



**THE DATASHEET OF  
ADSP-BF516KBCZ-3**



# Blackfin Processor Family



## Why Choose a Blackfin Processor?

- High performance, 16-/32-bit Blackfin® processor core with DSP and RISC functionality and programmability
  - Eliminates need for multiple separate processors
- Large portfolio of products ranging from 300 MHz to 600 MHz
  - Best-in-class MHz/mW performance
  - Best-in-class price performance
- Software controlled dynamic power management
  - Extends battery life in portable applications
- Application-tuned system peripherals
  - Provides glueless connectivity to a variety of external devices
- Many low cost pin- and code-compatible models
- Industrial temperature range allows for wide range of applications
- Supported by easy to use, world-class development tools
- System-level integration with integrated flash and ADC on certain models
- Processors available with Lockbox® Secure Technology
- World-class ecosystem components and RTOS offerings from leading partners
- On-chip low power codec available on certain models

## Blackfin Processors

Part Number	Package <sup>1</sup>	Speed (MHz)	RAM Memory (kB)	Ambient Temp Range (°C)	Key Peripherals	Price Range @ 1k (U.S.) <sup>2</sup>
ADSP-BF592BCPZ	64-lead LFCSP	400	68, L1 ROM 64	-40 to +85	SPI, PPI, SPORTs, UART	4.33
ADSP-BF592KCPZ	64-lead LFCSP	400		0 to 70		3.55
ADSP-BF504BCPZ-4 <sup>3</sup>	88-lead LFCSP	400	68	-40 to +85	SPI, PPI, SPORTs, UART, PWM, CAN, ADC control module	5.18 to 13.78
ADSP-BF504KCPZ-4	88-lead LFCSP	400		0 to 70		
ADSP-BF504BCPZ-3F	88-lead LFCSP	300	68, Flash memory 512k × 16	-40 to +85	SPI, PPI, SPORTs, UART, PWM, CAN, ADC control module, 4 MB parallel flash	
ADSP-BF504KCPZ-3F	88-lead LFCSP	300		0 to 70		
ADSP-BF504BCPZ-4F	88-lead LFCSP	400		-40 to +85		
ADSP-BF504KCPZ-4F	88-lead LFCSP	400		0 to 70		
ADSP-BF506BSWZ-3F	120-lead LQFP_EP	300		-40 to +85		
ADSP-BF506KSWZ-3F	120-lead LQFP_EP	300		0 to 70		
ADSP-BF506BSWZ-4F	120-lead LQFP_EP	400	-40 to +85	SPI, PPI, SPORTs, UART, PWM, CAN, ADC control module, 4 MB parallel flash, 12-bit ADC		
ADSP-BF506KSWZ-4F	120-lead LQFP_EP	400	0 to 70			
ADSP-BF512BBCZ-3	168-ball CSP_BGA	300	116	-40 to +85	PPI, SPI, SPORTs, TWI, UART	6.26 to 10.31
ADSP-BF512BBCZ-4	168-ball CSP_BGA	400				
ADSP-BF512BSWZ-3	176-lead LQFP_EP	300				
ADSP-BF512BSWZ-4 <sup>3</sup>	176-lead LQFP_EP	400				
ADSP-BF512KBCZ-3	168-ball CSP_BGA	300		0 to 70		
ADSP-BF512KBCZ-4	168-ball CSP_BGA	400				
ADSP-BF512KSWZ-3	176-lead LQFP_EP	300				
ADSP-BF512KSWZ-4	176-lead LQFP_EP	400				
ADSP-BF512BBCZ-4F4	168-ball CSP_BGA	400	116, Flash memory 512k × 16	-40 to +85	PPI, SPI, SPORTs, TWI, UART, SPI flash	
ADSP-BF512BSWZ-4F4	176-lead LQFP_EP	400		-40 to +85		
ADSP-BF512KBCZ-4F4	168-ball CSP_BGA	400		0 to 70		
ADSP-BF512KSWZ-4F4	176-lead LQFP_EP	400		0 to 70		
ADSP-BF514BBCZ-3	168-ball CSP_BGA	300	116	-40 to +85	PPI, SPI, SPORTs, TWI, UART, SDIO, CE-ATA, eMMC	7.77 to 10.88
ADSP-BF514BBCZ-4	168-ball CSP_BGA	400				
ADSP-BF514BSWZ-3 <sup>3</sup>	176-lead LQFP_EP	300				
ADSP-BF514BSWZ-4	176-lead LQFP_EP	400				
ADSP-BF514KBCZ-3	168-ball CSP_BGA	300		0 to 70		
ADSP-BF514KBCZ-4	168-ball CSP_BGA	400				
ADSP-BF514KSWZ-3	176-lead LQFP_EP	300				
ADSP-BF514KSWZ-4	176-lead LQFP_EP	400				
ADSP-BF514BBCZ-4F4	168-ball CSP_BGA	400	116, Flash memory 512k × 16	-40 to +85	PPI, SPI, SPORTs, TWI, UART, SDIO, CE-ATA, eMMC, SPI flash	
ADSP-BF514BSWZ-4F4	176-lead LQFP_EP	400		-40 to +85		
ADSP-BF514KBCZ-4F4	168-ball CSP_BGA	400		0 to 70		
ADSP-BF514KSWZ-4F4	176-lead LQFP_EP	400		0 to 70		
ADSP-BF516BBCZ-3	168-ball CSP_BGA	300	116	-40 to +85	PPI, SPI, SPORTs, TWI, UART, 10/100 Ethernet, SDIO, CE-ATA, eMMC	8.92 to 12.03
ADSP-BF516BBCZ-4	168-ball CSP_BGA	400				
ADSP-BF516BSWZ-3 <sup>3</sup>	176-lead LQFP_EP	300				
ADSP-BF516BSWZ-4	176-lead LQFP_EP	400				
ADSP-BF516KBCZ-3	168-ball CSP_BGA	300		0 to 70		
ADSP-BF516KBCZ-4	168-ball CSP_BGA	400				
ADSP-BF516KSWZ-3	176-lead LQFP_EP	300				
ADSP-BF516KSWZ-4	176-lead LQFP_EP	400				
ADSP-BF516BBCZ-4F4	168-ball CSP_BGA	400	116, Flash memory 512k × 16	-40 to +85	PPI, SPI, SPORTs, TWI, UART, 10/100 Ethernet, SDIO, CE-ATA, eMMC, SPI flash	
ADSP-BF516BSWZ-4F4	176-lead LQFP_EP	400		-40 to +85		
ADSP-BF516KBCZ-4F4	168-ball CSP_BGA	400		0 to 70		
ADSP-BF516KSWZ-4F4	176-lead LQFP_EP	400		0 to 70		

<sup>1</sup>Packages: LQFP\_EP (low profile quad flat pack exposed pad); CSP\_BGA (chip scale package ball grid array); PBGA (plastic ball grid array); LFCSP (lead frame chip scale package).

<sup>2</sup>All pricing is budgetary and subject to change.

<sup>3</sup>Available in automotive grade.

## Blackfin Processors (continued)

Part Number	Package <sup>1</sup>	Speed (MHz)	RAM Memory (kB)	Ambient Temp Range (°C)	Key Peripherals	Price Range @ 1k (\$U.S.) <sup>2</sup>	
ADSP-BF518BBCZ-4	168-ball CSP_BGA	400	116	-40 to +85	PPI, SPI, SPORTs, TWI, UART, 10/100 Ethernet with 1588, SDIO, CE-ATA, eMMC, SPI flash	13.07 to 14.45	
ADSP-BF518BSWZ-4 <sup>3</sup>	176-lead LQFP_EP						
ADSP-BF518BBCZ-4F4	168-ball CSP_BGA						
ADSP-BF518BSWZ-4F4	176-lead LQFP_EP						
ADSP-BF522KBCZ-3	289-ball CSP_BGA	300	132	0 to 70	PPI, SPI, SPORTs, NAND interface, TWI, host DMA, UART, Lockbox	8.18 to 12.04	
ADSP-BF522BBCZ-3A	208-ball CSP_BGA			-40 to +85			
ADSP-BF522KBCZ-3C2	289-ball CSP_BGA	0 to 70					
ADSP-BF522KBCZ-4	289-ball CSP_BGA	0 to 70					
ADSP-BF522BBCZ-4A	208-ball CSP_BGA	-40 to +85					
ADSP-BF522KBCZ-4C2	289-ball CSP_BGA	0 to 70					
ADSP-BF523KBCZ-5	289-ball CSP_BGA	533		0 to 70			13.46 to 19.24
ADSP-BF523BBCZ-5A	208-ball CSP_BGA			-40 to +85			
ADSP-BF523KBCZ-5C2	289-ball CSP_BGA						
ADSP-BF523KBCZ-6	289-ball CSP_BGA	600		0 to 70			
ADSP-BF523KBCZ-6A	208-ball CSP_BGA						
ADSP-BF523KBCZ-6C2	289-ball CSP_BGA						
ADSP-BF524KBCZ-3	289-ball CSP_BGA	300	132	0 to 70	PPI, SPI, SPORTs, NAND interface, TWI, host DMA, UART, Lockbox, HS USB OTG	9.58 to 13.74	
ADSP-BF524BBCZ-3A	208-ball CSP_BGA			-40 to +85			
ADSP-BF524KBCZ-3C2	289-ball CSP_BGA	0 to 70					
ADSP-BF524KBCZ-4	289-ball CSP_BGA	0 to 70					
ADSP-BF524BBCZ-4A	208-ball CSP_BGA	-40 to +85					
ADSP-BF524KBCZ-4C2	289-ball CSP_BGA	0 to 70					
ADSP-BF525KBCZ-5	289-ball CSP_BGA	533		0 to 70			15.17 to 21.00
ADSP-BF525BBCZ-5A <sup>3</sup>	208-ball CSP_BGA			-40 to +85			
ADSP-BF525KBCZ-5C2	289-ball CSP_BGA						
ADSP-BF525KBCZ-6	289-ball CSP_BGA	600		0 to 70			
ADSP-BF525KBCZ-6A	208-ball CSP_BGA						
ADSP-BF525KBCZ-6C2	289-ball CSP_BGA						
ADSP-BF526KBCZ-3	289-ball CSP_BGA	300	132	0 to 70	PPI, SPI, SPORTs, 10/100 Ethernet, TWI, host DMA, NAND interface, UART, Lockbox, HS USB OTG	10.76 to 15.53	
ADSP-BF526BBCZ-3A	208-ball CSP_BGA			-40 to +85			
ADSP-BF526KBCZ-3C2	289-ball CSP_BGA	0 to 70					
ADSP-BF526KBCZ-4	289-ball CSP_BGA	0 to 70					
ADSP-BF526BBCZ-4A	208-ball CSP_BGA	-40 to +85					
ADSP-BF526KBCZ-4C2	289-ball CSP_BGA	0 to 70					
ADSP-BF527KBCZ-5	289-ball CSP_BGA	533		0 to 70			16.99 to 22.89
ADSP-BF527BBCZ-5A	208-ball CSP_BGA			-40 to +85			
ADSP-BF527KBCZ-5C2	289-ball CSP_BGA						
ADSP-BF527KBCZ-6	289-ball CSP_BGA	600		0 to 70			
ADSP-BF527KBCZ-6A	208-ball CSP_BGA						
ADSP-BF527KBCZ-6C2	289-ball CSP_BGA						

<sup>1</sup>Packages: LQFP\_EP (low profile quad flat pack exposed pad); CSP\_BGA (chip scale package ball grid array); PBGA (plastic ball grid array); LFCSP (lead frame chip scale package).

<sup>2</sup>All pricing is budgetary and subject to change.

<sup>3</sup>Available in automotive grade.

## Blackfin Processors (continued)

Part Number	Package <sup>1</sup>	Speed (MHz)	RAM Memory (kB)	Ambient Temp Range (°C)	Key Peripherals	Price Range @ 1k (U.S.) <sup>2</sup>				
ADSP-BF531SBB400	169-ball PBGA	400	52	-40 to +85	PPI, UART, SPI, 2 SPORTs, 3 timers, 16 GPIOs	5.99 to 12.81				
ADSP-BF531SBBC400	160-ball CSP_BGA									
ADSP-BF531SBBCZ400 <sup>3</sup>	160-ball CSP_BGA									
ADSP-BF531SBBZ400 <sup>3</sup>	169-ball PBGA									
ADSP-BF531SBSTZ400 <sup>3</sup>	176-lead LQFP									
ADSP-BF532SBBC400	160-ball CSP_BGA	400	84	-40 to +85		PPI, UART, SPI, 2 SPORTs, 3 timers, 16 GPIOs	9.33 to 17.31			
ADSP-BF532SBBCZ400 <sup>3</sup>	160-ball CSP_BGA									
ADSP-BF532SBSTZ400 <sup>3</sup>	176-lead LQFP									
ADSP-BF532SBB400	169-ball PBGA									
ADSP-BF532SBBZ400	169-ball PBGA									
ADSP-BF533SBBC400	160-ball CSP_BGA	400	148	-40 to +85	PPI, UART, SPI, 2 SPORTs, 3 timers, 16 GPIOs		12.19 to 23.32			
ADSP-BF533SBBCZ400	160-ball CSP_BGA	400								
ADSP-BF533SBBZ400	169-ball PBGA	400								
ADSP-BF533SBSTZ400	176-lead LQFP	400								
ADSP-BF533SBBC500	160-ball CSP_BGA	500								
ADSP-BF533SBBCZ500 <sup>3</sup>	160-ball CSP_BGA	500								
ADSP-BF533SBB500	160-ball CSP_BGA	500								
ADSP-BF533SBBZ500 <sup>3</sup>	169-ball PBGA	500								
ADSP-BF533SBBC-5V	160-ball CSP_BGA	533								
ADSP-BF533SBBCZ-5V	160-ball CSP_BGA	533								
ADSP-BF533SKBC-6V	160-ball CSP_BGA	600				0 to 70				
ADSP-BF533SKBCZ-6V	160-ball CSP_BGA	600								
ADSP-BF534BBC-4A	182-ball CSP_BGA	400				132		-40 to +85	CAN <sup>®</sup> PPI/SPI, TWI, 8 timers, 48 GPIOs, 2 SPORTs/UARTs	12.40 to 18.53
ADSP-BF534BBCZ-4A <sup>3</sup>	182-ball CSP_BGA	400								
ADSP-BF534BBCZ-4B <sup>3</sup>	208-ball CSP_BGA	400								
ADSP-BF534BBC-5A	182-ball CSP_BGA	500								
ADSP-BF534BBCZ-5A	182-ball CSP_BGA	500								
ADSP-BF534BBCZ-5B	208-ball CSP_BGA	500								
ADSP-BF534YBCZ-4B3	208-ball CSP_BGA	400								
ADSP-BF535PBB-200	260-ball PBGA	200	308	-40 to +85	2 SPIs, 2 SPORTs, USB device, PCI	31.27 to 48.22				
ADSP-BF535PBBZ-200	260-ball PBGA	200		-40 to +85						
ADSP-BF535PKB-300	260-ball PBGA	300		0 to 70						
ADSP-BF535PKBZ-300	260-ball PBGA	300		0 to 70						
ADSP-BF535PBB-300	260-ball PBGA	300		-40 to +85						
ADSP-BF535PKB-350	260-ball PBGA	350		0 to 70						
ADSP-BF535PKBZ-350	260-ball PBGA	350		0 to 70						
ADSP-BF536BBC-3A	182-ball CSP_BGA	300		100			-40 to +85	10/100 Ethernet, CAN, PPI, TWI, 8 timers, 48 GPIOs, 2 SPORTs/UARTs, SPI	10.07 to 15.14	
ADSP-BF536BBCZ-3A	182-ball CSP_BGA	300								
ADSP-BF536BBCZ-3B	208-ball CSP_BGA	300								
ADSP-BF536BBC-4A	182-ball CSP_BGA	400								
ADSP-BF536BBCZ-4A	182-ball CSP_BGA	400								
ADSP-BF536BBCZ-4B	208-ball CSP_BGA	400								

<sup>1</sup>Packages: LQFP\_EP (low profile quad flat pack exposed pad); CSP\_BGA (chip scale package ball grid array); PBGA (plastic ball grid array); LFCSFP (lead frame chip scale package).

<sup>2</sup>All pricing is budgetary and subject to change.

<sup>3</sup>Available in automotive grade.

## Blackfin Processors (continued)

Part Number	Package <sup>1</sup>	Speed (MHz)	RAM Memory (kB)	Ambient Temp Range (°C)	Key Peripherals	Price Range @ 1k (\$U.S.) <sup>2</sup>
ADSP-BF537BBC-5A	182-ball CSP_BGA	500	132	-40 to +85	10/100 Ethernet, CAN, PPI, TWI, 8 timers, 48 GPIOs, 2 SPORTs/UARTs, SPI	17.15 to 21.20
ADSP-BF537BBCZ-5A	182-ball CSP_BGA	500				
ADSP-BF537BBCZ-5B	208-ball CSP_BGA	500				
ADSP-BF537BBCZ-5AV	182-ball CSP_BGA	533		0 to 70		
ADSP-BF537BBCZ-5BV	208-ball CSP_BGA	533				
ADSP-BF537KBCZ-6AV	182-ball CSP_BGA	600				
ADSP-BF537KBCZ-6BV	208-ball CSP_BGA	600				
ADSP-BF538BBCZ-4A	316-ball CSP_BGA	400	148	-40 to +85	CAN 2.0B, 54 GPIOs, 4 SPORTs, 3 UARTs, 3 SPIs, 2 TWIs, PPI, 8 MB flash	16.03 to 20.67
ADSP-BF538BBCZ-4F8	316-ball CSP_BGA	400				
ADSP-BF538BBCZ-5A	316-ball CSP_BGA	533				
ADSP-BF538BBCZ-5F8	316-ball CSP_BGA	533		MXVR, CAN, 54 GPIOs, 4 SPORTs, 3 UARTs, 3 SPIs, 2 TWIs, PPI, 8 MB flash	Contact ADI	
ADSP-BF539BBCZ-5A <sup>3</sup>	316-ball CSP_BGA	533				
ADSP-BF539BBCZ-5F8 <sup>3</sup>	316-ball CSP_BGA	533				
ADSP-BF542BBCZ-4A	400-ball CSP_BGA	400	132	-40 to +85	CAN, <sup>4</sup> HS USB OTG, 3 EPPIs, pixel comp, ATAPI-6, Lockbox	15.66 to 19.14
ADSP-BF542BBCZ-5A <sup>3</sup>	400-ball CSP_BGA	533	132	-40 to +85		
ADSP-BF542KBCZ-6A	400-ball CSP_BGA	600		0 to 70		
ADSP-BF542MBBCZ-5M <sup>5</sup>	400-ball CSP_BGA	533	-40 to +85			
ADSP-BF544BBCZ-4A	400-ball CSP_BGA	400	132	-40 to +85	CAN, <sup>4</sup> Host DMA, 3 EPPIs, pixel comp, Lockbox	16.56 to 18.40
ADSP-BF544BBCZ-5A <sup>3</sup>	400-ball CSP_BGA	533	196			
ADSP-BF544MBBCZ-5M <sup>5</sup>	400-ball CSP_BGA	533	132			
ADSP-BF547BBCZ-5A	400-ball CSP_BGA	533	260	-40 to +85	HS USB OTC, 3 EPPIs, pixel comp, ATAPI-6, Lockbox	20.11 to 22.12
ADSP-BF547KBCZ-6A	400-ball CSP_BGA	600	260	0 to 70		
ADSP-BF547MBBCZ-5M <sup>5</sup>	400-ball CSP_BGA	533	132	-40 to +85		
ADSP-BF548BBCZ-5A	400-ball CSP_BGA	533	260	-40 to +85	HS USB OTG, 3 EPPIs, pixel comp, ATAPI-6, Lockbox, CAN	20.71
ADSP-BF548MBBCZ-5M <sup>5</sup>	400-ball CSP_BGA	533	132			
ADSP-BF561SKB500	297-ball PBGA	500	328	0 to 70	2 PPIs, UART, 12 timers, 2 SPORTs	20.40 to 37.53
ADSP-BF561SKBZ500	297-ball PBGA	500		0 to 70		
ADSP-BF561SKBCZ-5A	256-ball CSP_BGA	500		0 to 70		
ADSP-BF561SKBCZ-5V	256-ball CSP_BGA	533		0 to 70		
ADSP-BF561SBB500	297-ball PBGA	500		-40 to +85		
ADSP-BF561SBBZ500 <sup>3</sup>	297-ball PBGA	500		-40 to +85		
ADSP-BF561SBBCZ-5A <sup>3</sup>	256-ball CSP_BGA	500		-40 to +85		
ADSP-BF561SKB600	297-ball PBGA	600		0 to 70		
ADSP-BF561SKBZ600	297-ball PBGA	600		0 to 70		
ADSP-BF561SKBCZ500	256-ball CSP_BGA	500		-40 to +85		
ADSP-BF561SKBCZ-6A	256-ball CSP_BGA	600		0 to 70		
ADSP-BF561SKBCZ-6V	256-ball CSP_BGA	600		0 to 70		
ADSP-BF561SBB600	297-ball PBGA	600		-40 to +85		
ADSP-BF561SBBZ600	297-ball PBGA	600		-40 to +85		

<sup>1</sup>Packages: LQFP\_EP (low profile quad flat pack exposed pad); CSP\_BGA (chip scale package ball grid array); PBGA (plastic ball grid array); LFCSP (lead frame chip scale package).

<sup>2</sup>All pricing is budgetary and subject to change.

<sup>3</sup>Available in automotive grade.

<sup>4</sup>Available on automotive-grade parts only.

<sup>5</sup>M designates support for 1.8 V mobile DDR memory.

## Development Tools

The Blackfin processor is supported by the Analog Devices CROSSCORE® line of robust and flexible development tools.

### VisualDSP++ Software

VisualDSP++® software delivers efficient project management, enabling programmers to move easily between editing, building, and debugging within a single interface. Key features include an optimizing C/C++ compiler, advanced plotting tools, embedded OS support (VDK), award-winning statistical profiling, TCP/IP and USB support, free software upgrades, and technical support.

### EZ-Board Evaluation Boards

The EZ-Board™ evaluation board provides developers with a low cost platform for initial evaluation of the processors via an external emulator or  $\mu$ Clinix.™ The EZ-Board evaluation board has an expansion interface that allows for modularity with different EZ-Extender boards.

### EZ-KIT Lite Evaluation Kit

The EZ-KIT Lite® evaluation kit is a standalone evaluation board and evaluation suite of VisualDSP++ software to facilitate architecture evaluation.

### EZ-Extender Daughter Boards

EZ-Extender® daughter boards enable developers to access and connect various peripherals from Analog Devices and third parties to the expansion interface of the EZ-KIT Lite evaluation kits.

### Emulators

Analog Devices cost-effective and high performance emulators provide an easy, portable, nonintrusive, target-based debugging solution for Analog Devices JTAG processors and DSPs.

These powerful emulators perform a wide range of emulation functions, including single-step and full-speed execution with predefined breakpoints, and viewing and/or altering of register and memory contents.

### Standalone Debug Agent Board

The Standalone Debug Agent is intended to provide a modular low cost emulation solution for EZ-Board evaluation boards as well as evaluation boards designed by third parties. The Standalone Debug Agent is very similar to the Debug Agent that is on existing EZ-KIT Lite evaluation boards but will have the flexibility to move from one board to another.

## Software Modules

Analog Devices has a wide range of tested and optimized software modules available, including decoders, encoders, codecs, and other algorithms that provide multimedia functions for the Blackfin and SHARC processor families. The software modules allow engineers to quickly and easily incorporate these functions, providing a faster development path to the end product. In addition, the highly optimized software modules feature a consistent API and framework to ensure rapid development of multiple functions. Visit [www.analog.com/software](http://www.analog.com/software) for more information.

## Platforms and Reference Designs

Platforms and reference designs help jump-start your design. They include comprehensive software suites with documented APIs running on application-specific evaluation boards. The easy to use APIs enable customization and control of core system functions, letting you focus on adding value through product differentiation. For more information on Analog Devices platforms, reference designs, and third-party reference designs, visit [www.analog.com/referencedesigns](http://www.analog.com/referencedesigns).

## Extended Development Tools and Support

### Starter Kits

Analog Devices starter kits provide everything you need to get started on an application. Kits contain a Blackfin EZ-KIT Lite, EZ-Extender daughter board(s), and the software development kit (SDK), which contains sample code, “how to” documents, and various encoders/decoders that make getting started on an application easy and shorten the learning curve.

### Software Development Kits

The SDK contains example software, source code, device drivers, algorithms, utilities information, and application notes that allow you to develop processor applications. The software can be used as a framework, or as examples of how to use certain aspects and peripherals, in conjunction with an ADI processor. The SDK is included in the starter kits and is also downloadable for free, provided you have the required hardware, at [www.analog.com/sdk/downloads](http://www.analog.com/sdk/downloads).

### $\mu$ Clinix

The  $\mu$ Clinix kernel and GNU toolchain are available for the Blackfin processor and can be downloaded from the  $\mu$ Clinix for Blackfin processor website ([www.blackfin.uclinux.org](http://www.blackfin.uclinux.org)), which is the central repository for all Blackfin processor open-source projects. One of the board support packages available is the ADSP-BF537 STAMP  $\mu$ Clinix kernel board support package (BSP). The BSP is composed of the ADSP-BF537 STAMP development board (including the full complement of memory along with serial and network interfaces), a recent copy of the open-source development tools,  $\mu$ Clinix kernel, and bootloader. The STAMP board is specifically designed to support the development and porting of open-source  $\mu$ Clinix applications.

## Blackfin Processor Development Tools

Blackfin Processor	Hardware	Emulator	VisualDSP++ Development Software	Additional Software Available	
ADSP-BF592	ADZS-BF592-EZLITE <i>Key Features</i> <ul style="list-style-type: none"><li>ADSP-BF592 Blackfin processor</li><li>SPI flash memory: Numonyx M25P16—16 MB</li><li>Audio codec</li><li>UART</li></ul>				
ADSP-BF504 ADSP-BF504F ADSP-BF506F	ADZS-BF506F-EZLITE <i>Key Features</i> <ul style="list-style-type: none"><li>ADSP-BF506F Blackfin processor with integrated 12-bit ADC and 4 MB stacked flash</li><li>12-bit ADC input connectors</li><li>UART interface/DB9 connector</li><li>SDIO interface</li><li>Expansion interface</li><li>Standalone debug agent interface</li></ul>				
ADSP-BF512 ADSP-BF512F ADSP-BF514 ADSP-BF514F ADSP-BF516 ADSP-BF516F ADSP-BF518 ADSP-BF518F	ADZS-BF518F-EZBRD <i>Key Features</i> <ul style="list-style-type: none"><li>ADSP-BF518F Blackfin processor</li><li>SDRAM</li><li>Flash</li><li>SPI flash</li><li>Audio codec</li><li>Power analysis interface</li><li>Ethernet PHY</li><li>Analog-to-digital converter</li><li>Thumbwheel</li><li>UART</li><li>RTC battery</li></ul>	ADZS-BF518F-EZLITE ADZS-BFLLCD-EZEXT ADZS-DBGAGENT-BRD ADZS-BLUET-EZEXT ADZS-BF5HUSB-EZEXT			
ADSP-BF522 ADSP-BF522C ADSP-BF524 ADSP-BF524C ADSP-BF526 ADSP-BF526C	ADZS-BF526-EZBRD <i>Key Features</i> <ul style="list-style-type: none"><li>ADSP-BF526 Blackfin processor</li><li>SDRAM</li><li>Flash: 4 MB (2M × 16)</li><li>NAND flash: 2 Gb</li><li>SPI flash</li><li>Audio codec</li><li>Power analysis interface</li><li>Ethernet PHY</li><li>Battery or USB bus powered</li></ul>	ADZS-BF526-EZLITE ADZS-DBGAGENT-BRD ADZS-BFLLCD-EZEXT ADZS-BLUET-EZEXT ADZS-BF5HUSB-EZEXT	ADZS-ICE-100B ADZS-USB-ICE ADZS-HPUSB-ICE	VDSP-BKFN-PC-TEST VDSP-BLKFN-PC-FULL VDSP-BLKFN-PCFLOAT VDSP-BLKFN-PCFLT-5	Adeneo Embedded (ADSP-BF51x parts only)  Arcturus (ADSP-BF54x parts only)  MathWorks® (ADSP-BF531/ADSP-BF532/ADSP-BF533/ADSP-BF534/ADSP-BF536/ADSP-BF537/ADSP-BF538/ADSP-BF539 only)  µClinux—open source (All parts except ADSP-BF535 and ADSP-BF50x family)  GNU toolchain (Not available for the ADSP-BF535)
ADSP-BF523 ADSP-BF523C ADSP-BF525 ADSP-BF525C ADSP-BF527 ADSP-BF527C	ADZS-BF527-EZLITE <i>Key Features</i> <ul style="list-style-type: none"><li>ADSP-BF527 Blackfin processor</li><li>SDRAM</li><li>NAND flash: 4 Gb</li><li>Audio codec</li><li>HS USB OTG</li><li>Ethernet PHY</li><li>LCD display</li><li>Touch screen/keyboard controller</li></ul>	ADZS-BF527-MPSKIT ADZS-BFAV-EZEXT ADZS-BFFPGA-EZEXT			
ADSP-BF531 ADSP-BF532 ADSP-BF533	ADZS-BF533-EZLITE <i>Key Features</i> <ul style="list-style-type: none"><li>ADSP-BF533 Blackfin processor</li><li>64 MB (32M × 16-bit) SDRAM</li><li>2 MB (512k × 16-bit × 2) flash memory</li><li>AD1836 96 kHz audio codec with 4 input and 6 output RCA jacks</li><li>ADV7183 video decoder with 3 input RCA jacks</li><li>ADV7171 video encoder with 3 output RCA jacks</li><li>ADM3202 RS-232 line driver/receiver</li></ul>	ADZS-BF-EZEXT-1 ADZS-BFAV-EZEXT ADZS-USBLAN-EZEXT ADZS-BFAUDIO-EZEXT ADZS-BFFPGA-EZEXT ADZS-BF533-MMSKIT			

## Blackfin Processor Development Tools (continued)

Blackfin Processor	Hardware	Emulator	VisualDSP++ Development Software	Additional Software Available	
ADSP-BF534 ADSP-BF536 ADSP-BF537	<p>ADZS-BF537-EZLITE</p> <p><i>Key Features</i></p> <ul style="list-style-type: none"> <li>ADSP-BF537 Blackfin processor</li> <li>Max core clock rate of 600 MHz</li> <li>64 MB (32M × 16) SDRAM, 4 MB (2M × 16) flash memory</li> <li>SMSC LAN83C185 10/100 PHY with RJ45 connector</li> <li>CAN TJA1041 transceiver with 2 RJ10 connectors</li> <li>AD1871 96 kHz stereo ADC with 1/8" jack connector</li> <li>AD1854 96 kHz stereo DAC with 1/8" jack connector</li> <li>RS-232 UART line driver/receiver</li> <li>National Instruments Educational Laboratory Virtual Instrumentation Suite (NI ELVIS) interface</li> </ul>	<p>ADZS-BLUET-EZEXT ADZS-BFAV-EZEXT ADZS-BFLLCD-EZEXT ADZS-USBLAN-EZEXT ADZS-BFAUDIO-EZEXT ADZS-BFFPGA-EZEXT ADZS-BF537-ASKIT</p> <p>Additional Hardware</p> <ul style="list-style-type: none"> <li>ADSP-BF537-STAMP</li> <li>PHYTEC Phycore®</li> </ul>			
ADSP-BF538 ADSP-BF538F	<p>ADZS-BF538F-EZLITE</p> <p><i>Key Features</i></p> <ul style="list-style-type: none"> <li>ADSP-BF538F Blackfin processor</li> <li>64 MB (32M × 16) SDRAM</li> <li>4 MB (2M × 16) flash memory</li> <li>ADM3202 RS-232 line driver/receiver</li> <li>AD1871 96 kHz stereo ADC</li> <li>AD1854 96 kHz stereo DAC</li> <li>TJA1041 transceiver</li> <li>2 RJ10 connectors</li> <li>9 LEDs</li> </ul>	ADZS-BFLLCD-EZEXT			<p>Adeneo Embedded (ADSP-BF51x parts only)</p> <p>Arcturus (ADSP-BF54x parts only)</p> <p>MathWorks (ADSP-BF531/ADSP-BF532/ ADSP-BF533/ADSP-BF534/ ADSP-BF536/ADSP-BF537/ ADSP-BF538/ADSP-BF539 only)</p> <p>µClinux—open source (All parts except ADSP-BF535 and ADSP-BF50x family)</p> <p>GNU toolchain (Not available for the ADSP-BF535)</p>
ADSP-BF542 ADSP-BF544 ADSP-BF547 ADSP-BF548	<p>ADZS-BF548-EZLITE</p> <p><i>Key Features</i></p> <ul style="list-style-type: none"> <li>ADSP-BF548 Blackfin processor</li> <li>DDR SDRAM</li> <li>BURST flash</li> <li>NAND flash</li> <li>Hard drive</li> <li>LCD display</li> <li>AC'97 codec</li> <li>Ethernet PHY</li> <li>Touch screen/keyboard controller</li> </ul>	<p>ADZS-BLUET-EZEXT ADZS-BFAV-EZEXT ADZS-BFFPGA-EZEXT ADZS-BFLLCD-EZEXT ADZS-BF548-MPSKIT</p>	<p>ADZS-ICE-100B ADZS-USB-ICE ADZS-HPUSB-ICE</p>	<p>VDSP-BKFN-PC-TEST VDSP-BLKFN-PC-FULL VDSP-BLKFN-PCFLOAT VDSP-BLKFN-PCFLT-5</p>	
ADSP-BF561	<p>ADZS-BF561-EZLITE</p> <p><i>Key Features</i></p> <ul style="list-style-type: none"> <li>ADSP-BF561 Blackfin processor</li> <li>64 MB (16M × 16-bit × 2) SDRAM</li> <li>8 MB (4M × 16-bit) flash memory</li> <li>AD1836 multichannel 96 kHz audio codec</li> <li>RCA jacks for stereo audio input/output</li> <li>ADV7183A advanced 10-bit video decoder</li> <li>3 RCA jacks for composite (CVBS), differential component (YUV), or S-Video (Y/C) input</li> <li>ADV7179 chip scale NTSC/PAL video encoder</li> <li>3 RCA jacks for composite (CVBS), component (RGB), differential component (YUV), or S-Video (Y/C) output</li> </ul>	ADZS-BF561-MMSKIT			

## Blackfin Processor Product Portfolio

	ADSP-BF592*	ADSP-BF504* ADSP-BF504F ADSP-BF506F	ADSP-BF512*	ADSP-BF514 ADSP-BF516 ADSP-BF518*	ADSP-BF522 ADSP-BF524 ADSP-BF526	ADSP-BF523 ADSP-BF525* ADSP-BF527	ADSP-BF531* ADSP-BF532*	ADSP-BF533*	ADSP-BF534* ADSP-BF535 ADSP-BF536	ADSP-BF537	ADSP-BF538 ADSP-BF539*	ADSP-BF542* ADSP-BF544* ADSP-BF547 ADSP-BF548	ADSP-BF561*	Future
Low BOM Cost	•	•	•		•	•	•							
Baseline Connectivity	•	•	•		•	•	•	•					•	
System-Level Connectivity		•		•	•	•			•	•	•	•		•
Low Standby	•	•	•	•	•									•
Lockbox Security			•	•	•	•						•		•
System Integration (Flash, Mixed-Signal)		•	•	•	•	•					•			
600 MHz or Greater						•		•		•		•	•	•
Multicore													•	•

\*Automotive grade available.

## Blackfin Processor Target Applications

**ADSP-BF592:** Low cost DSP for audio and imaging applications.

**ADSP-BF504/ADSP-BF504F/ADSP-BF506F:** Optimized for industrial control and advanced power applications, as well as low cost general-purpose DSP applications.

**ADSP-BF512/ADSP-BF514/ADSP-BF516/ADSP-BF518:** Low cost, low power, general-purpose parts with enhanced Internet and consumer connectivity.

**ADSP-BF523/ADSP-BF525/ADSP-BF527 and ADSP-BF522/ADSP-BF524/ADSP-BF526:** Low power processors that balance the combination of high performance, power efficiency, and system integration to enable highly optimized designs.

**ADSP-BF531/ADSP-BF532:** Low power, general-purpose processors for audio, voice, imaging, biometrics, and industrial applications.

**ADSP-BF533:** High performance for consumer video, security/surveillance, broadband home gateways, and automotive vision systems.

**ADSP-BF534:** CAN connectivity for automotive, industrial, and medical applications.

**ADSP-BF535:** Optimized for networked Internet appliances, central office/network switches, industrial control, and automation applications.

**ADSP-BF536/ADSP-BF537:** Embedded network connectivity for video, industrial, biometrics, instrumentation, medical, and consumer appliances.

**ADSP-BF538/ADSP-BF538F:** Ideally suited for a broad range of industrial, instrumentation, and medical appliance applications.

**ADSP-BF542/ADSP-BF544/ADSP-BF547/ADSP-BF548:** High performance convergent multimedia processors with a flexible platform for industrial, instrumentation, consumer, communications, and automotive applications.

**ADSP-BF561:** Symmetric multiprocessor optimized for high performance signal and media processing.

## Third-Party Developers

More than 200 third parties provide software, hardware, and consulting services to support Blackfin embedded processors. For more information, visit [www.analog.com/processors/collaborative](http://www.analog.com/processors/collaborative).

### Hardware

- Companion chip/chipsets
- Development boards
- Development systems
- Emulators
- Evaluation/starter boards
- Reference designs
- COTS DSP boards
- Daughter boards

### Software and Algorithms

- Speech G.7xx
- Telephony (DTMF, caller ID, etc.)
- Echo cancellation
- Audio (MP3, AAC/AAC+, WMA9, Dolby,<sup>®</sup> DTS,<sup>®</sup> etc.)
- Video/imaging (JPEG, MPEG-2/MPEG-4, H.264, H.263, WMV9, etc.)
- Image processing
- Facial/object recognition software
- VoIP suites
- Embedded Web browser
- Voice recognition
- Proprietary algorithms (3D audio effects, etc.)

### OS/RTOS

- Green Hills<sup>®</sup> Software/Integrity<sup>®</sup>
- Green Hills Software/veIOSity<sup>™</sup>
- Green Hills Software/ $\mu$ -veIOSity<sup>™</sup>
- Express Logic/ThreadX<sup>®</sup>
- Micri $\mu$ m  $\mu$ C/OS-II
- Quadros Systems/RTXC<sup>™</sup> Quadros
- Unicoi Systems<sup>™</sup>/Fusion<sup>™</sup>
- KADAK Systems/KwikNet<sup>™</sup>
- Open Source/ $\mu$ Clinux
- Analog Devices VisualDSP++ Kernel

### Design Test, Verification, and Validation

- National Instruments
- The MathWorks

### Software IDDE Tools

- Green Hills Software/MULTI<sup>®</sup>
- GAIO Technology/Blackfin design kit

### HW Development Kits

- PHYTEC/Rapid Development Kits
- Arcturus Networks

### Design Services

- Boston Engineering
- Schmid Engineering
- Advanced Energy Conversion

## Complimentary Support Resources

### EngineerZone Online Support Community

[www.EZ.analog.com](http://www.EZ.analog.com)

### Blackfin Visual Training and Development

[www.analog.com/vtd](http://www.analog.com/vtd)

### Analog Devices Sales and Distributors

[www.analog.com/salesdir](http://www.analog.com/salesdir)

### Worldwide Processor and Development Tools Technical Support

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## Companion Power Selection Guide for the Blackfin Processor

ADI power management products provide optimized power for Blackfin products—whether it's a single processor or multiple processors, in handheld or high power applications. ADI has a solution to meet your needs.

### How to Use This Guide

Determine the peak current requirement for each rail of your processor by referring to the relevant data sheets and engineer-to-engineer notes. Then, use this companion guide to select a power solution that offers the required  $V_{OUT}$  for that rail.

The ADIsimPower™ design tool offers a complete set of features to create a complete BOM for all of these solutions. Visit [www.analog.com/ADIsimPower](http://www.analog.com/ADIsimPower).

Blackfin Processors		Speed (MHz)	Min Voltage (V)	Max Voltage (V)	Max Voltage (V)	Max IDD <sub>INT</sub> (mA)
ADSP-BF50X		All	1.1	1.47		300
ADSP-BF51X		All	1.1	1.47		250
ADSP-BF522/ADSP-BF524/ADSP-BF526		All	1.235	1.47		250
ADSP-BF523/ADSP-BF525/ADSP-BF527		All	0.95	1.26		500
ADSP-BF531/ADSP-BF532/ADSP-BF533		400	0.8	1.32		350
ADSP-BF533		500, 533, 600	0.8	1.45		900
ADSP-BF534/ADSP-BF536		300, 400	0.8	1.32		400
ADSP-BF534/ADSP-BF536/ADSP-BF537		500, 533, 600	0.8	1.43		900
ADSP-BF538/ADSP-BF539		400, 533	0.8	1.375		850
ADSP-BF54X		400	0.9	1.43		750
ADSP-BF54X		533, 600	0.9	1.43		1350
ADSP-BF561		All	0.8	1.42		1600
VDD <sub>INT</sub> Domain		Min Voltage (V)	Nominal Voltages (V)	Max Voltage (V)	Max Current (mA)	
VDD <sub>OUT</sub>		1.7	1.8, 2.5, 3.3	3.6	N/A	
VDD <sub>RAM</sub>		1.7	1.8, 2.5, 3.3	3.6	N/A	
VDD <sub>USER</sub>		2.5	2.6	2.7	N/A	
VDD <sub>USB</sub>		3	3.3	3.6	30	
VDD <sub>OP</sub>		2.25	2.5	2.75	25	
LDO Regulators		Part Number	Input Voltage Range (V)	Output Voltage Range (V)	Maximum Output Current (A)	
ADP1720		ADP1720	4.0 to 28	1.23 to 5.0	50 mA	
ADP220		ADP220	2.5 to 5.5	0.8 to 2.8	Dual 200 mA	
ADP170		ADP170	1.6 to 3.6	0.8 to 3.0	300 mA	
ADP123		ADP123	2.3 to 5.5	0.8 to 5.0	300 mA	
ADP125		ADP125	2.3 to 5.5	0.8 to 5.0	500 mA	
ADP1752		ADP1752	1.6 to 3.6	0.75 to 3.0	800 mA	
ADP1753		ADP1753	2.5 to 5.5	0.8 to 5.0	1.0	
ADP1754		ADP1754	1.6 to 3.6	0.75 to 3.0	1.2	
ADP1740		ADP1740	1.6 to 3.6	0.75 to 3.0	2.0	
ADP1741		ADP1741	1.6 to 3.6	0.75 to 3.0	2.0	
ADP2102		ADP2102	2.7 to 5.5	0.8 to 1.87	600 mA	
ADP2140		ADP2140	2.3 to 5.5	0.8 to 3.3	Buck and LDO 600 mA, 300 mA	
ADP2108		ADP2108	2.3 to 5.5	1.0 to 3.3	600 mA	
ADP5020		ADP5020	2.4 to 5.5	1.1 to 3.3	Dual buck and LDO 0.6 + 0.25, 0.15	
ADP5022		ADP5022	2.4 to 5.5	1.2 to 3.3	Dual buck and LDO 0.6 + 0.6, 0.15	

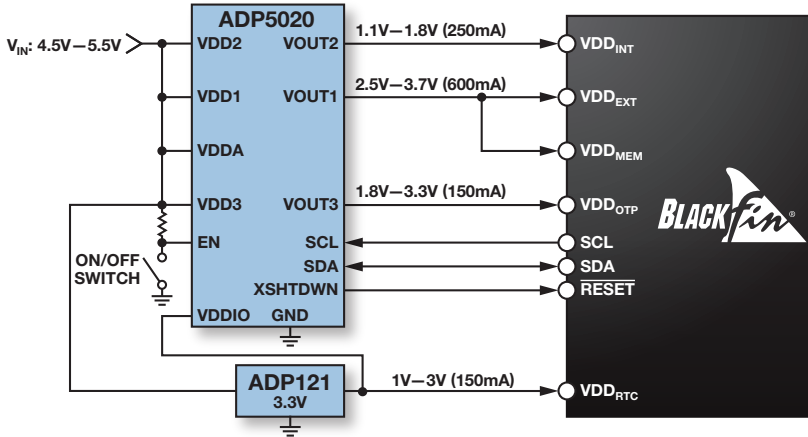
• Indicates that the regulator will support the current draw at the maximum specified frequency, voltage, and industrial temperature.

• Indicates that the regulator will support the current draw in some applications, but the maximum IDD<sub>INT</sub> must be calculated using the appropriate Blackfin data sheet to ensure compatibility.

\*Refer to the relevant data sheet and engineer-to-engineer note to determine the exact "other domain" requirements of each individual processor.

Many applications power more than one device or domain using a single regulator. Compute and add the maximum current draw for each device and domain in a particular application before choosing a regulator.

## Example\* Power Solution for Blackfin Processors



\* Numerous variables affect the power requirements of an embedded system. Ambient temperature, core and system frequency, supply voltages, pin capacitances, power modes, application code, and peripheral utilization all contribute to the average power requirements; therefore, this is just one suggested solution.

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