Blackfin ADSP-BF50x Processors

Breakthrough Price/Performance Extends Visual Development and Complex Algorithms to New Products and Applications

Analog Devices' Blackfin® processors for converged digital signal and control processing applications deliver exceptional processing performance at low price points, enabling system designers to build innovative features into their existing products, create new products, and successfully enter new markets. Complemented by a rich ecosystem of development tools, applications, and third-party support, ADI Blackfin processors continue to gain popularity among domain experts and designers seeking to create differentiating product value in a competitive marketplace.

ADI's new Blackfin ADSP-BF50x series processors are optimized for a wide range of price/performance-sensitive applications, including applications previously serviced by high end (32-/64-bit) microcontrollers (MCUs). Designers facing a choice between incorporating DSPs and/or MCUs in their systems can utilize Blackfin ADSP-BF50x processors to run the complex algorithms and execute the system control tasks they require to realize their design objectives—without compromising on processor cost. With performance headroom to spare, designers needn't be experts in DSP programming to take advantage of Blackfin-caliber performance today.

Blackfin ADSP-BF50x Series Processors Ensure Greater Development Agility

Blackfin ADSP-BF50x processors deliver unmatched price/performance, providing up to 400 MHz of processing performance at a price point where 150 MHz to 200 MHz clock speeds have been the norm. This performance profile extends high performance digital signal processing capabilities to a broader range of applications, many of which previously required designers to implement algorithms in hand optimized C code, and in some cases assembly code, in order to run the application with the performance limitations of the processor or MCU.

Designers can leverage the Blackfin ADSP-BF50x processors ample performance headroom to utilize advanced visual programming software, which helps designers shorten development cycles and reduce design complexity. These easy to use programming tools enable designers to evaluate concepts, develop and validate algorithms, map parallel, deterministic tasks, and tune parameters in real-time before committing to a hardware prototype. With the flexibility to model, simulate, and deploy systems utilizing user-friendly visual programming tools, design teams are empowered to make the best use of their resources and accelerate time to market.

Reduce Development Complexity with Visual Programming

Visual programming tools can preclude the need for specialized DSP programming experience, providing system designers with an abstracted design interface that handles low-level code generation in the background. Built-in abstractions liberate the designer from the strict modeling style guides that are required by general-purpose languages, allowing design objects to be represented with a high degree of efficiency.

Designers programming DSPs using traditional text-based languages, such as assembly or C, spend much of their time performing tasks that require multiple steps to make small changes. With visual programming tools, they can reduce iterative design cycles and overall development time. Commercially available model-based programming products can also provide support for Analog Devices' VisualDSP++® integrated development and debug environment (IDDE) to ensure end-to-end development simplicity spanning executable specification, design with simulation, embedded code generation, debugging, and code verification. The integration of these capabilities helps to reduce or eliminate errors associated with hand coding and can incorporate system-level test bench capabilities, which eliminate the need for a different set of software tools for verification.

Efficient Algorithm Development and Implementation

Higher performing DSPs can run a greater number of algorithm cycles and process more sophisticated algorithms in a fixed amount of time. Blackfin ADSP-BF50x processors' superior performance profile and ample on-chip memory (4 MB executable flash) equips designers to achieve greater system functionality and precision through the use of more advanced algorithms.

For solar energy inverter applications, for example, sophisticated algorithms can enable inverters to convert variable dc output into *clean* current and regulate power flow into the commercial electrical grid and/or local electrical networks fed by residential and municipal photovoltaic (PV) cell arrays. Maximum power point tracking (MPPT) algorithms maximize the amount of energy that can be extracted from individual and/or serial-connected solar panels, and designers typically employ multiple MPPT algorithms to accommodate a range of environmental variables. Blackfin ADSP-BF50x processors provide the superior signal processing performance to execute complex MPPT algorithms, ensuring ultraefficient energy extraction in inverter applications for which comparably priced, lesser-performing processors and MCUs would be inadequate.

For motor control applications, the ability to process complex algorithms assures dynamic control that adapts to real-time variations in system behavior to yield smoother performance and reduced power consumption. Consider a sensorless field-oriented control (FOC) algorithm, which can enable variable-speed control of permanent magnet synchronous motors (PMSMs) to yield greater energy efficiency and eliminate the need for speed and position sensors within the motor (sensorless vector control). Utilizing advanced Blackfin ADSP-BF50x-hosted modeling algorithms to accurately determine rotor shaft position and speed, designers can eliminate the need for position/speed sensors to realize smaller form factors, reduced costs, and greater system reliability.

Best of Both Worlds—Algorithm Optimization with Visual Programming

Algorithms such as the aforementioned sensorless FOC algorithms can be readily developed, manipulated, and validated with the aid of visual programming tools. Variables such as vectors, scalars, and matrices are accounted for and correlated, freeing an algorithm developer from having to declare variables or create iterative loops to implement operations of this nature. Visual programming tools typically manage a host of automated mathematical functions that would allow the designer to focus on the top-level sensorless FOC algorithm, rather than reimplementing operations centric to sine or cosine flux. These tools facilitate hierarchical design so that complex functions can be structured and presented in a manner that is intuitive to the designer and easy for other members of a design team to understand, while offering visualization options that can include 2D/3D plotting, as well as animated graphics.

These automated capabilities don't preclude designers from manipulating the lower-level code or porting existing code to the visual programming environment. As many designers maintain and reuse a stable of highly optimized, manually coded algorithms, most visual programming environments accommodate the integration and continued refinement of existing C code. In this way, visual software tools provide designers with a flexible, unified development environment via which they can tune and reuse code and port designs to multiple platforms—all of which helps to shorten development cycles for subsequent design initiatives.

ADI Blackfin Fixed-Point Digital Signal Processors

Analog Devices' 16-/32-bit fixed-point Blackfin digital signal processors are designed specifically to meet the computational demands and power constraints of today's embedded industrial, automotive, audio, video, and consumer electronics applications. Blackfin processors deliver breakthrough performance and power efficiency with a RISC programming model, combining advanced signal processing functionality with the ease-of-use attributes found in general-purpose microcontrollers. This combination of processing attributes enables Blackfin processors to perform equally well in both signal processing and control processing applications—in many cases eliminating the requirement for separate heterogeneous processors. This capability greatly simplifies both the hardware and software design implementation tasks.

Comprehensive Development and Support Ecosystem

Analog Devices software and hardware development tools are designed to provide easier and more robust methods for engineers to develop and optimize systems, simplifying product development processes and reducing time to market. The Blackfin processor family leverages familiar development tools, including the VisualDSP++ integrated development and debug environment (IDDE) and the EZ-Kit Lite® evaluation and application prototyping platform. A rich third-party software support network further enables developers to design more intelligent and efficient solutions for the industrial market.

For more information about ADI's full portfolio of digital signal processors, software, development tools, and support, visit *www.analog.com*.

Analog Devices, Inc.
Worldwide Headquarters
Analog Devices, Inc.
One Technology Way
P.O. Box 9106
Norwood, MA 02062-9106
U.S.A.
Tel: 781.329.4700
(800.262.5643,
U.S.A. only)
Fax: 781.461.3113

Analog Devices, Inc.
Europe Headquarters
Analog Devices, Inc.
Wilhelm-Wagenfeld-Str. 6
80807 Munich
Germany
Tel: 49.89.76903.0
Fax: 49.89.76903.157

Analog Devices, Inc.
Japan Headquarters
Analog Devices, KK
New Pier Takeshiba
South Tower Building
1-16-1 Kaigan, Minato-ku,
Tokyo, 105-6891
Japan
Tel: 813.5402.8200
Fax: 813.5402.1064

Analog Devices, Inc.
Southeast Asia
Headquarters
Analog Devices
22/F One Corporate Avenue
222 Hu Bin Road
Shanghai, 200021
China
Tel: 86.21.2320.8000
Fax: 86.21.2320.8222

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