Product Bulletin

TMS320™ DSP Algorithm Standard

Key Features:

- Allows mixing of interoperable components
- Lowers support and development costs by eliminating custom coding
- Reduces system integration time
- Enables creativity and innovation
- Choose from hundreds of compliant algorithms available today

Texas Instruments real-time eXpressDSP™ Software and Development Tools is a premier open software environment for TI DSPs. With eXpressDSP, a simplified and streamlined development infrastructure helps reduce development time. Programmers spend more time creating innovative applications rather than working on cumbersome and repetitive development and integration tasks.

A key component of eXpressDSP Software is the TMS320™ DSP Algorithm Standard, also known as XDAIS. This standard frees DSP designers from an exclusive "custom-crafted" approach to a new paradigm of interoperable components. A significant base of system-ready algorithms allows real "make vs. buy" decisions.

Where DSP Comes Together

The TMS320 DSP Algorithm Standard is part of the overall eXpressDSP software technology initiative. eXpressDSP Software includes four major elements: DSP/BIOS™, a scalable real-time kernel; eXpressDSP Reference Frameworks, the industry's first getting started software for DSP applications; TMS320 DSP Algorithm Standard, a set of rules and guidelines for developers to

Enabling System-Ready Algorithms
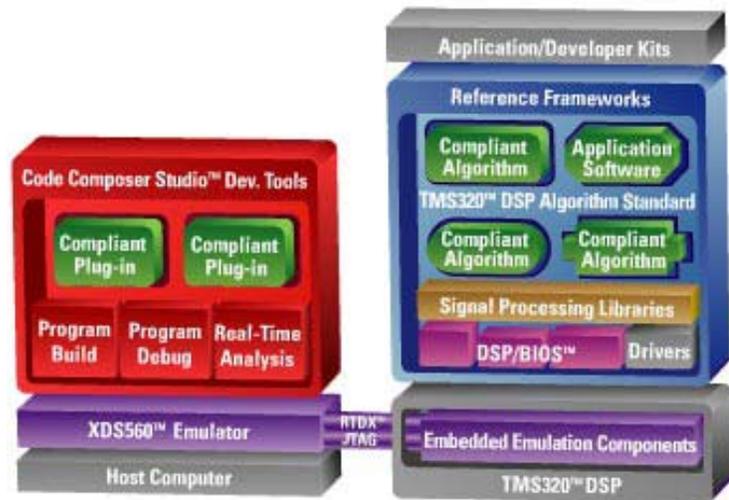
create standard algorithms, and TI's Third-Party Network with its large base of TI DSP-based software modules.

TMS320 DSP Algorithm Standard

The standard is a set of coding conventions for algorithm writers that reduces time-consuming system integration for anyone trying to put algorithms into their system. This is achieved by defining common programming rules and guidelines with a set of programming interfaces that are consistently used by algorithms across a wide variety of applications.

A DSP First: Interface Standards to Enable System-Ready Software Algorithms

Previously, the DSP market suffered from a lack of standardization in software algorithms, which enable DSPs to perform complex signal-processing functions. Because there were no standards to ensure a consistent programming interface, DSP design engineers faced time-consuming problems when integrating existing algorithms into new or different applications. Frequently, they focused valuable resources on re-engineering code. The lack of standards made the

integration of algorithms from more than a single source very difficult. As a result, integration times are extended, debugging is tricky, and it is difficult or impossible to compare two similar algorithms. By publishing and supporting the TMS320™ DSP Algorithm Standard, TI aids in decreasing software system integration and debug time.

The TMS320 DSP Algorithm Standard Solves Integration Issues

The TMS320 DSP Algorithm Standard Developer's Kit provides all of the information necessary to enable application developers and system integrators to understand and utilize algorithms that are compliant to the standard. Information and tools are also provided for generation of new algorithms that are compliant to the standard. All of this information is included on the Code Composer Studio™ IDE CD.

The Result of the Standard: Hundreds of Compliant Algorithms Available Today

More than 90 TI third-party Algorithm developers have been working with TI's TMS320 DSP Algorithm Standard for more than three years and have developed over 600 algorithms that comply with the standard. These algorithms are designed for ease of integration and to reduce the amount of time spent debugging the system as algorithms are added. Some examples of algorithms available today are video, imaging, voice, speech, hearing, biometrics, telephony, wireless and control. Algorithms are available for all three TI DSP architectures: TMS320C2000™, TMS320C5000™,
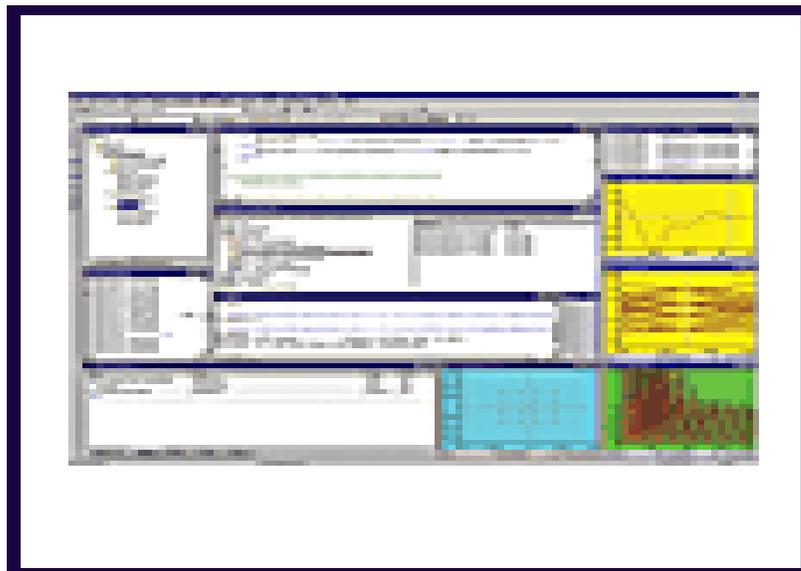
The Developer's Kit demo shows how easily eXpressDSP-compliant algorithms interoperate.

and TMS320C6000™. For the most up-to-date listing of eXpressDSP-compliant algorithms, check TI's DSP Village at
www.dspvillage.com

Compliance Program

The compliance testing program ensures that all algorithms carrying the eXpressDSP™-Compliant mark have been subjected to a test suite and meet the requirements stated in the specification. Only those algorithms that pass the test are given the opportunity to display the eXpressDSP-Compliant mark and be sold through TI's eStore. The compliance mark gives you an easy way to identify off-the-shelf algorithms that can be easily integrated.

Tools and Software Homepage

TI's DSP Village is the place to look for more information or technical support for any of TI's software

Scope of the Standard

Mandatory Rules

The standard consists of the following:

- 39 basic "common sense" rules for all algorithms
- IALG APIs – Abstracts DSP memory management away from algorithms
- IDMA APIs – Abstracts DSP DMA management away from algorithms
- Instruction Set Architecture (ISA) rules for DSPs
- Naming conventions to reduce name space pollution

Optional Guidelines

- Several guidelines to help system integrators
- Real-Time Trace/Debug API (IRTC) – A standard API suggested for test modes
- Methods for extending baseline APIs for added functionality – allowing for differentiation

products. There is a discussion group, DSP KnowledgeBase, DSP Hotline On-line, application notes, user manuals and much more. Visit **www.dspvillage.com** to get a jump-start on application development.

Training

TI's Technical Training Organiza-tion offers one-day and three-day training courses on the Algorithm Standard. The workshops cover the basic concepts and interfaces of the standard, the creation of algorithms that are compliant with the standard and the concept of frameworks to combine standard algorithms with system software. In addition, there are two on-line training courses available. One is a half-hour high-level overview of the standard, the other, a two-hour more in depth look at the business and technical issues involved in the decision of making vs. buying software. For more information, visit TI's Training Web page at **www.ti.com/sc/training/software**

eStore

TI's eStore is your one-stop shop for eXpressDSP™-Compliant algorithms. All algorithms listed in the eStore have passed compliance testing and adhere to the standard. The eStore is also home to TI tools and software. Visit the eStore at **dspvillage.ti.com**

Algorithm Standard Developer's Kit

Using the TMS320™ DSP Algorithm Standard is easy. Simply look on your Code Composer Studio™ IDE CD-ROM (V 2.0 and higher) for the TMS320 DSP Algorithm Standard Developer's Kit. The kit contains everything needed to get started. It includes:

- The TMS320 DSP Algorithm Standard Specification

TMS320 DSP Algorithm Standard

Mandatory Rules

1. All algorithms must follow the run-time conventions imposed by TI's implementation of the C programming language.
2. All algorithms must be reentrant within a preemptive environment (including time-sliced preemption).
3. All algorithm data references must be fully relocatable (subject to alignment requirements). That is, there must be no "hard-coded" data memory locations.
4. All algorithm code must be fully relocatable. That is, there can be no hard-coded program memory locations.
5. Algorithms must characterize their ROM-ability; i.e., state whether they are ROM-able or not.
6. Algorithms must never directly access any peripheral device. This includes, but is not limited to on-chip DMAs, timers, I/O devices and cache control registers.
7. All header files must support multiple inclusions within a single source file.
8. All external definitions must be either API identifiers or API and vendor prefixed.
9. All undefined references must refer either to the operations specified in Appendix B (a subset of C run-time support library functions and the DSP/BIOS™) or other eXpressDSP-compliant modules.
10. All modules must follow the naming conventions of the DSP/BIOS for those external declarations disclosed to the client.
11. All modules must supply an initialization and finalization method.
12. All algorithms must implement the IALG interface.
13. Each of the IALG methods implemented by an algorithm must be independently relocatable.
14. All abstract algorithm interfaces must derive from the IALG interface.
15. Each eXpressDSP-compliant algorithm must be packaged in an archive which has a name that follows a uniform naming convention.
16. Each eXpressDSP-compliant algorithm header must follow a uniform naming convention.
17. Different versions of a standard-compliant algorithm from the same vendor must follow a uniform naming convention.
18. If a module's header includes definitions specific to a "debug" variant, it must use the symbol _DEBUG to select the appropriate definitions; _DE-BUG is defined for debug compilations and only for debug compilations.
25. All C6000 algorithms must be supplied in little endian format.
26. All C6000 algorithms must access all static and global data as far data.
27. C6000 algorithms must never assume placement in on-chip program memory; i.e., they must properly operate with program memory operated in cache mode.
28. On processors that support large program model compilation, all core run-time support functions must be accessed as far functions; for example, on the C54x™ DSP, the calling function must push both the XPC and the current PC.
29. On processors that support large program model compilation, all algorithm functions must be declared as far functions; for example, on the C54x DSP, callers must push both the XPC and the current PC and the algorithm functions must perform a far return.
30. On processors that support an extended program address space (paged memory), the code size of any object file should never exceed the code space available on a page when overlays are enabled.
31. All C55x™ algorithms must document the content of the stack configuration register that they follow.
32. All C55x algorithms must access all static and global data as far data; also the algorithms should be instantiable in a large memory model.
33. C55x algorithms must never assume placement in on-chip program memory; i.e., they must properly operate with program memory operated in instruction cache memory.
34. All C55x™ algorithms that access data by B-bus must document: the instance number of the IALG_MemRec structure that is accessed by the B-bus (heap-data), and the data-section name that is accessed the B-bus (static-data).

- Application notes for both producers and users of algorithms
- Example code that builds on EVMs (evaluation modules) and DSKs (starter kits)
- Tools to help with creation of standard header files
- Demo that illustrates the simplicity of algorithm integration
- Support for C5000™, C6000™, and C2000™ platforms

For More Information

For more information or to order the TMS320™ Algorithm Standard, visit the TI DSP Village Web site at **www.dspvillage.com**

TMS320 DSP Algorithm Standard (Continued)

Performance Characterization Rules

19. All algorithms must characterize their worst-case heap data memory requirements (including alignment).
20. All algorithms must characterize their worst-case stack space memory requirements (including alignment).
21. Algorithms must characterize their static data memory requirements.
22. All algorithms must characterize their program memory requirements.
23. All algorithms must characterize their worst-case interrupt latency for every operation.
24. All algorithms must characterize the typical period and worst-case execution time for each operation.

IDMA Rules

IDMA Rule 1: All data transfer must be completed before return to caller
IDMA Rule 2: All algorithms using the DMA resource must implement the IDMA interface
IDMA Rule 3: Each of the IDMA methods implemented by an algorithm must be independently relocatable
IDMA Rule 4: All algorithms must state the maximum number of concurrent DMA transfers to each logical channel
IDMA Rule 5: All algorithms must characterize the average and maximum size of the data transfers per logical channel for each operation. Also, all algorithms must characterize the average and maximum frequency of data transfers per logical channel for each operation.

TI Worldwide Technical Support

Internet

TI Semiconductor Product Information Center Home Page
support.ti.com

TI Semiconductor KnowledgeBase Home Page
support.ti.com/sc/knowledgebase

Product Information Centers

Americas
Phone	+1(972) 644-5580
Fax	+1(972) 927-6377
Internet/Email	support.ti.com/sc/pic/americas.htm

Europe, Middle East, and Africa
Phone
Belgium (English)	+32 (0) 27 45 55 32
Finland (English)	+358 (0) 9 25173948
France	+33 (0) 1 30 70 11 64
Germany	+49 (0) 8161 80 33 11
Israel (English)	1800 949 0107
Italy	800 79 11 37
Netherlands (English)	+31 (0) 546 87 95 45
Spain	+34 902 35 40 28
Sweden (English)	+46 (0) 8587 555 22
United Kingdom	+44 (0) 1604 66 33 99
Fax	+(49) (0) 8161 80 2045
Email	epic@ti.com
Internet	support.ti.com/sc/pic/euro.htm

Japan
Fax	International	+81-3-3344-5317
	Domestic	0120-81-0036
Internet/Email	International	support.ti.com/sc/pic/japan.htm
	Domestic	www.tij.co.jp/pic

Asia
Phone
	International	+886-2-23786800
	Domestic	Toll-Free Number
	Australia	1-800-999-084
	China	108-00-886-0015
	Hong Kong	800-96-5941
	Indonesia	001-803-8861-1006
	Korea	080-551-2804
	Malaysia	1-800-80-3973
	New Zealand	0800-446-934
	Philippines	1-800-765-7404
	Singapore	800-886-1028
	Taiwan	0800-006800
	Thailand	001-800-886-0010
Fax	886-2-2378-6808	
Email	tiasia@ti.com	
Internet	support.ti.com/sc/pic/asia.htm	

TEXAS INSTRUMENTS

SPRT256A