Code Composer Studio™ IDE

Creating a universe of DSP software

ROBUST

RELIABLE

PROVEN

QUALITY

eXpressDSP
SOFTWARE & DEVELOPMENT TOOLS

The eXpressDSP™ host tools provide an integrated development environment consisting of:

- **Code Composer Studio™ IDE Development Tools –** a powerful set of integrated development tools that can be enhanced with TI and third-party plug-ins. With all these tools in one integrated environment, CCStudio boosts your effectiveness and productivity.

The eXpressDSP real-time target-side software saves valuable time by providing:

- **DSP/BIOS™ Kernel –** a proven, scalable, real-time software kernel including chip support libraries that create the foundation for software development work, eliminating many low-level coding tasks and greatly simplifying real-time task scheduling.

- **TMS320™ DSP Algorithm Standard –** an interoperability coding standard that facilitates the reuse of software components from your previous projects, other developers and outside sources.

- **eXpressDSP Reference Frameworks –** a set of open source, C-based starterware templates optimized for multiple application parameters. Production-ready code, which is simple to modify, enables you to be up and running very quickly.

The world's largest DSP Third Party Network:

- **The TI DSP Third Party Network** provides a rich library of TMS320™ DSP-based software modules and host tool plug-ins that are easily integrated to

fit the needs of your application. This network also provides hardware platforms, emulators and consultant services.

What's New in Code Composer Studio™ IDE Platinum Edition:

Code Composer Studio (CCStudio) Platinum Edition Integrated Development Environment (IDE) provides developers with a unified DSP platform development environment with a collection of integrated tools designed to boost productivity and reduce common debug frustrations. With new features added to every stage of the development process, the CCStudio Platinum enables developers to meet their application performance and schedule goals with easy to use, robust development tools and software.

End debug frustration and stress:

- **Connect/Disconnect** makes it easier to connect and disconnect with the target dynamically. This new functionality provides robust and resilient connection to the target board and even allows you to restore the previous debug state when connecting again.

- **Rewind Debugging** saves developers from repeating tedious reload and rerun sequences with a single keystroke back-step option to quickly jump to the previous instruction in the source code.

Shorten learning curve and simple configuration control:

- **CodeWright:** Industry's most familiar and popular editor now integrated with CCStudio shortens learning curve and offers rich editing capabilities.

and Development Tools

- **Component manager:** Simple configuration control of CCStudio components allows developers to freeze or evaluate new versions of compilers and DSP/BIOS™ kernel releases.

- **CCStudio v3.1 IDE:** One look and feel for three DSP platforms eliminates learning curve for evolving/expanding cross platform DSP development.

Achieve programming goals in less time with maximum results:

- **Application Code Tuning** takes weeks out of the optimization process with a collection of integrated tuning tools. CCS Platinum enables developers to build applications faster and easier than ever before, utilizing a "tuning approach" that allows full optimization of both the code and the silicon.

- **Tuning Dashboard** provides the user with a single interface for managing the optimization process. A user-defined Goals window allows the user to setup optimization targets and track progress towards the desired goals. The dashboard also contains a proactive Advice Window that provides specific optimization suggestions and advice on which tuning tools to use to achieve development goals. A Profile Setup and Viewer feature manages and displays the data collected during development.

- **Compiler Consultant** analyzes your application and makes recommendations for efficient coding. Each time the application is compiled, Compiler Consultant will examine the code and create suggestions for different optimization techniques to improve code efficiency.

- **CacheTune** makes it easier to identify non-optimal cache usage by graphically representing cache memory accesses. This visual/temporal view of cache accesses enables quick identification of problem areas (such as areas related to conflict, capacity, or compulsory misses) to help you greatly improve an application's overall cache efficiency.

- **CodeSizeTune (CST)** enables you to easily optimize the trade-off between code size and cycle count for an application. Using a variety of profiling configurations CST profiles the user's application, collects data on individual functions, and determines the best combinations of compiler options. CST then produces a graph of these function-specific option sets, permitting a choice of the configuration best suited for your needs.

*All CCStudio features described may not be available for every supported TI processor. Please check the Features by Platform support matrix for support details.

TI's Development Tools and Software

Application Design		Code & Build	

Application Design

- Host Tools
  - Select target
  - DSP/BIOS™ configuration
  - Power Planning
- Target Software
  - Reference Frameworks
  - DSP/BIOS Kernel
  - TMS320™ DSP Algorithm Standard

Code & Build

- Host Tools
  - Project Manager
  - Component Manager
  - CodeWright Editor
  - Code Generation
  - Device & CPU Simulators
- Target Software
  - Libraries
  - Drivers

The tight integration of Code Composer Studio™ (CCStudio) software with eXpressDSP™ software and the TMS320 DSP and OMAP™ processors speed your design through each stage of the design cycle. Take advantage of the many features of eXpressDSP products to become more productive and accelerate time-to-market.

Application Design
Host Tools

Quickly setup and configure your application with CCStudio setup. The drag-and-drop configuration utility enables you to quickly select and setup hardware systems and initialize the CCStudio environment. Even a system with multiple boards and CPUs can be configured in a few seconds.

Configure DSP/BIOS resources during application design with the DSP/BIOS configuration tool. Create and configure DSP/BIOS objects used by your program and eliminate resource contention at this early stage.

Estimate and plan power consumption early with device-specific planning tools.

Target Software

Get started faster and eliminate many low-level coding tasks up front by using ready-to-go eXpressDSP Software.

Jump start development with eXpressDSP Reference Frameworks. Choose the framework which best fits your application: RF1 "Compact," RF3 "Flexible" or RF5 "Extensive." Built on the foundation of DSP/BIOS™ Kernel and the TMS320™ DSP Algorithm Standard, this solid production-quality base code can get your applications off the ground quickly.

Get productive faster and eliminate the need to design and validate your own scheduler. Take advantage of the industry-proven scalable DSP/BIOS real-time kernel to perform time scheduling and synchronization. Use the built-in host-to-target communications and real-time instrumentation for real-time analysis in later stages of development. The kernel includes pre-emptive multi-threading, hardware abstraction, real-time analysis, configuration tools and chip support libraries so you can spend time on more innovative and productive activities.

Make, buy or reuse software. Utilize the TMS320 DSP Algorithm Standard to make your code reusable and to take advantage of the rich offering of eXpressDSP-compliant algorithms ready to drop into your application.

Code & Build
Host Tools

Manage your project effectively using the visual Project Manager. It provides fast access and manipulation of single or multiple project files with drag-and-drop as well as double-click edit capabilities. The Project Manager also can integrate with a number of industry-standard source control systems, giving development teams better control of their project.

Lock down compiler and/or DSP/BIOS versions for the life of the project. The component manager lets developers freeze critical components by project and continue to upgrade the IDE. The flexibility of the component manager allows developers to easily evaluate new versions before committing to them in their design.

Improve Code Integrity. Integrated CodeWright editor includes powerful editing features like CodeSense to ensure code syntax and parameters are written correctly. This familiar and easy-to-use editor includes many text processing capabilities such as: file diffing and merging, custom code templates, block indenting, case conversion and comment insertion.

Generate efficient DSP code. CCStudio supports C/C++ and Assembly language coding. TI's compile tools are co-developed with the DSP architecture, offering you best-in-class performance with industry-leading global view analysis and architecture-specific optimizations that include interactive profiling, tuning and feedback.

Start software development earlier using TI's fast simulators to do more coding and validation. Start before your hardware system is ready. A wide array of simulators provide options to determine how much of the device to simulate: CPU only, CPU and memory or full device simulators.

Target Software

Chip support libraries and drivers **reduce the need to open a data book** to correctly configure TMS320 DSP device peripherals.

Available Throughout Design Cycle

- Debug Host Tools
  - Familiar debug interface
  - Multi-processor support
  - Data I/O visualization and Probe Points ™
  - Connect/Disconnect
  - Rewind
- Scripting Emulators
  - XDS560™ Emulator
  - XDS510™ Emulator
  - Watch Windows and Symbol Browser
- Host Tools
  - Profiler
  - Power Analyzer
  - Advanced Code Tuning
- Target Software
  - Real-time analysis
  - RTDX
  - Power-Scaling Library

TI's Third Parties are a valuable resource: In addition to eXpressDSP™-compliant algorithms, the TI DSP Third Party Network provides target boards, application starter kits, consultant services, as well as software tools, Code Composer Studio™ (CCStudio) plug-ins and additional hardware tools to help you through each stage of the design flow.

Debug
Host Tools

Get productive immediately with CCStudio's integrated debugger. This familiar easy-to-use interface has many features you would expect in a traditional debugger as well as many DSP-specific and multi-processor design capabilities.

Control execution of your code with software breakpoints or with hardware and conditional breakpoints which can evaluate a C expression, a local variable or a CPU register location. Use global breakpoints to synchronize the debug of multiple processors on a multi-processor system.

Input and output data on your target with Probe Points™ data breakpoints to control when data displays are updated. Use Graph Options to display data in useful formats such as FFTs, eye diagrams, constellation plots and images.

Dynamic Host-to-target connection enables developers to isolate hardware/software real time issues. Connect/Disconnect eliminates the need for frequent reset and restart sequences.

Step or run backwards to a previous point in execution. Rewind restores the state of resources to help developers quickly narrow down code problems in a single keystroke.

Examine your data and program during run-time with the watch window or simply roll your cursor over a variable in the editor to use the ToolTip feature to see its value.

Navigate your code with CCStudio's symbol browser, which has detailed knowledge of your application and displays all associated files, functions, global variables, types and labels of a loaded COFF output file (*.out).

Automate repetitive tasks using CCStudio Scripting and CCStudio GEL language. Use familiar languages such as Perl or Visual Basic to automate debug, testing and validation of applications with CCStudio software.

Emulators

CCStudio supports XDS510 and XDS560 class emulators. The XDS560 Emulator reaches real-time data rates of over 2 MB/second on enabled high-speed RTDX processors to provide an unparalleled level of real-time debug. The XDS560 Emulator is fully upward compatible with TI's XDS510 Emulator.

Analyze & Tune
Host Tools and Target Software

Get insight into your running application and determine how to maximize performance, minimize footprint, manage power consumption and/or make your code more robust.

Examine operation of your system in real time and find glitches and bottlenecks that may only show up in real-time operation. This is made possible by the advanced RTDX and DSP/BIOS technologies integrated with CCStudio which allow you to get data from your application while it runs in real time.

Continuous visibility and communication with your target application without halting the processor using RTDX data transfers between host and target. With real-time data rates of over 2 MB/second, some processors can transfer large data files such as video images in real time.

Analyze task interaction with DSP/BIOS run-time services on your running application to determine if tasks are well integrated and if your application is best utilizing resources.

Optimize power consumption for power-sensitive applications. CCStudio's power analyzer and power-scaling library allow developers to visualize power consumption across the DSP, I/O or system. Use the power-scaling library to automatically scale the frequency and voltage of power-hungry functions, resulting in lower power consumption for the full application.

Extract maximum performance and full feature utilization from your DSP system with a comprehensive tool chain designed specifically to optimize (or tune) your DSP system.

Tuning tools are used to improve execution time, utilize cache more efficiently and decrease memory usage. These tools are wrapped with an interactive advisor that walks the user through the optimization process specific to the goals set by the developer.

Feature	CCStudio Platinum					
	C6000™ DSPs				C5000™ DSPs	
	C62x™	C64x™	C67x™	DM64x™	C54x™	C55x™
Application Design						
DSP/BIOS™ Kernel	X	X	X	X	X	X
TMS320™ DSP Algorithm Std.	X	X	X	X	X	X
Reference Frameworks†	X	X	X	X	X	X
Chip Support Library	X	X	X	X	X	X
Data Converter Selector Plugin†	X	X	X	X	X	X
Driver Development Kit†	X	X	X	X	X	X
Update Advisor	X	X	X	X	X	X
Code & Build						
CCStudio Point and Click IDE	X	X	X	X	X	X
C/C++ and Assembly	X	X	X	X	X	X
CodeWright Integrated Editor	X	X	X	X	X	X
Online Help	X	X	X	X	X	X
Project Manager	X	X	X	X	X	X
Debug						
RTDX™	X	X***	X	X***	X	X
Fast Simulation	X	X	X	X		X
Simulators	X	X	X	X	X	X
Watch Windows	X	X	X	X	X	X
GEL Scripting (internal)	X	X	X	X	X	X
Perl/VBA Scripting† (external)	X	X	X	X	X	X
Parallel Debug Manager	X	X	X	X	X	X
Connect/Disconnect	X	X	X	X		X
Flashburn Utility†	X	X	X	X	X	X
Advance Event Triggering		X		X		X
Code Coverage	X	X	X	X		X
Analyze & Tune						
Pipeline Analysis						X
Rewind						X
Tuning Dashboard and Profiler	X	X	X	X	X	X**
Compiler Consultant	X	X	X	X		
CodeSizeTune‡	X	X	X	X		
Cache Tune	X	X	X	X		X

Legend

* C and ASM support only
*** HSRTDX available

** Includes power management advice
‡ Formerly called Profile-Based Compiler

Features and Benefits

Feature	CCStudio Platinum					
	OMAP™ Processors				C2000™ Controllers	
	C54x™	C55x™	ARM7™	ARM9™	C24x™	C28x™
Application Design						
DSP/BIOS™ Kernel	X	X				X
TMS320™ DSP Algorithm Std.	X	X			X	X
Reference Frameworks†	X	X				
Chip Support Library	X	X				
Data Converter Selector Plugin†	X	X			X	X
Driver Development Kit†	X	X				X
Update Advisor	X	X	X	X	X	X
Code & Build						
CCStudio Point and Click IDE	X	X	X	X	X	X
C/C++ and Assembly	X	X	X	X	X*	X
CodeWright Integrated Editor	X	X	X	X	X	X
Online Help	X	X	X	X	X	X
Project Manager	X	X	X	X	X	X
Debug						
RTDX™	X	X				X
Fast Simulation		X				
Simulators	X	X	X	X		X
Watch Windows	X	X	X	X	X	X
GEL Scripting (internal)	X	X	X	X	X	X
Perl/VBA Scripting† (external)	X	X	X	X	X	X
Parallel Debug Manager	X	X	X	X	X°	X°
Connect/Disconnect		X	X	X		X
Flashburn Utility†	X	X	X	X		
Advance Event Triggering		X				
Code Coverage		X				
Analyze & Tune						
Pipeline Analysis		X				X
Rewind		X				
Tuning Dashboard and Profiler	X	X**	X	X	X	X
Compiler Consultant						
CodeSizeTune‡						
Cache Tune		X				

° Supports only homogeneous multi-processing
† Available through Update Advisor for users with active CCStudio IDE subscription

For more information, visit www.ti.com

Code Composer Studio™ Key Benefits

- Quick start with familiar tools and interfaces
- Easily manage large multi-user, multi-site and multi-processor projects
- Utilize fast code creation, optimization and debugging tools
- Maximize reuse and portability for faster code development
- Perform real-time analysis enabled by RTDX and DSP/BIOS technologies

Update Advisor

All CCStudio registered users with a valid subscription have access to CCStudio's live update capability. The Update Advisor is a web-based application designed to allow you to keep your system efficient and up-to-date. The Update Advisor is aware of every CCStudio component installed on your system, and it is able to compare this information with the available CCStudio updates. It then compiles a custom list of available, easy-to-install system updates. This allows you to keep your system up-to-date with the latest software from TI and also gives you access to valuable resources on the web to cut your development time.

Resources for eXpressDSP™ Software and Development Tools

Learn more about CCStudio and the eXpressDSP Software capability with the online tutorial, multimedia demos and built-in context-sensitive help. Go to CCStudio's Help Menu to access these resources. In addition, there are a number of other web-based resources available.

- **DSP Information:** www.dspvillage.com
- **eStore:** www.ti.com/dspestore
- **Technical Documentation:** www.ti.com/dspappnotes
- **Knowledge Base:** www.ti.com/dspkbase
- **Discussion Groups:** www.ti.com/dspdiscussgroups
- **Online Training:** www.ti.com/dsptraining
- **Workshops:** www.ti.com/dspworkshops
- **Third Party Catalog:** www.ti.com/thirdpartycatalog

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Code Composer Studio IDE is accompanied by a complete documentation set that includes online help, tutorials, reference guides, user's guides, and application reports.

Note: *Viewing the Code Composer Studio IDE online manuals and application notes requires Adobe Acrobat Reader. Adobe Acrobat Reader 7.0 is provided on the installation CD.*

ONLINE

From the Code Composer Studio Help Menu…

From the Menu Bar, choose Help →… Contents. The following dialog box appears and provides access, through links, to the complete set of online help topics and documentation:

From the Start Menu…

You can also access the online help without opening Code Composer Studio IDE by choosing

Start → All Programs → Texas Instruments → Code Composer Studio → Documentation → [Platform] Help.

Welcome to Code Composer Studio™ IDE

Welcome to Code Composer Studio™ Version 3.1

What's New
> Read a brief summary (PDF) of new and different features in Code Composer Studio IDE 3.1.

User Manuals
> View a list of all available user guides, reference manuals and application reports available for your target device (PDF format, installed locally).

Tutorial
> Learn how to begin developing DSP applications with Code Composer Studio™ IDE:

DSP Knowledgebase
> Search the latest FAQs, updates, bugs and troubleshooting online:

Multimedia Demos for Code Composer Studio IDE
> Animated demo of how to perform basic IDE operations:

Release Notes
> Read essential information about bug fixes and known problems associated with this release.

Product Registration, Technical Support Phone Numbers and TI Support Web Sites
> Read about the range of services and support available to you as a TI customer.

TMS320™ DSP Algorithm Standard
> Learn about a set of coding conventions and standards for developing third-party algorithms and incorporating other algorithms into your own product:

Where and How to Look for Information
> A short guide about how to find the information you need in online help.

Places to Start:
Setting Default IDE Behaviors & Paths at Startup
Using the CodeWright Text Editor
Working with Projects
Debugger Basics

References
GEL Functions: Alphabetical List
Keyboard Shortcuts

Code Composer Studio™ IDE - Quick Start Reference Guide

Installation Requirements

These operating platform requirements are necessary to install the Code Composer Studio Integrated Development Environment (IDE):

Minimum

- 500 MHz or higher Pentium™ compatible CPU
- 128 MB of RAM
- 600 MB of free hard disk space
- SVGA (800 X 600) display
- Internet Explorer™ (5.0 or later)
- Local CD-ROM drive

Recommended

- 2 GHz or higher Pentium-compatible CPU
- 512 MB of RAM
- 16-bit color

Supported Operating Systems

- Windows® 2000 Service Pack 4
- Windows XP Pro Service Pack 1 & 2
- Windows XP Home Service Pack 1 & 2

Installing Code Composer Studio IDE

Note: Before starting the Code Composer Studio IDE installation, be sure that any anti-virus software is disabled. You must install and run Code Composer Studio IDE using administrator privileges. If installing hardware, follow the instructions provided with the hardware.

1 Insert the installation CD into the CD-ROM drive.

An install screen should appear after a few seconds; if not, go to Windows Explorer and run setup.exe from your CD-ROM.

2 Respond to the dialog boxes as the installation program runs. You can customize the components that are installed.

Setting up your Device Configuration

The first step in using Code Composer Studio is to configure the target board or simulator that you want to use.

To load a standard configuration file:

Invoke the setup application by double clicking on the Setup CCStudio icon that appears on your desktop. The list of standard configurations is listed in the center pane of the setup program.

1 Click on the Factory Boards tab located at the bottom of the center pane. This will display a list of standard configurations provided by Texas Instruments or installed Third Party packages.

2 Select the appropriate board or simulator configuration. Use Filters to help narrow the available choices, and either double click on the item, drag the selected configuration to the left pane or click on the configuration and hit the add button to add it to your system.

3 Repeat the step above for each board or simulator you wish to add to your system. Your configuration may contain more than one target board.

Within the setup interface, the configuration you selected is graphically displayed under My System in the left pane.

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If you select more than one target configuration in the setup, the Parallel Debug Manager (PDM) will be launched when you start Code Composer Studio IDE. The PDM lets you control multiple debug sessions.

4 Click the button labeled Save and Quit. The configuration is saved in the System Registry.

5 Click Yes to the question, *"Start Code Composer Studio on Exit?"* The Setup utility is closed and Code Composer Studio IDE is started.

To set up a new system configuration:

If you have a custom board or you cannot find your board under the Factory Boards you can create your own configuration.

1 Select the Create Board tab located at the bottom of the center pane.

2 Select the appropriate connection type (emulator or simulator). Double click on it or hit Add to bring up the Connection Properties Connection Properties dialog.

3 Fill in the properties for the connection and click Finish.

4 You will then be presented with a list of the supported processor types in the center pane. Double click on the desired processor to bring up the Device Properties dialog.

5 Fill in the properties for the device and click Finish. Repeat as necessary.

6 Click the button labeled Save and Quit. The configuration is saved in the System Registry.

7 Click Yes to the question, *"Start Code Composer Studio on Exit?"* The Setup utility is closed and Code Composer Studio IDE is started.

For more information on setting up a new system configuration, see the Code Composer Studio IDE Setup online help.

Running the Code Composer Studio IDE Tutorial

The interactive Code Composer Studio IDE tutorial as well as the Code Composer Studio IDE Getting Started Guide, provides an effective method to learn about the new and existing features of this tool.

1 Code Composer Studio IDE should now be running. If it is not already running, double-click on the CCStudio icon on your desktop.

2 From the Code Composer Studio IDE Help menu, select Tutorial.

Using Code Composer Studio IDE to Build a Program

To create a new project:

1 Select Project → New from the menu. This opens the Project Creation dialog box. In the Project Name field, type the new project name.

2 In the Location field you can either type the name of the correct project directory where you want the project to reside or you can browse to it by clicking the … button.

3 In the Project Type field, select library or executable, depending on the type of output you are creating.

QUICK START

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4 In the Target field, select the target you have configured for Code Composer Studio IDE and click Finish.

To open an existing project:

1 Select Project → Open from the menu. The Project Open dialog box appears. Navigate to the correct project directory. Highlight the project you want to use and choose Open.

Existing projects created under previous versions of Code Composer Studio IDE will automatically be migrated to the latest format when they are opened.

To add files to a project:

1 Select Project → Add Files to Project. In the Add Files to Project dialog box, navigate to the appropriate location, select the file, and click Open.

Note: Code Generation Tools include runtime library files (e.g., rts6400.lib). The runtime libraries contain the Standard C Library of functions. If you are going to be using Standard C Library

functions, you must add the target-specific runtime libraries to your project.

Do not try to specify include or header files directly. These files are automatically added to the project by scanning the source files for dependencies.

Building and running the program:

- **Setting Build Options:** Select Project → Build Options from the menu. You can change options for the compiler and linker.

- **Building the program:** Choose Project → Rebuild All to re-compile, re-assemble, and re-link all the files in the project. Messages about this process are shown in a frame at the bottom of the window.

- **Loading the program:** Select File → Load Program to load the executable file (*.out). Select the program you just rebuilt and click Open.

- **Running the program:** Select Debug → Run.

DSP/BIOS™ Kernel

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What is DSP/BIOS Kernel?

DSP/BIOS is a scalable, real-time kernel that is designed for applications that require real-time scheduling and synchronization, host-to-target communication, or real-time instrumentation.

The DSP/BIOS kernel is packaged as a set of modules that can be linked into an application. It is integrated with Code Composer Studio™ Integrated Development Environment (IDE), requires no runtime license fees, and is fully supported by Texas Instruments. The kernel is also a key component of TI's eXpressDSP™ technology.

DSP/BIOS kernel enables you to develop and deploy sophisticated applications and eliminates the need to develop and maintain custom operating systems or control loops. Because multi-threading enables real-time applications to be cleanly partitioned, applications using DSP/BIOS kernel are easier to maintain and new functions can be added without disrupting real-time response. DSP/BIOS kernel provides standardized APIs across TMS320C2000™, TMS320C5000™ and TMS320C6000™ DSP platforms to support rapid application migration. Additionally, it includes configuration support for EVMs, DSKs, simulators, and some third-party boards. Existing configuration templates are easily adaptable to provide support for custom boards and other third-party boards.

DSP/BIOS kernel is integrated into the Code Composer Studio IDE. Code Composer Studio's kernel object viewer and real-time analysis provide a powerful set of integrated tools specifically focused on debugging and tuning multitasking applications.

DSP/BIOS Kernel Components

The DSP/BIOS kernel includes the following components:

- **DSP/BIOS Configuration Tool.** This tool allows you to create and configure the DSP/BIOS kernel objects used by your program. You can use this tool to configure memory, thread priorities, and interrupt handlers settings.

  To open the DSP/BIOS Configuration Tool, choose File → New → DSP/BIOS Configuration within Code Composer Studio IDE. Select the template for your DSP target and click OK.

  For help on the Configuration Tool, press F1 while the Configuration Tool window is active.

- **DSP/BIOS Real-Time Analysis Tools.** These tools allow you to view program activity in real time. For example, the Execution Graph shows a diagram of thread activity.

  To open a DSP/BIOS kernel analysis tool, use the DSP/BIOS kernel menu or the Real-Time Analysis toolbar within Code Composer Studio IDE.

  For help on a DSP/BIOS kernel analysis tool, press F1 while the tool window is active.

- **DSP/BIOS Kernel.** Your C, C++, and assembly language programs can call over 150 DSP/BIOS functions.

  For reference information on DSP/BIOS kernel, choose Help → Contents and open the DSP/BIOS book in the Contents tab.

DSP/BIOS™ Kernel

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Learning about DSP/BIOS™ Kernel

See the following documents and online locations for information about DSP/BIOS kernel.

Use this document:	If you need this information:	How to open it:
DSP/BIOS Tutorial	How to get started with DSP/BIOS kernel and gain a hands-on introduction to various modules.	**Online Help:** Within Code Composer Studio™, choose Help → Tutorial. Go to the Using DSP/BIOS section.
DSP/BIOS User's Guide	How DSP/BIOS works. This manual includes an overview of DSP/BIOS and discusses the threading model, real-time analysis and instrumentation, memory management, and I/O.	**Adobe Acrobat file:** In Code Composer Studio, choose Help → User Manuals. In the web page that opens, follow the link to open the DSP/BIOS User's Guide.
DSP/BIOS API Reference	Reference information about DSP/BIOS modules, objects, API functions, device drivers, and utilities. This information is also provided in the DSP/BIOS online help.	**Adobe Acrobat file:** In Code Composer Studio, choose Help → User Manuals. Follow the link to the DSP/BIOS API Reference for your DSP platform.
DSP/BIOS Online Help	Answers to questions about how to use DSP/BIOS; reference information about DSP/BIOS modules, objects, API functions, device drivers, and utilities; troubleshooting information.	**Online help:** Within Code Composer Studio, choose Help → Contents and open the DSP/BIOS book in the Contents tab.
DSP/BIOS Website	The DSP/BIOS area of the TI website includes links to application notes, benchmarks, a discussion group, and training classes.	**Website:** On the Web go to http://www.dspvillage.com and click on the DSP/BIOS link in the eXpressDSP™ box.

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What is the TMS320 DSP Algorithm Standard?

The TMS320 DSP Algorithm Standard is a key ingredient of eXpressDSP™ Technology. It is a set of coding conventions for algorithm writers that ultimately eliminates much of the time-consuming re-engineering work required to integrate algorithms into a variety of applications. It achieves this by defining common programming rules, guidelines, and interfaces.

The TMS320 DSP Algorithm Standard enforces known behaviors, requires documentation of features relevant to integration, and defines interfaces for algorithms to use to request resources. As a result, the standard facilitates the integration and deployment of algorithms in a variety of systems.

Rules and guidelines are provided for the following DSP generations:

- TMS320C62x™/C64x™/C67x™/DM64x™

- TMS320C54x™/C55x™

- TMS320C24x™/C28x™

Utilizing the TI provided test tool, QualiTI, users can test TMS320 algorithms for compliance with the TMS320 DSP Algorithm Standard. Passing algorithms are allowed to display and use the compliance logo shown here. By using such algorithms, system integrators can avoid bugs that result from unfounded assumptions by the algorithm about resource availability and calling context.

The TMS320 DSP Algorithm Standard documentation, header files and examples are included in Code Composer Studio. The full developers kit may be downloaded from TI's website.

To Create eXpressDSP-Compliant Algorithms

Download the TMS320 DSP Developer's Kit from **www.dspvillage.com**. Select Software DSP Algorithm Standard. Start by using the Hyperception Component Wizard for step-by-step guidance to create a pre-built wrapper that prevents the user from using non-conforming entries.

While adding your own unique IP, leverage the various documents listed below to ensure compliance with the standard. Upon completion, verify compliance with the standard by using the automated test tool – QualiTI.

To Use eXpressDSP-Compliant Algorithms

To browse and purchase off-the-shelf, production-ready algorithms, visit TI's web site to view a list of companies that have produced eXpressDSP compliant algorithms. Go to the DSP Developers' Village and follow the links in the eXpressDSP Compliance Program box.

The following documentation, application notes and user's guides are available to learn more about the TMS320 DSP Algorithm Standard.

TMS320™ DSP Algorithm Standard

Code Composer Studio™ IDE - Quick Start Reference Guide

Use this document:	If you need information about:
Design and Implementation of an eXpressDSP™-Compliant DMA Manager for C6x1x (SPRA789)	Following an overview of DMA abstractions for eXpressDSP-compliant algorithms, this application describes a C6x1x-optimized (C6211, C6711) ACPY2 library implementation and DMA Resource Manager, which can also be run on C64x™ devices. An algorithm and example application is provided (including source code) to demonstrate enhancements to DMA access.
DMA Guide for eXpressDSP-Compliant Algorithm Producers and Consumers (SPRA445)	This application note provides an overview of the DMA architecture specified by the TMS320™ DSP Algorithm Standard. It also describes two sets of APIs used for accessing DMA resources: the IDMA2 abstract interface and the ACPY2 library.
Making DSP Algorithms Compliant with the TMS320 DSP Algorithm Standard (SPRA579)	A tutorial on how to make an algorithm compliant to the standard.
The TMS320 DSP Algorithm Standard – a White Paper (SPRA581)	A high-level overview of the algorithm standard.
TMS320 DSP Algorithm Standard API Reference (SPRU360)	The formal API specification that algorithms must conform to in order to be compliant to the standard.
TMS320 DSP Algorithm Standard Developer's Guide (SPRU424)	Implementing the TMS320 DSP Algorithm Standard interface.
TMS320 DSP Algorithm Standard Rules and Guidelines (SPRU352)	The formal specification of the standard's rules and guidelines plus overall descriptions and explanations.
Using the TMS320 DSP Algorithm Standard in a Dynamic DSP System (SPRA580)	Using standard algorithms in a system in which data objects are created and destroyed over the life of the system.
Using the TMS320 DSP Algorithm Standard in a Static DSP System (SPRA577)	Using standard algorithms in a system in which data objects are created at design time.
Techniques for Implementing Shared Relocatable Buffers Using the TMS320 DSP Algorithm Standard (SPRA790)	This application note presents several mechanisms supported by the TMS320 DSP Algorithm Standard which can be employed by algorithm writers to assist application developers in optimizing their system's performance and sharing of memory resources.

Code Composer Studio™ IDE - Quick Start Reference Guide

Enhance your knowledge and help get your customers to market easily and quickly by leveraging TI DSP support. From your personal, online "24/7" DSP KnowledgeBase to technical documentation, TI offers the fast and accurate technical support you need when you need it. Online training, webcasts, workshops and the TI Developer Conference provide an array of convenient support choices.

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TI's web-based "Getting Started" DSP support tool helps engineers get their designs from inspiration to implementation quickly and easily. Designers choosing to use TI DSPs in their real-time applications get easy-to-access introductory DSP content, thus decreasing the learning curve and speeding products to market. **www.ti.com/gettingstarted**

The Essential Guide to Getting Started with DSP CD-ROM

This free CD contains links to a variety of getting started resources including documentation and the latest new product information. It also provides you a guided tour of the eXpressDSP™ Software and Development Tools. Order your CD-ROM or download today. **www.ti.com/getstartedcd**

TI DSP Discussion Groups

Join the community of DSP users and share information about signal processing application design. Peer-to-peer discussion groups include High Performance Digital Signal Processing, Power-Efficient Digital Signal Processing, Control- Optimized Digital Signal Processing and for users new to DSP, Getting Started with Digital Signal Processing discussion groups. **www.ti.com/discussgroup**

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Code Composer Studio™ IDE - Quick Start Reference Guide

Publications

eTech Innovations eNewsletter
Receive the latest digital signal processing news from TI including: DSP silicon, software, systems applications and support information. Subscribe today for this free monthly eNewsletter.
www.ti.com/etechsubscribe

DSP Applications Journal
To support the design of specific DSP-based systems, view the online *DSP Applications Journal* with the latest application notes by platform and software.
www.ti.com/appsjournal

Embeddded Edge Online Magazine
The *Embedded Edge* online magazine offers comprehensive solutions, tips, tricks and advice from people who have met and conquered some of the development problems embedded developers face every day. Register today to receive information on news, products and services and make your life easier.
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TI DSP Training Options

TI Developer Conference, North America
Create the Next Leading-Edge Signal Processing Design
The three-day TI Developer Conference provides networking opportunities with industry and TI experts, must-have technical training and peer-to-peer interaction for embedded designers. Tracks include: audio, communications, control, education, systems, tools, and video/imaging.
For more information, visit
www.ti.com/tidc

Europe
In one day, in one place, find the signal processing solution you need for your application.
For more information, visit
www.ti.com/europe/devcon

Asia
Get in-depth, technical information and interact with TI and industry experts.
For more information, visit
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One-Day Workshops
One-day workshops are designed to offer product or technology knowledge and more advanced information about a particular category of devices. These workshops include a significant "hands-on" section and are ideal introductions to get started with DSP. A list of available courses and schedule information can be found at
www.ti.com/1dayworkshops

Multi-Day Workshops
Multi-day workshops are for engineers who need to sharpen their design and development skills. These workshops include significant "hands-on" labs emphasizing the demonstration and application of techniques and skills. TI workshops are highly beneficial in helping developers implement their DSP designs quickly. A list of available courses and the schedule can be found at
www.ti.com/multidayworkshops

Free Online Training
Learn more about how to design your digital signal processing application with self-paced online training covering DSP applications, TMS320™ DSPs and easy-to-use software development tools. Dozens of courses such as "1-GHz DSP Overview" to

"Reference Frameworks for eXpressDSP™ Software" are available today and run from 30 minutes to two hours each. For a complete list of available courses, visit **www.ti.com/onlinetraining**

TI DSP Webcast Library

TI conducts free DSP webcasts to address topics most critical to designers. A typical webcast includes a presentation followed by a question & answer session with the technical engineering presenter specializing in the topic. After the live event, DSP webcasts are available via the archive library. To access the library, visit **www.ti.com/webcasts**

DSP Third Party Network Overview

More than 700 independent third parties provide a vital link between TI silicon and the final application by providing additional hardware, algorithms and libraries, software tools and consulting services. Product/services include:

- eXpressDSP™ compliant algorithms and libraries for a variety of applications such as voice, audio, video, imaging, telecommunications, speech, biometrics, encryption, motor control, as well as others.

- Hardware includes emulators, device programmers and development boards. Development systems include logic analyzers, TIM modules, data acquisition boards, multiprocessing OEM boards and add-on cards.

- Software tools include simulators, debuggers and software development utilities such as filters, signal analyzers, C-code generators and eXpressDSP-compliant plug-ins for Code Composer Studio™ Development Tools.

- Consulting services include turnkey designs, hardware and software integration, training, research and development.

TI DSP Third Party Support

Video/Imaging and Audio	**Comprehensive Development Support**
• Compression software • Research and development support • Hardware and reference designs • Enhancement libraries • Print head control software	• DSP boards, starter kits and add-ons • Customized debuggers • Targeted development platforms • Real-time emulation • Consulting services • Simulation models
Getting Started with DSP	**Communications**

• On-site customized training
• Contract engineering design resources
• Subsystem development
• Software experts in applications:
  embedded control, set-top box, optical
  networking, digital radio, telematics
  and biometrics
	• Modem & DSL software
	• Encryption software
	• Voice and fax software
	• Wireless software
	• Real-time operating systems (RTOS)
	• Hardware and reference designs
	• Consultants

TI Worldwide Technical Support

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TI Semiconductor KnowledgeBase Home Page
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Product Information Centers

Americas

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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 54 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
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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
Internet	support.ti.com/sc/pic/euro.htm

Japan

Fax	International	+81-3-3344-5317
	Domestic	0120-81-0036

Inquiry Web Site (Japanese):	http://www.tij.co.jp/pic
Inquiry Web Site (English):	http://www-k.ext.ti.com/sc/technical-support/pic/japan.htm
DSP User Forum:	http://www.tij.co.jp/DSPForum

Asia

Phone

International	+886-2-23786800
Domestic	Toll-Free Number
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Mailing Address: Texas Instruments

Post Office Box 655303 Dallas, Texas 75265

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