Automotive Infotainment

Improving the user experience with in-car infotainment

Overview

Infotainment features can make or break a new car purchasing decision, so the rush is on to greatly improve the user experience. People now expect that their connected digital lifestyles will extend into their cars and that infotainment systems will be as intuitive to use as their smartphones. Automobile manufacturers need to quickly add new features in a flexible way, as algorithms to implement these features are still evolving and a variety of software suppliers are developing targeted expertise.

Speeding the Design Cycle for Infotainment Systems

As the design of infotainment systems has become more complex with consumer demand for innovative features, Cadence has helped manufacturers with the design and verification of chips, boards, and systems that make these systems possible.

Cadence also offers a wealth of proven, tested intellectual property (IP) that can speed the design cycle for tomorrow's infotainment designs. Our analog, interface, and memory IP are used to quickly

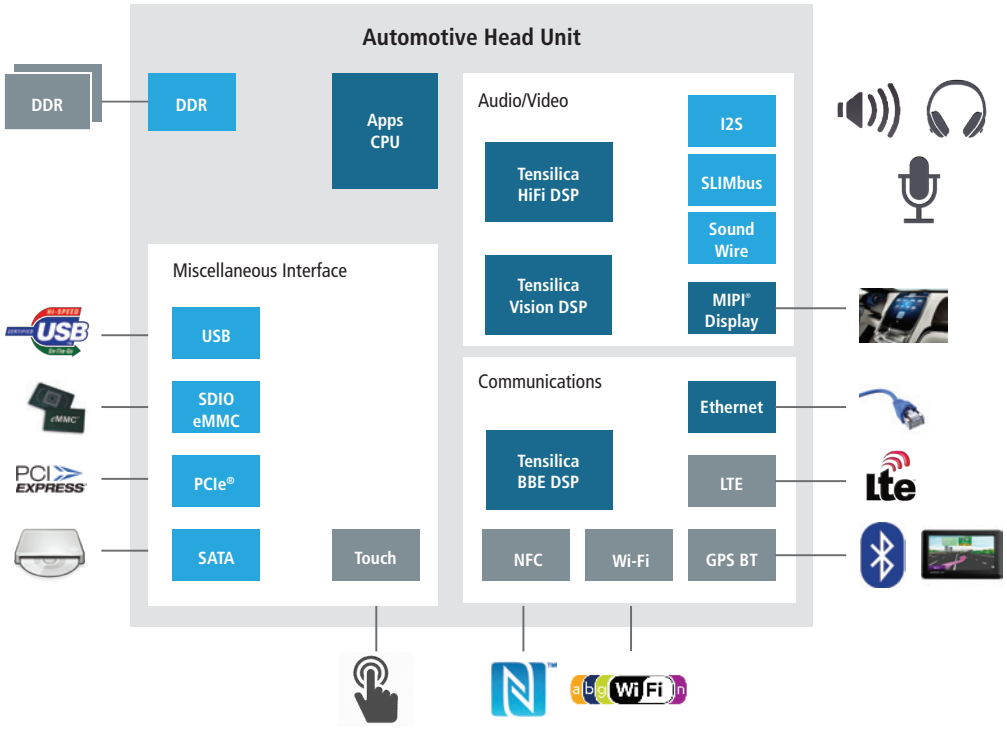

Figure 1: Where Cadence IP fits in infotainment designs

add critical capabilities. Cadence® Tensilica® processors can provide the flexibility to help future-proof your designs with significant post-silicon flexibility to adapt to new algorithms. They can often provide functionality in half the silicon area and half the cost of other solutions.

Here are just some of the areas where we can help speed your next design to market:

- Digital/satellite radio support
- Always-listening voice recognition and enhancement
- Immersive surround sound and audio post-processing
- Active Noise Control (ANC)
- Automobile navigation systems
- Wi-Fi, Bluetooth, LTE radios, and USB

Digital/Satellite Radio Support

All digital terrestrial and satellite radio audio standards are supported on our Tensilica HiFi DSP for Audio, Voice, and Speech.

- HD radio—Available from iBiquity Digital
- DAB—Available from Cadence
- DAB+—Available from Cadence, certified by Dolby
- DRM (Digital Radio Mondiale)—Available from Cadence, certified by Fraunhofer
- Sirius-XM Satellite—Available from Sirius-XM
- T-DMB (BSAC audio)—Available from Cadence
- ISDB-T—Available from Cadence

In addition to supporting all of the digital audio codecs found in today's digital radio standards, Cadence partners offer digital radio demodulation software. By leveraging this software running on the BBE16 DSP, licensees can develop an SoC as a software-defined radio (SDR) platform that can support all of the world's digital radio standards.

Always-Listening Voice Recognition and Enhancement

Our Tensilica Fusion F1 DSP excels at ultra-low-power, always-listening voice recognition. Cadence has worked with several software partners to offer a complete solution for not just voice activation and recognition, but also the pre- and post-processing necessary to enhance voice communications in a noisy compartment. We can provide excellent far-field speech recognition that is also highly accurate.

Benefits

- Proven in hundreds of chip designs
- Customizable for your application
- Expansive software library so you don't have to port and optimize code yourself
- Efficient, very low power

Immersive Surround Sound and Audio Post-Processing

Cadence and its HiFi audio partners have a library of over 175+ audio software packages, so you can design your radio to provide the best in-cabin listening experience using any of our Tensilica HiFi DSPs. Spanning the latest standards from industry leaders such as Dolby® and DTS to innovative algorithms from smaller companies, we can provide all the software you need. We also offer a complete set of codecs for digital radio, including DAB, DAB+, DRM, T-DMB, and ISDB.

We work with several audio partners that help automobile manufacturers tune the sound to match cabin dynamics for the best listening experience. Find out more about our audio partners on our partner page.

Together with our software partners, we can help you minimize the hardware investment, yet get very high-quality sound from the speakers. This software can greatly reduce the cost of adding a great-sounding audio system to your automobile.

When it comes to integrating that system in your infotainment center, don't forget about Cadence's large library of interface, analog, and memory IP. By using our pre-verified and production-ready IP, you'll save yourself the time and effort of designing these blocks yourself.

Benefits

- Largest collection of software partners in the DSP IP industry
- Software already ported and optimized for HiFi architecture speeds your design process
- Sound quality verified by industry leaders

Active Noise Control

Cadence's Tensilica HiFi DSPs for Audio, Voice, and Speech can be used to isolate vehicles from engine and road noise for active noise control (ANC) or active noise reduction (ANR). "Anti-noise" can be used to deaden many sounds, with strategically placed microphones that monitor noise. The HiFi DSP can be used to help cancel the noise by generating an identical signal that is 180 degrees out-of-phase with the surrounding sounds.

Cadence has several partners that provide the necessary software and will help automobile manufacturers figure out the best speaker and microphone placements for noise reduction. Reducing road noise in this way can greatly improve the feel of quality in the cabin for a much smaller investment than sound-dampening equipment.

The Strongest Partner Ecosystem for Automotive

- **AM3D:** Audio post-processing
- **Arkamys:** Audio post-processing, active noise control
- **Audyssey:** Audio post-processing
- **DTS:** Audio codecs, post-processing
- **Fortemedia:** Voice pre-processing
- **Fraunhofer:** Codecs
- **Ibiquity:** Digital radio codec
- **Kronoton:** Audio post-processing
- **MightyWorks:** Audio, voice pre-processing
- **Mueller-BBM:** Active noise control
- **QNX:** ANC, voice pre-processing
- **SPL:** Audio post-processing
- **Waves:** Audio post-processing, voice pre-processing

Benefits

- Proven partners with designs already in automobiles
- Efficient DSP saves weight and cost of sound-dampening equipment
- Greatly improves cabin experience for driver and passengers

Automobile Navigation Systems

Cadence's IP portfolio can speed the design of automobile navigation systems. For displays, the Tensilica IVP Image/Video DSP helps provide clear, crisp image processing, while our display interface IP supports all of the major standards required in the mobile and consumer worlds. Whether you're working with HDMI, DisplayPort, MHL incorporating HDCP, VESA, and/or CEA-861 standards, our IP cores are mature and proven to be compliant.

Need the processing power to deliver navigation results in real time? Consider using a Tensilica ConnX DSP. We have a full range of DSPs from two to 64 MACs, so you can pick the right performance for your application. Whether your need is for a single core, a homogeneous multi-core solution, or a highly optimized heterogeneous mix of DSPs, DPUs, and hardware accelerator blocks, our ConnX family of DSPs and DPUs supported by the Xtensa® tool chain is the ideal place to get started on your baseband platform design. And because it's based on our Xtensa processors, you can customize these DSPs to exactly match your requirements.

Benefits

- Speed your design with proven display interfaces
- Choose from a variety of DSPs to match to your application requirements
- Generate your own optimized DSP for maximum efficiency

USB, Wi-Fi, Bluetooth Communication, and LTE Radios

Today, USB and multiple wireless radios are employed in automobiles. Cadence USB PHY and controller IP support both USB 2.0 and USB 3.0 specification. Tensilica ConnX DSPs are ideal for use in the heart of Wi-Fi, Bluetooth communications, and LTE radios in car infotainment centers.

Benefits

- Speed your design with proven USB PHYs and controllers
- Efficiently process huge data streams with ConnX DSPs

Tensilica HiFi Portfolio

Fusion F1/HiFi Mini Ultra-Low Power	HiFi 2 / EP Mainstream	HiFi 3 Leading Energy Efficiency	HiFi 4 Ultimate High Performance
• Lowest power for always-on functions • Target applications – Voice trigger – Voice recognition – Sensor fusion – All "always-on" functions	• Balance in area (power) / performance • Most popular audio DSP architecture	• Most energy efficient/highest MMACs/mw • Target applications – Mobile devices – Home entertainment – Automotive • Optimized for HD audio codecs and post-processing and voice codecs / pre-processing	• Highest performance/highest MMACs/MHz • Best 32-bit performance • Target applications: – Home/automotive – Complex multi-mic voice/speech noise reduction/pre-processing • Good fit for multi-DSP use cases
175+ software packages compatible across all HiFi cores			

Pre-Silicon Functional Verification

The increasing number and complexity of interfaces in automotive SoC designs makes pre-silicon functional verification a priority. Cadence Verification IP (VIP) offloads work from the verification team by providing proven VIP that checks compliance with standard interface specifications such as CAN, LIN, DDR, Ethernet, Flash, USB, and dozens of other interfaces.

Benefits

- The proven solution, chosen by over 500 customers
- VIP available for over 100 interface and memory standards
- Reduces functional verification effort by up to 80%]

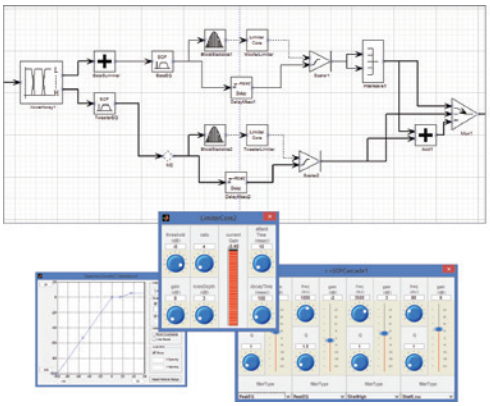

Figure 2: Audio Weaver

Graphical Audio Design and Tuning Tool

Audio Weaver™ from DSP Concepts is an innovative graphical design environment for developing and tuning optimized embedded audio software such as the Tensilica HiFi DSP. Development teams can create applications that realize their desired sound quality up to 10X faster than traditional development approaches by allowing developers to work in parallel at different stages of the development cycle and by re-using pre-built, highly optimized audio processing modules. The real-time tuning capabilities of the Audio Weaver tool gives automotive audio engineers complete control of their audio signal chain.

Benefits

- One tool for all stages of audio development
- Up to 10X reduction in development times
- Greatly reduced development risk
- Supports Agile development process
- Significant cost savings

System Development and Validation

Centered around our Incisive® and Palladium® core engines, the Cadence system-to-silicon verification solution allows you to efficiently integrate and verify your designs in the context of the software powering modern designs. The Palladium acceleration and emulation environment is used for verification of chips and the system environments in which they reside. For instance, our Cadence Palladium Hybrid technology enabled one customer to shave months off the development cycle for their infotainment systems with up to 200X speed-up for OS bring up. The Protium™ FPGA-based prototyping system is ideally suited to start embedded software development early, and also run excessive, high-speed regressions to assure that the highest quality systems are delivered on time.

Benefits

- High-performance software execution
- Early software validation
- Hardware/software debug
- Increased validation throughput
- Accelerated embedded software development

To learn more about Tensilica's IP options for automotive, visit www.cadence.com/automotive.

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Cadence Design Systems enables global electronic design innovation and plays an essential role in the creation of today's electronics. Customers use Cadence software, hardware, IP, and expertise to design and verify today's mobile, cloud, and connectivity applications. **www.cadence.com**