CRD1569-1

Voice Capture Development Kit for Amazon AVS-Enabled Products

Complete Development Kit

- Enhances quality of voice interaction
- Minimizes customer need for voice control expertise
- Full product development lifecycle, reducing cost, risk and time-to-market:
  - Allows in-depth evaluation of AVS
  - Simple prototyping
  - Demonstration of solutions

Voice Capture Board

- Contains CS47L24 DSP and dual CS7250B MEMS microphones
- On-board functions:
  - Multi-microphone hands-free voice capture
  - Spatial noise reduction
  - Barge-in AEC
  - Hi-Fidelity audio playback with EQ
  - Sensory™'s TrulyHandsfree™ wake word engine tuned to "Alexa"
- Input:
  - External two-microphone array interface (optional)
- Outputs:
  - Digital (stereo)
  - Line out (stereo)
  - Speaker (mono)
- Mounts directly on Raspberry Pi 3 for compact solution, or optionally connects using supplied ribbon cable

Cirrus Logic CS47L24 Digital Interface DSP

- Device includes:
  - Dual-core low-power audio hub DSP (ADSP2)
  - Hi-Fi DACs (121 dB SNR)
  - Two-watt mono speaker amplifier, stereo headphone amplifier
- Complete AVS front-end on-chip; voice capture board includes, and customer solutions need to add only:
  - Two digital MEMS microphones
  - Power regulation
  - Crystal oscillator
  - Typical passive components
- No additional LSI/ULSI required in kit or reference design

Kit Contents

- Voice capture board with CS47L24 DSP and two on-board CS7250B Bottom Port Compact MEMS microphones
- Raspberry Pi 3 with power supply
- Ribbon cable to connect voice capture board to Raspberry Pi 3 GPIO header (optional)
- microSD card, with:
  - operating system
  - Cirrus Logic AVS drivers
  - specialized, proprietary tuning and diagnostic tool
- Compact passive speaker box

1 General Description

The Cirrus Logic Voice Capture Development Kit for Amazon Alexa Voice Service (AVS)-enabled products is a complete solution designed to assist device manufacturers in easily enabling Alexa capability in a wide range of their electronic devices. The end-to-end reference design incorporates the entire audio front end system, from the microphone array to the Digital Signal Processor with proprietary audio processing algorithms, and is intended to interface with the AVS client application on the device system processor.

The reference solution provides all the hardware and software required for product development.

Advance Product Information

This document contains information for a product under development. Cirrus Logic reserves the right to modify this product.

A generalized block diagram is shown in Figure 1-1.

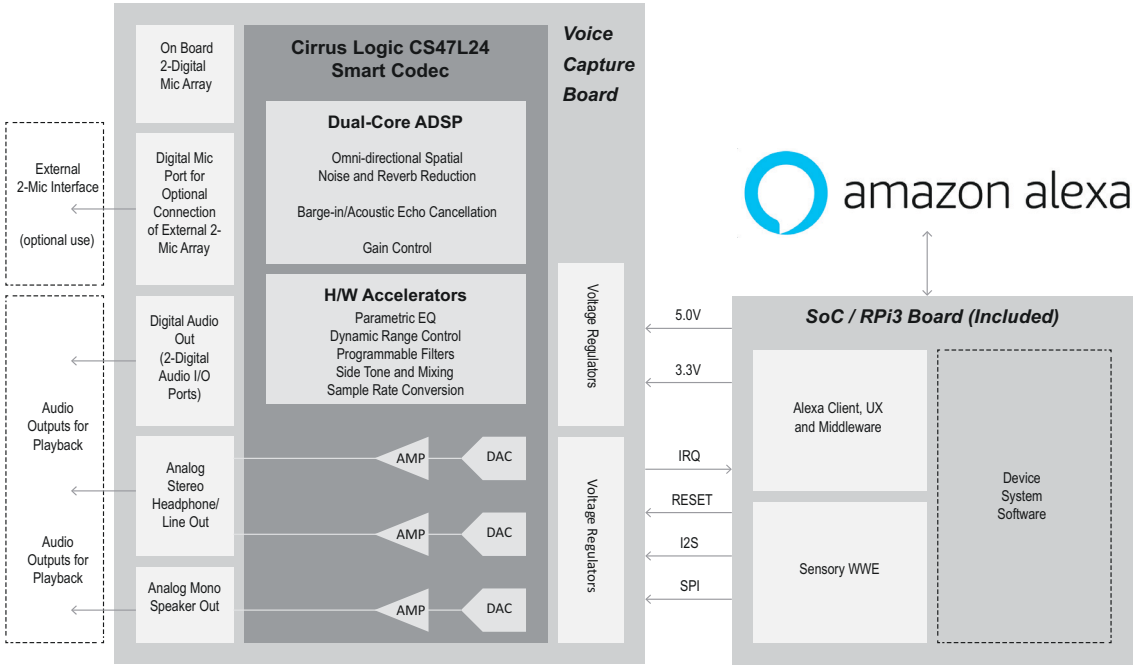

Figure 1-1. Reference Solution Block Diagram

2 Reference Solution Definition

The voice capture board, in combination with a Raspberry Pi 3, provides a fully-functional AVS reference design and development platform featuring Sensory's TrulyHandsfree wake-word engine tuned to "Alexa", and Alexa Voice Service with barge-in AEC. While no two-microphone solution will approach the range or performance of the seven-microphone technology integrated into some commercial products, the CRD1569-1 two-microphone reference solution provides a cost-effective solution suitable for many applications including voice controlled devices, hands-free portable speakers, and networked speakers.

The heart of the voice capture board is the CS47L24 smart codec that includes a dual-core DSP, Hi-Fi D/As, Hi-Fi stereo headphone/line-out and mono amplified speaker out. The CS47L24 also includes three bi-directional Digital Audio Interfaces (AIFs), one of which streams audio between the voice capture board and Raspberry Pi 3 and two which are available to stream audio data to amplifiers, codecs or other devices as an alternative to the integrated analog outputs.

2.1 Target Applications

The CRD1569-1 two-microphone reference solution supports a variety of omni-directional capture applications, such as:

— digital assistants
— hands-free home and entertainment control
— portable and movable wireless speakers
— tabletop devices

2.2 Proprietary Audio Processing Algorithms

To support far-field two-microphone voice control, the CRD1569-1 reference solution contains the following proprietary audio processing algorithms:

- speech capture processor – suppresses noise and reverberation for improved wake word, AVS and barge-in accuracy and reliability

- barge-in AECs – enables wake word and voice request during playback
- playback channel – allows gain control and equalization of playback

2.3 Tuning and Diagnostic Tool

Cirrus Logic supplies a specialized, proprietary software tool to assist developers and system integrators to characterize audio performance and tune the far-field algorithms for best performance within specific customer designs. The Control Console, a powerful, yet simple-to-learn tool that will aid development and minimize technical support requirements:

- integrates trigger, AVS and CRD1569-1 solution controls into a single screen:
  - includes hands-free dual-microphone voice control diagnostics and tuning
  - enables users to save, load and compare tuning parameters
  - exports tuning parameters to simplify technical support
  - eliminates the need for entering Linux line commands
- provides a web server-based solution:
  - access the console through any web browser (laptop, tablet, phone...):
    - on a common network
    - using the Raspberry Pi 3 as a hotspot
    - via VPN from a remote location
  - solution can be headless (no display, keyboard or mouse connected to the Raspberry Pi 3)

2.4 Additional Hardware Components

Due to the high functional integration of the CS47L24, the only additional components that are required to use the voice capture board are a host Raspberry Pi 3 and speaker, both of which are supplied in the kit.

The voice capture board includes a two-microphone digital MEMS array, level-shifters, and voltage regulators to interface to the Raspberry Pi 3 GPIO header, and typical passive components. Most of the board real estate is dedicated to enhancing system flexibility and usability by providing connections for an optional external two-microphone array, exposing unassigned GPIO signals on the Raspberry Pi 3 and extra AIFs and GPIOs on the CS47L24.

2.5 Additional Software Requirements

In addition to the Control Console tool, the Raspberry Pi 3 requires a Linux operating system and Cirrus Logic AVS drivers; these are supplied on the included microSD card. No other software is required.

3 Revision History

Table 3-1. Revision History

Date	Change
0.1 MAY ‘17	• Initial draft
0.2 JUN ‘17	• Review
1.0 JUL ‘17	• First release

Contacting Cirrus Logic Support

For all product questions and inquiries, contact a Cirrus Logic Sales Representative.
To find the one nearest you, go to www.cirrus.com.