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Tensilica Fusion F1 DSP

Configurable processor for Internet of Things applications

Choosing the right processor for Internet of Things (IoT) and wearable applications can be challenging, as these types of devices must meet requirements for low cost, low energy, multiple sensors, and connectivity. While no one processor will be optimal for all IoT applications, the Cadence® Tensilica® Fusion F1 DSP offers the low energy along with high-performance control and signal processing for a broad segment of IoT and wearable designs.

Overview

The Fusion F1 DSP has the high configurability to scale the breadth of potential IoT and wearable applications, and its architecture provides very good DSP performance, both fixed and floating point, to process all of the sensor data available in these new devices. Developed on a highly configurable architecture, the Fusion F1 DSP is specifically designed to excel at "always-on" processing, including wake-on-voice and sensor Fusion F1 applications. Additionally, the Fusion F1 DSP is very efficient in running the narrowband wireless communications standards typically associated with IoT device communications.
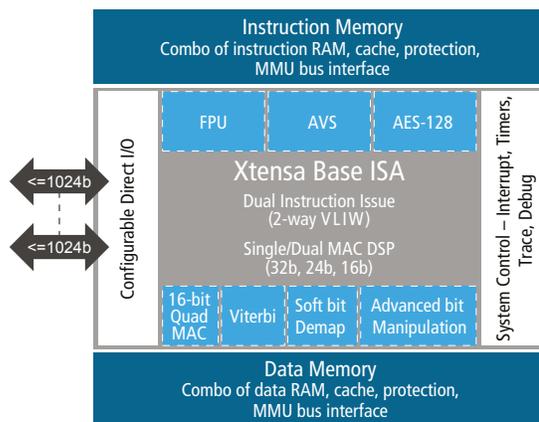

Figure 1: The Fusion F1 DSP is based on the customizable Xtensa configurable processor, which allows you to configure parameters and add predefined or custom instructions to your processor in a way that is fully blended and verified in the final processor.

Proven Click-Box Configuration Options

Option	Benefits
Single-precision FPU	• Floating-point instructions issued concurrently with 64-bit load/store • Speeds software porting
Audio/Voice/Speech (AVS)	• Software compatibility with the Tensilica HiFi 3 DSP for audio • Access to 175+ HiFi audio/voice software packages
16-bit quad MAC (four 16x16)	• Accelerates communications standards like BLE and Wi-Fi • Accelerates voice algorithm performance
BLE/Wi-Fi/AES-128	• Encryption acceleration for wireless
Advanced bit manipulation	• Accelerates performance of bit operations for implementation of baseband
Viterbi	• Supports Viterbi for WiFi and LTE
Soft bit demap	• Supports soft bit demapping for WiFi and LTE

Low-Energy, High-Performance Audio DSPs

Designed for low-energy, high-performance IoT/wearable applications, the Fusion F1 DSP is the industry leader for voice-trigger/wake-on-voice applications. The Fusion F1 DSP also excels at sensor Fusion F1 processing. Its single-precision floating-point unit (FPU) efficiently runs the software suites of the leading sensor software providers.

Key Tensilica Fusion F1 DSP Features

Feature	Supported	Benefits
VLIW Slots	2	Allows two concurrent operations
Fixed-Point MACs per Cycle	One 32x32	Flexible MAC architecture efficiently handles broad set of data types
	Two 24x24	
	Two 16x16 (four optional)	
Accumulator	64-bit	
FPU (optional)	Integrated scalar VLIW FPU	Tightly integrated for efficient performance
ITU/ETSI Intrinsics	Yes	Accelerates ITU voice codec performance
Circular Buffer	Yes	Efficiently manage streams of DSP data
Bit Stream VLD (incl. Huffman)	Yes	Accelerates audio codec performance
Prefetch for Cache-based Configurations	Optional	Improves cache memory performance
Customer-defined Instructions for Further Optimization	Yes	Extend the instruction set architecture (ISA) to efficiently meet customer requirements
Additional Options	AVS / Advanced bit manipulation	Compatible with HiFi DSP software (option) ISA extensions to accelerate wireless communications standards (option)

Scale Across Your IoT/Wearable Portfolio

No one processor will be able to serve the tremendous breadth of applications in the IoT market. That's why it's essential to give you the opportunity to choose a processor that only includes functionality that is needed for your particular application to keep the costs and energy consumption down. With the Fusion F1 DSP, you can quickly configure the processor with the options that are required. This approach allows performance, energy, and area optimization with very little additional engineering effort. In addition, this configurability allows an SoC provider to scale the same processor architecture, development tools, and hardware flow across the entire IoT/wearables portfolio.

Example Tensilica Fusion F1 DSP Usage Scenarios

		16-bit Quad MAC	FPU	AVS	AES	Advanced Bit Manipulation
FEATURE	Voice Activation	•				
	Sensor Fusion F1		•			
	Audio/Voice/Speech			•		
	Wireless Communications	•			•	•
END PRODUCTS	Activity Band	•	•	•	•	•
	Healthcare Band	•	•		•	•
	Smart Home	•	•		•	•
	Smart Meter	•			•	•

Software and Ecosystem

OEMs are continuing to look to audio/voice/speech (AVS) as a means to differentiate their products and provide a compelling user experience. For instance, they're adding features such as voice trigger and advanced voice recognition to their products. For the home audio market, this could mean supporting the latest object-based audio decoder or the latest 3-D audio post-processing suite.

By enabling the AVS configuration option, you can gain software compatibility with the HiFi DSP family. The HiFi software ecosystem has the broadest set of codecs, pre and post-processing and sensor Fusion F1, voice- and face-triggering software in the industry. Currently, there are more than 175 different software packages available in an ecosystem that includes more than 80 different companies that help OEMs create compelling products.

Flexibility

The Fusion F1 DSP provides a high level of flexibility to help you create the right processor for your end applications. Based upon the Tensilica Xtensa® configurable processor, processors with the Fusion F1 DSP are fully configurable. Configuration options are pre-defined by Cadence and give you control over numerous features, including the memory subsystem, debug, and interrupts.

In addition to the pre-defined configuration options, you can also add custom instructions to further improve the performance and differentiation on any given application, with full development tools and flow support provided automatically. The Xtensa Processor Generator makes configuration and customization possible. All changes remain completely compatible with the existing software ecosystem.

Ease of Programming

A key advantage of the Fusion F1 DSP is its simple programming model. Because of the efficiency of the compiler, software developers can write their applications completely in C while maintaining or surpassing the performance of assembly on other DSP and CPU architectures.

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
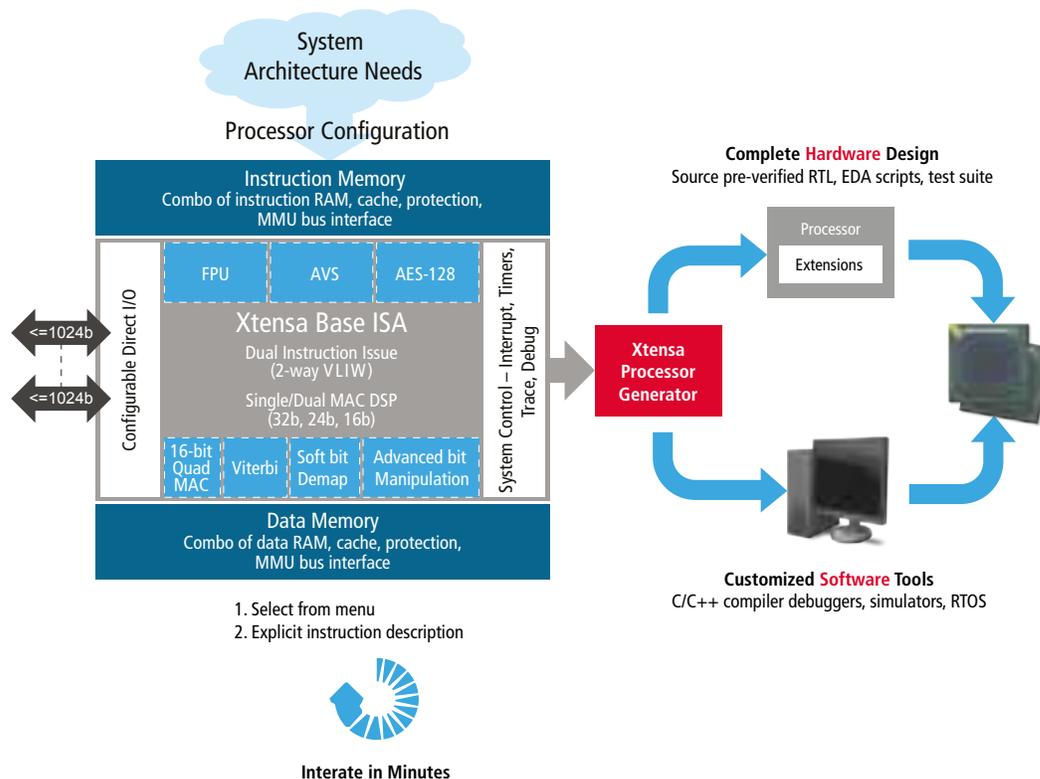

Figure 2: The Xtensa Processor Generator makes configuration and customization of your Fusion F1 DSP environment possible.

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