CIRRUS LOGIC®

Smart Home

Audio Experts in a Voice Connected World

Cirrus Logic Consumer and Mobile Audio Solutions

World-Class Audio Leadership

Cirrus Logic is the leading supplier of hardware and software solutions for audio signal processing from voice capture to audio playback in the newest technology found in mobile, consumer and automotive applications.

Audio Innovation for a Voice Connected World™

Best-in-Class Hardware and Software

With a complete portfolio of products throughout the audio signal chain — from voice capture to playback — Cirrus Logic's best-in-class, ultra low power ICs and patented SoundClear® software technology elevate the clarity and quality of the audio signal by enhancing voice quality, voice capture, speech recognition and audio playback.

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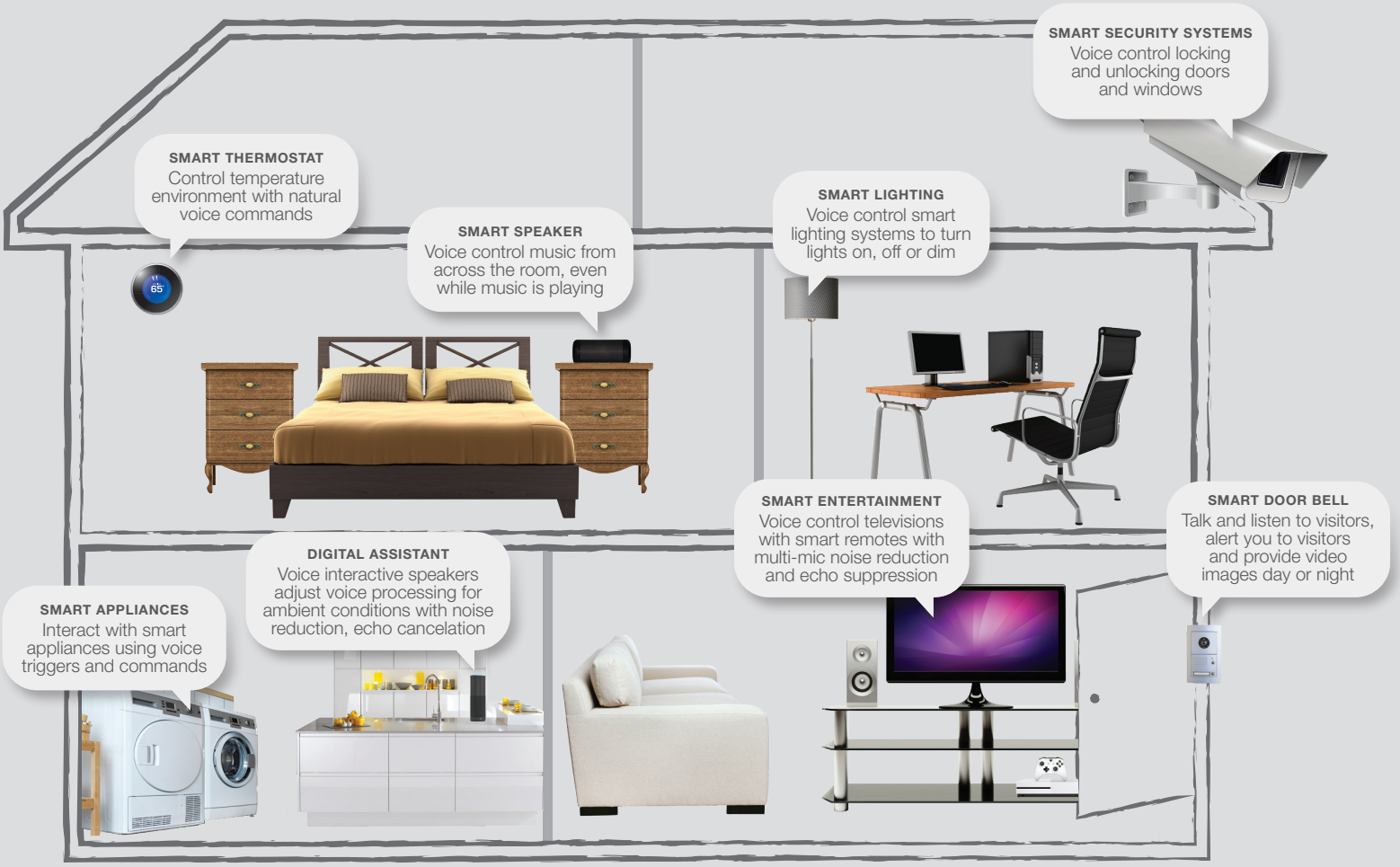
CIRRUS LOGIC®

Audio Innovation for the Smart Home

The “Smart Home” is a *connected home* where multiple smart devices are integrated to create an environment that is automated and easily controlled. Cirrus Logic’s portfolio of advanced audio and voice solutions allows the natural interaction with these smart devices—using them for communication, controlling them easily with voice commands, using them to detect audio events, and of course, using them to enjoy high-fidelity audio playback. By combining Cirrus Logic’s extensive portfolio of audio ICs with our SoundClear software technology, every aspect of the smart home experience can be enhanced daily.



Audio Components

Audio DSPs

- Single chip solution for Dolby ATMOS and DTS UHD
- 3 to 4 32-bit DSP cores, 300 MHz, 2.88 MB on chip RAM
- Clock PLL, rich set of serial audio I/O
- Cirrus DSP tool support

Codecs

- Superior input and playback performance
- Low power sleep mode, smart accessory detect
- Support for digital and analog microphone interfaces
- Choice of features, performance, digital interfaces and packages allows a wide-range of system architectures

D/A Converters

- Advanced multibit delta-sigma architecture
- Up to 24-bit, 192 kHz with 128 dB dynamic range
- High-end HiFi digital filters for improved audio playback
- Professional audio quality for consumer products

A/D Converters

- Advanced multibit delta-sigma architecture
- 2 to 8 channels with up to 24-bit, 192 kHz inputs
- Ultra low idle power consumption for “always on” applications
- Enhances voice clarity for mic-array and beam-forming algorithms

Headphone and Speaker Amplifiers

- Class-D speaker amplifier with high efficiency and low idle power consumption
- Speaker driver up to 2.4 W into 4 ohm @ 1% THD+N
- Class-G headphone amplifier with 3.8 mW quiescent power consumption
- Headphone driver up to 32 mW into 15 ohm @ <1% THD

MEMS Microphones

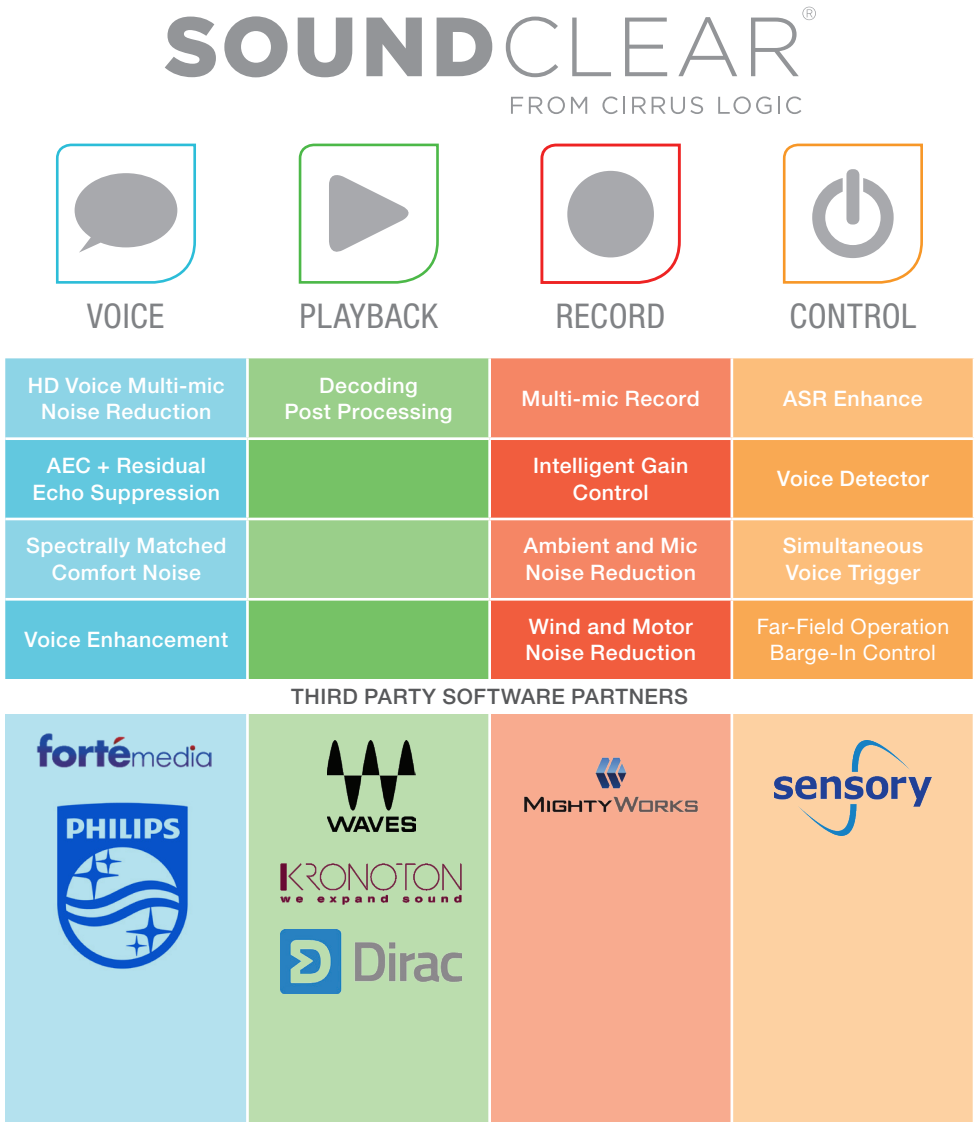
- The best sounding audio capture
- Leading dynamic range and linearity for true accuracy and clarity
- Devices acoustically matched to enhance algorithms
- Super robust MEMS minimize field issues

S/PDIF Interfaces

- Single chip 192 kHz transmitter and receiver
- Advanced jitter attenuating PLL
- Single 2.7 to 3.6 V digital and PLL supply
- Small SSOP package size

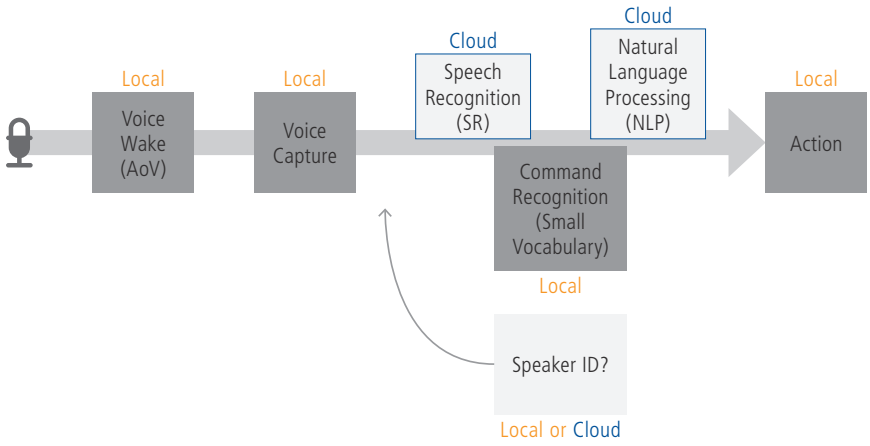
The SoundClear® Advantage

Cirrus Logic's SoundClear Control software is defining the next generation of easy to use connected home devices via touchless user interfaces, including natural voice control and ultrasonic gesture control. Conversations are clearer and noise free, whether 5 inches or 5 feet away from the device. Smoke alarms, security systems and baby monitors can now be smart devices running intelligent acoustic event "detection" software. For the music lover, whether your speakers are in the living room or the kitchen, on the floor or on the counter-top, you won't ever compromise on audio playback quality. Cirrus Logic delivers high-fidelity quality audio to multiple devices, wall outlet– or battery– powered. The Cirrus Logic technology advantage includes working with our software partners to broaden the use cases supported by our smart codec and DSP products, as well as working with customers to enable their proprietary software on a Cirrus Logic IC.



Voice Call and Control in the Smart Home

SoundClear® Voice is designed to be flexible and robust, improving voice quality by eliminating noise through advanced processing features such as multi-mic noise reduction, echo cancelation and speech enhancement. SoundClear® Control enables “always on, always listening” voice activation and control of a device without keeping the application processor awake. This ultra low power solution eliminates the need for keypress activation to awaken devices such as smartphones, tablets, computers, home electronics, wireless speakers, appliances and other audio enabled devices. SoundClear Control allows a wide variety of trigger phrases which may be system—or user—defined and can be targeted to specific localities.



Far Field ASR Enhanced and Barge-In Control

Cirrus Logic’s SoundClear Control also provides industry-leading Far Field ASR Enhance™ to maintain communication that is relaxed and effortless even in a noisy environment. The range of communication between the user and the smart device can extend to 15 feet or beyond and still the impact of distracting background noise is reduced. Additionally, “barge-in” technology extends voice commands for touchless operation even during loud music playback.

Voice controlled music player

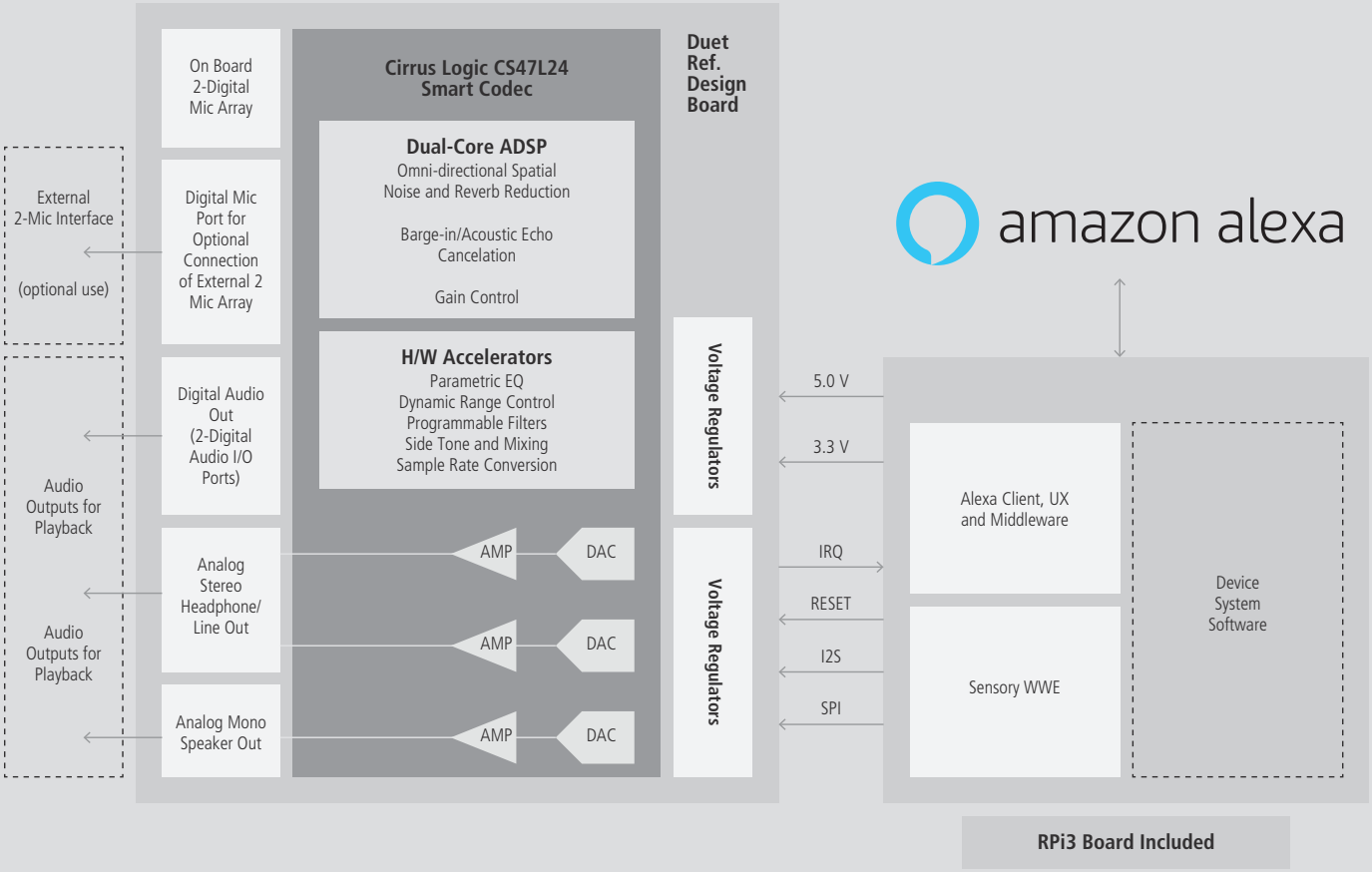
“Answer phone” when ring-tone is playing

Alarm clock “snooze” or “cancel” without getting out of bed

High-Fidelity Audio Playback

Audio playback using smart devices should be a near perfect reproduction of the original recording. Cirrus Logic audio ICs supported by SoundClear Playback, or a partner software offering, deliver a music playback experience that maximizes volume while maintaining audio quality. Software partner solutions include Waves and Dirac to provide the ultimate listening experience.

Development Platforms for Alexa-Enabled Smart Home Products



Cirrus Logic's Amazon certified voice capture development kit requires minimum customization to reduce time-to-market for the evaluation, prototyping and development of smart home products enabled with Alexa Voice Service (AVS). The CRD1569-1 kit is a fully functioning solution featuring the SoundClear® Voice Control two-mic reference board designed to enhance the end-user experience of AVS by increasing accuracy of voice interaction and by supporting high-fidelity audio playback. A web-based control console simplifies tuning and provide audio diagnostics.

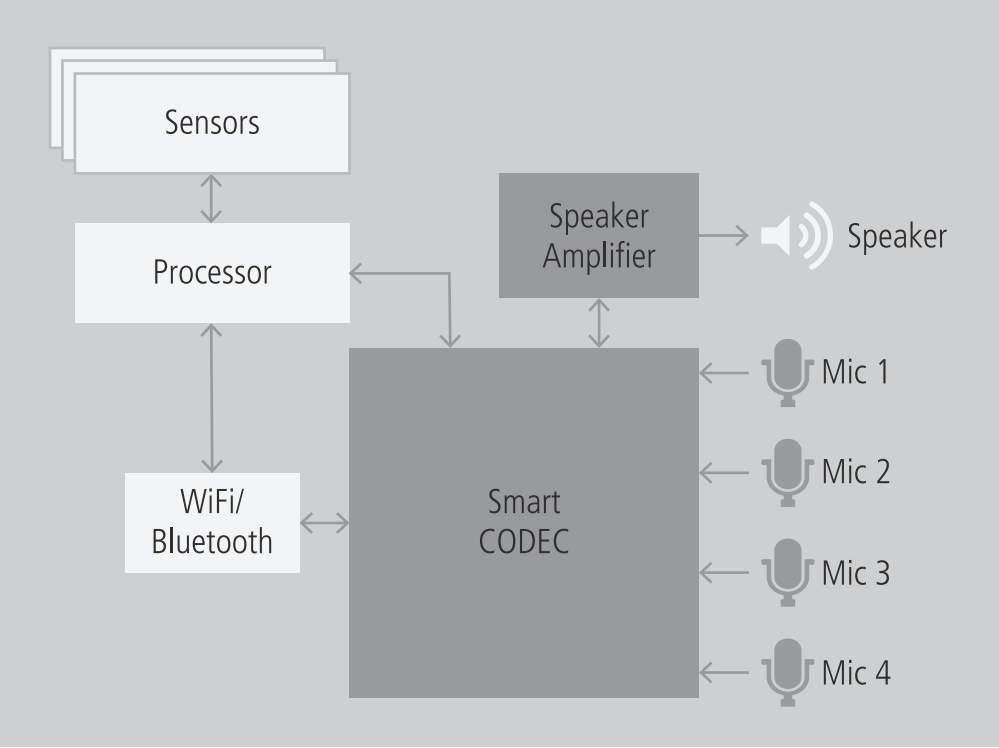
Features

- Enhanced "Alexa" wake-word triggering and command interpretation at distance and in noisy environments
- Increases accuracy and reliability of Alexa voice responses to voice requests
- Acoustic Echo Cancelation (AEC) enables users to "barge-in" during Alexa response and music playback and be understood
- Consumes only 2mW for low power always on triggering
- Reference board features the Cirrus Logic CS47L24 dual core, low power smart codec with SoundClear® two-mic voice control DSP firmware
- Built-in 2 W Class D speaker driver
- Dual high performance digital MEMS microphone array for omni-directional spatial capture and noise reduction
- Port for connecting optional external digital MEMS microphone array
- Web-based firmware control console for simplified interactive operation, acoustic tuning and diagnostics
- Operates headless and wireless without anything connected to the RPi3 board other than the 5 V power source

eCommerce, Information and Entertainment:
Digital Assistants, Smart Speakers

Soundclear Software Featuring “Always On” Voice Control

- Soundclear ASRe
- Soundclear Barge-in
- Sounclear Control
- Software Partner Far Field Voice solutions
- Software Partner Voice triggers and commands



Digital Assistant Application Diagram

Smart Codecs

Product	DACs	ADCs	DAC Dynamic Range (dB)	ADC Dynamic Range (dB)	DAC THD+N (dB)	ADC THD+N (dB)	Sample Rate (kHz)	Analog Inputs/ Outputs	ADSP Cores	DSP Capability (MIPS)	Analog Power Supply (V)	Supply Current (µA)	Package
CS47L15	3	2	115	98	-92	-88	192	Pseudo-differential	1	150	1.8	1.2	173 WCSP
CS47L24	3	4	121	121	-85	-88	192	Pseudo-differential	2	300	1.8	1.2-1.8	63 WCSP
CS47L35	3	4	120	122	-85	-88	8-192	Pseudo-differential	3	450	1.8	1.2-1.8	102 WCSP
WM8281	8	6	121	100	-92	-89	192	Single-ended; differential	4	600	1.7-5.5	1.14-1.9	138 WLCSP
CS47L90	10	7	115	98	-93	-88	192	Single-ended; differential	4	600	1.8		70 WLCSP

Amplifiers

Product	Input Type	Channels	Output Power (V)	SNR (dB)	THD+N @ 1 W (dB)	Power Supply (V)	Package
CS35L32	Analog	Class D Speaker Driver; 1 x Mono Hybrid	1.7 W into 8 ohm	102	0.02	3-5.25	30 WLCSP
CS35L33	I²S; TDM	Class D Speaker Driver; 1 x Mono Hybrid	4.4 W into 8 ohm	95	0.02	3-5.5	42 WLCSP

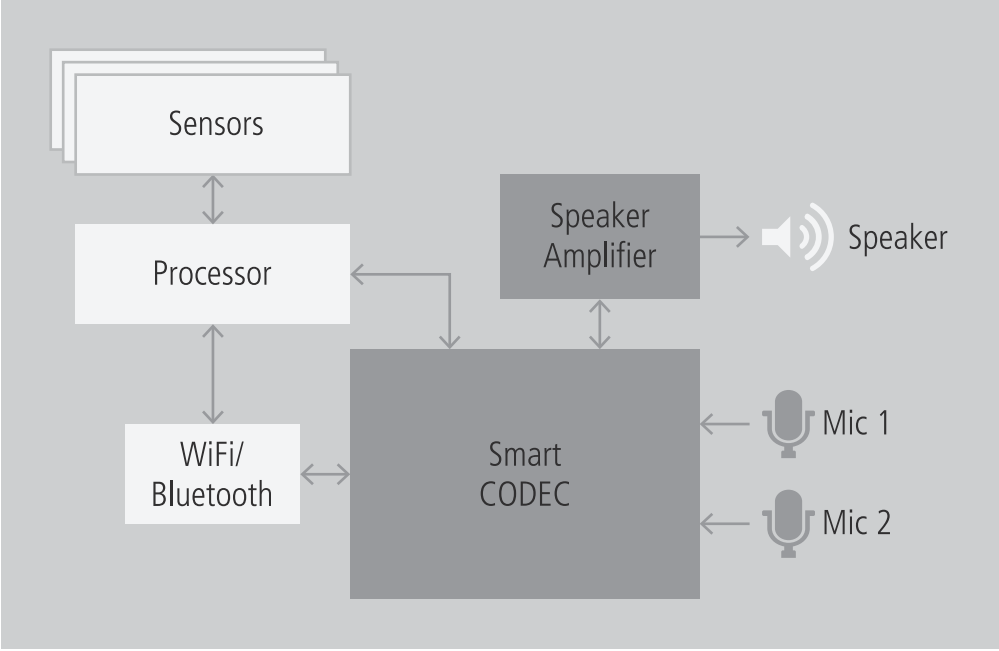
Portable Codecs

Product	DACs	ADCs	DAC THD+N (db)	ADC THD+N (dB)	Sample Rate (kHz)	Analog Power Supply	Supply Current (uA)	Package
CS42L51	2	2	-86	-88	96	1.8-2.5		32QFN

Energy and Appliance Control:
Lighting, Heating, Appliances

Soundclear Software Featuring “Always On” Voice Control

- Soundclear ASRe
- Soundclear Barge-in
- Sounclear Control
- Software Partner Voice triggers and commands



Smart Thermostats Application Diagram

Smart Codecs

Product	DACs	ADCs	DAC Dynamic Range (dB)	ADC Dynamic Range (dB)	DAC THD+N (dB)	ADC THD+N (dB)	Sample Rate (kHz)	Analog Inputs/ Outputs	ADSP Cores	DSP Capability (MIPS)	Analog Power Supply (V)	Supply Current (µA)	Package
CS47L15	3	2	115	98	-92	-88	192	Pseudo-differential	1	150	1.8	1.2	173 WCSP
CS47L24	3	4	121	121	-85	-88	192	Pseudo-differential	2	300	1.8	1.2-1.8	63 WCSP
CS47L35	3	4	120	122	-85	-88	8-192	Pseudo-differential	3	450	1.8	1.2-1.8	102 WCSP
WM8281	8	6	121	100	-92	-89	192	Single-ended; differential	4	600	1.7-5.5	1.14-1.9	138 WLCSP

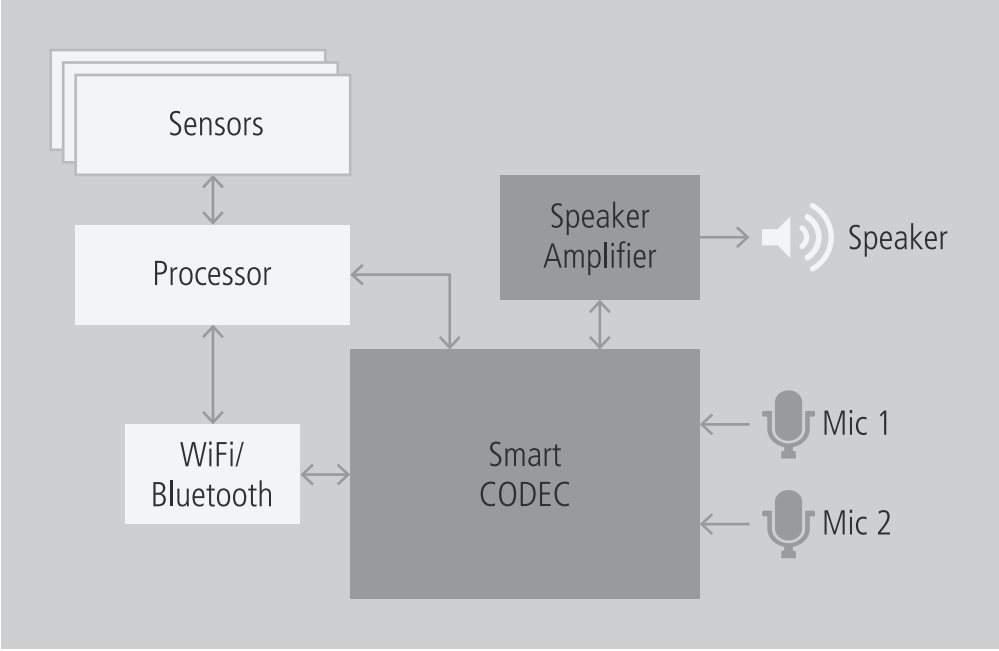
Amplifiers

Product	Input Type	Channels	Output Power (V)	SNR (dB)	THD+N @ 1 W (dB)	Power Supply (V)	Package
CS35L32	Analog	Class D Speaker Driver; 1 x Mono Hybrid	1.7 W into 8 ohm	102	0.02	3-5.25	30 WLCSP
CS35L33	I²S; TDM	Class D Speaker Driver; 1 x Mono Hybrid	4.4 W into 8 ohm	95	0.02	3-5.5	42 WLCSP

Security Systems and Audio Monitoring: Wireless Security Cameras, Smoke Detectors, Audio Monitoring Systems

Soundclear Software Featuring “Always On” Voice Control

- Soundclear Record
- Sounclear Control
- Software Partner Audio Sensors



Wireless Security Camera Block Diagram

Smart Codecs

Product	DACs	ADCs	DAC Dynamic Range (dB)	ADC Dynamic Range (dB)	DAC THD+N (dB)	ADC THD+N (dB)	Sample Rate (kHz)	Analog Inputs/ Outputs	ADSP Cores	DSP Capability (MIPS)	Analog Power Supply (V)	Supply Current (µA)	Package
CS47L15	3	2	115	98	-92	-88	192	Pseudo-differential	1	150	1.8	1.2	173 WCSP
CS47L24	3	4	121	121	-85	-88	192	Pseudo-differential	2	300	1.8	1.2-1.8	63 WCSP
CS47L35	3	4	120	122	-85	-88	8-192	Pseudo-differential	3	450	1.8	1.2-1.8	102 WCSP
WM8281	8	6	121	100	-92	-89	192	Single-ended; differential	4	600	1.7-5.5	1.14-1.9	138 WLCSP

Amplifiers

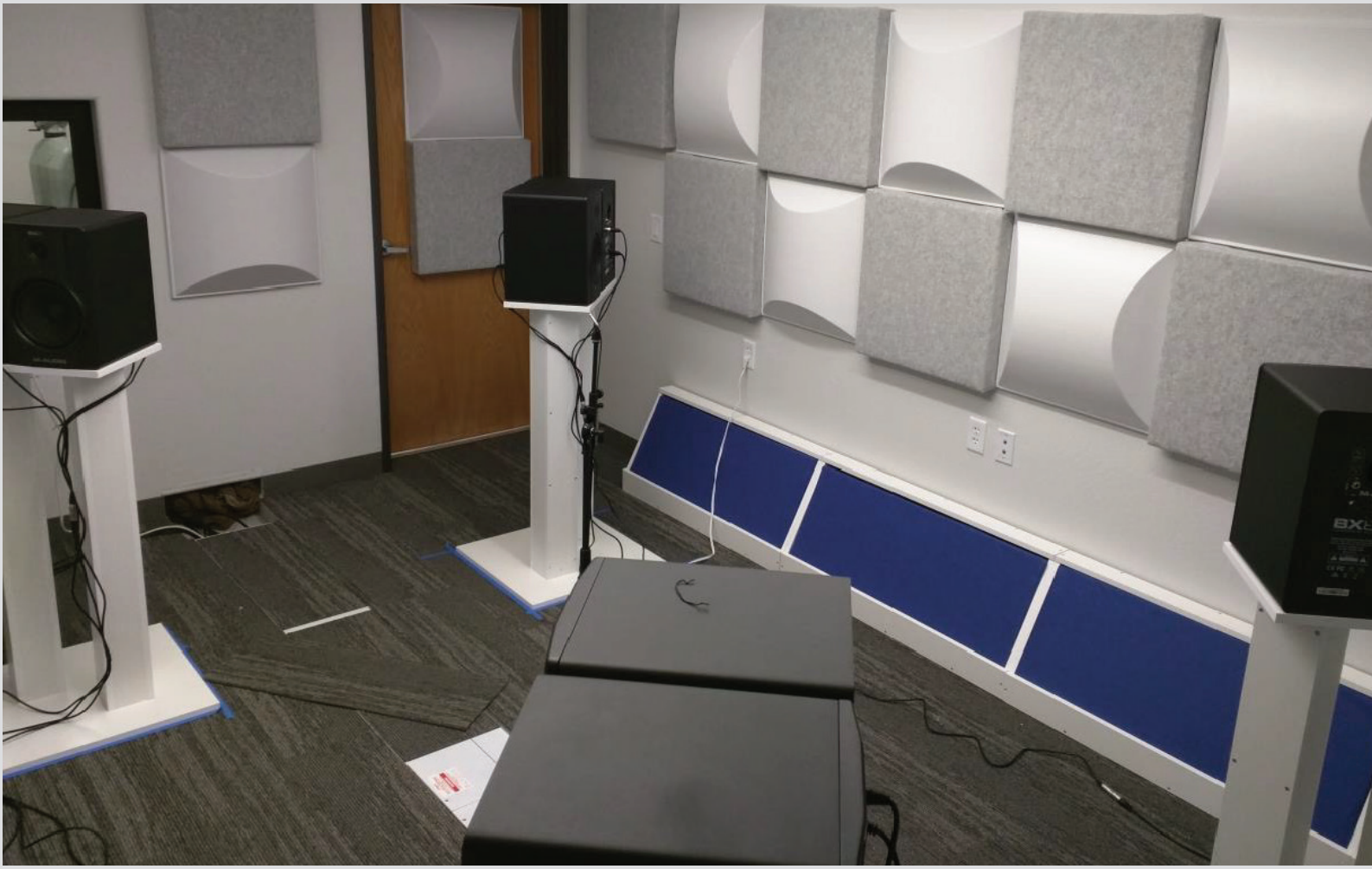
Product	Input Type	Channels	Output Power (V)	SNR (dB)	THD+N @ 1 W (dB)	Power Supply (V)	Package
CS35L32	Analog	Class D Speaker Driver; 1 x Mono Hybrid	1.7 W into 8 ohm	102	0.02	3-5.25	30 WLCSP
CS35L33	I²S; TDM	Class D Speaker Driver; 1 x Mono Hybrid	4.4 W into 8 ohm	95	0.02	3-5.5	42 WLCSP

Proven Technology

Cirrus Logic's network of acoustic lab facilities provides feasibility and viability testing for our smart home hardware and software technologies. The centerpiece of these activities is our Phoenix, Arizona location featuring a far-field lab, AVS test chamber, three listening rooms, an Anechoic chamber and an ACQUA text lab.

Far-Field Lab Features:

- Moveable walls enable ability to test in varying room volumes
- Ability to recreate varying noise environments
- Varechoic cabinets provide tunable reverberation times



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