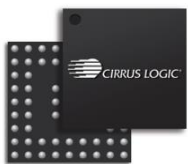




## Cirrus Logic: TWS Headset Solutions



*Advanced Signal Processing Components*

# The Truly Wireless Earbud Market is Growing Rapidly

**Battery life, comfort and sound quality are critical design considerations**



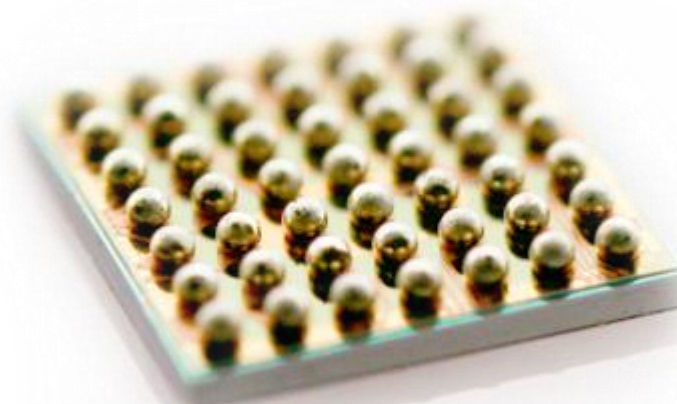
**Cirrus Logic' Smart Codecs and SoundClear Headset software suite deliver the best TWS audio experience at low power consumption**

# Cirrus SoundClear Solutions Enable a Better Wireless Headset



Software Algorithms

+



TWS Codec

+



BT Radio

- Paired with the best BT radio

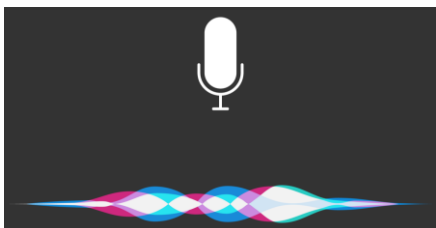
# How can Cirrus Technologies Enhance TWS Headsets



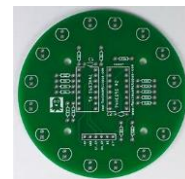
**The Best Voice Call  
Quality**



**Low Power Headphone  
Playback**



**Always-Enabled Voice  
Control**



**Smaller PCB area  
including external  
components**



**Natural Sounding Ambient  
Awareness/ Augmented Audio**

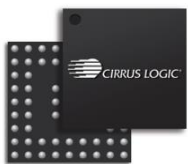


**Low Power ANC**





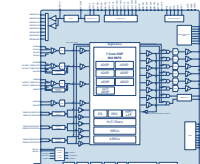
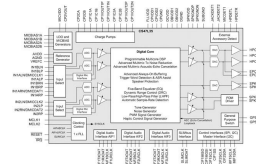
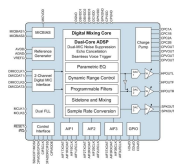
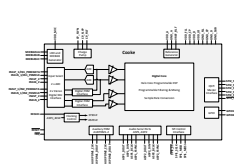
## Smart codecs for Headsets



*Advanced Signal Processing Components*

# Cirrus Logic Smart Codec overview

CS47L15	CS48L32	CS47L24	CS47L35	CS47L90
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DSP cores	1 ADSP2	1 Halo	2 ADSP2	3 ADSP2	7 ADSP2
Headphone SNR	127dB	N/A	121dB	122dB	127dB
HP THD+N (20mW)	-92dB	N/A	-90dB	-91dB	-93dB
Max playback sample	24 bit	N/A	24 bit	24 bit	32 bit
DSP Capability	150MIPS	200 MIPS	300MIPS	450MIPS	975MIPS
Memory	144kbyte	1048kbyte	472kbyte	668kbyte	1664kbyte
Mic channel	4xAna, 4xDig	4xAna, 4xDig	4xDig	6x Ana, 4xDig	7xAna, 10xDig
Integrated Class D	1	0	1	1	0
Availability (MP)	Now	Now	Now	Now	Now

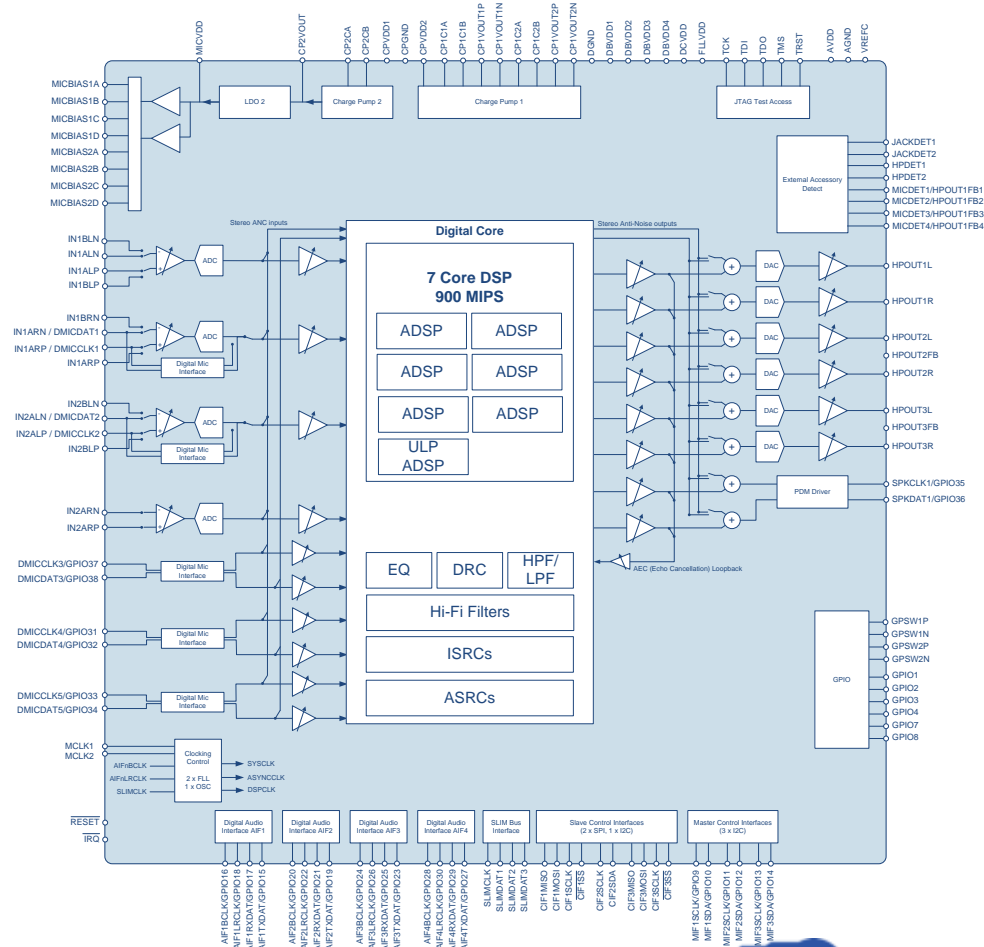
# Which features runs on each device?

Feature	CS47L15	CS48L32	CS47L24	CS47L35	CS47L90
Hearing Augmentation/PSAP	✓		✓*	✓	✓
2 Mic Voice TX		✓	✓*	✓	✓
AoV with Seamless command		✓	✓*	✓	✓
ANC					✓

\* = can run but not concurrently

# CS47L90 Block Diagram and Features

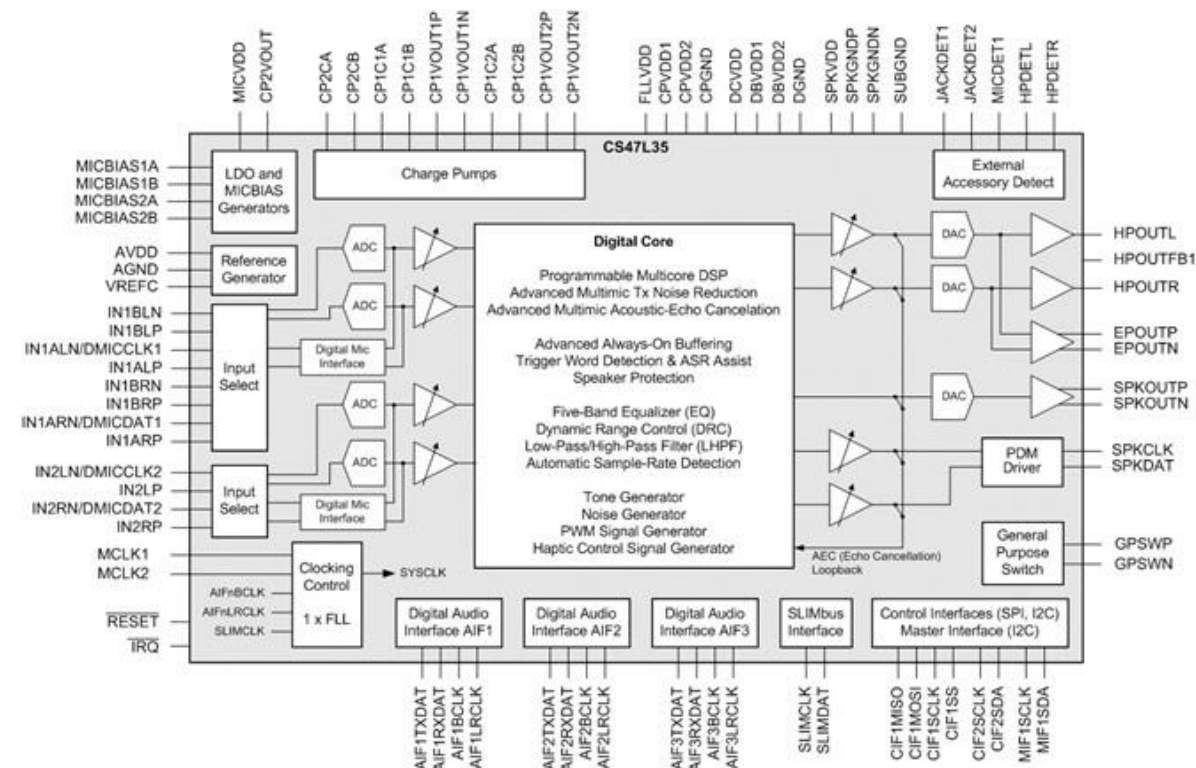
- 7 ADSP2 DSP Cores with 900 MIPS total processing speed
- 1.6MB Memory
- 124dB SNR Headphone Playback
- Hi-Fi quality audio playback up to 192kHz
- 32 bit audio playback support
- 44.1kHz support
- Low power / high performance switch mode ADCs
- 4 ADCs with muxed inputs
- RX ANC
- 4 \* Multi- I2S and SPI audio interfaces
- PDM inputs for digital microphones





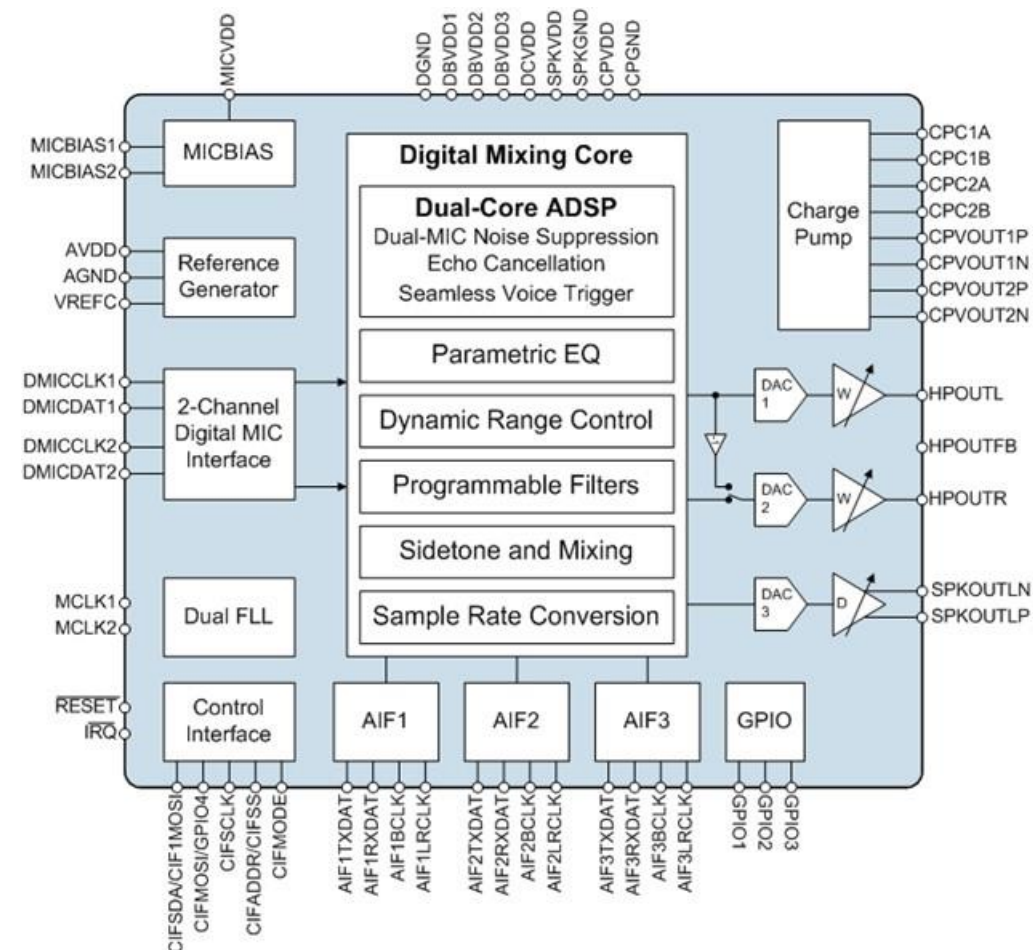
# CS47L35 Block Diagram & Features

- 3 ADSP2 DSP Cores with 450 MIPS total processing speed
- 668KB Memory
- 124dB SNR Headphone Playback
- Hi-Fi quality audio playback up to 192kHz
- 44.1kHz support
- 4 ADCs with muxed inputs
- 3 \* Multi- I2S and SPI audio interfaces
- PDM inputs for digital microphones



# CS47L24 Block Diagram & Features

- **Compact smart codec for wearable devices**
  - Ultra-compact <10mm W-CSP
- **High-performance DSP**
  - 300 MIPS dual-core ADSP2
  - *SoundClear Voice* 2-mic voice processing with Tx NR and AEC, omni-direction support, and 1-4cm mic spacing support
  - *SoundClear control* with seamless voice trigger
  - Further software features from Cirrus catalogue and extensive 3<sup>rd</sup> party ecosystem as required
  - Programmable Filters, EQ & DRC
- **Inputs / Outputs**
  - Dual DMIC & MICBIAS; Separate DMICCLK and DMICDAT
  - Stereo ground-ref class W
  - Mono 1W@4.2V class D
  - 3 x AIF & associated SRC, 2x GPIO, 1x SPI



# CS48L32 Block Diagram and Features

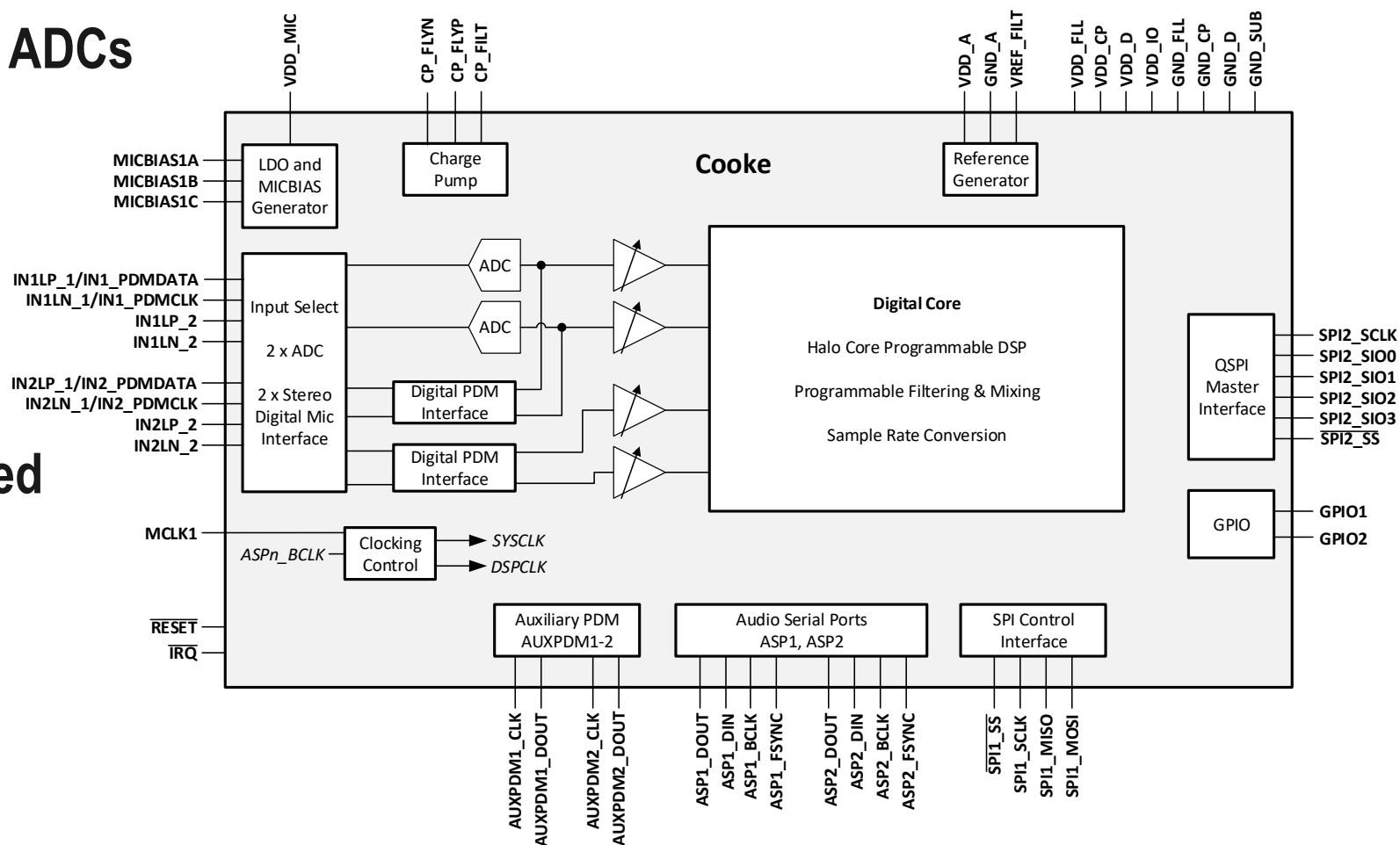
- 2 x AoV specifically designed ADCs

- HALOCORE™**  
FROM CIRRUS LOGIC

- 1 MB Memory
- 100 MHz operation dual MAC

- All Digital connectivity required**

- I2S
- Aux PDM (for connectivity)



# CS47L15 Block Diagram & Features

- 1 ADSP2 DSP Cores
- 144KB Memory
- 122dB SNR Headphone Playback
- 2 Low power ADCs with muxed inputs
- PDM inputs for digital microphones
- Self Boot capability
- Hearing Augmentation via Software

