

# ADSP-218x 16-BIT DIGITAL SIGNAL PROCESSORS

Code- and Pin-Compatible Devices offering 1.8 V to 5 V Core Operation

## KEY FEATURES:

- 80 MHz/MIPS (0.3 mA/MIP) at 1.8 volts
- 160 Kbits to 2 Mbits of on-chip SRAM
- Code-compatible with over 250 ADI DSPs
- Pin-compatible with over 100 ADI DSPs
- All instructions execute in a single clock cycle
- Easy-to-use algebraic assembly language syntax
- Three computational units in parallel operate simultaneously with two data address generators and powerful program sequencer
- 16-bit-wide internal DMA port
- 2 serial ports, including multi-channel serial port for direct interfacing to T1/E1 lines
- Byte DMA transfers of up to 4 Mbytes of stored code or data

## OVERVIEW

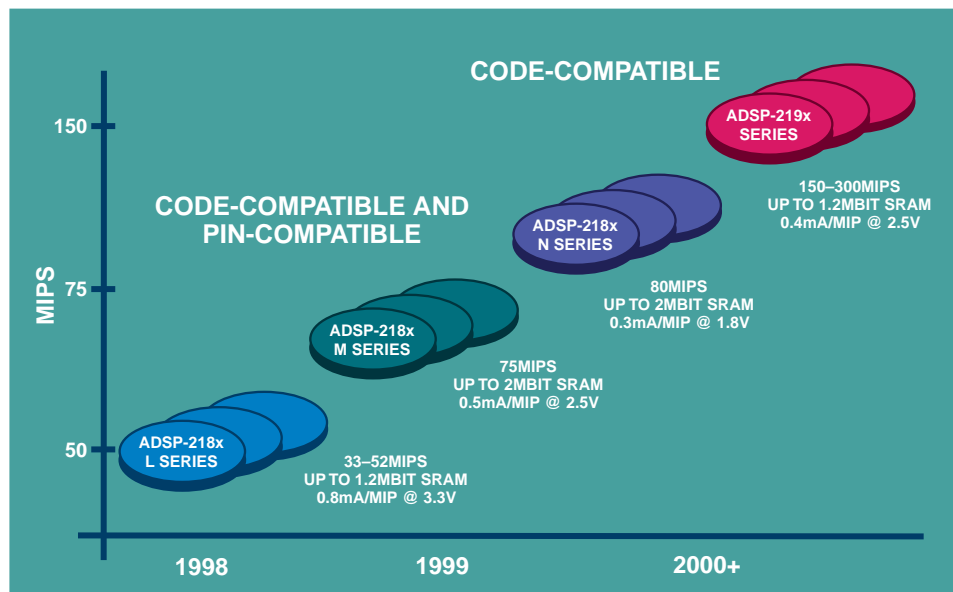
The ADSP-218x family of highly integrated 16-bit digital signal processors extends Analog Devices' fifteen year tradition of providing the industry's easiest to use programmable DSP. The ADSP-218x family is noted for its easy-to-use algebraic assembly language that enables programmers to quickly become proficient in Analog Devices' DSP programming. In addition, the recently announced ADSP-218x 'N' series enables significantly reduced power consumption. Consuming 0.3 mA/MIP (at 1.8 volt core operation), the 'N' series offers a 50% reduction in power

consumption over previous ADSP-218x derivatives.

The ADSP-218x family is completely code-compatible with all other ADSP-21xx devices. This architectural feature preserves and ensures the reuse of ADSP-21xx code throughout multiple generations of user's products.

Multiple pin-compatible devices are offered within the ADSP-218x family to mitigate the design risks associated with new product developments. Users can migrate to smaller memory devices to reduce system costs or move to larger memory devices to increase end-product functionality. In

## ADSP-218x DSP Roadmap



*The ADSP-218x family includes over 100 code-compatible and pin-compatible ADI DSPs. Designers can change speed, memory, or voltage without redesigning their hardware.*

either case, hardware redesign effort is not required.

With up to 2 Mbits of on-chip SRAM, the ADSP-218x family members enable many algorithms and functions to reside completely in on-chip memory, which simplifies board design, algorithm development, and debug. Additionally, on-chip memory reduces total chip count, system cost, board space, and power consumption.

## CODE-COMPATIBLE ARCHITECTURE

The ADSP-2100 architecture consists of three computational units arranged architecturally in parallel, two independent address generators, and a powerful program sequencer. The computational units provide all mathematical functions for the processor, including

single-cycle multiply/accumulates, bit manipulation, and shifting operations. The dual Data Address Generators can provide simultaneous addresses to two memory spaces, allowing the processors to fetch two data values in a single processor cycle. The Program Sequencer provides single-cycle operation for all instructions, low-latency interrupt response, and nested, zero-overhead looping.

## MAXIMIZING MEMORY AND I/O BANDWIDTH

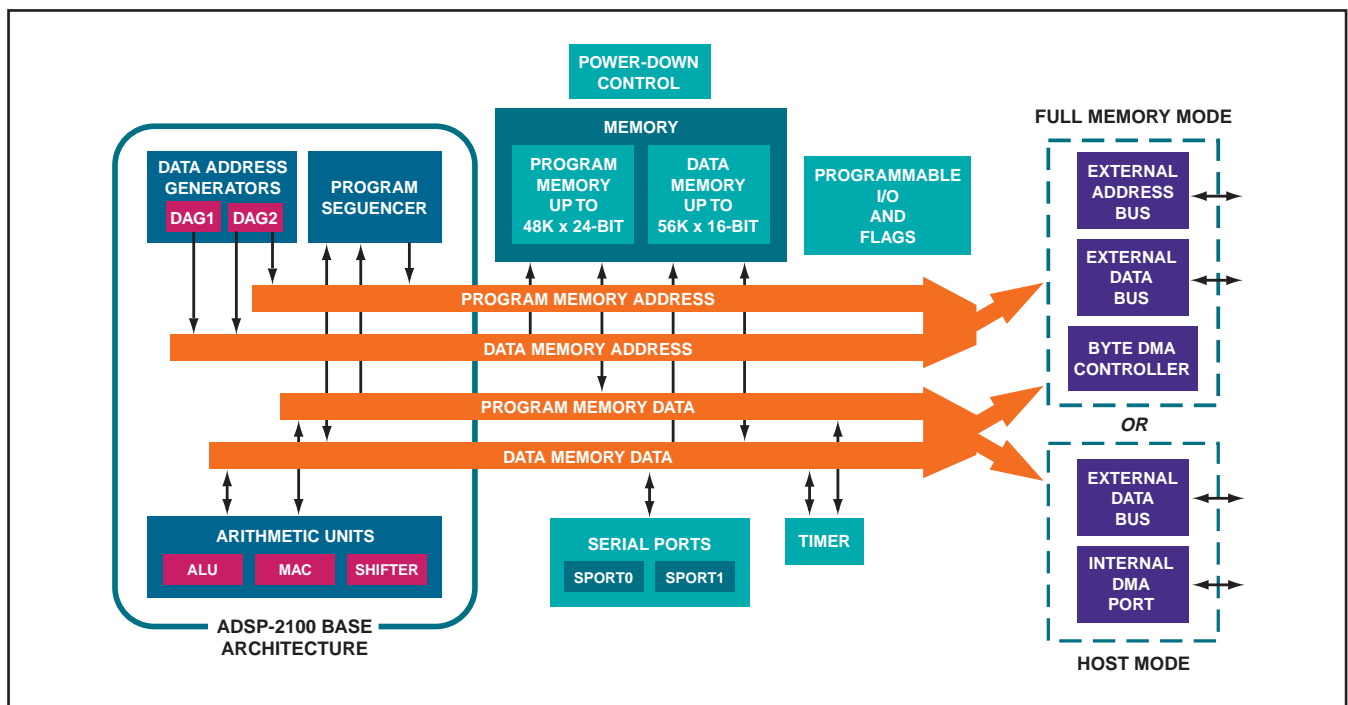
With the SRAM available on the ADSP-218x processors, many applications can be implemented without the use of external SRAM. This increases processor efficiency by eliminating any wasted clock cycles caused by the bottlenecks

that occur with off-chip memory accesses. Multifunction instructions, enabled by the 24-bit instruction word, and zero-overhead nested looping capabilities, combine to produce very efficient algorithm execution.

## Direct Memory Access

To maintain data flow to and from the core, the ADSP-218x family incorporates several types of peripheral DMA support. The ADSP-218x DSPs can access up to 4 Mbytes of stored code or data through Byte DMA (BDMA) transfers. Host processor systems can read or write DSP memory directly through a 16-bit-wide Internal DMA (IDMA) port. Serial port autobuffering supports direct memory reads and writes of serial port data.

ADSP-218x Architecture Block Diagram



The DMA functionality allows for modular system designs with a minimum of external circuitry. For applications where a DSP will be used alone, the BDMA feature allows the ADSP-218x processors to access very large code and data segments without the need for fast, expensive SRAM. Because BDMA transfers happen in the background, the DSP continues uninterrupted, executing programs or accessing data sets. This access can be through the use of low-cost, byte-wide storage media such as EPROM.

For host-based systems, the IDMA port allows a great deal of system flexibility while keeping chip count low. Since the host has direct write access to both DSP Program Memory and Data Memory, no external memory devices are required for the DSP. The host can boot-load code and data into the DSP, write data variables, and reload, or load additional code if the system requires it.

### **Multichannel Serial Ports**

The multichannel serial port on the ADSP-218x processors allows direct interface to T1 and E1 lines. This built-in time division multiplexing eliminates the complicated code development that would be required to divide the

serial data stream into channels, and can support 24-channel and 32-channel frames.

### **LOW POWER OPERATION**

All ADSP-218x family members have multiple power-down modes that significantly reduce power dissipation when the device operates under standby conditions. The CLKOUT pin may also be disabled to reduce external power dissipation. At 0.5 mW/MIP @ 1.8 volts, the 'N' Series offers the lowest active power dissipation within the ADSP-218x family.

### **ADVANCED PACKAGING TECHNOLOGY**

ADI attains industry-leading memory density by offering most ADSP-218x devices in the space-saving 10mm x 10mm Mini-BGA package. This one centimeter square package significantly reduces the board space requirement for small form factor portable devices or in applications requiring multiple DSPs per system. The 144-ball Mini-BGA package is offered in an easy-to-manufacture lead pitch of 0.8 mm.

### **DEVELOPMENT TOOLS**

Since all the ADSP-2100 family members are code-compatible,

ADI offers one software package that supports over 250 ADI DSPs.

VisualDSP® tools include an integrated development environment (IDE) and a debugger that delivers efficient project management so programmers can move easily between editing, building and debugging. VisualDSP offers programmers a powerful programming tool with flexibility that significantly decreases the time required to port software code to a DSP, reducing time-to-market.

The EZ-KIT Lite™ development system is a complete, ultralow-cost tool for evaluating and prototyping. The kit includes an ADSP-2189M-based board, assembler, linker, simulator, C compiler, PROM splitter utility, and demo source code.

An ADSP-218x EZ-ICE® system provides a productive software and hardware development and integration environment for the ADSP-218x family of products. It features full-speed, in-circuit emulation of all ADSP-218x derivatives, connects to the target system via a special emulator port, supports uploading/downloading of memory from a PC, allows display and modification of memory and registers, single-step execution, and breakpoint execution, and provides a Windows®-based GUI.

## ADSP-218x DSP FAMILY SELECTION GUIDE

Product	Package Options	MAX MIPS/MHz	Program RAM	Data RAM	Serial Ports	Core V <sub>DD</sub>	I/O V <sub>DD</sub>
ADSP-2181	128-LQFP, 128-MQFP	40	16 K	16 K	2	5 V	5 V
ADSP-2183	128-LQFP, 144-MBGA	52	16 K	16 K	2	3.3 V	3.3 V
ADSP-2184	100-LQFP	40	4 K	4 K	2	5 V	5 V
ADSP-2184L	100-LQFP	40	4 K	4 K	2	3.3 V	3.3 V
ADSP-2185	100-LQFP	33	16 K	16 K	2	5 V	5 V
ADSP-2185L	100-LQFP, 144-MBGA	52	16 K	16 K	2	3.3 V	3.3 V
ADSP-2185M	100-LQFP, 144-MBGA	75	16 K	16 K	2	2.5 V	2.5 V–3.3 V
ADSP-2185N	100-LQFP, 144-MBGA	80	16 K	16 K	2	1.8 V	1.8 V–3.3 V
ADSP-2186	100-LQFP, 144-MBGA	40	8 K	8 K	2	5 V	5 V
ADSP-2186L	100-LQFP, 144-MBGA	40	8 K	8 K	2	3.3 V	3.3 V
ADSP-2186M	100-LQFP, 144-MBGA	75	8 K	8 K	2	2.5 V	2.5 V–3.3 V
ADSP-2186N	100-LQFP, 144-MBGA	80	8 K	8 K	2	1.8 V	1.8 V–3.3 V
ADSP-2187L	100-LQFP	52	32 K	32 K	2	3.3 V	3.3 V
ADSP-2187N	100-LQFP, 144-MBGA	80	32 K	32 K	2	1.8 V	1.8 V–3.3 V
ADSP-2188M	100-LQFP, 144-MBGA	75	48 K	56 K	2	2.5 V	2.5 V–3.3 V
ADSP-2188N	100-LQFP, 144-MBGA	80	48 K	56 K	2	1.8 V	1.8 V–3.3 V
ADSP-2189M	100-LQFP, 144-MBGA	75	32 K	48 K	2	2.5 V	2.5 V–3.3 V
ADSP-2189N	100-LQFP, 144-MBGA	80	32 K	48 K	2	1.8 V	1.8 V–3.3 V

### DSP SUPPORT

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