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# Audio Solutions

PRODUCT SELECTION GUIDE

SUMMER 2010



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- Telematics System

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- Desktop Media Speaker
- Digital Audio Broadcasting (DAB) Receiver
- Digital Television
- Digital Set-Top Box
- Docking Station

- HD A/V Receiver
- Soundbar, Entry-Level (15W x 2)
- Soundbar, Mid-Level (30W x 2)
- Sound Projector, Entry-Level (10W x 8)
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# AUDIO SOLUTIONS Portfolio

## OUR VALUE

- Broad Product Portfolio of Comprehensive Audio System Solutions
- Great Audio Performance That Enhances the Listening Experience
- Highly Integrated Audio ICs That Reduce Development Efforts
- Custom Solutions & Design Resources Dedicated to Automotive Applications
- A Dedicated Quality Group with Fast & Thorough Responses
- A “single stop-shop” licenses, ports, certifies and maintains the latest 3rd party audio algorithms
- World-Class Audio System Design Experience, Development Tools & Support

Call us for **free confidential** schematic and layout service available by **experienced application engineers** in our Austin, Texas, headquarters.

**512-851-4000**

## A Comprehensive Portfolio of Audio Products

As the market for digital media products soars, so does the need for high-quality capture, signal processing, routing and playback of audio signals. Handheld audio and video players, digital video recorders and televisions, car audio amplifiers, consumer home audio and professional studio equipment all share the need for high-quality data conversion and signal processing with a broad range of performance and functional requirements.

Cirrus Logic offers a comprehensive portfolio of audio ICs and reference designs focusing on data conversion, audio DSPs and the latest in integration: Audio SoCs which melds the best of both worlds. This portfolio is largely based on proprietary multibit Delta-Sigma modulators and low-latency digital filtering techniques offering both stereo and multichannel configurations for the line-up of ADCs, DACs, CODECs and Audio SoCs, while both the Audio DSP and Audio SoC families offer the latest in 32-bit processing architectures. These products offer 16- to 24-bit data conversion at key audio sampling rates up to 216 kHz, sample-rate conversion, transmission and reception of digital audio data between end products, volume control, signal amplification and dynamic range performance from 96 dB to 120 dB.

Having shipped more than one billion audio ICs, Cirrus Logic is an industry leader for innovative data converters, digital audio interfaces, audio DSPs, Class D amplifiers, analog control products and now audio SoCs. With more than 60 new mixed-signal and DSP audio products introduced over the past five years, Cirrus Logic provides designers with a comprehensive portfolio of audio products for every step of the audio signal chain, from the analog and digital inputs to the DSP, to the huge library of licensable 3rd party certified audio algorithms, to the state-of-the-art firmware development tools, to the complete turn-key reference designs, and on through to the headphone, line out and speaker outputs, Cirrus Logic leads the way.

# Application Diagrams

## AUTOMOTIVE AUDIO

- Automotive Audio Distribution Amplifier
- Telematics System

## CONSUMER AUDIO

- Blu-ray Disc Receiver
- Desktop Media Speaker
- Digital Audio Broadcasting (DAB) Receiver
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## PORTABLE AUDIO

- Portable Media Player
- MP3 Player
- Portable Navigation Device (PND)
- Smartphone

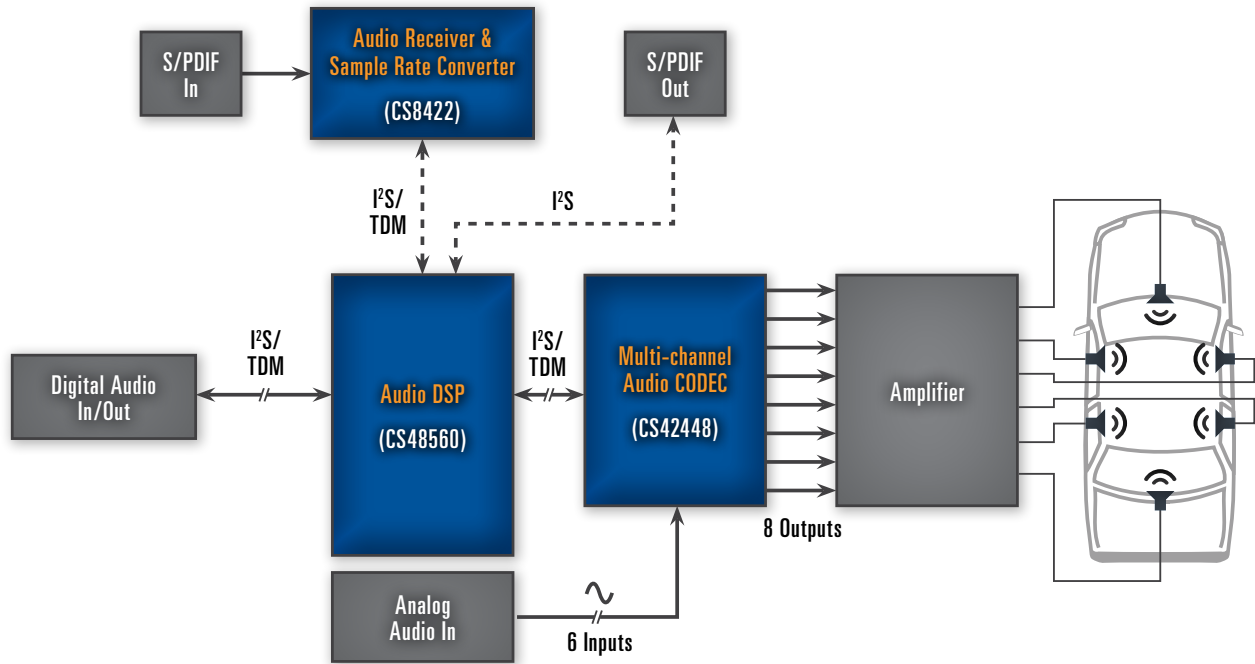
## PROFESSIONAL AUDIO

- Audio Interface
- Mixing Console



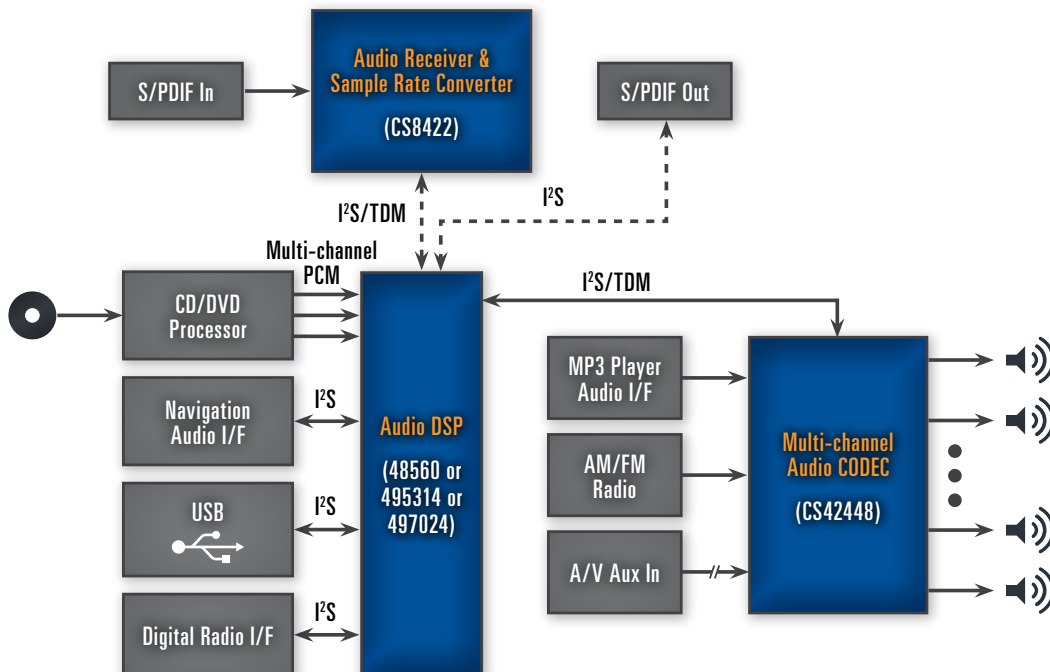
# Automotive Audio Distribution Amplifier

AUTOMOTIVE AUDIO



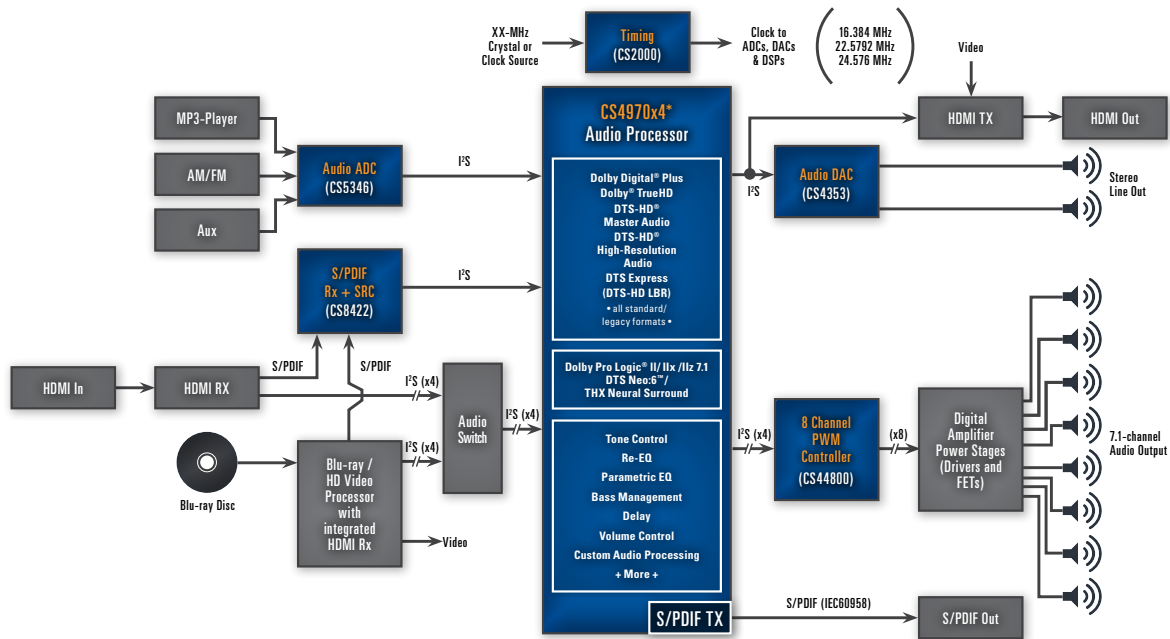
# Telematics System

AUTOMOTIVE AUDIO



# Blu-ray Disc Receiver

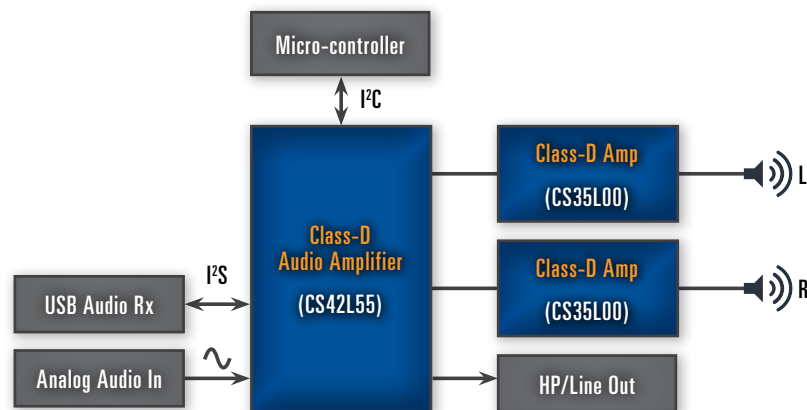
## CONSUMER AUDIO



\* Use CS4953x4 for advance post-processing or Legacy Audio decoding (AC-3, DTS, AAC) if HD Audio Decoding capability is not required

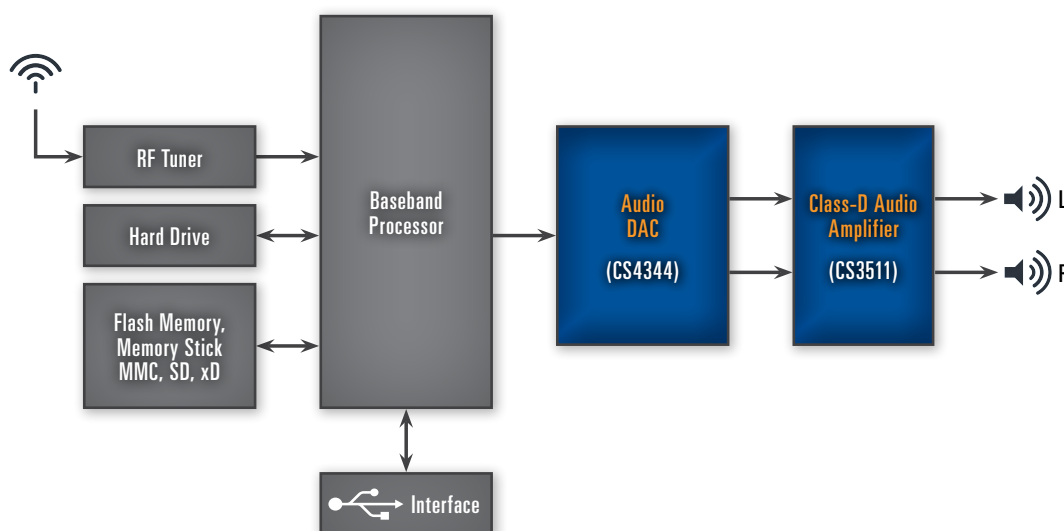
# Desktop Media Speaker System

## CONSUMER AUDIO



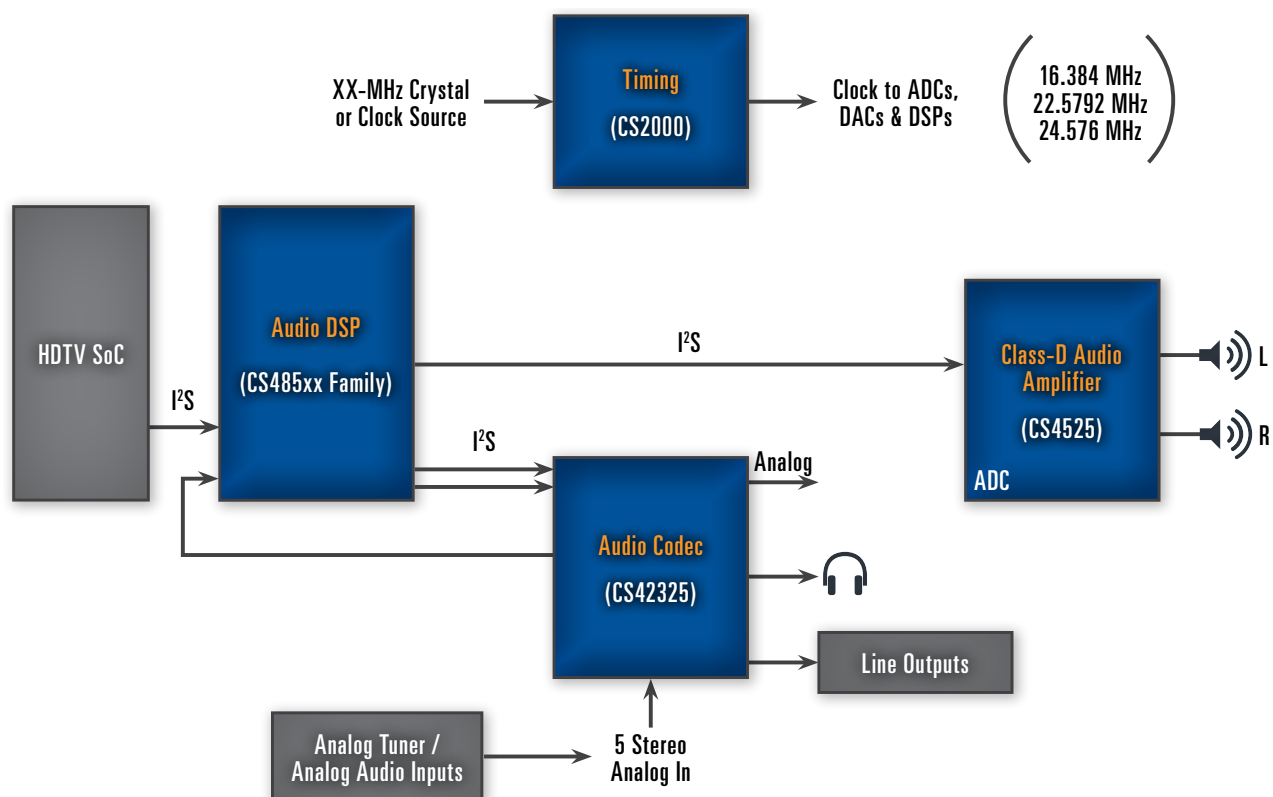
# Digital Audio Broadcasting (DAB) Receiver

CONSUMER AUDIO



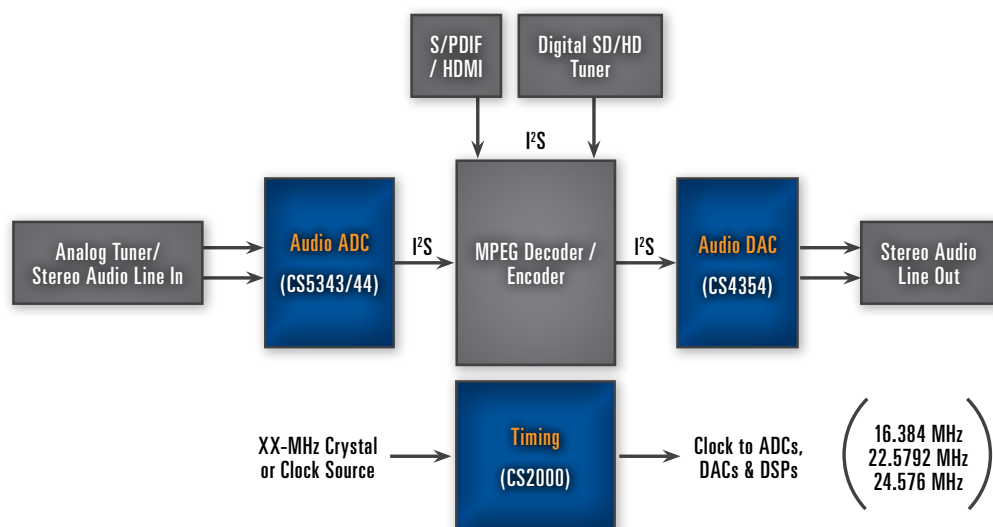
# Digital Television

CONSUMER AUDIO



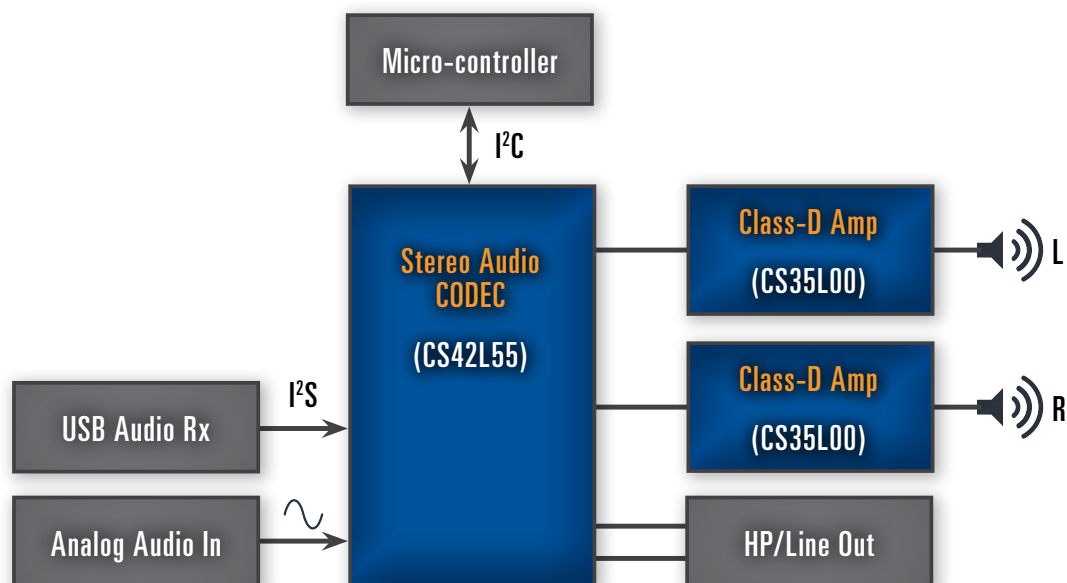
# Digital Set-Top Box

CONSUMER AUDIO



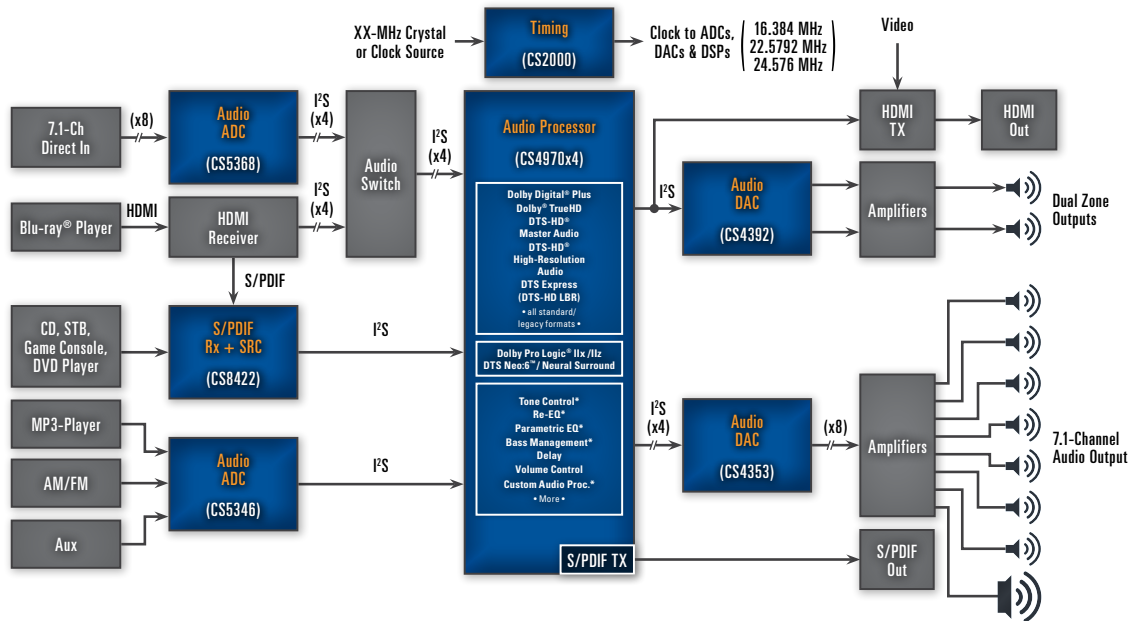
# Docking Station

CONSUMER AUDIO



# HD A/V Receiver

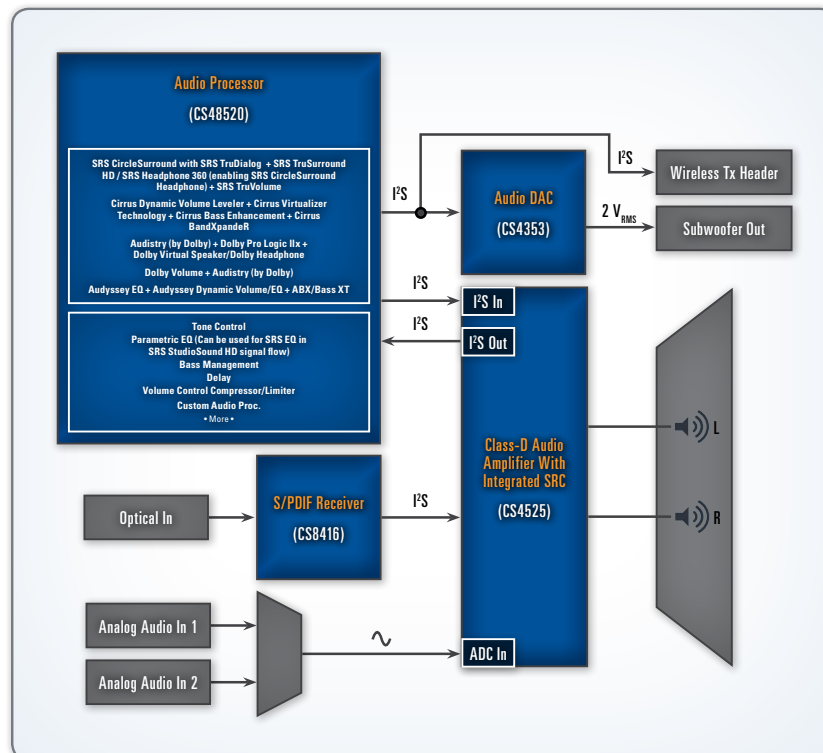
## CONSUMER AUDIO



\*Note: Please refer to HD Audio Processing Concurrency Matrix document for the CS4970x4 document available through your Sales representative or FAE.

# Soundbar, Entry-Level (15W x 2)

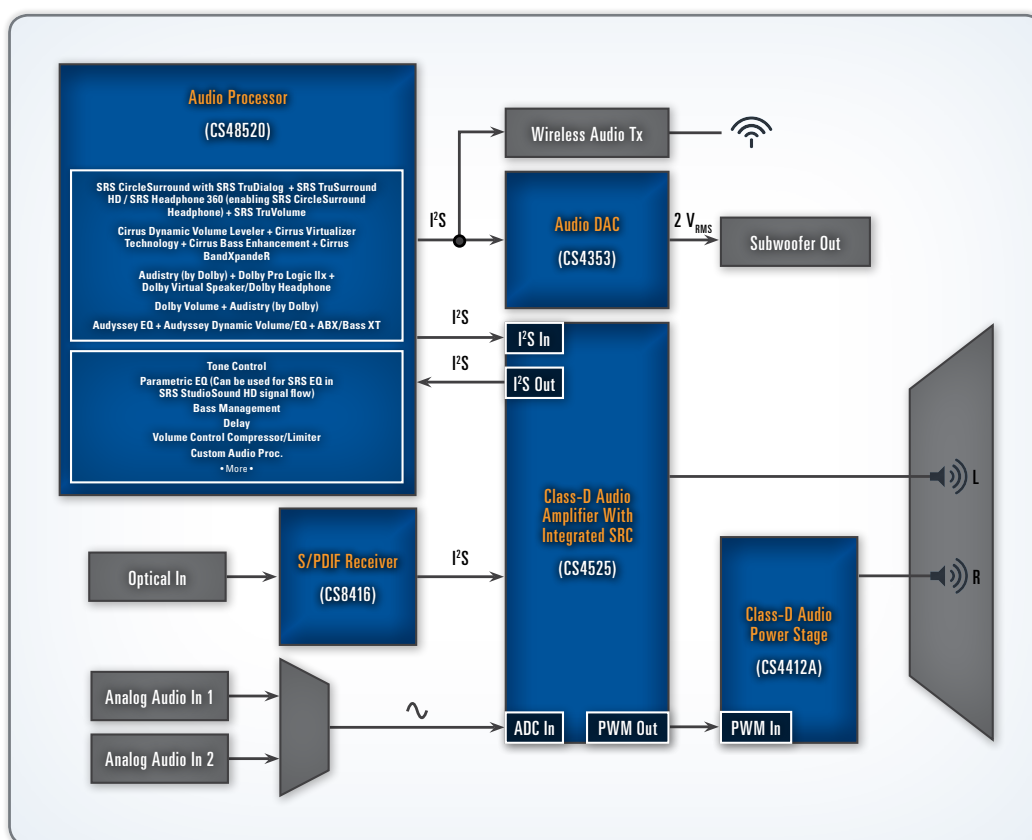
## CONSUMER AUDIO



\*Note: Please contact your sales representative or FAE for the reference design files associated with this block diagram (CRD-SB15Wx2).

# Soundbar, Mid-Level (30W x 2)

CONSUMER AUDIO

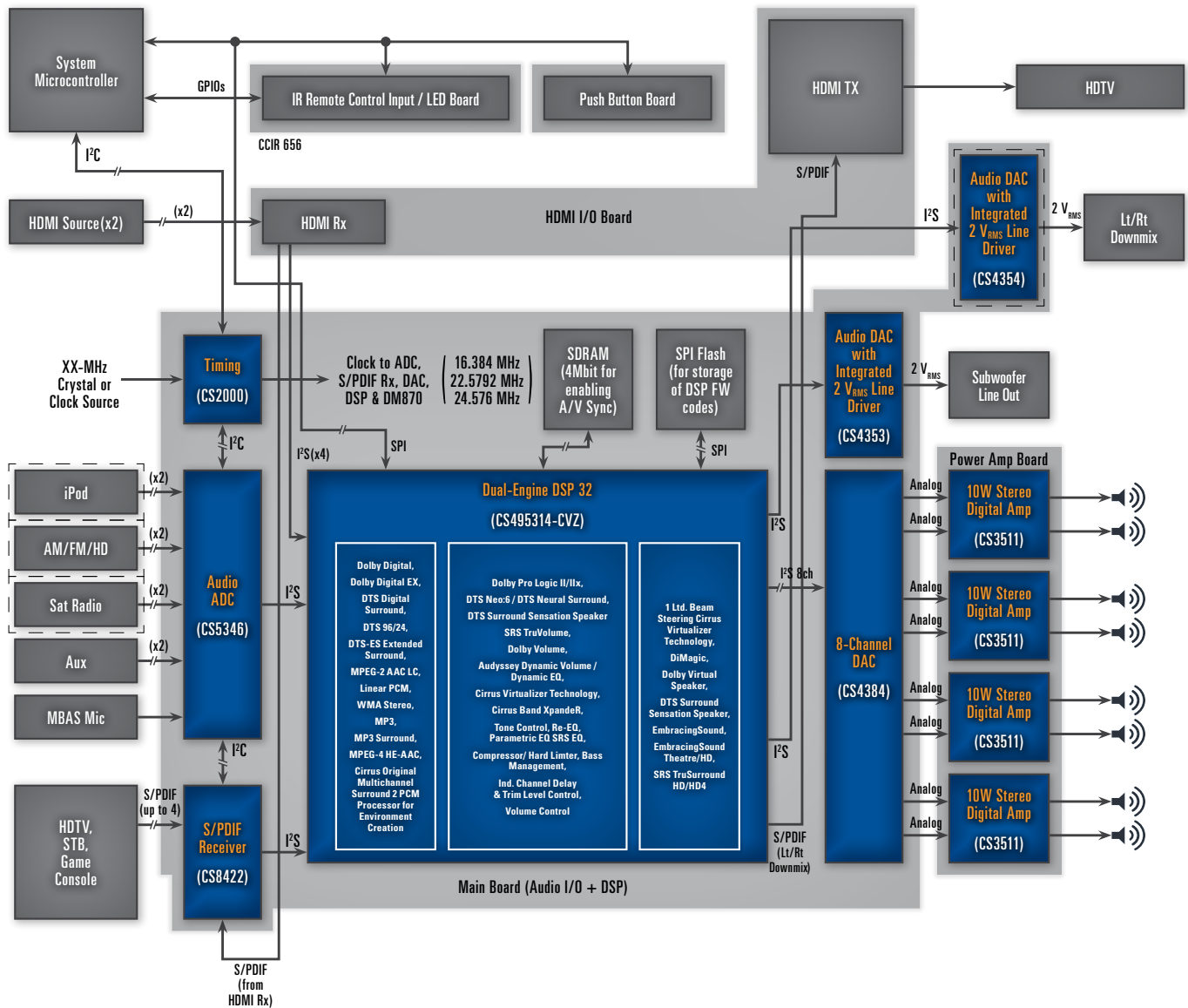


\*Note: The reference design files associated with this block diagram are available for download from [www.cirrus.com/sb](http://www.cirrus.com/sb)



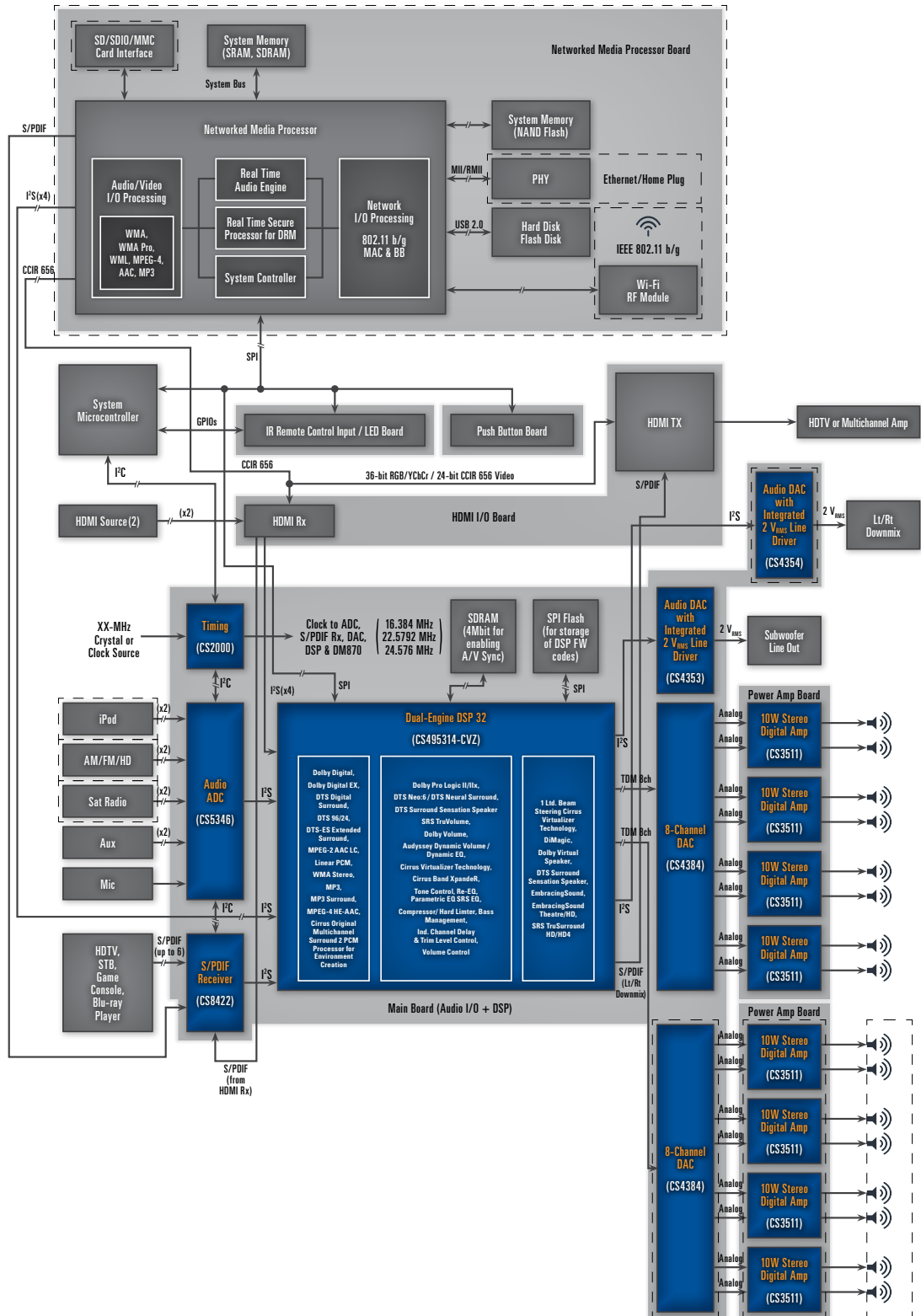
# Sound Projector, Entry-Level (10W x 8)

CONSUMER AUDIO



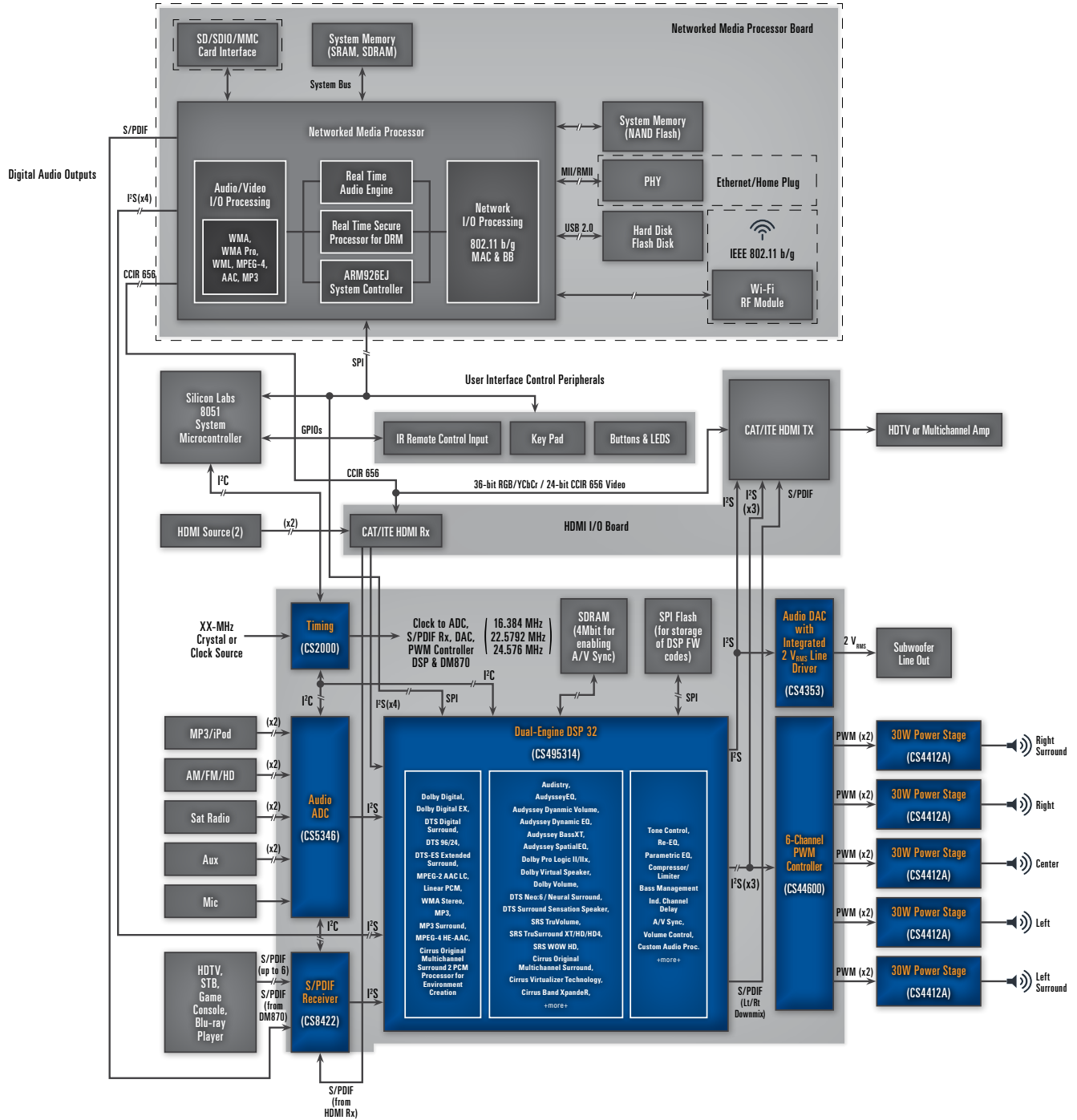
# Media Connected Sound Projector, Mid/High-End (10W x 8/16)

## CONSUMER AUDIO



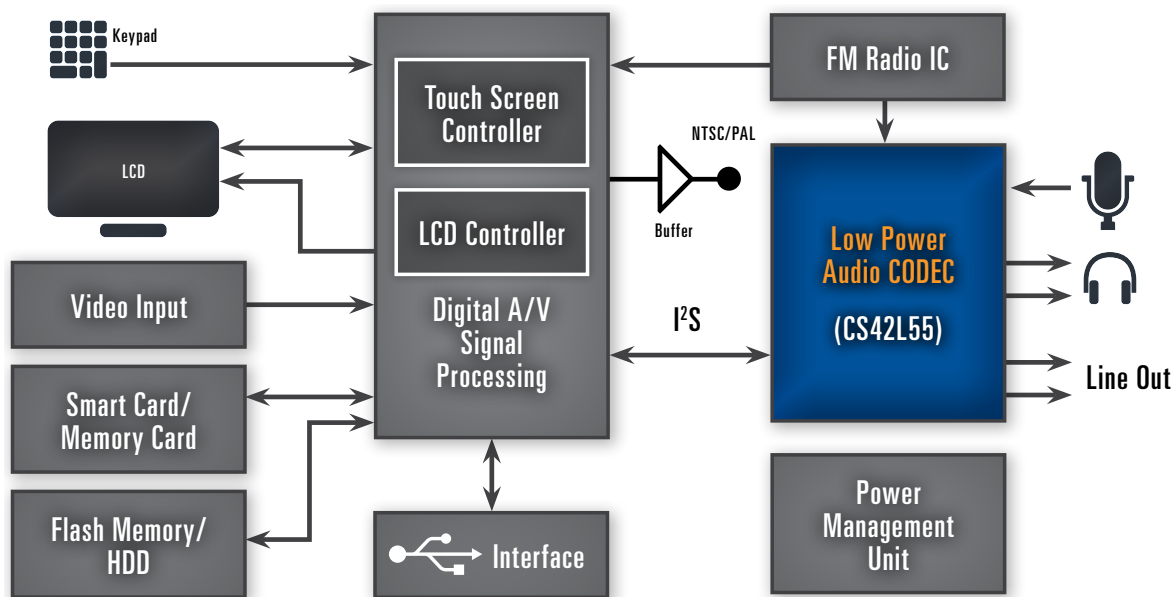
# Media Connected Soundbar, High-End (30W x 5)

## CONSUMER AUDIO



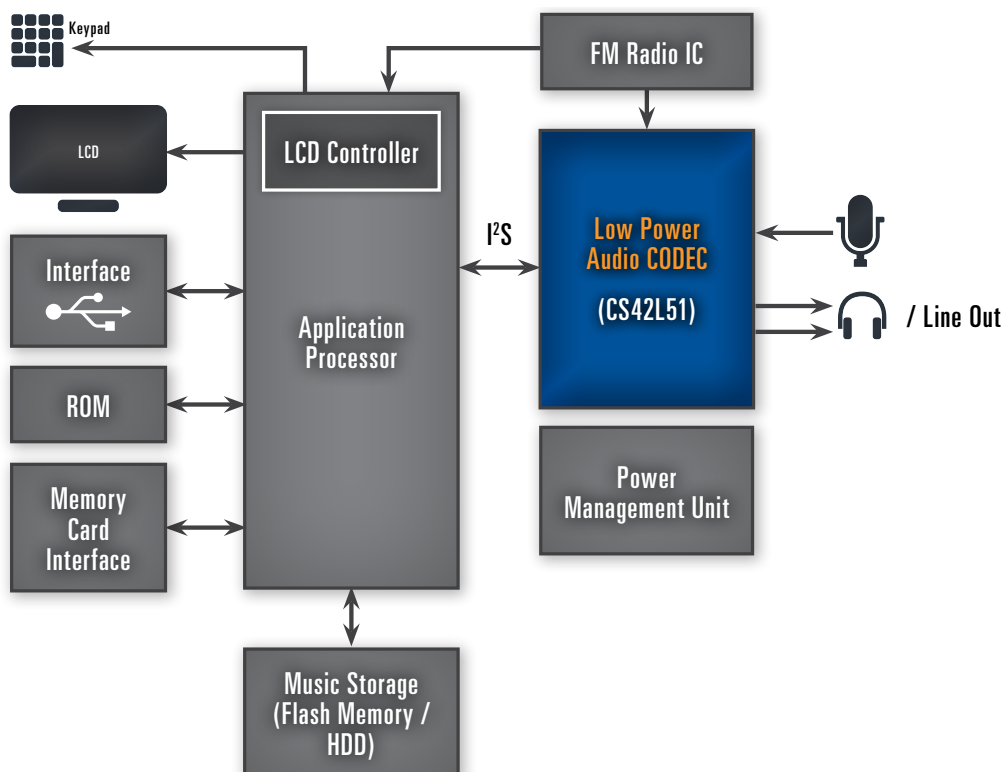
# Portable Media Player

PORTABLE AUDIO



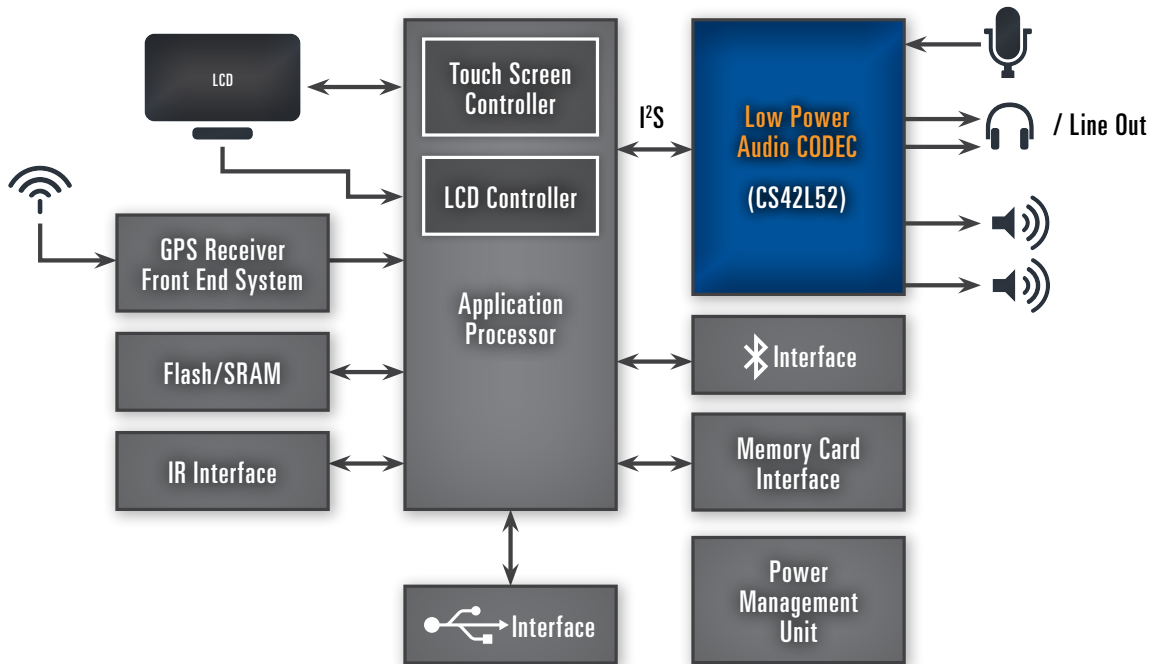
# MP3 Player

PORTABLE AUDIO



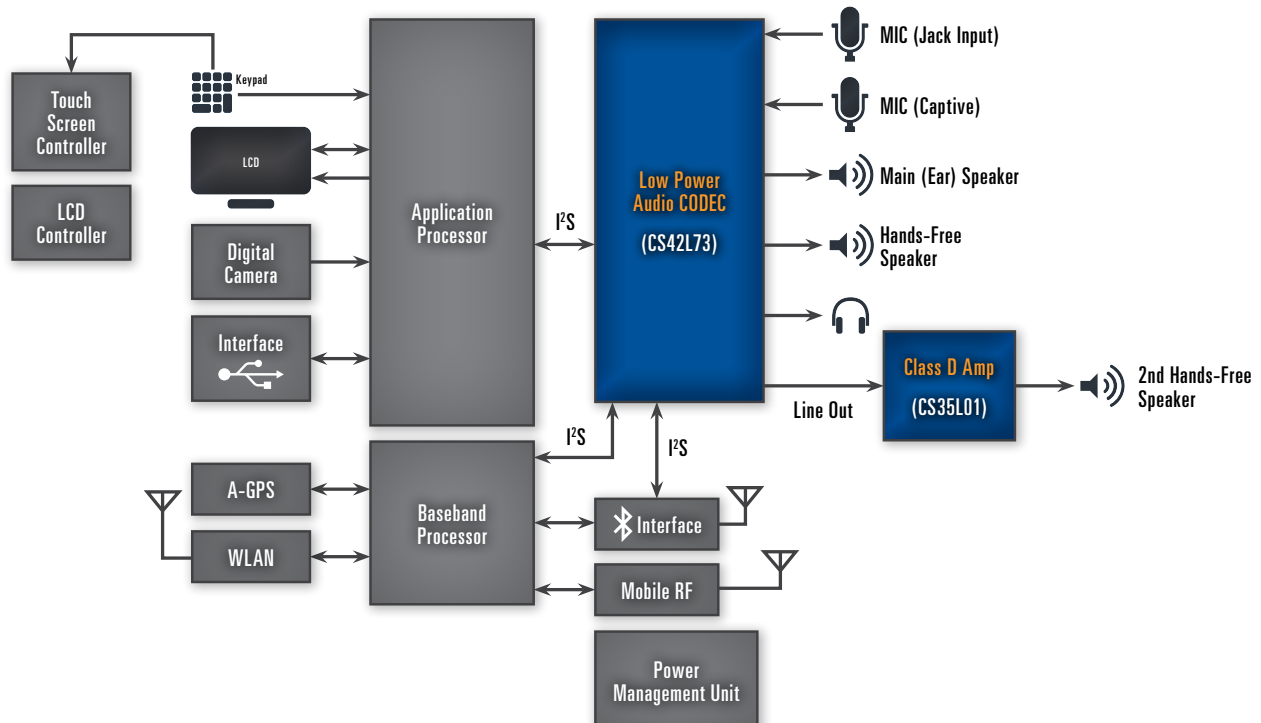
# Portable Navigation Device (PND)

PORTABLE AUDIO



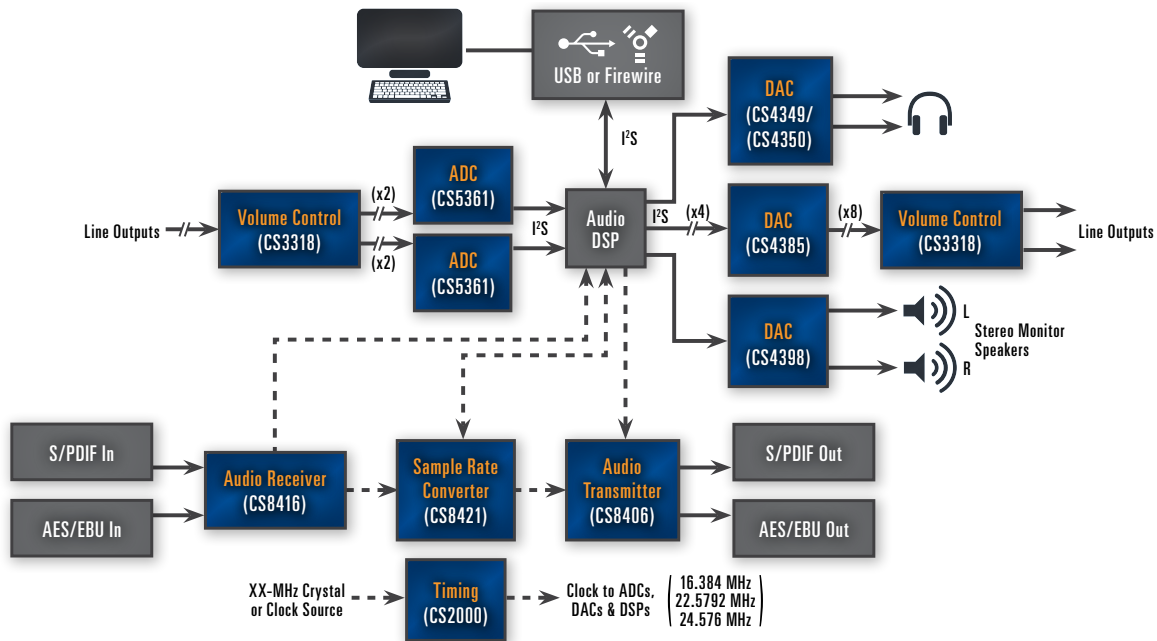
# Smart Phone

PORTABLE AUDIO



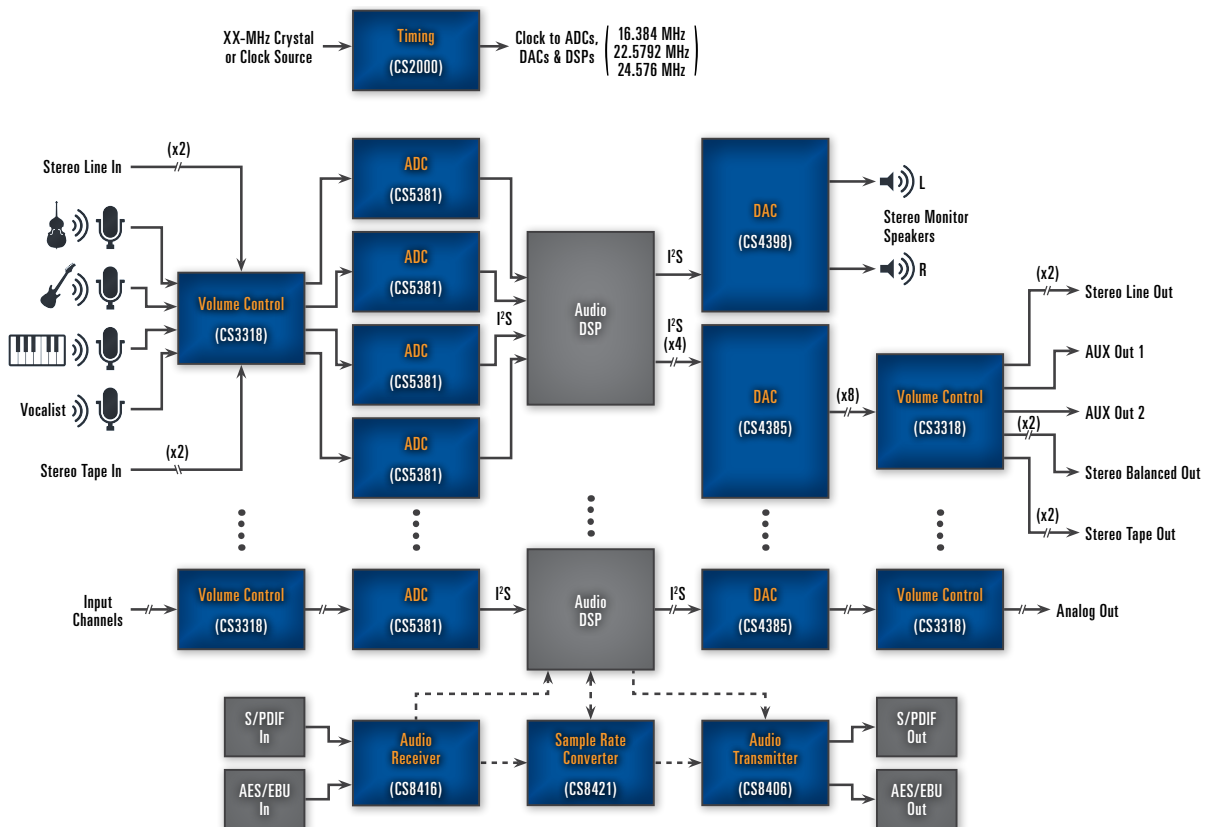
# Audio Interface

PROFESSIONAL AUDIO



# Mixing Console

PROFESSIONAL AUDIO





# Audio Components

## AUDIO SOLUTIONS

### DIGITAL AUDIO PROCESSING

#### AUDIO DSP

- CS485xx Family
- CS4953xx Family
- CS4970x4 Family

#### AUDIO SoC

- CS470xx Family

#### COBRANET

- CS1810xx
- CS4961xx
- CM-1
- CM-2
- EV-2
- CobraCom

### MIXED-SIGNAL AUDIO COMPONENTS

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- CS4272

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#### AC '97 CODECS

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- CS4205
- CS4299

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- CS42432
- CS42435
- CS42436/38
- CS4244
- CS42448
- CS42516/26
- CS42518/28
- CS42888

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- CS42L52
- CS42L55
- CS42L73
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- CS43L22
- CS53L21

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- CS35L01
- CS35L03

#### DIGITAL AMPLIFIERS

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- CS44600/800
- CS4461
- CS4525

#### INTERFACE & SAMPLE-RATE CONVERTERS

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- CS8416
- CS8420
- CS8421
- CS8422
- CS8427

#### TIMING SOLUTIONS

- CS2xxx Family

#### VOLUME CONTROL

- CS3308
- CS3310
- CS3318

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# Audio DSPs

## SPECIFICATIONS

Part	Processor	DSP Tools	Key Firmwares & Features	DSP Core Frequency Temp Range (Multiply Accumulates /Sec)	Package
<b>CS485xx</b>	<b>Tiny, cost effective, mega-performance PCM processors targeted for: mini-systems, DVD receivers, speaker bars, car audio, DTVs (replaces functionality of CS48AU2B and CS48DV2A and CS48DV2B)</b>				
<b>CS48520</b>	Single 32-bit	DSP Composer, ASM, C	4 channel audio PP1 + Micro Condenser	150 MHz~70 °C (300 M MAC/Sec)	48 QFP
<b>CS48540</b>	Single 32-bit	DSP Composer, ASM, C	8 channel audio PP1 + Micro Condenser	150 MHz~70 °C (300 M MAC/Sec)	48 QFP
<b>CS48560</b>	Single 32-bit	DSP Composer, ASM, C	> 8 channel audio PP1 + Micro Condenser	150 MHz~70 °C & 130 MHz~85 °C	48 QFP
<b>CS4953xx</b>	<b>Single-chip multistandard surround sound decoder targeted for playback from analog &amp; S/PDIF sources</b>				
<b>CS495303</b>	Dual 32-bit	DSP Composer, ASM, C	(DD, DDEX, AAC) + PP2	150 MHz~70 °C (600 M MAC/Sec)	128 LQFP
<b>CS495313</b>	Dual 32-bit	DSP Composer, ASM, C	(DD, DDEX, DTS, DTSES, DTS96, AAC) + PP2	150 MHz~70 °C (600 M MAC/Sec)	128 LQFP 144 LQFP
<b>NEW CS495314</b>	Dual 32-bit	DSP Composer, ASM, C	(DD, DDEX, DTS, DTSES, DTS96, AAC) + PP2 + DSP Condenser	150 MHz~70 °C (600 M MAC/Sec)	128 LQFP
<b>CS4970x4</b>	<b>Single-chip multistandard surround sound decoder targeted for playback from Blu-ray Disc® players, &amp; all analog, S/PDIF &amp; HDMI® sources</b>				
<b>CS497014</b>	Dual 32-bit	DSP Composer, ASM, C	(DD+, DTHD, DD, DDEX, DTS, AAC) + PP2 + DSP Condenser	150 MHz~70 °C (600 M MAC/Sec)	128 LQFP
<b>CS497024</b>	Dual 32-bit	DSP Composer, ASM, C	(DD+, DTHD, DTSHRA, DTSMA, DTSLB, DTSES, DTS96, DD, DDEX, DTS, AAC) + PP2 + DSP Condenser	150 MHz~70 °C (600 M MAC/Sec)	128 LQFP

NEW

# Audio SOCs (DSP with Integrated Mixed-Signal)

## SPECIFICATIONS

Part	Processor	Speed (MIPS)	Car Audio DSPs	General Audio DSPs	Resolution (bits)	Dynamic Range (dB)	A/D Channels	D/A Channels	Comments	Package
<b>CS470xx</b>	<b>Tiny, cost effective, mega-performance PCM processors with integrated CODEC targeted for mini-systems, DVD receivers, speakerbars, car audio, DTVs</b>									
<b>NEW</b> <b>CS47024</b>	Single 32-bit	150	CS47024C-DQZ	CS47024C-CQZ	24	108 DAC 105 ADC	2	4	2 Ch ADC w/ 5:1 MUX, 4 Ch DAC, S/PDIF Tx, SRC (2 Ch)	100 LQFP
<b>NEW</b> <b>CS47028</b>	Single 32-bit	150	CS47028C-DQZ	CS47028C-CQZ	24	108 DAC 105 ADC	2	8	2 Ch ADC w/ 5:1 MUX, 8 Ch DAC, S/PDIF Rx/Tx, SRC (8 Ch)	100 LQFP
<b>NEW</b> <b>CS47048</b>	Single 32-bit	150	CS47048C-DQZ	CS47048C-CQZ	24	108 DAC 105 ADC	4	8	4 Ch ADC w/ 5:1 MUX on one 2 Ch ADC, 8 Ch DAC, S/PDIF Rx/Tx, SRC (8 Ch)	100 LQFP

Note: Firmware features similar to CS485xx Family

# Algorithm & Nomenclature Abbreviations

Decoding Algorithm & Nomenclature Abbreviation Table	
AAC = MPEG-2 AAC LC Multichannel	DTSBRA = DTS® High Resolution Audio
DD = Dolby Digital®	DTSBR = DTS® Express
DD+ = Dolby Digital® Plus	DTSMA = DTS® Master Audio
DDEX = Dolby Digital® Surround EX®	HE-AAC = MPEG-4 HE-AAC
DTHD = Dolby® TrueHD / MLP	MP3 = MPEG 1, Layer III
DTS = DTS Digital Surround™	MPEG = MPEG 2, Layer II Stereo & Multichannel
DTS96 = 96 kHz/24-bit	PP = Post-Processing
DTS-ES = DTS-ES™ Matrix/Discrete	
Post-Processing (PP1) Inclusion & Algorithm Abbreviation Table	
CBM = Cross-Bar Mixer	PLIIZ = Dolby Pro Logic IIz 7.1
CS2 = SRS CircleSurround II / SRS CS Auto	REEQ = THX® Cinema Re-EQ™
CSHP = SRS CircleSurround Headphone, which includes SRS CircleSurround and SRS Headphone 360	SSHP = DTS Surround Sensation Headphone
DC = SRS Dialog Clarity	SSS = DTS Surround Sensation Speaker
DH = Dolby Headphone® 2	TB = SRS® TruBass®
DTSNER = DTS Neural Surround	TC = Tone Control
DVL = Cirrus® Dynamic Volume Leveler	TD = SRS TruDialog, part of SRS StudioSound HD
DVS = Dolby® Virtual Speaker® 2	TEX = THX® Surround EX™
L7 = Logic7™	THX = THX® Cinema
LIM = Compressor/Limiter	TSHD = SRS® TruSurround® HD/HD4
NEO = DTS:Neo6™	TSXT = SRS® TruSurround XT®
NER = Neural-THX® Surround	TUX = THX® Select2/Ultra2™ Surround EX
PL = Dolby® Pro Logic®	TV = SRS® TruVolume®
PLII = Dolby® Pro Logic® II	WOW™ = SRS® WOW™
PLIIX = Dolby® Pro Logic® IIx	WOWHD™ = SRS® WOW HD™
PLIIZ = Dolby Pro Logic IIz 7.1	
Post-Processing (PP2) includes all of the above + Inclusion & Algorithm Abbreviation Table	
AUD = Audistry®	DYNVOL = Audyssey® Dynamic Volume®/Dynamic EQ®
DV = Dolby Volume Multichannel	TUX+ = THX® Select2/Ultra2™ Surround EX™
	TV_MC = SRS TruVolume Multichannel

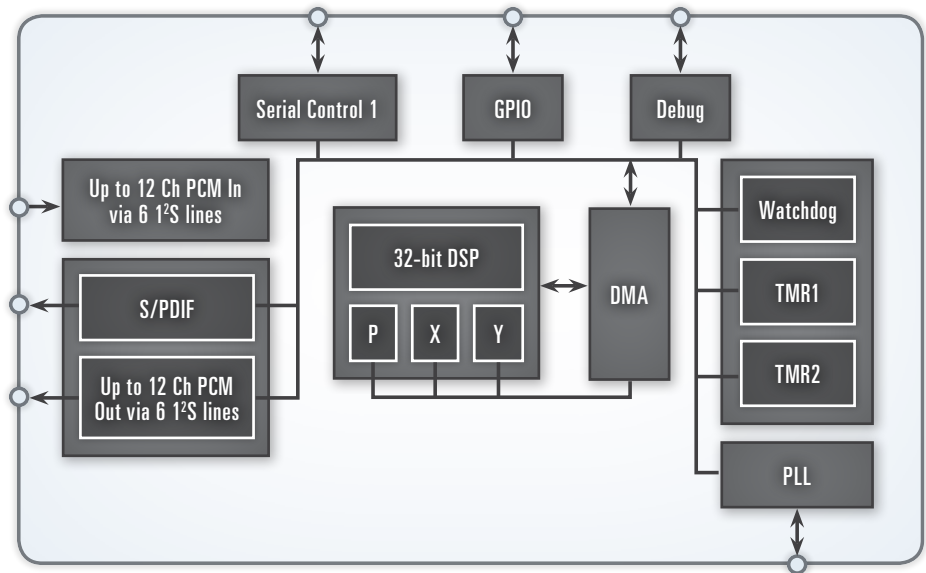
# CS485xx

## CONSUMER AUDIO

### FEATURES

- Multichannel 32-bit audio post processing at 150 MHz
- Up to 4 channels of 32-bit PCM input/output (CS48520)
- Up to 8 channels of 32-bit PCM input/output (CS48540)
- Up to 12 channels of 32-bit PCM input/output (CS48560)
- 192 kHz S/PDIF Tx
- SPI/I2C master/slave serial control port
- Low-power standby mode
- Hardware watchdog timer
- Up to 19 GPIOs available
- Dual clock domains on PCM input
- Dual processing paths on PCM output
- Customer software security keys
- 24K x 32 RAM
- Programmable via DSP Composer with help from Micro Condenser
- Licensed 3rd party audio processing algorithms in ROM
  - Dolby Headphone 2, Dolby Virtual Speaker 2
  - SRS TruSurround XT
  - Dolby ProLogic II & Dolby ProLogic IIx
  - SRS CSII / SRS CS Auto
- Cirrus Original Multichannel Surround (COMS)
- Licensed 3rd party algorithms or custom firmware can be downloaded through SPI/I2C port
  - Audistry
  - Maxx Bass
  - Dolby TV
  - Dolby Volume
  - DTS Neural Surround
  - DTS Neo:6
  - SRS CircleSurround Headphone
  - SRS TruDialog
  - SRS StudioSound HD
  - SRS TruSurround HD/HD4
  - SRS TruVolume
- And more...

Differentiating from the legacy Cirrus multi-standard, multichannel decoders, the CS485xx Family are based on the high-performance 32-bit, fixed-point digital signal processor core, with lower memory, tailoring them for more cost-effective applications associated with multichannel and virtual-channel sound enhancements.



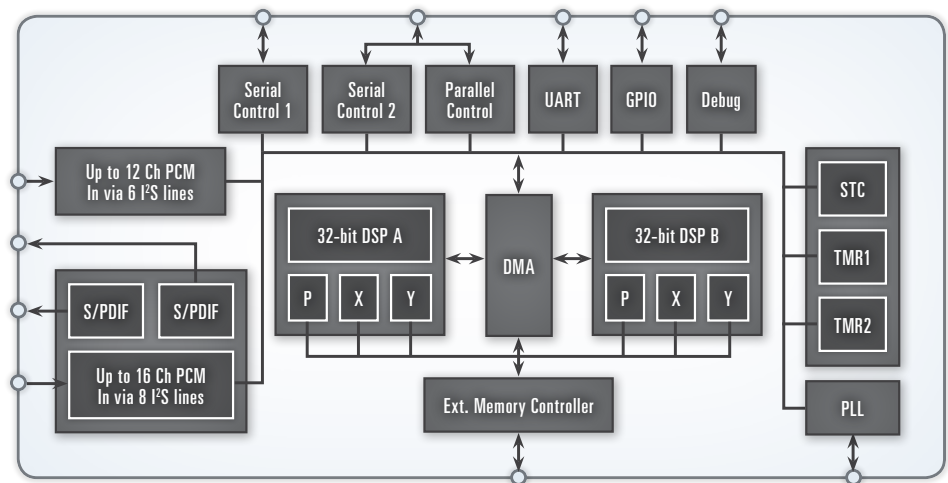
# CS4953xx

## CONSUMER AUDIO

### FEATURES

- Powerful 32-bit, dual core audio DSPs
  - Multi-standard 32-bit audio decoding plus post processing
- Up to 12 channels of 32-bit serial audio input
- 16 channels of 32-bit PCM output with dual 192 kHz
- S/PDIF transmitter
- Two SPI/I<sup>2</sup>C
- SDRAM and serial flash memory support
- Customer software security keys
- Large on-chip X, Y and program RAM & ROM
- Framework™ applications library in ROM
  - Dolby Digital Pro Logic II, Dolby Digital Pro Logic IIx, Dolby Digital EX, Dolby Headphone, Dolby Virtual Speaker 2
  - DTS-ES 96/24™, DTS-ES™ Discrete 6.1, DTS-ES Matrix 6, DTS: Neo6
  - SRS Circle Surround™, SRS TruSurround XT
  - THX Ultra2, THX Surround EX
  - MPEG-2 AAC LC Multichannel
  - WMA 9, MP3
  - Cirrus Original Multichannel Surround (COMS)
  - Crossbar mixer, signal generator
  - Advanced Post-Processor including: 7:1 bass manager, tone control, 12-band parametric EQ, delay, 1:2 upsampler
- Framework applications for download
  - Thomson MP3 Surround
  - Audyssey ABX
  - AudysseyEQ
  - Audyssey Dynamic Volume
  - Audyssey Dynamic EQ
  - Audyssey BassXT
  - Dolby Pro Logic IIz 7.1
  - Dolby Volume Multichannel
  - SRS CircleSurround Headphone
  - SRS TruDialog
  - SRS TruSurround HD/HD4
  - SRS TruVolume Multichannel

The CS4953xx Family is implemented with dual 32-bit fixed point cores. Within each core exists twin 72-bit multiply accumulators. The CS4953xx includes all mainstream audio processing codes in on-chip ROM. This saves external memory for code storage. In addition, the intensive decoding tasks of Dolby Digital EX, MPEG-2 AAC LC multichannel, DTS-ES 96/24, THX Ultra2 Cinema and Dolby Headphone can be accomplished without the expense of external SDRAM memory. With up to 150 MHz per core, the CS4953xx supports the most demanding post processing requirements. The CS49530x supports all license free and Dolby algorithms while the CS49531x also supports DTS technologies.





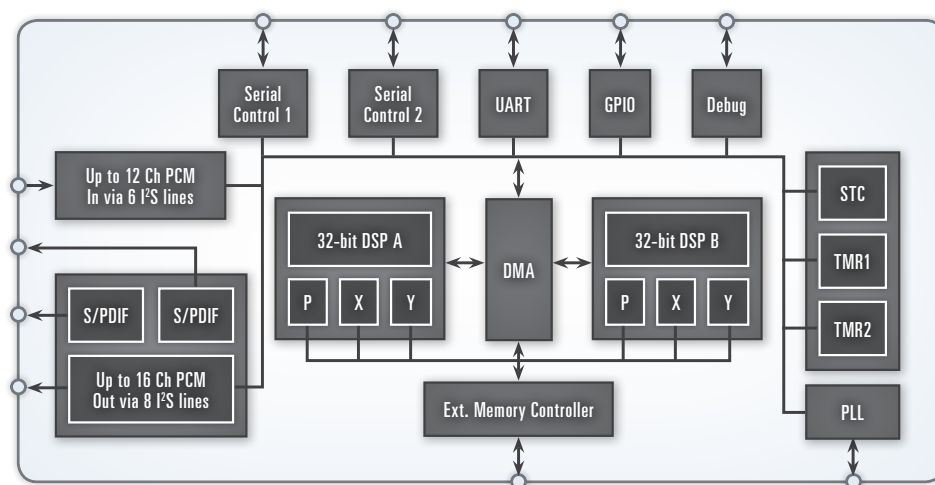
# CS4970x4

## CONSUMER AUDIO

### FEATURES

- Up to 12 channels of 32-bit serial audio input
- Multi-standard 32-bit high definition audio decoding plus post processing
- Supports high-definition audio formats including:
  - Dolby Digital Plus
  - Dolby TrueHD
  - DTS-HD High Resolution Audio\*
  - DTS-HD master Audio\*
- Additional Applications Library
  - Dolby Digital EX, Dolby Pro Logic IIx, Dolby Headphone, Dolby Virtual Speaker
  - DTS-ES 96/24™, DTS-ES™ Discrete 6.1, DTS-ES Matrix 6.1\*
  - AAC Multichannel 5.1
  - SRS® CS2® and TSXT®
  - THX Ultra2, THX ReEQ
  - Crossbar Mixer, Signal Generator
- Advanced Post-processor including:
  - 7.1 Bass Manager, Tone Control, 11- Band Parametric EQ, Delay, 1:2 Upsampler
- Thomson MP3 Surround, DTS Neo:6, Neural Surround, Cirrus Original Multichannel surround 2 (COMS2)
- Audyssey ABX
- AudysseyEQ
- Audyssey Dynamic Volume
- Audyssey Dynamic EQ
- Audyssey BassXT
- Dolby Pro Logic IIz 7.1
- Dolby Volume Multichannel
- SRS CircleSurround Headphone
- SRS TruDialog
- SRS TruSurround HD/HD4
- SRS TruVolume Multichannel

The CS4970x4 DSP family is an enhanced version of the CS4953xx DSP family with higher overall performance. In addition to all the mainstream audio processing codes in onchip ROM that the CS4953xx DSP offers, the CS4970x4 device family also supports the decoding of major high-definition audio formats. The CS4970x4, a dual-core device, performs the high-definition audio decoding on the first core, leaving the second core available for audio post-processing and audio enhancement. The CS4970x4 device will support the most demanding audio post processing requirements. It is also designed as an easy upgrade path to systems currently using the CS495xxx or CS4953xx device with minor hardware and software changes.



\* (CS497024 only)

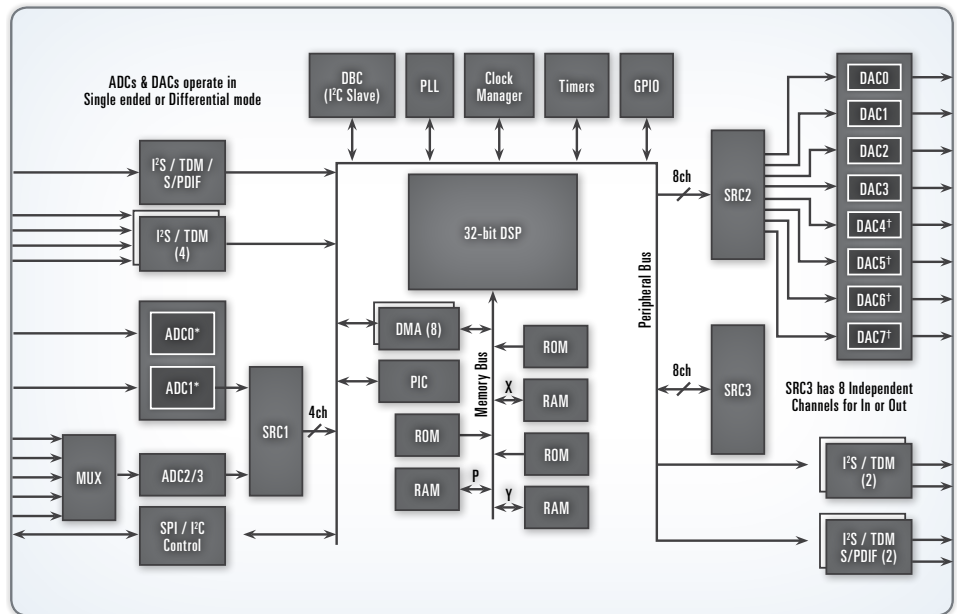
# CS470xx

## CONSUMER AUDIO

### FEATURES

- Multichannel 32-bit audio processing at 150 MHz with dual MACs & 72-bit accumulator
- Advanced Delta-Sigma converter architecture
- Single-ended or differential analog I/O
- Up to 4-channel 24-bit, 105 dB ADC
- Stereo 5:1 analog input MUX
- Up to 8-channel 24-bit, 105 dB DAC
- Integrated 192 kHz S/PDIF Rx and Tx
- Integrated multichannel, reassignable SRCs
- Supports both TDM (Time-division Multiplexed) and standard serial audio formats
- SPI™/I²C® serial control port
- Low-power standby: 350 µW
- 32 K x 32 RAM which is reassignable
- DSP Composer GUI simplifies programming and generation of custom signal processing using extensive library of primitives
- Licensed third party audio processing algorithms in ROM, plus extensive library of Cirrus proprietary downloadable and customizable firmware
- Excellent development tools to simplify system design and provide faster time to market
- Easy to design – most standard processing features and some third party algorithms in ROM
- Best in class analog performance and sound quality
- High level of integration enables small PCB footprint and lower system cost
- No external memory needed

The CS470xx Family audio SoC gives OEMs a cost-effective and simple-to-design audio processing solution with integrated high-performance mixed signal that provides an extensive selection of enhanced audio features to maximize the end user's listening experience within the automotive entertainment space.



\* Only available in the CS47048

† Only Available in the 47028 and CS47048

# CobraNet<sup>®</sup> Transport and Audio Network Processor ICs

## SPECIFICATIONS

Family	Description	CobraNet Part Numbers	Audio Channels over Ethernet	Serial Input/Serial Output Ports	Ethernet Interface	IC Package
<b>CS1810xx</b> <b>CS4961xx*</b>	The CS1810xx family contains CobraNet <sup>®</sup> networked digital audio interface ICs. The CS4961xx family provides digital audio signal processing along with the network interface function.	CS181002 CS496102*	2	One synchronous, capable of supplying up to 2 full-duplex channels at 48 and/or up to 96 kHz sample rates.	Supports 100BASE-Tx, 100 Mbps, full duplex Ethernet, fully compliant with IEEE 802.3u.	144 LQFP
		CS181012 CS496112*	8	Quad synchronous, capable of supplying up to 8 full-duplex channels at 48 and/or up to 96 kHz sample rates.		
		CS181022 CS496122*	16	Quad synchronous, capable of supplying up to 16 full-duplex channels at 48 kHz, or up to 8 channels at 96 kHz sample rates.		

\*The CS4961xx series includes a 32-bit, 120 MIPS digital signal processor for audio processing of any or all channels.

## CobraNet Software Tools

### FEATURES

<b>DSP Conductor™</b>	DSP Conductor™ software is a powerful, graphical tool for rapid, drag-and-drop audio signal processing firmware development on CS4961xx-based platforms, such as the CM-2 module or an OEM's custom hardware. Drawing upon a comprehensive library of DSP functions, an OEM can design the audio processing of a product, then lock the DSP firmware down into the CS4961xx-based CobraNet product. These audio functions can be controlled either by the product's user interface or through remote SNMP commands over the CobraNet Ethernet LAN. Further, any CS4961xx node can be reprogrammed in real-time from a PC on the network, enabling multi-purpose products to serve different audio processing functions for different applications at the push of a button.
<b>CobraCAD™</b>	CobraCAD™ software is a graphical, drag-and-drop design and verification tool for modeling a network of CobraNet-enabled gear and standard Ethernet switches. A library of commercially available, CobraNet-enabled products is the place to start for designing a virtual CobraNet network, then making sure it will perform as required. CobraCad™ software is ideal for consultants and integrators preparing a bid for a client and for installers and expert end users who need to visualize the network before or after deployment.
<b>CobraNet<sup>®</sup> Discovery</b>	CobraNet <sup>®</sup> Discovery is a CobraNet network maintenance utility that automatically discovers CobraNet devices on the network, configures them and queries and reports the working state of a CobraNet network and its devices. Discovery also provides a CobraNet firmware update function.

# CobraNet System Modules and Reference Designs

## SPECIFICATIONS

Product	Description	CobraNet Part Numbers	Audio Channels over Ethernet (full-duplex)	Serial Input/Output Ports	Ethernet Interface	Integrated DSP (MIPS)	Board Dimensions
<b>CM-1</b>	Digital audio network interface module with dual Ethernet ports	See your Cirrus Logic sales representative for available models.	32	Quad synchronous, up to 32 channels at 48 and/or up to 96 kHz sample rates	100BASE-Tx, 100 Mbps, full duplex Ethernet, fully compliant with IEEE 802.3u	—	3.5" X 3.5"
<b>CM-2</b>	Digital audio network interface module with dual Ethernet ports and audio DSP (available as reference design)	CPB181012-CM2, CPB181022-CM2 and CPB496122-CM2 (all are available with female-bottom or male-top headers)	16	Quad synchronous, capable of supplying up to 16 full-duplex channels at 48 kHz sample rate or up to 8 full-duplex channels at 96 kHz sample rate	100BASE-Tx, 100 Mbps, full duplex Ethernet, fully compliant with IEEE 802.3u	32-bit DSP, 120 MIPS	3.5" X 3.5"
<b>EV-2</b>	CobraNet evaluation and development platform for use with the CM-1 and CM-2 modules	CDB-496122-EV2	16	One digital AES3 input stream (two channels) or one digital AES3 output stream (two channels). Two analog audio input channels, two analog audio output channels	100BASE-Tx, 100 Mbps, full duplex Ethernet, fully compliant with IEEE 802.3u	32-bit DSP, 120 MIPS	8" X 7"
<b>CobraCom</b>	CobraNet microphone and network-powered loudspeaker reference design	CRD-CobraCom	16	Using the CS4961xx series provides up to 16 audio channels with audio DSP capability	100BASE-Tx, 100 Mbps, full duplex Ethernet, fully compliant with IEEE 802.3u and 802.3af Power-over-Ethernet	32-bit DSP, 120 MIPS	5.4" X 4"

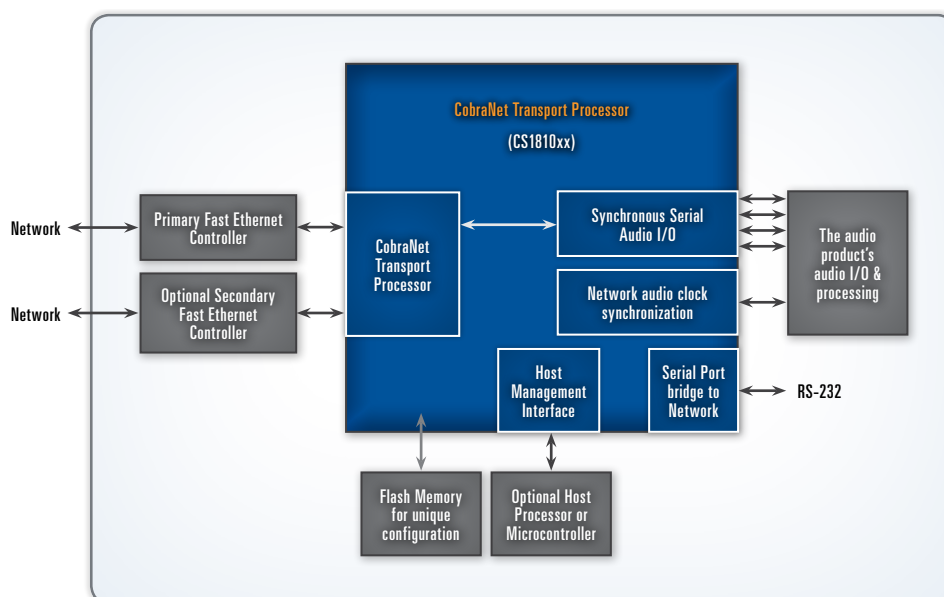
# CS1810xx

## COBRANET TRANSPORT PROCESSORS

### FEATURES

- Implements the CobraNet standard for synchronous, networked digital audio for immediate compatibility with other CobraNet enabled audio products
- Compatible with standard, IEEE 802.3 Ethernet technology and network products
- Maintains a sub-nanosecond-jitter audio clock synchronized across the network of devices for precise audio processing
- Three IC models provide networking of 2, 8 or 16 full duplex, pro quality audio channels
- Digital audio sample sizes of 16, 20, and 24 bits
- Pro audio sample rates of 48 and 96 kHz
- Transport latency configurable for 5.33, 2.66, or 1.33 ms between similarly configured devices across a network
- Quad 32-bit synchronous serial digital audio I/O ports interface flexibility to the product's custom audio processing functions
- Asynchronous serial port bridges RS-232, RS-485 to and from other devices on the network, enabling remote status and control
- Available in a lead-free, surface mount, 144-pin LQFP

The CS1810xx family provides an easy way for manufacturers to add CobraNet, the de facto industry standard for networked digital audio, to an audio product. Leveraging standard Ethernet technology, the CS1810xx implements the CobraNet transport protocol along with managing other network traffic directed at the audio product.



### APPLICATIONS

- Ceiling and Self-Powered Speakers
- Facility Audio Distribution
- Media Servers
- Microphone Preamps
- Mixing Consoles
- Paging Stations and Intercoms
- Power Amplifiers
- Signal Processors
- Voice Audio Recording, Archival and Playback

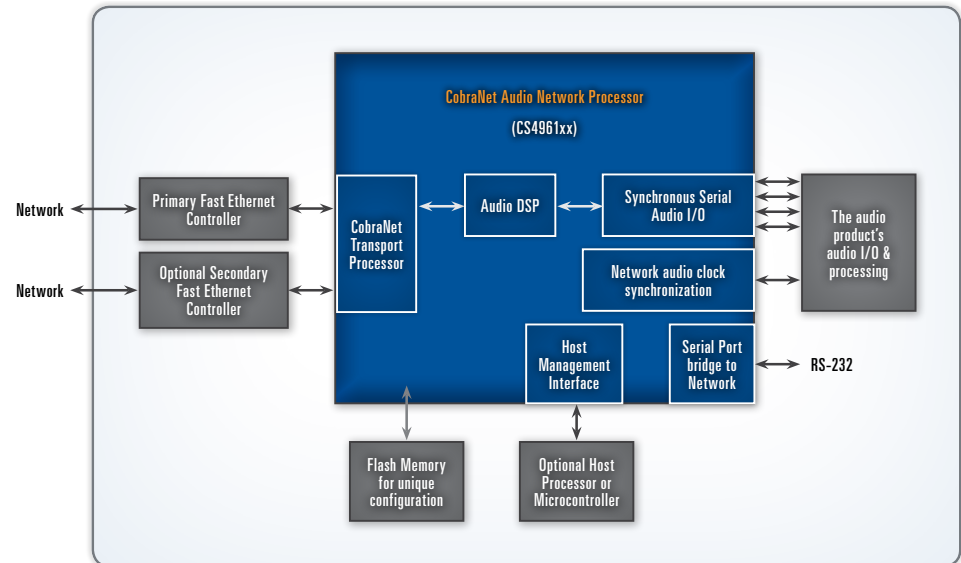
# CS4961xx

## COBRANET AUDIO SYSTEMS PROCESSORS

### FEATURES

- Provides all functions of the CS1810xx family and is pin-for-pin, drop-in compatible
- A 32-bit, fixed-point, 120 MIPS DSP core provides audio signal processing to the digital audio streams transported over CobraNet
- Integration of CobraNet transport and audio DSP reduces overall system costs, complexity, and development effort
- Audio signal processing can be applied to audio channels arriving from the network to the product, or from the product on their way to the network
- DSP Conductor Windows-based software provides a graphical, drag-and-drop DSP programming environment, eliminating the need for assembly of C coding of audio functions
- Audio DSP functions created with DSP Conductor can be locally controlled by the OEM's user interface or remotely over the CobraNet network through SNMP commands, creating new ways to manage an audio network

The CS4961xx family of ICs takes CobraNet networked digital audio to the next level through the addition of a high-performance audio DSP. Any and all audio streams flowing between the network and the audio product can be locally processed through the use of common functions such as filters, equalizers, compressors, delay lines, gain blocks, and level meters. The CS4961xx and CS1810xx families are completely pin-compatible, allowing the development of different models of audio products with and without local DSP processing.



### APPLICATIONS

- Ceiling and Self-Powered Speakers
- Facility Audio Distribution
- Media Servers
- Microphone Preamps
- Mixing Consoles
- Paging Stations and Intercoms
- Power Amplifiers
- Signal Processors
- Voice Audio Recording, Archival and Playback



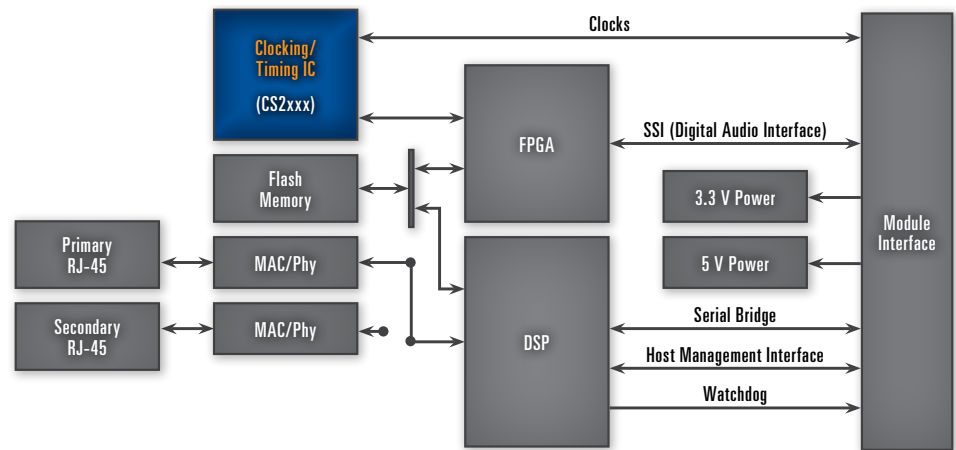
# CM-1

## COBRANET MODULE

### FEATURES

- 100BASE-Tx Ethernet interface—100 Mbps, full-duplex Ethernet, fully compliant with IEEE 802.3u Standard
- Secondary 100BASE-Tx Ethernet interface—redundant network connection for fault tolerance
- Quad synchronous serial output ports — capable of supplying 32 channels at 48 or 96 kHz sample rates
- Quad synchronous serial input ports—capable of receiving 32 channels at 48 or 96 kHz sample rates
- Studio-grade, low-jitter clock source—less than 1 ns of jitter
- High-speed parallel host port interface—interfaces to an optional external control processor
- SNMP agent—standards-based Ethernet control, monitoring and management
- TFTP support—firmware updates over the network
- Low latency—selectable 1.33, 2.66 or 5.33 ms across network
- Optional remote power through RJ-45 connection—for powering via the Cat-5 Ethernet connection. External circuitry required
- Asynchronous serial I/O port—bridge serial control data over Ethernet
- Status LEDs—link, activity and CobraNet conductor status for each Ethernet jack
- Order CM-1 or CM-1-FW option—the CM-1 Ethernet connector includes an RJ-45 jack with integrated transformer isolation. The CM-1-FW option and includes solder points to be wired to external Ethernet connector

The CM-1 is a DSP based solution providing an interface in the form of a compact, low-power module. Featuring up to 32 simultaneous bi-directional audio channels, the CM-1 is designed for easy integration into a wide variety of audio products such as signal processors, mixers, amplifiers and powered speakers.



### APPLICATIONS

- Ceiling and Self-Powered Speakers
- Facility Audio Distribution
- Media Servers
- Microphone Preamps
- Mixing Consoles
- Paging Stations and Intercoms
- Power Amplifiers
- Signal Processors
- Voice Audio Recording, Archival and Playback

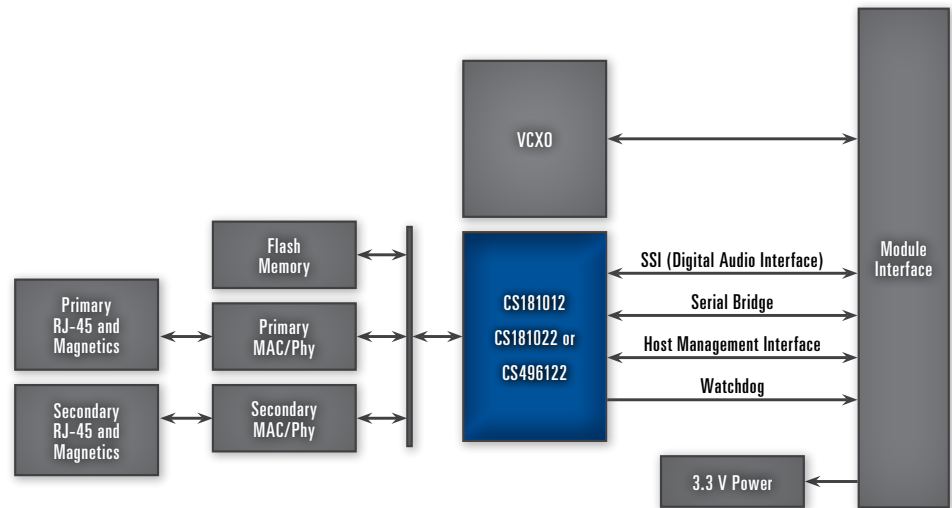
# CM-2

## COBRANET MODULE

### FEATURES

- 100BASE-Tx Ethernet interface—100 Mbps, full-duplex Ethernet, fully compliant with IEEE 802.3u Standard
- Secondary 100BASE-Tx Ethernet interface—redundant network connection for fault tolerance
- Quad synchronous serial output ports—capable of supplying up to 16 full-duplex channels at 48 or 96 kHz sample rates
- Quad synchronous serial input ports—capable of receiving up to 16 full-duplex at 48 or 96 kHz sample rates
- Studio-grade, low-jitter clock source—less than 1 ns of jitter
- High speed parallel host port interface—interfaces to an optional external control processor
- SNMP agent—standards-based Ethernet control, monitoring and management
- TFTP support—firmware updates over the network
- Low latency—selectable 1.33, 2.66 or 5.33 ms across network
- Optional remote power through RJ-45 connection—for powering via the Cat-5 Ethernet connection. External circuitry required
- Asynchronous serial I/O port—bridge serial control data over Ethernet
- Status LEDs—link, activity and CobraNet conductor status for each Ethernet jack
- License/royalty-free and available as a module or reference design with all deliverables (BOM, schematics, source files) on [www.cirrus.com](http://www.cirrus.com)

The CM-2 is based on the highly integrated CS1810xx or CS4961xx CobraNet Silicon Series, providing an interface in the form of a compact, low-power, low-cost module. Featuring 2, 8 or 16 bi-directional channels, the CM-2 is designed to be easily integrated into a wide variety of audio products such as signal processors, mixers, amplifiers and self-powered loudspeakers.



### APPLICATIONS

- Ceiling and Self-Powered Speakers
- Facility Audio Distribution
- Media Servers
- Microphone Preamps
- Mixing Consoles
- Paging Stations and Intercoms
- Power Amplifiers
- Signal Processors
- Voice Audio Recording, Archival and Playback

# EV-2

## COBRANET EVALUATION KIT

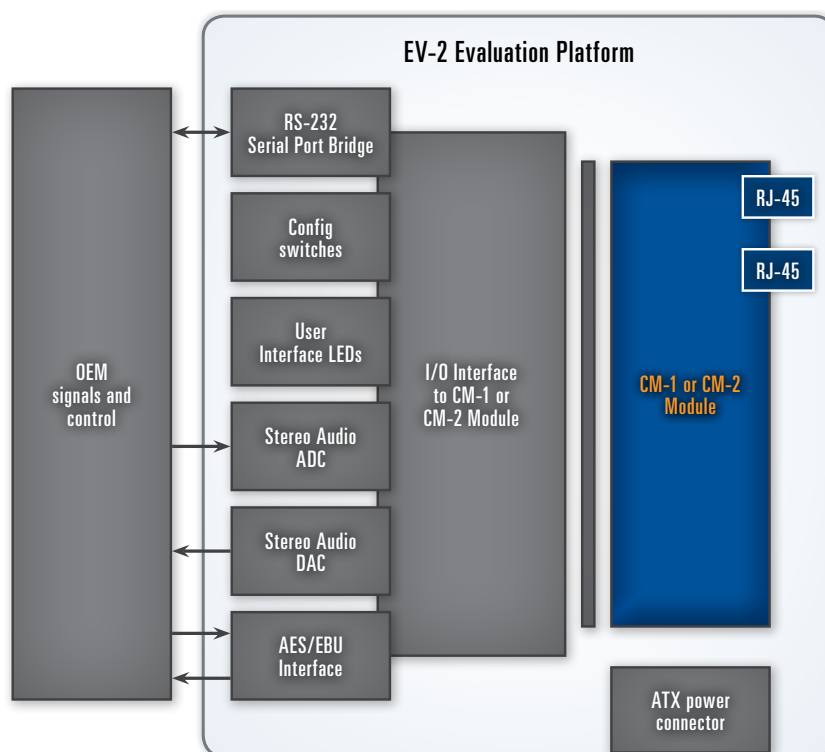
### FEATURES

- Complete, bench-top circuit board platform for evaluating the CobraNet CM-1 and CM-2 modules and for OEM product development
- 2-channel audio ADC input converts to 16, 20 or 24-bit stereo data at 48 or 96 kHz sample rates
- 2-channel 48 or 96 kHz digital audio DAC converts to stereo analog audio output
- Supports AES3 input and output streams
- RS-232 interfaces provide communication with the platform and the CM-2 module
- Configurable sine wave test tones provide an alternate audio test source
- Hex switches for setting location ID of the CM-2 and user development
- 3 LED indicators are supplied for user development

The EV-2 platform provides an easy way to evaluate and develop with CobraNet modules. The EV-2 evaluation kit comes standard with CM-2 modules but will work equally well with CM-1 modules if needed.

The EV-2 platform and kit are available for purchase, after entering into a CobraNet non-disclosure agreement. For additional information on how to obtain the EV-2 kit or CobraNet licensing information, please contact your local Cirrus Logic sales representative, or see [www.cirrus.com](http://www.cirrus.com) for contact information.

The EV-2 Kit includes two EV-2 boards, two CM-2 CobraNet modules, one Ethernet cross-over cable and one software CD.



# CobraCom™

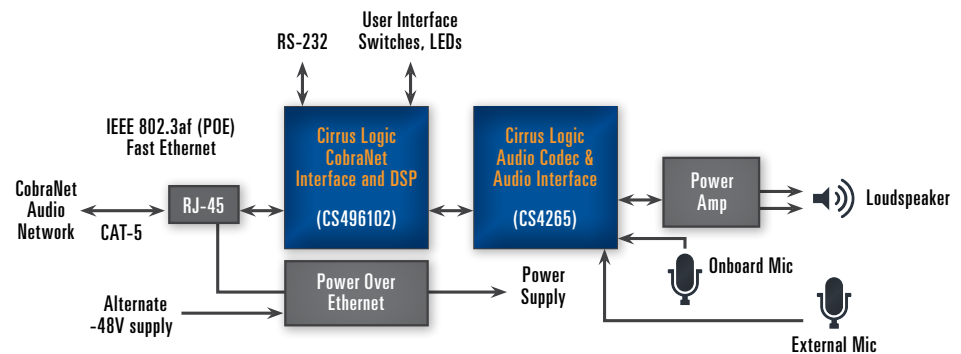
## COBRACOM NETWORK-POWERED COBRANET REFERENCE DESIGN

### FEATURES

- Two pro quality, uncompressed digital audio channels in, two channels out (2x2)
  - Optional upgrade to 8x8 and 16x16 channel support
- Configurable 16, 20 and 24-bit digital audio resolutions at 48 and 96 kHz audio sample rates
- Local 32-bit audio DSP processing
  - DSP Conductor™ graphical audio signal processing development tool
- IEEE 802.3af Power-over-Ethernet (PoE) delivers 15.4 W of total power at 100 m
  - Use CobraCom Reference platform with standard, off-the-shelf PoE Ethernet switches
  - No need for custom, zone-limited matrix amplifiers
  - Higher power possible at shorter distance
- Class AB loudspeaker power amplifier delivers 6 W average, 15 W peak into 8 Ω
- Popguard® technology reduces loudspeaker output clicks and pops
- Dual, board-level electret and external mics
- 2x2 GPIO for simple user interface
- RS-232 for serial communication
- 2-layer PCB measuring 5.4" x 4"
- Optional external—48 V network power

The CobraCom Reference Design allows for easy implementation of network-powered CobraNet digital audio devices. Through real-time transport of uncompressed digital audio over ubiquitous Ethernet, CobraNet combines the routing flexibility of a network with pro quality, multichannel audio. By providing one channel of speaker level audio output, one channel of microphone input, 32-bit audio DSP, GPIO for a simple user interface, RS-232 and standard Power-over-Ethernet (PoE) power conditioning, many different networked products can be developed.

For example, CobraCom Reference platform can be used to create an integrated, multizone, high fidelity music, intercom and audio surveillance system running over standard Ethernet infrastructure, perhaps sharing the network with IP cameras. Local audio DSP can be applied to such tasks as automated background music ducking, zone equalization, hands-free intercom, ambient audio-driven security system triggering, to name only a few. Cirrus Logic's DSP Conductor software makes DSP function design a snap, with no programming required.



# Audio A/D Converters

## SPECIFICATIONS

Part	Resolution (bits)	Dynamic Range (dB)	THD+N (dB)	Sample Rate (kHz)	Analog Inputs	Power Supply (V)	Comments	Package
<b>CS5340</b>	24	101	-94	192	Single-ended	VA = 3.3 or 5, VD = 3.3 or 5, VL = 1.8 to 5	Pin compatible with CS5341	16 TSSOP
<b>CS5341</b>	24	105	-98	192	Single-ended	VA = 3.3 or 5, VD = 3.3 or 5, VL = 1.8 to 5	Pin compatible with CS5340	16 TSSOP
<b>CS5342</b>	24	105	-98	192	Single-ended	VA = 3.3 or 5, VD = 3.3 or 5, VL = 2.5 to 5	384*Fs MCLK	16 TSSOP
<b>CS5343/44</b>	24	98	-92	96	Single-ended	VA = 3.3 or 5	CS5343—I <sup>2</sup> S CS5344—LJ	10 TSSOP
<b>CS5346</b>	24	103	-95	192	Single-ended	VA = 5, VD = 3.3, VL = 3.3 to 5	6:1 input MUX, PGA, mic pre-amp, high input impedance	48 LQFP
<b>CS5351</b>	24	108	-98	192	Single-ended	VA = 5, VD = 3.3 or 5, VL = 2.5 to 5	Functionally compatible with CS5361	24 SOIC 24 TSSOP
<b>CS5361</b>	24	114	-105	192	Differential	VA = 5, VD = 3.3 or 5, VL = 2.5 to 5	Pin compatible with CS5381	24 SOIC 24 TSSOP
<b>CS5364/66/68</b>	24	114	-105	192	Differential	VA = 5, VD = 3.3 or 5, VLS/VLC = 1.8 to 5	4-/6-/8-channel ADC, TDM, on-chip oscillator	48 LQFP
<b>CS5381</b>	24	120	-110	192	Differential	VA = 5, VD = 3.3 or 5, VL = 2.5 to 5	Flagship performance	24 SOIC 24 TSSOP

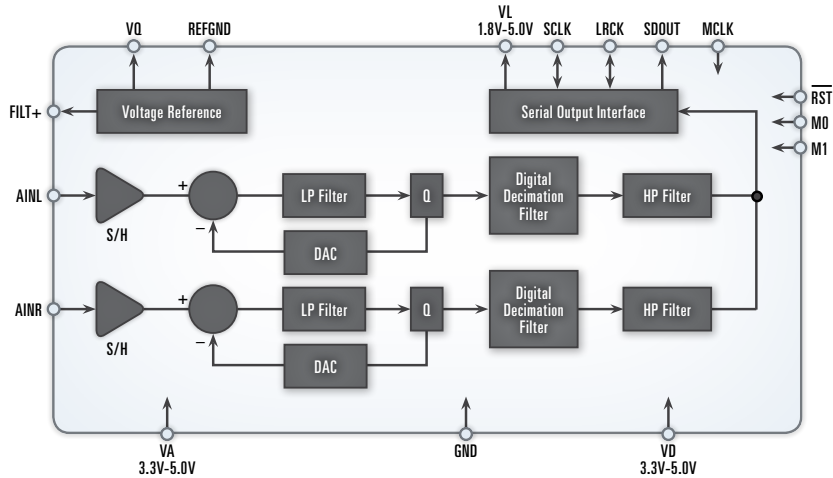
# CS5340

## 101 dB, 192 kHz STEREO A/D CONVERTER

### FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- Supports all audio sample rates including 192 kHz
- 101 dB dynamic range at 5 V
- -94 dB THD+N
- High-pass filter to remove DC offsets
- Low-latency digital filter
- 90 mW power consumption at 3.3 V
- Analog/digital core supplies from 3.3 V to 5 V
- Supports logic levels between 1.8 V and 5 V
- Auto-mode selection
- Pin compatible with CS5341
- Consumer and automotive grades
- Package: 16-pin TSSOP, lead-free assembly

The CS5340 is a complete A/D converter for digital audio systems. It performs sampling, A/D conversion and decimation filtering, generating 24-bit values for both left and right inputs in serial form at sample rates up to 200 kHz per channel.



### APPLICATIONS

- Automotive Applications
- Effects Processors
- Karaoke Systems
- Blu-ray/DVD Recorders
- Home Theater
- Set-Top Boxes

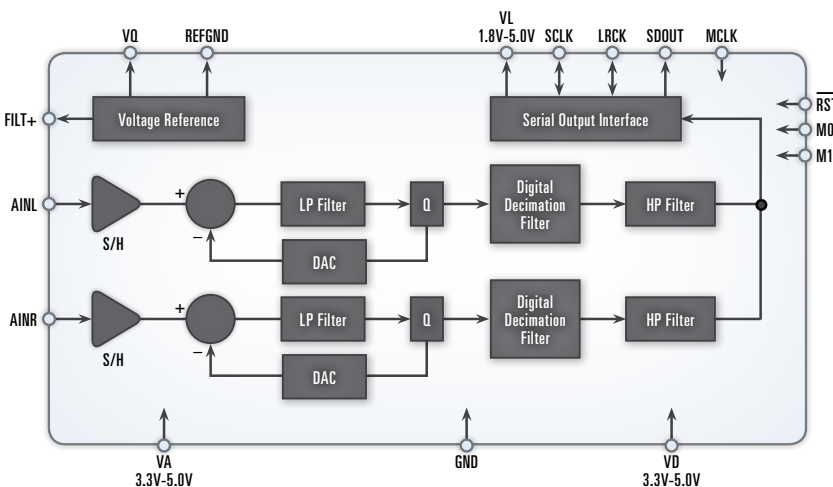
# CS5341/42

## 105 dB, 192 kHz STEREO A/D CONVERTERS

### FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- Supports all audio sample rates including 192 kHz
- 105 dB dynamic range at 5 V
- -98 dB THD+N
- High-pass filter to remove DC offsets
- Low-latency digital filter
- 90 mW power consumption at 3.3 V
- Analog/digital core supplies from 3.3 V to 5 V
- Supports logic levels between 1.8 V and 5 V (CS5341) and between 2.5 V and 5 V (CS5342)
- Auto-mode selection
- $384 \times F_s$  MCLK (CS5342)
- Package: 16-pin TSSOP, lead-free assembly

The CS5341 and CS5342 are complete A/D converters for digital audio systems. They perform sampling, A/D conversion and decimation filtering, generating 24-bit values for both left and right inputs in serial form at sample rates up to 200 kHz per channel.



### APPLICATIONS

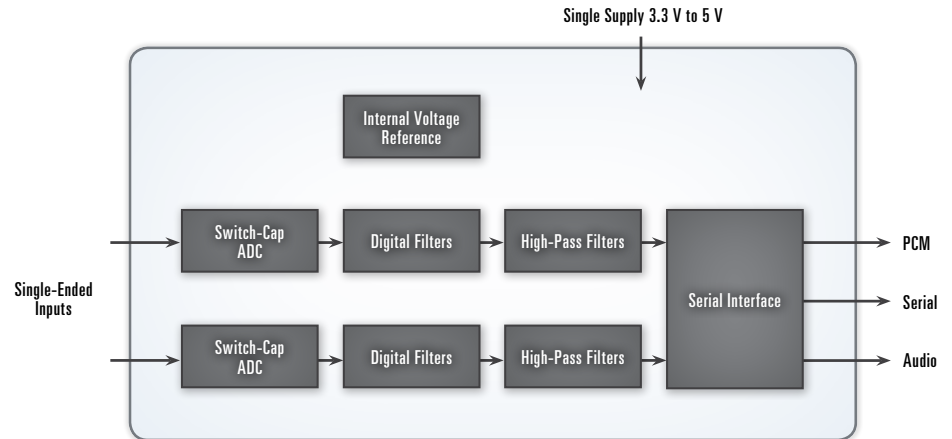
- Audio/Video Receivers
- Blu-ray/DVD Recorders
- Effects Processors
- Automotive Entertainment Applications
- Digital Mixing Consoles
- Home Theater

# CS5343/44

**98 dB, 96 kHz STEREO A/D CONVERTERS****FEATURES**

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- Supports all audio sample rates up to 108 kHz
- 98 dB dynamic range at 5 V
- -92 dB THD+N
- Low-latency digital filter
- High-pass filter to remove DC offsets
- Single +3.3 V or +5 V power supply
- 36 mW power consumption at 3.3 V
- Auto-mode sample-rate selection
- 256x or 384x MCLK/LRCK ratio
- CS5343 supports I<sup>2</sup>S audio format
- CS5344 supports L<sup>2</sup>J audio format
- Master or slave operation
- Consumer and automotive grades
- 10-pin TSSOP package, lead-free assembly

The CS5343/4 is a cost-effective complete A/D converter for digital audio systems. It performs sampling, A/D conversion and decimation filtering, generating 24-bit values for both left and right inputs in serial form at sample rates up to 108 kHz per channel.

**APPLICATIONS**

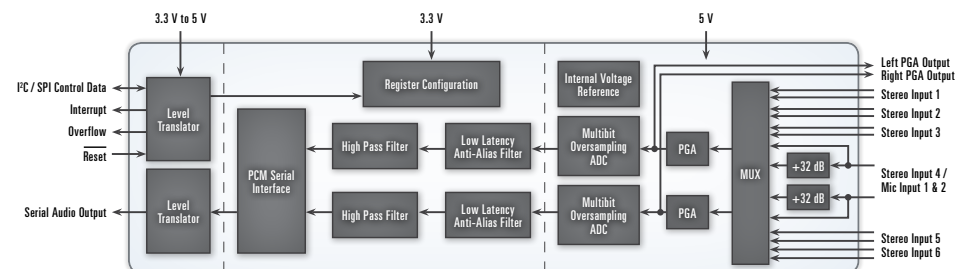
- A/V Receivers
- Blu-ray/DVD Recorders
- Karaoke Players
- Automotive Applications
- Effects Processors
- Set-Top Boxes

# CS5346

**103 dB, 192 kHz STEREO A/D CONVERTER WITH MUX AND PGA****FEATURES**

- Advanced multibit Delta-Sigma architecture
- Complete stereo A/D converter
- 24-bit conversion
- System sampling rates up to 192 kHz
- 103 dB dynamic range
- -95 dB THD+N
- 6:1 stereo input MUX
- Microphone pre-amp with 32 dB gain and low-noise bias supply
- Single-ended inputs
- 5 V analog; 3.3 V digital power supply
- Support for direct interface to logic levels from 3.3 V to 5 V
- High-pass filter with defeat
- Package: 48-pin LQFP, lead-free assembly
- Consumer and automotive grade

The CS5346 is a highly integrated A/D converter with a 6:1 stereo input MUX. The microphone path includes a mic pre-amp with 32 dB gain and a PGA is available for line or microphone inputs providing gain or attenuation of  $\pm 12$  dB. With its updated architecture, the CS5346 is ideal for cost sensitive consumer and automotive applications requiring high input impedance.

**APPLICATIONS**

- Audio/Video Receivers
- Blu-ray Disc Players/Receivers
- Digital TVs
- Automotive Entertainment Systems
- DVD Recorders
- Set-Top Boxes

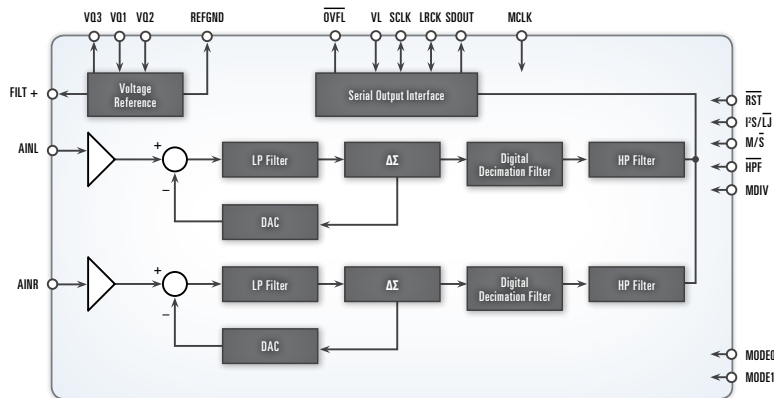
# CS5351

## 108 dB, 192 kHz STEREO A/D CONVERTER

### FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- System sampling rates up to 192 kHz
  - DVD-Audio-compatible
- 108 dB dynamic range
- -98 dB THD+N
- Low-latency digital filter
- High-pass filter and DC offset calibration
- Single-ended analog architecture
- Supports master or slave mode operation
- Supports logic levels between 2.5 V and 5 V
- 135 mW power consumption
- 3.3 V or 5 V digital power supply
- 5 V analog power supply
- Functionally compatible with CS5361
- Package: 24-pin TSSOP, 24-pin SOIC, lead-free assembly

The CS5351 is a complete A/D converter for digital audio systems. It performs sampling, A/D conversion and decimation filtering, generating 24-bit values for both left and right inputs in serial form at sample rates up to 192 kHz per channel.



### APPLICATIONS

- Audio Interfaces
- Audio/Video Receivers
- Automotive Entertainment Systems
- Digital Mixing Consoles
- Effects Processors
- Musical Instruments

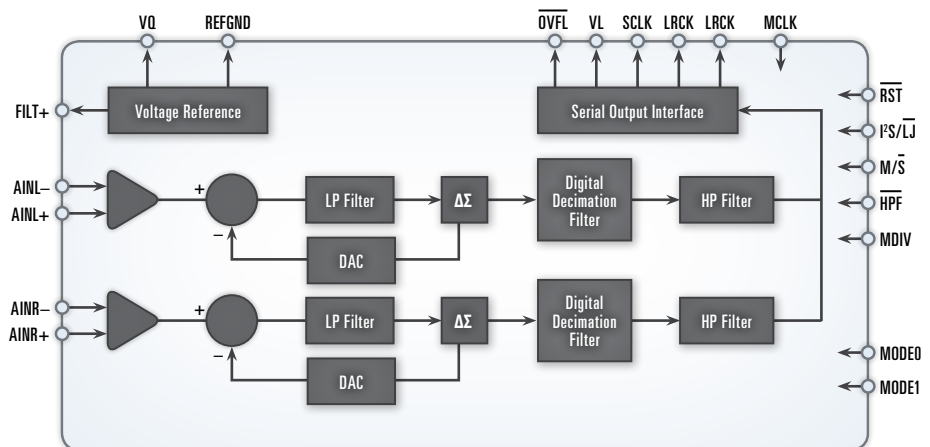
# CS5361

## 114 dB, 192 kHz STEREO A/D CONVERTER

### FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- System sampling rates up to 192 kHz
  - DVD-Audio-compatible
- 114 dB dynamic range
- -105 dB THD+N
- Low-latency digital filter
- High-pass filter and DC offset calibration
- Differential analog architecture
- Supports master or slave mode operation
- Pin compatible with the CS5381
- Supports logic levels between 2.5 V and 5 V
- 135 mW power consumption
- 3.3 V to 5 V digital power supply
- 5 V analog power supply functionally compatible with CS5351
- Consumer and automotive grades
- Package: 24-pin TSSOP, 24-pin SOIC, lead-free assembly

The CS5361 is a complete A/D converter for digital audio systems. It performs sampling, A/D conversion and decimation filtering, generating 24-bit values for both left and right inputs in serial form at sample rates up to 192 kHz per channel.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- Broadcast Equipment
- Digital Mixing Consoles
- Effects Processors
- Multitrack Recorders



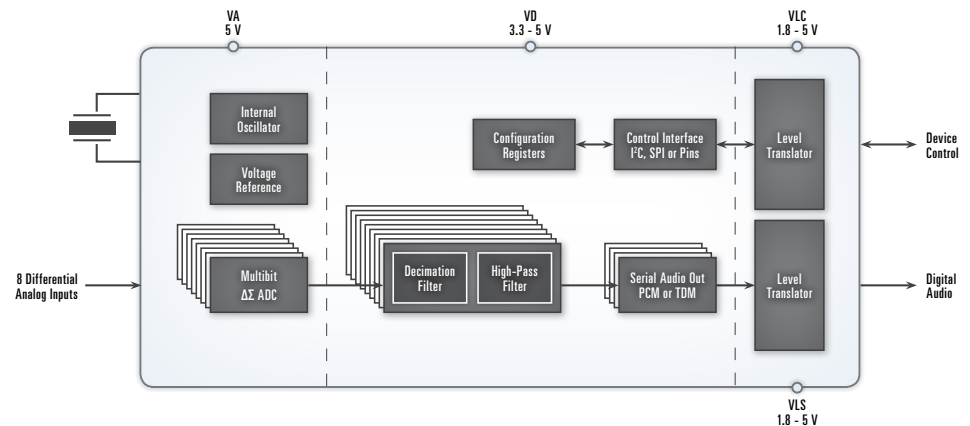
# CS5364/66/68

## 114 dB, 192 kHz 4-, 6- AND 8-CHANNEL A/D CONVERTERS

### FEATURES

- Multibit Delta-Sigma architecture
- 24-bit conversion
- System sampling rates up to 192 kHz
- 114 dB dynamic range
- -105 dB THD+N
- Selectable audio interface formats
  - Left-justified, I<sup>2</sup>S, TDM
  - 8-channel TDM interface formats
- Low-latency digital filters
- On-chip oscillator driver
- 5 V analog power supply
- 3.3-5 V digital power supply
- Supports logic levels between 1.8 V and 5 V for control and serial ports
- Less than 600 mW power consumption
- High-pass filter for DC offset calibration
- Differential analog architecture
- Supports master or slave mode
- Overflow detection
- Consumer and automotive grades
- Lead-free 48-pin LQFP, 8-, 6- and 4-channel pin-compatible family

The CS5368 premium-performance audio A/D converter is designed for today's demanding surround-sound consumer and multichannel pro audio applications. The highly integrated IC provides designers with a space-saving solution that streamlines product development, reduces design complexity and lowers overall system costs compared to boards that use multiple stereo A/D converters for surround sound or multichannel designs.



### APPLICATIONS

- Audio Interfaces
- Automotive Amplifiers
- Effects Processors
- Audio/Video Receivers
- Digital Mixing Consoles
- Multitrack Recorders

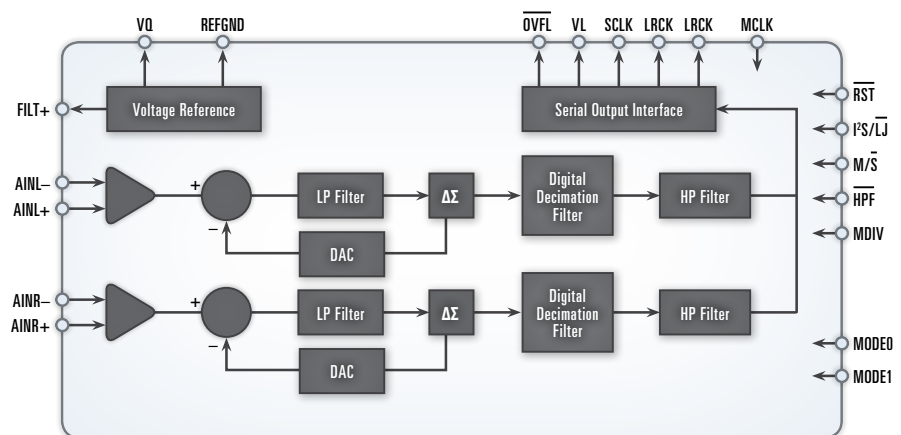
# CS5381

## 120 dB, 192 kHz STEREO A/D CONVERTER

### FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- System sampling rates up to 192 kHz
  - DVD-Audio-compatible
- 120 dB dynamic range
- -110 dB THD+N
- Low-latency digital filter
- High-pass filter or DC offset calibration
- Differential analog architecture
- Supports master or slave mode operation
- Pin compatible with the CS5361
- Supports logic levels between 2.5 V and 5 V
- 260 mW power consumption
- 3.3 V to 5 V digital power supply
- 5 V analog power supply
- Package: 24-pin SOIC, 24-pin TSSOP, lead-free assembly

The CS5381 is a complete A/D converter for digital audio systems. It performs sampling, A/D conversion and decimation filtering, generating 24-bit values for both left and right inputs in serial form at sample rates up to 200 kHz per channel.



### APPLICATIONS

- Audio/Video Receivers
- Effects Processors
- Digital Mixing Consoles
- Multitrack Recording Systems

# Audio D/A Converters

## SPECIFICATIONS

Part	Channels	Resolution (bits)	Dynamic Range (dB)	THD+N (dB)	Sample Rate (kHz)	Analog Outputs	Power Supply (V)	Comments	Package
<b>CS4334/35/38/39</b>	2	24	96	-88	96	Single-ended	VA = 5	Entry-level stereo DAC	8 SOIC
<b>CS4344/45/46/48</b>	2	24	105	-90	192	Single-ended	VA = 3.3 or 5	Upgrade for CS4340 and CS4340A	10 TSSOP
<b>CS4349</b>	2	24	101	-91	192	Single-ended	VA = 3.3 or 5	1 V <sub>RMS</sub> @ 3.3 V, TDM	24 TSSOP
<b>CS4350</b>	2	24	109	-91	192	Single-ended or Differential	VA = 3.3 or 5 VLC = 3.3 to 5 VLS = 1.5 to 5	Integrated PLL, TDM	24 TSSOP
<b>CS4351</b>	2	24	112	-100	192	Single-ended	VA = 9 or 12 VD = 3.3 VL = 1.8 to 3	Line driver, 2 V <sub>RMS</sub> output	20 TSSOP
<b>CS4352</b>	2	24	106	-93	192	Single-ended	VA = 9 or 12 VD = 3.3 VL = 1.5 to 5	Line driver, 2 V <sub>RMS</sub> output	20 TSSOP
<b>CS4353</b>	2	24	106	-93	192	Single-ended	VA/VD = 3.3 VCP = 3.3 VL = 0.9 to 3.3	Ground-Centered 2 V <sub>RMS</sub> line-level outputs	24 QFN
<b>NEW CS4354</b>	2	24	101	-86	192	Single-ended	VA/VD = 5.0 VL = 1.5 to 5.0	2 V <sub>RMS</sub> line drivers	14 SOIC
<b>CS4361</b>	6	24	105	-95	192	Single-ended	VA = 5 VL = 1.8 to 5	Entry-level 6-channel DAC	20 TSSOP
<b>CS4362A/82A</b>	6/8	24	114	-100	192	Differential	VA = 5 VD = 2.5 VL = 1.8 to 5	6-/8-channel DAC, DSD	48 LQFP
<b>CS4364/84</b>	6/8	24	103	-88	192	Single-ended	VA = 5 VD = 2.5 VL = 1.8 to 5	6-/8-channel DAC, DSD, footprint-compatible with CS4365/85	48 LQFP
<b>CS4365/85</b>	6/8	24	114	-100	192	Differential	VA = 5 VD = 2.5 VL = 1.8 to 5	6-/8-channel DAC, DSD, TDM	48 LQFP
<b>CS4392</b>	2	24	114	-100	192	Differential	VA = 5 VL = 1.8 to 5	DSD, selectable digital filters, pin compatible with CS4391A	20 TSSOP
<b>CS4398</b>	2	24	120	-107	192	Differential	VA = 5 VD = 3.3 or 5 VL = 1.8 to 5	Flagship DAC, DSD processor, selectable D-filter	28 TSSOP

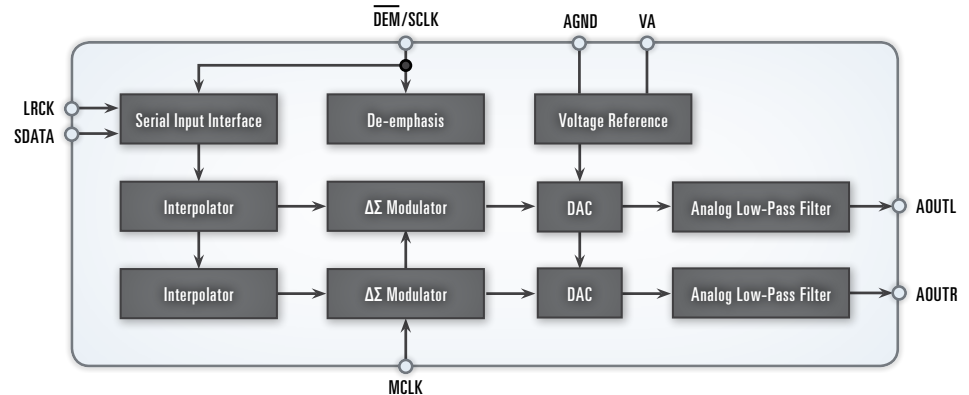
# CS4334/35/38/39

8-PIN, 24-BIT, 96 kHz STEREO D/A CONVERTERS

## FEATURES

- Complete stereo D/A converter system: interpolation, D/A, output analog filtering
- 24-bit conversion
- 96 dB dynamic range
- -88 dB THD+N
- Low-clock-jitter sensitivity
- Filtered line-level outputs
- On-chip digital de-emphasis
- Popguard® technology for control of clicks and pops
- Single 5 V power supply
- Consumer and automotive grades
- Package: 8-pin plastic SOIC, lead-free assembly

The CS4334/35/38/39 family of products are complete stereo D/A converter output systems including interpolation, 1-bit D/A conversion and output analog filtering in an 8-pin package. The CS4334/35/38/39 products support all major audio data interface formats, and the individual devices differ only in the supported interface format.



## APPLICATIONS

- Automotive Entertainment Systems
- Blu-ray/DVD Players
- Home Theater
- Set-Top Boxes

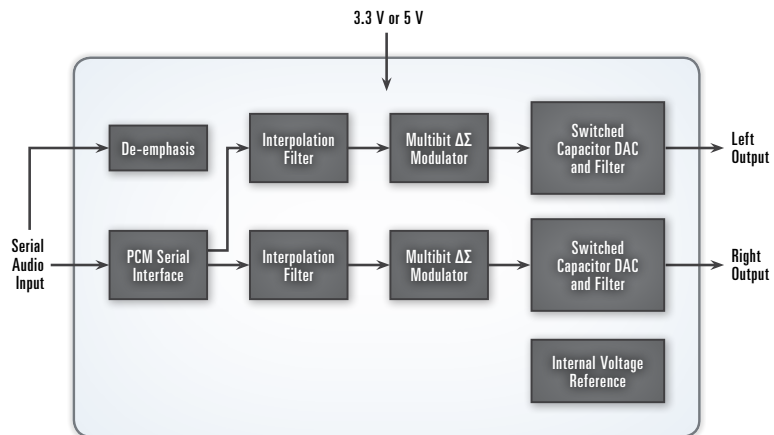
# CS4344/45/46/48

105 dB, 10-PIN, 24-BIT, 192 kHz STEREO D/A CONVERTERS

## FEATURES

- Advanced multibit Delta-Sigma architecture
- 105 dB dynamic range
- -90 dB THD+N
- 24-bit conversion
- Automatic detection of sample rates up to 192 kHz
- Single 3.3 V or 5 V power supply
- Single-ended outputs
- Popguard® technology
- Low-clock-jitter sensitivity
- On-chip digital de-emphasis
- Support for all standard audio interface formats
- Consumer and automotive grades
- Package: 10-pin TSSOP, lead-free assembly

The CS4344 family are complete stereo D/A converter output systems including interpolation, multibit D/A conversion and output analog filtering in a 10-pin package. The CS4344/5/6/8 supports all major audio data interface formats, and the individual devices differ only in the supported interface format.



## APPLICATIONS

- Automotive Entertainment Systems
- Blu-ray/DVD Players/Recorders
- Digital TVs
- Home Theater
- Set-Top Boxes

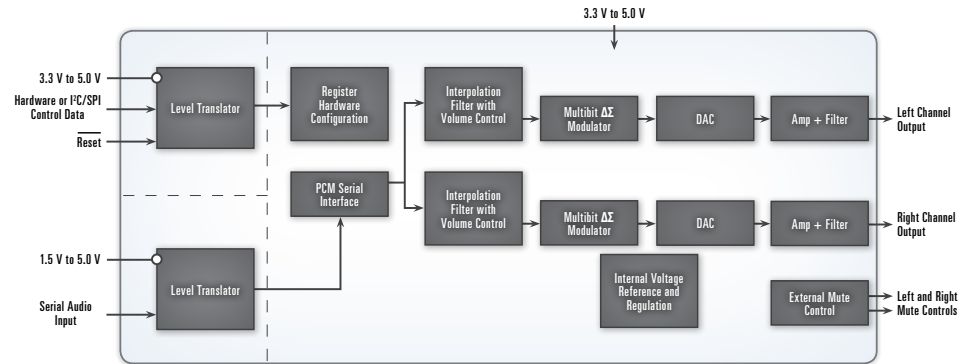
# CS4349

192 kHz STEREO DAC WITH VOLUME CONTROL AND 1 V<sub>RMS</sub> SINGLE-ENDED OUTPUTS AT 3.3 V

## FEATURES

- Advanced multibit Delta-Sigma architecture
- 101 dB dynamic range
- -91 dB THD+N at 5.0 V
- -84 dB THD+N at 3.3 V
- 24-bit conversion
- Supports audio sample rates up to 192 kHz
- Low-latency digital filtering
- Single-ended analog output architecture
- Automatic sample-rate range detection
- Popguard® technology for control of clicks and pops
  - Popguard® technology disable function for fast startups
- Supports all standard serial audio formats including time-division multiplexed (TDM)
- +3.3 V or +5.0 V analog supply
- +1.5 V to +5.0 V logic supplies for serial port
- +3.3 V to +5.0 V control port interface

The CS4349, an upgrade of the CS4341 and CS4341A, is a stereo D/A converter based on an advanced multibit Delta-Sigma architecture with integrated volume control and 1 V<sub>RMS</sub> single-ended output drive capability at 3.3 V.



## APPLICATIONS

- A/V Receivers
- Audio Interfaces
- Blu-ray/DVD Players/Recorders
- Digital TVs
- Mixing Consoles
- Musical Instruments
- Set-Top Boxes

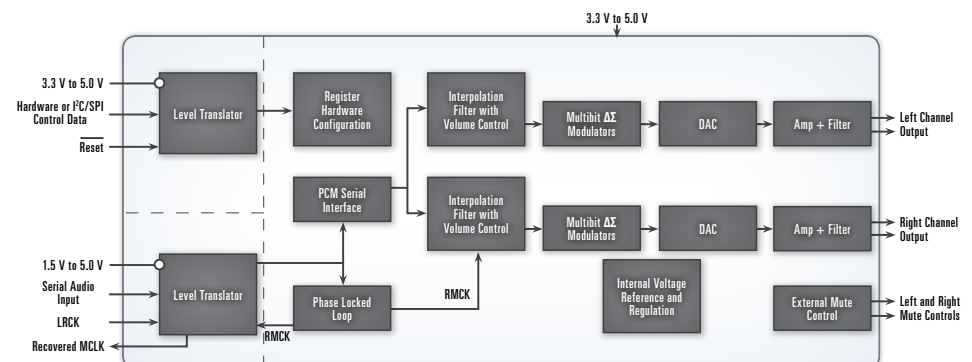
# CS4350

109 dB, 24-BIT, 192 kHz STEREO D/A CONVERTER WITH INTEGRATED PLL

## FEATURES

- Advanced multibit Delta-Sigma modulator
- 109 dB dynamic range, -91 dB THD+N
- 24-bit/192 kHz sample rates with automatic sample rate detection
- Single-ended or differential analog output architecture
- Integrated PLL locks to incoming left-right clock—no MCLK required
- Single 3.3 or 5 V power supply, supports logic levels from +1.5 V to +5 V
- Popguard® technology for control of clicks and pops
- Supports all standard serial audio formats including time-division multiplexed (TDM)
- 24-pin TSSOP, lead free package

The CS4350 is a complete stereo digital-to-analog system with on-chip Phase-Locked-Loop (PLL) based master clock derivation. The integrated PLL locks to the incoming Left-Right clock eliminating the need for external master clock line routing. The CS4350 includes digital interpolation, 5th-order multibit Delta-Sigma digital-to-analog conversion, digital de-emphasis, volume control, channel mixing and analog filtering with high tolerance to clock jitter and a minimal set of external components.



## APPLICATIONS

- A/V Receivers
- Blu-ray/DVD Players
- DVRs
- Digital TVs
- Mini-Component Systems
- Musical Instruments
- Professional Audio Equipment
- Set-Top Boxes

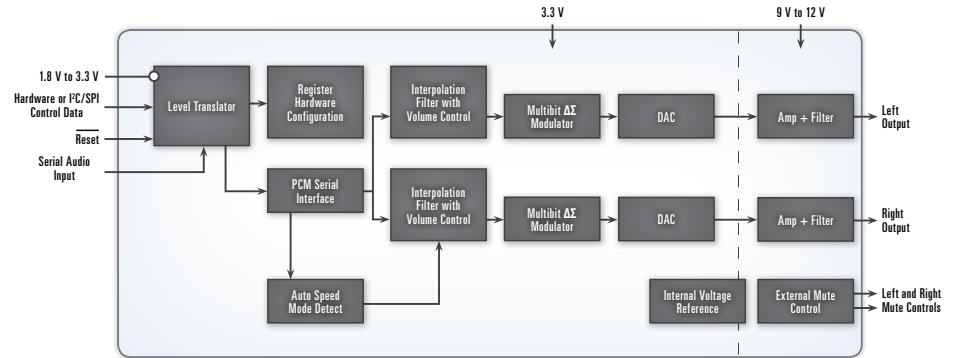
## CS4351

## 112 dB, 24-BIT, 192 kHz STEREO D/A CONVERTER WITH LINE DRIVER

## FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- Up to 192 kHz sample rates
- 112 dB dynamic range
- -100 dB THD+N
- Integrated line driver
  - 2 V<sub>RMS</sub> output into 5 k $\Omega$  AC load
- Digital volume control with soft ramp
  - 119 dB attenuation
  - 0.5 dB step size
  - Zero crossing click-free transitions
- Automatic sample-rate detection
- ATAPI mixing
- Low-clock-jitter sensitivity
- Popguard® technology for control of clicks and pops
- 9 V or 12 V analog power supply
- 3.3 V digital power supply
- Direct interface with 1.8 V to 3.3 V logic
- Consumer and automotive grades
- Package: 20-pin TSSOP, lead-free assembly

The CS4351 is a complete stereo D/A converter system including digital interpolation, fifth-order multibit Delta-Sigma D/A conversion, digital de-emphasis, volume control, channel mixing, analog filtering and integrated line-level driver.



## APPLICATIONS

- Audio/Video Receivers
- Digital TVs
- Set-Top Boxes
- Blu-ray/DVD Players/Recorders
- Mini-Component Systems

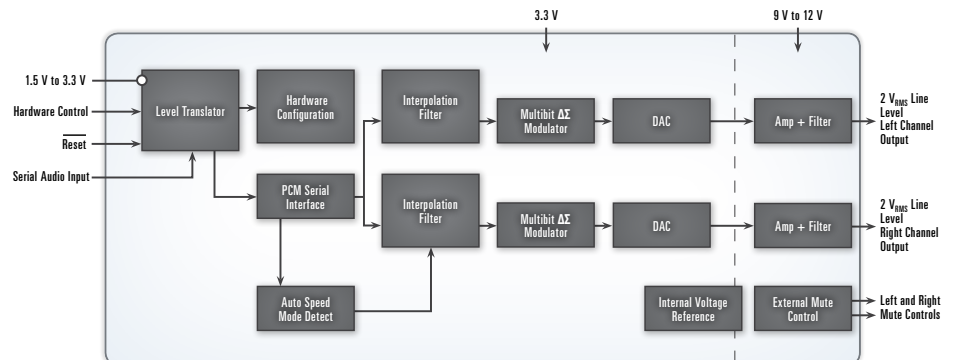
## CS4352

## 106 dB, 24-BIT, 192 kHz STEREO D/A CONVERTER WITH LINE DRIVER

## FEATURES

- Advanced multibit Delta-Sigma modulator
- 106 dB dynamic range
- -93 dB THD+N
- 24-bit/192 kHz sample rates
- Integrated line driver
- 2 V<sub>RMS</sub> output into 5 k $\Omega$  AC load
- Compliant with consumer line level and SCART output
- Low latency digital filtering
- +9 to +12 V analog power supply, +3.3 V digital power supply
- Supports direct interface to logic levels from +1.5 V to +3.3 V
- Compliant with the Cell Broadband Engine® (Cell processor)
- Single-ended outputs
- Popguard® technology for control of clicks and pops
- Automatic sample rate detection
- Supports standard PCM audio format
- 20-pin TSSOP, lead free available

The CS4352 is high-performance stereo D/A converter for consumer electronics, professional and automotive audio applications. This low profile 20-pin, 106 dB D/A converter is a pin-compatible, hardware mode only, cost efficient version of the popular CS4351 stereo D/A converter.



## APPLICATIONS

- A/V Receivers
- Digital TVs
- Outboard Converters
- Automotive Audio System
- Digital Mixing Consoles
- Personal Video Recorders (PVRs)
- Blu-ray/DVD Players/Recorders
- Effects Processors
- Set-Top Boxes
- Multitrack Recording Systems
- Video Game Consoles

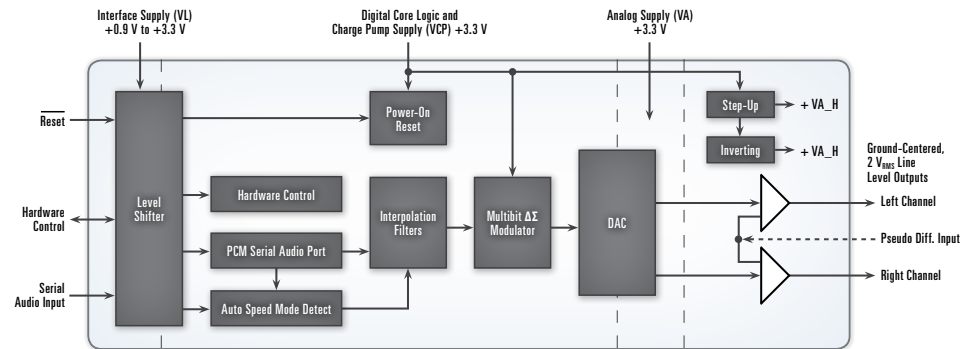
# CS4353

## 106 dB, 192 kHz STEREO D/A CONVERTER WITH 2 V<sub>RMS</sub> LINE OUTPUT

### FEATURES

- Advanced multibit Delta-Sigma architecture
- 106 dB (A-wt) dynamic range
- -93 dB THD+N
- Single-ended ground centered analog architecture
  - No DC-blocking capacitors required
  - Integrated step-up/Inverting charge pump
  - Filtered line-level outputs
  - Selectable 1 or 2 V<sub>RMS</sub> fullscale output
- Low clock-jitter sensitivity
- Low-latency digital filtering
- Supports sample rates up to 192 kHz
- 24-bit resolution
- Power supplies
  - +3.3 V charge pump and core logic
  - +3.3 V analog
  - +0.9 to 3.3 V interface
- 24-pin QFN, lead-free assembly
- Commercial and Automotive Grades

The CS4353 is a 24-bit, 192 kHz stereo audio D/A converter with an on-chip 2 V<sub>RMS</sub> line driver working from a single 3.3 V power supply. The CS4353 is ideal for any application that requires a line-level output, such as DTVs, Blu-ray Disc players, set-top boxes, and video game consoles.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- Blu-ray Disc Players/Receivers
- DVD Players/Recorders
- Digital TVs
- Mixing Consoles
- Set-Top Boxes
- Video Game Consoles

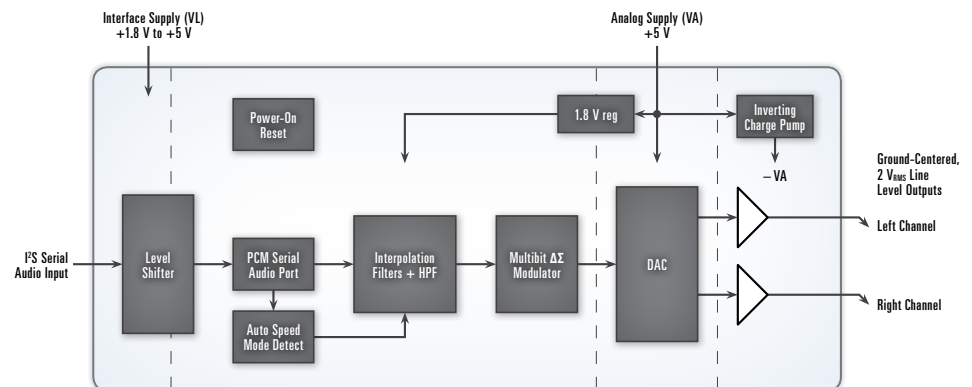
# NEW CS4354

## 5 V STEREO DAC WITH 2 V<sub>RMS</sub> GROUND-CENTERED OUTPUTS

### FEATURES

- Multi-bit delta-sigma modulator
- 101 dB A-wt dynamic range
- -86 dB THD+N
- Single-ended ground centered analog architecture
  - No DC-blocking capacitors required
  - Integrated step-up/Inverting charge pump
  - Filtered line-level outputs
- Low clock-jitter sensitivity
- Low-latency digital filtering
- Supports sample rates up to 192 kHz
- 24-Bit resolution
- Power supplies
  - +5 V analog
  - +1.5 to 5 V interface
- 50mW power consumption
- 14-pin SOIC, lead-free assembly

The CS4354 is an audio stereo D/A converter with an on-chip 2 V<sub>RMS</sub> line driver working from a single 5 V power supply. It features digital interpolation, fifth order multi-bit Delta Sigma digital-to-analog conversion, digital de-emphasis and analog filtering.



### APPLICATIONS

- Blu-ray/ DVD Players/Recorders
- Digital TV
- Set-Top boxes
- Video Game Consoles

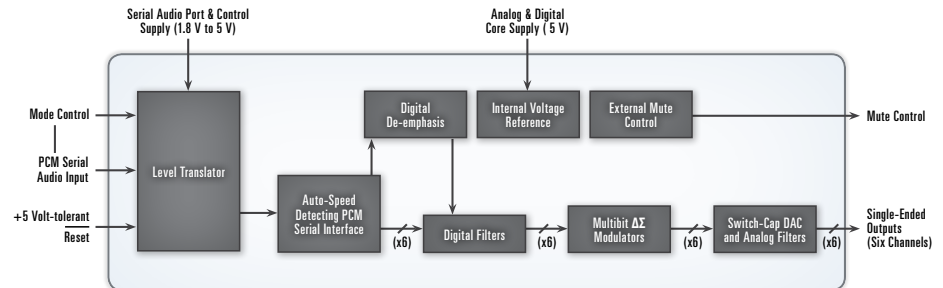
## CS4361

105 dB, 24-BIT, 192 kHz, 6-CHANNEL D/A CONVERTER

## FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- 105 dB dynamic range
- -95 dB THD+N
- Up to 192 kHz sample rates for DVD-Audio equipment
- 5 V analog and digital power supply
- 1.8 V to 5 V interface power
- Single-ended outputs
- Mute control output
- Filtered line-level outputs
- On-chip digital de-emphasis
- Popguard® technology for control of clicks and pops
- Low-clock-jitter sensitivity
- Available in a 20-pin TSSOP, lead-free assembly

The CS4361 is a complete 6-channel D/A converter that includes interpolation, multibit D/A conversion and output analog filtering in a compact, 20-pin package. The CS4361 supports all major data interface formats.



## APPLICATIONS

- Blu-ray/DVD Players/Recorders
- Digital TVs
- Home Theater
- Set-Top Boxes

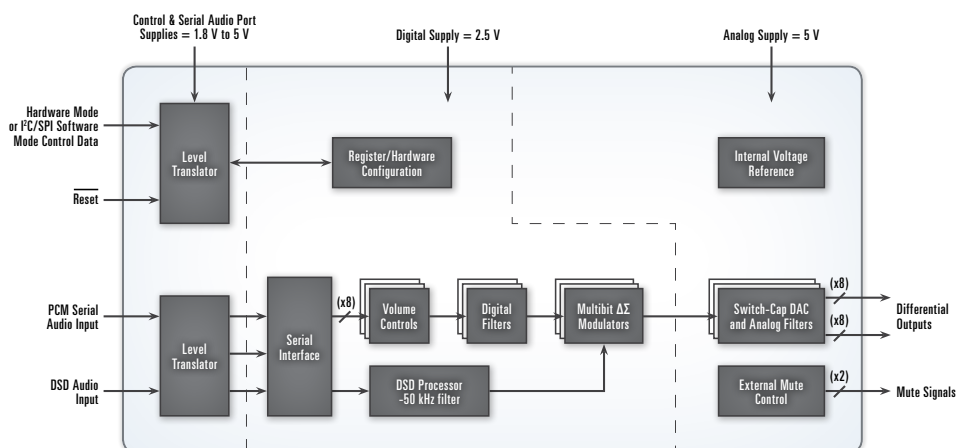
## CS4362A/82A

114 dB, 24-BIT, 192 kHz, 6- AND 8-CHANNEL D/A CONVERTERS WITH DSD SUPPORT AND LOW-LATENCY DIGITAL FILTERING

## FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- 114 dB dynamic range
- -100 dB THD+N
- Up to 192 kHz sample rates for DVD-Audio equipment
- Selectable low-latency digital filters
- Direct Stream Digital® mode (SACD)
  - On-chip 50 kHz filter
  - Dedicated inputs
- Volume control with soft ramp
  - 1 dB step size
  - Zero crossing click-free transitions
- Low-clock-jitter sensitivity
- $\mu$ C or standalone operation
- Six mute output pins (CS4362A)
- Two mute output pins (CS4382A)
- Pin-compatible devices for easy upgrade path
- Consumer and automotive grades
- Available in a 48-pin LQFP, lead-free assembly

The CS4362A/82A are pin-compatible 6- and 8-channel D/A converters. They feature digital de-emphasis, one-dB step size volume control, ATAPI channel mixing, selectable fast and slow digital interpolation filters followed by an oversampled, multibit Delta-Sigma modulator which includes mismatch shaping technology that eliminates distortion due to capacitor mismatch.



## APPLICATIONS

- Audio/Video Receivers
- Blu-ray/DVD Players
- Mixing Consoles
- Automotive Entertainment Systems
- Effects Processors

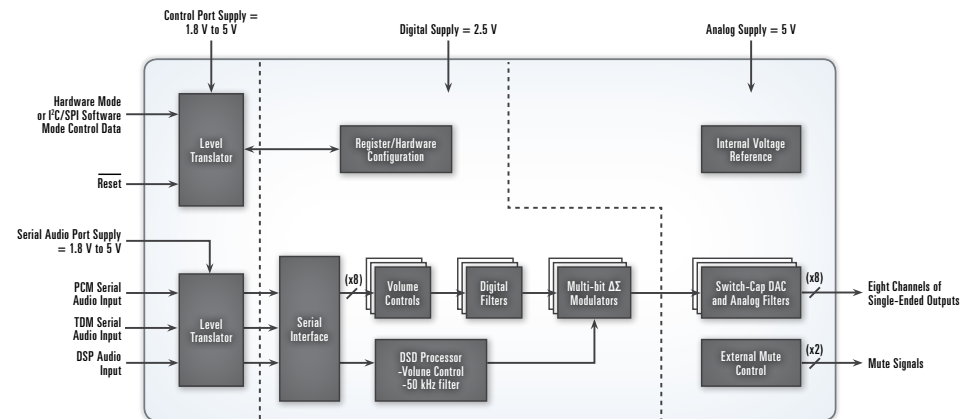
# CS4364/84

## 24-BIT, 6- AND 8-CHANNEL D/A CONVERTERS WITH DSD SUPPORT, LOW-LATENCY DIGITAL FILTERING, TDM INTERFACE AND SINGLE-ENDED OUTPUT ARCHITECTURE

### FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- 103 dB dynamic range
- -88 dB THD+N
- Single-ended output architecture
- Up to 192 kHz sample rates for DVD-Audio equipment
- Direct Stream Digital® mode (SACD)
  - Non-decimating volume control
  - On-chip 50 kHz filter
  - Dedicated inputs
- Supports industry-standard TDM interface
- Selectable low-latency digital filters
- Volume control with soft ramp
  - 0.5 dB step size
  - Zero crossing click-free transitions
- Low-clock-jitter sensitivity
- $\mu$ C or standalone operation
- 6 mute output pins (CS4364)
- 2 mute output pins (CS4384)
- Pin-compatible devices for easy upgrade path
- Available in a 48-pin LQFP, lead-free assembly

The CS4364/84 are pin-compatible 6- and 8-channel D/A converters. They feature digital de-emphasis, half-dB step-size volume control, ATAPI channel-mixing, selectable fast and slow digital interpolation filters followed by an oversampled, multibit Delta-Sigma modulator which includes mismatch shaping technology that eliminates distortion due to capacitor mismatch.



### APPLICATIONS

- A/V Receivers
- Automotive Entertainment Systems
- Digital TVs
- Effects Processors
- Mixing Consoles
- Sound Cards



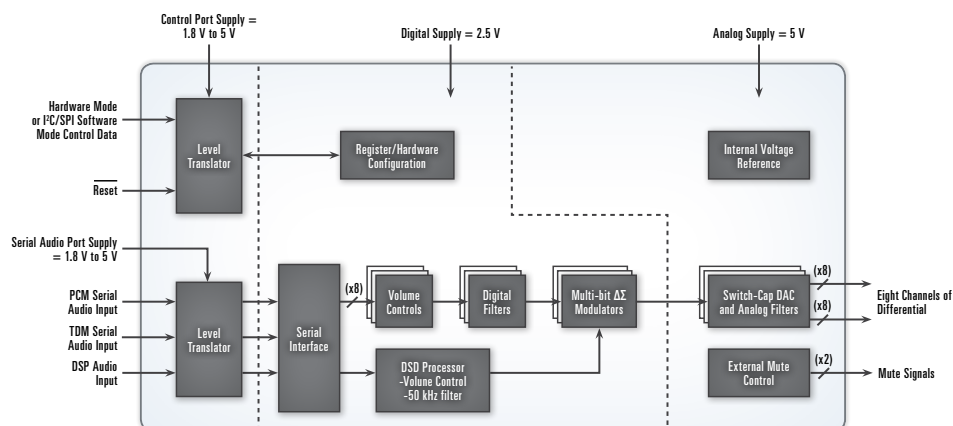
# CS4365/85

114 dB, 24-BIT, 192 kHz, 6- AND 8-CHANNEL D/A CONVERTERS WITH DSD SUPPORT, LOW-LATENCY DIGITAL FILTERING AND TDM INTERFACE

## FEATURES

- Advanced multibit Delta-Sigma architecture
- 24-bit conversion
- 114 dB dynamic range
- -100 dB THD+N
- Up to 192 kHz sample rates for DVD-Audio equipment
- Direct Stream Digital® mode (SACD)
  - Non-decimating volume control
  - On-chip 50 kHz filter
  - Dedicated inputs
- Supports industry-standard TDM interface
- Selectable low-latency digital filters
- Volume control with soft ramp
  - 0.5 dB step size
  - Zero crossing click-free transitions
- Low-clock-jitter sensitivity
- $\mu$ C or standalone operation
- Six mute output pins (CS4365)
- Two mute output pins (CS4385)
- Pin-compatible devices for easy upgrade path
- Consumer and automotive grades
- Available in a 48-pin LQFP, lead-free assembly

The CS4365/85 are pin-compatible 6- and 8-channel D/A converters. They feature digital de-emphasis, half-dB step-size volume control, ATAPI channel-mixing, selectable fast and slow digital interpolation filters followed by an oversampled, multibit Delta-Sigma modulator which includes mismatch shaping technology that eliminates distortion due to capacitor mismatch.



## APPLICATIONS

- A/V Receivers
- Digital TVs
- Mixing Consoles
- Automotive Entertainment Systems
- Effects Processors
- Sound Cards

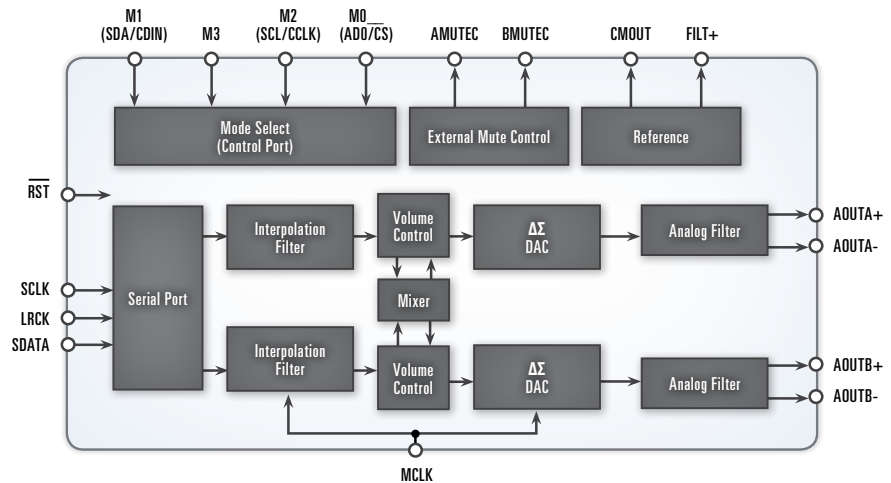
## CS4392

### 114 dB, 24-BIT, 192 kHz STEREO D/A CONVERTER WITH DSD SUPPORT

#### FEATURES

- Complete stereo D/A converter system: interpolation, D/A, output analog filtering
- 114 dB dynamic range
- -100 dB THD+N
- Up to 192 kHz sample rates
- Direct Stream Digital® mode (SACD)
- Low-clock-jitter sensitivity
- Selectable digital filters
  - Fast and slow roll-off
- Volume control with soft ramp
  - 1 dB step size
  - Zero crossing click-free transitions
- ATAPI mixing functions
- Direct interface with 1.8 V to 5 V logic
- Single 5 V power supply
- Pin compatible with the CS4391A
- Package: 20-pin TSSOP, lead-free assembly

The CS4392 is a complete stereo D/A converter system including digital interpolation, fifth-order Delta-Sigma D/A conversion, digital de-emphasis, volume control, channel mixing and analog filtering. The advantages of this architecture include: ideal differential linearity, no distortion mechanisms due to resistor matching errors, no linearity drift over time and temperature and a high tolerance to clock jitter.



#### APPLICATIONS

- Audio/Video Receivers
- Blu-ray/DVD Players
- Professional Audio Systems

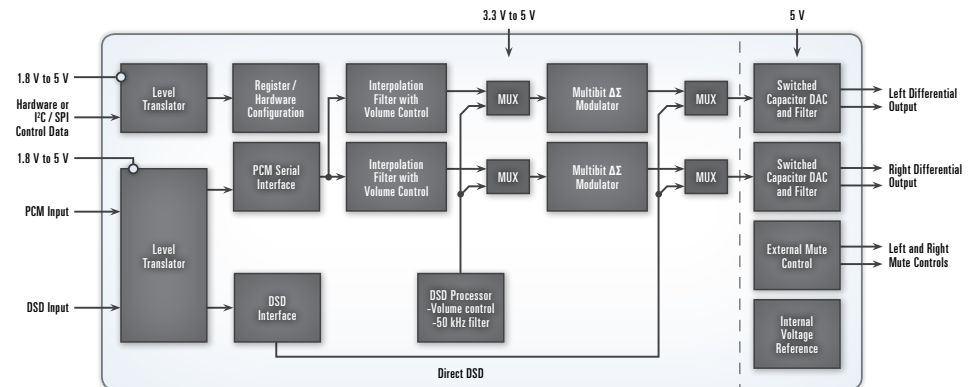
## CS4398

### 120 dB, 24-BIT, 192 kHz STEREO D/A CONVERTER WITH DSD SUPPORT

#### FEATURES

- Advanced multibit Delta-Sigma architecture
- 120 dB dynamic range
- -107 dB THD+N
- Up to 192 kHz sample rates
- Low-latency digital filter
- Direct Stream Digital® mode (SACD)
  - Non-decimating volume control
  - On-chip 50 kHz filter
- Dedicated input pins
- Low-clock-jitter sensitivity
- Differential analog outputs
- 5 V analog power supply
- 3.3 V or 5 V digital power supply
- Supports direct interface to logic levels from 1.8 V to 5 V
- Control output for external muting
- Package: 28-pin TSSOP, lead-free assembly

The CS4398 is a complete stereo 24-bit/192 kHz D/A converter system. This D/A system includes digital de-emphasis, half dB step-size volume control, ATAPI channel mixing, selectable fast and slow roll off digital interpolation filters followed by an oversampled multibit Delta-Sigma modulator, which includes mismatch shaping technology that eliminates distortion due to capacitor mismatch.



#### APPLICATIONS

- Audio/Video Receivers
- Digital Mixing Consoles
- Blu-ray/DVD Players
- Effects Processors
- Outboard Converter Systems

## Stereo CODECs

### SPECIFICATIONS

Part	Resolution (bits)	Dynamic Range (dB)	THD+N (dB)	Sample Rate (kHz)	Analog I/O	Power Supply (V)	Comments	Package
<b>CS4245</b>	24	104 ADC 104 DAC	-95 ADC -90 DAC	192	Single-ended	VA = 3.3 or 5 VD = 3.3 or 5 VL = 1.8 to 5	6:1 input MUX, mic pre-amp, PGA	48 LQFP
<b>CS4265</b>	24	104 ADC 104 DAC	-95 ADC -90 DAC	192	Single-ended	VA = 3.3 or 5 VD = 3.3 or 5 VL = 1.8 to 5	2:1 input MUX, mic pre-amp, PGA, S/PDIF out	32 QFN
<b>CS4270</b>	24	105 ADC 105 DAC	-95 ADC -95 DAC	192	Single-ended	VA = 3.3 or 5 VD = 3.3 or 5 VL = 1.8 to 5	Volume control, passive filters, 3.3 V operation	24 TSSOP
<b>CS4271</b>	24	108 ADC 114 DAC	-98 ADC -100 DAC	192	Single-ended ADC Differential DAC	VA = 5 VD = 3.3 or 5 VL = 2.5 to 5	Stereo CODEC, volume control, compatible with CS4272	28 TSSOP
<b>CS4272</b>	24	114 ADC 114 DAC	-100 ADC -100 DAC	192	Differential ADC Differential DAC	VA = 5 VD = 3.3 or 5 VL = 2.5 to 5	Stereo CODEC, volume control, on-chip oscillator	28 TSSOP

## HD AUDIO CODECs

### SPECIFICATIONS

Part	Bus	Converters	Feature
<b>CS4207</b>	HD	Six 192 kHz DACs; Four 96 kHz ADCs	S/PDIF receiver with sample-rate converter, 2 S/PDIF transmitters, mic pre-amp, ground centered HP driver, 2 digital mic inputs

## AC '97 CODECs

### SPECIFICATIONS

Part	Bus	Converters	Feature	Package
<b>CS4202</b>	AC '97	20-bit stereo DAC; 18-bit stereo ADC	S/PDIF transmitter	48 TQFP/LQFP
<b>CS4205</b>	AC '97	20-bit stereo DAC; 18-bit stereo ADC	Sample-rate converter	48 TQFP/LQFP
<b>CS4299</b>	AC '97	20-bit stereo DAC; 18-bit stereo ADC	Sample-rate converter	48 TQFP/LQFP

# Multichannel CODECs

## SPECIFICATIONS

Part	Resolution (bits)	Dynamic Range (dB)	THD+N (dB)	Sample Rate (kHz)	Analog I/O	Power Supply (V)	Comments	Package
<b>CS42324/25</b>	24	100 DAC 95 ADC	-90 DAC -88 ADC	96	Single-ended	VA = 9 or 12 VD = 3.3 VL = 1.8 or 3.3	4 DACs, 2 ADCs, 2 V <sub>RMS</sub> I/O, I/O MUX, HP Driver (CS42325 only)	48 LQFP
<b>CS42416/26</b>	24	110/114 DAC 114 ADC	-100 DAC -100 ADC	192	Differential DACs Single-ended or Differential ADCs	VA = 5 VD = 3.3 or 5 VL = 1.8 to 5	6 DACs, 2 ADCs, digital volume control	64 LQFP
<b>CS42418/28</b>	24	110/114 DAC 114 ADC	-100 DAC -100 ADC	192	Differential	VA = 5 VD = 3.3 or 5 VL = 1.8 to 5	8 DACs, 2 ADCs, PLL, digital volume control	64 LQFP
<b>CS42432</b>	24	108 DAC 105 ADC	-98 DAC -98 ADC	192	Single-ended or Differential	VA = 3.3 or 5 VD = 3.3 VL = 1.8 to 5	6 DACs, 4 ADCs, TDM I/F	52 MQFP
<b>CS42435</b>	24	108 DAC 105 ADC	-98 DAC -98 ADC	192	Single-ended or Differential	VA = 3.3 or 5 VD = 3.3 VL = 1.8 to 5	8 DACs, 6 ADCs, TDM I/F	52 MQFP
<b>CS42436/38</b>	24	105/108 DAC 102/105 ADC	-95/-98 DAC -95/-98 ADC	192	Single-ended or Differential	VA = 3.3 or 5 VD = 3.3 VL = 1.8 to 5	6/8 DACs, 6 ADCs, TDM I/F	52 MQFP
<b>CS4244</b>	24	109 DAC 105 ADC	-90 DAC -95 ADC	192	Single-ended or Differential	VA = 3.3 or 5 VL = 1.8 to 5	4 DACs, 4 ADCs, PCM and TDM I/F	40 QFN
<b>CS42448</b>	24	108 DAC 105 ADC	-98 DAC -98 ADC	192	Single-ended or Differential	VA = 3.3 or 5 VD = 3.3 to 5 VL = 1.8 to 5	8 DACs, 6 ADCs, TDM and PCM I/F	64 LQFP
<b>CS42516/26</b>	24	110/114 DAC 114 ADC	-100 DAC -100 ADC	192	Differential	VA = 5 VD = 3.3 or 5 VL = 1.8 to 5	6 DACs, 2 ADCs, S/PDIF Rx, digital volume control	64 LQFP
<b>CS42518/28</b>	24	110/114 DAC 114 ADC	-100 DAC -100 ADC	192	Differential	VA = 5 VD = 3.3 or 5 VL = 1.8 to 5	8 DACs, 2 ADCs, S/PDIF Rx, digital volume control	64 LQFP
<b>CS42888</b>	24	108 DAC 105 ADC	-98 DAC -98 ADC	192	Single-ended or Differential	VA = 3.3 or 5 VD = 3.3 or 5 VL = 1.8 to 5	8 DACs, 4 ADCs, PCM and TDM I/F	64 LQFP

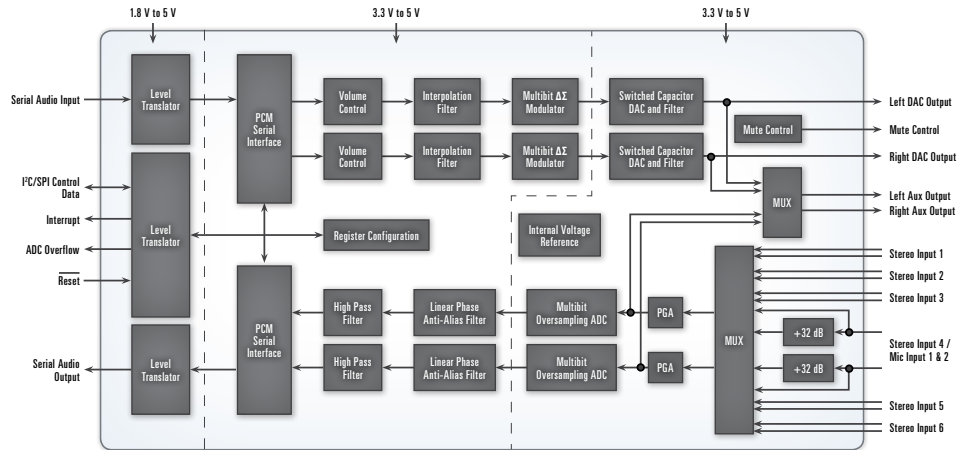
## CS4245

104 dB, 24-BIT, 192 kHz STEREO AUDIO CODEC WITH MUX AND PGA

## FEATURES

- Complete stereo CODEC
- 24-bit conversion
- System sampling rates up to 192 kHz
- Advanced multibit Delta-Sigma architecture
- 104 dB dynamic range
- -95 dB THD+N D/A converter; -90 dB THD+N A/D converter
- Optional asynchronous serial port operation
- 6:1 input MUX
  - Up to six stereo input sources, pass-through mode
- Programmable gain amplifier:  $\pm 12$  dB gain, 0.5 dB step sizes with zero crossing
- Microphone pre-amp with 32 dB gain and low-noise bias supply
- Digital volume control
- Aux output
- Popguard® technology for control of clicks and pops
- Single-ended inputs and outputs
- 3.3 V or 5 V power supply
- Support for direct interface to logic levels from 1.8 V to 5 V
- Overflow detection
- Support for asynchronous A/D and D/A converter sample rates
- Pin compatible with the CS5345
- Package: 48-pin LQFP, lead-free assembly

The highly integrated CS4245 stereo CODEC provides developers with a solution that streamlines product development, reduces overall design complexity and cost, and delivers premium audio performance. The CS4245's front-end features an integrated analog input selector to accommodate up to six stereo audio sources.



## APPLICATIONS

- Automotive Entertainment Systems
- Digital TVs
- Digital Video Recorders/Personal Video Recorders
- Blu-ray/DVD Recorders/Receivers
- Home Theater Products
- PC Sound Cards
- Set-Top Boxes
- Home Media Centers

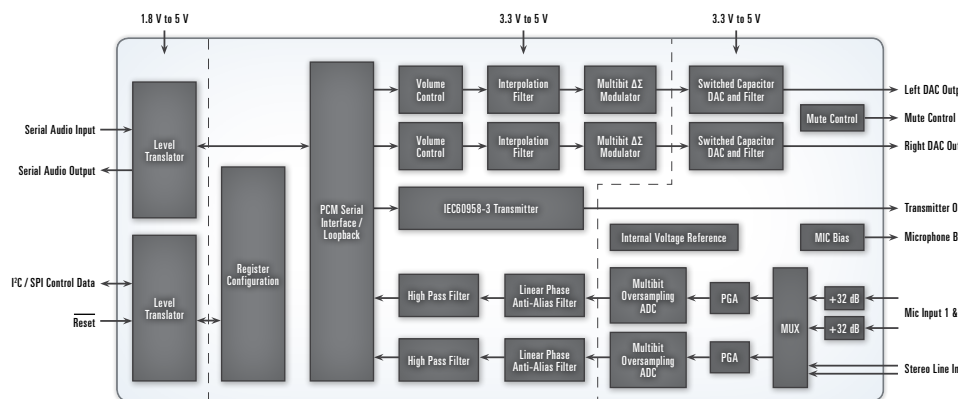
## CS4265

104 dB, 24-BIT, 192 kHz STEREO AUDIO CODEC WITH MUX AND S/PDIF TRANSMITTER

## FEATURES

- Complete stereo CODEC
- Integrated 192 kHz S/PDIF transmitter
- 24-bit conversion
- System sampling rates up to 192 kHz
- Advanced multibit Delta-Sigma architecture
- 104 dB dynamic range
- -95 dB THD+N D/A converter; -90 dB THD+N A/D converter
- 2:1 input MUX
- IEC60958-3 transmitter
- Programmable gain amplifier:  $\pm 12$  dB gain, 0.5 dB step sizes with zero crossing
- Microphone pre-amp with 32 dB gain and low-noise bias supply
- Digital volume control
- Popguard® technology for control of clicks and pops
- Single-ended inputs and outputs
- 3.3 V or 5 V power supply
- Support for direct interface to logic levels from 1.8 V to 5 V
- Overflow detection
- High-pass filter with defeat
- Package: 32-pin QFN, lead-free assembly

The highly integrated CS4265 stereo CODEC with S/PDIF output provides premium audio performance and an innovative design that integrates five chips into one. The CS4265 features an integrated analog front-end with 2:1 input MUX. Also included is a programmable gain amplifier (PGA) capable of  $\pm 12$  dB of analog gain in 0.5 dB step sizes with zero-crossing, click-free transitions to maintain superior audio quality.



## APPLICATIONS

- Automotive Entertainment Systems
- Digital TVs
- Digital Video Recorders/Personal Video Recorders
- Blu-ray/DVD Recorders/Receivers
- Home Media Centers
- Notebook Computers
- PC Sound Cards
- Set-Top Boxes

## CS4271

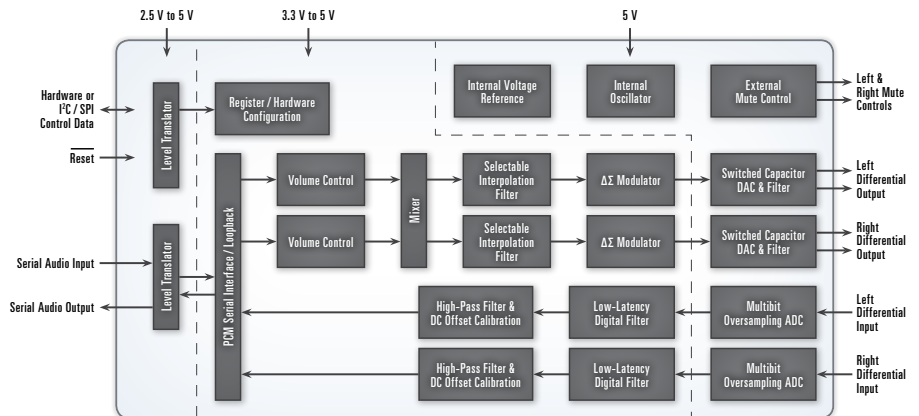
## CS4272

114 dB, 24-BIT, 192 kHz STEREO CODEC

## FEATURES

- Complete stereo CODEC
- 24-bit conversion
- System sampling rates up to 192 kHz
- 114 dB dynamic range
- -100 dB THD+N
- Output digital volume control with soft ramp
- Low-latency digital filter
- Selectable digital filter response
- High-pass filter or DC offset calibration
- Differential analog architecture
- On-chip oscillator
- Supports master or slave mode operations
- 5 V analog power supply
- 3.3 V or 5 V digital power supply
- Supports direct interface to logic levels from 2.5 V to 5 V
- Footprint-compatible with the CS4271
- Package: 28-pin TSSOP, lead-free assembly
- Consumer and automotive D-grade availability

The CS4272 is a high-performance integrated audio CODEC that performs stereo A/D and D/A conversion of up to 24-bit serial values at sample rates up to 192 kHz. The CS4272 utilizes a differential analog architecture to deliver unmatched analog performance and maximize system flexibility with an on-chip oscillator, output volume control with soft ramp and zero crossing, selectable digital filter response and integrated level shifters for direct interface to logic levels from 2.5 V to 5 V.



## APPLICATIONS

- Automotive Entertainment Systems
- Blu-ray/DVD Recorders
- Effects Processors
- Digital Mixing Consoles
- Set-Top Boxes

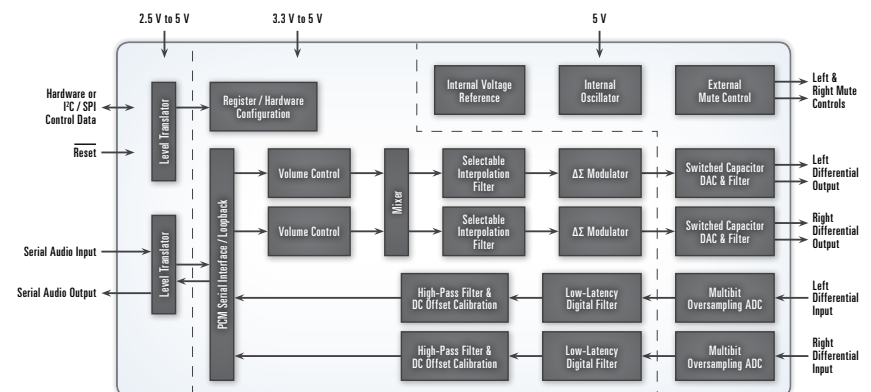
## CS4207

HD AUDIO CODEC

## FEATURES

- Headphone amplifier features
  - 105 dB dynamic range, -95 dB THD+N
  - Ground-centered outputs – no DC-blocking capacitors required
  - 44 mW power/channel into 16  $\Omega$
- Digital to analog features
  - 108 dB dynamic range, -95 dB THD+N
  - 192 kHz sample rates independently.
  - Digital volume control
- Analog to digital features
  - 105 dB dynamic range, -92 dB THD+N
  - Analog programmable gain amplifier (PGA) +/-12dB
  - Microphone pre-amplifier up to +30 dB gain settings
  - 96 kHz sample rates independently
  - Additional digital attenuation control -13.0 dB to -51.0 dB
- Digital interface for two dual digital microphone Inputs
- S/PDIF receiver
  - 32 kHz to 192 kHz sample rate range
  - Integrated sample rate converter
- Two S/PDIF transmitters
  - 32 kHz to 192 kHz sample rate range
- Power consumption as low as <7mW
- Jack detect does not require HDA bus BITCLK
- Variable power supplies
  - 1.5 V to 1.8 V digital core voltage
  - 3.3 V to 5.0 V analog core voltage & headphone drivers
  - 1.5 V to 3.3 V HD bus interface logic
  - 3.3 V interface logic levels for GPIO, S/PDIF and digital microphone

The CS4207 is a highly integrated, multi-channel low-power HD Audio CODEC featuring six 192 kHz DACs and four 96 kHz ADCs. The device also offers one S/PDIF receiver with an integrated sample rate converter, two 192 kHz S/PDIF transmitters, microphone pre-amp, a ground centered headphone driver and two digital microphone inputs. This robust set of features makes it ideal for notebooks, netbooks or Mobile Internet Devices (MIDs) and PC-based automotive systems.



## APPLICATIONS

- Netbooks or Mobile Internet Devices
- Notebook Computers
- PC-based Automotive Systems



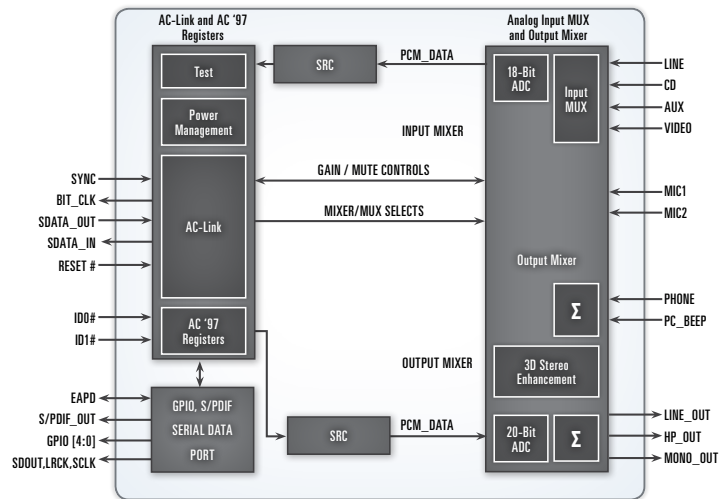
## CS4202

### AUDIO CODEC '97 WITH HEADPHONE AMPLIFIER

#### FEATURES

- AC '97 2.2-compliant
- Exceeds Microsoft® PC 2001 audio requirements
- Integrated high-performance headphone amplifier
- On-chip PLL for use with external clock sources
- Integrated high-performance microphone pre-amplifier
- Automatic jack sense through general-purpose I/O
- BIOS driver interface for audio feature configuration through software
- 20-bit stereo D/A converter; 18-bit stereo A/D converter with sample-rate converters
- Inputs:
  - Line-level: 3 stereo and 2 mono
  - Mic-level: 2 mono
  - High-quality pseudo-differential CD input
- Outputs:
  - S/PDIF digital audio output
  - I<sup>2</sup>S serial digital for cost-effective 6-channel applications
  - Simultaneous S/PDIF and 6-channel audio playback
  - Stereo and mono line-level
- Package: 48-pin TQFP, lead-free assembly

The CS4202 is an AC '97 2.2-compliant, stereo audio CODEC designed for PC multimedia systems. It uses industry-leading Delta-Sigma mixed-signal technology with features that are designed to help enable the design of PC 99- and PC 2001-compliant, high-quality audio systems for desktop, portable and entertainment PCs.



#### APPLICATIONS

- High-Quality Audio Systems for Desktop, Portable and Entertainment PCs
- PC 99- and PC 2001-Compliant

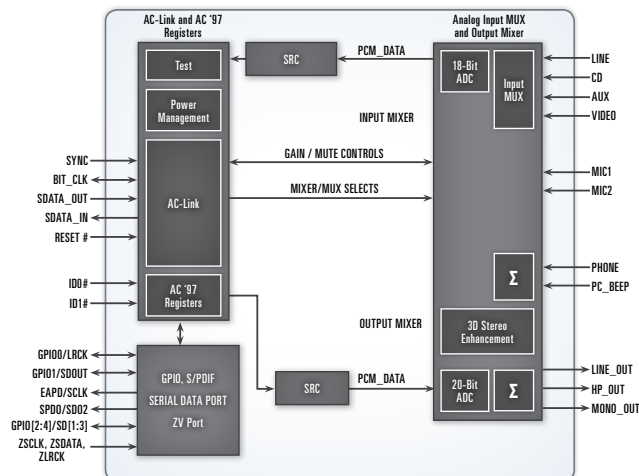
## CS4205

### AUDIO CODEC '97 FOR PORTABLE COMPUTING

#### FEATURES

- AC '97 2.1-compliant
- Meets or exceeds the Microsoft® PC 99 and PC 2001 audio performance requirements
- Integrated asynchronous I<sup>2</sup>S input port (ZV port)
- Integrated high-performance microphone pre-amplifier
- Integrated digital effects processing for bass and treble
- Digital docking of I<sup>2</sup>S output, 3 synchronous I<sup>2</sup>S inputs
- High-performance digital mixer with SRS 3D stereo enhancement
- On-chip PLL for use with external clock sources
- Dedicated microphone A/D converter
- S/PDIF digital audio output
- PC beep bypass
- 20-bit stereo D/A converter; 18-bit stereo A/D converter with sample-rate converters
- Analog, line-level stereo inputs: LINE\_IN, VIDEO and AUX
- High-quality, pseudo-differential CD input
- Extensive power-management support
- Package: 48-pin TQFP, lead-free assembly

The CS4205 is an AC '97 2.1-compliant, stereo audio CODEC designed for PC multimedia systems. It uses industry-leading Delta-Sigma and mixed-signal technology.



#### APPLICATIONS

- High-Quality Audio Systems for Desktop, Portable and Entertainment PCs
- PC 99- and PC 2001-Compliant



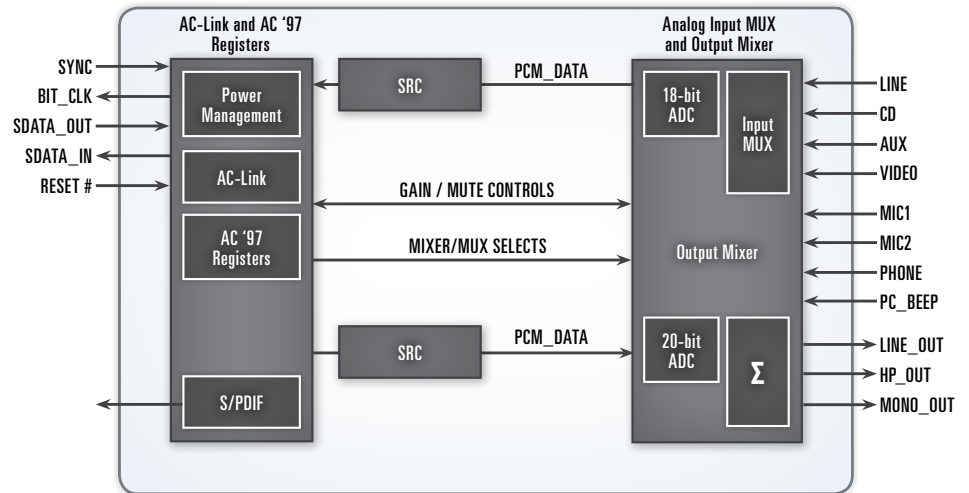
# CS4299

## AUDIO CODEC '97

### FEATURES

- AC '97 2.1-compliant
- Meets or exceeds the Microsoft® PC 99 audio performance requirements
- Industry-leading mixed-signal technology
- 20-bit stereo D/A converter; 18-bit stereo A/D converter
- Sample-rate converters
- Four analog, line-level stereo inputs: LINE\_IN, CD, VIDEO and AUX
- Two analog, line-level mono inputs: modem and internal PC beep
- Dual stereo line-level outputs: LINE\_OUT and ALT\_LINE\_OUT
- Dual microphone inputs
- High-quality, pseudo-differential CD input
- S/PDIF digital audio output
- 3D stereo enhancement
- Extensive power-management support
- Package: 48-pin TQFP, lead-free assembly

The CS4299 is an AC '97 2.1-compliant, stereo audio CODEC designed for PC multimedia systems. Using industry-leading Delta-Sigma and mixed-signal technology, the CS4299 enables the design of PC 99-compliant desktop, portable and entertainment PCs.



### APPLICATIONS

- PC 99-Compliant Desktop, Portable and Entertainment PCs

# CS42324/25

## 2-IN, 4-OUT, AUDIO CODEC WITH 2 V<sub>RMS</sub> ANALOG I/O

### D/A FEATURES

- Dual 24-bit stereo DACs
- Multibit Delta-Sigma modulator
- 100 dB dynamic range (A-wtd)
- -90 dB THD+N
- Integrated line driver
  - 2 V<sub>RMS</sub> output
  - Single-ended outputs
- Headphone Driver (CS42325 only)
  - Up to 96 kHz sampling rates
- Stereo 7:1 output multiplexer
- Volume control with soft ramp
  - 0.5 dB step size
  - Zero crossing click-free transitions
- Selectable serial audio interface formats
  - Left- or right-justified, up to 24-bit
  - I<sup>2</sup>S up to 24-bit
- Selectable 50/15 µs de-emphasis
- Internal analog mute
- Control output for external muting
- Popguard® technology

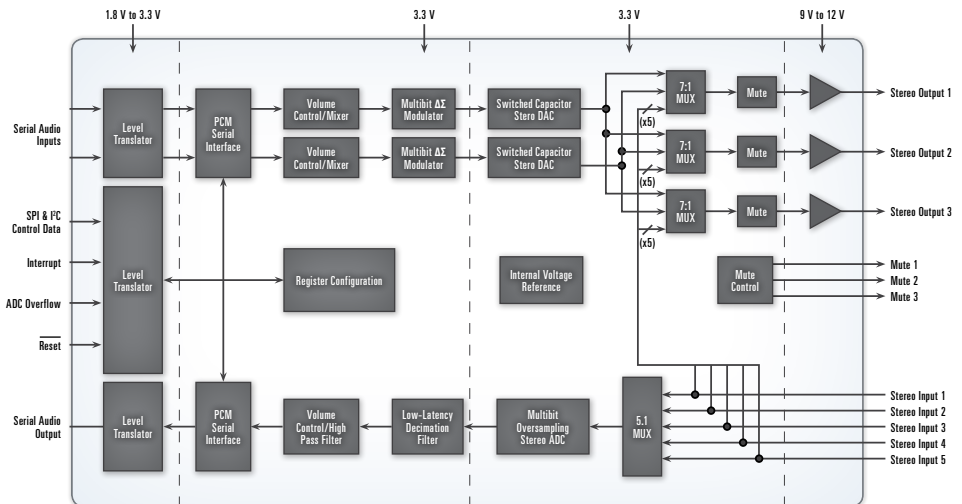
### A/D FEATURES

- Multibit Delta-Sigma modulator
- 24-bit conversion
- Up to 96 kHz sampling rates
- 95 dB dynamic range (A-wtd)
- -88 dB THD+N
- Stereo 5:1 input multiplexer
- Digital volume control with soft ramp
  - 0.5 dB step size
- Selectable serial audio interface formats
  - Left-justified
  - I<sup>2</sup>S
- High-pass filter or DC offset calibration

### SYSTEM FEATURES

- Direct interface with 1.8 V to 3.3 V logic levels
- Supports asynchronous serial port operation
  - Two independent clock domains
  - ADC, DAC1, and DAC2 can be independently assigned to the two clock domains
  - Each serial port supports master or slave operation
- Internal digital loopback
- +3.3 V analog power supply
- +3.3 V digital power supply
- +9 V to +12 V high-voltage power supply
- Hardware or software mode configuration
  - Supports I<sup>2</sup>C® and SPI™ software interface

The CS42324 and the CS42325 are highly integrated multi-channel audio CODECs. The CS42325 is a footprint compatible option with a stereo headphone driver. Through very high levels of feature integration, including stereo analog-to-digital conversion and up to four channels of digital-to-analog conversion, the CS42324/25 CODECs have greatly simplified the audio system design challenges through flexible signal routing within flat-panel televisions and DVD recorders.



### APPLICATIONS

- Blu-ray/DVD Recorders
- Digital Video Recorders
- MP3 Docking Stations
- Digital Audio Distribution Systems
- Flat-Panel Digital TVs
- Micro/Mini Shelf Systems

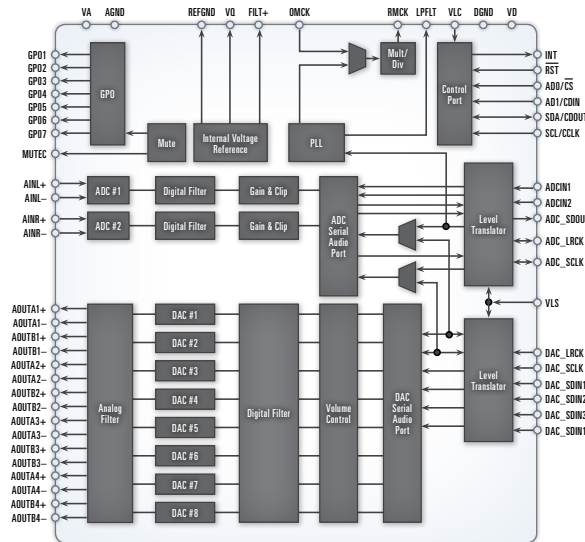
# CS42416/18/26/28

## 114 dB, 192 kHz, 6- AND 8-CHANNEL SURROUND-SOUND CODECS WITH PLL

### FEATURES

- Six or eight D/A converters, two 24-bit A/D converters
- 110 dB or 114 dB D/A dynamic range
- 114 dB A/D dynamic range
- -100 dB THD+N
- System sampling rates up to 192 kHz
- Integrated low-jitter PLL for increased system jitter tolerance
- PLL clock or OMCK system clock selection
- Seven configurable general-purpose outputs
- A/D converter high-pass filter for DC offset calibration
- Expandable A/D converter channels and 1-line mode support
- Digital output volume control with soft ramp
- Digital  $\pm 15$  dB input gain adjust for A/D converter
- Differential analog architecture
- 5 V analog power supply
- 3.3 V or 5 V digital power supply
- Supports logic levels between 1.8 V and 5 V
- Package: 64-pin LQFP, lead-free assembly
- Consumer and automotive D-grade availability

The CS42416/18/26/28 family of 24-bit surround-sound CODECs provides two A/D and six or eight D/A Delta-Sigma converters, as well as an integrated PLL (phase-locked loop) for a low-jitter system clock. This family of products supports sampling rates of up to 192 kHz.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers
- Digital Speaker Systems

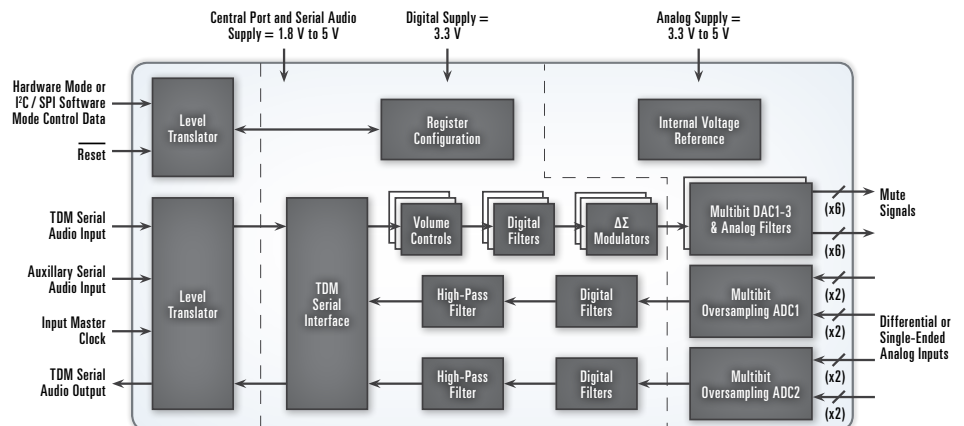
# CS42432

## 108 dB, 192 kHz 4-IN, 6-OUT SURROUND-SOUND TDM CODEC

### FEATURES

- Four 24-bit A/D converters and six 24-bit D/A converters
- System sampling rates up to 192 kHz
- D/A converter dynamic range
  - 105 dB differential
  - 102 dB single-ended
- D/A converter dynamic range
  - 108 dB differential
  - 105 dB single-ended
- THD+N (A/D and D/A converters)
  - -98 dB differential
  - -95 dB single-ended
- A/D input MUX—single-ended mode
- Programmable A/D converter high-pass filter for DC offset calibration
- Compatible with industry-standard TDM serial interface
- Auxiliary input source for additional external A/D or S/PDIF receiver
- Logarithmic digital volume control
- I<sup>2</sup>C®/SPI™ host control port
- Hardware mode
- Support for logic levels between 1.8 V and 5 V
- 3.3 V or 5 V analog power supply
- 3.3 V digital supply
- Package: 52-pin MQFP, lead-free assembly
- Consumer and automotive D-grade availability

The CS42432 is a highly integrated CODEC engineered to simplify design for home theaters and automotive audio systems. This CODEC allows system designers to deliver advanced multichannel surround-sound performance for entry- and mid-level audio products.



### APPLICATIONS

- A/V Receivers
- Applications That Require Wide Dynamic Range, Negligible Distortion and Low Noise
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers

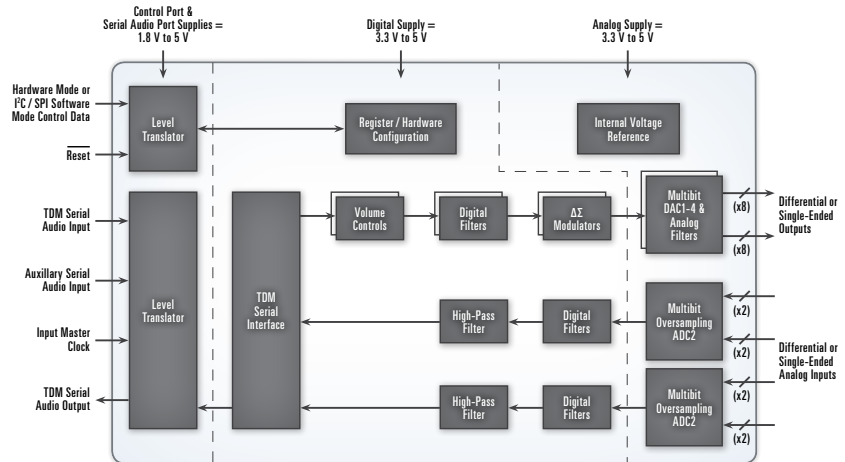
# CS42435

108 dB, 192 kHz, 4-IN, 8-OUT TDM CODEC

## FEATURES

- Four 24-bit A/D converters and eight 24-bit D/A converters
- System sampling rates up to 192 kHz
- A/D converter dynamic range
  - 105 dB differential
  - 102 dB single-ended
- D/A converter dynamic range
  - 108 dB differential
  - 105 dB single-ended
- THD+N (A/D and D/A converters)
  - -98 dB differential
  - -95 dB single-ended
- A/D input MUX—single-ended mode
- Programmable A/D converter high-pass filter for DC offset calibration
- Compatible with industry-standard TDM serial interface
- Support for logic levels between 1.8 V and 5 V
- Package: 52-pin MQFP, lead-free assembly
- Consumer and automotive D-grade availability

Introduced to specifically meet the needs of automotive audio platforms, the CS42435 CODEC incorporates features such as a flexible power supply, level translators and digital integration. This IC simplifies the designers' job, allowing them to deliver advanced multichannel surround-sound performance for entry- and mid-level audio products, all in a single 52-pin LQFP package.



## APPLICATIONS

- A/V Receivers
- Applications That Require Wide Dynamic Range, Negligible Distortion and Low Noise
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers

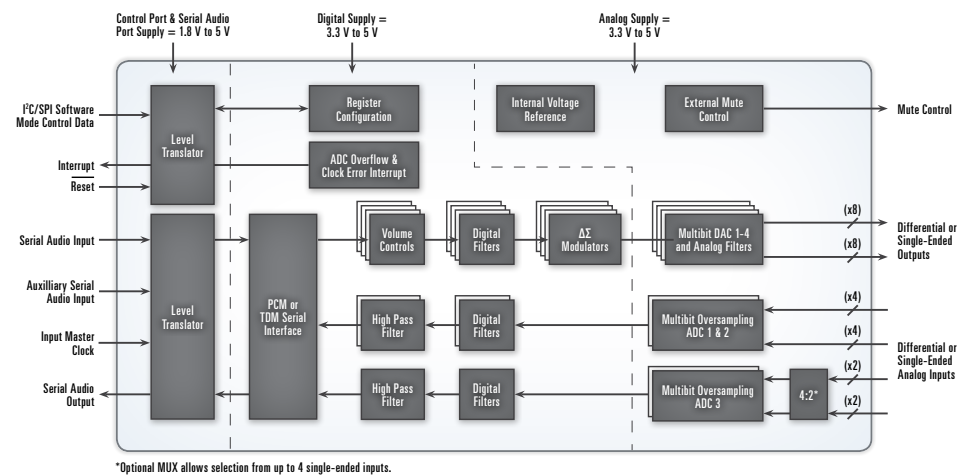
# CS42436/38

108 DB, 192 KHZ, 6-IN, 6-OUT/8-OUT SURROUND-SOUND TDM CODECS

## FEATURES

- Six 24-bit A/D converters and eight 24-bit D/A converters (CS42438)
- System sampling rates up to 192 kHz D/A converter/96 kHz A/D converter
- A/D converter dynamic range
  - 105 dB differential
  - 102 dB single-ended
- D/A converter dynamic range
  - 108 dB differential
  - 105 dB single-ended
- THD+N (A/D and D/A converters)
  - -98 dB differential
  - -95 dB single-ended
- A/D input MUX—single-ended mode
- Programmable A/D converter high-pass filter for DC offset calibration
- I2C®/SPI™ host control port
- Hardware mode
- Compatible with industry-standard TDM serial interface
- Support for logic levels between 1.8 V and 5 V
- Package: 52-pin MQFP, lead-free assembly
- Consumer and automotive D-grade availability

The CS42436/38 family of highly integrated CODECs is engineered to simplify design for home theaters and automotive audio systems. These CODECs allow system designers to deliver advanced multichannel surround-sound performance for entry- and mid-level audio products.



## APPLICATIONS

- A/V Receivers
- Applications That Require Wide Dynamic Range, Negligible Distortion and Low Noise
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers

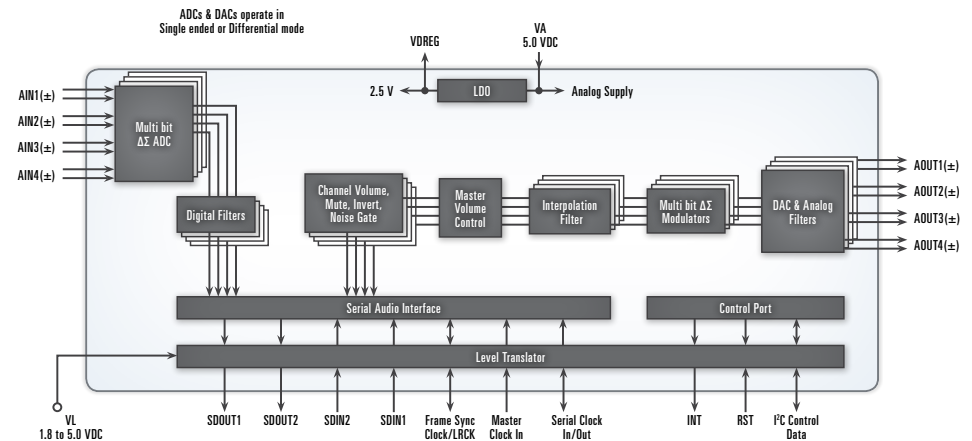
## CS4244

## 4 IN/4 OUT AUDIO CODEC WITH PCM AND TDM INTERFACES

## FEATURES

- Differential or Single-ended Outputs
- Dynamic Range (A-Weighted)
  - -109 dB Differential
  - -105 dB Single-Ended
- THD+N
  - -90 dB Differential
  - -88 dB Single-Ended
- 2 V<sub>RMS</sub> Full-scale Output into 3 k $\Omega$  AC Load
- Rail-to-rail Operation
- Differential or Single-ended Inputs
- Dynamic Range (A-weighted)
  - -105 dB Differential
  - -102 dB Single-Ended
- THD+N
  - -88 dB Differential
  - -88 dB Single-Ended
- TDM, Left Justified, and I<sup>2</sup>S Serial Inputs and Outputs
- I<sup>2</sup>C Host Control Port
- Supports Logic Levels Between 5 V and 1.8 V
- 24 bit resolution
- Supports Sample Rates up to 96 kHz
- Consumer and Automotive temperature grade availability

The CS4244 CODEC provides four multi-bit analog-to-digital and four multi-bit digital-to-analog delta-sigma converters and is compatible with either differential or single-ended inputs and outputs. Digital volume control, noise gating, and muting is available for each DAC path. A selectable high-pass filter is provided for the 4 ADC inputs. The CS4244 supports both Master or Slave mode.



## APPLICATIONS

- Automotive Audio Systems
- Audio Mixing Consoles
- Audio Effects Processors
- AV Receivers
- DVD Receivers
- Amplifiers
- Automotive Head Units with Internal Class H

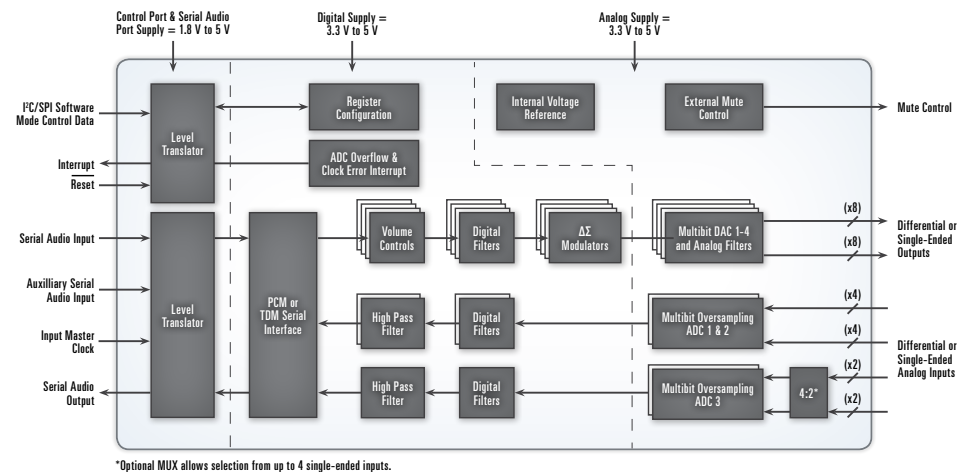
## CS42448

## 108 dB, 192 kHz, 6-IN, 8-OUT SURROUND-SOUND CODEC

## FEATURES

- Six 24-bit A/D converters and eight 24-bit D/A converters
- System sampling rates up to 192 kHz
- A/D converter dynamic range
  - 105 dB differential
  - 102 dB single-ended
- D/A converter dynamic range
  - 108 dB differential
  - 105 dB single-ended
- THD+N (A/D and D/A converters)
  - -98 dB differential
  - -95 dB single-ended
- A/D input MUX—single-ended mode
- Cirrus Logic Popguard® technology to minimize clicks and pops
- Programmable A/D converter high-pass filter for DC offset calibration
- I<sup>2</sup>C®/SPI™ host control port
- Support for logic levels between 1.8 V and 5 V
- Package: 64-pin LQFP, lead-free assembly
- Selectable audio interface formats
  - Left-justified, I<sup>2</sup>S, TDM
- Consumer and automotive D-grade availability

The CS42448 is a highly integrated CODEC that is engineered to simplify design for home theaters and automotive audio systems. This CODEC allows system designers to deliver advanced multichannel surround-sound performance for entry- and mid-level audio products.



\*Optional MUX allows selection from up to 4 single-ended inputs.

## APPLICATIONS

- A/V Receivers
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers

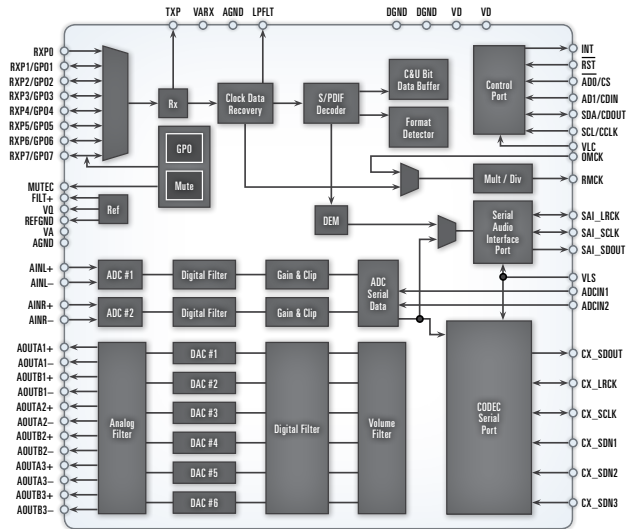
# CS42516/26

## 110/114 dB, 192 kHz, 2-IN, 6-OUT SURROUND-SOUND CODECS WITH S/PDIF RECEIVER

### FEATURES

- Six 24-bit D/A converters, two 24-bit A/D converters
- 110 dB D/A converter/114 dB A/D converter dynamic range (CS42516)
- 114 dB D/A converter/114 dB A/D converter dynamic range (CS42526)
- -100 dB THD+N
- System sampling rates up to 192 kHz
- S/PDIF receiver compatible with EIAJ CP1201 and IEC-60958
- 8:2 S/PDIF input MUX
- A/D converter high-pass filter for DC offset calibration
- Digital output volume control with soft ramp
- Digital  $\pm 15$  dB input gain adjust for A/D converter
- Differential analog architecture
- 5 V analog power supply
- 3.3 V or 5 V digital power supply
- Supports logic levels between 1.8 V and 5 V
- Package: 64-pin LQFP, lead-free assembly
- Consumer and automotive D-grade availability

The CS42516/26 CODEC family provides two A/D and six D/A Delta-Sigma converters, as well as an integrated S/PDIF receiver. The CS42516/26 family's integrated S/PDIF receiver supports up to eight inputs, clock recovery circuitry and format auto-detection.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers
- Digital Speakers

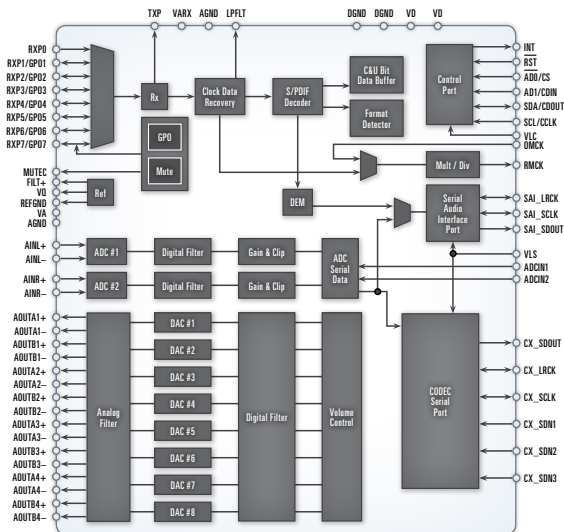
# CS42518/28

## 110/114 dB, 192 kHz, 2-IN, 8-OUT SURROUND-SOUND CODECS WITH S/PDIF RECEIVER

### FEATURES

- Eight 24-bit D/A converters, two 24-bit A/D converters
- 110 dB D/A converter/114 dB A/D converter dynamic range (CS42518)
- 114 dB D/A converter/114 dB A/D converter dynamic range (CS42528)
- -100 dB THD+N
- System sampling rates up to 192 kHz
- S/PDIF receiver compatible with EIAJ CP1201 and IEC-60958
- 8:2 S/PDIF input MUX
- Recovered S/PDIF clock or OMCK system clock selection
- A/D converter high-pass filter for DC offset calibration
- Digital output volume control with soft ramp
- Digital  $\pm 15$  dB input gain adjust for A/D converter
- Differential analog architecture
- 5 V analog power supply
- 3.3 V or 5 V digital power supply
- Supports logic levels between 1.8 V and 5 V
- Package: 64-pin LQFP, lead-free assembly
- Consumer and automotive D-grade availability

The CS42518/28 CODEC family provides two A/D and eight D/A Delta-Sigma converters, as well as an integrated S/PDIF receiver. The CS42518/28 family's integrated S/PDIF receiver supports up to eight inputs, clock recovery circuitry and format autodetection.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers
- Digital Speakers

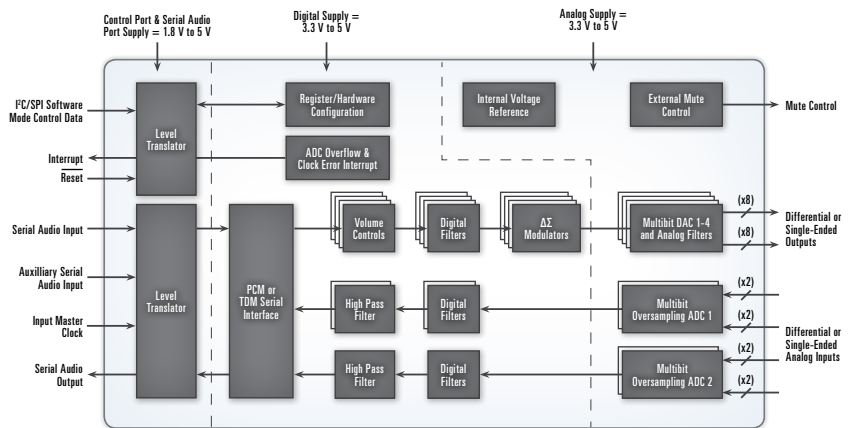
# CS42888

**108 dB, 192 kHz 4-IN, 8-OUT MULTI-CHANNEL CODEC**

## FEATURES

- Four 24-bit A/D, eight 24-bit D/A converters
- A/D converter dynamic range
  - 105 dB differential
  - 102 dB single-ended
- D/A converter dynamic range
  - 108 dB differential
  - 105 dB single-ended
- A/D/D/A converter THD+N
  - -98 dB differential
  - -95 dB single-ended
- Compatible with industry-standard time division multiplexed (TDM) serial interface
- System sampling rates up to 192 kHz
- Programmable A/D converter high-pass filter for DC offset calibration
- Logarithmic digital volume control
- I<sup>2</sup>C<sup>®</sup>/SPI<sup>™</sup> host control port
- Hardware mode
- Supports logic levels between 5 V and 1.8 V
- Popguard<sup>®</sup> technology
- Lead-free assembly
- Consumer and automotive grade availability

The CS42888 CODEC provides four multibit A/D and eight multibit D/A Delta-Sigma converters. The CODEC is capable of operation with either differential or single-ended inputs and outputs, in a 64-pin LQFP package. Four fully differential, or single-ended, inputs are available on stereo A/D converter1 and A/D converter2. Digital volume control is provided for each A/D converter channel, with selectable overflow detection.



## APPLICATIONS

- A/V Receivers
- Applications That Require Wide Dynamic Range, Negligible Distortion and Low Noise
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers



# Portable Audio Converters

## SPECIFICATIONS

Part	Resolution (bits)	Dynamic Range (dB)	THD+N (dB)	Sample Rate (kHz)	Analog I/O	Power Supply (V)	Comments	Package
<b>CS42L51</b>	24	98 ADC 98 DAC	-88 ADC -86 DAC	96	Single-ended	VA = 1.8 to 2.5 VD = 1.8 to 2.5 VL = 1.8 to 3.3	CODEC, 3:1 MUX, PGA, mic pre-amp, HP amp	32 QFN
<b>CS42L52</b>	24	98 ADC 98 DAC	-88 ADC -86 DAC	96	Single-ended	VA/VD = 1.65 to 2.83 VP = 2.37 to 5.35 VL = 1.8 to 3.3	CODEC, 4:1 MUX, PGA, mic pre-amp, HP/speaker amps	40 QFN
<b>CS42L55</b>	24	95 ADC 99 DAC	-87 ADC -86 DAC	48	Pseudo-differential	VA/VD = 1.65 to 2.71 VCP = 1.65 to 2.73 VL = 1.65 to 3.47	CODEC, Class-H HP amp, 2:1 MUX, PGA	36 QFN
<b>CS42L73</b>	24	91 ADC 97 DAC	-85	48	Pseudo-differential	VA/VCP/VL = 1.66 to 1.94 VP = 3.0 to 5.25 VD = 0.85 to 1.40	2 ADCs, 4 DACs, Class-H HP, Class A/B speaker driver, 3x asynchronous serial ports	65 FBGA 64 WLCSP
<b>CS43L21</b>	24	98	-86	96	Single-ended	VA = 1.8 to 2.5 VD = 1.8 to 2.5 VL = 1.8 to 3.3	DAC with HP amp and volume control	32 QFN
<b>CS43L22</b>	24	98	-88	96	Single-ended	VA/VD = 1.65 to 2.83 VP = 2.37 to 5.35 VL = 1.8 to 3.3	DAC with HP and Class-D speaker amps	40 QFN
<b>CS53L21</b>	24	98	-88	96	Single-ended	VA = 1.8 to 2.5 VD = 1.8 to 2.5 VL = 1.8 to 3.3	ADC, 3:1 MUX, PGA, mic pre-amp	32 QFN



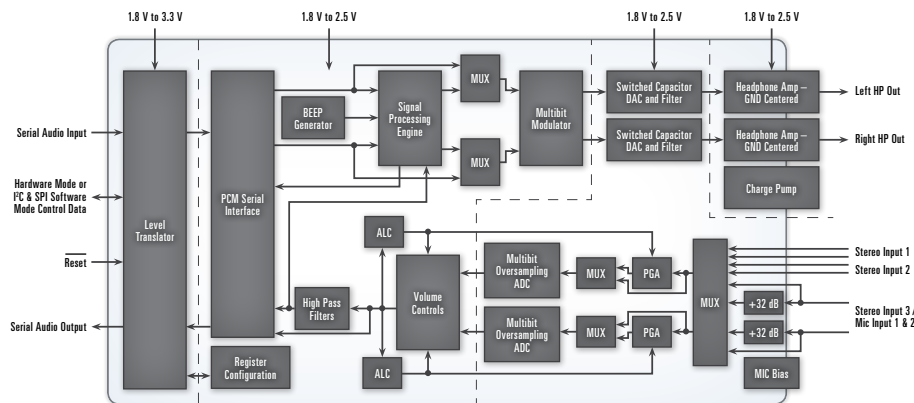
## CS42L51

## LOW-POWER STEREO CODEC WITH HEADPHONE AMPLIFIER

## FEATURES

- Low-power audio CODEC
  - Stereo playback: 13 mW @ 1.8 V
  - Stereo record and playback: 20 mW @ 1.8 V
- Operates from a single 1.8 V or 2.5 V supply
- Analog inputs
  - 3:1 stereo input selector
  - PGA, +12 dB to -3 dB in 0.5 dB steps
  - +32 dB or +16 dB stereo microphone pre-amp with bias supply
  - Automatic level control with overflow detection
- Analog outputs
  - Configurable as stereo headphone or line-level outputs
  - Ground centered outputs—no DC-blocking capacitors required
  - Up to 88 mW into stereo 16  $\Omega$  headphones (2.5 V)
  - Up to 46 mW into stereo 16  $\Omega$  headphones (2.5 V)
- Digital signal processing engine
  - Digital bass and treble tone control
  - Programmable peak signal detect and limiter
  - Digital volume control with soft ramp and zero cross
  - On-chip beep generation
- 98 dB dynamic range
- -88 dB THD+N (-75 dB with HP load)
- 24-bit conversion, up to 96 KHz sample rates
- Flexible power-down management—chip/block selectable
- Package: 32 QFN, lead-free assembly

The CS42L51 delivers excellent audio performance while providing portable device developers with an innovative solution that maximizes battery life while minimizing end-product form factors. The CS42L51's key distinction is that it operates from a single, 1.8 V power supply for low power consumption, yet delivers plenty of output power, 46 mW, into stereo 16  $\Omega$  headphones for a great listening experience.



## APPLICATIONS

- Digital Cameras & Camcorders
- Digital Voice Recorders
- Guitar Effects Pedals
- Hard-Disc Drive & Flash-Based Portable Audio Players
- Mini-Disc Players and Recorders
- PDAs & Smartphones
- Personal Media Players
- Portable Audio Recording Systems
- Portable Gaming Systems
- Wireless Headsets

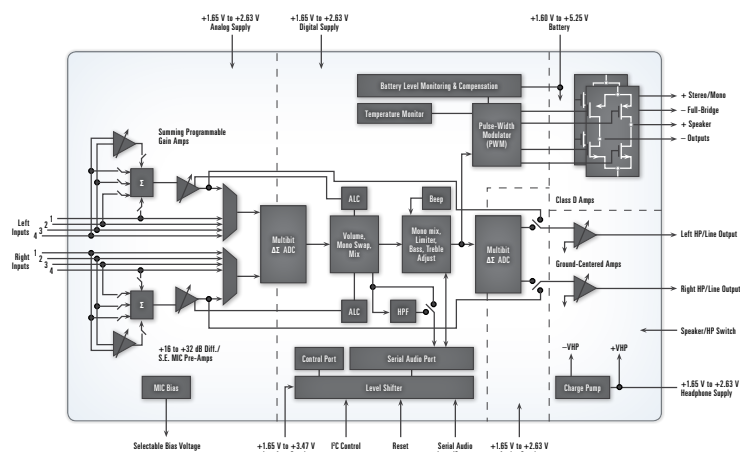
## CS42L52

## LOW-POWER STEREO CODEC WITH HP AMP AND 2 W CLASS-D STEREO SPEAKER AMPLIFIER

## FEATURES

- Low-power operation
  - Stereo analog pass through: 10 mW @ 1.8 V
  - Stereo playback: 14 mW @ 1.8 V
  - Stereo record and playback: 23 mW @ 1.8 V
- 98 dB dynamic range (A-wtd) and -88 dB THD+N
- 24-bit conversion, up to 96 kHz sample rates
- 4:1 analog input MUX
- Analog input mixing and pass through
- Analog programmable gain amplifier (PGA) and automatic level control (ALC)
- Dual MIC inputs
- Digital signal processing engine
  - Bass and treble tone control, de-emphasis
  - Master volume control
  - Soft-ramp and zero-cross transitions
  - Programmable peak-detect and limiter
  - Beep generator with full tone control
- Package: 40-pin QFN, lead free assembly
- Consumer and automotive grade availability
- Low 384 k switching frequency

The CS42L52 CODEC functions as the complete audio package for portable audio applications. Incorporating an efficient on board Class-D speaker driver, ground centered head phone amplifier and digital signal processing engine, the CS42L52 delivers excellent audio performance while providing portable device developers with an innovative all around solution.



## APPLICATIONS

- Digital Cameras
- Digital Voice Recorders
- Handheld GPS
- MP3 Players
- PDAs & Smartphones
- Portable Gaming Systems
- Portable Media Players (MP4)
- Toys

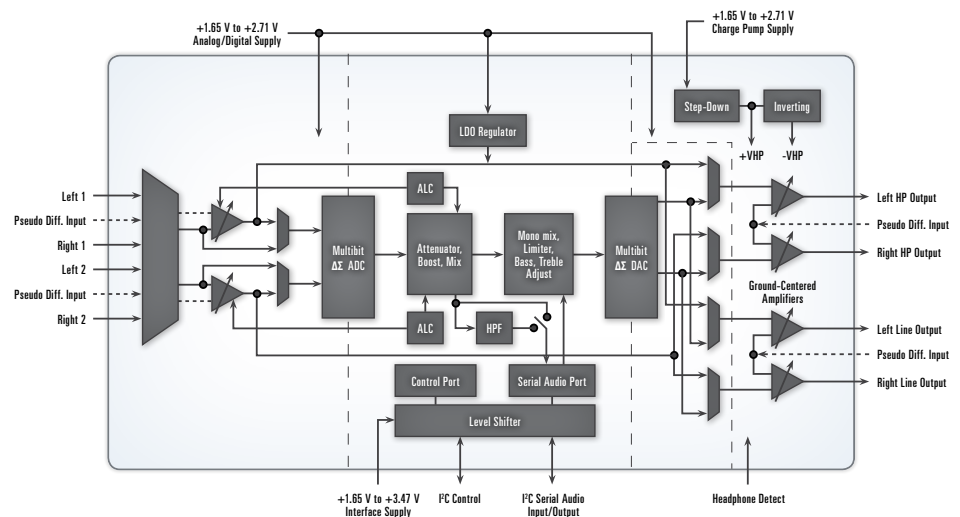
# CS42L55

## ULTRA-LOW POWER STEREO CODEC WITH CLASS H HEADPHONE AMPLIFIER

### FEATURES

- Ultra-low power stereo audio CODEC
  - Stereo playback to headphone: 5.08 mW @ 1.8 V
  - Stereo record and playback: 8.23 mW @ 1.8 V
- Operates from a single 1.8 V or 2.5 V supply
- 24-bit conversion, up to 48 kHz sample rates
- 12 MHz USB master clock input
- Digital to analog features
  - 99 dB dynamic range (A-wtd) and -86 dB THD+N
  - Class H amplifier—automatic supply adjusting
    - High efficiency and low EMI
    - 2 x 20 mW power into 32  $\Omega$  @ 1.8 V
    - 2 x 20 mW power into 16  $\Omega$  @ 1.8 V
    - -75 dB THD+N
- Pseudo-differential ground-centered outputs—no DC-blocking capacitors required
- 1 V<sub>RMS</sub> Line Output @ 1.8 V
- Analog volume control (+12 to -55 dB in 1 dB steps)
- Analog in to analog out passthrough
- Pop and click suppression
- Analog to digital features
  - 95 dB dynamic range (A-wtd) and -87 dB THD+N
  - 2:1 stereo input multiplexer
  - Pseudo differential inputs
  - PGA, +12 dB to -6 dB in 0.5 dB steps
- Digital signal processing engine
  - Digital bass and treble tone control
  - Programmable peak signal detect and limiter
  - Digital volume control with soft ramp and zero cross
  - Beep generator with full tone control
- Power down management—chip/block selectable
- CS42L55, 36X-QFN, lead-free assembly

The CS42L55 is a 24-bit, ultra-low power stereo CODEC that offers excellent audio performance, feature integration and battery life. The CS42L55 features an automatic, supply-adjusting bimodal Class H headphone amplifier that combines the efficiency of an integrated stepdown and inverting charge pump with the linearity and low EMI of a Class AB amplifier. The amplifier delivers a ground-centered output with a large signal swing even at low voltages and eliminates the need for external DC-blocking capacitors.



### APPLICATIONS

- Digital Voice Recorders
- Portable Audio Recording Systems
- Portable Gaming Systems
- Portable Media Players
- Portable Navigation Devices
- Wireless Headsets

# CS42L73

## HIGHLY INTEGRATED LOW POWER MOBILE STEREO CODEC

### FEATURES

#### ANALOG I/O

- Stereo high performance ADC
- 91 dB Dynamic Range (A-wtd)
- -85 dB THD+N
- Dual digital microphone interface
- Independent MIC bias outputs
- Stereo DAC to headphone amplifier
- 94 dB Dynamic Range (A-wtd)
- -81 dB THD+N into 32  $\Omega$
- Integrated Step-down/Inverting Charge Pump
- Class H amplifier - automatic supply adj.
- High HP Power Output at -70/-81 dB THD+N
- 2 x 17/8.5 mW into 16/32  $\Omega$  @ 1.8 V
- Stereo DAC to Line Outputs

#### STEREO HIGH PERFORMANCE LINE LEVEL DAC

- 97 dB Dynamic Range (A-wtd)
- -86 dB THD+N
- 1 V<sub>RMS</sub> from a single 1.8 V power supply

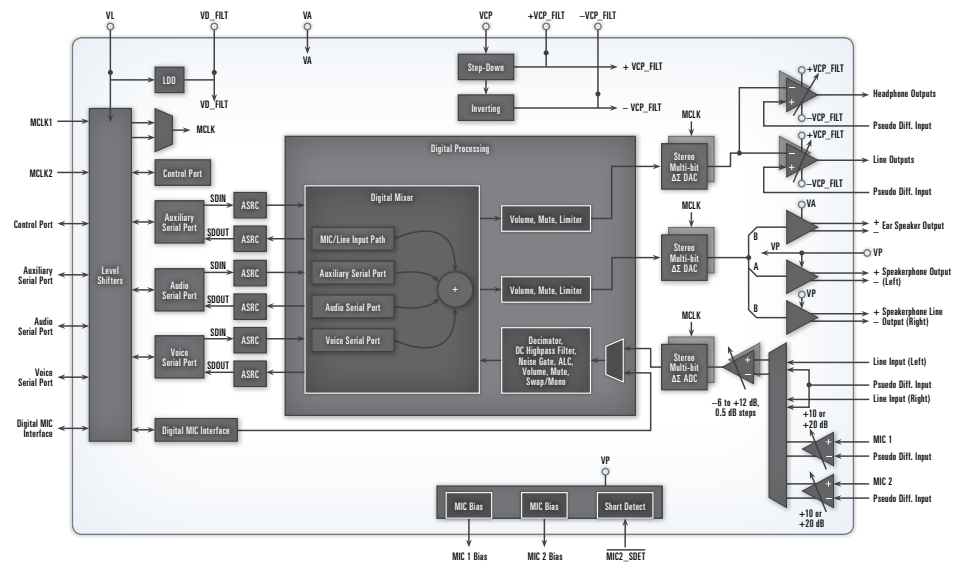
#### MONO DAC TO EAR SPEAKER AMPLIFIER

- High Power Output at -70 dB (0.032%) THD+N
- -45 mW into 16  $\Omega$  @ 1.8 V

#### MONO DAC TO SPEAKERPHONE AMPLIFIER

- High output power at  $\leq 1\%$  THD+N
- -1.18/0.84/0.66 W into 8  $\Omega$  @ 5.0/4.2/3.7 V
- Direct battery-powered operation

CS42L73 is a highly integrated, low-power, mobile audio distribution network that incorporates two stereo DACs and a stereo ADC with ground centered headphone, line and speaker amplifiers for smartphone and portable applications. Three asynchronous bidirectional serial ports with integrated asynchronous sample rate converters (ASRCs) that accept a wide range of incoming audio sample rates can be used to feed the integrated digital mixing engine, which is the heart of the CS42L73.



### APPLICATIONS

- Smartphones
- Bluetooth Headsets
- Mobile Internet Devices

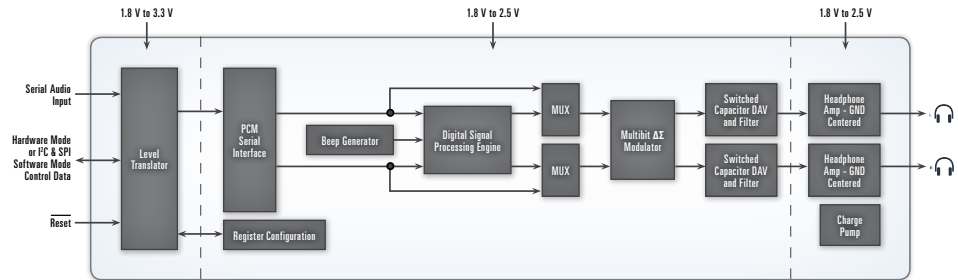
## CS43L21

### D/A CONVERTER WITH VOLUME CONTROL AND GROUND CENTERED OUTPUT

#### FEATURES

- Stereo playback: 12.93 mW @ 1.8 V
- Operates from a single 1.8 V or 2.5 V supply
  - 1.8 V to 2.5 V digital & analog
  - 1.8 V to 3.3 V interface logic
- Power down management
- Software mode (I<sup>2</sup>C®/SPI™ control)
- Hardware mode (standalone control)
- Digital signal processing engine
  - Bass & treble tone control, de-emphasis
- On chip beep generator
- Master or slave operation
- High-impedance digital output option (for easy muxing between D/A converter and other data sources)
- Quarter-speed mode—(i.e. allows 8 kHz Fs while maintaining a flat noise floor up to
- Headphone Amplifier—GND Centered
  - On-Chip Charge Pump Provides -VA\_HP
  - No DC-Blocking Capacitor Required
  - 46 mW Power Into Stereo 16  $\Omega$  @ 1.8 V
  - 88 mW Power Into Stereo 16  $\Omega$  @ 2.5 V
  - 75 dB THD+N
- 98 dB Dynamic Range (A-wtd)
- 86 dB THD+N
- Lead-free assembly

The CS43L21 is a highly integrated, 24-bit, 96 kHz, low power stereo D/A converter with astounding audio performance for its size. An integrated charge pump, and headphone amplifier that outputs up to 88 mW of ground centered Power into 16  $\Omega$  speakers, offers designers a flexible solution for their portable audio needs.



#### APPLICATIONS

- PDA's
- Portable Media Peripherals and Docking Stations
- Portable Media Players
- Portable Gaming
- Wireless Stereo Headphones
- Toys

## CS43L22

### D/A CONVERTER WITH 1 W PER CHANNEL PWM SPEAKER AMPLIFIER

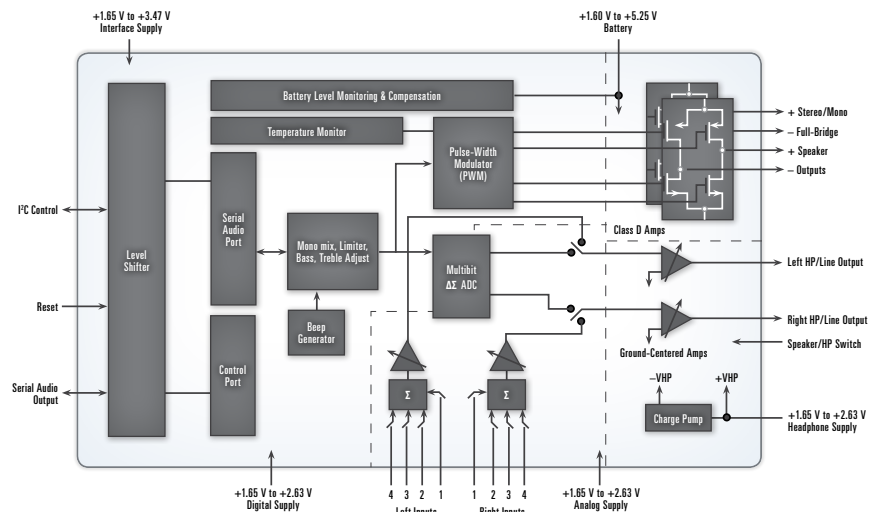
#### D/A FEATURES

- 98 dB dynamic range (A-wtd)
- 88 dB THD+N
- 4 kHz to 96 kHz sample rates
- Digital signal processing engine
- Class D stereo/mono speaker amplifier
- No external filter required
- High stereo output power
- 2 x 1.00 W into 8  $\Omega$  @ 5.0 V
- 2 x 550 mW into 8  $\Omega$  @ 3.7 V
- Direct battery powered operation
- Low quiescent current
- Stereo headphone amplifier/line output
- Ground centered outputs w/integrated charge pump
- No DC-blocking capacitor required
- High power output at -75 dB THD+N
- 2 X 23 mW into 16  $\Omega$  @ 1.8 V

#### SYSTEM FEATURES

- Flexible clocking options
- 12, 24, and 27 MHz master clock support in addition to typical audio clock rates
- Low quiescent power operation
- Stereo analog passthrough: 10 mW @ 1.8 V
- Stereo playback: 14 mW @ 1.8 V
- Variable power supplies
- 1.8 V to 2.5 V digital & analog
- 2.5 V to 5 V class D amplifier
- 1.8 V to 2.5 V headphone amplifier
- 1.8 V to 3.3 V interface logic
- Chip block selectable power down management
- I<sup>2</sup>C® control port operation
- Headphone/speaker detection input
- Pop and click suppression

The CS43L22 is a high performance 24-bit Stereo DAC with a PWM speaker amplifier capable of driving 1 W per channel. The CS43L22 also features a ground centered Headphone/Line output, digital signal processing engine, and very low power consumption, all packaged in a vanishingly thin 40-pin QFN.



#### APPLICATIONS

- Handheld GPS
- IP Set-Top Boxes
- MP3 Docking Stations
- MP3 Players
- Portable DVD Player
- Portable Gaming Devices
- Portable Media Players
- Toys

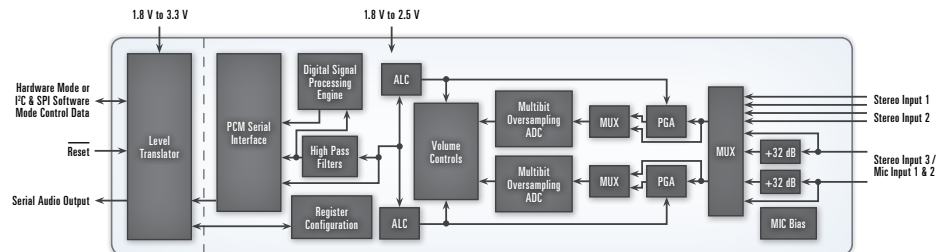
## CS53L21

## LOW-POWER STEREO ANALOG-TO-DIGITAL CONVERTER

## FEATURES

- Low-power audio A/D converter
- Stereo record (A/D converter):  
8.72 mW @ 1.8 V
- Stereo record (MIC to PGA and A/D converter):  
13.73 mW @ 1.8 V
- Operates from a single 1.8 V or 2.5 V supply
- Supports direct interface to logic levels from 1.8 V to 3.3 V
- 3:1 stereo input selector
- Analog gain controls
  - PGA, +12 dB to -3 dB in 0.5 dB steps
  - +32 dB or +16 dB stereo MIC pre-amp with bias supply
- Programmable automatic level control
  - Noise gate for noise suppression
  - Programmable threshold and attack/release rates
- Independent left/right channel control
- Digital volume control with soft ramp and zero cross
- High-pass filter disable for DC measurements
- Master or slave mode operation
- Hardware or software control
- 98 dB dynamic range
- -88 dB THD+N
- 24-bit conversion, up to 96 kHz sample rates
- Flexible power-down management—chip/block selectable
- Package: 32 QFN, lead-free assembly

The CS53L21 is a highly integrated, 24-bit, 96 kHz, low-power stereo A/D. Based on multibit, Delta-Sigma modulation, it allows infinite sample rate adjustment between 4 kHz and 96 kHz.



## APPLICATIONS

- Audio/Video Capture Cards
- Digital Voice Recorders
- Voice Recognition Systems
- Digital Microphones
- Portable Audio Players

## Low Power Class-D Audio Amplifiers

### SPECIFICATIONS

Part	Power (W)	Dynamic Range (dB)	THD+N %	PSRR (dB)	Channels	Power Supply (V)	Gain	Comments	Package
<b>CS35L00</b>	3.0	98	0.02	-85	1	2.5 to 5.5	Selectable +6/+12dB	Hybrid Class-D architecture, < 1mA quiescent current	10 DFN
<b>CS35L01</b>	3.0	98	0.02	-85	1	2.5 to 5.5	+6dB	Hybrid Class-D architecture, < 1mA quiescent current	9 WLCSP
<b>CS35L03</b>	3.0	98	0.02	-85	1	2.5 to 5.5	+12dB	Hybrid Class-D architecture, < 1mA quiescent current	9 WLCSP

## Digital Amplifier Power Stages

### SPECIFICATIONS

Part	Power (W)	Dynamic Range (dB)	THD+N %	Channels	Power Supply (V)	Comments	Package
<b>CS4412A</b>	30	102	0.1	4	VP = 8 to 18 VD = 2.5 to 5	Quad power stage IC thermally enhanced	48 QFN

## Digital Amplifier Controllers

### SPECIFICATIONS

Part	Resolution (bits)	Dynamic Range (dB)	THD+N %	Sample Rate (kHz)	Power Supply (V)	Comments	Package
<b>CS44600</b>	24	100	< 0.05	192	VD = 2.5 VL = 3.3 to 5	6-Channel digital amplifier controller	64 LQFP
<b>CS44800</b>	24	100	< 0.05	192	VD = 2.5 VL = 3.3 to 5	8-Channel digital amplifier controller	64 LQFP
<b>CS4461</b>	—	—	—	—	VD = 5 VL = 3.3 to 5	PSR feedback ADC	24 TSSOP

## Integrated Class-D Audio Amplifier

### SPECIFICATIONS

Part	Power (W)	Dynamic Range (dB)	THD+N %	Channels	Power Supply (V)	Comments	Package
<b>CS4525</b>	30	102	0.1	2.1	VP = 8 to 18 VD = 2.5 to 5	Integrated digital audio amp w/ADC, SRC and signal processor	48 QFN

# CS35L00/01/03

## A/D CONVERTER FOR CLASS D REAL-TIME PSR FEEDBACK

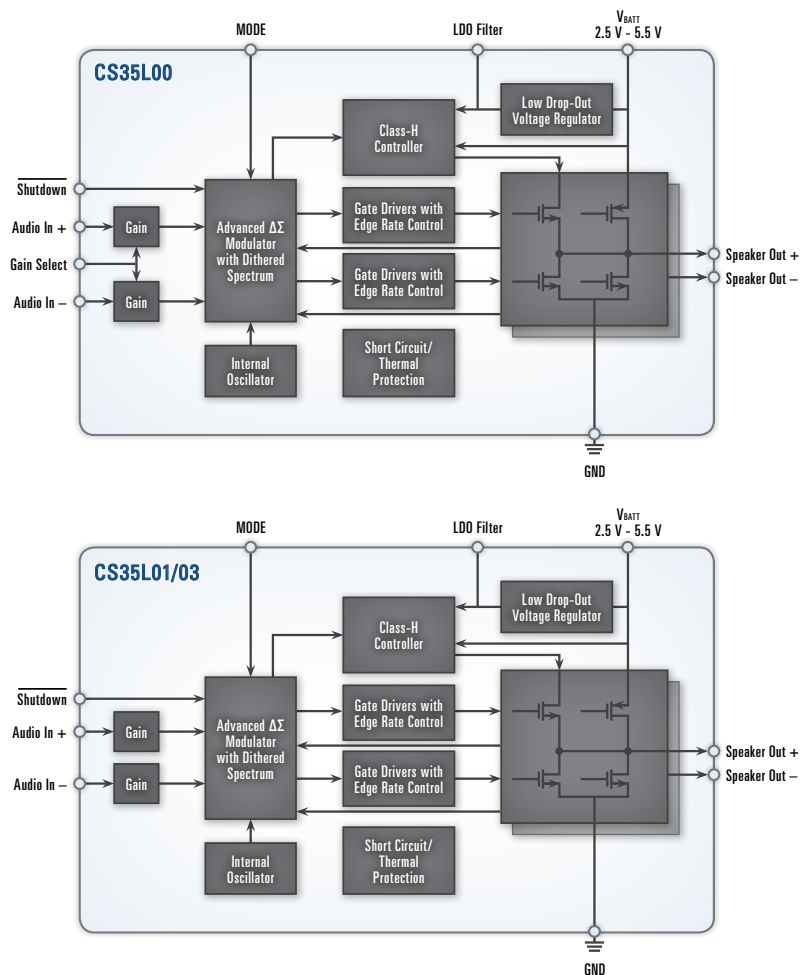
### FEATURES

- Hybrid Class-D Architecture
  - 1 x 3.0 W into 4  $\Omega$  (10% THD+N)
  - 1 x 2.3 W into 4  $\Omega$  (1% THD+N)
  - 1 x 1.7 W into 8  $\Omega$  (10% THD+N)
  - 1 x 1.4 W into 8  $\Omega$  (1% THD+N)
- Ultra-low Power Consumption
  - <1 mA Quiescent Current
- Advanced  $\Delta\Sigma$  Closed-loop Modulation
  - 97 dB Signal-to-Noise Ratio (A-Weighted)
  - 0.02% THD+N @ 1 W (SD & HD Mode)
  - -85 dB Power Supply Rejection Ratio @ 217Hz
  - -70 dB Common Mode Rejection Ratio
- Integrated Protection and Automatic Recovery for Output Short-circuit and Thermal Overload
- Pop and Click Suppression
- Available in Low-profile 10-pin DFN or 9-ball WLCSP
  - CS35L00: +6 dB or +12dB Selectable Gain
  - CS35L01: +6 dB default Gain
  - CS35L03: +12 dB default Gain

The CS35L00/01/03 are 2.9W high efficiency Hybrid Class-D audio amplifiers with ultra low idle current consumption at <1 mA. The family features an advanced closed-loop architecture to provide 0.02% THD+N at 1 W and -85 dB PSRR at 217 Hz.

A flexible Hybrid Class-D output stage offers four modes of operation: Standard Class-D (SD) mode offers full audio bandwidth and high audio performance; Hybrid Class-D (HD) mode offers a substantial reduction in idle power consumption with an integrated Class-H controller; Reduced Frequency Class-D (FSD) mode reduces the output switching frequency, producing lower electromagnetic interference (EMI); and Reduced Frequency Hybrid Class-D (FHD) mode produces both the lower idle power consumption of HD mode and the reduced EMI benefits of FSD mode.

Requiring minimal external components and PCB space, the CS35L00 is available in 3 mm x 3 mm, 10-pin DFN package and the CS35L01/03 are available in a 1.2 mm x 1.2 mm, 9-ball WLCSP package with Commercial temperature grade (-10°C to +70°C).



### APPLICATIONS

- Smartphones
- UMPC/MID
- Docking Stations
- Active Speakers
- Portable Gaming



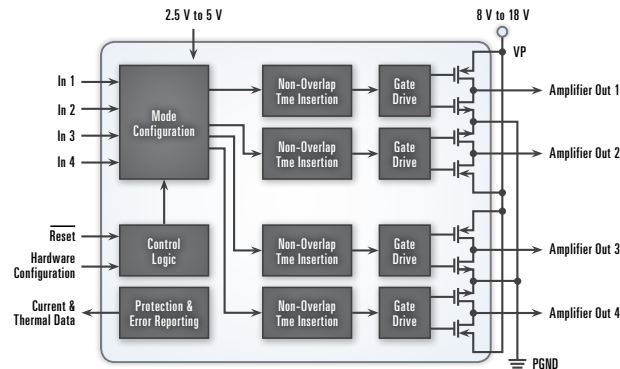
# CS4412A

## 30 W QUAD HALF-BRIDGE DIGITAL AMPLIFIER POWER STAGE

### FEATURES

- Configurable outputs (10% THD+N)
  - 2 x 15 W into 8  $\Omega$ , full-bridge
  - 1 x 30 W into 4  $\Omega$ , parallel full-bridge
  - 4 x 7 W into 4  $\Omega$ , half-bridge
  - 2 x 7 W into 4  $\Omega$ , half-bridge + 1 x 15 W into 8  $\Omega$ , full-bridge
- Space-efficient thermally-enhanced QFN
  - No external heat sink required
- 100 dB dynamic range—system level
- < 0.1% THD+N @ 1 W—system level
- Built-in protection with error reporting
  - Over-current
  - Thermal warning and overload
  - Under-voltage
- +8 V to +18 V high voltage supply
- PWM Popguard® technology for quiet startup
- No bootstrap required
- Low quiescent current
- Low power standby mode

The CS4412A is a high-efficiency power stage for digital Class-D amplifiers designed to input PWM signals from a modulator such as the CS4525. The power stage outputs can be configured as four half-bridge channels, two half-bridge channels and one full-bridge channel for 2.1 stereo, two full-bridge channels for 2.0 stereo, or one parallel full-bridge channel for mono configuration.



### APPLICATIONS

- Desktop Speakers
- Digital TVs
- MP3 Docking Stations
- Micro/Mini Shelf Systems
- Video Gaming Systems

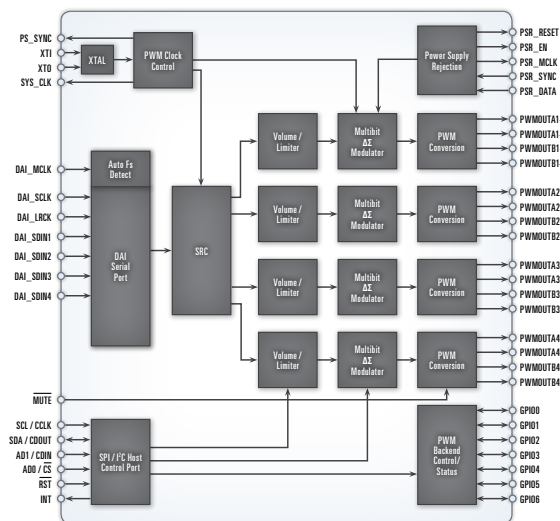
# CS44600/800

## 6- AND 8-CHANNEL DIGITAL AMPLIFIER CONTROLLERS

### FEATURES

- Integrated sample-rate converter
- Patented power-supply noise rejection feedback capability
- 6- or 8-channel PWM outputs
- 32 kHz to 192 kHz sample rates
- >100 dB dynamic range—system level
- <0.05% THD+N
- 24-bit conversion
- Single-ended or differential operation
- Popguard® technology to minimize clicks and pops in single-ended mode
- System clock generation
- AM frequency-compatible
- Digital volume control with soft ramp
  - +24 dB to -127 dB in 0.25 dB steps
- Peak detect and volume limiter with programmable attack and release rates
- I<sup>2</sup>C®/SPI™ Host Control interfaces
  - 1.8 V to 5 V supply
  - Glueless interface to DSPs/MPEG processors
- 2.5 V digital supply
- 3.3 V to 5 V power stage interface supply
- Package: 64-pin LQFP, lead-free assembly

The CS44600 and CS44800 pin-compatible Class D digital amplifier controllers provide a simple, small and cost-effective solution for DVD receivers, home theater recorders and entry-level audio/video recorders and home-theater-in-a-box systems. These multichannel digital-to-PWM (pulse width modulation) audio system controllers include interpolation, sample-rate conversion and half- and full-bridge PWM driver outputs.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- DVD Recorders
- Digital TVs
- Home Theater Recorders
- Musical Instruments
- Professional Audio Products
- Set-Top Boxes

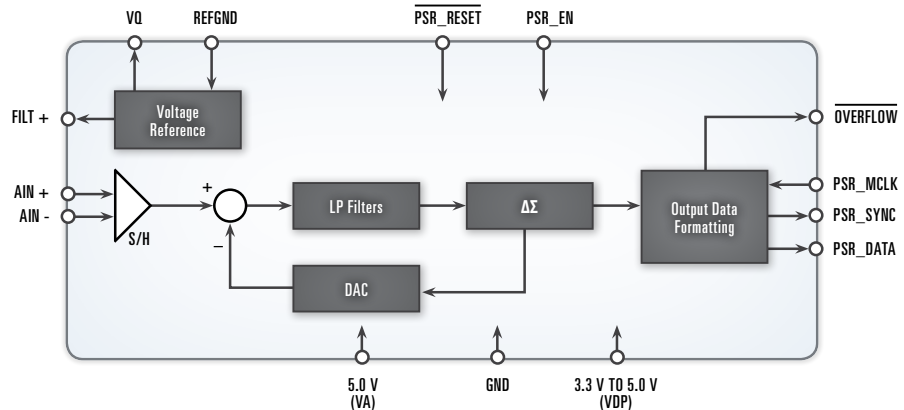
# CS4461

## A/D CONVERTER FOR CLASS D REAL-TIME PSR FEEDBACK

### FEATURES

- Advanced multibit Delta-Sigma architecture
- Real-time feedback of power-supply conditions
- Filterless digital output resulting in very low signal delay
- 135 mW power consumption
- Support for logic levels between 3.3 V and 5 V
- Differential analog architecture
- Modulator overflow detection
- Direct interface to CS44600/800 Class D PWM modulator
- Multibit conversion at up to 7.5 MHz
- Delivery of modulated data over 2-wire interface
- Package: 24-pin TSSOP, lead-free assembly

The CS4461 is a complete A/D converter for Class D PSR (power-supply rejection) feedback. It performs sampling and A/D conversion, generating digital data for input to a Class D modulator.



### APPLICATIONS

- Blu-ray/DVD Receivers
- Home-Theater-in-a-Box Systems
- Home Theater Recorders and Entry-Level Audio/Video Receivers

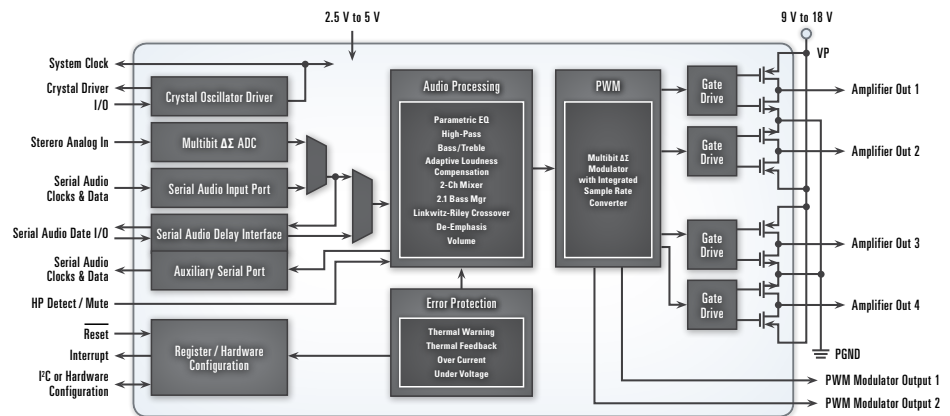
# CS4525

## 30 W INTEGRATED DIGITAL AMPLIFIER WITH ON-CHIP STEREO A/D CONVERTER

### FEATURES

- Fully integrated power amplifier
- Stereo A/D converter
  - Sample-rate converter
  - Digital audio processor
  - PWM controller
  - Power MOSFETs
- High efficiency
- No heatsink required
  - Programmable power foldback on thermal warning
- > 100 dB dynamic range
- < 0.1% THD+N @ 1 W
- Configurable outputs (10% THD+N)
  - 1 x 30 W into 4 Ω, parallel full-bridge
  - 2 x 15 W into 8 Ω, full-bridge
  - 2 x 7 W into 4 Ω, half-bridge + 1 x 15 W into 8 Ω, full-bridge
- PWM Popguard® technology for half-bridge mode
- Built-in protection with error reporting
  - Overcurrent/undervoltage/thermal overload shutdown
  - Thermal warning reporting
- Programmable channel delay and spread spectrum PWM modulation for system noise and radiated emissions management
- On-chip stereo A/D converter
  - 24-bit, 48 kHz conversion
  - 95 dB dynamic range, -88 dB THD+N
  - 2 V<sub>RMS</sub> input supports SCART
- Thermally enhanced QFN package, lead-free assembly

The CS4525 is a stereo analog or digital input PWM high efficiency Class-D amplifier audio system with an integrated stereo analog-to-digital (A/D) converter. The stereo power amplifiers can deliver up to 15 W per channel into 8 Ω speakers from a small space saving 48-pin QFN package. The PWM amplifier can achieve greater than 85% efficiency and the package is thermally enhanced for optimal heat dissipation, which eliminates the need for a heatsink.



### APPLICATIONS

- Desktop Speakers
- Digital TVs
- MP3 Docking Stations
- Micro/Mini Shelf Systems
- Video Gaming Systems

# Interfaces & Sample-Rate Converters

## SPECIFICATIONS

Part	Sample Rate (kHz)	S/PDIF, IEC-60958 Transmitter	S/PDIF, IEC-60958 Receiver	AES/EBU	EIAJ CP1201	Host Interface	Channel Status Buffer Memory	SRC	Package
<b>CS8406</b>	192	✓	—	✓	✓	✓	✓	—	28 SOIC 28 TSSOP
<b>CS8416</b>	192	—	✓	✓	✓	✓	✓	—	28 SOIC 28 TSSOP 28 QFN
<b>CS8420</b>	96	✓	✓	✓	✓	✓	✓	✓	28 SOIC
<b>CS8421</b>	192	—	—	—	—	—	—	✓	20 TSSOP 20 QFN
<b>CS8422</b>	192	—	✓	✓	✓	✓	✓	✓	32 QFN
<b>CS8427</b>	96	✓	✓	✓	✓	✓	✓	—	28 SOIC 28 TSSOP

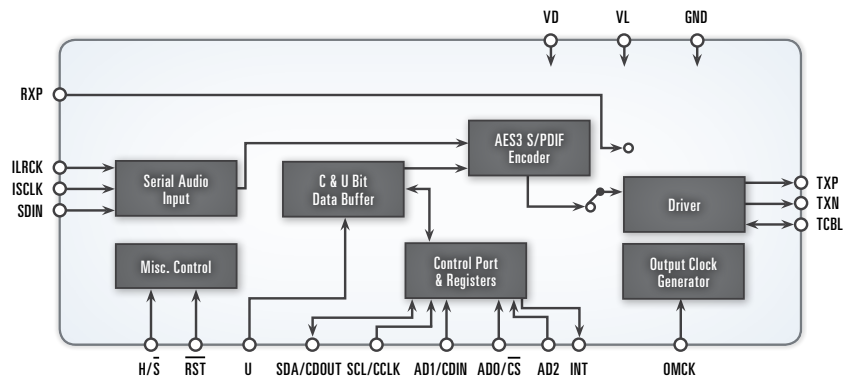
# CS8406

## 192 kHz DIGITAL AUDIO TRANSMITTER

### FEATURES

- Compatible with EIAJ CP1201, IEC-60958 and AES3 standards
- On-chip channel status user bit buffer memories allow block-sized updates
- Flexible 3-wire, serial digital audio input port
- Up to 192 kHz frame rate
- Microcontroller write access to channel status and user bit data
- On-chip differential line driver
- Generates CRC (cyclical redundancy check) codes and parity bits
- Standalone mode allows use without a microcontroller
- 3.3 V or 5 V digital interface supply (VL)
- 3.3 V or 5 V digital supply (VD)
- Pin compatible with CS8405A
- Package: 28-pin SOIC, 28-pin TSSOP, lead-free assembly
- Consumer and automotive D-grade availability

The CS8406 is a digital audio transmitter that supports 192 kHz and is fully compatible with EIAJ CP1201, IEC-60958 and AES3 standards. It enables consumer and professional audio products to exchange 192 kHz S/PDIF and AES/EBU audio data. The CS8406 accepts and encodes audio and digital data, which is then multiplexed, encoded and driven onto a cable/optical transmission interface.



### APPLICATIONS

- Automotive Entertainment Systems
- Blu-ray/DVD Players/Recorders
- Digital Audio/Video Receivers
- Digital Mixing Consoles
- Digital Video Recorders (PVRs)
- Effects Processors

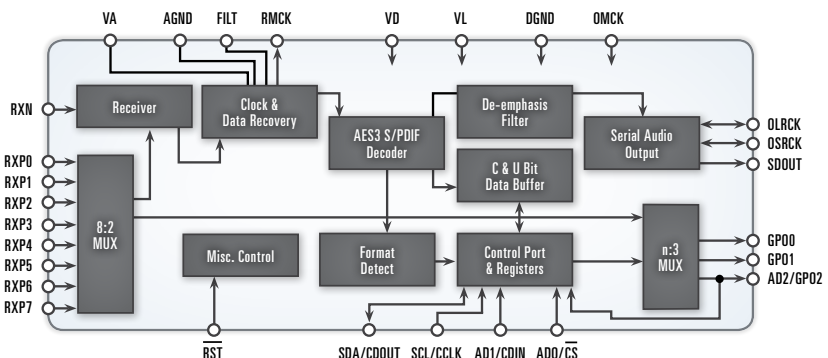
# CS8416

## 192 kHz DIGITAL AUDIO RECEIVER

### FEATURES

- Compatible with EIAJ CP1201, IEC-60958 and AES3 standards
- 8:2 S/PDIF input MUX; selectable pins in hardware mode
- Selectable signal routing to three general-purpose output pins
- S/PDIF to Tx inputs selectable in hardware mode
- Flexible 3-wire serial digital output port
- 32 kHz to 192 kHz sample frequency range
- Low-jitter clock-recovery
- Pin and microcontroller read access to channel status and user data
- SPI™ (serial port interface) or I²C® Control Port software mode and standalone hardware mode
- Differential cable receiver
- On-chip channel status data buffer memories
- Autodetection of compressed audio input streams
- Decodes CD Q subcode
- OMCK system clock mode
- 3.3 V analog supply (VA), 3.3 V digital supply (VD) and 3.3 V to 5 V digital interface supply (VL)
- Package: 28-pin SOIC, 28-pin TSSOP, 28-pin QFN, lead-free assembly
- Consumer and automotive D-grade availability

The CS8416 is an ultra-low jitter digital audio receiver that features an 8:2 input MUX. Receiving and decoding audio data with sample rates up to 192 kHz, it enables consumer and professional audio products to exchange S/PDIF and AES/EBU audio data.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers
- Digital Mixing Consoles
- Multimedia Speakers
- Set-Top Boxes

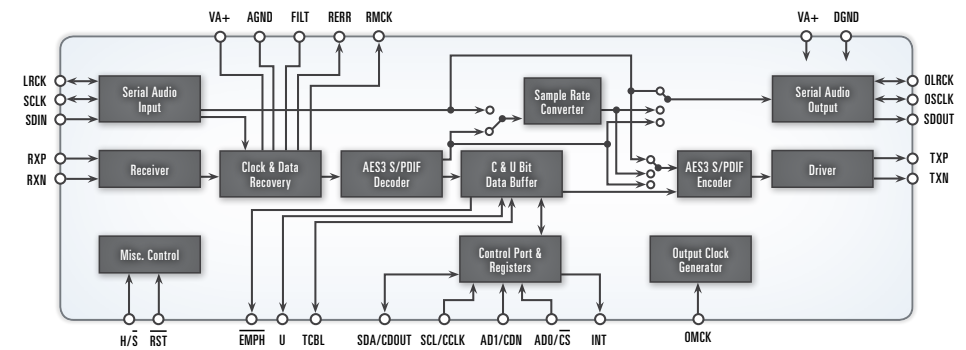
## CS8420

## 24-BIT, 96 kHz SAMPLE-RATE CONVERTER AND TRANSCEIVER

## FEATURES

- Complete IEC-60958, AES3, S/PDIF and EIAJ CP1201 transceiver with asynchronous sample-rate converter; compatible with standards
- Flexible 3-wire serial digital I/O ports
- 8 kHz to 108 kHz sample-rate range
- 1:3 and 3:1 maximum input to output sample-rate ratio
- 128 dB dynamic range
- -117 dB THD+N at 1 kHz
- Excellent performance at almost a 1:1 ratio
- Excellent clock-jitter rejection
- 24-bit I/O words
- Pin and microcontroller read/write access to channel status and user data
- Microcontroller and standalone mode
- Package: 28-pin SOIC, lead-free assembly
- Consumer and automotive D-grade availability

The CS8420 is a stereo, digital audio sample-rate converter with AES3 type and serial digital audio inputs and AES3 type and serial digital audio outputs, along with comprehensive control via a 4-wire microcontroller port. Channel status and user data can be assembled in block-sized buffers, making read/modify/write cycles easy.



## APPLICATIONS

- CD-R
- Computer Audio Systems
- DAT (Digital Audio Tape)
- DVD and Video Tape Recorder (VTR) Equipment
- Digital Audio Transmission Equipment
- Effects Processors
- High-Quality D/A and A/D Converters
- Minidisc
- Mixing Consoles

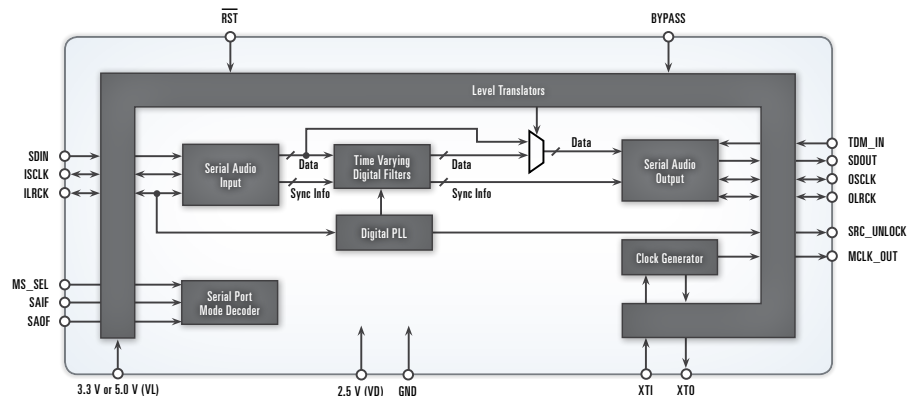
## CS8421

## 32-BIT, 192 kHz, ASYNCHRONOUS STEREO SAMPLE-RATE CONVERTER

## FEATURES

- High-performance, asynchronous sample-rate converter
- 16-, 20-, 24-, 32-bit support
- Supports sample rates 8 kHz to 192 kHz
- Input/Output ratios from 7.75:1 to 1:8
- 175 dB dynamic range
- -140 dB THD+N
- H/W mode—no programming required
- Low group delay
- Bypass mode
- TDM mode with matched phase for daisy chaining
- On-chip crystal oscillator
- Flexible 3-wire serial digital audio input port
- +2.5 V digital power supply (VD)
- +3.3 V or 5 V interface power supply (VL)
- Space-saving 20-pin QFN or TSSOP package, lead-free assembly
- Consumer and automotive D-grade availability

The CS8421 is a 32-bit, 192 kHz, asynchronous, stereo sample-rate converter. Digital audio inputs and outputs can be 32-, 24-, 20- or 16-bits. Input and output data can be completely asynchronous, synchronous to an external data clock or the part can operate without any external clock by using an integrated oscillator.



## APPLICATIONS

- Automotive Entertainment Systems
- Computer Sound Cards and Pro Audio Equipment Such as Digital Mixing Consoles
- Consumer Electronics Devices
- Effects Processors
- Multitrack Digital Recorders

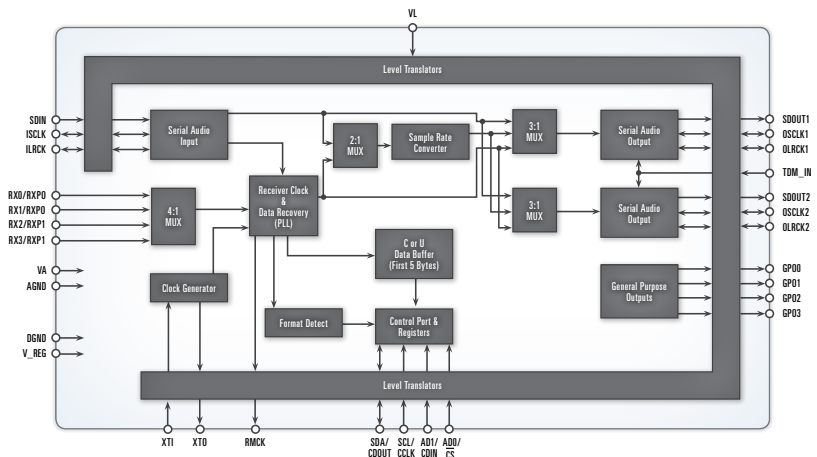
# CS8422

## 192 kHz S/PDIF RECEIVER WITH SAMPLE-RATE CONVERTER

### FEATURES

- Complete EIAJ CP1201, IEC-60958, AES3, S/PDIF compatible receiver
- Receiver supports 28 kHz to 216 kHz sample-rate range
- SRC supports sample rates up to 211 kHz
- Sample-rate ratios from 6:1 to 1:6
- 16, 18, 20, or 24-bit data I/O
- 140 dB dynamic range
- -120 dB THD+N
- 4:1 S/PDIF or 2:1 differential AES3 inputs
- High input jitter tolerance and ultra-low jitter clock recovery
- No external PLL filter components required
- AES3 direct output and AES3 Tx pass-through
- No external master clock required
- SPI or I<sup>2</sup>C software mode and standalone hardware mode
- Flexible 3-wire digital serial audio input port and dual serial audio output ports
- Four general-purpose output pins
- Time division multiplexing (TDM) mode
- 1.8 V to 5.0 V digital interface
- Space-saving 32-pin QFN package

The CS8422 is a digital audio interface receiver with a 24-bit, high performance, asynchronous sample-rate converter. This integrated feature set removes the requirement for system platforms to vary system clocking when integrating asynchronous digital interfaces such as S/PDIF. System integrators can now maintain a constant-frequency, high-quality system clock and provide a digital interface to external devices operating at various asynchronous samples rates from 32 kHz to 211 kHz.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- Blu-ray Disc Receivers
- Effects Processors
- Set-Top Boxes
- Mixing Consoles

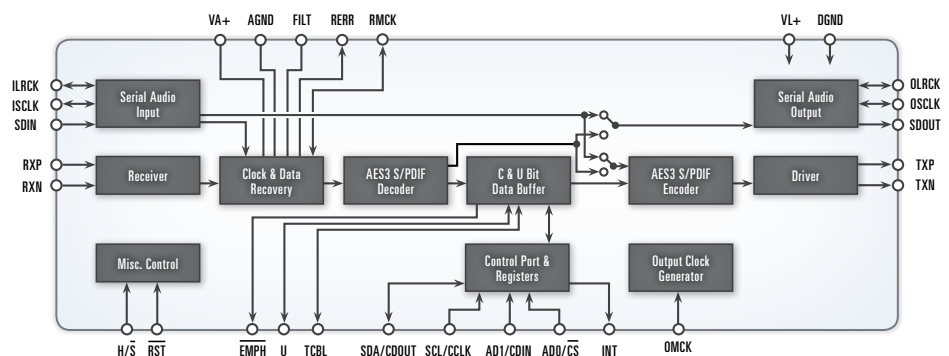
# CS8427

## 96 kHz DIGITAL AUDIO TRANSCIVER

### FEATURES

- Complete EIAJ CP1201, IEC-60958, AES3 and S/PDIF transceiver; compatible with standards
- Flexible 3-wire serial digital I/O ports
- Adjustable sample rate up to 96 kHz
- Low-jitter clock-recovery
- Pin and microcontroller read/write access to channel status and user data
- Microcontroller and standalone modes
- Differential cable driver and receiver
- On-chip channel status and user data buffer memories permit block reads and writes
- OMCK system clock mode
- Decodes audio CD Q subcode
- 5 V analog supply (VA)
- 3 V to 5 V digital supply (VL)
- Package: 28-pin SOIC, 28-pin TSSOP, lead-free assembly

The CS8427 is a stereo, digital audio transceiver with AES3 and serial digital audio inputs and outputs, along with comprehensive control through a 4-wire microcontroller port. Channel status and user data are assembled in block-sized buffers, making read/modify/write cycles easy.



### APPLICATIONS

- Audio/Video Receivers
- Automotive Entertainment Systems
- Blu-ray/DVD Receivers
- Computers
- CD-R
- Digital Mixing Consoles
- Effects Processors
- Multimedia Speakers
- Set-Top Boxes

# Clock Generation and Multiplication Timing Solutions

## SPECIFICATIONS

Host Interface	One-Time Programmable	Frequency Synth/Clock Generator	Clock Multiplier/Jitter Remover	Power Supply (V)	Input Frequency Range (Hz)	Reference Frequency Range	Output Frequency Range	Package
<b>CS2000-CP</b>	CS2000-OTP	✓	✓	3.3	50 Hz to 30 MHz	8 to 75 MHz	6 to 75 MHz	10 MSOP
<b>CS2100-CP</b>	CS2100-OTP	—	✓	3.3	50 Hz to 30 MHz	8 to 75 MHz	6 to 75 MHz	10 MSOP
<b>CS2200-CP</b>	CS2200-OTP	✓	—	3.3	—	8 to 75 MHz	6 to 75 MHz	10 MSOP
<b>CS2300-CP</b>	CS2300-OTP	—	✓	3.3	50 Hz to 30 MHz	Internally Generated	6 to 75 MHz	10 MSOP

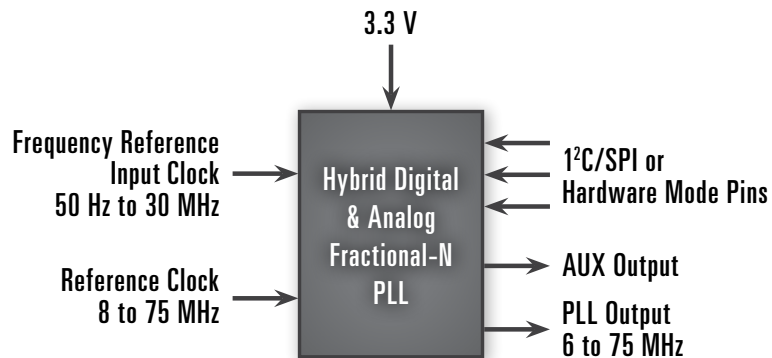
## CS2xxx Family

### CLOCK GENERATION AND MULTIPLICATION TIMING SOLUTIONS

#### FEATURES

- High-performance analog/digital phase locked loop
- Clock multiplier/jitter reduction
  - Generates a low-jitter 6-75 MHz output clock from a jittery or intermittent 50 Hz to 30 MHz clock source
- Clock generation/frequency synthesis
  - Generates a low-jitter 6-75 MHz clock relative to 8-75 MHz reference clock
- Highly accurate PLL multiplication factor
  - Less than 1 PPM error
- Flexible control options
  - One-time-programmable configuration for hardware mode
  - I<sup>2</sup>C®/SPI™ control port
- Configurable auxiliary output
  - Buffered reference clock
  - PLL Lock indication
  - Second PLL output
  - Buffered version of CLK\_IN
- Flexible sourcing of reference clock
  - External oscillator or clock source
  - Supports inexpensive local crystal
- Minimal board space required
  - NO external analog loop-filter components required
  - Packaged in a 10-pin MSOP
- CS2300 has internal LCO for reference clock
- CS2200 is a subset and consists of clock generation
  - CS2100 is a subset and consists of clock multiplication

Precise clocking solutions are essential in electronics applications because they are used to synchronize the components used in professional and consumer audio equipment and directly affect audio quality. The CS2000 is unique because it offers both a clock generator feature and clock cleanup in a single IC. The IC's ability to significantly reduce jitter, or noise, make it ideal for the pro audio as well as mainstream consumer audio/video application.



#### APPLICATIONS

- Audio/Video Receivers
- Camcorders
- Digital Effects Processors
- Digital Mixing Consoles
- Outboard ADC and DAC Converters
- Satellite Radio Systems

# Volume Control

## SPECIFICATIONS

Part	Channel	Dynamic Range (dB)	THD+N (dB)	Analog I/O	Power Supply (V)	Comments	Package
CS3308	8	123	-112	Single-ended	VA = ±5 VD = 3.3	+22 dB gain/-96 dB attenuation, 0.25 dB step	48 LQFP
CS3310	2	116	-100	Single-ended	VA = ±5 or VD = 5	+31.5 dB gain/-95.5 dB attenuation, 0.5 dB step	16 SOIC
CS3318	8	127	-112	Single-ended	VA = ±8 to ±9 VD = 3.3	+22 dB gain/-96 dB attenuation, 0.25 dB step	48 LQFP

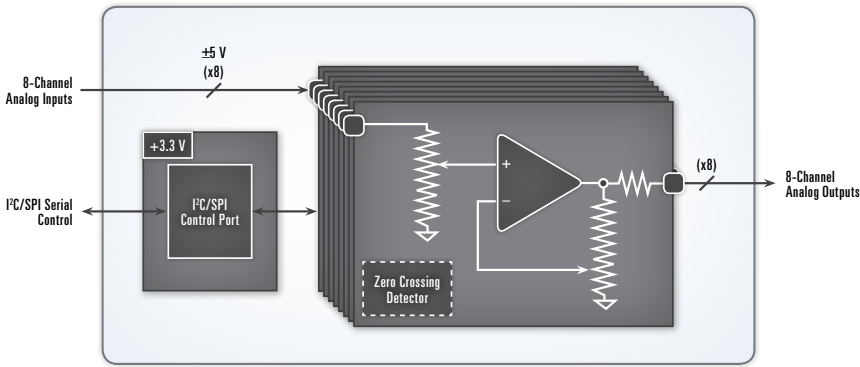
# CS3308

## 123 dB, 8-CHANNEL ANALOG VOLUME CONTROL

FEATURES

- Complete analog volume control
  - 8 independently controllable channels
  - 3 configurable master volume and muting controls
- Wide adjustable volume range
  - -96 dB to +22 dB in 1/4 dB Steps
- Low distortion and noise
  - 123 dB dynamic range
  - -112 dB THD+N
- Noise-free level transitions
  - Zero crossing detection with programmable time out
- Low channel-to-channel crosstalk
  - 120 dB inter-channel isolation
- Comprehensive serial control port
  - Supports I<sup>2</sup>C®/SPI™ communication
  - Independent control of up to 128 devices on a shared 2-wire I<sup>2</sup>C® or 3-wire SPI™ control bus
  - Supports individual and grouped control of all CS3308 devices on the I<sup>2</sup>C®/SPI™ control bus
- Standard power supply voltages
  - ±5 V analog supply
  - +3.3 V digital supply
- Lead-free assembly

The CS3308 is an eight-channel digitally controlled analog volume control designed specifically for high-end audio systems. It features a comprehensive I<sup>2</sup>C®/SPI™ serial control port for easy device and volume configuration of eight independent, low-distortion audio channels.



APPLICATIONS

- A/V Receivers
  - DSP Amplifiers
  - Digital Mixing Consoles
- External Audio Interfaces
  - Home Theater Systems
  - In-Car Entertainment Systems
- Outboard Audio Converters
  - PC Soundcards



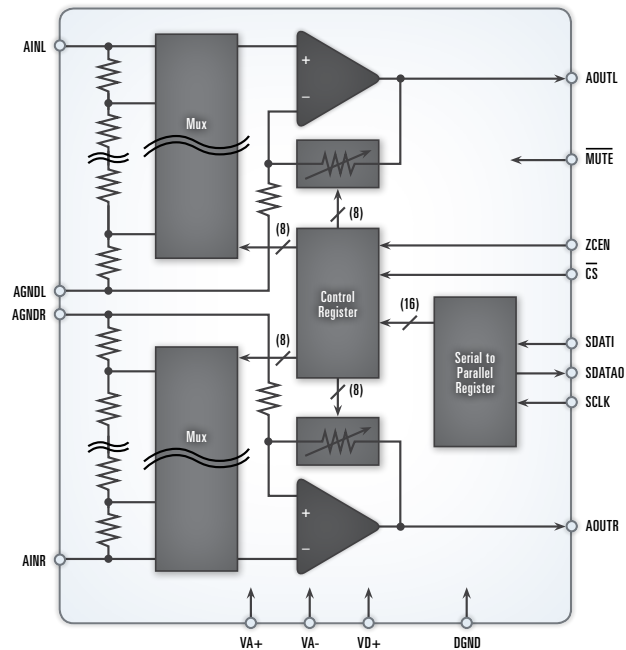
# CS3310

## STEREO ANALOG VOLUME CONTROL

### FEATURES

- Complete digital volume control
  - Two independent channels
  - Serial control
  - 0.5 dB step size
- Wide adjustable range
  - -95.5 dB attenuation
  - +31.5 dB gain
- Low distortion and noise
  - -100 THD+N
  - 116 dB dynamic range
- Noise-free level transitions
- Channel-to-channel crosstalk better than 110 dB
- Package: 16-pin plastic SOIC, lead-free assembly

The CS3310 is a complete stereo digital volume control designed specifically for audio systems. It features a 16-bit serial interface that controls two independent, low-distortion audio channels.



### APPLICATIONS

- A/V Receivers
- DSP Amplifiers
- Digital Mixing Consoles
- External Audio Interfaces
- Home Theater Systems
- In-Car Entertainment Systems
- Outboard Audio Converters
- PC Soundcards

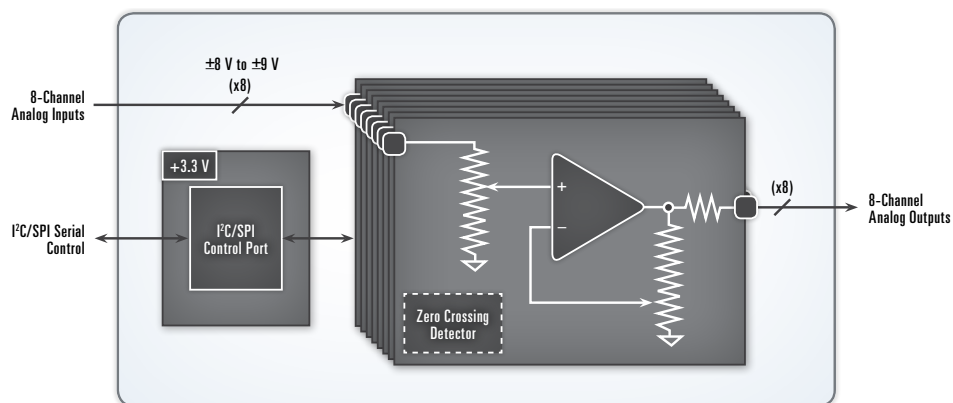
# CS3318

## HIGH-PERFORMANCE 8-CHANNEL ANALOG VOLUME CONTROL

### FEATURES

- Complete analog volume control
  - 8 independently controllable channels
  - 3 configurable master volume and muting controls
- Wide adjustable volume range
  - -96 dB to +22 dB in 1/4 dB steps
- Low distortion and noise
  - 127 dB dynamic range (CS3318)
  - -112 dB THD+N
- Noise-free level transitions
  - Zero-crossing detection with programmable time out
- Low channel-to-channel crosstalk
  - 120 dB inter-channel isolation
- Comprehensive serial control port
  - Supports I<sup>2</sup>C<sup>®</sup>/SPI<sup>™</sup> communication
  - Independent control of up to 128 devices on a shared 2-Wire I<sup>2</sup>C<sup>®</sup> or 3-wire SPI<sup>™</sup> control bus
  - Supports individual and grouped control of all CS3308/18 devices on the I<sup>2</sup>C<sup>®</sup> or SPI<sup>™</sup> control bus
- Standard power supply voltages
  - ±8 V and ±9 V analog supply (CS3318)
  - +3.3 V digital supply
- Lead-free assembly

The flagship CS3318 is an eight-channel, high-voltage, digitally controlled analog volume control IC that is the benchmark for audio quality, showcasing 127 dB dynamic range. The CS3318 operates from a ±9 V power supply, with 118 dB adjustable range from +22 dB to -96 dB, negligible distortion and inter-channel isolation. Plus, a 0.25 dB step size with zero-crossing detection and programmable time out ensures remarkably smooth control of volume adjustment.



### APPLICATIONS

- A/V Receivers
- DSP Amplifiers
- Digital Mixing Consoles
- External Audio Interfaces
- Home Theater Systems
- In-Car Entertainment Systems
- Outboard Audio Converters
- PC Soundcards

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