

Cadence Tensilica HiFi DSP

Configurable processors for audio, voice, and speech processing

Today's audio, voice, and speech processing applications challenge designers to manage a wide breadth of performance and power requirements to create compelling, interactive, and immersive experiences for their customers. The Cadence® Tensilica® HiFi DSP family for Audio, Voice, and Speech offers a low-energy, high-performance, highly optimized DSP solution that spans the entire spectrum of audio algorithms and end equipment.

Overview

Audio/voice/speech (AVS) processing covers a very wide range of performance and power consumption requirements. On one end of the spectrum is the ultra-low power "wake on voice" processing found in many of today's smartphones and wearables. On the other end, emerging object-based audio standards, such as Dolby ATMOS or MPEG-H, require home entertainment products to process many more audio data objects transmitted with the audio stream. At the heart of these new AVS innovations is the desire of OEMs to create more compelling, interactive, and immersive experiences with their devices.

Using different processor architectures to handle the breadth of applications in the AVS domain would be very costly in terms of software development and product management. The Cadence Tensilica HiFi DSP family for audio, voice, and speech addresses this broad range of requirements, offering low-energy, high-performance processing for the entire spectrum of audio processing algorithms and end equipment while maintaining software compatibility across the portfolio. HiFi DSPs can be found in SOCs across all major markets including mobile, automotive, home audio, television, computing, and gaming (see Figure 1). Whether you are optimizing to increase battery life, save thermal power, or save costs, there is a compelling HiFi DSP that meets your audio requirements.

With over 70 licensees, over 75 partners, and over 160 software packages, HiFi is the #1 DSP architecture for SOC designers.



Figure 1. HiFi DSP Audio Applications

HiFi DSP Family Specifications

	24-bit HiFi ISA			32-bit HiFi ISA	
DSP	HiFi 2	HiFi Mini	HiFi EP	HiFi 3	HiFi 4
ISA variant	v24	v24	v24e	v32(vf)	v32(vf)
VLIW slots	2			3	4
VLIW bundle instruction sizes	64-bit	40-bit	64-bit	64-bit	48-/88-bit
Fixed-point MACs per cycle					
32x32	n/a			2	4
24x24	2			4	4
16x16	2			4	8
Accumulator	56-bit	n/a	56-bit	64-bit	64-/72-bit
Floating-point unit (FPU)—optional	Scalar (independent)			Integrated Vector FPU with 2-way SIMD	Integrated Vector FPU with dual 2-way SIMD
ITU intrinsic support	No			Yes	
Circular buffer support	None	None	1	1	2
Bit stream VLD support including Huffman	Yes			Yes	
Prefetch option for cache-based configurations	n/a		Optional	Optional	
User-defined instructions	Yes	Limited	Yes	Yes	
32x24 precision MAC	No	No	Yes	No	

HiFi DSP Family Summary

- HiFi Mini —A superset of the HiFi 2 DSP designed to support lowest energy for always-listening voice trigger
- HiFi 2—Good balance for performance and low energy consumption
- HiFi EP—A superset of the HiFi 2 DSP with advanced optimizations for DTS-HD master audio, improved voice pre- and post-processing, and improved cache memory subsystem
- HiFi 3—Most energy-efficient DSP for a broad range of applications in mobile, home, and automotive applications
- HiFi 4—Highest performance HiFi DSP especially for object-oriented audio decoders

Low-Power, High-Performance Audio DSPs

The HiFi DSP ISA is highly optimized for AVS applications. By optimizing more than 150 audio software packages, the HiFi ISA provides the lowest energy, highest performance DSPs for audio. This performance scales across the entire DSP product family from the ultra-low-energy 24x24 dual MAC HiFi Mini, to the energy-efficient 24x24 quad MAC HiFi 3, to the high-performance 32x32 quad-MAC HiFi 4.

Audio Software and Ecosystem

OEMs continue to look to AVS as a means to differentiate their products and provide a compelling user experience, adding features such as voice trigger and advanced voice recognition to their products. In the home audio market, this could mean supporting the latest object-based audio decoder or the latest 3-D audio post-processing suite.

By choosing Cadence's HiFi family of DSPs, SoC designers can ensure that the broadest set of codecs and pre-/post-processing software is immediately available to their customers. Currently more than 150 different software packages are available as part of the largest audio ecosystem for any DSP in the market. This means that all of the newest and most innovative audio IP is always available with HiFi DSPs.

Flexibility

HiFi DSPs are completely configurable, giving the SoC designer control of numerous pre-defined functions and features, including the memory subsystem, debug, floating point, and many others.

In addition to configuration options, the SOC designer can choose to further improve performance and reduce energy for any given application by adding custom instructions and more I/O bandwidth. This is possible because all HiFi DSPs are based upon the Cadence Tensilica Optimization Platform, which

allows designers to add value through additional customization while remaining completely compatible with the HiFi software ecosystem. See Figure 2.

Ease of Programming

HiFi DSPs offer a key advantage—their simple programming model. Software developers can write audio and voice applications completely in C using efficient, optimized audio and voice instructions, maintaining or surpassing the performance of the same applications build with assembly code.

Cadence Services and Support

- Cadence Tensilica application engineers can answer your technical questions, and provide technical assistance and custom training.
- Cadence certified instructors teach a series of courses on Tensilica IP and bring their real-world experience into the classroom
- Internet Learning Series (iLS) online courses allow you the flexibility of training at your own computer via the Internet
- The Cadence Tensilica IP support site gives you 24x7 online access to a knowledgebase of the latest solutions, technical documentation, software downloads, and more at ip.cadence.com/support

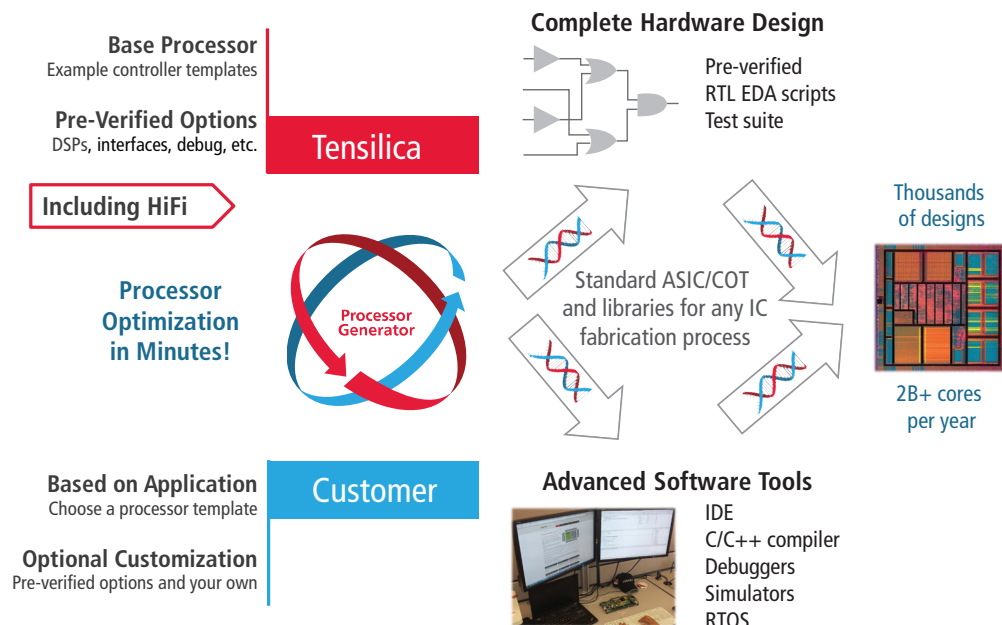


Figure 2. Cadence Tensilica Optimization Platform