

# CS47L15

Smart Codec with Audio DSP  
and Headphone Amplifier

Featuring SmartHIFI for Mobile Playback and KTV Enabled for Handsets and Headsets



## Product Overview

The Cirrus Logic CS47L15 is a highly integrated, smart audio codec with expanded audio features, such as “always on” voice activation, enhanced karaoke (KTV) and virtual stereo for smartphones and tablets. Low power analog and digital interfaces provide flexible support of the DSP core to enable advanced audio processing functions such as speaker protection and acoustic echo cancelation (AEC) to remove the effects of echo from recordings. A SPI master interface provides autonomous self-boot capability with configuration via an external, non-volatile memory that functions independently of a host processor to enable the codec to work independently in a system saving cost and conserving battery life.



A fully integrated audio subsystem featuring Cirrus Logic’s proprietary SmartHIFI™ offers the best high resolution, stereo playback experience. Specifications for the CS47L15 include a transparent phase and frequency response across the full bandwidth. A low output impedance offers natural audio reproduction independent of the headphone make and model. Pro-audio filters provide a transparent time domain response to enable high fidelity headphone and speaker playback. Low jitter clock circuits ensure clean and precise audio, as well as low noise ratings of 127 dB SNR and 115 dB DNR distortion.

The concept of “virtual stereo” is integrated with the CS47L15’s speaker protection to provide the stereo playback experience by utilizing existing transducer components. A 30 mW stereo headphone/earpiece/line output driver provides ground-referenced output with noise levels as low as 0.45 micro V<sub>RMS</sub> and just 0.1% total harmonic distortion (THD+N). Additionally, a 2.5 W Class D driver can enable an extended stereo region for the earpiece speaker with two channels of stereo PDM output to match the louder boosted amplifier.

The CS47L15 also introduces the Karaoke experience “KTV” thanks to a low latency 3 ms monitor path that allows users to hear themselves singing. Provided through a third party application, KTV can be used in both headset and handset modes. The smart codec provides realistic room reverberation and ambience effects in headphone mode and AEC to remove the echo effect associated with speaker mode. The device is powered from 1.8 V and 1.2 V supplies, and the power, clocking, and output driver architectures are designed to maximize battery life in voice, music and standby modes. Low-power “sleep mode” (25 μW) is supported, with configurable wake-up events. Wideband noise reduction and speech enhancement are also provided.

## Available Software Features\*

<b>Communications</b> VOICE	SoundClear® Voice <ul style="list-style-type: none"> <li>• Supports 8/16 kHz processing</li> <li>• 1 and 2 mic headset, handset and speakerphone modes</li> <li>• Dramatically reduces stationary and non-stationary background noise</li> </ul>	<ul style="list-style-type: none"> <li>• Enhanced AEC, far-field AGC, automatic volume control, parametric EQ</li> </ul>	Make and receive calls with optimized voice quality for smartphone, wearables and smart home products
<b>Convenience</b> CONTROL	SoundClear Control <ul style="list-style-type: none"> <li>• “Always on” trigger word detection</li> </ul>		“Always on” listening with minimal power consumption
<b>Capture</b> RECORD	SoundClear Record (Supporting KTV) <ul style="list-style-type: none"> <li>• Ultra low latency monitor path</li> <li>• Up to 48 kHz processing</li> </ul>	<ul style="list-style-type: none"> <li>• Headset and handset modes</li> </ul>	Sing karaoke for practice or social media using your handset or tablet.
<b>Content</b> PLAYBACK	SoundClear Playback <ul style="list-style-type: none"> <li>• MasterHIFI™</li> <li>• Speaker protection</li> </ul>	<ul style="list-style-type: none"> <li>• Multi-band compressor</li> <li>• Virtual stereo</li> </ul>	Enjoy 192 kHz, 24-bit high resolution audio playback; support for branded third party algorithms

\*Software features and pricing vary based on specific use application. Contact a local Cirrus Logic sales representative for further information.

## Target Applications

The CS47L15 is targeted at mobile and portable applications, including smartphones, tablets and wearable technology.

## System Features

150 MIPS, 150 MMAC DSP audio-signal processor

- Low power, "always on" voice trigger capability
- Speaker protection algorithm support
- Event loggers with time-stamp and interrupt functions
- Programmable wideband audio processing
- Transmit path noise reduction and echo cancelation

24-bit playback support

- Via audio outputs such as headphone, earpiece and external speakers
- To digital SPDMA output and external devices

Advanced clocking architecture

- FLL(s) generate all clocks needed, internal and external
- To/from any reference from 32 kHz – 27 MHz with no buffering/streaming gap during swap
- Powerful sample rate conversion
- Lowest possible power for all use cases
- Natural speech recognition
- Simplified software integration
- Jitter-free audio

Self-boot capability from external non-volatile memory

"Always on" low current consumption

- Including low power mode A/D converters to enable low power when using analog mics

Fixed function signal-processing functions

- Dynamic range control, fully parametric EQs
- Tone, noise, PWM, haptic control signal generators

Up to four analog or four digital microphone inputs

Stereo headphone/earpiece/line output driver

- 30 mW into 32 Ω load at 0.1% THD+N
- Hi-fi filters for audiophile quality playback

Speaker protection

Three full digital audio interfaces

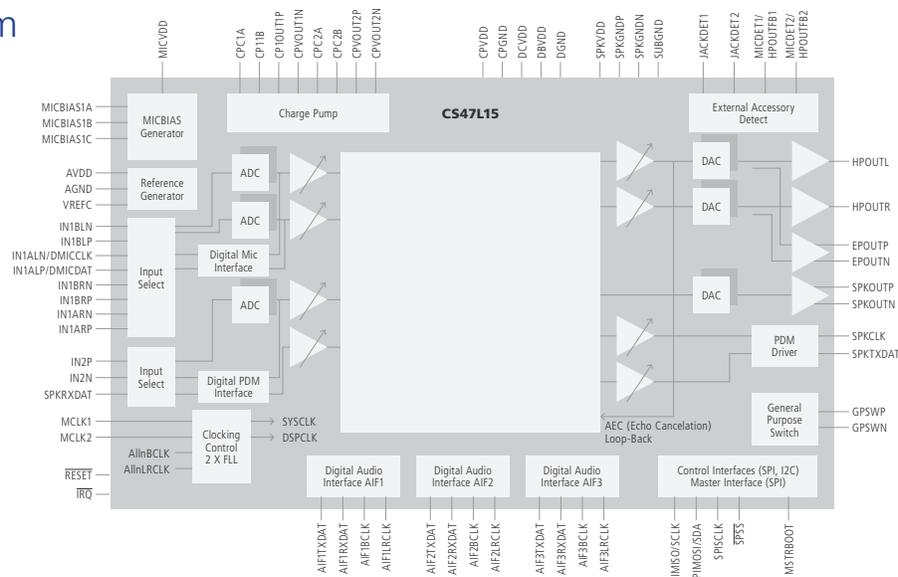
- Standard sample rates from 8 to 192 kHz
- TDM support on AIF 1 and 2

Compact WLCSOP package with 0.4-mm, staggered 70-ball array

Integrated multi-channel 24-bit hi-fi audio hub codec featuring SmartHIFI™

- Low distortion: 98 dB SNR mic input (48 kHz)
- Low noise: 127 dB SNR headphone playback (48 kHz)
- High dynamic range: 115 dB headphone, referenced to 1 V<sub>RMS</sub>
- Linearity: >94 dB THD
- Transparent frequency and phase response
  - +/-0.003 dB
  - Low headphone amp output impedance maintains flatness even when driving complex impedance loads
- Transparent time domain response: pro audio hi-fi filters
- High sample rate and bit depth
  - 24-bit, 192 kHz playback

## Block Diagram Schematic



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