Industry’s Performance Leading
Ultra-Low-Power DSP Solution

The New ADSP-BF70x Series
of DSP Processors

June 12, 2014  v4.0
Processor Market Trends Driving Change

- **Ever Increasing Need for Cost Effective Real-time Processing**
  - Low latency, deterministic performance
  - Access to low power 32-bit processing
  - Demand for cost effective machine intelligence
    - e.g. real-time image analysis & detection
  - Faster time-to-market & optimized algorithms

- **Lowest Power Solutions**
  - More portable equipment, extended battery life
  - Shrinking power budgets (limited bus power)
  - Green energy products & regulation…..

- **System Integration**
  - Reduced footprint & BOM cost requirements
  - Glue-less peripheral connectivity
  - Software IP Protection & fast boot time
  - Handling of soft-error issues in safety critical systems
BF70x Series: Next Generation Blackfin

Low Power High Performance Fixed-point DSP

- New Blackfin+ Core
  - Single-Cycle 2x16-bit, 32-bit & Complex Math
  - 16bit: 800MMACS, 32bit: 400MMACS
  - Blackfin Code Compatible

- 1MByte SRAM

- Large On-Chip Memory

- Ultra Low Power
  - 95mW @ 400MHz
  - \( V_{DDINT} \) Power at 25°C \( T_j \)

Low BoM Cost & Glue-less Connectivity Options

- Starting at only $3.99 (1K units)

- Quad-SPI, I2C, UART, SPORT, Video ePPI, 4-ch 12-bit ADC & more

- Enhanced Connectivity Options

Ease-of-Use & Fast Time-to-Market

- Efficient C Compiler, Optimized Libraries & Algorithms

- Hardware Reference Designs & JTAG Emulators

- Experienced 3rd Party Network

Security/IP Protection & Data Integrity

- Cryptography Accelerators On-Chip

- Fast Secure Booting

- ECC Parity CRC

- On-chip Memory Protection & Integrated Safety Features
  - Ultra-low SER-FIT
Example Use Case Comparison

Yesterday vs. Today

Example Imaging Use Cases
- Occupancy Sensing
- People Counting
- Access Monitoring
- Barcode Reader
- Banknote Reader

Example Audio Use Cases
- Guitar Effects
- Portable Audio/Voice Recorders
ADSP-BF70x Series: Lowest Power Blackfin
Extending ADI’s Leadership Position for Low Power DSP Performance

Note: Typical silicon power comparison at $T_{\text{junction}} \ 25^\circ\text{C}$ & comparable setup conditions
ADSP-BF70x Processor Architecture
Enhanced Blackfin+ DSP Core

- Evolved Blackfin core: “Blackfin+”:
  - Single-cycle 32 x 32-bit Multiply/MAC (with 72-bit accumulate)
  - 16-bit complex multiplication and MAC
  - Cache enhancements & parity on L1 memory
  - Branch prediction, memory system & instruction set enhancements
- Provides performance increase with benefits in power
  - Equivalent or better performance per cycle vs. previous Blackfin core
    - 30% improved 16-bit CFFT benchmarks due to complex math improvements
    - Improved 32-bit benchmarks e.g. 2-3x filtering benefit for FIR & IIR
    - 20% improvement in subset of typical benchmark suites
    - Additional performance increases due to major enhancements in device fabric and internal/external memory system
- Instruction set compatibility with low software impact & full binary backward compatibility
Key New Features to Blackfin

- First use of Blackfin+ core
- 40nm low power technology
  - 35% lower power than previous Blackfin products at the same MHz
- Improved memory bandwidth compared to previous Blackfins
  - More cache fill buffers, internal 64-bit data paths, support for misaligned access and improved choices to accelerate cache fills
    - Large L2 SRAM with 1.5x-3x improved cache throughput
    - DDR cache throughput increased by up to 2x
    - Memory-to-memory DMA up to 800 MBytes/sec
- High-speed memory-mapped Quad-SPI (25MBytes/sec)
  - With HOST & Execute-in-Place modes
- Advanced Security for IP protection & more
- Integrated house-keeping ADC
- ARM® CoreSight™ & SWD Debug enabling trace capability
  
  plus many other performance & usability enhancements.....
Advanced Security Features
Safeguarding software & algorithm investments

- **IP Protection via on-chip Cryptography Accelerators**
  - Intended Use Cases include
    - Fast Secure Boot with Authentication and Decryption
    - Options for Authentication Only
  - Memory-based encryption/decryption
    - Providing fast run-time security options
  - Power optimized hardware design
    - Ultra-low power when inactive

- **Key Hardware Blocks & Performance**
  - Ciphers: AES128..256, DES/3DES
    - Performance: AES-128 decrypt – 2.46 bits/cycle
  - HASH Functions: SHA-1, SHA-2 (224/256)
    - Performance: SHA-224 – 7.88 bits/cycle
  - Public Key Acceleration
    - ECC Verify (224-bit ECDSA) in 1.7M cycles
  - True Random Number Generator

- **OTP Memory 4KBytes**

512KByte secure boot with Decrypt & Authentication in < 55ms
Best-in-Class Memory Protection Performance
Providing ultra-low “Soft-Error-Rates” for harsh environments

◆ Soft Errors are due to external ambient radiation sources
  ● Causing transient errors in processor execution or data results
  ● Examples include Alpha Particles & Cosmic Rays
  ● Not due to design or manufacturing defects & no permanent damage to device

◆ Growing awareness & demand for low SER-FIT in Safety Critical Apps
  ● Automotive
  ● Military, Space & Avionics
  ● Industrial - 24/7 safety critical apps

◆ ADSP-BF70x: Data Integrity features provide significant SER-FIT reduction
  ● On-chip SRAM Protection
    ◆ Detection for L1 (Parity) & Correction for L2 (ECC)
  ● Peripheral memory protection & CRC engine for off-chip traffic
  ● Effective SRAM SER-FIT can be reduced to significantly below 1 FIT

Note: SER = Soft Error Rate, FIT = Failures in Time (Faults per 10⁹ Device Hours)
Example: 1 SER-FIT equals approx. 114,100 years between device failures
# ADSP-BF70x Product Feature Matrix

<table>
<thead>
<tr>
<th>Generic Device</th>
<th>DSP Core Performance</th>
<th>On-chip Memory</th>
<th>External Memory</th>
<th>Key Connectivity Options</th>
<th>Other Features</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADSP-BF700</td>
<td>100MHz to 400MHz</td>
<td>132KB L1 SRAM/Cache L2 SRAM options of 128KB 256KB 512KB</td>
<td>N/A</td>
<td>ePPI, SPORT(2), Quad/Dual SPI(3), I²C, UART(2), CAN2.0B (2) SD/SDIO/MMC(4-bit) USB2.0 HS OTG</td>
<td>OTP, Security Accelerator, Data Integrity (with L1 parity &amp; L2 ECC), WDT, RTC</td>
<td>QFN 88-lead 12x12mm</td>
</tr>
<tr>
<td>ADSP-BF701</td>
<td>800MMACs 16-bit 400MMACs 32-bit</td>
<td>512KB 1MBytes 512KB L2 ROM 16-bit LPDDR DDR2 Above options plus SDIO/MMC/eMMC (8-bit) 4-ch 12-bit ADC</td>
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<tr>
<td>ADSP-BF702</td>
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<td>N/A</td>
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<tr>
<td>ADSP-BF703</td>
<td></td>
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<td>N/A</td>
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<tr>
<td>ADSP-BF704</td>
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<td>N/A</td>
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<tr>
<td>ADSP-BF705</td>
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<td>N/A</td>
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<tr>
<td>ADSP-BF706</td>
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<td>N/A</td>
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<tr>
<td>ADSP-BF707</td>
<td></td>
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<td>N/A</td>
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</tbody>
</table>

**Price range (1K)**: $3.99 → $10 (with different variants & features)
Support for Commercial / Industrial / Automotive grades

**Product Status**:
- Sample availability: June 2014
- CCES, EZ-KIT, ICE Production: June 2014
- Production: 3Q 2015
CrossCore® Embedded Studio 1.1.0

CrossCore® Embedded Studio is ADI’s New Eclipse™ based Tool Chain
- IDE
- Debugger
- Compilers
- Assemblers
- Linker
- Loader
- Algorithm & DSP Libraries

Add-ins enable graphical configuration and code generation
- System Services and Device Drivers
- And much more...

Seamless integration with middleware
- Micrium µC/OS-III™, µC/OS-II™ Real Time Kernels
- Micrium µC/USB Device™, Host™ Stacks & Class Drivers
- Micrium µC/FS™ File System
Blackfin Software Module Examples
Optimized and available with no ADI license-fee

Image Processing Software

- Video Occupancy Sensor
- Vision Analytics Toolbox
- Video Content Analysis Toolbox
- Spatial Transform
- Lens Distortion Correction
- Graphics Primitives

Audio

- Encode & Decode
  - JPEG, H.264 BP/MP, MPEG-4, WMV9

Audio Decoders & Post Decoders
- DTS Neo:6; 5.1 Decoder
- Dolby Digital (AC-3) 5.1 Decoder; Headphone v2; Virtual Speaker; Pro Logic Ilx Decoder

Audio Encoder & Decoders
- MP3, MPEG-4 AAC-LC/HE-AACv2, WMA9

Audio Post Processing
- Asynchronous Sample Rate Converter
- Multi-band Graphic Equalizer

For complete list & latest info: www.analog.com/BlackfinModules
ADI Hardware Development Tools

- Low Cost BF70x Development Boards
  - 400MHz BF707 EZKIT board with DDR and key peripherals supported
    - Optional EZ-Extenders for increased features
    - ADZS-BF707-EZLITE (includes CCES & ICE-1000)
  - Blackfin Low-Power Imaging Platform (BLIP)
    - Advanced Occupancy Detection Solution

- New USB based JTAG Emulators
  - $150 Low Cost ICE-1000 (ADZS-ICE-1000)
  - USB-bus powered & JTAG/SWD up to 46MHz
  - ARM® CoreSight™ based trace for program & system debug

- Watch out for future announcements of additional hardware platforms.....
  - Including ultra-low-cost Audio
Example Blackfin 3rd Party Support

www.analog.com/3rdParty

- Recent ADSP-BF70x Solution Partners
  - EBSYS - Europe
    - Vision & Image algorithm expertise in Industrial, Consumer & Automotive
  - DSP Concepts – North America
    - Accelerating the development of embedded audio products & technology
  - Twisthink – North America
    - Image Processing & Algorithm Development for Industrial Applications
## ADSP-BF70x Summary

**Broad Range of Markets with Strong Feature Alignment**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Key Markets Addressed</th>
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</thead>
<tbody>
<tr>
<td><strong>Scalable Performance</strong></td>
<td>- <strong>Intelligent Lighting &amp; Occupancy Detection</strong></td>
</tr>
<tr>
<td>Up to 400MHz Blackfin+ core</td>
<td>- <strong>Industrial Imaging</strong></td>
</tr>
<tr>
<td>Single-Cycle 2x16-bit, 32-bit &amp;</td>
<td>- <strong>Barcode, Biometrics, Cameras</strong></td>
</tr>
<tr>
<td>complex math</td>
<td></td>
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<tr>
<td><strong>Best-in-Class Power Efficiency</strong></td>
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<tr>
<td>118µW / MMAC @ 400MHz</td>
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<tr>
<td>95mW at 800MMACs</td>
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<tr>
<td><strong>Lowest BOM Cost</strong></td>
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<tr>
<td>Starting at $3.99, Large SRAM</td>
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<tr>
<td>(up to 1MByte), Glue-Less</td>
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<tr>
<td>Connectivity, ADC &amp; DDR Option</td>
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<tr>
<td>&amp; Cost Optimized Packaging</td>
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<tr>
<td><strong>Advanced Security</strong></td>
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<tr>
<td>IP Protection with Fast Secure</td>
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<tr>
<td>Boot &lt; 55msec for 512KByte Boot</td>
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<tr>
<td>Image</td>
<td></td>
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<tr>
<td><strong>Memory Protection</strong></td>
<td></td>
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<tr>
<td>SRAM Parity &amp; ECC for Safety</td>
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<tr>
<td>Providing Best-in-Class SER-FIT</td>
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</tr>
<tr>
<td>Performance</td>
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<tr>
<td><strong>Industry Standard Connectivity</strong></td>
<td></td>
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<tr>
<td>Options</td>
<td></td>
</tr>
<tr>
<td>USB2.0HS, SDIO/eMMC, CAN2.0 &amp;</td>
<td></td>
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<tr>
<td>more…</td>
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<tr>
<td><strong>Fast Time-to-Market</strong></td>
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<tr>
<td>Efficient C Compiler, Optimized</td>
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<tr>
<td>Libraries, Blackfin Family Code</td>
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<tr>
<td>Compatibility &amp; Hardware Reference Designs</td>
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</tr>
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Industry’s Performance Leading Ultra-Low-Power DSP Solution

Delivering High Performance, Lowest Power, Low BOM Cost And Fast Time-to-Market

For More Information on the ADSP-BF70x DSP Processor Products visit

www.analog.com/BF70x