

CS5334
CS5335

20-Bit, Stereo A/D Converter for Digital Audio

The following information is based on the technical datasheet:

DS237PP2 NOV '96

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

CRYSTAL SEMICONDUCTOR PRODUCTS DIVISION PRODUCT INFORMATION

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PI237PP1 JAN '98

20-Bit, Stereo A/D Converter for Digital Audio

Features

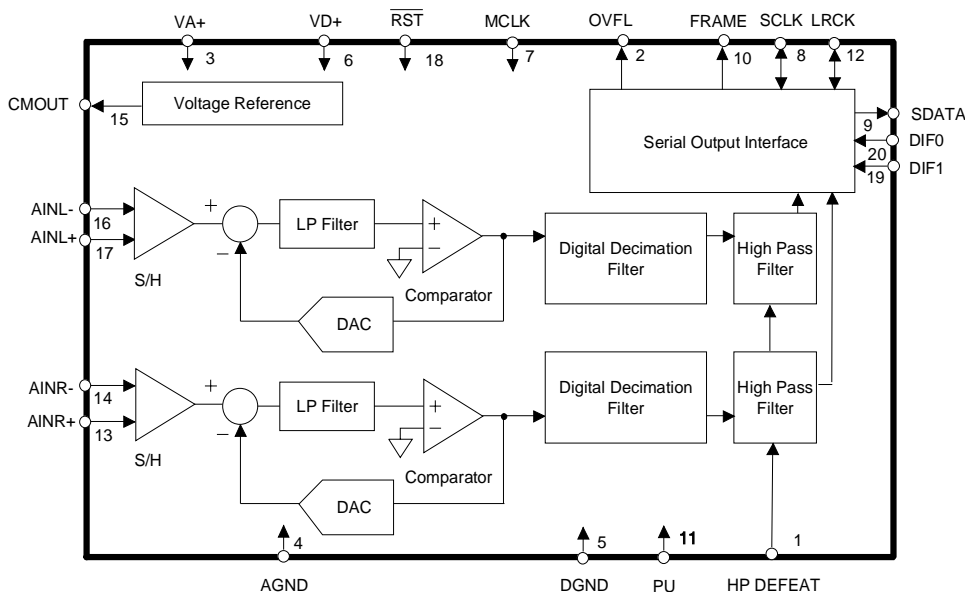
- CS5334
 - Dynamic Range: 100 dB
 - THD+N: -90 dB
- CS5335
 - Dynamic Range: 105 dB
 - THD+N: -95 dB
- 128X Oversampling
- Fully Differential Inputs
- Linear Phase Digital Anti-Alias Filtering
 - 21.7 kHz passband ($f_s = 48$ kHz)
 - 85 dB stop band attenuation
 - 0.0025 dB pass band ripple
- High Pass Filter - DC offset removal
- Peak Signal Level Detector
 - High Resolution and Bar Graph Modes

Description

The CS5334 and CS5335 are 2-channel, single +5 V supply, pin compatible analog-to-digital converters for digital audio systems. The CS5334 and CS5335 perform sampling, analog-to-digital conversion and anti-alias filtering, generating 20-bit values for both left and right inputs in serial form. The output word rate can be up to 50 kHz per channel.

The CS5334 and CS5335 use 4th-order, delta-sigma modulation with 128X oversampling followed by digital filtering and decimation, which removes the need for an external anti-alias filter. These ADCs use a differential architecture which provides excellent noise rejection.

The CS5334 and CS5335 have a filter passband to 21.7 kHz. The filter has linear phase, 0.0025 dB pass-band ripple, and >85 dB stopband rejection. An on-chip high pass filter is also included to remove DC offsets.



Overview

Crystal Semiconductor is introducing two new high performance, stereo, 20-bit audio A/D converters for digital audio applications. These devices are Crystal's lowest cost 20-bit converters; therefore, they offer the optimal price/performance benefit to our customers. The primary difference between the CS5334 and CS5335 is a 5 dB difference in dynamic range and total harmonic distortion performance. The devices are pin-for-pin compatible, and therefore a customer can upgrade his design from the CS5334 to the CS5335 gaining a 5 dB performance improvement without changing his design!

20-bit Audio A/D Converter Feature Summary

CS5335	CS5334
20-bit A/D Resolution	
105 dB Dynamic Range	100 dB Dynamic Range
-95 dB THD+N	-90 dB THD+N
Differential Inputs	
Peak Signal Level Detection - Indicates peak ADC input level	
Overflow output pin	
High Pass Filter - Removes DC offsets, can be disabled	
20 pin SSOP package	
Single +5V power supply	
325 mW power consumption	315 mW power consumption

CS5335 and CS5334 Functionality

The CS5335 and CS5334 are stereo 20-bit A/D converters offering additional features not found in competitive products. Designed in 0.8 micron technology, these devices are Crystal's first audio A/D products offered in a space saving 20-pin SSOP package. Specifically, these devices feature peak input

signal level detection and outputs for A/D converter input overflow conditions. Both devices feature differential inputs and have the capability to disable the high pass filter for applications that require digitizing a DC input signal. These additional features, in addition to the wide dynamic range (100 - 105 dB) of these products, position the CS5334 and CS5335 as unique 20-bit A/D converter offerings.

Peak Signal Level Detection

There are many audio systems that feature an input signal level metering function; examples of such systems include digital mixing consoles, multi-track recorders, DAT (Digital Audio Tape) players, reverb units, and digital audio editing systems. The input signal level metering typically consists of a display of LEDs which indicates whether the input signal is “clipping” (exceeding the full scale input level of the system) or is within the range of desired recording levels (0 to -60 dB from full scale). In digital audio systems, this function is typically accomplished with a DSP (digital signal processor) which reads the input signal level from the A/D converter, performs peak detection, and then sends the information to the LED display. The CS5334 and CS5335 have the capability to perform peak signal level detection, which will reduce the MIPS requirements in the DSP enabling the system designer to add other features in the DSP.

There are two Peak Signal Level Metering modes in the CS5334 and CS5335 - High Resolution and Bar Graph Mode. In both modes, there are 8 bits Peak Signal Level (PSL) bits which are output in a serial format following the 20 bit audio data bits. The PSL bits are formatted differently for High resolution vs. Bar Graph Mode, and the peak signal level is updated by toggling the PU pin (Peak Update) pin.

High Resolution Mode

The Peak Signal Level (PSL) bits indicate whether the A/D converter input signal is within the +5 dB (exceeding the A/D converter input level by 5 dB) to -60 dB input range. The eight PSL bits have a resolution of 1dB. Typically, a micro-controller would “interpret” the PSL data from the CS5334/5 to a format usable by the LED display.

Bar Graph Mode

In this mode, the PSL bits only provide 8 metering levels: 0 dB, -3 dB, -6 dB, -10 dB, -20 dB, -30 dB, -40 dB, and -60 dB. The PSL bits can be used to directly drive the LED display network.

Overflow Output Pin

The CS5334 and CS5335 contain a OVFL pin which indicates a analog input overrange for both the left and right channels. This pin goes high when an overrange occurs, and it is cleared when the Peak Update pin is toggled. This pin may be used to light an overrange LED on an audio system front panel.

Audio A/D Converter Family

Total Audio Solutions

Crystal offers a complete line of audio A/D converters ranging from 18-24 bit resolution and 94 dB to 120 dB dynamic range. This breadth of product offerings enables us to achieve all the necessary price/performance points for high volume consumer audio applications and high performance professional audio systems. The breadth of audio A/D converter product offerings in addition to Crystal's complete line of audio D/A converters, audio codecs, S/PDIF transmitters and receivers, and volume control solutions enables Crystal to sell our customers a complete audio solution.

Summary of Audio A/D Converter Family

	Resolution	Dy Range	THD+N	High Pass Filter	Peak Detect	Power	Package
CS5396/7	24 bit	120 dB	-105 dB	Disableable	Yes	1000 mW	28 SOIC
CS5394	24 bit	117 dB	-103 dB	Yes	No	900 mW	28 SOIC
CS5335	20 bit	105 dB	-95 dB	Disableable	Yes	300 mW	20 SSOP
CS5334	20 bit	100 dB	-90 dB	Disableable	Yes	300 mW	20 SSOP
CS5330A/ 5331A	18 bit	94 dB	-84 dB	Yes	No	150 mW	8 SOIC

Target Market

The target market for the CS5334 and CS5335 are applications that demand either >100 dB dynamic range, or systems that want to market “20-bit” performance. The market for this performance range of product is the musical instrument/semi-professional audio market, and the professional audio market. Applications also exist in the consumer market, and they are outlined below.

Musical Instrument /Semi-professional Applications

Reverb units, sampling keyboards, guitar amplifiers, low-cost digital recorders, graphic equalizers

Professional Applications

Mixing consoles, DAT players, multi-track recorders, digital video tape recorders, digital audio editing systems

Consumer Applications

Desktop Mini-Disc, THX certified A/V amplifiers

CS5334 and CS5335 Support

Customer Presentation - attached is a foil set highlighting the key parameters and selling features of the products. Use this information to sell the part to your customers.

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Availability

Datasheet	CS5334/ CS5335	Available from Crystal web site www.crystal.com A copy has also been mailed to each sales office
Evaluation board	CDB5334 CDB5335	Now Now
Samples	CS5334 CS5335	Now Now
Production	CS5334 CS5335	Now Now

FAQs

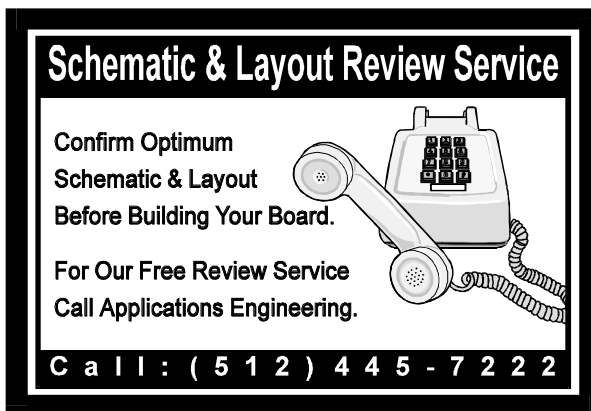
- 1) Is the CS5335 Crystal's lowest cost 20-bit converter?
A: No. The CS5334 is the lowest cost 20-bit converter, yet the CS5335 is pin compatible with the CS5334 and it is the optimal price/performance solution.
- 2) When used with the CS4329 20-bit DAC, what is the dynamic range performance in loopback mode (analog in to analog out)?
A: 102-103 dB dynamic range.
- 3) What advantage does the high pass filter offer over traditional calibration techniques to reduce offsets?
A: The CS5335 high pass filter can remove both offsets in the input circuitry driving the ADC and internal offsets generated within the ADC. The use of a digital high pass filter technique to reduce offsets consistently produces a zero LSB offset which cannot be achieved with traditional calibration techniques.
- 4) Is the high pass filter defeatable for applications where DC information is important.
A: Yes.

- 5) How is the peak signal level detector used?
- A: The peak signal detector monitors the input signal level into the ADC and outputs 8 bits which correspond to the peak input level. These bits can be used to implement a low cost bar graph display. These 8 bits are output from the ADC following the audio data, and they indicate whether the input signal is clipping (5 dB above full scale) or -60 dB from full scale in 1 dB step resolution. The peak signal detector is updated by toggling the PU (peak update) pin.
- 6) How is the overflow output used?
- A: The OVFL pin goes high when the audio data exceeds the analog input range of the ADC. This pin can be used to light an LED on a system front panel indicating an overrange condition. This pin is cleared with the PU (peak update) pin.

Ordering Info

CS5334-KS	-10° to 70°C	20-pin Plastic SSOP
CS5335-KS	-10° to 70°C	20-pin Plastic SSOP

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



Sales Office and Applications Support

UNITED STATES

Sales Office and Applications Support:

WESTERN AREA

Cirrus Logic
Crystal Semiconductor Div.
50 Airport Pkwy.
San Jose, CA 95110
Ph: 408-437-7743
FAX: 408-437-4943

Cirrus Logic
Crystal Semiconductor Div.
6 Venture,
Ste. 100
Irvine, CA 92718
Ph: 714-453-5910
FAX: 714-453-5914

CENTRAL AREA

Cirrus Logic
Crystal Semiconductor Div.
14205 Burnet Rd.,
Ste. 400
Austin, TX 78728
Ph: 512-255-8893
FAX: 512-255-0733

EASTERN AREA

Cirrus Logic
Crystal Semiconductor Div.
5511 Capital Center Dr.,
Ste. 103
Raleigh, NC 27606
Ph: 919-859-5393
FAX: 919-859-5334

Cirrus Logic
10 New England Business Center,
Ste. 100
Andover, MA 01810
Ph: 978-794-9138
FAX: 978-794-9998

Cirrus Logic
Crystal Semiconductor Div.
10440 Little Patuxent Pkwy.,
Ste. 300
Columbia, MD 21044-3559
Ph: 410-740-5654
FAX: 410-740-6961

EUROPE

Sales Office and Applications Support:

Cirrus Logic France
Immeuble Andre Malraux
93561 Rosny s/s Bois CEDEX,
France
Ph: +33(148)122812
FAX: +33(148)122810

Cirrus Logic
Crystal Semiconductor (UK) Ltd.
Spectrum Point,
279 Farnborough Rd.,
Farnborough,
Hampshire GU14 7LS,
United Kingdom
Ph: +44(0)1252372762
FAX: +44(0)1252372763

Cirrus Logic GmbH
Muehlfelder-Strasse 2
D-82211 Herrsching, Germany
Ph: +49(08152)92460
FAX: +49(08152)924699

FAR EAST

Sales Office and Applications Support:

CHINA

Cirrus Logic International Ltd.
A-1403, Qiancun Commercial
Mansion
Beijing, China 100029
Ph: (8610)6443-0783
Ph: (8610)6443-0784
Ph: (8610)6443-0785
FAX: (8610)6443-0786

HONG KONG

Cirrus Logic International Ltd.
1203 Park Tower
15 Austin Rd., Tsimshatsui
Kowloon, Hong Kong
Ph: (852)2376-0801
FAX: (852)2375-1202

KOREA

Cirrus Logic, Korea Co., Ltd.
Rm 1302 SangKyung Bldg., 824-
21 YeokSam-Dong,
KangNam-Ku,
Seoul, Korea
Ph: +82(2)565-8561
FAX: +82(2)565-8565

SINGAPORE

Cirrus Logic
Crystal International
6 Kaki Bukit Ave. 1,
Ste. 03-03
Singapore 417940
Ph: +65-743-4111
FAX: +65-742-4111

TAIWAN

Cirrus Logic International Ltd.
Taiwan Branch
10F, No.214 Tun Hwa North Rd.
Taipei, Taiwan R.O.C.
Ph: +886(2)2718-4533
FAX: +886(2)2718-4526

JAPAN

Sales Office and Applications Support:

Cirrus Logic K.K.
Shinjuku Green Tower, Bldg. 26F
6-14-1 Nishi-Shinjuku,
Shinjuku-ku,
Tokyo, 160
Japan
Ph: +81(03)3340-9111
FAX: +81(03)3340-9120



**CRYSTAL SEMICONDUCTOR
PRODUCTS DIVISION**

**PO BOX 17847
4210 S. INDUSTRIAL DRIVE
AUSTIN, TEXAS 78744
512.445.7222 / 800.888.5016
FAX: 512.445.7581**

**WORLDWIDE WEB:
<http://www.crystal.com>**