

**CS4226**

# Surround Sound Codec

The following information is based on the technical datasheet:

*CS4226 DS188PP5 NOV '96*

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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PI188PP1 JAN '98

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## ***Surround Sound Codec***

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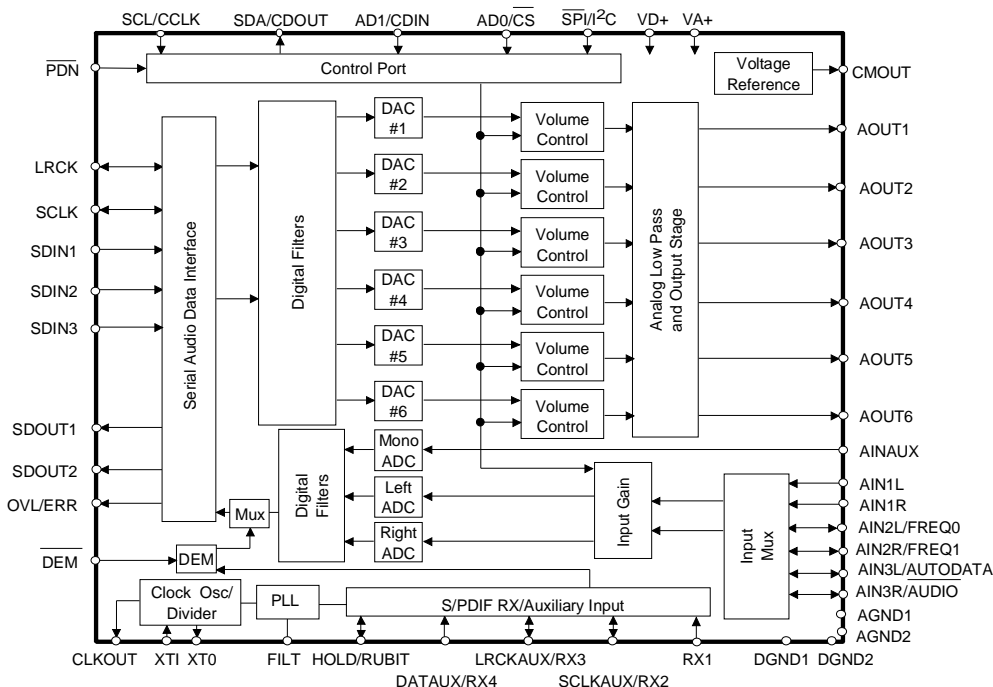
### **Features**

- Stereo 20-bit A/D Converters
- Six 20-bit D/A Converters
- S/PDIF Receiver
  - AC-3® & MPEG Auto-detect Capability
- 108 dB DAC Signal-to-Noise Ratio (EIAJ)
- Mono 20-bit A/D Converter
- Programmable Input Gain & Output Attenuation
- On-chip Anti-aliasing and Output Smoothing Filters
- De-emphasis for 32 kHz, 44.1 kHz, 48 kHz

### **Description**

The CS4226 is a single-chip codec providing stereo analog-to-digital and six digital-to-analog converters using delta-sigma conversion techniques. This +5 V device also contains volume control independently selectable for each of the six D/A channels. An S/PDIF receiver is included as a digital input channel. Applications include Dolby® Pro-logic™, THX®, and Dolby Digital™ AC-3® home theater systems, DSP based car audio systems, and other multi-channel applications.

The CS4226 is packaged in a 44-pin plastic TQFP.



## Overview

The CS4226 has 2 channels of 20-bit analog-to-digital conversion and 6 channels of 20-bit digital-to-analog conversion. A mono 20-bit ADC is also provided. All ADCs and DACs are delta-sigma converters. The stereo ADC inputs have adjustable input gain, while the DAC outputs have adjustable output attenuation. The device also contains an S/PDIF receiver capable of receiving compressed AC-3/MPEG or uncom-pressed digital audio data.

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. Control for the functions available on the CS4226 are communicated over a serial microcontroller interface.

## FAQs

- 1) Why does the CS4226 contain an S/PDIF receiver?  
A: The CS4226 Surround Sound Codec along with the CS4923 Dolby Digital decoder implements a two chip solution to home theater A/V receivers. The S/PDIF receiver on the CS4226 locks onto the digital audio source (DVD, LD, CD), and transfers the digital audio data to the CS4923 DSP for AC-3 decoding. This CS4226 contains six DACs for playback to six speakers and an A/D converter for digitizing an analog pro-logic source.
  
- 2) What does the AUTODATA output signal?  
A: For AC-3, MPEG, or DTS applications, it is important to know whether the incoming S/PDIF data stream is digital audio or compressed AC-3/MPEG/DTS data. This information is typically conveyed by setting channel status bit 1 (audio/non-audio bit), but some AC-3/MPEG/DTS sources may not strictly adhere to this convention and the bit may not be properly set. The CS4226 S/PDIF receiver can automatically detect the presence of compressed audio data streams by monitoring the sync codes in the data stream. When the sync code is detected, the AUTODATA indicator (pin 10) will go high. The AUTODATA pin can flag the DSP to change algorithms or to mute the DAC outputs.
  
- 3) Is the CS4226 volume control analog or digital?  
A: The CS4226 implements a combined analog/digital volume control architecture which is the optimal solution for performance and cost. The first 24 dB of attenuation is performed in the analog domain which reduces the residual output noise to that achieved in the mute state. Because the attenuation is performed in the analog domain, as the signal is attenuated the noise floor is attenuated thus preserving dynamic range. The remaining attenuation is performed digitally to a maximum attenuation of 86 dB.

- 4) Why is de-emphasis performed in the S/PDIF receiver data path?
- A: The CS4226 S/PDIF receiver acquires data from a digital audio source (i.e. CD, DVD player) and transfers the data to a digital signal processor (DSP). If the data from the digital audio source is pre-emphasized, then de-emphasis should be performed prior to the DSP so that the DSP can process audio data with a flat frequency response.

## Ordering Information


CS4226-KQ      TQFP, -10 °C to +70 °C  
CDB4226      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.

### Schematic & Layout Review Service

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