

The World Leader in High Performance Signal Processing Solutions



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



*The New ADSP-BF70x Series
of DSP Processors*

June 12, 2014 v4.0

ADI Confidential Information – Not for external distribution





BF70x Family : Next Generation Blackfin


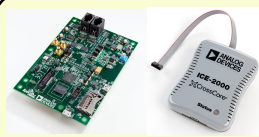
Low Power High Performance Fixed-point DSP

 <p>New Blackfin+ Core Single-Cycle 2x16-bit, 32-bit & Complex Math 16bit: 800MMACS, 32bit: 400MMACS <i>Blackfin Code Compatible</i></p>	<p>1MByte SRAM Large On-Chip Memory</p>	 <p>Ultra Low Power 95mW @ 400MHz V_{DDINT} Power at 25°C T_j</p>
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Low BoM Cost & Glue-less Connectivity Options

 <p>Starting at only \$3.99 (1K units)</p>	<p>Quad-SPI, I2C, UART, SPORT, Video ePPI, 4-ch 12-bit ADC & more</p>	<p>Enhanced Connectivity Options</p> 
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Ease-of-Use & Fast Time-to-Market

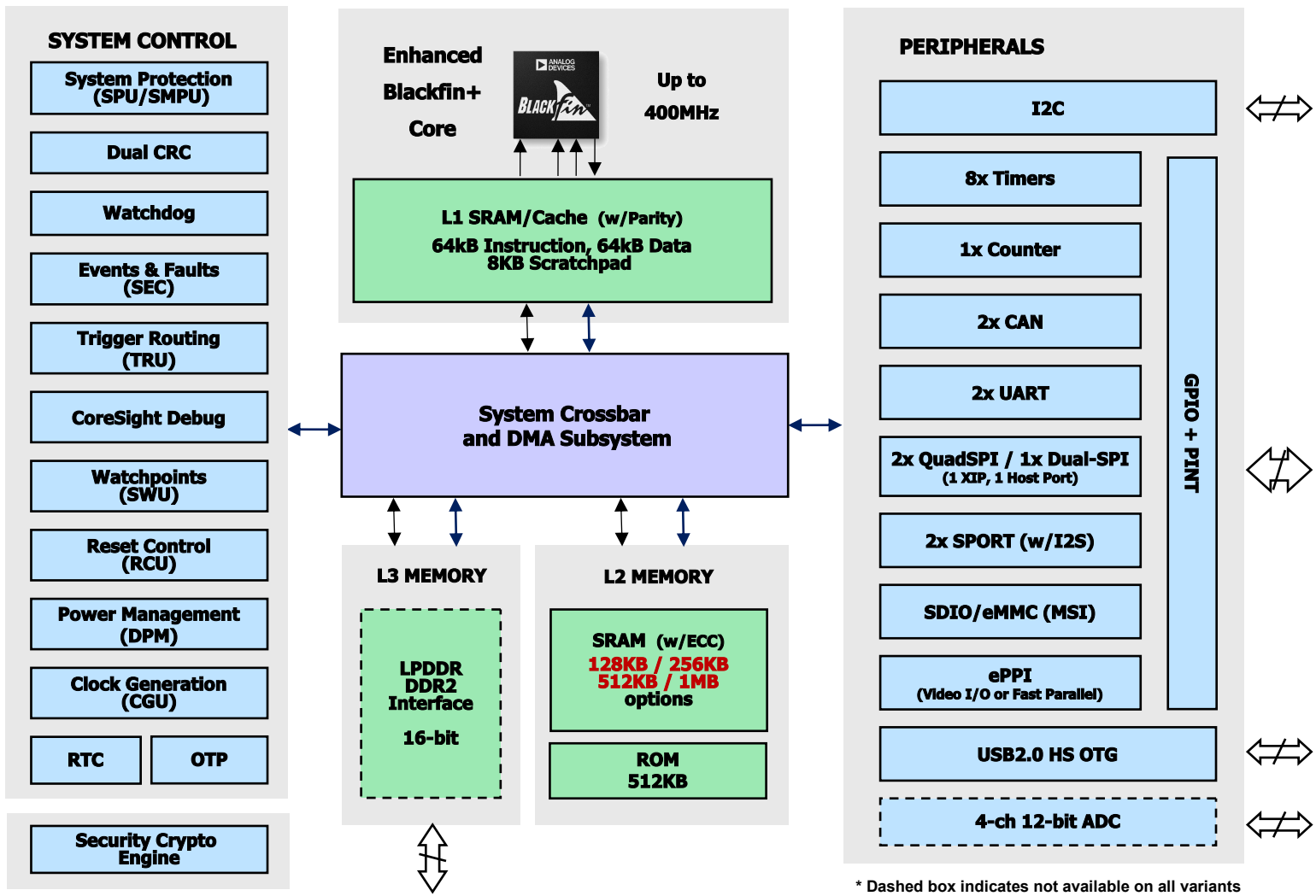
 <p>Efficient C Compiler, Optimized Libraries & Algorithms</p>	 <p>Hardware Reference Designs & JTAG Emulators</p>	<p>Experienced 3rd Party Network</p>
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Security/IP Protection & Data Integrity

 <p>Cryptography Accelerators On-Chip</p>	<p>Fast Secure Booting</p>	<p>ECC Parity CRC On-chip Memory Protection & Integrated Safety Features <i>Ultra-low SER-FIT</i></p>
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ADSP-BF70x Block Diagram





ADSP-BF70x : Feature Summary

Core & Memory



- ◆ **Enhanced BlackFin+ Core**
 - 40nm-LP process, 400MHz
 - 16 & 32-bit MAC support & more
- ◆ **L1 SRAM with parity**
 - 64KB PM, 64KB DM, 8KB scratchpad
- ◆ **Large On-chip L2 SRAM with ECC**
 - 128KB, 256KB, 512KB, 1MB variants
- ◆ **On-chip L2 ROM (512KB)**
- ◆ **L3 interface** (csp-BGA only)
 - Optimized for lowest system power
 - 16-bit LPDDR & DDR2 (up to 200MHz)
 - Multi-vendor & long term supply
- ◆ **Security & OTP**
 - Crypto hardware accelerator
 - Fast secure boot & IP protection
 - memDMA encryption/decryption for fast run-time security

Peripheral Summary

- USB2.0 HS OTG multi-pt
- ePPI for video I/O & high speed parallel
- eMMC/RSI/SDIO
- 2x CAN2.0
- 4x Half SPORTs (w/ I²S support)
- Up to 2x QuadSPI / 1x DualSPI
 - ◆ 1 w/execute-in-place, 1 w/Host mode
- I²C (TWI), 2x UART, GPIO, WDT, RTC
- 8x GP Timers
 - ◆ Support for sync PWM, signal capture, event count
- 4-ch 12-bit housekeeping ADC (csp-BGA)
- ◆ **Low cost packaging**
 - QFN (88-lead 12x12mm)
 - csp-BGA (184ball 12x12mm, 0.8p)
 - Low cost board design & BOM cost
- ◆ **Low System Power Design**
 - Targeting use cases <100mW (400MHz,25°C)
 - 1.8V or 3.3V VDD_{EXT} Support
 - Commercial / Industrial / Automotive grade



ADSP-BF70x Product Feature Matrix

Generic Device	DSP Core Performance	On-chip Memory	External Memory	Key Connectivity Options	Other Features	Package
ADSP-BF700 ADSP-BF702 ADSP-BF704 ADSP-BF706	100MHz to 400MHz	132KB L1 SRAM/Cache L2 SRAM options of 128KB 256KB 512KB 1MBytes 512KB L2 ROM	N/A	ePPI, SPORT(2), Quad/Dual SPI(3), I ² C, UART(2), CAN2.0B (2) SD/SDIO/MMC(4-bit)  USB2.0 HS OTG	OTP, Security Accelerator, Data Integrity (with L1 parity & L2 ECC), WDT, RTC	QFN 88-lead 12x12mm
ADSP-BF701 ADSP-BF703 ADSP-BF705 ADSP-BF707	800MMACs 16-bit 400MMACS 32-bit	512KB L2 ROM	16-bit LPDDR DDR2	<i>Above options plus</i> SDIO/MMC/eMMC (8-bit)  4-ch 12-bit ADC	Integrity (with L1 parity & L2 ECC), WDT, RTC	BGA 184-ball 12x12mm 0.8p

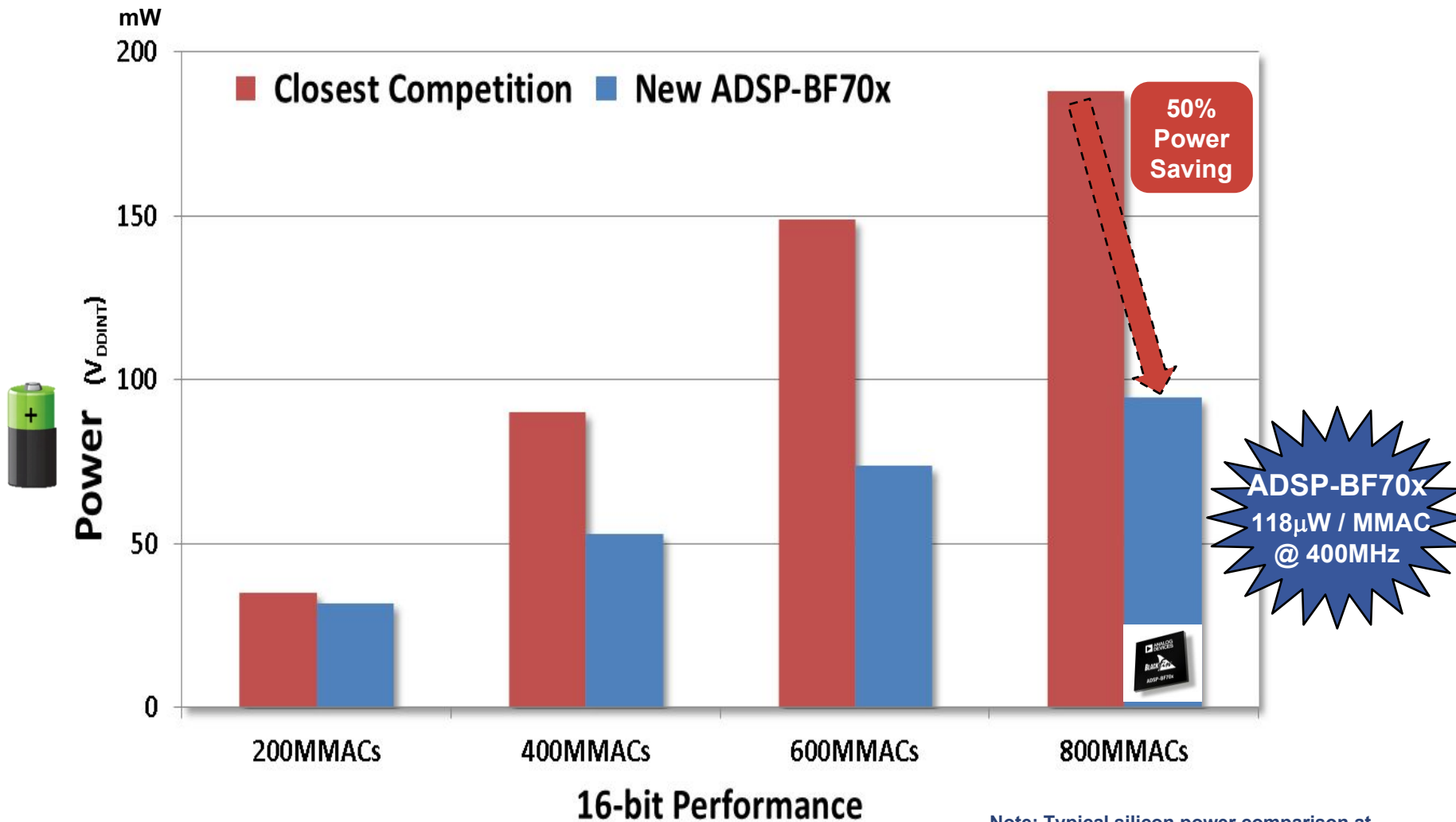
ADSP-BF70x Power Comparison (Prelim)

Core (MHz)	ADSP-BF70x *	ADSP-BF512	ADSP-BF524	ADSP-BF531
400MHz	86mA @ 1.1V	107mA @ 1.4V	114mA @ 1.4V	125mA @ 1.15V
	95mW	150mW	160mW	144mW
300MHz	67mA @ 1.1V	68mA @ 1.3V	83mA @ 1.3V	92mA @ 1.1V
	74mW	89mW	108mW	101mW
200MHz	48mA @ 1.1V	55mA @ 1.25V	59mA @ 1.25V	63mA @ 1.0V
	53mW	69mW	73mW	63mW
100MHz	29mA @ 1.1V	34mA @ 1.25V	38mA @ 1.25V	40mW @ 1.0V
	32mW	43mW	47mW	40mW
DeepSleep	1.3mA @ 1.1V	1.9mA @ 1.25V	2.0mA @ 1.25V	7.5mA @ 1.0V
	1.4mW	2.3mW	2.5mW	7.5mW

- ◆ Power comparison estimates for V_{DDINT} domain
 - Typical, T_j 25degC, ASF 1.0
 - SCLK/SYSCLK 25MHz (BF70x SYSCLK/SCLK0 25MHz, SCLK1/DCLK OFF)
- ◆ ADSP-BF70x results from early silicon testing (* subject to change)
 - BF70x Higher Temperature : Typical Deepsleep & MHz Power adders
 - ◆ 85degC T_j add 6.4mW, 105degC T_j add 12.5mW
- ◆ ADSP-BF5xx power information from released datasheets

ADSP-BF70x Family : Lowest Power Blackfin

Extending ADI's Leadership Position for Low Power DSP Performance

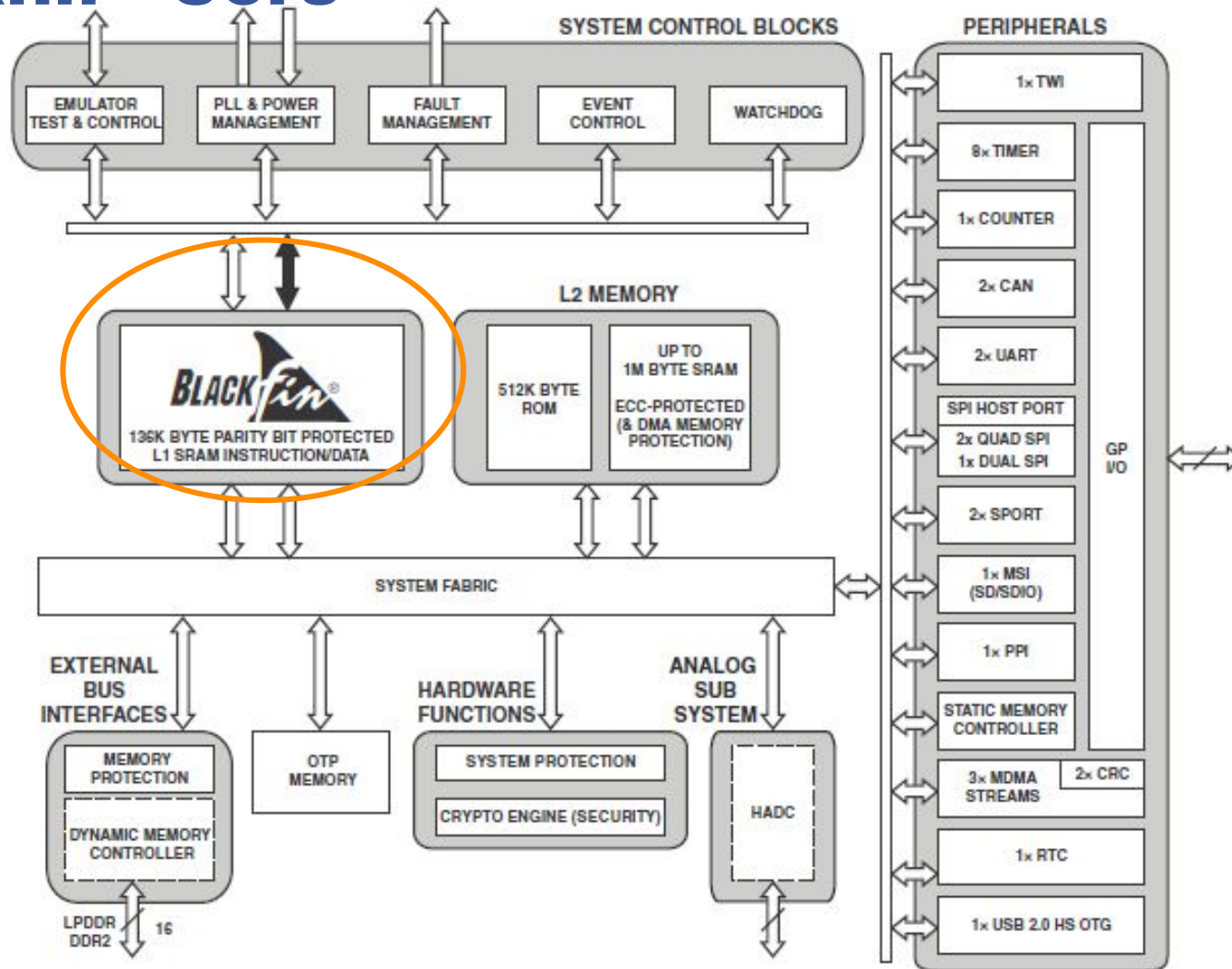


Note: Typical silicon power comparison at $T_{junction}$ 25°C & comparable setup conditions

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ADSP-BF70x Processor Architecture – Blackfin+ Core





Enhanced Blackfin+ DSP Core

Performance enhancements vs. Blackfin Today

- ◆ 16-bit CFFT benchmarks due to complex math improvements
 - Estimated 30% improved in cycle count for 16 bit data and coefficients
- ◆ 32-bit single cycle multiply benchmarks
 - 32-bit FIR : 2x increase in performance
 - 32-bit IIR : up to 3x increase in performance (depending on implementation)
- ◆ Branch-Target- Buffer Enhancements
 - Subset of EEMBC-like benchmarks:
 - ◆ Without BTB : 8% improvement
 - ◆ With BTB : 20% improvement
- ◆ Increase in performance due to overall fixes to core (workarounds & anomalies)
 - Estimate of 2% at the core level and 5% at the system level
- ◆ Note : Additional performance increases due to major enhancements in device fabric and internal/external memory system



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**

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

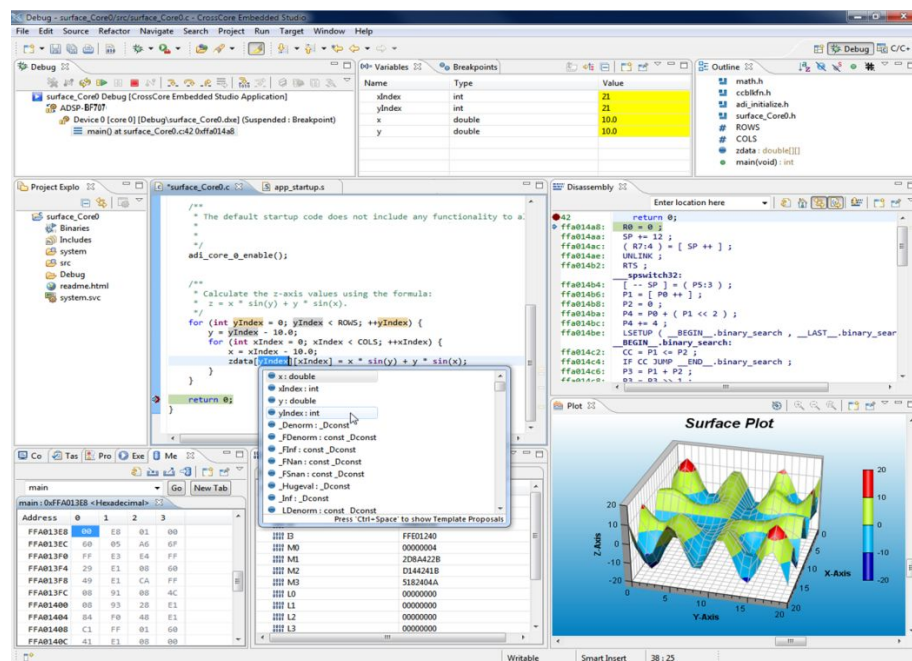
- **Ciphers: AES128..256, DES/3DES**
 - ◆ Performance : AES-128 decrypt – 2.46 bits/cycle
- **HASH Functions: SHA-1, SHA-2 (224/256)**
 - ◆ Performance : SHA-224 – 7.88 bits/cycle
- **Public Key Acceleration**
 - ◆ ECC Verify (224-bit ECDSA) in 1.7M cycles
- **True Random Number Generator**
- ◆ **OTP Memory 4KBytes**

512KByte secure boot with Decrypt
& Authentication in **< 55ms**





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**

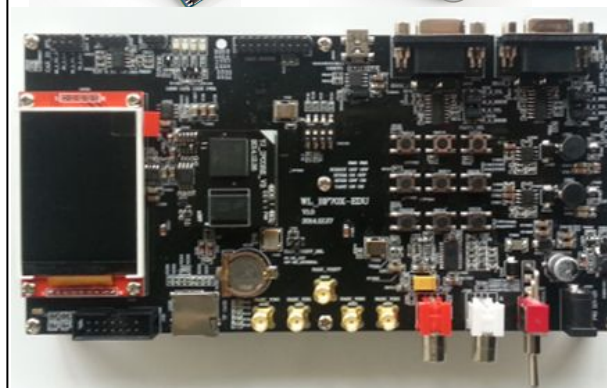
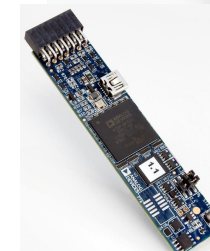
◆ **Seamless integration with middleware**

- Micrium μC/OS-III™ Real Time Kernel
- Micrium μC/USB Device™ Stack
- Micrium μC/FS™ File System
- System Services and Device Drivers
- And much more...

ADI Hardware Development Tools



- ◆ **Low Cost BF70x Development Board**
 - 400MHz BF707 processor board with DDR and key peripherals supported
 - Optional EZ-Extenders for increased features
 - ADZS-BF707-EZLITE (includes ICE-1000)
 - ADZS-BF707-EZBRD
 - **WL-BF707-EDU**
- ◆ **New USB based JTAG Emulators**
 - \$150 Low Cost ICE-1000 (ADZS-ICE-1000)
 - High Performance ICE-2000 (ADZS-ICE-2000)
 - USB-bus powered & JTAG/SWD up to 46MHz
 - CoreSight based trace for program & system
- ◆ **Watch out for future announcements of additional hardware platforms.....**
 - Including low-cost Video & Audio

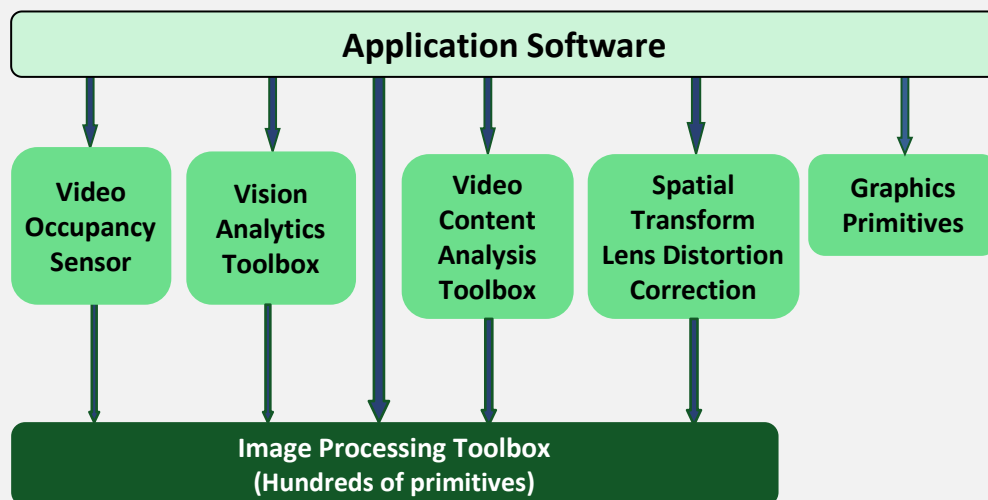




Blackfin Software Module Examples

Optimized and available with no ADI license-fee

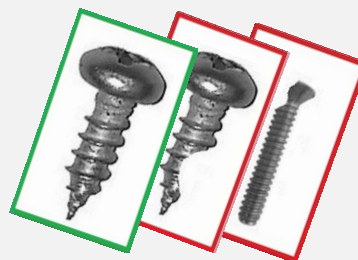
Image Processing Software



Sobel Edge Detection



Occupancy & Object Detection



Industrial Defect Detection

Imaging & SD Video

Encode & Decode

JPEG, MPEG-4 SP/ASP, H.264 BP, WMV9 Standard

MPEG-2 Video Decoder

Audio

Audio Decoders & Post Decoders

DTS Neo:6; 5.1 Decoder



Dolby Digital (AC-3) 5.1 Decoder; Headphone v2; Virtual Speaker; Pro Logic IIx Decoder



Audio Encoder & Decoders

MP3, WMA9 Standard, MPEG-4 AAC-LC/HE-AACv2

Dolby Digital (AC-3) Consumer Encoder

Audio Post Processing

Asynchronous Sample Rate Converter

Multi-band Graphic Equalizer

For complete list & latest info: www.analog.com/en/processors-dsp/blackfin/products/index.html



BF70x Software Modules, Libraries & Benchmarks

- ◆ **Software Modules on BF70x EZ-Kit and WL-BF707-EDU**
 - Blackfin Image Processing Toolbox (IPTBX)
 - Blackfin 2D Graphics Library
 - H.264 BP/MP Encoder
 - JPEG Encoder
- ◆ **Software Modules on BLIP2 board and WL-BF707-EDU**
 - Video Occupancy Sensor (VOS) with GUI to configure sensor and VOS
- ◆ **Benchmark**
 - Gain varies for functions - For many there is no change
 - Few Math primitives of IPTBX (multi precision multiplication), up to 50% reduction in cycles

BF70x Runtime Software Support

- ◆ **CCES 1.1.0 includes all Drivers, Documentation and Sketches for the ADSP-BF707**
- ◆ **The following BSP (Board Support Packages) are available**
 - **ADSP-BF707 BSP (Examples for all on-chip and off-chip drivers)**
 - **Camera EI3 Extender Card BSP**
 - **Video Decoder and Encoder EI3 Extender Card BSPs**
 - **WVGA/LCD EI3 Extender Board BSP**
 - **Audio EI3 Extender Board BSP**
- ◆ **Middleware Available**
 - **Micrium's uC/OS-III RTOS**
 - **Micrium's uC/OS-II RTOS**
 - **Micrium's uC/USB Device Classes**
 - ◆ **Audio, HID, PHDC, ACM, MSC, Vendor**
 - **Micrium's uC/USB Host Classes**
 - ◆ **MSC, HID**
 - **Micrium's uC/FS and uC/FS Journaling**



Example Blackfin 3rd Party Support



◆ Recent ADSP-BF70x Solution Partners

- **EBSYS - Europe**
 - ◆ Vision & Image algorithm expertize in Industrial, Consumer & Automotive
- **DSP Concepts – North America**
 - ◆ Accelerating the development of embedded audio products & technology
- **Twistthink – North America**
 - ◆ Image Processing & Algorithm Development for Industrial Applications
- **Azure Vision – China**
 - ◆ Image Processing & Algorithm Development for Industrial Applications










远景蔚蓝



ADSP-BF70x Summary

Broad Range of Markets with Strong Feature Alignment

Feature	Key Markets Addressed	
Scalable Performance Up to 400MHz Blackfin+ core Single-Cycle 2x16-bit, 32-bit & complex math	Intelligent Lighting & Occupancy Detection 	Industrial Imaging Barcode, Biometrics, Cameras 
Best-in-Class Power Efficiency 118μW / MMAC @ 400MHz 95mW at 800MMACs		
Lowest BOM Cost Starting at \$3.99, Large SRAM (up to 1MByte), Glue-Less Connectivity, ADC & DDR Option & Cost Optimized Packaging	Portable Audio Audio Recorders, & Effects... 	Communications & Mil/Aero 
Advanced Security IP Protection with Fast Secure Boot < 55msec for 512KByte Boot Image		
Memory Protection SRAM Parity & ECC for Safety Providing Best-in-Class SER-FIT Performance		
Industry Standard Connectivity Options USB2.0HS, SDIO/eMMC, CAN2.0 & more...	Automotive Audio & more... 	Healthcare Patient Monitoring 
Fast Time-to-Market Efficient C Compiler, Optimized Libraries, Blackfin Family Code Compatibility & Hardware Reference Designs		



Q&A