

# CS4399

Next Generation, Low Power, High-Fidelity  
Audio D/A Converter

Featuring Cirrus Logic's MasterHIFI for Mobile Playback



## Product Overview

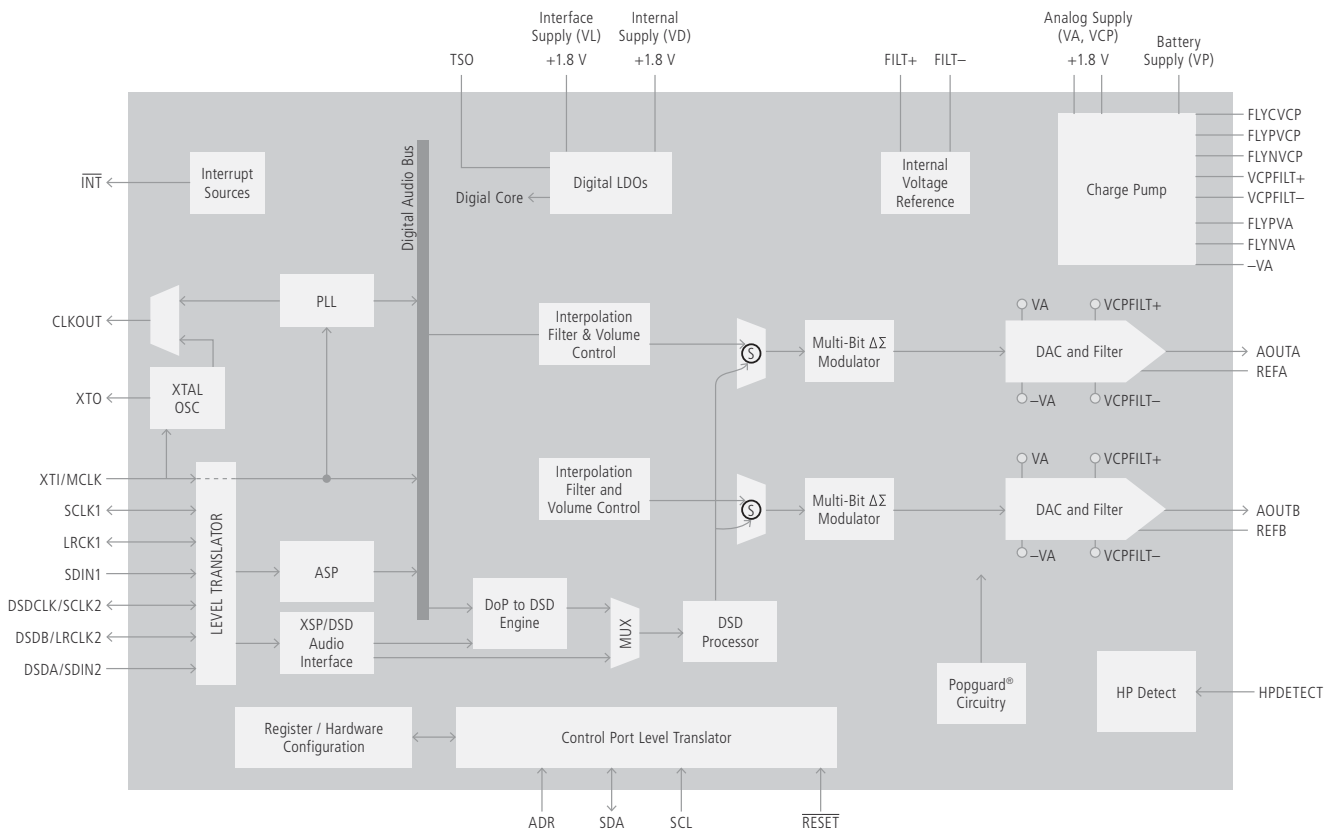
The Cirrus Logic CS4399 is a 32-bit, stereo audio D/A converter that delivers best-in-class, system-level audio performance. For the designer, the CS4399 provides the ability to differentiate through performance and features, including a 130 dBA dynamic range, an impressive THD+N rating of  $-108$  dB, and interchannel isolation of  $>110$  dB.



To minimize pre-echos and ringing artifacts, the CS4399 is designed with proprietary digital-interpolation filters that support five selectable digital filter responses. Filtering options include low group delay with pseudo-linear phase and a fast or slow roll-off to preserve audio integrity. A patented on-chip DSD processor supports up to DSD128 in direct mode while providing non-decimating volume control with soft ramp and 50 kHz filtering as recommended by Scarlet Book. Volume matching of the analog output levels and channel mixing enable a seamless transition between the DSD and PCM playback paths.

The CS4399 supports sampling frequencies of up to 384 kHz while consuming just 23 mW of power. Its advanced 32-bit oversampled multibit modulator with mismatch shaping technology and on-chip component mismatch eliminates distortion. Volume control is processed in 0.5 dB steps and digital de-emphasis with a 44.1 kHz sample rate.

## Block Diagram Schematic



## Target Applications

The CS4399 is targeted at mobile and portable applications, including smartphones, tablets, multimedia handsets, laptops, digital headphones and powered speakers.

## System Features

Advanced 32-bit oversampled multi-bit modulator with mismatch shaping technology

- Eliminates distortion due to on-chip component mismatch
- Supports up to 384 kHz sampling frequency
- Low clock jitter sensitivity
- Auto mute detection

Patented dedicated DSD processor featuring high resolution audio format support

- DirectStream Digital™ (DSD)
- DSD over PCM (DSD DoP), up to DSD128
- Handles switching between DSD and PCM audio streams, matching the analog audio output level

Integrated high performance output

- 130 dB dynamic range (A weighted)
- -108 dB THD+N
- 110 dB interchannel isolation

Serial audio input

- I<sup>2</sup>S, right-justified, left-justified, DoP, DSD and TDM interface
- Master or slave operation
- Volume control with 0.5 dB step size and soft ramp
- 44.1 kHz de-emphasis and inverting feature

Supply Voltages

- VA = 1.8 V
- VP = 3 V to 5 V
- VD/VL = 1.8 V

Integrated PLL

- Reference clock sourced from MCLK pin
- System clock output

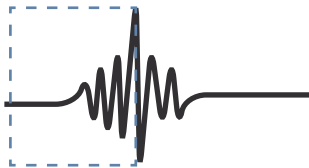
1 MHz I<sup>2</sup>C and hardware mode control

42-ball WLCSP or 40-pin QFN (0.4 mm pitch)

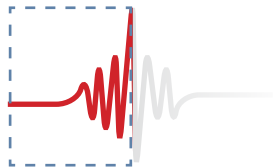
## CS4399 with MasterHIFI

Achieving high-fidelity audio with high quality DACs can be easy, but it typically requires using excessive power, the mortal enemy of battery life. Our next generation DACs have multi-level output technology that actively adjusts the output signals to match the music being played. A good DAC should not unintentionally ‘color’ the material it plays. So what do you get from this? High quality audio that sounds amazing for longer with the lowest power consumption possible.

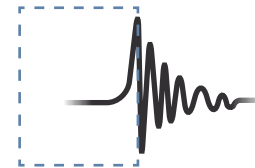
- Supports high-fidelity audio line out
- Sample rate up to 384 kHz, 32-bit
- Up sampling filters from 44.1 kHz to 96 kHz, 16-bit and 24-bit
- Minimum phase apodizing low pass DAC filter to reduce pre-ringing for cleaner, less muddy audio
- FLAC and ALAC supported



Conventional  
Linear Phase Filter



Pre-ringing of a Conventional  
Linear Phase Filter



Playback Filter Response



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