VL, the pin to set the logic interface voltage level. Pin 2 ceases to be  $\overline{\text{SMUTE}}$  and becomes XTO, the drive pin for the on chip crystal oscillator.

## Ordering Information

CS4223-KS	-10 to 70 °C	28-pin SSOP
CS4224-KS	-10 to 70°C	28-pin SSOP
CDB4223/4	Evaluation Board	

For further information on Crystal products, please visit our website “[www.crystal.com](http://www.crystal.com)” or call our literature department (800) 888-5016 ext. 3594 or (512) 912-3594 for data sheets and application notes.

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