CS47L90

Low Power, Highly Integrated Smart Audio Codec

Featuring SoundClear Software for "Always On, Always Listening"
Voice Activation and SmartHIFI for Mobile Playback

CIRRUS LOGIC®

Product Overview

The Cirrus Logic CS47L90 is an ultra low power high-fidelity smart audio codec that combines an advanced DSP feature set with a flexible and highly integrated hi-fi audio codec featuring Cirrus Logic's SmartHIFI™. With seven programmable DSP cores, the CS47L90 can support multiple voice applications and audio features in parallel, including multi-mic wideband noise reduction, high performance acoustic-echo cancellation (AEC), stereo ambient noise cancellation (ANC), and advanced speech and media enhancements – without draining battery life.

The CS47L90 features a 975 MIPS multi-core audio signal processor with advanced clocking architecture and a high performance 4 channel ADC/8 channel DMIC 24-bit hi-fi audio codec embedded with SoundClear® software technology. SoundClear Control provides "always on, always listening" seamless multi-trigger word detection that does not require the applications processor to remain awake and thus conserves standby mode power. SoundClear Playback provides speaker protection and virtual stereo sound, while the codec's DNA delivers SmartHIFI audio for mobile playback devices. SmartHIFI is a unique combination of powerful DSP processing and audio performance to deliver an audio experience typically associated with high-end audio equipment but now optimized for mobile audio playback while maximizing battery life. In addition to leading specifications for typical audio parameters such as THD, SNR, etc, SmartHIFI includes a high-end feature set – tunable hi-fi filters, jitter-free audio, high sample rate and bit depth support (24/32-bit, 192 kHz). Support for third party DSP programming also allows creativity for customer defined product feature differentiation.

Additional specifications for the CS47L90 include three stereo, multi-purpose headphone output drivers each with stereo ground reference or mono BTL outputs, 127dB SNR and noise levels as low as 0.63 μV_{RMS} for hi-fi quality headphone output, plus a four-channel digital speaker interface. Programmable wideband, multi-microphone processing is standard with the device's seven analog inputs and up to 10 PDM digital inputs, along with single-ended or differential mic/line inputs. The device is powered from 1.8 V and 1.2 V supplies with support for low power sleep mode (10 mA) and configurable wake-up events.

Available Software Features*

Communications VOICE	SoundClear Voice • Up to 16 kHz processing • Up to 3-mic handset or speakerphone Tx NR & AEC	• Speaker protection • Wind noise reduction	Make/receive calls with optimized voice quality based on use cases from a smartphone or tablet
Convenience CONTROL	SoundClear Control • Multi-trigger word detection • User defined trigger word detection • Extended audio buffer	• Two-channel input, output • Barge-in supported	"Always on" listening with minimal power consumption range
Capture RECORD	SoundClear Record • Up to 48 kHz processing • 2~4 Concurrent MIC input processing	• Wind/mic/focus/background noise reduction	Capture noise-free audio when and where needed
Content PLAYBACK	SoundClear Playback • MasterHIFI™ • Speaker protection	• Multi-band compressor • Stereo ANC	Enjoy 192k, 24-bit high resolution audio playback; support for branded third party algorithms
Contextual Awareness SENSE	SoundClear Sense • Proof of sensor fusion capability		

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

Target Applications

The CS47L90 is targeted at mobile and portable applications, including smartphones, tablets and multimedia handsets.

System Features

"Always on" low current consumption
- Including low power mode A/D converters to enable low power when using analog mics

32-bit playback support
- Via audio outputs such as headphone, earpiece and external speakers
- To digital SPDM output and external devices
- Enables 32-bit playback through devices such as external D/A converters

Enhanced memory sharing between DSP cores
- Up to four 1K windows can be allocated to any core
- Dramatically improves memory sharing

Seamless 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 with no pause/prompt
- Simplified software integration
- Jitter-free audio

975 MIPS seven-core audio DSP
- Fixed function signal-processing functions
  ◦ Dynamic range control, fully parametric EQs
  ◦ Tone, noise, PWM, haptic control signal generators
- Multi-channel asynchronous sample rate conversion

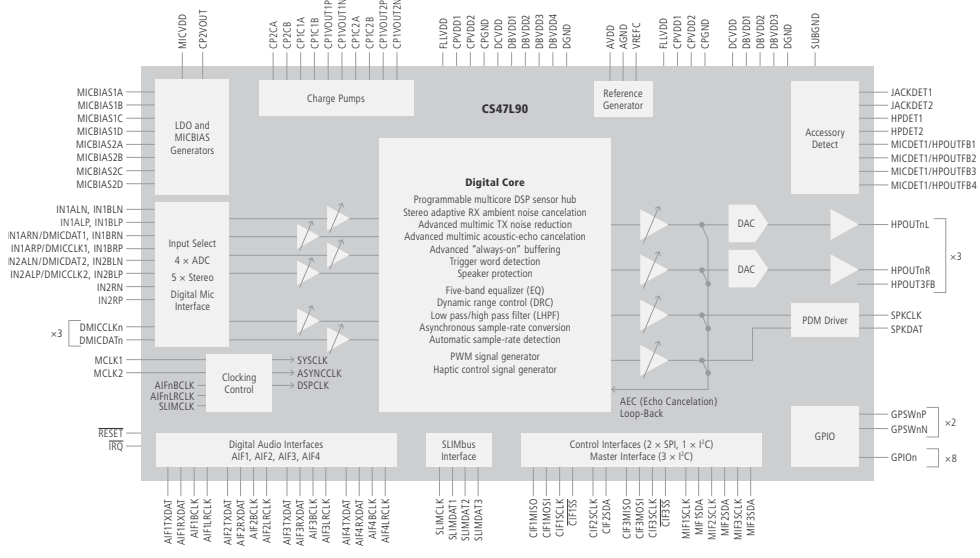Up to seven analog or ten digital microphone inputs (two stereo interfaces)

Multipurpose 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

Four full digital audio interfaces
- Standard sample rates from 192 kHz, 32-bits
- TDM support on all AIFs

Compact WCSP package with 0.4-mm, staggered 173-ball array

Integrated multi-channel 24-bit hi-fi audio hub codec featuring SmartHIFI™
- Integrated multi-channel 24-bit hi-fi audio hub codec with SmartHIFI
- Low distortion: 95 dB THD+N at low power, 32 Ω
- Low noise: 127 dB SNR headphone playback (48 kHz)
- Dedicated audio FLL minimizes clock jitter
- High dynamic range: 115 dB headphone, referenced to 1 V_{RMS}
- Linearity: >100 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 (based on WM8741 pro audio DAC)
- High sample rate and bit depth
  ◦ 24/32-bit, 192 kHz playback
- Low headphone amp output impedance: 0.2 Ω

Block Diagram Schematic

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